OPERATION AND SERVICE MANUAL

MICROWAVE SPECTRUM ANALYZER

AN/USM-394

SYSTRON-DONNER MODEL 762-21

Effective for Units Manufactured after June 1973

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AN/USM-394
MICROWAVE
SPECTRUM ANALYZER
MODEL 762-21

SYSTRON DONNER
CORPORATION
INSTRUMENT GROUP

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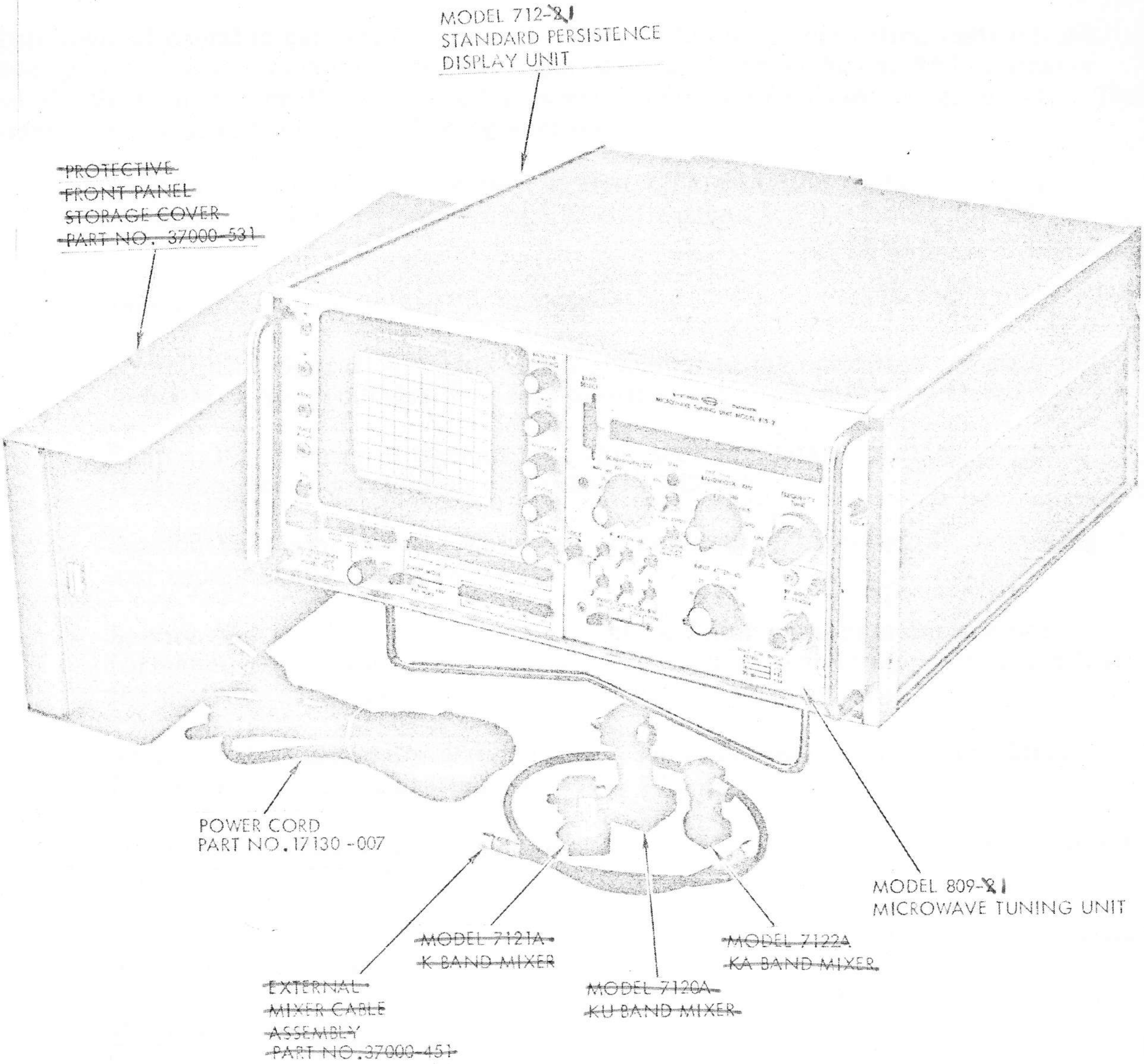


Figure 1-1. Systron-Donner Model 762-2 Microwave Spectrum Analyzer

SECTION I

INTRODUCTION AND DESCRIPTION

1-1. SCOPE

This manual contains general description, installation data, operating instructions, theory of operation, performance check and calibration procedures, and diagrams for the Systron Donner Model 762-2.1 Microwave Spectrum Analyzer (Figure 1-1). The manual is organized into the following sections.

Section I: Introduction and Description. This section contains general descriptive data and performance specifications for the Model 762-2.1

Section II: Installation and Setup. This section contains installation instructions and data for the Model 762-2.1

Section III: Operation. This section describes the operating controls and indicators, and contains general operating procedures for the Model 762-2.1

Section IV: Theory of Operation. This section contains a block diagram level functional description of the Model 762-2.1

Section V: Maintenance. This section contains instructions for servicing and repair of the Model 762-2.1

Section VI: Performance Checks. This section contains complete performance check procedures for the Model 762-2.1 providing verification that the instrument is operating within its performance specifications.

Section VII: Calibration Procedures. This section contains procedures for adjusting and calibrating the Model 762-2.1

Section VIII: Parts List. This section contains the list of replaceable parts for the Model 762-2.1

Section IX: Diagrams. This section contains interconnection and schematic diagrams for the Model 762-2.1

1-2. DESCRIPTION OF EQUIPMENT

The Model 762-2.1 Microwave Spectrum Analyzer, hereinafter referred to as the analyzer, is a self-contained field and laboratory spectrum analyzer which operates in the frequency range from 10 MHz to ~~40~~ 12.4 GHz. The analyzer consists of two modules: The Model 712-2.1 Standard Persistence Display Unit and the Model 809-2.1 Microwave Tuning Unit. The system is designed as a sensitive panoramic receiver which utilizes a cathode ray tube (CRT) as the display device. The display is presented on a calibrated graticule, 10 divisions wide on the horizontal (frequency) axis, and 8 divisions high on the vertical (amplitude) axis.

~~External mixers are provided for operation over the KA-band, K-band, and KU-band.~~

1-3. CAPABILITIES AND PERFORMANCE

The Model 762-~~2~~1 microwave spectrum analyzer is intended for multiple laboratory or field uses in connection with communications and surveillance equipment.

Detailed performance specifications for the Model 762-~~2~~1 are given in table 1-1.

Salient features of the system are summarized in the following paragraphs.

1-3.1 External Power Requirements

The Model 762-~~2~~1 is capable of operating on AC line voltage of 115/230 ±10% volts, 50 to 60/~~400 Hz,~~ single phase. Power dissipation is approximately 70 watts.

1-3.2 Frequency Range

The Model 762-2 uses the fundamental and harmonics of its internal local oscillator to cover the frequency range from 10 MHz to ~~40~~ 12.4 GHz. This frequency range is covered in eight bands, with band selection accomplished by a front panel control. The frequency reading is indicated on a slide rule dial which is accurate to within 1% of dial reading ±~~2~~5MHz, using an indexing expanded scale in conjunction with the tuning control.

1-3.3 Horizontal Display

The frequency scan width on the horizontal (frequency) display is continuously adjustable between 17 calibrated fixed positions of the scanwidth control between 10 kHz (1 kHz/division) and 2 GHz (200 MHz/division) full scale. A zero dispersion mode is also provided. The sweep time is selectable in seven calibrated steps between 30 seconds (3 seconds per division) to 30 milliseconds (3 msec per division). In the fast sweep mode, five calibrated sweep speeds are provided from 10 milliseconds (1000 microseconds per division) to 100 microseconds (10 microseconds per division). The sweep can be internal free-running, synchronized to the video trigger, to the AC power line, to an external sync signal, or initiated by a single sweep pushbutton on the front panel. Manual sweep (controlled by a single-turn-potentiometer on the front panel), or external sweep (controlled by an external sweep voltage) can also be selected.

1-3.4 Vertical Display

Either a linear or logarithmic amplitude may be selected. In the linear display mode, the display amplitude is proportional to the signal voltage.

In the logarithmic display mode, the display amplitude is compressed according to a logarithmic function.

1-3.5 Stabilization

The first local oscillator is stabilized automatically at scanwidth settings at and below 500 kHz/division. Stabilized operation of the first local oscillator is indicated by a light on the front panel. A front panel control switch disables the stabilization circuitry when selected.

1-3.6 IF Bandwidth

Five IF bandwidths of 300 Hz, 1 kHz, 10 kHz, 100 kHz, and 1000 kHz are provided to permit selection of optimum resolution for the spectrum analysis problem of interest.

1-3.7 Input and IF Attenuation

Up to 60 dB of input attenuation is provided in 10 dB steps by means of a front panel control. IF attenuation, in 1 dB steps up to 41 dB, can be used to adjust overall gain of the analyzer.

1-3.8 External Recording

Horizontal and vertical output connectors are provided to permit recording of the CRT display on remote equipment. A connector provides relay contact connections for pen lift during retrace, if an X-Y recorder is employed.

1-3.9 Camera Recording

A bezel adapter for camera recording may be applied to the analyzer as an option. Illumination of the edge-lighted graticule is controllable from a front panel potentiometer.

~~1-3.10 External Mixers.~~

~~Three external wave guide mixers and interconnecting cable are supplied for processing signals in the KU-band (12.4 - 18.0 GHz), K-band (18.0 - 26.0 GHz), and KA-band (26.0 - 40.0 GHz).~~

Table 1-1. Performance Specifications

Item	Parameter	Specification
1	Frequency Range:	10 MHz to ~~40 GHz~~ 12.4GHz
2	Center Frequency:	Continuously tunable from 10 MHz to ~~40~~ 12.4 GHz in 5 overlapping bands.
3	Tuning Accuracy:	1% of dial reading ±15MHz
4	Fine Tuning:	A fine tuning control is mounted on the front panel with the main tuning control. Fine tuning resolution is 500 Hz with a range of 500 kHz on all bands.
5	Signal Identifier:	A front panel spring loaded toggle switch is provided for signal identification.
6	Local Oscillator:	
6.1	Frequency:	2 to 4 GHz
6.2	Residual FM:	Less than 15 kHz at 1 - mixing not phase locked; less than 150 Hz when phase locked.
6.3	Long Term Drift:	Less than 50 kHz/10 min. at 1 - mixing at constant temperature after warm-up not phase locked; less than 10 kHz/10 min. phase locked.
7	Phase Lock:	For scandwidths of 5 MHz full screen or less, first LO phase locked to an internal 1 MHz reference signal. Front panel light indicates when first LO is stabilized. An override switch allows operator to disable phase lock circuitry.
8	Scanwidth:	Selectable from 10 kHz to 2 GHz full screen in 1, 2, 5, 10 sequence by an 18 position front panel rotary switch. Combined scan-width and linearity accuracy is better than ±10% in the calibrated position. Scanwidth is continuously adjustable between cali-brated positions by means of a vernier con-trol concentric with the scanwidth switch.
9	Zero Scan:	The scanwidth control has a zero scan position. In this setting, the analyzer be-comes a tuned receiver with center fre-quency determined by the main tuning dial. Amplitude variations of the input RF versus time can be displayed on the CRT.

Table 1-1. Performance Specifications (cont)

Item	Parameter	Specification
10	Full Scan:	Front panel toggle switch overrides scanwidth setting and main tuning dial sets up full scan of band selected.
11	External Scan:	DC voltage from 0 to +10 volts produces full horizontal displacement on the CRT and causes a scan as selected by scan-width switch.
12	Sweep Speed:	Standard, Fast and Manual sweeps provided, selected by front panel switch. Standard sweep selectable from 3 msec/div. to 3 sec/div. in 1, 3, 10 sequence. In AUTO optimum sweep time selected by setting of scanwidth control. Fast sweep selectable from 10 usec/div to 1 msec/div in 1, 3, 10 sequence. Manual sweep allows horizontal positioning of spot by means of front panel control or external voltage.
13	Synchronization:	Four modes available: Single Sweep (initiated by front panel push button), External (sweep initiated by external trigger signal), Free Run (sweep free runs at internal rate), Line (sweep synchronized to frequency of power line).
14	Resolution:	IF bandwidth of 300 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz and AUTO selected by front panel switch. Accuracy is ±20% measured at 3 dB points. Skirt selectivity 20:1 measured at 60 dB and 3 dB points. In AUTO, optimum resolution selected by setting of scan-width control.
15	Optimum Resolution:	When both Resolution and Sweep Speed controls are set to AUTO, sweep speed and IF bandwidth automatically selected by setting of Scanwidth control for optimum resolution.

Table 1-1. Performance Specifications (cont)

Item	Parameter	Specification
16	Sensitivity:	Typical CW sensitivity (defined as $\frac{S+N}{N}=2$) at 100 kHz resolution.

Band	Frequency Range (GHz)	Sensitivity
1	0.01 to 1.8	-85 dBm
2	1.75 to 3.75	-80
3	3 to 5	-75
4	4.75 to 9.25	-70
5	9 to 12.4	-55

Item	Parameter	Specification
17	Frequency Response:	(with 10 dB RF attenuation) Maximum amplitude variation is 3 dB or less over any 100 MHz portion of the spectrum up to 12.4 GHz. ~~Above 12.4 GHz the maximum amplitude variation is 6 dB or less over any 100 MHz portion of the spectrum.~~
18	Amplitude Display:	Logarithmic or Linear selected by front panel switch. Calibration accuracy ± 2 dB in Log, ±20% in Linear.
19	Video Duration:	Front panel switch selects peak detector to enhance display of short duration or low PRF pulses. Three positions provided: LONG, SHORT and OFF.
20	Video Filter:	1 kHz low pass filter selected by front panel switch.
21	Dynamic Range:	Display dynamic range > 70 dB. Harmonics, hum, intermodulation and higher order distortion products more than 46 dB below two equal -30 dBm signals with zero RF and IF attenuation.
22	Residual Responses:	Referred to input on 1 - mixing < -90 dBm
23	Input Impedance:	50 ohm; VSWR at front panel less than 1.5:1 with 10 dB RF attenuation, Type N connector.

Table 1-1. Performance Specifications (cont)

Item	Parameter	Specification
24	RF Attenuation:	0 to 60 dB in 10 dB steps: Accuracy 0.5 dB or 2% of attenuation whichever is greater. Maximum power input: Attenuation — Max. Input 0 — +15 dBm 10 — +25 dBm 20-60 — +33 dBm
25	IF Attenuation:	0 to 41 dB in 1, 2, 3, 5, 10, 20 sequence
26	Display:	8 x 10 cm, Rectangular, flat face CRT with 3 KV acceleration potential, magnetically shielded, P-31 phosphor. Front panel controls for base line blanking, graticule illumination, intensity, focus, trace alignment, astigmatism and horizontal/vertical position.
27	Graticule:	Divided in 10 horizontal and 8 vertical divisions. Horizontal base line and center vertical line divides into 5 increments per division. Left edge calibrated from 1 to 8 for Linear operation, right edge calibrated from 0 to 70 dB for Log.
28	Recorder Output:	Vertical and horizontal signals available at rear panel BNC connectors. Nominal output 0 to 1 Volt for full screen deflection. Rear panel connector supplies pen lift signal for X-Y recorder.
29	Power:	105-125/207-293 ~~115/230~~ VAC, rms, ±10%; 57-63 ~~50~~ to ~~60/400~~ Hz; approximately 70 Watts.
30	Size:	7" H x 16-3/4" W x 19-1/2" D not including front panel cover. Shipping Container 16" x 24" x 28" cardboard complies with Spec PPP+B-836C
31	Service Conditions:	Equipment meets performance specifications under any combination of following service conditions: Altitude - 0 to 10,000 feet above MSL Ambient Temperature - 0° to +50° C Relative Humidity - 10% to 80%

SECTION II

INSTALLATION AND SETUP

2-1. UNPACKING AND INSPECTION

The analyzer is delivered in one carton; the associated mobile test cart and drawer is delivered in another carton. Carefully open the carton, remove the equipment, and thoroughly inspect for evidence of damage during shipment. Remove and file the warranty record.

2-1.1 Equipment Supplied

The following equipment is normally supplied:

Model 712-1 Display Unit
Model 809-1 Tuning Unit
Power Cord, Part No. 17130-006, 1 each
Pen Lift Connector Assembly, Part No. 36000-043, 1 each

2-2. MOUNTING

Figure 2-1 shows outline dimensions for the analyzer.

2-3. REAR PANEL CONTROLS AND CONNECTORS

The rear panel is illustrated in figure 2-2, and the functions of the controls and connectors are described in table 2-1. These controls and connectors are used in setting up the analyzer for operation.

2-4. SETUP PROCEDURE

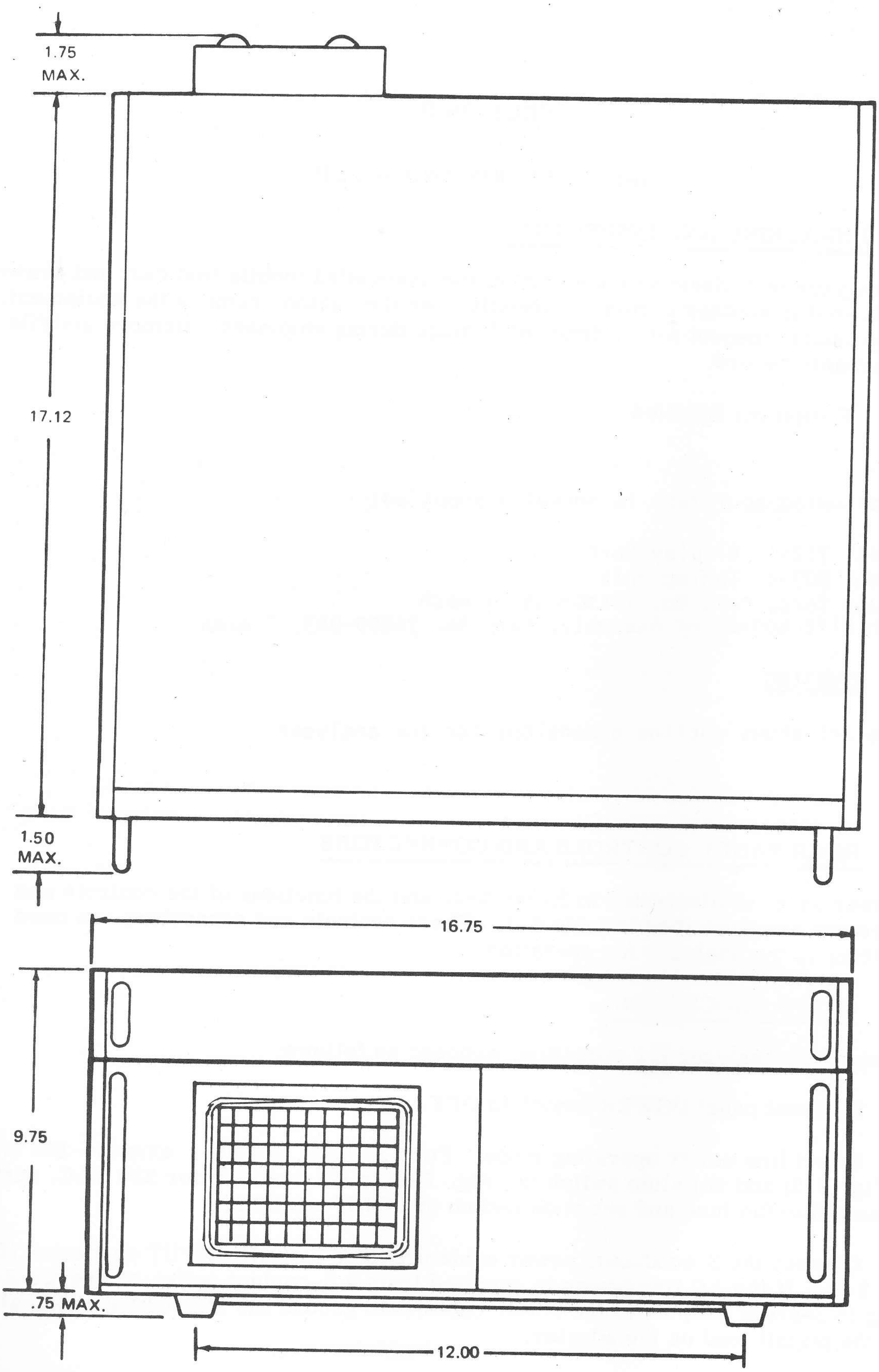
To set up the analyzer for operation, proceed as follows:

a. Set front panel POWER switch to OFF.

b. Select line power operating mode. For 115 VAC, install 1-amp Slo-Blo fuse (8, Fig. 2-2) and set slide switch (9, Fig. 2-2) in UP position; for 230 VAC, install 1/2-amp Slo-Blo fuse and set slide switch in DOWN position.

c. Connect the 3-conductor power cable provided to LINE INPUT connector (11, Fig. 2-2). If the AC line power is supplied from a 2-contact outlet, connect a 2-prong to 3-prong adapter to the power cable, and ground the instrument externally with the pigtail lead on the adapter.

d. If an external monitoring device is to be used with the analyzer, make connections from OUTPUTS connectors VERT (1, Fig. 2-2) and HORIZ (2, Fig. 2-2) to the external monitoring device.



CART DIMENSIONS

LENGTH	32 IN.
WIDTH	19-1/8 IN.
HEIGHT	36 IN.

Figure 2-1. Outline Dimensions

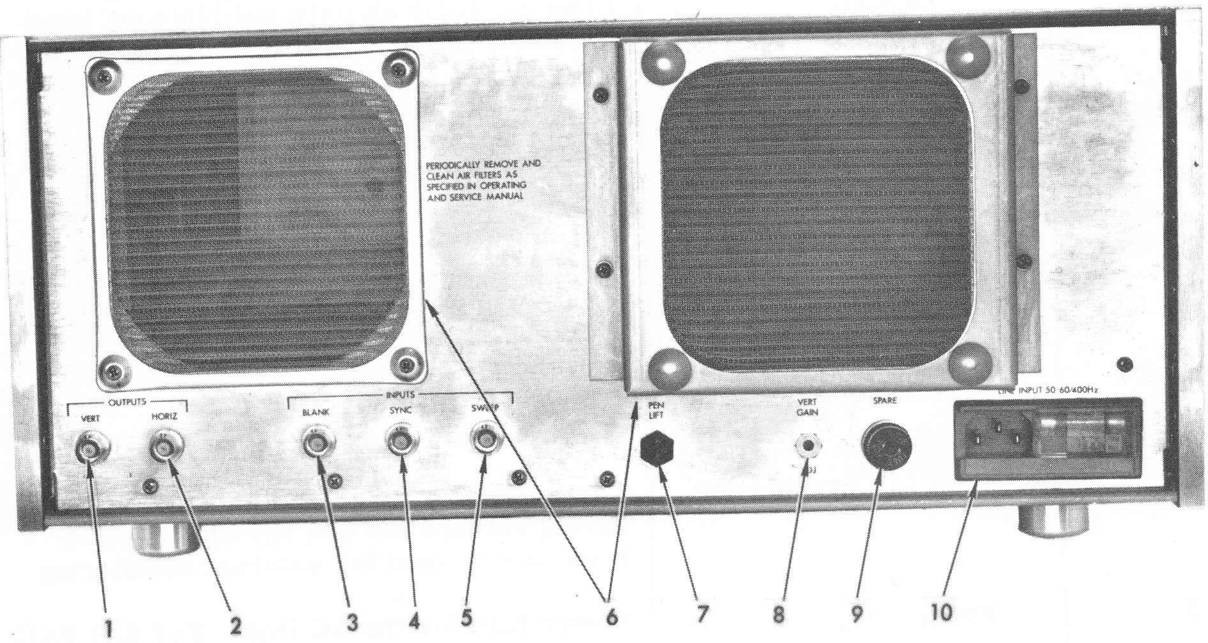


Figure 2-2. Rear Panel Controls and Connectors

Table 2-1. Rear Panel Controls and Connectors

Index No. (Fig. 2-2)	Panel Name and Description	Function
	OUTPUTS connectors	These connectors provide access to the vertical and horizontal signals applied to the scope amplifiers for external monitoring. Full scale deflection for horizontal or vertical is +1.0 nominal volt into 600 ohms.
1	VERT	
2	HORIZ	
	INPUTS connectors	
3	BLANK	Connection for an external blanking input. A +5 volt signal signal cuts off the CRT.
4	SYNC	Connection for an external sweep synchronization input. Sweep will be initiated by a signal of +1 to +50 volts peak.
5	SWEEP	Connection for an external sweep ramp input. A 0 to 10 volts ramp signal will produce a full horizontal sweep.
6	Air Filters	Removable filters to be cleaned periodically.
7	PEN LIFT connector	Connection for relay contact opening during retrace for pen lift when an X-Y recorder is used for external monitoring.
8	Fuse	Power fuse for the AC line. For 230 VAC power, a 1/2-amp Slo-Blo fuse is required; for 115 VAC power, a 1-amp Slo-Blo fuse is required.
9	AC line power select slide switch	Used to select either 230 VAC line power (in DOWN position) or 115 VAC line power (in UP position).
10	VERT GAIN ADJ Screwdriver adjustment	Sets the full scale deflection on the CRT in the vertical axis.
11	LINE INPUT connector	Connection point for AC line power.

e. If the external monitoring device is an X-Y recorder, and the pen lift feature is to be utilized, the following hook-ups to the X-Y recorder must be made from the pen lift connector assembly provided, which mates with PEN LIFT connector (7, Fig. 2-2):

(1) Jumper from pin A to pin B.

(2) Pin C: pen lift control input from X-Y recorder to arm of relay contact.

(3) Pin D: pen lift control output from normally-closed relay contact to X-Y recorder.

f. If external blanking is desired, connect the blanking signal inputs to INPUTS connector BLANK (3, Fig. 2-2). A +5 volt signal is required.

g. If external sweep synchronization is desired, connect the sweep sync input to INPUTS connector SYNC (4, Fig. 2-2). Required signal is +1 to +50 volt peak, 1 usec nominal.

h. If external sweeping of the display is desired, connect the sweeping signal source to INPUTS connector SWEEP (5, Fig. 2-2). A ramp, 0 to 10 volt peak will deflect the horizontal sweep full scale.

SECTION III

OPERATING INSTRUCTIONS

3-1. SCOPE

This section contains descriptions of front panel operating controls and indicators, an initial operating procedure, and a summary of precautions for proper usage of the analyzer.

3-2. FRONT PANEL CONTROLS AND INDICATORS

The front panel controls, indicators, and connectors are illustrated in figure 3-1, and are listed and described in table 3-1.

NOTE

> Rear panel controls and connectors used in equipment setup are described and illustrated in Section II, Installation and Setup.

3-3. INITIAL OPERATING PROCEDURES

Figure 3-2 contains condensed initial operating procedures for the Model 762-2. These procedures are applicable to any signal analysis problem.

3-4. DISPLAY ADJUSTMENTS (figure 3-1)

Four front panel screwdriver adjustments are located at the left side of the CRT. These adjustments control sweep and display positioning and trace alignment and astigmatism and may require occasional re-adjustment. To set up the display, proceed as follows:

a. Set tuning unit controls: IF ATTEN-dB (27, Fig. 3-1) to 30, BANDWIDTH KHz (19) to 1.0. Set display unit controls: POWER (1) to ON, SYNC (34) to FREE RUN, STD SWEEP (30) to 3 msec/DIV, SWEEP VAR/MAN (8) to CAL, BASELINE BLANKING (12) to OFF.

b. Adjust INTENSITY control (10) for good visibility, ASTIG (4) and FOCUS (9) for sharpest possible spot.

c. Adjust TRACE ALIGN (3) to bring horizontal trace parallel with horizontal graticule lines.

d. Adjust horizontal H control (6) to center horizontal trace in the graticule.

e. Adjust vertical V control (5) to position horizontal trace on the bottom line of the graticule.

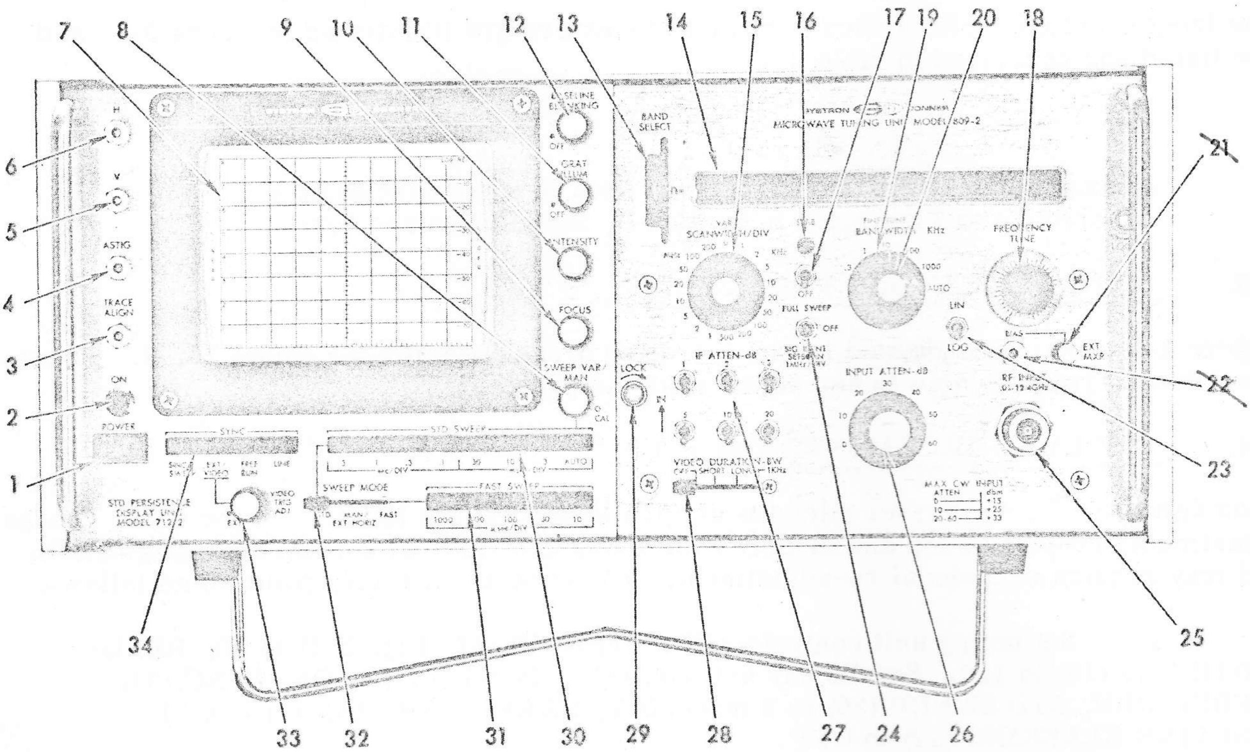


Figure 3-1. Front Panel Controls and Indicators

Table 3-1. Front Panel Controls and Indicators

Index No. (Fig. 3-1)	Front Panel Name and Description	Function
1	POWER pushbutton	Press to turn power on; press to turn off. When set to ON, the type of power connected at LINE INPUT connector on rear panel is applied to the system.
2	ON pilot light	Illuminates when POWER pushbutton is set to ON.
3	TRACE ALIGN screwdriver adjustment	Aligns the horizontal scope trace with the horizontal scale on the graticule.
4	ASTIG screwdriver adjustment	Adjusts the shape of the CRT spot to circular form.
5	V screwdriver adjustment	Sets the vertical position of the scope trace.
6	H screwdriver adjustment	Sets the horizontal position of the scope trace.
7	Cathode ray tube display	8 X 10-division graticule over P-31 phosphor. The 8-division vertical axis represents signal amplitude, and the 10-division horizontal axis represents frequency. Graticule divisions have subdivision marks, 5 per division. The left hand scale of the vertical axis is calibrated for linear display operation, where each division represents 1/8 of full scale, where full scale is 8. The right hand scale of the vertical axis is calibrated for logarithmic display operation, in which each division represents 10 dB, and full scale is 0 dB. The horizontal scale 5-division point (CF) corresponds to the center frequency setting on the frequency scale (14). The frequency count per division is determined by the SCANWIDTH/DIV control (15).

