ORDER NO. OMTD030301C8

# Service Manual

## Personal Cellular Telephone

GSM

# EB-G60


| | 900 MHz | 1800 MHz |
|---|---|---|
| Frequency Range | Tx: 880-915 MHz<br>Rx: 925-960 MHz | Tx: 1710-1785 MHz<br>Rx: 1805-1880 MHz |
| Tx/Rx frequency separation | 45 MHz | 95 MHz |
| RF Channel Bandwidth | 200 KHz | |
| Number of RF channels | 174 | 374 |
| Speech coding | Full rate/Half rate/Enhanced Full rate | |
| Operating temperature | –10 °C to +55 °C | |
| Type | Class 4 Handheld | Class 1 Handheld |
| RF Output Power | 2W maximum | 1W maximum |
| Modulation | GMSK (BT = 0.3) | |
| Connection | 8ch/TDMA | |
| Transmission speed | 270.833 kbps | |
| Signal Reception | Direct conversion | |
| Antenna Impedance | 50 Ω | |
| Antenna VSWR | < 3 : 1 | |
| Dimensions | 104 mm X 47 mm X 19.15 mm | |
| Volume | 75 cc | |
| Weight | 84 g | |
| Display | 128 X 128 pixels, 4096-colour palette (RGB) | |
| Illumination | 8 LEDs for keypad backlighting (Green)<br>2 LEDs for LCD backlighting (White) | |
| Keys | 16-key Keypad, 4-key Direction key,<br>Navigation key | |
| SIM | 3 V Plug-in type only | |
| External DC Supply Voltage | 5.8 V | |
| Battery | 3.7V nominal, 740mAh, Li-Ion | |
| Standby Time | 100 – 200 hrs maximum | |
| Talk Time | > 180 minutes maximum | |

### ⚠ WARNING

This service information is designed for experienced repair technicians only and is not designed for use by the general public.
It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product.
Products powered by electricity should be serviced or repaired only by experienced professional technicians. Any attempt to service or repair the product or products dealt with in this service information by anyone else could result in serious injury or death.

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CP8 PATENTS

Comments or correspondence concerning this manual should be addressed to:
Panasonic Mobile Communications Co., Ltd.
600, Saedo-cho, Tsuzuki-ku, Yokohama, 224-8539, Japan

# CONTENTS

# 1. INTRODUCTION

**WARNING**

The equipment described in this manual contains polarised capacitors utilising liquid electrolyte. These devices are entirely safe provided that neither a short-circuit nor reverse polarity connection is made across the capacitor terminals. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN DAMAGE TO THE EQUIPMENT OR, AT WORST, POSSIBLE INJURY TO PERSONNEL RESULTING FROM ELECTRIC SHOCK OR THE AFFECTED CAPACITOR EXPLODING. EXTREME CARE MUST BE EXERCISED AT ALL TIMES WHEN HANDLING THESE DEVICES.

**Caution**

The equipment described in this manual contains electrostatic devices (ESDs). Damage can occur to these devices if the handling procedures described in Section 4 are not adhered to.

**Caution**

This equipment may contain an internal battery in addition to the external battery packs. These batteries are recyclable and should be disposed of in accordance with local legislation. They must not be incinerated, or disposed of as ordinary rubbish.

## 1.1. Purpose of the Manual

This Service manual contains the information and procedures required for installing, operating and servicing the Panasonic GSM Personal Cellular Mobile Telephone system operating on GSM Digital Cellular Networks.

## 1.2. Structure of the Manual

The manual is structured to provide service engineering personnel with the following information and procedures:

1. General and technical information - provides a basic understanding of the equipment, kits and options, together with detailed information for each of the major component parts.

2. Installation and operating information - provides instructions for unpacking, installing and operating the equipment.

3. Servicing information - provides complete instructions for the testing, disassembly, and reassembly of the product. Step-by-step troubleshooting information is given to enable the isolation and identification of a malfunction, and thus determine what corrective action should be taken. The test information enable verification of the integrity of the equipment after any remedial action has been carried out.

4. Illustrated parts list - provided to enable the identification of all cosmetic and some electrical components, for the ordering of replacement parts.

## 1.3. Servicing Responsibilities

The procedures described in this manual must performed by qualified service engineering personnel, at an authorized service center.
The service engineering personnel are responsible for fault diagnosis and repair of all equipment described in this manual.

# 2. GENERAL DESCRIPTION

## 2.1. General

This section provides a general description and kit composition details for the GSM Handportable Telephone system and optional kits.

## 2.2. Features

The Panasonic Telephone Model G60 is a high performance, small, light, handset for business and domestic use. The following features are provided:

1. Triple Rate, which includes Full Rate, Half rate and Enhanced Full Rate (EFR) speech, codec.
2. Dual Band, E-GSM 850/900 and GSM 1800/1900 operation.
3. Tegic T9 Text Entry.
4. Voice Ringer.
5. Desktop Hand free function comprising integral echo cancellation and noise suppression.
6. Wireless Application Protocol (WAP) Browser.
7. Backup Battery.
8. Downloadable polyphonic melody ring tones.
9. Clock, Calculator and Currency Converter.

## 2.3. Handportable Main Kit

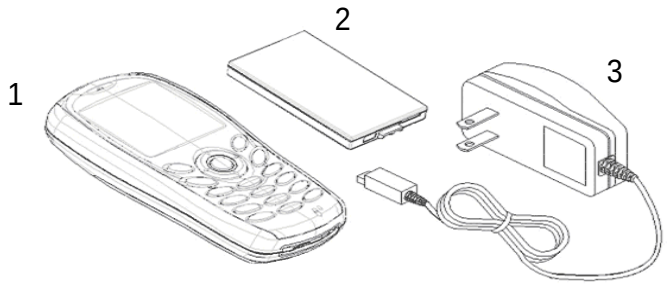



**Figure 2.1: Handportable Main Unit Kit Contents**

| Item | DESCRIPTION | PART NUMBER |
|---|---|---|
| 1 | Main Unit | 770040RH01W |
| 2 | Battery, Standard | 761PV11RD1W |
| 3 | Travel Charger | 7620003482W |
| | Document Pack | See Section 9 |

# 3. OPERATING INSTRUCTIONS

## 3.1. General

This section provides a brief guide to the operation and facilities available on the telephone handset. Refer to the

Operating Instructions supplied with the telephone for full operational information.

## 3.2. Liquid Crystal Display

The telephone handset has a graphical chip on glass display. The following icons are available:


**Figure 3.1: Liquid Crystal Display**

| | |
|---|---|
| | Indicates received signal strength: strong signal area ; weak signal area |
| | Indicates that it is possible to make an emergency call. |
| Menu Number | The number of the feature indicated by the pointer. To access a feature enter the menu number on the keypad. |
| | Displays the battery charge level: "<br>Battery is at full charge<br>Battery requires charging<br>The battery icon flashes during charging |
| Menu Icon | Displays a small icon related to the current status of the telephone:"<br>telephone is roaming on a non-home network.<br>using the “Call Divert” feature or the telephone has Call-Divert set;<br>shows that vibration alert is switched on;<br>shows that the telephone is in silent mode - no tones;<br>flashes to indicate that there are unread text (SMS) messages. Lit when SMS area is full;<br>indicates the telephone is locked;<br>Abc shows that the normal character set has been selected;<br>ABΓ shows that the Greek character set has been selected;<br>ÄÅÅ shows that the Extended character set has been selected;<br>Number shows that numbers have been selected for text entry<br>T9 indicates that Tegic T9R predictive text mode is selected |
| Information Icon | Displays a small icon according to the current menu level:<br>indicates the alarm is set."<br>indicates the current Phonebook is sourced from the Mobile Phonebook.<br>indicates the current Phonebook is sourced from the SIM Phonebook |

Following some operations, the display will clear automatically after three seconds or after pressing any key except .

## 3.3. Location of Controls

Incoming / Charge indicator:

Green - Incoming call.

Red - Charging battery pack.

External connector:

Used to connect to external accessories or to charging equipment

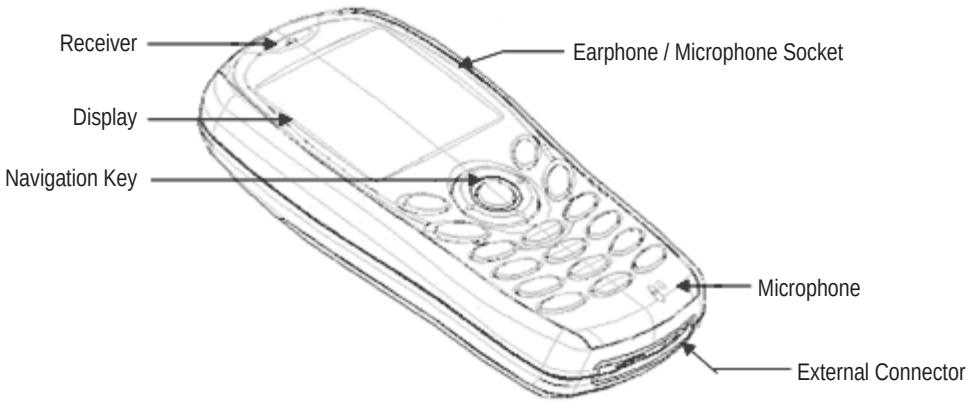
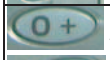
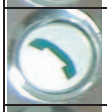
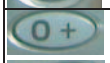
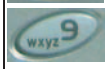



**Figure 3.2: Location of Controls**

### The keypad Type A

| | |
|---|---|
|  | Navigation Key. Scrolls through options or features menu and increases or decreases volume. |
|  | Cancel Key. Used mainly to cancel the current operation and return to the previous menu level. In some menus it has other functions. |
|  | Option key. Primarily used for accessing the Phonebook or switching character types. |
|  | Send Key. Makes a call. |
|  | End Key. Ends a call or switches the telephone on/off when pressed and held. |
|  to  | Digit keys. Enter wild numbers or pauses when pressed and held. Where appropriate the 0 key scrolls up or down through abbreviated control names and then select to reveal the international access code “+”. |
|  | Vibrate enable/disable Key. Press and hold to enable or disable the vibrate alert. |

## The keypad Type B

| | |
|---|---|
|  | Navigation Key. Scrolls through options or features menu and increases or decreases volume. |
|  | Cancel Key. Used mainly to cancel the current operation and return to the previous menu level. In some menus it has other functions. |
|  | Option key. Primarily used for accessing the Phonebook or switching character types. |
|  | Send Key. Makes a call. |
|  | End Key. Ends a call or switches the telephone on/off when pressed and held. |
|  to  | Digit keys. Enter wild numbers or pauses when pressed and held. Where appropriate the 0 key scrolls up or down through abbreviated control names and then select to reveal the international access code “+”. |
|  | Vibrate enable/disable Key. Press and hold to enable or disable the vibrate alert. |

# 3.4. Alpha Entry

## 3.4.1 Character Set / Key Assignments

Alpha entry is used to enter alphanumeric characters in to the Phonebook, Short Messages and Greeting Message areas

