ORION™
29 - 50 MHz SYNTHESIZER/RECEIVER BOARD
CMN-350A/B

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ILLUSTRATIONS

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DESCRIPTION

The M/A-COM **ORION™** Low Band Synthesizer/Receiver Board provides, on one printed circuit board, circuits for both the synthesizer and receiver. The synthesizer circuits generates transmit frequencies for two splits 29-42 MHz designated by **(A)** and 35 - 50 MHz designated by **(B)**. The synthesizer also generates the receiver injection frequencies .

The FM dual-conversion, super-heterodyne receiver is designed for operation in the 29 - 50 MHz frequency range. A regulated 9.0 volts is provided to all receiver stages except the audio PA IC and noise blanker unit, which operates from the switched A+ supply.

The receiver has **I**ntermediate **F**requency (**IF**) of 20.8 MHz and 455 kHz. Adjacent channel selectivity is obtained by using a band-pass filter, a 20.8 MHz crystal filter and a 455 kHz ceramic filter.

The receiver circuit consists of:

- Front End Mixer
- 20.8 MHz 1st IF, 455 kHz 2nd IF and FM Detector d lkd dlkd dkld
- **A**udio **S**ignal **P**rocessor (**ASP**) including Squelch
- Audio PA
- Noise Blanker

The Front End and Mixer circuit is on the Synthesizer/Receiver Board. The 20.8 MHz 1st IF, 455 kHz 2nd IF, FM Detector, ASP, Audio PA and Noise Blanker circuits are on the System Control Logic/IF Board (Maintenance Manual LBI-39145).

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).It 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 VCOs 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 29 MHz to 50 MHz. The Rx VCO operates over the range of 49.8 to 70 MHz.

Reference Oscillator

The reference oscillator consists of a 5 PPM **T**emperature **C**ompensated (**X**)Crystal **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 degrees C to +60 degrees 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 5 kHz channel reference frequency 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 input compares 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 **P**hase-**L**ock-**L**oop (**PLL**) to acquire the new frequency.

The **SYNTH ENABLE** pulse from the microcomputer 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 or by the adder circuit, operational amplifier IC203-B.

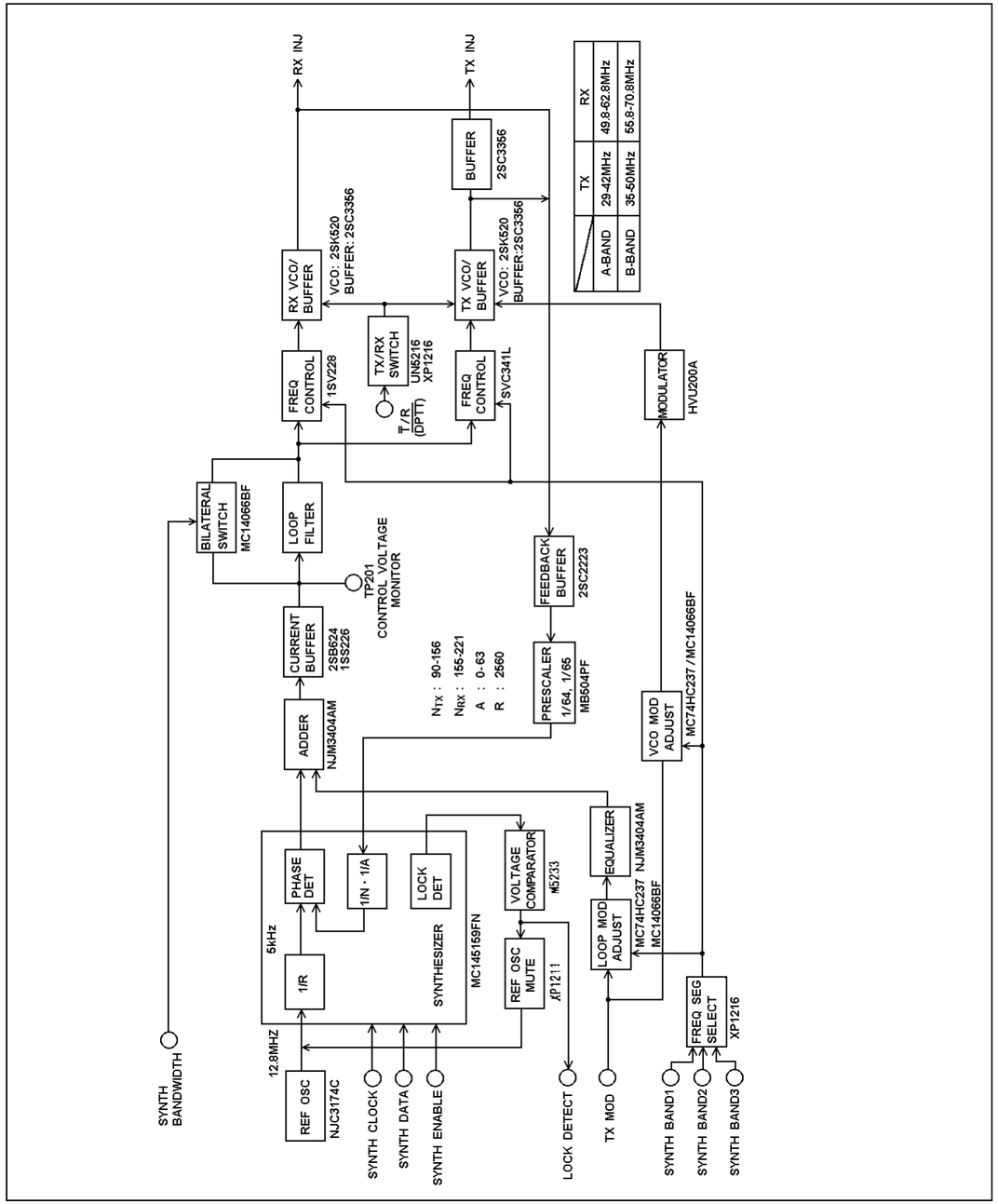


Figure 1 - Synthesizer/Receiver Block Diagram

DC Offset And High Current Buffers

DC offset buffer transistors TR201 and TR202 and diode CD202-A receive error voltage from the synthesizer and increases 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 DC offset butter TR202. Resistor R214, diode 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 C2112. 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 IC240-B & D are turned on for 3 milliseconds. When changing from receive to transmit, bilateral switches IC204--C & E are turned on for 15 milliseconds and IC204- B & D are turned on 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 a 9 volt **SYNTH BANDWIDTH** and **SYNTH ENABLE** pulse. When the **SYNTH BANDWIDTH** pulse and 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 VCOs to adjust and maintain the VCO frequency.

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

Receiver Voltage Controlled Oscillator

The receiver VCO consists of low-noise JFET oscillator TR240 followed by high-gain buffer transistor TR241. Transistor TR241 prevents external loading and provides power-gain. The VCO is a colpitts oscillator with the various varactors, capacitors and coil forming the tank circuit.

The VCO is switched on and off under control of the Line. When the line is high, the receiver VCO is turned on, transistor TR242 is on. Oscillator output is typically 0 dBm. The output is applied to the feedback buffer for VCO frequency control and as the Receiver (**Rx**) injection frequency to the Rx 1st mixer through **L**ocal **O**scillator (**LO**) buffers on the receiver board. The Rx VCO also uses a high-Q coil to achieve superior noise performance. The VCO operates over a frequency range of 49.8-70.8 MHz. The VCO voltage need only be set once at some frequency of the band and split, after which it operates over the entire split with no additional tuning.

Transmitter Voltage Controlled Oscillator

The transmitter VCO is basically the same as the receiver VCO. The wideband VCO allows frequency separation of 13 MHz or 15 MHz as determined by the bandsplit the radio is operating on, 29-42 MHz or 35-50 MHz. The varactors in conjunction with the frequency segment selector circuitry , transistors TR2301 - TR2303 and band switching diodes CD285 - CD290, provide a Voltage-controlled adjustment range that extends across the entire frequency split. VCO control switch transistor TR282 turns the transmit VCO on when the is low.

Feedback Buffer

The buffered output of the Rx VCO and Tx VCO, from transistors TR241 and TR281 respectively, are supplied to feedback buffer transistor TR2101. This drives the dual-modulus prescaler IC205. The buffered VCO outputs also provide Rx or Tx injection drive.

Dual Modulus Prescaler

The dual-modulus prescaler completes the **P**hase-**L**ock-**L**oop (**PLL**) feedback path from the synthesizer to the loop-filter, to the VCOs and feedback buffers and then back to the synthesizer through the prescaler. The prescaler divides the VCO by 64 or 65 under control of the **M CONT** from the synthesizer. The output of the prescaler is applied to the synthesizer where it is divided down to 5 kHz by and internal **+N, A** counter and compared in frequency and phase with the divided-down frequency for the reference oscillator. The result of this comparison is the error voltage used to maintain frequency lock. The **+N, A** counter is controlled by data received from the microcomputer. Depending on the operating frequency, the DC voltage at Test Point TP201 should be within 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 and the reference oscillator if the loop loses lock. It also provides a fast locking -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 may increase positive 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, preventing muting of the reference oscillator.

