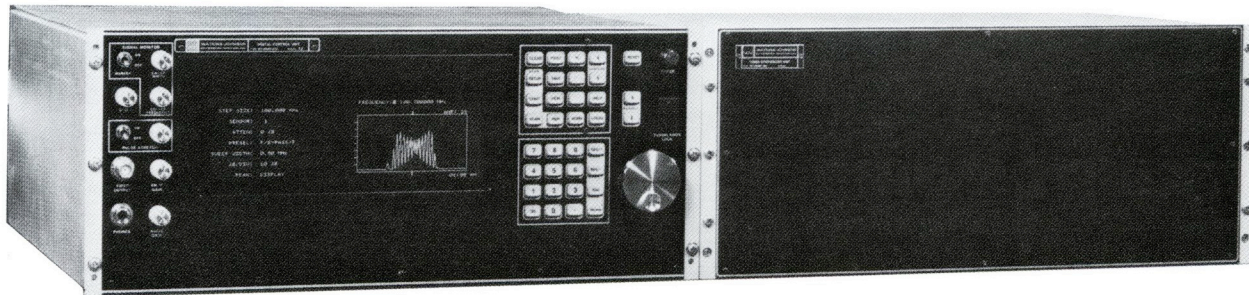




292.00

# WJ-8999 PORTABLE EMC/TEMPEST TEST RECEIVER



## FEATURES

- **Frequency Coverage: 1 kHz to 1 GHz (1 GHz to 12.4 GHz Optional)**
- **Receiver Sensitivity and Dynamic Range Optimized for EMC Testing**
- **18 standard IF Bandwidths: 100 Hz to 50 MHz (100 and 200 MHz Optional)**
- **18 Video Bandwidths: 50 Hz to 20 MHz Plus Bypass (50 and 100 MHz Optional)**
- **Fixed Frequency, Scan/Plot, Scan/Monitor and Remote Control Modes**
- **Audio, Video, IF, Signal Monitor and Printer Outputs Available**
- **Optional Built-In Signal Monitor**
- **Furnished With Two Carrying Cases and the Necessary Hardware for Rack Mounting**

## INTRODUCTION

The WJ-8999 Portable EMC/TEMPEST Test Receiver is a multipurpose receiving system designed to satisfy the requirements for electromagnetic compatibility (EMC) investigations. It has the flexibility to perform other types of spectral surveys and the analysis of both narrowband and broadband signals. The standard configuration tunes from 1 kHz to 1 GHz; contains 18 IF bandwidths from 100 Hz to 50 MHz; and provides AM, AM/AGC, FM, CW and LOG signal detection modes. Audio, Video, IF, and

Signal Monitor outputs are provided for further signal analysis, and a printer/IEEE-488 remote control interface is provided to simplify record keeping.

