TECHNICAL MANUAL

FOR

MMX-4
MULTI - MODE EXCITER
(Preliminary Issue)

PUBLICATION NUMBER

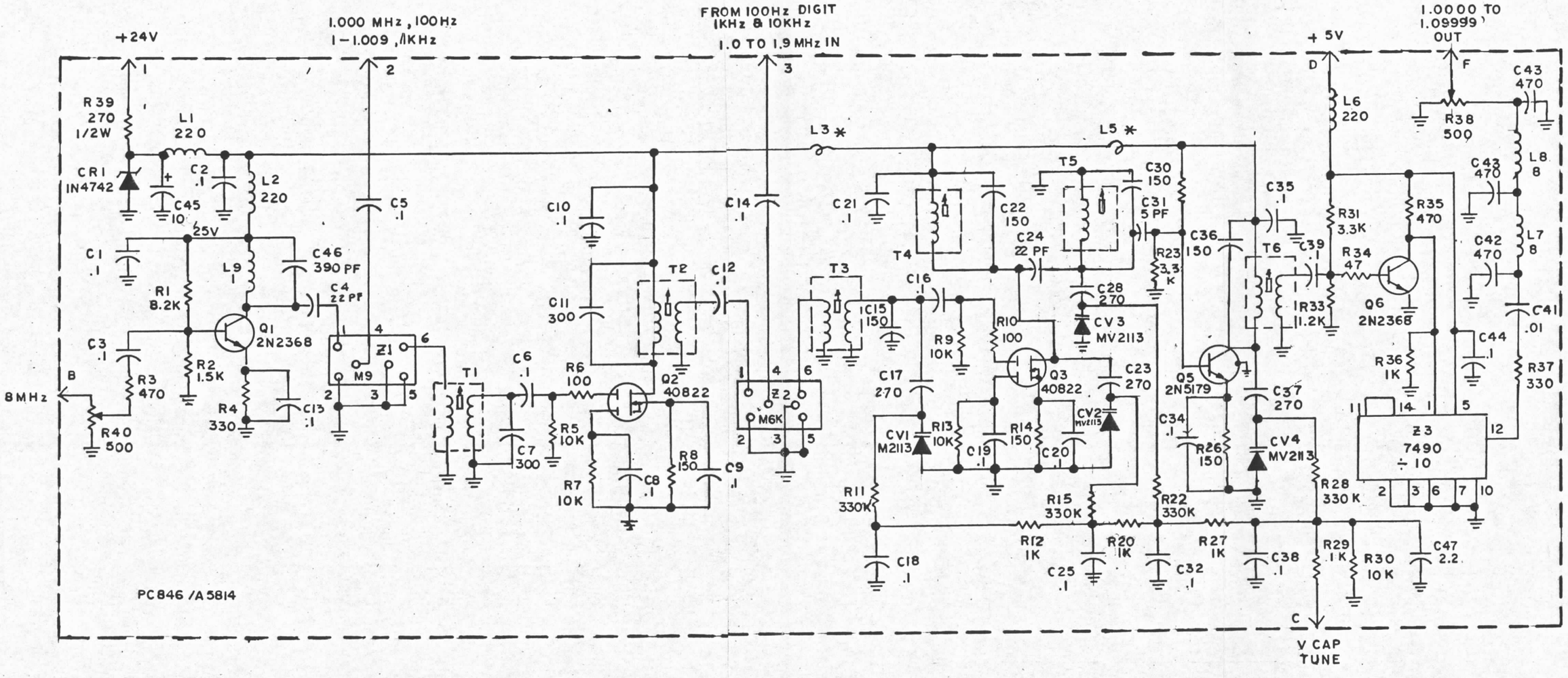
204-4119-001

ISSUE DATE

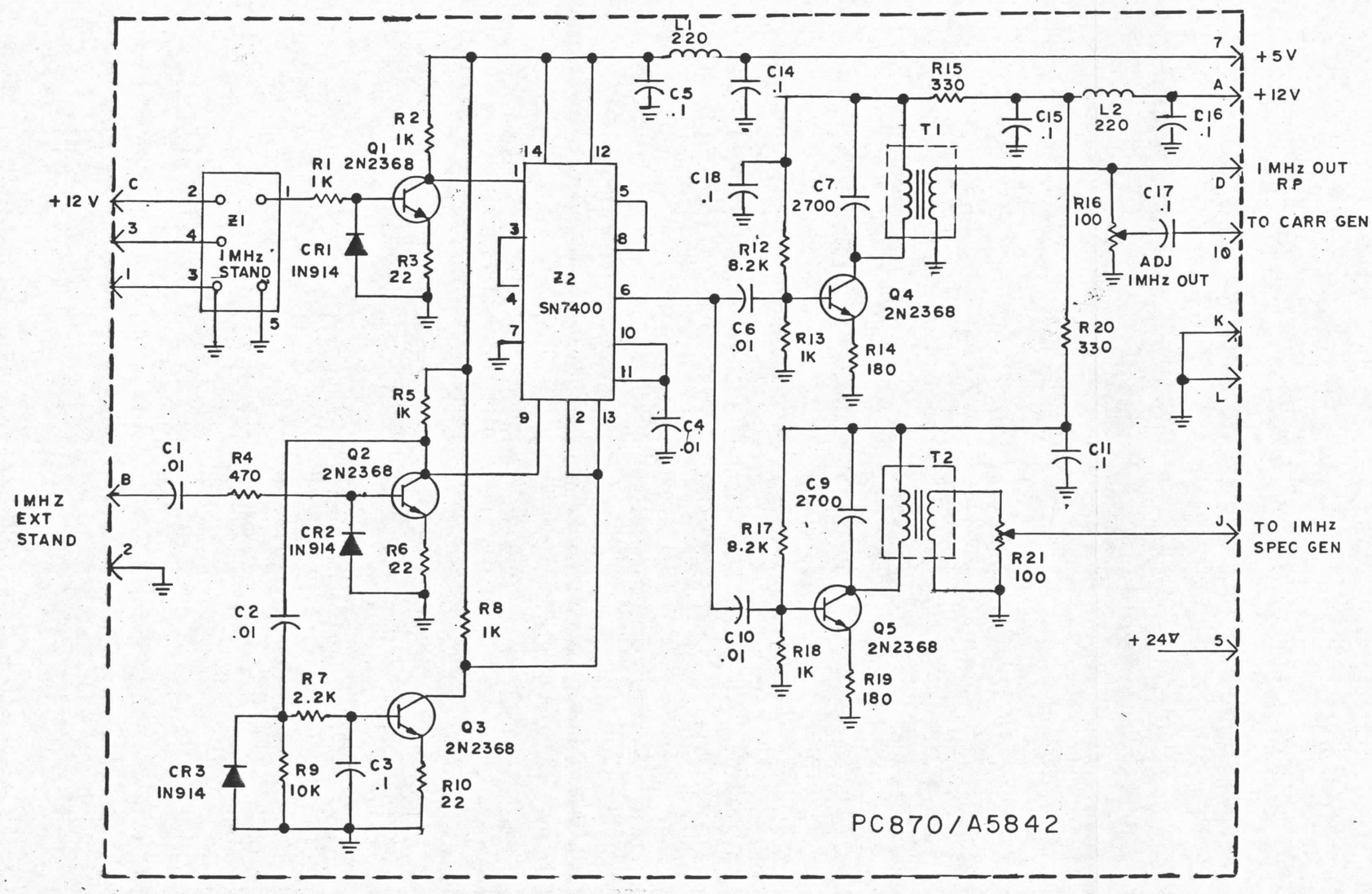
8/30/85

THE TECHNICAL MATERIEL CORPORATION

CABLE: TEPEI 700 FENIMORE ROAD, MAMARONECK, NY 10543 U.S.A. TLX: 137-358
TEL: 914-698-4800 TWX: 710-566-1100



Z101, Z102, Z103 .1, 1, 10, KHz SYNTHESIZER A5814



Z002 1 MHz STANDARD AND SWITCH A5842

1. 1 MHz STANDARD AND SWITCH Z002 generates a 1 MHz standard reference frequency that is used for generating all the primary reference frequencies created in the Exciter. A highly stable temperature compensated crystal oscillator is employed for stability and efficiency. The 1 MHz standard signal is buffered, gated, amplified and then distributed to several card assemblies for further processing. An input is available at the rear panel for an external standard frequency. A sensing circuit monitors the level of the external standard frequency; if it should drop to below .7VRMS, switching logic will receive an external standard override signal and automatically direct the 1 MHz amplifying and shaping circuits to the internal standard. This ensures that a reference standard signal will be immediately available to the Exciter if the external standard signal is lost or of the improper amplitude.

The SPECTRUM GENERATOR Z104 derives several discrete frequencies used for conversion and modulation in the Exciter. The 1 MHz standard frequency is first clipped and amplified and then sent to a 1 MHz spectrum generator where it is squared; this squared output contains harmonics of the 1 MHz fundamental, for use in the tuned comb filters. This 1 MHz signal is rich in harmonics for generation of 3 other discrete frequencies: 8 MHz , 20 MHz and one of 4 discrete frequencies, either 9,10,11 or 12 MHz . The 8 MHz output is applied to the synthesizers and mixer sections as the fundamental input frequency; the 20 MHz output is coupled to the multiplier/mixer assembly for further multiplication; and the 9-12 MHz generator section through the action of the switching transistors provides the correct fundamental input frequency to the MHz synthesizer for determination of the correct MHz integer . The control signals for the correct switching of the 9-12 MHz circuits are generated by the microprocessor assembly in accordance with the desired output frequency selected on the front panel keypad.

2. .1, 1, 10, 100 KHz and MHz TUNED COMB FILTERS Z107-Z111 produce 10 discrete output frequencies from 1.0 MHz to 1.9 MHz in 100 KHz steps. To accomplish this the 10th through 19th harmonic of the 1 MHz spectrum is applied to "high q" varactor tuned filter/amplifier stages which select the correct harmonic of the 1 MHz spectrum input. A dc varactor tune voltage is supplied to tune the comb filter stages to the correct 1 MHz step, as indicated by the .1,1,10,100 KHz integer entered on the front panel assembly. This 10-19 MHz signal is then divided by 10 to yield 1.0-1.9 MHz which is then applied to the corresponding synthesizer.

.1,1,10,KHz SYNTHESIZERS Z101, Z102, Z103 consist of 3 frequency channels that can be considered a cascaded frequency counter; each channel is controlled by a DC varactor tune voltage supplied by the front panel assembly to determine the appropriate 100's, 1,000's and 10,000's integers of the desired output frequency. In the 100 Hz channel, 8 MHz from the spectrum generator is then modulated by the 1 MHz input to yield a basic frequency of 9 MHz. This frequency is then mixed with the 1.0-1.9 MHz input from the 100 HZ tuned comb filter. The 100 KHz step selected by the tuned comb filter will correspond to the integer selected. This mix produces a sum frequency of 10.0-10.9 MHz which is divided by 10 to yield a 1.00-1.09 MHz input to the next synthesizer. By modulating the 8 MHz input to each successive channel with the net output of the previous channel and the desired frequency from the next higher frequency select position ,a final output of 1.000-1.999 MHz results with the last 3 integers representing the least significant 3 decimal places in the selected output frequency.

3. FINAL MIXER Z106 provides the 100 KHz digit and also mixes the 3 MHz signal from the 3 MHz generator with the 10.0000-10.9999 MHz created in the synthesizer section of the final mixer. Generation of the 100 KHz step frequency supplied by the 100 KHz tuned comb filter is identical to the operation of the identical to the .1,1,10 KHz synthesizers. The output of the 10 KHz synthesizer is mixed with 8 MHz from the spectrum generator to yield 9.000-9.999 to be mixed with the output of the 100 KHz tuned comb filter which produces a 10.0000-10.9999 MHz IF frequency. This 10.0000-10.9999 MHz IF is not divided by ten as in the previous synthesizers but is instead modulated with a 3 MHz carrier generated in the modulating circuits of carrier generator Z115, sideband generator Z004 and 3 MHz generator to create through varactor tuned amplifier stages a 13.0000-13.9999 MHz IF frequency that is modulated by the 4 least significant integers selected on the front panel assembly and any modulated audio intelligence.

4. MHz synthesizer Z105 along with the step frequency provided from the MHz tuned comb filter provide for generation of the MHz digits. The operation of the MHz tuned comb filter is identical to that of the .1, 1, 10 KHz tuned comb filters previously described, while the operation of the MHz synthesizer is similar to that of the .1,1,10 KHz synthesizers. The fundamental reference frequency, unlike the previous synthesizers , is one of 4 discrete frequencies. Either 9, 10, 11, or 12 MHz is modulated by a 100 KHz step frequency applied from the MHz tuned comb filter Z111. The shifting of the 9, 10, 11, 12 MHz to one continuous successive frequency range under control of the 1 and 10 MHz frequency select input positions on the front panel assembly thereby derives the two

most significant digits of the desired output frequency. The final mixer does not contain a divider circuit and therefore its output is over a larger frequency range. This creates a 10.3-13.2 MHz I.F. frequency that is applied directly to the x2 amplifier for frequency multiplication. Determination of the correct fundamental frequency is accomplished in the front panel assembly as described in the reference and spectrum generation section.

MHz	selected position	primary reference	100 KHz step	tune control	MHz output
*Option	0	12	1.3	8.16	13.3
	1	12	1.2	8.16	13.2
	2	12	1.1	8.16	13.1
	3	11	2.0	8.16	13.0
	4	11	1.9	6.85	12.9
	5	11	1.8	6.85	12.8
	6	11	1.7	6.85	12.7
	7	11	1.6	5.58	12.6
	8	11	1.5	5.58	12.5
	9	11	1.4	5.58	12.4
	10	11	1.3	4.53	12.3
	11	11	1.2	4.53	12.2
	12	11	1.1	4.53	12.1
	13	11	2.0	3.58	12.0
	14	10	1.9	3.58	11.9
	15	10	1.8	3.58	11.8
	16	10	1.7	2.71	11.7
	17	10	1.6	2.71	11.6
	18	10	1.5	2.71	11.5
	19	10	1.4	2.06	11.4
	20	10	1.3	2.06	11.3
	21	10	1.2	2.06	11.2
	22	10	1.1	1.52	11.1
	23	9	2.0	1.52	11.0
	24	9	1.9	1.52	10.9
	25	9	1.8	0.95	10.8
	26	9	1.7	0.95	10.7
	27	9	1.6	0.95	10.6
	28	9	1.5	0.50	10.5
	29	9	1.4	0.50	10.4

CARRIER GENERATOR Z115 receives a 1 MHz standard frequency input from the spectrum generator assembly, which is supplied to both the 250 KHz and the 2.750 MHz frequency generation circuits. In the 250 KHz channel the 1 MHz input is divided by 4 to derive the basic 250 KHz subcarrier frequency; a control ground input from the front panel assembly is applied to enable the generation of the 250 KHz subcarrier output signals. In the CW mode a key ground is supplied to interrupt the enable and insert the 250 KHz subcarrier at the key rate, thereby producing a 250 KHz subcarrier CW output. The output is distributed to various sections on the carrier generator. The 2.750 MHz channel produces an RF output by dividing the 1 MHz input by 4 and then multiplying the resultant by 11 and filtering to derive the 2.750 MHz translation frequency. Note that 2.750 MHz will only be present when a control ground enables the 250 KHz subcarrier circuits. When in FSK or FAX operation the 250 KHz subcarrier and the 2.750 MHz channel signals are not required therefore control ground enable is removed from the 250 KHz circuits turning them off, and since the 2.750 MHz signal is derived from the 250 KHz subcarrier it will also be removed. The AM amplifier section, consisting of an audio amplifier circuit and mixer circuits, develops an amplitude modulated 250 KHz signal in the AM mode of operation. In the AM mode, the USB and/or LSB audio is routed to the audio amplifier stage and then to the mixer. The resultant amplitude modulated 250 KHz signal is routed to the converter section of the 3 MHz generator. Carrier reinsertion is controlled through the application of a control ground applied to one of 3 carrier reinsertion control inputs. If no control ground is present on any of the reinsertion inputs full carrier suppression will result. A tune ground signal normally supplied from the associated transmitter automatically switches the Exciter to the CW mode regardless of the mode of operation selected on the front panel. The sideband generator includes both upper and lower sideband which are similar in configuration and operation; the exception is the tuned frequency of the USB and LSB amplifier circuits. When a microphone is used, microphone audio from 300 Hz to 6.7KHz is applied to the microphone preamplifier circuit on the keypad motherboard assembly and then to the USB/LSB front panel audio select switches where it is applied to both upper and lower sideband amplifier circuits. Similarly 600 ohm line audio from 350 Hz to 6.7 KHz is applied to the front panel USB/LSB select switches. The select switches determine whether line or mike audio input will be applied to the front panel USB/LSB audio level control. In the AM mode the audio input is coupled to the carrier generator for amplitude modulation of the RF AM carrier. The SSB modulation section of the sideband generator accepts both a 250 KHz subcarrier and USB/LSB audio via the front panel level adjusts. These two signals are applied to a balanced modulator to derive the upper and/or lower sideband intelligence; the 250 KHz subcarrier is suppressed. The resulting USB and/or LSB signals are applied to the mode switching network and are then routed to the converter section of the 3 MHz generator.

The 3 MHz GENERATOR Z003 contains two sections; the

frequency shift buffer section and the converter section. The frequency shift generator section provides input buffering of the frequency shift (option) or facsimile signal (option) created in the frequency shift assembly Z117. The converter section of Z003 modulates the 2.750 MHz carrier signal with the selected modulation signal (250 KHz AM, USB, LSB, ISB or CW from the carrier and sideband generator boards). The modulated 3 MHz sum signal is amplified and then applied to the final mixer assembly Z106.

MULTIPLIER/MIXER Z122 performs the function of producing an output frequency of 133.0000-133.9999 MHz that is generated from the 20 MHz primary reference signal applied from the spectrum generator assembly Z104 and the 13.0000-13.9999 MHz signal from the final mixer assembly Z106. The 20 MHz reference signal is first multiplied by a factor of 2 and amplified to yield 60 MHz, then again multiplied by 2 and amplified to yield a 120 MHz primary reference injection frequency. This 120 MHz signal is then modulated with the 13.0000-13.9999 MHz to produce 133.0000-133.9999 MHz which is then applied to the translator assembly Z123.

X2 AMPLIFIER Z124 and **X5 AMPLIFIER Z125** operation is similar; the only difference is the multiplication factor. The X2 multiplier assembly Z124 receives the 10.4-13.3 MHz signal from the MHz synthesizer assembly Z105 and through the action of varactor tuned amplifier/filter circuits multiplies the selected input frequency to an output frequency range of 20.8-26.6 MHz. This is then applied to the X5 multiplier which yields an output of 104-133 MHz to be applied directly to the translator assembly Z123. In order for the X2 and X5 multipliers to select the correct harmonic of the input frequency a DC varactor tune voltage is supplied from the control microprocessor in the front panel assembly.

Translator Z123 performs the function of producing a 400 KHz-29.9999 MHz output signal by subtracting the 104-133 MHz (applied from the X5 multiplier assembly) from the 133.0000-133.9999 MHz developed in the multiplier mixer assembly Z122. A difference output signal results in the range of 400 KHz-29.9999 MHz. In addition a DC control voltage developed across RF output control potentiometer on the front panel assembly is applied to a varistor attenuator circuit which offers RF output gain control. In remote operation this DC voltage may also be applied to the remote gain input on the Exciter rear panel audio and filter connector J124. The output of the translator assembly is enabled by a ground applied from the PTT line. This PTT line ground is supplied from either the front panel mike jack, the rear panel audio input filter jack or the control microprocessor in the front panel assembly.

The **POWER SUPPLY** used in the MMX-4 operates from either 115 or 230 VAC when the power transformer is properly wired. The power supply outputs are regulated voltages of +24 and +12 VDC and unregulated +28VDC for operation of the Exciter circuits. The

+12 and the +24 VDC are both applied to the Exciter circuits through the front panel standby-on switch while the +28 power supply output is applied directly to the 3 MHz frequency standard and also the RF output assembly.

The **CONTROL MICROPROCESSOR** accepts frequency and mode control information from the front panel keypad assembly and controls display of the current operating parameters, DC control voltages for the varactor tuned circuits throughout the Exciter, and control grounds.

NOTICE

RECORD OF REVISIONS

NO.	ISSUED	DESCRIPTION	ENTERED	BY
001				
002				
003				
004				
005				
006				
007				
008				
009				
010				

NOTE: Please file Technical Newsletters at back of manual for permanent record.

WORLD WIDE SUPPLIERS OF ELECTRONIC COMMUNICATIONS EQUIPMENT

THE TECHNICAL MATERIEL CORPORATION

COMMUNICATIONS ENGINEERS

700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.

2. That the defect is not the result of damage incurred in shipment from or to the factory.

3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.

4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

PREFACE

This technical manual discusses the information you will require to install, operate and maintain the Synthesized High Frequency ISB Exciter, Model MMX-4 Series. This manual is intended for operators and technicians who will be responsible for the proper functioning of the equipment. The manual applies to the following models of the MMX-4 Exciter:

MMX-4 Synthesized HF/ISB Exciter

Differences between models are noted in the text, and related publications are referenced when applicable. You should read this manual in sequence, section by section, to become totally familiar with the Exciter. After completing the manual, you should be able to install, operate, and depending on your level of technical training, perform maintenance on the Exciter to the component level.

Changes are periodically made to this manual through publication of TECHNICAL NEWSLETTERS that are distributed to users of this equipment. The REGISTRATION CARD located at the front of this manual should be completed and sent to:

THE TECHNICAL MATERIEL CORPORATION

700 Fenimore Road

Mamaroneck, New York 10543 U.S.A.

Attention: Technical Data Group

Your name and address will be entered on permanent TMC records and applicable publications automatically mailed to you. Requests for related publications should be made to your TMC representative, to a TMC field office in your area, or to TMC at the above address. Forms are provided at the back of this manual for your use. Included are the following: READER'S COMMENTS; REQUEST FOR SPARE PARTS; REQUEST FOR FIELD SERVICE; REQUEST FOR PUBLICATIONS; REQUEST FOR TRAINING; NOTES; and a TMC LOCATION MAP. To facilitate maintenance of accurate records on the operation of the Exciter, a SERVICE LOG and FIELD REPORT are also included.

TABLE OF CONTENTS

SECTION 1

GENERAL INFORMATION

INTRODUCTION

This manual presents operating and maintenance instructions for the Synthesized High Frequency ISB Exciter, Model MMX-4, designed and manufactured by The Technical Materiel Corporation (TMC) of Mamaroneck, New York, 10543 U.S.A. This manual includes a general discussion of the equipment; preparation instructions for installation and use; operating instructions; principles of operation; maintenance data; and diagrams with parts lists.

1.1 PURPOSE AND USE OF EQUIPMENT

The MMX-4 Exciter is a solid state device used to control the output frequency of a transmitter in a single sideband (SSB) transmitting system. It provides amplitude modulated (AM); amplitude modulated equivalent (AME); or two-channel independent sideband (ISB) intelligence on an RF carrier frequency between 1.6 and 29.9999MHz to 400KHz at reduced power.

The MMX-4 also features built-in frequency stability of 4 parts in 10 to the 7th per day, and provides continuously adjustable 100 milliwatt output in AM, AME, SSB and ISB modes.

1.2 IDENTIFICATION AND MODEL DIFFERENCES

The MMX-4 is identified by a metal nameplate affixed to the front panel at the upper left-hand corner. When installed in a TMC transmitter system, this nameplate is transferred to the right-hand side of the chassis. The nameplate is lettered with the generic name, TMC model number, and serial number of the Exciter. Similar information, including manufacturing lot number, is stamped on a metal foil attached to the rear panel.

Two models of the MMX-4 Exciter are manufactured by TMC. Common elements of both are referred to in the manual as simply the MMX-4.

MMX-4 Synthesized HF/ISB Exciter

The MMX-4 is the standard RF drive unit for all TMC General Purpose (GPT) and High Frequency (HFT) Transmitters.

1.3 FUNCTIONAL DESCRIPTION

The MMX-4 Exciter is a completely integrated RF drive unit that requires no tuning or peaking for proper operation. All frequency control elements, power supplies, amplifiers, and control circuits are designed in to the Exciter. Only RF, audio, and AC power lines are required for proper operation to specification.

Front panel controls permit operator selection of the operating modes which include CW, AM, USB, LSB, ISB and FSK/FAX. A carrier control is included on the front panel to permit the operator to select the desired amount of carrier insertion. This level is normally pre-set at the time of manufacture for -6, -20, -30 and FULL (-55db) but can be changed to other values. Similarly, the optional FSK feature is pre-set for carrier shifts of + 42.5, +85, +170 and +425H\, switch-selectable at the rear panel. These values can be changed as required.

Front panel controls include level adjusts for USB or LSB line/mike inputs and for RF output. A built-in meter indicates the operating levels of critical circuits in the Exciter by monitoring internal test points. A front panel jack permits 55dbm low-impedance microphone and a dry contact keyer to be coupled to the Exciter.

Standard BNC-type connectors are provided on the rear panel to interface the standard 1MHz output frequency; the 1MHz monitor; the RF output; automatic load and drive control (ALC); and the RF monitor with external equipment.

1.4 PHYSICAL DESCRIPTION

The majority of the electronic components which constitute the Exciter are mounted on removeable printed circuit cards which plug in to the chassis and are easily accessible from the top and bottom of the Exciter by removal of protective covers.

The Exciter chassis is designed for installation in a standard 19-inch (483mm) wide electrical operating cabinet. Removeable top and bottom protective covers are provided on the chassis. The Exciter is convection cooled and requires a minimum of three (3) inches clearance for proper air circulation.

SPECIFICATIONS

Table 1-1 presents the pertinent electrical and mechanical specifications for the Exciter.

EQUIPMENT SUPPLIED

Table 1-2 presents the equipment and materials supplied with the Exciter.

1.5 TECHNICAL SPECIFICATIONS

OPERATING PARAMETERS

FREQUENCY RANGE

2.0000-29.0000MHz

400KHz-29.9999MHz (Reduced power)

FREQUENCY SELECTION

Direct synthesis in 100Hz steps

Phase Jitter: Less than 5 degrees in two successive 10 msec. periods

FREQUENCY STABILITY

Five parts in 10^{7} per day/15 ^{o}C change

Optional One part in 10^{9} per day/15 ^{o}C change

FREQUENCY DISPLAY

Front panel digital

MODES OF OPERATION

CW (A1)/AM (A3)/AME (A3H)/USB, LSB (A3A, A3J)/ISB (A3B)

Optional FSK (F1)/FAX (F4)

POWER OUTPUT

100 mW PEP and Average (CW)

INPUT/OUTPUT IMPEDANCE

50 ohm (nominal) unbalanced, BNC-type connector

TUNING

Remote/Local (digital)

REMOTE CONTROL

Optional interface circuits are available for remote monitoring and control of frequency, mode and carrier.

AUDIO PARAMETERS

AUDIO SIDEBAND RESPONSE

250-3040Hz, +/-1.5 db CCIR

Optional 250-6080Hz, +/-1.5 db CCIR

EQUALIZED FILTERS (special order)

Optional 250-3040Hz: 1.5 db max.

Envelope delay: Less than 500 usec, 600-2900Hz

Less than 150 usec for any 100 Hz step, 500-3050Hz

AUDIO INPUT

1. Independent 600-ohm channels, balanced or unbalanced

-20 to + 10 dbm; rear-apron terminals.

2. Built-in microphone pre-amplifier for low-level dynamic input -55 db into 47 K-ohms; front-panel jack.

KEYING INPUT

1. CW key jack on front panel; 200-baud; dry contact

2. FSK: 75-baud or optional 200-baud and higher.

Shift +/- 42.5/85/170/425Hz; Others on request.

Input Neutral or Polar 20/60 ma, 50 or 100 volts and dry contact keying.

3. FAX: + 1 to + 10VDC produces 800 Hz linear shift.

Tone keyers are available for audio FSK operation (single or multi-tone)

TRANSMIT CHARACTERISTICS

UNWANTED SIDEBAND REJECTION

500Hz tone is minimum 60 db below PEP

SPURIOUS SIGNALS

Nominal 60 db below PEP

INTERMODULATION DISTORTION

Minimum 40 db below either tone of a two-tone test at 100 mw PEP

RESIDUAL NOISE AND HUM

Minimum 70 db below PEP. Power supply ripple 55 db below PEP

CARRIER SUPPRESSION

Selectable at -6, -20, -30, -55 db (FULL); Other values on request

ENVIRONMENTAL AND INSTALLATION

COOLING

Convection.

OPERATING CONDITIONS

0 to +50 °C; up to 95% relative humidity at MSL

STORAGE CONDITIONS

-30 °C to + 80 °C; up to 95% humidity at MSL

POWER SUPPLY

Totally solid-state.

115 or 230 volts AC +/- 10%, 50/60/400Hz, single-phase

SIZE AND WEIGHT

5.25" (13.4 cm) high x 19" (48.3 cm) wide x 20" (50.8 cm) deep

30 pounds/(13.66 kg)

SHIPPING DATA

Commercial packing for domestic U.S. (air) shipment.

One (1) container - 10" x 30" x 30"

Total weight - 58 pounds (26.36 kg)

Total cube - 5.2 cu. ft. (.15 cu. meters)

TECHNICAL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2
INSTALLATION

INTRODUCTION

This section describes the requirements for preparing the Exciter for use. It includes procedures for unpacking and inspection; electrical and mechanical installation considerations; and power requirements.

2.1 UNPACKING AND INSPECTION

The Exciter is calibrated and tested at the factory prior to shipment. When it is received at the operating site, the external packing case should be inspected for obvious signs of mishandling and damage. Such signs could include crimped or crushed corners on the shipping container indicating the container had been dropped; or loose/broken sealing tape indicating rough handling by the carrier. With respect to damage to the Exciter for which the carrier is responsible, the customer should file a claim against the carrier. TMC will assist in describing methods of repair and/or furnishing replacement parts if the Exciter is damaged.

After inspecting the shipping container, the Exciter may be unpacked. The Exciter is normally shipped in heavy-duty, tri-wall cartons when the method of shipment is air freight or the destination is within the United `States. All other shipments require the use of wood boxes built by TMC. The container number and contents are stenciled on the outside of each carton or box.

Various precautions must be observed in handling to prevent injury and/or damage to the Exciter. The Exciter with the loose items package and technical manuals are packed in a single shipping container which is placed in a second outer container. If a wood box is provided, the outer container is placed snugly inside the box.

The following information outlines the general uncrating methods to be used. Follow each step, keeping in mind previous discussions.

Remove wire straps or bands from around the shipping container with tin snips.

When a wood box is used and unless otherwise specified, remove nails from the top and two adjacent sides of the shipping container with a nail puller. DO NOT USE claw hammers, pinch bars or other leverage devices.

After the sides are removed, remove the top covering to

expose the outer cardboard container. Strip off the pressure-sensitive tape from this container.

CAUTION

When using a knife to cut the pressure-sensitive tape, care must be taken not to mar the Exciter in the inner container.

Remove the inner container from the outer container.

If a barrier bag is encountered, remove the bag from the inner container.

Remove the pressure-sensitive tape from the inner container observing the same precautions discussed previously.

Remove dessicant bags, loose items package and technical manuals from the inner container.

Remove the top section of the plastic-encased form to expose the Exciter. Note that the Exciter sits in a second plastic-encased form that is contoured to the shape of the Exciter when it is packed.

Carefully remove the Exciter from the inner container.

Repack the packing material in reverse order. Retain this material, including the pre-contoured forms, for future use should repacking for shipment or storage become necessary.

After the Exciter has been removed from the shipping container, it should be inspected on a bench for signs of damage. The following procedure is recommended:

Inspect the front panel for nicks, scratches, discolored paint, or other obvious signs of mishandling.

Check the meter plexiglass for scratches or cracks.

Check the fuse housing and indicator lamp housings for cracks.

Remove line fuse (on the rear panel) and check for correct value: 1.0 ampere for 115VAC line input and 0.5 ampere for 230VAC line input.

Exercise all switches and controls on the front panel to check for ease of operation without unnecessary binding.

Inspect the rear panel for scratches, nicks, etc.

Check the condition of all connectors for nicks, burred threads, dents or other signs of wear. Check for bent or broken pins and connectors.

Check the printed circuit board edges for cracks, nicks and firm mounting.

Loosen the threaded screws securing the bottom cover and remove. Inspect the power transformer input terminals to verify parallel connection of the primary winding for 115VAC operation or cross connection of the primary winding for 230VAC operation. Refer to Figure 2-1 for the proper connections. Recheck the line fuse for proper rating.

Replace the bottom cover and verify that a "230 volts" decal is affixed to the rear panel if the Exciter is correctly wired for 230VAC operation. No decal is used for 115VAC operation.

Inspect the power cable assembly for frays, cuts, etc.

Recheck the loose items package and the "Equipment Supplied" list to verify that all items are present and accounted for. Complete the REGISTRATION CARD at the front of the manual and send with the requested information to TMC.

2.2 POWER REQUIREMENTS

The Exciter is designed for operation at 115 or 230VAC, 50/60Hz single-phase primary power. Unless otherwise specified by the customer, the unit is shipped wired for 115VAC operation. For 230VAC operation, a wiring change is required on the primary of the transformer (Figure 2-1). Line fuse must be changed to 0.5 ampere rating for 230VAC operation.

2.3 FINAL INSPECTION

The final inspection procedure consists of a visual and mechanical check of the Exciter to verify that it is ready for operation.

Ensure that all dust and foreign matter is removed.

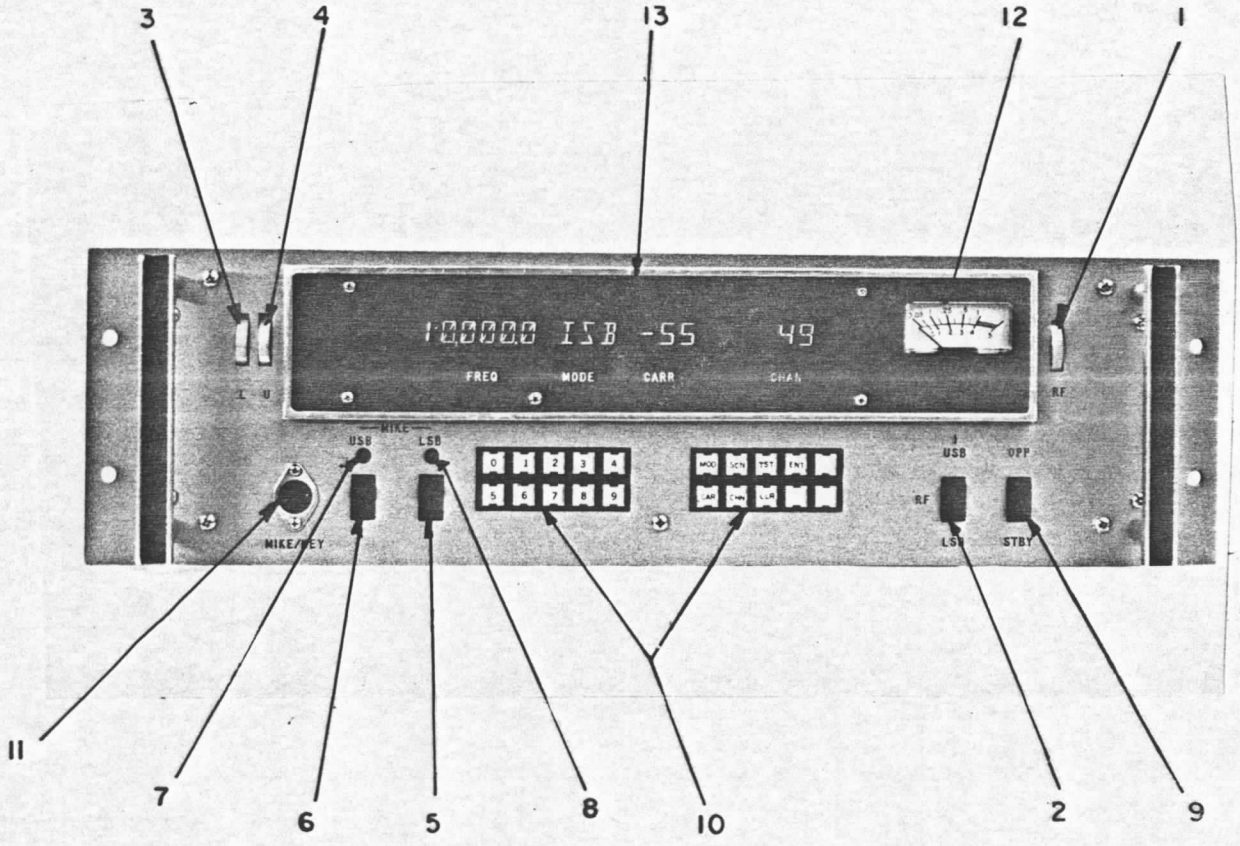
Ensure that all external controls are operating properly.

