

## APPENDIX A — FM/AM-1500 SPECIFICATIONS

### A-1 RF SIGNAL GENERATOR

Frequency Range:	100 kHz to 999.9999 MHz in 100 Hz increments.
Frequency Accuracy:	(See TCXO Master Oscillator)
Residual FM:	< 50 Hz (typical 30 Hz RMS) (Post detection 50-300 Hz)
RF Output Power:	0 dBm to -128 dBm continuously adjustable into 50 $\Omega$ . (No range changing)
Accuracy:	$\pm 2$ dB, -10 to -80 dBm $\pm 2.5$ dB, -80 to 128 dBm (-80 to -120 on IEEE version)
Attenuator Dial:	One continuous dial with uV and dBm.
Modulation:	FM: 2 Hz to 30 kHz rate at 0 to $\pm 25$ kHz deviation. For external inputs DC to 30 kHz rate. (DC, if generated lock control is in the variable position). Flat to $\pm 2$ dB DC to 30 kHz 6 Vp-p $\pm 2$ Vp-p produce $\pm 15$ kHz deviation AM: 10 Hz to 5 kHz rate at 0-90% 6 kHz to 30 kHz rate at 0-30% 3 Vp-p $\pm 1$ Vp-p produces 90% modulation External Mod impedance 600 $\Omega$

#### NOTE:

FM<sub>1</sub>, FM<sub>2</sub>, FM<sub>3</sub>, and FM<sub>4</sub> are all FM modulation.  
SSB, AM<sub>1</sub>, and AM<sub>2</sub> are AM modulation. SSB has no function other than AM in the generator mode.

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**A-1 RF SIGNAL GENERATOR (Cont'd)****Freq. Shift with  
Modulation:**

When the generator is in the "lock" position, the center frequency is phase-locked to the system clock.

**Modulation  
Distortion:**

The FM modulation distortion plus noise at  $\pm 25$  kHz deviation is less than 2% from 200 Hz to 20 kHz.

**Generator  
Freq. Control:**

When in the "locked" position, the generator is phase-locked to the master clock. When switched off from the "locked" position, the generator may be varied  $\pm 10$  kHz. The FM modulation input is DC coupled for this unlocked function. (Internal or external modulation.)

**Microphone  
Input:**

Generator can be switched on by an external microphone. It has internal preamp with adjustable level.

**SSB Noise:  
Deviation Accuracy  
of Processor  
controlled audio  
levels:**

90 dBc/Hz at  $\pm 20$  kHz from carrier.

$\pm 5\%$  from 20 Hz to 5 kHz and  $\pm 10\%$  from 5 kHz to 20 kHz.

**Generator Spurious:**

Harmonics: > 25 dBc

Non Harmonics: > 40 dBc

Typically: > 60 dBc

In-Band, typically: > 70 dBc

A-2



**A-2 DUPLEX GENERATOR**

Freq Range:	$\pm 49.99$ MHz from receive frequency (as indicated on front panel (LCD) in 10 kHz increments.)
Freq Accuracy:	See TXCO Master Oscillator.
Output Level:	
DUPLEX Connector:	0 dBm to -128 dBm continuously adjustable into 50 $\Omega$ . (No range changing.)
TRANS Connector:	40 dB ( $\pm 3$ dB) below Attenuator settings from -10 to -80 dBm. 40 dB ( $\pm 3.5$ dB) below Attenuator settings from -80 to -128 dBm.

**A-3 RECEIVER/MONITOR**

Frequency Range:	300 kHz to 999.9999 MHz.
Resolution:	100 Hz
10 dB Sinad Sensitivity (typical):	2 $\mu$ V (1 MHz to 1 GHz). Sensitivity reduced below 1 MHz (for 15 kHz RF bandwidth and 8 kHz post detection bandwidth)
Selectivity: (3 dB):	6 kHz: SSB and AM, 15 kHz: AM <sub>2</sub> and FM <sub>1</sub> , 200 kHz: FM <sub>2</sub> , FM <sub>3</sub> and FM <sub>4</sub> . FM <sub>1</sub> and FM <sub>2</sub> has post demodulation bandwidth of 8 kHz. FM <sub>3</sub> has a post demodulation bandwidth of 20 kHz. FM <sub>4</sub> has a post demodulation bandwidth of 80 kHz. FM <sub>4</sub> has a demodulation flatness of $\pm 2$ dB referenced to 1 kHz from 10 Hz to 20 kHz.



