1.4 SPECIFICATIONS

1.4.1 PERFORMANCE

1.4.1.1 RF SECTION

Frequency Coverage	0.5-18 GHz (standard) 0.03-18 GHz (option 3) Extended to 40 GHz with external FE-904 Frequency Extender.
RF Bands	0.5-2 (.03-2 with option 3), 2-4, 4-8, 8-12, 12-18 GHz, .5-18 (.03-18), 18-26.5, 26.5-40 GHz.
Frequency Indicator	5 digit LED display indicates true RF center frequency to an accuracy of ±0.5% ±1 count, in "CW" mode. Displays marker frequency in "BAND" or "F1-F2" modes, frequency limits in "F1-F2" mode, according to F1/F2/F0 pushbutton selection.
Band Overlap	10 MHz minimum.
First Image Rejection	0.5-12 GHz, 70 dB minimum 12-18 GHz, 65 dB minimum 0.03-0.5 GHz, 70 dB minimum (option 3)
Preselection	0.5-18 GHz automatically tracked in all tuning modes. 3 ball YIG filters with 18 dB/octave selectivity. .03-0.5 GHz, low-pass filter (option 3).
I.F. Rejection	70 dB, minimum
LO Radiation	.03-12 GHz, -70 dBm, maximum 12-18 GHz, -60 dBm, maximum
RF Input Impedance	50 ohms nominal, unbalanced to ground
Noise Figure (dB)	20 dB typical over 90% of band, 23 dB maximum.
LO Sample (Opt. 2)	Frequency: 2.25-18.25 GHz Minimum output: -12 dBm, min.
3rd Order Intercept Point	+5 dBm typical at RF input.

1.4.1.2 FREQUENCY STABILITY AND NOISE

(Measured in "CW" mode, with AFC off)

Residual FM:	RF Band:	Max Residual FM:
	.03-4.0 GHz	20 kHz p-p
	4.0-8.0 GHz:	40 kHz p-p
	8.0-12.0 GHz:	75 kHz p-p
	12-18 GHz:	100 kHz p-p
Frequency Stability ..... (Short Term)	1 part in 10^{-5} of RF, maximum, drift per second. With 5 minute warm-up, at 25°C ambient.	
(Long Term)	5 parts in 10^{-5} of RF, maximum, drift per 3 minute interval. After 30 minute warm-up at 25°C ambient, at fixed RF frequency.	
Frequency Pulling	1 part in 10^{-5} of RF, maximum, with either (a) input VSWR change from 1.0 to (b) in-band RF signal of -20 dBm.	

1.4.1.3 250 MHz IF OUTPUT

Bandwidth at 3 dB	40 MHz minimum, limited only by the YIG pre-selector.
RF/IF Gain	7 $\pm$ 2 dB, with IF GAIN at maximum setting, IF attenuator set for 0 dB.
1 dB Compression Point	-3 dBm minimum at output.
Impedance	50 ohms nominal, unbalanced to ground.

1.4.1.4 21.4 MHz IF OUTPUT

Bandwidth at 3 dB	8 MHz, nominal
Output Level	Gain is automatically controlled to provide an output level of -20 $\pm$2 dBm for an input level of 0 dBm; output reduces by 5 db maximum when input is reduced by 50 dB.

1.4.1.5 160 MHz IF OUTPUT (Option 4B)

Bandwidth at 3 dB	20 MHz, nominal
RF/IF Gain	10 $\pm$ 3 dB, with IF ATTENUATOR set for 0 dB.
Dynamic Range	60 dB, minimum.
Impedance	50 ohms nominal, unbalanced to ground.
1 dB Compression Point	0 dBm, minimum at output

Impedance	.....	50 ohms nominal, unbalanced to ground.
1 dB Compression Point	.....	0 dBm, minimum at output

1.4.1.6 70 MHz IF OUTPUT (Option 4C)

Bandwidth at 3 dB	.....	20 MHz, nominal
RF/IF Gain	.....	10 $\pm$ 3 dB, with IF ATTENUATOR set for 0 dB.
Dynamic Range	.....	60 dB, minimum.
Impedance	.....	50 ohms nominal, unbalanced to ground.
1 dB Compression Point	.....	0 dBm, minimum at output

1.4.1.7 IF SELECTIVITY AND IMAGE REJECTION

IF Selectivity	..... 1)	100 $\pm$10 kHz @ -3 dB
	2)	1.0 $\pm$0.2 MHz @ -3 dB
	3)	5.0 MHz $\pm$ 1 MHz at -3 dB.
	4)	30 MHz $\pm$ 2 MHz at -3 dB.
Image Rejection	... .	Second IF images, and all subsequent IF images, are at least 65 dB down.

1.4.1.8 AM VIDEO OUTPUT

Linear or logarithmic video output is available at the rear panel; selection is made at the front panel.

