

Model RFA-2 AM RF AMPLIFIER

Guide to Operations

1/01

©



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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 state-of-the-art design of the Belar RFA-2 AM RF Amplifier - a selective, high gain, all solid state unit with automatic gain control (AGC) and companion to the Belar AM Frequency and Modulation Monitors makes it possible to monitor off-the-air AM signals accurately and conveniently without the problems associated with changes in transmitter power level, antenna patterns, and signal fading. The RFA-2 allows monitoring of both carrier frequency deviation and modulation characteristics from a point remote from the transmitters in the 530-1710 kHz band.

The RFA-2 uses both crystal controlled superheterodyne and heterodyne repeater principles to provide a virtually distortionless, spurious-free output for modulation monitoring and a frequency restored output for frequency monitoring.

The intermediate frequency (IF) of the RFA-2 is 260 kHz and a precision 30 kHz wide band-pass filter is used to remove the unwanted adjacent channels and still retain the full frequency response and linearity for accurate monitoring of 10 kHz modulating frequencies. The IF skirt selectivity is such that an adjacent channel 40 kHz removed is more than 40 dB down.

The IF is amplified by a linear feedback amplifier to a level of 5 Vrms at the unit output so it can be fed to a separate AM modulation monitor. There is a 6 dB margin in the output capability to permit the high positive peaks of supermodulated carriers to be accurately monitored.

A portion of the 260 kHz is fed to a limiter to remove modulation and is mixed with the local oscillator frequency to restore the original station frequency. The output is filtered to remove unwanted signals and is amplified to provide a frequency measuring output.

One outstanding feature of the RFA-2 is its AGC range - the total range is more than 30 dB. Sufficient feedback is employed to hold the output level constant to better than 2% for an input level change of 12 dB. This eliminates the problems encountered when a station has to change power level or antenna pattern. The AGC also holds the level constant in remote locations where signal fading is a problem.

1-2 Physical Description

The RFA-2 is constructed on a standard 3.5 x 19 inch EIA rack mount panel. All factory adjustments are located within the shielded compartment of the unit. The RELATIVE OUTPUT meter and pilot lamp are located on the front panel. The AC power input, RF input and outputs, and the RF LEVEL control are located on the rear panel of the chassis.

The RFA-2 is completely solid state, utilizing all silicon transistors and integrated circuits for long trouble-free life. The individual circuits are constructed on military grade, glass epoxy, plated printed circuit boards. High reliability industrial and military grade components are used throughout.

1-3 Electrical and Mechanical Specifications

RF Sensitivity	100 μ V across 50 Ω minimum 300 μ V for a S/N ratio of 40 dB
Antenna Required	Whip or Loop
Bandwidth	0.2 dB \pm 10 kHz -3 dB \pm 16 kHz Greater than -40 dB \pm 40 kHz
Intermediate Frequency (IF)	260 kHz
Image Rejection	Greater than 50 dB
IF Rejection	Greater than 50 dB
RF Outputs	260 kHz, 5 Vrms min. for modulation measurements FREQ RF OUT for station frequency measurement
AGC Range	Less than 2% change in carrier level for 12 dB change in input level
Dimensions	3.5"H x 11.5"D x 19"W (EIA Rack Mount)
Net Weight	8 lbs (3.6 kgs)
Shipping Weight	11 lbs (5 kgs)
Power Requirements	115/230 Vac, 50/60 Hz

1-4 Instrument Identification

The instrument is identified by the model number and a six digit serial number. The model number and serial number appear on a plate located on the rear panel of the unit. All communications with your Belar representative or the Belar factory in regard to the instrument should reference the model number and complete serial number.

1-5 Accessories

BELAR SHIELDED LOOP ANTENNAS LP-1 and LP-1A:

BELAR Shielded Loop Antennas are recommended when excessive electrical interference exists, or in the presence of an interfering station.

The basic design of a loop receiving antenna reduces electrostatic noise, and by using the natural directional receiving pattern, off-axis interference from other stations can be minimized by rotating the antenna.

SPECIFICATIONS:

Model LP-1 Shielded Loop Antenna

Frequency Range	530 kHz to 1710 kHz in three ranges
Diameter	36" (914 mm)
Mounting	1/2" NPT
Connector	BNC
Attenuation	30 dB
Permissible Wind Load	150 mph (100 mph with 3/4" ice)

Model LP-1A Shielded Loop Antenna (Amplified)

The specifications for the LP-1A are the same as the LP-1 above, except that an internal amplifier provides 30 dB gain for unity output. +12 to +15 Vdc is required to power the amplifier. Belar RFA-2 Amplifiers can be easily modified to provide this voltage or the LP-1A Option 01 (external 12 Vdc power supply) may be used.

2 Unpacking

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 RFA-2 is shipped with an instruction book, three wire line cord, four beige rack mount screws, and a BNC coaxial cable.

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.

3 Installation and Setup

3-1 General

The RFA-2 is designed to be mounted in a standard 19 inch rack. The unit should be mounted either immediately below or above the modulation monitor. This is so the RF output cables may be kept as short as possible and dressed away from the RF input cable.

When the amplifier 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 RFA-2. In no instance should the ambient chassis temperature be allowed to rise above 50°C (122°F). Mount the RFA-2 in the rack using the four non-marring rack mount screws provided.

3-2 Power Connection

Newer RFA-2s can be operated from either a 105 to 125 Vac or 210 to 250 Vac, single phase, 50 to 60 Hz power source. Older RFA-2s are not field selectable for line voltage. Be sure the unit is set up for the proper voltage as follows:

Units prior to serial number 902422:

These units are not field selectable and are factory wired for 115 Vac or 230 Vac, single phase, 50 to 60 Hz power source operation only. Check the rear panel of the unit for a label which shows the line voltage that the unit is wired to operate with.

Units beginning with serial number 902422 and higher:

These units can be operated from either a 105 to 125 Vac or 210 to 250 Vac single phase, 50-60 Hz power source. Make sure the unit is set for the proper voltage as follows: Unplug the line cord. Slide the line voltage selector switch (S1) to the 115 V or 230 V position. Ensure that the fuse (F1) is the proper current rating for the selected voltage ($\frac{1}{2}$ A 250 V for 115 Vac, $\frac{1}{4}$ A 250 V for 230 Vac).

Connect the three-wire grounded line cord provided. If a substitute line cord is used, be sure that the ground lead is connected to "G" on the line cord receptacle.

3-3 RF Input Connection

Connect the antenna cable to the RF IN connector (J1), at the rear of the chassis. 50 Ω coaxial cable should be used for this connection. If the RFA-2 is being fed by a Belar LP-1 or LP-1A loop antenna, see the users guide supplied with the antenna for a discussion of loop antenna applications.

The ideal input level for the RFA-2 is 300 μ V of RF. Operating the amplifier at this level

assures the best signal-to-noise ratio and keeps the unit within its AGC range. The RFA-2 will operate with a lower input signal (down to 100 μV) but the S/N ratio will be degraded.

If the RFA-2 is being used with a Belar LP-1A amplified loop antenna, make sure that the RFA-2 has been modified to supply phantom power to the LP-1A amplifier. There is a kit available from Belar for this modification or the unit may have been modified at the factory.

3-4 Modulated RF Output Connection

WARNING!

The Belar Electronics Laboratory model RFA-2 AM RF Amplifier is designed to operate only with Belar AM modulation monitors such as models AMM-1, AMM-2, AMM-2A, AMM-2B, AMM-2C, AMM-3, AMM-3A and the AMMA-1. If one of these models is being used, make sure that the input is configured for 1000 Ω input impedance not 50 Ω .

The model RFA-2 output is designed to operate into a minimum load of 1000 Ω . Use of the model RFA-2 with a lower load impedance will damage the RFA-2, and such damage will not be covered by the Belar Warranty. For additional information, please contact the Belar Customer Service Department.

Using the 50 Ω coaxial cable supplied with the unit, connect the MOD RF OUT (J2), at the rear of the RFA-2 to the RF input of the modulation monitor. This signal is modulated 260 kHz so the modulation monitor being used should operate accurately down to this frequency. All models of Belar AM modulations monitors are designed to operate at this frequency.