Loop Mod Adjust

The loop mod adjust circuit automatically sets the loop modulation level applied to the equalizer IC202, IC203 through Loop Mod adjuster RV201. The loop mod adjust modulation circuit consists of IC208, IC209, resistors R2001-R2006 and RV201. The loop modulation level is controlled by turning bilateral switches IC209 on or off (under control of IC208) to include resistors R2001-R2006 in the circuit. Resistors R2001-R2006 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.

VCO Mod Adjust

The VCO Mod adjust circuit automatically sets the VCO modulation level applied to modulator diode CD282. The VCO Mod adjust modulation circuit consists of IC210, IC211 and resistors R2810-R2813. The VCO modulation level is controlled by turning bilateral switches IC211 on or off (under control of IC210) to include resistors R2810-2813 in the circuit. Resistors R2810-R2813 form an adjustable voltage divider to change the VCO modulation level as required. Table 1 also identifies the resistor (if applicable) used for each frequency segment.

Frequency Segment Selector

The frequency-segment selector switches capacitance in and out of the Tx and Rx VCO tank circuits to select the frequency segment containing the selected channel (refer to the **Shift Tune Control** section). The frequency segment selector consists of transistors TR2301 - TR2303, diodes CD243 - CD248 and CD285 - CD290 and operates under control of the microcomputer. Capacitors C260-C262, C266-C268, C272-C274, C277-C279, C2104-C2107, C2111-C2114 and C2118-C2121 are selected or deselected for operation in a given segment. Table 2 identifies the circuit conditions existing for selection of each segment and the capacitors used.

Reverse bias to turn off the band switching diodes are provided by the +8 Volt supply through resistors R2303, R2306 and R2309. Forward bias for the diodes and current for the switching transistors are provided by the + 8 Volt supply through resistors R2301- R2302, R2304, R2307 and R2308. When segment 3 is selcted, transistors TR2302 and TR2303 are turned on. In the Tx VCO diodes CD287, CD288, CD289 and CD290 are reverse biased and diodes CD285 and CD286 are turned on. Capacitors C2111. C2112. C2118 and C2119 are effectively isolated from ground and capacitors C2104 and C2105 are connected to ground through diodes CD285 and CD286.

Similarly in the Rx VCO capacitors C266, C267, C272 and C273 are isolated from ground and capacitors C260 and C261 are grounded through diodes CD243 and CD244.

Operation of the radio over the frequency ranges 29-42 MHz or 35-50 MHz. is determined by the group number of the synthesizer board. Each frequency split is divided into four operating segments varying from 2.5 to 5 MHz wide.

RECEIVER CIRCUIT

Receiver Front End

An RF signal from the antenna is coupled through a low-pass filter, antenna switch and band-pass filter to the input (base) of RF amplifier transistor TR401. The output of TR401 (collector) is coupled through another high-pass filter and another band-pass filter to the input of first mixer circuit HC441. The Front End selectivity is provided by this band-pass filter (see Figure 2).

Shift Tune Control

The frequency of the band-pass filter is controlled by the Shift Tune Control circuit and the microprocessor on the System Control Logic/IF board. Transistor switches TR431and TR432-1 connect the frequency determining components in the filter circuit. Transistor switch TR431-1 selects the components to tune the band-pass filter for RX Band 1 (29-42 MHz). TR432-1 selects the components to tune the band-pass filter for RX Band 2 (35-50 MHz).

For more information refer to the frequency Synthesizer **Frequency Segment Selector** section.

Receiver Injection

Receiver RF injection frequency (49.8-70.8 MHz) from the synthesizer VCO is applied to the base amplifier transistor TR461. The output (collector) of amplifier TR461 is coupled to the base of amplifier transistor TR462. The output (collector) of amplifier TR462 is filtered by a low-pass filter consisting of capacitors C4011 through C4014 and inductor L412. This filter is tuned to pass frequency in the 49.8-70.8 MHz pass band.

Table 1 - Frequency Segment Selection

	Segment	Frequency Split (MHz)	Synth Band 1 (Input TR2302)	Synth Band 2 (Input TR2303)	Synth Band 3 (Input TR2302)	Grounded Modulation Resistor
29-42 MHz	1	29-32	1	1	1	R2813 R333
	2	32-35	0	1	1	R2812
	3	35-38.5	0	1	0	R2811
	4	38.5-42	0	0	0	R2810
35-50 MHz	1	35-37.5	1	1	1	R2813
	2	37.5-41	0	1	1	R2812
	3	41-45	0	1	0	R2811
	4	45-50	0	0	0	R2810

Table 2 - Capacitor Selection

	Transistor Switch*			Band Switching Diodes						
Segment	TR2301	TR2302	TR2303	CD243 CD244	CD245 CD246	CD247 CD248	CD285 CD286	CD287 CD288	CD289 CD290	Grounded Capacitors
1	0	0	0	On	On	On	On	On	On	All
2	0	0	1	On	On	Off	On	On	On	C260, C261, C266, C267, C2104, C2105, C2111, C2112
3	0	1	1	On	Off	Off	On	Off	Off	C260, C261, C2104, C2105
4	1	1	1	Off	Off	Off	Off	Off	Off	None

*"1" Indicates transistor is turned on.

1st Mixer

The first mixer is a double-balanced diode mixer (HC441) that converts a signal in the 29-50 MHz frequency range to 20.8 MHz first IF. In the Mixer stage, RF from the 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.

1st IF

The 20.8 MHz 1st IF output signal is coupled from the output of mixer HC441 through capacitor C501 to the source input of IF amplifier/buffer **J**unction **F**ield **E**ffect **T**ransistors (**JFET**) TR501 and TR502. These components are located on the System Control logic/IF board (refer to LBI-39145).

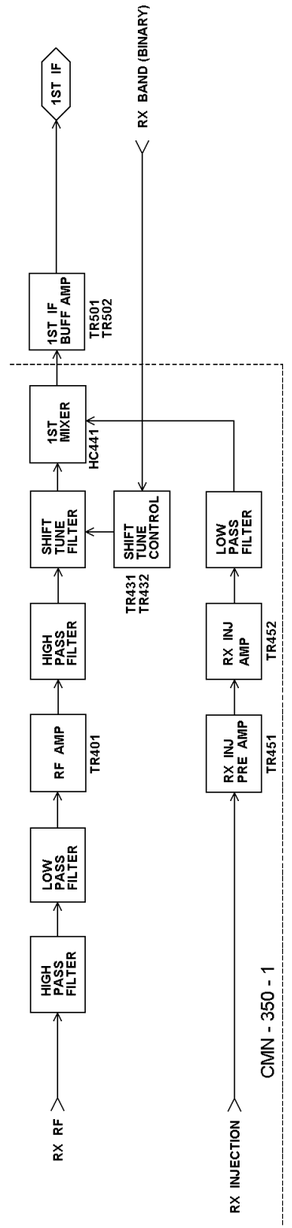


Figure 2 - Receiver Block Diagram

SYNTHESIZER/RECEIVER BOARD
SYNTHESIZER SECTION
CMN-350A2 (Used in P1, P3)
CMN-350B2 (Used in P2, P4)
Issue 3

SYMBOL	PART NO.	DESCRIPTION
		------CAPACITORS------
C201		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C202	NOTE: Parts listed are for reference only.	Ceramic: 470 pF ±5% 50 VDCW, temp coef +350 ± 1000 PPM.
C203	Refer to Service Section for Servicable parts	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: 1µF ±10%.
C211		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C212		Polypropylene: 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		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C216		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C217		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C218		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C219		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C220		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C221		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C222		Ceramic: 180 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		Tantalum: 4.7µF ±20% 16 VDCW.
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.
C237 and C238		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C240		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C241		Ceramic: 180 pF ±5% 50 VDCW, temp coef -750±120 PPM (Used in A).
C241		Ceramic: 120 pF ±5% 50 VDCW, temp coef -750±120 PPM (Used in B).
C242		Ceramic: 100 pF ±5% 50 VDCW temp coef -750±120 PPM.
C244		Ceramic: 68 pF ±5% 50 VDCW, temp coef -750±120 PPM.
C246		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C247		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15%.
C248		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C250		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C252 and C253		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C255		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C256		Ceramic: 18 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C257		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C257		Ceramic: 27 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C258		Ceramic: 18 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C260		Ceramic: 18 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C260		Ceramic: 22 pF ±5% 50 VDCW, temp coef 0±30 PPM.(Used in B).
C261		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C262		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.(Used in A).
C263 and C264		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.

