



## SMR-3822 WIDEBAND MICROWAVE RECEIVING SYSTEM

### FEATURES

- 0.5 to 20 GHz,  
Extendable Up to 40 GHz
- *SEI Certified*
- IF Outputs at 1 GHz, 160  
MHz, and 70 MHz
- Built-in Spectrum  
Display Processor for  
RF Sweep and IF Pan
- Eight IF Bandwidths:  
250 kHz to 100 MHz
- AM, FM, and Log  
Detectors
- Controlled from Workstation or  
Front Panel Controls
- Built-in Test Functions
- F1-F2 Sweep and Fixed  
Frequencies
- Ethernet 10/100BaseT control
- Integrated Local Control Panel



the IF up to 20 GHz tuned frequency. The receiver also includes an optional wideband FM discriminator and a standard wideband log video amplifier, both derived from the 1 GHz IF.

#### Front Panel Controller

Local backup operation of the Receiver is accomplished with front panel controls. Operational features of these controls include user-friendly, soft key driven menus combined with a numeric keyboard and rotary tuning knob operation. A comprehensive alphanumeric display shows operator inputs and receiver responses. Menu routines include frequency and IF bandwidth selection, gain control, video output levels, demodulation, BIT and I/O communication information. The receiver also supports remotely controlled operations.

#### Remote Control by Laptop or Workstation

Remote control of the receiver is via the Ethernet 100BaseT LAN or RS-232 port. Graphical User Interface (GUI) software is included for control of the receiver from a remote laptop or workstation. The software runs under the Windows NT™ operating system and provides spectrum display windows of RF Sweep or IF Pan plus all receiver control functions that are available in the two operating modes. The included Display/Control software is implemented as Microsoft® Windows NT™ application. The Display/Control software application looks and

### DESCRIPTION

The SMR-3822 Receiver, a member of the SMR-3800 family of high-performance synthesized microwave receivers, covers 0.5 to 20 GHz. Frequency extension to millimeter wave frequencies is possible using a frequency extender. An internal Spectrum Display Generator (SDG) generates data that can be used to develop RF Sweep and IF Pan spectrum displays on a remote workstation or laptop. The receiver provides simultaneous wideband IF outputs at 1 GHz (500 MHz bandwidth), 70 MHz (50 MHz bandwidth), and 160 MHz (100 MHz bandwidth) in addition to a post filtered 160 MHz IF output. All IF outputs have a noninverted spectrum; in addition, there is operator selectable inversion of

behaves in a typical Microsoft Windows manner and thereby promotes visual and functional consistency with other Microsoft Windows applications. Additional information about the SMR-3822 GUI software is contained in a separate data sheet.

**Spectrum Display Generator**

A Spectrum Display Generator provides formatted digital data which can be used by a host computer to provide a graphical display of spectral data. The SDG supports operation in both the RF Sweep mode and in IF Pan mode. In the RF Sweep mode, the operator may view from one to six separate scans as wide as the entire receiver input tuning range of 0.5 to 20 GHz. In IF Pan mode, up to a 100 MHz wide bandwidth is centered at the receiver fixed tuned frequency. Greatly enhanced hardware design implementation provides increased functional capability, including high dynamic range (>100 dB, 70 dB instantaneous), a wide range of selectable resolution bandwidths, video filtering, zero span mode with video triggering, logarithmic or linear amplitude display, adjustable vertical scaling, and increased amplitude measurement accuracy. This provides capabilities equivalent to a full-function spectrum analyzer.

**RF Sweep Mode**

During an RF sweep, the SDG LO is fix-tuned to process the 1 GHz IF center frequency. The tuner front end is then swept over the desired RF range. While the tuner is swept, the SDG Controller collects spectral data which is then formatted for display. In the RF Sweep mode, the full spectrum, 0.5-20 GHz, can be scanned in less than 300 ms with a 1 MHz or wider resolution bandwidth (RBW).

**IF Pan Manual Mode**

IF Pan spectrum data is generated when the receiver is tuned to a fixed frequency and the synthesized LO in the SDG is swept across the desired IF Pan display range. The bandwidth resolution is determined by selecting one of six switched filters. Bandwidths ranging from 30 kHz to 10 MHz are provided. In the IF Pan mode, a maximum sweep width of 100 MHz is available, and the spectrum may be swept in 30 msec.

**RF Inputs**

Key RF parameters include low noise figure, high intercept point, and high dynamic range. Excellent LO phase noise performance ensures clean down-conversion and low distortion of signal modulation characteristics.