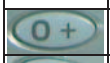
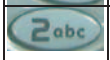
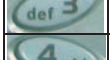
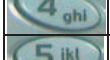
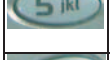
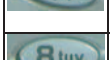
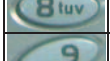
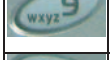
### The keypad of Type A

| Key | | Character / Operation | | | |
|---|---|---|---|---|---|
| | T9® | Normal | Greek | Extended | Numeric |
| 0 + | Alternatives | + – | + – | + – | 0+P_ |
| 1 | Punctuation | " @ – , . ; : ! ¡ ? ¿ ( ) ' & % + – / < > = £ $ ¥ ¤ § | | | 1 |
| 2abc | abc | A B C a b c | Α Β Γ | A Ä Å Æ B C Ç a ä å æ à b c | 2 |
| 3def | def | D E F d e f | Δ Ε Ζ | D E É F d e é è f | 3 |
| 4ghi | ghi | G H I g h i | Η Θ Ι | G H I g h i ì | 4 |
| 5jkl | jkl | J K L j k l | Κ Λ Μ | J K L j k l | 5 |
| 6mno | mno | M N O m n o | Ν Ξ Ο | M N Ñ O Ö o m n ñ o ö ø | 6 |
| 7pqrs | pqrs | P Q R S p q r s | Π Ρ Σ | P Q R S p q r s ß | 7 |
| 8tuv | tuv | T U V t u v | Τ Υ Φ | T U U V t u ü ù v | 8 |
| 9wxyz | wxyz | W X Y Z w x y z | Χ Ψ Ω | W X Y Z w x y z | 9 |
| * ⇧ | Shift / Lock | * | * | * | * |
| ⌨ # | Space | # | # | # | # |

Each time a key is pressed, it will display the next character. When another key is pressed, or no key is pressed for a short time, the cursor will move to the next position.

To cycle between Greek characters (Α Β Γ), extended characters (A Ä Å), numerals (0-9) and normal characters (A B C) press  .

### The keypad of Type B

| Key | | Character / Operation | | | |
|---|---|---|---|---|---|
| | T9R | Normal | Greek | Extended | Numeric |
|  | Alternatives | + - | + - | + - | 0+P_ |
|  | Punctuation | " @ – , . ; : ! ¡ ? ¿ ( ) ' & % + – / < > = £ $ ¥ ¤ § | | | 1 |
|  | abc | A B C a b c | Α Β Γ | A Ä Å Æ B C Ç a ä å æ à b c | 2 |
|  | def | D E F d e f | Δ Ε Ζ | D E É F d e é è f | 3 |
|  | ghi | G H I g h i | Η Θ Ι | G H I g h i ì | 4 |
|  | jkl | J K L j k l | Κ Λ Μ | J K L j k l | 5 |
|  | mno | M N O m n o | Ν Ξ Ο | M N Ñ O Ö o m n ñ o ö ø | 6 |
|  | pqrs | P Q R S p q r s | Π Ρ Σ | P Q R S p q r s ß | 7 |
|  | tuv | T U V t u v | Τ Υ Φ | T U U V t u ü ù v | 8 |
|  | wxyz | W X Y Z w x y z | Χ Ψ Ω | W X Y Z w x y z | 9 |
|  | Shift / Lock | * | * | * | * |
|  | Space | # | # | # | # |

Each time a key is pressed, it will display the next character. When another key is pressed, or no key is pressed for a short time, the cursor will move to the next position.

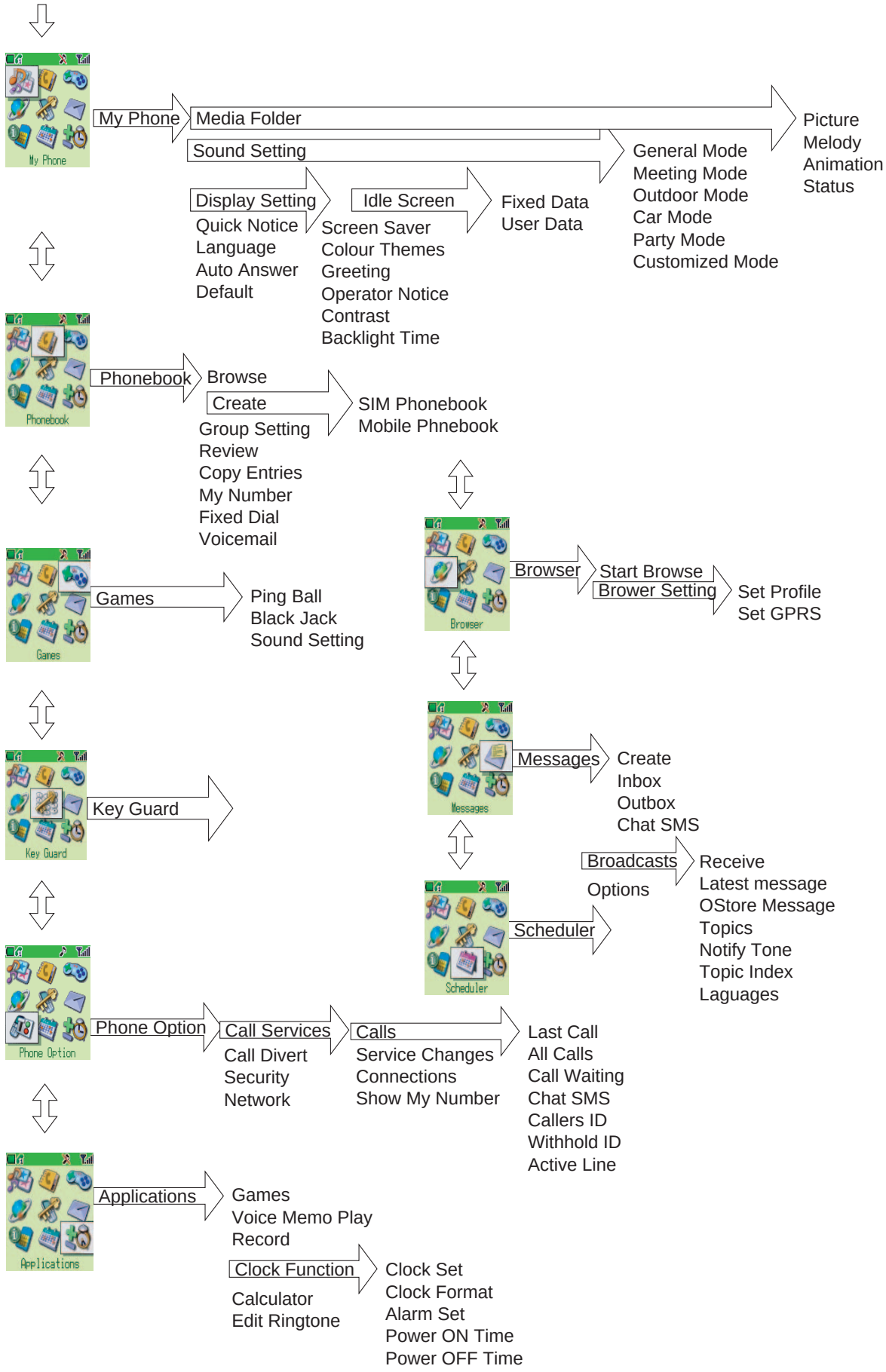
To cycle between Greek characters (Α Β Γ), extended characters (A Ä Å), numerals (0-9) and normal characters (A B C) press  .

## 3.4.2 Editing Alpha Entry

Pressing  will move the cursor up or down or left or right. When the cursor is moved over a character and another key pressed this will insert the new character.

Pressing  will delete the character to the left of the cursor.

## 3.5. Features Menu Structure



## 3.6. Glossary of Terms

| Term | Definition |
|---|---|
| DTMF | Dual Tone Multiple Frequency tones. The numeric keys 0 to 9, and * and # will generate different DTMF tones when pressed during conversation. These are used to access voice mail, paging and home banking services. |
| GSM | Global System for Mobile communications. The name given to the advanced digital technology that the telephone uses. |
| Home network | The GSM network on which subscription details are held. |
| Hot Key Dial | Hot Key Dial allows quick access to numbers stored in the Phonebook of Service Dial Number list. The source of the Hot Key Dial may be defined by the user or preprogrammed by the Service Provide. It is most likely to be preprogrammed to the Service Dial Numbers by the Service Provider. |
| Lock code | Used for security of the telephone. Factory set to “0000”. |
| Message Centre | Where messages are sent before they are forwarded on to their destination. The Message Centre telephone number may be programmed into the SIM or supplied by the service provider. |
| Network operator | The organisation responsible for operating a GSM network. |
| Password | Used for the control of the call bar function. Supplied by the service provider. |
| PIN | Personal Identification Number used for SIM security. Supplied by the service provider. |
| PIN2 | Personal Identification Number used for the control of Fixed Dial Memory and call charge metering. Supplied by the service provider. |
| PUK/ PUK2 | PIN/PIN2 Unblocking Key. Used to unblock the PIN/PIN2. Supplied by the service provider. |
| Registration | The act of locking on to a GSM network. This is usually performed automatically by the telephone. |
| Roaming | The ability to use the telephone on networks other than the Home network. |
| Service Dial Numbers | Service Dial Numbers are predefined numbers that allow the user to access a set of special services provided by the Service Provider. For example billing information or access to Voice Mail. |
| Service provider | The organisation responsible for providing access to the GSM network. |
| SIM | Subscriber Identification Module. A small smart-card which stores unique subscriber and user-entered information such as Phone Book, Fixed Dial Memory and short messages. Supplied by the service provider. |
| Supplementary service | Network-controlled GSM functions supported by the telephone. Supplementary services may only be available on a subscription bases. |
| Wild numbers | Spaces in a stored telephone number. When the telephone number is recalled pressing a numeric key will fill in a space. This can be used to restrict dialling to a specific area. |

# 4. TECHNICAL SPECIFICATIONS

## 4.1. Tx Characteristics

All data is applicable to E-GSM 900 and GSM 1800 except where stated.

### 4.1.1. Frequency Error

±0.1 ppm max., relative to base station frequency.