Check for loose hardware, handles and knobs.

Verify that all covers are in place and fit properly.

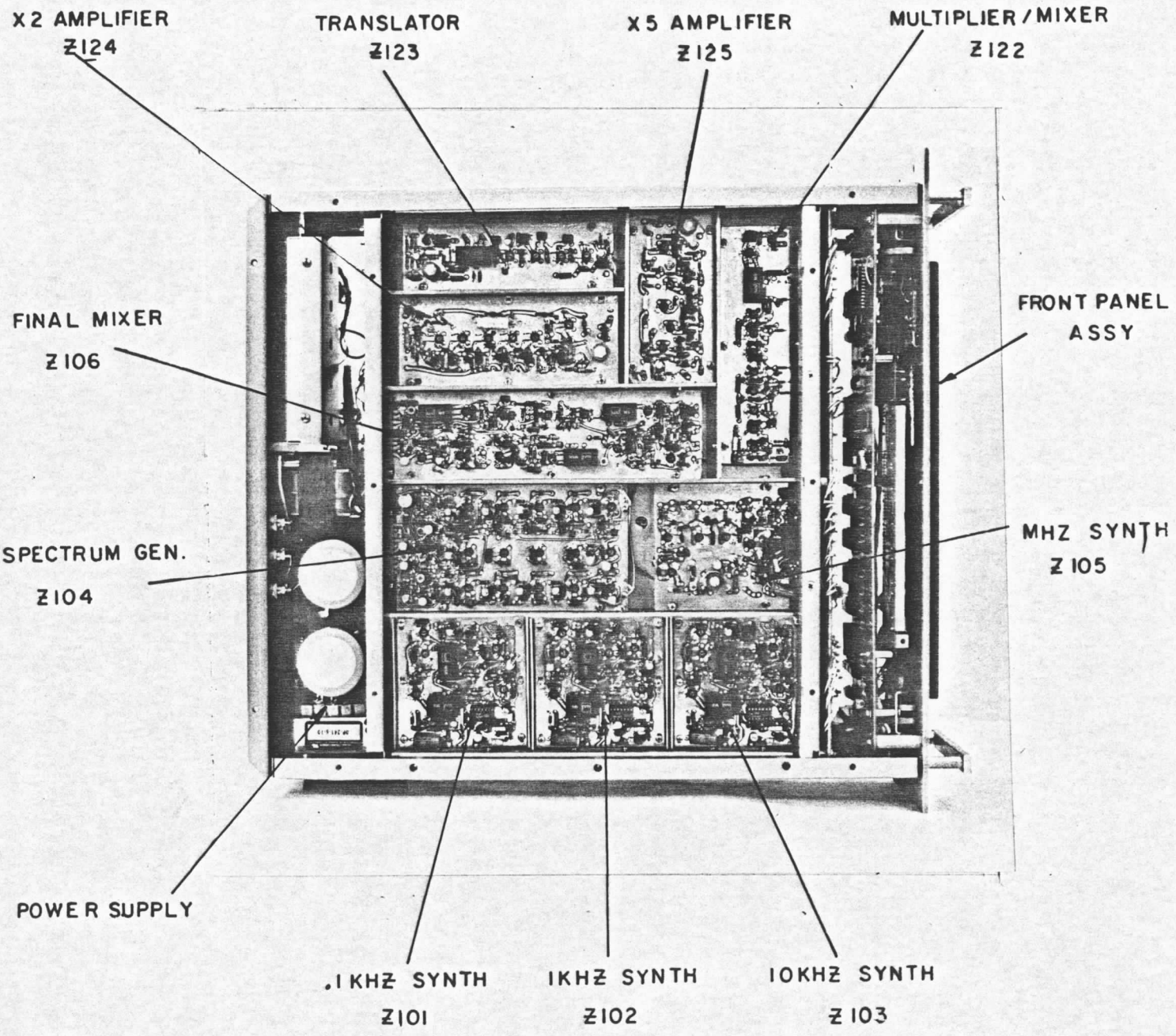
Check all exterior surfaces for correct finish and absence of marks or scratches.

Check that all requested information, including model and serial number of the Exciter, has been entered on the enclosed REGISTRATION CARD and mailed to TMC.



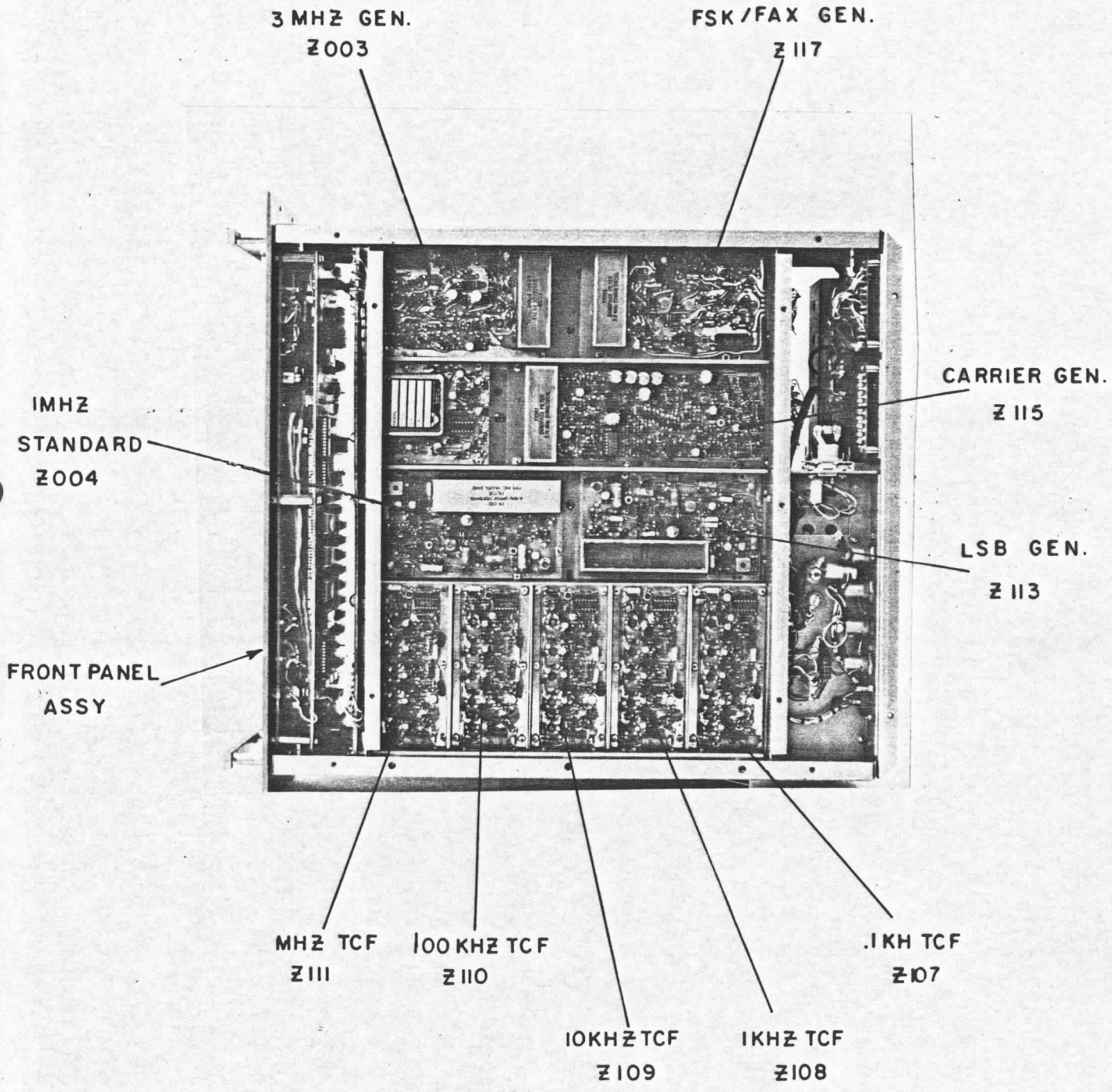
FRONT PANEL CONTROLS

FIG. NO. 2



MMX-4 TOP VIEW

FIG. NO. 3



MMX-4 BOTTOM VIEW

FIG. NO. 4

SECTION 3
OPERATION INSTRUCTIONS

3.1 INITIAL CHECKOUT

Although the Exciter has been aligned and throughly checked against the manufacturer's specifications prior to shipment, it is necessary to insure correct installation and proper Exciter operating conditions by performing the following checkout procedures. Refer to SECTION 3.2 for location and functions of all operating controls and indicators. If an obvious malfunction is detected, refer to SECTION 5 MAINTENANCE INSTRUCTIONS FOR PROPER CORRECTIVE ACTION.

NOTE

Unless otherwise indicated, item numbers (numbers in parentheses) and callouts refer to figure 2.

The following test equipment is required for the initial checkout of the Exciter:

Audio Oscillator HEWLETT-PACKARD 200CD OR EQUIV.

A. Set standby/operate switch (9) to standby position.

B. Connect a source of 115 VAC line power to connector J123.

C. Connect a 47 ohm 2 watt noninductive load resistor to the RF output jack J118.

D. Rotate RF output control (1) downward to minimum output.

E. Place the standby operate switch (9) to operate. The ready prompt will appear on the front panel display (13) after a short delay.

F. Select the keypad (10) switch marked TST and cycle each position on the keypad while observing the display (13). The display will indicate that each button is working properly by indicating the position selected on the front panel display. Example: press the MOD keypad button and the characters MOD will be displayed. When all positions of the keypad have tested properly, selection of the enter position will terminate the initial test of the internal microprocessor and place the Exciter in the enter mode.

G. Using the keypad (10) entry switches on the front panel set the output frequency to 29.9999 MHz, then press the ENT key.

H. Using the keypad entry switch marked MOD, toggle through the operating modes until CW operation is indicated on the front panel display (13), then press the ENT key.

I. Place a ground on the rear panel connector P121 pin 22 [EXTERNAL PTT] and pin 21 [KEY] these grounds may alternately be placed on the front panel mike jack (11) P206 pin 2 [PTT] and pin 3 [KEY].

J. Position meter switch (2) to the RF position.

K. Monitor meter (12) shall indicate zero with RF output control (1) at minimum [fully downward].

L. AdJust RF output gain control (1) for a minimum indication of 0.1 watts as indicated on the front panel meter (12).

M. Select 15.0000 MHz as the output frequency and repeat step L.

N. Select 2.0000 MHz as the output frequency and repeat step L.

This concludes the CW portion of the initial checkout procedure.

O. Using the keypad entry switch marked MOD select the ISB position and press ENT.

P. Using the keypad entry switch marked CAR select full carrier suppression [-55Db] and press ENT.

Q. NOT USED

R. Set USB/LSB gain controls(4/3) downward to minimum.

S. Connect HEWLETT-PACKARD Model 200 CD audio generator [or equivalent] to USB 600-ohm terminals [9 and 5 J121] and to LSB 600-ohm terminals [1 and 5 J121] on the rear panel. Set the audio frequency for 1 KHz at 1 volt RMS.

T. Set meter switch (2) to USB (2a) and adjust USB gain control (4) for an indication of 2/5 full scale on the monitor meter (12).

U. Set meter switch (2) to LSB position (2c) and adjust LSB gain control (3) for an indication of 2/5 full scale on the monitor meter (12).

V. Place the meter switch (2) to monitor RF (2c). Adjust the RF gain control (1) for an output of at least .1 watts as indicated on the front panel meter (12).

W. Without changing the RF gain control previously set adjust the USB/LSB gain controls (3/4) to minumum [fully downward] and toggle the CAR position on the keypad (10) to display -6Db of carrier suppression while monitoring the front panel meter (12) for an indication of approximatly .025 watts.

X. This concludes the initial checkout procedure. Disconnect all test equipment and remove power from the Exciter.

Operating Procedures

The following procedure should be followed when placing the exciter in operation.

* * * CAUTION * * *
Verify that the STANDBY/OPERATE switch (9) is in the STANDBY position.
* * * ******* * * *

Connect the source of 115 or 230VAC, 50/60Hz, single-phase power, as appropriate, to the Exciter rear panel connector J123 through the powercord provided.

Make the necessary interface connections from the rear panel connectors to the transmitter, audio/keying units, and optional remote units.

Turn RF OUTPUT control (1) fully downward before selecting different modes of operation.

The following procedure should be followed for single sideband operation with any degree of carrier insertion.

Set the STANDBY/OPERATE switch (9) to the ON position. After approximately 1 second the front panel display will indicate the "ready" prompt and the exciter may be tested or programmed to operate.

Select the desired sideband by toggling the mode switch to indicate on the front panel display the desired sideband.

Set meter switch (2) to monitor the audio input level of the desired sideband.

Connect a mike to the front panel MIKE jack if used.

Adjust the Mike/Line control of the sideband used (3 LSB, 4 USB) to the appropriate level as indicated on the meter (12).

* * * CAUTION * * * *
DO NOT ENTER THE RED REGION ON THE METER. When the mike input is used, adjust the level so as not to exceed red region with the highest input from the microphone.
* * * ******* * * *

Select desired carrier suppression level by depressing the CAR key on the keypad (10) until the desired amount of suppression is indicated.

Set the meter switch (2) to the RF position (2c).

The following procedure should be followed for independent

sideband with any degree of carrier.

Set the STANDBY/OPERATE switch (9) to the ON position.

Set the USB (4) and LSB (3) Mike/Line controls to zero (fully downward).

Select the "ISB" position by toggling the MOD button on the keypad (10).

Set the meter switch (2) for monitoring the LSB audio input level. Adjust the Line/Mike LSB control for a meter (12) indication up to but not exceeding the red region.

Repeat the previous step for the USB input.

Set the meter switch (2) to the rf position(2c) and adjust the RF OUTPUT control for the desired level of RF output as indicated on the meter (12).

The following procedure should be followed for conventional AM operation of the Exciter.

Set the STANDBY/OPERATE switch (9) to the ON position.

USB (6) and LSB (5) source switches are set to the line position when using either the USB or LSB 600-ohm input so that the mike indicator is off. When using the MIKE jack input on the front panel place the USB/LSB source switch to the mike position illuminating the indicator. Either USB or LSB line or MIKE audio may be used.

Toggle the MOD button on the keypad (10) to the "AM" position.

Connect a microphone to the MIKE jack if used.

Adjust the Mike/Line control of the sideband used to the appropriate level on the meter (12).

Set the meter switch (2) to the RF position(2c). Vary the RF OUTPUT control for the desired level of RF output as indicated on the meter (12).

The following procedure should be followed for Frequency Shift teletype operation.

Connect the external dry contact keyer to terminals (16) and (18) on J121. If a teletype unit is used, connect to FSK terminals (24) and (25).

Set the STANDBY/OPERATE switch (9) to ON.

Toggle the MOD button to indicate on the display "FSK" operation.

Select the appropriate FSK operation by setting the FS LOOP and

SHIFT switches to the appropriate positions.

Place the SHIFT SENSE switch to the desired sense, + or -.

Set the meter switch (2) to the RF position(2c). Adjust the RF OUTPUT control for the desired RF output level as indicated on the meter (12).

The following procedure should be followed for facsimile operation.

Connect the FAX machine to J121 pins (23) and (7) on the rear panel.

Set the STANDBY/OPERATE switch (9) to ON.

Advance the MOD button to indicate "FAX" operation.

Set the meter switch (2) to RF and adjust the RF OUTPUT control for the desired level as indicated on the meter (12).

The following procedure should be used for CW telegraph operation.

Set the STANDBY/OPERATE switch (9) to ON.

Advance the "MOD" switch to the CW position.

Connect the key to the input jack (11) on the front panel or to the key input terminals (21) and (6) on TB104 at the rear panel.

INDEX	CONTROL	FUNCTION
F101	+5 VOLTS	Controls continuity for +5 volts for Exciter
F102	+12V, +24V, +28V	Controls continuity for +12 VDC, +24 VDC and +28 VDC
F103	LINE FUSE	Controls continuity of power for Exciter 1.0 Amp rating for 115 VAC 0.5 Amp rating for 230 VAC
F104	LINE FUSE	Same as F103
J105	ALDC	Controls internal ALDC voltages
J112	EXT. STD. INPUT	Provides for input of an external 1 MHz standard
J114	INT. STD. OUTPUT	Provides for output of the 1 MHz std
J118	RF OUTPUT	Provides the Exciter RF output signal
J119	RF MONITOR	Provides the output monitor signal
J121	AUDIO AND CONTROL	
J122	REMOTE	
J123	AC LINE INPUT	

INDEX	CONTROL/INDICATOR	FUNCTION
1	RF OUTPUT	Adjusts RF output power level
2	METER SWITCH	Selects internal circuits to be monitored on the front panel meter
2a	USB	Controls monitoring of the USB audio input
2b	LSB	Controls monitoring of the LSB audio input
2c	RF	Controls monitoring of the RF output level
3	LSB GAIN	Adjusts level of LSB audio input
4	USB GAIN	Adjusts level of USB audio input
5	LSB SOURCE	Selects line or microphone input to the LSB circuits
6	USB SOURCE	Selects line or microphone input to the USB circuits
7	USB MIKE IND	When lit indicates USB audio source switch in microphone position
8	USB MIKE IND	When lit indicates LSB audio source switch in microphone position
9	OPERATE/STBY	Two position toggle switch for selecting operating conditions
10	KEYPAD	Allows digital entry of desired output frequency and desired operating modes
11	MIKE/KEY JACK	Input jack for a 47K-ohm microphone and a dry contact CW keyer
12	MONITOR METER	Monitors circuit function as selected by the meter switch 2a-2c
13	DISPLAY	Indicates the current operating parameters of the Exciter

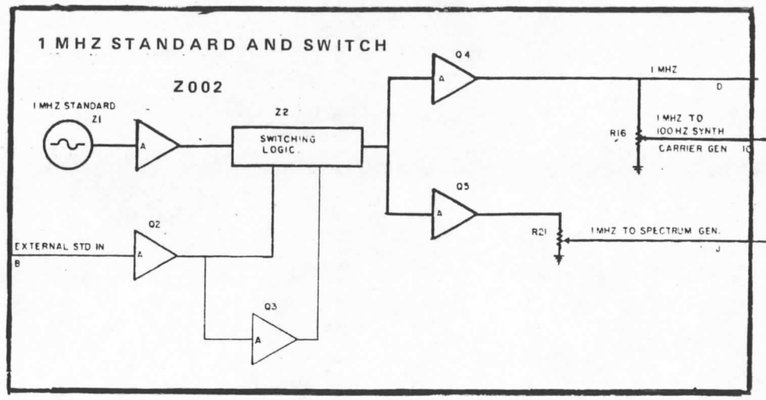
SECTION 4
PRINCIPLES OF OPERATION

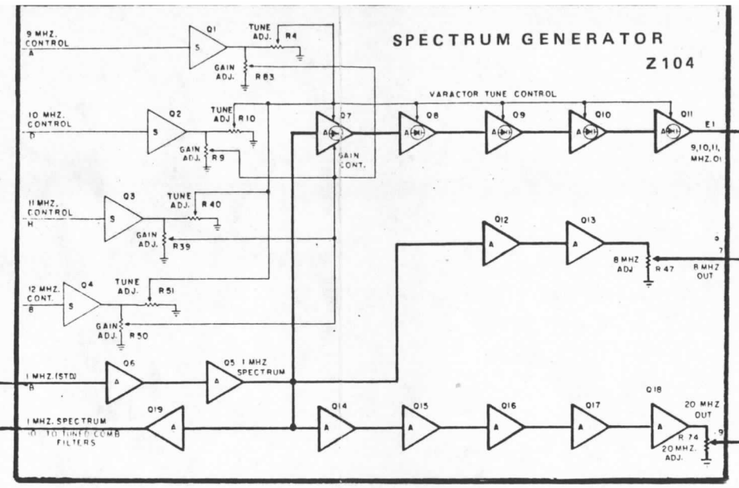
FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

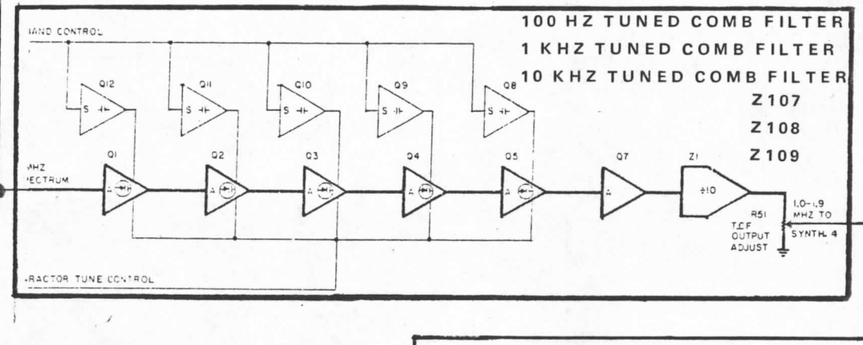
The MMX-4 is an RF Exciter capable of providing amplitude mmodulated A3/(AM) operation ; amplitude modulated equivalent A3H/(AME) operation; single sideband suppressed carrier A3A, A3J/ (USB, LSB) ; independent sideband A3B/(ISB) operation; continuous wave A1/ (CW) operation; frequency shift keyer F1/ (FSK) operation and facsimile F4/ (FAX) operation. Both FSK and FAX are optional. The RF output appears in the 2.0-29.9999 MHz range (operation as low as 400 KHz may be obtained with reduced output), and is selectable in discrete 100 Hz increments by means of a keypad input on the front panel assembly. The Exciter contains a spectrum generator; 5 tuned comb filters; 5 cascaded frequency counters (synthesizers);a final mixer (synthesizer); a X 2 multiplier; a X 5 multiplier; 2 sideband generators; a carrier generator and AM amplifier; a frequency shift generator; a converter (3 MHz generator); a multiplier mixer; an RF translator; an RF output amplifier; a front panel assembly consisting of a control microprocessor,keypad assembly, and microphone preamplifier; a power supply assembly and a 1 MHz standard and switch assembly. The following paragraphs provide brief descriptions of each of these sections.

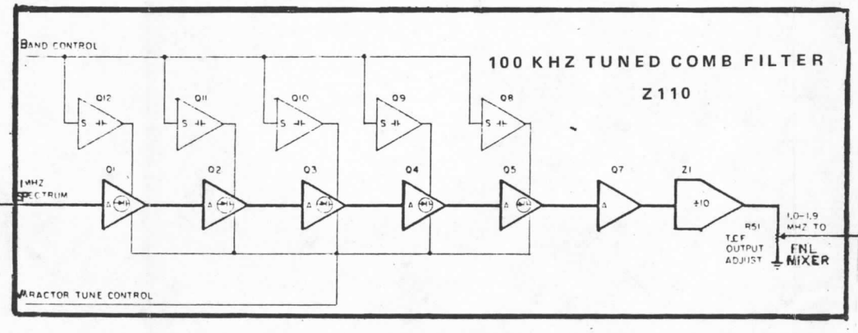
To produce RF output frequencies in the range of 2 MHz to 29.9999 MHz (to 400 KHz at reduced output power) the Exciter generates many RF frequencies, all of them derived from the 1 MHz reference signal. For the purpose of this discussion the generation of output carrier and sidebands is divided into 6 sections:

1. reference standard and spectrum generation
2. generation of the .1,1,10 KHz integers
3. generation of the 100 KHz integer
4. generation of the 1 and 10 MHz integers
5. generation, keying and modulating of the subcarrier
6. translation and amplification of the RF output signal



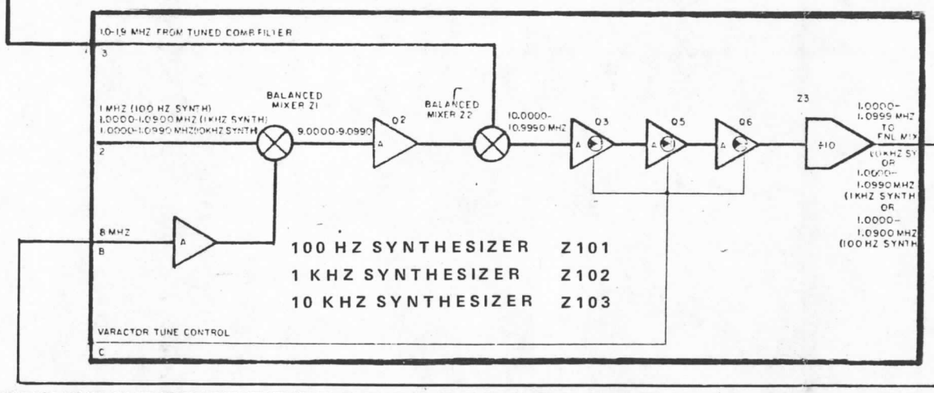


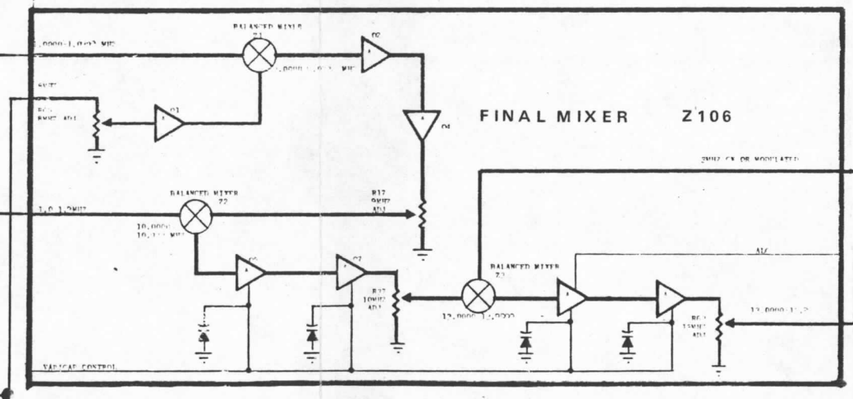


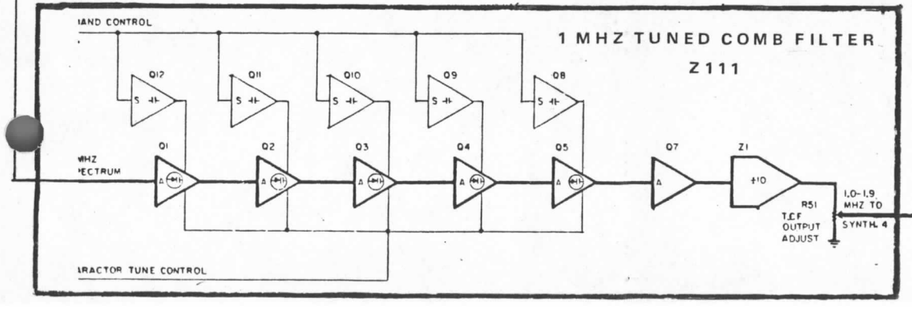


100 KHZ DIGIT

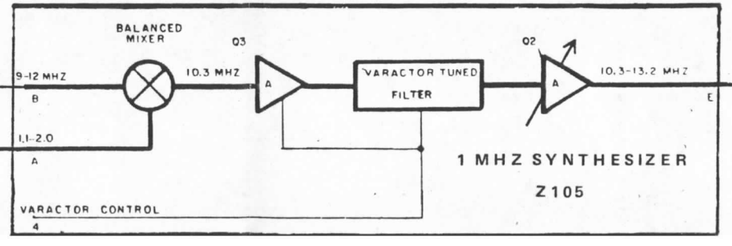
.1,1,10 KHZ DIGITS

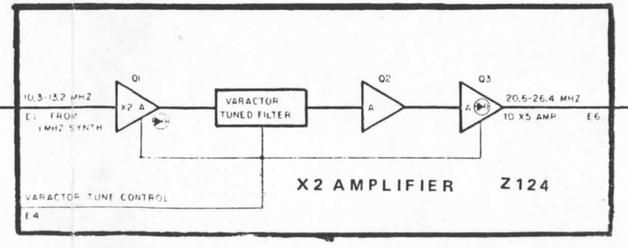


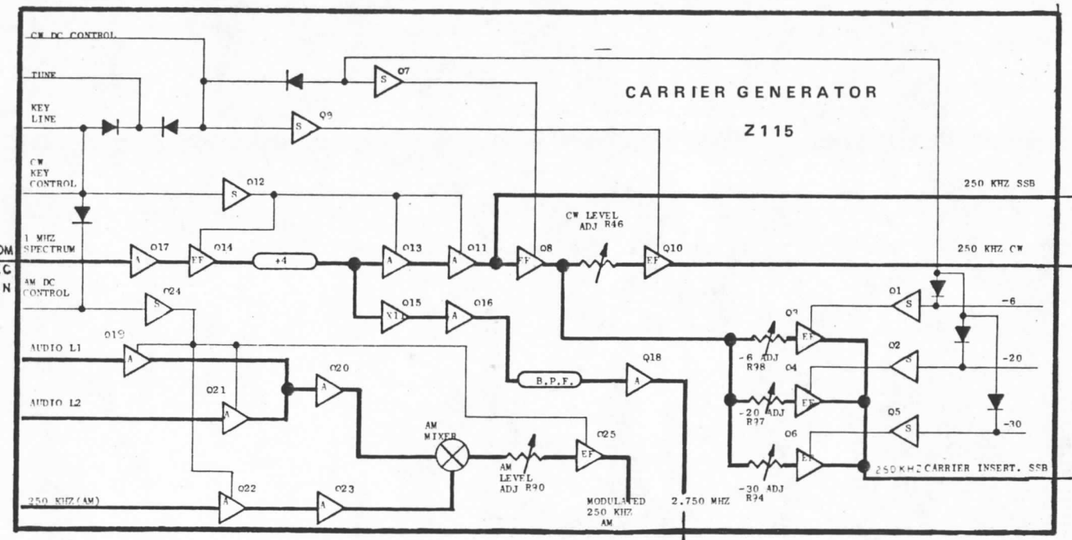




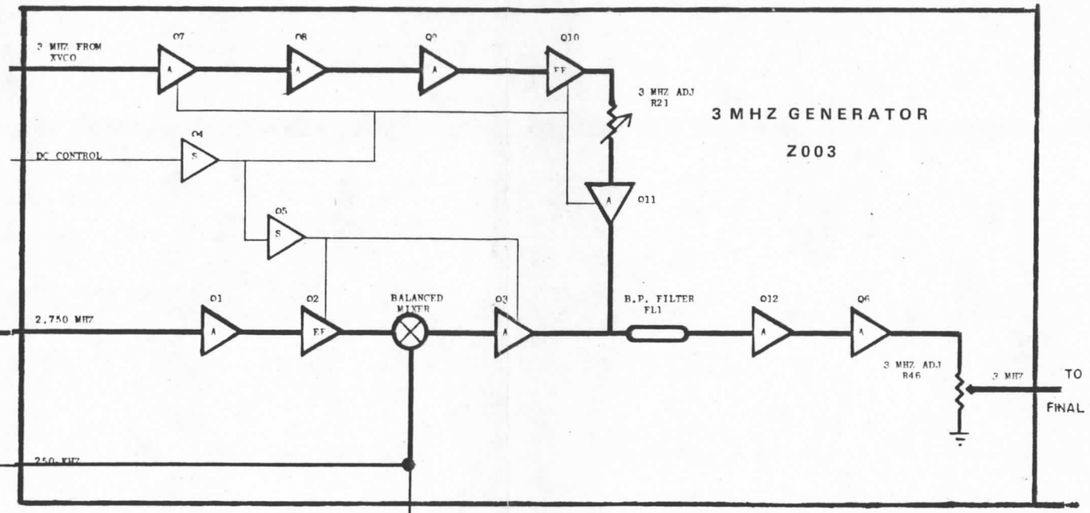
1,10 MHZ DIGITS

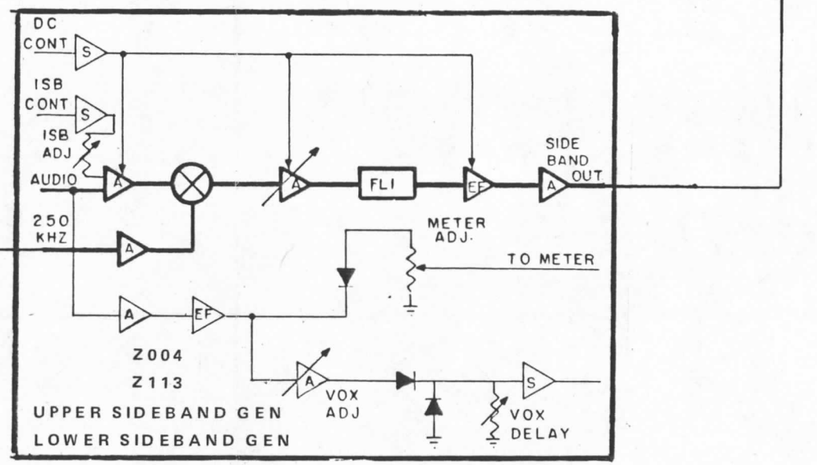


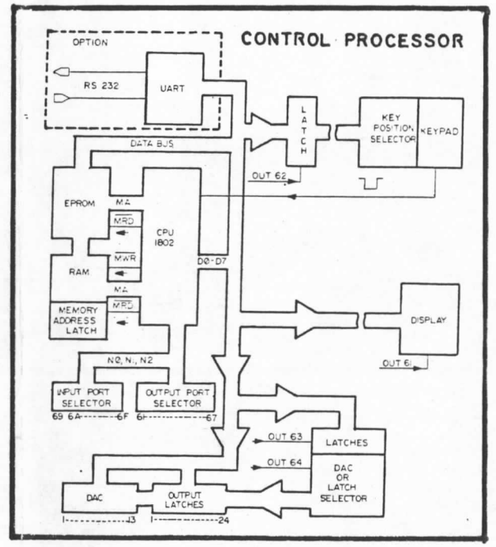




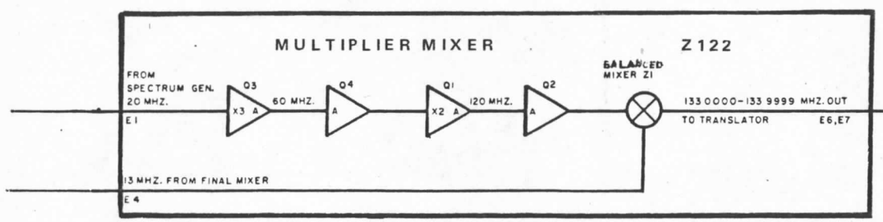
FROM SPEC GEN

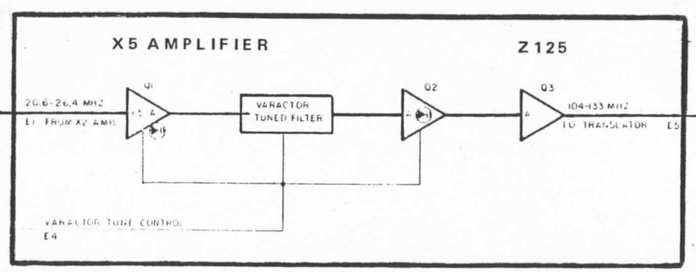


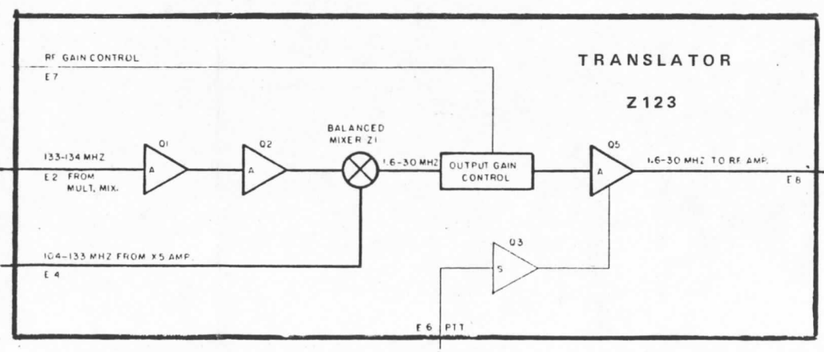


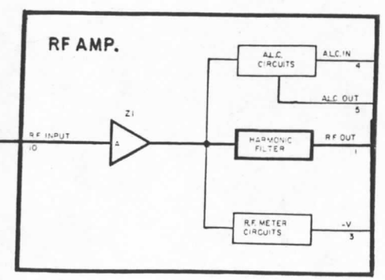


FROM SHEET 1









NOTE:

