WILTRON

MODEL 6213D RF PLUG-IN
OPERATION AND MAINTENANCE
MANUAL

THE 6213D RF PLUG-IN
IS USED IN THE 610 SERIES
SWEEP GENERATOR MAINFRAME.

APPLICABLE SERIAL NUMBERS

This manual applies to
serial numbers 908001 and above.

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10 330-00010, Rev B
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WARRANTY

All products are warranted against defects in materials and workmanship for one year from the date of shipment except YIG-tuned oscillators, which have a two-year warranty period. Our obligation covers repairing or replacing products which prove to be defective during the warranty period and which shall be returned with transportation charges prepaid to WILTRON. Obligation is limited to the original purchaser. We are not liable for consequential damages.

MANUAL CHANGES

MODEL 6213D OPERATION AND MAINTENANCE MANUAL

CHANGE #1

Serial Numbers Affected

112001 and above

A. On page 1-2, Table 1-1, change LEVELED POWER OUTPUT spec to +10 dBm (10mW).

B. On page 4-1, Section 4-2, change the second paragraph to read:

> "The 6213D plug-in consists of a YIG-tuned transistor oscillator, a low-band RF section (local oscillator, two low-pass filters, a mixer and an amplifier); bandswitching; RF power leveling; and modulator circuits. The plug-in has two bands: Band 1, 0.01-1 GHz; and Band 2, 0.01-4.2 GHz, which includes the 0.01-2 GHz and the 2-4.2 GHz ranges. The 0.01-2 GHz portion of the band is produced by heterodyning the outputs of the YIG oscillator and low-band RF section, while the YIG oscillator generates the 2-4.2 GHz portion of the sweep. Then, bandswitching and modulator circuits alternately switch between the two outputs to produce the 0.01-4.2 GHz band. Also, these circuits control the YIG oscillator and low-band RF section to create the 0.01-1 GHz band."

C. On page 4-1, Section 4-3, change the second and third paragraphs to read:

> "The output of the Lo Band Ramp Amp is fed to the YIG oscillator via the Bias Slope Amp, YIG Swept Bias Supply, and YIG Coil Driver. The Bias Slope Amp and YIG Swept Bias Supply provide the necessary bias voltages for the YIG oscillator, while the YIG Coil Driver provides the necessary YIG oscillator tuning current. Also, the YIG Fixed Bias Supply provides a fixed bias for the transistor in the YIG oscillator. Consequently, the YIG oscillator generates a 2-4.2 GHz sweep that is fed to the RF OUTPUT connector via the 2-4.2 GHz Isolator, 2-4.2 GHz Directional Coupler, and 0.01-2 GHz Leveling PIN Modulator. The YIG output also branches off to the Mixer.
>
> The Mixer heterodynes the YIG output and 4.3 GHz Local Oscillator signal to produce the 0.01-2 GHz band. Note that a 6.5 GHz Low-Pass Filter filters the local oscillator output before it goes to the Mixer. After the 2-4.2 GHz output mixes with the local oscillator signal, the heterodyned signal passes through a 2000 MHz Low-Pass Filter before it is amplified 25 dB and fed to the 2-Pole PIN Switch Modulator. During the 0.01-2 GHz sweep, the Bandswitch Detector, Return Port Driver, and Bandswitch Logic circuitry turn on the Lo Band

Port On/Off Driver, which sends the 0.01-2 GHz sweep at the lo band port of the 2-Pole PIN Switch Modulator to the RF OUTPUT connector through the Internal Level Detector."

D. On page 4-3, change Figure 4-1 as shown in Figure 1 below and delete the Downconverter Bias Supply.

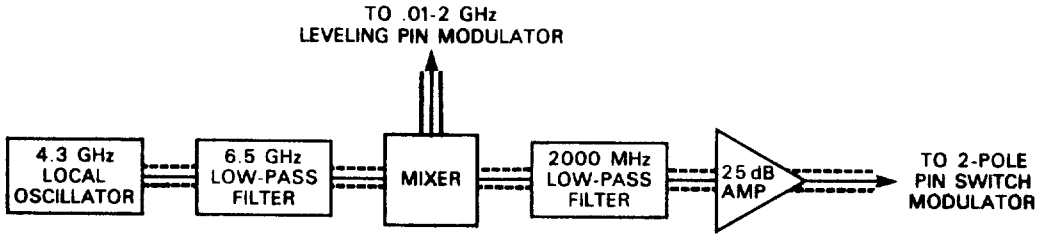


Figure 1

E. On page 5-6, Table 5-5, change the bias voltage at A2TP12 to +15V.

F. On page 5-7/5-8, Figure 5-6, delete "A2R135, +20V BIAS ADJ."

G. On page 5-9/5-10, Figure 5-8, delete R135, R136, and U12.

H. On page 5-13, Section 5-3.5, steps j and l, change power output to "+10 dBm."

I. On page 6-3, Table 6-2, make the following value changes:

REF. DES.	DESCRIPTION	WILTRON PART NO.
A1R27	24.3k, 1/4W, 1%, MF	110-24.3k-1
A1R64	5.76k, 1/4W, 1%, MF	110-5.76k-1
A1R75	7.5k, 1/4W, 1%, MF	110-7.5k-1
A1R76	36.5k, 1/4W, 1%, MF	110-36.5k-1

J. On page 6-5, Table 6-3, make the following changes:

REF. DES.	DESCRIPTION	WILTRON PART NO.
A2R134	15k, 1/4W, 1%, MF	110-15k-1
A2R135	DELETE	
A2R136	DELETE	

K. On page 6-7/6-8, Table 6-7, make the following additions and deletions:

ADD:

——	Amplifier, 25 dB	60-10
——	Low-pass Filter, 2000 MHz	1030-21
——	Low-pass Filter, 6.5 GHz	1030-25
——	Mixer	60-12
——	Oscillator, Fixed-Frequency, 4.3 GHz	B-9778
——	Directional Coupler, Front Panel	6213-D-7906

DELETE:

----	Downconverter, .01-2 GHz	1006-2
----	Pad, 3 dB	1010-26
----	Directional Coupler, Front Panel	MS-5408

L. On page 6-9/6-10, Figure 6-1, change R27 to 24.3k.

M. On page 6-11/6-12, Figure 6-2, change R64 to 5.76k, R75 to 7.5k, and R76 to 36.5k.

N. On page 6-13/6-14, change Figure 6-3 as shown in Figure 2 below; change R134 to 15k and delete R135, R136 and U12.

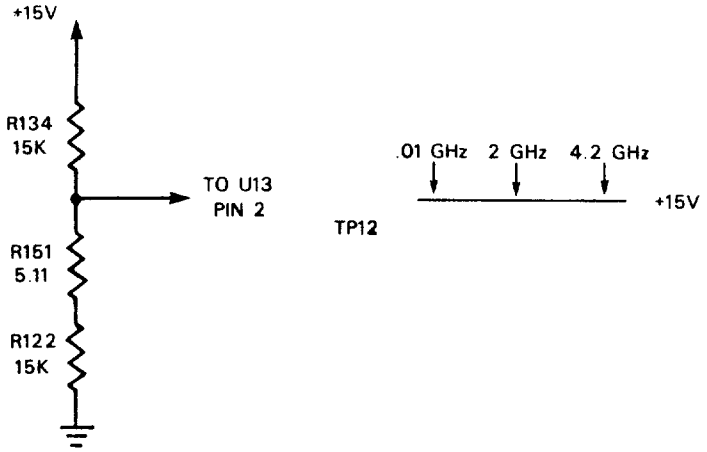
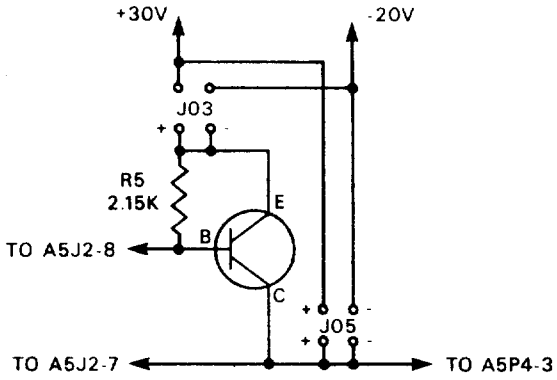


Figure 2

O. On page 6-19/6-20, change Figure 6-7 as shown in Figure 3 below:



COMPONENTS

Model No.	J05
6213D	+

Figure 3

PCO 2068A
29 May 1981

CHANGE #2

Serial Numbers Affected

112001 to 112010

A. On page 6-5, YIG Driver PC Assembly parts list, make the following value changes:

REF DES.	FROM	TO
R18	110-13.3k-1	110-1.78k-1
R37	110-13.3k-1	110-3.32k-1
R137	110-13.3k-1	110-1.78k-1

B. On page 6-13/6-14, YIG Driver schematic, make the above changes.

G511
22 May 1981

CHANGE #3

Serial Numbers Affected

112001 to 112010

A. On page 6-2, Level Bandswitch parts list, make the following changes:

REF DES.	FROM	TO
A1C1	.01μF	Factory-select
A1C4	.1μF	Factory-select

B. On page 6-9/6-10, Level Bandswitch schematic, make the changes above.

TECO G513
22 May 1981

CHANGE #4

Serial Numbers Affected

111007 thru 111010

A. On page 6-3, make the following value changes:

REF. DES.	DESCRIPTION	PART NO.
A1R64	**TO:** 5.76k, 1/4W, 1%, MF	110-5.76k-1
A1R75	**TO:** 7.5k, 1/4W, 1%, MF	110-7.5k-1
A1R76	**TO:** 36.5k, 1/4W, 1%, MF	110-36.5k-1

B. On page 6-11/6-12, make the above changes on the schematic.

c. On page 6-7/6-8, Table 6-7, change the WILTRON PART NO. of the "Directional Coupler, Front Panel"

FROM: 6210-MS-5408

TO: 6213-D-7906

TECO G382
5-28-81

CHANGE #5

Serial Numbers Affected

113001 and above

A. On page 6-5, YIG Driver parts list, make the following changes:

REF. DES.	FROM	TO
R18	110-13.3k-1	110-1.78k-1
R37	110-13.3k-1	110-3.32k-1
R137	110-13.3k-1	110-1.78k-1

B. On page 6-13/6-14, the YIG Driver Schematic, change the following resistor values:

REF. DES.	FROM	TO
R18	13.3k	1.78k
R37	13.3k	3.32k
R137	13.3k	1.78k

PCO 2233
June 29, 1981

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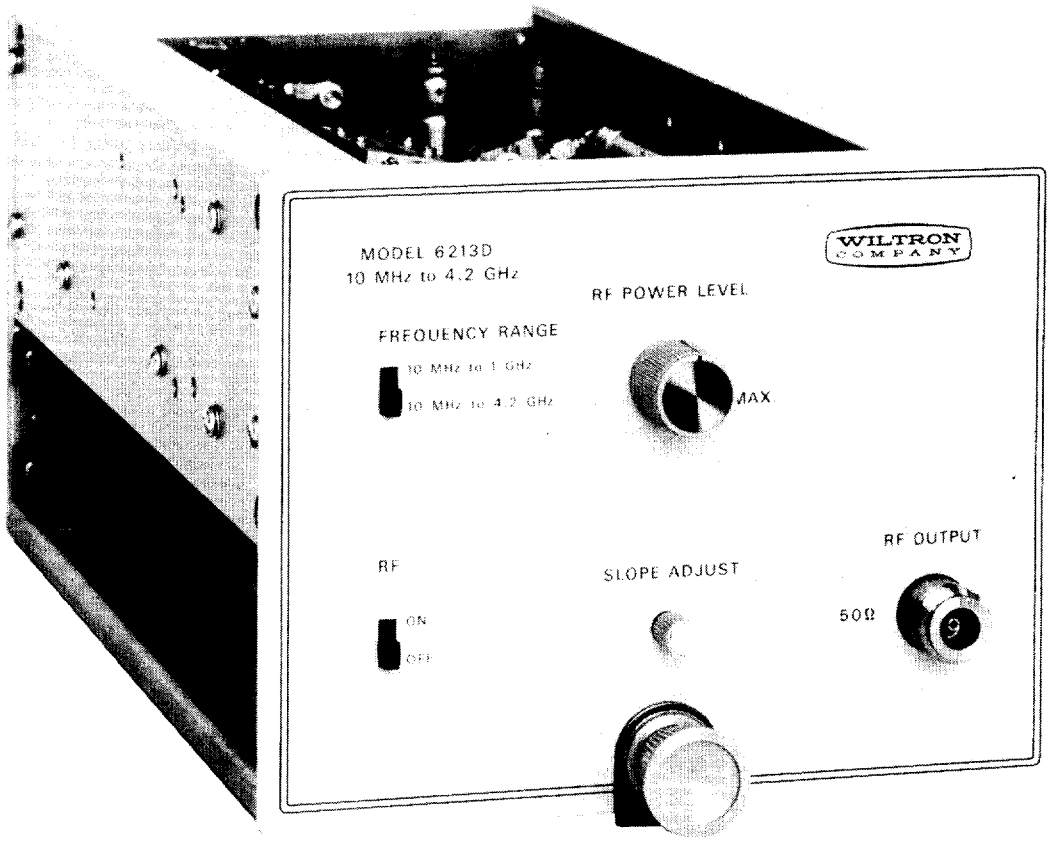


Figure 1-1. Model 6213D RF Plug-In

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains operation and maintenance information for the WILTRON Model 6213D RF Plug-In. This section of the manual provides a general description of the Model 6213D, including the equipment specifications. Section II contains instructions for unpacking and installing the RF plug-in. Section III describes the function of the controls and connectors, and provides detailed procedures for operating the RF plug-in when it is installed in the WILTRON Model 610 Mainframe. Section IV describes the theory of operation of the plug-in circuits. Step-by-step procedures for maintenance and calibration are presented in Section V along with a troubleshooting chart. A complete list of the replaceable parts and the schematic diagrams can be found in Section VI.

1-2. DESCRIPTION

The Model 6213D RF Plug-In (see Figure 1-1) is used in conjunction with the WILTRON Model 610B, 610C, or 610D Sweep Generator Mainframe to provide a swept or fixed-frequency signal source over a frequency range of 10 MHz to 4.2 GHz. A bandswitch on the front panel of the RF plug-in selects either the complete 10 MHz to 4.2 GHz range, or a range of 10 MHz to 1 GHz. The 10 MHz to 4.2 GHz swept frequency range is covered in two sequentially-swept bands. The whole band or any portion of it can be swept, depending on the control settings on the mainframe. Electronic bandswitching is used to obtain a smooth display with no gaps. In the CW mode, a fixed-frequency signal is generated.

The Model 6213D RF Plug-In is supplied with a slide rule dial with separate calibrated scales for the total frequency range covered by each band. The slide rule dial is installed in the front panel of the Model 610 Mainframe when the RF plug-in is installed. When the RF plug-in is removed from the mainframe, the slide rule dial is stored under two clips on the side of the unit.

The internal RF portion of the Model 6213D RF Plug-In is modularized with individually-shielded RF housings. The RF interconnections between these housings are made by miniature, semi-rigid coaxial cables which are used because of their very low RF leakage and rugged mechanical characteristics. Each modular housing is identified by its function, and each can readily be traced through the block diagram in Section IV and schematic diagrams in Section VI of this manual. This type of construction facilitates troubleshooting an RF plug-in to isolate a malfunction.

1-3. RF PLUG-IN IDENTIFICATION

WILTRON employs a six-digit serial number to identify RF plug-ins. The serial number, along with the model number, is located on the serial plate attached to the rear panel of each unit. Refer to these numbers when ordering replacement components as they will help us to expedite your order.

1-4. SPECIFICATIONS

Table 1-1 contains specifications for the Model 6213D RF Plug-In when used in conjunction with a calibrated WILTRON Model 610 Mainframe. Values and measurements provided in other sections of this manual are there as an aid to the user, and do not constitute additional specifications. The over-all dimensions of an RF plug-in are 6-3/4 inches wide by 5-1/4 inches high by 14-1/4 inches deep. The typical weight of a unit is 10 pounds; the shipping weight is 14 pounds.