### 4.1.2 Modulation Phase Error

RMS: Equal to or less than 5 °

Peak: Equal to or less than 20 °

### 4.1.3. Output RF Spectrum due to Modulation

| Offset from Centre Frequency (kHz) | Maximum Level Relative to Carrier (dB) |
|---|---|
| ±100 | +0.5 |
| ±200 | –30 |
| ±250 | –33 |
| ±400 | –60 |
| ±600 to 1800 | –60 |

### 4.1.4. Output RF Spectrum due to Switching Transients

| Offset from Centre Frequency (kHz) | Maximum Level (dBm) | |
|---|---|---|
| | E-GSM 900 | GSM 1800 |
| ±400 | –19 | –22 |
| ±600 | –21 | –24 |
| ±1200 | –21 | –24 |
| ±1800 | –24 | –27 |

Measurement conditions for output RF spectrum measurements:

| | |
|---|---|
| Frequency Span | 0 Hz |
| Measurement Bandwidth: | 30 kHz |
| Video Bandwidth: | 30 kHz (modulation) |
| | 100 kHz (switching) |
| Average (Modulation) | over 200 burst |
| Peak Hold (Switching) | over 10 burst |

### 4.1.5. Spurious Emissions at Antenna Connector

| Frequency Range | Frequency offset | Filter Bandwidth | Approx Video B/W | Limits(dBm) | |
|---|---|---|---|---|---|
| | | | | E-GSM 900 | GSM1800 |
| 100KHz to 50MHz | - | 10KHz | 30KHz | -36 | -36 |
| 50 to 500MHz | - | 100KHz | 300KHz | -36 | -36 |
| 500MHz to 1GHz | 0 to 1MHz | 100KHz | 300KHz | -36 | -36 |
| 1 GHz to 12.75 GHz<br>Excl. rel evant TX band<br>E-GSM:880 to 915 MHz<br>DCS:1710 to 1785 MHz<br>-and the Rx bands<br>925 -960 MHz<br>1805 -1880 MHz | 0 to 10MHz<br>>10MHz<br>>30MHz<br>(off trom edge of relevant Tx band) | 100KHz<br>300KHz<br>3MHz | 300KHz<br>1MHz<br>3MHz | -30<br>-30<br>-30 | -30(1.0 -1.710GHz)<br>-36(1.710 -1.785 GHz)<br>-30(1.785 -12.75 GHz) |
| Relevant TX band:<br>E-GSM:880 to 915 MHz<br>DCS:1710 to 1785 MHz | 1.8 to 6.0 MHz<br>>6.0MHz | 30KHz<br>100KHz | 100KHz<br>300KHz | -36<br>-36 | -36<br>-36 |

### 4.1.6. Residual Peak Power

Equal to or less than 70 dBc (BW = 300 kHz)

## 4.2. Rx Characteristics

### 4.2.1. Sensitivity

#### E-GSM 900 Full Rate Speech

The reference sensitivity performance in terms of frame erasure, bit error, or residual bit error rates (whichever is appropriate) is specified in the following table, according to the propagation conditions.

| Channels | Propagation conditions TU high | | Propagation conditions RA | | Propagation conditions HT | | Static Conditions | |
|---|---|---|---|---|---|---|---|---|
| | Tes t Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples |
| TCH/FS FER | 6.742* a | 8900 | | | | | 0.122* a | 164000 |
| class Ib | 0.42/ a | 10000 00 | | | | | 0.41/ a | 20000000 |
| (RBER) | 8.333 | 120000 | 7.5 | 24000 | 9.333 | 60000 | 2.439 | 8200 |
| class II (RBER) | | | | | | | | |

The reference sensitivity level is < -104 dBm.

NOTE: 1 < $\alpha$ < 1.6. The value of a can be different for each channel condition but must remain the same for FER and class 1b RBER measurements for the same channel condition.

## E-GSM 900 Half Rate Speech

The reference sensitivity performance in terms of frame erasure, bit error, or residual bit error rates (whichever is appropriate) is specified in the following table, according to the propagation conditions.

| Channels | Propagation conditions TU high | | Propagation conditions RA | | Propagation conditions HT | |
|---|---|---|---|---|---|---|
| | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples |
| TCH/HS(FER)<br>TCH/HS clas s Ib (BFI=0)<br>TCH/HS class II (BFI=0)<br>TCH/HS (UFR)<br>TCH/HSL class Ib ((BFI or UFI)=0) | 4.598<br>0.404<br>7.725<br>6.250<br>0.269 | 13050<br>148500<br>25500<br>9600<br>227000 | 8.500 | 20000 | 7.600 | 20000 |

## GSM 1800 Full Rate Speech

The reference sensitivity performance in terms of frame erasure, bit error, or residual bit error rates (whichever is appropriate) is specified in the following table, according to the propagation conditions.

| Channels | Propagation conditions TU high | | Propagation conditions RA | | Propagation conditions HT | | Static Conditions | |
|---|---|---|---|---|---|---|---|---|
| | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples |
| TCH/FS FER | 4.478* a | 13400 | | | | | 0.122* a | 164000 |
| class Ib | 0.32/ a | 1500000 | | | | | 0.41/ a | 20000000 |
| (RBER) | 8.333 | 60000 | 7.5 | 24000 | 9.333 | 30000 | 2.439 | 8200 |
| class II (RBER) | | | | | | | | |

The reference sensitivity level is < -103 dBm.

**NOTE**: $1 < \alpha < 1.6$. The value of a can be different for each channel condition but must remain the same for FER and class 1b RBER measurements for the same channel condition.

## GSM 1800 Half Rate Speech

The reference sensitivity performance in terms of frame erasure, bit error, or residual bit error rates (whichever is appropriate) is specified in the following table, according to the propagation conditions.

| Channels | Propagation conditions TU high | | Propagation conditions RA | | Propagation conditions HT | |
|---|---|---|---|---|---|---|
| | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples | Test Limit error rate % | Minimum No of samples |
| TCH/HS(FER)<br>TCH/HS class Ib (BFI=0)<br>TCH/HS class II (BFI=0)<br>TCH/HS (UFR)<br>TCH/HSL class Ib ((BFI or UFI)=0) | 4.706<br>0.426<br>7.725<br>6.383<br>0.291 | 12750<br>141000<br>25500<br>9400<br>206000 | 8.735 | 20000 | 7.600 | 20000 |

## Blocking:

| Frequency | Small MS level in dBµVemf( ) | |
|---|---|---|
| | E-GSM 900 | GSM 1800 |
| FR ± 600 kHz to FR ± 800 kHz | 70 | 70 |
| FR ± 800 kHz to FR± 1,6 MHz | 70 | 70 |
| FR ± 1,6 MHz to FR ± 3 MHz | 80 | 80 |
| 915 MHz to FR - 3 MHz | 90 | - |
| FR ± 3 MHz to FR 980 MHz | 90 | - |
| FR ± 600 KHz to FR ± 800 KHz | - | 87 |
| 1785 MHz to FR - 3 MHz | - | 87 |
| 835 MHz to < 915 MHz | 113 | - |
| > 980 MHz to 1000 MHz | 113 | - |
| 100 KHz to < 835 MHz | 90 | - |
| > 1000 MHz to 12.75 GHz | 90 | - |
| 100 KHz to 1705 MHz | - | 113 |
| > 1705 MHz to < 1785 MHz | - | 101 |
| > 1920 MHz to 1980 MHz | - | 101 |
| > 1980 MHz to 12.75 GHz | - | 90 |

Measurement Conditions:

Wanted carrier is 3 dB above reference sensitivity.

Interferer is CW.

Spurious response exceptions:

Six exceptions are permitted IN band 915 - 980 MHz.

24 exceptions are permitted OUTSIDE band 915 - 980 MHz.

## Intermodulation Characteristics

| Interferer Level ( f1& f2) dBm | Interferer Frequencies ( f1&f2 ) |
|---|---|
| -49 | Wanted frequency= 2f1 - f2,<br>and [ f1 - f2] = 800 kHz |

# 5. TECHNICAL DESCRIPTION

## 5.1. RF Overview

### 5.1.1. Introduction

#### ■ General Specifications

The telephone is a Dual Band product incorporating two switch able transceivers, one for the E-GSM 900 band and another for the GSM 1800 (DCS 1800) band. The transmit and receive bands for the mobile are given in the table below:

| | Tx | Rx |
|---|---|---|
| E-GSM 900 | 880 - 915 MHz | 925 - 960 MHz |
| GSM 1800 | 1710 - 1785 MHz | 1805 - 1880 MHz |
| GSM 850 | 824 - 849 MHz | 869 - 894 MHz |
| GSM 1900 | 1850 - 1910 MHz | 1930 - 1990 MHz |

Other salient technical features are as follows:

| | E-GSM 900 | GSM 1800 | GSM 850 | GSM 1900 |
|---|---|---|---|---|
| Rx Bandwidth | 35 MHz | 75 MHz | 25 MHz | 60 MHz |
| Tx Bandwidth | 35 MHz | 75 MHz | 25 MHz | 60 MHz |
| Duplex Spacing | 45 MHz | 95 MHz | 45 MHz | 80 MHz |
| Number of Channels | 174 | 374 | 124 | 299 |
| AFRCN(Channel Numbers) | 0 - 124<br>975 - 1023 | 512 - 885 | 128 - 251 | 512 - 810 |
| 1st Tx Channel | 880.2 MHz<br>(Ch975) | 1710.2 MHz<br>(Ch512) | 824.2 MHz<br>(Ch128) | 1850.2 MHz<br>(Ch512) |
| Last Tx Channel | 914.8MHz<br>(Ch124) | 1784.8 MHz<br>(Ch885) | 848.8 MHz<br>(Ch251) | 1909.8 MHz<br>(Ch810) |
| 1st Rx Channel | 925.2 MHz<br>(Ch 975) | 1805.2 MHz<br>(Ch512) | 869.2 MHz<br>(Ch128) | 1930.2 MHz<br>(Ch512) |
| Last Rx Channel | 959.8 MHz<br>(Ch124) | 1879.8 MHz<br>(Ch885) | 893.8 MHz<br>(Ch251) | 1989.8 MHz<br>(Ch810) |
| Maximum Tx power | 33.0dBm<br>{Class 4}(PL5) | 30dBm<br>{Class 1}(PL0) | 33.0dBm<br>{Class 4}(PL5) | 30dBm<br>{Class 1}(PL0) |
| Minimum Tx power | 5.0dBm<br>(PL19) | 0.0dBm<br>(PL15) | 5.0dBm<br>(PL19) | 0.0dBm<br>(PL15) |

#### ■ Main PCB Description

All components required for the RF and Logic circuits, excluding the LCD module, are contained on a single printed circuit board (PCB). The PCB has six layers with lay1-2 and layer 5-6 build-up Surface and back layer tracks are gold-plated to prevent oxidization and enable better soldering. The PCB mother broad thickness is 1 mm ± 0.1 mm; MMI is 0.4 min ± 0.05 mm. All RF components are located on one side of the bottom half area of the PCB, with the baseband components (Logic circuits) occupying the lower half of the PCB. A metallised shield shields the RF circuit area. The top half of the back case has been designed to provide a shielded enclosure to reduce further spurious emissions and logic noise.

