

# APPENDIX D - SPECIFICATIONS

- A warm-up time of 5 minutes is required for the following performance requirements.
- RF measurements are referenced to 50  $\Omega$ .
- Accuracy and Resolution stated in percent are referenced to measured or selected value unless otherwise stated.
- Where resolution exceeds accuracy, resolution takes precedence.
- Specifications and features are subject to change without notice.

## D-1 GENERATOR (Receiver Test)

### FREQUENCY:

Range:	1 MHz to 2.7 GHz
Resolution:	1 Hz
Accuracy:	Same as Time Base

## D-2 AMPLITUDE

### GEN CONNECTOR:

Range:	+10 to -110 dBm
Resolution:	0.1 dB
Accuracy:	$\pm 1.5$ dB

### T/R CONNECTOR:

Range:	-30 to -137 dBm
Resolution:	0.1 dB
Accuracy:	$\pm 1$ dB (<1.3 GHz >-120 dBm, >1.3 GHz >-110 dBm)

### SPECTRAL PURITY:

Harmonic Spurious:	-25 dBc max
Non-Harmonic Spurious:	-50 dBc max <1.5 GHz -30 dBc max >1.5 GHz
Residual FM:	<15 Hz rms (Post Detection BW = 300 Hz to 3 kHz)
SSB Phase Noise (20 kHz offset):	-100 dBc/Hz typical -92 dBc/Hz max
Residual AM:	0.1% (Post Detection BW = 300 Hz to 3 kHz)

### FREQUENCY AGILITY:

10 ms <100 MHz step (to <100 Hz frequency error)

### GEN Connector:

Connector Protection:	50 W (+47 dBm) for 30 sec.
Threshold:	+20 dBm (nominal)

### D-3 GENERATOR MODULATOR

FM:

Deviation Accuracy:	3%, + residual, $\pm$ LSD (1 kHz through 20 kHz deviation, 1 through 10 kHz rate) 5%, + residual, $\pm$ LSD (>20 kHz deviation, 1 through 20 kHz rate)
Deviation Range:	Off, 10 Hz - 40 kHz deviation
Deviation Resolution:	10 Hz
Modulation Rate Bandwidth:	DC to 20 kHz (MOD 1, MOD 2, and Audio in [SINAD] unbalanced) 50 Hz to 20 kHz (Audio in [SINAD] balanced and Mic in)
Modulation Distortion (THD):	1% (1 to 10 kHz, 6 kHz dev.) 2% (10 to 20 kHz, 6 kHz dev.)
External Modulation Sensitivity:	1 Vpp = 4 kHz Deviation $\pm$ 10%
Digital Modulation Formats:	C4FM at 9.6 kbits/s
FSK Error:	<1% typical, <2% max
Project 25 Compliant Signals:	1011 Hz tone 5% BER calibration tone Speech (repeated test phrases) Silence Voice from audio inputs

### D-4 RECEIVER (Transmitter Test)

T/R CONNECTOR:

VSWR - T/R Connector:	<1.2:1 to 1 GHz, <1.25:1 (typical) >1 GHz to 2.7 GHz, 1.3:1 max
Maximum Power:	50 W continuous, 125 W 1 min/4 min off
Alarm:	Alert sounds at 100°C Pad Temp or 135 W

BROADBAND POWER METER FUNCTIONS (T/R CONNECTOR):

Frequency Range:	1 MHz to 2.7 GHz
Accuracy:	10% $\pm$ LSD
Dynamic Range:	10 mW to 125 W
Resolution:	3 digits

NARROWBAND POWER METER FUNCTIONS (T/R CONNECTOR):

Frequency Range:	1 MHz to 2.7 GHz
Range:	1 $\mu$ W (-30 dBm) to 125 W (+53 dBm)
Resolution:	3 digits
Alarm:	Alert sounds at 100°C Pad Temp or 135 W

## ANT CONNECTOR

ANT Connector Protection: +50 dBm for 30 sec.  
Threshold: +20 dBm (nominal)

## ANTENNA RECEIVE LEVEL METER:

Range: -100 to -10 dBm (25 kHz BW, no input attenuation selected - +10 dBm max)  
-80 to -10 dBm (200 kHz BW, no input attenuation selected - +10 dBm max)  
Resolution: 0.1 dB  
Accuracy:  $\pm 1.5$  dB (after CAL and no UNCAL indication)  
Frequency Range: 10 MHz to 2.7 GHz