1. A SELECTED FREQUENCY OF 21.7146 IS SHOWN TO ILLUSTRATE THE SYNTHESIS PROCESS

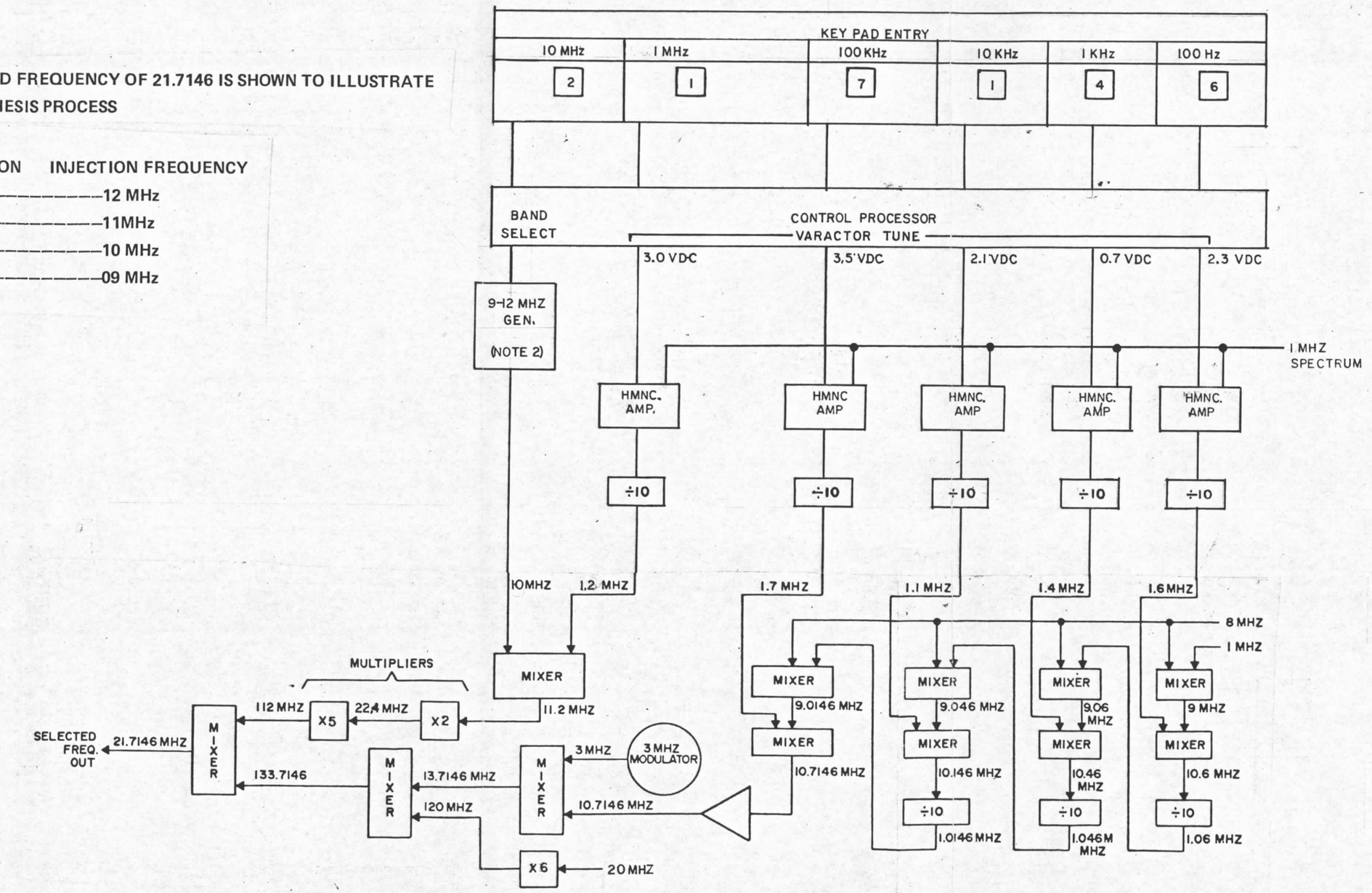
2. MHz POSITION INJECTION FREQUENCY

   00–02 MHz————————12 MHz

   03–12 MHz————————11MHz

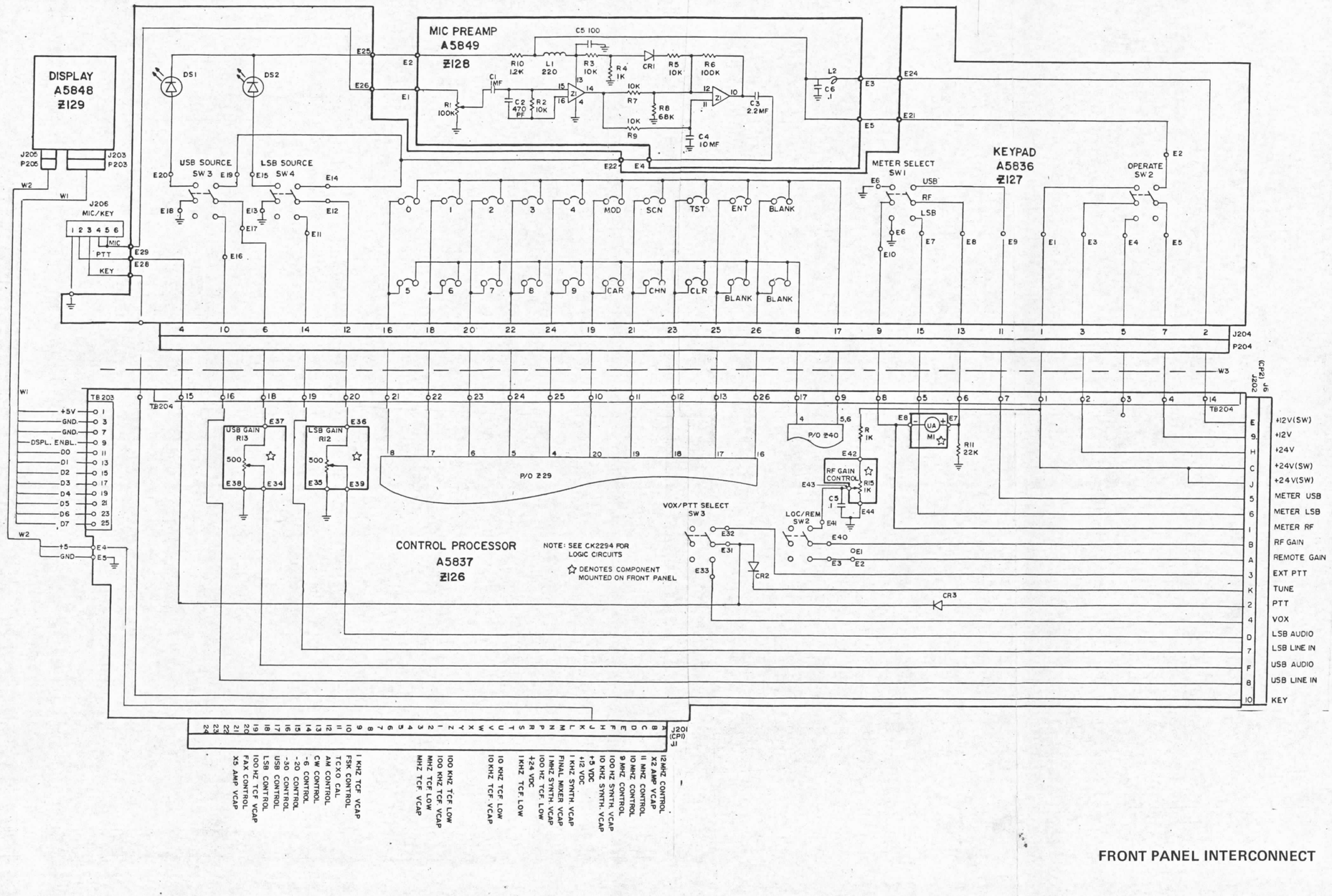
   13–22 MHz————————10 MHz

   23–30 MHz————————09 MHz

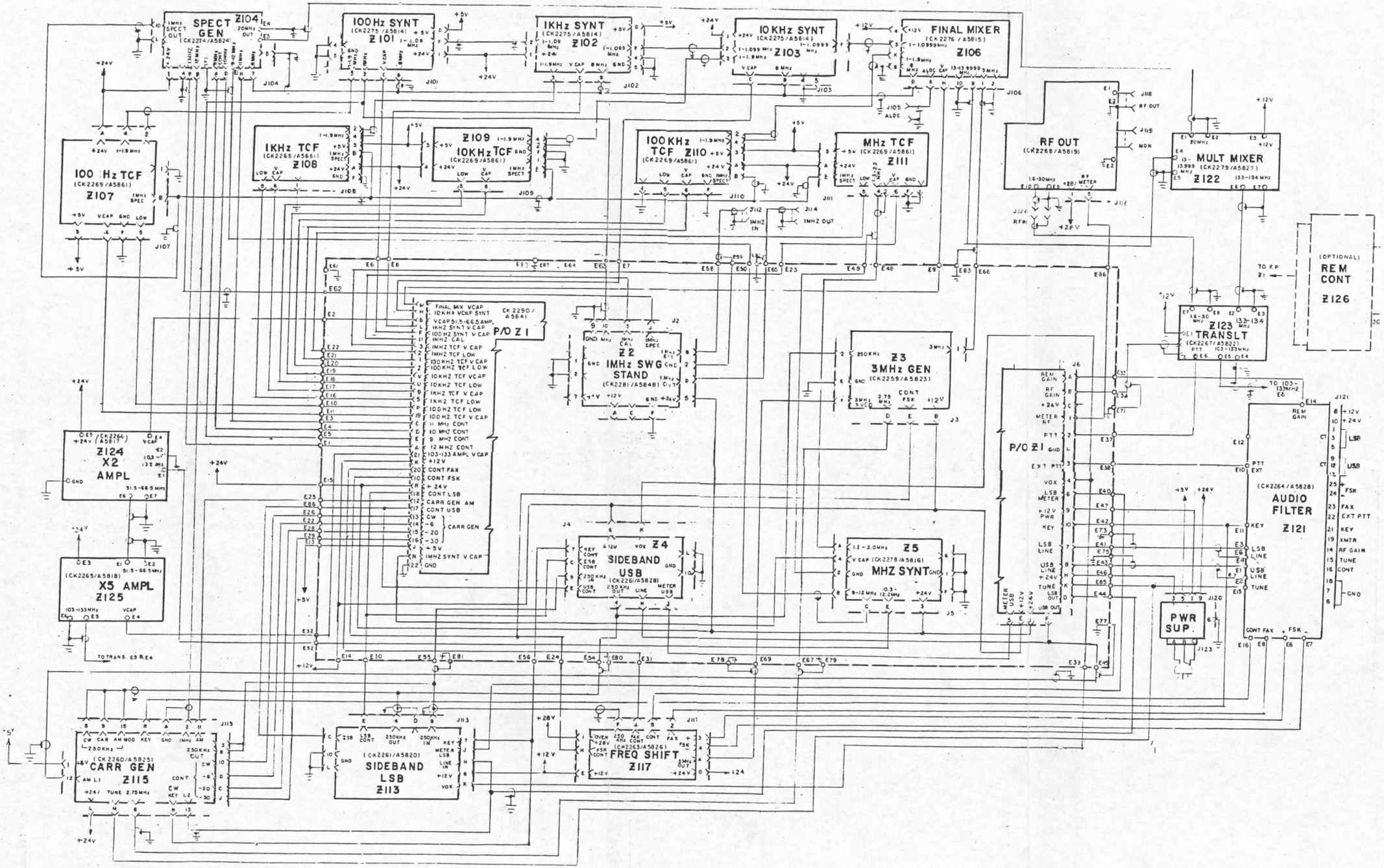


FIGURE

FREQUENCY SYNTHESIS EXAMPLE



FRONT PANEL INTERCONNECT



OVERALL INTERCONNECT DIAGRAM

4.2 MHz STANDARD AND SWITCH

GENERAL DESCRIPTION

The 1 MHz standard and switch assembly Z002: generates an internal 1 MHz reference frequency, monitors for an external reference frequency and, if available, automatically selects the external standard reference frequency, amplifies and buffers the 1 MHz standard reference frequency. The assembly contains a 1 MHz temperature compensated crystal controlled oscillator that offers a 4 parts in 10 to the 7th per day basic accuracy . The switching portion of the assembly is automatically controlled by the action of a quadruple 2-input positive-nand gate.

DETAILED DESCRIPTION

With the 1 MHz standard output from the TCXO coupled to the base of transistor switch Q1, CR1 maintains a positive voltage of 0.7VRMS and maintains a constant input level to the base of Q1. The collector output of Q1 is then applied to Z2 which is preprogrammed to look for a 1 MHz external reference signal at pin B. If an external reference signal is applied to pin B at a sufficient level to turn on Q2 (0.7VRMS), the external standard signal will be applied to the external detect circuits of transistor Q3. A voltage is developed across CR3 sufficient to turn on external detect transistor Q3 which places a ground on pins 2 and 13 of Z1. This will force selection of the external reference frequency instead of the internally generated reference frequency. The output at pin 6 of Z2 is then coupled to 2 tuned collector transistor amplifiers Q4 and Q5. The tuned collector output of Q5 is developed across the secondary of T1 and level adjust R16 and then applied to the carrier generator assembly Z115 and the 100 Hz synthesizer Z107. An additional 50 ohm output from T1 secondary is applied through PIN D and is available at the 1 MHz output jack J114 where it is available is for external use. The standard reference frequency is also applied to the base of Q5 and then developed across the secondary of T2 and level adjust R21. The output signal at pin J is then applied to the 1 MHz spectrum generator assembly Z104.

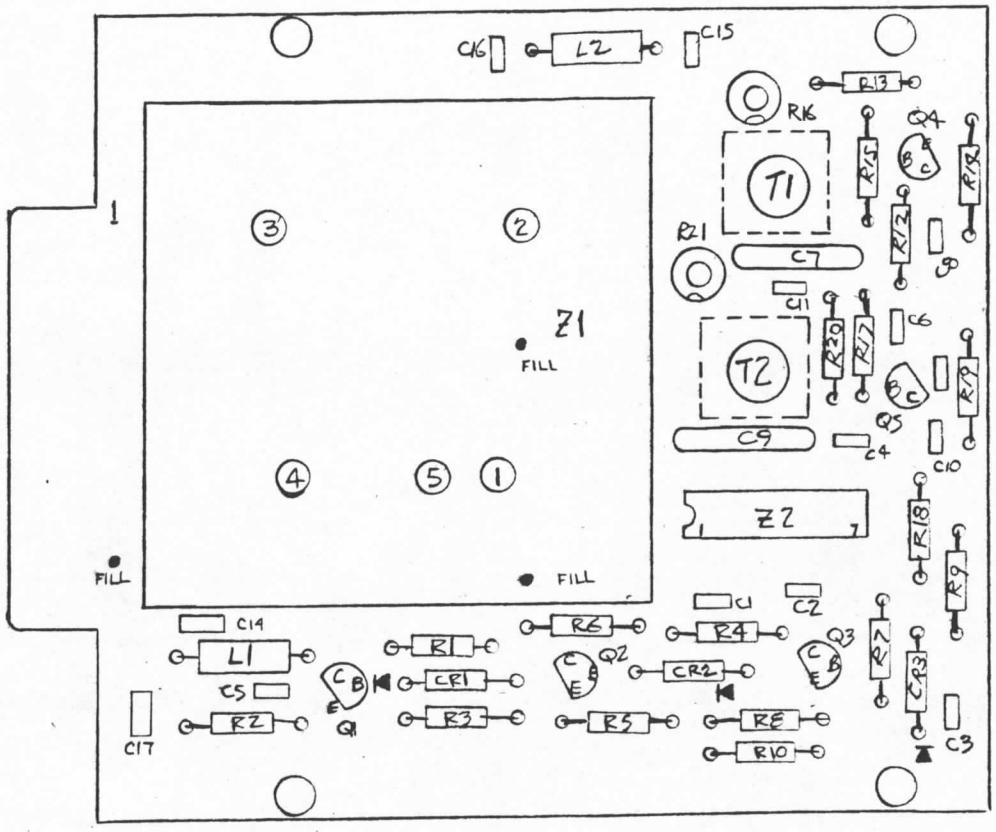
DIMENSIONS:

POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:

TECHNICAL CHARACTERISTICS:


C16
L2
C15
R13
RV1
T1
Q4
R15
R12
R14
C7
C8
C11
C6
R20
R17
T2
Q5
R19
C9
C4
C10
Z2
R18
R9
Z1
FILL
FILL
FILL
C14
L1
C5
C17
R2
Q1
R1
CR1
R3
R6
Q2
R5
R4
CR2
R8
Q3
R7
CR3
C3
C1
C2

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER _____

DATE COMPILED _____

Part Number	Description	Used On	Qty	Symbol Number	S1200
AO130	1MHz Standard	A5842	1	Z1	
CC131-32	Cap., Fixed, Cer., .01UF	A5842	5	C1, 2, 4, 6, 10	
CC131-39	Cap., Fixed, Cer., 1UF	A5842	7	C3, 5, 11, 14, 15, 16, 17	
CE122	Cap., Tant., Fixed	A5842	1	C20	
CL275-221	Coil, R.F., Fixed	A5842	2	C1, 2	
CM111E272JSS	Cap., Fixed, Mica	A5842	2	C7, 9	
NW*SN7400		A5842	1	Z2	
RC07GF102J	Resistor, Comp., Fixed	A5842	6	R1, 2, 5, 8, 13, 18	
RC07GF103J	Resistor, Comp., Fixed	A5842	1	R9	
RC07GF181J	Resistor, Comp., Fixed	A5842	2	R14, 19	
RC07GF220J	Resistor, Comp., Fixed	A5842	3	R3, 6, 10	
RC07GF222J	Resistor, Comp., Fixed	A5842	1	R7	
RC07GF331J	Resistor, Comp., Fixed	A5842	2	R15, 20	
RC07GF471J	Resistor, Comp., Fixed	A5842	1	R4	
RC07GF822J	Resistor, Comp., Fixed	A5842	2	R12, 17	
RV124-1-101	Resistor, Variable	A5842	2	R16, 21	
RV124-1-203	Resistor, Variable	A5842	1	R24	
TT285-2	Transformer, Tunable	A5842	2	T1, 2	
1N751	Semiconductor Diode	A5842	1	CR4	
1N914	Semiconductor Diode	A5842	3	CR1, 2, 3	
1N4742	Semi., Dio., Zener	A5842	1	CR5	
2N2368	Semiconductor, Trans.	A5842	5	Q1, 2, 3, 4, 5	

4.3 SPECTRUM GENERATOR

GENERAL DESCRIPTION

The spectrum generator is used to develop 4 different fundamental RF output frequencies which are all derived from a stable 1 MHz standard frequency developed in the 1 MHz standard and switch assembly Z002. These 4 freqencies are the 1 MHz spectrum, 8 MHz, 20 MHz and one of 4 discrete frequencies (either 9, 10, 11 or 12 MHz) and may be selected depending on the operating frequency desired. The 9-12 MHz generator section consists of 4 high Q varactor tuned amplifier sections. Tuning is further controlled by 4 transistor switches which enable 2 preset potentiometers. One potentiometer is for controlling the input gain of the first amplifier to maintain a smooth frequency response and the other is set for the correct varactor tune voltage for the selected fundamental frequency determined by the front panel assembly.

DETAILED DESCRIPTION

1 MHz applied from the 1 MHZ STANDARD AND SWITCH assembly Z002 is coupled through capacitor C58 to the input of the 1 MHz squarewave generator Q6. This stage essentially reacts as an overdriven amplifier. The output squarewave is coupled through C39 and is amplified by 1 MHz spectrum output amplifier Q5. This output signal consists of the 1 MHz fundamental frequency, plus harmonics, and is applied to each of the reference generator sections on this assembly. The collector output of Q3 is also applied to the 1 MHz spectrum amplifier Q19 (a conventional amplifier) for further amplification and then output through pin 10 to the tuned comb filter assemblies Z107-Z111.

9-12 MHz GENERATOR CIRCUITS

One of 4 discrete frequencies is created for use in the 1 MHz synthesizer Z005. The DC control of the "bandswitching transistors" is the same for all 4 frequencies, therefore only 9 MHz will be used for this discussion. With the MHz position on the front panel assembly in any frequency position except 23-29 MHz, transistor switch Q1, which is normally enabled, places a ground at the input to the adjustable voltage divider at the collector of Q1. This enables use of another voltage divider to set the peak response of the 9-12 MHz generator circuits to the correct reference frequency as determined by front panel control.

HIGH-LOW SWITCH

With the MHz position of the front panel assembly set between 23 MHz and 29 MHz, a control ground from the front panel assembly is placed at the base of transistor switch Q1. With the collector output of Q1 high, a DC voltage is developed across gain potentiometer R83 and varactor tune control potentiometer

R4. R83 level is set so that the 9 MHz output level can be adjusted to the same level as the other three reference frequencies. R4 is set to develop the correct amount of varactor DC tune voltage for the varactor tuned output stages of Q7, Q8, Q9, Q10 and Q11.

20 MHz GENERATOR CIRCUITS

The 20 MHz generator is a sharply tuned filter/amplifier circuit designed to amplify the 20th harmonic of the 1 MHz spectrum input signal and, due to the sharply tuned resonate circuits, filter all other harmonics to provide a harmonic-free reference frequency of 20 MHz. Q14, 15, 16 and 17 are conventional tuned drain FET amplifiers . The filtering action of each tuned output stage is progressive through the circuit. Due to the loose coupling between stages and the sharp tuning of the filtered outputs along with the relatively low level of the 20th harmonic compared to the fundamental, loss must be compensated for through the gain of FET amplifiers Q14, 15, 16 and 17. The tuned drain output of Q17 is loosely coupled to the base of 20 MHz amplifier Q18. The output of Q18 is then developed across the secondary of tuned transformer T15 which further filters the 20 MHz signal and also converts to the proper output impedance. With the output of the secondary of T15 coupled directly to the 20 MHz level adjust potentiometer R74 the 20 MHz operating level may be set. The 20 MHz signal is then coupled through a short jumper to pin 9 to be applied to the multiplier mixer assembly Z122.

8 MHz GENERATOR CIRCUITS

The 8 MHz generator circuit consists of one tuned drain FET amplifier and one conventional transistor amplifier. Selection of the 8th harmonic of the 1 MHz reference frequency is the same as explained in the 20 MHz generator section of the spectrum generator. Due to the relatively higher level of the 8th harmonic and a lower output level requirement, only one FET amplifier is required to achieve a satisfactory output level. With the tuned collector output of Q13 coupled to the 8 MHz level set control, as in the 20 MHz generator circuits, the output level of 8 MHz is set and coupled to pin 7 and applied to synthesizers and final mixer assemblies.

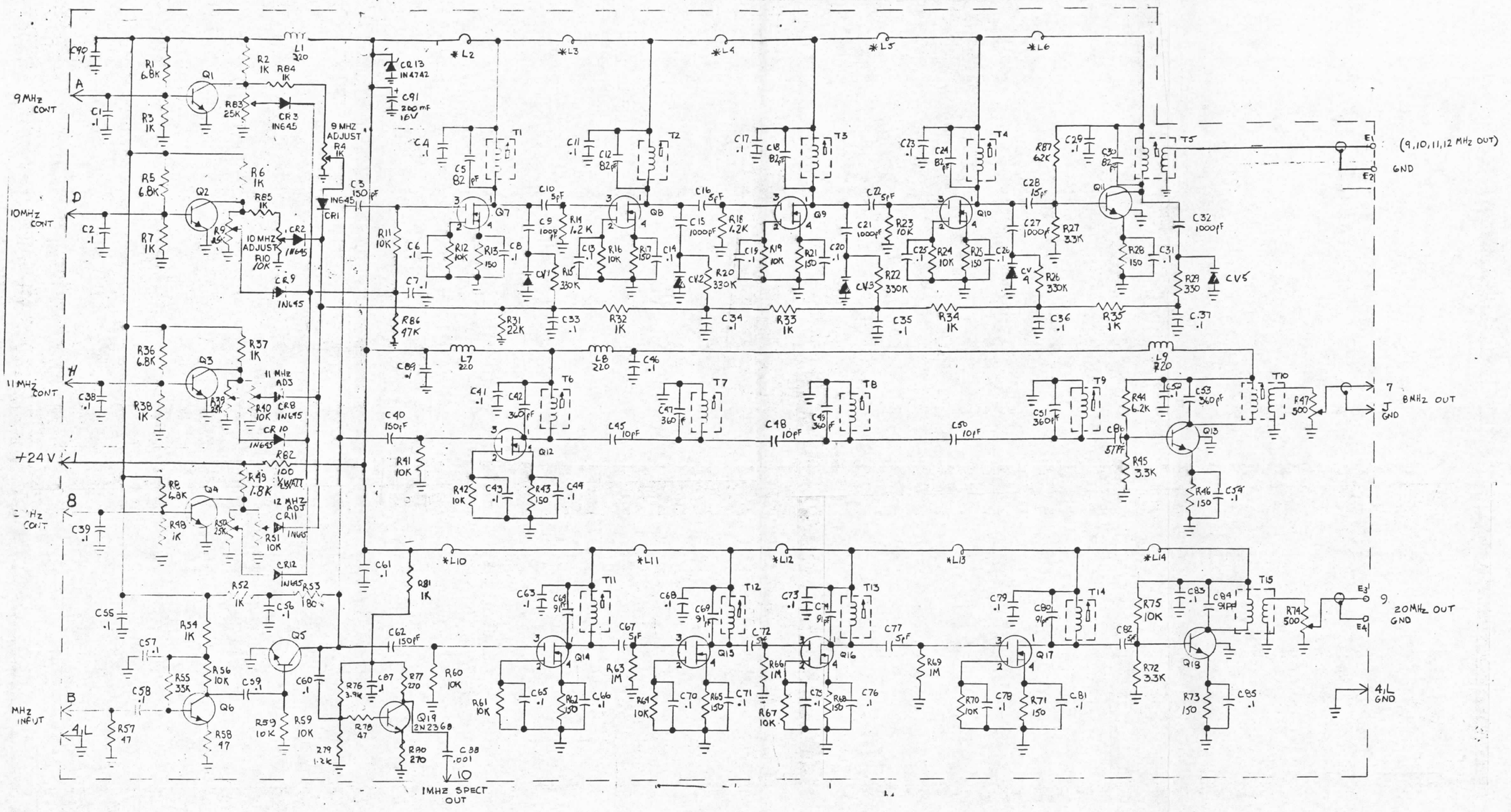
TECHNICAL CHARACTERISTICS:

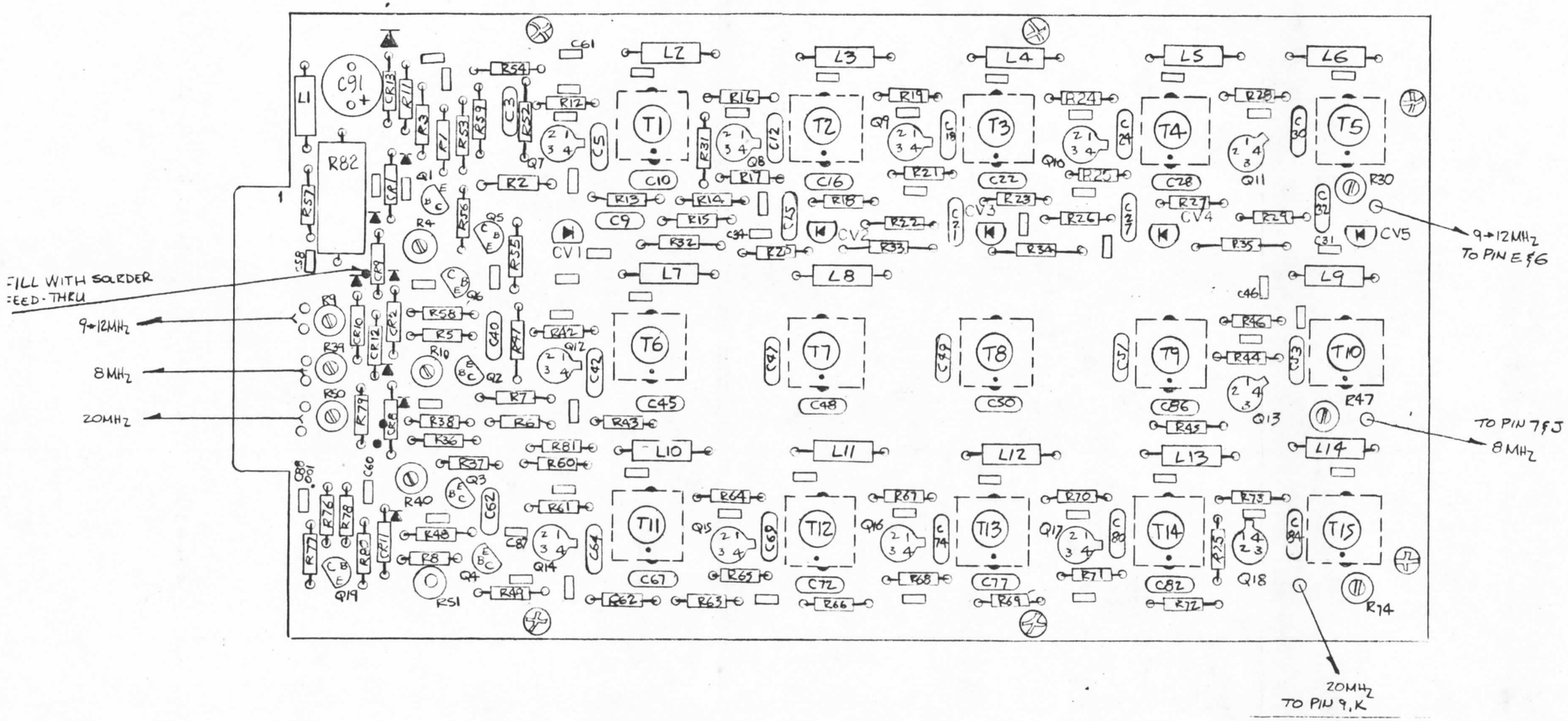
DIMENSIONS:

POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:


9MHz CONT
10MHz CONT
11MHz CONT
+24 V
8 MHz CONT
MHz INPUT
9 MHZ ADJUST
10 MHZ ADJUST
11 MHz ADJ
12 MHZ ADJ
CR13 IN4742
C91 200 mf 16V
IN645
IN695
L1 220
*L2
*L3
*L4
*L5
*L6
T1
T2
T3
T4
T5
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19 2N2368
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
L7 220
L8 220
L9 220
*L10
*L11
*L12
*L13
*L14
(9,10,11,12 MHz OUT)
GND
8MHz OUT
20MHz OUT
4.1L GND
10 1MHZ SPECT OUT
Z104 SPECTRUM GENERATOR A5824


FILL WITH SOLDER FEED-THRU
9→12MHz
8MHz
20MHz
9→12MHz TO PIN E,G
TO PIN 7,J 8MHz
20MHz TO PIN 9,K

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER A5824

DATE COMPILED 7/11/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-9	Cap., Fixed, Cer. 5.6PF	A5824	8	C10, 16, 22, 28, 67, 72, 77, 82	
CC131-12	Cap., Fixed, Cer. 10PF	A5824	3	C45, 48, 50	
CC131-16	Cap., Fixed, Cer. 51PF	A5824	1	C86	
CC131-24	Cap., Fixed, Cer. 1000PF	A5824	6	C9, 15, 21, 27, 32, 88	
CC131-19	Cap., Fixed, Cer. 150PF	A5824	3	C3, 40, 62	
CC131-21	Cap., Fixed, Cer. 330PF	A5824	5	C42, 47, 49, 51, 53	
CC131-39	Cap., Fixed, Cer. .1uf	A5824	54	C1, 2, 4, 6, 7, 8, 11, 13, 14, 17, 19, 20, 23, 25, 26, 29, 31, 33, 34, 35, 36, 37, 38, 39, 41, 43, 44, 46, 52, 54, 55, 56, 57, 58, 59, 60, 61, 63, 65, 66, 68, 70, 71, 73, 75, 76, 78, 79, 81, 83, 85, 87, 89, 90	
CE135-7	Cap., Elect. 225uf 16V	A5824	1	C91	
CI120	Ferrite Beads	A5824	13	L2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	
CL275-221	Coil, RF Fixed 220uH	A5824	1	L1	
CM111E820JSS	Cap., Fixed Mica 82PF	A5824	5	C5, 12, 18, 24, 30	
CM111E910JSS	Cap., Fixed Mica 91PF	A5824	5	C64, 69, 74, 80, 84	
MV2115	Diode Varactor	A5824	5	CV1, 2, 3, 4, 5	
RC07GF102J	Res., Comp., Fixed	A5824	16	R2, 3, 6, 7, 32, 33, 34, 35, 37, 38, 48, 52, 54, 81, 84, 85	
RC07GF103J	Res., Comp., Fixed	A5824	16	R11, 12, 16, 19, 24, 41, 42, 56, 59, 60, 61, 64, 67, 70, 75, 23	
RC07GF105J	Res., Comp., Fixed	A5824	3	R63, 66, 69	
RC07GF122J	Res., Comp.	A5824	2	R79, 14	
RC07GF151J	Res., Comp., Fixed	A5824	12	R13, 17, 21, 25, 28, 43, 46, 62, 65, 68, 71, 73	
RC07GF182J	Res., Comp.	A5824	1	R49	
RC07GF184J	Res., Comp., Fixed	A5824	1	R53	
RC07GF223J	Res., Comp., Fixed	A5824	1	R31	
RC07GF271J	Res., Comp.	A5824	2	R77, 80	
RC07GF332J	Res., Comp., Fixed	A5824	3	R27, 45, 72	
RC07GF333J	Res., Comp., Fixed	A5824	1	R55	
RC07GF334J	Res., Comp., Fixed	A5824	5	R15, 20, 22, 26, 29	
RC07GF392J	Res., Comp.	A5824	1	R76	
RC07GF470J	Res., Comp., Fixed	A5824	3	R57, 58, 78	
RC07GF473J	Res., Comp., Fixed	A5824	1	R86	
RC07GF622J	Res., Comp., Fixed	A5824	2	R44, 87	
RC07GF682J	Res., Comp., Fixed	A5824	4	R1, 5, 8, 36	

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER A5824

DATE COMPILED 7/11/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
RC32GF101J	Res., Comp.	A5824	1	R82	
RV124-101	Res., Variable Comp.	A5824	3	R30, 47, 74	
RV124-103	Res., Variable Comp.	A5824	3	R4, 10, 40, 51	
RV124-253	Res., Variable Comp.	A5824	4	R9, 39, 50	
TT285-5	Transformer, Tunable 11 Turns No Sec.	A5824	8	T1, 2, 3, 4, 6, 7, 8, 9	
TT285-5	Transformer, Tunable 11 Turns with Sec.	A5824	2	T5, 10	
TT285-10	Transformer, Tunable 8 Turns with sec.	A5824	1	T15	
TT285-10	Transformer, Tunable 8 Turns No sec.	A5824	4	T11, 12, 13, 14	
1N645	Semiconductor Diode	A5824	7	CR1, 2, 9, 8, 10, 11, 12	
1N4742	Diode, Zener	A5824	1	CR13	
2N2368	Semicond., Trans.	A5824	1	CR19	
2N3646	Semicond., Trans.	A5824	6	Q1, 2, 3, 4, 5, 6	
2N5179	Semicond. Trans.	A5824	3	Q11, 13, 18	
40822	Semicond. Field Effect	A5824	9	Q7, 8, 9, 10, 12, 14, 15, 16, 17	

4.4 .1, 1, 10, 100, MHZ TUNED COMB FILTERS

GENERAL DESCRIPTION

To create a 1.0-1.9 MHz step frequency in discrete 100 KHz steps the tuned comb filters must first select the 10th-19th harmonic of the 1 MHz spectrum and then divide by a factor of 10 to yield the output frequency range of 1.0-1.9 MHz (1.1-2.0MHz in the MHz tuned comb filter). Operation of the tuned comb filters is essentially the same except that the selectable output range of 1.1-2.0 MHz is used instead of the 1.0-1.9 MHz generated in the MHz tuned comb filters . A five stage amplifier/filter circuit employing high "Q" varactor tuned amplifiers develops the desired step frequency in 100 KHz increments. Frequency agility is provided by a DC varactor tune voltage supplied by the microprocessor in accordance with the operating frequency selected on the front panel keypad.