Output Impedance	.....	50 ohm unbalanced to ground.
Amplitude	.....	0.2 to 4.0V maximum, unloaded.
Baseband	.....	One half the selected IF bandwidth, dc coupled.
Video Filter	.....	Switchable from front panel; reduces baseband to 50 kHz in all IF bandwidths.
Logarithmic Range	.....	70 dB, minimum
Logarithmic Accuracy	...	$\pm$2 dB
Linear Gain Control	....	60 dB, minimum, front panel controllable.

1.4.1.9 FM VIDEO OUTPUT

Output Impedance	.....	50 ohm unbalanced to ground.

Amplitude ..... 2.0 V/p-p minimum, unloaded, with input at -40 dB and frequency deviation of ±0.5 times selected IF bandwidth.

Baseband ..... dc to 0.5 times selected IF bandwidth, minimum.

AM Rejection ..... 20 dB, minimum

1.4.1.10 AUTOMATIC FREQUENCY CONTROL

When receiver is in CW mode, AFC control ON, the AFC provides at least 10:1 correction (i.e. frequency drift is reduced by a factor of 10 or more) in all IF bandwidth modes. Capture range is minimum of ±50% of selected IF bandwidth.

When receiver is in any other mode, AFC is disabled by the MODE selector.

1.4.1.11 SPURIOUS AND RESIDUAL RESPONSES

Spurious .....

1) Due to out-of-band signals above 0.5 GHz: 50 dB rejection, minimum.

2) Due to out-of-band signals below 0.5 GHz (including all IF frequencies): 70 dB rejection, minimum.

3) Due to two in-band signals, spaced by 10 MHz, with amplitudes of -30 dBm: all inter-mod products are at least 20 dB down, with IF GAIN adjusted for no larger than full scale display at AM VIDEO output.

Residual ..... With 50 ohm termination of ANTENNA input, internally generated residual responses do not exceed -90 dBm equivalent input, at any RF frequency.

1.4.1.12 AUDIO OUTPUT (at phone jack)

Output Level ..... ±0.40V, maximum output capability into 600 ohms unbalanced load, without clipping.

Sensitivity ..... With passive 50 ohm termination on ANTENNA jack, audio noise level at all RF frequencies is 0.1 milliwatts, minimum into 600 ohm load in all signal modulation modes, with IF GAIN and AUDIO GAIN maximum.

Response ..... ±3 dB, 250 Hz to 10 kHz.

1.4.1.13 DRIVE CIRCUITRY FOR PANORAMIC DISPLAY

Sweep Widths	BAND mode: Fixed sweep of the entire width of the RF band selected. F1-F2 mode: Fixed sweep of the entire range selected. ΔF0 mode: Sweep width variable from 0 to ±5% of width of RF band selected. Calibration accuracy ±20% or better. MAN mode: Same width as VAR-SCAN mode, but sweep is manual.
Display Shift	In ΔF0 mode, shift of center frequency of display is less than 1% of width of RF band selected, as sweep width is varied from maximum to minimum.
Sweep Rate	In BAND, F1-F2 and ΔF0 modes, variable over the range of 0.1 Hz or less to 30 Hz or greater.
Horizontal Output	±3 volts dc coupled and centered at 0 volts dc, with 1000 ohms, minimum load impedance. Sweep amplitude is independent of actual frequency range swept. Positive-going sweep voltage (negative going flyback) corresponds to increasing RF frequency on all RF bands.
Horizontal Linearity	5% maximum.
RF Marker	In BAND and F1-F2 modes, negative marker pulse of 0.1 volts amplitude and 0.5 millisecond nominal duration is added to the vertical output signal.
Blanking	+10 volt retrace blanking pulse is applied in BAND, F1-F2 and ΔF0 modes.

1.4.1.14 POWER SOURCE SPECIFICATIONS

Line Frequency	50-400 Hz.
Line Voltage	115 or 230 volts, switch selectable ± 10%
Period of Operation	Indefinite.
Line Input Protection	Fuses: 115V, 2A, 3AG, slo-blo 230V, 1A, 3AG, slo-blo
Power Consumption	120 watts, nominal

1.4.2 MECHANICAL SPECIFICATIONS

1.4.2.1 WEIGHT

Total receiver weight is 45 pounds, nominal. The remotable RF tuner weighs 12 pounds.

1.4.2.2 CONTROL, CONNECTOR AND INDICATOR LAYOUT

Within the limitations imposed by space restrictions, placement and identification of all functional controls, connectors, and indicators (sections 3.1 and 3.2) have been made to facilitate proper operation of the system by nonspecialized personnel.

1.4.2.3 ENVIRONMENTAL PROTECTION

Impact	No impact protection beyond that afforded by the standard cabinet.
Shock and Vibration	Subchassis and circuit board assemblies are constructed and mounted to prevent shock and vibration damage when the system is transported via commercial carrier.
Humidity and Dust	Dust and water-resistant subchassis assemblies are utilized whenever possible. Circuits not afforded this protection are appropriately coated providing moisture resistance.

1.4.2.4 TEMPERATURE RANGE

Operating temperature range of the MSR-904A is 0 to 50°C. All specifications listed previously are maintained in this range, unless otherwise stated.