3-5 Frequency RF Output Connection

If the station frequency is being monitored, connect another coax cable between the FREQ RF output connector (J3) and the RF input connector of the frequency monitor.

The Belar AMM-4 Digital Frequency Monitor is ideal for this purpose because it displays frequency deviation directly and has built-in frequency and level alarms.

When using the RFA-2 FREQ RF OUT with an AMM-4, R65 (2k) on the A2 Board in the AMM-4 has to be paralleled with a 2k resistor to insure that the AMM-4 receives sufficient signal to operate accurately.

3-6 Initial Setup

To place the unit into initial operation:

1. Turn the RF LEVEL control (R1), on the rear panel of the unit, fully counterclockwise.
2. Apply ac power by inserting the line cord into the receptacle on the unit rear. The pilot lamp on the front panel will illuminate indicating power on.
3. Turn the RF LEVEL control clockwise. Note that the RELATIVE OUTPUT meter (M1) moves upscale. Continue turning R1 clockwise until the meter is indicating in the green area.
4. Make sure that the meter remains in the green area at all of the station's normal transmitter power operating levels.

If the reading goes above the green at the highest operating power level, turn R1 down *just enough* to bring the reading down to the green then recheck it at the lowest operating power level.

If the reading goes below the green at the lowest operating power level, turn R1 up *just enough* to bring the reading up to the green then recheck it at the highest operating power level.

The broad AGC range of the RFA-2 should accommodate most normal transmitter carrier power level changes without readjustment of the RF amplifier.

When an RF amplifier is operated in close proximity to a transmitter on another AM frequency, input overload may become a problem. If you suspect an overload problem, watch the RF level indicator when your carrier is turned off. The indicator should drop to the same point on the scale as with the antenna disconnected. If it does not, try reducing the input level, and if necessary, insert a pad. Belar does not recommend introducing filters between the antenna and the RF amplifier, to attenuate adjacent frequency interference because of the likelihood that the filter will introduce errors into the signal.

4 Maintenance

4-1 Tuning the RFA-2

Equipment required: RF Signal Generator
AC Voltmeter

1. Install the new front end coil set and crystal in the RFA-2.
2. Connect the signal generator to the RF IN jack (J1). Set the level for 300 microvolts output from the generator at the new operating frequency.
3. Connect the AC voltmeter to the MOD RF OUT jack (J2). Set the range for 5 Vrms on the AC voltmeter.
4. Plug in the RFA-2. Set the RF LEVEL pot (R1) on the rear of the RFA-2 for 5V output on the AC voltmeter.
5. With a clip lead, disable the AGC line of the RFA-2 by grounding the negative side of

C43 (5 μ F/ 25 V) on the A1 board. The output will probably go up. You may need to lower the RF input from the RF signal generator to prevent clipping of the RFA-2's output.

6. Watching the AC voltmeter, tune the variable capacitors C3 and C10 and the slugs in L2 and L3 on the coil set bracket on the chassis. Tune for maximum output on the AC voltmeter connected to the unit output.
7. Remove the clip lead shorting C43. With the RF LEVEL pot (R1) on the rear of the RFA-2 set to maximum *and* 300 microvolts input from the RF generator, the output from the RFA-2 should be 5 Vrms. If not, adjust R37 (the pot towards the corner of the A1 board) for this value.
8. The front panel RELATIVE OUTPUT meter should read 0.3 under these conditions. If not, adjust the meter adjust pot R25 (the pot near the center of the A1 board) for this value.

5 Circuit Description

5-1 General

The RFA-2 is a solid state, sensitive, high gain RF amplifier consisting of an FET RF preamp, an FET mixer, a 260 kHz IF amplifier and a crystal oscillator for modulation measurements and an up-converter and filter for frequency measurements. The IF filter is less than 0.2 dB down at ± 10 kHz and more than 40 dB down at ± 40 kHz. High level (5 Vrms) 260 kHz is supplied to a rear output connector (J2), for modulation measurements. Low level 260 kHz is fed to a limiter to remove modulation and then mixed with the local oscillator output to restore the original station frequency. This is then supplied to a rear output connector (J3), for frequency measurements.

The AGC of the amplifier is such that a 12 dB input change will produce less than 2% change in carrier level thereby allowing the monitor to remain in calibration through the largest power change in use.

5-2 A1 (RF/IF) Board

RF from the RF LEVEL control (R1) on the rear panel is supplied to gate 1 of RF amp Q1 through a tuned circuit consisting of C1, C2 and C3 on the A1 board and L1 on the chassis mounted tuning assembly, A3. The output of Q1 is fed through tuned circuits consisting of C8, C9 and C10 on the A1 board and L2 and L3 on the chassis mounted tuning assembly, A3, to gate 1 of mixer Q2. C11 and L1 on the A1 board form a 260 kHz trap. The output of the mixer is fed through the IF filter to Q3. Q3 and Q4 form a gain controlled buffer that matches the IF filter output impedance to the IF amplifier U1. U1 supplies approximately 30 dB of gain and drives the IF output amplifier. The IF output amplifier consists of voltage amplifier Q6 and complementary drivers Q7 and Q8. Diodes CR3 and CR4 develop the AGC voltage and Q5 drives the RELATIVE OUTPUT meter. R37 sets the 260 kHz output voltage by fixing the AGC reference level. The AGC voltage is fed through low pass filter R34, R35, C41, C42 and C43 to gate 2 of Q1 and Q3.

5-3 A2 (Oscillator/Power Supply) Board

Diodes CR1 and CR2 supply approximately -30 Vdc to pre-regulator Q1 and zener VR1. The output of Q1 is -27 Vdc. Diodes CR3 and CR4 supply approximately +30 Vdc to pre-regulator Q2 and zener VR2. The output of Q2 is +27 Vdc. Zeners VR5 and VR6 supply regulated -6.2 Vdc and +6.2 Vdc respectively. +27 Vdc is fed thru R5 and U1 to zener VR3. VR3 regulates at +15 Vdc and supplies the +15 V bus of the amplifier. U1 acts as a dropping resistor for VR3 and thereby derives its +4 Vdc operating voltage. Zener VR4 protects U1 in case of a short on the +15 V bus.

Transistor Q3 and associated circuitry form a crystal controlled oscillator operating between 3200 kHz and 5360 kHz, depending on the crystal installed. The output of the oscillator is fed to U1 which is a dual J-K flip-flop. The flip-flops are connected to divide their input frequency by 4. This produces an output between 790 kHz and 1450 kHz which becomes the local oscillator (station frequency ± 260 kHz). The output on pin 14 of U1 is fed through a high-pass filter consisting of R6, R7, C7 and C8 to mixer Q2 on the A1 board. The output on pin 13 is fed to the mixer CR5 thru CR8 which restores the station frequency for frequency measurements.

Q4 and Q5 form a limiter which is supplied 260 kHz from U1 on the A1 board. The limiter removes most of the modulation and drives the mixer with 260 kHz. Tuned circuit C11, C12, C13 and L1 select the proper mixer output and Q6 drives the frequency output. C11A is used for stations below 700 kHz.