Table 3-1. Front Panel Controls and Indicators (Cont)

Index No. (Fig. 3-1)	Front Panel Name and Description	Function
8	SWEEP VAR/MAN control	In extreme clockwise (CAL) position, the sweep is calibrated. Turning this control positions the spot horizontally on the CRT when SWEEP MODE control (index 32) is in the MAN/EXT HORIZ position. When SWEEP MODE control is in either STD or FAST position, turning this control varies the sweep rate.
9	FOCUS adjustment	Adjusts the focus of the spot on the CRT.
10	INTENSITY control	Potentiometer control adjusts the display brightness from cutoff to maximum intensity. Intensity is increased as control is turned clockwise.
11	GRAT ILLUM control	Potentiometer control adjusts the brightness of engraved lines on the edge-lighted graticule. Brightness is increased as control is turned clockwise; the extreme counterclockwise position is a positive OFF.
12	BASELINE BLANKING control	Potentiometer control permits variable amplitude blanking of the display to eliminate the bright horizontal baseline and noise appearing at higher levels. Turning the control clockwise blanks the display from the bottom up, until the lower half has been cut off. The extreme counterclockwise position is a positive OFF, and the control should be left in this position unless blanking is desired.
13	BAND SELECT thumb control	Selects one of ~~eight~~ 5 frequency bands for calibrated signal analysis.
14	Frequency scale	Rotating drum frequency dial, having ~~eight~~ 5 separate frequency scales to cover the range from 10 MHz to ~~40~~ 12.4 GHz.

Table 3-1. Front Panel Controls and Indicators (Cont)

Index No. (Fig. 3-1)	Front Panel Name and Description	Function
15	SCANWIDTH/DIV concentric selector switch	This 18-position switch and concentric vernier control (designated VAR) sets the width of the frequency display on the CRT. The scanwidth of the display, in kHz/division or MHz/division, is indicated for each calibrated position of the scanwidth switch. The vernier control permits the scanwidth to be continuously varied between the fixed scanwidth positions. In the zero scanwidth position, the analyzer has the capability as a tuned receiver to display signals in amplitude-versus-time coordinates.
16	STAB indicator light	This light illuminates when the first local oscillator is stabilized.
17	STAB/OFF toggle switch	When in OFF position, the stabilization circuitry is disabled.
18	FREQUENCY TUNE control	This 10-turn control tunes the analyzer center frequency over the range indicated on the frequency scale. The pointer on the frequency scale indicates the center frequency, which corresponds to the frequency of the signal appearing on the 5th division on the horizontal scale of the CRT display. Sub-divisions of a turn of the control are read on an expanded scale which can be indexed for setting zero position.
19	BANDWIDTH KHz	Selects the IF bandwidth resolution for the display. Six positions: 0.3, 1, 10, 100, 1000 kHz and AUTO.
20	FINE TUNE control	Located concentric with the bandwidth switch. Dual-range potentiometer permits coarse and fine adjustment of display frequency.

Table 3-1. Front Panel Controls and Indicators (Cont)

Index No. (Fig. 3-1)	Front Panel Name and Description	Function
21	EXT MXR connector	Connector for external mixer cable assembly, accepts inputs in the 12.4 - 40.0 GHz range, using external wave guide mixers.
22	BIAS screwdriver adjustment	Adjusts external mixer input for optimum sensitivity.
23	LIN/LOG toggle switch	Selects the response mode of the video signal. When set to LIN, signal amplitude is linear and left hand graticule scale applies. When set to LOG, amplitude is logarithmic and right hand scale in dB applies.
24	SIG IDENT momentary contact toggle switch	If the correct band has been selected, the signal displayed will move 2 divisions to the left and reduce in amplitude approximately 6 dB on alternate sweeps when this control is placed in SIG INDENT position. When placed in FULL SWEEP position, the full local oscillator range is swept, overriding the SCANWIDTH and FREQUENCY TUNE controls.
25	RF INPUT	This type N RF receptacle accepts the input signal to the analyzer
26	INPUT ATTEN - dB selector switch	Selects seven steps of input attenuation from 0 to 60 dB in 10 dB steps.
27	IF ATTEN - dB toggle switches	These six toggle switches select IF attenuation in 1 dB steps from 0 to 41 dB.
28	VIDEO DURATION - BW slide control	This 4-position control selects either OFF or two ranges of video duration, SHORT and LONG, to enhance the display of short duration or low PRF pulse signals. The 1 KHz position provides a low pass of 1000 Hz to smooth out noise in the display.
29	Left hand lock	Together with Right hand lock, secures the Model 809-2 tuning unit in the main frame. Turn fully clockwise to lock. Must be unlocked to remove tuning unit.

Table 3-1. Front Panel Controls and Indicators (Cont)

Index No. (Fig. 3-1)	Front Panel Name and Description	Function
30	STD SWEEP pushbutton controls	Only one pushbutton can be depressed at a time, selecting (when SWEEP MODE is in STD position) sweep rates in seven values from 3 milliseconds/division to 3 seconds/division. An eighth position, AUTO, is also provided which selects an optimum sweep rate when used in conjunction with the AUTO setting of the BANDWIDTH control.
31	FAST SWEEP pushbutton controls	Only one pushbutton can be depressed at a time selecting (when SWEEP MODE is in FAST position) sweep rates in five values from 10 microseconds/division to 1000 microseconds/division. This position of the SWEEP MODE switch is used for zero dispersion operation only.
32	SWEEP MODE slide control	This is a 3-position control. In STD position, the STD SWEEP pushbutton controls are activated for standard spectrum analyzer operation. In FAST position, the FAST SWEEP pushbutton controls are activated for zero dispersion operation only. In MAN/EXT HORIZ position, the horizontal position of the CRT spot is controlled from left to right by varying the SWEEP VAR/MAN control (index 8); or when an external sweep input is applied to INPUTS - SWEEP connector on the rear panel. The horizontal position of the CRT spot is controlled by this input.
33	VIDEO TRIG ADJ control	When set to EXT, this control selects an external sweep synchronization input (from INPUTS-SYNC connector on rear panel) if SYNC - EXT/VIDEO pushbutton (index 34) is activated. When rotated, this control adjusts sensitivity of sweep triggering on the video signal.

Table 3-1. Front Panel Controls and Indicators (Cont)

Index No. (Fig. 3-1)	Front Panel Name and Description	Function
34	SYNC pushbutton control	Only one of three pushbuttons can be depressed at a time; the fourth is a momentary contact pushbutton. Three pushbuttons select the synchronization mode for the horizontal sweep. In FREE RUN setting, the sweep is internally generated; in LINE setting, the sweep is synchronized to the AC line frequency; in EXT/VIDEO setting, the sweep is synchronized to either an external sync input applied to INPUTS - SYNC connector on the rear panel (with the VIDEO TRIG ADJ control set to the EXT position); or by the video signal (with the VIDEO TRIG ADJ control set to the desired triggering level). The SINGLE SWEEP momentary contact pushbutton initiates a single sweep each time it is depressed when the EXT/VIDEO setting is selected and the VIDEO TRIG ADJ control (index 33) is in the EXT position.

3-5. HINTS AND PRECAUTIONS

Although a spectrum analyzer display is superficially similar to that of a conventional laboratory oscilloscope, this similarity could lead to incorrect use and misinterpretation of the display waveforms. For example, the problem of input overload is not encountered with laboratory oscilloscopes, but is a major concern when using a spectrum analyzer. Other unique problems arise because harmonic mixing is employed to achieve the wide frequency range of the instrument.

3-5.1 Input Overload Problems

Since the spectrum analyzer has no preselection capability, it is very susceptible to input overload, which can produce spurious signals and possible burnout of the crystal input mixer. (Replacement of the input mixer is a simple procedure. Refer to applicable instructions.)

Unlike the standard oscilloscope, the spectrum analyzer spreads out the input signal power on the horizontal axis, thus, at any given instant, the spectrum analyzer display is responding to only a small part of the total input signal power. The spectrum analyzer front end, however, is responding to the total input signal power at all frequencies. Input overload occurs whenever the strongest frequency component of the input signal exceeds full-scale deflection, or when the input signal power exceeds the dynamic range of the front end. Any attempt to increase the input signal level or to reduce the input attenuation in order to obtain a full-scale display of a small part of the input signal spectrum can result in serious overload. In addition, the dynamic range of the instrument is reduced when IF attenuation is introduced. When IF attenuation is introduced, and the input signal level is then increased so that the frequency component of interest produces full-scale deflection, input overload can result.

To avoid the possibility of an input overload, particularly when the spectrum of the input signal is unknown, proceed as follows:

a. Set the SCANWIDTH/DIV control to 50 MHz, and set all IF ATTEN - dB switches to the down (out) position.

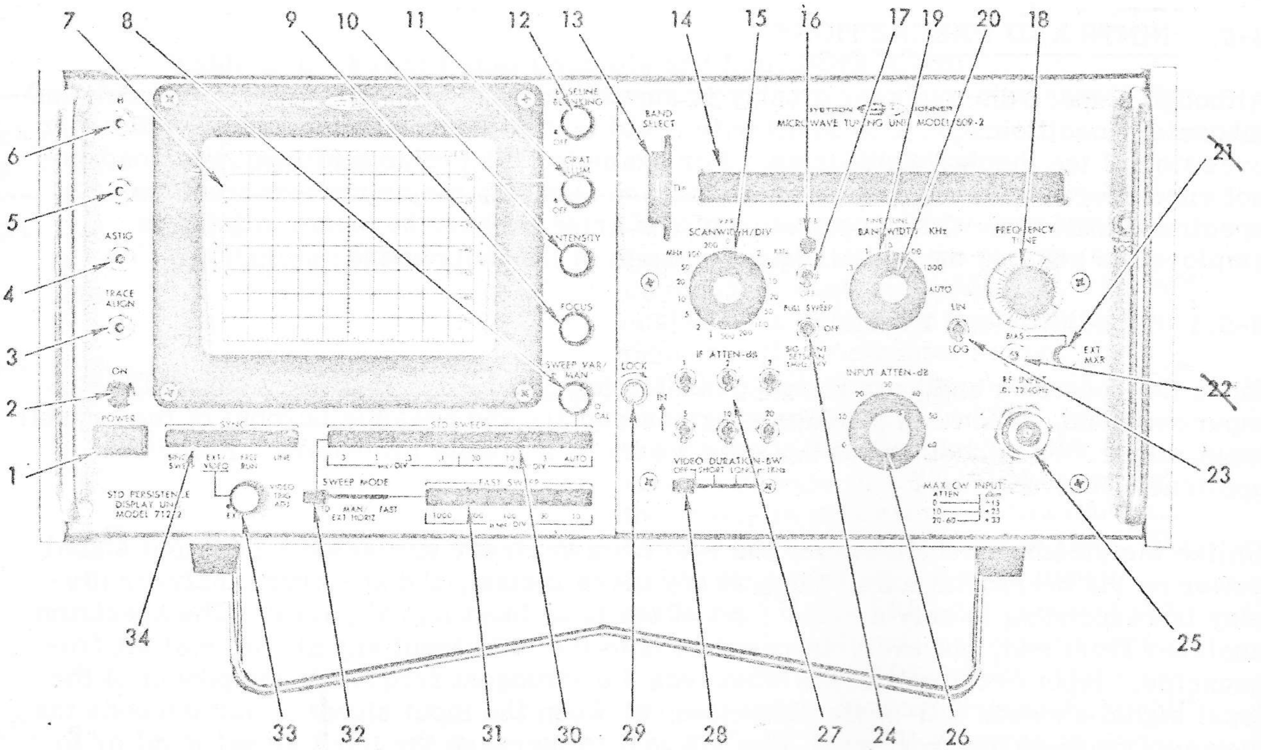
b. Using the INPUT ATTEN - dB control, set the amount of input signal attenuation so that the strongest signal on the display is close to, but does not exceed full scale.

c. When closing in on a signal of interest, do not increase the input signal level above that established in step (b).

d. Do not increase the input signal level after introducing IF attenuation.

A good method for determining whether an input overload or nonlinear condition exists is to introduce 10 dB of RF attenuation. The amplitude of the signal of interest should be reduced by 10 dB in the logarithmic display mode. If the amplitude changes by more or less than 10 dB, an input overload is present.

The maximum allowable input signal power that can be applied to the Model 762-2 is



A. POWER TURN-ON

1. Depress POWER pushbutton (1) and observe that ON pilot light (2) illuminates.

2. Refer to instructions under DISPLAY ADJUSTMENTS and adjust the display for optimum position and clarity.

NOTE: Allow instrument to warm up for 30 minutes before making adjustments.

B. PRELIMINARY CONTROL SETTINGS

Display Controls

Control	Setting
SYNC (34)	FREE RUN
SWEEP MODE (32)	STD
STD SWEEP (30)	3 msec/DIV
SWEEP VAR/MAN (8)	CAL

Tuning Unit Controls

Control	Setting
SCANWIDTH/DIV (15)	200 MHz/DIV
BANDWIDTH KHZ (19)	AUTO
Selector LIN/LOG (23)	LOG
STAB/OFF toggle (17)	STAB
INPUT ATTEN - dB (26)	10 dB

Figure 3-2. Initial Operating Procedure
(Sheet 1 of 2)

C. TYPICAL SIGNAL ANALYSIS

Control	Setting
BAND SELECT (13)	Select to match input frequency range
FREQUENCY TUNE (18)	Set to input frequency
IF ATTEN - dB (27)	Set for desired display

CAUTION: AVOID INPUT OVERLOAD: DO NOT APPLY EXTERNAL SIGNAL TO RF INPUT CONNECTOR (25) WHICH EXCEEDS LIMITS POSTED ON FRONT PANEL.

Connect signal to RF INPUT (25). The resulting display is a WIDE DISPERSION display. Wide dispersion is used for harmonic distortion measurements and for examining the full range of a signal.

When examining low frequency modulation of an RF signal, or when comparing amplitude and frequency of two closely-spaced signals, a NARROW DISPERSION display is desirable. To obtain a narrow dispersion display:

Control	Setting
SCANWIDTH/DIV (15)	500 kHz/DIV or lower, for dispersion desired. Note that STAB indicator light (16) illuminates when scanwidths in the 1 to 500 kHz/DIV range are selected.
FREQUENCY TUNE (18)	Adjust to center the signal on screen.
BANDWIDTH KHZ (19)	Adjust for desired resoluteion.

NOTE: The sweep time setting on the display unit must also be slow enough to sweep narrow bandwidth settings without loss of amplitude or symmetry, especially if the scanwidth is considerably greater than the bandwidth. Adjust STD SWEEP (30) accordingly.

D. OTHER CONTROLS

1. Selector LIN/LOG (23) : In LOG position, signal amplitudes are compared in dB. The LOG position provides the advantage of wide dynamic range: signals with 60 dB difference in amplitude can be displayed. Amplitude differences less than 2 dB cannot be resolved in LOG mode. The LIN position enables comparison of fractional dB differences, as well as voltage comparisons.

2. SIG IDENT toggle (24) : Provides a means of distinguishing between the fundamental signal and its harmonics. When depressed, this control causes the fundamental signal to appear two divisions to the left at reduced amplitude on alternate scans, when SCANWIDTH/DIV (15) is set to 1 MHz/DIV.

3. FINE TUNE control (20) : Used to adjust centering of the display at narrow bandwidth settings.

4. VIDEO DURATION - BW control (28) : In 1 KHz position, provides video filter; in the SHORT or LONG positions, provides enhancement of short duration or low PRF displays.

Figure 3-2. Initial Operating Procedure
(Sheet 2 of 2)

dependent upon the setting of the INPUT ATTEN - dB control, but should never exceed +33 dBm. Table 3-2 lists the maximum safe input power level that can be applied to the RF INPUT connector. If the input power is allowed to exceed the levels specified in table 3-2, the crystal diode input mixer and/or the input attenuator can be damaged.

Table 3-2. Maximum Safe Input Power Level

Input Attenuator Setting (dB)	Maximum CW Input (dBm)
0	+15
10	+25
20-60	+33

3-5.2 Sweep Rate, Scanwidth, and IF Bandwidth Selection

Because the spectrum analyzer is a swept instrument, the input sensitivity control is affected by the display sweep rate and the IF bandwidth. Normally, the STD SWEEP control (or the external sweep) is set for the fastest rate consistent with the input signal characteristics, the setting of the SCANWIDTH switch, and the setting of the IF BANDWIDTH switch. If the sweep rate is increased above the optimum value, the IF response curve widens and loses its symmetry, causing the input signal amplitude on the display to decrease. If the input signal level is then increased to restore full-scale deflection, input overload will result.

SECTION IV

THEORY OF OPERATION

4-1. OVERALL FUNCTIONAL DESCRIPTION (figure 4-1)

Figure 4-1 is a simplified block diagram of the spectrum analyzer, which is composed of the Model 809-1 Microwave Tuning Unit and the Model 712-1 Standard Persistence Display Unit.

Basically, the spectrum analyzer is an electronically tuned, multiple conversion, heterodyne receiver with a CRT display that indicates signal amplitude as a function of frequency. The frequency spectrum display along the horizontal axis of the CRT is produced by linearly tuning the receiver local oscillator frequency in synchronism with the horizontal deflection voltage for the CRT. This dispersion sweep of the local oscillator is analogous to manually tuning a conventional receiver across a frequency band and measuring received signal amplitude at each point in the tuning range.

4-1.1 Model 809-1 Microwave Tuning Unit

This unit receives the RF signal input from the unit under test. The RF signal input from the unit under test is first applied to an RF attenuator. The amount of attenuation is controlled by an INPUT ATTEN switch on the front panel. The attenuated output is applied to the power combiner, where the signal is combined with a marker input (optional). The resulting composite RF signal is then processed by the first, second, third, and fourth IF circuits, and the fourth IF signal is applied to the video circuits that produce the vertical deflection inputs to the Model 712-1 Display Unit.

The center frequency of the Model 809-1 is established by the FREQUENCY TUNE control on the front panel, and is indicated in the tuning dial window. This center frequency is related to the center frequency of the first oscillator in the 1st and 2nd IF circuits.

A derivative of the sweep sawtooth used to drive the horizontal deflection circuits in the display unit is supplied as the dispersion sweep signal to the Model 809-1. Except in the fast sweep mode (no dispersion sweep), this dispersion sweep signal is applied to either the first or third local oscillator, depending upon the setting of the SCANWIDTH switch. For scanwidths of 1 MHz per division or greater (wide-scan sweep), the dispersion sweep sawtooth is applied to the first local oscillator. For scanwidths of less than 1 MHz per division (narrow-scan sweep), the dispersion sweep sawtooth is applied to the third local oscillator.

The local oscillator which receives the dispersion sweep signal is swept across a frequency range established by the SCANWIDTH and BAND SELECT switch settings. This dispersion sweep causes the output frequency to increase linearly as the CRT beam is deflected from left to right across the display. The center position on the display cor-

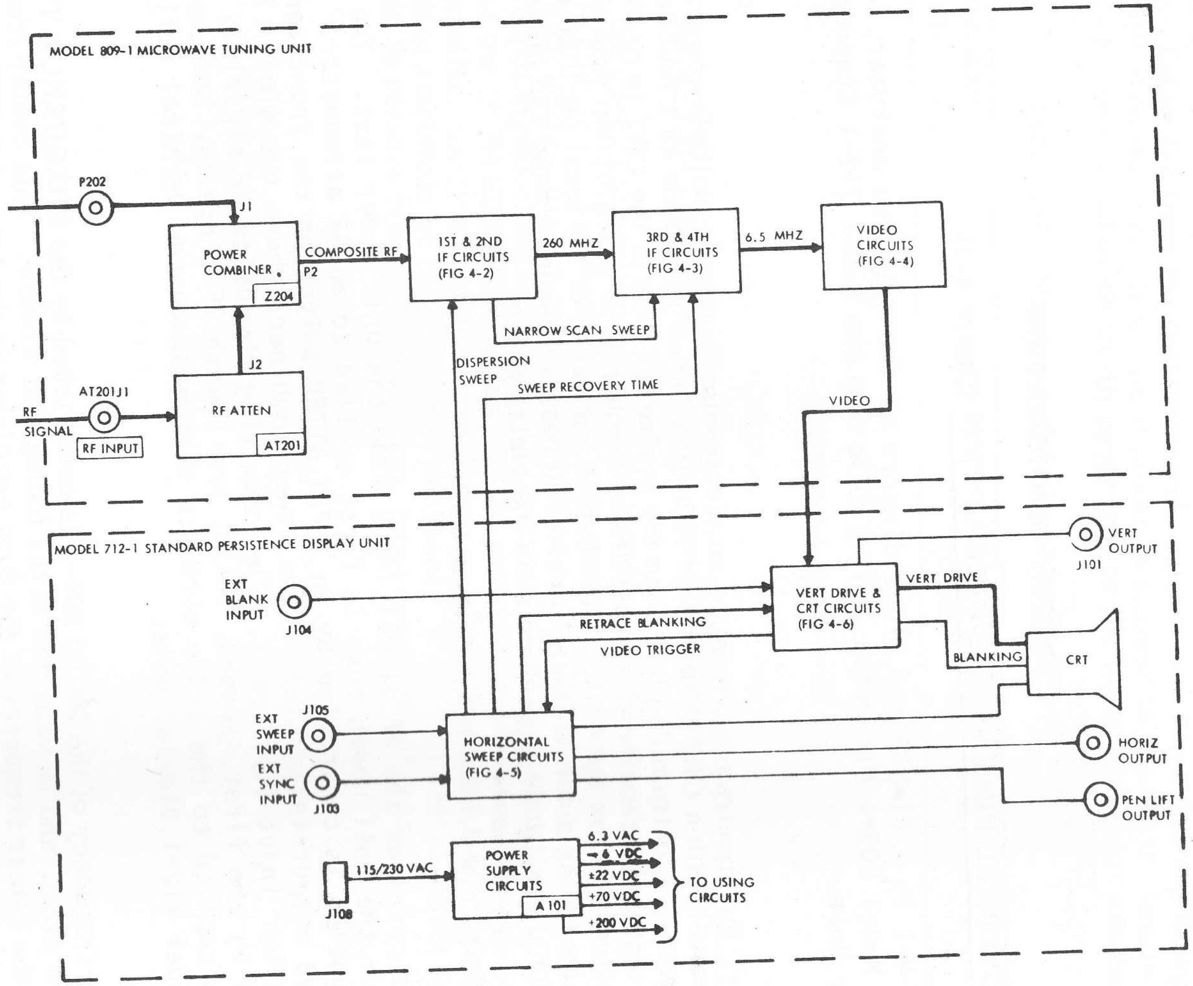


Figure 4-1. Overall Block Diagram

responds to the center frequency established by the FREQUENCY TUNE control. The swept local oscillator output is applied to a mixer, where it is mixed with the signal being analyzed. The mixing action produces sum and difference signal components. The difference signal products are defined as follows:

$$f_{dif} = f_{sig} - nf_{lo},\ nf_{lo} - f_{sig} \quad (1)$$

Where:

f_{dif} = the frequency of the difference signal

f_{sig} = the frequency of the RF input (signal being analyzed).

f_{lo} = the frequency of the swept local oscillator at any given instant

n = the harmonic of the local oscillator frequency (1st, 2nd, 3rd, etc. harmonic).

As the local oscillator sweeps across the frequency range established by the FREQUENCY TUNE control and the dispersion sweep signal, a point will be reached where a difference signal equal to the associated IF frequency is produced. The Model 809-1 produces a video output only when the difference signal is equal to the associated IF frequency, consequently, a video output is produced for each frequency component of the signal being analyzed which is in the range established by the first local oscillator center frequency and the dispersion sweep sawtooth.

The video output for each frequency component is applied to the vertical deflection circuits in the display unit, producing vertical deflections whose amplitudes are proportional to the relative power of each frequency component. The vertical deflection for a particular frequency component occurs at the point on the horizontal sweep where:

$$nf_{lo} = f_{sig} \pm f_{if} \quad (2)$$

Where:

f_{if} = the intermediate frequency associated with the mixer stage where the signal of interest is mixed with the swept local oscillator signal.

f_{sig} = the frequency of a particular frequency component in the signal of interest.

That is, when the swept local oscillator reaches a frequency (nf_{lo}) which is equal to the frequency of the signal of interest plus or minus the IF frequency (f_{if}), the resulting mixer output will produce a vertical deflection.

Since the local oscillator and the CRT horizontal deflection are swept in synchronism, the horizontal position on the display defines the frequency of the signal of interest.

The tuning range of the first local oscillator is 2.0 to 4.1 GHz. To cover the frequency range from 10 MHz to 12.4 GHz, the first, second, and third harmonics (n = 1, 2, 3) of the first local oscillator are utilized. The selected harmonic is determined by the position of the BAND SELECT control, which selects the harmonic number being utilized. The band number (1 through 5) is indicated on the BAND SELECT switch (bands 6 through 8 are not utilized in this application). The selected harmonic number is indicated in the tuning window for each band, as follows:

Band	Harmonic (n =)
1	1
2	1
3	2
4	3
5	3

For bands 1, 3, 4, and 5, the selected harmonic of the first local oscillator is mixed with the RF input to produce a first IF frequency of 2.050 GHz. For band 2, the first harmonic is mixed with the RF input to produce a first IF frequency of 260 MHz. In the wide-scan sweep positions of the SCANWIDTH/DIV switch (1 MHz per division or above), nf_{lo} in equation (2) is the frequency of the selected harmonic of the first local oscillator, f_{sig} in equation (2) has a frequency of 10 MHz to 12.5 GHz and f_{if} is 2.050 GHz (bands 1, 3, 4, and 5) or 260 MHz (band 2).

In the narrow-scan positions of the SCANWIDTH switch (less than 1 MHz per division), nf_{lo} in equation (2) is the fundamental frequency (n = 1) of the swept third local oscillator, f_{sig} has a frequency of 260 ± 5 MHz, and f_{if} is 60 MHz. The maximum tuning range of the third local oscillator is 195 MHz to 205 MHz (200 ± 5 MHz).

The width of the dispersion sweep is determined by the setting of the BAND SELECT (wide-scan only) and SCANWIDTH switches, and is varied by attenuating the dispersion sweep sawtooth applied to the local oscillator being swept. When the SCANWIDTH switch is set to 1 MHz per division or higher (wide scan sweep), and the FULL SWEEP/SIG IDENT switch is operated to the FULL SWEEP position, the first local oscillator is swept across the entire 2 - 4 GHz range, regardless of the settings of the BAND SELECT and SCANWIDTH switches. A 200 MHz per division display is produced.

The bandwidth of the final (4th) IF frequency (6.5 MHz) is determined by the setting of the BANDWIDTH switch. In the narrow bandwidth positions of this switch, higher resolution of discrete frequency components in the signal of interest can be accomplished. An IF attenuator, controlled by front-panel switches, permits the 6.5 MHz IF signal to be attenuated by as much as 41 dB before video detection is performed. Either linear or logarithmic video detection may be selected.

The VIDEO DURATION - BW control on the front panel provides a video filter when set to the 1 KHz position. When set to SHORT or LONG positions, displays of narrow pulse signals can be enhanced.

When a signal of unknown frequency is being analyzed, the correct frequency band must first be determined. To aid in identifying the correct frequency band, a signal identification feature is incorporated. First, the FREQUENCY TUNE control is used to center the unknown signal on the CRT display. Then, with the SCANWIDTH/DIV switch set for 1 MHz per division (wide-scan sweep), the FULL SWEEP/SIG IDENT switch is depressed. This action causes the following events to occur:

a. The third local oscillator is shifted down in frequency by 2 MHz.

b. The third IF signal is attenuated by 6 dB.

These actions cause a 6 dB down image of the signal of interest to appear on the display to the left of the center line where the real signal of interest is being displayed. The correct band is then determined by operating the BAND SELECT switch until the image appears two major divisions to the left of the center line.

4-1.2 Model 712-1 Standard Persistence Display Unit

This unit (hereinafter called the display unit) contains the following elements:

a. The power supplies which supply d-c voltages to the Markers/Signal Source Unit, the Model 809-1 and the circuits in the display unit.

b. The horizontal sweep circuits which produce the horizontal sweep on the CRT. and the dispersion sweep signal for the Model 809-1.

c. The vertical drive circuits which receive the video output of the Model 809-1 and produce the vertical drive for the CRT.

d. The circuits associated with the CRT, which include video blanking circuits, high-voltage power supplies, and the focus, intensity, astigmatism, and trace alignment controls. The CRT utilizes electrostatic deflection.

The video output of the Model 809-1 is converted to vertical drive signals for the CRT. Also, a vertical output for external equipment is provided, and a video trigger is supplied to the horizontal sweep circuits when the horizontal sweep is being synchronized to a video trigger.

The horizontal sweep circuits produce the sweep sawtooth used for the CRT horizontal drive and the dispersion sweep. Depending upon the mode, the sweep can be synchronized to any of the following:

a. A video trigger from the vertical drive circuits.

b. An external sync input.

c. A single sweep switch on the front panel, which initiates a sweep each time the switch is pressed.

d. A free-running mode.

The sweep rate (sweep time per division) is selected by means of front panel switches in either the standard or fast-sweep mode. Alternatively, an external sweep sawtooth may be used (no internal synchronization required), or a manual sweep can be selected, in which the operator controls the sweep by means of a front panel control.

During the interval between sweeps, a pen lift output is provided to external equipment, and retrace blanking of the CRT occurs. Also, sync output to the Model 809-1 is produced, which resets the Model 809-1 after each sweep when the signal identification feature is being utilized. A horizontal sweep output is made available to external equipment.

4-2 MODES OF OPERATION

The spectrum analyzer can be operated in a number of different modes, as selected by the front panel controls. The succeeding sub-paragraphs describe major modes of operation.

4-2.1 Sweep Modes

4-2.1.1 Automatic Mode

In this mode, the SWEEP MODE switch on the Model 712-1 is set to STD, the BANDWIDTH switch on the Model 809-1 is set to AUTO, and the STD SWEEP AUTO button on the Model 712-1 is activated. In the automatic mode, the IF bandwidth is determined by the SCANWIDTH/DIV switch setting. Also, the horizontal sweep rate (sweep time per division) in the Model 712-1 is optimized.

4-2.1.2 Fast Sweep Mode

This mode is selected when the SWEEP MODE switch on the Model 712-1 is set to FAST, and one of the FAST SWEEP buttons is pressed. In the fast sweep mode, no dispersion sweep is produced, and the spectrum analyzer is used as an ordinary superheterodyne receiver that is tuned to the frequency of the signal of interest. The CRT display (amplitude on the vertical axis, time on the horizontal axis) is similar to that of a conventional oscilloscope, and consists of the detected video pulse whose carrier frequency is equal to the center frequency indicated on the tuning dial. Normally, the horizontal sweep of the CRT is synchronized to an external sync signal, or to the video pulses themselves. Sweep times between 100 microseconds (10 microseconds per division) and 10 milliseconds (1000 microseconds per division) can be selected.

4-2.1.3 Standard Sweep Mode

This is the most commonly used sweep mode for spectrum analysis. The SWEEP MODE switch on the Model 712-1 is set to STD, and one of the seven STD SWEEP pushbuttons is pressed to select a specific sweep rate (sweep time per division). The mode of sweep synchronization is selected by the SYNC switches. Sweep times between 30 seconds (3 seconds per division) and 30 milliseconds (3 milliseconds per division) can be selected. By means of the SWEEP VAR/MAN control, sweep times may be varied between the fixed values selected by the pushbuttons.

4-2.1.4 External Sweep Mode

In this mode, the SWEEP MODE switch on the Model 712-1 is set to MAN/EXT HORIZ, and an external source of a sweep sawtooth is applied to the SWEEP input connector on the rear of the unit. Also, an external blanking signal input is applied to the BLANK input connector on the rear of the unit to blank the CRT between sweeps. Centering of the horizontal sweep is accomplished using the SWEEP VAR/MAN control on the Model 712-1.

4-2.1.5 Manual Sweep Mode

The SWEEP MODE switch must be set to MAN/EXT HORIZ. The SWEEP VAR/MAN control is used to move the horizontal beam on the CRT. This control varies the dispersion sweep signal applied to the Model 809-1.

4-2.1.6 Single Sweep Mode

In this mode, the SYNC SINGLE SWEEP button must be pressed to initiate each horizontal sweep of the CRT. The sweep rate (sweep time per division) is determined by the settings of the SWEEP MODE and STD SWEEP or FAST SWEEP switches.

4-2.2 Scan Modes

4-2.2.1 Full Sweep/Signal Identification Mode

This mode is normally used to locate a video signal of interest in the 10 MHz to 12.4 GHz range. Initially, the settings of the SCANWIDTH, BAND SELECT and FREQUENCY TUNE controls are irrelevant. The FULL SWEEP/SIG IDENT switch is first operated to the FULL SWEEP position. Each dispersion sweep will then cause the first local oscillator to sweep across the full 2 GHz range. Harmonic mixing will cause any signal in the 10 MHz to 12.4 GHz range to appear on the CRT. The location (distance to the left or right of center) of the signal of interest can then be used to determine the approximate setting of the FREQUENCY TUNE control to center the signal on the CRT. After the signal of interest has been centered, the scanwidth is progressively reduced, and the signal of interest is recentered. Then, with the signal of interest centered, and the SCANWIDTH/DIV switch set to 1 MHz per division, the FULL SWEEP/SIG IDENT switch is set to SIG IDENT. A reduced-amplitude (6 dB) image of the signal of interest will appear to the left of the centerline. The BAND SELECT switch is then operated to the position where the image signal is displaced two major divisions to the left of the centerline. The frequency of the signal of interest can then be read directly from the tuning dial since the correct band has been chosen.