SYMBOL	PART NO.	DESCRIPTION
C266		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C266		Ceramic: 33 pF ±5% 50 VDCW temp coef 0±30 PPM (Used in B).
C267		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C268		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C269 and C270		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C272		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C273		Ceramic: 120 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A.)
C273		Ceramic: 47 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C274		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C275 and C276		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C277 thru C279		Ceramic: 5 pF }0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C280		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C281		Ceramic: 6 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C281		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C282		Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C283		Ceramic: 680 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C285		Ceramic: 150 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C285		Ceramic: 82 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C286		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C288		Ceramic: 330 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C288		Ceramic: 82 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C290		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C291		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15%.
C293		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C295		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C295		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C296 thru C298		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C2001		Tantalun: 10µF ±20% 10 VDCW.
C2100		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2100		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2101		Ceramic: 68 pF ±5% 50 VDCW, temp coef 0±30 PPM.
C2102		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2102		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2104		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2104		Ceramic: 33 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2105		Ceramic: 47 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2105		Ceramic: 39 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2106		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C2106		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C2107		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2107		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C2108		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15% (Used in A).
C2108		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% (Used in B).
C2109		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15% (Used in A).
C2109		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% (Used in B).
C2111		Ceramic: 120 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).

SYMBOL	PART NO.	DESCRIPTION
C2111		Ceramic: 47 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2112		Ceramic: 150 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2112		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2113		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C2113		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C2114		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2114		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C2115		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15% (Used in A).
C2115		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% (Used in B).
C2116		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15% (Used in A).
C2116		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% (Used in B).
C2118		Ceramic: 470 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2118		Ceramic: 100 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2119		Ceramic: 560 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2119		Ceramic: 150 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2120		Ceramic: 10 pF ±0.5 pF 50 VDCW, temp coef 0±30 PPM (Used in A).
C2120		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C2121		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2121		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in B).
C2122		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15% (Used in A).
C2122		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15% (Used in B).
C2123		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15% (Used in A).
C2123		Ceramic: 1000 pF ±0% 50 VDCW, temp coef ±15% (Used in B).
C2202		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C2801 and C2802		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C2803		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C2804 thru C2806		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
C2807		Ceramic: 82 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in A).
C2807		Ceramic: 56 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B).
C2808		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
		-------VARIABLE CAPACITORS-------
CV240		Variable: 10 pF max.
CV280		Variable: 10 pF max.
		----------DIODES----------
CD201		Zener: 4.7 V; sim to HITACHI HZM4.7NB2.
CD202		Silicon: fast recovery (2 diodes in series); sim to TOSHIBA 1SS226.
CD203		Zener: 3.9 V; sim to HITACHI HZM3.9NB2.
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.
CD242		Silicon: (Schottky Barrier); sim to HITACHI HSU88.
CD243 thru CD248		Silicon: Epitaxial Planer Diode: sim to ROHM 1SS356.
CD281		Silicon: fast recovery (2 diodes in series); sim to PANASONIC MA153A.
CD282		Silicon: Variable capacitance Diode; sim to HITACHI HVU200A.
CD284		Silicon: (Schottky Barrier); sim to HITACHI HSU88.
CD285 thru CD290		Silicon: Epitaxial Planer Diode: sim to ROHM 1SS356.
CD2401 thru CD2403		Silicon: Variable Capacitance Diode; sim to TOSHIBA 1SV228.

SYMBOL	PART NO.	DESCRIPTION
CD2801 and CD2802 CD2804		Silicon: Variable Capacitance Diode; sim to SANYO SVC341. Silicon: fast recovery(2 diodes with cathode common); sim to TOSHIBA 1SS184
		----------FILTER----------
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 MB504PF.
IC207		Linear: Dual Comparator; sim to MITSUBISHI M5233FP.
IC208		Digital: Decoder; sim to MOTOROLA MC74HC237F.
IC209		Digital: Bilateral switch sim to MOTOROLA MC14066BF.
IC210		Digital: Decoder; sim to MOTOROLA MC74HC237F.
IC211		Digital: Bilateral switch sim to MOTOROLA MC14066BF.
IC230		Linear: Positive Voltage Regulator; sim to PANASONIC AN6541.
		------------COIL------------
L220		Coil RF: 1 µH ±20%.
L230		Choke Coil: 4.7 µH ±10%.
L240 and L241		Choke Coil: 10 µH ±10%.
L242		Coil RF (Used in A).
L242		Coil RF (Used in B).
L244		Choke Coil: 10 µH ±10%.
L245		Coil RF: 1 µH ±20%.
L246		Coil RF: 68 nH ±10% (Used in A).
L246		Coil RF: 56 nH ±10% (Used in B).
L247 thru L252		Choke Coil: 10 µH ±10%.
L280 and L281		Choke Coil: 10 µH ±10%.
L282		Coil RF (Used in A).
L282		Coil RF (Used in B).
L284		Choke Coil: 10 µH ±10%.
L285		Coil RF: 1 µH ±20%.
L286		Coil RF: 100 nH ±10%.
L287		Choke Coil: 15 µH ±10% (Used in A).
L287		Choke Coil: 10 µH ±10% (Used in B).
L288		Choke Coil: 15 µH ±10% (Used in A).
L288		Choke Coil: 10 µH ±10% (Used in B).
L289		Choke Coil: 15 µH ±10% (Used in A).
L289		Choke Coil: 10 µH ±10% (Used in B).
L290		Choke Coil: 15 µH ±10% (Used in A).
L290		Choke Coil: 10 µH ±10% (Used in B).
L291		Choke Coil: 15 µH ±10% (Used in A).
L291		Choke Coil: 10 µH ±10% (Used in B).
L292		Choke Coil: 15 µH ±10% (Used in A).
L292		Choke Coil: 10 µH ±10% (Used in B).
L2801		Choke Coil: 10 µH ±10%.
L2802		Choke Coil: 1 µH ±20%.
		-------CONNECTOR--------
P201		Connector, RF.
		--------RESISTORS---------
R201		Metal film: 10k ohms ±5% 50 VDCW 1/16W.
R203		Metal film: 150k ohms ±5% 50 VDCW 1/16W.
R204		Metal film: 470k ohms ±5% 50 VDCW 1/16W.
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.
R212		Metal film: 1M ohms ±5% 50 VDCW 1/16W.
R213		Metal film: 1M ohms ±5% 1/16W.
R214		Metal film: 330 ohms ±5% 200 VDCW 1/4W.
R215		Metal film: 10k ohms ±5% 100 VDCW 1/10W.
R216		Metal film: 560k 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: 100 ohms ±5% 50 VDCW 1/16W.
R220 thru R224		Metal film: 10k ohms ±5% 50 VDCW 1/16W.

SYMBOL	PART NO.	DESCRIPTION
R228		Metal film: 220k ohms ±5% 50 VDCW 1/16W.
R229		Metal film: 390k ohms ±5% 50 VDCW 1/16W (Used in A).
R229		Metal film: 180k ohms ±5% 50 VDCW 1/16W (Used in B).
R230		Metal film: 470k ohms ±5% 50 VDCW 1/16W (Used in A).
R230		Metal film: 560k ohms ±5% 50 VDCW 1/16W (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.
R239		Metal film: 2.2k ohms ±5% 100 VDCW 1/10W.
R241		Metal film: 47k ohms ±5% 100 VDCW 1/10W.
R242		Metal film: 270 ohms ±5% 100 VDCW 1/10W.
R243		Metal film: 5.6k ohms ±5% 100 VDCW 1/10W.
R244		Metal film: 1.5k ohms ±5% 100 VDCW 1/10W.
R245		Metal film: 120 ohms ±5% 100 VDCW 1/10W.
R246		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R247		Metal film: 56 ohms ±5% 100 VDCW 1/10W.
R248		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R249		Metal film: 220 ohms ±5% 100 VDCW 1/10W.
R280		Metal film: 100k ohms ±5% 100 VDCW 1/10W.
R281		Metal film: 33k ohms ±5% 100 VDCW 1/10W.
R282		Metal film: 22k ohms ±5% 100 VDCW 1/10W.
R284		Metal film: 47k ohms ±5% 100 VDCW 1/10W.
R286		Metal film: 47k ohms ±5% 100 VDCW 1/10W.
R287		Metal film: 270 ohms ±5% 100 VDCW 1/10W.
R288		Metal film: 5.6k ohms ±5% 100 VDCW 1/10W.
R289		Metal film: 1.5k ohms ±5% 100 VDCW 1/10W.
R290		Metal film: 120 ohms ±5% 100 VDCW 1/10W.
R291		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R292		Metal film: 68 ohms ±5% 100 VDCW 1/10W (Used in A).
R292		Metal film: 56 ohms ±5% 100 VDCW 1/10W (Used in B).
R293		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R294		Metal film: 220 ohms ±5% 100 VDCW 1/10W.
R295		Metal film: 100 ohms ±5% 100 VDCW 1/10W .
R296 and R297		Metal film: 10k ohms ±5% 100 VDCW 1/10W .
R2001		Metal film: 82k ohms ±5% 50 VDCW 1/16W .
R2002		Metal film: 68k ohms ±5% 50 VDCW 1/16W (Used in A).
R2002		Metal film: 56k ohms ±5% 50 VDCW 1/16W (Used in B).
R2003		Metal film: 100k ohms ±5% 50 VDCW 1/16W (Used in A).
R2003		Metal film: 68k ohms ±5% 50 VDCW 1/16W (Used in B).
R2004		Metal film: 100k ohms ±5% 50 VDCW 1/16W (Used in A).
R2004		Metal film: 56k ohms ±5% 50 VDCW 1/16W (Used in B).
R2005		Metal film: 10k ohms ±5% 50 VDCW 1/16W.
R2006		Metal film: 33k ohms ±5% 50 VDCW 1/16W.
R2008		Metal film: 330 ohms ±5% 50 VDCW 1/16W.
R2011		Metal film: 1M ohms ±5% 50 VDCW 1/16W.
R2012		Metal film: 100k ohms ±5% 100 VDCW 1/10W.
R2013		Metal film: Less than 50m ohms 1/16W.
R2101		Metal film: 5.6k ohms ±5% 100 VDCW 1/10W.
R2102		Metal film: 1.5k ohms ±5% 100 VDCW 1/10W.
R2103		Metal film: 220 ohms ±5% 100 VDCW 1/10W.
R2104		Metal film: 180 ohms ±5% 100 VDCW 1/10W.
R2105		Metal film: 33 ohms ±5% 100 VDCW 1/10W.
R2106		Metal film: 180 ohms ±5% 100 VDCW 1/10W.
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.
R2801		Metal film: 220 ohms ±5% 100 VDCW 1/10W.

