

**AS210-03
FREQUENCY
GENERATOR MODULE**

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PREFACE

This manual contains operation and maintenance instructions for the AS210-03 Frequency Generator. The data contained herein is arranged as follows:

Chapter 1	General Information
Chapter 2	Installation
Chapter 3	Operation
Chapter 4	Theory of Operation
Chapter 5	Maintenance and Calibration
Chapter 6	Illustrated Parts List

Reference Publications

AS-210RM	Rack Mount Mainframe Operation and Maintenance Manual
AS-210PM	Portable Mainframe Operation and Maintenance Manual
AS-210-01A	Module Controller Operation and Maintenance Manual
AS-210-02	Frequency Comparator Operation and Maintenance Manual
AS-210-04	Digital Delay Generator Operation and Maintenance Manual
AS-210-05	Standby Battery Operation and Maintenance Manual
AS-210-06	Microwave Generator Operation and Maintenance Manual
AS-210-08	Distribution Amplifier Operation and Maintenance Manual
AS-210-20	Time Clock Operation and Maintenance Manual

CHAPTER 1 GENERAL INFORMATION

1-1 INTRODUCTION

The AS210-03 Frequency Generator illustrated in Figure 1.1 is a modular plug-in used in the ARGOSystems AS210 Electronic Counter and Frequency Standard Calibration system. This module is used for testing the amplitude and frequency specifications of electronic counters. Eight individual frequency outputs at nine selectable output levels are provided by the unit. A leveling loop permits an output accuracy of better than 1 dB over 60 dB of dynamic range. The AS210-03 is programmable through the IEEE 488 interface in the AS210-01 Module Controller. Descriptions of other modules of the AS210 series are provided in separate publications referenced in the preface and available from ARGOSystems.

1-2 PHYSICAL AND ELECTRICAL DESCRIPTION

The AS210-03 Frequency Generator is modularly constructed for insertion in the AS210 Mainframe. The front panel contains controls for selection of frequency, output level, and a BNC connector for the output. The circuitry of the AS210-03 is mounted on one printed circuit card assembly and six Voltage Controlled Oscillator (VCO) subassemblies. The 10 MHz frequency output is provided directly by the Rubidium frequency standard from the Mainframe, while a $\times 10$ frequency divider provides the 1 MHz signal. Frequencies of 500, 400, 300, 200, 100, and 50 MHz are obtained from the Phase-Locked Oscillators (PLO) locked to the Rubidium frequency standard. Output level is controlled via a digitally controlled step attenuator. The frequency and level controls are scanned periodically by the microprocessor in the AS210-01 Module Controller. This data is returned to the Frequency Generator in the form of commands for switching PLOs or the attenuator. Table 1-1 is an Equipment Specification for the AS210-03 installed in the AS210 Mainframe.

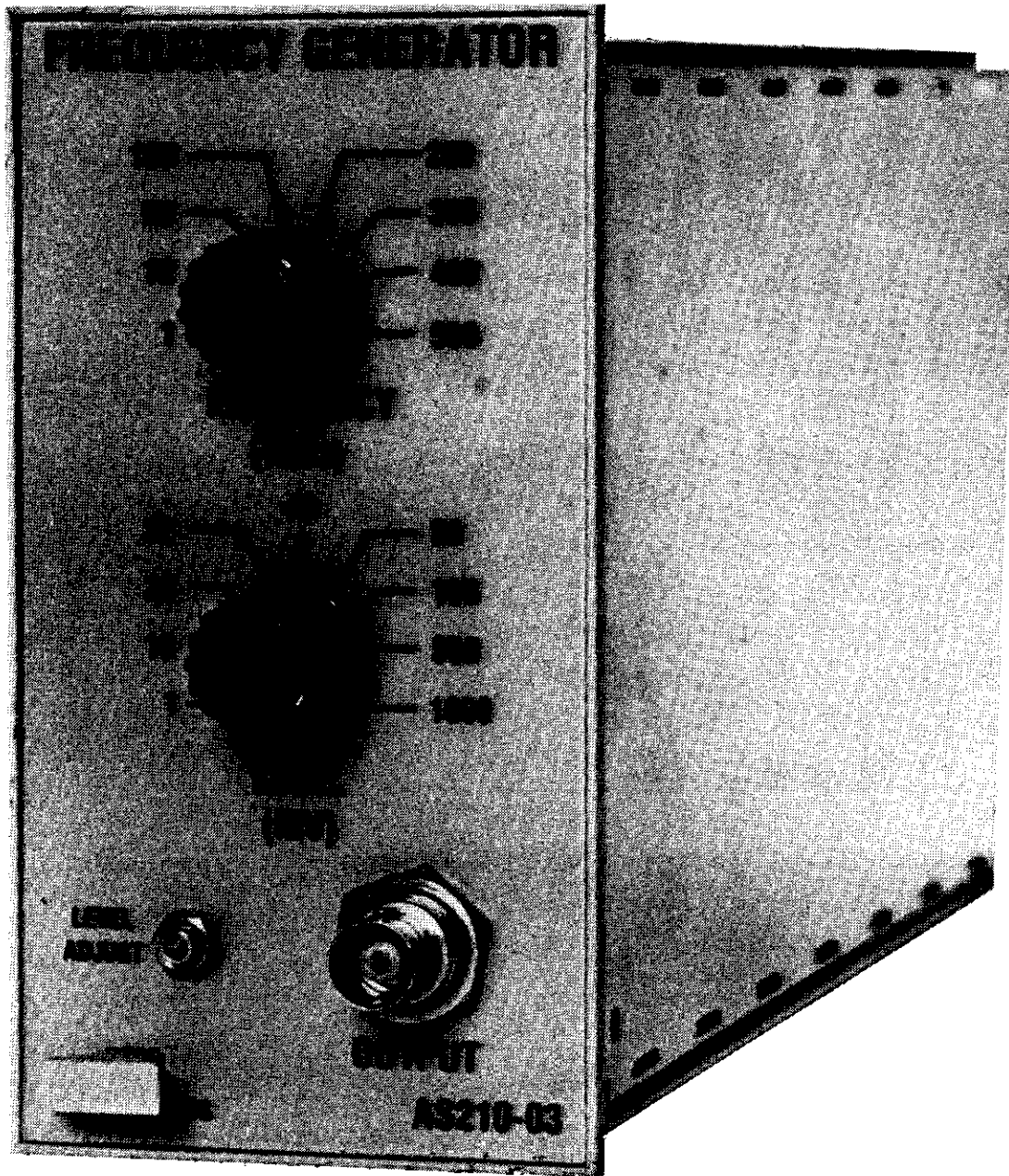


Figure 1.1 AS210-03 Frequency Generator Module

Table 1-1
AS210-03 EQUIPMENT SPECIFICATION

OUTPUT FREQUENCIES	1, 10, 50, 100, 200, 300, 400, or 500 MHz selectable
FREQUENCY ACCURACY	$\pm 6 \times 10^{-11}$ maximum from 10°C to 40°C Less than $\pm 5 \times 10^{-11}$ maximum per day
HARMONIC CONTENT	
2nd HARMONIC	24 dB minimum below desired frequency
3rd HARMONIC AND ABOVE	30 dB minimum below desired frequency
NON-HARMONIC SPURIOUS RESPONSE	50 dB minimum below desired frequency
OUTPUT LEVELS	1, 10, 20, 32, 40, 50, 100, 500, or 1000 millivolts selectable
OUTPUT LEVEL ACCURACY	
1 MHz TO 300 MHz	± 10 percent maximum, 5 percent typical
400-500 MHz	± 15 percent maximum, 5 percent typical
OPERATING TEMPERATURE	0° to 40°C
POWER REQUIREMENT	Supplied by AS-210 Mainframe
WEIGHT	2.75 pounds

CHAPTER 2 INSTALLATION

2-1 INTRODUCTION

The AS210-03 Frequency Generator Module plugs into the AS210 Mainframe. The module is electrically connected through a rear edge connector and mechanically retained via a front panel locking bar.

NOTE 1: Because of the high retention force of the rear card edge connector, it may be necessary to pull on the RF LEVEL switch knob at the same time as the release mechanism is pulled, to remove the Frequency Generator from the Mainframe. (See Figure 3.1.)

NOTE 2: The power in the AS210 Mainframe must be turned OFF when inserting or removing the Frequency Generator Module.

CAUTION

AS210 series plug-ins will not work in Tektronix TM-500 series mainframes. Severe damage will result if operation in this mode is attempted.

Power and signal interface is provided through the Mainframe. The signal output is from a BNC connector on the front panel.

CHAPTER 3 OPERATION

3-1 INTRODUCTION

This chapter contains operation data and instructions for the Frequency Generator. Operator interface is provided through three controls and a connector on the front panel of the module. The AS210-03 is designed to be used in conjunction with the AS210-01 Module Controller. However, this interface is transparent to the user of the Frequency Generator. Chapter 5, Maintenance and Calibration, explains the self-diagnostic capability of the AS210-03 when used with the Module Controller.

3-2 CONTROLS AND CONNECTORS

Figure 3.1 is a front panel photograph of the Frequency Generator with index numbers keyed to Table 3-1.

3-3 OPERATING INSTRUCTIONS

The AS210-03 is connected via 50 ohm cable with a BNC connector. Select the desired standard frequency and choose the output level as required. A level adjustment is provided on the front panel for calibrating the LEVEL (mV) control. Specific procedures for this alignment are contained within the Maintenance chapter.

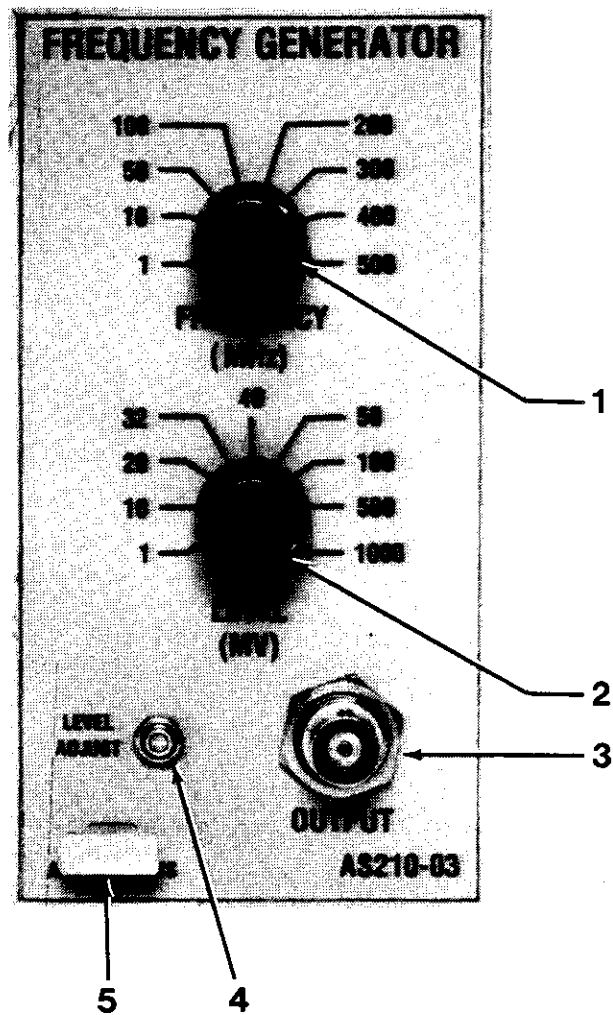


Figure 3.1 AS210-03 Controls and Connectors

Table 3-1
AS210-03 CONTROLS AND CONNECTORS

INDEX NUMBER (Figure 3-1)	PANEL MARKING	FUNCTION
1	FREQUENCY (MHz)	Selects one of eight standard frequencies: 1, 10, 50, 100, 200, 300, 400, or 500 MHz
2	LEVEL (mV)	Selects one of nine output levels: 1, 10, 20, 32, 40, 50, 100, 500, or 1000 millivolts
3	OUTPUT	Output connector - BNC, 50 ohms
4	LEVEL ADJUST	Level calibration adjustment (see Chapter 5)
5	None	Release mechanism for retention and removal of the module

CHAPTER 4 THEORY OF OPERATION

4-1 INTRODUCTION

This chapter provides a description of the circuits used in the Frequency Generator. The circuit description is keyed to a functional block diagram and the schematic diagrams included in Chapter 5. Details of common type circuits (power supplies, etc.) are not included in this description.

