

GB210 Service Manual

(GSM Cellular Phone)

Pantech Co., Ltd., Korea

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For Use by Authorized Service/Maintenance Personal Only

Documents to Receive This Addendum:

GB210 Maintenance/Repair/Operating Manual

CONTENTS

SECTION 1 INTRODUCTION	3
1.1 INTRODUCTION	3
1.2 FREQUENCY ALLOCATION AND ITS USE	3
1.3 ITEM NAME AND USE	4
1.4 CHARACTERISTICS.....	4
SECTION 2 ELECTRICAL SPECIFICATIONS.....	5
2.1 GENERAL	5
2.2 TRANSMITTER.....	5
2.3 RECEIVER.....	5
SECTION 3 OPERATION.....	6
3.1 NAME OF EACH PART.....	6
3.2.DISPLAY	7
3.3 KEYPAD	7
SECTION 4 THEORY OF OPERATION.....	8
4.1 LOGIC SECTION	8
4.1.1 Dc DISTRIBUTION AND REGULATION PART.....	8
4.1.2 LOGIC PART.....	8
4.1.2.1 SUMMARY.....	9
4.1.2.2 BASEBAND DIGITAL SIGNAL PROCESSING.....	10
4.1.3 MEMORY PART.....	12
4.1.4 NOTIFICATION PART	13
4.1.5 KEY PAD PART.....	13
4.1.6 LCD MODULE(DISPLAY PART).....	13
4.2 RADIO TRANSCEIVER SECTION	14
4.2.1 DC DISTRIBUTION AND REGULATION PART	15
4.2.2 TRANSCEIVER PIN DESCRIPTION.....	15
4.2.3 RECEIVE SECTION.....	17
4.2.3.1 AN OVERVIEW OF RECEIVE SECTION.....	17
4.2.3.2 RECEIVER PART.....	18
4.2.4 TRANSMIT SECTION	19
4.2.4.1 AN OVERVIEW OF TRANSMIT SECTION	19
4.2.4.2 TRANSMITTER PART	20
4.2.5 OFFSET PLL.....	22
4.2.5.1 AN OVERVIEW OF OFFSET PLL	22
4.2.5.2 VCTCXO(VOLTAGE CONTROLLED TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR):V801	23
SECTION 5 ALIGNMENT PROCEDURE	24
5.1 RECOMMENDED TEST EQUIPMENT.....	24
5.2 CONNECTION OF TEST EQUIPMENT.....	24
SECTION 6 EQUIPMENT REPAIR PROCEDURE	25
6.1 NO POWER ON WITH BATTERY APPLIED	25
6.1.1 POWER CHECK.....	25
6.1.2 OSCILLATION CHECK	28
6.1.3 KEYPAD LED NOT IN OPERATION	29
6.1.4 STATUS LED	30
6.2 AUDIO PART(EARPIECE, HANDS FREE EARPHONE, MICROPHONE, HANDS FREE MIC)	31
6.2.1 NO RECEIVING TONE HEARD (EARPIECE)	31
6.2.2 SIDETONE NOT TRANSMITTED (MIC)	33
6.2.3 SIDETONE NOT TRANSMITTED (HANDS FREE MIC)	33
6.2.4 HOOK SWITCH NOT WORKING	34
6.2.5 MELODY NOT RINGING	35
6.2.6 VIBRATOR NOT WORKING	37

6.3 SIM CARD PART	38
6.3.1 SIM ERROR	38
6.4 CHARGER PART.....	39
6.4.1 CHARGING ERROR	39
6.5 CAMERA SENSOR PART.....	41
6.5.1 CAMERA PREVIEW ERROR.....	41
6.6 RF PART.....	43
6.6.1 TEST CONDITIONS.....	43
6.6.2 POWER SUPPLY CHECK POINT.....	44
6.6.3 POWER AMPLIFIER MODULE	46
6.6.4 VCTCXO.....	48
6.6.5 FRONT END MODULE.....	49

SECTION 1. Introduction

1.1 An Introduction of GSM Digital Cellular Mobile Communication System

GSM (Global System for Mobile communication) concluded that digital technology working in the Time Division Multiple Access (TDMA) mode would provide the optimum solution for the future system. Specifically , a TDMA system has the following advantage

- ▶ Offers a possibility of channel splitting and advanced speech coding ,resulting in improved spectrum efficiency.
- ▶ Allows considerable improvements to be made with regards to the protection of information.

The GSM system is basically designed as a combination of three major subsystem;

The network subsystem, the radio subsystem, and the operation support system.

The functional architecture of a GSM system can be divided into the Mobile Station (MS), the Base Station (BS), and the Network Subsystem (NS). The MS is carried by the subscriber, the BS subsystem controls the radio link with the MS and the NS performs the switching of calls between the mobile and other fixed or mobile network users as well as mobility management. The MS and the BS subsystem communicate across the Um interface also known as radio link

The specifications relating to MS are as follows:

- TS 100 607-1 : Digital cellular telecommunication system(Phase2+)Mobile Station (MS) con Formance specification Part1:Conformance specification

1.2 Frequency Allocation and Its Use

- Transmit frequency band : 824 MHz ~ 849 MHz(For GSM850),1710 MHz ~ 1785 MHz(For DCS) 1850 MHz ~ 1910 MHz(For PCS1900)
- Receive frequency band: 869 MHz ~ 894 MHz(For GSM850) , 1805 MHz ~ 1880 MHz(For DCS) 1930 MHz ~ 1990 MHz(For PCS1900)
- Channel spacing : 200 KHz
- ARFCN(Absolute Radio Frequency Channel Number) : 128~251 (For GSM850), 512~885 (For DCS), 512~810 (For PCS1900).
- Separation between Transmit and Receive channels [MHz] : GSM850 ;45 MHz, DCS ;95 MHz, PCS ;80 MHz

1.3 Item Name and Usage

GB210, GSM digital cell phone, is supercompact, superlight mobile communication terminal for personal use. It has a GSM 850MHz and DCS 1800MHz/PCS 1900MHz frequency band and adopts GSM850 and DCS/PCS mode having excellent spectrum efficiency, economy, and portability.

This product is GSM Cellular type portable phone, adopting 1-cell Li-ion battery and power saving circuit to maximize its operation time. Also, it is equipped with a fixed antenna and its color LCD with font built in enables both Chinese and English text service. And power control(basic feature of GSM), security feature, voice symbol feature, and variable data rate feature are used appropriately to ensure its best performance. This product consists of a handset, battery pack, and Travel charger.

1.4 Characteristics

- 1) All the active devices of GB210 are made of semiconductors to ensure excellent performance and semi-permanent use.
- 2) Surface mounting device (SMD) is used to ensure high reliability, compactness and lightness.
- 3) GB210 adopts the Silabs's AERO RF transceiver, which is CMOS RF front-end for multi-band GSM digital cellular handsets. The Aero's highly-integrated architecture eliminates the IF SAW filter, low noise amplifiers (LNAs) for three bands, transmit and RF voltage-controlled oscillator (VCO) modules, and more than 60 other discrete components found in conventional GSM handsets to deliver smaller, more cost effective GSM solutions that are easier to design and manufacture.
- 4) GB210 is designed to perform excellently even in the worst environment

Section 2. Electrical Specifications

2.1 General

GSM 850 / DCS 1800/PCS1900

Mobile Transmit Frequency[MHz]	824 ~ 849 /1710 ~ 1785/ 1850 ~ 1910
Mobile Receive Frequency[MHz]	869 ~ 894 /1805 ~ 1880/ 1930 ~ 1990
Multiplex number	8
The Number of Channels	124/ 375 / 299
Channel Spacing	200 kHz
Power Supply	Rechargeable Li-polymer Battery 3.7V/840mAh
Operating Temperature	-20°C ~ +50°C
Dimension	84(H) × 42(W) × 22.5(D) mm
Weight	85g

2.2 Transmitter

GSM 850 / DCS 1800/PCS1900

Maximum Output Power	33±2 / 30±2 dBm/30±2 dBm
Frequency Error	± 90Hz/± 180Hz/± 190Hz
Phase Error	RMS < 5° , PEAK < 20°
Minimum Output Power	5±5 / 0±5 dBm /0±5 dBm
Power Control	5~19(2 dB Step)/0~15(2 dB Step)/ 0~15(2 dB Step)/
Output RF Spectrum	TS 100 910V6.2.0
Switching Transient	TS 100 910V6.2.0
Intermodulation attenuation	
Conducted Spurious Emissions	Idle Mode -57dBm 9KHz~1GHz -53dBm 1850MHz~ 1910MHz -47dBm 1GHz~12.75GHz Allocated Channel -36dBm 9KHz~ 1GHz -30dBm 1GHz~ 12.75GHz

2.3 Receiver

Reference Sensitivity	For GSM850 small MS :-102dBm	
	For DCS1800 class3 MS : -102dBm	
	For PCS1900 class3 MS : -102dBm	
For Adjacent interference	C/Ic	9 dB
For Adjacent(200KHz) interference	C/Ia1	-9 dB
For Adjacent(400KHz) interference	C/Ia2	-41 dB
For Adjacent(600KHz) interference	C/Ia3	-49 dB

Section 3 Operation

3.1 Name of each part



3.2 Display(Dual LCD)

Parameter	Projected Actual (MAIN LCD)
Display	1.8' 65K CSTN Transmissive (Resolution : 128 * 160) European Character : (font size : 8×14) 11 lines x 16 characters Chinese Character : (font size : 14×15) 10 lines x 9 characters
Driver	SSD1783R1 (Solomon)
Module Dimen.	36(H) x 46.7(V) x 5.1(D)
View size	30.54(H) x 36.04(V)
Active Area	27.252(H) x 34.068(V)
Number of dots	128(H) x RGB(H) x 160(V)
Dot pitch	0.071mm(H) x 0.213mm(V)

Parameter	Projected Actual (SUB LCD)
Display	1.0" white LED back lighting Pixels : 96 x 48 European Character : (font size : 8×14) 4 lines x 12 characters Chinese Character : (font size : 14×15) 4 lines x 6 characters
Driver	SSD1815 R1 (Solomon)
Module Dimen.	36(H) x 46.7(V) x 5.1(D)
View size	20.02(W) x 14.0(H)
Active Area	18.225(W) x 12.145(H)
Number of dots	96(H) x 64(V)
Dot pitch	0.19mm(H) x 0.19mm(V)

3.3 Keypad

	Market Goal	Projected Actual	Comments
English Keypad	0-9, *,# Send (Color) End/Pwr (Color) Up (Melody), Down (Phonebook), Left (Organizer), Right (SMS), CENTER(WA P, OK), MENU, Contacts, CLR Camera, * Key: Vib. Mode # Key: Auto Lock 0/+Key: International 2 Volume Keys 1 Camera key	0-9, *,# Send (Color) End/Pwr (Color) Up (Melody), Down (Phonebook), Left (Organizer), Right (SMS), CENTER(WAP, OK), MENU, Contacts, CLR Camera, * Key: Vib. Mode # Key: Auto Lock 0/+Key: International 2 Volume Keys 1 Camera key	Meets Goal. (Industrial design sample required) Meets Goal Keys for VR and Lock International Volume up/down

Section 4. Theory of Operation

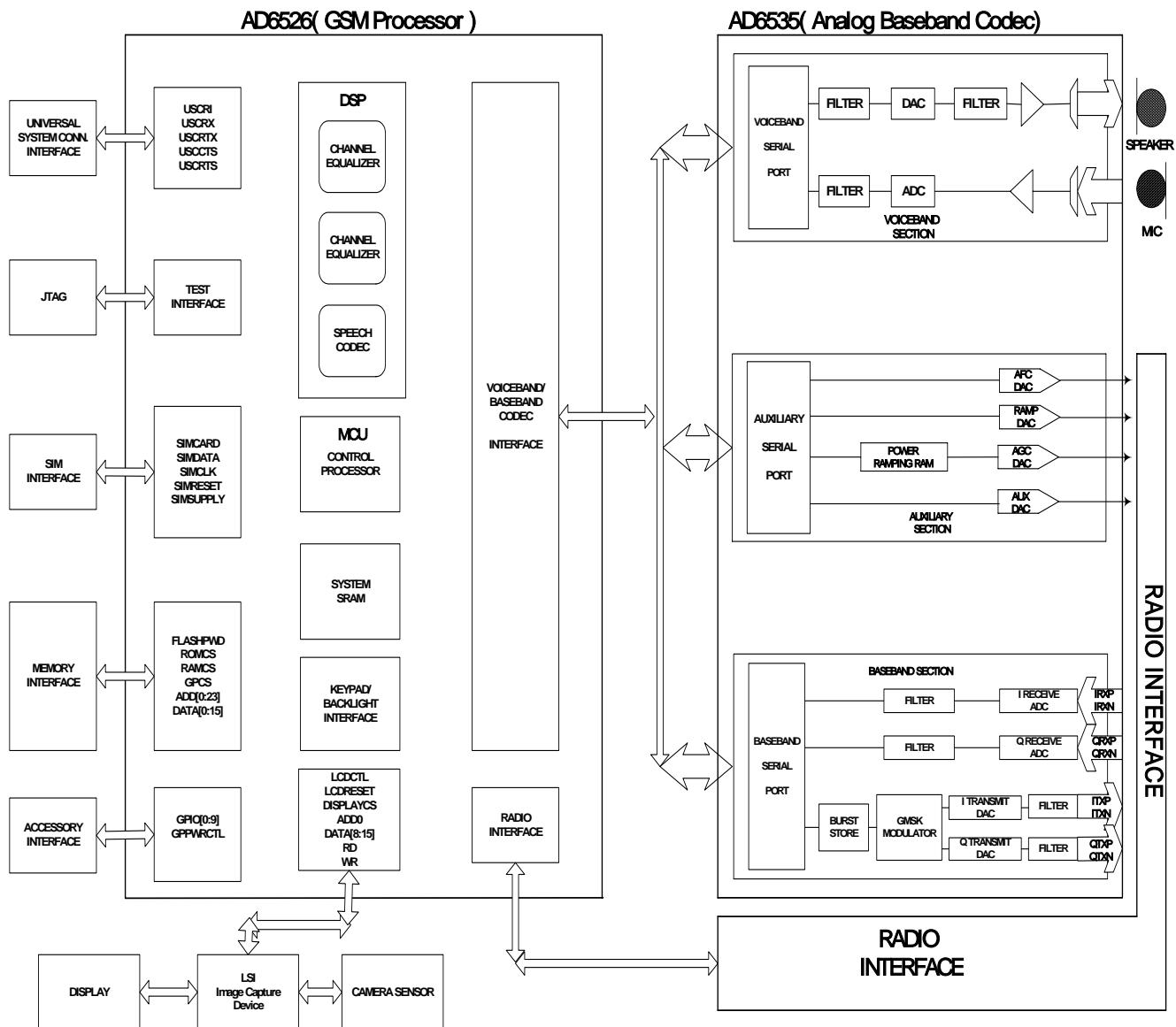
4.1 Logic Section

4.1.1 DC Distribution and Regulation Part

Applying battery voltage and pressing “END” key on the key pad short-circuits “Ground” and “_PowerON”. AD6535(U102) control that power manage regarding power on/off in handset. Pressing POWERKEY on the key pad is active on the handset.

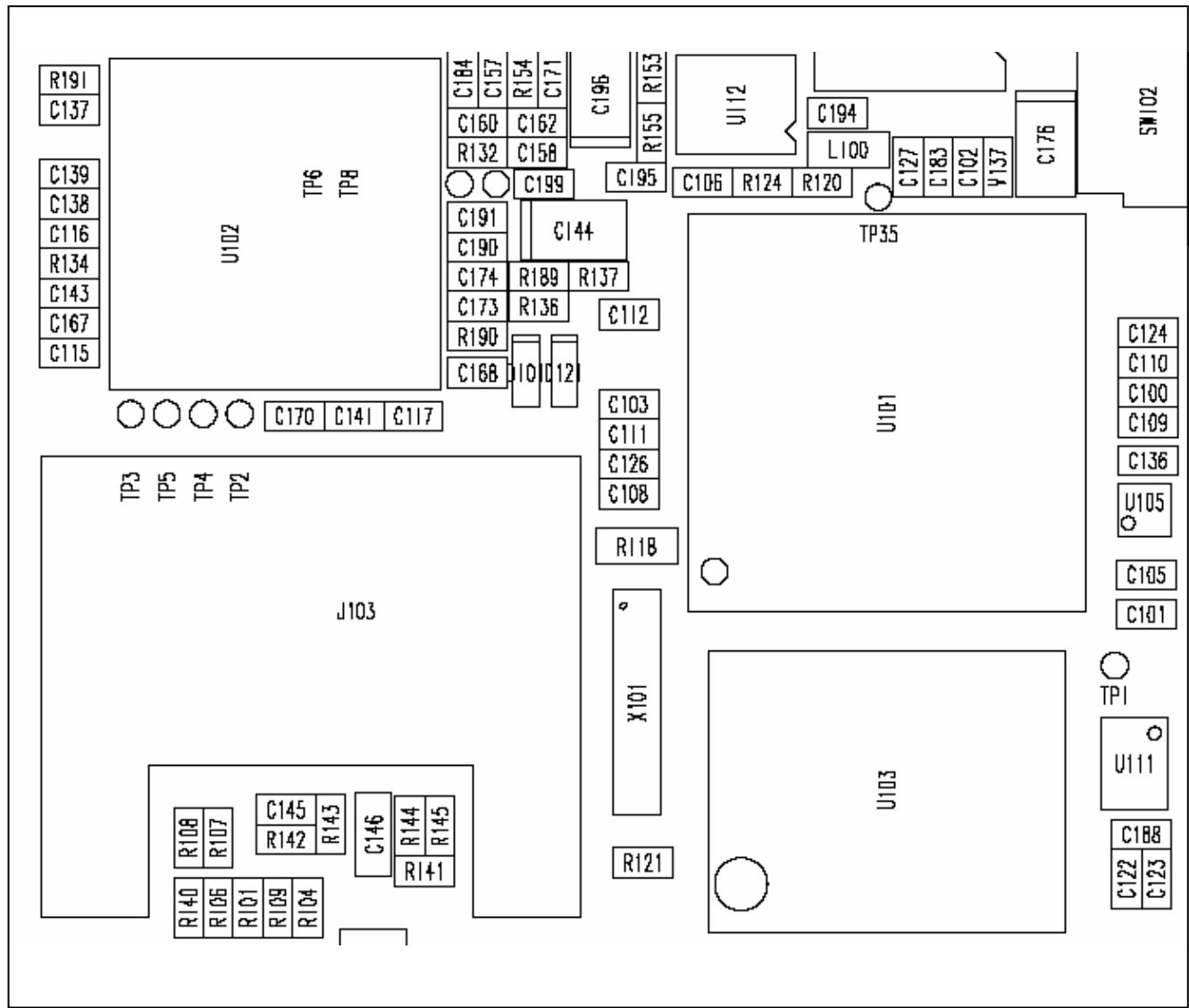
This will turn on all the LDOs, when POWERKEY is held low. The power of RF Tx power amplifier is supplied directly by the battery.

4.1.2 Logic part



4.1.2.1 Summary

The logic part consists of AD6526 ARM7 microprocessor-combined GSM-ASIC, COMBO(flash ROM & SRAM), AD6535 VBC Chip. AD6526 is GSM-ASIC chipset implemented for GSM terminal's system control and baseband digital signal processing.



