

CHAPTER 1

GENERAL DESCRIPTION

1-1. INTRODUCTION.

1-2. This manual contains intermediate operation instructions, maintenance instructions, and parts list for Surveillance Receivers SR-212A-2 and SR-212A-3 (figure 1-1).

1-3. PURPOSE OF EQUIPMENT.

1-4. Receivers SR-212A-2 and SR-212A-3 detect FM, AM, or CW signals over the VHF/UHF frequency spectrum of 30-1000 MHz.

1-5. DESCRIPTION.

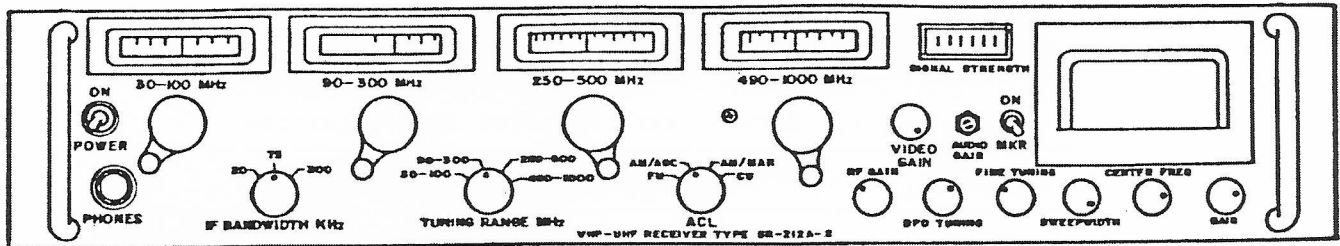
1-6. PHYSICAL. The compact, solid-state receiver mounts in a standard 19 inch electrical equipment rack. Refer to table 2-1 for physical details.

1-7. FUNCTIONAL. Manual (MAN) or Automatic Gain Control (AGC) is applied to RF and IF Amplifiers in the AM mode. Only MAN is applied in CW mode and only AGC is applied in FM.

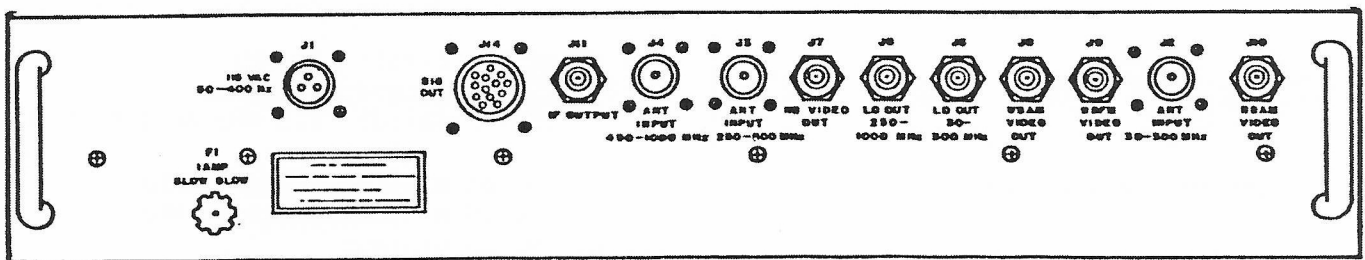
1-8. The receiver operates on 115 VAC, 50-400 Hz, single-phase. Power consumption is approximately 30 watts.

1-9. Receiver SR-212A-3 Wide Band Amplifier WBA-203-2 provides LO (local oscillator) isolation. Terminal Board TB-201 supplies an output at J14 to allow external equipment to monitor RF Tuner selection, and a voltage divider network provides an adjustable AGC Reference Voltage through J14 to external equipment.

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FRONT VIEW



REAR VIEW

Figure 1-1. Surveillance Receiver SR-212A-2 and SR-212A-3

CHAPTER 2
SPECIFICATIONS

2-1. INTRODUCTION.

2-2. The Surveillance Receiver SR-212A-2 and SR-212A-3 specifications are listed in table 2-1.

