

# **Model FMRR-4**

## **FREQUENCY AGILE**

## **FM REBROADCAST RECEIVER**

## **Guide to Operations**

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**BELAR ELECTRONICS LABORATORY, INC.**

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## **WARRANTY AND ASSISTANCE**

All Belar products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, FOB factory or, in the case of certain major components listed in the instruction manual, for the specified period. Belar will repair or replace products which prove to be defective during the warranty period provided that they are returned to Belar prepaid. No other warranty is expressed or implied. Belar is not liable for consequential damages.

For any assistance, contact your Belar Sales Representative or Customer Engineering Service at the Belar factory.

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# **1 General Information**

## **1-1 General Description**

The Belar FMRR-4 Frequency Agile FM Receiver is a microprocessor controlled, tunable receiver designed for rebroadcasting and other applications that require accurate FM reception and composite output. The FMRR-4 features 10 memory locations for one-button access to 10 stations with call letters. Direct dial of any standard FM frequency is also possible, and UP/DOWN buttons are included. The station's call letters can be programmed into the display with the frequency for quick and easy reference. A sophisticated, multistage filter ensures the highest possible performance.

The precision demodulator features two buffered 75 ohm composite outputs suitable for rebroadcast of mono, stereo, and SCA signals.

## **1-2 Physical Description**

The FMRR-4 is constructed on a standard EIA 1 $\frac{3}{4}$  x 19 inch rack mount panel (one EIA rack unit). Operational controls are front panel mounted. Factory adjustments are located within the unit. The RF input and composite outputs are BNC connectors located on the rear of the unit. Balanced audio (selectable de-emphasis) is available on a rear-mounted XLR-type connector. There is also a headphone jack on the front panel. Two input attenuator switches, a mute switch, and a calibrator switch are located on the rear of the unit. Carrier-fail relay contacts (NO or NC) are also located on the rear panel.

## **1-3 Electrical Description**

The FMRR-4 consists of an RF amplifier section and a precision demodulator section. The RF amplifier is a solid state RF amplifier designed to accurately receive FM signals for measurement and monitoring purposes. It features a proprietary multi-stage filter and digitally-synthesized PLL tuner for maximum performance. Presets and other settings are stored in non-volatile memory in the unit so that no settings are lost in the event of power failure.

The precision demodulator is the same high-quality demod as used in the FMMA-1, The Wizard. It incorporates a highly linear and stable digital pulse counting discriminator to demodulate the FM signal. The demodulator has two 75 ohm buffered composite outputs, and a balanced audio output with selectable de-emphasis on an XLR-type connector.

Upon loss of carrier (or low signal), the unit will automatically mute the audio and composite outputs, and activate the carrier alarm contacts.

## 1-4 Electrical and Mechanical Specifications

RF Input Sensitivity . . . . .	100 $\mu$ V
Signal-to-Noise Ratio:	
100 $\mu$ V input . . . . .	75 dB
500 $\mu$ V input . . . . .	85 dB
RF Input Impedance . . . . .	75 $\Omega$ , BNC Connector
Input Attenuator . . . . .	0, 6, 12, 18 dB
RF Frequency Range . . . . .	87.7 - 108.0 MHZ in 50 kHz increments
Carrier Alarm Relay . . . . .	Form C, 4 watts max, 0.2 amps max, 100 VDC max DO NOT CONNECT 115VAC TO THIS RELAY!
Output . . . . .	two 75 ohm Buffered Composite, 4.2V P-P (1.5 Vrms)
Audio Output . . . . .	600 ohm balanced, XLR-type connector, +10dBm
Headphone Audio Output (front panel) . . . . .	Stereo headphone jack wired mono, 5 Vrms
De-emphasis . . . . .	selectable, 75 $\mu$ sec, 50 $\mu$ sec, or none
Capture Ratio . . . . .	1.5 dB
Selectivity:	
Alternate Channel . . . . .	27 dB
3rd Adjacent Channel . . . . .	46 dB
Harmonic Distortion . . . . .	< 0.03%
@ 1 kHz, 75 kHz deviation	
Separation . . . . .	
1 kHz . . . . .	65 dB
15 kHz . . . . .	55 dB
Dimensions . . . . .	1 EIA Rack Unit 1.75"H x 14.5"D x 19"W
Power Requirements . . . . .	100 to 240 VAC, 50/60 Hz
Power Consumption . . . . .	15 W
Shipping Weight . . . . .	11 lbs.

## **2 Installation**

### **2-1 Initial Inspection**

Check the shipping carton for external damage. If the carton exhibits evidence of abuse in handling (holes, broken corners, etc.), ask the carrier's agent to be present when the unit is unpacked. Carefully unpack the unit to avoid damaging the equipment through use of careless procedures. Inspect all equipment for physical damage immediately after unpacking. Bent or broken parts, dents and scratches should be noted. If damage is found, refer to Paragraph 2-2 for the recommended claim procedure. Keep all packing material for proof of damage claim or for possible future use.

The FMRR-4 is shipped with an instruction book, three wire line cord, and four black rack mount screws.

### **2-2 Claims**

If the unit has been damaged, notify the carrier immediately. File a claim with the carrier or transportation company and advise Belar of such action to arrange the repair or replacement of the unit without waiting for a claim to be settled with the carrier.

### **2-3 Repacking for Shipment**

If the unit is to be returned to Belar, attach a tag to it showing owner and owner's address. A description of the service required should be included on the tag. The original shipping carton and packaging materials should be used for reshipment. If they are not available or reusable, the unit should be repackaged in the following manner:

- a. Use a double-walled carton with a minimum test strength of 275 pounds.
- b. Use heavy paper or sheets of cardboard to protect all surfaces.
- c. Use at least 4 inches of tightly packed, industry approved, shock absorbing material such as extra firm polyurethane foam or rubberized hair. NEWSPAPER IS NOT SUFFICIENT FOR CUSHIONING MATERIAL!
- d. Use heavy duty shipping tape to secure the outside of the carton.
- e. Use large FRAGILE labels on each surface.
- f. Return the unit, freight prepaid. Be sure to insure the unit for full value.

## **2-4 Preparation for Use**

The FMRR-4 Frequency Agile FM Receiver is designed to be mounted in a standard 19-inch rack. When the receiver is mounted above high heat generation equipment such as power amplifiers, consideration should be given to cooling requirements which allow a free movement of cooler air around the FMRR-4. In no instance should the ambient chassis temperature be allowed to rise above 45°C (113°F).

### ***Units beginning with serial number 420071***

These units can be operated from a 100 to 240 VAC single phase, 50-60 Hz power source with no user adjustments. The fuse should be a 5mm x 20mm type GMA-3, 3 AMP-250V (UL/CSA) or T3.15A-250V (IEC) fuse only. A spare fuse is stored in the removable fuse compartment.

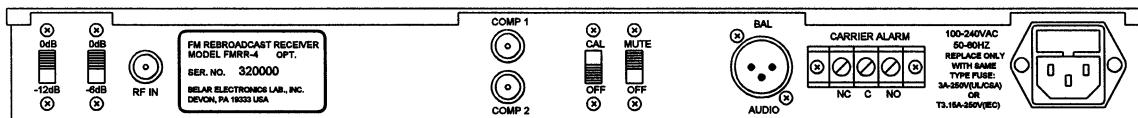
### ***Units prior to serial number 420071***

These units can be operated from either a 105 to 125 Vac or 210 to 250 Vac single phase, 50 to 60 Hz power source. Make sure the unit is set for the proper voltage as follows:

Unplug the line cord. Open the fuse compartment door and pull lever to remove fuse. Using needlenose pliers, pull the voltage select board straight out of the power entry module. While facing the rear of the unit, orient the voltage select board so the desired line voltage is face up and reads correctly ("120" for 115Vac operation, "240" for 230Vac operation. The "100" and "220" positions on the bottom of the board are not used.) Reinsert the board into the power entry module, install the proper fuse (½A 250V for 115Vac, ¼A 250V for 230Vac), close the fuse door, and plug the line cord back in.

## 2-5 Interconnections & Controls

### FMRR-4 Rear Panel Jacks and Switches



#### RF IN

RF Input: connect your receiving antenna to this input.

#### 0dB-6dB

#### 0dB-12dB

These attenuation switches reduce the RF input level by 6 dB, 12 dB, or 18 dB. These switches may be used in high signal strength areas to prevent overload and for optimum signal-to-noise ratio.

#### COMP1

#### COMP2

These two jacks provide separate 75 ohm buffered composite outputs.

#### CAL

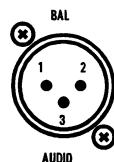
This switch turns on the internal calibrator on the demod, when a calibration tone is required (for use with the Belar FMS-2 Stereo monitor, for example).

#### MUTE

When enabled, the unit mutes the audio and composite outputs when the receiving frequency is weak or non-existent.

#### XLR Connector

Audio Out, 600Ω, balanced, +10 dBm. Pin 1 is ground, pin 2 is+, pin 3 is-.



#### Carrier Alarm

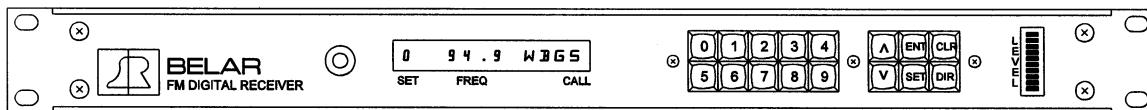
Provides a contact closure or opening, depending on which contacts are used, upon loss of carrier or low signal level. Contacts are rated at 4 watts, 0.2 amps max, 100 Vdc max. DO NOT USE THIS RELAY TO DIRECTLY SWITCH 115Vac CIRCUITS.

## 3 Operation

### 3-1 Initial Operation

1. Connect your receiving antenna cable to the RF Input Jack on the back of the unit. A good antenna positioned for minimum multipath is critical to achieving good reception.
2. Ensure the unit is set for the proper line voltage (see *Section 2-4*) and plug in the line cord.

### 3-2 Front Panel Indicators and Controls



The Belar FMRR-4 has 10 preset memory locations for one-touch access. In addition, direct entry of frequencies is possible, as is manually scaling up or down the band. The display shows the currently selected preset, frequency and call letters (when programmed).

The RF Level indicator shows the relative strength of the RF Input. At least 1 indicator bar must be lit for the mute to operate.

The stereo headphone jack is wired for mono and is suitable for headphone impedances of 200 ohms or greater. A mono headphone plug should not be used in this jack as it will short the output.

### 3-3 Setting or Changing the preset

Press **SET**. The unit will flash **ENTER PRESET** and blank out. Press the desired memory location (**0-9**). The unit will flash **ENTER FREQ** and blank out. Using the numeric keypad, enter the desired frequency. If you press the trailing **0** (e.g. you enter **88.10**) the frequency will be automatically entered; if you omit the trailing **0** (e.g. **88.1**) you must press **ENT** to select the frequency. The unit will then flash **ENTER CALL** and display **W** (the suggested first letter). Use the **Λ** and **∨** keys to run through the alphabet for the first character of the call letter display. Then press **ENT** to move to the next character position. When all the call letters are entered, press **ENT** a final time to store the frequency and call letters in the memory location you selected.

### **3-4 Preset Selection**

Press the desired preset number (**0-9**). The programmed station will be tuned in and the display will indicate the frequency and call letters (if programmed). If the preset has never been programmed, the unit will display NO PROGRAM.

### **3-5 Direct Dial (for non-programmed stations)**

Press **DIR**. The unit will prompt **ENTER FREQ.** and blank out. Using the numeric keypad, enter the desired frequency. If you press the trailing **0** (e.g. you enter **88.10**) the frequency will be automatically entered; if you omit the trailing **0** (e.g. **88.1**) you must press **ENT** to select the frequency.

### **3-6 Manual Scanning**

Use the **Λ** and **∨** keys to manually step up or down the FM band, in 50 kHz increments. The tuning range of the FMRR-4 is from 87.7 MHZ to 108.0 MHZ.

### **3-7 De-emphasis**

The de-emphasis is set at the factory at  $75\mu$ -seconds unless  $50\mu$ -seconds was specified with order. The de-emphasis is easily changed with Jumper P2 (see FMRR-1A/4 A4 Demodulator Board Connections & Adjustments diagram in Section 4). The  $75\mu$ -second setting is with the jumper toward the front of the unit; the  $50\mu$ -second setting is with jumper toward the rear of the unit. Removing the jumper completely removes the de-emphasis.

## 4 Diagrams, Schematics and Parts Lists

**Replaceable Parts.** This page contains information for ordering replaceable parts for the unit. The tables that follow list the parts in alphanumeric order by reference designation and provides a description of the part with the Belar part number.

**Ordering Information.** To order a replacement part from Belar, address the order or inquiry to Belar and supply the following information:

- a. Model number and serial number of unit.
- b. Description of part, *including the reference designation and location.*

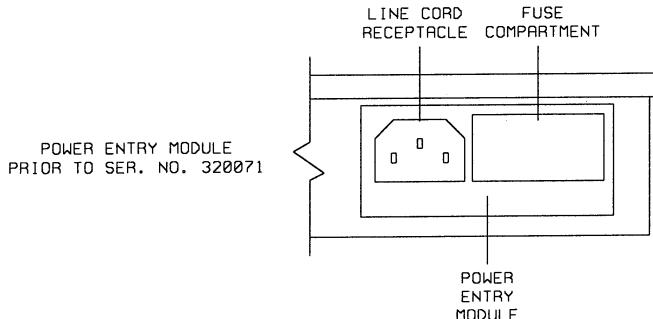
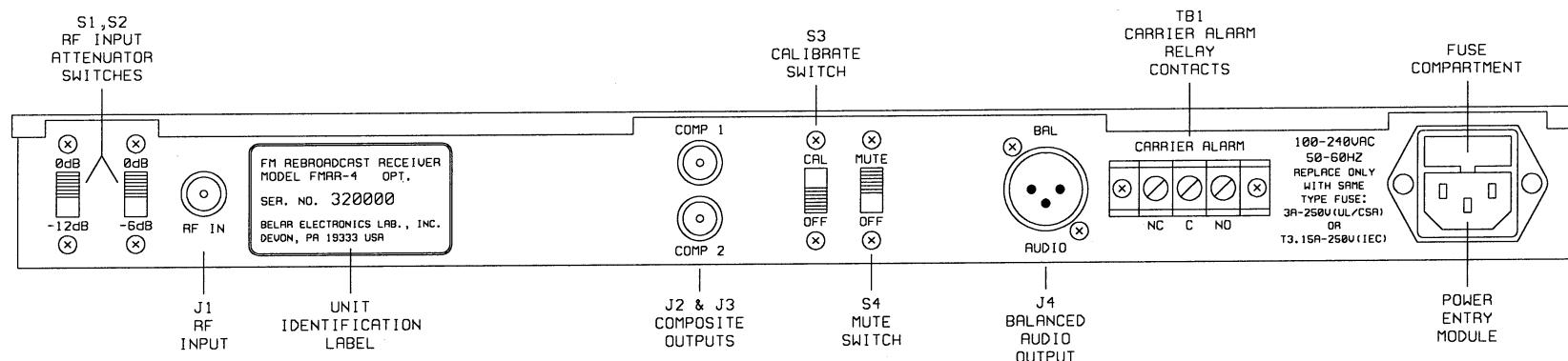
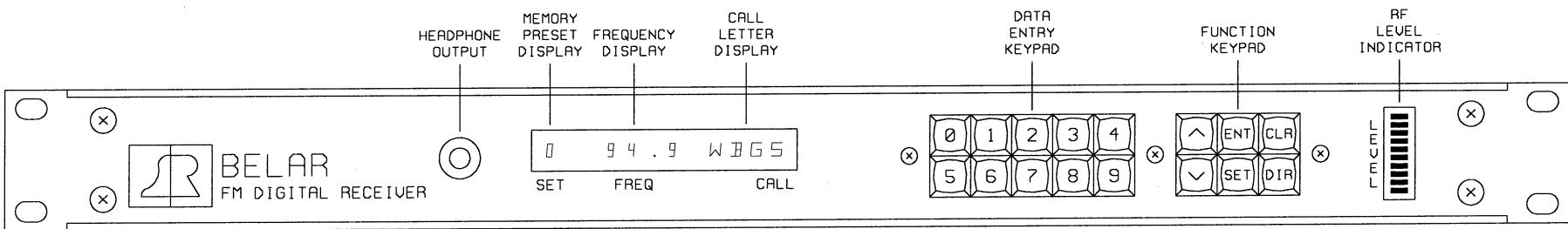
Orders may also be taken over the telephone. Parts orders can be put on your VISA, MasterCard, or American Express card, or we can ship them COD.

