SPECIAL OPTION

3746A OPTION H39

Selective Level Measuring Set

AT&T A-SPEC

OPERATION AND
SPECIFICATION CHANGES

HEWLETT PACKARD

General Information 1

This Supplemental Operating Manual contains the information required to update the 3746A Operating Manual (p/n 03746-90007), to include Special Option H39.

Option H39 includes the following Options :-

- Option 011   Group Filter (48KHz)

- Option 012   Tracking Generator

- Option 014   High Stability Frequency Reference

- Option 016   Channel Impairments (North America)

- Option 908   Rack Mount Kit with Front Handles

- Option H10   BNC 75Ω Unbalanced Input moved to Rear Panel. Balanced Inputs changed to WECO connectors.

This Supplemental Operating Manual consists of the following sections :-

- Section 1   General Information & Specifications

- Section 2   Changes in Operation

Specifications

The specifications listed in Table 1-1 of this Supplemental Operating Manual replace the specifications given in the 3746A Operating Manual.

Table 1-1 Specifications

Frequency Accuracy : ±10Hz (20KHz to 25MHz) (including ageing over 1 year)

75Ω Input

Connector : BNC (Rear Panel)

Maximum Power : +20dBm

Frequency Range : 10 kHz to 25 MHz

Impedance : 75Ω Unbalanced

Measurement Range : +10 to -125dBm

Return Loss : >27dB (50KHz to 25MHz)

Measurement Accuracy (Selective)

FILTER BANDWIDTH	FREQUENCY RANGE	ACCURACY +10 to -70dBm	ACCURACY -70 to -100dBm	ACCURACY -100 to -105dBm	ACCURACY -105 to -110dBm
55 Hz & 3.1 kHz	20 kHz to 50 kHz	±0.5dB	±1.0dB	±1.0dB	±1.5dB
55 Hz & 3.1 kHz	50 kHz to 22 MHz	±0.25dB	±0.7dB	±1.0dB	±1.5dB
55 Hz & 3.1 kHz	22 MHz to 25 MHz	±0.5dB	±1.0dB	±1.0dB	±1.5dB
48 kHz	100 kHz to 25 MHz	±1.0dB	N/A	N/A	N/A

Measurement Accuracy (Wideband)

FREQUENCY RANGE	MEASUREMENT ACCURACY +10 to -45dBm
20 kHz to 25 MHz	±1.0dB

Balanced Inputs

124Ω

Connector : Accepts WECO 372 plug (Front Panel)

Impedance : 124Ω Balanced

Frequency Range : 20KHz to 12MHz

Return Loss : >26dB (50KHz to 12MHz)

Frequency Response (124Ω Balanced)

FREQUENCY RANGE	MEASUREMENT ACCURACY 0 to -80dBm
50KHz to 12MHz	±0.5dB

135Ω

Connector : Accepts WECO 241 plug (Front Panel)

Impedance : 135Ω Balanced

Frequency Range : 20KHz to 1MHz

Return Loss : >26dB (50KHz to 620KHz)

Frequency Response (135Ω Balanced)

FREQUENCY RANGE	MEASUREMENT ACCURACY 0 to -80dBm
50KHz to 620KHz	±0.5dB

Intermodulation & Spurious Products

2nd Order Intermodulation Rejection : > 63dB, relative to the total power of input signals and measured at (f1 ± f2) where this is in band.

3rd Order Intermodulation Rejection : > 70db (2 tones > 50KHz apart). > 60dB (2 tones < 50KHz apart), relative to the total power of 2 input signals and measured at (2f1 ± f2) and (2f2 ± f1) where these are in band.

Image & IF Rejection

DESCRIPTION	FREQUENCY	REJECTION
$1/2 \times 1^{st}$ IF	$1/2 \times 1^{st}$ IF	> 65dB
1st IF (55 Hz & 3.1 kHz Filters only)	1st IF	> 70dB
1st IF Image (55 Hz & 3.1 kHz Filters only)	TF + 2 $\times 1^{st}$ IF *	> 70dB
2nd IF (55 Hz & 3.1 kHz Filters only)	2nd IF	> 70dB
2nd IF Image (55 Hz & 3.1 kHz Filters only)	TF + 2 $\times 2^{nd}$ IF *	> 70dB
3rd IF (55 Hz Filter only)	3rd IF	> 70dB
3rd IF Image (55 Hz Filter only)	TF + 2 $\times 3^{rd}$ IF *	> 65dB

* TF = Tuned Frequency

Other Spurious Response : < -100dBm (20 kHz to 25 MHz)

Noise Measurement Performance

A commercially available White Noise Generator provides flat noise to the 75Ω input of the instrument. Standard CCITT Noise Bandwidth filters together with the designated Bandstop (SLOT) filter are used. The instrument is tuned to the designated SLOT Frequency and the Level checked.

Noise Measurement Requirements

NOISE GENERATOR LEVEL (dBm) *	BAND DEFINING FILTER	SLOT FREQUENCY	MEASURED LEVEL (dBm) **
-31.2	316 to 8160KHz	2438KHz	< = -120.8
-10.4	316 to 8160KHz	2438KHz	< = -100.0
-30.0	316 to 8160KHz	2438KHz	< = -119.6
-9.2	316 to 8160KHz	2438KHz	< = -98.8
-26.1	316 to 17300KHz	2438KHz	< = -121.2
-26.1	316 to 17300KHz	16400KHz	< = -116.6
-13.2	316 to 17300KHz	2438KHz	< = -108.3
-13.2	316 to 17300KHz	16400KHz	< = -103.7

* Measured with instrument in Broadband Power mode.

** Measured with instrument in Selective mode with 3.1KHz Channel Filter selected.

Filters

Pilot Filter (55Hz)

Ripple Over 30 Hz Bandwidth : <0.1dB pK-pK

3dB Bandwidth : 55 Hz ±10%

Rejection At > ±80 Hz : > 35dB

Rejection At > ±300 Hz : > 60dB

Rejection at > ±2 kHz : > 70dB

Max. Measurement Speed : 6 Measurements/Second

Group Filter (48 kHz)

Ripple over 35 kHz Bandwidth : < 1.2dB pK-pK

3dB Bandwidth : 48 kHz ±12%

Rejection At > ±48 kHZ : > 25dB

Rejection At > ±80 kHz : > 40dB

Equivalent Noise Bandwidth : 52 kHz nominal

Channel Filter (3.1 kHz)

Ripple Over 2.5 kHz Bandwidth : < 0.5dB pK-pK

3dB Bandwidth : 3.1 kHz ±10%

Rejection At > ±1.85 kHz : > 55dB

Rejection At > ±4 kHz : > 65dB

Equivalent Noise Bandwidth : 3.1 kHz Nominal

Impairments

Notch Filter (1010 Hz Notch)

Rejection 995 Hz to 1025 Hz : > 50db

Rejection At 862Hz & 1182Hz : < 3dB

Out Of Band Ripple <400Hz & >1700Hz : <±0.5dB (Switched in series with the 3.1KHz Filter)

Phase Jitter

Input Level (Tone) : > = -65dBm

Measurement Range : 0.5 Deg. to 30 Deg. pK-pK

Measurement Accuracy : ±15% ±0.5Deg.

Residual Phase Jitter

SELECTABLE BANDWIDTH	RESIDUAL PHASE JITTER
20Hz to 300Hz	< 0.5Deg. pK-pK
4Hz to 300Hz	< 1Deg. pK-pK

Additional Inputs

External Frequency Standard

Connector : BNC (Rear Panel)

Impedance : 50Ω Unbalanced

Lock Frequency : 10 MHz or any integer sub-multiple of 10 MHz in the range 1 to 10 MHz

Level (50Ω) : -3dBm to +10dBm

Remote Control Interface

Interface : IEEE Standard 488-1978

Interface Function Subset : SH1, AH1, T6, L4, SR1, RL1, DC1, DT1, C0

Outputs

Tracking Generator

Connector : BNC (Rear Panel)

Impedance : 75Ω Unbalanced

Level : -10dBm ±0.5dB

Flatness : ±1dB (20 kHz to 25 MHz)

Frequency : As Tuned Frequency & co-incident with the centre of the 55 Hz & 3.1 kHz Filters only

Demodulated Channel

Connector : Accepts WECO 310 plug (Rear Panel)

Impedance : 600Ω Balanced

Demodulation Type : Single Sideband LSB or USB

Translated Frequency : 0 to 4KHz

Frequency Response : ±1dB (0.6 to 3.1 kHz)

Output Level : +7 to -13dBm

Internal Frequency Standard

Connector : BNC (Rear Panel)

Impedance : 50Ω Unbalanced

Frequency : 10MHz

Level ; +6dBm ±2dB (50Ω)

Operating Environment

Temperature : +10 to +35 Deg C for specified accuracy. +5 to +10Deg C and +35 to +40Deg C add ±0.1dB uncertainty to all level measurements.

Relative Humidity : 10% to 90% Noncondensing

Altitude : Up to 2,500 metres

Power Requirements

A.C. Line Voltage : 120V +5% to -10%

A.C. Line Frequency : 48 Hz to 66 Hz

Power Consumption : < 200VA

Thermal Output : < 1500 BTU/hr

Mounting Requirements

Standard : 19 in. relay rack

Non Operating Environment

Temperature : -40 to +70Deg C

Relative Humidity : 10% to 90% Noncondensing

Shock & Vibration : Complies with AT&T PUB 51001 Network Equipment- Building System (NEBS) Requirements. In Packaged Test 3D only the range 5Hz to 55Hz has been tested and verified.

Option (H42) : 23 in. relay rack

Changes In Operation

This section contains information relating to the changes in operation incurred by Option H39. These changes impact on the following areas :-

- Averaging

- Auto-Calibration Cycle

- Pilot Filter Bandwidth

- Addition of Identity via HP-IB

- Low Level Search (removed)

- Chart Recorder (removed)

Averaging

Averaging is explained on pages 3-5/3-6 and 6-11 for the standard 3746A.

For Option H39, three averaging modes are available which affect the time taken for each measurement and the resolution of the level display :-

Averaging Mode	Display Resolution	Typical Application
AVE 0	0.1dB	Fastest measurement speed but reduced accuracy
AVE 1	0.01dB	Accurate measurement of stable signals +10 to -90dBm
AVE 2	0.01dB	Long averaging of Noise or Time varying signals +10 to -110dBm

NOTE

The time taken for each measurement is not fixed but depends on the filter chosen and the difference in level between successive measurements.

The selection of averaging will not cause an auto calibration cycle.

If the 48kHz or Weighted or Notch Filter is selected , only AVE 0 and AVE 1 are available.

If an Input Power measurement is selected, only AVE 0 is available.

Auto-Calibration Cycle

An Auto Calibration Cycle only occurs at power-up and at ten minute intervals. Selection of Averaging or selection of a Filter will not cause an Auto-Calibration Cycle.

Pilot Filter Bandwidth

The Pilot Filter bandwidth has been increased to 55Hz. This reduces the settling time thus increasing the measurement speed.

All reference to 38Hz should be changed to 55Hz.

Addition Of Identity Via HP-IB

An Identity response from the 3746 Option H39 has been added via the HP-IB. This has been incorporated via Internal Switch 1 (Measurement Message Format) using position 6 of the switch.

The 3746A Option H39 returns HP3746A #011 #012 #013 #016 in response to "IS16 PR" HP-IB command.

Low Level Search

The 3746A Option H39 does not include the Low Level Search capability therefore all reference to Low Level Search in the Operating Manual should be deleted (page 3-41/3-42).

Chart Recorder

The 3746A Option H39 does not include the rear panel Chart Recorder output therefore all reference to Chart Recorder in the Operating Manual should be deleted (pages 2-6, 4-5 & 6-17).

Bridged (High Impedance) Inputs

The 3746A Option H39 is fitted with this capability as detailed in the Errata section of the Manual Changes, however TERMINATED wake-up mode is factory preset. BRIDGED mode operation is not recommended with rear-panel 75Ω input as fitted to Option H39.

HEWLETT PACKARD

┌─ MANUAL IDENTIFICATION ─┐
Model Number: 3746A
Date Printed: Jan, 1984
Part Number: 03746-90007

Operating Manual

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections.

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Make Manual Changes		Serial Prefix or Number	Make Manual Changes
2410U	NONE			
2508U	Change 1			
2730U	Change 1			

* NEW ITEM

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of the supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement or the model number and print date from the title page of the manual.

26 Aug 1987

Page 1 of 4

hp HEWLETT PACKARD

ERRATA

*Page 1-4:
 Add: OPTION W30 This option is available at the time of purchase and
                    gives 3 year Extended Hardware Support. It provides
                    2 additional years of return-to-HP hardware service
                    support (for 2nd and 3rd years).

Page 3-42, Add:

BRIDGED - ALL INPUTS: This key is fitted to all instruments on and
above serial numbers 2405U-00412. Pressing the key selects/deselects
the BRIDGED inputs. In the Bridged state, all inputs are configured
to a high impedance state suitable for making measurements in FDM
systems with unprotected monitor points.

Selecting instrument "wake-up" mode - BRIDGED/TERMINATED:

A switch A60S2(8) located on the Controller Assembly (A60) can be
preset to determine the wake-up mode of the instrument. If A60S2(8) is
set to the "ON" position (see Figure 1) the instrument will have all inputs
in the BRIDGED state at power-on. If A60S2(8) is set to "OFF" the instrument
"wakes-up" with all inputs in the TERMINATED mode.

Note: All instruments are factory preset to the BRIDGED mode.
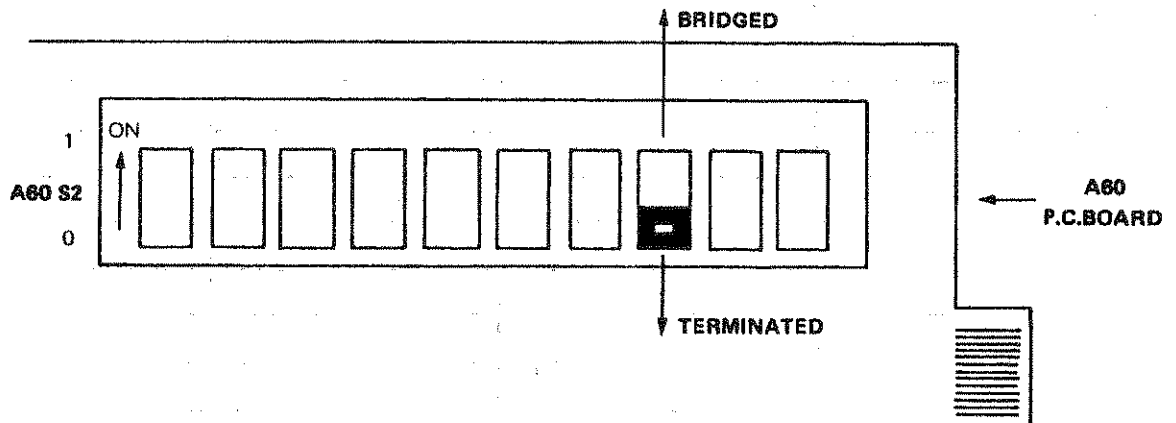
Figure 1

ERRATA (continued)

Page 5-5, Add to Table 5-1:

Key	ASCII	Programming Code
Bridged *(ON)	HZ1	
(OFF)	HZ0	

*This facility is only available on instruments above serial number 00411.
 The code HZ0 sets all inputs to the unterminated mode, HZ1 sets the inputs
 to the bridged terminated mode.

Page 6-1, Paragraph 6-3, Step 2:
  Change: MMX1-MMX2: to
          MMX1, MMX2, MMG:

CHANGE 1

On and above Serial Number 2508U00742 the System II cabinet parts including
rack mount kits are changed to metric sizes. Any screws used with these
parts must have metric threads.

Page 2-3, Figure 2-2 Rack Mount Kits:

7H FRONT HANDLE KIT

 Change: Kit Part Number from 5061-0090 to 5061-9690
         Front handle Assy Part Number from 5020-8897 to 5061-9500
         Screw Part Number and Description from 8-32 X 3/8 screw 2510-0195
         to M4 X 0.7 X 10 screw, flat head 90° 0515-0896

7H RACK MOUNT KIT WITH FRONT HANDLES

 Change: Kit Part Number from 5061-0084 to 5061-9684
         Front handle Assy Part Number from 5020-8897 to 5061-9500
         Screw Part Number and Description from 8-32 X 5/8 screw 2510-0194
         to M4 X 0.7 X 16 screw, pan head 0515-1106

7H RACK MOUNT KIT WITHOUT FRONT HANDLES

 Change: Kit Part Number from 5061-0078 to 5061-9678
         Screw Part Number and Description from 8-32 X 3/8 screw 2510-0193
         to M4 X 0.7 X 10 screw, pan head 0515-1114

HEWLETT PACKARD

OPERATING MANUAL

3746A
SELECTIVE LEVEL MEASURING SET
(Including Options 001,005,011,012,014, 015 and 016)

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2403U. For additional important information about serial numbers see INSTRUMENTS COVERED BY MANUAL in Section 1.

© Copyright HEWLETT-PACKARD LIMITED 1984
SOUTH QUEENSFERRY, WEST LOTHIAN, SCOTLAND

WARNING

READ THE FOLLOWING NOTES BEFORE INSTALLING OR SERVICING THE INSTRUMENT.

1. IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTO-TRANSFORMER MAKE SURE THAT THE COMMON TERMINAL OF THE AUTO-TRANSFORMER IS CONNECTED TO THE NEUTRAL POLE OF THE POWER SOURCE.

2. THE INSTRUMENT MUST ONLY BE USED WITH THE MAINS CABLE PROVIDED. IF THIS IS NOT SUITABLE, CONTACT YOUR NEAREST HP SERVICE OFFICE. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

3. THE SERVICE INFORMATION FOUND IN THIS MANUAL IS OFTEN USED WITH POWER SUPPLIED TO AND PROTECTIVE COVERS REMOVED FROM THE INSTRUMENT. ENERGY AVAILABLE AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

4. BEFORE SWITCHING ON THIS INSTRUMENT:

    (a) Make sure the instrument input voltage selector is set to the voltage of the power source.

    (b) Ensure that all devices connected to this instrument are connected to the protective (earth) ground.

    (c) Ensure that the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient).

    (d) Check that the instrument fuse(s) is of the correct type and rating.

