VLA TECHNICAL REPORT #23

MODULE L3

L.O. TRANSMITTER

Harry Beazell

March 1976

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MOD BOARD	A13230Z23	A24675	4
5 MHZ MOD DRIVER	A13230Z26	A25975	3
5 MHZ MOD DRIVER	A13230Z27	A25975	3

ASSEMBLY_DRAWINGS

5 MHZ MODULATOR DRIVER	B13230P25	B27475	1
DATA MOD DRIVER ENCL	B13230P33	B26775	1
DATA MOD DRIVER BOARD	B13230P34	A24675	1
5 MHZ MODULATOR DRVR	B13230P36	-28374	1

SCHEMATIC_DIAGRAMS

DATA MODULATOR DRIVER	C13230S07	-16975	1
5 MHZ MOD DRIVER ASSY	B13230S09	-28774	1

LOGIC_DIAGRAMS

NONE

PC_BOARD_ARTWORK

5 MHZ MODULATION FILTER	A13230AB07	-25175	2
DATA MODULATOR DRIVER	B13230AB08	-24775	2

PC_BOARD_SILKSCREEN

NONE

PC_BOARD_MECHANICAL

PARTITION PLATE	C13230M25	D28275	1
5 MHZ MOD FILTER OR DIAG	B13230M59	-13275	1

BLOCK DIAGRAMS

BLOCK DIAGRAM	D13230B03	-13675	1
RF INTCON BLK DIAG	D13230B15	B34575	1

WIRE LISTS

NONE

MECHANICAL DRAWINGS

GUIDE	B13050M04-L3	D8775	1
RIGHT & LEFT SIDE PLATES	B13050M18-L3	C8775	1
COVER,PERFORATED	C13050M22-1-L3	C5175	1
BAR,SUP. TOP & BOTTOM	B13050M23-L3	C4375	1
PNL,R.,42&34 PN PWR CON	B13050M32-L3	B4375	1
MIXER MOUNT	A13050M33-L3	C5075	1
PANEL, REAR	C13210M04-L3	D4275	1
X2-X3 MULT OUTLINE DWG	C13230M01	-35375	1
PANEL, FRONT	B13230M32	C20075	1
DATA FILTER END PANEL	B13230M38-L3	B4975	1
5MHZ MOD FILTER ENCLOSURE	B13230M41	D26675	1
DATA MOD DRVR END PANEL	B13230M46-L3	C18375	1
DTA MOD DRVR SIDE PANEL	B13230M49-L3	C18375	1
TERMINAL, TURRET MOD	B13230M98-L3	-26275	1

1.0.2 NRAO SPECIFICATION

SPECIFICATION NO: A13210N1

NAME: Frequency Multiplier

DATE: May 16, 1974

PREPARED BY: _____ APPROVED BY: _____

1. GENERAL DESCRIPTION

A frequency multiplier unit is required which will accept a 600 MHz continuous-wave input and will provide separate outputs of 1200 MHz and 1800 MHz.

2. ENVIRONMENTAL REQUIREMENTS

1. Temperature: Operation 20°C to 45°C
   Storage -25°C to 75°C
   Forced air cooling will be provided as shown in Drawing D13210M6. Module base-plate temperature will be stabilized within the above operating range to within +1°C rms or better.

2. Shock & Vibration:
   a. Unit must survive normal shock and vibration in handling and shipping.
   b. Unit will not be subject to operating shocks or vibrations greater than 1G at any frequency.

3. ELECTRICAL

See attached block diagram.

1. Input: Frequency 600 MHz
   Impedance 50.0 ohms
   Power +10 dBm
   VSWR 1.2:1

2. Output: Frequency 1 1200 MHz (X2)
   Impedance 50.0 ohms
   Power +26 dBm* minimum
   Load VSWR 1.5:1

   Frequency 2 1800 MHz (X3)
   Impedance 50.0 ohms
   Power +26 dBm* minimum
   Load VSWR 1.5:1

*9 dB limiting should be provided such that:
   (a) 0 dBm input gives +25 dBm (min) output, and
   (b) +10 dBm input gives +26 dBm (min) output.

Other outputs as shown on block diagram.

3. Power: Voltages available are 0.01% regulated and should preferably be ±15 or +20 volts. If necessary, +28 and +24 volts are also available.
   Design should minimize power consumption.

4. Phase Requirements: A major design objective is that the group delay for both the 1200 MHz and the 1800 MHz channels track together for temperature variations and hence that they be as nearly identical as possible. It is desired (continued)

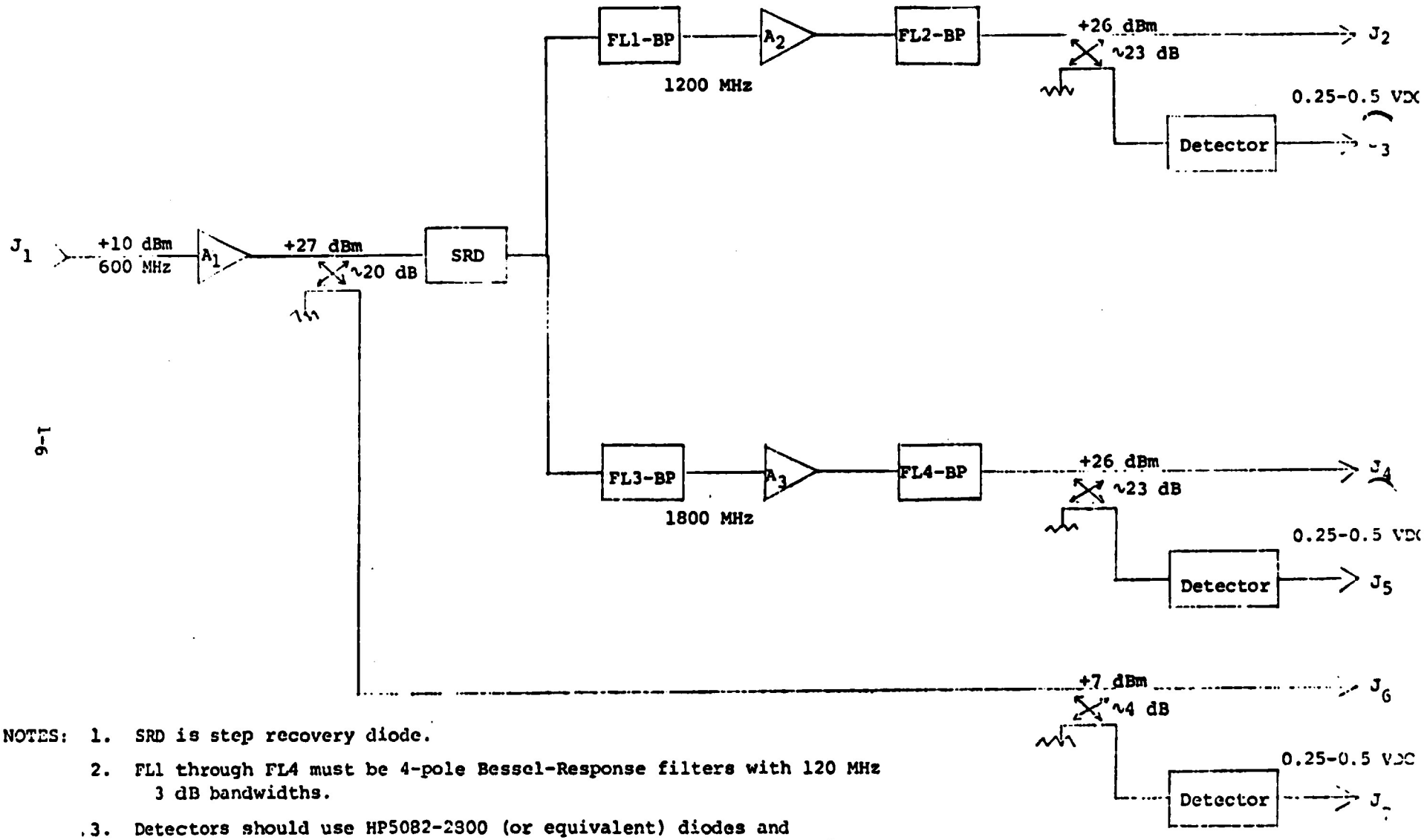
4. Phase Requirements: (cont.)

that the phase variation between the 600 MHz input and the difference between the 1200 MHz and 1800 MHz outputs be less than 0.2° rms per 1°C rms.