SYMBOL	PART NO.	DESCRIPTION
R2802		Metal film: 56k ohms ±5% 100 VDCW 1/10W.
R2803		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R2804		Metal film: 56 ohms ±5% 100 VDCW 1/10W.
R2805		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R2810		Metal film: 10k ohms ±5% 100 VDCW 1/10W (Used in A).
R2810		Metal film: 15k ohms ±5% 100 VDCW 1/10W (Used in B).
R2811		Metal film: 15k ohms ±5% 100 VDCW 1/10W (Used in A).
R2811		Metal film: 22k ohms ±5% 100 VDCW 1/10W (Used in B).
R2812		Metal film: 22k ohms ±5% 100 VDCW 1/10W (Used in A).
R2812		Metal film: 33k ohms ±5% 100 VDCW 1/10W (Used in B).
R2813		Metal film: 33k ohms ±5% 100 VDCW 1/10W (Used in A).
R2813		Metal film: 39k ohms ±5% 100 VDCW 1/10W (Used in B).
R2814		Metal film: 4.7k ohms ±5% 100 VDCW 1/10W.
R2815		Metal film: 5.6k ohms ±5% 100 VDCW 1/10W.
RV201		Variable: 20k ohms ±25% 1/10W.
		---------TERMINAL---------
TP202		Test terminal.
		------TRANSISTORS-------
TR201 and TR202		Silicon, PNP; sim to NEC 2SB624.
TR203		Silicon, NPN; sim to PANASONIC XP1211.
TR230		Silicon, NPN; sim to NEC 2SD596.
TR240		N-channel, field effect.(Junction Singe Gate);sim to NEC 2SK520.
TR241		Silicon, NPN; sim to NEC 2SC3356.
TR242		Silicon, NPN; sim to PANASONIC UN5216.
TR280		N-channel, field effect.(Junction Singe Gate);sim to NEC 2SK520.
TR281		Silicon, NPN; sim to NEC 2SC3356.
TR282		Silicon, NPN; sim to PANASONIC XP1216.
TR283		Silicon, NPN; sim to NEC 2SC3356.
TR2101		Silicon, NPN; sim to NEC 2SC2223.
TR2301 thru TR2303		Silicon, NPN; sim to PANASONIC XP1216.
		----------CRYSTAL----------
XU201		Reference Oscillator unit: 12.8 MHz 5 PPM.
E201		H-7EZLD0001.

RECEIVER SECTION
CMN-350A/B

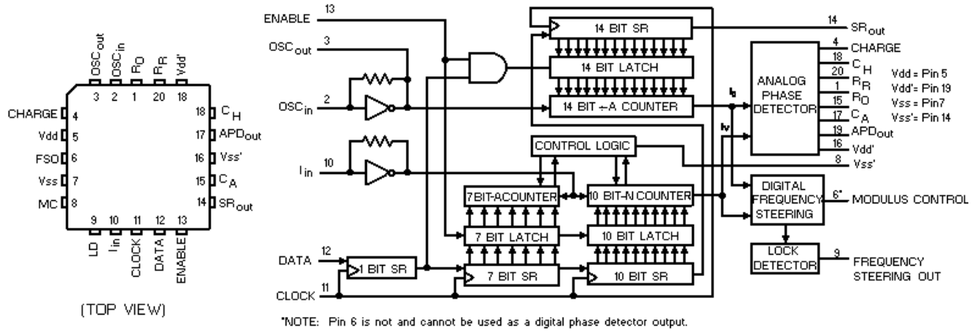
SYMBOL	PART NO.	DESCRIPTION
		---------CAPACITORS-----
C401	NOTE: Parts	Ceramic: 120 pF ±5% 50 VDCW temp coef 0 ±60 PPM .
C403	listed are for	Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C405	reference only.	Ceramic: 68 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C407	Refer to	Ceramic: 10 pF 0.5 pF 50 VDCW temp coef 0 ±60 PPM.
C409	Service Section for serviceable	Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in A).
C409	parts.	Ceramic: 150 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in B).
C410		Ceramic: 47 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in A).
C410		Ceramic: 22 pF ±5% 50 VDCW temp coef 0 ±60 PPM(Used in B).
C411		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM(Used in A).
C411		Ceramic: 68 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in B).
C412		Ceramic: 5 pF 0.25 pF 50 VDCW temp coef 0 ±60 PPM(Used in A).
C412		Ceramic: 22 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in B).
C413		Ceramic: 27 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in A).
C413		Ceramic: 33 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in B).
C414		Ceramic: 3 pF 0.25 pF 50 VDCW temp coef 0 ±60 PPM(Used in A).

SYMBOL	PART NO.	DESCRIPTION
C415		Ceramic: 56 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in A).
C415		Ceramic: 68 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C416		Ceramic: 2 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 ±60 PPM.(Used in B).
C420 and C421		Ceramic: 0.01µF 10% 50 VDCW temp coef 0±15%.
C423		Ceramic: 150 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C425		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C427		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C429		Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C430		Ceramic: 27 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C431		Ceramic: 68 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C433		Ceramic: 470 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C435		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C440		Ceramic: 150 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in A).
C440		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C441		Ceramic: 39 pF ±5% 50 VDCW temp coef 0±60 PPM. (Used in A)
C441		Ceramic: 33 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C443 and C444		Ceramic: 0.01µF ±10% 50 VDCW temp coef 0±15%.
C445		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in A)
C445		Ceramic: 68 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C447 and C448		Ceramic: 0.01µF ±10% 50 VDCW temp coef0 0±15%.
C453		Ceramic: 120 pF ±5% 50 VDCW temp coef 0±60 PPM. (Used in A).
C453		Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C455		Ceramic: 390 pF ±5% 50 VDCW temp coef 0 ±60 PPM
C456		Ceramic: 330 pF ±5% 50 VDCW temp coef 0±60 PPM. (Used in A).
C456		Ceramic: 390 pF ±5% 50 VDCW temp coef 0±60 PPM. (Used in B).
C457		Ceramic: 220 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C458		Ceramic: 180 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C459 and C460		Ceramic: 0.01µF 10% 50 VDCW temp coef 0±15%.
C461		Ceramic: 560 pF ±5% 50 VDCW temp coef 0 ±60 PPM.(Used in A).
C461		Ceramic: 470 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C462		Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C463 and C464		Ceramic: 0.01µF 10% 50 VDCW temp coef 0±15%.
C469		Ceramic: 120 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in A).
C469		Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C470		Ceramic: 39 pF ±5% 50 VDCW temp coef 0±60 PPM. (Used in A).
C470		Ceramic: 33 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C472		Ceramic: 0.01µF ±10% 50 VDCW temp coef 0±15%.
C473		Ceramic: 0.01µF ±10% 50 VDCW temp coef 0±15%.
C474		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in A).
C474		Ceramic: 68 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C476 and C477		Ceramic: 0.01µF ±10% 50 VDCW temp coef0 ±15%.
C482		Ceramic: 150 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in A).
C482		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C485		Ceramic: 220 pF ±5% 50 VDCW temp coef 0±60 PPM.
C486		Ceramic: 22 pF ±5% 50 VDCW temp coef 0 ±60 PPM.