To remove receiver front end gain variations, a gain controlled RF component is set automatically by the microprocessor based on internal calibration tables. Removing the front end gain ripple allows accurate signal amplitude data to be collected.

**IF Outputs**

The internal 1 GHz IF from the RF front end is preamplified and power divided. One of the divider outputs is filtered to a 100 MHz, minimum bandwidth and down converted to a 160 MHz (140 MHz optional) center frequency. The other output is filtered to a 50 MHz, minimum bandwidth and converted to a 70 MHz center frequency. The IF filter module provides eight selectable bandwidths.

Integral to the IF/Demodulator module is an IF/AGC Amplifier module which provides 70 dB of AGC/MGC gain control range. The AGC/MGC module generates the narrowband (post-filtered) IF output as well as the input to the demodulator module. The receiver provides fixed gain IF outputs at nominal 20 dB gain, a gain controlled, post-filtered IF output, AM Video, FM Video, switched AM linear/AM stretched/FM Audio, and Log Video outputs.

The FM video is derived either from the post-filtered 160 MHz IF signal or optionally from the 1 GHz IF. Switching is determined by operator selection of FM Video mode. Standard Log Video is derived from the 1 GHz Log Detector. With the optional NB Log Video, the Log Video output can be switched to select either the WB Log Video or Log Video derived from the gain controlled, post-filtered, 160 MHz IF signal. In this case the level and risetime of the log video is dependent upon the user-selected IF bandwidth.

The SMR-3822 Receiver is powered from the ac mains by an internal autosensing power supply. Built-In-Test (BIT) status of receiver phase lock, power supply voltages, and operating temperature limits are provided.

Extensive mechanical and environmental testing ensures that the SMR-3822 will perform in the most demanding environments.

**POST-FILTERED IF GAIN RANGE**

SMR-3822 RF-to-Post-Filtered IF Absolute Gain Versus IF BW and Rated Output Level (Shown for 0 dB IF Atten – 70 dB IF Atten)				
IF Bandwidth (MHz)	Rated Output Level			
	-20 dBm	-15 dBm	-10 dBm	-5 dBm
0.25	85 dB to 15 dB	90 dB to 20 dB	95 dB to 25 dB	100 dB to 30 dB
0.5	82 dB to 12 dB	87 dB to 17 dB	92 dB to 22 dB	97 dB to 27 dB
2.5	75 dB to 5 dB	80 dB to 10 dB	85 dB to 15 dB	90 dB to 20 dB
5	72 dB to 2 dB	78 dB to 7 dB	83 dB to 12 dB	88 dB to 17 dB
8	70 dB to 0 dB	75 dB to 5 dB	80 dB to 10 dB	85 dB to 15 dB
24	65 dB to -5 dB	70 dB to 0 dB	75 dB to 5 dB	80 dB to 10 dB
40	63 dB to -7 dB	68 dB to -2 dB	73 dB to 3 dB	78 dB to 8 dB
100	60 dB to -10 dB	65 dB to -5 dB	70 dB to 0 dB	75 dB to 5 dB

**RF SPECIFICATIONS AT 25° C**

<b>RF Input</b>	Single SMA connector, 50 $\Omega$ input impedance
<b>Input VSWR</b>	2.5:1, typical
<b>Frequency Range</b>	0.5 to 20 GHz (0.1-20 GHz, optional)
<b>Long Term Frequency Stability</b>	<1 ppm/Yr
<b>Frequency Accuracy vs. Temperature</b>	< $3 \times 10^{-7}$ over 0° to 50° C
<b>External Frequency Standard</b>	10 MHz at 0 dBm $\pm$ 3 dB, autoswitching
<b>Reference Output</b>	10 MHz, 0 dBm $\pm$ 3 dB, min.
<b>Tuning Resolution</b>	1 kHz
<b>Linear Dynamic Range</b>	>90 dB, RF to IF, 1 MHz BW
<b>Single Tone Spurious Free Dynamic Range</b>	>60 dB, RF to IF, 1 MHz BW
<b>Two Tone Spurious Free Dynamic Range</b>	>65 dB, RF to IF, 1 MHz BW f1 - f2 <25% of IF BW
<b>Third Order Intercept Point</b>	0 dBm, typ.; -3 dBm, min.*
<b>Image Rejection</b>	>70 dB
<b>LO Reradiation</b>	< -95 dBm at the RF input

