

NOTE: The A2B differs from the A2 only in certain mechanical changes such as the connectors on the tuning units and the use of different types of transistors in some circuits. All operating and technical specifications are identical.

Due to the use of different connectors, the modules of the A2B are NOT interchangeable with those supplied with previous A2's. The change was made effective with serial number 421.

RADIO RECEIVER WITH SPECTRUM DISPLAY  
MODEL A-2B

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FAIRFIELD, CONNECTICUT, U.S.A.

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## SECTION 1 GENERAL DESCRIPTION

### 1.1 Purpose of Equipment

#### Spectrum Surveillance

The primary purpose of the A-2 Receiver is to search the radio frequency spectrum for clandestine transmissions. Electronic eavesdropping has become a threat to the integrity of confidential information.

As the frequency spectrum is scanned, both an audio and visual display enables the operator to identify the received signals.

The knowledge of the presence of a listening device may be more important than the discovery of the exact location. A physical search which uncovers a "bug" may alert the perpetrator and prevent his apprehension.

#### Electromagnetic Compatibility of Equipment

Especially important in airborne systems, electromagnetic compatibility insures the non-interference between equipments within an installation. In aircraft, for instance, the various sub-system components are carefully designed to have minimum spurious outputs, but interaction of legitimate signals may generate false responses in navigation and communications equipment.

The A-2 Receiver system allows an investigation of the frequency spectrum to be carried on while the aircraft is in operation. The portability of the A-2 also permits access to confined areas of the aircraft. The visual display will assist in the identification of the signals which may be present.

#### Electromagnetic Shielding Investigation

Screen room installations are usually accepted as preventing the entrance of external RF fields. Investigation has shown that there are several paths such as doors, power lines and antenna access ports which permit interfering signals to enter the test area. Tests involving small signal amplification such as noise figure, intermodulation and cross modulation distortion and power gain are susceptible to interfering signals.

Because of its portability, small size and battery operation, the A-2 Receiver is especially useful in surveying electromagnetic enclosures for shielding integrity.

### 1.2 General Description

#### 1.2.1 Major Components

The A-2 Receiver System is composed of the following components:

1.2.2 Models of Operation

The A-2 Receiver System can be operated using its internal batteries for power. Thirty-five (35) hours of operation will be obtained before battery replacement will be necessary (15 hours when S-1 is used). An external battery pack (BP-1) is supplied and can be attached to the basic receiver, providing a total of 120 hours of operation (60 hours when S-1 is used).

If AC operation is desired, the AC power supply is attached to the basic unit. The AC range of 95 to 250 volts, 50/60 Hz can be used.

The S-1 Monitor may be mounted either on back of A-2 with thumbscrews, or operated as a separate unit alongside the receiver with joining cables.



- 5) Plug headphones in jack on extreme right of basic unit.
- 6) Rotate AF GAIN knob until noise is heard.
- 7) Tune in signal by rotating tuning knob on top of tuner.  
Tune for maximum deflection of S meter.
- 8) Place LO-HI TEST switch in either LO or HI, whichever gives convenient meter deflection (LO-low signal level, HI-high signal level).
- 9) If signal is frequency modulated place FM-AM-CW switch in FM position.
- 10) If signal is amplitude modulated place FM-AM-CW switch in AM position.
- 11) If signal is unmodulated place FM-AM-CW switch in CW position and rotate PITCH knob until desired tone is heard.
- 12) Select bandwidth by placing NAR-MED-WIDE switch in desired position  
(NAR - 12 KHz, MED - 100 KHz, WIDE - 350 KHz)
- 13) If manual control of IF gain is desired, place OFF-ON-MAN in MAN position.
- 14) The IF GAIN control is now operative and can be adjusted for desired gain.
- 15) For ease of tuning signal use bandspread control located on front surface of tuner (end surface on T-650, T-1200, and T-2000 tuner)
- 16) Second detector AC and DC outputs are available at the IF test point jack directly under the meter. Use high impedance level only.
- 17) The spurious CW signal at 23.5 MHz will beat with any incoming signal at 23.5 MHz. By detuning slightly at this point, the incoming signal can be received.
- 18) If AC power supply is used and line voltage is not known, place line voltage switch located on top of power supply to the "200-250" position. Set A-2 meter switch to "TEST." Turn power supply on and A-2 Receiver on. If meter reads less than 7.5, set voltage switch to next lower voltage position until meter reaches 7.5. Voltage switch is then in proper position. Always start at highest voltage position when line voltage is unknown, or line fuses will burn out.

### 2.3 Operation of S-1 Visual Monitor

- 1) The S-1 visual monitor is required only if scanned visual display of r. f. signals is desired.

- 13) Place A-2 FM-AM-CW switch in AM position for AM signals and FM position for FM signals. (AM setting appears as the IF band pass curve on one side of base line. FM setting appears as FM "S" curve on both sides of line.) See Fig. 11.
- 14) Place SWEEP switch in SPEECH position. In this position a bright indicating spot will appear in the center of the screen. When it is desired to listen to the modulation of a particular signal, center that signal on the spot by tuning the tuner. The modulation of the signal will be heard. Some sweep rate noise will also be heard. If the signal must be heard clearly with no sweep noise, place SWEEP switch in OFF position. When viewing intermittent pulse modulation it may be advantageous to use a faster rate of sweep to reduce the possibility of missing the signal. The faster sweep rate can be obtained by placing the SWP RATE switch in the FAST position. When using the fast sweep rate it will be difficult to listen to the modulation. When listening, place desired signal in center of screen over bright spot and place SWEEP switch in OFF position.

Place SWEEP switch in LFB-NAR position when using LFB/TLF Set in NARROW Bandwidth position (500 cycle bandwidth).

- 15) The FILT position of the SWEEP switch provides background noise filtering of the signal and is useful in wide and medium band width positions of the A-2 receiver. Though this filter is useful in defining very low level signals against background noise, caution must be used as some signal detail is lost.
- 16) If a large viewing area is desired an external oscilloscope can be used. Connecting cables should be used to connect the jack marked EXT SCOPE SWP to horizontal input of oscilloscope. Internal sweep of oscilloscope should be disabled. Connecting cable should be used to connect EXT SCOPE SIG to vertical input of oscilloscope. The oscilloscope can then be used for viewing the display in the same manner as when using the S-1 Monitor.



may be found at 2, 3, 4 or even 50 times the original frequency. Most bugging devices will have harmonics, but legitimate transmitters will not. Since there are very few legitimate signals in the higher frequency ranges, the harmonic is easy to spot.

3. Plug the whip antenna into the BNC Connector on the top of the Tuner. Extend the whip to its full length being careful not to bend the small upper elements.
4. If AC power supply is used and line voltage is not known, place line voltage switch located on the back of the power supply in the "200-250" position. Set A-2 meter switch to "TEST". Turn power supply on and A-2 Receiver on. If meter reads less than 7.5, set voltage switch to next lower voltage position until meter reaches 7.5. Voltage switch is then in proper position. Always start at highest voltage position when line voltage is unknown, or line fuses will burn out. The line fuses are located in the AC plug.
5. Place OFF-ON-MAN switch in ON position. (If AC supply is being used place both power supply switch and ON-OFF-MAN switch in ON position.)
6. Place LO-HI-TEST switch in TEST position. Meter should indicate between 7.5 and 9.0. This procedure tests the condition of batteries or AC supply output. If the meter does not indicate the correct voltage, batteries should be replaced, or AC power supply voltage switch adjusted as in step 4.
7. Place HI-LO-TEST switch in LO position. Do not leave on TEST.
8. Plug headphones in jack on extreme right of A2 basic unit.
9. Rotate AF GAIN knob until noise is heard.
10. Put bandwidth switch on A2 in cent. - Med. position.
11. Place FM-AM-CW switch in FM.
12. For portable operation, mount S-1 on rear of A2. Orient viewing screen so that it is on same end as tuner. Tighten the two thumbscrews.
13. If portable operation is not important the S-1 can be operated on a table or desk in any position. The connecting cables supplied are long enough to allow this method of operation.
14. Insert red plug into jack on side bottom of T2000 tuner. Insert black

22. The FILT position of the SWEEP switch provides background noise filtering of the signal and is useful in wide and medium band width positions of the A-2 receiver. Though this filter is useful in defining very low level signals against background noise, caution must be used as some signal detail is lost.

When a signal is received:

1. Tune in signal by rotating tuning knob on side of tuner. Tune for maximum deflection of S meter.
2. Place LO-HI-TEST switch in either LO or HI, whichever gives convenient meter deflection (LO-low signal level, HI-high signal level).
3. If signal is frequency modulated place FM-AM-CW switch in FM position. Most bugs are frequency modulated.
4. If signal is amplitude modulated place FM-AM-CW switch in AM position. If it cannot be determined if the signal is AM or FM, use the switch position which gives the least audio distortion.
5. If signal is unmodulated place FM-AM-CW switch in CW position and rotate PITCH knob until desired tone is heard.
6. Select bandwidth by placing NAR-MED-WIDE switch in desired position (NAR - 12 KHz, MED - 100 KHz, WIDE - 350 KHz)
7. If manual control of IF gain is desired, place OFF-ON-MAN in MAN position. This control is rarely required and normally it is left in the full counterclockwise position.
8. The IF GAIN control is now operative and can be adjusted for desired gain.
9. For ease of tuning signal use bandsread control located on front surface of tuner (end surface on T-650, T-1200, and T-2000 tuner).
10. Several techniques may be used to find out if a bug is present if the signal is suspicious.
  - a. The first and most obvious is the identification of the information being transmitted. The broadcast of an informal, private business conversation sounds quite different from a legitimate



When using electronic surveillance equipment and following the sweep patterns and techniques mentioned above, it is important to employ the following procedures. It is generally recommended practice, especially when you have reason to believe a room is bugged, to conduct the electronic surveillance from an adjacent room. Normal conversations should continue in the bugged room (of course, nothing confidential should be discussed). If this is not possible, security officers can conduct a synthetic meeting to provide a seemingly legitimate sound source. If this is not possible, a radio or tape recording can be used.

Whatever is used, it must appear to be a legitimate sound source so that the eavesdropper listening won't suspect entrapment. Also, the sound source used must be familiar to the person operating the surveillance equipment so that he can easily identify its clandestine broadcast.

Some surveillance operators prefer to run a sweep in the room which is suspected to contain the bug. During the sweep, the received signals are played through a loudspeaker. When the receiver detects the bug in the room, the rustling noise in the speaker will be picked up by the room bug, rebroadcast and fed back through the speaker producing a screech or howl. This technique is very effective and positively establishes the existence of a bug. However, if the eavesdropper is monitoring his transmission, he will identify this technique and either turn off or abandon the bug to prevent its discovery, or his entrapment. Therefore, where counter-use of the bug (by providing false information) or entrapment of the bugger are contemplated, the feedback technique should not be used.

If these are not the objectives, then the feedback technique can be very helpful in locating the bug in the room. First, tune the receiver to the bug's broadcast frequency and turn the speaker volume control up until the feedback screech is heard. Then, turn down the volume until the screech stops. Move the receiver around the room until the screech is heard again. This means that you are now closer to the bug. Continue this process as often as possible until you have narrowed your search to as small an area of the room as possible. At this point, a physical search procedure should be employed.

B. Operation with T1200 Tuner

1. Replace the T2000 tuner with the T1200 tuner which covers 650 to 1200 MHz. Repeating all steps covered by the T2000.

Also the T340 covers a large percentage of the frequencies used by the "non-professional" eavesdropper as well as the harmonics of those frequencies. These and the older types of bugs are to be found between 80 and 88 MHz, and a modified FM receiver may be used by the culprit.