4-3 DETAILED FUNCTIONAL DESCRIPTIONS

4-3.1 Model 809-1 Microwave Tuning Unit (figure 9-9 and 9-7)

As shown in figure 4-1, the major functional elements of the Model 809-1 are the 1st and 2nd IF circuits, the 3rd and 4th IF circuits, and the Video circuits. The detailed block diagram for each of these elements is indicated in figure 4-1. The succeeding subparagraphs provide detailed block diagram descriptions for each of the three major elements. The location (reference designation) of each element is indicated on the detailed block diagrams.

4-3.1.1 1st and 2nd IF Circuits (figure 4-2)

The composite RF signal from the power combiner is supplied through coaxial switch S208 to either the 1st IF mixer (Z201) or to the 2nd IF mixer (Z203). The output of the 1st local oscillator (Y201) is also supplied through switch S208 to either the 1st or 2nd IF mixer. When the BAND SELECT switch is selecting any band except band 2, switch S208 routes the signals to the 1st IF mixer, and the 2nd IF mixer receives the 2.050 GHz 1st IF signal and the 1.79 GHz output of the 2nd local oscillator (Y202). When band 2 is selected, the 1st IF mixer is bypassed, and the 2nd IF mixer receives the RF signal input and the 1st local oscillator output. The signal path from the 2nd local oscillator to the 2nd IF mixer is interrupted.

When band 1, 3, 4, or 5 is selected, the difference frequency output of the 1st IF mixer is applied to bandpass filter FL201, producing the 2.050 GHz 1st IF signal applied to the

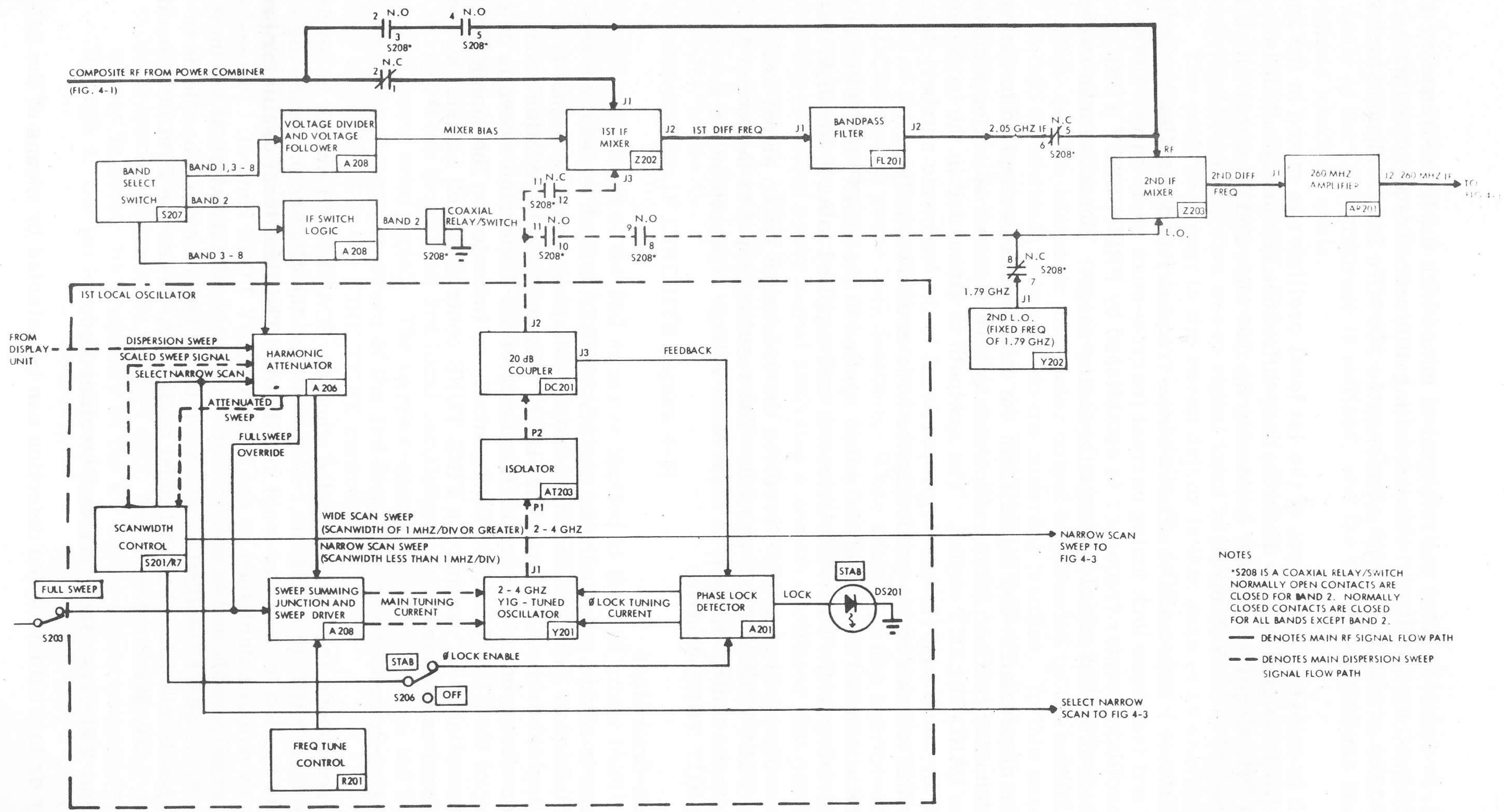


Figure 4-2. 1st and 2nd IF Circuits

2nd IF mixer. The 2.050 GHz 1st IF signal is mixed with the fixed-frequency 1.79 GHz output of the 2nd local oscillator. The resulting difference frequency output is applied through 260 MHz amplifier AR201, producing the 260 MHz 2nd IF signal which is applied to the 3rd and 4th IF circuits.

When band 2 is selected, the output of the 1st local oscillator is mixed in the 2nd IF mixer with the RF signal input. The resulting difference frequency output is applied through 260 MHz Amplifier AR201, producing the 260 MHz 2nd IF signal which is applied to the 3rd and 4th IF circuits.

Oscillator Y201 is a YIG-tuned oscillator whose frequency is controlled by the main tuning current and the phase lock tuning current (narrow-scan mode only). In the wide-scan mode, the oscillator center frequency is established by FREQUENCY TUNE control R201, and the wide-scan sweep signal controls the tuning range. The wide-scan sweep signal is derived as follows:

a. The dispersion sweep signal from the display unit is supplied to the harmonic attenuator (part of A206), which also receives switch selection signals from the BAND SELECT switch. The sawtooth is attenuated in the harmonic attenuator by an amount (inversely proportional to the harmonic number) determined by the selected band, producing the wide-scan sweep signal.

b. The attenuated sweep signal is then applied to the SCANWIDTH switch, scaled according to the scanwidth selected, and supplied to A206 for distribution.

A sweep summing junction on A208 receives the wide-scan sweep signal and the d-c output of the FREQUENCY TUNE control. The resulting input to the sweep driver (which produces the main tuning current) is a sawtooth voltage centered on the d-c voltage from the FREQUENCY TUNE control.

4-3.1.2 Wide-Scan Mode

The wide-scan is always selected when the SCANWIDTH switch is set for a scanwidth of 1 MHz per division or greater. In this mode, the dispersion sweep signal from the display unit is applied to the first local oscillator. Phase-locked operation cannot be selected in the wide-scan mode. The center frequency of the dispersion sweep is determined by the setting of the FREQUENCY TUNE control, as indicated on the tuning dial. Fine tuning is accomplished by varying the FINE TUNE control, which adjusts the frequency of the third local oscillator.

4-3.1.3 Narrow-Scan Mode

The narrow-scan mode is always selected when the SCANWIDTH switch is set for a scanwidth of less than 1 MHz per division. In this mode, the dispersion sweep signal from the display unit is applied to the third local oscillator. The first local oscillator produces a fixed frequency output established by the FREQUENCY TUNE control. Phase-locked operation is normally used, and is selected by setting the STAB switch to the up (on) position. This action causes the first local oscillator to be locked to a harmonic of a 1 MHz reference signal to stabilize the first local oscillator. When the first local oscillator is phase-locked, a STAB indicator lights.

4-3.1.4 Linear and Logarithmic Video Detection Modes

Either linear or logarithmic video detection can be selected by means of the LIN/LOG switch on the Model 809-1. When the linear detection mode is selected, the left-hand scale on the CRT graticule is utilized, and the video amplitude on the CRT is a linear function of signal voltage. When the logarithmic detection mode is selected, the right-hand scale of the CRT graticule is utilized, and the video amplitude is compressed on a logarithmic (decibel) scale.

When the FULL SWEEP/SIG IDENT switch (S203) is set to FULL SWEEP, the FREQUENCY TUNE input to the summing junction, and the harmonic attenuator, are both disabled, and the dispersion sweep signal input is not attenuated in the SCANWIDTH switch. The resulting input to the sweep driver in this case is an unattenuated sawtooth centered on the d-c voltage that corresponds to the 1 GHz center frequency of the 1st local oscillator.

In the narrow-scan mode, the scaled sweep signal from the SCANWIDTH/DIV switch is interrupted, and the harmonic attenuator output is grounded by the select narrow scan signal so that no sawtooth is applied to the summing junction. In this case, the main tuning current is controlled solely by the FREQUENCY TUNE control, and no frequency sweep occurs. If STAB switch S206 is set to the up (on) position, the phase lock detector is enabled.

A sample of the oscillator Y201 output is supplied through isolator AT203 and 20 dB coupler DC201 to the phase lock detector. When enabled in the narrow-scan mode, the phase lock detector compares the phase of the oscillator Y201 output with the phase of the nearest harmonic of a 1 MHz reference oscillator. If the phase relationship is incorrect, the resulting error signal activates a search oscillator that produces a phase lock tuning current. This tuning current produces small changes in the oscillator frequency. When the correct phase relationship is obtained, the search oscillator stops, and the STAB indicator lights to indicate that the 1st local oscillator is phase-locked.

4-3.1.5 3rd and 4th IF CIRCUITS (figure 4-3)

The 260 MHz IF output of the 2nd mixer is applied to the 3rd mixer (A201) which also receives the output of the 3rd local oscillator (A201). In the wide-scan mode, the 3rd local oscillator frequency is established by the FINE TUNE control (S202R1), which is normally set for a frequency of 200 MHz. In this case, the resulting difference frequency is applied to the 60-MHz amplifier-filter (A202) which produces the 60 MHz 3rd IF signal.

In the narrow-scan mode, the 3rd local oscillator is enabled for narrow-scan sweeps by the select narrow scan signal. The narrow-scan sweep signal from the SCANWIDTH/DIV switch causes a dispersion sweep of the 3rd local oscillator, centered on the center frequency established by the FINE TUNE control.

In the full scan/signal identification mode, when the FULL SCAN/SIG IDENT switch is set to SIG IDENT, the following actions occur:

a. For bands 1 through 4, the 3rd local oscillator output frequency is reduced by 2 MHz. For band 5 only, the image decoder logic (A208) causes the frequency to be increased by 2 MHz. The difference between band 5 and the other four bands is caused by the fact that, for band 5, the 1st local oscillator frequency is below the frequency of the RF signal input, whereas for bands 1 through 4, the 1st local oscillator frequency is above the RF input frequency.

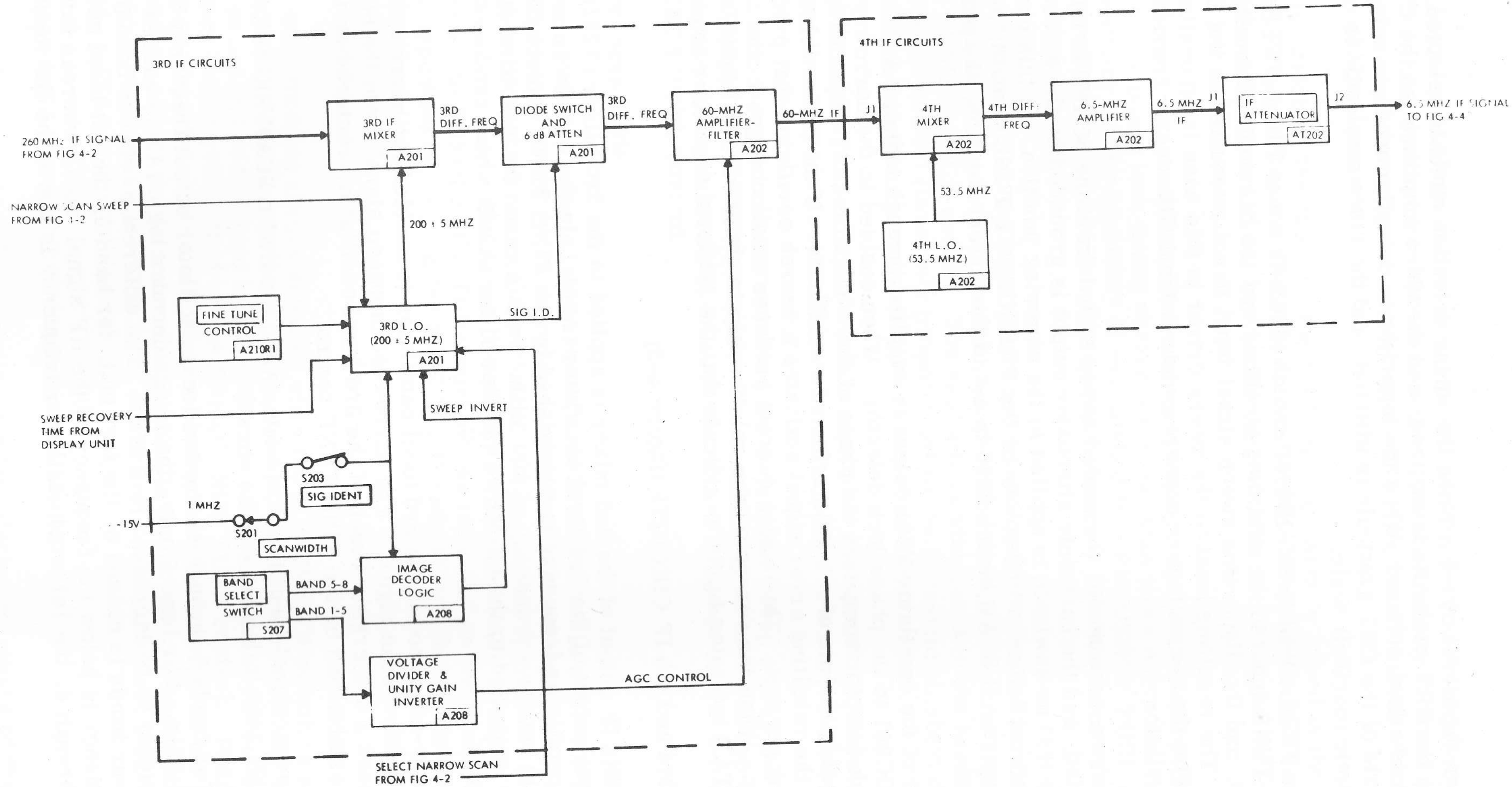


Figure 4-3. 3rd and 4th IF Circuits

b. The diode switch is activated by the SIG IDENT level, causing the 60 MHz output of the 3rd IF mixer to be attenuated by 6 dB. The attenuated output is ultimately used to produce the image signal on the CRT, which is used to identify the frequency band of a signal of interest.

c. After the FULL SCAN/SIG IDENT switch is returned to the center-off position, the SYNC pulse (from the display unit) produced during the next sweep retrace time terminates the 2 MHz shift in the 3rd local oscillator frequency. Also, the diode switch is disabled, removing the 6 dB attenuation of the 3rd IF mixer output.

The 60 MHz amplifier-filter includes an automatic gain control (AGC) circuit (A208) whose reference level depends upon the selected frequency band. The gain is adjusted to compensate for higher conversion loss in mixer number 1.

The 60 MHz output of the 3rd IF circuits is applied to the 4th IF mixer (A202) where it is mixed with the 53.5 MHz output of the 4th local oscillator (A202). The resulting difference frequency output is amplified by the 6.5 MHz amplifier (A202), producing the 6.5 MHz 4th IF signal. The 4th IF signal is applied through an IF attenuator (AT202) to the video circuits. The IF attenuator, controlled by front panel switches, permits up to 41 dB of attenuation to be applied to the IF signal.

4-3.1 6 Video Circuits (figure 4-4)

When BANDWIDTH switch S202 is in any position except AUTO, switch S202 selects the IF bandwidth (1000 kHz, 100 kHz, 10 kHz, 1 kHz, or .3 kHz) of the 4th IF signal. When switch S202 is in the AUTO position, the position of the SCANWIDTH switch selects the bandwidth, assuring that the optimum IF bandwidth is selected in automatic operation. The bandwidth selection lines control the 100 kHz filter (A203), the 6.5 MHz crystal filter (A204), and the video filter (A206).

The 100 kHz filter and the 6.5 MHz crystal filter operate together to select the IF bandwidth of the 6.5 MHz 4th IF signal. Diode switches bypass all filter elements when the 1000 kHz bandwidth is selected. When the 100 kHz bandwidth is selected, diode switches also bypass the filter elements in the 6.5 MHz crystal filter. The 100 kHz filter performs bandpass filtering when the selected bandwidth is 100 kHz or less, and the 6.5 MHz crystal filter performs additional filtering when the selected bandwidth is less than 100 kHz. No filtering is required for the 1000 kHz bandwidth.

The amplified and filtered output of the 6.5 MHz crystal filter is applied to the LIN/LOG amplifier (A205). After four stages of input amplification, a diode switch routes the 6.5 MHz signal to either the linear or the logarithmic amplifier-detector, as determined by the setting of LIN/LOG switch S204. The detected video output of the selected amplifier-detector is supplied through an output amplifier to the video processor.

The video processor contains a video duration circuit and a low-pass video filter. The video duration circuit, controlled by VIDEO DURATION - BW switch S205, is bypassed when switch S205 is in the OFF or 1 kHz position. In the SHORT or LONG position of the switch, the video duration circuit is activated, and provides a selectable delay in the fall time of the displayed signal. When used with narrow pulse signals, this delay has the effect of brightening the display. The SHORT or LONG position is selected for optimum affect.

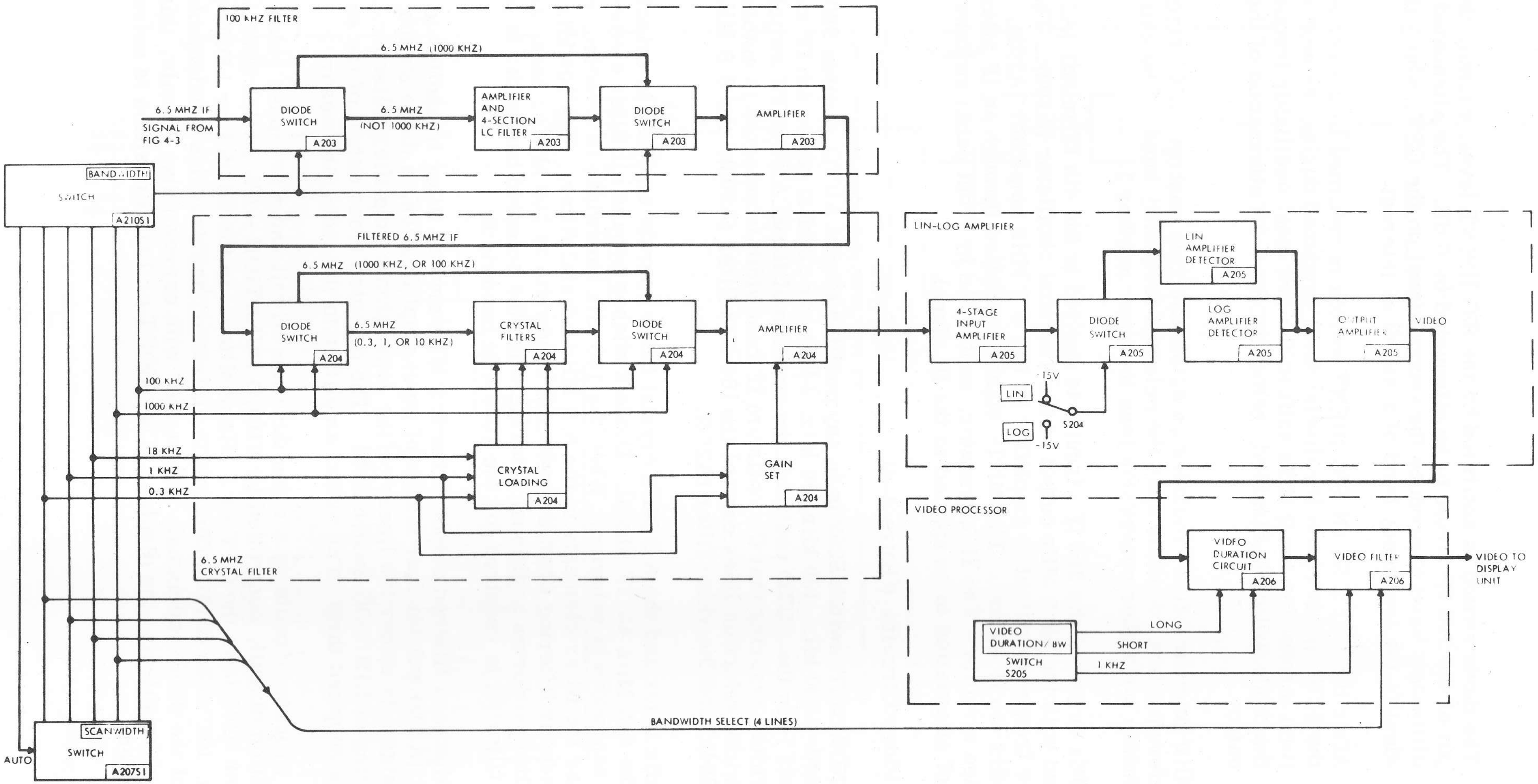


Figure 4-4. Video Circuits

When VIDEO DURATION - BW switch S205 is not in the 1 kHz position, the cut-off frequency of the video filter is determined by the selected IF bandwidth, as follows:

Selected IF Bandwidth	Video Filter Cut-Off Frequency
1000 kHz	None
100 kHz	100 kHz
10 kHz	100 kHz
1 kHz	1 kHz
.3 kHz	1 kHz

When switch S205 is in the 1 kHz position, the video filter cut-off frequency is 1 kHz, regardless of the selected IF bandwidth.

4-3.2 Model 712-1 Standard Persistence Display Unit (figure 9-1)

As shown in figure 4-1, the major elements of the display unit are the power supply circuits, the horizontal sweep circuits, the vertical drive circuits, and the CRT circuits.

4-3.2.1 Power Supply Circuits

A-c power (115 volts or 230 volts) is supplied to the unit via LINE INPUT connector J108 on the rear panel. Fuse F101 provides input power protection. When POWER ON switch S101 is set to ON, power is applied (via 115 VAC/230 VAC switch S103) to stepdown transformer T101. Power supply A101 converts the outputs from the secondary windings of T101 to the d-c voltages required for the operation of all spectrum analyzer modules. The following d-c voltages are produced by the power supply:

a. +12 volts e. -6 volts

b. ±22 volts

c. +70 volts

d. +200 volts

4-3.2.2 Horizontal Sweep Circuits (figure 4-5)

As shown in figure 4-5, the horizontal sweep circuits include the sync circuits and the sweep generator. Except when an external horizontal sweep input is being used, the sync circuits initiate the generation of each sawtooth sweep by the sweep generator.

4-3.2.2.1 Sync Circuits

Sweep synchronization is determined by the SYNC switches, as follows:

a. Video Triggering - When EXT/VIDEO switch S2 on A102 is pressed, and VIDEO TRIG ADJ control R110S1 is switched from the EXT position, the video trigger signal from the vertical drive circuits triggers the sync one-shot (PCB103), producing the sweep start triggers.

b. External Sync - When EXT/VIDEO switch S2 on PCB102 is pressed and VIDEO TRIG ADJ control R110S1 is set to EXT, the external sync input from J103 is applied to a sync amplifier and differentiator A103. The differentiated

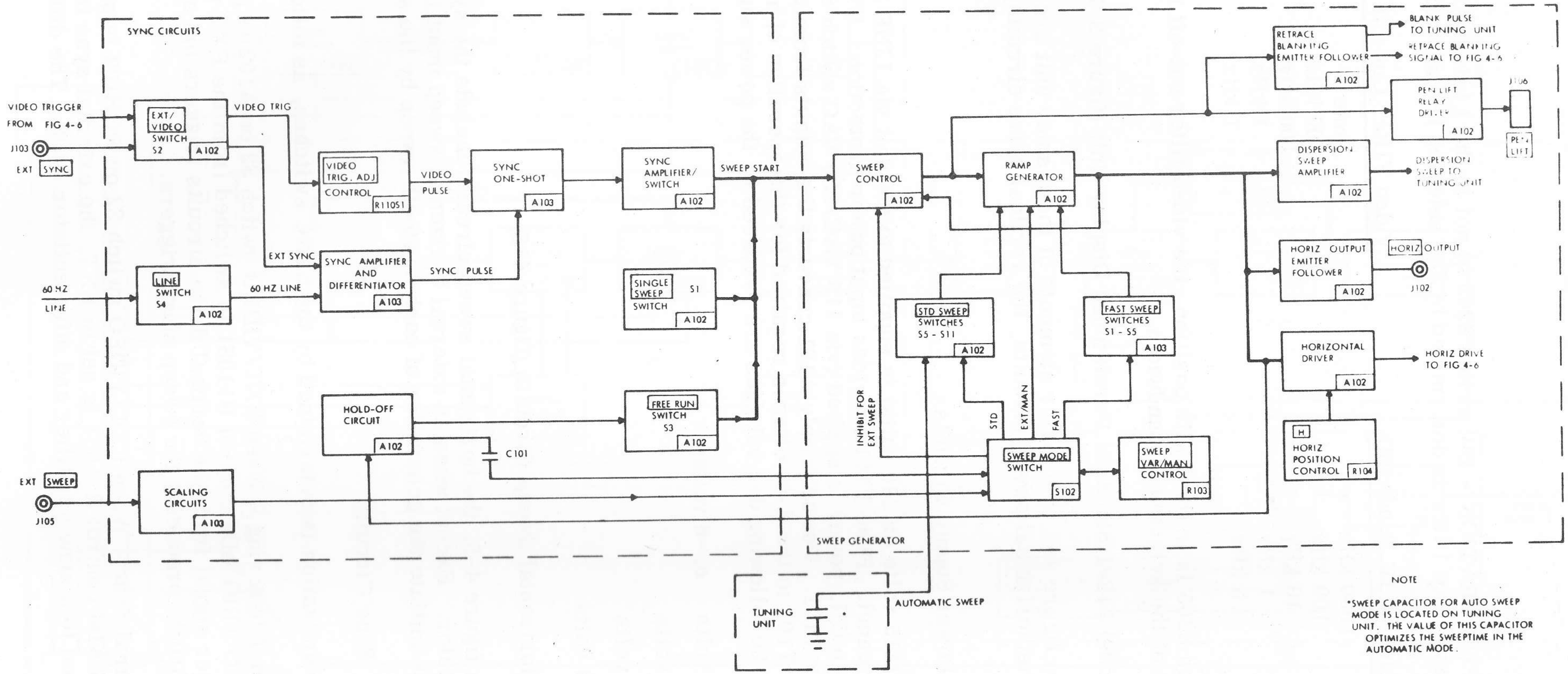


Figure 4-5. Horizonyal Sweep Circuits

pulse output is used to trigger the sync one-shot (A103), producing the sweep start triggers.

c. Line Sync - When LINE switch S4 on A102 is pressed, a 60 Hz signal from transformer T101 is applied to the sync amplifier and differentiator (A103). The resulting differentiated pulses are used to trigger the sync one-shot (A103), producing sweep start triggers at a 60 Hz rate.

d. Single Sweep - Each time SINGLE SWEEP switch S1 on A102 is pressed, a sweep start trigger is produced.

e. Free-Run - When FREE RUN switch S3 on A102 is pressed, the interval between sweep start triggers is controlled by a hold-off circuit (A102) which receives the ramp output of the sweep generator. After each sweep terminates, the hold-off circuit delays the start of the next sweep by a fixed time interval determined by an R-C time constant.

4-3.2.2.2 Sweep Generator

The sweep start trigger from the sync circuits is applied to the sweep control (A102). Each time the sweep control is triggered, a sawtooth sweep by the ramp generator (A102) is initiated. The slope of the sawtooth voltage is determined by the position of SWEEP MODE switch S102. In conjunction with the STD SWEEP (A102) and FAST AWEEP (A103) switches. When the SWEEP MODE switch is set to STD, the sawtooth slope is determined by the capacitor selected by the STD SWEEP switches. When the SWEEP MODE switch is set to FAST, the slope is determined by the capacitor selected by the FAST SWEEP switches.

When the SWEEP MODE switch is set to MAN/EXT HORIZ, the sweep control and ramp generator are disabled, and the sweep sawtooth is a function of the external sweep input to J105, or (if no external sweep input is provided) SWEEP VAR/MAN control R103 (manual sweep mode). When MAN/EXT HORIZ is not selected, SWEEP VAR/MAN control R103 allows the slope of the sawtooth to be varied between the sweep steps selected by the STD SWEEP or FAST SWEEP switches.

When the SWEEP MODE switch is set to STD or FAST, the sweep control terminates each sweep when the sawtooth voltage reaches the voltage that is equivalent to maximum horizontal deflection. Another sweep is generated each time a sweep start trigger is applied to the sweep control. Each time the sweep control terminates the sweep, a retrace blanking signal is produced and supplied to the CRT circuits, and a pen lift relay driver supplies a pen lift pulse to an external device connected to PEN LIFT connector J106.

The sawtooth voltage from the ramp generator is distributed as follows:

a. The dispersion sweep amplifier (A102) supplies the sawtooth (dispersion sweep) to the tuning unit.

b. The horizontal output-emitter follower (A102) supplies the sawtooth to an external device connected to J102.

c. The horizontal driver (A102) supplies the sawtooth horizontal drive) to the CRT circuits.

4-3.2.3 Vertical Drive Circuits (figure 4-6)

Video from the tuning unit is supplied through the emitter followers to the following points:

a. The vertical output amplifier (A102), which supplies the video signal to the CRT circuits.

b. The baseline blanking comparator (A104) in the CRT circuits.

c. The horizontal sweep circuits, for use in sync triggering in the video trigger mode (see paragraph 4-3.2.2.1).

d. An external device connected to J101.

4-3.2.4 CRT Circuits (figure 4-6)

The CRT deflection is controlled by the vertical drive signal from the vertical drive circuits and the horizontal drive signal from the horizontal sweep circuits. A video blanking signal, applied to the CRT by a blanking driver (A104) derived from any of the following sources:

a. At the termination of each horizontal sweep, the horizontal sweep circuits supply a retrace blanking signal to the retrace blanking amplifier (A104).

b. A baseline blanking comparator (A104) blanks the video below a level established by the BASELINE BLANKING control (R111).

c. When the horizontal drive is being provided by an external sweep source, sweep retrace blanking must be provided from an external blanking signal applied to J104. This signal is supplied to the external blanking amplifier (A104).

The high voltages required for CRT operation are supplied by high voltage power supply A105, which produces ±1500-volt outputs. Voltage dividers (A104) and the INTENSITY FOCUS, and ASTIG controls provide voltages required for the various CRT grids. A trace alignment coil, controlled by TRACE ALIGN potentiometer R102, permits any tilt in the horizontal trace to be eliminated.

