LBI-38910A

MAINTENANCE MANUAL ORION™ 136-174 MHz SYNTHESIZER/RECEIVER/EXCITER BOARD B19/CMN-352 A/B

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DESCRIPTION

The ORION[™] 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 two ranges. Range A (or Part 1) is 136-153 MHz, and range B (or Part 2) is 150-174 MHz. Receiver injection frequencies are also generated by the synthesizer of 181.1-219.1 MHz.

The receive circuit is an FM dual-conversion, superheterodyne receiver designed for operation in the 136-174 MHz frequency range. Regulated 9 Volts is supplied 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. Adjcent channel selectivity is obtained by two band-pass filters, an 82.2 MHz crystal filter, and a 455 kHz ceramic filter.

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

- Front End Mixer
- 45.1 MHz 1st IF, 455 kHz 2nd IF and FM Detector
- Audio Signal Processor (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-38906).

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The exciter circuit consists of two wide-band amplifier stages operating over a frequency range of 136-174 MHz without any tuning. The Exciter circuit amplifies a 1 milliwatt signal generated by a Voltage Controlled Oscillator (VCO) in the synthesizer circuit to a 400 milliwatt drive input to the power amplifier.

CIRCUIT ANALYSIS

FREQUENCY SYNTHESIZER

The frequency synthesizer receives SYNTH CLOCK, SYNTH DATA, and control information from the microcomputer and from this generates the transmit and receive 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 Voltage Controlled Oscillators (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 136 MHz to 174 MHz. The Rx VCO operates over the range of 181.1 to 219.1 MHz.

Reference Oscillator

The reference oscillator consists of a 2-PPM Temperature Compensated Xrystal Oscillator (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 a hole in the top of the housing. The TXCO is compensated by an internal temperature compensating circuit for both low and high temperatures. With no additional compensation the oscillators 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 from the reference ocillator, 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 \pm error voltage when the phases differ and a constant output voltage when the frequency detector inputs compare in frequency and phase.

If a phase error is detected an error voltage is developed and applied to the VCO DC offset buffer, high current buffers, and loop-filter to adjust the VCO frequency. The count of the \div N, \div 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-locked-loop 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 C206. 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 Phase-Lock-Loop (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, diode CD202-A 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, B, C, and D are turned on for 4 milliseconds. When changing from receive to transmit, bilateral switches IC204-C, E, D, and B, are turned on for 10 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 pulse. When the SYNTH BANDWIDTH pulse is present, the bilateral switch shorts out the low-pass filter, 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 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 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 (TR 242 is ON). Oscillator output is typically 0 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 Rx VCO uses a high-Q coil to achieve superior noise performance. The VCO operates over a frequency range of 181.1 - 219.1 MHz. The VCO voltage need only be set once at the highest frequency of the band split, after which it operates over the entire split with no additional tuning.

Transmitter Voltage Controlled Oscillator

The transmit VCO is basically the same as the receiver VCO. The wideband VCO allows frequency separation of 17 MHz, or 24 MHz as determined by the bandsplit the radio is operating on, 136-153 MHz, or 150-174 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 T/R line is low.

Feed Back Buffer

The buffered output of the Rx VCO and Tx VCO, from buffer transistors TR241 and TR281 respectively, are supplied to feedback buffer IC206. This, in turn, drives dual modulus prescaler IC205. The buffered VCO output also provides Rx or Tx injection drive.

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 (C_R) of the synthesizer increases voltage on the LD line from the synthesizer. Thus, transistor TR203 disables the reference oscillator and allows the PLL loop to be brought back to synchronization rapidly.

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Dual Modulus Prescaler

The dual modulus prescaler completes the PLL feedback path from the synthesizer to the loop-filter, to the VCO's and feedback buffers and then back to the synthesizer through the prescaler. The prescaler divides the VCO frequency by 64 or 65 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

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

Loop Mod Adjust

The Loop Mod Adjust circuit automatically sets the loop modulation level applied to equalizer circuit IC202 and IC203 through Loop Mod Adjuster RV201. The loop Mod Adjust modulation circuit consists of decoder IC208, bilateral switch IC209, resistors R2001 through R2006 and RV201. The loop modulation level is controlled by turning bilateral switches IC209 On or Off (under control of IC208) to include attenuators R2001 through R2006 in the circuit. Resistors R2001 through 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.

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 CD285 through CD290. Capacitors C260, C261, C266, C267, C272, C273, C2104-C2107 and C2111-C2114, C2118-C2120 and 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 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 transistors TR2302 and TR2303 are turned on. In the Tx VCO diodes CD287, CD288, CD289 and CD290 are reverse biased and CD285 and CD286 are turned on. Capacitors C211 and C2112, C2118 and C2119 are effectively isolated from ground and C2104 and C2105 are connected to ground through CD285 and CD286.

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

Operation of the radio over the frequency ranges 136-153 MHz or 150-174 MHz is determined by the group number of the synthesizer board. Each frequency split is divided into four operating segments varying from 4 to 6.5 MHz wide.

RECEIVER

Receiver Front End

An RF signal from the antenna is coupled through a lowpass filter, antenna relay, high-pass filter and switchable impedance matching network to the input of RF amplifier (RF AMP) transistor TR401 (Refer to Figure 2). The RF amplifier TR401 is gain switched through a switchable attenuator (about 18 dB / 14 db) by diode CD403.

The output of TR401 is coupled through a low-pass filter and a band-pass filter to the input of 1st mixer HC441. Front end selectivity is provided by this band-pass filter.

Receiver Injection

Receiver RF injection (181.1-219.1 MHz) from the synthesizer Voltage Controlled Oscillator (VCO) is applied to the base of receiver injection amplifier (Rx INJ AMP) transistor TR461. The input level of TR461 is between 1.0 and 2.0 milliwatts. The output of TR461 is coupled to the input of receiver injection amplifier (Rx INF AMP) transistor TR462. The output of amplifier TR462 is filtered by a lowpass filter consisting of capacitors C475, C476, C477 and inductor L465. This filter is tuned to pass frequencies in the 181.1-219.1 MHz pass band.

<u>1st Mixer</u>

The first mixer is a double-balanced diode mixer (HC441) that converts a signal in the 136-174 MHz frequency range to the 45.1 MHz first IF frequency. 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 45.1 MHz first Intermediate Frequency (IF). The circuit analysis for the receiver is continued in maintenance manual LBI-38907 for SYSTEMCONTROL/IF/AUDIO FREQUENCY **BOARD CMF-138W.**

Exciter Circuit

The 136-174 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 C153 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 R153, R152 and diode CD151 set the bias voltage for TR151.