E. Operation with the T75 Tuner

1. Replace the T340 tuner with the T75 tuner which covers 18 to 75 MHz, repeating all steps covered by the T2000, except for antenna mounting.
2. Connect the antenna marked 18-340 MHz to the side of the T75.
3. The legitimate stations encountered in this band will be:
  - a. Television - 75 to 54 MHz
  - b. Amateur Radio - 54 to 50 MHz
  - c. 2 Way Mobile Radio - 30 to 50 MHz
  - d. Amateur Radio - 30 to 28 MHz
  - e. Citizens Band - 27.25 to 27 MHz
  - f. Foreign Broadcast, including teletype, voice, facsimile, code etc; occasional amateur radio - 27 to 18 MHz

F. Operation with the T18 Tuner

1. Replace the T75 tuner with the T18 tuner which covers 4.5 to 18 MHz, repeating all steps covered by the T2000, except for antenna mounting setting the Bandwidth switch to IN-NAR.
2. Connect the antenna with the switch on the side of the block to the T18. Note that the switch should be placed in the frequency range which you are tuning through (either 4.5 to 10 MHz or 10 to 18 MHz.)
3. In this band will be found mostly foreign broadcast, amateur radio and some time stations such as WWV on 5, 10 and 15 MHz which give the time every 5 minutes with a ticking tone in between.



**C. TLF-1 (2 to 9 KHz)**

1. Connect the TLF-1 Tuner to the right hand side of the A2. Align the blue plug and the snap fastener of the TLF-1 with the blue socket and hole of the LFB-1 and push together. Note that there is no holding bolt as there is on the high frequency tuners.
2. Set the Bandwidth Switch on the LFB-1 to IN-NAR.
3. If an external speaker is used, feedback to the TLF-1 may occur due to the low frequency range of this tuner. Do not use an external antenna with the TLF-1.
4. Slowly tune from 2 to 9 KHz. Very seldom will any signal be found with this tuner, but a great deal of man-made and natural noise will be noted. Squawks, squeaks, squeals and impulse type electrical sounds will prevail.
5. If you should find a signal on this tuner, it will be very apparent on the signal strength meter. On the TLF-1, the visual display unit (S1) may not be usable and the signal strength meter will provide adequate indication.
6. Note that the movable antenna on the top of the tuner is directional and may be turned to "peak" the signal on the S meter. At null or minimum signal strength, the antenna axis will be pointing toward the signal source in most cases. Note also that touching the various controls with the hand will affect the signal indication.
7. Remove the tuner by pulling it away from the LFB-1. Prying the tuner off by pulling against the bottom edge is helpful in freeing the fastener. DO NOT use the antenna as a handle for removing the TLF tuners.

**D. TLF-2 (9 to 43 KHz)**

1. Connect the TLF-2 Tuner to the right hand side of the A2. Align the blue plug and the snap fastener of the TLF-2 with the blue socket and hole of the LFB-1 and push together. Note that there is no holding bolt as there is on the high frequency tuners.
2. Set the Bandwidth Switch on the LFB-1 to CENT.-MED.

5. If you should find a signal on this tuner, it will be very apparent on the signal strength meter.
6. Note that the movable antenna on the top of the tuner is directional and may be turned to "peak" the signal on the S meter. At null or minimum signal strength, the antenna axis will be pointing toward the signal source in most cases. Note also that touching the various controls with the hand will affect the signal indication.
7. Remove the tuner by pulling it away from the LFB-1. Prying the tuner off by pulling against the bottom edge is helpful in freeing the fastener. DO NOT use the antenna as a handle for removing the TLF tuners.

F. TLF-4 (130 to 475 KHz)

1. The TLF-4, which tunes 130 to 475 KHz will cover the operating range of all KNOWN carrier current devices, but don't become overconfident and neglect the other tuners.
2. Connect the TLF-4 Tuner to the right hand side of the A2. Align the blue plug and the snap fastener of the TLF-4 with the blue socket and hole of the LFB-1 and push together. Note that there is no holding bolt as there is on the high frequency tuners.
3. Set the Bandwidth Switch on the LFB-1 to out-wide.
4. Plug the power line antenna to an AC outlet and the white jack on the bottom side of the TLF-4.
5. If an external speaker is used, feedback to the TLF-4 may occur due to the low frequency range of this tuner.
6. Slowly tune from 130 to 475 KHz. You may start noticing legitimate signals in this band, depending on your location. Use of the BFO on the LFB-1 may aid in their reception. They may appear as on-off tones, teletype, facsimile, CW code or voice. Most of these legitimate stations will be received better if no external antenna is used, but the carrier current devices will be received better by using the power line antenna. As you tune through 455 KHz, you may find a "birdie". This is a false signal generated within the A2 Receiver.



5. Note that the movable antenna on the top of the tuner is directional and may be turned to "peak" the signal on the S meter. At null or minimum signal strength, the antenna axis will be pointing toward the signal source in most cases. Note also that touching the various controls with the hand will affect the signal indication.
6. Remove the tuner by pulling it away from the LFB-1. Prying the tuner off by pulling against the bottom edge is helpful in freeing the fastener. DO NOT use the antenna as a handle for removing the TLF tuners.

#### H. TLF-6 (1.47 to 4.5 MHz)

1. Connect the TLF-6 Tuner to the right hand side of the A2. Align the blue plug and the snap fastener of the TLF-6 with the blue socket and hole of the LFB-1 and push together. Note that there is no holding bolt as there is on the high frequency tuners.
2. Set the Bandwidth Switch on the LFB-1 to out-wide. If there is interference between two stations very close to each other, put the Bandwidth Switch to CENT. -MED.
3. The SI Visual Display is suggested for use in this band. Place the controls as follows (see Figure 2A):
  - a. SWP. Rate - SPEECH
  - b. Power - ON
  - c. SWEEP - FILT. ON
  - d. INT., SWP. WIDTH AND SWP. GAIN - fully clockwise
  - e. SIG. GAIN - as needed for full screen vertical display.

When a signal is found, the SWEEP may be turned off so that any audio on the signal may be identified.

4. Slowly tune from 1.47 to 4.5 MHz. The TLF-6 covers the top of the AM Broadcast band and some of the foreign broadcast short-wave bands. An external antenna is not necessary.
5. Note that the movable antenna on the top of the tuner is directional and may be turned to "peak" the signal on the S meter. At null or minimum signal strength, the antenna axis will be pointing toward the signal source in most cases. Note also that touching the various controls with the hand will affect the signal indication.

## SECTION III MAINTENANCE

## 3.1 Battery Replacement - Basic Unit

- 1) Place OFF-ON-MAN Switch in OFF position.
- 2) Remove the four flathead screws in rear panel of basic unit and remove panel.
- 3) Remove the two 9.8 volt batteries from holders.
- 4) Install fresh batteries in holders. Observe polarity. Burgess H137R, Eveready E137, or Mallory TR137R may be used.
- 5) Replace cover and screws.

## 3.2 Battery Replacement - Battery Pack

- 1) Remove two screws from left cover (cover nearest thumbscrew knob).
- 2) Remove cover.
- 3) Remove batteries from holder.
- 4) Install new batteries. Observe polarity shown on block. Any of the following batteries may be used:

Mallory	RM-12 or RM-12R	Mercury
Burgess	Hg-12	Mercury
Burgess	Hg-12R	Mercury
Burgess	Hg-9	Mercury
Eveready	N46	Nickel-Cadmium
Eveready	E91	Alkaline
Eveready	915	Carbon

- 5) Replace cover, tighten screws evenly. Test immediately by attaching to A-2 and switching Meter Switch to TEST. If meter doesn't read or is low, remove battery pack cover and check polarity carefully.



## SECTION IV THEORY

### 4.1 General Theory of Operation - Refer to Fig. 4

The modulated carrier received at the antenna is coupled through a tuned RF filter section and is applied to a transistor mixer (in the T-340, T-650, T-1200 and T-2000 a diode is used). The local oscillator produces a signal tracked at 23.5 MHz above the incoming RF signals which is also applied to the mixer. The resultant 23.5 MHz IF signal is coupled out of the tuner to the first IF stage in the basic unit.

The signal is amplified in three transformer-coupled IF stages and is applied to a switching circuit which selects either a narrow (12 KHz) band width crystal filter, a medium (90 KHz) band width crystal filter, or for wide bandwidth operation, no crystal filter.

In wideband operation the bandwidth is equal to the selectivity of the IF strip (about 350 KHz). The signal is amplified through two additional IF stages and coupled simultaneously to the FM discriminator and the AM-CW detector. A switching circuit then selects the output of either the discriminator, for FM operation, or the diode detector, for AM and CW operation, for application to the audio amplifier. The signal meter, obtaining its current through the detector, indicates relative signal strength in any mode. In CW operation, power is applied to the beat-frequency oscillator, whose output is loosely coupled back to the first IF stage. The detected IF signal is fed through two stages of audio amplification and is transformer-coupled to the phones.

Operating power for the receiver is provided from batteries within the Basic Unit, the BP-3 Battery Pack, or from the PS-2 AC supply. A switching circuit in the power jack disconnects the internal batteries if either of the external power sources are being used. The "S" meter, with the meter switch in TEST position, measures the output under load of the power source employed.

### 4.2 S-1 Monitor Theory of Operation

Refer to Figure 12. The S-1 Monitor receives demodulated signals from the A-2 Receiver and converts them so that they are adapted for display on a cathode ray tube. As shown in Figure 12, the S-1 Monitor consists of four basic units -- sweep generator, signal amplifier, high voltage supply, and display tube.

The sweep generator provides a sweep voltage which is applied to the deflection plates of the cathode ray tube. A portion of the sweep voltage

## SECTION V LFB/TLF TUNER SET

### 5.1 Purpose of Equipment:

The purpose of the LFB/TLF tuner set is to extend the frequency range of the A-2 Receiver System downward to 2 kilohertz. It is also a purpose of this equipment to provide radio frequency, tuned, directional, magnetic field, antennas from 2 KHz to 4500 KHz.

### 5.2 General Description

The LFB/TLF tuner set consists of seven components as follows:

- 1) LFB-1 Basic 455 KHz IF amplifier section
- 2) TLF-1 Tuner, 2 - 9 KHz
- 3) TLF-2 Tuner, 9 - 43 KHz
- 4) TLF-3 Tuner, 43 - 130 KHz
- 5) TLF-4 Tuner, 130 - 475 KHz
- 6) TLF-5 Tuner, 475 - 1470 KHz
- 7) TLF-6 Tuner, 1470 - 4500 KHz

The LFB-1 section bolts on to the A-2 basic receiver and may be left mounted at all times. This LFB-1/A-2 combination will then accept all "TLF" and "T" type tuners. The A-2 provides the LFB-1 with power, audio amplification, S-meter and use of auxiliary components.

The LFB/TLF set provides 3 switchable IF bandwidths; BFO; tape dials; band spread; directional, magnetic, electrostatic, and powerline antennae. When provided with other components of the A-2 system, visual scanning, S-meter, audio output, external AC and battery supplies are also usable over the TLF tuner range.

It may be desirable on certain occasions to operate the LFB/TLF set as a separate receiver. To achieve this, it will be necessary to order an adapter (LFA-1) from F. G. Mason Engineering. The LFA-1 furnishes the power, S meter and audio functions for the LFB/TLF when used as a separate unit. Use as a separate receiver will allow two operators to use the equipment, one scanning the frequencies from



## SECTION VI COMPONENT ASSEMBLY

## 6.1 Removing and Mounting LFB-1 to A-2:

To remove the LFB-1 from the A2, unscrew the flush mounting bolt on the right side of the LFB-1 with the special flat key which is provided. Note that this mounting bolt is hollow and is used to secure the T series tuning heads to the LFB-1. Remove the LFB-1.