4. MECHANICAL

1. Unit to be mounted by NRAO in an unshielded 1UA module as detailed in attached Drawing D13210M6.
2. Location of connectors should be as shown. Rf connectors should be OSM type 206-1 or equivalent. Monitor and power feed through capacitors should be Spectrum Control FB 3B102W or equivalent.
3. Unit should be completely RF shielded and may utilize the side plate (Drawing) as either the mounting surface or as one of the shielding covers.
4. Maximum height above side plate (Item 5) is 1 inch.

SUGGESTED BLOCK DIAGRAM



NOTES:
1. SRD is step recovery diode.
2. FL1 through FL4 must be 4-pole Bessel-Response filters with 120 MHz 3 dB bandwidths.
3. Detectors should use HP5082-2800 (or equivalent) diodes and Spectrum Control FB3B102W (or equivalent) feed-through capacitors.

2.0 FUNCTIONAL DESCRIPTION

The L.O. Transmitter Module L3 is located in the vertex room B rack. It accepts the 600 MHz master signal from L2 and provides the 1200 MHz and 1800 MHz phase stable base band carriers for the data modulator and 5 MHz modulator. The combined base band pair is level set and provided to the modem. A reference output at 2400 MHz is provided for the modems. A summed output at 3000 MHz is provided for the front end rack.

3.0 DETAILED CIRCUIT DESCRIPTION

Reference Block Diagram D13230B3

3.0.1 X_2/X_3 Multiplier

Reference Specification A13210N1

The X_2/X_3 Multiplier (A_2), provides outputs of 1200 MHz and 1800 MHz at a level of +25 dBm (316 mW) minimum. A 600 MHz +7 to + 10 dBm signal is provided as a sample of the internal 600 MHz power amplifier that drives the multiplier stages. Signal level monitors (0.45 VDC typically) of the three outputs are also provided. The input 600 MHz can be 0 to +10 dBm with a 1 dB change in the outputs. For specific values, data sheets for each unit are available in the module logs.

3.0.2 1200 MHz and 1800 MHz Modulators

The 1200 MHz signal from the X_2/X_3 multiplier is coupled -10 dB through (DC3) to the L terminal of a double balanced modulator (Z1). The level (+15 dBm) is high and when the DC bias level at the I port is set to produce a loss of about -29 dB, the 5 MHz modulation sidebands are produced with good linearity. The $\pm$5 MHz sideband level is -10 dBc (The second harmonic content of the 5 MHz signal must be -30 dB or less.) Amplifier (AR1) and attenuator (AT1) provide isolation and a good match to the filter (FL2).

The 1800 MHz signal is processed in an identical fashion thru (DC4), (Z2), (AR2), (AT2), and (FL3). The two signals are then summed by (DC6) and delivered to the output connector J8. Each carrier is set to -19 dBm with $\pm$5 MHz sidebands -10 dB on the 1200 MHz and $\pm$300 kHz data sidebands -15 dB down on the 1800 MHz. The filters (FL2) and (FL3) were required to eliminate crosstalk, (5 MHz sidebands on the 1800 MHz, data sidebands on 1200 MHz) and second harmonics (2400 MHz and 3600 MHz).

3.0.3 2400 MHz Output

The 1200 MHz signal is coupled -10 dB (DC2) to doubler (Z4). The input level is +13 dBm and the output, filtered by (FL1) is 0 dBm minimum at J14.

3.0.4 3000 MHz Output

The 1200 MHz and 1800 MHz signals are -10 dB coupled via (DC1) and (DC5) to mixer Z_3. The levels +13 dBm and +14 dBm provide an output filtered by (FL4) of -8 dBm minimum at J7.

3.0.5 5 MHz Modulator Driver

Reference Schematic B13230S9

In this unit, R5 provides an adjustable DC bias current of +0.6 to +20.0 Mz through R1 and L_1 to the modulator (Z_1). The 5 MHz signal, level of 0 to +4 dBm, is applied to the modulator through C_2. R, R_3 and R_4 maintain a near 50Ω input impedance to J1, and R_4 provides adjustment of the 5 MHz. Carrier and sideband levels are set by observing the outputs at J_8. Modulation 5 MHz can be monitored on a front BNC J_3.

3.0.6 Data Modulator Driver

Reference Schematic C13230S7

A TTL sink input at J_1 is coupled by C14 to a limiter circuit R_3, CR_1 and CR_2. The output is set by R_4 and applied to a non inverting gain of 3 amplifier U_1. The output of U_1 is coupled via C6 and summed with adjustable bias from R_7 and R_8. The sum is low pass filtered by C_7, C_8, C_9, L_1 and L_2. The filter source impedance is established by R_9 (240Ω) and the load by R_{10} and R_{11} (543Ω), and U_2. The low pass cutoff (-3 dB) is at $\sim$3 MHz and C6 provides a high pass corner at 5 kHz. The filter drives a unity gain follower U_2 to provide a low impedance drive through R_{15} and a $\sim$10 MHz low pass L_3 and C_{13} to J_3 and the data modulator.

4.0 ADJUSTMENTS

4.0.1 1200 MHz Modulator

The 5 MHz modulator is set at the module test level to give a 1200 MHz output at J8 of -18.6 dBm carrier and 5 MHz sidebands of -10 dBc. Input 5 MHz levle is +10 dBm and other conditions are as recorded on the module test data sheet.

4.0.2 1800 MHz Modulator

The data 300 kHz modulator is set at the module test level to give an 1800 MHz output at J8 of -18.6 dBm with first data sidebands of -15 dBc. The input signal is 3.5V p-p at 300 kHz and other conditions are as recorded on the module test data sheet.

4.0.3 System Level Adjustments

Both of the above adjustments may be made at the system level to correct for minor level differences of the 1200 MHz and 1800 MHz . A departure of more than ± 3 dB carrier level from the specified value should not be made without careful checking of the modulator performance. Larger adjustments can be made by the value of AT_1 and AT_2.