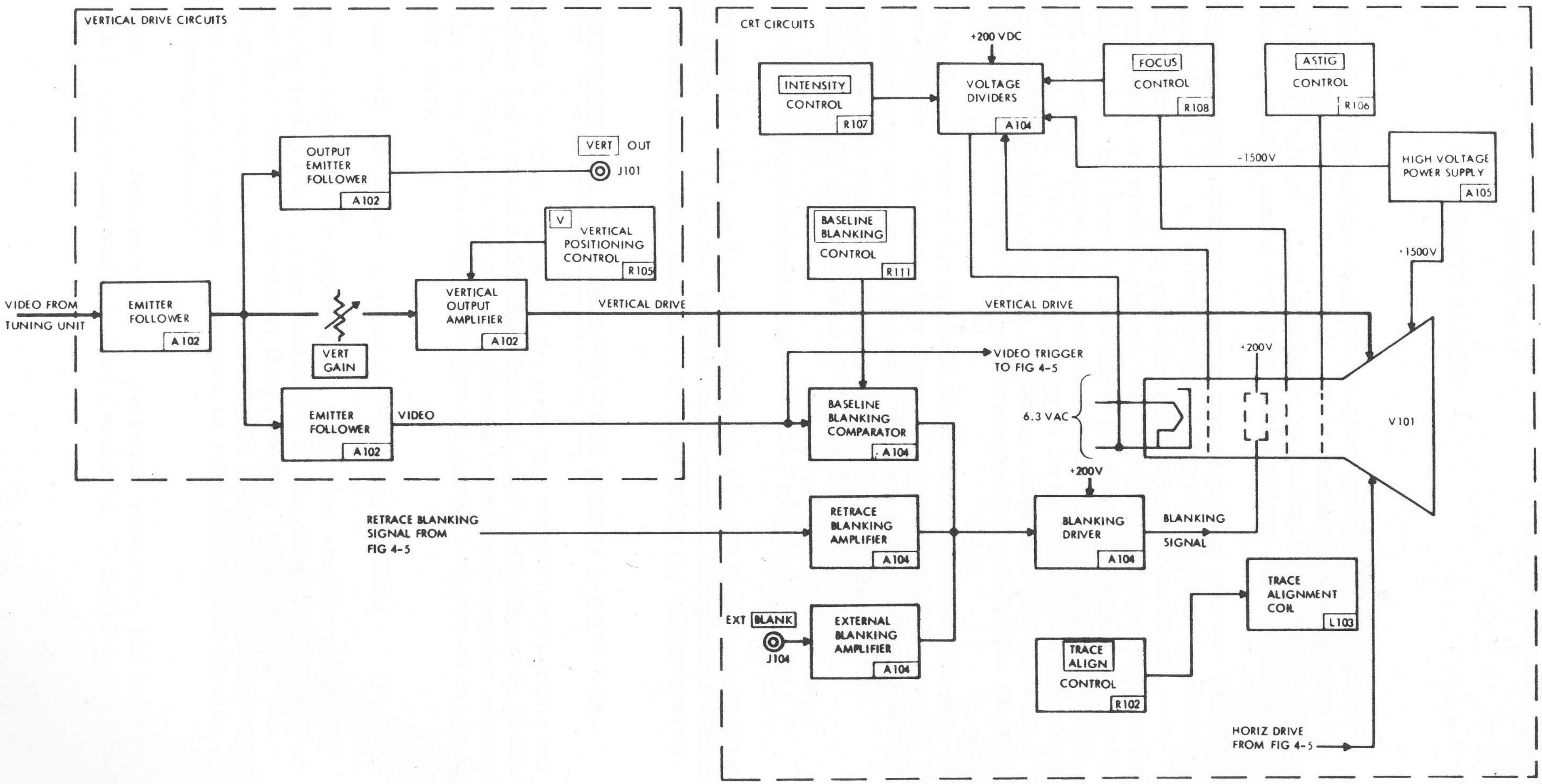


Figure 4-6. Vertical Drive and CRT Circuits

SECTION V

MAINTENANCE

5-1. GENERAL

Maintenance of the Microwave Spectrum Analyzer system includes performance testing, calibration, troubleshooting, and repair. Performance tests (Section VI) and calibrations (Section VII) are normally conducted periodically to assure that the instrument is operating properly, and to verify that calibrations are within limits.

In general, faults in the spectrum analyzer system can be divided into two categories. Degradation faults are indicated by a gradual deterioration in equipment performance. Degradation faults are detected by making periodic performance checks and comparing results with previously-recorded values. Faults of this type may ordinarily be corrected by recalibration, but frequent necessity for recalibration, or inability to achieve calibration, is an indication of a marginal or defective component which should be isolated and replaced. The other category of faults consists of component failures, resulting in an obvious failure of the spectrum analyzer, such as loss of display, loss of frequency scan, or loss of signal between the input and the display.

For degradation faults, an analysis of the specific performance test results or calibration procedure observations which show abnormalities will usually permit localization of the trouble. For component failures, it is usually necessary first to isolate the trouble to the display section or tuning unit section. Final trouble isolation is then accomplished by signal checks in the malfunctioning unit.

5-1.1 Location of Components and Adjustments

The interior views presented in figure 5-1 are marked to identify major assemblies and component assemblies. Each internal adjustment control is designated. These views are useful for repair operations, and also for performing the calibration of Section VII.

5-2. OVERALL CHECKOUT AND TROUBLESHOOTING (figures 5-2 and 5-3)

The performance checks in Section VI provide the principal means for checking out the Model 762-2. Figure 5-2 provides detailed checkout and troubleshooting of the Model 712-2 display unit. Figure 5-3 provides detailed troubleshooting for the Model 809-2 tuning unit. These two troubleshooting diagrams permit isolation of faults to the replaceable module level.

In using figures 5-2 and 5-3, the following general procedure applies:

Step 1. Analyze the symptoms of malfunction to determine whether or not the Model 712-2 display unit can be eliminated as the cause. If the display unit cannot be eliminated, perform the procedure in figure 5-2. Successful completion of the procedure in figure 5-2 without any abnormal indications provides essentially conclusive evidence that the display unit is operating normally.

Step 2. If the display unit is determined to be operating normally, the fault is in the Model 809-2 tuning unit. Before proceeding to figure 5-3, perform the following steps:

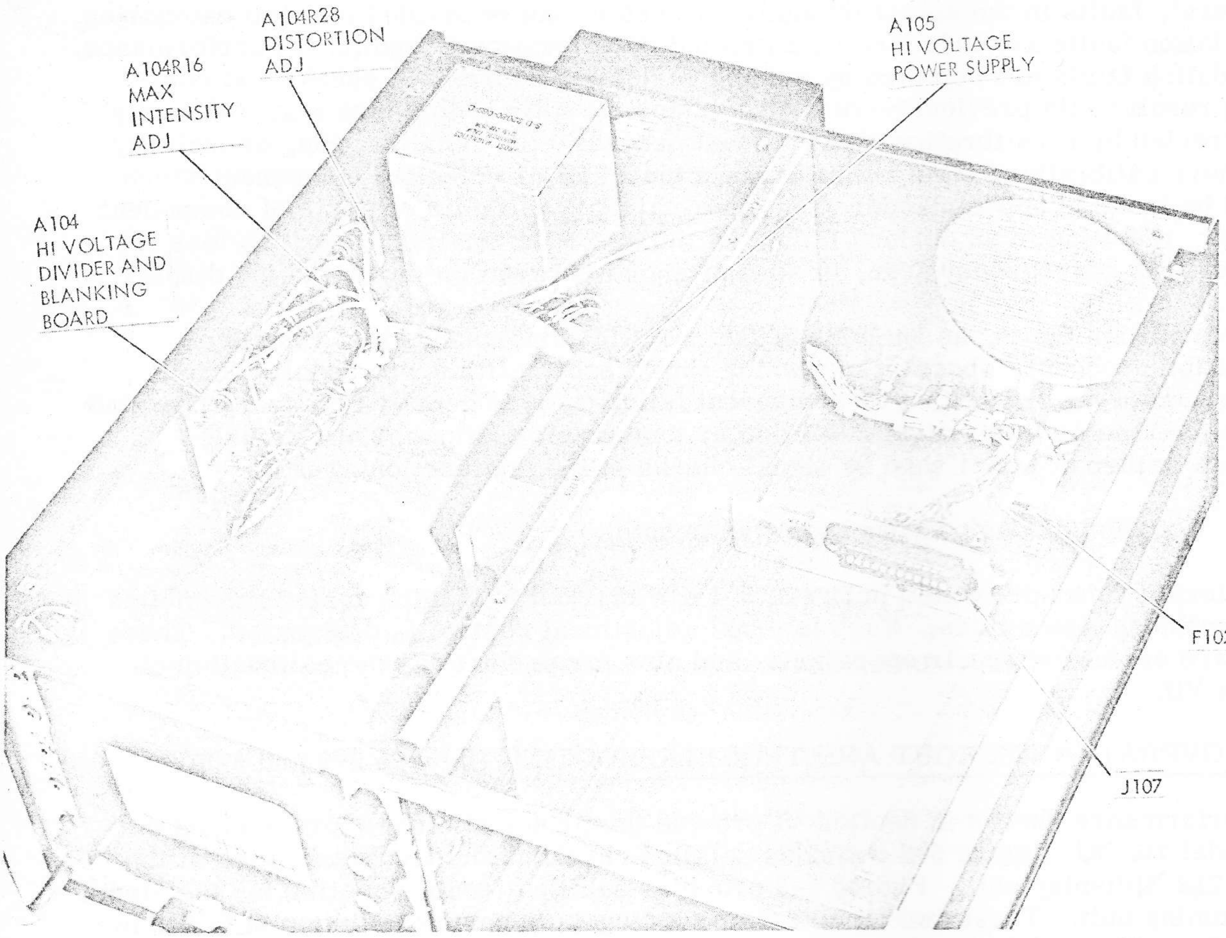


Figure 5-1. Components and Adjustments Location
(Sheet 1)

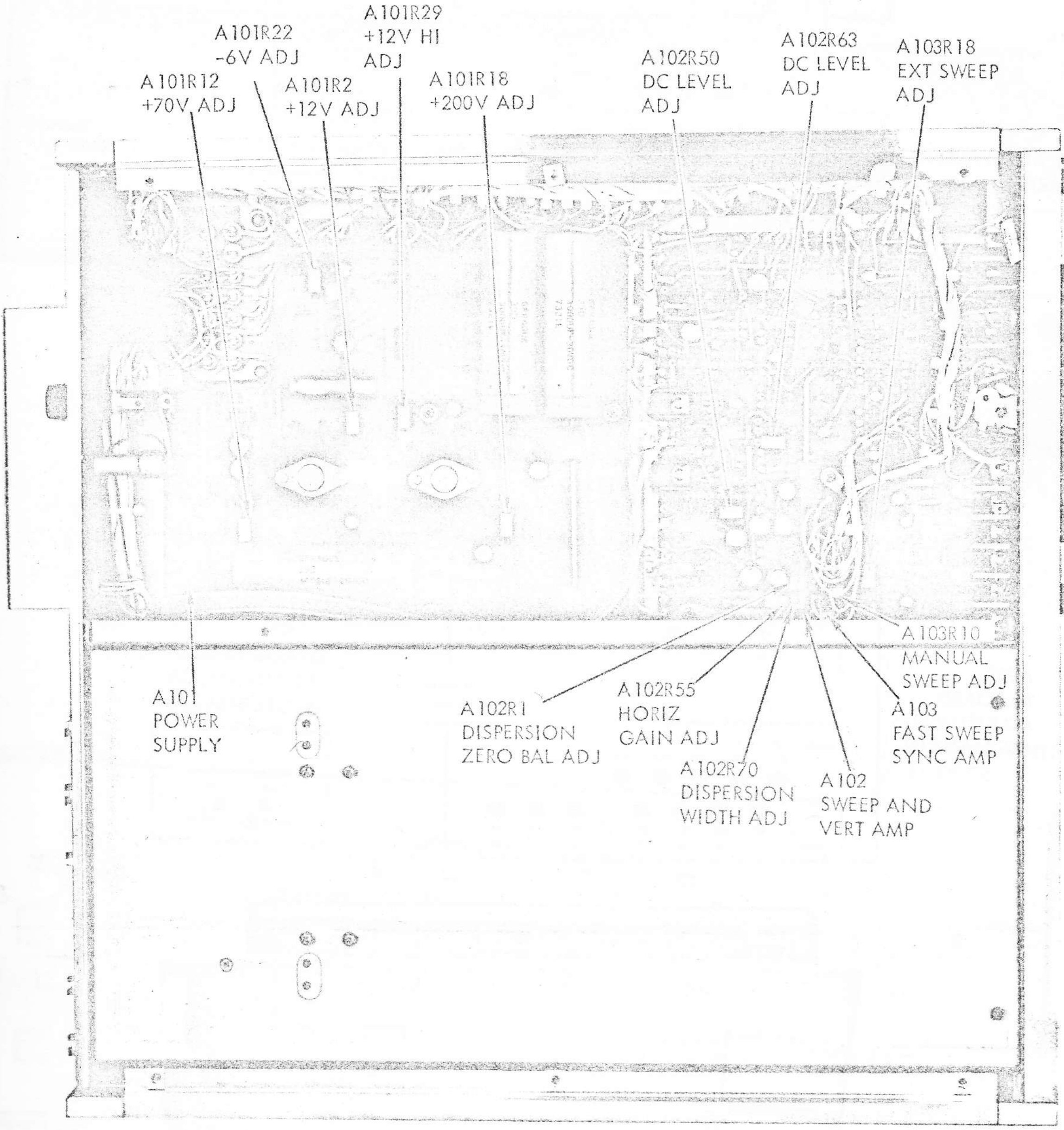
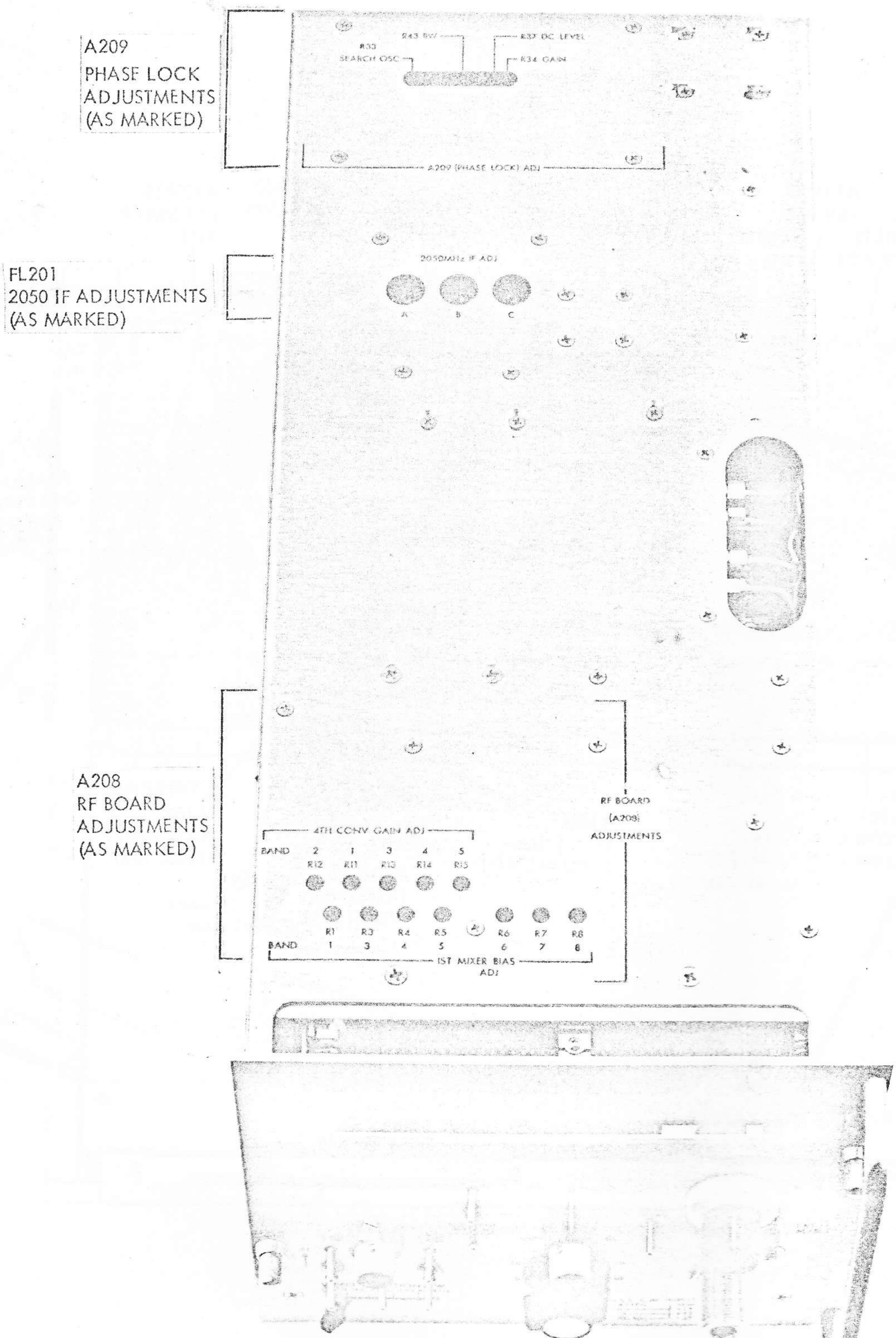
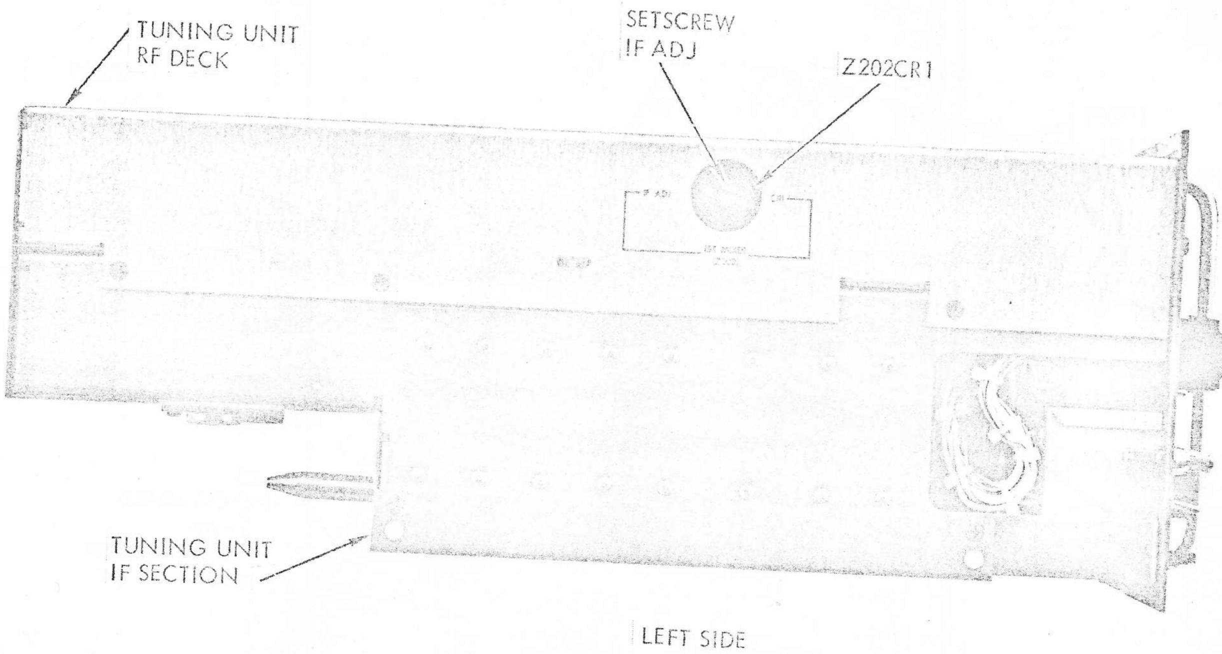


Figure 5-1. Components and Adjustments Location
(Sheet 2)



RF DECK - TOP VIEW

Figure 5-1. Components and Adjustments Location
(Sheet 3)



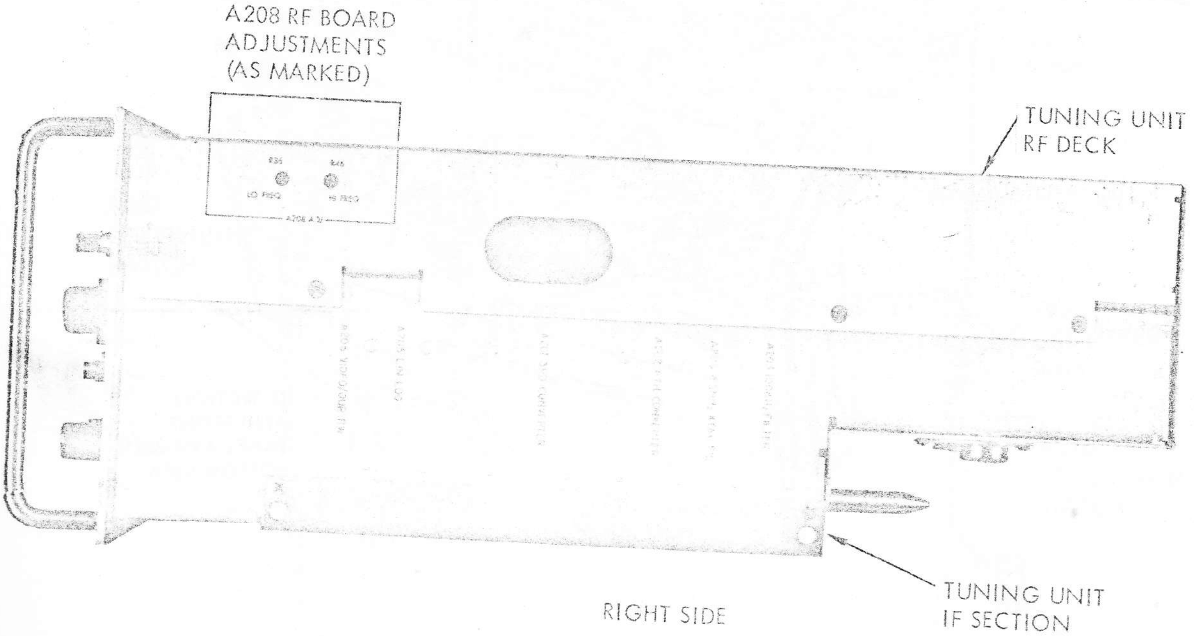


Figure 5-1. Components and Adjustments Location
(Sheet 4)

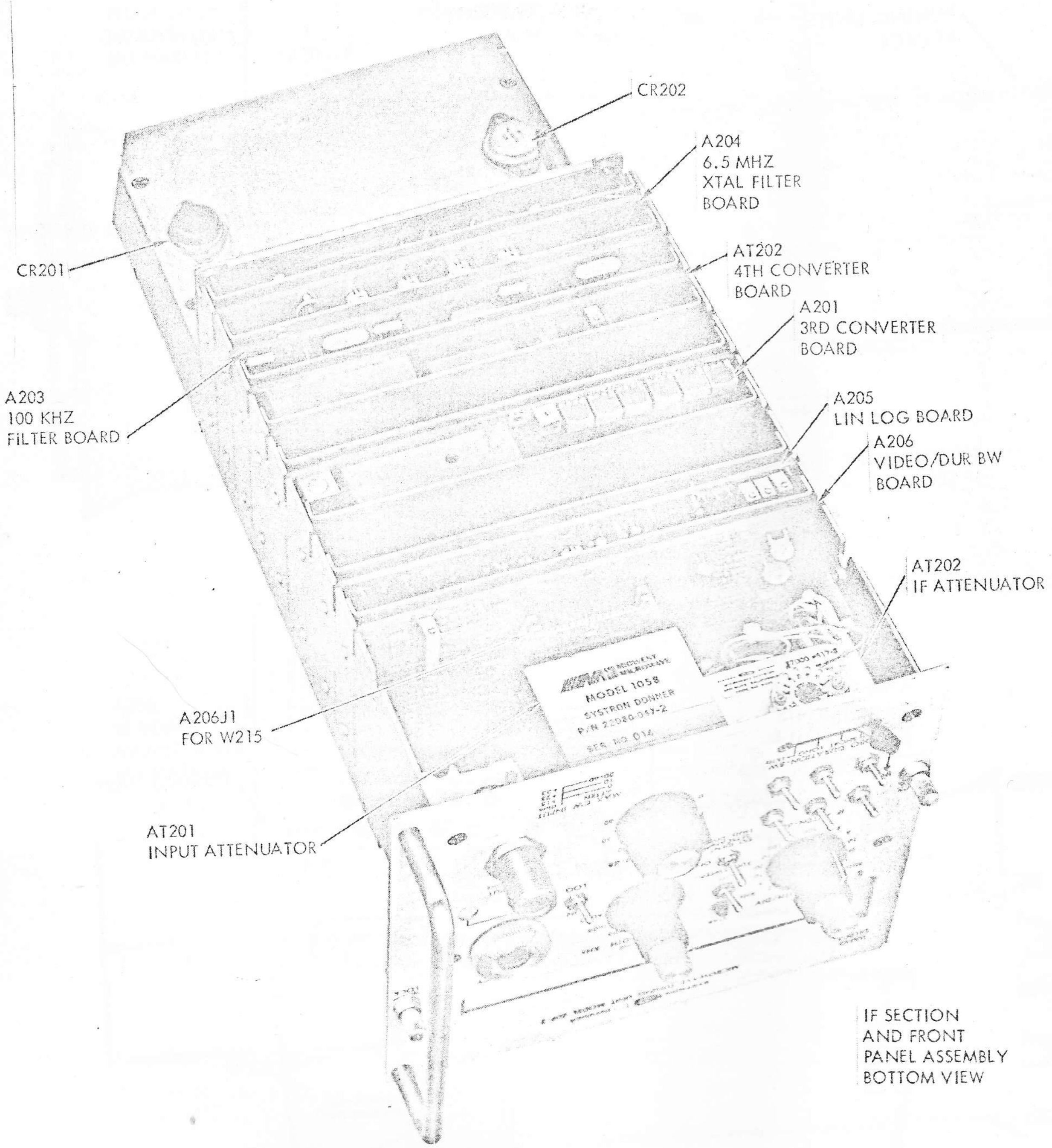


Figure 5-1. Components and Adjustments Location
(Sheet 5)

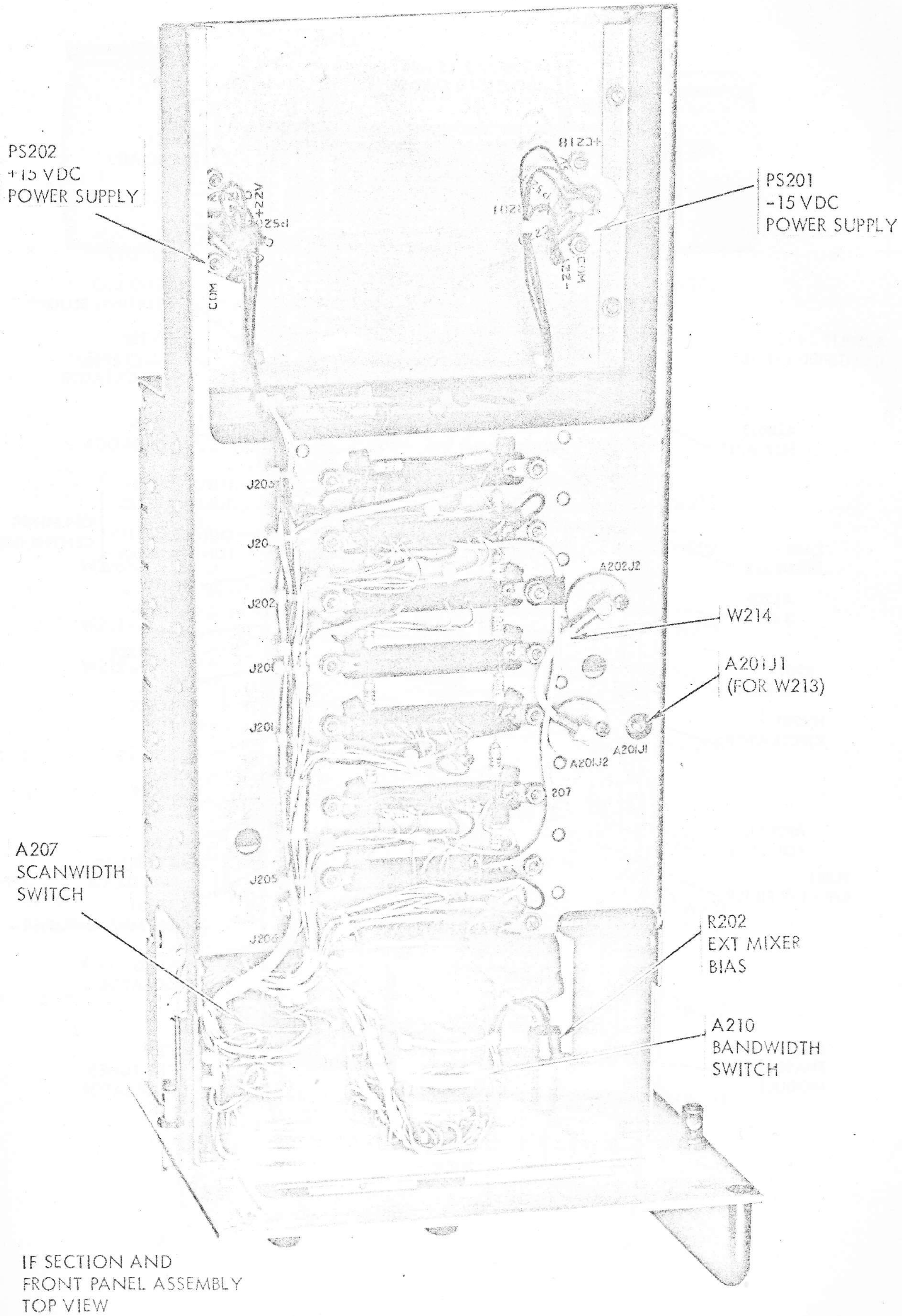


Figure 5-1. Components and Adjustments Location
(Sheet 6)

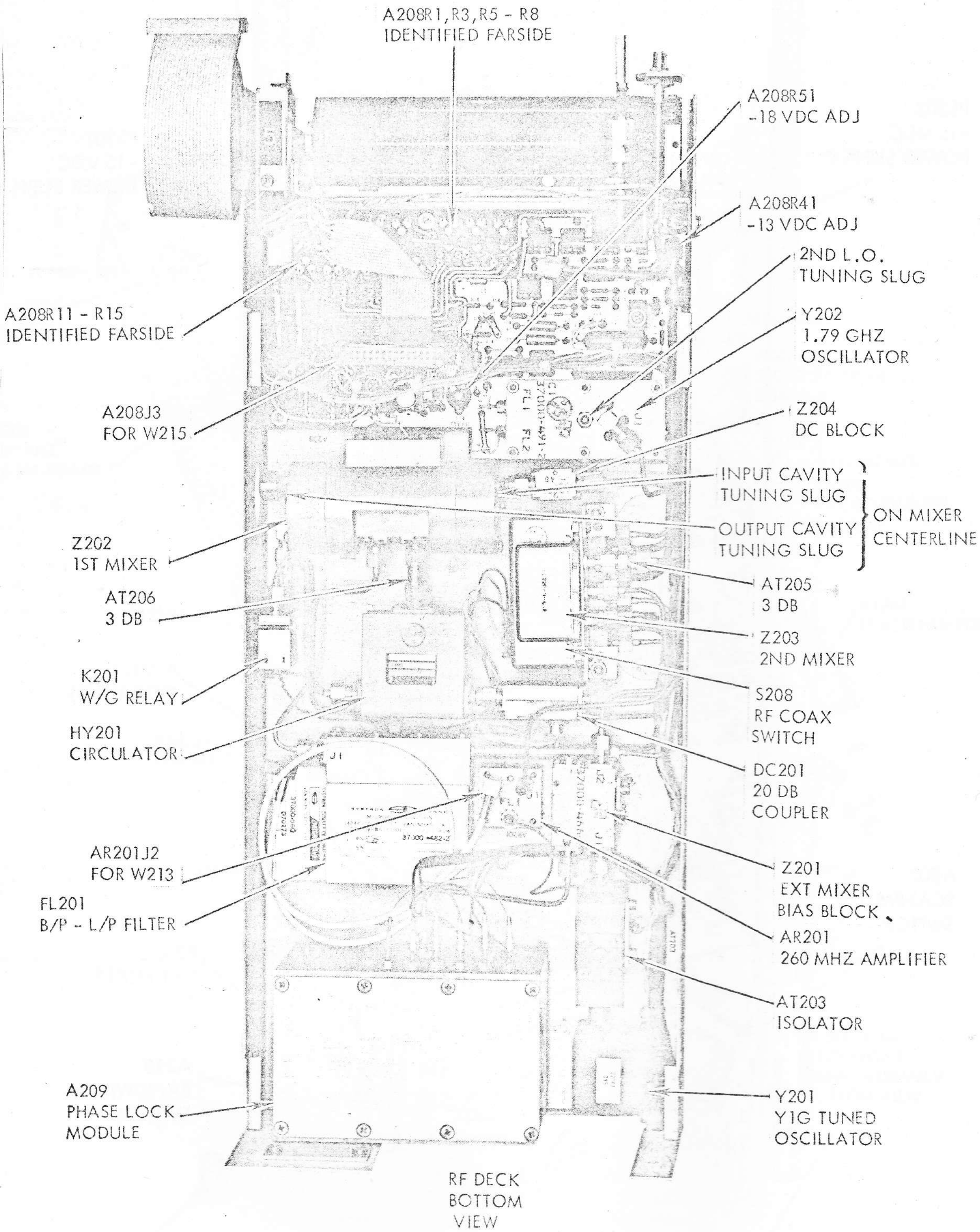


Figure 5-1. Components and Adjustments Location
(Sheet 7)

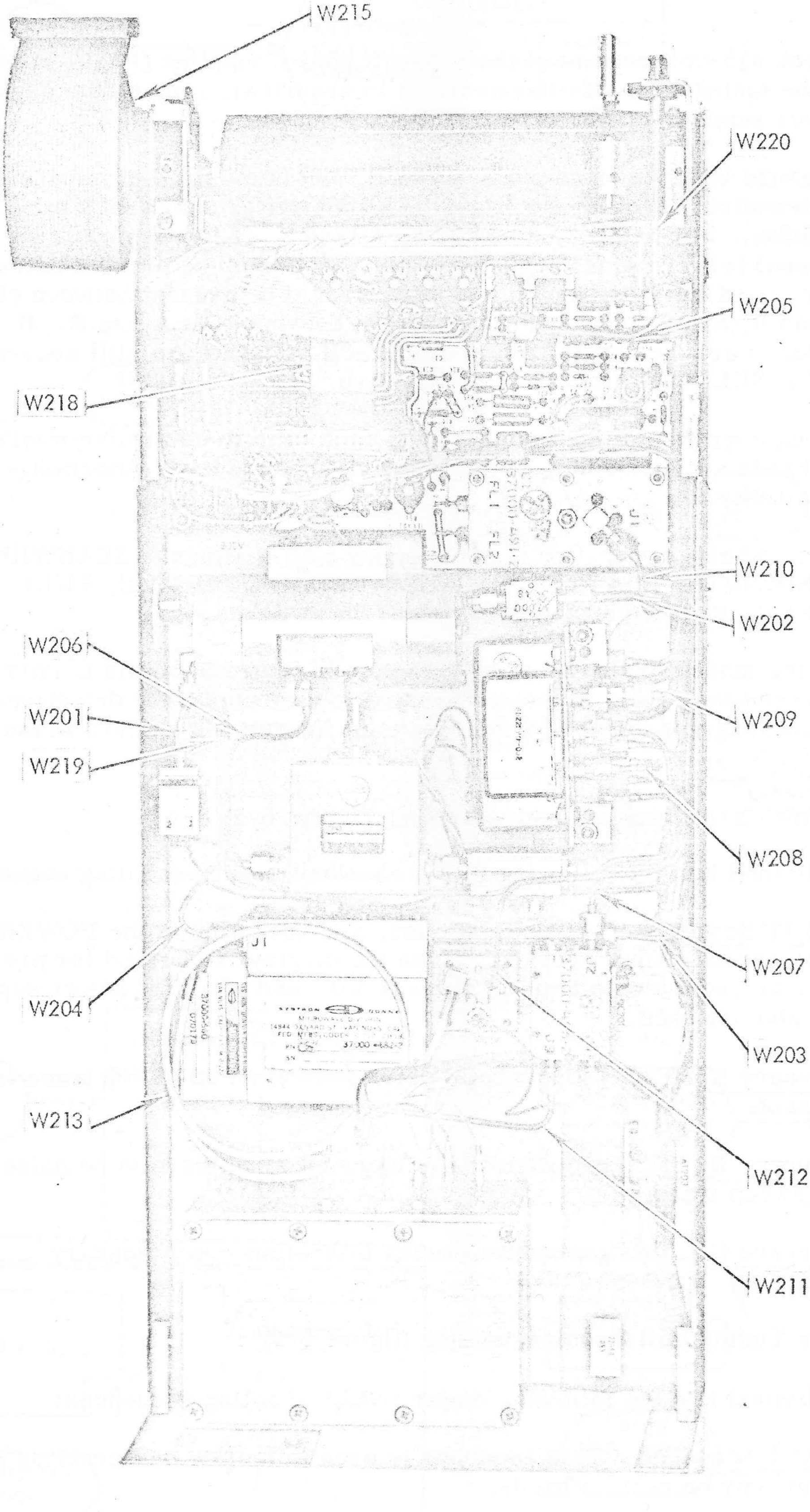


Figure 5-1. Components and Adjustments Location
(Sheet 8)

a. Check ±15-volt outputs of the ±15-volt power supplies (PS201 and PS202) in the tuning unit. If either voltage is abnormal, replace the associated power supply.

b. Measure voltages from pin A to pin B, and from pin C to pin B, of coax switch S208 with the BAND SELECT switch set to each band position. For bands 1, 3, 4, 5, 6, 7, and 8, +22 volts should be present between pins A and B, and 0 volts should be present between pins C and B. For band 2, +22 volts should be present between pins C and B, and 0 volts should be present between pins A and B. If voltages are abnormal, replace A208. If voltages are still abnormal, BAND SELECT switch S207 is defective.

c. Check operation of the tuning unit in each band to determine whether all bands are abnormal, or if only certain bands have abnormally low sensitivity.

d. Check whether operation is abnormal for all settings of SCANWIDTH, BANDWIDTH, IF ATTEN, LIN/LOG, VIDEO DURATION, FULL SWEEP/SIG IDENT, and INPUT ATTEN switches.