Table 1-1. Specifications for Model 6213D Plug-In

FREQUENCY RANGE:	10 to 4200 MHz (10 MHz to 4.2 GHz)
LEVELED POWER OUTPUT:	+9 dBm (8mW) at 25° C
MAXIMUM LEVEL VARIATION:	±0.4 dB at 25°C
FREQUENCY BANDS:	
BAND 1:	10 to 1000 MHz ±10 MHz (10 MHz to 1 GHz)
BAND 2:	10 to 4200 MHz ±20 MHz (10 MHz to 4.2 GHz)
MAXIMUM RESIDUAL FM (CW MODE):	7 kHz peak (Note A)
HARMONICS:	-20 dB, 10 to 100 MHz and 2000 to 2200 MHz
	-30 dB, 100 to 2000 MHz and 2200 to 4200 MHz
SPURIOUS:	-30 dB, 10 to 2000 MHz
	-60 dB, 2000 to 4200 MHz
SQUARE WAVE ON/OFF RATIO:	>50 dB
RF OFF:	>50 dB
FREQUENCY DRIFT:	
WITH TEMP:	< ±100 kHz/°C
WITH LINE VOLTAGE:	< ±20 kHz
WITH 10 dB POWER LEVEL CHANGE:	<500 kHz
WITH 3:1 MISMATCH:	<100 kHz
FM MODULATION (Optional):	6 MHz/V or 20 MHz/V, switch-selectable
MAXIMUM DEVIATION:	±50 MHz

Note A: Residual FM is measured at an ac line frequency of 60 Hz, with a modulation meter that has a 30 Hz to 28 kHz bandwidth. Residual FM may be about twice the specified value when the ac line frequency is 50 Hz.

SECTION II

INSTALLATION

2-1. INTRODUCTION

This section of the manual contains the information necessary to unpack, inspect, and install the Model 6213D RF Plug-In unit.

2-2. INSPECTION

The RF plug-in is thoroughly inspected for electrical and mechanical operation prior to shipment. It is recommended that the unit be carefully removed from its packaging and inspected for physical damage that may have resulted during transit. Completeness of your order should be verified at this time. Refer to the warranty in the front of this manual should damage or deficiency be evident. If the unit is damaged, contact WILTRON and file a claim with the transfer company. Original packaging should be retained to facilitate any claim or return shipment (see paragraph 2-4).

The RF plug-in can be checked for proper operation by following the steps outlined in maintenance procedures presented in Section V of this manual. Should the RF plug-in fail to operate properly, contact WILTRON since internal damage may have resulted during transit.

2-3. INSTALLATION

The RF plug-in plugs directly into the rectangular compartment in the Model 610 Mainframe.

To install the RF plug-in, proceed as follows:

1. Ensure that the main power ON switch on the Model 610 Main Frame is set to the off position.
2. Remove the slide rule dial from the storage clips and secure it in place on the Model 610 Mainframe front panel.
3. Rotate the latch knob on the RF plug-in fully counter-clockwise to its stop.
4. Insert the RF plug-in into the compartment and push the unit firmly into place.
5. Rotate the latch knob fully clockwise to secure the unit.

To remove the RF plug-in from the Model 610 Mainframe, proceed as follows:

1. Ensure that the main power ON switch is set to the off position.
2. Rotate the latch knob fully counter-clockwise to its stop.
3. Grasp the latch knob and pull the unit from the Model 610 Mainframe.

NOTE

If any difficulty is encountered during installation or removal of the RF plug-in, ensure that the retaining latch is rotated fully counter-clockwise to its stop, and that the connectors are mating properly.

4. Remove the slide rule dial from the Model 610 Mainframe front panel and return it, printed side down, to the storage clips on the side of the RF plug-in. Install another slide rule dial or a blank dial in the mainframe to protect the pointers from damage.

2-3.1 Power Requirements

All of the electrical power and control voltages necessary to operate the RF plug-in are supplied by the Model 610 Mainframe in which the unit is installed.

2-3.2 Cooling

The RF plug-in does not require forced air cooling; however, the sides, top and bottom of the Model 610 Mainframe in which it is installed must not be obstructed from normal ambient air flow.

2-4. PACKAGING

Do not ship a Model 6213D RF Plug-In when installed in a Model 610 Mainframe. Ship each unit separately, using the original packaging or equivalent.

CAUTION

Damage may occur to both instruments if the RF plug-in is not removed from the mainframe during transit.

SECTION III
OPERATION

3-1. INTRODUCTION

This section describes the function of the controls and connectors and provides a detailed procedure for operation of the RF plug-in when installed in the Model 610 Mainframe.

3-2. FUNCTION OF CONTROLS AND CONNECTORS

The function of each front and rear panel control and connector is fully described in the following paragraphs.

Front Panel

RF POWER LEVEL - potentiometer used to set the RF power output level. Maximum leveled power output results with this control set fully clockwise.

RF OUTPUT - Type N connector for RF power output.

SLOPE ADJUST - potentiometer used to provide a positive or negative slope in the RF power output. This is used to correct for slope caused by external cable lengths, couplers, detectors, etc.

FREQUENCY RANGE (2-position switch) - 10 MHz to 1 GHz; 10 MHz to 4.2 GHz.

Rear Panel

RF plug-in connector - 24-pin connector J401, used to interconnect the RF plug-in to the Model 610 Mainframe. See Table 5-1 for connector voltages and waveforms.

RF sample connector - BNC type connector used to supply a sample of the RF output to the birdie marker mixer.

3-3. OPERATIONAL PROCEDURE

The following step-by-step procedure is recommended to ensure proper operation of this instrument.

1. Install the RF plug-in and slide rule dial in the Model 610 Mainframe. Refer to paragraph 2-3.
2. Verify that the Input Line Selector, located on the rear panel of the Model 610 Mainframe, is set to correspond with the power source to be used (115 or 230 volts ac).
3. With the main power ON switch set to the off position, plug the power cord into the power source.
4. Set the main power ON switch to ON and allow sufficient warmup time for the circuits of the instrument to stabilize (approximately 30 minutes).
5. Ensure that nothing is connected to the rear panel connectors and that the 1 kHz switch is set to OFF and the FM/NORM switch is set to NORM.

6. Set the front panel controls as follows:

VAR FREQ MARKER: Desired marker type

AMPLITUDE: As required

SWEEP MODE: AUTO

MANUAL: Fully CCW

SWEEP TIME (SEC): Desired sweep rate

VERNIER: Fully CW

FREQ SELECTOR: F1 TO F2

RETRACE RF: OFF

F1: Desired lower test frequency

VAR FREQ MKR: Desired marker frequency

ΔF FREQ: 0 (fully CCW)

F2: Desired upper test frequency

LEVELING (610C and 610D): INT

MODULATION (610B): NORMAL

7. Set the RF POWER LEVEL control for minimum power output (fully CCW) so as not to exceed the power rating of the RF detector to be used.
8. Connect a suitable cable between the VERT OUT connector and the vertical input of a dc-coupled oscilloscope. Set the vertical sensitivity to 0.1V/cm.
9. Connect a suitable cable between the HORIZ OUT connector and the horizontal input of a dc-coupled oscilloscope. Set the horizontal sensitivity to 1V/cm and adjust the horizontal time base vernier for a full 10cm display.
10. Connect a suitable RF detector directly to the RF OUTPUT connector, located on the RF plug-in.
11. Connect a suitable cable between the output of the RF detector and the FROM EXT DET connector, located on the front panel of the Model 610 Mainframe.
12. Set the desired test signal level with the RF POWER LEVEL control, located on the RF plug-in.

CAUTION

The test signal from the RF plug-in should not be adjusted so as to exceed the power rating of the RF detector being used. A high-level setting may damage the detector.

13. Adjust the SLOPE ADJUST potentiometer, located on the RF plug-in, to correct the RF output for slope effects due to the external detector, etc.
14. Disconnect the RF detector from the RF OUTPUT connector and connect it to the output of the device to be tested.
15. Connect the input of the device to be tested directly to the RF OUTPUT connector.

NOTE

If it is not possible to connect the input of the device to be tested directly to the RF OUTPUT connector, additional cabling or RF hardware can be used, but it should be inserted in the test setup prior to the insertion of the device to be tested. Thus, errors due to the added cable or hardware can be adjusted out, so as not to affect the measurement accuracy.

16. Observe the frequency response displayed on the oscilloscope screen.
17. Refer to paragraph 2-7 of the Model 610D or 610C Mainframe Instruction Manual or Section 3 of the Model 610B Manual for variations which can be made to this basic test setup.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION

This section describes the operation of the various circuits in the 6213D Plug-In.

4-2. GENERAL DESCRIPTION

The RF plug-in contains the RF signal generating circuits for the Model 610 Series Sweep Generator. The plug-in receives operating power and frequency control signals from the 610 Mainframe. Details of mainframe circuits are found in the Model 610 Instruction Manual.

The 6213D Plug-In consists of a YIG-tuned transistor oscillator, a down converter (which consists of an oscillator, mixer, amplifier, and filter), bandswitching, RF power leveling, and modulator circuits. The 6213D Plug-In has two bands: Band 1, 0.01 to 1 GHz, and Band 2, 0.01 to 4.2 GHz. Band 2 consists of the 0.01 to 2 GHz and the 2 to 4.2 GHz ranges. The 0.01 to 2 GHz portion of the sweep is produced by the down converter and the YIG oscillator. The down converter establishes a 4.2 GHz reference frequency that is heterodyned with the YIG oscillator output (4.19 to 2 GHz) to produce the 0.01 to 2 GHz sweep. Bandswitching and modulator circuits switch between the 2 to 4.2 GHz YIG oscillator output and the 0.01 to 2 GHz down converter output to produce the 0.01 to 4.2 GHz band. The bandswitching and modulator circuits control the YIG oscillator and down converter to produce the 0.01 to 1 GHz band.

4-3. BLOCK DIAGRAM DESCRIPTION

As shown in Figure 4-1, the 0 to +9.75V ramp from the mainframe is applied to the Lo and Hi Band Ramp Amps and the Bandswitch Detector via the Ramp Inverter on the A1 level bandswitch board (Figure 4-1 is located at the end of this section). In the following description the FREQUENCY RANGE switch is in the 10 MHz to 4.2 GHz position. Then, the inverted 0 to -10V ramp from the Ramp Inverter is sent to Analog Switch U7D through the Lo Band Ramp Amp. The output of the Lo Band Ramp Amp is a 0 to -10V ramp that is sent to the A2 YIG driver board.

The output of the Lo Band Ramp Amp is fed to the YIG Oscillator via the Bias Slope Amp, YIG Swept Bias Supply, and YIG Coil Driver. The Bias Slope Amp and YIG Swept Bias Supply provide the necessary bias voltages for the YIG Oscillator, while the YIG Coil Driver provides the necessary YIG oscillator tuning current. Also, the YIG Fixed Bias Supply provides a fixed bias for the transistor in the YIG Oscillator. Consequently, the YIG Oscillator develops a 4.2 to 2 GHz sweep that is fed to the 0.01 to 2 GHz Down Converter via the 2 to 4.2 GHz Isolator, 2 to 4.2 GHz Directional Coupler, 0.01 to 2 GHz Leveling PIN Modulator and 3 dB Pad.

The YIG output is heterodyned with the down converter output to produce a 0.01 to 2 GHz output that is fed to the 2-Pole PIN Switch Modulator. During the 0.01 to 2 GHz sweep, the Bandswitch Detector, Return Port Driver, and Bandswitch Logic circuitry turn on the Lo Band Port On/Off Driver that sends the 0.01 to 2 GHz sweep at the lo band port of the 2-Pole PIN Switch Modulator to the RF OUTPUT connector through the Internal Level Detector.

Meanwhile, as the 0 to +9.75V tuning ramp increases, the inverted ramp from the Ramp Inverter will become equal to a reference voltage at the Bandswitch Detector. When the inverted ramp is equal to or greater than the reference voltage, the

Bandswitch Detector and Bandswitch Logic circuitry will open the pin contacts of Analog Switch U7D and close the pin contacts of Analog Switch U7C. As a result, the inverted 0 to -10V ramp is sent to the YIG driver board through the Hi Band Ramp Amp. Then, this ramp is fed to the YIG Oscillator via the Bias Slope Amp, YIG Swept Bias Supply, and YIG Coil Driver. Consequently, the YIG Oscillator develops a 2 to 4.2 GHz sweep that is fed to the 2-Pole PIN Switch Modulator through the 2 to 4.2 GHz Directional Coupler. The Bandswitch Logic and Lo Band PIN Driver turn off the 0.01 to 2 GHz Leveling PIN Modulator to prevent the 2 to 4.2 GHz sweep from passing through it. At the same time the 0.01 to 2 GHz Leveling PIN Modulator turns off, the Bandswitch Logic, Return Port Driver, and Hi Band PIN Driver circuitry switches the 2 to 4.2 GHz sweep through the hi band port of the 2-Pole PIN Switch Modulator to the Internal Level Detector.

There are two types of leveling: internal and external. The leveling circuits provide RF power level control and external AM modulation capability. In other words, the leveling circuits maintain the RF output at a constant power level. Note that a portion of the RF output from the Internal Level Detector is sent to the Internal Level Preamp. When the mainframe LEVELING switch is in the INT position, Int/Ext Switch Detector closes the pin contacts of Analog Switch U8A that send the detected RF sample to the Summing Amplifier. The settings of the SLOPE ADJUST and RF POWER LEVEL controls as well as the ALC reference and blanking signals establish a reference level at the input of the Summing Amplifier. When the power level of the RF sample either increases or decreases in relation to the reference level at the input of the Summing Amplifier, the Summing Amplifier sends a correction signal to the Hi or Lo Band PIN Drivers via the Leveling Amp. Likewise, the Hi or Lo Band PIN Drivers send correction signals to the 0.01 to 2 GHz Leveling PIN Modulator and the 2-Pole PIN Switch Modulator to maintain the RF power output at a constant level. Whenever the RF output is above or below the leveling range of the Leveling Amp, the Unlevel Light Driver sends a signal to the mainframe Level Amp (not shown) that turns on the UNLEVELED lamp.

External leveling is accomplished by connecting a negative crystal detector to the mainframe INPUT connector and setting the LEVELING switch to EXT. The ext switch signal from the mainframe is sent to the Int/Ext Switch Detector that closes pin contacts of Analog Switch U8D. The external leveling signal is then sent to the Leveling Amp via the Summing Amplifier. The operation of the PIN drivers and modulators is similar for external and internal leveling.

Furthermore, a CW Filter circuit is added to the YIG coil driver tuning line to reduce residual FM. When the mainframe FREQ SELECTOR switch is set to one of the CW positions and the rear panel FM/NORM switch is in the NORM position, the Relay Driver energizes a relay that adds capacitance across the YIG coil driver tuning line to minimize residual FM.

The Phase Lock board, Option 28, provides either a phase lock or a frequency modulation capability for the mainframe and 6213D Plug-In combination. The PHASE LOCK INPUT, which is sent through the rear panel of the mainframe, comes from an external phase lock box or from a frequency counter with phase lock capability. If the phase of the plug-in signal attempts to drift, it is sensed and the phase lock box sends a correction signal to the Phase Lock board. This correction signal is amplified by the Phase Lock board and directed to the YIG oscillator FM coil. The current through this FM coil will correct the phase of the YIG Oscillator.

