HIGH SPECIFICATION DATA TRANSCEIVER
PART NO. 242-3474-XX0

The E.F. Johnson Company designs and manufactures two-way radio equipment to serve a wide variety of communicat needs. Johnson produces equipment for the mobile telephone and land mobile radio services which include business, in trial, government, public safety, and personal users. In addition, Johnson designs and manufactures electronic compone used in communications equipment and other electronic devices.

LAND MOBILE PRODUCT WARRANTY

The manufacturer's warranty statement for this product is available from your product supplier or from the E.F. Johnsor pany, 299 Johnson Avenue, Box 1249, Waseca, MN 56093-0514. Phone (507) 835-6222.

WARNING

This device complies with Part 15 of the FCC rules. Operation is subject to the condition that this device does not cause ful interference. In addition, changes or modification to this equipment not expressly approved by E. F. Johnson could the user's authority to operate this equipment (FCC rules, 47CFR Part 15.19).

DO NOT allow the antenna to come close to or touch, the eyes, face, or any exposed body parts while the radio is transr

DO NOT operate the radio near electrical blasting caps or in an explosive atmosphere.

DO NOT operate the radio unless all the radio frequency connectors are secure and any open connectors are properly t nated.

DO NOT allow children to operate transmitter equipped radio equipment.

SAFETY INFORMATION

I per operation of this radio will result in user exposure below the Occupational Safety and Health Act and Federal C m tion Commission limits.

..e formation in this document is subject to change without notice.

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SECTION 1 GENERAL INFORMATION

1.1 SCOPE OF MANUAL

This service manual contains alignment and service information for the Johnson DM3474 UHF High Specification Data Module Transceiver.

1.2 EQUIPMENT DESCRIPTION

1.2.1 GENERAL

The E.F. Johnson DM3474 is a synthesized data transceiver (transmitter and receiver) which operates in the 403-512 MHz UHF frequency range. Transmitter power output is 2 watts nominal, and operation is simplex or half duplex.

Versions of the 3474 covered in this manual are indicated in Section 1.4. The 3474 has a frequency stability of ± 1.5 PPM (see Section 3).

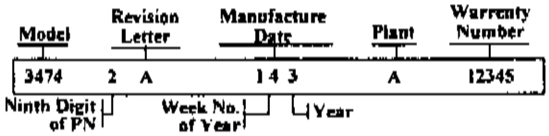
The number of channels that can be selected with the DM3474 model is determined by the customer supplied synthesizer loading circuitry.

1.2.2 DM3474 SYNTHESIZER PROGRAMMING

The DM3474 requires customer supplied circuitry to load the synthesizer with channel information. The protocol that this circuitry must follow is described in Section 3.

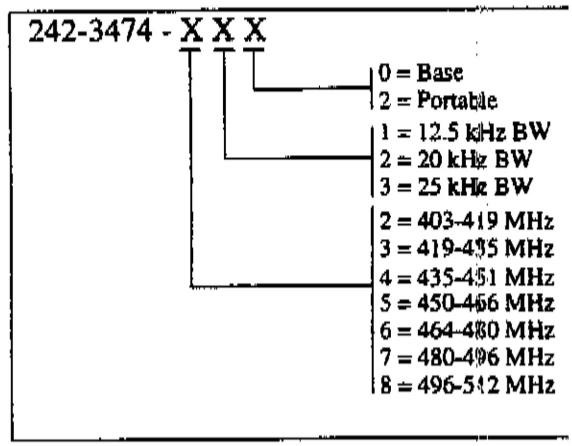
1.3 TRANSCEIVER IDENTIFICATION

The transceiver identification number is printed on a label that is affixed to the PC board. The following information is contained in that number:



1.4 PART NUMBER BREAKDOWN

The following is a breakdown of the part nu
used to identify this transceiver:



1.5 ACCESSORIES

Accessories available for the 3474 data tran
ceiver are listed in Table 1-1.

Table 1-1 ACCESSORIES

Accessory	Part N
DM3474 Receive Test Filter	023-347
MCX to SMA RF cable	023-347
3474 Low Power Kit	023-347

1.6 FACTORY CUSTOMER SERVICE

The Customer Service Department of the E
Johnson Company provides customer assistance
technical problems and the availability of local
factory repair facilities. Customer Service hours

7:30 a.m. - 4:30 p.m. Central Time, Monday - Friday. There is also a 24-hour emergency technical support telephone number. From within the continental United States, the Customer Service Department can be reached at this toll-free number

1-800-328-3911

When your call is answered at the E.F. Johnson Company, you will hear a brief message informing you of numbers that can be entered to reach various departments. This number may be entered during or after the message using a tone-type telephone. If you have a pulse-type telephone, wait until the message is finished and an operator will come on the line to assist you. When you enter a first number of "1" or "2", another number is requested to further categorize the type of information you need. You may also enter the 4-digit extension number of the person that you want to reach if you know what it is.

FAX Machine - Sales	(507) 835-6485
FAX Machine - Cust Serv	(507) 835-6969

If you are calling from outside the continental United States, the Customer Service telephone numbers are as follows:

Customer Service Department - (507) 835-6911
Customer Service FAX Machine - (507) 835-6969

You may also contact the Customer Service Department by mail. Please include all information that may be helpful in solving your problem. The mailing address is as follows:

E.F. Johnson Company
Customer Service Department
299 Johnson Avenue
P.O. Box 1249
Waseca, MN 56093-0514

1.7 PRODUCT WARRANTY

The warranty statement for this transceiver is available from your product supplier or from the Warranty Department, E.F. Johnson Company, 299 Johnson Avenue, Box 1249, Waseca, MN 56093-0514. This information may also be requested by phone from the Warranty Department. The Warranty Department may also be contacted for Warranty Service Reports, claim forms, or any questions concerning warranties or warranty service by dialing (507) 835-6970.

1.8 REPLACEMENT PARTS

E.F. Johnson replacement parts can be ordered directly from the Service Parts Department. To order parts by phone, dial the toll-free number and then enter "7" as described in Section 1.6. When ordering, please supply the part number and quantity of each part ordered. E.F. Johnson dealers also need to give their account number.

If there is uncertainty about the part number, include the designator (C112, for example) and the model number of the equipment the part is from (refer to Section 1.3).

You may also send your order by mail or FAX. The mailing address is as follows and the FAX number is shown in Section 1.6.

E.F. Johnson Company
Service Parts Department
299 Johnson Avenue
Box 1249
Waseca, MN 56093-0514

1.9 FACTORY RETURNS

Repair service is normally available through local authorized E.F. Johnson Land Mobile Radio Service Centers. If local service is not available, the equipment can be returned to the factory for repair. However, it is recommended that you contact the Field Service Department before returning equipment. A service representative may be able to suggest a solution to the problem so that return of the equipment would not be necessary. If using the toll-free number in the preceding section, enter "8".

Be sure to fill out a Factory Repair Request Form #271 for each unit to be repaired, whether it is in or out of warranty. These forms are available free of charge by calling the repair lab (see Section 1.6) or by requesting them when you send a unit in for repair. Clearly describe the difficulty experienced in the space provided and also note any prior physical damage to the equipment. Include a form in the shipping container with each unit. Your phone number and contact name are very important because there are times when the technicians have specific questions that need to be answered in order to completely identify and repair a problem.

When returning equipment for repair, it is also a good idea to use a PO number or some other reference number on your paperwork in case you need to call the repair lab about your unit. These numbers are referenced on the repair order to make it easier and faster to locate your unit in the lab.

Return Authorization (RA) numbers are not necessary unless you have been given one by the Field Service Department. They require RA numbers for exchange units or if they want to be aware of a specific problem. If you have been given an RA number, reference this number on the Factory Repair Request Form sent with the unit. The repair lab will then contact the Field Service Department when the unit arrives.

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The following are general specifications intended for use in testing and servicing this transceiver. For current vertised specifications, refer to the specification sheet available from the Marketing Department. Specifications subject to change without notice.

GENERAL	
Frequency Range	403-512 MHz
Frequency Control	Synthesized
Channel Spacing	12.5/20/25 kHz
Mode of Operation	Simplex or Half Duplex
Operating Voltage	+7.5V DC ±10%
Regulated Supply Voltages	+5V DC ±5%
RF Input/Output	MCX Jack
Power and Data Interface	14-pin in-line socket, 100 mil center
Operating Temperature	-30° to +60° C (-22° to +140° F)
Maximum Dimensions	2.83" L (7.19 cm), 2.19" W (5.56 cm), 0.64" H (1.70 cm)
Weight (w/o Loader Bd)	2.3 oz (65 g)
FCC Compliance	DM3474 customer must apply
RECEIVER	
Bandwidth	16 MHz
Frequency Stability	±1.5 PPM
Sensitivity - 12 dB SINAD	0.45 µV
RF Input Impedance	50 ohms
Selectivity	-70 dB
Spurious and Image Rejection	-60 dB (12.5 kHz), -70 dB (20/25 kHz)
Intermodulation	-70 dB
FM Hum and Noise	-40 dB (12.5 kHz), -45 dB (20/25 kHz)
Conducted Spurious	-57 dBm
Receive Current Drain	< 70 mA nominal
Receive Attack Time	< 7 ms (dependent on synthesizer loading implementation)
Audio	
Distortion	< 3%
Output Level DM3474	600-1200 mV P-P or 200-400 mV RMS (1 kHz at ±3 kHz)
Response	
DM3474	±2 dB from DC to 5 kHz (reference to 1 kHz)
Minimum Load Impedance	1k ohms
TRANSMITTER	
Bandwidth	16 MHz
Frequency Stability	±1.5 PPM
TCXO Coupling	DC
RF Power Output	2W nominal adjustable to 500 mW (-XX0) 500 mW nominal adjustable to 75 mW (with Low Power Kit)
RF Output Impedance	50 ohms
Modulation Distortion	< 3%
Duty Cycle	50%, 60 seconds maximum transmit
Transmitter Attack Time	< 7 ms (dependent on synthesizer implementation)
Spurious and Harmonic FM	-37 dBm
FM Hum and Noise	-40 dB 12.5 kHz, -45 dB 25 kHz
Audio Response	±1.5 dB from DC to 5 kHz (reference to 1 kHz) Programmable to ±1 dB at the RF band edges via J201, pin 14.
Data Input Impedance	100k ohm
Modulation Response	±1 dB from DC to 5 kHz (reference to 1 kHz)
Current Drain	< 800 mA at 2W, +7.5V DC

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SECTION 2 INSTALLATION

2.1 PRE-INSTALLATION CHECKS

Field alignment should not be required before the 3474 is installed. However, it is still good practice to check the performance to ensure that no damage occurred during shipment. Performance tests are located in Section 6.2.

2.2 INTERFACING WITH DATA EQUIPMENT

2.2.1 DM3474 ONLY

Connector J201 on the data transceiver PC board provides the interface with the data equipment. This is a 14-pin female connector with .025" square pins on 0.1" centers (Dupont 76308-114). An interface cable diagram and pin designations are shown in Figure 2-1. This cable is not included with the data transceiver.

The following is a general description of the various J201 input and output signals.

Pin 1 (Ground) - Chassis ground.

Pin 2 (+7.5V DC Continuous) - This voltage should be stabilized near +7.5V DC. Variations from +6V to +9V can change power output as much as 6 dB.

Pin 3 (+7.5V DC Transmit) - This input should be +7.5V DC in transmit mode only.

Pin 4 (+5V DC Receive Control Line) - This input should be +5V DC in the receive mode only, ≤ 0.3 V DC in Tx, input impedance ≥ 10k ohms.

Pin 5 (+5V DC Continuous) - This voltage should be stabilized near +5V DC.

Pin 6 (Tx Input) - Provides a response of ±1.5 dB f DC to 5 kHz. The sensitivity is approximately 7 k deviation per volt RMS. When this input is used, temperature compensated 2.5V DC bias is require cause variations in voltage cause the frequency to change. In addition, the transceiver regulatory cor ance must be applied for with the customer suppli modulation limiting/filter circuit and chassis.

Pin 7 (Synthesizer Lock) - Output from synthesi lock detect circuit. Low = unlocked, high = locke

Pin 8 (Synthesizer Enable) - Latch enable signal rising edge on this input latches the data loaded in synthesizer IC U801.

Pin 9 (Synthesizer Data) - Serial data line used f programming synthesizer IC U801.

Pin 10 (Synthesizer Clock) - Software generated al clock. Data is valid on the rising edge of this si

Pin 11 (Carrier Detect) - This output is not used at time.

Pin 12 (RSSI Output) - The RSSI (Receive Signa Strength Indicator) output provides a voltage that creases in proportion to the strength of the RF inpu signal.

Pin 13 (Rx Output) - The data output level is 600 1200 millivolts P-P (200-400 mV RMS) with a mo lation signal of 1 kHz at 60% of maximum deviati The output is DC coupled and referenced to +2.5V Load impedance should be 10k-100k ohms.

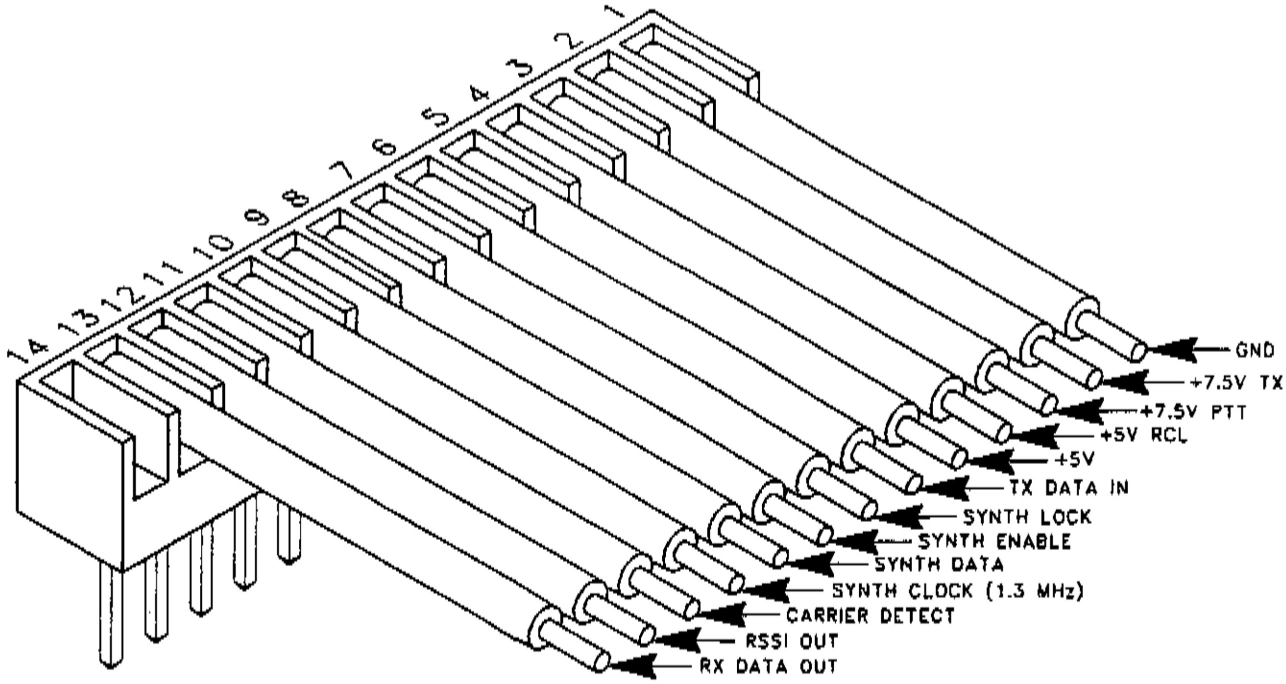

Figure 2-1 DM3474 INTERFACE CABLE

SECTION 3 PROGRAMMING

3.1 INTRODUCTION

DM3474 - The information in Section 3.2 describes synthesizer programming protocol. This information can be used as a basis for designing the synthesizer programming hardware and software required.