If replacement of the module indicated to be defective in figure 5-3 fails to correct the malfunction, check the cables to the module that is indicated to be defective. The succeeding subparagraphs describe the checks in figures 5-2 and 5-3 in more detail.

5-2.1 Display Unit Checkout and Troubleshooting (figure 5-2)

This diagram is divided into the following major checkout/troubleshooting sequences:

a. <u>START Sequence.</u> Power is applied, and operation of the POWER ON indicator and fan is checked. Then the display is checked for presence of noise and a sweep trace. The ±22 VDC and +70 VDC power supplies are also checked.

b. <u>Sequence A.</u> This procedure is performed when no sweep trace is present.

c. <u>Sequence B.</u> This procedure is performed when there is no noise on the sweep trace.

d. <u>Sequence C.</u> This procedure checks miscellaneous secondary functions.

5-2.2 Microwave Tuning Unit Troubleshooting (figure 5-3)

This diagram is divided into the following major troubleshooting sequences:

a. <u>START Sequence.</u> This sequence is used to isolate malfunctions that occur only on certain bands.

b. <u>Sequence A.</u> If all bands are abnormal, this sequence is used to determine whether the fault is present in all operating modes and switch positions. If the fault is present in all operating modes and switch positions, the 1st local oscillator output is checked to determine whether or not the fault is in the 1st local oscillator circuits.

c. Sequence B. This sequence is used to isolate faults in the 1st local oscillator circuits.

d. Sequence C. When the 1st local oscillator output is normal, this sequence is used to determine whether the fault is in the RF deck or in the IF and video circuits. If the fault is in the RF deck, detailed troubleshooting isolates the defective module.

e. Sequence D. This sequence is used to isolate faults in the IF and video circuits.

f. Sequence E. This sequence is used to isolate faults that occur only in certain modes, or in certain positions of the SCANWIDTH, BANDWIDTH, INPUT ATTEN, IF ATTEN, and VIDEO DURATION switches.

NOTE

Measurement of average noise level with a signal injected at various points in the tuning unit is used extensively in figure 5-3 to isolate malfunctions. Refer to paragraph 5-3 for the general procedure for measuring average noise level.

5-3. GENERAL PROCEDURE FOR MEASURING AVERAGE NOISE LEVEL

Measurement of average noise level is one of the principal techniques for fault isolation in the tuning unit. To perform this test, the RF/IF signal path at some point in the tuning unit is interrupted, and a signal generator is connected to the point where the path was interrupted. The frequency of the signal generator output depends upon the point of connection, and corresponds to the frequency normally present at that point. The signal generator output level is then adjusted until the resulting level on the CRT is 20 dB above the average noise level present when the signal generator output is zero The adjusted signal generator output level is then recorded from the output level meter of the signal generator. The average noise level in dBm is then obtained by subtracting 20 dB from the signal generator level previously recorded. The procedure is as follows:

Step 1. Make the following preliminary control settings:

Control	Setting
SWEEP MODE	STD
STD SWEEP	10 msec/DIV
SYNC	FREE RUN
BASELINE BLANKING	OFF
BANDWIDTH - KHz	100
SCANWIDTH/DIV	100 kHz
LIN/LOG	LOG
STAB	OFF
FULL SWEEP/SIG IDENT	OFF
VIDEO DURATION - BW	1 KHz
IF ATTEN	None (all switches down)

Step 2. Connect the signal generator to the point of test, and set up the signal generator for the frequency which corresponds to the intermediate frequency normally present at the point of test.

Step 3. With zero signal output from the signal generator, observe the CRT display, and note the level (in dB) which corresponds to the average noise level.

Step 4. Adjust the signal generator output level until the horizontal line procuced on the CRT display by the signal generator output is exactly 20 dB above the average noise level noted in step 3.

Step 5. Read and record the signal generator output level, as indicated on the output level meter of the signal generator.

Step 6. Subtract 20 dB from the output level recorded in step 5 to obtain the average noise level. For example, if the output level recorded in step 5 is -95 dBm, the average noise level is -95 dBm -20 dB = -115 dBm.

5-4. DETAILED TROUBLESHOOTING OF REPLACEABLE MODULES

After locating the defective module using the procedures in figures 5-2 and 5-3, the malfunctioning module is normally removed and replaced. In some cases, it may be necessary to isolate, remove, and replace the defective part on printed circuit boards. The following data is provided to aid in isolating faults to the defective part on printed circuit boards:

a. The detailed theory descriptions in Section IV, supported by detailed block diagrams.

b. The schematic diagram in Section IX, with supporting voltage data and waveforms.

c. The calibration procedures for individual modules, provided in Section VII. These procedures can be used in the same manner as a test procedure for an individual circuit board.

The following modules are considered non-repairable at the field level:

a. A105
b. A209
c. ~~Z201~~
d. Z202 (except for diode CR1 - see paragraph 5-7)
e. Z203
f. Z204
g. Y201
h. A208Y202
i. ~~HY201~~
j. S208
k. ~~K201~~
l. AT201
m. AT203

n. AT205
o. AT206
p. FL201
q. AR201
r. DC201
s. A209
t. PS201
u. PS202

5-5. REPAIR AND REPLACEMENT

The schematic diagrams in Section IX include parts location information for each component assembly and circuit board assembly. Complete replacement parts information is given in the parts list, Section VIII.

If repair assistance is required, contact the factory:

Sales Manager, Microwave Division
Systron Donner Corporation
14844 Oxnard Street
Van Nuys, California 91409
Telephone (213) 786-1760

Be sure to include the equipment model number and serial number in all communications.

5-5.1 Replacement of First Mixer Diode

The input mixer diode is suceptible to damage from input signal overloads. Replace a damaged diode as follows:

(a) Remove ~~timing~~ tuning unit from display unit.

(b) Unscrew the diode cap, accessible through the left side panel opening (see figure 5-1).

(c) Remove and replace diode (Z202CR1).

(d) Install diode cap.

NOTE

It is advisable to conduct a performance check of the unit after replacing input mixer diode, followed by the indicated adjustments if required.

SECTION VI

PERFORMANCE CHECKS

6-1. INTRODUCTION

This section contains the performance check procedures listed in Table 6-1.

Table 6-1. Performance Checks

Paragraph No.		Specification Reference Item (Table 1-1)
6-3	Functional Check	5, 10, 12, 20, 26
6-4	Residual Responses	22
6-5	Tuning Accuracy	3
6-6	Local Oscillator Stability	6
6-7	Scanwidth Accuracy	8
6-8	Resolution Accuracy, Optimum Resolution	14, 15
6-9	Amplitude Display Accuracy	18
6-10	Input Attenuation Accuracy	24
6-11	IF Attenuation Accuracy	25
6-12	Dynamic Range	21
6-13	Sensitivity	16
6-14	Frequency Response	17

These performance checks verify that the instrument meets the applicable performance specifications in Table 1-1. Performance Check Record Forms, containing blanks for entering actual performance measurements are included at the end of this section The blank forms should be duplicated, so that a new record can be made each time performance checks are conducted. Comparisons of these records will reveal any significant changes in performance which may indicate potential malfunctions or need for re-calibration of the instrument. Failure to meet performance specifications limits listed on the forms indicates a need for corrective action.

6-2. EQUIPMENT REQUIRED

Items of test equipment required to conduct performance checks are listed in Table 6-2.

Table 6-2. Performance Check Test Equipment

Item			Recommended Type*
1	Comb Generator	1, 10, 100 MHz	H.P. 6406A
2	Low Pass Filter	1.8 GHz	KNL Microwave 5L380-1800-0
3	Calibrated Signal Generators	400 MHz and 410 MHz	HP 608E
4	Leveled Sweeper	0.01 - 12 GHz	Various

*Equipment having equivalent characteristics may be substituted.

6-3. FUNCTIONAL CHECK

6-3.1 Description

Display is set up with no external signal, using V and TRACE ALIGN controls. With signal from comb generator, display is adjusted, using H, ASTIG, FOCUS, and VERT GAIN (rear panel) controls. Various displays, synchronization, sweep, and video capabilities are checked.

6-3.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	3 msec/DIV
SWEEP VAR/MAN	CAL
BASELINE BLANKING	OFF
BAND SELECT	1
INPUT ATTEN-dB	0
IF ATTEN - dB	30
VIDEO DURATION - BW	OFF
LIN/LOG	LOG
STAB/OFF	OFF
SIG IDENT FULL SWEEP	OFF
SCANWIDTH/DIV	100 kHz
BANDWIDTH KHz	1

6-3.3 Procedure

(1) Display Setup

(a) Adjust INTENSITY control for nominal visibility. Then adjust V control to position sweep trace exactly on bottom graticule division line. Adjust TRACE ALIGN control to align sweep trace parallel with horizontal line.

(b) Connect comb generator (1, table 6-2) and 1.8 GHz low pass filter (2, table 6-2) to RF INPUT as shown in figure 6-1. Set comb generator for 100 MHz, full amplitude.

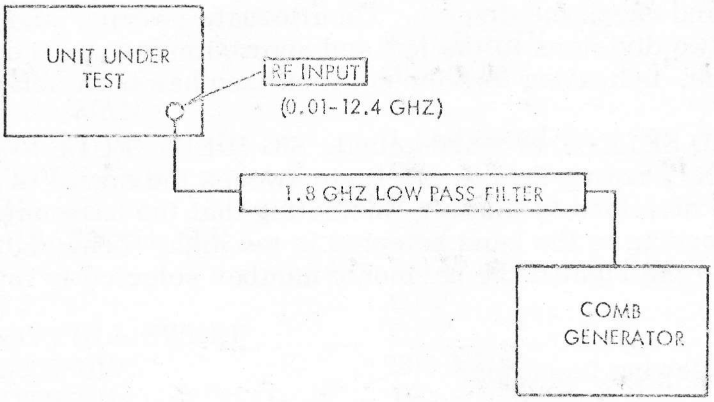


Figure 6-1. Performance Checks with Comb Generator

(c) Set controls as follows:

Control	Setting
SIG IDENT FULL SWEEP	FULL SWEEP
BANDWIDTH KHz	1000
SCANWIDTH/SCAN WITH DIV.	Any position in MHz range

(d) Observe that in full sweep mode the full comb is displayed. Set SIG IDENT/FULL SWEEP to OFF, SCANWIDTH DIV to 1 MHz. Select a line in the comb and continue to observe this line during the next operations. Use FREQUENCY TUNE to center the selected line.

(e) Set SCANWIDTH/DIV to 200 MHz and use H control as necessary to re-center the selected line.

(f) Set BANDWIDTH KHZ to 100, SCANWIDTH/DIV to 100 kHz, use ASTIG and FOCUS controls together to obtain sharpest possible display.

(2) Vertical Gain (rear-panel control)

(a) With 100 MHz full amplitude signal from comb generator, set STD SWEEP to 10 msec/DIV, SCANWIDTH/DIV to 20 KHz, BANDWIDTH- KHz to 10. IF ATTEN-dB to 0. INPUT ATTEN-dB to 10, VIDEO DURATION-BW to 1 kHz. Select convenient comb response using FREQUENCY TUNE and/or FINE TUNE controls.

(b) Use INPUT ATTEN-dB to add 30 to 40 dB attenuation, and note that signal level decreases in 10 dB steps as attenuation is increased.

(c) Adjust VERT GAIN rear panel control to obtain even 10 dB steps as attenuation is applied.

(3) Signal Identified

(a) Set SCANWIDTH DIV to 1 MHz, BANDWIDTH KHZ to 100, and center the display. Then actuate SIG IDENT/FULL SWEEP to SIG IDENT and check the display. On alternate sweeps, signal will appear two divisions to the left and approximately 6 dB down in amplitude, indicating that the correct band has been selected.

(b) Set BAND SELECT to 3 and actuate SIG IDENT/FULL SWEEP to SIG IDENT, noting that on alternate sweeps the signal is now more than two divisions to the left, indicating that the harmonic number corresponding to the band selected is too high. (The signal will appear to the right if the harmonic number selected is in the + range.)

(4) Check the following functions:

(a) Rotate BASELINE BLANKING control and note that at least the lower half of the display can be blanked.

(b) Rotate GRAT ILLUM control and note that edge-lighted markings are intensified.

(c) Place VIDEO DURATION - BW control to 1 kHz and note that noise in the display is smoothed.

(d) Actuate STD SWEEP pushbuttons 3, 1, .3, and .1 sec/DIV, and 30, 10, 3 msec/DIV, and note that sweep rate changes accordingly.

(e) Activate SYNC pushbutton to LINE and note that sweep is controlled by 60 Hz power line frequency.

(f) Actuate SYNC pushbutton to EXT/VIDEO, VIDEO TRIG ADJ to EXT, and push SINGLE SWEEP pushbutton, noting that a single sweep is produced.

(g) Place SWEEP MODE to MAN/EXT HORIZ and rotate SWEEP VAR/MAN control counterclockwise from the CAL position to run the spot across the CRT. Return to CAL.

(h) Place SWEEP MODE to FAST. This position generates an amplitude-versus-time display of a signal.

(i) Advance VIDEO TRIG ADJ control clockwise and note that sweep triggering occurs at some position of the control.

6-4. RESIDUAL RESPONSES

6-4.1 Description

Instrument is swept through full local oscillator range and checked for residual responses with full input attenuation.

6-4.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	3 sec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	1 and noted
INPUT ATTEN - dB	60
IF ATTEN - dB	0
VIDEO DURATION - BW	OFF
LIN/LOG	LOG
STAB/OFF	OFF
SIG IDENT/FULL SWEEP	OFF
SCANWIDTH/DIV	200 MHz
BANDWIDTH KHz	10
FREQUENCY TUNE	1.0 GHz

6-4.3 Procedure

(1) Observe display for responses. There shall be no response above the 60 dB line on the right hand (LOG) scale (-90 dBm).

(2) Set BAND SELECT to 2 and repeat step 1.

6-5. TUNING ACCURACY

6-5.1 Description

The signal from a comb generator is tuned across screen, and deviation between graticule reading and frequency dial reading is noted.

6-5.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	10 msec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	0
IF ATTEN - dB	20
VIDEO DURATION	OFF
LIN/LOG	LOG
STAB/OFF	OFF
SIG IDENT/FULL SWEEP	OFF
SCANWIDTH/DIV	5 MHz
BANDWIDTH KHz	100

6-5.3 Procedure

(1) Connect comb generator (1, table 6-2) and low pass filter (2, table 6-2) to RF INPUT as shown in figure 6-1. Select 100 MHz signal and adjust amplitude to full on.

(2) Adjust FREQUENCY TUNE control to center zero beat signal on screen, and position outside scale of control to align zero with index mark on knob.

(3) Advance FREQUENCY TUNE control from 0.2 to 1.8 GHz in 200 MHz increments (exactly one turn) and observe translation of markers to the left. Record frequency error of the respective marker as indicated on display.

(4) Frequency error shall not exceed ±(~~2 MHz~~ ±1% of dial reading) ~~at~~ ±5 MHz at each position (see record form).

6-6. LOCAL OSCILLATOR STABILITY

6-6.1 Description

A 1.0 GHz signal from a comb generator is displayed screen center. FM stability is measured by observing peak deviation between sweeps.

6-6.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	3 msec/DIV
SWEEP VAR MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	0
IF ATTEN - dB	Adj. for full scale display
VIDEO DURATION - BW	OFF
LIN/LOG	LIN
STAB/OFF	STAB
SIG IDENT/FULL SWEEP	OFF
FREQUENCY TUNE	1.0 GHz
BANDWIDTH KHz	AUTO
SCANWIDTH/DIV	500 KHz and noted

6-6.3 Procedure

(1) Connect comb generator (1, table 6-2) as shown in figure 6-1. Set for 100 MHz, adjust level for full on.

(2) Decrease SCANWIDTH/DIV setting to 1 KHz/DIV, using FINE TUNE control to keep signal centered on screen.

(3) Check the frequency scale for peak deviation of the trace between sweeps. Peak deviation shall not exceed 150 Hz (0.15 division on frequency scale).

6-7. SCANWIDTH ACCURACY

6-7.1 Description

A comb generator is used to check each scanwidth setting by comparing the number of responses displayed with requirements.

6-7.2 Preliminary Control Settings

Control	Setting
SYNC	STD
STD SWEEP	10 msec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	0
IF ATTEN - dB	20
VIDEO DURATION - BW	OFF
LIN/LOG	LOG
STAB/OFF	OFF
SIG IDENT/FULL SWEEP	OFF
SCANWIDTH/DIV	100 MHz and noted
BANDWIDTH KHz	AUTO

6-7.3 Procedure

(1) General

(a) Connect comb generator (1, table 6-2), and 1.8 GHz low pass filter (2, table 6-2) to RF INPUT (see figure 6-1).

(b) With comb generator set to indicated frequency, adjust FREQUENCY TUNE and/or FINE TUNE to position a vertical response on extreme left graticule marking.

(c) Record the number of vertical responses displayed. Vertical responses shall number 10 to 12 in each instance.

(2) Operate analyzer and comb generator at the following settings, observing the results:

SCANWIDTH/DIV	Comb Generator
100 MHz	100 MHz
10 MHz	10 MHz
1 MHz	1 MHz

6-8. RESOLUTION ACCURACY, OPTIMUM RESOLUTION

6-8.1 Description

A signal is displayed at 3 IF bandwidth settings, and the display width is checked against specifications at 3 dB and 60 dB down from peak. With sweep rate and bandwidth controls set on AUTOMATIC, the bandwidth is checked at various dispersions for an appropriate display.

Preliminary Control Setting

Control	Setting
SYNC	FREE RUN
STD SWEEP	10 msec/DIV and noted
SWEEP VAR/MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	0
IF ATTEN - dB	10
VIDEO DURATION - BW	1 KHz and noted
LIN/LOG	LOG
STAB/OFF	STAB
SIG IDENT/FULL SWEEP	OFF
FREQUENCY TUNE	0.400 GHz
SCANWIDTH DIV	noted
BANDWIDTH KHz	noted

6-8.2 Procedure

6-8.3 (1) General

(a) Connect calibrated signal generator (3, table 6-2) to RF INPUT (see figure 6-2), and set for 400 MHz.

(b) With indicated settings of analyzer, adjust signal level in each instance from -20 dBm output level to obtain signal peak near full scale. Check the display. At 3 dB down from peak, width of display shall be 0.4 to 0.6 division (±20%). At 60 dB down from peak, width of display shall be equal to or less than 10 divisions (20 times the width at 3 dB down).

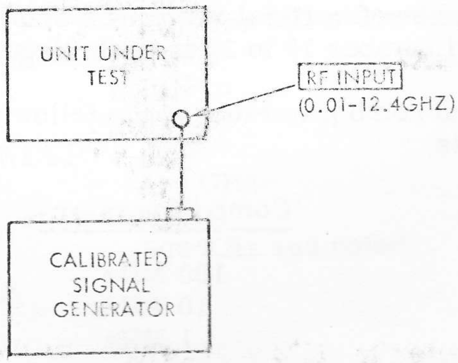


Figure 6-2. Performance Checks with Signal Generator

(2) Operate analyzer and signal generator as follows, noting the display characteristics:

BANDWIDTH KHz	SCANWIDTH/DIV
1000	2 MHz
10	20 KHz
1	2 KHz

(3) To check optimum control, proceed as follows:

(a) Set STD SWEEP and BANDWIDTH KHZ to AUTO, VIDEO DURATION BW to OFF. Using FINE TUNE control to keep the signal centered, vary SCANWIDTH/DIV over the full range from 200 MHz to 1 kHz.

(b) Check the display. A good signal with satisfactory resolution shall be obtained, indicating that bandwidth is changing to match the dispersion selected.

6-9. AMPLITUDE DISPLAY ACCURACY

6-9.1 Description

A signal is presented on the display. Input attenuation and IF attenuation are switched in 10 dB steps. The display is monitored and the indicated response is compared with specification.

6-9.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	3 msec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	40 and noted
IF ATTEN - dB	0 and noted
VIDEO DURATION - BW	1 kHz
LIN/LOG	LOG
STAB/OFF	STAB
SCANWIDTH/DIV	20 kHz
BANDWIDTH KHZ	10
FREQUENCY TUNE	0.400 GHz

6-9.3 Procedure

(1) Connect signal generator (3, table 6-2) at RF INPUT (Fig. 6-2) and apply 400 MHz signal. Adjust signal level to obtain -40 dB peak amplitude on LOG scale.

(2) Step INPUT ATTEN - dB to 30, 20, and 10, recording display amplitude at each position.

(3) Place INPUT ATTEN - dB to 40, and step IF ATTEN - dB to 10, 20, and 30, recording display amplitude at each position.

(4) Signal peak shall shift in 10 dB increments, corresponding to attenuator settings. Deviation at each position shall not exceed ±2 dB (±0.2 division).

6-10. INPUT ATTENUATOR ACCURACY

6-10.1 Description

A calibrated signal is displayed on screen, and signal level increments are substituted to restore a preset signal level on screen as input attenuator is stepped in. The signal generator signal level required is compared with specification at each position of input attenuator.

6-10.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	3 msec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	Noted
IF ATTEN - dB	Noted
VIDEO DURATION - BW	1 kHz
LIN/LOG	LIN
STAB OFF	OFF
SCANWIDTH/DIV	100 kHz
BANDWIDTH KHz	100
FREQUENCY TUNE	0.400 GHz

6-10.3 Procedure

(1) Connect calibrated signal generator (3, table 6-2) at RF INPUT (Fig. 6-2), set INPUT ATTEN - dB to 0, and apply 400 MHz signal at calibrated power level of -65 dBm.

(2) Adjust IF ATTEN - dB to position signal peak on screen at an amplitude reading of 6 on the left hand (LIN) scale.

(3) Advance INPUT ATTEN - dB one step to 10, increase signal generator level to -55 dBm, and record exact level setting required to restore signal peak on screen.

(4) Repeat step 3 in successive steps of INPUT ATTEN - dB of 20, 30, 40, 50, and 60 dB: and increases of signal level correspondingly to -45, -35, -25, -15, and -5 dBm.

(5) Deviations of power level to restore signal peak shall not exceed ±0.5 dB, or ±2% of attenuator setting, whichever is greater.

6-11. IF ATTENUATOR

6-11.1 Description

The signal from a calibrated signal generator is varied to restore a set signal peak level on screen as increments of IF attenuation are stepped in. The signal generator level is compared with specification.

6-11.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
SWEEP MODE	STD
STD SWEEP	10 msec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	30 dB
IF ATTEN - dB	Noted
VIDEO DURATION - BW	1 KHz
LIN/LOG	LIN
STAB/OFF	STAB
SIG IDENT/FULL SWEEP	OFF
SCANWIDTH DIV	100 kHz
BANDWIDTH KHz	100 kHz
FREQUENCY TUNE	0.400 GHz

compared with VHF atten SQ A219

6-11.3 Procedure

(1) Connect calibrated 400 MHz signal generator (3, table 6-2) at RF INPUT (Fig. 6-2).

(2) With IF ATTEN - dB all OUT, adjust signal generator signal level to obtain amplitude reading of signal peak on screen of 6 divisions.

(3) Set IF ATTEN - dB to 1 dB, adjust input signal level on signal generator to restore signal peak reading of 6, and record incremental signal level on signal generator.

(4) Repeat step 3 for IF ATTEN - dB settings of 3, 6, 11, 21, and 41.

(5) Incremental signal level for each step shall be within ±0.5 dB of the value of the step (See record form).

6-12. DYNAMIC RANGE

6-12.1 Description

Signals from two external signal generators, 10 MHz different in frequency, are combined and displayed full screen. Intermodulation products are checked for compliance with specification.

6-12.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
SWEEP MODE	STD
STD SWEEP	3 msec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	1
INPUT ATTEN - dB	0
IF ATTEN - dB	0
VIDEO DURATION - BW	OFF
LIN/LOG	LOG
STAB/OFF	OFF
SIG IDENT/FULL SWEEP	OFF
SCANWIDTH/DIV	5 MHz
BANDWIDTH KHz	100
FREQUENCY TUNE	0.405 GHz

6-12.3 Procedure

(1) Connect to RF INPUT two calibrated signal generators (3, table 6-2), combined in a 6 dB tee (see figure 6-3).

(2) Set one signal generator at 400 MHz, -24 dBm signal level; set the other at 410 MHz, -24 dBm signal level. Two signals should appear near full scale on screen.

(3) Check the display. Intermodulation products shall be at least 46 dB down on right hand scale.

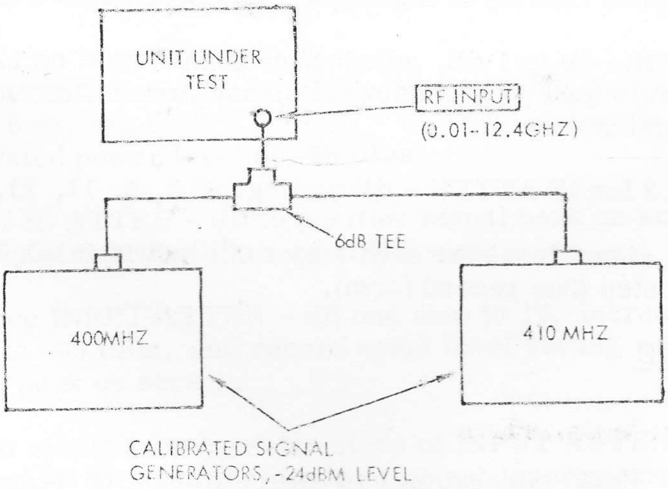


Figure 6-3. Dynamic Range Check

6-13. SENSITIVITY - 100 KHz BANDWIDTH BANDS 1-5

6-13.1 Description

The sensitivity of bands 1 through 5 is confirmed to be equal to or better than the specification by checking the average noise level.

6-13.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	3 msec/DIV
SWEEP VAR/MAN	CAL
INPUT ATTEN - dB	0
IF ATTEN - dB	0
VIDEO DURATION - BW	1 KHz
LIN/LOG	LOG
STAB/OFF	OFF
SCANWIDTH/DIV	Any MHz setting
BANDWIDTH KHz	100
SIG IDENT/FULL SWEEP	Full Sweep

6-13.3 Procedure

(1) Operate the analyzer at the following bands, observing the response: Full Scale Log = -30 dBm - (bands 1 - 5 only).

Band Select Setting	Average Noise Level
1	-85 dBm
2	-80 dBm
3	-75 dBm
4	-70 dBm
5	-55 dBm

6-14. FREQUENCY RESPONSE

6-14.1 Description

With center frequency adjusted at the center of each segment of interest, and the corresponding levelled sweeping signal source connected, each band is checked for amplitude deviation by tuning the signal source across the band.

6-14.2 Preliminary Control Settings

Control	Setting
SYNC	FREE RUN
STD SWEEP	3 msec/DIV
SWEEP VAR/MAN	CAL
BAND SELECT	Noted
INPUT ATTEN - dB	30
IF ATTEN - dB	0
VIDEO DURATION - BW	OFF
LIN/LOG	LOG
STAB/OFF	OFF
SCANWIDTH/DIV	100 MHz
BANDWIDTH KHz	1000

6-14.3 Procedure

(1) General

(a) Ensure that output of each sweeping signal source has been checked with a power meter and determined to be flat across the range to be swept.

(b) Connect sweepers (5, table 6-2) and power meter as shown in figure 6-4. Use external 10 dB pad and set signal source level to obtain -0 to -10 dBm level incident to RF INPUT connector.

(c) Slowly tune each sweeper across the indicated ranges and observe the display for amplitude variations.

(d) Amplitude variation (flatness) shall be no greater than 3 dB/100 MHz.

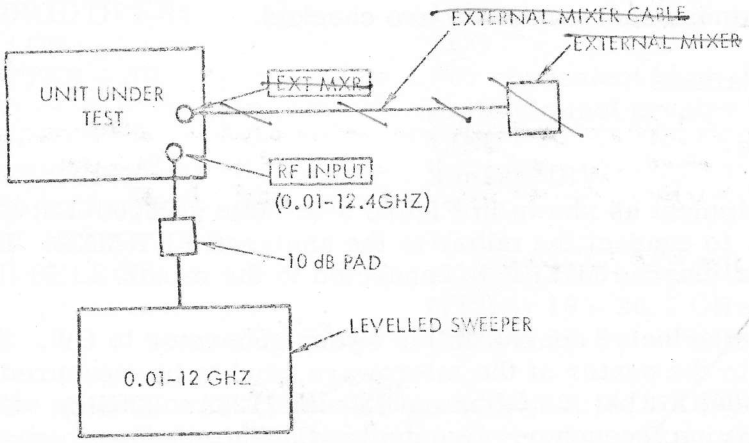


Figure 6-4. Frequency Response

(2) Operate analyzer and signal sources in the following ranges:

BAND SELECT	FREQ. RANGE
1	.01 - 1.8
2	1.75 - 3.75
3	2.5 - 5.0
4	4.75 - 9.25
5	9.0 - 12.4

6-15 WAVEGUIDE MIXERS CHECK

6-15.1 Description

The output of a leveled sweeper is swept across the frequency range of the respective mixer. Response flatness and sensitivity are checked.