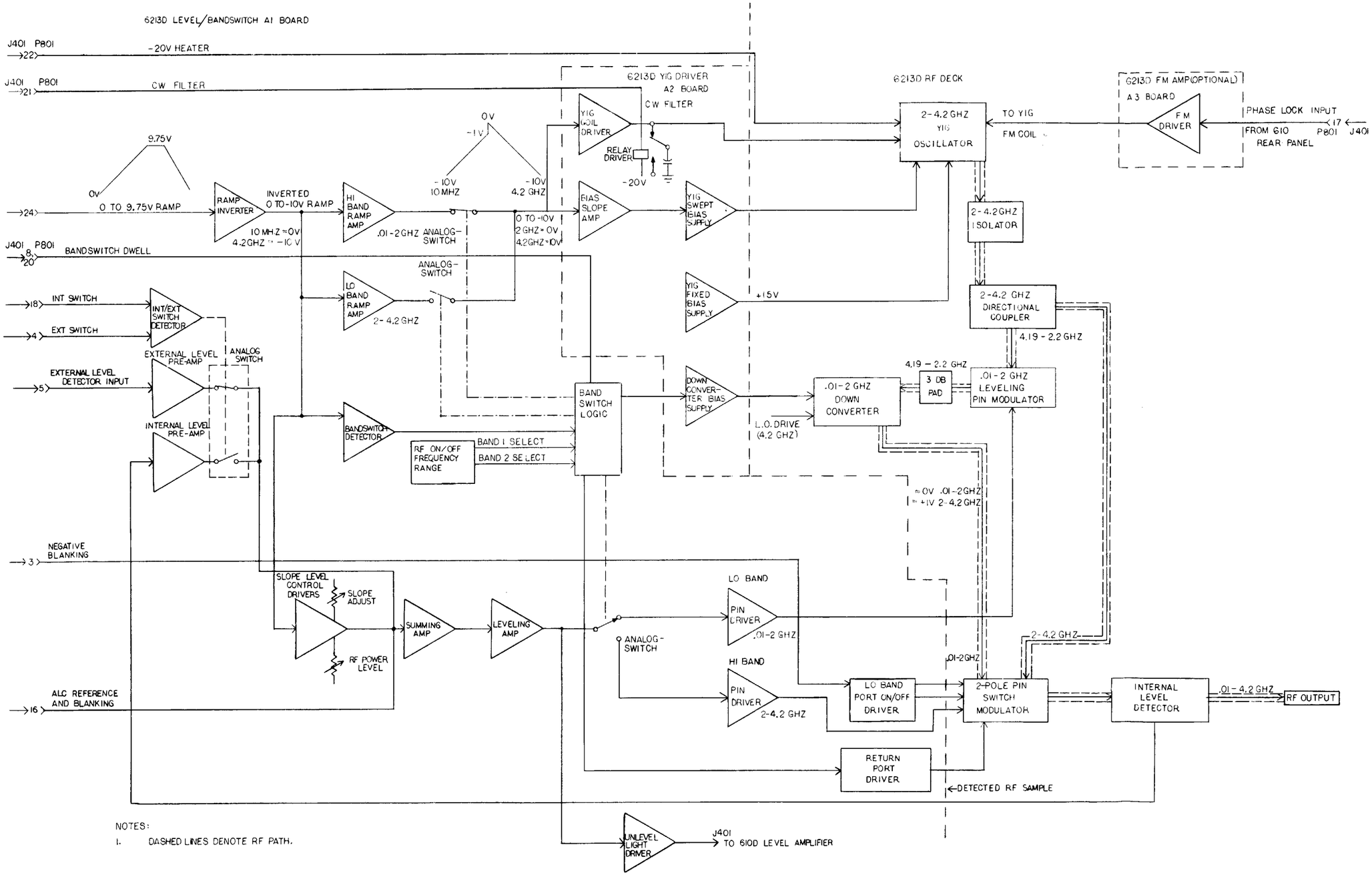


Figure 4-1. Model 6213D Block Diagram

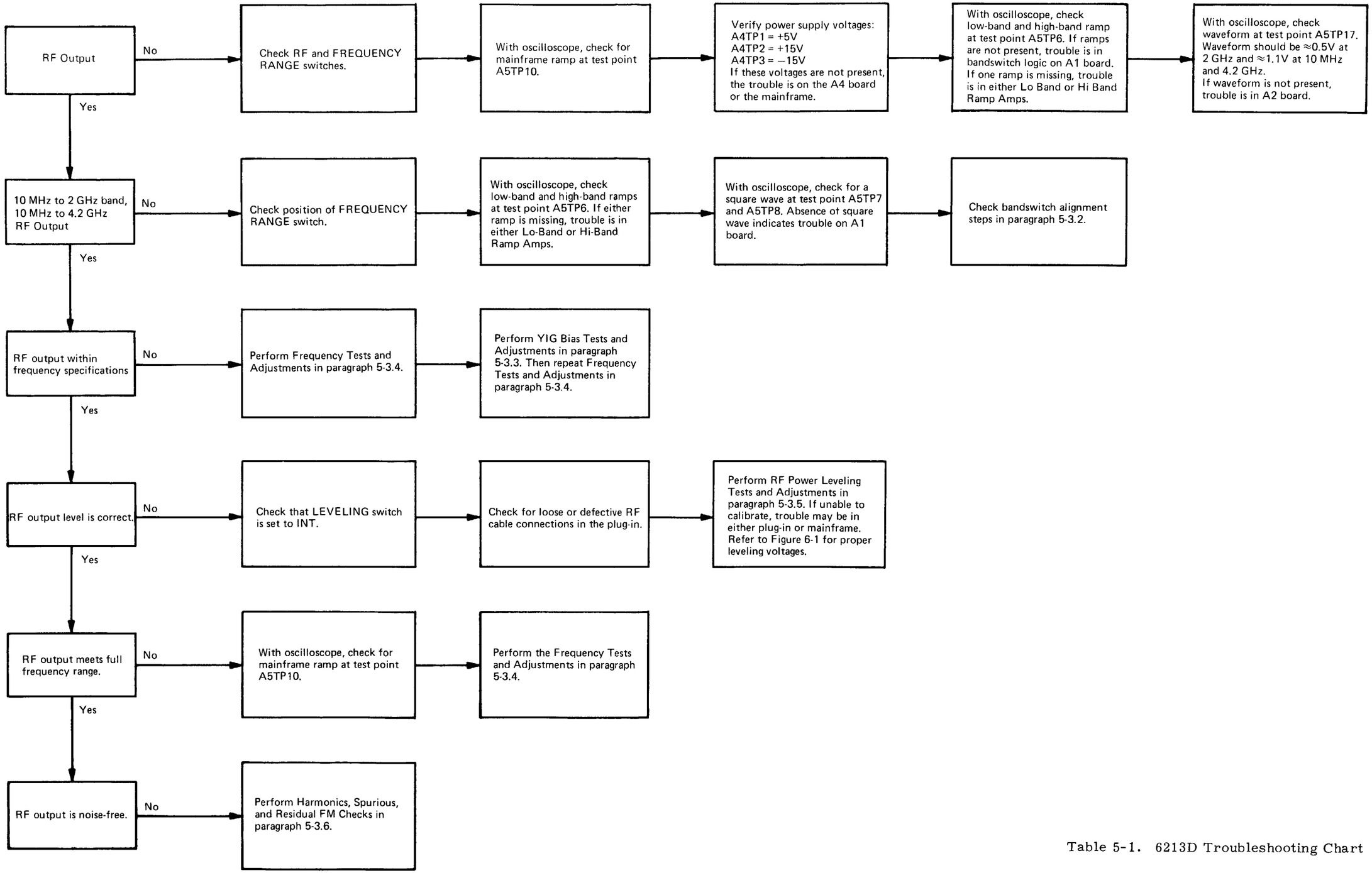


Table 5-1. 6213D Troubleshooting Chart

SECTION V
MAINTENANCE

5-1. INTRODUCTION

This section provides maintenance and calibration procedures as well as a troubleshooting chart for the 6213D Plug-In. These procedures consist of two parts: (1) Mainframe Tests and (2) RF Plug-In Tests and Adjustments. Before performing these procedures, check that:

a. Plug-in cables and connectors are free of cracks and other defects.

b. Plug-in, device under test, external RF components, and cables have the same characteristic impedances.

c. Good mechanical connections exist between cables, connectors, adapters, and terminations.

Calibration procedures should be performed in sequence because an adjustment of one circuit may affect the calibration of other circuits. Therefore, when trouble is encountered during a step in the procedure, the trouble must be corrected and the entire procedure should be repeated from the beginning. A troubleshooting chart, Table 5-1, is provided as an aid in isolating a possible defective section of the plug-in. Additional troubleshooting aids, such as voltage levels and waveforms, are located in the schematics in Section VI.

5-1.1 Test Equipment

The test equipment listed in Table 5-2 can be used for all tests and adjustments in this section.

Table 5-2. Recommended Test Equipment

INSTRUMENT	REQUIRED CHARACTERISTICS	MANUFACTURER
Mainframe	Calibrated per factory specifications	WILTRON Model 610D with Option 1
RF Detector	Frequency Range: 0.01 - 12.4 GHz	WILTRON Model 74N50
Extender Cable	-------	WILTRON P/N 610-MS-383
Digital Multimeter	DC Voltage Range: to 30V	Fluke Model 8600A
Power Meter	50Ω Power Sensor	HP Models 435A/8482A
Oscilloscope	Bandwidth: 60 MHz Sensitivity: 1mV	Tektronix Models 5440/5A48/5A42
Frequency Counter	Frequency Range: 0.01 - 18.5 GHz	EIP Model 351D
Modulation Meter	FM Measurement	Marconi Model TF2300
Spectrum Analyzer	Frequency Range: 0.01 - 18 GHz	HP Models 140T/8555A
Frequency Counter	Frequency Range: 1 - 18 GHz	HP Models 5246L/5255A
Attenuator	6 dB, dc to 6 GHz	Narda Model 773-6

5-1.2 System Test Preparation

a. Install the 6213D Plug-In in the mainframe.

b. Remove the bottom cover from the mainframe.

c. Set front panel controls as listed in Table 5-3.

d. If only the plug-in needs calibration, omit all steps in Mainframe Tests.

5-2. MAINFRAME TESTS

The Mainframe Tests consist of the following:

- DC Voltage Tests
- Sweep Tests
- RF Power Leveling Tests
- Frequency Instruction Voltage Tests

5-2.1 DC Voltage Tests

NOTE

Although it is more convenient to operate the plug-in from an extender cable, more accurate results are obtained when the plug-in operates in the mainframe.

Table 5-3. Equipment Control Settings

Mainframe, Front Panel	
VAR FREQ MARKER:	INTENSITY
AMPLITUDE:	Fully CCW
SWEEP MODE:	AUTO
SWEEP TIME (SEC):	.1 - .01
VERNIER:	Fully CW
FREQ SELECTOR:	F1 TO F2
RETRACE RF:	OFF
F1:	.01
F2:	2.0
VAR FREQ MKR:	4.2
ΔF FREQ:	5
EXT ALC GAIN:	Fully CW
LEVELING:	INT
HARMONIC MARKERS:	OFF
AMPLITUDE:	Fully CCW
WIDE/NARROW:	WIDE
POWER:	ON
Mainframe, Rear Panel	
1 kHz:	OFF
FM/NORM:	NORM
6213D RF Plug-In	
RF POWER LEVEL:	Fully CW
FREQUENCY RANGE:	10 MHz - 4.2 GHz
SLOPE ADJUST:	Midrange
RF:	ON

a. On the plug-in, measure the dc voltages listed in Table 5-4 on the A4 Front Panel PC Board. Measure these voltages with respect to A4TP2 (Figure 5-1).

Table 5-4. 6213D Power Supply Voltages

Voltage (Vdc)	Tolerance (Vdc)	Test Point
-20	±0.2	A4TP4
+30	±0.2	A4TP6
+15	±0.4	A4TP5
+5	±0.25	A4TP1
-15	±0.4	A4TP3

b. If the -20V or +30V supplies are out-of-tolerance, perform the Power Supply Calibration in paragraph 4-2.3 of the 610D Sweep Generator Instruction Manual.

c. If the +15V, +5V, or -15V supplies are out-of-tolerance, the fault is probably U1, U2, or U3 on the A4 board.

d. If the 610D power supplies are adjusted, perform the Sweep Generator Calibration in paragraph 4-2.4 and the Frequency Instruction Calibration in paragraph 4-2.5 of the 610D manual.

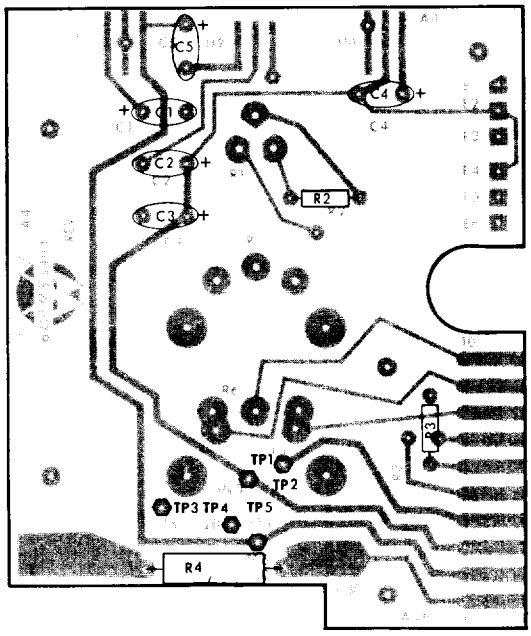


Figure 5-1. A4 Front Panel PC Board Test Point Locations

5-2.2 Sweep Tests

a. On plug-in, turn RF switch to OFF.

b. On the oscilloscope, do the following:

1. Connect a cable from mainframe HORIZ OUT to Vertical Input.
2. Check that ramp amplitude is about +11.2V (Figure 5-2).
3. Check that trace duration is 10ms ±20% and that retrace time is about 2ms (Figure 5-2).
4. Check each setting of the SWEEP TIME control. Sweep duration should be the value shown on the front panel ±20%.

c. If sweep rate is out-of-tolerance, perform the Sweep Generator Calibration in paragraph 4-2.4 of the 610D manual.

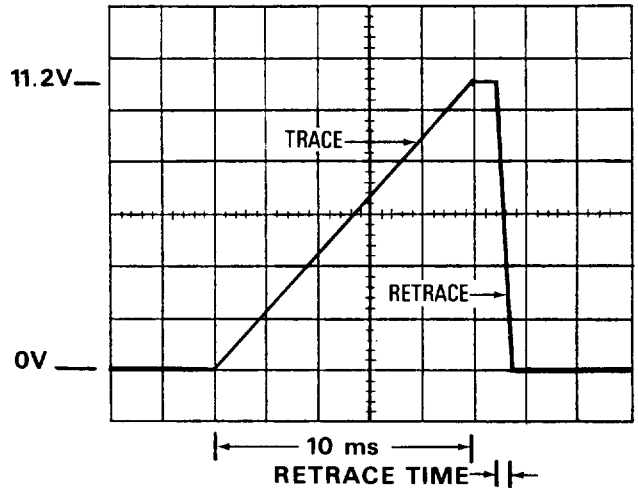


Figure 5-2. Mainframe HORIZ OUT Waveform

5-2.3 RF Power Leveling Tests

NOTE

If the leveling loop is operating properly, omit the following checks.

a. Connect the equipment as shown in Figure 5-3.

b. Set FREQ SELECTOR to F1 TO F2.

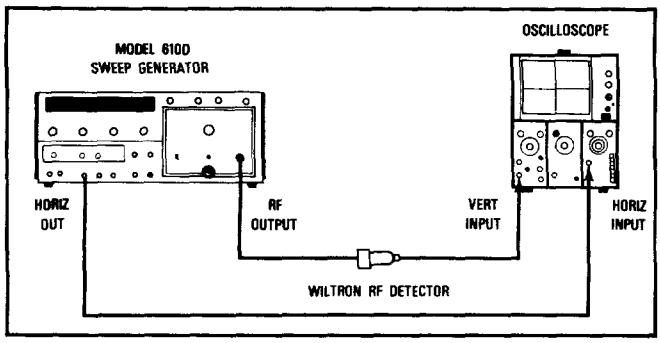


Figure 5-3. Test Setup for RF Power Leveling and Bandswitch Logic Tests

c. On the oscilloscope, do the following:

1. Adjust Vertical Position to place retrace line precisely on top of the top horizontal graticule line.
2. Adjust Horizontal Position and Horizontal Gain until trace is 10 divisions wide and centered horizontally.

d. Set LEVELING to EXT.

e. Check that UNLEVELED lamp is now lit; if not, the trouble is in mainframe.

f. On the oscilloscope, note that the unleveled RF power is greater than the leveled RF power; if not, the trouble may be either in the plug-in or in the mainframe. To determine whether the mainframe or plug-in is at fault, refer to Figures 6-1 and 6-2 for the proper leveling voltages.

5-2.4 Frequency Instruction Tests

NOTE

When a plug-in operates from an extender cable, a shift of 30 to 40mV occurs at A5TP5 compared to when the plug-in operates in the mainframe.

a. On the A5 Motherboard in the plug-in, connect DVM between A5TP5 and A5TP6 (Figure 5-4).