Major parts used in the logic part are as follows:

- 1) AD6526 : U101, [ARM7 Processor Core + GSM Signal Processing] ASIC
- 2) AD6535 : U102, Analog Baseband Codec
- 3) COMBO MEMORY(Flash ROM : U103, 128Mbit Flash Memory + 32Mbit SRAM)

4.1.2.2 Baseband Digital Signal Processing

AD6526 is a GSM core device containing ARM7 CPU core. AD6535 is 148 pin BGA package, consisting of terminal chips. The function and characteristics of clock are as follows:

- 1) Complete single chip GSM Processor
- 2) Channel codec sub-system
 - Channel coder and decoder
 - Interleaver and Deinterleaver
 - Encryption and Decryption
- 3) Control Processor Subsystem including
 - Parallel and serial Display interface
 - Keypad Interface
 - SIM Interface
 - Control of RADIO subsystem
 - Real Time Clock with Alarm

☞ Configuration by Function of AD6526

1 Microprocessor Core

AD6526 has a built-in ARM7 microprocessor core, including microprocessor interrupt controller, timer/counter, and DMA controller. And besides, 32bit data path is included, and up to 8Mbyte addressing is enabled and can be extended up to 16Mbyte. Although external clock should be provided to operate the microprocessor, this core uses 13MHz VCTCXO to provide clock.

2 Input Clock

1) Main Clock(13 MHz):

This is the clock needed for the microprocessor built in AD6526 to operate.

2) VC-TCXO(13 MHz) , 32.768KHz Clock:

This is the system reference clock to control SLEEP mode.

This is the clock derived from 13MHz VC-TCXO clock, provided by RF part. It is the timing reference clock for GSM signal processing.

3 DSP Subsystem

This is a GSM signal processing part in GSM mode, consisting of speech transcoding and

Channel equalization as follows:

1) Speech transcoding

In full rate, the DSP receives the speech data stream from VBC and encodes data from 104kbps to 13kbps. Using algorithm is Regular Pulse Excitation with Long Term Prediction (RPE-LTP).

2) Equalization

The Equalizer recovers and demodulates the received signal

The Equalizer establishes local timing and frequency references for mobile terminal as well as RSSI calculation.

The equalization algorithm is a version of Maximum Likelihood Sequence Estimation(MLSE) using Viterbi Algorithm.

☞ GSM Core and RF Interface

1) Transmitter:

AD6535 VBC receive data at 270kbps and use an on chip lock-up table to perform GMSK modulation. A pair of 10bit matched differential DACs convert the modulated data and pass I and Q analog data to the transmit section of the radio system.

2) Receiver:

The receiver I and Q signals are sampled by a pair of ADCs at 270kbps.

The I and Q samples are transferred to the EGSM through a dedicated receive path serial port.

4 RF Interface

This interfaces the RF part to control power amplifier, Tx LO buffer amplifier, VC-TCXO, and

AGC-end on transmit/receive paths in the RF part.

1) Transmitter Interface:

This transmits TX_AGC signal to Tx AGC amplifier to adjust transmit power level and sends Ramp_DAC signal to the RF part to control power amplifier.

2) Receiver Interface:

This transmits RX_AGC signal to Rx AGC amp. to adjust receive path gain.

5 General Purpose ADC Support

The AD6535 includes a general purpose 10bit auxiliary ADC with four multiplexed input channel. These are used for measurement of battery voltage ID, temperature and accessory ID.

6 USC(Universal System Connector) Interface

A Typical GSM handset requires serial connections to provide data during normal phone operation manufacturing, testing and debugging.

7 General Purpose Interface

The AD6526 provides 32 interface pin for control of peripheral devices.

All GPIO pins start up as inputs. Additional purpose inputs and outputs are available under SW control.

8 Speech Transcoding

In full rate mode, the DSP receive the speech data stream from the VBC and encodes data from 104kbps to 13kbps. Using algorithm is Regular Pulse Excitation with Long Term Prediction as specified GSM Recommandation

9 Power Down Control Section

1) Idle Mode Control:

If IDLE/ signal turns 'Low', transmitter section becomes disabled.

2) Sleep Mode Control:

If IDLE/ and SLEEP/ signals turn 'Low', all the sections except for VC-TCXO circuit become disabled.

3) Receiver & Transmitter Mode Control:

If IDLE/ and SLEEP/ signals turn 'High', all the sections become enabled to perform transmit/receive operation.

4.1.3 Memory Part

Memory consists of COMBO (flash ROM & SRAM).

1 Flash ROM

Flash ROM has a capacity of 128Mbit(16MByte). The main programs of the terminal(call processing, user interface, and diagnostic task) and supplemental programs (NAM program and test program) are stored in the flash ROM. Even if the program version may be changed in the future, customers can download the program.

2 Static RAM

SRAM has a capacity of 32Mbit(4MByte) and stores system parameters, data buffer, and stack of each

task in it.

3 Key Tone Generation

All alert signals are generated by the DSP and output to the EVBC.

These alert can be used for the earpiece.

4.1.4 Notification Part

The notification of incoming call is given by melody, vibrator, and 3-Color LED.

1) Melody:

This is a device sounding alert/melody tones.

The melody data are stored in flash memory (U103) And generated by Melody IC(U104).

2) Vibrator:

This is a device enabling vibration. The vibrator data is stored in flash memory(U103)

And generated by AD6526(U101).

3) 3-color LED:

This is a device to indicate a notification mode.

Q542 drive the lamp to flash.

4.1.5 Key Pad Part

To enable key operation to input information, the key matrix is configured using strobe signal of KEYPADROW(0-4) and 5 input ports of KEYPADCOL(0-4). Also, to use the key even at light, the backlight circuit is provided for LED 12s.

4.1.6 LCD Module(Display Part)

LCD module consists of LCD, controller, LED-Backlight, and LCD reflector.using dual LCD

Main LCD: 1S/W Icon x 1 lines[(128x3)x160] can be displayed on the LCD panel. 6 icons could be provided by S/W. Controller with English font built in has been used.

Sub LCD: 1S/W Icon x 1 lines[(96x3)x64] can be displayed on the LCD panel. 6 icons are provided. Controller with English font built in has been used.

LED-backlight Using illuminates the LCD panel, and LCD reflector enhances LCD display effect.

4.2 Radio Transceiver Section

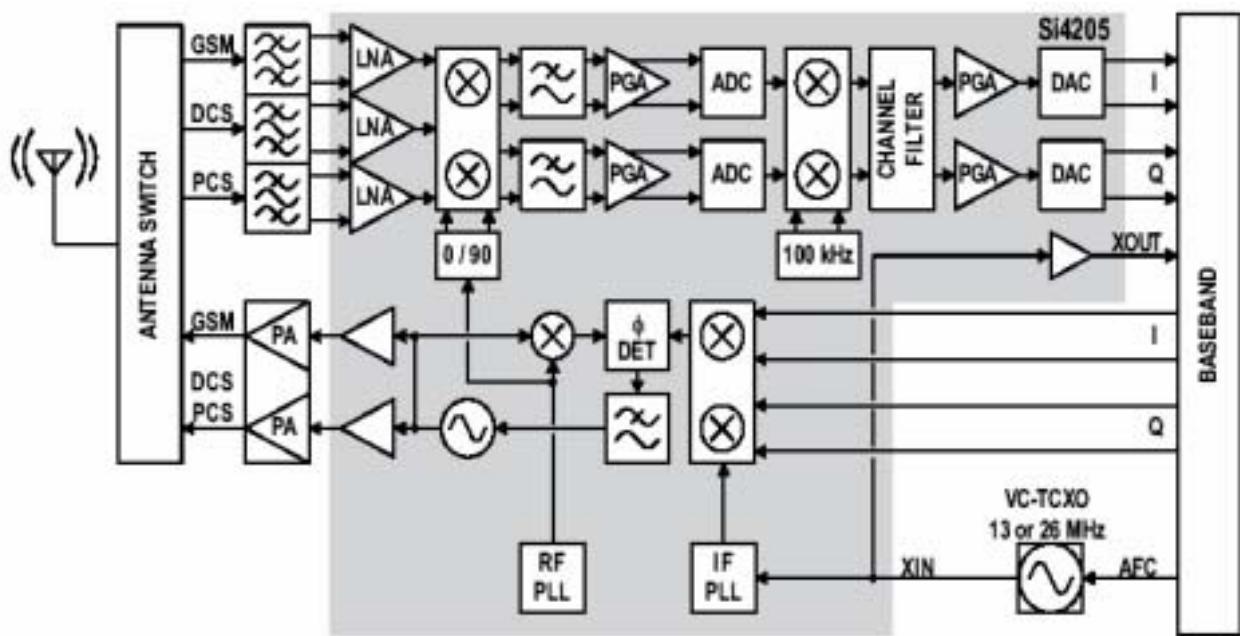


Fig.4-1. RF Transceiver block diagram

The GB210's RF Transceiver, which is AEROI(SI4205) transceiver is the industry's most integrated

RF front end for multi-band GSM/GPRS digital cellular handsets and wireless data modems.

The highly integrated solution eliminates the IF SAW filter, external low noise amplifiers (LNAs) for three bands, transmit and RF voltage controlled oscillator (VCO) modules, and more than 70 other discrete components found in conventional designs. The receive section uses a digital low-IF architecture that avoids the difficulties associated with direct conversion while delivering lower solution cost and reduced complexity. The baseband interface is compatible with any supplier's baseband subsystem. The transmit section is a complete up-conversion path from the baseband subsystem to the power amplifier, and uses an offset phase-locked loop (PLL) with a fully integrated transmit VCO. The frequency synthesizer uses Silicon Laboratories' proven technology, which includes integrated RF and IF VCOs, varactors, and loop filters. The unique integer-N PLL architecture produces a transient response that is superior in speed to fractional-N architectures without suffering the high phase noise or spurious modulation effects often associated with those designs. This fast transient response makes the AEROI(SI4205) transceiver well suited to GPRS multi-slot applications where channel switching and settling times are critical.

The following Figure shows of RF Transceiver PCB Layout

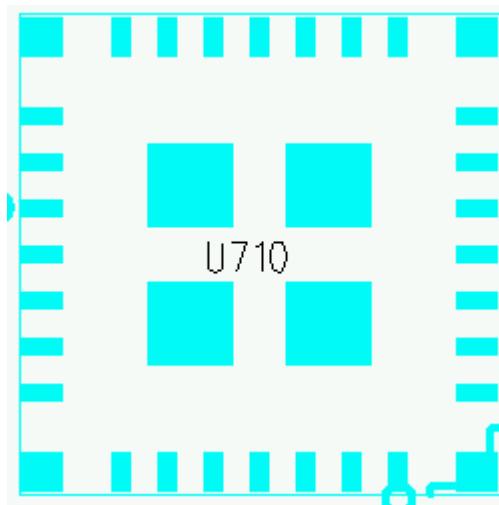


Fig.4-2. Top view of RF Transceiver PCB Layout

4.2.1 DC Distribution and Regulation Part

The battery voltage, in return, is applied to the logic part and RF part via LDO(Low Drop-Out) regulator. As several LDO regulators are used, power can be supplied for each necessary part efficiently. Audio/Logic parts use +2.8V. Si4205 RF Transceiver (U710) also use +2.8V DC voltage.

4.2.2 Transciever pin description

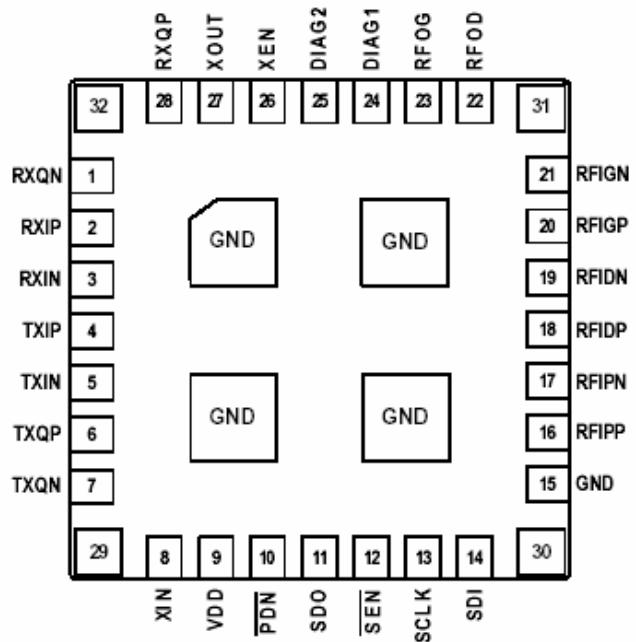


Fig.4-3. Top View of Si4205-BM

Pin Number(s)	Name	Description
1, 28	RXQN, RXQP	Receive Q output (differential).
2, 3	RXI _P , RXIN	Receive I output (differential).
4, 5	TXI _P , TXIN	Transmit I input (differential).
6, 7	TXQP, TXQN	Transmit Q input (differential).
8	XIN	Reference frequency input from crystal oscillator.
9, 32	VDD	Supply voltage.
10	PDN	Powerdown input (active low).
11	SDO	Serial data output.
12	SEN	Serial enable input (active low).
13	SCLK	Serial clock input.
14	SDI	Serial data input.
15, 29–31	GND	Ground. Connect to ground plane on PCB.
16, 17	RFIPP, RFIPN	PCS LNA input (differential). Use for PCS 1900 band.
18, 19	RFIDP, RFIDN	DCS LNA input (differential). Use for DCS 1800 band.
20, 21	RFIGP, RFIGN	GSM LNA input (differential). Used for GSM 850 or E-GSM 900 bands.
22	RFOD	DCS and PCS transmit output to power amplifier. Used for DCS 1800 and PCS 1900 bands.
23	RFOG	GSM transmit output to power amplifier. Used for GSM 850 and E-GSM 900 bands.
24, 25	DIAG1, DIAG2	Diagnostic output. Can be used as digital outputs to control antenna switch functions.
26	XEN	XOUT pin enable.
27	XOUT	Clock output to baseband.

Table 4-1. Pin Description of Si4205-BM

4.2.3 Receiver Section

4.2.3.1 An Overview of Receive section

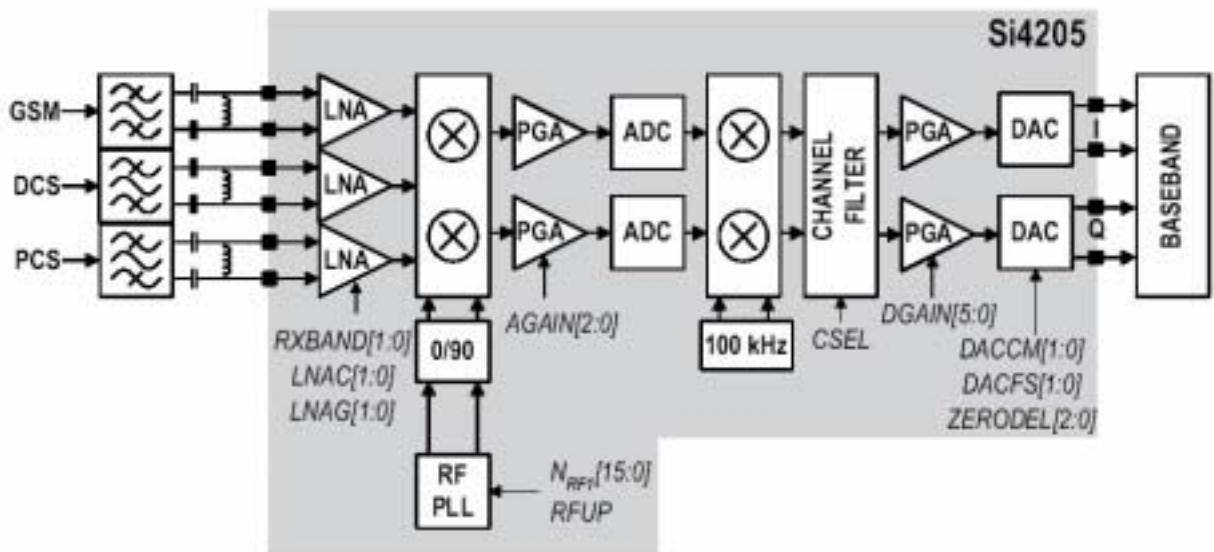


Fig.4-6. Receiver block diagram

GB210's Aero I transceiver uses a low-IF receiver architecture which allows for the on-chip integration of the channel selection filters, eliminating the external RF image reject filters and the IF SAW filter required in conventional superheterodyne architectures. Compared to a direct-conversion architecture, the low-IF architecture has a much greater degree of immunity to dc offsets, which can arise from RF local oscillator (RFLO) self-mixing, 2nd-order distortion of blockers, and device 1/f noise. This relaxes the common-mode balance requirements on the input SAW filters, and simplifies PC board design and manufacturing.

Three differential-input LNAs are integrated on the Aero I transceiver. The GSM input supports the GSM 850 (869–894 MHz) or EGSM 900 (925–960 MHz) bands. The DCS input supports the DCS 1800 (1805–1880 MHz) band. The PCS input supports the PCS 1900 (1930–1990 MHz) band.

The LNA inputs are matched to the 150 balanced output SAW filters through external LC matching networks. The LNA gain is controlled with the LNAG and LNAC bits.

A quadrature image-reject mixer downconverts the RF signal to a 100 kHz intermediate frequency (IF) with the RFLO from the frequency synthesizer. The RFLO frequency is between 1737.8 to 1989.9 MHz, and is internally divided by 2 for GSM 850 and E-GSM 900 modes. The mixer output is amplified with an analog programmable gain amplifier (PGA), which is controlled with the AGAIN bits in register 05h. The quadrature IF signal is digitized with high resolution A/D converters (ADCs).

The ADC output is downconverted to baseband with a digital 100 kHz quadrature LO signal. Digital decimation and IIR filters perform channel selection to remove blocking and reference interference signals. The response of the IIR filter is programmable to a high selectivity setting or a low selectivity setting. The low selectivity filter has a flatter group delay response which may be desirable where the

final channelization filter is in the baseband chip. After channel selection, the digital output is scaled with a digital PGA, which is controlled with the DGAIN bits.

The LNAG, LNAC, AGAIN and DGAIN bits must be set to provide a constant amplitude signal to the baseband receive inputs.

DACs drive a differential analog signal onto the RXIP, RXIN, RXQP, and RXQN pins to interface to standard analog-input baseband ICs. No special processing is required in the baseband for offset compensation or extended dynamic range. The receive and transmit baseband I/Q pins can be multiplexed together into a 4-wire interface. The common mode level at the receive I and Q outputs is programmable, and the full scale level is also programmable.

4.2.3.2 Receiver Part

A. Front End Module : U750

SWITCHPLEXER consists of Tx filter, RX Dual SAW filter and having an antenna port, and dual configuration with the transmitting path isolated from the receiving path. A signal receives from the antenna of frequency band which is 942.5 ± 17.5 MHz for EGSM bands, 1842.5 ± 37.5 MHz for DCS bands and transmits it to dual saw filter. The Tx filter passes through the output signals of frequency band that is 897.5 MHz ± 17.5 MHz for EGSM bands, 1747.5 ± 37.5 MHz for DCS bands from the power amplifier and transmits it to the antenna. The maximum insertion loss is about 0.8 dB for the receiving bands at 25° C and about 1.35 dB for the transmitting bands at 25° C.

