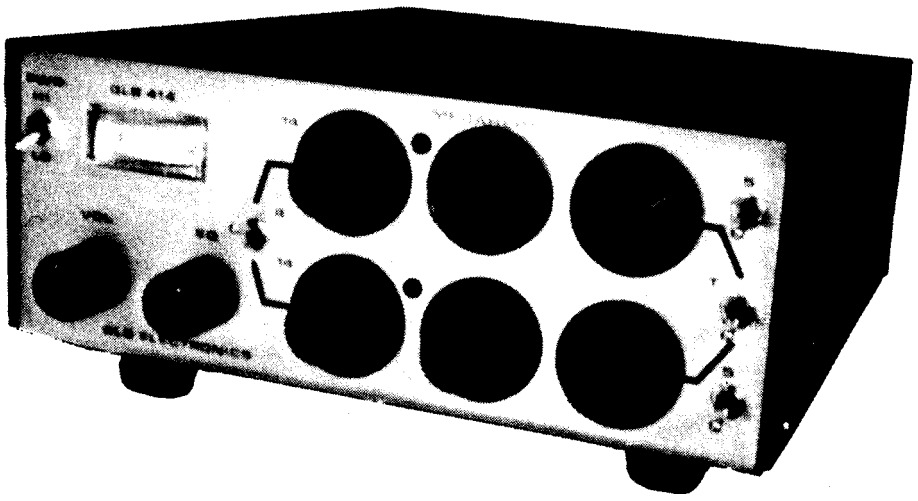
OWNERS MANUAL
GLB 414 TRANSCEIVER



GLB ELECTRONICS

UNPACKING

Immediately upon receipt of your GLB 414 make a visual inspection to determine that it arrived in good condition. Report any damage to the carrier immediately.

BE SURE TO READ PAGES 6 and 7 of this manual before operating the unit. It would be a shame to get this far and then be caused disappointment by damaging the unit.

BEFORE TAMPERING with adjustments or the inside of the GLB 414 read the warranty!

Your GLB 414 was throughly adjusted and tested before shipment, but occasionally a component dies during transit. If this should occur notify GLB and return the unit; but first make sure there is really something wrong!

FACTORY SERVICE. In-warranty repairs must be made by GLB ELECTRONICS, and they will be made free of charge if the terms of the warranty are not violated. In other cases a charge will be made for labor and any necessary parts. Our service rates are reasonable and it is recommended that the unit be returned to GLB if service becomes necessary. Often it happens that user-serviced equipment becomes more costly to repair because new problems have been introduced.

RETURNS. Keep the original shipping carton in case return to GLB is necessary. Make sure that the unit is well-padded and protected against damage in shipment, and insure it. Include the microphone. Include a note accurately describing the reasons for return and any symptoms, particularly in cases of intermittent operation. An accurate description can substantially reduce the cost of repair and improve our chances of fixing it to your satisfaction.

Ship prepaid to: GLB ELECTRONICS Tel. 716-668-0566
SALES DIVISION
60 AUTUMNWOOD DR.
BUFFALO, N. Y. 14227

Return shipments will be sent collect.

WARRANTY

GLB ELECTRONICS warrants that for a period of 180 days from the date of shipment, all GLB-supplied equipment shall be free from defects in materials or workmanship and shall perform within specifications. Defective equipment shall be replaced or repaired only upon the return of such equipment without further damage to GLB ELECTRONICS. This warranty applies only to the original purchaser and is and shall be in lieu of all other warranties, whether expressed or implied and in no case will GLB ELECTRONICS be liable for any anticipated profits, consequential damages, loss of time, or other losses incurred by the purchaser in connection with the purchase or operation of GLB products. Equipment damaged by the purchaser will not be replaced. This warranty does not apply to equipment that has been tampered with or modified.

CONGRATULATIONS! Your choice of the GLB 414 transceiver reveals concern for quality of performance as well as flexibility and convenience. The GLB 414 is the result of an extensive research and design effort aimed at the production of an Amateur transceiver combining the flexibility and precision of a frequency synthesizer with a transmitter-receiver system achieving performance on a par with expensive commercial-specification equipment.

The best features of the famous GLB Model 400B Channelizer have been incorporated in the GLB 414, and extended frequency coverage in 5 khz steps plus illuminated dials has been added. Redesigned synthesizer circuitry achieves spurious rejection improved by a factor of at least 100. An extra set of digital frequency control inputs has been added to accommodate options such as a preset channel matrix or a channel scanner. Space is left within the unit to house such additions without external boxes.

Design criteria in the development of the receiver included super adjacent-channel selectivity, spurious rejection and sensitivity combined with a wide dynamic range. The wide dynamic range provides unmatched rejection of cross-modulation, intermodulation and strong-signal desensitization and in the GLB 414 is achieved without compromising sensitivity. An improved squelch circuit is stable, sensitive and remarkably free of "popping" and "chopping". High acoustic power and low distortion round out receiver quality, and a wide-range AGC provides a usable "S" meter indication over a wide range.

From the high power output working back to the microphone, no transmitter feature has escaped special attention. A unique single-circuit microphone connection permits the use of a simple, rugged connector that swivels to extend the life of the cord. The high-quality dynamic microphone is coupled with more-than ample gain, text-book pre-emphasis and deviation limiting. A 3-pole low-pass splatter filter is added to hold the transmitted bandwidth to commercial requirements. A rear jack provides input for a tone pad (or other tone system) with only one circuit connection. This unique system provides power to the pad, keying and delay to the transmitter and audio input to the transmitter, and requires no external parts except the pad. Best of all, the transmitter provides full output power across the entire frequency range, including MARS frequencies! Finally-if you don't need all that power you can reduce it by flipping a switch!

Non-Standard Features

A series of optional features are intended to increase the flexibility and convenience of the GLB 414. Provision for adding them to the basic unit has been made within the transceiver cabinet. The GLB 414 panel has been made removable so that it can be replaced to accommodate any new panel layouts that might be required for a particular combination of features. A list of planned options is shown on Table 1.

TABLE 1. Optional features for the GLB 414. (Write GLB for current price and availability.)

1. Automatic 600 khz offset. Provides automatic frequency shift of the transmitter (or the receiver for reverse-pair!) from the panel switch settings to comply with the ARRL frequency plan.

2. Priority channel sampler - Periodically samples a priority channel selected on one set of switches while listening on the other. Locks to the priority channel when a signal appears on that channel.

3. Preset Channel switch and matrix - Allows the user to pre-program up to 10 often-used channels to a separate panel switch. Thereafter any of these channels can be selected with the single switch, controlling both transmitter and receiver.

4. Tone burst/Continuous tone squelch generator - Inserts a tone burst at the start of each transmission or a continuous tone for the duration of the transmission to access tone-guarded repeaters.

5. Channel scanner - Used in conjunction with programmable preset channels, this option permits sequential scanning of the preset channels, stopping at channels where a signal is present.

6. Digital frequency display - A six-digit LED frequency indicator that displays the channel frequency (in MHZ) entered in the synthesizer at any given time. Enhances the convenience of options 1, 2, 3 and 5.

If you don't see a feature you would like, write us. If we like it too we'll design it!

SPECIFICATIONS FOR THE GLB 414

RECEIVER:

Design: A double-conversion superheterodyne.

First intermediate frequency: 10.7 MHZ

Second intermediate frequency: 455 KHZ

Antenna impedance: 50 ohms

Sensitivity: 0.2 uv for 20 db quieting (typ at 147 mhz)
1 uv or better at 142 and 149.995 mhz.

Selectivity: 15 khz bandwidth @ -6 db
100 db rejection at ± 30 KHZ.

Spurious responses: At least 80 db below sensitivity[1]

Overload level: at least 100 db above sensitivity.

Audio power: At least 2 watts into a 3-ohm load.

Loudspeaker: High-efficiency 3" cone with ceramic magnet.

TRANSMITTER:

Design: Broad-band with phase-locked loop system.

Power output: 40 watts minimum @ 13.6 volts. Low-power position approx. 3 watts.

Spurious outputs: At least 80 db below carrier.

SWR protection: No shut-down circuitry needed at any load up to 15 volts supply.

Modulation: True FM - adjustable 0 to 15 khz deviation

Audio processing: 6 db/octave pre-emphasis, deviation limiter, 3-pole Chebyshev low-pass splatter filter. Separate tone input with independent gain adjustment. 500-ohm dynamic microphone.

SYNTHESIZER:

Design: Digital phase-locked-loop indirect synthesizer with single master oscillator control.

Frequency range and steps: 10.7 mhz below 142 to 149.995 mhz in 5 khz steps.

Frequency stability and accuracy: ± 5 parts per million (0.0005%) from -20 to +50 degrees Centigrade.

Lock time: 15 milliseconds maximum.

Controls: Two sets of illuminated frequency control switches, independently selectable for use on either transmitter, receiver or both by means of two selector switches. Extra set of independent BCD inputs, TTL-compatible.

continued -

GLB-414 SPECIFICATIONS, continued.

TRANSCEIVER:

Dimensions: 3.4 H x 8.2 W x 10 deep (inches); 8.6 X 21 X 25 cm.

Power requirement: 11 to 15 volts DC, negative ground.

Current drain: 750 ma max receive, squelched. Unsquelched current varies with volume setting. Transmit, 3A nom. low power, 8A high power.

Warm-up time: zero

Complement: 25 integrated circuits, 49 transistors.

Modular construction: 9 subassemblies.

Microphone: 500 ohm dynamic with PTT switch.

Ext. Connections: RF output (SO-239), Power input connector, Ext. speaker jack, Tone pad input jack.

Adjustments accessible from outside: Mic. gain, Tone input level, Deviation limit, master frequency trim.

Panel Controls (See Fig. 1):

1. Volume, ON-OFF
2. Squelch
3. High/low transmit power switch
4. Receiver frequency control selector
5. Transmitter frequency control selector
6. Upper row MHZ control switch
7. Lower row MHZ control switch
8. Upper row 100 KHZ control switch
9. Lower row 100 KHZ control switch
10. Upper row 10 KHZ control switch
11. Lower row 10 KHZ control switch
12. Upper row 5 KHZ control switch
13. Lower row 5 KHZ control switch
14. Meter
15. Illuminated decimal point, upper row
16. Illuminated decimal point, lower row

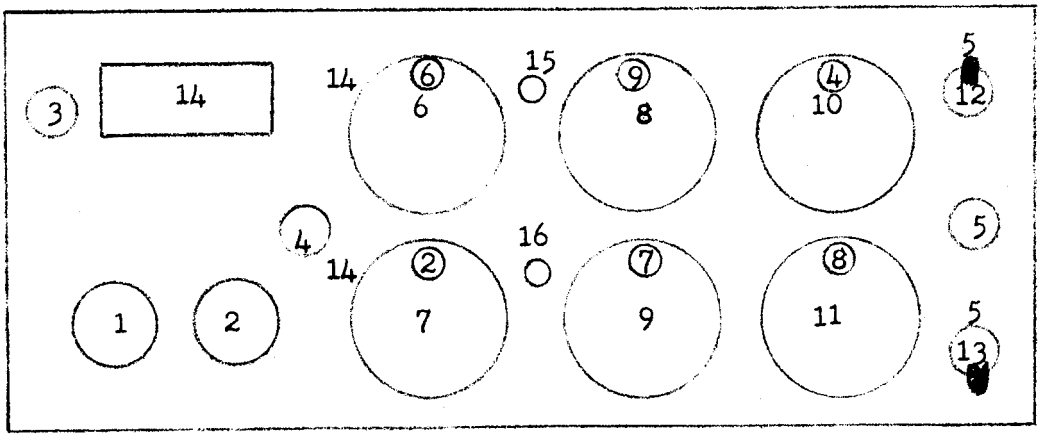


Figure 1. Panel control identification.