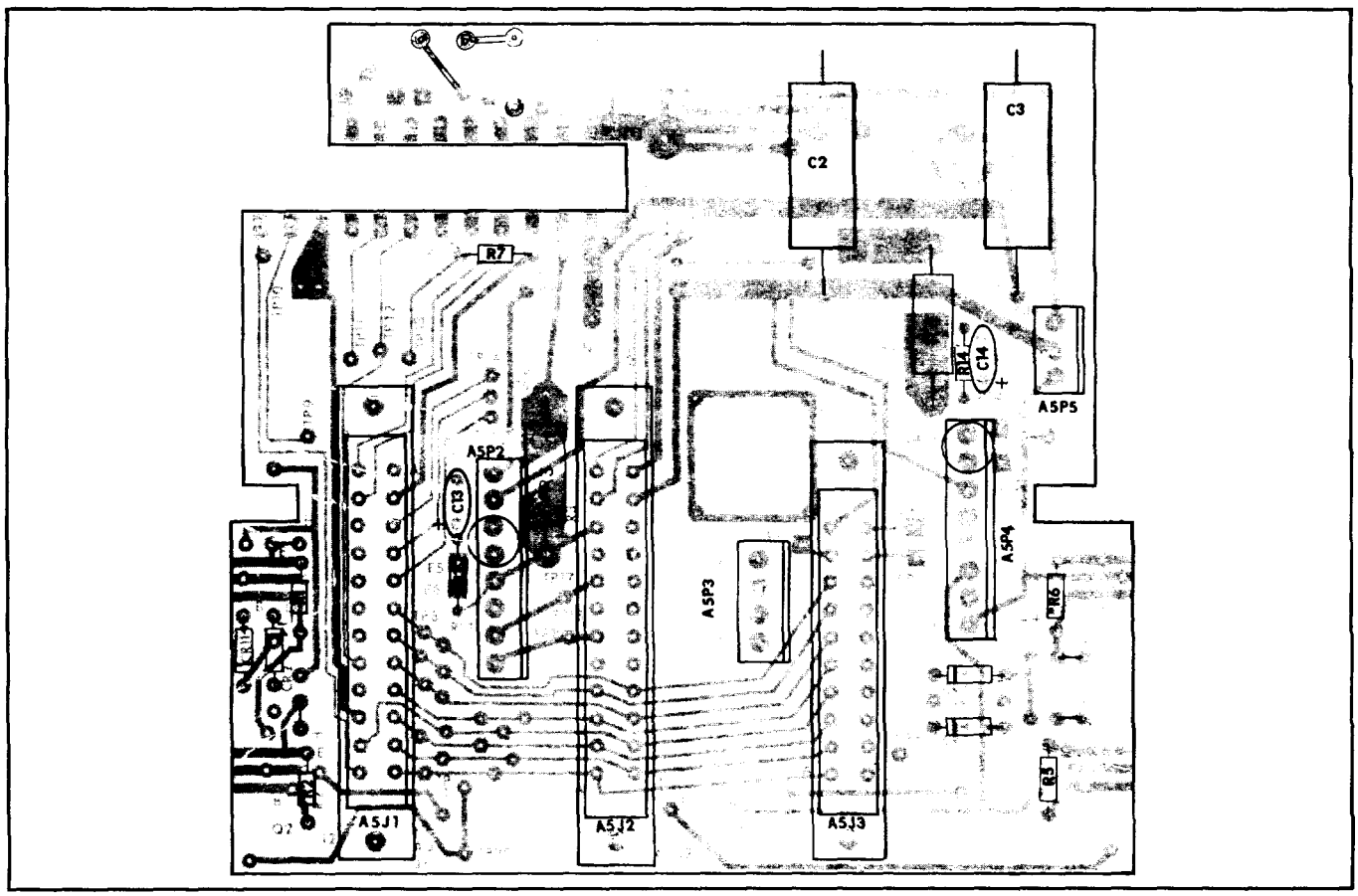


Figure 5-4. A5 Motherboard PC Assembly

b. On the mainframe, do the following:

1. Set FREQ SELECTOR to CW F1.
2. Adjust F1 control until DVM reads 0 ±5mV.
3. Check that F1 dial pointer is precisely on top of the Cal marks near the Start end of the dial (Figure 5-5).
4. Set FREQ SELECTOR to CW MKR.
5. Repeat steps 2 and 3 using the VAR FREQ MKR control and dial pointer instead of the F1 control and dial pointer.
6. Set FREQ SELECTOR to CW F2.
7. Repeat steps 2 and 3 using the F2 control and dial pointer instead of the F1 control and dial pointer.
8. Set FREQ SELECTOR to CW F1.
9. Adjust F1 control until DVM reads +9.75V ±5mV.
10. Check that F1 dial pointer is precisely on top of the Cal marks near the Stop F2 end of the dial scale.
11. Set FREQ SELECTOR to CW MKR.
12. Repeat steps 9 and 10 using the VAR FREQ MKR control and dial pointer instead of the F1 control and dial pointer.
13. Set FREQ SELECTOR to CW F2.
14. Repeat steps 9 and 10 using the F2 control and dial pointer instead of the F1 control and dial pointer.

c. If the frequency instruction voltages are out-of-tolerance, perform the Frequency Instruction Calibration in paragraph 4-2.5 of the 610D Manual.

5-3. RF PLUG-IN TESTS AND ADJUSTMENTS

The RF plug-in tests and adjustments are listed below:

- Bandswitch Logic Tests and Adjustments
- YIG Bias Tests and Adjustments
- Frequency Tests and Adjustments
- RF Power Leveling Tests and Adjustments
- Harmonics, Spurious, and Residual FM Tests

5-3.1 System Test Preparation

NOTE

Operate the plug-in from an extender cable for the YIG bias tests. However, operate the plug-in in the mainframe for the other tests.

a. Set equipment controls as listed in Table 5-3.

b. On the oscilloscope, do the following:

1. Adjust Vertical Position to place the retrace line precisely on top of the top horizontal graticule line.
2. Adjust Horizontal Position until trace is 10 divisions wide and centered horizontally.

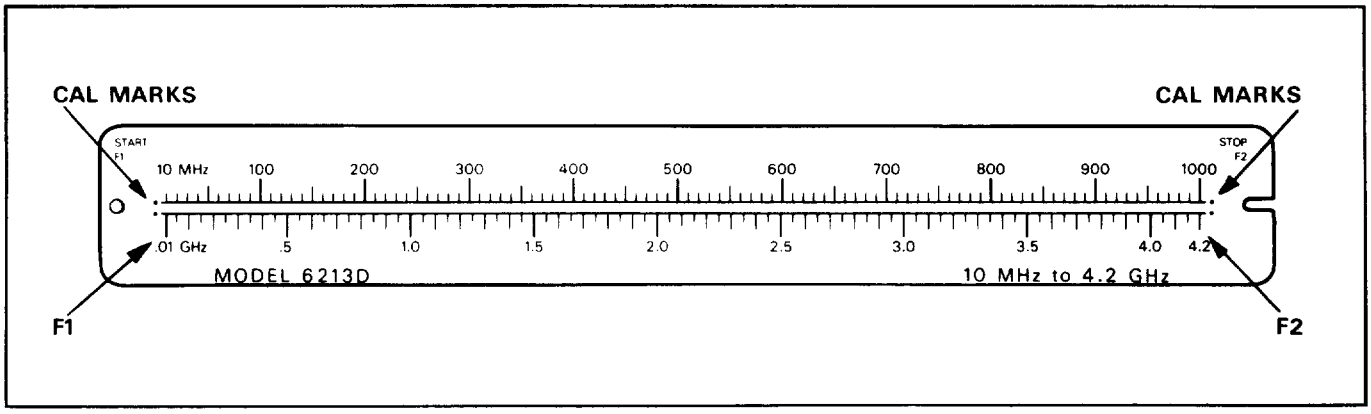


Figure 5-5. 6213D Dial Scale

5-3.2 Bandswitch Logic Tests and Adjustments

a. Connect system as shown in Figure 5-3.

b. On the oscilloscope, observe the intensity spot at the bandswitch point.

c. On the mainframe, do the following:

1. Set FREQ SELECTOR to ΔF.
2. Set ΔF FREQ to 5.
3. Adjust VAR FREQ MKR to place the bandswitch point in the center of the CRT.
4. Check that VAR FREQ MKR dial pointer indicates a reading between 1.95 and 2.05 GHz.

d. If the bandswitch point does not appear, the trouble is probably on A1 board.

NOTE

Do not adjust bandwitch point until all tests have been completed. If the plug-in meets frequency, power, harmonic, and spurious specifications, do not adjust the bandswitch point.

e. If the bandswitch point requires adjustment, adjust Bandswitch Adj A1R5 (see Figures 5-6 and 5-7.

5-3.3 YIG Bias Tests and Adjustments

NOTE

Do not adjust the YIG bias voltages until all tests have been completed. If the plug-in meets frequency, power, harmonic, and spurious specifications, do not adjust the YIG bias voltages.

CAUTION

If the maximum bias voltage is exceeded, the YIG oscillator may be damaged.

a. On the mainframe, do the following:

1. Set equipment controls as listed in Table 5-3.
2. Set SWEEP TIME to 0.1 to 0.01.

b. On the plug-in, do the following:

1. Connect scope probe to each test point listed in Table 5-5.
2. Check that the voltages are within tolerance; if not, make the appropriate adjustment listed in Table 5-5.

Table 5-5. YIG Bias Checks and Adjustments ①

TP②	Freq (GHz)	Bias Voltage (Vdc)	Adjustment②	Name
A2TP2	0.01	+15 ±0.1③	A2R30	Bias Slope Adj
	2.0	+10 ±0.1③	A2R35	Bias Start Adj
A2TP3	4.2	+15 ±0.1③	A2R30	Bias Slope Adj
	0.01 - 4.2	+15 ±0.1③	A2R20	Fixed Bias Adj
A2TP12	0.01 - 2.0	+20 ±0.05	A2R135	+20V Bias Adj
A5TP17	0.01	+1.1		YIG Coil Drive
	2.0	+0.5		
	4.2	+1.1		

① See schematics in Section VI for specific test point waveforms.
② See Figures 5-6 and 5-8 for location of test points and adjustments.
③ Do NOT exceed +15V.

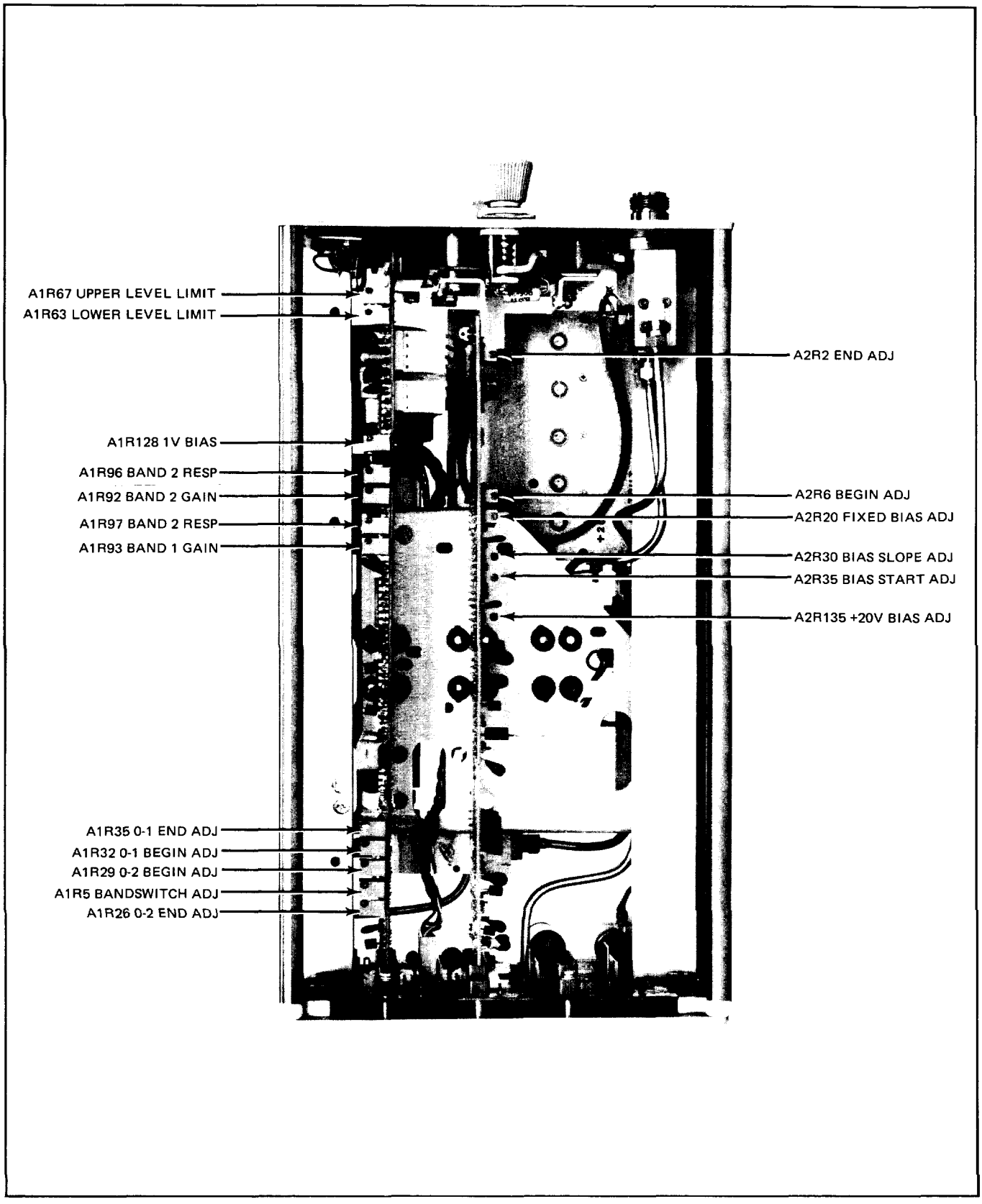


Figure 5-6. 6213D Plug-In, Bottom View

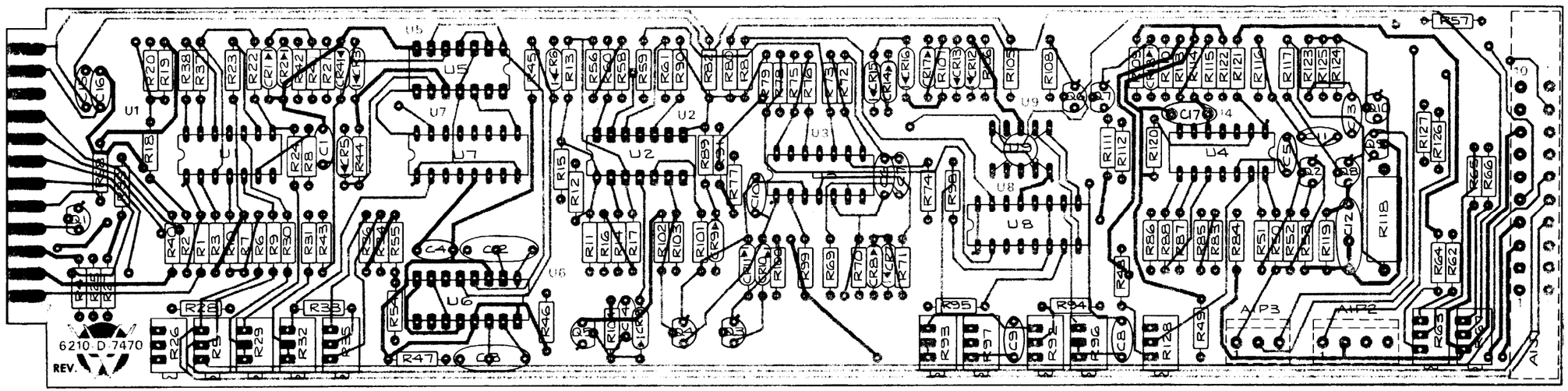


Figure 5-7. A1 Level/Bandswitch PC Assembly (6210-D-7470-3)

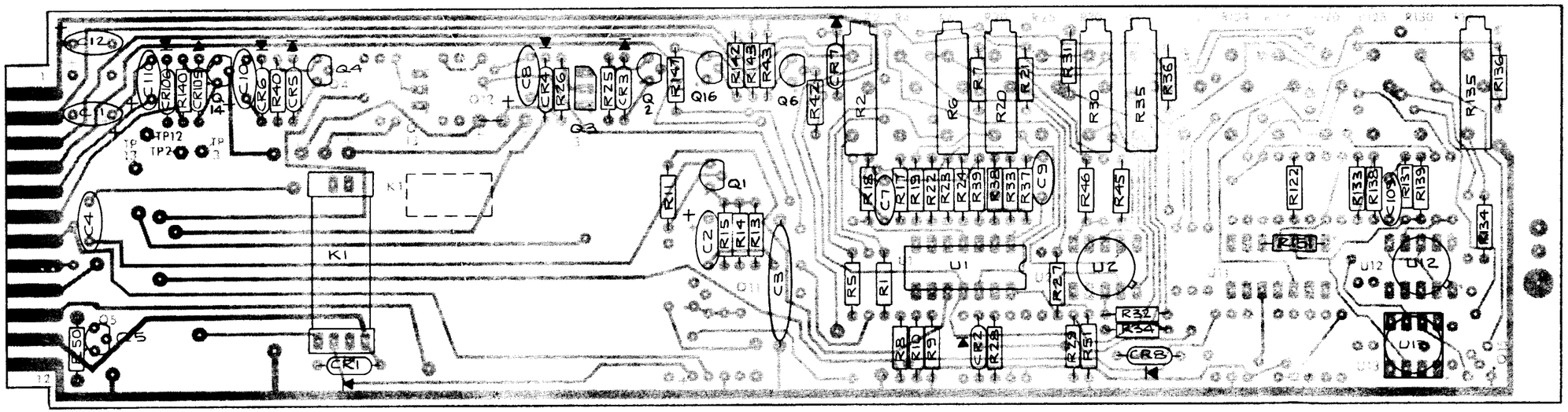


Figure 5-8. A2 YIG Driver PC Assembly (6210-L-5402-30)

5-3.4 Frequency Tests and Adjustments

NOTE

If Option 1 is not installed in the mainframe, measure frequency with an EIP 351D Counter or equivalent.

a. Connect equipment as shown in Figure 5-9.