4-2 OVERALL DESCRIPTION

The Frequency Generator circuit consists of the front panel controls and the circuit card assemblies. A1 is the main circuit board assembly, the VCOs are A1A1 through A1A6. Figure 4.1 is a functional block diagram of the module depicting how the generator produces standard frequency outputs of 1, 10, 50, 100, 200, 300, 400, and 500 MHz. Front panel controls select the desired frequency and output level. The Frequency Generator's front panel switches are interrogated 10 times per second by the module controller of the AS210 System. The frequency and level data are shifted from the module controller's Central Processing Unit (CPU) into latches (A1U11-frequency, A1U8-level) on the generator through a bidirectional multiplexer A1U4, and A1U6. The CPU \overline{RD} signal determines the direction of data flow through the multiplexer. Address bits A8 and A15 from the CPU are used to load frequency or level data from the data bus. The output of the front panel frequency select switch is also multiplexed with test data in A1U5 by address bit A0. Test data informs the CPU whether the PLOs are locked and that the output is leveled for self-test purposes.

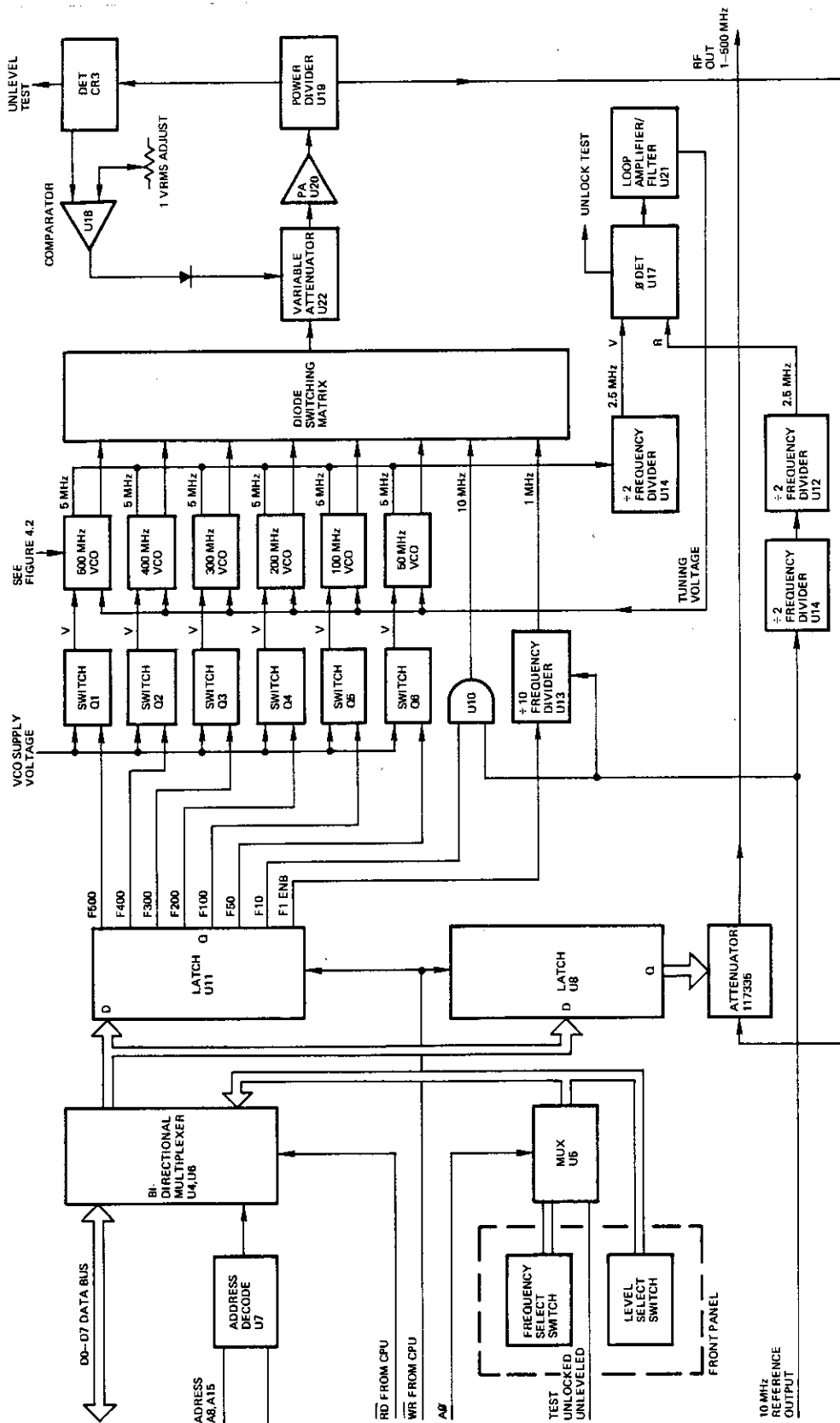


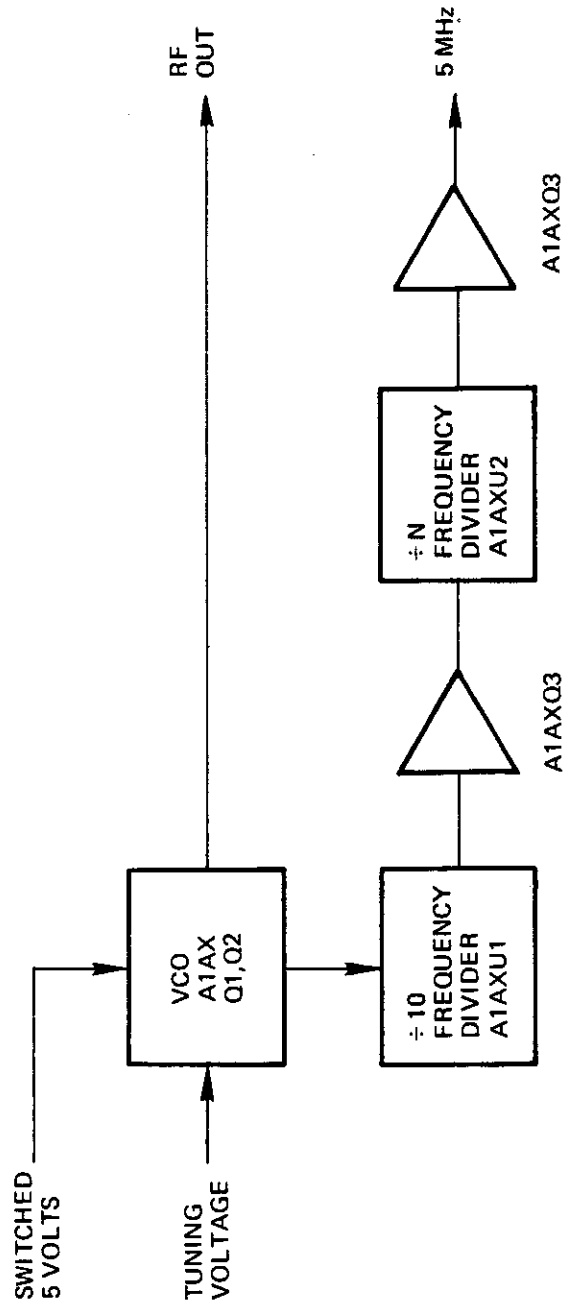
Figure 4.1 Frequency Generator Functional Block Diagram

4-3 FREQUENCY GENERATION

The frequency generation circuits consist of six phase-locked oscillators (PLO), frequency reference dividers, PLO voltage supply gating circuits and the 1 and 10 MHz gating circuit. The PLO circuitry is composed of six voltage controlled oscillators (VCO) with a common frequency divider, phase comparator, and loop amplifier/filter. Six of the standard outputs are provided by the VCOs A1AX (with X equaling 1 through 6 for A1A1 through A1A6). These are the 500, 400, 300, 200, 100, and 50 MHz outputs. The 10 MHz output is obtained directly from the reference input. The 1 MHz output is obtained by dividing the 10 MHz reference input by 10. Only one output frequency can be obtained from the generator at a time. When the front panel switch is set for 50, 100, 200, 300, 400, or 500 MHz, the applicable line from the frequency latch A1U11 (F50, F100, F200, F300, F400, or F500) activates one of six transistor switches (Q6-Q1). The switches allow 11 volts to be applied to the appropriate VCO. Each VCO (Figure 4.2 and schematic diagrams Figures 5.4 through 5.11) is identical except for the frequency-determining circuit elements. Component designators for the VCOs will be preceded by A1AX (with X equaling 1 through 6) to differentiate them from main board components. A varactor-controlled transistor oscillator (A1AXQ1, A1AXQ2) is tuned by a voltage from the phase detector A1U17 through the loop filter/amplifier A1U21. The RF output of the oscillator is provided at connector A1AXJ1.

4-4 PHASE LOCK SIGNAL

The RF output of all the PLOs is divided by 10 in A1AXU1, buffered by A1AXQ3 and divided again by A1AXU2 (except in the 50 MHz PLO). The frequency division accomplished by A1AXU2 is determined by the oscillator frequency. A 5 MHz oscillator output is desired from A1AXU2, therefore the division ratio is $f/n = 5 \text{ MHz}$. For example, the 400 MHz PLO requires a $\div 8$ frequency division ($n = 8$) at A1A2U2 since it has been previously divided by 10 at A1A2U1. In the case of the 50 MHz PLO, the original division by 10 yields 5 MHz.



