

## MAINTENANCE MANUAL SYNTHESIZER BOARD 19C851880G3 403-440 MHz 19C851880G4 440-470 MHz

TABLE OF CONTENTS					
DESCRIPTION	<u>Page</u> Front Cover				
CIRCUIT ANALYSIS	Front Cover				
FIGURE 1 - SYNTHESIZER BLOCK DIAGRAM	1				
OUTLINE DIAGRAM	2				
SCHEMATIC DIAGRAM	3				
PARTS LIST	4				
IC DATA	4				

### **DESCRIPTION**

The Synthesizer Board 19C851880G3 & G4 (403-440 MHz & 440-470 MHz) generates all transmit and receive RF frequencies for the MPI-II Personal Radio. The frequency synthesizer circuit generates the transmit carrier frequency and the first mixer injection frequency for the receive circuit. This circuit uses a phase-locked Voltage Controlled Oscillator (VCO) operating on the actual transmitter frequency (403-470 MHz) during transmit and 45 MHz below the actual receive frequency during receive. The Synthesizer Board plugs into the Transmit/Receive Board at P5 and P6. See Figure 1 for the Synthesizer Block Diagram.

### **CIRCUIT ANALYSIS**

The synthesizer frequency output is controlled by the microprocessor on the Transmit/Receive Board. Frequency stability is maintained by a temperature compensated crystal controlled reference oscillator (TCXO) module (U203). The oscillator has a stability of  $\pm 5$  PPM over the temperature range of -30°C to 60°C and determines the overall frequency stability of the radio.

The synthesizer output signal is generated directly by VCO module U204. The output from U204 is fed through a low pass filter to the Prescaler U202, with output SYNTH to the Local Oscillator buffer Q421 and the Power Amplifier buffer Q102. The Local Oscillator and the Power Amplifier are located on the T/R Board. The VCO output is also buffered by transistor Q201 to feed divide-by 128/129 dual modulus prescaler U202. The prescaler feeds the Fin input of the Phase-Lock-Loop (PLL) chip U201.

Within U201, the prescaler signal is further divided down to 12.5 kHz to be compared with a reference signal. This reference signal is derived by division within U201 from the 12.8 MHz output of the TXCO module U203. Divider circuits in U201 are programmed by three inputs from the microprocessor on the T/R Board. These are SYN ENABLE, SYN DATA and SYN CLOCK lines. A LOCK DETECT line from the PLL chip to the T/R Board microprocessor is used to prevent transmissions when the synthesizer is unlocked. A pulsed beep will be sounded if this condition occurs.



Ericsson GE Mobile Communications Inc. Mountain View Road • Lynchburg, Virginia 24502

Audio modulation from the T/R Board is applied to the Synthesizer Board at P6-2. Audio Modulation then goes to Mod Pot R230 to adjust the modulation level. The output from the Mod Pot is summed with the unfiltered control voltage and fed to operational amplifier U206.2. Amplifier U206.2 is biased to produce gain variation with different control voltages. When the control voltage is below 1.7 volts, both diodes in diode package D201 are biased off. The op amp gain is then unity. As the control voltage rises above approximately 1.7 volts, one of the diodes (D201) is forward biased. This increases the op amp gain to approximately 1.2. Further increases in the control voltage above approximately 2.5 volts turns both diode paths on, thus increasing gain to about 1.4. Gain variation versus control voltage compensates for decreasing VCO gain at higher control voltages. The net affect of this is to linearize the loop response across the frequency band to maintain relatively constant audio modulation and constant digital Channel Guard waveshape.

The synthesizer enable line also drives bilateral switches U205.2 and U205.3. The pulse applied to these gates, when channel changes occur, turns the gates on which shorts out resistors R224 and R225. This allows rapid channel acquisition.

During Standby operation, the Synthesizer 5.4 volts is switched ON for 25 ms and OFF for 75 ms. In order to facilitate channel acquisition during Standby operation, bilateral switch U205.1 is driven by the Synthesizer data line to quickly determine if a carrier with the proper signaling tone is present. If no carrier or a carrier with incorrect tone is detected, the radio remains in Standby. If a carrier with the proper tone is detected, the Synthesizer 5.4 volts is switched ON continuously until the carrier and/or the tone is removed.



### LBI-38560

S

EF. 0SC U203

#### COMPONENT SIDE (19C851880, Sh. 1, Rev. 4 (19C851881, Rev. 3) +. +u C @ 2 ( C283 2 O28 +\_ $(\oplus)$ +**\*** + + + 1.10 $\oplus$ + 6227+ **(** $\oplus$ +. $\oplus$ + <sup>2</sup>⊕ + $\oplus$ + C215+ 0 4 $\oplus$ # $\oplus$ UZØ Ŧ € ŧ, $\oplus$ Ð ÷ ÷÷ Ð (+ c214+ + R230

OUTLINE DIAGRAM







SYNTHESIZER BOARD 19C851880G3 403-440 MHz 19C851880G4 440-470 MHz



LT: [1] - R233 REPLACES R232 IN CASES WHERE THE ALTERNATE PRESCALER DIVIDER RATIO IS REONIRED. SEE MAINT.MANUAL FOR FURTHER INFORMATION.