3.2 DM3474 SYNTHESIZER DATA PROTOCOL

Programming of the dividers and the charge pumps are performed on a 3-line bus; SYNTH ENABLE, SYNTH DATA, AND SYNTH CLK. On initial power up three 34-bit words are required to load the 3474 Data Transceiver. After the initial load, one 32-bit word can be used to change channels.

The SA7025 Synthesizer IC uses four address words; D, C, B and A (see Figure 3-4). The C word is not used in the 3474. The 24- and 32-bit words contain one or four address bits, depending on the address bits, the data is latched into registers. When the A-word is loaded, the data of these temporary registers is loaded together with the A-word into the work registers.

3.2.1 D-WORD

Refer to Figure 3-1.

TCXO Reference Frequency is 17.5 MHz.
Loop Reference Frequency is 50 kHz.
Reference Divide (NR) = 17.5 MHz ÷ 50 kHz
=350 Decimal or 000010101110 Binary.

The 3474 has frequency resolution of 6.25 kHz and 10 kHz. When programming 6.25 kHz frequency resolution use FMOD=8. When programming 10 kHz frequency resolution use FMOD=5.

Example:

(FCM) ÷ FMOD = 50 kHz ÷ 8 = 6.25 kHz
(FCM) ÷ FMOD = 50 kHz ÷ 5 = 10 kHz

Where:
⁻CM = Loop Reference Frequency
⁻ ⁻OD = Fractional N Modulus

Since FMC is the same for both 6.25 kHz anc 10 kHz the loop dynamics are very similar and the same loop filter values can be used.

3.2.2 B-WORD

The B-Word is 24-bits long (see Figure 3-2). contains the Address, Charge Pump setting factor (CN), Binary Acceleration factors (CK, CL), and Prescaler Type (PR).

The Charge Pump Current setting (CN) coul changed on a channel-by-channel basis for ultim rejection of the Fraction N spurious responses cl into the carrier frequency. The 3474 synthesizer an adjust (R855) for the fractional compensation rent. The factory preset value will allow CN to t to the following ranges:

Frequency in a Band	CN
Lowest TX	86
Highest TX	90
Lowest RX	96
Highest RX	100

The value of CN should be interpolated for quencies between the band edges. With these re mended values of CN, the transceiver should ha fractional spurs minimized far below the levels r to make ETSI 70 dB adjacent channel RX or T specifications.

Example:

Model 3474-530 is a 450-466 MHz transceiver
458 MHz TX CN = 88 01011000 Binary
458 MHz RX CN = 98 01100010 Binary

3.2.3 A-WORD

The A-Word must be sent last (see Figure The A-Word contains new data for the loop di and is programmed for every channel. The A- can be a 24-bit or 32-bit word depending on th of the flag LONG in the D-Word. The 24-bit (A0) is sent if LONG=0 and the 32-bit word (sent if LONG=1. The extra 8-bits in A1 are th charge pump settings. Upon power up the D-, A-Words must be sent, but after that only the needs to be sent.

The Fractional-N increment (NF) is a 3-bit word that is channel dependent. NF is used to program the sub-channels below the 50 kHz Loop Reference frequency. FCM = 50 kHz and if FMOD = 8, then the Fractional-N increment is: 50 kHz ÷ 8 = 6.25 kHz

To program an 18.75 kHz channel:

NF = 18.75 kHz ÷ 6.25 kHz
NF = 3

NM1 and NM2 are calculated as follows:

N = (NM1 + 2) x 64 + NM2 x 65
Where:

N = total division ratio

NM1 = Number of main divider cycles when prescaler modulus equals 64
NM2 = Number of main divider cycles when prescaler modulus equals 65

Example:

Calculate NM1 and NM2 to Receive 454.500 MHz.

LO = 454.5 + 52.95 = 507.45 MHz
(52.95 MHz IF with High Side Injection)

N = RX LO ÷ FCM = 507.45 ÷ 0.05 = 10149
(FMC = Loop Reference Frequency)

NM2 = 64 x FRAC [N ÷ 64]
= 64 x FRAC [10149 ÷ 64]
= 64 x 0.57813
= 37

NM1 = INTEGER [N ÷ 64] - 2 - NM2
= 158 - 2 - 37
= 119

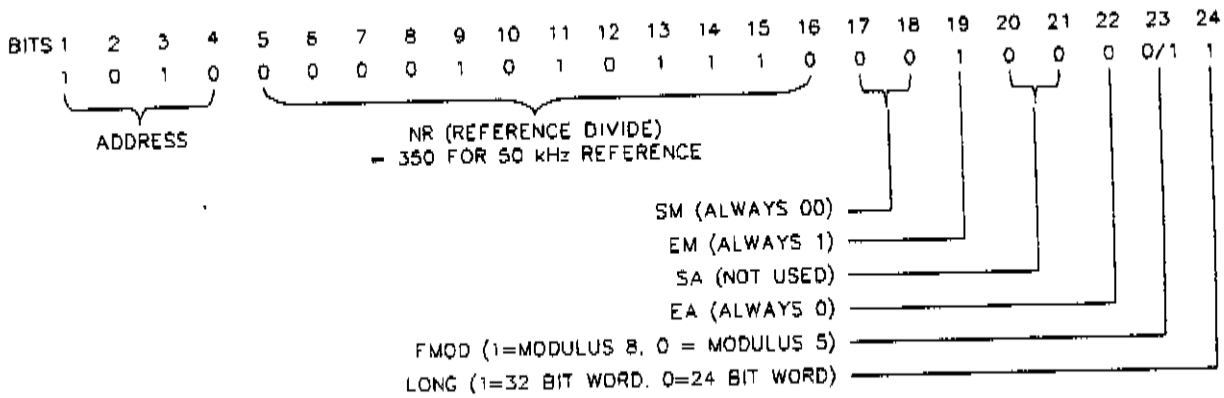

Figure 3-1 D-WORD

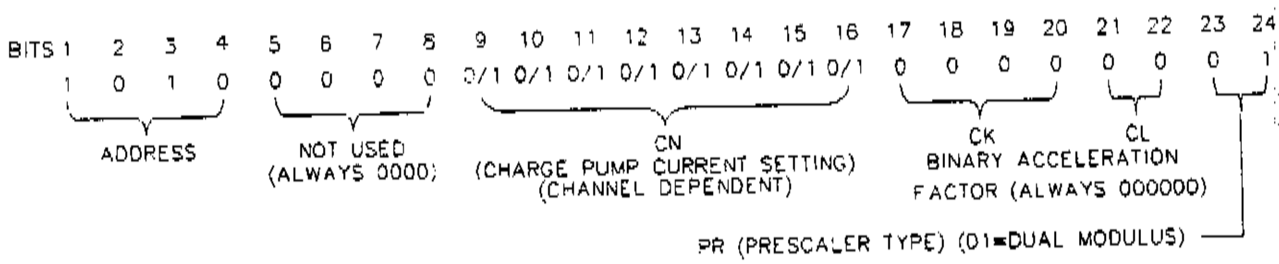

Figure 3-2 B-WORD

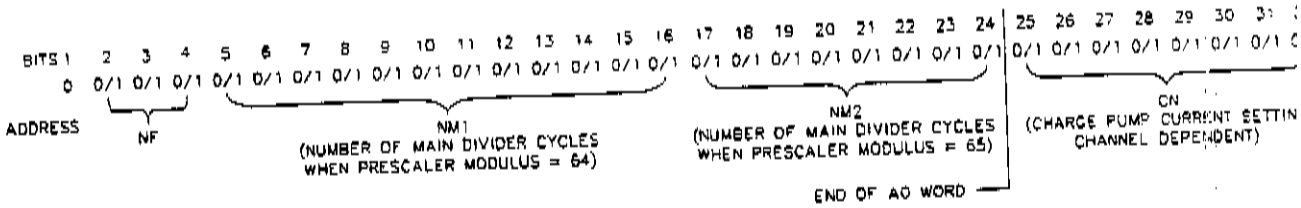

Figure 3-3 A-WORD

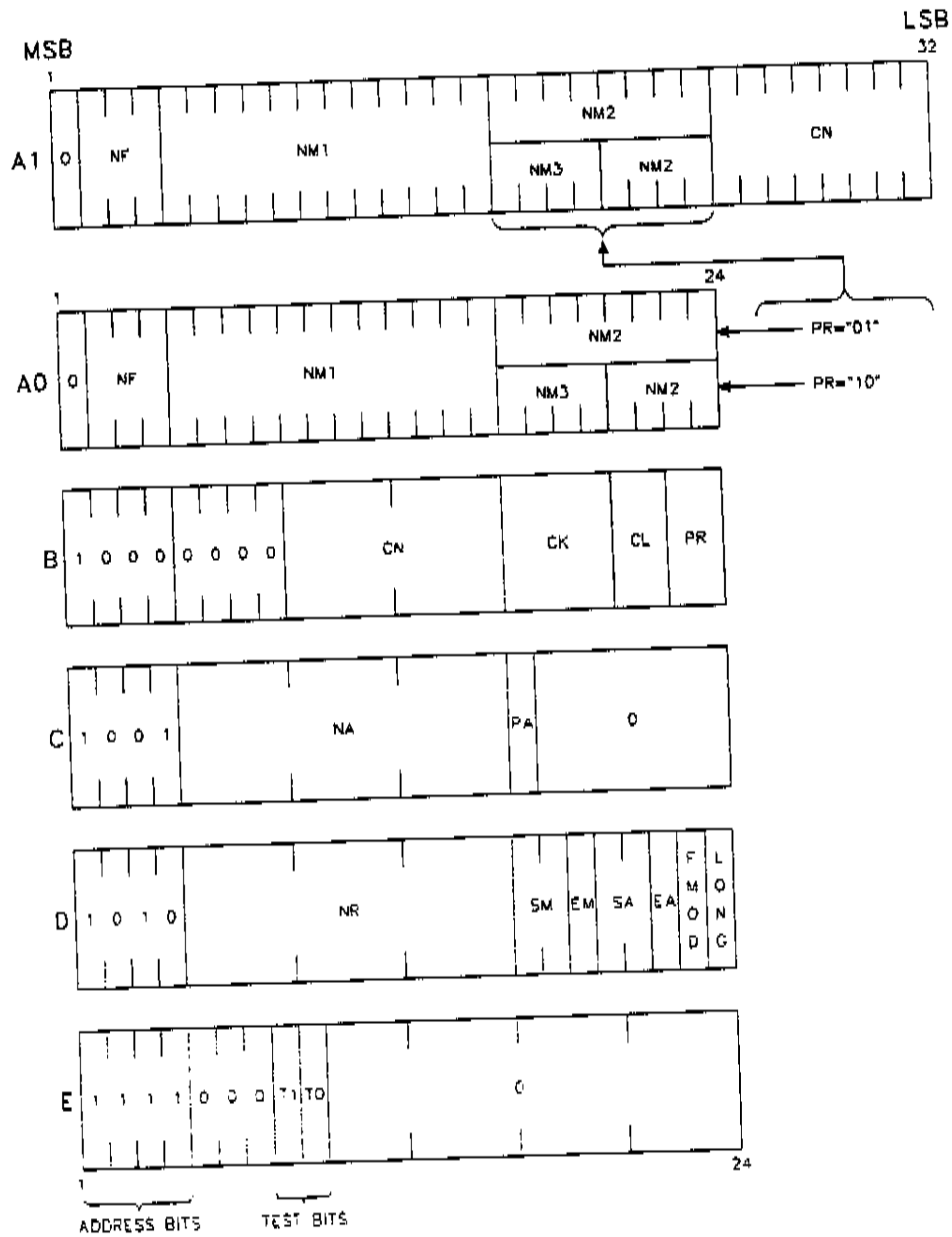

Figure 3-4 SERIAL INPUT WORD FORMAT

3.3 RECEIVE TO TRANSMIT SEQUENCE

Refer to Figure 3-5.

1. Synthesizer is loaded (B and A 24-Bit words or one long 32-bit A-Word).
2. The state of the 5RCL line does not have to be changed until the last bit is sent. However, RX will cease as soon as it is changed.
3. The SYNTH ENABLE line should be held HIGH for 2 to 3 milliseconds after the last word is sent. This puts the frequency synthesizer in a SPEEDUP MODE and slightly improves lock times.
4. After the last word is strobed in, 7 milliseconds (worst case) should elapse before 7.5 TX is turned ON. This allows the synthesizer to come within 1 kHz of the desired frequency.

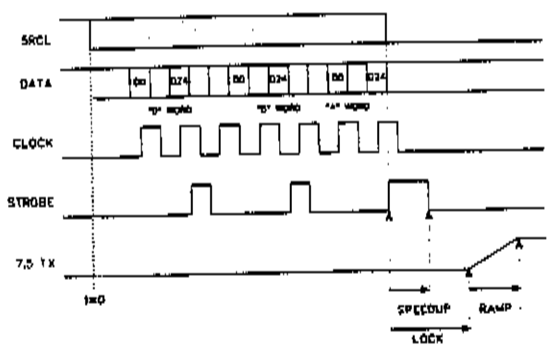

Figure 3-5 RX TO TX TIMING DIAGRAM

Dekey is a length of time to allow the TX to power down while the synthesizer is still in lock. This is needed to meet ETSI (European Telecommunications Standards Institute) adjacent power specifications. Dekey is approximately 3 ms in length. The 7.5 TX should be ramped or optimally filtered in such a way as to reduce the Sinx/x power spreading. Speedup will slightly improve lock times and is 1 to 2 ms.

3.4 TRANSMIT TO RECEIVE SEQUENCE

Refer to Figure 3-6.

1. 7.5 TX is turned OFF. For best TX adjacent channel power performance this could be shaped.
2. The synthesizer load process could begin slightly before, but when the last bit is strobed in the synthesizer it will become unlocked. For ETSI specs, the TX should be turned OFF "on-frequency".
3. The 5RCL line should switch from low to high AFTER the 7.5 TX is switched. The 5RCL not only turns the RX circuits on but also Pin Shifts the VCO.
4. For quickest lock times the SYNTH ENABLE line on the last load word should be held high for 2 to 3 milliseconds. It MUST NOT be left high as the synthesizer in the SPEEDUP mode has poor noise performance and would degrade the RX performance.

