NATIONAL RADIO ASTRONOMY OBSERVATORY
VERY LARGE ARRAY PROJECT
SOCORRO, NEW MEXICO

VLA ELECTRONICS MEMORANDA #135

February 1976

ELECTRONIC-SYSTEM CABLING IN THE CONTROL BUILDING

A. R. Thompson

This memorandum outlines the main cable requirements for interconnection of the various racks of the electronic system and thus provides the basis for detailed planning of cable trays and distribution panels beneath the floor of the Central Electronics Room.

I. RACK LOCATIONS

The locations of the racks in the Central Electronics Room are shown in Figure 1. The three rows designated N, E and W are the IF/LO racks that communicate with antennas on the north, southeast and southwest arms respectively. They are positioned above the corresponding sections of the waveguide signal distributor. There are positions for 11 racks on each row corresponding to 11 channels in the waveguide and signal distributor system. Only nine of these channels will be used on each arm. The two spare channels have not been finally decided at this time but will probably be nos. 1 and 11 or 10 and 11. Note that the rack positions for the different channel numbers do not follow a uniformly increasing sequence from one end of the rows to the other but depend upon the positions of the output ports of the signal distributor as shown in Figure 1.

The row of racks nearest the northeast end (the window end) of the Central Electronics Room will be used for the master L.O. and monitor equipment. The row of rack positions at the opposite end, nearest to the Shielded Room, is for future expansion and will not be used at this time.

Each rack in the Central Electronics Room is located over an opening in the floor through which the air condition ducts and all cables and waveguides will pass. Access to the cables and signal distributor will be from catwalks suspended from the ceiling of the room below.

Racks containing the digital samplers, the delay and multiplier system, the spectral line system and some associated control equipment will all be in the Shielded Room at the southwest end of the Central Electronics Room. The Shielded Room has a computer floor to allow interconnections between racks. Ray Escoffier will specify the positions of the racks and the cable requirements within this room.

II. L.O. SYSTEM CABLES

Nine distribution networks are required to transmit signals from the master LO system to each of the 27 N, E and W racks. Each network will be driven by a medium power amplifier in the LO racks and will contain 13 4-way power dividers as shown in Figure 2. Low loss cable will generally be used from the power amplifier to the final power dividers. From the final power dividers to the racks the connections are relatively short and a second cable type is more convenient in some cases. Details of the frequencies and the type of cables, connectors and power dividers are given in Table I. The 1200 and 1800 MHz signals are distributed on the same network. For these and the 2400 MHz signal the most economical power dividers have SMA connectors. The connector spacing on the dividers is too close to for standard adapters to cables with type N connectors. The use of 141 semi-rigid cable for the final connections to the racks is a considerable convenience in these cases, as well as a cost saving by reducing the number of the expensive connectors that are required for the Spirofoam Cable.

Note that the use of 4-way power dividers is an approximately optimum compromise between cost and performance. A branching network with 2-way dividers gives equal path lengths to all racks, which is desirable, but requires a large number of divider units and interconnecting cables and thus is a more expensive solution.

III. IF AND ALC CABLES

Four IF signals go from each of the N, E and W racks to the Shielded Room. A total of 108 IF cables is needed. They enter the room through bulkhead-mounting filters in a metal plate just beneath the floor level. The filters are 70 MHz low-pass (K and L 5L340-70-NX) and keep the 100 MHz signals in the digital equipment from getting outside the Shielded Room and being radiated. The filters have type N female connectors. Cables from the racks to the bulkhead filters will be 3/8-inch Spirofoam with Prodelin 76-380 type N male connectors. Cables within the screened room from the filters to the sampler racks will be RG8/U with type N male connectors.

Four ALC signals also go from each of the N, E and W racks to the sampler racks in the Shielded Room. These are carried by four pairs in a six-shielded-pair cable, Belden 8778. A separate cable is used for each N, E or W rack, and the connector at the rack is a Bendix PT06A-12-10S(SR). Entry to the shielded room will be through filters, Erie type 1212-502.

IV. MISCELLANEOUS CABLES

1. Two 100 MHz clock lines are required from the master local oscillator racks to the Shielded Room. These will be 3/8-inch Spirofoam with type N connectors and will enter the room through 120 MHz low-pass bulkhead filters (K and L 5L340-120-NX).
2. A two-conducter shielded cable is required to take blanking-time signals from the master L.O. racks to the Shielded Room.