<b>Noise Figure</b>	12 dB, max., (<10 dB, typ.)*														
<b>RF to IF Linear Differential Group Delay</b>	5 ns, max. ( $\leq$ 3.5 ns, typ.) over 80% of IF bandwidth @ 1 GHz & 160 MHz														
<b>RF Scan Time</b>	$\leq$ 80 msec, 0.5 to 20 GHz in a RBW of 10 MHz														
<b>Phase Noise (typical)</b>	<table border="1"> <thead> <tr> <th>Offset</th> <th>dBc/Hz</th> </tr> </thead> <tbody> <tr> <td>100 Hz</td> <td>-75</td> </tr> <tr> <td>1 kHz</td> <td>-85</td> </tr> <tr> <td>10 kHz</td> <td>-90</td> </tr> <tr> <td>100 kHz</td> <td>-100</td> </tr> <tr> <td>1 MHz</td> <td>-130</td> </tr> <tr> <td>10 MHz</td> <td>-140</td> </tr> </tbody> </table>	Offset	dBc/Hz	100 Hz	-75	1 kHz	-85	10 kHz	-90	100 kHz	-100	1 MHz	-130	10 MHz	-140
Offset	dBc/Hz														
100 Hz	-75														
1 kHz	-85														
10 kHz	-90														
100 kHz	-100														
1 MHz	-130														
10 MHz	-140														
<b>Integrated Phase Noise</b>	$\leq$ 0.65°, 100 Hz to 100 MHz*														
<b>RF to IF Gain</b>	20 dB $\pm$ 1 dB														

\*Applies to 80% of the 0.5-20 GHz tuning range at 1 GHz, 160 MHz WB, 70 MHz WB IF's only.

**IF OUTPUT SPECIFICATION**

IF OUTPUT PORT	GAIN	NOISE FIGURE	BANDWIDTH
1 GHz	20 dB, nominal (FIXED)		500 MHz
160 MHz Wideband	20 dB, nominal (FIXED)		100 MHz
70 MHz	20 dB, nominal (FIXED)		50 MHz
160 MHz Post Filtered	<ol style="list-style-type: none"> <li>Selectable MGC/AGC</li> <li>0 dB to 70 dB IF Attenuation Range</li> <li>Rated Output Selectable -5, -10, -15, or -20 dBm</li> <li>Gain/BW Normalized</li> <li>Absolute Gain (see table on page 2)</li> </ol>	12 dB, maximum at 0 dB to 30 dB IF attenuation	Selectable 250 kHz      8.0 MHz 500 kHz      24 MHz 2.5 MHz      40 MHz 5.0 MHz      100 MHz

**IF SPECIFICATIONS (cont)**

<b>Video Outputs</b> <b>Linear AM Video</b>	0 to 1 V, 75 Ω, Adjustable 5% to 100%
<b>FM Video</b> <b>(Selectable NB/WB)</b> <b>NB Mode</b>	1 V <sub>p-p</sub> , 75 Ω, for deviation of 2/3 selected IF BW; Adjustable 5% to 100%
<b>WB Mode</b>	500 MHz linear BW, 25 nsec risetime, 10 mV/MHz, nominal slope
<b>Log Video</b> <b>(Selectable NB/WB)</b> <b>NB Mode</b>	Gain controlled 0-2.5 V IF BW dependent
<b>WB Mode</b>	500 MHz bandwidth 10 ns risetime 1.5 V output for -14 dBm receiver input Dynamic range 60 dB 25 mV/dB, nominal log slope
<b>Audio Outputs</b> <b>Rear Panel</b>	15 kHz bandwidth, 600 Ω, 1.0 V <sub>rms</sub> , 80 dB attenuation control range. Mode selectable: FM, AM linear, AM stretched
<b>Front Panel</b>	Standard 1/8 in. phone jack, manual level control, 1.0 V <sub>rms</sub> at 600 Ω

Specifications subject to change without notice.