6 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.*

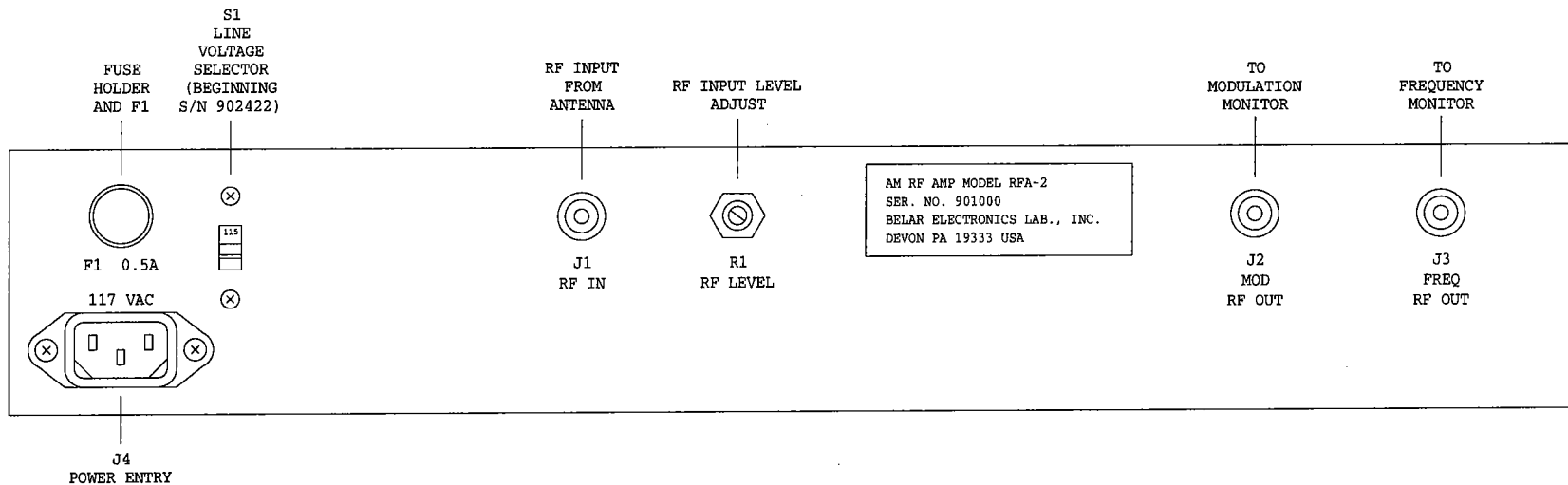
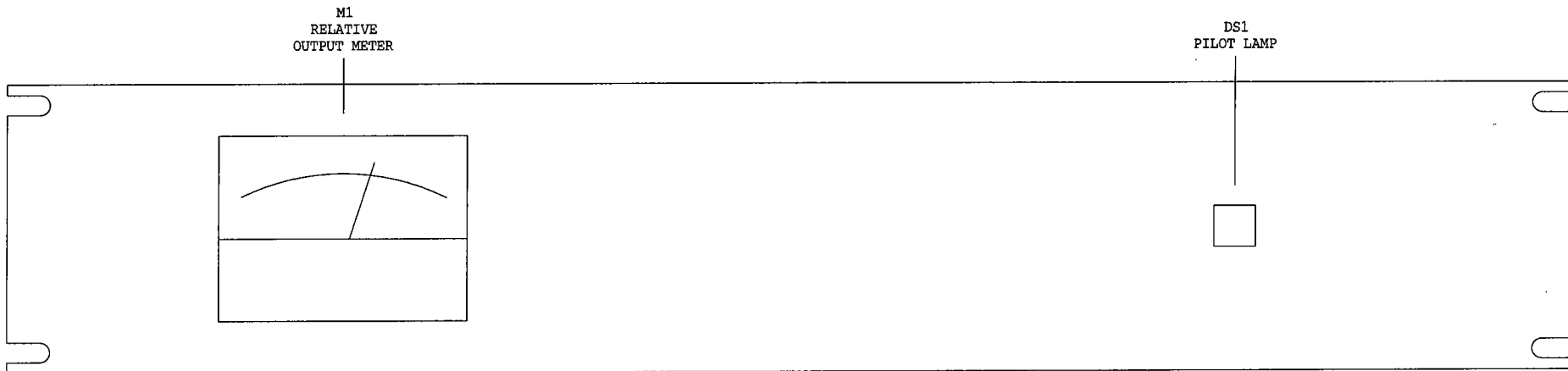
Orders may also be taken over the telephone. Parts orders can be put on your VISA, MasterCard, or American Express card, or we can ship them COD.

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	VR	= voltage regulator
F	= fuse	R	= resistor	W	= cable
FL	= filter	RL	= relay	X	= socket
HDR	= header connector	RN	= resistor network	Y	= crystal