OPERATION of the GLB 414.

Refer to fig. 1.

1. Volume control and ON-OFF switch. Clockwise rotation turns the GLB 414 on and increases the audio level.

2. SQUELCH control. Clockwise rotation opens the squelch. The best setting is obtained by turning it from full clockwise position until receiver noise disappears completely with no received signal present.

3. HIGH/LOW POWER switch. In the upper position the transmitter develops full output power.

4. RECEIVE SELECTOR SWITCH. This switch selects which of the two sets of frequency control switches is in control of the receiver frequency. In the upper position the receiver is tuned to the frequency indicated on the top row of frequency control switches. In the lower position the receiver is tuned to the frequency indicated on the lower set of frequency control switches.

5. TRANSMIT SELECTOR SWITCH. This switch operates exactly like the RECEIVE SELECTOR switch, except that it determines which row of frequency control switches controls the transmitter when keyed.

6. through 13. Frequency control switches. The upper row (6, 8, 10, 12) is a duplicate of the lower row (7, 9, 11, 13). Each row operates in the same way but independently of the other. To set a frequency on the top row add the numbers indicated on each switch as follows:

	140 MHZ	(fixed)
+	6 MHZ	(number on switch 6)
+	.9 MHZ	(number on switch 8)
+	.04 MHZ	(number on switch 10)
+	.005 MHZ	(number on switch 12 if switch is in upper position; add zero
=	146.945 MHZ	if switch 12 is in lower position)

This frequency can be read directly by scanning across the switches from the panel-marked 14 on the left to the 5 khz indication on the right as seen on fig. 1. In fig. 1 the top row of switches is shown set to 146.945 mhz, the bottom row is shown on 142.780 mhz.

14. METER. In the receive mode relative signal strength is indicated; in the transmit mode relative output power is indicated.

15, 16. ILLUMINATED DECIMAL POINTS. When the upper decimal point is lighted the upper row of switches is in control of frequency. When the lower decimal point is lighted the lower set of switches is in control of frequency.

The MICROPHONE JACK is located under the chassis behind the squelch control.

Depressing the microphone button keys the transmitter and disables the receiver.
CAUTION: Before transmitting;

(1.) Make sure an antenna or other load is connected. Don't stress the output transistor unnecessarily with no-load operation.
(2.) Check the position of the frequency control switches to which the transmit selector is set, making sure the frequency is one for which you are licensed to transmit.

INSTALLATION of the GLB 414.

1. Power Source. The GLB 414 is intended for use with a negative ground, 12-volt nominal automotive electrical system. It will function with voltages ranging from 11 to 15 volts applied to the rear connector. Rated power is achieved at a supply voltage of 13.6 volts.

PRECAUTION When making connection to any power source for the first time, measure the voltage first and double-check the polarity. Turn the on-off switch to the OFF position and the Hi/Lo power switch to LOW power. The safest way to make the connection is first to connect only the POSITIVE lead to the supply, and then the negative side momentarily to the chassis. If the wrong lead is accidentally connected to the positive terminal only the power source fuse would blow with this procedure, rather than damaging the GLB 414. The negative lead can then be connected to the supply, if no short occurred in the former step. Observe the following, EVEN WITH THE POWER SWITCH in the OFF POSITION!

DO NOT connect a supply of any voltage with reversed polarity to the GLB 414. DO NOT exceed at any time 15.5 volts continuous or 20 volt "spikes".

The power amplifier stages are not fed thru the ON-OFF switch, to minimize voltage drop. They are on the line continuously, although they do not draw current with the transceiver turned off. In the LOW POWER position there is a measure of protection due to the insertion of a series resistor between the supply line and the power amplifier stages.

ALWAYS use a power cable with a series 10-ampere fuse. Spare power cables can be obtained at nominal cost at GLB ELECTRONICS for use in more than one installation.

MOBILE INSTALLATION TIPS:

Use heavy wire (#12 or larger) and connect as shown in fig. 2. Connection directly to the battery minimizes noises on the carrier due to electrical noise in the vehicle and minimizes the possibility of damaging voltage transients. Voltage stability is also improved. If shut-off with the ignition switch is desired, use a relay as shown. Keep leads as short as possible.

After installation, check the voltage at the rear connection with the engine racing and the transmitter keyed in high power (antenna connected). You should have between 13.6 and 14.4 volts.

A mounting bracket is supplied with the GLB 414 to fasten it securely under the dash of an automobile. To prevent damage to the cover finish use the fiber washers provided or tape the inside of the bracket before tightening the screws. Don't use longer screws than 3/4", otherwise they could protrude far enough inside the unit to damage internal parts. The bracket permits several angular positions for the unit. It is mounted with the single hole toward the panel.

AVOID positioning the unit directly in front of the hot blast of air from the heater. If you can't avoid it, deflect the air by positioning the heater vanes if possible.

FIXED STATION INSTALLATION TIPS:

For operation from AC mains, use a regulated supply capable of 8 amperes output at 13.6 volts. Operation from an unregulated supply is recommended only if an automobile storage battery is connected across the output to stabilize the voltage.

2. Antenna System.

The GLB 414 is designed for use with an antenna system having an impedance of 50 ohms. As with any solid-state power amplifier performance falls off rapidly with increasing SWR. Thus it is important to obtain the lowest possible SWR in the antenna system. Use the shortest possible run of low-lost coax to minimize feedline losses. Remember, the loss of performance applies to the received signal as well as the transmitted signal.

Avoid extreme SWR; although the power amplifier will take it, operation into any mismatch causes additional power to be dissipated in the output transistor. This causes additional temperature rise in the junction and consequent reduced reliability.

NOTE: The output transistor may burn out if the SWR is high and the supply voltage is in excess of 15 volts.

ADJUSTMENTS

As shown in fig. 3, there are four access holes holes beneath the chassis. Three are audio adjustments for the transmitter, the fourth is a frequency trim adjustment for the master oscillator in the synthesizer. Do not disturb this adjustment unless absolutely necessary. The frequency has been accurately set at the factory.

1. Microphone gain adjust. Counterclockwise rotation with a small screwdriver increases gain. Use this adjustment for best audio reports with your voice.
2. Tone pad level adjustment. Counterclockwise rotation increases the tone level. The factory adjustment is set for correct level from a standard telephone tone pad.
3. Deviation limit adjustment. This control sets the maximum deviation level permitted by the deviation limiter. Deviation increases with counterclockwise rotation.

To adjust deviation, use the following procedure:
1. Turn the microphone gain fully counterclockwise (max gain)
2. Speak in a loud voice, as close to the microphone as possible while observing the deviation level. A deviation meter is the best indicator, but a trained ear can recognize overdeviation on a receiver having appropriate bandwidth.
3. Turn the deviation control as high as possible without overdeviating.
4. Speaking in a normal tone of voice adjust the microphone gain control for the most pleasing audio quality.

Once the deviation limit adjustment is made, leave it alone! Use only the gain control to adjust the "amount" of audio.

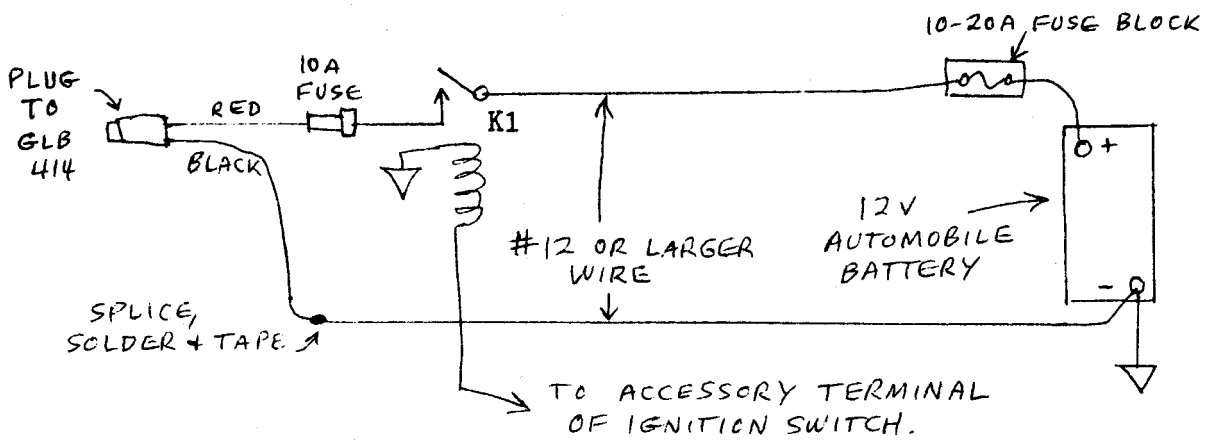


Figure 2. Recommended connection for GLB 414 in a mobile installation. K1 is a 12-volt relay with 10 ampere contacts, used only if turn-off with the ignition switch is desired.