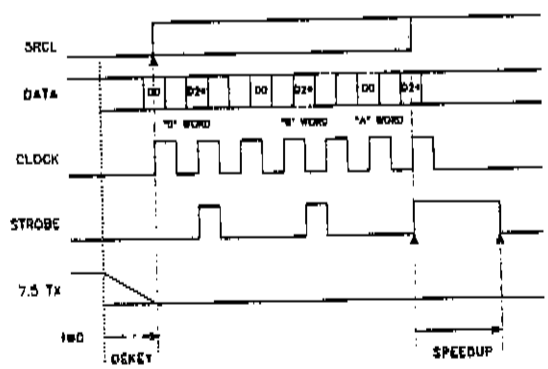

Figure 3-6 TX TO RX TIMING DIAGRAM

Speedup is 2 to 3 ms
Lock is approximately 7 ms
Ramp is approximately 3 ms

IMPORTANT

If the receiver is to be operated at 510-512 MHz (-810), a spurious condition may occur to degrade the receiver sensitivity 2 to 3 dB. If this degradation is unacceptable, the synthesizer can be reprogrammed to a comparison frequency (FCM) of 31.25 kHz (so that a multiple of this would not be 52.95 MHz) and a modulus (FMOD) of 5 with a reference divide (NR) of 560. These parameters place the spurious at harmonics of 31.25 kHz (instead of 50 kHz) outside the passband of the IF filters where the sensitivity is not degraded.

SECTION 4 CIRCUIT DESCRIPTION

4.1 GENERAL

4.1.1 INTRODUCTION

The main subassemblies of this transceiver are the RF board, VCO board, TCXO. A block diagram of the transceiver is located in Figure 4-1.

The VCO board is enclosed by a metal shield and soldered directly to the RF board. The VCO is not serviceable.

The 3474 is available with a reference oscillator stability of ±1.5 PPM. The TCXO (Temperature Compensated Crystal Oscillator) is soldered directly to the RF board.

4.1.2 SYNTHESIZER

The VCO (voltage-controlled oscillator) output signal is the receiver first injection frequency in the Receive mode and the transmit frequency in the Transmit mode. The first injection frequency is 52.95 MHz above the receive frequency. The frequency of this oscillator is controlled by a DC voltage produced by the phase detector in synthesizer chip U801.

Channels are selected by programming counters in U801 to divide by a certain number. This programming is performed over a serial bus formed by the Synth Clock, Synth Enable, and Synth Data pins of J201. This programming is performed by user supplied hardware and software (see Section 3).

The frequency stability of the synthesizer in both the receive and transmit modes is established by the stability of the reference oscillator described in the preceding section. These oscillators are stable over a temperature range of -30° to +60° C (-22° to +140° F).

4.1.3 RECEIVER

The receiver is a double-conversion type with intermediate frequencies of 52.95 MHz / 450 kHz. Two helical bandpass filters reject the image, half I injection, and other unwanted frequencies. A four-pole crystal filter enhances receiver selectivity

4.1.4 TRANSMITTER

The transmitter produces a nominal RF power output of 2W adjustable to 500 mW (-XX0) or 500 mW adjustable to 75 mW (with Low Power Kit). F quency modulation of the transmit signal occurs in synthesizer. Transmit audio processing circuitry i contained in the customer-supplied equipment.

4.2 SYNTHESIZER

4.2.1 INTRODUCTION

A block diagram of the synthesizer is shown Figure 4-1 and a block diagram of Synthesizer IC U801 is shown in Figure 4-2. As stated previousl the synthesizer output signal is produced by a VC (voltage controlled oscillator). The VCO frequen is controlled by a DC voltage produced by the ph detector in U801. The phase detector senses the p and frequency of the two input signals and cause VCO control voltage to increase or decrease if th are not the same. The VCO is then "locked" on t quency.

Programming of the synthesizer provides th necessary for the internal prescaler and counters. input signal is the reference frequency. This freq is produced by the 17.5 MHz reference oscillato (TCXO). The other input signal is the VCO frequency.

CIRCUIT DESCRIPTION

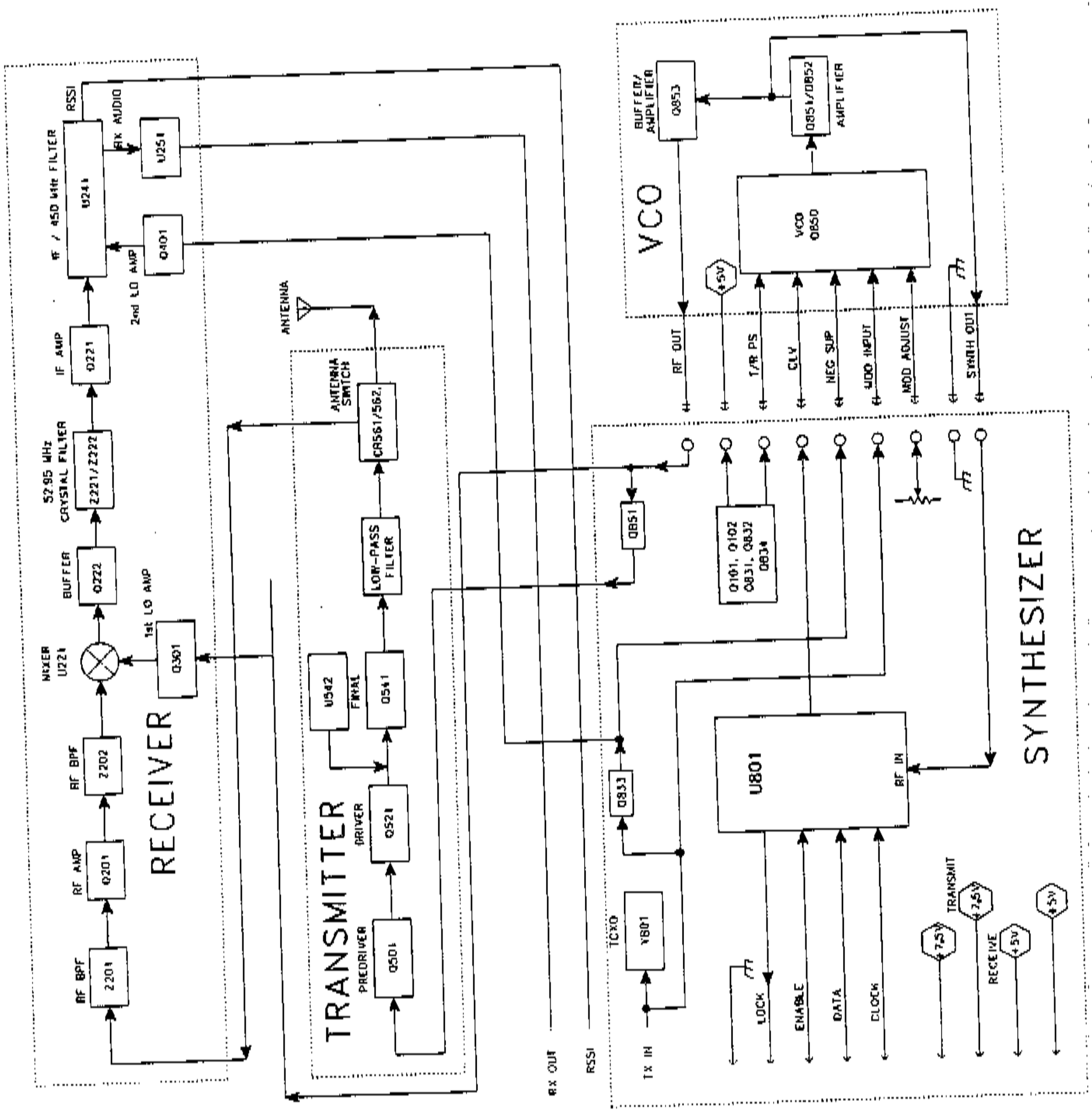

Figure 4-1 DATA TRANSCEIVER BLOCK DIAGRAM

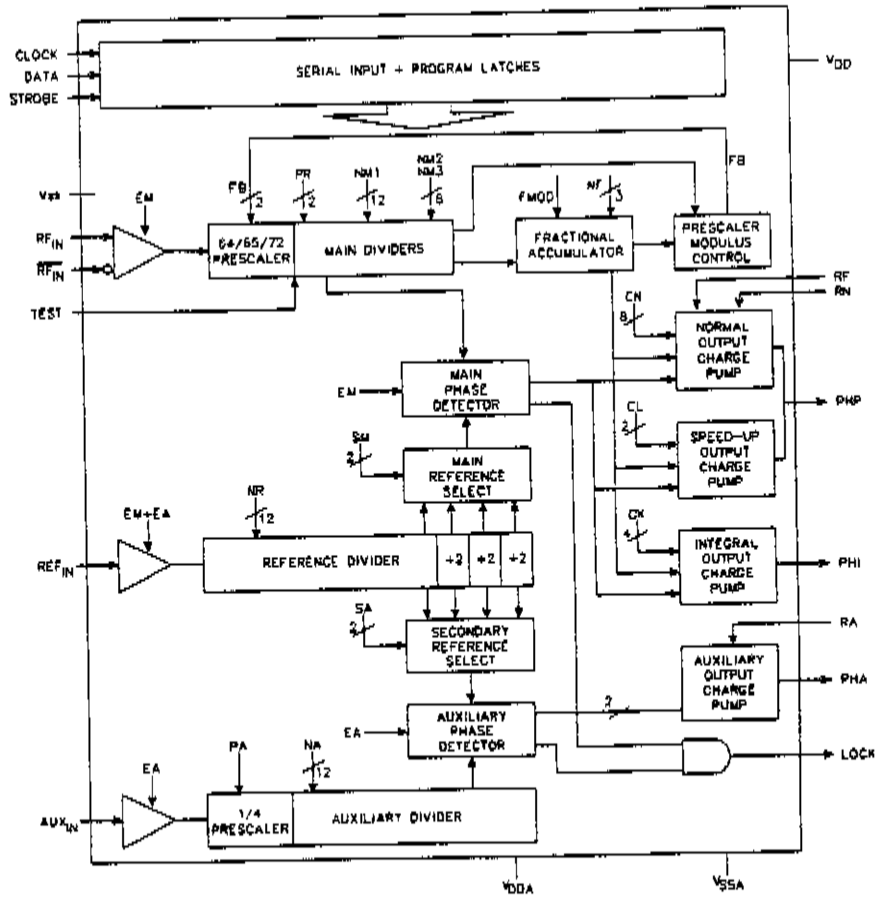

Figure 4-2 U801 SYNTHESIZER BLOCK DIAGRAM

4.2.2 VOLTAGE-CONTROLLED OSCILLATOR

<u>Oscillator (Q850)</u>

The VCO is formed by Q850, several capacitors and varactor diodes, and a ceramic resonator. It oscillates at the transmit frequency in transmit mode and first injection frequency in the receive mode (approximately 450 MHz in transmit and 500 MHz in receive).

Biasing of Q850 is provided by R862, R867 and R868. An AC voltage divider formed by C859, C861 and C862 initiates and maintains oscillation and also matches Q850 to the tank circuit. The ceramic resonator is grounded at one end to provide shunt inductance to the tank circuit.

<u>Frequency Control and Modulation</u>

The VCO frequency is controlled in part by voltage across varactor diodes CR854, CR855, C and CR851. As voltage across a reverse-biased tor diode increases, its capacitance decreases. Tl fore, VCO frequency increases as the control vol increases. CR854/CR855 and CR856/CR851 ar alleled varactors to divide the capacitance and improve liniarity. The varactors are biased at -2 adjust to the voltage output of U801. The contro is isolated from tank circuit RF by choke L851 a L854 and decoupling capacitor C854. The amou frequency change produced by CR854/CR855/C CR851 is controlled by series capacitor C853.

The -2V applied to the VCO is derived from the TCXO frequency that is amplified by Q833, rectified by CR831 and filtered by C844, C845, C846 and C847 on the RF board.

The VCO frequency is modulated using a similar method. The transmit audio/data signal is applied across varactor diode CR852 which varies the VCO frequency at an audio rate. Series capacitors C856/C870 set the amount of deviation produced along with CR853 and C858. R854 provides a DC ground on the anodes of CR852/CR853, and isolation is provided by R852 and C855.

The DC voltage across CR853 provides compensation to keep modulation relatively flat over the entire bandwidth of the VCO. This compensation is required because modulation tends to increase as the VCO frequency gets higher (capacitance of CR854/CR855/CR856/CR851 gets lower). CR853 also balances the modulation signals applied to the VCO and TCXO. An external voltage from J201, pin 14 can also adjust the modulation.

The DC voltage applied across CR853 comes from the modulation adjust control R810. R811 applies a DC biasing voltage to CR852; C814 provides DC blocking; and C818 attenuates AC signals applied through R811. RF isolation is provided by C858, R853, C817 and R812.

4.2.3 VCO AND REFERENCE OSCILLATOR MODULATION

Both the VCO and reference oscillator (TCXO) are modulated in order to achieve the required frequency response. If only the VCO was modulated, the phase detector in U801 would sense the frequency change and increase or decrease the VCO control voltage to counteract the change (especially at the lower audio frequencies). If only the reference oscillator frequency is modulated, the VCO frequency would not change fast enough (especially at the higher audio frequencies). Modulating both VCO and reference oscillators produces a flat audio response. Potentiometer R810 sets the VCO modulation sensitivity so that it is equal to the reference oscillator modulation sensitivity.

4.2.4 CASCODE AMPLIFIERS (Q851/Q852)

The output signal on the collector of Q850 is coupled by L861/C864 to buffer amplifier Q851/Q852. This is a shared-bias amplifier which provides amplification and also isolation between the VCO and the stages which follow. The signal is direct coupled from the collector of Q852 to the emitter of Q851. The resistors in this circuit provide biasing and stabilization, and C865 and C866 are bypass capacitors.

4.2.5 AMPLIFIER (Q853)

Amplifier Q853 provides amplification and isolation between the VCO and receiver and transmitter. C868 provides matching between the amplifiers. Bias for Q853 is provided by R871, R872 and R874. Inductor L856 and capacitor C873 provide impedance matching on the output.

4.2.6 VOLTAGE FILTER (Q832)

Q832 is a capacitance multiplier to provide filtering of the 4.6V supply to the VCO. R836 provides transistor bias and C834 provides the capacitance that is multiplied. If a noise pulse or other voltage change appears on the collector, the base voltage does not change significantly because of C834. Therefore, base current does not change and transistor current remains constant. CR832 decreases the charge time of C834 when power is turned on. This shortens the startup time of the VCO. C841, C840 and C855 are RF decoupling capacitors.

4.2.7 VCO FREQUENCY SHIFT (Q831)

The VCO must be capable of producing frequencies from approximately 403-564.95 MHz to produce the required receive injection and transmit frequencies. If this large of a shift was achieved by varying the VCO control voltage, the VCO gain would be undesirably high. Therefore, capacitance is switched in and out of the tank circuit to provide a coarse shift in frequency.

This switching is controlled by the T/R pin shift on J201, pin 4, Q831/Q834 and pin diode CR850. When a pin diode is forward biased, it presents a vary low impedance to RF; and when it is reverse biased, it presents a very high impedance. The capacitive leg is switched in when in transmit and out when in receive.

When J201, pin 4 is high in receive, Q834 is turned off, Q101 is turned on and the collector voltage goes low. A low on the base of Q102 turns the transistor on and the regulated +5.5V on the emitter is on the collector for the receive circuitry. With a low on the base of Q831 the transistor is off and the collector is high. With a high on the collector of Q831 and a low on the emitter of Q834, this reverse biases CR850 for a high impedance.

The capacitive leg is formed by C851, CR850, C852 and C876. When J201, pin 4 is low in transmit, Q834 is turned on and a high is on the emitter, Q101 is turned off and the collector voltage goes high. A high on the base of Q102 turns the transistor off and the regulated +5.5V is removed from the receive circuitry. With a high on the base of Q831 the transistor is on and the collector is low. With a low on the collector of Q831 and a high on the emitter of Q834, this forward biases CR850 and provides an RF ground through C851 and C852/C876 are effectively connected to the tank circuit. This decreases the resonant frequency of the tank circuit.