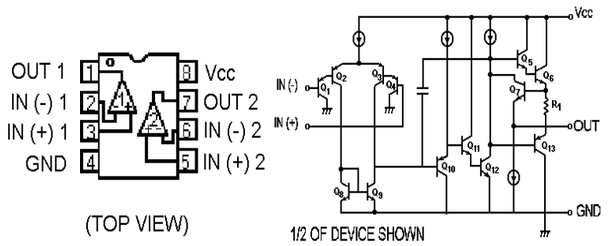
SYMBOL	PART NO.	DESCRIPTION
C487		Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in B).
C490 thru C493		Ceramic: 0.01µF ±10%. 50 VDCW temp coef 0±15%.
C496 and C497		Ceramic: 0.01µF ±10%. 50 VDCW temp coef 0±15% (Used in A).
C4001 and C4003		Ceramic: 0.01µF ±10%. 50 VDCW temp coef 0±15%.
C4004 thru C4007		Ceramic: 0.01µF ±10%. 50 VDCW temp coef 0±15%.
C4008		Ceramic: 10 pF 0.5 pF 50 VDCW temp coef 0 ±60 PPM.
C4009 and C4010		Ceramic: 0.01µF ±10%. 50 VDCW temp coef 0±15%.
C4011		Ceramic: 56 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in A).
C4011		Ceramic: 47 pF ±5% 50 VDCW temp coef 0 ±60 PPM. (Used in B).
C4013		Ceramic: 27 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C4014		Ceramic: 56 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in A).
C4014		Ceramic: 47 pF ±5% 50 VDCW temp coef 0 ±60 PPM (Used in B).
C4020		Ceramic: 0.01µF ±10%. 50 VDCW temp coef 0±15%.
C4021 and C4022		Ceramic: 0.1µF ±10% 25 VDCW temp coef 0±15%.
C4023		Tantalum: 22 µF ±20% 16 VDCW.
C4024		Tantalum: 22 µF ±20% 16 VDCW.
C4025		Ceramic: 56 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C4026		Ceramic: 68 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C4027		Ceramic: 100 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C4032		Ceramic: 0.01µF ±10% 50 VDCW temp coef 0±15%.
C4034		Ceramic: 82 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
C4036		Ceramic: 22 pF ±5% 50 VDCW temp coef 0 ±60 PPM.
		----------DIODES----------
CD441		Silicon fast recovery ; sim to HITACHI HSU277.
CD442		Silicon fast recovery ; sim to HITACHI HSU277.
CD444		Silicon fast recovery ; sim to HITACHI HSU277.
CD445		Silicon fast recovery ; sim to HITACHI HSU277.
CD447		Silicon fast recovery ; sim to HITACHI HSU277.
CD448		Silicon fast recovery ; sim to HITACHI HSU277.
		--------VARIABLE CAPACITORS--------
CV441		Variable: 30 pF max.
CV442		Variable: 30 pF max.
		----------FILTER----------
FL481		EMI Filter: 1000 pF.
		-------HYBRID CIRCUITS-------
HC441		Double Balanced Mixer.
		-------INTEGRATED CIRCUITS -------
IC481		Linear: Positive Voltage Regulator; sim to PANASONIC AN6541.
		-------CONNECTORS------
J501		Connector: 30 pins.
		----------COILS----------
L401		Coil: RF 0.56 µH.
L402		Coil: RF (Used in A).
L402		Coil: RF (Used in B).
L403		Coil: RF (Used in A).
L403		Coil: RF (Used in B).
L404		Coil: RF.
L405		Coil: RF 0.68µH.
L406		Coil: RF 0.47µH.
L407		Coil: RF 0.33µH.
L408		Coil: RF (Used in A).
L408		Coil: RF (Used in B).
L410		Coil: RF.
L411		Coil: RF.
L412		Coil: RF 84 nH ±5%.
L413		Coil: RF 10µH.
L414		Coil: RF 0.39µH ±10%.
L415		Coil: RF 74 nH ±10%.

SYMBOL	PART NO.	DESCRIPTION
L416		Coil: RF 120 nH ±10%.
L419		Coil: RF 4.7µH ±10%.
		------CONNECTORS------
P401		Connector: 20 Pins.
		--------RESISTORS --------
R401		Metal film: 1.8K ohms ±5% 50 VDCW 1/16W.
R402		Metal film: 4.7K ohms ±5% 50 VDCW 1/16W.
R403		Metal film: 5.6 ohms ±5% 50 VDCW 1/16W.
R404		Metal film: 470 ohms ±5% 50 VDCW 1/16W.
R405		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R407		Metal film: 0 ohms.
R420		Metal film: 2.2K ohms ±5% 50 VDCW 1/16W.(Used in A).
R420		Metal film: 10K ohms ±5% 50 VDCW 1/16W. (Used in B).
R421		Metal film: 2.2K ohms ±5% 50 VDCW 1/16W.(Used in A).
R421		Metal film: 10K ohms ±5% 50 VDCW 1/16W. (Used in B).
R423		Metal film: 2.2K ohms ±5% 100 VDCW 1/16W.
R424		Metal film: 2.2K ohms ±5% 50 VDCW 1/16W.
R426		Metal film: 2.2K ohms ±5% 50 VDCW 1/16W.(Used in A).
R426		Metal film: 10K ohms ±5% 50 VDCW 1/16W. (Used in B).
R427		Metal film: 2.2K ohms ±5% 50 VDCW 1/16W.(Used in A).
R427		Metal film: 10K ohms ±5% 50 VDCW 1/16W. (Used in B).
R429		Metal film: 180 ohms ±5% 50 VDCW 1/16W.
R430		Metal film: 33 ohms ±5% 50 VDCW 1/16W.
R431		Metal film: 180 ohms ±5% 50 VDCW 1/16W.
R433		Metal film: 0 ohms.
R440		Metal film: 100K ohms ±5% 50 VDCW 1/16W.
R441		Metal film: 10K ohms ±5% 50 VDCW 1/16W.
R442		Metal film: 100K ohms ±5% 50 VDCW 1/16W.
R443		Metal film: 10K ohms ±5% 50 VDCW 1/16W.
R444		Metal film: 100K ohms ±5% 50 VDCW 1/16W.
R445		Metal film: 100K ohms ±5% 50 VDCW 1/16W.
R446		Metal film: 10K ohms ±5% 50 VDCW 1/16W.
R447		Metal film: 100K ohms ±5% 50 VDCW 1/16W.
R448		Metal film: 10K ohms ±5% 50 VDCW 1/16W.
R449		Metal film: 100K ohms ±5% 50 VDCW 1/16W.
R460		Metal film: 470 ohms ±5% 50 VDCW 1/16W.
R461		Metal film: 10 ohms ±5% 50 VDCW 1/16W.
R462		Metal film: 470 ohms ±5% 50 VDCW 1/16W.
R463		Metal film: 1.0K ohms ±5% 50 VDCW 1/16W.
R464		Metal film: 5.6K ohms ±5% 50 VDCW 1/16W.
R465		Metal film: 10 ohms ±5% 50 VDCW 1/16W.
R466		Metal film: 470 ohms ±5% 50 VDCW 1/16W.
R467		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R468		Metal film: 180 ohms ±5% 50 VDCW 1/16W.
R469		Metal film: 680 ohms ±5% 50 VDCW 1/16W.
R470		Metal film: 1.0K ohms ±5% 50 VDCW 1/16W.
R471		Metal film: 5.6K ohms ±5% 50 VDCW 1/16W.
R472		Metal film: 10 ohms ±5% 50 VDCW 1/16W.
R473		Metal film: 470 ohms ±5% 50 VDCW 1/16W.
R474		Metal film: 100 ohms ±5% 100 VDCW 1/10W.
R475		Metal film: 270 ohms ±5% 100 VDCW 1/10W.
R476		Metal film: 18 ohms ±5% 100 VDCW 1/10W.
R477		Metal film: 270 ohms ±5% 100 VDCW 1/10W.
R490		Metal film: 0 ohms.(Used in A).
R490		Metal film: 680 ohms ±5% 50 VDCW 1/16W.(Used in B).
		-------TRANSISTORS-----
TR401		Silicon, NPN; sim to NEC 2SC3357.
TR431 and TR432		Silicon, NPN; sim to PANASONIC XN6401.
TR461 and TR462		Silicon, NPN; sim to NEC 2SC3357.