3. Cables carrying low frequency digital signals are required from the master L.O. area to each of the N, E and W racks. There are three RG174/U coaxial cables and one twisted pair for timing and control signals and two twisted pairs from the serial line controllter. The timing and control signals are the same for all racks and can run from one rack to another down each row. The signals from the serial line controller require individual lines to each rack.
4. A 115V line outlet is required for each rack. Current capacity should be at least 10A, preferably 15A.

V. PLANNING AND INSTALLATION

In planning the cable trays, etc. required for the runs beneath the floor of the Central Electronics Room a fairly generous capacity for other miscellaneous cables and future expansion should be allowed. In particular room should be provided for at least two more of the distribution networks described in section II. The system of cable trays should connect with the space beneath the computer floor in the Control Room to allow connections to units there and in the Computer Room.

In addition to cable trays, some junction panels will be required for mounting the power dividers. Approximate locations for these should be the northwest end of the center row of racks, the center of each of the N, E and W rows and the center of each group of four racks in the N, E and W rows.

The installation of electronic equipment is forecast to begin in June 1976. Equipment for seven antennas should be installed and operating by the end of 1976 and for ten antennas by about April 1977. The initial configuration of the array will have most of the antennas on the west arm except for ones at the ends of the completed portions of the north and east arms

(CE9 and CN9) and one near the center of the array, probably at DN1. Cabling should therefore first be completed for the racks of row W and next for the required one or two positions on the other rows. For initial operation only two IF channels will be used from each rack, but is may be more convenient to install all four cables at the same time.

Planning for the installation of cables and equipment in the Control Building is under the supervision of R. M. Mitchell, and Emory Egler will design the mechanical structures for support of the cables, signal distributor, etc.