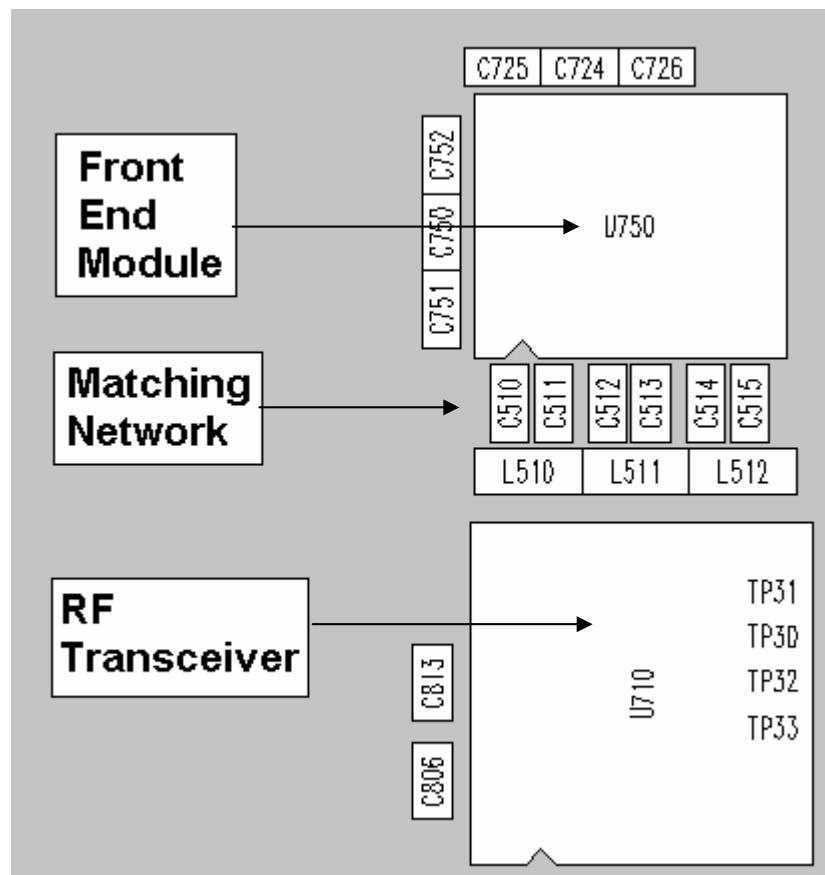


Fig.4-7. Receiver part PCB Layout

4.2.4 Transmit Section

4.2.4.1 An Overview of Transmit Section

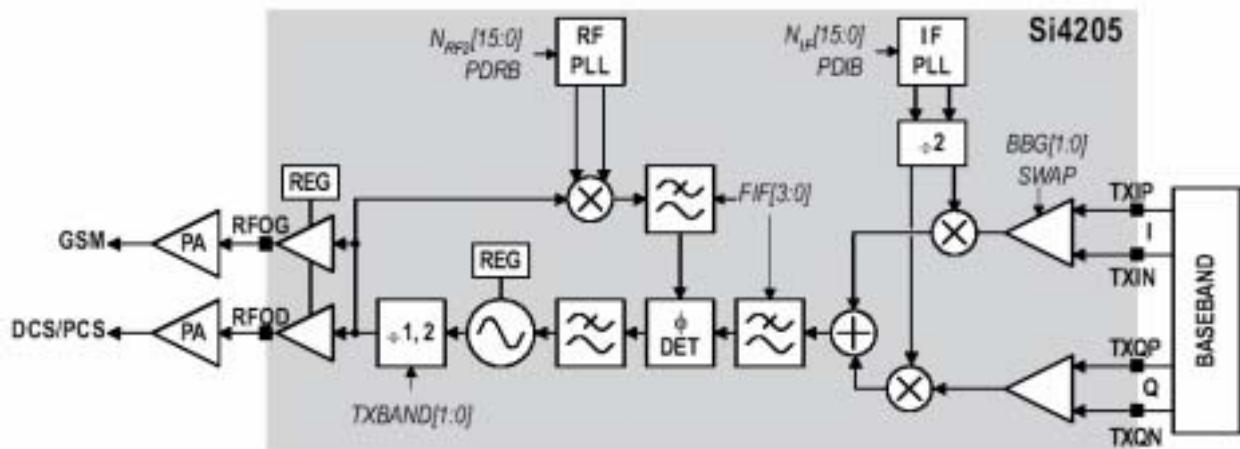


Fig.4-8. Transmitter block diagram

The transmit (TX) section consists of an I/Q baseband upconverter, an offset phase-locked loop (OPLL) and two output buffers that can drive external power amplifiers (U701), one for the GSM 850 (824 to 849 MHz) and E-GSM 900 (880 to 915 MHz) bands and one for the DCS 1800 (1710 to 1785 MHz) and PCS 1900 (1850 to 1910 MHz) bands. The OPLL requires no external duplexer to attenuate transmitter noise or spurious signals in the receive band, saving both cost and power. Additionally, the output of the transmit VCO(TXVCO) is a constant-envelope signal that reduces the problem of spectral spreading caused by non-linearity in the PA.

A quadrature mixer upconverts the differential in-phase (TXIP, TXIN) and quadrature (TXQP, TXQN) signals with the IFLO to generate a SSB IF signal that is filtered and used as the reference input to the OPLL. The IFLO frequency is generated between 766 and 896 MHz and internally divided by 2 to generate the quadrature LO signals for the quadrature modulator, resulting in an IF between 383 and 448 MHz. For the E-GSM 900 band, two different IFLO frequencies are required for spur management. Therefore, the IF PLL must be programmed per channel in the E-GSM 900 band. The OPLL consists of a feedback mixer, a phase detector, a loop filter, and a fully integrated TXVCO. The TXVCO is centered between the DCS 1800 and PCS 1900 bands, and its output is divided by 2 for the GSM 850 and E-GSM 900 bands. The RFLO frequency is generated between 1272 and 1483 MHz. To allow a single VCO to be used for the RFLO, high-side injection is used for the GSM 850 and E-GSM 900 bands, and low-side injection is used for the DCS 1800 and PCS 1900 bands. The I and Q signals are automatically swapped when switching bands. Additionally, the SWAP bit in register 03h can be used to manually exchange the I and Q signals. Low-pass filters before the OPLL phase detector reduce the harmonic content of the quadrature modulator and feedback mixer outputs. The cutoff frequency of the filters is programmable.

4.2.4.2 Transmitter Part

A. 5dB attenuator, 6dB attenuator : Z706, Z705

These passive components are adopted for PAM to operate in a stable output power.

B. FEM(Front End Module / built in LPF): U750

These filters pass through the signals of which frequency band of 824~849MHz, 1710MHz~1785MHz and 1850MHz~1910MHz which is the transmit frequencies of GSM850, DCS and PCS1900 system terminal respectively, and it suppresses other images and spurious frequencies when the terminal transmits GMSK modulated frequencies

C. Power AMP Module(PAM): U720

This device amplifies signals ahead of transmitting them through the antenna to provide a sufficient RF power. It has amplification factor of 28dB and efficiency of about 55% typically in GSM band and amplification of 27dB and efficiency of about 52% typically DCS/PCS band.

D. RF Switch connector: J701

RF Switch connector used to test Mainboard's RF characteristics and to calibrate.

E. Antenna Contact Plate: J702

This device enables signals to be transmitted and received from BTS by Um interface.

External Antenna can be contacted with Mainboard through Antenna Contact Plate.

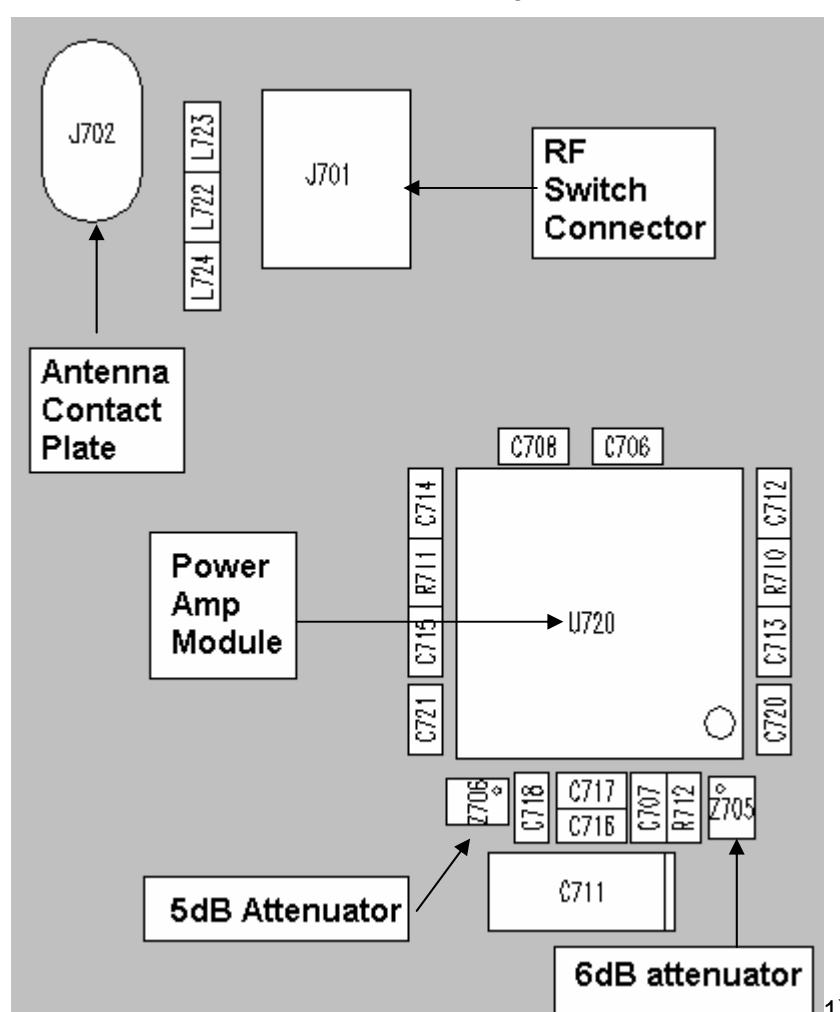


Fig.4-9. Transmit part PCB Layout

4.2.5 Offset PLL

4.2.5.1 An Overview of Offset PLL

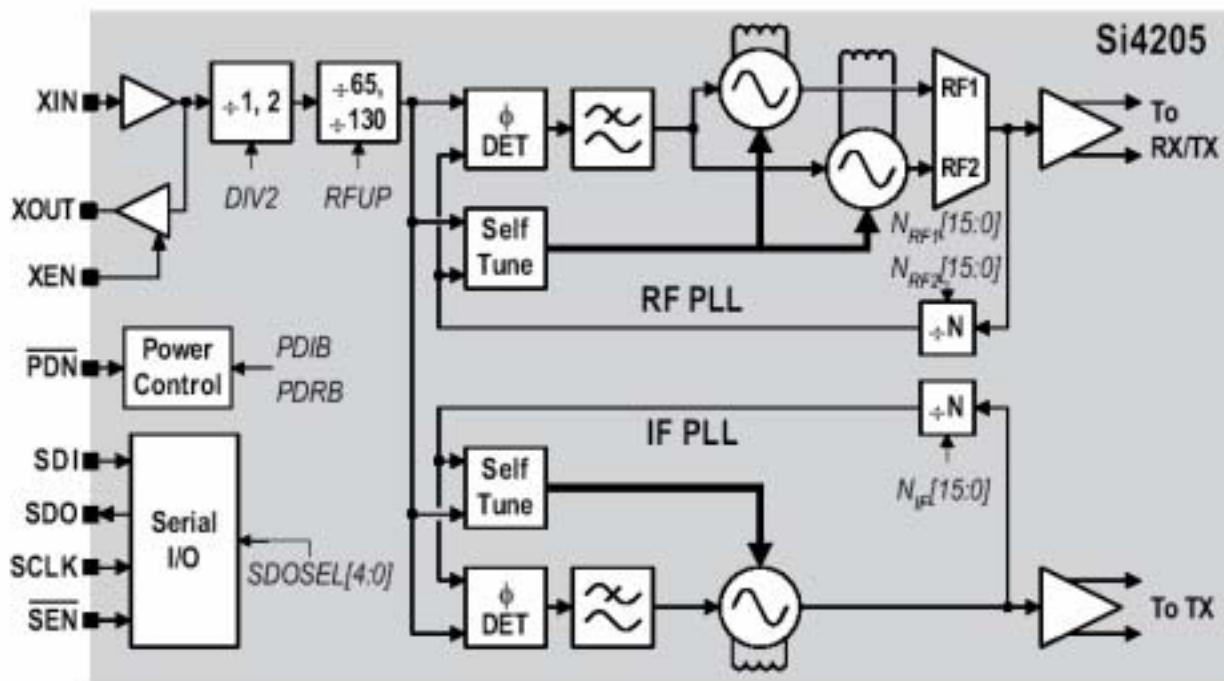


Fig.4-10. Si4205 Frequency Synthesizer Block Diagram

The Aero I transceiver integrates two complete PLLs including VCOs, varactors, resonators, loop filters, reference and VCO dividers, and phase detectors. The RF PLL uses two multiplexed VCOs. The RF1 VCO is used for receive mode, and the RF2 VCO is used for transmit mode. The IF PLL is used only during transmit mode. All VCO tuning inductors are also integrated. The IF and RF output frequencies are set by programming the N-Divider registers, NRF1, NRF2 and NIF. Programming the N-Divider register for either RF1 or RF2 automatically selects the proper VCO. The output frequency of each PLL is as follows:

$$f_{\text{OUT}} = N \times f$$

The DIV2 bit in register 31h controls a programmable divider at the XIN pin to allow either a 13 or 26 MHz reference frequency. For receive mode, the RF1 PLL phase detector update rate (f_{PD}) should be programmed $f_{\text{PD}} = 100$ kHz for DCS 1800 or PCS 1900 bands, and $f_{\text{PD}} = 200$ kHz for GSM 850 and E-GSM 900 bands. For transmit mode, the RF2 and IF PLL phase detector update rates are always $f_{\text{PD}} = 200$ kHz.

4.2.5.2 VC-TCXO(Voltage Controlled Temperature Compensated Crystal Oscillator): V801

This is the mobile station's reference frequency source. Its frequency is 13MHz, this signal is applied to Si4205(U710)_Pin8, AD6526(U101)_Pin L12 .

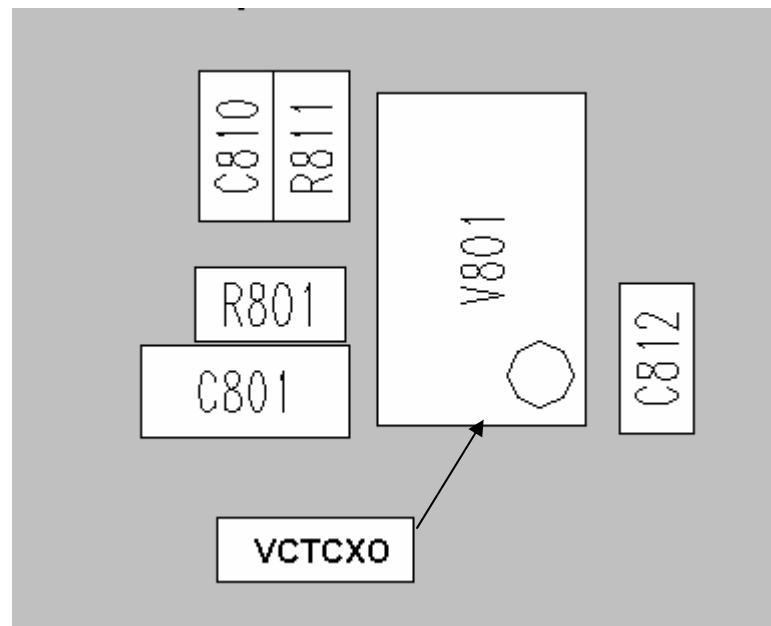


Fig.4-11. Top view of VCTCXO part on the PCB artwork

Section 5. Alignment Procedure

5.1 Recommended Test Equipment

Model No.	Description	Maker	Remark
8960	GSM Mobile Station Test Set	Agilent Technologies	
8593E	Spectrum Analyzer	Hewlett Packard	
TDS 3054B	Oscilloscope	Tektronix	
FLUKE 87	Digital Multimeter	Fluke	
E3630A	DC Power Supply	Hewlett Packard	
Others	Accessory		Interface Connectors RF Connectors

5.2 Connection of Test Equipment

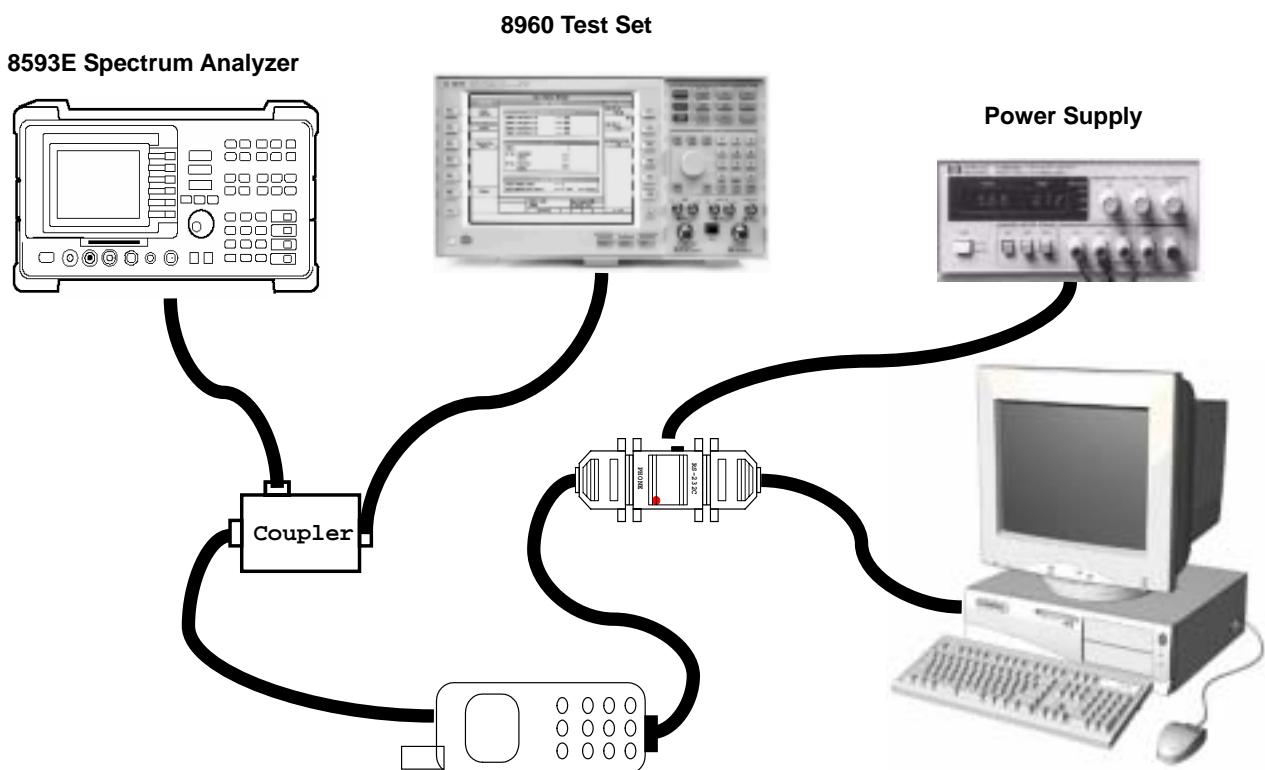


Fig.5-1. Test Set Configuration

SECTION 6. Equipment Repair Procedure

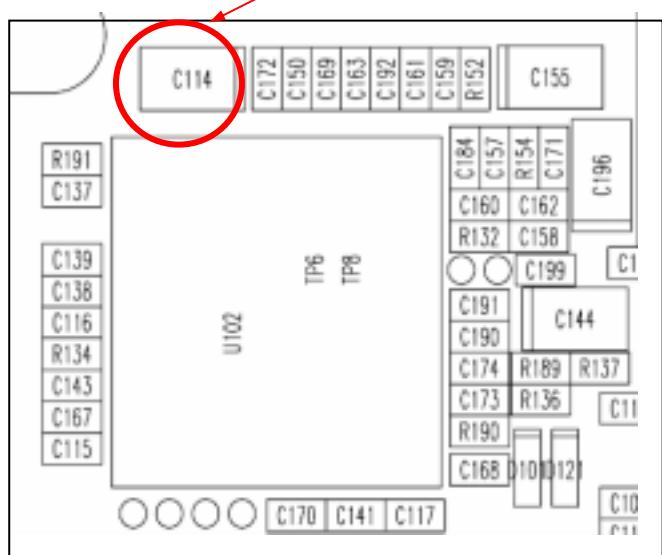
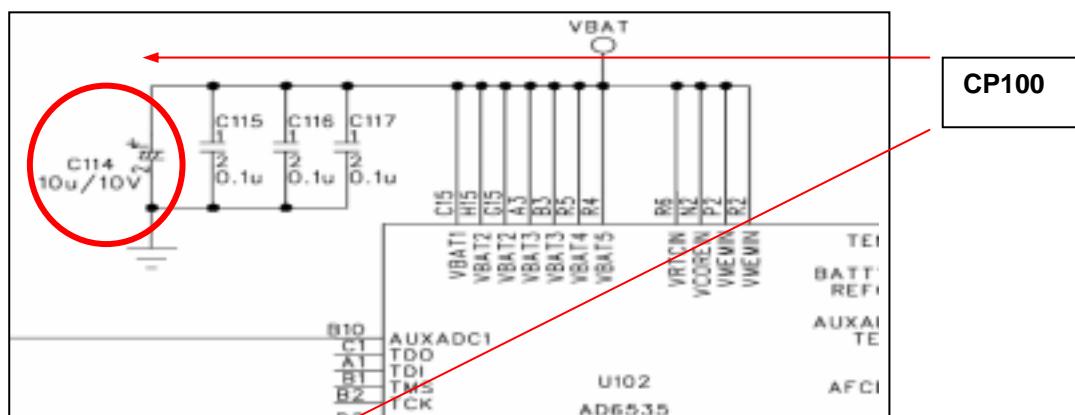
6.1 no power on with battery applied