To mount LFB-1 to A-2, place coaxial connector on left side of LFB-1, in line with mating coaxial connector on right side of A-2. At the same time line up mounting screw protruding from LFB-1 with threaded hole in A-2. Turn screw with special key provided. Screw head is on right hand side of LFB-1. As screw is tightened, push units together making sure that connector and alignment screw head at bottom are properly seated. When units are tightly mounted, tighten set screw through access hole in back of LFB-1 unit in line with mounting screw. Use hex wrench provided. This locks mounting screw.

Place black plug from LFB-1 into jack on A-2 marked "black." This completes mounting of LFB-1 to A-2. This combination will now operate with all other receiver components without removal.

## 6.2 Mounting Tuners to LFB-1:

Mounting "T" series tuners (T18, T75, T340, T650, T1200, T2000) is accomplished in the same manner described in Section II of the A-2 manual except that they are now mounted to the LFB-1 right hand surface instead of the A-2 right hand surface.

Mounting TLF tuners to the LFB-1 is accomplished by aligning the blue plug and the snap fastener of the tuner with the blue socket and hole of the LFB-1 and pushing together. Remove by pulling apart. Prying the tuner off by pulling against the bottom edge is helpful in freeing the fastener. DO NOT use the antenna as a handle removing the TLF tuners.

Cable to A-2 Black Jack: Plug into "black jack" on A-2.  
(Black and red jacks are for use with S-1 monitor.)

#### 7.1.5 TLF Controls and Operation

**Main Tuning:** Large knob on right hand side. Eight revolutions tune unit through its range. Direct reading dial indicates RF frequency received. Do not force knob against stops at end of rotation as damage will occur.

**Band Spread:** Smaller knob on right hand side of tuner. 3/4 revolution fine tunes RF frequency within a small range of dial frequency. The TLF-1 does not have a Band Spread Control.

#### 7.1.6 Antennas:

TLF tuners are provided with loop antennas mounted on a swivel on top of the unit. In signal searching, it is best to first plug in either the whip antenna (marked 18 -340 MHz) or the long wire antenna (use bottom banana jack), since these are non-directional at these frequencies. Then search the spectrum desired for signals. When a signal is detected by earphones, "S" meter, or Visual Monitor, then remove external antenna and find direction of signal by rotating loop antenna. At null or minimum signal strength, the antenna axis will be pointing toward signal emission in most cases.



## SECTION VIII LFA ACCESSORY

### PURPOSE

The LFA is a combination "S" meter, Audio Amplifier, and Battery Pack, designed for use with the Model LFB (455 KHz IF Amplifier). It is not furnished with the A2 system, but may be ordered as an accessory.

The LFA, LFB, and a TLF set combine to form a low frequency receiver system which allows an operator to scan the low frequency range while a second operator scans the high frequency range.

### SPECIFICATIONS

Size:  $4\frac{1}{2}$ H x  $2\frac{1}{2}$ W x 1 7/8D  
Weight: with five 4.05 VDC TR133R Mercury batteries - 19 oz.  
Battery: 35 hour continuous operation; 15 hours with S-1  
Output: 1000 ohms audio - 30 mw

### MOUNTING THE LFA TO THE LFB

To mount the LFA to LFB, place coaxial connector on left side of LFB in line with mating coaxial connector on right side of LFA. At the same time, line up mounting screw protruding from LFB with threaded hole in LFA. Turn screw with special key provided. (Screw head is on right hand side of LFB). As screw is tightened, push units together making sure that connector and alignment screw head at the bottom are properly seated. When units are tightly mounted, tighten set screw through access hole in back of LFB unit in line with mounting screw. (Use hex wrench provided). This locks mounting screw. Place black plug from LFB into jack on LFA marked "black". This completes mounting of LFB to LFA. This combination will now operate with any TLF tuner.

### EXTERNAL POWER SOURCE

The BP-3 Battery Pack or the PS-2 AC power supply can be connected on left side of LFA to provide additional operating time. Connect the BP-3 or PS-2 supply by plugging into left hand end of the LFA unit and tightening the thumbscrew.

### OPERATION OF LFA/LFB UNIT

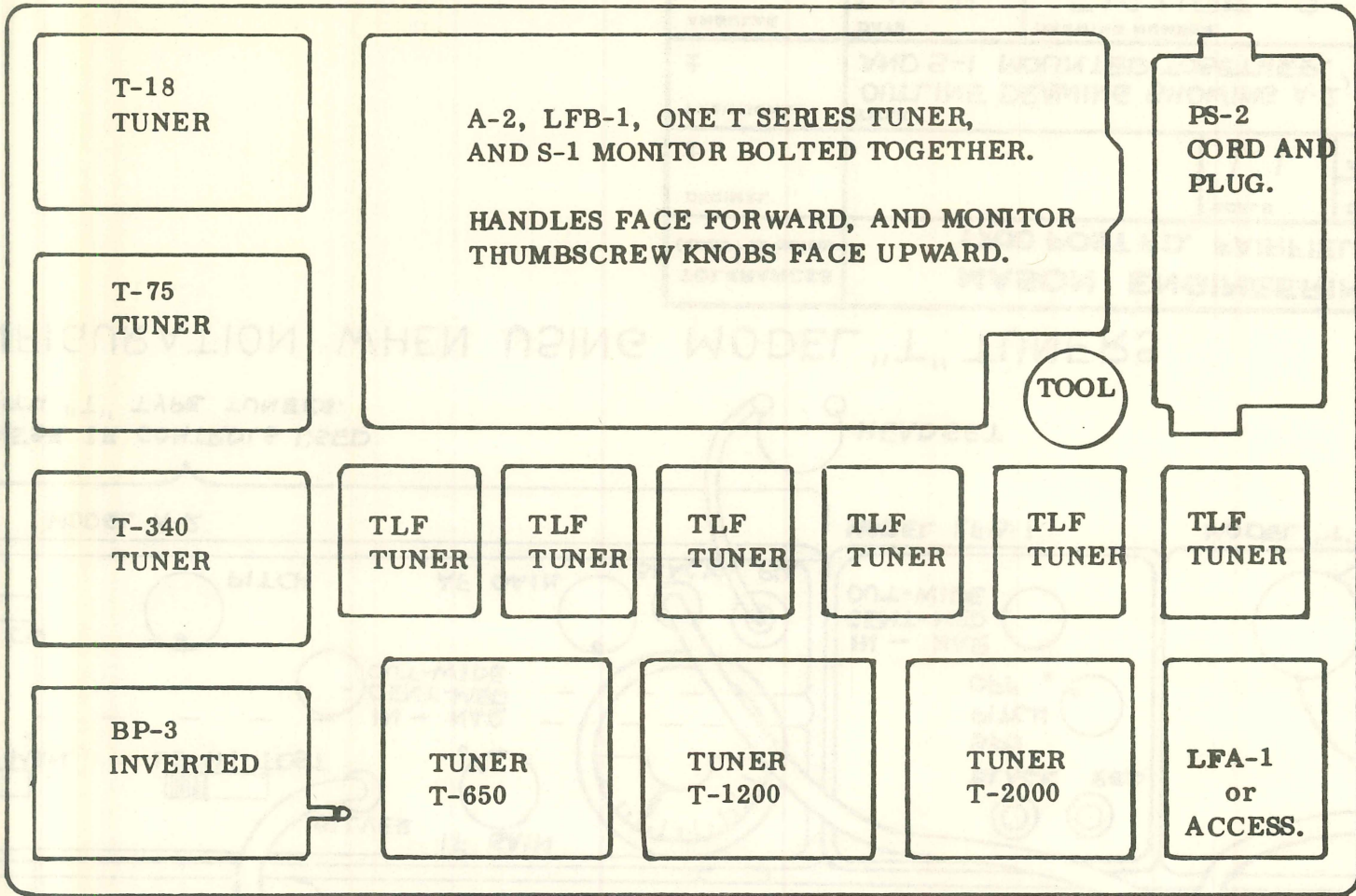
- 1) With the LFA and LFB joined together, connect any TLF tuner to the LFB.
- 2) Turn Audio Gain control clockwise to turn unit on.

- 5) Replace cover and install screws. Tighten screws evenly. Test immediately by placing Low-High-Test switch to Test and turning audio control on. If meter does not read properly, remove cover to check for correct polarity and that the springs are fully down to the bottom of the holes.

#### Transistor Replacement

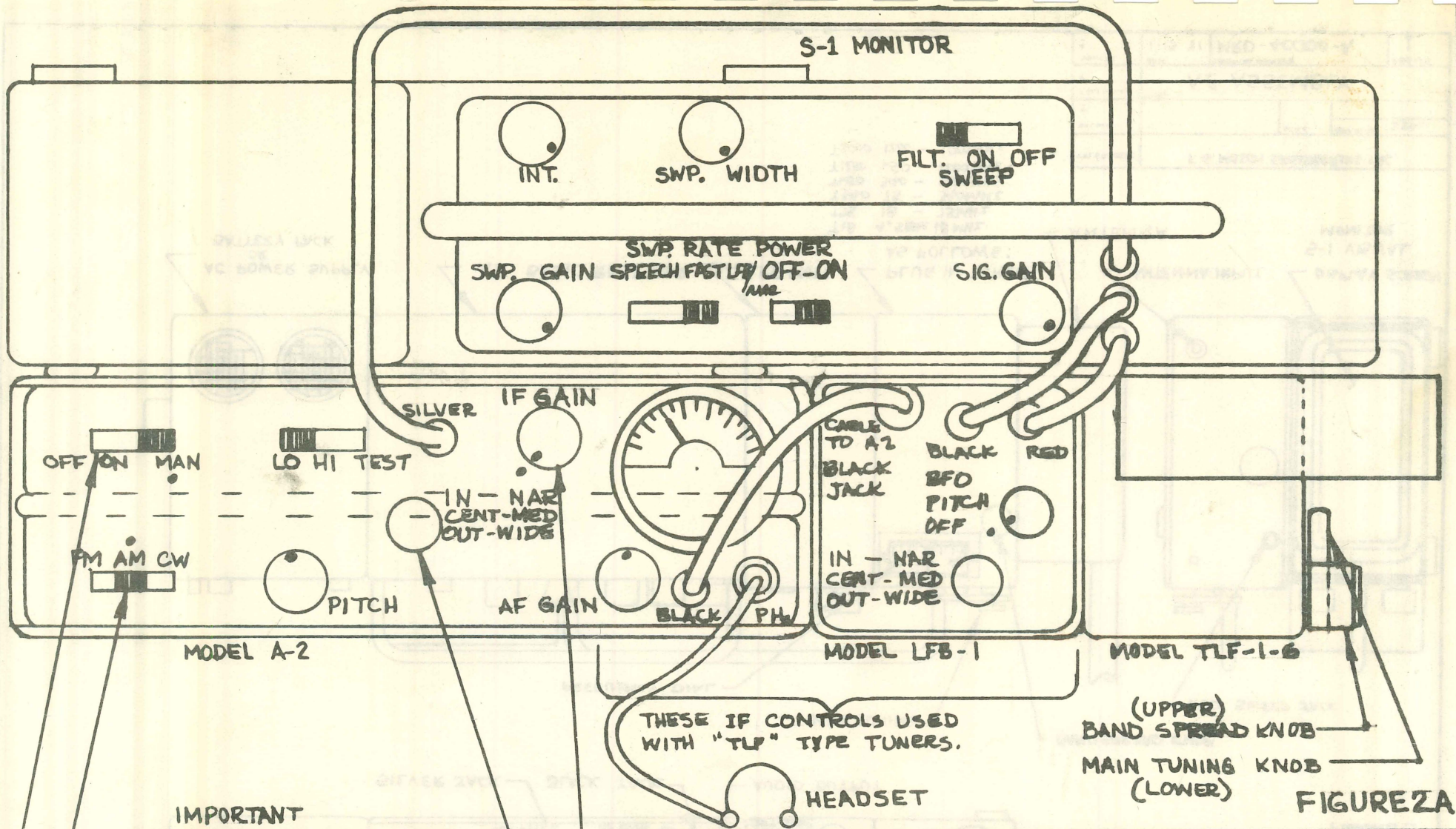
Remove six 4-40 screws on both front side and backside of LFA and slide top half upward. This operation will expose the 2N217 (next to the transformer) and the 2N109. (Note: do not replace transistors with unit energized).





