



HL -1511 Series TRANSCIVER

SERVICE MANUAL

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1. INTRODUCTION

HL -1511 Series is a micro size FM transceiver operating between 136 ~ 174 MHz With the output power of 5 Watts , the radio is capable of communicating up 7 miles.

Like other Headline Systems quality products, HL-1511 Series carries a 24 months limited warranty. Please call our technical or customer service representatives at 913-859-9515 when you need help or visit us on the Web www.tecnetusa.com.

2. DESCRIPTION OF UNIT



A. Power on / off and Volume Control Switch

Turn the transceiver on by rotating power on / off and volume control switch clockwise and control the volume.

B. Channel Select Button

Select the desired channel with pressing Up and Down button, pressing and holding down more than 1 second makes the channel moving fast. And you can choose, On or Off in function mode.

C. Speaker .

D. Whip Antenna. (^/4)

E. Tx / Rx Indicate LED (3 colors)

Red	On	Transmitting
	Blinking	Low battery
Green	On	Receiving, monitoring
	Blinking	Different sub-tone when receiving
Orange	On	Power on

F. External Earphone/MIC and Programming Jack Socket

G. PTT(Push To Talk) Button

Hold down to transmit, release to receive.

H. Function Button

Refer to “OPERATION” page 7.

I. Monitor Button

Press to monitor. Holding down over 2 seconds keeps monitoring function on, and press shortly again or PTT Button to stop.

J. Battery Pack

3. THEORY OF OPERATION

INTRODUCTION

HL-1511 Series is a micro size 99 channel portable FM transceiver constructed with a microprocessor controlled, temperature compensated Phase Locked Loop (PLL) frequency synthesizer. The radio features a double conversion receiver and a direct FM transmitter modulator. A special integrated circuit provides support to sub-audible signaling (CTCSS & DCS) , 2 Tone and most of the receiving parts are switched off periodically in the power save mode to reduce battery current drain during standby.

The Block Diagram RF and Control Circuit Diagrams for HL-1511 Series shall be used in associate with the following circuit description.

CIRCUIT DESCRIPTIONS

1) PHASE-LOCK LOOP (PLL) CIRCUIT

*** Reference OSC(VCTCXO)**

The reference oscillator consists of X401 with a frequency of 14.4MHz. The reference oscillator frequency is stabilized by the Temperature and drives a divider to produce a comparison frequency.

This comparison frequency is selected by decoding the first three bits of the data input from microcomputer.

*** Programmable divider**

The programmable divider in IC401 consists of a two-modulus prescaler with a 7 bit control register followed by an 11-bit internal programmable divider. The overall division ratio is selected by a single 19-bit word located on the serial data bus.

*** Phase Comparator**

A digital-type phase comparator in IC401 with output (pin 5) and an open drain lock detect output (pin 14) compares divided VCO frequency with the comparison frequency. It generates a correction voltage that is applied to a low-pass filter consisting of R406, C25 and R403, R405, R19, C405, C406 then sent to the VCO circuit.

*** VCO Circuit**

The transmit/receive frequency is directly generated by the Colpitts oscillation circuit contains Q302, Q303. The oscillation frequency is variable by applying the VCO control voltage to variable capacitors D310, D311, D303, D312, D306, D307(TX) and D304, D305, D301, D302(RX). To switch between transmit and receive frequencies, Q305, Q306 turn on, and Q302 (VCO for transmission) oscillates when the T/R pin is High.

2) TRANSMITTER

*** MIC AMP Circuit**

Voice signal from the microphone are applied to microphone amplifier IC602 through SP_JK JACK1.

IC602 contains a low-pass filter that has a 6dB/oct response between 300Hz and 3 kHz and eliminates harmonics above 3 kHz. The pre-emphasized audio signal is applied to RV301 from U606 pin 23 to adjust maximum frequency deviation.

*** VCO AND Amplifier**

The VCO signal output is amplified by Q301 and then fed to power module Q201 from Q205, Q203, Q202

*** TX Power Amplifier Circuit**

Q201 is provided approximately 7.5V DC power source.

RF power output is adjusted by D/A converter IC803.

Signals from Q201 is supplied through antenna switch D101, D3 to a low-pass filter made up of L101, L102, L103 and C101, C102, C103, C105, C106 then applied to Antenna Connector.

3) RECEIVER

*** ANT Switching Circuit**

Signals from antenna connector fed to the antenna switching circuit through the low pass filter consisting of L101, L102, L103, L105 and C101, C102, C103, C105, C106. In receive mode, D101, D3 is turned off, isolates the antenna from the transmitter circuit and matching circuitry, so that the incoming signals are fed to the Front-end through L105.

*** Front-end Amplifier Circuit**

The signals from the switching circuit are fed to the RF amplifier Q101 through a band pass filter made up of molded coil, varactor diode and capacitor.

*** First Mixer Circuit**

The amplified signals are fed to Gate 1 of the first mixer Q105 through C51.

First local oscillator signal is supplied to Gate 2 of Q105 from the VCO through C132 to convert the RF signals into 43.655MHz first IF signal.

*** IF Circuit**

The first IF signals from Q105 are fed to the matched pair crystal filter F101, then IF signals are amplified in Q103. And those signals are fed to U1 which is composed of the second local oscillator, second mixer, limiter amplifier, quadrature detector and active filter circuit. The second local oscillator at 43.2MHz with X401 and is fed to the second mixer with the first IF signals to convert into 455kHz second IF signals.

The second IF signals leave through pin 3, and are fed to external ceramic filters F101 which has excellent selectivity, then fed to U1 (pin 5) again to be amplified and detected. The detected AF signals are output from pin 9.

*** Audio and Squelch Circuit**

The detected audio signals are put through a 6dB/oct de-emphasis circuit made up of C162 and R153. The signal is then applied to audio power amplifier IC603 through audio signal processor IC606(Out pin16 through pin14) and the volume control SW701 to obtain enough power to driver the speaker.

Part of the recovered noise signal is fed to the integrated operational amplifier inside U1, which, with AMP (Q110), R147,C165,C166 makes up a low pass filter . The Audio signal processor reaches the integrated DC amplifier in Q110 which has hysteresis to prevent jitter. The sensitivity of squelch is adjusted by A/D of IC801.

4. ALIGNMENT PROCEDURE

Measurement Condition

The following sections describe the alignment procedure for HL-1511 Series LMR transceiver under the following reference environment conditions:

Temperature	:	25℃
Relative Humidity	:	65%
Power Supply Voltage	:	7.5VDC +/- 5%

Test Equipment / Tools required

The following list of equipment is recommended for use in setting up the radio properly. Please ensure the test equipment is calibrated according to the manufacturer's instructions:

- Frequency counter more than 400MHz +/-100Hz tolerance, high input impedance and high sensitivity
- FM Signal generator, 1GHz with adjustable frequency, FM deviation, and RF output attenuators. 50Ω Output impedance.
- Oscilloscope, high input impedance.
- 16Ω 1 Watt resistor as loudspeaker load
- Audio Signal Generator, 10Hz to 20KHz, 600Ω impedance with attenuators.
- RF Watt meter, with 50Ω 10 Watt termination resistor (Or RF Voltmeter with 50Ω termination and external 50Ω attenuators)
- Regulated Power Supply 7.5VDC 3A output
- Digital A-V-O Multi-meter
- SINAD Meter
- External Speaker Mic. plug (or special audio test jig)
- Interconnection test cable for RF and Control PCB
- Circuit Diagram for HL-1511Series
- PCB layout diagram for HL-1511 Series
- Tuning tools for RF/IF transformer and the VR potentiometers

Disassembling the unit

The antenna

Disconnect the antenna

The Cover

- Remove the battery.
- Remove the 2 screws.
- The case could then be opened for servicing.
- Be careful NOT to disconnect the pin connector between RF board and Control board.

The PCBs

- The radio consists of two PCBs, the RF (rear side) and control board (front side)..
- On the RF Board, connect ANT1 to a signal generator or RF power meter.
- On the RF Board, connect Power Supply to the battery terminal contacts.
- Connect External Speaker Mic Plug (or Audio Test Jig) to Jack1.

Transmitter Circuit Adjustment

Model : HL-1511

- Crystal frequency

On receiving mode, check Crystal output is at 14.4MHz

- Transmitter Frequency

Connect RF Power meter to ANT1, Activate PTT to transmit on 155.0250MHz(HL-1511). And Set RV401 for transmitting frequency error is within +/- 200Hz.

- Transmitter Output Power(Tune mode)

- Tune Mode ; Power SW on during (up + down + Fun key) keys push to test mode then push (■) to tuning mode. Push “■” to select [001P-xx] then PTT on, Push “up/down” after tuned and press to Enter key(Monitor Key). Where, 001 “P” means rf Power

Activate PTT to transmit on 155.0250MHz, Set Tune mode for rating power output at ANT1. And Set rf power output at ANT1 after changing Low power output mode.

- Transmitter Sub-Audible Tone Deviation

Set radio to transmit on Carrier frequency, with CDCSS code 023 and no audio modulation. Adjust RV601 for 0.45KHz deviation.

- Transmitter Deviation Limit

Set radio to transmit on Carrier frequency. At the external microphone input, inject 1KHz tone at -20dBm. Adjust RV301 for 2.0/4.0KHz deviation.

Receiver Circuit Adjustment

- FM Demodulator Adjustment

Set radio to receive on Carrier frequency, No CTCSS or DCS and any tone. Connect RF Signal Generator to ANT1, Set generator to frequency at -47dBm (50Ω) output with 1KHz tone modulation at 1.5KHz deviation.