DETAILED DESCRIPTION

A brief discussion follows on the operation of the various varactor tuned stages used in the Exciter with special attention given to the operating parameters of abrupt junction varactor diodes.

Most silicon diodes exhibit some amount of change in diode junction capacitance as the reverse bias applied to them is varied. A varactor diode simply takes advantage of this principle.

Varactor tuning action occurs across the depletion region and is mainly due to majority carriers in both regions moving away from the junction and producing a depletion region which may be varied by the reverse bias voltage. This affects a change in junction capacitance and therefore a change in total capacitance.

Referring to Figure 4/4-1 Cj represents a varactor diode junction capacitance and Rb represents bulk resistance. The "Q" of the varactor will be determined not only by diode junction capacitance but also by the bulk resistance for a given frequency (Q=X/R).

Varactor diodes are relatively sensitive to changes in their supply voltage and therefore require heavy power supply regulation to assure stability, a preregulated 24 VDC supply voltage is applied to a 12.0 VDC zener diode on each of the RF assemblies in the MMX4 Exciter which contain varactor diode stages.

Referring to figure 4/4-2 which is a typical varactor tuned stage in the MMX-4 Exciter. The collector output signal at Q1 is developed across the parallel resonate circuit consisting of C1 and T1. Depending on the particular function of the circuit the output is loosely coupled to the next stage. Capacitor C3 serves

as a DC blocking capacitor which does not affect the tuning of the parallel resonate circuit due to its low value of capacitive reactance. Resistor R1 serves to isolate the tuned circuit from the other varactor tuned stages controlled by the same tune line.

With the 1 MHz spectrum applied to pin B and coupled to gate 2 of fet amplifier Q1 the tuned drain output of Q1 is developed across tuned transformer T1 and varactor diode CV1 which form a frequency agile parallel resonate circuit that selects the proper harmonic frequency of the 1 MHz spectrum signal as determined by the microprocessor from the desired operating frequency entered on the front panel keypad. With a 0,1 or 2 digit entered on the associated frequency select positions on the front panel keypad a control ground applied at pin 5 is removed by the microprocessor. Switching transistor Q12 is biased on which then provides a low impedance path for C4 to ground. This places C4 in parallel with the resonate circuit of T1, CV1. This allows for a smoother frequency response across the 10-19 MHz frequency range in the filter/amplifier circuits of the tuned comb filter. Four of the five stages are identical with each stage exhibiting approximately the same amount of gain. The last stage consisting of transistor Q5, tuned transformer T5 and varactor diode CV5 is biased to achieve a larger gain figure than the four previous stages. The 10-19 MHz signal at the secondary of T5 is coupled through coupling capacitor C44 to the base of driver transistor Q7 which performs two functions: squares the 10-19 MHz signal and also lowers the impedance of the 10-19 MHz signal. The proper level of forward bias required for squaring of the signal in Q7 is set through level set R40. The emitter output of Q7 is applied directly to divide-by-ten decade Z1 producing the resultant frequency range of 1.0-1.9 MHz (1.1-2.0 MHz for the MHz tuned comb filter) which is then applied to a low pass filter and shaping circuit consisting of RF chokes L7,L8 and capacitors C48-C50. The resultant sinusoidal output is developed across level set R51 and coupled to output pin 4 to be applied to the associated synthesizer.

VARACTOR TUNE VOLTAGES

FREQ MHz	LEVEL PIN 5	TUNING V PIN 6	FREQ MHz	LEVEL PIN 5	TUNING V PIN 6	FREQ DIGIT
10	LOW	0.25+	13	LOW	9.5	0
11	LOW	2.1	12	LOW	3.0	1
12	LOW	8.0	11	LOW	0.7	2
13	HIGH	0.25	20	HIGH	6.7	31
14	HIGH	0.7	19	HIGH	4.8	4
15	HIGH	1.3	18	HIGH	3.4	5
16	HIGH	2.3	17	HIGH	2.1	6
17	HIGH	3.5	16	HIGH	1.4	7
18	HIGH	5.0	15	HIGH	0.7	8
19	HIGH	7.2	14	HIGH	0.25	9

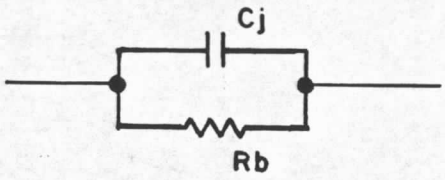


FIG 4/4-1

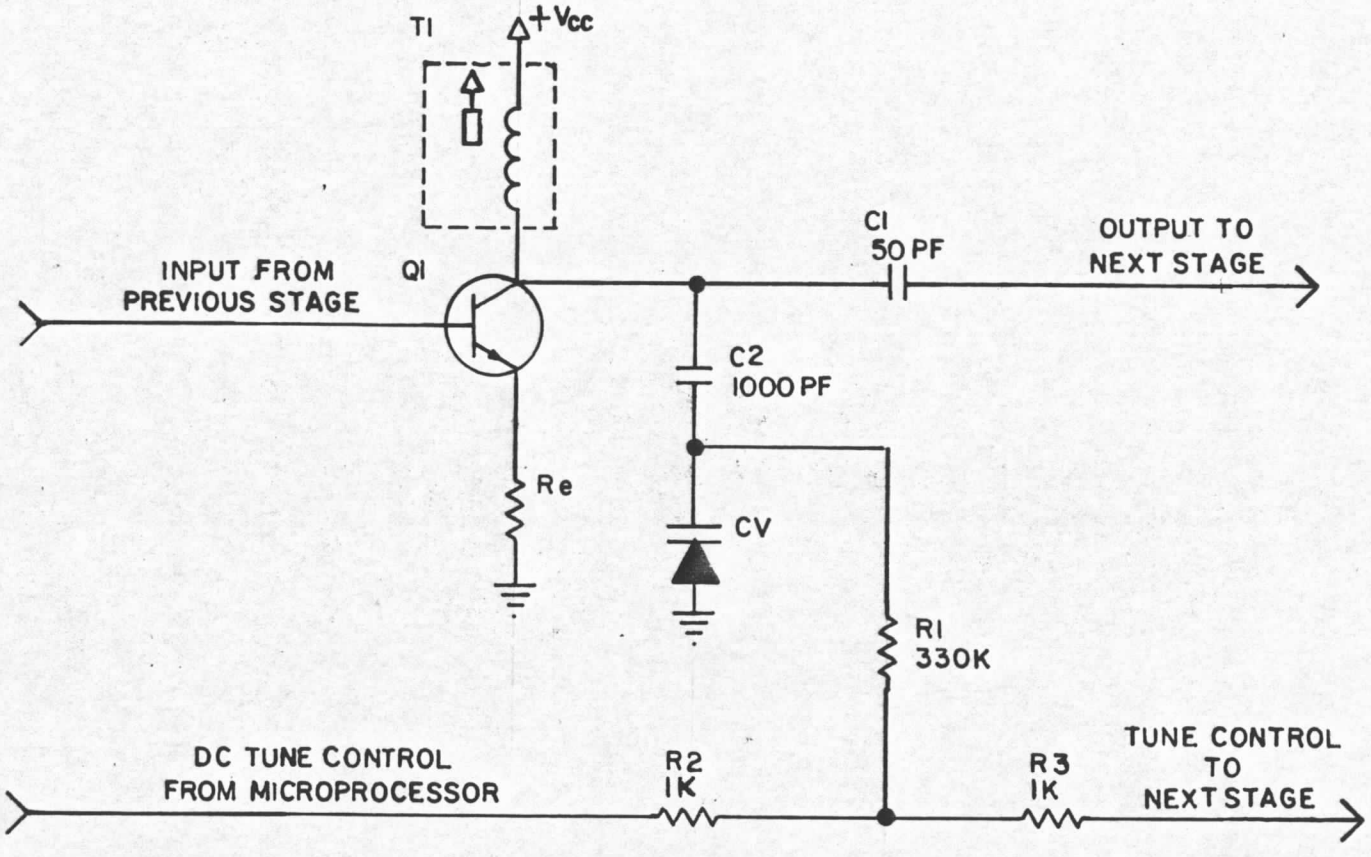


FIG 4/4-2

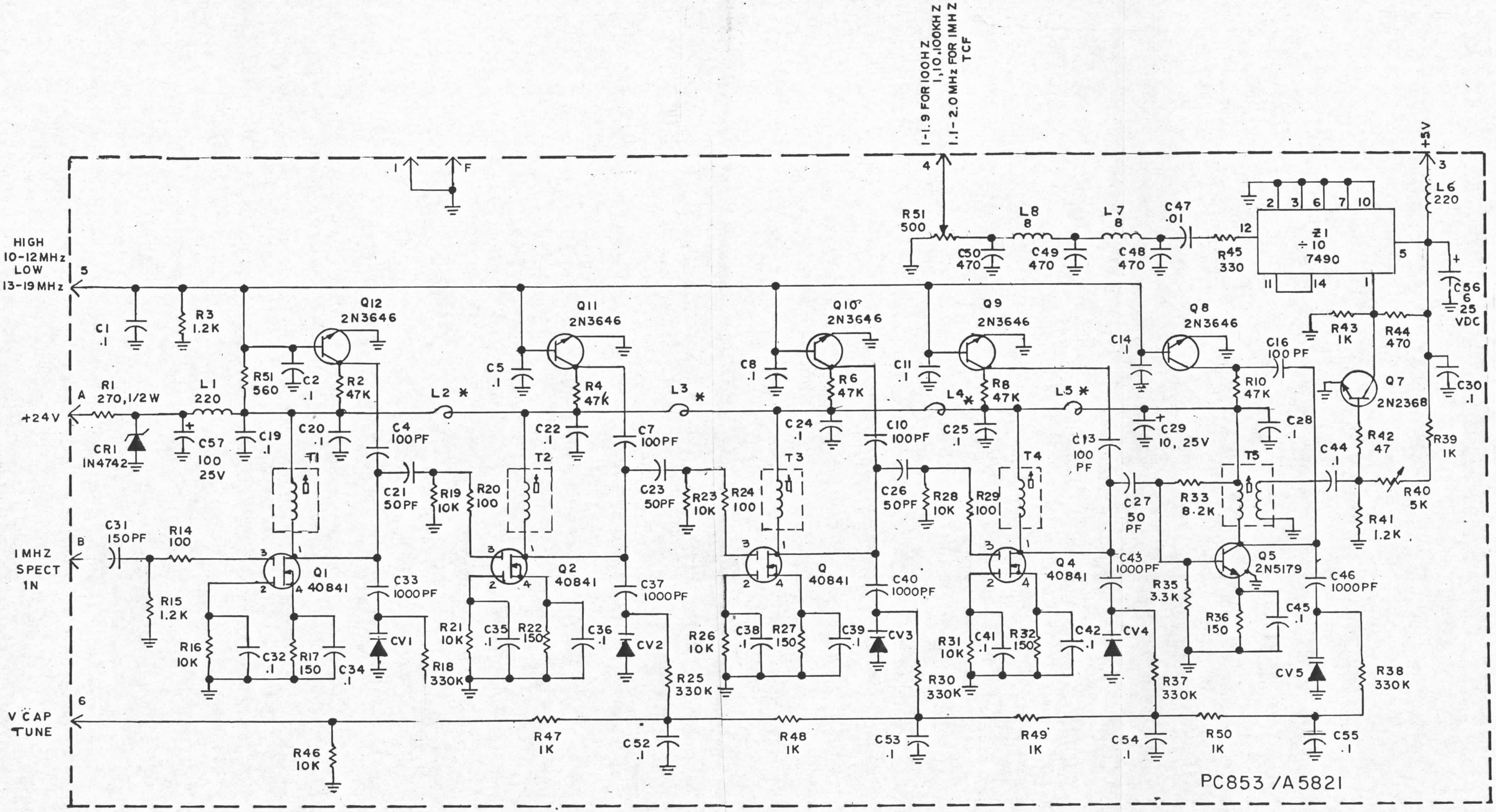
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

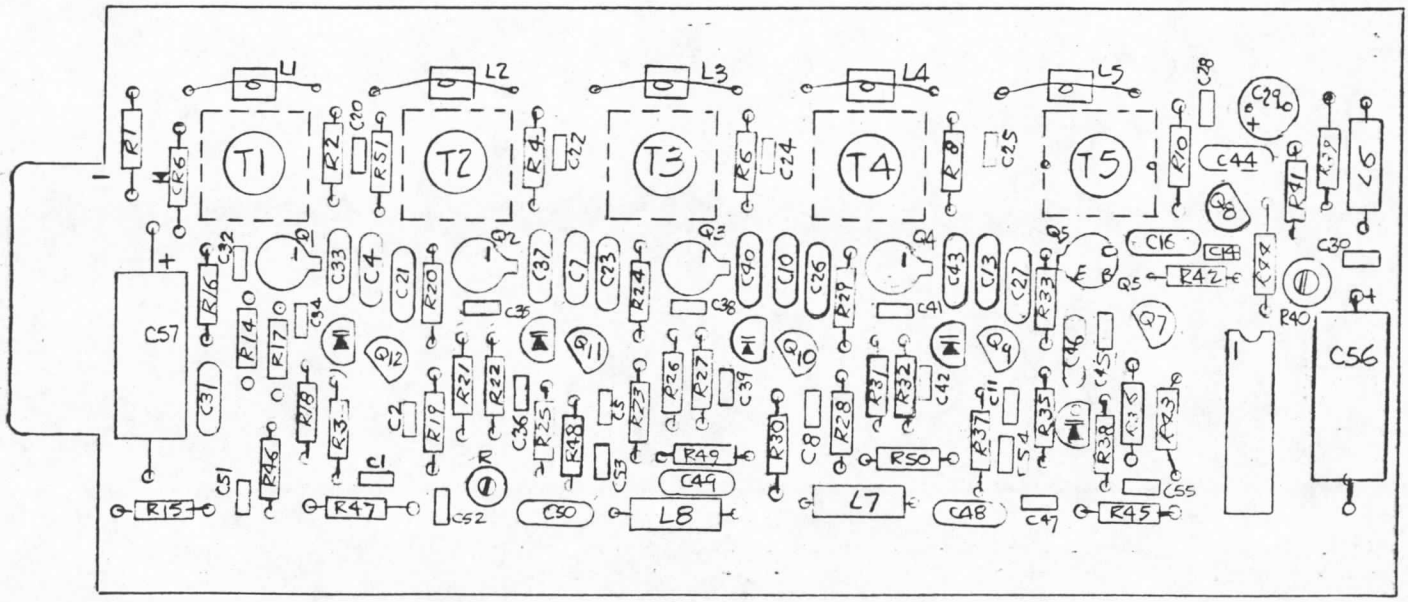
POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:



Z107–Z111 TUNED COMB FILTER A5821



Z107–Z111 TUNED COMB FILTER A5821

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER A5821

DATE COMPILED 8/29/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-32	Cap., Fixed, Cer.	A5821	1	C47	
CC131-39	Cap., Fixed, Cer.	A5821	28	C1, 2, 5, 8, 11, 14, 19, 20, 22, 24, 25, 28, 30, 32, 34, 35, 36, 38, 39, 41, 42, 44, 45, 51, 52, 53, 54, 55	
CE105-6-25	Cap., Fixed, Electro.	A5821	1	C56	
CE105-10-25	Cap., Fixed, Electro.	A5821	1	C29	
CE105-100-25	Cap., Fixed, Electro.	A5821	1	C57	
CI120	Ferrite Bead	A5821	4	L2, 3, 4, 5	
CL275-8RO	Coil, RF	A5821	2	L7, 8	
CL275-221	Coil, RF	A5821	2	L1, 6	
CM111F5RO	Cap., Fixed, Mica.	A5821	3	C23, 26, 27	
CM111F100	Cap., Fixed, Mica.	A5821	1	C21	
CM111F101	Cap., Fixed, Mica.	A5821	5	C4, 7, 10, 13, 16	
CM111F102	Cap., Fixed, Mica.	A5821	5	C33, 37, 40, 43, 46	
CM111F151	Cap., Fixed, Mica.	A5821	1	C31	
CM111F471	Cap., Fixed, Mica.	A5821	3	C48, 49, 50	
MV2113	Diode, Varactor	A5821	5	CV1, 2, 3, 4, 5	
NW*SN7490	Network Divider	A5821	1	Z1	
RC07GF101J	Resistor, Fxd., Comp.	A5821	4	R14, 20, 24, 29	
RC07GF102J	Resistor, Fxd., Comp.	A5821	7	R39, 43, 47, 48, 49, 50, 53	
RC07GF103J	Resistor, Fxd., Comp.	A5821	8	R16, 19, 21, 23, 26, 28, 31, 46	
RC07GF122J	Resistor, Fxd., Comp.	A5821	3	R3, 15, 41	
RC07GF151J	Resistor, Fxd., Comp.	A5821	5	R17, 22, 27, 32, 36	
RC20GF221J	Resistor, Fxd., Comp.	A5821	1	R1	
RC07GF331J	Resistor, Fxd., Comp.	A5821	1	R25	
RC07GF332J	Resistor, Fxd., Comp.	A5821	1	R35	
RC07GF334J	Resistor, Fxd., Comp.	A5821	5	R18, 25, 30, 37, 38	
RC07GF470J	Resistor, Fxd., Comp.	A5821	1	R42	
RC07GF471J	Resistor, Fxd., Comp.	A5821	2	R44, 52	
RC07GF473J	Resistor, Fxd., Comp.	A5821	5	R2, 4, 6, 8, 10	
RC07GF561J	Resistor, Fxd., Comp.	A5821	1	R51	
RC07GF822J	Resistor, Fxd., Comp.	A5821	1	R33	
RV124-50	Resistor, Variable	A5821	1	R54	
RV124-502	Resistor, Variable	A5821	1	R40	
TT285-5	Transformer, RF, Adj.	A5821	5	T1, 2, 3, 4, 5	
1N4742	Diode, Semi.	A5821	1	CR1	
2N2366	Transistor, Semi.	A5821	1	Q7	
2N3646	Transistor, Semi.	A5821	5	Q8, 9, 10, 11, 12	
2N5179	Transistor, Semi.	A5821	1	Q5	
40841	Transistor, Semi.	A5821	4	Q1, 2, 3, 4	

4.5 100 Hz, 1 KHz, 10 KHz SYNTHESIZERS

GENERAL DESCRIPTION

The synthesizers are essentially frequency shift modulators; their purpose is to shift a basic 8 MHz input signal such that a frequency component or step frequency, as input to the front panel keypad, is generated having 3 decimal places, and representing hundreds (100 Hz) through ten-thousands (10 KHz). The circuits accomplish the task of shifting the fundamental 8 MHz through the use of varactor tuned, balanced-modulator and amplifier circuits. Because the circuit configuration and principle of operation is the same for each synthesizer only the 100 Hz synthesizer will be discussed.

DETAILED DESCRIPTION

The 8 MHz output from spectrum generator Z104 is supplied to the inputs of each synthesizer and to the input of the final mixer. In the 100 KHz synthesizer the 8 MHz input is applied to 8 MHz transistor amplifier Q1; the 8 MHz signal developed across the parallel resonate circuit of inductor L9 and capacitor C46 is coupled to a balanced modulator Z1. The balanced modulator also receives the standard 1.0 MHz from the spectrum generator Z104 and produces a sum frequency which is applied to the tuned transformer T1. The 9 MHz signal at the secondary of T1 is coupled to the 9 MHz amplifier Q2. The tuned drain output of Q2 developed across the secondary of T2 and the 1.0-1.9 Mhz from the 100 Hz tuned comb filter assembly are coupled to balanced mixer Z2 where . As a result the 9 MHz signal is modulated as explained previously for 8 MHz, thereby resulting in a 10.0-10.9 MHz signal. The output is tuned by 3 frequency agile varactor tuned tank circuits consisting of transformers T4, T5, T6, and varactor diodes CV1, CV2, CV4. These tank circuits act as peak filters which allow only the sum frequency to pass. The microprocessor supplies a varactor DC tune voltage which when applied to the varactor diodes causes their internal junction capacitance to change, allowing fine tuning of the filter tanks(see the tuned comb filter detailed explanation for a further discussion on varactor tuning). The 10.0-10.9 MHz signal at the secondary of T6 is applied to Q6 the clipper driver stage and the output signal from Q6 is applied to dual mixer divider Z3 where division of the 10.0-10.9 mhz signal is accomplished to yield an output of 1.00-1.09 MHz. This signal is then applied to the 1 KHz synthesizer.

The remaining 1 KHz and 10 KHz synthesizers function the same with the output of each feeding the next to modulate the basic 8 MHz primary signal; the output of the 1 KHz synthesizer is from 1.000-1.099 thereby satisfying the 1 KHz digit ; the output of the 10 KHz synthesizer is from 10.0000-10.0999 satisfying the 10 KHz digit

VARACTOR TUNE VOLTAGE

FREQ DIGIT	FREQ MHz	TUNING V PIN C
0	10.0	0.3
1	10.1	0.5
2	10.2	0.8
3	10.3	1.0
4	10.4	1.5
5	10.5	1.9
6	10.6	2.5
7	10.7	3.3
8	10.8	4.0
9	10.9	5.2

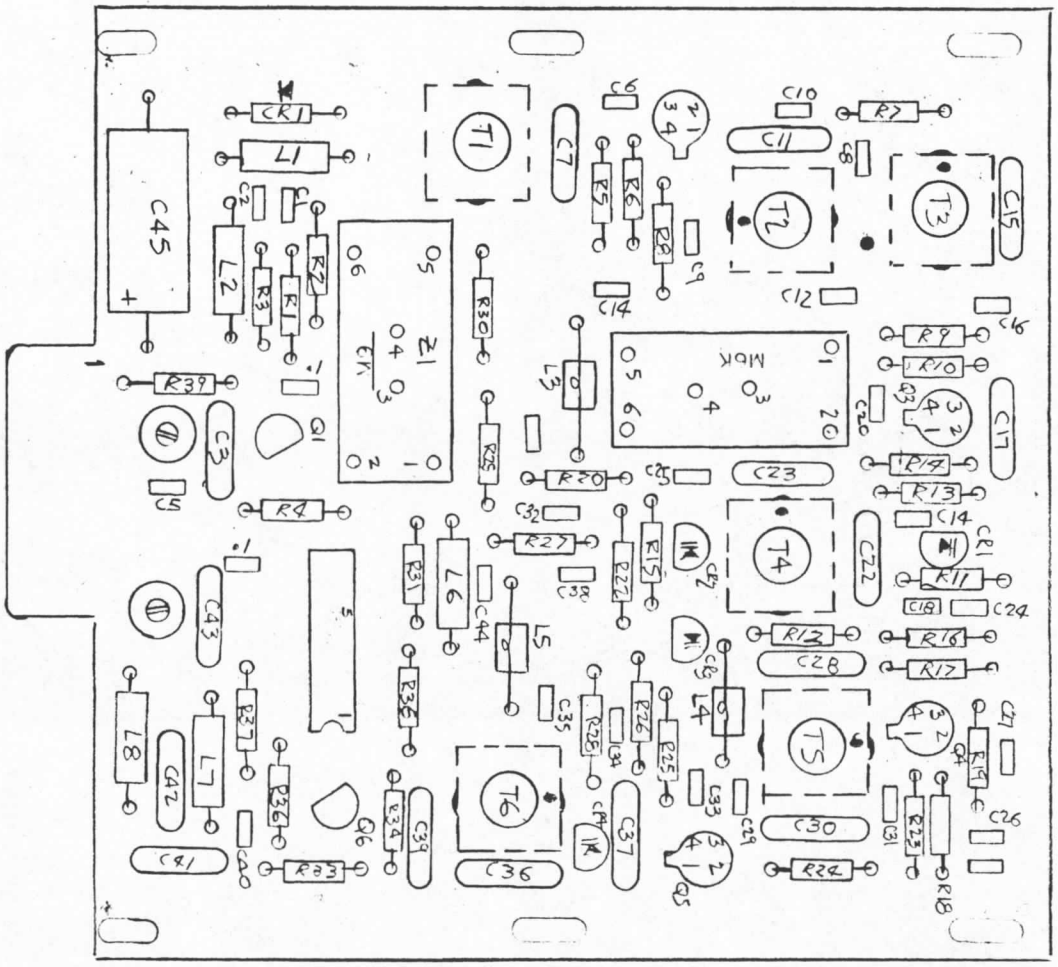
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:


Z101
Z102
Z103
MBK
T1
T2
T3
T4
T5
T6
L1
L2
L3
L4
L5
L6
L7
L8
C45
CR1
Q1
Q2
Q3
Q4
Q5
Q6

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER X5

MODEL NUMBER A5814

DATE COMPILED

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-14	Cap., Fixed, Cer. 22PF	A5814	1	C39	
CC131-16	Cap., Fixed, Cer. 47PF	A5814	3	C41, 42, 43	
CC131-19	Cap., Fixed, Cer. 150PF	A5814	4	C15, 22, 30, 36	
CC131-18	Cap., Fixed, Cer. 100PF	A5814	1	C3	
CC131-21	Cap., Fixed, Cer. 300PF	A5814	2	C7, 11	
CC131-32	Cap., Ceramic	A5814	2	C40	
CC131-39	Cap., Ceramic	A5814	23	C1, 2, 4, 5, 6, 8, 9, 10, 12, 14, 16, 18, 19, 20, 21, 24, 25, 31, 32, 34, 35, 38, 44	
CE105-100-25	Cap., Electro	A5814	1	C45	
CI120	Bead, Ferrite	A5814	2	L3, 5	
CK2235	Schematic	A5814	1		
CL275-8RO	Choke, Fxd.	A5814	2	L3, 7	
CL275-221	Choke, Fxd.	A5814	3	L1, 2, 6	
CM111E122J15S	Cap., Fixed, Mica.	A5814	1	C41	
CM111E271J15S	Cap., Fixed, Mica.	A5814	4	C17, 23, 28, 37	
DD148	Network, Mixer	A5814	1	Z1	
DD149	Network, Mixer	A5814	1	Z2	
MV2113	Diode, Tuning	A5814	4	CV1, 2, 3, 4	
NW(SN7490)	Network, Divider	A5814	1	Z3	
PC846	PC Board	A5814	1		
RC07GF101J	Res., Carbon	A5814	2	R6, 10	
RC07GF102J	Res., Carbon	A5814	5	R12, 27, 29, 31, 36	
RC07GF103J	Res., Carbon	A5814	6	R5, 7, 9, 13, 23, 30	
RC07GF122J	Res., Carbon	A5814	1	R33	
RC07GF151J	Res., Carbon	A5814	3	R8, 14, 36	
RC07GF152J	Res., Carbon	A5814	1	R2	
RC07GF182J	Res., Carbon	A5814	1	R1	
RC07GF221J	Res., Carbon	A5814	1	R3	
RC07GF331J	Res., Carbon	A5814	1	R37	
RC07GF333J	Res., Carbon	A5814	4	R11, 15, 22, 28	
RC07GF471J	Res., Carbon	A5814	1	R35	
RC21GF271J	Res., Carbon	A5814	1	R39	
RV124-1-501	Res., Var.	A5814	2	R4, 38	
TT285-5NS	Xfmer., Adj.	A5814	6	T1, 2, 3, 4, 5, 6	
40822	Semicond., Fet.	A5814	3	Q2, 3, 5	
1N4742	Diode, Zener	A5814	1	CR1	
2N2368	Transistor	A5814	2	Q1, 6	
CC131-48	Cap., Fixed, Cer. 2.2mfd	A5814	1	C47	

4.6 FINAL MIXER

GENERAL DESCRIPTION

The final mixer assembly is divided into 2 sections: the fourth and last channel of the synthesizers (100 KHz synthesizer) and the 13 MHz generator section. Final mixer assembly Z106 receives the 3 MHz signal from the 3 MHz generator assembly and the output of the 10 KHz synthesizer(1.0000-1.0999 MHz) Z103. The fixed reference frequency of 8 MHz from the spectrum generator assembly Z104 and a 1.0-1.9 MHz step frequency from the 100 KHz tuned comb filter Z110 are applied to a balanced mixer whose sum output is an IF of 9.0000-9.0999 MHz and whose 3 least significant digits are identical to the 3 least significant digits entered on the front panel(100 Hz , 1 KHz , 10 KHz). The 9.0000-9.0999 MHz signal is then mixed with the 1.1-1.9 MHz from the 100 KHz tuned comb filter to create an IF of 10.0000-10.9999 MHz that varies directly with the 4 least significant digits entered on the front panel assembly. This 10.0000-10.9999 MHz IF signal is then mixed with the 3 MHz signal from the 3 MHz generator Z003. The resultant positive mix of 13.0000-13.9999 MHz has the sideband intelligence when in an audio mode or has just a carrier in the CW mode. The 13.0000-13.9999 MHz signal is then applied to the translator assembly Z123.

DETAILED DESCRIPTION

The 8 MHz primary reference signal is applied to pin D and coupled to the base of 8 MHz amplifier Q1. The collector output of Q8 is coupled through capacitor C75 to the input of the balanced mixer Z1. With the 1.0000-1.0999 MHz step frequency from the 10 KHz synthesizer applied to pin 3 and coupled directly to Z1, the 8 MHz primary reference frequency is modulated to create a 9.0000-9.0999 IF frequency that is developed across the tuned secondary of T1. T1 rejects all of the mix frequencies except the positive mix . The secondary output of T1 is then coupled to FET amplifier Q2. Q2 has a very high input impedance and will not load down the output of Z1. The tuned drain output of Q2 is loosely coupled through coupling capacitor C8 to tuned transformer T3 where it is further filtered and then coupled to the base of IF amplifier Q4. The tuned collector output of Q4 is developed across transformer T4 and level adjust potentiometer R17 where the correct amount of 9.0000-9.0999 MHz insertion is set. With a 1.0-1.9 MHz step frequency input from the 100 KHz synthesizer and the 9.0000-9.0999 MHz applied to Z2 the 9.0000-9.0999 MHz is modulated by the 100 KHz step frequency to produce a 10.0000-10.9999 MHz IF that is developed across the secondary of T5 and coupled to gate 2 of the 10.0000-10.9999 MHz amplifier FET Q5. The varactor tuned drain output of Q5 is developed across the parallel resonate circuit consisting of tuned transformer T6 , capacitor C27, capacitor C31 and varactor diode CR2. This stage is a high Q frequency agile network that changes its peak tuning as the varactor DC control voltage

changes. This allows a high degree of filtering for each 100 KHz step while maintaining a smooth frequency response across the operating bandwidth. Each discrete frequency step of 100 KHz has its own DC varactor tune control voltage (see chart) which is determined in the front panel assembly in accordance with the desired operating frequency. The tuned drain output of Q5 is loosely coupled to a filter network consisting of tuned transformer T7, capacitors C35 and C37, and varactor diode CR3 which further filters the 10.0000-10.9999 MHz IF and applies it to the base of transistor amplifier Q7 where it is filtered and amplified as in the previous stage (Q5) just described. The tuned collector signal of Q7 is then developed across the secondary of T8 and level adjust potentiometer R37 where the correct level of 10.0000-10.9999 MHz is set and then coupled to the balanced modulator Z3. With the 10.0000-10.9999 MHz selectable frequency range input and the 3 MHz signal applied to balanced modulator Z3, the modulator outputs the sum and difference frequencies while attenuating the original two frequencies. This output is applied to the tuned coupling network consisting of tuned transformer T9, capacitors C45 and C44, and varactor diode CR5 and loosely coupled to gate of FET amplifier Q8. The signal at the tuned drain of Q8 is developed in the varactor tuned parallel circuit consisting of tuned transformer T10, capacitors C56 and C58, and varactor diode CR6 and loosely coupled to a varactor tuned input network consisting of tuned transformer T11, capacitors C60 and C63, and varactor diode CR7 and through to the base of the transistor amplifier Q10. The collector output of Q10 is developed across the secondary of tuned transformer T12 and 13 MHz level adjust potentiometer R63.