5. SERVICING INFORMATION:

    (a) This manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

    (b) Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

    (c) Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

    (d) Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

LIST OF CONTENTS

SECTION I GENERAL INFORMATION

SECTION II INSTALLATION

Model 3746A

SECTION III OPERATION

SECTION IV PERIPHERALS

SECTION V HEWLETT-PACKARD INTERFACE BUS

SECTION VI CONTROLS, CONNECTORS AND INDICATORS

SECTION VII APPENDICES

SECTION VIII MANUAL CHANGES
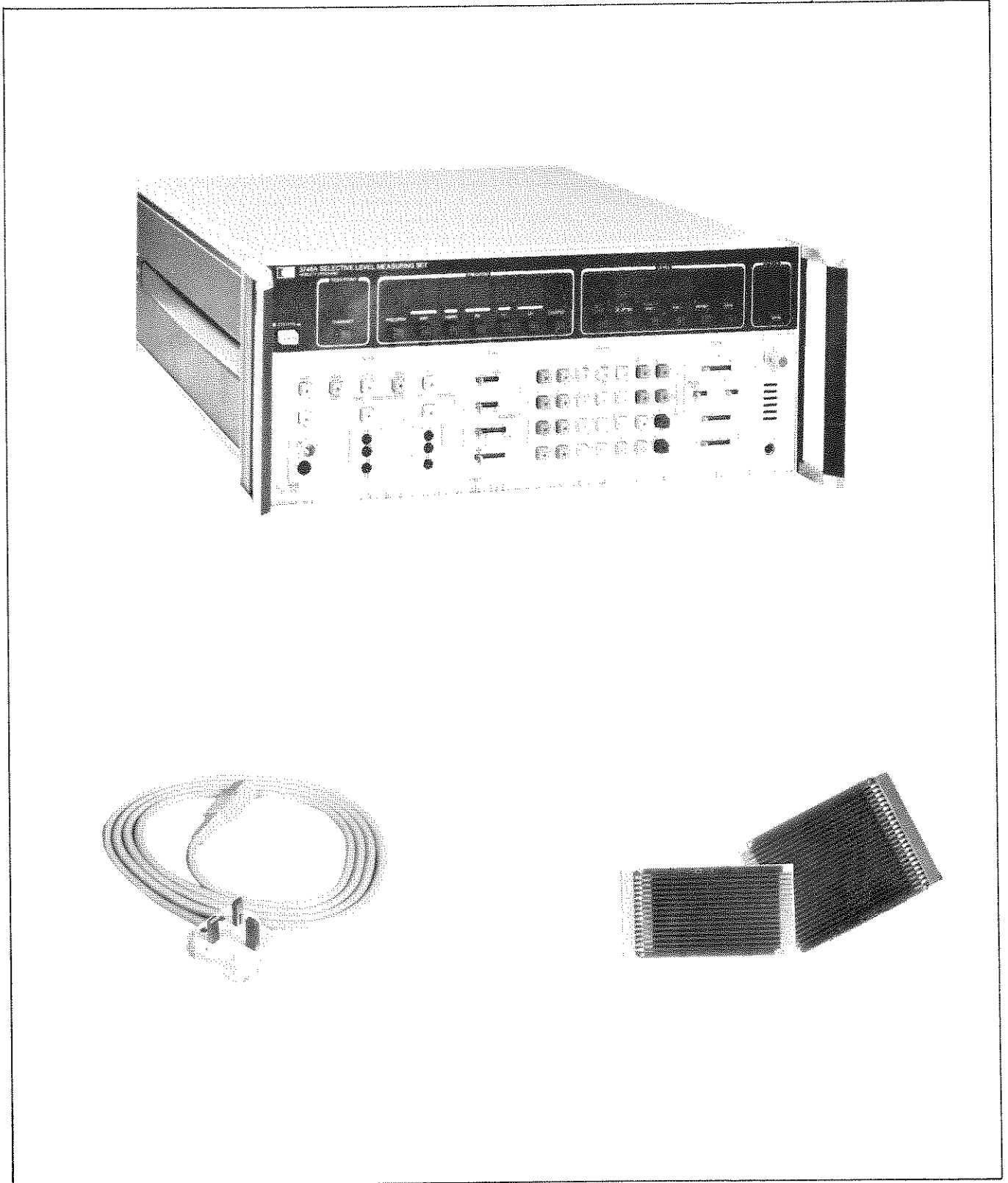
Figure 1-1 The 3746A Selective Level Measuring Set with Accessories Supplied

SECTION 1
GENERAL INFORMATION

1-1 INTRODUCTION

1-2 This operating manual contains information required to install and operate the Hewlett-Packard Model 3746A Selective Level Measuring Set (SLMS). The instrument together with the accessories supplied are shown in Figure 1-1.

1-3 Service information is contained in a separate Service Manual.

1-4 On the title page of this manual is a Microfiche Part Number. This number can be used to order 4 x 6-inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo duplicates of the manual pages.

1-5 SPECIFICATION

1-6 Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested.

1-7 SAFETY CONSIDERATION

1-8 This product is a Safety Class B instrument (provided with a protective earth terminal). The instrument and manual should be reviewed for safety markings and instructions before operation. Also read the Warning on Page ii.

1-9 INSTRUMENTS COVERED BY MANUAL

1-10 Attached to the instrument is a serial number plate. This serial number is in the form XXXXUXXXXX. It is in two parts; the first four digits and the letter are the serial prefix and the last five are the suffix. The prefix is the same for all identical instruments, it changes only when a change is made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

1-11 An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this new instrument is accompanied by a Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

1-12 In addition to change information, the supplement may contain information for correcting errors in the manual.To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-13 For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-14 DESCRIPTION

1-15 The Hewlett-Packard 3746A Selective Level Measuring Set (SLMS), is a high quality tunable power meter dedicated for use by operators and manufacturers of high density Frequency Division Multiplex (FDM) systems.

1-16 The SLMS has been specifically designed for manufacturers and operators conforming to both CCITT recommendations and for the North American Standards.

1-17 The SLMS is basically a tunable receiver, employing a synthesized local oscillator, controlled by a processor. A keyboard provides the interface between the operator and the processor.

1-18 The SLMS measures signal powers in the range 50Hz to 32MHz at levels between +20dBm and -115dBm, depending upon the measurement bandwidth used.

1-19 Either balanced or unbalanced measurements may be made.

1-20 Measured levels are true RMS values.

1-21 The instrument displays power levels either in dBm or in dB´s relative to a dBm reference level. Automatic correction ensures that whichever input is selected the display will be correct for the chosen terminating impedance.

1-22 The frequencies at which measurements are required may be entered via the keyboard, either directly in kHz or as a description in a chosen FDM plan.

1-23 This ability to enter FDM descriptions directly into the instrument eliminates the need for FDM charts and line frequency tables to determine the frequencies to which the instrument is to be tuned.

1-24 Tuning to the measurement frequency is accomplished by mixing the received signal with a variable frequency signal from an internal synthesized local oscillator to give a fixed intermediate frequency. To achieve the high degree of selectivity and image rejection required, the SLMS uses multiple intermediate frequency (IF) stages.

1-25 The standard instrument is equipped with selective filters to allow a choice of measurement bandwidth.

1-26 The measurement of narrow bandwidth tones in a wideband measuring set requires extreme accuracy in the local oscillator frequencies used. This requirement is met by the use of a frequency synthesizer as the local oscillator in the SLMS. A master oscillator with a 10MHz crystal source, high spectral purity, and an aging rate of less than 1.5 x 10-8 parts per month is available as an option.

1-27 A processor provides overall control within the instrument, implementing routines which govern the measurement functions of the instrument and calculating from the various auto-ranging and analog to digital settings the levels to be displayed. The processor also determines the frequency and bandwidth setting required when FDM descriptions are entered.

1-28 The SLMS has a built-in control and drive circuitry which enables the SLMS to control up to 111 Access Switches.

1-29 The processor will accept instructions either from the operator via the keyboard or, if remote control of the instrument is required, through the Hewlett-Packard Interface Bus (HP-IB) connector on the rear panel. A degree of in-built intelligence in the processor enables it to detect if the instrument is required to perform an invalid measurement or if incorrect data is entered. In these circumstances a code number will appear in the TEST-POINT display window.

1-30 The processor performs a calibration of the measuring circuits at periodic intervals, substituting for the incoming signal an accurately defined signal derived from an internal high stability source. The processor stores the result of this measurement and uses any deviation from the expected measurement to modify the results of measurements made on external signals. Thus any inaccuracies resulting from thermal drift or aging in the measurement stages are greatly reduced.

1-31 OPTIONS

1-32 The following options are available with the SLMS and are covered by this manual:

Option 001   –   Siemens series 2.5/6mm (75 ohm) connector substituted for the Unbalanced input connector.

Option 005   –   Commercial equivalent of WECO 477B substituted for the Unbalanced and 124 ohm input connectors. Commercial equivalent of WECO 223A substituted for the 135 ohm and 600 ohm input connectors.

Option 011   –   Group Filter

Option 012 – Tracking Generator

Option 014 – High Stability Oscillator

Option 015 – Channel Impairments - CCITT [phase jitter WTD Filter, Noise with Tone, Impulse Noise (single threshold)].

Option 016 – Channel Impairments - North America [phase jitter WTD Filter, Noise with Tone, Impulse Noise (single threshold)].

1-33 ACCESSORIES SUPPLIED

1-34 Figure 1-1 shows the HP Model 3746A together with the accessories supplied.

(a) The line power cable is supplied in one of six configurations depending upon the country of destination of the instrument (see Paragraph 2-11).

(b) The following manuals are supplied with each instrument.

1) Service Manual..................HP 03746-90000

2) Operating Manual...............HP 03746-90003

(C) Four extender boards H.P. Part No. 03746-60090 (2 off) and 03746-60091 (2 off) are supplied to extend PC boards during maintenance and repair procedures.

1-35 EQUIPMENT AVAILABLE

1-36 A 25MHz High-Impedance Active Probe (HP Model 15580A) is used in conjunction with the SLMS for bridging measurements. It has a 0dBm insertion Loss and a flatness of <+-0.2dB, over the frequency range 50kHz to 20MHz.

1-37 A 25MHz High-Impedance Passive Probe (HP Model 15581B) is used in conjunction with the SLMS for bridging measurements. It has a flatness of <+-0.2dB over the frequency range 50kHz to 20MHz, with a 20dB insertion Loss.

1-38 A Return Loss Kit (HP Model 15582A), in conjunction with a suitable Level Generator, allows the SLMS to make balanced and unbalanced return loss measurements over the frequency range 10kHz to 25MHz.

1-39 A Transit Case (9211-2650) with its custom mould inserts provides the SLMS with maximum protection during transit.

1-40 An Instrument Cart (Hp Model 15589A) carries the SLMS and its auxiliary equipment. Additional shelves can be supplied on request.

1-41 A Directional Bridge (HP Model 8721A OPT 008) with a suitable Level Generator allows the SLMS to make 75 ohm unbalanced return loss measurements over the frequency range 100kHz to 30MHz.

1-42 HP-IB Cables (HP Model 10833A/B/C/D) interface the SLMS with other HP-IB compatible instruments.

(The Hewlett-Packard Interface Bus (HP-IB) is Hewlett-Packard´s implementation of IEEE Standard 488-1978.)


```
10833A  -  1 metres   (3.3  feet)
10833B  -  2 metres   (6.6  feet)
10833C  -  4 metres   (13.2 feet)
10833D  -  0.5 metres (1.6  feet)
```


1-43 A Printer (HP Model 5150A OPT 001 or 2631B OPT 046) connected to the SLMS will provide a printed copy of measurement data such as frequency, level, FDM description and time of measurement. The SLMS can instruct the printer to print data for all, or any individual measurements or, if desired, record details of measurements which violate limits set by the operator.

1-44 An X-Y Display (HP Model 37461A) connected to the SLMS will provide a visual display of measurement data such as frequency and level measurements.

1-45 A tracking Frequency Synthesizer/Level Generator (HP Model 3335A or 3336A) is available and can be used in conjuction with the SLMS.

Table 1-1 Specifications

Except where otherwise indicated, the following parameters are warranted performance specifications. Parameters described as "typical" or "nominal" are supplemental characteristics which provide a useful indication of typical, but non-warranted, performance characteristics. Unless otherwise stated, all specifications are for 0° to 55°C after 30 minute warm-up.

FREQUENCY RANGE

Unbalanced Input (75Ω): 50 Hz to 32 MHz.
Balanced Inputs: 150Ω : 10 kHz to 2 MHz
600Ω : 50 Hz to 100 kHz
124Ω (Option 005) : 10 kHz to 12 MHz
135Ω (Option 005) . 10 kHz to 2 MHz
Minimum Frequency Step Size: 1 Hz.

FREQUENCY TUNING ACCURACY

INTERNAL STANDARD REFERENCE OSCILLATOR

Initial Setting Accuracy + Ageing over 1 year + Temperature Drift: $< \pm 5 \times 10^{-5}$.

OPTIONAL HIGH ACCURACY REFERENCE OSCILLATOR (Option 013)

Initial Setting Accuracy: $\pm 1 \times 10^{-7}$.
Ageing Rate: $< \pm 1.5 \times 10^{-7}$/Year.

WITH EXTERNAL REFERENCE OSCILLATOR

Frequency Error: error of external reference oscillator ± 1 Hz.

INTERNAL FREQUENCY COUNTER
(In addition to accuracy of Reference Oscillator)

Counter Accuracy: ± 1 Hz (38 Hz Filter, tone within 3 dB points) or ± 2 Hz (38 Hz, 3.1 kHz, Weighted and Notch Filters, tone within 55 dB points; 48 kHz Filter (Option 011), tone < 25 kHz from tuned frequency), for tone/measured interference ratio > 40 dB*.

* A variation of 0.2 dB pk-pk in the measured level of a tone within the 3 dB bandwidth of the 38 Hz filter at 0.1 dB resolution (AVE 1) would indicate a tone/interference ratio of 40 dB (nominal).

MEASUREMENT RANGES

UNBALANCED INPUT (75Ω)

Filter	Range	Noise Floor including Spurious Products (with open-circuit input)
38 Hz — Pilot	+20 to −115 dBm	< −105 dBm, 250 Hz to 50 kHz; < −115 dBm, 50 kHz to 32 MHz
3.1 kHz — Channel	+20 to −115 dBm	< −105 dBm, 10 kHz to 50 kHz; < −115 dBm, 50 kHz to 32 MHz
48 kHz — Group (Option 011)	+20 to −90 dBm	< −90 dBm, 100 kHz to 32 MHz
Broadband — Input Power	+20 to −55 dBm	< −55 dBm

BALANCED INPUTS†

Filter	Impedance	Range	Noise Floor including Spurious Products (with open-circuit input)
38 Hz — Pilot 3.1 kHz — Channel	124Ω 135Ω 150Ω	0 to −113 dBm	−113 dBm, 50 kHz to 10 MHz −113 dBm, 50 kHz to 2 MHz −113 dBm, 50 kHz to 2 MHz
	600Ω	0 to −90 dBm	−90 dBm, in basic channel (1.85 kHz)

† Standard input impedances: 600Ω and 150Ω; with Option 005: 600Ω, 124Ω and 135Ω.

INPUT CIRCUITS

UNBALANCED INPUT (75Ω)

Impedance	Return Loss 50 kHz to 32 MHz	Maximum ac Input Power	Maximum Continuous dc Voltage	Connector Type*
75Ω	> 30 dB	+25 dBm	± 0.5V	BNC

* Alternative connector types available — see OPTIONS.

Table 1-1 Specifications (continued)

BALANCED INPUTS†

Impedance	Return Loss	Common Mode Rejection Common Mode Signal < 0 dBm	Maximum ac Input Power	Maximum Continuous dc Voltage	Maximum Longitudinal Voltage	Connector Type
124Ω	> 30 dB, 10 kHz to 12 MHz	> 40 dB, 10 kHz to 2 MHz > 35 dB, 2 MHz to 12 MHz	+25 dBm	± 3V	ac : 3V rms dc : 3V	Accepts WECO Plug 439A or 440A (Pair)
135Ω	> 30 dB, 10 kHz to 2 MHz	> 40 dB, 10 kHz to 2 MHz	+25 dBm	± 3V	ac : 3V rms dc : 3V	Accepts WECO Plug 241A (Pair)
150Ω	> 30 dB, 10 kHz to 2 MHz	> 40 dB, 10 kHz to 2 MHz	+25 dBm	± 3V	ac : 3V rms dc : 3V	Siemens Type 9 REL STP-6AC
600Ω	> 30 dB nominal, dc to 100 kHz	> 35 dB, dc to 100 kHz	+20 dBm	± 3V	ac : 3V rms dc : 3V	Standard: Siemens Type 9 REL STP-6AC Option 005: accepts WECO Plug 241A

† Standard input impedances: 600Ω and 150Ω; with Option 005: 600Ω, 124Ω and 135Ω.

MEASUREMENT ACCURACY

UNBALANCED INPUT (75Ω) — SELECTIVE MEASUREMENT (38 Hz AND 3.1 kHz FILTERS)

Frequency Range	Level Uncertainty over temperature range 10° to 35°C, after autocalibration (See Notes 1, 2, 4 and 5)	
	+20 to −80 dBm	−80 to −100 dBm (nominal)
38 Hz and 3.1 kHz Filters 200 Hz to 10 kHz	< ± 1 dB (+20 to −70 dBm)	
10 kHz to 50 kHz	< ± 0.45 dB	< ± 0.65 dB
50 kHz to 20 MHz	< ± 0.25 dB	< ± 0.5 dB
20 MHz to 30 MHz	< ± 0.45 dB	< ± 0.7 dB

UNBALANCED INPUT (75Ω) — BROADBAND MEASUREMENT

Frequency Range	Level Uncertainty over temperature range 0° to 55°C, after autocalibration (See Note 3)
50 Hz to 32 MHz	< ± 1 dB, +20 to −45 dBm

UNBALANCED INPUT (75Ω) — GROUP POWER MEASUREMENT (48 kHz FILTER) OPTION 011

Frequency Range	Level Uncertainty over temperature range 0° to 55°C, after autocalibration (See Notes 3 and 5)
100 kHz to 32 MHz	< ± 1 dB, +20 to −75 dBm

Table 1-1 Specifications (continued)

BALANCED INPUTS† — SELECTIVE MEASUREMENT (38 Hz AND 3.1 kHz FILTERS)

Impedance	Frequency Range	Level Uncertainty over temperature range 10° to 35° C, after autocalibration (See Notes 1, 2, 4 and 5)	
		0 to −80 dBm	−80 to −100 dBm (nominal)
124Ω	10 kHz to 50 kHz	< ± 0.5 dB	< ± 0.7 dB
	50 kHz to 12 MHz	< ± 0.3 dB	< ± 0.5 dB
135Ω	10 kHz to 50 kHz	< ± 0.5 dB	< ± 0.7 dB
	50 kHz to 2 MHz	< ± 0.3 dB	< ± 0.5 dB
150Ω	10 kHz to 50 kHz	< ± 0.5 dB	< ± 0.7 dB
	50 kHz to 2 MHz	< ± 0.3 dB	< ± 0.5 dB
600Ω	200 Hz to 100 kHz	< ± 1 dB (0 to −70 dBm)	

BALANCED INPUTS† — GROUP POWER MEASUREMENT (48 kHz FILTER) OPTION 011

Impedance	Frequency Range	Level Uncertainty over temperature range 0° to 55° C, after autocalibration (See Notes 3 and 5)
124Ω	100 kHz to 12 MHz	< ± 1 dB, 0 to −75 dBm
135Ω	100 kHz to 2 MHz	< ± 1 dB, 0 to −75 dBm
150Ω	100 kHz to 2 MHz	< ± 1 dB, 0 to −75 dBm

BALANCED INPUTS† — BROADBAND MEASUREMENT

Impedance	Frequency Range	Level Uncertainty over temperature range 0° to 55° C, after autocalibration (See Note 3)
124Ω	10 kHz to 12 MHz	< ± 1 dB, 0 to −45 dBm
135Ω	10 kHz to 2 MHz	< ± 1 dB, 0 to −45 dBm
150Ω	10 kHz to 2 MHz	< ± 1 dB, 0 to −45 dBm
600Ω	200 Hz to 100 kHz	< ± 1 dB, 0 to −45 dBm

† Standard input impedances: 600Ω and 150Ω; with Option 005: 600Ω, 124Ω and 135Ω.

NOTE 1 To extend temperature range for 0° to 55°C operation, add ± 0.1 dB for all selective measurements in the frequency range 10 kHz to 32 MHz.

NOTE 2 Accuracy specified is for 0.01 dB display resolution. For 0.1 dB resolution, add ± 0.08 dB. For 1 dB resolution, add ± 1.5 dB (nominal).

NOTE 3 Accuracy specified is for 0.1 dB display resolution. For 1 dB resolution, add ± 1.5 dB (nominal).

NOTE 4 Accuracy specified is for single input signal within defined level range.

NOTE 5 Accuracy specified assumes that 3746A is tuned to signal frequency ± 1 Hz.

MEASUREMENT DISPLAY

Resolution: 0.01 dB with Averaging 2
(38 Hz and 3.1 kHz filters only)
0.1 dB with Averaging 1
1 dB with Averaging 0.

FILTERS

PILOT FILTER — 38 Hz

Ripple over 22 Hz Bandwidth: < 0.1 dB pk-pk.
3 dB Bandwidth: 38 Hz, ± 10%.
Adjacent Pilot Rejection (± 60 Hz): > 38 dB.
Rejection at > ± 110 Hz: > 60 dB.
Rejection at > ± 2 kHz: > 80 dB.
Equivalent Noise Bandwidth: 44 Hz (nominal).

Table 1-1 Specifications (continued)

CHANNEL FILTER — 3.1 kHz

Ripple over 2.6 kHz Bandwidth: < 0.5 dB pk-pk.
3 dB Bandwidth: 3.1 kHz, ± 10%.
Virtual Carrier Rejection at ± 1.85 kHz: > 65 dB.
Adjacent Channel Rejection (± 4 kHz): > 70 dB.
Equivalent Noise Bandwidth: 3.1 kHz (nominal).

GROUP FILTER — 48 kHz (OPTION 011)

Ripple over 35 kHz: < 1.2 dB pk-pk.
3 dB Bandwidth: 48 kHz, ± 12%.
Adjacent Group Rejection (± 48 kHz): > 25 dB.
Rejection at > ± 80 kHz: > 40 dB.
Equivalent Noise Bandwidth: 52 kHz (nominal).

