

Operating manual

RADIO TEST SYSTEMS

2957D and 2960D

for AMPS (including D-AMPS)

Part no. 52957-940H and 52960-940H (with 2955A)
52957-421K and 52960-421K (with 2955R)
52957-502L and 52960-502L (with 2955B)

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Contents

Preface	v
Precautions	vi
Hazard symbols	vi
Safety	vi
Electrical hazards	vi
Fire hazard	vii
Other hazards	vii
Precautions	ix
Vorsichtsmassnahmen.....	xi
Precauzioni	xiii
Precauciones.....	xv
Chapter 1 GENERAL INFORMATION	1-1
INTRODUCTION.....	1-1
Operating modes	1-1
Test sequences	1-2
Test routines.....	1-2
Pause facility.....	1-2
Displays of signalling data	1-2
Standard interfaces	1-2
PERFORMANCE DATA - AMPS	1-3
PERFORMANCE DATA - DIGITAL AND RF SECTION	1-18
PERFORMANCE DATA - GENERAL	1-20
Chapter 2 INSTALLATION	2-1
VENTILATION.....	2-1
TEST SET INTERCONNECTIONS	2-1
Converting a 2955 to a 2957D or 2960D	2-1
POWER REQUIREMENTS.....	2-4
AC power supply.....	2-4
DC power supply.....	2-5
GPIB PORTS	2-5
Internal.....	2-5
External	2-5
PARALLEL CONTROL PORT	2-6
SERIAL PORT	2-8
DISC INTERFACE PORT	2-9
TEST INTERFACE ADAPTER PORT	2-10
Chapter 3-0 INTRODUCTION TO OPERATION	3-0-1
CHAPTERS	3-0-1
INTERCONNECTIONS	3-0-1
STARTING.....	3-0-1
CHANGING FORMAT	3-0-1
FULL AUTO TEST	3-0-2
GO/NO-GO TEST.....	3-0-2
MANUAL TEST.....	3-0-2
TEST SEQUENCES	3-0-2
TEST ROUTINES	3-0-2
Chapter 3-1 OPERATION	3-1-1
INTRODUCTION.....	3-1-1
INDICATORS, CONTROLS AND CONNECTORS.....	3-1-1
2957D and 2960D front panel	3-1-1
2957D and 2960D rear panel.....	3-1-3
Adapter side panel.....	3-1-5
DISC OPERATION	3-1-6

Preparation	3-1-6
Formatting	3-1-7
Saving	3-1-7
Loading	3-1-7
Deleting	3-1-7
Locking	3-1-7
Catalogue	3-1-8
Fault messages	3-1-8
OPERATING SUMMARY	3-1-9
INTERCONNECTIONS	3-1-11
CRTS MODE	3-1-13
Conditions indicated by LEDs	3-1-15
Self test failure messages	3-1-15
MAIN TOP LEVEL MENU	3-1-16
SYSTEM SELECTION MENU	3-1-17
2960D only	3-1-17
FIRST TIME OPERATION	3-1-17
CHANGE FORMAT MENU	3-1-18
OPTION KEYS	3-1-19
SYSTEM PARAMETERS MENU	3-1-19
SYSTEM DEFINITION MENU	3-1-22
MOBILE PARAMETERS MENU	3-1-24
DISPLAY FORMAT MENU	3-1-25
TEST SEQUENCE MENU	3-1-26
PRINTER MENU	3-1-27
INTERFACE MENU	3-1-29
MISCELLANEOUS MENU	3-1-30
SYSTEM PARAMETER WORD 1 MENU	3-1-35
SYSTEM PARAMETER WORD 2 MENU	3-1-37
PARAMETER STORAGE	3-1-38
GO/NO-GO TEST MODE	3-1-38
FULL AUTO TEST MODE	3-1-39
TEST SEQUENCE PAUSE	3-1-41
MANUAL TEST MODE	3-1-47
BUILT-IN TEST SEQUENCES	3-1-59
NON-SYSTEM SPECIFIC TEST ROUTINES	3-1-62
SYSTEM SPECIFIC TEST ROUTINES	3-1-67
Chapter 4-0 REMOTE OPERATION	4-0-1
REMOTE CONTROL	4-0-1
REMOTE PASS-THROUGH MODE	4-0-1
REMOTE CRTS MODES	4-0-2
Chapter 4-1 INTRODUCTION TO PROGRAMMING	4-1-1
PURPOSES OF PROGRAMMING	4-1-1
METHODS OF REMOTE CONTROL	4-1-1
RS-232 INTERFACE UNIT	4-1-2
Port setting in BASIC	4-1-3
Setting the 2957D or 2960D	4-1-3
GPIB PROGRAMMING	4-1-3
RS-232 PROGRAMMING IN BASIC	4-1-3
PROGRAMMING MODES	4-1-3
Chapter 4-2 WRITING A PROGRAM	4-2-1
INTRODUCTION	4-2-1
SYNTAX	4-2-2
Conventions	4-2-2
Delimiters	4-2-2
Syntax forms	4-2-3
COMMAND CODES	4-2-4
TEST ROUTINE PARAMETERS	4-2-4
Parameter 1	4-2-4

Chapter 4-2 WRITING A PROGRAM (contd.)	
Parameter 2	4-2-5
Parameter 3	4-2-5
Parameter 4	4-2-6
Parameters 4 and 5	4-2-6
Parameters 6	4-2-6
Changing the parameters	4-2-6
USER-DEFINED TEST SEQUENCES	4-2-6
Entering a program	4-2-7
Program construction	4-2-8
ERROR MESSAGES	4-2-9
Chapter 4-3 COMMAND CODES	4-3-1
INTRODUCTION TO COMMAND CODES FOR THE IMMEDIATE MODE	4-3-1
INTRODUCTION TO COMMAND CODES FOR THE LEARN MODE AND THE USER	
MODE	4-3-4
DETAILS OF COMMAND CODES	4-3-8
Chapter 4-4 TEST ROUTINE PARAMETERS	4-4-1
Chapter 4-5 BUILT-IN TEST SEQUENCE PROGRAMS	4-5-1
INTRODUCTION	4-5-1
CALL PROCESSING ONLY SEQUENCE	4-5-1
CALL AND RF TESTING SEQUENCE (D-AMPS ONLY)	4-5-1
BRIEF TESTING SEQUENCE (D-AMPS ONLY)	4-5-2
COMPREHENSIVE TESTING SEQUENCE (D-AMPS ONLY)	4-5-7
COMMON SUBROUTINES	4-5-9
Chapter 4-6 SAMPLE PROGRAMS	4-6-1
USING A GPIB CONTROLLER	4-6-1
USING A PC-COMPATIBLE COMPUTER	4-6-2
Chapter 5 ACCEPTANCE TEST SCHEDULE	5-1
DC POWER MEASUREMENT ACCURACY	5-1
DC meter	5-1
AF INPUT TO AF OUTPUT GAIN	5-4
EXTERNAL MODULATION SENSITIVITY	5-4
PSOPHOMETRIC FILTER - C-MESSAGE	5-7
PSOPHOMETRIC FILTER - CCITT	5-9
SAT GENERATOR	5-10
Distortion	5-10
Deviation accuracy	5-12
Frequency	5-14
SAT MEASUREMENT - AMPS	5-15
RF INPUT VSWR	5-18
RF POWER MEASUREMENT	5-20
RF SIGNAL GENERATOR ACCURACY	5-22
PHONE OPERATION TEST	5-24

ASSOCIATED PUBLICATIONS

	Part no.
Operating Manual, 2955A and 2955R	46882-952B
Programming Manual, 2955A and 2955R	46882-953K
Operating Manual, 2955B	46882-113R
Service Manual, 2957D Adapter	46882-140T
Service Manual 2955A and 2955R	46882-954A
Service Manual, 2955B	46882-114B

Preface

The Radio Test System 2957D consists of a Radio Communications Test Set 2955 series with a Cellular Adapter as follows:-

System type	System part no.	Test Set type
2957D	52957-940H	2955A (With modification L281 for D-AMPS)
	52957-421K	2955R (With modification L281 for D-AMPS)
	52957-502L	2955B (All versions)

For the 2957D, the Cellular Adapter is common to all variants (except for colour) and includes software for AMPS including D-AMPS.

The Radio Test System 2960D consists of a Radio Communications Test Set 2955 series with a Multi-system Cellular Adapter as follows:-

System type	System part no.	Test Set type
2960D	52960-940H	2955A (With modification L281 for D-AMPS)
	52960-421K	2955R (With modification L281 for D-AMPS)
	52960-502L	2955B (All versions)

For the 2960D, the Multi-system Adapter is common to all variants (except for colour) and includes software for one or more systems. The Adapter can accept up to six co-resident systems. The D-AMPS system is always fitted. Three other options are currently available as below.

There is a separate Operating Manual Supplement and Programming Manual Supplement for each other option as follows:-

Option no.	System	Operating Manual Supplement Part no.	Programming Manual Supplement Part no.
10	NMT	46881-901J	46881-931N
30	TACS	46881-903G	46881-933J
50	Band III	46881-905S	46881-935G

This Manual covers instruments which contain the following software:-

- (a) System controller board mother software (equivalent to the motherboard software on the non-digital variants) - version 6.
- (b) System controller board personality software for AMPS (equivalent to the personality board software on the non-digital variants) - version 8.
- (c) Digital and RF tray software - version 3.

Precautions

WARNING

CAUTION

Note

These terms have specific meanings in this manual:

WARNING

information to prevent personal injury.

CAUTION






information to prevent damage to the equipment.

Note

important general information.

Hazard symbols

The meaning of hazard symbols appearing on the equipment is as follows:

Symbol	Nature of hazard	Reference in manual
	Dangerous voltage	Page vi
	Static sensitive component	Page vii
	Fire hazard	Page vii
	Lithium batteries are used in this equipment. Appropriate caution should be exercised when handling these items.	Page vii
	Input overload	Pages vii

Safety

This product has been designed and tested in accordance with BS4743 'Specification for safety requirements for electronic measuring apparatus' and IEC Publication 348 'Safety requirements for electronic measuring apparatus'.

WARNING

Electrical hazards

AC supply voltage

This equipment conforms with IEC Safety Class 1, meaning that it is provided with a protective grounding lead. To maintain this protection the supply lead must always be connected to the source of supply via a socket with a grounded contact.

Be aware that the supply filter contains capacitors that may remain charged after the equipment is disconnected from the supply. Although the stored energy is within the approved safety requirements, a slight shock may be felt if the plug pins are touched immediately after removal.

Fuses

Note that there are supply fuses in both the live and neutral wires of the supply lead. If only one of these fuses should rupture, certain parts of the equipment could remain at supply potential.

Removal of covers

Disconnect the supply before removing the covers so as to avoid the risk of exposing high voltage parts. If any internal adjustment or servicing has to be carried out with the supply on, it must only be performed by a skilled person who is aware of the hazard involved.

WARNING

Fire hazard

Make sure that only fuses of the correct rating and type are used for replacement.

If an integrally fused plug is used on the supply lead, ensure that the fuse rating is commensurate with the current requirements of this equipment. See under 'Performance Data' in Chapter 1 for power requirements.

WARNING

Other hazards

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.

Lithium

A Lithium battery (or a Lithium battery contained within an IC) is used in this equipment:

As Lithium is a toxic substance, the battery should in no circumstances be crushed, incinerated or disposed of in normal waste.

Do not attempt to recharge this type of battery. Do not short circuit or force discharge since this might cause the battery to vent, overheat or explode.

CAUTION

Input overload

On the 2955 series instrument, an input overload is indicated by the message 'REMOVE RF INPUT' and an audible warning.

With the Adapter connected and active, this overload system remains functional. However, during some stages of Adapter operation, an overload is indicated only by the audible warning.

In the event of a warning, remove the source of RF power immediately. Failure to respond could result in damage to the equipment.

The triggering of a warning can also cause changes to the instrument settings. Therefore, after an overload, check all settings and repeat any suspect tests.

CAUTION

Static sensitive components

This equipment contains static sensitive components which may be damaged by handling - refer to the Maintenance part of the Service Manual for handling precautions.

WARNING

Tilt facility

When the instrument is in the tilt position, it is advisable, for stability reasons, not to stack other instruments on top of it.

Precautions

WARNING

CAUTION

Note

Les termes suivants ont, dans ce manuel, des significations particulières:

WARNING

contient des informations pour éviter toute blessure au personnel.

CAUTION




contient des informations pour éviter les dommages aux équipements.

Note

contient d'importantes informations d'ordre général.

Symboles signalant un risque

La signification des symboles liés à cet équipement est la suivante:

Symbole	Nature du risque	Référence dans le manuel
	Tension dangereuse	Page ix
	Risque lié au feu	Page x
	Piles au Lithium utilisées dans cet équipement. Des précautions particulières sont à prendre lors de la manipulation de ces composants.	Page x

Securite

Cet appareil a été conçu et testé conformément aux normes BS4743 "Spécifications des conditions de sécurité pour instruments de mesure électronique" et CEI Publication 348 "Conditions de sécurité pour instruments de mesure électronique".

WARNING

Securite électrique

Tension d'alimentation alternative

Cet appareil est protégé conformément à la norme CEI de sécurité class 1, c'est-à-dire que sa prise secteur comporte un fil de protection à la terre. Pour maintenir cette protection, le câble d'alimentation doit toujours être branché à la source d'alimentation par l'intermédiaire d'une prise comportant une borne terre.

Notez que les filtres d'alimentation contiennent des condensateurs qui peuvent encore être chargés lorsque l'appareil est débranché. Bien que l'énergie contenue soit conforme aux exigences de sécurité, il est possible de ressentir un léger choc si l'on touche les bornes sitôt après débranchement.

Fusibles

Notez qu'il y a deux fusibles, l'un pour la phase et l'autre pour le neutre du câble d'alimentation. Si un seul fusible est coupé, certaines parties de l'appareil peuvent rester au potentiel d'alimentation.

Retrait des couvercles

L'appareil doit être débranché avant de retirer les couvercles afin d'éviter tout contact avec les éléments haute tension. Si toutefois un réglage interne ou une réparation nécessitent la présence de l'alimentation, ils devront être effectués par une personne qualifiée et avisée des risques encourus.

WARNING

Risque lie au feu

Lors du remplacement des fusibles vérifiez l'exactitude de leur type et de leur valeur.

Si le cable d'alimentation comporte une prise avec fusible intégré, assurez vous que sa valeur est compatible avec les besoins en courant de l'appareil. Pour la consommation, reportez-vous au Chapitre 1 "Spécifications".

WARNING

Autres risques

Certains composants utilisés dans cet appareil peuvent contenir des résines et d'autres matières qui dégagent des fumées toxiques lors de leur incinération. Les précautions d'usages doivent donc être prises lorsqu'on se débarrasse de ce type de composant.

Lithium

La batterie utilisée dans cet équipement contient du **Lithium**:

le **Lithium** est une substance toxique; en conséquence on ne doit l'écraser, l'incinérer ou la jeter dans la "poubelle".

Ne pas essayer de la recharger, ne pas la court-circuiter, une forte décharge rapide risque de provoquer une surchauffe voire l'explosion de celle-ci.

WARNING

Position inclinée

Lorsque l'appareil est dans une position inclinée, il est recommandé, pour des raisons de stabilité, de ne pas y empiler d'autres appareils.

Vorsichtsmassnahmen

WARNING

CAUTION

Note

Diese Hinweise haben eine bestimmte Bedeutung in diesem Handbuch:

WARNING

dienen zur Vermeidung von Verletzungsrisiken.

CAUTION




dienen dem Schutz der Geräte.

Note

enthalten wichtige Informationen.

Gefahrensymbole

Die Gefahrensymbole auf den Geräten sind wie folgt:

Symbol	Gefahrenart	Im Handbuch
	Gefährliche Spannung	Seite xi
	Feuergefährlich	Seite xii
	Lithium Batterien - Vorsicht bei Austausch o.ä.	Seite xii

Sicherheit

Dieses Gerät wurde in Übereinstimmung mit BS4743 und IEC 348 entwickelt und geprüft.

WARNING

Elektrische Schläge

Wechselspannungsversorgung

Das Gerät entspricht IEC Sicherheitsklasse 1 mit einem Schutzleiter nach Erde. Das Netzkabel muß stets an eine Steckdose mit Erdkontakt angeschlossen werden.

Filterkondensatoren in der internen Spannungsversorgung können auch nach Unterbrechung der Spannungszuführung noch geladen sein. Obwohl die darin gespeicherte Energie innerhalb der Sicherheitsmargen liegt, kann ein leichter Spannungsschlag bei Berührung kurz nach der Unterbrechung erfolgen.

Sicherungen

Es ist zu beachten, daß es Sicherungen in beiden (spannungsführenden und neutralen) Zuleitungen gibt. Wenn nur eine von diesen Sicherungen schmilzt, so bleiben einige Geräteteile immer noch auf Spannungspotential.

Abnahme von Abdeckungen

Die Spannungsversorgung muß vor Abnahme von Gehäuseabdeckungen unterbrochen sein, damit hochspannungsführende Teile gefahrlos zugänglich sind. Falls Abgleiche oder Servicearbeiten unter Spannung notwendig werden, dürfen solche Arbeiten nur von fachkundigem Personal durchgeführt werden, das die Gefahren kennt.

WARNING

Feuergefahr

Es dürfen nur Ersatzsicherungen vom gleichen Typ mit den korrekten Spezifikationen entsprechend der Stromaufnahme des Gerätes verwendet werden. Siehe hierzu die Leistungsdaten (Performance Data) in Kapitel 1.

WARNING

Andere Gefahren

In einigen Bauelementen dieses Geräts können Epoxyharze oder andere Materialien enthalten sein, die im Brandfall giftige Gase erzeugen. Bei der Entsorgung müssen deshalb entsprechende Vorsichtsmaßnahmen getroffen werden.

Lithium

Eine **Lithium**-Batterie ist in diesem Gerät eingebaut.

Da Lithium ein giftiges Material ist, sollte es als Sondermüll entsorgt werden.

Diese Batterie darf auf keinen Fall geladen werden. Nicht kurzschließen, da sie dabei überhitzt werden und explodieren kann.

WARNING

Schrägstellung

Bei Schrägstellung des Geräts sollten aus Stabilitätsgründen keine anderen Geräte darauf gestellt werden.

Precauzioni

WARNING

CAUTION

Note

Questi termini vengono utilizzati in questo manuale con significati specifici:

WARNING

riportano informazioni atte ad evitare possibili pericoli alla persona.

CAUTION




riportano informazioni per evitare possibili pericoli all'apparecchiatura.

Note

riportano importanti informazioni di carattere generale.

Simboli di pericolo

Significato dei simboli di pericolo utilizzati nell'apparato:

Simbolo	Tipo di pericolo	Riferimento nel manuale
	Tensione pericolosa	Pagina xiii
	Pericolo d'incendio	Pagina xiv
	Batterie al litio. Opportune precauzioni devono essere prese prima di maneggiarle.	Pagina xiv

Sicurezza

Questo prodotto è stato progettato e provato secondo le norme BS4743 "Specification for safety requirements for electronic measuring apparatus" e la pubblicazione IEC 348 "Safety requirements for electronic measuring apparatus".

WARNING

Pericoli da elettricità

Alimentazione c.a.

Quest' apparecchio è provvisto del collegamento di protezione di terra e rispetta le norme di sicurezza IEC, classe 1. Per mantenere questa protezione è necessario che il cavo, la spina e la presa d'alimentazione siano tutti provvisti di terra.

Il circuito d'alimentazione contiene dei filtri i cui condensatori possono restare carichi anche dopo aver rimosso l'alimentazione. Sebbene l'energia immagazzinata è entro i limiti di sicurezza, purtuttavia una leggera scossa può essere avvertita toccando i capi della spina subito dopo averla rimossa.

Fusibili

Notare che entrambi i capi del cavo d'alimentazione sono provvisti di fusibili. In caso di rottura di uno solo dei due fusibili, alcune parti dello strumento potrebbero restare sotto tensione.

Rimozione dei coperchi

Prima di rimuovere i coperchi occorre scollegare la spina d'alimentazione onde evitare il rischio di esposizione di parti ad alta tensione. Eventuali operazioni di manutenzione che richiedono la presenza dell'alimentazione dovranno essere eseguite solo da parte di personale specializzato ed a conoscenza dei pericoli coinvolti.

WARNING

Pericolo d'incendio

Assicurarsi che, in caso di sostituzione, vengano utilizzati solo fusibili della portata e del tipo prescritto.

Se viene usata una spina con fusibili, assicurarsi che questi siano di portata adeguata coi requisiti di alimentazione richiesti dallo strumento. Tali requisiti sono riportati nel cap. 1 "Performance data".

WARNING

Altri pericoli

Alcuni dei componenti usati in questo strumento possono contenere resine o altri materiali che, se bruciati, possono emettere fumi tossici. Prendere quindi le opportune precauzioni nell'uso di tali parti.

Litio

Quest'apparato incorpora una batteria al **litio** o un circuito integrato contenente una batteria al **litio**.

Poiché il litio è una sostanza tossica, la batteria non deve essere mai né rotta, né incenerita, né gettata tra i normali rifiuti.

Questo tipo di batteria non può essere sottoposto né a ricarica né a corto-circuito o scarica forzata. Queste azioni possono provocare surriscaldamento, fuoriuscita di gas o esplosione della batteria.

WARNING

Posizionamento inclinato

Quando lo strumento è in posizione inclinata è raccomandato, per motivi di stabilità, non sovrapporre altri strumenti.

Precauciones

WARNING

CAUTION

Note

Estos términos tienen significados específicos en este manual:

WARNING

contienen información referente a prevención de daños personales.

CAUTION




contienen información referente a prevención de daños en equipos.

Note

contienen información general importante.

Símbolos de peligro

Los significados de los símbolos de peligro que aparecen en los equipos son los siguientes:

Símbolo	Naturaleza del peligro	Referencia en manual
	Voltaje peligroso	Página xv
	Peligro de incendio	Página xvi
	Utiliza baterías de Litio. Debe de aplicarse cuidados especiales al manipularlas	Página xvi

Seguridad

Este producto ha sido diseñado y probado según las normas, BS4743 'Especificaciones de los requisitos de seguridad para instrumentos electrónicos de medida' e IEC publicación 348 'Requisitos de seguridad para instrumentos electrónicos de medida'.

WARNING

Nivel peligroso de electricidad

Tensión de red

Este equipo cumple las normas IEC Seguridad Clase 1, lo que significa que va provisto de un cable de protección de masa. Para mantener esta protección, el cable de alimentación de red debe de conectarse siempre a una clavija con terminal de masa.

Tenga en cuenta que el filtro de red contiene condensadores que pueden almacenar carga una vez desconectado el equipo. Aunque la energía almacenada está dentro de los requisitos de seguridad, pudiera sentirse una ligera descarga al tocar la clavija de alimentación inmediatamente después de su desconexión de red.

Fusibles

Se hace notar que el Equipo está dotado de fusibles tanto en el activo como el neutro de alimentación. Si sólo uno de estos fusibles fundiera, existen partes del equipo que pudieran permanecer a tensión de red.

Para retirar las tapas

Desconectar de red antes de retirar las tapas para evitar el riesgo que supone tener accesibles aquellas partes del equipo expuestas a alta tensión. Aquellas operaciones que requieran tener

alimentación con las tapas abiertas para mantenimiento o ajuste deben de ser realizadas por personal cualificado, que esté al tanto de los riesgos implicados.

WARNING

Peligro de incendio

Asegúrese de utilizar sólo fusibles del tipo y valores especificados como recuento.

Si se utiliza una clavija con fusible incorporado, asegúrese de que los valores del fusible corresponden a los requeridos por el equipo. Ver sección de especificaciones del capítulo 1 para comprobar los requisitos de alimentación.

WARNING

Otros peligros

Alguno de los componentes utilizados en este equipo pudieran incluir resinas u otro tipo de materiales que al arder produjeran sustancias tóxicas, Por tanto, tome las debidas precauciones en la manipulación de esas piezas.

Litio

En este equipo se utiliza una batería de **litio** (o contenida dentro de un CI).

Dada que el **litio** es una sustancia tóxica las baterías de este material no deben ser aplastadas, quemadas o arrojadas junto a basuras ordinarias.

No trate de recargar este tipo de baterías. No las cortocircuite o fuerce su descarga ya que puede dar lugar a que la esta emita gases, se recaliente o explote.

WARNING

Tener en cuenta con el equipo inclinado

Si utiliza el equipo en posición inclinada, se recomienda, por razones de estabilidad, no apilar otros equipos encima de él.

Chapter 1

GENERAL INFORMATION

INTRODUCTION

The Radio Test System 2957D consists of a Radio Communications Test Set 2955 series with a Cellular Adapter for D-AMPS only.

The Radio Test System 2960D consists of a Radio Communications Test Set 2955 series with a Multi-system Adapter for D-AMPS and other systems as required.

The 2957D or 2960D provides DC, audio and RF test facilities for testing cellular mobile radios and it provides the signalling for base station simulation. The 2955 and the Adapter are fitted together to form one transportable instrument.

On powering up, the 2957D or 2960D behaves like a normal 2955. This is indicated by a LED above the Adapter's 2955 key. To invoke the operating modes, the Adapter's CRTS key is pressed. The 2957D or 2960D goes through a self test. When an Adapter is fitted to a different 2955, it goes through a series of self tests which include self calibration.

Operating modes

There are three modes of operation as follows:-

- (a) GO/NO-GO TEST.
- (b) FULL AUTO TEST.
- (c) MANUAL TEST.

The GO/NO-GO TEST mode offers the user a rapid start to running a sequence of test routines. The results are summarized on the screen as a single line of information per test routine. If necessary, the display scrolls. However, the failed results remain on the display. This eliminates the need for continuous attendance.

Most of the selections and settings are set up in the FULL AUTO TEST mode. This mode offers the user a series of easy menus which allow many of the parameters, the sequence of test routines, the display and the interfaces to be altered. Sets of settings can be stored or recalled in this mode allowing rapid changes to be made between mobile types and system options. A sequence of test routines can then be run in this mode.

The MANUAL TEST mode offers manual control of the base station simulation. This is particularly useful when fault-finding or adjusting.

GENERAL INFORMATION

Test sequences

For the GO/NO-GO TEST mode and the FULL AUTO TEST mode, the 2957D or 2960D automatically executes a chosen test sequence. There is a choice of four built-in sequences.

The combination of selectable test modes and test sequence gives a great degree of flexibility and allows the user to define an area and depth of testing.

In addition to the four built-in test sequences, the user can define his own test sequences. This is done using a learn mode in remote control using the GPIB or through the RS-232 port. One user-defined test sequence can be stored within the instrument in non-volatile memory. Up to ten of them can be stored on a floppy disc when a disc drive is connected.

Test routines

Each test sequence consists of a number of individual test routines.

Pause facility

For when it is necessary to diagnose a fault or to carry out repairs and alignment, a pause facility is provided. This shows simultaneously the transmitter and receiver RF and AF parameters and the current test results.

Displays of signalling data

Another feature is the ability to look at the signalling data which is sent between the mobile and the 2957D or 2960D. Thus, the signalling data transmitted and received by the mobile can be seen and each word can be examined in detail.

Standard interfaces

The Adapter carries GPIB, RS-232, Centronics parallel and disc interface connectors. The GPIB port or the RS-232 port can be connected to an external controller to form a sophisticated ATE system. Alternatively, one of these or the Centronics parallel port can be used to drive a printer. The disc interface port is compatible with a 5.25 or 3.5 inch single-sided or double-sided disc drive. The disc drive can be used to down-load previously-written user-defined test sequences.

PERFORMANCE DATA - AMPS

General AMPS system information

In the table below, AMPS is the default setting of the user-defined AMPS system and is specified as a subset of E-AMPS.

System type	Base Tx frequency channel 1	Mobile Tx frequency channel 1	Minimum channel number	Maximum channel number	Channel spacing	Duplex offset (Rx - Tx)
	MHz	MHz			kHz	MHz
E-AMPS	870.030	825.030	1	1023	30	45
N-AMPS	870.030	825.030	1 WIDE	1023 WIDE	30	45
	870.020	825.020	1 BELOW	1023 BELOW	30	45
	870.030	825.030	1 NARROW	1023 NARROW	30	45
	870.040	825.040	1 ABOVE	1023 ABOVE	30	45
D-AMPS	870.030	825.030	1	1023	30	45
AMPS	870.030	825.030	1	666	30	45

N-AMPS BELOW channels are offset from the NARROW channels by -10 kHz, N-AMPS ABOVE channels are offset from the NARROW channels by +10 kHz.

Allocation of channels

1 to 333: System A.
 334 to 666: System B.
 667 to 716: System A'.
 717 to 799: System B'.
 800 to 990: Reserved.
 991 to 1023: System A''.

Dedicated control channels

313 to 333: System A.
 334 to 354: System B.

Voice/traffic deviation FM

Except narrowband: 12.0 kHz maximum.
 N-AMPS narrowband: 5.0 kHz maximum.

Data deviation

Except narrowband: 8.0 kHz ±10%.
 N-AMPS narrowband: 700 Hz ±10%.

Data type

FSK Manchester encoded, BCH parity.

Data rate

Except narrowband: 10 kbit/s ±1 bit/s.
 N-AMPS narrowband: 100 ±0.1 bit/s.

SAT frequencies

5.970, 6.000 and 6.030 kHz.

SAT deviation

2.0 kHz ±10%.

Signalling tone frequency

10.0 kHz ±1 Hz.

Signalling tone deviation

8.0 kHz ±10%.

Signalling tone duration

50 ms, 400 ms or 1.8 s ±10%.

GENERAL INFORMATION

DSAT sequences 2556CBH, 255B2BH, 256A9BH, 25AD4DH, 26AB2BH, 26B2ADH and 2969ABH.

DST sequences DAA934H, DAA4D4H, DA9564H, DA52B2H, D954D4H, D94D52H and D69654H.

DSAT and DST deviation (N-AMPS narrowband.) 700 Hz \pm 10%.

DSAT and DST type NRZ (DSAT, DST and sync word).

DSAT and DST rate 200 bit/s \pm 0.2 bit/s.

Other tones DTMF sent in conversation from mobile by pressing key pad.

Noise measurement filtration C-message psophometric.

Mobile transmit power

Power level	Power			
	Class I	Class II	Class III	Class IV
0	2.82 W	1.12 W	447 mW	447 mW
1	1.12 W	1.12 W	447 mW	447 mW
2	447 mW	447 mW	447 mW	447 mW
3	178 mW	178 mW	178 mW	178 mW
4	70.8 mW	70.8 mW	70.8 mW	70.8 mW
5	28.2 mW	28.2 mW	28.2 mW	28.2 mW
6	11.2 mW	11.2 mW	11.2 mW	11.2 mW
7	4.47 mW	4.47 mW	4.47 mW	4.47 mW
8	4.47 mW	4.47 mW	4.47 mW	1.78 mW
9	4.47 mW	4.47 mW	4.47 mW	708 μ W
10	4.47 mW	4.47 mW	4.47 mW	282 μ W
SCM	0xx00	0xx01	0xx10	0xx11

Levels 8, 9 and 10 are for D-AMPS digital channels only.

System parameter settings

System type As selected. Default E-AMPS.

System identity 5 digits (decimal). Default 00002.

Control channel 1 to 1023. Default 334.

First voice/traffic channel 1 to 1023. Default 1.

Last voice/traffic channel 1 to 1023. Default 666.

Handoff increment 1 to 1023. Default 333.

SAT frequency	5.970, 6.000 or 6.030 kHz. Default 5.970 kHz.
Digital colour code (DCC)	0, 1, 2 or 3. Default 0.
DSAT colour code (DSCC)	(N-AMPS only.) 0 to 6. Default 0.
Digital verification colour code (DVCC)	(D-AMPS only.) 1 to 255. Default 15.
Burst indicator (SBI)	(D-AMPS only.) Shortened, Full 1 or Full 2. Default Shortened.
TDMA channel	(D-AMPS only.) FACCH or SACCH. Default FACCH.

Mobile parameter settings

Mobile number (MIN)	Format xxx-xxx-xxxx. Default 000-000-0000.
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Display format settings

Display format	SUMMARY or FULL. Default FULL.
Pause	ALWAYS, MANUAL ONLY or ON FAILURE. Default MANUAL ONLY.
Number format	HEXADECIMAL, DECIMAL, OCTAL, STANDARD or STANDARD 2. Default STANDARD 1.

Test sequence settings

Test sequence	BRIEF TESTING, COMPREHENSIVE TESTING, CALL PROCESSING ONLY, CALL AND RF TESTING or NO SEQUENCE DEFINED (user-defined sequence until the title is reset). Default BRIEF TESTING.
DTMF	ENABLED or DISABLED. Default DISABLED.
Hook flash	ENABLED or DISABLED. Default DISABLED.

Printer settings

Printer port	UNASSIGNED, GPIB, RS-232 or PARALLEL. Default UNASSIGNED.
Print	OFF, ALL, ON FAILURE or ON PASS. Default OFF.
Terminate	<CR> and <LF>, <LF> or <CR>. Default <LF> and <CR>.

GENERAL INFORMATION

Interface settings

Baud rate	75, 150, 300, 600, 1200, 2400, 4800 or 9600. Default 1200.
Length/parity	7/EVEN, 7/ODD, 7/NONE, 8/EVEN, 8/ODD or 8/NONE. Default 8/NONE.
Stop bits	1 or 2. Default 1.
GPIB address	01 to 30. Default 06.
TIA format	IS-55, hexadecimal, ASCII 1, ASCII 2 or ASCII 3.

Test sequences

CALL PROCESSING ONLY

REGISTRATION, Test routine no. 20.
CALL MS TO CELL, Test routine no. 22.
 Repeated if failed first time.
 The following three are omitted if failed second time.
DTMF TONES, Test routine no. 30 (if enabled).
HOOK FLASH, Test routine no. 31 (if enabled).
SPEECH LOOPBACK, Test routine no. 37 (digital only).
CLEAR FROM MS, Test routine no. 27.
CALL CELL TO MS, Test routine no. 21.
 Repeated if failed first time.
AUTO HANDOFF, Test routine no. 24 (with N-AMPS channel rotation when applicable).
CLEAR FROM CELL, Test routine no. 26.
Print summary.

CALL AND RF TESTING

REGISTRATION, Test routine no. 20.
CALL MS TO CELL, Test routine no. 22.
 Repeated if failed first time.
 The following three are omitted if failed second time.
DTMF TONES, Test routine no. 30 (if enabled).
HOOK FLASH, Test routine no. 31 (if enabled).
SPEECH LOOPBACK, Test routine no. 37 (digital only).
CLEAR FROM MS, Test routine no. 27.
CALL CELL TO MS, Test routine no. 21.
 Repeated if failed first time.
 The following are repeated as many times as necessary to satisfy the channel settings in the system parameters menu (i.e. from the first voice/traffic channel to the last voice/traffic channel incrementing by the handoff increment with N-AMPS channel rotation when applicable).
HANDOFF, Test routine no. 23.
 Skip on to end if failed.
TX POWER, Test routine no. 28 (power level 0).
TX FREQUENCY, Test routine no. 2 (analog only).
SAT (or DSAT) TRANSPONDING, Test routine no. 25 (analog only).

SAT (or DSAT) DEVIATION, Test routine no. 25 (analog only).

After the above have been repeated as necessary -
 RMS VECTOR ERROR, Test routine no. 35 (digital only).
 CLEAR FROM CELL, Test routine no. 26.
 Print summary.

BRIEF TESTING

REGISTRATION, Test routine no. 20.

CALL MS TO CELL, Test routine no. 22.

Repeated if failed first time.

The following three are omitted if failed second time.

DTMF TONES, Test routine no. 30 (if enabled).

HOOK FLASH, Test routine no. 31 (if enabled).

SPEECH LOOPBACK, Test routine no. 37 (digital only).

CLEAR FROM MS, Test routine no. 27.

CALL CELL TO MS, Test routine no. 21.

Repeated if failed first time.

The following are repeated three times from the first voice/traffic channel to the last voice/traffic channel incrementing by the handoff increment with N-AMPS channel rotation when applicable).

HANDOFF, Test routine no. 23.

Skip on to try next channel if failed.

SAT (or DSAT or DVCC) TRANSPONDING, Test routine no. 25.

SAT (or DSAT) DEVIATION, Test routine no. 25 (analog only).

SAT FREQUENCY, Test routine no. 25 (wideband only).

TX POWER, Test routine no. 28 (all levels).

TX FREQUENCY, Test routine no. 2 (analog only).

RMS VECTOR ERROR, Test routine no. 35 (digital only).

BER REPORT, Test routine no. 29 (digital only).

DIGITAL RSSI, Test routine no. 38 (digital only).

TX SINAD, Test routine no. 3 (analog only).

TX LIMITING, Test routine no. 4 (analog only).

DATA DEVIATION, Test routine no. 32 (wideband only, if enabled).

RX SINAD, Test routine no. 6 (analog only).

RX SENSITIVITY, Test routine no. 7 (analog only).

After the above have been repeated three times -

Print results.

CLEAR FROM CELL, Test routine no. 26.

DIGITAL BER, Test routine no. 36 (digital only, if enabled).

Print summary.

The results are printed in a tabular form annotated LOW CHANNEL, MID CHANNEL and HIGH CHANNEL. Three channels are always tested, regardless of the handoff increment etc.

COMPREHENSIVE TESTING

REGISTRATION, Test routine no. 20.

CALL MS TO CELL, Test routine no. 22.

Repeated if failed first time.

The following three are omitted if failed second time.

DTMF TONES, Test routine no. 30 (if enabled).

HOOK FLASH, Test routine no. 31 (if enabled).

SPEECH LOOPBACK, Test routine no. 37 (digital only).

CLEAR FROM MS, Test routine no. 27.

GENERAL INFORMATION

CALL CELL TO MS, Test routine no. 21.
Repeated if failed first time.

ANALOG BER, Test routine no. 29 (wideband only).
The following are repeated as many times as satisfies the channel settings in the systems parameters menu (i.e. from first voice/traffic channel to the last voice/traffic mnel incrementing by the handoff increment with N-AMPS channel rotation when applicable).

HANDOFF, Test routine no. 23.
Skip on to end if failed.

SAT (or DSAT or DVCC) TRANSPONDING, Test routine no. 25.
SAT (or DSAT) DEVIATION, Test routine no. 25 (analog only).
SAT FREQUENCY, Test routine no. 25 (wideband only).

TX POWER, Test routine no. 28 (power level 7).
DC POWER, Test routine no. 9.
TX POWER, Test routine no. 28 (power level 6).
DC POWER, Test routine no. 9.
TX POWER, Test routine no. 28 (power level 5).
DC POWER, Test routine no. 9.
TX POWER, Test routine no. 28 (power level 4).
DC POWER, Test routine no. 9.
TX POWER, Test routine no. 28 (power level 3).
DC POWER, Test routine no. 9.
TX POWER, Test routine no. 28 (power level 2).
DC POWER, Test routine no. 9.
TX POWER, Test routine no. 28 (power level 1).
DC POWER, Test routine no. 9.
TX POWER, Test routine no. 28 (power level 0).
DC POWER, Test routine no. 9.

TX FREQUENCY, Test routine no. 2 (analog only).
TX SINAD, Test routine no. 3 (analog only).
TX NOISE, Test routine no. 3 (wideband only).
TX LIMITING, Test routine no. 4 (analog only).
TX COMPRESSION, Test routine no. 5 (analog only).
DATA DEVIATION, Test routine no. 32 (wideband only, if enabled).
RX SINAD, Test routine no. 6 (analog only).
RX SENSITIVITY, Test routine no. 7 (analog only).
RX EXPANSION, Test routine no. 8 (analog only).
RMS VECTOR ERROR, Test routine no. 35 (digital only).
BER REPORT, Test routine no. 29 (digital only).
DIGITAL RSSI, Test routine no. 38 (digital only).
FIRST 10 SYMBOLS, Test routine no. 35 (digital only).
ORIGIN OFFSET, Test routine no. 35 (digital only).

After the above have been repeated as necessary -

CLEAR FROM CELL, Test routine no. 26.
DC POWER, Test routine no. 9.
DIGITAL BER, Test routine no. 36 (digital only, if enabled).
Print summary.

Non-system specific test routines

Test routine no. 1	Transmitter RF power (TX POWER)
Reference power	10 mW to 100 W, 10 to 44 dBm or -20 to 14 dBW. Default 3 W.
Maximum error	0 to 100%, 0 to 30 dB, 10 mW to 100 W, 10 to 44 dBm or -20 to 14 dBW. Default 2 dB.
Test routine no. 2	Transmitter RF frequency (TX FREQUENCY)
Reference frequency	1.5 to 1000 MHz.
Maximum error	0 to 100%, 0 to 1000 ppm or 0 to 100 MHz. Default 2.2 kHz (analog except N-AMPS narrowband), 0.9 kHz (N-AMPS narrowband) or 200 Hz (D-AMPS digital).
Test routine no. 3	Transmitter distortion (TX DISTORTION), transmitter SINAD (TX SINAD), transmitter SINAD (TX DISTORTION), transmitter S/N (TX S/N) or transmitter residual noise (TX NOISE)
	(Not applicable to D-AMPS digital channels.)
Test type	Distortion, SINAD (titled SINAD or DISTORTION) or S/N. Default SINAD (titled DISTORTION).
Filtration	0.3 to 3.4 kHz, 15 kHz LP or 300 Hz LP. Default 0.3 to 3.4 kHz.
Distortion upper limit	0 to 30%.
SINAD lower limit	0 to 50 dB. Default 26 dB.
S/N lower limit	0 to 50 dB.
Residual noise upper limit	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad.
Modulation level	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad. Default 8.0 kHz (except N-AMPS narrowband) or 1.5 kHz (N-AMPS narrowband).

GENERAL INFORMATION

Test routine no. 4	Transmitter modulation limiting (TX LIMITING)
	(Not applicable to D-AMPS digital channels.)
Upper limit	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad. Default 12.0 kHz (except N-AMPS narrowband) or 5.0 kHz (N-AMPS narrowband).
Overload factor	0 to 30 dB. Default 20 dB.
Modulation level	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad. Default 8.0 kHz (except N-AMPS narrowband) or 3.0 kHz (N-AMPS narrowband).
Test routine no. 5	Transmitter modulation compression (TX COMPRESSION)
	(Not applicable to D-AMPS digital channels.)
Reference compression ratio	0 to 10. Default 2.
Maximum error	0 to 100% or 0 to 10. Default 10%.
Modulation level	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad. Default 2.9 kHz (except N-AMPS narrowband) or 1.5 kHz (N-AMPS narrowband).
Test routine no. 6	Receiver AF distortion (RX DISTORTION), receiver SINAD (RX SINAD), receiver SINAD (RX DISTORTION) or receiver S/N (RX S/N)
	(Not applicable to D-AMPS digital channels.)
Test type	Distortion, SINAD (titled SINAD or DISTORTION) or S/N. Default SINAD (titled DISTORTION).
Filtration	0.3 to 3.4 kHz, 15 kHz LP or psophometric C-message weighting. Default psophometric C-message.
Distortion upper limit	0 to 30%.
SINAD lower limit	0 to 50 dB. Default 26 dB.
S/N lower limit	0 to 50 dB.

GENERAL INFORMATION

RF level	0.023 to 22 μ V or -140 to -80 dBm. Default -80 dBm.
Modulation level	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad. Default 8.0 kHz (except N-AMPS narrowband) or 1.5 kHz (N-AMPS narrowband).
Test routine no. 7	Receiver sensitivity (RX SENSITIVITY) (Not applicable to D-AMPS digital channels.)
Filtration	0.3 to 3.4 kHz, 15 kHz LP or psophometric C-message weighting. Default psophometric C-message.
RF level upper limit	0.023 to 22 μ V or -140 to -80 dBm. Default -116 dBm.
SINAD	0 to 50 dB. Default 12dB.
Modulation level	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad. Default 8.0 kHz (except N-AMPS narrowband) or 3.0 kHz (N-AMPS narrowband).
Test routine no. 8	Receiver demodulation expansion (RX EXPANSION) (Not applicable to D-AMPS digital channels.)
Referencer expansion ratio	0 to 10. Default 2.
Maximum error	0 to 100% or 0 to 10. Default 10%.
Modulation level	100 Hz to 25 kHz, 1 to 70% or 0.1 to 10 rad. Default 2.9 kHz (except N-AMPS narrowband) or 1.5 kHz (N-AMPS narrowband).
Test routine no. 9	DC power consumption (DC POWER)
Upper limit	100 mW to 200 W. Default 100 W.
Lower limit	100 mW to 200 W. Default 200 mW.
Test routines nos. 10 to 19	(Not implemented.)

GENERAL INFORMATION

System specific test routines

Test routine no. 20	Registration of mobile on control channel (REGISTRATION)
RF generator level	-50 (D-AMPS only), -40 (except D-AMPS), -60 or -80 dBm. Default -50 (D-AMPS only) or -40 (except D-AMPS).
Test routine no. 21	Call from cell to mobile (CALL CELL TO MS)
Control port user output	Request mobile to answer call and reset to 0 when call is answered (output 4).
RF generator level	-50 (D-AMPS only), -40 (except D-AMPS), -60 or -80 dBm. Default -50 (D-AMPS only) or -40 (except D-AMPS) dBm.
Initial channel	Wide, narrow, below or above (N-AMPS) or analog, digital 1 + 4, digital 2 + 5 or digital 3 + 6 (D-AMPS). Default wide (N-AMPS) or analog (D-AMPS).
Time alignment (D-AMPS digital channels)	0 to 31 for half symbol increments from 45 to 60.5. Default 0 for 45 symbols (standard offset reference).
Test routine no. 22	Call from mobile to cell (CALL MS TO CELL)
Control port user output	Instruct mobile to make call and reset to 0 when call is made (output 2).
RF generator level	-50 (D-AMPS only), -40 (except D-AMPS), -60 or -80 dBm. Default -50 (D-AMPS only) or -40 (except D-AMPS) dBm.
Initial channel	Wide, narrow, below or above (N-AMPS) or analog, digital 1 + 4, digital 2 + 5 or digital 3 + 6 (D-AMPS). Default wide (N-AMPS) or analog (D-AMPS).
Time alignment (D-AMPS digital channels)	0 to 31 for half symbol increments from 45 to 60.5. Default 0 for 45 symbols (standard offset reference).

Test routine no. 23	Handoff from current to chosen voice/traffic channel (HANDOFF)
SCC, DSCC or DVCC	No change or incremented at handoff. Default incremented.
Handoff channel	Wide, narrow, below or above (N-AMPS) or analog, digital 1 + 4, digital 2 + 5 or digital 3 + 6 (D-AMPS). Default wide (N-AMPS) or analog (D-AMPS).
Time alignment (D-AMPS digital channels)	0 to 31 for half symbol increments from 45 to 60.5. Default 0 for 45 symbols (standard offset reference).
Test routine no. 24	Automatic handoffs from first to last voice/traffic channels (AUTO HANDOFF)
SCC, DSCC or DVCC	No change or incremented at handoff. Default incremented.
Handoff channel	Wide, narrow, below or above (N-AMPS) or analog, digital 1 + 4, digital 2 + 5 or digital 3 + 6 (D-AMPS). Default wide (N-AMPS) or analog (D-AMPS).
Time alignment (D-AMPS digital channels)	0 to 31 for half symbol increments from 45 to 60.5. Default 0 for 45 symbols (standard offset reference).
Test routine no. 25	SAT, DSAT or DVCC transponding (SAT (or DSAT or DVCC) TRANSPONDING or SAT (or DSAT) DEVIATION or SAT FREQUENCY)
Test type	(Except D-AMPS digital channels.) Transponding only, transponding and deviation or transponding and frequency. Default transponding and deviation.
Reference deviation	2.0 kHz SAT or 700 Hz (DSAT).
SAT reference frequency	As SAT colour code (i.e. 0 = 5.970 kHz, 1 = 6.000 kHz and 2 = 6.030 kHz).
Devaition or frequency maximum error	Default 20%.
Test routine no. 26	Clearing down from cell (CLEAR FROM CELL)

GENERAL INFORMATION

Test routine no. 27	Clearing down from mobile (CLEAR FROM MS)
Control port user output	Request mobile to clear down and et to 0 when call is cleared (output 3).
Test routine no. 28	Transmitter RF power (TX POWER)
Power level	0 to 7 (analog channels) or 0 to 10 (D-AMPS digital channels). (See under 'General AMPS system information'.)
Upper limit	Default +2 dB.
Lower limit	Default -4 dB.
Test routine no. 29 - Analog	Data performance (ANALOG BER)
Lower limit	0 to 100% of audit orders confirmed by mobile. Default 95%.
RF generator level	-141 to -80 dBm. Default -113 dBm.
Test routine no. 29 - Digital	BER reporting (BER REPORT)
Introduced bit errors	0 to 40 bits in error per time slot (260 bits). Default 0. Equivalent to 0 to 15% BER.
RF generator level	-120 to -50 dBm. Default -60 dBm.
BER report upper limit	0 to 7. Default 0.
BER report lower limit	0 to 7. Default 0.
Test routine no. 30	DTMF tones (DTMF TONES)
Summary line	Printing and scrolling disabled or enabled when test routine is disabled. Default enabled.
Test routine no. 31	Hook flash (HOOK FLASH)
Summary line	Printing and scrolling disabled or enabled when test routine is disabled. Default enabled.
Test routine no. 32	Data deviation (DATA DEVIATION)
	(Not applicable to N-AMPS narrowband or D-AMPS digital channels.)
Nominal deviation	8.0 kHz.
Maximum error	0 to 100% or 0 to 8 kHz. Default 10%.

Test routine no. 33	ST deviation (ST DEVIATION)
	(Not applicable to N-AMPS narrowband or D-AMPS digital channels.)
Nominal deviation	8.0 kHz.
Maximum error	0 to 100% or 0 to 8 kHz. Default 10%.
Test routine no. 34	ST duration (ST DURATION)
	(Not applicable to N-AMPS narrowband or D-AMPS digital channels.)
Nominal duration	Dependent on preceding tests. 50 ms for Handoff. 400 ms for Hook flash. 1.8 s for a Clear down.
Maximum error	0 to 100% or 0 to 10 s. Default 10%.
Test routine no. 35	Digital modulation error (RMS VECTOR ERROR, FIRST 10 SYMBOLS, ORIGIN OFFSET or BURST ENVELOPE)
	(Applicable only to D-AMPS digital channels.)
Test type	RMS vector error, first 10 symbols origin offset or burst envelope. Default RMS vector error.
RMS vector error upper limit	0 to 40% or 0.4. Default 12.5%.
First 10 symbols upper limit	0 to 40% or 0.4.
Origin offset upper limit	-50 to -10 dB.
Test routine no. 36	Digital RF sensitivity (DIGITAL BER)
	(Applicable only to D-AMPS digital channels.)
Data	Pseudo-random inserted in the data field after convolutional coding but before interleaving.
Multi-path simulation	2-ray equal amplitude non-faded signal, 1 symbol delay (41.15 μ s).
Upper limit	0 to 40%. Default 3%.
RF generator level	-120 to -50 dBm. Default -110 dBm.

GENERAL INFORMATION

Test routine no. 37	Digital speech loopback quality (SPEECH LOOPBACK) (Applicable only to D-AMPS digital channels.)
Speech delay	2 s.
Timeout	5 or 20 s. Default 20 s.
Test routine no. 38	Digital RSSI (DIGITAL RSSI) (Applicable only to D-AMPS digital channels.)
RSSI report channel	Current digital traffic channel or another channel in the range 1 to 1023.
RF level for RSSI channel	120 to -50 dBm. Default current digital traffic channel for 2955 A/B/R) Default -100 dBm. -120 to -80 dBm (for 2955 if report channel is not current traffic channel).
Upper limit	0 to 31. Default 9.
Lower limit	0 to 31. Default 3.
RF level for current traffic channel if not RSSI channel	-120 to -50 dBm. Default -60 dBm.
Test routine no. 39	(Not implemented.)

Manual test operation

Channel selection	1 to 1023. (Channels 800 to 990 are mapped below channel 991.)
Channel type	Wide, narrow, below or above (N-AMPS) or analog, digital 1 + 4, digital 2 + 5 or digital 3 + 6 (D-AMPS). Default wide (N-AMPS) or analog (D-AMPS).
SAT frequency setting	3 to 8 kHz. (Hardware resolution 5 Hz.)
SAT level	0 to 2.5 kHz. (Hardware resolution nominally 12 Hz.)
DSAT and DST level	0 to 1.0 kHz. (Hardware resolution nominally 5 Hz.)
Data level	0 to 10 kHz. (Hardware resolution nominally 47 Hz.)
DSAT data (DSCC) selection	0 to 6.

DVCC	1 to 255 (D-AMPS digital channels only). Default 15
Time alignment	0 to 31 (D-AMPS digital channels only). Default 0.
RF generator level	-120 to -50 dBm (D-AMPS analog and digital channels only). Default -80 dBm.
Non-conversation operating modes	DATA OFF, SIGNAL TONE, DOTTING, FCC, REGISTRATION, PAGE MOBILE, PLACE CALL, DIRECTED RETRY, NEW ACCESS CHANNEL, OVERLOAD CLASS and RF SENSITIVITY (D-AMPS digital channels only).
Conversation operating modes	CONVERSATION, HANDOFF, POWER LEVEL, RSSI REPORT (D-AMPS digital channels only), BER REPORT (D-AMPS digital channels only) and CLEAR DOWN.
Audio paths for use with 2955 mode	RX (AF input), RX x20 (AF input amplified with a gain of 20) and TX (demodulated signal from Adapter).
SAT, DSAT or DST measurement	Deviation is measured while SAT, DSAT or DST is being displayed. Otherwise, the reading is frozen. Update rate is every 6 seconds if DC voltage is >1 V. Otherwise, it is every 2 seconds.
ST or DST indication	When a signalling tone is being received, ST or DSAT is displayed.
Sync indication	When in conversation on a D-AMPS digital channel, SYNC is displayed while data with the correct sync pattern for the current channel type is being received.
SB indication	SB is displayed while digital shortened burst data with the correct sync pattern for the current channel type is being received.
DTMF tones	Up to 16 tones are displayed. More than 16 causes the display to scroll.
DC power	DC voltage, current and calculated power indicated when the DC level is >1 V.
Digital measurements	On a D-AMPS digital channel when in conversation. Update rate is every 3 seconds.

GENERAL INFORMATION

Transmitter offset	The difference in symbols between the end of the transmit slot and the start of the sync word of the receive slot.
Transmitter RF power	The mean power in Watts during the burst between symbols 9 and 159.
Transmitter RF frequency	As defined in IS-55 section 3.3.2.1.
RMS vector error	As defined in IS-55 section 3.3.2.1.
First 10 symbols	The RMS vector error during the first 10 symbols of a burst following the ramp up.
Origin offset	As defined in IS-55 section 3.3.2.1.

PERFORMANCE DATA - DIGITAL AND RF SECTION

General

Input impedance	50 Ω nominal.
VSWR	<1.35:1.
Connector type	N socket (female).
Input power range	-15 to +35 dBm (31 μ W to 3 W).
Maximum input power	100 W.
Frequency range	824.010 to 848.970 MHz and 869.010 to 893.970 MHz in 30 kHz steps.

Transmitter measurements

RF frequency meter	
Measurement range	± 500 Hz from channel centre.
Accuracy	± 20 Hz relative to the frequency reference of 2955 series instrument.
Resolution	± 10 Hz.
Modulation type	(Applicable only to D-AMPS digital traffic channels.) Any data pattern of $\pi/4$ DQPSK ($\alpha = 0.35$) as defined in IS-54.
Measurement sample	(Applicable only to D-AMPS digital traffic channels.) 156 symbols, 6.4 ms.

RF power meter	
Measurement range	-45 to +5 dBW.
Accuracy	±0.7 dB.
Measurement sample	(Applicable only to D-AMPS digital traffic channels.) 150 symbols, 6.17 ms.
Burst timing	(Applicable only to D-AMPS digital traffic channels.)
Measurement range	±30 symbols relative to the standard offset reference. (45 symbols)
Accuracy	1/8 symbol, 5 μs.
Modulation error	(Applicable only to D-AMPS digital traffic channels.)
Modulation type	Any data pattern of $\pi/4$ DQPSK ($\alpha = 0.35$) as defined in IS-54.
Residual Error Vector	3% max.

Receiver measurements

Signal generator	
Level range	-120 to -50 dBm.
Level accuracy	±2 dB.
Level resolution	1 dB.
Frequency range	824.010 to 848.970 MHz and 869.010 to 893.970 MHz in 30 kHz steps.
Frequency accuracy	As frequency reference of 2955 series instruments.
Duplex offset	45 MHz.
Modulation generator	(Applicable only to D-AMPS digital traffic channels.)
Modulation type	$\pi/4$ DQPSK ($\alpha = 0.35$) as defined in IS-54.
RMS vector error	<3.2% unwarrented 4% max.
Multi-path simulation	2-ray equal-amplitude non-faded signal, 1 symbol delay (approximately 41.15 μs).
Channel data	Pseudo-random data or speech loopback or FACCH or pseudo-speech (noise).