- Receiver Squelch Adjustment

- Tune Mode ; Power SW on during (up + down + Fun key) keys push to test mode then push (■) to tuning mode. Push “■” to select [001S-xx] then PTT on, Push “up/down” after tuned and press to Enter key(Monitor Key). Where, 001 “S” means Squelch

After checking the receiver sensitivity, further lower the RF Signal Generator output to 8-10dB SINAD and observe the squelch circuit operates.

At tune mode

- The “001 F – A0” means 1ch, Front-end(RX sense), A0 hex Value(Up/Down)
- The “001 S – 00” means 1ch, Squelch(Close), 00 hex Value(Up/Down)
- The “001 S – 00 , H ” means 1ch, Opening Squelch, 00 hex Value(Up/Down)
- The “001 P – 60 ” means 1ch, RF Low Power, 60 hex Value(Up/Down)
- The “001 P – 88 , H” means 1ch, RF High Power, 88 hex Value(Up/Down)
- Channel change Method
; ■ key + Up key or ■ key + Down key

5. TECHNICAL SPECIFICATIONS

Model Number: HL -1521Series, Headline Systems Ltd.

A. GENERAL

1) Frequency Range	: 136~174 MHz
2) Modulation Type	: 8.5KOF3E (FM)
3) Channel capacity	: 99 channels
4) Channel spacing	: 12.5 KHz
5) Power Supply	: DC 7.5V, Ni-Mh or Li-ion(Optional) Rechargeable Pack
6) Current Drain	: High Transmitter (4W) -- < 1.8A (Ni-Mh or Li-ion(Optional) Rechargeable Pack) Low Transmitter (1W) --- < 0.8A (Ni-Mh or Li-ion(Optional) Rechargeable Pack) Receiver (1.0W) ----- < 200mA
7) Battery Life	: 10/14 hrs (Ni-Mh,1350 mA, Rechargeable Pack) (at 5%-5%-90% transmit-receive-standby cycles)
8) Operating Temperature	: -30℃ to + 60℃
9) Dimension	: 105(H) x 50(W) x 35(D) mm, Ni-Mh / 105(H) x 50(W) x 30(D) mm, Li-ion
10) Weight (W/Batteries)	: 290g (1350mAH, Ni-Mh battery) / 232g (1700mAH, Li-ion battery).

B. TRANSMITTER

1) Power Output	: High (5W), Low (1W)
2) Frequency Stability	: Better than +/- 5ppm within operating temperature
3) Hum & Harmonic	: -40dB (with 300Hz to 3KHz audio filter)
4) Spurious & Harmonics	: -65dBc

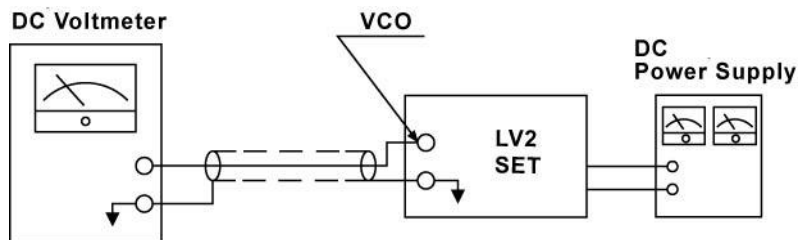
- 5) Audio Distortion : Less than 5% (1KHz tone 6 0% modulation)
 6) Audio Response @6dB/oct : +1 /- 3dB (pre-emphasized)

C. RECEIVER

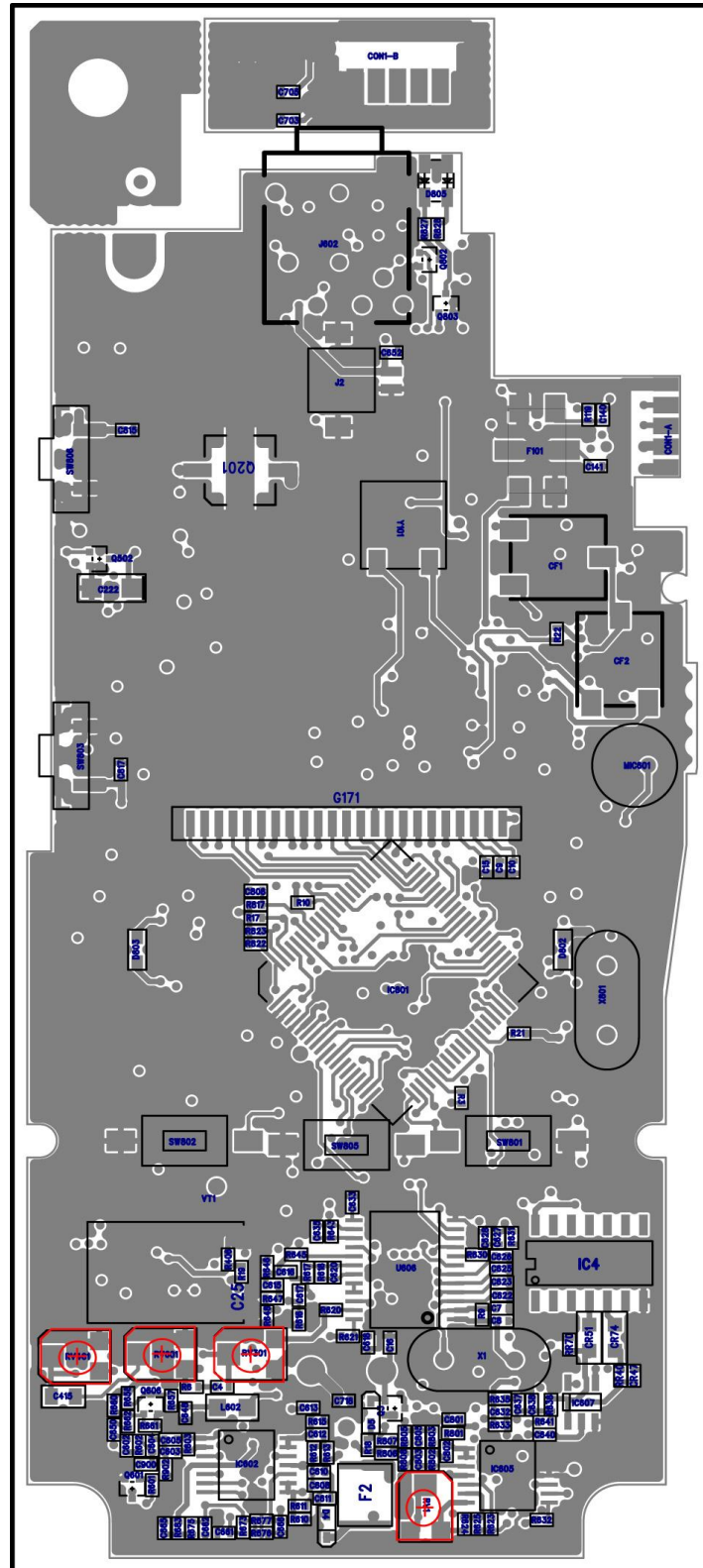
- 1) Sensitivity (12dB SINAD) : 0.25uV (-119dBm SINAD)
 2) Selectivity : -65dB
 3) Inter-modulation : -65dB
 4) Spurious and image rejection : -70dB
 5) Maximum Audio Output : More than 1W (15% distortion)
 6) Audio Distortion : less than 5%

