MAINTENANCE MANUAL
ORION™
UHF SYNTHESIZER/RECEIVER/EXCITER BOARD
CMN-354 A/B/C

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ILLUSTRATIONS

DESCRIPTION

The ORION™ UHF Synthesizer/Receiver/Exciter Board provides, on one printed circuit board, circuits for the synthesizer, receiver and transmitter exciter. The synthesizer circuit generates transmit frequencies for three splits, 403-440 MHz designated by (**A**), 440-470 MHz designated by (**B**) and 470-512 MHz designated by (**C**). The synthesizer circuit also generates the receiver injection frequencies, 320.8-357.8 MHz, 357.8-387.8 MHz and 387.8-429.8 MHz so the receive circuit can operate on the same three splits respectively.

The receive circuit is an FM dual-conversion, superheterodyne receiver designed for operation in the 403-512 MHz frequency range splits (**A**), (**B**) and (**C**). Regulated 9 Volts is provided to all receiver stages except the audio PA integrated circuit which operates from the switched A+ supply.

The receiver has Intermediate Frequencies (IF's) of 82.2 MHz and 455 kHz. Adjacent channel selectivity is obtained by using two band-pass filters, an 82.2 MHz crystal filter and a 455 kHz ceramic filter.

ERICSSON

Ericsson Inc.
Private Radio Systems
Mountain View Road
Lynchburg, Virginia 24502
1-800-528-7711 (Outside USA, 804-528-7711)

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The receiver circuit except for the synthesizer circuit consists of the following:

- Front End and Mixer
- 82.2 MHz 1st IF, 455 kHz 2nd IF and FM Detector
- **A**udio **S**ignal **P**rocessor (**ASP**) including Squelch
- Audio PA

The receiver Front End and Mixer Circuits are on the Synthesizer/Receiver/Exciter Board. The 82.2 MHz 1st IF and the 455 kHz 2nd IF FM Detector, ASP and Audio PA circuits are on the System Control/IF Board (refer to Maintenance Manual LBI-39034).

The Exciter circuit consists of three wide band amplifiers operating over a frequency range of 403-512 MHz without any tuning. The Exciter circuit amplifies a 2 milliwatt signal generated by a **V**oltage **C**ontrolled **O**scillator (**VCO**) in the synthesizer circuit to 500 milliwatts drive to the power amplifier.

CIRCUIT ANALYSIS

FREQUENCY SYNTHESIZER

The frequency synthesizer receives **SYNTH CLOCK**, **SYNTH DATA**, and control information from the microcomputer and generates the Tx/Rx RF frequencies (Refer to Figure 1). The synthesizer also provides frequency-lock status to the microcomputer. The synthesizer consists of synthesizer chip IC201, low and high current buffers, loop filters, Tx and Rx **V**oltage **C**ontrolled **O**scillators (**VCO**'s), feedback amplifiers, the dual modulus prescaler and the reference oscillator. The VCO's are locked to the reference oscillator by a single direct divide synthesis loop consisting of the feedback buffer, prescaler and synthesizer. The Tx VCO operates over a frequency range of 403 MHz to 512 MHz. The Rx VCO operates over the range of 320.8 to 429.8 MHz.

Reference Oscillator

The reference oscillator consists of a 2-PPM **T**emperature **C**ompensated **X**rystal **O**scillator (**TCXO**). The standard reference oscillator frequency is 12.8 MHz. The TCXO is enclosed in an RF shielded housing. Access to the oscillator trimmer is made through the hole in the top of the housing. The TCXO is compensated by an internal temperature compensating circuit for both low and high temperatures. With no additional compensation the oscillators will provide 2 PPM stability from -30°C to +60°C.

Synthesizer

Synthesizer chip IC201 contains a programmable reference oscillator divider (+R), phase detector and programmable VCO dividers (÷N, ÷A). The reference frequency , 12.8 MHz is divided by a fixed integer number to obtain a 6.25 kHz or 5 kHz channel reference for the synthesizer. This divide value can be changed by PROM programming. The internal phase detector compares the output of the reference divider with the output of the internal N, A counter. The N, A counter receives as an input the VCO frequency divided by the dual modulus prescaler and programmed by the microcomputer. This comparison results in a ± error voltage when the phases differ and a constant output voltage when the inputs compare in frequency and phase.

If a phase error is detected an error voltage is developed and applied to the VCO DC offset, high current buffers and loop-filter to reset the VCO frequency. The count of the N, A counters is controlled by the frequency data received on the **SYNTH CLOCK** and **SYNTH DATA** lines from the microcomputer. When a different channel is selected or when changing to the transmit or receive mode an error voltage is generated and appears at the phase-detector output, **APD OUT**, causing the Phase-Lock-Loop (**PLL**) to acquire the new frequency.

The **SYNTH ENABLE** pulse from the micro-computer enables the synthesizer and allows frequency data to be internally stored.

Equalizer

The equalizer circuit consists of operational amplifier IC203-A, resistors R205 and R207 and capacitor C205. This circuit receives transmit audio from Loop Modulation Adjust RV201. The output of the equalizer is summed with the output signal from the Phase Detector in the Adder operational amplifier IC203-B.

DC Offset And High Current Buffers

DC offset buffer transistors TR201 and TR202 and diode CD202-A receive error voltage from the synthesizer and increase the level of this error voltage by 1.8 Vdc. This extends the operating range of the high current buffers. When the PLL is off frequency due to a channel change or frequency drift, the error voltage from the Synthesizer (APD) rises or falls, turning TR201 either On or Off. This transistor (TR201) controls the DC offset buffer TR202. Resistor R214, capacitor CD202 and transistor TR202 complete a high current rapid charge or discharge path for capacitors C210, C211 and C212. As the error voltage decreases, TR201, TR202 and CD202-A turn on, completing a discharge path for C210 through C212. When the error voltage goes positive, TR201, TR202 and CD212 are turned off, allowing C210 through C212 to charge through R214.

When a channel is changed in receive and when changing from transmit to receive, bilateral switch IC204-E is turned on for 4 milliseconds and bilateral switches IC204-B & D are turned on for 3 milliseconds. When changing from receive to transmit, bilateral switches IC204C & E are turned on for 15 milliseconds and IC204B & D are turned for 5 milliseconds.

Loop Filter

The loop filter consists of resistors R216 through R218 and capacitors C210 through C212. This filter controls the bandwidth and stability of the synthesizer loop. Bilateral switch IC204 is controlled by 9 Volt **SYNTH BANDWIDTH** and **SYNTH ENABLE** pulse. When the **SYNTH BANDWIDTH** pulse and **SYNTH ENABLE** pulse are present, the bilateral switch greatly increasing the loop bandwidth to achieve the 4 millisecond channel acquisition time required for dual priority scan. The low-pass filter removes noise and other extraneous signals internal to the synthesizer chips.

The output of the filter is applied to the varicaps in the transmit and receive VCO's to adjust and maintain the VCO frequency.

The use of two VCO's allows rapid independent selection of transmit and receive frequencies across the frequency split.

Receiver Voltage Controlled Oscillator

The receiver VCO consists of low-noise oscillator transistor TR241 followed by high-gain buffer transistor TR242 and doubler transistor TR244. Transistor TR242 prevents external loading and provides power gain. Transistor TR244 multiplies the input frequency by 2. The VCO is a Colpitts oscillator circuit with the various varactors, capacitors and a high-Q resonator coil forming the tank circuit.

The VCO is switched On and Off under the control of the **T/R** line. When the **T/R** line is high, the receiver VCO is turned on (TR243). Oscillator output is typically +10 dBm. The output is applied to the feedback buffer for VCO frequency control and as the Rx injection frequency to the receiver 1st mixer through local oscillator buffers in the receive circuit. The VCO operates over a frequency range of 320.8- 429.8 MHz. The VCO voltage need only be set once at the highest frequency of the band split, after which it will operate over the entire split with no additional tuning.

Transmitter Voltage Controlled Oscillator

The transmit VCO is basically the same as the receiver VCO. This wide band VCO allows frequency separation of 37 MHz, 30 MHz or 42 MHz as determined by the bandsplit the radio is operating on, 403-440 MHz, 440-470 MHz or 470-512 MHz. The variactors in conjunction with the frequency segment selector circuitry provide a voltage controlled adjustment range that extends across the entire frequency split. The selector circuitry consists of silicon NPN transistor packages TR2301 and TR2302, and diodes CD277 through CD282. VCO control switch transistor TR273 turns the transmit VCO on when the DPTT line is low.

Feed Back Buffer

The buffered output of the Rx VCO and Tx VCO, from buffer transistors TR245 and TR274 respectively, are supplied to feedback buffer IC206. This, in turn, drives dual modulus prescaler IC205. The buffered output also provides Rx or Tx injection drive.

Dual Modulus Prescaler

The dual modulus prescaler completes the PLL feedback path from the synthesizer to the loop- filter, to the feedback buffers and then back to the synthesizer through the prescaler. The prescaler divides the VCO frequency by 128 or 129 under control of **M CONT** signal from the synthesizer. The output of the prescaler is applied to the synthesizer where it is divided down to 6.25 kHz or 5 kHz by an internal +N, A counter and compared in frequency and phase with the divided-down frequency from the reference oscillator. The result of this comparison is the error voltage used to maintain frequency lock. The +N, A counter is controlled by frequency data received from the microcomputer. Depending on the operating frequency, the DC voltage at Test Point TP201 should be within the range of 3.5 to 7.5 Vdc when the PLL is locked.

Lock Detect

The lock detect circuit consists of comparator IC207, diodes CD204 and CD205 and reference oscillator mute switch transistor TR203. It is used to quickly synchronize the phase relation of the divided- down VCO frequency with the reference oscillator if the loop loses lock. It also provides a fast lock-detect signal to the microcomputer to turn on the out-of-lock indicator. If a large change in frequency is required, the ramp capacitor output (**CR**) of the synthesizer will increase voltage on the LD line from the synthesizer. Thus, TR203 disables the reference oscillator and allows the PLL to be brought back to synchronization rapidly.

If a large frequency error exists, the LD positive lead from the synthesizer will carry negative spikes to the microcomputer. Transistor TR203 is turned on, muting the reference oscillator.

Loop Mod Adjust

The Loop Mod Adjust circuit automatically sets the loop modulation level applied to equalizer circuit IC202 and IC203 through Loop Mod Adjust RV291. The loop Mod Adjust modulation circuit consists of decoder IC208, bilateral switch IC209, resistors R2001 through R2005 and RV201. The loop modulation level is controlled by turning bilateral switches IC209 on or Off (under control of IC203) to include attenuators R2001 through R2005 in the circuit. Resistors R2001 through R2005 form an adjustable voltage divider to change the loop modulation level as required. Table 1 also identifies the resistor (if applicable) used for each frequency segment.