WITH X = 1 THROUGH 6 FOR A1A1 THROUGH A1A6

- A1A1 - 500 MHz VCO CIRCUIT CARD
- A1A2 - 400 MHz VCO CIRCUIT CARD
- A1A3 - 300 MHz VCO CIRCUIT CARD
- A1A4 - 200 MHz VCO CIRCUIT CARD
- A1A5 - 100 MHz VCO CIRCUIT CARD
- A1A6 - 50 MHz VCO CIRCUIT CARD

Figure 4.2 Voltage Controlled Oscillator (VCO) Block Diagram

4-5 PHASE LOCKING

The second output (J2) of the VCO, a 5 MHz signal, is supplied to circuit board A1 and is divided by 2 in A1U14 and applied to the phase detector A1U17 variable input. The 10 MHz reference from the Rubidium standard on the AS210 Mainframe is divided by 4 at A1U14 and A1U12 and the 2.5 MHz resultant signal is applied to the reference input of the phase detector. The phase detector's output is amplified, filtered (A1U21), and applied to the VCO as its tuning voltage. An unlock or unlevelled condition test signal is also provided to the CPU for diagnostic purposes through multiplexer A1U5. When the 10 MHz output is selected, the 10 MHz frequency standard is gated to the output by the A1U11 latch's F10 line. When the 1 MHz output is selected, a ± 10 frequency divider A1U13 is enabled by the A1U11 latch's F1 line. The selected RF signal is applied to a leveling circuit by a diode switching network.

4-6 OUTPUT AMPLITUDE LEVELING

The RF leveling circuit is provided to supply a constant one volt RMS signal to the digitally controlled step attenuator (assembly 117335). The level control loop consists of a current controlled variable attenuator A1U22, power amplifier A1U20, 3 dB power divider A1U19, detector A1CR3, and comparator A1U18. The output of the switching network is applied to the input of the variable attenuator A1U22. The signal from the output of the variable attenuator is amplified by A1U20 and applied to the input of the 3 dB power divider A1U19. One output of the power divider A1U19 is applied to the input of the digitally controlled step attenuator (assembly 117335). The other output of the power divider is detected by A1CR3 and then compared to a reference voltage by A1U18. The resulting error voltage is applied to the control input of the variable attenuator A1U22 through diode A1CR2 and resistor A1R19. Note: as the error voltage applied to diode A1CR2 increases, the attenuation of the RF signal passing through the variable attenuator A1U22 decreases. The error voltage may be monitored at the ALC test point on A1. A1R24 and A1C23 comprise a circuit to compensate for non-linearities

in the attenuator. A front panel control (1K) adjusts the output level by determining the reference voltage of the comparator. Comparator A1U15 provides an output to the CPU for diagnostic purposes. A1U15 determines when the signal level, detected by A1CR3, exceeds the threshold established by dividers A1R1, A1R3, A1R4, and A1R9. The output of A1U15 goes low to illuminate LED A1CR1 when an unlevelled condition exists. This information is also sent to the CPU. An unlocked condition at A1U17 also provides an indication through A1U15 to the CPU. The attenuator level of the output signal is digitally controlled by the data from the level latch A1U8. The RF output signal is therefore provided at the frequency and amplitude selected by the front panel controls.

CHAPTER 5
MAINTENANCE AND CALIBRATION

5-1 INTRODUCTION

The purpose of this chapter is to provide maintenance and calibration data for the AS210-03 Frequency Generator. Section I covers routine preventive maintenance procedures. Section II outlines performance tests for the Frequency Generator. Section III contains the calibration/alignment procedures for the AS210-03 module, and Section IV describes troubleshooting data. Figures 5.4 through 5.11 are the schematic diagrams of the Frequency Generator Module. Please contact the factory for any assistance required in the maintenance or servicing of the AS210-03.

SECTION I

5-2. PREVENTIVE MAINTENANCE

Table 5-1 lists preventive maintenance checks and services which should be performed regularly.

Table 5-1
PREVENTIVE MAINTENANCE CHECKS AND SERVICES

ITEM	PROCEDURES
CABLES	Visually inspect cables for strained, cut, frayed, or other damaged insulation.
CLEANLINESS	<p>Make sure the exterior surfaces of the unit are clean. If necessary, clean exterior surfaces as follows:</p> <ul style="list-style-type: none"> A. Remove the dust and loose dirt with a clean soft cloth. B. Remove dust or dirt from plugs and jacks with a brush. <p style="text-align: center;"><u>WARNING</u></p> <p>Use <u>only</u> warm soapy water for cleaning all plastic parts. Many solvents will cause the plastic to become brittle.</p>
CORROSION	Make sure exterior surfaces of unit are free of rust and corrosion.
PRESERVATION	<p>Inspect exterior surfaces of the unit for chipped paint or corrosion. If necessary, spot-paint surfaces as follows:</p> <ul style="list-style-type: none"> A. Remove rust and corrosion from metal surfaces by lightly sanding them with sandpaper. B. Brush two coats of paint on base metal to protect it from further corrosion.

SECTION II

5-3 PERFORMANCE TESTING

This section describes the procedure to test the AS210-03 Frequency Generator to assure proper performance of the instrument. The AS210-03 must be used in conjunction with the AS210-01 Module Controller since the CPU in the AS210-01 monitors the controls and output of the AS210-03. The AS210-03 Frequency Generator will not operate without the AS210-01 Module Controller installed. If the AS210-03 fails any of the performance tests, please see Section III, Calibration/Alignment procedures, and/or Section IV, Troubleshooting procedures in this chapter.

5-4 RF OUTPUT FREQUENCY PERFORMANCE TEST

The following is a procedure for testing the eight selectable output frequencies of the AS210-03. Table 5-2 contains the required equipment to perform this test.

Table 5-2
REQUIRED TEST EQUIPMENT FOR RF OUTPUT FREQUENCY PERFORMANCE TEST

ITEM	RECOMMENDED TEST EQUIPMENT
ELECTRONIC COUNTER FREQUENCY STANDARD COAXIAL CABLE (2 Required)	HEWLETT-PACKARD 5345A HEWLETT-PACKARD 5061A OR 5062C OPT 01 3 FOOT LONG, 50 OHM, BNC

5-5 TEST PROCEDURE

- A. Ensure that power is disconnected from the AS210 system before beginning this procedure.

- B. Connect the equipment as indicated in Figure 5.1 and apply power to the AS210. The Rubidium Frequency Standard in the AS210 system will require 20 minutes warm-up time to reach the specified frequency accuracy.
- C. Select the 100 millivolt output voltage level on the AS210-03. Starting with the 1 MHz output frequency, compare the frequency displayed by the electronic counter to Table 5-3 to verify the output frequency is within 1,000,000 \pm 0.01 Hz. Continue this process through the remaining seven output frequencies available from the AS210-03. If any of the frequencies fall out of the limits for acceptable performance please see Section III, Calibration/Alignment Procedures, and/or Section IV, Troubleshooting Procedures.
- D. Disconnect the frequency counter from the AS210-03.

Table 5-3

MINIMUM PERFORMANCE LIMITS FOR RF OUTPUT FREQUENCIES OF THE AS210-03

FREQUENCY (MHz)	ACCEPTABLE FREQUENCY RANGE
1	1,000,000 \pm 0.01 Hz
10	10,000,000 \pm 0.1 Hz
50	50,000,000 \pm 0.5 Hz
100	100,000,000 \pm 1.0 Hz
200	200,000,000 \pm 2.0 Hz
300	300,000,000 \pm 3.0 Hz
400	400,000,000 \pm 4.0 Hz
500	500,000,000 \pm 5.0 Hz

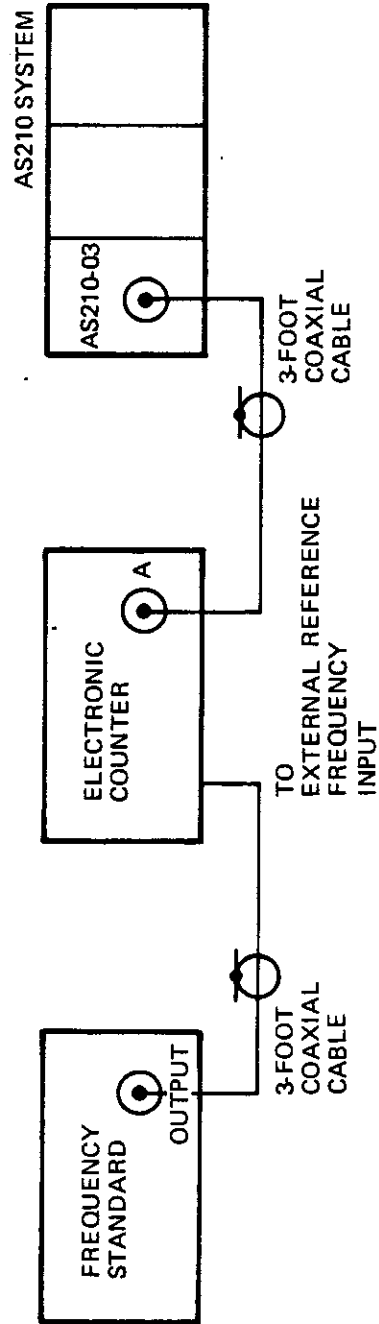


Figure 5.1 AS210-03 Frequency Generator RF Output Frequency Test Configuration

5-6 RF OUTPUT LEVEL PERFORMANCE TEST

The following is a procedure for testing the nine RF output levels for each of the eight selectable output frequencies of the AS210-03. Table 5-4 contains the required equipment for this performance test.

Table 5-4
REQUIRED TEST EQUIPMENT FOR RF OUTPUT LEVEL PERFORMANCE TEST

ITEM	RECOMMENDED TEST EQUIPMENT
RF VOLTMETER	BOONTON 92BD OPT 01, 09 WITH 50 OHM BNC ADAPTER
COAXIAL CABLE	3 FOOT LONG, 50 OHMS, BNC

5-7 TEST PROCEDURE

- A. Ensure that power is disconnected from the AS210 system before beginning this procedure.
- B. Connect the equipment as indicated in Figure 5.2 and apply power. The Rubidium Frequency Standard in the AS210 system will require 20 minutes warm-up time to reach the specified frequency accuracy.
- C. Starting with 1 MHz as the selected output frequency of the AS210-03 and one millivolt as the desired output voltage level, the RF voltmeter should read between 0.9 and 1.1 millivolts for acceptable performance. Next, change the output level to 10 millivolts. The RF voltmeter should read between 9 and 11 millivolts. Continue this process through the

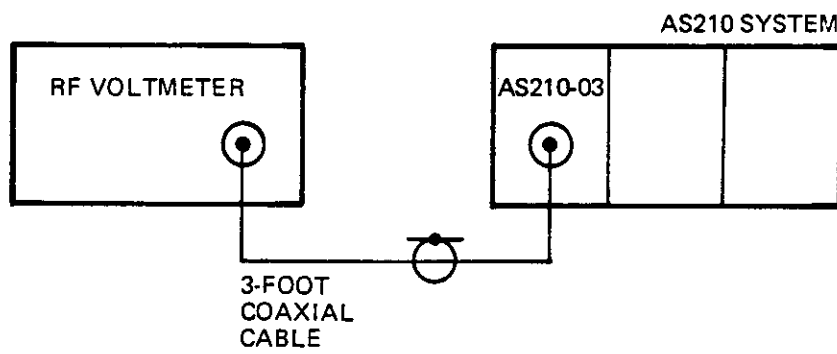


Figure 5.2 AS210-03 Frequency Generator RF Output Voltage Level Test Configuration

remaining six output levels comparing the readings to Table 5-5 for acceptable performance. Select the 10 MHz output frequency and repeat the procedure for each RF voltage level. Continue this process until all output levels for each output frequency have been verified to be within the specified limits of Table 5-5. If any of the levels fall out of the range for acceptable performance, please see Section III, Calibration/Alignment Procedures, and/or Section IV, Troubleshooting Procedures.