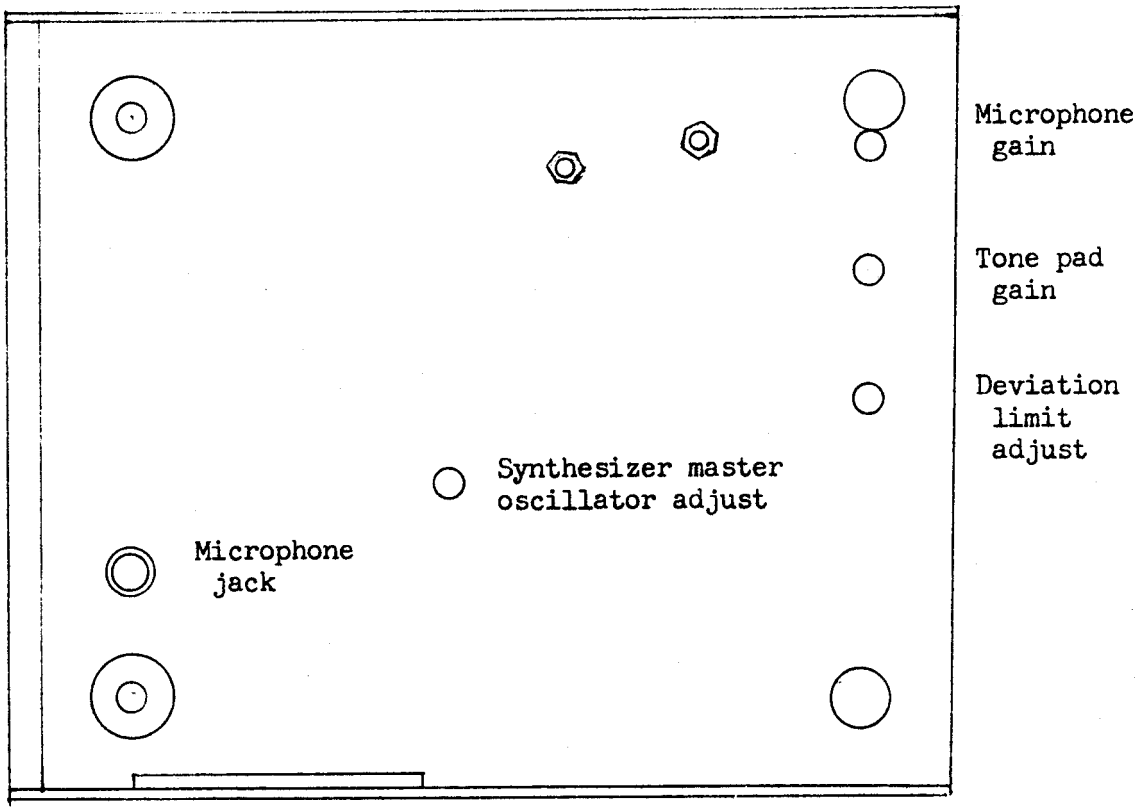


Figure 3. Location of adjustments accessible from bottom of chassis.

ADJUSTMENT OF FREQUENCY

The GLB 414 is factory-adjusted to frequency against a precision standard and should seldom need readjustment. If readjustment should prove necessary use the following procedure.

Connect a frequency counter to Z5 pin 3 on the trace side of the main synthesizer board. (Z5 is the 3rd IC from the left, rear row, panel facing you) If there is any doubt, just probe the pins until the counter reads 15.7 mhz plus or minus a few cycles. Turn the slug in the frequency-adjust coil with a small plastic tuning tool until the reading is 15.7 mhz plus or minus 8 hz.

The master oscillator determines the exact receive frequency, but the transmitter output is offset by 10.7 mhz from the receiver and the offset oscillator must also be checked.

Locate a bare tinned wire jumper on the modulator board (mounted to the rear panel) between Q3 and Z2. With the counter connected to this jumper and the transmitter keyed (in low power) set C1, the trimmer capacitor to the right, to indicate 5.35000 mhz plus or minus 50 hz.

TONE PAD HOOKUP

The rear phono jack is set to mate with a standard telephone-type of tone pad. In fig. 4 color codes are shown for a Western Electric type, but corresponding connections can be found on other makes and types. Since the telephone system is standardized, pads are also standard and level adjustment should not be required from the factory setting. Other tone systems can be accommodated using the hookup in fig. 5.

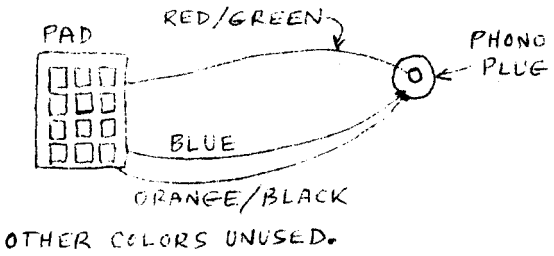


Figure 4. Tone pad connections.

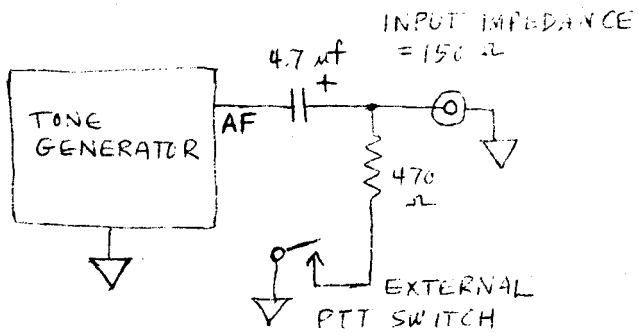


Figure 5. Hookup for other tone systems.

When using the tone pad, depressing any button will key the transmitter, power the pad and apply the resulting tones to the transmitted signal. The carrier remains keyed for approximately $\frac{1}{2}$ second after the button is released so that there is time to key the next digit without dropping the carrier.

With any other tone system audio is coupled in via a capacitor as shown. The transmitter is keyed simply by providing a DC load to ground.

Don't depress the microphone button while sending tones because it will change the tone level.

THEORY OF OPERATION

Figure 6 shows a block diagram of the GLB 414.

SYNTHESIZER

A local oscillator signal for the receiver is generated in the synthesizer voltage-controlled oscillator (SVCO), which is a tunable oscillator covering the range 131.3 to 139.295 mhz. Since the receiver first IF is 10.7 mhz, the receive tuning range is 142 to 149.995 mhz. Tuning of the SVCO is accomplished by varying the DC voltage applied to the tuning input, which becomes the voltage across a varactor diode.

SVCO output is amplified, split into two signal paths and extensively buffered in each path. One of these paths becomes the output to the receiver first mixer. (via Q4) The other path, buffered in Q3 and Q5 becomes a frequency sample signal and is fed to the synthesizer main board assembly. Extensive use of buffering, shielding and filtering of DC leads is essential to reject spurious frequencies.

At the main board further isolation is provided by amplifiers Q6 and Q7 and the signal is applied to one gate of the synthesizer mixer Q5. The other gate of the dual-gate MOSFET mixer is fed by a 141.3 mhz signal derived from the master crystal oscillator (15.7 mhz) by multipying first to 47.1 and finally to 141.3 mhz in two tripler stages, Q8 and Q9.

A "synthesizer IF" (SIF) is produced by the mixer, which varies in frequency with the output frequency of the synthesizer. Assuming, for example, that the receiver is set to 147.000 mhz, the synthesizer signal must be at 147 - 10.7= 136.3 mhz. When the SVCO is tuned to 136.3, and the frequency sample is mixed in Q5 with the 141.3 mhz reference frequency, the SIF becomes 141.3-136.3 = 5 mhz. The SIF is amplified, squared and fed to a programmable frequency divider (Z8, 9, 10, 11, 12 and $\frac{1}{4}$ of Z7). This circuit comprises a series of flip-flop dividers capable of dividing an input signal frequency by any integral between 401 and 2000. The divide ratio is controlled by means of digital control lines to the panel switches. At a receive frequency of 147 mhz the divider is set by the panel switches to 1000; thus the SIF is divided to 5 khz.

It is the purpose of the phase detector to maintain the divider output exactly at 5 khz. This purpose is accomplished by comparing the divider output to a signal known to be exactly 5 khz. (reference frequency) If the programmable divider is above or below 5 khz, the phase detector produces a change in a DC output line to the SVCO, correcting it in such a way as to reduce the error to zero.

Since the programmable divider output can be 5 khz only when the SVCO is tuned to the correct output frequency, when the phase detector completes its adjustment the output must be exact. The correction process is repeated 5000 times per second, hence the output frequency is held tightly to the correct setting.

The 5 khz reference frequency for the phase detector is derived from the 15.7 mhz oscillator by dividing it down in Z2, 3, 4, and 5 by a factor of 3140. Since both the 5 khz and the 141.3 mhz reference signals are derived from the same oscillator the stability of the output frequency is determin ed solely by the stability of the 15.7 mhz oscillator. Use of a high-accuracy crystal and temperature compensation holds temperature drift to 0.0005% or less.

Phase detector tuning voltage to the SVCO is filtered in an integrator and a carefully designed R-C filter to remove any trace of 5 khz ripple which could otherwise modulate the output.

RECEIVER

Starting at the antenna jack, the received signal passes thru K1, the first helical resonator into RF amplifier Q1, a dual-gate MOSFET transistor. After preamplification the signal is passed thru four more helical resonators into the first mixer Q2. Oscillator injection is derived from the synthesizer and amplified by Q3 to drive the mixer. Mixer injection level , load impedance and mixer bias level are carefully combined to achieve a high linearity to strong signals. Mixer output at 10.7 mhz goes immediately thru the 8-pole crystal filter to the IF/AF assembly. A portion of the signal is amplified in Q4 without having gone thru the filter. Q4 is used only in the transmit mode and is discussed in the transmitter description.

On the IF/AF assembly the 10.7 mhz filtered signal is amplified in Q1 and Q2, fed to the second mixer Q4 where it is mixed with a second LO signal from Q3 at 10.245 mhz, producing a 455 khz output signal. This signal is again filtered in two 455 khz transformers and rectified in Q5 for an AGC signal. The AGC voltage is connected to the "S" meter and is fed back via Q10 to control the gain of Q1 and Q2. AGC is used to increase the usable range of the S meter.

After the 455 khz filter the signal is applied to Z1, a limiter-discriminator integrated circuit. In Z1 the signal is limited and FM audio is recovered. Audio from Z1 is split into two paths; one thru audio series gate Q9 to the volume control and audio power amplifier; and the other thru a noise filter, amplifier Q6 and rectifier. These stages generate a DC output that depends upon the amplitude of the high-frequency audio noise on the signal. Normally at a high level with no signal, this noise recedes in amplitude when a signal is received. The squelch threshold is set by adjusting the squelch control, which regulates the amount of noise reaching the noise amplifier. A change in DC level at the noise rectifier output is sensed in Schmitt trigger circuit Q7, Q8. This circuit changes small variations in input level to a switching action to drive the audio gate, Q9. When a signal is received Q9 is turned on and passes the audio signal to the 2-watt amplifier Z2 to the speaker.

Q11 is a PNP switching transistor which applies the 10-volt regulated supply to the IF circuits only in the receive mode.

TRANSMITTER

A 2-meter signal is generated in the transmitter VCO (XVCO) by Q1, which works in the same manner as the SVCO, except that it tunes the range 142 to 149.995 mhz. This signal is amplified in Q2 and Q3 in the XVCO box, then to a power level of 1½ watts in exciter stages Q1,3 and 4. The two power amplifier stages Q1 and Q2 increase the power level to 40 watts. Low power operation is achieved by inserting a series dropping resistor between the power amplifier supply terminal and the incoming supply voltage.

The XVCO forms part of a secondary phase-locked loop which adjusts its frequency to the one selected by the switches. XVCO output is sampled by buffer Q4 and is fed thru a diode gate to the receiver front-end assembly, into the receiver input. The receiver front-end continues to operate in the transmit mode, despite the fact that the IF system is disabled. Thus when the transmitter is outputting at 147 mhz the receiver is set to 147 mhz in the transmit mode and the sampled signal is converted to 10.7 mhz at the front-end. This 10.7 mhz signal is amplified by Q4 (on the front-end assembly) and fed to the modulator assembly where is is further amplified and squared, divided by 2 in Z2 to 5.35 mhz and fed to phase detector Z3. A 5.35 mhz reference signal is generated in crystal oscillator Z1 and fed to Z3. Z3 generates a tuning voltage for the XVCO, adjusting it until the input from the receiver front-end is exactly 10.7 mhz. At this point the loop is locked and the transmitter is on the correct frequency.