GENERAL INFORMATION

PERFORMANCE DATA - GENERAL

User controls and indicators	Four colour-coded keys and LEDs as below.
2955	Selects normal 2955 operation.
CRTS	Selects cellular radio test system mode.
DISC	Selects disc menu.
PSOPH	Selects psophometric filter. Selects local when in remote.
DC power meter	
Voltage range	1 to 25 V.
Voltage accuracy	±5% ±100 mV.
Current range	0 to 10 A.
Current accuracy	±5% ±200 mA.
Power accuracy	±10% ±20 mW at 100 mW to 200 W.
AF input to AF output	As 2955 except AC coupling only and x20 amplifier for <100 mV.
External modulation input	0.5 V pk-pk for 5 kHz deviation ±10% at 1 kHz.
AF measurement de-emphasis	
Frequency response	6 dB/octave, 300 Hz to 3.4 kHz.
Insertion loss	0 dB ±1.3 dB at 1 kHz.
Psophometric (CCITT) filter	Conforms to CCITT Recommendation P53.
Frequency response	50 to 300 Hz ±2 dB. 300 to 800 Hz ±1 dB. 800 Hz ±0 dB. 800 Hz to 3 kHz ±1 dB. 3 to 3.5 kHz ±2 dB. 3.5 to 5 kHz ±3 dB.

Psophometric (C-message) filter

Frequency response	60 Hz	55.7 ±2 dB.
	100 Hz	42.5 ±2 dB.
	200 Hz	25.0 ±2 dB.
	300 Hz	16.5 ±1 dB.
	400 Hz	11.4 ±1 dB.
	500 Hz	7.5 ±1 dB.
	600 Hz	4.7 ±1 dB.
	700 Hz	2.7 ±1 dB.
	800 Hz	1.5 ±1 dB.
	900 Hz	0.6 ±1 dB.
	1 kHz	0 ±1 dB.
	1.2 kHz	0.2 ±1 dB.
	1.3 kHz	0.5 ±1 dB.
	1.5 kHz	1.0 ±1 dB.
	1.8 kHz	1.3 ±1 dB.
	2 kHz	1.3 ±1 dB.
	2.5 kHz	1.4 ±1 dB.
	2.8 kHz	1.9 ±1 dB.
	3 kHz	2.5 ±1 dB.
	3.3 kHz	5.2 ±2 dB.
	3.5 kHz	7.6 ±2 dB.
	4 kHz	14.5 ±3 dB.
	4.5 kHz	21.5 ±3 dB.
	5 kHz	28.5 ±3 dB.

SAT generation

Frequency range	3 to 8 kHz in 5 Hz steps, normally 4 or 6 kHz.
Frequency accuracy	Crystal derived, better than ±1 Hz (at SAT frequencies).
Output level accuracy	±10%, 300 Hz to 2.5 kHz at system frequencies, i.e. 3.955 to 4.045 kHz and 5.970 to 6.030 kHz.
Distortion	<3%. <2% at 4 kHz ±45 Hz. <2% at 6 kHz ±30 Hz.

SAT measurement

Accuracy	±10% at nominal system SAT frequencies and levels.
----------	--

ST measurement

Measurement accuracy	±10% at 5 to 10 kHz.
Tone duration	±10 ms at 40 ms to 5 s.

GENERAL INFORMATION

FFSK data	Phase-continuous frequency shifted tones of 1200 Hz and 1800 Hz
Generated data deviation	±10% at 1 to 4 kHz.
Bit rate	1200 baud ±1 bit/s.
Measurement deviation	±10% at 1 to 10 kHz.
FSK data (wideband)	Manchester encoded NRZ.
Generated data deviation	±10% at 1 to 10 kHz.
Bit rate	±1 bit/s at 8 or 10 kHz.
Measurement deviation	±10% at 1 to 10 kHz.
DTMF tone generation	
Frequency accuracy	±1 Hz at DTMF frequencies.
Deviation	±10% for 1 to 5 kHz high tone. Low tone = high tone ±2 dB.
Distortion	<3% (individual tones).
Digital SAT and ST generation	Sub-audible FSK data, Manchester encoded and bandwidth limited.
Data rate	200 bit/s.
Data rate accuracy	±0.01 bit/s.
Deviation range	0 to 1 kHz.
Deviation accuracy	±10% at 700 Hz.
Digital SAT and ST measurement	Sub-audible FSK data, Manchester encoded and bandwidth limited.
Deviation accuracy	±10% at nominal system level (700 Hz).
Control interfaces	
GPIB (IEEE 488)	For printing, for remote instrument control and for the programming of user-defined test sequences.
Capability	Complies with the following subsets as defined in IEEE 488:- SH1, AH1, T5, TEO, L4, LEO, SR1, RL1, PPO, DC1, DT1, CO, E1.
Serial (RS-232)	For remote instrument control and for the programming of user-defined test sequences.

Connector	9-way D socket (female).
Modem control	Provision is made for modem set-up messages.
Parallel	Standard parallel printer protocol for results printing and control port with four TTL compatible outputs and four TTL compatible inputs.
Connector	25-way D socket (female).
Test	For connection to a mobile test interface adapter to enable special test features within the radio as specified in EIA/TIA IS-55.
Connector	15-way D socket (female).
Disc interface	
Connector	25-way D plug (male).
Frequency standard	
Internal	As 2955 series instrument.
Frequency	10 MHz.
Temperature stability	<5 parts in 10^8 , 5 to 55°C.
Ageing rate	<2 parts in 10^7 per year.
Warm-up time	<10 minutes for <2 parts in 10^7 at 20°C.
External	As 2955 series instrument.
Frequency	1 MHz.
Power requirements, AC	
Supply voltage	94 to 132 V and 190 to 264 V.
Supply frequency	45 to 440 Hz.
Maximum power	30 VA.
Power requirements, DC	
Supply voltage	11 to 32 V.
Maximum power	25 W.
Electro-magnetic compatibility	Conforms to the requirements of EEC Directive 76/889 as to limits of RF interference.

GENERAL INFORMATION

Safety Complies with IEC 348.

Environmental

Rated range of use 0 to 55°C and up to 95% relative humidity at 40°C.

Conditions of storage and transport

Temperature -40 to +70°C.

Altitude Up to 2500 m (pressurized freight at 27 kPa differential (3.9 lbf/ in²).

MTBF >5000 hours.

Dimensions and Weight

Including handle, feet and cover

Height	231 mm (9.1 in)
Width	345 mm (13.6 in)
Depth	490 mm (19.3 in)
Weight	20.0 kg (44 lb)

ACCESSORIES

Supplied

	Part no.
Operating Manual	46882-135W
Fixing Kit and Cable Assemblies	46884-621S
Front Stowage Cover	37591-628E

Optional

Service Manual, 2957D and 2960D Adapter	46882-140T
Service Manual, 2955A and 2955R	46881-954A
Service Manual, 2955B	46882-114B
DC Power Supply Cable Kit	46883-907V
Cable Assembly, GPIB	46883-962H
Cable Adapter, GPIB, IEEE to IEC	46883-408K
Cable Assembly, Parallel to Printer Centronics socket	43130-592K
Cable Assembly, Serial to Printer 25-way D socket	43138-369A
Cable Assembly, Serial to Computer 25-way D plug	43138-207U
Cable Assembly, Serial to Computer 9-way D plug	43138-206E
Cable Assembly, to Disc 37-way D socket	43138-370B
Cable Assembly, to TIA 25-way D socket	43138-208Y
Cable Assembly, N plug and TNC plug	43130-596E
PATSIE Custom Test Software Package	44991-064D
PMRTEST Custom Test Software Package	44991-129S
Hard Transit Case	46662-192W
Soft Case	46662-426J

Chapter 2

INSTALLATION

VENTILATION

If the 2957D or 2960D has a cover, this should be removed before the instrument is connected to the power supply. The instrument is air-cooled through vents with fan assistance. Air is drawn over the heat-producing elements and is expelled by the fan through the vents.

Do not obstruct the air vents while the instrument is in use. Avoid standing the instrument on or close to other equipment which is hot.

TEST SET INTERCONNECTIONS

If the instrument received is a complete Radio Test System 2957D or 2960D, it only requires connection to the power supply and the peripherals to be fully operational.

Note

On the 2955's GPIB interface unit, check that the 2 and 4 switches are set on (not OPEN) to give an address of 6 (or any other address in the range 1 to 30) and that the TALK ONLY switch is set to OPEN. See Fig. 2-3.

If the instrument received is an Adapter for converting an existing Radio Communications Test Set 2955 series to a Radio Test System 2957D or 2960D, follow the procedure below. First, make sure that the 2955 is fitted with a GPIB interface unit.

Converting a 2955 to a 2957D or 2960D

The 2957D or 2960D consists of an Adapter and a 2955 which are assembled together. See Fig. 2-1 and Fig. 2-2. Proceed as follows:-

- (1) Unpack the Multi-system Adapter and check that the accompanying Fixing Kit (part no. 46884-621S) contains the items given in Table 2-1. If any part is missing, contact your nearest Marconi Instruments representative. (For the address, see the rear cover).
- (2) Turn the 2955 upside down and lever off the caps covering the screws which hold the feet in place. Save the caps.
- (3) Unscrew and remove the 4 feet. Save the screws.
- (4) Insert the 4 clips (items 5 and 6) in the slots in the positions formerly occupied by the feet. The clips are handed. Lay them flat and positioned so that the screw holes in the clips line up with the screw holes in the 2955's bottom cover.

TABLE 2-1 FIXING KIT CONTENTS

Item	Description	Part no.	Quantity
1	Cable Assembly, BNC connectors, 0.13 m	43130-498L	2
2	Cable Assembly, BNC connectors, 0.26 m	43130-499J	1
3	Cable Assembly, AC power supply	43137-364J	1
4	Pillar assembly	41700-616V	4
5	Clip (right-hand)	35905-447D	2
6	Clip (left-hand)	35905-448T	2
7	Rear support bar	41700-639Y	2
8	Screw pan head M4 x 8	21837-459D	2
9	Screw pan head M4 x 12	21837-463T	2
10	Crinkle washer M4	21177-650H	4
11	Cable Assembly, RF, N plugs	43137-999K	1

- (5) In place of the 4 feet, screw in the 4 pillar assemblies (item 4).
- (6) With the 2955 upside down, position the Adapter, also upside down, over it so that the pillars on the 2955 enter the 4 cutouts in the Adapter without trapping any of the cables. At this point, both instruments should line up all the way round.
- (7) Screw the 4 feet into the ends of the pillar assemblies and replace the caps.
- (8) On the 2955, remove the 2 screws which retain the rear cover. Discard the screws.
- (9) Hook the curved ends of the 2 rear support bars into the slots in the 2955's upper 2 rear feet.
- (10) Screw the other ends of the bars into the Adapter's rear casting using the 2 shorter M4 screws (item 8) with washers (item 10).
- (11) Insert the 2 longer screws (item 9) with washers (item 10) through the rear support bars (using the inside holes) into the rear cover screw holes.
- (12) Finally, check that both instruments are securely held together. This completes the mechanical connection.
- (13) Connect the Adapter's MOD OUT socket to the 2955's EXT MOD INPUT socket and the Adapter's AF OUT socket to the 2955's AF INPUT socket using the 0.13 m coaxial Cable Assemblies (item 1).
- (14) Connect the Adapter's IF IN socket to the 2955's IF OUT socket using the 0.26 m coaxial Cable Assemblies (item 2).
- (15) Connect the Adapter's RF LINK TO TEST SET socket to the 2955's RF IN/OUT N socket using the N to N Cable Assembly (item 11).
- (16) Connect the Adapter's AC SUPPLY OUT socket to the 2955's AC SUPPLY socket using the AC power supply Cable Assembly (item 3).

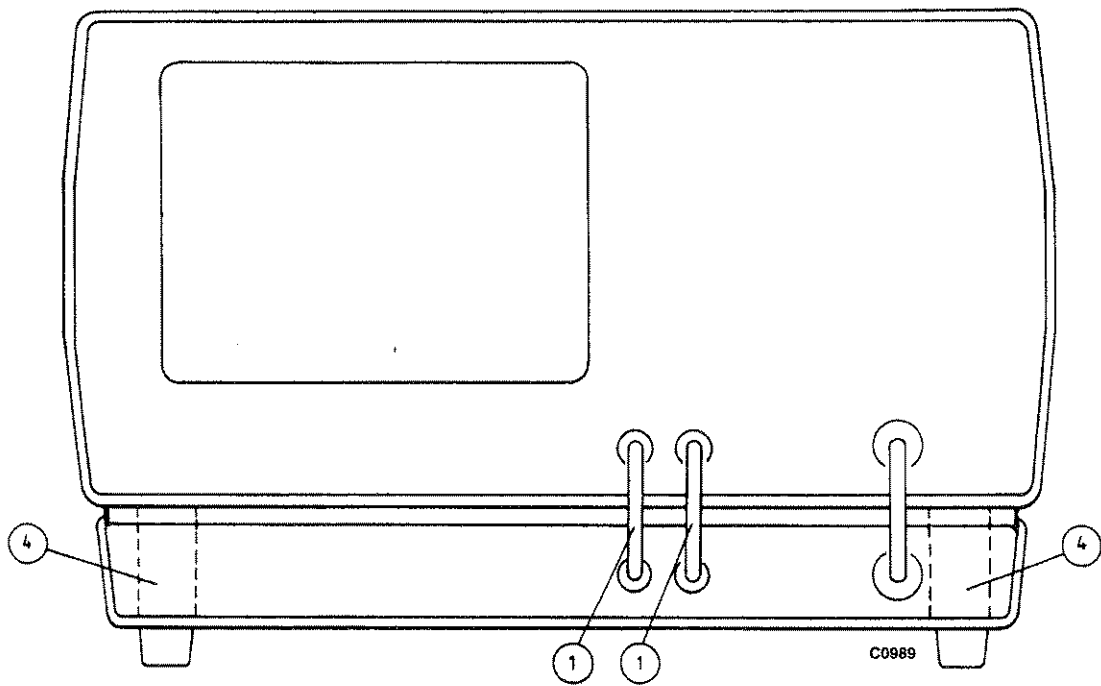


Fig. 2-1 Front view showing electrical and mechanical connections (item numbers as given in Table 2-1)

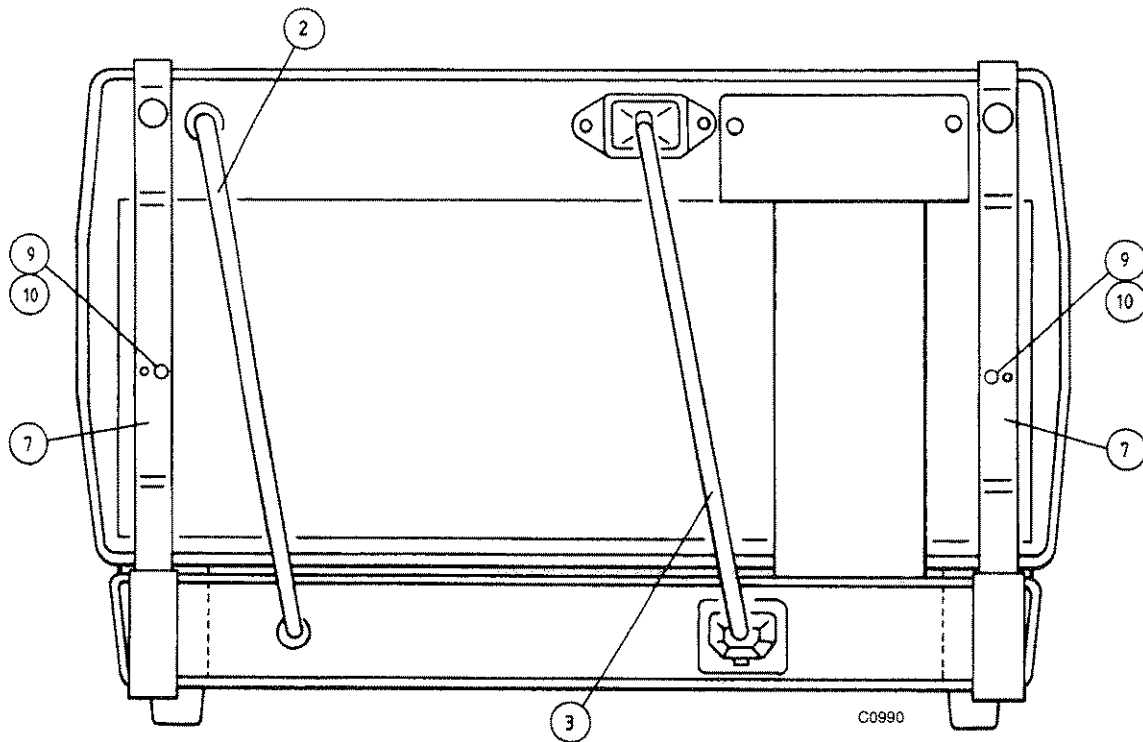


Fig. 2-2 Rear view showing electrical and mechanical connections (item numbers as given in Table 2-1)

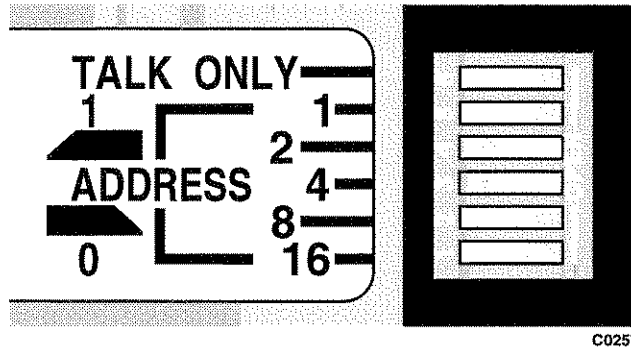


Fig. 2-3 Switches on the 2955's GPIB interface unit set to address 6 (2 + 4) and not to TALK ONLY

- (17) Connect the Adapter's internal GPIB ribbon cable to the 2955's GPIB connector and fasten it using the lock screws provided.
- (18) On the 2955's GPIB interface unit, set the 2 and 4 switches to on (not OPEN) to give an address of 6 (or set any other address in the range 1 to 30). Set the TALK ONLY switch to OPEN. See Fig. 2-3.
- (19) Finally, switch on both the Adapter and the 2955 after ensuring that both voltage selectors are set to the correct range with correct fuses fitted. Check that the GPIB address is correct. Press the CRTS key and check that the self test sequence commences.

POWER REQUIREMENTS

AC power supply

The 2955 and the Adapter each require 105 to 120 V or 210 to 240 V AC, 50 to 400 Hz. For the Adapter, the required supply fuses (time lag) are 500 mA for 105 to 120 V or 250 mA for 210 to 240 V.

Before switching on, ensure that the rear panel voltage range switches are in their correct positions as revealed by the cut-outs in the locking plates and that the correct value fuses are fitted. To change a voltage setting, reverse the locking plate after setting the slide switch to its alternative position.

Ensure that the Adapter and the 2955 are both set to the same voltage Oorange and that the Cable Assembly is fitted between the Adapter's AC SUPPLY OUT and the 2955's AC SUPPLY connectors.

The Cable Assembly is fitted at one end with a female plug which mates with the AC connector at the rear of the Adapter.

For fitting a supply plug, the core colours are as follows:-

- Ground - Green and yellow
- Neutral - Blue
- Live (phase) - Brown

When attaching the Cable Assembly to a non-soldered plug, it is recommended that the tinned ends of the conductors are first cut off to avoid the danger of cold flowing of any solder which could result in intermittent connections.

DC power supply

Connect ±11 to 32 V to the left-hand red (live) and black (chassis) terminals on the rear.

GPIB PORTS

Internal

On the Adapter, there is an internal GPIB ribbon cable which is connected to the 2955's GPIB port.

External

On the rear panel of the Adapter, there is a 24-way IEEE 488.1 socket which is used to connect to other equipment. See Fig. 2-4.

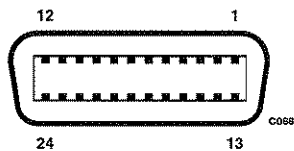


Fig. 2-4 GPIB socket contacts (from the front)

The functions of the socket contacts are as follows:-

Contact	Function	Contact	Function
1	Data I/O 1	13	Data I/O 5
2	Data I/O 2	14	Data I/O 6
3	Data I/O 3	15	Data I/O 7
4	Data I/O 4	16	Data I/O 8
5	EOI	17	REN
6	DAV	18	Pair with 6
7	NRFD	19	Pair with 7
8	NDAC	20	Pair with 8
9	IFC	21	Pair with 9
10	SRQ	22	Pair with 10
11	ATN	23	Pair with 11
12	Ground shield	24	Logic ground

INSTALLATION

For connection to other equipment which has a 24-way IEEE 488.1 socket, there is a GPIB Cable Assembly (part no. 43139-189U) which is available as an optional accessory.

Where conformity with the radio frequency limits specified by VDE (Verband Deutscher Electrotechniker) is required, there is a double-screened Cable Assembly (part no. 46883-962H) which is available as an optional accessory.

The cable assemblies have male-female connectors at both ends. This allows several connectors to be stacked on top of one another and secured by lockscrews.

CAUTION There could be damage with too large a stack.

For connection to other equipment (or another cable assembly) which has a 25-way IEC 625 plug, there is an IEEE to IEC Adapter (part no. 46883-408K) which is available as an optional accessory. See Fig. 2-5.

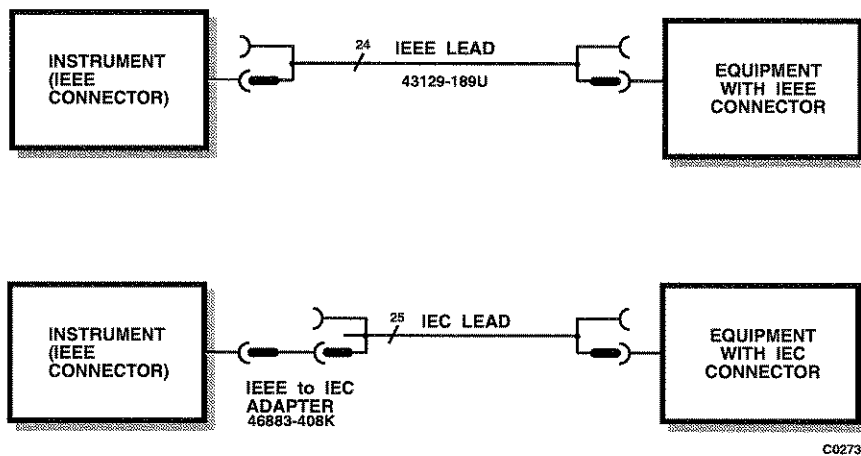


Fig. 2-5 GPIB interconnections

PARALLEL CONTROL PORT

This has a 37-way D socket which is mounted on the right-hand side panel. See Fig. 2-6.

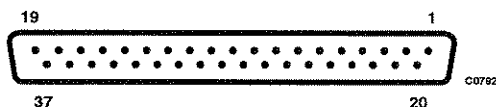


Fig. 2-6 Parallel control port socket contacts (from the front)

The functions of the socket contacts are as follows:-

Contact	Function	Contact	Function
1	+5 V out	20	Ground
2	Latch in 2	21	Latch in 1
3	Latch in 4	22	Latch in 3
4	Unused	23	Unused
5	I/O control strobe (L)	24	Unused
6	Data 7	25	Data 8
7	Latch out 2	26	Data 6
8	Latch out 3	27	Ground
9	Data 5	28	Latch out 1
10	Data 3	29	Data 4
11	Data 1	30	Data 2
12	I/O control ACK (L)	31	I/O control
13	Latch out 4	32	I/O control
14	Ground	33	Ground
15	Ground	34	Ground
16	Unused	35	Unused
17	Latch out 5	36	Latch out 6
18	Latch out 7	37	Latch out 8
19	Unused		

For connection to other equipment which has a Centronics socket, there is a Printer Cable Assembly (part no. 43130-592K) which is available as an optional accessory. This has a Centronics plug. See Fig. 2-7.

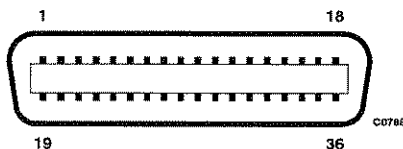


Fig. 2-7 Printer Cable Assembly plug contacts (from the front)

On the Printer Cable Assembly, the functions of the Centronics plug contacts are as follows:-

Contact	Function	Contact	Function
1	Strobe L	7	Data 6
2	Data 1	8	Data 7
3	Data 2	9	Data 8
4	Data 3	10	ACK L
5	Data 4	17	Chassis
6	Data 5	19 to 26	Ground

INSTALLATION

SERIAL PORT

This has a 9-way D socket which is mounted on the right-hand side panel. See Fig. 2-8.

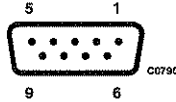


Fig. 2-8 Serial port socket contacts (from the front)

The functions of the socket contacts are as follows:-

Contact	Function	Contact	Function
1	DCD	6	DSR
2	Rx data in	7	RTS
3	Tx data out	8	CTS
4	DTR	9	RI
5	Ground		

For connection to other equipment (or another cable assembly) which has a 25-way D socket, there is a Printer Cable Assembly (part no. 43138-369A) which is available as an optional accessory. This has a 25-way D plug. See Fig 2-9.

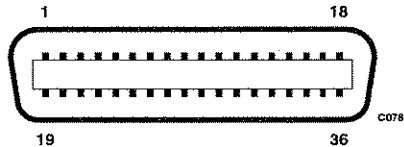


Fig. 2-9 Printer Cable Assembly plug contacts (from the front)

On the Printer Cable Assembly, the functions of the 25-way D plug contacts are as follows:-

Contact	Purpose	Contact	Purpose
2	RX	5	CTS
3	TX	7	Ground
4	RTS		

For connection to other equipment which has a 25-way D plug, there is a Computer Cable Assembly (part no. 43138-207U) which is available as an optional accessory. This has a 25-way D socket. See Fig. 2-10.

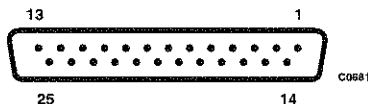


Fig. 2-10 Computer Cable Assembly socket contacts (from the front)

On the Computer Cable Assembly, the functions of the 25-way D socket contacts are as follows:-

Contact	Purpose
2	TX
3	RX
7	Ground

For connection to other equipment which has a 9-way D plug, there is a Computer Cable Assembly (part no. 43138-206E) which is available as an optional accessory. This has a 9-way D socket. See Fig. 2-11.

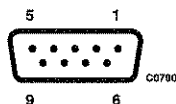


Fig. 2-11 Computer Cable Assembly socket contacts (from the front)

On the Computer Cable Assembly, the functions of the 9-way D socket contacts are as follows:-

Contact	Purpose
2	RX
3	TX
5	Ground

DISC INTERFACE PORT

This has a 25-way D socket which is mounted on the right-hand side panel. See Fig. 2-12.

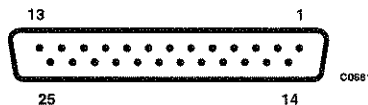


Fig. 2-12 Disc interface socket contacts (from the front)

INSTALLATION

The functions of the socket contacts are as follows:-

Contact	Function	Contact	Function
1	Index	14	Ground
2	Ground	15	Write data
3	DS0	16	Ground
4	Ground	17	Write gate
5	DS1	18	Ground
6	Ground	19	Track 00
7	Unused	20	Ground
8	Ground	21	Write protect
9	Motor on	22	Ground
10	Ground	23	Read data
11	Direction	24	Ground
12	Ground	25	Side select
13	Step		

For connection to other equipment which has 37-way D socket, there is a Disc Cable Assembly (part no. 43138-370B) which is available as an optional accessory. This has a 37-way D plug.

TEST INTERFACE ADAPTER PORT

This has a 15-way D socket which is mounted on the right-hand side panel. See Fig. 2-13.

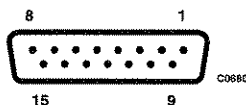


Fig. 2-13 Test port socket contacts (from the front)

The functions of the socket contacts are as follows:-

Contact	Function	Contact	Function
1	Shield	9	RI
2	Tx data out	10	+10 V (≤ 100 mA)
3	Rx data in	11	Audio out
4	RTS	12	A ground
5	CTS	13	A ground
6	DSR	14	Audio in
7	D ground	15	DTR
8	DCD		

For connection to other equipment which has a 25-way D socket, there is a TIA Cable Assembly (part no. 43138-208Y) which is available as an optional accessory. This has a 25-way D plug.

Chapter 3-0

INTRODUCTION TO OPERATION

CHAPTERS

Local operation is covered in two chapters as follows:-

- (a) Chapter 3-0. This introductory chapter.
- (b) Chapter 3-1. This covers local operation by using the controls on the 2955 and on the Adapter.

Chapter 4 covers remote control using the GPIB interface port or the RS-232 serial interface port. Chap. 4-0 to Chap. 4-6 cover programming for remote control and to enable the user to define his own test sequences and to define parameters in test routines for local control.

INTERCONNECTIONS

Start by connecting the radio under test to the 2957D or 2960D as described on page 3-1-11.

STARTING

When you switch on, the normal RECEIVER TEST display appears. See Fig. 3-6. Press the CRTS key on the Adapter. Initializing and self testing take place as shown on the display. See Fig. 3-7. When this is completed, the main top level menu appears. See Fig. 3-8.

Press the FULL AUTO TEST key. The FULL AUTO TEST intermediate display appears. See Fig. 3-10. If the parameters which are shown on this display exactly match the needs of your radio, you can carry on by pressing the START TEST key.

These top level menus and options are summarized in Table 3-1.

Note

When testing a digital radio, unless an external 1 MHz standard is in use, it is recommended that 5 minutes warm-up time be allowed for the internal frequency standard to stabilize.

CHANGING FORMAT

If the system parameters do not match the radio under test, press the CHANGE FORMAT soft key. The CHANGE FORMAT MENU appears. See Fig. 3-10. This leads you to a series of menus so that you can alter any of these parameters. These menus are summarized in Table 3-2.

For full details, see pages 3-1-18 to 3-1-38.

TABLE 3-1 TOP LEVEL MENUS AND OPTIONS FOR AMPS

Menu	Option	Menu	Option	Page
Main				3-1-16
	GO/NO-GO TEST			3-1-39
	FULL AUTO TEST	Intermediate		3-1-18
			START TEST	3-1-40
			CHANGE FORMAT	3-1-18
	MANUAL TEST			3-1-47

FULL AUTO TEST

When you start this test, the 2957D or 2960D automatically performs the test routines which make up a test sequence. The test sequence is built-in or user-defined and is selected from the CHANGE FORMAT MENU.

For full details, see pages 3-1-40 and 3-1-41.

GO/NO-GO TEST

This is similar to the FULL AUTO TEST but it provides only summarized results for each test routine.

For full details, see page 3-1-39.

MANUAL TEST

When you select this mode, you are given the choice of a number of manual tests which can be made. This is useful for trouble-shooting and fault-finding.

For full details, see pages 3-1-47 to 3-1-58.

TEST SEQUENCES

The FULL AUTO TEST and the GO/NO-GO TEST consist of a number of test routines which are combined into built-in or user-defined test sequences.

For full details, see pages 3-1-59 to 3-1-61.

TEST ROUTINES

Each test routine is carried out automatically. There is a choice of twenty-eight test routines which are combined in the four built-in test sequences and which are available for user-defined test sequences.

For full details, see pages 3-1-62 to 3-1-88.

TABLE 3-2 CHANGE FORMAT MENUS FOR AMPS

Menu	Option	Menu	Option	Page
SYSTEM PARAMETERS				3-1-19
	SYSTEM TYPE			3-1-20
		SYSTEM DEFINITION		3-1-22
			SYSTEM TITLE	3-1-23
			LOWEST CHANNEL	3-1-23
			HIGHEST CHANNEL	3-1-23
			TX BASE FREQUENCY	3-1-23
			DUPLEX OFFSET	3-1-24
			CHANNEL SPACING	3-1-24
			MEAN DATA DEVIATION	3-1-24
			SAT DEVIATION	3-1-24
	SYSTEM ID			3-1-21
	CONTROL CHANNEL			3-1-21
	VOICE CHANNEL			3-1-21
	HANDOFF INCREMENT			3-1-21
	SAT FREQUENCY			3-1-21
	DSCC			3-1-21
	DVCC			3-1-21
	REGID			3-1-22
	ID STEP			3-1-22
	REGINCR			3-1-22
	DCC			3-1-22
	BURST INDICATOR			3-1-22
	TDMA CHANNEL			3-1-22
MOBILE PARAMETERS				3-1-24
	MOBILE NUMBER			3-1-24
DISPLAY FORMAT				3-1-25
	DISPLAY FORMAT			3-1-25
	PAUSE			3-1-26
	NUMBER FORMAT			3-1-26
TEST SEQUENCE				3-1-26
	BRIEF TESTING			3-1-60
	COMPREHENSIVE TESTING			3-1-61
	CALL PROCESSING ONLY			3-1-59
	CALL AND RF TESTING			3-1-59
	User-defined test sequence			
	DTMF			3-1-27
	HOOK FLASH			3-1-27
PRINTER				3-1-27
	PRINTER PORT			3-1-28
	PRINT			3-1-28
	TERMINATE			3-1-28
INTERFACE				3-1-29
	SERIAL PORT PARAMETERS or TIA PORT PARAMETERS			3-1-29
	BAUD RATE			3-1-30
	LENGTH/PARITY			3-1-30
	STOP BITS			3-1-30
	GPIB ADDRESS			3-1-30
	TIA FORMAT			3-1-30

INTRODUCTION TO OPERATION

Menu	Option	Menu	Option	Page
MISCELLANEOUS				3-1-30
	DE-MOD SOURCE			3-1-31
	DISC STEP RATE			3-1-31
	PRINTER PORT COMMAND			3-1-31
	SYSTEM CONFIGURATION			3-1-31
EDIT COMMAND				3-1-34
SYSTEM PARAMETER WORD 1				3-1-35
SYSTEM PARAMETER WORD 2				3-1-37

Chapter 3-1

OPERATION

INTRODUCTION

The 2957D and 2960D are combined instruments which consist of a Radio Communications Test Set 2955 series and an Adapter.

As this chapter describes the operation of Radio Test Systems 2957D and 2960D, the operation of the 2955 is not explained except where pertinent. Full details of 2955 operation are given in the Operating Manual for the 2955.

Note

The SYSTEM CONFIGURATION default setting is 00A0H. When testing a digital mobile on D-AMPS, it is necessary to have a setting other than 0000H (e.g. 0020H, 0080H or 00A0H). See page 3-1-31.

INDICATORS, CONTROLS AND CONNECTORS

2957D and 2960D front panel

See Fig. 3-1.

- (1) SUPPLY switches. When both switches are set to ON, power is supplied through the rear panel AC SUPPLY IN connector to the Adapter, and from the AC SUPPLY OUT connector through the AC SUPPLY connector to the 2955. Note that the Adapter's SUPPLY switch does not control power to the AC SUPPLY OUT connector as it is wired directly to the AC SUPPLY IN connector.
- (2) 2955 MODE key. Selects the normal mode of operation of the 2955. During this mode, the Adapter is mainly passive. When 2955 mode is selected and the Adapter is in conversation mode and sending or generating data, the CRTS indicator LED remains on. This is to remind the user that modulation generated by the 2955 is combined with these signals. To disable these signals, press the 2955 key again. If the 2955 mode is selected when the system is in remote, on the GPIB or the RS-232 interface, any modulating signals are removed immediately to ensure a fast flow of data through the Adapter.
- (3) CRTS MODE key. Selects the Radio Test System mode of operation with the Adapter controlling the 2955. The 2957D or 2960D goes through a self test. When an Adapter is fitted to a different 2955, it goes through a series of self tests which include self calibration. When this key is pressed immediately following 2955 operation, the 2957D or 2960D returns to the menu previously selected (if permissible). It can also be used to abort a particular test sequence and to return to the top level menu at any time.
- (4) DISC MODE key. Selects a menu which permits user-defined sequences to be loaded and saved using an accessory disc drive. This key is enabled when one of the top level system menus is being displayed.

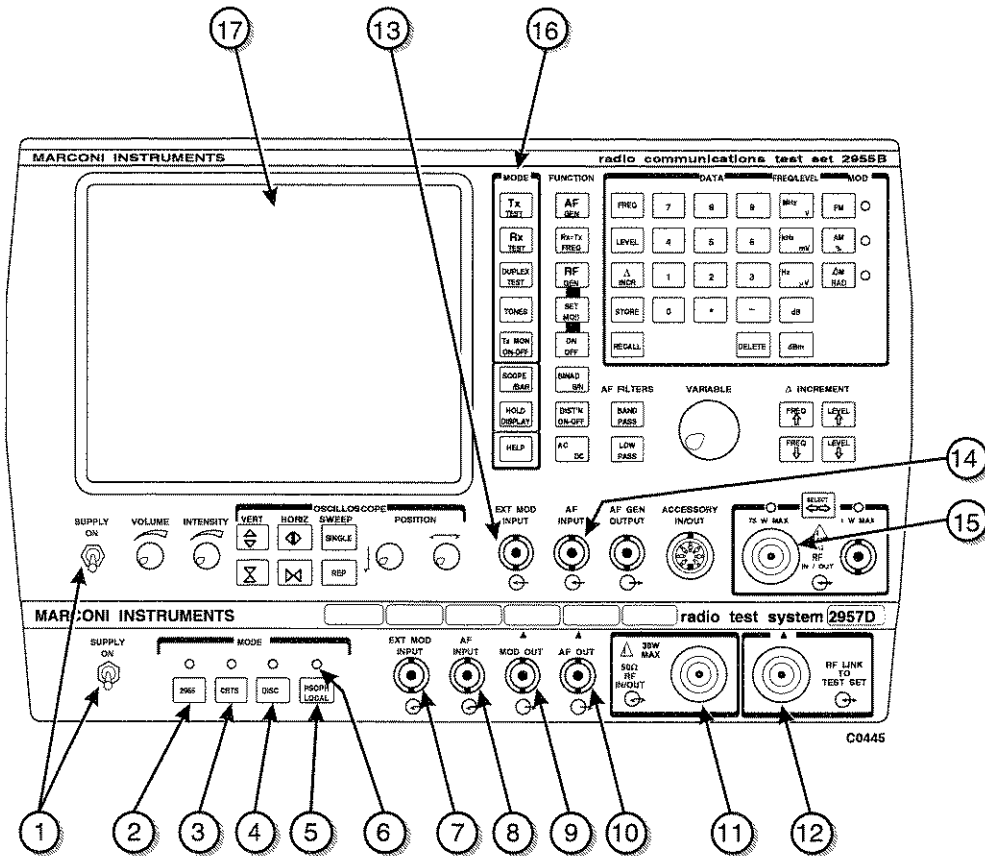


Fig. 3-1 2957D front panel

- (5) PSOPH/LOCAL MODE key. The PSOPH key function is only enabled during 2955 local operation. It toggles between removal and insertion of the psophometric filter in the AF input path. When the filter is inserted, the LED above the key is lit. The LOCAL key function is only enabled during remote operation (unless GPIB local lockout asserted). It switches control from remote to local as shown on the display.
- (6) MODE key LEDs. These light to indicate that the selected mode is enabled and functioning. One or more LEDs flashing indicates a fault condition as follows:-

LED	Fault
All	Volatile RAM fault.
2955	2955 not responding.
CRTS	ROM fault.
DISC	Non-volatile RAM fault.
PSOPH	System option ROM fault.

Flashing of the CRTS, DISC or PSOPH LED can be cancelled by pressing another of the Adapter's MODE keys. If either CRTS or DISC is then pressed and the associated LED flashes, this indicates that the 2955 is not connected or not addressable. Switch the instrument off and on again after the fault has been corrected.

- (7) EXT MOD INPUT socket. BNC socket for the application of an external modulation source when this is required for additional tones signalling. Also used for an external demodulated source when selected from the MISCELLANEOUS menu. This enables data signals to be sent to the modem in the 2957D or 2960D without being modulated on a carrier. This is useful for testing logic boards.
- (8) AF INPUT socket. BNC socket for audio signals from the mobile. The input is AC coupled.
- (9) MOD OUT socket. BNC socket for connection to the 2955's EXT MOD INPUT socket (13). Modulates the 2955 signal generator with serial data and tones.
- (10) AF OUT socket. BNC socket for connection to the 2955's AF INPUT socket (14).
- (11) RF IN/OUT socket. N socket for the RF input. 50 X impedance.
- (12) RF LINK TO TEST SET socket. N socket for connection to the 2955's RF IN/OUT socket (15).
- (13) EXT MOD INPUT socket. BNC socket for the modulating output from the Adapter's MOD OUT socket (9).
- (14) AF INPUT socket. BNC socket for the AF output from the Adapter's AF OUT socket (10).
- (15) RF IN/OUT socket. N socket for the RF signal from the Adapter's RF LINK TO TEST SET socket (12).
- (16) Soft keys. When in CRTS mode, these are used as soft keys to select a programmed function. The function is displayed on the screen alongside the activating key.
- (17) Display. Used to display the operating menus and test sequences. At times, certain of the hard keys are depicted on the screen. This indicates that these keys can be used.

2957D and 2960D rear panel

See Fig. 3-2.

- (1) DC in/out connectors. Used to connect a DC supply and for making power consumption measurements. The DC supply for the unit under test is connected to the left-hand pair of terminals. The DC output to supply the unit under test is connected to the right-hand pair of terminals. In both cases the upper, red terminal is live (+) and the lower, black terminal is connected to the chassis (-). The Adapter's DC supply comes into operation when AC is not connected or when the SUPPLY switch is not ON.
- (2) IF IN socket. BNC socket for connection from the 2955's IF OUT socket (13).

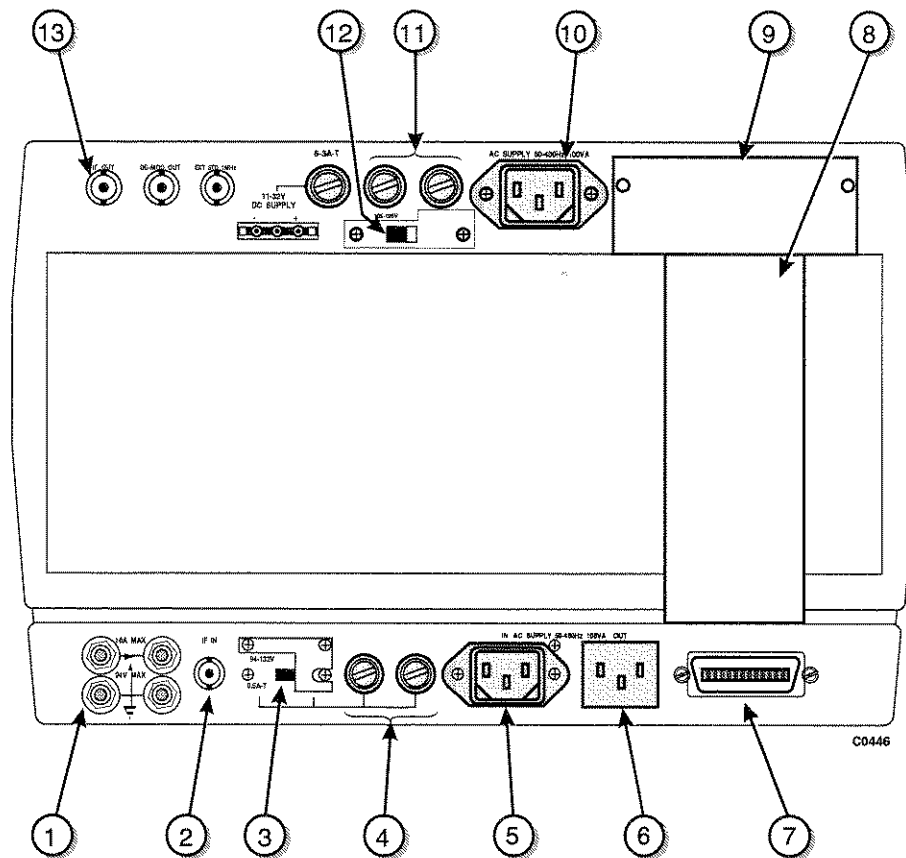


Fig. 3-2 2957D and 2960D rear panel

- (3) AC supply voltage selector. To change the Adapter's AC range. The 2955's supply voltage selector (12) has to agree with this setting.
- (4) AC supply fuses. Time delay cartridge type for fusing the Adapter.
- (5) AC SUPPLY IN connector. Supplies both the Adapter fused by (4) and the 2955 through the AC SUPPLY OUT socket (6).
- (6) AC SUPPLY OUT connector. Supplies power to the 2955's AC SUPPLY connector (10).
- (7) External GPIB connector. Enables the 2957D or 2960D to be remotely controlled using the IEEE488 (or IEC625 with an adapter) bus. Can also be used for the connection of a printer in listen only mode.
- (8) Internal GPIB cable and connector. For connection to the 2955's GPIB connector (9).
- (9) 2955 GPIB connector. For internal GPIB connector (8) which allows the Adapter to remotely control the 2955 using the IEEE488 bus.

- (10) AC SUPPLY connector. Supplied with power from the Adapter's AC SUPPLY OUT connector (6). Fused by (11).
- (11) AC supply fuses. Time delay cartridge type for fusing (10).
- (12) AC supply voltage selector. To change the range. Has to be set to agree with the setting of the Adapter's supply voltage selector (3).
- (13) IF OUT socket. BNC socket supplying a 110 ± 10 kHz IF output to the Adapter's IF IN socket (2).

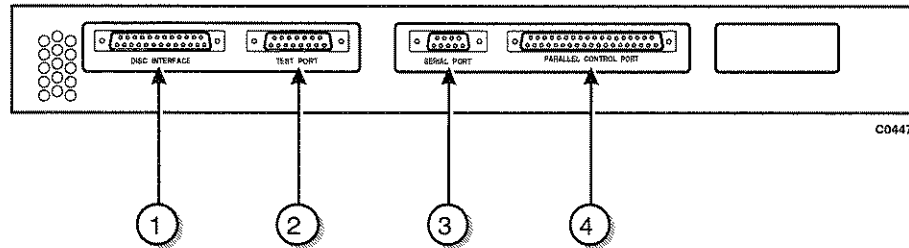


Fig. 3-3 Adapter side panel

Adapter side panel

See Fig. 3-3.

- (1) DISC INTERFACE connector. For a floppy disc drive. Enables user-defined tests to be loaded into or saved from the Adapter's non-volatile memory.
- (2) TEST PORT connector. To provide the connection to the test interface adapter in accordance with EIA/TIA IS-55.
- (3) SERIAL PORT connector. Enables the 2957D or 2960D to be remotely controlled from a terminal or computer using the RS-232 interface. Can also be used for the connection of a printer with a suitable cable.
- (4) PARALLEL CONTROL PORT connector. Used for connection to a Centronics or parallel type printer or for automatic control of mobile interfaces.

OPERATION

DISC OPERATION

A 3.5 or 5.25 inch, 40 or 80 track floppy disc drive can be connected. Single-sided or double-sided discs can be used but only 40 tracks on one side are used. Head stepping times of 6 or 12 ms can be selected; 6 ms is the default setting. These times refer to the inter-track stepping time, not the head settling time. For example, if the drive has a 10 ms step time, the time should be set to the next slower speed, i.e. 12 ms. Most modern drives are 3 or 6 ms.

Preparation

Connect the disc drive to its power supply and switch on. Connect the drive ribbon cable to the DISC INTERFACE connector. For connector compatibility, see Chap. 2. Insert a disc in the drive slot and close the lock.

Press the DISC key. The **DISC CATALOGUE MENU** appears as shown in Fig. 3-4. The drive should start up.

If the message DISC FAULT appears, it indicates that the catalogue cannot be read as the disc has not been formatted or is faulty. If the message DRIVE NOT READY is shown, there has been no response from the drive. In either case, remove the disc drive cable, check the connections and supply and then reconnect the drive cable. Press CAT to re-attempt to read the disc catalogue. If DRIVE NOT READY is again shown, there is probably a fault with the disc drive. If NO DISC INSERTED is shown, insert or re-insert the disc and press CAT. If a file which has been recorded under a superseded software issue is loaded, a warning message is shown in reverse field at the bottom of the screen. An attempt to use this file may cause the system to malfunction and should be avoided.

DISC CATALOGUE MENU		
FILE	TITLE	
0	RX TEST 1	ACCESS
1	L PRODUCTION TEST	CAT
2	TROUBLESHOOTING	
3	-- NO FILE --	LOAD
4	L GOODS INWARD CHECK	SAVE
5	FULL SPEC TEST	
6	-- NO FILE --	DELETE
7	-- NO FILE --	
8	MENU OF TX TESTS	FORMAT
9	NO SEQUENCE DEFINED	

CURRENT USER TEST SEQUENCE IS
GOODS INWARD CHECK

Fig. 3-4 DISC CATALOGUE MENU

The **DISC CATALOGUE MENU** shows files 0 to 9 together with their titles or NO FILE where appropriate. It shows all the disc functions using the ACCESS, CAT, LOAD, SAVE, DELETE and FORMAT soft keys. When a fault message is shown during operation, refer to 'Fault messages' in Table 3-3.

Formatting

Before a new blank disc can be used, it has to be formatted for the disc filing system. To do this, press the FORMAT key. FORMAT and ENTER flash on the display. As formatting automatically erases all previously saved files, the message DATA ON DISC WILL BE LOST, PRESS ENTER TO CONFIRM is shown. To abort the formatting process, press any other soft key except ENTER. Otherwise, press ENTER to confirm. Formatting takes place and, when completed, the catalogue is updated while CAT flashes.

When CAT stops flashing, NO FILE is shown against all ten files. Discs which have been formatted on 40 track disc drives are not interchangeable with those formatted on 80 track disc drives. On 80 track disc drives, only the first 40 tracks on the disc are formatted.

Saving

To save a file, press the SAVE key. SAVE flashes on the display and the file number is requested. Enter the file number using the keypad or abort by pressing any soft key. If a file already exists for that number, the message OVERWRITE EXISTING FILE? PRESS ENTER TO CONFIRM is shown and ENTER flashes. To abort the saving process, press any other soft key except ENTER. Otherwise, press ENTER (which changes to SAVE) to confirm. Saving on disc then takes place and when it is completed, the catalogue is updated while CAT flashes. When CAT stops flashing, the file name or NO SEQUENCE DEFINED is shown against the file number.

Loading

To load a file, press the LOAD key. LOAD flashes on the display and the file number is requested. Enter the file number using the keypad or abort by pressing any soft key. Loading to memory then takes place and when completed, LOAD stops flashing.

Deleting

To delete a file, press the DELETE key. DELETE flashes on the display and the file number is requested. Enter the file number using the keypad or abort by pressing any soft key. If no file is present under that number, the message FILE DELETED is shown. When a file is present, the message ABOUT TO DELETE FILE, PRESS ENTER TO CONFIRM is shown and ENTER flashes. To abort the deletion process, press any other soft key except ENTER. Otherwise, press ENTER (which changes to DELETE) to confirm. File deletion takes place and, when completed, the catalogue is updated while CAT flashes. When CAT stops flashing, --NO FILE-- is shown against the file number.

Locking

To lock a file to prevent it being overwritten by SAVE or deleted by DELETE or to unlock a previously locked file, press the ACCESS key. ACCESS flashes on the display and the file number is requested. Enter the file number using the keypad or abort by pressing any soft key. The catalogue is then updated while CAT flashes. When CAT stops flashing, the letter L is shown against the file number to indicate that it is now locked or, alternatively, the letter L is removed to show that the file has been restored to its normal unlocked state.

OPERATION

Catalogue

Normally, the catalogue is kept updated but, if the disc is changed, it is necessary to press the CAT key to read the catalogue. This is also necessary after a disc drive fault condition. While the catalogue is being updated, CAT flashes. When CAT stops flashing, the current catalogue is shown.

Fault messages

The fault messages, together with their meanings and suggested remedies, are listed in Table 3-3.

TABLE 3-3 DISC DRIVE FAULT MESSAGES

Fault message	Meaning	Remedy
DRIVE NOT READY	No response from drive	Check disc inserted correctly, check all connections, check power supply, replace faulty drive
NO DISC INSERTED	No disc is present or not correctly inserted in drive or lock not closed	Insert disc correctly and close lock
FILE DELETED	No file present	-
FILE LOCKED	File locked to prevent overwriting	Unlock using ACCESS key
DISC FAULT	(1) Disc not formatted or for different system	Format using FORMAT key
	(2) Discs formatted for 40 and 80 tracks are mixed	Separate different formats
	(3) Verification error (e.g. disc unreliable or dirty head)	Replace disc or clean head
	(4) Faulty drive	Repair or replace drive
	(5) Head misalignment between drives	Try another drive or use one drive for saving and loading
DISC CHANGED	Disc changed since updating of catalogue	Press CAT key for new catalogue
WRITE PROTECTED	Disc physically protected from overwriting	Remove physical protection

OPERATING SUMMARY

The 2957D or 2960D is used to test a cellular mobile radio by simulating the functions of a cell base station.

Any one of the following test modes can be used:-

- (a) GO/NO-GO TEST. See page 3-1-39.
- (b) FULL AUTO TEST. See page 3-1-40.
- (c) MANUAL TEST. See page 3-1-47.

For the FULL AUTO TEST, the display is in one of the following forms:-

- (a) SUMMARY DISPLAY. See page 3-1-39.
- (b) FULL DISPLAY. See page 3-1-40.

These are selectable from a menu. With FULL DISPLAY, the top half of the display is the 2955's normal **DUPLX** test display. The bottom half shows the title, the status and the result of the current test routine. SUMMARY DISPLAY is always selected for the GO/NO-GO TEST mode and it can be selected for the FULL AUTO TEST mode. The SUMMARY DISPLAY shows only the title, the status and the result of the current test routine. Passed test routines scroll up and off the screen; failed test routines remain at the top of the screen.

There are four built-in test sequences as follows:-

- (a) CALL PROCESSING ONLY. See page 3-1-59.
- (b) CALL AND RF TESTING. See page 3-1-59.
- (c) BRIEF TESTING. See page 3-1-60.
- (d) COMPREHENSIVE TESTING. See page 3-1-61.

Each of the test sequences consists of a number of test routines. There are two groups - non-system specific test routines as shown in Table 3-4 and system specific test routines as shown in Table 3-5. The non-system specific test routines are applicable to any cellular radio system but these system specific test routines are applicable only to AMPS.

Full details of test sequences and test routines are included under the following headings:-

- (a) Performance data. See pages 1-7 to 1-9 and 1-10 to 1-19.
- (b) Operation. See pages 3-1-59 to 3-1-61 and 3-1-62 to 3-1-88.
- (c) Parameters. See pages 4-4-1 to 4-4-16.
- (d) Built-in programs. See pages 4-5-1 to 4-5-10.

Different AMPS systems (E-AMPS, N-AMPS and D-AMPS) can be selected. In addition, the user can define his own system with its own system title, channel numbers, transmitter base frequency, duplex offset, channel spacing, mean data deviation and SAT deviation.

TABLE 3-4 NON-SYSTEM SPECIFIC TEST ROUTINES

No.	Full title	Display title	Applicability
1	Transmitter RF power	TX POWER	
2	Transmitter RF frequency	TX FREQUENCY	
3	Transmitter distortion	TX DISTORTION	Analog only
	Transmitter SINAD	TX SINAD	Analog only
	Transmitter S/N	TX S/N	Analog only
	Transmitter residual noise	TX NOISE	Analog only
4	Transmitter modulation limiting	TX LIMITING	Analog only
5	Transmitter modulation compression	TX COMPRESSION	Analog only
6	Receiver AF distortion	RX DISTORTION	Analog only
	Receiver SINAD	RX SINAD	Analog only
	Receiver S/N	RX S/N	Analog only
7	Receiver sensitivity	RX SENSITIVITY	Analog only
8	Receiver demodulation expansion	RX EXPANSION	Analog only
9	DC power consumption	DC POWER	

TABLE 3-5 SYSTEM SPECIFIC TEST ROUTINES (AMPS)

No.	Full title	Display title	Applicability
20	Registration of mobile on control channel	REGISTRATION	
21	Call from cell to mobile	CALL CELL TO MS	
22	Call from mobile to cell	CALL MS TO CELL	
23	Handoff from current to chosen voice/traffic channel	HANDOFF	
24	Automatic handoffs from first to last voice/traffic channels	AUTO HANDOFF	
25	SAT, DSAT or DVCC transponding	SAT TRANSPONDING	
		SAT DEVIATION	Analog only
		SAT FREQUENCY	Wideband only
26	Clearing down from cell	CLEAR FROM CELL	
27	Clearing down from mobile	CLEAR FROM MS	
28	Transmitter RF power	TX POWER	
29	Analog data performance (BER)	ANALOG BER	Analog only
	Digital BER reporting	BER REPORT	Digital only
30	DTMF tones	DTMF TONES	
31	Hook flash	HOOK FLASH	
32	Data deviation	DATA DEVIATION	Wideband only
33	ST deviation	ST DEVIATION	Wideband only
34	ST duration	ST DURATION	Wideband only
35	Digital modulation error	RMS VECTOR ERROR	Digital only
		FIRST 10 SYMBOLS	Digital only
		ORIGIN OFFSET	Digital only
		BURST ENVELOPE	Digital only
36	Digital RF sensitivity (BER)	DIGITAL BER	Digital only
37	Digital speech loopback quality	SPEECH LOOPBACK	Digital only
38	Digital RSSI	DIGITAL RSSI	Digital only

The menus which allow the user to define all the parameters are accessed by selecting FULL AUTO TEST on the top level menu. The succeeding menu gives the option CHANGE FORMAT. Pressing this soft key brings up two pages of CHANGE FORMAT MENU which enables the user to change parameters from the following:-

- (a) **SYSTEM PARAMETERS MENU.**
- (b) **MOBILE PARAMETERS MENU.**
- (c) **DISPLAY FORMAT MENU.**
- (d) **TEST SEQUENCE MENU.**
- (e) **PRINTER MENU.**
- (f) **INTERFACE MENU.**
- (g) **MISCELLANEOUS MENU.**

Six memories are available for storing six full sets of parameters.