- D. Disconnect the RF voltmeter from the AS210-03 output connector.

Table 5-5
 MINIMUM PERFORMANCE LIMITS FOR RF OUTPUT VOLTAGE LEVEL OF THE AS210-03

OUTPUT FREQUENCY (MHz)	1		10		20		OUTPUT LEVEL (millivolts)				50		100		500		1000	
	MIN	MAX	MIN	MAX	MIN	MAX	32		40		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
							MIN	MAX	MIN	MAX								
1	0.9	1.1	9	11	18	22	28.8	34.2	36	44	45	55	90	110	450	550	900	1100
10	0.9	1.1	9	11	18	22	28.8	34.2	36	44	45	55	90	110	450	550	900	1100
50	0.9	1.1	9	11	18	22	28.8	34.2	36	44	45	55	90	110	450	550	900	1100
100	0.9	1.1	9	11	18	22	28.8	34.2	36	44	45	55	90	110	450	550	900	1100
200	0.9	1.1	9	11	18	22	28.8	34.2	36	44	45	55	90	110	450	550	900	1100
300	0.9	1.1	9	11	18	22	28.8	34.2	36	44	45	55	90	110	450	550	900	1100
400	0.85	1.15	8.5	11.5	17	23	27.2	36.8	34	46	42.5	57.5	85	115	425	575	850	1150
500	0.85	1.15	8.5	11.5	17	23	27.2	36.8	34	46	4.25	57.5	85	115	425	575	850	1150

SECTION III

5-8 CALIBRATION/ALIGNMENT PROCEDUREWARNING

The following Calibration/Alignment Procedures (Chapter 5, Section III), and Troubleshooting Procedures (Chapter 5, Section IV) are for use by qualified personnel only. To avoid personal injury, do not perform any servicing other than that of Routine Maintenance (Chapter 5, Section I), and Performance Testing (Chapter 5, Section II) unless you are qualified to do so.

Figure 5.3 is a flow diagram of the Calibration/Alignment Procedure for the AS210-03 Frequency Generator. Use this flow diagram with the theory of operation in Chapter 4, the text in this chapter, and the illustrated parts lists in Chapter 6. The AS210 internal frequency standard calibration data, contained in the AS210 mainframe operation and maintenance manual, is also referenced in this flow diagram. Please note it is not necessary to disassemble the AS210 system to determine if calibration/alignment is needed. For any assistance needed in performing this calibration/alignment procedure, please contact the factory.

5-9 ACCESS TO AS210-03 FREQUENCY GENERATOR MODULE

Please reference the AS210 mainframe manual for the disassembly procedure of the AS210 system to allow access to the AS210-03 Frequency Generator module. Access to the module circuitry itself is gained by removing the two metal side covers with a small straight-blade screwdriver. Place the module on one of its sides so that one cover is facing up. Starting with the end toward the edge connector, insert the screwdriver into one of the slots

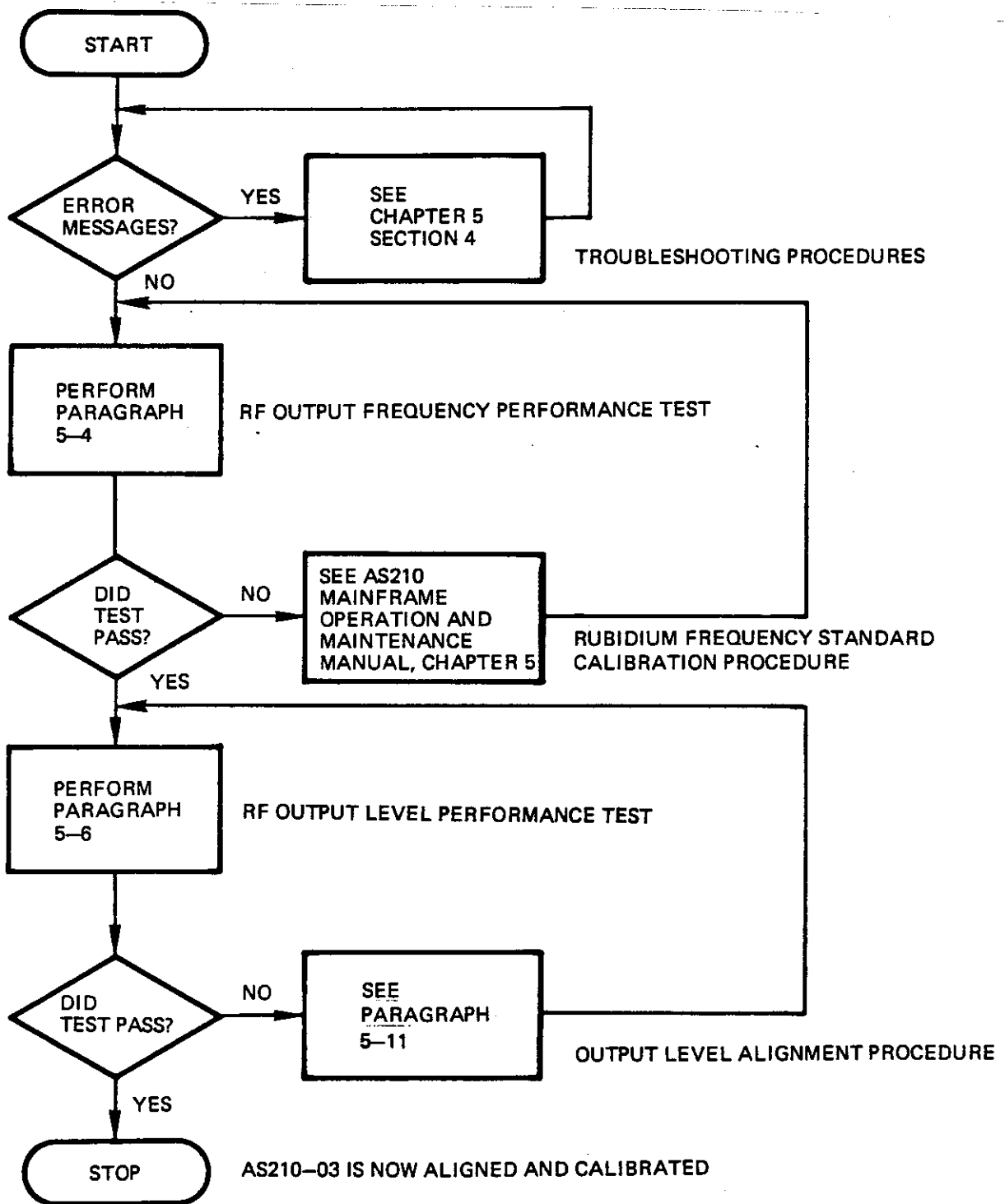


Figure 5.3 Flow Diagram of Calibration/Alignment Procedure for AS210-03 Frequency Generator

where the cover mates with the module chassis and pry the cover up. It will be necessary to move along the slot toward the front panel of the module and repeat the prying action to loosen the side of the cover from the module. Repeat this technique to free the other side of the cover from the chassis. Set the free cover clear of the module and flip the module over so that the second cover is now facing up. Repeat the above procedure to free this cover.

5-10 PLO ALIGNMENT PROCEDURE

The following is the alignment procedure for the six phase-locked oscillators (PLO) in the AS210-03 Frequency Generator. Table 5-6 contains the required test equipment for this alignment procedure.

Table 5-6
REQUIRED TEST EQUIPMENT FOR THE PLO ALIGNMENT PROCEDURE

ITEM	RECOMMENDED TEST EQUIPMENT
OSCILLOSCOPE WITH PROBES ELECTRONIC COUNTER COAXIAL CABLE	TEKTRONIX 465 OR EQUIVALENT HEWLETT PACKARD 5345A 3 FOOT LONG, 50 OHM, BNC

- A. Obtain access to the AS210-03 module circuits by referencing paragraph 5-9 in this chapter.
- B. The individual frequencies of each PLO may be adjusted by C11 and R7 located on the respective VCO circuit board. In order to adjust the individual frequencies, monitor with the oscilloscope the Automatic Level Control (ALC) (U18 pin 6 or junction C17 and CR2 of assembly A1) and the VCO Tuning Voltage (TV) (junction of C5 and R10 of assembly A1). Please note

that the 500 MHz VCO circuit card is located closest to the front panel of the AS210-03. The 400, 300, 200, 100, and 50 MHz VCO circuit cards are located in descending order behind the 500 MHz VCO circuit card. The selected VCO circuit card will have CR3 dimly lit. All other VCO circuit cards will have CR3 brightly lit.

- C. Select the desired frequency on the front panel and monitor the output frequency with the electronic counter.
- D. Adjust C11 for a minimum ALC voltage of approximately 2 volts +1 VDC.
- E. Now adjust R7 for a tuning voltage of 1 volt +1 VDC.

NOTE: It may be necessary to readjust C11 and R7 alternately due to the interaction of these adjustments.

- F. After PLO adjustment, steps C, D, and E may need to be repeated.

The AS210-03 Frequency Generator output frequencies should now be aligned. To confirm that the Frequency Generator is operating properly, reference Section II, Performance Testing of the AS210-03, contained in this chapter.

5-11 OUTPUT LEVEL ALIGNMENT PROCEDURE

The following is the alignment procedure for the output level of the AS210-03 Frequency Generator. Table 5-7 contains the required test equipment for this alignment procedure.

Table 5-7

REQUIRED TEST EQUIPMENT FOR AS210-03 OUTPUT LEVEL ALIGNMENT PROCEDURE

ITEM	RECOMMENDED TEST EQUIPMENT
RF VOLTMETER	BOONTON 92BD OPT 01, 09 WITH 50 OHM BNC ADAPTER

- A. Obtain access to the AS210-03 module circuits by referencing paragraph 5-9 in this chapter.
- B. Connect the AS210-03 frequency generator output to the input of the RF voltmeter, as in Figure 5.2.
- C. Select the 1000 millivolt output level and the 10 MHz output frequency with the front panel.
- D. Adjust the front panel level adjustment for an output level of 1000 millivolts, while monitoring the output of AS210-03 with the RF voltmeter. It may be necessary to change this setting depending on the desired output level.
- E. Adjust C23 located on A1 (117236) for a minimum amplitude difference between 400 MHz and 500 MHz by alternately selecting 400 and 500 MHz with frequency select knob on the front panel.

The AS210-03 Frequency Generator output levels should now be aligned. To confirm that the Frequency Generator is operating properly, reference Section II, Performance Testing of the AS210-03, contained in this chapter.

SECTION IV

5-12 TROUBLESHOOTING PROCEDURES

Troubleshooting of the Frequency Generator is facilitated by a combination of error codes displayed on the Module Controller display and LED indicators on the main circuit card assembly, A1. The circuit card is illustrated in Figure 6.2. Table 5-8 correlates the error code, displayed on the Module Controller when a fault occurs, to the malfunction. An explanation of the problem is provided with possible solutions. Table 5-9 is a list of visual indicators on circuit card A1 and the meaning of their indications. Figures 5.4 through 5.11 are the schematic diagrams of the AS210-03. For further assistance, please contact the factory.