4.2.8 SYNTHESIZER INTEGRATED CIRCUIT (U801)

Introduction

Synthesizer chip U801 is shown in Figure 4-2. This device contains the following circuits: R (reference), Fractional-N, NM1 and NM2; phase and lock detectors, prescaler and counter programming circuitry. The basic operation was described in Section 4.2.1.

Channel Programming

Frequencies are selected by programming the R, Fractional-N, NM1 and NM2 in U801 to divide by a certain number. These counters are programmed by a user supplied programming circuit. More information on programming is located in Section 3.

As previously stated, the counter divide numb are chosen so that when the VCO is oscillating on t correct frequency, the VCO-derived input to the ph detector is the same frequency as the reference osci tor-derived frequency.

The VCO frequency is divided by the internal prescaler and the main divider to produce the input the phase detector.

4.2.9 LOCK DETECT

When the synthesizer is locked on frequency, SYNTH LOCK output of U801, pin 18 (J201, pin a high voltage. Then when the synthesizer is unlocked, the output is a low voltage. Lock is defi as a phase difference of less than 1 cycle of the TCXO.

4.3 RECEIVER CIRCUIT DESCRIPTION

4.3.1 HELICAL FILTER (Z201), RF AMPLIFIE (Q201)

Capacitor C201 couples the receive signal fr the antenna switch to helical filter Z201. (The ant switch is described in Section 4.4.5.) Z201 is a b pass filter tuned to pass only a narrow band of fre quencies to the receiver. This attenuates the imag and other unwanted frequencies. The helicals are tory set and should not be tuned.

Impedance matching between the helical filt and RF amplifier Q201 is provided by C203, C2(and L201. Q201 amplifies the receive signal to recover filter losses and also to increase receiver sitivity. Biasing for Q201 is provided by R201, I and R203; and C208/C209 provide RF bypass. C protects the base-emitter junction of Q201 from e sive negative voltages that may occur during hig nal conditions. Additional filtering of the receiv nal is provided by Z202. L202, and C205 provic impedance matching between Q201 and Z202. I tor R204 is used to lower the Q of L202 to make frequency selective.

4.3.2 MIXER (U221), FIRST LO AMPLIFIER (Q301)

First mixer U221 mixes the receive frequency with the first injection frequency to produce the 52.95 MHz first IF. Since high-side injection is used, the injection frequency is 52.95 MHz above the receive frequency. The RF signal is coupled to the mixer through C211.

The first injection frequency from the VCO is coupled to the first local oscillator amplifier Q301 through C301. L301 and C302 match Q301 to the VCO. Bias for Q301 is provided by R301, R302 and R303, and C303 decouples RF signals. Impedance matching to the mixer is provided by L302, R304 and C304.

4.3.3 AMPLIFIER (Q222), CRYSTAL FILTER (Z221/Z222), IF AMP (Q221)

The output of U221 is coupled to buffer Q222. C222, R229 and Q222 match the 50 ohm output of U221. Bias for Q222 is provided by R228 and R229. The output of Q222 is matched to crystal filter Z221 via L222, C223 and R230. This filter presents a low impedance to 52.95 MHz and attenuates the receive, injection, and other frequencies outside the 52.95 MHz passband.

Z221 and Z222 form a 2-section, 4-pole crystal filter with a center frequency of 52.95 MHz and a -3 dB passband of 8 kHz (12.5 kHz BW) or 15 kHz (20/25 kHz BW). This filter establishes the receiver selectivity by attenuating the adjacent channel and other signals close to the receive frequency. C232, C224, and L223 adjust the coupling of the filter. L224, C225 and C227 provide impedance matching between the filter and Q221.

IF amplifier Q221 amplifies the 52.95 MHz IF signal to recover filter losses and improves receiver sensitivity. Biasing for Q221 is provided by R222, R223, R225 and R226 and C228, C229 decouple RF signals. The output of Q221 is coupled to the detector by C230.

4.3.4 SECOND LO AMP/TRIPLER (Q401), SECOND IF FILTER (Q901)

The input frequency to Q401 is 17.5 MHz from TCXO Y801 coupled through C402. Bias for Q401 is provided by R401, R402, R403 and R404. C403, C404 decouple RF from the amplifier. L401, L402, C405, C406 and C407 pass the third harmonic of the input (52.5 MHz) to U241, pin 1. The output of the amplifier is coupled to U241, pin 1 by C241, and C410 and L404 provided low frequency decoupling.

4.3.5 SECOND MIXER/DETECTOR (U241)

<u>Oscillator and Mixer</u>

As shown in Figure 4-3, U241 contains the second oscillator, second mixer, limiter, detector, and squelch circuitry. The 52.95 MHz IF signal is mixed with a 52.5 MHz signal produced by second LO amplifier Q401 from TCXO Y801.

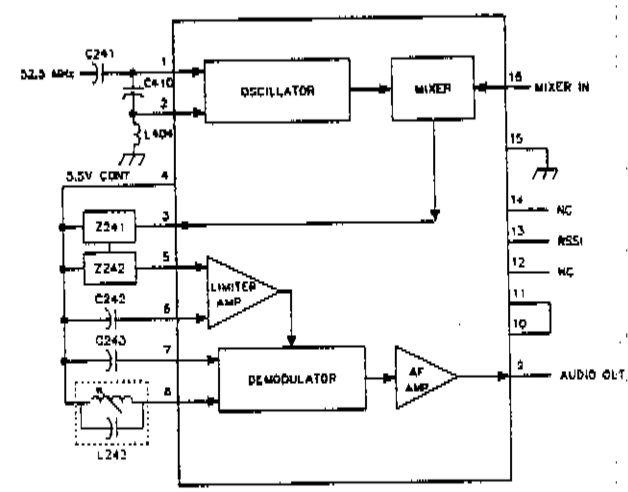

Figure 4-3 U241 BLOCK DIAGRAM

<u>Second IF Filter</u>

The output of the internal double-balanced mixer is the difference between 52.95 MHz and 52.5 MHz which is 450 kHz. This 450 kHz signal is fed out on pin 3 and applied to second IF filters Z241 and Z242. These filters have passbands of 9 kHz (12.5 kHz BW), 15 kHz (20 kHz BW) or 20 kHz (25 kHz BW) at the -6 dB points and are used to attenuate wideband noise.

Limiter-Amplifier

The output of Z241/Z242 is applied to a limiter-amplifier circuit in U241. This circuit amplifies the 450 kHz signal and any noise present; then limits this signal to a specific value. When the 450 kHz signal level is high, noise pulses tend to get clipped off by the limiter; however, when the 450 kHz signal level is low, the noise passes through. C242, C243 decouple the 450 kHz signal.

Quadrature Detector

From the limiter stage the signal is fed to the quadrature detector. An external phase-shift network connected to pin 8 shifts the phase of one of the detector inputs 90° at 450 kHz (all other inputs are unshifted in phase). When modulation occurs, the frequency of the IF signal changes at an audio rate as does the phase of the shifted input. The detector, which has no output with a 90° phase shift, converts this phase shift into an audio signal. L242 is tuned to provide maximum undistorted output from the detector. R242 is used to lower the Q of L242. From the detector the audio and data signal is fed out on pin 9.

Audio/Data Amplifier

The audio/data output of U241 on pin 9 is fed to the audio amplifier U261. U261 amplifies the detected audio/data signal and shifts the DC bias level to 2.5V. The gain is set at approximately 1.5 by R261/R262. R263 and R264 provide a 1.9V DC reference bias voltage. The audio output of U261 is applied to J201, pin 13.

Receive Signal Strength Indicator (RSSI)

U241, pin 13 is an output for the RSSI circuit which provides a current proportional to the strength of the 450 kHz IF signal. The voltage developed across R241 is applied to J201, pin 12.

4.4 TRANSMITTER CIRCUIT DESCRIPTION

4.4.1 BUFFER (Q851)

The output signal is applied to a 50-ohm pad formed by R851, R852, and R853. This pad provides attenuation and isolation. Q851 provides amplification and also additional isolation between the VCC and transmitter. Biasing for this stage is provided R854, and decoupling of RF signals is provided by C852 . Impedance matching with the transmitter i provided by L501 and C502, and impedance match with the receiver is provided by L301, C302.

4.4.2 PRE-DRIVER (Q501), DRIVER (Q521)

Pre-driver Q501 is biased class A by R501 ar R502 and R506. L501 and C502 match Q501 to Q851. C520 and C508 bypass RF from the DC lir and R503 provides supply voltage isolation. R507 the +7.5V supply to the circuit for high power app tions and R508 ties the circuit to +5V for low pow applications. Impedance matching between Q501 and Q521 is provided by L502, L503 and C511. R and C504 provide negative feedback to prevent osciallation.

Driver Q521 is biased nearly Class C by R52 and R522. Impedance matching with Q541 is pro vided by L521, C525, C527, L522 and C526.

4.4.3 -5V POWER CONTROL SUPPLY

The 17.5 MHz from the TCXO is coupled through C902 to Q901. Bias for Q901 is provide R903, R904, R901, R902 and R905. C901 and C provide RF decoupling. The amplified signal rect by CR901/CR902 to produce a -5V DC source. (stabilizes the voltage level and C910 and C911 pr vide RF decoupling. This -5V source is used in t transmit power control circuit U542.

4.4.4 FINAL (Q541), POWER CONTROL (U54

Q541 is biased for Class C operation. The o is matched to the low-pass filter by L541, C552, several capacitors. The supply voltage is isolate from RF by ferrite bead EP541.

Power control is provided by U542. The 5.: transmit supply is passed by U542 to power adju R542. The other end of R542 is the rectified -5V Q901. This negative voltage is required when lo power is used to pinch off Q541 to the required (put.

The low-pass filter consists of L561, C561, L562, C562, L563, C563 and L564. The filter attenuates spurious frequencies occurring above the transmit frequency band. The transmit signal is then fed through the antenna switch to antenna jack J501.

4.4.5 ANTENNA SWITCH (CR561, CR562)

The antenna switching circuit switches the antenna to the receiver in the receive mode and the transmitter in the transmit mode. In the transmit mode, +7.5V is applied to L565 and current flows through diode CR561, L566, diode CR562, and R562/R563. When a diode is forward biased, it presents a low impedance to the RF signal; conversely, when it is reverse biased (or not conducting), it presents a high impedance (small capacitance). Therefore, when CR561 is forward biased, the transmit signal has a low-impedance path to the antenna through coupling capacitor C568.

C567, L566, and C570 form a discrete quarter-wave line. When CR561 is forward biased, this quarter-wave line is effectively AC grounded on one end by C570. When a quarter-wave line is grounded on one end, the other end presents a high impedance to the quarter-wave frequency. This blocks the transmit signal from the receiver. C569 matches the antenna to 50 ohms in transmit and receive.

In the receive mode, no power is applied to L565, so all the diodes are "off". The receive signal then has a high-impedance path into the transmitter and a low-impedance path into the receiver because the quarter-wave line is not grounded.

SECTION 5 SERVICING

5.1 GENERAL

5.1.1 PERIODIC CHECKS

This transceiver should be put on a regular maintenance schedule and an accurate performance record maintained. Important checks are receiver sensitivity and transmitter frequency, modulation, and power output. A procedure for these and other tests is located in Section 6. It is recommended that transceiver performance be checked annually even though periodic checks are not required by the FCC. During the first year, make an additional check or two to ensure no TCXO frequency drifting has occurred.

5.1.2 SURFACE-MOUNTED COMPONENTS

A large number of the components used on the transceiver board are the surface-mounted type. Since these components are relatively small in size and are soldered directly to the PC board, care must be used when they are replaced to prevent damage to the component or PC board. Surface-mounted components should not be reused because they may be damaged by the unsoldering process.

5.1.3 SCHEMATIC DIAGRAMS AND COMPONENT LAYOUTS

Schematic diagrams and component layouts of the PC boards used in this transceiver are located in Section 8. A component locator guide is also provided to aid in component location.

5.1.4 REPLACEMENT PARTS LIST

A replacement parts list with all the parts used in this transceiver is located in Section 7. Parts are listed alphanumerically according to designator. For information on ordering parts, refer to Section 1.8.

5.1.5 TCXO MODULE NOT SERVICEABLE

The ±1.5 PPM TCXO module is not field serviceable. Part changes require a factory recalibration to ensure that the oscillator stays within its ±1.5 PPM tolerance.

5.2 SYNTHESIZER SERVICING

5.2.1 INTRODUCTION

When there is a synthesizer malfunction, the VCO is not locked on frequency. When an unlock VCO is detected by the lock detector circuit, U801 pin 18 goes low (0V).

NOTE: The user-supplied circuitry must disable t transmitter and receiver when an out-of-lock cond tion is indicated.

When the VCO is unlocked, the f_R and f_V inp to the phase detector are usually not in phase (see tion 4.1.2). The phase detector in U801 then caus the VCO control voltage to go to the high or low e of its operating range. This in turn causes the VC oscillate at the high or low end of its frequency ra

As shown in Figure 4-1, a loop is formed by VCO Q850, amplifier Q851/Q852, and the RF IN U801. Therefore, if any of these components begi malfunction, improper signals appear throughout t loop. However, correct operation of the counters still be verified by measuring the input and output quencies to check the divide number.

Proceed as follows to check the synthesizer I signals to determine if it is operating properly.

5.2.2 REFERENCE OSCILLATOR

Check the signal at U801, pin 8. It should be 17.5 MHz at a level of approximately 1.5V P-P. I TCXO module is defective, it is not serviceable a must be replaced with a new module as described Section 5.1.5.

5.2.3 VCO

Output Level

The output level of Q853 can be measured w an RF voltmeter or some other type of high imped meter. The minimum level after a power splitter R851 should be -10 dBm.

Control Voltage

Check the DC voltage at C815 with a channel near the center of the band. If the VCO is locked on frequency, this should be a steady DC voltage near 3V. If it is not locked on frequency, it should be near the lower or upper end of its range (0V or 5.5V).

Output Frequency

Check the VCO frequency at R851. If the VCO is locked on frequency, it should be stable on the transmit channel frequency. If the VCO is not locked on frequency, the VCO control voltage is probably near 0V or 5.5V.

5.2.4 SYNTHESIZER (U801)

Lock Detector

When the VCO is locked on frequency, the lock detect output on J201, pin 7 should be high.

5.3 RECEIVER SERVICING

To isolate a receiver problem to a specific section, refer to the troubleshooting flowchart in Figure 5-1. Tests referenced in the flowchart are described in the following information.

NOTE: Supply voltages are provided by the user.

5.3.1 SUPPLY VOLTAGES AND CURRENT

Measure the supply voltages on the following pins at interface connector J201:

Pin 4 - 5.0V DC Receive
Pin 5 - 5.0V DC

Place a DC ammeter in the supply line to the transceiver and the following maximum currents should be measured:

Pin 4 - 10 mA
Pin 5 - 50 mA

5.3.2 MIXER/DETECTOR (U201)

Data Output

Using a .01 µF coupling capacitor, inject at U241, pin 16, a 52.95 MHz, 1 mV signal, modulated with 1 kHz at ± 3 kHz deviation. The audio output level at U241, pin 9 should be approximately 400 mV RMS.

The data output on J201, pin 13 should be 600 mV to 1.2V P-P or 212 mV to 424 mV RMS with the preceding injection signal.