6.1.1 Power CHECK

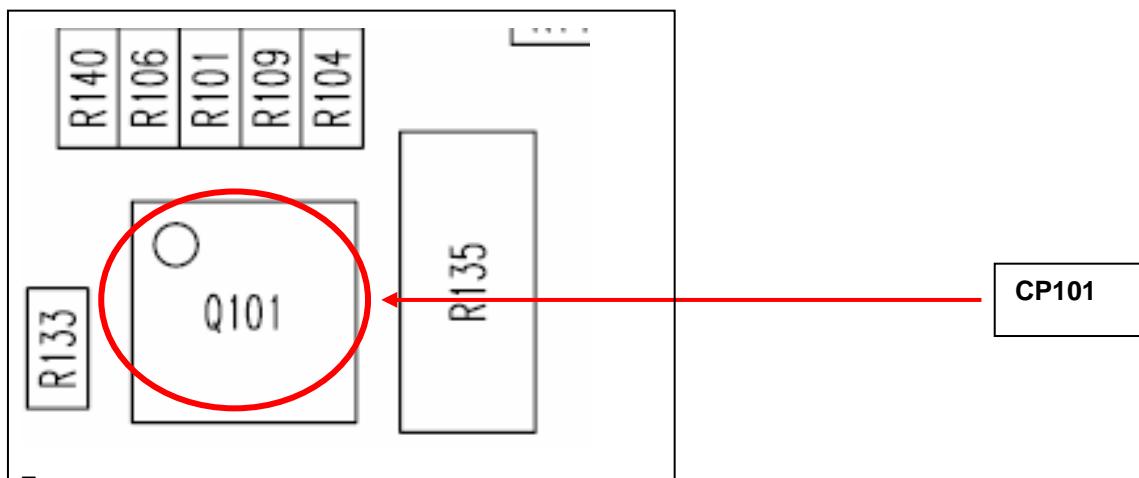
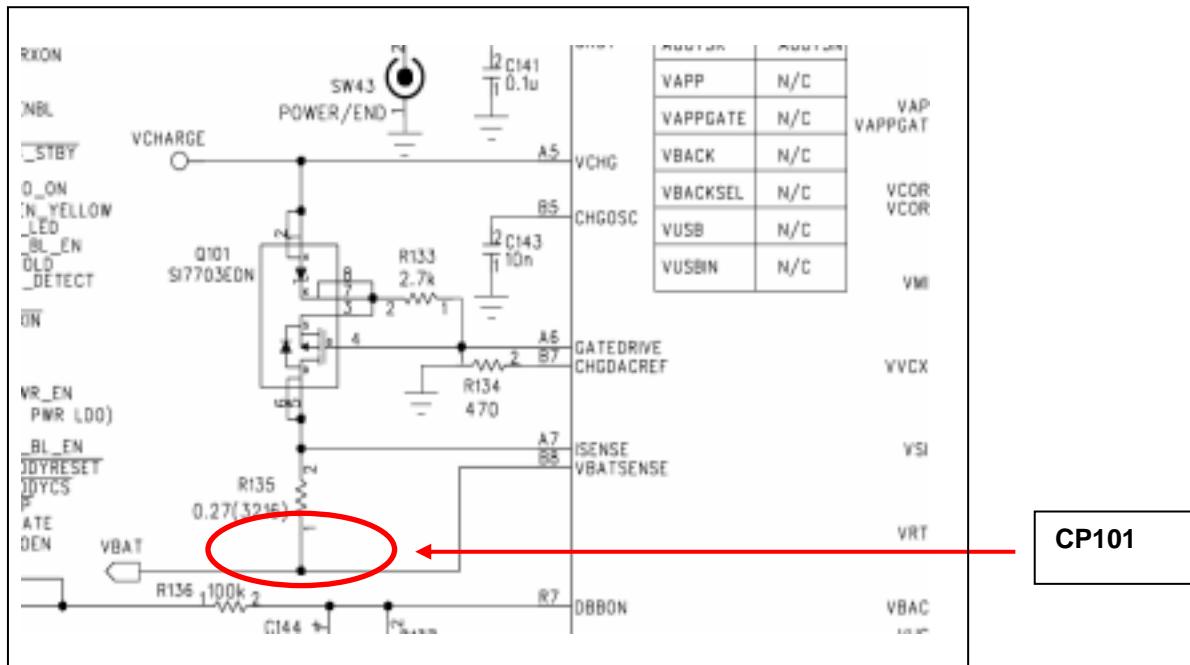
1. Check battery power : 3.5V~4.2V.



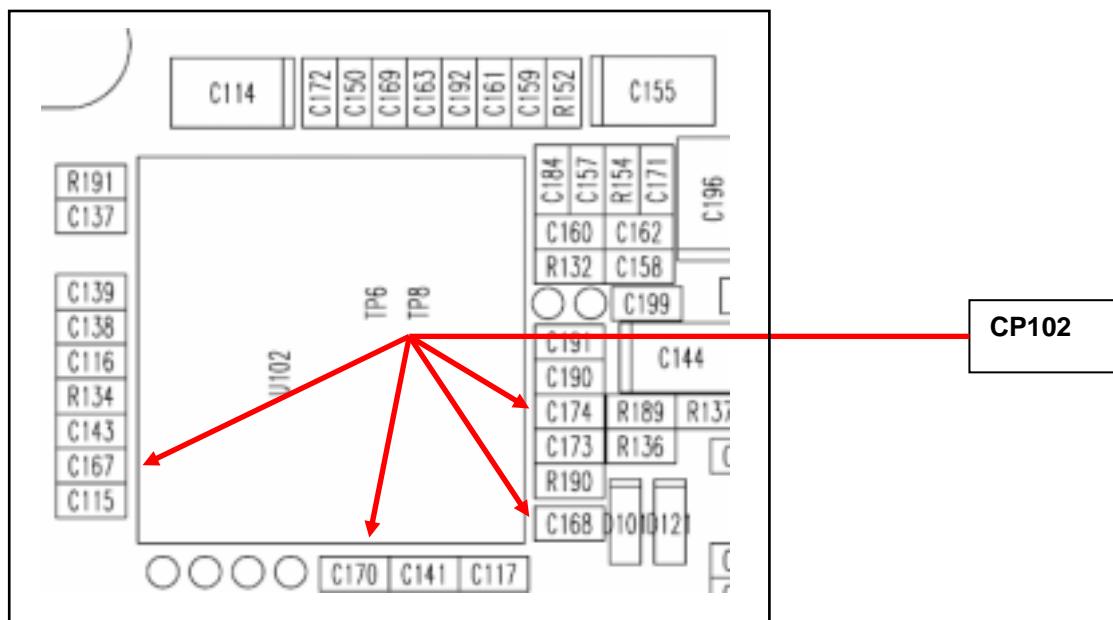
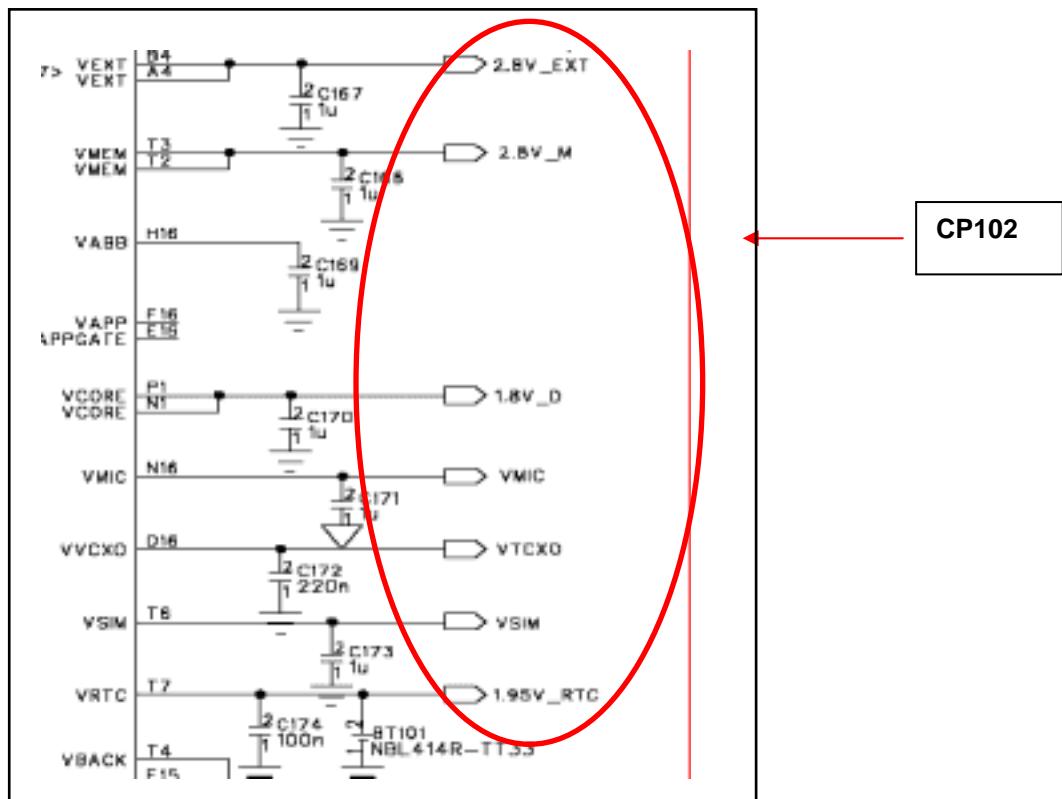
2. Check to see if U102.C15 pin voltage is same with battery power : CP100



3. Check to see if Q101_5.6 pin is same with battery power : CP101

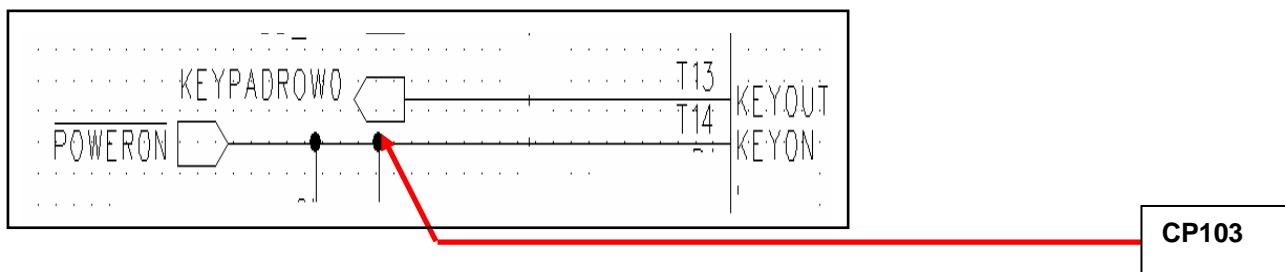


4. Check to see if U102. A4,B4,T2,T3,P1,N1, and T7 pin is 2.8V, 2.8V,1.8V and 1.95V : CP102



5. Check to see if U102_T14 pin becomes to 0V : CP103

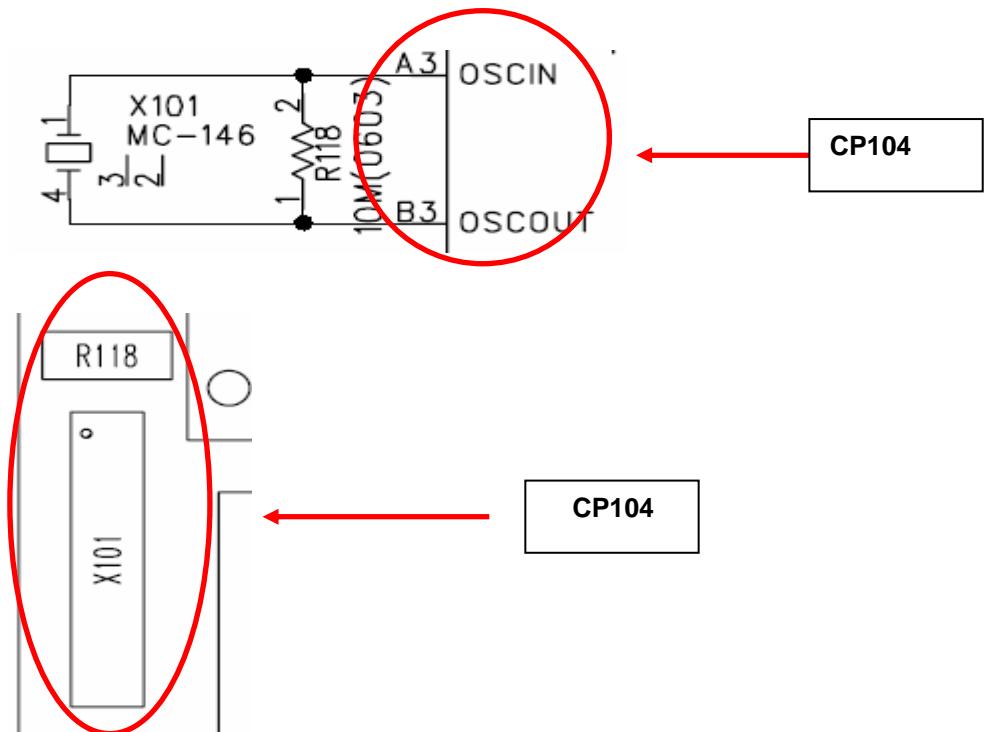
Pressing “END” key to turn on equipment.



6.1.2 Oscillation CHECK

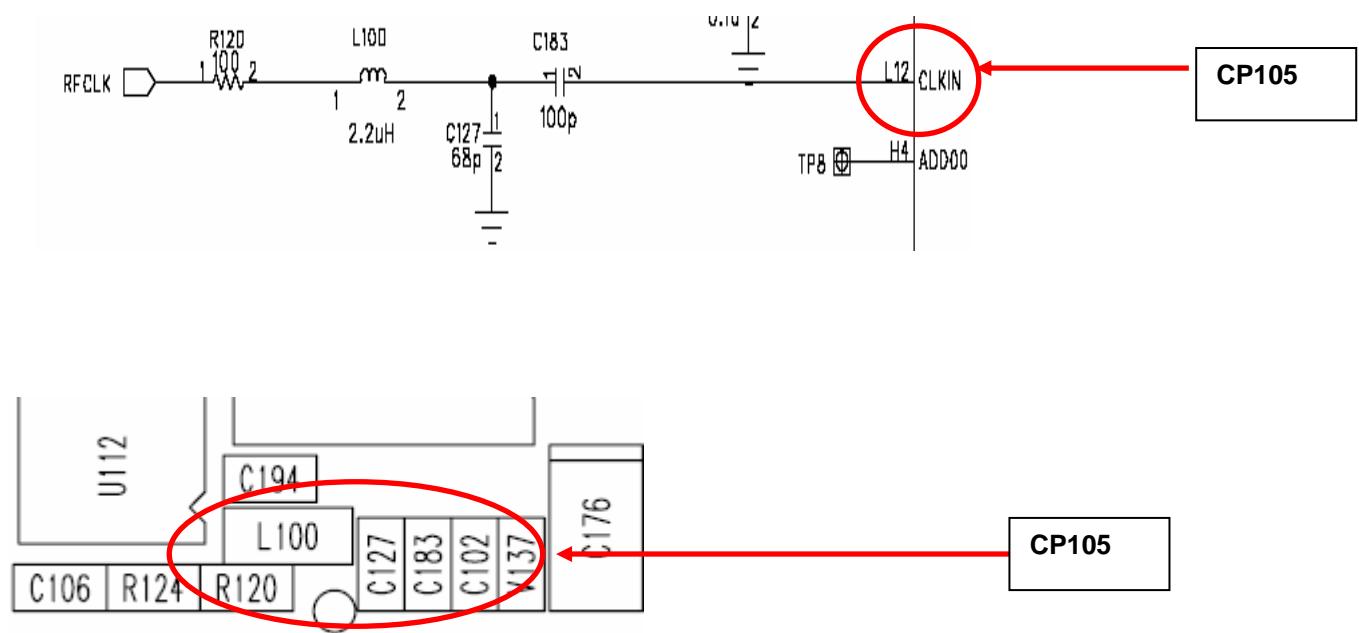
1. Check to see if U101_A3 and B3 pin is oscillated(32.768KHz) : CP104