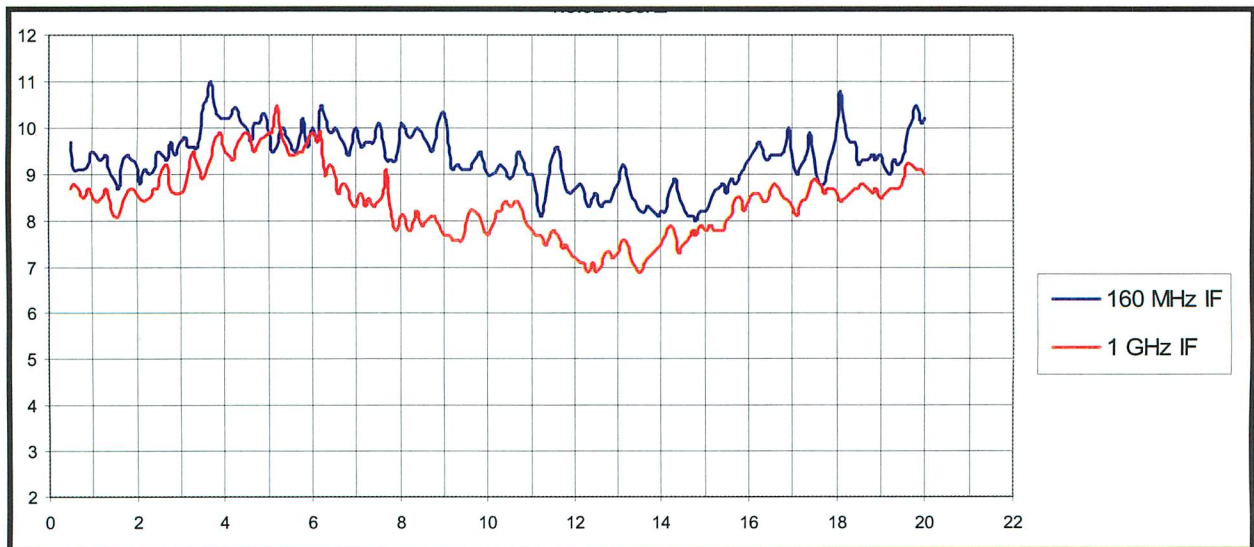
**SYSTEM SPECIFICATIONS**

<b>Built In Test</b>	Activated during power up and on command. Monitors power supply voltages, temperature, and phase lock.
<b>Operating Power</b>	100-240 Vac, 47 - 440 Hz 0.99 Power Factor
<b>Power Consumption</b>	185 Watts nominal
<b>RFI/EMI</b>	Designed to meet MIL-STD-461E; CE102 & RE102
<b>Enclosure Size</b>	3.5 x 8.5 x 22.5 inches (8.6 x 24.1 x 57.15 centimeters)
<b>Weight</b>	27 pounds (12 kg) maximum.
<b>Operating Temperature</b>	0° to +50° C
<b>Control</b>	RS-232 & Ethernet 100BaseT

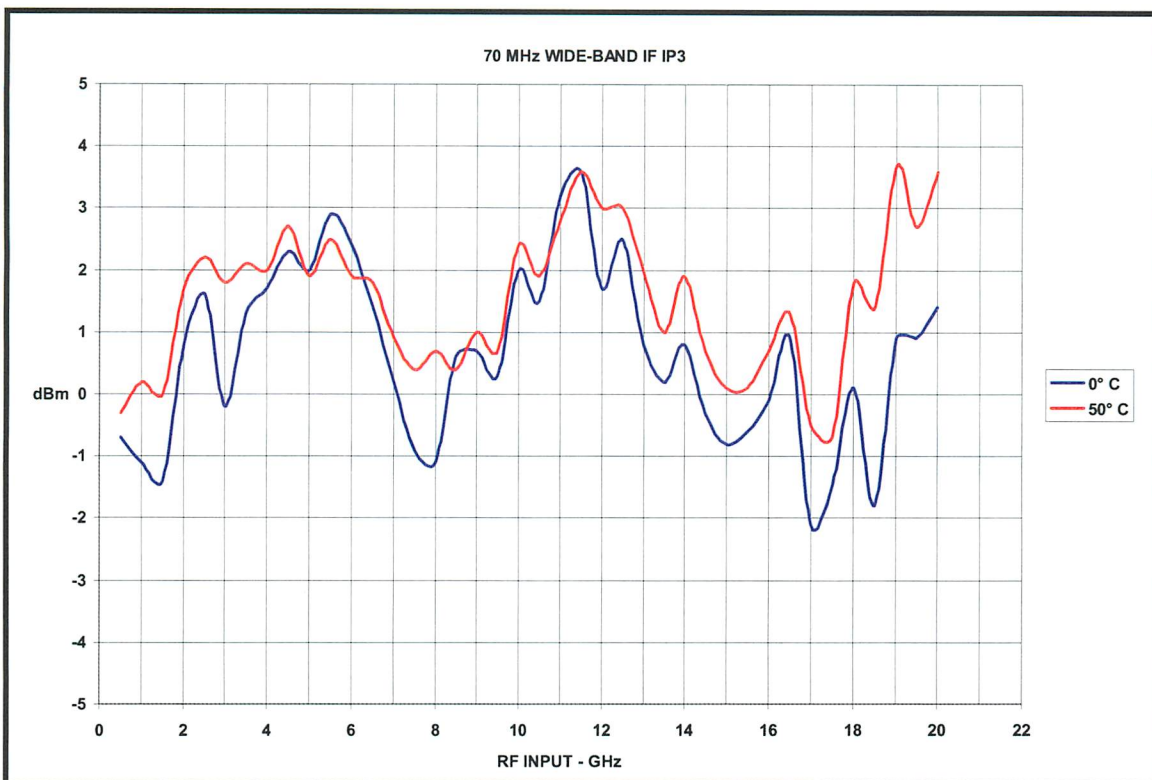
**OPTIONS**

- ◆ RF Blanking
- ◆ Front-End Attenuation
- ◆ Other filter bandwidths available
- ◆ 0.1 GHz Frequency Extension