A printer can be connected to the GPIB port (with the printer in listen-only mode), the RS-232 port (serial printer) or to the parallel control port (parallel printer). The printer can print either a summary of the test routines performed or only the passes or failures as they occur.

A disc drive can be connected to the Adapter using the connector on the right-hand side. The drive has to be compatible with the Shugart S.400 interface and may be 3.5 or 5.25 inch, 40 or 80 track. Discs can be single-sided or double-sided although only 40 track on one side are used.

During the FULL AUTO TEST mode, the test sequence can be halted by use of the PAUSE key. A menu is provided to allow the user to define when the selected test sequence should halt. See page 3-1-26. Options available are as follows:-

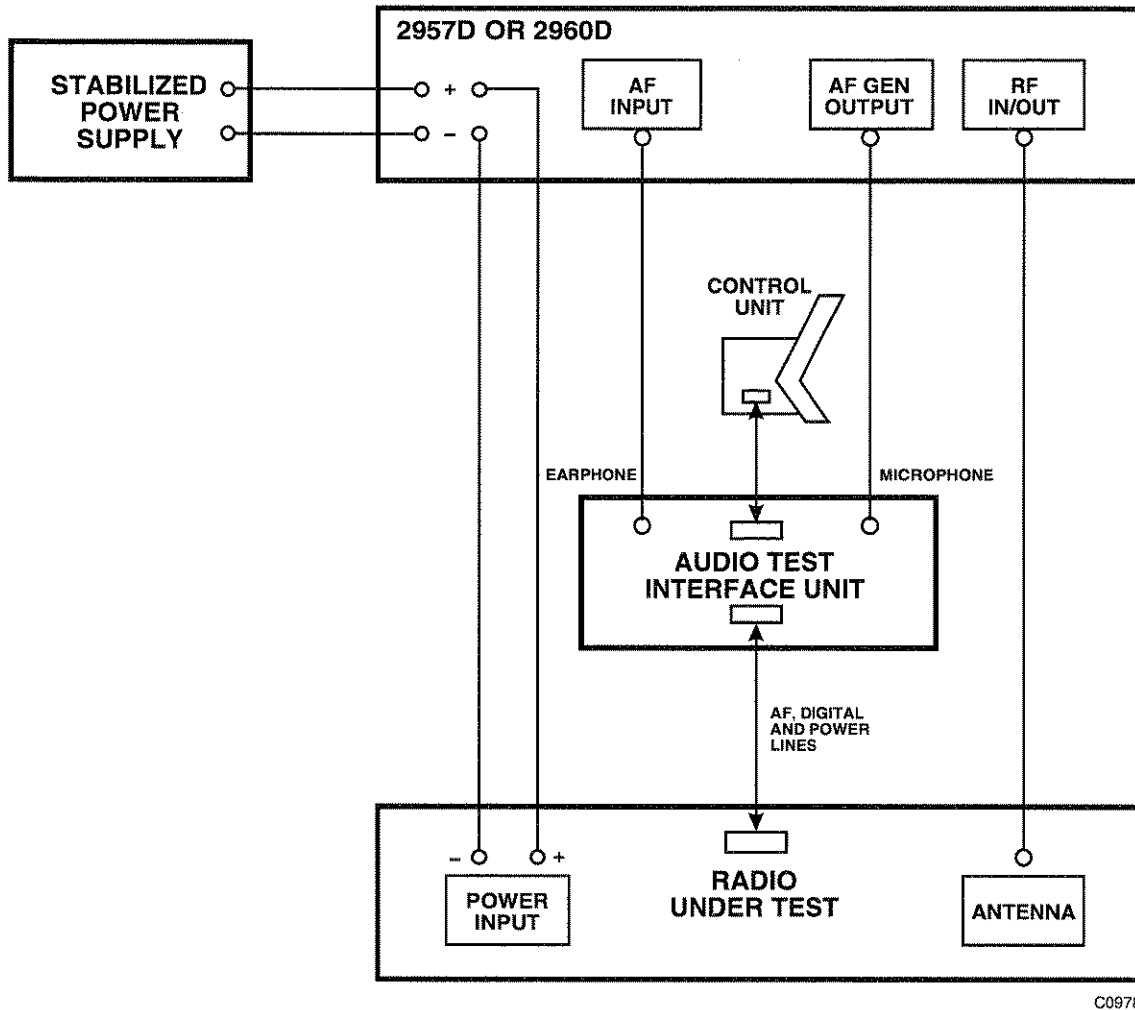
- (a) Pause after each test routine.
- (b) Pause by manual use of the PAUSE key.
- (c) Pause when failure occurs in a test routine.

INTERCONNECTIONS

For audio tests, it may be necessary for the user to construct an interface unit. The unit has to be compatible with the radio under test and with the 2955's AF output and the Adapter's AF input requirements. The unit is typically connected between the radio's handset and its transceiver unit to provide suitable unbalanced connections from the microphone to the 2955's AF GEN OUTPUT socket and the earphone to the Adapter's AF INPUT socket.

Bearing in mind that the radio and test interface connections are likely to vary between manufacturers, connect the 2957D or 2960D to the radio under test, as shown in Fig. 3-5, as follows:-

- (1) Connect the 2955's RF IN/OUT N socket to the transceiver's antenna connector. This is required for all tests.
- (2) Connect the 2955's AF GEN OUTPUT socket and the Adapter's AF INPUT socket to the audio test interface unit. This is required for the BRIEF TESTING and the COMPREHENSIVE TESTING sequences.



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Fig. 3-5 Interconnections

- (3) Connect the radio's DC power input leads to its DC supply using the Adapter's DC in/out connectors - the radio to the right-hand pair and the supply to the left-hand pair. These connections are only required for measuring the radio's input power in the COMPREHENSIVE TESTING sequence or in the MANUAL TEST mode. Otherwise, the radio can be connected directly to its power supply.

CRTS MODE

Proceed as follows:-

- (1) Switch on both the 2955 and the Adapter. (There is no particular order of switching on). All four LEDs on the Adapter light and then three go out after a pause. The LED remains lit above the 2955 key. The **RECEIVER TEST** display appears on the screen as shown in Fig. 3-6. If one or more LEDs flash, this indicates a fault condition. (See 'Conditions indicated by LEDs' below).

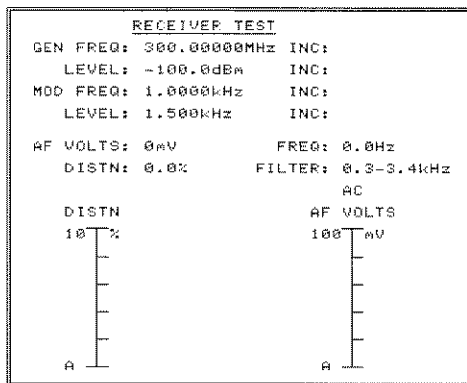


Fig. 3-6 Display following switch-on

- (2) Press the CRTS key. The display changes to **AMPS CELLULAR RADIO TEST SYSTEM** as shown in in Fig. 3-7. The 2957D or 2960D goes through a self test. When an Adapter is fitted to a different 2955, it goes through a series of self tests which include self calibration. For each self test, a line appears on the display and, if passed, is replaced by the next one. When a failure occurs, the CONTINUE key appears together with an appropriate message.
- (3) To retain the display line for a test and subsequent tests, press the Tx TEST key during that test. This effect is cancelled when the Tx TEST key is pressed again.

Occasionally, the instrument may indicate a failure. This could be caused by a genuine fault or could be due to some other reason. Some examples are as follows:-

- (a) An active radio is attached to the 2955 series Test Set during calibration.
- (b) One or more link leads is missing, incorrectly fitted or defective.
- (c) A signal is applied to the EXT MOD INPUT socket during calibration.
- (d) There is a failure during self calibration because of sporadic mistiming.

OPERATION

When there is a failure during self calibration, the instrument assumes default calibration settings. This ensures normal operation of the other areas of the instrument.

Self calibration routines have been optimized for speed based on typical performances of Adapters and 2955 series Test Sets. Occasionally, calibration may not be completed correctly because of noise effects, temperature variation and digital offsets. When a failure is indicated, press the Tx TEST key to repeat the self test and calibration. If the repeat is satisfactory, there is no further cause for concern.

If failures occur repeatedly, this would indicate a problem. Contact your service agent for further advice.

At the end of the self tests, part numbers for the Adapter's system controller board and its digital and RF tray are give along with the hardware serial number. During the self tests, software version numbers (and any qualifying letter) are displayed as follows:-

- (a) M. System controller board mother software. This is equivalent to the motherboard software on the 2957A, 2957B, 2960 or 2960B.
- (b) P. System controller board personality software. This is equivalent to the personality board software on the 2957A, 2957B, 2960 or 2960B.
- (c) D. Digital and RF tray software.
- (d) T. Test Set 2955 series software.

When the self tests are successfully completed, the main top level menu appears on the screen. This menu is the starting point for selecting the various test functions.

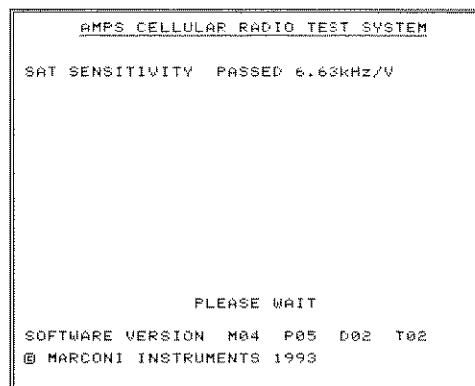


Fig. 3-7 Display following CRTS mode selection

Note

If the message MEMORY CORRUPTED appears, it means that the settings used when the 2957D or 2960D was last switched on have been lost. They are replaced by the default settings.

Conditions indicated by LEDs

When one or more of the LEDs on the Adapter flashes, it indicates a failure to successfully enter the required mode or that there is an error condition. The various conditions are summarized in Table 3-6.

TABLE 3-6 LED INDICATIONS

LEDs	Condition	Meaning
All on	At power on	Test function - LEDs should go out after a pause
All flashing	At power on	Volatile RAM failure - instrument cannot continue
2955 flashing	At power on	2955 is not responding on private GPIB - instrument cannot continue until fault is rectified
CRTS flashing	At power on	ROM checksum failure - instrument continues when an Adapter key is pressed if it can
	After power on	CRTS has been selected but 2955 is not responding or is set to talk only mode
DISC flashing	At power on	Non-volatile RAM checksum failure - instrument continues and resets memory to default data when an Adapter key is pressed
	After power on	DISC has been selected but the 2955 is not responding or is set to talk only mode
PSOPH flashing	At power on	System option ROM checksum failure - instrument continues when an Adapter key is pressed if it can

Self test failure messages

When a failure occurs during self testing, an appropriate message is displayed.

For each source of error, a bit is set in an error byte which can be read in remote control by using the command RD56.

OPERATION

MAIN TOP LEVEL MENU

An option is selected from a menu by pressing the blue MODE key which is alongside the function shown on the screen. These soft key functions over-ride the normal function of the keys when a menu appears on the screen.

The main top level menu is the menu from which the test modes are selected. See Fig. 3-8. The options are as follows:-

- (a) GO/NO-GO TEST. This is a special version of the FULL AUTO TEST mode which provides a quick appraisal of the unit under test. The display format is SUMMARY and the pause is MANUAL ONLY. All other parameters are as specified in FULL AUTO TEST including the test sequence (e.g. COMPREHENSIVE TESTING).
- (b) FULL AUTO TEST. This executes a preselected test sequence, either one of the four built-in test sequences or a user-defined test sequence. It is intended for main routine testing. It provides access to the two pages of the **CHANGE FORMAT MENU** which are used to define the test parameters and instrument settings.
- (c) MANUAL TEST. This provides the user with a number of individual call processing tests as well as manual control of the data and SAT generators. It would normally be used for trouble shooting and repair work.
- (d) SELECT SYSTEM. 2960D only. This option is displayed when the 2960D is fitted with more than one of the system options. It provides access to the **SYSTEM SELECTION MENU**.

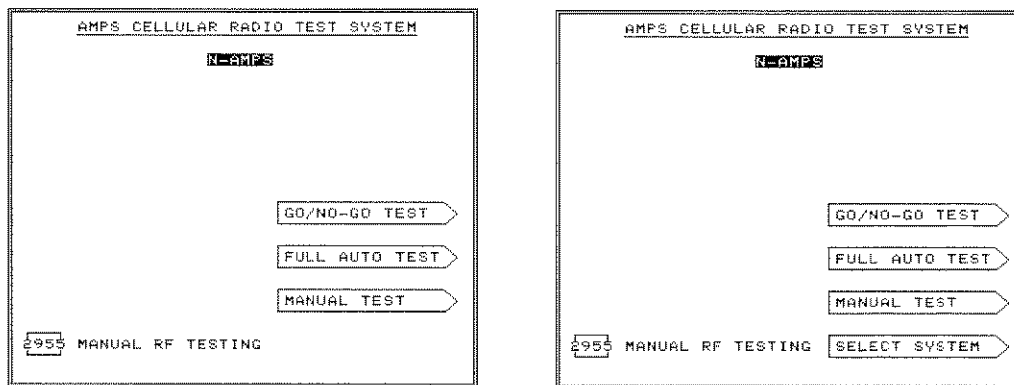


Fig. 3-8 Main top level menu - 2957D and 2960D (with extra option(s))

Pressing the CRTS key aborts the current test and returns to the main top level menu.

The 2955 and DISC keys provide the following additional facilities:-

- (a) 2955 manual RF testing. Pressing the 2955 key allows the user to manually test the RF and audio stages of a mobile. When the 2955 key is pressed, the 2955's DUPLEX test display appears. The display and the test settings are saved as indicated by the LED above the CRTS key. The normal 2955 operating mode can be accessed by pressing the 2955 key a second time.
- (b) Disc facility. Pressing the DISC key allows the user to control a disc drive so that test sequences can be stored and retrieved from a floppy disc without the need for an external controller.

SYSTEM SELECTION MENU

2960D only

This menu allows the user to select which of the system options is to be used. There is a soft key for each of the system options which is fitted. The current system option is shown by an asterisk. See Fig. 3-9.

To change the system, press the appropriate SELECT key twice. Initializing then takes place and the main top level menu is restored, showing the new system. Also, this is then the current system at the next switch-on. Pressing the RETURN soft key restores the main top level menu.

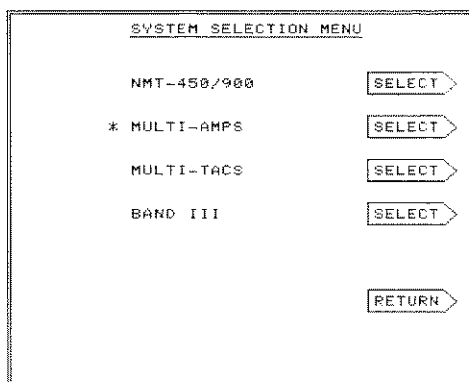


Fig. 3-9 **SYSTEM SELECTION MENU**

FIRST TIME OPERATION

When the instrument is used for the first time, the test settings have to be defined and selected by means of the **CHANGE FORMAT MENU**. To access this menu, first press the FULL AUTO TEST key. The FULL AUTO TEST intermediate display appears as shown in Fig. 3-10. This shows the main test settings currently selected. It also gives the options of CHANGE FORMAT to select the settings or START TEST to commence testing (once the settings have been defined). Press the CHANGE FORMAT key to obtain the **CHANGE FORMAT MENU**.

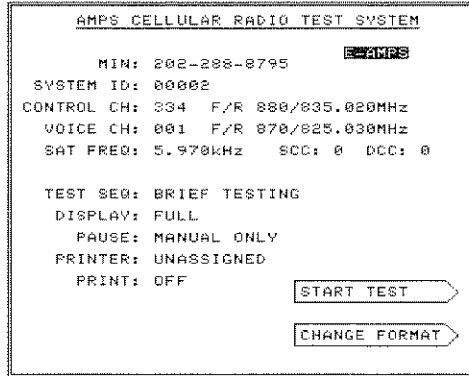


Fig. 3-10 FULL AUTO TEST intermediate display

CHANGE FORMAT MENU

This menu allows the user to define and select test settings before testing is carried out. The current settings are stored in non-volatile memory. This menu is accessed when FULL AUTO TEST is selected from the main top level menu and then CHANGE FORMAT is selected from the FULL AUTO TEST display. The **CHANGE FORMAT MENU** consists of two pages of options to change settings or format display as shown in Fig. 3-11.

Page 1 allows changes to be made under the following options:-

- (a) **SYSTEM PARAMETERS MENU.** See page 3-1-19.
- (b) **MOBILE PARAMETERS MENU.** See page 3-1-24.
- (c) **DISPLAY FORMAT MENU.** See page 3-1-25.
- (d) **TEST SEQUENCE MENU.** See page 3-1-26.

Pressing PAGE 2 selects the other page of the menu; RETURN restores the FULL AUTO TEST display.

Page 2 allows changes to be made under the following options:-

- (a) **PRINTER MENU.** See page 3-1-27.
- (b) **INTERFACE MENU.** See page 3-1-29.
- (c) **MISCELLANEOUS MENU.** See page 3-1-30.

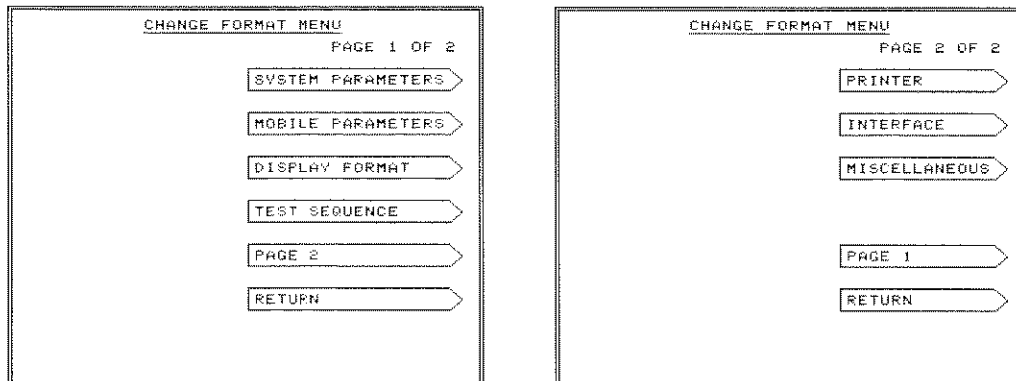


Fig. 3-11 CHANGE FORMAT MENU pages 1 and 2

Pressing PAGE 1 selects the other page of the menu; RETURN restores the intermediate menu.

OPTION KEYS

Some of the option keys are marked SELECT and some are marked CHANGE.

A SELECT key has to be pressed repeatedly to scroll through the choices until the required setting is obtained.

A CHANGE key has to be pressed once and then it changes to ENTER. The numerical setting can be then changed by entering a new value on the 2955 keypad. If a mistake is made, press the DELETE key then press the correct key. Any change can be aborted by pressing any other soft key. If the entry is correct, press the ENTER key and then it changes back to CHANGE. If a mistake is now found in the data, the number has to be re-entered after pressing CHANGE.

SYSTEM PARAMETERS MENU

This menu allows the user to change parameters. There are three pages of options as shown in Fig. 3-12.

Page 1 allows changes to be made under the following options:

- (a) SYSTEM TYPE.
- (b) SYSTEM ID.
- (c) CONTROL CHANNEL.
- (d) VOICE CHANNEL.
- (e) HANDOFF INCREMENT.

In addition, this page allows changes to be made under the **SYSTEM PARAMETER WORD 1 MENU** and the **SYSTEM PARAMETER WORD 2 MENU** which are not shown in the options. These are selected by pressing the Tx TEST key and then, within 1 second, pressing the 1 or 2 key. See pages 3-1-35 to 3-1-38.

Pressing PAGE 2 selects the next page of the menu; RETURN restores the **CHANGE FORMAT MENU**.

Page 2 allows changes to be made under the following options:

- (a) SAT FREQ.
- (b) DSCC (N-AMPS only) or DVCC (D-AMPS only).
- (c) REGID.
- (d) ID STEP.
- (e) REGINCR.

Pressing PAGE 3 selects the next page of the menu; RETURN restores the **CHANGE FORMAT MENU**.

Page 3 allows changes to be made under the following options:-

- (a) DCC.
- (b) BURST INDICATOR (D-AMPS only).
- (c) TDMA CHANNEL (D-AMPS only).

OPERATION

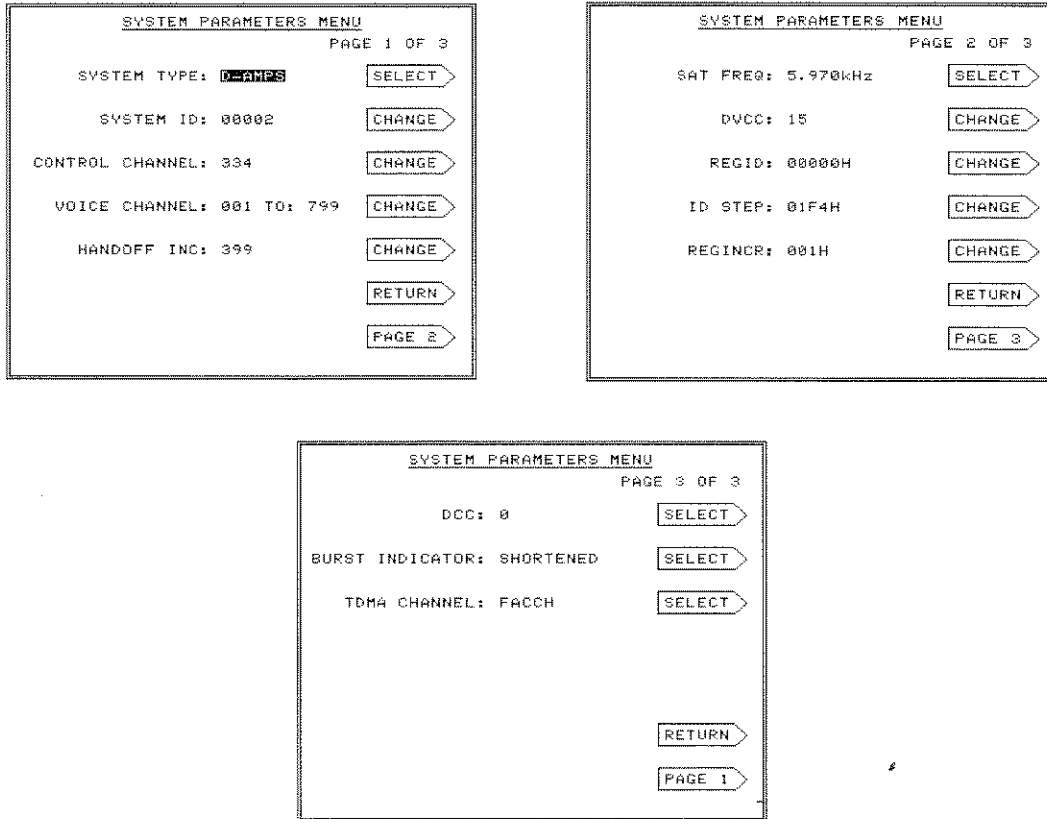


Fig. 3-12 **SYSTEM PARAMETERS MENU** pages 1 to 3 - D-AMPS

Pressing PAGE 1 selects the first page of the menu; RETURN restores the **CHANGE FORMAT MENU**.

SYSTEM TYPE selection

Different system types can be selected. See Table 3-8. Repeatedly pressing the SYSTEM TYPE soft key shows the different systems in turn in reverse video. Stop pressing when the required system appears. The title of the selected system type is shown in reverse video on the top level menus. When a new system type is selected, default settings for calling channels and voice/traffic channels are used and appear on the screen after 2 seconds.

When the user wishes to define his own system, this is done by stepping through the built-in systems, as described above, until the word DEFINITION is shown flashing. This appears after the current title of the user-defined system, the default title of which is AMPS. If DEFINITION is left flashing for more than 2 seconds, the **SYSTEM DEFINITION MENU** appears. See page 3-1-22.

SYSTEM ID setting

Enter a 5-digit decimal number. The default setting is 00002.

CONTROL CHANNEL setting

Enter a number in the range 0 to 1023. The default setting is 334.

VOICE CHANNEL setting

For the first voice/traffic channel and the last voice/traffic channel, enter two numbers in the range 0 to 1023. The default settings are 1 and 666.

The first number is for the initial voice/traffic channel that the mobile is to be assigned to when it goes into conversation. The second number is for the final voice/traffic channel that the mobile is to be assigned to in the test sequences and the automatic handoff test routine (no. 24).

HANDOFF INCREMENT setting

Enter a number in the range 1 to 1023. The default setting is 333.

This number is for incrementing between the first voice/traffic channel and the last during the automatic handoff test routine (no. 24). Usually 3 or 4 channels are tested.

SAT FREQUENCY selection

Select a SAT frequency (5.970, 6.000 or 6.030 kHz) to be generated by the mobile when it goes into conversation. Repeatedly pressing the SAT FREQUENCY soft key shows the different frequencies in turn in reverse video. Stop pressing when the required frequency appears. The default selection is 5.970 kHz.

DSCC selection

This applies only to N-AMPS. For the digital SAT colour code, select from the following:-

DSCC	Data (hexadecimal)	DSCC	Data (hexadecimal)
0	2556CB	4	26AB2B
1	255B2B	5	26B2AD
2	256A9B	6	2969AB
3	25AD4D		

The default selection is 0.

DVCC setting

This applies only to D-AMPS. For the digital verification colour code, enter a number in the range 1 to 255. The default setting is 15.

OPERATION

REGID **setting**

Enter a 5-digit hexadecimal number. The default setting is 00000H.

This is part of the overhead message which is sent on a control channel during registration.

ID STEP **setting**

Enter a 4-digit hexadecimal number. The default setting is 01F4H.

This is the increment of REGID when each registration test is started.

REGINCR **setting**

Enter a 3-digit hexadecimal number. The default setting is 001H.

This is also part of the overhead message which is sent on a control channel during registration.

DCC **selection**

For the digital colour code, select 0, 1, 2 or 3. The default selection is 0.

BURST INDICATOR **selection**

This applies only to D-AMPS. The SBI is sent to the mobile in a Handoff message. Set the SBI to 00, 01 or 10 by selecting FULL 0, FULL 1 or SHORTENED. The default selection is SHORTENED.

TDMA CHANNEL **selection**

This applies only to D-AMPS. Physical Layer Control messages (Time Alignment or Power Level) or Stop Measurement order message are sent to the mobile on the FACCH or SACCH. Select FACCH or SACCH. The default selection is FACCH.

SYSTEM DEFINITION MENU

The system definitions for the built-in system types are shown in Table 3-8. The **SYSTEM DEFINITION MENU** consists of two pages of options which allow the user to define his own system. See Fig. 3-13. This is accessed by allowing the word DEFINITION to flash in the SYSTEM TYPE field of the **SYSTEM PARAMETERS MENU** for longer than 2 seconds.

Page 1 allows changes to be made under the following options:-

- (a) SYSTEM TITLE.
- (b) LOWEST CHANNEL.
- (c) HIGHEST CHANNEL.

Pressing PAGE 2 selects the other page of the menu; RETURN restores the **SYSTEM PARAMETERS MENU**.

SYSTEM DEFINITION MENU	
PAGE 1 OF 2	
SYSTEM TITLE: AMPS	CHANGE
LOWEST CHANNEL: 001	CHANGE
HIGHEST CHANNEL: 666	CHANGE
	RETURN
	PAGE 2

SYSTEM DEFINITION MENU	
PAGE 2 OF 2	
TX BASE FREQ: 825.0300MHz	CHANGE
DUPLEX OFFSET: 45.0000MHz	CHANGE
CHANNEL SPACING: 30.00kHz	CHANGE
MEAN DATA DEVN: 8.000kHz	CHANGE
SAT DEVN: 2.000kHz	CHANGE
	RETURN
	PAGE 1

Fig. 3-13 **SYSTEM DEFINITION MENU** pages 1 and 2

Page 2 allows changes to be made under the following options:-

- (a) TX BASE FREQUENCY.
- (b) DUPLEX OFFSET (positive or negative).
- (c) CHANNEL SPACING (positive or negative).
- (d) MEAN DATA DEVIATION.
- (e) SAT DEVIATION.

Pressing PAGE 1 selects the other page of the menu; RETURN restores the **SYSTEM PARAMETERS MENU**.

SYSTEM TITLE **setting**

This is entered by pressing its soft key. A table of letters appears at the bottom of the display. Select each letter of the title by entering first the line number (1 to 3) followed by the column number (0 to 9). Each selected character appears in the SYSTEM TITLE field in reverse video. Errors can be rectified by using the DELETE key. The title can be aborted at any time by pressing any other soft key. If the title is not required, it can be removed by deleting characters to leave a blank field.

LOWEST CHANNEL **setting**

Enter a number in the range 0 to the highest channel setting.

HIGHEST CHANNEL **setting**

Enter a number in the range from the lowest channel setting to 2047.

TX BASE FREQUENCY **setting**

This is the mobile transmitter base frequency and is the value for channel 1. Enter a value in the range 10 to 1000.0000 MHz using a unit key after the numerical keys. The system rounds to the nearest 100 Hz.

OPERATION

DUPLEX OFFSET **setting**

Enter a value in the range 0 to 75.0000 MHz using a unit key after the numerical keys. The system rounds to the nearest 100 Hz. Negative values may be entered for systems with an inverse base frequency (i.e. where the transmitter frequency is higher than the receiver frequency).

CHANNEL SPACING **setting**

Enter a value in the range 5 to 100.00 kHz using a unit key after the numerical keys. The system rounds to the nearest 50 Hz. Negative values may be entered for systems with reverse channel numbering.

MEAN DATA DEVIATION **setting**

Enter a value in the range 0 to 8.000 kHz using a unit key after the numerical keys.

SAT DEVIATION **setting**

Enter a value in the range 0 to 2.500 kHz using a unit key after the numerical keys.

TABLE 3-8 BUILT-IN SYSTEM TYPES

System type	Minimum channel number	Maximum channel number	Mobile Tx	Duplex	Channel spacing	Deviation	
			frequency channel 1	offset (Rx - Tx)		Mean data	SAT
			MHz	MHz	kHz	kHz	kHz
E-AMPS	1	1023	825.030	45	30	8.0	2.0
N-AMPS	1	1023	825.030	45	30	8.0	2.0
D-AMPS	1	1023	825.030	45	30	8.0	2.0
AMPS	1	666	825.030	45	30	8.0	2.0

MOBILE PARAMETERS MENU

This menu, as shown in Fig. 3-14, allows a change to be made under the MOBILE NUMBER option.

Pressing RETURN restores the **CHANGE FORMAT MENU**.

MOBILE NUMBER **setting**

The mobile is identified by a number which has the format xxx-xxx-xxxx. Enter a suitable number. The default setting is 000-000-0000.

```

MOBILE PARAMETERS MENU

MOBILE NUMBER: 000-000-0000  CHANGE

RETURN

```

Fig. 3-14 MOBILE PARAMETERS MENU

DISPLAY FORMAT MENU

This menu, as shown in Fig. 3-15, allows selections to be made under the following options:-

- (a) DISPLAY FORMAT.
- (b) PAUSE.
- (c) NUMBER FORMAT.

Pressing RETURN restores the **CHANGE FORMAT MENU**.

```

DISPLAY FORMAT MENU

DISPLAY FORMAT IS FULL  SELECT
PAUSE MANUAL ONLY      SELECT
NUMBER FORMAT IS STANDARD 1  SELECT

RETURN

```

Fig. 3-15 DISPLAY FORMAT MENU

DISPLAY FORMAT selection

This option selects the display format to be used in the FULL AUTO TEST mode. The choice is between FULL and SUMMARY. FULL format uses a split duplex screen to display the RF and AF parameters of the mobile in the top half with the summary line comprising title, status and result fields together with other information relating to the test routine (e.g. test limits) in the bottom half. SUMMARY format shows a scrolling window of up to 10 summary lines with up to the first 9 failures being retained.

Since it is only intended to provide brief information, the GO/NO-GO TEST mode automatically uses the SUMMARY format.

OPERATION

PAUSE selection

This option selects the method of interrupting a test sequence in the FULL AUTO TEST mode from one of the following:-

- (a) PAUSE ALWAYS. This causes the test sequence to be halted after each test routine has been completed.
- (b) PAUSE MANUAL ONLY. This halts the test sequence only when the PAUSE key is pressed.
- (c) PAUSE ON FAILURE. This causes a halt only when a failure has occurred or when the PAUSE key is pressed.

Since it is intended for rapid testing, the GO/NO-GO TEST mode automatically uses PAUSE MANUAL ONLY.

NUMBER FORMAT selection

This option selects between HEXADECIMAL, DECIMAL, OCTAL, STANDARD 1 and STANDARD 2 for the mobile's equipment serial number (ESN) which is displayed in the call processing tests. The default setting is STANDARD 1.

When HEXADECIMAL is selected, the number may subsequently be entered in hexadecimal with the letters A to F being entered by using the SCOPE keys. These are reassigned as a letter keypad and depicted on the screen.

When STANDARD 1 or STANDARD 2 is selected, the ESN is in 32 bits which are divided into 4 or 3 fields respectively in accordance with BABT recommendations.

TEST SEQUENCE MENU

This menu, as shown in Fig. 3-16, allows selection of the test sequence which is used in the GO/NO-GO TEST and the FULL AUTO TEST modes. Selection is made from the following sequences:-

- (a) BRIEF TESTING. See page 3-1-60.
- (b) COMPREHENSIVE TESTING. See page 3-1-61.
- (c) CALL PROCESSING ONLY. See page 3-1-59.
- (d) CALL AND RF TESTING. See page 3-1-59.
- (e) Title of a user-defined sequence which is held in the non-volatile user memory. NO SEQUENCE DEFINED is displayed as the default title until it is redefined. A user-defined sequence is not available if a user-defined subroutine has been entered under remote control (using the USER command).

BRIEF TESTING is executed by default.

Also, the menu allows selections to be made under the following options:-

- (a) DTMF.
- (b) HOOK FLASH.

Pressing RETURN restores the **CHANGE FORMAT MENU**.

TEST SEQUENCE MENU	
BRIEF TESTING	SELECT
DTMF IS DISABLED	SELECT
HOOK FLASH IS DISABLED	SELECT
	RETURN

Fig. 3-16 **TEST SEQUENCE MENU****DTMF selection**

For the DTMF tones test routine (no. 30) in test sequences, selection is made between DISABLED and ENABLED. The default setting is DISABLED.

HOOK FLASH selection

For the hook flash test routine (no. 31) in test sequences, selection is made between DISABLED and ENABLED. The default setting is DISABLED.

PRINTER MENU

This menu, as shown in Fig. 3-17, allows selections to be made under the following options:-

- (a) PRINTER PORT.
- (b) PRINT.
- (c) TERMINATE.

Pressing RETURN restores the **CHANGE FORMAT MENU**.

PRINTER MENU	
PRINTER PORT IS UNASSIGNED	SELECT
PRINT OFF	SELECT
TERMINATE WITH <CR> <LF>	SELECT
	RETURN

Fig. 3-17 **PRINTER MENU**

OPERATION

PRINTER PORT selection

This option selects which of the three printer ports, GPIB TALK-ONLY, SERIAL RS-232 or PARALLEL, is to be connected to the printer for producing a printed copy of the results in the GO/NO-GO TEST or the FULL AUTO TEST mode. When a printer is not to be used or is not connected, select UNASSIGNED. Otherwise, a PRINTER TIMEOUT error message may be displayed during the test sequence. The default selection is UNASSIGNED.

PRINT selection

This option selects the criteria for printing a test routine and its result as ALL, ON FAILURE or ON PASS. When a printout is not required, select OFF. The default selection is OFF.

TERMINATE selection

This option selects the characters which the printer requires to terminate a line. Selections are <CR> and <LF>, <LF> only and <CR> only. The default selection is <CR> and <LF>.

Note

A printer can be used in 2955 TALK ONLY mode as follows:-

- (1) Connect the printer to the appropriate port and select the parameters from the menus as above.
- (2) Switch off both the 2955 and the Adapter.
- (3) Set the 2955's GPIB unit to TALK ONLY (switch 6 to 1) and select the printing mode using switches 1 and 2 as follows:-

Switches 1 and 2	Case	<CR>
00	Upper and lower	Suppressed
01	Upper and Lower	Not suppressed
10	Upper only	Suppressed
11	Upper only	Not suppressed

- (4) Switch on both the 2955 and the Adapter then press the HOLD DISPLAY key.
- (5) Press PRT to start the printout. Data is now passed from the 2955 through the Adapter to the printer.
- (6) When printing is complete, restore the 2955 GPIB unit switch settings to normal.

INTERFACE MENU

This menu, as shown in Fig. 3-18a and Fig. 3-18b, allows selections to be made for the serial interface port and the TIA port under the following options:-

- (a) SERIAL PORT PARAMETERS or TIA PORT PARAMETERS.
- (b) BAUD RATE.
- (c) LENGTH/PARITY.
- (d) STOP BITS.
- (e) GPIB ADDRESS (for the SERIAL PORT PARAMETERS only).
- (f) TIA FORMAT (for the TIA PORT PARAMETERS only).

Pressing RETURN restores the **CHANGE FORMAT MENU**.

INTERFACE MENU	
SERIAL PORT PARAMETERS	SELECT
BAUD RATE IS 1200	SELECT
LENGTH/PARITY IS 8/NONE	SELECT
STOP BITS IS 1	SELECT
GPIB ADDRESS 06	CHANGE
	RETURN

Fig. 3-18a **INTERFACE MENU** - SERIAL PORT PARAMETERS

INTERFACE MENU	
TIA PORT PARAMETERS	SELECT
BAUD RATE IS 1200	SELECT
LENGTH/PARITY IS 8/NONE	SELECT
STOP BITS IS 1	SELECT
TIA FORMAT IS IS-55	SELECT
	RETURN

Fig. 3-18b **INTERFACE MENU** - TIA PORT PARAMETERS

SERIAL PORT PARAMETERS or TIA PORT PARAMETERS selection

This allows selections to be made for the appropriate port. The default selection is SERIAL PORT PARAMETERS.

OPERATION

BAUD RATE selection

The baud rate is selected from 75, 150, 300, 600, 1200, 2400, 4800 and 9600. The default selection is 1200.

LENGTH/PARITY selection

Length and parity are selected from 7/EVEN, 7/ODD, 7/NONE, 8/EVEN, 8/ODD and 8/NONE. The default selection is 8/NONE.

STOP BITS selection

A stop bit or bits is assigned to the end of every byte. This is selected from 1 and 2. The default selection is 1.

GPIB ADDRESS setting

This applies only for the SERIAL PORT PARAMETERS. Enter the 2-digit GPIB address using the keypad. Addresses in the range 01 to 30 can be entered. Ensure that TALK ONLY is not selected (i.e. that switch 6 is not set to 0) unless the 2957D or 2960D is only to be used in the 2955 mode (i.e. for use as a printer port converter). The default setting is 06.

TIA FORMAT selection

This applies only for the TIA PORT PARAMETERS. The format is selected from IS-55, HEX and ASCII. See under 'TIA selection' on page 3-1-57.

MISCELLANEOUS MENU

This menu, as shown in Fig. 3-19, allows selections to be made under the following options:-

- (a) DE-MOD SOURCE.
- (b) DISC STEP RATE.
- (c) PRINTER PORT COMMAND.
- (d) SYSTEM CONFIGURATION.

Pressing RETURN restores the **CHANGE FORMAT MENU**.

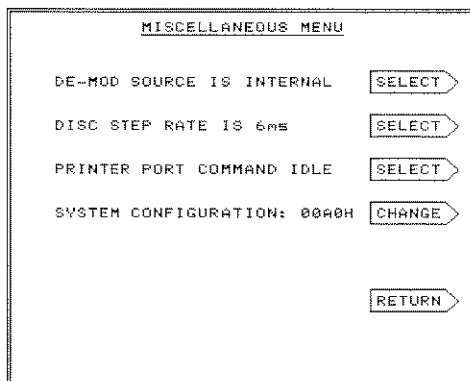


Fig. 3-19 MISCELLANEOUS MENU

DE-MOD SOURCE selection

This selects the method of demodulating the mobile's transmitted signal as INTERNAL (i.e. through the internal demodulator) or EXTERNAL (i.e. through an external modulation meter). INTERNAL is automatically selected when the Adapter is switched on. The EXTERNAL facility enables the RF section of the mobile to be bypassed so as to test only the modem section.

DISC STEP RATE selection

This selects the disc drive head stepping rate to permit a range of drives to be used. Press SELECT once or twice until 6 ms or 12 ms appears as appropriate for the drive in use. The selected rate is saved automatically with each file.

PRINTER PORT COMMAND selection

This is used when the printer is required to print a specified message. Selection is made from the following:-

- (a) IDLE. There is no printer output. This is the default selection.
- (b) SEND (flashing). This sends a string (which has been entered under the **EDIT COMMAND MENU**) to the printer. Prior to this, appropriate selections have to be made under the **PRINTER MENU** and the printer has to be enabled. After sending, IDLE is restored.
- (c) EDIT (flashing). The **EDIT COMMAND MENU** appears. See page 3-1-34.

SYSTEM CONFIGURATION setting

This facility is included so that lesser-used functions and features can be enabled without having full menus. They are enabled by setting bits in two bytes in memory. This is done by entering the equivalent 4-digit hexadecimal number. The bits which are used at present for AMPS are detailed below, the other bits being undefined and reserved for future use. Once an entry has been made for a particular application, it can be saved, along with the other settings, in the non-volatile store.

In internal test sequences, the receiver sensitivity test routine can be replaced by the receiver SINAD test routine but using the parameters as set for the receiver sensitivity test. This allows faster operation when only a pass or fail result is required.

In internal test sequences, the data deviation and the digital RF sensitivity (BER) test routines can be included or not.

The 2957D and 2960D programming capability has been enhanced over that of the the 2957. In applications where 2957 compatibility is required, this can be invoked.

In the PAGE MOBILE mode, transmission to the mobile can be made to be only a single word (the abbreviated address message).

Normally, when a call placement is being made, a delay of approximately 2 seconds is applied before a voice/traffic channel is assigned. This delay can be avoided.

OPERATION

As an N-AMPS mobile has to be able to handoff from a wideband channel to a narrowband channel and vice versa, the channel types have to be selected for FULL AUTO TEST sequences. The initial voice/traffic channel type can be set and the handoff voice/traffic channel can be set to the same channel type or to rotate between WIDE, NARROW, BELOW and ABOVE channel types.

As a D-AMPS mobile has to be able to handoff from a wideband channel to a digital channel and vice versa, the channel types have to be selected for FULL AUTO TEST sequences. The initial voice/traffic channel type can be set and the handoff voice/traffic channel can be set to the same channel type or to rotate between ANALOG, DIGITAL 1 + 4, DIGITAL 2 + 5 and DIGITAL 3 + 6 channel types.

When there is no response to a REGISTRATION request on the default control channel, normally a further attempt is made in the alternative system's block of control channels. This retry can be disabled.

For a group call to apparatus which does not respond, the response requirement can be omitted.

In internal test sequences when the receiver sensitivity test is replaced by the receiver SINAD test routine as described above, the RF level can be set to -118 dBm instead of the level set for the receiver sensitivity test.

A 4-digit hexadecimal number is shown against SYSTEM CONFIGURATION. To invoke any of the above conditions, enter a 4-digit hexadecimal number which is calculated by adding together the hexadecimal numbers in Table 3-9.

The default setting is 00A0H. When testing a digital mobile on D-AMPS, it is necessary to have a setting other than 0000H (e.g. 0020H, 0080H or 00A0H).

TABLE 3-9 SYSTEM CONFIGURATION SETTINGS

Setting	Entry	Default
	Hexadecimal	
	(Binary)	
	a + b + c + d + e + f + g + h + j + k where	
Analog receiver sensitivity or SINAD: Sensitivity test included	a = 0000 (xxxxxxxx xxxxxxx0)	0000
SINAD test included (using parameters of Sensitivity test)	or 0001 (xxxxxxxx xxxxxxx1)	
Data deviation: Test not included	b = 0000 (xxxxxxxx xxxxxx0x)	0000
Test included	or 0002 (xxxxxxxx xxxxxx1x)	
2957 operation: Normal 2957D or 2960D	c = 0000 (xxxxxxxx xxxxx0xx)	0000
2957 compatible	or 0004 (xxxxxxxx xxxxx1xx)	
Page mobile address: Full	d = 0000 (xxxxxxxx xxxx0xxx)	0000
Single word	or 0008 (xxxxxxxx xxxx1xxx)	
Call placement delay: 2 s delay included	e = 0000 (xxxxxxxx xxx0xxxx)	0000
Delay not included	or 0010 (xxxxxxxx xxx1xxxx)	
N-AMPS initial voice/traffic channel: WIDE channel	f = 0000 (xxxxxxxx x00xxxxx)	
NARROW channel	or 0020 (xxxxxxxx x01xxxxx)	0020
BELOW channel	or 0040 (xxxxxxxx x10xxxxx)	
ABOVE channel	or 0060 (xxxxxxxx x11xxxxx)	
D-AMPS initial voice/traffic channel: Analog channel	f = 0000 (xxxxxxxx x00xxxxx)	
Digital 1 + 4	or 0020 (xxxxxxxx x01xxxxx)	0020
Digital 2 + 5	or 0040 (xxxxxxxx x10xxxxx)	
Digital 3 + 6	or 0060 (xxxxxxxx x11xxxxx)	
N-AMPS and D-AMPS handoff voice/traffic channel: Same channel type	g = 0000 (xxxxxxxx 0xxxxxxxx)	
Rotate channel type	or 0080 (xxxxxxxx 1xxxxxxxx)	0080
Registration retry on timeout: Retry alternate channel	h = 0000 (xxxxxxx0 xxxxxxxx)	0000
No retry	or 0100 (xxxxxxx1 xxxxxxxx)	
Digital RF sensitivity (BER): Test included	j = 0000 (xxxxxxx0x xxxxxxxx)	0000
Test not included	or 0200 (xxxxxxx1x xxxxxxxx)	
Test routines 21, 23 and 24 for receiver-only apparatus: Normal signalling	k = 0000 (0xxxxxxxx xxxxxxxx)	0000
No response expected	or 8000 (1xxxxxxxx xxxxxxxx)	
RF level for receiver SINAD tests when substituted for receiver sensitivity test: RF level as Sensitivity test	c = 0000 (xxxxxx0xx xxxxxxxx)	0000
RF level set to -118 dBm	or 0400 (xxxxxx1xx xxxxxxxx)	

OPERATION

EDIT COMMAND MENU

To enter this menu, select the **MISCELLANEOUS MENU**, the **PRINTER PORT COMMAND** option and then **EDIT**.

This menu, as shown in Fig. 3-20, allows entry of a message of up to 30 characters to be sent to the printer when required. The default message is a <LF>.

To enter or change the message, press the upper **CHANGE** key. A table of characters appears at the bottom of the display. Select each character of the message by entering first the line number (1 to 3) followed by the column number (0 to 9). Each selected character appears in the **PRINTER PORT COMMAND** field. Errors can be rectified by using the **DELETE** key. The message can be aborted at any time by pressing any other soft key. If the message is not required, it can be removed by deleting characters to leave a blank field.

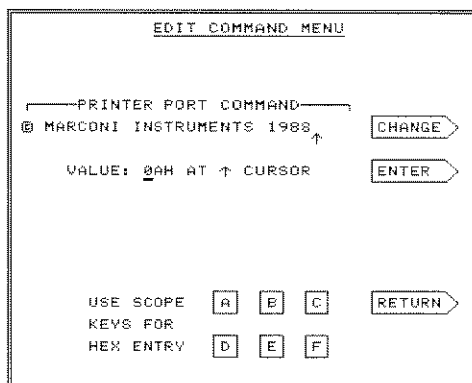


Fig. 3-20 **EDIT COMMAND MENU**

Alternatively or subsequently, press the lower **CHANGE** key. Hexadecimal digits A to F appear at the bottom of the display to show that the 2955's **OSCILLOSCOPE** keys are used for these. Select each character of the message by entering its 2-digit hexadecimal code for the 2955's character set as given in its Operating Manual. For numbers and upper-case letters, these are the same as ASCII codes. Terminate the message with 0A (i.e. for <LF>). Each selected character appears in the **PRINTER PORT COMMAND** field. Codes below hexadecimal 20 (decimal 32) or above hexadecimal 7F (decimal 127) can be entered. Each of these is entered directly or subsequently after leaving a space for it and is shown in the **PRINTER PORT COMMAND** field as a ?.

To move the cursor along (or back to the first position after the last), press **ENTER**.

Pressing **RETURN** restores the **MISCELLANEOUS MENU**.

SYSTEM PARAMETER WORD 1 MENU

This is a 'hidden' menu - it is not shown on any of the other menus. To enter, select the **SYSTEM PARAMETERS MENU** and then press the Tx TEST key. Then, within 2 seconds, press the 1 key.

This menu, as shown in Fig. 3-21a, Fig. 3-21b and Fig. 3-21c, allows the user to change certain bit fields in the overhead message which is sentpri/que=lab\$printer on a control channel. Each bit field which can be changed is shown in the menu with a code letter above it as follows:-

Parameter	Code
Extended protocol	E (N-AMPS and D-AMPS)
Authentication	A (D-AMPS)
Protocol capability indicator	P (D-AMPS)

The default settings are necessary for correct operation of the internal test sequences. However, the user may wish to verify correct operation of a mobile with these bits changed. This would normally be done in a user-defined test sequence or by using the manual test mode.

For a full description of these bits and their significance to the mobile under test, refer to the relevant air-interface specification.

To select the bit field, press the SELECT key. The selected bit field is shown in reverse video. To change the bit field, press the TOGGLE key.

For bit fields with more than one bit, the TOGGLE key changes to SELECT. To change a bit, press the SELECT key, enter a decimal number on the keypad and press the ENTER key.

To restore all the bit fields to their default values, press the DEFAULT key. Changes to bit fieldss are retained only until the instrument is switched off.

Pressing RETURN restores the **SYSTEM PARAMETERS MENU**.

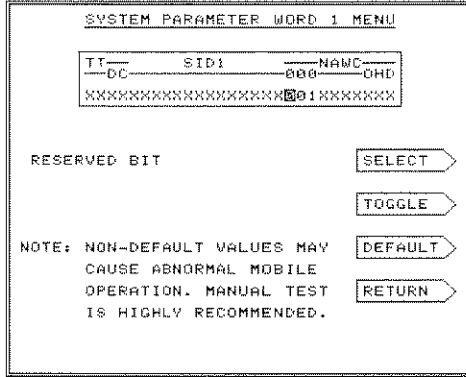


Fig. 3-21a **SYSTEM PARAMETER WORD 1 MENU - E-AMPS**

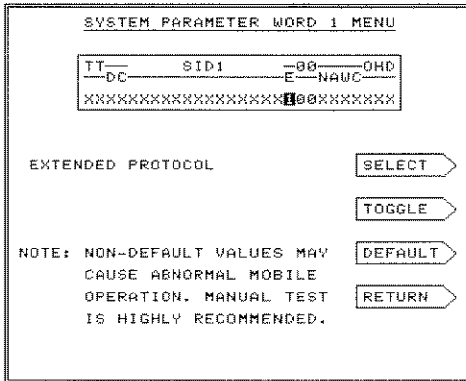


Fig. 3-21b **SYSTEM PARAMETER WORD 1 MENU - N-AMPS**

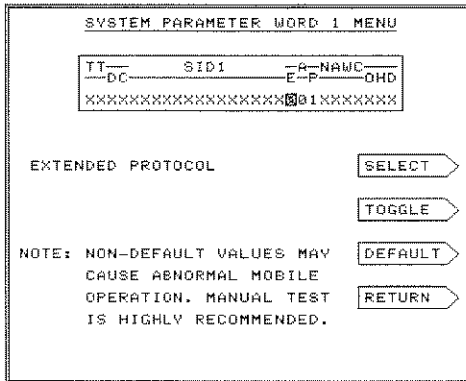


Fig. 3-21c **SYSTEM PARAMETER WORD 1 MENU - D-AMPS**

SYSTEM PARAMETER WORD 2 MENU

This is a 'hidden' menu - it is not shown on any of the other menus. To enter, select the **SYSTEM PARAMETERS MENU** and then press the Tx TEST key. Then, within 2 seconds, press the 2 key.

This menu, as shown in Fig. 3-22a and Fig. 3-22b, allows the user to change certain bit fields in the overhead message which is sent on a control channel. Each bit field which can be changed is shown in the menu with a code letter above it as follows:-

Parameter	Code
Serial number	S
Extended address	E
Home registration	H
Roamer registration	R
Discontinuous transmission	D (E-AMPS) or DT (N-AMPS and D-AMPS)
Number of paging channels - 1	N - 1
Read control filler	R
Combined paging and access	C
Number of access channels - 1	C MAX - 1

Roamer registration does not apply to N-AMPS. In these cases, the bit is shown as reserved.

The default settings are necessary for correct operation of the internal test sequences. However, the user may wish to verify correct operation of a mobile with these bits changed. This would normally be done in a user-defined test sequence or by using the manual test mode.

For a full description of these bits and their significance to the mobile under test, refer to the relevant air-interface specification.

To select the bit field, press the SELECT key. The selected bit field is shown in reverse video. To change the bit field, press the TOGGLE key.

For bit fields with more than one bit, the TOGGLE key changes to CHANGE. To change a bit, press the CHANGE key, enter a decimal number on the keypad and press the ENTER key.

To restore all the bit fields to their default values, press the DEFAULT key. Changes to bit fields are retained only until the instrument is switched off.

Pressing RETURN restores the **SYSTEM PARAMETERS MENU**.

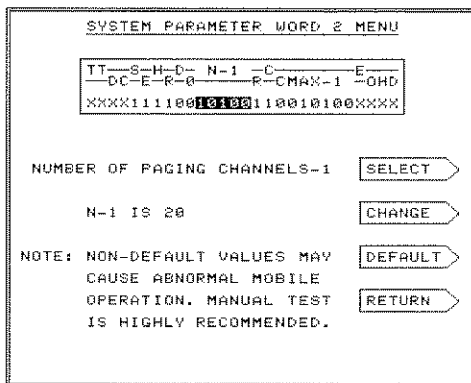


Fig. 3-22a SYSTEM PARAMETER WORD 2 MENU - E-AMPS

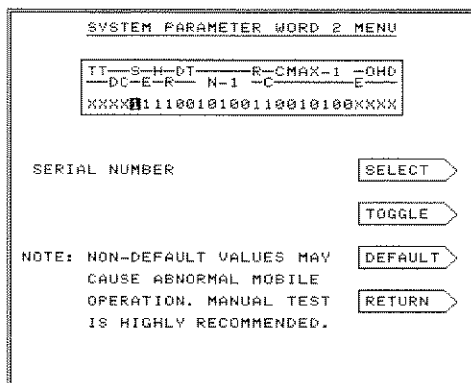


Fig. 3-22b SYSTEM PARAMETER WORD 2 MENU - N-AMPS and D-AMPS

PARAMETER STORAGE

Six full sets of parameters can be stored.

From the main top level menu, select FULL AUTO TEST. The FULL AUTO TEST intermediate display appears as shown in Fig. 3-9.

To store the current settings, press the 2955's STORE key followed by one digit from 1 to 6.

To recall settings, press the 2955's RECALL key followed by the same digit which was used to store the setting. The intermediate display is updated accordingly.

When more than one system is being used, settings for one system cannot be recalled into another system. The user has to take note of which store he has used for each set of parameters. This allows the rapid restoration of settings when changing between system options.

GO/NO-GO TEST MODE

This is designed for rapid operation. It executes the test sequence which has been selected from the **CHANGE FORMAT MENU**. It may be one of the four built-in test sequences or an externally-written test sequence which has been loaded into the memory.

The GO/NO-GO TEST mode is accessed from the main top level menu, as shown in Fig. 3-8, by pressing the GO/NO-GO TEST key. The SUMMARY DISPLAY FORMAT display then appears as shown in Fig. 3-23 and the test sequence is immediately started. The DISPLAY FORMAT is automatically set to SUMMARY irrespective of the current setting in the **DISPLAY FORMAT MENU**.

Results of each test routine are shown but the main purpose of using the GO/NO-GO TEST mode is to make a quick appraisal of the mobile so a PASSED, ERROR: or *FAIL* status is displayed for every test routine. This saves the user's time in interpreting data or checking measurements.

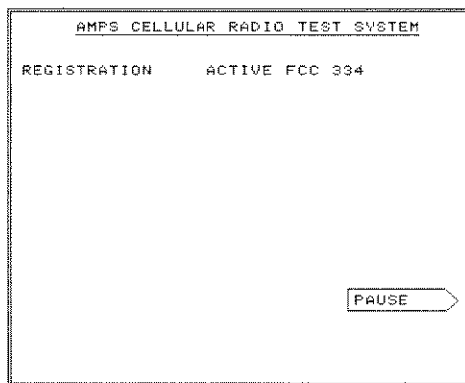


Fig. 3-23 SUMMARY DISPLAY FORMAT display

When printing has been selected from the **PRINTER MENU**, the user can obtain a printout of the test routines and their results using one of the user ports. The format of the printout can be ALL, ON FAILURE or ON PASS depending on the user's selection.

As there may be more than ten test routines in a sequence, scrolling is employed when the screen is full. Failed test routines are collected at the top of the display until the sequence is finished.