Integrator Q1 and a loop filter eliminate all traces of 5.35 mhz on the tuning line to the XVCO, providing a clean DC voltage to tune it.

As a precaution an interlock circuit, consisting of a 10.7 mhz IF transformer and a diode detector keeps the transmitter amplifiers on the exciter assembly turned off until the XVCO is locked.

Modulation is produced by superimposing the processed audio signal on the SVCO tuning voltage, producing direct true FM. Response time of the main synthesizer loop is kept slow enough to prevent tuning out audio variations, but in the transmitter loop it is extremely fast, allowing the XVCO to follow any audio-frequency variations coming from the SVCO. Thus the SVCO modulation is passed on to the XVCO producing FM at the output.

Audio from the dynamic microphone is first amplified by Q6, pre-emphasized in Z4 and limited by diodes D5 and D6. Z5 is the active element in a three-pole low-pass active filter cutting off at 3 khz, which filters out any high-frequency audio products that would splatter or produce squelch "chopping" in another receiver.

Z6, Q4 and D8 comprise a 10-volt regulator circuit which supplies the receiver (except the audio output amplifier) and the low-level transmitter circuits, stabilizing operation with voltage variations and filtering out power supply noises such as hum, ignition noise and alternator whine.

The microphone push-to-talk signal is derived by sensing the presence of a DC path to ground. Q5 senses the path by passing a few microamperes of current thru the microphone element and initiates the PTT circuit D3, Q8 and Q9, Q10 providing switching signals to the synthesizer, the receiver and the transmitter.

Similarly, Q7 detects the presence of a DC load at the tone-pad input. The encoder pad is wired in such a way that the circuit is open until one of the buttons is depressed. This action closes the DC and audio circuits as in the microphone PTT circuit. In this case the sensing current is made high enough to provide operating current to the encoder pad. When the transmitter is keyed via the tone-pad input a capacitor is charged which sustains the PTT for a half-second after the button is released, preventing carrier drop-out between digits.

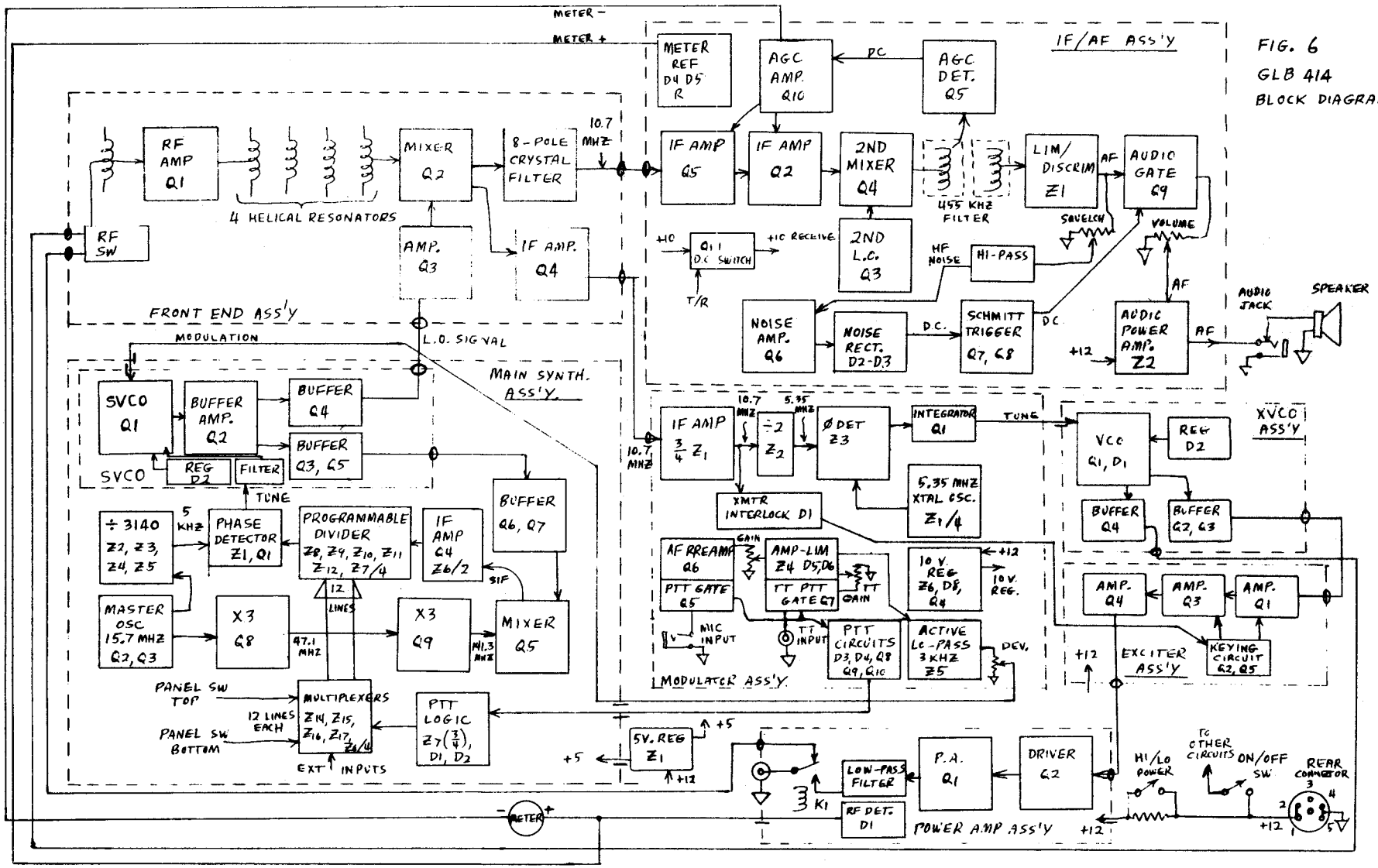
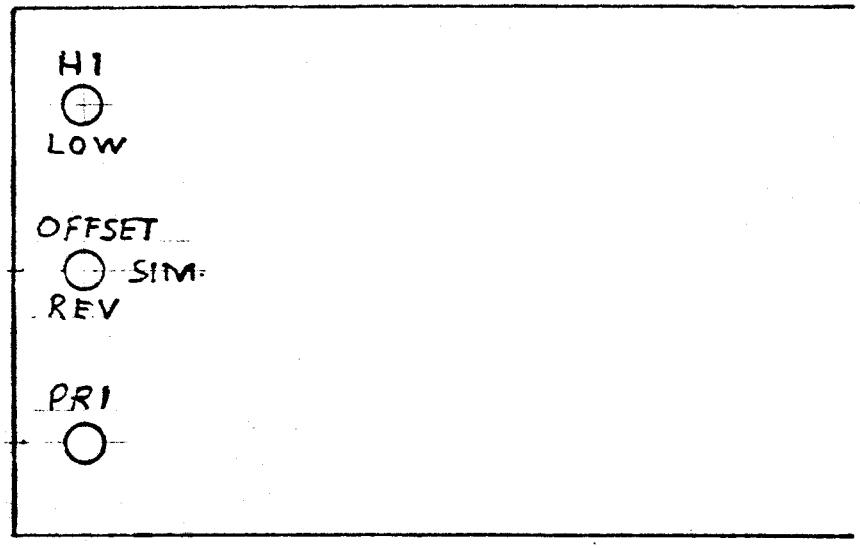


FIG. 6
GLB 414
BLOCK DIAGRAM

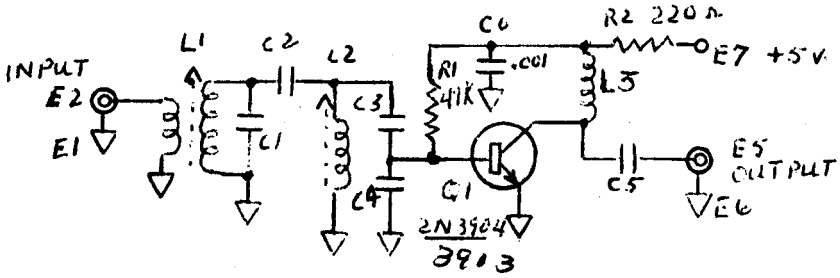


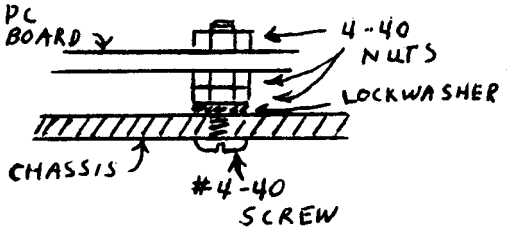
With 600 KHz switch in lower position the 414 will receive the repeater input.

For 600 KHz offset: Priority

Transmit and Receive toggle switches in upper position. Set repeater output frequency on upper set of switches. Offset switch in upper position. 414 will automatically transmit the proper input frequency. Below 147 MHz, 600 KHz low. Above 147 MHz, 600 KHz high. The lower set of switches can be set to monitor a priority frequency. With the Priority switch in the upper position, the lower set of switches will be sampled for a signal. When a signal appears, the receiver will lock on this signal and stay locked on as long as a signal is present. With a signal present, switching the priority switch to the off position will not disable the priority, until there is a break in the signal. This can be accomplished by switching the MHz switch by one position. The MHz switch can be switched back immediately. This short break will disable the Priority function. If the Priority switch is turned off when there is no signal present on the Priority frequency, it will disable the Priority immediately.

GLB ELECTRONICS
Frequency Multiplier Assembly Instructions





Output Frequency	C1	C2	C3	C4	C5	L1	L2	L3
48 MHz	15 pf	2.2 pf	22 pf	100 pf	47 pf	wound	wound	.33 uh
18 "	33	4.7	68	220	68	"	"	3.3
Input coupling link- 1½ turns - 48MHz. 2½ turns - 18MHz.								
72 MHz	15 pf	2.2 pf	15 pf	68 pf	33 pf	6½T #36	6½T #36	7T 1/8 #28 dia.
36 "	22	2.2	22	220	68	10½ T	10½ T	.33uh
Input coupling link - 1½ turns - 72 and 36MHz.								

Assembly:

Mount and solder the following parts on board.

Q1 - (✓) R2 - (✓) - C6 - (✓) C2 - (✓) C1 - (✓) R1 - (✓)
C3 - (✓) C5 - (✓) C4 - (✓) L3 - (✓)

Wind the slug-tuned coils if required as per table and fig. 2.
Wind input coupling link on one of the coils. This will be L1.
L1 must be oriented so link terminals of coil connect to E2 trace and ground. (fig. 1).
Mount and solder L1 and L2.
Connect +5 volt line to E7; input coax to E1-E2 and output coax to E6-E5.
Mount assembly using #4 hardware. Two holes are provided at rear of chassis. Board mounts with coils facing front of Channelizer.
72 and 48MHz multipliers require Red dot 74H00 IC at Z11 on VCO board.
18MHz multiplier requires 100 ohm resistor across transmit output jack.
Tune coils for maximum output into transceiver.