### REFERENCE DESIGNATORS

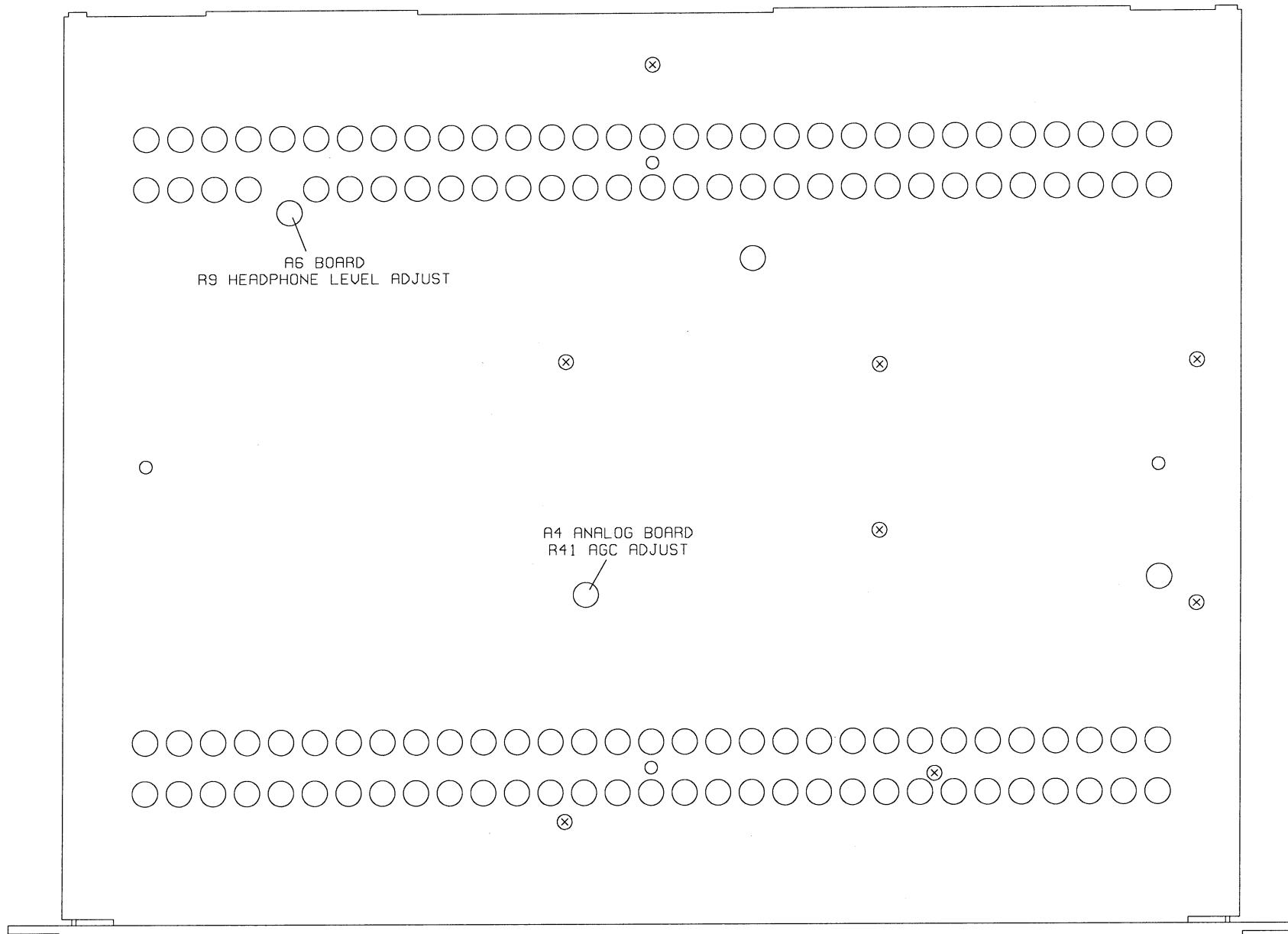
A	= assembly	J	= jack	S	= switch
BR	= diode bridge	L	= inductor	T	= transformer
C	= capacitor	M	= meter	TB	= terminal block
CR	= diode or LED	P	= plug	U	= integrated circuit
DS	= display or lamp	Q	= transistor	W	= cable
F	= fuse	R	= resistor	X	= socket
FL	= filter	RL	= relay	Y	= crystal
HDR	= header connector	RN	= resistor network		

### ABBREVIATIONS

BCD	= binary coded decimal	PIV	= peak inverse voltage
CER	= ceramic	POLY	= polystyrene
COMP	= composition	PORC	= porcelain
CONN	= connector	POT	= potentiometer
DPM	= digital panel meter	SEMICON	= semiconductor
ELEC	= electrolytic	SI	= silicon
GE	= germanium	TANT	= tantalum
IC	= integrated circuit	uF	= microfarads
k	= kilo = 1,000	V	= volt
M	= meg = 1,000,000	VAR	= variable
MOD	= modulation	VDCW	= dc working volts
MY	= Mylar	W	= watts
PC	= printed circuit	WW	= wirewound
pF	= picofarads		



FMRR-4 FRONT & REAR VIEW  
BELAR ELECTRONICS



FMRR-4  
TOP COVER ADJUSTMENT HOLE LOCATIONS  
BELAR ELECTRONICS

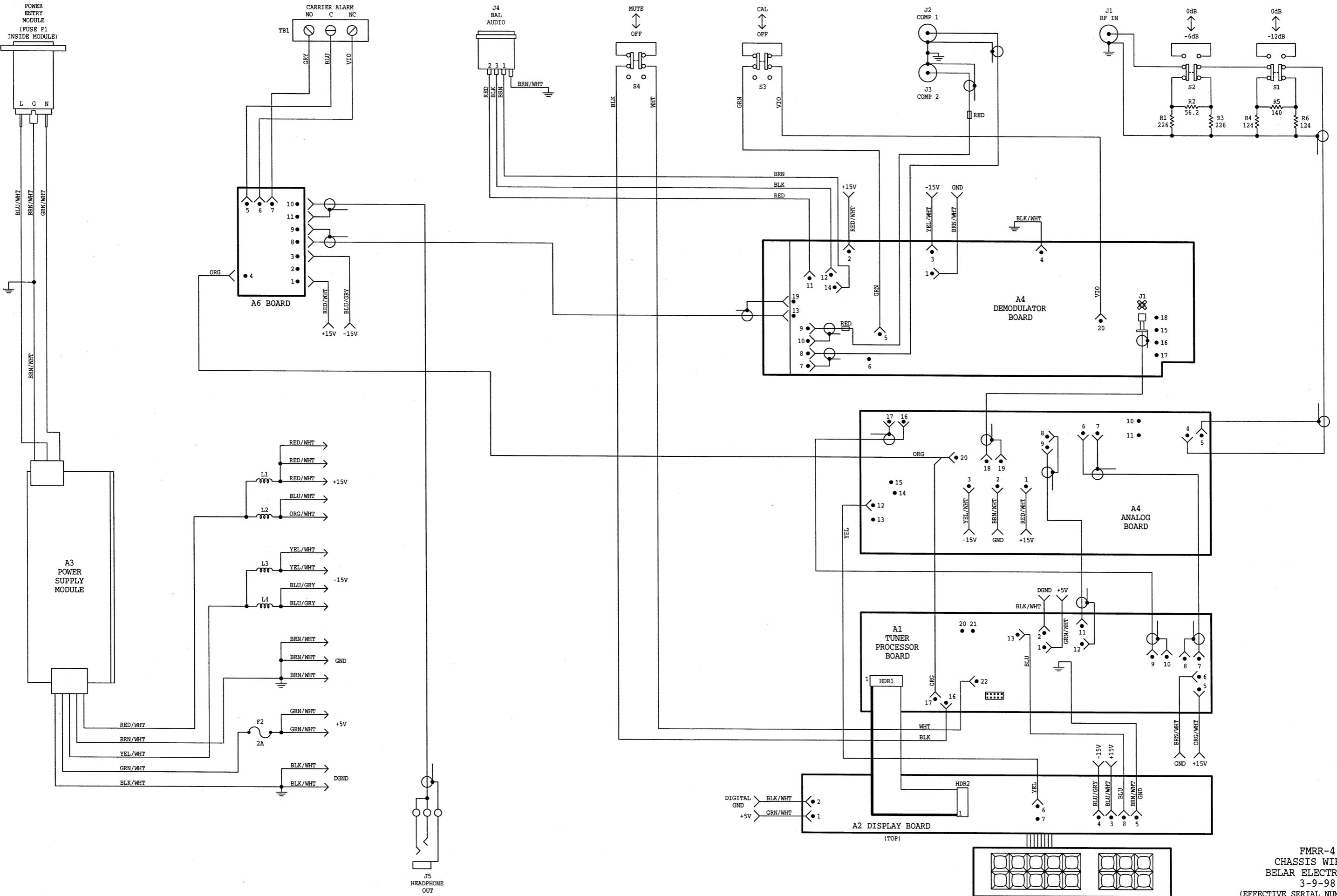
FMRR-4 PARTS LISTS

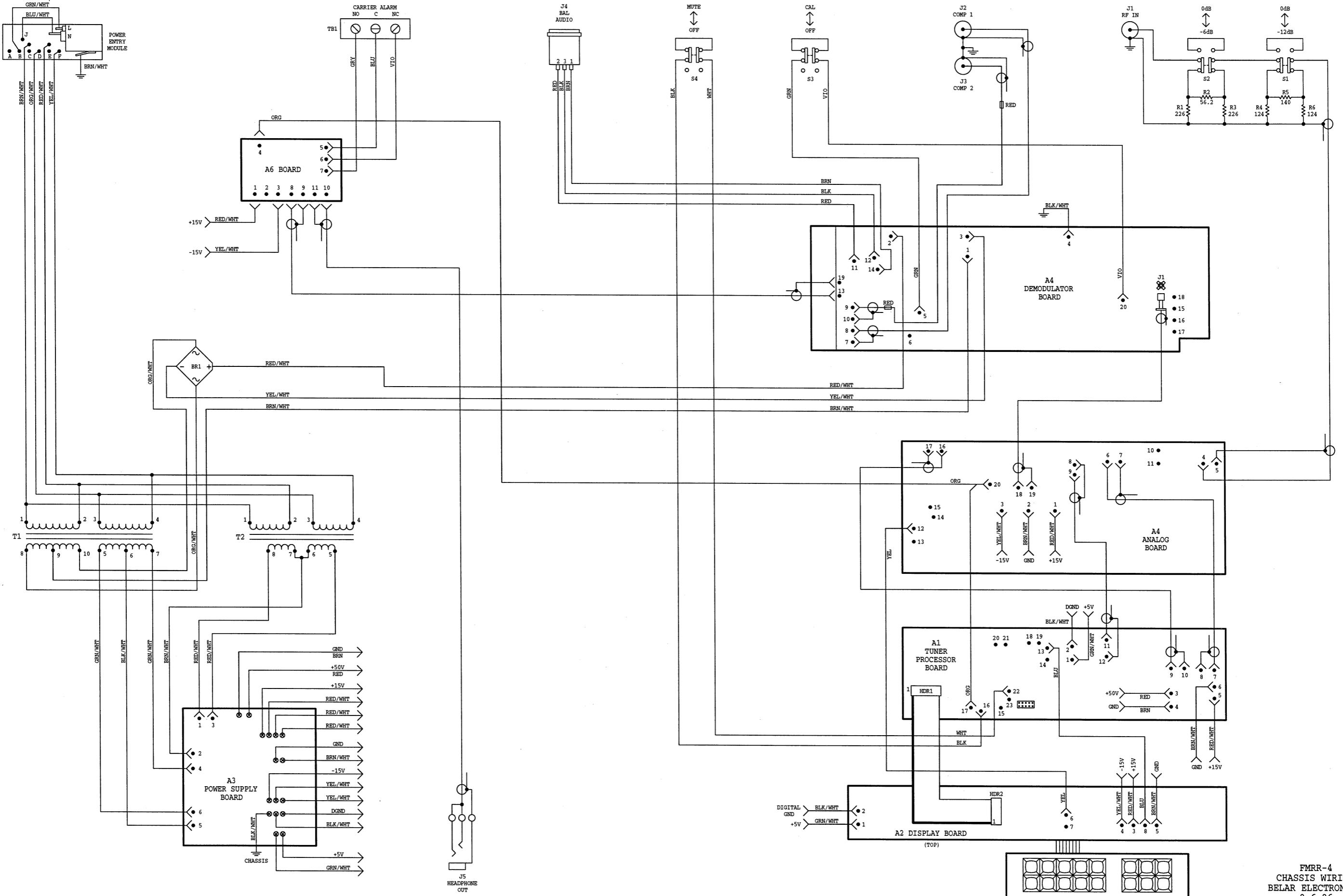
**MAIN CHASSIS**

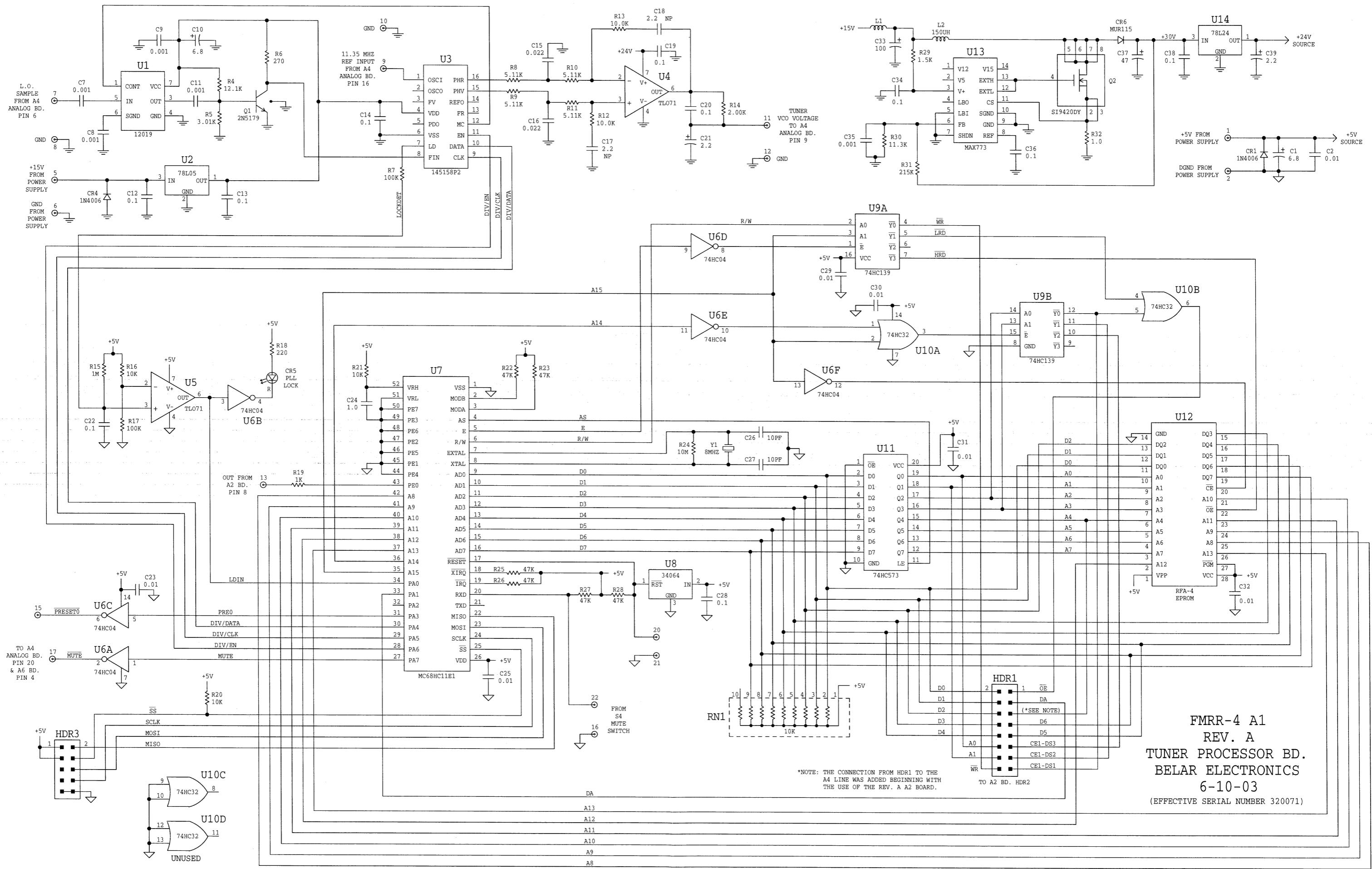
Reference Designation	Description	Part Number
A3	POWER SUPPLY MODULE: 15V, 15W	(note 2) 4005-0019A
--	POWER ENTRY MODULE: 6EGG1-1	(note 2) 0360-0021
F1	FUSE: GMA-3A 250V(UL/CSA) or T3.15A-250V(IEC)	(note 2) 2110-0009
--	FUSE HOLDER: CHASSIS MOUNT	(note 2) 2110-0010
F2	FUSE: AGC-2A 250V	(note 2) 2110-0006
--	POWER ENTRY MODULE: 6J4	(note 1) 0360-0020
	FUSE: AGC 1/2A 250V	(note 1) 2110-0001
BR1	DIODE: BRIDGE KBPC602 GI	(note 1) 1900-0025
J1 thru J3	JACK: BNC	0360-0005
J4	JACK: XLR MALE	0360-0047
J5	JACK: HEADPHONE	0365-0044
L1 thru L4	CHOKE: RF	(note 2) 9140-0011
R1	R: METAL FILM 226 1%	0721-2260
R2	R: METAL FILM 56.2 1%	0721-56R2
R3	R: METAL FILM 226 1%	0721-2260
R4	R: METAL FILM 124 1%	0721-1240
R5	R: METAL FILM 140 1%	0721-1400
R6	R: METAL FILM 124 1%	0721-1240
S1 thru S4	SWITCH: SLIDE, DPDT	3102-0003
T1	TRANSFORMER: POWER, DMPC-Y-12	(note 1) 9100-0020
T2	TRANSFORMER: POWER, DPC-34-700	(note 1) 9100-0022
TB1	TERMINAL BLOCK: 3 POSITION	0360-0051
--	FLAT CABLE ASSEMBLY: 16 CONDUCTOR	8900-0014
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004