Collector voltage (+9 Volts) for TR151 is applied through the collector feed network resistor R154 and inductor L155. 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 C160 and C161.

Table 1 - Frequency Segment Selection

	Segment	Frequency Split (MHz)	SYNTH Band 1 (INPUT TR2303)	SYNTH Band 2 (INPUT TR2301)	SYNTH Band 3 (INPUT TR2302)	Grounded Modulation Resistor
136-153 MHz	1	136-140	1	1	1	R2004
	2	140-144	0	1	1	R2003
	3	144-148	0	1	0	R2002
	4	148-153	0	0	0	R2006
150-174 MHz	1	150-155.5	1	1	1	R2004
	2	155.5-161.5	0	1	1	R2003
	3	161.5-167.5	0	1	0	R2002
	4	167.5-174	0	0	0	R2006

Table 2 - Capacitor Selection

Segment	Transistor Switch				Band Switching Diodes					Grounded
	TR2301	TR2302	TR2303	CD243 CD244	CD245 CD246	CD247 CD248	CD285 CD286	CD287 CD288	CD289 CD290	Capachors
1	0	0	0	ON	ON	ON	ON	ON	ON	ALL
2	0	0	1	ON	ON	OFF	ON	ON	OFF	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

NOTE: 1 - Transistor turned ON, 0 - Transistor turned OFF



Figure 1 - Synthesizer Block Diagram

Figure 2 - Receiver Block Diagram

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Resistor R155 provides negative feedback through capacitor C157 and C168 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

IC DATA

RF WIDE BAND AMPLIFIER IC151

SYNTHESIZER IC201

POSITIVE VOLTAGE REGULATOR IC152



DUAL OPERATIONAL AMPLIFIER IC202

DUAL OPERATIONAL AMPLIFIER IC203

PRESCALER IC205



1/2 of device shown









6

BILATERAL SWITCH IC204, IC209

Vdd **b**14

Control

Control

Control 3 Out 3

Control 2

b 13

b 12

In 4 🗖 11

Out 4 🗖 10

In/Out 👁

Control 💁

RF WIDE BAND AMPLIFIER IC206

0

IC DATA

Y

É

• + Vcc

• OUT

DUAL COMPARATOR IC207

OUT 1 1 IN(-) 1 1 IN(+) 1 1

GND 4



GND

Å

POSITIVE VOLTAGE REGULATOR IC230

DECODER IC208

POSITIVE VOLTAGE REGULATOR IC481



o Out∤In

174 of device shown



5 IN (+) 2

INf+



2 🗖

3 🗖

4 🗖

5 🗖

6 🗖





SYNTHESIZER BOARD SYNTHESIZER SECTION CMN-352A2W (Used in 344A4577P1) CMN-352B2W (Used in 344A4577P2)

C275 and C276 C280 C281 C282 C282 C283 C284 C285 C286 C287 C288 C288 C289 C290 C291 and C292 C293 C293 C294 C295 C296 thru C298 C2001 C2100 C2101 C2102 C2104 C2104 C2105 C2105

SYMBOL	EGE PART NO.	DESCRIPTION
C201	NOTE: Parts listed	Ceramic: 0.047 μF ±10% 25 VDCW, temp coef ±15%.
C202	are for reference only. Refer to	Ceramic: 470 pF ±5% 50 VDCW, temp coef +350~-1000 PPM.
C203	Service Section	Electrolytic: 220 μF ±20% 10 VDCW.
C204	for serviceable parts.	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		Electrolytic: 47 µF ±20% 16 VDCW.
thru		
C209		
C210		Metallized Plastic: $1 \ \mu F \pm 10\%$.
C211		Ceramic: 0.047 µF ±10% 25 VDCW, temp coef ±15%.
C212		Polypropylene: 0.1 µF ±5% 50 VDCW.
C213		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
C214		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
C215		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
and C216		
C217		Ceramic: 0.047 uF ±10% 25 VDCW. temp coef ±15%
C218		Ceramic: 1000 pF ±10% 50 VDCW, temp coef +15%
thru		
C220		
C221		Ceramic: 0.047 μF ±10% 25 VDCW, temp coef ±15%.
C222		Ceramic: 150 pF \pm 5% 50 VDCW, temp coef 0 \pm 30 PPM.
C223		Ceramic: 680 pF $\pm 5\%$ 50 VDCW, temp coef +350~-1000 PPM.
C224		Tantalum: 10mF ±20% 10 VDCW.
C225		Tantalum: 4.7 µF ±20% 16 VDCW.
C230		Polyester: 0.1 µF ±5% 50 VDCW.
C231		Electrolytic: 47 µF ±20% 16 VDCW.
C232		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
and		
0233		
0234		Electrolytic: 47 μ F ±20% 16 VDCW.
C235		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coet \pm 15%.
C236		Electrolytic: 47 µF ±20% 16 VDCW.
C237		Ceramic: 0.047 μ F ±10% 25 VDCW, temp coef ±15%.
C238		
C240		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%,
C241		Ceramic: 18 pF ±5% 50 VDCW, temp coef -750120 PPM (I sed in A)
C241		Ceramic: 22 pF ±5% 50 VDCW, temp coef -750120 PPM
0040		
0242		
0243		Ceramic: 5 pr ±0.25 pr 50 vDCvv, temp coer 0±30 PPM .
0244		Ceramic: 27 pF ±5% 50 VDCW, temp coet -750120 PPM.
0246		Ceramic: 22 pF ±5% 50 VDCW, temp coet 0±30 PPM.
0247		Ceramic: 1000 pF ±10% 50 VDCW, temp coet ±15%.
0248		Ceramic: 22 pF ±5% 50 VDCW, temp coet 0±30 PPM.
0249		Ceramic: 1000 pF ±10% 50 VDCW, temp coef ±15%.
0250		Ceramic: 1 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.
C251 thru		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
C253		
C255		Ceramic: 1000 pF ±10% 50 VDCW. temp coef +15%
		Ceramic: 15 pF +5% 50 VDCW temp coef 0+30 PPM
C256		
C256 C257		(eramic: 8 nE () 5nE 5() V()('W/ temp coet ()+3() PDW
C256 C257 C258		Ceramic: 8 pF 0.5pF 50 VDCW, temp coef 0±30 PPM.
C256 C257 C258		Ceramic: 8 pF 0.5pF 50 VDCW, temp coer 0 \pm 30 PPM. Ceramic: 15 pF \pm 5% 50 VDCW, temp coef 0 \pm 30 PPM.
C256 C257 C258 C260		Ceramic: 8 pF 0.5pF 50 VDCW, temp coel 0±30 PPM. Ceramic: 15 pF ±5% 50 VDCW, temp coel 0±30 PPM. Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coel 0±30 PPM.(Used in A).
C256 C257 C258 C260 C260		Ceramic: 8 pF 0.5pF 50 VDCW, temp coef 0 ± 30 PPM. Ceramic: 15 pF $\pm5\%$ 50 VDCW, temp coef 0 ± 30 PPM. Ceramic: 4 pF ±0.25 pF 50 VDCW, temp coef 0 ± 30 PPM.(Used in A). Ceramic: 6 pF 0.5 pF 50 VDCW, temp coef 0 ± 30 PPM.(Used in B).