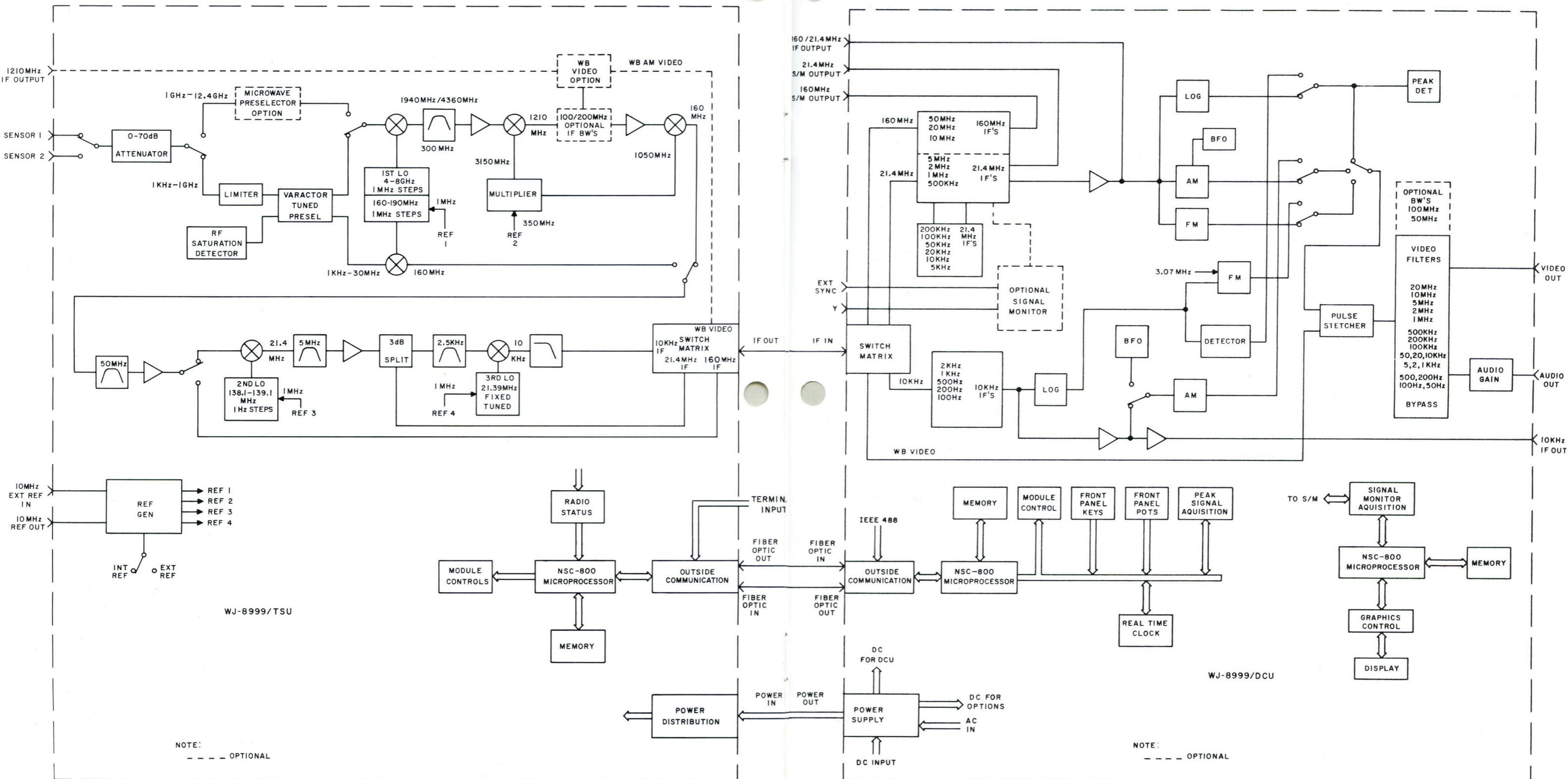
Available options include:

1. The WJ-8999/FE, which extends the tuning range from 1 GHz to 12.4 GHz.
2. The WJ-8999/WBW, which provides two additional IF bandwidths (100 MHz and 200 MHz), video bandwidths (50 MHz and 100 MHz) and a wideband AM video output.
3. The WJ-8999/SM, which is a built-in signal monitor that uses the front panel display and provides video and sync outputs for an external display.
4. WJ-8999/PATS, MS DOS software package which allows PC-AT based automated TEMPEST testing to the following specifications: AMMSG 720A, AMMSG 720B, BTR-01-202(3), BTR-01-202(4), BTR-01-210, NACSIM 5100, and NACSIM 5100A.

## EQUIPMENT CONFIGURATION

The WJ-8999 Receiving System is comprised of a Digital Control Unit (DCU) and a Tuner/Synthesizer Unit (TSU). These two units are housed with the necessary interconnecting power, IF, and fiber optic control cable assemblies and an external limiter (for the 1 GHz to 12.4 GHz option) in two carrying cases.





WJ-8999 Portable EMC/TEMPEST Test Receiver Simplified Block Diagram



## OPERATING MODES

The WJ-8999 Receiving System provides four operating modes:

1. Fixed Frequency Mode
2. Sector Scan/Plot Mode
3. Sector Scan/Monitor Mode
4. Remote Control Mode

The Fixed Frequency Mode provides the capability to manually tune the receiver using the keypad, the tuning wheel, or up/down keys on the front panel. The other system operating parameters are selected using the front panel keypad and are displayed on the electroluminescent display. The optional signal monitor may also be displayed with an abridged set of the operating parameters.

In the Sector Scan/Plot Mode, eight sectors may be programmed with start frequency, stop frequency, step size and the other receiver parameters. Any individual sector may be scanned, and the operator has the option to plot the data on the display screen. The displayed plot data may be expanded on either axis, and the base of the y axis may be reset. A cursor is provided to allow amplitude data to be read back from memory. The receiver's tuned frequency tracks the cursor in this mode.