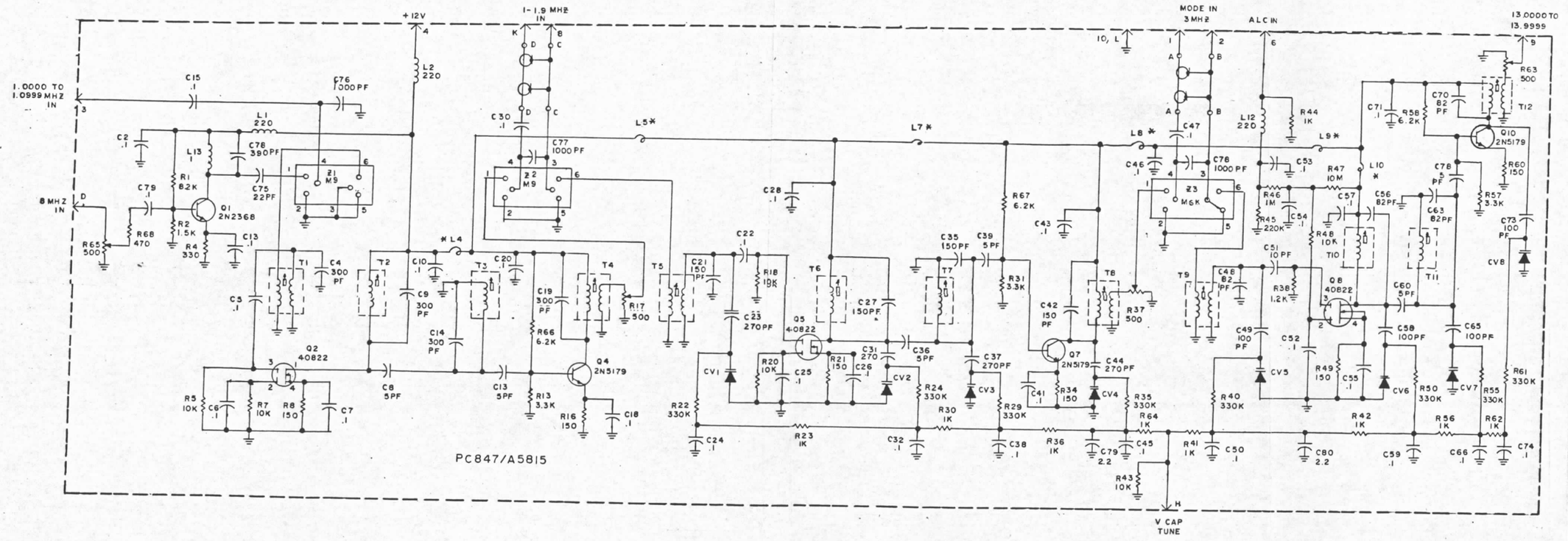
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

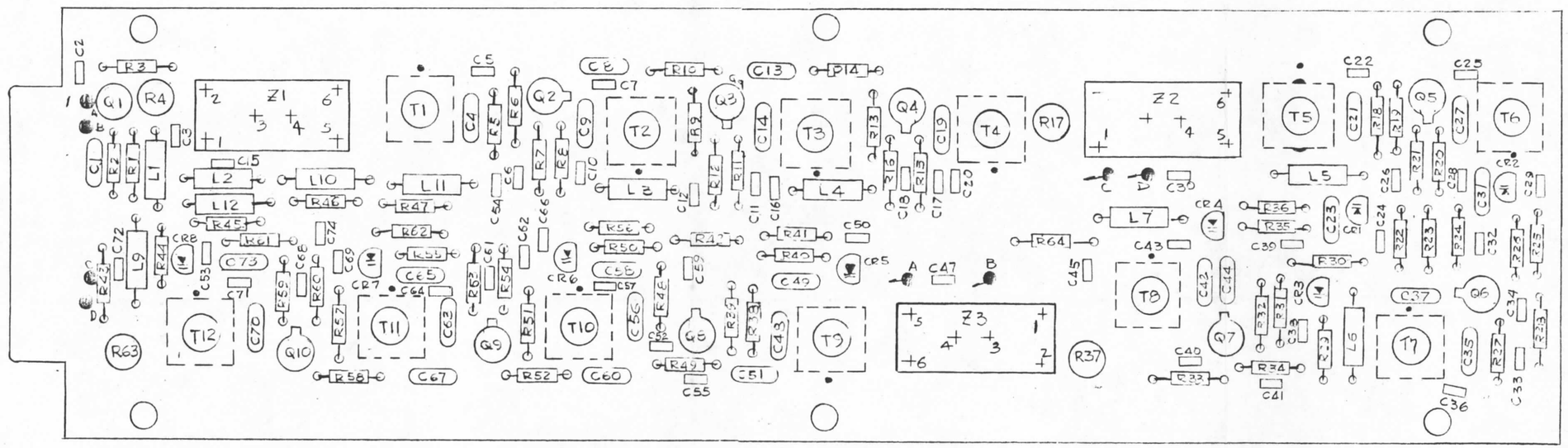
POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:



Z106 FINAL MIXER A5815



Z106 FINAL MIXER A5815

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER A5815

DATE COMPILED 8/7/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
A5815	Assembly Drawing	A5815	1		
CC131-9	Cap., Fixed, Cer. 5.6PF	A5815	4	C8, 13, 36, 39	
CC131-12	Cap., Fixed, Cer. 10PF	A5815	4	C1, 51, 60, 67	
CC131-15	Cap., Fixed, Cer. 100PF	A5815	4	C49, 58, 65, 73	
CC131-19	Cap., Fixed, Cer. 150PF	A5815	4	C21, 27, 35, 42	
CC131-20	Cap., Fixed, Cer. 200PF	A5815	1	C75	
CC131-21	Cap., Fixed, Cer. 330PF	A5815	4	C4, 9, 14, 19	
CC131-39	Cap., Fixed, Cer.	A5815	38	C2, 3, 5, 6, 7, 10, 13, 15, 18, 20, 22, 24, 25, 26, 28, 29, 30, 32, 34, 38, 39, 40, 41, 43, 45, 47, 50, 52, 53, 54, 55, 57, 59, 66, 69, 71, 72, 74	
CI120	Ferrite Beads	A5815	7	L4, 5, 7, 8, 9, 10, 11	
CK2276	Schematic Diag.	A5815	1		
CL275-1RO	Coil, RF, Fixed	A5815	1	L13	
CL275-221	Coil, RF, Fixed	A5815	3	L1, 2, 12	
CM111E201JSS	Cap., Fixed, Mica	A5815	1	C35	
CM111E271JSS	Cap., Fixed, Mica	A5815	4	C23, 31, 37, 44	
CM111E391JSS	Cap., Fixed, Mica	A5815	1	C78	
CM111E820JSS	Cap., Fixed, Mica	A5815	4	C48, 56, 63, 70	
DD148	Network Mixer	A5815	1	Z3	
DD149	Network Mixer	A5815	2	Z1, 2	
MV2115	Cap., Voltage, Var.	A5815	8	CR1, 2, 3, 4, 5, 6, 7, 8	
RC07GF101J	Resistor, Fixed, Comp.	A5815	3	R6, 52, 58	
RC07GF102J	Resistor, Fixed, Comp.	A5815	9	R23, 30, 36, 41, 42, 44, 56, 62, 64	
RC07GF103J	Resistor, Fixed, Comp.	A5815	9	R5, 7, 13, 18, 20, 31, 48, 59, 43	
RC07GF105J	Resistor, Fixed, Comp.	A5815	1	R46	
RC07GF106J	Resistor, Fixed, Comp.	A5815	1	R47	
RC07GF151J	Resistor, Fixed, Comp.	A5815	7	R8, 12, 16, 21, 34, 49, 60	
RC07GF152J	Resistor, Fixed, Comp.	A5815	1	R2	
RC07GF221J	Resistor, Fixed, Comp.	A5815	1	R3	
RC07GF222J	Resistor, Fixed, Comp.	A5815	2	R38, 51	
RC07GF224J	Resistor, Fixed, Comp.	A5815	1	R45	
RC07GF331J	Resistor, Fixed, Comp.	A5815	1	R4	
RC07GF332	Resistor, Fixed, Comp.	A5815	1	R31	
RC07GF333J	Resistor, Fixed, Comp.	A5815	8	R22, 24, 29, 35, 40, 50, 55, 61	
RC07GF471J	Resistor, Fixed, Comp.	A5815	1	R68	
RC07GF562J	Resistor, Fixed, Comp.	A5815	1	R57	
RC07GF822	Resistor, Fixed, Comp.	A5815	1	R1	

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER A5815

DATE COMPILED 8/7/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
RV124-501	Resistor, Variable, Comp.	A5815	4	R17, 37, 63, 65	
TT285-5	Transformer, Tunable w/sec	A5815	6	T1, 4, 5, 8, 9, 12	
TT285-5	Transformer, Tunable no/sec	A5815	6	T2, 3, 6, 7, 10, 11	
2N2368	Semiconductor, Trans.	A5815	1	Q1	
40822	Semiconductor, Trans.	A5815	6	Q2, 4, 5, 7, 8, 10	

4.7 MHz SYNTHESIZER

GENERAL DESCRIPTIONI

The purpose of the MHz SYNTHESIZER is to mix, filter and amplify the frequencies used to create the 1 and 10 MHz digits entered into the front panel assembly. The MHz SYNTHESIZER is a high Q varactor-tuned amplifier/filter which receives a reference frequency from the spectrum generator Z104. Depending on the operating frequency selected by the front panel control one of 4 reference frequencies of 9, 10, 11 or 12 MHz may be used to combine with the 1.1-2.0 MHz output from the 1 MHz tuned comb filter Z111.

The amplifier/filter section is varactor diode tuned to permit sharp tuning in discrete 100 KHz increments by a DC voltage supplied by the front panel assembly. The amplifier filter stages are tuned to pass only the positive mix of Z1. This RF frequency is then applied to the X2 multiplier (20.8-26.6 MHz) amplifier Z124 for further multiplication.

DETAILED DESCRIPTION

The 1.1-2.0 MHz RF carrier from the output of the 1 MHz tuned comb filter Z111 is applied to pin A and coupled directly to the balanced mixer Z1. This frequency will vary directly in accordance with the frequency selected on 10 MHz and 1 MHz entry positions on the front panel assembly. One of four discrete frequencies (either 9, 10, 11, 12MHz) will be selected (see chart) by front panel control and applied to pin B. All of these injection frequencies are generated from the 1 MHz reference in the spectrum generator Z104. For the purpose of this discussion only 9 MHz will be used. With 9 MHz and 1.3 MHz applied to Z1 the plus mix of 10.3 MHz is developed across the secondary of tuned transformer T1, capacitor C6 and varactor diode CV1 and then loosely coupled through C18 to gate 2 of fet amplifier Q3. The tuned stages of T2, T3, T4, T5 and T6, along with their associated varactor diodes, form a continuously tuned cascaded filter network. The filter stages are very loosely coupled and therefore exhibit some loss from stage to stage. The filtered signals from the drain of Q3 are then applied to the base of amplifier Q2 through the filter network. Q2 has very high gain and develops its output signal across the center tap of transformer T7. T7 is a broadband center tap transformer. The 10.4-13.3 MHz output is then coupled to R29 level control. The signal is then applied to the 20.8-26.6 MHz amplifier Z124 for further up conversion.

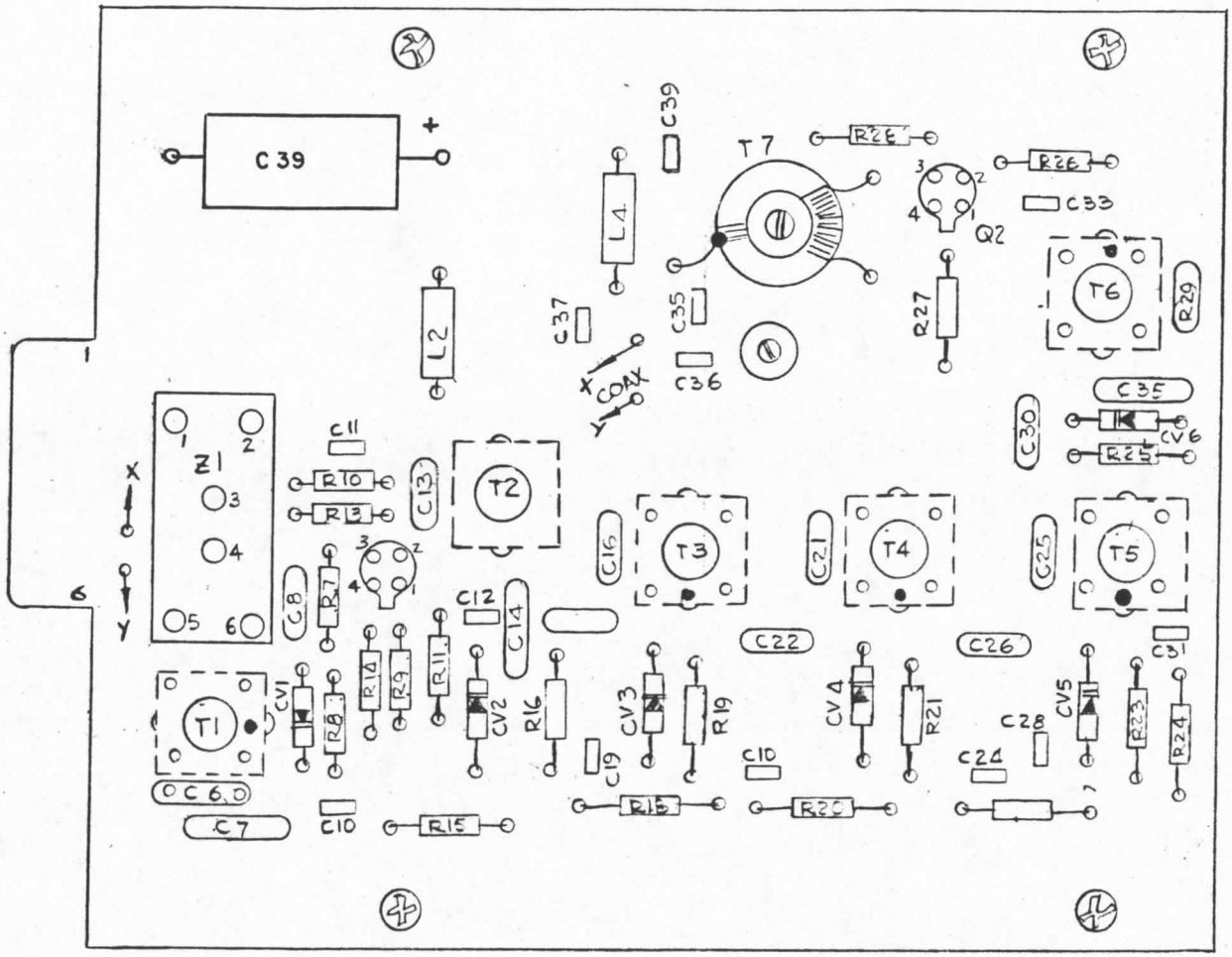
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:


C 39
+
C39
T7
R26
R26
C33
Q2
L4
L2
C37
C35
C36
R27
T6
R29
C35
C30
R25
CV6
Z1
X
Y
C11
R10
R13
C13
T2
C8
R7
C12
C14
C16
T3
C21
T4
C25
T5
C22
C26
C9
CV1
R8
R14
R9
R11
CV2
R16
C19
CV3
R19
C10
CV4
R21
C28
CV5
R23
R24
C24
T1
C6
C7
C10
R15
R18
R20

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER X3
MODEL NUMBER A5816
DATE COMPILED 7/9/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-24	Cap., Ceramic, Fixed	A5816	7	C7, 14, 18, 23, 27, 32, 33	
CC131-39	Cap., Ceramic, Fixed	A5816	14	C 10, 11, 12, 15, 19, 20, 28, 31, 34, 35, 36, 37, 38, 40	
CE105-220-16	Cap., Electrolytic	A5816	1	C39	
CL275-121	Coil, RF, Fixed	A5816	4	L1, 2, 3, 4	
CM111E050JSS	Cap., Mica, Fixed	A5816	4	C17, 22, 26, 30	
CM111E180JSS	Cap., Mica, Fixed	A5816	1	C8	
CM111E200JSS	Cap., Mica, Fixed	A5816	6	C6, 13, 16, 21, 25, 29	
CM111E561JSS	Cap., Mica, Fixed	A5816	1	C1	
DD149	Network Mixer	A5816	1	Z1	
MV2115	Diode Varactor	A5816	6	CV1, 2, 3, 4, 5, 6	
RC07GF101J	Res., Comp., Fixed	A5816	2	R10, 31	
RC07GF102J	Res., Comp., Fixed	A5816	5	R15, 18, 20, 22, 24	
RC07GF103J	Res., Comp., Fixed	A5816	1	R13	
RC07GF620J	Res., Comp., Fixed	A5816	1	R11	
RC07GF151J	Res., Comp., Fixed	A5816	2	R14, 27	
RC07GF332J	Res., Comp., Fixed	A5816	1	R26	
RC07GF334J	Res., Comp., Fixed	A5816	6	R8, 16, 19, 21, 23, 25	
RC07GF472J	Res., Comp., Fixed	A5816	2	R7, 9	
RC07GF822J	Res., Comp., Fixed	A5816	1	R28	
RC20GF431	Res., Comp., Fixed	A5816	1	R30	
RV124-251-1	Res., Comp., Variable	A5816	1	R29	
TT285-5	Transformer, Tunable	A5816	4	T2, 3, 4, 5	
TT285-5	Transformer, Tunable	A5816	1	T6	
TT285-6	Transformer, Tunable	A5816	1	T1	
TZ220	Toroid Fixed	A5816	1	T7	
2N3646	Semicond., Transistor	A5816	1	Q1	
2N5179	Semicond., Transistor	A5816	1	Q2	
40822	Semicond., Field Effect	A5816	1	Q3	

4.8 X2 AMPLIFIER

GENERAL DESCRIPTION

Multiplication of the basic 10.4-13.3 MHz signal by a factor of 2 is accomplished by first amplifying the basic input frequency to a high level. Through high "Q" filter circuits all unwanted harmonic signals are removed leaving only the correct harmonic which is further amplified to produce a 20.8-26.6 MHz signal to be applied to the X5 amplifier for further up conversion.

DETAILED DESCRIPTION

The 10.4-13.3 MHz signal from the MHz synthesizer is applied to TERMINAL E1 and then coupled through L1 and C3 to the base of transistor amplifier Q1. Q1 amplifies the basic 10.4-13.3 MHz input signal for selection of the second harmonic by the subsequent filter circuits. The signal at the varactor tuned collector of Q1 is then applied to a five stage cascaded filter network consisting of T1-5 and CV1-6. A DC varactor tune voltage supplied from the front panel assembly is applied at E4 to "fine tune" the cascaded filter network. The 2nd harmonic (20.8-26.6 MHz) of the basic input frequency (10.4-13.3 MHz) is applied to the base of transistor amplifier Q2 where the 20.8-26.6 MHz signal is further amplified and filtered. The varactor tuned collector output of Q2 is then loosely coupled to the base of Q3 through coupling capacitor C25 to the base of transistor amplifier Q3. Q3 is biased for very high output gain across its broadband output transformer T7. The 20.8-26.6 MHz signal at the tap of T7 is then supplied via E6 to the X5 amplifier for further frequency multiplication.

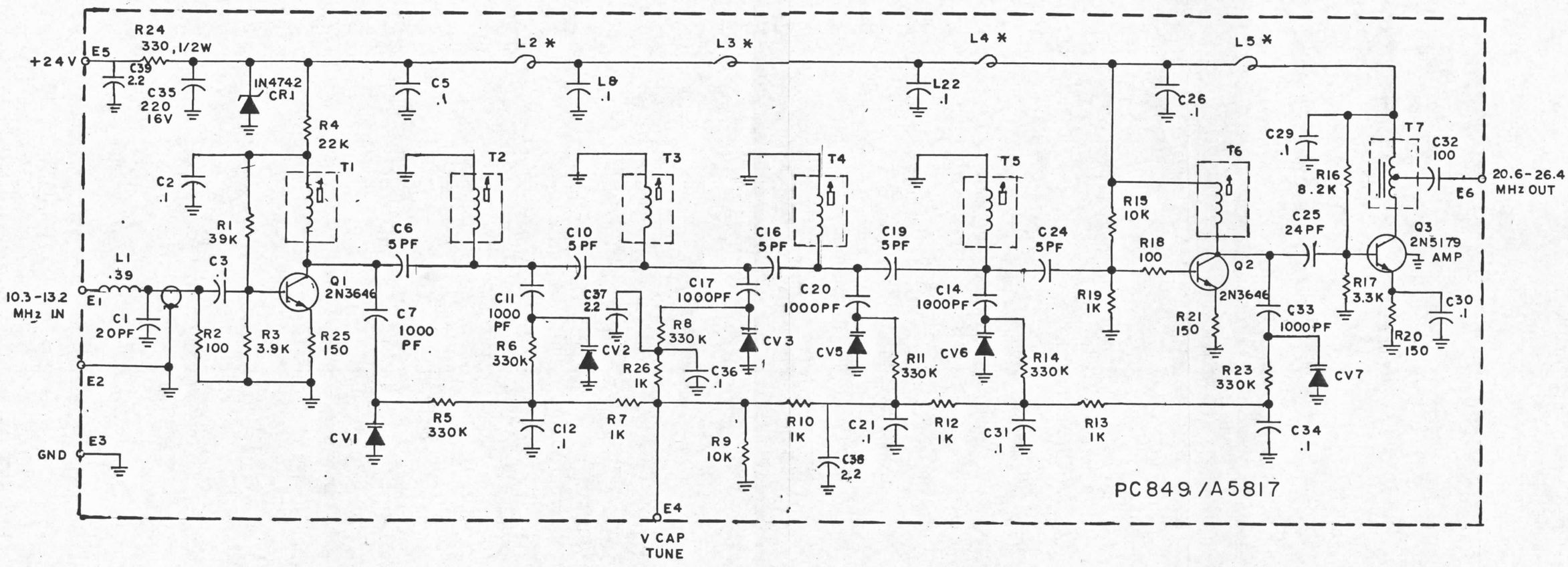
TECHNICAL CHARACTERISTICS:

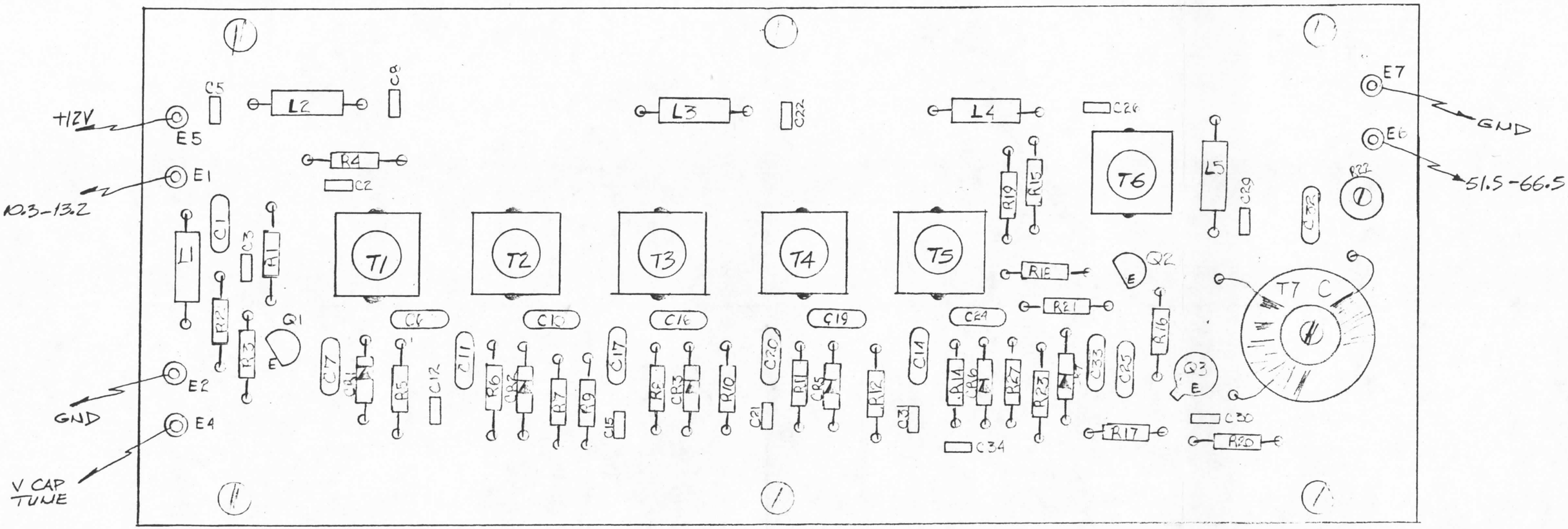
DIMENSIONS:

POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:


+24V
E5
R24
330, 1/2W
C39
2.2
C35
220
16V
IN4742
CR1
R4
22K
C5
.1
L2 *
L3 *
L4 *
L5 *
L8
.1
L22
.1
C26
.1
T1
T2
T3
T4
T5
T6
T7
C2
.1
R1
39K
C6
5PF
C10
5PF
C16
5PF
C19
5PF
C24
5PF
C29
.1
R16
8.2K
C32
100
E6
20.6-26.4
MHz OUT
R15
10K
C25
24PF
Q3
2N5179
AMP
R18
100
Q2
2N3646
R17
3.3K
R19
1K
R21
150
C33
1000PF
C30
.1
R20
150
R23
330K
CV7
L1
.39
C3
.1
10.3-13.2
MHz IN
E1
C1
20PF
Q1
2N3646
C7
1000
PF
C11
1000
PF
C37
2.2
C17
1000PF
C20
1000PF
C14
1000PF
R2
100
R3
3.9K
R25
150
R6
330K
CV2
R8
330K
CV3
R26
1K
C36
.1
CV5
R11
330K
CV6
R14
330K
E2
R5
330K
C12
.1
R7
1K
R9
10K
R10
1K
C21
.1
R12
1K
C31
.1
R13
1K
C34
.1
CV1
C38
2.2
GND
E3
E4
V CAP
TUNE
PC849/A5817



Z124 X2 AMPLIFIER 5817

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER _____

DATE COMPILED _____

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-48	Cap, Fixed, Ceramic	A5817	3	C37,38,39	
CC131-39	Cap., Fixed Ceramic	A5817	13	C2, 3, 5, 8, 12, 15, 21, 22, 26, 29, 30, 31, 34	
CE105-220-16	Cap., Elect.	A5817	1	C35	
CI120	Ferrite Beads	A5817	4	L2, 3, 4, 5	
CL275-3RO	Coil, RF Fixed	A5817	1	L1	
CM111E050JSS	Cap., Fixed, Mica	A5817	5	C6, 10, 16, 19, 24	
CM111E101J1SS	Cap., Fixed, Mica	A5817	1	C32	
CM111E200	Cap., Fixed, Mica	A5817	1	C24	
CM111E240J1SS	Cap., Fixed, Mica	A5817	1	C25	
CM111E361J1SS	Cap., Fixed, Mica	A5817	6	C7, 11, 17, 14, 33, 20	
MV2113	Vari-Cap., Diode	A5817	6	CV1, 2, 3, 5, 6, 7	
RC07GF101J	Resistor, Carbon	A5817	2	R2, 18	
RC07GF102J	Resistor, Carbon	A5817	6	R7, 10, 12, 15, 19, 13	
RC07GF103J	Resistor, Carbon	A5817	1	R9	
RC07GF151J	Resistor, Carbon	A5817	2	R20, 21	
RC07GF243J	Resistor, Carbon	A5817	1	R4	
RC07GF332J	Resistor, Carbon	A5817	1	R17	
RC07GF334J	Resistor, Carbon	A5817	6	R5, 6, 8, 11, 14, 23	
RC07GF392J	Resistor, Carbon	A5817	1	R3	
RC07GF393J	Resistor, Carbon	A5817	1	R1	
RC07GF822J	Resistor, Carbon	A5817	1	R16	
RC20GF331J	Resistor, Carbon	A5817	1	R24	
RV124-251	Resistor, Variable	A5817	1	R22	
TT285-10	Transformer Tunable	A5817	6	T1, 2, 3, 4, 5, 6	
TZ220	Toroid Fixed	A5817	1	T7	
1N4742	Semicond. Diode	A5817	1	CR1	
2N3646	Semicond. Transistor	A5817	2	Q1, 2	
2N5179	Semicond. Transistor	A5817	1	Q3	

4.9 X5 AMPLIFIER

GENERAL DESCRIPTION

Multiplication of the 20.8-26.6 MHz signal by a factor of 5 is accomplished by first amplifying the basic input frequency to a high level. All the unwanted harmonic signals are removed through high "Q" filter circuits leaving only the desired harmonic which is further amplified to produce a 104-133 MHz signal to be applied to the final conversion circuits of the translator assembly.

DETAILED DESCRIPTION

The 20.8-26.6 MHz signal from the X2 amplifier is applied to terminal E1 and then coupled through C1 to the base of transistor amplifier Q1. Q1 amplifies the basic 20.8-26.6 MHz input signal for selection of the 5th harmonic by the subsequent filter circuits. The signal at the varactor tuned collector of Q1 is then applied to a four stage cascaded filter network consisting of T1-4 and CV1-4. A DC varactor tune voltage supplied from the front panel assembly is applied at E4 to "fine tune" the cascaded filter network. The 5th harmonic (104-133 MHz) of the basic input frequency (20.8-26.6 MHz) is applied to the base of transistor amplifier Q2 where the 104-133 MHz signal is further amplified and filtered. The varactor tuned collector output of Q2 is then loosely coupled to the base of Q3 through coupling capacitor C24 to the base of transistor amplifier Q3. Q3 is biased for very high output gain across its broadband output transformer T6. The 104-133 MHz signal at the tap of T6 is then supplied via E5 to the translator assembly for final frequency translation.

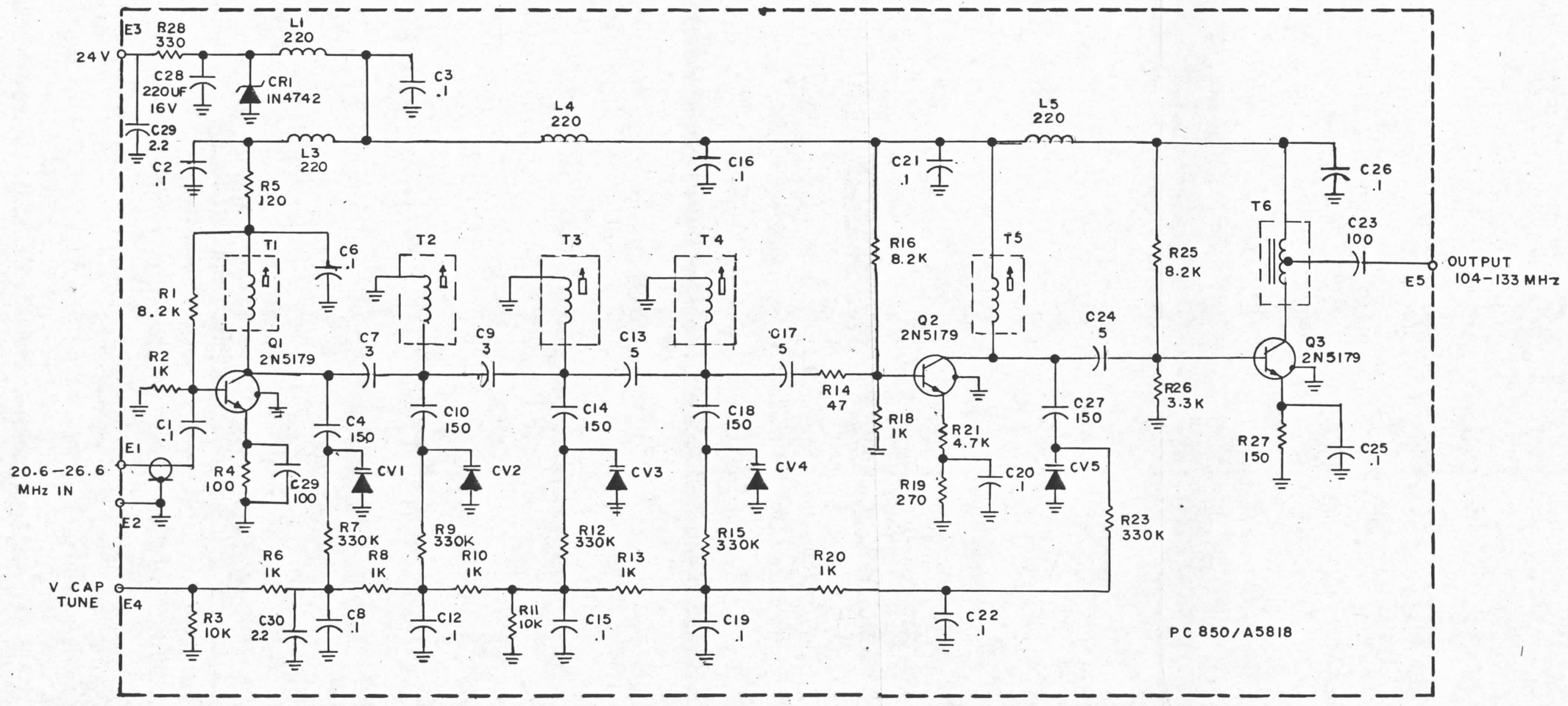
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

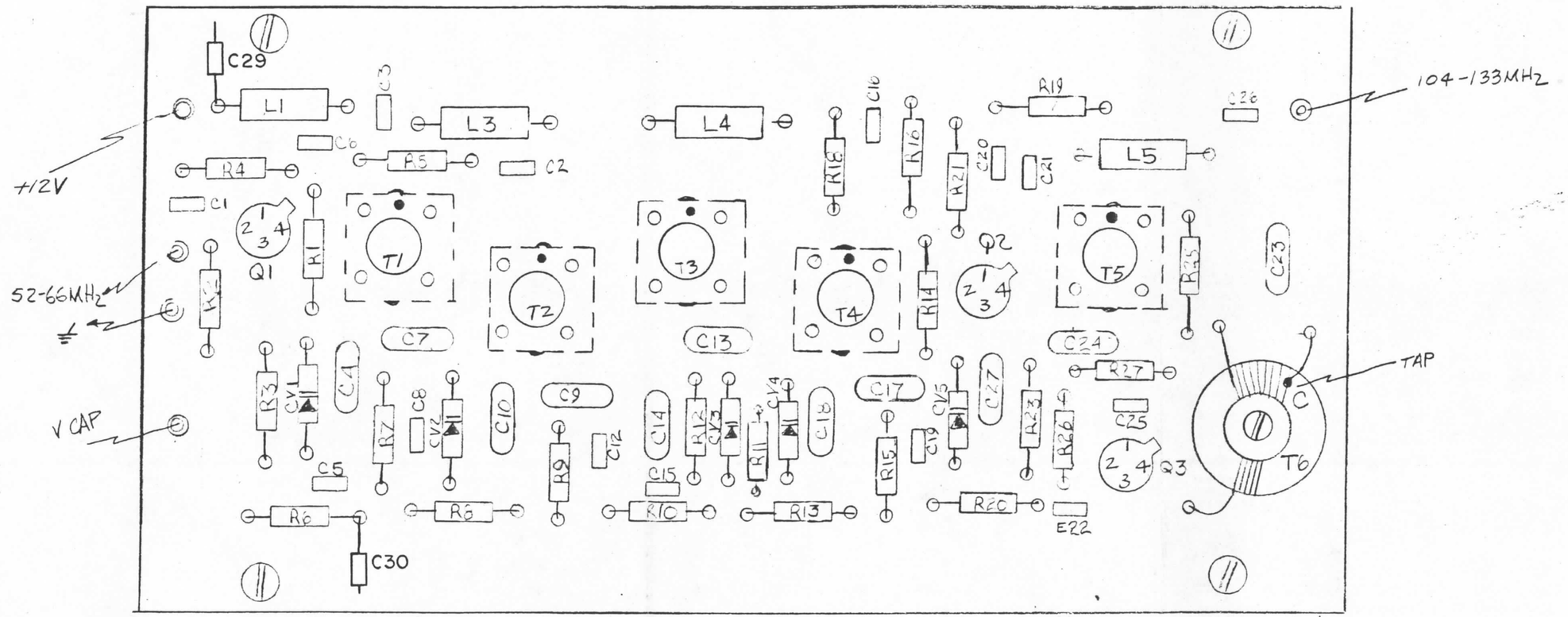
POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:



Z125 X5 AMPLIFIER A5818



Z125 X5 AMPLIFIER A5818

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER X2
MODEL NUMBER A5818
DATE COMPILED 7/11/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-48	Cap., Fixed, Cer., 2.2mf	A5818	2	C 29,30	
CC131-7	Cap., Fixed, Cer., 3.3PF	A5818	2	C7, 9	
CC131-9	Cap., Fixed, Cer., 5.6PF	A5818	3	C17, 24, 13	
CC131-18	Cap., Fixed, Cer., 100PF	A5818	1	C23	
CC131-19	Cap., Fixed, Cer., 150PF	A5818	5	C4, 10, 18, 27, 14	
CE105-220-16V	Cap., Electro.	A5818	1	C28	
CL275-121	Coil, RF, Fixed	A5818	5	L1, 2, 3, 4, 5	
1N4742	Semi, Diode	A5818	1	CR1	
MV2105	Diode Varactor	A5818	5	CV1, 2, 3, 4, 5	
RC07GF101J	Resistor, Comp., Fixed	A5818	1	R4	
RC07GF102J	Resistor, Comp., Fixed	A5818	7	R2, 6, 8, 10, 13, 18, 20	
RC07GF103J	Resistor, Comp., Fixed	A5818	2	R3, 11	
RC07GF151J	Resistor, Comp., Fixed	A5818	1	R27	
RC07GF222J	Resistor, Comp., Fixed	A5818	1	R5	
RC07GF271J	Resistor, Comp., Fixed	A5818	1	R19	
RC07GF332J	Resistor, Comp., Fixed	A5818	1	R26	
RC07GF334J	Resistor, Comp., Fixed	A5818	5	R7, 9, 12, 15, 23	
RC07GF470J	Resistor, Comp., Fixed	A5818	2	R14, 21	
RC07GF882J	Resistor, Comp., Fixed	A5818	3	R1, 16, 25	
TT285-24	Transformer	A5818	5	T1, 2, 3, 4, 5	
TZ220	Torroid Fixed	A5818	1	T6	
2N5179	Semicond. Transistor	A5818	3	Q1, 2, 3	

4.10 MULTIPLIER/MIXER

GENERAL DESCRIPTION

The multiplier mixer assembly is a sharply tuned multiplier filter/amplifier and upconverter section which is used to create the 120 MHz injection frequency. This injection frequency is then mixed with the 13.0000-13.9999 MHz IF signal from the final mixer assembly Z106. This creates an IF of 133.0000-133.9999 MHz to be mixed and downconverted in the translator assembly Z123.

DETAILED DESCRIPTION

A 20 MHz reference frequency is applied to the base of Q3, the X3 multiplier transistor, through coupling capacitor C16. The tuned collector output of Q3 is developed across the tuned circuit consisting of capacitor C22 and T1. This tuned circuit selects the 3rd harmonic of the 20 MHz reference frequency to create the 60 MHz reference frequency that is then loosely coupled through C24 to the sharply tuned harmonic filter consisting of capacitor C25 and tuned transformer T2 and capacitor C28 and tuned transformer T3 . This 60 MHz reference frequency is then coupled through to the base of the 60 MHz amplifier Q4 where it is further tuned and amplified. The tuned collector signal at Q4 is then loosely coupled to the X2 amplifier Q1 whose tuned collector output selects the 2nd harmonic of 60 MHz (120 MHz). This 120 MHz reference is then loosely coupled to 2 sharply tuned filter stages consisting of capacitor C7 and tuned transformer T6, and capacitor C9 and tuned transformer T7. This filtered 120 MHz reference frequency is then coupled to the base of the 120 MHz amplifier Q2 where it is further filtered and amplified.

The 120 MHz reference signal generated in the multiplier section of MULTIPLIER/MIXER Z122 is then applied to the balanced mixer Z1 where it is mixed with the 13.0000-13.9999 MHz IF signal from the final mixer. Z1 selects the difference frequency which is then coupled to the tuned stages of tuned transformer T9 and capacitor C17 and tuned transformer T10 and capacitor C19. These filter stages further eliminate the unwanted products of Z1 and ensure no spurious signals are present on this final IF frequency.