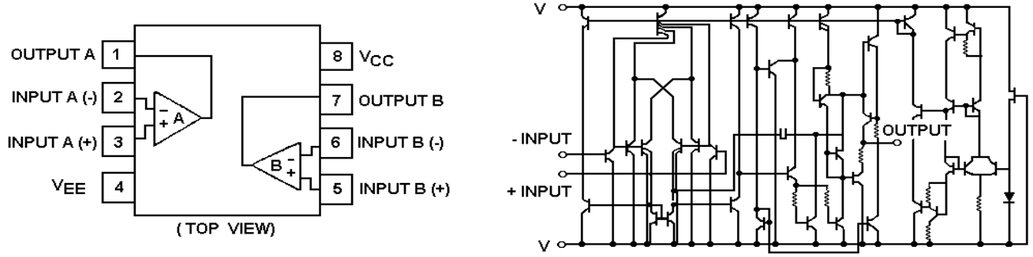
Synthesizer IC201
(MC145159FN)



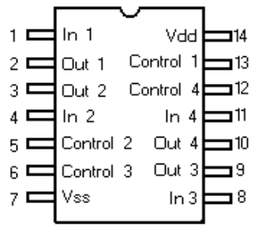
Dual Operational Amplifier IC202
(M5223FP)

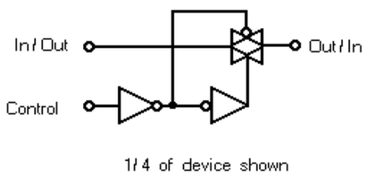


Dual Operational Amplifier IC203
(NJM3404AM)



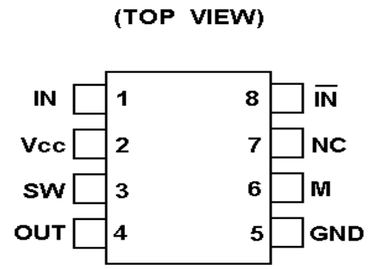
Bilateral Switch IC204, IC209, IC211
(MC14066BF)

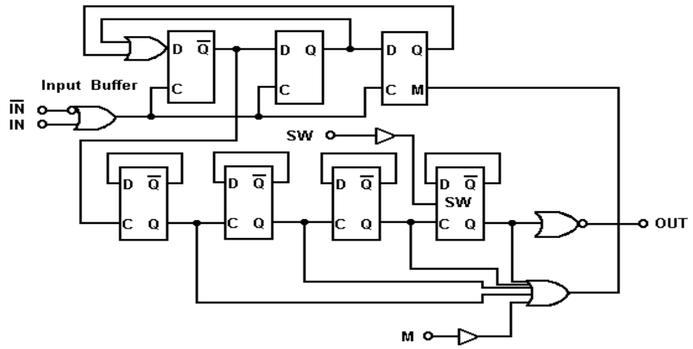




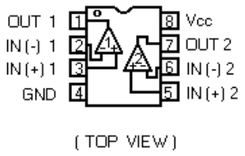
Control	Switch
0 = Vss	OFF
1 = Vdd	ON

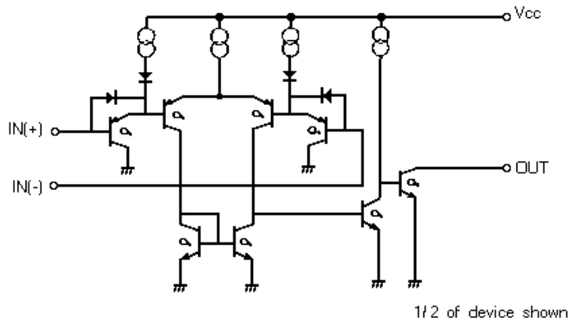
Prescaler IC205
(MB505PF)



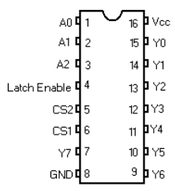


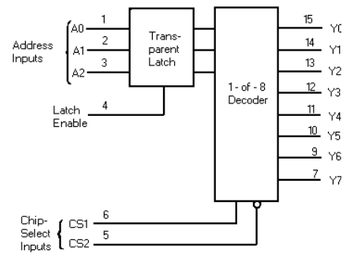
Dual Comparator IC207
(M5233FP)



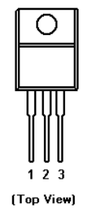


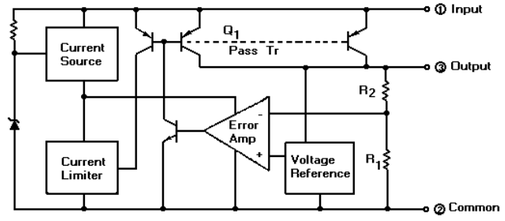
Digital Decoder IC208, IC210
(MC74HC237F)





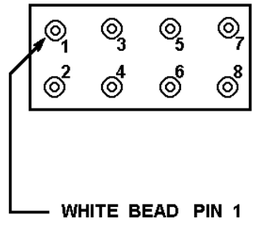
Positive Voltage Regulator IC230, IC481
(AN6541)



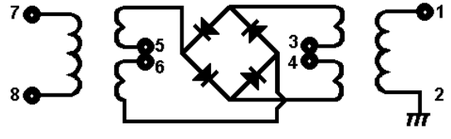


Double Balanced Mixer HC441

PINOUT



CIRCUIT DIAGRAM



RECEIVER

SYMBOL	CMN-350A-1 A (29-42 MHz)	CMN-350-1 B (35-50 MHz)
C409	100 pF	150 pF
C410	47 pF	220 pF
C411	82 pF	68 pF
C412	5 pF	22 pF
C413	27 pF	33 pF
C414	3 pF	0 pF
C415	56 pF	68 pF
C416	2 pF	3 pF
C440	150 pF	82 pF
C441	39 pF	33 pF
C445	82 pF	68 pF
C453	120 pF	100 pF
C456	330 pF	390 pF
C458	0 pF	180 pF
C461	560 pF	470 pF
C462	0 pF	100 pF
C469	120 pF	100 pF

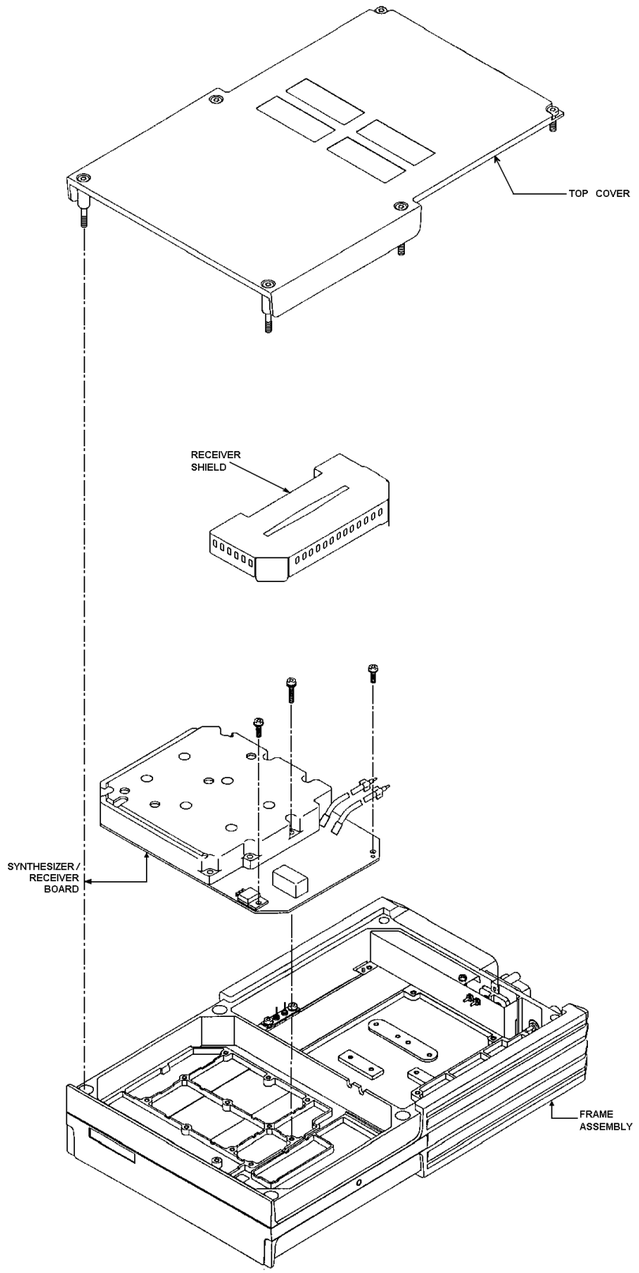
SYMBOL	CMN-350A-1 A (29-42 MHz)	CMN-350-1 B (35-50 MHz)
C470	39 pF	33 pF
C474	82 pF	68 pF
C482	150 pF	82 pF
C4011	56 pF	47 pF
C4014	56 pF	47 pF
L402	H-6LALD24256	H-6LALD24206
L403	H-6LALD24258	H-6LALD24308
L408	H-6LALD24306	H-6LALD24305
L409	H-6LALD24306	H-6LALD24305
L412	84 nH	64 nH
R420 ~ R421	2.2 k Ohms	10 k Ohms
R426 ~ R427	2.2 k Ohms	10 k Ohms
R429	180 Ohms	180 Ohms
R430	33 Ohms	33 Ohms
R431	180 Ohms	180 Ohms
R490	0 Ohms	680 Ohms