Table 2-1. Surveillance Receiver Specifications

Parameter	Specification
Frequency Tuning Range	Continuously tunable, 30 to 1000 MHz in 4 bands Band A: 30-100 MHz Band B: 90-300 MHz Band C: 250-500 MHz Band D: 490-1000 MHz
Type of Reception	AM, FM, and CW
Noise Figure	Band A: 4 dB maximum below 60 MHz; 4.5 dB maximum at 60 to 100 MHz Band B: 6.5 dB maximum Band C: 10 dB maximum Band D: 12 dB maximum
Intermediate Frequency	Band A and B: First: 21.4 MHz Second: 2.5 MHz or 1.65 MHz Band C and D: First: 60 MHz Second: 21.4 MHz Third: 2.5 MHz or 1.65 MHz
Intermediate Frequency Rejection	Band A: 55 dB minimum below 40 MHz 60 dB minimum above 40 MHz Band B: 90 dB minimum Band C: 90 dB minimum Band D: 90 dB minimum
Image Rejection	Band A: 60 dB minimum Band B: 50 dB minimum Band C: 65 dB minimum Band D: 80 dB minimum

Table 2-1. Surveillance Receiver Specifications (Cont)

Parameter	Specification
Oscillator Radiation	Band A: 5 uV maximum Band B: 15 uV maximum below 260 MHz 25 uV maximum above 260 MHz Band C: 15 uV maximum Band D: 50 uV maximum
Input Impedance	All Bands: 50 ohms nominal
IF Bandwidth	All Bands: 20, 75, 300 kHz and 2 MHz
AM Sensitivity	Band A and B 20 kHz Bandwidth: 1 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum Band C and D 20 kHz Bandwidth: 2 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum Band A and B 75 kHz Bandwidth: 2 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum Band C and D 75 kHz Bandwidth: 4 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum Band A and B 300 kHz Bandwidth: 4 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum Band C and D 300 kHz Bandwidth: 8 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum Band A and B 2 MHz Bandwidth: 13 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum Band C and D 2 MHz Bandwidth: 26 uV input, modulated 50% at 1 kHz rate shall produce 10 dB S+N/N minimum
FM Sensitivity	Band A and B 20 kHz Bandwidth: 2 uV input, modulated at 1 kHz rate with 7 kHz deviation shall produce 21 dB S+N/N minimum Band C and D 20 kHz Bandwidth: 4 uV input, modulated at 1 kHz rate with 7 kHz deviation shall produce 21 dB S+N/N minimum

Table 2-1. Surveillance Receiver Specifications (Cont)

Parameter	Specification
FM Sensitivity (Cont)	<p>Band A and B 75 kHz Bandwidth: 3 μV input, modulated at 1 kHz rate with 25 kHz deviation shall produce 21 dB S+N/N minimum</p> <p>Band C and D 75 kHz Bandwidth: 6 μV input, modulated at 1 kHz rate with 25 kHz deviation shall produce 21 dB S+N/N minimum</p> <p>Band A and B 300 kHz Bandwidth: 4 μV input, modulated at 1 kHz rate with 100 kHz deviation shall produce 21 dB S+N/N minimum</p> <p>Band C and D 300 kHz Bandwidth: 8 μV input, modulated at 1 kHz rate with 100 kHz deviation shall produce 21 dB S+N/N minimum</p> <p>Band A and B 2 MHz Bandwidth: 13 μV input, modulated at 1 kHz rate with 750 kHz deviation shall produce 21 dB S+N/N minimum</p> <p>Band C and D 2 MHz Bandwidth: 26 μV input, modulated at 1 kHz rate with 750 kHz deviation shall produce 21 dB S+N/N minimum</p>
AM Dynamic Range (All Bandwidths)	<p>Band A and B: Less than 7 dB variation for input range of 70 dB above 3.5 μV</p> <p>Band C and D: Less than 7 dB variation for input range of 70 dB above 2.0 μV</p>
FM Dynamic Range (All Bandwidths)	<p>Band A and B: Less than 2 dB variation for inputs above 2 μV</p> <p>Band C and D: Less than 2 dB variation for inputs above 4 μV</p>
Audio Amplifier Response	Less than 3 dB variation from 250 Hz to 20 kHz
Audio Power Output	75 mW minimum into 600-ohm load unbalanced; 7 mW nominal at phone jack
Video Amplifier Response	Less than 3 dB variation from 20 Hz per second to 4 MHz when terminated into a 93-ohm load
Video Amplifier Output (J7)	5 volt peak-to-peak maximum output into a 93-ohm load