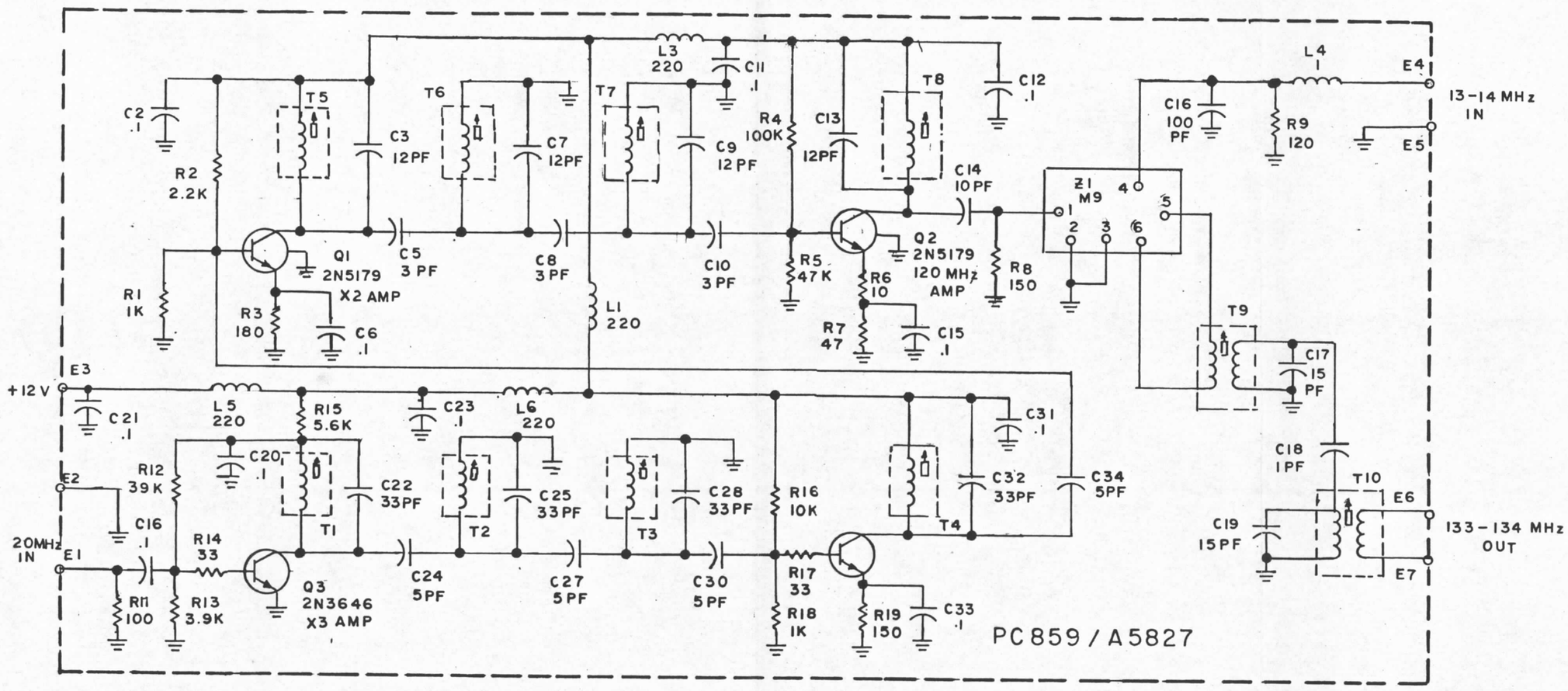
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

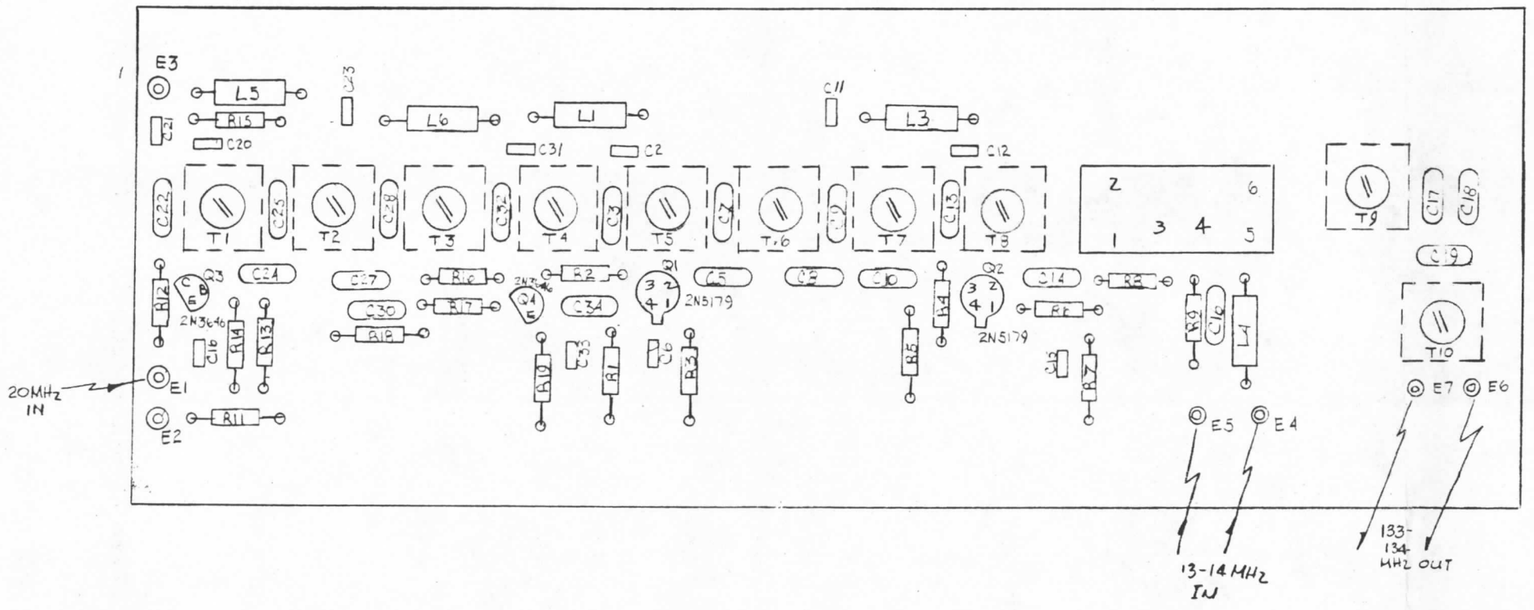
POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:



Z122 MULTIPLIER/MIXER A5827



A5827 MULTIPLIER MIXER Z122

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER _____

DATE COMPILED _____

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-39	Cap., Fixed, Cer.	A5827	11	C2, 6, 11, 12, 15, 16, 20, 21, 23, 31, 33	
CL275-1RO	Coil, R.F., Fixed	A5827	1	L4	
CL275-121	Coil, R.F., Fixed	A5827	4	L1, 3, 5, 6	
CM111E1ROJSS	Cap., Fixed, Mica	A5827	1	C18	
CM111E3ROJSS	Cap., Fixed, Mica	A5827	3	C5, 8, 10	
CM111E5ROJSS	Cap., Fixed, Mica	A5827	4	C24, 27, 30, 34	
CM111E100JSS	Cap., Fixed, Mica	A5827	1	C14	
CM111E101JSS	Cap., Fixed, Mica	A5827	1	C16	
CM111E120JSS	Cap., Fixed, Mica	A5827	4	C3, 7, 9, 13	
CM111E150JSS	Cap., Fixed, Mica	A5827	2	C17, 19	
CM111E330JSS	Cap., Fixed, Mica	A5827	4	C22, 25, 28, 32	
RC07GF100JS	Resistor, Fixed, Comp.	A5827	1	R6	
RC07GF101JS	Resistor, Fixed, Comp.	A5827	1	R11	
RC07GF102JS	Resistor, Fixed, Comp.	A5827	2	R1, R18	
RC07GF103JS	Resistor, Fixed, Comp.	A5827	1	R16	
RC07GF104JS	Resistor, Fixed, Comp.	A5827	1	R4	
RC07GF121JS	Resistor, Fixed, Comp.	A5827	1	R9	
RC07GF151JS	Resistor, Fixed, Comp.	A5827	2	R8, 19	
RC07GF181JS	Resistor, Fixed, Comp.	A5827	1	R3	
RC07GF222JS	Resistor, Fixed, Comp.	A5827	1	R2	
RC07GF330JS	Resistor, Fixed, Comp.	A5827	2	R14, 17	
RC07GF392JS	Resistor, Fixed, Comp.	A5827	1	R13	
RC07GF393JS	Resistor, Fixed, Comp.	A5827	1	R12	
RC07GF470JS	Resistor, Fixed, Comp.	A5827	1	R7	
RC07GF473JS	Resistor, Fixed, Comp.	A5827	1	R5	
RC07GF562JS	Resistor, Fixed, Comp.	A5827	1	R15	
TT285-	Transformer, Tunable	A5827	2	T9, 10	
TT285-	Transformer, Tunable	A5827	4	T5, 6, 7, 8	
TT285-	Transformer, Tunable	A5827	4	T1, 2, 3, 4	
2N3646	Transistor	A5827	2	Q3, 4	
2N5179	Transistor	A5827	2	Q1, 2	

4.11 TRANSLATOR

GENERAL DESCRIPTION

Translator assembly Z123 performs downconversion of the 133-134 MHz IF signal by mixing it with the 104-133 MHz reference frequency to produce the final output frequency range of .4-29.9999 mhz. The assembly consists of an input amplifier stage; a balanced modulator; waveshaping circuits; RF output level control circuits and an output switching network which is used to attenuate the RF input to the RF amplifier assembly A5840.

DETAILED DESCRIPTION

133-134 MHz is applied to the base of transistor amplifier Q1 through coupling capacitor C2. Q1 exhibits high gain to the input signal which is developed across the tuned parallel resonate circuit of tuned transformer T1 and capacitor C3. The 133-134 MHz signal is coupled to a two stage tuned filter network which provides additional filtering and then to the balanced mixer driver transistor Q2. Due to the loose coupling between tuned stages T1, T2 and T3 the 133-134 MHz signal must be amplified before being applied to the balanced mixer. With the 104-133 MHz applied to terminal E4 and coupled to the balanced mixer Z1, and the 133-134 MHz reference signal coupled through capacitor C14 from collector Q2, balanced mixer Z1 develops a difference frequency (.4-29.9999 MHz) which is applied to a waveshaping circuit consisting of L3, L4, L5, C17 and C20. Metal oxide varistors (MOV) CR1 and CR2 act together to control the amount of RF output signal. With the RF gain control input applied, CR1 exhibits a value of series resistance and CR2 acts as a shunt resistance to the output signal path, depending on the DC level applied to terminal E7. CR1 and CR2 are connected to compensate for the change in the output impedance seen by the balanced mixer Z1 under different gain settings. When CR2 is a low shunt resistance CR1 is a high value of series resistance which places the base of Q5 near RF ground. Due to the high series resistance of CR1 a method of isolation between the output of the balanced mixer and the RF grounded base of transistor amplifier Q5 results, offering a smooth response in gain control with a minimum amount of signal distortion. With no PTT ground at terminal E6, transistor switch Q3, which is normally biased on, removes the forward bias applied through R17 and R18 to transistor amplifier Q5, disabling it. When a PTT ground signal is present on Q3 base, Q3 is turned off and the ground is removed from the junction of R17, R18 which enables transistor amplifier Q5. With Q5 enabled the 1.6-29.9999 MHz collector signal is developed across the tapped transformer T5 and applied to the RF amplifier assembly.

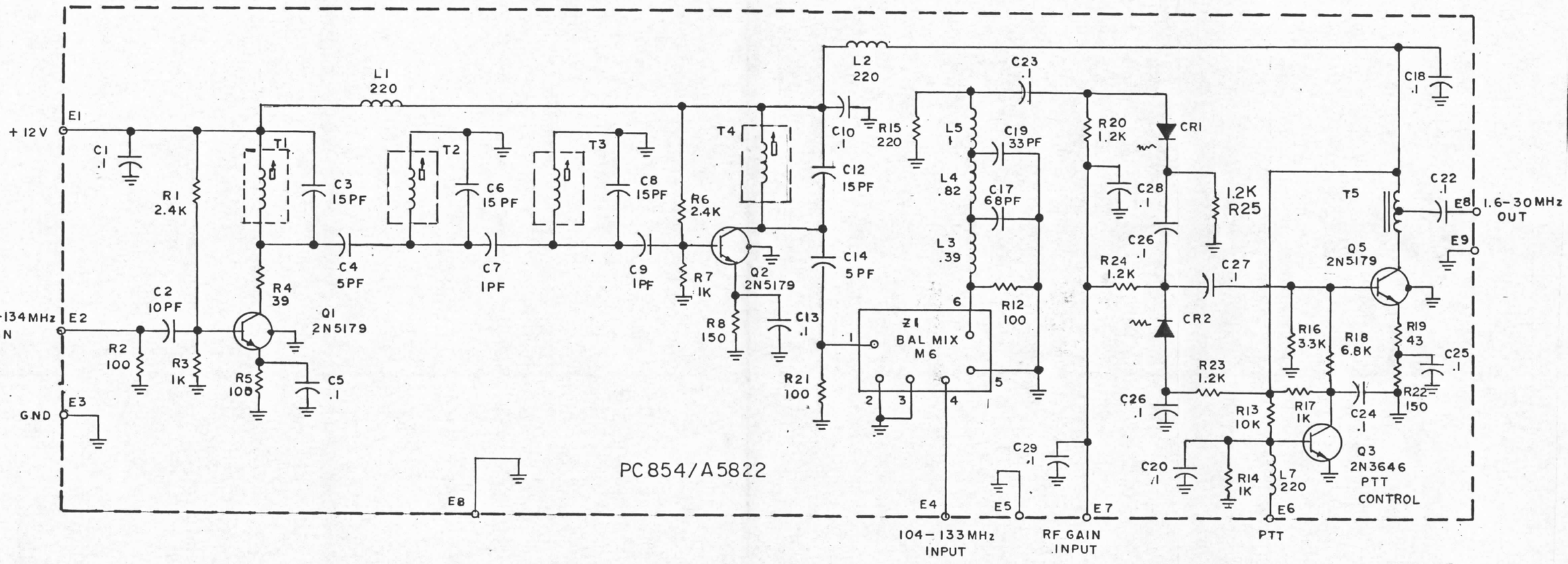
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

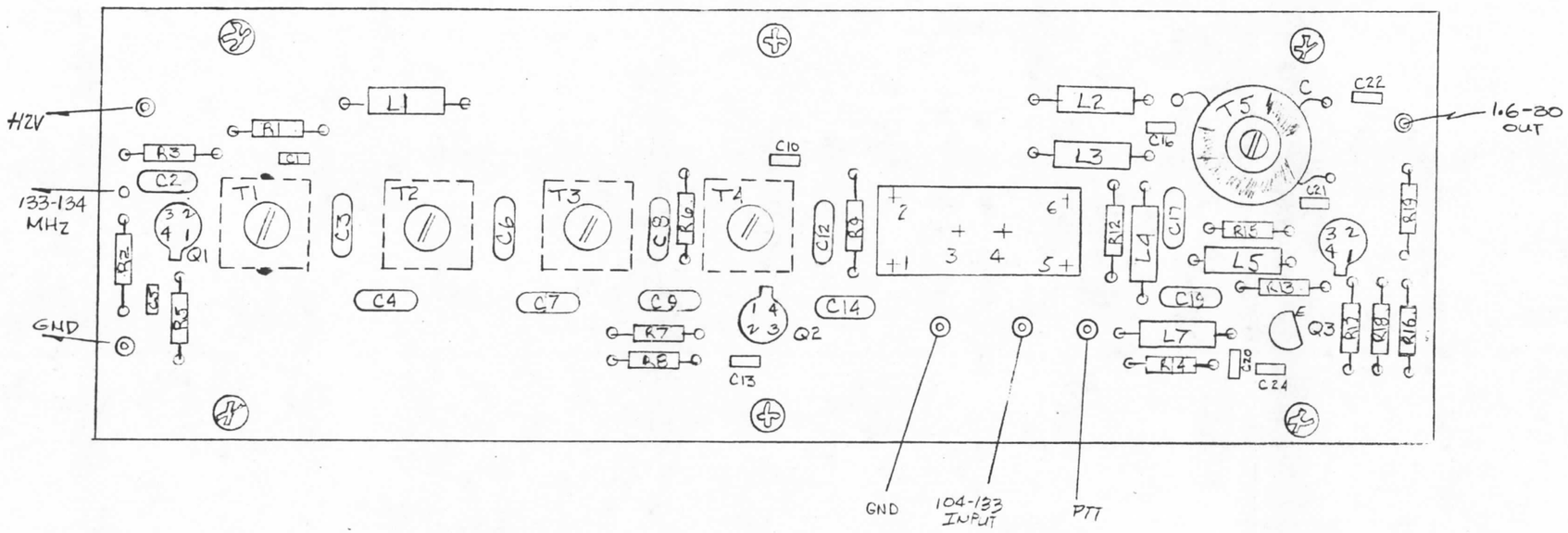
POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:



Z123 TRANSLATOR A5822


+12V
133-134 MHz
GND
1.6-80 OUT
GND
104-133 INPUT
PTT
L1
L2
L3
L4
L5
L7
T1
T2
T3
T4
T5
Q1
Q2
Q3
C1
C2
C3
C4
C6
C7
C8
C9
C10
C12
C13
C14
C16
C17
C19
C21
C22
C24
R1
R2
R3
R4
R5
R6
R7
R8
R9
R12
R13
R14
R15
R16
R17
R18
D1
D2

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____
MODEL NUMBER A5822
DATE COMPILED 8/7/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-1	Cap., Fixed, Cer. 1PF.	A5822	2	C7, 9	
CC131-9	Cap., Fixed, Cer. 5PF.	A5822	2	C4, 14	
CC131-12	Cap., Fixed, Cer. 10PF.	A5822	1	C2	
CC131-13	Cap., Fixed, Cer. 15PF.	A5822	4	C3, 6, 8, 12	
CC131-15	Cap., Fixed, Cer. 33PF.	A5822	1	C19	
CC131-17	Cap., Fixed, Cer. 68PF.	A5822	1	C17	
CC131-20	Cap., Fixed, Cer. 220PF.	A5822	1	C21	
CC131-39	Cap., Fixed, Cer. .1UF	A5822	14	C1,5,10,13,18,20,22,23 24, 25, 26, 27, 28, 29	
CL275-R39	Coil, R.F., Fixed	A5822	1	L3	
CL275-R82	Coil, R.F., Fixed	A5822	1	L4	
CL275-1RO	Coil, R.F., Fixed	A5822	1	L5	
CL275-221	Coil, R.F., Fixed	A5822	4	L1, 2, 7, 8	
NW 163	Network Mixer	A5822	1	Z1	
R07GF101JS	Resistor, Fixed, Comp.	A5822	5	R2, 5, 12, 15, 21	
RC07GF102JS	Resistor, Fixed, Comp.	A5822	4	R3, 7, 14, 17	
RC07GF103JS	Resistor, Fixed, Comp.	A5822	1	R13	
RC07GF122JS	Resistor, Fixed, Comp.	A5822	3	R20, 23, 24	
RC07GF151JS	Resistor, Fixed, Comp.	A5822	2	R8, 22	
RC07GF221JS	Resistor, Fixed, Comp.	A5822	1	R15	
RC07GF242JS	Resistor, Fixed, Comp.	A5822	2	R1, 6	
RC07GF332JS	Resistor, Fixed, Comp.	A5822	1	R16	
RC07GF390JS	Resistor, Fixed, Comp.	A5822	1	R4	
RC07GF430JS	Resistor, Fixed, Comp.	A5822	1	R19	
RC07GF682JS	Resistor, Fixed, Comp.	A5822	1	R18	
RR136	Semicond. Varistor	A5822	2	CR1, 2	
TT285-	Transformer, Tunable	A5822	4	T1, 2, 3, 4	
TZ237	Torriod, Fixed	A5822	1	T5	
2N3646	Transistor	A5822	1	Q3	
2N5179	Transistor	A5822	3	Q1, 2, 5	

4.12 RF AMPLIFIER

GENERAL DESCRIPTION

The RF amplifier assembly provides a nominal 20 db gain to the 50 ohm RF output level required. The RF amplifier assembly also contains a low pass filter to further attenuate harmonics above 34 MHz to an acceptable level. The heart of the RF amplifier assembly is an RF power amplifier ic chip Z1 which is a thin film RF power linear hybrid amplifier. A high level of gain with low distortion and harmonics is achieved through the use of push-pull circuitry in Z1. A portion of the RF output is sampled and detected for use in the RF output metering circuits.

DETAILED DESCRIPTION

Although the RF power amplifier assembly is designed for a 1 watt maximum output, all levels are measured around a 100 milliwatt output level to get maximum third order intermodulation distortion and harmonic figures. With the output of the translator Z123 applied to the input of Z1 the RF amplifier increases the output voltage of the desired output frequency to a level approximately 20 db above that at its input. 100 milliwatts PEP is the nominal output power of the amplifier. Exceeding this level may cause the output signal to contain improper levels of third order intermodulation distortion and also harmonics of the fundamental.

With the output of the hybrid amplifier Z1 applied to the low pass filter circuits consisting of L5, L9, L10, L11, L12, L13 and capacitors C21, C22 and C23, RF output harmonic signals above approximately 34 MHz are attenuated, insuring a low level of harmonic frequency output. A portion of the RF output of Z1 is applied to the RF metering circuits through resistor R5 and capacitor C11 to the meter detect diode CR4 where a proportional DC voltage is developed and then coupled through meter adjust potentiometer R9 and then applied through pin 3 to the RF meter on the front panel assembly. Level adjust potentiometer R9 allows calibration of the front panel RF meter to indicate the correct level of the RF output signal.

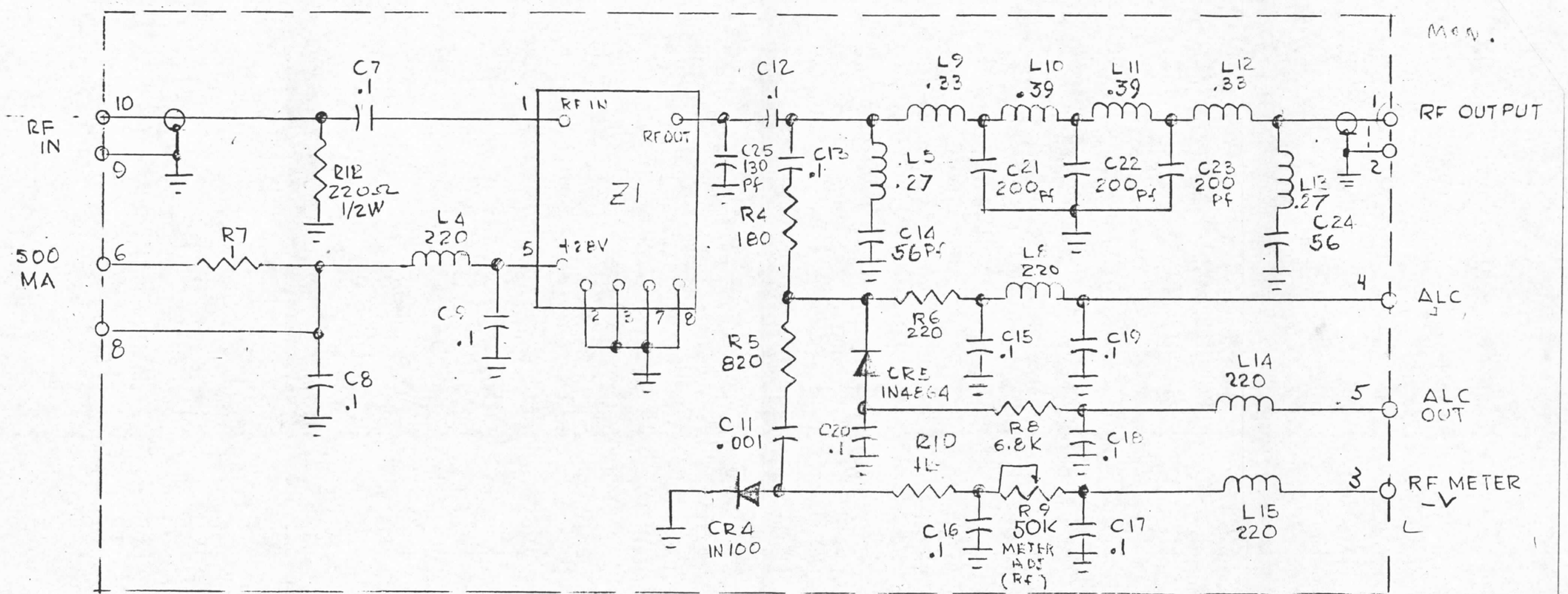
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

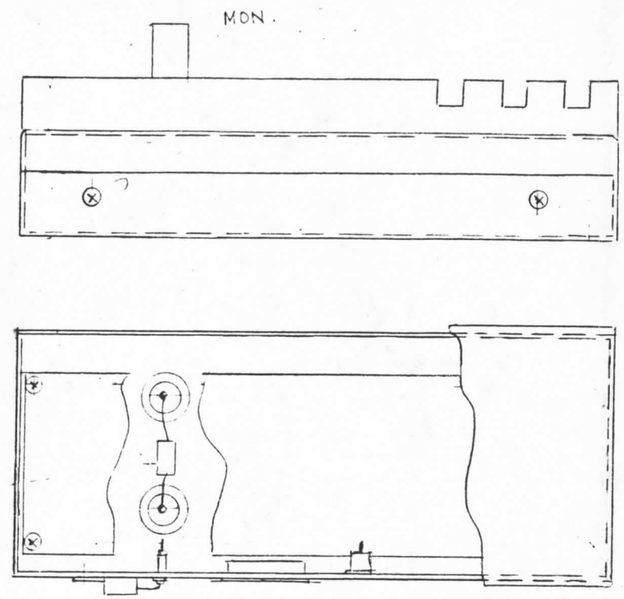
POWER REQUIREMENTS, TYPICAL:

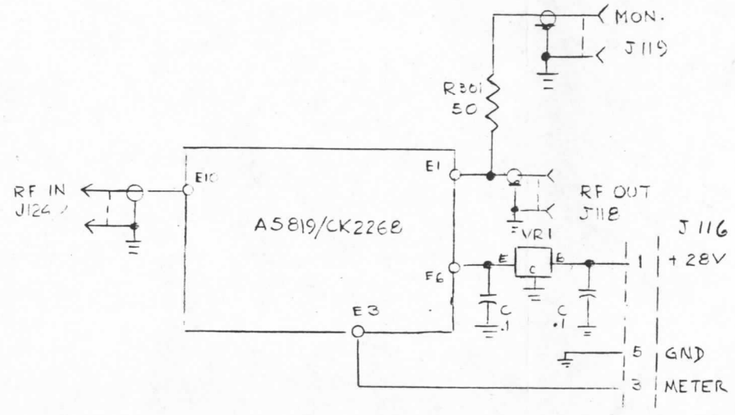
SIGNAL INPUTS:

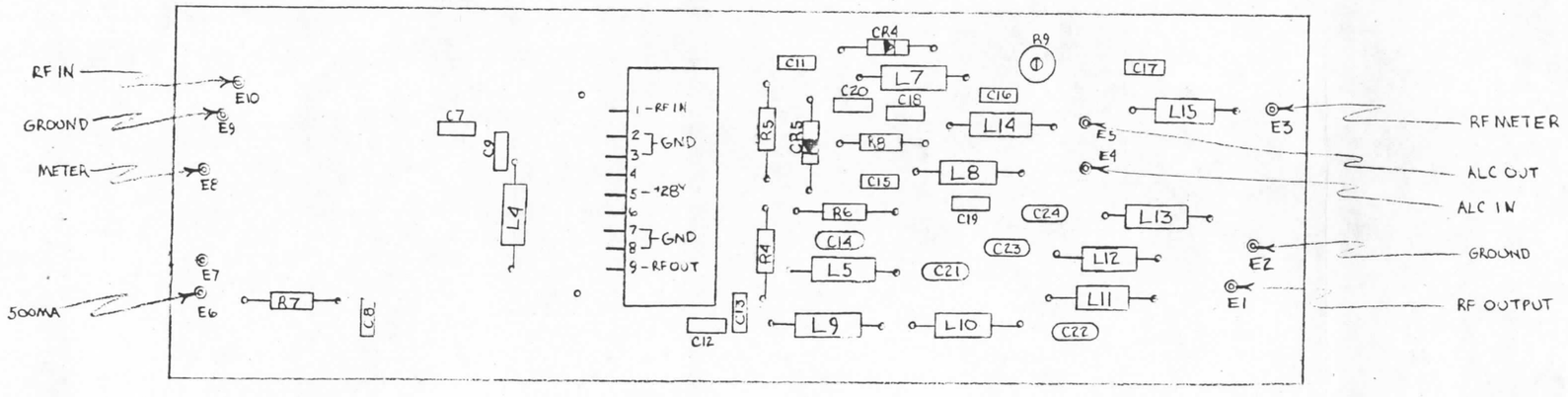
SIGNAL OUTPUTS:



RF AMPLIFIER A5819







RF AMPLIFIER ASSEMBLY A5850

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____
MODEL NUMBER A5819
DATE COMPILED 8/7/85

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC100-24	Cap., Fixed, Ceramic	A5819	1	C11	
CC100-32	Cap., Fixed, Ceramic	A5819	1	C10	
CC100-39	Cap., Fixed, Ceramic	A5819	11	C7, 8, 9, 12, 13, 15, 16, 17, 18, 19, 20	
CK2268	Schematic	A5819	1		
CL275-R27	Coil, RF, Fixed	A5819	2	L5, 13	
CL275-R33	Coil, RF, Fixed	A5819	2	L9, 12	
CL275-2R2	Coil, RF, Fixed	A5819	1	L8	
CL275-39	Coil, RF, Fixed	A5819	2	L10, 11	
CL275-120	Coil, RF, Fixed	A5819	3	L4, 14, 15	
CM111F131J5S	Cap., Fixed, Mica	A5819	1	C25	
CM111F201J5S	Cap., Fixed, Mica	A5819	3	C21, 22, 23	
CM111F560J5S	Cap., Fixed, Mica	A5819	2	C14, 24	
HD138	Heat Sink	A5819	1		
MS7160	Shield, PC Board	A5819	1		
MS7161	Cover, Shield	A5819	1		
RC07GF102J	Resistor, Fixed, Comp.	A5819	1	R10	
RC20GF1ROJ	Resistor, Fixed, Comp.	A5819	1	R7	
RC20GF103J	Resistor, Fixed, Comp.	A5819	1	R3	
RC20GF181J	Resistor, Fixed, Comp.	A5819	1	R4	
RC20GF221J	Resistor, Fixed, Comp.	A5819	2	R6, 11	
RC20GF473J	Resistor, Fixed, Comp.	A5819	1	R9	
RC20GF682J	Resistor, Fixed, Comp.	A5819	1	R8	
RC20GF821J	Resistor, Fixed, Comp.	A5819	1	R5	
RV124-503	Resistor, Variable	A5819	1	R9	
1N100	Resistor, Fixed, Diode	A5819	1	CR4	
1N4864	Resistor, Fixed, Diode	A5819	1	CR5	

4.13 CARRIER GENERATOR

GENERAL DESCRIPTION

A 1 MHz reference standard frequency enters the carrier generator at pin 2 and is applied to the base of driver transistor Q17 and then to buffer Q14. The transistors are driven from cutoff to saturation producing a semi-squarewave of sawtooth waveform which is applied to the input of the divide by 4 logic gate Z1 to create the 250 KHz subcarrier. The divider triggers on the falling edge of the sawtooth waveform and applies its 250 KHz reference frequency to Q11 and Q13 where it is filtered, amplified and keyed.

DETAILED DESCRIPTION

In the CW mode the DC bias for Q11, Q13 and Q14 is enabled by the key line control transistor Q12 which in turn is controlled through L10 by the keyline control input at pin R which is a key closure to ground from the front or rear panel key jacks. A control ground is placed at CW DC control pin 10 and coupled to CW DC control transistor switch Q9 and also to carrier insertion control switch Q7 through steering diode CR7. The collector output of Q7 then goes high placing forward bias on 250 KHz emitter follower Q8. The keyed 250 KHz output at the secondary of T1 is then coupled to the base of the 250 KHz emitter follower Q8 whose emitter output is then coupled to the base of the CW emitter follower transistor Q10 through the CW level adjust R46. This level is set to the proper CW output level.

In the audio modes the output of the secondary of T1 is applied through coupling capacitor C32 to the 250 KHz output at pin B. This is the 250 KHz carrier frequency for all audio modes. The secondary output of T1 is also coupled to the base of the 250 KHz emitter follower Q8 through coupling capacitor C38. Q8 will only be energized when sideband operation with reinserted carrier or CW operation is selected by the front panel control.

In SSB operation a control ground is placed at the keyline control transistor Q12 from CW key control input pin N. This control ground keeps Q11, Q13 and Q14 constantly on and provides the 250 KHz carrier. With no carrier insertion the carrier insertion control switch Q7, which is normally enabled, removes the forward bias from the 250 KHz transistor Q8 and the maximum amount of carrier rejection is obtained. If carrier reinsertion is entered into the front panel assembly a control ground is placed at one of the three transistor switches Q1, Q2 or Q5 depending on the amount of reinsertion selected. The control ground is also applied to the base of the carrier insertion control switch Q7 through one of the steering diodes CR4, CR5 or CR6. The method of controlling the amount of carrier insertion is the same for any amount specified. For the purpose of this discussion -6DB of carrier insertion will be used. A control ground is applied to pin D and coupled directly to the base of carrier insertion control transistor Q1. Q1 collector voltage

goes high and places a forward bias on carrier insertion emitter follower Q3. The control ground at pin D is also applied to the base of the carrier insertion control switch Q7 through steering diode CR5. With Q7 turned off the low is removed from the forward bias circuit of Q8 turning it on. The signal at the emitter output of Q8 is then developed across the -6 adjust potentiometer R98 where the correct level of carrier reinsertion is set and coupled into the base of the carrier insert emitter follower Q3. With Q3 enabled as described above the 250 KHz carrier is coupled to the carrier output pin 9 for reinsertion to the carrier. A portion of the 250 KHz is applied to the base of the X11 multiplier Q15. The collector output of Q15 is developed across the secondary of T3 which selects the 11th harmonic (2.750 MHz) of the 250 KHz reference signal. The unfiltered 2.750MHz is then applied to FL1 for removal of all undesired harmonics. Q18 then amplifies the signal and offers the correct output impedance through T4 to the output at pin 6.

The AM amplifier section performs the function of amplitude-modulating the 250 KHz subcarrier signal with audio intelligence in the 350 Hz to 7500 Hz range, and supplies it to the 3 MHz generator board Z003 when selected by front panel control.

With the AM position selected a control ground is placed at the base of Q24 from pin 11. Q24 is normally biased on removing forward bias from Q19, Q21, Q22 and Q25, effectively turning off the AM modulator circuit. With Q24 disabled USB and/or LSB audio is supplied from the front panel audio level control through coupling capacitors C41 and C36 to the bases of Q19 and Q21 conventional audio amplifiers. Both collector outputs are tied to amplifier Q20 whose collector output is developed across transformer T6. The secondary output from T6 is then applied to the tuned collector circuit of modulator Q22. The 250 KHz subcarrier frequency is coupled to the base of the 250 KHz amplifier Q23. The collector output of Q23 is coupled through capacitor C61 to the base of modulator Q22. Since the tuned collector of Q22 is modulated with the audio signal, the resultant collector signal across the T5 primary and C66 consists of a 250 KHz subcarrier whose amplitude fluctuates at the audio signal rate. The 250 KHz amplitude modulated signal at the T5 tuhed secondary is developed across AM level adjust R90 and coupled through C77 to the base of the AM gating transistor Q25. The emitter output of Q25 is then coupled to the 250 KHz AM output pin 15.

A tune ground signal normally supplied from the associated transmitter automatically switches the Exciter to a CW mode of operation. Tune input at pin M places a ground at Q7 through steering diodes CR2 and CR7, CW control transistor Q9 and also to divider stage control transistor Q12 through steering diode CR1. This causes the divider stages and the gating/amplifier stages to be energized in the CW mode regardless of mode of operation selected on the front panel assembly.