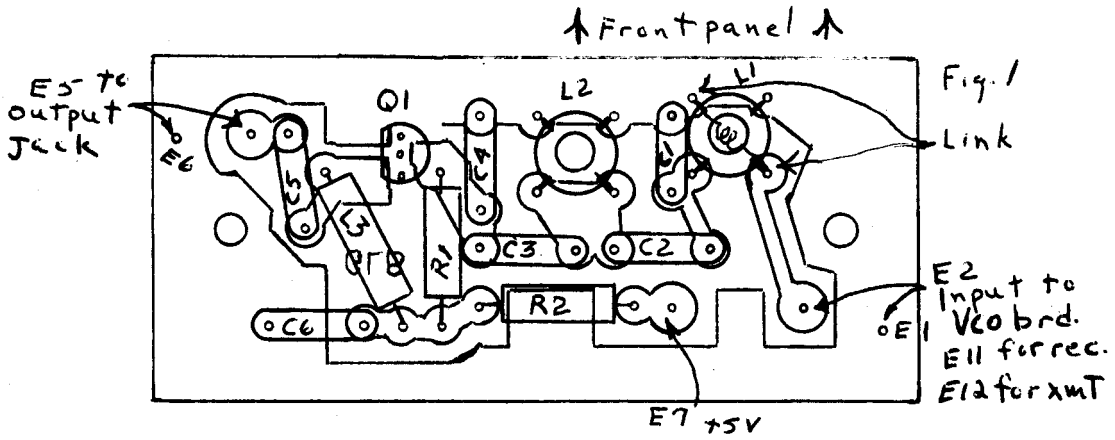


Fig. 1
Link

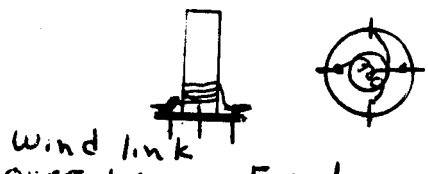
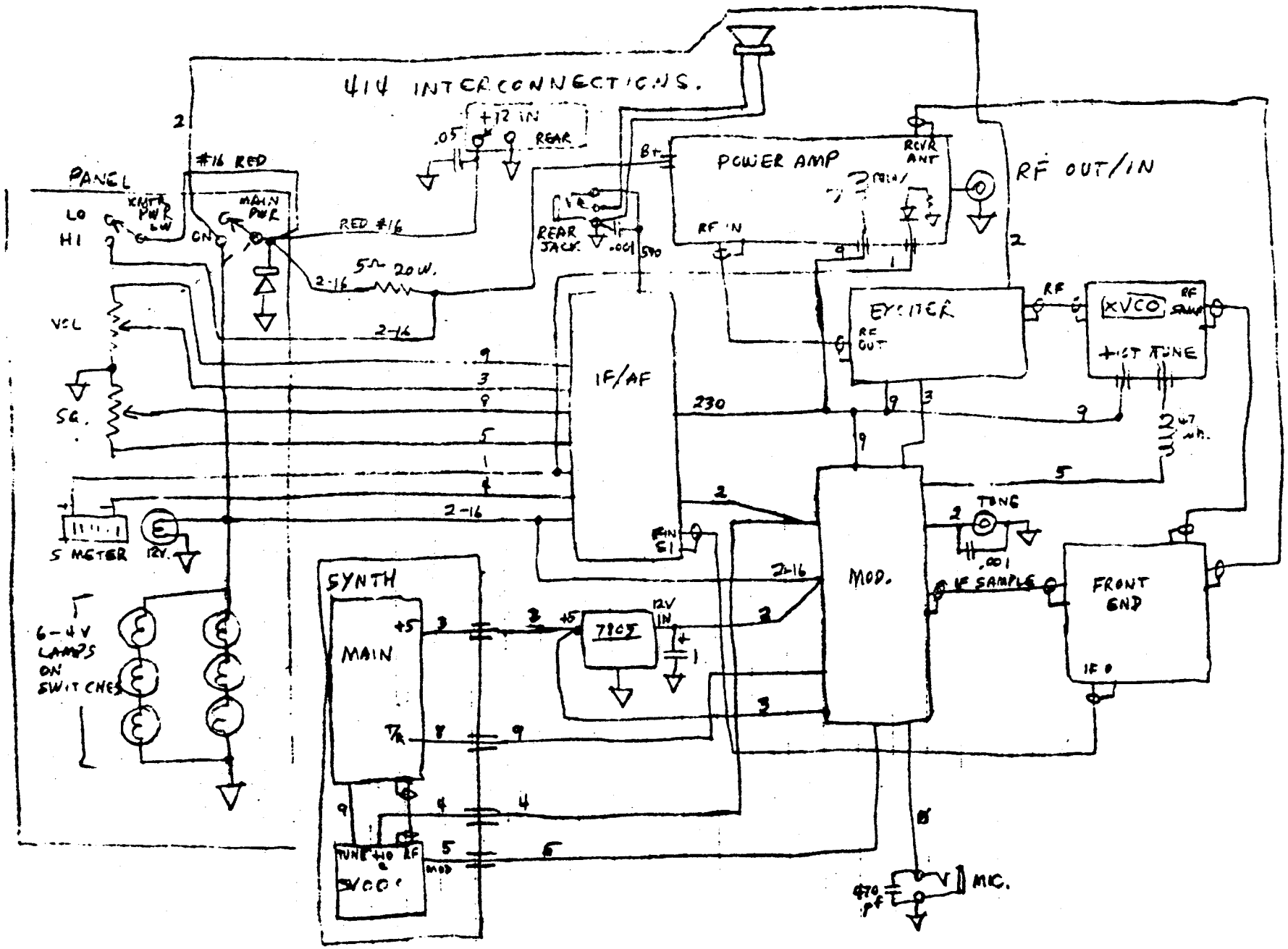
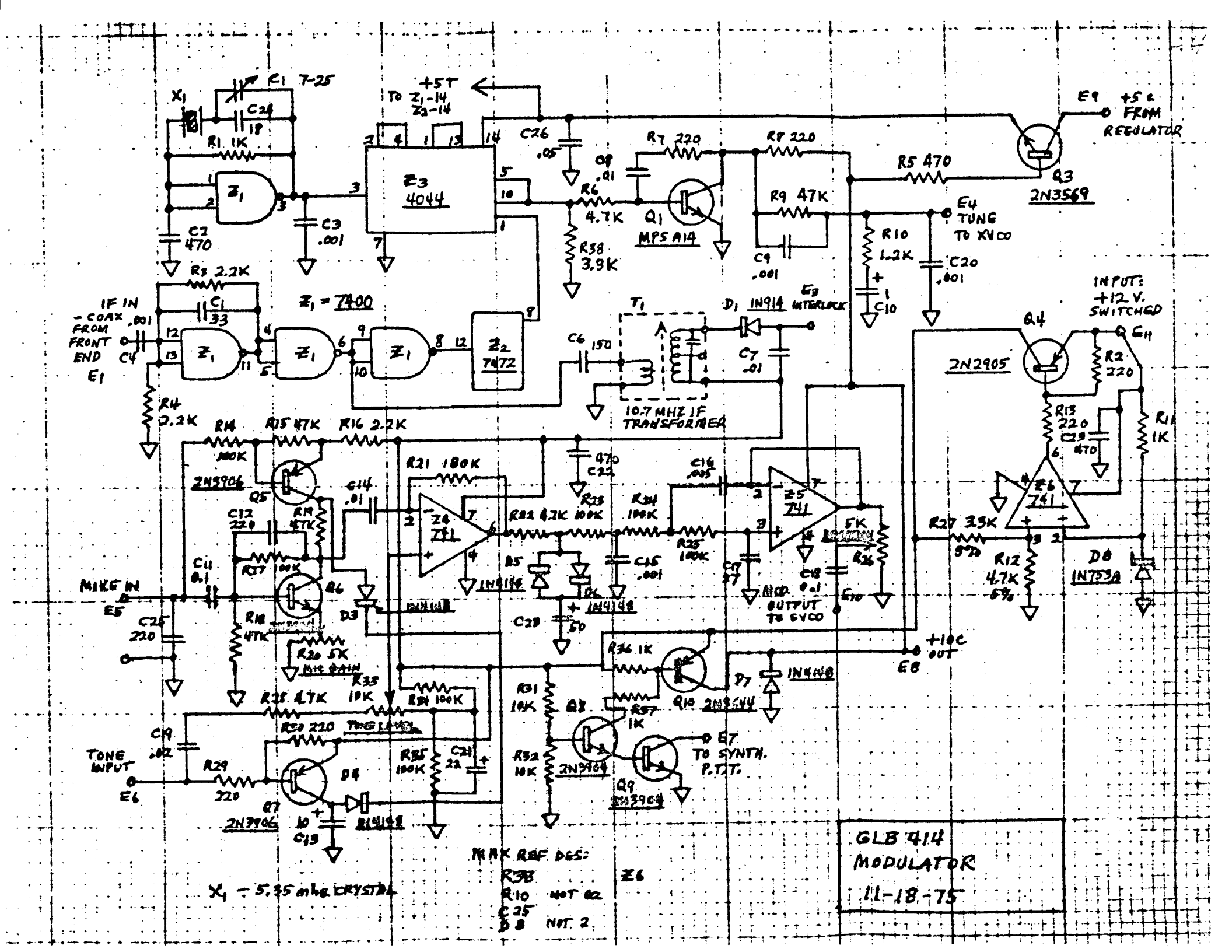
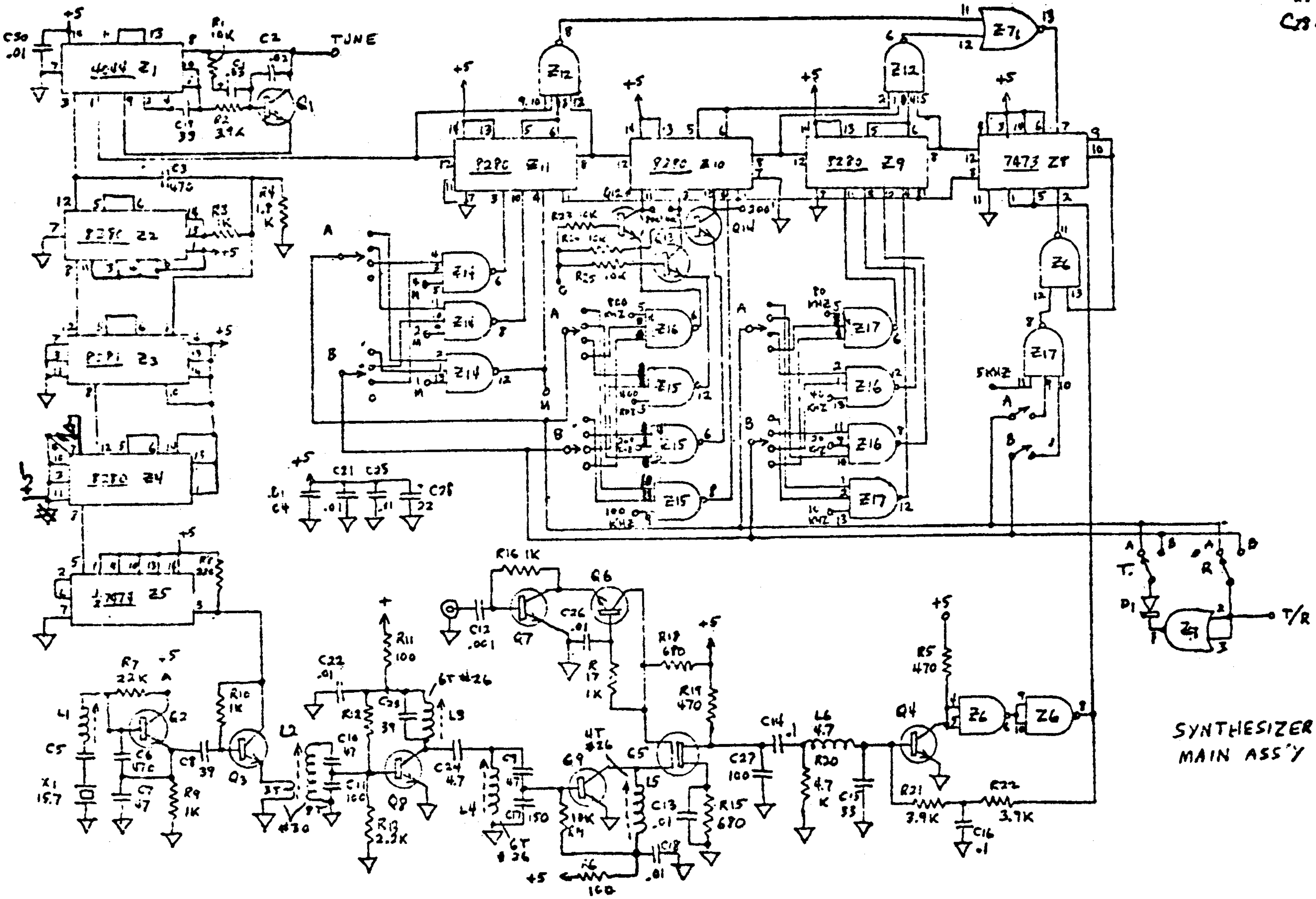