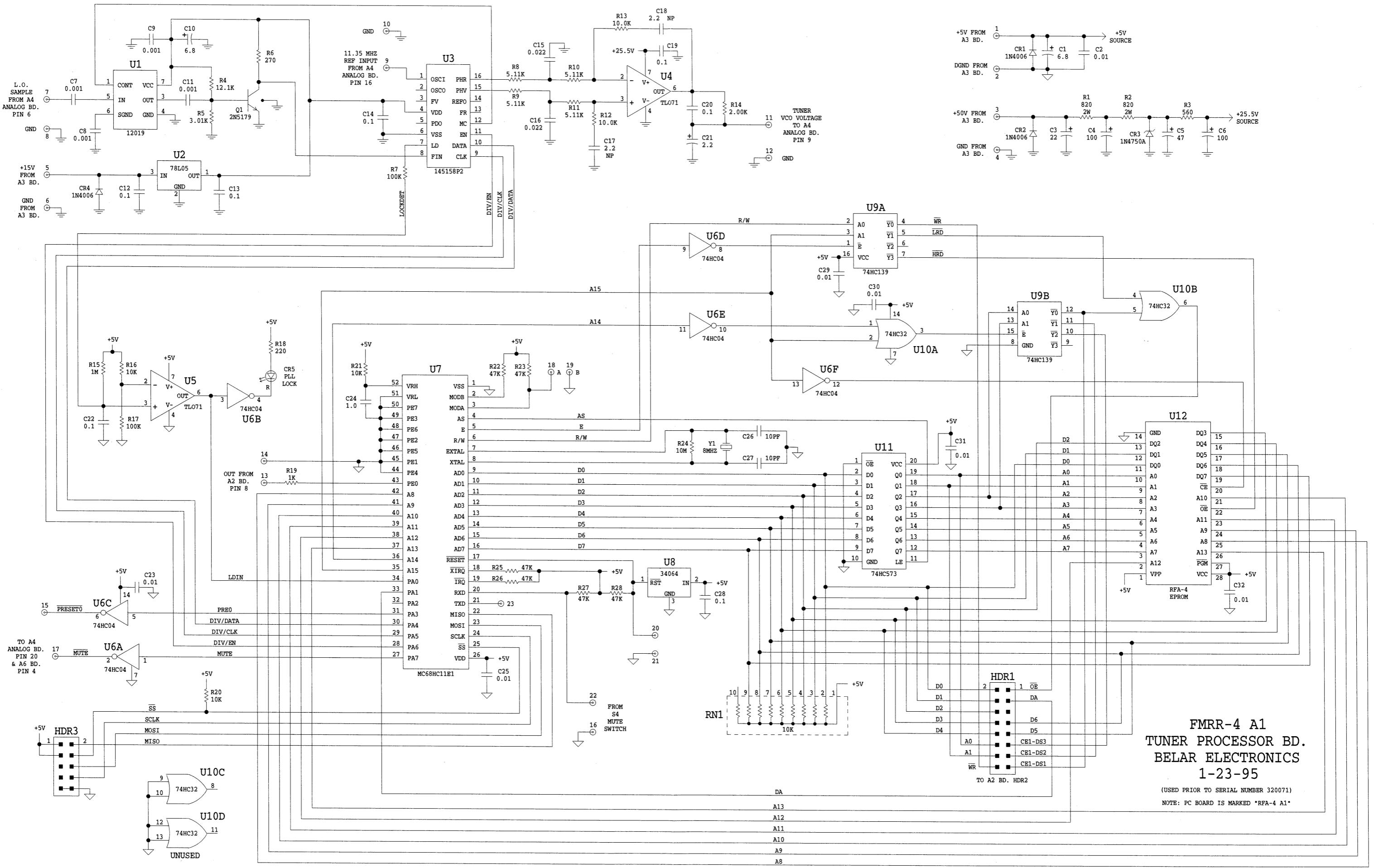
note 1: USED PRIOR TO SERIAL NUMBER 320071.

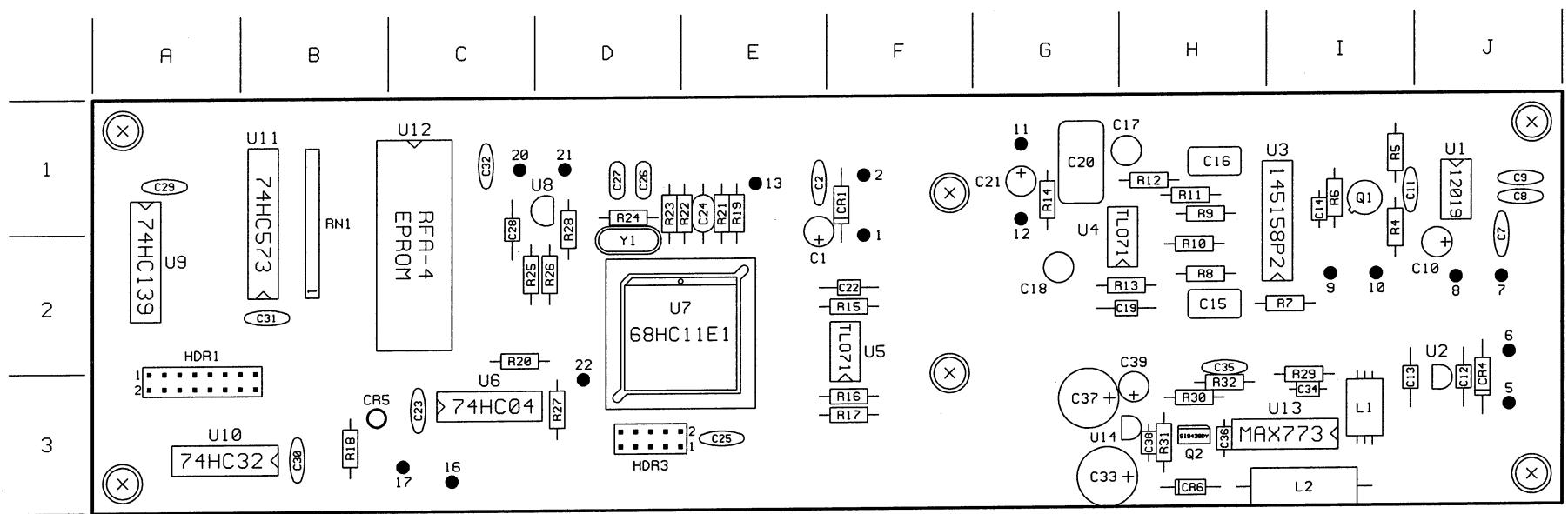
note 2: USED BEGINNING SERIAL NUMBER 320071.



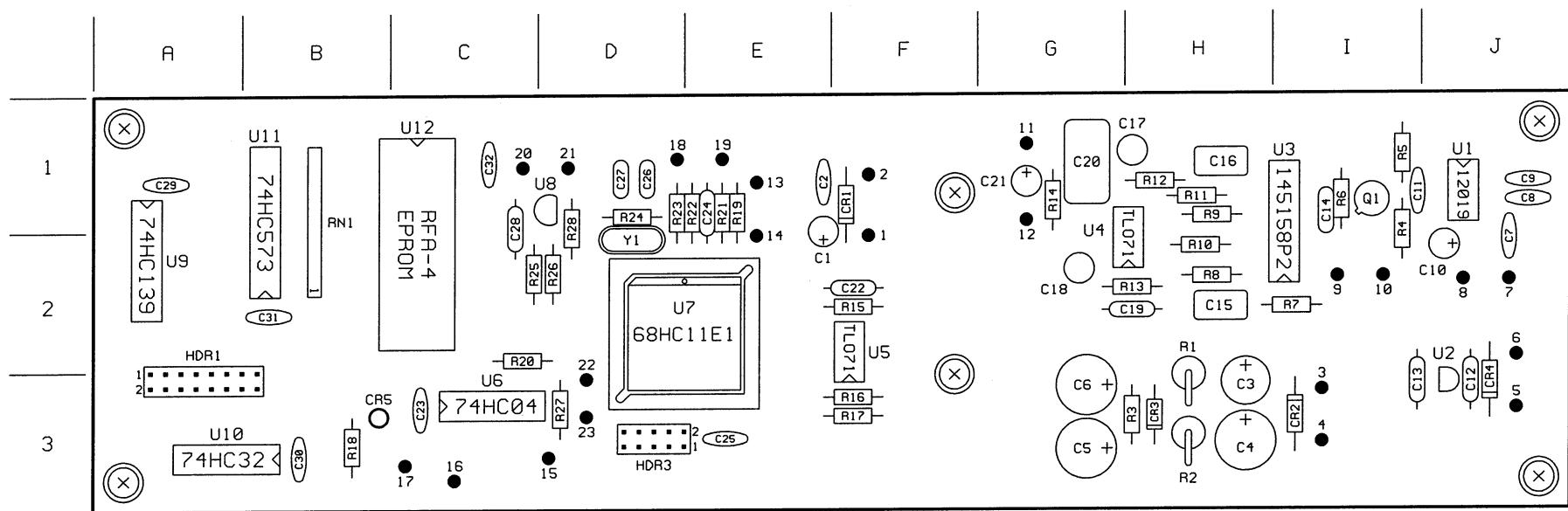








FMRR-4 A1  
REV. A  
TUNER PROCESSOR BOARD  
COMPONENT LAYOUT  
BELAR ELECTRONICS  
(EFFECTIVE SERIAL NUMBER 320071)



FMRR-4 A1  
TUNER PROCESSOR BOARD  
COMPONENT LAYOUT  
BELAR ELECTRONICS  
(USED PRIOR TO SERIAL NUMBER 320071)

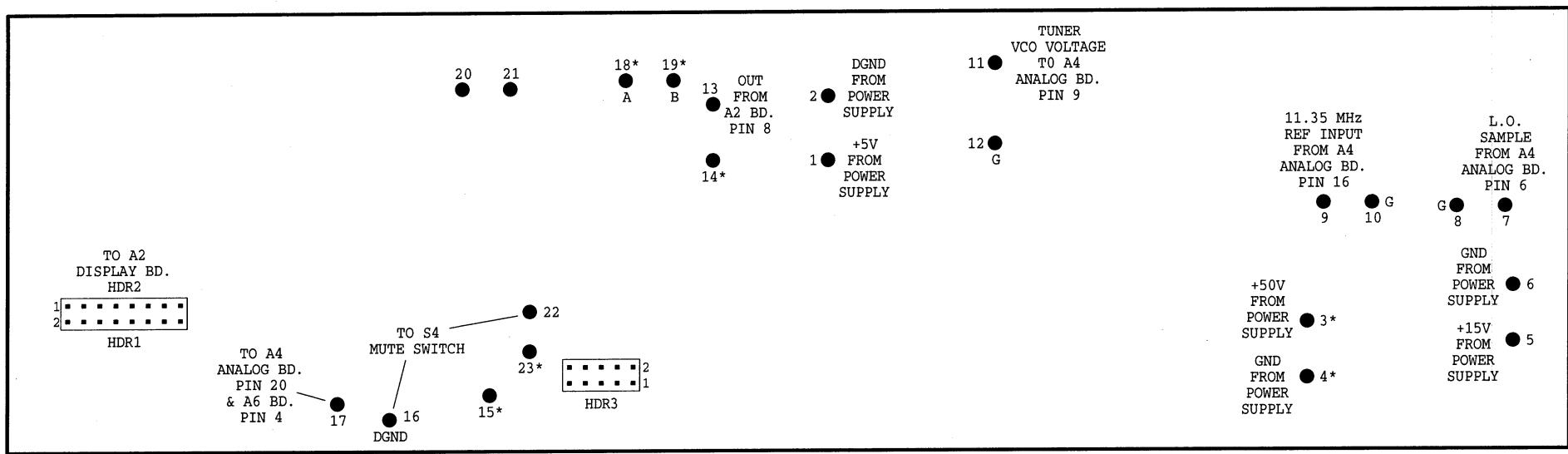
NOTE: PC BOARD IS MARKED "RFA-4 A1"

FMRR-4 A1 BOARD  
PART LOCATIONS

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1 E2	C27 D1	Q1 I1	R24 D1	Y1 D2
C2 E1	C28 C1	Q2# H3	R25 C2	
C3* H3	C29 A1		R26 D2	<u>pins</u>
C4* H3	C30 B3	R1* H3	R27 D3	1 F2
C5* G3	C31 B2	R2* H3	R28 D1	2 F1
C6* G3	C32 C1	R3* H3	R29# I3	3* I3
C7 J2	C33# G3	R4 I2	R30# H3	4* I3
C8 J1	C34# I3	R5 I1	R31# H3	5 J3
C9 J1	C35# H3	R6 I1	R32# H3	6 J2
C10 J2	C36# H3	R7 I2		7 J2
C11 I1	C37# G3	R8 H2	RN1 B1	8 J2
C12 J3	C38# H3	R9 H1		9 I2
C13 I3	C39# H3	R10 H2	U1 J1	10 I2
C14 I1		R11 H1	U2 J3	11 G1
C15 H2	CR1 F1	R12 H1	U3 I1	12 G1
C16 H1	CR2* I3	R13 H2	U4 H2	13 E1
C17 H1	CR3* H3	R14 G1	U5 F2	14* E2
C18 G2	CR4 J3	R15 F2	U6 C3	15* D3
C19 H2	CR5 B3	R16 F3	U7 D2	16 C3
C20 G1	CR6# H3	R17 F3	U8 D1	17 C3
C21 G1		R18 B3	U9 A2	18* D1
C22 F2	HDR1 A3	R19 E1	U10 A3	19* E1
C23 C3	HDR3 D3	R20 C2	U11 B1	20 C1
C24 E1		R21 E1	U12 C2	21 D1
C25 E3	L1# I3	R22 E1	U13# I3	22 D3
C26 D1	L2# I3	R23 D1	U14# I3	23* D3

\*NOTE: USED PRIOR TO SERIAL NUMBER 320071.

#NOTE: USED BEGINNING SERIAL NUMBER 320071.



FMRR-4 A1  
TUNER PROCESSOR BOARD  
CONNECTION DRAWING  
BELAR ELECTRONICS

A1 BOARD FMRR-4

Reference Designation	Description	Part Number
C1	C: FIXED TANT 6.8uF 25V	0185-0002
C2	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C3 (note 1)	C: FIXED ELEC 22uF 100V	0180-0031
C4 (note 1)	C: FIXED ELEC 100uF 63V	0180-0032
C5 (note 1)	C: FIXED ELEC 47uF 50V	0180-0017
C6 (note 1)	C: FIXED ELEC 100uF 35V	0180-0018
C7 thru C9	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C10	C: FIXED TANT 6.8uF 25V	0185-0002
C11	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C12 thru C14	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C15, C16	C: FIXED POLY 0.022uF 10% 100V	0122-2231
C17, C18	C: FIXED ELEC 2.2uF 50V NON-POLAR	0180-0030
C19	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C20	C: FIXED POLY 0.1uF 10% 100V	0122-1041
C21	C: FIXED TANT 2.2uF 35V	0185-0009
C22	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C23	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C24	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C25	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C26, C27	C: FIXED MICA 10pF 5%	0142-1005
C28	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C29 thru C32	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C33 (note 2)	C: FIXED ELEC 100uF 35V	0180-0018
C34 (note 2)	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C35 (note 2)	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C36 (note 2)	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C37 (note 2)	C: FIXED ELEC 47uF 50V	0180-0017
C38 (note 2)	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C39 (note 2)	C: FIXED TANT 2.2uF 35V	0185-0009
CR1	DIODE: 1N4006	1900-0016
CR2 (note 1)	DIODE: 1N4006	1900-0016
CR3 (note 1)	DIODE: 1N4750A	1900-0004
CR4	DIODE: 1N4006	1900-0016
CR5	LED: RED	1910-0004
CR6 (note 2)	DIODE: MUR115	1900-0034
HDR1	HEADER: 16 PIN	0361-0016
HDR3	HEADER: 10 PIN	0361-0010
L1 (note 2)	CHOKE: RF	9140-0011
L2 (note 2)	CHOKE: 150 uH	9140-0150
Q1	TRANSISTOR: 2N5179	1850-0023
Q2 (note 2)	TRANSISTOR: SI9420DY	1850-0035

note 1: Used prior to serial number 320071.