**A-3 RECEIVER/MONITOR (Cont'd)**

	AM <sub>1</sub> and SSB have an RF bandwidth of 6 kHz and post detection bandwidth of 8 kHz. AM <sub>2</sub> has an RF bandwidth of 15 kHz and a post detection bandwidth of 8 kHz.
Antenna Attenuator:	Selectable 0, -20 dB, and -40 dB ( $\pm 2$ dB each)
Quieting:	Deviation measurements can be made down to 0.1 kHz in post detection bandwidth of 8 kHz.
Adjacent Channel Rejection:	> 25 dB at $\pm 25$ kHz (when on 15 kHz RF bandwidth) > 40 dB at $\pm 50$ kHz (when on 15 kHz RF bandwidth)
Beat Frequency Oscillator (BFO):	Fixed at center frequency.
Demodulation Output Level: (600 $\Omega$ Load)	AM: 100% = 0.5 Vp-p nominal (selectable by modulation switch) FM: $\pm 10$ kHz deviation = 1.0 Vp-p nominal
Demodulation Output Level Impedance:	600 ohms
Receiver Antenna Input Protection:	0.25 Watts maximum level without damage
FM Demodulation Noise + Distortion:	Less than 2% at $\pm 25$ kHz deviation for modulation frequencies from 200 Hz to 20 kHz with a receiver input level of -50 dBm. (RF bandwidth = 200 kHz, post detection bandwidth = 80 kHz)
Image Rejection:	+ 1.4 MHz, 50 dB + 21.4 MHz, 50 dB + 238.6 MHz, 50 dB + 2500 MHz $\pm 10$ MHz, 5 dB



**A-3 RECEIVER/MONITOR (Cont'd)**

Deviation  
Monitor Meter:  
(max peak either  
polarity)

Scales: 2 kHz, 6 kHz, 20 kHz, 60 kHz  
Accuracy  $\pm 5\%$  full scale for modulation frequencies of 30 Hz  
to 10 kHz at a signal level of -50 dBm.

AM Modulation  
Digital Display:  
(max peak,  
positive or  
negative  
Digital  
Deviation Display  
(CRT):

0.1% resolution on 20% and 60% ranges, 1% on 200% and  
600% ranges. Accuracy 5% reading  $\pm 20$  counts at received  
signal of -50 dBm for modulation frequency of 1 kHz.  
(10% to 90% depth)

Range is 0.00 to 60.0 kHz  
Accuracy is  $\pm 3\%$  at these two points:

1. 6 kHz rate at  $\pm 2$  kHz with 8 kHz post detection BW.
2. 10 kHz rate at  $\pm 8$  kHz with 20 kHz post detection BW.

AM Modulation  
Monitor Meter:

Scales 0-20%, 0-60%, 0-200%  
Accuracy  $\pm 7\%$  of reading,  $\pm 5\%$  full scale.

**A-4 SPECTRUM ANALYZER**

Inputs:

Transmitter: Transmitter under test when power exceeds 0.1  
watt. A 100 watt signal produces a top graticule  
reading. (marked -30 dBm)

Antenna Jack: The log scale is marked for dBm for this input  
when the antenna attenuator is set for "0". The  
signal can be attenuated by 20 dB or 40 dB by the  
antenna attenuator switch.

Log Scale:

Within  $\pm 2$  dB linearity from -30 dBm to -90 dBm indication.  
Switchable between 1 dB/DIV and 10 dB/DIV.

Dynamic Range:

70 dB, additional 40 dB selectable by input attenuator.



#### A-4 SPECTRUM ANALYZER (Cont'd)

Modes:	Full Scan:	1 MHz to 1000 MHz; 650 kHz bandwidth
	10 MHz/DIV:	Center frequency as selected; 650 kHz bandwidth
	5 MHz/DIV:	Center frequency as selected; 650 kHz bandwidth
	2 MHz/DIV:	Center frequency as selected; 650 kHz bandwidth
	*1 MHz/DIV:	Center frequency as selected; 30 kHz bandwidth
	*0.5 MHz/DIV:	Center frequency as selected; 30 kHz bandwidth
	*0.2 MHz/DIV:	Center frequency as selected; 30 kHz bandwidth
	*0.1 MHz/DIV:	Center frequency as selected; 30 kHz bandwidth
	*20 kHz/DIV:	Center frequency as selected; 3 kHz bandwidth
	*10 kHz/DIV:	Center frequency as selected; 3 kHz bandwidth
	*2 kHz/DIV:	Center frequency as selected; 300 Hz bandwidth
	*1 kHz/DIV:	Center frequency as selected; 300 Hz bandwidth

- \* The receiver is fixed on the center frequency for monitoring while the analyzer scans as specified. On wider scans, the receiver and monitor portion are not usable.

#### A-5 TRACKING GENERATOR

Frequency Range:	1.0 MHz to 1000 MHz as selected by the frequency control.
Output Level:	Same as RF generator; 0 dBm to -128 dBm.
Sweep Mode:	The oscilloscope is switchable to external vertical input when in the tracking generate mode.