Table 5-8
ERROR CODE LISTING

ERROR CODE	PROBLEM	RECOMMENDED SOLUTION
3-03	1 MHz MALFUNCTION, NO LEVELING LOOP INDICATION	SEE TABLE 5-9
3-04	10 MHz MALFUNCTION, NO LEVELING LOOP INDICATION	SEE TABLE 5-9
3-X1	FREQUENCY X DID NOT PHASE-LOCK WHERE X IS 0 THROUGH 5 AND 0= 50 MHz 1=100 MHz 2=200 MHz 3=300 MHz 4=400 MHz 5=500 MHz	CHECK PLO ALIGNMENT, SECTION III, THIS CHAPTER, AND SEE TABLE 5-9
3-X2	FREQUENCY X HAD NO LEVELING LOOP INDICATION WHERE X IS 0 THROUGH 5 (SEE 3-X1 ABOVE)	CHECK PLO ALIGNMENT, SECTION III, THIS CHAPTER, AND SEE TABLE 5-9

Table 5-9
VISUAL INDICATIONS

INDICATOR	PROBLEM	RECOMMENDED SOLUTION
A1CR1 ON	RF level from U20 is too high or too low (unleveled)	If on at only one frequency check that specific oscillator; if on at all frequencies, check Q7, U22, U20, U19, or U18
A1CR4 ON*	If A1CR5, CR6, CR7, and CR8 are also on (normal) problem with U17, U21, or the oscillator assembly is probable	Check U17, U21, and oscillator assembly
A1CR5,CR6 OFF	10 MHz reference signal Q8, U10, and U14	Check reference signal, Q8, U10, and U14
A1CR7,CR8* OFF	Oscillator assembly or U14	The LEDs are turned on by the 5 MHz output from one of the oscillators (50-500 MHz) through U14; check the oscillator assembly or U14

*No meaning when 1 or 10 MHz selected.

CHAPTER 6
ILLUSTRATED PARTS LIST

6-1 INTRODUCTION

This chapter contains an illustrated parts list for the AS210-03 Frequency Generator Module. The assembly numbers and assembly title are listed at the top of the parts lists. The parts lists are divided into six columns and arranged in the following order:

Column 1 - Item Number

Column 2 - Quantity per assembly.

Column 3 - Manufacturer's Code

Column 4 - Part Number

Column 5 - Description

Column 6 - Reference Designation

ASSEMBLY NUMBER 117170-01 - FREQUENCY GENERATOR AS-210-03

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	117335-01	Attenuator Assembly	
2	1	33472	117201-01	Frame Section - Top	
3	1	33472	117201-02	Frame Section - Bottom	
4	1	33472	117235-01	Frequency Generator Assembly	A1
5	1	33472	117205-01	Phase Locked Oscillator	500 MHz
6	1	33472	117205-02	Phase Locked Oscillator	400 MHz
7	1	33472	117205-03	Phase Locked Oscillator	300 MHz
8	1	33472	117205-04	Phase Locked Oscillator	200 MHz
9	1	33472	117205-05	Phase Locked Oscillator	100 MHz
10	1	33472	117205-06	Phase Locked Oscillator	50 MHz
11	1	33472	117302-01	Bar, Ground Tab	
12	0	33472	117357-01	Cable Assembly, Coaxial	
13	1	81349	MS24693-C4	Screw, FLH 4-40X3/8	
14	6	81349	MS24693-C1	Screw, FLH 4-40X3/16	
15	2	81349	MS24693-C2	Screw, FLH 4-40X1/4	
16	1	81349	MS51957-26	Screw PNH 6-32X1/4	
17	1	81349	MS24693-C30	Screw, FLH 6-32X3/4	
18	2	81349	NAS620-C6	Reduced OD Flat Washer #6	
19	3	81349	MS35338-136	Split Lock Washer #6	
20	3	81349	NAS620-C4	Reduced OD Flat Washer #4	
21	1	81349	MS35338-135	Split Lock Washer #4	
22	3	81349	NAS671-C4	Small Pattern Hex Nut #4	
23	3	81349	NAS671-C6	Small Pattern Hex Nut #6	
24	2	81349	1488-4	Lug #4	
25	1	33472	117354-01	Cable Assembly, 3 Wire	
26	1	33472	117182-01	Panel, Front, Lexan	
27	0	33472	117199	Wire List	

ASSEMBLY NUMBER 117170-01 - FREQUENCY GENERATOR AS-210-03 (Continued)

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
28	2	95146	PKG-50B1/4	Knob, Black	
29	2	34472	117188	Switch, Rotary 30 Degree	
30	1	27264	22-01-2101	Connector, Plug, 10 Pin	
31	10	27264	08-50-0114	Pin, Crimp	
32	1	33472	117358-01	Cable Trimpot	
33	3	81349	NAS620-C10	Reduced OD Flat Washer #10	
34	1	33472	117356-014	Cable, Coaxial	
35	1	33472	117182-02	Subpanel, Plastic	
36	1	33472	117182-03	Panel, Rear	
37	1	33472	3284-2240-00	BNC to OSM Connector	
38	1	33472	366-1690-01	Latch Pull	
39	1	80009	105-0718-01	Latch	
40	1	80009	105-0719-00	Latcher Retainer	
41	1	80009	426-0724-00	Bottom	
42	2	80009	337-1399-00	Side Cover	
43	1	80009	214-1061-00	Tension Spring	
44	1	80009	426-0725-00	Top	
45	2	80009	386-3657-01	Guide Pin	
46	1	81349	0000	Screw FLH, STL, Sheetmetal #2X1/4	
47	4	81349	MS24693-C26	Screw FLH 6-32X3/8	
48	4	81349	0000	Screw PNH, STL, Sheetmetal #6X3/8	

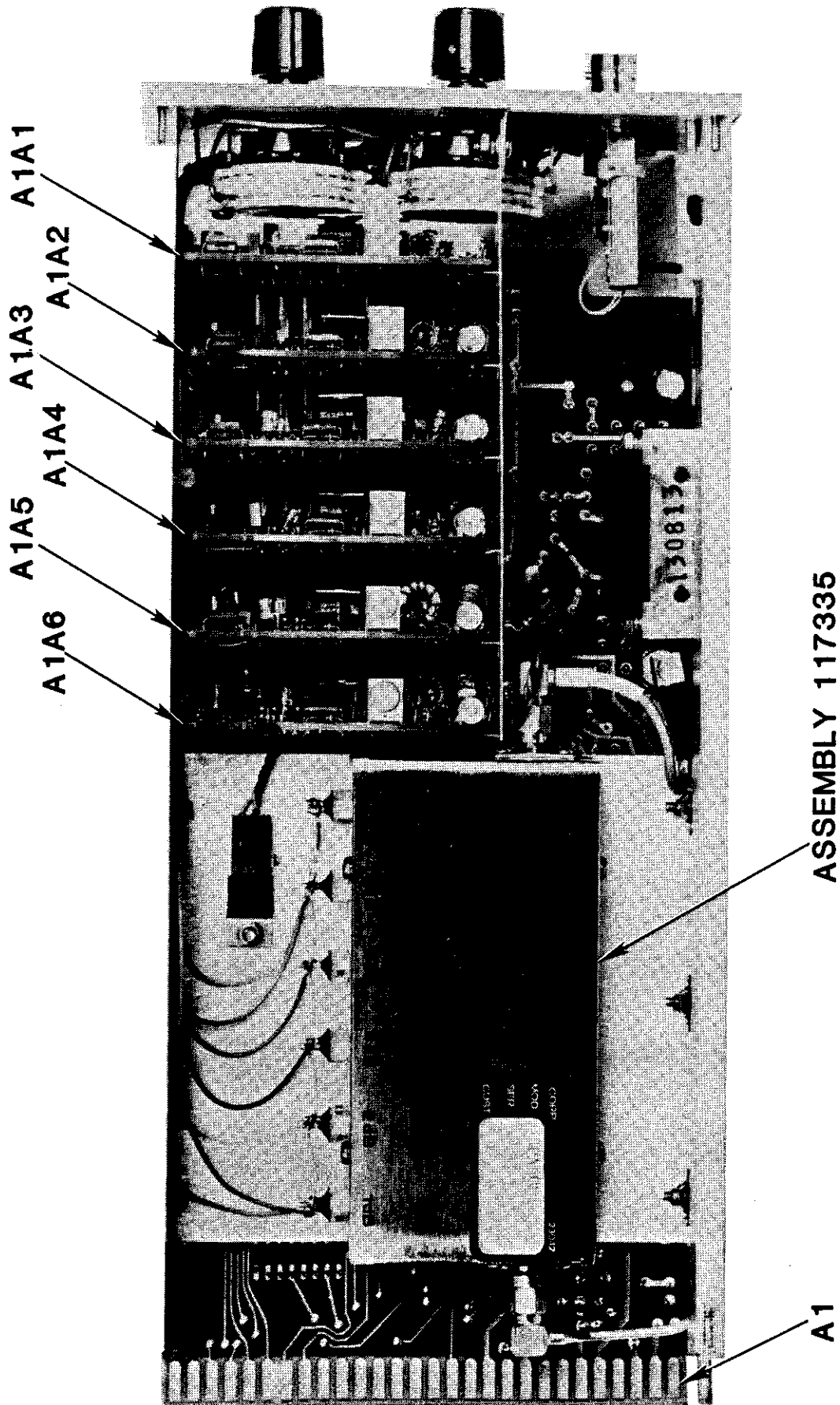


Figure 6.1 AS210-03 Frequency Generator

ASSEMBLY NUMBER 117235-01 - STANDARD FREQUENCY GENERATOR A1

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	117238-01	PC Board	
2	0	33472	117236	Schematic	
3	0	33472	117235	Assembly Drawing	
4	4	81349	CK05BX102K	.001 UFD 10% Ceramic Capacitor	C17,C33,C34, C35
5	6	81349	CK05BX103K	.01 UFD 10% Ceramic Capacitor	C14,C36,C37, C38,C41,C42
6	9	81349	CK05BX104K	.1 UFD 10T Ceramic Capacitor	C1,C5,C7,C22, C39,C40,C43, C50,C51
7	4	81349	300-50-601- 105M	1 UFD 20% Ceramic Capacitor	C2,C8,C21, C24
8	6	81349	CK05BX471K	47 OPFD 10% Ceramic Capacitor	C15,C16,C20, C25,C26,C28
9	5	81349	CK05BX473K	.047 UFD 10% Ceramic Capacitor	C9,C10,C11, C12,C29
10	1	81349	CM04FA391JS	390 PF Silver Mica	C49
11	1	81349	CK05BX104K	.1 UFD 10% Ceramic Capacitor	C49
12	5	81349	196D156X- 9020KA1	15 UFD 10% Solid Tantalum	C13,C445,C46, C47,C48
13	1	81349	CSR13G106KL	10 UFD 50V Electrolytic Capacitor	C18
14	1	72982	513-010-A2- 10	2-10 PFD Variable Capacitor	C23
15	2	81349	CK05BX472K	.0047 UFD 10% Ceramic Capacitor	C30,C32
16	1	81349	CK05BX681K	680 PFD 10% Ceramic Capacitor	C27
17	2	81349	CK05BX682K	.0068 UFD 10% Ceramic Capacitor	C19,C31
18	1	81349	CK05BX101K	100 PF 10% Ceramic Capacitor	C52