## 5.1.2. RF Function Block

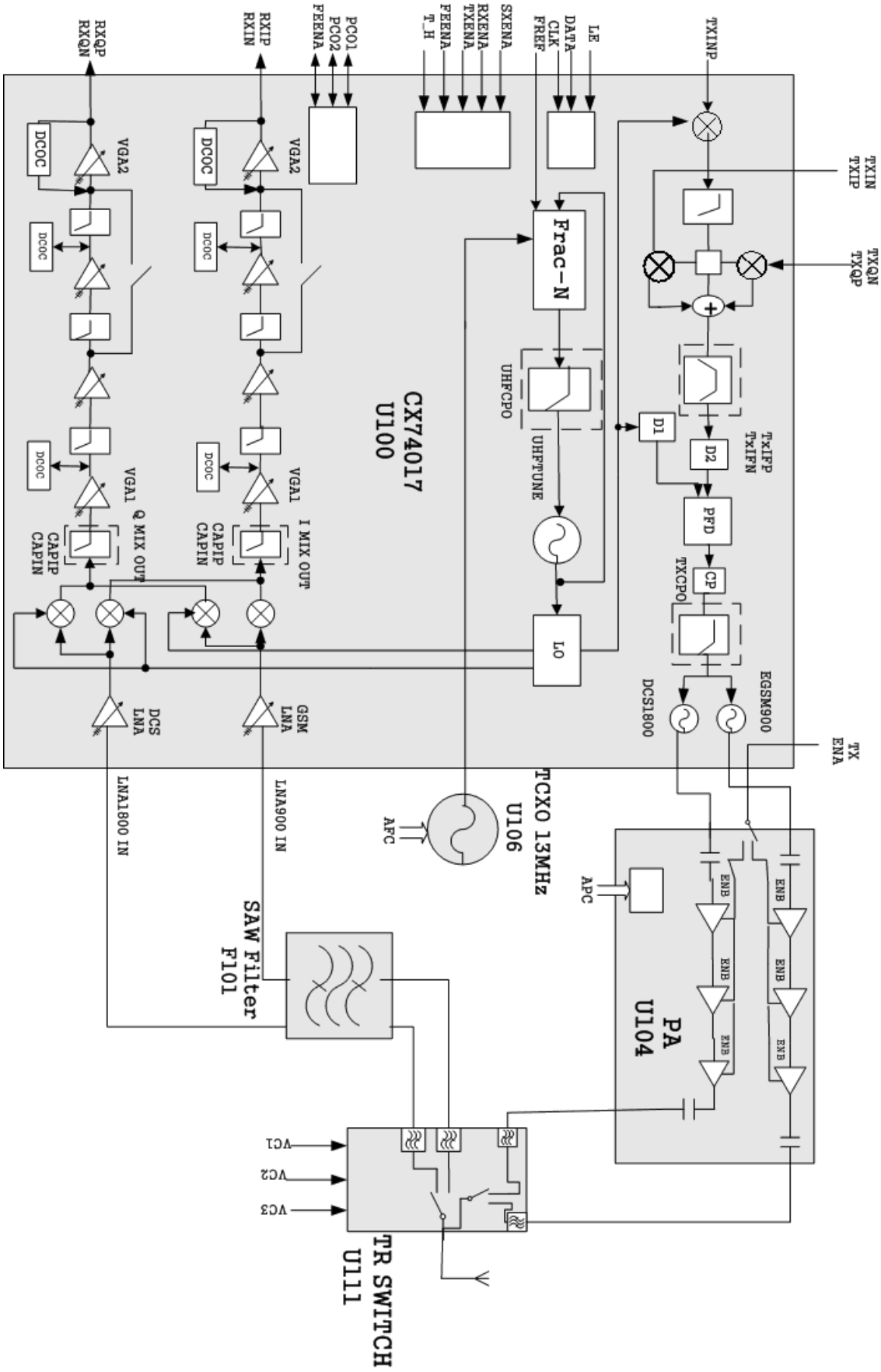



**Figure 5.1. : RF Function Block Diagram**

## 5.1.3. Functional Description

### ■ Frequency Plan

The frequency plan is shown below:

| | TX | TXIF | TX UHF LO |
|---|---|---|---|
| E-GSM 900 | 880 - 915 MHz | 88.46 - 114.35 MHz | 1459.59 - 1543.725 MHz |
| GSM 1800 | 1710 - 1785 MHz | 90.31 - 104.77 MHz | 1354.73 - 1414.482 MHz |
| GSM 850 | 824 - 850 MHz | 82.42 - 105.55 MHz | 1359.93 - 1424.922 MHz |
| GSM 1900 | 1850 - 1910MHz | 97.37 - 112.34 MHz | 1460.68 - 1516.606MHz |

| | RX | RX LO |
|---|---|---|
| E-GSM 900 | 925 - 960 MHz | 925.2 - 959.8 MHz |
| GSM 1800 | 1805 - 1880 MHz | 1805.2 - 1879.8 MHz |
| GSM 850 | 869 - 894 MHz | 869.2 - 893.8 MHz |
| GSM 1900 | 1930 - 1990MHz | 1930.2 - 1989.8 MHz |

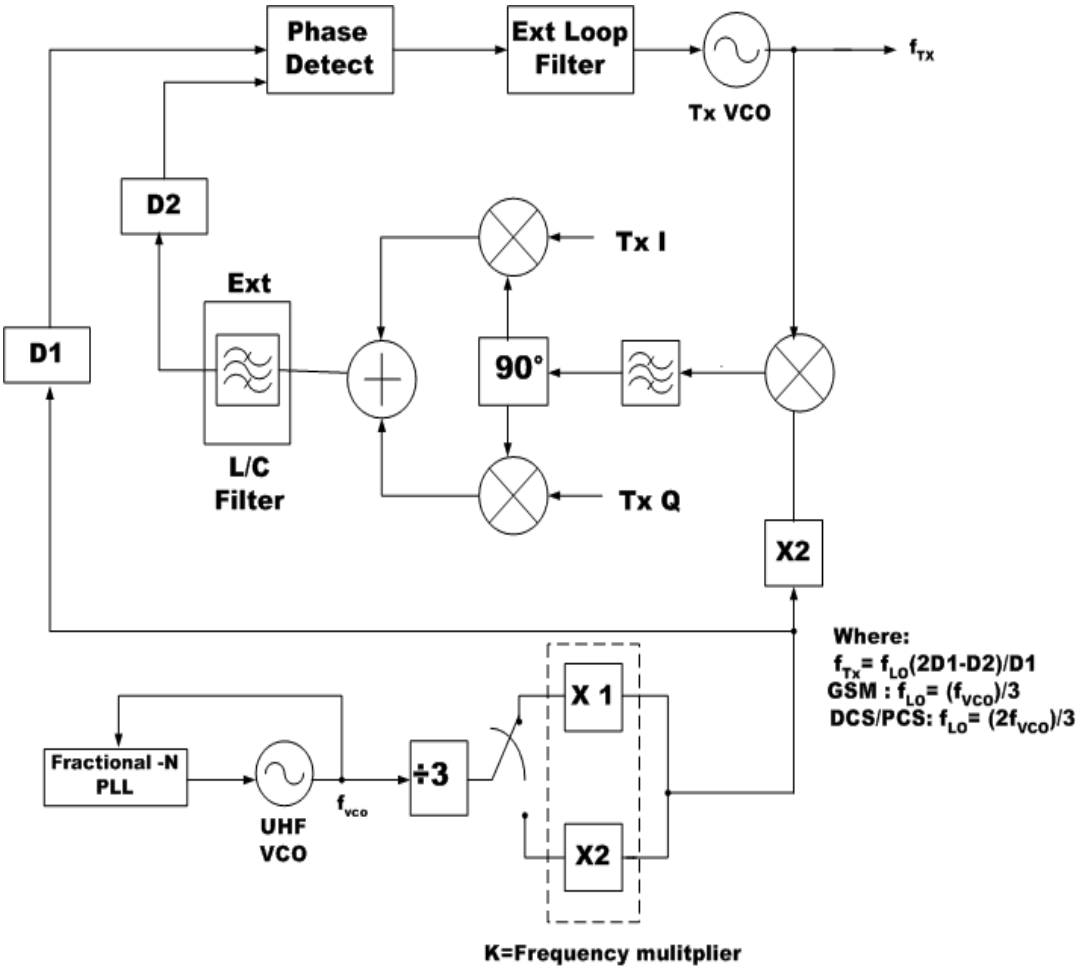



**Fig 5.2 Transmitter Frequency Generation**

The CX74017 transmitter functional block diagram is shown in Figure 5.2 The transmit (Tx) chain is based on a translational loop architecture. The baseband information is injected within the loop therefore the output signal is phase-modulate.

One of the advantages of this architecture is that the Transmit Intermediate Frequency (TxIF) is kept within a narrow frequency range. This improves phase and amplitude accuracy in the

In-Phase and Quadrature (I/Q) modulator.

The CX74017 has two frequency dividers:

- D1: set to divide by 9, 10, 11, or 12
- D2: set to divide by 2 or 1

To minimize the range of the TxIF and the required tuning range of the UHF VCO, the D2 divider is set to /2 mode for low band operation. Low band operation includes the EGSM. For high band operation, the D2 divider is set to /1 mode.High band operation includes the DCS1800 .

The UHF VCO is divided by three. After this block, the VCO is multiplied by 1 for low band operation or multiplied by 2 for high band operation. This block drives both the D1 divider, which feeds the phase detector, and a doubler stage, which feeds the high side injection down converter 1/2  Local Oscillator (LO) mixer. The mixer mixes the transmit frequency down to the TxIF frequency that drives the I/Q modulator. The output of the modulator is filtered externally and then fed back into the CX74017 where it drives the D2 divider. The D2 divider feeds the other input of the phase detector, which produces an error voltage that is externally filtered. The error voltage tunes the internal Transmit Voltage Controlled

Oscillator (TxVCO).

## ■ General

RF circuit design is built around and Skyworks CX74017 IC. Other major components include filters, power amplifiers and the antenna subsystems.

Direct conversion is employed on both receiver bands.

The Tx VCO is on-channel in both E-GSM 900 and GSM 1800 modes of operation.

The RF LO always requires re-tuning between transmit and receive modes, as well as when monitoring adjacent cells.

## ■ Antenna

The antenna is an internal inverted F-type. It is optimized for both free space and talk positions on GSM 900 and GSM 1800 bands. The RF coaxial connector incorporates a mechanical switch for routing the RF signal to an external antenna for car kit installations and for test purposes.

## ■ Transmit and Receive

The transmit and receive paths are covered in their own specific chapters later in this Technical Guide.

# 5.2. TRANSMITTER

## 5.2.1. Introduction

This section provides a technical description of the transmitter circuits of the Main PCB. A circuit diagram of the whole system is provided in the Service Manual.