**A-6 OSCILLOSCOPE**

Display Size:	2" x 2½"
Vertical Bandwidth:	DC to 1 MHz (at 3 dB bandwidth)
External Vertical Input Ranges:	10 mV, 100 mV, 1 V, 10 V per division
Horizontal Sweep Rate:	10 mSec, 1 mSec, 100 uSec, 10 uSec per division

**A-7 AUDIO GENERATORS**

Operating Modes:	Internal: Variable frequency generators, one or both. External plus Internal: Any external tone(s) plus either or both internal tones simultaneously.
Frequency Range:	Variable from 2 Hz to 30 kHz.
Accuracy:	0.01%
Resolution:	0.1 Hz; 2 Hz to 9999.9 Hz; 1 Hz, 10.000 kHz to 30 kHz.
Output Level:	Variable from 0 to 2.5 VRMS minimum either tone into 150Ω.
Distortion:	< 2% (10 Hz to 100 Hz) < 0.7% typical 100 Hz to 30 kHz Some frequencies have a measured distortion of less than 1.5% as measured on a typical null type distortion analyzer.
Output Distribution:	Each tone selectable OFF or into either AM or FM modulator when not under processor sequence control. Each tone level variable through "Tones Out" jack regardless of selection of "FM", "AM" or "OFF" by the manual switches.
Speaker:	Selectable from receiver or same signal as "Tone Out" jack.



**A-8 FREQUENCY ERROR METER MEASUREMENT CAPABILITY****RF Signals**

Sensitivity: Typically 1.5  $\mu$ V above 1 MHz (sensitivity is reduced below 1 MHz)  
Ranges:  $\pm 30$  Hz,  $\pm 100$  Hz,  $\pm 300$  Hz,  $\pm 1$  kHz,  $\pm 3$  kHz,  $\pm 10$  kHz  
Resolution:  $\pm 1$  Hz on the  $\pm 30$  Hz and  $\pm 100$  Hz ranges

**Demodulated Audio Signals**

Ranges:  $\pm 3$  Hz,  $\pm 30$  Hz,  $\pm 300$  Hz as referenced to frequency of Tone Generator #1.  
Resolution:  $\pm 0.1$  Hz on  $\pm 3$  Hz scale  
Frequency Range: 20 Hz to 10 kHz

**A-9 DEMODULATED AUDIO FREQUENCY COUNTER**

Range: 10 Hz to 20 kHz  
Resolution: 1 Hz  
Accuracy:  $\pm 2$  counts

**A-10 INTERNAL SINAD METER**

Input: 0.5 to 10 VRMS  
Frequency: 1 kHz  
Range: 0 to 20 dB  
Accuracy:  $\pm 1.5$  dB at 12 dB reading

**A-11 POWER MONITOR**

Frequency Range: 1 MHz to 1000.00 MHz (wideband detector circuit)



**Power Ranges:** 0 to 15 and 0 to 150 Watts  
**Accuracy:** 1 to 600 MHz,  $\pm 7\%$  of reading  
 $\pm 3\%$  of full scale.  
600 to 1000 MHz  $\pm 17\%$  of reading  
 $\pm 3\%$  of full scale  
821 MHz to 896 MHz  $\pm 7\%$  reading,  $\pm 3\%$  of full scale  
**Input Power:** 50 watts continuous  
150 watts until "over temp" lamp illuminates

Changeover from generate to monitor mode occurs at nominally 100 mW input level to the TRANS/-40 dB DUPLEX Connector.

#### A-12 TCXO MASTER OSCILLATOR

**Accuracy:**  $5 \times 10^{-7} = 0.00005\%$  (typically  $2 \times 10^{-7}$ ). Greater accuracy is attainable with front panel adjustment.  
**Aging Stability:** 2 to 3 PPM during first year . . . 1 PPM per year thereafter.  
**EXT. Clock:** BNC Connector for EXT 10 MHz STD.

#### A-13 PHYSICAL CHARACTERISTICS

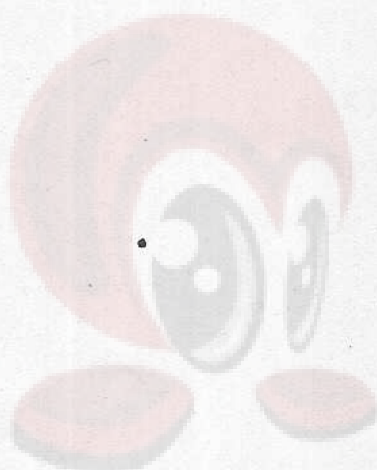
**Dimensions:** 12.5" wide, 9" high, 19.5" deep  
(31.8 cm W, 22.9 cm H, 49.5 cm D)  
**Weight:** 46 lbs. (20.9 kg)  
**Temperature Range:** 0° to 50° C

A-9



**A-14 POWER**

Conveniently portable. Self-contained battery automatically recharges when AC line is connected. Operates on 106 to 266 VAC without switching, 50-400 Hz, 85 watts, or 11 to 18 VDC. Typical DC currents 6.0 A at 12 V.



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