## FILTERS

IF Filters: 200 kHz wide band  
25 kHz medium band  
12.5 kHz narrow band

## FREQUENCY COUNTER/FREQUENCY ERROR METER:

Accuracy: Same as timebase  $\pm$  LSD  
In-Band Frequency Range:  $\frac{1}{2}$  selected receive bandwidth  
Resolution: 1 Hz

## DYNAMIC RANGE LEVEL:

ANT Connector: Input Level  $> -60$  dBm  
T/R Connector: Input Level  $> -20$  dBm  
Broadband Frequency Response: 10 MHz to 2.7 GHz

## FM DEVIATION METER:

Resolution: 10 Hz  
Accuracy:  $\pm 5\%$ ,  $\pm 2$  LSD + residual (12.5 kHz IF, 1 kHz rate, deviation  $> 1$  kHz and  $\leq 5$  kHz)  
 $\pm 5\%$ ,  $\pm 2$  LSD + residual (25 kHz IF, 1 kHz rate, deviation  $> 1$  kHz and  $\leq 10$  kHz)  
 $\pm 7\%$ ,  $\pm 2$  LSD + residual (200 kHz IF, 50 to 20 kHz rate, deviation  $> 5$  kHz and  $\leq 40$  kHz)

## DYNAMIC RANGE:

Meter Ranges: 5 kHz, 10 kHz, 20 kHz, 50 kHz, 100 kHz

## LEVEL:

T/R Connector: Input Level  $> -20$  dBm  
ANT Connector: Input Level  $> -60$  dBm  
Audio Frequency Bandwidth: DC to 20 kHz  
RF Bandwidth: 10 MHz to 2.7 GHz  
Demod Output Sensitivity: 5 kHz deviation = 1 Vpp  $\pm 15\%$

RECEIVE AUDIO FREQUENCY COUNTER  
INPUT LEVEL RANGE:

ANT Connector: Input Level >-60 dBm

T/R Connector: Input Level >-20 dBm

MODULATION LEVEL RANGE:

FM: 500 Hz to 40 kHz deviation

FREQUENCY RANGE:

FM: 50 Hz to 20 kHz

Accuracy: Same as time base  $\pm 1$  count

Resolution: 0.1 Hz/1 Hz

RECEIVE SINAD METER INPUT LEVEL  
RANGE:

ANT Connector: Input Level >-60 dBm

T/R Connector: Input Level >-20 dBm

MODULATION LEVEL RANGE:

FM: 500 Hz to 40 kHz deviation

Test Frequency: 1000 Hz

Meter Range: 20 and 40 dB full scale

Accuracy:  $\pm 1$  dB  $\pm 1$  LSD at 1 kHz rate and 12 dB SINAD

Resolution: 0.1 dB

RECEIVE DISTORTION METER INPUT  
LEVEL RANGE:

ANT Connector: Input Level >-60 dBm

T/R Connector: Input Level >-20 dBm

MODULATION LEVEL RANGE:

FM: 500 Hz to 100 kHz deviation

Test Frequency: 1000 Hz

Meter Range: 5%, 10%, 20%, 50%, 100% full scale ranges

Accuracy:  $\pm 1.5\%$   $\pm 1$  LSD at 1 kHz rate at 5% distortion

Resolution: 0.1%

DIGITAL DEMODULATION METERS (C4FM  
FSK ERROR) INPUT LEVEL RANGE:

ANT Connector: Input Level >-60 dBm

T/R Connector: Input Level >-20 dBm

FSK Error: <2% from ideal, 3% to 10% reading, 400 symbols

## D-5 AUDIO FREQUENCY GENERATOR

### WAVE SHAPE FORMATS:

Wave Shapes:	Sine, Square, Triangle, Ramp
Amplitude Level:	(The combination of FGEN 1 and FGEN 2 cannot exceed the following connector limitations.)
Unbalanced:	0 to 20 Vpp into 10 k $\Omega$ (Audio Out 1 [FGEN] and Audio Out 2 [DEMODO])
Balanced - High Range:	0 to 6 Vrms into 10 k $\Omega$ (Audio Out 1 [FGEN] only)
Balanced - Low Range:	0 to 600 mVrms into 10 k $\Omega$ (Audio Out 1 [FGEN] only)