RSSI Output

The RSSI output on J201, pin 12 should be greater than 100 mV at 12 dB SINAD and less than 2.5V with 1 mV input. If either of the preceding measurements is not correct, there may be a problem with U241.

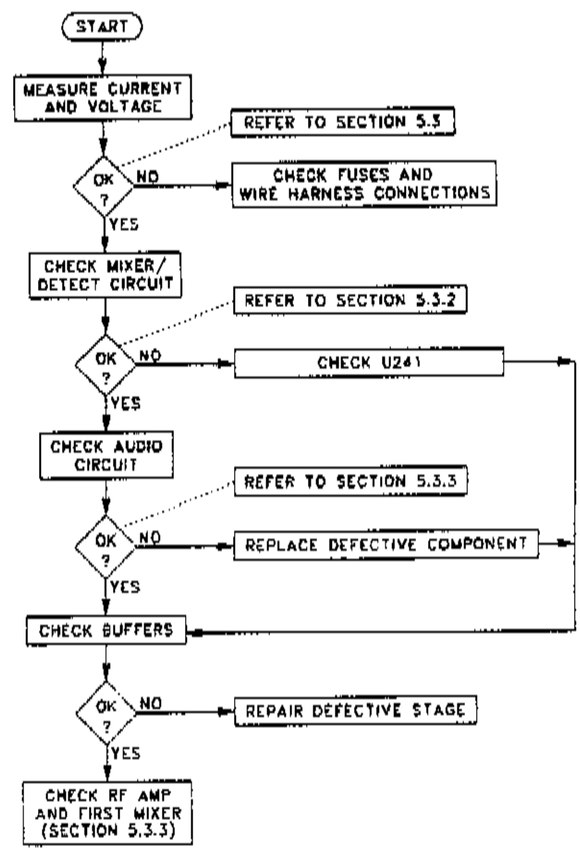

Figure 5-1 RECEIVER SERVICING FLOWCHART

5.3.3 RF AMPLIFIER (Q201) AND FIRST MIXER (Q221)

Refer to the schematic diagram for signal levels and test points for measuring levels.

5.3.4 RF AND IF AMPLIFIERS, FIRST MIXER

Check the DC voltages shown on the schematic diagram. If they are normal, inject a signal at the input and output of each stage using a .01 μF coupling capacitor. If the stage is producing gain, the injection level on the input of a stage should be less than that required on the output to produce the same SINAD at the receive output.

5.4 TRANSMITTER SERVICING

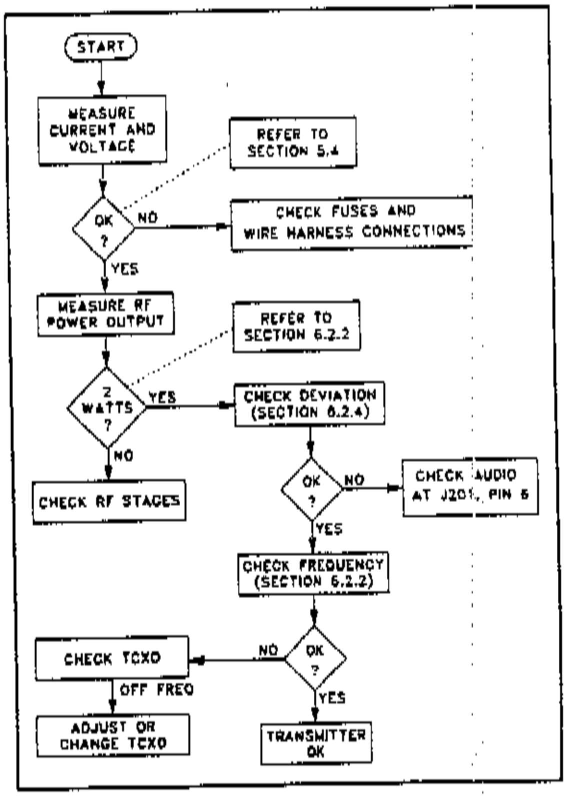

Figure 5-2 TRANSMITTER SERVICING FLOWCHART

5.4.1 SUPPLY VOLTAGES AND CURRENT

Measure the supply voltages on the following pins of interface connector J201:

Pin 2 - 7.5V DC
Pin 3 - 7.5V DC
Pin 4 - 0.0V DC (while transmitting)
Pin 5 - 5.0V DC
Pin 6 - 2.5V DC Transmit In/1.5V P-P max

Place a DC ammeter in the supply line to the transceiver and the following maximum currents should be measured:

Pin 2 - 650 mA
Pin 3 - 250 mA
Pin 5 - 12 mA

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SECTION 6 ALIGNMENT PROCEDURE AND PERFORMANCE TESTS

6.1 GENERAL

Receiver or transmitter alignment may be necessary if repairs are made that could affect tuning. Alignment points diagrams are located in Figure 6-3 or component layouts are located in Section 8.

Fabricate test cables by referring to Figure 2-1. This cable should include power and ground, a transmit keying switch that shorts the keying line to ground, data input and data output. The test setup must apply the various supply voltages and load the synthesizer with channel information.

6.2 DL3474 TRANSCEIVER ONLY

6.2.1 FREQUENCY AND CONTROL LINE VOLTAGE CHECK

1. Connect the test setup shown in Figure 6-1. Set the power supply for +7.5V DC. See Figure 2-1 for interface cable.
2. Load the synthesizer with the channel frequency (see Section 3.2).
3. Connect a DC voltmeter at the junction of R808/C815 to measure the VCO control line voltage for a meter reading of ≥0.50 - ≤4.90V DC (see Figure 6-3).
4. Key the transmitter.
5. Measure the VCO control line voltage for a meter reading of ≥0.75 - ≤5.00V DC
6. Unkey the transmitter.

6.2.2 2W TRANSMITTER POWER ALIGNMENT

1. Connect the test setup shown in Figure 6-1. A DC ammeter capable of measuring up to 1.5A should be installed in the supply line.
2. Load the synthesizer with the center channel frequency.
3. Key the transmitter and make sure that the supp voltage at the RF board is 7.5V. **(Do not transmit for extended periods.)**
4. Adjust C553 counterclockwise for minimum current.
5. Connect a voltmeter to the junction of R542/R5
6. Adjust R542 clockwise for 2.30V DC (+0/-0.1\ DC).
7. Readjust C553 counterclockwise for minimum current.
8. Tune C527 clockwise for maximum power.
9. Tune C553 clockwise for 2.0W (±0.1W). Curre should be less than 900 mA. (Power output sho be 1.6-2.4W and current less than 900 mA fron 403-512 MHz.)
10. Monitor the frequency with a frequency counter adjust TCXO (Y801) for the channel frequency ±100 Hz.

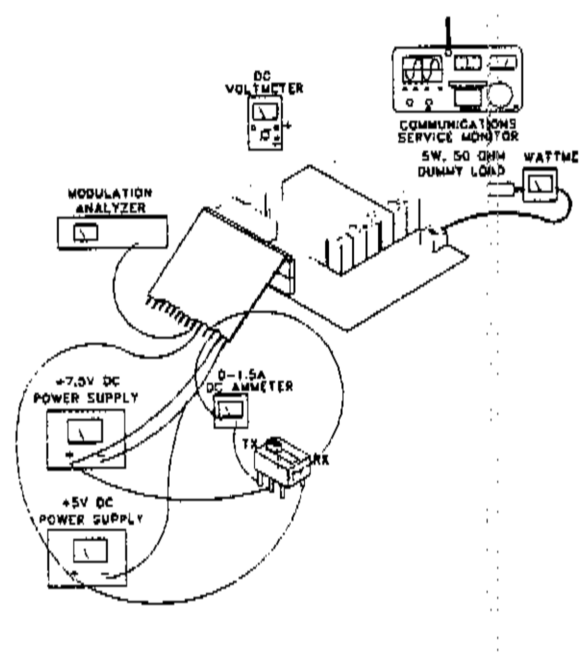

Figure 6-1 TRANSMITTER TEST SETU

6.2.3 LOW POWER ALIGNMENT

1. Connect the test setup shown in Figure 6-1.
2. Load the synthesizer with the center channel frequency.
3. Connect a voltmeter to the junction of R542/R543.
4. Adjust R542 clockwise for -1.5V DC (±0.1V DC).
5. Tune C527 clockwise for maximum power.
6. Tune C553 clockwise for minimum power.
7. Adjust R542 for the required power level.
8. Tune C527 for power balance at frequencies which are as close as possible to ±5 MHz from the center of the channel frequency.
9. Re-adjust R542 for the power level required if necessary.
10. Monitor the frequency with a frequency counter and adjust TCXO (Y801) for the channel frequency ±100 Hz.

6.2.4 MODULATION FLATNESS ALIGNMENT

1. Inject a 220 Hz square-wave tone at approximately 0.35V P-P, biased at 2.5V DC on J201, pin 6.
2. Transmit into the modulation analyzer and observe modulation output on the oscilloscope. Set the modulation analyzer high pass filtering off and no less than a 15 kHz low pass filter.
3. Adjust R810 for a flat square-wave on the oscilloscope.
4. Inject a 1 kHz sine-wave on J201, pin 6, biased at 2.5V DC, at the level below according to the bandwidth:

   0.200V RMS for 12.5 kHz BW (-X10 Radios)
   0.330V RMS for 20.0 kHz BW (-X20 Radios)
   0.400V RMS for 25.0 kHz BW (-X30 Radios)

5. Switch on TX Modulation. Set the modulation analyzer for 3 kHz low pass filtering.
6. The transmit deviation should measure between:

   ±1.2/±1.9 kHz for 12.5 kHz BW (-X10 Radios)
   ±1.9/±3.0 kHz for 20.0 kHz BW (-X20 Radios)
   ±2.4/±3.8 kHz for 25.0 kHz BW (-X30 Radios)

7. Set a 0 dB reference on the Audio Analyzer.
8. Input a 100 Hz sine-wave. The level should be within ±1.5 dB of the 1 kHz reference.
9. Remove transmit modulation and unkey the transmitter.
10. Connect a DC voltmeter at the junction of R807/R855.
11. Adjust R855 to 2.10V DC (±0.05V DC).

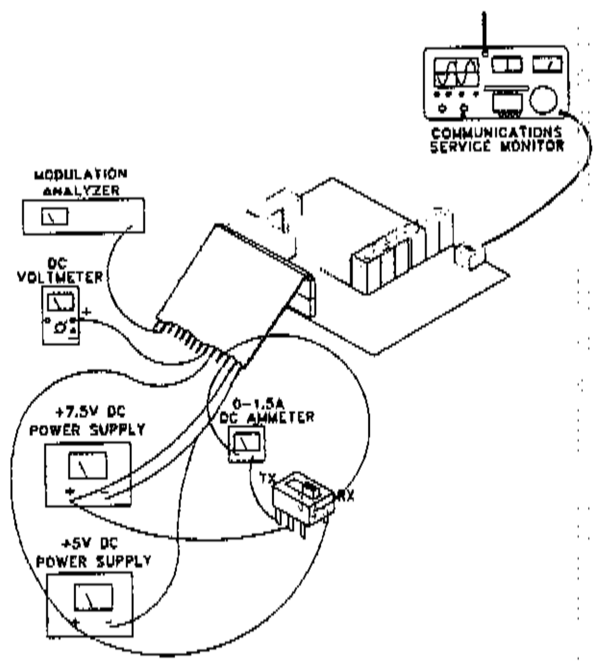

Figure 6-2 RECEIVER TEST SETUP

6.2.5 RECEIVER ALIGNMENT

CAUTION

Do not key the transmitter with the generator connected because severe generator damage may result.

1. Connect the test setup shown in Figure 6-2. Adjust the power supply for +7.5V DC.

2. Measure the receive current drain. (Typically current should be <80 mA.)

3. Preset tuning slugs of L222/L224 to the full clockwise position (slug in all the way).

4. Preset C232 to center position (slot in-line with axis of part).

5. Readjust L224 counterclockwise 2 turns.

6.2.6 IF AND AUDIO ADJUSTMENTS

1. Load the synthesizer with the channel frequency.

2. Set the RF signal generator for this frequency with a 1 kHz tone (modulated output shown below) at a level of -47 dBm (1000 μV) and inject into J501.

   1.5 kHz deviation (-X10 12.5 kHz BW Radio)
   2.4 kHz deviation (-X20 20.0 kHz BW Radio)
   3.0 kHz deviation (-X30 25.0 kHz BW Radio)

NOTE: Maintain these deviation levels throughout the test when measuring AC levels, SINAD and % distortion.

3. Adjust L242 for 2.5V DC (±0.05V DC) at the receive audio output.

4. Set the RF signal generator level to -105 dBm, "unmodulated".

5. Set the generator frequency 3 kHz below channel center (-X10) or 5 kHz below channel center (-X20/ -X30).

6. Adjust C232, then L222 for peak RSSI voltage.

   NOTE: Use 2V scale on DVM.

7. Set the RF signal generator frequency back to ch nel center at -47 dBm with standard deviation le

8. Adjust L224 for minimum distortion.

9. Set the RF signal generator to -105 dBm, "unmo lated".

10. Adjust L222 for peak RSSI voltage.

    NOTE: Use 2V scale on DVM.