D. VCO ALIGNED

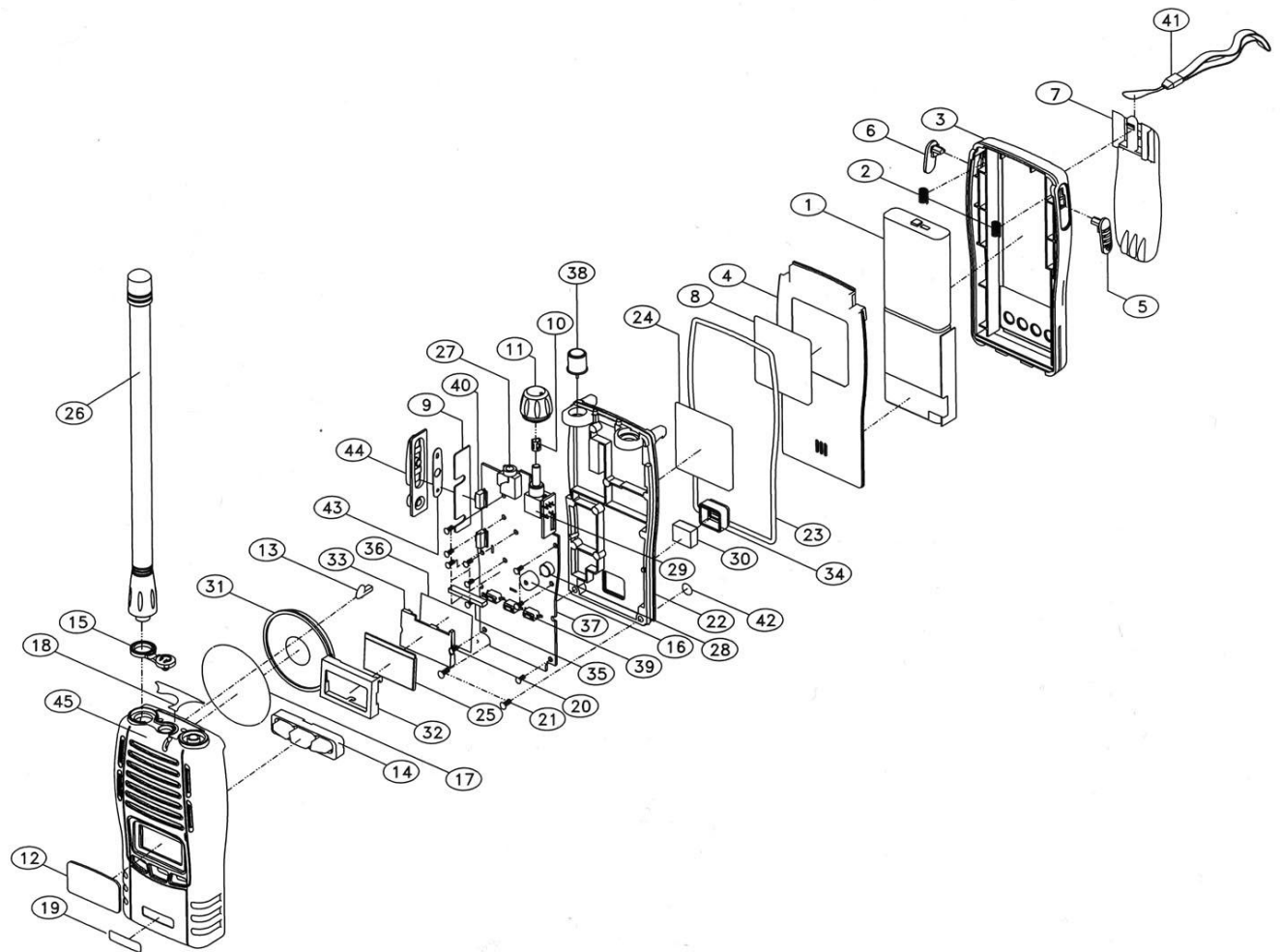
Step	Setting	Connection	Adjuster	Adjust for
1	Power on	With the use of dc voltmeter connect the positive terminal of voltmeter to VT test point of the pcb and negative terminal of the voltmeter to the ground. Measure the reading of VCO Voltage.	Rx[L304] Tx[L307]	DC3.8~4.0V[169.9750Mhz] DC4.4~4.6V[169.9750Mhz]



6.ADJUSTMENT REFERENCE POINTS



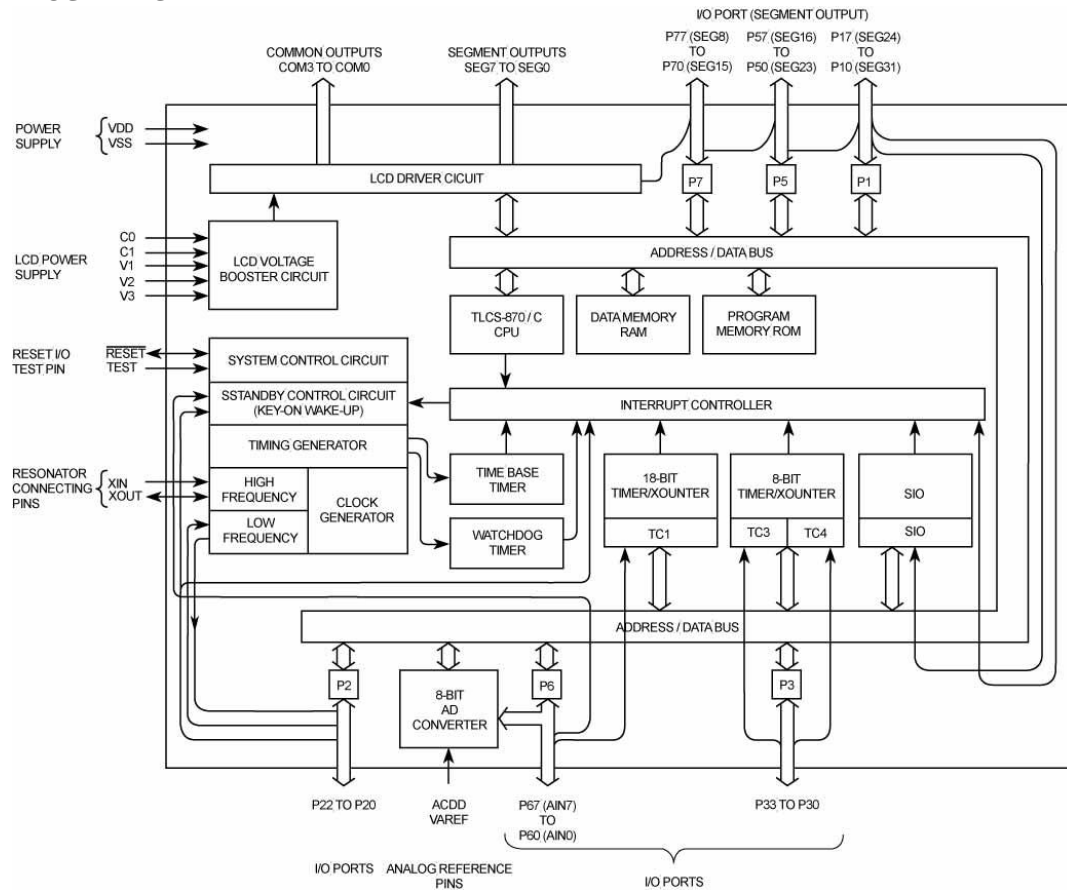
7. EXPLODED VIEW



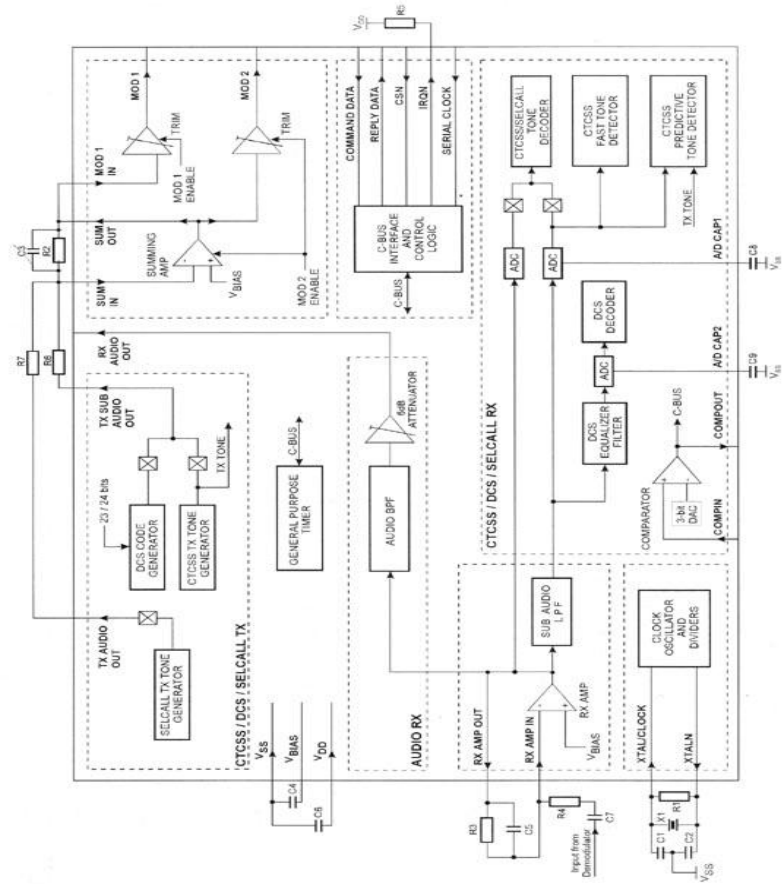
8. PARTS LIST, PCB LAYOUT , CIRCUIT DIAGRAM, BLOCK DIAGRAM & OUTER DRAWINGS.

IC 801 H8/38327

BLOCK DIAGRAM



IC2 FX828D5



PARTLIST

모품목:LMR-00018-PHBKGS HL-1511 (HP) USA GS

ITEM-CODE	ITEM-NAME	Q'TY	LOCATION	MANUFACTURE
LMR-00018-PHBKGS	HL-1511 (HP) USA GS (BLACK)			
LMR-00018-BLA	BELT CLIP ASSY			
680-00021-AA	PIN	1.000		으뜸정밀
780-00036-AA	SPRING	1.000		SEUNG WOO SPRING
870-00037-BB	BELT CLIP	1.000		DEADONG TECH
870-00038-BA	BELT CLIP BRACKET	1.000		DEADONG TECH
LMR-00018-COA	COVER ASSY			
740-00005-AA	PTT PLATE	1.000		HEADTECH IND(PHILS)
780-00020-AA	LOCKING SPRING	1.000		HEADTECH IND(PHILS)
830-00088-AA	VOLUME KNOB	1.000		HEADTECH IND(PHILS)
850-00054-AA	LENS	1.000		SEIL ELECT(PERSON)
860-00030-AA	INDICATOR	1.000		HEADTECH IND(PHILS)
880-00083-AA	KEY PAD	1.000		DONGHWAN PHILS.
880-00085-AA	MIC CAP	1.000		DONGHWAN PHILS.
880-00116-AA	EAR CAP	1.000		HEADTECH IND(PHILS)
900-00012-BA	SPONGE MIC	1.000		JEON JIN IND
900-00085-AA	SPONGE	1.000		JEON JIN IND
900-00086-AA	SPONGE	2.000		JEON JIN IND
900-00087-AA	SPONGE	1.000		JEON JIN IND
901-00017-AA	FELT SPK	1.000		HAN CO.LTD
911-00023-AA	TOP PLATE	1.000		SEIL ELECT(PERSON)
911-00024-AA	FRONT PLATE	1.000		SEIL ELECT(PERSON)
991-00002-AA	SILICONE BOND	1.000		DUKSIN SIRICON
LMR-00018-MFA	MAIN FRAME ASSY			
611-00003-AA	SCREW	8.000		HAP DONG IND
643-00003-AA	SCREW	2.000		HAP DONG IND
700-00005-AB	MAIN FRAME	1.000		NAMSAN DC
881-00036-AA	GASKET MAIN	1.000		DONGHWAN PHILS.
900-00088-AA	SPONGE	1.000		JEON JIN IND
990-00642-AA	NAME LABEL	1.000		HEADLINE
LMR-00018-MPA	MAIN PCB MECHANICAL			
770-00102-AA	VCO CAN FOR LMR	1.000		HEADTECH KOR
770-00108-AA	LCD HOUSING	1.000		HEADTECH IND(PHILS)
860-00031-AA	REFLECTOR	1.000		HEADTECH IND(PHILS)
881-00037-AA	GASKET POWER	1.000		DONGHWAN PHILS.