## 5.2.2. Uplink Frequencies

### ■ E-GSM 900

The uplink frequencies for the E-GSM 900 band are as follows:

| CHANNEL NUMBERS | UPLINK FREQUENCIES | | | | |
|---|---|---|---|---|---|
| 975 - 979 | 880.200 | 880.400 | 880.600 | 880.800 | 881.000 |
| 980 - 984 | 881.200 | 881.400 | 881.600 | 881.800 | 882.000 |
| 985 - 989 | 882.200 | 882.400 | 882.600 | 882.800 | 883.000 |
| 990 - 994 | 883.200 | 883.400 | 883.600 | 883.800 | 884.000 |
| 995 - 999 | 884.200 | 884.400 | 884.600 | | 885.000 |
| 1000 - 1004 | 885.200 | 885.400 | 885.600 | 885.800 | 886.000 |
| 1005 - 1009 | 886.200 | 886.400 | 886.600 | 886.800 | 887.000 |
| 1010 - 1014 | 887.200 | 887.400 | 887.600 | 887.800 | 888.000 |
| 1015 - 1019 | 888.200 | 888.400 | 888.600 | 888.800 | 889.000 |
| 1020 - 1024 | 889.200 | 889.400 | 889.600 | 889.800 | 890.000 |
| 1 - 5 | 890.200 | 890.400 | 890.600 | 890.800 | 891.000 |
| 6 - 10 | 891.200 | 891.400 | 891.600 | 891.800 | 892.000 |
| 11 - 15 | 892.200 | 892.400 | 892.600 | 892.800 | 893.000 |
| 16 - 20 | 893.200 | 893.400 | 893.600 | 893.800 | 894.000 |
| 21 - 25 | 894.200 | 894.400 | 894.600 | 894.800 | 895.000 |
| 26 - 30 | 895.200 | 895.400 | 895.600 | 895.800 | 896.000 |
| 31 - 35 | 896.200 | 896.400 | 896.600 | 896.800 | 897.000 |
| 36 - 40 | 897.200 | 897.400 | 897.600 | 897.800 | 898.000 |
| 41 - 45 | 898.200 | 898.400 | 898.600 | 898.800 | 899.000 |
| 46 - 50 | 899.200 | 899.400 | 899.600 | 899.800 | 900.000 |
| 51 - 55 | 900.200 | 900.400 | 900.600 | 900.800 | 901.000 |
| 56 - 60 | 901.200 | 901.400 | 901.600 | 901.800 | 902.000 |
| 61 - 65 | 902.200 | 902.400 | 902.600 | 902.800 | 903.000 |
| 66 - 70 | 903.200 | 903.400 | 903.600 | 903.800 | 904.000 |
| 71 - 75 | 904.200 | 904.400 | 904.600 | 904.800 | 905.000 |
| 76 - 80 | 905.200 | 905.400 | 905.600 | 905.800 | 906.000 |
| 81 - 85 | 906.200 | 906.400 | 906.600 | 906.800 | 907.000 |
| 86 - 90 | 907.200 | 907.400 | 907.600 | 907.800 | 908.000 |
| 91 - 95 | 908.200 | 908.400 | 908.600 | 908.800 | 909.000 |
| 96 - 100 | 909.200 | 909.400 | 909.600 | 909.800 | 910.000 |
| 101 - 105 | 910.200 | 910.400 | 910.600 | 910.800 | 911.000 |
| 106 - 110 | 911.200 | 911.400 | 911.600 | 911.800 | 912.000 |
| 111 - 115 | 912.200 | 912.400 | 912.600 | 912.800 | 913.000 |
| 116 - 120 | 913.200 | 913.400 | 913.600 | 913.800 | 914.000 |
| 121 - 124 | 914.200 | 914.400 | 914.600 | 914.800 | |

**Table 5.1**

Uplink frequencies for the extended part of E-GSM 900 band (975 = ARFCN = 1023) can be calculated as follows:
Uplink frequency = 890 MHz - ((1024 - ARFCN) x 0.2 MHz) e.g. for CH984
890 MHz - 984) x 0.2 MHz)
= 890 MHz - (8 MHz)
= 882 MHz

Uplink frequencies for the standard GSM 900 band (0 = ARFCN = 124) can be calculated as follows:

Uplink frequency = 890 MHz + (ARFCN x 0.2 MHz) e.g. for CH55

890 MHz + (55 x 0.2 MHz)

= 890 MHz + (11 MHz)

= 901 MHz

## ■ GSM 1800

Uplink frequencies for the GSM 1800 band can be calculated as follows:

Uplink frequency = 1710 MHz + ((ARFCN - 511 MHz) x 0.2) e.g. for CH512

1710 MHz + ((512 - 511) x 0. 2MHz)

= 1710 MHz + (0.2 MHz)

= 1710.2 MHz

## ■ E-GSM 850

The uplink frequencies for the E-GSM 850 band are as follows:

| CHANNEL NUMBERS | UPLINK FREQUENCIES | | | | |
|---|---|---|---|---|---|
| 128 - 132 | 869.200 | 869.400 | 869.600 | 869.800 | 870.000 |
| 133 - 137 | 870.200 | 870.400 | 870.600 | 870.800 | 871.000 |
| 138 - 142 | 871.200 | 871.400 | 871.600 | 871.800 | 872.000 |
| 143 - 147 | 872.200 | 872.400 | 872.600 | 872.800 | 873.000 |
| 148 - 152 | 873.200 | 873.400 | 873.600 | 873.800 | 874.000 |
| 153 - 157 | 874.200 | 874.400 | 874.600 | 874.800 | 875.000 |
| 158 - 162 | 875.200 | 875.400 | 875.600 | 875.800 | 876.000 |
| 163 - 167 | 876.200 | 876.400 | 876.600 | 876.800 | 877.000 |
| 168 - 172 | 877.200 | 877.400 | 877.600 | 877.800 | 878.000 |
| 173 - 177 | 878.200 | 878.400 | 878.600 | 878.800 | 879.000 |
| 178 - 182 | 879.200 | 879.400 | 879.600 | 879.800 | 880.000 |
| 183 - 187 | 880.200 | 880.400 | 880.600 | 880.800 | 881.000 |
| 188 - 192 | 881.200 | 881.400 | 881.600 | 881.800 | 882.000 |
| 193 - 197 | 882.200 | 882.400 | 882.600 | 882.800 | 883.000 |
| 198 - 202 | 883.200 | 883.400 | 883.600 | 883.800 | 884.000 |
| 203 - 207 | 884.200 | 884.400 | 884.600 | 884.800 | 885.000 |
| 208 - 212 | 885.200 | 885.400 | 885.600 | 885.800 | 886.000 |
| 213 - 217 | 886.200 | 886.400 | 886.600 | 886.800 | 887.000 |
| 218 - 222 | 887.200 | 887.400 | 887.600 | 887.800 | 888.000 |
| 223 - 227 | 888.200 | 888.400 | 888.600 | 888.800 | 889.000 |
| 228 - 232 | 889.200 | 889.400 | 889.600 | 889.800 | 890.000 |
| 233 - 237 | 890.200 | 890.400 | 890.600 | 890.800 | 891.000 |
| 238 - 242 | 891.200 | 891.400 | 891.600 | 891.800 | 892.000 |
| 243 - 247 | 892.200 | 892.400 | 892.600 | 892.800 | 893.000 |
| 248 - 251 | 893.200 | 893.400 | 893.600 | 893.800 | |

**Table 5.2**

Uplink frequencies for the extended part of E-GSM 850 band (128 = ARFCN = 251) can be calculated as follows:
Uplink frequency = 824 MHz + ((ARFCN - 127) x 0.2 MHz) e.g. for CH128
824 MHz + ((185 - 127) x 0.2 MHz)
= 824 MHz + (11.6 MHz)
= 835.6 MHz

## ■ GSM 1900

Uplink frequencies for the GSM 1900 band can be calculated as follows:

Uplink frequency = 1850 MHz + ((ARFCN - 511 MHz) x 0.2) e.g. for CH680

1850 MHz + ((680 - 511) x 0. 2MHz)

= 1850 MHz + (33.8 MHz)

= 1853.8 MHz

## 5.2.3. Functional Description

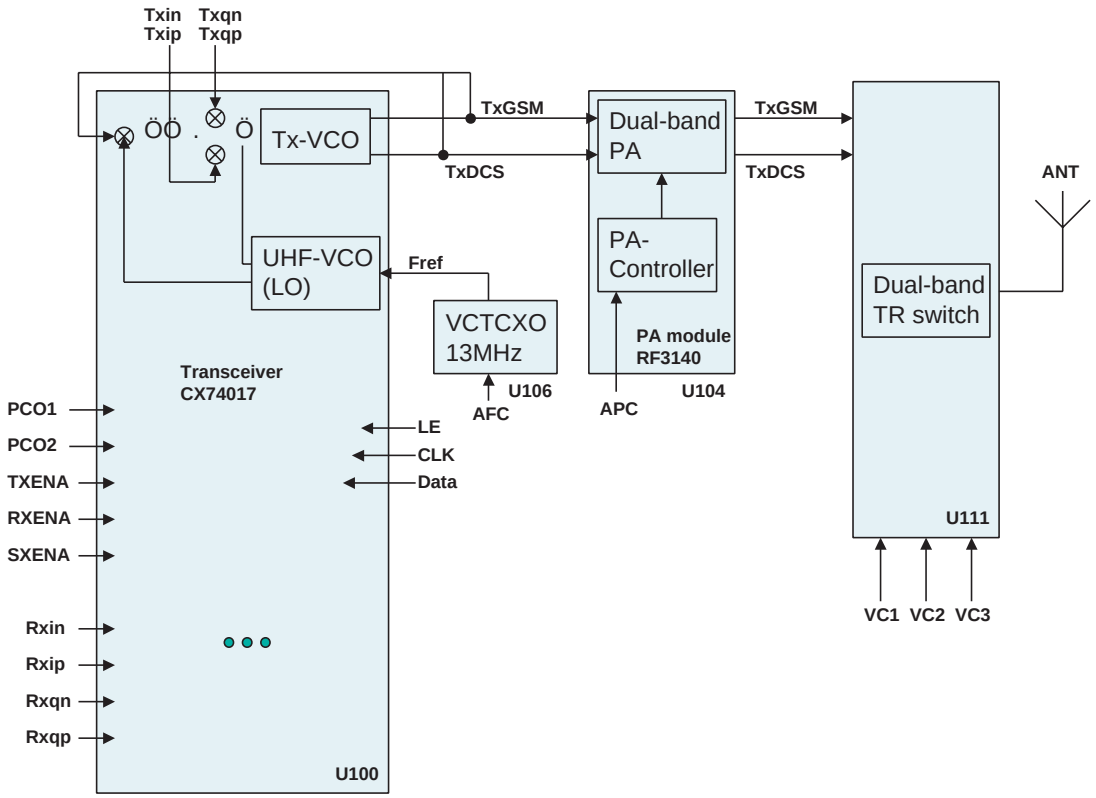



**Figure 5.3. : Functional Description**

G60 is model using DCR (Direct Conversion Receiver) in it that eliminates the need for IF components (IF SAW), the transceiver also integrates TXVCO and LO, and PA module integrate PAC.

1.

| PCO1 | PCO2 | Select |
|---|---|---|
| 0 | 0 | No action |
| 0 | 0 | EGSM |
| 1 | 0 | DCS |

2.

| TXENA | RXENA | SXENA | ACTION |
|---|---|---|---|
| 1 | 0 | 1 | TX |
| 0 | 1 | 1 | RX |
| X | X | 0 | RF off |

3.

| VC1 (Pin2) | VC2 (Pin4) | VC3 (Pin8) | ACTION |
|---|---|---|---|
| 0 | 1 | 0 | EGSM TX |
| 0 | 0 | 1 | DCS |
| 0 | 0 | 0 | EGSM/DCS RX |

**Table 5.3**

The CX74017 transceiver is a highly integrated device for multi-band Global System for Mobile Communications™ (GSM ™) or General Packet Radio Service (GPRS) applications. The device requires a minimal number of external components to complete a GSM radio subsystem. The CX74017 supports EGSM900/DCS1800 applications.