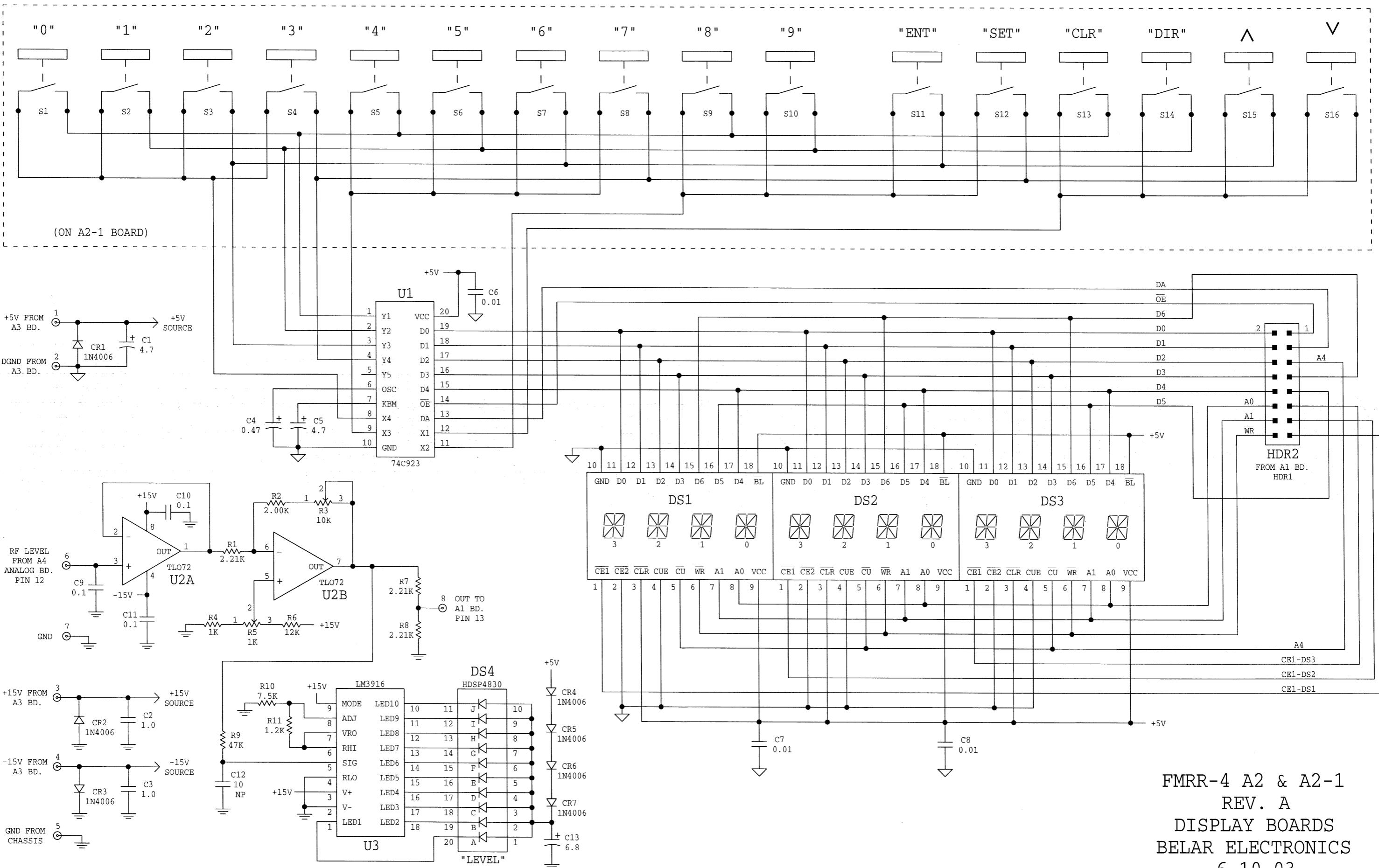
note 2: Used beginning serial number 320071.

A1 BOARD FMRR-4 CONT.

Reference Designation	Description	Part Number
R1, R2 (note 1)	R: WIREWOUND 820 5% 2W	0811-0020
R3 (note 1)	R: METAL FILM 560 2% 1/4W	0751-5612
R4	R: METAL FILM 12.1k 1%	0721-1212
R5	R: METAL FILM 3.01k 1%	0721-3011
R6	R: METAL FILM 270 2% 1/4W	0751-2712
R7	R: METAL FILM 100k 2% 1/4W	0751-1042
R8 thru R11	R: METAL FILM 5.11k 1%	0721-5111
R12, R13	R: METAL FILM 10.0k 1%	0721-1002
R14	R: METAL FILM 2.00k 1%	0721-2001
R15	R: METAL FILM 1M 2% 1/4W	0751-1052
R16	R: METAL FILM 10k 2% 1/4W	0751-1032
R17	R: METAL FILM 100k 2% 1/4W	0751-1042
R18	R: METAL FILM 220 2% 1/4W	0751-2212
R19	R: METAL FILM 1k 2% 1/4W	0751-1022
R20, R21	R: METAL FILM 10k 2% 1/4W	0751-1032
R22, R23	R: METAL FILM 47k 2% 1/4W	0751-4732
R24	R: FIXED CARBON 10M 5% 1/4W	0683-1065
R25 thru R28	R: METAL FILM 47k 2% 1/4W	0751-4732
R29 (note 2)	R: METAL FILM 1.5k 2% 1/4W	0751-1522
R30 (note 2)	R: METAL FILM 11.3k 1%	0721-1132
R31 (note 2)	R: METAL FILM 215k 1%	0721-2153
R32 (note 2)	R: METAL FILM 1.0 2% 1/4W	0751-1R02
RN1	R: NETWORK 10 PIN 10k	0910-1032
U1	IC: 12019	1822-0059
U2	IC: 78L05CP	1826-0012
U3	IC: 145158P2	1823-0003
U4, U5	IC: TLO71	1826-0004
U6	IC: 74HC04	1822-0041
U7	IC: MC68HC11E1	1840-0010
U8	IC: MC34064	1826-0048
U9	IC: 74HC139	1822-0048
U10	IC: 74HC32	1822-0043
U11	IC: 74HC573	1822-0052
U12	IC: RFA-4 EPROM	1840-0003C
U13 (note 2)	IC: MAX773	1826-0059
U14 (note 2)	IC: 78L24CP	1826-0012
Y1	XTAL: 8 MHz	0411-0005

note 1: Used prior to serial number 320071.

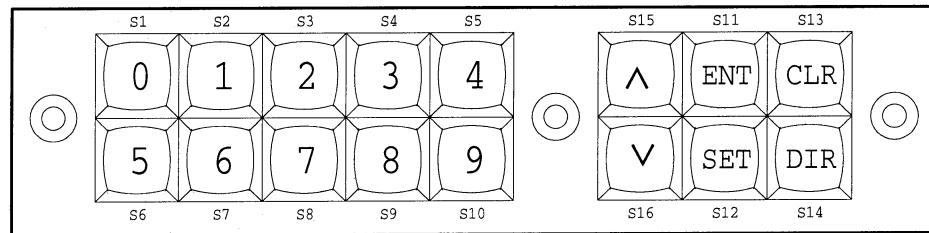
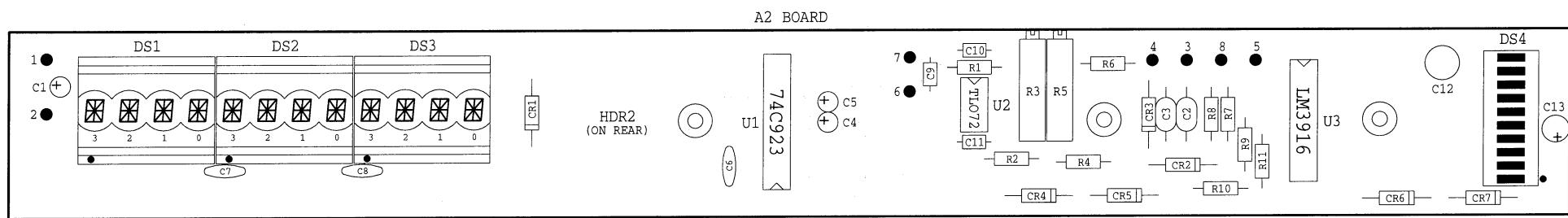
note 2: Used beginning serial number 320071.



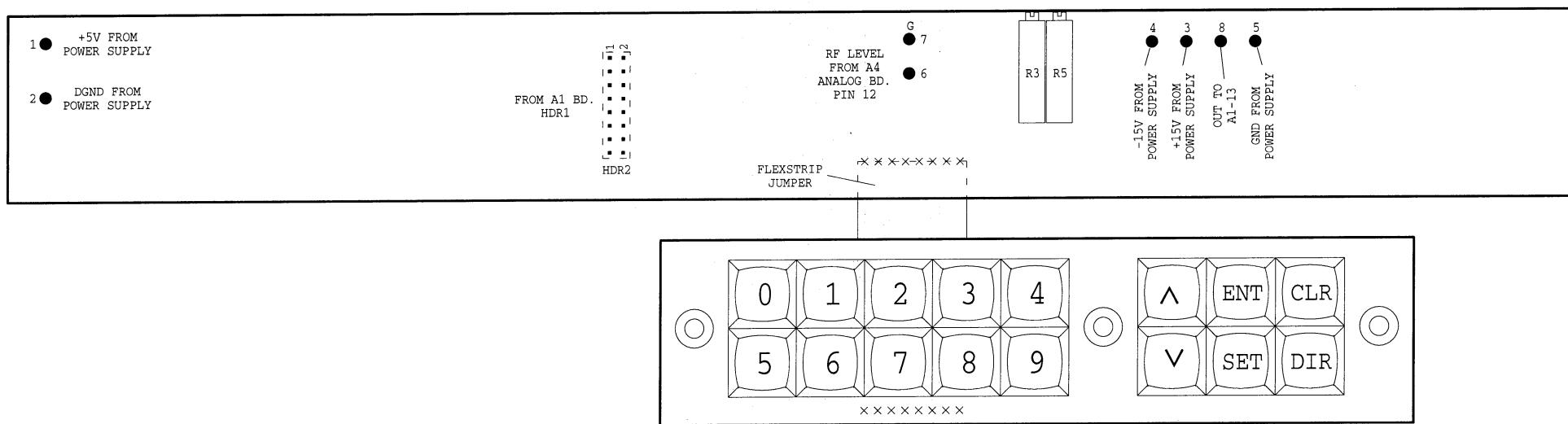
FMRR-4 A2 & A2-1  
REV. A  
DISPLAY BOARDS  
BELAR ELECTRONICS  
6-10-03

PRIOR TO REV. A OF THE A2 BOARD, PIN 5 OF DS1 THRU DS3 WAS CONNECTED TO +5V.

NOTE: PC BOARDS ARE MARKED "RFA-4 A2 & RFA-4 A2-1"



FMRR-4 A2 & A2-1  
REV. A  
DISPLAY BOARDS  
COMPONENT LAYOUT  
BELAR ELECTRONICS

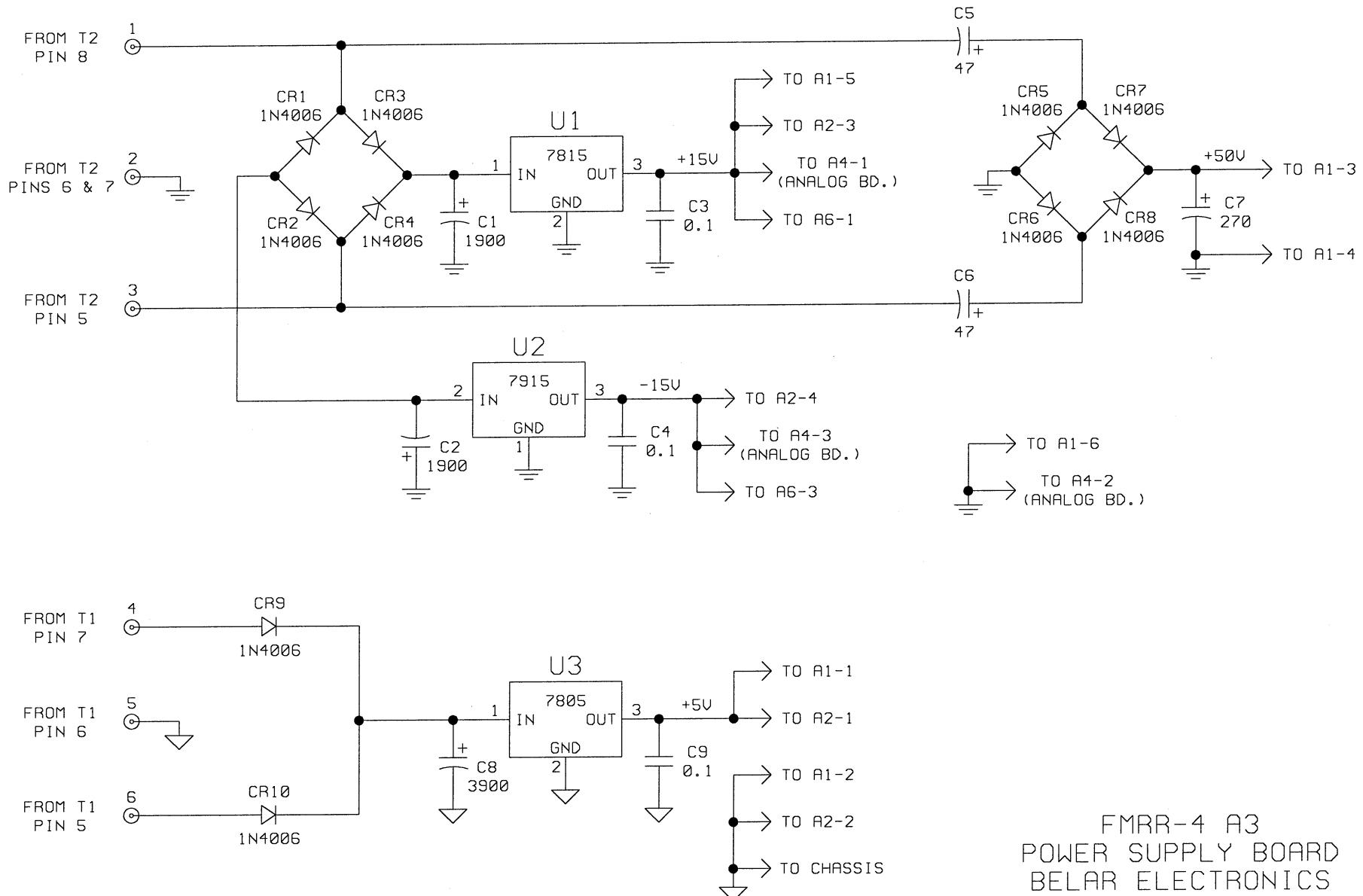


FMRR-4 A2 BOARD  
REV. A  
CONNECTIONS & ADJUSTMENTS  
BELAR ELECTRONICS

NOTE: PC BOARD IS MARKED "RFA-4 A2"