The Sector Scan/Monitor Mode gives the operator the ability to scan multiple sectors. The number of sectors and the order in which they may be scanned are operator selectable. The option to scan the selected sectors repetitively is also available. The optional signal monitor may be displayed on the screen with an abridged set of scan parameters.

Operation in the Remote Control Mode allows the system to be customized to the needs of a particular application utilizing the IEEE-488 bus. In this mode, the DCU becomes an intelligent interface between the macro commands of the host computer and the micro commands required at the module and component level of the system. All functions accessible to the operator in the Fixed Frequency Mode are available as remote control commands.

## DIGITAL CONTROL UNIT (DCU)

The DCU contains three major sections: the digital control section, the IF Demodulator section, and the system power supply.

The digital control section provides command and control information to all other modules in the DCU and TSU. One of two NSC 800 microprocessors handles front panel control, printer/IEEE-488 remote control interface, the fiber-optic link to the TSU, and overall system

operation. The second NSC 800 processor, coupled with a display processor, controls all of the electroluminescent display functions.

The operator controls the DCU using a 32-key keypad, a tuning wheel, up/down keys, audio gain control, BFO, AM/IF gain control, and a pulse stretch control. If the optional signal monitor is installed, the center frequency, sweepwidth and marker controls are also available. The system checks and verifies operator inputs ensuring that the data presented to the system is correct. Should an error be detected, the system will not accept the erroneous input.

The IF Demodulator section contains the 18 standard IF bandwidths ranging from 100 Hz to 50 MHz in a 1-2-5 sequence. These IF filters are centered at 160 MHz, 21.4 MHz or 10 kHz. This section also contains the AM, FM, and Log detectors. These detected signals, and the wideband AM video from the optional 100 MHz and 200 MHz IF's (located in the TSU), provide the input to the video filters. These filters range from 50 Hz to 20 MHz in a 1-2-5 sequence with a bypass mode. If the optional 100 MHz and 200 MHz IF's are installed, two additional video filters (50 MHz and 100 MHz) will also be installed. IF and video outputs are provided.

The system power supply provides  $\pm 8$  volts DC and  $\pm 18$  volts DC for both the DCU and the TSU. The system may be operated from 100 to 130/200 to 260 volts AC, 48 to 62 Hz power. An additional DC output connector is provided for future expansion.

## TUNER/SYNTHESIZER UNIT (TSU)

The TSU provides frequency coverage from 1 kHz to 1 GHz with optional coverage from 1 GHz to 12.4 GHz. The internal synthesizers and conversion scheme permit 1 Hz tuning steps when the final IF frequency is 21.4 MHz or 10 kHz (bandwidths from 100 Hz to 5 MHz). When the final IF frequency is 160 MHz or optionally 1210 MHz (bandwidths from 10 MHz to 200 MHz), the minimum step size is 1 MHz.

The signal input to the TSU is provided by one of two selectable input ports. An RF attenuator with 70 dB of range in 10 dB steps may be operated in either a manual or an auto-ranging mode based on information from the RF and IF saturation detectors. A set of fixed-tuned and varactor-tuned bandpass filters are used for preselection in the TSU. The varactor-tuned preselector filters may be bypassed if desired.

An NSC 800 microprocessor performs the control decoding and system monitoring functions as well as driving the link back to the DCU.