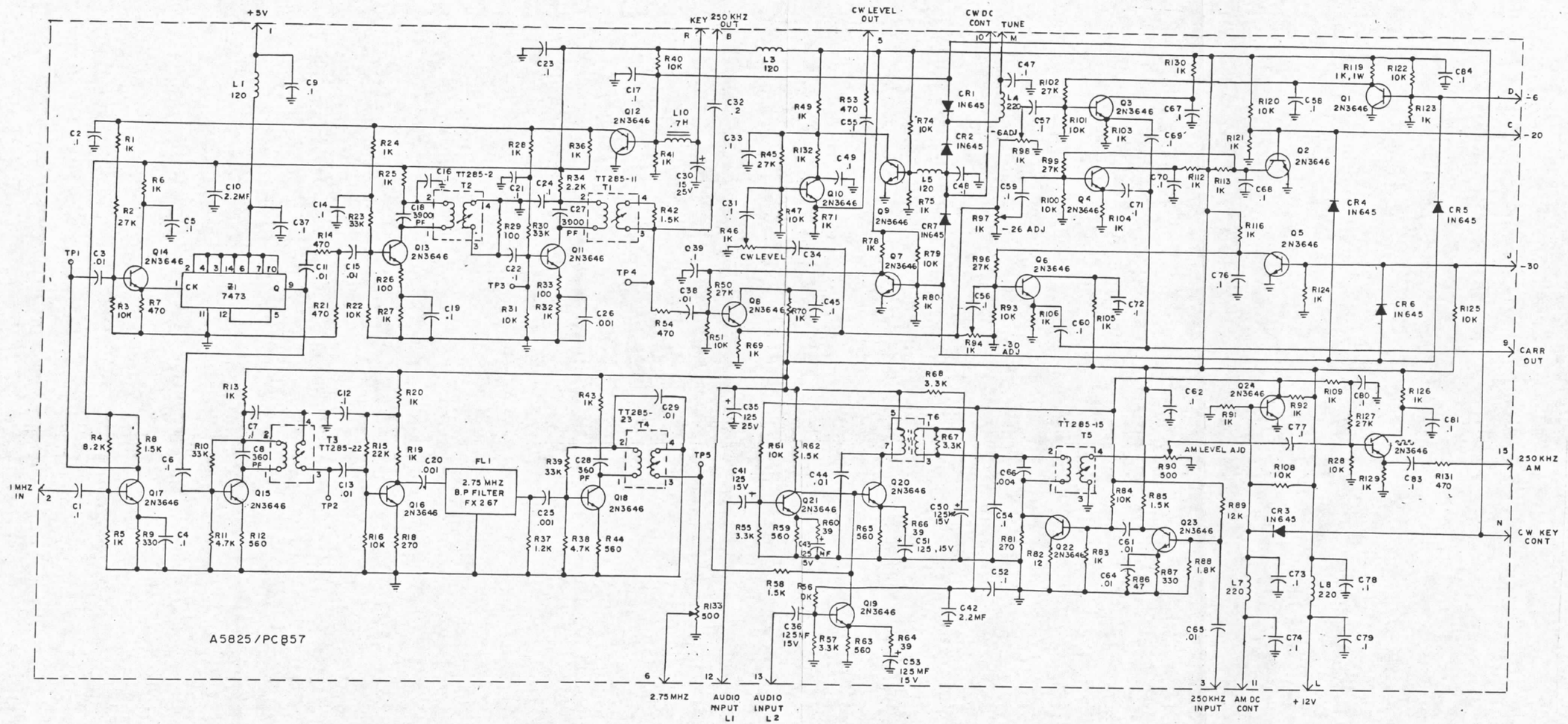
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

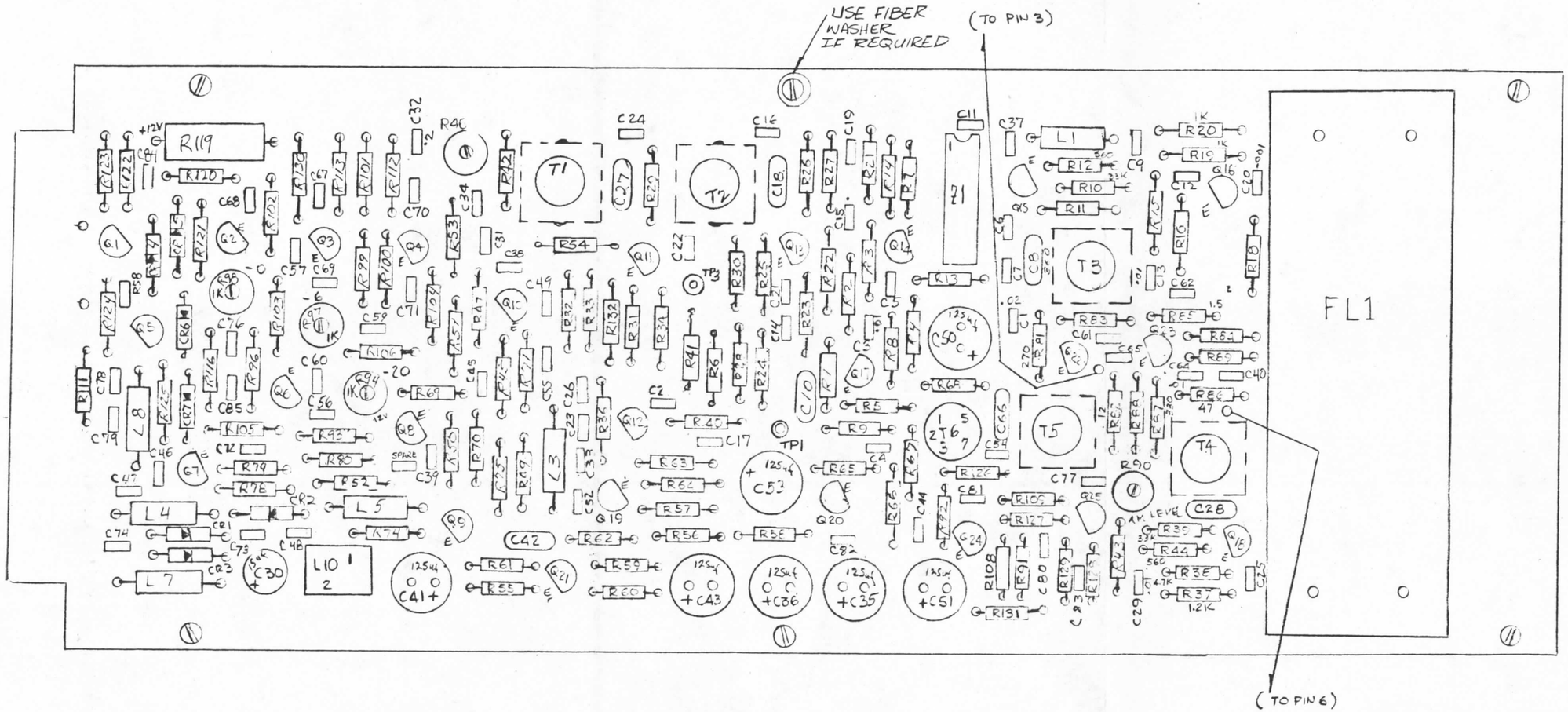
POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:



Z115 CARRIER GENERATOR A5825



Z115 CARRIER GENERATOR A5825

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER A5825

DATE COMPILED _____

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-24	Cap., Fxd., Cer. 2.2UFD	A5825	3	C20, 25, 26	
CC131-29	Cap., Fxd., Cer. 3300PF	A5825	1	C66	
CC131-32	Cap., Fxd., Cer. .01UFD	A5825	10	C3, 11, 13, 15, 29, 38, 44, 61, 64, 65	
CC131-39	Cap., Fxd., Cer. .1UFD	A5825	54	C1, 4, 5, 6, 7, 9, 12, 14, 16, 17, 19, 21, 22, 23, 24, 31, 33, 34, 37, 39, 40, 45, 46, 47, 48, 49, 52, 54, 55, 56, 57, 58, 59, 60, 62, 67, 68, 69, 70, 71, 72, 73, 74, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85	
CC131-41	Cap., Fxd., Cer. .22UFD	A5825	1	C32	
CC131-48	Cap., Fxd., Cer. 2.2UFD	A5825	2	C10, 42	
CE135-1	Cap., Fxd., Elect. 15UF 25V	A5825	1	C30	
CE135-7	Cap., Fxd., Elect. 125UF 25V	A5825	7	C35, 36, 41, 43, 50, 51, 53	
CK2260	Dia., Schematic	A5825	1		
CL275-221	Choke 220UH	A5825	6	L1, 3, 4, 5, 7, 8	
CL501	Choke .7H	A5825	1	L10	
CM111F361F5S	Cap., Fxd., Mica	A5825	2	C8, 28	
CM112F392F5S	Cap., Fxd., Mica	A5825	2	C18, 27	
FX267	Filter, Band Pass	A5825	1	FL1	
NW7473	Network, Semicond.	A5825	1	Z1	
PC857A	Printed Circuit Bd.	A5825	1		
RC07GF101J	Resistor Carbon	A5825	3	R26, 29, 33	
RC07GF102J	Resistor Carbon	A5825	42	R1, 5, 6, 13, 19, 20, 24, 25, 27, 28, 32, 34, 36, 41, 43, 47, 48, 49, 52, 69, 70, 71, 75, 78, 80, 83, 91, 103, 104, 105, 106, 109, 112, 113, 116, 121, 123, 124, 126, 129, 130, 132	
RC07GF103J	Resistor, Carbon	A5825	20	R3, 16, 22, 31, 40, 51, 56, 61, 74, 79, 84, 93, 100, 108, 120, 122, 125, 128, 101, 47	

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER _____

MODEL NUMBER A5825

DATE COMPILED _____

Part Number	Description	Used On	Qty	Symbol Number	S1200
RC07GF120J	Resistor, Carbon	A5825	1	R82	
RC07GF122J	Resistor, Carbon	A5825	1	R37	
RC07GF123J	Resistor, Carbon	A5825	1	R89	
RC07GF152J	Resistor, Carbon	A5825	5	R8, 42, 58, 62, 85	
RC07GF182J	Resistor, Carbon	A5825	1	R88	
RC07GF222J	Resistor, Carbon	A5825	1	R34	
RC07GF223J	Resistor, Carbon	A5825	1	R15	
RC07GF271J	Resistor, Carbon	A5825	2	R81, 18	
RC07GF273J	Resistor, Carbon	A5825	7	R2, 45, 50, 96, 99, 102, 127	
RC07GF331J	Resistor, Carbon	A5825	2	R9, 87	
RC07GF332J	Resistor, Carbon	A5825	4	R55, 57, 67, 68	
RC07GF333J	Resistor, Carbon	A5825	4	R10, 23, 30, 39	
RC07GF390J	Resistor, Carbon	A5825	3	R60, 64, 66	
RC07GF470J	Resistor, Carbon	A5825	1	R86	
RC07GF471J	Resistor, Carbon	A5825	7	R7, 14, 21, 53, 54, 111, 131	
RC07GF472J	Resistor, Carbon	A5825	2	R11, 38	
RC07GF561J	Resistor, Carbon	A5825	5	R12, 44, 59, 63, 65	
RC07GF822J	Resistor, Carbon	A5825	1	R4	
RC32GF102J	Resistor, Carbon	A5825	2	R92, 119	
RV124-1-102	Resistor, Var.	A5825	4	R94, 97, 98, 46	
RV124-1-501	Resistor, Var.	A5825	1	R90	
RV124-1-502	Resistor, Var.	A5825	1	R17	
TF420	Transformer, Audio	A5825	1	T6	
TT285-11	Transformer, Output	A5825	1	T1	
TT285-12	Transformer, Interstage	A5825	1	T2	
TT285-15	Transformer, Interstage	A5825	1	T5	
TT285-22	Transformer, Interstage	A5825	1	T3	
TT285-23	Transformer, Output	A5825	1	T4	
1N645	Diode, Semicond.	A5825	7	CR1, 2, 3, 4, 5, 6, 7	
2N3646	Transistor, Semicond.	A5825	25	Q1 thru Q25	

4.14 SIDEBAND GENERATOR

GENERAL DESCRIPTION

The sideband generators Z004 and Z113 are identical in configuration and operation. USB will be used for this explanation.

The USB modulation circuit receives the audio input from the front panel level control. The input to the front panel level control can be either a 600 ohm line at the rear panel of the MMX or through a preamplified front panel microphone jack. Whether the front panel audio control switch is in microphone or line position the USB gain control always sets the amplitude of the USB audio signal input to the USB sideband generator. These signals are applied to a balanced modulator to derive the upper and/or lower sideband intelligence; the 250 KHz subcarrier is suppressed. The resulting USB and/or LSB signals are then routed to the converter section of the 3 MHz assembly Z003. A sample of the audio is rectified to operate the audio input level meter and VOX circuits.

Mode switching at this point can be divided into 3 sections; Audio, CW, FSK and FAX Operation.

DETAILED DESCRIPTION

With USB or ISB as the selected mode, audio signals developed across the AF gain control are coupled through C14 to the base of the audio emitter follower Q2. Output signals at the emitter are RC coupled to the balanced modulator consisting of diodes CR1-CR4 where they are modulated by the 250KHz subcarrier. Output signals from the 250KHz emitter follower Q8 are also supplied to the mixer which produces sum and difference frequencies and attenuates the subcarrier and audio frequencies. The sum and difference frequencies are transformer coupled via T1 to IF amplifier Q3. The sideband output at the collector of Q3 is coupled through C18 and USB filter FL1 to IF emitter follower Q4.

In the upper sideband generator FL1 is tuned to the upper sideband frequency 250,350 Hz. In the lower sideband generator FL1 is tuned to the lower sideband frequency range of 242,500 to 249,650 Hz.

The filter consisting of T1 tuned primary, C29, C40 and trimmer capacitor C28, presents a decided notch there by fully suppressing the 250 KHz subcarrier center frequency.

DC control transistor Q1 is biased on removing forward bias from Q2, Q3, Q4 and Q8. This disables the output of the sideband generator and allows the use of other modes to create a 3 MHZ carrier. Control ground on pin E from the processor is required to return normal bias to the amplifiers and allow sideband output at pin 4 to the 3 MHz mixer. During ISB operation a control ground is placed at pin C disabling Q10 and enabling Q11, placing

R54 ISB adjust in the forward biasing circuit of Q2 audio amplifier. This allows the gain of Q2 to be preset, satisfying the requirements of ISB operation. Under USB operation pin C is high and Q11 is disabled.

The metering circuit consists of meter amplifier Q5, emitter follower Q6, and the halfwave filter output consisting of diode CR7 and capacitors C36 and C37. This circuit receives either microphone or 600 ohm line from the USB/LSB/MIKE/LINE controls via the USB or LSB positions of the meter switch S and provides conversion to a DC level proportional to amplitude for display on the front panel meter. The sideband output from amplifier Q4 is coupled through C22 and R34 to output pin 4 and then applied to the 3 MHz assembly.

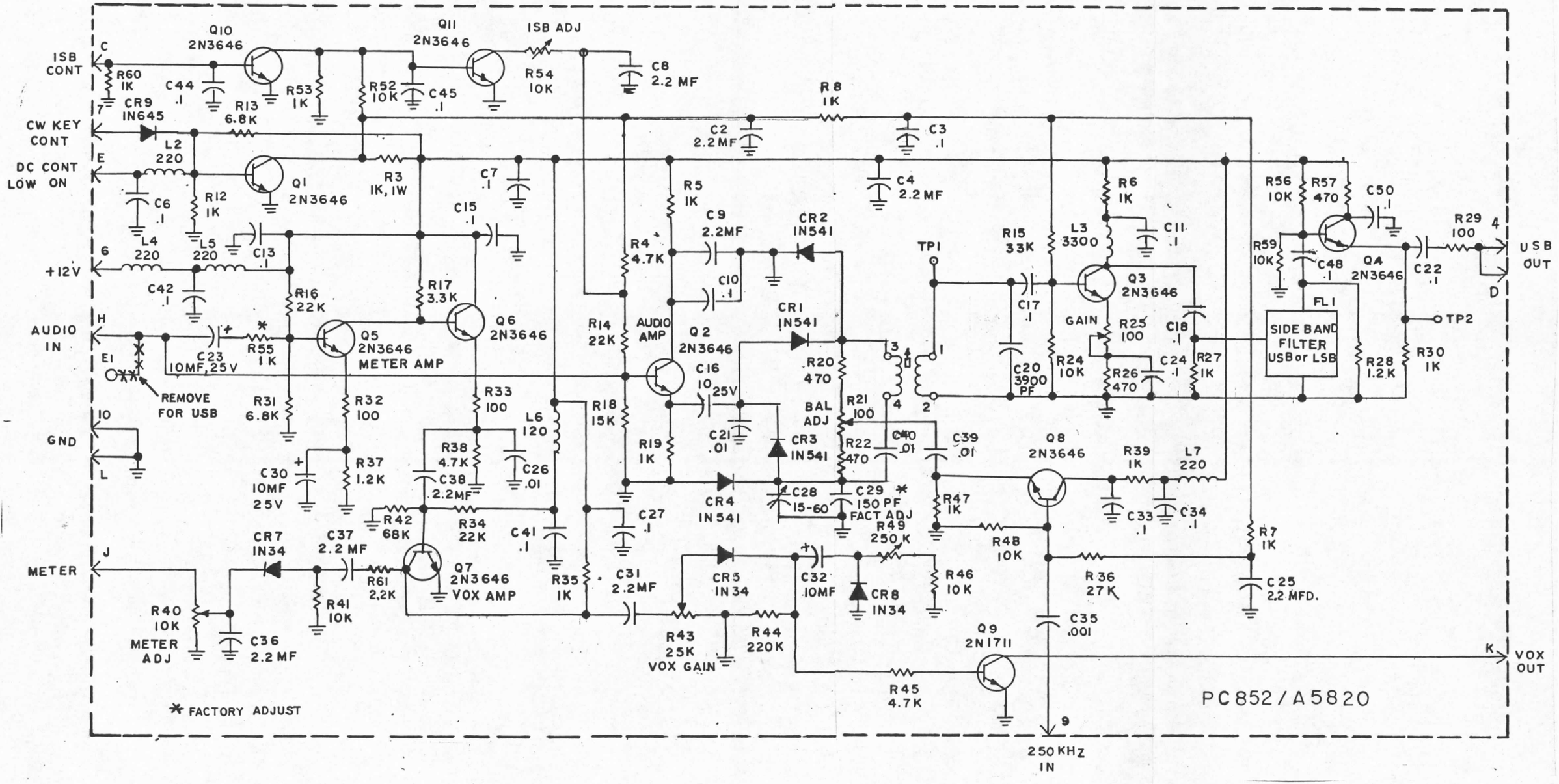
TECHNICAL CHARACTERISTICS:

DIMENSIONS:

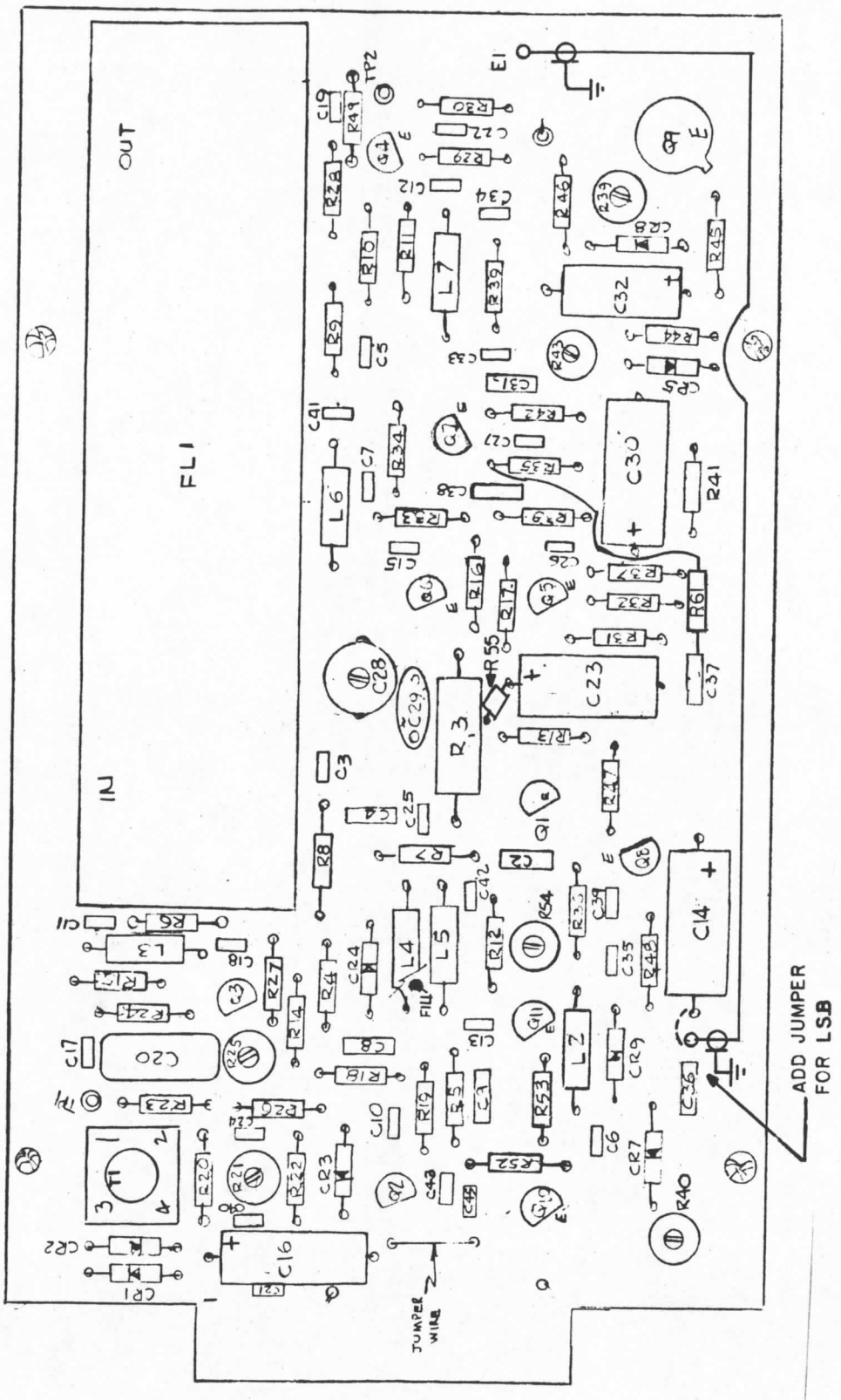
POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

SIGNAL OUTPUTS:



Z004,Z113 SIDEBAND GENERATOR A5820



Z004 SIDEBAND GENERATOR A5822
Z113

MATERIAL LIST

030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER X4
MODEL NUMBER A5820
DATE COMPILED 5-2-85

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-24	Cap., Fxd., Cer. 1000PF	A5820	1	C35	
CC131-19	Cap., Fxd., Cer. 150PF	A5820	1	C29	
CC131-32	Cap., Fxd., Cer. .01uf	A5820	4	C21,26,39,40	
CC131-39	Cap., Fxd., Cer. .1uf	A5820	22	C3,5,6,7,10,11,12,13,15 17,18,19,22,24, ,27,33, 34,41,44,45,48,50	
CC131-48	Cap., Fxd., Cer. 2.2uf	A5820	9	C2,4,8,9,31,36,37,38,25	
CE105-5-25	Cap., Fxd. Elect.	A5820	1	C32	
CE105-10uf25v	Cap., Fxd. Elect.	A5820	4	C14,16,23,30	
CK2261	Schematic, Dia.	A5820	1		
CL275-221	Coil, RF 220uf	A5820	5	L2,4,5,6,7	
CL275-332	Coil, RF 220uh	A5820	1	L3	
CM111F392J1SS	Cap., Fxd., Mica.	A5820	1	C20	
CV112-5	Cap., Var., Mica.	A5820	1	C28	
1N541	Semiconduct. Diode	A5820	4	CR1,2,3,4	
1N645	Semiconduct. Diode	A5820	1	CR9	
1N914	Semiconduct. Diode	A5820	3	CR5,7,8	
RC07GF222J	Resistor, Fxd. Comp.	A5820	1	R61	
RC07GF101J	Resistor, Fxd. Comp.	A5820	3	R29,32,33	
RC07GF102J	Resistor, Fxd. Comp.	A5820	15	R5,6,7,8,9,12,19, ,27, 30,35,39,47,53,55,60	
RC07GF103J	Resistor, Fxd. Comp.	A5820	8	R10, ,24,41,44,46,48 49,52	
RC07GF122J	Resistor, Fxd. Comp.	A5820	2	R28,37	
RC07GF153J	Resistor, Fxd. Comp.	A5820	1	R18	
RC07GF223J	Resistor, Fxd. Comp.	A5820	3	R14,16,34	
RC07GF273J	Resistor, Fxd. Comp.	A5820	1	R36	
RC07GF332J	Resistor, Fxd. Comp.	A5820	1	R17	
RC07GF333J	Resistor, Fxd. Comp.	A5820	1	R15	
RC07GF471	Resistor, Fxd. Comp.	A5820	4	R11,20,22,26	
RC07GF472	Resistor, Fxd. Comp.	A5820	3	R4,38,45	
RC07GF682	Resistor, Fxd. Comp.	A5820	2	R13,31	
RC07GF683	Resistor, Fxd. Comp.	A5820	1	R42	
RC32GF102J	Resistor, Fxd. Comp.	A5820	1	R5	
RV124-1-101	Resistor, Var. Comp.	A5820	2	R21,25	
RV124-1-253	Resistor, Var. Comp.	A5820	1	R43	
RV124-1-254	Resistor, Var. Comp.	A5820	1	R49	
RV124-1-103	Resistor, Var. Comp.	A5820	2	R40,54	
TT285-11	Transformer, Tuned	A5820	1	T1	
2N1711	Semiconductor, Trans.	A5820	2	Q1,9	
2N3646	Semiconductor, Transistor	A5820	9	Q2,3,4,5,6,7,8,10,11	
FX265 *Optional	Filter, USB	A5820	1	FL1	
FX266 *Optional	Filter, LSB	A5820	1	FL1	

4.15 3 MHz GENERATOR

GENERAL DESCRIPTION

The 3MHz generator consists of two sections: the frequency shift amplifier and buffer section and the converter section. The frequency shift amplifier and buffer operate in the frequency shift (FSK) and facsimile (FAX) modes. The converter section operates in all other modes except FSK and FAX and functions to produce an amplitude-modulated (AM) or single sideband (SSB) RF carrier of 3MHz for use in the final mixer.

DETAILED DESCRIPTION

AUDIO MODES

With any mode selected except FSK/FAX a control high is placed at pin E and coupled to the base of transistor switch Q4 through CR1. This turns on Q4 which then places a low at the base of transistor switch Q5. With Q5 disabled forward bias voltage for the converter section will be enabled to 2.750MHz amplifiers Q2 and Q3.

2.750 MHz developed in the carrier generator circuits Z115 is applied to pin D and coupled through C3 to the base of 2.750MHz input amplifier Q1. This input is amplified and then applied to the 2.750MHz emitter follower Q2. The output from Q2 is applied to balanced modulator Z1 in the AM mode. The 250 KHz input signal consists simply of a 250 KHz subcarrier, amplitude-modulated by audio intelligence in the 350 to 7500 Hz range. When the signal is mixed with the 2.750MHz input the balanced modulator produces sum and difference frequencies while attenuating the two original frequencies. The combination of tuned transformer T1 and capacitor C20 traps the 2.750MHz signal. As a result an amplitude-modulated sum frequency of 3 MHz results and is amplified by Q3. The collector output of Q3 is coupled through the 3 MHz bandpass filter FL1 and is amplified and filtered by tuned collector stages Q6 and Q12. The 3MHz tuned collector output of Q12 is developed across level adjust potentiometer R49 and is applied to the final mixer Z106.

With USB, LSB or ISB selected the 250 KHz input to the converter section consists of an upper and/or a lower sideband audio intelligence in the 300 to 3300 Hz range with the 250 KHz carrier suppressed or unsuppressed according to the amount of the carrier insertion control entered on the front panel.

Since the 2.750MHz RF carrier input is also present in these modes, the balanced modulator produces upper and/or lower sideband signals with a center frequency of 3MHz. If the 250 KHz subcarrier is suppressed, so also is the 3MHz carrier-- the sum frequency of 2.750 MHz and 250 KHz. The upper and/or lower sideband signals are amplified in the same manner as the AM signal and are sent to the final mixer Z106.

In the CW mode the 250 MHz input is not modulated by audio intelligence, but is interrupted at a rate determined by a keyer input at key jack J301 on the front panel or on the rear panel audio jack J121 pin 21. This results in a keyed difference frequency of 3MHz in the balanced modulator. The CW RF is then amplified as before and sent to the final mixer.

SHIFT MODES

When FSK or FAX operation is selected a control ground is applied to pin E through CR1 to the base of transistor switch Q4. Q4 then enables the forward bias to Q7, Q10 and Q11 (the FSK/FAX buffer amplifiers). The 3 MHz signal from the shift generator Z117 is applied at pin F and capacitively coupled to the base of buffer-amplifier Q7 and applied to the base of Q8. Q8 and Q9 act together to maintain amplitude within acceptable limits without destroying the frequency shift characteristics. The limiter output at the collector of Q9 is applied to emitter follower Q10 and then applied through FSK/FAX level control R49 to amplifier Q11. Since the 2.750MHz amplifiers are disabled in the FSK/FAX modes the 3MHz output at the collector of Q11 is then injected directly into the 3MHz bandpass filter.

TECHNICAL CHARACTERISTICS:

DIMENSIONS:

POWER REQUIREMENTS, TYPICAL:

SIGNAL INPUTS:

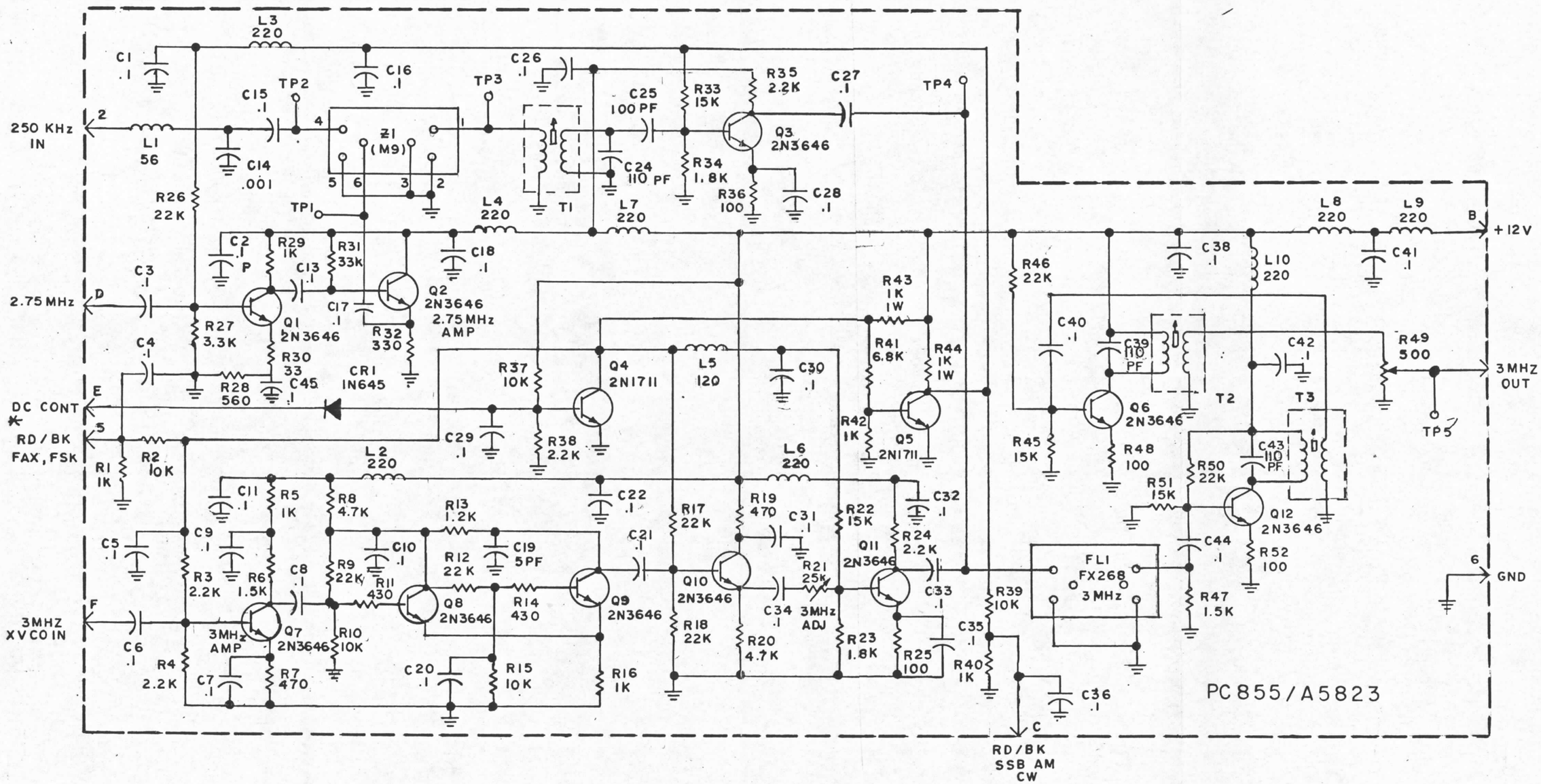
SIGNAL OUTPUTS:

MATERIAL LIST

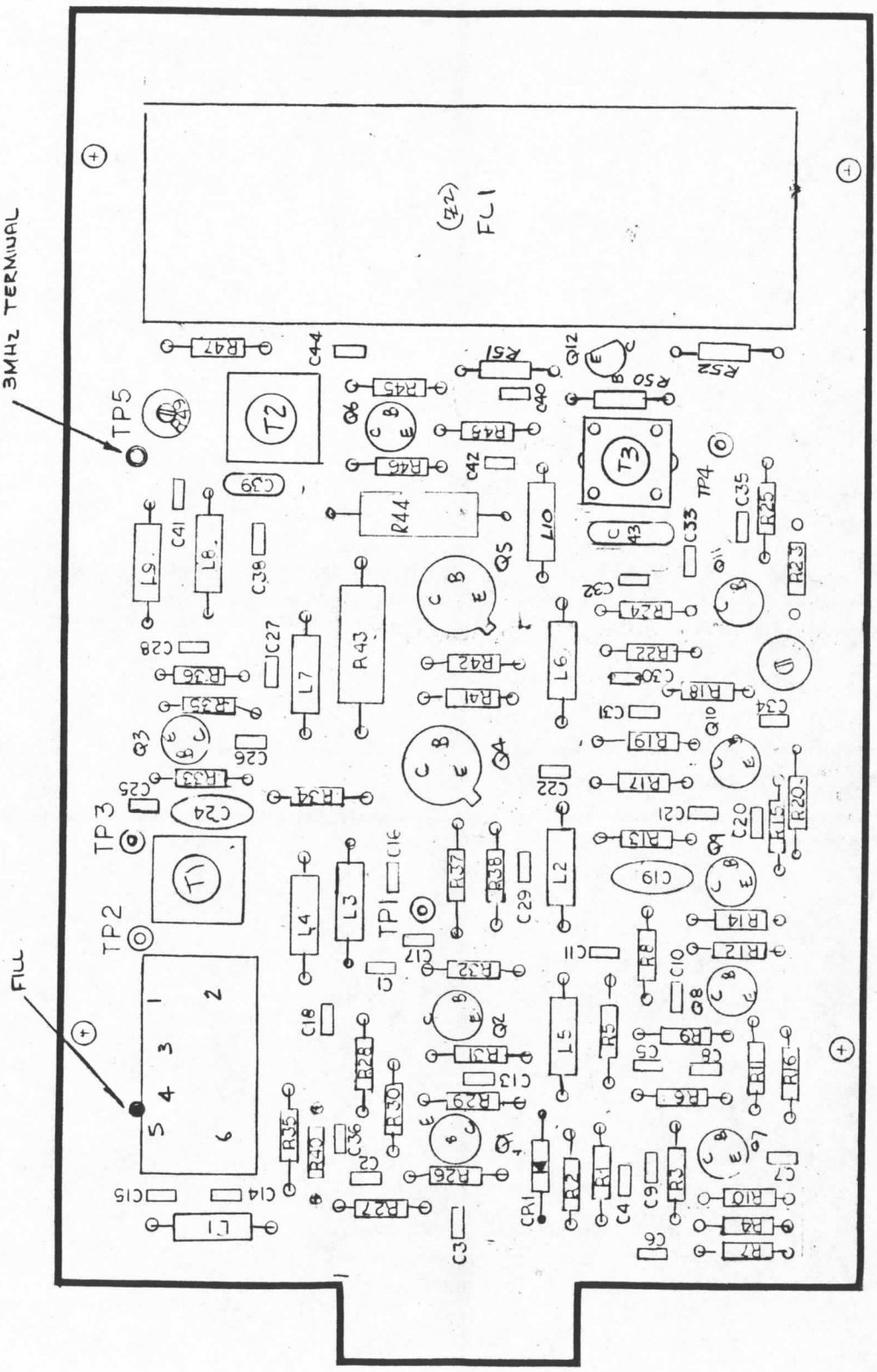
030 – General
031 – Electrical
032 – Mechanical