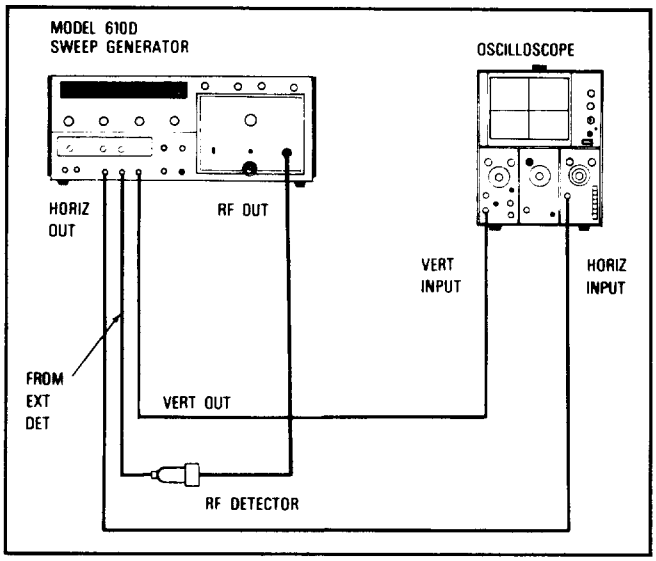


Figure 5-9. Test Setup for Frequency Tests and Adjustments

b. Set equipment controls as listed in Table 5-3.

c. On the oscilloscope, do the following:

1. Adjust Horizontal Position and Horizontal Gain until trace is exactly 10 divisions wide and centered horizontally.
2. Adjust Vertical Position so trace is precisely on top of the center horizontal graticule line.

d. On the mainframe, do the following:

1. Set HARMONIC MARKERS to 10.
2. Turn Harmonic Marker AMPLITUDE fully CW.
3. Set FREQ SELECTOR to ΔF.
4. Adjust VAR FREQ MKR to place its pointer on top of the 0.01 marking on the dial scale.

e. On the oscilloscope, check that the 10 MHz marker of 10 MHz is ±25 MHz from the center of the graticule; if not, adjust 0-2 Begin Adj A1R29 (see Figures 5-6 and 5-7 at the end of Section V).

f. On the mainframe, do the following:

1. Adjust VAR FREQ MKR to place its pointer at 2.0 on the dial scale.
2. Set HARMONIC MARKERS to 100.

g. On the oscilloscope, identify the 100 MHz marker of 2 GHz.

h. On the mainframe, set HARMONIC MARKERS to 10.

i. On the oscilloscope, do the following:

1. As shown in Figure 5-10, check that the lo band 10 MHz marker of 2 GHz is within ±25 MHz from the center of the graticule; if not, adjust 0-2 End Adj A1R26 (Figures 5-6 and 5-7).
2. As shown in Figure 5-10, check that the hi band 10 MHz marker of 2 GHz is within ±25 MHz from the center of the graticule; if not, adjust Begin Adj A2R6 (Figures 5-6 and 5-8).

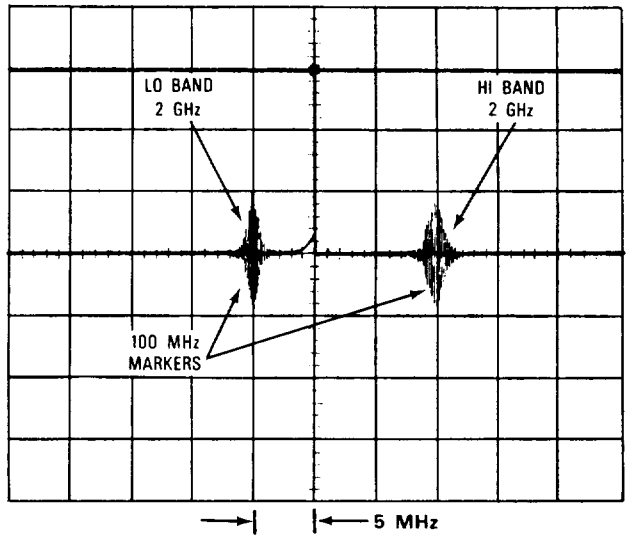


Figure 5-10. Low-Band and Hi-Band 2 GHz Frequency Adjustments

j. On the mainframe, do the following:

1. Adjust VAR FREQ MKR so its dial pointer is exactly on top of the 4.2 marking on the dial scale.
2. Set HARMONIC MARKERS to 100.

k. On the oscilloscope, identify the 100 MHz marker of 4.2 GHz.

l. On the mainframe, set HARMONIC MARKERS to 10.

m. On the oscilloscope, check that the 10 MHz marker of 4.2 GHz is ±25 MHz from the center of the graticule; if not, adjust End Adj A2R2 (Figures 5-6 and 5-8).

n. On the plug-in, set FREQUENCY RANGE to 10 MHz to 1 GHz.

o. On the mainframe, set HARMONIC MARKERS to 100.

p. On the oscilloscope, identify the 100 MHz marker of 1 GHz.

q. On the mainframe, set HARMONIC MARkers to 10.

r. On the oscilloscope, check that the 10 MHz marker of 1 GHz is within ±25 MHz from the center of the graticule; if not, adjust 0-1 End Adj A1R35 (Figures 5-6 and 5-7).

s. On the mainframe, adjust VAR FREQ MKR to place its dial pointer on top of the 10 MHz indication on the dial scale.

t. On the oscilloscope, check that the 10 MHz marker of 10 MHz is within ±25 MHz from the center of the graticule; if not, adjust 0-1 Begin Adj A1R32 (Figures 5-6 and 5-7).

u. Repeat steps b through t until no further improvement is noticed.

5-3.5 RF Power Leveling Tests and Adjustments

a. Connect equipment as shown in Figure 5-3.

b. Set front panel controls as listed in Table 5-3.

c. On the oscilloscope, do the following:

1. Adjust Vertical Position to place retrace line precisely on top of the top horizontal graticule line.
2. Adjust Horizontal Position and Horizontal Gain so the trace is exactly 10 divisions wide and centered horizontally on the CRT.

d. On the plug-in, do the following:

1. Adjust RF POWER LEVEL fully CCW.
2. Adjust Lower Level Limit A1R63 and Upper Level Limit A1R67 until the detected RF output in the 2-4.2 GHz portion of the sweep will no longer decrease (Figures 5-6 and 5-7).
3. Adjust 1V Bias Adj A1R128 until detected RF output just begins to increase (Figures 5-6 and 5-7).
4. Adjust 1V Bias Adj A1R128 until detected RF output just stops decreasing.
5. Turn RF POWER LEVEL fully CW.
6. Adjust Upper Level Limit A1R67 for maximum leveled RF output.
7. Set RF POWER LEVEL fully CCW.
8. Adjust Lower Level Limit A1R63 until RF trace lies just above the second major division of the horizontal graticule line (Figure 5-11).

e. Repeat step d until maximum leveled RF power is obtained.

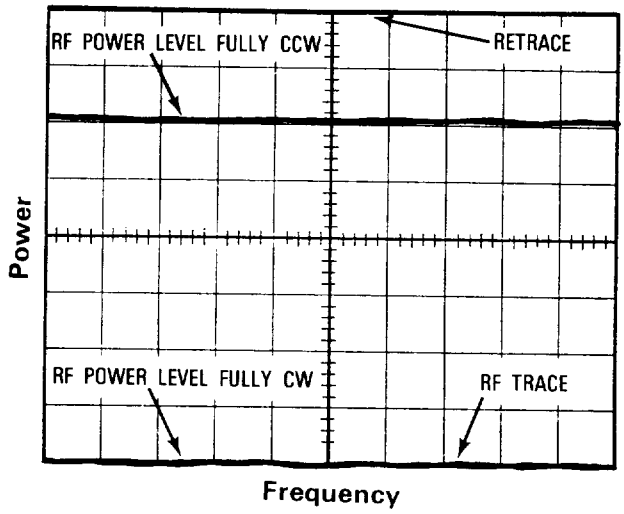


Figure 5-11. 10 dB RF Power Level Control Range Adjustment

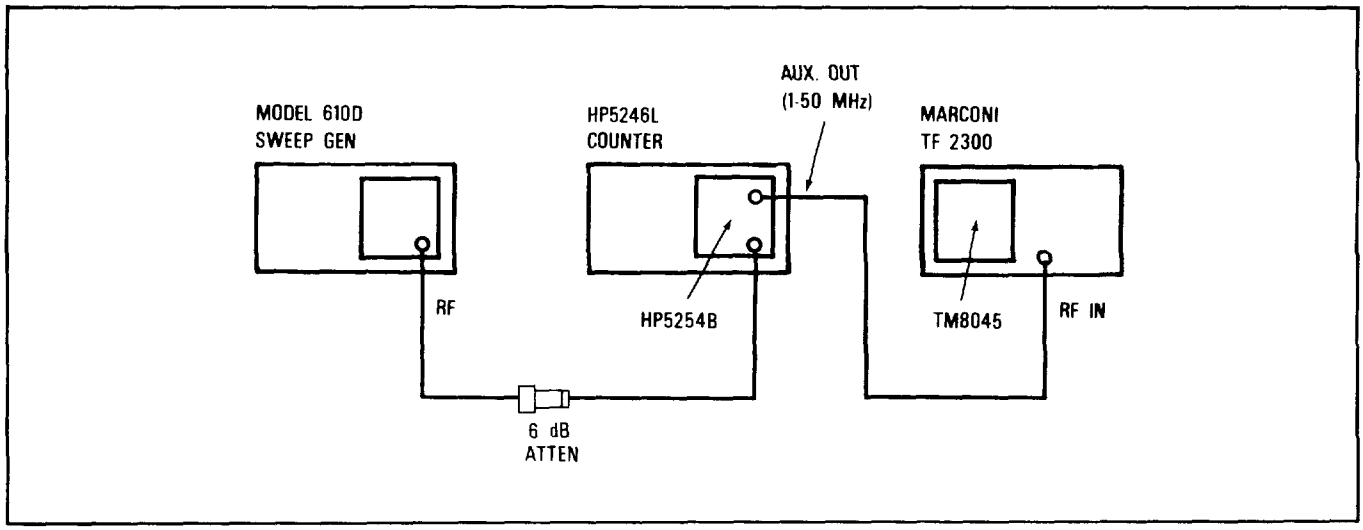


Figure 5-12. Test Setup for Residual FM Checks

NOTE

Do not measure residual FM with a spectrum analyzer, since its bandwidth is too wide for accurate readings.

i. On the mainframe, do the following:

1. Set FREQ SELECTOR to CW MKR.
2. Set VAR FREQ MKR to several different points on the band and check that residual FM does not exceed 7 kHz peak.

SECTION VI
PARTS LISTS AND SCHEMATICS

6-1. GENERAL

This section contains the parts lists and schematic diagrams for the 6213D RF Plug-In.

The parts lists include the reference designation, complete part description, and WILTRON part number for each item used in the manufacturing of the unit. Items such as machined parts, nuts, etc. are not included, but these may be ordered through us on special request.

The parts lists are organized under PC Assembly, RF Components, and Front Panel Hardware.

6-2. ORDERING REPLACEABLE PARTS

Replacement parts for an RF plug-in may be ordered through your local WILTRON representative, or directly from:

WILTRON Company
825 East Middlefield Road
Mountain View, CA 94043

Telephone: (415) 969-6500
TWX: 910-379-6578

When placing your order, give our representative complete information regarding the part required, including the model and serial number of the instrument in which the part is to be used, reference designation, full part description, WILTRON part number, and the total quantity desired.

6-3. ABBREVIATIONS

The following abbreviations are used in the parts lists in Tables 6-2 to 6-7.

Resistors

CC = Carbon Comp
CM = Cermet
MF = Metal Film
WW = Wire Wound
* = Factory Select

Capacitors

C = Ceramic
E = Electrolytic
M = Mica
My = Mylar
T = Tantalum

6-4. SCHEMATICS

Table 6-1 lists the schematics in this section.

Table 6-1. List of Schematic Diagrams

Figure	Title	Drawing No.	Page
6-1	6213D Level Bandswitch Schematic	6213D-A1 (sheet 1)	6-9/6-10
6-2	6213D Level Bandswitch Schematic	6213D-A1 (sheet 2)	6-11/6-12
6-3	6213D YIG Driver Schematic	6213D-A2	6-13/6-14
6-4	Phase Lock PC Ass'y, Parts Location	6210-L-5403	6-15/6-16
6-5	Phase Lock Schematic (Option 28)	6210-A3	6-15/6-16
6-6	Front Panel Schematic	6210-A4	6-17/6-18
6-7	Motherboard Schematic	6210-A5	6-19/6-20

Table 6-2. A1 Level Bandswitch PC Assembly 6210-D-7470-2 Replaceable Parts

REF. DES.	DESCRIPTION	WILTRON PART NO.
	CAPACITORS	
A1C1	.01μF, 100V, C	230-11
A1C2	.1μF, 250V, My	210-30
A1C3	.1μF, 250V, My	210-30
A1C4	.1μF, 10V, C	230-12
A1C5	.002μF, 500V, C	230-33
A1C6	.033μF, 50V, C	230-32
A1C7	.033μF, 50V, C	230-32
A1C8	560pF, 500V, M	220-560
A1C9	.001μF, 50V, C	230-30
A1C10	560pF, 500V, M	220-560
A1C11	.002μF, 500V, C	230-33
A1C12	.1μF, 250V, My	210-30
A1C13	.001μF, 50V, C	230-30
A1C14	470pF, 500V, M	220-470
A1C16	.002μF, 500V, C	230-33
A1C17	.1μF, 10V, C	230-12
	DIODES	
A1CR1	Silicon	10-1N4446
A1CR2	Silicon	10-1N4446
A1CR3	Silicon	10-1N4446
A1CR4	Silicon	10-1N4446
A1CR5	Silicon	10-1N4446
A1CR6	Silicon	10-1N4446
A1CR7	Silicon	10-1N4446
A1CR8	Silicon	10-1N4446
A1CR9	Silicon	10-1N4446
A1CR10	Silicon	10-FD300
A1CR11	Silicon	10-1N4446
A1CR12	Silicon	10-1N4446
A1CR13	Silicon	10-1N4446
A1CR14	Silicon	10-1N4446
A1CR15	Silicon	10-1N4446
A1CR16	Silicon	10-1N4446
A1CR17	Silicon	10-1N4446
A1CR18	Silicon	10-1N4446
A1CR19	Zener, 24V, 1W, 5%	10-1N4749A

REF. DES.	DESCRIPTION	WILTRON PART NO.
	TRANSISTORS	
A1Q1	PNP	20-2N3638
A1Q2	NPN	20-2N3904
A1Q3	PNP	20-2N3906
A1Q4	NPN	20-2N3904
A1Q5	PNP	20-2N3906
A1Q6	PNP	20-2N3906
A1Q7	PNP	20-2N3906
A1Q8	NPN	20-2N3904
A1Q9	PNP	20-2N3906
A1Q10	PNP	20-2N3906
	RESISTORS	
A1R1	10k, 1/4W, 1%, MF	110-10k-1
A1R2	10k, 1/4W, 1%, MF	110-10k-1
A1R3	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R4	15k, 1/4W, 1%, MF	110-15k-1
A1R5	1k, Variable	157-1kB
A1R6	4.12k, 1/4W, 1%, MF	110-4.12k-1
A1R7	100, 1/4W, 1%, MF	110-100-1
A1R8	10k, 1/4W, 1%, MF	110-10k-1
A1R9	10k, 1/4W, 1%, MF	110-10k-1
A1R10	42.2k, 1/4W, 1%, MF	110-42.2k-1
A1R11	61.9k, 1/4W, 1%, MF	110-61.9k-1
A1R12	10k, 1/4W, 1%, MF	110-10k-1
A1R13	10.5k, 1/4W, 1%, MF	110-10.5k-1
A1R14	4.75k, 1/4W, 1%, MF	110-4.75k-1
A1R15	1k, 1/4W, 1%, MF	110-1k-1
A1R16	12.4k, 1/4W, 1%, MF	110-12.4k-1
A1R17	2.1k, 1/4W, 1%, MF	110-2.1k-1
A1R18	20k, 1/4W, 1%, MF	110-20k-1
A1R19	35.7k, 1/4W, 1%, MF	110-35.7k-1
A1R20	1.1k, 1/4W, 1%, MF	110-1.1k-1
A1R21	6.04k, 1/4W, 1%, MF	110-6.04k-1
A1R22	20k, 1/4W, 1%, MF	110-20k-1
A1R23	4.64k, 1/4W, 1%, MF	110-4.64k-1
A1R24	1k, 1/4W, 1%, MF	110-1k-1
A1R25	23.7k, 1/4W, 1%, MF	110-23.7k-1

Table 6-2. A1 Level Bandswitch PC Assembly 6210-D-7470-2
Replaceable Parts (Continued)