Frequency Segment Selector

The Frequency Segment Selector, operating under control of the microcomputer, switches capacitance in and out of the Tx and Rx VCO tank circuits to select the frequency segment containing the selected channel. The Frequency Segment Selector consists of transistor packages TR2301 through TR2303 and band switching diodes CD243 through CD248 and capacitors C277 through C282. Capacitors C224, C245, C249, C250, C254, C255 C289 C290 and C291 •are selected or deselected for operation in a given segment. Table 1 identifies the circuit conditions existing for selection of each segment and the capacitors used.

Reverse bias to turn off the band switching diodes is provided by the +8 Volt filtered supply through resistors R2303, R2306 and R2309. Forward bias for the diodes and current for the switching transistors is provided by the +8 Volts supply through resistors R2301, R2302, R2304, R2305, R2307 and R2308. When segment 3 is selected, switching TRR2301 and TR2303 are turned on. In the Tx VCO diodes CD277, CD278, CD281 and CD282 are reverse biased and CD279 and CD280 are turned on. Capacitors C289 and C291 are effectively isolated from ground and C290 is connected to ground through CD279 and CD280.

Similarly in the Rx VCO capacitors C244, C245, C254 and C255 are isolated from ground. Capacitor C250 is grounded through diodes CD245 and CD246.

Operation of the radio over the frequency ranges 403-440 MHz, 440-470 MHz or 470-512 MHz is determined by the group number of the synthesizer board. Each frequency split is divided into four operating segments varying from 7 to 13 MHz wide.

RECEIVER

Receiver Front End

An RF signal from the antenna is coupled through a low-pass filter, antenna relay and high-pass filter to the input of pre-amplifier (**PRE AMPL**) transistor TR411 (Refer to Figure 2). The output of TR411 is coupled through a switchable attenuator (about 6 dB attenuation when switched into the signal path) to the input of RF amplifier (**RF AMPL**) transistor TR412. The attenuator is controlled by pre-amplifier switch (**PRE AMPL SW**) transistor TR413. The output of TR412 is coupled through a band-pass filter to the input of 1st Mixer HC441. Front end selectivity is provided by this band-pass filter.

The **SHIFT TUNE** and **SHIFT TUNE CONTROL** selects components required to tune the receiver front end to the operating frequency. This circuit is controlled by a microprocessor inputs RxB1 and RxB2 through PNP switching transistors TR431-1 and TR431-2, TR432-1 and TR432-2. Depending on the state of **RxB1** and **RxB2**, diodes CD431 through CD434 are switched in or out to tune the RF filter between TR412 and mixer HC441 to any one of four (4) frequency segments in the split.

Table 1 - Capacitor Selection

SEGMENT	TRANSISTOR SWITCH			BAND SWITCHING DIODES						GROUNDED CAPACITORS
	TR2301	TR2302	TR2303	CD243 CD244	CD245 CD246	CD247 CD248	CD277 CD278	CD279 CD280	CD281 CD282	
1	0	0	0	ON	ON	ON	ON	ON	ON	ALL
2	0	0	1	ON	ON	ON	ON	ON	OFF	C249, C250, C244, C245, C289, C290
3	1	0	1	OFF	ON	OFF	OFF	ON	OFF	C249, C250, C290
4	1	1	1	OFF	OFF	OFF	OFF	OFF	OFF	NONE

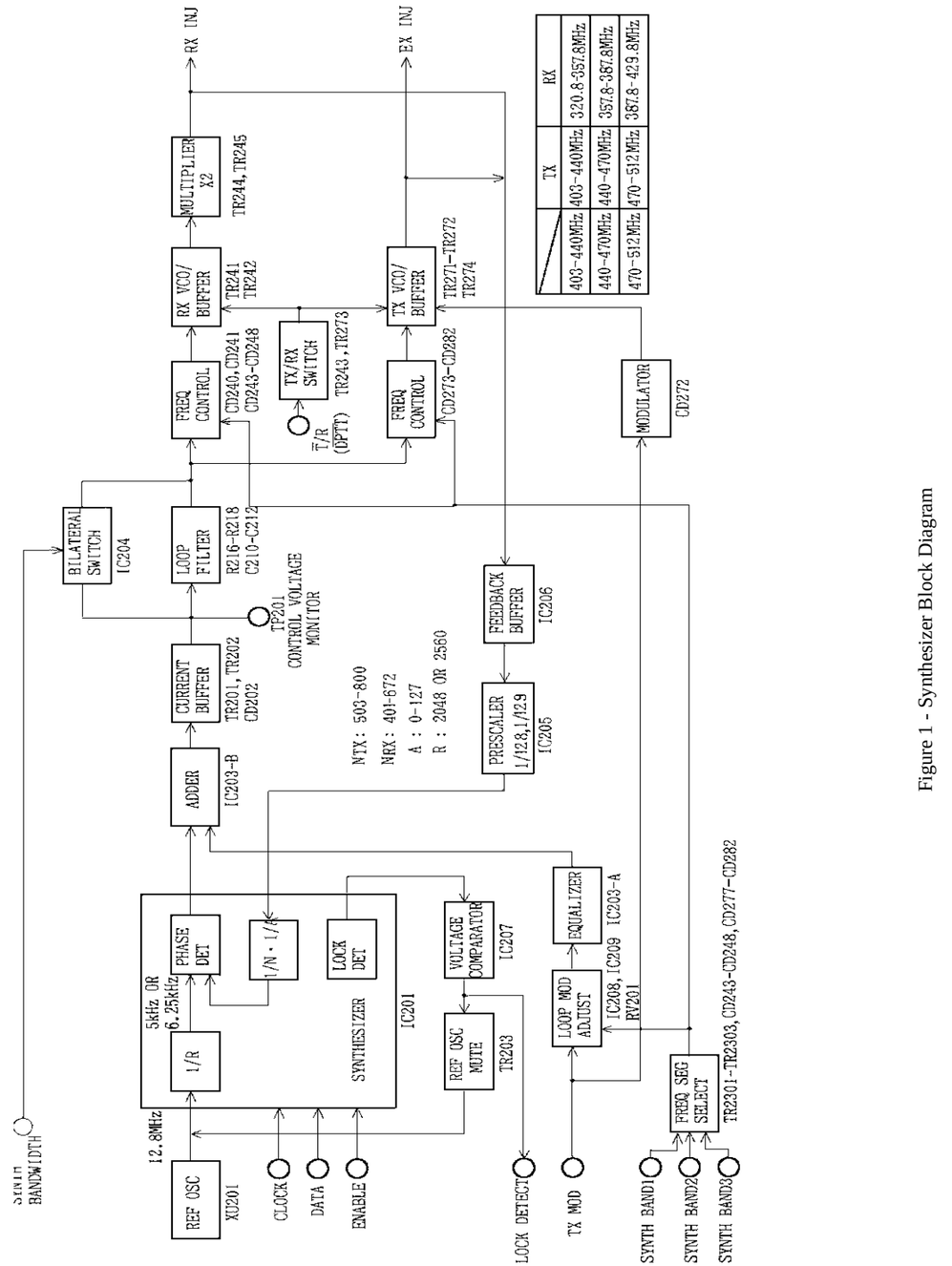


Figure 1 - Synthesizer Block Diagram

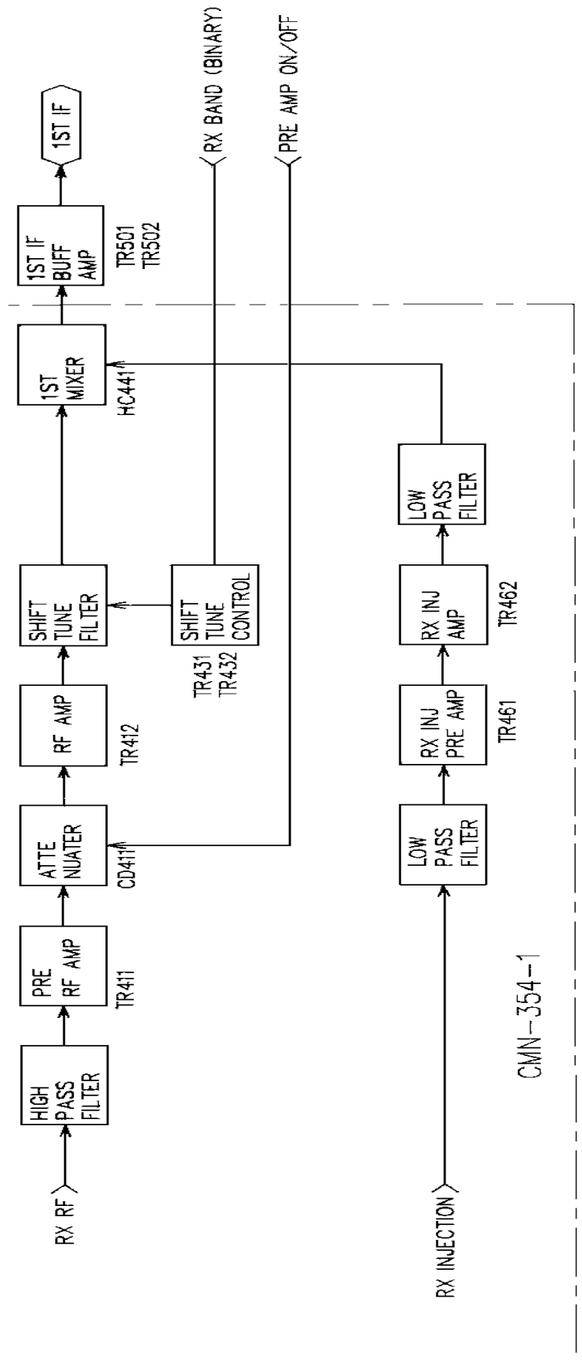


Figure 2 - Receiver Block Diagram

Receiver Injection

Receiver RF injection (320.8-429.8 MHz) from the synthesizer **V**oltage **C**ontrolled **O**scillator (**VCO**) is applied to the base of receiver injection amplifier (**Rx INJ AMP**) transistor TR451. The input level to TR451 is between 1.0 and 2.0 milliwatts. The output of TR451 is coupled to the input of receiver injection amplifier (**Rx INF AMP**) transistor TR452. The output of amplifier TR452 is filtered by a bandpass filter consisting of capacitors C475, C476, C477 and inductor L456. This filter is tuned to pass frequencies in the 320.8-429.8 MHz pass band.

1st Mixer

The first mixer is a double-balanced diode mixer (HC401) that converts a signal in the 403-512 MHz frequency range to the 82.2 MHz first IF. In the mixer stage, RF from the receiver front-end RF filter is applied to one input of the mixer. Injection voltage from the amplifier stage is applied to the other input of the mixer. The difference between the receiver front-end RF frequency and the injection frequency produces the 82.2 MHz first **I**ntermediate **F**requency (**IF**). The circuit analysis for the receiver is continued in maintenance manual LBI-38907 for **SYSTEM CONTROL LOGIC/IF/AUDIO FREQUENCY BOARD CMF-138W.**

EXCITER

The 403-512 MHz Tx injection (**TX INJ**) input from the Tx VCO is applied to the input of amplifier IC151 through an impedance matching circuit consisting of capacitor C151, inductor L151 and capacitor C152 (refer to Figure 3). The Vcc supply voltage (+5 Volts) is applied through Vcc feed network resistor R151 and inductor L152. Capacitor C155 is used to bypass the supply line. The +5 Volts is supplied by voltage regulator IC152 (3-terminal voltage regulator).