<b>MASON ENGINEERING INC.</b>			
1700 POST RD. FAIRFIELD, CONN.			
	TITLE <b>CASE INSERT DIAGRAM</b>		
		FIGURE 1	ISSUE





IMPORTANT  
WHEN USING "TLF" TUNERS  
SET A2 CONTROLS AS FOLLOWS:

- 1) OFF ON MAN AT "MAN"
- 2) FM AM CW AT "AM"
- 3) IN CENT OUT AT "IN"
- 4) IF GAIN AT MIN. GAIN (CCW)

TOLERANCES (EXCEPT AS NOTED)		MASON ENGINEERING INC. 1700 POST RD. FAIRFIELD, CONN.	
DECIMAL	SCALE		
±	1:1	APPROVED BY	
FRACTIONAL	TITLE	DRAWING NUMBER	
±	OUTLINE DRAWING SHOWING A-2, LFB-1, TLF TUNER, AND S-1 MOUNTED TOGETHER.	FIGURE 2A	
ANGULAR	DATE	DRAWING NUMBER	ISSUE
±	1-18-71	FIGURE 2A	1



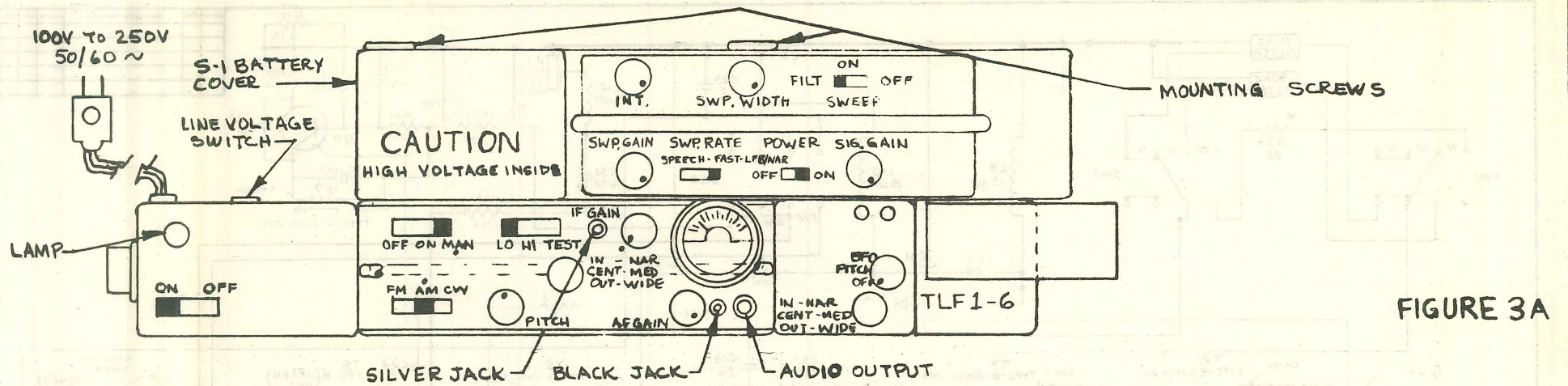
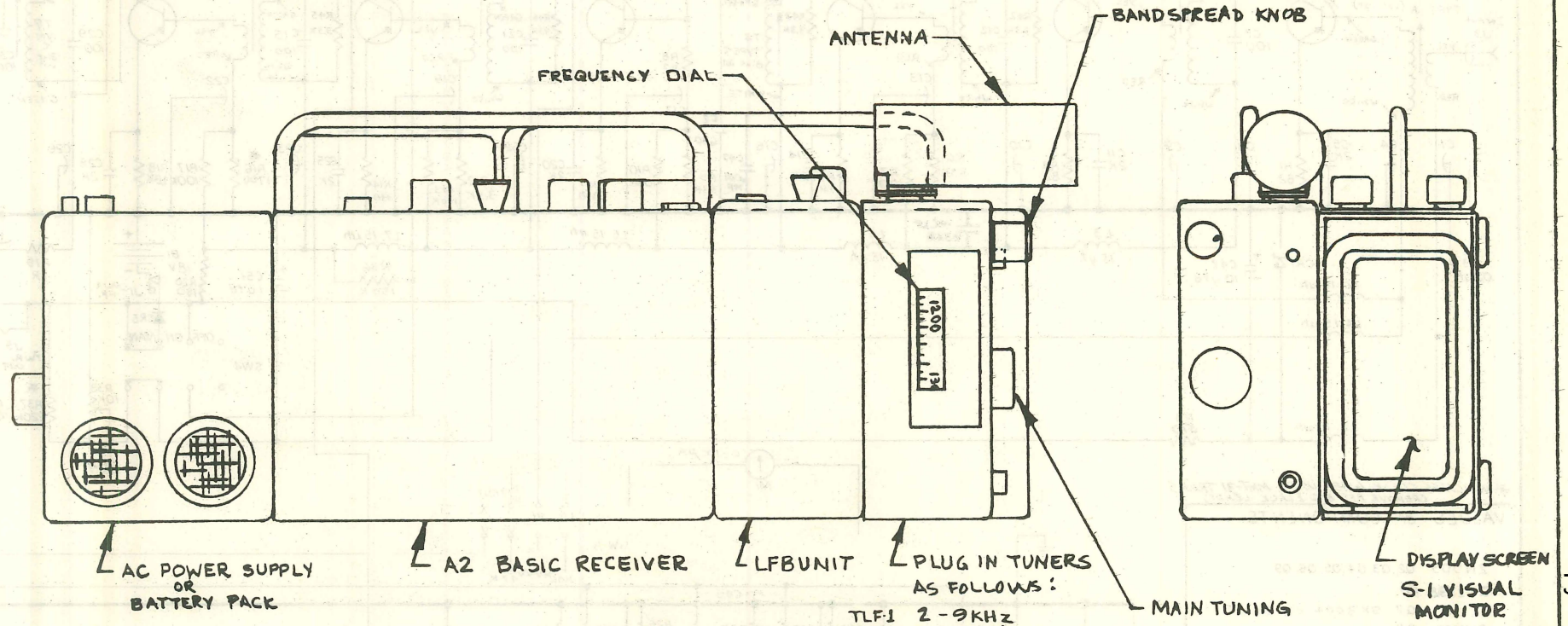


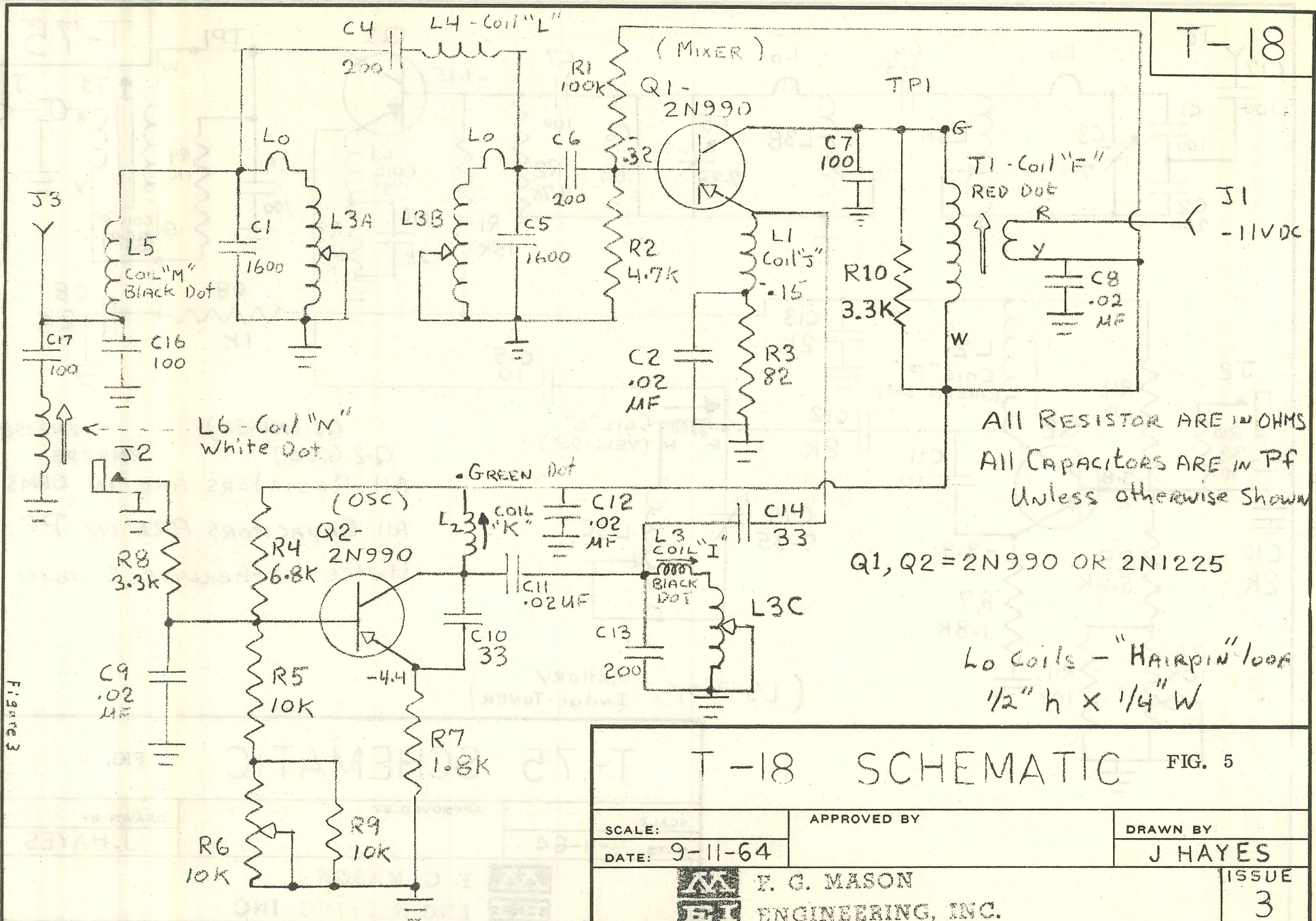
FIGURE 3A



- AS FOLLOWS:
- TLF-1 2 - 9 KHZ
  - TLF-2 9 - 43 KHZ
  - TLF-3 43 - 130 KHZ
  - TLF-4 130 - 475 KHZ
  - TLF-5 475 - 1470 KHZ
  - TLF-6 1470 - 4500 KHZ