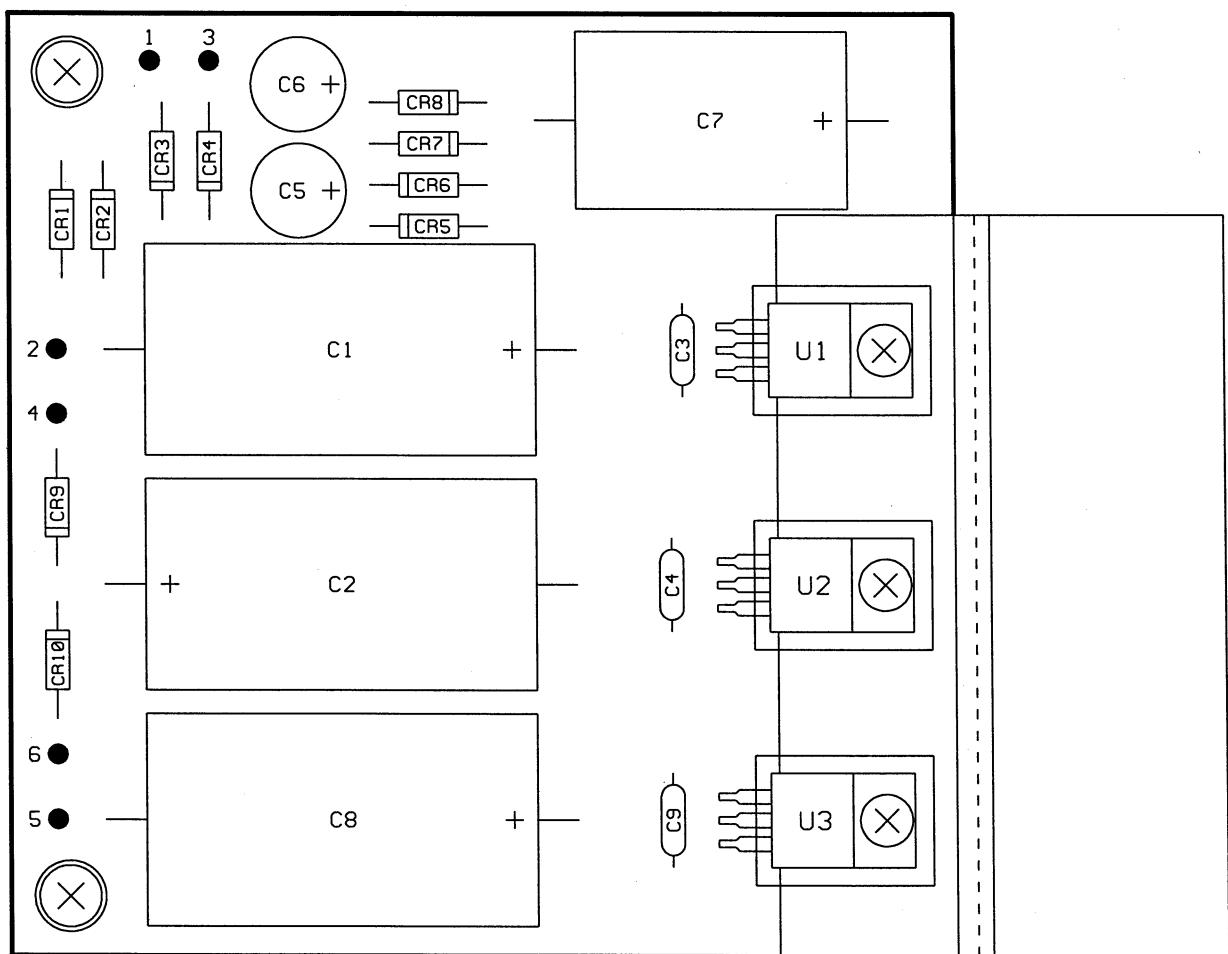
A2 BOARD FMRR-4, REV. A  
 (Note: pc board is marked "RFA-4 A2")

Reference Designation	Description	Part Number
C1	C: FIXED TANT 4.7uF 10V	0185-0001
C2 , C3	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C4	C: FIXED TANT 0.47uF 35V	0185-0008
C5	C: FIXED TANT 4.7uF 10V	0185-0001
C6 thru C8	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C9 thru C11	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C12	C: FIXED ELEC 10uF 35V NON-POLAR	0180-0029
C13	C: FIXED TANT 6.8uF 25V	0185-0002
CR1 thru CR7	DIODE: 1N4006	1900-0016
DS1 thru DS3	DISPLAY: HDLO-2416 <small>(prior to rev. A, DS1 thru DS3 were the HPDL2416 display,      Belar P/N 1930-0005. These parts are not interchangeable.)</small>	1930-0008
DS4	DISPLAY: HDSP-4830	1930-0006
HDR2	HEADER: 16 PIN	0361-0016
R1	R: METAL FILM 2.21k 1%	0721-2211
R2	R: METAL FILM 2.00k 1%	0721-2001
R3	R: VAR COMP 10k, 10 TURN	2100-0018
R4	R: METAL FILM 1k 2% 1/4W	0751-1022
R5	R: VAR COMP 1k, 10 TURN	2100-0023
R6	R: METAL FILM 12k 2% 1/4W	0751-1232
R7 , R8	R: METAL FILM 2.21k 1%	0721-2211
R9	R: METAL FILM 47k 2% 1/4W	0751-4732
R10	R: METAL FILM 7.5k 2% 1/4W	0751-7522
R11	R: METAL FILM 1.2k 2% 1/4W	0751-1222
S1 thru S16	SWITCH: PUSHBUTTON, MOMENTARY <small>(ON A2-1 BOARD)</small>	3105-0001
U1	IC: 74C923	1823-0006
U2	IC: TLO72	1826-0038
U3	IC: LM3916	1826-0049



NOTE: PC BOARD IS MARKED "RFA A3"

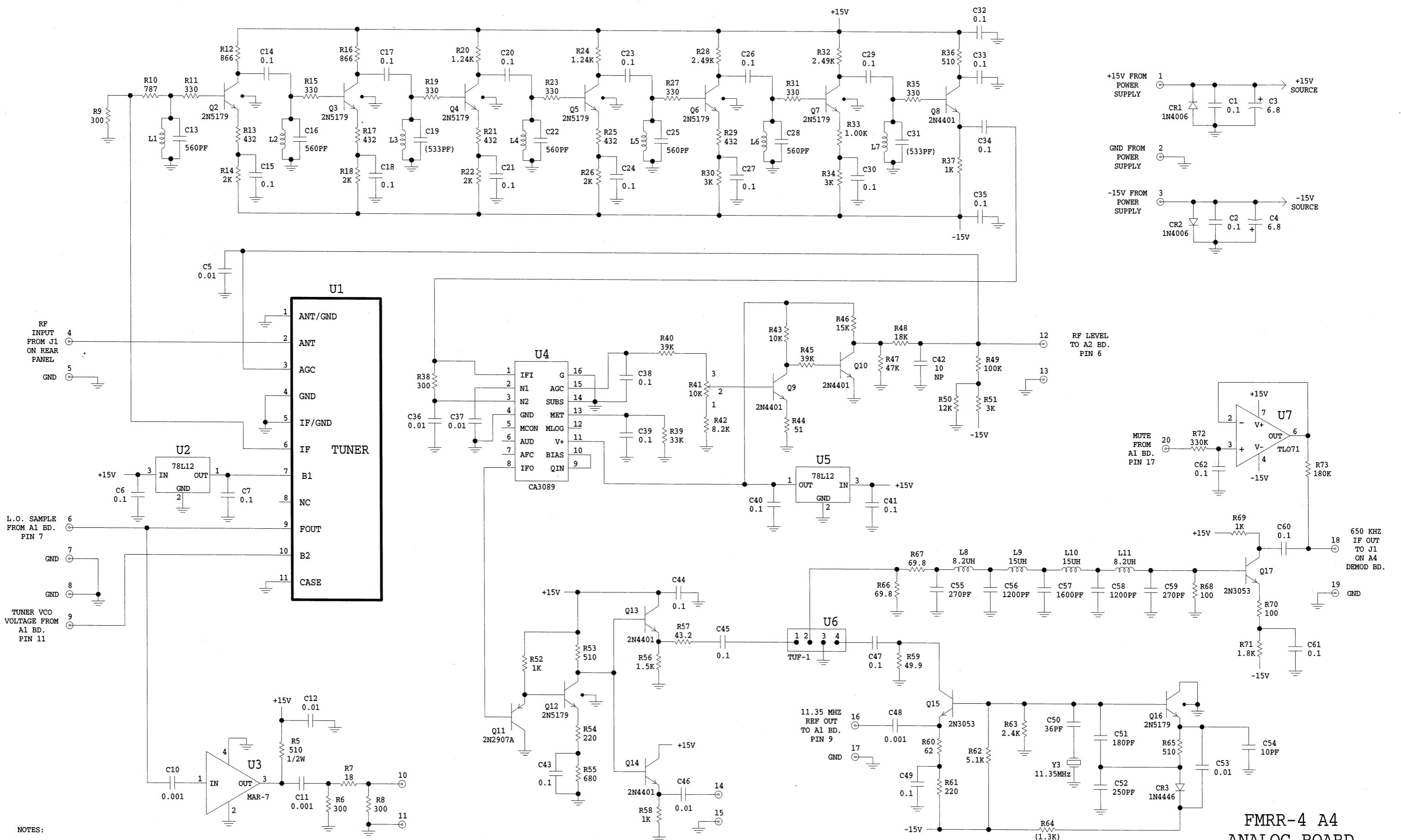
FMRR-4 A3  
POWER SUPPLY BOARD  
BELAR ELECTRONICS  
11-14-94  
(ONLY USED PRIOR TO SERIAL NUMBER 320071)



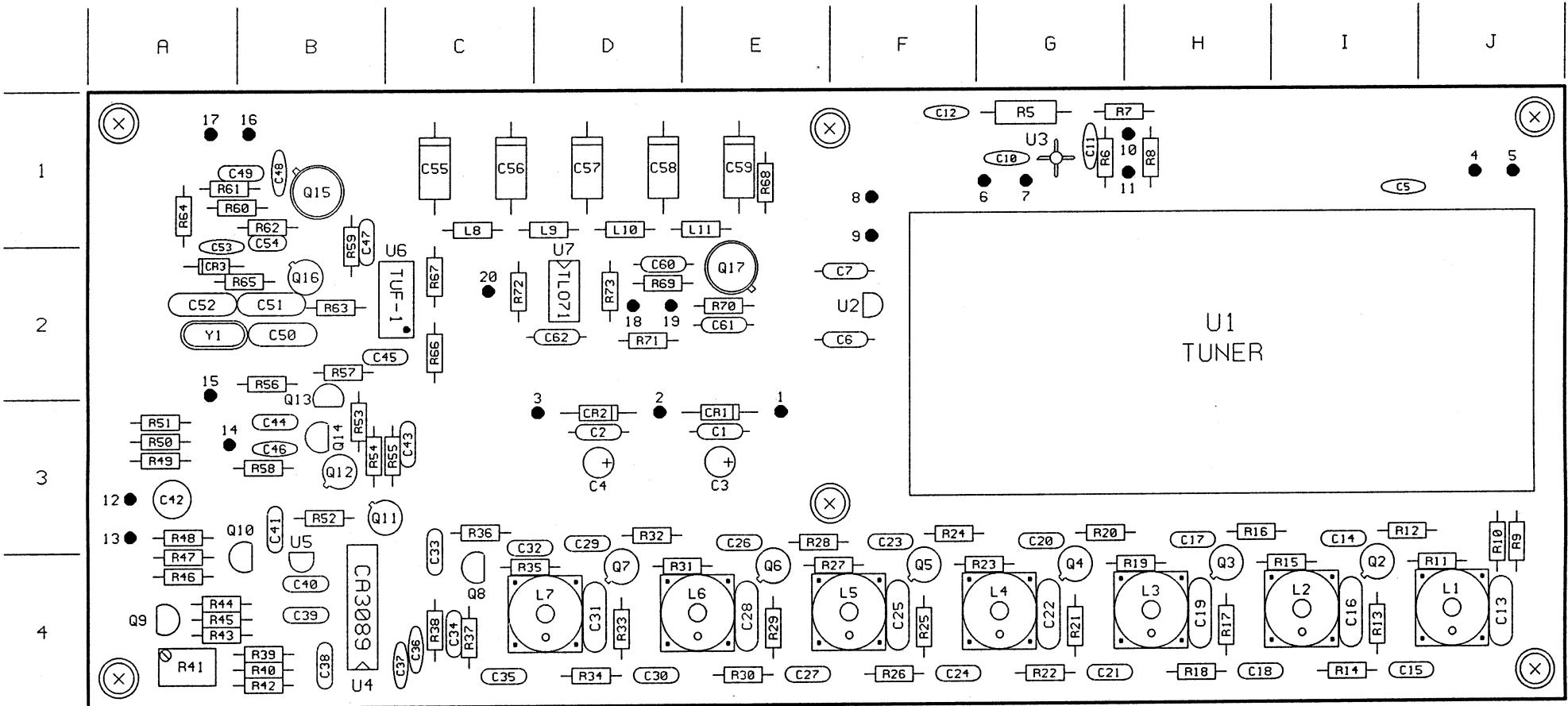
FMRR-4 A3 BOARD  
COMPONENT LAYOUT  
BELAR ELECTRONICS  
(ONLY USED PRIOR TO SERIAL NUMBER 320071)

A3 BOARD FMRR-4  
(Only used prior to serial number 320071)

Reference Designation	Description	Part Number
C1, C2	C: FIXED ELEC 1900uF 50V	0180-0027
C3, C4	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C5, C6	C: FIXED ELEC 47uF 50V	0180-0017
C7	C: FIXED ELEC 270uF 100V	0180-0034
C8	C: FIXED ELEC 3900uF 25V	0180-0035
C9	C: FIXED CERAMIC 0.1uF 50V	0151-0006
CR1 thru CR10	DIODE: 1N4006	1900-0016
U1	IC: 7815C	1826-0031
U2	IC: 7915C	1826-0033
U3	IC: 7805C	1826-0014



FMRR-4 A4  
ANALOG BOARD  
BELAR ELECTRONICS  
2-24-98

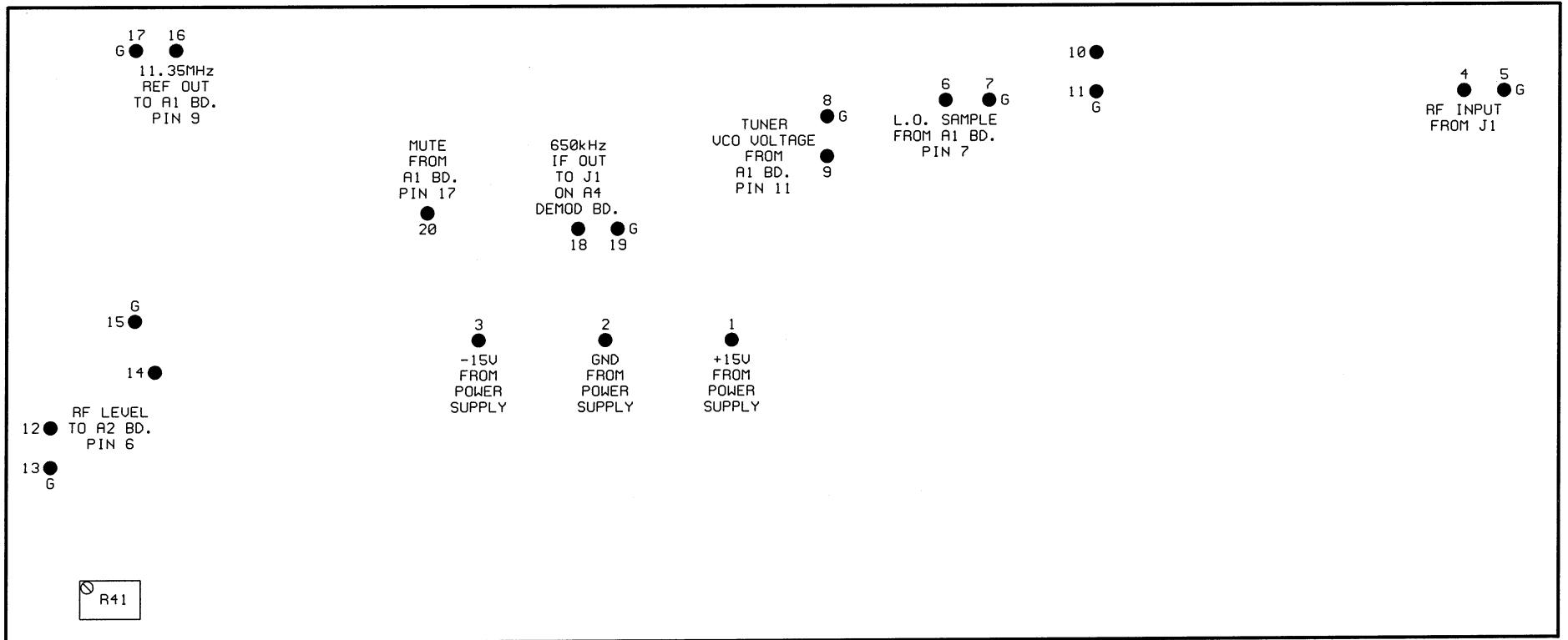


FMRR-1A & -4 A4  
ANALOG BOARD  
COMPONENT LAYOUT  
BELAR ELECTRONICS

FMRR-1A & -4 A4 ANALOG BOARD\*  
PART LOCATIONS

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1 E3	C42 A3	Q3 H4	R28 E3	R67 C2
C2 D3	C43 C3	Q4 G4	R29 E4	R68 E1
C3 E3	C44 B3	Q5 F4	R30 E4	R69 D2
C4 D3	C45 B2	Q6 E4	R31 D4	R70 E2
C5 I1	C46 B3	Q7 D4	R32 D3	R71 D2
C6 F2	C47 B1	Q8 C4	R33 D4	R72 C2
C7 F2	C48 B1	Q9 A4	R34 D4	R73 D2
C10 G1	C49 B1	Q10 B4	R35 C4	
C11 G1	C50 B2	Q11 B3	R36 C3	U1 H2
C12 F1	C51 B2	Q12 B3	R37 C4	U2 F2
C13 J4	C52 A2	Q13 B2	R38 C4	U3 G1
C14 I3	C53 A1	Q14 B3	R39 B4	U4 B4
C15 I4	C54 B1	Q15 B1	R40 B4	U5 B4
C16 I4	C55 C1	Q16 B2	R41 A4	U6 C2
C17 H3	C56 C1	Q17 E2	R42 B4	U7 D2
C18 H4	C57 D1		R43 A4	
C19 H4	C58 D1	R5 G1	R44 A4	Y1 A2
C20 G3	C59 E1	R6 G1	R45 A4	
C21 G4	C60 D2	R7 G1	R46 A4	<u>pins</u>
C22 G4	C61 E2	R8 H1	R47 A4	1 E3
C23 F3	C62 D2	R9 J3	R48 A3	2 D3
C24 F4		R10 J3	R49 A3	3 D3
C25 F4	CR1 E3	R11 J4	R50 A3	4 J1
C26 E3	CR2 D3	R12 I3	R51 A3	5 J1
C27 E4	CR3 A2	R13 I4	R52 B3	6 G1
C28 E4		R14 I4	R53 B3	7 G1
C29 D3	L1 J4	R15 I4	R54 B3	8 F1
C30 D4	L2 I4	R16 H3	R55 C3	9 F1
C31 D4	L3 H4	R17 H4	R56 B2	10 H1
C32 C3	L4 G4	R18 H4	R57 B2	11 H1
C33 C3	L5 F4	R19 H4	R58 B3	12 A3
C34 C4	L6 E4	R20 G3	R59 B1	13 A3
C35 C4	L7 D4	R21 G4	R60 A1	14 A3
C36 C4	L8 C1	R22 G4	R61 A1	15 A2
C37 C4	L9 D1	R23 G4	R62 B1	16 B1
C38 B4	L10 D1	R24 F3	R63 B2	17 A1
C39 B4	L11 E1	R25 F4	R64 A1	18 D2
C40 B4		R26 F4	R65 B2	19 D2
C41 B3	Q2 I4	R27 F4	R66 C2	20 C2