11. Adjust deviation to the level in Step 2. Record RMS voltage level ______RMS. (Typically : mV ±50 mV.)

12. Record the percent distortion ______%. (Typ cally <3%.)

13. Adjust the RF input level until 12 dB SINAD i measured. (Typically <0.45 μV).

14. Adjust the generator RF level to -120 dBm an measure DC (RSSI) voltage on J201, pin 12. (ically ≤ 0.90V DC.)

15. Adjust the generator RF level to -60 dBm and sure DC (RSSI) voltage on J201, pin 12. (Typi ≥ 2.40V DC.)

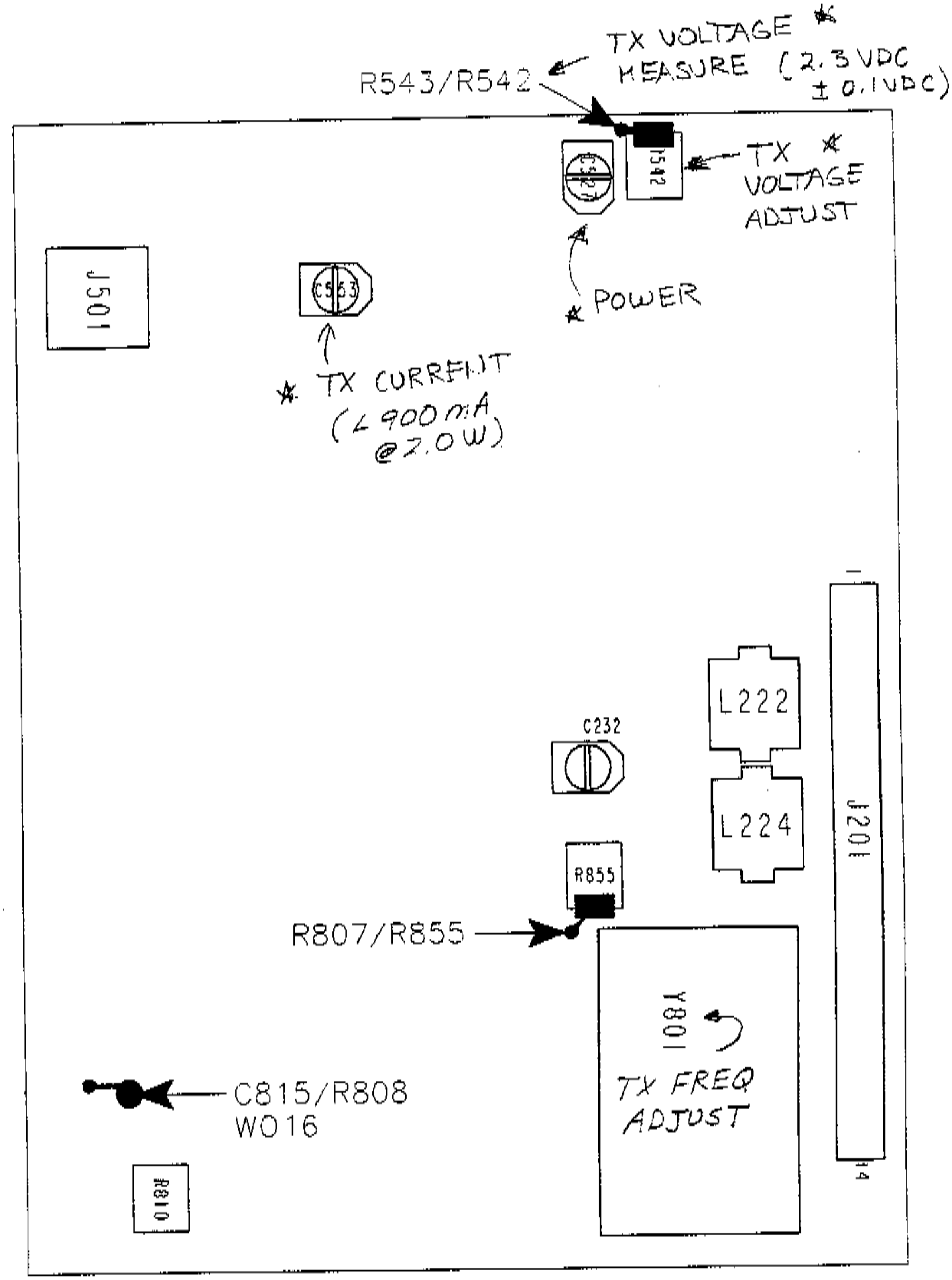

Figure 6-3 ALIGNMENT POINTS DIAGRAM

SECTION 7 PARTS LIST

HIGH-SPEC DATA TRANSCEIVER
PART NO. 242-3474-XX0

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
A 801	VCO 403-419 MHz	023-3474-240
A 801	VCO 419-435 MHz	023-3474-340
A 801	VCO 435-451 MHz	023-3474-440
A 801	VCO 450-466 MHz	023-3474-540
A 801	VCO 464-480 MHz	023-3474-640
A 801	VCO 480-496 MHz	023-3474-740
A 801	VCO 496-512 MHz	023-3474-840
C 101	68 pF ±5% NPO 0603	510-3674-680
C 102	68 pF ±5% NPO 0603	510-3674-680
C 103	68 pF ±5% NPO 0603	510-3674-680
C 104	68 pF ±5% NPO 0603	510-3674-680
C 105	68 pF ±5% NPO 0603	510-3674-680
C 106	68 pF ±5% NPO 0603	510-3674-680
C 107	68 pF ±5% NPO 0603	510-3674-680
C 108	68 pF ±5% NPO 0603	510-3674-680
C 109	68 pF ±5% NPO 0603	510-3674-680
C 110	68 pF ±5% NPO 0603	510-3674-680
C 111	68 pF ±5% NPO 0603	510-3674-680
C 112	68 pF ±5% NPO 0603	510-3674-680
C 113	68 pF ±5% NPO 0603	510-3674-680
C 114	1 µF 16V SMD tantalum	510-2625-109
C 115	68 pF ±5% NPO 0603	510-3674-680
C 116	.01 µF ±10% X7R 0603	510-3675-103
C 117	1 µF 16V SMD tantalum	510-2625-109
C 118	68 pF ±5% NPO 0603	510-3674-680
C 123	68 pF ±5% NPO 0603	510-3674-680
C 124	1 µF 16V SMD tantalum	510-2625-109
C 125	1 µF 16V SMD tantalum	510-2625-109
C 126	.01 µF ±10% X7R 0603	510-3675-103
C 201	68 pF ±5% NPO 0603	510-3674-680
C 202	68 pF ±5% NPO 0603	510-3674-680
C 203	68 pF ±5% NPO 0603	510-3674-680
C 204	8.2 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673-829
	6.2 pF ±0.1% NPO 0603 (435-480 MHz)	510-3673-629
	5.6 pF ±0.1% NPO 0603 (480-512 MHz)	510-3673-569
C 205	20 pF ±5% NPO 0603	510-3674-200

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 206	68 pF ±5% NPO 0603	510-3674-
C 207	68 pF ±5% NPO 0603	510-3674-
C 208	68 pF ±5% NPO 0603	510-3674-
C 209	220 pF ±5% NPO 0603	510-3674-
C 210	4.7 pF ±0.1% NPO 0603 (403-435 MHz)	510-3673-
	3.6 pF ±0.1% NPO 0603 (435-480 MHz)	510-3673-
	3 pF ±0.1% NPO 0603 (480-512 MHz)	510-3673-
C 222	.01 µF ±5% X7R 0603 chip	510-3675
C 223	3.9 pF ±0.1% NPO 0603	510-3673
C 224	4.7 pF ±0.1% NPO 0603	510-3673
C 225	.01 µF ±10% X7R 0603 (12.5 kHz BW)	510-3675
	39 pF ±5% NPO 0603 (20-25 kHz BW)	510-3674
C 226	.01 µF ±10% X7R 0603	510-3675
	8.2 pF ±0.1% NPO 0603 (12.5 kHz BW)	510-3673
C 227	12 pF ±5% NPO 0603 (20-25 kHz BW)	510-3674
C 228	.01 µF ±10% X7R 0603	510-3675
C 229	.01 µF ±10% X7R 0603	510-3675
C 230	.01 µF ±10% X7R 0603	510-3675
C 232	1.5-5 pF ceramic SMD	512-1602
C 233	.01 µF ±10% X7R 0603	510-3675
C 234	.01 µF ±10% X7R 0603	510-3675
C 235	68 pF ±5% NPO 0603	510-3674
C 241	.01 µF ±10% X7R 0603	510-3675
C 242	.1 µF ±5% X7R 1206	510-3609
C 243	.1 µF ±5% X7R 1206	510-3609
C 245	.01 µF ±10% X7R 0603	510-3675
C 246	1 µF 16V SMD tantalum	510-2625
C 247	.01 µF ±10% X7R 0603	510-3675
C 248	.01 µF ±10% X7R 0603	510-3675
C 261	27 pF ±5% NPO 0603	510-3674
C 262	68 pF ±5% NPO 0603	510-3674
C 263	.1 µF ±5% X7R 1206	510-3609
C 301	68 pF ±5% NPO 0603	510-3674
C 302	10 pF ±0.1% NPO 0603 (403-435 MHz)	510-367
	8.2 pF ±0.1% NPO 0603 (435-466 MHz)	510-367

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
	6.8 pF ±0.1% NPO 0603 (464-496 MHz)	510-3673-689
C 302	6.2 pF ±0.1% NPO 0603 (496-512 MHz)	510-3673-689
C 302	4.7 pF ±0.1% NPO 0603	510-3673-479
C 303	68 pF ±5% NPO 0603	510-3674-680
C 304	4.7 pF ±0.1% NPO 0603 (403-435 MHz)	510-3673-479
	3.3 pF ±0.1% NPO 0603 (435-496 MHz)	510-3673-339
	3.3 pF ±0.1% NPO 0603 (496-512 MHz)	510-3673-339
C 305	.01 µF ±10% X7R 0603	510-3675-103
C 306	68 pF ±5% NPO 0603	510-3674-680
C 309	1 µF 16V SMD tantalum	510-2625-109
C 401	.01 µF ±10% X7R 0603	510-3675-103
C 402	.01 µF ±10% X7R 0603	510-3675-103
C 403	.01 µF ±10% X7R 0603	510-3675-103
C 404	.01 µF ±10% X7R 0603	510-3675-103
C 405	100 pF ±5% NPO 0603	510-3674-101
C 406	6.8 pF ±0.1% NPO 0603	510-3673-689
C 407	100 pF ±5% NPO 0603	510-3674-101
C 408	.01 µF ±10% X7R 0603	510-3675-103
C 410	.1 µF ±5% X7R 1206	510-3609-104
C 501	68 pF ±5% NPO 0603	510-3674-680
C 502	7.5 pF ±0.1% NPO 0603 (435-451 MHz)	510-3673-759
	6.8 pF ±0.1% NPO 0603 (450-480 MHz)	510-3673-689
C 503	68 pF ±5% NPO 0603	510-3674-680
C 504	470 pF ±5% NPO 0603	510-3674-471
C 505	.01 µF ±10% X7R 0603	510-3675-103
C 506	68 pF ±5% NPO 0603	510-3674-680
C 507	68 pF ±5% NPO 0603	510-3674-680
C 508	68 pF ±5% NPO 0603	510-3674-680
C 509	68 pF ±5% NPO 0603	510-3674-680
C 510	120 pF ±5% NPO 0603	510-3674-121
C 511	6.8 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673-689
	5.6 pF ±0.1% NPO 0603 (419-435 MHz)	510-3673-569
	5.1 pF ±0.1% NPO 0603 (435-451 MHz)	510-3673-519
	3.9 pF ±0.1% NPO 0603 (450-480 MHz)	510-3673-399
	2.2 pF ±0.1% NPO 0603 (480-496 MHz)	510-3673-229
	1 pF ±0.1% NPO 0603 (496-512 MHz)	510-3673-100
C 520	22 pF ±5% NPO 0603	510-3674-220
C 521	68 pF ±5% NPO 0603	510-3674-680
C 522	.01 µF ±10% X7R 0603	510-3675-103
C 523	68 pF ±5% NPO 0603	510-3674-680
C 524	470 pF ±5% NPO 0603	510-3674-471
C 525	27 pF ±5% NPO 0603	510-3674-270
C 526	22 pF ±5% NPO 0603 (403-419 MHz)	510-3674-220
	18 pF ±0.1% NPO 0603 (419-435 MHz)	510-3673-180
	15 pF ±5% NPO 0603 (435-512 MHz)	510-3674-150
C 527	2.5-10 pF SMD ceramic	512-1602-002
C 541	68 pF ±5% NPO 0603	510-3674-680
C 542	.01 µF ±10% X7R 0603	510-3675-103
C 543	68 pF ±5% NPO 0603	510-3674-680
C 544	.01 µF ±10% X7R 0603	510-3675-103
C 545	68 pF ±5% NPO 0603	510-3674-680
C 546	68 pF ±5% NPO 0603	510-3674-680
C 547	68 pF ±5% NPO 0603	510-3674-680
C 548	1 µF 16V SMD tantalum	510-2625-109
C 549	.01 µF ±10% X7R 0603	510-3675-103
C 550	36 pF ±5% NPO 0805 (403-451 MHz)	510-3601-360
	30 pF ±5% NPO 0805 (450-466 MHz)	510-3601-300
	27 pF ±5% NPO 0805 (464-480 MHz)	510-3601-270
	20 pF ±5% NPO 0805 (480-496 MHz)	510-3601-200
	18 pF ±5% NPO 0805 (496-512 MHz)	510-3601-180
C 551	33 pF ±5% NPO 0805 (403-419 MHz)	510-3601-330
	27 pF ±5% NPO 0805 (419-435 MHz)	510-3601-270
	24 pF ±5% NPO 0805 (435-451 MHz)	510-3601-240
	18 pF ±5% NPO 0805 (450-480 MHz)	510-3601-180
	16 pF ±5% NPO 0805 (480-496 MHz)	510-3601-160
	15 pF ±5% NPO 0805 (496-512 MHz)	510-3601-150

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 552	3.9 pF ±5% NPO 0805	510-3601-399
C 553	2.5-10 pF ceramic SMD	512-1602-002
C 554	68 pF ±5% NPO 0603	510-3674-680
C 555	33 pF ±5% NPO 0603 (403-480 MHz)	510-3674-330
C 555	39 pF ±5% NPO 0603 (480-512 MHz)	510-3674-390
C 560	22 pF ±5% NPO 0603	510-3674-220
C 561	7.5 pF ±5% NPO 0805 (403-419 MHz)	510-3601-759
	6.2 pF ±5% NPO 0805 (419-435 MHz)	510-3601-629
	5.6 pF ±5% NPO 0805 (435-451 MHz)	510-3601-569
	5.1 pF ±5% NPO 0805 (450-466 MHz)	510-3601-519
	4.7 pF ±5% NPO 0805 (464-480 MHz)	510-3601-479
	4.3 pF ±5% NPO 0805 (480-496 MHz)	510-3601-439
	3.9 pF ±5% NPO 0805 (496-512 MHz)	510-3601-399
C 562	8.2 pF ±5% NPO 0805 (403-419 MHz)	510-3601-829
	7.5 pF ±5% NPO 0805 (419-435 MHz)	510-3601-759
	6.8 pF ±5% NPO 0805 (435-451 MHz)	510-3601-689
	6.2 pF ±5% NPO 0805 (450-480 MHz)	510-3601-629
	5.6 pF ±5% NPO 0805 (480-496 MHz)	510-3601-569
	5.1 pF ±5% NPO 0805 (496-512MHz)	510-3601-519
C 563	11 pF ±5% NPO 0805 (403-419 MHz)	510-3601-110
	10 pF ±5% NPO 0805 (403-419 MHz)	510-3601-100
	8.2 pF ±5% NPO 0805 (435-451 MHz)	510-3601-829
	7.5 pF ±5% NPO 0805 (450-466 MHz)	510-3601-759
	6.8 pF ±5% NPO 0805 (464-480 MHz)	510-3601-689
	6.2 pF ±5% NPO 0805 (480-496 MHz)	510-3601-629
	5.6 pF ±5% NPO 0805 (496-512 MHz)	510-3601-569

SYMBOL NUMBER	DESCRIPTION	PA NUMB
C 564	.01 μF ±10% X7R 0603	510-3675-
C 565	68 pF ±5% NPO 0603	510-3674-
C 567	10 pF ±5% NPO 0805 (403-419 MHz)	510-3601-
	7.5 pF ±5% NPO 0805 (419-435 MHz)	510-3601-
C 567	5.6 pF ±5% NPO 0805 (435-466 MHz)	510-3601-
	5.1 pF ±5% NPO 0805 (464-496 MHz)	510-3601-
	4.3 pF ±5% NPO 0805 (496-512 MHz)	510-3601-
C 568	47 pF ±5% NPO 0603	510-3674-
C 569	9.1 pF ±5% NPO 0805 (403-419 MHz)	510-3601-
	6.8 pF ±5% NPO 0805 (419-435 MHz)	510-3601
	5.6 pF ±5% NPO 0805 (435-451 MHz)	510-3601
	5.1 pF ±5% NPO 0805 (451-466 MHz)	510-3601
	4.7 pF ±5% NPO 0805 (464-512 MHz)	510-3601
C 570	33 pF ±5% NPO 0603	510-3674
C 801	.01 μF ±10% X7R 0603	510-3675
C 802	.01 μF ±10% X7R 0603	510-3675
C 803	.01 μF ±10% X7R 0603	510-3675
C 804	3.3 pF ±0.1% NPO 0603	510-3673
C 805	.01 μF ±10% X7R 0603	510-3675
C 806	68 pF ±5% NPO 0603	510-3674
C 807	.01 μF ±10% X7R 0603	510-3675
C 808	68 pF ±5% NPO 0603	510-3674
C 809	100 pF ±5% NPO 0805	510-360
C 810	.1 μF ±5% X7R 1206	510-360
C 811	.001 μF ±10% X7R 0603	510-367
C 812	.0047 μF ±10% X7R 0805	510-360
C 813	.001 μF ±10% X7R 0603	510-367
C 814	1 μF 16V SMD tantalum	510-262
C 815	.0047 μF ±10% X7R 0805	510-360
C 817	68 pF ±5% NPO 0603	510-367
C 818	1 μF 16V SMD tantalum	510-262
C 819	3.9 pF ±0.1% NPO 0603	510-367
C 831	.01 μF ±10% X7R 0603	510-367
C 832	.01 μF ±10% X7R 0603	510-367
C 833	68 pF ±5% NPO 0603	510-367
C 834	4.7 μF 10V SMD tantalum	510-262