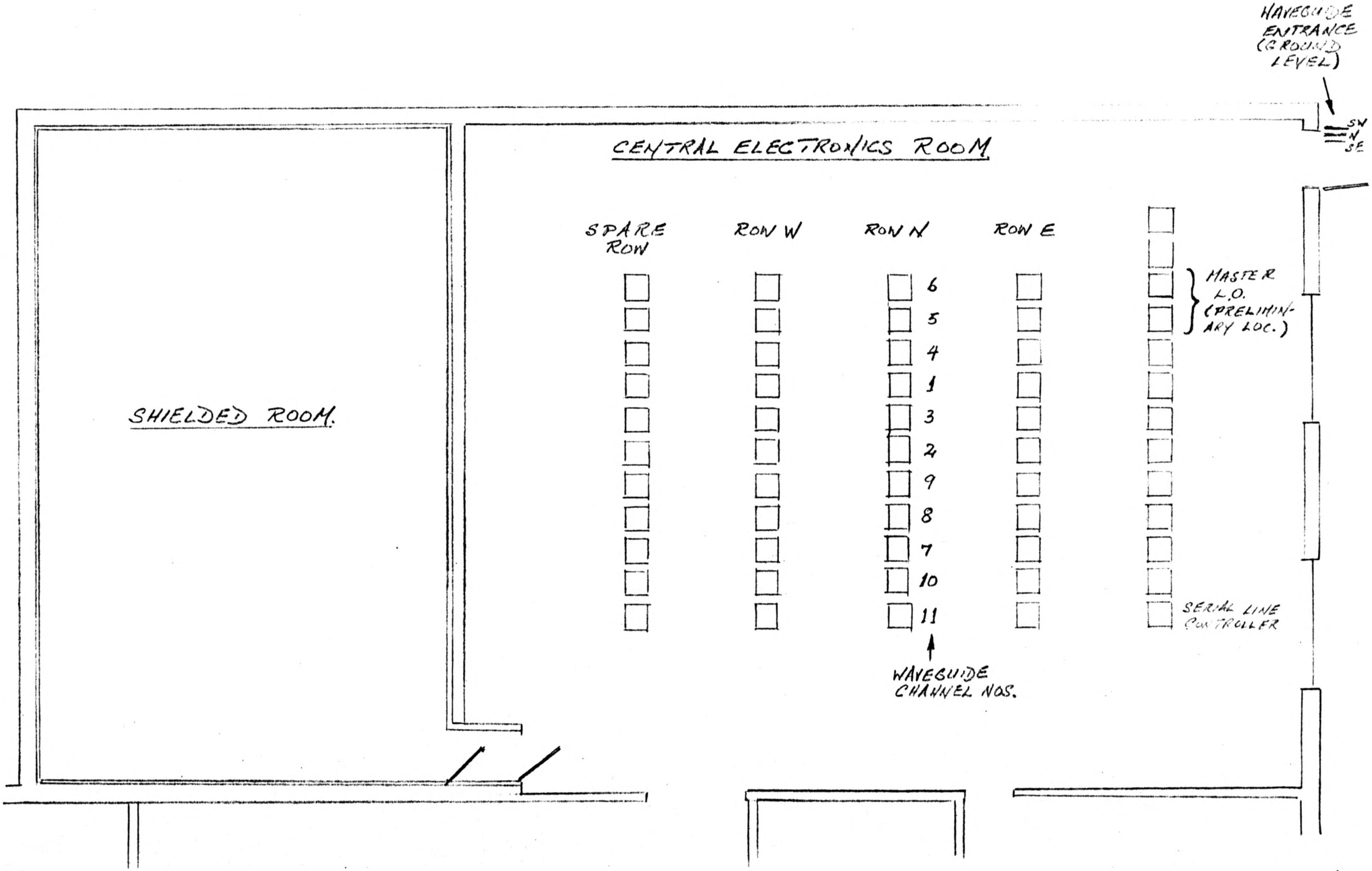

Figure 1. RACK LAYOUT.

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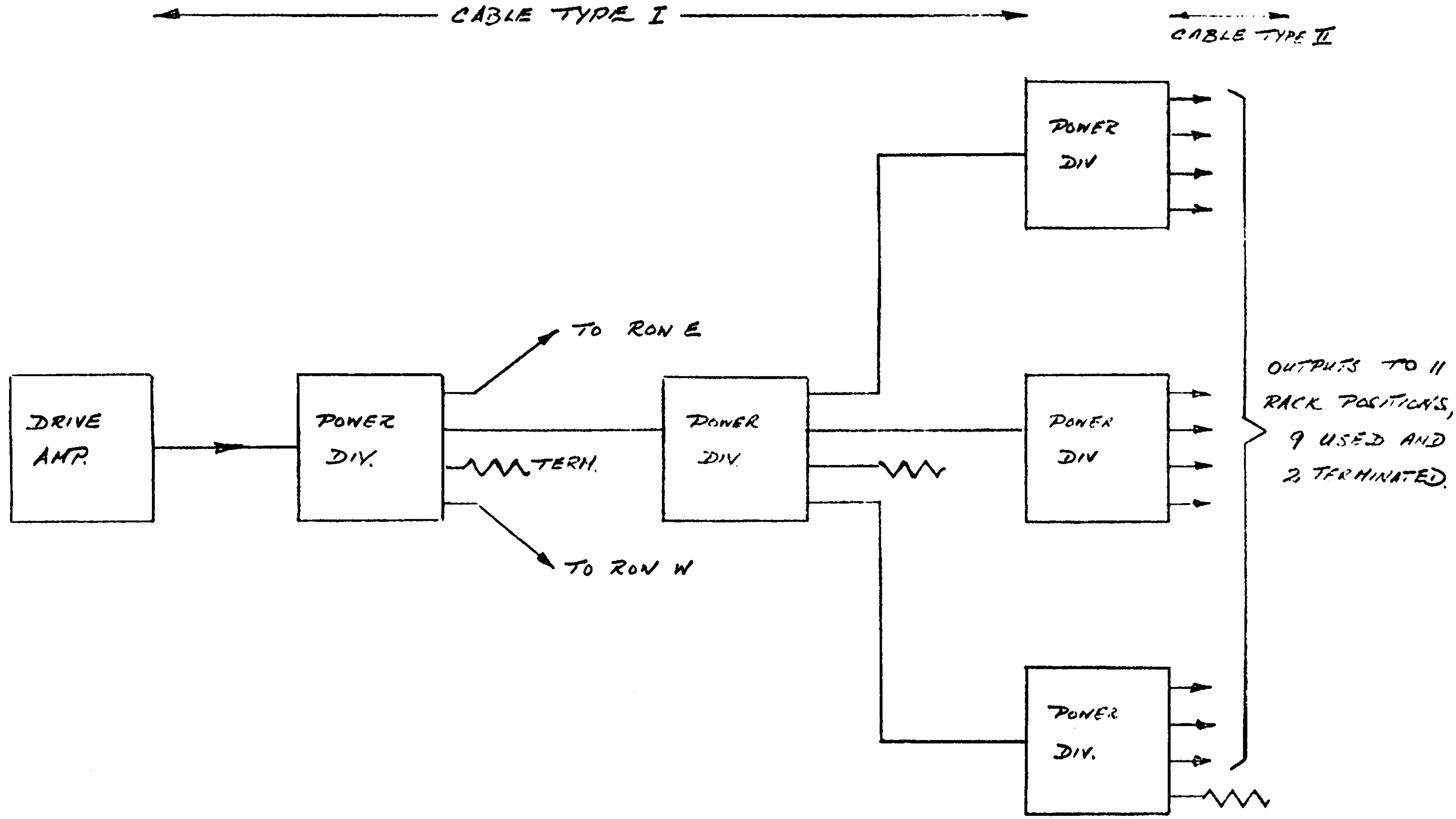

Figure 2. L.O. DISTRIBUTION NETWORK.