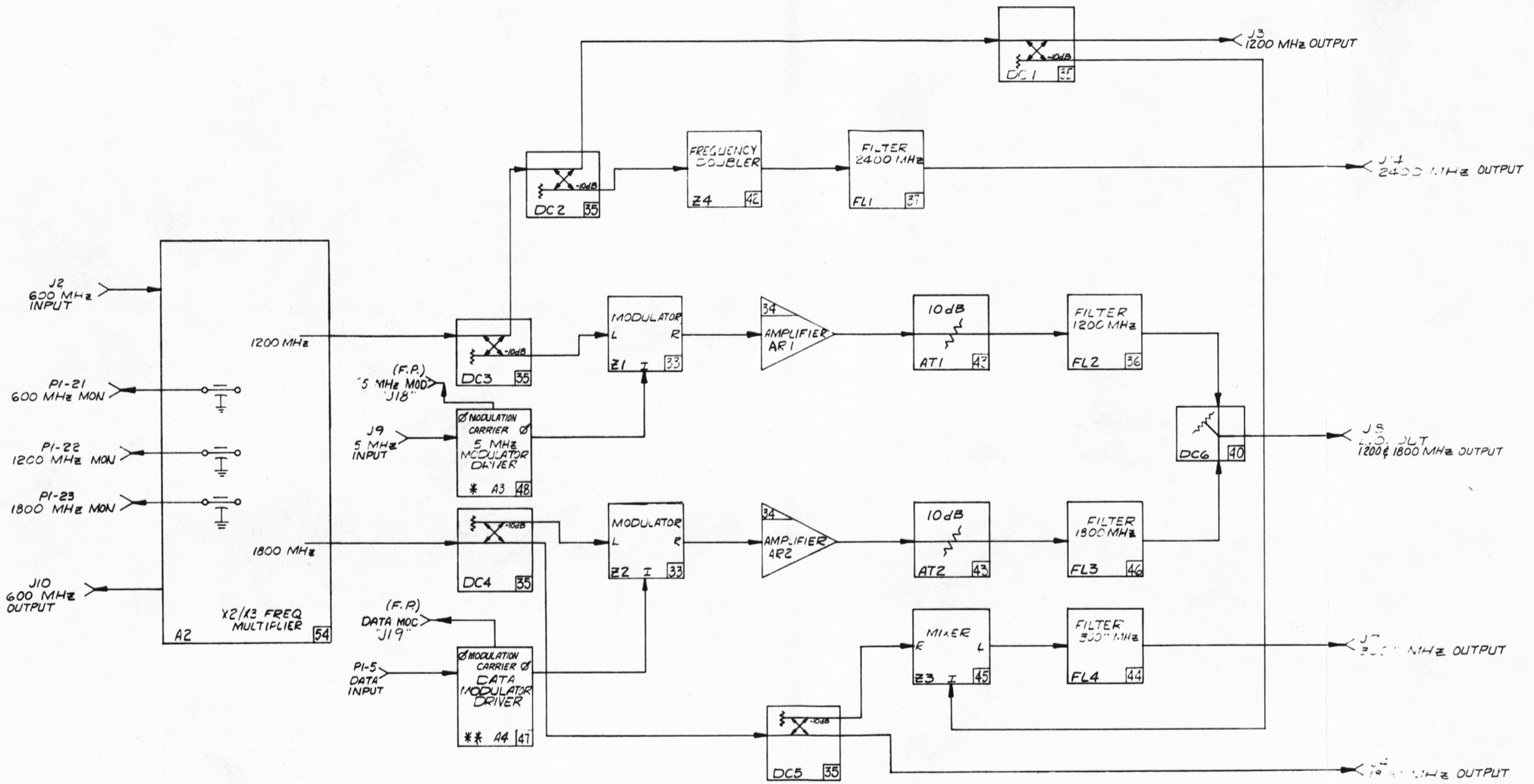
5.0 SCHEMATIC AND BLOCK DIAGRAMS INCLUDED

5.0.1 L3 LO Transmitter Block Diagram - D13230B3

5.0.2 5 MHz Modulator Driver - D13230S9

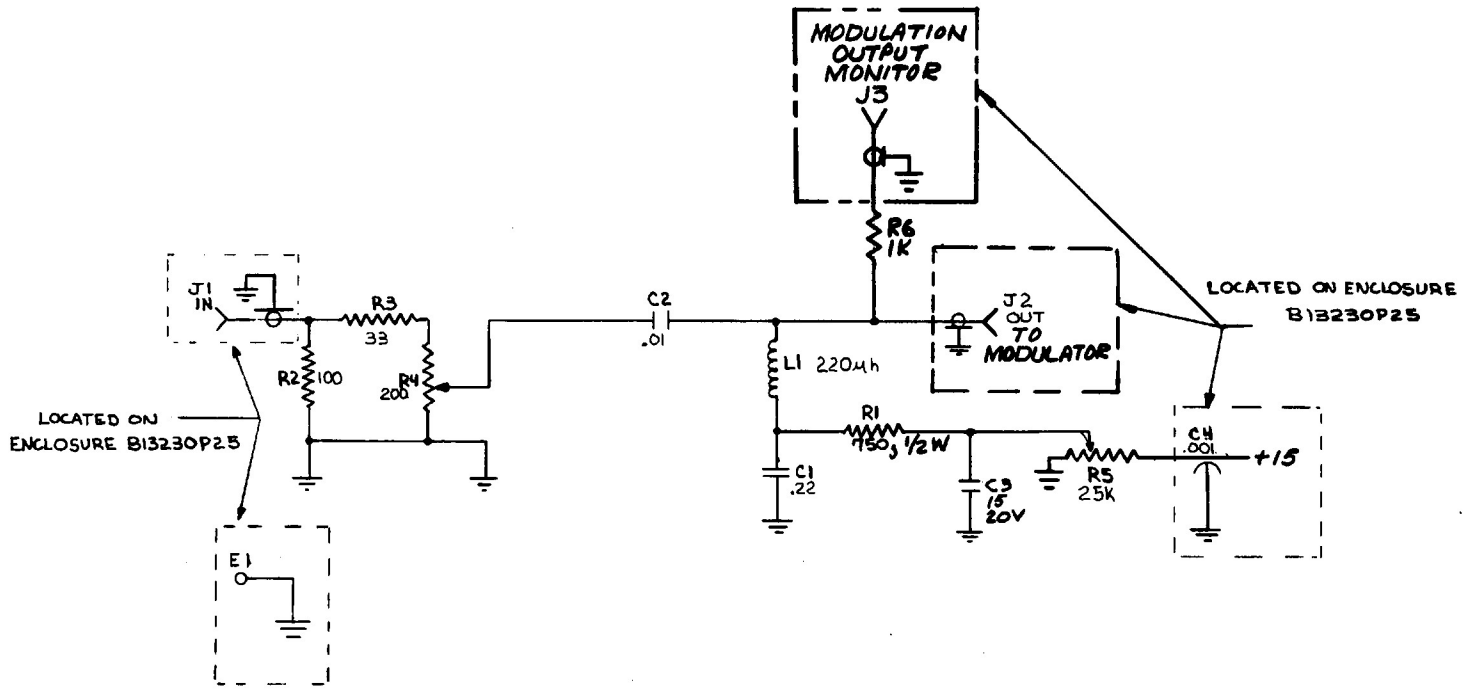
5.0.3 Data Modulator Dirver - C13230S7

REV	DATE	DRAWN BY	APPRV'D BY	DESCRIPTION
B	11/11/87	[illegible]	[illegible] 12-19	REVISED EXTENSIVELY



NOTES:
1. J2, J3, J4, J7, J8, J9, J10 & J14 ARE ON REAR PANEL
2. P1 – 42 PIN CONNECTOR
3. * = ASSY DWG B13230F25, BOM A13230E27, SCHEMATIC DWG B1323059
   ** = ASSY DWG B13230P33, BOM A13230E22, SCHEMATIC DWG C1323057
4. J18 & J19 BNC ON FRONT PANEL
5. → ARROW INDICATES SIGNAL FLOW
6. DC4 35
   ITEM NUMBERS PER BOM A1323023
   REF DESIG PER IEEE NO.315 & NRAO SPEC

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES	VLBA	NATIONAL RADIO ASTRONOMY OBSERVATORY
TOLERANCES: ANGLES ± / 1 PLACE DECIMALS .X ± / 2 PLACE DECIMALS .XX ± / 3 PLACE DECIMALS .XXX ±	VLBA LO TRANSMITTER	CHARLOTTESVILLE, VA. 22901
MATERIAL	BLOCK DIAGRAM	DRAWN BY [illegible] DATE 11/6/87
FINISH		DESIGNED BY [illegible] DATE [illegible]
NEXT ASSY / USED ON	SHEET NUMBER / DRAWING NUMBER D1323083 REV B	APPROVED BY [illegible] DATE 12/2/87 SCALE



NOTES:
1. UNLESS OTHERWISE SPECIFIED
   A. ALL RESISTOR VALUES ARE IN OHMS, ¼ WATT
   B. ALL CAPACITOR VALUES ARE IN MICROFARADS