TOLERANCES	E. G. MASON ENGINEERING, INC.		
DECIMAL		SCALE	PERIOD S.P.M.
+			
-			
FRACTIONAL	A2 ASSEMBLY		
+			
-			
ANGLE	DATE	PERFORMING ORGANIZATION	ISSUE
+	1-18-71	MRD-40001-A	1






T-18

All RESISTOR ARE IN OHMS  
 All CAPACITORS ARE IN PF  
 Unless otherwise shown

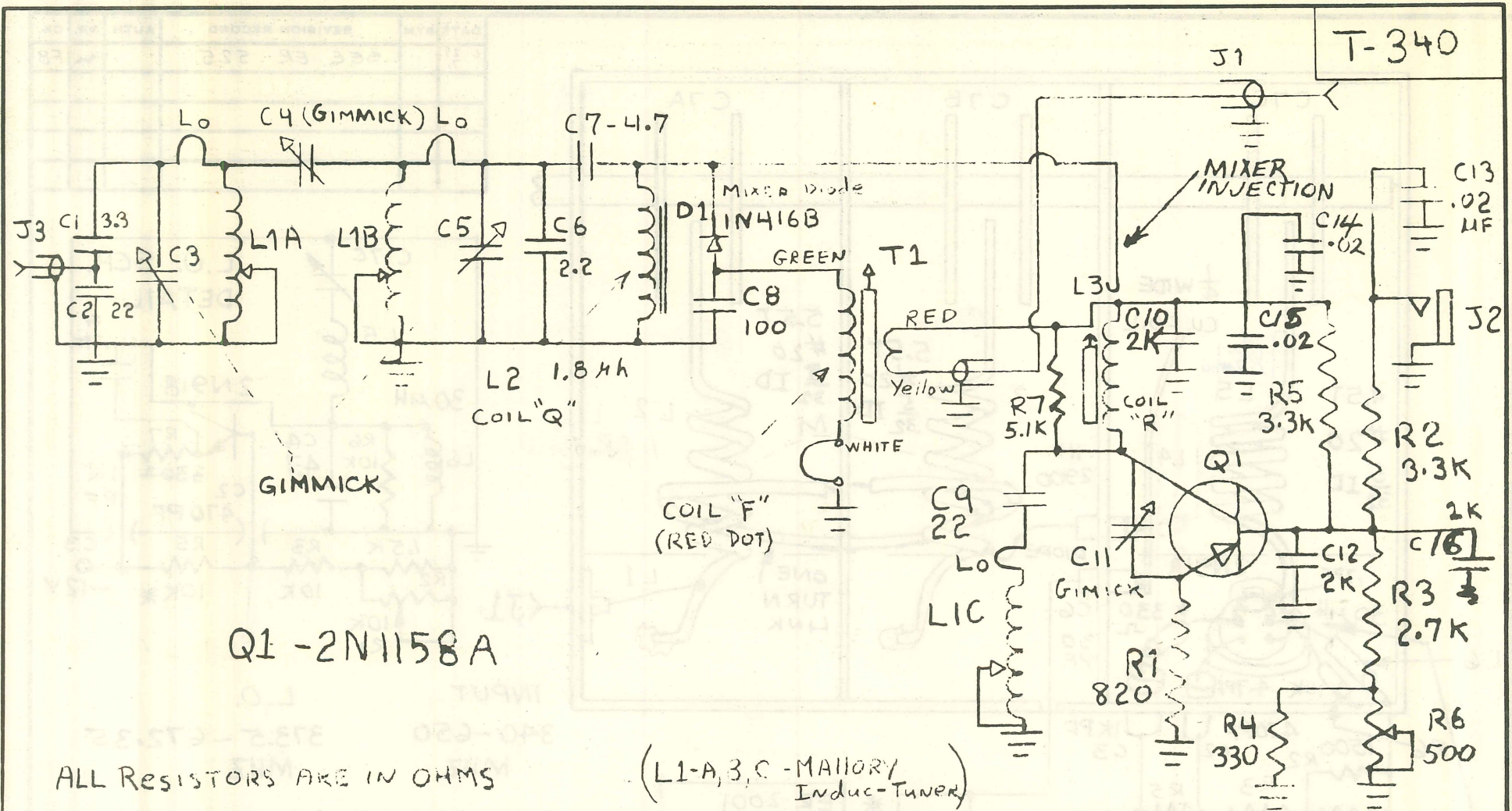
Q1, Q2 = 2N990 OR 2N1225

Lo coils - "Hairpin" loops  
 1/2" h x 1/4" W

**T-18 SCHEMATIC** FIG. 5

SCALE:	APPROVED BY	DRAWN BY
DATE: 9-11-64	 F. G. MASON ENGINEERING, INC. 1700 POST ROAD FAIRFIELD, CONN.	J HAYES
		ISSUE 3
6-15-76 SEE ER-821 FB 1-6-76 SEE ER-778 #1013 ER-2001		DRAWING NUMBER SWD-4012-A





Q1 - 2N1158A

ALL RESISTORS ARE IN OHMS

ALL CAPACITORS ARE IN PF  
UNLESS OTHERWISE SHOWN

(L1-A, B, C - MALLORY  
INDUC-TUNER)

MASON ENGINEERING INC.  
1700 POST RD. FAIRFIELD, CONN.

FIG. 7

SCALE:	APPROVED BY	DRAWN BY
DATE: 9-10-64		J. HAYES

### T-340 SCHEMATIC DIAGRAM

SWD-4014-A

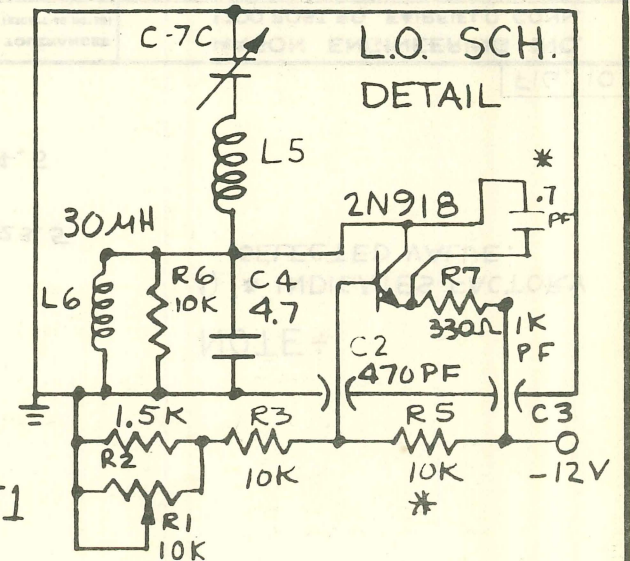
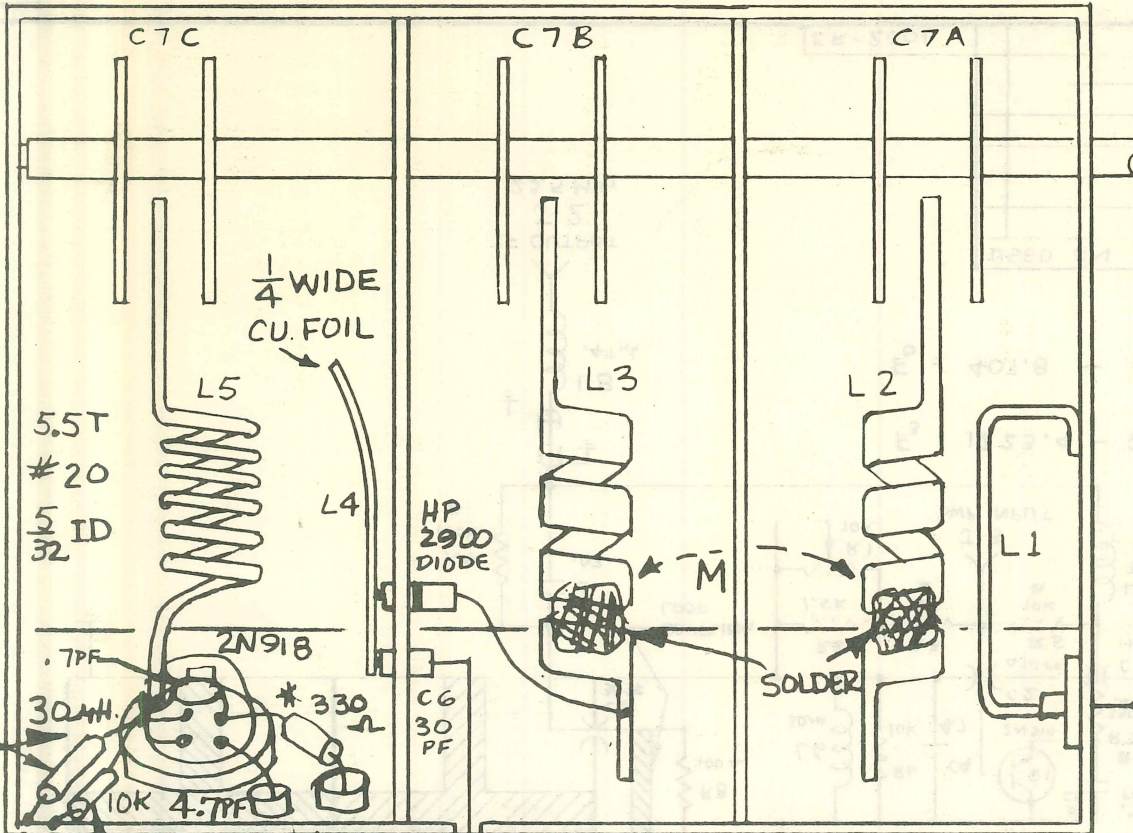
ISSUE  
3

ER-2001

1-22	76	SEE ER-2001
6-1	11	SEE ER-515



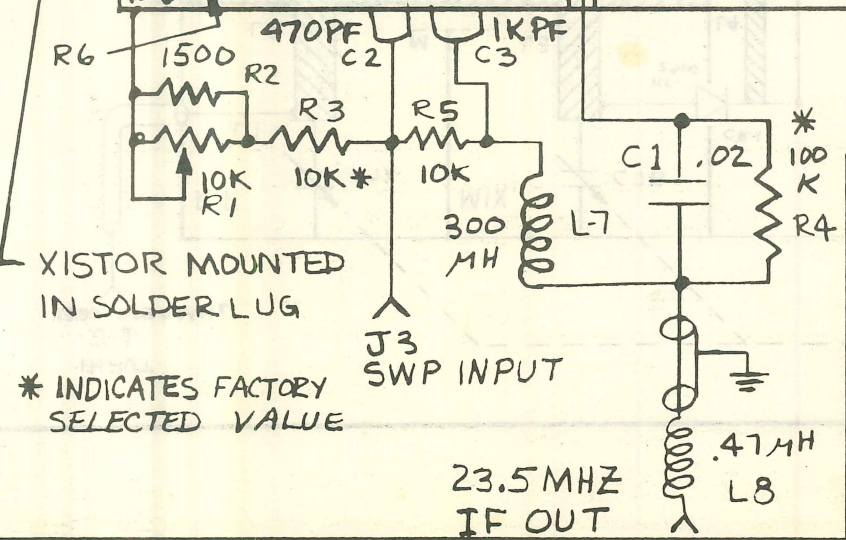
DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
6-29-71		SECRET 525			FP



INPUT 650-1200 MHZ  
 L.O.  $f_2$  673.5 - 1223.5  
 $f_0$  336.75 - 611.75

ER-2001

TOLERANCES (EXCEPT AS NOTED)		MASON ENGINEERING INC. 1700 POST RD. FAIRFIELD, CONN.	
DECIMAL	±	SCALE	DRAWN BY SPM.
FRACTIONAL	±	NONE	APPROVED BY
ANGULAR	±	TITLE T1200 SCHEMATIC	
DATE 5-11-70		DRAWING NUMBER FIG-9 ◊ SWD 4071-A	ISSUE 1



XISTOR MOUNTED IN SOLDER LUG  
 \* INDICATES FACTORY SELECTED VALUE



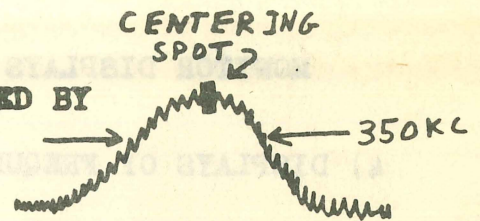
FIGURE 11A

MONITOR DISPLAYS:

1) DISPLAYS OF CONTINUOUS WAVE SIGNALS AS VARIED BY CONTROL POSITIONS.