The output of IC151 drives amplifier transistor TR151 through an impedance matching circuit consisting of capacitor C154, inductor L153 and coupling capacitor C156. Resistors R151, R152 and diode CD151 set the bias voltage for TR151.

Collector voltage (+9 Volts) for TR151 is applied through a collector feed network consisting of resistor R154 and inductor L155. Capacitors C158 and C159 are bypass capacitors.

The output of TR151 is coupled to connector J151 through impedance matching components consisting of inductor L156 and capacitors C150 and C151.

Resistor R155 provides negative feedback through capacitor C157 to ensure stability.

Transistor TR151 amplifies a 20 milliwatt input level to about 400 milliwatts.

Supply voltage (A+) from connector J501 is regulated to 9 Volts by regulator IC481 (3-terminal regulator). The +9 Volts regulated output on IC481, pin 3 is applied to IC152 and TR151 through Tx power switch transistor TR152. When **TX ENBL** is high (receive mode) +9 Volts is not applied. The exciter energizes when the **TX ENBL** state is made low by the microprocessor, causing TR152 to conduct and apply the regulated +9 Volts to all exciter stages. A typical emitter voltage for TR151 is 1.5 volts.

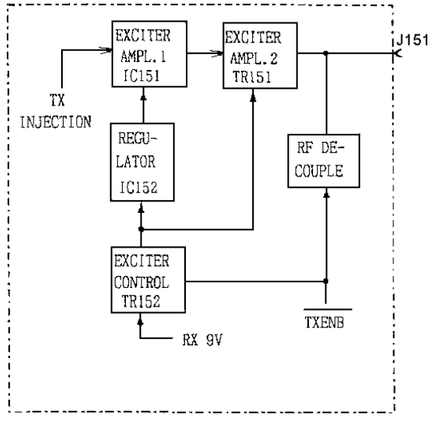
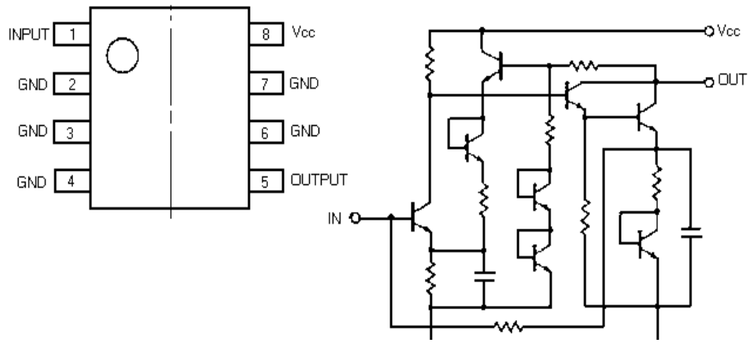
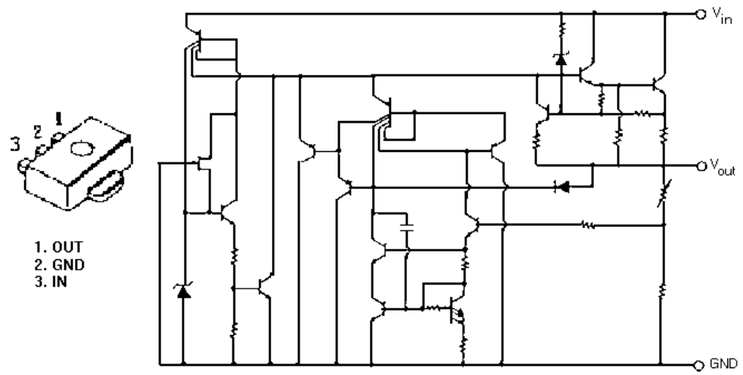


Figure 3 - Exciter Block Diagram

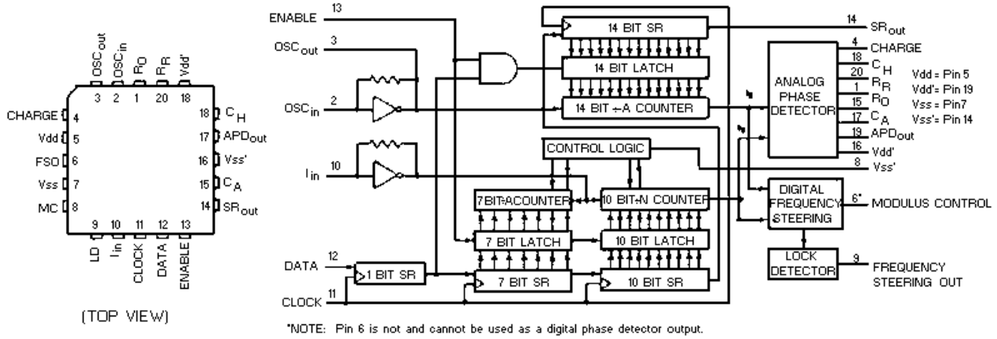
RF WIDE-BAND AMPLIFIER IC151



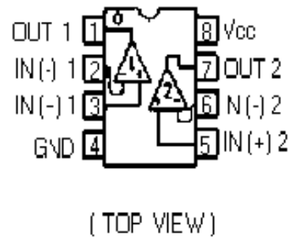
POSITIVE VOLTAGE REGULATOR IC152

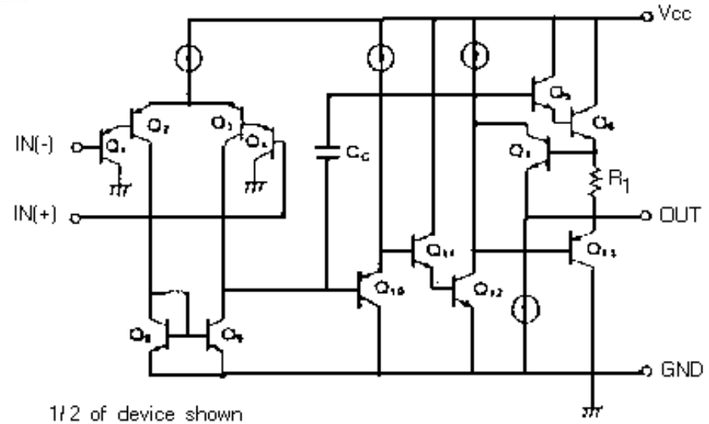


SYNTHESIZER IC201

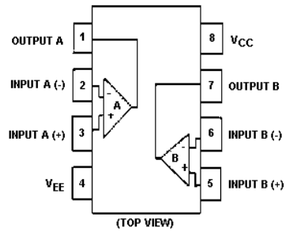


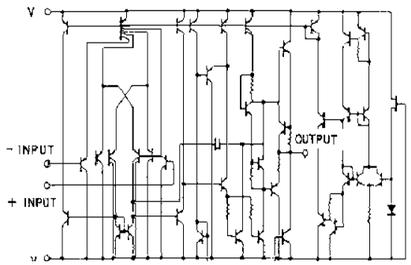
DUAL OPERATIONAL AMPLIFIER IC202



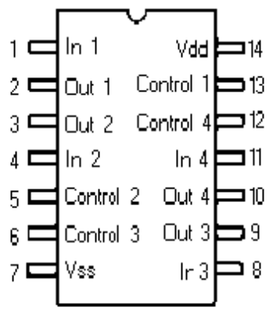


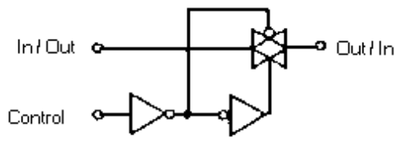
DUAL OPERATIONAL AMPLIFIER IC203





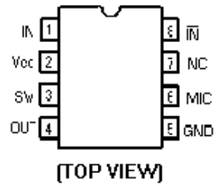
BILATERAL SWITCH IC204, IC209





Control	Switch
0 = Vss	OFF
1 = Vdd	ON

PRESCALER IC205



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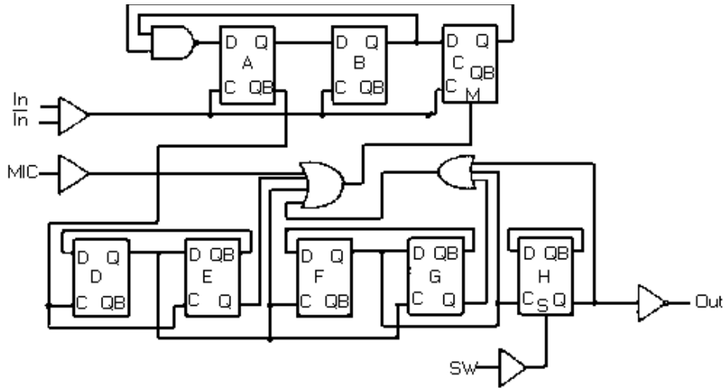

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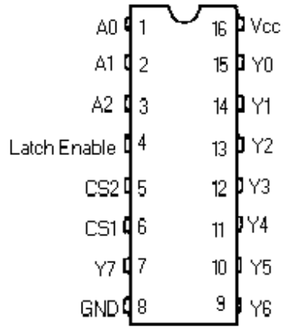
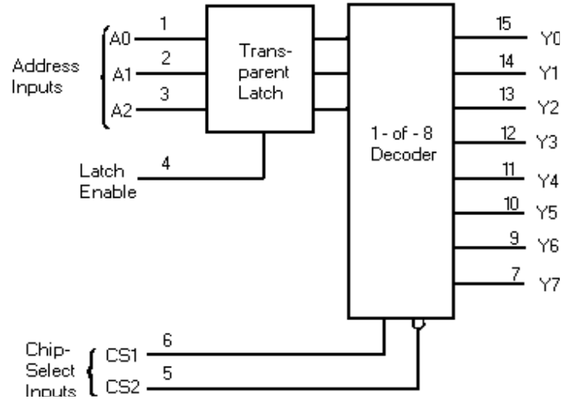
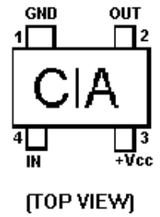




RF WIDE BAND AMPLIFIER IC206



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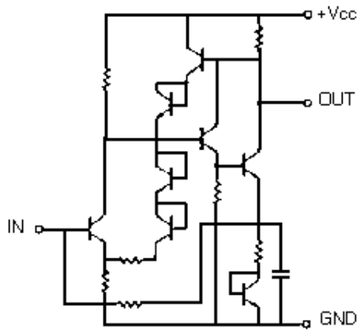
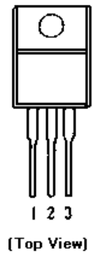