Fig. 1


414 INTERCONNECTIONS.
PANEL
#16 RED
+12 IN
.05
REAR
POWER AMP
RCVR ANT
RF OUT/IN
LO
HI
XMTR PWR LW
MAIN PWR
ON
RED #16
5Ω 20W.
2-16
REAR JACK
.001
500
RF IN
VOL
SQ.
IF/AF
230
EXCITER
RF OUT
XVCO
RF SAMP
+1ST TUNE
2.7 uh.
S METER
12V.
2-16
MOD.
TUNE
.001
RF SAMPLE
FRONT END
IF O
SYNTH
MAIN
+5
7805
12V IN
6-4V LAMPS ON SWITCHES
TUNE +10 RF
VCO
MOD
470 pf
MIC.

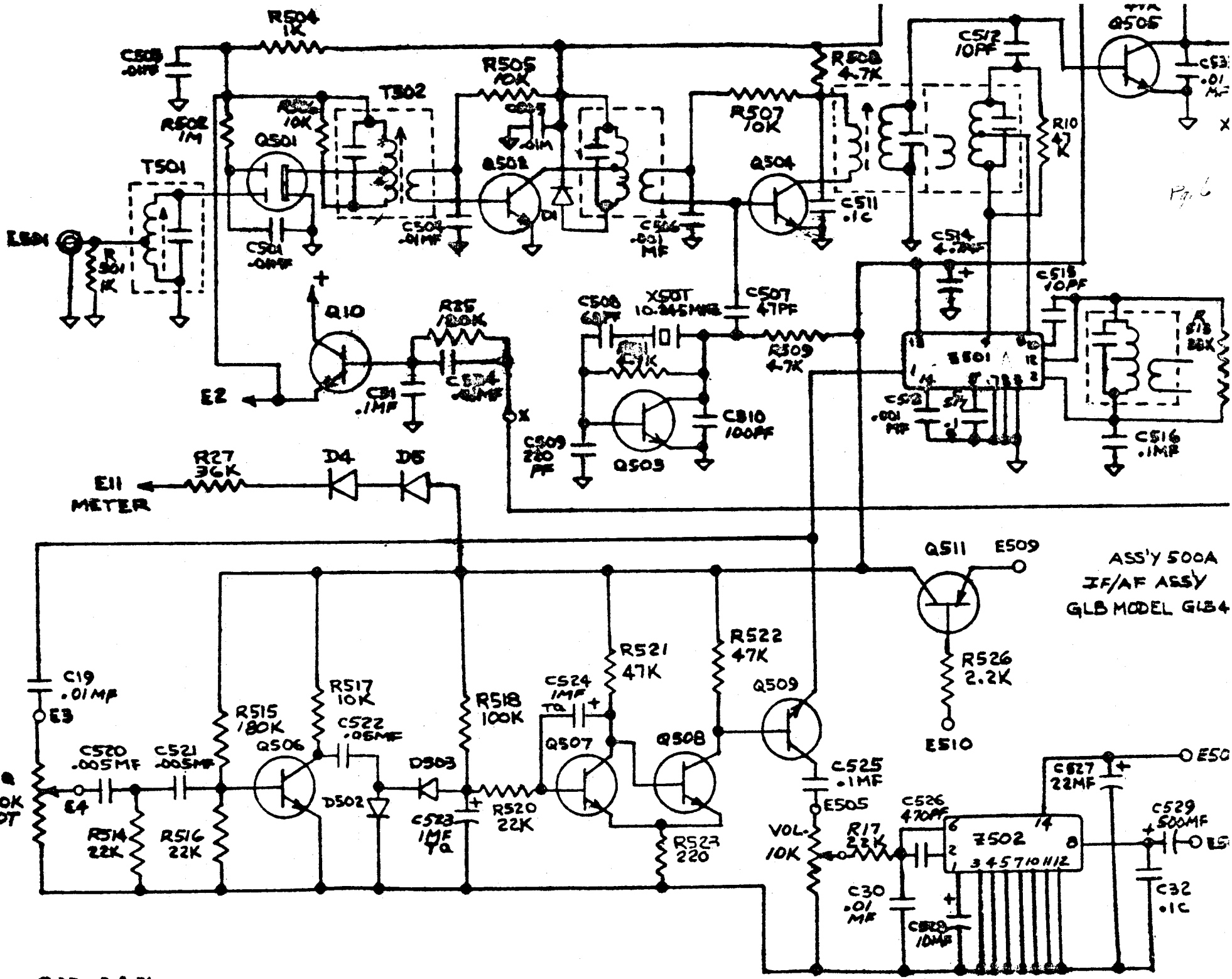

X1
C1 7-25
C24 18
R1 1K
Z1
C2 470
C3 .001
+5T
To Z1-14 Z2-14
Z3 4044
C26 .05
C8 .01
R6 4.7K
R58 3.9K
Q1 MPSA14
R7 220
R8 220
R9 47K
C9 .001
R5 470
Q3 2N3569
E9 +5 FROM REGULATOR
E4 TUNG TO XVCO
R10 1.2K
C10 1
C20 .001
R3 2.2K
C1 33
IF IN - COAX FROM FRONT END
C4 .001
E1
Z1 = 7400
Z2 7472
T1
D1 IN914
E3 INTERLOCK
C6 150
C7 .01
10.7 MHZ IF TRANSFORMER
INPUT: +12 V. SWITCHED
Q4 2N2905
E11
R2 220
R13 220
C19 470
R11 1K
R14 2.2K
R14 100K
R15 47K
R16 2.2K
2N5906 Q5
C14 .01
R21 180K
C22 470
R23
Z4 741
R22 4.7K 100K
R24 100K
C16 .005
Z5 741
5K
R26
R27 33K 5%
Z6 741
R12 4.7K 5%
D8 IN753A
C12 220
R17 47K
R37 100K
C11 0.1
MIKE IN
E5
C25 220
R18 47K
R20 5K MIC GAIN
Q6
D3
R35
C15 .001
D5
D6
C17 27
C18 0.1
MOD OUTPUT TO SVCO
E10
C23 50
R36 1K
Q10 2N3644
D7 IN4148
+10C OUT
E8
R25 4.7K
R19 100K
R30 220 TONE LEVEL
C21 22
R31 10K
R32 10K
Q8 2N3904
R37 1K
Q9 2N3904
E7 TO SYNTH. P.T.T.
TONE INPUT
E6
C9 .002
R29 220
Q7 2N3906
D4
C13 10
X1 = 5.35 mhz CRYSTAL
MARK REF DES:
R38
R10 NOT 62
C25
D8 NOT 2
Z6
GLB 414
MODULATOR
11-18-75

R25 - 4
C28 :