## SPECIFICATIONS

Frequency Range .....	1 kHz to 1 GHz fully synthesized 1 GHz to 12.4 GHz fully synthesized (optional)
Frequency Accuracy for 50 MHz Reference .....	$\pm 1$ ppm 0 to 65 °C
Aging Accuracy .....	$\pm 1$ ppm/year
Reception Modes .....	LOG, AM, AM/AGC, FM, CW
Antenna/Sensor Input	
Inputs .....	Two
Isolation .....	Greater than 60 dB
Switching Time .....	Less than 20 ms
Input Impedance .....	50 ohms
Input VSWR .....	Less than 2.5:1, preselector or bypass mode
Input Attenuator	
Range .....	0 to 70 dB in 10 dB steps
Accuracy .....	$\pm 3\%$ in dB from attenuator setting
Switching Time .....	Less than 30 ms
Selection .....	Local, remote or automatic as a function of RF or IF overload
Preselectors	
1 kHz to 100 kHz .....	Fixed tuned
100 kHz to 500 MHz (Bandwidth Approximately 25% of Tuned Frequency) .....	Varactor tuned with bypass mode provided
500 MHz to 1 GHz .....	Four suboctave bandpass filters with bypass mode provided
1 GHz to 12.4 GHz .....	Suboctave bandpass filters for use with the 1 GHz to 12.4 GHz tuning option
Input Protection	
1 kHz to 1 GHz .....	Built-in limiter will protect against +40 dBm 10% duty cycle input
1 GHz to 12.4 GHz .....	RF limiter provides protection against +40 dBm CW input. Limiter connects to antenna input, external to tuner
Noise Figure	
1 kHz to 500 MHz .....	Less than 10 dB
500 MHz to 1 GHz .....	Less than 12 dB
1 GHz to 10 GHz .....	Less than 15 dB
10 GHz to 12.4 GHz .....	Less than 17 dB
Image Rejection .....	Greater than 90 dB
IF Rejection .....	Greater than 90 dB
LO Leakage at Input Port .....	Less than -90 dBm in bypass mode
Intermodulation Intercept Point	
Third Order (Out of Band) .....	-5 dBm in a 1 MHz Bandwidth Using Tone 1 = 313 MHz, Tone 2 = 315 MHz at -20 dBm +40 dBm, minimum with preselector engaged
Second Order .....	
Frequency Tuning	
Manual .....	Keypad entry, tuning wheel, up/down arrow keys
Scan .....	Single sweep one sector, repetitive sweep single or multiple sectors
Scan Widths .....	Start and stop frequencies presettable from front panel for each sector
Step Size .....	(A) Minimum step size is 1 Hz when using IF bandwidths 100 Hz through 5 MHz, or (B) Minimum step size is 1 MHz when using IF bandwidths 10 MHz through 200 MHz, or (C) Step size is a percentage of IF bandwidth from 1% to 100% in 1% increments subject to the restrictions of A and B above. (The step size being rounded down to the nearest 1 Hz or 1 MHz increment.)

**SPECIFICATIONS (Continued)**

**IF Bandwidths**

6 dB Bandwidth Filters  
(± 10% of Bandwidth Selected) .....

18, from 100 Hz to 50 MHz in 1-2-5 sequence.  
100 MHz, 200 MHz Bandwidths optional  
(WJ-8999/WBW)

IF Output Center Frequencies  
(± 5% of Bandwidth Selected) .....

CF	IF Bandwidth
10 kHz	100 Hz through 2 kHz
21.4 MHz	5 kHz through 5 MHz
160 MHz	10, 20, and 50 MHz
1210 MHz	100 and 200 MHz

IF Filter Shape Factors (60 dB : 6 dB) .....

4:1 maximum (5 kHz to 200 MHz Bandwidths)  
4.7:1 maximum for 100 Hz to 2 kHz

Frequencies At Which IF Bandwidths Are Available:  
1 kHz to 29.999999 MHz .....  
30 MHz to 12.4 GHz .....  
Detection Modes .....

Bandwidths of:  
100 Hz to 50 MHz  
100 Hz to 200 MHz

Mode	Bandwidth
LOG, AM, FM	100 Hz to 50 MHz
CW	100 Hz to 5 MHz
AM	100 MHz, 200 MHz optional

Dynamic Range (From System RMS Noise Level to  
1 dB Compression) .....

IF Shelf	IF BW	IF Output	AM Video	Log Video
1210 MHz	100 MHz	60 dB	25 dB	—
160 MHz	10 MHz	76 dB	40 dB	60 dB
21.4 MHz	5 kHz	95 dB	50 dB	80 dB
10 kHz	100 Hz	95 dB	60 dB	90 dB

Switched Video Output .....  
Constant Video Output .....

AM, CW, LOG, FM  
FM

Video Output Level:  
AM: 1210 MHz IF (100 MHz Bandwidth) .....  
LOG, AM: 160 MHz IF (50 MHz Bandwidth) .....  
LOG, AM, CW: 21.4 MHz IF (5 MHz Bandwidth) ....  
LOG, AM, CW: 10 kHz IF (2 kHz Bandwidth) .....  
FM (30% Peak Deviation of IF Bandwidth) .....