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 835	.01 µF ±10% X7R 0603	510-3675-103
C 836	.01 µF ±10% X7R 0603	510-3675-103
C 837	.01 µF ±10% X7R 0603	510-3675-103
C 838	68 pF ±5% NPO 0603	510-3674-680
C 839	.01 µF ±10% X7R 0603	510-3675-103
C 840	68 pF ±5% NPO 0603	510-3674-680
C 841	.01 µF ±10% X7R 0603	510-3675-103
C 842	.01 µF ±10% X7R 0603	510-3675-103
C 844	1 µF 16V SMD tantalum	510-2625-109
C 845	.01 µF ±10% X7R 0603	510-3675-103
C 846	68 pF ±5% NPO 0603	510-3674-680
C 847	.01 µF ±10% X7R 0603	510-3675-103
C 848	68 pF ±5% NPO 0603	510-3674-680
C 849	68 pF ±5% NPO 0603	510-3674-680
C 850	68 pF ±5% NPO 0603	510-3674-680
C 851	68 pF ±5% NPO 0603	510-3674-680
C 852	68 pF ±5% NPO 0603	510-3674-680
C 853	1 µF 16V SMD tantalum	510-2625-109
C 855	68 pF ±5% NPO 0603	510-3674-680
C 901	.01 µF ±10% X7R 0603	510-3675-103
C 902	27 pF ±5% NPO 0603	510-3674-270
C 903	.01 µF ±10% X7R 0603	510-3675-103
C 904	220 pF ±5% NPO 0805	510-3601-221
C 905	270 pF ±5% NPO 0805	510-3601-271
C 906	.01 µF ±10% X7R 0603	510-3675-103
C 907	.01 µF ±10% X7R 0603	510-3675-103
C 908	.01 µF ±10% X7R 0603	510-3675-103
C 909	1 µF 16V SMD tantalum	510-2625-109
C 910	.01 µF ±10% X7R 0603	510-3675-103
C 911	68 pF ±5% NPO 0603	510-3674-680
CR201	Switching diode SOT-23	523-1504-002
CR561	Pin switch diode SOT-23	523-1504-001
CR562	Pin switch diode SOT-23	523-1504-001
CR831	Dual switch diode SOT-23	523-1504-023
CR901	Dual switch diode SOT-23	523-1504-023
CR902	Dual switch diode SOT-23	523-1504-023
EP200	Mini cer crystal pin insulator	010-0345-280
EP501	Ferrite bead SMD	517-2503-001

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
EP541	Ferrite bead SMD	517-2503-001
J 201	14-pin single row receptacle	515-7110-214
J 501	Straight terminal PC bd mt	515-3013-030
L 201	Inductor LL2012 F15N	542-9003-157
L 202	10 nH ±10% SMD NHY0805	542-9003-107
L 222	1 µH ±6%5mm variable	542-1012-015
L 201	15 nH ±10% SMD 0805 (403-466 MHz)	542-9003-157
	12 nH ±10% SMD 0805 (464-512 MHz)	542-9003-127
L 202	12 nH ±10% SMD 0805	542-9003-127
L 223	.82 µH SMD inductor	542-9001-828
L 224	1 µH ±6%5mm variable	542-1012-015
L 242	680 µH quad coil	542-5102-001
L 301	Inductor LL2012 F12N (403-435 MHz)	542-9003-127
L 301	Inductor LL2012 F10N (435-512 MHz)	542-9003-107
L 302	Inductor LL2012 F15N	542-9003-157
L 401	82 nH ±10% SMD 0805	542-9003-827
L 402	82 nH ±10% SMD 0805	542-9003-827
L 404	1 µH SMD inductor	542-9001-109
L 501	18 nH inductor LL2012 F15N (435-451 MHz)	542-9003-187
	15 nH inductor LL2012 F15N (450-480 MHz)	542-9003-157
L 502	1 µH SMD inductor	542-9001-109
L 503	15 nH inductor LL2012 F15N (403-496 MHz)	542-9003-157
	12 nH inductor LL2012 F12N (496-512 MHz)	542-9003-127
L 521	43 nH 10-turn SMD air core	542-0030-010
L 522	3.9 nH inductor LL2012 F3N9 (403-419 MHz)	542-9003-396
	3.3 nH inductor LL2012 F3N3 (419-466 MHz)	542-9003-336
	2.7 nH inductor LL2012 F2N7 (464-496 MHz)	542-9003-276
	2.2 nH inductor LL2012 F2N2 (496-512 MHz)	542-9003-226

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
L 541	18.5 nH 5-turn SMD air core	542-0030-005
L 561	18.5 nH 5-turn SMD air core	542-0030-005
L 562	35.5 nH 9-turn SMD air core	542-0030-009
L 563	35.5 nH 9-turn SMD air core	542-0030-009
L 564	18.5 nH 5-turn SMD air core	542-0030-005
L 565	1 μH SMD inductor	542-9001-109
L 566	12.5 nH SMD air core	542-0030-004
L 801	39 μH ±10% SMD NHY0805	542-9003-397
L 851	1 μH SMD inductor	542-9001-109
L 901	.68 μH SMD inductor	542-9001-688
MP801	VCO can	017-2225-751
MP802	Top shield, transmitter	017-2225-761
MP803	Bottom shield, transmitter	017-2225-762
MP804	Bottom shield	017-2225-763
MP805	Bottom shield	017-2225-764
MP806	Crystal filter shield	017-2225-699
PC001	PC board	035-3474-030
Q 101	NPN amplifier SOT-23	576-0003-616
Q 102	PNP digital w/res SOT-23	576-0003-621
Q 103	NPN amplifier SOT-23	576-0003-616
Q 201	NPN low noise SOT-23	576-0003-636
Q 221	VHF/UHF amp SOT-23	576-0003-634
Q 222	Si N-chnl JFET SOT	576-0006-019
Q 301	NPN low noise SOT-23	576-0003-636
Q 401	VHF/UHF amp SOT-23	576-0003-634
Q 501	NPN low noise SOT-23	576-0003-636
Q 521	NPN .2-2 GHz SO-8	576-0003-604
Q 541	RF FET	576-0006-450
Q 831	NPN amplifier SOT-23	576-0003-616
Q 832	Si NPN gen purp sw/amp	576-0001-300
Q 833	VHF/UHF amp SOT-23	576-0003-634
Q 834	PNP digital w/res SOT-23	576-0003-621
Q 851	Bi-polar MMIC SOT-143	576-0003-638
Q 901	VHF/UHF amp SOT-23	576-0003-634

SYMBOL NUMBER	DESCRIPTION	PA NUM
R 120	100k ohm ±5% .063W 0603	569-0155-
R 121	330k ohm ±5% .063W 0603	569-0155-
R 201	82 ohm ±5% .063W 0603	569-0155-
R 202	16k ohm ±5% .063W 0603	569-0155-
R 203	3.9k ohm ±5% .063W 0603	569-0155-
R 204	180 ohm ±5% .063W 0603	569-0155-
R 222	330 ohm ±5% .063W 0603	569-0155
R 223	22k ohm ±5% .063W 0603	569-0155
R 224	1k ohm ±5% .063W 0603	569-0155
R 225	15k ohm ±5% .063W 0603	569-0155
R 226	470 ohm ±5% .063W 0603	569-0155
R 227	270 ohm ±5% .063W 0603	569-0155
R 228	100 ohm ±5% .063W 0603	569-0155
R 229	330 ohm ±5% .063W 0603	569-0155
R 230	2.7k ohm ±5% .063W 0603 (12.5 kHz BW)	569-0155
	1.8k ohm ±5% .063W 0603 (20-25 kHz BW)	569-0155
R 241	56k ohm ±5% .063W 0603	569-0155
R 242	27k ohm ±5% .063W 0603	569-0155
R 243	270 ohm ±5% .063W 0603	569-0155
R 261	200k ohm ±5% .063W 0603 (12.5 kHz BW)	569-0155
	120k ohm ±5% .063W 0603 (20 kHz BW)	569-0155
	100k ohm ±5% .063W 0603 (25 kHz BW)	569-0155
R 262	100k ohm ±5% .063W 0603	569-015
R 263	10k ohm ±5% .063W 0603	569-015
R 264	18k ohm ±5% .063W 0603	569-015
R 265	10 ohm ±5% .063W 0603	569-015
R 301	3.3k ohm ±5% .063W 0603	569-015
R 302	1.8k ohm ±5% .063W 0603	569-015
R 303	180 ohm ±5% .063W 0603	569-015
R 304	1k ohm ±5% .063W 0603	569-015
R 401	10 ohm ±5% .063W 0603	569-015
R 402	15k ohm ±5% .063W 0603	569-015
R 403	2.7k ohm ±5% .063W 0603	569-015
R 404	330 ohm ±5% .063W 0603	569-015
R 501	2.2k ohm ±5% .063W 0603	569-015
R 502	2.2k ohm ±5% .063W 0603	569-015
R 503	10 ohm ±5% .063W 0603	569-015
R 504	560 ohm ±5% .063W 0603	569-015

PARTS LIST

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 506	100 ohm ±5% .063W 0603	569-0155-101
R 521	1k ohm ±5% .063W 0603	569-0155-102
R 522	150 ohm ±5% .063W 0603	569-0155-151
R 524	220 ohm ±5% .063W 0603	569-0155-221
R 541	220k ohm ±5% .063W 0603	569-0155-224
R 542	1M ohm SMD trimmer	562-0130-105
R 543	10k ohm ±5% .063W 0603	569-0155-103
R 546	47 ohm ±5% .063W 0603	569-0155-470
R 547	100k ohm ±5% .063W 0603	569-0155-104
R 548	330k ohm ±5% .063W 0603	569-0155-334
R 549	560k ohm ±5% .063W 0603	569-0155-564
R 562	620 ohm ±5% .063W 0603	569-0155-621
R 563	620 ohm ±5% .063W 0603	569-0155-621
R 564	47k ohm ±5% .063W 0603	569-0155-473
R 801	10k ohm ±5% .063W 0603	569-0155-103
R 802	10k ohm ±5% .063W 0603	569-0155-103
R 804	10 ohm ±5% .063W 0603	569-0155-100
R 805	27k ohm ±5% .063W 0603	569-0155-273
R 806	12k ohm ±5% .063W 0603	569-0155-123
R 807	4.7k ohm ±5% .063W 0603	569-0155-472
R 808	18k ohm ±5% .063W 0603	569-0155-183
R 810	220k ohm SMD trimmer	562-0130-224
R 811	27k ohm ±5% .063W 0603 (435-451 MHz)	569-0155-273
	18k ohm ±5% .063W 0603 (450-466 MHz)	569-0155-183
	27k ohm ±5% .063W 0603 (435-451 MHz)	569-0155-273
R 812	10k ohm ±5% .063W 0603	569-0155-103
R 813	100k ohm ±5% .063W 0603	569-0155-104
R 831	10k ohm ±5% .063W 0603	569-0155-103
R 834	10k ohm ±5% .063W 0603	569-0155-103
R 835	1.5k ohm ±5% .063W 0603	569-0155-152
R 836	10k ohm ±5% .063W 0603	569-0155-103
R 838	100 ohm ±5% .063W 0603	569-0155-101
R 839	680 ohm ±5% .063W 0603	569-0155-681
R 840	22k ohm ±5% .063W 0603	569-0155-223
R 841	15k ohm ±5% .063W 0603	569-0155-153
R 842	470 ohm ±5% .063W 0603	569-0155-471
R 843	10 ohm ±5% .063W 0603	569-0155-100
R 844	680 ohm ±5% .063W 0603	569-0155-681
R 851	270 ohm ±5% .063W 0603 (403-435 MHz)	569-0155-271
	150 ohm ±5% .063W 0603 (435-480 MHz)	569-0155-151
	270 ohm ±5% .063W 0603 (480-512 MHz)	569-0155-271

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
R 852	18 ohm ±5% .063W 0603 (403-435 MHz)	569-0155-180
	39 ohm ±5% .063W 0603 (435-480 MHz)	569-0155-390
	18 ohm ±5% .063W 0603 (480-512 MHz)	569-0155-180
R 853	270 ohm ±5% .063W 0603 (403-435 MHz)	569-0155-271
	150 ohm ±5% .063W 0603 (435-480 MHz)	569-0155-151
	270 ohm ±5% .063W 0603 (480-512 MHz)	569-0155-271
R 854	82 ohm ±5% .063W 0603	569-0155-820
R 855	100k ohm SMD trimmer	562-0130-104
R 856	4.7k ohm ±5% .063W 0603	569-0155-472
R 857	4.7k ohm ±5% .063W 0603	569-0155-472
R 858	4.7k ohm ±5% .063W 0603	569-0155-472
R 860	100 ohm ±5% .063W 0603	569-0155-101
R 901	22k ohm ±5% .063W 0603	569-0155-223
R 902	15k ohm ±5% .063W 0603	569-0155-153
R 903	100 ohm ±5% .063W 0603	569-0155-101
R 904	330 ohm ±5% .063W 0603	569-0155-331
R 905	220 ohm ±5% .063W 0603	569-0155-221
R 906	10 ohm ±5% .063W 0603	569-0155-100
R 907	2.2k ohm ±5% .063W 0603	569-0155-222
U 101	5.5V regulator SO-6	544-2603-086
U 122	+5V regulator micropower SO	544-2003-067
U 221	Double balanced mixer	544-0007-014
U 241	FM IF MC3371D SO-16	544-2002-031
U 261	Single op amp SOT-23-5	544-2016-001
U 542	Single op amp SOT23-5	544-2016-001
U 801	Fractional-N synthesizer	544-3954-027
Y 801	17.5 MHz TCXO ±1.5 PPM	518-7009-521
Z 201	443 MHz helical filter SMD (435-451 MHz)	532-1005-042
Z 201	459 MHz helical filter SMD (450-466 MHz)	532-1005-044
Z 201	472 MHz helical filter SMD (464-480 MHz)	532-1005-045