SYMBOL	EGE PART NO.	DESCRIPTION	SYMBO
C263 and		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$	C2111
C264 C266		Ceramic: 6 pF 0.5 pF 50 VDCW, temp coef 0±30 PPM	C2112
C266		(Used in A). Ceramic: 7 pF 0.5 pF 50 VDCW temp coef 0±30 PPM (and C2114
C267		Used in B). Ceramic: 4 pF ± 0.25 pF 50 VDCW, temp coef 0 ± 30 PPM	C2115 and
C267		(Used in A). Ceramic: 8 pF 0.5pF 50 VDCW, temp coef 0±30 PPM	C2116 C2118
C269		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.	C2118
C270			C2119
C272		Ceramic: 6 pF 0.5 pF 50 VDCW, temp coef 0 ± 30 PPM (Used in A).	C2120 and
C272		Ceramic: 8 pF 0.5pF 50 VDCW, temp coef 0 \pm 30 PPM (Used in B).	C2121
C273		Ceramic: 7 pF 0.5 pF 50 VDCW, temp coef 0 \pm 30 PPM (Used in A).	and C2123
C273		Ceramic: 12 pF \pm 5%. 50 VDCW, temp coef 0 \pm 30 PPM (Used in B).	C2201
C275		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%$.	02304
and C276			
C280		Ceramic: 1000 pE +10% 50 VDCW, temp coef +15%.	CD201
C281		Ceramic: 1 pE +0.25 pE 50 VDCW temp coef 0+30 PPM	CD202
C282		Ceramic: $4 \text{ pF} \pm 0.25 \text{ pF} 50 \text{ VDCW}$, temp coef $0\pm 30 \text{ PPM}$ (Used in A).	CD203
C282		Ceramic: 5 pF \pm 0.25 pF 50 VDCW, temp coef 0 \pm 30 PPM (Used in B)	CD204
C283		Ceramic: 220 pF ±5% 50 VDCW, temp coef 0±30 PPM.	CD205
C284		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%$.	CD241
C285		Ceramic: 33 pF \pm 5% 50 VDCW, temp coef -750120 PPM.	GD241
C286		Ceramic: 22 pF $\pm 5\%$ 50 VDCW, temp coef -750120 PPM .	CD242
C287		Ceramic: 2 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM.	CD243
C288		Ceramic: 82 pF \pm 5% 50 VDCW, temp coef 0 \pm 30 PPM (Used in A).	thru CD248
C288		Ceramic: 68 pF $\pm 5\%$ 50 VDCW, temp coef 0 ± 30 PPM (Used in B).	CD281
C289		Ceramic: 7 pF 0.5 pF 50 VDCW, temp coef 0 \pm 30 PPM (Used in B).	CD282
C290		Ceramic: 22 pF ±5% 50 VDCW, temp coef 0±30 PPM.	CD283
C291 and		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$	CD284
C292			CD285
0293		(Used in A).	CD290
C293		Ceramic: 18 pF \pm 5% 50 VDCW, temp coef 0 \pm 30 PPM (Used in B).	CV240 CV280
C294		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.	FL204
C295		Ceramic: 1 pF ± 0.25 pF 50 VDCW, temp coef 0 ± 30 PPM.	
C296 thru		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$	
0298			IC201
02001			
C2100		Ceramic: 18 pF ±5% 50 VDCW, temp coet 0±30 PPM.	IC202
C2101		Ceramic: 15 pF ±5% 50 VDCW, temp coet 0±30 PPM.	IC203
C2102 C2104		Ceramic: 18 pF ±5% 50 VDCW, temp coet 0±30 PPM. Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM	IC204
C2104		(Used In A). Ceramic: 8 pF 0.5 pF 50 VDCW, temp coef 0±30 PPM (Lead in P)	IC205 IC206
C2105		Ceramic: 12 pF 5 pF 50 VDCW, temp coef 0±30 PPM	IC207
C2105		Ceramic: 10 pF 0.5 pF 50 VDCW, temp coef 0±30 PPM (Leed in R)	IC208 IC209
C2106 and		Ceramic: 3 pF ±0.25 pF 50 VDCW, temp coef 0±30 PPM (Used in A).	IC230
C2107 C2108 and		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%$	
C2109			L201
C2111		Ceramic: 15 pF ±5% 50 VDCW, temp coef 0±30 PPM	L220