6-15.2 Response Flatness

6-15.2.1 Procedure

(1) Connect equipment as shown in Figure 6-5. Use a 36000-143 Cable Assy, Ext. Mixer, to connect the mixer to the analyzer EXT MXR. Be certain the cable end marked MIXER is connected to the mixer.

(2) Set the sweep selector control in the sweep generator to CW. Set Start/CW control to the center of the microwave band to be measured. (Model 7120A: 15 GHz) (Model 7121A: 22 GHz) and (Model 7122A: 32GHz). Use the sweeper dial to determine frequency. Use appropriate procedure to ensure that sweeper is leveled.

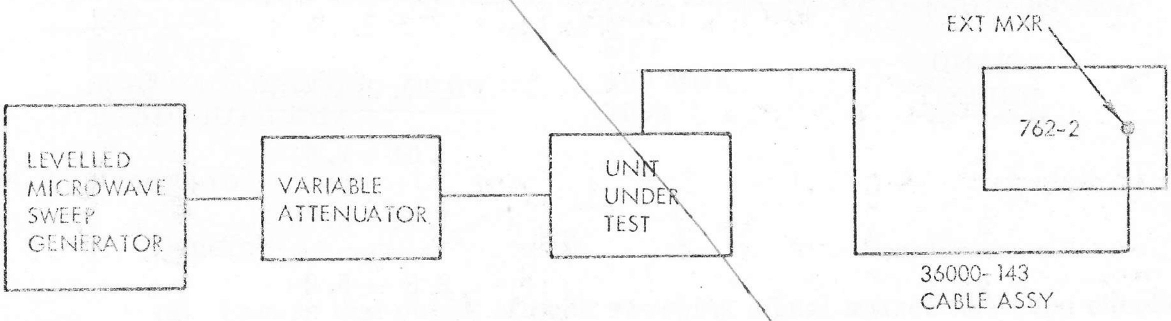


Figure 6-5. Waveguide Mixers Check

(3) Set spectrum analyzer controls as follows:

Control	Setting
SCANWIDTH/DIV	500 kHz
BANDWIDTH KHz	100
LIN/LOG	LOG
IF ATTEN - dB	For convenient base line on CRT graticule (not greater than 20 dB)
SYNC	LINE
STD SWEEP	3 msec/DIV
VIDEO DURATION - BW	1 kHz
INPUT ATTEN - dB	10 dB
BAND SELECT	(7120A) 12.4 - 18 GHz (4+) (7121A) 18 - 26.5 GHz (6+) (7122A) 26.5 - 40 GHz (10+)

(4) Set variable attenuator to 0 attenuation and adjust the FREQUENCY TUNE control to the frequency indicated by the sweep generator, and to center the signal on the analyzer CRT. Adjust the analyzer mixer BIAS control for maximum signal on the analyzer CRT.

(5) Set frequency of sweep generator to the lowest frequency to be tested (Model 7120A: 12.4 GHz) (Model 7121A: 18GHz) and (Model 7122A: 26 GHz). Set SCANWIDTH/DIV control at 200 MHz and BANDWIDTH KHz at 1 MHz.

(6) Increase the frequency of the sweep generator. The signal display on the CRT will traverse from left to right.

As signal generator is being increased in frequency, adjust FREQUENCY TUNE control of analyzer to keep signal display, as indicated by the CRT, visible. Maintain leveled output at < -30dBm. Amplitude of signal, as indicated by the CRT graticule, must not vary more than 6 dB over any 100 MHz sector of the mixer frequency band. Minimum average noise level must also be maintained. If the variation over a 100 MHz band is greater than 6 dB, readjust the BIAS control to minimize the variation in that band (bias set at one value only as frequency is varied) if the variation, for all bias settings (minimum average noise level must be maintained) exceeds 6 dB/100 MHz, the unit fails the check.

6-15.2.2 Specifications

Display Flatness ≤ 6 dB over any 100 MHz band (7120A: 12.4 - 18) (7121A: 18 - 26.5) (7122A: 26.5 - 40).

6-15.3 Sensitivity

6-15.3.1 Procedure

(1) Set up as in 6-15.2.1. Verify that the spectrum analyzer noise level at 2050 GHz at the EXT MXR input is less than -107 dBm. 100 kHz BW.

SECTION VII

CALIBRATION

7-1. GENERAL

This section contains instructions for aligning the Model 762-2 system, and for calibrating the individual subassemblies. A complete alignment of the system is necessary when parts have been replaced, or when periodic performance checks reveal out-of-tolerance conditions. Calibration of individual subassemblies, including circuit boards and the microwave chassis, is necessary when components have been replaced, or when the system fails to align in some respects.

7-1.1 Test Equipment

Table 7-1 lists items of test equipment required for system alignment and calibration procedures.

7-1.2 Adjustment Procedures

Unless otherwise indicated, as in the case of an individual circuit board which has been repaired, conduct adjustments in the sequence given in tables 7-2, 7-3 and 7-4. Refer to figure 5-1 for location of components and adjustment controls. Remove instrument covers as necessary for access. Alignment and calibration of tuning unit in conjunction with display unit is advisable, and is facilitated by use of extender cable, part of optional Maintenance Kit, part No. 37000-610.

Table 7-1. Required Test Equipment

NOTE: Equivalent substitutes may be used

Comb Generator	1, 10, 100 MHz	HP 8406A
Low Pass Filter	1.8 GHz	K&L Microwave 5L380-1800-0
Oscilloscope		HP 1202A
Digital Voltmeter		S-D 7050
Spectrum Analyzer	260 MHz	S-D 762-2
Power Meter		HP 431C
Calibrated Signal Generator		HP 8614A
Function Generator		Wavetek 115
Impedance Pad	6 dB	Commercially available
Impedance Pad	20 dB	Commercially available
Crystal Detector		HP 420A

Table 7-2. System Alignment

Adjustment	Reference Designation	Location	Reference Paragraph No.
V		Front Panel (712-2)	7-2.1

Table 7-2. System Alignment (Cont)

Adjustment	Reference Designation	Location	Reference Paragraph No.
H		Front Panel (712-2)	7-2.1
ASTIG		Front Panel (712-2)	7-2.1
TRACE ALIGN		Front Panel (712-2)	7-2.1
VERT GAIN		Rear Panel (712-2)	7-2.1
FREQUENCY TUNE		Front Panel (809-2)	7-2.2.1
HI FREQ	A208R46	Side Panel (809-2)	7-2.2.1
LO FREQ	A208R36	Side Panel (809-2)	7-2.2.1
~~EXT MXR BIAS~~		~~Front Panel (809-2)~~	~~7-2.2.2~~
~~BAND GAIN ADJ (Bands 6-8)~~	~~A208R6, R7, R8~~	~~Top Panel (809-2)~~	~~7-2.2.2~~
BAND GAIN ADJ (Bands 1 - 5)	A208R11, R12, R13, R14, R15	Top Panel (809-2)	7-2.2.3
DC LEVEL ADJ	A209R37	Top Panel (809-2)	7-2.2.4

7-2. SYSTEM ALIGNMENT

7-2.1 Display Unit

Refer to Operating Instructions, paragraph 3-4, and adjust display unit front panel controls as directed. If unable to obtain satisfactory adjustments, refer to Calibration Instructions, Paragraph 7-3.1 and adjust individual controls as required.

7-2.2 Tuning Unit

Alignment of the tuning unit will require calibrated signals in some instances. Test equipment listed in table 7-1 should suffice. Test setup will be in accordance with figure 7-1.

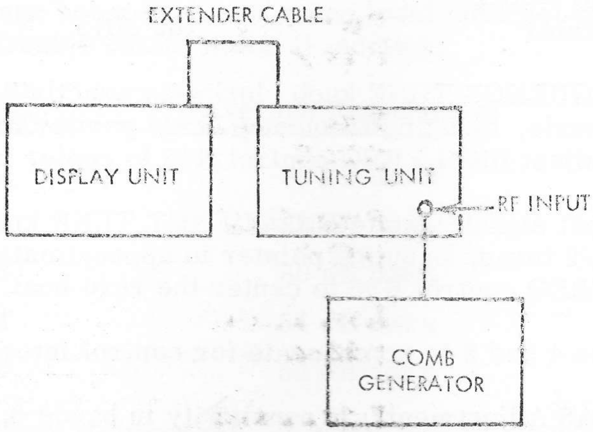


Figure 7-1. Tuning Unit Alignment Setup

CAUTION

SOME OF THE ACCESSIBLE CONTROLS IN THE TUNING ARE FACTORY ADJUSTED AND MAY ALSO BE SEALED. ONLY THE CONTROLS IDENTIFIED IN THE PROCEDURE AND IN TABLE 7-2 NORMALLY REQUIRE ATTENTION IN THE FIELD.

7-2.2.1 Tuning Dial Accuracy. If the tuning dial accuracy is unsatisfactory, proceed as follows:

(1) With BAND SELECT set to 1, rotate FREQUENCY TUNE knob fully counter clockwise and check that pointer stops over the dot to left of scale zero, ±0.020 inch. Rotate knob fully clockwise and check that pointer stops over the dot to right of 1.9 GHz scale reading, ±0.020 inch. A mechanical adjustment of the pointer may be made to satisfy these requirements.

(2) Rotate FREQUENCY TUNE knob counter clockwise to the left hand stop position, then turn the outside scale to position its zero index at 12 o'-clock. Loosen setscrews retaining FREQUENCY TUNE knob to shaft, and set index mark on knob to align with 9 o'clock on outside scale, taking care not to rotate tuning potentiometer shaft. Tighten setscrews.

(3) Connect a comb generator (or accurate signal source at 1.9 GHz). Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	1
SCANWIDTH/DIV	5 MHz
BANDWIDTH - KHz	100
Comb Generator	100 MHz

(4) Rotate FREQUENCY TUNE knob clockwise exactly 9-3/4 turns, measured on outside scale, bringing frequency scale pointer to approximately 1.9 GHz reading. Adjust HIGH FREQ control R46 to center the 1.9 GHz response.

(5) Turn off input signal, rotate FREQUENCY TUNE knob counter clockwise exactly 9-1/2 turns, bringing pointer to approximately scale zero. Adjust LOW FREQ control R36 to center the zero beat.

(6) Repeat steps 4 and 5 to compensate for control interaction.

7-2.2.2 EXT MXR BIAS Adjustment. If sensitivity in bands 6, 7, and 8 is not satisfactory, proceed as follows:

(1) Provide external waveguide mixers and signal generators in the frequency range of bands 6 - 8.

(2) Set EXT MXR BIAS front panel control fully clockwise.

(3) With signal displayed on screen, make coarse adjustments of R6, R7, R8, respectively, for bands 6, 7, 8, to obtain response slightly past the amplitude peak.

(4) Fine tune EXT MXR BIAS to obtain peak.

7-2.2.3 Fourth Converter Gain Adjustment. If sensitivity in bands 1 through 5 is not satisfactory, proceed as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	Noted
SIG IDENT	Noted
SCANWIDTH/DIV	Set for convenient display
BANDWIDTH - KHz	AUTO
IF ATTEN - dB	0
INPUT ATTEN - dB	10
Calibrated Signal Level	-30 dBm

(2) Adjust R11, R12, R13, R14, R15 in its respective band to position the signal level on the -10 dB line in each instance.

NOTE

Use SIG IDENT control to ensure that adjustments are made on in-band signal. Place to ON, check response, place to OFF.

(3) Check average noise level. If noise level does not meet the value specified, trouble exists in the IF section.

Band	Average Noise Level
1	65 dB down
2	63 dB down
3	60 dB down
4	54 dB down
5	53 dB down

7-2.2.4 Phase Lock Offset Adjustment. If signal jumps off screen when STAB/OFF control is placed to STAB, adjust DC LEVEL control R37 to obtain a condition where the phase locked signal remains in convenient display position when control is set to STAB.

7-3. CALIBRATIONS

Follow the sequence of adjustments as detailed for each subassembly and summarized in table 7-3.

Table 7-3. Calibration Adjustments

Function	Control	Location	Reference Paragraph
+12V HI	R29	A101 Power Supply	7-3.1.1
+12V	R2	A101 Power Supply	7-3.1.1
+70V	R12	A101 Power Supply	7-3.1.1
+200V	R18	A101 Power Supply	7-3.1.1
-6V	R22	A101 Power Supply	7-3.1.1
Dispersion Zero Balance	R1	A102 Sweep & Vert. Amp.	7-3.1.2
Dispersion Width	R70	A102 Sweep & Vert. Amp.	7-3.1.2
VERT GAIN	R109	Display Unit Rear Panel	7-3.1.2
D.C. Level	R50	A102 Sweep & Vert. Amp.	7-3.1.2
Horiz. Gain	R55	A102 Sweep & Vert. Amp.	7-3.1.2
D.C. Level	R63	A102 Sweep & Vert. Amp.	7-3.1.2
External Sweep	R18	A103 Fast Sweep/Sync Amp.	7-3.1.3

Table 7-3. Calibration Adjustments (Cont)

Function	Control	Location	Reference Paragraph
Manual Sweep	R10	A103 Fast Sweep/Sync Amp.	7-3.1.3
Maximum Intensity	R16	A104 High Voltage Divider/ Blanking	7-3.1.4
-13VDC	R41	A108 RF Board (internal)	7-3.2.1.1
-18VDC	R51	A208 RF Board (internal)	7-3.2.1.1
Low Freq	R36	A208 RF Board (external)	7-3.2.1.3
High Freq	R46	A208 RF Board (external)	7-3.2.1.3
2nd L.O. Freq	Tuning Slug	Y202 2nd L.O.	7-3.2.1.5
1st Mixer Input	Tuning Slug	Z202 1st Mixer	7-3.2.1.6
2050 MHz IF	Slugs A, B, C	A208 RF Board (external)	7-3.2.1.6
1st Mixer Output	Tuning Slug	Z202 1st Mixer	7-3.2.1.6
Band 1 Gain	R11	A208 RF Board (external)	7-3.2.1.8
Band 2 Gain	R12	A208 RF Board (external)	7-3.2.1.8
Band 3 Gain	R13	A208 RF Board (external)	7-3.2.1.8
Band 4 Gain	R14	A208 RF Board (external)	7-3.2.1.8
Band 5 Gain	R15	A208 RF Board (external)	7-3.2.1.8
Linearity Adj	R47	A201 3rd Converter Board	7-3.2.2.1
Linearity Adj	R57	A201 3rd Converter Board	7-3.2.2.1
Linearity Adj	R58	A201 3rd Converter Board	7-3.2.2.1
Linearity Adj	R61	A201 3rd Converter Board	7-3.2.2.1
Linearity Adj	R43	A201 3rd Converter Board	7-3.2.2.1
Response Adj	R67	A201 3rd Converter Board	7-3.2.2.1
Oscillator Adj	C7	A201 3rd Converter Board (oscillator)	7-3.2.2.1
Oscillator Compensation	R69	A201 3rd Converter Board (oscillator)	7-3.2.2.1
Scan Width Cal	R25	A201 3rd Converter Board	7-3.2.2.1
Amplitude Peaking	C44	A205 LIN-LOG Board	7-3.2.2.2
LIN Adj	R58	A205 LIN-LOG Board	7-3.2.2.2
Zero Adj	R62	A205 LIN-LOG Board	7-3.2.2.2

Table 7-3. Calibration Adjustments (Cont)

Function	Control	Location	Reference Paragraph
LOG Adj	R45	A205 LIN-LOG Board	7-3.2.2.2
Sweep Amp. Cal Adj	R3	A206 Harmonic Atten/ Video Duration - BW	7-3.2.2.3
10 KHz Adj	R93	A204 6.5 MHz Control Filter Board	7-3.2.2.4
1 kHz Adj	R87	A204 6.5 MHz Crystal Filter Board	7-3.2.2.4
300 Mhz Adj	R86	A204 6.5 MHz Crystal Filter Board	7-3.2.2.4
100 kHz Amp Adj	R13	A203 100 kHz B.P. Filter Board	7-3.2.2.5
Symmetry Adj	C13	A203 100 kHz B.P. Filter Board	7-3.2.2.5
Symmetry Adj	C15	A203 100 kHz B.P. Filter Board	7-3.2.2.5
Symmetry Adj	C17	A203 100 kHz B.P. Filter Board	7-3.2.2.5
Symmetry Adj	C19	A203 100 kHz B.P. Filter Board	7-3.2.2.5
Bandwidth Adj	C42	A202 Fourth Converter Board	7-3.2.2.6
Bandwidth Adj	C19	A202 Fourth Converter Board	7-3.2.2.6
Bandwidth Adj	C43	A202 Fourth Converter Board	7-3.2.2.6
Symmetry Adj	C30	A202 Fourth Converter Board	7-3.2.2.6
Symmetry Adj	C30	A202 Fourth Converter Board	7-3.2.2.6
Symmetry Adj	C31	A202 Fourth Converter Board	7-3.2.2.6
Symmetry Adj	C32	A202 Fourth Converter Board	7-3.2.2.6
Symmetry Adj	C33	A202 Fourth Converter Board	7-3.2.2.6

7-3.1 Display Unit

Calibrations of individual circuit boards are conducted with boards installed in the display unit.

7-3.1.1 A101 Power Supply Board. Refer to table 7-4 and set D.C. voltage controls as indicated. Use a digital voltmeter (table 7-1).

CAUTION

NO SHORT CIRCUIT PROTECTION IS PROVIDED IN THIS ASSEMBLY. MAKE CERTAIN VOLTMETER IS SET FOR CORRECT VOLTAGE RANGE. OTHERWISE, BURNOUT OF VOLTMETER AND D.C. CIRCUIT MAY RESULT.

Table 7-4. A101 Power Supply Board D.C. Voltage Adjustments

D.C. Voltage	Control	Pin No.	Limits - VDC
+12V HI	R29	21	+11.9 to 12.1
+12V	R2	19	+11.9 to 12.1
+70V	R12	17	+69.0 to 71.0
+200V	R18	10	+198 to 202
-6V	R22	9	-6.06 to -5.94

7-3.1.2 A102 Sweep and Vertical Amplifier Board. Set oscilloscope as indicated for each test point (figure 7-2). Proceed as follows:

(1) With display unit controls SYNC at INT, STD SWEEP at 3 msec/DIV, and oscilloscope set to 1V/DIV vertical, 5 ms/DIV horizontal, apply probe to pin 19. Adjust Dispersion Zero Balance R1 to position base of ramp (A, figure 7-2) at -2.6V ±0.05V. Adjust Dispersion Width R70 to position peak of ramp at +2.6V ±0.05V.

NOTE

Unless otherwise specified, waveforms of figure 7-2 are nominal. Voltages can be within ±10%.

(2) Set oscilloscope for 10V/DIV vertical, 5 ms/DIV horizontal. Connect function generator (table 7-1) to J07-24 (figure 7-3). Apply probe to pin 8.

NOTE

Make certain that baseline of wave is not at ground potential and cut off by amplifier. Check pin 8 and pin 7. Adjust D.C. Level R63 if necessary, keeping D.C. level as low as possible.

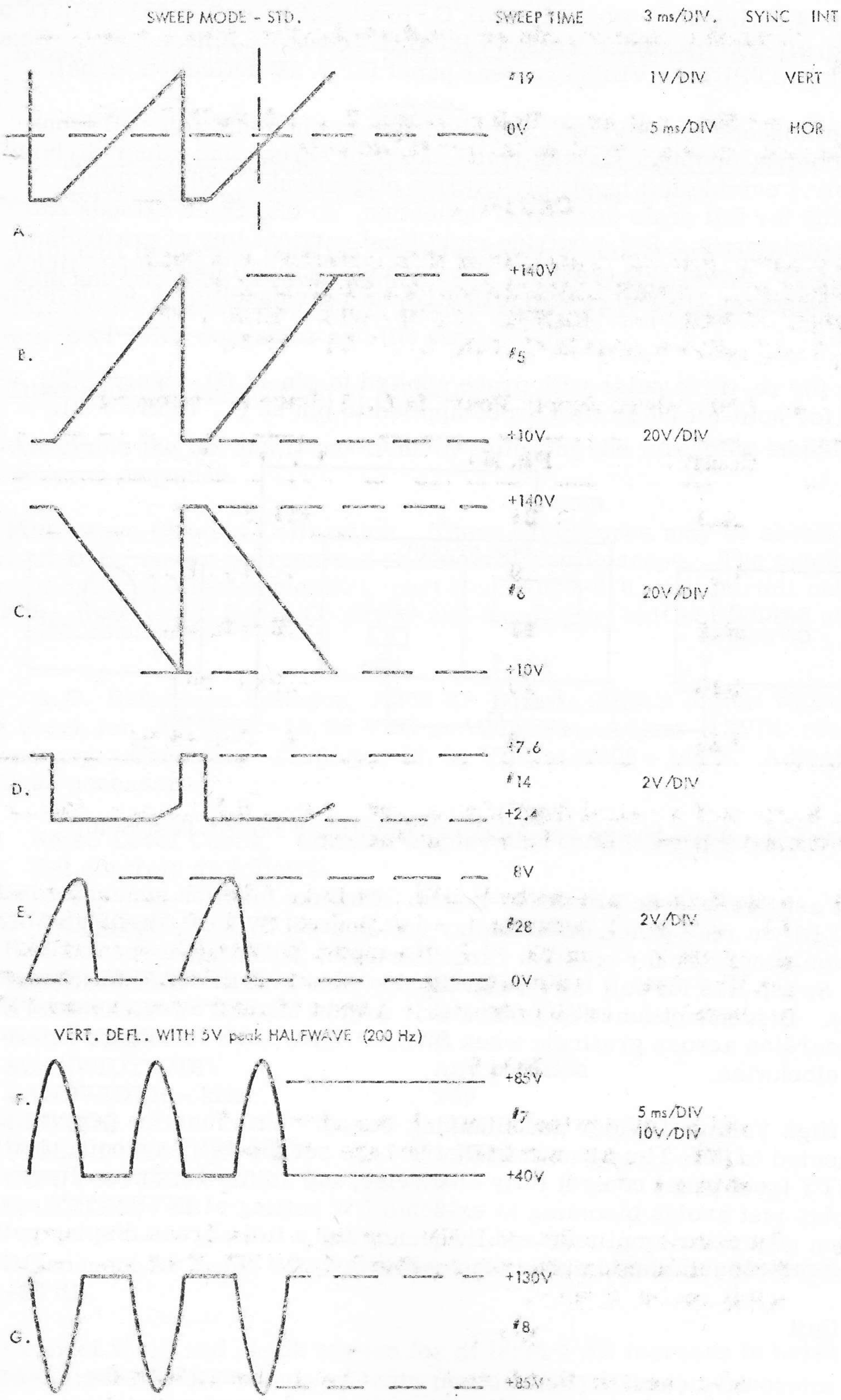


Figure 7-2. A102 Waveforms

(3) Adjust V front panel control to position baseline of wave on bottom line of graticule. Adjust VERT GAIN rear panel control to obtain 1/2-screen display (4 divisions). Now adjust D. C. level R50 to obtain 85V peak (F and G, figure 7-2). Readjust V and VERT GAIN controls if necessary. Check at J101 (OUTPUTS - VERT) on rear panel for 0.5V deflection signal.

(4) Set oscilloscope for 20V/DIV. Apply probe to pin 5 and adjust H front panel control to obtain start of trace at left of screen one minor division (0.2 Div.) outside left hand vertical line of graticule. Adjust Horiz. Gain R55 for full scale horizontal deflection, so that trace extends one minor division (0.2 Div.) outside right hand vertical line of graticule. Adjust D. C. Level R63 to center the wave on the oscilloscope (B, figure 7-2). Check at J10 (OUTPUTS - HORIZ) on rear panel for 1.0V deflection signal.

(5) Check for re-trace pulse with probe applied to pin 14 (D, figure 7-2); check for hold-off pulse with probe applied to pin 28 (E, figure 7-2).

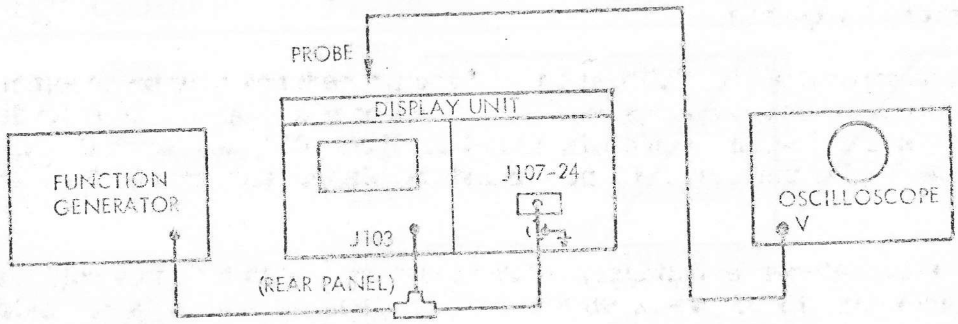


Figure 7-3. A102 Sweep and Vertical Amplifier Board Test Setup

7-3.1.3 A103 Fast Sweep/Sync Amplifier Board. Connect function generator (table 7-1) to EXT SWEEP on rear panel. Set display unit control SWEEP MODE to MAN/EXT. Set function generator for positive ramp sawtooth, 10V peak-to-peak 100 Hz. Adjust External Sweep R18 for full horizontal display (use SWEEP VAR/MAN control to center sweep). Disconnect function generator. Adjust Manual Sweep control R10 to obtain full excursion across graticule when SWEEP VAR/MAN front panel control is rotated fully clockwise.

7-3.1.4 A104 High Voltage Divider and Blanking Board. With function generator (table 7-1) connected to J07-24 as shown in figure 7-3, set for 10V sawtooth, 1 kHz. Rotate INTENSITY front panel control fully clockwise, and adjust Maximum Intensity R16 so that display just avoids blooming at extreme CW setting of INTENSITY control. Set function generator amplitude and frequency for a full screen display pattern, and adjust Distortion R28 to obtain a rectilinear display.

7-3.2 Tuning Unit

Calibrations of microwave chassis (RF section) must be conducted with the RF and IF sections separated. To separate RF and IF sections, proceed as follows:

(1) Remove four 6-32 screws and bottom cover.

(2) Disconnect W215 ribbon cable from A206J and remove A206 board.

(3) Disconnect W215 cable from input attenuator.

(4) Remove FREQUENCY TUNE knob ~~and 50-ohm termination from EXT MXR.~~

~~NOTE~~

~~The EXT MXR front panel connector will have the 50-ohm termination applied at all times except when in use.~~

(5) With unit in upright position, remove three 6-32 screws from each side and two 6-32 screws from rear of microwave chassis. Then slide microwave chassis away from front panel to clear frequency tune shaft ~~and EXT MXR connector~~ and lift straight up.

(6) Disconnect IF cable W213 at AR201J2.

(7) Assemble the RF and IF sections by following the foregoing steps in reverse sequence.

7-3.2.1 Microwave Chassis Calibration. These procedures may be accomplished using external D. C. power sources and an external oscilloscope. The extender cable, part of optional Maintenance Kit, part No. 37000-610, will permit calibrations using the display unit for D. C. power and the display unit screen for signal displays.

7-3.2.1.1 D. C. Reference Voltages, A208 RF Board. With a digital voltmeter (table 7-1) check for -13.02 to -12.98 VDC at A208TP1. Adjust -13VDC control R41 as necessary. Check for -18.05 to -17.95 VDC at A208 - pin 2. Adjust -18 VDC control R51 as necessary.

7-3.2.1.2 Noise Level Check. Connect display unit and tuning unit as shown in figure 7-4. Set controls as follows:

Control	Setting
SWEEP MODE	FREE RUN
STD SWEEP	3 msec/DIV
BAND SELECT	6
SCANWIDTH/DIV	Any position
BANDWIDTH - kHz	100
LIN/LOG	LOG
VIDEO DURATION - BW	1 KHz
INPUT ATTEN - dB	0
IF ATTEN - dB	0

(1) Disconnect RF cable W213 and check for noise level of approximately -50 dB.

(2) Connect W213 and check screen for at least 5 dB increase in noise level (see figure 7-4).

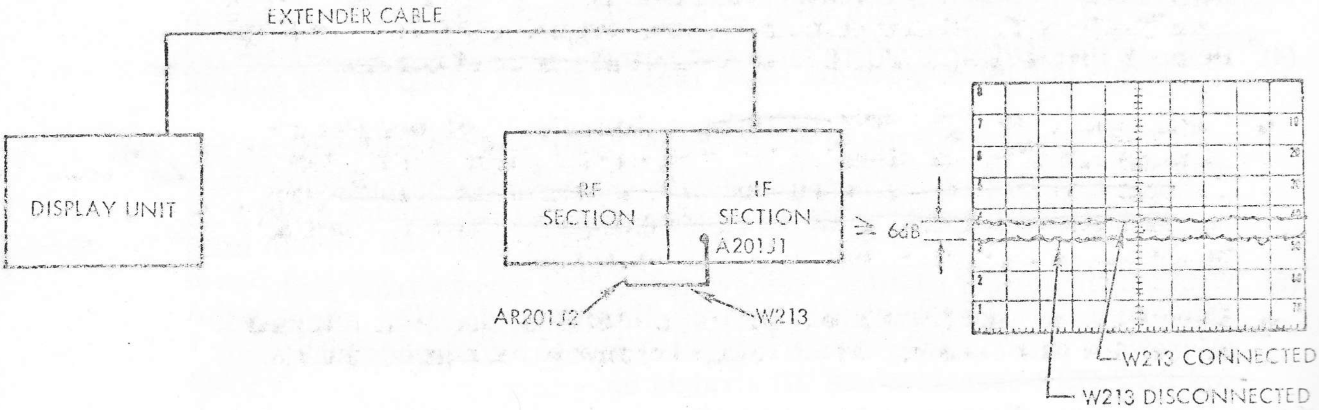


Figure 7-4. Noise Level Test Setup

7-3.2.1.3 Dial Tracking Calibration. Connect comb generator, low pass filter, 6 dB pad (table 7-1) as shown in figure 7-5. Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	1
SCANWIDTH/DIV	20 MHz
BANDWIDTH - KHz	100
LIN/LOG	LOG
VIDEO DURATION - BW	OFF

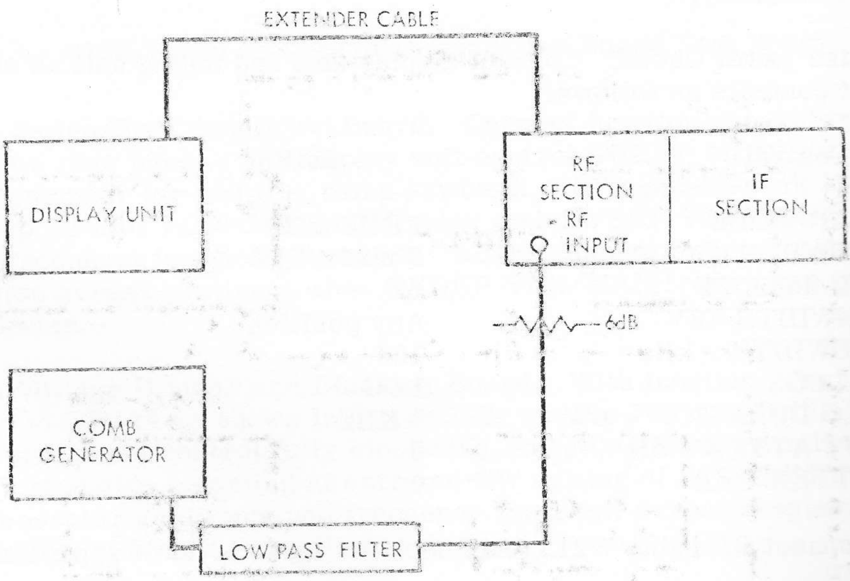


Figure 7-5. Dial Tracking Test Setup

(1) Rotate FREQUENCY TUNE knob clockwise to stop and check that pointer stops on the dot to right of scale zero. Rotate FREQUENCY TUNE knob counterclockwise to stop and check that pointer stops on the dot to left of 1.9 GHz scale reading.

(2) Set comb generator for 100 MHz, adjust BASELINE BLANKING front panel control to take out noise. Set FINE TUNE control to Mid-range, FREQUENCY TUNE dial pointer to zero. Adjust A208R36 (Low Frequency) control to position the beat signal at center of screen.