NO → Check R118 and then replace X1



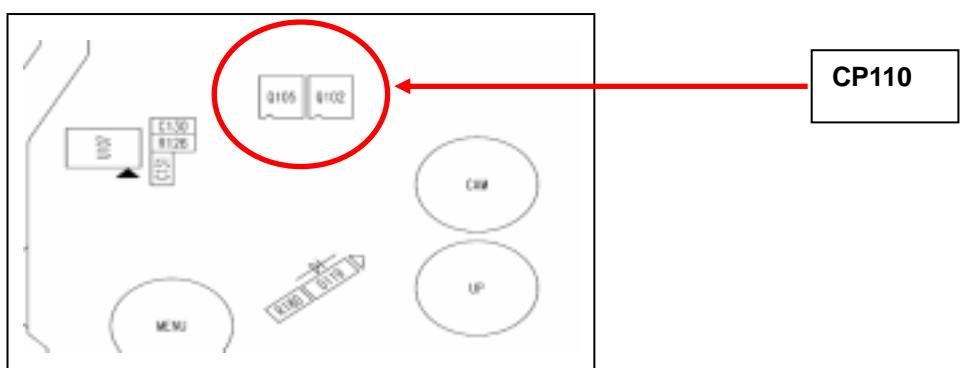
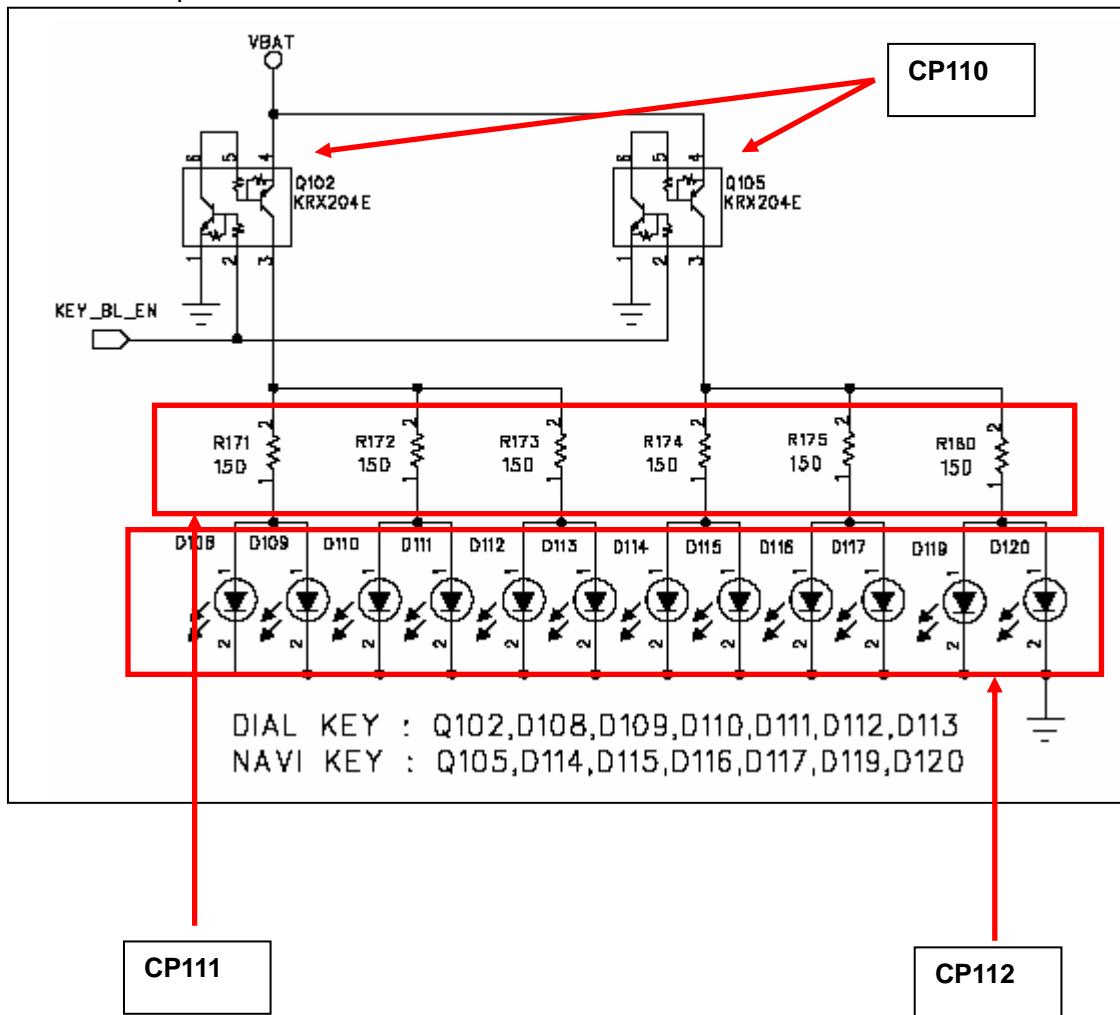
2. Check to see if R120.1 pin Master Clock(13MHz). : CP105

NO → Check C183.2 pin and then check the PCB pattern, soldering



6.1.3 KEYPAD LED Not in Operation

1. Check to see if Q102,Q103 are around 2.8V : CP110
NO → Check Q102, Q103 and then replace those.
2. Check to see if R171,R172,R173,R174,R175,R180 are same with battery voltage : CP111
NO → Check the PCB pattern between battery and the resistors.
NO → Replace the resistors.
3. Check to see if D108~D117, D119~D120 are well operated by multimeter : CP112
NO → Replace the LEDs.



6.1.4 Status LED

During Operating Mode

Status → LED Should be blinking during Operating Mode(Folder open, games).

1. Check to see if Q542_2,5 pin voltage is around 2.8V : CP115

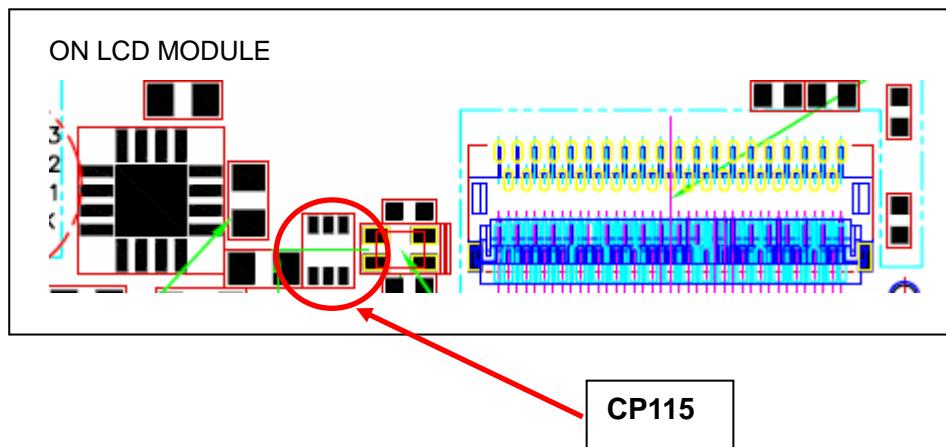
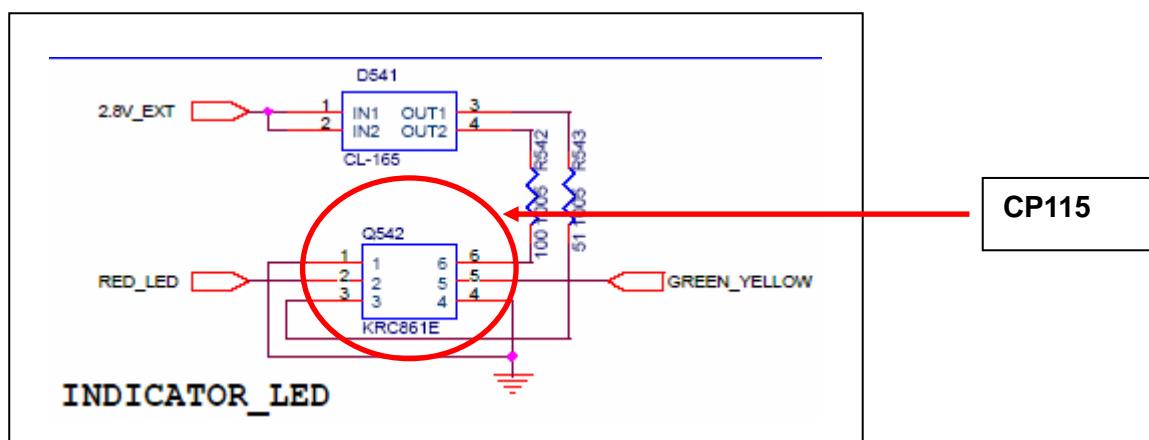
NO → Replace the Transistor.

During Incoming Call Mode.

Status → LED should be blinking during Incoming Call

1. Check to see if Q542 is well operated. : CP115

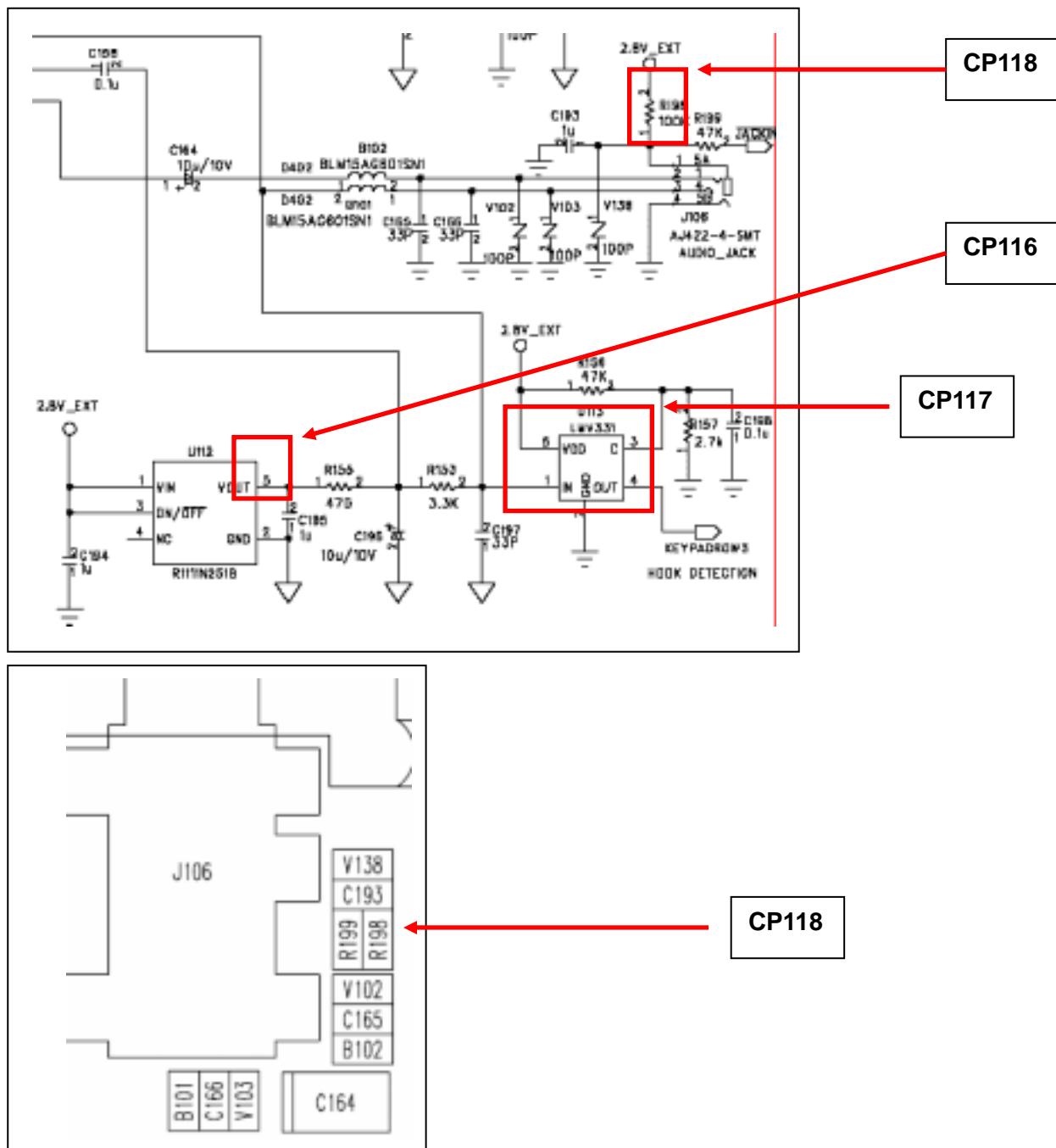
NO → Replace the Transistor.

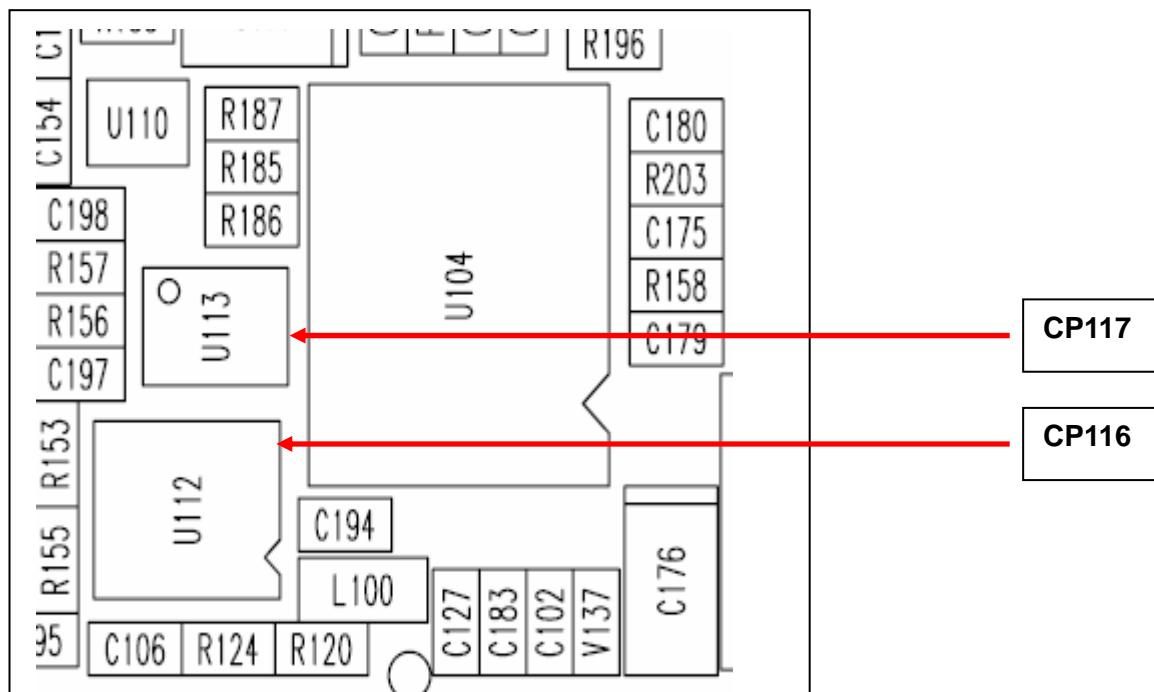


6.2 Audio Part (Earpiece, Hands-free Earphone, Microphone, Hands-free Mic)

6.2.1 No receiving tone heard (Ear-piece)

1. Check to see if U112.5 is 2.5V : CP116
2. Check to see if U113.1 is around 1.2V : CP117
- Set to HP8922M to connect a call and then set to 1kHz.
3. Check to see if R198.1 is 0V : CP118





6.2.2 Side Tone Not transmitted (Mic.)

1. Check to see if Mic + pin is around 1.8V : CP125

NO → Check that R470, R152, C184 and C155 is cold solder, broken, short to the other PCB pattern or not

If you find out any defective part, you replace it.

Set to HP8922M to connect a call and then set to 1kHz with Echo audio mode.

2. Check U102-MIC101 (C156) pins for wave form : CP126

NO → Replace MIC

6.2.3 Side Tone Not transmitted (Hands-free Mic.)

Repeat 6-2-2 No receiving tone heard. (Hands-free Earphone).

1. Check to see if U102 P15 (C161) pin is around 1.5V · CP127

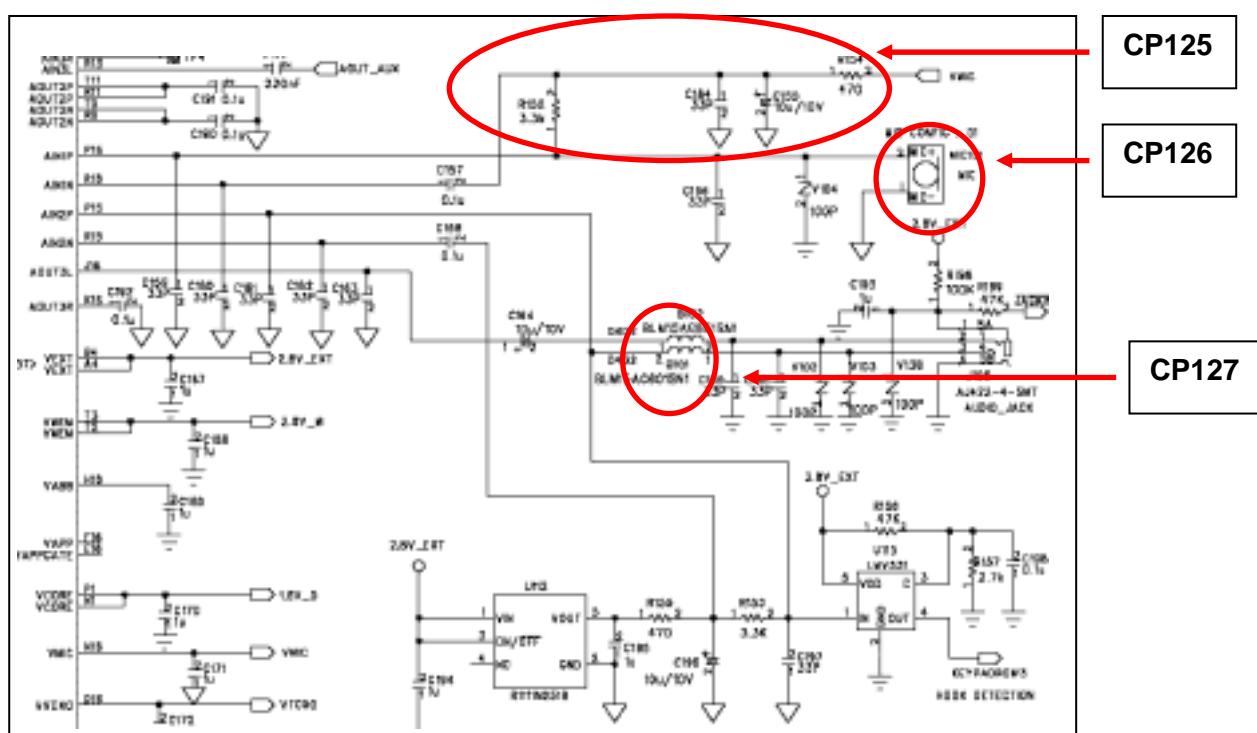
NO → Check that B101, R155, R153 and U112 is cold solder, broken, short to the other PCB pattern or not

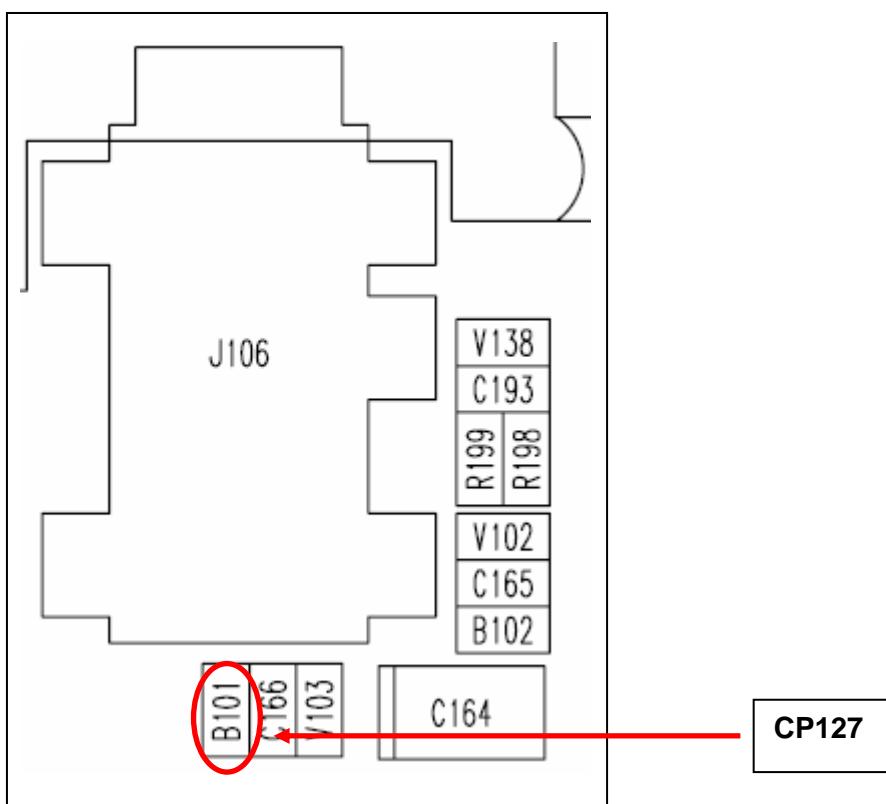
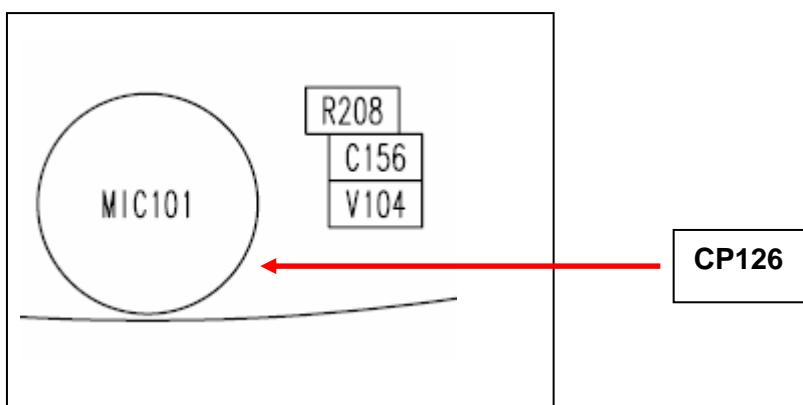
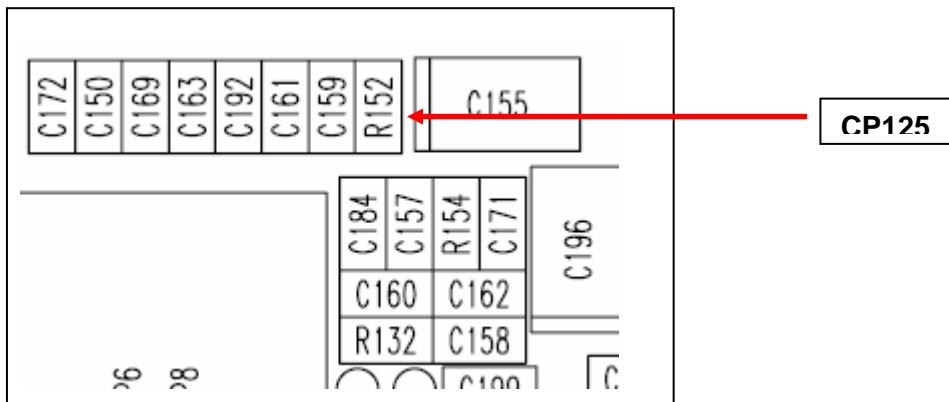
If you find out any defective part, you replace it.