PARTS LIST

OL	EGE PART NO.	DESCRIPTION
		Ceramic: 12 pF ±5% 50 VDCW, temp coef 0±30 PPM (Used in B)
2		Ceramic: 15 pF ±5% 50 VDCW. temp coef 0±30 PPM.
3		Ceramic: 3 pF \pm 0.25 pF 50 VDCW, temp coef 0 \pm 30
		PPM (Used in A).
		Ceramic: 1000 pF ±10% 50 VDCW temp coef +15%
		(Used in A).
		Ceramic: 18 pF \pm 5% 50 VDCW, temp coef 0 \pm 30 PPM (Used in B).
		Ceramic: 27 pF \pm 5% 50 VDCW, temp coef 0 \pm 30 PPM.
		Ceramic: 3 pF ± 0.25 pF 50 VDCW, temp coef 0 ± 30 PPM (Used in A).
		Ceramic: 1000 pE +10% 50 VDCW/ temp coef +15%
		$\pm 10\%$ v DOW, temp to $\pm 10\%$.
		Ceramic: 15 pF \pm 5% 50 VDCW, temp coef 0 \pm 30 PPM. Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
		DIODES
		Zener: 4.0 V; sim to HITACHI HZM3.9NB2.
		Silicon: fast recovery (2 diodes in series); sim to
		TOSHIBA 1SS226.
		Zener: 3.0 V; sim to HI IACHI HZK3B.
		TOSHIBA 1SS226.
		Silicon: fast recovery(2 diodes with anode common); sim to TOSHIBA 1SS181.
		Silicon: Variable Capacitance Diode: sim to TOSHIBA ISV228.
		Silicon: (Schottky Barrier); sim to HITACHI HSU88.
		Silicon: Epitaxial Planer Diode: sim to ROHM 1SS318.
		Silicon: fast recovery (2 diodes in series); sim to PANA- SONIC MA153A.
		Silicon: Variable Capacitance Diode; sim to HITACHI HVU202.
		Silicon: Variable Capacitance Diode: sim to TOSHIBA ISV228.
L I		Silicon: (Schottky Barrier); sim to HITACHI HSU88.
		Silicon: Epitaxial Planer Diode: sim to ROHM 1SS318.
		Variable: 10 pF max.
		Variable: 10 pF max.
		EMI Filter:
		INTEGRATED CIRCUITS
		Synthesizer: CMOS serial input; sim to MOTOROLA
		MU145159FN. Linear: Dual OP AMP: sim to MITCUPICUI ME222ED
		Linear: Dual OF AIVIF, SIII (0 MITSOBISTI M3223FP.
		Digital: Bilateral switch sim to MOTOROLA
		Prescaler: sim to MOTOROLA MC12022SLAD
		RF Wide bend amplifier; sim to NEC UPC1676G.
		Linear: Dual Comparator; sim to MITSUBISHI
		Digital: Decoder; sim to MOTOROLA MC74HC237F.
		Digital: Bilateral switch sim to MOTOROLA
		Linear: Positive Voltage Regulator; sim to PANASONIC
		AN0341.
		COILS
		Coil RF: 33 uH +10%.

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SYMBOL	EGE PART NO.	DESCRIPTION
1 230		Choke Coil: 4.7 uH +10%
1 240		Choke Coil: $0.68 \text{ \muH} \pm 10\%$
and		
L241		
L242		Coil RF (Used in A).
L242		Coil RF (Used in B).
L243		Choke Coil: 1 µH ±10%.
L244		Choke Coil: 0.68 μH ±10%.
L245		Choke Coil: 1 µH ±20%.
L246		Coll RF: 22 μ H ±20%.
L247		Choke Coll: $0.82 \mu\text{H} \pm 10\%$.
L248 thru		Choke Coil: 0.82 μ H ±10% (Used in A).
L252		
L248		Choke Coil: 0.68 μH $\pm 10\%$ (Used in B).
thru		
1 280		Choke Coil: 0.68 µH ±10%
and		
L281		
L282		Coil RF (Used in A).
L282		Coil RF (Used in B).
L283		Choke Coil: 0.82 μH ±10%.
L284		Choke Coil: 0.68 μH ±10%.
L285		Choke Coil: 1 µH ±20%.
L286		Coll RF: 22 µH ±20%.
L287		Choke Coll: 1 μ H ±10% (Used in A).
L287		Choke Coll: 0.68 μ H ±10% (Used in B).
L288		Choke Coll: 0.68 μH ±10%.
L289		Choke Coll. 1 μ H ±10% (Used in A).
L289		Choke Coll: 0.68 μ H ±10% (Osed III B).
1 291		Choke Coll: 1.040μ H $\pm 10\%$ (Used in A)
1 291		Choke Coil: 0.68 μ H ±10% (Used in R)
L292		Choke Coil: 0.68 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 1/16W.
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		Vietal film: 2.2K ohms ±5% 50 VDCW 1/16W.
R209		ivietai iiim: 100 onms \pm 5% 50 VDCW 1/16W.
R210		Metal film: $100K$ ohms $\pm 5\%$ 50 VDCW $1/16W$.
R213		Metal film: 0 ohm
R214		Metal film: 330 ohms +5% 200 \/DCW 1/4W
R215		Metal film: 10K ohms +5% 100 VDCW 1/4W.
R216		Metal film: 470K 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		Metal film: 10K ohms ±5% 50 VDCW 1/16W.
thru		
R224		Metal film: 220K obms +5% 50 \/DC\// 1/16\//
R220		Metal film: 68K ohms +5% 50 VDCW 1/16W/ Upod in
11229		A).
R229		Metal film: 82K ohms ±5% 50 VDCW 1/16W (Used in
		В).
R230		Metal film: 3.9K ohms ±5% 50 VDCW 1/16W (Used in
P220		A).
rt230		ווווווווווווווווווווווווווווווווווווו
R231		Metal film: 22K ohms ±5% 50 VDCW 1/16W.
R232		Metal film: 1.5K ohms ±5% 50 VDCW 1/16W.
1		