ITEM-CODE	ITEM-NAME	Q'TY	LOCATION	MANUFACTURE
920-00070-AA	WHITE SHEET	1.000		HAN CO.LTD
LMR-00018-MPM	MAIN PCB MANUAL ASSY	1.000		
ALD-Q0720-SA	LCD DISPLAY (DOTS)	1.000	LCD1	SECHANG INTERNATION
CPB-105JM-DA	METALLIZED POLYESTER FILM CONDENSER	1.000	C25	DAE HUNG ELECT
JDN-35M7M-IA	STEREO JACK	1.000	J602	인성전자
MCN-44PBB-BB	MIC CONDENSER	1.000	MIC601	카모스테크
NCS-02TD1-GA	CONNECTER SOCKET	1.000	J1	신명 A.T
NPC-GR254-GA	POWER CONTACT	1.000	J701	신명 A.T
NSM-00005-AA	CONNECTOR ANT	1.000		TACHYON COMET
XCN-4000A-HA	CRYSTAL	1.000	X801	HEILL TECH CO
XCN-4032A-KA	CRYSTAL	1.000	X1	EXA ENC
ZME-203KM-TA	POTENTIO METER	1.000	SW701	TAEHEUNG ELECT
ZSP-40AE2-MA	SPEAKER	1.000	SPK1	ACE ACOUSTICS CO
LMR-00018-MPS	MAIN PCB SMD ASSY			
ALC-1204W-SA	LED DUAL CHIP	1.000	D805	STANLEY(CIEAMA KOREA
AMC-1113F-SB	LED LAMP CHIP	2.000	D802,803	STANLEY(CIEAMA KOREA
B16-120NJ-TA	COIL CHIP	1.000	L117	TAIYOYUDEN
B16-121NJ-TA	COIL CHIP	3.000	L301,210,211	TAIYOYUDEN
B16-181NJ-TA	COIL CHIP	1.000	L108	TAIYOYUDEN
B16-221NJ-TA	COIL CHIP	4.000	L302,308,201,113	TAIYOYUDEN
B16-270NJ-TA	COIL CHIP	1.000	L118	TAIYOYUDEN
B16-390NJ-TA	COIL CHIP	1.000	L205	TAIYOYUDEN
B16-470NJ-TA	COIL CHIP	1.000	L208	TAIYOYUDEN
B16-680NJ-TA	COIL CHIP	1.000	L116	TAIYOYUDEN
BBA-121VS-SA	CHIP BEAD	1.000	R901	COIL AND PARTS COM
BBA-320VS-SA	CHIP BEAD	1.000	L501	COIL AND PARTS COM
BBA-451VS-SA	CHIP BEAD	2.000	L601,602	COIL AND PARTS COM
BSC-3010C-AA	COIL SPRING	1.000	L202	PHILFINE ELECTRONICS
BSC-3516E-AA	COIL SPRING	2.000	L207,304	PHILFINE ELECTRONICS
BSC-H020D-AE	SPRING COIL	1.000	L203	PHILFINE ELECTRONICS
BSC-H070A-AH	SPRING COIL	1.000	L101	PHILFINE ELECTRONICS
BSC-H070D-AD	SPRING COIL	1.000	L204	PHILFINE ELECTRONICS
BSC-H070D-AE	SPRING COIL	4.000	L105,103,102,307	PHILFINE ELECTRONICS
BWC-560GN-AA	COIL WOUND	2.000	L110,111	ABCO
BWC-680GN-AA	COIL WOUND	2.000	L106,2	ABCO
BWC-681JN-AA	COIL WOUND	1.000	L190	ABCO
BWC-821JN-AA	COIL WOUND	3.000	L120,305,306	ABCO
C10-010ZB-AA	CHIP CERAMIC 1005	4.000	C316,315,908,907	SAMYOUNG ELECT
C10-020ZC-AA	CHIP CERAMIC 1005	2.000	C116,153	SAMYOUNG ELECT
C10-030ZC-AA	CHIP CERAMIC 1005	1.000	C323	SAMYOUNG ELECT

ITEM-CODE	ITEM-NAME	Q'TY	LOCATION	MANUFACTURE
C10-040ZC-AA	CHIP CERAMIC 1005	4.000	C1,112,130,51	SAMYOUNG ELECT
C10-050ZC-AA	CHIP CERAMIC 1005	3.000	C126,318,23	SAMYOUNG ELECT
C10-060ZC-AA	CHIP CERAMIC 1005	1.000	C141	SAMYOUNG ELECT
C10-100ZJ-AA	CHIP CERAMIC 1005	7.000	C233,132,133,50, 135,632,306	SAMYOUNG ELECT
C10-101ZJ-AA	CHIP CERAMIC 1005	1.000	C632	SAMYOUNG ELECT
C10-102ZK-AA	CHIP CERAMIC 1005	35.000	C410,220,652,658, 662,667,47,46,217, 190,703,705,706,707, 715,810,811,815~818, 146,646,118,120,201, 615,645,606,160,150, 412,502,136,820	SAMYOUNG ELECT
C10-103ZK-AA	CHIP CERAMIC 1005	18.000	C142,148,402,416, 418,617,643,656,657, 670,822,801,805.227. 2.111.177.145	SAMYOUNG ELECT
C10-104ZZ-AA	CHIP CERAMIC 1005	31.000	C123,301,310,417, 508,618,627,630,633, 602,661,403,311,641, 650,665,673,701,712, 808,812,616,813,221, 308,168,19,18,181, 157,156	SAMYOUNG ELECT
C10-105ZK-AA	CHIP CERAMIC 1005	13.000	C640,653,660,804, 821,9~15,4	SAMSUNG MECHA PHILS
C10-120ZJ-AA	CHIP CERAMIC 1005	1.000	C137	SAMYOUNG ELECT
C10-150ZJ-AA	CHIP CERAMIC 1005	5.000	C122,303,320,191,22	SAMYOUNG ELECT
C10-153ZK-AA	CHIP CERAMIC 1005	1.000	C608	SAMYOUNG ELECT
C10-180ZJ-AA	CHIP CERAMIC 1005	2.000	C231,151	SAMYOUNG ELECT
C10-181ZJ-AA	CHIP CERAMIC 1005	1.000	C611	SAMSUNG MECHA PHILS
C10-182ZK-AA	CHIP CERAMIC 1005	1.000	C162	SAMSUNG MECHA PHILS
C10-220ZK-AA	CHIP CERAMIC 1005	7.000	C806,807,7,8,225, 228,R119	SAMSUNG MECHA PHILS
C10-221ZK-AA	CHIP CERAMIC 1005	8.000	C623,625,626,635, 655,420,421,422	SAMSUNG MECHA PHILS
C10-222ZK-AA	CHIP CERAMIC 1005	2.000	C637,163	SAMSUNG MECHA PHILS
C10-223ZK-AA	CHIP CERAMIC 1005	1.000	C216	SAMSUNG MECHA PHILS
C10-270ZJ-AA	CHIP CERAMIC 1005	1.000	C321	SAMSUNG MECHA PHILS
C10-331ZK-AA	CHIP CERAMIC 1005	4.000	C601,166,165,164	SAMSUNG MECHA PHILS
C10-333ZK-AA	CHIP CERAMIC 1005	1.000	C638	SAMSUNG MECHA PHILS
C10-390ZJ-AA	CHIP CERAMIC 1005	1.000	C305	SAMSUNG MECHA PHILS
C10-471ZK-AA	CHIP CERAMIC 1005	14.000	C307,413,501,505, 507,510,647,648,651, 6,226,230,238,5	SAMSUNG MECHA PHILS