POSITIVE VOLTAGE REGULATOR IC230



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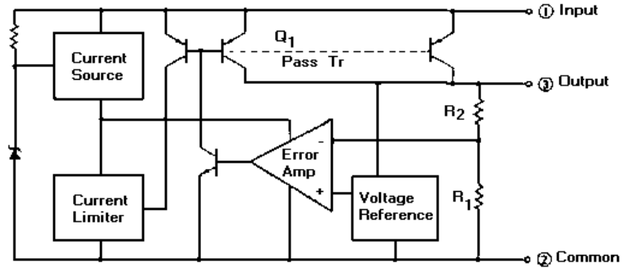
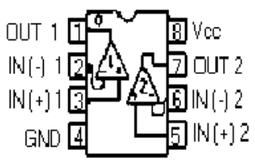


DUAL COMPARATOR IC207



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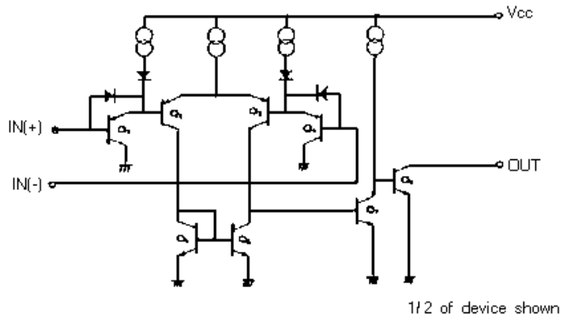

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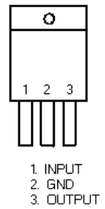
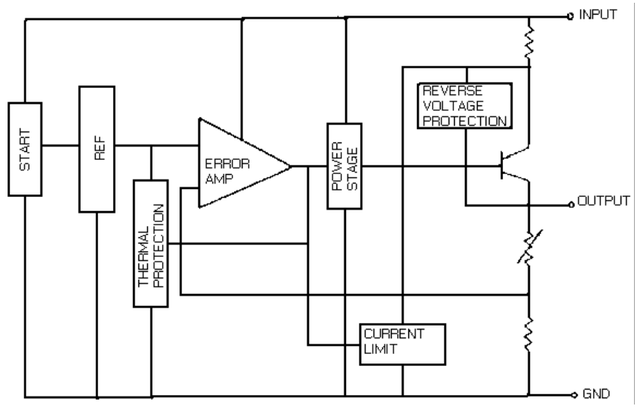
POSITIVE VOLTAGE REGULATOR IC481





SYNTHESIZER BOARD
CMN-354K2 A/B/C
CMN-354A (Used in P1)
CMN-354B (Used in P2)
CMN-354C (Used in P3)
Issue 2

SYMBOL	PART NO.	DESCRIPTION
	NOTE: Parts listed are for reference only. Refer to Service Section for serviceable parts.	----------CAPACITORS----------
C201		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C202		Ceramic: 470 pF ±5% 50 VDCW, temp coef +350 -1000 PPM.
C203		Electrolytic: 220 µF ±20% 10 VDCW.
C204		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C205		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15%.
C206		Polyester: 0.47 µF ±5% 50 VDCW.
C207 Thru C209		Electrolytic: 47 µF ±20% 16 VDCW.
C210		Metallized Plastic: 1 µF ±10%.
C211		Ceramic: 0.047µF ±10% 25 VDCW, temp coef ±15%.
C212		Polyester: 0.1 µF ±5% 50 VDCW.
C213		Ceramic:1000 pF ±10% 50 VDCW, temp coef ±15%.
C214		Ceramic:1000 pF ±10% 50 VDCW, temp coef ±15%.
C215 and C216		Ceramic:1000 pF ±10% 50 VDCW, temp coef ±15%.
C217		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef 0±15%.
C218 thru C220		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C221		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C222		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C223		Ceramic: 680 pF ±5% 50 VDCW, temp coef +350-1000 PPM.
C224		Tantalum: 10 µF ±20% 10 VDCW.
C225		Tantaium: 4.7 µF ±20% 16 VDCW.
C226		Tantalum: 10 µF ±20% 10 VDCW.
C227		Ceramic: 680 pF ±5% 50 VDCW, temp coef +350-1000 PPM.
C230		Polyester: 0.1 µF ±5% 50 VDCW.
C231		Electrolytic: 47 µF ±20% 16 VDCW.
C232 and C233		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C234		Electrolytic: 47 µF ±20% 16 VDCW.
C235		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C236		Electrolytic: 47 µF ±20% 16 VDCW.
C240		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C241		Ceramic: 22 pF ±5%. 50 VDCW, temp coef 0±30 PPM (Used in A).
C241		Ceramic: 18 pF ±5%. 50 VDCW, temp coef 0±30 PPM (Used in B).
C241		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in C).

*COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
C242		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef -750+120 PPM (Used in A).
C242		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef -750+120 PPM (Used in B).
C243		Ceramic: 18 pF ±10%. 50 VDCW, temp coef 0±30 PPM (Used in A,B).
C243		Ceramic: 22 pF ±10%. 50 VDCW, temp coef 0±30 PPM (Used in C).
C244		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM.
C245		Ceramic: 8 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C245		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C245		Ceramic: 6 pF ±0.5 pF. 50 VDCW, temp coef 0±30 PPM (Used in C).
C247 and C248		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C249		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in A,C).
C249		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C250		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C250		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C250		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in C).
C252 and C253		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C254		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C254		Ceramic: 10 pF ±5 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C254		Ceramic: 8 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in C).
C255		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C255		Ceramic: 10 pF ±5 pF 50 VDCW, temp coef 0±30 PPM (Used in B,C).
C257 and C258		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C259		Ceramic: 22 pF ±5 pF 50 VDCW, temp coef 0±30 PPM (Used in A,B).
C259		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% (Used in C).
C260		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef -750±120 PPM (Used in A).
C260		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C260		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef -750±120 PPM (Used in C).
C261		Ceramic: 27 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C261		Ceramic: 22 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B,C)
C262		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C262		Ceramic: 27 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B,C).
C263		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C264 and C265		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% PPM.

SYMBOL	PART NO.	DESCRIPTION
C266 thru C268		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% PPM.
C270		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C271		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C272		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C273 and C274		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C275		Ceramic: 18 pF ±5% 50 VDCW, temp coef -7501±20 PPM (Used in A).
C275		Ceramic: 12 pF ±5%. 50 VDCW, temp coef -7501±20 PPM (Used in A,B).
C277		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C278		Ceramic: 8 pF ±0.25 pF 50 VDCW, temp coef ±30 PPM (Used in A).
C278		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C278		Ceramic: 7 pF ±0.2 pF 50 VDCW, temp coef 0±30 PPM (Used in C)
C279		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C280		Ceramic: 15 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C280		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B,C).
C281		Ceramic: 18 pF ±10%. 50 VDCW, temp coef 0±30 PPM (Used in A).
C281		Ceramic: 12 pF ±5%. 50 VDCW, temp coef 0±30 PPM (Used in B,C).
C282		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C283		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C284		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15 %.
C285		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM.
C286 and C287		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C288		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15 %.
C289		Ceramic: 7 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C289		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C289		Ceramic: 5 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in C).
C290		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C290		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B,C).
C291		Ceramic: 8 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C291		Ceramic: 7 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C291		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in C).
C293		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C295		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C297 thru C299		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.

SYMBOL	PART NO.	DESCRIPTION
C2001		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef ±15%.
C2304		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef 0±30 PPM.
C2401		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C2402 and C2404		Ceramic: 1000pF ±10% 50 VDCW, temp coef ±15%.
C2405		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM.
C2406 and C2407		Ceramic: 1000pF ±10% 50 VDCW, temp coef ±15%.
C2408		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C2409		Ceramic: 1000pF ±10% 50 VDCW, temp coef ±15%.
C2411		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C2701		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C2702		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM.
C2703		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C2704		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C2705		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C2706		Ceramic: 1000pF ±10% 50 VDCW, temp coef ±15%.
C2707		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%
		---------- DIODES ----------
CD201		Zener: 4.0 V; sim to HITACHI HZM3.9N.
CD202		Silicon: fast recovery (2 diodes in series); sim to TOSHIBA 1SS226.
CD203		Zener: 3.6 V; sim to HITACHI HZK3B.
CD204		Silicon: fast recovery (2 diodes in series); sim to TOSHIBA 1SS226.
CD205		Silicon: fast recovery (2 diodes with anode Common); sim to TOSHIBA 1SS181.
CD240 and CD241		Silicon: Variable Capacitance Diode; sim to TOSHIBA 1SV228.
CD243 thru CD248		Silicon: Epitaxial Planer Diode: sim to ROHM 1SS318.
CD271		Silicon: fast recovery (2 diodes in series); sim to PANASONIC MA153A.
CD272		Silicon: Variable Capacitance Diode; sim to HITACHI HVU202.
CD273 thru CD276		Silicon: Variable Capacitance Diode; sim to HITACHI HVU351.
CD277 thru CD282		Silicon: Epitaxial Planer Diode: sim to ROHM 1SS318.
CD283		Silicon (Schottky Barrier); sim to HITACHI HSU88.
CV201 and CV202		Variable: 9 pF max.
		----------FILTERS----------
FL201 and FL202		RF Filter: BPF 320-358 MHz (Used in A).