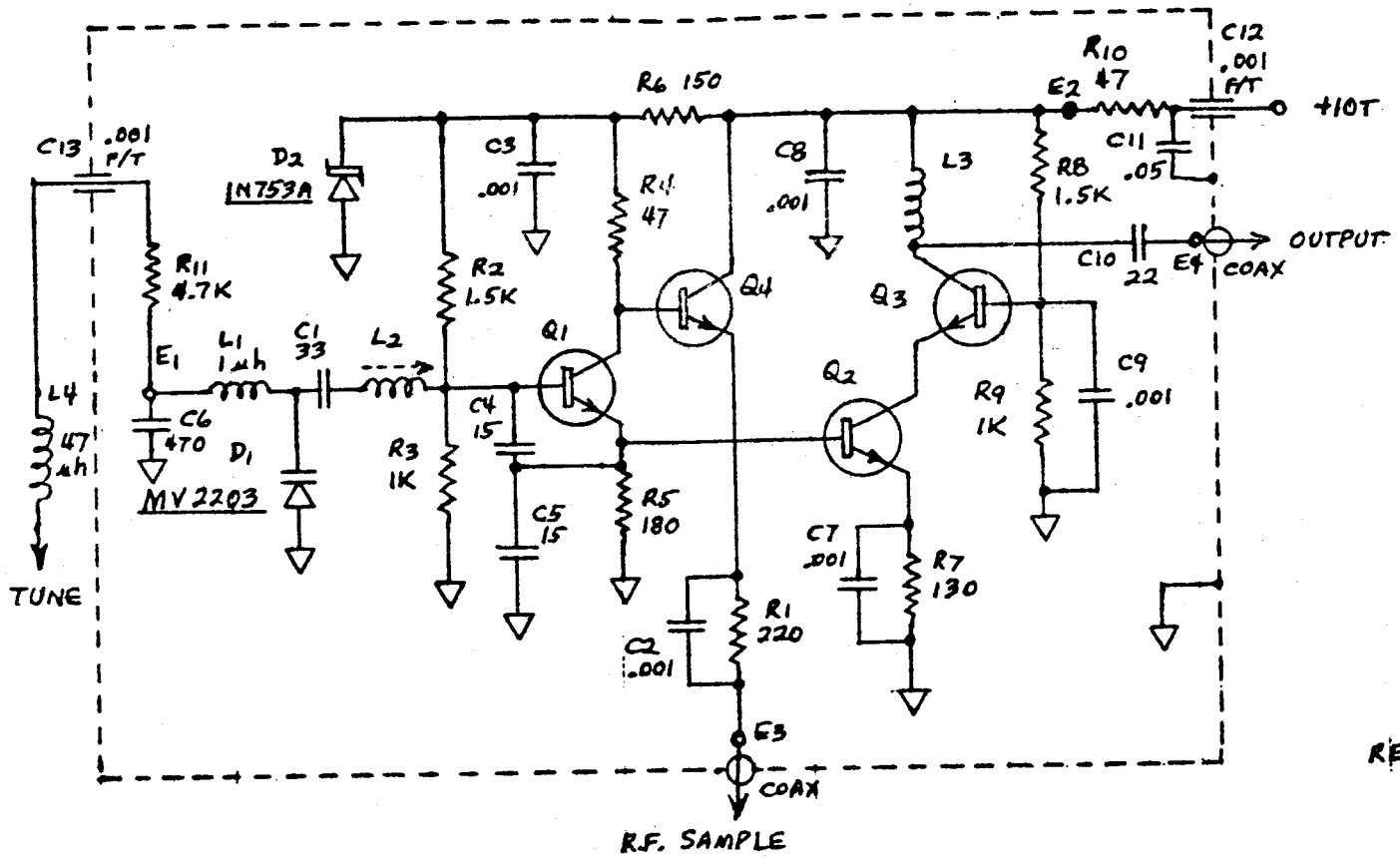


SYNTHESIZER
MAIN ASS'Y

CTR 414
STANDARD
7-74


R504 1K
C505 .01MF
R502 1M
T502
R505 10K
R508 4.7K
C512 10PF
Q505
R507 10K
R10 47K
Q501
T501
Q502
Q504
C511 .1C
E501
R501 1K
C501 .01MF
C503 .01MF
C506 .001 MF
C514 4.7MF
C515 10PF
Q10
R25 100K
C508 68PF
X501 10.245MHZ
C507 47PF
R509 4.7K
E501
C513 82K
C512 .001 MF
C516 .1MF
E2
C81 .1MF
C504 .01MF
C509 220 PF
Q503
C510 100PF
R27 36K
D4
D5
E11 METER
Q511
E509
ASS'Y 500A
IF/AF ASS'Y
GLB MODEL GLB4
R526 2.2K
E510
C19 .01MF
E3
R515 180K
R517 10K
C522 .05MF
R518 100K
C524 1MF Tq
R521 47K
R522 47K
Q509
C520 .005MF
C521 .005MF
Q506
D502
D503
Q507
Q508
C525 .1MF
E505
R514 22K
R516 22K
C523 1MF Tq
R520 22K
R523 220
VOL. 10K
R17 22K
C526 470PF
Z502
C527 22MF
C529 500MF
C30 .01 MF
C528 10MF
C32 .1C
50K POT
E4

GJB 3-2-76



$Q_1 - Q_4$ 2N5130

C VALUES IN pf. UNLESS FRACTIONAL
FRACTIONAL C VALUES IN UF.
ALL R ¼W.

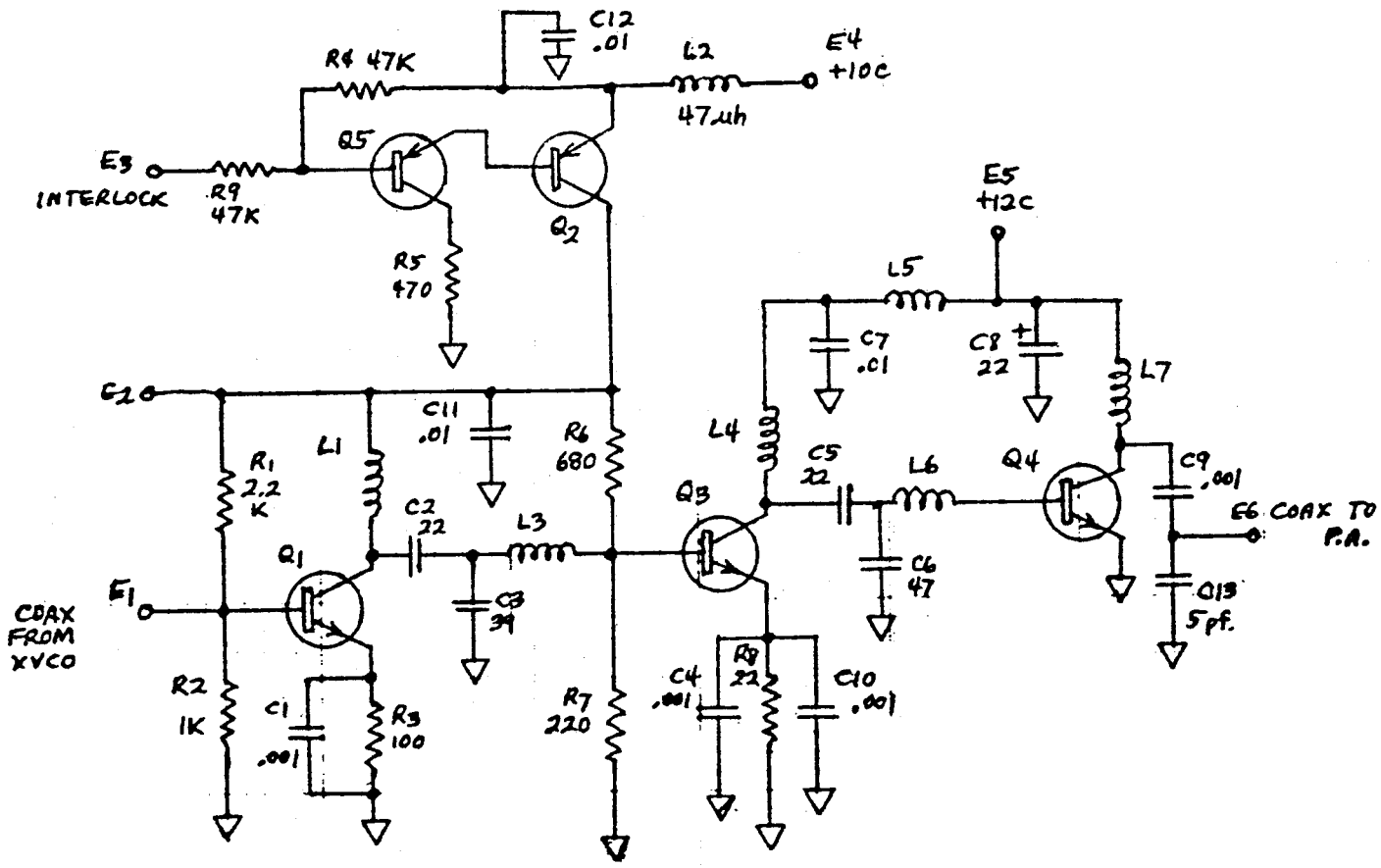
L2 – 6½ T #24 ON SLUG-TUNED FORM.

L3 – 5½ T. #24 0.15" I.D.

REF DES:

HIGHEST	UNUSED
R11	
C13	
Q4	
D2	
L4	

TRANSMITTER VCO 11-18-75
GLB 414



ALL R – 1/4 W.
C – FRACTIONAL VALUES, UF.
IF DESIGNATED WITH A SIGN, μF.
– OTHERWISE PF.

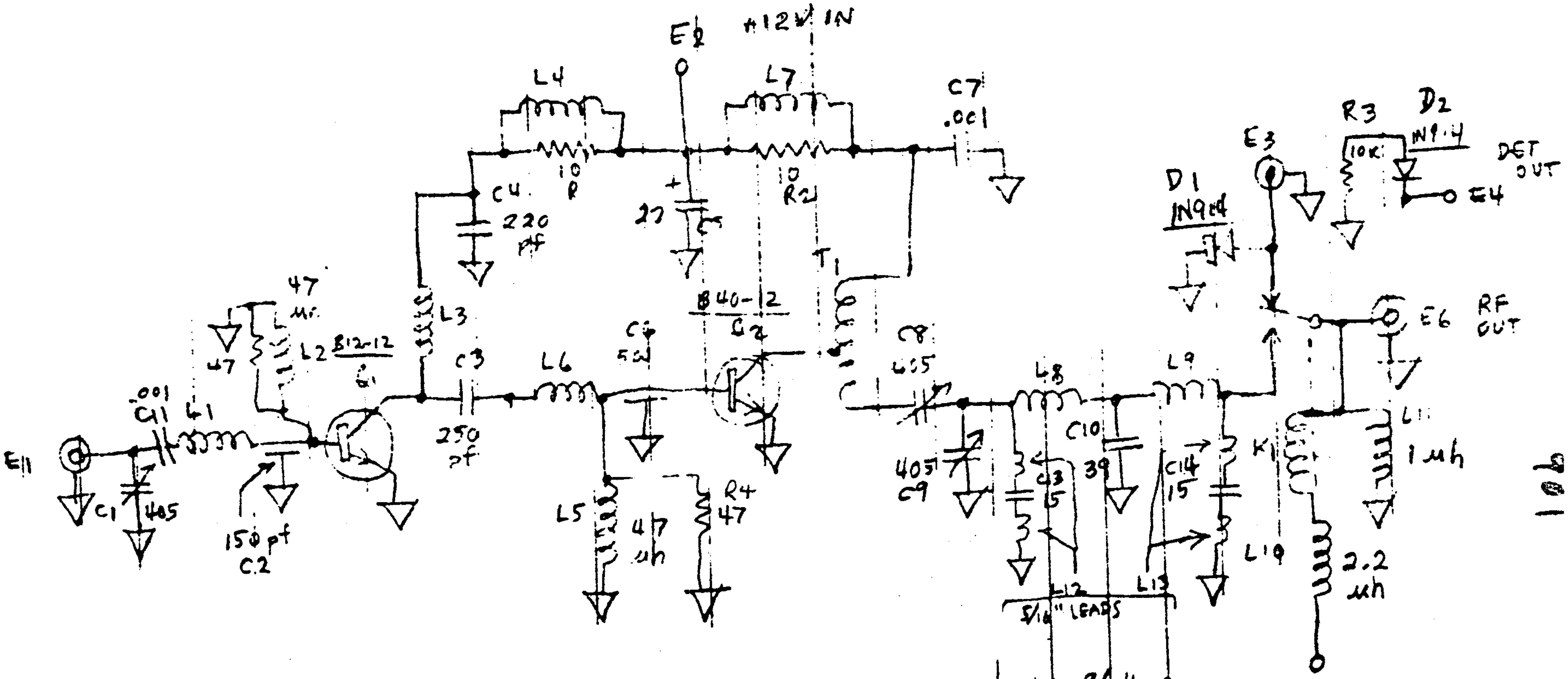
MAX REF:

RB
Q5
C13
L7

Q1 2N5130	L1 5½ T #24
Q2 2N3644	L2 47μh
Q3 2N3866	L3 2½ T #24
Q4 2N4427	L4 3½ T #24
Q5 2N3906	L5 2.2μh
	L6 0.8" LOOP #22
	L7 5T #24

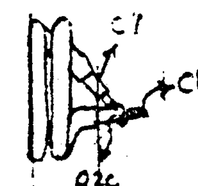
L4, L3, L4, L7 . 0.15" ID.