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
Z 202	443 MHz helical filter SMD (435-451 MHz)	532-1005-042
Z 202	459 MHz helical filter SMD (450-466 MHz)	532-1005-044
Z 202	472 MHz helical filter SMD (464-480 MHz)	532-1005-045
Z 221	52.95 MHz 4-pole 8 kHz BW (12.5 kHz bandwidth)	532-0009-011
Z 221	52.95 MHz 4-pole 15 kHz BW (20 kHz and 25 kHz bandwidth)	532-0009-009
Z 222	52.95 MHz 4-pole 8 kHz BW (12.5 kHz bandwidth)	532-0009-011
Z 222	52.95 MHz 4-pole 15 kHz BW (20 kHz and 25 kHz bandwidth)	532-0009-009
Z 241	450 kHz, 9 kHz BW (12.5 kHz bandwidth)	532-2004-015
Z 241	Ceramic data filter (20 kHz bandwidth)	532-2004-016
Z 241	450 kHz, 20 kHz BW (25 kHz bandwidth)	532-2004-013
Z 242	450 kHz, 9 kHz BW (12.5 kHz bandwidth)	532-2004-015
Z 242	Ceramic data filter (20 kHz bandwidth)	532-2004-016
Z 242	450 kHz, 20 kHz BW (25 kHz bandwidth)	532-2004-013

VCO
PART NO. 023-3474-X40

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
C 850	68 pF ±5% NPO 0603	510-3674-680
C 851	9.1 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673-919
	8.2 pF ±0.1% NPO 0603 (419-466 MHz)	510-3673-829
	68 pF ±5% NPO 0603 (466-512 MHz)	510-3674-680
C 852	7.5 pF ±0.1% NPO 0603	510-3673-759
C 853	12 pF ±5% NPO 0603 (403-419 MHz)	510-3674-120
	10 pF ±5% NPO 0603 (419-451 MHz)	510-3674-120
	9.1 pF ±0.1% NPO 0603 (464-480 MHz)	510-3673-919
	8.2 pF ±0.1% NPO 0603 (435-451 MHz)	510-3673-829
	8.2 pF ±0.1% NPO 0603 (480-496 MHz)	510-3673-829

SYMBOL NUMBER	DESCRIPTION	PART NUM
C 854	100 pF ±5% NPO 0603	510-3674
C 855	68 pF ±5% NPO 0603	510-3674
C 856	2.7 pF ±0.1% NPO 0603	510-3673
C 858	68 pF ±5% NPO 0603	510-3674
C 859	8.2 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673
	7.5 pF ±0.1% NPO 0603 (419-466 MHz)	510-3673
	6.8 pF ±0.1% NPO 0603 (464-480 MHz)	510-3673
C 859	8.2 pF ±0.1% NPO 0603 (480-496 MHz)	510-3673
C 860	1 pF ±0.1% NPO 0603 (403-419/435-451 MHz Only)	510-3673
C 861	8.2 pF ±0.1% NPO 0603 (403-435 MHz)	510-3673
	6.8 pF ±0.1% NPO 0603 (435-451 MHz)	510-3673
	8.2 pF ±0.1% NPO 0603 (450-461 MHz)	510-3673
	5.6 pF ±0.1% NPO 0603 (464-480 MHz)	510-3673
	6.8 pF ±0.1% NPO 0603 (480-496 MHz)	510-3673
C 862	6.8 pF ±0.1% NPO 0603	510-3673
C 863	100 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673
	68 pF ±5% NPO 0603 (419-512 MHz)	510-3674
C 864	10 pF ±0.1% NPO 0603	510-3673
C 865	100 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673
	68 pF ±5% NPO 0603 (419-512 MHz)	510-3674
	100 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673
	68 pF ±5% NPO 0603 (419-512 MHz)	510-3674
C 867	100 pF ±0.1% NPO 0603 (403-419 MHz)	510-367
	68 pF ±5% NPO 0603 (419-512 MHz)	510-367
C 868	2.4 pF ±0.1% NPO 0603 (403-419 MHz)	510-367
	2.2 pF ±0.1% NPO 0603 (419-435 MHz)	510-367
	1.8 pF ±0.1% NPO 0603 (435-466 MHz)	510-367

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
	1.2 pF ±0.1% NPO 0603 (464-480 MHz)	510-3673-129
	1.8 pF ±0.1% NPO 0603 (480-496 MHz)	510-3673-189
C 870	1 pF ±0.1% NPO 0603	510-3673-109
C 871	100 pF ±5% NPO 0603	510-3674-101
C 873	100 pF ±5% NPO 0603	510-3674-101
C 874	3.3 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673-339
C 874	3.3 pF ±0.1% NPO 0603 (419-435 MHz)	510-3673-339
	3.3 pF ±0.1% NPO 0603 (435-496 MHz)	510-3673-339
C 876	10 pF ±0.1% NPO 0603 (403-419 MHz)	510-3673-100
	9.1 pF ±0.1% NPO 0603 (419-435 MHz)	510-3673-919
	8.2 pF ±0.1% NPO 0603 (435-496 MHz)	510-3673-829
C 877	1.2 pF ±0.1% NPO 0603 (403-435 MHz)	510-3673-129
	1 pF ±0.1% NPO 0603 (435-496 MHz)	510-3673-109
C 878	10 pF ±0.1% NPO 0603 (403-435 MHz Only)	510-3673-100
CR850	Pin switch diode SOT-23	523-1504-001
CR851	Varactor SOD-323 BB535	523-5005-022
CR852	Varactor diode SOD-123	523-5005-020
CR853	Varactor diode SOD-123	523-5005-020
CR854	Varactor SOD-323 BB535	523-5005-022
CR855	Varactor SOD-323 BB535	523-5005-022
CR856	Varactor SOD-323 BB535	523-5005-022
L 851	82 nH ±10% SMD 0805	542-9003-827
L 852	82 nH ±10% SMD 0805 (435-466 MHz)	542-9003-827
	150 nH ±10% SMD 0805 (464-480 MHz)	542-9003-158
L 853	22 nH ±10% SMD 0805 (403-480 MHz)	542-9003-227
	18 nH ±10% SMD 0805 (480-512 MHz)	542-9003-187
L 854	82 nH ±10% SMD 0805 (435-466 MHz)	542-9003-827
	150 nH ±10% SMD 0805 (464-480 MHz)	542-9003-158
L 855	56 nH inductor LL2012 F56N	542-9003-567
L 856	27 nH ±10% SMD 0805 (403-435 MHz)	542-9003-277
	22 nH ±10% SMD 0805 (435-480 MHz)	542-9003-227
	18 nH ±10% SMD 0805 (480-512 MHz)	542-9003-187
L 861	12 nH inductor LL2012 F12N (435-480 MHz)	542-9003-127
	15 nH inductor LL2012 F12N (480-512 MHz)	542-9003-157
Q 850	NPN transistor NE85619	576-0003-651
Q 851	NPN transistor NE85619	576-0003-651
Q 852	NPN transistor NE85619	576-0003-651
Q 853	NPN transistor NE85619	576-0003-651
R 851	10k ohm ±5% .063W 0603	569-0155-103
R 852	47k ohm ±5% .063W 0603	569-0155-473
R 853	47k ohm ±5% .063W 0603	569-0155-473
R 854	10 ohm ±5% .063W 0603	569-0155-100
R 856	10 ohm ±5% .063W 0603	569-0155-100
R 857	6.8k ohm ±5% .063W 0603	569-0155-682
R 858	1k ohm ±5% .063W 0603	569-0155-102
R 862	10k ohm ±5% .063W 0603	569-0155-103
R 863	10 ohm ±5% .063W 0603	569-0155-100
R 864	10k ohm ±5% .063W 0603	569-0155-103
R 865	10k ohm ±5% .063W 0603	569-0155-103
R 866	470 ohm ±5% .063W 0603	569-0155-471
R 867	12k ohm ±5% .063W 0603	569-0155-123
R 868	390 ohm ±5% .063W 0603	569-0155-391
R 869	270 ohm ±5% .063W 0603	569-0155-271
R 870	18 ohm ±5% .063W 0603	569-0155-180
R 871	3.9k ohm ±5% .063W 0603	569-0155-392
R 872	1.8k ohm ±5% .063W 0603	569-0155-182
R 874	680 ohm ±5% .063W 0603	569-0155-681
R 875	270 ohm ±5% .063W 0603	569-0155-271
Z 850	Coaxial xmit line ind 835 MHz (403-419 MHz Only)	542-9004-002
	Coaxial xmit line ind 885 MHz (419-435 MHz Only)	542-9004-003
	Coaxial xmit line ind 935 MHz (435-451 MHz Only)	542-9004-004
	Coaxial xmit line ind 985 MHz (450-466 MHz Only)	542-9004-005
	Coaxial xmit line 1035 MHz (464-480 MHz Only)	542-9004-006

SYMBOL NUMBER	DESCRIPTION	PART NUMBER
	Coaxial xmit line 1095 MHz (480-496 MHz Only)	542-9004-007
	Coaxial xmit line 1180 MHz (496-512 MHz Only)	542-9004-008

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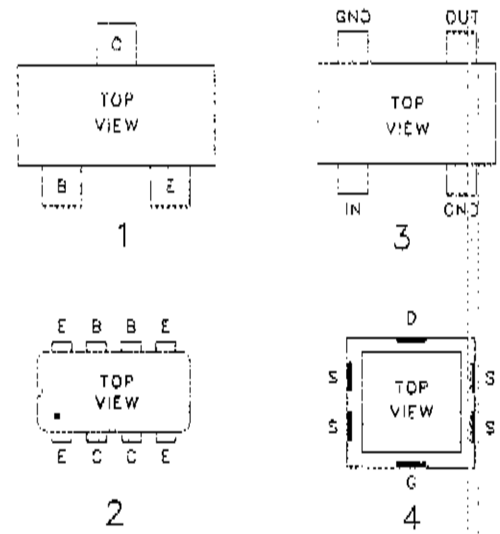
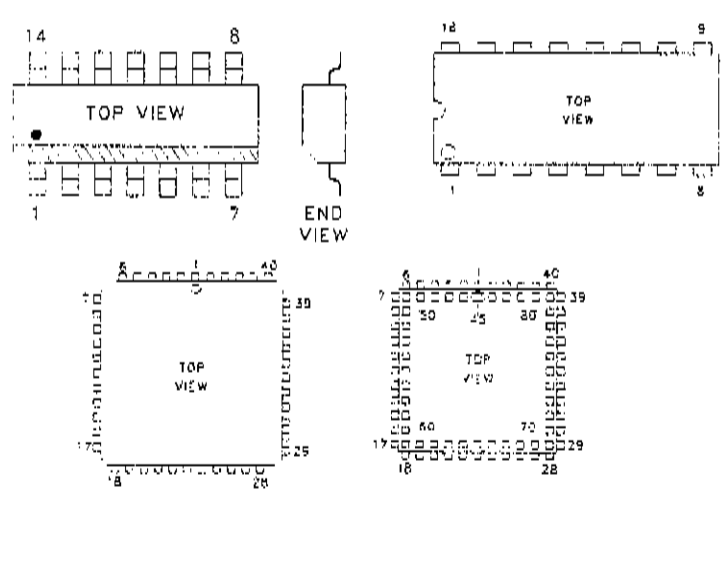
SECTION 8 SCHEMATICS AND COMPONENT LAYOUTS

TRANSISTOR AND DIODE BASING REFERENCE TABLE		
TRANSISTORS		
Part Number	Basing Diagram	Identification
576-0001-300	1	1R
576-0003-604	2	3604
576-0003-616	1	26
576-0003-621	1	74
576-0003-634	1	3B
576-0003-636	1	R25
576-0003-638	3	-
576-0003-651	1	24
576-0006-450	4	-
DIODES		
523-1504-001	-	4D
523-1504-002	-	5A
523-1504-023	-	A7
523-5005-020	-	S
523-5005-022	-	S



INTEGRATED CIRCUITS



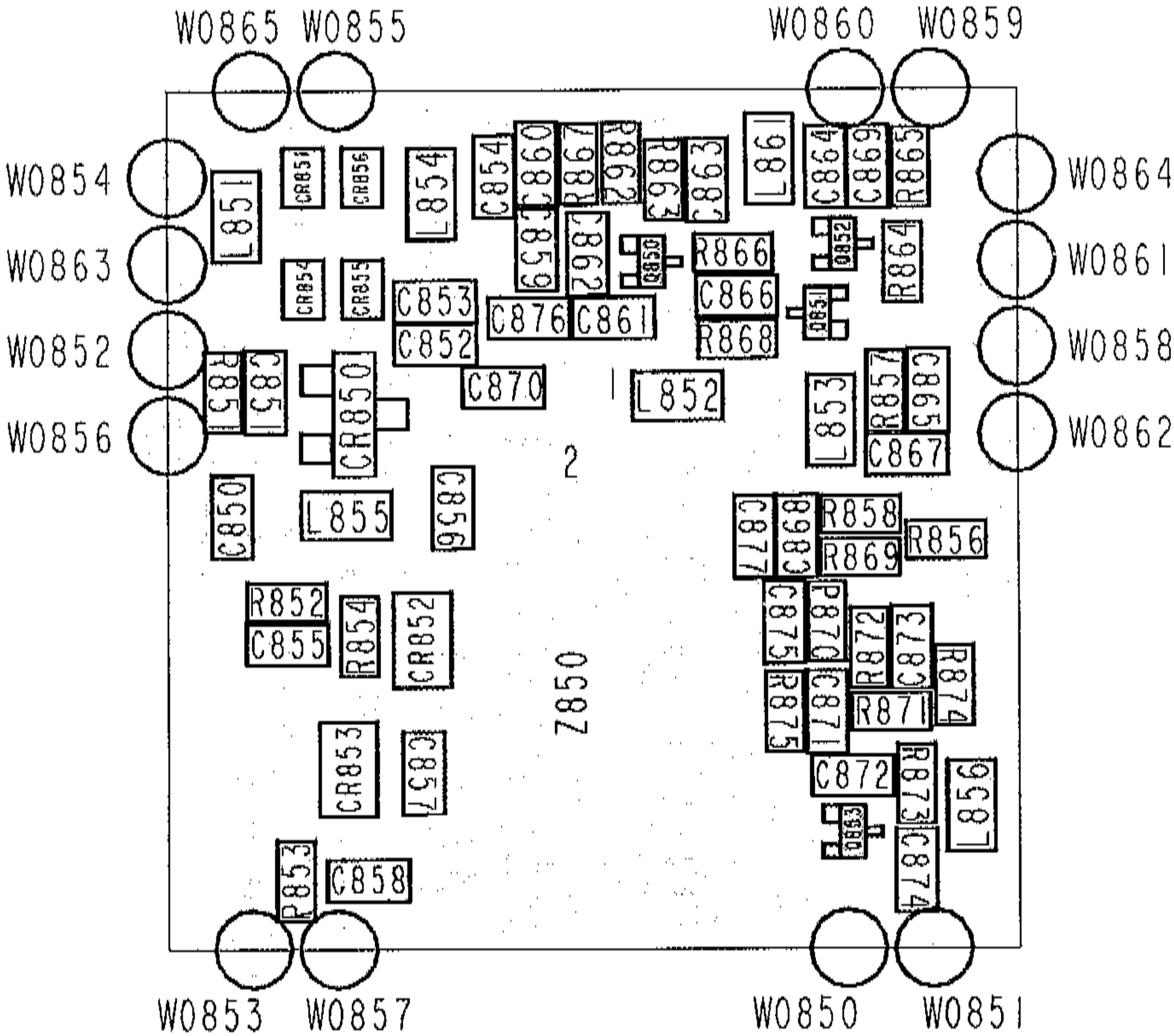


Figure 8-1 VCO COMPONENT LAYOUT (COMPONENT SIDE VIEW)