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Table 2-1. Surveillance Receiver Specifications (Cont)

Parameter	Specification
Beat Frequency Oscillator (BFO)	Operable with 20 kHz or 75 kHz bandwidths. BFO pitch: +20 kHz minimum, using tuning crank, FINE TUNING Control, and BFO TUNING Control
Signal Display Unit	CRT size, standard 1" x 3" display
Sweepwidth	From DC to 3 MHz continuously adjustable
Resolution	10 kHz
IF Frequency	First IF: 4.3 MHz Second IF: 455 kHz
Amplitude Response	±1.5 dB within any sweepwidth
Sensitivity	2.5 uV at any RF input produces at least 1" deflection with SWEEPWIDTH Control set to approximately 50 kHz
Crystal Marker	21.4 MHz center frequency marker
Linearity	5% within sweepwidth
Weight	Approximately 40 pounds
Dimensions	3-1/2" H x 19" W x 17-1/4" D
Power Input	115 VAC, 50-400 Hz, single-phase
Power Consumption	Approximately 30 watts
Finish	Gray enamel per MIL-E-15090, Color No. 26329, Federal Standard 595

CHAPTER 3

OPERATION

3-1. INTRODUCTION.

3-2. This chapter contains information on indicators, controls, connectors, and operating procedures for the Surveillance Receivers. All operating controls are located on the front panel and input/output connections are located on the rear panel.

3-3. INDICATORS, CONTROLS, AND CONNECTORS.

3-4. Front and rear panel indicators, controls and connectors, with functions and reference designations are listed in table 3-1. Refer to figure 1-1 for front and rear panel details.

Table 3-1. Indicators, Controls, and Connectors

Reference Designation	Indicator, Control or Connector	Function
J12	PHONES (Connector)	A phone jack for aural monitoring of receiver operation.
M1	SIGNAL STRENGTH (Meter)	Indicates relative strength of incoming signal.
R1	VIDEO GAIN (Potentiometer)	Controls gain of Video Amplifier VA-202-1 (A11).
R2	AUDIO GAIN (Potentiometer)	Adjusts gain of Audio Amplifier AA-206 (A12).
R4	RF GAIN (Potentiometer)	Adjusts gain of selected RF Tuner.
R7	BFO TUNING (Potentiometer)	Adjusts the frequency of the LO of the Tuner of the selected band.
R8	FINE TUNING (Potentiometer)	Adjusts the frequency of the LO of the Tuner of the selected band.

Table 3-1. Indicators, Controls, and Connectors (Cont)

Reference Designation	Indicator, Control or Connector	Function	
R13	GAIN (Potentiometer)	Adjusts output of Input Amplifier IA-104 (A13). Affects the Signal Display presentation only.	
R14	CENTER FREQ (Potentiometer)	Adjusts fixed DC bias in IF Amplifier and Sweep Oscillator IFS-101-2 (A14) to vary the Sweep Oscillator center frequency approximately +250 kHz from the center frequency. Affects the Signal Display presentation only.	
R16	SWEEPWIDTH (Potentiometer)	Adjusts sweepwidth of the local oscillator in IF Amplifier and Sweep Oscillator IFS-101-2 (A14). Affects the Signal Display presentation only.	
S1	POWER (Toggle Switch)	ON	Applies 115 \pm 10 VAC, 50-400 Hz, single-phase to circuits.
		Off	Removes all power from circuits.
S2	IF BANDWIDTH KHz (Rotary Switch)	20	Selects IF Amplifier IF-210-20 (A7).
		75	Selects IF Amplifier IF-211-75 (A8).
		300	Selects IF Amplifier IF-212-300 (A9).
S3	TUNING RANGE MHz (Rotary Switch)	30-100	Selects 30-100 MHz Tuner (Band A).
		90-300	Selects 90-300 MHz Tuner (Band B).
		250-500	Selects 250-500 MHz Tuner (Band C).
		490-1000	Selects 490-1000 MHz Tuner (Band D).