A.R.T. 2/25/76

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Pi TYPES

SIX CHANNEL TYPES

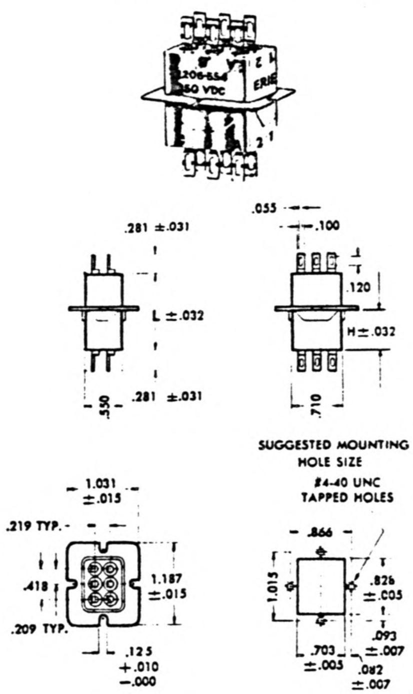

Fig. 1

TWELVE CHANNEL TYPES

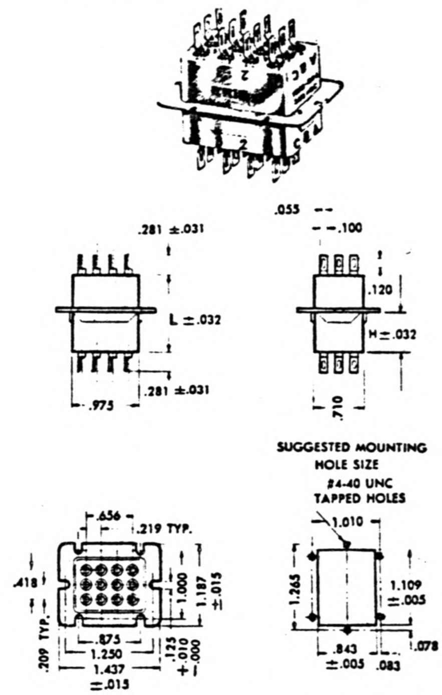

Fig. 2

ORDERING DATA

ERIE Part No.	Dimensions "L" IN.	Dimensions "H" In.	MINIMUM NO LOAD INSERTION LOSS (dB) PER MIL-STD-220 OVER THE TEMP. RANGE 100MHz	200MHz	2GHz	Capacitance @ 25°C 0.5 - 5.0 Vrms 1kHz	Fig.	Max. Weight in Grams	Insertion Loss * Curve
1206-502	1.125	.594	50	50	50	5000 pF	1	28	1
1212-502	1.125	.594	50	50	50	5000 pF	2	49	1
1206-554	.750	.437	45	50	50	2500 pF	1	22	2
1212-554	.750	.437	45	50	50	2500 pF	2	38	2

*(page 22)

SPECIFICATIONS

Operating Temperature Range .... −55°C to + 125°C
Working Voltage .... 350 Vdc
R. F. Current ....0.25 A maximum
Marking ......"ERIE", Erie part number, voltage rating and terminal identification
DC and Low Frequency Current ....10 A maximum
DC Resistance .... .01 ohm maximum
Cross Channel Coupling ...... 50 dB minimum between all sections
Material ....Silver Plated Brass Case