In the GO/NO-GO TEST mode, PAUSE is automatically set to MANUAL ONLY irrespective of the current setting in the **DISPLAY FORMAT MENU**. Pressing the PAUSE key causes the sequence to be stopped at the end of the current test routine and the CONTINUE key appears as shown in Fig. 3-26.

At the end of the test sequence, a summary of the test routines and their results is automatically displayed as shown in Fig. 3-25 so that the user can see if the mobile has failed any of the test routines. For test sequences which contain more than ten test routines, failed ones have priority. Pressing the CONTINUE key causes the mobile's MSN and name of country to appear at the bottom of the screen.

Pressing the RETURN key restores the main top level menu.

OPERATION

FULL AUTO TEST MODE

This executes the test sequence which has been selected from the **CHANGE FORMAT MENU**. It may be one of the four built-in test sequences or an externally-written test sequence which has been loaded into the memory. A split screen display is shown so that the service engineer can monitor the RF and AF parameters.

The FULL AUTO TEST mode is accessed from the main top level menu, as shown in Fig. 3-8, by pressing the FULL AUTO TEST key. The FULL AUTO TEST intermediate display then appears as shown in Fig. 3-9. This shows a summary status of the desired test parameters and display formats held in the non-volatile memory since the **CHANGE FORMAT MENU** was last accessed.

To change any of these, press the CHANGE FORMAT key. See page 3-1-18. To save all the format parameters, six non-volatile stores are available. To store the parameters, press the STORE key followed by a number from 1 to 6. To recall these parameters, press the RECALL key followed by the same number.

To start the test sequence, press the START TEST key.

When FULL DISPLAY FORMAT has been chosen, the display consists of three sections as shown in Fig. 3-24. Most of the top half is the 2955 DUPLEX display. This is not applicable to digital channels (except for RECEIVER FREQ, RECEIVER LEVEL and TRANSMITTER FREQ). The bottom half displays the limits for the transceiver test routines with the mobile's MSN and name of country. Separating the two is the current test routine shown being executed.

RECEIVER	DUPLEX	TRANSMITTER
FREQ: 880.02000MHz		FREQ: 835.02000MHz
LEVEL: -40.0dBm		POWER: 0.01mW
FREQ: 1.0000kHz		FREQ: 0.0Hz
LEVEL: 0Hz		LEVEL: 0.01kHz
AUDIO: 1mV		FILTER: 15kHz LP
-59.9dBV		AF GEN: 1.0000kHz
	AC ONE 9031	0.0mV
REGISTRATION	ACTIVE FCC 334	

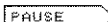
PAUSE 

Fig. 3-24 FULL AUTO TEST FULL DISPLAY FORMAT display

When SUMMARY DISPLAY FORMAT has been selected, the display is the same as that for the GO/NO-GO TEST mode as shown in Fig. 3-23. In this case, one line is shown for each test routine so that, as the screen is filled, the lines are scrolled upwards. Failed test routines are collected at the top of the screen.

PAUSE has been previously set to ALWAYS, MANUAL ONLY or ON FAILURE. Pressing the PAUSE key causes the sequence to be interrupted manually at the end of the current test routine. The CONTINUE key appears as shown in Fig. 3-26.

At the end of the test sequence, a summary of the test routines and their results is automatically displayed as shown in Fig. 3-25 so that the user can see which test routines the mobile has failed. For test sequences which contain more than ten test routines, failed ones have priority. Pressing the CONTINUE key causes the mobile's identity to appear at the bottom of the screen.

For N-AMPS, channel numbers are shown with the prefix WC, NC, BC or AC for WIDE, NARROW, BELOW or ABOVE type channels.

For D-AMPS, channel numbers are shown with the prefix F1, F2 or F3 for DIGITAL 1 + 2, DIGITAL 2 + 5 or DIGITAL 3 + 6 type channels.

Pressing the RETURN key restores the FULL AUTO TEST intermediate display.

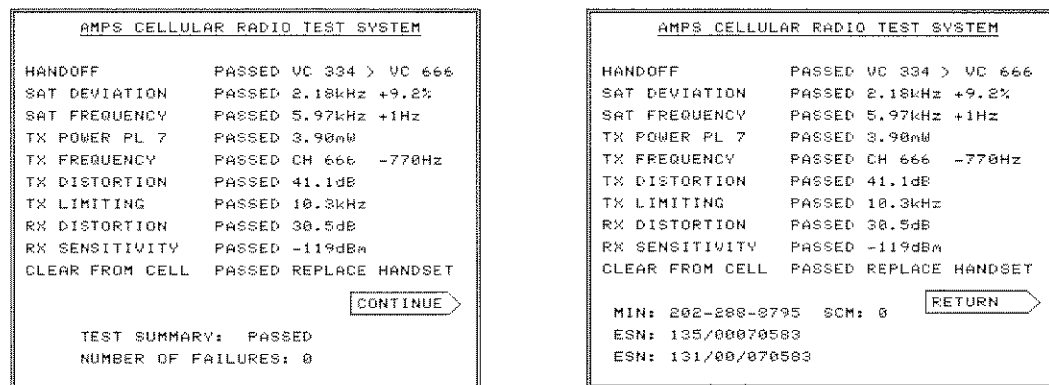


Fig. 3-25 Test summary displays

TEST SEQUENCE PAUSE

In the GO/NO-GO TEST mode, the test sequence can be interrupted by pressing the PAUSE key. In the FULL AUTO TEST mode, the PAUSE function can be activated manually, automatically after every test routine or when one has failed. This depends on which was selected from the **DISPLAY FORMAT MENU**. In all cases, the test sequence is interrupted only at the end of a test routine. When a PAUSE occurs, the CONTINUE key appears as shown in Fig. 3-26. The user can then select one of the following options:-

- (a) CONTINUE.
- (b) ABORT TESTING.
- (c) MANUAL RF TESTING.
- (d) DATA.

CONTINUE option

Pressing the CONTINUE key restarts the test sequence from the point at which it was halted.

OPERATION

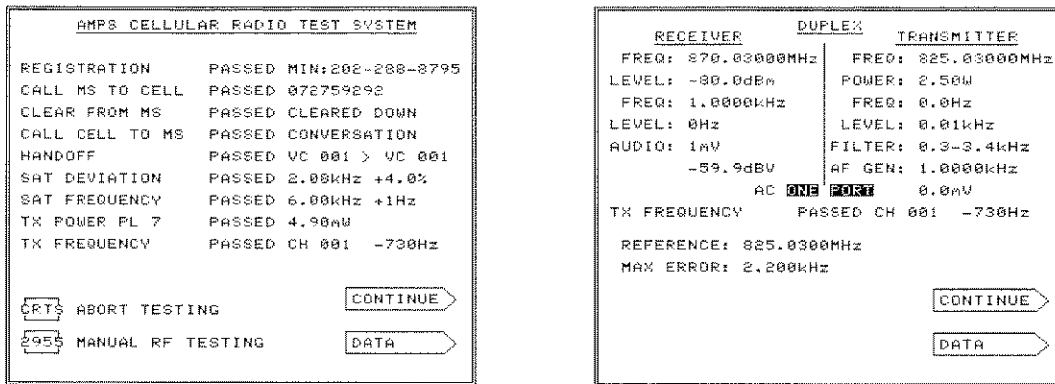


Fig. 3-26 SUMMARY DISPLAY FORMAT and FULL AUTO TEST FULL DISPLAY FORMAT paused displays

ABORT TESTING option

To abort the test sequence and access the main top level menu, press the CRTS key. This allows the user to enter the MANUAL TEST facility to carry out specific testing for more detailed fault-finding or to start another test sequence.

MANUAL RF TESTING option

This is not applicable to digital channels. When the display shows the 2955 key, the user can press the 2955 key to call up the DUPLEX display which has been automatically set to the parameters of the last test sequence. The user now has manual control of the RF and AF signal generators for alignment and fault finding purposes on the mobile's transceiver circuits. Do not leave DUPLEX operation (i.e. do not press the Tx TEST key or the Rx TEST key) or the mobile will drop out of service. Press the CRTS key to return to the test sequence.

DATA option

The data displays allow the user to view the data messages which are sent by the mobile to the cell and from the cell to the mobile during the call processing test routines and in a MANUAL TEST procedure. These displays allow the user to rapidly identify incorrect bits sent by the mobile which may have caused it to fail. They can also serve as an educational or reference facility for users who are unfamiliar with cellular signalling.

Press the DATA key to access the REVERSE WIDEBAND DATA display as shown in Fig. 3-27a, the REVERSE NARROW/WIDEBAND DATA display or the REVERSE DIGITAL/WIDEBAND DATA display as shown in Fig. 3-27b. In the lower half, this shows the 12 or 16 hexadecimal digits of the data words which have been sent by the mobile on the reverse channels during the last signalling test routine.

OPERATION

Press the FORWARD key to access the **FORWARD WIDEBAND DATA** menu as shown in Fig. 3-28, the **FORWARD NARROW/WIDEBAND DATA** menu or the **DIGITAL/WIDEBAND DATA** menu. The type of forward message can be then selected for analysis. Selection is from the following options:-

- (a) CONTROL FILLER words. These are null data which are sent when no active information is being transmitted. This enables mobiles to scan continuously for a strong signal onto which they can lock.
- (b) OVERHEAD MESSAGE words. These contain certain information which relates to the system parameters of the local network (e.g. SID, available control channels).
- (c) MOBILE STATION CONTROL FCC words. These contain commands and messages which are sent to a particular mobile on the forward control channel during registration and call set-up. Each word is repeated a number of times to ensure that the mobile receives the correct data.
- (d) MOBILE STATION CONTROL FVC or FDTC words. These contain commands and messages which are sent to a particular mobile on the forward analog voice channel or digital traffic channel during a call (i.e. handoff). Except for N-AMPS narrowband and D-AMPS digital, each word is repeated a number of times to ensure that the mobile receives the correct data. For N-AMPS narrowband, each word is not repeated. For D-AMPS digital, the word may be repeated if an Ack message is not received but this is not indicated on the data display.

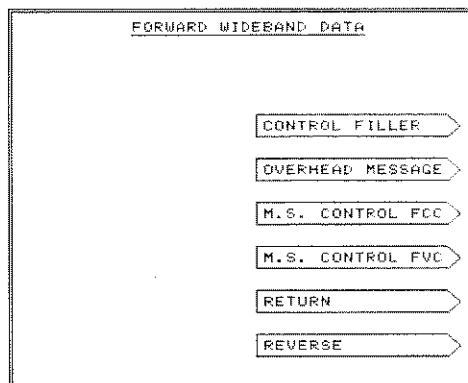


Fig. 3-28 **FORWARD WIDEBAND DATA** menu

Press one of the option keys to access the appropriate **FORWARD WIDEBAND DATA**, **FORWARD NARROW/WIDEBAND DATA** display or **FORWARD DIGITAL/WIDEBAND DATA** display. Examples are shown in Fig. 3-29a and Fig. 3-29b. In the lower half, there are the 10 or 16 hexadecimal digits of the data words which have been sent to the mobile during the last signalling test routine. The word type is shown together with the number of times that the particular word has been repeated.

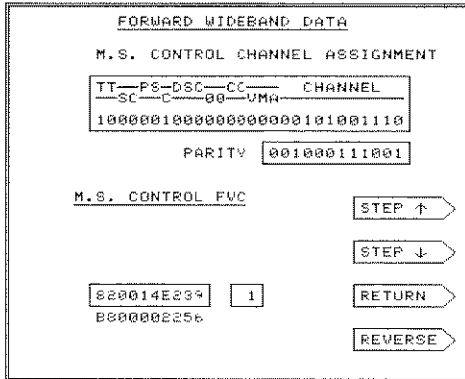


Fig. 3-29a OVERHEAD MESSAGE DISPLAY display

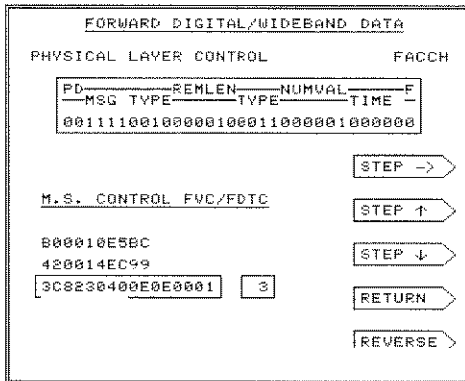


Fig. 3-29b MOBILE STATION CONTROL FDTC display

Press the REVERSE key to restore the appropriate display. Press the RETURN key to restore the previous display.

A word can be selected for analysis by pressing the STEP ↑ key or the STEP ↓ key until the word is displayed in the lower box.

OPERATION

Except for D-AMPS, the word is then shown as 40 or 48 bits in the box in the upper half together with the word type in accordance with the AMPS specification. A word which contains a single incorrect bit is indicated by a C in the ERR column. If more than one bit is incorrect, the word is indicated by a flashing E. When there is a single bit error in the data part of the word which is shown in the upper box, the incorrect bit is shown in reverse video. When there is an error in the parity part of the word, the incorrect bit is not shown.

For D-AMPS, under 8 of the hexadecimal digits, the box is dotted. These 8 hexadecimal digits are then shown as 32 bits in the box in the upper half together with the word type in accordance with the AMPS specification. The selected 8 hexadecimal digits can be moved along the word 4 digits at a time by using the STEP → key and 1 digit at a time backwards by using the DUPLEX key.

To print the data, enable the printer and then press the Rx TEST key. The selected word is then printed in the form of 40, 48 or 64 bits together with the word type. Repeated pressing of the Rx TEST key prints each successive word.

MANUAL TEST MODE

This provides the user with manual control of the 2957D or 2960D. It is intended to be used for troubleshooting and repair rather than for routine testing.

The MANUAL TEST mode is accessed from the main top level menu, as shown in Fig. 3-4, by pressing the MANUAL TEST key. The **MANUAL OPERATION** display then appears as shown in Fig. 3-30a, Fig. 30b or Fig. 3-30c. It consists of a generated section shown on the upper half and a measured section with readings shown on the lower half.

The supply voltage, current and DC power are shown except when the DC POWER reading is not selected for D-AMPS digital as below. If the voltage remains below 1V for longer than 6 seconds, the supply voltage, current and power readings are disabled. This enables the SAT readings to be updated three times faster than normal thus making adjustment easier.

The user can access the following options:-

- (a) CHANNEL.
- (b) SAT FREQ and SCC (except N-AMPS narrowband and D-AMPS digital), DSAT DATA and DSCC (N-AMPS narrowband) or DVCC (D-AMPS digital).
- (c) SAT LEVEL (except N-AMPS narrowband and D-AMPS digital), DSAT LEVEL (N-AMPS narrowband) or TIME ALIGN (D-AMPS digital).
- (d) DATA LEVEL (except D-AMPS), DATA LEVEL and GEN LEVEL (D-AMPS analog) or GEN LEVEL (D-AMPS digital).
- (e) MODE.
- (f) AF PATH.
- (g) TIA.
- (h) DATA.

In addition, for D-AMPS digital channels, the user can select between three sets of readings as follows:-

- (a) DTMF TONES and DC POWER.
- (b) TX POWER and TX FREQUENCY.
- (c) VECTOR, 1ST 10 and ORIGIN.

Pressing the CRTS key restores the main top level menu. Pressing the 2955 key calls up the 2955 **DUPLEX** display. If the CRTS key is pressed once again, the user is taken back to the **MANUAL OPERATION** display.

CHANNEL setting

This is selected by pressing the CHANNEL key (which changes to ENTER). Enter the number on the keypad and terminate by using the ENTER key.

This option is normally only used when the user is prompted in the HANDOFF mode. However, except for D-AMPS channels, it is possible to reverse the frequency plans by entering a negative number. This means that the MANUAL TEST procedure could be used for testing certain functions of a base station.

```

    AMPS CELLULAR RADIO TEST SYSTEM
    MANUAL OPERATION
    E-AMPS
    CHANNEL: 334          CHANNEL
    SAT FREQ: 5.970kHz   SCC: 0
    LEVEL: 2.000kHz     CHANGE
    DATA LEVEL: 8.000kHz DCC: 0
    MODE: CONVERSATION  MODE
    RX AF PATH
    SAT LEVEL: 2.086kHz SAT
    DTMF TONES: 123456789*0#
    DC POWER: 13.0V 2.26A 29.3W
    MIN: 202-288-8795   SCM: 0
    ESN: 135/00070583   TIA
    ESN: 135/00/070583  DATA
    DIGITS: 123456
    
```

Fig. 3-30a MANUAL OPERATION display - E-AMPS

```

    AMPS CELLULAR RADIO TEST SYSTEM
    MANUAL OPERATION
    N-AMPS
    CHANNEL: 334          NARROW CHANNEL
    DSAT DATA: 2556CBH  DSCC: 0
    LEVEL: 0.700kHz     CHANGE
    DATA LEVEL: 8.000kHz DCC: 0
    MODE: CONVERSATION  MODE
    RX AF PATH
    DSAT LEVEL: 0.640kHz DSAT
    DTMF TONES: 123456789*0#
    DC POWER: 13.0V 2.26A 29.3W
    MIN: 202-288-8795   SCM: 08H TIA
    ESN: 135/00070583
    ESN: 135/00/070583  DATA
    DIGITS: 123456
    
```

Fig. 3-30b MANUAL OPERATION display - N-AMPS narrowband

```

    AMPS CELLULAR RADIO TEST SYSTEM
    MANUAL OPERATION
    D-AMPS
    CHANNEL: 334          ANALOG CHANNEL
    SAT FREQ: 5.970kHz   SCC: 0
    LEVEL: 2.000kHz     CHANGE
    DATA LEVEL: 8.000kHz DCC: 0
    MODE: CONVERSATION  MODE
    RX AF PATH
    SAT LEVEL:          SAT
    DTMF TONES: 12345678*0#
    DC POWER: 13.0V 2.26A 29.3W
    MIN: 202-288-8795   SCM: 08H TIA
    ESN: 135/00070583
    ESN: 135/00/070583  DATA
    DIGITS: 123456
    
```

```

    AMPS CELLULAR RADIO TEST SYSTEM
    MANUAL OPERATION
    D-AMPS
    CHANNEL: 334          DIGITAL 1+4 CHANNEL
    DVCC: 15
    TIME ALIGN: 0        CHANGE
    GEN LEVEL: -80.0dBm
    MODE: CONVERSATION  MODE
    RX AF PATH
    TX OFFSET: 44.4     SWNC
    TX POWER: 3.0W     SELECT
    TX FREQ: 835.02000MHz
    MIN: 202-288-8795   SCM: 08H TIA
    ESN: 135/00070583
    ESN: 135/00/070583  DATA
    DIGITS: 123456
    
```

Fig. 3-30c MANUAL OPERATION display - D-AMPS analog and digital

For N-AMPS, the channel type WIDE, NARROW, BELOW or ABOVE is shown alongside the CHANNEL number. After entering the CHANNEL number, the ENTER key changes to SELECT. To select the channel type, press the SELECT key. When a narrowband channel has been selected, SAT, SCC and ST are replaced by DSAT, DSCC and DST on the display.

For D-AMPS, the channel type DIGITAL 1 + 4 (for full rate channel 1), DIGITAL 2 + 5 (for full rate channel 2), DIGITAL 3 + 6 (for full rate channel 3) or ANALOG is shown alongside the CHANNEL number. After entering the CHANNEL number, the ENTER key changes to SELECT. To select the channel type, press the SELECT key. The selection ANALOG gives a channel which is the same as an E-AMPS voice channel.

SAT FREQ and SCC settings

Not applicable to N-AMPS narrowband and D-AMPS digital.

This is selected by pressing the CHANGE key (which changes to NEXT). Enter the SAT FREQ on the keypad. The default SAT FREQ is taken from the setting in the **SYSTEM PARAMETERS MENU**.

The SCC (SAT colour code) value depends on the SAT frequency setting.

DSAT DATA and DSCC setting

Applicable to N-AMPS narrowband only.

This is selected by pressing the CHANGE key (which changes to NEXT). Enter the DSCC (digital SAT colour code) on the keypad and terminate by using the NEXT key. The default DSCC is taken from the setting in the **SYSTEM PARAMETERS MENU**.

The DSAT DATA depends on the DSCC setting.

DVCC setting

Applicable to D-AMPS digital only.

This is selected by pressing the CHANGE key (which changes to NEXT). Enter the DVCC (digital verification colour code) on the keypad and terminate by using the NEXT key. The default DVCC is taken from the setting in the **SYSTEM PARAMETERS MENU**. If the DVCC is changed while in conversation on a digital channel the mobile will drop out as the DVCC sent by the 2957D or 2960D no longer matches the DVCC expected.

SAT LEVEL setting

Not applicable to N-AMPS narrowband and D-AMPS digital.

This is selected by pressing the CHANGE key (which changes to NEXT) and then the NEXT key as necessary to scroll to this option. Enter the SAT LEVEL on the keypad. The default level is the AMPS specified nominal level.

OPERATION

DSAT LEVEL **setting**

Applicable to N-AMPS narrowband only.

This is selected by pressing the CHANGE key (which changes to NEXT) and then the NEXT key as necessary to scroll to this option. Enter the DSAT LEVEL on the keypad. The default level is the AMPS specified nominal level.

TIME ALIGN **setting**

Applicable to D-AMPS digital only.

The time alignment is selected by pressing the CHANGE key (which changes to NEXT) and then the NEXT key as necessary to scroll to this option. Enter the TIME ALIGN value on the keypad and terminate by using the NEXT key. The default value is 0. If the time alignment is changed when in conversation on a digital channel the TX offset measurement value should change accordingly. (A time alignment unit equals half a symbol.)

DATA LEVEL **setting**

Not applicable to D-AMPS digital.

This is selected by pressing the CHANGE key (which changes to NEXT) and then the NEXT key as necessary to scroll to this option. Enter the DATA LEVEL on the keypad. The default level is the AMPS specified nominal levels.

GEN LEVEL **setting**

Applicable to D-AMPS analog and digital only.

This is selected by pressing the CHANGE key (which changes to NEXT) and then the NEXT key as necessary to scroll to this option. For analog, scroll to the DATA LEVEL option and then press the NEXT key once more. DATA LEVEL is replaced by GEN LEVEL. Enter the GEN LEVEL on the keypad. The default level is -80 dBm.

MODE **selection**

This allows the user to select a signalling test mode depending on the state of the mobile under test. Some of the modes are the same as those in the built-in test sequences; others generate a pattern of data which is primarily intended to exercise a mobile's other functions. The user can access the DATA display by pressing the DATA key to check the mobile's responses. When the user selects a mode, screen prompts are given for the user to enter test parameters.

To select the mode, press the MODE key (which changes to SELECT). Scroll through the modes available until the required mode appears. The selected mode is implemented after a 2 second timeout or pressing any other key within this timeout. These modes operate as follows:-

(a) FCC.

This sends continuous Forward Control Channel (FCC) messages. If the system ID is different from the current setting, the mobile responds by registering. In this mode, a PLACE CALL can be initiated from the mobile. When this is done, PLACE CALL is shown on the display (non-flashing) and then the mode changes to CONVERSATION.

(b) REGISTRATION.

This is similar to the corresponding test routine in the built-in test sequences. The mobile's MIN, ESN and SCM (hexadecimal for N-AMPS and D-AMPS) are displayed when the mobile registers successfully. The mode then reverts to FCC.

(c) PAGE MOBILE.

This is the built-in CALL CELL TO MS test routine. A flashing prompt, together with the mobile's alert signal, requests the user to ANSWER CALL. Upon the user lifting the handset or pressing the SEND key, the mode changes to CONVERSATION.

(d) PLACE CALL.

This is the built-in CALL MS TO CELL test routine. A flashing prompt requests the user to PLACE CALL. On the handset, the user keys in up to 32 digits. When they are received, they are shown at the bottom of the screen, truncated to 16 digits. The mode changes to CONVERSATION.

(e) DIRECTED RETRY.

A Directed Retry command is used by a base station to instruct a mobile which has attempted to access the system to retry on a new control channel. When this mode is selected, there are prompts for a CHANNEL number and then for a CHANPOS number. After the CHANNEL number, enter a CHANPOS number in the range 1 to 127.

Except for N-AMPS, the formula is as follows:-

$$\text{CHANPOS number} = \text{NEW CHANNEL} - \text{FIRST CONTROL CHANNEL} + 1.$$

For N-AMPS, the formula is as follows:-

$$\text{CHANPOS number} = (\text{NEW CHANNEL} - \text{FIRST CONTROL CHANNEL} + 2) \div 2.$$

After entry, PLACE CALL is shown flashing. When an access attempt is received from the mobile, a Directed Retry Order is sent. The first entry is to CHANPOS. The mode changes to FCC on the NEW CHANNEL. The mobile should then re-attempt to access on the NEW CHANNEL changing the mode to PLACE CALL which is processed as usual.

With some mobiles, it may be necessary to use another signal generator to generate the NEW CONTROL CHANNEL. Connect the modulation input of the signal generator to the MOD OUT connector using a T-piece. Connect the RF output of the signal generator to the RF IN/OUT BNC connector on the 2955. On the signal generator, set the frequency to that of the NEW CHANNEL and the level to approximately -40 dBm (i.e. 40 dB above the level to be seen by the mobile).

OPERATION

(f) NEW ACCESS CHANNEL.

When this is selected, there is a prompt for a CHANNEL number. After this number is entered, the overhead message is reinitialized with the appropriate NEW ACCESS CHANNEL action message.

With some mobiles, it may be necessary to use another signal generator as in (e).

(g) OVERLOAD CLASS.

When this is selected, there is a prompt for a number in the range 0 to 15. When this is entered, an overload class global action message is created and transmitted. If the mobile has an overload class number equal to that in the received message, further access to the system by the mobile is prevented. This does not prevent access to the mobile by the system.

(h) RF SENSITIVITY.

This is only available for D-AMPS digital channels.

In this mode, the RF sensitivity of the mobile's receiver is measured in terms of bit error rate (BER). For this measurement, the mobile echoes the data sent to it by using the mobile's test interface adapter (EIA/TIA IS-55 Section 8). Connect the TIA serial port to TEST PORT so that appropriate commands for the mobile to enter the TDMAON mode are sent before starting the measurement.

When this mode is selected, there is a prompt for the RF generator level which is required for the measurement. When this is entered, the mobile is commanded into echo mode as above. Pseudo-random data is then transmitted to the mobile. This data is inserted in the data field after convolutional decoding but before interleaving. The data echoed by the mobile is then compared for bit errors. The ratio of errors to the total number of bits received in 1 second (BER) is displayed each second in place of the TX OFFSET.

The 2957D or 2960D continuously checks for full TDMA bursts. When these are received with the correct sync pattern, SYNC is shown in reverse video on the display.

Possible error messages are as follows:-

OUT OF LOCK. When the measurement is started, each frame of received data is compared with the first frame of sent data until a frame with <20% errors is received. This is to synchronize sent frames and received frames. If synchronization fails, the measurement is not updated and the error message is displayed. If error rates approaching 20% are anticipated, the measurement should be started at a higher level (-80 dBm) and then reduced as required when synchronization has been achieved. If the error rate exceeds 40% during the measurement period, synchronization is lost and the process is restarted.

SLOTS MISSING. If complete slots of data are lost during the measurement period (perhaps because the synchronization pattern has been corrupted), the measurement is not updated and the error message is displayed.

(i) DATA OFF.

When an analog wideband channel is selected, the current SAT frequency is generated. When an N-AMPS narrowband channel is selected, the current DSAT pattern is generated. When a digital channel is selected, the 2957D or 2960D simulates a traffic channel without having to enter conversation with filler octets for SACCH and pseudo-speech (a buzzing sound).

On wideband channels, the system continuously checks for SAT and ST. When these are detected, SAT and ST are shown in reverse video on the display. The SAT LEVEL and ST DURATION are measured and displayed as appropriate.

On narrowband channels, the system continuously checks for DSAT and DST. When these are detected, DSAT and DST are shown in reverse video on the display.

On digital channels, the system continuously checks for full or shortened TDMA bursts. When these are received with the correct sync pattern, SYNC is shown in reverse video on the display. When shortened bursts are received, SB is shown in reverse video on the display. The TX OFFSET, TX POWER, TX FREQUENCY, VECTOR, 1ST 10 and ORIGIN (as selected) are measured and displayed. These tests for mobile transmit burst timing (TX OFFSET), Tx power and digital modulation error (VECTOR, 1ST 10 and ORIGIN) are the same as the test routines for the built-in test sequences.

(j) SIGNAL TONE.

The data generator sends a continuous signal tone of 10.0 kHz. On wideband channels, the system continuously checks for SAT and ST. When these are detected, SAT and ST are shown in reverse video on the display. The SAT LEVEL and ST DURATION are measured and displayed as appropriate. On narrowband channels, the system continuously checks for DSAT and DST. When these are detected, DSAT and DST are shown in reverse video on the display.

(k) DOTTING.

The 2957D or 2960D generates a 5 kHz dotting pattern (a series of alternate 1's and 0's). On wideband channels, the system continuously checks for SAT and ST. When these are detected, SAT and ST are shown in reverse video on the display. The SAT LEVEL and ST DURATION are measured and displayed as appropriate. On narrowband channels, the system continuously checks for DSAT and DST. When these are detected, DSAT and DST are shown in reverse video on the display.

OPERATION

When the PAGE MOBILE is answered or when the PLACE CALL is successful, there is another level of modes. In these modes, the system continuously checks for the following signals:-

- (a) SAT and ST on wideband channels. When these are detected, SAT and ST are shown in reverse video on the display. The SAT LEVEL and ST DURATION are measured and displayed as appropriate.
- (b) DSAT and DST on narrowband channels. When these are detected, DSAT and DST are shown in reverse video on the display.
- (c) Full or shortened TDMA bursts on digital channels. When these are received with the correct sync pattern, SYNC is shown in reverse video on the display. When shortened bursts are received, SB is shown in reverse video on the display. The TX OFFSET, DTMF TONES, TX POWER, TX FREQUENCY, VECTOR, 1ST 10 and ORIGIN (as selected) are measured and displayed. These tests for mobile transmit burst timing (TX OFFSET), DTMF tones, Tx power and digital modulation error (VECTOR, 1ST 10 and ORIGIN) are the same as the test routines for the built-in test sequences.

Also, the received DTMF tones are displayed.

These modes operate as follows:-

- (a) CONVERSATION.

In this mode, the user can test the handset's numerical, SEND and END keys. When a digital channel is selected, any speech data received from the mobile is looped back to the mobile after a delay of approximately 2 seconds. If no acceptable speech data is received from the mobile, pseudo-speech data (a buzzing sound) is sent.

- (b) HANDOFF.

When this mode is selected, the user is prompted to select a new channel by the flashing cursor and ENTER sign. The new channel number and channel type are entered as described under 'CHANNEL setting'. The mobile then changes to the new channel and the mode changes to CONVERSATION.

- (c) POWER LEVEL.

When this mode is selected, SELECT changes to ENTER and the level number in the range 0 to 7 for analog or 0 to 10 for digital is entered on the keypad. Selection of 8, 9 or 10 is inhibited unless a D-AMPS digital channel has been selected. The mobile changes its transmitter power level accordingly and the mode reverts to CONVERSATION. When the ENTRY key is pressed instead of a new level number, the last selected power level is used.

(d) RSSI REPORT.

Applicable to D-AMPS digital only.

This mode is to check the accuracy of the mobile's RSSI measurement on the current traffic channel or a channel other than the current traffic channel. When this mode is selected, the user is prompted to enter the channel number and the RF generator level to be used for the measurement. When these have been entered, a Measurement Order message is sent to the mobile with the selected channel number. The RSSI is sent by the mobile in the Channel Quality messages and this is displayed in place of the TX OFFSET. See the table below. On leaving the mode, a Stop Measurement Order message is sent to the mobile.

RF generator level				RF generator level			
dBm	RSSI			dBm	RSSI		
	Nom	Lower	Upper		Nom	Lower	Upper
<-117	0	0	0	-83	15	11	18
-115	0	0	1	-81	16	12	19
-113	0	0	2	-80	17	13	20
-111	1	0	3	-79	17	13	20
-110	2	0	4	-77	18	14	21
-109	2	0	4	-75	19	14	22
-107	3	0	5	-73	20	15	23
-105	4	0	6	-71	21	16	24
-103	5	1	7	-70	22	17	25
-101	6	2	8	-69	22	17	25
-100	7	3	9	-67	23	18	26
-99	7	3	9	-65	24	19	27
-97	8	4	10	-63	25	20	28
-95	9	5	11	-61	26	20	29
-93	10	6	12	-60	27	20	30
-91	11	7	14	-59	27	20	30
-90	12	8	15	-57	28	20	31
-89	12	8	15	-55	29	20	31
-87	13	9	16	-53	30	21	31
-85	14	10	17	>-51	31	21	31

(e) BER REPORT.

Applicable to D-AMPS digital only.

This mode is to check the accuracy of the mobile's BER measurement on the current traffic channel. When this mode is selected, the user is prompted to enter the number of introduced bit errors per time slot for the measurement. When this has been entered, a Measurement Order message is sent to the mobile. The BER is sent by the mobile in the Channel Quality messages and this is displayed in place of the TX OFFSET. See the table below. On leaving the mode, a Stop Measurement Order message is sent to the mobile.

OPERATION

Errors/ time slot	BER %	BER report code	Errors/ time slot	BER %	BER report code
0	0	0	21	8.077	6-7
1	0.385	2	22	8.461	6-7
2	0.769	3	23	8.846	6-7
3	1.154	3-4	24	9.231	6-7
4	1.538	4	25	9.615	6-7
5	1.923	4-5	26	10.000	6-7
6	2.308	4-5	27	10.385	6-7
7	2.692	5	28	10.769	7
8	3.077	5	29	11.154	7
9	3.461	5-6	30	11.538	7
10	3.846	5-6	31	11.923	7
11	4.231	5-6	32	12.308	7
12	4.615	5-6	33	12.692	7
13	5.000	5-6	34	13.077	7
14	5.385	6	35	13.461	7
15	5.769	6	36	13.846	7
16	6.154	6	37	14.231	7
17	6.538	6-7	38	14.615	7
18	6.923	6-7	39	15.000	7
19	7.308	6-7	40	15.385	7
20	7.692	6-7	-----	-----	-----

(f) CLEAR DOWN.

This mode is used to terminate the CONVERSATION mode and revert to FCC.

TX OFFSET, DTMF TONES, DC POWER, TX POWER, TX FREQUENCY, VECTOR, 1ST 10 and ORIGIN readings selection

Applicable to D-AMPS digital channels only.

These are selected by pressing the SELECT key to scroll to the required set of test results as follows:-

- (a) DTMF TONES and DC POWER.
- (b) TX POWER and TX FREQUENCY.
- (c) VECTOR, 1ST 10 and ORIGIN.

AF PATH selection

This is selected by toggling the AF PATH soft key. The selected audio signal is routed to the Adapter's AF OUT socket (and hence to the 2955's AF INPUT socket) when the 2955 mode is selected and both the CRTS and 2955 indicators are on. The choices are as follows:-

- (a) RX. Normal routing from the Adapter's AF INPUT socket to its AF OUT socket.
- (b) RX X20. As (a) but with a 26 dB (x 20) amplifier in the path.
- (c) TX. Routing of the DE-MOD SOURCE (as selected under the **MISCELLANEOUS MENU**) through the currently selected filters to the Adapter's AF OUT socket.

TIA selection

Pressing the TIA key accesses the **TEST INTERFACE ADAPTER MENU** as shown in Fig. 3-31. This can be used to send the listed commands to the mobile. Those marked * are not implemented in this version of software.

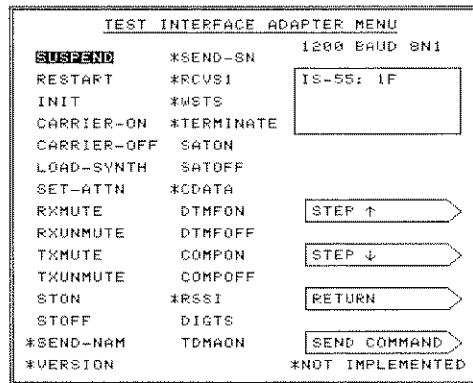


Fig. 3-31 **TEST INTERFACE ADAPTER MENU**

The BAUD RATE, LENGTH/PARITY and STOP BITS are selected by using the **INTERFACE MENU** for the TIA PORT PARAMETERS. See page 3-1-29. The current selections are displayed also on the **TEST INTERFACE ADAPTER MENU** at the right-hand side below the heading.

OPERATION

Also on the **INTERFACE MENU**, the TIA FORMAT can be selected. This gives the following choices:-

- (a) IS-55. Command codes hexadecimal in accordance with the EIA/TIA recommendation.
- (b) HEX. Command codes hexadecimal. Also, the LOAD-SYNTH command code is low byte then high byte instead of high byte then low byte. Also, for the DIGTS command, the slot data is 1 less than for IS-55.
- (c) ASCII 1. Command codes as the ASCII bytes for each of the hexadecimal digits preceded by the ASCII bytes for a space (hexadecimal 20) and an @ sign (hexadecimal 40). Also, the LOAD-SYNTH command code is low byte then high byte instead of high byte then low byte. Also, for the DIGTS command, the slot data is 1 less than for IS-55.
- (d) ASCII 2. Command codes as the ASCII bytes for each of the hexadecimal digits preceded by the ASCII bytes for a space (hexadecimal 20) and an @ sign (hexadecimal 40). Also, the LOAD-SYNTH command code is low byte then high byte instead of high byte then low byte. For the DIGTS command, the slot data is not decremented.
- (e) ASCII 3. Command codes as the ASCII bytes for each of the hexadecimal digits preceded by the ASCII bytes for a space (hexadecimal 20) and an @ sign (hexadecimal 40). The LOAD-SYNTH command code is high byte then low byte. For the DIGTS command, the slot data is not decremented.

On the right-hand side of the **TEST INTERFACE ADAPTER MENU**, there is a box which contains the selected command code and any applicable data in the selected format.

On the **TEST INTERFACE ADAPTER MENU**, the options are as follows:-

- (a) STEP ↑ and STEP ↓. These keys are used to step through the commands.
- (b) SEND COMMAND. When this key is pressed, the command is sent and SENDING ... appears flashing and there is an audible indication for a short time.

Pressing RETURN restores the MANUAL OPERATION display.

DATA selection

Pressing the DATA key accesses the DATA displays as described for 'DATA option' under 'FULL AUTO TEST MODE'.

BUILT-IN TEST SEQUENCES

A number of test routines are combined into built-in test sequences which can be executed in the GO/NO-GO TEST and the FULL AUTO TEST modes. There are four built-in test sequences to choose from as follows:-

- (a) CALL PROCESSING ONLY.
- (b) CALL AND RF TESTING.
- (c) BRIEF TESTING.
- (d) COMPREHENSIVE TESTING.

The required sequence is selected from the TEST SEQUENCE MENU. See page 3-1-26.

CALL PROCESSING ONLY sequence

This sequence is the basis of all of the built-in test sequences. It consists of a series of data signalling test routines to check the mobile's ability to initiate and receive calls and to respond to system commands. It is intended for first-line testing of radios which have been reported as faulty to retailers and installers. It can also be used for validation testing to determine whether a unit is suitable for sale or installation. The only connection required is from the mobile's antenna socket to the RF IN/OUT N socket. The sequence of test routines is as follows:-

- (a) 20. REGISTRATION.
- (b) 22. CALL MS TO CELL.
- (c) 30. DTMF TONES. Optional.
- (d) 31. HOOK FLASH. Optional.
- (e) 37. SPEECH LOOPBACK. Digital only.
- (f) 27. CLEAR FROM MS.
- (g) 21. CALL CELL TO MS.
- (h) 24. AUTO HANDOFF.
- (i) 26. CLEAR FROM CELL.

CALL AND RF TESTING sequence

As well as performing the CALL PROCESSING ONLY test routines, this also measures the pertinent RF parameters on all of the channels which have been selected in the SYSTEM PARAMETERS MENU. It is intended to be used by workshops for first-line testing. This sequence can also be performed using only the RF connection. The sequence of test routines is as follows:-

- (a) 20. REGISTRATION.
- (b) 22. CALL MS TO CELL.
- (c) 30. DTMF TONES. Optional.
- (d) 31. HOOK FLASH. Optional.
- (e) 37. SPEECH LOOPBACK. Digital only.
- (f) 27. CLEAR FROM MS.
- (g) 21. CALL CELL TO MS.
- (h) 23. HANDOFF.
- (i) 28. TX POWER.
- (j) 2. TX FREQUENCY.
- (k) 25. SAT (or DSAT) TRANSPONDING. Analog only.
SAT (or DSAT) DEVIATION. Analog only.
- (l) 35. RMS VECTOR ERROR. Digital only.
- (m) 26. CLEAR FROM CELL.

} These are repeated for each selected channel.

OPERATION

BRIEF TESTING **sequence**

This performs some of the standard transceiver test routines in addition to the routines in the CALL AND RF TESTING sequence. It is intended for use by small workshops and regional service centres as their main test facility.

Test routines are performed on three voice/traffic channels. The first voice/traffic channel is that selected in the **SYSTEM PARAMETERS MENU**; the second and third are determined by the HANDOFF INCREMENT. It is necessary to connect the audio paths between the mobile and the handset to the test system for this sequence as well as from the mobile's antenna to the RF IN/OUT N socket. The sequence of test routines is as follows:-

- (a) 20. REGISTRATION.
- (b) 22. CALL MS TO CELL.
- (c) 30. DTMF TONES. Optional.
- (d) 31. HOOK FLASH. Optional.
- (e) 37. SPEECH LOOPBACK. Digital only.
- (f) 27. CLEAR FROM MS.
- (g) 21. CALL CELL TO MS.
- (h) 23. HANDOFF.
- (i) 25. SAT (or DSAT or DVCC) TRANSPONDING.
SAT (or DSAT) DEVIATION. Analog only.
SAT FREQUENCY. Wideband only.
- (j) 28. TX POWER.
- (k) 2. TX FREQUENCY.
- (l) 35. RMS VECTOR ERROR. Digital only.
- (m) 29. BER REPORT. Digital only.
- (n) 38. DIGITAL RSSI. Digital only.
- (o) 3. TX SINAD. Analog only.
- (p) 4. TX LIMITING. Analog only.
- (q) 32. DATA DEVIATION. Wideband only, optional.
- (r) 6. RX SINAD. Analog only.
- (s) 7. RX SENSITIVITY. Analog only.
- (t) 26. CLEAR FROM CELL.
- (u) 36. DIGITAL BER. Digital only, optional.

} These are repeated on three channel.

COMPREHENSIVE TESTING **sequence**

This is intended for major service centres and manufacturers who wish to test more of the mobile's operational aspects. All of the connections which are shown in Fig. 3-5 are required for this test sequence. The sequence of test routines is as follows:-

- (a) 20. REGISTRATION.
- (b) 22. CALL MS TO CELL.
- (c) 30. DTMF TONES. Optional.
- (d) 31. HOOK FLASH. Optional.
- (e) 37. SPEECH LOOPBACK. Digital only.
- (f) 27. CLEAR FROM MS.
- (g) 21. CALL CELL TO MS.
- (h) 29. ANALOG BER. Wideband only.
- (i) 23. HANDOFF.
- (j) 25. SAT (or DSAT or DVCC) TRANSPONDING.
SAT (or DSAT) DEVIATION. Analog only.
SAT FREQUENCY. Wideband only.
- (k) 37. SPEECH LOOPBACK. Digital only.
- (l) 28. TX POWER.
- (m) 9. DC POWER.
- (n) 2. TX FREQUENCY.
- (o) 3. TX SINAD. Analog only.
TX NOISE. Wideband only.
- (p) 4. TX LIMITING. Analog only.
- (q) 5. TX COMPRESSION. Analog only.
- (r) 32. DATA DEVIATION. Wideband only,
- (s) 6. RX SINAD. Analog only.
- (t) 7. RX SENSITIVITY. Analog only.
- (u) 8. RX EXPANSION. Analog only.
- (v) 35. RMS VECTOR ERROR. Digital only.
FIRST 10 SYMBOLS. Digital only.
ORIGIN OFFSET. Digital only.
- (w) 29. BER REPORT. Digital only.
- (x) 38. DIGITAL RSSI. Digital only.
- (y) 26. CLEAR FROM CELL.
- (z) 9. DC POWER.
- (aa) 36. DIGITAL BER. Digital only, optional.

These are
repeated
for each
optional
channel.

OPERATION

NON-SYSTEM SPECIFIC TEST ROUTINES

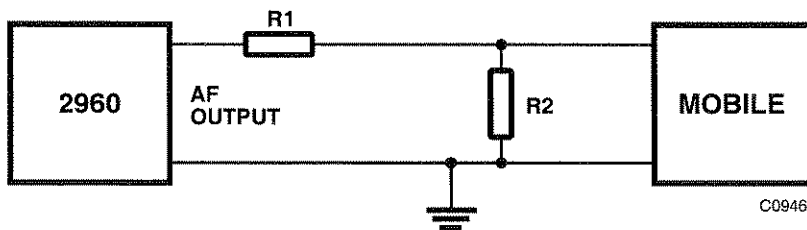
The test routines which are not specific to AMPS are described below together with any applicable error messages and their meanings. When performing transmitter test routines (no. 1 to no. 5), the 2957D or 2960D automatically adjusts the audio generator output level in order to excite the mobile at the required nominal deviation. If it cannot get a settled reading of this deviation, the test routine is failed and READING UNSTABLE is reported in the result field. This is normally due to one of the two following causes:-

- (a) The microphone in the mobile under test is still live and ambient noise is causing the reading to be unstable. This situation should be avoided as it degrades an otherwise good SINAD or distortion measurement.
- (b) The corresponding audio generator level is such that the setting resolution is greater than the tolerance of deviation being set (e.g. at 9 mV, with steps of 1mV, gives a setting resolution of 11% which is greater than the acceptance tolerance of ±5%). To rectify this, an attenuator should be inserted to bring the required level above 10 mV.

When performing transmitter limiting test routines, the audio generator output level is adjusted to obtain the nominal deviation. The output level is then increased by an overload factor of 20 dB. If this new level exceeds the maximum output level of the audio generator (2.5 V for a 2955 or 4.0 V for a 2955A, 2955R or 2955B), then the test routine is failed and the message LOW SENS MIC I/P is displayed. Normally, 250 mV is sufficient to excite a mobile. A low output level could be due to a mismatch, typically a balanced input. In this case, a balun transformer could be used to balance the output and also provide voltage gain.

The effective dynamic range of the audio generator output is $20 \log (\text{maximum output level} / 10\text{mV}) = 48 \text{ dB} (2955) \text{ or } 52 \text{ dB} (2955A, 2955R \text{ or } 2955B)$. As the required dynamic range is 20 dB, the ideal value for the output level is $10 \text{ mV} + 14 \text{ dB} = 50 \text{ mV} (2955) \text{ or } 10 \text{ mV} + 16 \text{ dB} = 63 \text{ mV} (2955A, 2955R \text{ or } 2955B)$.

Assuming that the mobile has an input impedance of greater than 1 kΩ, see Fig. 3-32 for suitable resistance values to obtain approximate attenuations.



Attenuation	R1	R2
3 dB	33 Ω	68 Ω
6 dB	50 Ω	50 Ω
10 dB	68 Ω	33 Ω
20 dB	91 Ω	10 Ω

Fig. 3-32 AF generator output attenuator

Test routine no. 1 - Transmitter RF power (TX POWER)

This test routine is not applicable to D-AMPS digital channels. It measures the RF power. It is not used in the standard test sequences since the CALL AND RF TESTING, BRIEF TESTING and COMPREHENSIVE TESTING sequences use the system specific power test routine which sets the mobile to the required power levels before measuring. Messages are as follows:-

- (a) *FAIL* NO TX POWER. Power <1 mW. Probably there is no carrier so a very low power level is not displayed.
- (b) *FAIL* READING UNSTABLE. After 15 attempts, could not obtain two consecutive readings within 20%.

Test routine no. 2 - Transmitter RF frequency (TX FREQUENCY)

This test routine first ensures that a carrier is present and then auto-tunes to measure the RF frequency. For cellular radios, it then manually retunes to the correct channel. Messages are as follows:-

- (a) *FAIL* NO TX POWER. Power <1 mW. Assumes there is no carrier so cannot take meaningful frequency measurement.
- (b) *FAIL* READING UNSTABLE. Frequency not within 1% after 15 readings.

**Test routine no. 3 - Transmitter distortion (TX DISTORTION),
transmitter SINAD (TX SINAD),
transmitter S/N (TX S/N) and
transmitter residual noise (TX NOISE)**

This test routine is not applicable to D-AMPS digital channels. It attempts to set the AF level to produce a reference modulation level (but not for the residual noise test routine). The demodulated signal is routed to the AF INPUT of the 2955 to test audio as for receiver distortion and SINAD. S/N is measured by reading the demodulated level with and without a modulating signal. Residual noise measurement is deviation of the carrier in the absence of a modulating signal. Messages are as follows:=-

- (a) *FAIL* LOW DEMOD LEVEL. Internal demodulated level <100 mV either due to fault or reference modulation level is too low to produce 100 mV demodulated.
- (b) *FAIL* READING UNSTABLE. Demodulated level not within 10% after 15 readings.
- (c) *FAIL* READING UNSTABLE. Demodulated noise level not within 100% after 15 readings.
- (d) *FAIL* READING UNSTABLE. Distortion etc not within 20% after 5 readings.
- (e) *FAIL* READING UNSTABLE. Residual noise not within 50% after 10 readings.
- (f) AF GEN RESOLUTION ERROR. (Displayed in reverse video at the bottom of the screen). Audio generator output level is below 10 mV. This means that, with steps of 1 mV, it may not be possible to set the required deviation to within ±5%.

OPERATION

Test routine no. 4 - Transmitter modulation limiting (TX LIMITING)

This test routine is not applicable to D-AMPS digital channels. It attempts to set an AF level to produce a reference modulation level, then increases the AF level by the overload factor and measures the resulting deviation in a 15 kHz bandwidth (including de-emphasized SAT). Messages are as follows:-

- (a) *FAIL* LOW SENS MIC I/P. AF level required to set the transmitter to reference modulation level was too high to overload by the factor given.
- (b) *FAIL* NO MODULATION. Deviation <100 Hz/1%/0.1 rad measured.
- (c) *FAIL* READING UNSTABLE. Deviation not within 10% after 5 readings.

Test routine no. 5 - Transmitter modulation compression (TX COMPRESSION)

This test routine is not applicable to D-AMPS digital channels. It attempts to set an AF level to produce a reference modulation level, then alters the AF level by +10 dB and -10 dB. Measurement is resulting change in modulation level. Result is (20 dB) / (modulation level change in dB). Messages are as follows:-

- (a) *FAIL* LOW DEMOD LEVEL. Demodulated level is below 100 mV.
(Demodulated level is reference level + compressed 10 dB change.)
- (b) *FAIL* LOW DEMOD LEVEL. Demodulated level is below 10 mV.
(Demodulated level is reference level - compressed dB change.)
- (c) *FAIL* READING UNSTABLE. Demodulated level not within 10% after 15 readings.
- (d) *FAIL* NO MODULATION. ± 10 dB change in AF generator output produced <1 dB change in transmitter modulation.
- (e) *FAIL* LOW SENS MIC I/P. Cannot modulate to reference level +10 dB (i.e. >2.5 V for a 2955 or >4.0 V for a 2955A, 2955R or 2955B).
- (f) AF GEN RESOLUTION ERROR. (Displayed in reverse video at the bottom of the screen). Audio generator output level is below 10 mV. This means that, with steps of 1 mV, it is not possible to set the required deviation to within $\pm 5\%$.

Note

When conducting receiver tests, it is necessary to have a recovered audio signal level of >5 mV, corresponding to the required deviation (i.e. 8.0 kHz). Otherwise, the SINAD/distortion measurement may not be accurate. If the recovered level is below 50 mV, then either a fault exists in the interface circuit or there is a gross mismatch. Where there is a balanced output, this may be rectified by using a balun transformer or the Marconi Instruments 600 Ω accessory.

**Test routine no. 6 - Receiver AF distortion (RX DISTORTION),
receiver SINAD (RX SINAD) and
receiver S/N (RX S/N)**

This test routine is not applicable to D-AMPS digital channels. It sets modulation level directly and measures distortion, SINAD and S/N directly on the 2955 through the x20 amplifier. The AF IN (mobile's receiver audio) is routed to the 2955 AF IN. Messages are as follows:-

- (a) *FAIL* LOW DEMOD LEVEL. Receiver audio level <5 mV (100 mV on display).
- (b) *FAIL* READING UNSTABLE. Distortion etc not within 20% after 5 readings.
- (c) *FAIL* AF I/P OVERLOAD. AF input to 2960 >6 V RMS which causes clipping within the instrument.

Test routine no. 7 - Receiver sensitivity (RX SENSITIVITY)

This test routine is not applicable to D-AMPS digital channels. It attempts to adjust the receiver level until the mobile's receiver audio produces the required SINAD reading. Result is the RF level. Messages are as follows:-

- (a) *FAIL* LOW DEMOD LEVEL. Receiver audio level <5 mV (100 mV on display).
- (b) *FAIL* NO DEMODULATION. Reached receiver level limit at -95 dBm or -122 dBm without reaching reference SINAD level.
- (c) *FAIL* READING UNSTABLE. SINAD not within 20% after 5 readings and 10 iterations of setting level.
- (d) *FAIL* AF I/P OVERLOAD. AF input to 2960 >6 V RMS which causes clipping within the instrument.

Test routine no. 8 - Receiver demodulation expansion (RX EXPANSION)

This test routine is not applicable to D-AMPS digital channels. It sets receiver modulation level directly to reference level -5 dB and +5 dB. Measurement is resulting change in receiver audio level in dB. Result is (audio level change in dB) / (10 dB).

- (a) *FAIL* LOW DEMOD LEVEL. Demodulation level <5 mV (reference level -5 dB).
- (b) *FAIL* LOW DEMOD LEVEL. Demodulation level <5 mV (reference level +5 dB).
- (c) *FAIL* READING UNSTABLE. Demodulation not within 10% after 15 readings.
- (d) ERROR: MODULATION LIMIT. Cannot modulate to reference level +5 dB.
- (e) *FAIL* AF I/P OVERLOAD. AF input to 2960 >6 V RMS which causes clipping within the instrument.

OPERATION

Test routine no. 9 - DC power consumption (DC POWER)

Routes voltages corresponding to DCV/25 and DCA/10 to 2955; measures DC voltages and calculates power. Messages are as follows:-

- (a) *FAIL* NO DC POWER. <250 mV or <100 mA or <100 mW.
- (b) *FAIL* READING UNSTABLE. Not within 10% after 15 readings.

Test routines no. 10 to no. 19

Not implemented.

SYSTEM SPECIFIC TEST ROUTINES

The test routines which are specific to AMPS are described below together with any applicable error messages and their meanings.

Test routine no. 20 - Registration of mobile on control channel (REGISTRATION)

This test routine checks the mobile's ability to register on the system. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D initializes the data generation system as a control channel.
- (2) The 2957D or 2960D generates an FCC for the mobile to lock onto. The FCC number is shown on the display.
- (3) If the mobile cannot lock onto the control channel, the 2957D or 2960D tries again in other systems (independent provider or local company). The message *FAIL* NO RESPONSE means that there is no response or CRTS is aborted.
- (4) The mobile locks onto the FCC and sends Registration Updating messages with the MIN, ESN and SCM (hexadecimal for N-AMPS and D-AMPS).
- (5) The 2957D or 2960D checks the received data and displays the MIN and PASSED for a good test. When FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen. Other messages are as follows:-
 - (a) *FAIL* DATA INCOMPLETE. Not all of the message was received.
 - (b) *FAIL* DATA IGNORED. There were insufficient correct repetitions.
 - (c) *FAIL* TOO MANY WORDS. The message was longer than the format.
 - (d) *FAIL* WRONG RESPONSE. The response was wrong for the message which was sent.

Test routine no. 21 - Call from cell to mobile (CALL CELL TO MS)

This test routine checks the mobile's ability to answer an incoming call. The number called is the currently stored MIN. Operation is as follows:-

- (1) The test routine title is displayed.
- (2) For D-AMPS, the time alignment parameter is checked for correct unit and correct value within the range 0 to 31. If not, the ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (3) The 2957D or 2960D generates an FCC for the mobile to lock onto. PAGING MS is displayed and the mobile is paged every 2 seconds. The message *FAIL* NO RESPONSE means that no response was received within 30 seconds.
- (4) The mobile locks onto the FCC and responds with data.

OPERATION

- (5) The 2957D or 2960D checks the received data. If the data is correct, when FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen followed by the ORDER/QUALIFIER code which has been received. Failure messages are as follows:-
 - (a) *FAIL* DATA INCOMPLETE. Not all of the message was received.
 - (b) *FAIL* DATA IGNORED. There were insufficient correct repetitions.
 - (c) *FAIL* TOO MANY WORDS. The message was longer than the format.
 - (d) *FAIL* WRONG RESPONSE. The response was wrong for the message which was sent.
- (6) The 2957D or 2960D checks the SCM. Failure messages are as follows:-
 - (a) ERROR: 666 CHANNEL MS. An attempt was made to access a channel beyond the mobile's capability.
 - (b) ERROR: N-AMPS CHANNEL. An attempt was made to access a narrowband channel on a wideband mobile.
 - (c) ERROR: DIGITAL CHANNEL. An attempt was made to access a D-AMPS digital channel on a mobile which is equipped only for analog channels.
 - (d) ERROR: ANALOG CHANNEL. An attempt was made to access a D-AMPS analog channel on a mobile which is equipped only for digital channels.
- (7) The 2957D or 2960D assigns and displays the first voice/traffic channel in the form ASSIGN tt nnn where tt is the channel type and nnn is the channel number.