Set to HP8922M to connect a call and then set to 1kHz with Echo audio mode

2. Check U102 P15 (B101) pins for wave form · CP127

NO → Replace Handsfree Mic





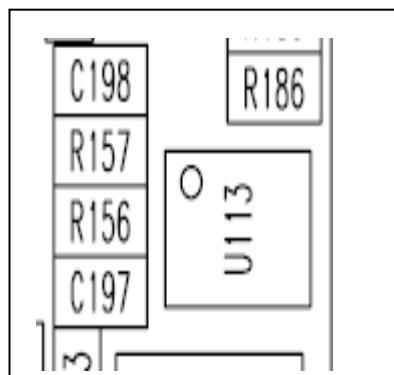
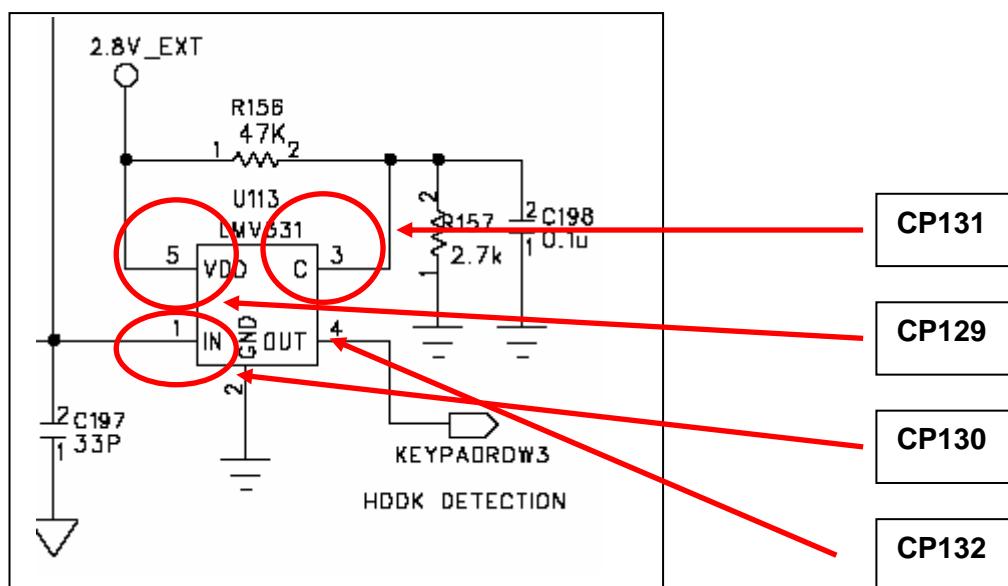
6.2.4 Hook Switch not working

1. Check to see if U113.5 pin is 2.8V : CP129
2. Check to see if U113.1 pin is around 0.12V during pressing Hook Switch : CP130
3. Check to see if U113.3 pin is around 0.21V : CP131

NO → Check that R156 and R157 cold solder, broken, short to the other PCB pattern or not
If you find out any defect, you replace it

4. Check to see if U113.4 pin is around 0V, when you press Hook Switch : CP132

NO → Check that U113 cold solder, broken, short to the other PCB pattern or not
If you find out any defect, you replace it

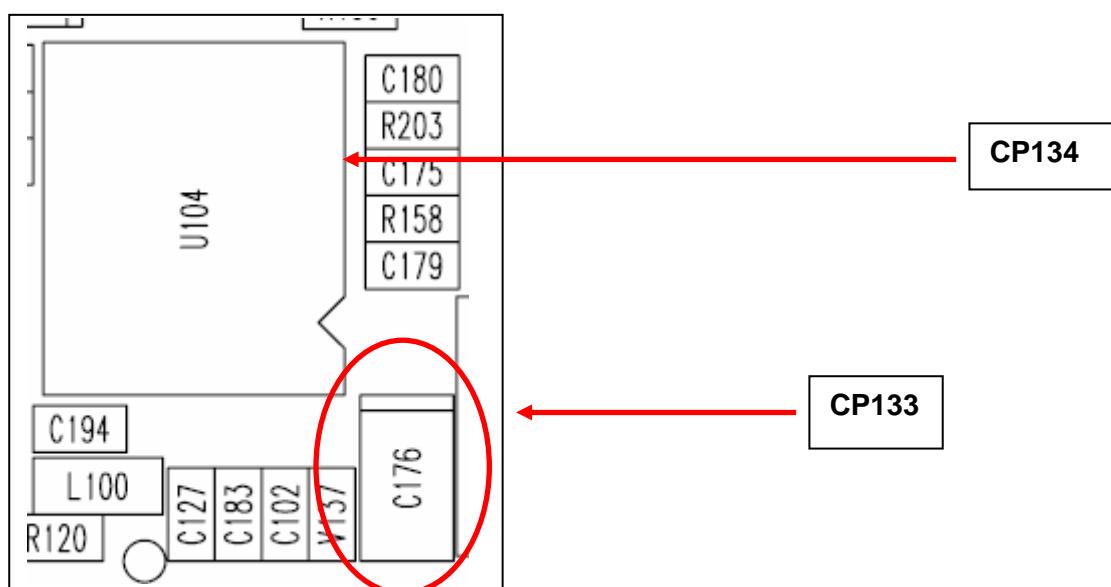
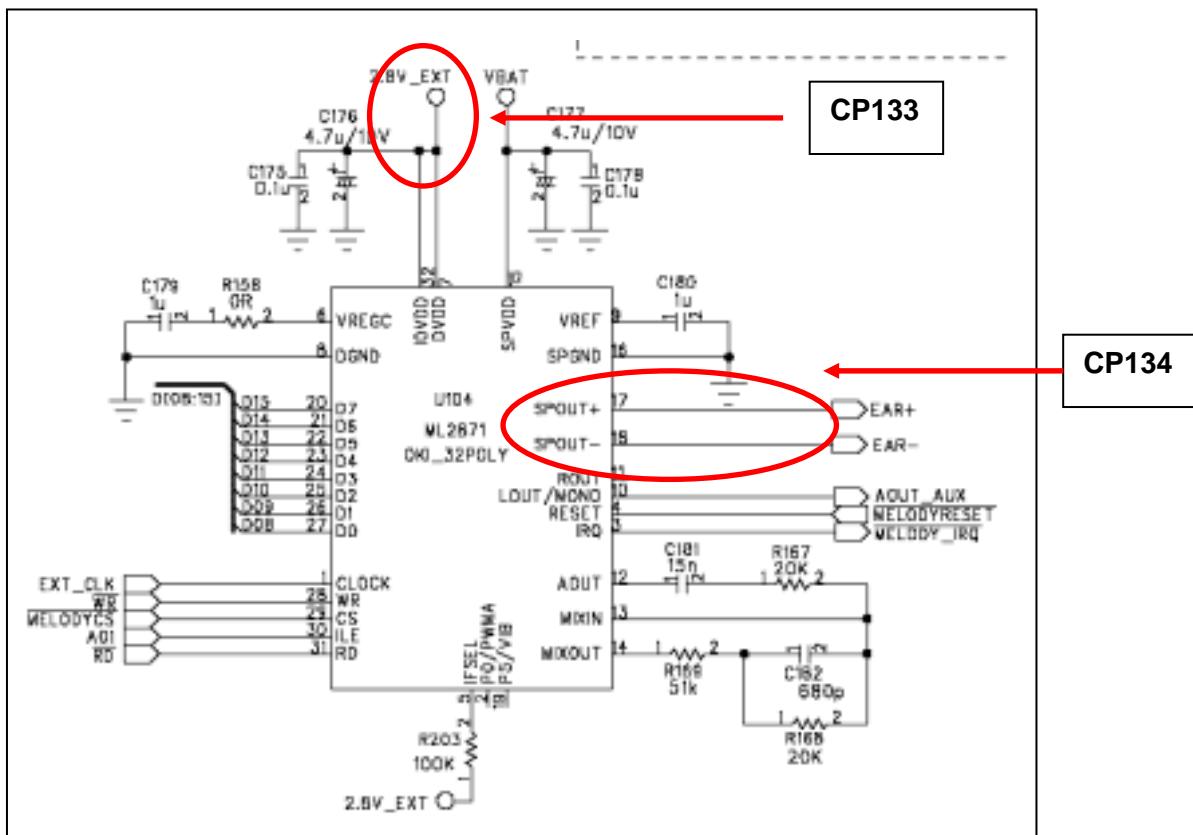


6.2.5 Melody not ringing

1. Check to see if U104.32, 7 pin is 2.8V : CP133

2. Check SPK_L,SPK_R for waveform : CP134

NO → Replacd SPK



6.2.6 Vibrator not working

1. Check to see if Q103.1 pin is 2.8V : CP137

NO → Check to see Q103 cold solder, broken, short to the other PCB pattern or not

If you find out any defect, you replace it

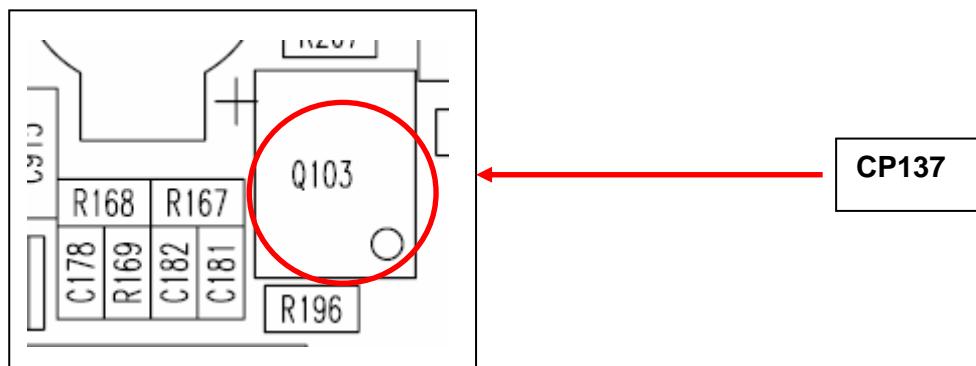
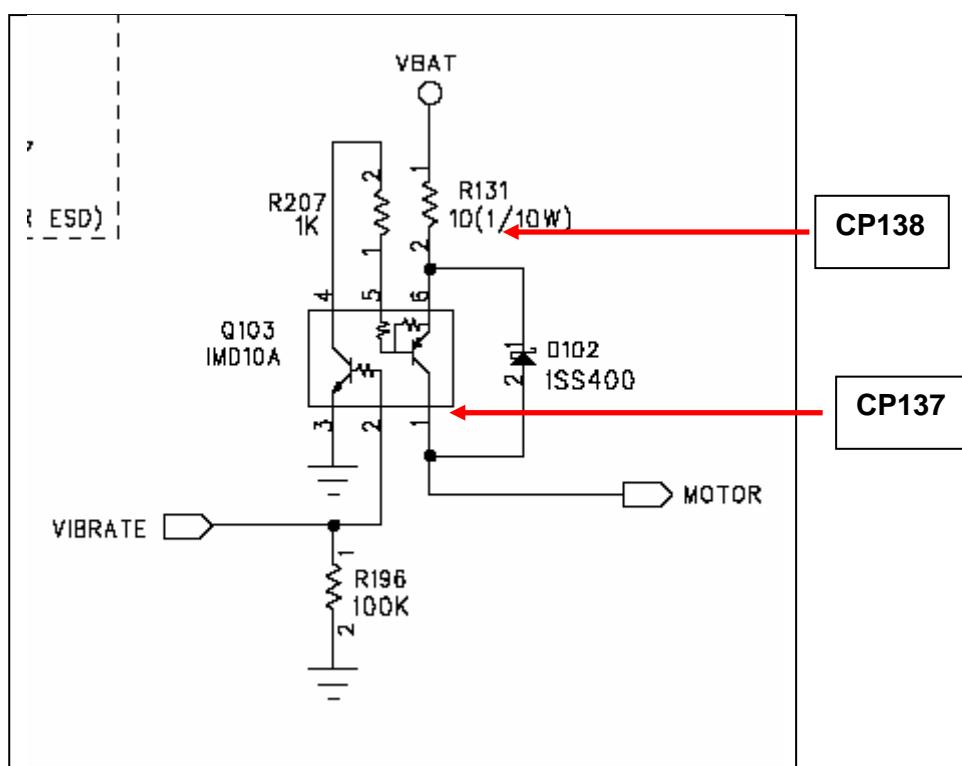
2. Check to see Q103.6 is same with battery power : CP138

NO → Check to see Q103 and R131 cold solder, broken, short to the other PCB pattern or not

If you find out any defect, you replace it

3. Check to see Vibrator

If you find out any defect, you replace it



6.3 SIM card part

6.3.1 SIM error

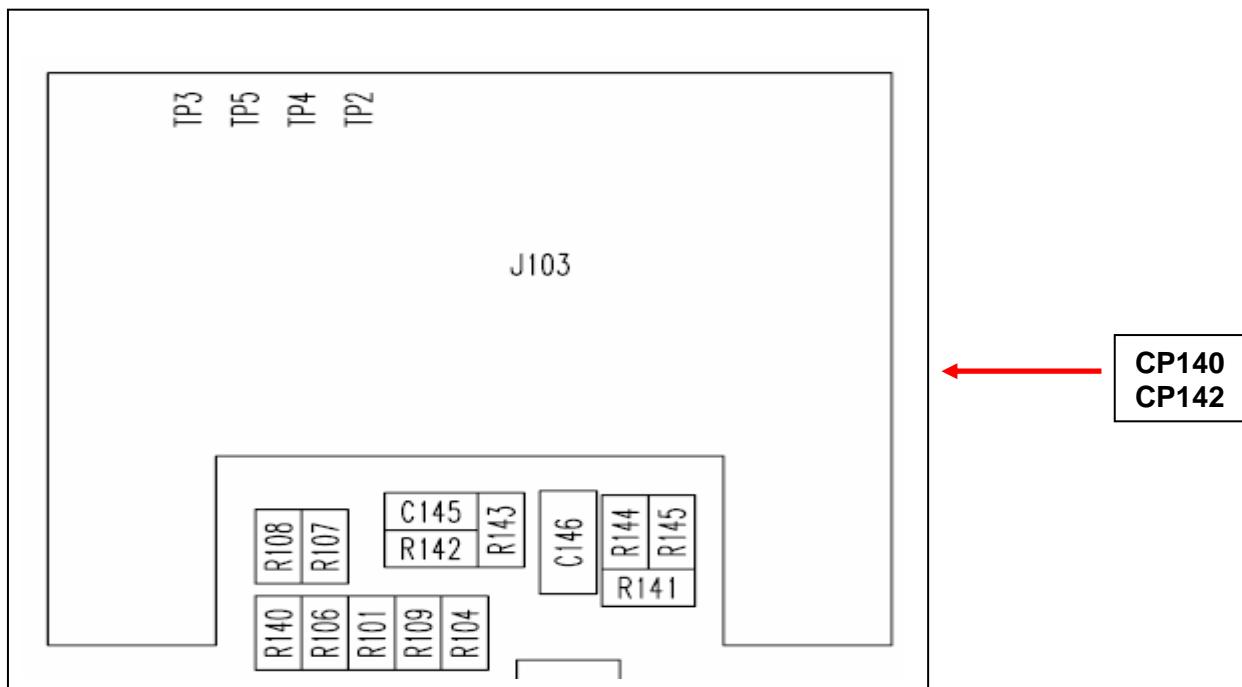
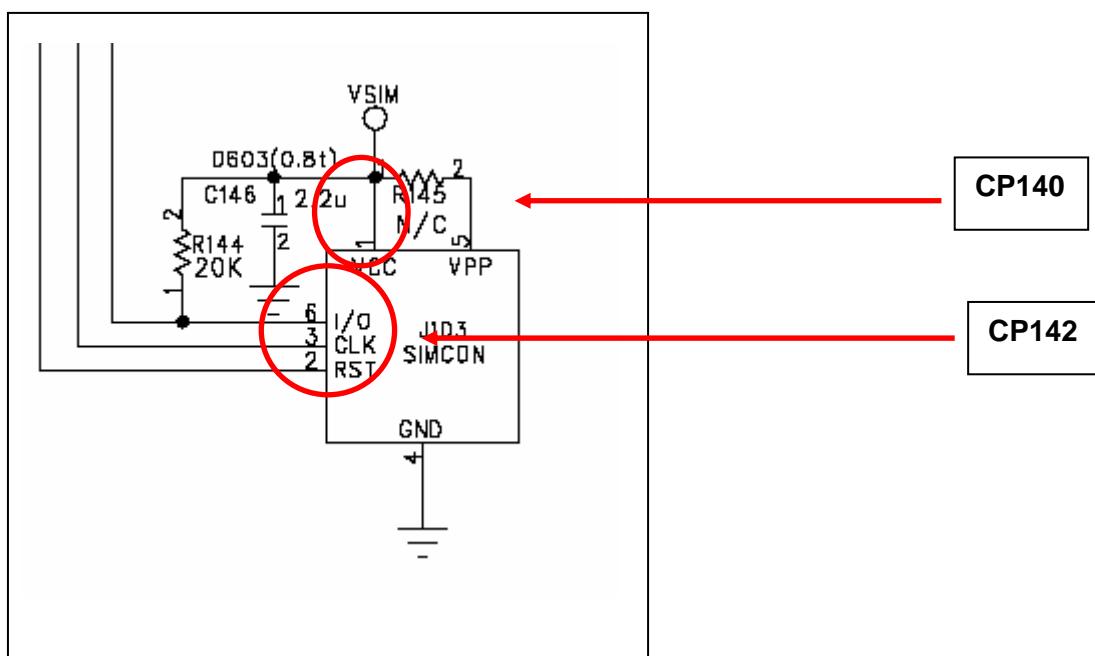
1. Check to see if J103.1 pin is around 2.85V : CP140

If you find out any defect, you replace it

2. Check to see J103.2, 3, 6 for wave form : CP142

NO → Check to see J103, R145 and C146 cold solder, broken, short to the other PCB pattern or not

If you find out any defect, you replace it



6.4 Charger part

6.4.1 Charging error

Insert adaptor into I/O jack.