SYNTHESIZER

SYMBOL	A (29-42 MHz)	B (35-50 MHz)
C241	180 pF (UJ)	120 pF
C256	18 pF	18 pF
C257	33 pF	27 pF
C258	18 pF	18 pF
C260	18 pF	22 pF
C261	33 pF	33 pF
C262	4 pF	-
C266	39 pF	33 pF
C267	39 pF	39 pF
C268	4 pF	-
C272	39 pF	39 pF
C273	120 pF	47 pF
C274	4 pF	-
C277	5 pF	-
C278	5 pF	-
C279	5 pF	-
C281	6 pF	4 pF
C285	150 pF	82 pF
C288	330 pF	82 pF
C295	10 pF	5 pF
C2100	39 pF	33 pF
C2101	68 pF	47 pF
C2102	39 pF	33 pF
C2104	39 pF	33 pF
C2105	47 pF	39 pF
C2106	10 pF	2 pF
C2107	12 pF	3 pF
C2108	0.01 µF	1000 pF
C2109	0.01 µF	1000 pF
C2111	120 pF	47 pF
C2112	150 pF	100 pF
C2113	10 pF	2 pF
C2114	12 pF	3 pF
C2115	0.01 µF	1000 pF
C2116	0.01 µF	1000 pF

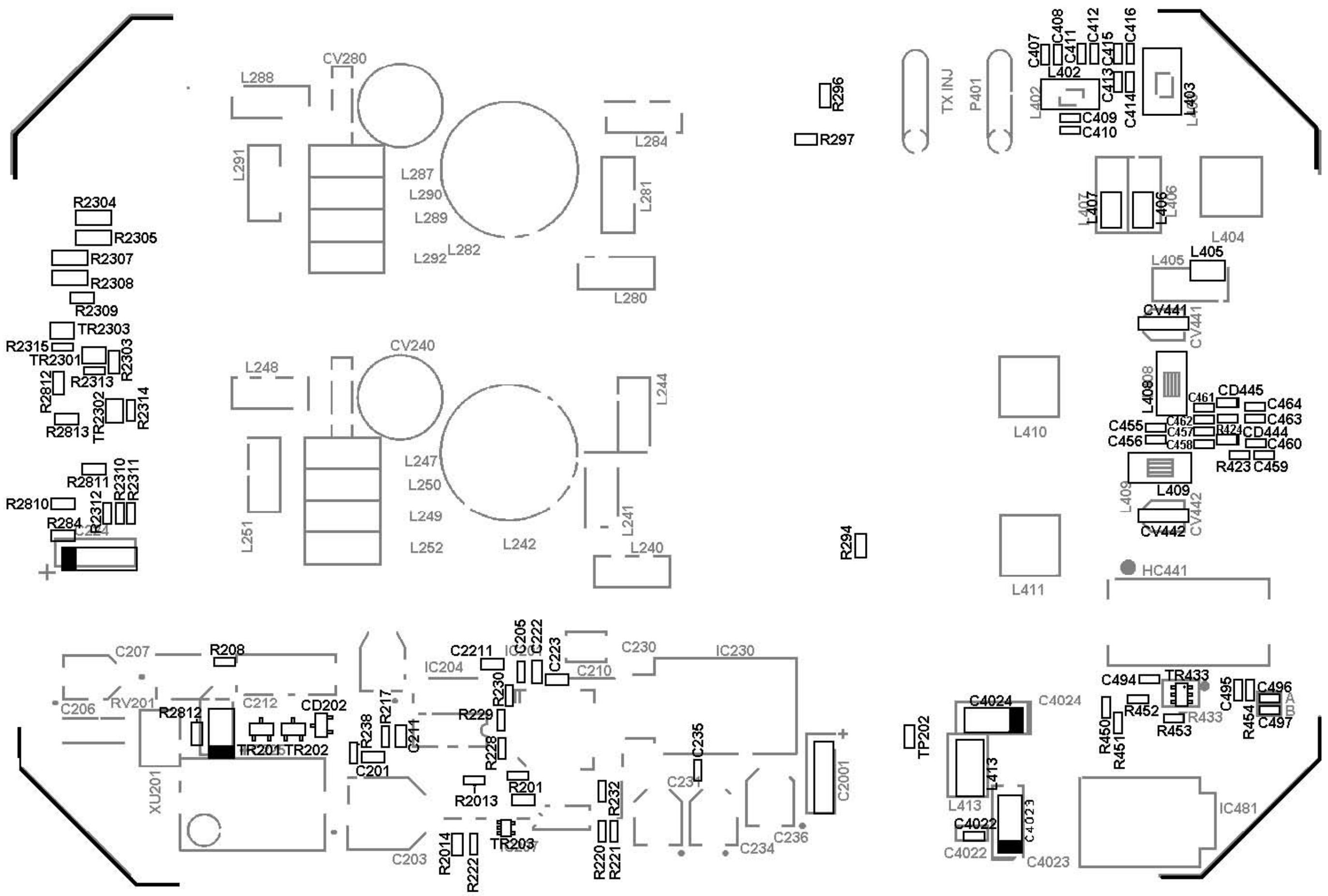
SYMBOL	A (29-42 MHz)	B (35-50 MHz)
C2118	470 pF	100 pF
C2119	560 pF	150 pF
C2120	10 pF	2 pF
C2121	12 pF	3 pF
C2122	0.01 µF	1000 pF
C2123	0.01 µF	1000 pF
C2807	82 pF	56 pF
L242	JR-NB-14063	JR-NB-14064
L246	68 nH	56 nH
L282	JR-NB-14061	JR-NB-14062
L286	100 nH	100 nH
L287	15 µH	10 µH
L288	15 µH	10 µH
L289	15 µH	10 µH
L290	15 µH	10 µH
L291	15 µH	10 µH
L292	15 µH	10 µH
R229	390 k Ohms	180 k Ohms
R230	470 k Ohms	560 k Ohms
R291	100 Ohms	100 Ohms
R292	68 Ohms	56 Ohms
R293	100 k Ohms	100 Ohms
R2002	68 k Ohms	56 k Ohms
R2003	100 k Ohms	68 k Ohms
R2004	100 k Ohms	56 k Ohms
R2005	10 k Ohms	10 k Ohms
R2006	33 k Ohms	33 k Ohms
R2810	10 k Ohms	15 k Ohms
R2811	15 k Ohms	22 k Ohms
R2812	22 k Ohms	33 k Ohms
R2813	33 k Ohms	39 k Ohms

(DD02-CMN-350-1 2/2)