ABBREVIATIONS

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



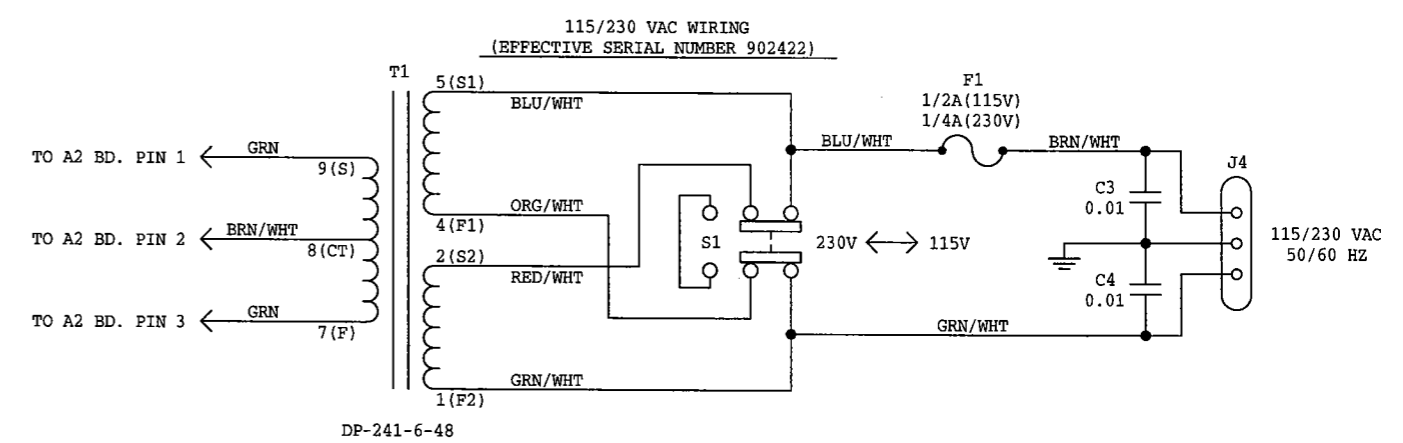
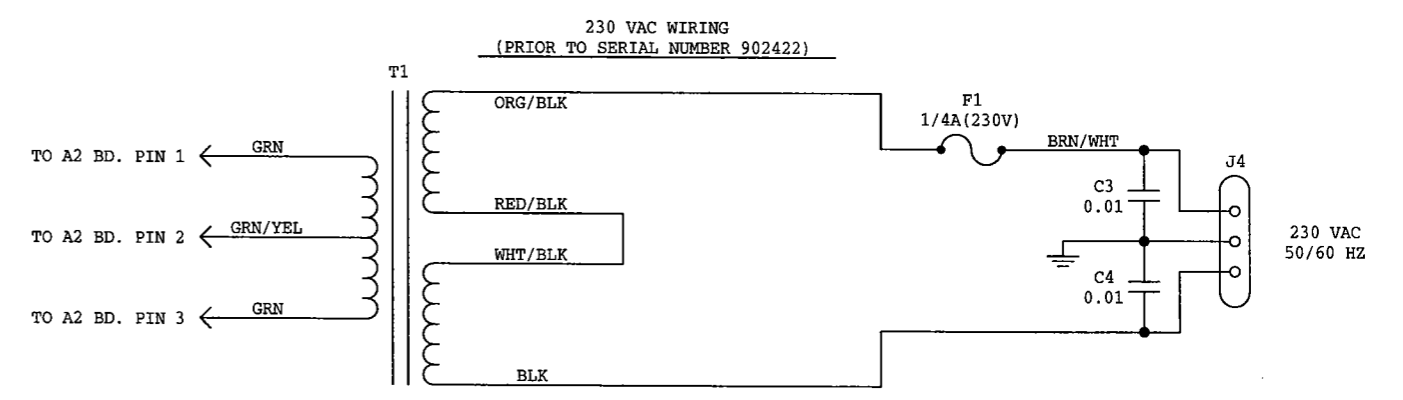
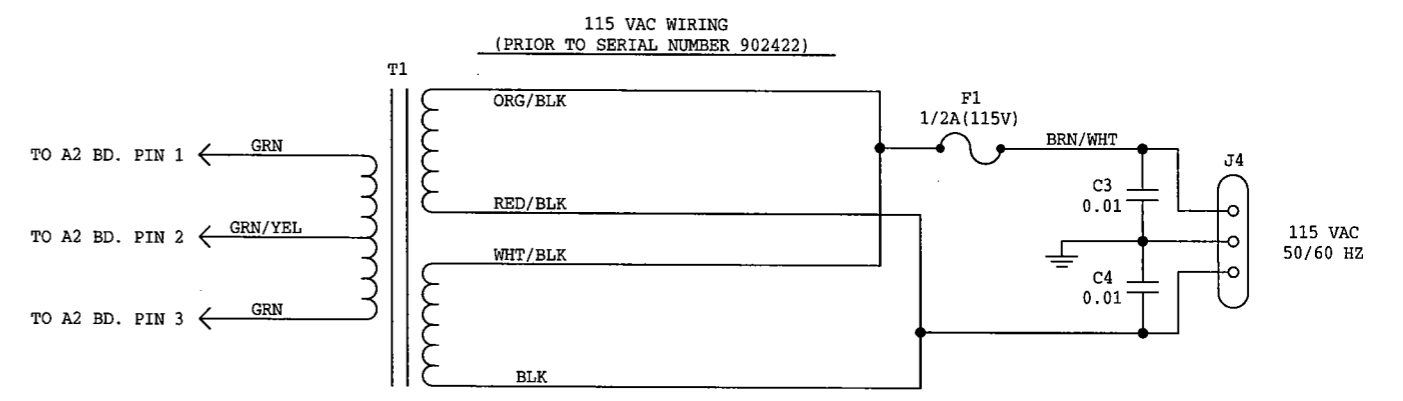
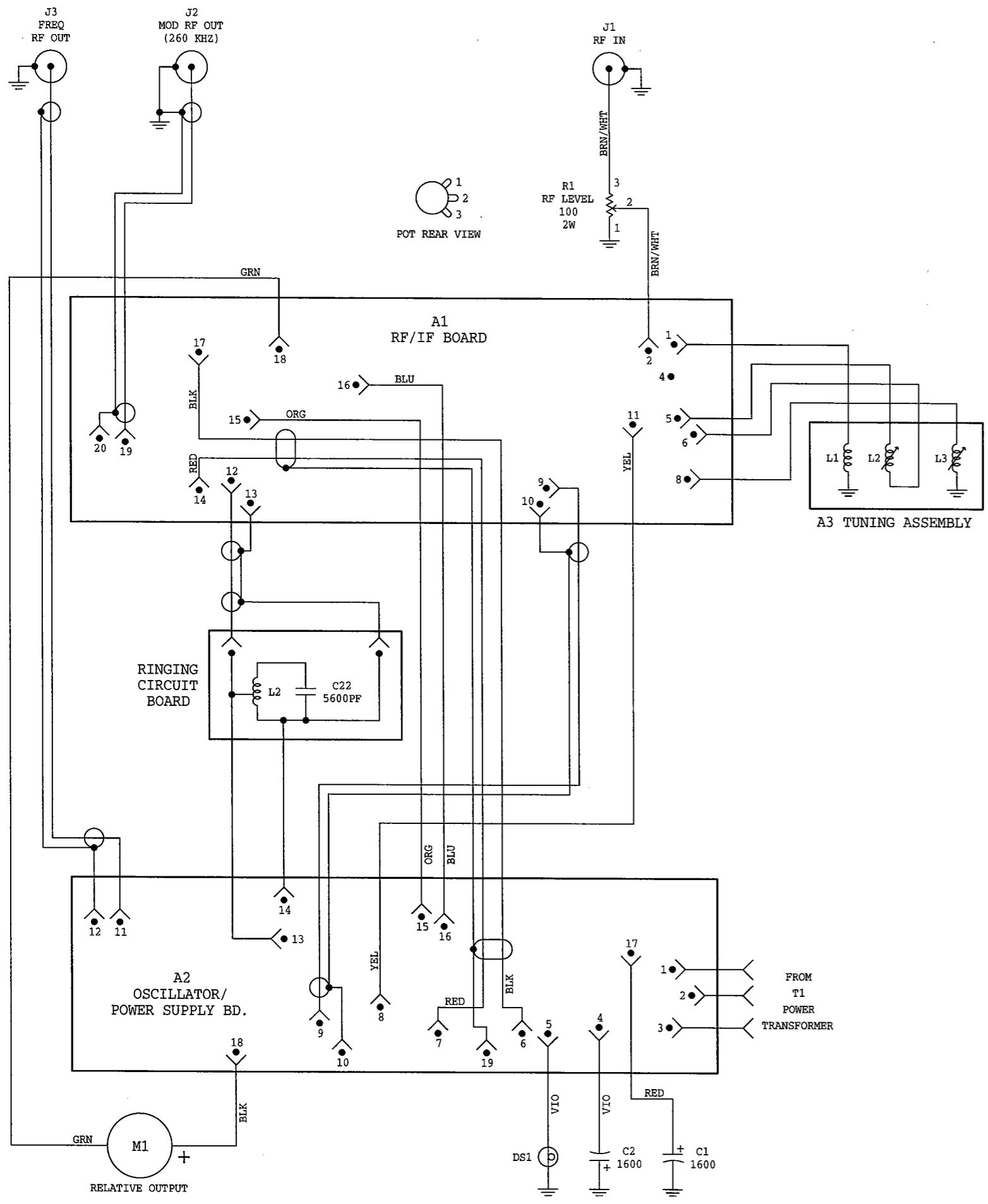
RFA-2 FRONT & REAR VIEW
BELAR ELECTRONICS