(3) Slowly rotate FREQUENCY TUNE knob clockwise until dial pointer reaches 1.9 GHz, counting the 100 MHz comb lines at the right of the beat signal as they translate to the left, making certain to identify the 19th line (1.9 GHz). Adjust A208R46 (High Frequency) control to position this 19th line exactly on center of screen.

(4) Repeat steps 2 and 3 until beat signal and 19th line can be positioned respective at screen center when dial reading is zero and 1.9 GHz.

7-3.2.1.4 First L.O. (Y201) Power and Response. Connect oscilloscope, detector, 20 dB pad (table 7-1) as shown in figure 7-6. Set controls as follows:

Setting	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	Noted
STAB	FULL SWEEP
SCANWIDTH/DIV	Any MHz setting
BANDWIDTH - KHz	100
LIN/LOG	LOG
EXT MXR BIAS	0 V (Fully CCW)
Oscilloscope VERT	10 mV/DIV
HORIZ	0.5 V/DIV

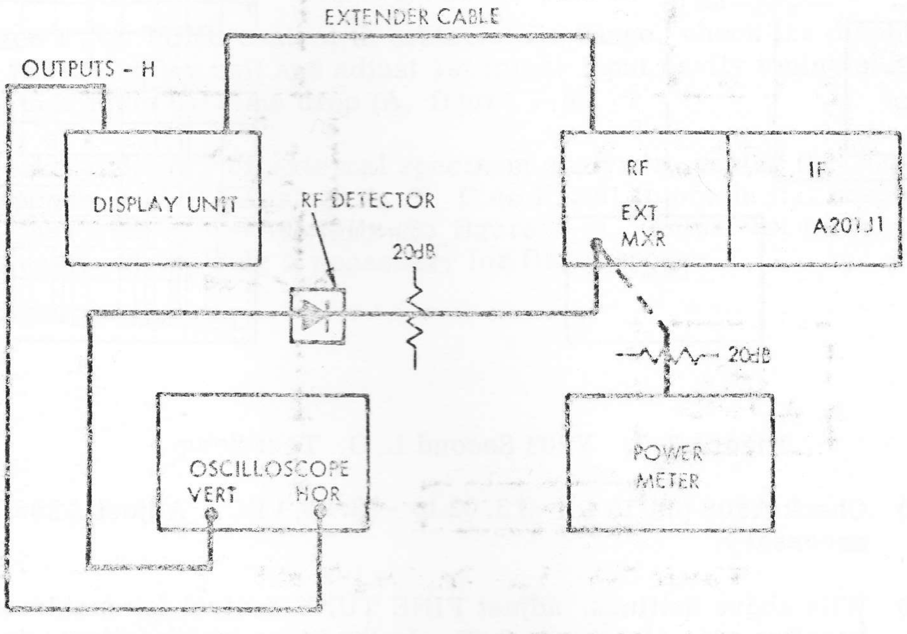


Figure 7-6. Y201 First L.O. Test Setup

(1) Check bands 1, 3 through 8 for flatness.

(2) Using a power meter and 20 dB pad, check for approximately +10 dBm power level at EXT MXR connector.

7-3.2.1.5 Second L.O. (Y202) Frequency. Connect digital voltmeter and comb generator (table 7-1) as shown in figure 7-7. Set controls as follows:

Control	Setting
STD SWEEP	10 msec/DIV
BAND SELECT	2 and noted
STAB	OFF
SCANWIDTH/DIV	5 MHz and noted
BANDWIDTH - KHz	100 kHz
LIN/LOG	LOG
IF ATTEN - dB	0 and noted
VIDEO DURATION - BW	OFF
Comb Generator	10 MHz and noted

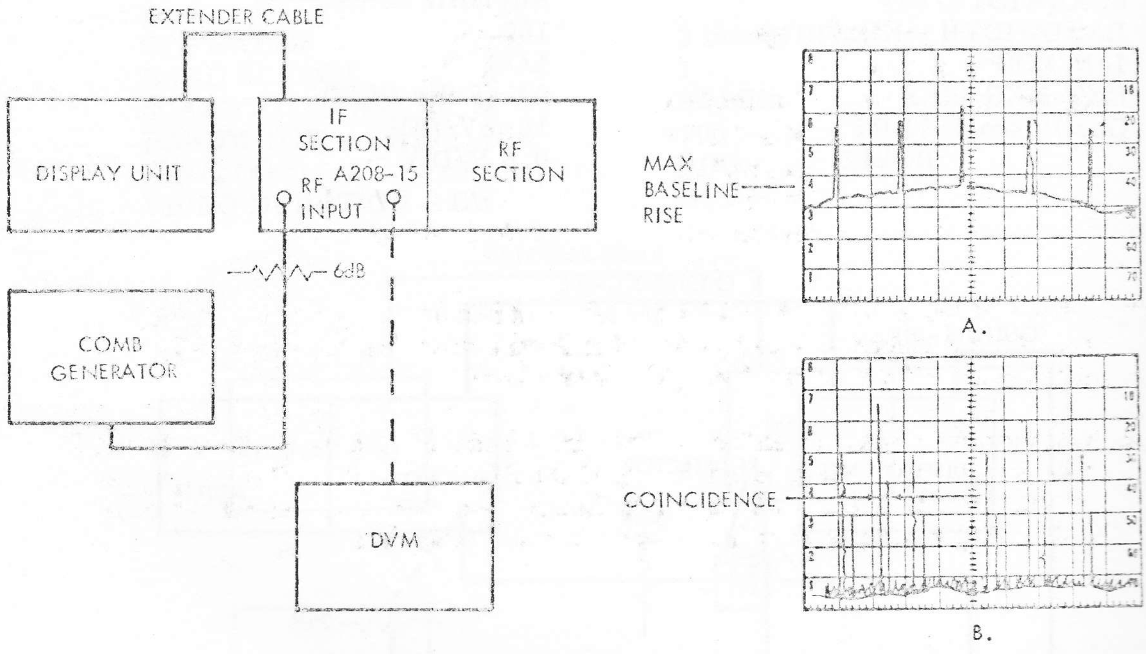


Figure 7-7. Y202 Second L.O. Test Setup

(1) Check A208 pin 15 for -13.02 to -12.98 VDC. Adjust A208R41 if necessary.

(2) With above settings, adjust FINE TUNE control for maximum baseline rise (A, figure 7-7). In the steps which follow, do not vary FINE TUNE control.

(3) Set BAND SELECT to 1, FREQUENCY TUNE to 260 MHz, SCANWIDTH/DIV to 20 MHz, IF ATTEN - dB to 20 dB, Comb generator to 100 MHz. Adjust BASELINE BLANKING control to take out noise.

(4) Adjust 2nd L.O. tuning slug to obtain coincidence between short and tall lines of comb (B, figure 7-7). Loosen locknut, adjust tuning slug, tighten locknut.

7-3.2.1.6 First Mixer (Z202) and BP-LP Filter (FL201) Response. Connect comb generator and spectrum analyzer (table 7-1) as shown in figure 7-8. Set controls as follows:

Control		Setting
STD SWEEP		10 msec/DIV and noted
BAND SELECT		1
STAB		OFF
SCANWIDTH/DIV		50 MHz
BANDWIDTH - KHz		100
IF ATTEN - dB		4
LIN/LOG		LOG
VIDEO DURATION - BW		OFF
Comb Generator		10 MHz
Spectrum Analyzer	Frequency	260 MHz
	Bandwidth	100 KHz
	Scanwidth	5 MHz/DIV
	Sweep	External
	Sweep Rate	3 msec/DIV

(1) Place FINE TUNE control in center of its range, check the display on 712-2 display unit and adjust 1st mixer input cavity tuning slug for maximum baseline drop (A, figure 7-8).

(2) Check the display on external spectrum analyzer, center the 260 MHz response, and adjust slugs A, B, C on FL201 to obtain flat response at least from 255 to 265 MHz (B, figure 7-8). Adjust 1st mixer output cavity tuning slug if necessary for flat response.

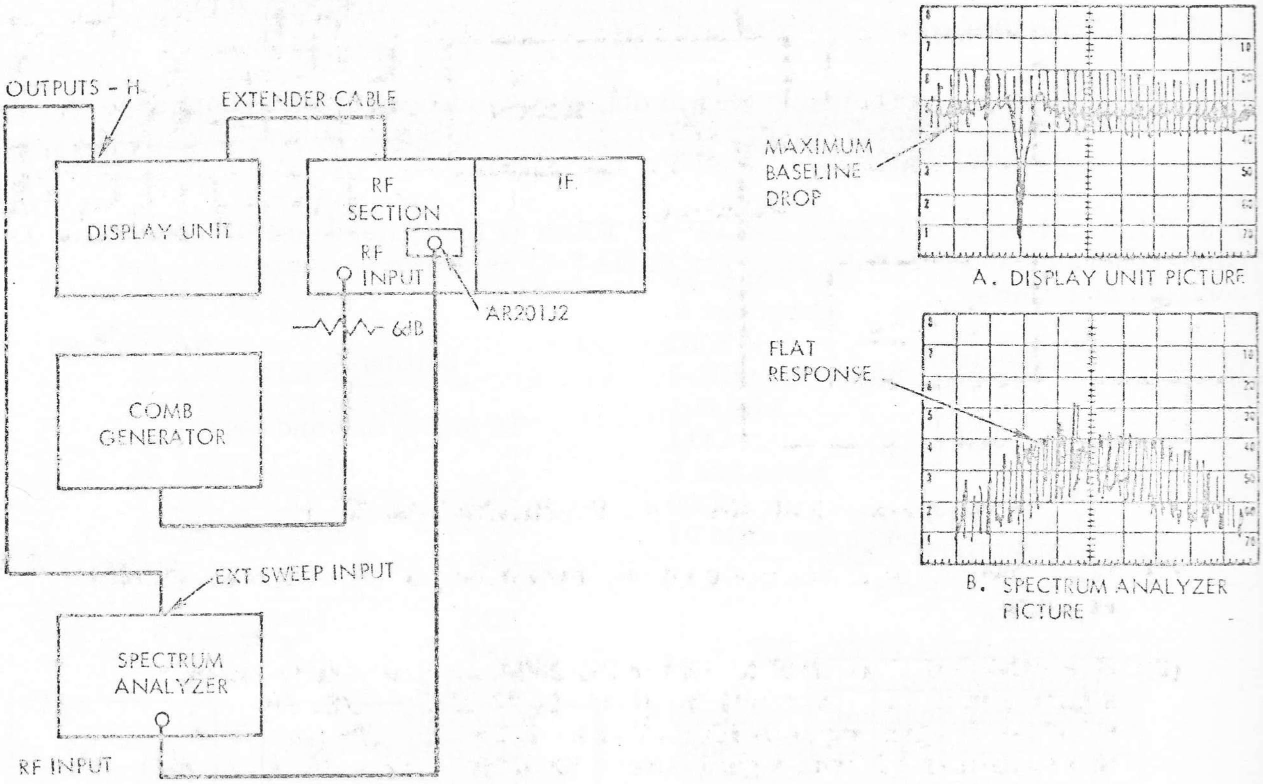


Figure 7-8. Z202 First Mixer and BP-LP Filter Test Setup

7-3.2.1.7 2050 MHz I.F. Sensitivity. Connect signal generator (table 7-1) as shown in figure 7-9. Provide a power meter (table 7-1). Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	6
FREQUENCY TUNE	15.0 GHz
STAB	OFF
SCANWIDTH/DIV	100 MHz
BANDWIDTH - KHz	100
IF ATTEN - dB	5
LIN/LOG	LOG
VIDEO DURATION - BW	1 kHz
Signal Generator Frequency	2050 MHz
Level	Noted

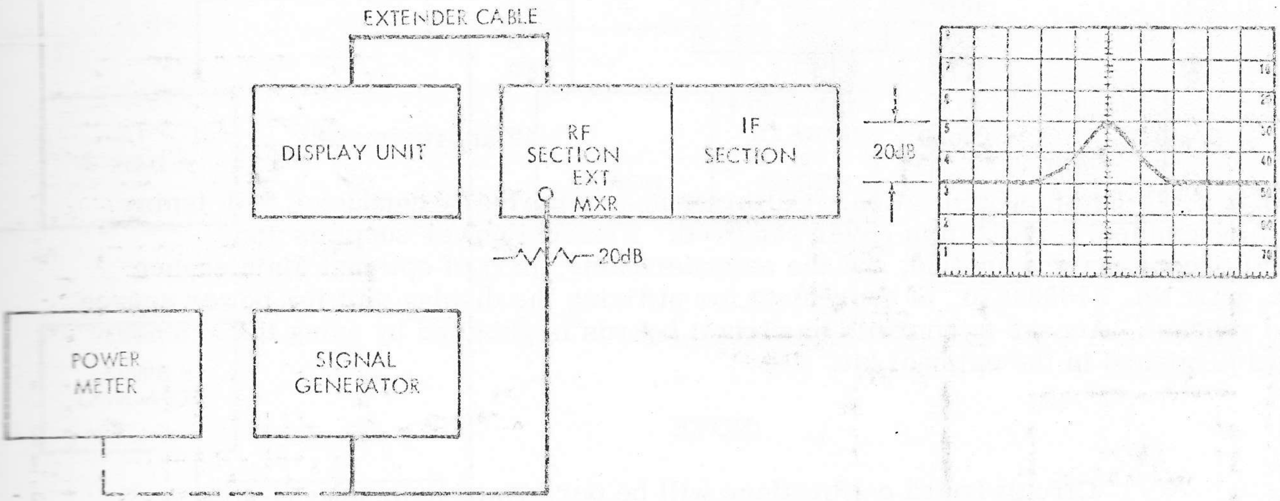


Figure 7-9. 2050 MHz I. F. Sensitivity Test Setup

(1) With power meter, calibrate output level of signal generator at -7 dBm setting.

(2) Use FINE TUNE control to center the 2050 MHz response. Reduce signal generator output until response is 20 dB above noise level. Calibrated signal input to EXT MXR shall be -107 dBm or lower level, calibrated from signal generator output reading + pad level + signal level above noise.

7-3.2.1.8 RF Board (A208) Preliminary Gain Adjustments. Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	Noted
STAB	OFF
SCANWIDTH/DIV	20 MHz
BANDWIDTH - KHz	100
VIDEO DURATION - BW	1 kHz

(1) Select bands, and tune noise level with A208 controls to values tabulated below.

Band	Control	Noise Level, dB
1	R11	-65
2	R12	-63
3	R13	-59

Band	Control	Noise Level, dB
4	R14	-53
5	R15	-52
6 - 8	None	-42 approximately

7-3.2.2 IF Section Calibration. Calibrations are normally conducted with tuning unit assembled, with bottom cover removed. External power supplies and oscilloscope may be applied, but the extender cable, part of optional Maintenance Kit, part No. 37000-610, is convenient for utilizing the display unit for power source and readout. Access to controls on circuit boards is obtained by using the extender card furnished in the optional kit.

NOTE

Circuit board calibrations will be performed as much as possible with the board installed in operating position. Make certain that good ground contact is obtained when re-installing boards after finishing with extender card.

7-3.2.2.1 Third Converter Board (A201). Connect digital voltmeter, comb generator and low pass filter (table 7-1) as shown in figure 7-10. Disconnect 260 MHz input cable W213 from J1. With extender card installed, connect an RF cable between circuit board connector J2 and receptacle on chassis for A202J2. Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	1
STAB	OFF
SCANWIDTH/DIV	1 MHz and noted
BANDWIDTH - KHz	10
LIN/LOG	LOG
Comb Generator	10 MHz and 1 MHz Modulation

(1) Rotate shaping circuit controls R47, R57, R58, R61 fully clockwise (or until no effect is observed on screen). Then adjust FINE TUNE front panel to obtain 6.95 to 7.05 VDC reading on DVM.

(2) Set SCANWIDTH/DIV to 500 kHz and adjust tuning capacitor C7 (through hole in cover) to center the 260 MHz response.

(3) Set comb generator for 1 MHz interpolation markers to obtain at least five side bands on each side of 260 MHz response (not simultaneously visible). Tune FINE TUNE control in clockwise direction until all five sidebands to right of 260 MHz responses are exposed. Adjust R67 to place the 260 MHz response on screen.

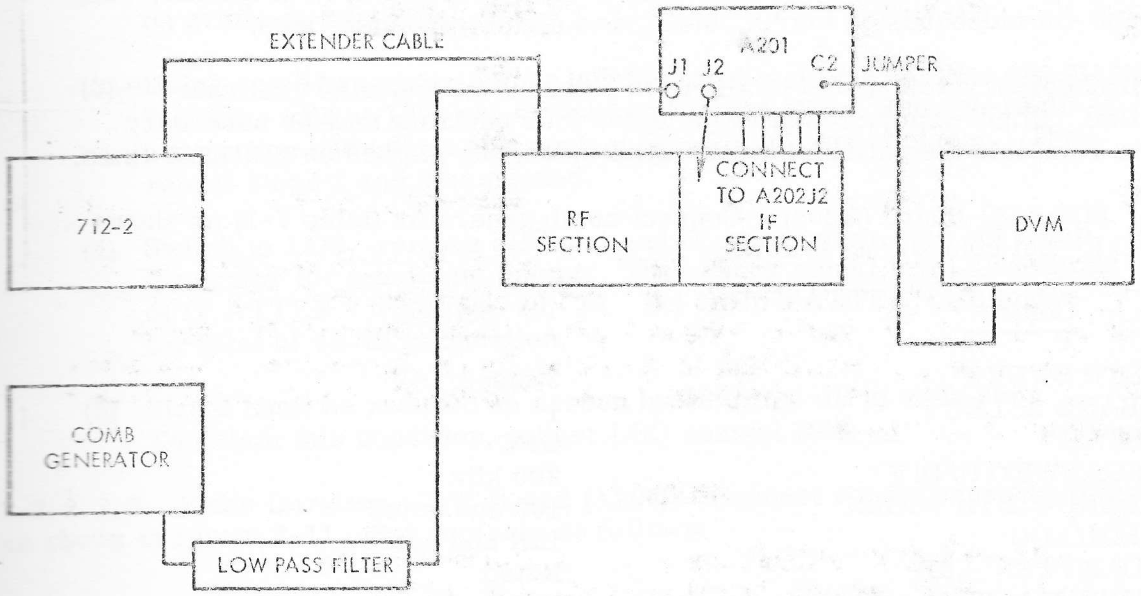


Figure 7-10. A201 Third Converter Board Test Setup

NOTE

Depending upon nature of repair to 3rd converter board, it may be necessary to improve linearity by adjusting R69 on oscillator board, adjacent to C7. This adjustment requires removal of cover.

(4) Adjust R25 to obtain uniform spacing of sidebands, aligned on graticule lines two divisions apart, plus or minus one minor division.

(5) Tune FINE TUNE control in counterclockwise direction until all five sidebands to left of 260 MHz response are exposed, or until 260 MHz response is aligned on right hand graticule line.

(6) Adjust R43 to position the outboard (5th) sidebands on left hand edge of screen, then adjust R43 to move the 4th sideband one quarter of a major division to the left.

NOTE

The adjustments which follow will move the 5th sideband toward the left hand graticule line. Presetting R43 is intended to insure that movement will not carry it to the right of the line. If this condition seems likely, reset R43.

(7) Adjust R61 counterclockwise to align 1st sideband on second graticule line from right hand line.

(8) Adjust R58, R57, R47, respectively in sequence given, to align 2nd, 3rd, and 4th sidebands on fourth, sixth, and eighth graticule lines.

(9) If necessary adjust R43 to align 5th sideband on left hand graticule line. Slight readjustment of the other four controls may be necessary to complete the calibration with all 5 sidebands aligned on graticule lines.

7-3.2.2.2 LIN-LOG Board (A205). Connect comb generator (table 7-1) as shown in figure 7-11. Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	1
STAB	OFF
SCANWIDTH/DIV	200 kHz
BANDWIDTH - KHz	100 and noted
LIN/LOG	LIN and noted
IF ATTEN - dB	Noted
INPUT ATTEN - dB	Noted
Comb Generator	10 MHz
VIDEO DURATION - BW	1 KHz

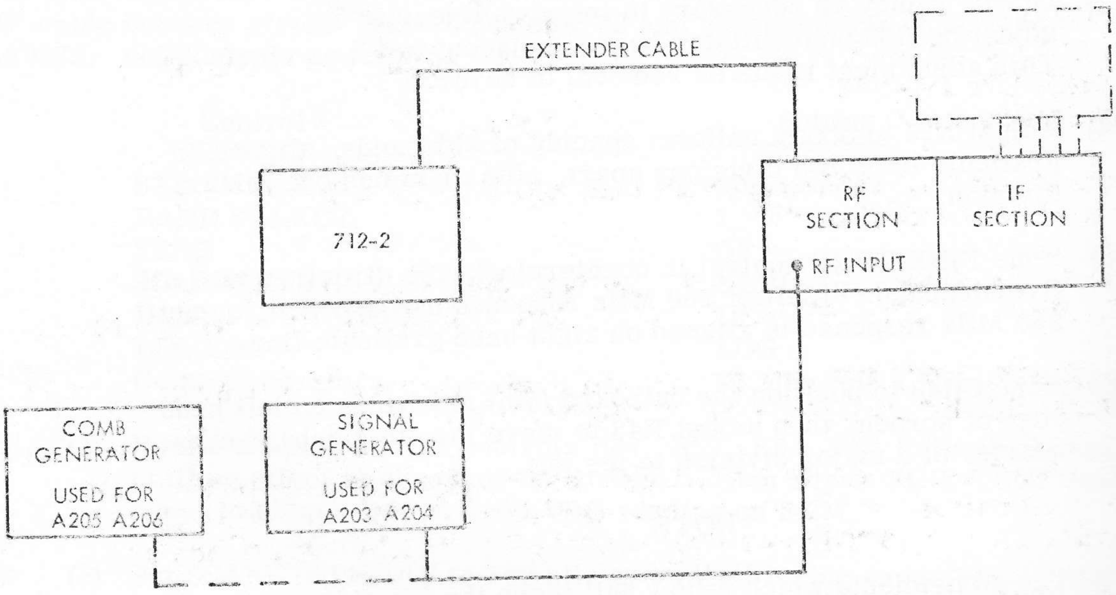


Figure 7-11. IF Section Circuit Boards Test Setup

(1) Use FREQUENCY TUNE and FINE TUNE controls to select a comb signal. Use INPUT ATTEN - dB and IF ATTEN - dB controls to set signal amplitude near full scale. With LIN-LOG board on extender card, adjust C44 for peak amplitude.

(2) Set BANDWIDTH - KHz to 1.0 and adjust zero control R62 to align trace on graticule baseline.

(3) Using comb generator output level control and IF ATTEN - dB, BANDWIDTH - kHz at 100, set signal level to 2.5 DIV. Remove 10 dB of attenuation and adjust LIN control R58 for full scale signal. Then repeat steps 2 and 3 as needed.

(4) Switch to LOG, remove all input and IF attenuation, and set comb generator for maximum output. Then check signal level at settings of IF ATTEN - dB of 10, 20, 30. Set INPUT ATTEN - dB to 10 for total of 40 dB attenuation.

(5) Signal shall be reduced on screen by 10 dB ±2 dB at each step. To obtain this condition, adjust LOG control R45.

7-3.2.2.3 Video Duration - BW Board (A206). Connect comb generator (table 7-1) as shown in figure 7-11. Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	1 and noted
STAB	OFF and noted
SCANWIDTH/DIV	10 MHz and noted
BANDWIDTH - KHz	100 and noted
LIN/LOG	LOG
IF ATTEN - dB	For convenient signal level
INPUT ATTEN - dB	0
Comb Generator	10 MHz

(1) Adjust Sweep Amplifier calibration adjust R3 to align responses on vertical lines of graticule.

(2) Check operation of FULL SWEEP switch. Then check operation of VIDEO DURATION - BW control in SHORT, LONG, and 1 kHz positions.

(3) Set SCANWIDTH/DIV to 1 kHz and check operation of STAB control. Adjust BANDWIDTH - KHz as SCANWIDTH is reduced.

(4) Set SCANWIDTH/DIV to 10 MHz and check operation of harmonic attenuator in bands 3 (2nd harmonic) and 4 (3rd harmonic). Combs shall appear as 20 MHz in 2nd harmonic and 30 MHz in 3rd harmonic.

7-3.2.2.4 6.5 MHz Crystal Filter Board (A204). Connect signal generator (table 7-1) as shown in figure 7-11. Set controls as follows:

Control	Setting
STD SWEEP	10 msec/DIV
BAND SELECT	1
STAB	OFF
SCANWIDTH/DIV	50 MHz and noted
BANDWIDTH - KHz	AUTO and noted
LIN/LOG	LOG and noted
IF ATTEN - dB	0
INPUT ATTEN - dB	0
Signal Generator Frequency	400 MHz
Calibrated Level	-30 dBm

(1) Check for full scale display at initial settings. If calibrated input of -30 dBm fails to produce full scale signal, adjust band 1 gain R11 on RF board A208.

(2) Set BANDWIDTH - KHz to 1000 and check for full scale display, plus or minus 2 dB. Now set BANDWIDTH - KHz to 100 and check for same level display (full scale ±2 dB).

(3) Set BANDWIDTH - KHz to 10, decrease SCANWIDTH/DIV as necessary for convenient display, set STAB to ON, and adjust 10 KHz control R93 for full scale display, plus or minus 2 dB.

NOTE

If necessary to calibrate at 1 kHz bandwidth, the procedure is similar to steps 3 or 4, using 1 kHz control R87 to adjust for full scale display.

(4) Set BANDWIDTH - KHz to 0. 3, adjust SCANWIDTH/DIV for convenient display, and adjust 300 Hz control R86 for full scale display, plus or minus 2 dB.

(5) Switch to LIN, set BANDWIDTH - KHz to 1000, SCANWIDTH/DIV to 1 MHz, adjust signal generator for 7 divisions amplitude and check signal width at 2 divisions down for 1 division plus or minus 1 minor division.

(6) Repeat step 4 at BANDWIDTH - KHz of 10, SCANWIDTH/DIV of 10 kHz.

(7) Repeat step 4 at BANDWIDTH - KHz of 1, SCANWIDTH/DIV of 1 kHz.

(8) Set BANDWIDTH - KHz to 0. 3, SCANWIDTH/DIV to 1 kHz, adjust signal level for 7 divisions, and check signal width at 2 divisions down for 0. 3 division, plus or minus 1 minor division.

NOTE

The bandwidth checks will determine if the 6. 5 MHz crystal filter board is serviceable. If checks are unsatisfactory, return the board to factory.

7-3.2.2.5 100 KHz B.P. Filter Board (A203). Connect signal generator (table 7-1) as shown in figure 7-11. Set controls as follows:

Control	Setting
STD SWEEP	10 msec/DIV
BAND SELECT	1
STAB	OFF
SCANWIDTH/DIV	500 kHz
BANDWIDTH - KHz	1000 and noted
LIN/LOG	LOG and noted
IF ATTEN - dB	0 and noted
INPUT ATTEN - dB	0
Signal Generator Frequency	400 MHz
Calibrated Level	-30 dBm

(1) Check for full scale display at initial settings. If calibrated input of -30 dBm fails to produce full scale signal, adjust Band 1 gain R11 on RF board A208.

(2) Set BANDWIDTH - KHz to 100, SCANWIDTH/DIV to 100 KHz, adjust FINE TUNE to center the signal on the 6.5 MHz response, and adjust R13 for full scale signal.

(3) Switch to LIN and adjust IF ATTEN - dB for signal peak at the 7 division line. Check for band width of one division at two divisions down from peak.

(4) With BANDWIDTH - KHz set at 100, adjust C13, C15, C17, C19 to obtain peak amplitude and best symmetry of signal centered on the 10 kHz response.

7-3.2.2.6 Fourth Converter Board (A202). Connect comb generator and low pass filter (table 7-1) as shown in figure 7-12. Set controls as follows:

Control	Setting
STD SWEEP	3 msec/DIV
BAND SELECT	1
STAB	OFF
SCANWIDTH/DIV	500 kHz
BANDWIDTH - KHz	10 and noted
LIN/LOG	LIN and noted
IF ATTEN - dB	Noted
INPUT ATTEN - dB	0
Comb Generator	10 MHz

(1) Adjust FINE TUNE to center signal.

(2) Set BANDWIDTH - KHz to 1000 and adjust IF ATTEN - dB to position signal peak at the 7 division line. Check for bandwidth of 2 divisions, plus or minus one minor division.

(3) Adjust C42, C19, four capacitors (C30 - C33) on the 60 MHz filter, and C43 to obtain the specified bandwidth, with a symmetrical signal, centered on the 10 KHz response of Step 1.

(4) Reinstall board in rack, switch to LOG, and adjust R12 to obtain maximum amplitude, then adjust R12 to bring signal down 11 dB from maximum amplitude point.

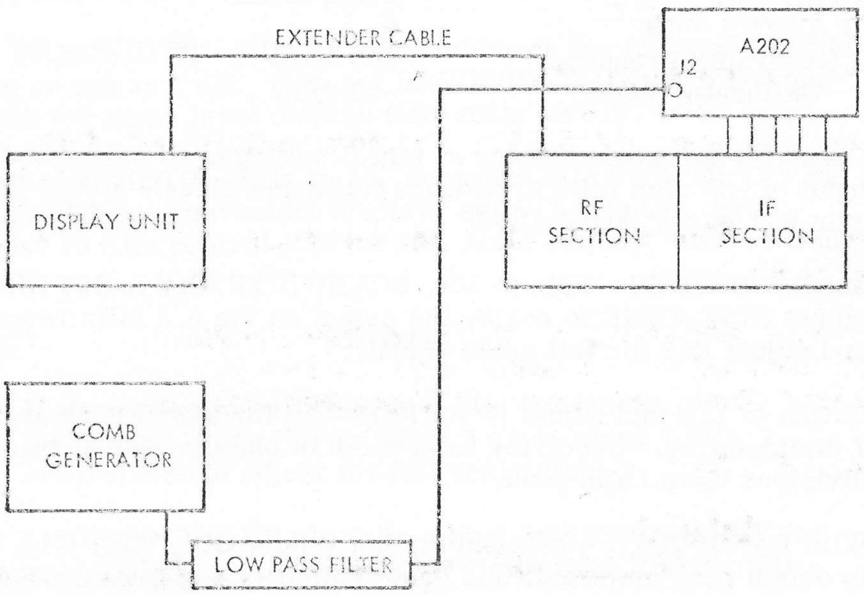


Figure 7-12. A202 Fourth Converter Board Test Setup

SECTION VIII

REPLACEABLE PARTS LIST

8-1. INTRODUCTION

Replaceable parts for the Model 762-2 Microwave Spectrum Analyzer are listed in this section. The parts are listed in three tables, as follows:

Table 8-1. Replaceable Parts for Model 762-2 Microwave Spectrum Analyzer

Table 8-2. Replaceable Parts for Model 712-2 Standard Persistence Display Unit

Table 8-3. Replaceable Parts for Model 809-2 Microwave Tuning Unit

Table 8-1 lists the major components. Tables 8-2 and 8-3 list replaceable parts of the units comprising the system.

8-2. EXPLANATION OF COLUMNS

The following is an explanation of the data contained in each column of the replaceable parts list.

(1) FIGURE NO.: This column references the figure in which the assembly or component is illustrated.

(2) REFERENCE DESIGNATION: Parts are listed in sequence by reference designation, within each table, Replaceable parts not assigned reference designations are listed last in each table, and in alphabetical sequence by name of component.

EXAMPLES:

```
A301C27
|  |
|  |________ COMPONENT REFERENCE DESIGNATION
|
|___________ ASSEMBLY

K301
|
|___________ COMPONENT WITHOUT ASSEMBLY PREFIX
```

(3) NAME OF COMPONENT AND DESCRIPTION: The assembly and component names, including values, tolerances, and other pertinent descriptions are given in this column. The notation "Same as___" appears when the component is identical to a preceding one within the same table; refer to the referenced component for description, manufacturer, and part numbers.

(4) SYSTRON-DONNER PART NUMBER: The part number in this column is assigned by Systron-Donner. Parts listed without a manufacturer's part number in column (6) are Systron-Donner manufactured, specification controlled, or source controlled parts and should be ordered by the Systron-Donner part number.

(5) MFR'S CODE: This column lists the five-digit manufacturer's code applicable to the part number in column (6). These codes are contained in Cataloging handbooks H4-1 and H4-2. A list of codes and corresponding manufacturers is included in this section.

(6) MANUFACTURER'S PART NUMBER: This column lists standard part numbers and suggested manufacturers part numbers. Equivalent parts procurable from other sources may be used.

(7) QTY USED: The figure in this column is the total quantity of that part numbered item used in the assembly of the unit covered by the table. The quantity appears only in the first entry of each part number and is the total of the subsequently listed identical parts listed with the notation "Same as ____".

(8) REMARKS: This column contains additional information useful in identification and ordering of parts. Where a component is part of a subassembly, not readily identifiable by the reference designation, the subassembly part numbers is contained in the notation "Part of ___" in the remarks column.