GLB 414 EXCITER	11-18-75



L8 } 2 1/2 T #1? - 9/32" ID
L9 }
L0 - 2.2 µh
L11 - 1 µh
L12
L13

T1 POSITION - TOP VIEW



L1 - C11 LEADS
L2 - 2.2 µh choke
L3 5 T # 24, .15" FORM
L4 - 14T #24 on 10Ω 1/2 w resistor
L5 - 2.2 µr
L6 - 0.2 Cu ribbon .125" LONG
L7 - 9 T # 20 on 1/2 w resistor

R3
Q2
L13
C14

CTR 414 POWER AMP
8-5-74
4/22/75

106

NOTE: THIS PROCEDURE PRECEDES MAIN CHASSIS ASSEMBLY SECTION.

INSTRUCTIONS FOR INSTALLATION OF PANEL LAMPS - PAGE 1

(X) 1. Inspect the two 5-segment terminal strips for short-circuits between segments. If there are any unetched spots or whisker-shorts, cut the segments clear with a knife.

IN THE FOLLOWING STEPS TAKE CARE NOT TO CUT YOUR FINGERS ON THE EDGES OF THE TERMINAL STRIPS. THEY MAY BE SHARP. PLACE A PIECE OF PROTECTIVE CARDBOARD ON EACH STRIP BEFORE PRESSING IT HARD INTO PLACE.

( ) 2. Remove the backing from one of the strips and position it as shown for TS-1. When it is precisely centered and 1/8" from the top of the panel, press it into place.

( ) 3. Remove the backing from the other strip and press it into position as TS-2.

( ) 4. The dots at the end of the lamp leads shown in the pictorial indicate the points to be soldered. Without heating them longer than necessary, tin the segments and build up a small amount of solder at the places shown:

( ) TS-1, segment A
( ) TS-1, B
( ) TS-1, C
( ) TS-1, D
( ) TS-1, E
( ) TS-2, segment B
( ) TS-2, C
( ) TS-2, E

IN THE FOLLOWING STEPS, AFTER CLIPPING THE LAMP LEADS TO THE LENGTHS GIVEN, STRIP 1/8" OF INSULATION FROM EACH LEAD AND TIN.

( ) 5. Clip the leads of one lamp to $\frac{1}{2}$". Holding the lamp in the position shown for lamp #1 and solder the leads to TS-1 segments A and B as shown.

( ) 6. Install the remaining lamps in the same manner, as in the table below:

	lead lengths:	Lamp number:	Solder to:
( )	$\frac{1}{2}$" 5/8"	2	TS-1, B and C
( )	3/4"	3	TS-1, C and D
( )	$\frac{1}{2}$" 5/8"	4	TS-1, D and E
( )	$\frac{1}{2}$" 5/8"	6	TS-2, B and C
( )	$\frac{1}{2}$" 5/8"	5	TS-2, C and E

( ) 7. Cut, strip and tin a 2" length of white-or-gray wire. Solder one end to TS-1, segment A and the other end to TS-2 segment B. Orient the lead as shown.

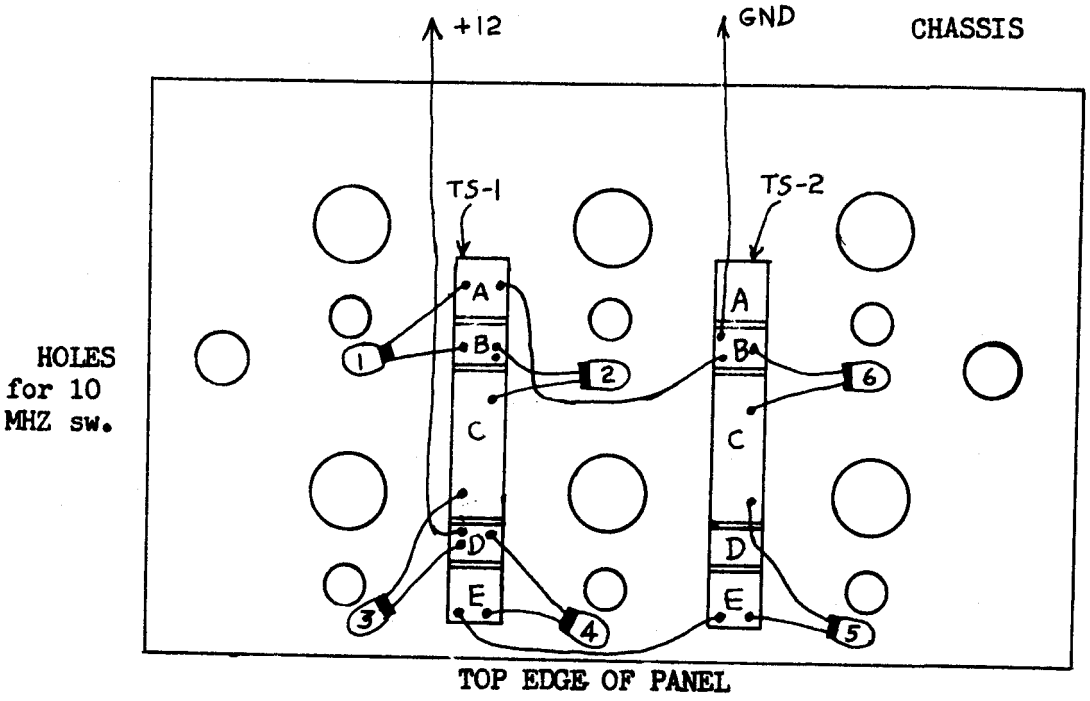
( ) 8.

( ) 8. Cut, strip and tin a 10" length of red-or-orange wire. Solder one end to TS-1 segment D. Orient the the lead along the bottom of the chassis and up the rear panel toward the feed-thru capacitors.

( ) 9. Cut, strip and tin a 10" length of white-or-gray wire. Solder one end to TS-2, segment B. Orient the free end parallel to and in the same direction as the wire in the previous step. The other ends of these wires will be connected later.

(✓) 10. Cut, strip and tin a 2" length of red-or-orange wire. Solder one end to TS-1, segment E, the other to TS-2, segment E.

IN SUCCEEDING STEPS WHEN THE SWITCHES ARE MOUNTED TAKE CARE THAT NONE OF THE LAMPS OR WIRES ARE TRAPPED BENEATH THE SWITCHES BEFORE TIGHTENING THE SWITCH HARDWARE. The wire between terminal strips should not get between the lamps and the corresponding holes above the knobs.



LAMP INSTALLATION PICTORIAL. VIEW IS FROM THE INSIDE OF THE FRONT PANEL.

Measurement of lamp lead length:

PROCEED TO STEP 1 IN THE MAIN CHASSIS ASSEMBLY SECTION.(page 7)

GLB ELECTRONICS
60 Autumnwood Dr.
BUFFALO, NEW YORK 14227
(716) 668-0566

CUSTOMER'S ORDER NO.	PHONE	DATE
003994		1/18/1977

NAME

ADDRESS

QUAN.	DESCRIPTION	AMOUNT
1	GLB 414/preset/offset	649 00
2	extra power cords @2.95	5 90
	shipping + insurance	3 50
	Paid-in-full	658 40
	(GB)	
	2-power cords to follow via 1st class mail.	
	TAX	
SOLD BY	RECEIVED BY — TOTAL	

All claims and returned goods MUST be accompanied by this bill. Thank You

2214

12/28-76
ORDER NUMBER № 003994

Have received your order for GLB Model 414

Please refer to the above order number in any communication to GLB.

Comments: Please send a list of the 9 tx + 9 rx frequencies you want on the Preset selector switch.

Yours truly,
J. Buhr

GLB ELECTRONICS
60 Autumnwood Drive
Phone 8 to 12 & 1 to 4
Buffalo, N. Y. 14227
(716) 668-05

ORDER NUMBER № 003994

Have received your order for GLB Model 414

Please refer to the above order number in any communication to GLB.

Comments: 2-extra power cords to follow via 1st Class Mail.

GLB ELECTRONICS
60 Autumnwood Drive
Phone 8 to 12 & 1 to 4
Buffalo, N. Y. 14227
(716) 668-05

1/20/77

1-716-668-0566

GLB ELECTRONICS announces.....

The GLB414, a 2-Meter synthesized FM transceiver, loaded with goodies!

Standard Features include.....

* Frequency coverage: 142 to 149.995 mhz in 5 khz steps!
* Transmitter power output of at least 40 watts, SWR-proof!
* Broad-band design delivers full power over the entire frequency range!
* Spurious levels exceed all commercial standards!
* Receiver has built-in preamp, 0.2 uv for 20 db quieting!
* 100 db receiver dynamic range for high overload and intermod rejection!
* Modular construction for easy maintenance and option interchangeability!
* Frequency stability 5 PPM (0.0005%)
* Two independent sets of frequency control switches with full flexibility!
* Illuminated frequency display!
* Illuminated signal-strength meter, doubles as transmitter output meter!
* High-efficiency, left-side mounted speaker!
* Built-in touch-tone interface with independent level control and simple hook-up!
* Unique single-circuit microphone system!
* External audio jack!
* Receiver bandwidth of 15 khz.
* Extra set of BCD (TTL-compatible) frequency control inputs for additional frequency control inputs, available on synthesizer main board!
* Internal space reserved for optional circuit cards (ours or yours!)
* High/low power switch; 40 watts hi, 3-4 watts low!

Optional equipment (under development - see note 1).....

* Synthesizer with LED digital display!
* Automatic 600 khz offset for repeater operation! with priority sampler @49.9
* Preset channel selector for 9 most-often-used preprogrammed channels! @ 79.95
* Frequency scanner!
* Tone-burst or continuous tone squelch generator!
* Others planned!

Size: 3¼" high, 8 1/8" wide, 10" deep (plus screws, knobs, connectors, feet)

Power requirements: 11 to 15 VDC negative-ground; less than 1 ampere receive, less than 8 amperes transmit. (full power output)

Price: ~~$~~649 plus shipping. + 3,50

Availability: Limited quantities ~~Dec. 1974~~.

A unit with offset + priority sampler option and the preset option @ $649.00

Address inquiries to:

GLB ELECTRONICS
60 Autumnwood Drive
Buffalo, N. Y. 14227

R. Buhr