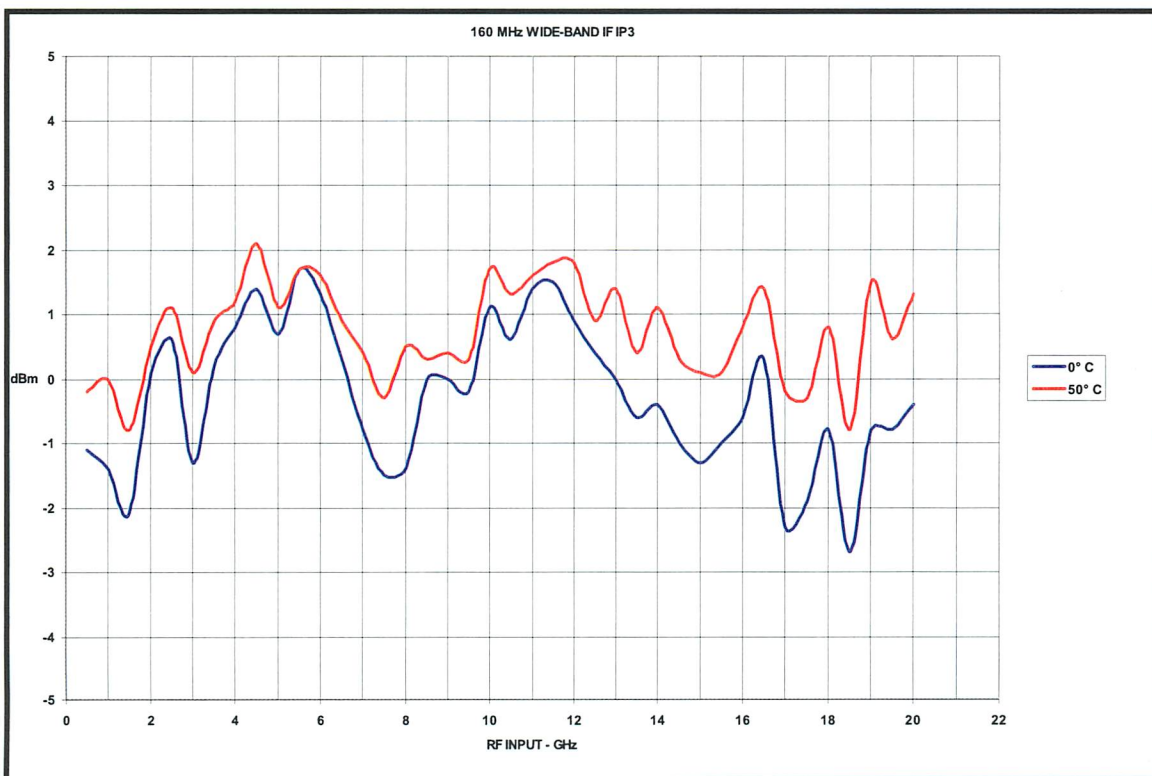
**TYPICAL MEASURED RF PERFORMANCE**



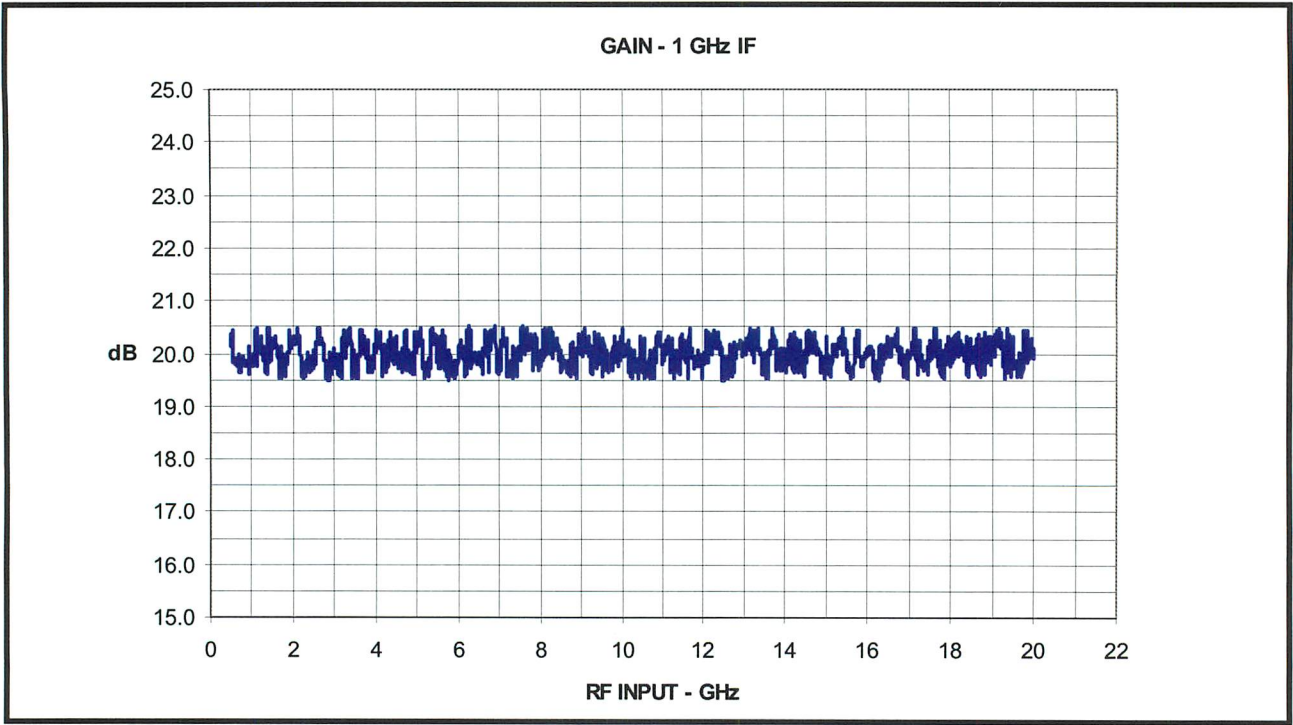
**NOISE FIGURE**



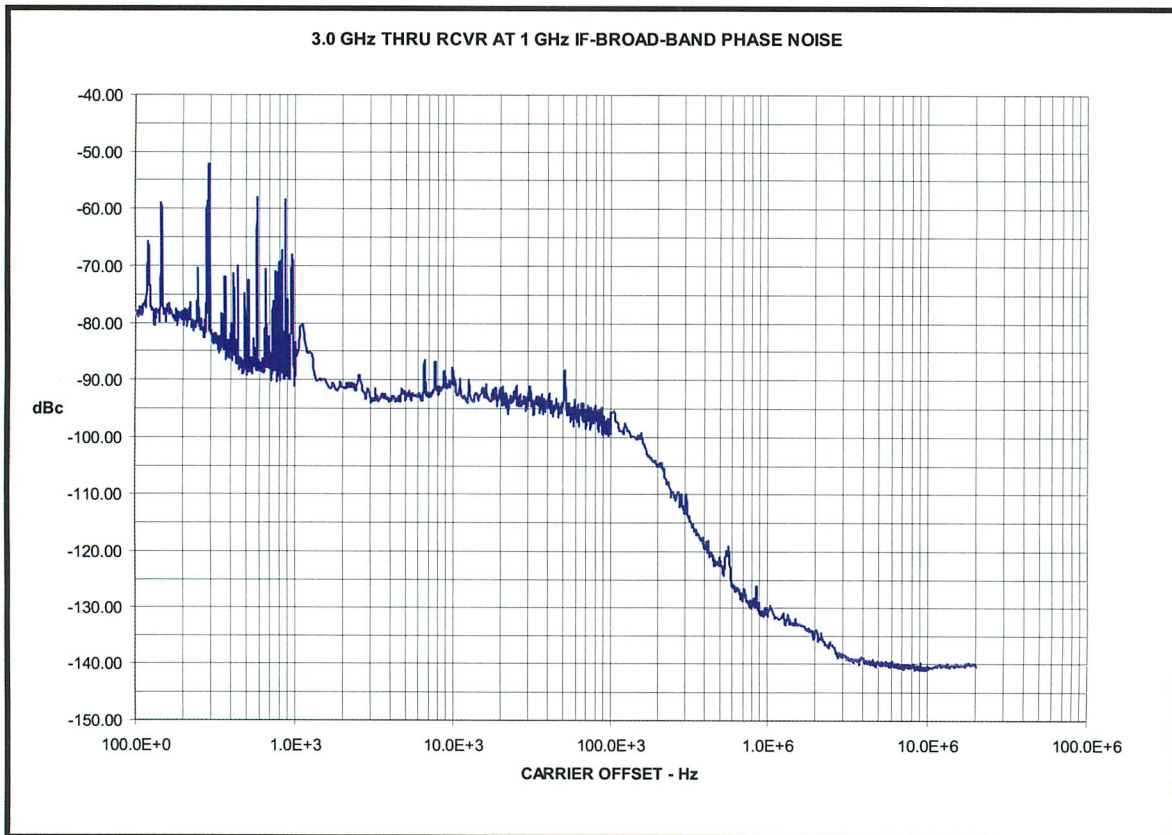
IP3 70 MHz



IP3 160 MHz

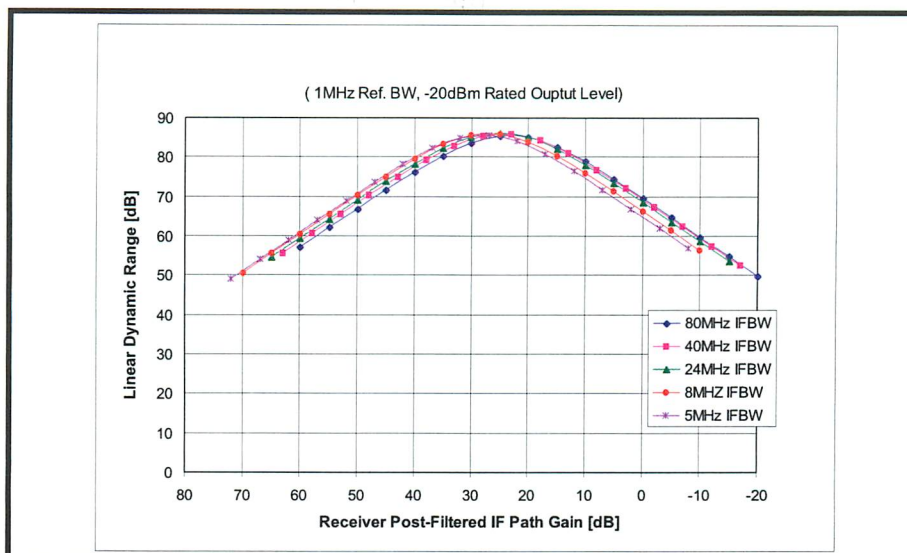