LAST COMPONENT DESIG. USED									
R	C	L							
6	4	1							

COMP. DESIG. NOT USED									

3/1/76 MW

REV.	DATE	DRAWN BY	APPR'D BY	DESCRIPTION

VLA L3 LO TRANSMITTER

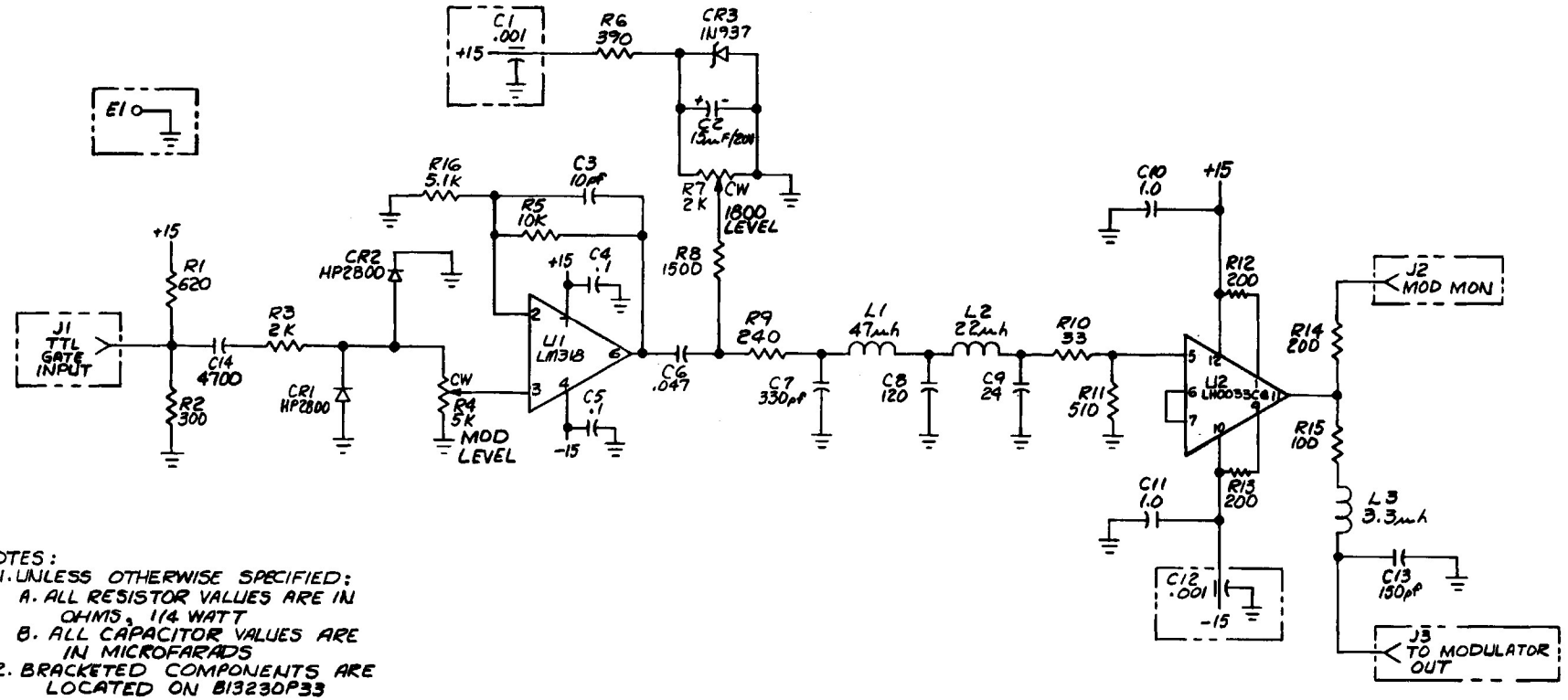
5 MHz MODULATOR DRIVER SCHEMATIC

NATIONAL RADIO ASTRONOMY OBSERVATORY
CHARLOTTESVILLE, VA. 22901

DRAWN BY T. HOGAN DATE 10-14-74
DESIGNED BY DATE 4-7-75
APPROVED BY DATE 9/24/75

SHEET NUMBER | DRAWING NUMBER B13230S9 | REV. | SCALE —

REV.	DATE	DRAWN BY	APPR'D BY	DESCRIPTION



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   A. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT
   B. ALL CAPACITOR VALUES ARE IN MICROFARADS
2. BRACKETED COMPONENTS ARE LOCATED ON B13230P33

LAST COMPONENT DESIG USED						
C	CR	J	L	R	U	
14	3	3	3	16	2	

NEXT ASSY	USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES: ANGLES ±
3 PLACE DECIMALS (.XXX): ±
2 PLACE DECIMALS (.XX): ±
1 PLACE DECIMALS (.X): ±
MATERIAL:
FINISH:

VLA PROJECT: L3 LO TRANSMITTER
L10 CENTRAL LO TRANSMITTER

TITLE: DATA MODULATOR DRIVER SCHEMATIC

NATIONAL RADIO ASTRONOMY OBSERVATORY
CHARLOTTESVILLE, VA. 22901

DRAWN BY		DATE 6/16/25
DESIGNED BY	S. WEINREB	DATE 6/16/25
APPROVED BY		DATE
SHEET NUMBER	DRAWING NUMBER C1323057	REV.
		SCALE

BRUNING 40-22 24984

6.0 BILLS OF MATERIALS INCLUDED

5 MHz Modulator Driver Board - A13230Z26

Data Modulator Board - A13230Z23

L.O. Transmitter - A13230Z03 (pages 3 and 4)

BILL OF MATERIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY

[X] ELECTRICAL [ ] MECHANICAL BOM # A13230Z26 REV A DATE 10/15/75 PAGE 1 OF 2

MODULE # L3 NAME LO Transmitter DWG # D13230P3 SUB ASMB 5 MHz Mod DRIVER DWG # B13230P36

SCHEMATIC DWG # B13230S9 LOCATION _____ QUA/SYSTEM _____ PREPARED BY _____ APPROVED _____

ITEM #	REF DESIG	MANUFACTURER	MFG PART #	DESCRIPTION	TOTAL QUA	
1		NRAO	A13230Z26	Assembly (B13230P36)	-	
2		NRAO	B13230M59	Board	1	
3		Keystone	1589-2	Swage Type Threaded Standoff	2	
4	R3		RCR07-330-5S	Resistor 1/4W 33 OHMS	1	
5	R4	BOURNS	3339H-1-102	POTENTIOMETER 1K	1	
6	R5	BOURNS	3339H-1-203	POTENTIOMETER 20K	1	
7	C1,C3	Erie Red Cap	8131-050-651-224M	.22 MF 50 Volt Cap	2	
8	C2	Erie Red Cap	8121-050-651-103M	.01 MF 50 Volt Cap	1	
9	L1			220 MICRO-HENRY CHOKE	1	
10	R1		RCR20 751-5S	Resistor 1/2W 750 OHMS	1	
11	R2		RCR07-101-5S	Resistor 1/4W 100 OHMS	1	
12						
13						
14						
15						

BILL OF MATERIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY

☐ ELECTRICAL ☒ MECHANICAL BOM # A13230Z26 REV A DATE 10/15/75 PAGE 2 OF 2

ITEM #	REF DESIG	MANUFACTURER	MFG PART #	DESCRIPTION	TOTAL QUA	
16						
17		NRAO	B13230AB7	Artwork Master	Ref	
18		NRAO	B13230S9	Schematic	Ref	
19						
20						
21						
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31						
32						