(Continued)

SYMBOL	PART NO.	DESCRIPTION
FL201 and FL202		RF Filter: BPF 357-388 MHz (Used in B).
FL201 and FL202		RF Filter: BPF 387-430 MHz (Used in C).
FL204		EMI Filter.
		-------INTEGRATED CIRCUITS --------
IC201		Synthesizer: CMOS serial input; sim to MOTOROLA MC145159FN.
IC202		Linear, Dual OP Amp; sim to MITSUBISHI M5223FP.
IC203		Linear, Dual OP Amp; sim to NEW JRC NJM3404AM.
IC204		Digital, Bilateral switch: sim to MOTOROLA MC14066BF.
IC205		Prescaler: sim to MOTOROLA MC12011SLAD.
IC206		RF wide band amplifier: sim to NEC UPC1675G.
IC207		Linear: Dual Comparator; sim to MITSUBISHI M5233FP.
IC208		Digital : Decoder; sim to MOTOROLA MC74HC237F.
IC209		Digital: Bilateral switch; sim to MOTOROLA MC14066BF.
IC230		Linear: Positive Voltage Regulator; sim to PANASONIC AN6541.
		----------INDUCTORS ----------
L201		Coil: RF 10µH ±10%.
L240 and L241		Coil: RF 0.68 µH±10%.
L242		Coil: RF 28 nH (Used in A).
L242		Coil: RF 20 nH (Used in B, C).
L243		Coil: RF 1.0 pH.
L244		Coil: RF 0.22 µF ±10%.
L245		Coil: RF 33 nH ±5%.
L246		Coil: RF 27 nH ±5%.
L247 thru L252		Coil: RF 0.68 µF ±10%.
L253		Coil: RF 27 nH ±5%.
L270 and L271		Coil: RF 0.18 µH ±10%.
L272		Coil: Dielectric resonater (Used in A).
L272		Coil: Dielectric resonater (Used in B).
L272		Coil: Dielectric resonater (Used in C).
L273		Coil: RF 0.47 µH ±10%.
L274		Coil: RF 0.18 µH ±10%.
L275		Coil: RF 33 nH ±10%.
L276 thru L278		Coil: RF 0.18 µH ±10%.
L279		Coil: RF 33 nH ±10%.
L280		Coil: RF 19 nH ±10%.
L281		Coil: RF 4.7 µH ±10%.
		---------- RESISTORS ----------
R201		Metal film: 10K ohms ±5%, 50 VDCW, 1/16W.
R202		Metal film: 22 ohms ±5%, 100 VDCW, 1/10W.
R203		Metal film: 150K ohms ±5%, 50 VDCW, 1/16W.
R204		Metal film: 470K ohms ±5%, 50 VDCW, 1/10W.
R205		Metal film: 150K ohms ±5%, 100 VDCW, 1/10W.
R206		Metal film: 2.2K ohms ±5%, 50 VDCW, 1/16W.
R207		Metal film: 1M ohms ±5%, 50 VDCW, 1/16W.
R208		Metal film: 2.2K ohms ±5%, 50 VDCW, 1/16W.
R209		Metal film: 100 ohms ±5%, 50 VDCW, 1/16W.
R210		Metal film: 470K ohms ±5%, 50 VDCW, 1/16W.
R211		Metal film: 100K ohms ±5%, 50 VDCW, 1/16W.
R213		Metal film: 0 ohms.
R214		Metal film: 330 ohms ±5%, 50 VDCW, 1/4W.
R215		Metal film: 10K ohms ±5% 100 VDCW.1/10W.
R216		Metal film: 56K ohms ±5%, 50 VDCW, 1/16W.
R217		Metal film: 15K ohms ±5%, 50 VDCW, 1/16W.
R218		Metal film: 6.8K ohms ±5%, 50 VDCW, 1/16W.
R219		Metal film: 15 ohms ±5%, 50 VDCW 1/16W.
R220 thru R224		Metal film: 10K ohms ±5%, 50 VDCW, 1/16W.
R225		Metal film: 180 ohms ±5%, 100 VDCW, 1/10W.
R226		Metal film: 33 ohms ±5%, 50 VDCW, 1/16W.
R227		Metal film: 180 ohms ±5%, 100 VDCW, 1/10W.
R228		Metal film: 220K ohms ±5%, 50 VDCW, 1/16W.
R229		Metal film: 39K ohms ±5%, 50 VDCW, 1/16W.
R230		Metal film: 8.2K ohms ±5%, 50 VDCW, 1/16W (Used in A,C).
R230		Metal film: 0 ohms (Used in B).
R231		Metal film: 22K ohms ±5%, 50 VDCW, 1/16W.
R232		Metal film: 1.5K ohms ±5%, 50 VDCW, 1/16W.
R233		Metal film: 22K ohms ±5%, 50 VDCW, 1/16W.
R234		Metal film: 100K ohms ±5%, 50 VDCW, 1/16W.
R235 and R236		Metal film: 10K ohms ±5%, 50 VDCW, 1/16W.
R237		Metal film: 4.7K ohms ±5%, 50 VDCW, 1/16W.
R238		Metal film: 5.6K ohms ±5%, 50 VDCW, 1/16W.
R240		Metal film: 2.2K ohms ±5%, 50 VDCW, 1/16W.
R241		Metal film: 6.8K ohms ±5%, 100 VDCW, 1/10W.
R242		Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R244		Metal film: 150K ohms 5%, 100 VDCW, 1/10W.
R245		Metal film: 5.6K ohms ±5%, 100 VDCW, 1/10W.
R246		Metal film: 1.5K ohms ±5%, 100 VDCW, 1/10W.
R247		Metal film: 150 ohms ±5%, 50 VDCW, 1/16W.
R248		Metal film: 5.6K ohms ±5%, 50 VDCW, 1/16W.
R249		Metal film: 1.5K ohms ±5%, 50 VDCW, 1/16W.
R250		Metal film: 150 ohms ±5%, 50 VDCW, 1/16W.
R251		Metal film: 180 ohms ±5%, 50 VDCW, 1/16W (Used in A).
R251		Metal film: 270 ohms ±5%, 50 VDCW, 1/16W (Used in B,C).
R252		Metal film: 33 ohms ±5%, 50 VDCW, 1/16W (Used in A).
R252		Metal film: 18 ohms ±5%, 50 VDCW, 1/16W (Used in B,C).
R253		Metal film: 180 ohms ±5%, 50 VDCW 1/16W (Used in A).
R253		Metal film: 270 ohms ±5%, 50 VDCW, 1/16W (Used in B,C).
R254		Metal film: 5.6K ohms ±5%, 50 VDCW, 1/16W.
R255		Metal film: 1.5K ohms ±5%, 50 VDCW, 1/16W.
R256		Metal film: 150 ohms ±5%, 50 VDCW, 1/16W.
R257		Metal film: 270 ohms ±5%, 50 VDCW, 1/16W.
R258		Metal film: 18 ohms ±5%, 50 VDCW, 1/16W.
R259		Metal film: 270 ohms ±5%, 50 VDCW 1/16W.
R260		Metal film: 68 ohms ±5%, 50 VDCW, 1/16W.
R261		Metal film: 220 ohms ±5%, 50 VDCW 1/16W.
R262 and R263		Metal film: 68 ohms ±5%, 100 VDCW, 1/10W.
R264		Metal film: 68 ohms ±5%, 50 VDCW, 1/16W.
R270		Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R271		Metal film: 33K ohms ±5%, 100 VDCW, 1/10W.
R272		Metal film: 22K ohms ±5%, 100 VDCW, 1/10W.
R273		Metal film: 12K ohms ±5%, 100 VDCW, 1/10W.
R274		Metal film: 82K ohms ±5%, 100 VDCW, 1/10W (Used in A).
R274		Metal film: 100K ohms ±5%, 100 VDCW, 1/10W (Used in B).
R274		Metal film: 120K ohms ±5%, 100 VDCW, 1/10W (Used in C).
R275		Metal film: 6.8K ohms ±5%, 100 VDCW, 1/10W.
R276		Metal film: 2.2K ohms ±5%, 100 VDCW, 1/10W.
R278		Metal film: 150 ohms ±5%, 50 VDCW, 1/16W.
R279		Metal film: 5.6K ohms ±5%, 50 VDCW, 1/16W.
R280		Metal film: 1.5K ohms ±5%, 50 VDCW, 1/16W.
R281		Metal film: 150 ohms ±5%, 50 VDCW, 1/16 W.
R282		Metal film: 10K ohms ±5%, 50 VDCW, 1/16W.
R283		Metal film: 56K ohms ±5%, 50 VDCW, 1/16W.
R284		Metal film: 150 ohms ±5%, 50 VDCW, 1/16W.
R285		Metal film: 150 ohms ±5%, 50 VDCW, 1/16W (Used in A).
R285		Metal film: 120 ohms ±5%, 50 VDCW, 1/16W (Used in B,C).
R286		Metal film: 39 ohms ±5%, 50 VDCW, 1/16W (Used in A).
R286		Metal film: 56 ohms ±5%, 50 VDCW, 1/16W (Used in B,C).
R287		Metal film: 150 ohms ±5%, 50 VDCW, 1/10W (Used in A.)
R287		Metal film: 120 ohms ±5%, 50 VDCW, 1/16W (Used in B,C).
R288 thru R293		Metal film: 100K ohms ±5%, 50 VDCW, 1/16W.
R294		Metal film: 10K ohms ±5%, 50 VDCW, 1/16W.
R2001		Metal film: 22K ohms ±5%, 50 VDCW, 1/16W.
R2002		Metal film: 820K ohms ±5%, 50 VDCW, 1/16W (Used in A,B).
R2002		Metal film: 270K ohms ±5%, 50 VDCW, 1/16W (Used in C).
R2003		Metal film: 180K ohms ±5%, 50 VDCW, 1/16W (Used in A).
R2003		Metal film: 270K ohms ±5%, 50 VDCW, 1/16W (Used in B).
R2003		Metal film: 100K ohms ±5%, 50 VDCW, 1/16W (Used in C).
R2004		Metal film: 120 ohms ±5%, 50 VDCW, 1/16W (Used in A,B).
R2004		Metal film: 27K ohms ±5%, 50 VDCW, 1/16W (Used in C.)
R2005		Metal film: 22K ohms ±5%, 50 VDCW, 1/16W.
R2008		Metal film: 330 ohms ±5%, 50 VDCW, 1/16W.
R2011		Metal film: 1 ohms ±5%, 50 VDCW, 1/16W.
R2012		Metal film: 100K ohms ±5%, 100 VDCW, 1/10W.
R2013		Metal film: 0 ohms.
R2301 and R2302		Metal film: 1K ohms ±5%, 200 VDCW, 1/8W.
R2303		Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R2304 and R2305		Metal film: 1K ohms ±5%, 200 VDCW, 1/8W.
R2306		Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R2307 and R2308		Metal film: 1K ohms ±5%, 200 VDCW, 1/8W.
R2309		Metal film: 4.7K ohms ±5%, 100 VDCW, 1/10W.
R2310 thru R2312		Metal film: 15K ohms ±5%, 50 VDCW, 1/16W.
R2313 thru R2315		Metal film: 39K ohms ±5%, 50 VDCW, 1/16W.

(Continued)

SYMBOL	PART NO.	DESCRIPTION
R2401		Metal film: 150 ohms ±5%, 50 VDCW, 1/16W (Used in A).
R2401		Metal film: 100 ohms ±5%, 50 VDCW, 1/16W (Used in B).
R2401		Metal film: 470 ohms ±5%, 50 VDCW, 1/16W (Used in C).
R2402		Metal film: 270 ohms ±5%, 50 VDCW, 1/16W.
R2403		Metal film: 18 ohms ±5%, 50 VDCW, 1/16W.
R2404		Metal film: 270 ohms ±5%, 50 VDCW, 1/16W.
RV201		Variable: 20K ohms ±25% , 1/10W.
		----------TRANSISTORS ----------
TR201 and TR202		Silicon, PNP: sim to NEC 2SC624.
TR203		Silicon, NPN: sim to PANASONIC XP1211.
TR230		Silicon, NPN: sim to NEC 2SD596.
TR241 and TR242		Silicon, NPN: sim to NEC 2SC3356.
TR243		Silicon, NPN: sim to PANASONIC UN5216.
TR244 and TR245		Silicon, NPN: sim to NEC 2SC3356.
TR271		Silicon, NPN: sim to HITACHI 2SC4591.
TR272		Silicon, NPN: sim to NEC 2SC3356.
TR273		Silicon, NPN: sim to NEC 2SC3356.
TR274		Silicon, NPN: sim to NEC 2SC3356.