SECTION 6

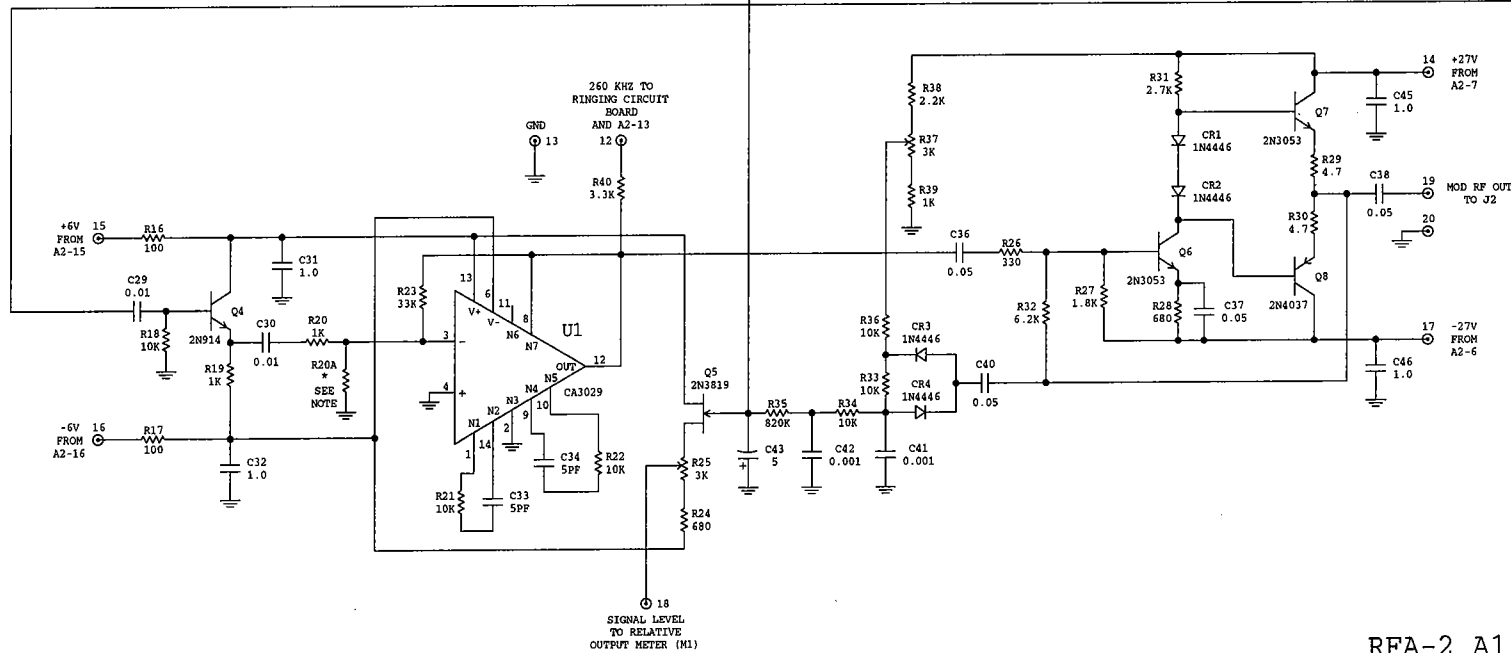
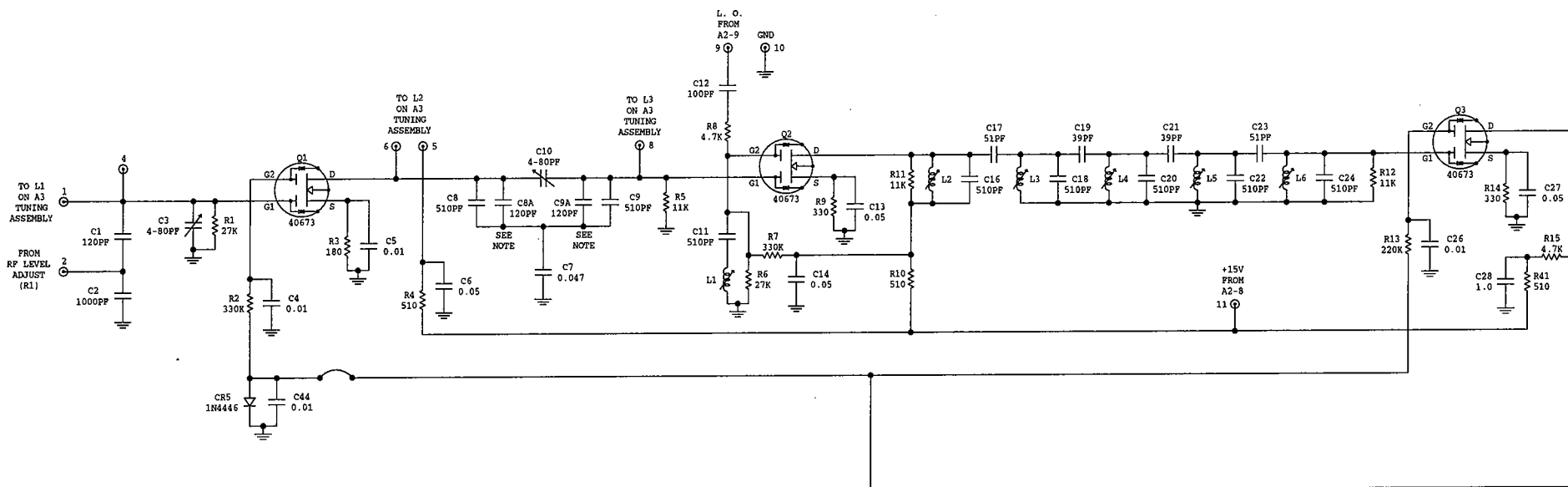
RFA-2 PART LISTS

MAIN CHASSIS

Reference Designation	Description	Part Number
A1	RF-IF CARD ASSEMBLY	Belar
A2	OSC-POWER SUPPLY CARD ASSEMBLY	Belar
A2-1	RINGING CIRCUIT ASSEMBLY	Belar
A3	TUNING ASSEMBLY	Belar
C1,C2	C: FIXED ELECT 1600uF 50V	0180-0033
C3,C4	C: FIXED CERAMIC 0.01uF 1.4kV	0151-0010
DS1	LAMP: #327	2140-0003
F1	FUSE: AGC 1/2A 250V (115 Vac line voltage)	2110-0001
	AGC 1/4A 250V (230 Vac Line voltage)	2110-0002
J1 thru J3	JACK: BNC	0360-0005
J4	JACK: POWER	0360-0010
M1	METER: RELATIVE OUTPUT	1120-0010
R1	R: VAR COMP 100, 2W	2100-0010
S1*	SWITCH: SLIDE 115/230V SELECTOR	3102-0002
	(*Note: S1 was added effective serial number 902422.)	
T1	TRANSFORMER: POWER	9100-0005
XDS1	SOCKET: LAMP	1450-0004
XF1	FUSEHOLDER:	2110-0003
--	LINE CORD (115 Vac line voltage)	8120-0002
--	LINE CORD (230 Vac line voltage)	8120-0004



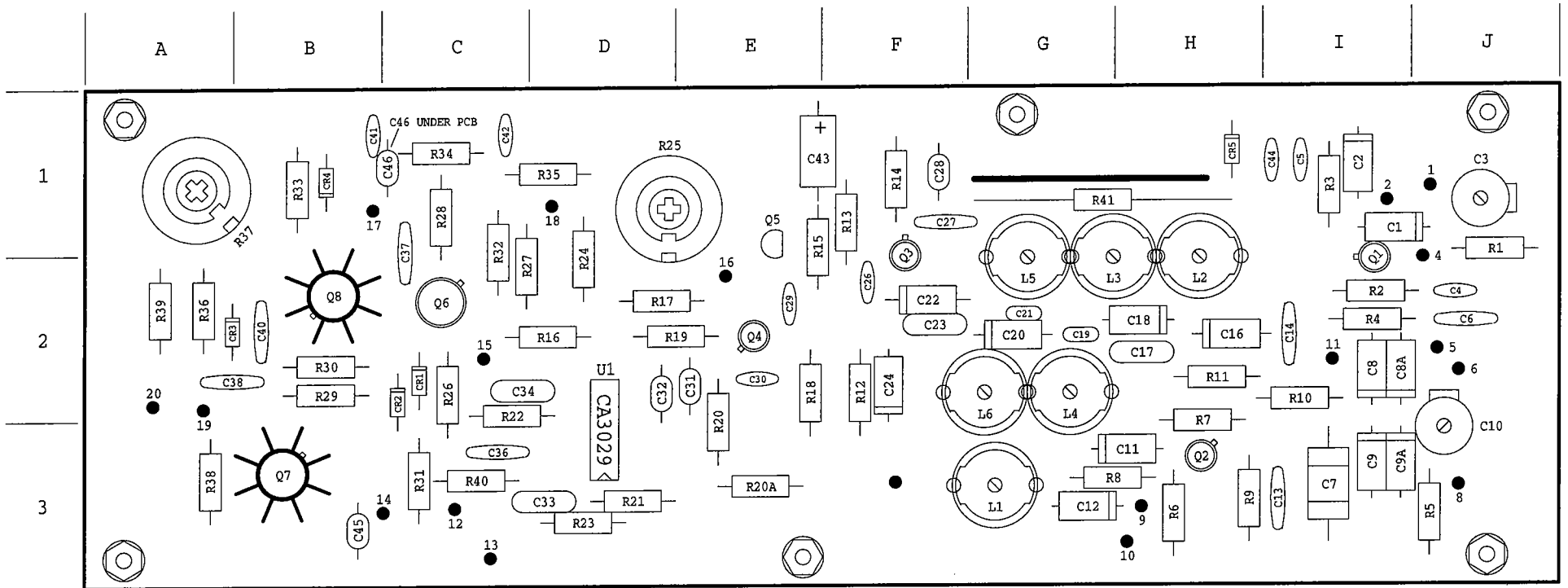
RFA-2 AM RF AMP
CHASSIS WIRING
1-8-01



NOTES:

1. DENOTES PCB JUMPER WIRE.
2. ALL RESISTANCE VALUES ARE IN OHMS.
3. ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
4. ALL CAPACITANCE VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED.
5. C8A AND C9A ARE USED FOR FREQUENCIES BELOW 700 KHZ.
6. R20A USED IF NECESSARY TO CORRECT DC OFFSET AT OUTPUT OF U1.