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SYMBOL	EGE PART NO.	DESCRIPTION	SYMBOL	EGE
R233		Metal film: 22K ohms ±5% 50 VDCW 1/16W.	R2307	
R234		Metal film: 100K ohms ±5% 50 VDCW 1/16W.	and P2208	
R235		Metal film: 10K ohms ±5% 50 VDCW 1/16W.	R2300	
and			R2303	
D227		Motal film: 4 7K abms +5% 50 \/DC\W 1/16W	thru	
D220		Motal film: 5.6K obms ±5% 50 VDCW 1/16W	R2312	
P220		Metal film: 2.2K ohms ±5% 100 \/DCW 1/10W	R2313	
D2/1		Motal film: 15K obms +5% 100 VDCW 1/10W	thru R2315	
D241		Metal film: 68 ohmo ±5% 100 VDCW 1/10W.	R2/01	
R242		Metal film: 5 6K abma +5% 100 VDCW 1/10W.	P2402	
R243		Metal film: 1.5K chara 15% 100 VDCW 1/10W	RV/201	
R244		Metal film: 1.5K onms ±5% 100 VDCW 1/10W.	RV201	
R240		Metal film: 120 ohms ±5% 100 VDCW 1/10W.		
R240		A).	TP202	
D247		B).		
R247		Metal film: 22 onms \pm 5% 100 VDCW 1/10W (Used in A).	TR201 and	
R247		Metal film: 33 ohms ±5% 100 VDCW 1/10W (Used in B).	TR202 TR203	
R248		Metal film: 220 ohms ±5% 100 VDCW 1/10W (Used in	TR230	
R248		Metal film: 180 ohms ±5% 100 VDCW 1/10W (Used in	TR240	
P240		D).	TR241	
11249 P280		Motal film: 1M obms +5% 100 VDCW 1/10W.	TR242	
1120U R281		Metal film: 33K ohms ±5% 100 VDCW 1/10W.	and	
R201		Metal film: 22K ahma ±5% 100 VDCW 1/10W	TR243	
D292		Motal film: 47K obms ±5% 100 VDCW 1/10W.	18260	
R284		Metal film: 27K ohms ±5% 100 VDCW 1/10W	TR281	
R286		Metal film: 15K ohms ±5% 100 VDCW 1/10W	TR282	
R287		Metal film: 270 obms +5% 100 VDCW 1/10W	TR2301	
R288		Metal film: 5.6K ohms +5% 100 VDCW 1/10W.	thru	
R289		Metal film: 1.5K ohms ±5% 100 VDCW 1/10W	TR2303	
R290		Metal film: 120 obms +5% 100 VDCW 1/10W		
R291		Metal film: 270 ohms ±5% 100 VDCW 1/10W	V/11004	
R292		Metal film: 15 ohms ±5% 100 VDCW 1/10W.	XU201	
R293		Metal film: 270 ohms ±5% 100 VDCW 1/16W .		
R294		Metal film: 220 ohms ±5% 100 VDCW 1/10W .		
R295		Metal film: 100 ohms ±5% 100 VDCW 1/10W .		
R296		Metal film: 10K ohms ±5% 100 VDCW 1/10W .		
R2001		Metal film: 22K ohms ±5% 50 VDCW 1/16W .		
R2002		Metal film: 390K ohms \pm 5% 50 VDCW 1/16W (Used in A).		
R2002		Metal film: 560K ohms \pm 5% 50 VDCW 1/16W (Used in B).		
R2003		Metal film: 270K ohms \pm 5% 50 VDCW 1/16W (Used in A).		
R2003		, we the term of		
R2004		, we the test of test		
R2004		Hetal film: 82K ohms \pm 5% 50 VDCW 1/16W (Used in B).		
R2005		A betal film: 18K ohms \pm 5% 50 VDCW 1/16W (Used in A).		
R2005		Metal film: 47K ohms \pm 5% 50 VDCW 1/16W (Used in B).		
R2008		Metal film: 330 ohms ±5% 50 VDCW 1/16W.		
R2009		Metal film: 0 ohm.		
R2011		Metal film: 1M ohms ±5% 50 VDCW 1/16W.		
R2012		Metal film: 100K ohms ±5% 100 VDCW 1/10W.		
R2301		Metal film: 1K ohms ±5% 200 VDCW 1/8W.		
and R2302				
R2303		Metal film: 4.7K ohms +5% 100 VDCW 1/10W		
R2304		Metal film: 1K ohms ±5% 200 VDCW 1/8W.		
and				
R2305				
R2306		Metal film: 4.7K ohms ±5% 100 VDCW 1/10W.		

EGE PART NO.	DESCRIPTION
	Metal film: 1K ohms ±5% 200 VDCW 1/8W.
	Metal film: 4.7K ohms ±5% 100 VDCW 1/10W.
	Metal film: 15K ohms ±5% 50 VDCW 1/16W.
	Metal film: 39K ohms ±5% 50 VDCW 1/16W.
	Metal film: 10K ohms ±5% 50 VDCW 1/16W.
	Metal film: 100K ohms ±5% 50 VDCW 1/16W.
	Variable: 20K ohms 2±5% 1/10W.
	TERMINAL
	TRANSISTORS
	Silicon, PNP; sim to NEC 2SB624 BV3.
	Silicon, NPN; sim to PANASONIC XP1211.
	Silicon, NPN; sim to NEC 2SD596 DV3.
	N-channel, field effect.(Junction Singe Gate);sim to SONY 2SK125.
	Silicon, NPN; sim to NEC 2SC3356.
	Silicon, NPN; sim to PANASONIC UN5216.
	N-channel, field effect.(Junction Singe Gate);sim to SONY 2SK1577
	Silicon, NPN: sim to NEC 2SC3356.
	Silicon, NPN; sim to PANASONIC XP1216TX.
	Silicon, NPN; sim to PANASONIC XP1216TX.
	CRYSTAL
	Reference Oscillator unit: 12.8MHz 2PPM.

PARTS LIST

SYNTHESIZER BOARD RECEIVER/EXCITER SECTION CMN-352A (Used in 344A4577P1) CMN-352B (Used in 344A4577P2)

				C441
SYMBOL	EGE PART NO.	DESCRIPTION		C442
C151 thru	NOTE: Parts listed are for reference	Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%$.		C442
C153	only. Refer to	Coramic: 27 pE +10% 50 V/DCW/ tomp coof 060 PPM		C443A
C156	Service Section for	Ceramic: 1000 pE $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%$		
thru	serviceable parts.		'	C443A
C159				C444A
C161		Ceramic: 5 pF ±0.25 pF 50 VDCW, temp coef 060 PPM.		C444B
C162 thru C164		Ceramic: 1000 pF ±10% 50 VDCW, temp coet ±15%.		C445A
C165 and		Ceramic: 0.1 μF ±10% 25 VDCW, temp coef ±15%.		C445A
C166 C167		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$		C446
C168		Ceramic: 0.01 μF ±10% 25 VDCW, temp coef ±15%.	'	C446
C169		Tantalum: 22mF ±20% 16 VDCW.		C447A
C401 and C402		Ceramic: 22 pF ±5% 50 VDCW, temp coef 060 PPM.		C447B
C403		Ceramic: 150 pF ±5% 50 VDCW, temp coef 060 PPM.		C447B
C404		Ceramic: 0.01 μ F ±10% 25 VDCW, temp coef ±15%.		04470
thru C407				C447C
C408		Ceramic: 1000 pF +10%, 50 VDCW, temp coef +15%,		0440
and C409				C448
C410		Ceramic: 0.01 μF ±10% 25 VDCW, temp coef ±15%.		C449A
C411				C440B
C412		Ceramic: 18 pF ±5% 50 VDCW, temp coef 060 PPM.		C449D
C413		Ceramic: 0.01 μF ±10% 25 VDCW, temp coef ±15%.		C449B
thru C415				
C416		Ceramic: 0.01 µF ±10% 50 VDCW, temp coef ±15%,		C450A
C417		Ceramic: 0.01 µF ±10% 25 VDCW, temp coef ±15%.		C450B
C431A		Ceramic: 9 pF 0.5 pF 50 VDCW, temp coef 060 PPM (Used in A).		C451A
C431A		Ceramic: 10 pF 0.5 pF 50 VDCW, temp coef 060 PPM (Used in B).		C454A
C432A		Ceramic: 22 pF \pm 5% 50 VDCW, temp coef 060 PPM.		C454B
C433A		Ceramic: 15 pF ±5% 50 VDCW, temp coef 060 PPM		C454C
C433A		Ceramic: 10 pF 0.5 pF 50 VDCW, temp coef 060 PPM (Used in B).		C455A C455B
C434A		Ceramic: 4 pF \pm 0.25 pF 50 VDCW, temp coef 060 PPM (Used in A).		C455C C456A
C434A		Ceramic: 2 pF ± 0.25 pF 50 VDCW, temp coef 060 PPM.(Used in B).		C456B
C434B		Ceramic: 0.5 pF \pm 0.25 pF 50 VDCW, temp coef 0250 PPM. (Used in B).		C457A
C435		Ceramic: 15 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM.		C457C
C436		Ceramic: 22 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in A).		C461
C436		Ceramic: 18 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in B).		C463 C464
C437		Ceramic: 18 pF +±5% 50 VDCW, temp coef 060 PPM (Used in A).		C465 C467
C437		Ceramic: 15 pF ±5% 50 VDCW, temp coef 060 PPM (Used in B).		C468 C469
C438		Ceramic: 27 pF ±5% 50 VDCW, temp coet 060 PPM.		and
C439		(Used in A).		C470 C471
C439		(Used in B).		and C472
C440		(Used in A).		C473 C474
C440		Ceramic: 15 pF ±5% 50 VDCW, temp coet 060 PPM (Used in B).		