### RESOLUTION:

High Range:	1 mV (Audio Out 1 [FGEN] and Audio Out 2 [DEMODO])
Low Range:	0.1 mV (Audio Out 1 [FGEN] only)

### ACCURACY (SINE WAVE):

Unbalanced:	3% (20 Hz through 3 kHz) (Audio 1 or 2, level >0.5 Vpp)
Balanced:	
High Range:	10% (frequency at 1 kHz, level >0.5 Vpp)
Low Range:	10% (frequency at 1 kHz, level >0.05 Vpp)
Distortion (THD, sine wave):	<0.5% (1 kHz, 3 Vpp) <2% (20 Hz to 20 kHz, 1 through 15 Vpp)
Distortion (THD):	<0.5% (1 kHz, 3 Vpp) <2% (20 Hz to 20 kHz, 1 through 15 Vpp)

### FREQUENCY RANGE:

Unbalanced:	DC to 20 kHz (Audio Out 1 [FGEN] and Audio Out 2 [DEMODO])
Balanced:	50 Hz to 20 kHz (Audio Out 1 [FGEN] only)
Resolution:	0.1 Hz
Accuracy:	$\pm$ 0.1 Hz

## D-6 BASE-BAND AUDIO FUNCTIONS

Input Level Range:	100 mVpp to 20 Vpp
Frequency Range:	
Audio IN (SINAD) input:	50 Hz to 20 kHz (unbalanced)
Audio IN (SINAD) input:	50 Hz to 20 kHz (balanced)
Mic (MIC) input:	50 Hz to 20 kHz (unbalanced)
Input Impedance:	Audio In (SINAD) Low impedance input: 600 $\Omega$ (balanced)
High Impedance Input:	10 k $\Omega$ (unbalanced)

**MIC IN (MIC) HIGH IMPEDANCE ONLY:**

Phantom Power +5 V through 5 k $\Omega$

**AUDIO FREQUENCY COUNTER INPUT  
LEVEL RANGE (DEMOD SELECTED):**

ANT Connector: Input Level >-60 dBm  
T/R Connector: Input Level >-20 dBm  
Input Sources: Demodulated Audio, MIC Input, Audio (SINAD) Input  
Ranges: 200, 500, 1 k, 2 k, 5 k, 10 k, 20 k  
Accuracy:  $\pm 1$  count  
Resolution: 0.1 Hz

**MICROPHONE AUDIO INPUT:**

Modes: Electret - +5 V through 5 k $\Omega$   
Dynamic

## **D-7 SPECTRUM ANALYZER FUNCTIONS**

**SWEEP (HORIZONTAL) ACCURACY:**

Frequency Range: 1 MHz to 2.7 GHz  
Frequency Resolution: 1 Hz

**FREQUENCY SPAN WIDTH RANGE:**

Analyzer Screen: Zero Span, 1 kHz to 2 GHz in a 1/2/5 sequence, plus Full Span  
Generate and Receive Screens: Zero Span, 1 kHz to 5 MHz in a 1/2/5 sequence  
Span Accuracy:  $\pm 1\%$  of (total) Span Width  
Frequency Display: Span accuracy + Frequency Standard accuracy + 50% of RBW  
Sweep Rate Range: 10 ms to 5 sec.  
Sweep Rate Accuracy: 1%  
1 dB Compression: >-10 dBm (ANT Connector, No input attenuation)  
Harmonic Spurious: -55 dBc at -40 dBm (ANT Connector, No input attenuation)  
Non-Harmonic Spurious: -60 dBc (10 MHz to 2.7 GHz) (ANT Connector, No input attenuation)  
Residual Spurious:  $\leq 85$  dBm (Input terminated, ANT Connector, No input attenuation)

**AMPLITUDE (VERTICAL):**

Level Accuracy:  $\pm 1.5$  dB at -20 dBm, ANT Connector, No input attenuation (typical)  
Scales: 2 dB/div, 5 dB/div, 10 dB/div  
LOG Linearity:  $\pm 2$  dB  
Reference Level Resolution: 1 dB

**ATTENUATOR:**

Range: 0 to 50 dB (Selectable manually or auto coupled to reference level.)  
Accuracy:  $\pm 0.5$  dB/step, up to  $\pm 1$  dB max