Except for a D-AMPS digital channel, operation continues as follows:-

- (8) The mobile tunes to the voice/traffic channel and then switches on the SAT or DSAT.
- (9) The 2957D or 2960D checks for the carrier and displays CARRIER ON or the message *FAIL* NO CARRIER. The failure message means that there was no carrier >100 mW within 5 seconds.
- (10) The 2957D or 2960D sends the Alerting Order message.
- (11) The mobile responds by switching on the ST or DST.
- (12) The 2957D or 2960D checks for the signalling tone. The message *FAIL* NO SIGNAL TONE means that no signalling tone was received within 3 seconds.
- (13) The mobile rings and PLEASE WAIT is displayed flashing. At this time, the 2957D or 2960D is measuring the ST deviation which can be displayed later on request.
- (14) The mobile rings and ANSWER CALL flashes on the display.
- (15) The user either picks up the handset or presses the SEND key, depending upon the audio connections.

- (16) When the ST or DST stops, CONVERSATION appears on the display together with PASSED for a successful test.

For a D-AMPS digital channel, operation continues as follows:-

- (8) The mobile tunes to the voice/traffic channel and then sends shortened bursts.
- (9) The 2957D or 2960D waits for shortened bursts with the correct sync pattern. The message *FAIL* NO SB DETECTED means that the bursts were not received within 3 seconds. The 2957D or 2960D then sends a Physical Layer Control message, with time alignment set in accordance with the parameter, on the FACCH or SACCH as selected under the **SYSTEM PARAMETERS MENU** and waits for a Physical Layer Control Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO PHYSICAL ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (10) The TX OFFSET (mobile transmit burst timing) is measured and the result is displayed at the bottom of the screen.
- (11) The 2957D or 2960D sends an Alert With Info message and waits for the appropriate Mobile Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO MOBILE ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (12) The mobile rings and ANSWER CALL flashes on the display.
- (13) The user either picks up the handset or presses the SEND key, depending on the audio connections.
- (14) When the mobile sends a Connect message, the 2957D or 2960D sends the appropriate Base Station Ack message. The message *FAIL* CORRUPT DATA means that the Connect message was corrupted. The message *FAIL* NO ANSWER means that the call was not answered within 60 seconds. Otherwise, CONVERSATION appears on the display with PASSED for a successful test.

Test routine no. 22 - Call from mobile to cell (CALL MS TO CELL)

This test routine checks the mobile's ability to place a call. Operation is as follows:-

- (1) The test routine title is displayed.
- (2) For D-AMPS, the time alignment parameter is checked for correct unit and correct value within the range 0 to 31. If not, ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (3) The 2957D or 2960D generates an FCC for the mobile to lock on to and displays WAIT FOR SERVICE. After 2 seconds, WAIT FOR SERVICE is replaced by PLACE CALL flashing.

OPERATION

- (4) The 2957D or 2960D waits for a response. The message *FAIL* NO RESPONSE means that no response was received within 40 seconds.
- (5) The user keys a number (up to 32 digits, only 16 being shown in a summary display) into the handset and presses the SEND key. The mobile sends the MIN, the ESN and the called number.
- (6) The 2957D or 2960D checks the received data. If the data is correct, when FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom of the screen followed by the ORDER/QUALIFIER code which has been received. Failure messages are as follows:-
 - (a) *FAIL* DATA INCOMPLETE. Not all of the message was received.
 - (b) *FAIL* DATA IGNORED. There were insufficient correct repetitions.
 - (c) *FAIL* TOO MANY WORDS. The message was longer than the format.
 - (d) *FAIL* WRONG RESPONSE. The response was wrong for the message which was sent.
- (7) The 2957D or 2960D checks the SCM. Failure messages are as follows:-
 - (a) ERROR: 666 CHANNEL MS. An attempt was made to access a channel beyond the mobile's capability.
 - (b) ERROR: N-AMPS CHANNEL. An attempt was made to access a narrowband channel on a wideband mobile.
 - (c) ERROR: DIGITAL CHANNEL. An attempt was made to access a D-AMPS digital channel on a mobile which is equipped only for analog channels.
 - (d) ERROR: ANALOG CHANNEL. An attempt was made to access a D-AMPS analog channel on a mobile which is equipped only for digital channels.
- (8) The 2957D or 2960D assigns and displays the first voice/traffic channel in the form ASSIGN tt nnn where tt is the channel type and nnn is the channel number.
- (9) The mobile tunes to the voice/traffic channel and, for a D-AMPS digital channel, sends shortened bursts.

Except for a D-AMPS digital channel, operation continues as follows:-

- (10) The 2957D or 2960D checks for the carrier and displays CARRIER ON or the message *FAIL* NO CARRIER. The failure message means that there was no carrier >100 mW within 5 seconds.
- (11) The 2957D or 2960D switches on the SAT and displays the dialled number with PASSED or the message *FAIL* NO CARRIER. The failure message means that no carrier is present.

For a D-AMPS digital channel, operation continues as follows:-

- (10) The 2957D or 2960D displays the dialled number.
- (11) The 2957D or 2960D waits for shortened bursts with the correct sync pattern. The message *FAIL* NO SB DETECTED means that the bursts were not received within 3 seconds. The 2957D or 2960D then sends a Physical Layer Control message, with time alignment set in accordance with the parameter, on the FACCH or SACCH as selected under the **SYSTEM PARAMETERS MENU** and waits for a Physical Layer Control Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 260D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO PHYSICAL ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (12) The TX OFFSET (mobile transmit burst timing) is measured and the result is displayed at the bottom of the screen.

Test routine no. 23 - Handoff from current to chosen voice/traffic channel (HANDOFF)

This test routine checks the mobile's ability to retune to another voice/traffic channel (which has been selected by the user under the **CHANGE FORMAT MENU**) while in the CONVERSATION mode (e.g. from channel 001 to 666 by an increment of 333). Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.
- (2) For D-AMPS, the time alignment parameter is checked for correct unit and correct value within the range 0 to 31. If not, ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (3) The 2957D or 2960D checks the SCM. Failure messages are as follows:-
 - (a) ERROR: 666 CHANNEL MS. An attempt was made to access a channel beyond the mobile's capability.
 - (b) ERROR: N-AMPS CHANNEL. An attempt was made to access a narrowband channel on a wideband mobile.
 - (c) ERROR: DIGITAL CHANNEL. An attempt was made to access a D-AMPS digital channel on a mobile which is equipped only for analog channels.
 - (d) ERROR: ANALOG CHANNEL. An attempt was made to access a D-AMPS analog channel on a mobile which is equipped only for digital channels.
- (4) The 2957D or 2960D displays the first voice/traffic channel in the form ASSIGN tt nnn where tt is the channel type and nnn is the channel number.

OPERATION

Except for a handoff from a D-AMPS digital channel, operation continues as follows:-

- (5) The 2957D or 2960D assigns the first voice/traffic channel and waits for the Handoff message confirmation. The message *FAIL* NO SIGNAL TONE means that no ST was received within 3 seconds. The message *FAIL* NO RESPONSE (N-AMPS narrowband channel only) means that no confirmation message was received within 5 seconds.

For a handoff from a D-AMPS digital channel, operation continues as follows:-

- (5) The 2957D or 2960D sends a Handoff message for the first channel and waits for the appropriate Mobile Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO MOBILE ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.

Except for a handoff to a D-AMPS digital channel, operation continues as follows:-

- (6) The mobile sends the ST or DST.
- (7) The 2957D or 2960D waits for the mobile's carrier on the new channel. The message *FAIL* NO CARRIER means that a carrier >100 mW was not received within 5 seconds.
- (8) The mobile tunes to the new voice/traffic channel.
- (9) The 2957D or 2960D confirms successful handoff in the form tt nnn > tt nnn where tt are the channel types and nnn are the channel numbers. When FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen.
- (10) The 2957D or 2960D checks the ST duration if applicable and displays PASSED for a good test. The message *FAIL* SIGNAL TONE DURATION means that the duration was not 50 ms \pm 5 ms or \pm 10%.

For a handoff to a D-AMPS digital channel, operation continues as follows:-

- (6) The mobile tunes to the new voice/traffic channel.
- (7) When the BURST INDICATOR option has been set to SHORTENED under the **SYSTEM PARAMETERS MENU**, the mobile sends shortened bursts and the 2957D or 2960D waits for shortened bursts with the correct sync pattern. The message *FAIL* NO SB DETECTED means that the bursts were not received within 3 seconds. The 2957D or 2960D then sends a Physical Layer Control message, with time alignment set in accordance with the parameter, on the FACCH or SACCH as selected under the **SYSTEM PARAMETERS MENU** and waits for a Physical Layer Control Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO PHYSICAL ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.

When the BURST INDICATOR option has been set to FULL 0 or FULL 1 under the SYSTEM PARAMETERS MENU, the mobile sends full bursts and the 2957D or 2960D waits for the full bursts with the correct sync pattern. The message *FAIL* NO FB DETECTED means that the bursts were not received within 3 seconds.

- (8) For a good test, when FULL DISPLAY FORMAT has been selected, the TX OFFSET (mobile transmit burst timing) is measured and the result is displayed at the bottom of the screen.
- (9) The 2957D or 2960D confirms successful handoff in the form tt nnn > tt nnn where tt are the channel types and nnn are the channel numbers. When FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen.

Test routine no. 24 - Automatic handoffs from first to last voice/traffic channels (AUTO HANDOFF)

This test routine is based on no. 23. However, the mobile steps from the first channel by the channel increment until the last channel is reached or exceeded (from channel 001 to 666 by an increment of 333). Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.
- (2) For D-AMPS, the time alignment parameter is checked for correct unit and correct value within the range 0 to 31. If not, ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (3) The 2957D or 2960D checks the SCM. Failure messages are as follows:-
 - (a) ERROR: 666 CHANNEL MS. An attempt was made to access a channel beyond the mobile's capability.
 - (b) ERROR: N-AMPS CHANNEL. An attempt was made to access a narrowband channel on a wideband mobile.
 - (c) ERROR: DIGITAL CHANNEL. An attempt was made to access a D-AMPS digital channel on a mobile which is equipped only for analog channels.
 - (d) ERROR: ANALOG CHANNEL. An attempt was made to access a D-AMPS analog channel on a mobile which is equipped only for digital channels.
- (4) The 2957D or 2960D displays the first voice/traffic channel in the form ASSIGN tt nnn where tt is the channel type and nnn is the channel number.

Except for handoff from a D-AMPS digital channel, operation continues as follows:-

- (5) The 2957D or 2960D assigns the first voice/traffic channel and waits for Handoff message confirmation. The message *FAIL* NO SIGNAL TONE means that no ST was received within 3 seconds. The message *FAIL* NO RESPONSE (N-AMPS narrowband channel only) means that no confirmation message was received within 5 seconds.

OPERATION

For a handoff from a D-AMPS digital channel, operation continues as follows:-

- (5) The 2957D or 2960D sends a Handoff message for the first channel and waits for the appropriate Mobile Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO MOBILE ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.

Except for a handoff to a D-AMPS digital channel, operation continues as follows:-

- (6) The mobile sends the ST or DST.
- (7) The 2957D or 2960D waits for the mobile's carrier on the new channel. The message *FAIL* NO CARRIER means that a carrier >100 mW was not received within 5 seconds.
- (8) The mobile tunes to the new voice/traffic channel.
- (9) The 2957D or 2960D confirms successful handoff in the form tt nnn > tt nnn where tt are the channel types and nnn are the channel numbers.
- (10) The handoff is repeated for channels 401 and 600.
- (11) For a good test, when FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen.
- (12) The 2957D or 2960D checks the ST if applicable and displays PASSED for a good test. The message *FAIL* SIGNAL TONE DURATION means that the duration was not 50 ms \pm 5 ms or \pm 10%.

For a handoff to a D-AMPS digital channel, operation continues as follows:-

- (6) The mobile tunes to the new voice/traffic channel.
- (7) When the BURST INDICATOR option has been set to SHORTENED under the **SYSTEM PARAMETERS MENU**, the mobile sends shortened bursts and the 2957D or 2960D waits for shortened bursts with the correct sync pattern. The message *FAIL* NO SB DETECTED means that the bursts were not received within 3 seconds. The 2957D or 2960D then sends a Physical Layer Control message, with time alignment set in accordance with the parameter, on the FACCH or SACCH as selected under the **SYSTEM PARAMETERS MENU** and waits for a Physical Layer Control Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO PHYSICAL ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.

When the BURST INDICATOR option has been set to FULL 0 or FULL 1 under the **SYSTEM PARAMETERS MENU**, the mobile sends full bursts and the 2957D or 2960D waits for the full bursts with the correct sync pattern. The message *FAIL* NO FB DETECTED means that the bursts were not received within 3 seconds.

- (8) The 2957D or 2960D confirms successful handoff in the form tt nnn > tt nnn where tt are the channel types and nnn are the channel numbers.
- (9) The handoff is repeated for channels 401 and 600.
- (10) For a good test, when FULL DISPLAY FORMAT has been selected, the TX OFFSET (mobile transmit burst timing) is measured and the result is displayed at the bottom of the screen.
- (11) For a good test, when FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen.

Test routine no. 25 - SAT, DSAT or DVCC transponding

(SAT (or DSAT or DVCC) TRANSPONDING,
SAT (or DSAT) DEVIATION or SAT FREQUENCY)

This test routine checks the SAT, DAT or DVCC for transponding. It also measures the SAT deviation or the SAT frequency for analog channels and the DSAT deviation for narrowband channels. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.

Except for a D-AMPS digital channel, operation continues as follows:-

- (2) The 2957D or 2960D tests the SAT or DSAT for transponding and SAT DETECTED or DSAT DETECTED is displayed. The message *FAIL* NO SAT DETECTED or *FAIL* NO DSAT DETECTED means that the SAT or DSAT was not detected.
- (3) If required, the SAT or DSAT deviation is checked. SAT DEVIATION or DSAT DEVIATION is displayed.
- (4) The 2957D or 2960D takes an average of eight measurements and PASSED is displayed for a good test. The message *FAIL* READING UNSTABLE means that the measurements are <100 mV or differ by >2%.
- (5) If required, the SAT frequency is checked. SAT FREQUENCY is displayed. This is not applicable to N-AMPS narrowband channels. DSAT DETECTED is displayed instead of a frequency.
- (6) The 2957D or 2960D takes an average of eight measurements and PASSED is displayed for a good test. The message *FAIL* READING UNSTABLE means that the measurements are <1.000 kHz or differ by >1%.

For a D-AMPS digital channel, this test routine compares the DVCC which is received from the mobile with the DVCC which is sent to the mobile. Provided these are the same, the PASSED DVCC DETECTED is displayed. Failure messages are as follows:-

- (a) *FAIL* NO DVCC DETECTED. No data received.
- (b) *FAIL* DVCC MISMATCH. DVCC received not as sent.

OPERATION

Test routine no. 26 - Clearing down from cell (CLEAR FROM CELL)

This test routine is the final one in all four built-in test sequences. It is similar to no. 27 except that it checks whether the mobile can acknowledge a call termination by the other party. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.

Except for a D-AMPS digital channel, operation continues as follows:-

- (2) ORDER RELEASE is displayed and the 2957D or 2960D sends the Clearing Order message and waits for a response. The message *FAIL* NO SIGNAL TONE means that no ST was received within 20 seconds. The message *FAIL* NO RESPONSE (N-AMPS narrowband channel only) means that no response was received within 20 seconds. The message *FAIL* WRONG RESPONSE (N-AMPS narrowband channel only) means that an incorrect response message was received.
- (3) The mobile sends the ST or DST.
- (4) When the ST is received, SIGNAL TONE is displayed. When the ST ends or a response message is received, CLEARED DOWN is displayed. When FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen.
- (5) The 2957D or 2960D checks the ST duration if applicable and PASSED is displayed for a good test. The message *FAIL* SIGNAL TONE DURATION means that the ST duration was not 1.8 s \pm 50 ms or \pm 10%.

For a D-AMPS digital channel, operation continues as follows:-

- (1) ORDER RELEASE is displayed and the 2957D or 2960D sends a Release message.
- (2) The 2957D or 2960D then waits for an appropriate Mobile Ack message from the mobile. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO MOBILE ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (3) If the operation is successful, PASSED CLEARED DOWN is displayed.

Test routine no. 27 - Clearing down from mobile (CLEAR FROM MS)

This test routine checks the mobile's ability to terminate the call which it has made in a previous test. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.

Except for a D-AMPS digital channel, operation proceeds as follows:-

- (2) END CALL flashes and the 2957D or 2960D waits for a response. The message *FAIL* NO SIGNAL TONE means that no ST was received within 20 seconds. The message *FAIL* NO RESPONSE (N-AMPS narrowband channel only) means that no response was received within 20 seconds. The message *FAIL* WRONG RESPONSE (N-AMPS narrowband channel only) means that an incorrect response message was received.
- (3) The user either replaces the handset or presses the END key.
- (4) The mobile sends the ST or DST.
- (5) When the ST is received, SIGNAL TONE is displayed. When the ST ends, CLEARED DOWN is displayed. When FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen.
- (6) The 2957D or 2960D checks the ST duration if applicable and PASSED is displayed for a good test. The message *FAIL* SIGNAL TONE DURATION means that the ST duration was not 1.8 s \pm 50 ms or \pm 10%.

For a D-AMPS digital channel, operation proceeds as follows:-

- (2) END CALL flashes and the 2957D or 2960D waits for a Release message from the mobile. The message *FAIL* NO RESPONSE or *FAIL* DATA CORRUPT means that the Release message was not received within 20 seconds.
- (3) The user either replaces the handset or presses the END key.
- (4) The mobile sends the Release message.
- (5) When the Release message is received, PASSED CLEARED DOWN is displayed. When FULL DISPLAY FORMAT has been selected, the MIN, SCM and ESN are displayed at the bottom the screen.

OPERATION

Test routine no. 28 - Transmitter RF power (TX POWER)

This test routine checks up to all eight (for analog channels) or eleven (for digital channels) of the mobile's RF power levels. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.
- (2) The 2957D or 2960D instructs the mobile to set a power level and then waits for a response. The power level number appears on the display. For an analog channel, the message *FAIL* NO RESPONSE means that no response was received within 700 ms. For a D-AMPS digital channel, the message *FAIL* NO PHYSICAL ACK means that no response was received from the mobile within 2 seconds.
- (3) The mobile acknowledges and then sets the power level.
- (4) The 2957D or 2960D decodes the response. Failure messages are as follows:-
 - (a) *FAIL* DATA INCOMPLETE. Not all of the message was received.
 - (b) *FAIL* DATA CORRUPT. The message was corrupted.
 - (c) *FAIL* DATA IGNORED. There were insufficient correct repetitions.
 - (d) *FAIL* TOO MANY WORDS. The message was longer than the format.
 - (e) *FAIL* WRONG RESPONSE. The response was wrong for the message which was sent.
- (5) The 2957D or 2960D takes an average of four measurements of the mobile's power level with reference to its SCM. The message *FAIL* READING UNSTABLE means that the measurements are <1 mW or differ by >2%.
- (6) If required, the 2957D or 2960D instructs the mobile to reset the power level and then takes another measurement.
- (7) PASSED is displayed for a good test. The message *FAIL* x.xxW means that the power level is outside limits.

Test routine no. 29 for analog channels - Data performance (ANALOG BER)

This test routine is not applicable to N-AMPS narrowband channels. It checks the accuracy of the mobile's data reception under low level conditions. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.
- (2) The 2957D or 2960D checks the RF generator level parameter for correct unit and correct value within the range -141 to -80 dBm. If not, ERROR: PARAMETER RANGE or ERROR: PARAMETER UNITS is displayed and the test routine is terminated.

- (3) The 2957D or 2960D checks the bit error rate lower limit parameter for correct unit and correct value within the range 0 to 100%. If not, ERROR: PARAMETER RANGE or ERROR: PARAMETER UNITS is displayed and the test routine is terminated.
- (4) The 2957D or 2960D sets the RF generator level in accordance with the parameter and then sends an Audit Order message to the mobile and waits for a confirmation message.
- (5) The 2957D or 2960D waits for the SAT to be transponded. The message *FAIL* SAT DROPOUT means that no SAT was detected within 3 seconds.
- (6) The 2957D or 2960D checks for response and logs success.
- (7) The 2957D or 2960D checks 10 times for any response. If no response is received, the test routine is aborted. Otherwise, the test routine repeats from (4) another 90 times. The message *FAIL* NO RESPONSE means that there was no response after 10 checks.
- (8) After 100 successful checks, PASSED is displayed together with the % bit error rate. The message *FAIL* xxx% means that the percentage pass was outside the limit.

Test routine no. 29 for digital channels - BER reporting (BER REPORT)

This test routine checks the accuracy of the mobile's bit error rate measurement by introducing bit errors in the data field of the transmitted signal (after convolutional coding and interleaving) and analyzing the BER which is reported by the mobile. For the appropriate values, see the table on page 3-1-56. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. If not, the message ERROR: NO VOICE CHANNEL is displayed and the test routine is terminated.
- (2) The introduced bit errors per time slot parameter is checked for correct unit and correct value within the range 0 to 40. If not, ERROR: PARAMETER RANGE or ERROR: PARAMETER UNITS is displayed and the test routine is terminated.
- (3) The RF generator level parameter is checked for correct unit and correct value within the range -120 to -50 dBm. If not, ERROR: PARAMETER RANGE or ERROR: PARAMETER UNITS is displayed and the test routine is terminated.
- (4) The upper and lower limit parameters are checked for correct unit and correct value within the range 0 to 7. If not, ERROR: PARAMETER RANGE or ERROR: PARAMETER UNITS is displayed and the test routine is terminated.
- (5) The 2957D or 2960D sets the RF generator level in accordance with the parameter.

OPERATION

- (6) The 2957D or 2960D then sends a Measurement Order message to the mobile and waits for the Measurement Order Ack message. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO ORDER ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (7) The mobile sends a Measurement Order Ack message, starts BER measurement and sends the result in a Channel Quality message every second.
- (8) The 2957D or 2960D starts introducing bit errors in the transmitted data and waits for Channel Quality messages from the mobile. The message *FAIL* NO RESPONSE or *FAIL* DATA CORRUPT means that a message was not received within 5 seconds.
- (9) The 2957D or 2960D stops introducing bit errors and sends a Stop Measurement Order message to the mobile and waits for the Stop Measurement Order Ack message. If this is not received within 2 seconds, the 2957D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO ORDER ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (10) The mobile sends a Mobile Ack message and stops BER measurement.
- (11) Provided Channel Quality messages were successfully received from the mobile, the BER report is compared with the limits and displayed with PASSED for within limits or *FAILED* for outside limits.

Test routine no. 30 - DTMF tones (DTMF TONES)

This test routine checks the mobile's ability to generate DTMF tones at the correct frequency. This is optional and has to be enabled or disabled under the TEST SEQUENCE MENU. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.
- (2) The 2957D or 2960D checks that this test routine is enabled. The message ERROR: NOT ENABLED means that it is not.
- (3) WAITING FOR TONES is displayed and the 2957D or 2960D waits for the tones. The message *FAIL* NO RESPONSE means that no tones were received within the time limit.
- (4) On the handset, the user presses the number, * and # keys. This transmits tone pairs (for analog channels) or a Data message (for D-AMPS digital channels) with each key press. These can be heard when the volume is turned up.
- (5) The data symbols are displayed (i.e. 1 2 3 4 5 6 7 8 9 0 * #) for confirmation sequentially as they are received. For D-AMPS digital channels, an Ack message is sent to the mobile.
- (6) The user checks the symbols for accuracy and then presses CONTINUE. This causes PASSED to appear on the display.

Test routine no. 31 - Hook flash (HOOK FLASH)

This test routine checks the mobile's ability to send a Hook Flash message or signalling tone of the correct duration and interrogates the mobile for the hook flash data. This is optional and has to be enabled or disabled under the **TEST SEQUENCE MENU**. Operation is as follows:-

- (1) The test routine title is displayed and the 2957D or 2960D checks that the mobile is in conversation. The message ERROR: NO VOICE CHANNEL means that the previous call placement has failed.
- (2) The 2957D or 2960D checks that this test routine is enabled. The message ERROR: NOT ENABLED means that it is not.
- (3) The 2957D or 2960D requests the user to send flash and waits for the signalling tone. The message *FAIL* NO SIGNAL TONE means that there was no ST. The message *FAIL* NO RESPONSE means that there was no flash message within 40 seconds (N-AMPS narrowband channel) or 20 seconds (D-AMPS digital channel).
- (4) On the handset, the user enters numerical data and then presses the SEND key. An ST (except N-AMPS narrowband channel) or Data message (N-AMPS narrowband or D-AMPS digital channel) is transmitted. This can be heard when the volume is turned up.
- (5) Except for a D-AMPS digital channel, the 2957D or 2960D receives the ST or Data message and instructs the mobile to send the called address. For a D-AMPS digital channel, the 2957D sends an Ack message.
- (6) Except for D-AMPS digital channels, the called address is displayed for confirmation.
- (7) Failure messages are as follows:-
 - (a) *FAIL* DATA INCOMPLETE. Not all of the message was received.
 - (b) *FAIL* DATA CORRUPT. The message was corrupted.
 - (c) *FAIL* DATA IGNORED. There were insufficient correct repetitions.
 - (d) *FAIL* TOO MANY WORDS. The message was longer than the format.
 - (e) *FAIL* WRONG RESPONSE. The response was wrong for the message which was sent.
 - (f) *FAIL* NO RESPONSE. No message received.
- (8) The 2957D or 2960D checks the ST duration if applicable and PASSED is displayed for a good test. The message *FAIL* SIGNAL TONE DURATION means that the ST duration was not 400 ms \pm 50 ms or \pm 10%.

OPERATION

Test routine no. 32 - Data deviation (DATA DEVIATION)

This test routine is not applicable to N-AMPS narrowband channels or D-AMPS digital channels. It is used to measure the mobile's data deviation while it is in conversation. A reference level of 8.0 kHz is used with a maximum error which has a default value of 10%. Operation is as follows:-

- (1) Upon initialization, the test routine title is displayed and a check is made to ensure that the mobile is in conversation. If not, the message NO VOICE CHANNEL is displayed and the test routine is terminated.
- (2) The maximum error parameter is checked for correct unit and correct value within the range 0 to 100% or 0 to 8.0 kHz. If not, the message ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (3) The 2957D or 2960D sends an Audit Order message to the mobile. The deviation of the mobile's response is then measured. If there is no response from the mobile, the message NO RESPONSE is displayed and the test routine is terminated.
- (4) Provided the measurement was successful, the result is displayed and the test routine is passed if it is within the specified limits. If the measurement was not successful, the message BELOW THRESHOLD or READING UNSTABLE is displayed. Other messages are as follows:-
 - (a) PASSED x.xxkHz ±xxxHz.
 - (b) PASSED x.xxkHz ±xx%.
 - (c) *FAIL* NO RESPONSE.
 - (d) *FAIL* BELOW THRESHOLD.
 - (e) *FAIL* READING UNSTABLE.
 - (f) *FAIL* x.xxkHz ±xxxHz.
 - (g) *FAIL* x.xxkHz ±xx%.
 - (h) *FAIL* TEST ABORTED.

Test routine no. 33 - ST deviation (ST DEVIATION)

This test routine is not applicable to N-AMPS narrowband channels or D-AMPS digital channels. It is used to measure the mobile's signalling deviation. To obtain a valid result, it has to follow a test routine no. 21 because the deviation is measured and stored while the mobile is ringing in the test routine no. 21. A reference level of 8.0 kHz is used with a maximum error which has a default value of 10%. Operation is as follows:-

- (1) Upon initialization, the test routine title is displayed.
- (2) The maximum error parameter is checked for correct unit and correct value within the range 0 to 100% or 0 to 8.0 kHz. If not, the message ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.

- (3) A check is made to see that a valid ST deviation reading has been taken. If not, the message NO READING is displayed and the test routine is terminated.
- (4) Provided the measurement was successful, the result is displayed and the test routine is passed if it is within the specified limits. Possible messages are as follows:-
- (a) PASSED x.xxkHz ±xxxHz.
 - (b) PASSED x.xxkHz ±xx%.
 - (c) *FAIL* NO READING.
 - (d) *FAIL* x.xxkHz ±xxxHz.
 - (e) *FAIL* x.xxkHz ±xx%.
 - (f) *FAIL* TEST ABORTED.

Test routine no. 34 - ST duration (ST DURATION)

This test routine is not applicable to N-AMPS narrowband channels or D-AMPS digital channels. It is used to measure the duration of the mobile's signalling tone. To obtain a valid result, it has to follow a test routine no. 23, 24, 26, 27 or 31 because the ST duration is measured and stored during these test routines. The reference duration is dependent on the test routine as follows:-

Test routine no.	Test type	Reference duration
23	Handoff	50 ms
24	Automatic handoff	50 ms
26	Clear from cell	1.8 s
27	Clear from mobile	1.8 s
31	Hook flash	400 ms

A maximum error is used. In all cases, it has a default value of 10%. The maximum error parameter can be specified in % or Hz. Operation is as follows:-

- (1) Upon initialization, the test routine title is displayed.
- (2) A check is made to ensure that a valid ST duration reading has been taken. If not, the message NO READING is displayed and the test routine is terminated.

OPERATION

- (4) Provided the measurement was successful, the result is displayed and the test routine is passed if it is within the specified limits. Possible messages are as follows:-
 - (a) PASSED xx.xs ±x.xs.
 - (b) PASSED xx.xs ±xx%.
 - (c) *FAIL* NO READING.
 - (d) *FAIL* xx.xs ±x.xs.
 - (e) *FAIL* xx.xs ±xx%.
 - (f) *FAIL* TEST ABORTED.

Test routine no. 35 - Digital modulation error (RMS VECTOR ERROR, FIRST 10 SYMBOLS, ORIGIN OFFSET or BURST ENVELOPE)

This test routine is applicable only to D-AMPS digital channels. It checks one of four different types of modulation error of the mobile's transmitter while it is in conversation. Operation is as follows:-

- (1) The test routine title for the selected modulation error type is displayed.
- (2) If D-AMPS has not been selected, the message ERROR: NOT APPLICABLE is displayed. If the mobile is not in conversation on a digital channel, the message NO VOICE CHANNEL or ERROR: ANALOG CHANNEL is displayed and the test routine is terminated.
- (3) The UL parameter is checked for correct unit and correct value within the range 0 to 40% or 0.4 for RMS vector error or first 10 symbols or -50 to -10 dBm for origin offset. If not, the message ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (4) The selected modulation error measurement is attempted. If it is unsuccessful, the message ERROR: NO READING is displayed.
- (5) When the first error type is selected, the RMS vector error is checked and displayed as x.xx or xx.x% with PASSED for within limits or *FAIL* for outside limits.
- (6) When the second error type is selected, the first 10 symbols are averaged over 10 full bursts within a 1 minute period, checked and displayed as x.xx or xx.x% with PASSED for within limits or *FAIL* for outside limits.
- (7) When the third error type is selected, the origin offset is checked and displayed as -xx.xdB with PASSED for within limits or *FAIL* for outside limits.

- (8) When the fourth error type is selected, the burst envelope is checked and one of the following messages is displayed:-
- (a) PASSED WITHIN MASK. This is displayed when the burst envelope is within the mask as defined below.
 - (b) *FAIL* RAMP UP. This is displayed when the level at the end of symbol period 3 is higher than -24 dB relative to the mean level between symbol periods 6 to 162.
 - (c) *FAIL* RAMP DOWN. This is displayed when the level at the end of symbol period 165 is higher than -24 dB relative to the mean level between symbol periods 6 to 162.
 - (d) *FAIL* +3dB APERTURE. This is displayed when the level at the end of symbol period 6 is higher than +3 dB relative to the mean level between symbol periods 6 to 162.
 - (e) *FAIL* -20dB APERTURE. This is displayed when the level at the end of symbol period 162 is lower than -20 dB relative to the mean level between symbol periods 6 to 162.

Test routine no. 36 - Digital RF sensitivity (DIGITAL BER or DIGITAL BER 2RAY)

This test routine is applicable only to D-AMPS digital channels. It checks the RF sensitivity of the mobile's receiver in terms of bit error rate while the mobile is in the loopback mode. This mode is entered either by special function(s) selectable from the mobile's handset (if available) or by using the mobile's test interface adapter (EIA/TIA IS-55 Section 8) with appropriate commands. To set the 2957D or 2960D to suit the mobile's TIA port, see page 3-1-57. Operation is as follows:-

- (1) In this test routine, the RF level is initially set to -80 dBm to allow the mobile to acquire sync quickly and to allow the test set to acquire PRBS lock.
- (2) The RF generator level parameter is checked for correct unit and correct value within the range -120 to -50 dBm. If not, the message ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (2) The 2957D or 2960D sets the RF generator level in accordance with the parameter.
- (3) The test routine normally pauses to allow the user to connect the mobile to the TIA port or to enter the appropriate hand set commands. The user then presses the CONTINUE key. There is a timeout of 60 s. Alternatively, if a TIA port can be permanently connected, the pause can be avoided by setting appropriate parameter. The message ERROR: NOT APPLICABLE appears if D-AMPS has not been selected.
- (4) Pseudo-random data (inserted in the data field after convolutional coding but before interleaving) is sent to the mobile. Data which is echoed by the mobile is compared for bit errors in 1 s periods.

OPERATION

- (5) Provided the measurement was successful, the result is displayed and the test routine is passed if it is within the specified limits. The result is shown as PASSED tF nnn x.xxx% where t is the channel type 1 (for 1 + 4), 2 (for 2 + 5) or 3 (for 3 + 6), F is for full rate slot, nnn is the channel number and x.xxx is the bit error rate to three places of decimals. 1 bit = approximately 0.008%.
- (6) Other messages are as follows:-
 - (a) ACTIVE WAITING TDMAON. When flashing, this prompts for the user to provide this manually. When static this is displayed when TDMAON is being acquired through the TIA port.
 - (b) ACTIVE IN TDMAON MODE. This is displayed while measurement is in progress.
 - (c) ERROR: NO READING.
 - (d) *FAIL* SLOTS MISSING. Displayed while active.
 - (e) *FAIL* OUT OF LOCK. Displayed while active.

Test routine no. 37 - Digital speech loopback quality (SPEECH LOOPBACK)

This test routine is applicable only to D-AMPS digital channels. It allows the user to confirm the quality of digital speech. The speech transmitted by the mobile is looped back in the 2957D or 2960D and transmitted to the mobile after a 2 second delay. Operation is as follows:-

- (1) The test routine starts by entering the pause mode in either local or remote waiting for the test routine to continue. The prompt ACTIVE SPEAK AND LISTEN appears. The message ERROR: NO VOICE CHANNEL or ANALOG CHANNEL means that the mobile is not in conversation on a digital channel.
- (2) The user speaks and then listens to the loopback so that he can judge the quality.
- (3) The test routine is assumed to be passed when the user presses the CONTINUE key within the specified timeout period. Otherwise, failure is indicated.
- (4) Other messages are as follows:-
 - (a) PASSED ACCEPTABLE.
 - (b) *FAIL* UNACCEPTABLE.

Test routine no. 38 - Digital RSSI (DIGITAL RSSI)

This test routine is applicable only to D-AMPS digital channels. It checks the accuracy of the mobile's RSSI measurement by setting the RF generator level and analyzing the RSSI which is reported by the mobile. For the appropriate values, see the table on page 3-1-55. The check can be made on the current digital traffic channel or a channel other than the current digital traffic channel. Operation is as follows:-

- (1) The test routine title is displayed.
- (2) If D-AMPS has not been selected, the message ERROR: NOT APPLICABLE is displayed. If the mobile is not in conversation on a digital channel, the message NO VOICE CHANNEL or ERROR: ANALOG CHANNEL is displayed and the test routine is terminated.
- (3) The RSSI measurement channel number parameter is checked for correct unit and correct value within the range 1 to 1023. If not, the message ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (4) The parameter for the RF level of the RSSI channel is checked for correct unit and correct value within the range -120 to -50 dBm (for 2955 A/B/R) or -80 dBm (for 2955) if the RSSI channel is not the correct traffic channel. If the unit is incorrect or the value is out of range, the message ERROR: PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (5) The upper and lower limit parameters are checked for correct unit and correct value within the range 0 to 31. If not, ERROR: PARAMETER RANGE or ERROR: PARAMETER UNITS is displayed and the test routine is terminated.
- (6) When the RSSI is to be measured on a channel other than the current channel, the parameter for the RF level of the current channel is checked for correct unit and correct value within the range -120 to -50 dBm. If not, the message ERROR; PARAMETER UNITS or ERROR: PARAMETER RANGE is displayed and the test routine is terminated.
- (7) When the RSSI is to be measured on the current channel, the 2957D or 2960D sets the RF level in accordance with the parameter.
- (8) When the RSSI is to be measured on a channel other than the current channel, the 2957D or 2960D sets the RF level for the current channel and that for the RSSI measurement channel in accordance with the parameters.
- (9) The 2957D or 2960D then sends a Measurement Order message to the mobile and waits for a Measurement Order Ack message. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO ORDER ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (10) The mobile sends a Measurement Order Ack message, starts RSSI measurement and sends the result in a Channel Quality message every second.

OPERATION

- (11) The 2957D or 2960D waits for Channel Quality messages from the mobile. The message *FAIL* NO RESPONSE or *FAIL* DATA CORRUPT means that a message was not received within 5 seconds.
- (12) The 2957D or 2960D sends a Stop Measurement Order message to the mobile and waits for the Stop Measurement Order Ack message. If this is not received within 2 seconds, the 2957D or 2960D sends the message again and waits for the Ack message. This is repeated up to three times. The message *FAIL* NO ORDER ACK or *FAIL* DATA CORRUPT means that the repeats were not successful.
- (13) The mobile sends a Mobile Ack message and stops RSSI measurement.
- (14) Provided Channel Quality messages were successfully received from the mobile, the RSSI report is compared with the limits and displayed as CH nnn RSSI: xx where nnn is the channel number and xx is the RSSI with PASSED for within limits or *FAIL* for outside limits.

Test routine no. 39

Not implemented.

Chapter 4-0

REMOTE OPERATION

REMOTE CONTROL

The 2957D or 2960D can be controlled remotely either from a GPIB controller or through the RS-232 serial interface.

The serial interface gives control from a dumb ASCII terminal, from a computer with a serial port or through a modem. In RS-232 operation, the commands are the same as for GPIB operation with the addition of commands which are specific to RS-232. For ease of use with a modem, the ECHO command can be used to cause any character which is sent to the 2957D or 2960D to be echoed back to the terminal.

There are three remote control modes as follows:-

- (a) Remote pass-through. To control the 2955.
- (b) Remote CRTS immediate. To control the 2957D or 2960D.
- (c) Remote CRTS learn. To enter a program.

The descriptions below assume that the controller is correctly connected and that the appropriate programming procedure is used. Refer to the manufacturer's literature.

Note

Remote operation may be slowed down when data is being generated.

REMOTE PASS-THROUGH MODE

This mode can be entered by one of the following methods:-

- (a) From 2955 local mode (i.e. the mode which is entered at switch-on), by the 2957D or 2960D receiving either REMOTE from the GPIB or by any character appearing at the RS-232 input.
- (b) From remote CRTS immediate mode, by receiving the program code Normal from the controller.

In this mode, the incoming data is routed straight to the 2955. The only data check is to see whether the input string contains the program code CRTS. When CRTS is received, the system enters the remote CRTS immediate mode.

When the 2957D or 2960D is addressed to talk in GPIB operation, it similarly addresses the 2955 to talk and holds off the external bus until it has received the data from the 2955 and placed it in its output buffer. Holdoff is then released and the data is sent out.

In RS-232 control, the SRQ function on the 2955 has to be enabled so that the program knows when there is data ready to be sent out.

REMOTE OPERATION

This mode can be exited by one of the following methods:-

- (a) To 2955 local mode, by GTL from the GPIB or by the program code LOCAL through the RS-232 input.
- (b) To 2955 local mode, by pressing the LOCAL key on the Adapter's front panel.
- (c) To remote CRTS immediate mode, by the program code CRTS from the controller.

For a summary of entering and exiting modes, see Fig. 4-1.

REMOTE CRTS MODES

These modes can be entered by one of the following methods:-

- (a) From local CRTS mode, by the 2957D or 2960D receiving REMOTE from the GPIB or by any character appearing at the RS-232 input.
- (b) From remote pass-through mode, by the program code CRTS from the controller.

The 2957D or 2960D goes into the remote CRTS immediate mode which is indicated by WAITING FOR RUN being shown on the display. At this point, changes can be entered as immediate mode commands which change the test sequence, format, etc. When run is initiated by <RETURN> (which is equivalent to pressing START TEST in local mode), this causes the test sequence which is displayed on the screen to be executed. The test sequence is that previously selected either from the **CHANGE FORMAT MENU** or by using the change procedure below.

When the program code LEarn is sent, followed by <RETURN>, the 2957D or 2960D goes into the remote CRTS learn mode which is indicated by IN LEARN MODE being shown on the display. A program can then be entered, terminated with the program code END. Pressing <RETURN> redisplay the message WAITING FOR RUN. When required, the program can be saved on disc using the program code SAve.

The remote CRTS immediate mode can be exited by one of the following methods:-

- (a) To local CRTS mode, by GTL from the GPIB or by the program code LOCAL through the RS-232 input.
- (b) To local CRTS mode, by pressing the LOCAL key on the Adapter's front panel.
- (c) To remote pass-through mode, by the program code NORmal from the controller.

For a summary of entering and exiting modes, see Fig. 4-1.

REMOTE OPERATION

Chapter 4-1

INTRODUCTION TO PROGRAMMING

PURPOSES OF PROGRAMMING

The programming capability of the 2957D or 2960D can be used for two distinct applications as follows:-

- (a) To operate the 2957D or 2960D from a remote position. The test sequences and test routines can be those which are built-in or they can be defined by the user.
- (b) To execute programs which have been written by the user.

In these programs, the user can define the following:-

- (a) Test sequences - sequences of built-in and/or user-defined test routines.
- (b) Test routines - routines as the built-in ones but with parameters changed.
- (c) Screen displays.
- (d) Printout formats.

The user's programs are retained in non-volatile memory and can be stored on and loaded from floppy discs.

METHODS OF REMOTE CONTROL

All the key-type controls on the 2957D or 2960D function in the same way as a computer keyboard. When a key is pressed, the key's code is sent to the internal microprocessor. It follows that the keys' codes can be generated externally.

Similarly, as the screen display is generated by the internal microprocessor, it follows that the display data can be passed to a printer.

As shown in Fig. 4-2, the three ways to remotely control an instrument are as follows:-

- (a) From a GPIB controller, through a GPIB to the instrument's GPIB port.
- (b) From a microcomputer which is fitted with a GPIB interface unit, through a GPIB to the instrument's GPIB port.
- (c) From a microcomputer which is fitted with an RS-232 interface unit, through an RS-232 link to the instrument's serial port.

INTRODUCTION TO PROGRAMMING

The GPIB system is suitable for connecting up to fifteen instruments on a maximum total bus length of 20 m. The maximum baud rate is 1 Mbits/s.

The RS-232 system is suitable for a direct link on a maximum length of 15 m. Modems can be inserted to use a telephone line or any other asynchronous system. The maximum baud rate is 9.6 kbits/s.

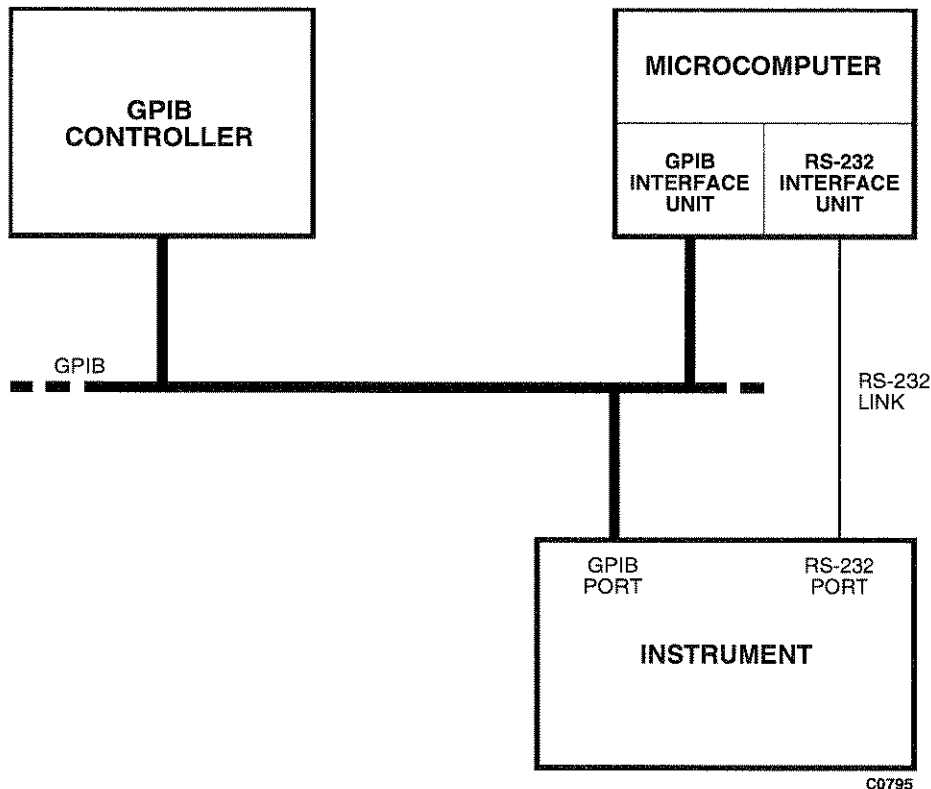


Fig. 4-2 Methods of remote control

RS-232 INTERFACE UNIT

When the unit has appropriate switches, it is necessary to set them to the COM port number and the IRQ number.

It is necessary to program the RS-232 interface for the required baud rate, parity, data bits and stop bits. This can be done under MS-DOS or in BASIC.

Port setting under MS-DOS

Enter the asynchronous communications mode as follows:-

```
MODE COM<m>:<baud>[,<parity>[,<databits>[,<stopbits>]]]
```

where m = COM port number,
baud = 110, 150, 300, 600, 1200, 2400, 4800 or 9600,
parity = N (none, O (odd) or E (even),
databits = 7 or 8,
stopbits = 1 or 2.

Port setting in BASIC

Open the communications channel as follows:-

```
OPEN "COM<m>:<baud>[,<parity>[,<databits>[,<stopbits>]]]"
```

```
where m      = COM port number,
      baud    = 110, 150, 300, 600, 1200, 2400, 4800 or 9600,
      parity  = N (none, O (odd) or E (even),
      databits = 7 or 8,
      stopbits = 1 or 2.
```

Setting the 2957D or 2960D

Using the INTERFACE MENU, it is necessary to set the instrument for the required baud rate, parity, data bits and stop bits.

GPIB PROGRAMMING

For a GPIB controller, the appropriate commands are detailed in Chapter 4-3.

For a microcomputer which has a GPIB interface unit, the same commands can be entered in a TBASIC program.

RS-232 PROGRAMMING IN BASIC

An instrument is controlled remotely by sending the appropriate commands to it. These are ASCII strings and are detailed in Chapter 4-3. The commands are sent to the instrument by entering them as constants in a BASIC program. When the BASIC program has been entered, then it can be RUN.

PROGRAMMING MODES

There are three of these as follows:-

- (a) Immediate mode. WAITING FOR RUN is displayed on the screen.
- (b) Learn mode. IN LEARN MODE is displayed on the screen.
- (c) User mode. IN USER MODE is displayed on the screen.

In immediate mode, the 2957D or 2960D responds to each individual command as it is received.

In learn mode, the 2957D or 2960D retains program statements for a user-defined test sequence.

In user mode, the 2957D or 2960D retains program statements for a user-defined test subroutine.



Chapter 4-2

WRITING A PROGRAM

INTRODUCTION

In the remote CRTS immediate mode, the 2957D or 2960D is controlled by means of commands on the GPIB or through the RS-232 port.

In the remote pass-through mode, the 2955 is controlled by means of commands on the GPIB or through the RS-232 port.

In the remote CRTS learn mode, the 2957D or 2960D is controlled by means of statements in a program.

Each command or program statement consists of a command code, numerical data as appropriate, ASCII strings as appropriate and suitable delimiters. For convenience, spaces can be included between command codes and data but not within data. The syntax of commands and program statements is in seven forms. Full details of syntax forms are given on pages 4-2-2 to 4-2-4.

Command codes are mnemonics of English words and abbreviated English words. They can be entered as upper or lower case letters - the 2957D or 2960D does not differentiate. To reduce the number of bytes used to store a program, most command codes are tokenized. Each token is a single byte above 7F hexadecimal (i.e. above the ASCII range). Full details of command codes are given in Chapter 4-3.

Programming also allows the user to define his own parameters in test routines. Further information on this subject is given on pages 4-2-4 to 4-2-6.

Programming allows the user to define his own test sequences. Further information on this subject is given on pages 4-2-6 to 4-2-8.

Error messages are detailed on page 4-2-9.

All ASCII strings have to be enclosed within single or double quotation marks except for the string following COMMAND. After COMMAND, the string is not enclosed in quotation marks unless they are also intended to be sent to the 2955.

SYNTAX

Conventions

The following are used in this Manual:-

Notation	Explanation	Example
AAAAA	Items which are entered as a string	END
AAAAaaaa	Minimum abbreviation in upper case and optional characters in lower case	SAve
<AAAAAA>	ASCII control code or keyboard function to be entered as a single key stroke	<SPACE>
<aaaaaa>	Information as described which is to be entered as a string	<integer>
<"aaaa">	Information as described which is to be entered as a string within quotation marks	<"text">
[]	Entry of the enclosed item is optional	[<LF>]
{ }	The enclosed two (or more) items are alternatives	{<,> <LF>}
...	The previous type of entry can be repeated as necessary	<integer> <,> ...

Delimiters

Every statement has to end with a delimiter or with another command code. There are three types of delimiter as follows:-

- (1) High priority. Used to terminate command statements.

<LF> for linefeed, <ETX> for end of text or <ETB> for end of text block.

Where a high priority delimiter <LF> is shown, <ETX> or <ETB> can be used instead.

- (2) Low priority. Used to give delimiting without a linefeed. Also used for the separation of separate fields within a command statement.

<,>, <SPACE> or <CR>.

Where a low priority delimiter <,> is shown, <SPACE> or <CR> can be used instead.

- (3) Text. Single or double quotation marks for ASCII literal strings.

Syntax forms

There are seven forms of syntax as follows:-

- (1) <command code> {<,>|<LF>}

Example: DEFAULT<,> (Set default parameters.)

- (2) <command code> [<,>] <integer> {<,>|<LF>}

Example: TEST 28<LF> (Execute test routine no. 28.)

- (3) <command code> [<,>] <integer> <,> ... <value> <,> ... <LF>

This syntax form has compulsory delimiters for separating adjacent numbers. There can be any number of separate integers and values.

Example: PARAMETER9,2,30W,5W<LF> (Set DC power parameters at 30 W and 5 W.)

- (4) <command code> [<,>] [<integer> <,> <integer>] <,> {<command code>|<"text">} {<,>|<LF>}

This syntax form applies to PRINT and WRITE only. There are two types of statement - one prints or displays immediately; the other does so at a defined set of co-ordinates. When the latter is required, the co-ordinates are entered as the two integers separated by a low priority delimiter. Then, there is another command code (e.g. ESN for the equipment serial number to be printed or displayed) or text.

Examples: (1) PRINT SEQTTL<,> (Print the current test sequence title.)

(2) WRITE 3,9,"WARNING"<LF> (Write WARNING at column 3, row 9.)

- (5) <command code> [<,>] <integer> <,> <integer> {<,>|<LF>}

This form has two integers separated by a compulsory delimiter.

Example: JBC7,66 (Jump to LABEL 66 if bit 7 is clear.)

- (6) <command code> <,> <"text"> <LF>

Example: SEQTTL "QUICK TEST"<LF> (Title of test sequence is QUICK TEST.)

- (7) <COMMAND> [<,>] <statement> ... <LF>

This is only used with COMMAND. It causes the statement(s) between COMMAND and the high priority delimiter to be passed through to the 2955.

Example: COMMAND RGFR850.015MZ<LF> (Generated RF to be 850.015 MHz.)

WRITING A PROGRAM

Note

- (1) Most statements can be concatenated into one data stream by using commas or spaces as delimiters. However, some of them require a terminating linefeed.
- (2) All numbers have to be in decimal format unless otherwise stated.
- (3) The maximum length of a string is 40 characters.
- (4) In serial control mode, the 2957D or 2960D inserts a linefeed whenever a carriage return is encountered.

COMMAND CODES

The command codes are detailed in Chapter 4-3.

Settings are retained in non-volatile memory except for CSL and SRQ. CSL and SRQ settings are not retained but revert to 0 when the instrument is switched on.

TEST ROUTINE PARAMETERS

Guidance on changing the parameters of the test routines is given below. In Chapter 4-4, details are given of the possible range and the default value of each parameter for each test routine.

For each test routine, there are from one to five parameters as described below.

Parameter 1

This controls, as appropriate, the following:-

- (a) The type of test result required.
- (b) Cellular radio or private mobile radio (PMR).
- (c) Type of measurement - Distortion, SINAD, S/N or residual noise. In test routines no. 3 and no. 6, SINAD (Distortion) is a special case in which SINAD is measured but DISTORTION is shown on the screen.
- (d) Type of filter - 15 kHz LP, 0.3 to 3.4 kHz, 300 Hz LP or psophometric.
- (e) Setting of control port lines.
- (f) RF power level settings.
- (g) Actions at handoff.
- (h) SAT transponding, deviation and frequency.

These are all controlled by 0 or 1 states of bits in a byte. The resulting binary number is converted to a decimal number for entry in a program.

The type of test result can be expressed in different ways as follows:-

- (a) Reference value and maximum error (RV & ME). This is a reference value (RV) together with a maximum permissible error (ME) (i.e. the maximum \pm difference from the RV). The RV and ME, UL or LL are set under parameters 2 and 3. The RV can be the current channel frequency (RV & ME (CC)).
- (b) Upper limit and lower limit (UL & LL). These are the limits of the range in which the reading is to be.

Examples: (1) If it is required to test transmitter power (test routine no. 1) using upper and lower limits, bit 0 has to be set to a binary number of 00000001. Accordingly, the decimal value 1 is entered as parameter 1 for test routine no. 1.

(2) If it is required to test transmitter AF residual noise (test routine no. 3) using a 300 Hz low pass filter, bits 4 and 5 have to be set for the residual noise measurement to a binary number of 00110000 (decimal 48) and bit 3 has to be set for the filter to a binary number of 00001000 (decimal 8). Adding these together gives a binary number of 00111000 (decimal 56). Therefore, the decimal number 56 is entered as parameter 1 for test routine no. 3.

Parameter 2

This contains, depending on the test routine and the type of result which has been selected, one of the following:-

- (a) Reference value and unit (RV).
- (b) Value and unit for the upper limit (UL).
- (c) Value and unit for the lower limit (LL).
- (d) Value and unit used in special tests.

Parameter 3

This contains, depending on the test routine and the type of result which has been selected, one of the following:-

- (a) Value and unit for the maximum permissible error (ME).
- (b) Value and unit for the lower limit (LL).
- (c) Value and unit used in special tests.

WRITING A PROGRAM

Note

- (1) RV & ME. Providing the ME is in the same units as the RV, the created range for $RV \pm ME$ is checked against the given range (e.g. if 900 MHz is entered as the RV and 150 MHz is entered as the ME, the range created is 750 to 1050 MHz. As the given range is 0 to 1000 MHz, a parameter range error is indicated).
- (2) UL & LL. Parameters 2 and 3 have to be in the same units.

Parameter 4

Except for test routine no. 28, test routine no. 29 for D-AMPS digital channels and test routine no. 38, this contains the nominal modulation level and complies with the ranges 100 Hz to 25 kHz, 1 to 70% and 0.1 to 10 rads.

Parameters 4 and 5

For test routine no. 28, test routine no. 29 for D-AMPS digital channels and test routine no. 38, these are upper limit and lower limit as parameters 2 and 3.

Parameters 6

For test routine no. 38 this is the RF level of the current digital traffic channel when testing RSSI of another channel.

Changing the parameters

Parameters are changed by means of a statement in a program. This consists of PARAMETER, the test routine number, the first parameter to be changed and the data for this and each subsequent parameter.

Example: `PARAMETER 6,1,28,26dB,-80dBm, 2kHz<LF>`

This begins (PARAMETER6) by specifying test routine no. 6 and then (1), parameter 1 is specified. The value and unit of parameters 1, 2, 3 and 4 (28, 26dB, -80dBm, 2kHz) are stated. This means a receiver SINAD measurement with the psophometric filter ($16 + 12 = 28$) with a lower limit of 26 dB and a reference modulation level of 2 kHz.

Note

The number of the first parameter is always given so that a shortened form can be used starting with parameter 2, 3 or 4.

USER-DEFINED TEST SEQUENCES

Guidance on entering your program is given below. Sample programs are given in Chapter 4-6. Also, the programs for the built-in test sequences are given so that these can be used as the basis for your own programs.