SYMBOL	EGE PART NO.	DESCRIPTION
C441		Ceramic: 22 pF ±5% 50 VDCW, temp coef 060 PPM
C441		(Used in A). Ceramic: 18 pF ±5% 50 VDCW, temp coef 060 PPM
C442		(Used in B). Ceramic: 22 pF ±5% 50 VDCW, temp coef 060 PPM
C442		(Used in A). Ceramic: 18 pF ±5% 50 VDCW, temp coef 060 PPM
C443A		(Used in B). Ceramic: 6 pF 0.5 pF 50 VDCW, temp coef 060 PPM
C443A		(Used in A). Ceramic: 5 pF ± 0.25 pF 50 VDCW, temp coef 060 PPM
C444A		(Used in B). Ceramic: 5 pF 0.5 pF 50 VDCW, temp coef 060 PPM.
C444B		Ceramic: 0.5 pF ±0.25 pF 50 VDCW, temp coef 0250 PPM.
C445A		Ceramic: 3 pF ± 0.25 pF 50 VDCW, temp coef 0120 PPM (Used in A).
C445A		Ceramic: 2 pF ± 0.25 pF 50 VDCW, temp coef 0250 PPM (Used in B).
C446		Ceramic: 18 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in A).
C446		Ceramic: 12 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in B).
C447A		Ceramic: 120 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM.
C447B		Ceramic: 180 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM (Used in A).
C447B		Ceramic: 68 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM (Used in B).
C447C		Ceramic: 120 pF $\pm 5\%~50$ VDCW, temp coef 060 PPM.
C448		Ceramic: 18 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in A).
C448		Ceramic: 12 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in B).
C449A		Ceramic: 0.75 pF ± 0.25 pF 50 VDCW, temp coef 0120 PPM. (Used in B).
C449B		Ceramic: 3 pF ± 0.25 pF 50 VDCW, temp coef 0120 PPM (Used in A).
C449B		Ceramic: 2 pF ± 0.25 pF 50 VDCW, temp coef 0120 PPM (Used in B).
C450A		Ceramic: 0.5 pF ± 0.25 pF 50 VDCW, temp coef 0120 PPM.
C450B		Ceramic: 5 pF ± 0.25 pF 50 VDCW, temp coef 060 PPM.
C451A		Ceramic: 6 pF 0.5 pF 50 VDCW, temp coef 060 PPM (Used in A).
C451A		Ceramic: 5 pF ± 0.25 pF 50 VDCW, temp coef 060 PPM (Used in B).
C454A		Ceramic: 470 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM.
C454B		Ceramic: 470 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM.
C454C		Ceramic: 470 pF \pm 5% 50 VDCW, temp coef 060 PPM.
C455A		Ceramic: 470 pF ±5% 50 VDCW, temp coef 060 PPM.
C455B		Ceramic: 470 pF ±5% 50 VDCW, temp coef 060 PPM.
C455C		Ceramic: 470 pF ±5% 50 VDCW, temp coet 060 PPM.
C456A		Ceramic: 470 pF ±5% 50 VDCW, temp coef 060 PPM.
C456C		Ceramic: 470 pF ±5% 50 VDCW, temp coef 060 PPM.
C457A		Ceramic: 470 pF ±5% 50 VDCW, temp coef 060 PPM.
C457B		Ceramic: 470 pF ±5% 50 VDCW, temp coef 060 PPM.
C457C		Ceramic: 470 pF ±5% 50 VDCW, temp coef 060 PPM.
C461		Ceramic: 1000 pF ±10% 50 VDCW. temp coef ±15%
C463		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
C464		Ceramic: 1000 pF ±10% 50 VDCW, temp coef 0±15%.
C465		Ceramic: 1000 pF \pm 10% 50 VDCW, temp coef \pm 15%.
C467		Ceramic: 27 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM.
C468		Ceramic: 1000 pF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$
C469		Ceramic: 18 pF $\pm 5\%$ 50 VDCW, temp coef 060 PPM.
and C470		
C471		Ceramic: 1000 pF ±10% 50 VDCW. temp coef ±15%.
and		
C472		
C473		Ceramic: 27 pF ±5% 50 VDCW, temp coef 060 PPM.
6474	I	Ceramic: 1000 pF ±10% 50 VDCW, temp coet ±15%.