NOMINAL MEASUREMENT TIMES

	0.01 dB Resolution		0.1 dB Resolution		1 dB Resolution
	3 dB Separation[+]	80 dB Separation[+]	3 dB Separation[+]	80 dB Separation[+]	
Pilot Filter	< 1250 ms	< 1600 ms	< 450 ms	< 800 ms	< 500 ms
Channel Filter	< 940 ms	< 1130 ms	< 140 ms	< 330 ms	< 140 ms
Group Filter (Option 011)	—	—	< 200 ms	< 300 ms	< 200 ms

[+] "Separation" is the difference in level (in dB) between adjacent measurements.

INTERMODULATION AND SPURIOUS PRODUCTS

Second Order Intermodulation Rejection: > 63 dB
(relative to the total power of two input signals and measured at $|f_1 \pm f_2|$ where this is in band).
Third Order Intermodulation Rejection: > 70 dB (for two tones greater than 50 kHz apart), > 60 dB (for two tones less than 50 kHz apart); relative to the total power of two input signals and measured at $|2f_1 \pm f_2|$ and $|2f_2 \pm f_1|$ where these are in band.

NOMINAL INTERMODULATION PERFORMANCE

Unbalanced Input: On a fully loaded 1800 channel system with a mean channel level of —15 dBm0, the SLMS intrinsic NPR is > 58 dB for all autoranging states.

IMAGE AND IF REJECTION

Description	Frequency	Rejection
½ x 1st IF	25.0078125 MHz	> 60 dB
1st IF (Channel & Pilot Filters)	50.015625 MHz	> 70 dB
1st IF Image	*	> 70 dB
2nd IF (Channel & Pilot Filters)	15625 Hz	> 70 dB
2nd IF Image	**	> 75 dB
3rd IF (Pilot Filter)	919 Hz	> 80 dB
3rd IF Image	***	> 65 dB

* 1st IF Image = Tuned Frequency + (2 x 1st IF) (Channel and Pilot Filters only)

** 2nd IF Image = Tuned Frequency + (2 x 2nd IF) (Channel and Pilot Filters only)

*** 3rd IF Image = Tuned Frequency + (2 x 3rd IF) (Pilot Filter only)

ADDITIONAL INPUTS/OUTPUTS

10 MHz REFERENCE INPUT

Frequency Required to Maintain Lock: 10 MHz, or any integer sub-multiple of 10 MHz, in range 1 to 10 MHz.
Level: —3 dBm to +20 dBm into 50Ω.

Accuracy and Stability: dependent on External Source.
Connector: BNC 50Ω.

10 MHz REFERENCE OUTPUT

Frequency: 10 MHz.
Initial Setting Accuracy
+
Ageing Rate
+
Temperature Drift
} **Total Error:** < ± 5 x 10^{-5}

Level: +6 dBm ± 2 dB into 50Ω, or —30 dBm ± 2 dB into 75Ω, dependent on setting of internal link.

Table 1-1 Specifications (continued)

10 MHz OVEN OUTPUT (OPTION 013)

Frequency: 10 MHz.
Initial Setting Accuracy: $\pm 1 \times 10^{-7}$.
Ageing Rate: $< \pm 1.5 \times 10^{-7}$/year.
Level (when oven has reached operating temperature):
0 dBm (nominal) into 50Ω.
Connector: BNC 50Ω.

AUDIO OUTPUTS (REAR PANEL)

Provide demodulated voice channel output when 3.1 kHz Filter is selected. Specifications only apply if 0.1 dB or 0.01 dB Resolution operative. An output is also available when Weighted & Notch Filters (provided by Options 015 and 016) are selected, but specifications relating to frequency response and level no longer apply.
Frequency Response: ± 1 dB (600 Hz to 3.1 kHz).
Nominal Impedance: 600Ω balanced.
Nominal Level (after autoranging): -3 dBm to -13 dBm.
Connector: Siemens type 9 REL STP-6AC (3-pin) and Jack Socket compatible with WECO 347 or ¼'' Jack Plug.

AUDIO OUTPUT (FRONT PANEL)

Provides amplified version of rear panel Audio Output to internal loudspeaker or audio jack.
Level: 0 dBm maximum into 600Ω, adjustable by volume control.
Connector: compatible with WECO 347 or ¼'' Jack Plug.

PROBE POWER

Voltages: $+ 15.5$V and -12V.
Current: 100 mA maximum (both voltage lines).
Connectors: compatible with Hewlett-Packard standard Probe Power Jack.

ACCESS SWITCH CONTROLLER

Provides control signals for HP 3754A, 3756A and/or 3757A Access Switches. Provides dc power sufficient for one 3757A Access Switch.
Number of Selectable Signal Ports: 10 with a single Access Switch, up to 1000 with 111 cascaded Access Switches.
Switch Control Path: 2-wire (only) to first level Access Switch; 2-wire or coaxial from first level Access Switch to second and third level switches.
Acceptable dc Resistance of 2-wire Path (between 3746A and first level Access Switch, or between Switches): 100Ω.
Nominal Connect/Disconnect Times using 3754A Access Switch(es):
Connection Time (N = Switch Port Number):
 $0.9 + (N \times 0.05)$s/switch, or
 $0.03 + (N \times 0.002)$s/switch with Rear Panel "Access Switch Speed" selector set to Normal or Fast respectively.
Input Termination Disconnect Time: 0.5 ms.

Digital Control Signals:
Nominal Pulse Rate: 20 pulses/s $\pm 15\%$ or 600 pulses/s $\pm 15\%$, depending on setting of rear panel switch (Normal or Fast, respectively).
Nominal Mark : Space Ratio: 50 : 50 $\pm 20\%$.
Power Supply Output (for 3757A Access Switch):
Voltages: $+15.5$V ± 1V
 -15.5V ± 1V
Current: 100 mA maximum (+ and $-$).
Connector: 5-screw terminal block (Power Supply and 2-wire output).

PHASE JITTER OUTPUT

Provides access to the sidebands on a 1 kHz tone as selected by Phase Jitter measurement.
Connector: BNC.

CHART RECORDER/METER DRIVE OUTPUT
(activated by special key sequence)

Provides two types of output drive — current or voltage — suitable for connection to an external Chart Recorder or Meter. Changeover between current and voltage drive is by means of internal switches.
Current Drive:
Output: 0 to +5 mA, proportional to measured level of SLMS input signal (after centering within dynamic range).
Dynamic Range: ± 3 dB.
Maximum Load Impedance: 1200Ω.
Voltage Drive:
Output: -3 to $+3$V dc; proportional to measured level of SLMS input signal (after centering within dynamic range).
Dynamic Range: ± 3 dB.
Nominal Output Impedance: 1000Ω.
Connectors: pair of Binding Posts (Banana Sockets) on 1'' (25.4 mm) centres.

HP-IB INTERFACE

Loading: 1 Bus Load, capable of driving up to 14 HP-IB devices.
Interface Functions Subset:
3746A as Controller: SH1 AH1 T4 L4 SRØ RLØ PPØ DCØ DTØ C1 C3 C4 C28.
3746A under remote control: SH1 AH1 T6 L4 SR1 RL1 PPØ DC1 DT1 CØ.
Compatible Peripherals (Bus-Controllable from SLMS):
Tracking Frequency Synthesizers: HP Models 3330B, 3335A and 3336A/B.
Printers: HP Models 82905A, 5150A, 2631B and other HP-IB Printers.
CRT Display: HP Model 37461A.
Standard HP-IB Addresses (decimal):
3746A: 10.
HP-IB Extender: 17.
CRT Display: 03.
Printer: 05.
Synthesizer: 04.

Table 1-1 Specifications (continued)

GENERAL

Dimensions:
   Height: 190 mm (7.5 in)
   Width: 460 mm (18.1 in)
   Depth: 495 mm (19.5 in)
(Overall — including handles, feet and connectors).
Weight:
   Net: 25 kg (55 lb)
   Shipping: 34 kg (75 lb)
Power:
   Voltages: 100/120/220/240V
   Tolerance: +5%, −10%
   Frequency: 48 to 66 Hz
   Power Consumption: 200 VA (max).

OPTIONS

CONNECTOR OPTIONS (FRONT PANEL ONLY)

OPTION 001

75Ω Unbalanced Input Connector: Siemens Series 1.6/5.6 mm.

OPTION 005

75Ω Unbalanced Input Connector: commercial equivalent of WECO Type 477B (accepts WECO Plug 358A).
124Ω Balanced Input Connectors (pair): commercial equivalent of WECO Type 477B on 16 mm (0.625 in) centres (accepts WECO Plug 358A).
135Ω Balanced Input Connectors (pair): commercial equivalent of WECO Type 223A on 16 mm (0.625 in) centres (accepts WECO Plug 241A).
600Ω Balanced Input Connectors: commercial equivalent of WECO Type 223A (accepts WECO Plug 241A).

MEASUREMENT OPTIONS

OPTION 011 — GROUP FILTER

Allows the 3746A to measure power in a 12-channel Group over 48 kHz bandwidth (−3 dB points). Full specification of Group Filter, including measurement range, accuracy and filter shape is provided in the main 3746A Specifications. The Group Filter Option also provides a Supergroup power measurement capability; the SLMS can automatically evaluate and display Supergroup power as the logarithmic sum of 5 Group power measurements.

OPTION 012 — TRACKING GENERATOR

Provides an integral Tracking Generator with output frequency the same as SLMS tuned frequency. Disabled when 48 kHz or Weighted Filters are selected.
Level: −10 dBm ± 0.5 dB (nominal).
Flatness: ± 0.2 dB, 10 kHz to 32 MHz.
Spurious and Harmonic Signals Relative to Main Output: < −40 dB.
Connector: BNC 75Ω.
Return Loss: > 30 dB, 10 kHz to 32 MHz.

OPTION 013 — HIGH STABILITY FREQUENCY REFERENCE

Increases SLMS tuning accuracy.
Initial Setting Accuracy: $\pm 1 \times 10^{-7}$.
Ageing Rate: $< \pm 1.5 \times 10^{-7}$/year.

OPTION 015 — CHANNEL IMPAIRMENTS (CCITT)

Provides a psophometrically weighted filter with selectable 1010 Hz notch, and measurement of Phase Jitter, and Impulse Noise.

WEIGHTED FILTER

Psophometric weighting superimposed on 3.1 kHz Channel Filter, in accordance with CCITT Recommendation P.53.A (Geneva 1980).
Uncertainty of Weighted Noise Measurement: < ± 1 dB.
Measurement Resolution: 1 dB or 0.1 dB.

PHASE JITTER

Measurement of Phase Jitter is performed on a demodulated 1 kHz Channel Test Tone.
Frequency of Demodulated Tone: 1 kHz ± 50 Hz.
Measurement Bandwidth: selectable: 4 Hz to 20 Hz, 20 Hz to 300 Hz or 4 Hz to 300 Hz.
Residual Phase Jitter: ≤ 0.5° pk-pk.
Accuracy: ± 15% ± 0.5°.

NOTCH FILTER

Adds a 1010 Hz Notch to Weighted Filter response in accordance with CCITT Recommendation O.132.

IMPULSE NOISE

Provides a single threshold Impulse Noise measurement in accordance with CCITT Recommendation O.71.
Maximum Measurement Period: 99 minutes 59 seconds.
Maximum Impulse Count: 999.
Counting Rate: 125 ms/count ± 5%.
Threshold Accuracy on 1700 Hz Tone: ± 1 dB for threshold ≥ −80 dBm, and ≤ + 20 dBm. Measured channel power should not exceed threshold by more than 54 dB.

Table 1-1 Specifications (continued)

**OPTION 016 – CHANNEL IMPAIRMENTS
(NORTH AMERICA)**

Provides a C-message weighted filter with selectable 1010 Hz notch, and measurement of Phase Jitter and Impulse Noise.

WEIGHTED FILTER

C-Message weighting superimposed on 3.1 kHz Channel Filter as specified in BSTR Pub. 41009.
Uncertainty of Weighted Noise Measurement: $< \pm 1$ dB.
Measurement Resolution: 1 dB or 0.1 dB.

PHASE JITTER

Measurement of Phase Jitter is performed on a demodulated 1 kHz Channel Test Tone.
Frequency of Demodulated Tone: 1 kHz $\pm$ 50 Hz.
Measurement Bandwidth: selectable: 4 Hz to 20 Hz, 20 Hz to 300 Hz or 4 Hz to 300 Hz.
Residual Phase Jitter: $\leq 0.5°$ pk-pk.
Accuracy: $\pm 15\% \pm 0.5°$.

NOTCH FILTER

Adds a 1010 Hz Notch to Weighted Filter response in accordance with BSTR Pub. 41009.
Rejection: > 50 dB, 995 Hz to 1025 Hz.
< 3 dB at 862 Hz and 1182 Hz.
Out of Band Ripple (< 400 Hz and > 1700 Hz): $< \pm 0.5$ dB.

IMPULSE NOISE

Provides a single threshold Impulse Noise measurement in accordance with BSTR Pub. 41009.
Maximum Measurement Period: 99 minutes 59 seconds.
Maximum Impulse Count: 999.
Counting Rate: 143 ms/count $\pm$ 5%.
Threshold Accuracy on 1700 Hz tone: ± 1 dB for threshold ≥ -80 dBm, and $\leq +20$ dBm. Measured channel power should not exceed threshold by more than 54 dB.

OPTION 907 – FRONT HANDLE KIT

Adds front handles to the SLMS.

OPTION 908 – RACK FLANGE KIT

Enables the SLMS to be secured in a 483 mm (19 in) rack.

OPTION 909 – RACK AND HANDLE KIT

Combination of Options 907 and 908.

OPTION 910 – EXTRA SET OF MANUALS

SECTION II
INSTALLATION

2-1 INTRODUCTION

2-2 This section provides installation instructions for the Hewlett-Packard Model 3746A Selective Level Measuring Set (SLMS) and its accessories. This section also includes information about initial inspection and damage claims, preparation for using SLMS and packaging, storage and shipment.

2-3 INITIAL INSPECTION

WARNING

TO AVOID HAZARDOUS ELECTRICAL SHOCK, DO NOT PERFORM ELECTRICAL TESTS WHEN THERE ARE SIGNS OF SHIPPING DAMAGE TO ANY PORTION OF THE OUTER ENCLOSURE (COVERS, PANELS, METERS).

2-4 Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1; procedures for checking electrical performance are given in Section IV of the Service Manual. If the contents are incomplete, if there is mechanical damage or defect or if the SLMS does not pass the Performance Tests, notify the nearest Hewlett-Packard office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carriers inspection. The HP office will arrange for repair or replacement at HP Option without waiting for claim settlement.

2-5 PREPARATION FOR USE

WARNING

TO AVOID THE POSSIBILITY OF INJURY OR DEATH, THE FOLLOWING PRECAUTIONS MUST BE FOLLOWED BEFORE THE INSTRUMENT IS SWITCHED ON.

(A) NOTE THAT THE PROTECTION PROVIDED BY GROUNDING THE INSTRUMENT CABINET MAY BE LOST IF ANY POWER CABLE OTHER THAN THE THREE-PRONGED TYPE SUPPLIED IS USED TO COUPLE THE AC LINE VOLTAGE TO THE INSTRUMENT.

(B) IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTO-
TRANSFORMER TO REDUCE OR INCREASE THE LINE VOLT-
AGE, MAKE SURE THAT THE COMMON TERMINAL IS CONN-
ECTED TO THE NEUTRAL POLE OF THE POWER SOURCE.

(C) THE POWER CABLE PLUG SHALL ONLY BE INSERTED INTO
A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH
CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGA-
TED BY THE USE OF AN EXTENSION CORD WITHOUT A PRO-
TECTIVE CONDUCTOR (GROUNDING).

2-6 Power Requirements

2-7 The SLMS requires a power source of 100V, 120V, 220V, or 240V ac,
+5%-10%, 48 to 66Hz single phase. The maximum power consumption is
200VA.

2-8 Line Voltage Selection and Fuse

2-9 The line voltage is selected by the rear panel switch labelled 100V,
120V, 220V and 240V.

CAUTION

Before connecting the instrument to a power outlet ensure that the line
voltage selector is correctly set, and that a fuse of the correct rating is
fitted.

2-10 Fuse ratings are given in Table 2-1.

Table 2-1 Fuses

Nominal Line	Fuse Rating	HP Part Number
100V 120V	2A	2110-0002
220V 240V	1A	2110-0001

2-11 Power Cable

2-12 This instrument is equipped with a three-wire power cable. When connected to a power outlet, this cable grounds the instrument case. The type of power cable shipped with each instrument depends on the country of destination. I fer to Figure 2-1 for part numbers of the power cable and plug configurations available. The number shown below each plug is the Hewlett-Packard part number of a power cord equipped with that plug. If the appropriate power cord is not included with the instrument, notify the nearest Hewlett-Packard Sales and Service Office and a replacement will be provided.

| 8120-2104 | 8120-1369 | 8120-1689 | 8120-1351 | 8120-1378 | 8120-2956 |
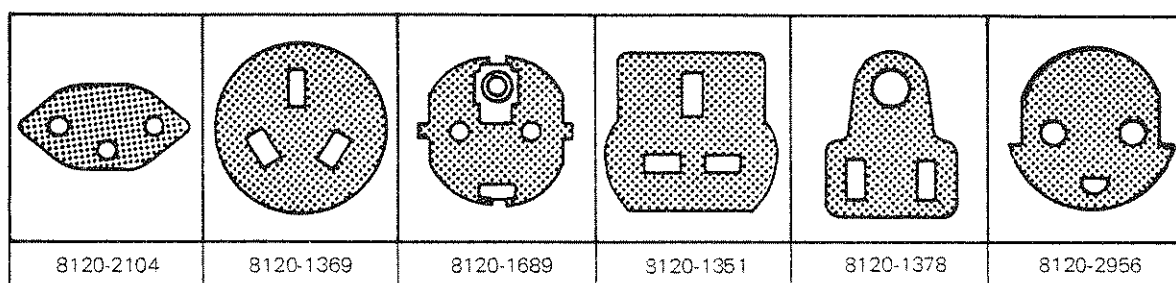
Figure 2-1 Power Receptacles

2-13 The colour code used in each power cable is given below:

        Line   Brown
        Neutral   Blue
        Ground   Green/Yellow

2-14 Operating Environment

2-15 Temperature —— The instrument may be operated in temperatures from 0 degrees centigrade to +55 degrees centigrade.

2-16 Humidity —— The instrument should be protected from temperature extremes which may cause condensation within the instrument.

2-17 Altitude —— The instrument may be operated at altitudes up to 4600m (15,000ft).

2-18 RACK MOUNTING

2-19 Illustrated in Figure 2-2 are the three Rack Mount Kits available with the SLMS.

7H FRONT HANDLE KIT
[PRODUCT HT. 177.0mm/6.969 in.]

HP PART NUMBER 5061-0090 (OPTION 907)
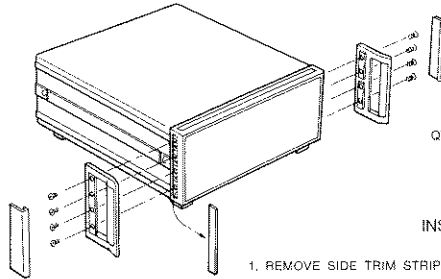
CONTENTS

QTY.		PART NO.
2	FRONT HANDLE ASS'Y	5060-9900
2	FRONT HANDLE TRIM	5020-8897
8	=8-32 x 3/8 SCREW	2510-0195

INSTRUCTIONS

1. REMOVE SIDE TRIM STRIPS.
2. ATTACH FRONT HANDLE ASS'Y WITH 4 SCREWS PER SIDE.
3. PRESS FRONT HANDLE TRIM IN PLACE.

7H RACK MOUNT KIT WITH FRONT HANDLES
[PRODUCT HT. 177.0mm/6.969 in.]

HP PART NUMBER 5061-0084 (OPTION 909)
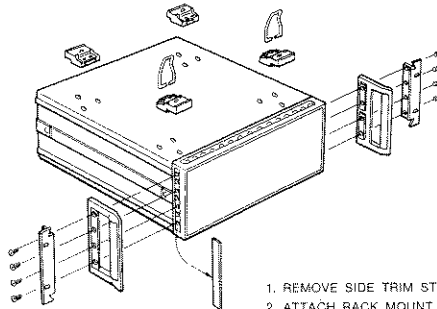
CONTENTS

QTY.		PART NO.
2	RACK MOUNT FLANGE	5020-8875
2	FRONT HANDLE ASS'Y	5060-9900
8	=8-32 x 5/8 SCREW	2510-0194

INSTRUCTIONS

1. REMOVE SIDE TRIM STRIPS.
2. ATTACH RACK MOUNT FLANGE AND FRONT HANDLE ASS'Y WITH 4 SCREWS PER SIDE.
3. REMOVE FEET AND TILT STANDS BEFORE RACK MOUNTING.