LIST NUMBER X3
MODEL NUMBER A5823
DATE COMPILED 7/10/85

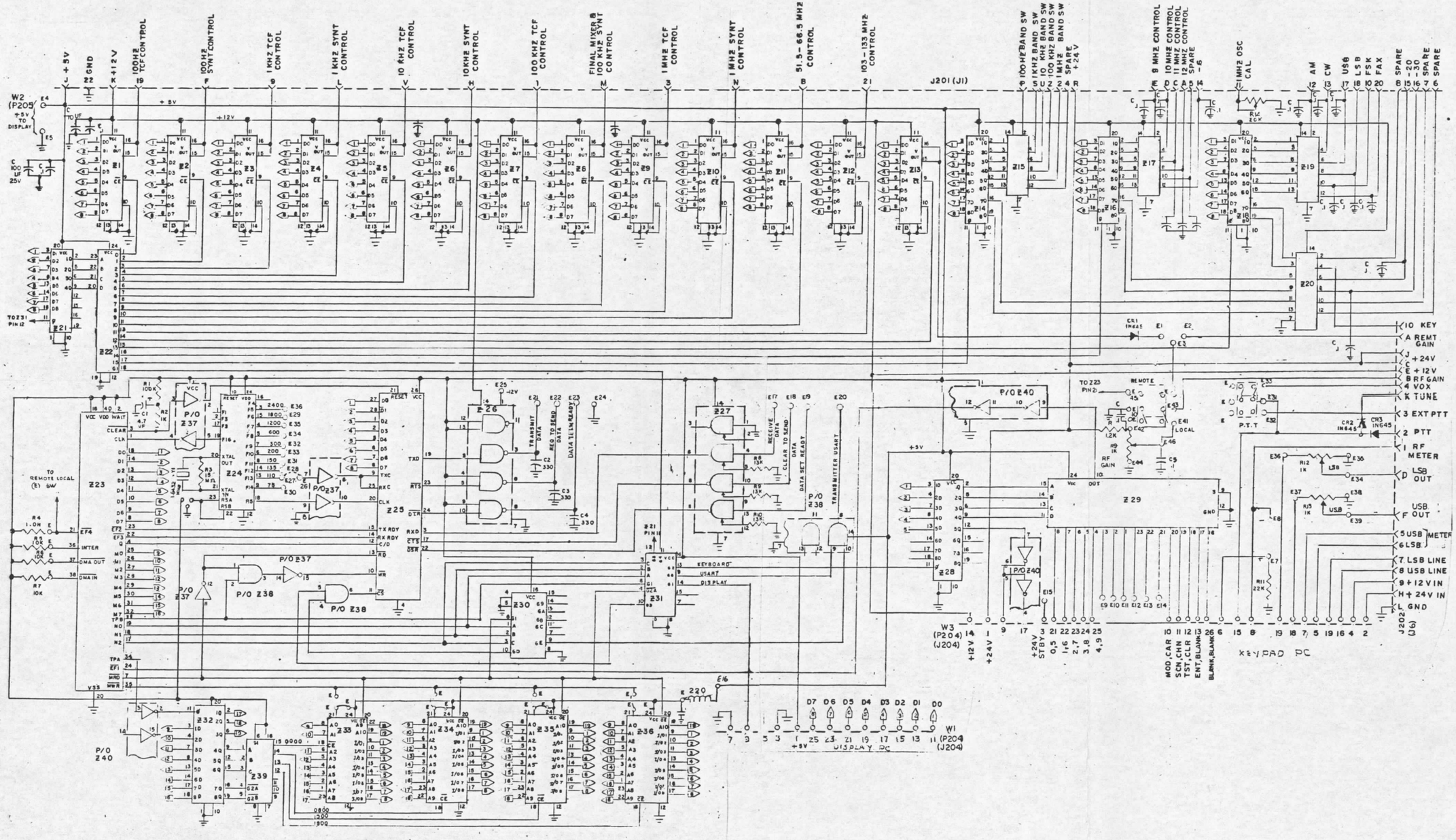
Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-24	Cap., Fxd., Cer.	A5823	1	C14	
CC131-39	Cap., Fad., Cer.	A5823	39	C1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 44, 45	
CL275-221	Coil, RF, Fxd.	A5823	9	L2, 3, 4, 5, 6, 7, 8, 9, 10	
CL275-560	Coil, RF, Fxd.	A5823	1	L1	
CM111E050J1SS	Cap., Fxd., Mica	A5823	2	C19, 25	
CM111E111J1SS	Cap., Fxd., Mica	A5823	3	C24, 39, 43	
FX268	Fil., BP.	A5823	1	FL1	
NW163	NW Bal. Mixer	A5823	1	Z1	
RC07GF101J	Res., Fxd., Comp.	A5823	4	R25, 36, 48, 52	
RC07GF102J	Res., Fxd., Comp.	A5823	6	R1, 5, 16, 29, 40, 42	
RC07GF103J	Res., Fxd., Comp.	A5823	5	R2, 10, 15, 37, 39	
RC07GF122J	Res., Fxd., Comp.	A5823	1	R13	
RC07GF152J	Res., Fxd., Comp.	A5823	2	R6, 47	
RC07GF153J	Res., Fxd., Comp.	A5823	4	R22, 33, 45, 51	
RC07GF182J	Res., Fxd., Comp.	A5823	2	R23, 34	
RC07GF222J	Res., Fxd., Comp.	A5823	5	R3, 4, 24, 35, 38	
RC07GF223J	Res., Fxd., Comp.	A5823	7	R9, 12, 17, 18, 26, 46 50	
RC07GF330J	Res., Fxd., Comp.	A5823	1	R30	
RC07GF331J	Res., Fxd., Comp.	A5823	1	R32	
RC07GF333J	Res., Fxd., Comp.	A5823	2	R27, 31	
RC07GF431J	Res., Fxd., Comp.	A5823	2	R11, 14	
RC07GF471J	Res., Fxd., Comp.	A5823	2	R7, 19	
RC07GF472J	Res., Fxd., Comp.	A5823	2	R8, 20	
RC07GF561J	Res., Fxd., Comp.	A5823	1	R28	
RC07GF682J	Res., Fxd., Comp.	A5823	1	R41	
RC32GF102J	Res., Fxd., Comp.	A5823	2	R43, 44	
RV124-1-501	Res., Var., Comp.	A5823	1	R49	
RV124-1-253	Res., Var., Comp.	A5823	1	R21	
TE0127-2	Term., Lug	A5823	5	TP1, 2, 3, 4, 5	
TT285-14	XFMR, RF, Adj.	A5823	3	T1, 2, 3	
1N645	Scond, Dev., Dio	A5823	1	CR1	
2N1711	Transistor	A5823	2	Q4, 5	
2N3646	Transistor	A5823	9	Q1, 2, 3, 6, 7, 8, 9, 10, 11, 12	
CK2259	Schematic	A5823	1		
PC855	Printed ckt. bd.	A5823	1		



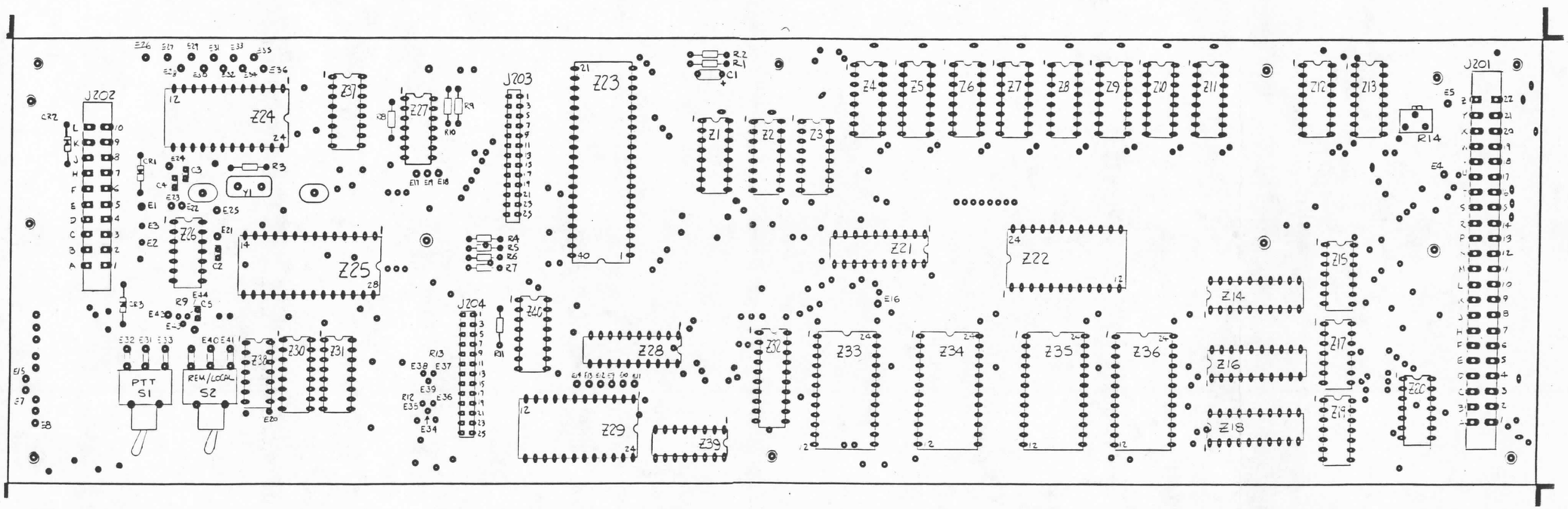
Z003 3 MHz GENERATOR A5823



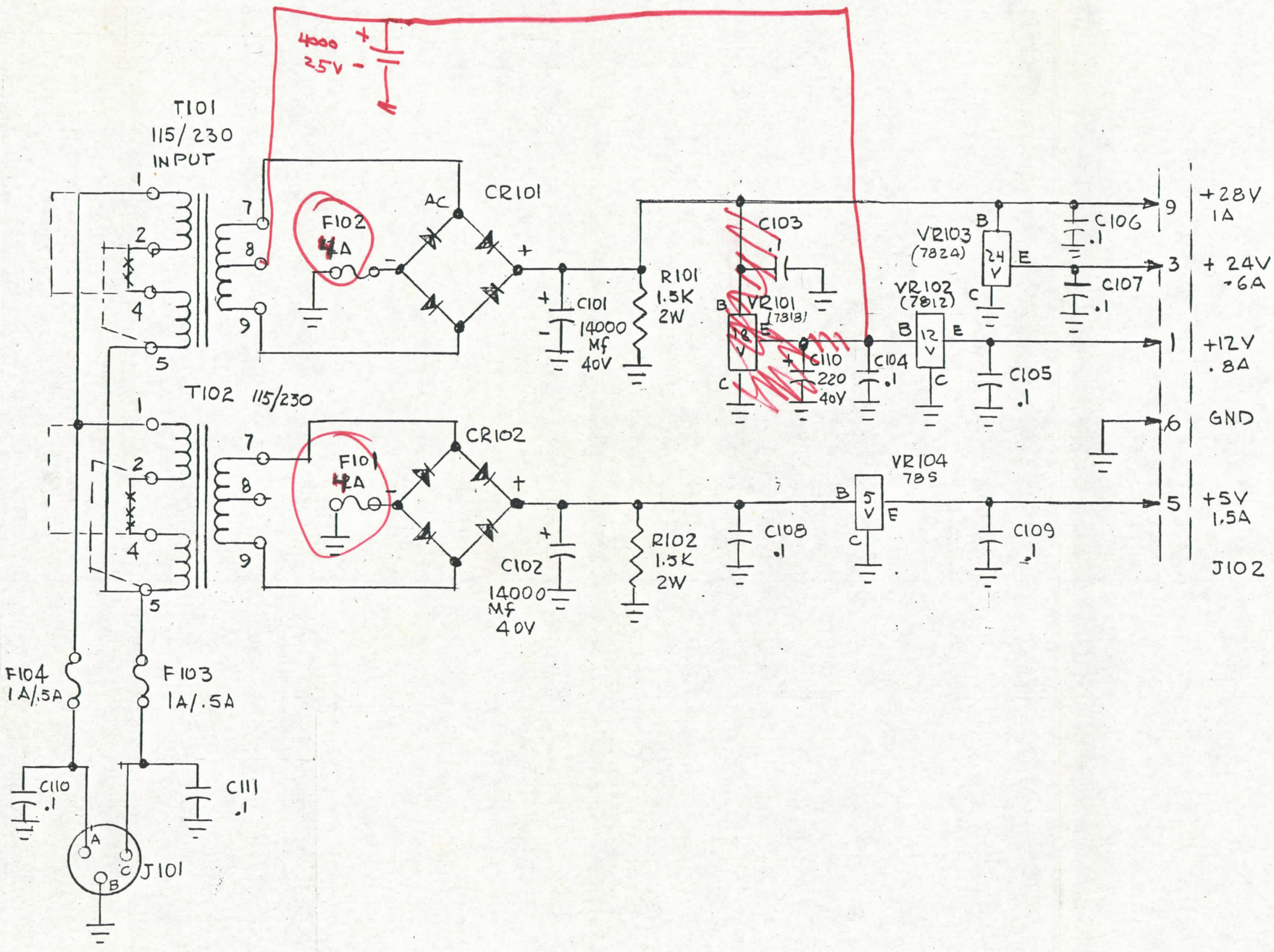
Z003 3 MHZ GENERATOR A5823

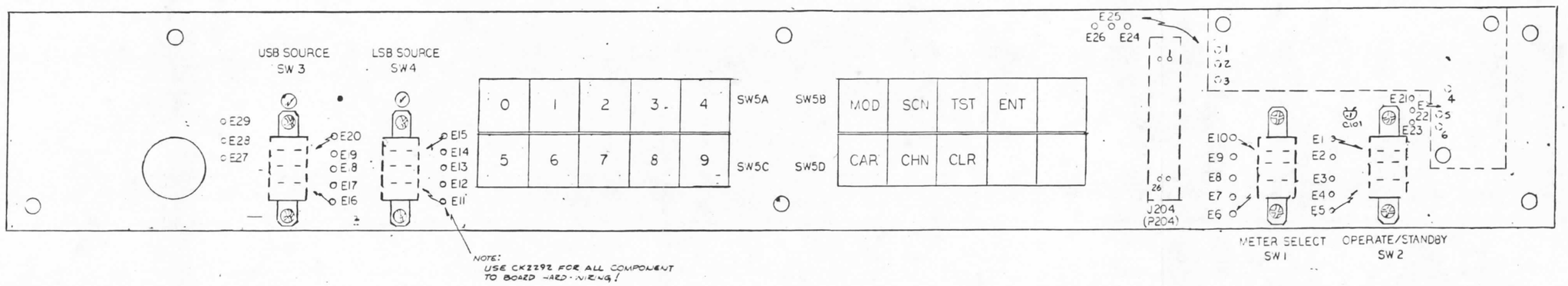


Z126 CONTROL MICROPROCESSOR A5837

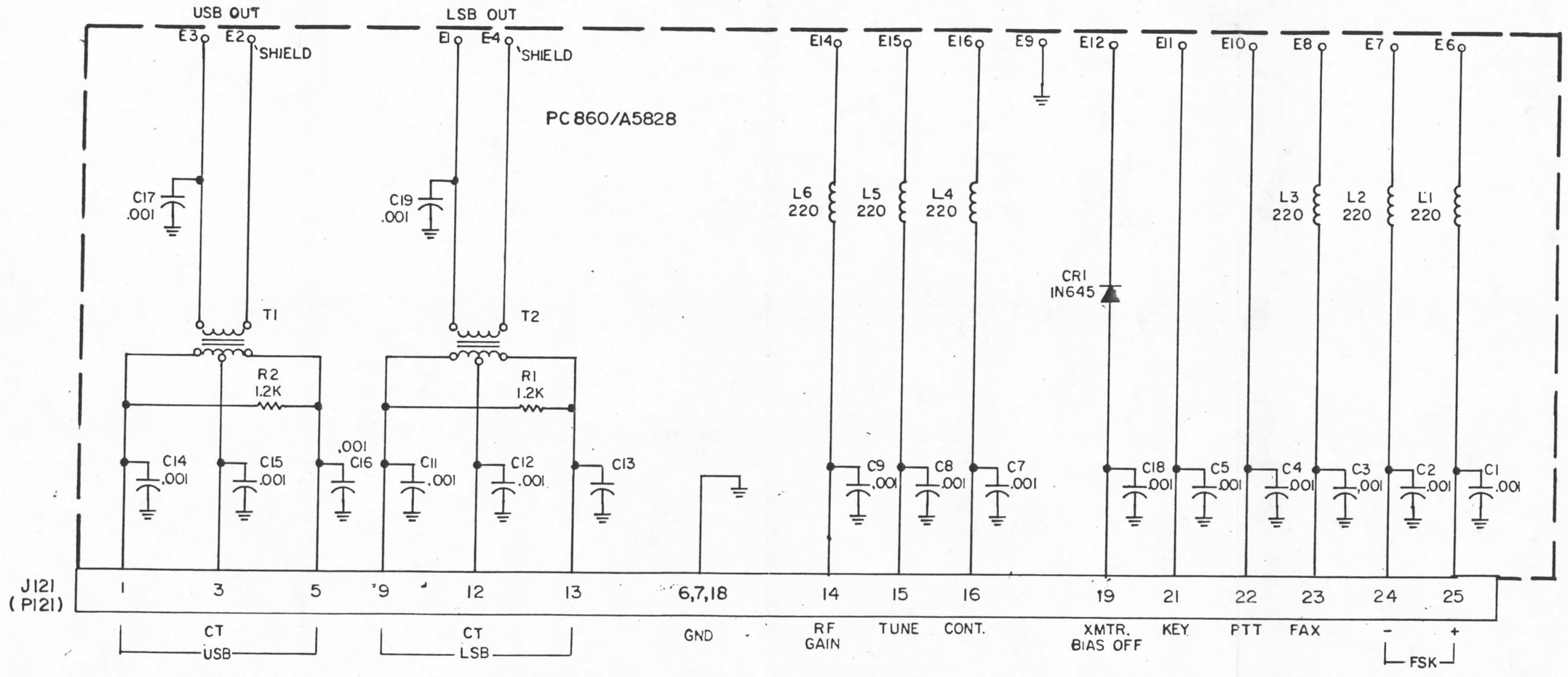


Z126 CONTROL MICROPROCESSOR A5837

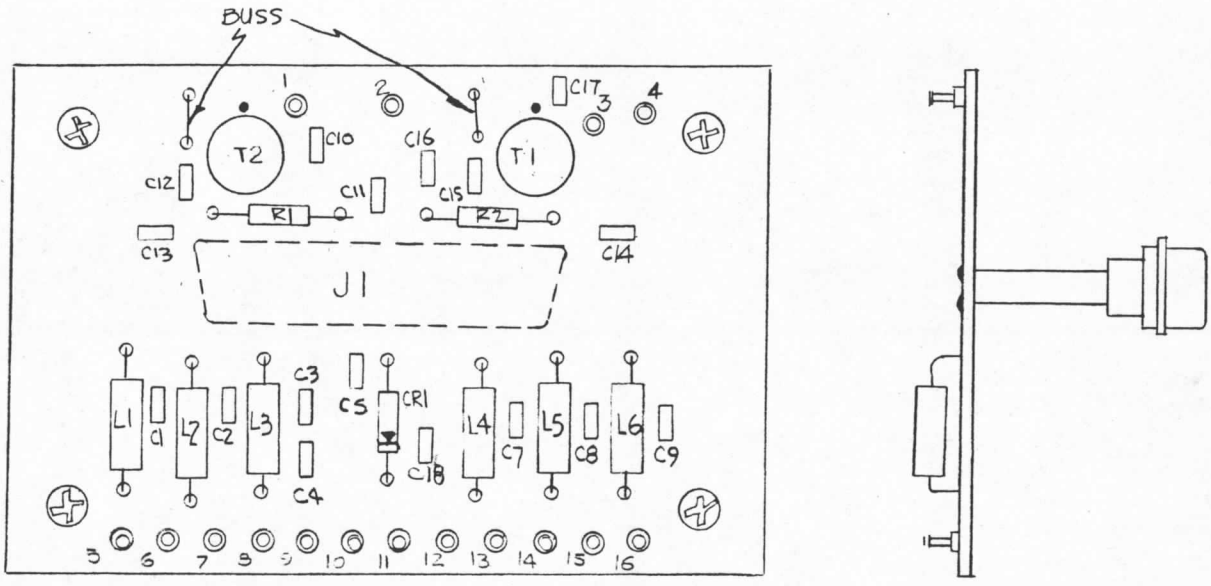

4000
25V
T101
115/230
INPUT
F102
4A
CR101
AC
R101
1.5K
2W
C101
14000
Mf
40V
C103
.1
VR101
(7818)
VR103
(7824)
VR102
(7812)
VR104
78S
C104
.1
C105
.1
C106
.1
C107
.1
C108
.1
C109
.1
C110
220
40V
+28V
1A
+24V
.6A
+12V
.8A
GND
+5V
1.5A
J102
T102 115/230
F101
4A
CR102
R102
1.5K
2W
C102
14000
Mf
40V
F104
1A/.5A
F103
1A/.5A
C110
.1
C111
.1
J101



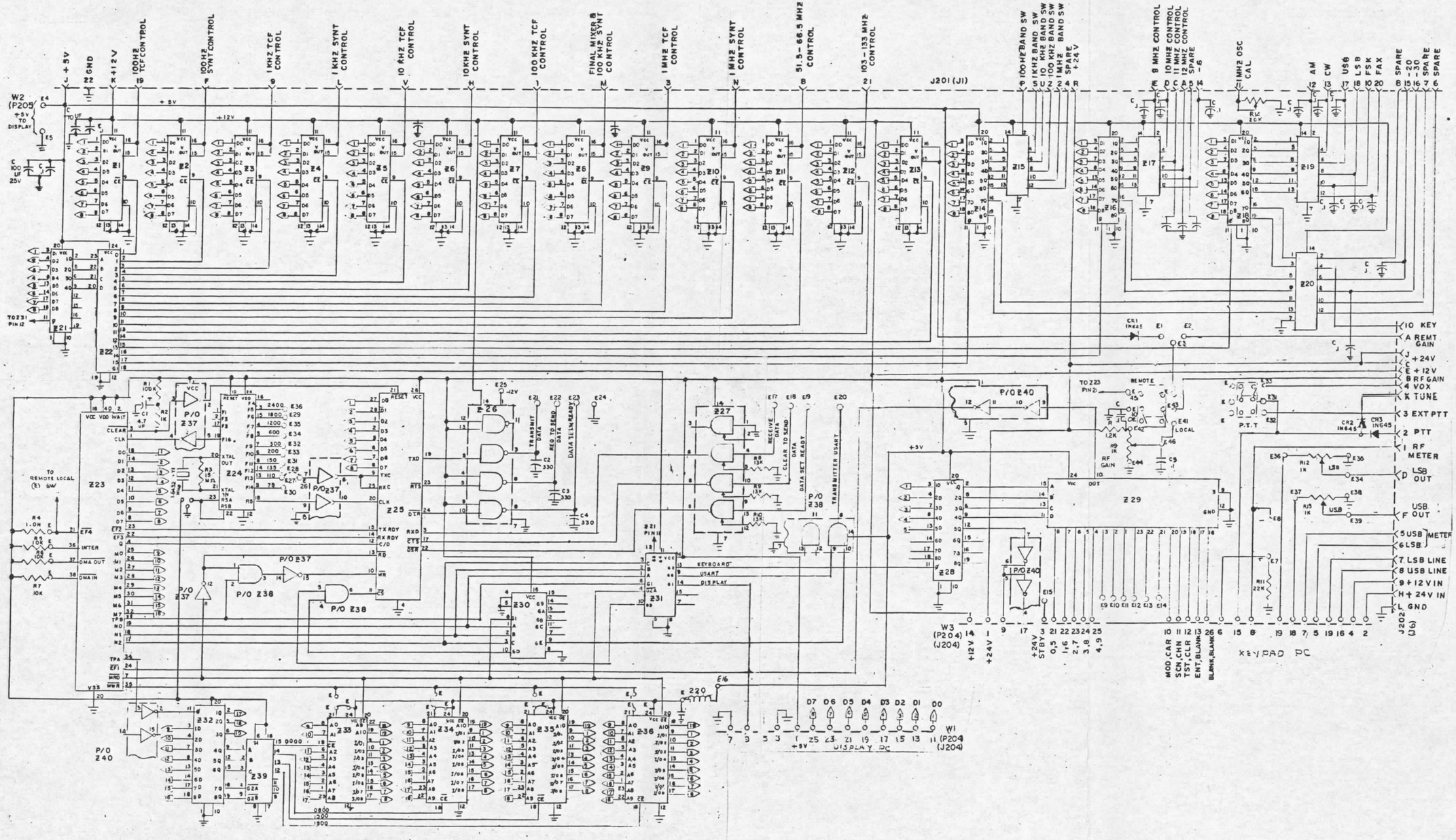
Z127 KEY PAD MOTHER BOARD A5836



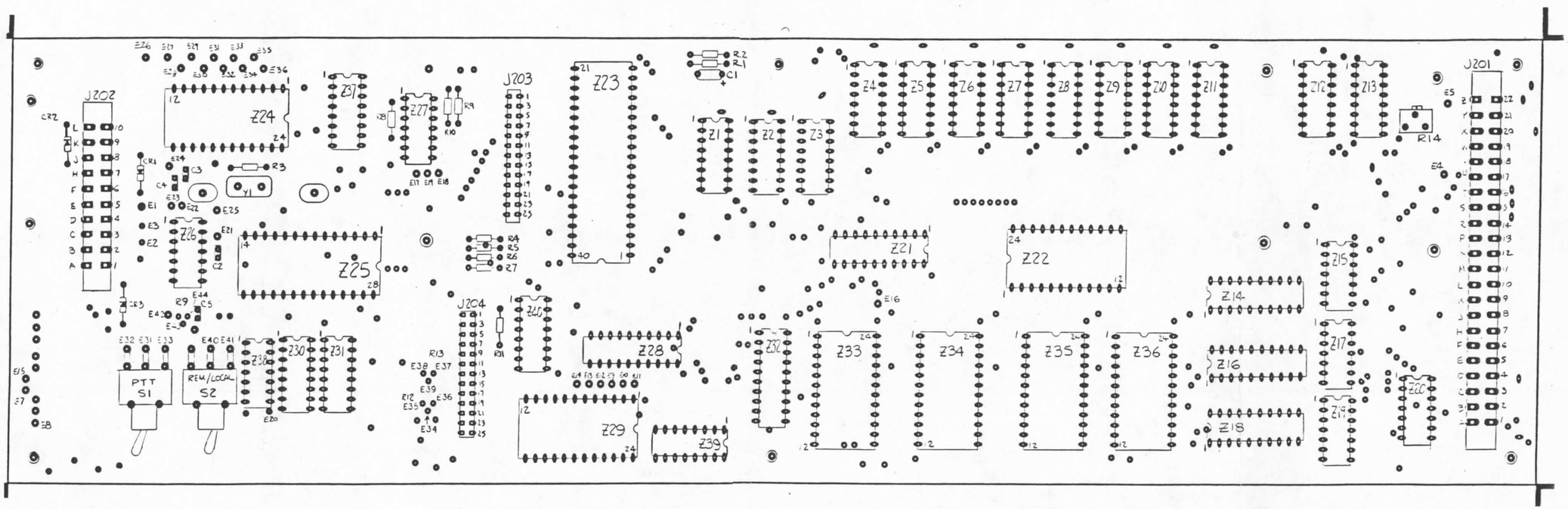
AUDIO INPUT FILTER ASSEMBLY



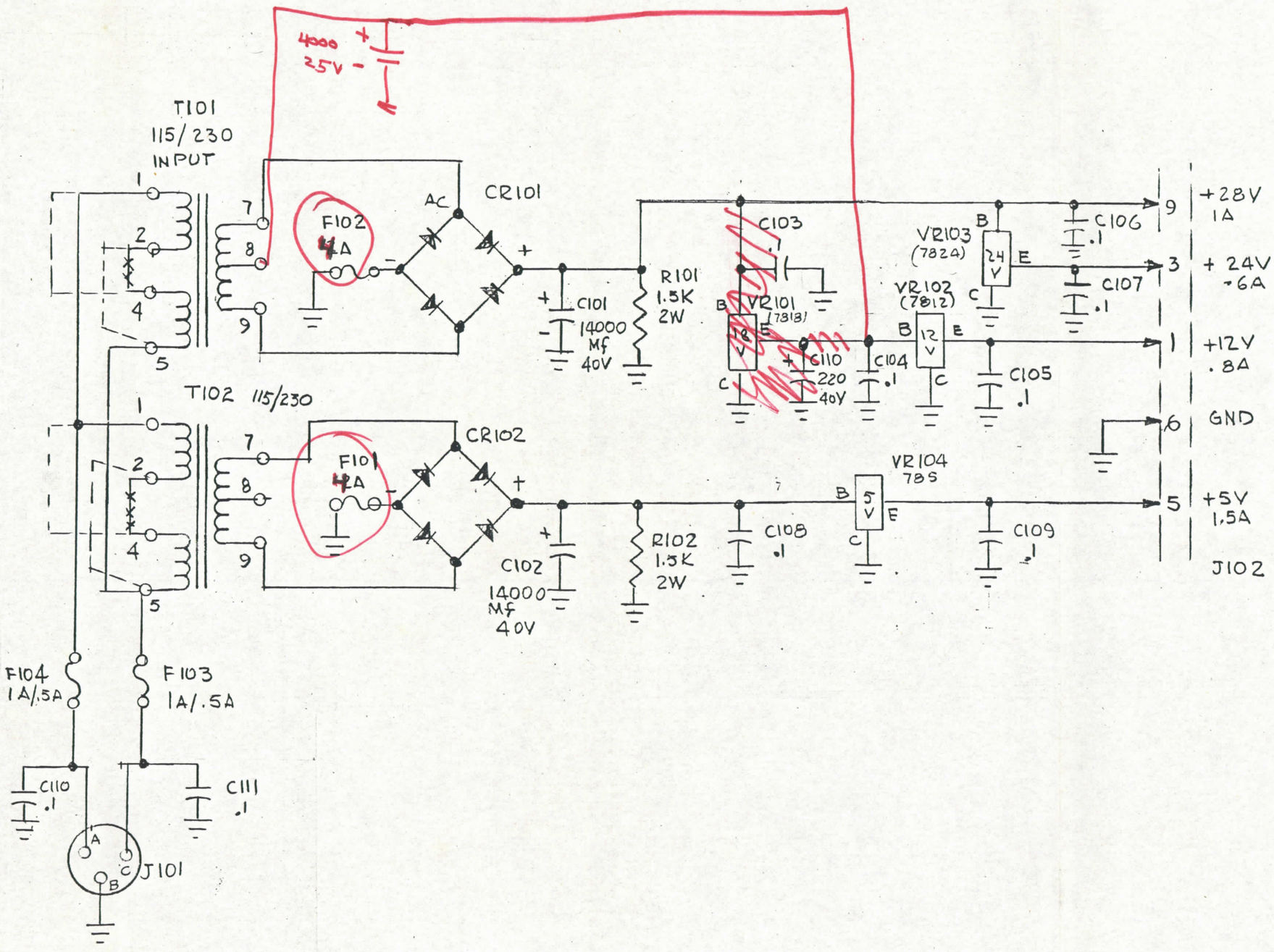
AUDIO INPUT FILTER ASSEMBLY

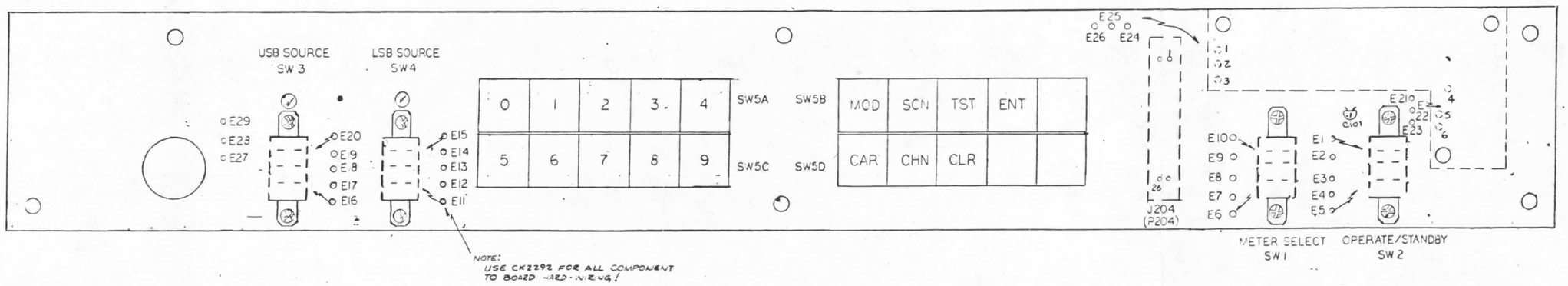


Z126 CONTROL MICROPROCESSOR A5837

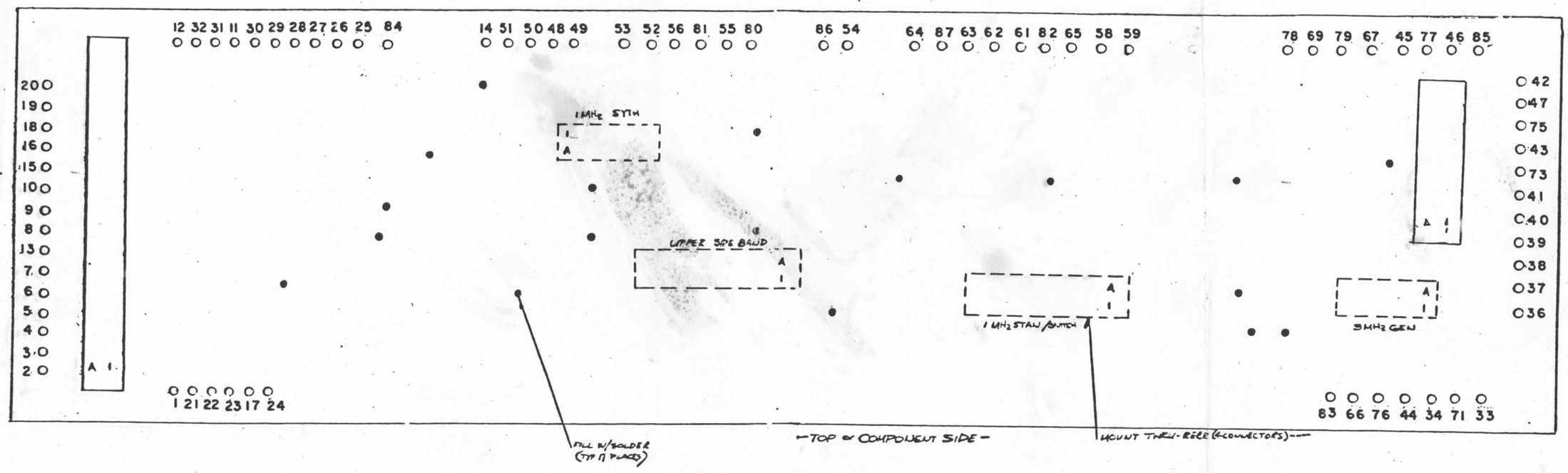


Z126 CONTROL MICROPROCESSOR A5837


4000
25V
T101
115/230
INPUT
F102
4A
CR101
AC
R101
1.5K
2W
C101
14000
Mf
40V
C103
.1
VR101
(7818)
VR103
(7824)
VR102
(7812)
VR104
78S
C104
.1
C105
.1
C106
.1
C107
.1
C108
.1
C109
.1
C110
220
40V
+28V
1A
+24V
.6A
+12V
.8A
GND
+5V
1.5A
J102
T102 115/230
F101
4A
CR102
R102
1.5K
2W
C102
14000
Mf
40V
F104
1A/.5A
F103
1A/.5A
C110
.1
C111
.1
J101



Z127 KEY PAD MOTHER BOARD A5836



FRONT CHASSIS MOTHER BOARD A5841