PARTS LIST

SYMBOL	EGE PART NO.	DESCRIPTION	SYMB
C475		Ceramic: 15 pF ±5% 50 VDCW, temp coef 060 PPM.	L153
and			L154
C476			and
C477		Ceramic: 4 pF \pm 0.25 pF 50 VDCW, temp coef 060 PPM.	L155
C480		Ceramic: 0.1 μ F ±10% 25 VDCW, temp coef ±15%.	L 150
C482		Ceramic: 0.1 μ F ±10% 25 VDCW, temp coef ±15%.	L 157
and		Ceramic. 0.01 μ F ±10% 50 VDCW, temp coel ±15%.	L401
C484			1 402
C485		Ceramic: 0.01 μF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$	1 403
C486		Ceramic: 0.01 μF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%.$	and
C488A		Ceramic: 15 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in A).	L404 L405
C488A		Ceramic: 12 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in B).	L406 L406
C488B		Ceramic: 1 pF \pm 0.25 pF 50 VDCW, temp coef 060 PPM (Used in B).	L431
C489A		Ceramic: 15 pF ±5% 50 VDCW, temp coef 060 PPM (Used in A).	L431 L432
C489A		Ceramic: 12 pF \pm 5% 50 VDCW, temp coef 060 PPM (Used in B).	L432 L433
C489B		Ceramic: 1 pF \pm 0.25 pF 50 VDCW, temp coef 0250 PPM (Used in B).	L433
C490		Ceramic: 10 pF 0.5 pF 50 VDCW, temp coef 060 PPM.(Used in A).	L434 L435
C490		Ceramic: 8 pF 0.5 pF 50 VDCW, temp coef 060 PPM.(Used in B).	L435 L436
C491		Tantalum: 22 μF ±20% 16 VDCW.	and
C492 and		Ceramic: 0.01 μF $\pm 10\%$ 50 VDCW, temp coef $\pm 15\%$	L437 L461
C493			L462
C494		Ceramic: 3 pF \pm 0.25 pF 50 VDCW, temp coef 0120 PPM.	thru 1.465
C495 C496		Tantalum: 22 μ F ±20% 16 VDCW. Ceramic: 1000 pF ±10% 50 VDCW temp coef 15 %.	L466
		DIODES	
CD151		Silicon: fast recovery sim to TOSHIBA ISS352.	R151
CD152		Silicon: fast recovery (2 diodes in cathode); sim to	R152
		TOSHIBA ISS184.	R153
CD401		Silicon: (Schottky Barrier); sim to MITSUBISHI MI809.	R154
CD403			R155
CD431		Silicon: Epitaxia Planar Diode; sim to HITACHI HSU277.	R156
thru			R157
CD434			R158
			R159
0)/404		CAPACITORS	thru
and		variable: 6 pF max.	R162
CV432			R163
			R164
		FILTER	R403
FL481		EMI Filter: 1000 pF.	R404
			R405
		HYBRID CIRCUIT	R405
HC441		Double Balanced Mixer.	R406
			R408
		INTEGRATED CIRCOTTS	R409 and
IC151		RF wide-band ampifier:sim to NEC UPC1678G.	R410
IC152		Linear: Positive Voltage Regulator; sim to JRC	R411
		NJM78L06UA.	R412
IC481		Linear: Positive Voltage Regulator; sim to NEC	R413
		UF62409HF.	R414
		JACKS	R415
J151		Connector: RF.	R417
J401		Connector: RF.	R418
J501		Connector: 30 pins.	R419
			R420
		COILS	R421
L152		Coil: RF 0.22 μH ±10%.	R422

EGE PART NO.	DESCRIPTION		
	Coil: RF 33 μH ±10%.		
	Coil: RF 0.22 μH ±10%.		
	Coil: RF 19 μH ±10%.		
	Coil: RF 1.0 μH ±20%.		
	Coil: RF .		
	Coil: RF 0.15 μH ±10% (Used in A).		
	Coll: RF 0.1 µH ±10% (Used in B).		
	Сон. КР 0.82 µп ±20%.		
	Coil: RF 68 μH ±10%.		
	Coil: RF 47 μ H ±10% (Used in A).		
	Coll: RF 39 μH ±10% (Used in B).		
	Coil: RF (Used in R).		
	Coil: RF (Used in A).		
	Coil: RF (Used in B).		
	Coil: RF (Used in A).		
	Coil: RF (Used in B).		
	Coil: RF		
	Coil: RF (Used in A).		
	Coil: RF (Used in B).		
	Coil: 0.1 μH ±10%.		
	Coil: RF 33 μH ±10%.		
	Coil: RF 39 μH ±20%.		
	RESISTORS		
	Metal film: 10 ohms ±5% 100 VDCW.1/16W.		
	Metal film: 220 ohms ±5% 100 VDCW.1/16W.		
	Metal film: 1.5K ohms ±5% 100 VDCW.1/16W.		
	Metal film: 4.7 onms ±5% 200 VDCW.1/2W.		
	Metal film: 220 ohms ±5% 100 VDCW 1/10W		
	Metal film: 3.3K ohms ±5% 100 VDCW.1/16W.		
	Metal film 1k ohms ±5% 100 VDCW.1/10W.		
	Metal film: 15 ohms ±5% 100 VDCW.1/16W.		
	Metal film: 330 ohms ±5% 100 VDCW.1/16W.		
	Ivietal film: 15 ohms ±5% 100 VDCW.1/6W. Motol film: 230 ohms ±5% 100 VDCW.1/6W.		
	Wetal film: 1.8K ohms ±5% 100 VDCW 1/16W		
	Metal film: 6.8K ohms ±5% 100 VDCW.1/16W.		
	Metal film: 27 ohms ±5% 100 VDCW.1/16W (Used in A).		
	Metal film: 39 ohms ±5% 100 VDCW.1/16W (Used in B).		
	Metal film: 27 ohms ±5% 100 VDCW.1/16W.		
	Metal film: 2.2K ohms ±5% 100 VDCW.1/16W.		
	Metal film: 47 ohms ±5% 100 VDCW.1/16W.		
	Metal film: 220 ohms ±5% 100 VDCW.1/16W.		
	Metal film: 12 ohms ±5% 100 VDCW 1/16W		
	Metal film: 470 ohms ±5% 100 VDCW.1/16W.		
	Metal film: 10K ohms ±5% 100 VDCW.1/16W.		
	Metal film: 2.2K ohms ±5% 100 VDCW.1/16W .		
	Metal film: 100K ohms ±5% 100 VDCW.1/16W.		
	Metal film: 10K ohms $\pm 5\%$ 100 VDCW.1/16W.		
	Metal film: 100K ohms ±5% 100 VDCW.1/16W.		