7H RACK MOUNT KIT WITHOUT FRONT HANDLES
[PRODUCT HT. 177.0mm/6.969 in.]

HP PART NUMBER 5061-0078 (OPTION 908)

CONTENTS

QTY.		PART NO.
2	RACK MOUNT FLANGE	5020-8863
8	=8-32 x 3/8 SCREW	2510-0193

INSTRUCTIONS

1. REMOVE SIDE TRIM STRIPS.
2. ATTACH RACK MOUNT FLANGE WITH 4 SCREWS PER SIDE.
3. REMOVE FEET AND TILT STANDS BEFORE RACK MOUNTING.

Figure 2-2 Rack Mount Kits

2-20 STORAGE AND SHIPMENT

2-21 Environment

2-22 The instrument may be stored or shipped in environments within the following limits:

```
Temperature....................-40 degrees centigrade to
                               +75 degress centigrade
Altitude......................15,300M (50,000ft)
```

2-23 The instrument should also be protected from temperature extremes which may cause condensation within the instrument.

2-24 Packaging

2-25 Tagging for Service ———— If the instrument is being returned to Hewlett-Packard for service, please complete one of the blue repair tags located at the front of this manual and attach it to the instrument.

2-26 Original Packaging ———— Containers and material identical to those used in the factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also mark the container ´FRAGILE´ to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-27 Other Packaging ———— The following general instructions should be used for re-packing with commercially available materials:

(a) Wrap instrument in heavy paper or plastic. (If shipping to Hewlett-Packard office or service centre, attach a tag indicating type of service required, return address, model number and full serial number.)

(b) Use strong shipping container. A double-walled carton made of 350-pound test material is adequate.

(c) Use a layer of shock absorbing material 70 to 100mm (3- to 4-inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside the container. Ensure the control panel is protected with cardboard or some other suitable material.

(d) Seal shipping container securely.

(e) Mark the shipping container ´FRAGILE´ to ensure careful handling.

(f) In any correspondence, refer to instrument by model number and full serial number.

2-28 ALTERNATIVE OUTPUTS

2-29 The rear panel 10MHz OUTPUT and CHART RECORDER OUTPUT both have two selectable output modes which are determined by the setting of test links and switches within the 3746A. The folowing paragraphs outline the procedures for converting these outputs.

WARNING

THE FOLLOWING PROCEDURES SHOULD BE PERFORMED BY SERVICE TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED.

2-30 10MHz OUTPUT (+6dBm, 50 ohm or —30dBm, 75 ohm)

2-31 The 3746A is normally supplied with the rear panel 10MHz OUTPUT in the +6dBm, 50 ohm mode. The following procedure modifies the output to −30dBm, 75 ohm.

PROCEDURE

1. Disconnect the power cable.

2. Remove the 3746A top cover.

3. Remove Assembly A40 from housing.

4. Remove A40TL1 from ´50´ position and fit it to ´75´ position.

5. Replace items in steps 1,2 and 3 (in the reverse order) to restore the 3746A ready for use.

2-32 CHART RECORDER OUTPUT (voltage or current drive)

2-33 The 3746A is normally shipped with the rear panel CHART RECORDER OUTPUT in the voltage drive mode. The following procedure modifies the output to current drive.

PROCEDURE

1. Disconnect the power cable.

2. Remove the 3746A top cover.

3. Remove Assemblies A21 and A60 from housings.

4. Remove A21TL1 from ´V´ position and fit it into ´I´ position.

5. Switch A60S2 switch position 1 to ON (or ´1´ position).

6. Replace items in steps 1,2 and 3 (in the reverse order) to restore the 3746A ready for use.

2-34 EXTENDING THE CCITT FDM PLANS

2-35 The SLMS CCITT FDM plans 1A and 2 are extended to 4 Super Master Groups and 4 Hypergroups respectively by carrying out the following procedure.

WARNING

BEFORE CARRYING OUT THE FOLLOWING PROCEDURE ENSURE THAT THE MAINS POWER CABLE IS DISCONNECTED FROM THE INSTRUMENT.

PROCEDURE

1. Remove the top cover.

2. Remove Assembly A60.

3. Switch A60S2(7) to the ´0´ position (see Figure 2-3).

4. Replace Assembly A60 and the top cover.

5. Set the front panel PLAN switch to CCITT (1A or 2 as required) and the MASTER GPS/SYSTEM BW switch to 12MHz position.
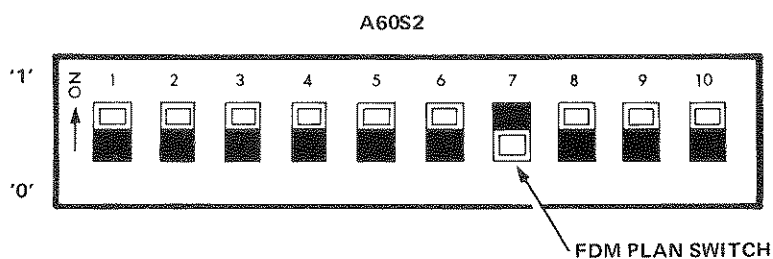
Figure 2-3 Extending FDM Plan

2-36 HEWLETT-PACKARD INTERFACE (HP-IB) BUS INSTALLATION

2-37 This section contains information and instructions on the installation of the 3746A Selective Level Measurement Set (SLMS) into a Hewlett-Packard Interface Bus (HP-IB) system.

2-38 The HP-IB is Hewlett-Packards implementation of the IEEE Standard 488-1978 (Digital Interface for Programmable Instrumentation). This standard defines a physical interface and protocol which enables the remote control of instrumentation systems.

2-39 CONNECTION TO THE HP-IB
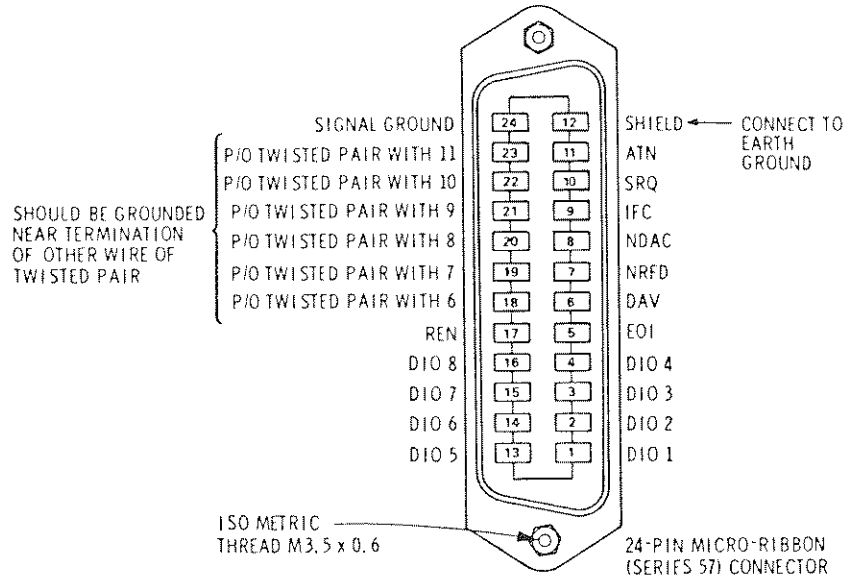
Figure 2-4 HP-IB (rear panel) Connector

2-40 The HP-IB connector on the rear panel of the SLMS provides the physical interface to connect the SLMS into an HP-IB system. Figure 2-4 illustrates the connector pin configuration. Devices in the HP-IB system may be interconnected in any suitable arrangement (star, delta, etc) using the HP-IB cables listed in Table 2-2 provided the restrictions given in Paragraph 2-41 are obeyed.

Table 2-2 HP-IB Interface Cables

HP-IB Part Numbers	Cable Lengths
HP10833A	1m (3.3ft)
HP10833B	2m (6.6ft)
HP10833C	4m (13.2ft)
HP10833D	0.5m (1.6ft)

2-41 To achieve design performance, restrictions are placed on the length of HP-IB system cable as follows:

1. The total length of HP-IB cable used to interconnect devices on the HP-IB must not exceed 2 metres (6 feet) times the number of devices in the system.

2. The total length of HP-IB cable used to interconnect all devices must not exceed 20 metres (65 feet).

2-42 SLMS CONFIGURATION

2-43 The SLMS may be configured either as the system controller in an HP-IB system containing certain selected peripherals or as a device under the remote control of a separate system controller (normally a computer or computing controller). Seperate installation information is given as described below depending upon whether the SLMS is con-figured as the system controller or as a device under the control of a separate system controller. Paragraphs 2-44 to 2-51 describe SLMS in-stallation in an HP-IB system where the SLMS is configured as the system controller. Paragraphs 2-52 to 2-56 describe SLMS installation in an HP-I system where the SLMS is configured as a device under the control of a separate system controller.

2-44 SLMS CONFIGURED AS SYSTEM CONTROLLER

2-45 The setting of the CNTRL switch (see Figure 2-5) on the SLMS rear panel to the CNTRL ON (1) position configures the SLMS as the system controller.

2-46 As the system controller the SLMS has the ability to control the operation of suitable Printers, Frequency Synthesizers, HP-IB Bus Ex-tenders and CRT Displays. A list of suitable HP equipment is given in Table 2-3.

Table 2-3 SLMS As Controller — Suitable HP Equipment

Device	HP Model
Printer	HP 5150A Opt 001 (20 column) HP 2631B Opt 046 (80 column)
Frequency Synthesizer	HP 3330B (0.1-13MHz) HP 3335A (200Hz-80MHz) HP 3336A/B/C (10Hz-21MHz)
CRT Display	HP 37461A CRT Display
HP-IB Bus Extender	HP 37201A Bus Extender

2-47 HP-IB DEVICE ADDRESSING

2-48 Each device in an HP-IB system requires a unique address to distinguish it from other devices in the system. An SLMS configured as the system controller has fixed listen and talk addresses as detailed in Table 2-4. Other devices on the HP-IB system must be set to respond to the appropriate address as listed in Table 2-4. Refer to the individual instrument operating manual for details on address setting.

Table 2-4 Device Addresses

Device	Listen Address		Talk Address	
	Decimal	ASCII Char	Decimal	ASCII Char
SLMS (Fixed)	42	*	74	J
Printer	05	%	–	–
Synthesizer	04	$	–	–
CRT Display	03	#	–	–
HP-IB Extender	49	1	81	Q

2-49 REAR PANEL HP-IB SWITCHES

Printer message formatted for
80 columns printer (HP 2631A Opt 046)

HP 37461A CRT Display
messages enabled

* HP 37201A Bus Extender
in the HP-IB system

SLMS as System Controller
(must be selected in this mode)

Defines the Synthesizer
message format (see table)

Set to 00

No HP 37201A Bus Extender
in the HP-IB system

HP 37461A CRT Display messages
disabled

Printer message formatted for 20 column
printer (HP 5150A Opt 001)

0	0	HP 3330B
0	1	HP 3335A
1	0	HP 3336A
1	1	HP 3336A

*Note: The HP-IB Extender setting must only be selected if the HP-IB network includes an HP 37201A HP-IB Extender. If this setting is selected and the HP-IB network does not include an HP 37201A HP-IB Extender the SLMS will hang-up. Do not select this position if the HP-IB system contains any bus extender other than the HP 37201A.

Figure 2-5 HP-IB Switch Settings — SLMS as System Controller

2-50 With the SLMS configured as the system controller, the switch settings on the rear panel HP-IB switch bank inform the SLMS which

message format is required for the particular devices connected into the HP-IB. The switch settings are explained and illustrated in Figure 2-5. For detailed descriptions of the message formats transmitted by the SLMS see Section V.

2-51 SLMS CONFIGURED AS DEVICE
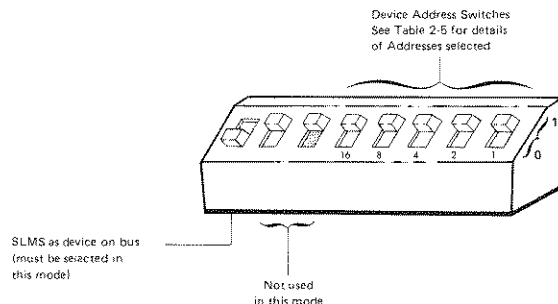
Figure 2-6 HP-IB Switches — SLMS as Device on Bus

2-52 The settings of the CNTRL switch (see Figure 2-6) on the SLMS rear panel to the CNTRL OFF (0) position configures the SLMS as an HP-IB device under the remote control of a separate HP-IB controller.

2-53 HP-IB ADDRESSING

2-54 Each device in the HP-IB system requires a unique address to enable the system controller to differentiate between devices. The SLMS has one listen address and three talk addresses. The addresses are defined by the setting of the Device Address switches within the HP-IB switch bank on the SLMS rear panel. The setting of these switches and the corresponding listen and talk addresses are illustrated in Figure 2-6 and Table 2-5 respectively. Note that the device address switch must not be set between 29 and 31 inclusive since this will cause invalid addresses.

2-55 Care should be taken to enusre that the listen or talk addresses of any other device in the HP-IB system does not duplicate one of the SLMS listen or talk addresses.

Table 2-5 SLMS Address Setting

Device Address					Device Address	Listen Address			Talk Addresses								
									Octal			Decimal			ASCII		
						Octal	Decimal	ASCII	1	2	3	1	2	3	1	2	3
16	8	4	2	1													
0	0	0	0	0	0	40	32	Space	100	101	102	64	65	66	@	A	B
0	0	0	0	1	1	41	33	!	101	102	103	65	66	67	A	B	C
0	0	0	1	0	2	42	34	"	102	103	104	66	67	68	B	C	D
0	0	0	1	1	3	43	35	#	103	104	105	67	68	69	C	D	E
0	0	1	0	0	4	44	36	$	104	105	106	68	69	70	D	E	F
0	0	1	0	1	5	45	37	%	105	106	107	69	70	71	E	F	G
0	0	1	1	0	6	46	38	&	106	107	110	70	71	72	F	G	H
0	0	1	1	1	7	47	39	'	107	110	111	71	72	73	G	H	I
0	1	0	0	0	8	50	40	(	110	111	112	72	73	74	H	I	J
0	1	0	0	1	9	51	41	)	111	112	113	73	74	75	I	J	K
0	1	0	1	0	10	52	42	*	112	113	114	74	75	76	J	K	L
0	1	0	1	1	11	53	43	+	113	114	115	75	76	77	K	L	M
0	1	1	0	0	12	54	44	'	114	115	116	76	77	78	L	M	N
0	1	1	0	1	13	55	45	−	115	116	117	77	78	79	M	N	O
0	1	1	1	0	14	56	46	.	116	117	120	78	79	80	N	O	P
0	1	1	1	1	15	57	47	/	117	120	121	79	80	81	O	P	Q
1	0	0	0	0	16	60	48	0	120	121	122	80	81	82	P	Q	R
1	0	0	0	1	17	61	49	1	121	122	123	81	82	83	Q	R	S
1	0	0	1	0	18	62	50	2	122	123	124	82	83	84	R	S	T
1	0	0	1	1	19	63	51	3	123	124	125	83	84	85	S	T	U
1	0	1	0	0	20	64	52	4	124	125	126	84	85	86	T	U	V
1	0	1	0	1	21	65	53	5	125	126	127	85	86	87	U	V	W
1	0	1	1	0	22	66	54	6	126	127	130	86	87	88	V	W	X
1	0	1	1	1	23	67	55	7	127	130	131	87	88	89	W	X	Y
1	1	0	0	0	24	70	56	8	130	131	132	88	89	90	X	Y	Z
1	1	0	0	1	25	71	57	9	131	132	133	89	90	91	Y	Z	[
1	1	0	1	0	26	72	58	:	132	133	134	90	91	92	Z	[	\
1	1	0	1	1	27	73	59	;	133	134	135	91	92	93	[	\	]
1	1	1	0	0	28	74	60	<	134	135	136	92	93	94	\	]	^
1	1	1	0	1	29	DO NOT USE THESE ADDRESSES											
1	1	1	1	0	30												
1	1	1	1	1	31												
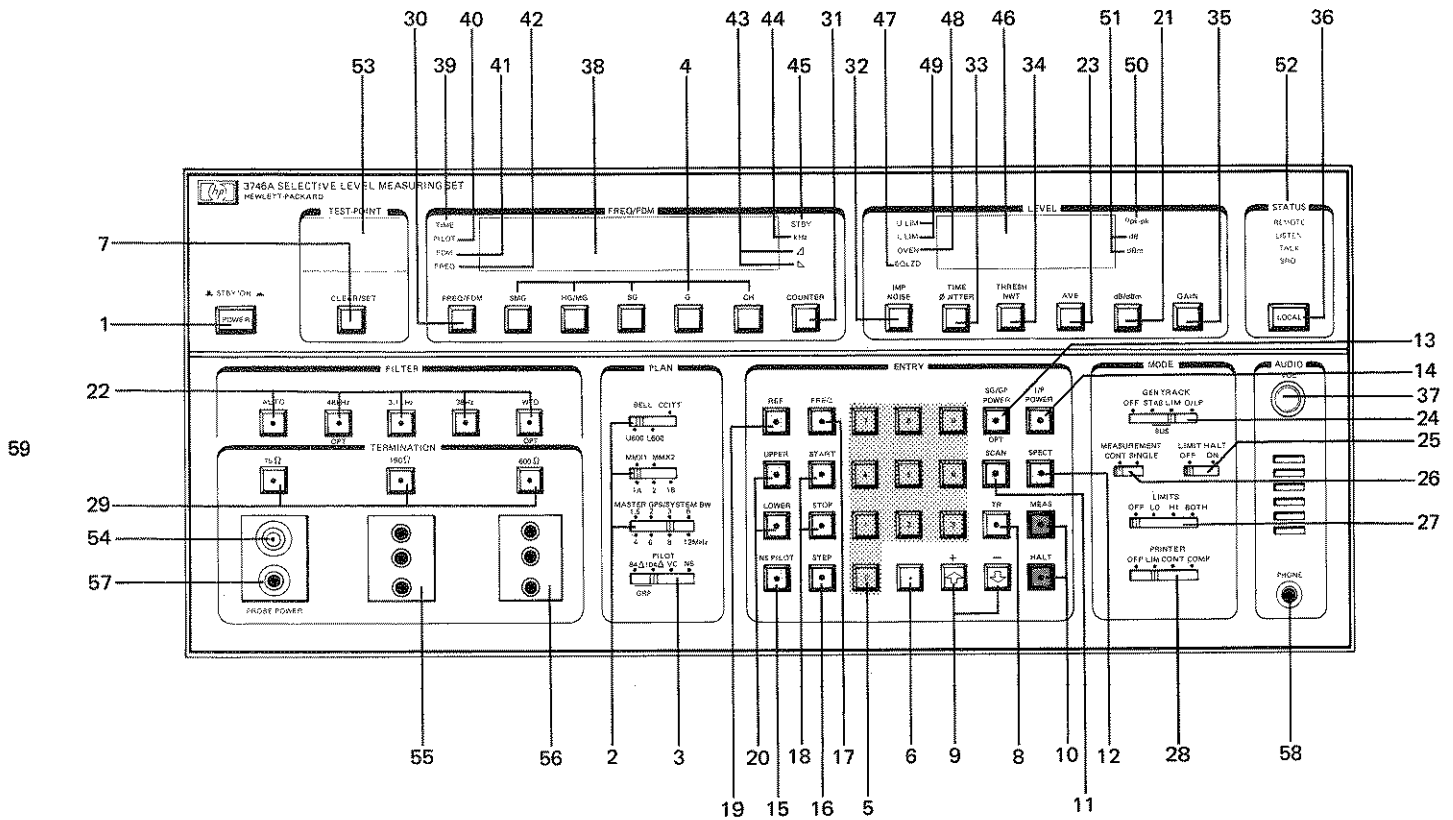
Figure 3-1 SLMS Front Panel

SECTION III

OPERATION

3-1 INTRODUCTION

3-2   This section describes and gives examples of some of the meas-
urements that can be made with the 3746A Selective Level Measuring
Set. A description of the function of each control is given in
Section VI. Any Frequency Division Multiplex (FDM) examples given
in this section apply to an MMX-2C (L4) system for operators working
to North American (BELL) standards and to Plan 1B, 12MHz, 2700 channel
system for those operators conforming to CCITT standards.