ASSEMBLY NUMBER 117235-01 - STANDARD FREQUENCY GENERATOR A1 (Continued)

<u>ITEM</u>	<u>QTY</u>	MANUFAC- TURER'S <u>CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
19	6	50434	5082-4487	LED	
20	3	81349	196D156X 9035	15 MFD, 35V, Tantalum	C3,C4,C6
21	7	50434	5082-3180	Switching Diode	CR9-15
22	1	27014	1N3064	Switching Diode	CR2
23	1	50434	5082-2303	Switch Diode	CR3
24	1	27264	22-03-2021	2 Pin Wafer	J4
25	1	27264	22-03-2031	3 Pin Wafer	J6
26	6	27264	22-10-2061	6 Pin Wafer	A-F
27	1	27264	22-03-2071	7 Pin Wafer	J3
28	1	27264	22-03-2101	10 Pin Wafer	J2
29	6	27264	22-10-2031	3 Pin Wafer	A-F
30	1	98291	51-051-0000	Snap On Connector	J5
31	3	02114	VK200-20/48	Wide Band Choke	L1,L2,L11
32	2	99800	1025-18	.82 UHY Molded RF Choke	L7,L8
33	3	99800	1025-42	8.2 UHY Molded RF Choke	L9,L10,L16
34	1	99800	1025-48	15 UHY Molded RF Choke	L3
35	3	33472	117305-02	9 Turn RF Choke	L4,L5,L6
36	8	27014	PN3644	Transistor	Q1-7,Q9
37	1	27014	2N5179	NPN Transistor	Q8
38	5	81349	RCR07G102JS	1K ohm 5% 1/4W Carbon Comp	R3,R5,R9, R20,R47
39	10	81349	RCR07G103JS	10K ohm 5% 1/4W Carbon Comp	R6,R7,R8, R17,R21,R25, R26,R29,R36, R39
40	1	81349	RCR07G681JS	680 ohm 5% 1/4W Carbon Comp	R14
41	1	81349	RCR07G122JS	1.2K ohm 5% 1/4W Carbon Comp	R13

ASSEMBLY NUMBER 117235-01 - STANDARD FREQUENCY GENERATOR A1 (Continued)

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
42	1	81349	RCR07G223JS	22K ohm 5% 1/4W Carbon Comp.	R11
43	1	81349	RCR07G332JS	3.3K ohm 5% 1/4W Carbon Comp	R10
44	1	81349	RCR07G392JS	3.9K ohm 5% 1/4W Carbon Comp.	R12
45	3	81349	RCR07G471JS	470 ohm 5% 1/4W Carbon Comp	R19,R35,R41
46	13	81349	RCR07G472JS	4.7 ohm 5% 1/4W Carbon Comp	R2, R16,R18, R22,R27,R28, R30,R33,R34, R37,R40,R45, R50,R52
47	2	81349	RCR07G242JS	2.4K ohm 5% 1/4W Carbon Comp	R90,R93
48	2	81349	RCR07G510JS	51 ohm 5% 1/4W Carbon Comp	R23,R31
49	1	81349	RCR07G821JS	820 ohm 5% 1/4W Carbon Comp	R4
50	1	81349	RCR07G750JS	75 ohm 5% 1/4W Carbon Comp	R24
51	5	81349	RCR07G222JS	2.2K ohm 5% 1/4 Carbon Comp	R1,R32,R38, R77,R78
52	1	81349	RCR07G622JS	6.2K ohm 5% 1/4W Carbon Comparator	R15
53	1	81349	RCR07G333JS	33K ohm 5% 1/4W Carbon Comp	R51
54	4	81349	RCR07G101JS	100 ohm 5% 1/4W Carbon Comp	R43,R46,R48, R49
55	8	81349	RCR07G301JS	300 ohm 5% 1/4W Carbon Comp.	R53,R55,R57, R59,R61,R65, R89
56	1	81349	RCR07G201JS	200 ohm 5% 1/4W Carbon Comp	R92

ASSEMBLY NUMBER 117235-01 - STANDARD FREQUENCY GENERATOR A1 (Continued)

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
57	10	81349	RCR07G512JS	5.1K ohm 5% 1/4W Carbon Comp	R54,R56,R58, R60,R62,R64, R66,R67,R91, R97
58	4	81349	RCR07G472JS	4.7K ohm 5% 1/4W Carbon Comp	R85,R86,R87, R88
59	5	01295	C9316-02	16 Pin Socket	
60	8	01295	C9314-02	IC, Socket, 14 Pin	
61	2	01295	C9308-02	IC Socket, 8 Pin	
62	2	01295	C9320-021JS	IC, Socket 20 Pin	
63	1	21912	PAS-1	Double Balanced Mixer	U22
64	2	27014	LM741CN	Differential Amp	U18,U21
65	1	27014	LM3302N	Quad Voltage Comparator	U15
66	2	01295	7406N	Hex Inverter Driver	U9,U16
67	1	01295	74LS00N	Quad 2 Input NAND Gate	U10
68	1	01295	74LS10N	Triple Input NAND Gate	U7
69	1	01295	74LS157N	Multiplexer	U5
70	2	01295	74LS273N	8 to 1 Multiplexer	U8,U11
71	1	01295	74LS290N	Decade Counter	U13
72	1	21812	PSC-2	Power Divider	U19
73	2	34649	P8216	Quad Tri-State Buss Driver	U4,U6
74	1	04713	MC4044P	Phase Comparator	U17
75	1	01295	74LS04N	Hex Inverter	U3
76	2	01295	74LS112N	Dual J-K Flip Flop	U12,U14
77	1	27014	LM342P-12	+12 Volt Regulator	U1
78	1	27014	LM320MP-12	+12 Volt Regulator	U2
79	1	01281	CA2820	RF Amplifier	U20
80	3	15849	2010B-1	Terminal	15849

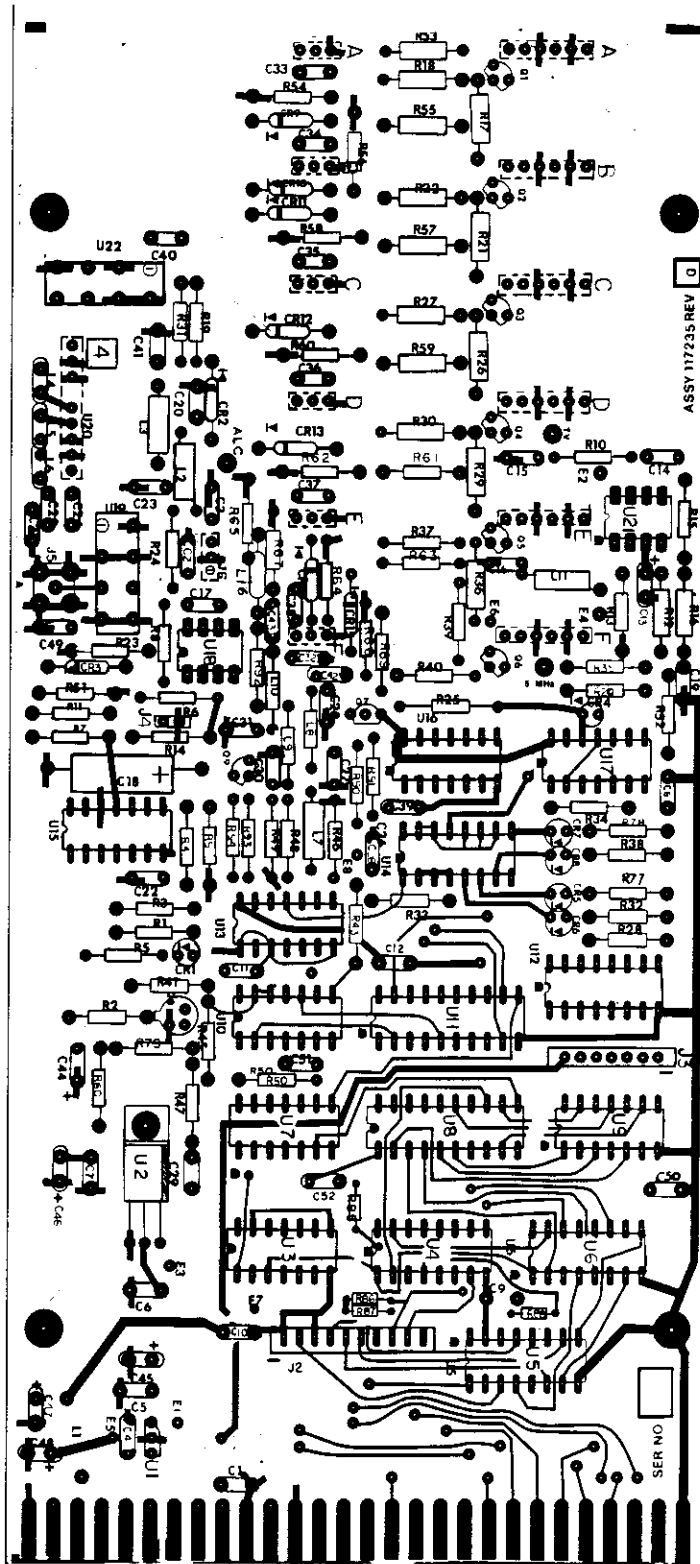


Figure 6.2 AS210-03 Frequency Generator Assembly, A1

ASSEMBLY NUMBER 117335-01 - ATTENUATOR ASSEMBLY

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	117200-01	Plate, Mounting	
2	1	33472	117191-01	Attenuator, 0-63 dB	
3	1	27264	22-01-2071	Connector, Plug 7 Pin	
4	7	27264	08-50-0114	Pin, Crimp	
5	2	81349	MS24693-C46	Screw FLH #8-32X1/4	
6	4	81349	MS51957-13	Screw, PNH, 4-40X1/4	
7	4	81349	NAS620-C4	Reduced OD Flat Washer #4	
8	4	81349	MS35338-135	Split Lock Washer #4	
9	0	92005	ET 26 AWG	Wire, 26 AWG Stranded Teflon	
10	1	27014	MC7824CT	24 Volt Regulator	U30

ASSEMBLY NUMBER 117205-01 - PHASE-LOCKED OSCILLATOR

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	117208-01	PC Board	
2	0	33472	117206-01	Schematic	
3	0	33472	117205-01	Assembly Drawing	
4	8	51642	100-50-W5R- 471J	470 PFD 5% Ceramic Capacitor	C3,C7,C10, C14,C15
5	2	51642	100-100- COG689J	6.8 PFD 5% Ceramic Capacitor	C8,C9
6	2	51642	300-50-601- 105M	1 UFD 20% Ceramic Capacitor	C1,C2
7	3	81349	CK05BX104K	.1 UFD 20% Ceramic Capacitor	C4,C19,C20
8	1	72982	513-010-A2- 10	2-10 PFD Variable Capacitor	C5
9	1	72982	518-002-A2-5	2-5 PFD Variable Capacitor	C11
10	2	04713	MV12098	Tuning Diode	CR1,CR2
11	1	54839	1N6263	Schottky Barrier Diode	CR4
12	1	50434	5082-4487	Light Emitting Diode	CR3
13	1	27264	22-16-2031	3 Pin Connector	J1
14	1	27264	22-16-2061	6 Pin Connector	J2
15	1	33472	117305-08	Tapped Inductor	L1
16	1	33472	117305-07	Tapped Inductor	L2
17	2	33472	117305-01	1 Turn Ferrite Choke	L3,L5
18	1	99800	1025-20	1 UHY RF Choke	L4
19	2	04713	MMT2857	NPN Transistor	Q1,Q2
20	1	04713	MPS3639	PNP Transistor	Q3
21	1	27014	2N2222A	NPN Transistor	Q4
22	2	81349	RCR05G102JS	1K ohm 5% 1/8W Carbon Comp	R12,R13
23	1	81349	RCR05G221JS	220 ohm 5% 1/8W Carbon Comp	R10