1. Check to see if U102.A5 pin is 5.2V : CP143

NO → Check to see J101.23, 24 pin cold solder, broken, short to the other PCB pattern or not : CP144

If you find out any defect, you replace it

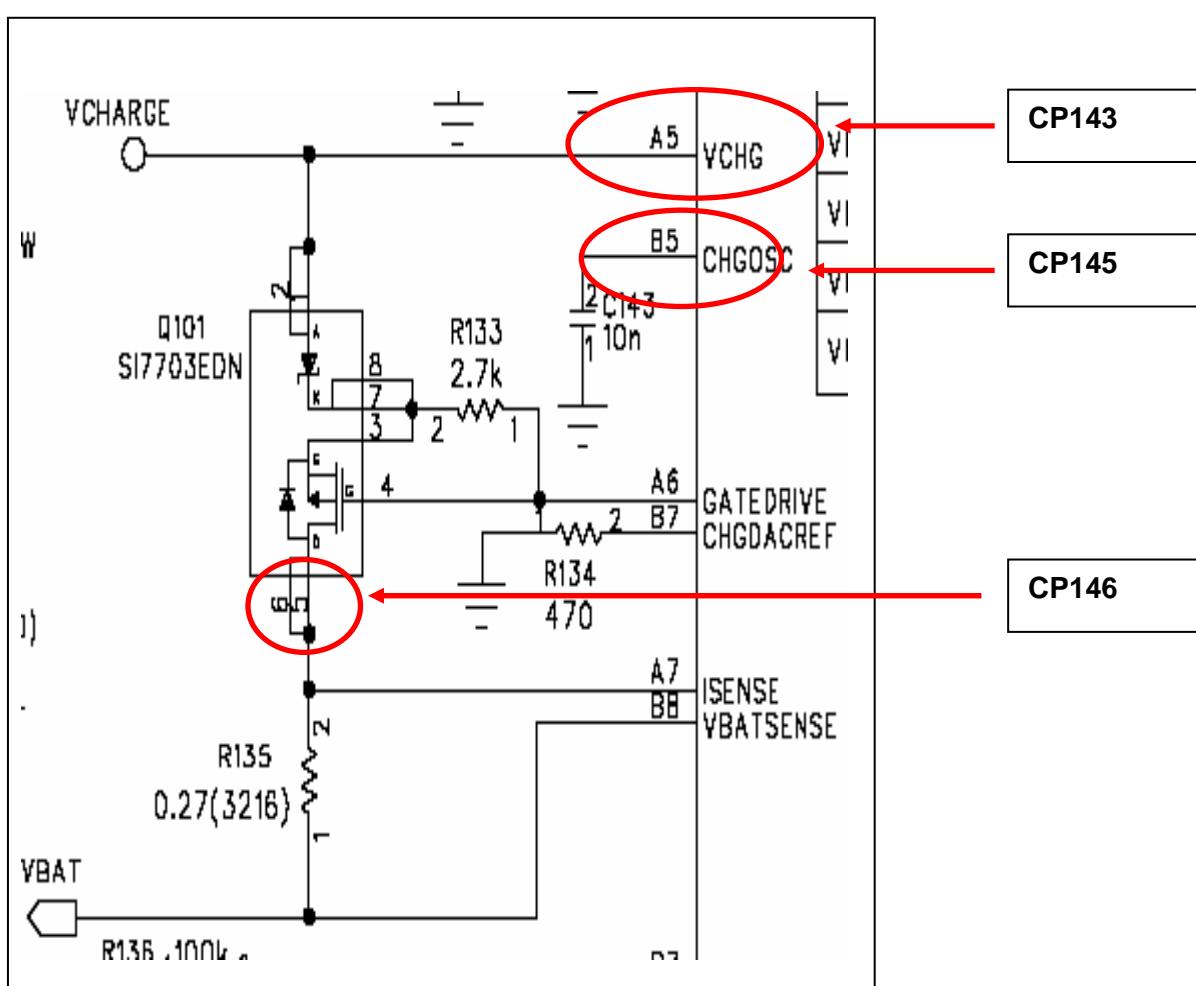
2. Check to see U102.B5 pin is low (0V) : CP145

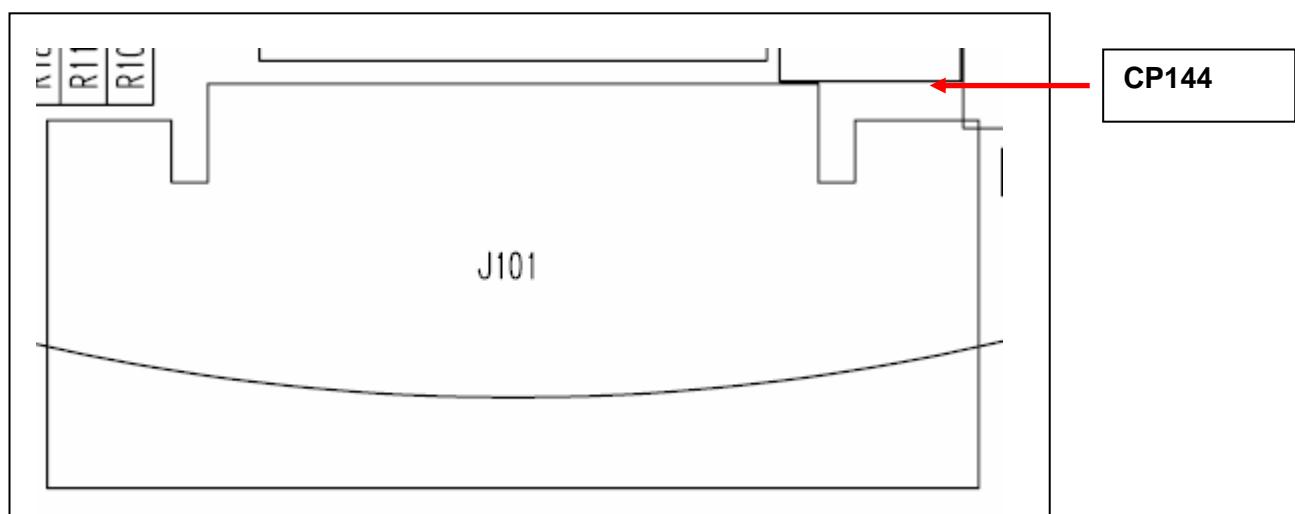
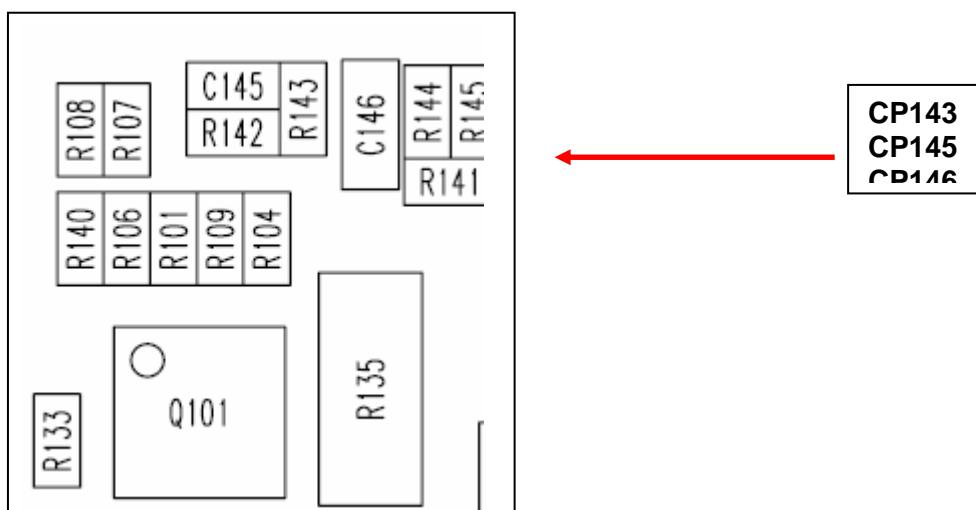
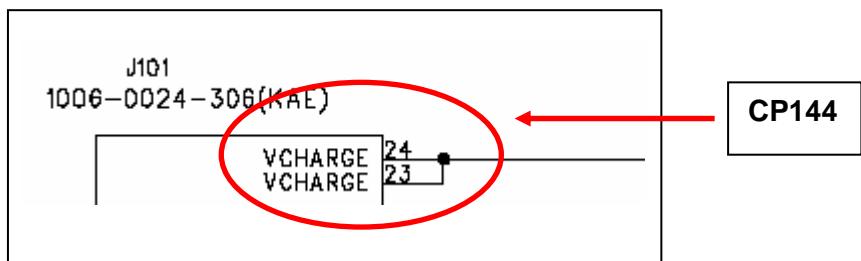
NO → Check to see U102 cold solder, broken, short to the other PCB pattern or not
If you find out any defect, you replace it

3. Check to see Q101.5,6 pin(same as the pin U102.A7) is 4.2V : CP146

NO → Check to see Q101, R135 cold solder, broken, short to the other PCB pattern or not

If you find out any defect, you replace it



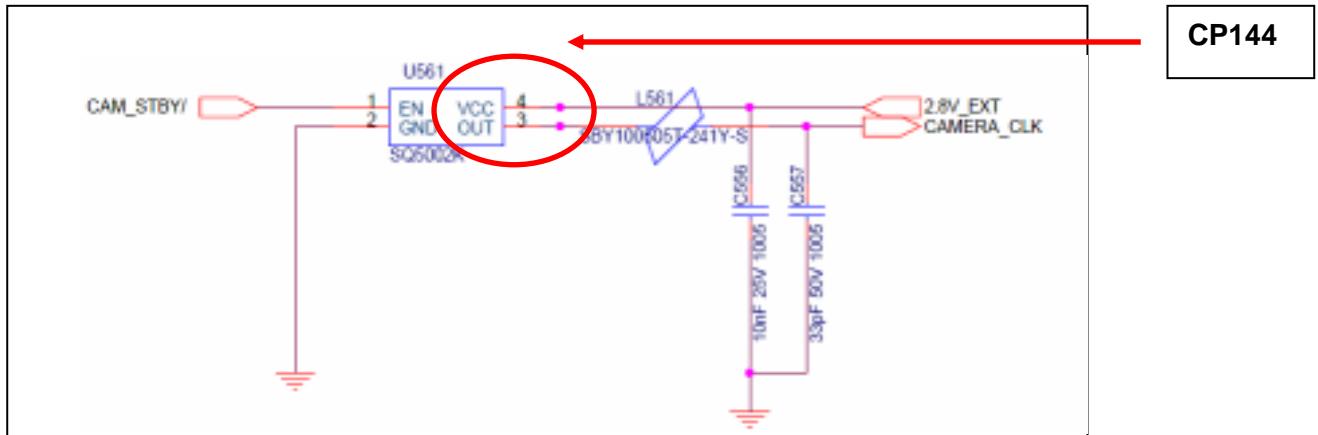
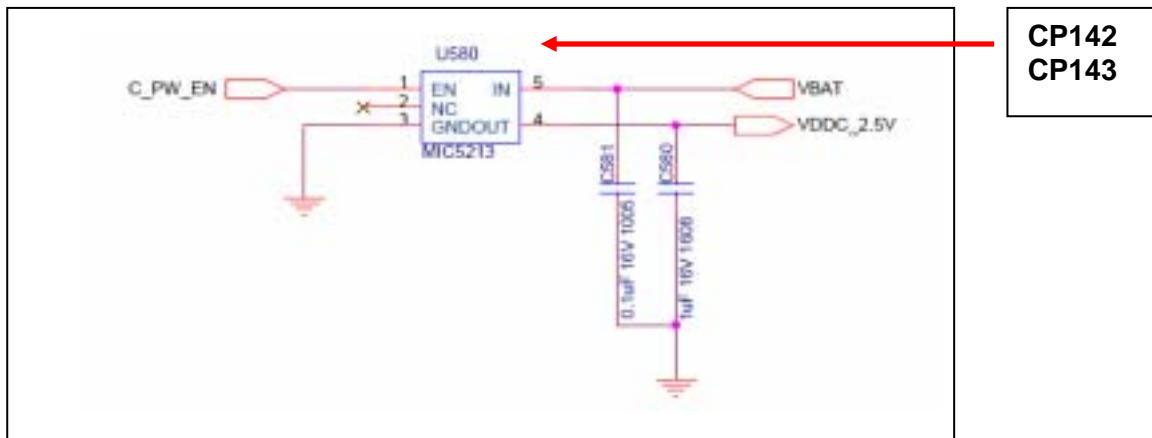


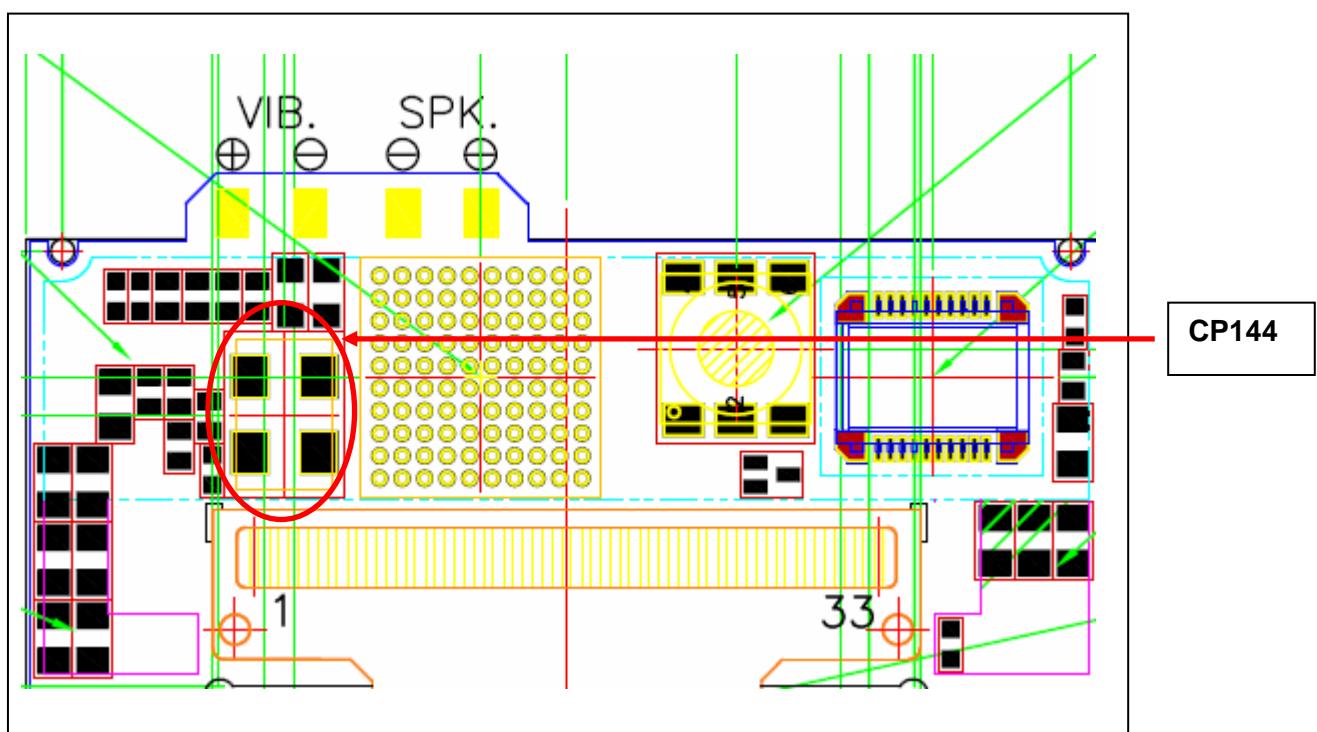
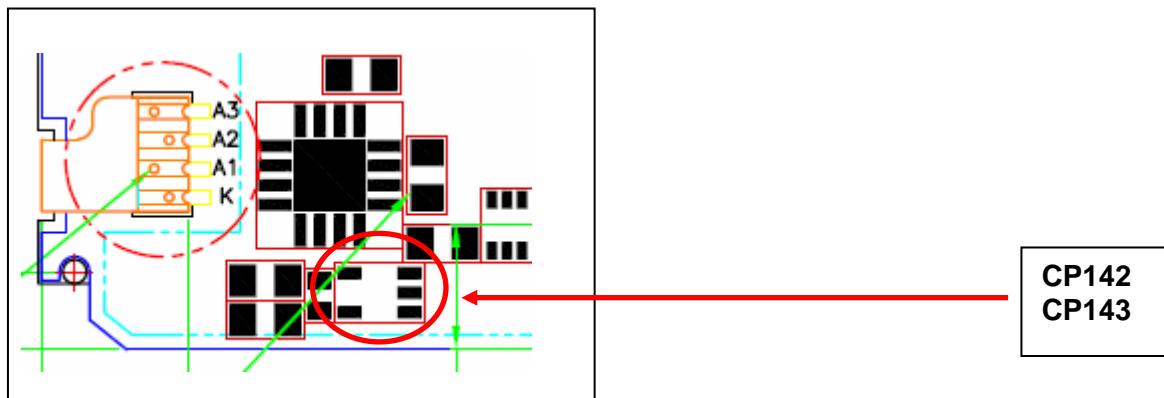
6.5 Camera Sensor Part

6.5.1 Camera Preview error

1. Check to see if U580.1 pin(On LCD Module) is around 2.8V : CP142
2. Check to see if U580.4 pin(On LCD Module) is around 2.5V CP143
3. Check to see if U561.3 pin(On LCD Module) is oscillated(27Mhz): CP144

NO → Replace the Crystal (U561)





6.6 RF Part

6.6.1 Test conditions

1. Test condition 1 : VBAT = 3.8V during all tests

2. Test condition 2 : Traffic channel :GSM850 Band

 Tx mode

 Ch190

 Power Level : 13

3. Test condition 3 : Traffic channel : DCS Band

 Tx mode

 Ch698

 Power Level : 10

4. Test condition 4 : Traffic channel :GSM850 Band

 Rx mode

 Ch190

 Input power : -70dBm

5. Test condition 5 : Traffic channel : DCS Band

 Rx mode

 Ch698

 Input power : -70dBm

6. Test condition 5 : Traffic channel : PCS Band

 Tx mode

 Ch662

 Input power : -70dBm

7. Test condition 6 : Traffic channel : Everything Test

 VCTCXO 13MHz Reference Check

% RF power values are measured using $50\ \Omega$ coaxial cable.