3-3 OPERATORS CHECK

3-4   The following procedure will give a reasonable indication to an
operator that the 3746A is functioning normally.

1.   Set the 3746A POWER switch to the STBY position, then set to ON.
     This procedure activates a reset sequence. All the display and
     switch indicators should be on and remain on for a few seconds.

2.   The 3746A should now be initialised with the 75 ohm TERMINATION,
     AUTO and 3.1kHz FILTER selected. The instrument will be in the HALT
     mode and will have a number displayed in the FREQ/FDM display. This
     is the frequency (recovered from the non volatile memory) to which
     the instrument was last tuned.

3.   Press the [AVE] then [2] key to give the 3746A a level resolution
     of 0.01dB. As the instrument is in the HALT mode nothing will
     appear to happen.

4.   Set all slide switches to their left hand position.

5.   Press the [FREQ] key and enter a frequency of 10000.00kHz using
     the numeric keys.

6. Press the [MEAS] key. The instrument should execute the CAL cycle (indicated by the word CAL appearing in the Level Display). The 3746A should then continuously monitor the signal level at the input. In the absence of an input signal the level displayed will be the noise floor of the instrument and should be <-115dBm.

7. Connect the Rear Panel 10MHz OUTPUT to the Front Panel 75 ohm INPUT. The 3746A Level Display should now indicate the level of the 10MHz OUTPUT.

8. Enter a Start Frequency of 50kHz, Stop Frequency of 32MHz and a step size of 10kHz using the following key sequences.

```
[START] [FREQ] [5] [0]
[STOP] [FREQ] [3] [2] [0] [0] [0]
[STEP] [1] [0]
```

Press [SPECT] [MEAS]. The Frequency Display should start at 50kHz and increment in steps of 10kHz towards 32MHz. If the instrument is fitted with the group filter option the 48kHz FILTER will be selected, otherwise the 3.1kHz FILTER will remain selected.

9. Press [HALT] at any time to Halt the measurement.

3-5 If the 3746A is fitted with option 013 High Stability Oscillator and the instrument is switched on from cold the OVEN annunciator will be illuminated indicating that the crystal oven used in the High Stability Oscillator has not reached its full operating temperature. Until the OVEN annunciator is extinguished the 3746A will not achieve its full tuning specifications.

3-6 FRONT AND REAR PANEL CONTROLS

3-7 Figures 3-1 and 3-2 identify all front and rear panel controls, connectors and indicators. The number associated with each control, connector or indicator refers to the number opposite its description in Section VI.

3-8 REFERENCE SETTINGS

3-9 For all measurements detailed in this section the following switch settings will give valid results, unless otherwise specified.

```
ALL INSTRUMENTS (CCITT and BELL)
    FILTER ......................... AUTO
    AVERAGING ..................... Press [AVE] [1]
    GEN TRACK ..................... OFF
    MEASUREMENT ................... CONT
    LIMIT HALT .................... OFF
    LIMITS ........................ OFF
    PRINTER ....................... OFF
    TERMINATION ................... 75 OHM
```

```
FOR BELL EXAMPLES                    FOR CCITT EXAMPLES
    U600/L600 .......... U600            BELL/CCITT ........ CCITT
    MMX1/MMX2 .......... MMX2            1A/2/1B ........... 1B
    MASTER GPS ......... 6               SYSTEM BW ......... 12MHz
    PILOT ............. 104Δ             PILOT ............ 84Δ
```

3-10 INPUT CONNECTORS

3-11 A choice of input impedances is available as detailed below:

```
    150 Ohm balanced ................... Siemens 3 pin plug
    600 Ohm balanced ................... Siemens 3 pin plug
```

3-12 The input connectors detailed above are those fitted to the standard instrument. When an option which affects the connectors is fitted the connectors will change as detailed below:

Option 001 .... Siemens series 2.5/6mm (75 Ohm) connector substituted for the 75 Ohm BNC unbalanced input connector.

Option 005 .... Input impedances of 75 Ohm (unbal) 124 Ohm, 135 Ohm and 600 Ohm (bal) Commercial equivalent of WECO Type 477B used for 75 Ohm and 124 Ohm inputs and Type 223A for 135 Ohm and 600 Ohm inputs.

Note: Measurement frequency range varies with the different inputs – see Table of Specifications in Section I.

3-13 Active and passive high impedance probes are available as accessories (see Section I) and permit bridging measurements to be made.

3-14 The input connections to the 3746A should be made through shielded cables equipped with the appropriate connector. The cables should be as short as possible, to minimise extraneous pick-up.

Note: Connections should not be made to more than one input, or input pair, simultaneously.

3-15 INPUT OVERLOADING

3-16 If the total input power to the 3746A exceeds approximately +20dBm on the unbalanced input or 0dBm on the balanced input, Overload (OLOAD) will appear in the FREQ/FDM Display and steps must be taken to reduce the received power level, since this may cause overloading of the input circuits.

CAUTION

If the total input power exceeds +25dBm damage may result.

3-17 ERROR CODES

3-18 If the user tries to make an invalid measurement, or incorrect data is entered via the keyboard, then ´E´ and a number will appear in the Test-Point Display indicating an Error. The significance of each Error Code is explained in Section VII.

3-19 ENTERING MEASUREMENT PARAMETERS

3-20 In the majority of cases pressing a key when the 3746A is in the Measurement mode will cause the instrument to revert to the Halt mode. This prevents parameters being changed during a measurement, which could give misleading or erroneous results.

3-21 LEVEL DISPLAY

3-22 The Level Display indicates the true rms power, in the selected filter bandwidth, centered on the frequency shown in the Frequency Display. The level displayed is either absolute power in dBm or power in dB´s relative to a previously entered reference level. The dB and dBm annunciators indicate the units in which the level measurement is displayed. To change from dBm to dB, or Vice Versa, press the [dB/dBm] key.

Note: If Options 015 or 016 are fitted then the Level Display will be used to display other parameters as described later in this section.

3-23 REFERENCE LEVEL

3-24   The level to which dB measurements are referenced are entered by pressing the [REF] key and entering the required level in dBm, using the numeric keys. The reference level may be either +ve or -ve and will always be in dBm. When the [REF] key is pressed the current reference level will be displayed in the Level Display.

EXAMPLE: Enter a reference level of -19.35dBm

            Press [REF] [-] [1] [9] [.] [3] [5]

            Level Display: -19.35

3-25 dBm0 MEASUREMENTS

3-26   If the reference level is set to correspond to the Relative Transmission Level at the point of measurement, then the Level Display readings can be considered as being dBm0 when the dB annunciator is illuminated.

3-27 dB RELATIVE TO 1mW IN 600Ω

3-28   In some countries it is common practice to relate all level measurements to a standard 1mW in 600 Ohm, even when the circuit impedance is 75 Ohm. The readings from the 3746A may be related directly to this standard by entering a Reference Level of -9.03dBm. Readings expressed in dB will then be relative to 1mW in 600 Ohm, ie, relative to 0.775V. The correction factor -9.03 corresponds to 10 log 75/600.

3-29 AVERAGING

3-30   Three averaging modes are available which affect the time taken for each measurement and thus the resolution of the Level Display. The averaging modes are selected as follows:

            Press [AVE] [0] .... Display resolution 1dB
            Press [AVE] [1] .... Display resolution 0.1dB
            Press [AVE] [2] .... Display resolution 0.01dB

Note: Changing the averaging when the 3746A is in the Measurement mode
      will initiate a calibration sequence indicated by CAL appearing
      in the Level Display. If the 3746A is in the Halt mode when the
      averaging is changed, the calibration sequence will be initiated
      when the [MEAS] key is pressed.

      If the 48kHz or WTD Filter is selected or if the 3746A is perform-
      ing an Input Power measurement then the Level Display will only
      indicate to 0.1dB even when [AVE] [2] has been selected.

3-31 TOTAL INPUT POWER MEASUREMENT

3-32   To display the total input power, press [I/P POWER] - all displays
will blank. Now press [MEAS] and the total input power will be
continually monitored and displayed in the Level Display.

3-33 MEASUREMENT BY FREQUENCY DESCRIPTION

3-33 (a) Tuning to a Particular Frequency

3-34   The 3746A will tune with a 1Hz resolution to any frequency within
its measurement range (50Hz to 32MHz). To tune to a particular frequency,
press [FREQ] - the last frequency to which the 3746A was tuned will
appear in the FREQ/FDM Display - followed by the required frequency
in kHz using the numeric keys. Press [MEAS] and the 3746A will tune to
the selected frequency and continuously measure and display the input
level at that frequency.

EXAMPLE: Tune to 13289.531kHz

           Set the switches to the reference settings (see paragraph
           3-8).

           Press [FREQ] [1] [3] [2] [8] [9] [.] [5] [3] [1]
           Press [MEAS]
           FREQ/FDM Display - 13289.531kHz
           Level Display - Signal Power

3-35 MANUAL TUNING

3-36   When the 3746A has been tuned to a frequency by the [FREQ] key and
is in the Measurement mode, pressing either [↔↑] or [-↓] will initially
Halt the measurement; subsequent [↔↑] or [-↓] keystrokes will respectively
increase or decrease the frequency to which the instrument is tuned, by
an amount equal to the content of the Step Size Register and make a
single level measurement at each frequency. If either key is held down,
then the frequency to which the 3746A is tuned will step continuously
in the specified direction.

3-37   An entry is made to the Step Size Register by pressing [STEP] and using the numeric keys to specify the required frequency increment in kHz. The minimum permissible step size is 1Hz (0.001kHz).

3-38 SPECTRUM

3-39   In a Spectrum measurement a sequence of level measurements is carried out, in equal steps, between specified frequency limits. These frequency limits and the frequency step, are specified by the contents of the Start Frequency, Stop Frequency and Step Size Registers. Entries to the Start and Stop Registers are made by pressing either [START] [FREQ] or [STOP] [FREQ] and using the numeric keys to specify the parameter in kHz. Entries to the Step Size Register are made by pressing the [STEP] key only, followed by the numeric keys. When [START] [FREQ], [STOP] [FREQ], or [STEP] is pressed the content of the corresponding register appears in the FREQ/FDM Display.

Note: The stop frequency must always be greater than the start frequency for a spectrum measurement.

When [SPECT] [MEAS] is pressed the 3746A will step between the start and stop frequencies by the frequency held in the Step Size Register, making a level measurement at each step.

EXAMPLE: Carry out a continuous Spectrum measurement between 9000kHz and 9500kHz using a 10kHz step.

Set the switches to the reference settings (see paragraph 3-8).

Press [START] [FREQ] [9] [0] [0] [0]
Press [STOP] [FREQ] [9] [5] [0] [0]

Press [STEP] [1] [0]
Press [SPECT] [MEAS]

3-40   At any time during a Spectrum measurement the [←↑] or [-↓] keys may be pressed to Halt the sweep. Subsequent [←↑] or [-↓] keystrokes will step the frequency manually. Each time [←↑] or [-↓] is pressed a single measurement of the level at the new frequency will be made and displayed. If [MEAS] is pressed again, the sweep will continue from the frequency shown in the FREQ/FDM Display but may sweep up or down depending on whether the [←↑] or [-↓] key was the last one pressed.

3-41 During a Spectrum measurement the [AUTO] Filter will select where possible, a filter whose bandwidth is greater than the step size (see Table 3-1).

Table 3-1 Auto Filter Selection (Spectrum)

Step Size	Filter
1Hz to 10Hz	38Hz
11Hz to 2.999kHz	3.1kHz
3kHz and above	48kHz*

*Option 011 only

Any filter can be manually selected by pressing the appropriate key. If a different filter is selected in the middle of a spectrum sweep, the instrument will revert to the Halt mode. To start the sweep again press [SPECT] [MEAS]. A new calibration cycle will be initiated (CAL appears in the Level Display) before the sweep continues. Another use of the [SPECT] mode is for High level Search, which is described in paragraph 3-173.

3-42 STORED RANDOM FREQUENCIES

3-43 When measurements are to be made at frequencies not related by a fixed increment or by an FDM structure, then up to 145 separate frequencies can be stored in the 3746A Random Frequency Register.

3-44 To gain access to the Random Frequency Register press [TR] [1] [1]. The number 001 should appear in the TEST-POINT Display which is used in this function as a register pointer. If position 001 has not had a frequency entered previously then 0.000kHz should appear in the FREQ/ FDM Display. To enter a frequency use the numeric and decimal point keys to specify the frequency in kHz. Press the [+↑] key to move the pointer to the next location and enter another frequency. Up to 145 frequencies may be stored in this way (if the register pointer is increased to 146 the word "End" will appear in the FREQ/FDM Display indicating that the maximum number of frequencies has been entered). The Register Pointer can be moved up and down at any time using the [+↑] and [-↓] keys.

Note: If at any time an error is made while entering a frequency, press [CLEAR/SET] and respecify the frequency.

3-45 Any number of frequencies (N) may be stored up to the maximum of 145. To restrict the sequence to N frequencies, increase the Register Point to N+1 after the Nth frequency is entered and press [CLEAR/SET] - "End" will appear in the FREQ/FDM Display. Pressing [SPECT] [NS PILOT] [MEAS] will sweep the 3746A through the frequencies held in the Random Frequency Register up to Register Pointer N. The sweep can be halted at any time by pressing the [HALT] key and the [↲↑] and [-↓] keys can then be used to manually step through the stored frequencies.

EXAMPLE: Store the following five frequencies in the Random Frequency Register and sweep through them continuously:

          10kHz, 11.95kHz, 12.1kHz, 15kHz, 16.5kHz

          Press [TR] [1] [1]
          Press [1] [0]
          Press [↲↑] [1] [1] [.] [9] [5]
          Press [↲↑] [1] [2] [.] [1]
          Press [↲↑] [1] [5]
          Press [↲↑] [1] [6] [.] [5]
          Press [↲↑] [CLEAR/SET]
          Press [SPECT] [NS PILOT] [MEAS]

3-46 FREQUENCY COUNTER/AFC

3-47 The 3746A can measure the frequency of the incoming signal and retune to that frequency, provided it is within certain limits of the frequency to which the 3746A is currently tuned. These limits vary with the filter selected.

Note: For full counter specifications see Table of Specifications in Section I.

EXAMPLE: Suppose a pilot is expected to be at 9.99995MHz but has drifted off frequency, the 3746A can measure the pilot frequency and retune to that frequency as shown below.

Set the switches to their reference settings (see paragraph 3-8).

Connect the rear panel 10MHz output to the front panel 75 Ohm input and select the 38Hz FILTER.

Press [FREQ] [9] [9] [9] [9] [.] [9] [5] [MEAS]

The 3746A Level Display will be reading approximately -60dBm indicating that the pilot is not at the correct frequency.

Press [COUNTER] [MEAS]

The FREQ/FDM Display should read 10000.000kHz +-2Hz – Note the 3746A is only measuring the input frequency and has not retuned. To retune the 3746A to the input frequency,

Press [TR] [COUNTER] [MEAS]

The 3746A will retune to the input signal (10000.000kHz) and display the measured level in the Level Display.

3-48   MEASUREMENT BY FDM DESCRIPTION

3-48 (a)   TUNING FROM AN FDM DESCRIPTION

3-49   Before attempting to tune within an FDM plan, the type of plan in use must first be specified using the three switches under PLAN. Section VII contains information to help identify the particular plan in use and also gives the required switch settings for each plan.

3-50   The PILOT switch must be set to the frequency of the basic group pilot and should not be in the NS (Non-Standard) or VC (Virtual Carrier) positions unless a specific measurement is being made which requires their selection. The use of the NS and VC positions is covered later in this section.

Note: It is important to ensure there are no unwanted, previously entered FDM skips. See paragraph 3-80.

3-51 MEASUREMENT BANDWIDTH IN FDM SYSTEMS

3-52   If the FILTER selection is in the AUTO position, then the 3746A
will automatically select a filter according to Table 3-2.

Table 3-2 Automatic Filter Selection (FDM)

FDM Measurement	Filter
Channel †	3.1kHz
Pilot	38Hz
Group Power*	48kHz

*Option 011 only
†Pilot switch not in VC or NS position

3-53 FDM DISPLAY

3-54   The FDM Display indicates the point in the FDM system to which
the 3746A is tuned. FDM and Frequency information share the same display
(FREQ/FDM) which can be toggled between frequency and FDM information
by the [FREQ/FDM] key.

3-55   The current content of the FDM Display can be altered by pressing
any of the FDM description keys twice (a ´-´ will appear in the
display) and entering the required number for that level using the
numeric keys. The other FDM levels can be changed in the same manner
except the description key for each level need only be pressed once.
FDM descriptions can be entered in any order.

3-56   If the measurement mode is changed to the Frequency mode the
content of the FDM Display is retained in memory and can be recalled
by pressing any of the FDM description keys once.

3-57 FDM DESCRIPTION

3-58   The 3746A may be connected at any stage of the FDM hierarchy
from a basic channel up to line level. When connected to a chosen point,
measurements may be made at all the levels of the FDM hierarchy below
that point. For example, when connected to a basic supergroup the 3746A
can measure any group or channel within the basic supergroup. Only
group and possibly channel numbers (depending on the measurement
being made) are required and the positions for supergroup and higher
levels must be left at zero.

EXAMPLE: Tune to channel 4 in the basic group.

Set the switches to the reference settings (see paragraph 3-8).

Press [Any FDM key] - to bring forward the FDM Display
Press [HG/MG] [0] [SG] [0] [G] [0] [CH] [4]
Press [MEAS]

Level Display - Signal level in channel
FDM Display - Channel 4 of the basic group
Press [FREQ/FDM]
Frequency Display - 94.150kHz

EXAMPLE: Tune to channel 4 of group 5 in the basic supergroup.
Set the switches to the reference settings (see paragraph 3-8).

Press [Any FDM key] - to bring forward the FDM Display
Press [HG/MG] [0] [SG] [0] [G] [5] [CH] [4]
Press [MEAS]

Level Display - Signal level in channel
FDM Display - Group 5, Channel 4 of the basic supergroup
Press [FREQ/FDM]
Frequency Display - 577.850kHz

3-59 CHANNEL MEASUREMENT

3-60 When a channel measurement is made using the 3.1kHz Filter, as in
the previous examples, the filter will select the exact audio band in
the channel as shown in Figure 3-3. Since the Frequency Display always
indicates the centre frequency of a chosen filter, then it will in this
case indicate the frequency to which the centre of this audio band
(1850Hz) would be translated at the indicated point in the FDM hier-
archy.
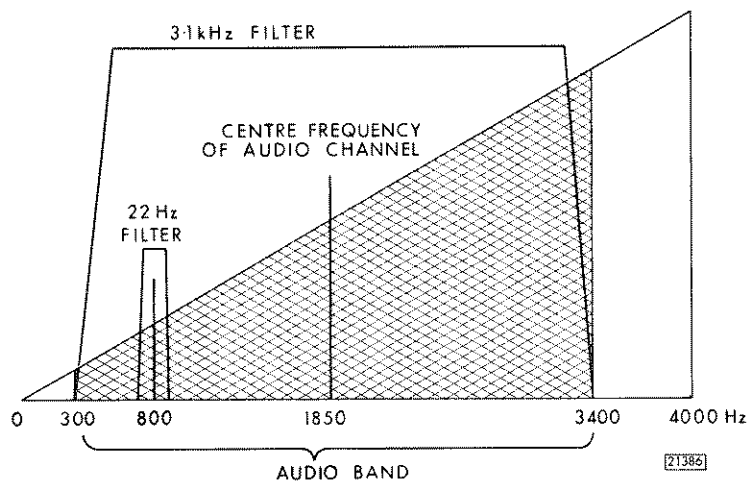
Figure 3-3   A Basic Voice Channel

3-61 TUNING TO THE 800Hz OR 1kHz CHANNEL TEST TONE

3-62   If the 38Hz Filter is selected when a channel is specified, the 3746A will no longer tune to the centre of the audio band, but instead will tune to the frequency that an 800Hz (1kHz for Bell) test tone would occupy in the selected channel and the 38Hz Filter will be centred on this point. It is possible to tune to any other test frequency in a channel by using the [NS PILOT] key as explained later in this section.