\*note: pc board is marked "RFA A4"



FMR-4 A4  
ANALOG BOARD  
CONNECTIONS & ADJUSTMENTS  
BELAR ELECTRONICS

A4 ANALOG BOARD FMRR-1A & -4  
 (Note: pc board is marked "RFA A4")

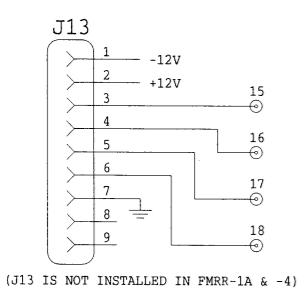
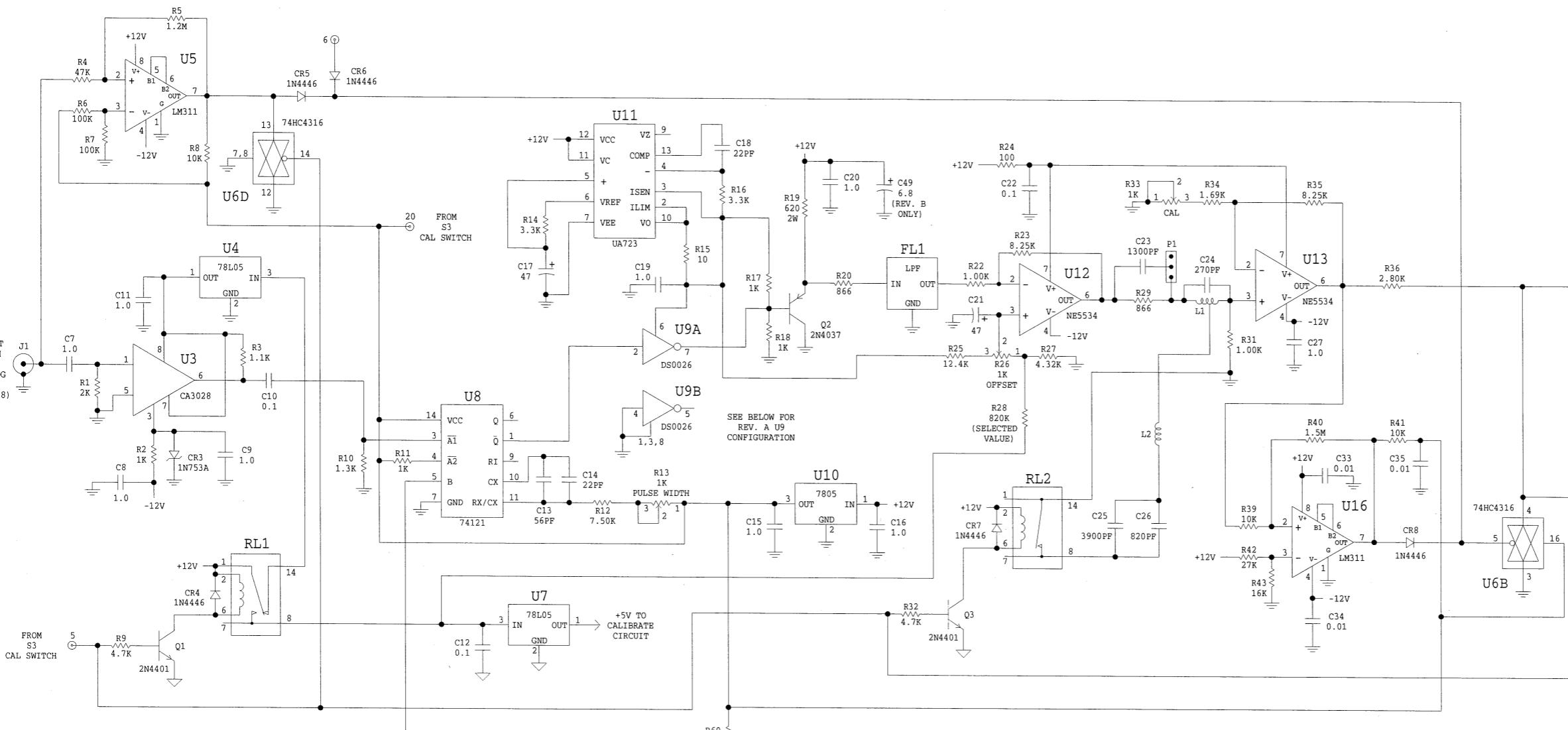
Reference Designation	Description	Part Number
C1, C2	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C3, C4	C: FIXED TANT 6.8uF 25V	0185-0002
C5	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C6, C7	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C8, C9	not used	
C10, C11	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C12	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C13	C: FIXED MICA 560pF 2%	0140-5612
C14, C15	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C16	C: FIXED MICA 560pF 2%	0140-5612
C17, C18	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C19	C: FIXED MICA 500pF 2%	0140-5012
	(C19 selected for value, nominal value shown)	
C20, C21	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C22	C: FIXED MICA 560pF 2%	0140-5612
C23, C24	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C25	C: FIXED MICA 560pF 2%	0140-5612
C26, C27	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C28	C: FIXED MICA 560pF 2%	0140-5612
C29, C30	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C31	C: FIXED MICA 500pF 2%	0140-5012
	(C31 selected for value, nominal value shown)	
C32 thru C35	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C36, C37	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C38 thru C41	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C42	C: FIXED ELEC 10uF 35V NON-POLAR	0180-0029
C43 thru C45	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C46	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C47	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C48	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C49	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C50	C: FIXED MICA 36pF 5%	0140-3605
C51	C: FIXED MICA 180pF 5%	0140-1815
C52	C: FIXED MICA 250pF 5%	0140-2515
C53	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C54	C: FIXED MICA 10pF 5%	0142-1005
C55	C: FIXED POLY 270pF 2.5% 160V	0130-2712
C56	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C57	C: FIXED POLY 1600pF 2.5% 160V	0130-1622
C58	C: FIXED POLY 1200pF 2.5% 160V	0130-1222
C59	C: FIXED POLY 270pF 2.5% 160V	0130-2712
C60 thru C62	C: FIXED CERAMIC 0.1uF 50V	0151-0006
CR1, CR2	DIODE: 1N4006	1900-0016
CR3	DIODE: 1N4446	1900-0002
L1 thru L7	COIL:	Belar
L8	CHOKE: 8.2uH	9141-0015
L9, L10	CHOKE: 15uH	9141-0025
L11	CHOKE: 8.2uH	9141-0015

A4 ANALOG BOARD FMRR-1A & -4 cont.

Reference Designation	Description	Part Number
Q1	not used	
Q2 thru Q7	TRANSISTOR: 2N5179	1850-0023
Q8 thru Q10	TRANSISTOR: 2N4401	1850-0028
Q11	TRANSISTOR: 2N2907A	1850-0027
Q12	TRANSISTOR: 2N5179	1850-0023
Q13, Q14	TRANSISTOR: 2N4401	1850-0028
Q15	TRANSISTOR: 2N3053	1850-0008
Q16	TRANSISTOR: 2N5179	1850-0023
Q17	TRANSISTOR: 2N3053	1850-0008
R1 thru R4	not used	
R5	R: METAL FILM 510 2% 1/4W	0771-5112
R6	R: METAL FILM 300 2% 1/4W	0751-3012
R7	R: METAL FILM 18 2% 1/4W	0751-1802
R8, R9	R: METAL FILM 300 2% 1/4W	0751-3012
R10	R: METAL FILM 787 1%	0721-7870
R11	R: METAL FILM 330 2% 1/4W	0751-3312
R12	R: METAL FILM 866 1%	0721-8660
R13	R: METAL FILM 432 1%	0721-4320
R14	R: METAL FILM 2k 2% 1/4W	0751-2022
R15	R: METAL FILM 330 2% 1/4W	0751-3312
R16	R: METAL FILM 866 1%	0721-8660
R17	R: METAL FILM 432 1%	0721-4320
R18	R: METAL FILM 2k 2% 1/4W	0751-2022
R19	R: METAL FILM 330 2% 1/4W	0751-3312
R20	R: METAL FILM 1.24k 1%	0721-1241
R21	R: METAL FILM 432 1%	0721-4320
R22	R: METAL FILM 2k 2% 1/4W	0751-2022
R23	R: METAL FILM 330 2% 1/4W	0751-3312
R24	R: METAL FILM 1.24k 1%	0721-1241
R25	R: METAL FILM 432 1%	0721-4320
R26	R: METAL FILM 2k 2% 1/4W	0751-2022
R27	R: METAL FILM 330 2% 1/4W	0751-3312
R28	R: METAL FILM 2.49k 1%	0721-2491
R29	R: METAL FILM 432 1%	0721-4320
R30	R: METAL FILM 3k 2% 1/4W	0751-3022
R31	R: METAL FILM 330 2% 1/4W	0751-3312
R32	R: METAL FILM 2.49k 1%	0721-2491
R33	R: METAL FILM 1.00k 1%	0721-1001
R34	R: METAL FILM 3k 2% 1/4W	0751-3022
R35	R: METAL FILM 330 2% 1/4W	0751-3312
R36	R: METAL FILM 510 2% 1/4W	0751-5112
R37	R: METAL FILM 1k 2% 1/4W	0751-1022
R38	R: METAL FILM 300 2% 1/4W	0751-3012
R39	R: METAL FILM 33k 2% 1/4W	0751-3332
R40	R: METAL FILM 39k 2% 1/4W	0751-3932
R41	R: VAR COMP 10k, 10 TURN	2100-0024
R42	R: METAL FILM 8.2k 2% 1/4W	0751-8222

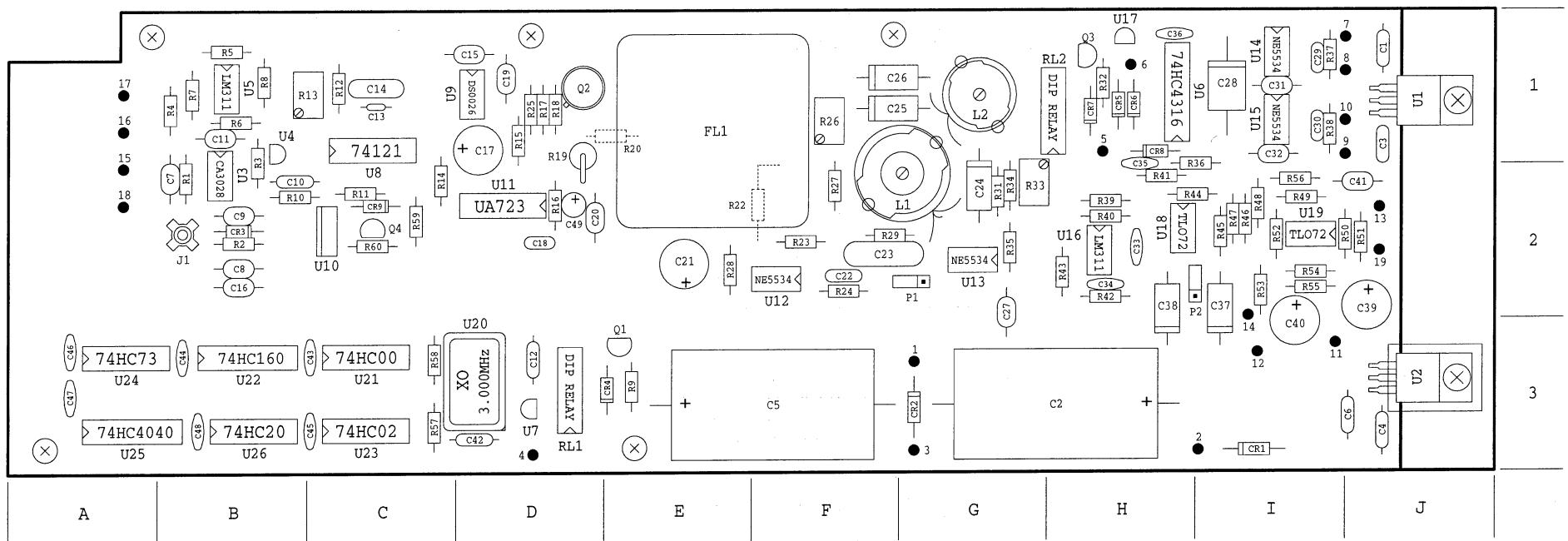
A4 ANALOG BOARD FMRR-1A & -4 cont.