### LBI-38560

SYNTHESIZER BOARD 19C851880G3 403-440 MHz 19C851880G4 440-470 MHz (19D902475, Sh. 1, Rev. 8)

### PARTS LIST

#### SYNTHESIZER BOARD 19C851880G3 403-440 MHz 19C851880G4 440-470 MHz

SYMBOL	PART NO.	DESCRIPTION	and R202	
			R203	19A7029
		CAPACITORS	R204	19B8012
C201	19A702061P69	Ceramic: 220 pF <u>+</u> 5%, 50 VDCW, temp coef 0 +30. PPM/°C.	R205 R206	19B8012 19B8012
C202	19A702061P99	Ceramic: 1000 pF ±5%, 50 VDCW, temp coef 0 +30 PPM/°C.	R207 and	19B8012
C203 thru	19A702061P61	Ceramic: 100 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.	R208 R209	19B8012
C205	404700004000		R211 R212	1988012
0206	19A702061P69	+30 PPM/°C.	R212	19B8012
C207	19A702052P14	Ceramic: 0.01 <i>u</i> F ±10%, 50 VDCW.	R215	19B8012
C208 and C209	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.	R216 and R217	19B8012
C210	19A702061P61	Ceramic: 100 pF <u>+</u> 5%, 50 VDCW, temp coef 0 +30 PPM.	R218	19B8012
C211	19A702061P29	– Ceramic: 22 pF <u>+</u> 5%, 50 VDCW, temp coef 0	R218	1988012
		<u>+</u> 30 PPM.	R219 R220	19A7029
C212	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 ±30 PPM.	R220	19A7029
C213	19A702052P14	Ceramic: 0.01 uF ±10%, 50 VDCW.	R220	19A7029
C214	T644ACP347K	Polyester: .047 uF ±10%, 50 VDCW. (Used in G3).	R221	19A7029
C214	T644ACP333K	Polyester: .033 uF ±10%, 50 VDCW. (Used in G4).	R222	19A7029
C215	19A700004P10	Metallized Polyester: 1.0 uF ± 10%, 63 VDCW.		
C216 thru	19A702052P14	Ceramic: 0.01 <i>u</i> F <u>+</u> 10%, 50 VDCW.	R222	19A7029
C220	104702061P77	Ceramic: 470 pE +5% 50 VDCW temp coef 0	R223	19B8012
0221	19A/02001F//	$\pm 30$ PPM.	R224	19B8012
C222			R225	19B8012
C223	19A705205P5	Tantalum: 6.8 uF, ±10 VDCW; sim to Sprague	R226	19B8012
		293D.	R227	19B8012
C224	19A702052P5	Ceramic: 1000 pF <u>+</u> 10%, 50 VDCW.	R228	19B8012
C225	19A705205P5	Tantalum: 6.8 <i>u</i> F, <u>+</u> 10 VDCW; sim to Sprague	R229	19B8012
and C226		293D.	R230	19B8007
C227	19A700004P9	Metalized polyester: 0.47 //E +10% 63 VDCW	R231	19B8012
C228	19A702052P14	Ceramic: 0.01 uF +10%. 50 VDCW.	R233	1988012
		DIODES	R234	190012
D201	19A703561P2	Silicon, fast recovery (2 diodes in series). INDUCTORS	R233	196012
L201	19A705470P5	Coil, Fixed: 22 nH; sim to Toko 380NB-22nM.	U201	19B8009
		PLUGS	0202	19A 1499
P5	19A704779P5	Connector, printed wiring, 6 circuits: sim to	0203	190013
and		Molex 22-17-2062.	0204	1908519
Чb		TRANSISTORS	11205	1968519
0004	10470470900	Silicon NDN: sim to NEC 22C22E6	0200	1341021
1 1. 11 1.1	19A/04/00P2	SIIICUT, INFIN: SITT LO INEC 2303330.	11000	1017000