RECEIVER/EXCITER SECTION
CMN-354A (Used in P1)
CMN-354B (Used in P2)
CMN-354C (Used in P3)

SYMBOL	PART NO.	DESCRIPTION
	NOTE: Parts listed	----------CAPACITORS----------
C151 and C152	are for reference only. Refer to Service Section for	Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM.
C153	serviceable parts.	Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C154		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM.
C156		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0æ60 PPM.
C157 thru C159		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C161		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM.
C162		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C163 and C164		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C165 and C166		Ceramic: 0.1 µF ±10% 25 VDCW, temp coef ±15%.
C169		Tantalum: 22µF ±20% 16 VDCW.
C171		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C401		Ceramic: 8 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A).
C401		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in B,C).
C402		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A).
C402		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM (Used in B,C).
C403		Ceramic: 8 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A,C).
C403		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in B).
C404		Ceramic: 7 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A,C).
C404		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in B).
C405		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A).
C405		Ceramic: 9 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in B,C).
C406		Ceramic: 75 pF ±5% 50 VDCW, temp coef 0±60 PPM (Used in A).
C406		Ceramic: 56 pF ±5% 50 VDCW, temp coef 0±60 PPM (Used in B).
C406		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±60 PPM (Used in C).
C407		Ceramic: 15 pF ±5% 50 VDCW, temp coef 0±60 PPM (Used in A).
C407		Ceramic: 13 pF ±5% 50 VDCW, temp coef 0±60 PPM (Used in B).
C407		Ceramic: 8 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in C).
C408		Ceramic: 9 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A).
C408		Ceramic: 8 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in B).

*COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
C408		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM (Used in C).
C409		Ceramic: 18 pF ±5% 50 VDCW, temp coef 0±60 PPM (Used in A,B).
C409		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±60 PPM (Used in C).
C411 and C412		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM (Used in A,B).
C411 and C412		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM (Used in C).
C413		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C414		Ceramic: 330 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C415		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C416		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM (Used in A).
C416		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±120 PPM (Used in B).
C416		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in C).
C417		Ceramic: 100 pF ±5%. 50 VDCW temp coef 0±60 PPM.
C418		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM.
C419		Ceramic: 330 pF ±5%. 50 VDCW temp coef 0±60 PPM.
C420		Ceramic: 1000 pF ±10%. 50 VDCW temp coef ±15%.
C421		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C423 and C424		Ceramic: 330 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C425		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C426		Ceramic: 1000 pF ±10%. 50 VDCW, temp coef ±15%.
C427 and C428		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C430		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in A).
C430		Ceramic: 0.5 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in B).
C430		Ceramic: 0.75 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in C).
C431		Ceramic: 0.75 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in A,B).
C431		Ceramic: 0.5 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in C).
C432		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in A).
C432		Ceramic: 1.5 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in B).
C433		Ceramic: 0.5 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in A).
C433		Ceramic: 0.75 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in B).
C433		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in C).
C434		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C436		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM.

SYMBOL	PART NO.	DESCRIPTION
C437		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A).
C437		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM (Used in B).
C437		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in C).
C438 and C439		Ceramic: 1.5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C438		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B,C).
C439		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C439		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in C).
C440		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM (Used in A).
C440		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM (Used in B).
C440		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in C).
C441		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM.
C443		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±120 PPM (Used in A).
C443		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in B).
C443		Ceramic: 0.75 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in C).
C444		Ceramic: 1.5 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in B,C).
C445		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C446		Ceramic: 1.5 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in A,C).
C446		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in B).
C447		Ceramic: 0.75 pF ±0.25 pF 50 VDCW, temp coef 0±250 PPM (Used in A,B).
C448 thru C456		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C459		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C461		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C462		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15 %.
C463		Ceramic: 100 pF ±5%. 50 VDCW, temp coef 0±60 PPM.
C465		Ceramic: 330 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C467		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM.
C468		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C473		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±60 PPM.
C474		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C475 and C476		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±120 PPM.
C477		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±60 PPM.
C478		Ceramic: 330 pF ±5% 50 VDCW, temp coef 0±60 PPM.
C479		Ceramic: 1000 pF ±10% 50 VDCW temp coef ±15%.

(Continued)

SYMBOL	PART NO.	DESCRIPTION
C480		Ceramic: 0.1µF ±10% 25 VDCW, temp coef ±15%.
C481		Tantalum: 22µF ±20% 16 VDCW.
C482		Ceramic: 0.1µF ±10% 25 VDCW, temp coef ±15%.
C483 thru C486		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C487		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
CV431 and CB432		Variable: 6 pF max.
		----------DIODES ----------
CD151		Silicon: fast recovery sim to TOSHIBA 1SS352.
CD152		Silicon: fast recovery (2 diodes in cathode); sim to TOSHIBA 1SS184.
CD411		Silicon: (Schottky Barrier): sim to MITSUBISHI MI809.
CD431 thru CD434		Silicon: Epitaxia Planar Diode ; sim to HITACHI HSU277
		---------- LINE FILTERS ----------
FL481		EMI Filter: 1000 pF.
		-------- HYBRID CIRCUITS --------
HC441		Double Balanced Mixer.
		---------- INTEGRATED CIRCUITS ----------
IC151		RF wide-band ampifier :sim to NEC UPC1678G.
IC152		Linear: Positive Voltage Regulator; sim to NJRC NJM78L06UA.
IC481		Linear: Positive Voltage Regulator; sim to NEC UPC2409HF.
		---------- CONNECTORS ----------
J151		Connector: RF.
J401		Connector: RF.
J501		Connector: 30 Pins.
		---------- COILS ----------
L151		Coil: RF 19 nh ±10%.
L152		Coil: RF 0.1 µh ±10%.
L154		Coil: RF 0.22 µh ±10%.
L155		Coil: RF 33 nh ±10%.
L156		Coil: RF 10 nh ±10%.
L157		Coil: RF 0.22 µh ±10%.
L401		Coil: RF (Used in A).
L401		Coil: RF (Used in B,C).
L402		Coil: RF (Used in A,C).
L402		Coil: RF (Used in B).
L403		Coil: RF (Used in A,C).
L403		Coil: RF (Used in B).
L404		Coil: RF (Used in A).
L404		Coil: RF (Used in B,C).
L411		Coil: RF.
L412		Coil: RF 22 nh ±10%.
L414		Coil: RF 22 nh ±10%.
L431 and L432		Coil: RF.

SYMBOL	PART NO.	DESCRIPTION
L462		Coil: RF 22 nh ±10%.
L464		Coil: RF 39 nh ±10%.
L465		Coil: RF 10 nh ±10%.
		----------RESISTORS ----------
R151		Metal film: 10 ohms ±5% 100 VDCW, 1/16W.
R152		Metal film: 220 ohms ±5% 100 VDCW, 1/16W.
R153		Metal film: 1.5K ohms ±5% 100 VDCW, 1/16W.
R154		Metal film: 2.2 ohms ±10% 100 VDCW, 1/2W.
R155		Metal film: 220 ohms ±5% 100 VDCW, 1/16W.
R156		Metal film: 100 ohms ±5% 100 VDCW, 1/10W.
R157		Metal film: 3.3K ohms ±5% 100 VDCW, 1/16W.
R158		Metal film: 1k ohms ±5% 100 VDCW, 1/10W.
R159		Metal film: 100 ohms ±5% 100 VDCW, 1/16W.
R411		Metal film: 5.6K ohms ±5% 100 VDCW, 1/16W.
R412		Metal film: 1.2K ohms ±5% 100 VDCW, 1/16W.
R413 and R414		Metal film: 10 ohms ±5% 100 VDCW, 1/16W.
R415		Metal film: 22 ohms ±5% 100 VDCW, 1/16W.
R416		Metal film: 10 ohms ±5% 100 VDCW, 1/16W.
R417		Metal film: 1.2K ohms ±5% 100 VDCW, 1/16W.
R418		Metal film: 5.6K ohms ±5% 100 VDCW, 1/16W.
R420		Metal film: 10 ohms ±5% 100 VDCW, /16W.
R421		Metal film: 100 ohms ±5% 100 VDCW, 1/16W.
R422		Metal film: 3.3K ohms ±5% 100 VDCW, 1/16W.
R423		Metal film: 8.2K ohms ±5% 100 VDCW, 1/16W.
R424		Metal film: 10 ohms ±5% 100 VDCW, 1/16W.
R425		Metal film: 2.2K ohms ±5% 100 VDCW, 1/16W.
R426		Metal film: 470 ohms ±5% 100 VDCW, 1/16W.
R431 thru R434		Metal film: 10K ohms ±5% 100 VDCW, 1/16W.
R435		Metal film: 18 ohms ±5% 100 VDCW, 1/16W.
R436 and R437		Metal film: 270 ohms ±5% 100 VDCW, 1/16W.
R438		Metal film: 0 ohms.
R445 thru R447		Metal film: 100K ohms ±5% 100 VDCW, 1/16W.
R448 and R449		Metal film: 10K ohms ±5% 100 VDCW, /16W.
R450 thru R452		Metal film: 100K ohms ±5% 100 VDCW, 1/16W.
R453 and R454		Metal film: 10K ohms ±5% 100 VDCW, 1/16W.
R461		Metal film: 5.6K ohms ±5% 100 VDCW, 1/16W.