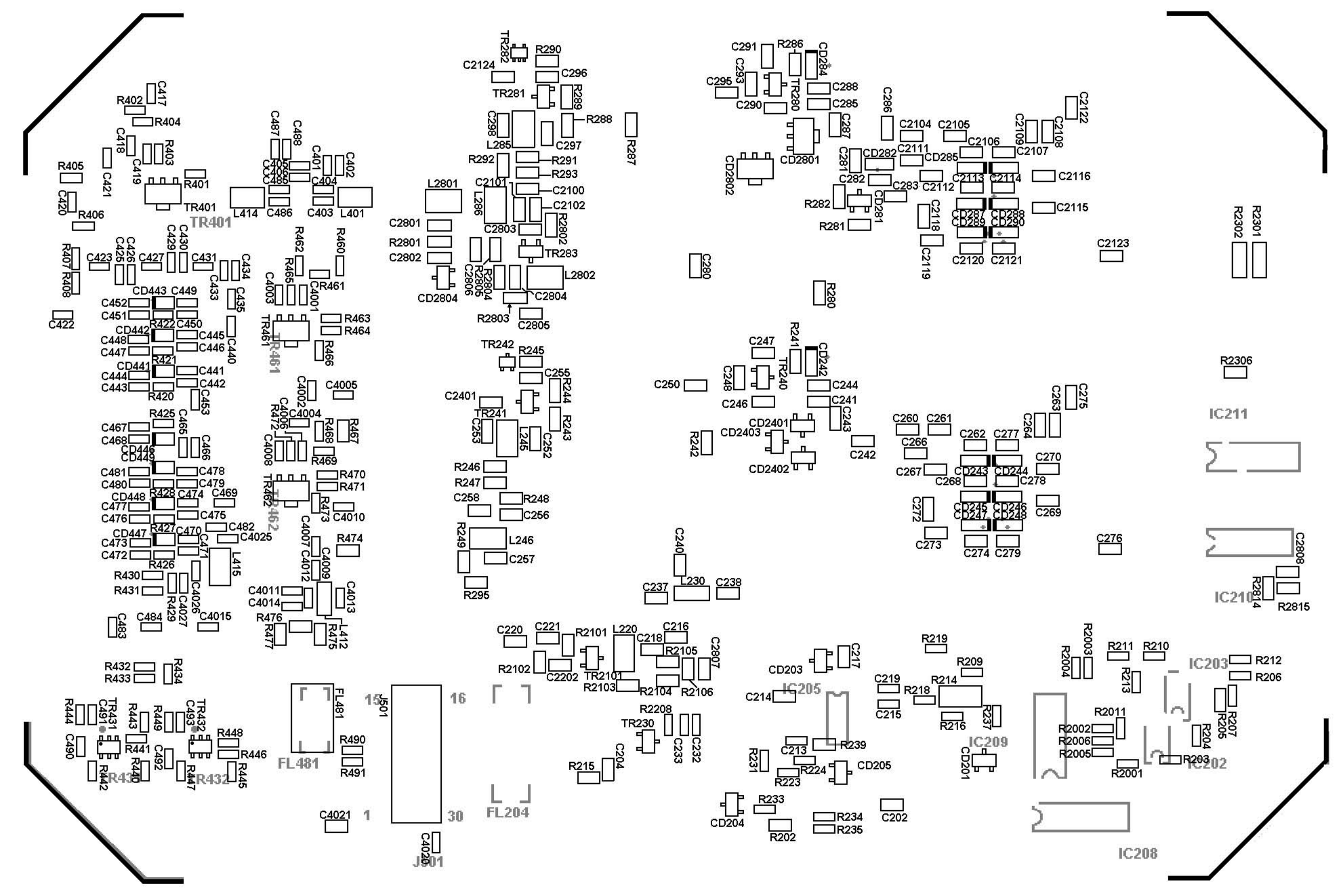


ORION LOW BAND
Synthesizer/Receiver

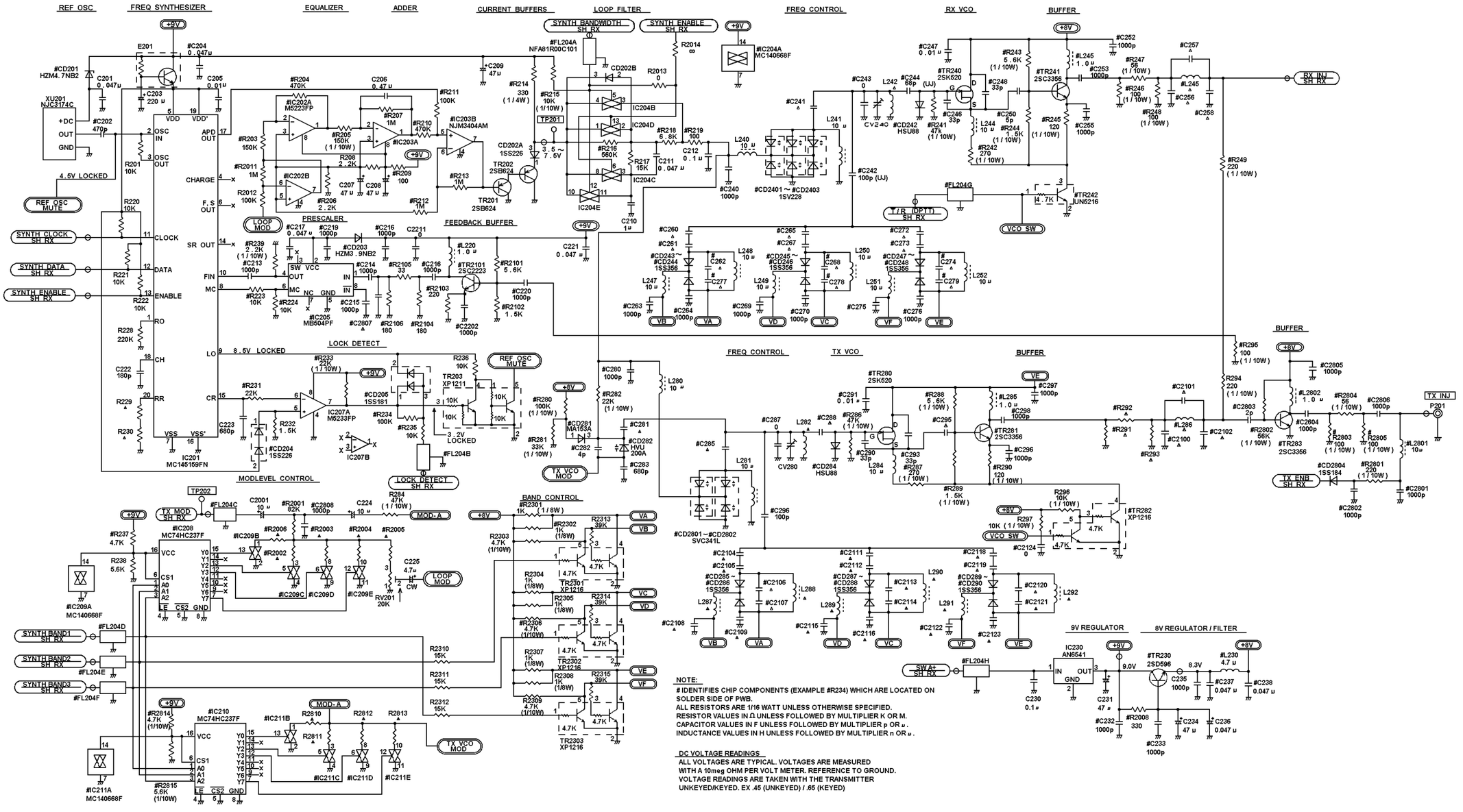
COMPONENT SIDE



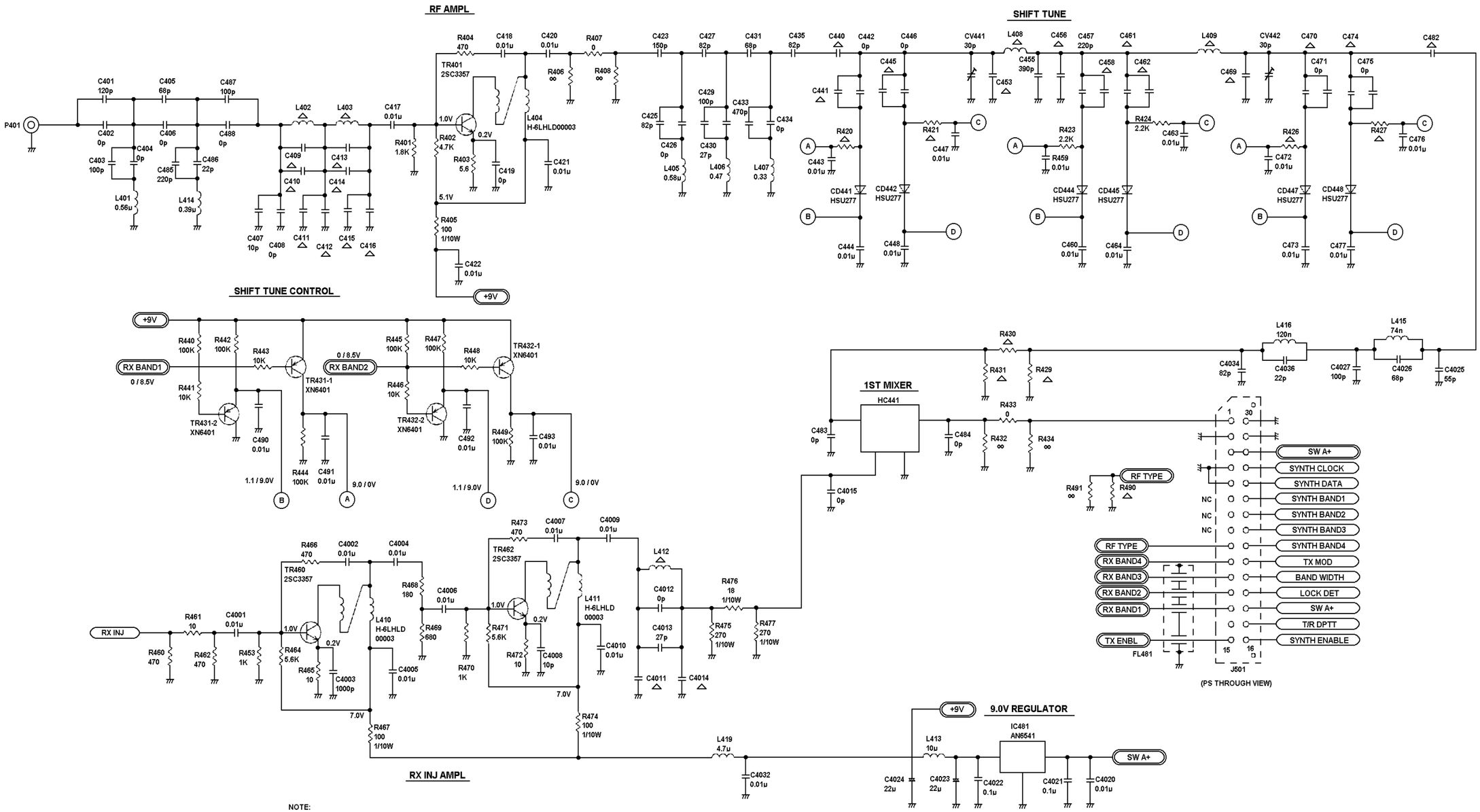
SOLDER SIDE



ORION LOW BAND
Synthesizer/Receiver
(6PCLD00290D)



ORION LOW BAND
Synthesizer
(DD02-CMN-350-2 1/2)



NOTE:
ALL RESISTORS ARE 1/16 WATT UNLESS OTHERWISE SPECIFIED.
RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER u OR p.
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER u OR n.

ORION LOW BAND
Receiver
(DD01-CMN-350-1 1/2)