Table 3-1. Indicators, Controls, and Connectors (Cont)

Reference Designation	Indicator, Control or Connector	Function
S4	<p>MODE SELECTOR (Rotary Switch)</p> <p>FM</p> <p>AM/AGC</p> <p>AM/MAN</p> <p>CW</p>	<p>Selects FM mode of operation. Only AGC is applied in this mode.</p> <p>Selects AM mode of operation. Only AGC is applied in this mode.</p> <p>Selects AM mode of operation. Only MAN is applied in this mode.</p> <p>Selects CW mode of operation. Only MAN is applied in this mode.</p>
S5	<p>MKR (Marker) (Toggle Switch)</p> <p>ON</p> <p>Off</p>	<p>Supplies -12 VDC to turn on the 21.4 MHz oscillator in the marker generator of Input Amplifier (A13). Affects the Signal Display presentation only.</p> <p>Removes -12 VDC to turn off the 21.4 MHz oscillator in the marker generator of Input Amplifier (A13). Affects the Signal Display presentation only.</p>
V1	<p>CRT (Display)</p> <p>Frequency Indicating Tape Dials and Associated Tuning Crank</p>	<p>Displays detected signal.</p> <p>Four direct-reading, frequency indicating tape dials, each recessed behind a transparent protective window. The dials are illuminated according to the position of the TUNING RANGE MHz Switch (S3). A tuning crank is located below each window for frequency tuning.</p>

Table 3-1. Indicators, Controls and Connectors

Reference Designation	Indicator, Control or Connector	Function
F1	FUSE	A 1 amp, slow-blow line fuse.
J1	115 VAC 50-400 Hz (Power Input Connector)	A 115 \pm 10 VAC, 50-400 Hz, single-phase, three-wire circuit is supplied.
J2	ANT INPUT 30-300 MHz (Connector)	RF input to RF Tuner 30-100 MHz (A1) or 90-300 MHz (A2) as routed through contacts of K3.
J3	ANT INPUT 250-500 MHz (Connector)	RF input to RF Tuner 250-500 MHz (A3).
J4	ANT INPUT 490-1000 (Connector)	RF input to RF Tuner 490-1000 MHz (A4).
J5	LO OUT 30-300 MHz (Connector)	Local oscillator output provided for connection to frequency monitoring equipment.
J6	LO OUT 250-1000 MHz (Connector)	Local oscillator output provided for connection to frequency monitoring equipment.
J7	NB VIDEO OUT (Connector)	Video output provided for connection to monitoring equipment.
J8	WB AM VIDEO OUT (Connector)	Video output provided for connection to monitoring equipment.
J9	WB FM VIDEO OUT (Connector)	Video output provided for connection to monitoring equipment.
J10	NB AM VIDEO OUT (Connector)	Video output provided for connection to monitoring equipment.
J11	IF OUTPUT (Connector)	IF output provided for connection to external equipment.
J14	SIG OUT (Connector)	Outputs consist of EXT TUNING METER (100-0-100 μ A), AGC OUT, GND, and a 600-ohm balanced audio output.

3-5. GENERAL OPERATING PROCEDURE.

3-6. This procedure applies to any mode of operation.