REF. DES.	DESCRIPTION	WILTRON PART NO.
	RESISTORS (Continued)	
A1R26	1k, Variable	157-1kB
A1R27	23.7k, 1/4W, 1%, MF	110-23.7k-1
A1R28	7.5k, 1/4W, 1%, MF	110-7.5k-1
A1R29	10k, Variable	157-10kB
A1R30	30.9k, 1/4W, 1%, MF	110-30.9k-1
A1R31	8.45k, 1/4W, 1%, MF	110-8.45k-1
A1R32	2k, Variable	157-2kB
A1R33	12.7k, 1/4W, 1%, MF	110-12.7k-1
A1R34	7.87k, 1/4W, 1%, MF	110-7.87k-1
A1R35	2k, Variable	157-2kB
A1R36	34k, 1/4W, 1%, MF	110-34k-1
A1R37	2.67k, 1/4W, 1%, MF	110-2.67k-1
A1R38	5.36k, 1/4W, 1%, MF	110-5.36k-1
A1R39	11.5k, 1/4W, 1%, MF	110-11.5k-1
A1R40	10k, 1/4W, 1%, MF	110-10k-1
A1R41	4.64k, 1/4W, 1%, MF	110-4.64k-1
A1R42	4.64k, 1/4W, 1%, MF	110-4.64k-1
A1R43	1.96k, 1/4W, 1%, MF	110-1.96k-1
A1R44	4.64k, 1/4W, 1%, MF	110-4.64k-1
A1R45	4.64k, 1/4W, 1%, MF	110-4.64k-1
A1R46	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R47	30.1k, 1/4W, 1%, MF	110-30.1k-1
A1R48	2.87k, 1/4W, 1%, MF	110-2.87k-1
A1R49	464, 1/4W, 1%, MF	110-464-1
A1R50	750, 1/4W, 1%, MF	110-750-1
A1R51	2k, 1/4W, 1%, MF	110-2k-1
A1R52	464, 1/4W, 1%, MF	110-464-1
A1R53	200, 1/4W, 1%, MF	110-200-1
A1R54	5.62k, 1/4W, 1%, MF	110-5.62k-1
A1R55	51.1k, 1/4W, 1%, MF	110-51.1k-1
A1R56	4.22k, 1/4W, 1%, MF	110-4.22k-1
A1R57	21k, 1/4W, 1%, MF	110-21k-1
A1R58	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R59	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R60	30.1k, 1/4W, 1%, MF	110-30.1k-1
A1R61	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R62	8.06k, 1/4W, 1%, MF	110-8.06k-1
A1R63	20k, Variable	157-20kB
A1R64	9.09k, 1/4W, 1%, MF	110-9.09k-1
A1R65	499, 1/4W, 1%, MF	110-499-1
A1R66	7.68k, 1/4W, 1%, MF	110-7.68k-1
A1R67	2k, Variable	157-2kB
A1R68	100k, 1/4W, 1%, MF	110-100k-1
A1R69	10M, 1/4W, 5%, CC	101-10M-5
A1R70	10M, 1/4W, 5%, CC	101-10M-5
A1R71	1.96k, 1/4W, 1%, MF	110-1.96k-1
A1R72	10k, 1/4W, 1%, MF	110-10k-1
A1R73	10k, 1/4W, 1%, MF	110-10k-1
A1R74	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R75	40.2k, 1/4W, 1%, MF	110-40.2k-1
A1R76	28k, 1/4W, 1%, MF	110-28k-1
A1R77	16.5k, 1/4W, 1%, MF	110-16.5k-1
A1R78	10k, 1/4W, 1%, MF	110-10k-1
A1R79	10k, 1/4W, 1%, MF	110-10k-1
A1R80	20k, 1/4W, 1%, MF	110-20k-1
A1R81	20k, 1/4W, 1%, MF	110-20k-1
A1R82	10k, 1/4W, 1%, MF	110-10k-1
A1R83	47.5k, 1/4W, 1%, MF	110-47.5k-1
A1R84	301, 1/4W, 1%, MF	110-301-1
A1R85	100k, 1/4W, 1%, MF	110-100k-1
A1R86	20k, 1/4W, 1%, MF	110-20k-1
A1R87	13k, 1/4W, 1%, MF	110-13k-1
A1R88	60.4k, 1/4W, 1%, MF	110-60.4k-1
A1R89	49.9k, 1/4W, 1%, MF	110-49.9k-1
A1R90	20k, 1/4W, 1%, MF	110-20k-1
A1R91	4.32k, 1/4W, 1%, MF	110-4.32k-1
A1R92	20k, Variable	157-20kB
A1R93	20k, Variable	157-20kB
A1R94	3.01k, 1/4W, 1%, MF	110-3.01k-1
A1R95	3.01k, 1/4W, 1%, MF	110-3.01k-1
A1R96	20k, Variable	157-20kB
A1R97	20k, Variable	157-20kB
A1R98	100k, 1/4W, 1%, MF	110-100k-1
A1R99	15k, 1/4W, 1%, MF	110-15k-1
A1R100	30.1k, 1/4W, 1%, MF	110-30.1k-1
A1R101	10k, 1/4W, 1%, MF	110-10k-1
A1R102	20k, 1/4W, 1%, MF	110-20k-1
A1R103	2.21k, 1/4W, 1%, MF	110-2.21k-1
A1R104	2k, 1/4W, 1%, MF	110-2k-1
A1R105	9.53k, 1/4W, 1%, MF	110-9.53k-1

Table 6-2. A1 Level Bandswitch PC Assembly 6210-D-7470-2
Replaceable Parts (Continued)

REF. DES.	DESCRIPTION	WILTRON PART NO.
	RESISTORS (Continued)	
A1R106	10k, 1/4W, 1%, MF	110-10k-1
A1R107	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R108	294, 1/4W, 1%, MF	110-294-1
A1R109	100k, 1/4W, 1%, MF	110-100k-1
A1R110	90.9k, 1/4W, 1%, MF	110-90.9k-1
A1R111	475, 1/4W, 1%, MF	110-475-1
A1R112	10k, 1/4W, 1%, MF	110-10k-1
A1R113	604k, 1/4W, 1%, MF	110-604k-1
A1R114	4.99k, 1/4W, 1%, MF	110-4.99k-1
A1R115	10k, 1/4W, 1%, MF	110-10k-1
A1R116	2k, 1/4W, 1%, MF	110-2k-1
A1R117	464, 1/4W, 1%, MF	110-464-1
A1R118	390, 1W, 5%, CC	103-390-5
A1R119	110, 1/4W, 1%, MF	110-110-1
A1R120	3.65k, 1/4W, 1%, MF	110-3.65k-1
A1R121	237k, 1/4W, 1%, MF	110-237k-1
A1R122	5.9k, 1/4W, 1%, MF	110-5.9k-1
A1R123	2k, 1/4W, 1%, MF	110-2k-1
A1R124	464, 1/4W, 1%, MF	110-464-1
A1R125	10k, 1/4W, 1%, MF	110-10k-1
A1R126	887, 1/4W, 1%, MF	110-887-1
A1R127	475, 1/4W, 1%, MF	110-475-1
A1R128	1k, Variable	157-1kB
	INTEGRATED CIRCUITS	
A1U1	Quad Op Amp	54-RC4136
A1U2	Quad Op Amp	54-RC4136
A1U3	Quad Op Amp	54-RC4136
A1U4	Quad Op Amp	54-RC4136
A1U5	Triple 3-Input NAND	54-7410
A1U6	Dual One Shot	55-9602
A1U7	Quad Analog Switch	54-20
A1U8	Quad Analog Switch	54-20
A1U9	Dual Analog Switch	50-DG200BA
	MISCELLANEOUS	
A1J1	Connector: 20-Pin	551-38
A1P2	Plug: 4-Pin	551-88
A1P3	Plug: 3-Pin	551-50

Table 6-3. A2 YIG Driver PC Assembly 6210-L-5402-30 Replaceable Parts

	CAPACITORS	
A2C2	10μF, 25V, 10%, T	250-42
A2C3	.47μF, 250V, 10%, My	210-32
A2C4	100pF, 300V, 5%, M	220-100
A2C7	.01μF, 100V, 20%, C	230-11
A2C8	4.7μF, 35V, 20%, T	250-39
A2C9	.01μF, 100V, 20%, C	230-11
A2C10	4.7μF, 35V, 20%, T	250-39
A2C11	10μF, 25V, 10%, T	250-42
A2C12	10μF, 25V, 10%, T	250-42
A2C109	.01μF, 100V, 20%, C	230-11
A2C110	4.7μF, 35V, 20%, T	250-39

	DIODES	
A2CR1	Silicon	10-1N4446
A2CR2	Zener, 5.6V, .4W, 5%	10-1N752A
A2CR3	Silicon	10-1N4446
A2CR4	Zener, 16V, 1W, 5%	10-1N4745A
A2CR5	Silicon	10-1N4446
A2CR6	Zener, 16V, 1W, 5%	10-1N4745A
A2CR7	Silicon	10-1N4446
A2CR8	Silicon	10-1N4446
A2CR105	Silicon	10-1N4446
A2CR106	Zener, 24V, 1W, 5%	10-1N4749A

Table 6-3. A2 YIG Driver PC Assembly 6210-L-5402-30 Replaceable Parts (Continued)

REF. DES.	DESCRIPTION	WILTRON PART NO.
	TRANSISTORS	
A2Q1	NPN	20-2N3904
A2Q2	NPN	20-2N3904
A2Q3	PNP	20-4
A2Q4	NPN	20-2N3904
A2Q5	PNP	20-2N3906
A2Q6	NPN	20-2N3904
A2Q14	NPN	20-2N3904
A2Q16	NPN	20-2N3904
	RESISTORS	
A2R1	30.9k, 1/4W, 1%, MF	110-30.9k-1
A2R2	10k, Variable	157-10k
A2R5	10k, 1/4W, 1%, MF	110-10k-1
A2R6	20k, Variable	157-20k
A2R7	59k, 1/4W, 1%, MF	110-59k-1
A2R8	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R9	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R10	24.3k, 1/4W, 1%, MF	110-24.3k-1
A2R11	10k, 1/4W, 1%, MF	110-10k-1
A2R13	68.1, 1/4W, 1%, MF	110-68.1-1
A2R14	1k, 1/4W, 1%, MF	110-1k-1
A2R15	1k, 1/4W, 1%, MF	110-1k-1
A2R17	15k, 1/4W, 1%, MF	110-15k-1
A2R18	13.3k, 1/4W, 1%, MF	110-13.3k-1
A2R19	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R20	2k, Variable	157-2k
A2R21	12.1k, 1/4W, 1%, MF	110-12.1k-1
A2R22	15k, 1/4W, 1%, MF	110-15k-1
A2R23	15k, 1/4W, 1%, MF	110-15k-1
A2R24	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R25	6.81k, 1/4W, 1%, MF	110-6.81k-1
A2R26	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R27	10k, 1/4W, 1%, MF	110-10k-1
A2R28	3.16k, 1/4W, 1%, MF	110-3.16k-1
A2R29	100, 1/4W, 1%, MF	110-100-1
A2R30	5k, Variable	157-5k

REF. DES.	DESCRIPTION	WILTRON PART NO.
	RESISTORS (Continued)	
A2R31	6.19k, 1/4W, 1%, MF	110-6.19k-1
A2R32	6.19k, 1/4W, 1%, MF	110-6.19k-1
A2R33	15k, 1/4W, 1%, MF	110-15k-1
A2R34	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R35	2k, Variable	157-2k
A2R36	17.8k, 1/4W, 1%, MF	110-17.8k-1
A2R37	13.3k, 1/4W, 1%, MF	110-13.3k-1
A2R38	15k, 1/4W, 1%, MF	110-15k-1
A2R39	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R40	6.81k, 1/4W, 1%, MF	110-6.81k-1
A2R42	4.64k, 1/4W, 1%, MF	110-4.64k-1
A2R43	6.34k, 1/4W, 1%, MF	110-6.34k-1
A2R45	3.16k, 1/4W, 1%, MF	110-3.16k-1
A2R46	5.11, 1/4W, 1%, MF	110-5.11-1
A2R50	15k, 1/4W, 1%, MF	110-15k-1
A2R51	5.11, 1/4W, 1%, MF	110-5.11-1
A2R133	15k, 1/4W, 1%, MF	110-15k-1
A2R134	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R135	2k, Variable	157-2k
A2R136	4.64k, 1/4W, 1%, MF	110-4.64k-1
A2R137	13.3k, 1/4W, 1%, MF	110-13.3k-1
A2R138	15k, 1/4W, 1%, MF	110-15k-1
A2R139	1.96k, 1/4W, 1%, MF	110-1.96k-1
A2R140	6.81k, 1/4W, 1%, MF	110-6.81k-1
A2R142	4.64k, 1/4W, 1%, MF	110-4.64k-1
A2R143	6.34k, 1/4W, 1%, MF	110-6.34k-1
A2R147	5.11, 1/4W, 1%, MF	110-5.11-1
A2R151	5.11, 1/4W, 1%, MF	110-5.11-1
	INTEGRATED CIRCUITS	
A2U1	Quad Op Amp	54-RC4136
A2U13	Op Amp	54-CA3140
	MISCELLANEOUS	
A2K1	Relay: Reed, DPST	690-13

Table 6-4. A3 Phase Lock PC Assembly 6210-L-5403-3 Replaceable Parts

REF. DES.	DESCRIPTION	WILTRON PART NO.
	CAPACITORS	
A3C5	47μF, 63V, E	250-51
A3C6	150μF, 25V, E	250-52
A3C7	47μF, 63V, E	250-52
A3C8	150μF, 25V, E	250-52
	DIODES	
A3CR2	Silicon	10-STB568
A3CR5	Silicon	10-STB568
	SWITCH	
A3S1	Switch: Slide, DPDT	430-46
	INTEGRATED CIRCUITS	
A3U1	Op Amp	54-CA3140
A3U2	Analog Switch	50-DG200BA
A3U4	-15V Regulator	54-MC7915
A3U5	+15V Regulator	54-MC7815
	TRANSISTORS	
A3Q1	PNP	20-4
A3Q2	NPN	20-3
	RESISTORS	
A3R1	10k, Variable	157-10k
A3R3	20k, Variable	157-20k
A3R7	5.11k, 1/4W, 1%, MF	110-5.11k-1
A3R8	21.5k, 1/4W, 1%, MF	110-21.5k-1
A3R9	61.9k, 1/4W, 1%, MF	110-61.9k-1
A3R10	3.16k, 1/4W, 1%, MF	110-3.16k-1
A3R11	10k, 1/4W, 1%, MF	110-10k-1
A3R14	6.8, 1W, 5%, CC	103-6.8-5
A3R15	261, 1/4W, 1%, MF	110-261-1
A3R16	1.78k, 1/4W, 1%, MF	110-1.78k-1
A3R17	261, 1/4W, 1%, MF	110-261-1
A3R19	3, 5W, 5%, WW	130-3-3
A3R20	3, 5W, 5%, WW	130-3-3
A3R21	5, 5W, 5%, WW	130-5-5

Table 6-5. A4 6210 Front Panel PC Assembly 6210-MS- 5404-3 Replaceable Parts

	CAPACITORS	
A4C1	6.8μF, 35V, T	250-41
A4C2	10μF, 25V, T	250-42
A4C3	10μF, 25V, T	250-42
A4C4	10μF, 25V, T	250-42
A4C5	10μF, 25V, T	250-42
	INTEGRATED CIRCUITS	
A4U1	+15V, Regulator	54-MC7815
A4U2	-15V, Regulator	54-MC7915
A4U3	+5V, Regulator	54-MC7805
	RESISTORS	
A4R1	1k, Variable	152-1kA
A4R2	332, 1/4W, 1%, MF	110-332-1
A4R3	110, 1/4W, 1%, MF	110-110-1
A4R4	5, 3W, WW	130-5-3
A4R6	25k, Variable	145-25k