BILL OF MATERIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY

☒ ELECTRICAL ☐ MECHANICAL BOM # A13230Z23 REV A DATE 3 SEPT 75 PAGE 1 OF 3

L3 LO TRANSMITTER DATA MODULATOR

MODULE # L10 NAME CENTRAL LO TRANSMITTER DWG # _____ SUB ASMB DRIVER BOARD ASSY DWG # B13230P34

SCHEMATIC DWG # C1323057 LOCATION _____ QUA/SYSTEM _____ PREPARED BY Harold Ward APPROVED [signature]

ITEM #	REF DESIG	MANUFACTURER	MFG PART #	DESCRIPTION	TOTAL QUA	
1		NRAO	A13230Z23	DATA MODULATOR DRIVER BOARD ASSY (B13230P34)	—	
2		NRAO	C13230M56	CIRCUIT BOARD	1	
3	R1		RCR07-621-5S	RESISTOR 1/4W 620 OHMS	1	
4	R2		RCR07-301-5S	RESISTOR 1/4W 300 OHMS	1	
5	R3		RCR07-202-5S	RESISTOR 1/4W 2K	1	
6	R4	BOURNS	3339P-1-502	POTENTIOMETER 5K	1	
7	R5		RCR07-103-5S	RESISTOR 1/4W 10K	1	
8	R6		RCR07-391-5S	RESISTOR 1/4W 390 OHMS	1	
9	R7	BOURNS	3339P-1-202	POTENTIOMETER 2K	1	
10	R8		RCR07-152-5S	RESISTOR 1/4W 1500 OHMS	1	
11	R9		RCR07-241-5S	240	1	
12	R10		RCR07-330-5S	33	1	
13	R11		RCR07-511-5S	510	1	
14	R12, 13 14		RCR07-201-5S	200	3	
15	R15		RCR07-101-5S	RESISTOR 1/4W 100 OHMS	1	

BILL OF MATERIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY

☒ ELECTRICAL ☐ MECHANICAL BOM # A13230E23 REV A DATE 3 SEPT 75 PAGE 2 OF 3

ITEM #	REF DESIG	MANUFACTURER	MFG PART #	DESCRIPTION	TOTAL QUA	
16	R16		RCR07-512-5S	RESISTOR 1/4W 5100 OHMS	1	
17	C2		CS13BE156K	CAPACITOR 20V 15 µf	1	
18	C3		CM04FD100J03	10pf 5% MICA	1	
19	C4,5	ERIE	8121-050-651-104M	50V .1µf	2	
20	C6	ERIE	8121-050-651-473M	50V .047µf	1	
21	C7		CM04FD331J03	330pf 5% MICA	1	
22	C8		CM04FD121J03	120pf 5% MICA	1	
23	C9		CM04FD240J03	24pf 5% MICA	1	
24	C10, 11	ERIE	8121-050-651-105M	50V 1.0Mf	2	
25	C13		CM04FD151J03	150pf 5% MICA	1	
26	C14	ERIE	8121-050-651-472	CAPACITOR 50V 4700pf	1	
27	L1	MILLER	9230-60	CHOKE 47µh	1	
28	L2	MILLER	9230-52	CHOKE 22µh	1	
29	L3	MILLER	9230-32	CHOKE 3.3µh	1	
30	CR1, 2	AERTECH	A25800	DIODE	2	
31	CR3		IN937B	ZENER DIODE	1	
32	U1	NATIONAL	LM318H	MICROCIRCUIT	1	

BILL OF MATERIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY

☒ ELECTRICAL ☐ MECHANICAL BOM # A13230223 REV A DATE 3 SEP 75 PAGE 3 OF 3

ITEM #	REF DESIG	MANUFACTURER	MFG PART #	DESCRIPTION	TOTAL QUA	
33	U2	NATIONAL	LH0033CG	MICROCIRCUIT	1	
34		ROBINSON / NUGENT	DP-5178	IC SOCKET 8 PIN	1	
35		ROBINSON/NUGENT	MP-12100	IC SOCKET 12 PIN	1	
36		NRAO	B13230AB8	ARTWORK	REF	
37		NRAO	C1323057	SCHEMATIC	REF	
38						
39						
40						
41						
42						
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BILL OF MATERIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY

[X] ELECTRICAL [ ] MECHANICAL BOM # A1323023 REV B DATE 3/3/75 PAGE 3 OF 4

ITEM #	REF DESIG	MANUFACTURER	MFG PART #	DESCRIPTION	TOTAL QUA	
33	Z1,Z2	Wakins Johnson	WJ M1-J	Mixer	2	
34	AR1,AR2	Avantek	UTA-8713	Amplifier	2	
35	DC1-DC5	Omni Spectra	20063-10	Coaxial Directional Coupler	5	
36	FL2	K & L Microwave, Inc.	4B120 1200/120-0	Bandpass Filter (with mnt. clips)	1	
37	FL1	K & L Microwave, Inc.	4B120 2400/200-0	Bandpass Filter (with mounting clips)	1	
38	P1	AMP	204186-5	Bin/Module Power Connector	1	
39	P	AMP	202394-2	Power Connector Metal Guard	1	
40	DC6	Omni Spectra	20493	Caoxial Power Divider	1	
41	J2,3,4,7,8,9,10,14	OMNI Spectra	OMQ 3043-75	Jack-Semi rigid cable	8	
42	Z4	Anzac	D-6-4	Doubler	1	
43	AT1,AT2	Narda (OR EQUIV)	4772-10	ATTENUATOR	2	
44	FL4	K & L Microwave, Inc.	4B120-3000/300-0	Bandpass Filter (with mounting clips)	1	
45	Z3	Wakins Johnson	WJ MIH	Mixer	1	
46	FL3	K & L Microwave, Inc.	4B120-1800/120-0	Bandpass filter (with mounting clips)	1	
47	A2	NRAO	A13230Z22	DATA MODULATOR DRIVER ENCLOSURE ASSY (B13230P33)	1	
48	A3	NRAO	A13230Z27	5 MHz MODULATOR DRIVER ASSEMBLY (B13230P25)	1	
49	P	Omni-Spectra	OSM 531-3	Right Angle Plug/Flex Cable	3	

BILL OF MATERIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY

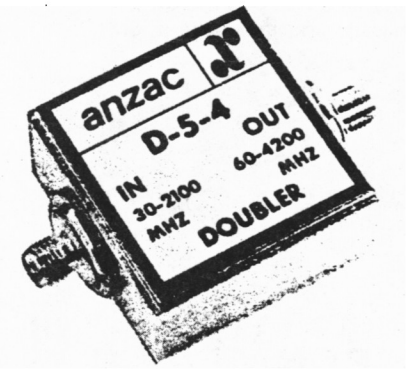
[X] ELECTRICAL [ ] MECHANICAL BOM # A13230Z3 REV B DATE 3/3/75 PAGE 4 OF 4

ITEM #	REF DESIG	MANUFACTURER	MFG PART #	DESCRIPTION	TOTAL QUA	
50	P	Omni-Spectra	OSM 201-1A	Plug/.141 in. Semi-Rigid Cable	29	
51	P	Omni-Spectra	OSM 201-1	Plug/.141 in. Semi-Rigid Cable	19	
52	W	Uniform Tubes	UT-141	Semi-Rigid Cable .141 dia.	16ft.	
53	W		RG-188A/U	Flex Cable	2ft.	
54	A1		A13210N1	X2/X3 FREQUENCY MULTIPLIER	1	
55	P	AMP	201143-5	Coax Pin	1	
56	P	AMP	204188-1	Crimp Pin	6	
57	P	AMP	203964-6	Socket, Guide	2	
58	P	AMP	200833-4	Pin, Guide	1	
59	P	AMP	202514-1	Pin, Guide	1	
60	J18,J19	KINGS	KC-19-153	BNC	2	
61				Stranded Wire		
62	DSH	NRAO	D13230B3	BLOCK DIAGRAM	REF	
63						
64						
65						
66						