SYMBOL	PART NO.	DESCRIPTION
R462		Metal film: 1K ohms ±5% 100 VDCW, 1/16W.
R464		Metal film: 10 ohms ±5% 100 VDCW, 1/16W.
R465		Metal film: 47 ohms ±5% 100 VDCW, 1/10W.
R466		Metal film: 5.6K ohms ±5% 100 VDCW, 1/16W.
R467		Metal film: 1K ohms ±5% 100 VDCW, 1/16W.
R469		Metal film: 47 ohms ±5% 100 VDCW, 1/10W.
R470		Metal film: 0 ohms.
R471 and R472		Metal film: 270 ohms ±5% 100 VDCW, 1/16W.
R473		Metal film: 18 ohms ±5% 100 VDCW, 1/16W.
R474		Metal film: 270 ohms ±5% 100 VDCW, 1/16W.
R475		Metal film: 18 ohms ±5% 100 VDCW, 1/16W.
R476		Metal film: 270 ohms ±5% 100 VDCW, 1/16W.
R477 and R478		Metal film: 47 ohms ±5% 100 VDCW, 1/10W.
R480		Metal film: 22K ohms ±5% 100 VDCW, 1/16W (Used in A).
R480		Metal film: 47K ohms ±5% 100 VDCW, 1/16W (Used in B).
R480		Metal film: 68K ohms ±5% 100 VDCW, 1/16W (Used in C).
R481		Metal film: 2.2K ohms ±5% 100 VDCW, 1/16W (Used in A).
R482		Metal film: 2.2K ohms ±5% 100 VDCW, 1/16W (Used in B).
R483		Metal film: 2.2K ohms ±5% 100 VDCW, 1/16W (Used in C).
R484		Metal film: 2.2K ohms ±5% 100 VDCW, 1/16W (Used in A).
R485		Metal film: 2.2K ohms ±5% 100 VDCW, 1/16W (Used in B).
R486		Metal film: 2.2K ohms ±5% 100 VDCW, 1/16W (Used in C).
R487		Metal film: 22 ohms ±5% 100 VDCW, 1/16W.
R488 thru R490		Metal film: 1K ohms ±5% 100 VDCW, 1/16W.
		----------TRANSISTORS ----------
TR151		Silicon, NPN; sim to MOTOROLA MRF559.
TR152		Silicon, PNP; sim to NEC 2SB624.
TR411 and TR412		Silicon, NPN; sim to NEC 2SC3357.
TR413		Silicon, PNP; sim to PANASONIC XN6401.
TR431 and TR432		Silicon, PNP; sim to PANASONIC XN6401.
TR461 and TR462		Silicon, NPN; sim to NEC 2SC3357.

COMPONENT IDENTIFICATION CHART
Synthesizer

Symbol	**A** (403-440 MHz)	**B** (440-470 MHz)	**C** (470-512 MHz)
C241	22pF	18pF	10pF
C242	4pF (UJ)	7pF (UJ)	----
C343	18pF	18pF	22pF
C244	7pF	7pF	7pF
C245	8pF	7pF	6pF
C249	7pF	6pF	7pF
C250	5pF	4pF	6pF
C254	12pF	10pF	8pF
C255	12pF	10pF	10pF
C259	10pF	10pF	1000pF
C260	7pF (UJ)	6pF	6pF (UJ)
C261	27pF	22pF	22pF
C262	33pF	27pF	27pF
C275	18pF (UJ)	12pF (UJ)	12pF (UJ)
C278	8pF	6pF	7pF
C279	3pF	3pF	3pF
C280	15pF	12pF	12pF
C281	18pF	12pF	12pF
C289	7pF	6pF	6pF
C290	4pF	3pF	4pF
C291	8pF	7pF	6pF
C2410	----	----	8pF (UJ)
C2411	----	5pF	----
FL201	BPF35819K (7C)	BPF35819K (7C)	BPF35819K (7C)
FL202	BPF35819K (7C)	BPF35819K (7C)	BPF35819K (7C)
L242	E22S6K2 , 6/13 , 2	E22S6K2 , 6/13 , 2	E22S6K2 , 6/13 , 2
R230	8.2kΩ	0Ω	8.2kΩ
R251	180Ω	270Ω	270Ω
R252	33Ω	18Ω	18Ω
R253	180Ω	270Ω	270Ω
R274	82kΩ	100kΩ	120kΩ
R285	150Ω	120Ω	120Ω
R286	39Ω	56Ω	56Ω
R287	150Ω	120Ω	120Ω
R2002	820kΩ	820kΩ	270kΩ
R2003	180kΩ	270kΩ	100kΩ
R2004	120kΩ	120kΩ	68kΩ
R2401	150Ω	100Ω	470Ω

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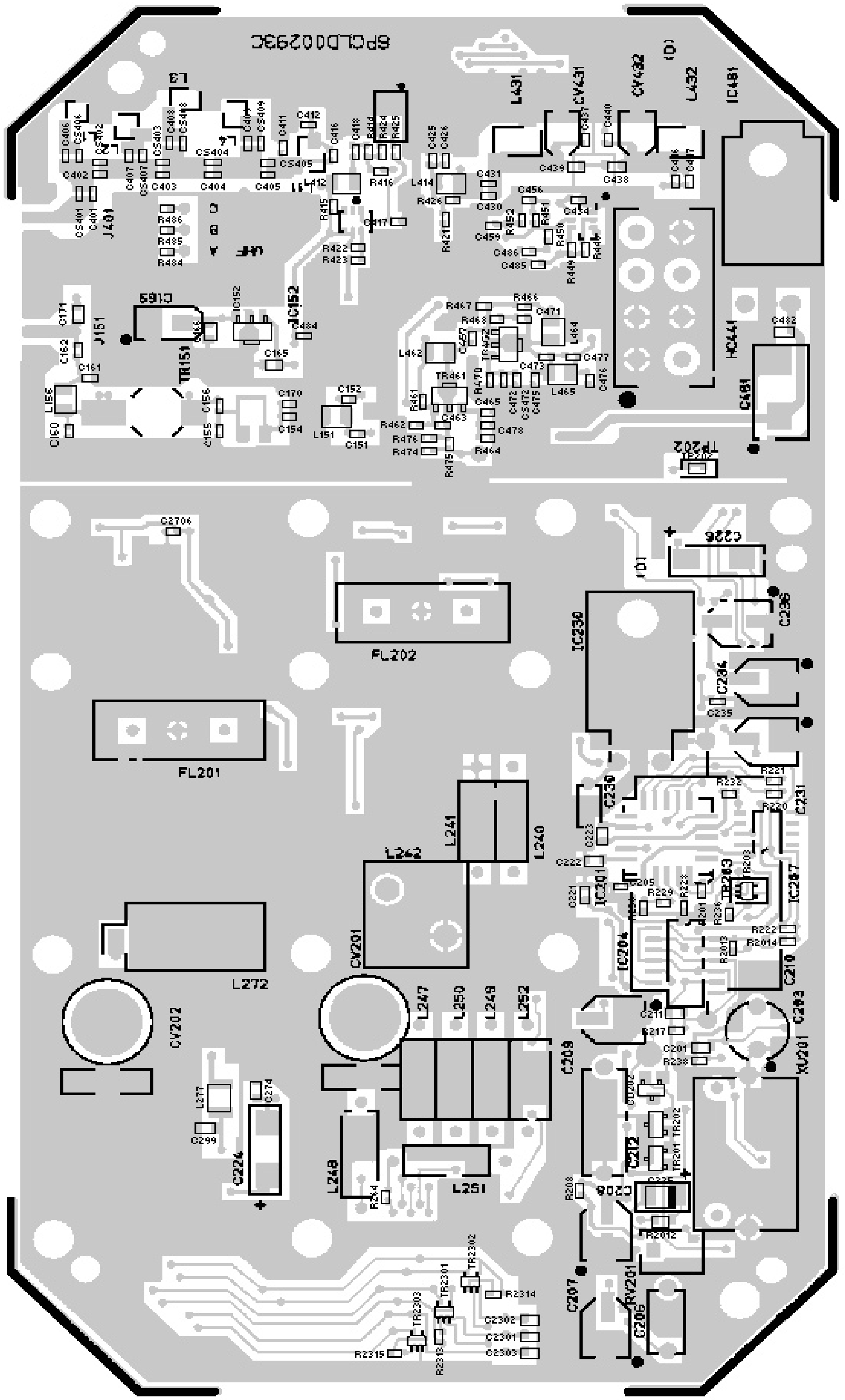
COMPONENT IDENTIFICATION CHART
Receiver/Exciter

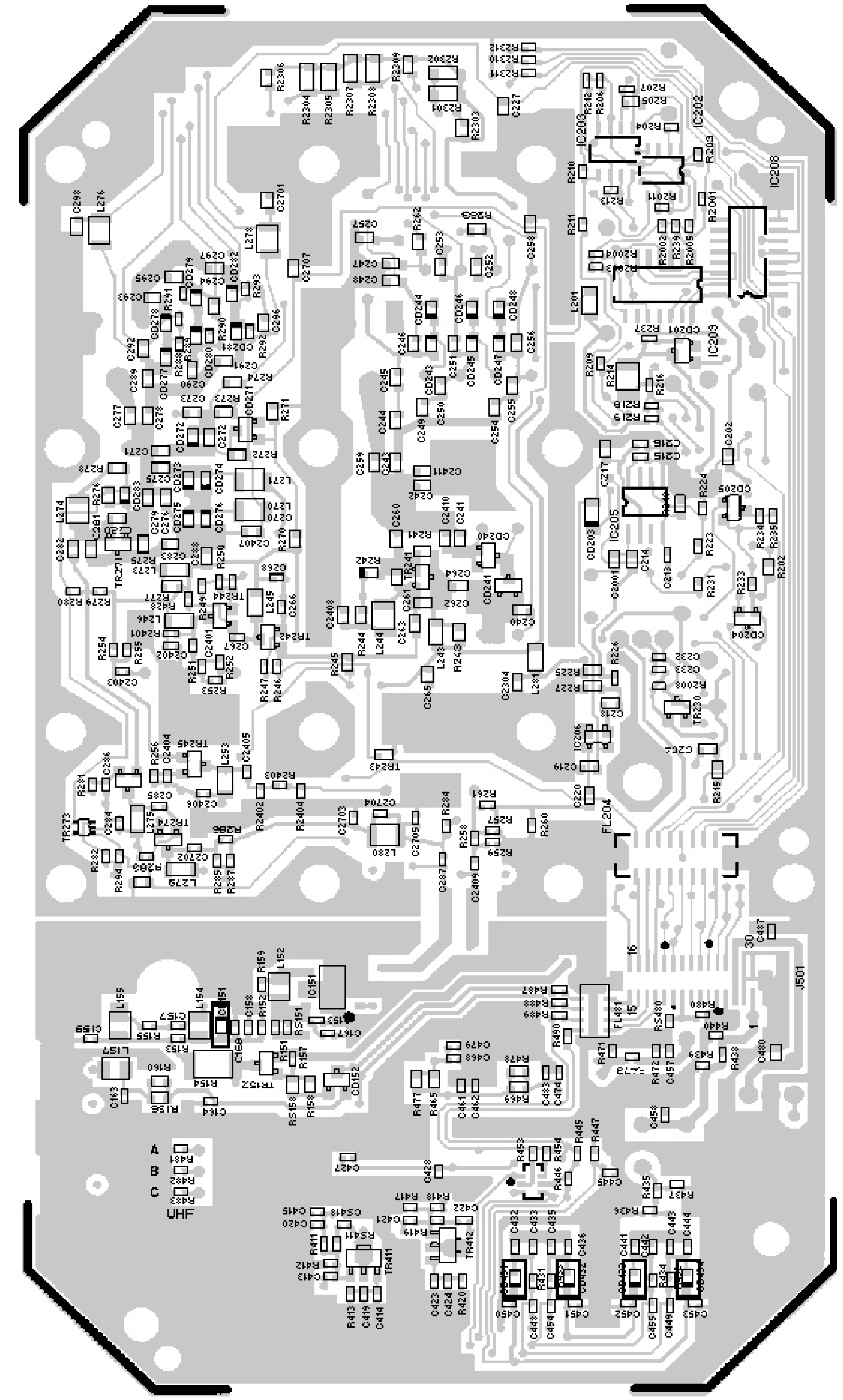
Symbol	**A** (403-440 MHz)	**B** (440-470 MHz)	**C** (470-512 MHz)
C401	8pF	7pF	7pF
C402	6pF	5pF	5pF
C403	8pF	7pF	8pF
C404	7pF	6pF	7pF
C405	10pF	9pF	9pF
C406	75pF	56pF	39pF
C407	15pF	13pF	8pF
C408	9pF	8pF	5pF
C409	18pF	18pF	12pF
C411	5pF	5pF	4pF
C412	5pF	5pF	2pF
C416	4pF	3pF	2pF
C430	1pF	0.5pF	0.75pF
C431	0.75pF	0.75pF	0.5pF
C432	2pF	1.5pF	0pF
C433	0.5pF	0.75pF	2pF
C435	0pF	0pF	0pF
C437	6pF	4pF	2pF
C438	1.5pF	1pF	1pF
C439	1.5pF	2pF	1pF
C440	6pF	4pF	2pF
C441	1pF	1pF	1pF
C442	0pF	0pF	0pF
C443	3pF	1pF	0.75pF
C444	0pF	1.5pF	1.5pF
C446	1.5pF	1pF	1.5pF
C447	0.75pF	0.75pF	0.75pF
C457	0pF	0pF	0pF
C458	0pF	0pF	0pF
L401	2.0Ø3T	1.8Ø3T	1.8Ø3T
L402	2.0Ø4T	1.8Ø4T	2.0Ø4T
L403	2.0Ø5T	1.8Ø5T	2.0Ø5T
L404	2.0Ø4T	1.8Ø4T	2.0Ø4T
R480	22kΩ	47kΩ	58kΩ
R481	2.2kΩ	∞	∞
R482	∞	2.2kΩ	∞
R483	∞	∞	2.2kΩ
R484	2.2kΩ	∞	∞
R485	∞	2.2kW	∞
R486	∞	∞	2.2k