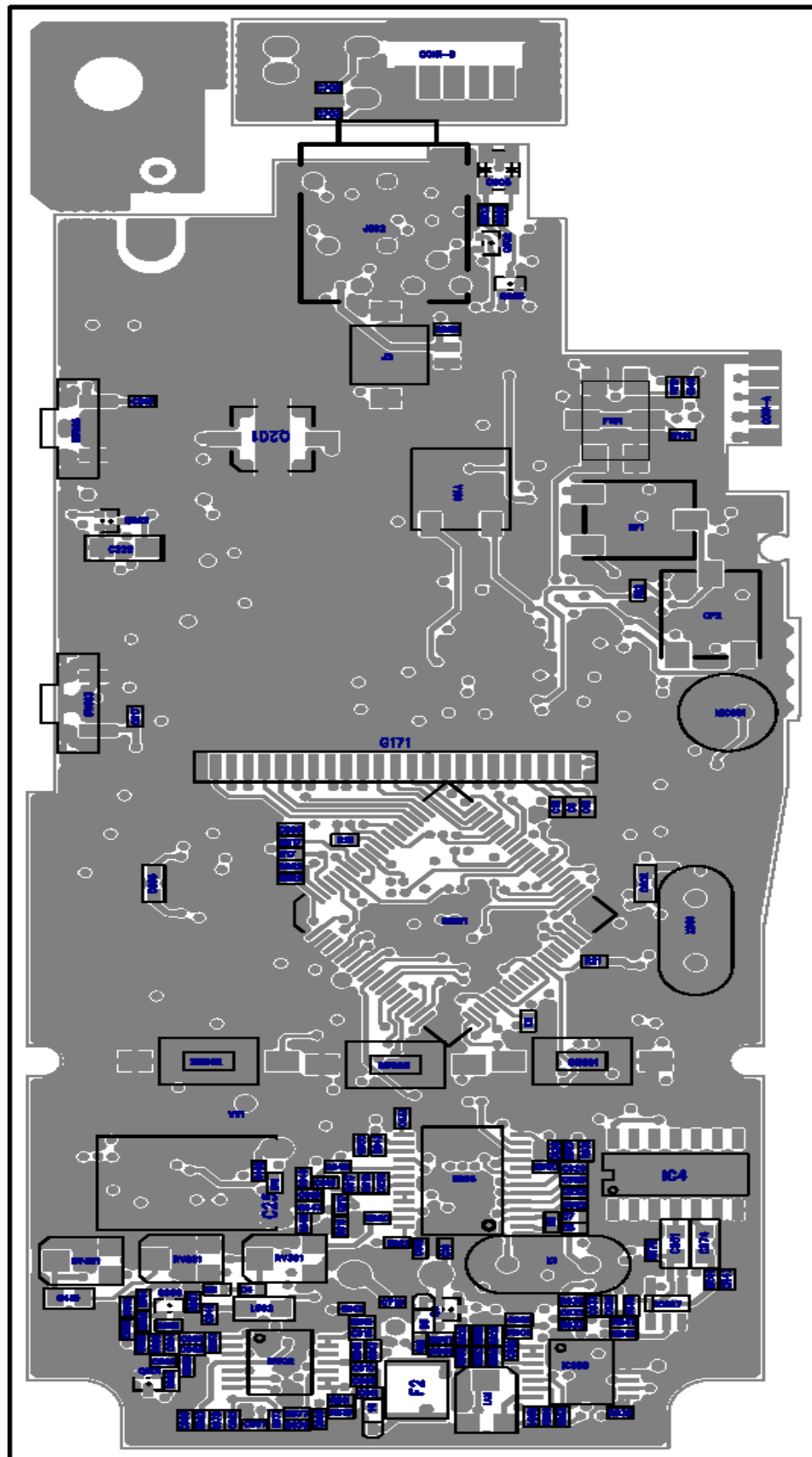
ITEM-CODE	ITEM-NAME	Q'TY	LOCATION	MANUFACTURE
C10-472ZK-AA	CHIP CERAMIC 1005	2.000	C174,613	SAMSUNG MECHA PHILS
C10-473ZK-AA	CHIP CERAMIC 1005	3.000	C178,802,406	SAMSUNG MECHA PHILS
C10-560ZJ-AA	CHIP CERAMIC 1005	2.000	R407,C158	SAMSUNG MECHA PHILS
C10-561ZK-AA	CHIP CERAMIC 1005	3.000	C803,211,232	SAMSUNG MECHA PHILS
C10-562ZK-AA	CHIP CERAMIC 1005	3.000	C607,612,628	SAMSUNG MECHA PHILS
C10-681ZK-AA	CHIP CERAMIC 1005	1.000	C3	SAMSUNG MECHA PHILS
C10-683ZK-AA	CHIP CERAMIC 1005	1.000	C405	SAMSUNG MECHA PHILS
C16-015ZC-AB	CHIP CERAMIC 1608	1.000	C103	SAMSUNG MECHA PHILS
C16-050ZC-AB	CHIP CERAMIC 1608	1.000	C214	SAMSUNG MECHA PHILS
C16-150ZJ-AB	CHIP CERAMIC 1608	1.000	C106	SAMSUNG MECHA PHILS
C16-180ZJ-AB	CHIP CERAMIC 1608	2.000	C101,205	SAMSUNG MECHA PHILS
C16-390ZJ-AB	CHIP CERAMIC 1608	2.000	C102,105	SAMSUNG MECHA PHILS
C16-470ZJ-AB	CHIP CERAMIC 1608	1.000	C202	SAMSUNG MECHA PHILS
C16-471ZJ-AB	CHIP CERAMIC 1608	1.000	C107	SAMSUNG MECHA PHILS
C16-560ZK-AB	CHIP CERAMIC 1608	2.000	C215,219	SAMSUNG MECHA PHILS
C16-620ZJ-AB	CHIP CERAMIC 1608	1.000	C203	SAMSUNG MECHA PHILS
C20-105ZZ-AB	CHIP CERAMIC 2012	1.000	C671	SAMSUNG MECHA PHILS
C20-225ZZ-AA	CHIP CERAMIC 2012	2.000	C631,180	SAMSUNG MECHA KOR
C20-475ZZ-AA	CHIP CERAMIC 2012	11.000	C401,415,672,702, 708,713,663,210,143, 20,161	SAMSUNG MECHA KOR
CTC-010AM-FA	CHIP TANTALUM	1.000	C636	PARTSNIC
CTC-100AM-FA	CHIP TANTALUM	3.000	C17,222,26	PARTSNIC
CTC-101CM-FB	CHIP TANTALUM	1.000	C675	PARTSNIC
CTC-220ZM-FA	CHIP TANTALUM	3.000	C668,800,21	PARTSNIC
DBC-S114E-BA	DIODE BAND S/W CHIP	6.000	D202,5,110,101,102,3	KEC GURO
DIC-S120E-AA	DIODE SI CHIP	2.000	D1,2	KEC GURO
DIC-S121E-AA	DIODE SI CHIP	1.000	D801	KEC GURO
DRC-SMA14-KA	DIODE RECTIFIER	1.000	D701	KEC GURO
DSC-S7000-AA	DIODE S/W	2.000	D103,111	KWANG ELECT
DVC-0273U-AA	DIODE VARICAP CHIP	10.000	D301,302,305,306, 307,310,311,303, 304,312	KEC GURO
DVC-154CS-AA	DIODE VARICAP CHIP	8.000	D105,106,107,108, 16,17,112,113	KEC GURO
DVC-SV270-TA	DIODE VIRICAP CHIP	1.000	D308	TOSHIBA
DZC-5115E-AA	DIODE ZENER CHIP	1.000	D201	KEC GURO
DZC-9115E-AA	DIODE ZENER CHIP	1.000	D4	KEC GURO
FCC-455F3-TA	FILTER CERAMIC	1.000	CF2	SEOUL TOKO
FCC-455G3-TA	FILTER CERAMIC	1.000	CF1	SEOUL TOKO