8-3. MANUFACTURER'S CODES

CODE	NAME
PIHER	Piher International Corp. Des Plaines, Il.
STM	STM Corp. Oakland, Ca.
00656	Aerovox Corp., Waltham, Mass. 02154
01121	Allen-Bradley Co. Milwaukee, Wis. 53204
01220	Systron-Donner Corp. Microwave Division Van Nuys, Ca. 91409
01281	TRW Electronic Components Semiconductor Division, Lawndale, Ca. 90260
02111	Sepctrol Electronics Corp., City of Industry, Ca. 91745
02114	Ferroxcube Corp. of America Saugerties, NY 12477
02660	Amphenol Corp., Broadview, Il. 60153

SECTION IX

DIAGRAMS

9-1 GENERAL

This section contains schematic diagrams for the Model 762-2 Microwave Spectrum Analyzer. Waveform and voltage measurement data appear on sheet 1 of each diagram where applicable, to assist in maintenance of the unit. Component identification illustrations are included on the pages with schematic diagram of circuit boards.

9-2 MODEL 762-2 MICROWAVE SPECTRUM ANALYZER DIAGRAMS

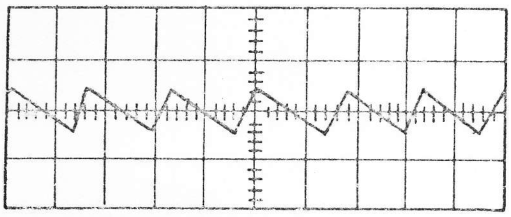
Figure 9-1 is a diagram of the Std Perisitence Display Unit. Figures 9-6 and 9-7 are diagrams of the Microwave Tuning IF Section and RF Deck. The remaining diagrams are of circuit boards and other modules referenced by 40000 schematic drawing numbers in figures 9-1, 9-6, and 9-7. The following is a list of diagrams and corresponding schematic drawing numbers.

Figure No.	Title	Schematic Drawing No.
9-1	Std Persistence Display Unit, Schematic Diagram	40000-152
9-2	Power Supply Board A101, Schematic Diagram	40000-120-2
9-3	Sweep & Vertical Amplifier Board A102, Schematic Diagram	40000-121-2
9-4	Fast Sweep/Sync Amplifier Board A103, Schematic Diagram	40000-125-2
9-5	Hi Voltage Divider & Blank Board A104, Schematic Diagram	40000-122-2
9-6	Microwave Tuning Unit IF Section, Schematic Diagram	40000-151
9-7	Microwave Tuning Unit RF Deck Interconnect, Schematic Diagram	40000-150
9-8	3rd Converter Board A201, Schematic Diagram	40000-138-2
9-9	60 MHz +6.5 MHz 4th Frequency Converter Board A202, Schematic Diagram	40000-139-2
9-10	100 KHz B. P. Filter Board A203, Schematic Diagram	40000-132-2
9-11	6.5 MHz Crystal Filter Board A204, Schematic Diagram	40000-117-2
9-12	LIN-LOG Amplifier Board A205, Schematic Diagram	40000-115-2
9-13	Harmonic Attenuator Board A206, Schematic Diagram	40000-142-2
9-14	RF Board A208, Schematic Diagram	40000-128-2
9-15	Phase Lock Module A209, Schematic Diagram	40000-131-2
9-16	IF Attenuator AT202, Schematic Diagram	40000-140-2

	1	2	3	4	5	6	7	8	9	10
AR1	+12.0	G	+23.0	+11.9	+11.7	+11.9	X	+3.3	11.9	G
AR2	-3.7	X	X	-15.9	-15.5	-6.0	-14.3	-6.0	-6.0	G
AR3	+12.1	G	+23.0	+12.0	+11.8	+12.0	X	+3.3	+12.0	G

	E	B	C
Q1	+70.8V	+62.6	+117.5
Q2	+41.2	X	+62.6
Q3	+198	+199	303
Q4	+107	X	+199

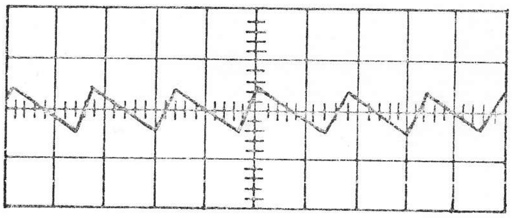
.5V AC/DIV



5 MS/DIV

AR1
PIN 3

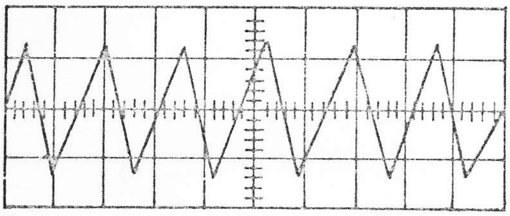
.5V AC/DIV



5 MS/DIV

Q1
COL.

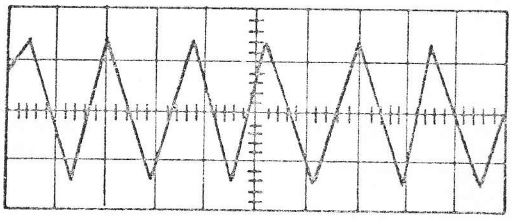
.5V AC/DIV



5 MS/DIV

AR2
PIN 4, 5

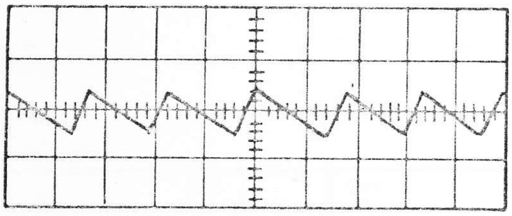
.5V AC/DIV



5 MS/DIV

Q3
COL

.5V AC/DIV



5 MS/DIV

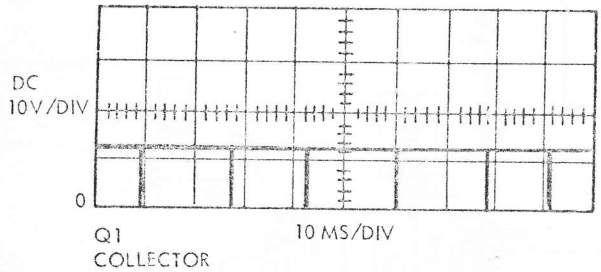
AR3
PIN 3

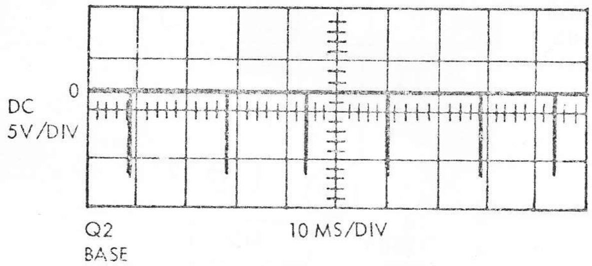
NOTES:

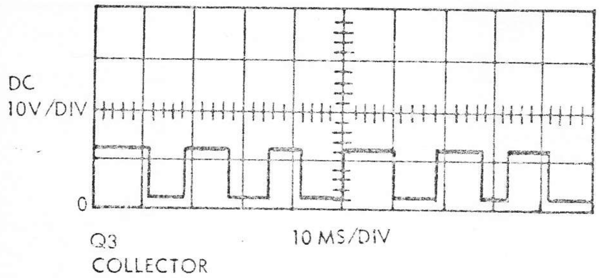
USE DVM FOR VOLTAGE READINGS,
TUNING UNIT REMOVED.

Figure 9-2. Power Supply Board A101, Schematic Diagram (Sheet 1)

	E	B	C
Q1	0	+.03	+11.07
Q2	0	+.73	+.20
Q3	0	-.12	+7.68







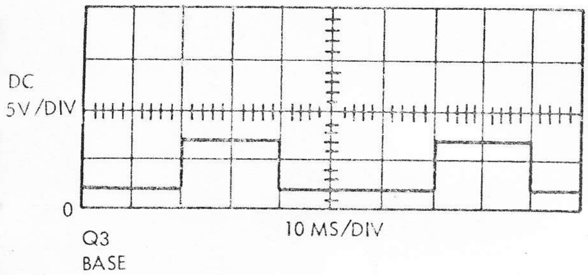
NOTES:

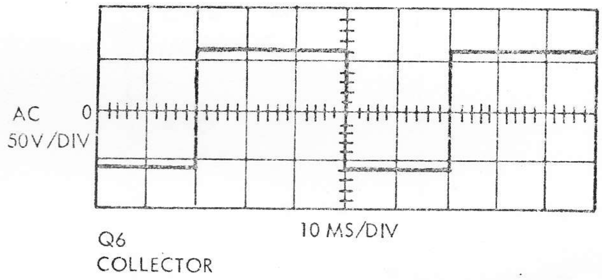
FOR VOLTAGE AND WAVEFORM MEASUREMENTS, REMOVE TUNING UNIT.

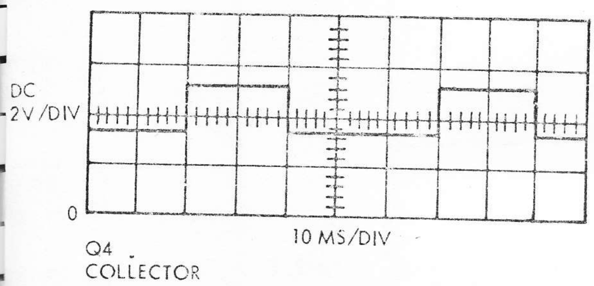
Figure 9-4. Fast Sweep/Sync Amplifier Board A103, Schematic Diagram (Sheet 1)

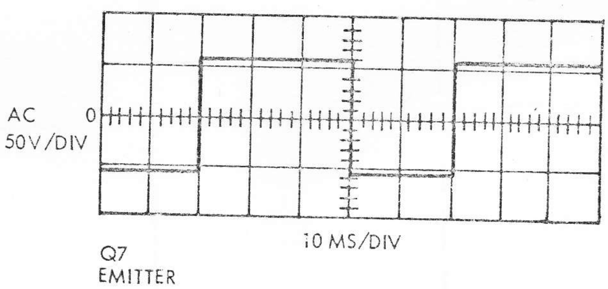
	E	B	C
Q1	0	0	+5.3
Q2	0	+.4	+5.3
Q3	+4.5	+4.5	+11.9
Q4	+4.5	+4.0	+3.6
Q5	0	+.5	+5.4
Q6	-0.15	0	+75.9
Q7	+75.4	+75.9	110

	1	2	3	4	5	6	7	8
AR1	0	0	+.08	-5.65	0	0	-.51	+11.28









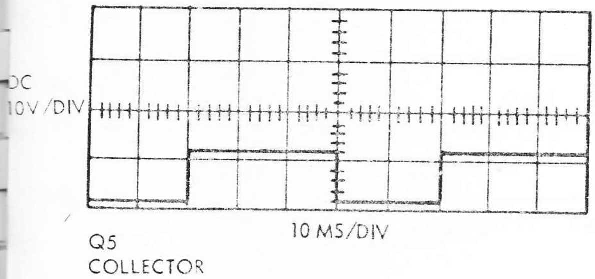


Figure 9-5. Hi Voltage Divider & Blank Board A104, Schematic Diagram (Sheet 1)

NOTES:

1. FOR VOLTAGE AND WAVEFORM MEASUREMENTS, SET CONTROLS AS FOLLOWS: (INPUT 100 MHZ, CW, -30dBm):

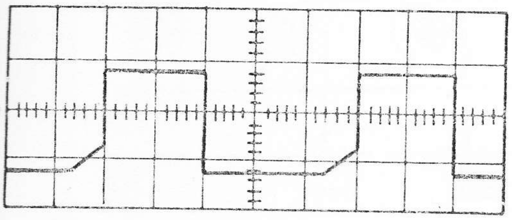
BAND SELECT	1
FREQUENCY TUNE	100 MHZ
INPUT ATTEN - dB	0
IF ATTEN - dB	0
SCANWIDTH/DIV	500 KHZ
BANDWIDTH - KHZ	100
LIN - LOG	LOG
VIDEO DURATION - BW	OFF
SIG IDENT	OFF
STAB	OFF
SYNC	LINE
STD SWEEP	3 MSEC/DIV

2. OSCILLOSCOPE RISE TIME APPROX. 0.006 μSEC.

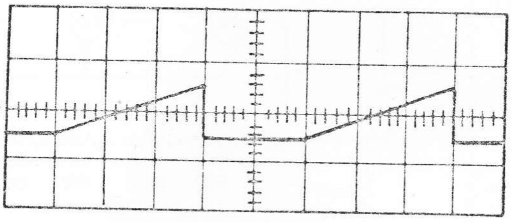
	1	2	3	4	5	6	7	8
AR1	-14.9	0	0	-15.0	-15.0	+1.17	+14.4	0
AR2	-14.9	0	0	-14.9	-14.9	+1.17	+14.4	0
AR3	-14.9	-6.12	-6.21	-14.9	-14.9	-9.64	0	0
AR4	-14.9	0	0	-14.9	-14.9	-3.3	+14.4	0

	E	B	C
Q1	*	*	*
Q2	+.69	+1.41	+0.81
Q3	0	+.02	+10.9
Q4	0	+.69	+.02
Q5	0	-.38	+2.9
Q6	+1.17	+5.03	0
Q7	0	+.68	0
Q8	+4.78	+5.41	+14.4
Q9	+3.05	+4.68	0
Q10	+3.05	+4.56	0
Q11	-3.92	-3.29	+7.07
Q12	+3.05	+3.89	0
Q13	+3.05	+3.48	0
Q14	+6.51	+7.08	+18.5
Q15	+2.82	+2.88	0
Q16	+2.63	+2.52	0
Q17	+2.51	+3.15	+14.45

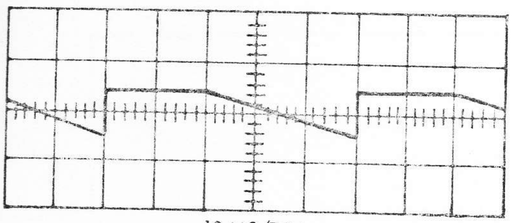
*INACCESSIBLE



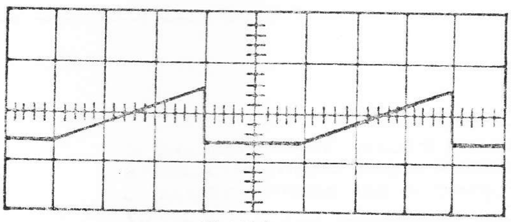
Q5
BASE



AR2
6



AR1
6



PIN 8

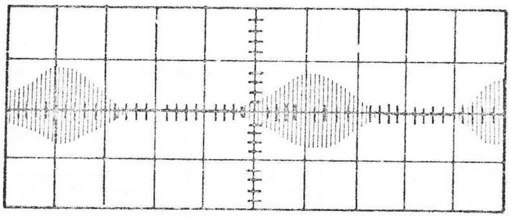
Figure 9-8. 3rd Converter Board A201, Schematic Diagram (Sheet 1)

	1	2	3	4	5	6	7	8	9	10
AR1	+.73	0	0	+.73	+3.45	+5.95	0	+3.39	+5.95	+3.38
AR2	+1.7	+2.94	+1.71	0	+5.95	+5.95	+5.95	0		

	E	B	C
Q1	*	*	*
Q2	-10.1	-9.36	0
Q3	+5.1	+5.89	+11.94

*INACCESSIBLE

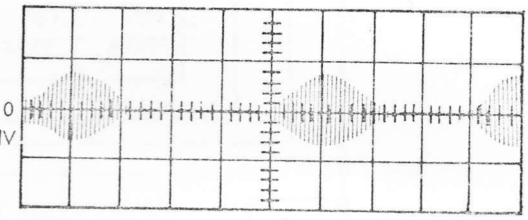
DC 0
.2V/DIV



10 MS/DIV

Q2
COLLECTOR

AC 0
.2V/DIV



10 MS/DIV

Q3
EMITTER

NOTES:

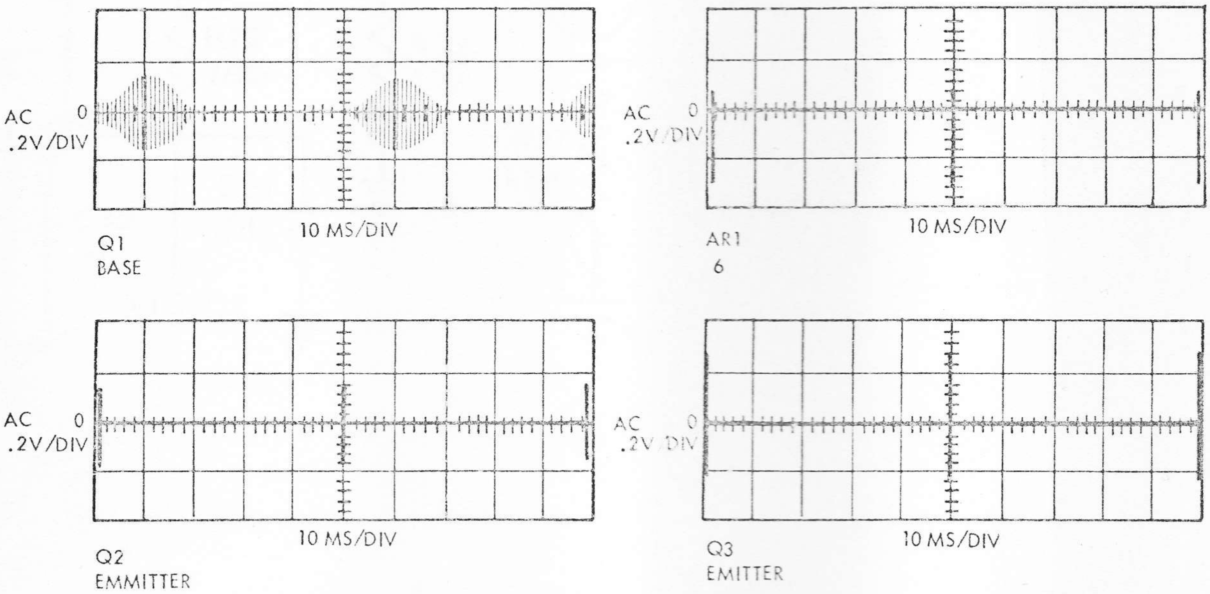
FOR VOLTAGE AND WAVEFORM MEASUREMENTS, SET CONTROLS AS FOLLOWS (INPUT 100 MHZ, -30 dBM):

BAND SELECT	1
FREQ TUNE	100 MHZ
SCANWIDTH/DIV	500 KHZ
BANDWIDTH KHZ	100
LIN/LOG	LOG
STAB	OFF
VIDEO DURATION - BW	OFF
INPUT ATTEN - dB	0
IF ATTEN - dB	0

Figure 9-9. 60 MHz - 6.5 MHz 4th Frequency Converter Board A202, Schematic Diagram (Sheet 1)

	1	2	3	4	5	6	7	8	9	10
AR1	+.75	0	0	+.75	+7.5	+14.1	0	+7.54	+14.39	+7.5

	E	B	C
Q1	-8.23	-7.48	0
Q2	-8.52	-7.76	0
Q3	+6.28	+7.03	+14.39



NOTE

FOR VOLTAGE AND WAVEFORM MEASUREMENTS, SET CONTROLS AS FOLLOWS (INPUT 100 MHZ, -30 dBM):

BAND SELECT	1
FREQ TUNE	100 MHZ
SCANWIDTH/DIV	500 KHZ
BANDWIDTH KHZ	100
LIN LOG	LOG
STAB	OFF
VIDEO DURATION - BW	OFF
INPUT ATTEN - dB	0
IF ATTEN - dB	0

Figure 9-10. 100 KHz B. P. Filter Board A203, Schematic Diagram (Sheet 1)

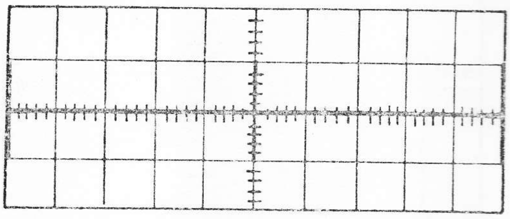
	E	B	C
Q1		-6.85	0
Q2	-.69	0	+4.58
Q4	-.69	0	+4.48
Q6	-7.81	-7.16	0
Q7	-.69	0	+4.35
Q9	-2.53	-1.89	+14.13
Q10	-4.98	-4.31	-0.99
Q11	-.37	-.99	-10.94
Q12	-11.60	-10.95	0
Q13	-7.56	-6.93	0
	D	G	S
Q3	-14.42	0	-1.61
Q5	-14.39	0	-2.04
Q8	-14.16	0	-1.89

NOTES:

FOR VOLTAGE AND WAVEFORM MEASUREMENTS, SET CONTROLS AS FOLLOWS (INPUT 100 MHZ, -30 dBM):

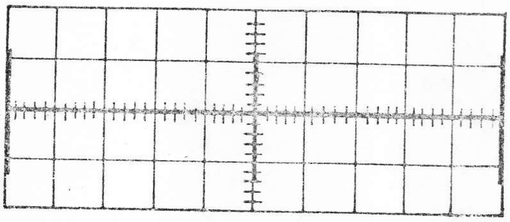
BAND SELECT	1
FREQ TUNE	100 MHZ
SCANWIDTH/DIV	500 KHZ
BANDWIDTH KHZ	100
LIN/LOG	LOG
STAB	OFF
VIDEO DURATION - BW	OFF
INPUT ATTEN - dB	0
IF ATTEN - dB	0

AC 0
0.5V/DIV



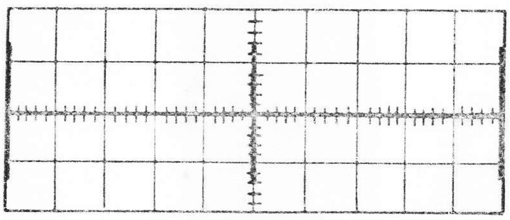
Q10
BASE

AC 0
1V/DIV



Q11
COLLECTOR

AC 0
1V/DIV



Q12
EMITTER

Figure 9-11. 6.5 MHz Crystal Filter Board A204, Schematic Diagram (Sheet 1)

	1	2	3	4	5	6	7	8	9	10
AR1	+11.12	+10.39	0	0	-14.39	+0.49	+12.08	+13.94	+12.05	+11.14

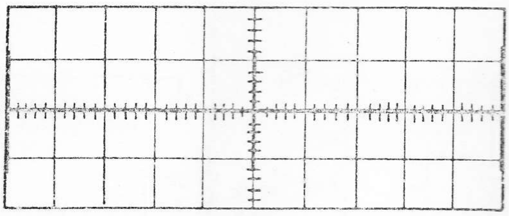
	E	B	C
Q1	-4.02	-3.22	0
Q2	-3.85	-3.14	0
Q3	-3.85	-3.13	0
Q4	-3.82	-3.12	0
Q5	-3.82	-3.14	0
Q6	-3.68	-3.15	0
Q7	-3.86	-3.24	+14.45

NOTES:

FOR VOLTAGE AND WAVEFORM MEASUREMENTS, SET CONTROLS AS FOLLOWS (INPUT 100 MHZ, -30 dBM):

BAND SELECT	1
FREQ TUNE	100 MHZ
SCANWIDTH/DIV	500 KHZ
BANDWIDTH KHZ	100
LIN/LOG	LOG
STAB	OFF
VIDEO DURATION - BW	OFF
INPUT ATTEN - dB	0
IF ATTEN - dB	0

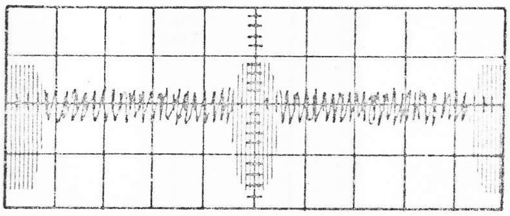
AC 0
1V/DIV



10 MS/DIV

Q1
BASE

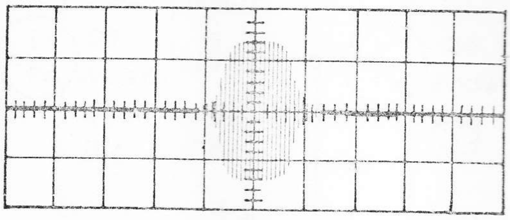
AC 0
2V/DIV



10 MS/DIV

Q6
BASE

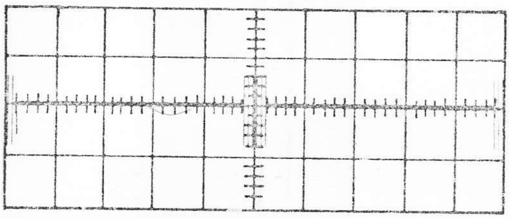
DC 0
2V/DIV



1 MS/DIV

Q2, Q3
COLLECTOR

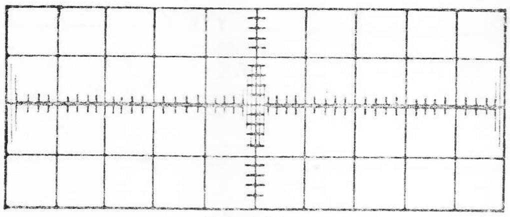
AC
.5V/DIV
0



10 MS/DIV

Q7
COLLECTOR

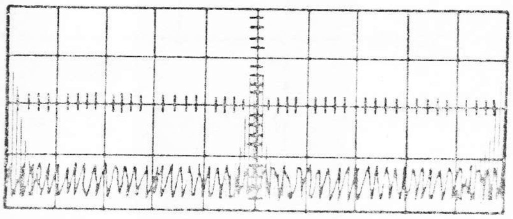
AC 0
2V/DIV



10 MS/DIV

Q4, Q5
BASE

DC
5V/DIV
0



10 MS/DIV

TP5
VIDEO
OUT

Figure 9-12. LIN-LOG Amplifier Board A205, Schematic Diagram (Sheet 1)

	1	2	3	4	5	6	7	8
AR1	-15.02	-1.05	-1.04	-15.03	-15.02	-2.16	+14.49	0
AR2	-15.02	-2.15	-2.15	-15.03	-15.02	-2.16	+14.47	0

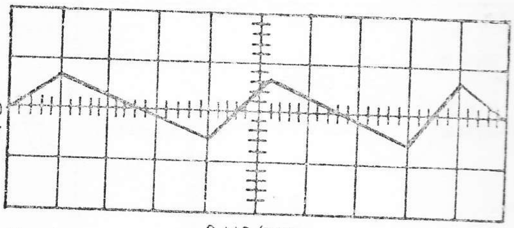
	E	B	C
Q1	0	+8.20	-2.15
Q2	0	+7.98	-2.15
Q3	0	+9.39	-2.15
Q4	0	+8.84	-2.13
Q5	0	+8.11	-2.10
Q6	0	+8.32	-2.15
Q7	0	-7.93	-.05
Q8	0	-7.77	-.69
Q9	0	-7.71	-.04
Q10	0	+.70	+.01
Q11	+14.49	+13.75	+14.43
Q12	+14.49	+13.88	-8.71
Q13	+14.49	+13.78	+14.47
Q14	+14.48	+14.01	+3.44

NOTES:

FOR VOLTAGE AND WAVEFORM MEASUREMENTS, SET CONTROLS AS FOLLOWS (INPUT 100 MHZ, -30 dBM):

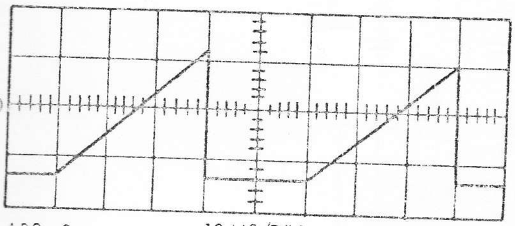
BAND SELECT	1
FREQ TUNE	100 MHZ
SCANWIDTH/DIV	500 KHZ
BANDWIDTH KHZ	100
LIN/LOG	LOG
STAB	OFF
VIDEO DURATION - BW	OFF
INPUT ATTEN - dB	0
IF ATTEN - dB	0

AC 0
.5V/DIV



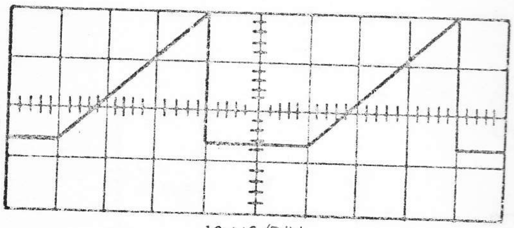
J1 - 13 2 MS/DIV

DC 0
5V/DIV



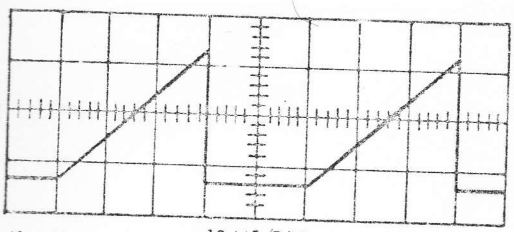
AR2 3 10 MS/DIV

DC 0
5V/DIV



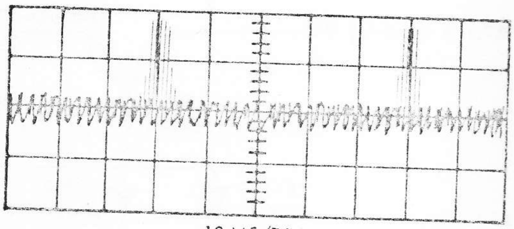
Q1 - Q6
COLLECTOR 10 MS/DIV

DC 0
5V/DIV



J1 - M 10 MS/DIV

AC 0
5V/DIV



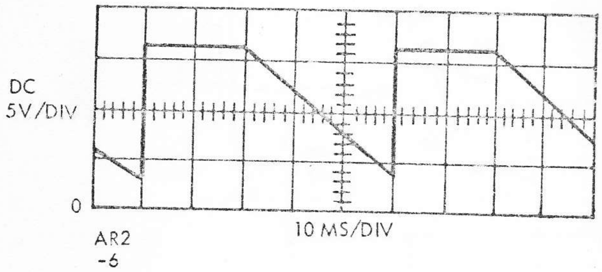
Q7, Q8, Q9
COLLECTOR 10 MS/DIV

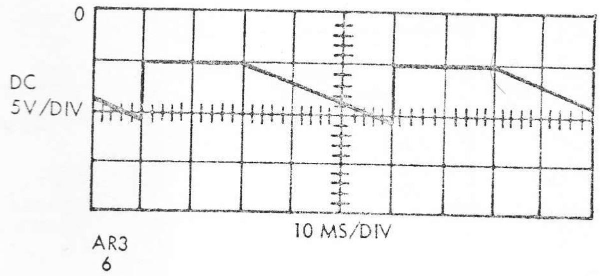
Figure 9-13. Harmonic Attenuator Board A206, Schematic Diagram (Sheet 1)

FOR RF BOARD & RF DECK CHECKS, SET UP EQUIPMENT AS FOLLOWS:		
RF DECK	BAND 1	
	TUNE	100 MHZ
	NO INPUT	
IF DECK	RF ATT	30 db
	IF ATT	0 db
	S.W.	100 MHZ
	B.W.	100 KHZ
	LIN - LOG	LOG
	SIG IDENT	FULL SWEEP
	STAB	OFF

	E	B	C
Q2	-17.95	-18.45	-18.42
Q4	-5.69	-6.33	-14.89
Q5	-5.10	-5.69	-14.89

	1	2	3	4	5	6	7	8
AR1	-17.93	-4.83	-4.82	-17.95	-17.93	-4.83	-14.54	0
AR2	-17.93	0	0	-17.95	-17.93	+9.82	+14.55	0
AR3	-17.93	-5.11	-5.10	-.17	-17.93	-5.11	0	0
AR4	-17.93	-14.45	-14.45	-17.92	-17.93	-14.45	0	0
AR5	-17.93	-5.11	-5.10	-17.95	-17.94	-6.35	0	-0.14
AR6	-17.93	-6.29	-6.29	-17.95	-17.94	-13.08	0	0
AR7	-17.92	0	0	-17.94	-17.94	+3.73	+14.54	0
AR8	-17.93	-13.07	-13.07	-17.94	-17.93	-15.06	0	0
Z1	INACCESSIBLE							





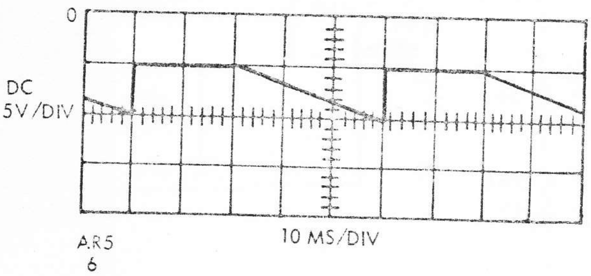


Figure 9-14. RF Board A208, Schematic Diagram (Sheet 1)