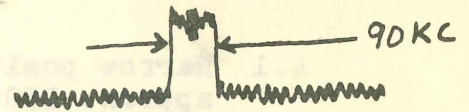
1.1 Wide position, AM, Max. sweep width-

*SIROKA POZICIJA AM MAX. ŠIRINA SVIPA*



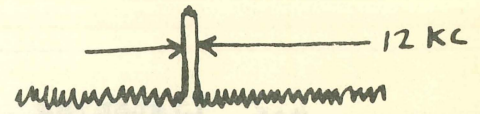
1.2 Medium " " " " " -

*SREDOŠTA*



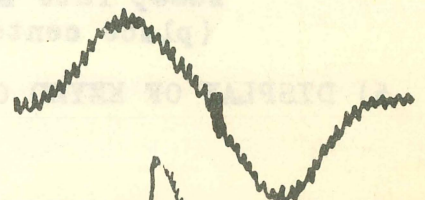
1.3 Narrow " " " " " -

*USKA*



1.4 Wide position, FM, Max. sweep width-

*SIROKA FM*



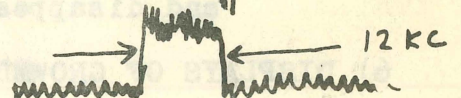
1.5 Medium " " " " " -

*SREDOŠTA*



1.6 Narrow position, AM,  $\frac{1}{2}$  sweep width -

*USKA*

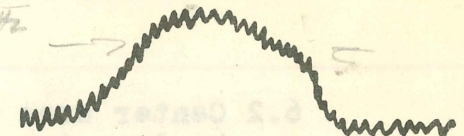


2) DISPLAYS OF TWO CONTINUOUS WAVE SIGNALS 15 Kc. APART.

*SA DVA CONTINUUMNA SIGNALA 15 KHz*

2.1 Wide position, AM, Max. sweep width-

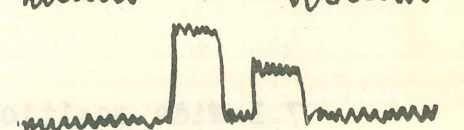
*SIROKA POZICIJA AM MAX. ŠIRINA SVIPA*



2.2 Medium position, " " " " " -

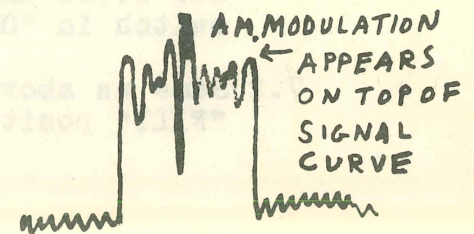


2.3 Narrow position, AM,  $\frac{1}{2}$  sweep width -



3) DISPLAYS OF AMPLITUDE MODULATED CARRIER.

3.1 Medium position, AM, sweep on -  
(To listen, center spot on curve)



3.2 Medium position, AM, sweep off -  
(Modulation only is seen and heard)

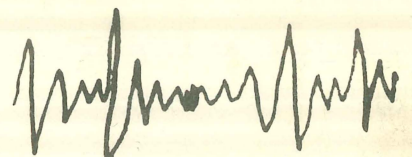


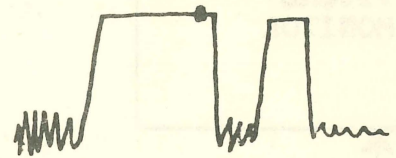


FIGURE 11C

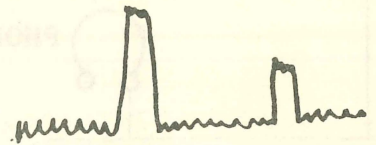
MONITOR DISPLAYS CONTINUED:

8) HIGH LEVEL SIGNAL DISPLAYS.

8.1 Narrow position, AM, Max. signal gain-

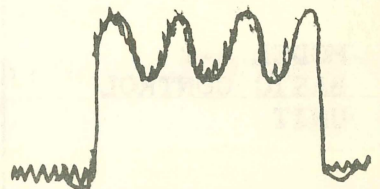


8.1 Same as above only signal gain lowered to avoid clipping.

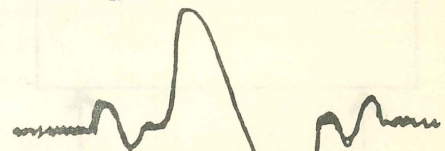


9) SOME OTHER TYPICAL DISPLAYS.

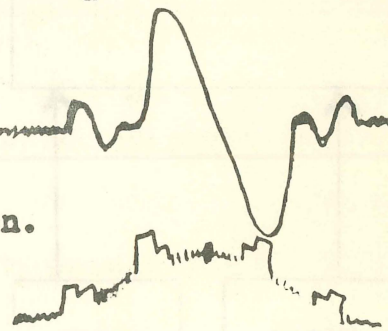
9.1 Carrier with single tone modulationn (AM)-



9.2 FM MULTIPLEX, receiver in FM position-



9.3 Television picture carrier with modulation. Receiver in AM, Wide, Max sweep width.



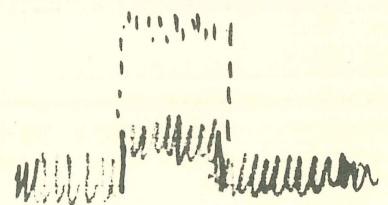
9.3 Same as above with sweep in "OFF" position to show modulation only



10) USING MONITOR TO TROUBLE SHOOT RECEIVER. (CORRECT CURVES SHOWN DOTTED.)

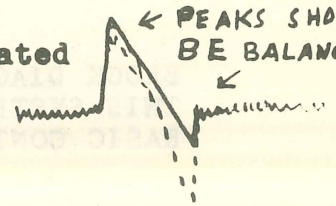
10.1 Medium position, AM, 5 uv signal applied at antenna unmodulated. Noise shows gain OK but signal to noise ratio poor. TUNER or first stage IF is defective.

PEAKS ROLL THROUGH



10.2 Medium position, FM, 5 uv signal, unmodulated shows unbalanced FM detector curve. Tune "T 8" in Basic unit, A-2. for balance.

← PEAKS SHOULD BE BALANCED



10.3 Medium position, AM, 5 uv signal, unmodulated shows IF amplifier strip missaligned. Tune T-2 through T-6 for correct curve.

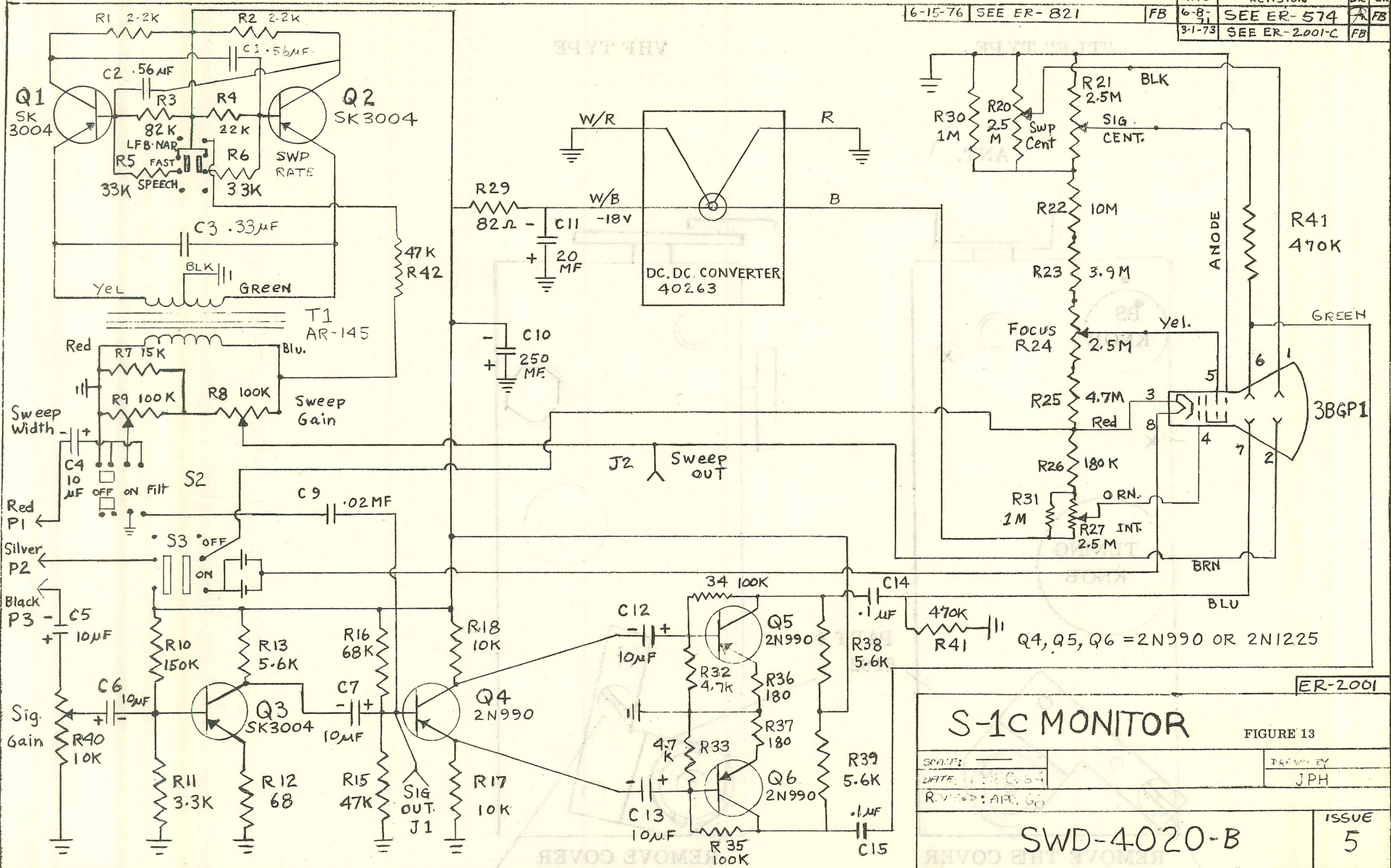
TOP SHOULD BE AS LEVEL AS POSSIBLE





MOUNTING DIAGRAM FOR B. K. C. ANTENNA ADAPTER  
F. G. MASON ENGINEERING, INC.  
FAIRFIELD, CONN.