RFA-2 A1
RF-IF BOARD
BELAR ELECTRONICS
1-8-01

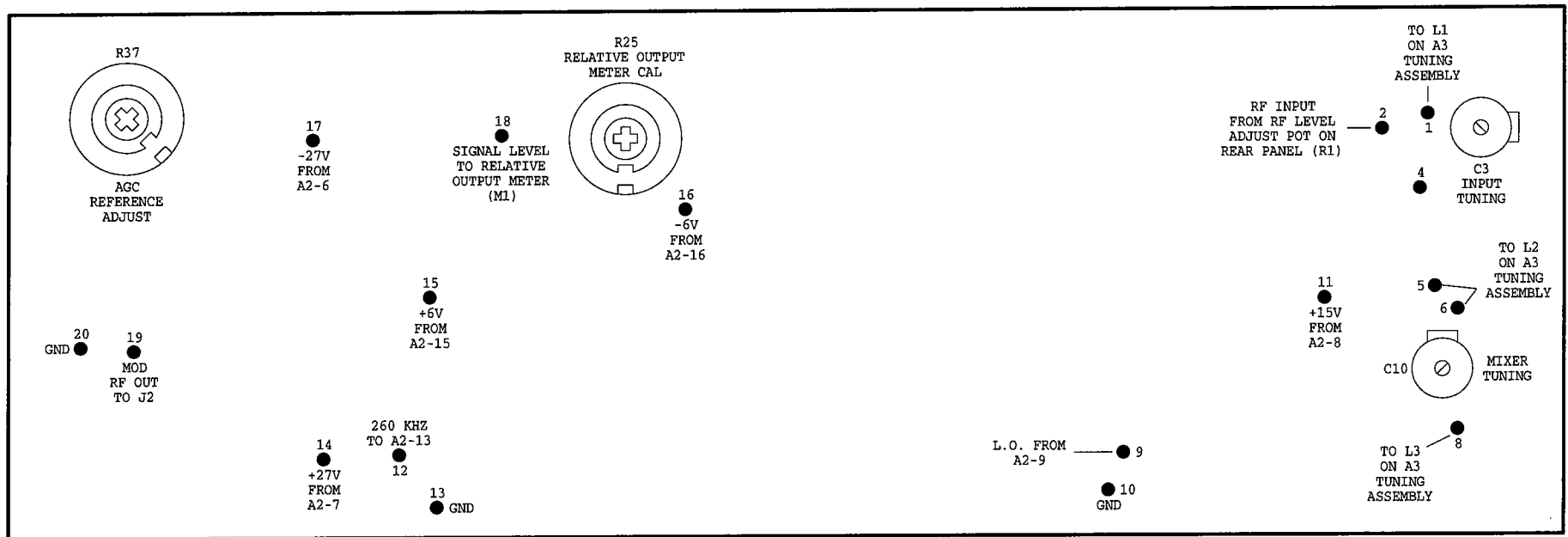


RFA-2 A1 BOARD
 COMPONENT LAYOUT
 BELAR ELECTRONICS

RFA-2 A1 BOARD
PART LOCATIONS

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1	I1	C27	F1	L1	G3	R13	F1	R40	C3
C2	I1	C28	F1	L2	H2	R14	F1	R41	G1
C3	J1	C29	E2	L3	G2	R15	E1		
C4	J2	C30	E2	L4	G2	R16	D2	U1	D3
C5	I1	C31	E2	L5	G2	R17	D2		
C6	J2	C32	D2	L6	G2	R18	E2		<u>pins</u>
C7	I3	C33	D3			R19	E2	1	J1
C8	I2	C34	C2	Q1	I2	R20	E3	2	I1
C8A	I2	C35	B1	Q2	H3	R20A	E3	3	--
C9	I3	C36	C3	Q3	F2	R21	D3	4	J2
C9A	I3	C37	C1	Q4	E2	R22	C2	5	J2
C10	J3	C38	A2	Q5	E1	R23	D3	6	J2
C11	H3	C39	C1	Q6	C2	R24	D2	7	--
C12	G3	C40	B2	Q7	B3	R25	D1	8	J3
C13	I3	C41	B1	Q8	B2	R26	C2	9	H3
C14	I2	C42	C1			R27	C2	10	H3
C15	H2	C43	E1	R1	J1	R28	C1	11	I2
C16	H2	C44	I1	R2	I2	R29	B2	12	C3
C17	H2	C45	B3	R3	I1	R30	B2	13	C3
C18	H2	C46	C1*	R4	I2	R31	C3	14	C3
C19	G2			R5	J3	R32	C1	15	C2
C20	G2	CR1	C2	R6	H3	R33	B1	16	E2
C21	G2	CR2	C2	R7	H3	R34	C1	17	B1
C22	F2	CR3	A2	R8	G3	R35	D1	18	D1
C23	F2	CR4	B1	R9	H3	R36	A2	19	A2
C24	F2	CR5	H1	R10	I2	R37	A1	20	A2
C25	F2			R11	H2	R38	A3		
C26	F2			R12	F2	R39	A2		