Entering a program

Enter your program as follows:-

- (1) Connect the programming device to either the GPIB port or the RS-232 port.
- (2) After switch-on, press the CRTS key to enter local CRTS mode. Wait until initializing and self-testing have finished.
- (3) Send the appropriate remote command from the programming device. Using a GPIB controller with a 2957D or 2960D which has been set to GPIB address 06, send REMOTE 706. For RS-232 operation, send <CR>.
- (4) The 2957D or 2960D enters the FULL AUTO TEST mode and displays WAITING FOR RUN. For RS-232 operation, it is useful to send ECHO 1 so that each character is echoed back to the terminal.
- (5) Allocate a title to the user-defined test sequence. Send SEQTTL followed by, enclosed in quotation marks, the title of up to 22 characters.
- (6) Send LEARN to enter the learn mode. WAITING FOR RUN is replaced by IN LEARN MODE.
- (7) Now, enter the main body of your program. Guidance on writing this is given below.
- (8) Terminate the program by sending END. The user-defined test sequence is now in memory. WAITING FOR RUN is redisplayed.
- (9) To select the user-defined test sequence, send TSI4. Using a typical GPIB controller, send OUTPUT 706;"TSI 4". This causes the display to change to the user-defined test sequence.
- (10) Prior to running the program, it is worth saving the program on disc in case it is later overwritten. If this happens, the program does not then need to be re-entered but merely reloaded from disc. The displayed starting parameters should be correctly set up before saving since both the user-defined program area and the non-volatile variables are recovered with the disc file.
- (11) To run the user-defined test sequence, send RUN. This is equivalent to START TEST in 2955 local mode.
- (12) The user-defined test sequence is now executed. If there is an error in the program, an ERROR message is displayed. See 'Error messages' on page 4-2-9. The error has to be corrected and the program reloaded before re-running. For a non-recoverable error (e.g. the program in a continuous loop), it is necessary to switch off and start again. If required during a run, the test sequence can be aborted by sending the ESCape character CHR\$(27).

Program construction

A modular programming technique should be used. In this, the main routine is used as follows to display the title of the test sequence, request operator interaction and display the measurement results.

Subroutines are used to perform the actual measurements or other actions. This allows the main routine to be defined without regard to the details of making the measurements etc. It also allows each subroutine to be changed without affecting either the main routine or the other subroutines.

To pass program flow from the main routine to a subroutine, GOSUB is used. To return to the main routine, RETURN is used. Subroutines can be nested to a depth of six levels. When this number is exceeded, a warning message is given. Each subroutine is identified by its LABEL which is uniquely numbered.

The default parameters for the built-in test routines (i.e. following DEFAULT) can be modified in user-defined test sequences.

```
Example: WRITE 3,29 SEQTTL GOSUB 60 WRITE 23,29,RESULT JUMP 61 <CR><LF>  
        LABEL 60 TEST 21 RETURN <CR><LF>  
        LABEL 61 END <CR><LF>
```

This begins (WRITE 3,29 SEQTTL) by writing the previously allocated title of the test sequence on the screen at column 3, row 29. It then goes (GOSUB 60) to the subroutine which is identified by LABEL 60. This subroutine (TEST 21) causes test routine no. 21 (call placement from to mobile) to be performed. After this, program flow is returned to the main routine (WRITE 23,29,RESULT). The result is written on the screen at column 23, row 29. Finally, the program makes an unconditional jump (JUMP 61) to LABEL 61. This terminates the program.

Note

- (1) In the example, the screen row which was chosen is far enough down the screen not to intrude on the normal test display area.
- (2) In the example, the three program lines could have been run together but, due to the restriction of the 80 character buffer, it is better practice to use high priority delimiters between quite small sections of program.
- (3) In the example, the JUMP 61 was used in the program in order to jump around the subroutine to the END command.
- (4) It is recommended that, following an unattended initializing and self-testing, RD56 is sent to read any calibration error code and, after a disc operation, RD57 is sent to read any disc error code.

ERROR MESSAGES

The following messages are displayed when errors are found in user-defined test sequences:-

Error message	Meaning
ERROR: PARAMETERS FLAG	Illegal bit combination in parameter 1.
ERROR: xxxxxxxxx FILTER	Illegal filter bits in parameter 1.
ERROR: PARAMETERS UNITS	Invalid units for one or more parameters.
ERROR: PARAMETERS RANGE	Parameters outside permitted range.
ERROR: NOT IMPLEMENTED	Test routines no. 10 to no. 19 not yet in use.
ERROR: ZERO REFERENCE	For a reference and maximum error type result, the reference cannot be zero unless the maximum error is in the same units as the reference.
ERROR: NO DC POWER	Avoids wasting time re-testing if failed already.

If a parameter is too large or too small, an acceptable value is shown with a > sign or a < sign (e.g. >9.99 or <0.01). This can also show when the user has not understood the syntax of parameter since the display shows the interpretation of the parameters.

During the DC power test, the DC voltage and current are also shown. The parameters and DC readings are only shown when the display format is FULL. When the display format is SUMMARY, only the single line giving the test routine title, status and result is displayed.

When the type of test result in parameter 1 is the reference value and the maximum error (RME), the 2957D or 2960D checks that the maximum error is in units which are compatible with the reference units for purposes of calculation. Compatible units, together with whether the result is a ratio (R) or a difference (D), are as follows:-

Maximum error unit	Reference unit												
	None	V	Hz	A	W	s	dB	dBm	dBV	dBW	rad	ppm	%
None	D	-	-	-	-	-	-	-	-	-	-	-	-
V	-	D	-	-	-	-	-	-	-	-	-	-	-
Hz	-	-	D	-	-	-	-	-	-	-	-	-	-
A	-	-	-	D	-	-	-	-	-	-	-	-	-
W	-	-	-	-	D	-	-	-	-	-	-	-	-
s	-	-	-	-	-	D	-	-	-	-	-	-	-
dB	-	R	-	R	R	-	D	D	D	D	-	-	-
rad	-	-	-	-	-	-	-	-	-	-	D	-	-
ppm	R	R	R	R	R	R	-	-	-	-	R	D	-
%	R	R	R	R	R	R	-	-	-	-	R	-	D

Transmitter RF distortion and transmitter modulation limiting test routines attempt to set the transmitter carrier to a reference modulation level deviation by varying the AF generator output. NO MODULATION or READING UNSTABLE is shown when the 2957D or 2960D is unable to set the reference modulation level.

Chapter 4-3

COMMAND CODES

INTRODUCTION TO COMMAND CODES FOR THE IMMEDIATE MODE

A test sequence can be run by using the following:-

Command code	Function	Syntax form	Data format
LOAD	Load a file from disc	2	1 digit
RUn	Run test sequence	1	-
TSi	Select test sequence	2	1 digit

The details of a test sequence can be displayed or printed by using the following:-

Command code	Function	Syntax form	Data format
CSl	Enable/disable continuous summary lines	2	1 digit
DFi	Set display format	2	1 digit
PRInt	Print to current printer port	4	2 & 2 digits & text/code
PRO	Set criteria for printing result of test routine	2	1 digit
SEqttl	Set title of user-defined test sequence	6	Text
WRIte	Write to 2955 screen at x, y	4	2 & 2 digits & text/code

Communications parameters can be set by using the following:-

Command code	Function	Syntax form	Data format
BRi	Set baud rate for RS-232 port	2	1 digit
DSi	Set disc step rate	2	1 digit
EChe	Enable/disable RS-232 echo	2	1 digit
LPi	Set data length and parity of serial port	2	1 digit
PPi	Select printer port	2	1 digit
PTi	Select printer terminator	2	1 digit
PURge	Clear RS-232 or GPIB buffer	1	-
SBi	Set number of stop bits	2	1 digit
SRq	Enable/disable service request	2	1 digit

COMMAND CODES

The parameters can be reset by using the following:-

Command code	Function	Syntax form	Data format
SYStem	Reset parameters to default values	6	2 digits

Various test conditions can be set by using the following:-

Command code	Function	Syntax form	Data format
CCH	Set current control channel	2	4 digits
CCi	Set default control channel	2	4 digits
DEfault	Load default parameter data, execute any user-defined subroutine	1	-
Ftc/Fvc	Set first voice/traffic channel	2	4 digits
HInc	Set handoff increment	2	4 digits
LTc/LVc	Set last voice/traffic channel	2	4 digits
PMi	Set pause mode	2	1 digit
TCh/VCh	Set current voice/traffic channel	2	4 digits

Various settings can be made and the settings can be read by using the following:-

Command code	Function	Syntax form	Data format
BI	Read burst indicator field	2	1 digit
	Read burst indicator field	1	-
DCC	Set digital colour code	2	1 digit
	Read digital colour code	1	-
DSCC	Set DSAT colour code	2	1 digit
	Read DSAT colour code	1	-
DTmf	Enable/disable DTMF test	2	1 digit
	Read DTMF test setting	1	-
DVCC	Set digital verification colour code	2	3 digits
	Read digital verification colour code	1	-
HF	Enable/disable hook flash test	2	1 digit
	Read hook flash test setting	1	-
Min	Set mobile identity number	6	Number
	Read MIN	1	-
NFI	Set number format	2	1 digit
	Read number format setting	1	-
SCC	Set SAT colour code	2	1 digit
	Read SAT colour code	1	-
SIId	Set system identity number	6	5 digits
	Read system identity number	1	-
TDMA	Set TDMA channel to FACCH or SACCH	2	1 digit
	Read TDMA channel	1	-

Various readings can be made by using the following:-

Command code	Function	Syntax form	Data format
ESn	Read equipment serial number	1	-
RD	Request a reading	2	3 digits
SCM	Read station class mark	1	-
VDigital	Read version of digital software	1	-
VMother	Read version of mother software	1	-
VPers	Read version of personality software	1	-

Under the supervision of a Marconi Instruments representative, the I/O port and the memory can be read by using the following:-

Command code	Function	Syntax form	Data format
PEI	Peek I/O port	2	3 decimal or 2 hexadecimal digits
PEM	Peek memory	2	5 decimal or 4 hexadecimal digits
POI	Poke I/O port with data	5	3 decimal or 2 hexadecimal & 3 decimal or 2 hexadecimal digits
POM	Poke memory with data	5	5 decimal or 4 hexadecimal & 3 decimal or 2 hexadecimal digits

The mode can be changed by using the following:-

Command code	Function	Syntax form	Data format
CRTS	Change to CRTS mode	1	-
LEarn	Enter learn mode	1	-
LOCal	Go to local control mode from RS-232	1	-
NORmal	Go to normal 2955 mode	1	-
USer	Enter user mode	1	-

COMMAND CODES

Other operations can be carried out by using the following:-

Command code	Function	Syntax form	Data format
COMmand	Control 2955 directly in CRTS mode	7	-
CONTinue	Continue after pause	1	-
DATE	Set current date	6	dd/mm/yyyy
	Read current date	1	-
PAUse	Pause at end of current test routine	1	-
RECall	Recall settings	2	1 digit
SAVE	Save current user-program on disc	2	1 digit
STORe	Store setting	2	1 digit
STR\$	Enter command string for printer port	6	x digits
	Read current string for printer port	1	-
TIME	Set current time	6	hh:mm:ss
	Read current time	1	-
UPI	Read parallel control port user input lines	1	-
UPO	Set parallel control port user output lines	2	3 decimal or 2 hexadecimal digit

INTRODUCTION TO COMMAND CODES FOR THE LEARN MODE AND THE USER MODE

A test routine can be programmed by using the following:-

Command code	Function	Syntax form	Data format
TEst	Execute following test routine	2	2 digits

The details of a test routine can be displayed or printed by using the following:-

Command code	Function	Syntax form	Data format
DFi	Set display format	2	1 digit
PRInt	Print to current printer port	4	2 & 2 digits & text/code
PRO	Set criteria for printing result of test routine	2	1 digit
WRite	Write to 2955 screen at x, y	4	2 & 2 digits & text/code

Communications parameters can be set by using the following:-

Command code	Function	Syntax form	Data format
BRI	Set baud rate for RS-232 port	2	1 digit
PPi	Select printer port	2	1 digit
PTi	Select printer terminator	2	1 digit

To display or print the details of a test routine, PRINT or WRITE precedes the following:-

Command code	Function	Syntax form	Data format
ASC\$	Print contents of flag register	4	-
Buffer	Print printer array buffer	4	-
CHR	Print single character which has ACII code equal to first 8 bits in flag register	4	-
CLear	Clear printer array buffer	4	-
DATE	Print current date	4	-
DIisable	Disable printing	4	-
ENable	Enable printing	4	-
ESn	Print or write ESN	4	-
HEX\$	Print contents of flag register as 2-digit hexadecimal number	4	-
Indicator	Print or write test status indicator	4	-
LIine	Print first line of printer array buffer	4	-
Min	Print or write MIN	4	-
PAGE	Print 63 lines of printer array buffer	4	-
RESult	Print or write test routine result	4	-
SCM	Print or write station class mark	4	-
SEqttl	Print or write test sequence title	4	-
STatus	Print or write test routine status	4	-
STR\$	Print command string as entered in the PRINTER PORT COMMAND option	4	-
TIME	Print current time	4	-
SUmmary	Print or write test routine summary	4	-
TITle	Print or write current test routine title	4	-

Various test conditions can be set by using the following:-

Command code	Function	Syntax form	Data format
BI	Set burst indicator field	2	1 digit
CCH	Set current control channel	2	4 digits
CCi	Set default control channel	2	4 digits
DCC	Set digital colour code	2	1 digit
DSCc	Set DSAT colour code	2	1 digit
DTmf	Enable/disable DTMF test	2	1 digit
DVCC	Set digital verification colour code	2	3 digits
Ftc/Fvc	Set first voice/traffic channel	2	4 digits
HF	Enable/disable hook flash test	2	1 digit
HInc	Set handoff increment	2	4 digits
LTC/LVC	Set last voice/traffic channel	2	4 digits
NFI	Set number format	2	1 digit
PARAMeter	Set test routine parameters	3	2 & 1 digits & text
PMi	Set pause mode	2	1 digit
SCc	Set SAT colour code	2	1 digit
SIId	Set system identity number	6	5 digits
TDMA	Set TDMA channel to FACCH or SACCH	2	1 digit
TCh/VCh	Set current voice/traffic channel	2	4 digits

COMMAND CODES

In learn mode only, the loading of default parameter data and the executing of any user-defined subroutine can be invoked by using the following:-

Command code	Function	Syntax form	Data format
DEfault	Load default parameter data, execute any user-defined subroutine	1	-

Subroutines and alternative paths can be entered by using the following:-

Command code	Function	Syntax form	Data format
Gosub	Call subroutine at given label	2	3 digits
JBC	Jump to label if designated bit is clear	5	1 & 3 digits
JBS	Jump to label if designated bit is set	5	1 & 3 digits
JEq	Jump to label if value is equal to contents of flag register	5	3 & 3 digits
JGE	Jump to label if value is greater than or equal to contents of flag register	5	3 & 3 digits
JGT	Jump to label if value is greater than contents of flag register	5	3 & 3 digits
JLE	Jump to label if value is less than or equal to contents of flag register	5	3 & 3 digits
JLT	Jump to label if value is less than contents of flag register	5	3 & 3 digits
JNe	Jump to label if value is not equal contents of flag register	5	3 & 3 digits
JOA	Jump to label if channel is analog	2	3 digits
JOD	Jump to label if channel is digital	2	3 digits
JOE	Jump to label on test error	2	3 digits
JOF	Jump to label on test failure	2	3 digits
JON	Jump to label if channel is narrowband	2	3 digits
JOP	Jump to label on test pass	2	3 digits
JOW	Jump to label if channel is wideband	2	3 digits
JUmp	Jump to label unconditionally	2	3 digits
LLabel	Marker for position in program	2	-
RETurn	Return from subroutine	1	-

Repetitions and loops can be invoked by using the following:-

Command code	Function	Syntax form	Data format
NEXt	Next pass of repeat loop	1	-
NXtch	Next channel or next RPTCH loop	1	-
REPeat	Repeat a loop	2	3 digits
RPTch	Repeat loop with NXTCH	1	-
STPch	Initialization for sequence of NXTCH steps	1	-

Under the supervision of a Marconi Instruments representative, the I/O port and the memory can be peeked and poked by using the following:-

Command code	Function	Syntax form	Data format
PEI	Peek I/O port and place contents in flag register	2	3 decimal or 2 hexadecimal digits
PEM	Peek memory and place contents in flag register	2	5 decimal or 4 hexadecimal digits
POI	Poke I/O port with data	5	3 decimal or 2 hexadecimal & 3 decimal or 2 hexadecimal digits
POM	Poke memory with data	5	5 decimal or 4 hexadecimal & 3 decimal or 2 hexadecimal digits

The exit from the learn mode or from the user mode is made by using the following:-

Command code	Function	Syntax form	Data format
END	End of program or user-defined subroutine, return to immediate mode	1	-

Other operations can be carried out by using the following:-

Command code	Function	Syntax form	Data format
COMmand	Control 2955 directly in CRTS mode	7	Text
Key	Wait for keypress and store value in flag register	1	-
MC	Move constant into a register	5	2 & 5 digits
MV	Move variable from one register to another	5	2 & 2 digits
OC	Do arithmetic operation on constant and contents of flag register	5	1 & 5 digits
OV	Do arithmetic operation on contents of a register and contents of flag register	5	1 & 2 digits
VR	Read contents of a register	2	2 digits
VW	Write flag register to another register	2	2 digits
WAI	Wait for n milliseconds	2	5 digits

COMMAND CODES

DETAILS OF COMMAND CODES

Note

- (1) The appropriate command codes are detailed below and summarized in Table 4-3-2 (at the end of this Chap.). Information which is applicable to the learn mode is also applicable to the user mode except where otherwise stated.
- (2) For the format, the number of digits is the maximum.
- (3) In the examples, the information within parentheses is explanatory and should not be entered and does not appear on the screen.
- (4) With a 2957D or 2960D, it is not possible to use programs which have been saved on disc from a 2957.
- (5) A 2957D or 2960D can be configured to use the same RD numbers as for the 2957. See the SYSTEM CONFIGURATION option under the MISCELLANEOUS MENU in Chap. 3-1.

ASC\$ (AScii String)

Function: Argument for PRINT, print contents of flag register as 5-digit decimal number.

Token: EB.

Format: ASC\$, immediately preceded by PRINT.

Modes: Learn only.

BI (Burst Indicator)

Function: Set shortened burst indicator field (SBI) in the signalling and expected responses accordingly. (See IS-54(B) sec. 2.1.3.3.5.2.)

Token: D6.

Format: BI, followed by a 1-digit number:
0 = Full 0, 1 = Full 1, 2 = Shortened.

Example: BI 0 (Set the burst indicator field to 'full 0').

Modes: Immediate and learn.

Function: Read shortened burst indicator code.

Format: BI alone.

Use: To pass the shortend burst indicator to other equipment.

Modes: Immediate only.

BRi (Baud Rate Is)

Function: Set baud rate for RS-232 port. The default number is 4.

Token: 96.

Format: BRI or BR, followed by a 1-digit number:
0 = 75, 1 = 150, 2 = 300, 3 = 600, 4 = 1200, 5 = 2400, 6 = 4800,
7 = 9600.

Example: BR 6 (Set the baud rate to 4800).

Modes: Immediate and learn.

Errors: Syntax (Out of range, baud rate number is not 0 to 7).

BUffer

Function: Argument for PRINT, print first ten lines of printer array buffer.

Token: E3.

Format: BUFFER or BU, immediately preceded by PRINT.

Modes: Learn only.

CCH (Control CHannel)

Function: Set current control channel.
 Token: 8F.
 Format: CCH followed by a 4-digit number.
 Example: CCH 43 (Set the current control channel to 43).
 Modes: Immediate and learn.
 Errors: Syntax (Out of range, control channel number is not within minimum and maximum).

CCi (Control Channel Is)

Function: Set default control channel. The default number is 334. This only affects the data in the menus and not the current control channel. See CCH.
 Token: 8E.
 Format: CCI or CC, followed by a 4-digit number.
 Example: CC 140 (Set the default control channel to 140).
 Modes: Immediate and learn.
 Errors: Syntax (Out of range, control channel number is not within minimum and maximum).

CHR (CHaRacter)

Function: Argument for PRINT, print single character which has ASCII code equal to first 8 bits in flag register.
 Token: E6.
 Format: CHR, immediately preceded by PRINT.
 Modes: Learn only.

CLear

Function: Argument for PRINT, clear printer array/buffer.
 Token: E2.
 Format: CLEAR or CL, immediately preceded by PRINT.
 Use: Fills the printer array/buffer with all spaces.
 Modes: Learn only.

COMmand

Function: Control 2955 directly in CRTS modes.
 Token: 9B.
 Format: COMMAND or COM, followed by string of up to 40 characters terminated with <LF>.
 Use: Passes a command code string, without checking, directly to the 2955.
 Example: COM RX,RG,FR123.5MZ<LF> (Set the 2955 to the RECEIVER TEST mode with an RF generator frequency of 123.5 MHz).
 Modes: Immediate and learn.

CONTinue

Function: Continue after pause.
 Format: CONTINUE or CON, alone.
 Use: Continues a test sequence following a PAUSE command.
 Modes: Immediate only.

COMMAND CODES

CRTS

Function: Change to CRTS modes from pass-through mode.
Format: CRTS alone.
Use: Transfers operation from 2955 to CRTS.
Modes: Immediate only.

CSL (Continuous Summary Lines enable/disable)

Function: Enable/disable output of summary line after a test routine. The default number is 0. (This is always set at power on)
Format: CSL or CS, followed by a 1-digit number: 0 = disable, 1 = enable.
Use: Passes the last summary line to the GPIB port or the RS-232 port.
Example: CS 1 (Enable output of summary lines).
Modes: Immediate only.

DATE

Function: Argument for PRINT, print current date.
Token: FE.
Format: DATE or DAT, immediately preceded by PRINT.
Modes: Learn only.

Function: Set current date.
Format: DATE or DAT, immediately followed by "dd/mm/yyyy" where dd is day, mm is month and yyyy is year.
Example: DAT "15/10/1993"
Modes: Immediate only.

Function: Read current date code.
Format: DATE or DAT, alone.
Use: To pass the current date to other equipment.
Modes: Immediate only.

DCC (Digital Colour Code)

Function: Set digital colour code. The default number is 0.
Token: DD.
Format: DCC or DC, followed by a 1-digit number in the range 0 to 3.
Example: DC 2 (Set the digital colour code to 2).
Modes: Immediate and learn.
Errors: Syntax (Out of range, digital colour code number is not 0 to 3).

Function: Read digital colour code.
Format: DCC or DC, alone.
Use: To pass the digital colour code to other equipment.
Modes: Immediate only.

DEfault

Function: Load default data for following test routines. Also, the 2957D or 2960D executes any user-defined test subroutine which has been entered under USER.
Token: 82.
Format: DEFAULT or DE, alone.
Modes: Immediate and learn.
Errors: Syntax.

DFi (Display Format Is)

Function: Set display format. The default number is 1. The display format cannot be changed during a test sequence.

Token: 94.

Format: DFI or DF, followed by a 1-digit number: 0 = summary, 1 = full.

Use: Sets the display format for FULL AUTO TEST mode. In the GO/NO-GO TEST mode, the display format is always summary.

Example: DF 0 (Set the default display format to summary).

Modes: Immediate and learn.

Errors: Syntax (Out of range, display format number is not 0 or 1).

DIisable

Function: Argument for PRINT, disable printing.

Token: E0.

Format: DISABLE or DI, immediately preceded by PRINT.

Use: Causes all printing to be disabled. Followed by PRINT ENABLE to re-enable printing.

Modes: Learn only.

DSCc (Digital SAT Colour code)

Function: Set DSAT colour code. The default number is 0.

Token: D5.

Format: DSCC or DSC, followed by a 1-digit number in the range 0 to 6.

Example: DSC 2 (Set the DSAT colour code to 2).

Modes: Immediate and learn.

Errors: Syntax (Out of range, DSAT colour code number is not 0 to 6).

Function: Read DSAT colour code.

Format: DSCC or DSC, alone.

Use: To pass the DSAT colour code to other equipment.

Modes: Immediate only.

DSi (Disc Step rate Is)

Function: Set disc step rate. The default number is 0.

Format: DSI or DS, followed by a 1-digit number: 0 = 6 ms, 1 = 12 ms.

Use: Selects for different types of disc drive.

Example: DS 1 (Select 12 ms step rate).

Modes: Immediate only.

COMMAND CODES

DTmf (DTMF enable/disable)

Function: Enable/disable DTMF tones test routine. The default number is 0.
Token: DB.
Format: DTMF or DT, followed by a 1-digit number: 0 = disable, 1 = enable.
Example: DT 1 (Enable the DTMF tones test).
Modes: Immediate and learn.
Errors: Syntax (Out of range, DTMF number is not 0 or 1).

Function: Read DTMF tones test setting.
Format: DTMF or DT, alone.
Use: To pass the DTMF tones test setting to other equipment.
Modes: Immediate only.

DVCC (Digital Verification Colour Code)

Function: Set DVCC.
Token: D5.
Format: DVCC, followed by a 3-digit number in the range 1 to 255 (not 0).
Example: DVCC 15 (Set the DVCC to 15).
Modes: Immediate and learn.
Errors: Syntax (Out of range, DVCC number is not 1 to 255).

Function: Read DVCC.
Format: DVCC, alone.
Use: To pass the DVCC to other equipment.
Modes: Immediate only.

ECho (ECHO enable/disable)

Function: Enable/disable RS-232 echo. The default number is 0.
Format: ECHO or EC, followed by a 1-digit number: 0 = off, 1 = on.
Example: EC 1 (Enable the RS-232 echo).
Modes: Immediate only.

ENable

Function: Argument for PRINT, enable printing.
Token: E1.
Format: ENABLE or ENA, immediately preceded by PRINT.
Use: Re-enables printing which has been halted by PRINT DISABLE.
Modes: Learn only.

END

Function: End of program or user-defined subroutine. The 2957D or 2960D then returns to the immediate mode.
Token: FF.
Format: END alone.
Use: Used at the end of a program to enable exit from learn mode.
Modes: Learn only.

ESn (Equipment Serial Number)

Function: Read equipment serial number. The default entry consists of fifteen full stops.
 Format: ESN or ES, alone.
 Use: To pass the number of the unit under test to other equipment.
 Example: ES (Send the equipment's serial number from the GPIB port or the RS-232 port).
 Modes: Immediate only.

Function: Argument for PRINT or WRITE, print or write equipment serial number.
 Token: F1.
 Format: ESN or ES, preceded by either PRINT or WRITE.
 Use: When preceded by PRINT, the ESN is sent to the printer port; when preceded by WRITE, the ESN is written on the screen.
 Example: WR 3,9,ES (Write the mobile's equipment serial number on the screen at column 3, row 9).
 Modes: Learn only.

Ftc (First Traffic Channel) or Fvc (First Voice Channel)

Function: Set first voice/traffic channel. The default number is 1.
 Token: 91.
 Format: FVC or F, followed by a 4-digit number.
 Example: F 50 (Set the default first voice/traffic channel to 50).
 Modes: Immediate and learn.
 Errors: Syntax (Out of range, voice/traffic channel number is not within minimum and maximum).

Gosub

Function: Call subroutine at given label.
 Token: 89.
 Format: GOSUB or G, followed by a 3-digit label number in the range 0 to 255.
 Use: Temporarily transfers the program flow to the named destination. Subroutines can be nested to a depth of six. Followed by a RETURN command to resume the main program.
 Example: G 30 (Transfer the program flow temporarily to LABEL 30).
 Modes: Learn only.
 Errors: Syntax (Fatal, label not found).

HEX\$ (HEXadecimal String)

Function: Argument for PRINT, print contents of flag register as 2-digit hexadecimal number.
 Token: EC.
 Format: HEX\$, immediately preceded by PRINT.
 Modes: Learn only.

COMMAND CODES

HF (Hook Flash enable/disable)

Function: Enable/disable hook flash test routine. The default number is 0.
Token: DA.
Format: HF followed by a 1-digit number: 0 = disable, 1 = enable.
Example: HF 1 (Enable the hook flash test routine).
Modes: Immediate and learn.
Errors: Syntax (Out of range, hook flash number is not 0 or 1).

Function: Read hook flash test setting.
Format: HF alone.
Use: To pass the hook flash test setting to other equipment.
Modes: Immediate only.

HInc (Handoff INCRement)

Function: Set default handoff increment. The default number is 333.
Token: 93.
Format: HINC or HI, followed by a 3-digit handoff increment in the range 1 to 180.
Example: HI 33 (Set the handoff increment to 33).
Modes: Immediate and learn.
Errors: Syntax (Out of range, maximum increment number is exceeded).

Indicator

Function: Argument for PRINT or WRITE, print or write test status indicator.
Token: EE.
Format: INDICATOR or I, preceded by either PRINT or WRITE.
Use: When preceded by PRINT, the status indicator (-, F or E) is sent to the printer port; when preceded by WRITE, it is written on the screen.
Example: WR 3,9,I (Write the status indicator for the last test routine on the screen at column 3, row 9.)
Modes: Learn only.

JBC (Jump if Bit Clear)

Function: Jump to label if designated bit in the flag register is clear.
Token: A4.
Format: JBC followed by a flag register bit number and a label number.
Use: If the numbered bit is logical 0, the program continues from the numbered label. The 8-bit flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JBC 2,30 (If bit 2 is clear, jump to LABEL 30).
Modes: Learn only.
Errors: Syntax (Fatal, label not found).

JBS (Jump if Bit Set)

Function: Jump to label if designated bit in the flag register is set.
Token: A5.
Format: JBS followed by a flag register bit number and a label number.
Use: If the numbered bit is logical 1, the program continues from the numbered label. The 8-bit flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JBS 2,30 (If bit 2 is set, jump to LABEL 30).
Modes: Learn only.
Errors: Syntax (Fatal, label not found).

JEq (Jump if Equal)

Function: Jump to label if given value is equal to contents of flag register.
Token: A6.
Format: JEq or JE, followed by a 3-digit decimal number and a label number.
Use: If the contents of the flag register is equal to the decimal value given, the program continues from the numbered label. The 8-bit flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JE 255,30 (If the contents of the flag register equal 255, jump to LABEL 30).
Modes: Learn only.

JGE (Jump if Greater or Equal)

Function: Jump to label if given value is greater than or equal to contents of flag register.
Token: AB.
Format: JGE, followed by a 3-digit decimal number and a label number.
Use: If the contents of the flag register is greater than or equal to the decimal value given, the program continues from the numbered label. The flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JGE 128,30 (If the contents of the flag register is greater than or equal to 128, jump to LABEL 30).
Modes: Learn only.

JGT (Jump if Greater Than)

Function: Jump to label if given value is greater than contents of flag register.
Token: AC.
Format: JGT, followed by a 3-digit decimal number and a label number.
Use: If the contents of the flag register is greater than the decimal value given, the program continues from the numbered label. The flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JGT 128,30 (If the contents of the flag register is greater than 128, jump to LABEL 30).
Modes: Learn only.

JLE (Jump if Less or Equal)

Function: Jump to label if given value is less than or equal to contents of flag register.
Token: AD.
Format: JLE, followed by a 3-digit decimal number and a label number.
Use: If the contents of the flag register is less than or equal to the decimal value given, the program continues from the numbered label. The flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JLE 128,30 (If the contents of the flag register is less than or equal to 128, jump to LABEL 30).
Modes: Learn only.

COMMAND CODES

JLT (Jump if Less Than)

Function: Jump to label if given value is less than contents of flag register.
Token: AE.
Format: JLT, followed by a 3-digit decimal number and a label number.
Use: If the contents of the flag register is less than the decimal value given, the program continues from the numbered label. The flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JLT 128,30 (If the contents of the flag register is less than 128, jump to LABEL 30).
Modes: Learn only.

JNe (Jump if Not Equal)

Function: Jump to label if given value is not equal to contents of flag register.
Token: A7.
Format: JNE or JN, followed by a 3-digit decimal number and a label number.
Use: If the contents of the flag register is not equal to the decimal value given, the program continues from the numbered label. The 8-bit flag register can contain the value for a key, the contents of a memory location or I/O port data.
Example: JN 255,30 (If the contents of the flag register are not equal to 255, jump to LABEL 30).
Modes: Learn only.
Errors: Syntax (Fatal, label not found).

JOA (Jump On Analog)

Function: Jump to label when channel is analog.
Token: A8.
Format: JOA followed by a label number.
Use: If the current voice/traffic channel is analog, the program continues from the numbered label.
Example: JOA 36 (If the channel is analog, jump to LABEL 36).
Modes: Learn only.
Errors: Syntax (Fatal, label not found).

JOD (Jump On Digital)

Function: Jump to label when channel is digital.
Token: A9.
Format: JOD followed by a label number.
Use: If the current voice/traffic channel is digital, the program continues from the numbered label.
Example: JOD 34 (If the channel is analog, jump to LABEL 34).
Modes: Learn only.
Errors: Syntax (Fatal, label not found).

JOE (Jump On Error)

Function: Jump to label on test routine error.
Token: A2.
Format: JOE followed by a label number.
Use: If an error occurs during the preceding test routine, the program continues from the numbered label.
Example: JOE 90 (If there is an error during the preceding test routine, jump to LABEL 90).
Modes: Learn only.
Errors: Syntax (Fatal, label not found).

JOF (Jump On Failure)

Function: Jump to label on test routine failure.
 Token: A3.
 Format: JOF followed by a label number.
 Use: If there is a failure in the preceding test routine, the program continues from the numbered label.
 Example: JOF 99 (If the preceding test routine fails, jump to LABEL 99).
 Modes: Learn only.
 Errors: Syntax (Fatal, label not found).

JON (Jump On Narrowband)

Function: Jump to label when channel is narrowband.
 Token: AA.
 Format: JON followed by a label number.
 Use: If the current voice/traffic channel is narrowband, the program continues from the numbered label.
 Example: JON 36 (If the channel is narrowband, jump to LABEL 36).
 Modes: Learn only.
 Errors: Syntax (Fatal, label not found).

JOP (Jump On Pass)

Function: Jump to label on test routine pass.
 Token: A1.
 Format: JOP followed by a label number.
 Use: If there is a pass in the preceding test routine, the program continues from the numbered label.
 Example: JOP 99 (If the preceding test routine passes, jump to LABEL 99).
 Modes: Learn only.
 Errors: Syntax (Fatal, label not found).

JOW (Jump On Wideband)

Function: Jump to label when channel is wideband.
 Token: A8.
 Format: JOW followed by a label number.
 Use: If the current voice/traffic channel is wideband, the program continues from the numbered label.
 Example: JOW 39 (If the channel is wideband, jump to LABEL 39).
 Modes: Learn only.
 Errors: Syntax (Fatal, label not found).

JUmp

Function: Jump to label unconditionally.
 Token: 86.
 Format: JUMP or JU, followed by a label number.
 Use: The program continues from the numbered label.
 Example: JU 21 (Continue program execution from LABEL 21).
 Modes: Learn only.
 Errors: Syntax (Fatal, label not found).

COMMAND CODES

Key

Function: Wait for keypress and store value in flag register.
Token: 9A.
Format: KEY or K, alone.
Use: Causes the program to wait until a key is pressed. The key code is then stored in the flag register for later testing. The values stored are as follows:-
0 = 2955, 1 = CRTS, 2 = DISC, 3 = PSOPH,
4 = TX, 5 = RX, 6 = DUPLEX, 7 = TONES,
8 = BAR CHART, blank or TX MON ON-OFF,
9 = SCOPE or SCOPE/BAR, 10 = HOLD DISPLAY, 11 = HELP.
Modes: Learn only.

LAbel

Function: Marker for position in program.
Token: 85.
Format: LABEL or LA, followed by a 3-digit number in the range 1 to 255.
Use: Provides a destination address for a GOSUB or JUMP.
Example: LA 30 (Identity of the following program subroutine).
Modes: Learn only.
Errors: Syntax.

LEarn

Function: Enter learn mode for a user-defined test sequence. The 2957D or 2960D cannot then respond to immediate mode commands until END is received. For a user-defined subroutine, see USER. Either a test sequence or a subroutine can be defined, not both in memory together.
Format: LEARN or LE, alone.
Use: Precedes the first command in a user-defined program in order to enter the learn mode.
Modes: Immediate only.

LIne

Function: Argument for PRINT, print first line of printer array buffer.
Token: E4.
Format: LINE or LI, immediately preceded by PRINT.
Modes: Learn only.

LOAd

Function: Load a file from disc. See Note (4) on page 4-3-7.
Format: LOAD or LOA, followed by a 1-digit file number.
Use: Loads a file from disc into the user-defined program area. File number range is 0 to 9.
Modes: Immediate only.

LOCal

Function: Go to local CRTS mode from RS-232.
Format: LOCAL or LOC, alone.
Use: Returns from RS-232 control to local control. For the GPIB, GTL or REN is used instead.
Modes: Immediate only.

LPI (Length and Parity Is)

Function: Set data length and parity of serial port. The default number is 5.

Format: LPI or LP, followed by 1-digit number: 0 = 7 even, 1 = 7 odd, 2 = 7 none, 3 = 8 even, 4 = 8 odd, 5 = 8 none.

Example: LP 5 (8 bits of data, no parity for serial port).

Modes: Immediate only.

LTC (Last Traffic Channel) or LVC (Last Voice Channel)

Function: Set last voice/traffic channel. The default number is 666.

Token: 92.

Format: LVC or LV, followed by a 4-digit number.

Example: LV 180 (Set the default last voice/traffic channel to 180).

Modes: Immediate and learn.

Errors: Syntax (Out of range, voice/traffic channel number is not within minimum and maximum).

MC (Move Constant)

Function: Move constant into a register.

Token: B1.

Format: MC, followed by the destination register number and then the constant. The destination register numbers are as follows:-
0 to 15 for sixteen 8-bit registers or
16 to 23 for eight 16-bit registers
(128 bits in total for 0 to 23),
24 for the 16-bit flag register,
25 for the 16-bit failure counter,
26 for the 16-bit system configuration word register.

Use: To enter the given value into the specified register for an arithmetic operation.

Example: MC 20, 25 (Enter 25 into register 20).

Modes: Immediate and learn.

Min (Mobile Identity Number)

Function: Set mobile identity number. The default number is 000-000-0000.

Format: MIN or M, followed by, within quotation marks, the mobile's telephone number in the form xxx-xxx-xxxx.

Example: M "123-456-7890" (My identity number is 123-456-7890).

Modes: Immediate only.

Function: Read mobile identity number.

Format: MIN or M, alone.

Use: To pass the MIN to other equipment.

Example: MIN (Send the mobile's identity number from the GPIB port or the RS-232 port).

Modes: Immediate only.

Function: Argument for PRINT or WRITE, print or write mobile identity number.

Token: F0.

Format: MIN or M, preceded by either PRINT or WRITE.

Use: When preceded by PRINT, the MIN is sent to the printer port; when preceded by WRITE, the MIN is written on the screen.

Example: WR 3,9,M (Write the mobile's identity number on the screen at column 3, row 9).

Modes: Learn only.

COMMAND CODES

MV (Move Variable)

Function: Move variable from one register to another.
Token: B2.
Format: MV, followed by the destination register number and then the source register number.
The register numbers are as follows:-
0 to 15 for sixteen 8-bit registers or
16 to 23 for eight 16-bit registers
(128 bits in total for 0 to 23),
24 for the 16-bit flag register,
25 for the 16-bit failure counter,
26 for the 16-bit system configuration word register.
Use: To copy the contents of the second specified register into the first specified register for an arithmetic operation.
Example: MV 20, 25 (Move the contents of register 25 to register 20).
Modes: Immediate and learn.

NEXt

Function: Next pass of repeat loop.
Token: 88.
Format: NEXT or NE, alone.
Use: NEXT follows REPEAT to initiate another loop.
Example: REPEAT 2
TEST 21
NEXT (Make 2 attempts at placing call to mobile).
Modes: Learn only.
Errors: Syntax.

NFI (Number Format Is)

Function: Set number format. The default number is 3.
Token: D9.
Format: NFI followed by 1-digit number:
0 = decimal, 1 = hexadecimal, 2 = octal, 3 = standard. 1,
4 = standard 2
Use: Selects the number format for printing or screen display.
Example: NFI 1 (Format the numbers in hexadecimal).
Modes: Immediate and learn.
Errors: Syntax (Out of range, format number is not 0 to 4).

Function: Read number format setting.
Format: NFI alone.
Use: To pass the number format setting to other equipment.
Modes: Immediate only.

NORmal

Function: Go to normal 2955 mode.
Format: NORMAL or NO, alone.
Use: Returns from remote CRTS mode to remote pass-through mode. To return to remote CRTS mode, use CRTS.
Modes: Immediate only.

NXtch (NeXT CHannel)

Function: Next voice/traffic channel or next RPTCH loop.
 Token: 8D.
 Format: NXTCH or NX, alone.
 Use: NXTCH following RPTCH increments the voice/traffic channel by HINC and initiates another loop. NXTCH following STPCH increments the voice/traffic channel by HINC only.
 Example: RPTCH
 TEST 23
 TEST 6
 NXTCH (Measure receiver distortion in the first to the last voice/traffic channels).
 Modes: Learn only.

OC (Operator constant)

Function: Do arithmetic operation on constant and contents of flag register.
 Token: B3.
 Format: OC, followed by an operator code and then the constant value.
 The operator codes are as follows:-
 0 = + (Plus), 1 = - (Minus), 2 = * (Multiply), 3 = ÷ (Divide),
 4 = MOD, 5 = AND, 6 = OR, 7 = XOR.
 Use: Using the given value and the contents of the flag register, do the specified arithmetic operation and replace the contents of the flag register by the result.
 Example: OC 2, 3 (Multiply the contents of the flag register by 3 and return the result to the flag register).
 Modes: Immediate and learn.

OV (Operator Variable)

Function: Do arithmetic operation on contents of a register and contents of flag register.
 Token: B4.
 Format: OV, followed by an operator code and then the source register number.
 The operator codes are as follows:-
 0 = + (Plus), 1 = - (Minus), 2 = * (Multiply), 3 = ÷ (Divide),
 4 = MOD, 5 = AND, 6 = OR, 7 = XOR.
 The source register numbers are as follows:-
 0 to 15 for sixteen 8-bit registers or
 16 to 23 for eight 16-bit registers
 (128 bits in total for 0 to 23),
 24 for the 16-bit flag register,
 25 for the 16-bit failure counter,
 26 for the 16-bit system configuration word register.
 Use: Using the contents of the given register and the contents of the flag register, do the specified arithmetic operation and replace the contents of the flag register by the result.
 Example: OV 2, 20 (Multiply the contents of register 20 by the contents of the flag register and return the result to the flag register).
 Modes: Immediate and learn.

COMMAND CODES

PAGe

Function: Argument for PRINT, print 63 lines of printer array buffer.
Token: E5.
Format: PAGE or PAG, immediately preceded by PRINT.
Modes: Learn only.

PARAmeter

Function: Set test routine parameters.
Token: 81.
Format: PARAMETER or PAR, followed by a 2-digit test routine number in the range 1 to 9, 20 to 25 or 27 to 34, then a 1-digit parameter number in the range 1 to 6 and then data.
Example: PAR 6,1,28,26dB,-80dBm,2kHz (Set parameters for test routine no. 6 SINAD measurement, using a psophometric filter, with lower limit 26 dB, RF generator level -80 dBm and reference modulation level 2 kHz).
Modes: Learn only.
Errors: Syntax (Less than 3 fields found or fields contain non-ASCII codes).

PAUse

Function: Pause at end of current test routine.
Format: PAUSE or PAU, alone.
Modes: Immediate only.

PEI (PEek I/O port)

This should not be used except under the supervision of a Marconi Instruments representative.

Function: Peek I/O port and place contents in flag register.
Token: 9D.
Format: PEI followed by a 3-digit decimal address (range 0 to 255) or by #H and a 2-digit hexadecimal address (range 0 to FF).
Use: Reads the contents of the designated I/O port address and places the value in the 8-bit flag register for later testing.
Example: PEI 96 or PEI #H60 (Peek I/O port decimal address 96 and place the contents in the flag register.)
Modes: Learn only.
Errors: Syntax.

Function: Peek I/O port.
Format: PEI followed by a 3-digit decimal address (range 0 to 255) or by #H and a 2-digit hexadecimal address (range 0 to FF).
Use: Reads the contents of the designated I/O port address. The result is decimal or hexadecimal according to which was used for the address.
Modes: Immediate only.

PEM (PEek Memory)

This should not be used except under the supervision of a Marconi Instruments representative.

Function: Peek memory and place contents in flag register.
 Token: 9E.
 Format: PEM followed by a 5-digit decimal address (range 0 to 65535) or by #H and a 4-digit hexadecimal address (range 0 to FFFF).
 Use: Reads the contents of the designated memory address and places the value in the 8-bit flag register for later testing.
 Example: PEM 55296 or PEM #HD800 (Peek memory decimal address 55296 and place the contents in the flag register).
 Modes: Learn only.
 Errors: Syntax.

Function: Peek memory.
 Format: PEM followed by a 5-digit decimal address (range 0 to 65535) or by #H and a 4-digit hexadecimal address (range 0 to FFFF).
 Use: Reads the contents of the designated memory address. The result is decimal or hexadecimal according to which was used for the address.
 Modes: Immediate only.

PMi (Pause Mode Is)

Function: Set pause option. This cannot be changed during a test sequence.
 Token: 95.
 Format: PMI or PM, followed by a number: 0 = manual only, 1 = on failure, 2 = always.
 Use: Selects the method of pausing after a test routine when in FULL AUTO TEST mode. In GO/NO-GO TEST mode, the pause is always manual only.
 Example: PM 0 (Set the pause to manual only).
 Modes: Immediate and learn.
 Errors: Syntax (Out of range, pause mode number is not 0 to 2).

POI (POke I/O port)

This should not be used except under the supervision of a Marconi Instruments representative.

Function: Poke I/O port with data.
 Token: 9F.
 Format: POI followed by a 3-digit decimal address (range 0 to 255) or by #H and a 2-digit hexadecimal address (range 0 to 255), a comma and then a 3-digit decimal number (range 0 to 255) or #H and a 2-digit hexadecimal number (range 0 to FF).
 Example: POI 96,255 or POI #H60,#HFF or POI 96,#HFF or POI #H60,255 (Poke I/O port decimal address 96 with 255).
 Modes: Immediate and learn.
 Errors: Syntax.

COMMAND CODES

POM (POke Memory)

This should not be used except under the supervision of a Marconi Instruments representative.

Function: Poke memory with data.
Token: A0.
Format: PEM followed by a 5-digit decimal address (range 0 to 65535) or by #H and a 4-digit hexadecimal address (range 0 to FFFF), a comma and a 3-digit decimal number (range 0 to 255) or #H and a 2-digit hexadecimal number (range 0 to FF).
Example: POM 55296,255 or POM #HD800,#HFF or POM 55296,#HFF or POM #HD800,255. (Poke memory decimal address 55296 with 255).
Modes: Immediate and learn.
Errors: Syntax.

PPi (Printer Port Is)

Function: Select printer port. The default number is 0.
Token: 97.
Format: PPI or PP, followed by a 1-digit number:
0 = unassigned, 1 = GPIB talk only, 2 = serial, 3 = parallel.
Example: PP 3 (Select the parallel printer port).
Modes: Immediate and learn.
Errors: Syntax (Out of range, printer port number is not 0 to 3).

PRInt

Function: Print to current printer port.
Token: 83.
Formats: PRINT followed by a message within quotation marks.
PRINT followed by a command code.
PRINT followed by 2-digit x and y co-ordinates and then a message within quotation marks.
PRINT followed by 2-digit x and y co-ordinates and then a command code.
Uses: Prints either directly to the printer port or inserted into a 10-row (0 to 9) by 80-column (0 to 79) array at the specified co-ordinates. The top left of the screen is 0,0.
Examples
1: PRI "WARNING" (Print WARNING on printer).
2: PRI 3,9,RESULT (Print the measurement result on the printer at column 3, row 9).
Modes: Immediate and learn (when quotation marks are used) or learn only (when a command code is used).
Errors: Syntax.

PRO (Print On)

Function: Set criterion for printing result of test routine. The default number is 0.
Token: 99.
Format: PRO followed by a 1-digit number:
0 = off, 1 = all, 2 = fail, 3 = pass.
Example: PRO 3 (Print if the test routine is passed).
Modes: Immediate and learn.
Errors: Syntax (Out of range, print on mode number is not 0 to 3).

PTi (Printer Terminator Is)

Function: Select printer terminator. The default number is 0.
 Token: 98.
 Format: PTI or PT, followed by a 1-digit number:
 0 = <CR> and <LF>, 1 = <LF> only, 2 = <CR> only, 3 = none.
 Example: PT 0 (Printer terminator to be used is <CR> and <LF>).
 Modes: Immediate and learn.
 Errors: Syntax (Out of range, printer terminator number is not 0 to 2).

PURge

Function: Clear the RS-232 or GPIB buffer.
 Format: PURGE or PU, alone.
 Modes: Immediate only.

RD (ReaD)

Function: Request a reading. See Note (5) on page 4-3-7.
 Format: RD followed by a 3-digit number as listed in Table 4-3-1.
 Modes: Immediate only.

RECall

Function: Recall one of stored 2957D or 2960D settings. See also under STORE.
 Format: RECALL or REC, followed by a 1-digit number in the range 0 to 6.
 Use: Replaces current settings by previously stored settings.
 Example: REC 6 (Recall the settings in store no. 6).
 Modes: Immediate only.

REPeat

Function: Repeat a loop.
 Token: 87.
 Format: REPEAT or REP, followed by a 3-digit number of loops in the range 0 to 255.
 Use: Repeats a loop n times, each loop being terminated by NEXT.
 Example: REP 2
 TEST 21
 NEXT (Attempt placing call to mobile twice).
 Modes: Learn only.
 Errors: Syntax.

RESult

Function: Argument for PRINT or WRITE, print or write result of test routine.
 Token: FC.
 Format: RESULT or RES, preceded by either PRINT or WRITE.
 Use: PRINT sends the result to the printer port; WRITE sends the result to the screen.
 Example: WR 3,9,RES (Write the result of the last test routine on the screen at column 3, row 9).
 Modes: Learn only.

TABLE 4-3-1 READ NUMBERS

RD number	Reading
0	Out of range.
1 to 38	2955 readings. See the 2955 Operating Manual, 2955A or 2955R Programming Manual or 2955B Operating Manual.
39	Out of range.
40 to 49	Last 1 to 10 summary lines (40 for line 1 to 49 for line 10).
50	For 2957 compatible operation only, mobile identity number.
51	For 2957 compatible operation only, equipment serial number.
50	Mobile identity number.
51	Equipment serial number.
52	Result field.
53	Test routine title field.
54	Test routine passed/failed field.
55	Serial poll byte as follows:- 0 = Not applicable, 1 = Not applicable, 2 = System at start of a test sequence, 3 = System paused, waiting for run/continue, 4 = Busy, system is working, 5 = System error, 6 = SRQ - Service request, 7 = RDY - Data ready, asserted with SRQ.
56	Calibration error byte as follows:- 0 = Peak error, 1 = SAT error, 2 = ST error, 3 = LF error, 4 = DTMF error, 5 = Data error, 6 = Not applicable to AMPS, 7 = Modem error.
57	Disc error byte as follows:- 0 = Successful completion, 1 = No disc inserted, 2 = Drive not ready, 3 = File locked, 4 = File deleted, 5 = Disc write protected, 6 = Disc fault, 7 = File number out of range, 8 = Disc fault default data (partial load data corrupted), 9 = Warning checksum failure, 10 = Warning different system, 11 = Read access only, 12 = Warning software issue.
58	For normal 2957D or 2960D operation, GPIB error byte as follows:- 0 = No errors, 1 = Invalid command, 2 = Syntax error, 3 = Out of range.
59	For 2957 compatible operation, enable output of summary lines. For normal 2957D or 2960D operation, I2C bus check as follows:- 0 = Satisfactory, >0 = Faulty. For 2957 compatible operation, disable output of summary lines.
60 to 99	Out of range.
100 to 109	2955 readings.
>109	Out of range

RETurn

Function: Return from subroutine.
 Token: 8A.
 Format: RETURN or RET, alone.
 Use: RETURN follows GOSUB to resume the main program sequence.
 Modes: Learn only.

RPTch (RePeaT CHannel)

Function: Repeat loop with NXTCH.
 Token: 8C.
 Format: RPTCH or RP, alone.
 Use: Sets up a loop between itself and the following NXTCH. Each pass of the loop causes the current voice/traffic channel number to be incremented by HINC. The process starts on the first voice/traffic channel and ends when the last voice/traffic channel has been reached.
 Example: RPTCH
 TEST 23
 TEST 6
 NXTCH (Measure receiver distortion in the first to the last voice/traffic channels).
 Modes: Learn only.

RUn

Function: Run the test sequence. See Note (4) on page 4-3-7.
 Format: RUN or RU, alone.
 Modes: Immediate only.

SAve

Function: Save the current user-defined program on disc. See Note (4) on page 4-3-7.
 Format: SAVE or SA, followed by a 1-digit file number.
 Modes: Immediate only.

SBi (number of Stop Bits Is)

Function: Set number of stop bits. The default number is 0.
 Format: SBI or SB, followed by a 1-digit number: 0 = 1, 1 = 2.
 Uses: Sets the RS-232 port.
 Example: SB 1 (Set the RS-232 port for 2 stop bits).
 Modes: Immediate only.

SCc (SAT Colour Code)

Function: Set SAT colour code. The default number is 0.
 Token: DE.
 Format: SCC or SC, followed by a 1-digit number:
 0 = 5.97 kHz, 1 = 6.00 kHz, 2 = 6.03 kHz.
 Example: SC 2 (Set the SAT to 6.03 kHz).
 Modes: Immediate and learn.
 Errors: Syntax (Out of range, SAT number is not 0 to 2).

Function: Read SAT colour code.
 Format: SCC or SC, alone.
 Use: To pass the SAT colour code to other equipment.
 Modes: Immediate only.

COMMAND CODES

SCM (System Class Mark)

Function: Read station class mark.
Format: SCM, alone.
Use: To pass the station class mark to other equipment.
Modes: Immediate only.

Function: Argument for PRINT or WRITE, print or write current station class mark (hexadecimal for N-AMPS only).
Token: F2.
Format: SCM, preceded by either PRINT or WRITE.
Use: PRINT sends the station class mark to the printer port; WRITE sends the station class mark to the screen.
Example: WR 4,10,SCM (Write the station class mark on the screen at column 4, row 10).
Modes: Learn only.

SEQttl (SEQuence TITLe)

Function: Set title of user-defined test sequence. The default setting is NO SEQUENCE DEFINED.
Format: SEQTTL or SE, followed by the test sequence title of up to 22 characters within quotation marks. Since the 2955 character set is used for the title, use upper case for all letters with the exception of d, k, m, s and z.
Example: SE "MYPROG" (The title of the test sequence is MYPROG).
Modes: Immediate only.

Function: Argument for PRINT or WRITE, print or write test sequence title.
Token: FA.
Format: SEQTTL or SE, preceded by either PRINT or WRITE.
Use: PRINT sends the title to the printer port; WRITE sends the title to the screen.
Example: WR 3,9,SE (Write the test sequence title on the screen at column 3, row 9).
Modes: Learn only.

SID (System ID number)

Function: Set system identity number. The default number is 03592.
Token: DF.
Format: SID or SI, followed by a 5-digit number within quotation marks.
Example: SI "36166" (Set the system identity number to 36166).
Modes: Immediate and learn.
Errors: Syntax (Invalid command).

Function: Read system identity number.
Format: SID or SI, alone.
Use: To pass the system identity number to other equipment.
Modes: Immediate only.

SRQ (Service ReQuest enable/disable)

Function: Enable/disable service request. The default number is 0.
Format: SRQ or SR, followed by a 1-digit number: 0 = disable, 1 = enable.
Use: Enables and disables the remote service request function on the GPIB. In RS-232 control, SRQ has to be enabled.
Modes: Immediate only.

STatus

Function: Argument for PRINT or WRITE, print or write test routine status.
 Token: ED.
 Format: STATUS or STA, preceded by either PRINT or WRITE.
 Use: PRINT sends the status (PASSED, FAILED or ERROR) to the printer port; WRITE sends the status to the screen.
 Example: WR 3,9,STA (Write the status of the last test routine on the screen at column 3, row 9.)
 Modes: Learn only.

STore

Function: Store the existing 2957D or 2960D settings. See also under RECALL.
 Format: STORE or STO, followed by a 1-digit number in the range 0 to 6.
 Use: Makes existing settings available for future recall.
 Example: STO 6 (Place existing settings in store no. 6).
 Modes: Immediate only.

STPch (STeP CHannel)

Function: Initialization for sequence of NXTCH steps.
 Token: 8B.
 Format: STPCH or STP, alone.
 Use: Enables the current voice/traffic channel to be increased by HINC without using a loop. STPCH sets the voice/traffic channel to the first voice/traffic channel and aborts any RPTCH loop. Subsequent NXTCH commands increment the voice/traffic channel by HINC but do not loop.
 Example: STPCH
 TEST 23
 NXTCH
 TEST 23 (Handoff to the first voice/traffic channel and then handoff to (the first voice/traffic channel + HINC)).
 Modes: Learn only.

STR\$

Function: Argument for PRINT, print command string as entered under the MISCELLANEOUS MENU in the PRINTER PORT COMMAND option or as below.
 Token: F9.
 Format: STR\$, immediately preceded by PRINT.
 Modes: Learn only.

Function: Enter command string for printer port.
 Format: STR\$, followed by, within quotation marks, the command string.
 Use: To enter the given command string for output as above.
 Modes: Immediate only.