The receive path implements a direct down-conversion architecture that eliminates the need for Intermediate Frequency (IF) components. The CX74017 receiver consists of three integrated Low Noise Amplifiers (LNAs), a quadrature demodulator, tunable receiver baseband filters, and a DC-offset correction sequencer.

In the transmit path, the device consists of an In-phase and Quadrature (I/Q) modulator within a frequency translation loop designed to perform frequency up conversion with high output spectral purity. This loop also contains a phase frequency detector, charge pump, mixer, programmable dividers, and high power transmit Voltage Controlled Oscillators (VCOs) with no external tank required.

The charge pump output signal produced by the phase detector is fed back to the Tx VCO to generate modulated RF output. The Tx VCO has been designed to provide a high level output thus obviating the need for a driver amplifier. Therefore, the Tx VCO output is applied directly to the PA which amplifies the signal to any required level up to PL5 (33 dBm at the antenna) for E-GSM 900 and PL0 (30 dBm) for GSM 1800. In the same way, the Tx VCO output is applied directly to the PA which amplifies the signal to any required level up to PL5 (33 dBm at the antenna) for GSM 850 and PL0 (30 dBm) for GSM 1900.

The CX74017 also features an integrated, fully programmable, sigma-delta fractional-N synthesizer suitable for GPRS multi-slot operation. Except for the loop filter, the frequency synthesizer function, including a wideband VCO, is completely on-chip.

# 5.3. RECEIVER

## 5.3.1. Introduction

This Section provides a technical description of the receiver section of the RF circuit. A complete circuit diagram is provided in the Service Manual.

## 5.3.2. Downlink Frequencies

### ■ E-GSM 900

The downlink frequencies for the E-GSM 900 band are as follows:

| CHANNEL NUMBERS | DOWNLINK FREQUENCIES | | | | |
|---|---|---|---|---|---|
| 975 - 979 | 925.200 | 925.400 | 925.600 | 925.800 | 926.000 |
| 980 - 984 | 926.200 | 926.400 | 926.600 | 926.800 | 927.000 |
| 985 - 989 | 927.200 | 927.400 | 927.600 | 927.800 | 928.000 |
| 990 - 994 | 928.200 | 928.400 | 928.600 | 928.800 | 929.000 |
| 995 - 999 | 929.200 | 929.400 | 929.600 | 929.800 | 930.000 |
| 1000 - 1004 | 930.200 | 930.400 | 930.600 | 930.800 | 931.000 |
| 1005 - 1009 | 931.200 | 931.400 | 931.600 | 931.800 | 932.000 |
| 1010 - 1014 | 932.200 | 932.400 | 932.600 | 932.800 | 933.000 |
| 1015 - 1019 | 933.200 | 933.400 | 933.600 | 933.800 | 934.000 |
| 1020 - 1024 | 934.200 | 934.400 | 934.600 | 934.800 | 935.000 |
| 1 - 5 | 935.200 | 935.400 | 935.600 | 935.800 | 936.000 |
| 6 - 10 | 936.200 | 936.400 | 936.600 | 936.800 | 937.000 |
| 11 - 15 | 937.200 | 937.400 | 937.600 | 937.800 | 938.000 |
| 16 - 20 | 938.200 | 938.400 | 938.600 | 938.800 | 939.000 |
| 21 - 25 | 939.200 | 939.400 | 939.600 | 939.800 | 940.000 |
| 26 - 30 | 940.200 | 940.400 | 940.600 | 940.800 | 941.000 |
| 31 - 35 | 941.200 | 941.400 | 941.600 | 941.800 | 942.000 |
| 36 - 40 | 942.200 | 942.400 | 942.600 | 942.800 | 943.000 |
| 41 - 45 | 943.200 | 943.400 | 943.600 | 943.800 | 944.000 |
| 46 - 50 | 944.200 | 944.400 | 944.600 | 944.800 | 945.000 |
| 51 - 55 | 945.200 | 945.400 | 945.600 | 945.800 | 946.000 |
| 56 - 60 | 946.200 | 946.400 | 946.600 | 946.800 | 947.000 |
| 61 - 65 | 947.200 | 947.400 | 947.600 | 947.800 | 948.000 |
| 66 - 70 | 948.200 | 948.400 | 948.600 | 948.800 | 949.000 |
| 71 - 75 | 949.200 | 949.400 | 949.600 | 949.800 | 950.000 |
| 76 - 80 | 950.200 | 950.400 | 950.600 | 950.800 | 951.000 |
| 81 - 85 | 951.200 | 951.400 | 951.600 | 951.800 | 952.000 |
| 86 - 90 | 952.200 | 952.400 | 952.600 | 952.800 | 953.000 |
| 91 - 95 | 953.200 | 953.400 | 953.600 | 953.800 | 954.000 |
| 96 - 100 | 954.200 | 954.400 | 954.600 | 954.800 | 955.000 |
| 101 - 105 | 955.200 | 955.400 | 955.600 | 955.800 | 956.000 |
| 106 - 110 | 956.200 | 956.400 | 956.600 | 956.800 | 957.000 |
| 111 - 115 | 957.200 | 957.400 | 957.600 | 957.800 | 958.000 |
| 116 - 120 | 958.200 | 958.400 | 958.600 | 958.800 | 959.000 |
| 121 - 124 | 959.200 | 959.400 | 959.600 | 959.800 | |

**Table 5.4**

Uplink frequencies for the extended part of E-GSM 900 band (975 = ARFCN = 1023) can be calculated as follows:

Uplink frequency = 935 MHz - ((1024 - ARFCN) x 0.2 MHz) e.g. for CH984

935 MHz - ((1024 - 984) x 0.2 MHz)

= 935 MHz - (8 MHz)

= 927 MHz

Uplink frequencies for the standard GSM 900 band (0 = ARFCN = 124) can be calculated as follows:

Uplink frequency = 935 MHz + (ARFCN x 0.2 MHz) e.g. for CH55

935 MHz + (55 x 0.2 MHz)

= 935 MHz + (11 MHz)

= 946 MHz

## ■ GSM 1800

Uplink frequencies for the GSM 1800 band can be calculated as follows:

Uplink frequency = 1805 MHz + ((ARFCN - 511) x 0.2 MHz) e.g. for CH512

1805 MHz + ((512 - 511) x 0. 2MHz)

= 1805 MHz + (0.2 MHz)

= 1805.2 MHz

## ■ GSM 850

The downlink frequencies for the GSM 850 band are as follows:

| CHANNEL NUMBERS | DOWNLINK FREQUENCIES | | | | |
|---|---|---|---|---|---|
| 128 - 132 | 869.200 | 869.400 | 869.600 | 869.800 | 870.000 |
| 133 - 137 | 870.200 | 870.400 | 870.600 | 870.800 | 871.000 |
| 138 - 142 | 871.200 | 871.400 | 871.600 | 871.800 | 872.000 |
| 143 - 147 | 872.200 | 872.400 | 872.600 | 872.800 | 873.000 |
| 148 - 152 | 873.200 | 873.400 | 873.600 | 873.800 | 874.000 |
| 153 - 157 | 874.200 | 874.400 | 874.600 | 874.800 | 875.000 |
| 158 - 162 | 875.200 | 875.400 | 875.600 | 875.800 | 876.000 |
| 163 - 167 | 876.200 | 876.400 | 876.600 | 876.800 | 877.000 |
| 168 - 172 | 877.200 | 877.400 | 877.600 | 877.800 | 878.000 |
| 173 - 177 | 878.200 | 878.400 | 878.600 | 878.800 | 879.000 |
| 178 - 182 | 879.200 | 879.400 | 879.600 | 879.800 | 880.000 |
| 183 - 187 | 880.200 | 880.400 | 880.600 | 880.800 | 881.000 |
| 188 - 192 | 881.200 | 881.400 | 881.600 | 881.800 | 882.000 |
| 193 - 197 | 882.200 | 882.400 | 882.600 | 882.800 | 883.000 |
| 198 - 202 | 883.200 | 883.400 | 883.600 | 883.800 | 884.000 |
| 203 - 207 | 884.200 | 884.400 | 884.600 | 884.800 | 885.000 |
| 208 - 212 | 885.200 | 885.400 | 885.600 | 885.800 | 886.000 |
| 213 - 217 | 886.200 | 886.400 | 886.600 | 886.800 | 887.000 |
| 218 - 222 | 887.200 | 887.400 | 887.600 | 887.800 | 888.000 |
| 223 - 227 | 888.200 | 888.400 | 888.600 | 888.800 | 889.000 |
| 228 - 232 | 889.200 | 889.400 | 889.600 | 889.800 | 890.000 |
| 233 - 237 | 890.200 | 890.400 | 890.600 | 890.800 | 891.000 |
| 238 - 242 | 891.200 | 891.400 | 891.600 | 891.800 | 892.000 |
| 243 - 247 | 892.200 | 892.400 | 892.600 | 892.800 | 893.000 |
| 248 - 251 | 893.200 | 893.400 | 893.600 | 893.800 | |

**Table 5.5**

Uplink frequencies for the GSM 850 band (128 = ARFCN = 251) can be calculated as follows:

Uplink frequency = 869 MHz + ((ARFCN - 127) x 0.2 MHz) e.g. for CH185

869 MHz + ((185 - 127) x 0. 2MHz)

= 869 MHz + (11.6 MHz)

= 880.6 MHz

## ■ GSM 1900

Uplink frequencies for the GSM 1900 band (512 = ARFCN = 810) can be calculated as follows:

Uplink frequency = 1930 MHz + ((ARFCN - 511) x 0.2 MHz) e.g. for CH680

1930 MHz + ((185 - 511) x 0. 2MHz)

= 1930 MHz + (33.8 MHz)