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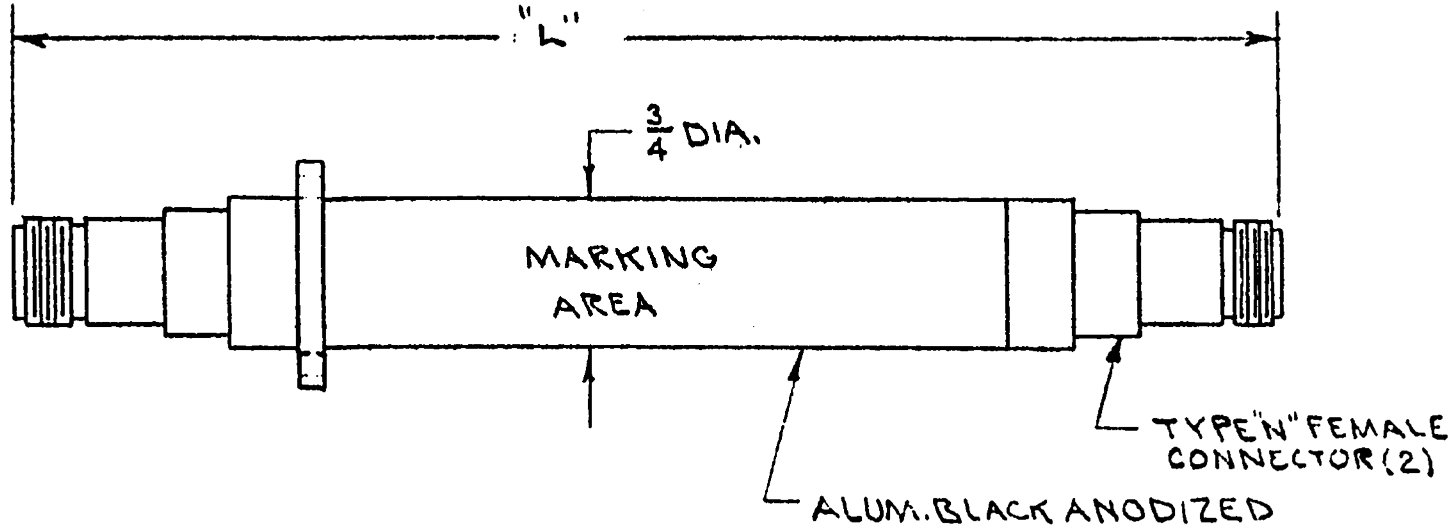
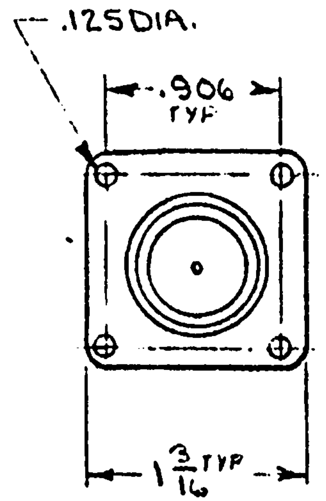
REV.	ECN.	DESCRIPTION	DATE





PRELIMINARY OUTLINE DRAWING

120 MHZ	
70 MHZ	
50 MHZ	
FREQUENCY	"L"

NEXT ASSEMBLY	
1	
2	
TOLERANCES	
DEC.	.X±
	.XX± .02
	.XXX± .010
FRAC.	± 1/32
ANG.	X° ±

K&L MICROWAVE, INC.

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MAT'L: ALUM	FINISH:	
TITLE LOWPASS FILTER		
CODE IDENT. NO. 50140	DRAWING NO. A003-281	

BRUNING 40-21 20657

Table I - SIGNALS DISTRIBUTED FROM MASTER L.O. TO N, E AND W RACKS

FREQUENCY (MHz)	POWER LEVEL AT RACK dBm	CABLES AND CONNECTORS I	CABLES AND CONNECTORS II	POWER DIVIDER	POWER LOSS (dB) Coupler	POWER LOSS (dB) Cable	FUNCTION
5	+10	RG214/U[1] Type N	RG214/U Type N	Merrimac PD-40-17	20	0.25	Standard Frequency
10	+10	"	"	" "	"	0.35	Modem Phase Lock
100±25	-7	3/8" Spirofoam[2] Type N	3/8" Spirofoam Type N	Merrimac PD-4-110	21	0.5	
150±25	-7	"	"	Merrimac PD-40-200	21	0.5	Fine Tuning
200±25	-7	"	"	" "	21	0.75	
250±25	-7	"	"	" "	21	0.75	
600	0	"	"	" PD-40-625	21	2	Phase Comparator Reference
1200/1800	-3	"	141, SMA	Vectronic PD-8305-4M	20	3.5	Standard Frequencies
2400	-3	"	141, SMA	" "	20	4.5	Modem Phase Lock

1. Belden No. 8268

2. Prodelin Cable No. 53-375 (plain) or 54-375 (jacketed)

3. Prodelin Spirolock No. 76-380 (Type N male).