*C46 IS ON BOTTOM OF PCB



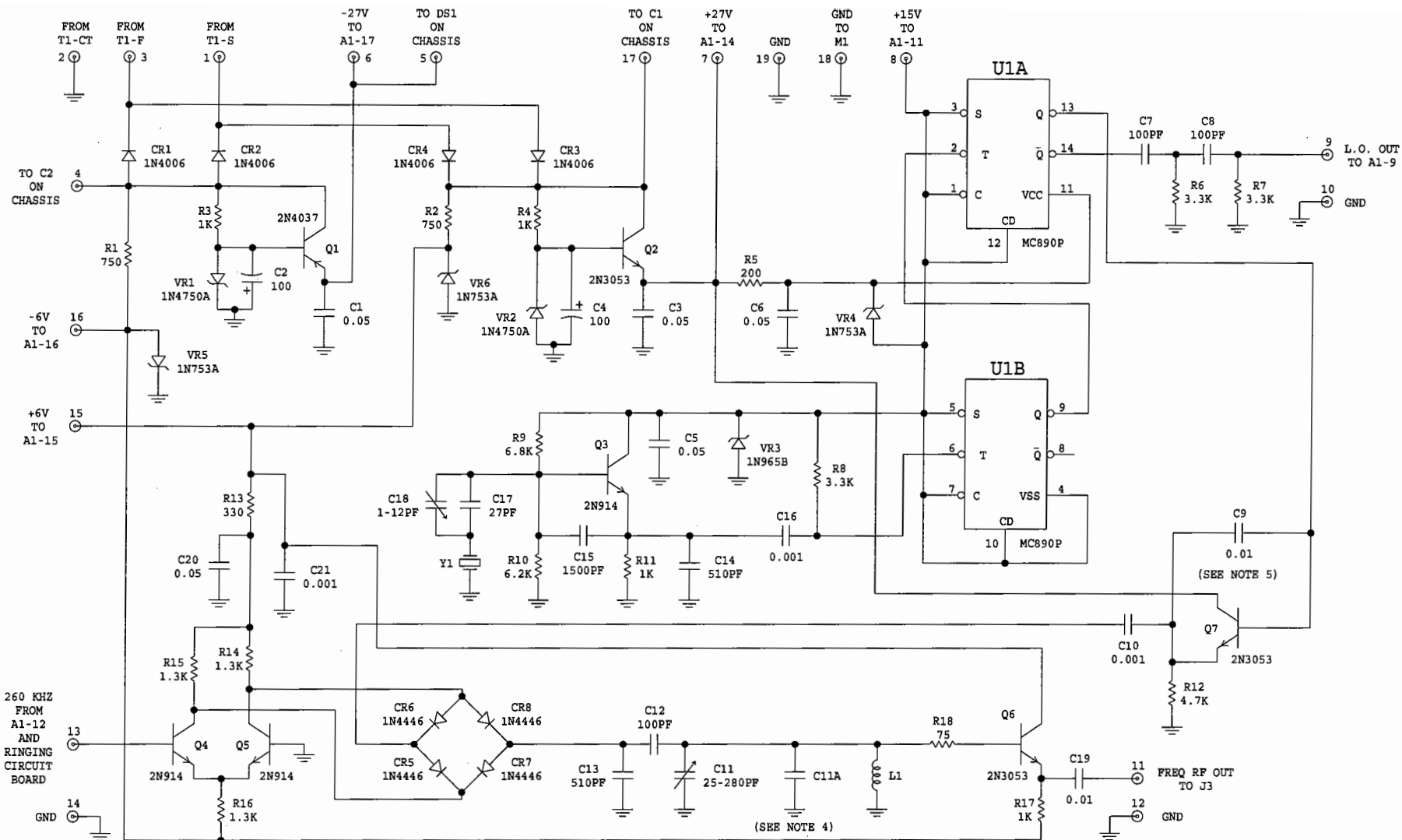
RFA-2 A1 BOARD
 CONNECTIONS & ADJUSTMENTS
 BELAR ELECTRONICS

A1 BOARD RFA-2

Reference Designation	Description	Part Number
C1	C: FIXED POLY 120pF 2.5% 160V	0130-1212
C2	C: FIXED POLY 1000pF 2.5% 160V	0130-1022
C3	C: VAR MICA 4-80pF	0121-0004
C4, C5	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C6	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C7	C: FIXED FILM 0.047uF 10% 200V	0120-4731
C8, C9	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C8A, C9A	C: FIXED POLY 120pF 2.5% 160V (C8A and C9A are only used when needed)	0130-1212
C10	C: VAR MICA 4-80pF	0121-0004
C11	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C12	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C13, C14	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C15	not used	
C16	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C17	C: FIXED MICA 51pF 5%	0140-5105
C18	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C19	C: FIXED MICA 39pF 5%	0142-3905
C20	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C21	C: FIXED MICA 39pF 5%	0142-3905
C22	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C23	C: FIXED MICA 51pF 5%	0140-5105
C24	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C25	not used	
C26	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C27	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C28	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C29, C30	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C31, C32	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C33, C34	C: FIXED MICA 5pF 5%	0140-0505
C35	not used	
C36 thru C38	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C39	not used	
C40	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C41, C42	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C43	C: FIXED ELEC 5uF 25V	0180-0007
C44	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C45, C46	C: FIXED CERAMIC 1.0uF 50V	0151-0008
CR1 thru CR5	DIODE: 1N4446	1900-0002
L1	INDUCTOR: VAR IF TRAP	Belar
L2 thru L6	INDUCTOR: VAR IF FILTER	Belar
Q1 thru Q3	TRANSISTOR: 40673 (ECG-222)	1850-0026
Q4	TRANSISTOR: 2N914	1850-0006
Q5	TRANSISTOR: 2N3819	1850-0001
Q6, Q7	TRANSISTOR: 2N3053	1850-0008
Q8	TRANSISTOR: 2N4037	1850-0011
R1	R: METAL FILM 27k 2% 1/2W	0771-2732
R2	R: METAL FILM 330k 2% 1/2W	0771-3342
R3	R: METAL FILM 180 2% 1/2W	0771-1812
R4	R: METAL FILM 510 2% 1/2W	0771-5112

A1 BOARD RFA-2 CONT.

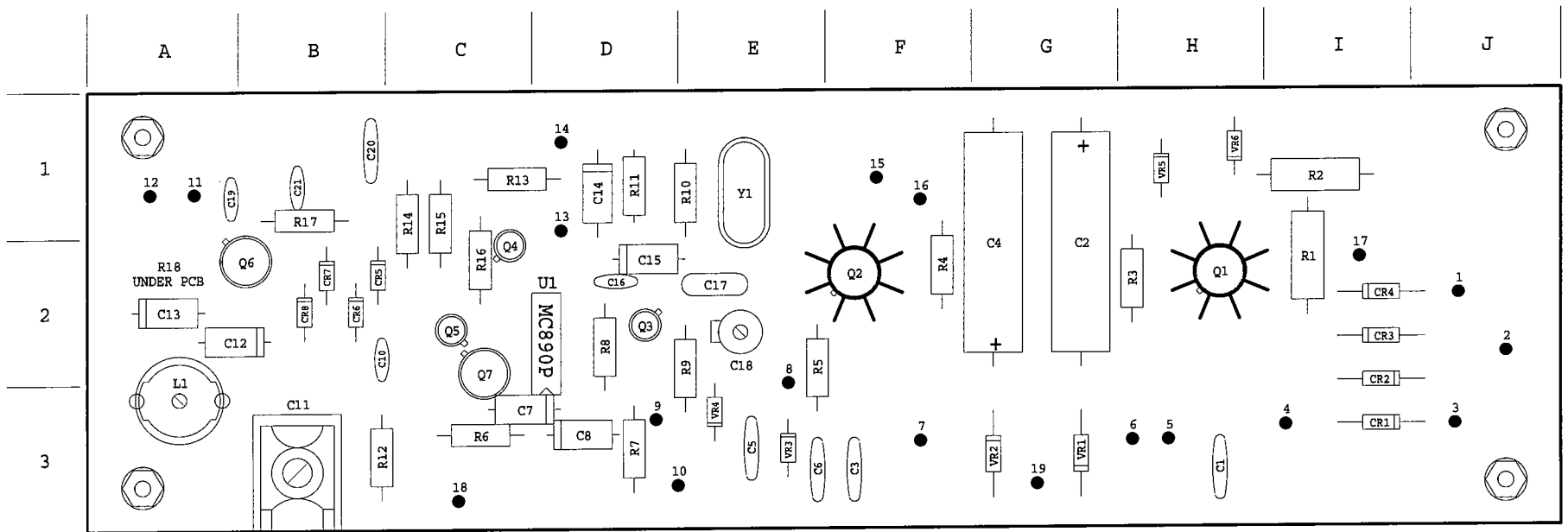
Reference Designation	Description	Part Number
R5	R: METAL FILM 11k 2% 1/2W	0771-1132
R6	R: METAL FILM 27k 2% 1/2W	0771-2732
R7	R: METAL FILM 330k 2% 1/2W	0771-3342
R8	R: METAL FILM 4.7k 2% 1/2W	0771-4722
R9	R: METAL FILM 330 2% 1/2W	0771-3312
R10	R: METAL FILM 510 2% 1/2W	0771-5112
R11,R12	R: METAL FILM 11k 2% 1/2W	0771-1132
R13	R: METAL FILM 220k 2% 1/2W	0771-2242
R14	R: METAL FILM 330 2% 1/2W	0771-3312
R15	R: METAL FILM 4.7k 2% 1/2W	0771-4722
R16,R17	R: METAL FILM 100 2% 1/2W	0771-1012
R18	R: METAL FILM 10k 2% 1/2W	0771-1032
R19,R20	R: METAL FILM 1k 2% 1/2W	0771-1022
R20A	R: METAL FILM - factory select	
(R20A used to correct dc offset at output of U1)		
R21,R22	R: METAL FILM 10k 2% 1/2W	0771-1032
R23	R: METAL FILM 33k 2% 1/2W	0771-3332
R24	R: METAL FILM 680 2% 1/2W	0771-6812
R25	R: VAR WW 3k 2W	2100-0005
R26	R: METAL FILM 330 2% 1/2W	0771-3312
R27	R: METAL FILM 1.8k 2% 1/2W	0771-1822
R28	R: METAL FILM 680 2% 1/2W	0771-6812
R29,R30	R: FIXED CARB 4.7 5% 1/2W	0686-47G5
R31	R: METAL FILM 2.7k 2% 1/2W	0771-2722
R32	R: METAL FILM 6.2k 2% 1/2W	0771-6222
R33,R34	R: METAL FILM 10k 2% 1/2W	0771-1032
R35	R: METAL FILM 820k 2% 1/2W	0771-8242
R36	R: METAL FILM 10k 2% 1/2W	0771-1032
R37	R: VAR WW 3k 2W	2100-0005
R38	R: METAL FILM 2.2k 2% 1/2W	0771-2222
R39	R: METAL FILM 1k 2% 1/2W	0771-1022
R40	R: METAL FILM 3.3k 2% 1/2W	0771-3322
R41	R: METAL FILM 510 2% 1/2W	0771-5112
U1	IC: CA3029	1820-0003



NOTES:

1. ALL RESISTANCE VALUES ARE IN OHMS.
2. ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITANCE VALUES ARE IN UF UNLESS OTHERWISE SPECIFIED.
4. C11A USED FOR FREQUENCIES BELOW 700KHZ.
5. BEGINNING SERIAL NUMBER 901561 C9 WAS NOT USED AND Q7 WAS ADDED.