0.5V peak-to-peak  
0.5V peak-to-peak  
0.5V peak-to-peak  
0.5V peak-to-peak

Bandwidth	FM Video Levels	
50 MHz } 20 MHz } 10 MHz }	20 MHz/V = .05V/MHz	
5 MHz } 2 MHz } 1 MHz }		2 MHz/V = .50V/MHz
500 kHz } 200 kHz } 100 kHz }		
50 kHz } 20 kHz } 10 kHz }	20 kHz/V = .05V/kHz	
5 kHz } 2 kHz } 1 kHz }		2 kHz/V = .50V/kHz
500 Hz } 200 Hz } 100 Hz }		

IF Output Level (at AGC Threshold) .....  
Video Output Impedance .....  
Audio .....

– 30 dBm minimum into 50 ohms  
50 ohms  
10 mW minimum into 600 ohms with gain control for  
headphone



## SPECIFICATIONS (Continued)

Signal Monitor Outputs:	
Center Frequencies .....	160 MHz and 21.4 MHz
Output Level .....	10 dB greater than RF input level into 50 ohms
Optional Internal Signal Monitor (WJ-8999/SM) .....	5 MHz sweepwidth displayed on electroluminescent digitally refreshed display
Outputs .....	Sync and video for use with an external scope
Video Filters (6 dB Bandwidth) .....	18, from 50 Hz to 20 MHz in a 1-2-5 sequence plus a bypass mode. 50 MHz, 100 MHz optional (Part of WJ-8999/WBW)
Variable Pulse Stretcher .....	Enables the operator to view a 10 ns pulse using a 1 ms sweep time
Local Control .....	Manual by tuning knob, up/down arrow and keypad entry. Microprocessor based design allows future enhancements. Electroluminescent display allows visual display of all parameters
Remote Control .....	IEEE-488 (1978) Bus. All front panel receiver parameters remotely controllable
Screen Print Output .....	Portable dot matrix printer model (supports HP-2225A) will print any displayed screen, receiver setup or optional signal monitor display
Environmental Conditions	
Operating Temperature .....	0°C to 40°C
EMI .....	Adequate shielding and filtering provided to prevent interference with measurement. Provision to disable displays if desired
Power Requirements .....	100 to 130/200 to 260 VAC, 48 to 62 Hz
AC Power Consumption .....	155 watts nominal
Weight (Each Unit) .....	42 pounds (18.9 kg), excluding options and case
Size (Each Unit) .....	Unit Size: 16-7/8 inches wide × 7 inches high × 15 inches deep (42.86 cm × 17.78 cm × 38.10 cm) Case Size: 27-1/2 inches × 12 inches × 25 inches (69.85 cm × 30.48 cm × 63.5 cm)
Rack Mounting Hardware .....	Rack Mounting Flanges furnished with units for instal- lation in standard 19-inch rack
Slides (Optional) .....	Jonathan 110 QD-14-2

TABLE 1

System Noise Figure	RECEIVER AM* Sensitivity in dBm																			
	100	200	500	1K	2K	5K	10K	20K	50K	100K	200K	500K	1M	2M	5M	10M	20M	50M	100M	200M
10 dB	-125	-122	-118	-115	-112	-108	-105	-102	-98	-95	-92	-88	-85	-82	-78	-75	-72	-68	-65	-62
11 dB	-124	-121	-117	-114	-111	-107	-104	-101	-97	-94	-91	-87	-84	-81	-77	-74	-71	-67	-64	-61
13 dB	-122	-119	-115	-112	-109	-105	-102	-99	-95	-92	-89	-85	-82	-79	-75	-72	-69	-65	-62	-59
15 dB	-120	-117	-113	-110	-107	-103	-100	-97	-93	-90	-87	-83	-80	-77	-73	-70	-67	-63	-60	-57

\*AM—The input signal level in dBm, AM modulated 50% by a 1 kHz tone for bandwidths greater than or equal to 10 kHz, by a 200 Hz tone for bandwidths from 2 kHz to 5 kHz and a 20 Hz tone for bandwidths from 100 Hz to 1 kHz, will produce 10 dB (S+N)/N minimum when used with a tuner having a noise figure as specified in Table 1.

NOTE: Sensitivity (dBm) is equal to  $-174 + 10 \log BW + (S+N)/N + \bullet \text{Mod}$ .  $\bullet \text{Mod}$  equals 9 dB for a 50 percent AM modulated signal because the sidebands are 12 dB down from the carrier and the two sidebands combine to yield a signal 9 dB down.