SYMBOL

SYMBOL	EGE PART NO.	DESCRIPTION
R431		Metal film: 10K ohms ±5% 100 VDCW.1/16W.
thru		
R434		
R435		Metal film: 0 ohms .
R438		Metal film: 0 ohms .
R445		Metal film: 100K ohms ±5% 100 VDCW.1/16W.
thru		
R447		
R448		Metal film: 10K ohms ±5% 100 VDCW.1/16W.
and R449		
R445		Matal (iles 400K along 15% 400 \/DOM/4/40W
K450 thru		Metal film: 100K onms ±5% 100 VDCVV.1/16VV.
R452		
R453		Metal film: 10K ohms +5% 100 VDCW.1/16W.
and		
R454		
R461		Metal film: 5.6K ohms ±5% 100 VDCW.1/16W.
R462		Metal film: 1K ohms ±5% 100 VDCW.1/16W.
and		
R463		
R464		Metal film: 10 ohms ±5% 100 VDCW.1/16W.
R465		Metal film: 22 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.
and		
R468		
R469		Metal film: 22 ohms ±5% 100 VDCW.1/10W.
R470		Metal film: 10 ohms ±5% 100 VDCW.1/16W.
R471		Metal film: 330 ohms ±5% 100 VDCW 1/16W
and		
R472		
R473		Metal film: 15 ohms ±5% 100 VDCW.1/16W.
R474		Metal film: 330 ohms ±5% 100 VDCW.1/16W.
and		
R475		
R476		Metal film: 15 ohms ±5% 100 VDCW.1/16W.
R477		Metal film: 330 ohms ±5% 100 VDCW.1/16W.
R478		Metal film: 15 ohms +5% 100 VDCW.1/10W.
R479		Metal film: 330 ohms +5% 100 VDCW 1/16W
R490		Motol film: 2 2K obmo ±5% 100 V/DCW 1/16W (Llood in
K400		A)
P480		Motal film: 4.7K abms +5% 100 \/DC\\/1/16\\/ (lead in
K400		B)
		TRANSISTORS
TD151		
TRIST		Silicon, NPN; Sim to MOTOROLA MRF559.
IR152		Silicon, NPN; sim to NEC 2SB624.
IR401		Silicon, NPN; sim to NEC 2SC3357.
TR402		Silicon, NPN; sim to NEC 2SD596.
TR403		Silicon, NPN; sim to PANASONIC XN6401.
TR431		Silicon, NPN; sim to PANASONIC XN6401.
and		
TR432		
TR461		Silicon, NPN; sim to NEC 2SC3357.
and		
TR462		

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PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number on the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the description of parts affected by these revisions.

REV. A - VHF TX RX 344A4577P1 & P2

Control Logic Board CMC-862 To eliminate "sneak" current path on switched outputs. Deleted diodes CD713 and CD714. Refer to Maintenance Manual LBI-39003.

REV. B - <u>VHF TX RX 344A4577P1 & P2</u> Synthesizer/Receiver/Exciter Board CMN-352A/B To improve receiver selectivity and intermodulation. Changed inductor $L466\,$ from 10 μ H to 39 μ H.

REV. C- VHF TX RX 344A4577P1 & P2

Control Logic Board CMC-862

To reduce TX hum and noise. Added 2.2k ohms resistor between capacitor C670 and capacitor C603. Refer to Maintenance Manual LBI-39003.

COMPONENT IDENTIFICATION CHART

Δ COMPONENT IDENTIFICATION CHART

SYMBOL	A 136~153MHz	B 150~174MHz
C241	18pF (UJ)	22pF (UJ)
C260	4pF	брF
C266	6pF	7pF
C267	4pF	8pF
C272	6pF	8pF
C273	7pF	12pF
C282	4pF	5pF
C288	82pF	68pF
C289	0	7pF
C293	27pF	18pF
C2104	12pF	8pF
C2105	12pF	10pF
C2106	3pF	0
C2107	3pF	0
C2111	15pF	12pF
C2113	3pF	0
C2114	3pF	0
C2118	27pF	18pF
C2120	3pF	0
C2121	3pF	0
L242	H-6LALD00171	H-6LALD00173
L248	0.82µH	0.68µH
L249	0.82µH	0.68µH
L250	0.82µH	0.68µH
L251	0.82µH	0.68µH
L252	0.82µH	0.68µH
L282	H-6LALD00170	H-6LALD00172
L287	1.0µH	0.68µH
L289	1.0µH	0.68µH
L291	1.0µH	0.68µH
R229	$68 \mathrm{k}\Omega$	82kΩ
R230	3.9kΩ	15kΩ
R246	220Ω	180Ω
R247	22Ω	33Ω
R248	220Ω	180Ω
R2002	390kΩ	560kΩ
R2003	270kΩ	180kΩ
R2004	120kΩ	82kΩ
R2005	$18 \mathrm{k}\Omega$	$47 \mathrm{k}\Omega$

Δ COMPONENT IDENTIFICATION CHART

PARTS NO.	CMN-352A-1 136-153MHz	CMN-352B-1 150-174MHz
C431A	9PF	10PF
C431B	OPF	0PF
C432A	22PF	22PF
C432B	OPF	OPF
C433A	15PF	10PF
C433B	OPF	4PF
C434A	4PF	2PF
C434B	OPF	0.5PF
C435	15PF	15PF
C436	22PF	18PF
C437	18PF	15PF
C438	27PF	27PF
C439	22PF	18PF
C440	18PF	15PF
C441	22PF	16PF
C442	22PF	18PF
C443A	6PF	5PF
C443B	OPF	OPF
C444A	5PF	5PF
C444B	0.5PF	0.5PF
C445A	3PF	2PF
C445B	OPF	0.75PF
C446	18PF	12PF
C447A	120PF	120PF
C447B	180PF	68PF
C447C	120PF	120PF
C448	18PF	12PF
C449A	OPF	0.75PF
C449B	3PF	2PF
C450A	0.5PF	0.5PF
C450B	5PF	5PF
C451A	6PF	5PF
C451B	OPF	0PF
C488A	15PF	12PF
C488B	OPF	1PF
C489A	15PF	12PF
C489B	OPF	1PF
C490	10PF	8PF
L402	150nF	100nF
L406	47nF	39nF
L431	2.0 ø6T	2.0 ø5T
L432	1.8 ø5T	2.0 ø4T
L433	2.5 ø4T	2.0 ø5T
L434	2.5 ø5T	2.0 ø5T
L435	1.8 ø5T	2.0 ø4T
R405	27Ω	39Ω
R406	27Ω	27Ω
R480	2.2KΩ	4.7ΚΩ

SYNTHESIZER

RECEIVER/EXCITER

OUTLINE DIAGRAM



SOLDER SIDE

SOLDER SIDE





COMPONENT SIDE

LBI-38910



SYNTHESIZER/RECEIVER/EXCITER

LBI-38910

SCHEMATIC DIAGRAM



SYNTHESIZER

SCHEMATIC DIAGRAM





NOTE:

ALL RESISTORS ARE 1/16 WATT UNLESS OTHERWISE SPECIFIED RESISTOR VALUES IN $\Omega\,\text{UNLESS}$ 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 in OR Ju

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RECEIVER/EXCITER