RFA-2 A2
 OSC & POWER SUPPLY
 BELAR ELECTRONICS
 6-23-04

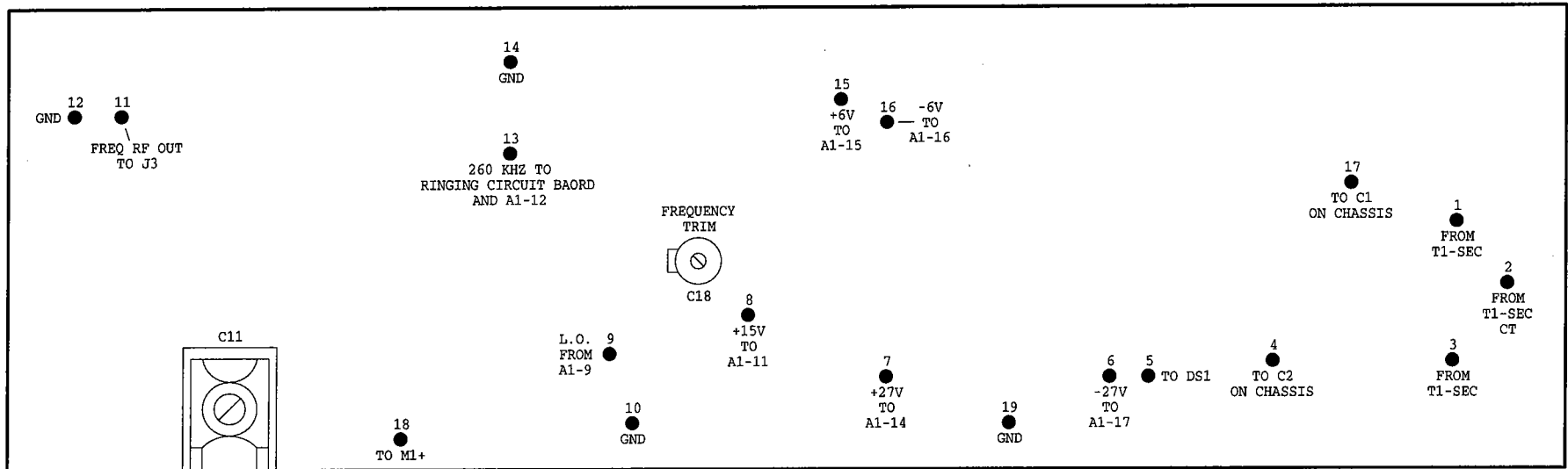


RFA-2 A2 BOARD
 COMPONENT LAYOUT
 BELAR ELECTRONICS

RFA-2 A2 BOARD
PART LOCATIONS

<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>	<u>Desig/Loc</u>
C1	H3	C22	*	R1	I2	VR2 G3
C2	G2			R2	I1	VR3 E3
C3	F3	CR1	I3	R3	H2	VR4 E3
C4	G2	CR2	I3	R4	F2	VR5 H1
C5	E3	CR3	I2	R5	E2	VR6 H1
C6	E3	CR4	I2	R6	C3	
C7	C3	CR5	B2	R7	D3	Y1 E1
C8	D3	CR6	B2	R8	D2	
C9	--	CR7	B2	R9	E2	<u>pins</u>
C10	B2	CR8	B2	R10	E1	1 J2
C11	B3			R11	D1	2 J2
C11A	B3	L1	A3	R12	B3	3 J3
C12	A2	L2	*	R13	C1	4 I3
C13	A2			R14	C1	5 H3
C14	D1	Q1	H2	R15	C1	6 H3
C15	D2	Q2	F2	R16	C2	7 F3
C16	D2	Q3	D2	R17	B1	8 E2
C17	E2	Q4	C2	R18	~	9 D3
C18	E2	Q5	C2			10 D3
C19	A1	Q6	B2	U1	D2	11 A1
C20	B1	Q7	C2			12 A1
C21	B1			VR1	G3	13 D1

*ON RINGING CIRCUIT BOARD
~ON PC BOTTOM

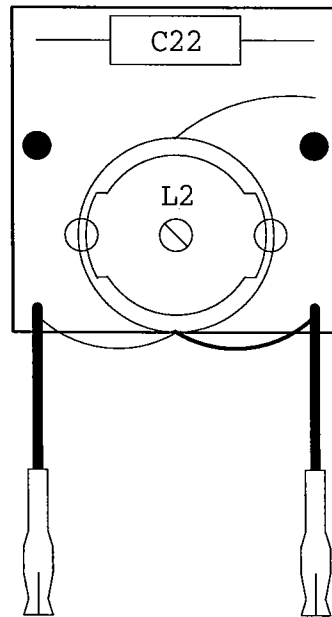


RFA-2 A2 BOARD
 CONNECTIONS & ADJUSTMENTS
 BELAR ELECTRONICS

A2 BOARD RFA-2

Reference Designation	Description	Part Number
C1	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C2	C: FIXED ELEC 100uF 50V	0180-0010
C3	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C4	C: FIXED ELEC 100uF 50V	0180-0010
C5,C6	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C7,C8	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C9*	C: FIXED CERAMIC 0.01uF 100V (*C9 not used beginning S/N 901561)	0151-0003
C10	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C11	C: VAR MICA 25-280pF	0121-0009
C12	C: FIXED POLY 100pF 2.5% 160V	0130-1012
C13,C14	C: FIXED POLY 510pF 2.5% 160V	0130-5112
C15	C: FIXED POLY 1500pF 2.5% 160V	0130-1522
C16	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C17	C: FIXED MICA 27pF 5%	0140-2705
C18	C: VAR MICA 1-12pF	0121-0005
C19	C: FIXED CERAMIC 0.01uF 100V	0151-0003
C20	C: FIXED CERAMIC 0.05uF 75V	0151-0005
C21	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
CR1 thru CR4	DIODE: 1N4006	1900-0016
CR5 thru CR8	DIODE: 1N4446	1900-0002
L1	INDUCTOR: FIXED	Belar
Q1	TRANSISTOR: 2N4037	1850-0011
Q2	TRANSISTOR: 2N3053	1850-0008
Q3 thru Q5	TRANSISTOR: 2N914	1850-0006
Q6,Q7*	TRANSISTOR: 2N3053 (*Q7 used beginning S/N 901561)	1850-0008
R1,R2	R: WIRE WOUND 750 5% 2W	0811-0006
R3,R4	R: METAL FILM 1k 2% 1/2W	0771-1022
R5	R: METAL FILM 200 2% 1/2W	0771-2012
R6 thru R8	R: METAL FILM 3.3k 2% 1/2W	0771-3322
R9	R: METAL FILM 6.8k 2% 1/2W	0771-6822
R10	R: METAL FILM 6.2k 2% 1/2W	0771-6222
R11	R: METAL FILM 1k 2% 1/2W	0771-1022
R12	R: METAL FILM 4.7k 2% 1/2W	0771-4722
R13	R: METAL FILM 330 2% 1/2W	0771-3312
R14 thru R16	R: METAL FILM 1.3k 2% 1/2W	0771-1322
R17	R: METAL FILM 1k 2% 1/2W	0771-1022
R18*	R: METAL FILM 75 2% 1/4W *R18 is on pc board bottom.	0751-7502
U1	IC: MC890P	1820-0008
VR1,VR2	DIODE: ZENER 1N4750A (1N3030B)	1900-0004
VR3	DIODE: ZENER 1N965B	1900-0007
VR4 thru VR6	DIODE: ZENER 1N753A	1900-0006
Y1	CRYSTAL: ORDER PER FREQUENCY	Belar
XY1	SOCKET: CRYSTAL	1200-0006

RFA-2 RINGING CIRCUIT BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS



(see Chassis Wiring Schematic)

Reference Designation	Description	Part Number
C22	C: FIXED POLY 5600pF 2.5% 160V	0130-5622
L2	INDUCTOR: VARIABLE	Belar