Table 6-6. A5 6213D Motherboard PC Assembly 6210-L-5440-6 Replaceable Parts

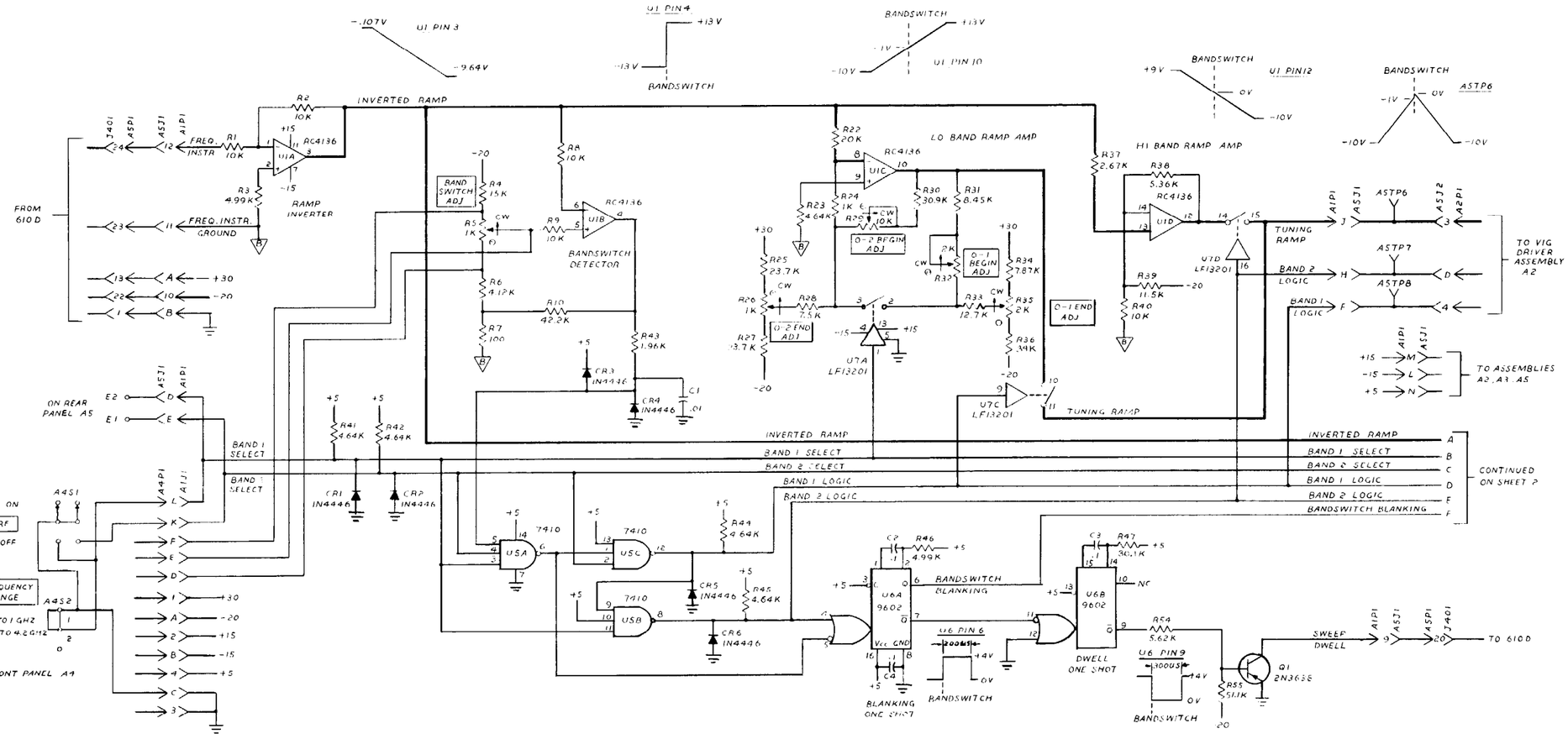
REF. DES.	DESCRIPTION	WILTRON PART NO.
	CAPACITORS	
A5C2	470μF, T	250-54
A5C3	470μF, T	250-54
A5C13	10μF, 25V, T	250-42A
	CONNECTORS	
A5J1	24-Pin	551-37
A5J2	24-Pin	551-37
A5J3	20-Pin	551-38
A5P1	24-Pin	525-11
A5P2	8-Pin	551-89
A5P3	4-Pin	551-88
A5P4	8-Pin	551-89
A5P5	3-Pin	551-50
	TRANSISTORS	
A5Q1	PNP	20-2N6041
A5Q2	PNP	20-2N6041
A5Q4	PNP	20-2N6041
	RESISTORS	
A5R1	2.15k, 1/4W, 1%, MF	110-2.15k-1
A5R2	2.15k, 1/4W, 1%, MF	110-2.15k-1
A5R3	5, 3W, 10%, CC	131-3
A5R5	2.15k, 1/4W, 1%, MF	110-2.15k-1
A5R6	2.15k, 1/4W, 1%, MF	110-2.15k-1
A5R49	20k, 1/4W, 1%, MF	110-20k-1
A5R13	49.9, 1/4W, 1%, MF	110-49.9-1
	DIODES	
A5CR1	Zener, 24V, 1W, 10%	10-1N4749A
A5CR2	Silicon	10-SI2

Table 6-7. 6213D RF Components

---	Isolator, 2-4.2 GHz	1000-25
---	YIG Oscillator, 2-4.2 GHz	1005-18
---	Downconverter, .01-2 GHz	1006-2
---	Pad, 3 dB	1010-26
---	PIN Switch, HP single-pole	1020-17
---	PIN Switch, 2-pole	1020-28
---	Low-pass Filter, 4.3 GHz	1030-24
---	Directional Coupler, Front Panel	MS-5408
---	Directional Coupler, 2-4.2 GHz	MS-3610-51

Table 6-8. Front Panel Hardware

S1	Switch, RF	430-61
S2	Switch, FREQUENCY RANGE	430-61
---	Knob, RF POWER LEVEL	710-49
---	Knob, Latch	710-53
---	Knob, SLOPE ADJUST	61084-S-5452
---	Latch	742-10



NOTES:

A. UNLESS OTHERWISE NOTED, RESISTANCES ARE IN OHMS, CAPACITANCES IN MICROFARADS, AND INDUCTANCES IN MICROHENRY'S. RESISTORS ARE 1/8 W, 1%.

B. PRIMARY SIGNAL PATH IS SHOWN BY A HEAVY SOLID LINE. SECONDARY OR FEEDBACK SIGNAL PATHS ARE SHOWN BY HEAVY DASHED LINE.

C. ⏚ DENOTES COMMON GROUND CONNECTION.

D. ▽ DENOTES FREQUENCY GROUND.

E. ▽ DENOTES LEVEL AMPLIFIER GROUND.

F. * DENOTES FACTORY SELECTED VALUES.

G. WAVEFORMS SHOWN BEGIN AT 10MHZ AND END AT 4.2 GHZ.

LOGIC & SWITCHING TRUTH TABLES

MODE	BND 1 SEL	BND 2 SEL	U5 - 5	U5 - 6	BND 1 LOGIC	BND 2 LOGIC	U7 - 2, 3	U7 - 6, 7	U7 - 10, 11	U7 - 14, 15	U8 - 6, 7	U8 - 10, 11	U9 - 4, 5	U9 - 8, 9
RF OFF	0	0	X	1	1	1	1	1	0	0	0	0	0	0
LO BAND	0	1	X	1	0	1	1	1	1	1	0	0	0	1
DUAL[A]	1	1	0	1	0	1	0	0	1	0	1	0	0	1
DUAL[B]	1	1	1	0	1	0	0	0	0	1	0	1	1	0

LEVELING	INTERNAL SWITCH SENSE LINE	EXTERNAL SWITCH SENSE LINE	U3 - 4	U8 - 2, 3	U8 - 14, 15
INTERNAL	+.5V	0V	+13V	0	0
EXTERNAL	0V	+.5V	-13V	1	1

A - BEFORE BANDSWITCH B - AFTER BANDSWITCH
X - INDICATES EITHER STATE MIGHT BE PRESENT
FOR ANALOG SWITCHES: 1 - SWITCH CLOSED 0 - SWITCH OPEN

REFERENCE DESIGNATORS			
LAST USED		NOT USED	
CR19	C17	C1[C]	
Q10	P3		
U9	J1		
R128			

Figure 6-1. Level Bandswitch Schematic (6213D-A1, Sheet 1 of 2)

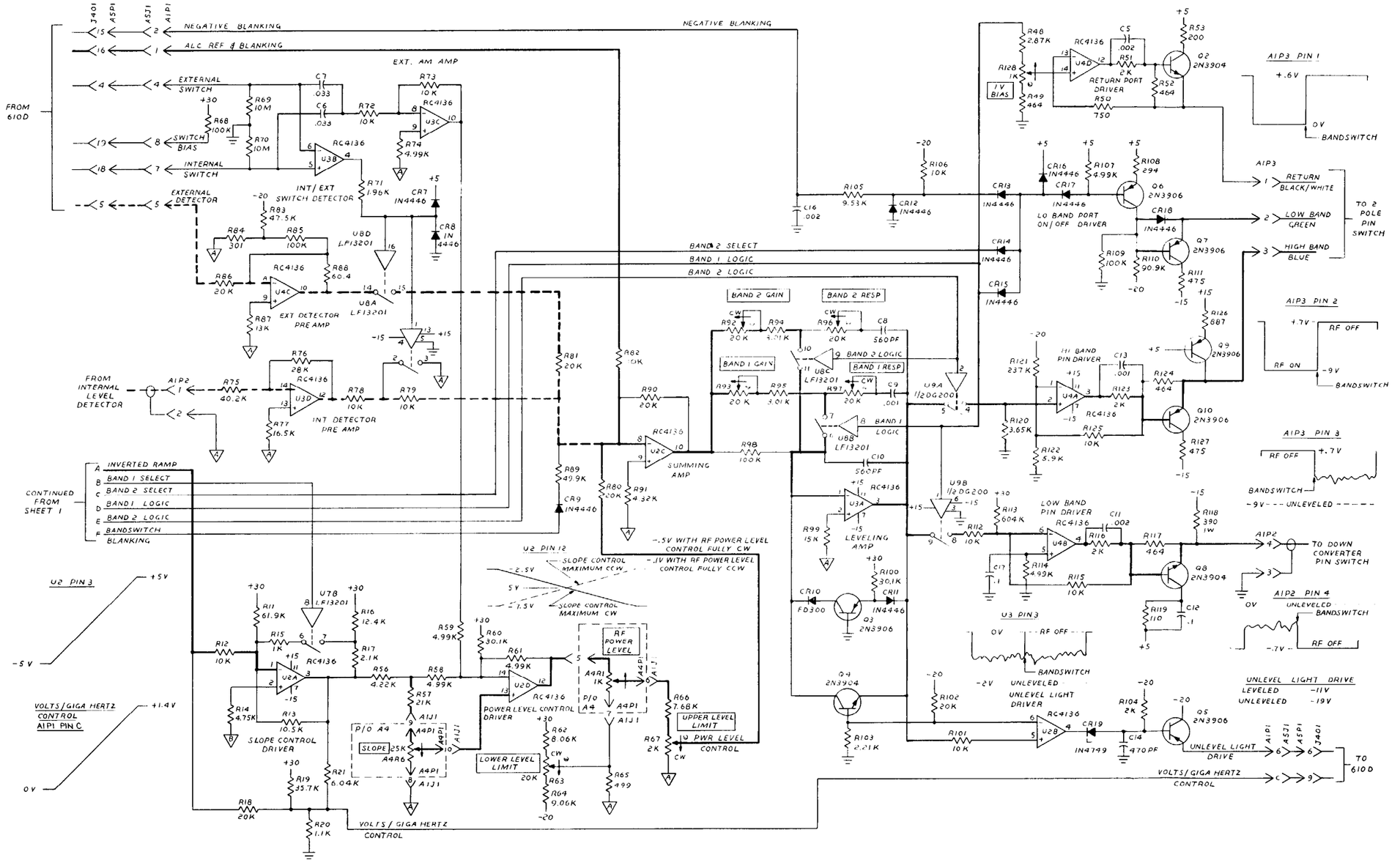
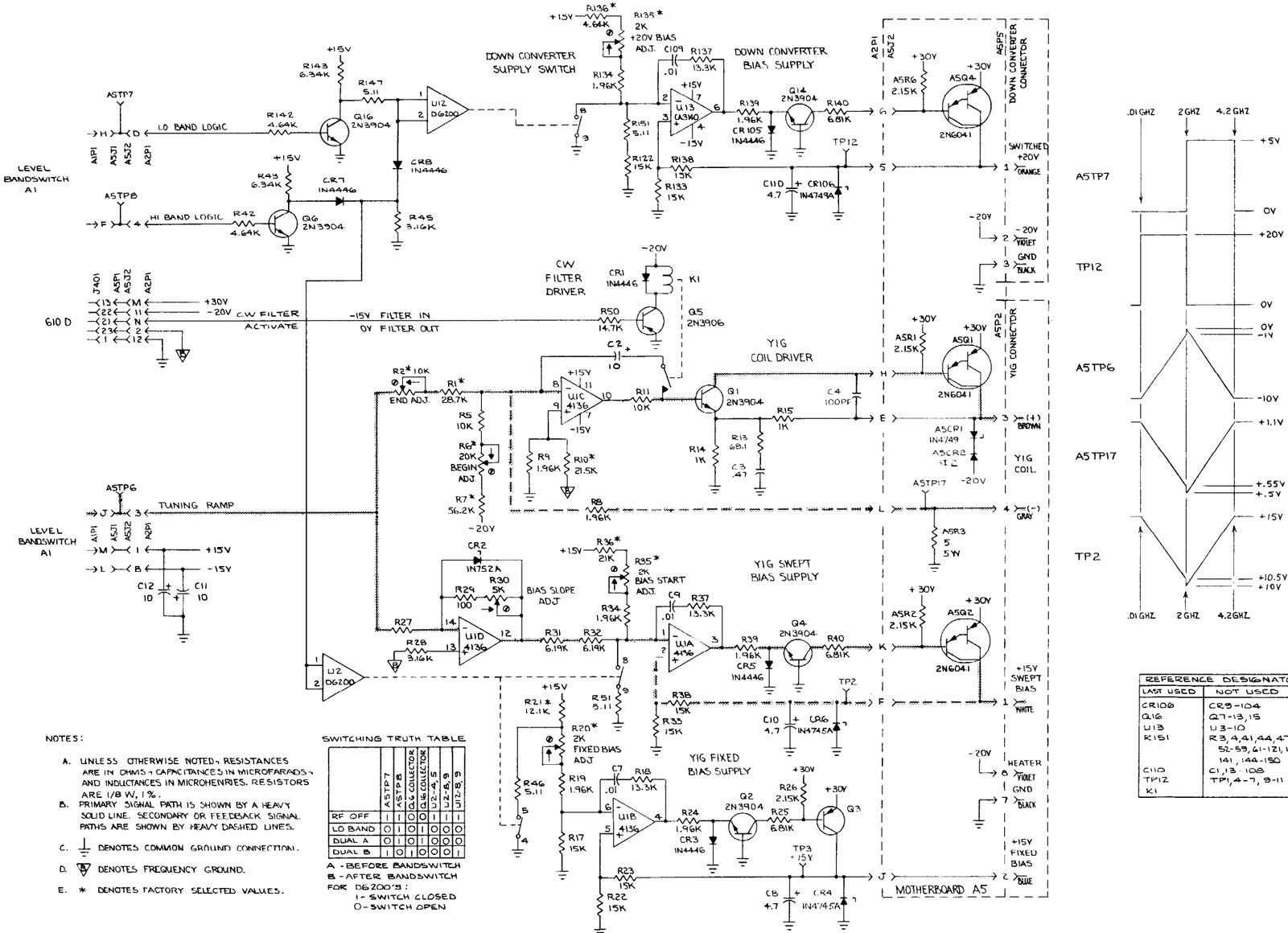


Figure 6-2. Level Bandswitch Schematic (6213D-A1, Sheet 2 of 2)



REFERENCE DESIGNATORS	
LAST USED	NOT USED
CR106	CR3-104
Q16	Q7-13, 15
U13	U3-10
R151	R3, 4, 41, 44, 47-49, 52-59, 61-121, 123-131, 141, 144-150
C110	C1, 13-108
TP12	TP1, 4-7, 9-11
K1	

Figure 6-3. YIG Driver Schematic (6213D-A2)