= 1963.8 MHz

## 5.3.3. Functional Description

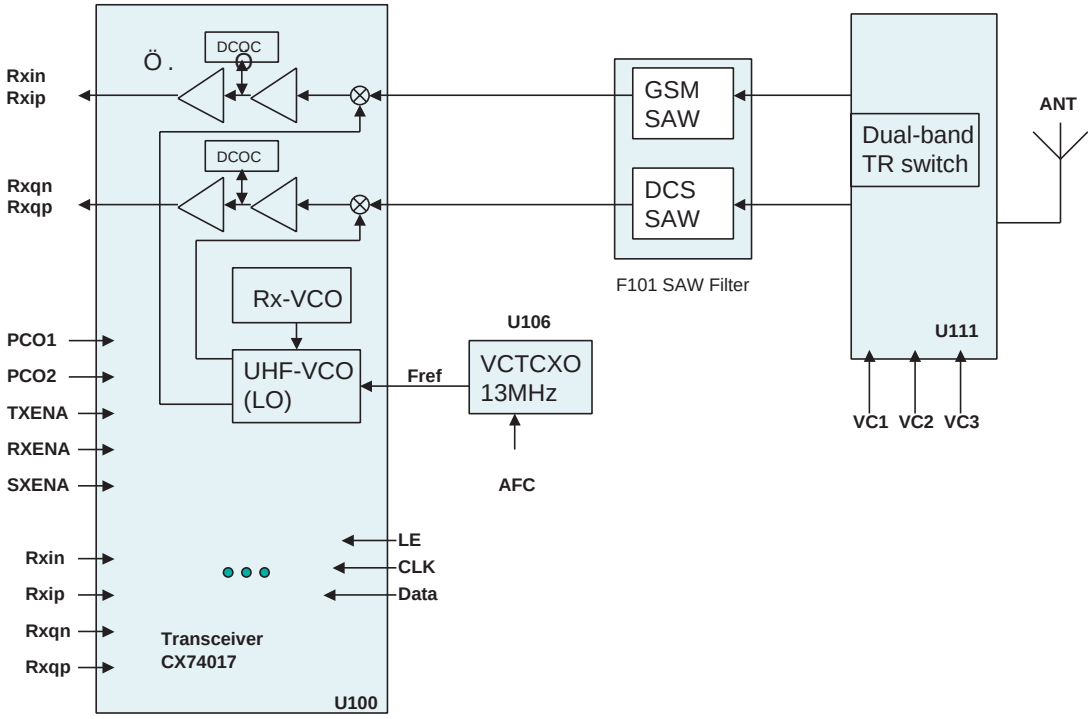



**Fig 5.4. : Receiving Blocking**

The main building block, illustrating as Fig 5.1 receive path, for the Dual Band receiver is the CX74017 transceiver IC (U100) which includes a direct conversion receiver with I and Q quadrature demodulation. Received signals from the antenna are passed to the dual band antenna switch module U111. This module contains a diplexer which filters the signal to the required receiver path (E-GSM 900 or GSM 1800). Pin diode switches within U111 route the signal path from the transmitter or to the receiver as required. Output signals from U111 are then applied via the dual band SAW filter FL101 to the balanced Low Noise Amplifiers (LNA) onboard U100.Output from the LNAs are applied to the buffer amplifiers and a pair of Gilbert Cell mixers within U100. The mixers convert the incoming signals directly down to baseband frequencies. The I, Q local oscillator signals for the mixers is derived from a 925M-1880M Hz RFLO, dived down by high speed converter. The receiver has two separate front-end blocks, optimized for 900 MHz and 1800 MHz respectively.

The front-end gain is programmed as follows:

These settings allow the signal in the receiver to be optimized, particularly under high signal level conditions. Front-End gain is programmed by 3-wire bus signal from the baseband.

The mixer stage is followed by the I, Q baseband low-pass filters and programmable gain amplifiers (PGA). Each three-stage VGA is DC-coupled and has a 100 dB control range in 2 dB steps.

# 5.4. BASEBAND OVERVIEW

## 5.4.1. Introduction

The baseband circuits of the phone are required to perform the following functions:

- Equalization
- Channel coding / decoding
- Speech coding / decoding
- Data Encryption
- Layer 1, 2 and 3 software tasks
- Man Machine interface (MMI)
- System Interface
- SIM Interface and Management
- Audio, and 16 Strings Melody Generation
- Power supply and battery management
- RF power control
- Synchronization
- Real time clock

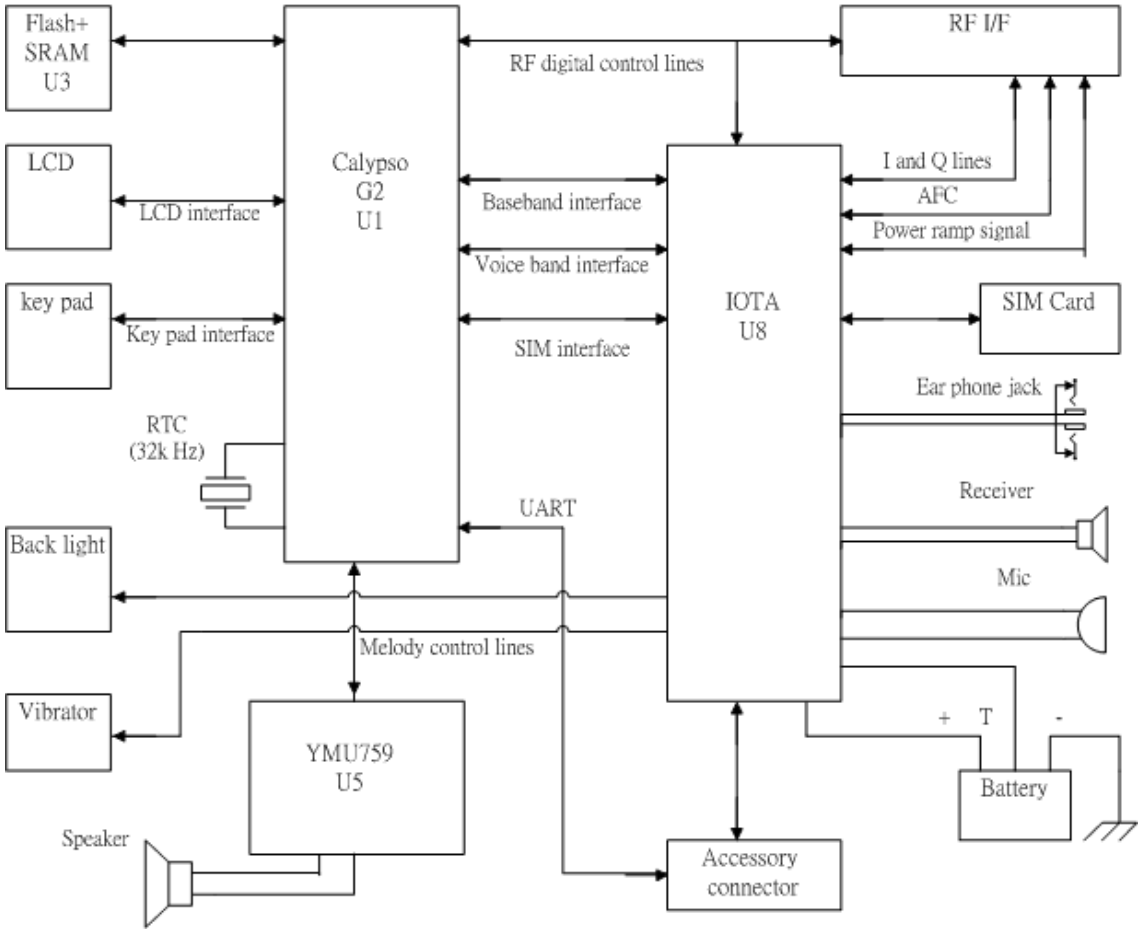
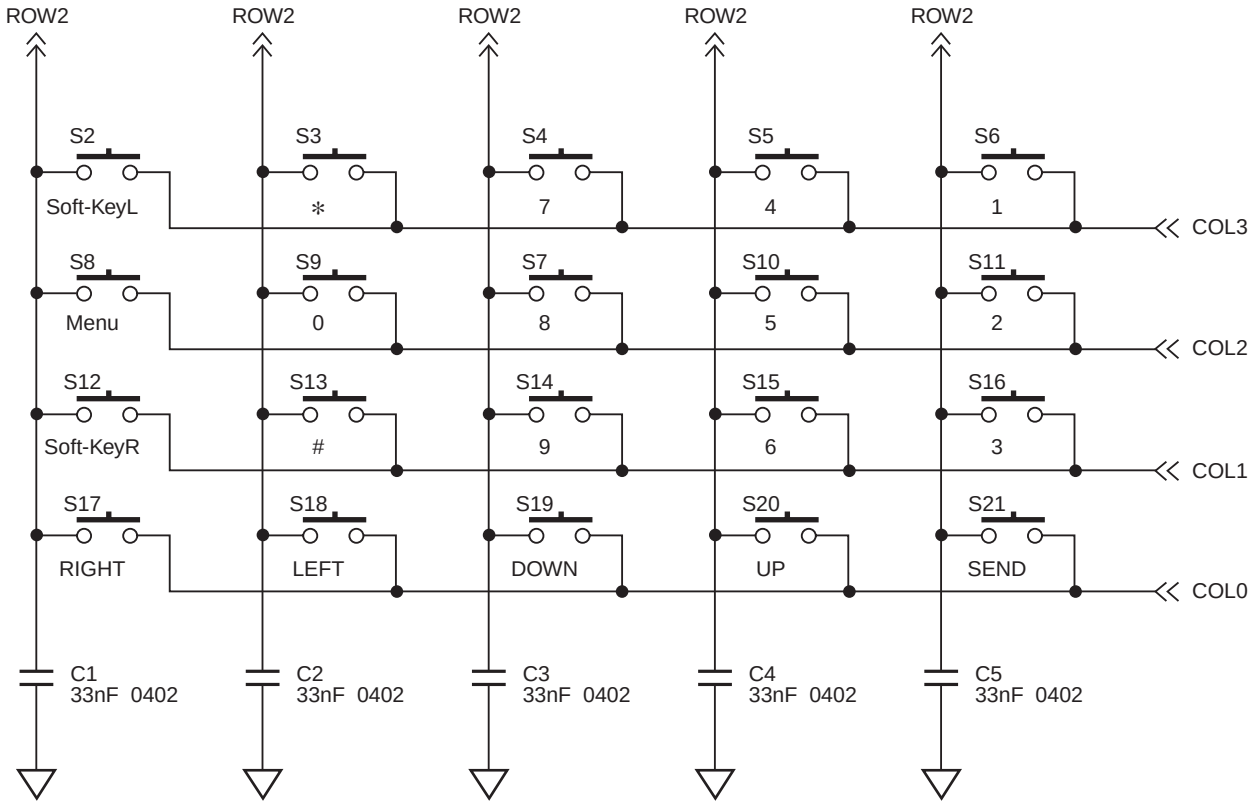



**Figure 5.5. : Baseband Block Diagram**

The G60 Baseband is built around a GSM chipset developed by Texas Instruments. One chip (Ulysses_G2) carries out signal processing with DSP and CPU, and the other chip (IOTA) provides the analogue interface. The highly integrated nature of the chips means that each can contain a large number of functions.

## 5.5. Keypad

The Keypad has a 4 x 5 matrix, allowing 20 keys to be scanned. When a key being pressed, a keypad interrupt is generated. To find which key has been pressed, the software scans each column in turn and reads which row is active. Because of key bounce, the key press is confirmed twice at approximately 20 ms intervals.




Keyboard scanning is controlled by software. ● Key pressed ● is indicated by an interrupt, but ● key released 8 is monitored by software.

## 5.6. Subscriber Identity Module (SIM)

The SIM interface is designed to support 3 V SIM. As G2 operates from a 2.85 V supply, level translation from 3 V is provided by IOTA.

| | | | |
|---|---|---|---|
| $FFFF:0000 | REG_SIM_CMD | SIM Control Register | Write only |
| $FFFF:0002 | REG_SIM_STAT | SIM status register | Read only |
| $FFFF:0004 | REG_SIM_CONF1 | SIM configuration register 1 | Read/Write |
| $FFFF:0006 | REG_SIM_CONF2 | SIM time delay parameters | Read/Write |
| $FFFF:0008 | REG_SIM_IT | SIM Interrupt status | Read only |
| $FFFF:000A | REG_SIM_DRX | SIM receive byte register | Read only |
| $FFFF:000C | REG_SIM_DTX | SIM transmit byte register | Read/Write |
| $FFFF:000E | REG_SIM_MASKIT | SIM interrupt mask register | Read/Write |

## 5.7. TPU

The TPU provides the GSM TPU TDMA timing requirements for the system.