Reference Designation	Description	Part Number
R43	R: METAL FILM 10k 2% 1/4W	0751-1032
R44	R: METAL FILM 51 2% 1/4W	0751-5102
R45	R: METAL FILM 39k 2% 1/4W	0751-3932
R46	R: METAL FILM 15k 2% 1/4W	0751-1532
R47	R: METAL FILM 47k 2% 1/4W	0751-4732
R48	R: METAL FILM 18k 2% 1/4W	0751-1832
R49	R: METAL FILM 100k 2% 1/4W	0751-1042
R50	R: METAL FILM 12k 2% 1/4W	0751-1232
R51	R: METAL FILM 3k 2% 1/4W	0751-3022
R52	R: METAL FILM 1k 2% 1/4W	0751-1022
R53	R: METAL FILM 510 2% 1/4W	0751-5112
R54	R: METAL FILM 220 2% 1/4W	0751-2212
R55	R: METAL FILM 680 2% 1/4W	0751-6812
R56	R: METAL FILM 1.5k 2% 1/4W	0751-1522
R57	R: METAL FILM 43.2 1%	0721-43R2
R58	R: METAL FILM 1k 2% 1/4W	0751-1022
R59	R: METAL FILM 49.9 1%	0721-49R9
R60	R: METAL FILM 62 2% 1/4W	0751-6202
R61	R: METAL FILM 220 2% 1/4W	0751-2212
R62	R: METAL FILM 5.1k 2% 1/4W	0751-5122
R63	R: METAL FILM 2.4k 2% 1/4W	0751-2422
R64	R: METAL FILM 1.3k 2% 1/4W	0751-1322
(R64 selected for value, nominal value shown)		
R65	R: METAL FILM 510 2% 1/4W	0751-5112
R66, R67	R: METAL FILM 69.8 1%	0721-69R8
R68	R: METAL FILM 100 1%	0721-1000
R69	R: METAL FILM 1k 2% 1/4W	0751-1022
R70	R: METAL FILM 100 2% 1/4W	0751-1012
R71	R: METAL FILM 1.8k 2% 1/4W	0751-1822
R72	R: METAL FILM 330k 2% 1/4W	0751-3342
R73	R: METAL FILM 180k 2% 1/4W	0751-1842
U1	TUNER ASSEMBLY	0412-0001
U2	IC: 78L12CP	1826-0015
U3	IC: MAR-7	1845-0027
U4	IC: CA3089	1826-0046
U5	IC: 78L12CP	1826-0015
U6	IC: TUF-1	1845-0011
U7	IC: TLO71	1826-0004
Y1	XTAL: 11.35MHz	0413-1135



REV. A U9 CONFIGURATION

FROM U8 PIN 1 → 1  
+5V FROM U10 → 2  
INA VCC1 → 3  
INB VCC2 → 4  
GND → 5  
OUTA → 6  
OUTB → 7  
+5V → 8  
C15 → 9  
GND → 10  
Q1 → 11  
Q2 → 12  
GND → 13  
Q3 → 14  
Q4 → 15  
GND → 16  
Q5 → 17  
Q6 → 18  
GND → 19  
Q7 → 20  
Q8 → 21  
GND → 22  
Q9 → 23  
Q10 → 24  
GND → 25  
Q11 → 26  
Q12 → 27  
GND → 28  
Q13 → 29  
Q14 → 30  
GND → 31  
Q15 → 32  
Q16 → 33  
GND → 34  
Q17 → 35  
Q18 → 36  
GND → 37  
Q19 → 38  
Q20 → 39  
GND → 40  
Q21 → 41  
Q22 → 42  
GND → 43  
Q23 → 44  
Q24 → 45  
GND → 46  
Q25 → 47  
Q26 → 48  
GND → 49  
Q27 → 50  
Q28 → 51  
GND → 52  
Q29 → 53  
Q30 → 54  
GND → 55  
Q31 → 56  
Q32 → 57  
GND → 58  
Q33 → 59  
Q34 → 60  
GND → 61  
Q35 → 62  
Q36 → 63  
GND → 64  
Q37 → 65  
Q38 → 66  
GND → 67  
Q39 → 68  
Q40 → 69  
GND → 70  
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GND → 88  
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Q54 → 90  
GND → 91  
Q55 → 92  
Q56 → 93  
GND → 94  
Q57 → 95  
Q58 → 96  
GND → 97  
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FMRR-1A & -4 A4  
DEMODULATOR BOARD  
REV. A & B  
COMPONENT LAYOUT  
BELAR ELECTRONICS

NOTE: PC BOARD IS MARKED "FMMA-1 A4"

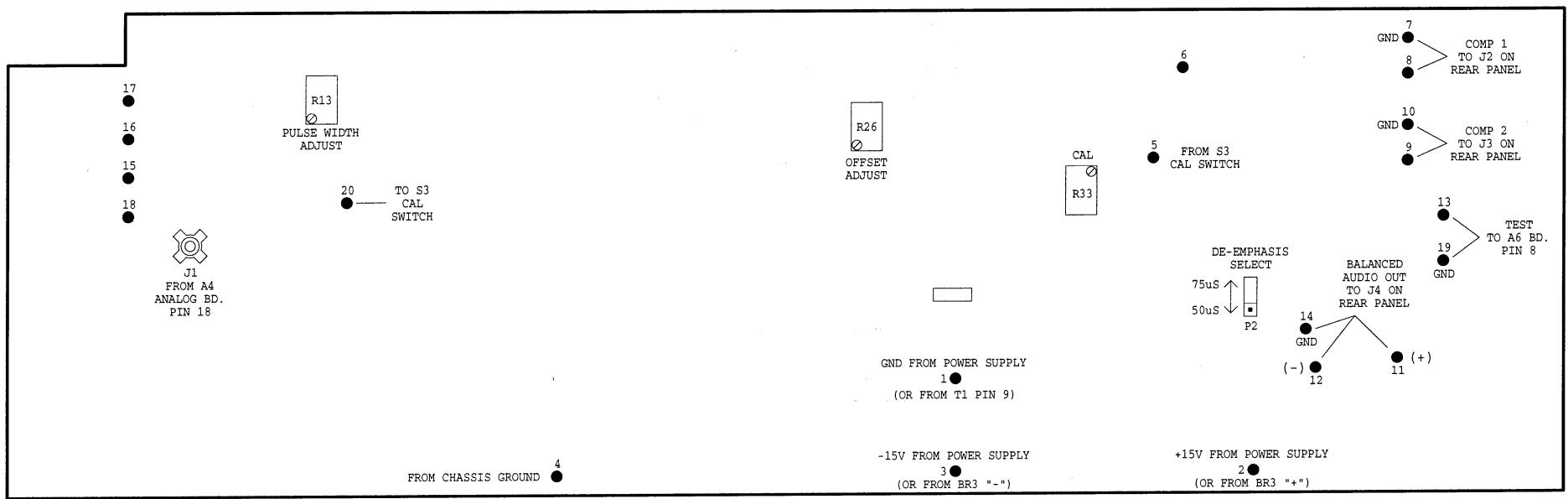
FMRR-1A & -4 A4 DEMODULATOR BOARD Rev A & B  
PART LOCATIONS

| <u>Desig/Loc</u> |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| C1 J1            | C33 H2           | L1 G2            | R22 F2*          | R54 I2           | U22 B3           |                  |
| C2 H3            | C34 H2           | L2 G1            | R23 F2           | R55 I2           | U23 C3           |                  |
| C3 J1            | C35 H1           |                  | R24 F2           | R56 I2           | U24 A3           |                  |
| C4 J3            | C36 H1           | P1 G2            | R25 D1           | R57 C3           | U25 A3           |                  |
| C5 F3            | C37 I2           | P2 H2            | R26 F1           | R58 C3           | U26 B3           |                  |
| C6 J3            | C38 H2           |                  | R27 F2           | R59 C2           |                  |                  |
| C7 B2            | C39 J2           | Q1 E3            | R28 E2           | R60 C2           |                  | <u>pins</u>      |
| C8 B2            | C40 I3           | Q2 D1            | R29 F2           |                  |                  | 1 G3             |
| C9 B2            | C41 J2           | Q3 H1            | R30 --           | RL1 D3           |                  | 2 I3             |
| C10 B2           | C42 D3           | Q4 C2            | R31 G2           | RL2 H1           |                  | 3 G3             |
| C11 B1           | C43 C3           |                  | R32 H1           |                  |                  | 4 D3             |
| C12 D3           | C44 B3           | R1 B2            | R33 G2           | U1 J1            |                  | 5 H1             |
| C13 C1           | C45 C3           | R2 B2            | R34 G2           | U2 J3            |                  | 6 H1             |
| C14 C1           | C46 A3           | R3 B1            | R35 G2           | U3 B2            |                  | 7 J1             |
| C15 D1           | C47 A3           | R4 B1            | R36 H1           | U4 B1            |                  | 8 J1             |
| C16 B2           | C48 B3           | R5 B1            | R37 I1           | U5 B1            |                  | 9 J1             |
| C17 D1           | C49 D2~          | R6 B1            | R38 I1           | U6 H1            |                  | 10 J1            |
| C18 D2           |                  | R7 B1            | R39 H2           | U7 D3            |                  | 11 I3            |
| C19 D1           | CR1 I3           | R8 B1            | R40 H2           | U8 C1            |                  | 12 I3            |
| C20 D2           | CR2 G3           | R9 E3            | R41 H2           | U9 D1            |                  | 13 J2            |
| C21 E2           | CR3 B2           | R10 B2           | R42 H2           | U10 C2           |                  | 14 I2            |
| C22 F2           | CR4 E3           | R11 C2           | R43 H2           | U11 D2           |                  | 15 A2            |
| C23 F2           | CR5 H1           | R12 C1           | R44 H2           | U12 F2           |                  | 16 A1            |
| C24 G2           | CR6 H1           | R13 B1           | R45 I2           | U13 G2           |                  | 17 A1            |
| C25 F1           | CR7 H1           | R14 C2           | R46 I2           | U14 I1           |                  | 18 A2            |
| C26 F1           | CR8 H1           | R15 D1           | R47 I2           | U15 I1           |                  | 19 J2            |
| C27 G2           | CR9 C2           | R16 D2           | R48 I2           | U16 H2           |                  | 20 C2            |
| C28 I1           |                  | R17 D1           | R49 I2           | U17 H1           |                  |                  |
| C29 I1           | FL1 E1           | R18 D1           | R50 I2           | U18 H2           |                  |                  |
| C30 I1           |                  | R19 D1           | R51 J2           | U19 I2           |                  |                  |
| C31 I1           | J1 B2            | R20 E1*          | R52 I2           | U20 D3           |                  |                  |
| C32 I1           |                  | R21 --           | R53 I2           | U21 C3           |                  |                  |

\*under pc board

R21 & R30 not used

~C49 not used on rev. A board  
pc board is marked "FMMA-1 A4"



FMRR-4 A4  
DEMODULATOR BOARD  
REV. A & B  
CONNECTIONS & ADJUSTMENTS  
BELAR ELECTRONICS

A4 DEMODULATOR BOARD FMRR-1A & -4 rev. A & B  
 (Note: pc board is marked "FMMA-1 A4")

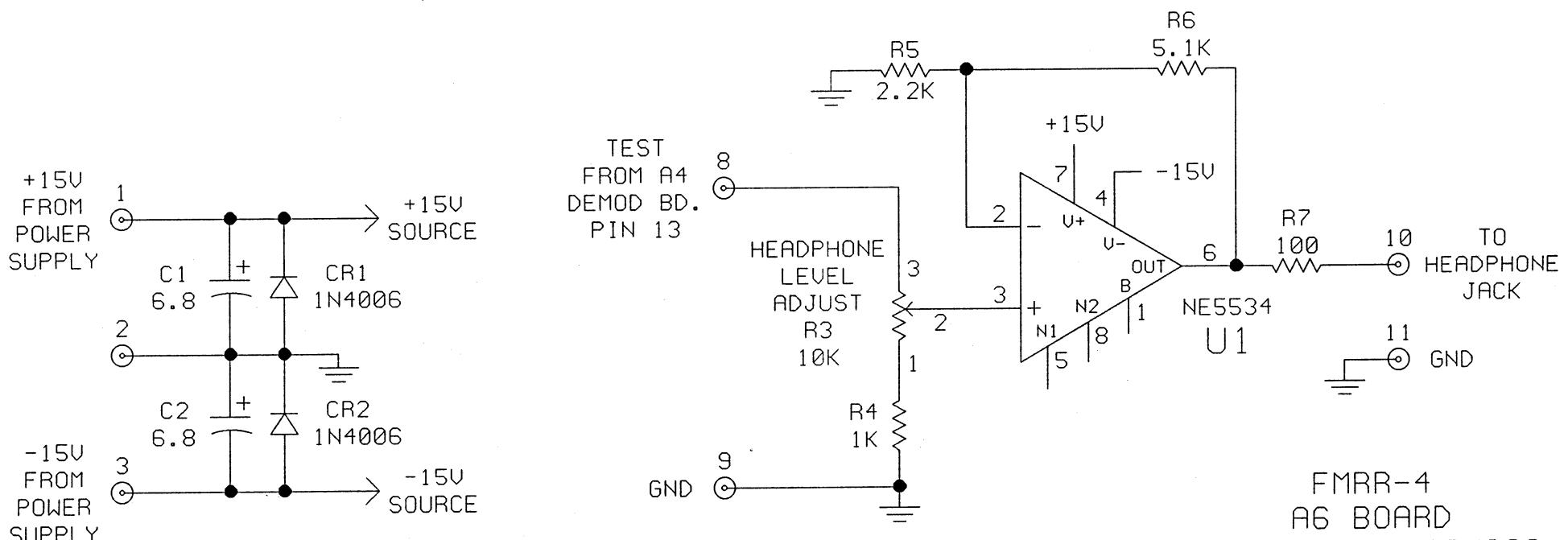
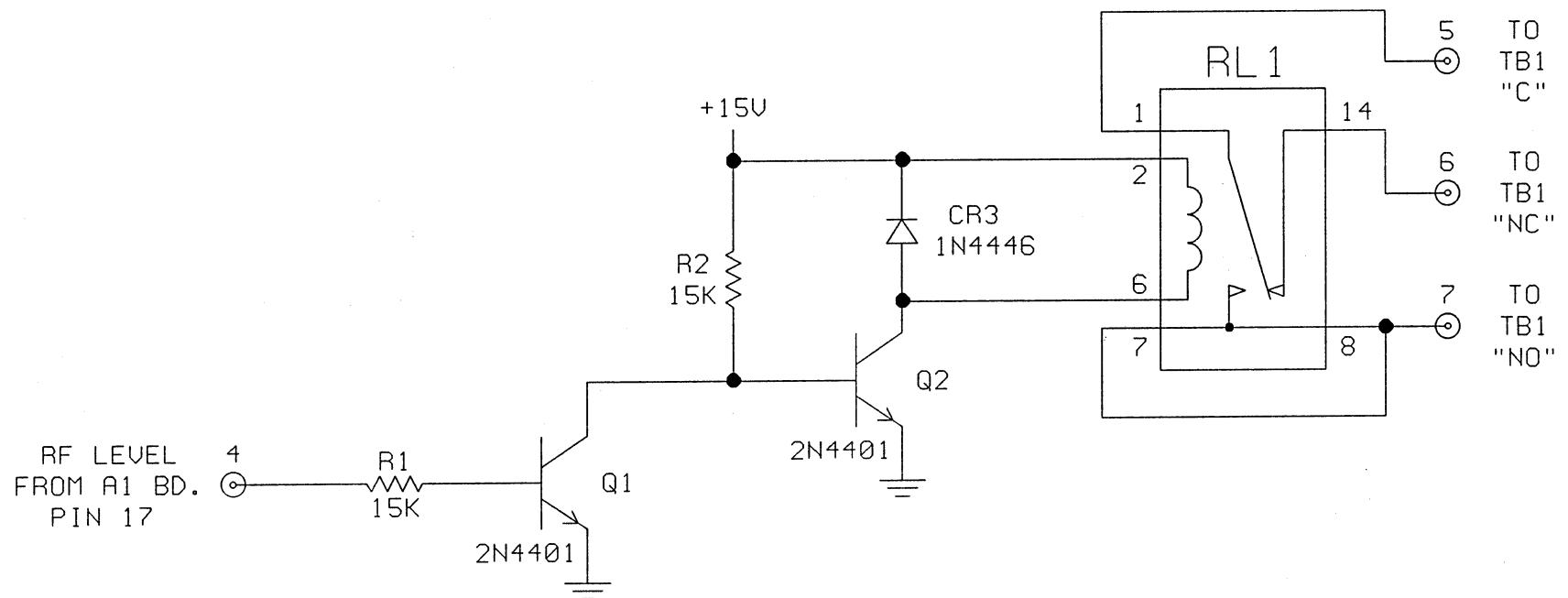
Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C2	C: FIXED ELEC 1900uF 50V	0180-0027
C3, C4	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C5	C: FIXED ELEC 1900uF 50V	0180-0027
C6	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C7 thru C9	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C10	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C11	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C12	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C13	C: FIXED CERAMIC 56pF 100V N750	0155-0005
C14	C: FIXED MICA 22pF 5%	0140-2205
C15, C16	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C17	C: FIXED ELEC 47uF 50V	0180-0017
C18	C: FIXED MICA 22pF 5%	0142-2205
C19, C20	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C21	C: FIXED ELEC 47uF 50V	0180-0017
C22	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C23	C: FIXED MICA 1300pF 1%	0141-1321
C24	C: FIXED POLY 270pF 2.5% 160V	0130-2712
C25	C: FIXED POLY 3900pF 2.5% 160V	0130-3922
C26	C: FIXED POLY 820pF* 2.5% 160V *C26 IS SELECTED BY TEST.	0130-8212
C27	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C28	C: FIXED POLY 10000pF 2.5% 160V	0130-1032
C29, C30	C: FIXED MICA 22pF 5%	0142-2205
C31, C32	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C33 thru C36	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C37	C: FIXED POLY 3300pF 2.5% 160V	0130-3322
C38	C: FIXED POLY 2200pF 2.5% 160V	0130-2222
C39, C40	C: FIXED ELEC 100uF 35V	0180-0018
C41	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C42	C: FIXED CERAMIC 0.1uF 50V	0151-0006
C43 thru C48	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C49*	C: FIXED TANT 6.8uF 25V	0185-0002
(*Note: C49 is not used on Rev. A boards.)		
CR1, CR2	DIODE: 1N4006	1900-0016
CR3	DIODE: 1N753A	1900-0006
CR4 thru CR8	DIODE: 1N4446	1900-0002
CR9	DIODE: HP5082-2800	1900-0026
FL1	FILTER: BELAR, LOW PASS	9120-0014
J1	JACK: SMB, PC MOUNT	0360-0040
L1	INDUCTOR: BELAR	9140-0039
L2	INDUCTOR: BELAR	9140-0038

A4 DEMODULATOR BOARD FMRR-1A & -4 rev. A & B cont.