3-63 PILOT FREQUENCIES

3-64   The 3746A can be tuned to pilots as well as channels, by means of an FDM description. However, before correct pilot frequencies can be extracted from the stored FDM plan information, the PILOT switch must be set to define the frequency of the basic reference pilots. Two standard settings are provided for the basic group reference pilot, 84Δ (84.08kHz) and 104Δ (104.08kHz). In either of these positions, the frequencies of the other basic reference pilots are as follows:

BELL		CCITT	
Basic Supergroup	315.92kHz	Basic Supergroup (104Δ)	547.920kHz
Basic Supermastergroup	2840kHz	Basic Supergroup (84Δ)	411.92kHz
		Basic Master/Hypergroup	1552kHz
		Basic Supermastergroup	11096kHz

3-65   If basic reference pilots at different frequencies are required, the PILOT switch should be set to Non-Standard (NS) and the appropriate frequency entered into the Non-Standard Pilot Register using the [NS PILOT] and numeric keys (see paragraph 3-87). Having defined the reference pilot in the basic group, supergroup, etc. the 3746A will calculate the corresponding pilot frequency at any stage in the multiplex.

3-66 PILOT MEASUREMENTS

3-67   A pilot measurement is defined by omitting the channel number from an FDM description. If a channel number is not specified then the 3746A will tune to the pilot of the lowest defined level in the FDM description.

EXAMPLE (CCITT):   Tune to group 4 pilot, of supergroup 5, of master-
                    group 8, of supermastergroup 2.

                    Set the switches to the reference settings (see
                    paragraph 3-8).

                    Press [CH] - to bring forward the FDM Display
                    Press [CH] [0] [G] [4] [SG] [5] [HG/MG] [8] [SMG] [2]
                    Press [FREQ/FDM] [MEAS]
                    Level Display - Group pilot level
                    Frequency Display - 5972.080kHz

EXAMPLE (BELL) :   Tune to group 4 pilot, of supergroup 15, of master-
                    group 6.

                    Set the switches to the reference settings (see para-
                    graph 3-8).

                    Press [CH] - to bring forward the FDM Display
                    Press [CH] [0] [G] [4] [SG] [15] [MG] [6]
                    Press [FREQ/FDM] [MEAS]
                    Level Display - Group Pilot level
                    Frequency Display - 16959.92kHz

3-68 MEASUREMENT OF BASIC REFERENCE PILOTS

3-69   To measure the basic pilot associated with the FDM level at which
the 3746A is connected simply enter a ´-´ in the display at that level
and enter 0 for all others.

EXAMPLE: With the 3746A connected to a basic group point, measure the
           level of the basic group pilot.

           Set the switches to the reference settings (paragraph 3-8).

           Press [CH] - to bring forward the FDM display
           Press [CH] [0] [SG] [0] [HG/MG] [0] [SMG]* [0]* [G]
           Press [FREQ/FDM] [MEAS]
           *CCITT Plans only

           Frequency Display - 104.08kHz (BELL), 84.08kHz (CCITT)
           Level Display - Basic Group Pilot Level

3-70 GROUP AND SUPERGROUP POWER MEASUREMENTS

3-71   Group and Supergroup power measurements are only available on instruments fitted with Option 011. Measurements are made by entering the FDM description of the group or supergroup to be measured then pressing the [SG/GP POWER] [MEAS] keys. The group or supergroup power will be continuously monitored and displayed.

EXAMPLE (BELL):   Measure the group power in group 4, of supergroup 13, of mastergroup 1.

Set the switches to the reference settings (paragraph 3-8).

Press [G] — to bring forward the FDM display
Press [G] [4] [SG] [13] [HG/MG] [1]
Press [SG/GP POWER] [FREQ/FDM] [MEAS]

Frequency Display — 636.000kHz
Level Display — Continuously updated group power
                measurement

EXAMPLE (CCITT): Measure the group power in group 4, of supergroup 5, of mastergroup 7, of supermastergroup 2.

Set the switches to the reference settings (see paragraph 3-8).

Press [G] — to bring forward the FDM display
Press [G] [4] [SG] [5] [HG/MG] [7] [SMG] [2]
Press [SG/GP POWER] [FREQ/FDM] [MEAS]

Frequency Display — 7292.000kHz
Level Display — Continuously updated group power
                measurement

3-72   Supergroup powers can be measured in the same way by setting the FDM entry in the group position to zero. The supergroup power measurement uses the 48kHz group power filter and averages the result over five measurements.

3-73   Basic group and supergroup power levels can be monitored by setting all the FDM entry levels to zero except group or supergroup (whichever is required) which should be left as a dash "-". Pressing [SG/GP POWER] [MEAS] will then continuously monitor the basic group or supergroup power level.

EXAMPLE: Monitor the level in the basic supergroup.

    Press [CH] - to bring forward the FDM display
    Press [CH] [G] [SMG]* [HG/MG] [SG] - a ˊ-ˊ should be in the
    SG position.

    *CCITT only

    Press [SG/GP POWER] [FREQ/FDM] [MEAS]

    Frequency Display - 432.000kHz
    Level Display - Continuously updated basic supergroup power
                  level

3-74 SCAN

3-75   In a scan a sequence of level measurements is carried out while
incrementing through the FDM hierarchy. The scan begins at the point
in the FDM plan indicated by the FDM display and proceeds in steps of
the lowest specified FDM entry. Thus, if the lowest FDM entry is a
channel, then channels will be scanned. If group is the lowest FDM
entry specified, then either group pilots or group powers will be
scanned, depending upon whether or not [SG/GP POWER] was pressed.
Similarly supergroup powers or pilots will be scanned if the lowest
FDM entry specified is a supergroup. When the number of the lowest
specified FDM level has reached its maximum value it will revert to
its minimum value and the next FDM level up if present will be
incremented. This process is repeated at all specified FDM levels so that
a continuous scan will cover all possible combinations of the specified
FDM levels.

EXAMPLE (CCITT):   Continually scan all group pilots starting at group 1,
                   of supergroup 2, of hypergroup 1, of supermastergroup 1.

    Set the switches to the reference settings (paragraph
    3-8).

    Press [TR] [FREQ/FDM] [Any FDM key] - this sequence
    can be used at any time to load the FDM registers with
    the logical start and stop of the FDM plan chosen by
    the PLAN switches.
    Press [CH] [0] - to eliminate a channel scan
    Press [FREQ/FDM] [SCAN] [MEAS]

    Frequency Display - Frequency of each group pilot
    Level Display - level of each group pilot

EXAMPLE (BELL):   Continually scan all group pilots starting at group 1,
                  of supergroup 13, of mastergroup 1.

                  Set the switches to the reference settings (para-
                  graph 3-8).

                  Press [TR] [FREQ/FDM] [Any FDM key] - this sequence can
                  be used at any time to load the FDM registers with the
                  logical start and stop of the FDM plan chosen by the
                  PLAN switches.
                  Press [CH] [0] - to eliminate a channel scan
                  Press [FREQ/FDM] [SCAN] [MEAS]

                  Frequency Display - Frequency of each group pilot
                  Level Display - level of each group pilot.

3-76   At any time during a scan [HALT] may be pressed to halt the sweep.
The [+↑] and [-↓] keys can then be used to step manually. Each
time [+↑] or [-↓] is pressed, a single measurement of the level at the
new frequency will be made and displayed. If [MEAS] is pressed again,
the scan will continue from the point in the FDM plan specified by the
FDM display but the direction of the scan will depend on whether the
[+↑] or [-↓] key was the last one pressed.

3-77   If at any time a scan has been halted, the Transfer [TR] key can
be used in conjunction with the [SCAN] [+↑] and [-↓] keys to specify
the scan starting point and direction when the scan is restarted.

[TR] [SCAN] [MEAS]   - Scans from the FDM limit held in the FDM Start
                             or Stop Registers, modified by the current
                             FDM description, in the same direction as
                             the previous scan, ie, if the previous scan
                             was from the Upper Limit down to the Lower
                             Limit then the SCAN will start again at the
                             FDM Upper Limit and scan down to the Lower
                             Limit. Similarly, if the previous scan was
                             from the Lower Limit up, then the scan will
                             start again at the Lower Limit and scan up.

[TR] [SCAN] [+] [MEAS] - Scans up from the Lower FDM limit irrespective
                         of the direction of the previous scan.

[TR] [SCAN] [-] [MEAS] - Scans down from the Upper FDM limit irrespective
                         of the direction of the previous sweep.

Note: Once a scan has been started, any attempt to change the FILTER
      selected will Halt the scan. If changes in FILTER selection were
      allowed, then the auto calibration of the measuring circuits
      would no longer be valid. If a change in FILTER is required, press
      the appropriate FILTER key (which will Halt the scan) then press
      [SCAN] [MEAS]. A new autocalibration cycle will be initiated
      (CAL appears in Level Display) before the scan continues.

3-78 RESTRICTING A SCAN TO PART OF AN FDM PLAN

3-79   There are two methods available for restricting the scan within
an FDM plan:

(1)   Using FDM Start/Stop values and the Transfer [TR] key - FDM Start
      and Stop Values can be entered into FDM Start and Stop Registers
      in a similar manner to the Start and Stop Frequencies for a
      spectrum measurement. The step size will be the lowest specified
      FDM level.

EXAMPLE (BELL):   Scan between channel 6, of group 1, of supergroup 13,
                  of mastergroup 1 and channel 3 of group 3, of super-
                  group 13, of mastergroup 1.

                  Set the switches to the reference settings (see para-
                  graph 3-8).

                  Press [START] [Any FDM key] - to bring forward the FDM
                   Display
                  Press [CH] [6] [G] [1] [SG] [13] [HG/MG] [1]
                  Press [STOP] [Any FDM key]
                  Press [CH] [3] [G] [3] [SG] [13] [HG/MG] [1]
                  Press [TR] [SCAN] [MEAS]

                  FDM Display - stepping one channel at a time between
                                the specified limits
                  Level Display - level of each channel

EXAMPLE (CCITT): Scan between channel 3, of group 1, of supergroup 2, of
                  hypergroup 1, of supermastergroup 1 and channel 6, of
                  group 5, of supergroup 2, of hypergroup 1 of supermaster-
                  group 1.

                  Set the switches to reference settings (see paragraph
                  3-8).

                  Press [START] [Any FDM key] - to bring forward FDM
                   Display
                  Press [CH] [3] [G] [1] [SG] [2] [HG/MG] [1] [SMG] [1]
                  Press [STOP] [Any FDM key]
                  Press [CH] [6] [G] [5] [SG] [2] [HG/MG] [1] [SMG] [1]
                  Press [TR] [SCAN] [MEAS]

                  FDM Display - stepping one channel at a time between
                                the specified limits
                  Level Display - level of each channel

Note 1: All the types of scan available in the ordinary scan mode are available in this mode, ie pilots, group and supergroup powers etc.

Note 2:

```
                    SMG   MG SG G CH

STOP REGISTER   [       | 1|  2|5|  6 ]
                            |
                            |
                            |
                            |
                            |
                            |                SMG MG  SG  G  CH
                            |                _____
                            |_____ [      | 1|  2|3|  2]   CURRENT
                            ↑                                       REGISTER
                            ↑
                            ↑
                            ↑
                    SMG  MG ↑SG  G  CH
START REGISTER  [       | 1|  2|1|  3 ]
```

Figure 3-3(a) Example (1) of Register states when an FDM scan is halted.

Figure 3-3(a) shows the values loaded into the START and STOP Registers. The CURRENT Register will be continuously changing, one channel step at a time.

Consider the SLMS is halted and the FDM/FREQ display indicates MG1 SG2 G3 CH2 (the value of the CURRENT Register).
If keys [TR] [SCAN] [MEAS] are pressed the SLMS will load the contents of the START Register into the CURRENT Register and the SLMS will re-start the scan from that point, in this case 1213.

```
                SMG MG SG G CH
STOP REGISTER  [   | 1| 2|5| 6]
                      |
                      |
                      |
                      |
                      |
                      |           SMG MG SG G CH
                      |          [   | 1| 2|4| 0]  CURRENT
                      +----------------------------  REGISTER
                      ↑
                      ↑
                      ↑
                      ↑
                      ↑
                SMG MG SG G CH
                      ↑
START REGISTER [   | 1| 2|1| 3]
```
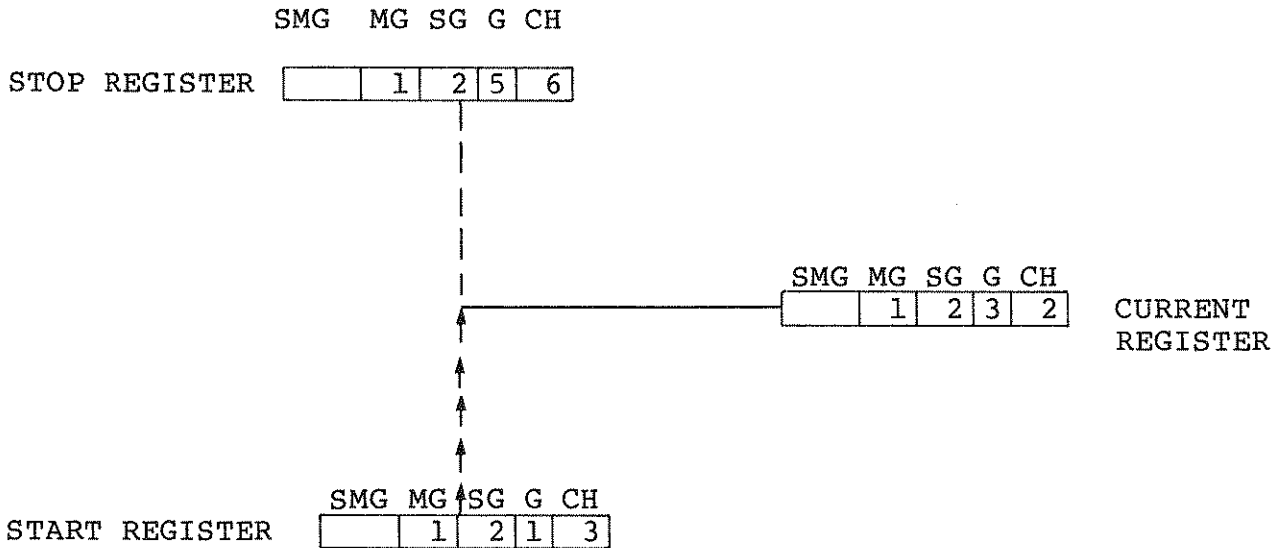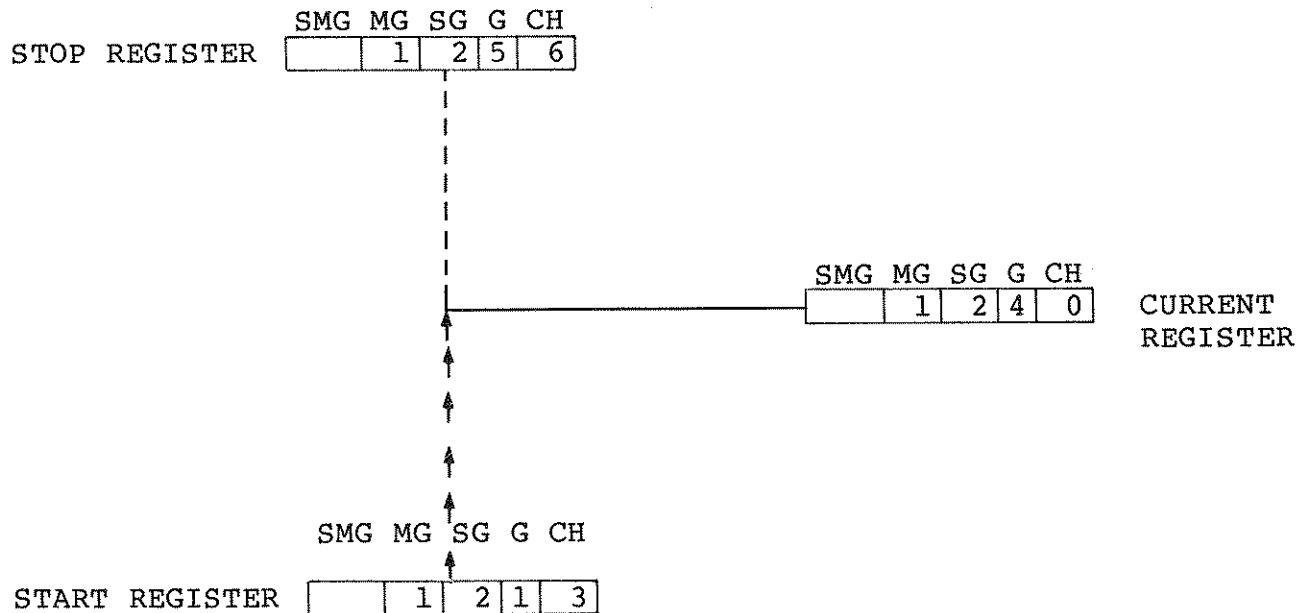
Figure 3-3(b) Example (2) of Register state when an FDM scan is halted.

Figure 3-3(b) shows the same values loaded into the START and STOP Registers as in Figure 3-3(a). This time however the SLMS is halted, and the CH entry changed to 0, such that the FDM/FREQ display (and CURRENT Register) indicates 1240. If keys [TR] [SCAN] [MEAS] are pressed, the SLMS overwrites the CURRENT Register with the contents of the START Register except where the CURRENT Register shows 0, i.e. the SLMS will re-start the SCAN from 1210, with the CURRENT Register changing one group step at a time.

Pressing [TR] [SCAN] sets the significant (i.e. non-zero) levels of the current FDM description equal to either the START FDM values or the STOP FDM values, depending on the current direction of sweep. This key sequence does not necessarily make the current FDM description equal at every level to the START/STOP description. The current measurement type (mastergroup pilot scan, supergroup pilot scan, etc) is thereby retained.

(2) Fixing using the decimal point [.] key – the 3746A will normally
     scan all the specified levels in the FDM hierarchy. It is possible
     however, to restrict the scan by holding part of the FDM
     description fixed. Only the FDM levels below the fixed level will
     then be incremented during the scan. For example, only the
     the channels in group 3, of a basic group may be scanned.

     To fix part of the FDM description, the decimal point [.] key is
     pressed immediately after the entry of the FDM level which is to
     remain fixed. To indicate which parts of the FDM description are
     fixed, the decimal point in the FDM Display at each fixed level
     is illuminated. Note that fixing one level of an FDM description
     automatically fixes all higher levels.

EXAMPLE (CCITT): Scan all group pilots in mastergroup 8, of super-
                  mastergroup 2 starting from group 1, of supergroup 4.

                  Set all the switches to the reference settings (see
                  paragraph 3-8).

                  Press [Any FDM key] – To bring forward the FDM Display
                  Press [CH] [0] [G] [1] [SG] [4] [SMG] [2] [HG/MG] [8]
                  [.]
                  Press [SCAN] [MEAS]
                  If [.] had been omitted from the above sequence then
                  all 225 Group Pilots in plan 1B would have been scanned.

EXAMPLE (BELL):   Scan all group pilots in supergroup 15, of mastergroup
                  2, starting at group 1. Set all switches to the refer-
                  ence settings (see paragraph 3-8).

                  Press [Any FDM key] – To bring forward FDM Display.
                  Press [CH] [0] [G] [1] [HG/MG] [2] [SG] [1] [5] [.]
                  Press [SCAN] [MEAS]
                  If [.] had been omitted from the above sequence then
                  all 300 Group Pilots would have been scanned.

Note: The lowest FDM level to be fixed is the last entered before the
       [.] key is pressed.

       To remove the restriction on the scan, press the FDM description
       key of the lowest fixed segment. The decimal points in the FDM
       description will be extinguished and any new valid FDM data may
       be entered.

       The range of an FDM scan is also influenced by the setting of the
       MASTER GPS/SYSTEM BW switch.

3-80 FDM SKIPS

3-81 If an FDM network has sections of the plan which are not loaded, the 3746A can be programmed to "Skip" up to 30 of these sections. FDM skips can only be entered down to supergroup level, ie, groups and channel levels cannot be entered in the FDM description for a skip.

3-82 To gain access to the FDM skip registers, press [TR] [1] [0]. The TEST-POINT Display, which is used in this function as a register pointer, should contain the first location ´F01´. If position F01 has not had an FDM description entered previously, then the FREQ/FDM display will contain either all zeros, or a mixture of zeros and dashes. To enter an FDM skip press the FDM level description key required followed by the numeric entry required. Press the [↤↑] key to move the pointer to the next location and enter the next FDM skip. Up to 30 FDM skips may be stored in this way. The register pointer can be moved up or down at any time using the [↤↑] and [↤↓] keys.