SYMBOL	PART NO.	DESCRIPTION	
		····· RESISTORS ·····	
P201	1089012518104	Motal film: 100K abms +5% 1/10 w	
and	1300012311 104		
R202			
R203	19A702931P233	Metal film: 2150 ohms ±1%, 200 VDCW, 1/8 w.	
R204	19B801251P272	Metal film: 2.7K ohms ±5%, 1/10 w.	
R205	19B801251P470	Metal film: 47 ohms ±5%, 1/10 w.	
R206	19B801251P331	Metal film: 330 ohms ±5%, 1/10 w.	
R207	19B801251P103	Metal film: 10K ohms <u>+</u> 5%, 1/10 w.	
and R208			
R200	10B801251P681	Metal film: 680 obms +5% 1/10 w	
P211	10B801251P473	Motal film: 47K obms +5% 1/10 w	
P212	10B901251P475	Metal film: 47 K offins <u>+</u> 5%, 1/10 w.	
R212	19B001251F121	Metal film: 12 offins <u>+</u> 3%, 1/10 w.	
R213	19D801251F100	Metal film: 100 chmc + 5%, 1/10 w.	
R213	19D001251F101	Metal film: $1700$ of $115 \pm 5\%$ , $1/10$ w.	
and	196012512470	Metal IIIII: 47 Onitis $\pm 5\%$ , 1/10 w.	
R217			
R218	19B801251P154	Metal film: 150K ohms <u>+</u> 5%, 1/10 w. (Used in G3).	
R218	19B801251P104	Metal film: 100K ohms <u>+</u> 5%, 1/10 w. (Used in G4).	
R219	19A702931P401	Metal film: 100K ohms ±1%, 200 VDCW, 1/8 w.	
R220	19A702931P365	Metal film: 46.4K ohms ±1%, 200 VDCW, 1/8 w. (Used in G3).	
R220	19A702931P381	Metal film: 68.1K ohms ±1%, 200 VDCW, 1/8 w. (Used in G4).	
R221	19A702931P358	Metal film: 39.2K ohms ±1%, 200 VDCW, 1/8 w.	
R222	19A702931P409	Metal film: 121K ohms ±1%, 200 VDCW, 1/8 w. (Used in G4).	
R222	19A702931P365	Metal film: 46.4K ohms <u>+</u> 1%, 200 VDCW, 1/8 w. (Used in G3).	
R223	19B801251P682	Metal film: 6.8K ohms ±5%, 1/10 w.	
R224	19B801251P105	Metal film: 1M ohms <u>+</u> 5%, 1/10 w.	
R225	19B801251P333	Metal film: 33K ohms ±5%, 1/10 w.	
R226	19B801251P224	Metal film: 220K ohms <u>+</u> 5%, 1/10 w.	
R227	19B801251P102	Metal film: 1K ohms <u>+</u> 5%, 1/10 w.	
R228	19B801251P221	Metal film: 220 ohms <u>+</u> 5%, 1/10 w.	
R229	19B801251P470	Metal film: 47 ohms <u>+</u> 5%, 1/10 w.	
R230	19B800779P8	Variable, cermet: 4.7K ohms ±25%, .3 w.	
R231	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.	
R233	19B801251P100	Metal film: 10 ohms ± 5%, 1/10 w.	
R234	19B801251P470	Metal film: 47 ohms <u>+</u> 5%, 1/10 w.	
R235	19B801251P104	Metal film: 100K ohms <u>+</u> 5%, 1/10 w.	
		INTEGRATED CIRCUITS	
U201	19B800902P5	Synthesizer, custom: CMOS. serial input.	
U202	19A149944P201	Prescaler; sim to Motorola MC12022A.	
U203	19B801351P8	Crystal Oscillator.	
U204	19C851916G1	Voltage Controlled Oscillator. (Used in G3)	
U204	19C851916G2	Voltage Controlled Oscillator, (Used in G4)	
U205	19A702705P4	Digital: Quad Analog Switch/Multiplexer; sim to 4066BM.	
U206	19A702293P3	Linear: Dual Op Amp; sim to LM358D.	

#### PRODUCTION CHANGES

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

REV.A - <u>SYNTHESIZER BOARD 19C851880G4</u> Incorporated in the initial Shipment.

# SYNTHESIZER





### IC DATA

# PRESCALER



### QUAD ANALOG SWITCH/MULTIPLEXER 19A702705PI,P4 (CMOS)

LOGIC DIAGRAM



### PIN CONFIGURATION



CRYSTAL OSCILLATOR 198801351P7,P88P13



1N 1

V<sub>CC</sub> 2 SW 3 OUT 4





PIN CONNECTIONS

I. COMMON AND CASE 2.OUTPUT 3.+ V<sub>CC</sub>



CONTROL	SWITCH
0	OFF
I	ON



ALL RESISTORS ARE 0.1 WATT UNLESS Otherwise specified and resistors Values are in ohms unless followed BY MULTIPLIER K OR M. Capacitor Values in F Unless Followed by Multiplier U, N or P. Inductance Values in H Unless Followed by Multiplier M or U.

THIS SCHEMATIC DIAGRAM APPLIES TO Model No. Rev Letter Pl19C851916G2 A

NOTE: SCHEMATIC DIAGRAM FOR REFERENCE ONLY



∆	group 2	GROUP 3
Component	440-470MHZ	470-512MHZ
L7	10	56 MH

OPERATIONAL AMPLIFIER 19A702293P2&P3





### LBI-38560

S Y N T H E S I Z E R

B 0

A R D