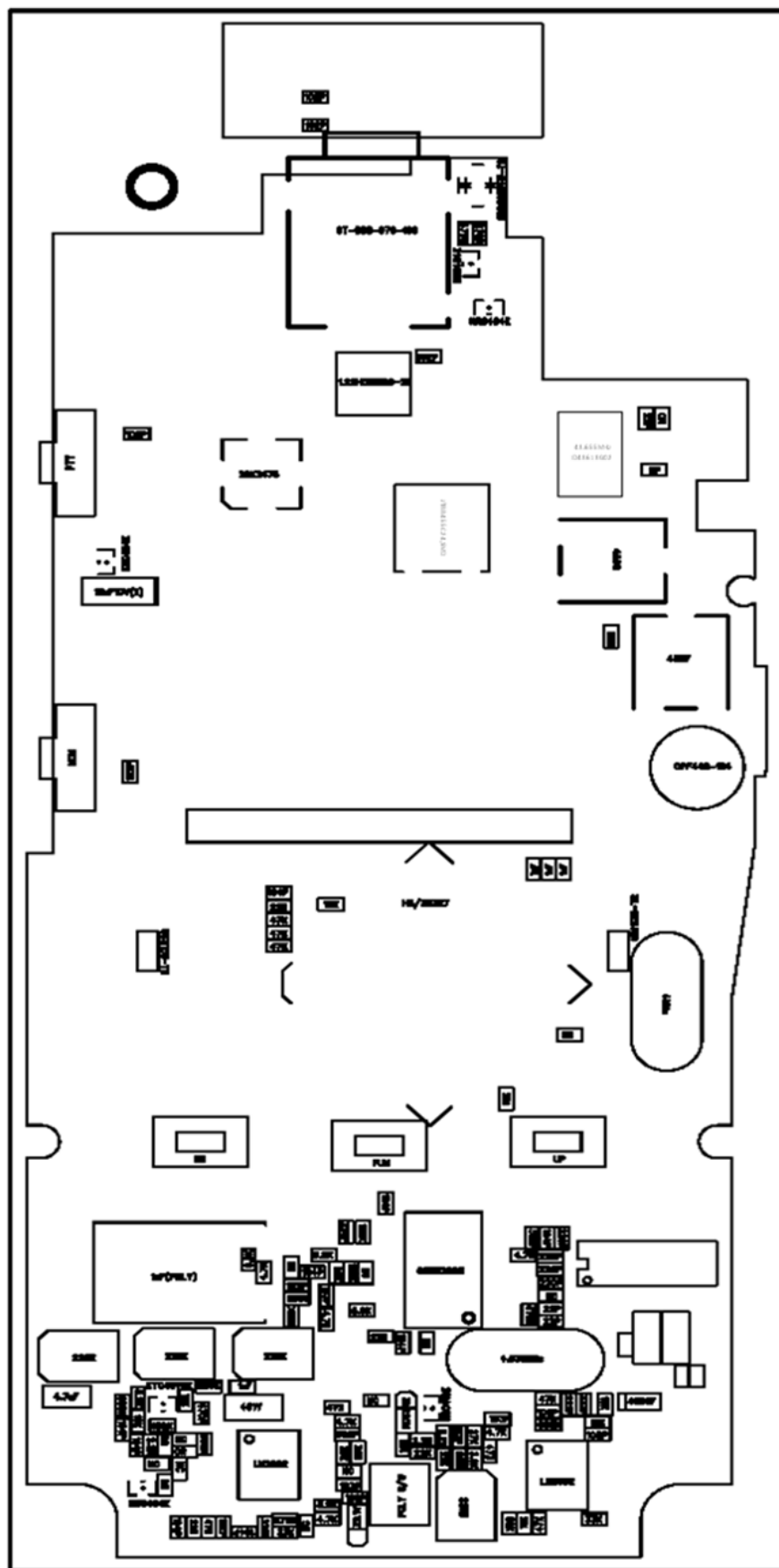
ITEM-CODE	ITEM-NAME	Q'TY	LOCATION	MANUFACTURE
FMC-436CP-FA	CRYSTAL MCF	1.000	F101	ALPHA COMPONENT
IAA-7233D-SA	IC AUDIO AMP	1.000	IC603	BUKSUNG COMPONENTS
IAP-828D5-CA	IC AUDIO PROCSSOR	1.000	U606	CML MICROCIRCUITS(UK
ICP-F8327-TA	CPU IC (FLASH)	1.000	IC801	RENESAS TECHNOLOGY
IDA-62334-MA	IC D/A SMD	1.000	IC803	MITSUBISHI
IEE-24C32-MA	IC EEPROM SMD	1.000	IC802	MICRO CHIP
IFI-31136-TA	IC IF SMD	1.000	U1	TOSHIBA
IOA-2902V-JA	IC AMP SSOP	2.000	IC602,605	J.R.C
IOA-75W01-DA	IC OP AMP SMD	1.000	IC501	TOSHIBA
IPL-1503C-UA	IC PLL	1.000	IC401	FUJITSU
IRG-250CS-TA	IC REGULATOR	1.000	IC701	SEOUL TOKO
ISW-4S66F-TA	IC ANALOG-SW	2.000	IC601,607	TOSHIBA
NCH-02HC1-GA	CONNECTER HEADER	1.000	J2	신명 A.T
PFM-00151-BE	PCB MAIN (HL-1511)	1.000		CHINA KAMFAI PCB
PFS-00048-BA	PCB SUB	1.000		CHINA KAMFAI PCB
R10-000AJ-AA	FILM CHIP RESISTOR	6.000	R301,601,126,C604,56,603	SAMSUNG MECHA PHILS
R10-100AJ-AA	FILM CHIP RESISTOR	3.000	R401,682,408	SAMSUNG MECHA PHILS
R10-101AJ-AA	FILM CHIP RESISTOR	6.000	R209,14.116,302,105,118	SAMSUNG MECHA PHILS
R10-102AJ-AA	FILM CHIP RESISTOR	6.000	R207,515,410.413.415.416	SAMSUNG MECHA PHILS
R10-103AJ-AA	FILM CHIP RESISTOR	25.000	R217,303,307,308,315,316,411,412,512,656,657,662,811,305,3,4.10.13.11.12,127,215,125,680,213	SAMSUNG MECHA PHILS
R10-104AJ-AA	FILM CHIP RESISTOR	12.000	R102,103,106,107,208,647,651,815,312,322,150,311	SAMSUNG MECHA PHILS
R10-105AJ-AA	FILM CHIP RESISTOR	1.000	R513	SAMSUNG MECHA PHILS
R10-122AJ-AA	FILM CHIP RESISTOR	1.000	R672	SAMSUNG MECHA PHILS
R10-124AJ-AA	FILM CHIP RESISTOR	1.000	R643	SAMSUNG MECHA PHILS
R10-152AJ-AA	FILM CHIP RESISTOR	1.000	R206	SAMSUNG MECHA PHILS
R10-154AF-BA	FILM CHIP RESISTOR	2.000	R701,702	DELTA CORP
R10-154AJ-AA	FILM CHIP RESISTOR	4.000	R607,661,618,120	SAMSUNG MECHA PHILS
R10-183AJ-AA	FILM CHIP RESISTOR	4.000	R625,641,18,638	SAMSUNG MECHA PHILS
R10-184AF-BA	FILM CHIP RESISTOR	3.000	R503,506,510	DELTA CORP
R10-184AJ-AA	FILM CHIP RESISTOR	2.000	R652,147	SAMSUNG MECHA PHILS
R10-220AJ-AA	FILM CHIP RESISTOR	9.000	R621,683,817,820,835,837,212,216,222	SAMSUNG MECHA PHILS
R10-221AJ-AA	FILM CHIP RESISTOR	3.000	R201,826,121	SAMSUNG MECHA PHILS