3-83 After the required entries have been made in the FDM skips Register, increase the register pointer to the next position and Terminate the FDM skips register by pressing [CLEAR/SET]. All FDM measurements (pilots, channel levels, group and supergroup powers etc) can be performed as normal except that during a scan when an FDM description falls within an FDM level stored as a skip, the 3746A will automatically jump to the next FDM level outside that specified by the skip.

EXAMPLE (BELL): Continually scan all supergroup powers starting at mastergroup 1, supergroup 13 and missing out the following supergroups:

        MG 2, SG 17
        MG 3, SG 15
        MG 4, SG 17
        MG 5, SG 26

Set the switches to the reference settings (see paragraph 3-8).

Press [TR] [1] [0]
Press [SG] [1] [7] [HG/MG] [2]
Press [↤↑] [SG] [1] [5] [HG/MG] [3]
Press [↤↑] [SG] [1] [7] [HG/MG] [4]
Press [↤↑] [SG] [2] [6] [HG/MG] [5]
Press [TR] [FREQ/FDM] [CH] - 1, 13, 1,1 should appear in the FREQ/FDM Display, which is the logical start of the plan.
Press [CH] [0] [G] [0] [SG/GP POWER] [SCAN] [MEAS]

The FREQ/FDM Display should scan through all the supergroups in the plan except those supergroups specified by the FDM skips register.

EXAMPLE (CCITT): Continually scan all supergroup powers starting at supergroup 2 of hypergroup 1, of supermastergroup 1 and missing out the following supergroups:

> SMG 1, HG 1, SG 9
> SMG 2, HG 7, SG 6
> SMG 2, HG 9, SG 5
> SMG 3, HG 9, SG 6

Set the switches to the reference settings (see paragraph 3-8).

Press [TR] [1] [0]
Press [SG] [9] [HG/MG] [1] [SMG] [1]
Press [+↑] [SG] [6] [HG/MG] [7] [SMG] [2]
Press [+↑] [SG] [5] [HG/MG] [9] [SMG] [2]
Press [+↑] [SG] [6] [HG/MG] [9] [SMG] [3]
Press [TR] [FREQ/FDM] [CH] - 1, 1, 2, 1, 1 should appear in the FREQ/FDM Display which is the logical start of the plan.
Press [CH] [0] [G] [0] [SG/GP POWER] [SCAN] [MEAS]

The FREQ/FDM Display should scan through all the supergroups in the plan except those supergroups specified by the FDM skips register.

Note: The FDM Skip Register should be cleared after the measurement unless it is intended to retain the skips. The Skips Register can be cleared by pressing [TR] [1] [0] and clearing each individual FDM skip using [CLEAR/SET] after accessing the skip with the register pointer.

3-84 SPECTRUM OF FDM SEGMENTS

3-85   The Start Frequency and Stop Frequency Registers can be loaded with the maximum and minimum frequencies of any FDM segment specified by the FDM Display. The registers are loaded when the description of an FDM Level is in the FDM/FREQ Display and [SPECT] is pressed (the lowest segment specified being loaded).

3-86   This facility may be used, for example, to perform a Spectrum within an FDM level to locate spurious tones.

EXAMPLE (BELL): Make a Spectrum sweep across channel 5, of group 4,
                 of supergroup 13, of mastergroup 1 using 20Hz
                 frequency steps.

                 Set the switches to the reference settings (see para-
                 graph 3-8).

                 Press [STEP] [.] [0] [2]
                 Press [Any FDM key] - to bring forward the FDM Display
                 Press [CH] [5] [G] [4] [SG] [1] [3] [HG/MG] [1]
                 Press [SPECT] [MEAS]

                 Frequency Display - Frequency at 20Hz intervals, across
                                     the selected channel (640.000kHz to
                                     644.000kHz).
                 Level Display   - Level at each frequency

EXAMPLE (CCITT): Make a Spectrum sweep across channel 6, of group 5, of
                 supergroup 3, of hypergroup 1, of supermastergroup 1
                 using 20Hz frequency steps.

                 Set the switches to the reference settings (see para-
                 graph 3-8).

                 Press [STEP] [.] [0] [2]
                 Press [Any FDM key] - to bring forward the FDM Display
                 Press [CH] [6] [G] [5] [SG] [3] [HG/MG] [1] [SMG] [1]
                 Press [SPECT] [MEAS]

                 Frequency Display - Frequency at 20Hz intervals across
                                     the selected channel (588.000kHz to
                                     592.000kHz)
                 Level Display - level at each frequency.

3-87 NON-STANDARD PILOTS

3-88   If the pilots used in an FDM system are not those held in the
3746A memory, then the 3746A may be tuned to these pilots either
manually by means of the [FREQ] and numeric keys or by storing the
required basic pilot frequency in the Non-Standard Pilot Register.

3-89   The Non-Standard Pilot Register is selected when the PILOT switch
is set to the NS position. An entry is made into the Non-Standard Pilot
Register by pressing [NS PILOT] and using the numeric keys to specify
the required frequency.

3-90 The frequency held in the Non-Standard Pilot Register is applied
as an offset from the Virtual Carrier (VC) of the current FDM descrip-
tion. The offset, which may be positive or negative with respect to the
VC is automatically applied by the 3746A depending on whether the FDM
segment being measured is erect (+ve offset) or inverted (-ve offset).
If the lowest specified level is a group, then the frequency held in
the Non-Standard Pilot Register will be interpreted as the frequency
of a pilot in the basic group and the 3746A will tune to the fre-
quency that this pilot would occupy in the group specified by the
FDM Display.

Note: Remember to set the PILOT switch back to the appropriate group
      pilot position when the Non-Standard pilot is no longer required.

EXAMPLE (CCITT): Tune to group 4 pilot, of supergroup 6, of mastergroup
                 8, of supermaster group 2, when the basic group pilot
                 is 84.14kHz.

Set the switches to the reference settings (see paragraph 3-8) except
set the PILOT switch to the NS position.

          Press [NS PILOT] [8] [4] [.] [1] [4]
          Press [Any FDM key] — To bring forward the FDM Display
          Press [CH] [0] [G] [4] [SG] [0] [HG/MG] [8] [SMG] [2]
          Press [FREQ/FDM] [MEAS]
          Frequency Display — 6220.140kHz
          Level Display — Pilot Level

EXAMPLE (BELL): Tune to group 4 pilot, of supergroup 16, of mastergroup
                3 when the basic group pilot is 92.15kHz.

Set the switches to the reference settings (see paragraph 3-8) except
set the PILOT switch to the NS position.

          Press [NS PILOT] [9] [2] [.] [1] [5]
          Press [Any FDM keys] — To bring forward the FDM Display
          Press [CH] [0] [G] [4] [SG] [1] [6] [HG/MG] [3]
          Press [FREQ/FDM] [MEAS]
          Frequency Display — 7699.850kHz
          Level Display — Pilot Level

3-91 VIRTUAL CARRIER MEASUREMENTS

3-92 If the PILOT switch is set to the VC position (Virtual Carrier)
then the 3746A, will tune to the virtual carrier frequency of the
lowest level specified in the FDM Display, enabling measurements of
carrier leak to be made.

Note: Since basic levels of the multiplex have, by definition, no carrier, the virtual carrier of any basic level will be interpreted as 0kHz. The 3746A cannot make measurements at 0kHz and since it would be undesirable to have a Scan stop, or an error code indicated, then in these circumstances the 3746A will correctly indicate a virtual carrier of 0kHz for basic FDM levels. However, the level measurement displayed will be erroneous and should be ignored.

EXAMPLE: tune to the virtual carrier of group 3 in the basic supergroup.

Set the switches to the reference settings (see paragraph 3-8) except set the PILOT switch to VC.
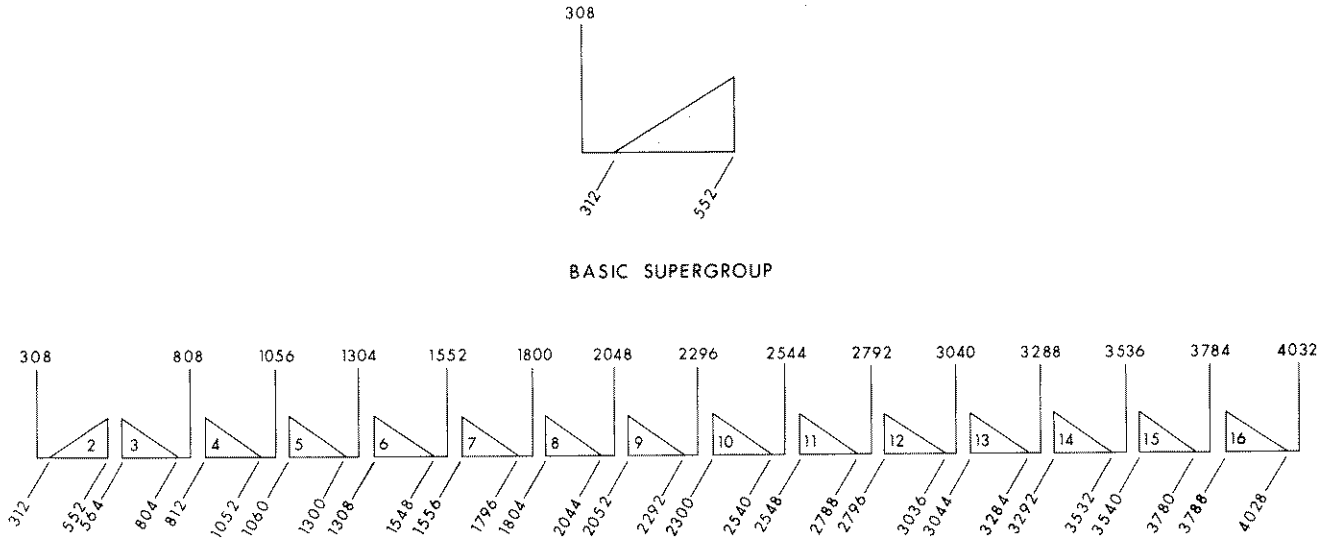
        Press [Any FDM key] — To bring forward the FDM Display
        Press [G] [3] and enter [0] in all other FDM levels
        Press [FREQ/FDM] [MEAS]
        Frequency Display — 516kHz
        Level Display — Carrier Level

3-93 INTERSUPERGROUP SLOT MEASUREMENTS

3-94   The Non-Standard Pilot Register may be used to simplify tuning to the frequencies within the guardbands between supergroups (intersupergroup slots). The Non-Standard Pilot Register is loaded with a frequency which when translated up the multiplex (as a supergroup pilot) will always tune the 3746A to a frequency within an intersupergroup slot.

Note: The 3.1kHz or WTD filter should be selected manually.

3-95   For example, if the Non-Standard Pilot Register is loaded with 308kHz and the FDM description of a supergroup within the basic hypergroup (CCITT)/U600 mastergroup (BELL) is entered, the 3746A will tune within the instersupergroup slots as illustrated in Figure 3-4.

(a) Basic Hypergroup Showing Intersupergroup Slot Frequencies
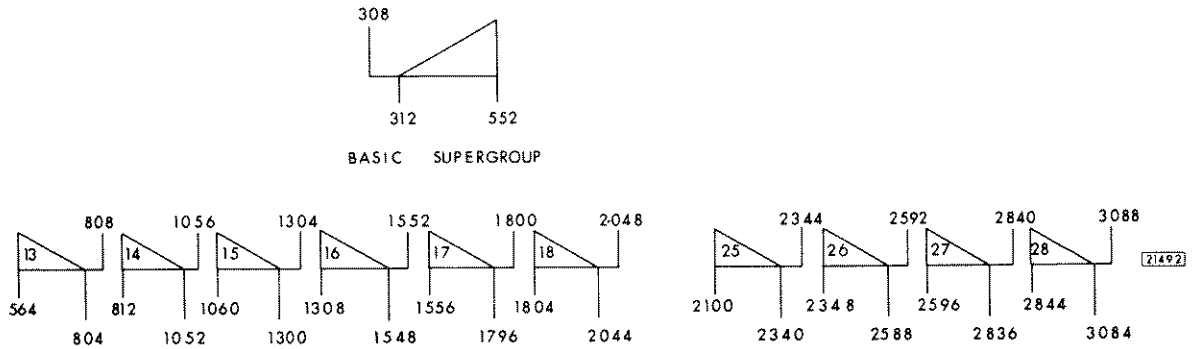
(b) Basic U600 Mastergroup Showing Intersupergroup Slot Frequencies

Figure 3-4 Intersupergroup Slot Frequencies

EXAMPLE (BELL):   Scan all intersupergroup slots in the basic master-
                   group.

                   Set the switches to the reference settings (see para-
                   graph 3-8), except set the PILOT switch to NS.

                   Press [NS PILOT] [3] [0] [8]
                   Press [Any FDM key] - To bring forward the FDM Dis-
                   play.

EXAMPLE (BELL):   Press [SG] [1] [3] — Set all other FDM levels to [0].
(continued)   Press [3.1kHz] / [WTD] [SCAN] [MEAS]
                     Frequency Display — Frequency of each intersupergroup
                                         slot
                     Level Display — Level in each intersupergroup slot

EXAMPLE (CCITT): Scan all intersupergroup slots in the basic hyper-
                 group.

Set the switches to the reference settings (see paragraphs 3-8), except
set the PILOT switch to NS.

         Press [NS PILOT] [3] [0] [8]
         Press [Any FDM key] — To bring forward the FDM Display
         Press [SG] [2] — Set all other FDM levels to [0]
         Press [3.1kHz] [WTD] / [SCAN] [MEAS]
         Frequency Display — Frequency of each intersupergroup slot
         Level Display — Level in each intersupergroup slot

3-96 FREQUENCY OFFSET OF FDM PLANS

3-97   The frequency offset facility allows all the stored FDM plan fre-
quencies to be offset by any amount, in 1Hz steps. The effect is to off-
set the frequency to which the 3746A would normally tune by the fre-
quency held in the Offset Frequency Register. Additionally, all other
frequencies derived from FDM descriptions will be offset by the same
amount, ie, during spectrum sweeps of FDM segments (see paragraph 3-84)
the content of the Start Frequency and Stop Frequency registers would
have the offset applied.

Note: Frequency Offset cannot be applied to non FDM based measurements,
      ie, when the 3746A is tuned using the [FREQ] key.

3-98   The content of the Offset Frequency Register is always applied to
FDM based measurements. At switch-on, the content of the register is
0kHz which ensures there is no offset applied. Entries are made into
the Offset Register by pressing [TR] [STEP] and specifying the desired
frequency offset in kHz using the numeric keys. Offsets may be entered
as either a positive or negative frequency using the [+↑] or [-↓] keys.
If neither is pressed a positive frequency offset is assumed. To cancel
the offset, enter an offset of 0kHz by pressing [TR] [STEP] [0].

CAUTION

**If the positive or negative offset entered is too large, the 3746A will be
taken outside its frequency range resulting in error condition (E16)**

3-99 MODIFYING FDM PLANS

3-100   Some standard modifications are available to the FDM plans
stored within the 3746A. CCITT Plans 1B and 2 can be modified to in-
clude Supergroup 1. The Bell U600 MMX-1 and MMX-2 plans can be modi-
fied to include; 1) Supergroup 12 in the first mastergroup, 2) Super-
group 11 and 12 in the first mastergroup, 3) the first ten supergroups
in a CCITT hypergroup in place of the first mastergroup.

Note: Only one of these modifications is permitted at any one time.

3-101 The modifications are introduced into the plans as follows:

CCITT Plans 1B and 2
To include Supergroup 1 press [TR] [Any FDM keys] [SG] [1]

Note: Supergroup 1 may also be extended to include Group A
by pressing [G] [8] after entering SG1.

BELL Plans U600 MMX-1 and MMX-2

To include Supergroup 12 press [TR] [Any FDM key] [SG] [1]
[2]
To include Supergroup 11 and 12 press [TR] [Any FDM key]
[1] [1]
To replace the first mastergroup with the first ten super-
groups in a CCITT hypergroup press [TR] [Any FDM keys] [SG]
[1] [0]

To cancel a plan modification, press [TR] [Any FDM keys]

[SG] [Any valid Supergroup number].

3-102 The effect of applying these modifications to the stored plans is
illustrated in Section VII.

3-103 Extending CCITT Plans 1A and 2 to 18MHz

3-104 CCITT plans 1A and 2 can be extended to 4 Supermastergroups and
4 Hypergroups respectively. Plan selection requires access to an inter-
nal switch (see Section II) and should only be performed by service
trained personnel who are aware of the hazards involved. Front panel
switch settings are included in Section II.

3- 105 MODES OF OPERATION
3- 105 (a) OUT OF LIMITS DETECTION AND LIMIT ALARMS

3-106 The levels measured by the 3746A are continually compared against internal level limits. If the measured signal level falls outside these limits, an indication is given by annunciators in the Level Display indicating either Upper Limit (ULIM) or Lower Limit (LLIM) as appropriate.

3-107 The level limits are relative to the level held in the Reference Level Register and are determined by the contents of the Upper and Lower Limit Registers. For example, if the reference level is -45dBm and the contents of the Upper Limit Register is 5 and the Lower Limit Register is -10, then an out of limits indication is given if the measured signal is greater than -40dBm or less than -55dBm.

3-108 Pressing either [REF], [UPPER] or [LOWER] displays the contents of the appropriate register and allows new data to be entered using the numeric keys (see the relevant key descriptions in Section VI).

3-109 The upper limit is normally entered as a positive value and the lower limit as a negative value relative to the reference level. To enter the reference level or lower limit as a negative value the [-] key should be pressed before or after entering its value, otherwise a positive value is assumed.

3-110 The LIMIT switch determines which if any of the out of limits conditions will cause a Limit Alarm, ie, Lower (LO) Upper (HI) or Both (BOTH). Limit Alarms can be used to halt a measurement, cause a printer to print the measurement result, or hold a tracking generator at the current frequency, (depending on the settings of the GEN TRACK, LIMIT HALT and PRINTER switches).

3-111 Limit Halt Sweep

3-112 A Limit Halt sweep is a continuous Spectrum or Scan in which the 3746A is programmed to stop at any frequency where a Limit Alarm occurs. The LIMIT HALT switch is set to ON and the LIMIT switch is set to the out of limits condition which will cause an alarm, ie, Low, High or Both.

3-113 The sweep will now stop during a Scan or Spectrum measurement whenever a Limit Alarm occurs. The sweep will not proceed if the signal returns within limits, and will only proceed if [MEAS] is pressed.

3-114 GENERATOR TRACKING

3-115 A Frequency Generator/Synthesiser may be set to track the frequency to which the 3746A tunes, in either a Scan or Spectrum measurement. Two basic modes of tracking are possible, either open loop or closed loop tracking via the Hewlett-Packard Interface Bus (HP-IB).

3-116 Closed Loop Tracking (via HP-IB)

3-117   In the two BUS tracking modes (STAB and LIM) of the GEN TRACK switch the 3746A controls the frequency of a suitable Generator via the HP-IB. The HP-IB interface requires that the Frequency Generator be set to a specific listen address before information may be passed from the 3746A. Section V contains information on the interconnection of a Frequency Generator and the 3746A on the HP-IB.

3-118   The 3746A can be set to output the frequency data in various formats to suit a variety of Frequency Generators. Output format is determined by the setting of the switches on the rear panel Device Address switch. Several H-P Frequency Generators are recommended for use with the 3746A (see section V).

3-119 BUS STAB (STABILITY)   ——   Each time the 3746A tunes to a new frequency it instructs the Frequency Generator via the HP-IB to go to the same frequency. A minimum of two measurements is made at each frequency in the sweep and the 3746A will only proceed to the next frequency in the sweep if both the following conditions are met:

1.   Two consecutive measurements at the same frequency are within 1dB with [AVE] [0] selected, 0.2dB with [AVE] [1] selected or 0.05dB with [AVE] [2] selected.

2.   The current measurement is within the limits set up in the [REF], [UPPER] and [LOWER] registers.

3-120 BUS LIM (LIMIT)   ——   Each time the 3746A tunes to a new frequency it instructs the Frequency Generator via the HP-IB to go to the same frequency. The 3746A will stop at any point in the sweep where a measurement is outside the limits set up in the [REF], [UPPER] and [LOWER] registers and continuously monitor the level at this point. When a measurement comes within limits the sweep will proceed to the next point.

Note: When the 3746A is Halted the [+ ↑] and [- ↓] keys cannot be used to step the sweep manually in the STAB and LIM positions.

For both these Generator Tracking modes, suitable values must be entered in the Upper, Lower and Reference Level Registers.