Function: Read command string.
 Format: STR\$, alone.
 Use: To pass the command string to other equipment.
 Modes: Immediate only.

COMMAND CODES

SUMmary

Function: Argument for PRINT or WRITE, print or write test routine summary.
Token: EF.
Format: SUMMARY or SU, preceded by either PRINT or WRITE.
Use: PRINT sends the summary to the printer port; WRITE sends the summary to the screen.
Example: WR 3,9,SU (Write the summary for the last test routine on the screen at column 3, row 9).
Modes: Learn only.

SYStem (SYSTEM type)

For 2957D

Function: Reset parameters to default values.
Format: SYSTEM or SYS, followed by, within quotation marks, 20.
Example: SYS "20" (Reset the parameters).
Modes: Immediate only.

For 2960D

Function: Set system type.
Format: SYSTEM or SYS, followed by, within quotation marks, a 2-digit number: 10 = NMT, 20 = AMPS, 30 = TACS, 50 = Band III.
Example: SYS "20" (Set the system to AMPS).
Modes: Immediate only.

Function: Read system type setting.
Format: SYSTEM or SYS, alone.
Use: To pass the system type setting to other equipment.
Modes: Immediate only.

TCh (Traffic CHannel)

Function: Set default current voice/traffic channel. Identical to VCh.
Token: 90.
Format: VCH or VC, followed by a 4-digit number.
Example: VC 100 (Set the default current voice/traffic channel to 100).
Modes: Immediate and learn.
Errors: Syntax (Out of range, voice/traffic channel number is not within minimum and maximum).

TDMA

Function: Set TDMA channel in forward signalling to FACCH or SACCH for physical layer control messages which can be sent on the FACCH or SACCH.
Token: D7.
Format: TDMA, followed by a 1-digit number:
0 = FACCH, 1 = SACCH.
Example: TDMA 0 (Set the TDMA channel to FACCH).
Modes: Immediate and learn.

Function: Read TDMA channel.
Format: TDMA, alone.
Use: To pass the TDMA channel to other equipment.
Modes: Immediate only.

TEST

Function: Execute the following test routine.
 Token: 80.
 Format: TEST or TE, followed by 2-digit test routine number in the ranges 1 to 9 and 20 to 38.
 Example: TE 28 (Measure transmitter power).
 Modes: Learn only.
 Errors: Syntax.

TIME

Function: Argument for PRINT, print current time.
 Token: FD.
 Format: TIME or TIM, immediately preceded by PRINT.
 Modes: Learn only.

Function: Set current time.
 Format: TIME or TIM, immediately followed by "hh:mm:ss" where hh is hours, mm is minutes and ss is seconds.
 Example: TIM "10:15:35"
 Modes: Immediate only.

Function: Read current time.
 Format: TIME or TIM, alone.
 Use: To pass the current time to other equipment.
 Modes: Immediate only.

TITLE

Function: Argument for PRINT or WRITE, print or write test routine title.
 Token: FB.
 Format: TITLE or TIT, preceded by either PRINT or WRITE.
 Use: PRINT sends the title to the printer port; WRITE sends the title to the screen.
 Example: WR 3,9,TIT (Write the test routine title on the screen at column 3, row 9).
 Modes: Learn only.

TSi (Test Sequence Is)

Function: Select current test sequence.
 Format: TSI or TS, followed by a 1-digit number:
 0 = Brief testing, 1 = Comprehensive testing,
 2 = Call processing only, 3 = Call and RF testing,
 4 = User-defined.
 Example: TS 4 (Select the user-defined test sequence).
 Modes: Immediate only.

UPI (User Port Input)

Function: Read parallel control port user input lines.
 Format: UPI alone.
 Use: Reads the user input lines on the PARALLEL CONTROL PORT connector.
 Modes: Immediate only.

COMMAND CODES

UPO (User Port Output)

Function: Set user parallel control port user output lines.
Format: UPO followed by a 3-digit decimal number (range 00 to 255) or #H and a 2-digit hexadecimal number (range 0 to FF).
Use: Sets the user output lines on the PARALLEL CONTROL PORT connector to the specified number.
Example: UPO 15 or UPO #HF (Set the user output lines to decimal 15 (binary 1111)).
Modes: Immediate only.

USeR

Function: Enter user mode to define a subroutine. The 2957D or 2960D cannot then respond to immediate mode commands until END is received. Whenever DEF is executed, the subroutine is also executed. Each internal test sequence is thus subject to modification by the user. It is necessary to conclude each subroutine with RETURN (so that the 2957D or 2960D resumes the test sequence) and then END. For a user-defined test sequence, see LEARN. Either a test sequence or a subroutine can be defined, not both in memory together.
Format: USER or US, alone.
Use: Has to precede the first command in a user-defined subroutine in order to enter the learn mode.
Modes: Immediate only.

VCh (Voice Channel)

Function: Set default current voice/traffic channel. Identical to TCh.
Token: 90.
Format: VCH or VC, followed by a 4-digit number.
Example: VC 100 (Set the default current voice/traffic channel to 100).
Modes: Immediate and learn.
Errors: Syntax (Out of range, voice/traffic channel number is not within minimum and maximum).

VDigital

Function: Read the version number (and any qualifying letter) of the software on the digital and RF tray.
Format: VDIGITAL or VD, alone.
Modes: Immediate only.

VMother

Function: Read the version number (and any qualifying letter) of the mother software on the system controller board.
Format: VMOTHER or VM, alone.
Modes: Immediate only.

VPers

Function: Read the version number (and any qualifying letter) of the personality software on the system controller board.
Format: VPERS or VP, alone.
Modes: Immediate only.

VR (Variable Read)

Function: Read contents of a register.
 Token: AF.
 Format: VR, followed by the register number.
 The register numbers are as follows:-
 0 to 15 for sixteen 8-bit registers or
 16 to 23 for eight 16-bit registers
 (128 bits in total for 0 to 23),
 24 for the 16-bit flag register,
 25 for the 16-bit failure counter,
 26 for the 16-bit system configuration word register.
 Use: To pass the contents of the a register to other equipment.
 Modes: Immediate and learn.

VW (Variable Write)

Function: Write the contents of the flag register to another register.
 Token: B0.
 Format: VW, followed by a register number.
 The register numbers are as follows:-
 0 to 15 for sixteen 8-bit registers or
 16 to 23 for eight 16-bit registers
 (128 bits in total for 0 to 23),
 24 for the 16-bit flag register,
 25 for the 16-bit failure counter,
 26 for the 16-bit system configuration word register.
 Modes: Immediate and learn.

WAI

Function: Wait for n milliseconds.
 Token: 9C.
 Format: WAIT or WA, followed by a 5-digit number in the range 0 to 65535.
 Use: Suspends program operation for up to 65.535 seconds.
 Example: WA 10000 (Suspend program operation for 10.000 seconds).
 Modes: Learn only.
 Errors: Syntax.

WRITE

Function: Argument for WRITE, write to the 2955 screen.
 Token: 84.
 Formats: WRITE or WR, followed by 2-digit x and y co-ordinates and then a message within quotation marks.
 WRITE or WR, followed by 2-digit x and y co-ordinates and then a command code.
 Uses: Writes to the screen at row x (0 to 31), column y (0 to 39). The top left of the screen is 0,0.
 Examples
 1: WRITE 3,9,"WARNING" (Write WARNING on screen at column 3, row 9).
 2: WRITE 3,9,RESULT (Write a measurement result on the screen at column 3, row 9).
 Modes: Immediate and learn (when quotation marks are used) or learn only (when a command code is used).
 Errors: Syntax.

TABLE 4-3-2 COMMAND CODES

Command code	Function	Token	Syntax form	Data format	Modes
ASC\$	Print contents of flag register	EB	4	-	L
BI	Set burst indicator field	D6	2	1 digit	I & L
	Read burst indicator field	-	1	-	I
BRI	Set baud rate for RS-232 port	96	2	1 digit	I & L
BUffer	Print printer array buffer	E3	4	-	L
CCH	Set current control channel	8F	2	4 digits	I & L
CCi	Set default control channel	8E	2	4 digits	I & L
CHR	Print single character which has ACII code equal to first 8 bits in flag register	E6	4	-	L
CLear	Clear printer array buffer	E2	4	-	L
COMmand	Control 2955 directly in CRTS mode	9B	7	Text	I & L
CONTinue	Continue after pause	-	1	-	I
CRTS	Change to CRTS mode	-	1	-	I
CS1	Enable/disable continuous summary lines	-	2	1 digit	I
DATE	Print current date	FE	4	-	L
	Set current date	-	6	"dd/mm/yyyy"	I
	Read current date	-	1	-	I
DCc	Set digital colour code	DD	2	1 digit	I & L
	Read digital colour code	-	1	-	I
DEfault	Load default parameter data, execute any user-defined subroutine	82	1	-	I & L
DFi	Set display format	94	2	1 digit	I & L
DIisable	Disable printing	E0	4	-	L
DSCc	Set DSAT colour code	D5	2	1 digit	I & L
	Read DSAT colour code	-	1	-	I
DSi	Set disc step rate	-	2	1 digit	I
DTmf	Enable/disable DTMF test	DB	2	1 digit	I & L
	Read DTMF test setting	-	1	-	I
DVCC	Set DVCC	D5	2	3 digits	I & L
	Read DVCC	-	1	-	I
ECho	Enable/disable RS-232 echo	-	2	1 digit	I
ENable	Enable printing	E1	4	-	L
END	End of program or user-defined subroutine, return to immediate mode	FF	1	-	L
ESn	Read equipment serial number	-	1	-	I
	Print or write ESN	F1	4	-	L
Ftc/Fvc	Set first voice/traffic channel	91	2	4 digits	I & L
Gosub	Call subroutine at given label	89	2	3 digits	L
HEX\$	Print contents of flag register as 2-digit hexadecimal number	EC	4	-	L

COMMAND CODES

Command code	Function	Token	Syntax form	Data format	Modes
HF	Enable/disable hook flash test	DA	2	1 digit	I & L
	Read hook flash test setting	-	1	-	I
HInc	Set handoff increment	93	2	4 digits	I & L
Indicator	Print or write test status indicator	EE	4	-	L
JBC	Jump to label if designated bit is clear	A4	5	1 & 3 digits	L
JBS	Jump to label if designated bit is set	A5	5	1 & 3 digits	L
JEq	Jump to label if value is equal to contents of flag register	A6	5	3 & 3 digits	L
JGE	Jump to label if value is greater than or equal to contents of flag register	AB	5	3 & 3 digits	L
JGT	Jump to label if value is greater than contents of flag register	AC	5	3 & 3 digits	L
JLE	Jump to label if value is less than or equal to contents of flag register	AD	5	3 & 3 digits	L
JLT	Jump to label if value is less than contents of flag register	AE	5	3 & 3 digits	L
JNe	Jump to label if value is not equal to contents of flag register	A7	5	3 & 3 digits	L
JOA	Jump to label if channel is analog	A8	2	3 digits	L
JOD	Jump to label if channel is digital	A9	2	3 digits	L
JOE	Jump to label on test error	A2	2	3 digits	L
JOF	Jump to label on test failure	A3	2	3 digits	L
JON	Jump to label if channel is narrowband	AA	2	3 digits	L
JOP	Jump to label on test pass	A1	2	3 digits	L
JOW	Jump to label if channel is wideband	A8	2	3 digits	L
JUmp	Jump to label unconditionally	86	2	3 digits	L
Key	Wait for keypress and store value in flag register	9A	1	-	L
LAbel	Marker for position in program	85	2	3 digits	L
LEarn	Enter learn mode	-	1	-	I
LIne	Print first line of printer array buffer	E4	4	-	L
LOAd	Load a file from disc	-	2	1 digit	I
LOCAl	Go to local control mode from RS-232	-	1	-	I
LPi	Set data length and parity of serial port	-	2	1 digit	I

COMMAND CODES

Command code	Function	Token	Syntax form	Data format	Modes
LTC/LVc	Set last voice/traffic channel	92	2	4 digits	I & L
MC	Move constant into a register	B1	5	2 & 5 digits	I & L
Min	Set mobile identity number	-	6	Number	I
	Read MIN	-	1	-	I
	Print or write MIN	F0	4	-	L
MV	Move variable from one register to another	B2	5	2 & 2 digits	I & L
NEXT	Next pass of repeat loop	88	1	-	L
NFI	Set number format	D9	2	1 digit	I & L
	Read number format setting	-	1	-	I
NORMAL	Go to normal 2955 mode	-	1	-	I
NXTch	Next channel or next RPTCH loop	8D	1	-	L
OC	Do arithmetic operation on constant and contents of flag register	B3	5	1 & 5 digits	I & L
OV	Do arithmetic operation on contents of a register and contents of flag register	B4	5	1 & 2 digits	I & L
PAGE	Print 63 lines of printer array buffer	E5	4	-	L
PARAMeter	Set test routine parameters	81	3	2 & 1 digits & text	L
PAUse	Pause at end of current test routine	-	1	-	I
PEI	Peek I/O port and place contents in flag register	9D	2)3 decimal	L
	Read I/O port	-	2)or 2)hexadecimal)digits	I
PEM	Peek memory and place contents in flag register	9E	2)5 decimal	L
	Read memory	-	2)or 4)hexadecimal)digits	I
PMi	Set pause mode	95	2	1 digit	I & L
POI	Poke I/O port with data	9F	5	3 decimal or 2 hexadecimal & 3 decimal or 2 hexadecimal digits	I & L
POM	Poke memory with data	A0	5	5 decimal or 4 hexadecimal & 3 decimal or 2 hexadecimal digits	I & L
PPi	Select printer port	97	2	1 digit	I & L
PRInt	Print to current printer port	83	4	2 & 2 digits & text/code	I & L
PRO	Set criteria for printing result of test routine	99	2	1 digit	I & L

Command code	Function	Token	Syntax form	Data format	Modes
PTi	Select printer terminator	98	2	1 digit	I & L
PURge	Clear RS-232 or GPIB buffer	-	1	-	I
RD	Request a reading	-	2	3 digits	I
RECall	Recall settings	-	2	1 digit	I
REPeat	Repeat a loop	87	2	3 digits	L
RESult	Print or write test routine result	FC	4	-	L
RETurn	Return from subroutine	8A	1	-	L
RPTch	Repeat loop with NXTCH	8C	1	-	L
RUn	Run test sequence	-	1	-	I
SAve	Save current user-defined program on disc	-	2	1 digit	I
SBi	Set number of stop bits	-	2	1 digit	I
SCc	Set SAT colour code	DE	2	1 digit	I & L
	Read SAT colour code	-	1	-	I
SCM	Read SCM	-	1	-	I
	Print or write SCM	F2	4	-	L
SEqttl	Set title of user-defined test sequence	-	6	Text	I
	Print or write test sequence title	FA	4	-	L
SIId	Set system identity number	DF	6	5 digits	I & L
	Read system identity number	-	1	-	I
SRq	Enable/disable service request	-	2	1 digit	I
STatus	Print or write test routine status	ED	4	-	L
STOre	Store setting	-	2	1 digit	I
STPch	Initialization for sequence of NXTCH steps	8B	1	-	L
STR\$	Print command string as entered in the PRINTER PORT COMMAND option or as below	F9	4	-	L
	Enter command string for printer port	-	6	x digits	I
	Read command string for printer port	-	1	-	I
SUMmary	Print or write test routine summary	EF	4	-	L
SYStem	Reset parameters to default values	-	6	2 digits	I
TCh	Set current voice/traffic channel	90	2	4 digits	I & L
TDMA	Set TDMA channel	D7	2	1 digit	I & L
	Read TDMA channel	-	1	-	I
TEst	Execute following test routine	80	2	2 digits	L
TIme	Print current time	FD	4	-	L
	Set current time	-	6	"hh:mm:ss"	I
	Read current time	-	1	-	I
TITle	Print or write current test routine title	FB	4	-	L
TSi	Select test sequence	-	2	1 digit	I
UPI	Read parallel control port user input lines	-	1	-	I

COMMAND CODES

Command code	Function	Token	Syntax form	Data format	Modes
UPO	Set parallel control port user output lines	-	2	3 decimal or 2 hexadecimal digit	I
USer	Enter user mode	-	1	-	I
VCh	Set current voice/traffic channel	90	2	4 digits	I & L
VDigital	Read version of software on digital and RF tray	-	1	-	I
VMother	Read version of mother software on system controller board	-	1	-	I
VPers	Read version of personality software on system controller board	-	1	-	I
VR	Read contents of flag register	AF	2	2 digits	
I & L VW	Write variable to flag register	B0	2	2 digits	I & L
WAit	Wait for n milliseconds	9C	2	5 digits	L
WRite	Write to 2955 screen at x, y	84	4	2 & 2 digits & text/code	I & L

Chapter 4-4

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 1 - TRANSMITTER RF POWER

Parameters 1, 2 and 3 can be selected from the following:-

Parameter	Setting	Entry	Default
1	RV & ME UL & LL	0 (xxxxxxx00) or 1 (xxxxxxx01)	0
2	RV or UL	10 mW to 100 W, 10 to 44 dBm, -20 to 14 dBW	3 W
3	ME ME or LL	0 to 100%, 0 to 30 dB 10 mW to 100 W, 10 to 44 dBm, -20 to 14 dBW	2 dB

TEST ROUTINE NO. 2 - TRANSMITTER RF FREQUENCY

Parameters 1, 2 and 3 can be selected from the following:-

Parameter	Setting	Entry	Default
1	RV & ME UL & LL RV & ME (CC) Cellular radio PMR	a + b where a = 0 (xxxxxxx00) or 1 (xxxxxxx01) or 3 (xxxxxxx11) b = 0 (0xxxxxxx) or 128 (1xxxxxxx)	3 (= 3 + 0)
2	RV or UL (Not applicable to RV & ME (CC))	1.5 to 1000 MHz	
3	ME ME or LL	0 to 100%, 0 to 1000 ppm 0 to 1000 MHz	Analog except N-AMPS narrowband: 2.2 kHz N-AMPS narrowband: 0.9 kHz D-AMPS digital: 200 Hz

TEST ROUTINE NO. 5 - TRANSMITTER MODULATION COMPRESSION

This test routine is not applicable to D-AMPS digital channels. Parameters 1, 2, 3 and 4 can be selected from the following:-

Parameter	Setting	Entry	Default
1	RV & ME UL & LL	0 (xxxxxxx00) or 1 (xxxxxxx01)	0
2	RV or UL	0 to 10	2
3	ME ME or LL	0 to 100% 0 to 10	10%
4	Modulation	100 Hz to 25 kHz, 1 to 70%, 0.1 to 10 rad	Except N-AMPS narrowband: 2.9 kHz N-AMPS narrowband: 1.5 kHz

TEST ROUTINE NO. 6 - RECEIVER AF DISTORTION, RECEIVER SINAD OR RECEIVER S/N

This test routine is not applicable to D-AMPS digital channels. Parameters 1, 2, 3 and 4 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Distortion SINAD SINAD (titled DISTORTION) S/N 15 kHz LP filter 0.3 to 3.4 kHz filter Psophometric filter Use parameters as defined here for SINAD or S/N Use parameters of test 7 for SINAD or S/N Use parameters of test 7 for SINAD or S/N except RF level which is set to -118 dBm	a + b + c where a = 0 (xx00xx00) or 16 (xx01xx00) or 19 (xx01xx11) or 32 (xx10xx00) b = 0 (xxxx00xx) or 4 (xxxx01xx) or 12 (xxxx11xx) c = 0 (00xxxxxx) c = 80 (10xxxxxx) c = C0 (11xxxxxx)	31 (= 19 + 12 +0)
2	Distortion UL SINAD or S/N LL	0 to 30% 0 to 50 dB	26 dB
3	RF level	0.023 to 22 μ V, -140 to -80 dBm	-80 dBm
4	Modulation	100 Hz to 25 kHz, 1 to 70%, 0.1 to 10 rad	Except N-AMPS narrowband: 8.0 kHz N-AMPS narrowband: 3.0 kHz

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 7 - RECEIVER SENSITIVITY

This test routine is not applicable to D-AMPS digital channels. Parameters 1, 2, 3 and 4 can be selected from the following:-

Parameter	Setting	Entry	Default
1	15 kHz LP filter 0.3 to 3.4 kHz filter Psophometric filter	0 (xxxx00xx) or 4 (xxxx01xx) or 12 (xxxx11xx)	12
2	RF level UL	0.023 to 22 μ V, -140 to -80 dBm	-116 dBm
3	SINAD	0 to 50 dB	12 dB
4	Modulation	100 Hz to 25 kHz, 1 to 70%, 0.1 to 10 rad	Except N-AMPS narrowband: 8.0 kHz N-AMPS narrowband: 3.0 kHz

TEST ROUTINE NO. 8 - RECEIVER DEMODULATION EXPANSION

This test routine is not applicable to D-AMPS digital channels. Parameters 1, 2, 3 and 4 can be selected from the following:-

Parameter	Setting	Entry	Default
1	RV & ME UL & LL	0 (xxxxxxx00) or 1 (xxxxxxx01)	0
2	RV or UL	0 to 10	2
3	ME ME or LL	0 to 100% 0 to 10	10%
4	Modulation	100 Hz to 25 kHz, 1 to 70%, 0.1 to 10 rad	Except N-AMPS narrowband: 2.9 kHz N-AMPS narrowband: 1.5 kHz

TEST ROUTINE NO. 9 - DC POWER CONSUMPTION

Parameters 1, 2 and 3 can be selected from the following:-

Parameter	Setting	Entry	Default
1	RV & ME UL & LL	0 (xxxxxxx00) or 1 (xxxxxxx01)	1
2	RV or UL	100 mW to 200 W	100 W
3	ME ME or LL	0 to 100% 100 mW to 200 W	200 mW

TEST ROUTINE NO. 20 - REGISTRATION OF MOBILE ON CONTROL CHANNEL

Parameter 1 can be selected from the following:-

Parameter	Setting	Entry	Default
1	RF level: -80 dBm -60 dBm -40 dBm (except D-AMPS) or -50 dBm (D-AMPS)	0 (xxxxxxx00) or 1 (xxxxxxx01) or 2 (xxxxxxx1x)	2

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 21 - CALL FROM CELL TO MOBILE

Parameters 1 and 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	<p>Set control port user output 4 to request mobile to answer call and reset to 0 when call is answered</p> <p>RF level: -80 dBm -60 dBm -40 dBm (except D-AMPS) or -50 dBm (D-AMPS)</p> <p>Initial voice/traffic channel: N-AMPS As under SYSTEM CONFIGURATION word NARROW channel BELOW channel ABOVE channel WIDE channel D-AMPS As under SYSTEM CONFIGURATION word DIGITAL 1 + 4 DIGITAL 2 + 5 DIGITAL 3 + 6 ANALOG channel</p>	<p>a + b + c where a = 0 (xxx0xxxx) or 16 (xxx1xxxx) b = 0 (xxxxxx00) or 1 (xxxxxx01) or 2 (xxxxxx1x) c = 0 (000xxxxx) + 0) or 32 (x01xxxxx) or 64 (x10xxxxx) or 96 (x11xxxxx) or 128 (100xxxxx) c = 0 (000xxxxx) or 32 (x01xxxxx) or 64 (x10xxxxx) or 96 (x11xxxxx) or 128 (100xxxxx)</p>	<p>18 (= 16 + 2 + 0)</p>
2	<p>Time alignment (in half symbols from 45 to 60.5)</p>	<p>0 to 31</p>	<p>0</p>

TEST ROUTINE NO. 22 - CALL FROM MOBILE TO CELL

Parameters 1 and 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Set control port user output 2 to instruct mobile to make a call and reset to 0 when call is made	a + b + c where a = 0 (xxx0xxxx)	18
	RF level:		
	-80 dBm	b = 0 (xxxxxx00)	
	-60 dBm	or 1 (xxxxxx01)	
	-40 dBm (except D-AMPS) or		
	-50 dBm (D-AMPS)	or 2 (xxxxxx1x)	+ 2
	Initial voice/traffic channel:		
	N-AMPS		
	As under SYSTEM		
	CONFIGURATION word	c = 0 (000xxxxx)	+ 0)
	NARROW channel	or 32 (x01xxxxx)	
	BELOW channel	or 64 (x10xxxxx)	
	ABOVE channel	or 96 (x11xxxxx)	
	WIDE channel	or 128 (100xxxxx)	
	D-AMPS		
	As under SYSTEM		
	CONFIGURATION word	c = 0 (000xxxxx)	
	DIGITAL 1 + 4	or 32 (x01xxxxx)	
	DIGITAL 2 + 5	or 64 (x10xxxxx)	
	DIGITAL 3 + 6	or 96 (x11xxxxx)	
	ANALOG channel	or 128 (100xxxxx)	
2	Time alignment (in half symbols from 45 to 60.5)	0 to 31	0

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 23 - HANDOFF FROM CURRENT TO CHOSEN VOICE/TRAFFIC CHANNEL

Parameters 1 and 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	No change in SCC, DSCC or DVCC at handoff	a + b where a = 0 (xxx0xxxx)	1
	Increment SCC, DSCC or DVCC on each handoff (omitting 0 for DVCC)	or 1 (xxxxxxx1)	(= 1
	Handoff voice/traffic channel: N-AMPS		
	As under SYSTEM CONFIGURATION word	b = 0 (000xxxxx)	+ 0)
	NARROW channel	or 32 (x01xxxxx)	
	BELOW channel	or 64 (x10xxxxx)	
	ABOVE channel	or 96 (x11xxxxx)	
	Rotate channel type, provided handoff is to a different channel number (with any bits 5 and 6)	or 128 (100xxxxx)	
	D-AMPS		
	As under SYSTEM CONFIGURATION word	b = 0 (000xxxxx)	
	DIGITAL 1 + 4	or 32 (x01xxxxx)	
	DIGITAL 2 + 5	or 64 (x10xxxxx)	
	DIGITAL 3 + 6	or 96 (x11xxxxx)	
2	Time alignment (in half symbols from 45 to 60.5)	0 to 31	0

TEST ROUTINE NO. 24 - AUTOMATIC HANDOFFS FROM FIRST TO LAST VOICE/TRAFFIC CHANNELS

Parameters 1 and 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	No change in SCC, DSCC or DVCC at handoff	a + b where a = 0 (xxx0xxxx)	1
	Increment SCC, DSCC or DVCC on each handoff (omitting 0 for DVCC)	or 1 (xxxxxxxx1)	(= 1
	Handoff voice/traffic channel:		
	N-AMPS		
	As under SYSTEM		
	CONFIGURATION word	b = 0 (000xxxxx)	+ 0)
	NARROW channel	or 32 (x01xxxxx)	
	BELOW channel	or 64 (x10xxxxx)	
	ABOVE channel	or 96 (x11xxxxx)	
	Rotate channel type, provided handoff is to a different channel number (with any bits 5 and 6)	or 128 (100xxxxx)	
	D-AMPS		
	As under SYSTEM		
	CONFIGURATION word	b = 0 (000xxxxx)	
	DIGITAL 1 + 4	or 32 (x01xxxxx)	
	DIGITAL 2 + 5	or 64 (x10xxxxx)	
	DIGITAL 3 + 6	or 96 (x11xxxxx)	
2	Time alignment (in half symbols from 45 to 60.5)	0 to 31	0

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 25 - SAT, DSAT OR DVCC TRANSPONDING

The parameters are not applicable to D-AMPS digital channels. Parameters 1 and 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Transponding only Transponding and deviation Transponding and frequency (except N-AMPS narrowband)	0 (xxxxxxx00) or 1 (xxxxxxx01) or 2 (xxxxxxx10)	1
2	Deviation or frequency ME	Value in % or Hz	20%

When 2 has been selected for parameter 1, the frequency ME is 10 Hz in internal sequences.

TEST ROUTINE NO. 26 - CLEARING DOWN FROM CELL

No parameters can be selected.

TEST ROUTINE NO. 27 - CLEARING DOWN FROM MOBILE

Parameter 1 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Set control port user output 3 to request mobile to clear down and reset to 0 when call is cleared	0 (xxx0xxxx) or 16 (xxx1xxxx)	16

TEST ROUTINE NO. 28 - TRANSMITTER RF POWER

There are different power levels and classes (assuming an antenna gain of 1.5 dB with respect to a half-wave dipole) as follows:-

Power level	Class I	Class II	Class III	Class IV
0	2.82 W	1.12 W	447 mW	447 mW
1	1.12 W	1.12 W	447 mW	447 mW
2	447 mW	447 mW	447 mW	447 mW
3	178 mW	178 mW	178 mW	178 mW
4	70.8 mW	70.8 mW	70.8 mW	70.8 mW
5	28.2 mW	28.2 mW	28.2 mW	28.2 mW
6	11.2 mW	11.2 mW	11.2 mW	11.2 mW
7	4.47 mW	4.47 mW	4.47 mW	4.47 mW
8	4.47 mW	4.47 mW	4.47 mW	1.78 mW
9	4.47 mW	4.47 mW	4.47 mW	708 μW
10	4.47 mW	4.47 mW	4.47 mW	28.2 μW
SCM	0xx00	0xx01	0xx10	0xx11

Parameters 1 to 3 can be selected from the following:-

Parameter	Setting	Entry	Default	
1	Power level 0	a + b where a = 0 (xxxx0000)	15	
	Power level 1	or 1 (xxxx0001)		
	Power level 2	or 2 (xxxx0010)		
	Power level 3	or 3 (xxxx0011)		
	Power level 4	or 4 (xxxx0100)		
	Power level 5	or 5 (xxxx0101)		
	Power level 6	or 6 (xxxx0110)		
	Power level 7	or 7 (xxxx0111)		
	Power level 8	} D-AMPS } DIGITAL } only		or 8 (xxxx1000)
	Power level 9			or 9 (xxxx1001)
	Power level 10			or 10 (xxxx1010)
Test all power levels	or 15 (xxxx1111)	(= 15		
Units: W	b = 0 (xx00xxxx)	+ 0)		
Units: dBW	or 16 (xx01xxxx)			
Units: dBm	or 32 (xx10xxxx)			
2	UL	Value and dB or %	2 dB	
3	LL	Value and dB or %	-4 dB	

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 29 FOR ANALOG CHANNELS - DATA PERFORMANCE (BER)

This test routine is not applicable to N-AMPS narrowband channels. Parameters 2 and 3 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Delay with SAT on between sending Audit Orders: None 500 ms	0 (xxxxxxx0) or 1 (xxxxxxx1)	0
2	LL	0 to 100%	95%
3	RF generator level	-141 to -80 dBm	-113 dBm

TEST ROUTINE NO. 29 FOR DIGITAL CHANNELS - BER REPORT

Parameters 2, 3, 4 and 5 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Not used		0
2	Number of introduced bit errors per time slot	0 to 40	0
3	RF generator level	-120 to -50 dBm	-60 dBm
4	BER report UL	0 to 7	0
5	BER report LL	0 to 7	0

For the appropriate values, see the table on page 3-1-56.

TEST ROUTINE NO. 30 - DTMF TONES

Parameter 1 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Disable printing of summary line and scrolling in summary display when test routine is disabled	0 (xxxxxxx0)	0
	Enable printing of summary line and scrolling in summary display when test routine is disabled	or 1 (xxxxxxx1)	

TEST ROUTINE NO. 31 - HOOK FLASH

Parameter 1 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Disable printing of summary line and scrolling in summary display when test routine is disabled	0 (xxxxxxxx0)	0
	Enable printing of summary line and scrolling in summary display when test routine is disabled	or 1 (xxxxxxxx1)	

TEST ROUTINE NO. 32 - DATA DEVIATION

This test routine is not applicable to N-AMPS narrowband channels or D-AMPS digital channels. Parameter 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Not used		0
2	ME	0 to 100%, 0 to 8 kHz	10%

TEST ROUTINE NO. 33 - ST DEVIATION

This test routine is not applicable to N-AMPS narrowband channels or D-AMPS digital channels. It is not used in built-in test sequence but is available for user-defined test sequences.

Parameter 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Not used		0
2	ME	0 to 100%, 0 to 8 kHz	10%

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 34 - ST DURATION

This test routine is not applicable to N-AMPS narrowband channels or D-AMPS digital channels. It is not used in built-in test sequence but is available for user-defined test sequences.

Parameter 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Not used		0
2	ME	0 to 100%, 0 to 8 kHz	10%

TEST ROUTINE NO. 35 - RMS VECTOR ERROR, FIRST 10 SYMBOLS, ORIGIN OFFSET OR BURST ENVELOPE

This test routine is applicable only to D-AMPS digital channels. Parameters 1 and 2 can be selected from the following:-

Parameter	Setting	Entry	Default
1	RMS vector error First 10 symbols (over 10 bursts) Origin offset Burst envelope	0 (xxxxxx00) or 1 (xxxxxx01) or 2 (xxxxxx10) or 3 (xxxxxx11)	0
2	RMS vector error UL First 10 symbols UL Origin offset UL	0 to 40% or 0.4 0 to 40% or 0.4 -50 to -10 dB	12.5%

When 1 has been selected for parameter 1, the first 10 symbols UL is 25% in internal test sequences.

When 2 has been selected for parameter 1, the origin offset UL is -20 dB in internal test sequences.

TEST ROUTINE NO. 36 - DIGITAL RF SENSITIVITY (BER)

This test routine is applicable only to D-AMPS digital channels. Parameters 1, 2 and 3 can be selected from the following:-

Parameter	Setting	Entry	Default
1	Pause for manual set-up (timeout 60 s) No pause Static/clear signal 2-ray equal-amplitude non-faded signal, 1 symbol delay Digital 1 + 4 Digital 1 + 4 Digital 2 + 5 Digital 3 + 6	a + b + c where a = 0 (xxxxxxx0) (= 0 or 1 (xxxxxxx1) b = 0 (xxxxxx0x) + 0 or 2 (xxxxxxx1x) c = 0 (x00xxxxxx) + 0) or 32 (x01xxxxxx) or 64 (x10xxxxxx) or 96 (x11xxxxxx)	0
2	UL	0 to 40%	3%
3	RF generator level	-120 to -50 dBm	-110 dBm

TEST ROUTINE NO. 37 - DIGITAL SPEECH LOOPBACK QUALITY

This test routine is applicable only to D-AMPS digital channels. Parameter 1 can be selected from the following:-

Parameter	Setting	Entry	Default
1	20 s timeout 5 s timeout	0 (xxxxxxx0) or 1 (xxxxxxx1)	0

TEST ROUTINE PARAMETERS

TEST ROUTINE NO. 38 - DIGITAL RSSI

This test routine is applicable only to D-AMPS digital channels. Parameters 1, 2, 3, 4 and 5 can be selected from the following:-

Parameter	Setting	Setting	Default
1	Report on current traffic channel Report on channel in parameter 2	0 (xxxxxxx0) or 1 (xxxxxxx1)	0
2	Channel number for RSSI report	Maximum to minimum	1
3	RF level for RSSI channel	-120 to -50 dBm for 2955 A/B/R (-80 dBm) for 2955 if RSSI channel is not the current channel	-100 dBm
4	Reported RSSI UL	0 to 31	9
5	Reported RSSI LL	0 to 31	3
6	RF level for current traffic channel if not the RSSI channel	-120 to -50 dBm	-60 dBm

For the appropriate values, see the table on page 3-1-55.

Chapter 4-5

BUILT-IN TEST SEQUENCE PROGRAMS

INTRODUCTION

The built-in test sequences for D-AMPS are listed below in detail so that they can be used as programming examples. Sections can be abstracted and used in user-defined test sequences.

Common subroutines 0 to 3, 25, 40, 50 to 52, 60 to 63, 95 and 97 to 99 are given after the four test sequences.

CALL PROCESSING ONLY SEQUENCE

GOSUB 40	Put up heading and prepare buffer
PRINT 3,1,"CALL PROCESSING ONLY"	
GOSUB 50	Common registration and output buffer
GOSUB 60	Common test routines
TEST 24	Automatic handoffs from first to last voice/traffic channels
JUMP 99	Common exit

CALL AND RF TESTING SEQUENCE (D-AMPS ONLY)

GOSUB 40	Put up heading and prepare buffer
PRINT 3,1,"CALL AND RF TESTING"	
GOSUB 50	Common registration and output buffer
GOSUB 60	Common test routines
GOSUB 1	Print one blank line
PRINT "HANDOFF/CHANNEL<7 spaces>TX POWER PL 0<10 spaces> TX FREQ<8 spaces>SAT DEV/RMS VECTOR"	
PRINT "-----<7 spaces>-----<10 spaces> -----<8 spaces>-----"	
GOSUB 1	Print one blank line
RPTCH	First to last voice/traffic channel
PRINT CLEAR	Clear buffer
PRINT DISABLE	
TEST 23	Handoff from current to chosen voice/traffic channel
JOP 30	Skip if passed
PRINT ENABLE	
PRINT "*** HANDOFF FAILED ***"	
JUMP 99	Common exit
LABEL 30	
PRINT 0,0,RESULT	
PAR 28,1,0	Transmitter RF power parameters
TEST 28	Transmitter RF power, level 0
PRINT 20,0,IND	
PRINT 22,0,RESULT	
TEST 2	Transmitter RF frequency
PRINT 40,0,IND	
PRINT 42,0,RESULT	

BUILT-IN TEST SEQUENCE PROGRAMS

JOD 66 Skip if digital channel
TEST 25 SAT or DSAT transponding and deviation
PRINT 60,0,IND
PRINT 62,0,RESULT
JUMP 67

LABEL 66 RMS vector error
TEST 35
PRINT 60,0,IND
PRINT 62,0,RESULT

LABEL 67
PRINT ENABLE
PRINT LINE
NXTCH Next channel
JUMP 95 Common exit

BRIEF TESTING SEQUENCE (D-AMPS ONLY)

GOSUB 40 Put up heading and prepare buffer
PRINT 3,1,"BRIEF TESTING"
GOSUB 50 Common registration and output buffer
GOSUB 60 Common test routines
GOSUB 1 Print one blank line
PRINT CLEAR Clear buffer
PRINT 6,0,"TEST" Print heading
PRINT 25,0,"LOW CHANNEL"
PRINT 45,0,"MID CHANNEL"
PRINT 65,0,"HIGH CHANNEL"
PRINT ENABLE
PRINT LINE
PRINT CLEAR Clear buffer
PRINT 6,0,"----"
PRINT 25,0,"-----"
PRINT 45,0,"-----"
PRINT 65,0,"-----"
PRINT LINE
PRINT CLEAR Clear buffer
GOSUB 1 Print one blank line
PRINT DISABLE Prevent summary lines

STPCH Start by handoff to first channel
PRINT 0,0,"HANDOFF" Print titles
PRINT 0,1,"SAT DEVN/DVCC"
PRINT 0,2,"SAT FREQ/SPEECH"
PRINT 0,3,"TX POWERS"
PRINT 0,4,"TX FREQUENCY"
PRINT 0,5,"TX DIST/RMS VECTOR"
PRINT 0,6,"TX LIMITING"
PRINT 0,7,"DATA DEVIATION" If included under system configuration
PRINT 0,8,"RX DIST/BER REPORT"
PRINT 0,9,"RX SENS/RSSI"
TEST 23 Handoff from current to chosen
voice/traffic channel

PRINT 23,0,RESULT
PRINT 20,0,IND

JOF 13	Next channel if handoff failed
JOE 13	Next channel if handoff error
GOSUB 25	SAT/DSAT/DVCC transponding and SAT/DSAT deviation
PRINT 23,1,RESULT	
PRINT 20,1,IND	
JOD 34	Speech loopback if digital channel
TEST 25	SAT frequency
PRINT 23,2,RESULT	
PRINT 20,2,IND	
JUMP 35	
LABEL 34	Speech loopback
TEST 37	
PRINT 23,2,RESULT	
PRINT 20,2,IND	
LABEL 35	Transmitter RF power
TEST 28	
JOP 10	Skip if passed
PRINT 14,3,TITLE	
PRINT 14,3,"<6 spaces>F "	
PRINT 28,3,RESULT	
JUMP 11	
LABEL 10	
PRINT 23,3,"ALL PASSED"	
LABEL 11	
TEST 2	Transmitter RF frequency
PRINT 23,4,RESULT	
PRINT 20,4,IND	
JOA 36	Skip if analog channel
TEST 35	RMS vector error
PRINT 23,5,RESULT	
PRINT 20,5,IND	
TEST 29	Digital BER reporting
PRINT 23,8,RESULT	
PRINT 20,8,IND	
TEST 38	Digital RSSI
PRINT 23,9,RESULT	
PRINT 20,9,IND	
JUMP 13	
LABEL 36	
TEST 3	Transmitter distortion and noise
PRINT 23,5,RESULT	
PRINT 20,5,IND	
TEST 4	Transmitter modulation limiting
PRINT 23,6,RESULT	
PRINT 20,6,IND	
TEST 32	Data deviation if included under system configuration
PRINT 23,7,RESULT	
PRINT 20,7,IND	
TEST 7	Receiver sensitivity if included under system configuration

BUILT-IN TEST SEQUENCE PROGRAMS

PRINT 23,9,RESULT	
PRINT 20,9,IND	
LABEL 13	
NXTCH	Next channel
TEST 23	Handoff from current to chosen voice/traffic channel
PRINT 43,0,RESULT	
PRINT 40,0,IND	
JOF 17	Next channel if failed
JOE 17	Next channel if error
GOSUB 25	SAT/DSAT/DVCC transponding and SAT/DSAT deviation
PRINT 43,1,RESULT	
PRINT 40,1,IND	
JOD 37	Skip if digital channel
TEST 25	SAT frequency
PRINT 43,2,RESULT	
PRINT 40,2,IND	
JUMP 38	
LABEL 37	Speech loopback
TEST 37	
PRINT 43,2,RESULT	
PRINT 40,2,IND	
LABEL 38	Transmitter RF power
TEST 28	
JOP 14	Skip if passed
PRINT 34,3,TITLE	
PRINT 34,3,"<6 spaces>F "	
PRINT 48,3,RESULT	
JUMP 15	
LABEL 14	
PRINT 43,3,"ALL PASSED"	
LABEL 15	
TEST 2	Transmitter RF frequency
PRINT 43,4,RESULT	
PRINT 40,4,IND	
JOA 39	Skip if analog channel
TEST 35	RMS vector error
PRINT 43,5,RESULT	
PRINT 40,5,IND	
TEST 29	Digital BER reporting
PRINT 43,8,RESULT	
PRINT 40,8,IND	
TEST 38	Digital RSSI
PRINT 43,9,RESULT	
PRINT 40,9,IND	
JUMP 17	
LABEL 39	
TEST 3	Transmitter distortion and noise
PRINT 43,5,RESULT	
PRINT 40,5,IND	
TEST 4	Transmitter modulation limiting

PRINT 43,6,RESULT	
PRINT 40,6,IND	
TEST 32	Data deviation if included under system configuration
PRINT 43,7,RESULT	
PRINT 40,7,IND	
LABEL 16	
TEST 7	Receiver sensitivity if included under system configuration
PRINT 43,9,RESULT	
PRINT 40,9,IND	
LABEL 17	
NXTCH	Next channel
TEST 23	Handoff from current to chosen voice/traffic channel
PRINT 63,0,RESULT	
PRINT 60,0,IND	
JOF 21	Next channel if failed
JOE 21	Next channel if error
GOSUB 25	SAT/DSAT/DVCC transponding and SAT/DSAT deviation
PRINT 63,1,RESULT	
PRINT 60,1,IND	
JOD 45	Skip if digital channel
TEST 25	SAT frequency
PRINT 63,2,RESULT	
PRINT 60,2,IND	
JUMP 46	
LABEL 45	
TEST 37	Speech loopback
PRINT 63,2,RESULT	
PRINT 60,2,IND	
LABEL 46	
TEST 28	Transmitter RF power
JOP 18	Skip if passed
PRINT 54,3,TITLE	
PRINT 54,3,"<6 spaces>F "	
PRINT 68,3,RESULT	
PRINT 78,3," "	
JUMP 19	
LABEL 18	
PRINT 63,3,"ALL PASSED"	
LABEL 19	
TEST 2	Transmitter RF frequency
PRINT 63,4,RESULT	
PRINT 60,4,IND	
JOA 47	Skip if analog channel
TEST 35	RMS vector error
PRINT 63,5,RESULT	
PRINT 60,5,IND	
TEST 29	Digital BER reporting
PRINT 63,8,RESULT	
PRINT 60,8,IND	

BUILT-IN TEST SEQUENCE PROGRAMS

TEST 38	Digital RSSI
PRINT 63,9,RESULT	
PRINT 60,9,IND	
JUMP 21	
LABEL 47	
TEST 3	Transmitter distortion and noise
PRINT 63,5,RESULT	
PRINT 60,5,IND	
TEST 4	Transmitter modulation limiting
PRINT 63,6,RESULT	
PRINT 60,6,IND	
TEST 32	Data deviation if included under system configuration
PRINT 63,7,RESULT	
PRINT 60,7,IND	
LABEL 20	
TEST 7	Receiver sensitivity if included under system configuration
PRINT 63,9,RESULT	
PRINT 60,9,IND	
LABEL 21	
PRINT ENABLE	Print results
PRINT BUFFER	
PRINT CLEAR	Clear buffer
PRINT DISABLE	
TEST 26	Clearing down from cell
PRINT 0,4,TITLE	
PRINT 17,4,STATUS	
PRINT 25,4,RESULT	
PRINT 40,2,"F = FAILURE, E = ERROR"	
STPCH	Low channel
TEST 36	Digital RF sensitivity if included under system configuration
PRINT 0,0,TITLE	
PRINT 23,0,RESULT	
PRINT 20,0,IND	
NXTCH	Middle channel
TEST 36	Digital RF sensitivity if included under system configuration
PRINT 43,0,RESULT	
PRINT 40,0,IND	
NXTCH	High channel
TEST 36	Digital RF sensitivity if included under system configuration
PRINT 63,0,RESULT	
PRINT 60,0,IND	
LABEL 23	
PRINT 25,8,"TEST SUMMARY:"	
PRINT 39,8,SUM	
PRINT ENABLE	
PRINT BUFFER	
JUMP 97	Common exit

COMPREHENSIVE TESTING SEQUENCE (D-AMPS ONLY)

GOSUB 40	Put up heading and prepare buffer
PRINT 3,1,"COMPREHENSIVE TESTING"	
GOSUB 50	Common registration and output buffer
GOSUB 60	Common test routines
JOD 54	Skip if digital channel
TEST 29	Analog data performance (once only)
LABEL 54	
RPTCH	First to last voice/traffic channel
PRINT CLEAR	Clear buffer
GOSUB 1	Print one blank line
PRINT " NEW VOICE CHANNEL"	Print heading
PRINT " -----"	
TEST 23	Handoff from current to chosen voice/traffic channel
JOF 99	Next channel if handoff failed
JOE 99	Next channel if error
GOSUB 25	SAT/DSAT/DVCC transponding and SAT/DSAT deviation
JOD 55	Skip if digital channel
TEST 25	SAT frequency
JUMP 56	
LABEL 55	Speech loopback if digital channel
TEST 37	
PAR 28,1,10	Transmitter RF power parameters
TEST 28	Transmitter RF power level 10
TEST 9	DC power, level 10
PAR 28,1,9	Transmitter RF power parameters
TEST 28	Transmitter RF power level 9
TEST 9	DC power, level 9
PAR 28,1,8	Transmitter RF power parameters
TEST 28	Transmitter RF power level 8
TEST 9	DC power, level 8
LABEL 56	
PAR 28,1,7	Transmitter RF power parameters
TEST 28	Transmitter RF power level 7
TEST 9	DC power, level 7
PAR 28,1,6	Transmitter RF power parameters
TEST 28	Transmitter RF power level 6
TEST 9	DC power, level 6
PAR 28,1,5	Transmitter RF power parameters
TEST 28	Transmitter RF power level 5
TEST 9	DC power, level 5
PAR 28,1,4	Transmitter RF power parameters
TEST 28	Transmitter RF power level 4
TEST 9	DC power, level 4
PAR 28,1,3	Transmitter RF power parameters
TEST 28	Transmitter power level 3
TEST 9	DC power, level 3
PAR 28,1,2	Transmitter RF power parameters
TEST 28	Transmitter power level 2
TEST 9	DC power, level 2
PAR 28,1,1	Transmitter RF power parameters
TEST 28	Transmitter power level 1

BUILT-IN TEST SEQUENCE PROGRAMS

TEST 9	DC power, level 1
PAR 28,1,0	Transmitter RF power parameters
TEST 28	Transmitter power level 0
TEST 9	DC power, level 0
TEST 2	Transmitter RF frequency
JOD 58	Skip if digital channel
PAR 3,1,23,26dB	Transmitter distortion and noise parameters
TEST 3	Transmitter distortion and noise
PAR 3,1,56,300Hz	Transmitter residual noise parameters
TEST 3	Transmitter residual noise
LABEL 96	
TEST 4	Transmitter modulation limiting
TEST 5	Transmitter modulation compression
TEST 32	Data deviation if included under system configuration
LABEL 22	
TEST 7	Receiver sensitivity if included under system configuration
TEST 8	Receiver demodulation expansion
JUMP 57	
LABEL 58	
PAR 35,1,0,12.5%	RMS vector error parameters
TEST 35	RMS vector error
PAR 35,1,1,25%	First 10 symbols parameters
TEST 35	First 10 symbols
PAR 35,1,2,-19.99dB	Origin offset parameters
TEST 35	Origin offset
TEST 29	BER reporting
TEST 38	Digital RSSI
LABEL 57	
NXTCH	Next channel
GOSUB 2	Print two blank lines
TEST 26	Clearing down from cell
TEST 9	DC power, quiescent
RPTCH	Next channel
PAR 36,1,0,3%,-110dBm	Digital RF sensitivity parameters
TEST 36	Digital RF sensitivity
PAR 36,1,2,3%,-103dBm	Digital RF sensitivity parameters
TEST 36	Digital RF sensitivity (2-Ray)
NXTCH	Next channel
JUMP 98	Common exit

COMMON SUBROUTINES

Subroutines 0 to 3

LABEL 3	Print three blank lines
PRINT ""	
LABEL 2	Print two blank lines
PRINT ""	
LABEL 1	Print one blank line
PRINT ""	
LABEL 0	
RETURN	

Subroutine 25

LABEL 25	
PAR 25,1,1,20%	SAT or DSAT deviation parameters
TEST 25	SAT/DSAT/DVCC transponding and SAT/DSAT deviation
PAR 25,1,2,10Hz	SAT or DSAT frequency parameters
RETURN	

Subroutine 40

LABEL 40	Heading and prepare buffer
PRINT "MARCONI INSTRUMENTS AMPS CELLULAR RADIO TEST SYSTEM"	
PRINT "-----"	
GOSUB 1	Print one blank line
DEF	Default parameters
PRINT CLEAR	Clear buffer
RETURN	

Subroutines 50 to 52

LABEL 50	
PRINT DISABLE	
TEST 20	Registration of mobile on control channel
PRINT 2,7,"DATE:....."	
PRINT 40,7,"TESTER:....."	
JOP 51	Skip if passed
PRINT 3,4,"*** REGISTRATION FAILED ***"	
JUMP 52	

LABEL 51	
PRINT 3,3,"ESN:"	
PRINT 8,3,ESN	
PRINT 3,5,"MIN:"	
PRINT 8,5,MIN	

LABEL 52	
PRINT ENABLE	
PRINT BUFFER	
PRINT CLEAR	Clear buffer
RETURN	

BUILT-IN TEST SEQUENCE PROGRAMS

Subroutines 60 to 63

LABEL 60	
STPCH	First voice/traffic channel
REPEAT 2	Two attempts
TEST 22	Call from mobile to cell
JOP 61	Skip if passed
NEXT	
PRINT "***SOME TESTS ABORTED***"	
JUMP 62	Skip next test(s) if failed
LABEL 61	Tests requiring user intervention
TEST 30	DTMF tones
TEST 31	Hook flash
JOA 63	Jump if analog channel
TEST 37	Speech loopback
LABEL 63	
TEST 27	Clearing down from mobile
LABEL 62	
REPEAT 2	Two attempts
TEST 21	Call from cell to mobile
JOP 0	Skip if passed
NEXT	Else try again
RETURN	

Subroutine 95

LABEL 95	Exit
GOSUB 1	Print one blank line
PRINT CLEAR	Clear buffer
PRINT 40,0,"F = FAILURE, E = ERROR"	
PRINT LINE	

Subroutine 99

LABEL 99	Exit
GOSUB 2	Print two blank lines
TEST 26	Clearing down from cell

Subroutines 97 and 98

LABEL 98	Exit
GOSUB 3	Print three blank lines
PRINT CLEAR	Clear buffer
PRINT 25,0,"TEST SUMMARY:"	
PRINT 39,0,SUM	
PRINT LINE	
LABEL 97	Exit
PRINT "<FF>"	Print a form feed (0C hexadecimal)
END	

Chapter 4-6

SAMPLE PROGRAMS

USING A GPIB CONTROLLER

To use a typical controller for a user-defined test sequence with redefined test routine parameters, a sample program is given below. The 2957D or 2960D has to be in the remote CRTS mode.

SEQTTL 'USER DEFINED EXAMPLE'	Define test sequence title
LEARN	Enter learn mode to define sequence
GOSUB 40	Put up heading and clear buffer
PRINT 3,1,'CALL PROCESSING ONLY'	
GOSUB 50	Registration and output buffer
GOSUB 60	Common test routines
TEST 24	Automatic handoffs from first to last voice/traffic channels
JUMP 99	Then skip to common exit
LABEL 40	Put up heading/clear buffer routine
PRINT 'MARCONI INSTRUMENTS AMPS CELLULAR RADIO TEST SYSTEM'	
PRINT '-----'	
PRINT''	Blank line
DEF	Set default parameters
PRINT CLEAR RETURN	Clear buffer then return
LABEL 50	Do registration and output buffer
PRINT DISABLE	Disable printer
TEST 20	Registration of mobile on control channel
PRINT 2,7,'DATE:.....'	
PRINT 40,7,'TESTER:.....'	
JOP 51	Skip if passed
PRINT 3,4,'*** REGISTRATION FAILED ***'	
JUMP 52	Failed, so skip ESN print routine
LABEL 51	ESN and MIN print routine
PRINT 3,3,'ESN:'	
PRINT 8,3,ESN	
PRINT 3,5,'MIN:'	
PRINT 8,5,MIN	
LABEL 52	Print buffer routine
PRINT ENABLE PRINT BUFFER RETURN	Enable and print buffer then return
LABEL 60	Do common place call from mobile
VCH 300	Start at centre frequency
REPEAT 2	Make two attempts
TEST 22	Place call from mobile
JOP 61	Skip if passed
NEXT	Else try again
PRINT '*** CLEAR FROM MS ABORTED ***'	
JUMP 62	Miss next test if failed
LABEL 61	
TEST 30	DTMF tones
TEST 31	Hook flash
TEST 27	Clearing down from mobile
LABEL 62	Call from cell to mobile mobile
REPEAT 2	Make two attempts
TEST 21	

SAMPLE PROGRAMS

JOP 63	Skip if passed
NEXT	Else try again
LABEL 63 RETURN	
LABEL 99	Common exit point
PRINT CLEAR PRINT LINE PRINT LINE	Two blank lines
TEST 26	Clearing down from cell
LABEL 98	
PRINT LINE PRINT LINE PRINT LINE	Three blank lines
PRINT 25,0,'TEST SUMMARY:'	
PRINT 39,0,SUMMARY PRINT LINE	
PRINT '<FF>'	Print a form feed (use CHR\$ in BASIC)
END	End of test sequence

USING A PC-COMPATIBLE COMPUTER

A test program can be created as a text file using a PC-compatible computer. The program is then transferred to the 2957D or 2960D in learn mode using the GPIB or the RS-232 port. Once in memory or saved on disc, the computer can be disconnected and the test can be subsequently run on the 2957D or 2960D whenever it is required.

A sample program for a user-defined test sequence is given below. This is for a computer connected to the GPIB and using GPIB address 06 for the 2957D or 2960D.

When the program is subsequently RUN, the test sequence puts the mobile into CONVERSATION mode and then proceeds to execute four receiver tests on the mobile using a redefined set of limits.

10	! **RX TESTING**	
20	!	
30	DIM A\$[100]	Set maximum length of command A\$
40	REMOTE 706	Put 2957D or 2960D in GPIB remote mode
50	READ A\$	Read the DATA command
60	OUTPUT 706 USING "K";A\$	Send the command to the 2957D or 2960D
70	IF A\$ <> "END" THEN GOTO 50	If A\$ isn't END, go to line 40
80	GOTO 230	If it is, go to end of program
90	DATA TSI 4	Select user-defined test sequence
100	DATA "SEQTTL 'RECEIVER TESTING'"	Set the sequence title
110	DATA LEARN	Put 2957D or 2960D into learn mode
120	DATA TEST 20	Registration on control channel
130	DATA TEST 21	Call from cell to mobile
140	DATA PAR 7,2,-115dBm,,5.7kHz	Set TEST 7 parameters
150	DATA TEST 7	Measure receiver sensitivity
160	DATA PAR 6,1,12,5%,-107dBm	Set TEST 6 parameters
170	DATA TEST 6	Measure receiver distortion
180	DATA PAR 6,1,36,, -80dBm,5.7kHz	Redefine TEST 6 parameters
190	DATA TEST 6	Measure receiver S/N
200	DATA PAR 8,3,3%	Set TEST 8 parameters
210	DATA TEST 8	Measure receiver expansion
220	DATA END	End of learn mode
230	END	End of program

Chapter 5

ACCEPTANCE TEST SCHEDULE

DC POWER MEASUREMENT ACCURACY

DC meter

These tests are for voltage, current and power measurement accuracy.