6.6.2 Power Supply Check Point _ TEST CONDITION 1

Step	Test point	Typical Value	Condition	Checking Point
2-1	U907 Pin#1	3.8V	2, 3, 4, 5,6	Check route connection : VBAT YES : Pass NO : Power Supply Check
2-2	U907 Pin#5	2.8V	2, 3, 4, 5,6	Check route connection : VCC_2.8V YES : Pass NO 1: Step2-1 Check NO 2: U907 Pin3 Check Logic High : LDO Repair Logic Low : Clock Check (Test Condition 6)

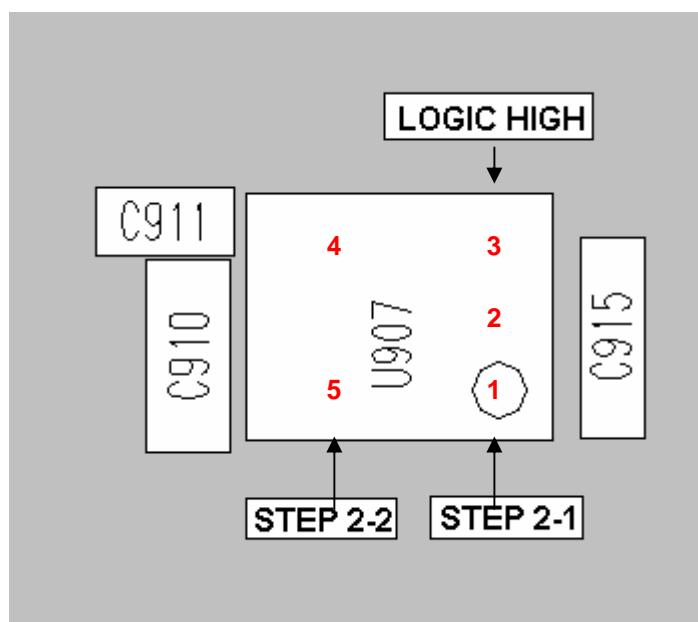


Fig.6-1 U907 Regulator Power Supply PCB Layout

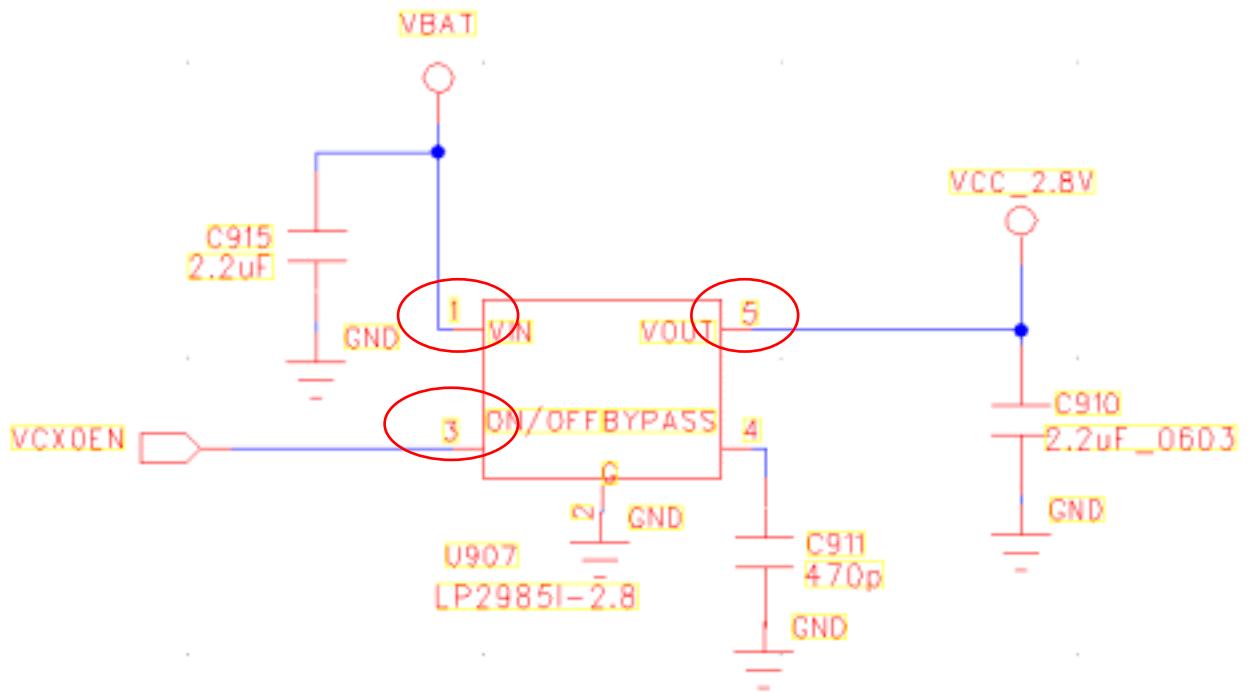


Fig.6-2 U907 Regulator Power Supply Schematic

6.6.3 Power Amplifier Module _ TEST CONDITION 2,3,4,5

Step	Test point	Typical Value	Condition	Checking Point
3-1	U720 Pin #4	3.8V	2,3,6	Check route connection : VBAT YES : Pass NO : Power Supply Check Test Condition1 Check
3-2	U720 Pin #3	LOGIC PULSE _ 217HZ	2,3,6	Check route connection : PAM Enable YES : Pass NO : U1 Repair
3-3	U720 Pin #2	LOGIC	2,3,6	Check this pin #2, When Logic High, then DCS/PCS Mode. While Logic Low , GSM mode is operating.

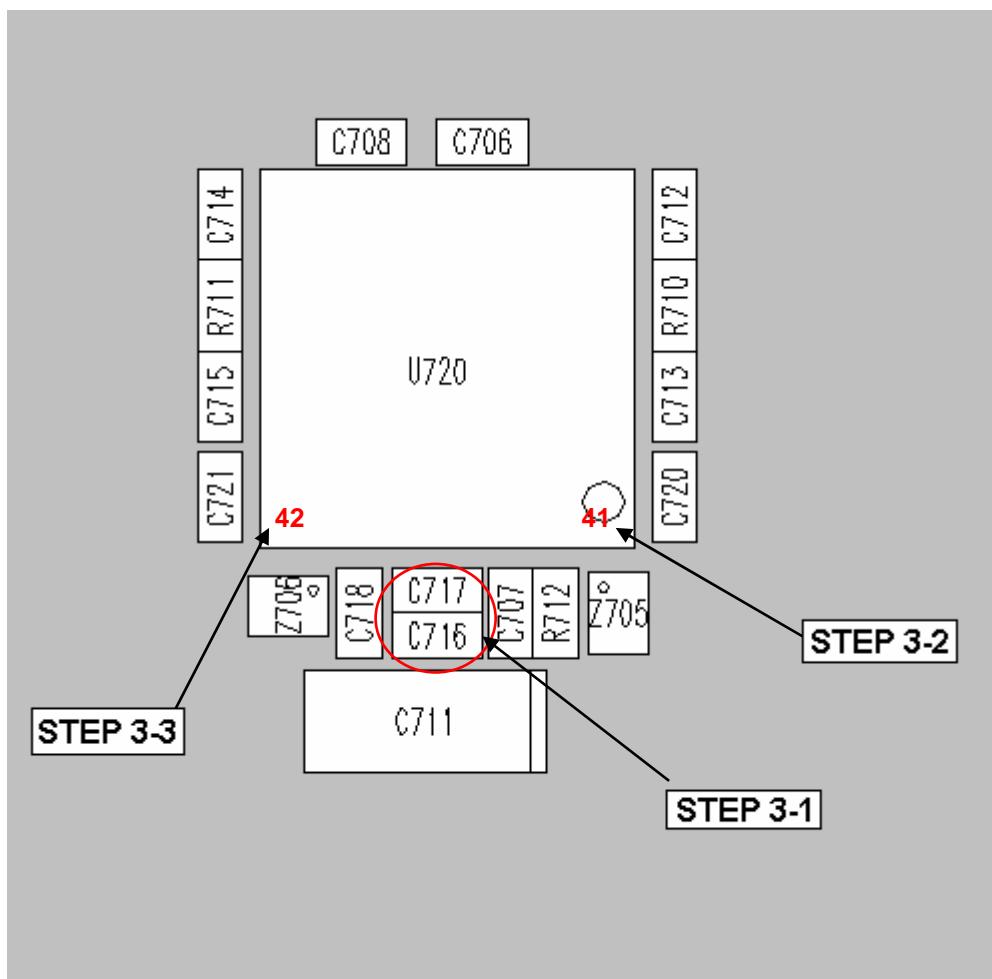


Fig.6-3. . Power Amp Module Test Point on the PCB LAYOUT

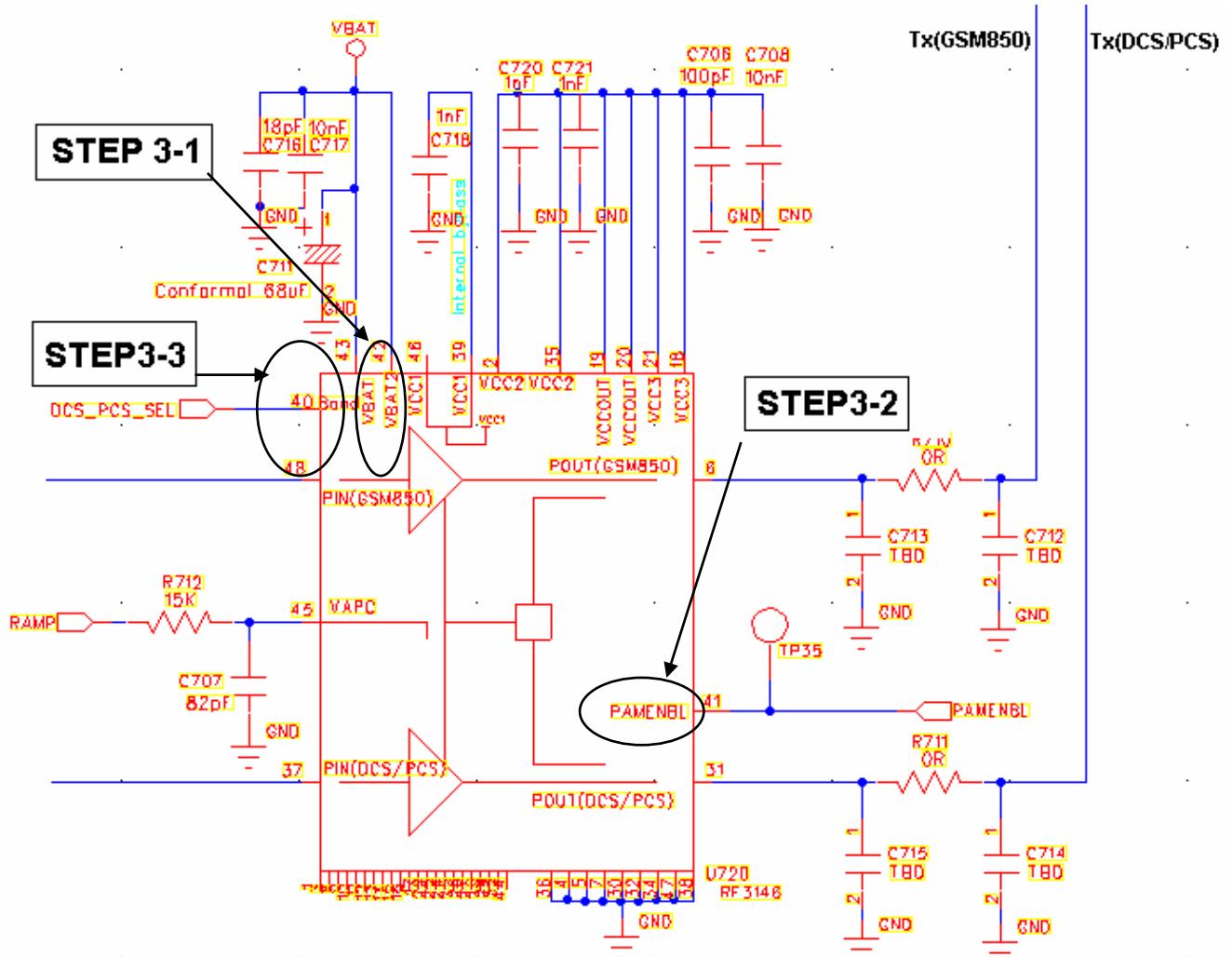


Fig.6-4. Power Amplifier's Test Point on the schematic

6.6.4 VCTCXO _ TEST CONDITION 6

Step	Test point	Typical Value	Condition	Reaction to Abnormality
4-1	V801 Pin#1	1.4V \pm 0.25V	2, 3, 4, 5, 6	Check route connection : AFC YES : Pass NO : U 1
4-2	V801 Pin#4	2.8V	2, 3, 4, 5, 6	Check route connection : VTCXO

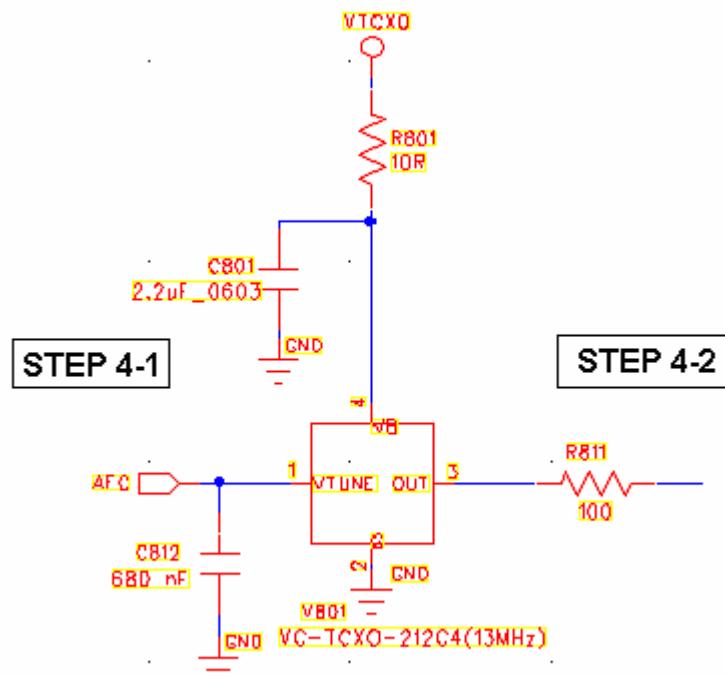


Fig.6-5. VCTCXO Check Point Circuit

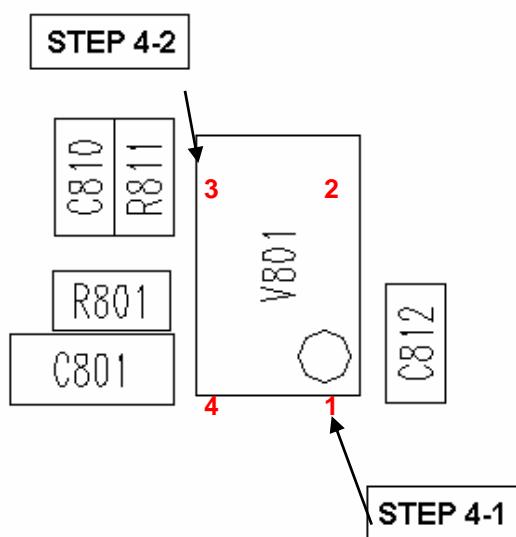


Fig.6-6. VCTCXO Check Point on the PCB Layout

6.6.5 Front End Module

Step	Test point	Typical Value	Condition	Check point
5-1	U750 Pin#11	2.6V	2	When Pin#11 is Logic High and Pin#2 is Logic Low the mode is GSM-850 band.
5-2	U750 Pin#9	2.6V	3,6	During Pin#9 and Pin#12 are Logic High and Pin#11 is Logic Low the operating mode is DCS band.
5-3	U750 Pin#12	2.6V	3,6	When PCS band is on operating, Both Pin#9 and Pin#12 logics are high.

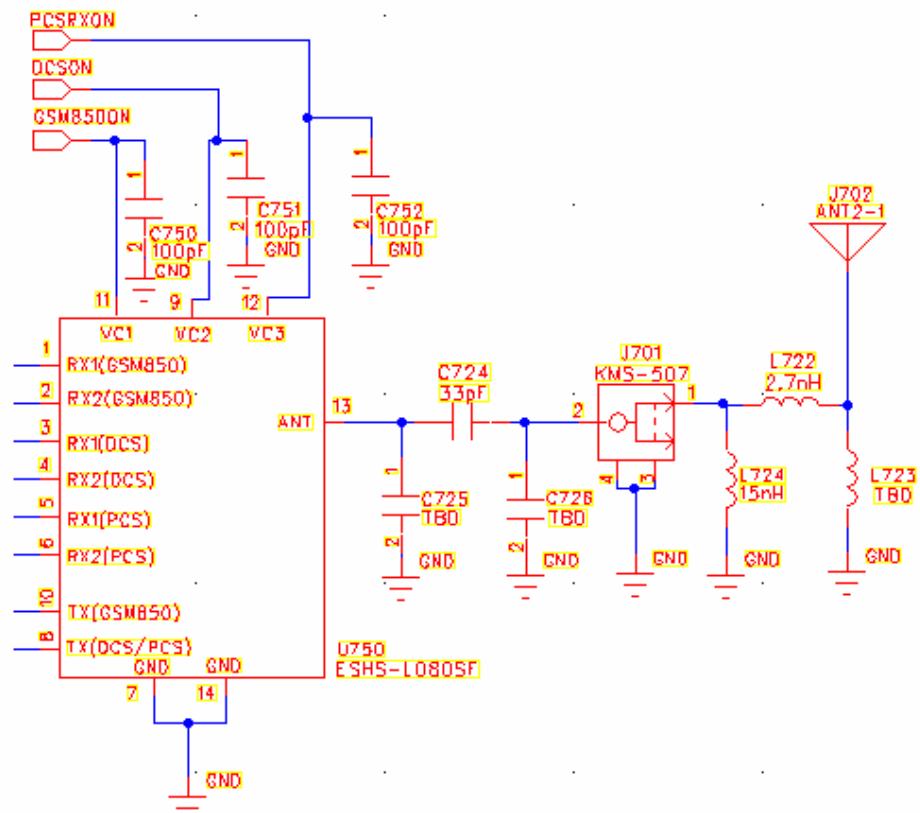


Fig. 6-7 Antenna Switch Module Circuit

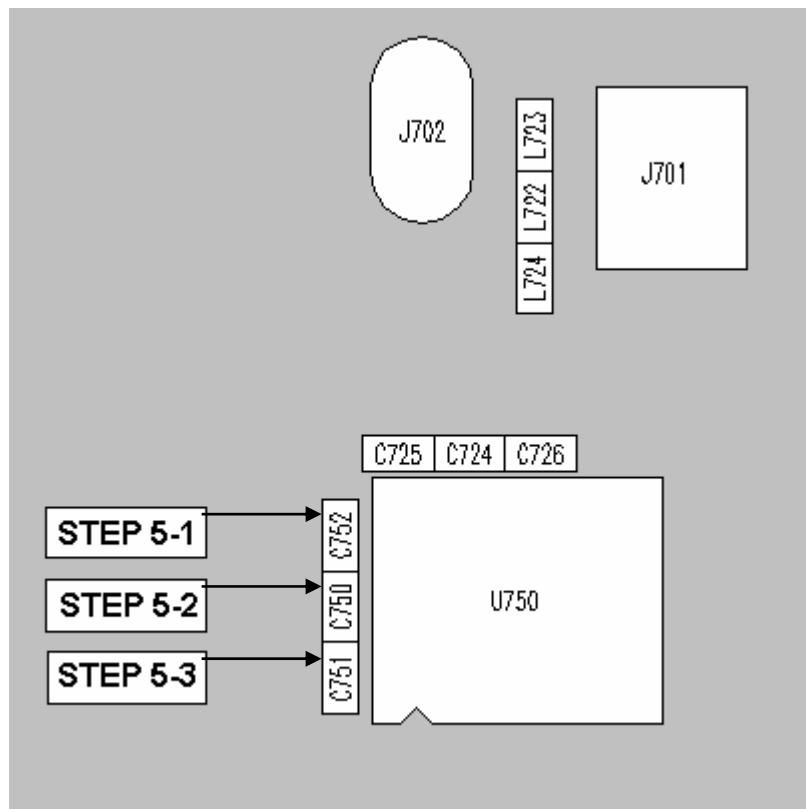


Fig. 6-8 Antenna Switch Module PCB Layout