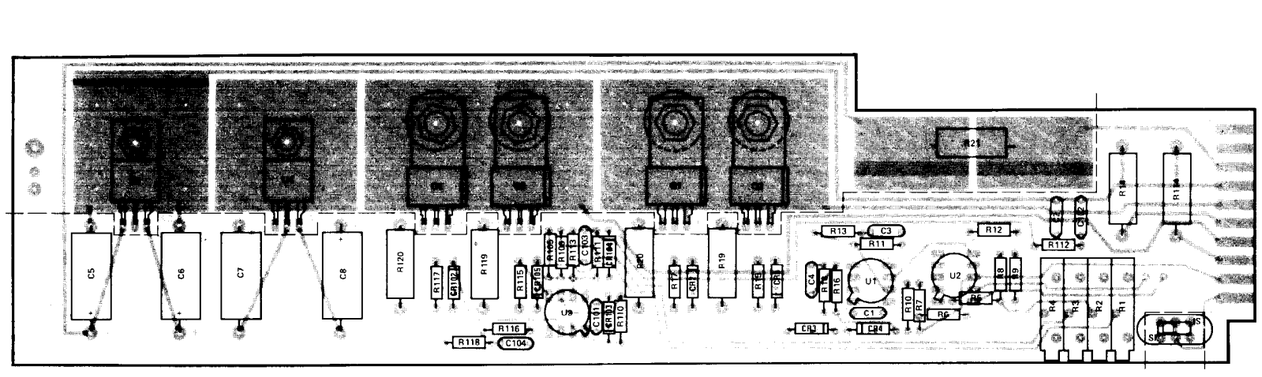
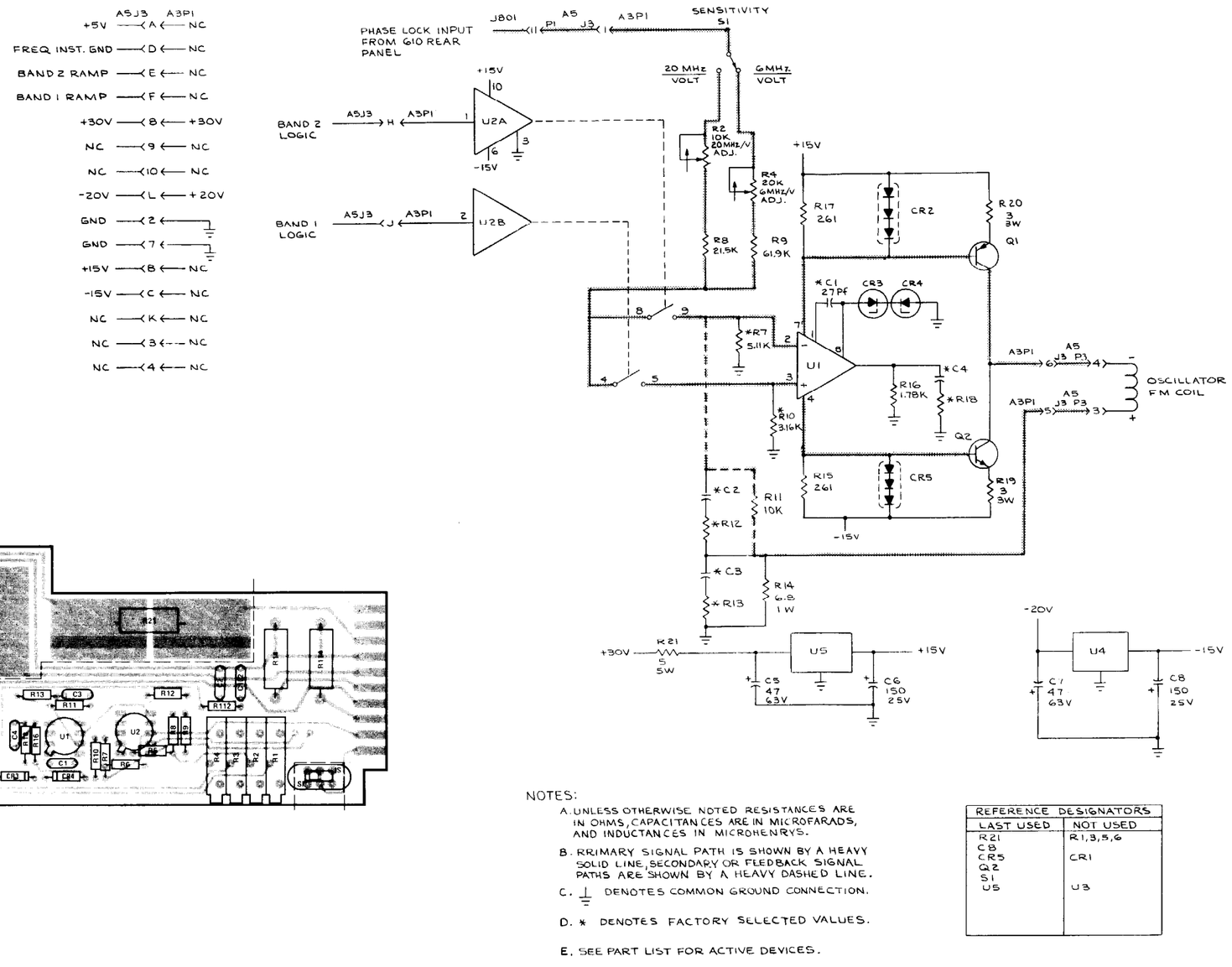


Figure 6-4. Phase Lock PC Assembly, Parts Location (6210-L-5403)



NOTES:

A. UNLESS OTHERWISE NOTED RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS, AND INDUCTANCES IN MICROHENRYS.

B. RRIMARY SIGNAL PATH IS SHOWN BY A HEAVY SOLID LINE, SECONDARY OR FEEDBACK SIGNAL PATHS ARE SHOWN BY A HEAVY DASHED LINE.

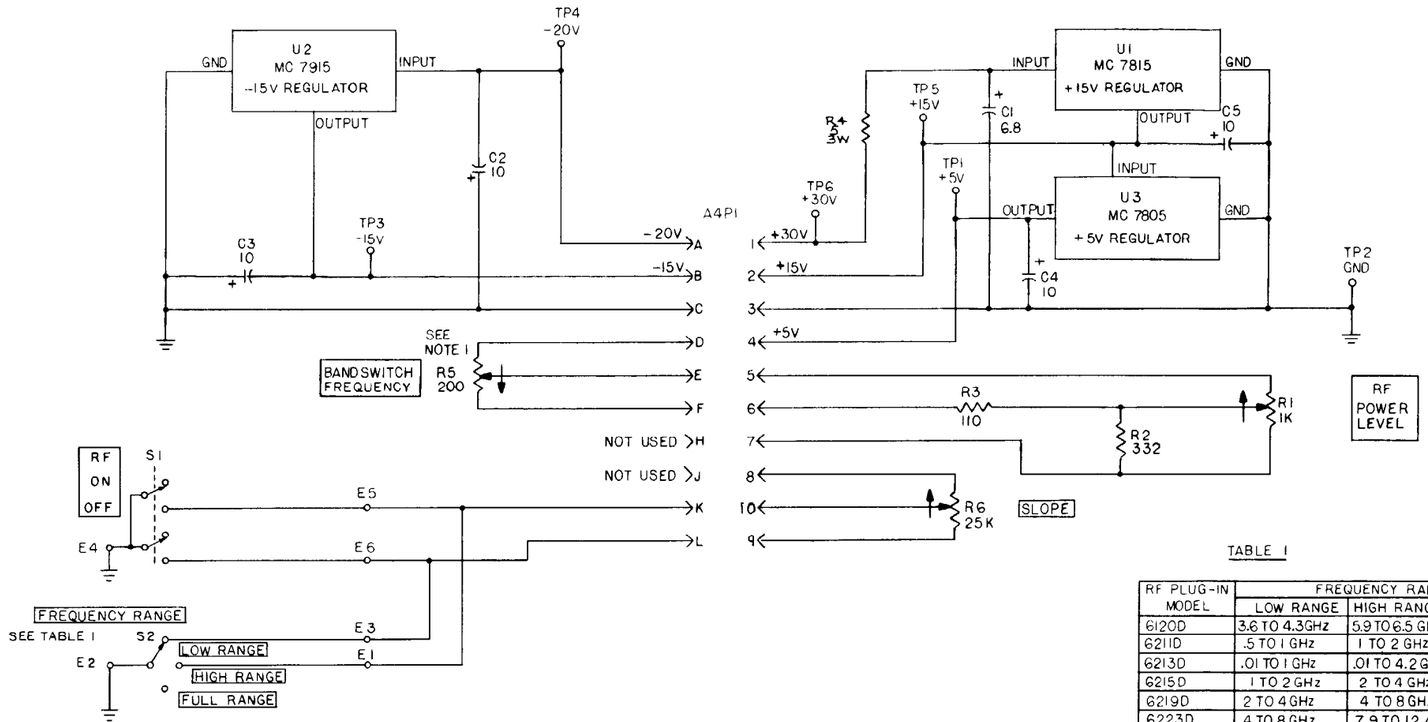
C. ⏚ DENOTES COMMON GROUND CONNECTION.

D. * DENOTES FACTORY SELECTED VALUES.

E. SEE PART LIST FOR ACTIVE DEVICES.

REFERENCE DESIGNATORS	
LAST USED	NOT USED
R21	R1,3,5,6
C8	
CR5	CR1
Q2	
S1	
U5	U3

Figure 6-5. Phase Lock Schematic (Option 28) (6210-A3)



NOTES: UNLESS OTHERWISE SPECIFIED:

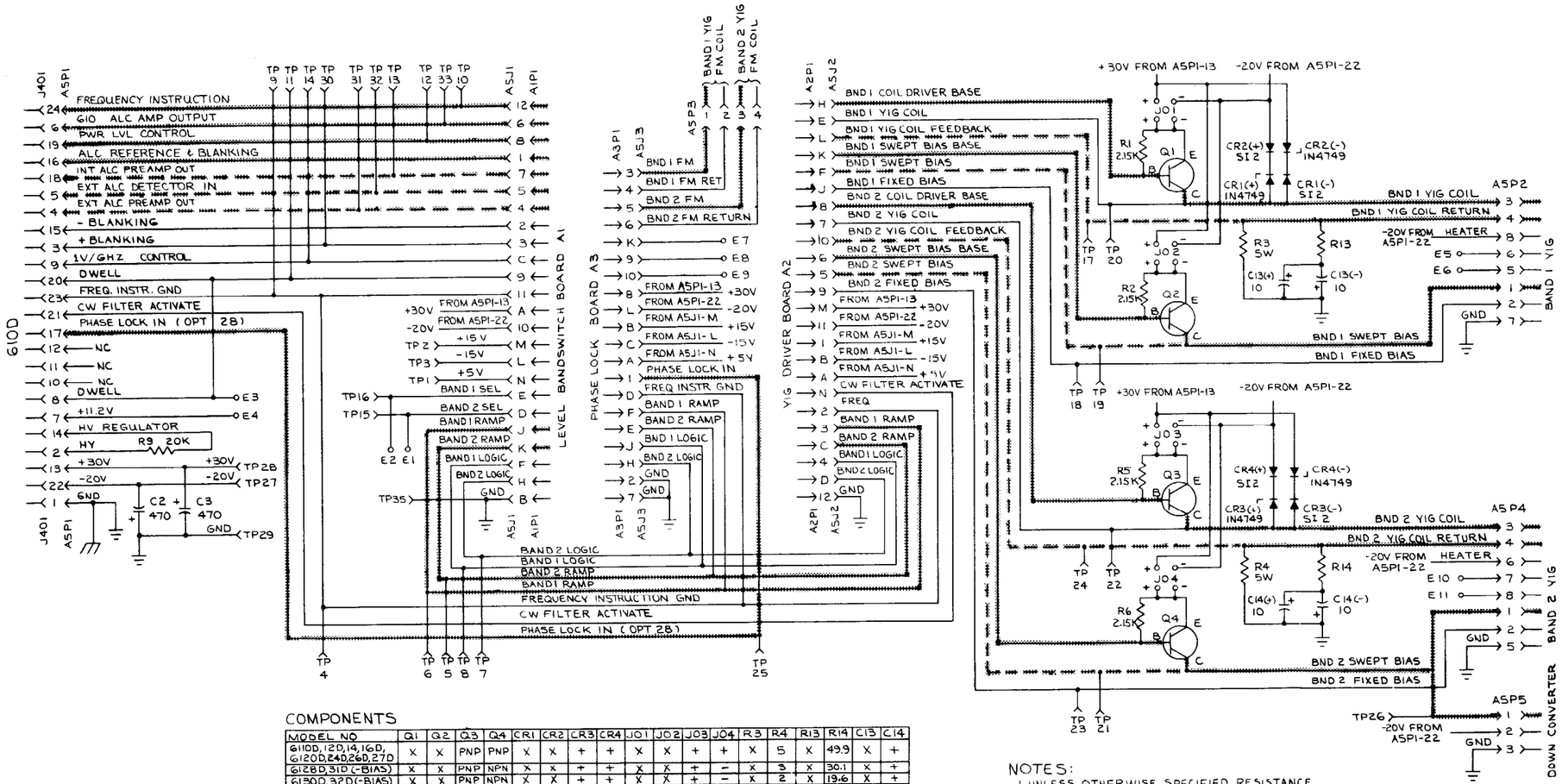
1. R5 OPTIONAL.
2. S2 OPTIONAL.
3. RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS.

REFERENCE DESIGNATORS			
LAST USED		NOT USED	
R6 C5 CR1 S2 U3 E6	TP6 A4P1	CR1	

TABLE 1

RF PLUG-IN MODEL	FREQUENCY RANGE		
	LOW RANGE	HIGH RANGE	FULL RANGE
6120D	3.6 TO 4.3GHz	5.9 TO 6.5 GHz	3.6 TO 6.5GHz
6211D	.5 TO 1 GHz	1 TO 2 GHz	.5 TO 2GHz
6213D	.01 TO 1 GHz	.01 TO 4.2 GHz	——
6215D	1 TO 2 GHz	2 TO 4 GHz	1 TO 4 GHz
6219D	2 TO 4 GHz	4 TO 8 GHz	2 TO 8 GHz
6223D	4 TO 8 GHz	7.9 TO 12.4GHz	4 TO 12.4 GHz
6229D	7.9 TO 12.4GHz	12.4 TO 18.5GHz	7.9 TO 18.5 GHz
6247D	.01 TO 2 GHz	.01 TO 18.5GHz	——
6100D SERIES EXCEPT 6120D	NOT INSTALLED		
6237D	NOT INSTALLED		

Figure 6-6. Front Panel Schematic (6210-A4)



REFERENCE DESIGNATORS			
LAST USED		NOT USED	
CR4	A5P5	R7,R8	TP34
Q4	TP35	R10,R11	
R14	J04	R12	
C14		C1,C4 THRUC12	
A5J3			

COMPONENTS

MODEL NO	Q1	Q2	Q3	Q4	CR1	CR2	CR3	CR4	J01	J02	J03	J04	R3	R4	R13	R14	C13	C14
6110D,12D,14,16D, 6120D,240,26D,27D	X	X	PNP	PNP	X	X	+	+	X	X	+	+	X	5	X	49.9	X	+
6128D,31D (-BIAS)	X	X	PNP	NPN	X	X	+	+	X	X	+	−	X	3	X	30.1	X	+
6130D,32D(-BIAS)	X	X	PNP	NPN	X	X	+	+	X	X	+	−	X	2	X	19.6	X	+
6128D,31D(+BIAS)	X	X	PNP	PNP	X	X	+	+	X	X	+	+	X	3	X	30.1	X	+
6130D,32D(+BIAS)	X	X	PNP	PNP	X	X	+	+	X	X	+	+	X	2	X	19.6	X	+
6211D,15D, 19D	PNP	PNP	PNP	PNP	+	+	+	+	+	+	+	+	5	5	49.9	49.9	+	+
6213D	PNP	PNP	X	PNP	+	+	X	X	+	+	X	+	5	X	X	X	X	X
6223D x BAND-BIAS	PNP	PNP	PNP	NPN	+	+	+	+	+	+	+	−	5	3	49.9	30.1	+	+
6223D x BAND+BIAS	PNP	PNP	PNP	PNP	+	+	+	+	+	+	+	+	5	3	49.9	30.1	+	+
6229D x BAND-BIAS	PNP	NPN	PNP	NPN	+	+	+	+	+	−	+	−	3	2	30.1	19.6	+	+
6229D x BAND+BIAS	PNP	PNP	PNP	NPN	+	+	+	+	+	+	+	−	3	2	30.1	19.6	+	+

\+ INDICATES JUMPER TO +30V OR INSTALLATION OF COMPONENT WITH (+) AFTER PART NO.
\- INDICATES JUMPER TO -20V OR INSTALLATION OF COMPONENT WITH (-) AFTER PART NO.
X INDICATES NOT INSTALLED
THE YIG COIL DRIVERS OF THE PLUG-INS IN THE TABLE ABOVE OPERATE OFF THE +30V SUPPLY. TO CONVERT TO OPERATION FROM THE -20V SUPPLY USE NPN FOR Q1,Q3 AND THE SIGNS OF J01, J03, CR1, CR2, CR3, CR4, C13, C14 WILL BE(-). SOME MODIFICATIONS OF THE YIG DRIVER BOARD WILL ALSO BE NECESSARY.
PNP - 2N6041
NPN - 2N6044

NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES IN MICROFARADS. RESISTORS ARE 1/8W, 1%.
2. PRIMARY SIGNAL PATHS ARE SHOWN BY A HEAVY SOLID LINE. SECONDARY OR FEEDBACK SIGNAL PATHS ARE SHOWN BY A HEAVY DASHED LINE.
3. FOR WAVEFORMS AND VOLTAGES SEE BLOCK DIAGRAM AND APPLICABLE SCHEMATICS.
4. * DENOTES FACTORY SELECTED VALUES.
5. ⏚ DENOTES COMMON GROUND CONNECTION.
6. ⏚ DENOTES CHASSIS GROUND CONNECTION.

Figure 6-7. Motherboard Schematic (6210-A5)