- a. Connect receiver to 115 VAC power source.
- b. Connect antenna to appropriate receiver RF input.
- c. Place POWER Switch (S1) to ON. A tape dial will illuminate. Allow a few minutes for Cathode Ray Tube (CRT) filaments to warm up.
- d. Rotate TUNING RANGE MHz Switch (S3) to select desired frequency band.
- e. Rotate MODE SELECTOR Switch (S4) to desired position.
- f. Select desired frequency with tuning crank located directly below designated frequency band.
- g. Rotate IF BANDWIDTH KHz Switch (S2) to desired position.
- h. Adjust AUDIO GAIN Control (R2) for desired level at J14, pins 5 and 6.
- i. Adjust VIDEO GAIN Control (R1) to vary level of NB video outputs.
- j. SIGNAL STRENGTH Meter (M1) indicates only relative level of carrier and is not calibrated in any special unit.

3-7. The CRT (V1) displays characteristics of the input signal, and the following adjustments are required:

- a. Set MKR Switch (S5) to OFF for initial operation.
- b. Adjust GAIN Control (R13) for desired amplitude of signals displayed on CRT screen.
- c. SWEEPWIDTH Control (R16) determines magnitude of excursion of sweep oscillator from its center frequency and therefore, the coverage of frequency spectrum as displayed on CRT screen. As a general practice, set SWEEPWIDTH Control (R16) for maximum sweepwidth (maximum clockwise position) when searching for signals or studying the activities around the desired signal. To analyze desired signal modulation (or any adjacent signal), reduce sweepwidth (by turning SWEEPWIDTH Control counterclockwise) to a convenient point for signal observation.
- d. CENTER FREQ Control (R14) determines sweep oscillator center frequency and therefore, relative incoming signal position with respect to the trace. For normal operation, the center of the sweep should correspond to the center of the incoming signal (which is 21.4 MHz). To center sweep, set MKR Switch (S5) to ON and adjust CENTER FREQ Control (R14) until 21.4 MHz marker is at center of the CRT screen. Reposition GAIN Control (R13) as necessary.

3-8. ANALYSIS OF MODULATION CHARACTERISTICS. A continuous wave (CW) signal appears as a signal deflection, just like the built-in marker.

3-9. An AM signal appears as a deflection of varying amplitude. Upper and lower sidebands start appearing when modulation exceeds 5-10 percent.

3-10. An FM signal appears as a train of deflections corresponding to the carrier and all adjacent pairs of sidebands. Relative carrier amplitude and the sidebands depends on carrier modulation index. At certain deviation indices the carrier disappears. This visual indication of carrier null can aid in calibrating FM signal generators or FM transmitters. In addition, at certain modulation indices, selected sideband pairs will null, permitting more sophisticated FM deviation calibration.

3-11. OPERATING PROCEDURE FOR SPECIFIC MODES.

3-12. AM MODE.

- a. Rotate MODE SELECTOR Switch (S4) to AM/AGC.
- b. Rotate IF BANDWIDTH KHz Switch (S2) to desired position.
- c. Turn appropriate RF tuning crank for desired signal.
- d. With the aid of Signal Display Unit (SDU), tune signal to center of band. When receiver is correctly tuned in, signal shall be at center of CRT (V1) and SIGNAL STRENGTH Meter (M1) shall register a peak indication.
- e. Adjust AUDIO GAIN (R2) and VIDEO GAIN (R1) Controls for desired output levels.

3-13. FM MODE.

- a. Rotate MODE SELECTOR Switch (S4) to FM.
- b. Repeat steps 3-12b through 3-12e.

3-14. CW MODE.

- a. Rotate MODE SELECTOR Switch (S4) to CW.
- b. Rotate IF BANDWIDTH KHz Switch (S2) to 20 or 75, as desired. This energizes the BFO.
- c. In CW operation, only manual gain control is possible. RF GAIN Control(R4) must be used to prevent saturation of RF and IF amplifiers and to give desired output level.
- d. Repeat steps 3-12c through 3-12e.
- e. Adjust BFO TUNING (R7) and FINE TUNING (R8) Controls for an audio beat tone on headphones. On some tuning ranges and especially on Bands A and B, the tuning crank associated with the frequency band may be adjusted to enhance beat note.