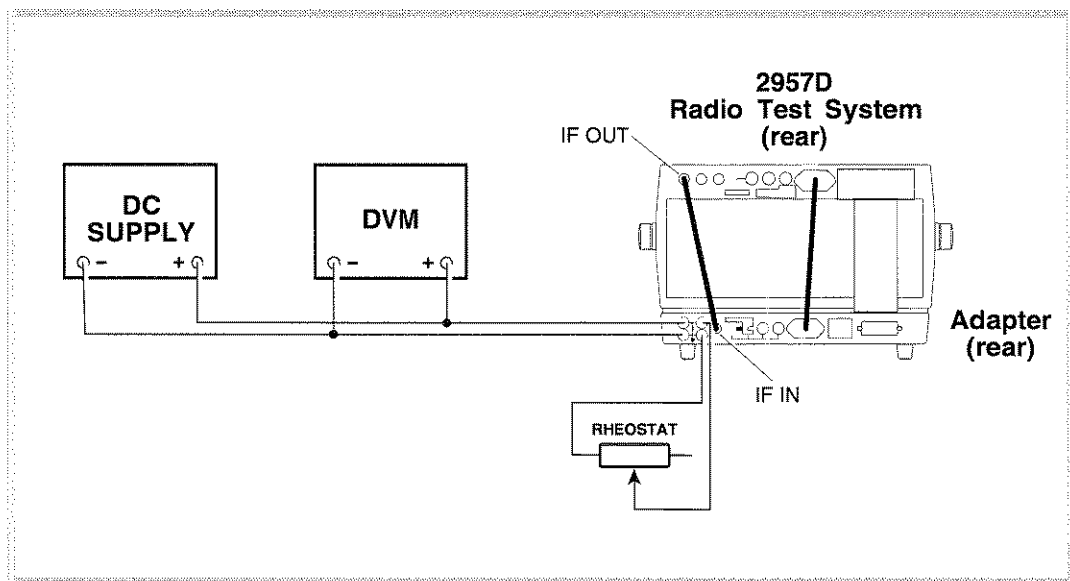
Specification:

Voltmeter	±5% ±100 mV at 1 to 25 V.
Ammeter	±5% ±200 mA at 0 to 10 A.
Power meter	±10% ±20 mW at 100 mW to 200 W.

Test equipment:

Description	Minimum specification	Example
DVM	DC volts: 1 M Ω , accuracy <0.5%	Solatron 7150+ or Datron 1065A
Rheostat	0 to 100 Ω . 10 A	Berco
DC power supply	0 to 25 V, 10 A	Farnell B30/10
DVM current shunt	10 A, 0.25% accuracy, sensitivity 10 mV/A	Fluke 80J-10

Test Procedure:



C1868

Fig. 5-1 Test equipment connections for DC meter test

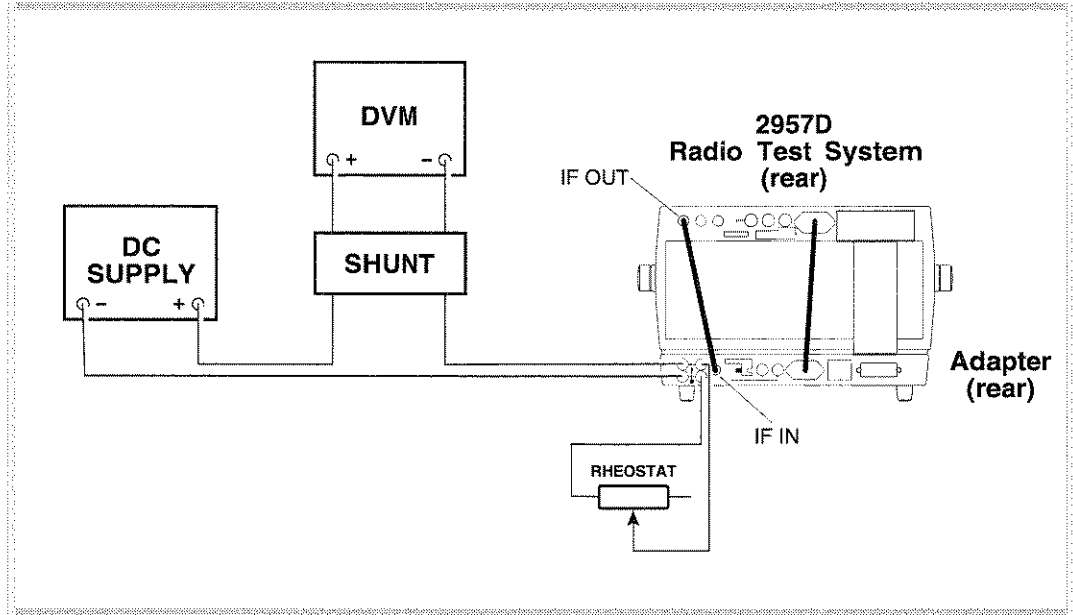
ACCEPTANCE TEST SCHEDULE

- (1) Connect the DC power supply to the Adapter's DC IN connectors, connect the DVM to the same connectors and connect the rheostat across the Adapter's DC OUT connectors as shown in Fig. 5-1.
- (2) Switch on the equipment and press the CRTS key.
- (3) When the instrument has completed its self-test, select MANUAL TEST.
- (4) Adjust the rheostat to give a load resistance of 10 Ω .
- (5) Set the DVM to read DC volts and then adjust the DC power supply to give approximately a 1 V reading on the DVM.
- (6) Check that the voltage displayed on the screen is within $\pm 5\%$ ± 100 mV of the voltage indicated on the DVM. Record the result on Table 5-1.
- (7) Check that the power reading displayed on the screen is equal to the current reading multiplied by the voltage reading.
- (8) Repeat for voltages between 2 V and 25 V as shown in Table 5-1.

Table 5-1 DC VOLTAGE MEASUREMENT

Nominal Voltage	DVM Reading	Screen Reading	Limits	PASS/FAIL
1			$\pm 5\%$	
2			$\pm 100\%$	
5				
10				
15				
20				
25				

- (9) Switch off the DC supply, disconnect the DVM and connect the current shunt across its inputs. Then reconnect the DVM in series with the positive supply as shown in Fig. 5-2. (Alternatively an Ammeter of suitable range and accuracy may be used.)



C1869

Fig. 5-2 Test equipment connections for DC meter test

- (10) Set the rheostat to give a load resistance of 5Ω .
- (11) Set the DC power supply to give an output of 10 V and switch it on.
- (12) Adjust the rheostat until the DVM indicates approximately 10.0 mV (1 A).
- (13) Check that the current reading displayed on the screen is within $\pm 5\%$ ± 200 mA of the current indicated on the DVM. (Every 10 mV displayed on the DVM is equivalent to 1 A.) Record the result on Table 5-2.
- (14) Using the rheostat to adjust the current, repeat for DC levels on the DVM from 2 mV to 100 mV (2 A to 10 A).

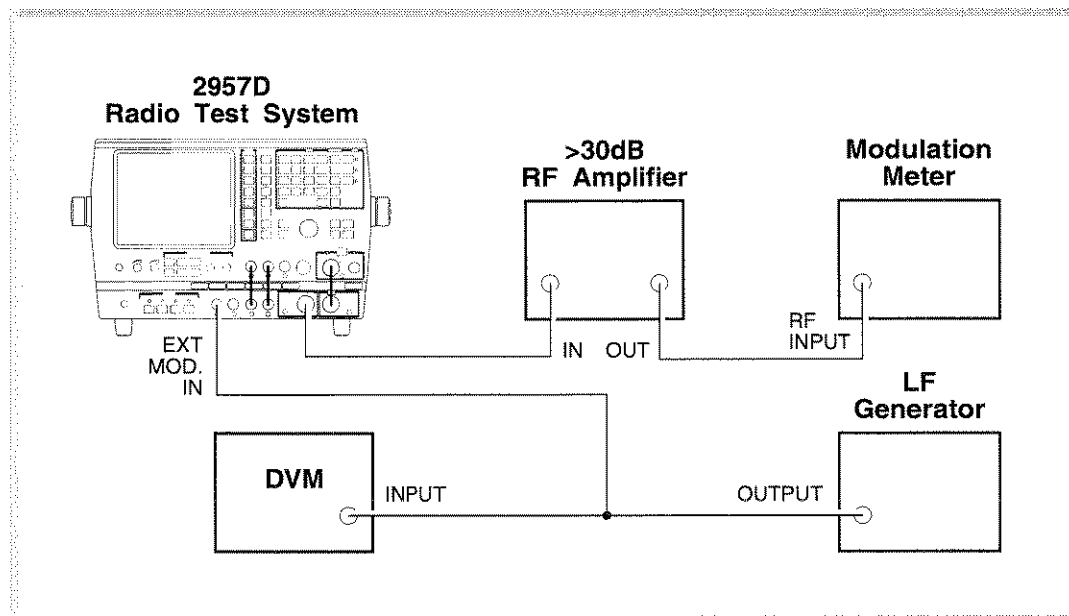
Table 5-2 DC CURRENT MEASUREMENT

Nominal Current	DVM (Ammeter) Reading	Screen Reading	Limits	PASS/FAIL
2A			$\pm 5\%$	
4A			± 200 mA	
6A				
8A				
10A				

Test equipment:

Description	Minimum specification	Example
Modulation meter	300 Hz to 3.4 kHz filter, LF output, measurement accuracy <2%	Marconi 2305
Synthesized LF generator	1 kHz, 0.5 V pk-pk	R & S SPN or HP 3325
DVM	AC: RMS accuracy <0.5%,	Solatron 7150+ or Datron 1065A
RF Amplifier	30 dB gain minimum at 880 MHz	

Test Procedure:



C1870

Fig. 5-3 Test equipment connections for external modulation test

- (1) Connect the LF Generator to the Adapter's EXT MOD INPUT socket and the DVM and connect the 2957D RF IN/OUT socket to the RF Amplifier input and the RF Amplifier output to the modulation meter input socket as shown in Fig. 5-3.
- (2) Select Manual Test mode. (If D-AMPS is not selected, it should be selected by pressing the CRTS key then pressing the following soft keys. FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS. The SELECT soft key may now be used to select D-AMPS. Return to Manual Test by pressing CRTS then MANUAL TEST.

ACCEPTANCE TEST SCHEDULE

- (3) Select Channel 334 Analog using the CHANNEL soft key if necessary.
- (4) Use the CHANGE soft key to set Data Level to 0 kHz and Gen Level to -50 dBm.
- (5) Turn the modulation meter to 880.02 MHz and select the 300 to 3.4 kHz filter.
- (6) Set the LF signal generator to give a reading of 176.7 mV on the DVM. (Equivalent to 500 mV pk-pk.)
- (7) Check that the modulation meter reads 5 kHz deviation $\pm 10\%$. Record the result.

Table 5-5 EXTERNAL MODULATION SENSITIVITY (D-AMPS)

Input Signal	Measured Deviation	Limits	PASS/FAIL
500 mV pk-pk		5 kHz $\pm 10\%$	

- (8) Press the CRTS key then the following soft keys FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS. Use SELECT soft key to select E-AMPS by repeated operation until E-AMPS appears. Now press the CRTS key and select MANUAL TEST using the appropriate soft key.
- (9) Select Channel 334 using the CHANNEL soft key if necessary.
- (10) Use the CHANGE soft key to set the Data LEVEL TO 0 kHz.
- (11) Press the 2955 key followed by RF GEN, LEVEL, -50, DBM.
- (12) Check that the modulation meter reads 5 kHz duration $\pm 10\%$. Record the result.

Table 5-6 EXTERNAL MODULATION SENSITIVITY (E-AMPS)

Input Signal	Measured Deviation	Limits	PASS/FAIL
500 mV pk-pk		5 kHz $\pm 10\%$	

PSOPHOMETRIC FILTER - C-MESSAGE

Specification:

C-message response	60 Hz	55.7 ±2 dB.
	100 Hz	42.5 ±2 dB.
	200 Hz	25.0 ±2 dB.
	300 Hz	16.5 ±1 dB.
	400 Hz	11.4 ±1 dB.
	500 Hz	7.5 ±1 dB.
	600 Hz	4.7 ±1 dB.
	700 Hz	2.7 ±1 dB.
	800 Hz	1.5 ±1 dB.
	900 Hz	0.6 ±1 dB.
	1 kHz	0 reference.
	1.2 kHz	0.2 ±1 dB.
	1.3 kHz	0.5 ±1 dB.
	1.5 kHz	1.0 ±1 dB.
	1.8 kHz	1.3 ±1 dB.
	2.0 kHz	1.3 ±1 dB.
	2.5 kHz	1.4 ±1 dB.
	2.8 kHz	1.9 ±1 dB.
	3.0 kHz	2.5 ±1 dB.
	3.3 kHz	5.2 ±2 dB.
	3.5 kHz	7.6 ±2 dB.
	4.0 kHz	14.5 ±3 dB.
	4.5 kHz	21.5 ±3 dB.
	5.0 kHz	28.5 ±3 dB.
	Attenuation to increase thereafter	
	12 dB/octave up to 60 dB.	

Test equipment:

Description	Minimum specification	Example
Synthesized LF generator	50 Hz to 5 kHz, 2 V RMS	R & S SPN or HP 3325
DVM	AC: RMS accuracy <0.5%, DC volts: 1 MΩ, accuracy <0.5%	Solatron 7150+ or Datron 1065A

ACCEPTANCE TEST SCHEDULE

Test Procedure:

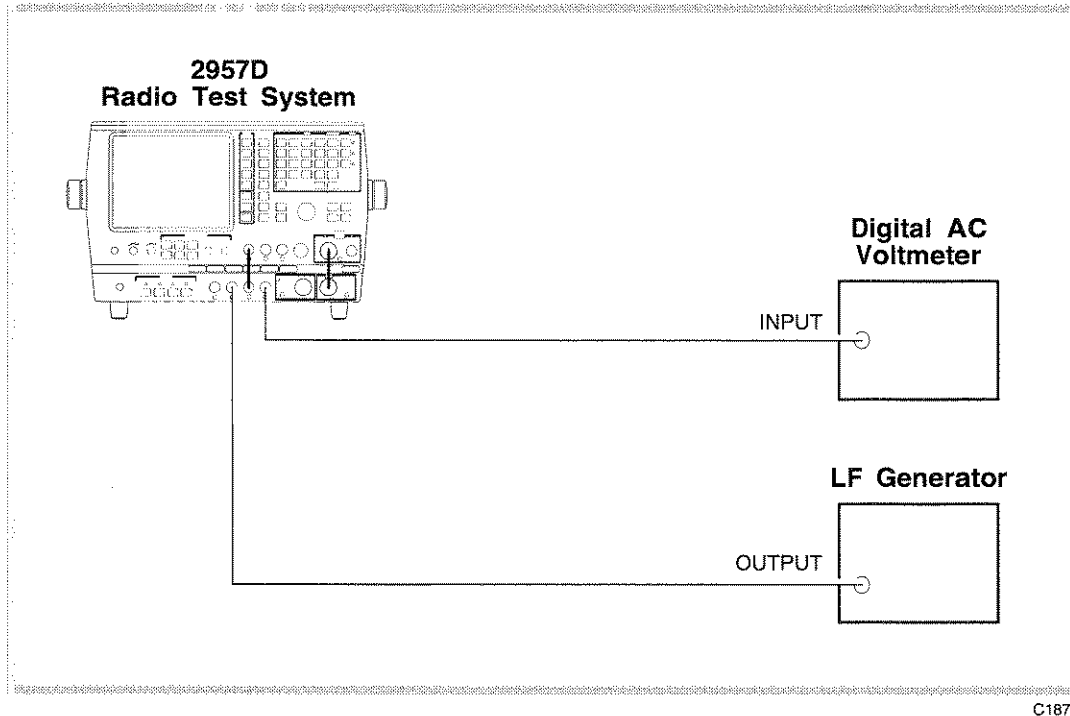


Fig. 5-4 Test equipment connections for psophometric filter test

- (1) Connect the LF synthesizer output socket to the Adapter's AF INPUT socket and connect the Adapter's AF OUT socket to the DVM input socket as shown in Fig. 5-4.
- (2) From MANUAL TEST press CRTS key once, then the 2955 key.
- (3) Set the LF generator to give a 1 kHz sinewave at 2 V RMS.
- (4) Set the DVM to monitor AC voltage.
- (5) Note the reading on the DVM (reading 1).
- (6) Press the PSOH/LOCAL key and check that the LED above this key and that above the 2955 key are both on.
- (7) Note the reading on the DVM (reading 2). This reading should be approximately 2 V.
- (8) Check that reading 2 is within 6% of reading 1.
- (9) With the LF generator at 1 kHz, adjust the LF generator output level until the DVM reads 2.000 V. This sets the reference at 1 kHz.
- (10) Set the LF generator to each of the frequencies given in Table 5-7 and check that the DVM readings fall within the limits given in the right-hand column.

TABLE 5-7 C-MESSAGE FILTER RESPONSE

Frequency Hz	Measured Volts	Limits (Volts)	Pass/Fail
90		0.00968 to 0.01535	
200		0.0893 to 0.1416	
300		0.2667 to 0.3358	
400		0.47946 to 0.60399	
500		0.7516 to 0.9463	
600		1.037 to 1.3063	
700		1.3063 to 1.6445	
800		1.4998 to 1.888	
900		1.6635 to 2.094	
1000		Reference	
1200		1.7419 to 2.193	
1300		1.4998 to 2.1185	
1500		1.5886 to 2.0000	
1800		1.5347 to 1.932	
2000		1.5347 to 1.932	
2500		1.517 to 1.91	
2800		1.432 to 1.803	
3000		1.336 to 1.683	
3300		0.873 to 1.384	
3500		0.662 to 1.0496	
4000		0.2667 to 0.532	
4500		0.119 to 0.2377	
5000		0.0532 to 0.1062	

PSOPHOMETRIC FILTER - CCITT

This test applies to 2960D only.

Specification:

CCITT response	50 Hz to 300 Hz	±2 dB.
(Recommendation P53)	300 Hz to 800 Hz	±1 dB.
	800 Hz reference	±0 dB ±0.2 dB.
	800 Hz to 3 kHz	±1 dB.
	3 kHz to 3.5 kHz	±2 dB.
	3.5 kHz to 5 kHz	±3 dB.

- (1) Press the CRTS key and select any system except AMPS i.e. TACS NMT or Band 3.
- (2) Press the 2955 key.
Using the test equipment as shown in Fig. 5-4.
- (3) Set the LF synthesizer to give an 800 Hz sinewave at 2 V RMS.
- (4) Set the DVM to monitor AC voltage.
- (5) Note the reading on the DVM (reading 1).

ACCEPTANCE TEST SCHEDULE

- (6) Press the PSOH/LOCAL key and check that the LED above this key and that above the 2955 key are both on.
- (7) Note the reading on the DVM (reading 2). This reading should be approximately 2 V.
- (8) Check that reading 2 is within 6% of reading 1.
- (9) With the LF generator at 800 Hz, adjust the LF generator output level until the DVM reads 2.000 V. This sets the reference at 800 Hz.
- (10) Set the LF generator to each of the frequencies given in Table 5-8 and check that the DVM readings fall within the limits given in the right-hand column.

TABLE 5-8 CCITT FILTER RESPONSE

Frequency Hz	Measured Volts	Limits (Volts)	Pass/Fail
150		0.05637 to 0.08934	
200		0.14159 to 0.2244	
300		0.4688 to 0.7430	
400		0.863 to 1.0865	
500		1.1777 to 1.4826	
600		1.4159 to 1.7825	
800		Reference	
1000		2.000 to 2.5179	
1200		1.7825 to 2.244	
1500		1.5347 to 1.9321	
2000		1.4159 to 1.7825	
2500		1.099 to 1.3837	
3000		0.8337 to 1.3214	
3500		0.5970 to 0.9463	
4000		0.2518 to 0.5024	
5000		0.02244 to 0.0448	

SAT GENERATOR

Distortion

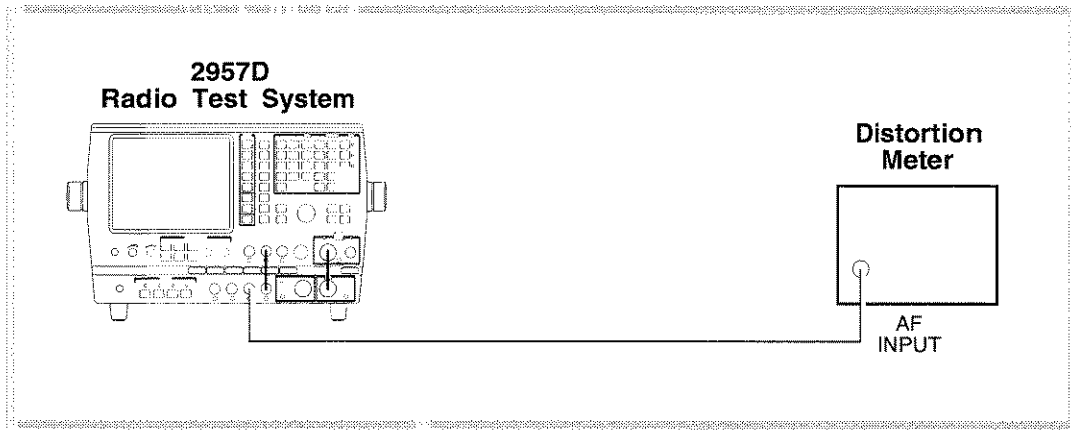
Specification:

SAT generator distortion Less than 2% at 4 kHz \pm 45 Hz,
less than 2% at 6 kHz \pm 30 Hz.

Test equipment:

Description	Minimum specification	Example
Distortion meter	3 to 8 kHz, measuring capability <0.2%	Marconi TF 2331A or HP 8903

Test Procedure:



C1872

Fig. 5-5 Test equipment connections for SAT generator distortion test

- (1) Select Manual Test with the AMPS system selected. Select D-AMPS if not already selected. (To select D-AMPS from Manual Test, press the CRTS key then press the following soft keys FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS. Press SELECT soft key repeatedly until D-AMPS is displayed on the screen. Return to Manual Test by pressing CRTS key then MANUAL TEST.)
- (2) Select Channel 334 Analog using the CHANNEL soft key if necessary.
- (3) Using the MODE soft key select DATA OFF.
- (4) Using the CHANGE soft key and the data keypad, set the SAT frequency to the first of the following frequencies:-

System	SAT frequencies
AMPS	5970, 6000, 6030 Hz

- (5) Also use the CHANGE soft key to set the SAT limit to 2.5 kHz
- (6) Connect the Adapter's MOD O/P socket to the distortion meter input as shown in Fig. 5-5.
- (7) Measure the distortion, checking that it is within 2%. (If the 2331A distortion meter is used, the reference should be set on the 10% range due to the low level of output from the Adapter's MOD O/P socket.)
- (8) Repeat for the other SAT frequencies.

Table 5-9 SAT GENERATOR DISTORTION

Frequency	Distortion	Limits	PASS/FAIL
5970 Hz		<2%	
6000 Hz			
6030 Hz			

ACCEPTANCE TEST SCHEDULE

Instruction 9 to 14 apply to 2960D only.

- (9) If NMT system is installed, select Manual Test with the NMT system selected. Otherwise proceed to next section.
- (10) Use the MODE soft key to select DATA OFF.
- (11) Using the CHANGE key and the data keypad, set the SAT frequency to the first of the following frequencies:

System	SAT frequencies
NMT	3955, 3985, 4015, 4045 Hz

- (12) Also use the CHANGE soft key to set the SAT Level to 2.5 kHz.
- (13) Measure the distortion, checking that it is within 2%. (If the 2331A distortion meter is used, the reference should be set on the 10% range due to the low level of output from the Adapter's MOD O/P socket.)
- (14) Repeat for the other SAT frequencies.

Table 5-10 SAT GENERATOR DISTORTION

Frequency	Distortion	Limits	PASS/FAIL
3955 Hz		<2%	
3985 Hz			
4015 Hz			
4045 Hz			

Deviation accuracy

Specification:

Deviation accuracy ±10% for deviations of 300 Hz to 2.5 kHz at system frequencies (3.955 kHz to 4.045 kHz and 5.970 kHz to 6.030 kHz).

Test equipment:

Description	Minimum specification	Example
Counter/timer	Frequency measurement accuracy 0.1 Hz	Marconi 2437
Modulation meter	RF in up to 1000 MHz FM, noise averaging, 50 Hz to 15 kHz filter, LF output	Marconi 2305
RF Amplifier	30 dB gain minimum at 880 MHz	

Test Procedure:

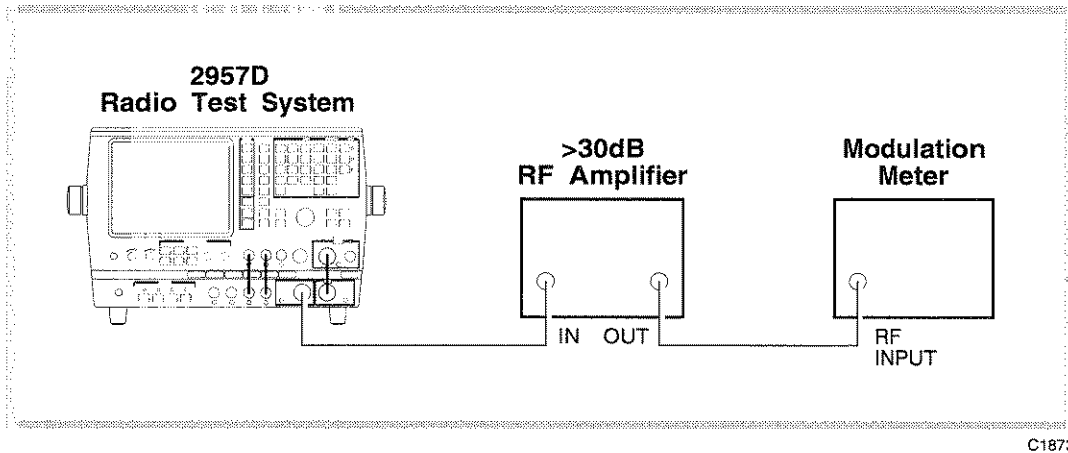


Fig. 5-6 Test equipment for SAT frequency and deviation tests

- (1) Connect the 2957D RF IN/OUT N socket to the modulation meter RF input socket and connect the counter/timer to the modulation meter LF output socket as shown in Fig. 5-6.
- (2) Select Manual Test with the AMPS system selected. D-AMPS should be selected. (If D-AMPS is not selected, it should be selected by pressing the CRTS key, then pressing the following soft keys FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS. The SELECT soft key may now be used to select D-AMPS. Return to Manual Test by pressing CRTS key the MANUAL TEST.
- (3) Using the CHANNEL soft key select Channel 334 Analog if necessary.
- (4) Using the Mode soft key select DATA OFF.
- (5) Using the CHANGE soft key, set the Gen. Level to -50 dBm
Hint: The CHANGE soft key needs pressing four times for the Gen. Level to be displayed on screen.
- (6) Manually tune the modulation meter to 880.02 MHz.
- (7) Set the modulation meter to monitor FM noise averaged in a 50 Hz to 15 kHz bandwidth.
- (8) Using the CHANGE soft key check the deviation for the SAT frequencies shown in Table 5-11.

Table 5-11 SAT DEVIATION D-AMPS

SAT Frequency	Measured Deviation	Limits	PASS/FAIL
5970 Hz		2 kHz $\pm 10\%$	
6000 Hz			
6030 Hz			

ACCEPTANCE TEST SCHEDULE

- (9) Now select E-AMPS by the following procedure:-
Press CRTS key then the following soft keys FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS then use the SELECT soft key to select E-AMPS. Return to Manual Test by pressing the CRTS key, followed by MANUAL TEST.
- (10) Use the CHANNEL soft key to select channel 334 if necessary.
- (11) Use the CHANGE soft key to a SAT frequency of 5970 Hz if necessary.
- (12) Use the MODE soft key to select DATA OFF.
- (13) Press the 2955 key then use the RF GEN key and the LEVEL key to set the RF Level to -50 dBm.
- (14) Check the deviation on the modulation meter and record the result on Table 5-12.
- (15) Press CRTS and use the SELECT soft key to set a SAT Frequency of 6000 Hz.
- (16) Repeat instructions (13) and (14).
- (17) Press CRTS and use the SELECT soft key to set a STA Frequency of 6030 Hz.
- (18) Repeat instructions (13) and (14).

Table 5-12 SAT DEVIATION E-AMPS

SAT Frequency	Measured Deviation	Limits	PASS/FAIL
5970 Hz		2 kHz $\pm 10\%$	
6000 Hz			
6030 Hz			

Frequency

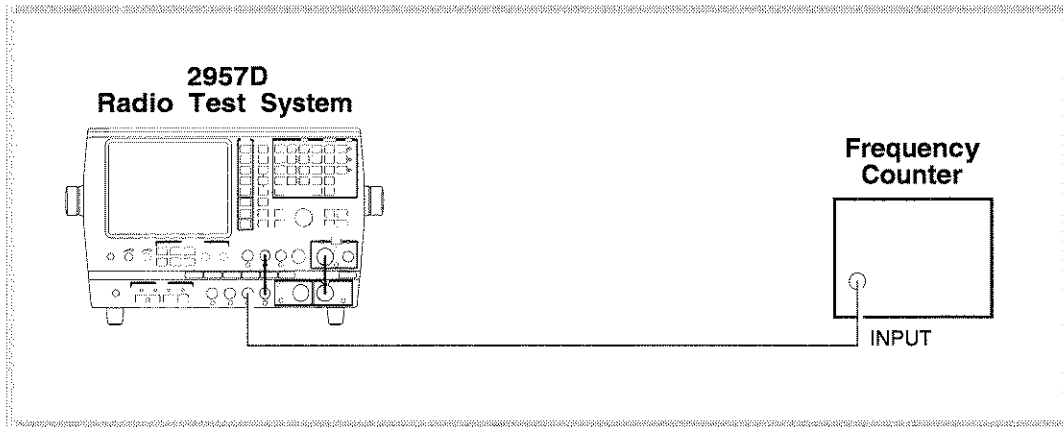
Specification:

Frequency accuracy ± 1 Hz (3 to 8 kHz)

Test equipment:

Description	Minimum specification	Example
Counter/timer	Period measurement accuracy <5 parts/ 10^6	Marconi 2437

Test Procedure:



C1874

Fig. 5-7 Test equipment connections for SAT frequency tests

- (1) Select Manual Test with the AMPS system selected.
- (2) Using the MODE soft key select DATA OFF.
- (3) Using the CHANGE soft key and the data keypad, set the SAT frequency to the first of the following frequencies:-
3000 Hz, 4000 Hz, 6000 Hz, 8000 Hz
- (4) Also use the CHANGE soft key to set SAT Level to 2 kHz if necessary.
- (5) Connect the Adaptor's MOD O/P socket to the Frequency counter input as shown in Fig. 5-7.
- (6) Measure the frequency (using the Hz range on the 2437). The result shall be within 1 Hz of the selected SAT frequency.
- (7) Repeat for the other SAT frequencies.

Table 5-13 SAT FREQUENCIES (AMPS)

SAT Frequency	Measured Frequency	Limits	PASS/FAIL
3000 Hz		±1 Hz	
4000 Hz			
6000 Hz			
8000 Hz			

SAT MEASUREMENT - AMPS

Specification:

Accuracy

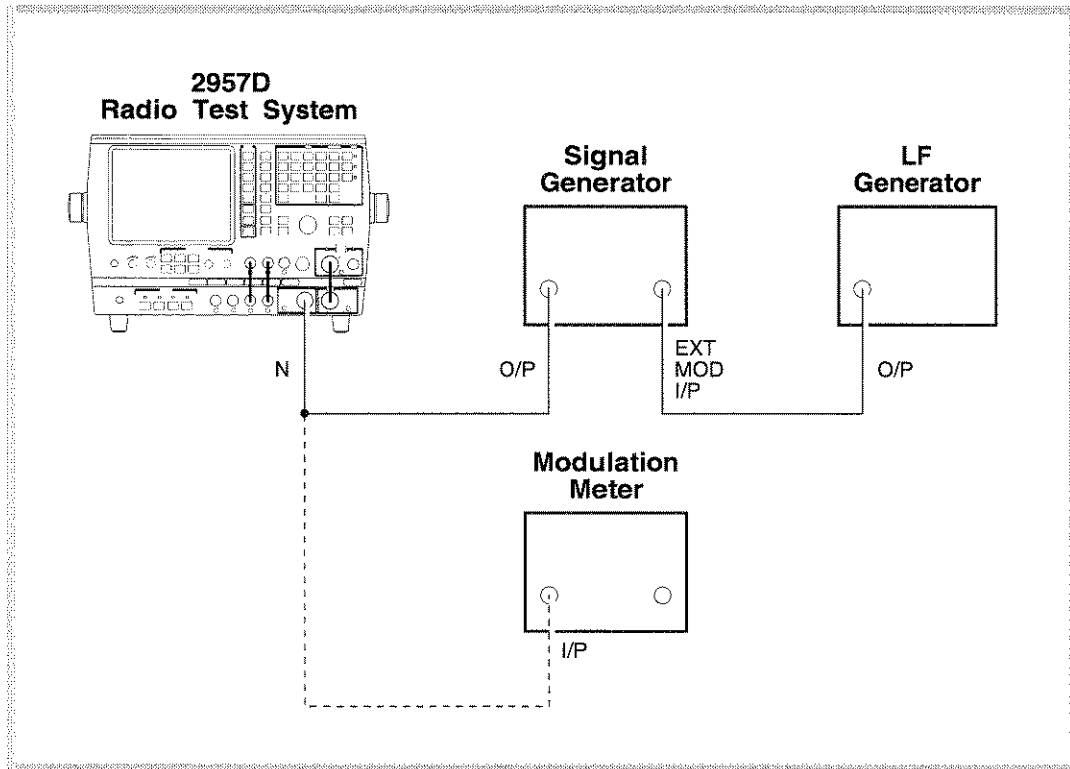
±10% at nominal system SAT frequencies and level.

ACCEPTANCE TEST SCHEDULE

Test equipment:

	Description	Minimum specification	Example
	Modulation meter	400 to 1000 MHz FM, noise averaging, 50 Hz to 15 kHz filter, measurement accuracy <2%	Marconi 2305
either	Signal generator	450 to 1000 MHz, 13 dBm, external FM capability	Marconi 2019A
	Synthesized LF generator	0 to 7 kHz, 1 V RMS	R & S SPN or HP 3325
or	Signal generator	450 to 1000 MHz 13 dBm full internal FM capability	Marconi 2030 or 2040 series

Test Procedure:



C1875

Fig. 5-8 Test equipment for SAT measurement test

Note...

The Adapter measures SAT deviation in a very narrow bandwidth centred on the SAT frequency. Independent filters of this characteristic are not generally available. Therefore, the test method is written around a good quality modulation meter with an internationally recognised filter bandwidth and noise averaging selected.

- (1) Connect the LF generator output socket to the signal generator external modulation input socket and connect the signal generator output socket to the modulation meter input socket as shown in Fig. 5-8.
- (2) Set the LF generator to give an output of 6000 Hz at a level suitable for the signal generator being used.
- (3) Set the signal generator to a frequency of 835.020 MHz with a deviation of 2 kHz. Set the RF Level to 13 dBm.
- (4) Set the modulation meter to monitor FM in a 50 Hz to 15 kHz bandwidth with noise average selected.
- (5) Note the deviation displayed on the modulation meter.
- (6) Switch on the Adapter and press the CRTS key. When the equipment has completed its self-test, check that the correct system is selected (i.e. AMPS or TACS).
- (7) Select MANUAL TEST. Ensure that Channel 334 is selected. Use the CHANGE soft key to select Channel 334 if necessary.
- (8) Use the MODE soft key to select DATA OFF.
- (9) Connect the signal generator output to the 2957D RF IN/OUT N socket.
- (10) Check that SAT appears in reverse on the screen and that the SAT Level displayed is within $\pm 10\%$ of the deviation noted on the modulation meter.
- (13) Repeat for LF generator frequencies of 5970 and 6030 Hz.

Table 5-14 SAT MEASUREMENT AMPS

SAT Frequency	Modulation Meter Deviation	2957D Deviation	Limits	PASS/FAIL
5970 Hz			$\pm 10\%$	
6000 Hz				
6030 Hz				

Note...

The following procedure applies to 2960D only if fitted with NMT option.

- (12) Following a similar procedure to the AMPS test, connect the LF generator output socket to the signal generator external modulation input socket and connect the signal generator output socket to the modulation meter input socket as shown in Fig. 5-8.
- (13) Set the LF generator to give an output of 4.015 kHz at a level suitable for the signal generator being used.
- (14) Set the signal generator to a frequency of 893.3625 MHz (NMT-900), 300 Hz deviation, RF Level 13 dBm.

ACCEPTANCE TEST SCHEDULE

- (15) Set the modulation meter to monitor FM in a 50 Hz to 15 kHz bandwidth with noise average selected.
- (16) Note the deviation displayed on the modulation meter. Press the CRTS key. Select the NMT system. When the equipment has completed its self-test, check that NMT-900 system type is selected. If not, press the following soft keys FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS. Use the SELECT soft key to select NMT-900. Press CRTS to return.
- (17) Select Manual Test. Ensure that Channel 135 is selected. Use the CHANGE soft key to select Channel 334 if necessary.
- (18) Use the MODE soft to select DATA OFF.
- (19) Connect the signal generator output to the 2957D RF IN/OUT N socket.
- (20) Check that ON appears in reverse on the screen and that the SAT Level displayed is within $\pm 10\%$ of the deviation noted on the modulation meter.
- (13) Repeat for LF generator frequencies of 3955, 3985 and 4045 Hz.

Table 5-15 SAT MEASUREMENT NMT

SAT Frequency	Modulation Meter Deviation	2957D Deviation	Limits	PASS/FAIL
3955 Hz			$\pm 10\%$	
3985 Hz				
4015 Hz				
4045 Hz				

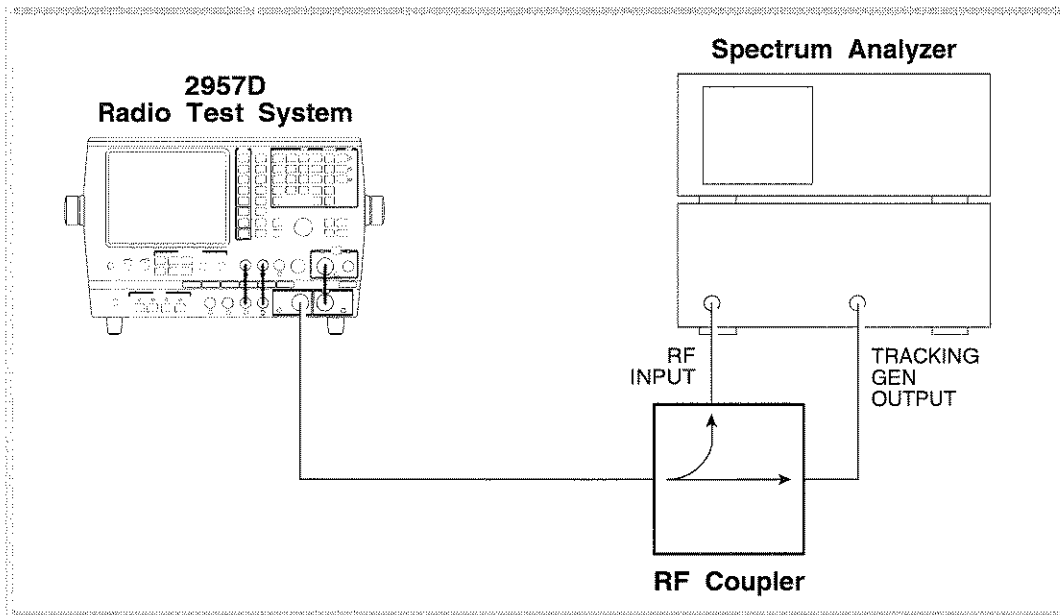
RF INPUT VSWR

Specification: VSWR <1.35

Test equipment:

Description	Minimum specification	Example
Spectrum Analyzer with Tracking	On screen limit < ± 0.3 dB	Marconi 2383
N-type RF Coupler	Coupling Factor ≈ 20 dB	

Test Procedure:



C1876

Fig. 5-9 Test equipment connections for RF Input VSWR

- (1) Connect the RF Coupler to the Spectrum Analyzer as shown in Fig. 5-9. The reverse (reflected) power coupling port is connected to the RF Input of the Spectrum Analyzer.
- (2) Set the Spectrum Analyzer to sweep between 800 and 900 MHz (Centre Frequency 850 MHz, Span/Div 10 MHz). Turn the Tracking Generator on.
- (3) Leaving the RF load port of the RF Coupler open circuit, normalize the response on the Spectrum Analyzer screen. (The NORMALIZE key on the 2383 will achieve this.)
- (4) Connect the RF Coupler to the 2957D RF In/Out N-type connector.
- (5) Turn off the 2957D and its associated 2955.
- (6) Check that the level displayed on the Spectrum Analyzer is 16 dB or more less than the level observed with the open circuit in the band 800 - 900 MHz.

Table 5-16 REFLECTED POWER

Limits	PASS/FAIL
<-16 dB w.r.t. reference	

ACCEPTANCE TEST SCHEDULE

RF POWER MEASUREMENT

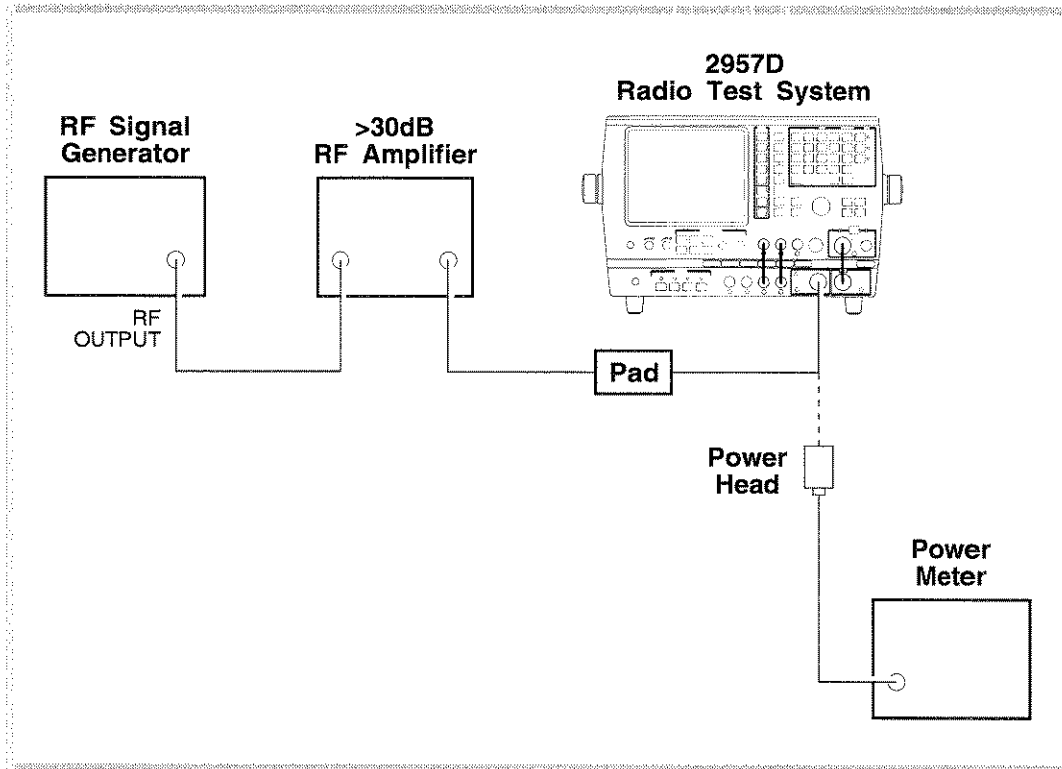
This test is for 2957D RF power measurement accuracy.

Specification: ± 0.7 dB

Test equipment:

Description	Minimum specification	Example
RF Signal Generator	824 MHz to 894 MHz 13 dBm	Marconi 2019A Marconi 2030 or 2040 series
RF Power Meter and Power Head	2% overall accuracy Measurement range -20 dBm to +20 dBm	Marconi 6960B and 6910 series Power Head
RF Amplifier	Max. O/P Power 1 W Gain >30 dB 824 MHz to 894 MHz	Amplifier Research 1 W 1000
10 dB RF Attenuator	Power Rating 1 W Maximum VSWR 1.1 824 MHz to 894 MHz	

Test Procedure:



C1877

Fig. 5-10 Test equipment connections for RF power measurement test

- (1) Connect the RF Signal Generator to the amplifier input. The amplifier output should be connected via the 10 dB pad to the Power Meter.
- (2) Set the RF Signal Generator to 880.02 MHz and adjust the RF Level until the Power Meter reads 20 dBm.
- (3) Disconnect the pad from the Power Meter and connect to RF In/Out N-type connector on the 2957D.
- (4) Select the AMPS system. Check that the D-AMPS system type is selected. If not, select D-AMPS by pressing the following soft keys FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS. Use the SELECT soft key to select D-AMPS. Press CRTS to return.
- (5) Press the following soft keys FULL AUTO TEST, CHANGE FORMAT, PAGE 2. Then press the HELP key followed by the TX key. This brings the **EDIT MEMORY MENU** on screen.
- (6) Use the appropriate CHANGE soft key to enter address EO6A. The numerical keys and the oscilloscope keys are used for this as shown on screen when the CHANGE soft key is pressed.
- (7) Use the appropriate CHANGE soft key to enter data 40.
- (8) Press CRTS and select MANUAL TEST. Ensure that Channel 334 Analog is selected. If not select this using the CHANGE soft key.
- (9) Use the MODE soft key to select DATA OFF.
- (10) Read the AGC Power in the box on screen.
- (11) Repeat step (1), (2), (3) and (10) except set the power level as read on the Power Meter to 10 dBm.

Table 5-17 RF Power Measurement Accuracy

Power Level	Reading	Upper Limit	Lower Limit	PASS/FAIL
20 dBm		112 mW	89.1 mW	
10 dBm		11.2 mW	8.91 mW	

- (12) Repeat steps (5) and (6).
- (13) Use the appropriate CHANGE soft key to enter data 00.

ACCEPTANCE TEST SCHEDULE

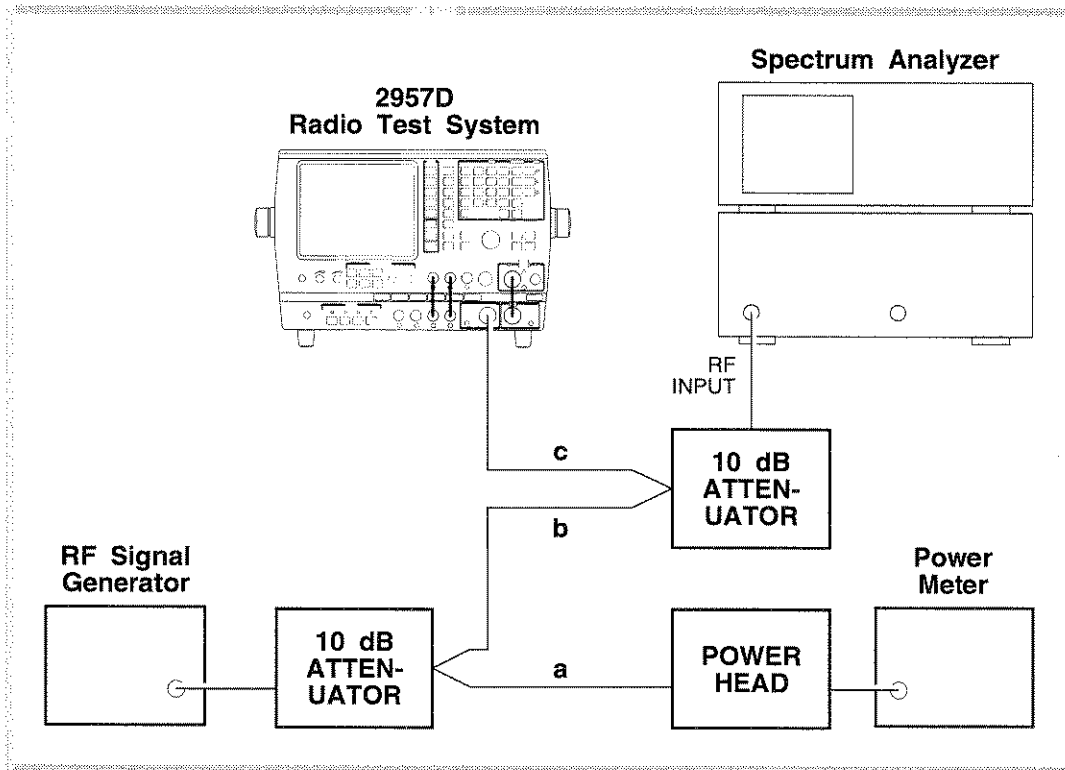
RF SIGNAL GENERATOR ACCURACY

Specification: ±2 dB, -50 dBm to -120 dBm

Test equipment:

Description	Minimum specification	Example
RF Signal Generator	824 MHz to 894 MHz	Marconi 2019A Marconi 2030 or 2040 series
RF Power Meter and Power Head	2% overall accuracy Measured at -20 dBm	Marconi 6960B and 6910 series Power Head
Spectrum Analyzer	Frequency Coverage 824 MHz to 894 MHz. Display Fidelity less than ±0.3 dB	Marconi 2383
10 dB RF Attenuator (2 Required)	Maximum VSWR 1.1 824 MHz to 894 MHz	

Test Procedure:



C1878

Fig. 5-11 Test equipment for RF signal generator accuracy

- (1) Connect the RF Signal Generator via a 10 dB attenuator to the Power Meter as shown in configuration (a) in Fig. 5-11.
- (2) Set the power to give average of 10 reading.
- (3) Set the RF Signal Generator to 880.02 MHz. Adjust the output level to give a reading of -20.0 dBm on the Power Meter.
- (4) Connect the RF Signal Generator to the Spectrum Analyzer via a second 10 dB as shown in configuration (b) in Fig. 5-11.
- (5) Set the Spectrum Analyser as follows:-

Ref Freq 880.02 MHz	Span/Div 500 Hz
Resolution Bandwidth 100 Hz	Video Bandwidth 170 Hz
Sweep Time	200 ms/div
RF Attenuator	0 dB
- (6) Set the peak to the top of the screen. The Peak Find and Marker/Ref Level may be useful for this.

The top of the screen is now calibrated to -20 dBm.

- (7) Set the Ref Level to -20 dB by the following procedure. Select dB scale. Set Ref Level to +20 dB. Select dB scale again. Select "Marker 1 Ref Level". Set Ref Level to -20 dB.
- (8) Connect the 2957D to the Spectrum Analyzer as shown in configuration (c). Select the D-AMPS system. Check that the D-AMPS system type is selected. If not, select D-AMPS by pressing the following soft keys FULL AUTO TEST, CHANGE FORMAT, SYSTEM PARAMETERS. Use the SELECT soft key to select D-AMPS. Press CRTS to return.
- (9) Select Manual Test. Ensure that Channel 334 Analog is selected. If not, select this using the CHANGE soft key.
- (10) Use the MODE soft key to select DATA OFF.
- (11) Use the CHANGE soft key to set to SAT Level to 0 kHz.
- (12) Use the CHANGE soft key to set the RF Level to -50 dBm. Set the Spectrum Analyzer to Video Average of 8 sweeps.
- (13) Measure the RF Level on the Spectrum Analyzer and repeat (12) for the RF Levels shown in Table 5-18.

ACCEPTANCE TEST SCHEDULE

Table 5-18 RF POWER MEASUREMENT ACCURACY

Gen Level	Reading	Upper Limit	Lower Limit	Pass/Fail
-50 dBm		-48.5 dBm	-51.5 dBm	
-51 dBm		-49.5 dBm	-52.5 dBm	
-52 dBm		-50.5 dBm	-53.5 dBm	
-53 dBm		-51.5 dBm	-54.5 dBm	
-54 dBm		-52.5 dBm	-55.5 dBm	
-55 dBm		-53.5 dBm	-56.5 dBm	
-56 dBm		-54.5 dBm	-57.5 dBm	
-57 dBm		-55.5 dBm	-58.5 dBm	
-58 dBm		-56.5 dBm	-59.5 dBm	
-59 dBm		-57.5 dBm	-60.5 dBm	
-60 dBm		-58.5 dBm	-61.5 dBm	
-70 dBm		-68.5 dBm	-71.5 dBm	
-80 dBm		-78.5 dBm	-81.5 dBm	
-90 dBm		-88.5 dBm	-91.5 dBm	

PHONE OPERATION TEST

Test Equipment:

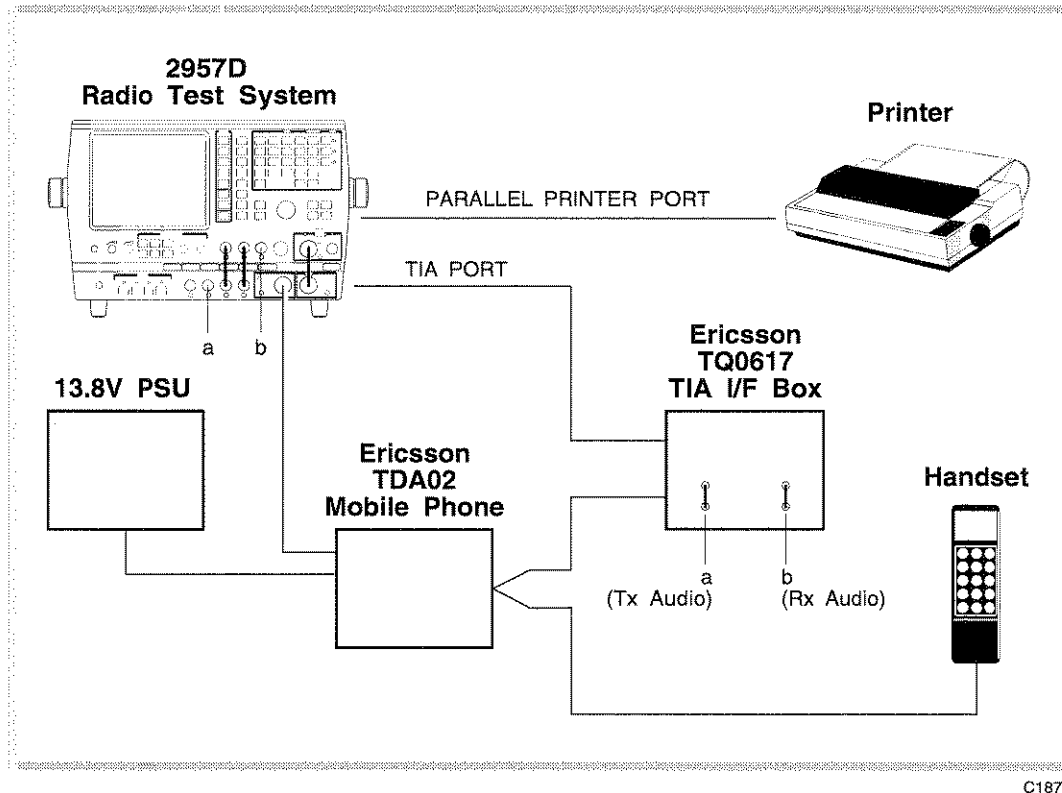
Description:

Emission Mobile Phone TDA02

Emission TIA Interface Box TQ0617

Printer with continuous interface

13.8 V DC Power Supply



C1879

Fig. 5-12 Test equipment for Phone operation test

Procedure:

- (1) Select the AMPS System. Press the FULL AUTO TEST soft key followed by the CHANGE FORMAT soft key.
- (2) Set the following format by use of the soft keys as described below. The hold type denotes a soft key on the **CHANGE FORMAT MENU**.

SYSTEM PARAMETERS

System type	D-AMPS
System ID	0002
System Control Channel	334
Voice Channel	001 to 1023
Handoff Increment	50

DISPLAY FORMAT

Display Format	Full
Pause	Manual only
Number Format	Standard 1

TEST SEQUENCE

Test Sequence	Comprehensive test
DTMF	Enabled
Hook Flash	Enabled

ACCEPTANCE TEST SCHEDULE

PAGE 2, PRINTER

Printer Port	Parallel
Print	All
Terminator	CR,LF

PAGE 2, INTERFACE, SERIAL

Baud Rate	1200
Length/Parity	8/none
Stop Bits	1
GPIB Address	6

PAGE 2, INTERFACE, TIA

Baud Rate	300
Length/Parity	8/none
Stop Bits	2
TIA Format	ASCII 3

PAGE 2, MISCELLANEOUS

De-Mod Source	Internal
Disc Step Rate	6mS
Printer command	Idle
System Configuration	00A0

- (3) Plug the handset into the phone, power it on and start the test running. As each test is completed, the results will be printed on the printer, they should all pass. Towards the end of the test, the system will attempt to run the Digital Bit Error Rate tests. At the point where it flashes "WAITING TDMA ON", the handset should be unplugged, the TQ0617 box plugged in, the phone switched on using the button on the box and the continue key pressed. All this must be accomplished within 1 Minute or the tests will fail.

Table 5-19 PHONE OPERATION TEST

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COMPREHENSIVE TEST	PASS/FAIL
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The international country codes in telephone and fax numbers are shown in square brackets [] whilst the national area codes are identified by round brackets ().

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(5, 2)

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All Marconi Instruments products are supported by the following network of Service Centres. Details of these establishments may change from time to time. If you experience difficulties, please contact our Customer Support Group at the UK Service Division at the address on the previous page.

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