### 1 GHz RF TO IF GAIN

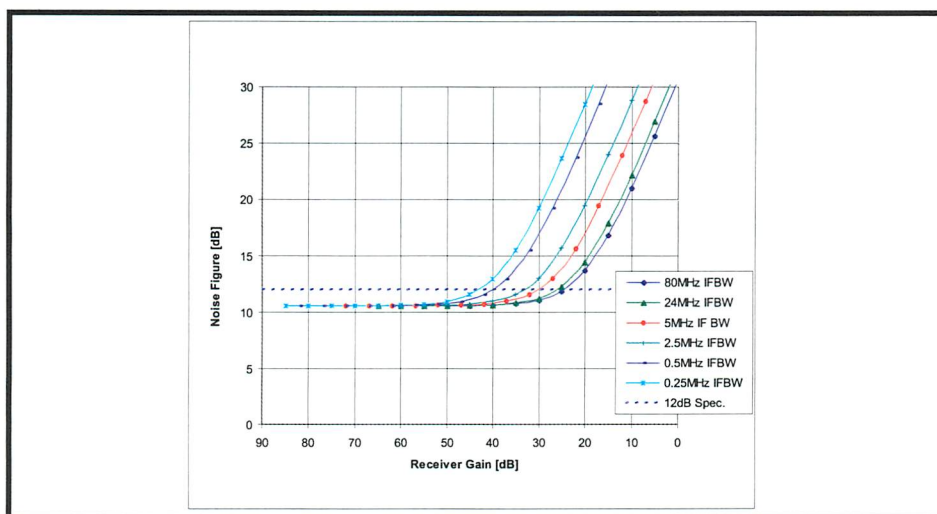


TYPICAL PHASE NOISE 0.49° rms INTEGRATED

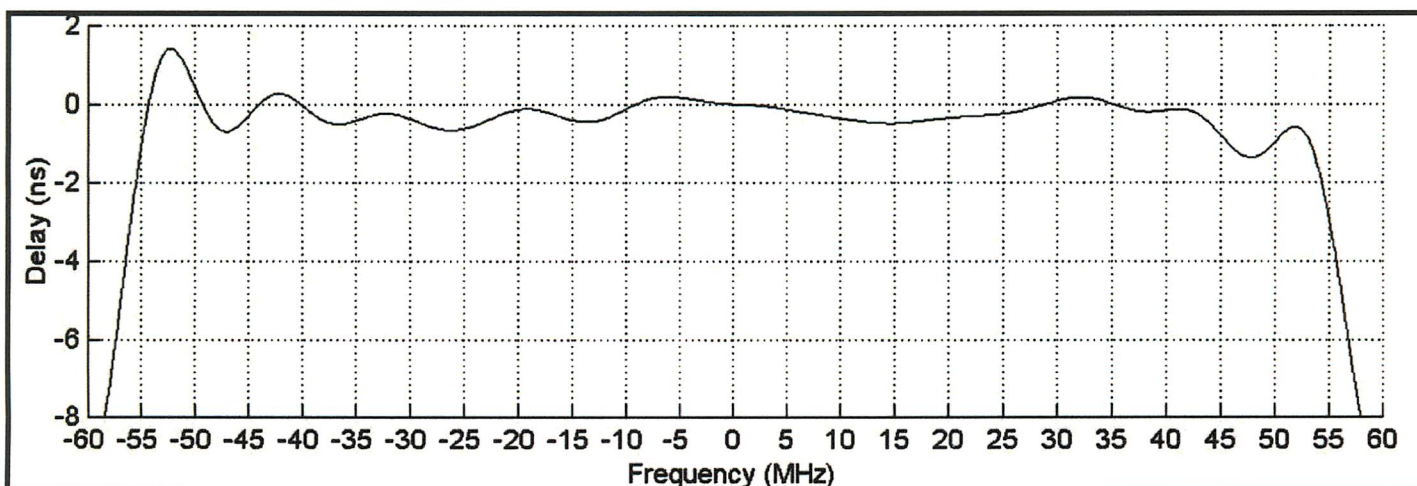
Courtesy of <http://BlackRadios.terryo.org>



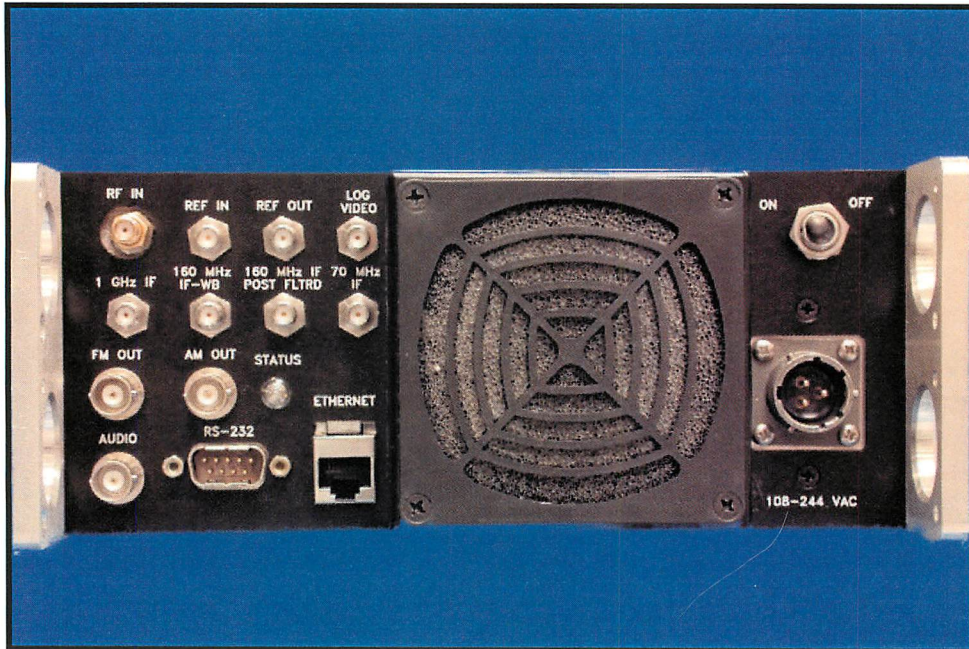
160 MHz POST-FILTERED IF LINEAR DYNAMIC RANGE



160 MHz POST-FILTERED PATH NOISE FIGURE vs GAIN



GROUP DELAY MEASURED AT 8 GHz, 160 MHz IF OUTPUT. IF BANDWIDTH IS 100 MHz



**SMR-3822 Connector Panel**

## WARRANTY

All M/A-COM SIGINT Products equipment is warranted for one year, except for damage caused by accident or misuse, provided the equipment is returned for repair to the plant in Hunt Valley, Maryland, U.S.A.



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