(DD00-CMN-354-1 2/2)

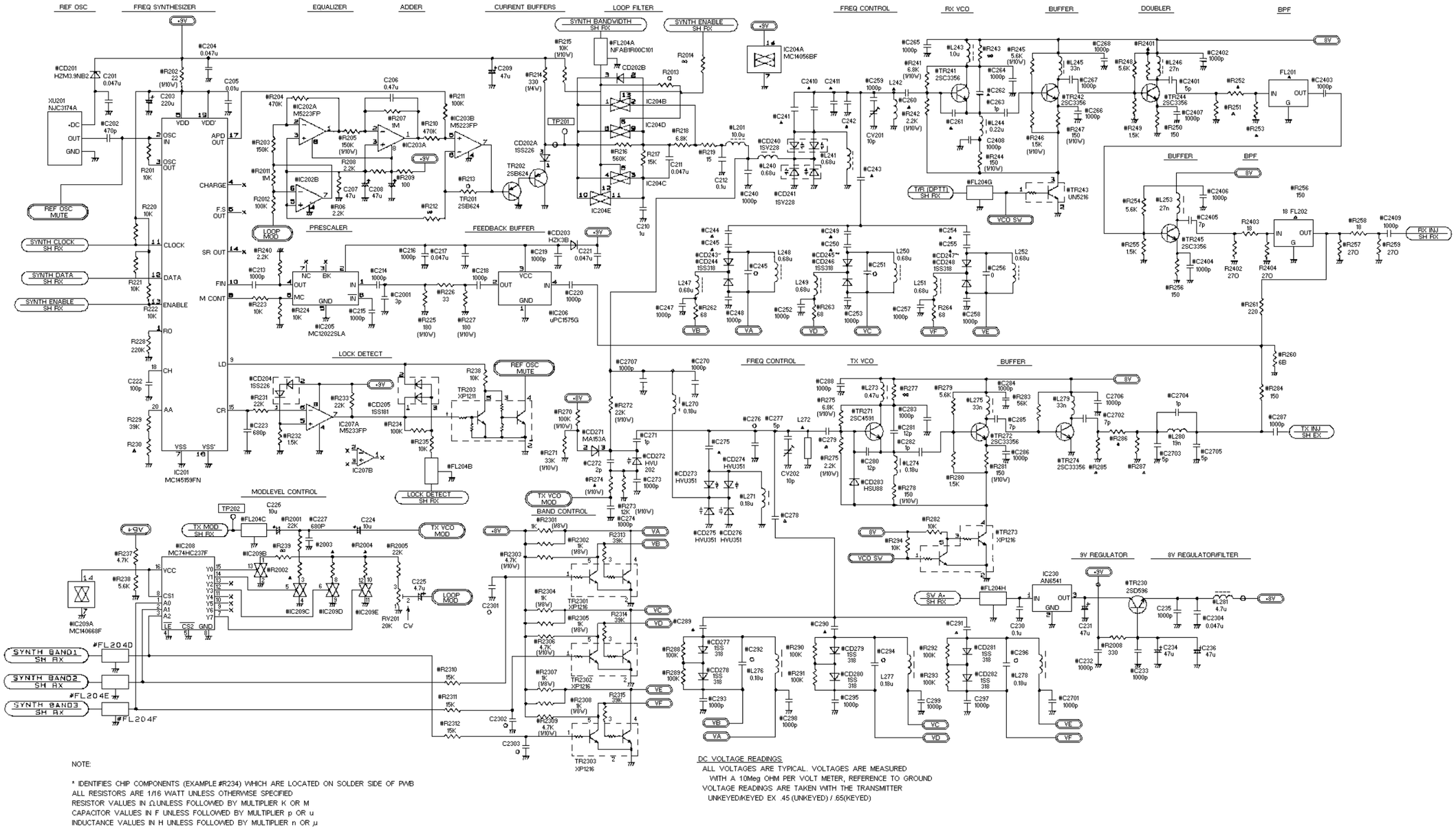
COMPONENT SIDE



SOLDER SIDE



Synthesizer/Receiver/Exciter Board



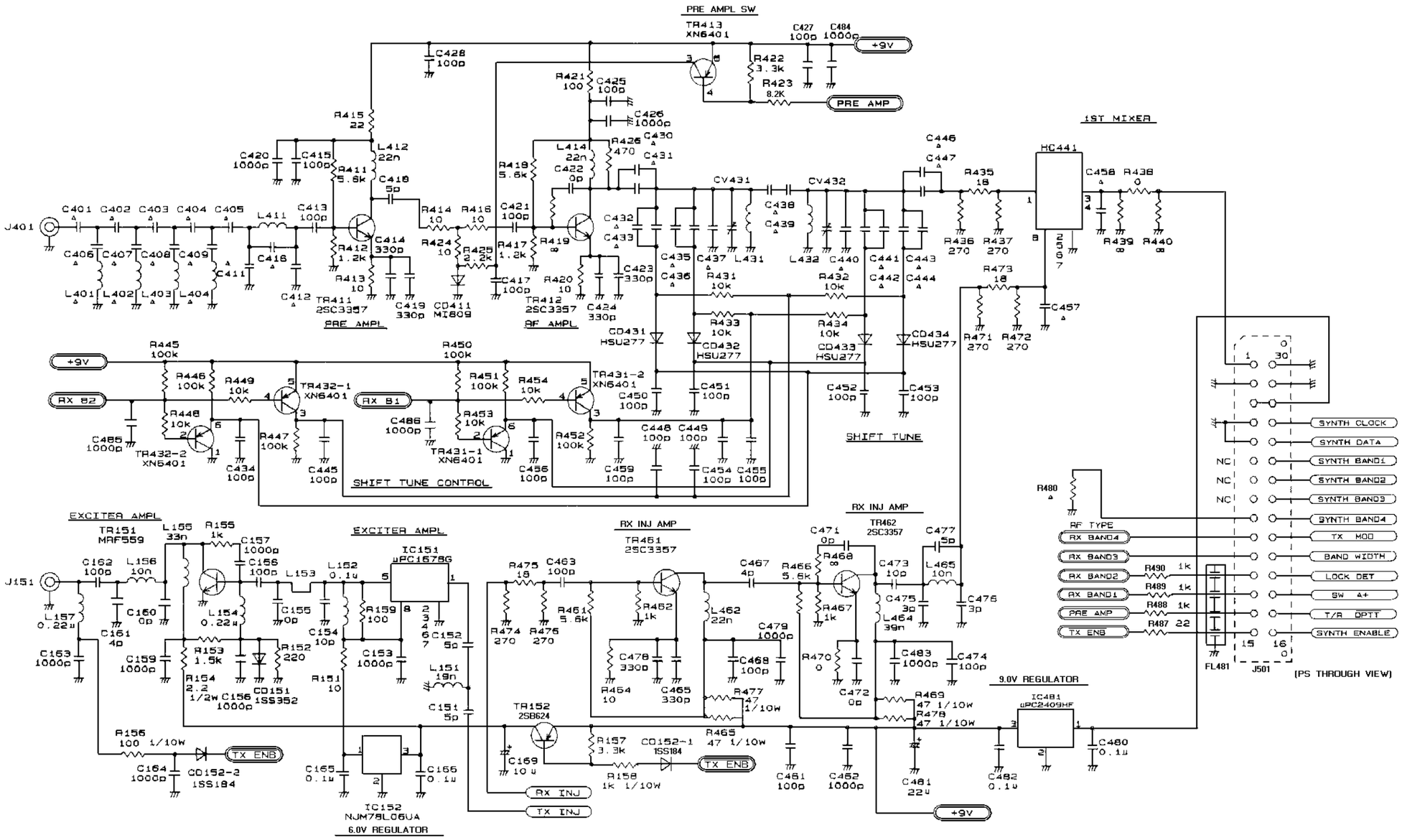
NOTE:

* IDENTIFIES CHIP COMPONENTS (EXAMPLE #R234) WHICH ARE LOCATED ON SOLDER SIDE OF PWB
ALL RESISTORS ARE 1/16 WATT UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER p OR u
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER n OR µ

DC VOLTAGE READINGS

ALL VOLTAGES ARE TYPICAL. VOLTAGES ARE MEASURED WITH A 10Meg OHM PER VOLT METER, REFERENCE TO GROUND
VOLTAGE READINGS ARE TAKEN WITH THE TRANSMITTER UNKEYED/KEYED EX .45 (UNKEYED) / .65(KEYED)

Synthesizer
(DD00-CMN-354 1/2)



NOTE:

ALL RESISTORS ARE 1/16 WATT UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER μ,n OR P
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER m,u OR n

Receiver/Exciter
(DD00-CMN-354-1 1/2)