ASSEMBLY NUMBER 117205-01 - PHASE-LOCKED OSCILLATOR (Continued)

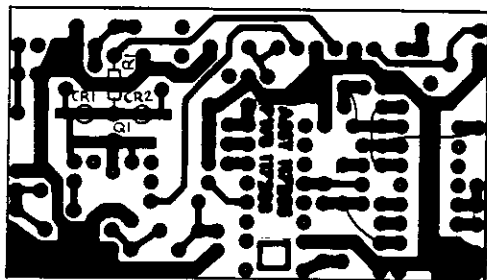
<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
24	1	81349	RCR05G223JS	22K ohm 5% 1/8W Carbon Comp	R1
25	1	81349	RCR05G390JS	39 ohm 5% 1/8W Carbon Comp	R8
26	3	81349	RCR05G471JS	470 ohm 5% 1/8W Carbon Comp	R3,R4,R6
27	1	81349	RCR05G472JS	4.7K ohm 5% 1/8W Carbon Comp.	R14
28	1	81349	RCR05G821JS	820 ohm 5% 1/8W Carbon Comp	R9
29	2	81349	RCR05G151JS	150 ohm 5% 1/8 Carbon Comp	R2,R5
30	1	81349	RCR05G621JS	620 ohm 5% 1/8W Carbon Comp	R11
31	1	73138	82-PAR-2K	2K ohm Variable Resistor	R7
32	1	55154	SP8630	Decade Counter	U1
33	1	27014	LM341P-5	5 Volt Regulator	U3
34	1	01295	74196N	Decade Counter	U2

ASSEMBLY NUMBER 117205-02 - PHASE-LOCKED OSCILLATOR

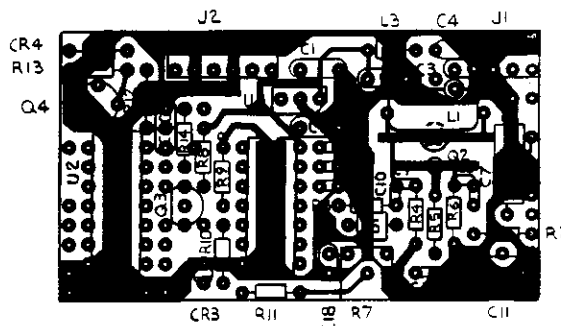
<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	117208-08	PC Board	
2	0	33472	117206-02	Schematic	
3	0	33472	117205-02	Assembly Drawing	
4	8	51642	100-50-W5R- 471J	47 OPFD 5% Ceramic Capacitor	C3,C7,C10, C14-18
5	2	51642	100-100- COG689J	6.8 PFD 5% Ceramic Capacitor	C8,C9
6	2	51642	300-50-601- 105M	1 UFD 20% Ceramic Capacitor	C1,C2
7	3	81349	CK05BX104K	.1 UFD 10% Ceramic Capacitor	C4,C19,C20
8	1	72982	513-010-A2- 10	2-10 PFD Variable Capacitor	C5
9	1	72982	518-002-A2-5	2-5 PFD Variable Capacitor	C11
10	2	04713	MV12098	Tuning Diode	CR1,CR2
11	1	54893	1N6263	Schottky Barrier Diode	CR4
12	1	50434	5082-4487	Light Emitting Diode	C43
13	1	27264	22-16-2031	3 Pin Connector	J1
14	1	27264	22-16-2061	6 Pin Connector	J2
15	1	33472	117305-08	Tapped Inductor	L1
16	1	33472	117305-07	Tapped Inductor	L2
17	2	33472	117305-01	1 Turn Ferrite Choke	L3,L5
18	1	99800	1025-20	1 UHY RF Choke	L4
19	2	04713	MMT2857	NPN Transistor	Q1,Q2
20	1	04713	MPS3639	PNP Transistor	Q3
21	1	27014	2N2222A	NPN Transistor	Q4
22	2	81349	RCR05G102JS	1K ohm 5% 1/8W Carbon Comp	R12,R13
23	2	81349	RCR05G151JS	150 ohms 5% 1/8 Carbon Comp.	R2,R10
24	1	81349	RCR05G223JS	22K ohms 5% 1/8 Carbon Comp.	R1

ASSEMBLY NUMBER 117205-02 - PHASE-LOCKED OSCILLATOR (Continued)

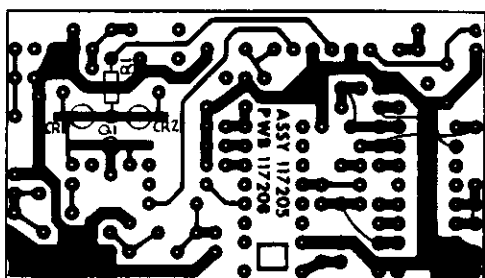
<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
25	1	81349	RCR05G390JS	39 ohm 5% 1/8W Carbon Comp:	R8
26	3	81349	RCR05G471JS	470 ohm 5% 1/8W Carbon Comp.	R3,R4,R5, R6
27	1	81349	RCR05G472JS	4.7K ohm 5% 1/8W Carbon Comp:	R14
28	1	81349	RCR05G821JS	820 ohm 5% 1/8W Carbon Comp.	R9
29	1	81349	RCR05G621JS	620 ohm 5% 1/8 Carbon Comp.	R11
30	1	73139	82-PAR-2K	2K ohm Variable Resistor	R7
31	1	55154	SP8630	IC, Decade Counter	U1
32	1	27014	LM341P-5	5 Volt Regulator	U3
33	1	01295	74197N	Decade Counter	U2



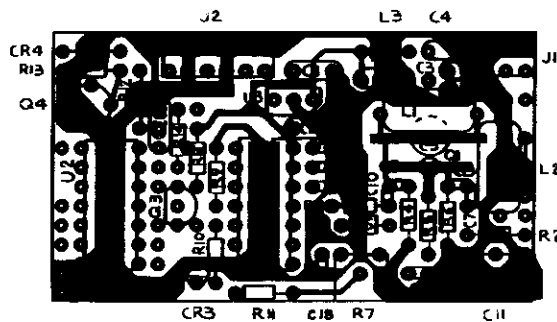
A1A1, 500 MHz
BACK SIDE



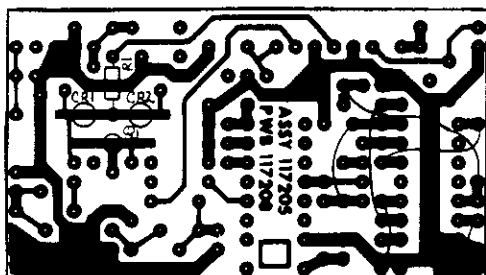
A1A1, 500 MHz
COMPONENT SIDE



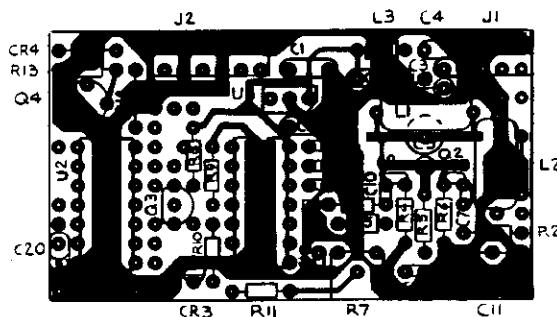
A1A2, 400 MHz
BACK SIDE



A1A2, 400 MHz
COMPONENT SIDE



A1A3, 300 MHz
BACK SIDE



A1A3, 300 MHz
COMPONENT SIDE

Figure 6.3 AS210-03 Frequency Generator VCO Circuit Card Assemblies A1A1 (500 MHz), A1A2 (400 MHz), and A1A3 (300 MHz)

ASSEMBLY NUMBER 117205-04 - PHASE-LOCKED OSCILLATOR

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	117208	PC Board	
2	0	33472	117206-04	Schematic	
3	0	33472	117205-04	Assembly Drawing	
4	8	51642	100-50-W5R- 471J	470 PFD 5% Ceramic Capacitor	C3,C7,C10, C14-18
5	2	51642	100-100- COG689J	6.8 PFD 5% Ceramic Capacitor	C8,C9
6	1	51642	200-100- COG100J	10 PFD 5% Ceramic Capacitor	C13
7	2	51642	300-50-601- 105M	1 UFD 20% Ceramic Capacitor	C1,C2
8	3	81349	CK05BX104K	.1 UFD 10% Ceramic Capacitor	C4,C19,C20
9	1	72982	513-010-A2- 10	2-10 PFD Variable Capacitor	C5
10	1	72982	518-002-A2-5	2-5 PFD Variable Capacitor	C11
11	1	04713	MV12098	Tuning Diode	CR1,CR2
12	2	54893	1N6263	Schottky Barrier Diode	CR4
13	1	50434	5082-4487	Light Emitting Diode	CR3
14	1	27264	22-16-2031	3 Pin Connector	J1
15	1	27264	22-16-2061	6 Pin Connector	J2
16	2	33472	117305-06	Tapped Inductor	L1,L2
17	2	33472	117305-01	1 Turn Ferrite Choke	L3,L5
18	1	99800	1025-20	1 UHY RF Choke	L4
19	2	04713	MMT2857	NPN Transistor	Q1,Q2
20	1	04713	MPS3639	PNP Transistor	Q3
21	1	27014	2N2222A	NPN Transistor	Q4
22	2	81349	RCR05G102JS	1K ohm 5% 1/8W Carbon Comp.	R12,R13
23	1	81349	RCR05G151JS	150 ohm 5% 1/8W Carbon Comp.	R10

ASSEMBLY NUMBER 117205-04 - PHASE-LOCKED OSCILLATOR (Continued)

<u>ITEM</u>	<u>QTY</u>	MANUFAC- TURER'S <u>CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
24	1	81349	RCR05G223JS	22K ohms 5% 1/8W Carbon Comp.	R1
25	1	81349	RCR05G301JS	300 ohm 5% 1/8W Carbon Comp	R2
26	1	81349	RCR05G390JS	39 ohm 5% 1/8W Carbon Comp	R8
27	4	81349	RCR05G471JS	470 ohm 5% 1/8W Carbon Comp	R3,R4,R5, R6
28	1	81349	RCR05G472JS	4.7K ohm 5% 1/8W Carbon Comp	R14
29	2	81349	RCR05G821JS	820 ohm 5% 1/8W Carbon Comp	R9
30	1	81349	RCR05G621JS	620 ohm 5% 1/8W Carbon Comp	R11
31	1	73139	82-PAR-2K	2K ohm Variable Resistor	R7
32	1	55154	SP8630	IC Decade Counter	U1
33	1	27014	LM341P-5	5 Volt Regulator	U3
34	1	01295	74197N	Decade Counter	U2