**DYNAMIC RANGE:**

ANT Connector:  $< -70$  dBm  
T/R Connector:  $< -30$  dBm  
Typical Noise Floor Performance:  $-110$  dBm, 10 MHz to 2.7 GHz (300 Hz Resolution Bandwidth selected)  
Residual Phase Noise:  $-92$  dBc/Hz at 20 kHz offset

**RESOLUTION BANDWIDTH:**

Analyzer Screen: 300 Hz, 3 kHz, 30 kHz, 60 kHz, 300 kHz, 3 MHz  
Generate and Receive Screens: 300 Hz, 3 kHz, 60 kHz  
Selectivity: 60 dB/3 dB ratio  $< 15:1$   
Bandwidth Switching Error:  $\pm 1$  dB  
Video Bandwidths: None, 10 Hz to 3 MHz in 1-3-10 steps

**SPECIAL FUNCTIONS:**

Display Modes: Live, Coupled/Uncoupled (span/sweep time/RBW)

**SPECTRUM ANALYZER VIDEO OUTPUT:**

Reference Level: = +5 V  
Bottom-of-Screen: = -5 V

**D-8 OSCILLOSCOPE FUNCTIONS**

Vertical Inputs: 2 input channels (CH1 and CH2), MIC Input, Audio I/O Input, Internal Demodulation  
Input Impedance: 1 M $\Omega$   
External Coupling: AC, DC, GND  
Range: 20 mV to 20 V/div in a 1, 2, 5 sequence  
Accuracy: 10% of full scale (DC to 50 kHz)  
Bandwidth: 500 kHz usable

**HORIZONTAL SWEEP:**

Range: 10  $\mu$ s to 1 sec per division  
Accuracy: 1% of full scale  
Trigger Source: Channel 1, Channel 2, Internal or External Trigger  
External Trigger: expects a TTL level (2 V - trigger level)  
Special Functions:  
Modes: Live, Triggered Mode (Auto, Normal, Single shot trigger)

## D-9 DVM FUNCTIONS

### AC:

Input Impedance:	1 M $\Omega$ 600 $\Omega$ 150 $\Omega$
Range:	400 mV to 100 V in a 1, 2, 4 sequence
Resolution:	1 mV through 5 V scale, 10 mV on the 10 through 100 V scales
Accuracy:	6% of full scale (50 Hz to 20 kHz) $\pm$ 1 LSB

### DC:

Range:	400 mV to 100 V in a 1, 2, 4 sequence
Resolution:	0.1 m 0.4 V scale 10 MV 10 V, 20 V and 40 V scales 1 mV 1 V, 2 V and 4 V scales 100 mV 100V scale
Accuracy:	2% of full scale $\pm$ 1 LSB
Input Impedance:	10 M $\Omega$

## D-10 TIME BASE

### ACCURACY:

Output Frequency:	10 MHz
Time Base Stability:	$\pm$ 0.01 ppm
Time Base Aging:	$\pm$ 0.1 ppm per year

### LEVEL:

Output Level:	1 to 5 Vpp into 10 k $\Omega$
Warm-Up:	<5 min.
Time Base Capture:	1 to 5 Vpp input (sine or square wave)

## D-11 DIGITAL I/O

Parallel Printer Connector  
Serial Connector (RS-232)  
Video Monitor Connector (VGA)  
Mouse Connector (PS2 Compatible)  
Keyboard Connector  
Ethernet Connector (10T/100T)  
Front Panel Test Connector  
3.5 inch Floppy Drive



**D-12 AC POWER**

Input Range: 100 to 120 VAC, 60 Hz,  
220 to 240 VAC, 50 Hz

Maximum Power Consumption: 220 W

Main Supply Fluctuations: <10% of nominal voltage

Transient Over-Voltage Installation: Category II

**D-13 ENVIRONMENTAL/MECHANICAL**

Weight: 33 lbs.

Volume: 7.75" (H) x 14" (W) x 19" (D)

Operating Temperature Range: 0° to 40°C

Storage Temperature Range: -25° to 70°C

Pollution: Pollution Degree 2

Altitude: 3000 meters

**D-14 MISCELLANEOUS**

Warranty 2 years  
(Extended Warranty available upon request)

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