7.0 MANUFACTURERS' DATA SHEETS

UHF BROADBAND FREQUENCY DOUBLERS

100 MHz—2.6 GHz OUTPUT (D-6-4)
60 MHz—4.2 GHz OUTPUT (D-5-4)



FEATURES

- Conversion Loss 13 db Max.
- Untuned
- Meets MIL Environments
- Low Spurious Noise
- Standard Connectors: BNC, TNC or SMA

GUARANTEED SPECIFICATIONS

	D-6-4	D-5-4		
Input Frequency Range:	50 MHz - 1.3 GHz	30 MHz - 2.1 GHz		
Output Frequency Range:	100 MHz - 2.6 GHz	60 MHz - 4.2 GHz		
Conversion Loss:	13 db Max. @ 20 mw input	13 db Max. @ 30 mw input		
Spurious (referred to Output F_2):	OUTPUT FREQUENCY (MHz)			
	100-1000	1000-2600	60-1000	1000-4200
F_1	-25 db	-15 db	-25 db	-15 db
F_3	-30 db	-20 db	-30 db	-20 db
F_4	-12 db	-12 db	-12 db	-20 db

TYPICAL PERFORMANCE

	D-6-4	D-5-4
Input VSWR:	1.8 : 1	1.5 : 1 (30 MHz - 1 GHz) 1.8 : 1 (1-2.1 GHz)
Input/Output Impedance:	50 ohms	50 ohms
Input Power (Loss increased 2 db @ mw and 100 ms):	20 mw Nom.	30 mw Nom.
Input Power:	1 Watt	1 Watt
Operating Temperature Range (0.5 db Max. Loss Variation):	-55°C to +85°C (Both models)	

DESCRIPTION

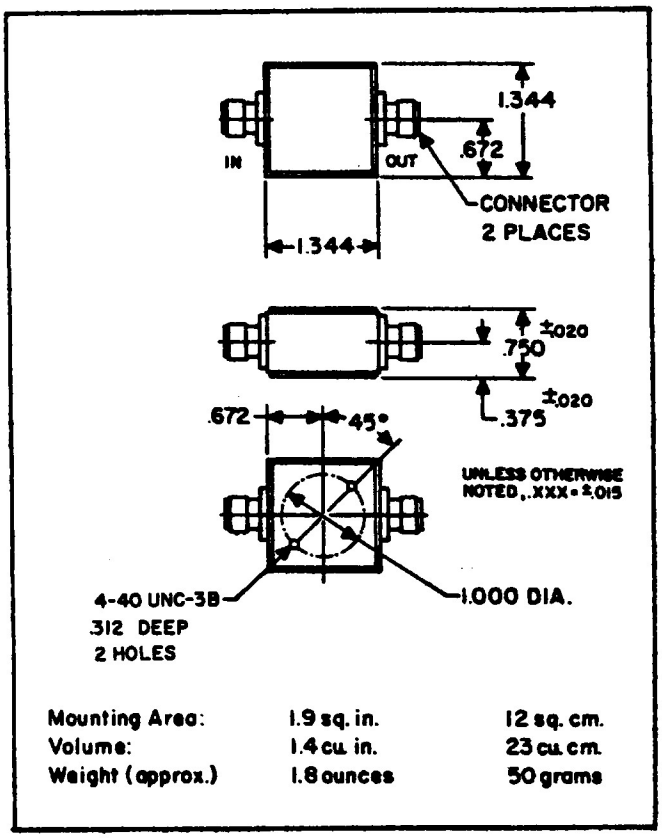
These doublers are small, low noise, untuned devices used to double any frequency in the 30-2100 MHz frequency range with minimum spurious generation.

ENVIRONMENTAL

These Devices Have Been Designed to Meet the Following Environmental and Physical Conditions of MIL-STD-202.

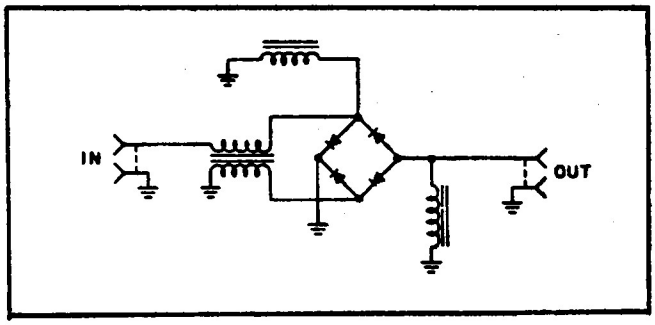
Thermal Shock:	Method 107, Test Condition A -55°C to +85°C, 30 minutes at temperature extremes, 5 cycles
Humidity:	Method 103, Test Condition B (96 hours)
Barometric Pressure:	Method 105, Test Condition D 100,000 feet
Moisture Resistance:	Method 106
Life Test:	Method 108, Test Condition B (250 hours)
Vibration:	Method 204, Test Condition B 10-2,000 Hz, 15 G peak
High Impact Shock:	Method 207

MECHANICAL DATA



Mounting Area:	1.9 sq. in.	12 sq. cm.
Volume:	1.4 cu. in.	23 cu. cm.
Weight (approx.)	1.8 ounces	50 grams

SCHEMATIC



ORDERING INFORMATION

Please specify Model No. and Connector Type when ordering.

Model	Price (1-5 Qty.)	Connector Types	Availability
D-6-4	$ 75.00	BNC, TNC, SMA	Stock
D-5-4	$150.00	BNC, TNC, SMA	Stock

Terms: Net 30, f.o.b. factory

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Division of Adams-Russell
39 Green Street, Waltham, Massachusetts 02154 • (617) 899-1900 • TWX 710-324-6484

M6E/(M6F)	M6T	M6K*/M6KC*/(M6N)*	M1A/(M1A-11)/[M3A]	M1G/(M1F)	M1H/M5H/M11H
5 (2) to 500 MHz	10 to 500 MHz	5 to 400 MHz	3 to 1000 (1200) MHz	.1 (1.8) to 4.2 GHz	1.8 to 6.2 GHz
DC to 500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 1000 (1200) MHz	DC to 1 (2) GHz	DC to 2 GHz
7.0 dB 10 (5) to 100 MHz	7.0 dB 10 to 200 MHz	7.5 dB 5 (10) to 200 MHz	7.5 dB 10 to 100 MHz	8.5 dB 1 to 1.5 GHz	7.0 dB 1.8 to 4.2 GHz/f_t DC to 2 GHz
8.0 dB 100 to 200 MHz	8.0 dB 200 to 350 MHz	9.0 dB 200 (5) to 400 MHz	10.0 dB 3 to 1000 (1200) MHz	7.5 dB 1.5 (1.8) to 4.2 GHz	8.0 dB 4.2 to 6.2 GHz/f_t DC to 500 MHz
9.0 dB 5 (2) to 500 MHz	9.0 dB 350 to 500 MHz				9.0 dB 4.2 to 6.2 GHz f_t 500 MHz to 2 GHz
7.0 dB 10 (5) to 100 MHz	7.0 dB 10 to 200 MHz		7.5 dB 10 to 100 MHz	8.5 dB 1 to 1.5 GHz	7.0 dB 1.8 to 4.2 GHz/f_t 30 to 2 GHz
8.0 dB 100 to 200 MHz	8.0 dB 200 to 350 MHz	not specified	10.0 dB 3 to 1000 (1200) MHz	7.5 dB 1.5 (1.8) to 4.2 GHz	8.0 dB 4.2 to 6.2 GHz/f_t 30 to 500 MHz
9.0 dB 5 (2) to 500 MHz	9.0 dB 350 to 500 MHz				9.0 dB 4.2 to 6.2 GHz f_t 500 MHz to 2 GHz
45 (40) dB 5 to 50 (2 to 150) MHz	40 dB 10 to 50 MHz	35 dB 5 to 100 MHz	40 dB 3 to 100 MHz	25 dB 1 (1.8) to 4.2 GHz	25 dB 1.8 to 4.2 GHz
30 (35) dB 50 (150) to 500 MHz	35 dB 50 to 100 MHz	25 dB 100 (5) to 400 MHz	[35 dB] 100 to 200 MHz		20 dB 4.2 to 6.2 GHz
	30 dB 100 to 200 MHz		30 dB 100 [200] to 1000 (1200) MHz		
	25 dB 200 to 500 MHz				
40 (35) dB 5 to 50 (2 to 150) MHz	35 dB 10 to 50 MHz	30 dB 5 to 100 MHz	40 dB 3 to 100 MHz	20 (15) dB 1 (1.8) to 4.2 GHz	20 dB 1.8 to 6.2 GHz
25 dB 50 (150) to 500 MHz	30 dB 50 to 100 MHz	20 dB 100 (5) to 400 MHz	[30 dB] 100 to 200 MHz		
	25 dB 100 to 200 MHz		20 dB 100 [200] to 1000 (1200) MHz		
	15 dB 200 to 500 MHz				
M6E (F) M6F G	H	M6K G M6KC I M6N G	M1A A M1A-11 A M3A E	A	M1H A M11H D M5H J
M6E 3 M6F 4	1	4	1	1	1
M6E Yes M6F No	Yes	M6K No M6KC Yes M6N No	No	M1G Yes M1F No	M1H/M5H Yes M11H No
pc mounted	pc mounted	pc mounted	M1A/M1A-11 BNC M3A UG-1464/U	M1G SMA M1F BNC	M1H SMA/M11H UG-1619/U M5H pc mounted
M6E 5.0 gms M6F 2.6 gms	1.4 gms	M6K 3.3 gms/M6KC 6.5 gms M6N 2.6 gms	M1A 1.6 oz/M1A-11 1.6 oz M3A 0.6 oz	M1G 1.1 oz M1F 1.6 oz	M1H 1.10 oz/M11H 0.37 oz M5H 0.24 oz
M6E $37 M6F $37	$50	M6K $25/M6KC $30 M6N $30	M1A $70/M1A-11 $90 M3A $160	$199	$199