1-9-76	SEE ER-772	RT	
DATE	REVISION	DR	CK
6-8-76	SEE ER-574	FB	FB
3-1-73	SEE ER-2001-C	FB	



**S-1C MONITOR** FIGURE 13

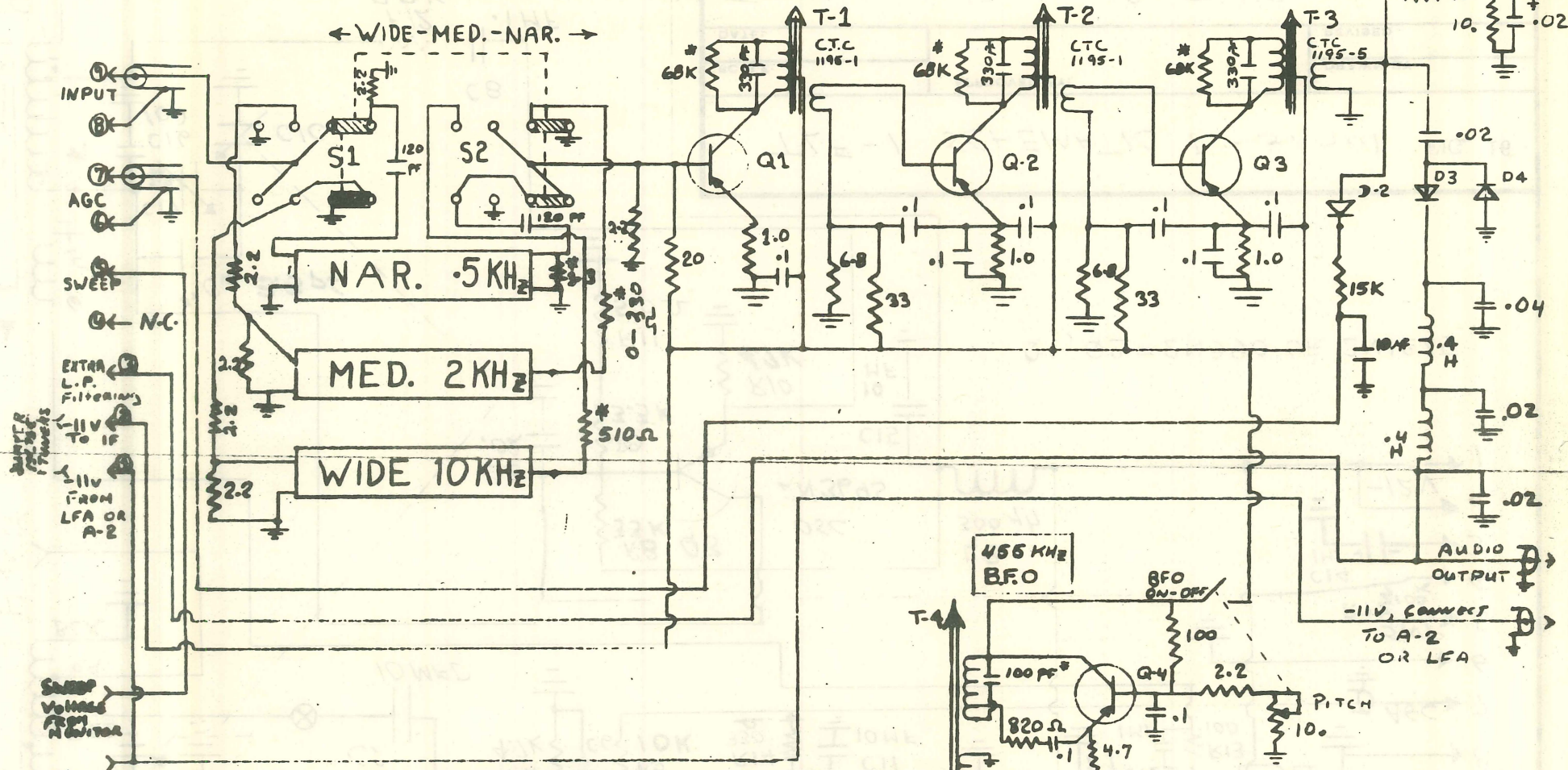
DATE: APR 68	DESIGNED BY: JPH
REVISION: APR 68	

**SWD-4020-B**

ISSUE **5**

REMOVE COVER  
SCREW AND  
MOUNT FLANGE  
SPACER UNDER CONNECTOR  
FLANGE, MOUNT LONG SCREW

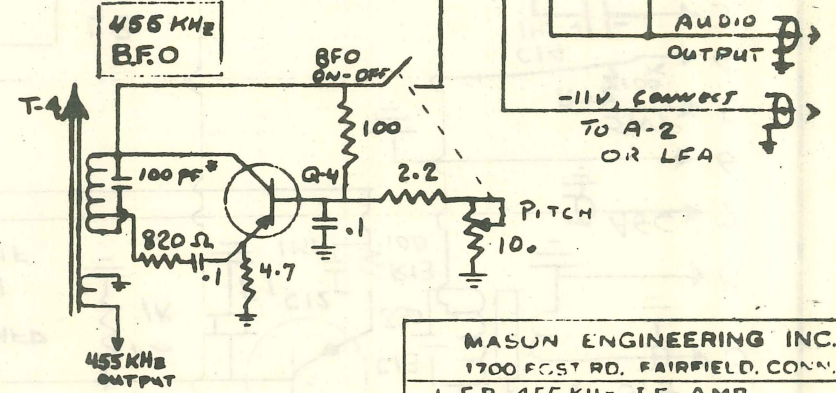




INPUT  
 AGC  
 SWEEP  
 N.C.  
 EXTRA L.P. Filtering  
 -11V TO IF  
 -11V FROM LFA OR A-2  
 SWEEP VOLTAGE FROM MONITOR  
 -11V TO VHF & UHF TUNERS WHEN USED WITH A-2

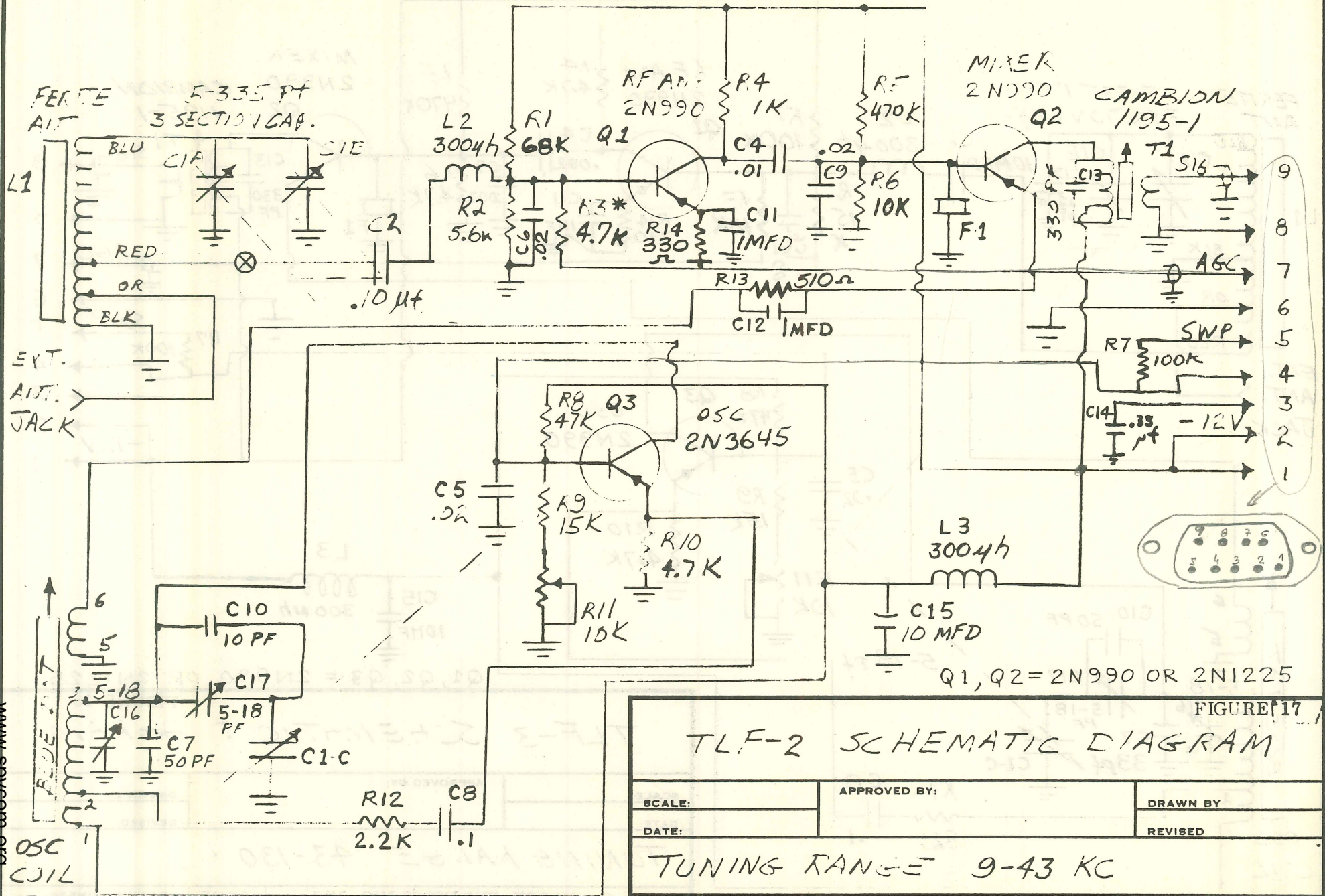
**NOTES:**

\* - FACTORY SELECTED VALUE TO ADJUST GAIN  
 D1,2,3,4 - 1N60 OR EQUIV.  
 Q1,2,3,4 - 2N990  
 ALL RESISTORS ARE IN KΩ UNLESS OTHERWISE SPECIFIED  
 ALL CAPACITORS ARE IN μF UNLESS OTHERWISE SPECIFIED (VDC RATING ≥ 20V)



MASON ENGINEERING INC.	
1700 FOST RD. FAIRFIELD, CONN.	
L.F.B. 455 KHZ I.F. AMP.	
SER. NO 620 UP	
ER-821	SWD-4135-B





Q1, Q2 = 2N990 OR 2N1225

FIGURE 17

## TLF-2 SCHEMATIC DIAGRAM

SCALE:	APPROVED BY:	DRAWN BY:
DATE:		REVISED:

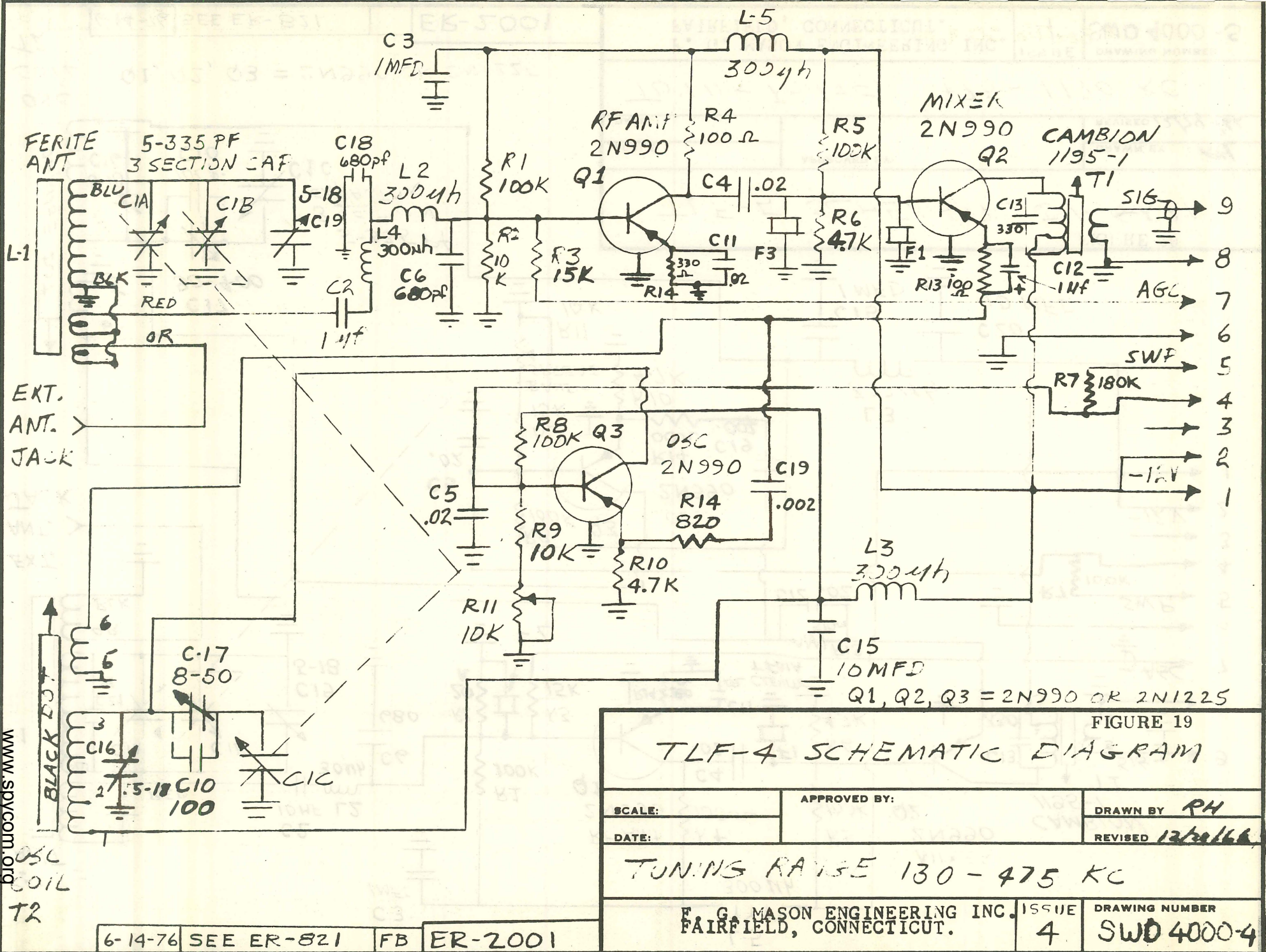
TUNING RANGE = 9-43 KC

F. G. MASON ENGINEERING INC. FAIRFIELD, CONNECTICUT	ISSUE 4	DRAWING NUMBER SWD 4000-2
--	------------	------------------------------

\* FACTORY SELECTED VALUE

ER-2001







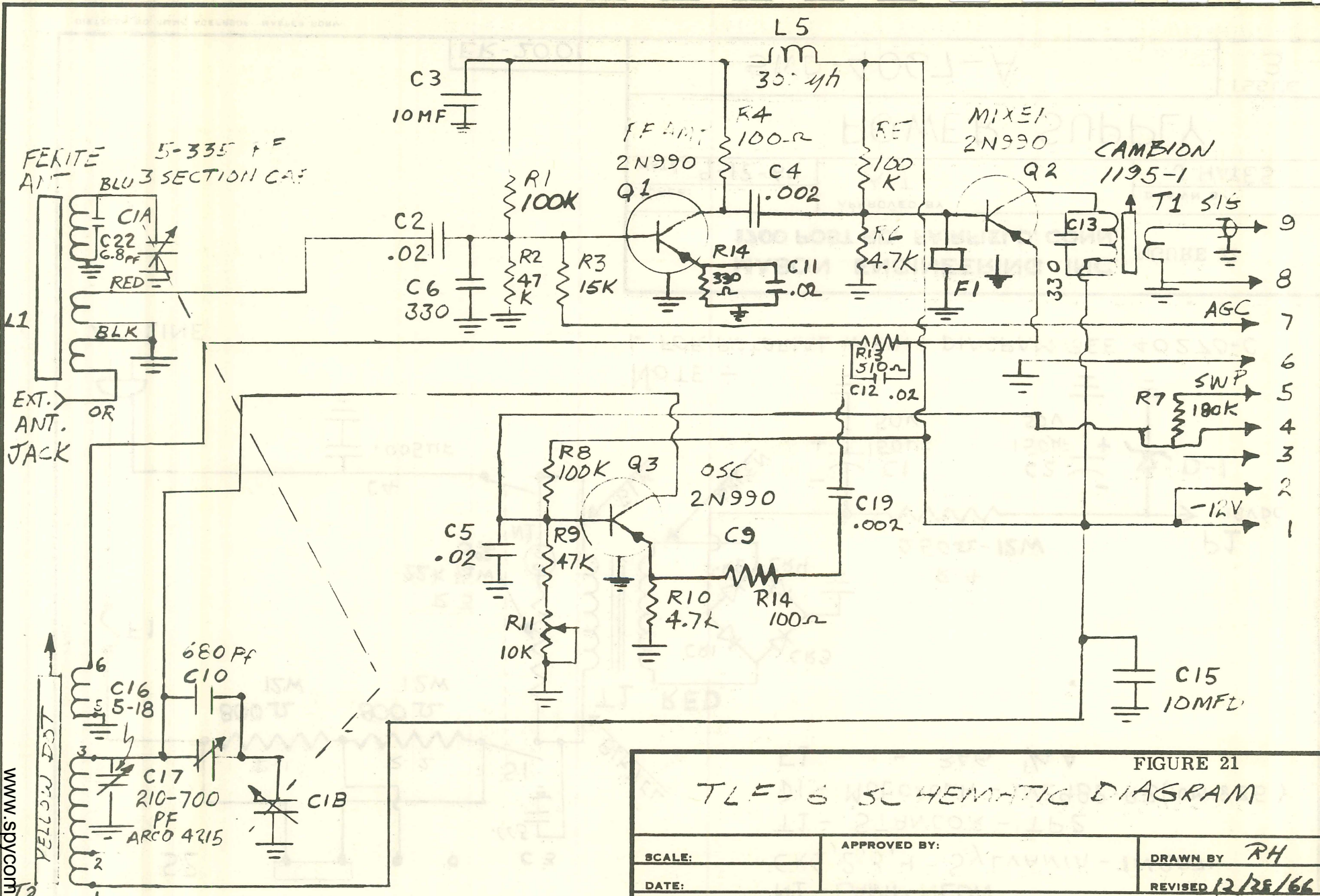


FIGURE 21  
TLF-6 SCHEMATIC DIAGRAM

SCALE:	APPROVED BY:	DRAWN BY <i>RH</i>
DATE:		REVISED <i>12/28/66</i>
<b>TONING RANGE 1.47 - 4.5 MC</b>		
F. G. MASON ENGINEERING INC. FAIRFIELD, CONNECTICUT.	ISSUE <b>4</b>	DRAWING NUMBER <b>SWD 4000-6</b>

Q1, Q2, Q3 = 2N990 OR 2N1225

6-14-76	SEE ER-821	FB	ER-2001
---------	------------	----	---------



4-3-72	SEE ER-626	FB
1-8-76	SEE ER-772	FB
1-9-76	SEE ER-782	FB

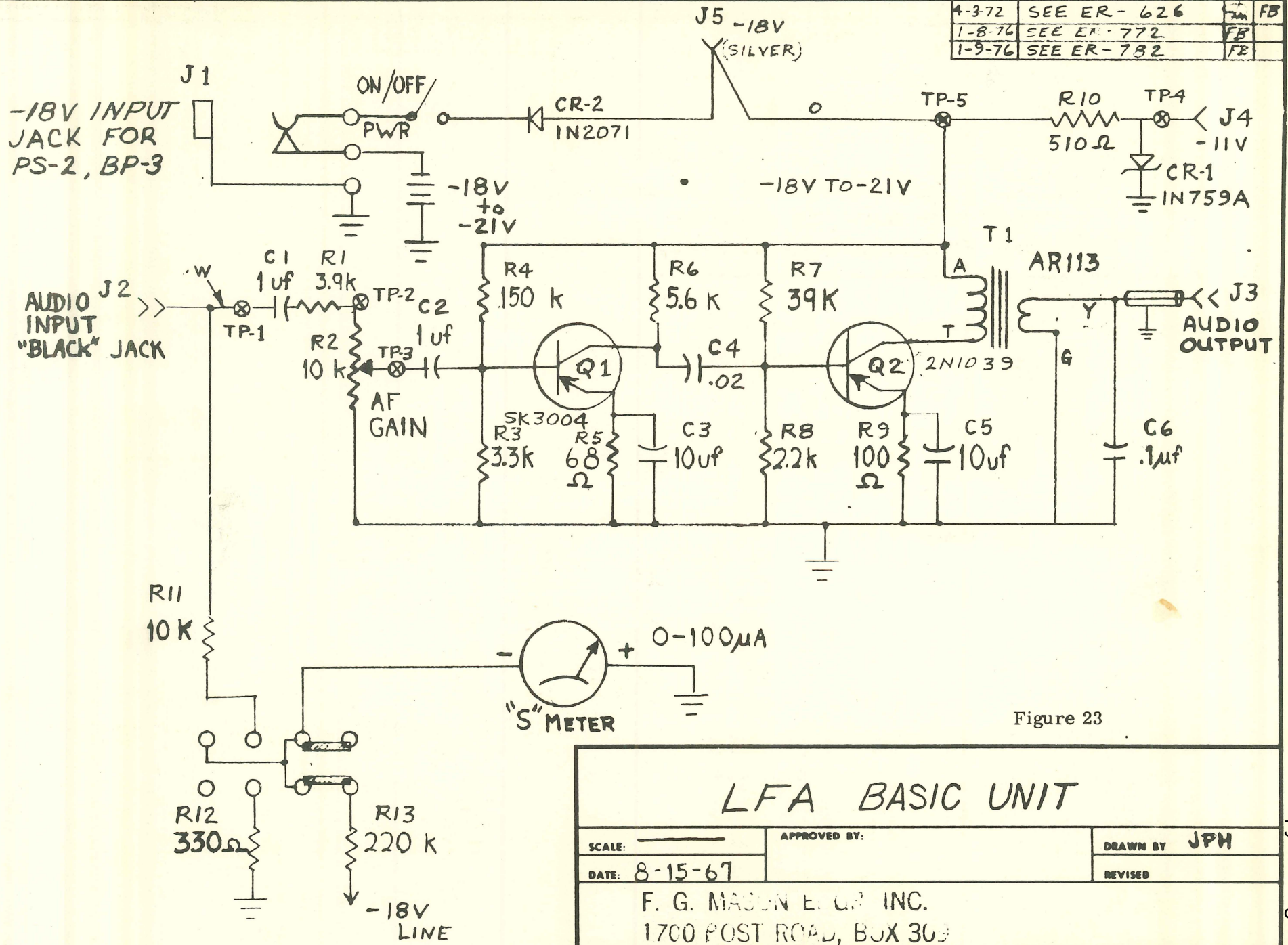


Figure 23

# LFA BASIC UNIT

SCALE: _____	APPROVED BY: _____	DRAWN BY <b>JPH</b>
DATE: <b>8-15-67</b>		REVISED
F. G. MASON ELECT. INC. 1700 POST ROAD, BOX 303 WINDFIELD, CONN. 06430		
	DRAWING NUMBER	ISSUE
	<b>SWD-4006</b>	<b>4</b>

ER-2001