3-121 Open Loop Tracking

3-122   In the Open Loop (O/LP) tracking mode of the GEN TRACK switch, the signal path is the only link required between the Frequency Generator and the 3746A. The Frequency Generator must step through the same sequence of frequencies as the 3746A and must spend sufficient time at each frequency to allow the 3746A to make a valid measurement.

3-123 Two tests are applied to each measurement result to ensure that the Frequency Generator and the 3746A are tuned to the same frequency. The 3746A will not proceed to the next frequency until the tests at the current frequency are satisfied. The tests used are:

1. Two consecutive measurements at the same frequency are within 1dB with [AVE] [0] selected, 0.2dB with [AVE] [1] selected or 0.05dB with [AVE] [2] selected.

2. The current measurement is within limits.

Note: Suitable values must be entered in the Upper, Lower and Reference Level Registers.

3-124 Tracking Generator (Option 012)

3-125 On instruments fitted with option 012 a TRACKING GENERATOR output, which tracks the frequency to which the 3746A is tuned, is available on the rear panel. The output level is a nominal -10dBm (75 ohm) with a flatness better than +/-0.2dB.

3-126 EQUALIZATION

3-127 Cabling from test points (via Access Switches) to the 3746A can introduce frequency dependent errors. The 3746A has an equalization routine available which can apply frequency dependent results correction to any measurement made. Correction is stored in the form of 32 equalization coefficients evaluated from measurements made at 1MHz intervals between 500kHz and 31.5MHz during an equalization cycle (or loaded via the HP-IB from an external controller).

3-128 In order to perform an equalization cycle the 3746A must be connected (through the cable path to be equalized) to a suitable Frequency/Level Generator either in the open loop mode, or in the closed loop mode via the HP-IB (see paragraphs 3-114 and 3-118). In closed loop operation the Generator output level will be automatically set to the level held in the 3746A Reference Level Register. For open loop operation the Generator output level must be set manually to the level held in the 3746A Reference Level Register.

3-129 Pressing [TR] [dB/dBm] [MEAS] will initiate the equalization cycle and in the closed loop mode will send the content of the Reference Level Register to the Generator to enable it to set its output level. The 3746A will perform a spectrum measurement at 1MHz intervals between 500kHz and 31.5MHz and will store the difference between the measured level and reference level as a correction factor to be applied to future measurements.

3-130 Pressing [TR] [+] [dB/dBm] turns the equalizer on and when a measurement is performed, correction will be applied according to the results stored during the equalization cycle. Pressing [TR] [-] [dB/dBm] turns the equalizer off.

3-131 VOICE CHANNEL DEMODULATION

3-132 When the 3.1kHz, WTD or notch filter is selected, a demodulated voice channel is present on the front panel loudspeaker and PHONE jack plug. The demodulated voice channel is also available on both rear panel AUDIO outputs (Jack or Siemens 3-pin) at a level between -3 and -13dBm into 600 ohm.

3-133 If a channel is selected by an FDM description then the demodulator always produces an erect channel, even if the measured channel is inverted.

3-134 Channel measurements made with the 3746A tuned to the channel carrier by the [FREQ] key must be offset from the carrier by either +1.85kHz for erect channels or -1.85kHz for inverted channels. Pressing either [TR] [UPPER] or [TR] [LOWER] will ensure correct demodulation for erect or inverted channels respectively.

3-135 REAL TIME CLOCK

3-136 The 3746A has an internal non-volatile real-time clock. The time can be brought forward and displayed in the FREQ/FDM Display. The display can be toggled between Hours/Minutes/Seconds and Day/Month/Year by the [FREQ/FDM] key.

3-137 Pressing [TR] [1] [9] will access the clock and display time. To change the display to date, press the [FREQ/FDM] key.

3-138 Setting Time and Date

3-139 Time: to set the time on the clock press [TR] [1] [9] to bring the time into the display.

            Press [SMG]   - enter hours using numeric keys
            Press [SG]   - enter minutes using numeric keys
            Press [CH]   - clears seconds display to 00
            Press [START] - to start clock when required.

            Note: the clock stops whenever [SMG] [SG] or [STOP] is
                  pressed.

3-140   Date: to set the date on the clock press [TR] [1] [9] [FREQ/FDM] to bring the date into the display.

        Press [SMG]   - enter day using numeric keys
        Press [SG]   - enter month using numeric keys
        Press [CH]   - enter year using numeric keys
        Press [START] - to restart the clock.

    Note: the clock stops whenever [SMG] [SG] or [CH] is
          pressed.

3-141   When the 3746A is connected to a printer and is acting as a controller measurement results will include a print-out of time and date (see sections IV and V).

3-142 AUTO CALIBRATION CYCLE

3-141   The 3746A will perform an auto calibration cycle using its own internal 1MHz, -25dBm calibration signal under the following conditions:

1)   At switch-on

2)   Every 10 minutes thereafter

3)   If the filter or averaging is changed.

When a calibration cycle is in progress the word ´CAL´ will appear in the Level Display.

3-144   Pressing [TR] [2] [9] measures, displays and if the 3746A is connected to a printer, prints the frequency and level of the calibration signal.

3-145 ACCESS SWITCH SELECTION

3-146   The 3746A has a built-in Access Switch Controller capable of accessing up to 1000 test points, ie, 111 Access Switches (HP Models 3754A, 3756A and 3757A). For all Switch models, control from the 3746A to the first Switch Level is via a 2-wire control output on the 3746A rear panel. For Models 3754A and 3757A only, subsequent levels may be controlled via the 2-wire control path or via the co-ax carrying the RF signal from the Access Switch. The 3756A control is by 2-wire at all levels.

LEVEL 1   Access Switch is connected to the 3746A and set to receive control pulses via the 2-wire control path.

LEVEL 2   Up to 10 Access Switches may be connected to level 1. The Access Switches are all connected and set to receive control pulses via the 2-wire control path.

LEVEL 3   Up to 100 Access Switches may be connected (if 10 are present at level 2). All the Access Switches are connected and set to receive control pulses via the 2-wire control path.
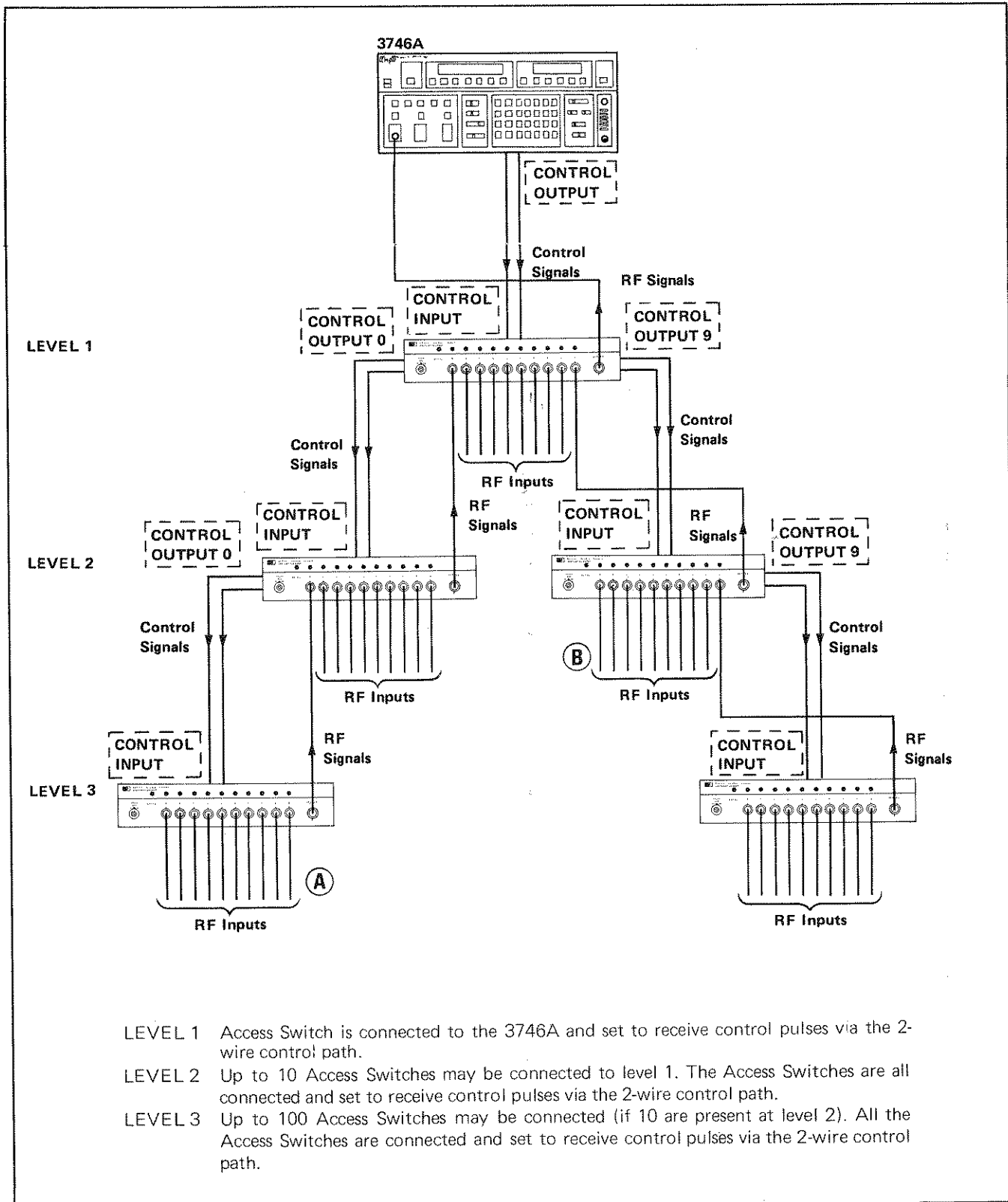
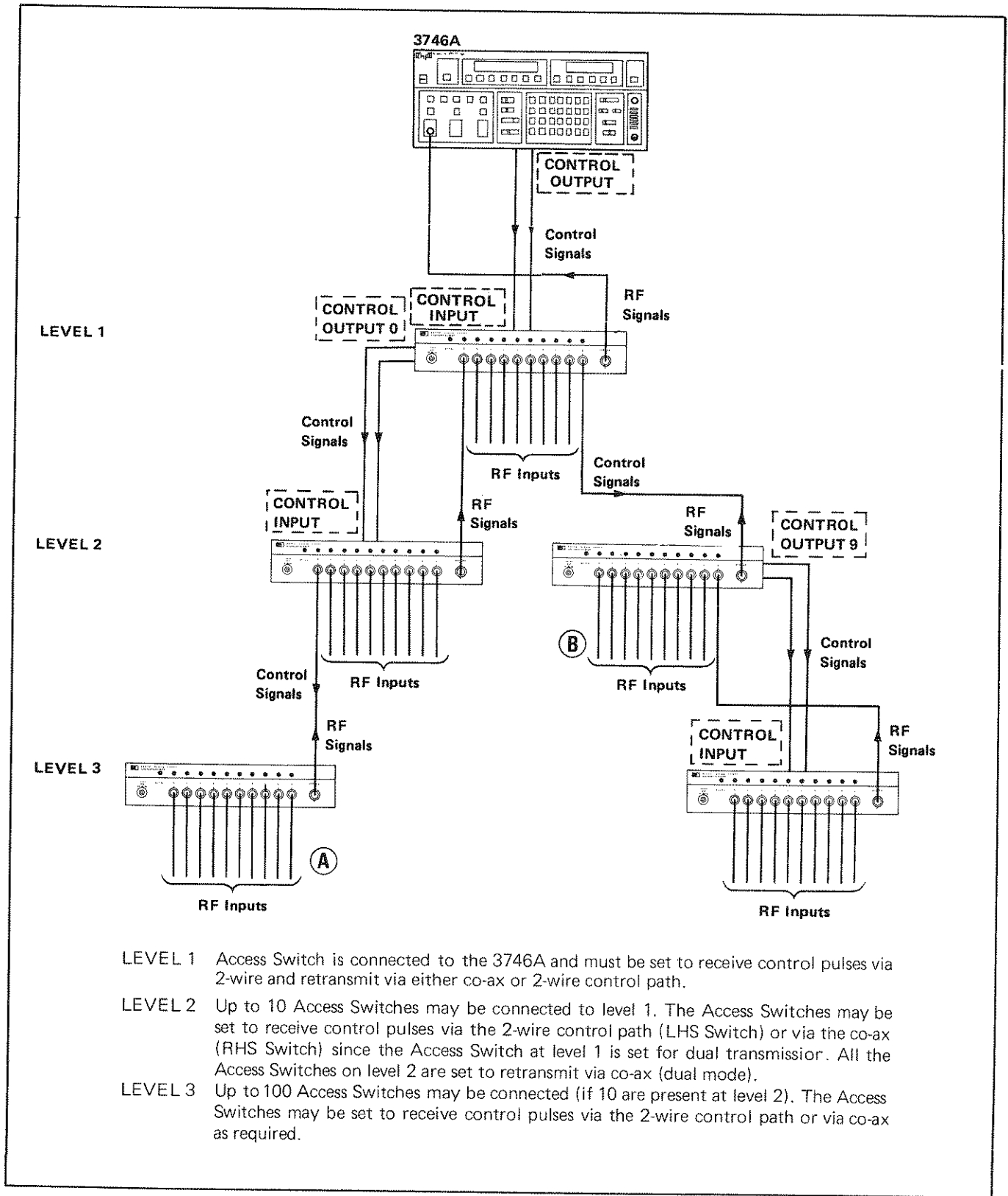**Figure 3-5 3746A and 3754A/3756A/3757A Cascading Access Switches — Connection Using 2-wire Control Path**

Figure 3-7 3746A and 3754A/3757A Cascading of Access Switches — Connection Using Combination of 2-wire Control Path and Co-ax

The figure labels and embedded text:

3746A

CONTROL OUTPUT

Control Signals

LEVEL 1

CONTROL OUTPUT 0 · CONTROL INPUT · RF Signals

Control Signals · RF Inputs · Control Signals

LEVEL 2

CONTROL INPUT · RF Signals · RF Signals · CONTROL OUTPUT 9

(B) · RF Inputs · Control Signals

Control Signals · RF Inputs · RF Signals

CONTROL INPUT · RF Signals

LEVEL 3

(A) · RF Inputs · RF Inputs

LEVEL 1 Access Switch is connected to the 3746A and must be set to receive control pulses via 2-wire and retransmit via either co-ax or 2-wire control path.

LEVEL 2 Up to 10 Access Switches may be connected to level 1. The Access Switches may be set to receive control pulses via the 2-wire control path (LHS Switch) or via the co-ax (RHS Switch) since the Access Switch at level 1 is set for dual transmission. All the Access Switches on level 2 are set to retransmit via co-ax (dual mode).

LEVEL 3 Up to 100 Access Switches may be connected (if 10 are present at level 2). The Access Switches may be set to receive control pulses via the 2-wire control path or via co-ax as required.

Figure 5

Figure 6

2)   3-band phase jitter measurement

3)   Impulse noise (single threshold) measurement.

4)   Noise with tone (notched noise) measurement.

3-151 Weighted Filter

3-152 Option 015 provides a psophometrically weighted filter and
Option 016 provides a C-message weighted filter superimposed on the
standard 3.1kHz filter. The filters allow weighted noise measurements
to be made on a voice channel at line frequencies.

3-153 Weighted noise measurements are made on voice channels in a
similar manner to measurements made with the 3.1kHz filter (see para-
graph 3-59) except that the [WTD] key is selected. Measurement results
are displayed in dBm (or dB's relative to the REF level) with the rele-
vant weighting applied.

Note: Weighted channel measurements made with the 3746A tuned to the
      channel carrier by the [FREQ] key, must be offset by either
      +1.85kHz for erect channels or -1.85kHz for inverted channels.
      Pressing [TR] [UPPER] or [TR] [LOWER] will ensure correct de-
      modulation for erect or inverted channels respectively. Tuning
      by means of an FDM description however will automatically ensure
      that the channel is demodulated correctly.

3-154 Noise with Tone

3-155 To make a notched channel (Noise with Tone) measurement, press
[NWT] [WTD] - the channel filter will be automatically selected with
the weighted and notch filters superimposed. The notch filter supp-
resses a demodulated tone at 1010Hz +/-15Hz by at least 50dB and
allows measurements in the presence of the tone to be made. Erect or
inverted sideband demodulation is available by pressing [TR] [UPPER]
for erect, or [TR] [LOWER] for inverted.

3-156 The [WTD] and notch [NWT] filters are automatically deselected
if [IMP NOISE], [Ø JITTER] or any other filter key is pressed.

3-157 Phase Jitter

3-158 The [Ø JITTER] key allows phase jitter measurements to be made
on a suitable test tone (normally injected into a voice channel).
Phase jitter measurements are made on the test tone after demodulation
by the 3746A and the demodulated test tone must be within the range
9050Hz to 1050Hz.

Model 3746A

3-176 MEASUREMENT SPEED

3-177 The measurement routine can sweep an 1800 channel baseband in under 20 seconds if no violations occur. The measurement time is increased for each violation detected. Since each violation is checked using part of the SLMS's normal measurement routine, the increase in time depends on the AVEraging mode selected and will be minimal if AVEraging 0 is used.

3-178 FREQ/FDM and LEVEL display

3-179 The measurement speed is too fast to provide a meaningful FDM/FREQ display and hence the display is only refreshed with the current value when a violation in the RMS signal level occurs. The LEVEL display flashes each time a peak violation occurs. When a RMS level violation occurs, if the SLMS is set to HALT on HI LIMITS, the SLMS enters the HALT mode and displays that LEVEL.

3-180 High Level Search with Limit Halt On

3-181 As with all High Level Search measurements, the START STOP and STEP parameters are entered as described for SPECTRUM measurements in paragraph 3-38, 3-39. The UPPER LIMIT and REF registers are set as described in paragraph 3-106 to 3-109.

EXAMPLE: To carry out a high level search between 1MHz and 20MHz to detect violations above -30dBm.

```
Enter [START] [FREQ] [1] [0] [0] [0]
Enter [STOP]  [FREQ] [2] [0] [0] [0] [0]
Enter [STEP]         [3]
Enter [REF]          [4] [0] [-]
Enter [UPPER]        [1] [0]
```

Set LIMITS switch to HI
Set LIMIT HALT switch to ON
Set all other MODE switches to the left hand position.

To start the measurement press

[SPECT] [UPPER] [MEAS]

The SLMS will make an uninterrupted swept measurement from 1MHz to 20MHz if all the signal levels are below -30dBm. If a violation occurs the SLMS will halt, refresh the FREQ/FDM display, and display the RMS level of the signal causing the violation.

3-182 High Level Search with automatic frequency measurement of the Violating Tone.

3-183 The measurement routine can be altered to include a frequency measurement of the violating tone. This is accomplished by setting the SLMS Frequency Counter ON as outlined by the amended key sequence.

To start the measurement press

[SPECT] [UPPER] [COUNTER] [MEAS]

If the SLMS is set to print on limits the output contains both TUNED frequency and COUNT frequency of the violating tone. The SLMS FREQ/FDM display will show the COUNTER frequency.

Note: When the SLMS is used in the COUNTER mode it makes a frequency count for each RMS threshold violation and this slows down the measurement time.

3-184 High Level Search - Remote Operation

3-185 The High level search can be operated over the HP-IB using a suitable controller. The codes are as follows:

High Level Search   SP UL ME

High Level Search
with COUNTER on   SP UL CN ME

3-186 LOW LEVEL SEARCH

3-187 This measurement is similar to the High Level Search except the comparison threshold is stored in the Lower Limits register and peak values of signals are compared to this lower limit.

3-188 This mode of operation can only be used when the SLMS is connected (via the HP-IB) to a suitable printer or a suitable controller. The SLMS outputs a printer message, each time a violation occurs, containing the frequency of the violating tone and an OUT statement in the limits column. The level print-out is not a true RMS reading and should not be treated as an absolute reading.

EXAMPLE: To carry out a Low Level search between 1MHz and 20MHz to detect violations below -90dBm.

Enter [START] [FREQ] [1] [0] [0] [0]
      [STOP] [FREQ] [2] [5] [0] [0] [0]
      [STEP]   [3]
      [REF]   -30
      [LOWER]   -60

Set LIMITS switch to LO
Set PRINTER to LIM
Set LIMIT HALT to OFF

3-42

To start the measurement press.

[SPECT] [LOWER] [MEAS]

For remote operation with a controller send SP LL ME