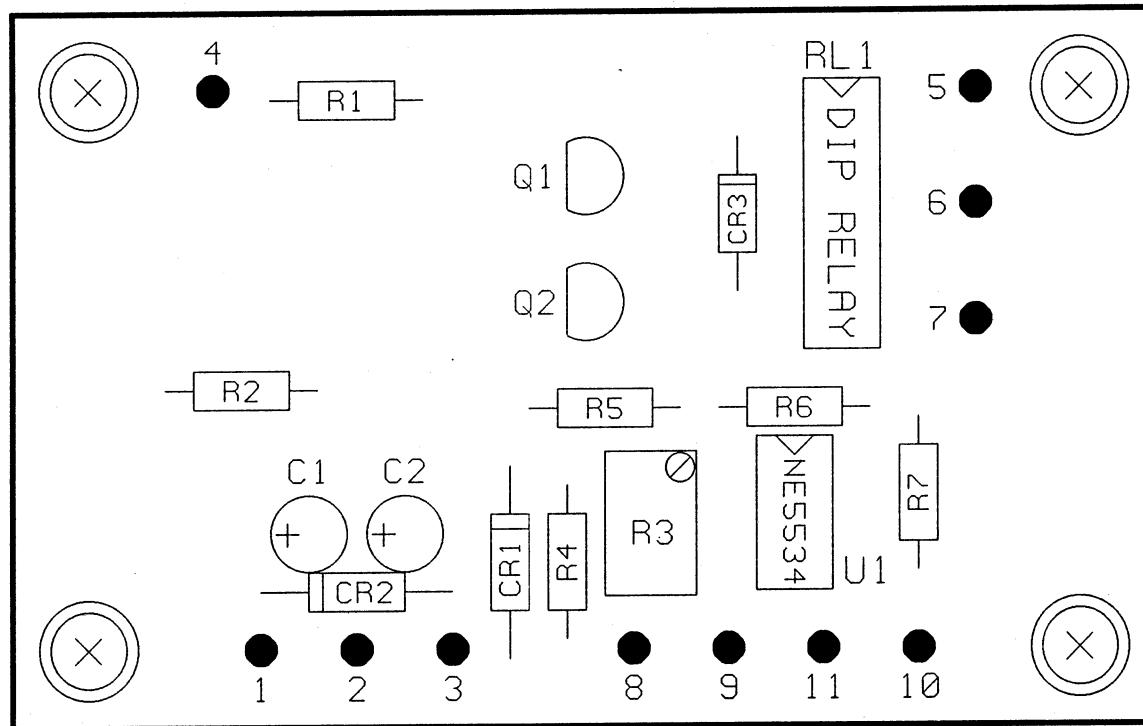
Reference Designation	Description	Part Number
P1, P2	PLUG: 3 PIN, PC MOUNT	0365-0030
--	JUMPER: 2 PIN (USED WITH P2)	0365-0028
Q1	TRANSISTOR: 2N4401	1850-0028
Q2	TRANSISTOR: 2N4037	1850-0011
Q3, Q4	TRANSISTOR: 2N4401	1850-0028
R1	R: METAL FILM 2k 2% 1/4W	0751-2022
R2	R: METAL FILM 1k 2% 1/4W	0751-1022
R3	R: METAL FILM 1.1k 2% 1/4W	0751-1122
R4	R: METAL FILM 47k 2% 1/4W	0751-4732
R5	R: FIXED CARBON 1.2M 5% 1/4W	0683-1255
R6, R7	R: METAL FILM 100k 2% 1/4W	0751-1042
R8	R: METAL FILM 10k 2% 1/4W	0751-1032
R9	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R10	R: METAL FILM 1.3k 2% 1/4W	0751-1322
R11	R: METAL FILM 1k 2% 1/4W	0751-1022
R12	R: METAL FILM 7.50k 1%	0721-7501
R13	R: VAR COMP 1k, 10 TURN	2100-0021
R14	R: METAL FILM 3.3k 2% 1/4W	0751-3322
R15	R: METAL FILM 10 2% 1/4W	0751-1002
R16	R: METAL FILM 3.3k 2% 1/4W	0751-3322
R17, R18	R: METAL FILM 1k 2% 1/4W	0751-1022
R19	R: WIRE WOUND 620 5% 2W	0811-0012
R20*	R: METAL FILM 866 1%	0721-8660
R21	not used	
R22*	R: METAL FILM 1.00k 1%	0721-1001
	(*R20 & R22 are on pc bottom)	
R23	R: METAL FILM 8.25k 1%	0721-8251
R24	R: METAL FILM 100 2% 1/4W	0751-1012
R25	R: METAL FILM 12.4k 1% (Rev. A)	0721-1242
	R: METAL FILM 12.1k 1% (Rev. B)	0721-1212
R26	R: VAR COMP 1k, 10 TURN	2100-0021
R27	R: METAL FILM 4.32k 1% (Rev. A)	0721-4321
	R: METAL FILM 5.11k 1% (Rev. B)	0721-5111
R28	R: METAL FILM 820k 2% 1/4W	0751-8242
R29	R: METAL FILM 866 1%	0721-8660
R30	not used	
R31	R: METAL FILM 1.00k 1%	0721-1001
R32	R: METAL FILM 4.7k 2% 1/4W	0751-4722
R33	R: VAR COMP 1k, 10 TURN	2100-0021
R34	R: METAL FILM 1.69k 1%	0721-1691
R35	R: METAL FILM 8.25k 1%	0721-8251
R36	R: METAL FILM 2.80k 1%	0721-2801
R37, R38	R: METAL FILM 75.0k 1%	0721-75R0
R39	R: METAL FILM 10k 2% 1/4W	0751-1032
R40	R: FIXED CARBON 1.5M 5% 1/4W	0683-1555

A4 DEMODULATOR BOARD FMRR-1A & -4 rev. A & B cont.

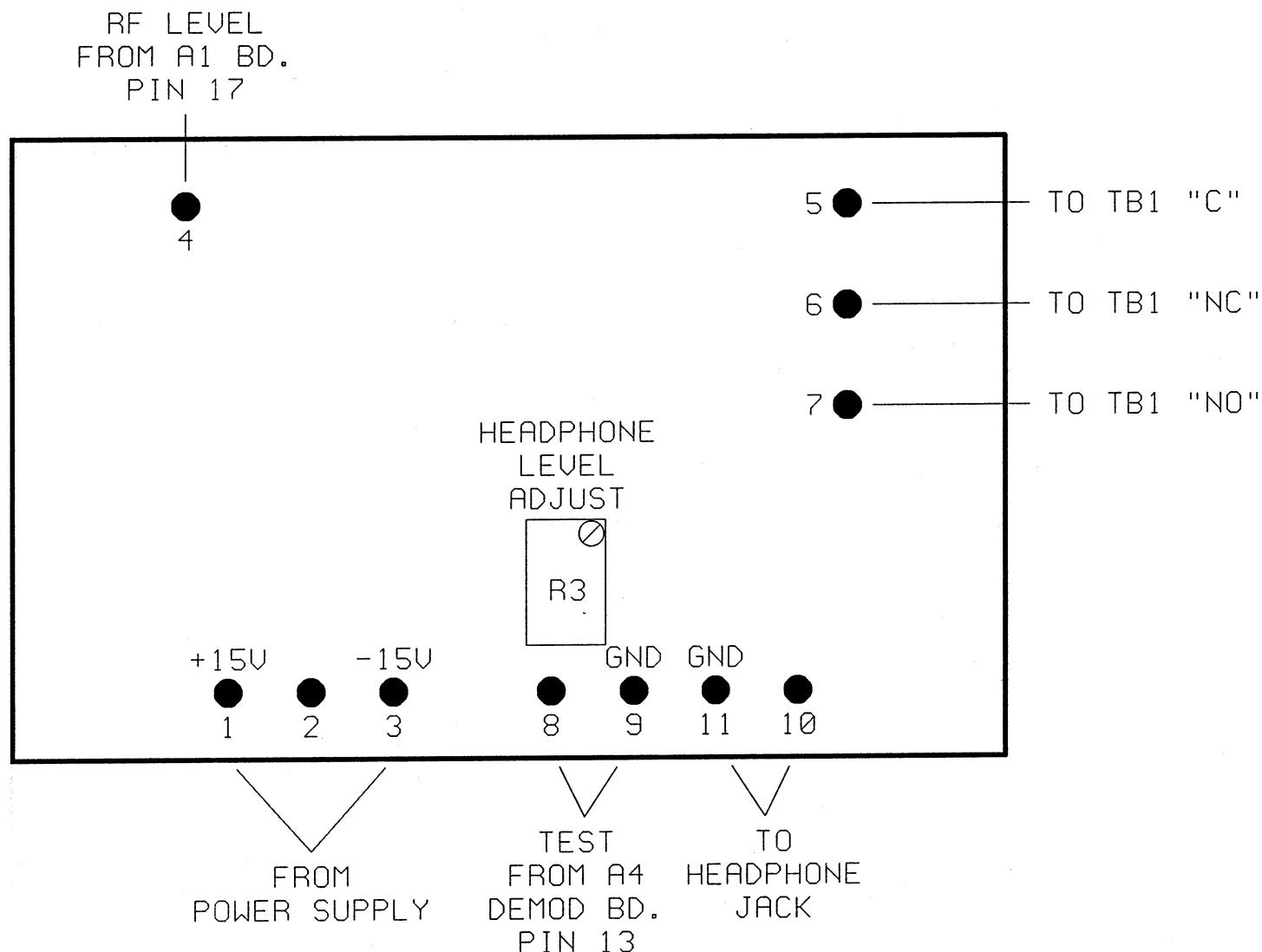
Reference Designation	Description	Part Number
R41	R: METAL FILM 10k 2% 1/4W	0751-1032
R42	R: METAL FILM 27k 2% 1/4W	0751-2732
R43	R: METAL FILM 16k 2% 1/4W	0751-1632
R44	R: METAL FILM 12.7k 1%	0721-1272
R45	R: METAL FILM 10.0k 1%	0721-1002
R46	R: METAL FILM 9.09k 1%	0721-9091
R47	R: METAL FILM 21.0k 1%	0721-2102
R48	R: METAL FILM 20.0k 1%	0721-2002
R49	R: METAL FILM 10.0k 1%	0721-1002
R50	R: METAL FILM 6.8k 2% 1/4W	0751-6822
R51	R: METAL FILM 300 2% 1/4W	0751-3012
R52, R53	R: METAL FILM 10.0k 1%	0721-1002
R54	R: METAL FILM 5.1k 2% 1/4W	0751-5122
R55	R: METAL FILM 300 2% 1/4W	0751-3012
R56	R: METAL FILM 10k 2% 1/4W	0751-1032
R57	R: METAL FILM 22 2% 1/4W	0751-2202
R58	R: METAL FILM 10k 2% 1/4W	0751-1032
R59	R: METAL FILM 1.5k 2% 1/4W	0751-1522
R60	R: METAL FILM 1k 2% 1/4W	0751-1022
RL1	RELAY: JWD-172-3	1600-0005
RL2	RELAY: JWD-171-14	1600-0004
U1	IC: 7812CT*	1826-0060
	(* earlier units used a 7815CT, P/N 1826-0031)	
U2	IC: 7912CT*	1826-0061
	(* earlier units used a 7915CT, P/N 1826-0033)	
U3	IC: CA3028	1826-0034
U4	IC: 78L05CP	1826-0012
U5	IC: LM311	1826-0009
U6	IC: 74HC4316	1822-0051
U7	IC: 78L05CP	1826-0012
U8	IC: 74121	1821-0014
U9*	IC: DS0026	1826-0021
	(*Note: On Rev. A boards, U9 is a 75372 IC, p/n 1823-0004)	
U10	IC: 7805CT	1826-0014
U11	IC: UA723	1820-0012
U12 thru U15	IC: NE5534	1826-0025
U16	IC: LM311	1826-0009
U17	IC: 79L05CP	1826-0017
U18, U19	IC: TLO72	1826-0038
U20	IC: XO, 3.000MHz	0415-0300
U21	IC: 74HC00	1822-0039
U22	IC: 74HC160	1822-0061
U23	IC: 74HC02A	1822-0040
U24	IC: 74HC73	1822-0044
U25	IC: 74HC4040A	1822-0062
U26	IC: 74HC20	1822-0060



FMRR-4  
A6 BOARD  
BELAR ELECTRONICS  
11-14-94



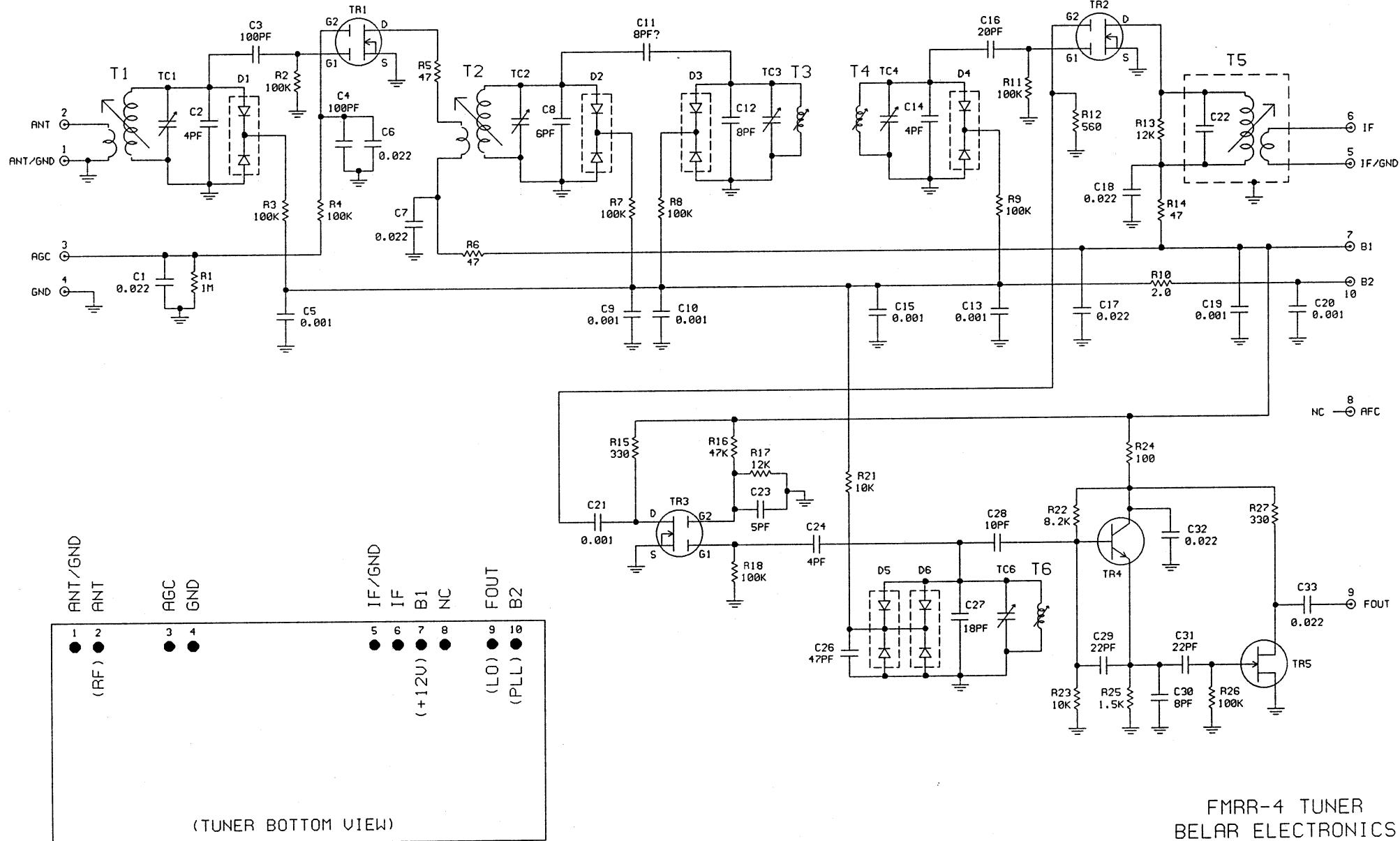
FMRR-4 A6 BOARD  
COMPONENT LAYOUT  
BELAR ELECTRONICS



FMRR-4 A6 BOARD  
CONNECTIONS & ADJUSTMENTS  
BELAR ELECTRONICS

A6 BOARD FMRR-4

Reference Designation	Description	Part Number
C1,C2	C: FIXED TANT 6.8uF 25V	0185-0002
CR1,CR2	DIODE: 1N4006	1900-0016
CR3	DIODE: 1N4446	1900-0002
Q1,Q2	TRANSISTOR: 2N4401	1850-0028
R1,R2	R: METAL FILM 15k 2% 1/4W	0751-1532
R3	R: VAR COMP 10k, 10 TURN	2100-0024
R4	R: METAL FILM 1k 2% 1/4W	0751-1022
R5	R: METAL FILM 2.2k 2% 1/4W	0751-2222
R6	R: METAL FILM 5.1k 2% 1/4W	0751-5122
R7	R: METAL FILM 100 2% 1/4W	0751-1012
RL1	RELAY: JWD-172-3	1600-0005
U1	IC: NE5534	1826-0025



FMRR-4 TUNER  
BELAR ELECTRONICS  
10-20-94