ASSEMBLY NUMBER 117205-05 - PHASE-LOCKED OSCILLATOR

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	117208	PC Board	
2	0	33472	117206-05	Schematic	
3	0	33472	117205-05	Assembly Drawing	
4	8	51642	100-50-W5R- 471	470 PFD 5% Ceramic Capacitor	C3,C7,C10, C14-18
5	1	51642	100-100- COG3398J	3.3 PFD 5% Ceramic Capacitor	C13
6	1	51642	150-100- COG220J	22 PFD 5% Ceramic Capacitor	C6
7	2	51642	300-50-601- 105M	1 UFD 20% Ceramic Capacitor	C1,C2
8	2	51642	100-100- COG-689	6.8 UFD 5% Ceramic Capacitor	C8,C9
9	3	81349	CK05BX104K	.1 UFD 10% Ceramic Capacitor	C4,C19,C20
10	1	72982	513-010-A2- 10	2-10 PFD Variable Capacitor	C5
11	1	72982	518-002-A2-5	2-5 PFD Variable Capacitor	C11
12	2	04713	MV12098	Tuning Diode	CR1,CR2
13	1	54893	1N6263	Schottky Barrier Diode	CR4
14	1	50434	5082-4487	Light Emitting Diode	CR3
15	1	27264	22-16-2031	3 Pin Connector	J1
16	1	27264	22-16-2061	6 Pin Connector	J2
17	1	33472	117305-09	Tapped Inductor	L1
18	1	33472	117305-04	Tapped Inductor	L2
19	2	33472	117305-01	1 Turn Ferrite Choke	L3,L5
20	1	99800	1025-20	1 UHY RF Choke	L4
21	2	04713	MMT2857	NPN Transistor	Q1,Q2
22	1	04713	MPS3639	PNP Transistor	Q3
23	1	27014	2N222A	NPN Transistor	

ASSEMBLY NUMBER 117205-05 - PHASE-LOCKED OSCILLATOR (Continued)

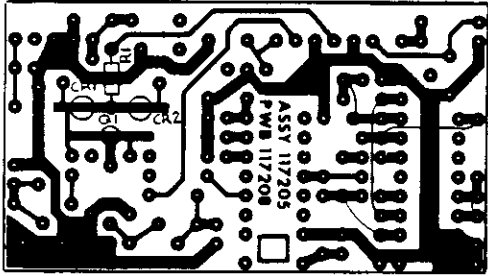
<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
24	2	81349	RCR05G102JS	1K ohm 5% 1/8W Carbon Comp	R12,R13
25	1	81349	RCR05G151JS	150 ohms 5% 1/8W Carbon Comp	R10
26	1	81349	RCR05G223JS	22K ohms 5% 1/8W Carbon Comp.	R1
27	1	81349	RCR05G390JS	39 ohm 5% 1/8W Carbon Comp.	R8
28	5	81349	RCR05G471JS	470 ohm 5% 1/8W Carbon Comp	R2,R3-6
29	1	81349	RCR05G472JS	4.7 ohm 5% 1/8W Carbon Comp	R14
30	2	81349	RCR05G821JS	820 ohm 5% 1/8W Carbon Comp	R9
31	1	81349	RCR05G621JS	620 ohm 5% 1/8W Carbon Comp	R11
32	1	73139	82-PAR-2K	2K ohm Variable Resistor	R7
33	1	55154	SP8630	Decade Counter	U1
34	1	27014	LM341P-5	5 Volt Regulator	U3
35	1	01295	74197N	Decade Counter	U2

ASSEMBLY NUMBER 117205-05 - PHASE-LOCKED OSCILLATOR

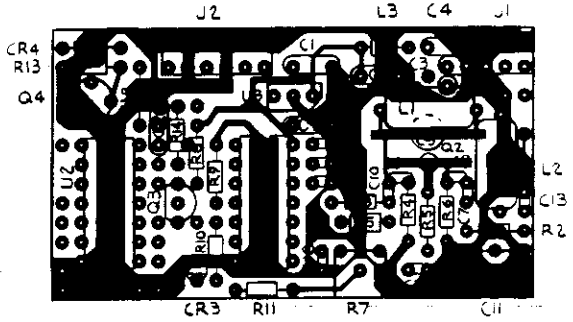
<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	33472	1172086	PC Board	
2	0	33472	117206-06	Schematic	
3	0	33472	117205-06	Assembly Drawing	
4	8	51642	100-50-W5R 471J	470 PFD 5% Ceramic Capacitor	C3,C7,C10, C14-18
5	1	51649	100-100- COG339J	3.3 PFD 5% Ceramic Capacitor	C13
6	2	51642	100-100- COG689J	6.8 PFD 5% Ceramic Capacitor	C8,C9
7	2	51642	200-100- COG270J	27 PFD 5% Ceramic Capacitor	C6,C21
8	2	51642	300-50-601- 105M	1 UFD 20% Ceramic Capacitor	C1,C2
9	2	81349	CK05BX104K	.1 UFD 10% Ceramic Capacitor	C4,C19
10	1	72982	513-010-A2 10	2-10 PFD Variable Capacitor	C5
11	1	72982	518-002-A2-5	2-5 PFD Variable Capacitor	C11
12	2	04713	MV12098	Tuning Diode	CR1,CR2
13	1	54893	1N6263	Schottky Barrier Diode	CR4
14	1	50434	5082-4487	Light Emitting Diode	CR3
15	1	27264	22-16-2031	3 Pin Connector	J1
16	1	27264	22-16-2061	6 Pin Connector	J2
17	1	33472	117305-03	Tapped Inductor	L1
18	1	33472	117305-04	Tapped Inductor	L2
19	2	33472	117305-01	1 Turn Ferrite Choke	L3,L5
20	1	99800	1025-20	1 UHY RF Choke	L4
21	2	04713	MMT2857	NPN Transistor	Q1,Q2
22	1	04713	MPS3639	PNP Transistor	Q3
23	1	27014	2N222A	NPN Transistor	Q4

ASSEMBLY NUMBER 117205-05 - PHASE-LOCKED OSCILLATOR (Continued)

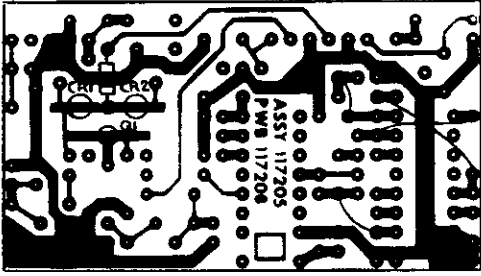
<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
24	2	81349	RCR05G102JS	1K ohm 5% 1/8W Carbon Comp.	R12,R13
25	1	81349	RCR05G151JS	150 ohm 5% 1/8W Carbon Comp	R10
26	1	81349	RCR05G223JS	22K ohms 5% 1/8W Carbon Comp	R1
27	1	81349	RCR05G390JS	39 ohm 5% 1/8W Carbon Comp	R8
28	5	81349	RCR05G471JS	470 ohm 5% 1/8W Carbon Comp	R2,R3,R4, R5,R6
29	2	81349	RCR05G821JS	820 ohm 5% 1/8W Carbon Comp	R9,R11
30	1	73138	82-PAR-2K	2K ohm Variable Resistor	R7
31	1	55154	SP8630	Decade Counter	U1
32	1	27014	LM341P-5	5 Volt Regulator	U3



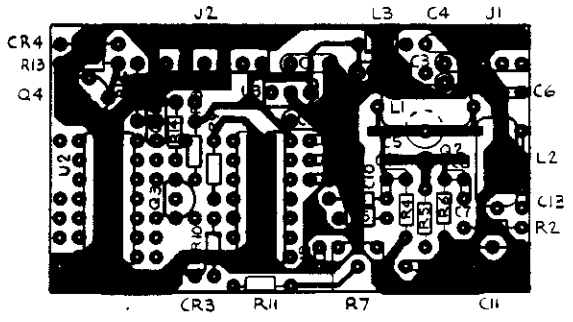
A1A4, 200 MHz
BACK SIDE



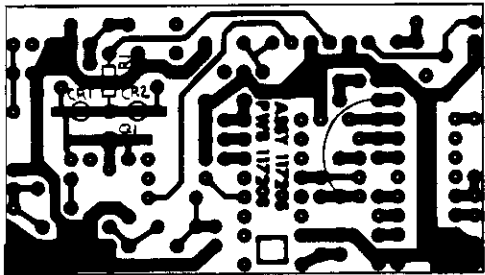
A1A4, 200 MHz
COMPONENT SIDE



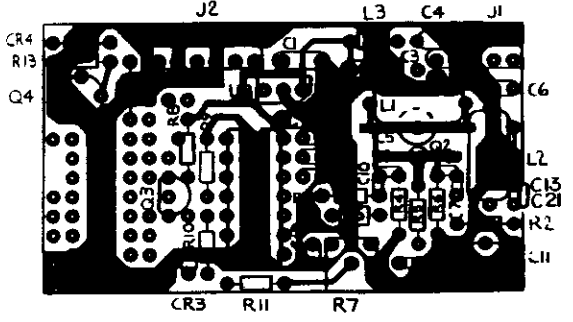
A1A5, 100 MHz
BACK SIDE



A1A5, 100 MHz
COMPONENT SIDE



A1A6, 50 MHz
BACK SIDE



A1A6, 50 MHz
COMPONENT SIDE

Figure 6.4 AS210-03 Frequency Generator VCO Circuit Card Assemblies A1A4 (200 MHz), A1A5 (100 MHz), and A1A6 (50 MHz)

ASSEMBLY NUMBER 117354-01 - CABLE ASSEMBLY

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	2	27264	22-01-2031	3 Pin Connector	
2	3	02114	56-590-65/38	Shielding Bead	
3	0	29005	ET 26 AWG	26 AWG, Stranded, Teflon Wire	Color as follows: red, violet, black
4	6	27264	08-50-0114	Crimp Terminal	

ASSEMBLY NUMBER 117356-01 - CABLE ASSEMBLY

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	98291	55-607-9172	OSM Connector, Straight	
2	1	98291	55-611-3702	OSM Connector, Right Angle	
3	0		08-50-0114	.085 Semi-Rigid Cable	

ASSEMBLY NUMBER 117357-01 - CABLE ASSEMBLY

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	98291	55-28-9188- 31	Connector	
2	0		RGU-316	Coax Wire, 50 ohm	As Required
3	1	98291	51-328-3188	Connector	

ASSEMBLY NUMBER 117358-01 - CABLE ASSEMBLY

<u>ITEM</u>	<u>QTY</u>	<u>MANUFAC- TURER'S CODE</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>REF. DESIG.</u>
1	1	73138	78LBWR1K	1K Potentiometer	
2	1	27264	22-01-2021	2 Pin Connector	
3	2	27264	08-50-0114	Crimp Terminal	