* The noise figure is not significantly worse than the specified conversion loss.
** Other connectors can be supplied upon request.

level of +10 dBm. The desensitization level is normally 3 dB below the conversion compression level.

Harmonic Intermodulation Distortion results from the mixing of mixer-generated harmonics of the input signals. Mathematically, it is expressed as $mf_L \pm nf_R$ where m and n represent the harmonic numbers of the input signals. Typical performance is shown on page 9 of the catalog. It is not normally specified since the relative level depends on input frequencies, input levels, terminating impedances, and unit to unit variance.

Cross Modulation Distortion is the amount of modulation transferred from a modulated carrier to an unmodulated carrier when both signals are applied to the R-port of the mixer. The higher the conversion compression or intercept point of a mixer, the greater the attenuation of the cross modulation.

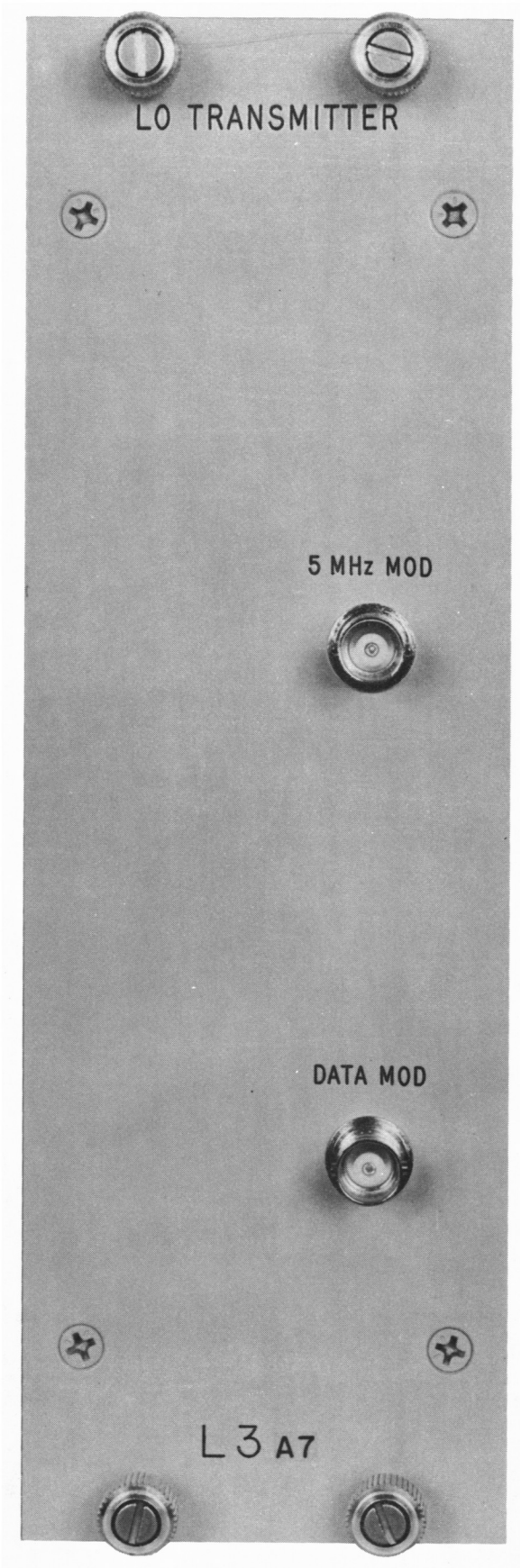


FIGURE 1 FRONT VIEW

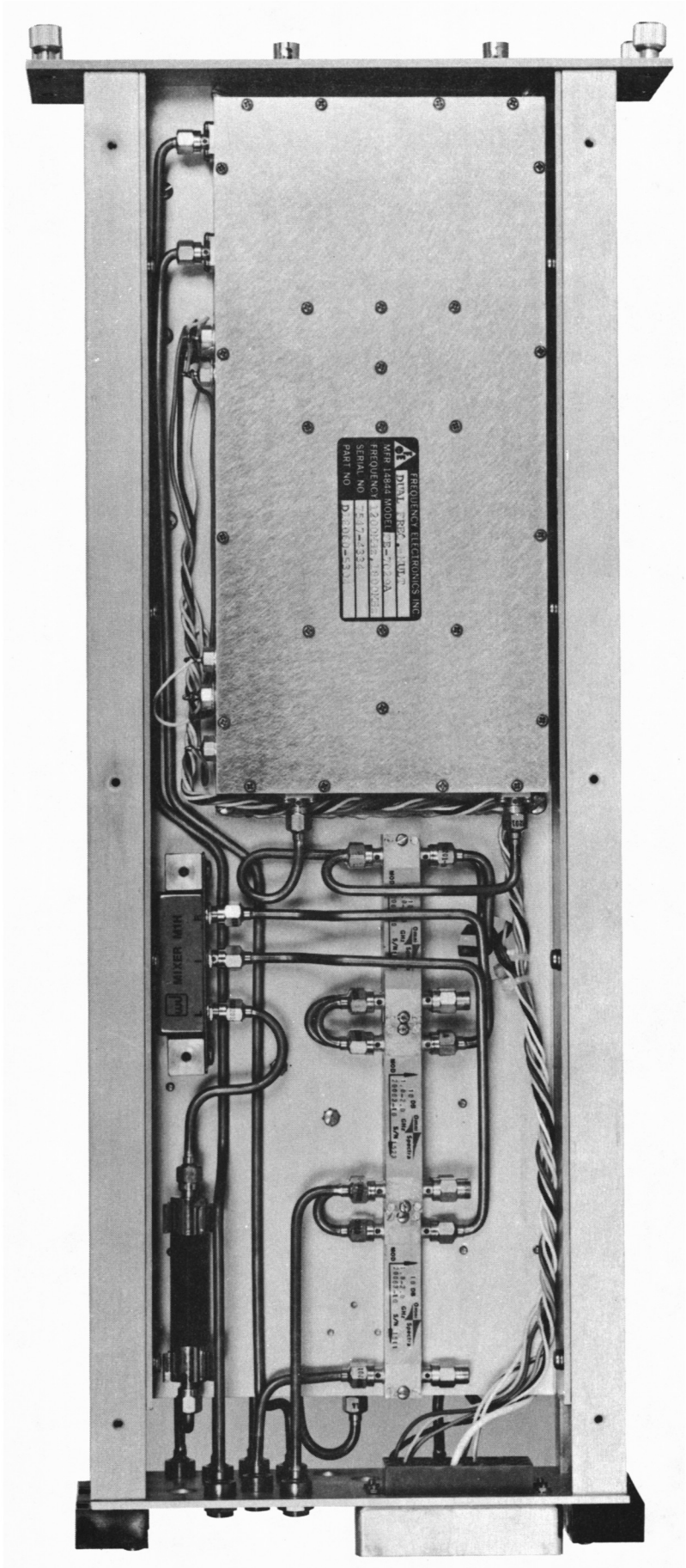


FIGURE 2 RIGHT SIDE VIEW

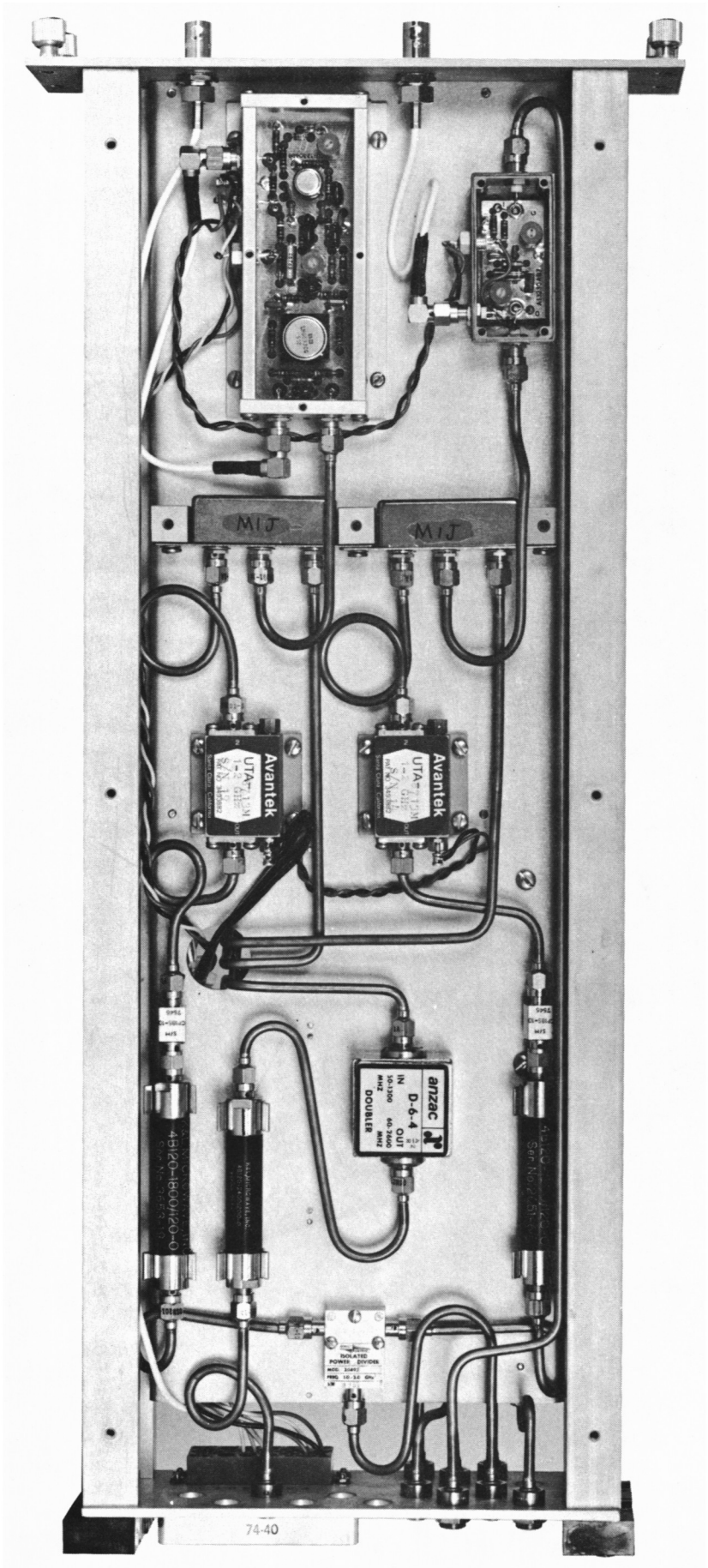
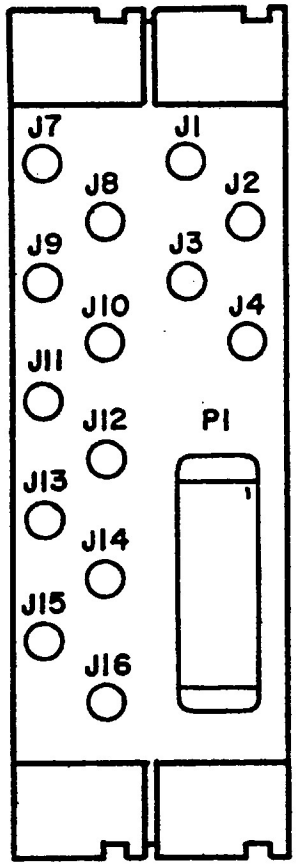
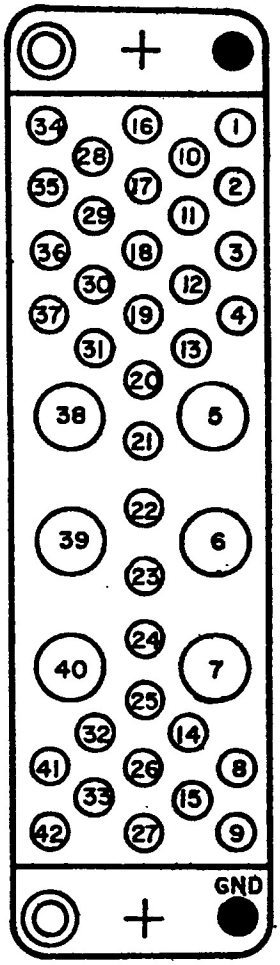


FIGURE 3 LEFT SIDE VIEW



DOUBLE WIDE MODULE
(REAR VIEW)

CONN	FUNCTION
J1	
J2	600 MHZ INPUT
J3	1200 MHZ OUT
J4	1800 MHZ OUT
J7	3000 MHZ OUT
J8	1200 + 1800 MHZ OUT
J9	
J10	600 MHZ OUT
J11	
J12	
J13	
J14	2900 MHZ OUT
J15	
J16	



P1 (REAR VIEW)

P1

PIN	FUNCTION	WIRE COLOR	PIN	FUNCTION	WIRE COLOR
1			22	1200 MHZ MON.	
2			23	1800 MHZ MON.	
3			24		
4			25		
5	DATA IN		26		
6			27		
7			28	−28VDC	GREEN
8			29	+28VDC	GREY
9			30		
10	+5VDC	ORANGE	31		
11	−5VDC	BROWN	32		
12			33		
13			34	PWR. GROUND	BLACK
14			35		
15			36		
16	+15VDC	RED	37		
17	−15VDC	YELLOW	38		
18			39		
19			40		
20			41		
21	600 MHZ MON.		42	HIGH QUAL. GROUND	

FIG. 4

L3