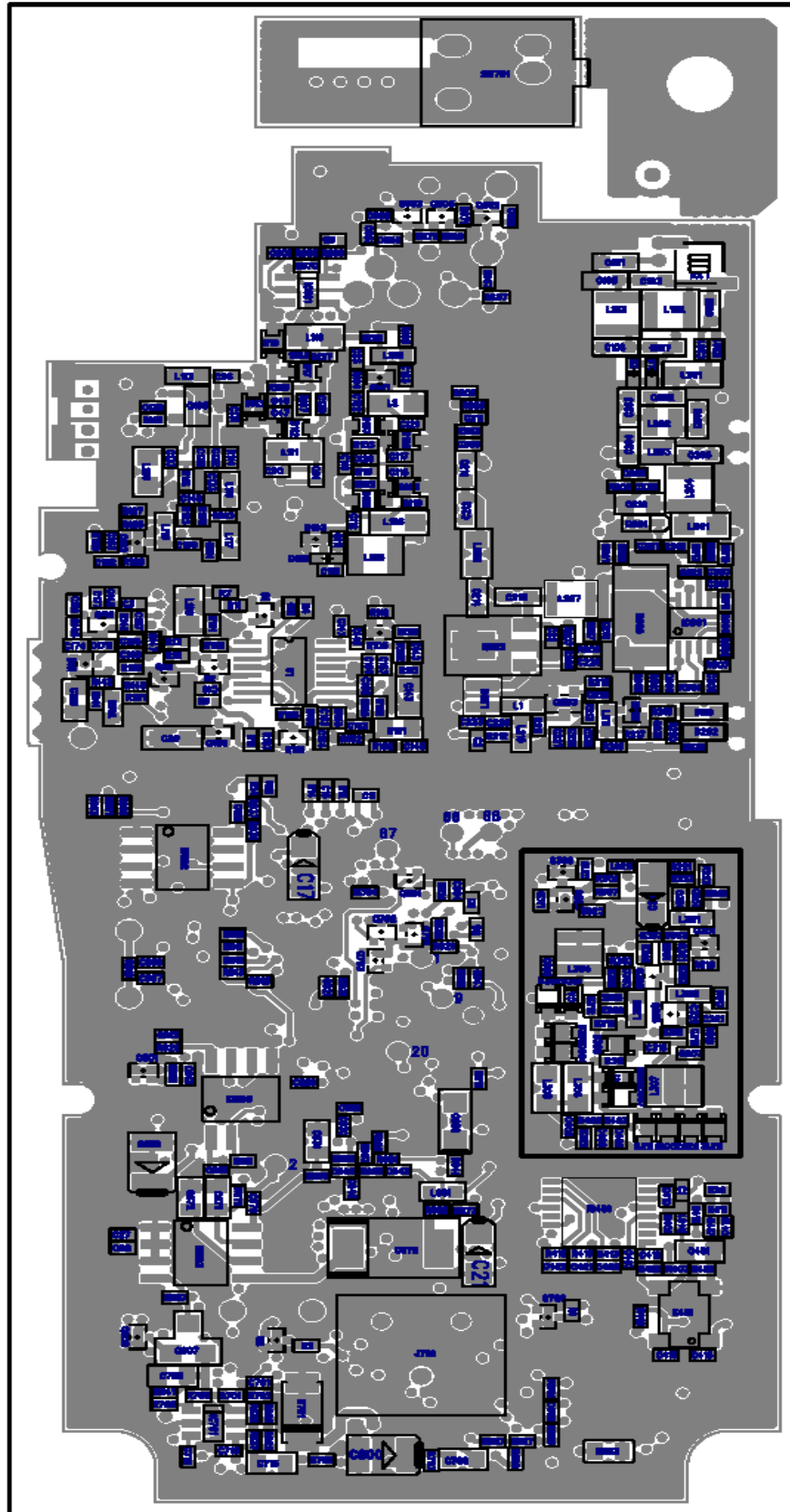
ITEM-CODE	ITEM-NAME	Q'TY	LOCATION	MANUFACTURE
R10-222AJ-AA	FILM CHIP RESISTOR	6.000	R602,663,665,807, 220,128	SAMSUNG MECHA PHILS
R10-223AJ-AA	FILM CHIP RESISTOR	8.000	R511,806,808,812, 8,7,16,5	SAMSUNG MECHA PHILS
R10-224AF-BA	FILM CHIP RESISTOR	4.000	R501,502,507,508	DELTA CORP
R10-224AJ-AA	FILM CHIP RESISTOR	4.000	R631,648,6,606	SAMSUNG MECHA PHILS
R10-270AJ-AA	FILM CHIP RESISTOR	2.000	R153,158	SAMSUNG MECHA PHILS
R10-271AJ-AA	FILM CHIP RESISTOR	3.000	R123,828,402	SAMSUNG MECHA PHILS
R10-272AJ-AA	FILM CHIP RESISTOR	3.000	R318,145,156	SAMSUNG MECHA PHILS
R10-273AJ-AA	FILM CHIP RESISTOR	2.000	R803,636	SAMSUNG MECHA PHILS
R10-274AJ-AA	FILM CHIP RESISTOR	2.000	R655,677	SAMSUNG MECHA PHILS
R10-331AJ-AA	FILM CHIP RESISTOR	4.000	R221,223,306,317	SAMSUNG MECHA PHILS
R10-332AJ-AA	FILM CHIP RESISTOR	4.000	R148,122,20,155	SAMSUNG MECHA PHILS
R10-333AJ-AA	FILM CHIP RESISTOR	6.000	R205,632,637,676, 203,1	SAMSUNG MECHA PHILS
R10-334AJ-AA	FILM CHIP RESISTOR	2.000	R146,673	SAMSUNG MECHA PHILS
R10-392AJ-AA	FILM CHIP RESISTOR	1.000	R802	SAMSUNG MECHA PHILS
R10-393AJ-AA	FILM CHIP RESISTOR	4.000	R608,612,613,626	SAMSUNG MECHA PHILS
R10-394AJ-AA	FILM CHIP RESISTOR	1.000	R151	SAMSUNG MECHA PHILS
R10-470AJ-AA	FILM CHIP RESISTOR	2.000	R140,320	SAMSUNG MECHA PHILS
R10-471AJ-AA	FILM CHIP RESISTOR	2.000	R827,115	SAMSUNG MECHA PHILS
R10-472AJ-AA	FILM CHIP RESISTOR	13.000	R610,615,616,630, 670,801,810,671,605, 218,19,403,405	SAMSUNG MECHA PHILS
R10-473AJ-AA	FILM CHIP RESISTOR	23.000	R2,104,143,622,623, 635,653,666~668,675, 703,813,818,821~823, 825,836,642,17,304, 114	SAMSUNG MECHA PHILS
R10-474AJ-AA	FILM CHIP RESISTOR	2.000	R816,9	SAMSUNG MECHA PHILS
R10-475AJ-AA	FILM CHIP RESISTOR	1.000	R678	SAMSUNG MECHA PHILS
R10-562AJ-AA	FILM CHIP RESISTOR	2.000	R157,620	SAMSUNG MECHA PHILS
R10-563AJ-AA	FILM CHIP RESISTOR	1.000	R141	SAMSUNG MECHA PHILS
R10-564AJ-AA	FILM CHIP RESISTOR	1.000	R603	SAMSUNG MECHA PHILS
R10-682AJ-AA	FILM CHIP RESISTOR	4.000	R681,321,645,406	SAMSUNG MECHA PHILS
R10-683AJ-AA	FILM CHIP RESISTOR	3.000	R617,624,22	SAMSUNG MECHA PHILS
R10-684AJ-AA	FILM CHIP RESISTOR	2.000	R660,633	SAMSUNG MECHA PHILS
R10-822AJ-AA	FILM CHIP RESISTOR	3.000	R611,658,805	SAMSUNG MECHA PHILS
R25-901FF-BA	FILM CHIP RESISTOR	1.000	R505	DELTA CORP
RSC-223ZN-JA	CHIP SEMI RESISTOR	1.000	RV1	BLUE PARTS COPORATION
RSC-224ZN-JA	CHIP SEMI RESISTOR	3.000	RV301,401,601	BLUE PARTS COPORATION
RTC-103ZJ-JA	CHIP THERMISTOR	1.000	R142	MAMI CHIPS KOREA

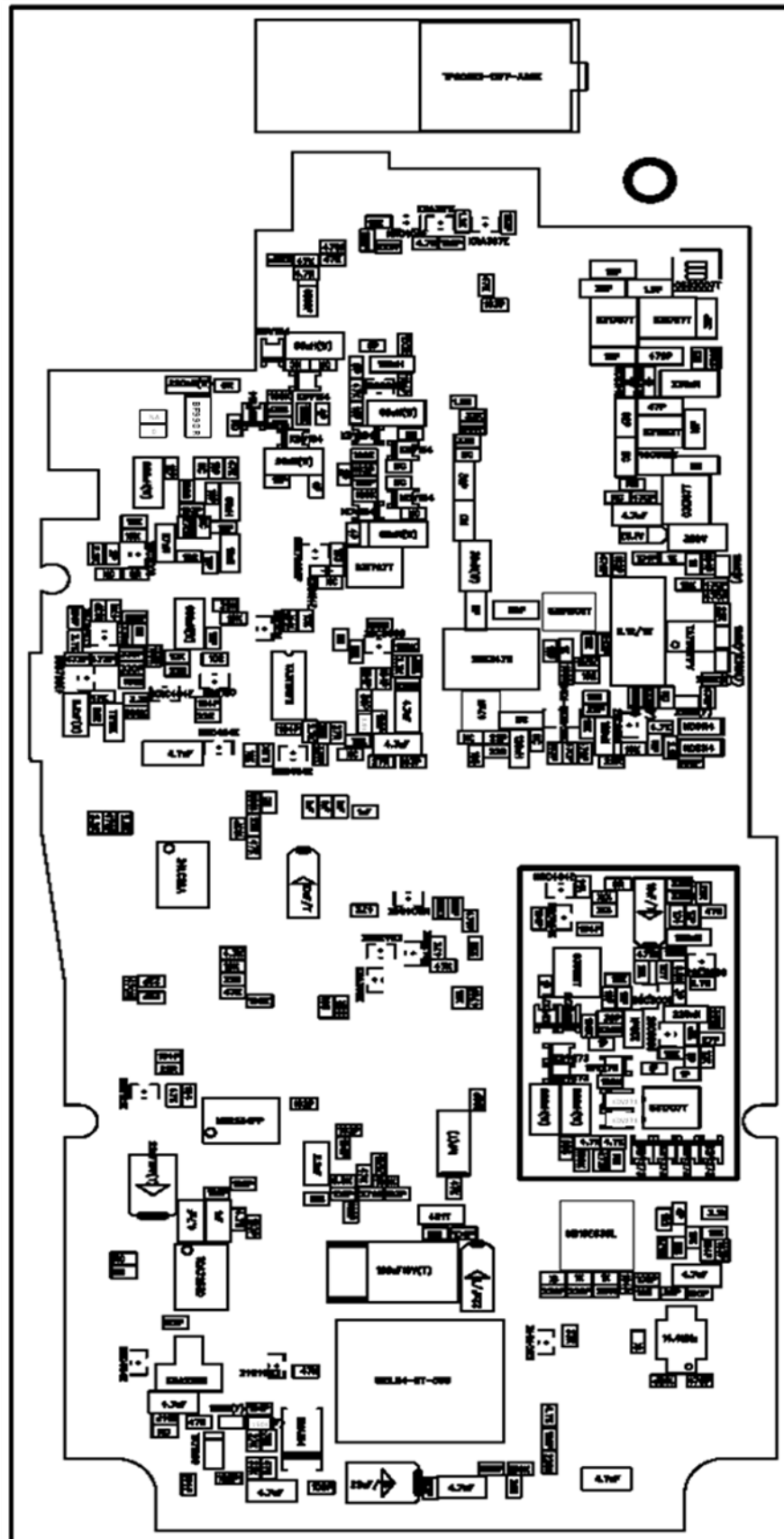
ITEM-CODE	ITEM-NAME	Q'TY	LOCATION	MANUFACTURE
SPO-C260F-CA	POLY SWITCH	1.000	F2	청호세이프텍(주)
STA-101HC-SA	TACT S/W SMD	3.000	SW801,802,805	SEKWANG ELECT
STA-101VC-DA	TACT S/W	2.000	SW803,806	DEAJIN IND
TRA-C404E-AA	TRANSISTOR BRT	14.000	Q2,112,305,306,502, 601,603,608,700,108, 803,802,801,111	KEC GURO
TRA-C410E-AA	TRANSISTOR	1.000	Q3	KEC GURO
TRC-226YU-NA	TRANSISTOR	1.000	Q203	NEC
TRC-3475C-DA	MOS FET-TR	1.000	Q202	TOSHIBA
TRC-3476M-DA	MOS FET-TR	1.000	Q201	TOSHIBA
TRC-4075G-AA	TRANSISTOR	2.000	Q110,606	KEC GURO
TRC-5006E-TA	TRANSISTOR	7.000	Q101,102,205,301, 302,303,103	NEC
TRC-BF998-PB	MOS-FET (Dual-gate)	1.000	Q105	PHILIPS
TRR-A226S-AA	TRANSISTOR BRT	1.000	Q607	KEC GURO
TRR-A301E-AA	TRANSISTOR	1.000	Q605	KEC GURO
TRR-A305E-AA	TRANSISTOR BRT	3.000	Q701,702,703	KEC GURO
TRR-A307E-AA	TRANSISTOR	1.000	Q602	KEC GURO
XED-455TA-KB	CERAMIC DISCRIMINATOR	1.000	Y101	CHEQUERS ELECTRONIC
XTC-1440I-PA	VCTCXO	1.000	X401	E.L.M(PROSS KOREA)
LMR-00018-PKA	PACKING ASSY			
930-90170-AA	POLY BAG	2.000		IL SHIN
942-00040-BA	PAD	1.000		PHIL-S
950-00253-AA	OWNERS MANUAL	1.000		SANG JANG
970-00055-BA	INNER BOX	2.000		PHIL-S
970-00136-BA	GIFT BOX	1.000		CHANNEL LINE
980-00393-AA	OUT BOX	.100		PHIL-S
990-00641-AA	SERIAL BARCODE LABEL	2.000		CAVITE STICKER
990-00667-AA	REMOVE STICKER	1.000		CAVITE STICKER
ZAC-165HS-CA	ANTENNA,SMA,MOLD	1.000		TACHYON COMET
LMR-00018-PTA	PTT ASSY			
740-00006-AA	PTT INSERT	1.000		HEADTECH IND(PHILS)
880-00082-AA	PTT BUTTON	1.000		DONGHWAN PHILS.
LMR-00018-UCA	UPPER COVER ASSY			
810-00232-AA	UPPER COVER	1.000		HEADTECH IND(PHILS)

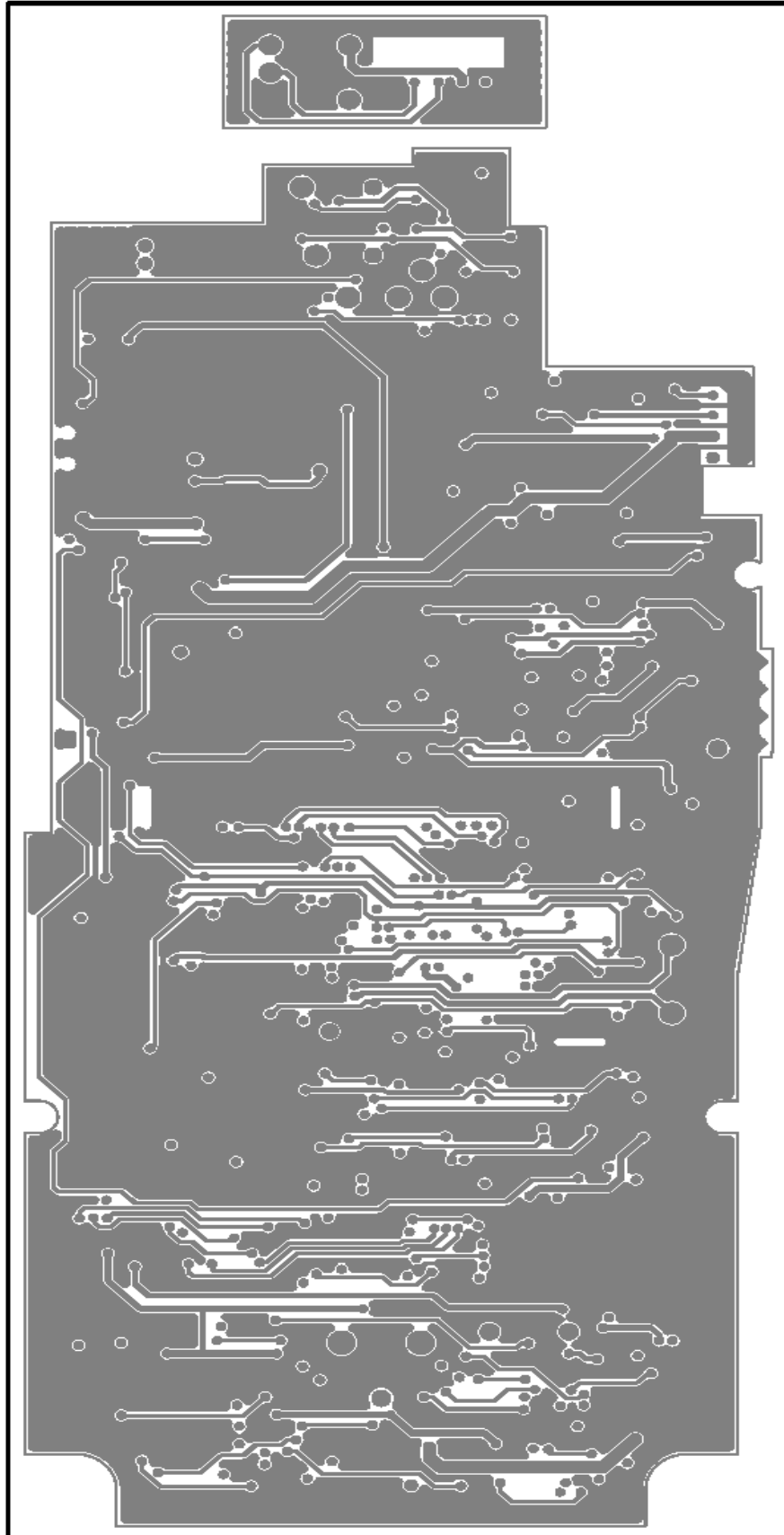
PCB LAYOUT

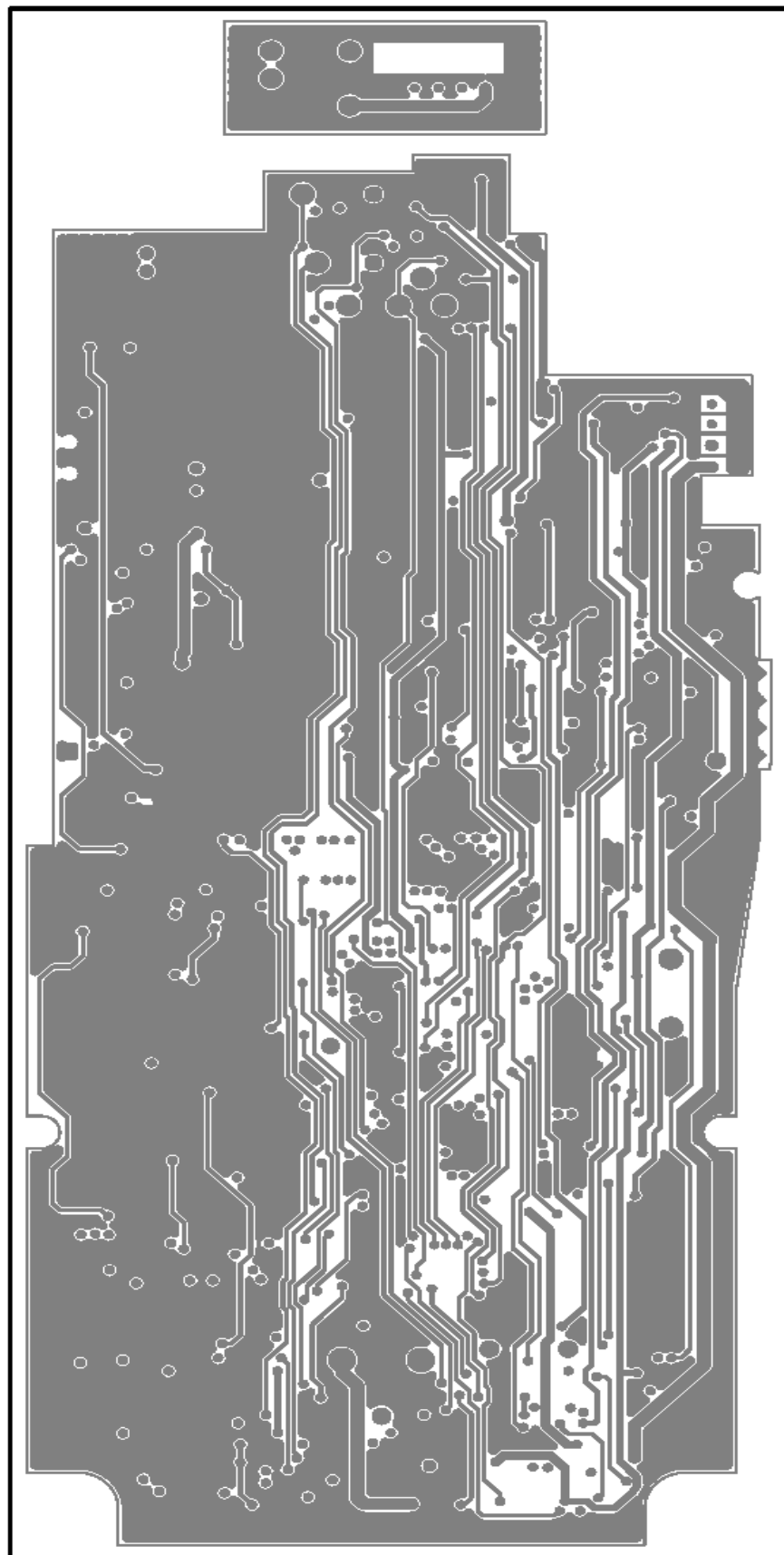












CIRCUIT DIAGRAM