External timing signals are provided that an area of micro-code.

| TPU Timing output signal assignments of G2 | | | | |
|---|---|---|---|---|
| **Name** | **PIN No.** | **Function** | **Connection** | **Configuration** |
| TSPACT 0 | M12 | TXON1 | RF | ASIC_CONF_REG(9)=0 |
| TSPACT 1 | M14 | NC | N/A | |
| TSPACT 2 | L12 | NC | N/A | |
| TSPACT 3 | L13 | VCO_EN | RF | |
| TSPACT 4 | J10 | PA_ON | EXT I/O | |
| TSPACT 5 | K11 | PCNnGSM | RF | |
| TSPACT 6 | K13 | DCS_PAON | RF | |
| TSPACT 7:CLKX_SPI | K12 | GSM_PAON | RF | |
| TSPACT 8:nMREQ | K14 | NC | N/A | |
| TSPACT 9:MAS1 | J11 | NC | N/A | |
| TSPACT 10:nWAIT | J12 | NC | N/A | |
| TSPACT 11:MCLK | J13 | NC | N/A | |

| | | | |
|---|---|---|---|
| $FFFF:100C | REG_TPU_OFFSET | offset operand value register | Read only |
| $FFFF:100E | REG_TPU_SYNCHRO | synchro operand value register | Read only |
| $FFFF:1000 | REG_TPU_CTRL | control & status register | Read/Write |
| $FFFF:1002 | REG_INT_CTRL | interrupt control register | Write only |
| $FFFF:1004 | REG_INT_STAT | interrupt status register | Read only |
| $FFFF:1020 | REG_IT_DSP_PG | DSP Programmable IT | Write only |

## 5.8. CPU Memory

To reduce component space, the phone uses a BGA package with Dual operation Flash memory and SRAM MCP.

The following memory configuration is used:

| | | |
|---|---|---|
| 64 Mbits Flash Memory | organized as | 4M * 16 |
| 8 Mbits SRAM | organized as | 512k * 16 + 256k * 16 |

## 5.9. LCD

The LCD module consists of a LCD glass and driver chip connection to the Main PCB via a flexible PCB strip.

A 128 x RGB x 128 pixels graphical display is used which can display up to 16 characters x 6 rows-plus two rows of icons. It can accommodate Chinese and large character sets.

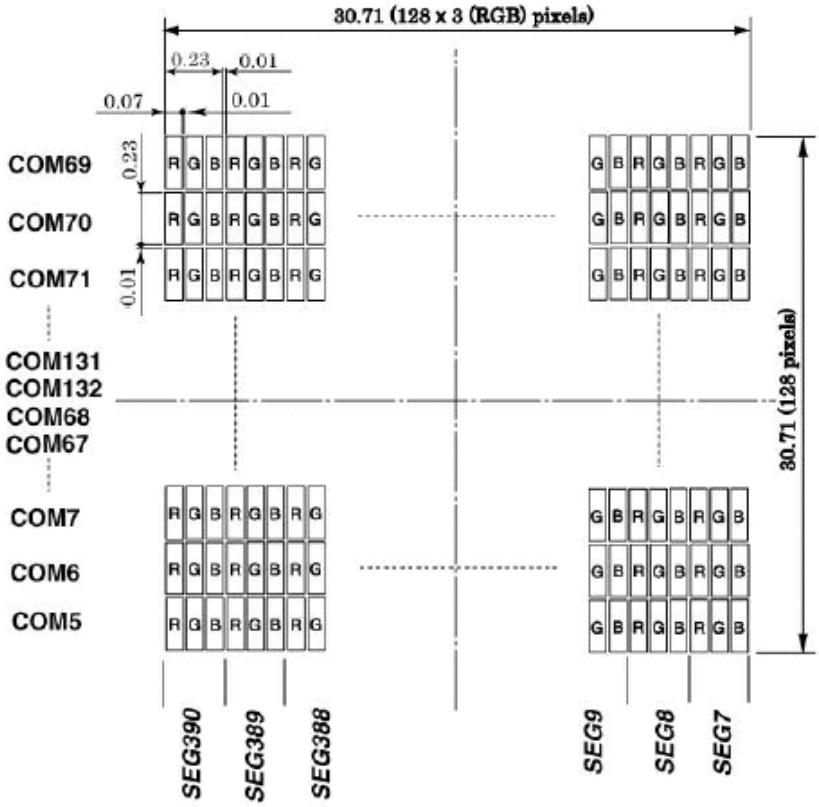



**Figure 5.6 : LCD Dimensions**

The LCD driver is controlled by setting the command register through the G2 u-wire interface and an I/O line, which distinguishes between command or data. To send data or a command to the display driver, the nCS2 line is used for chip select. LCDA0 (I/0 3) is set high to send data and set low to send commands.

## 5.10. Real Time Clock (RTC)

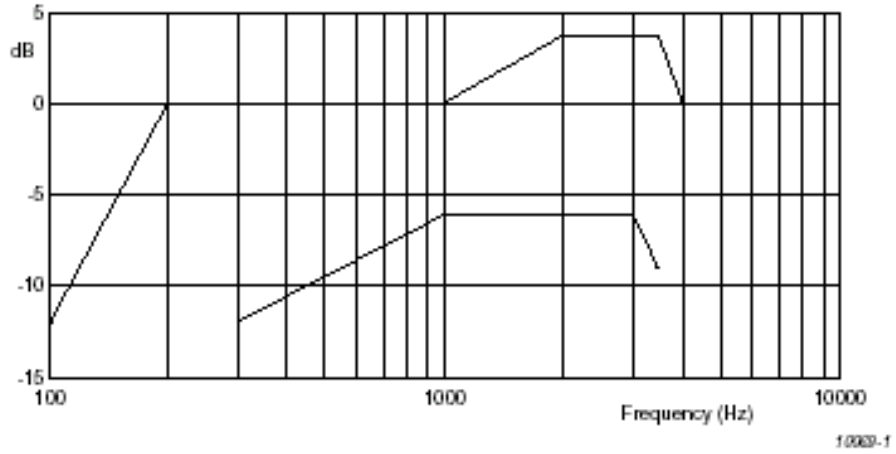
Clock Functions are provided by the Real Time Clock is built into G2. The module is synchronic  by a 32.768 kHz crystal and has a backup power source provided by a button battery.

G2 has a clock auto compensation function to take into account any inaccuracies of the crystal. This is able to calibrate out crystal tolerance / drift by writing to the compensation registers. This calibration can provide adjustments ±555.6ppm in 0.0085ppm increments.

Registers for RTC are assigned between $FFFE : 1800 - $FFFE:1815.

## 5.11. Microphone

The microphone is a noise canceling type to provide improved speech pick-up, noise immunity and reduced echo. The GSM Standard requires that when in handheld mode, the transmitter audio frequency response must fit within the mask shown below:

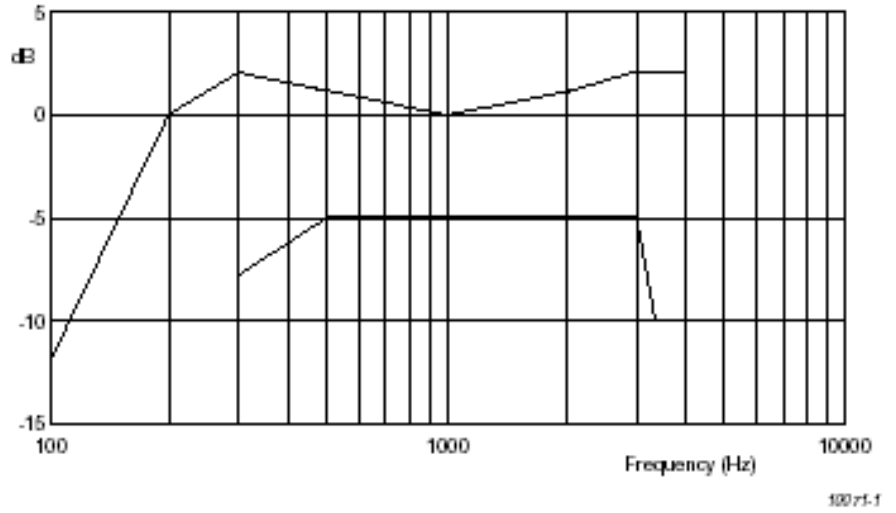



**Handheld GSM Transmit Audio Frequency Response Mask**

## 5.12. Receiver

### 5.12..1. Handheld Mode

Because IOTA is powered from a 2.85 V supply, a low impedance (dynamic) speaker must be used. The GSM Standard requires that the receiver audio frequency response must fit within the mask shown below




**Handheld GSM Receive Audio Frequency Response**

The phone is designed to meet requirements with a Type 1 artificial ear.

| Volume Levels | | | |
|---|---|---|---|
| Volume Level | PGA | Volume | Total Gain |
| 1 | 5 dB | -12 dB | +6.21 dB |
| 2 | 2 dB | -12 dB | +5.12 dB |
| 3 | -1 dB | -12 dB | +1.82dB |
| 4 | -2 dB | -18 dB | -6.43 dB |
| 5 | -2 dB | -24 dB | -12.76 dB |

### 5.12.2. Handfree Mode

A second speaker is mounted in the rear case for speaker operation.

Ring tones and melodies are played via the speaker. The volume level of ring and melody tones are defined YMU759, and the voice volume is defined IOTA. Timer 1 in G2 is used to time the period between switching the ringing on and off to make the tone. For complex ringing tones, the buzzer volume can be altered after each time-out of Timer 1.

## 5.13. Timers

There is a watchdog timer and two 16 bit general-purpose timers which can be used either as auto reload or one-shot timers to provide interrupts to the ARM CPU. A pre-scaler and 16 bits register define the timer clock duration. The watchdog timer receives a 928 kHz clock signal from the G2 clock module. A combination of pre-scaler and timer register gives a time range of 1.078 μs to 9.039 s. The general purpose timers receive a 812.5 kHz clock signal. Timer range is between 2.4615 μs and 20.649 s.

| | | |
|---|---|---|
| Timer 1 | Function | = Buzzer Timer |
| | Setting | = Tone frequency |
| Timer 2 | Function | = N/A |
| | Setting | = N/A |

The timer unit registers are as follows:

| | | | |
|---|---|---|---|
| $FFFF:F800 | Watchdog_CNTL_TIM | Watchdog control | Read/Write |
| $FFFF:F802 | Watchdog_LOAD_TIM | Load Watchdog | Write only |
| $FFFF:F802 | Watchdog_READ_TIM | Read Watchdog | Read only |
| $FFFF:F804 | Watchdog_TIM_MODE | Watchdog Mode | Read/Write |
| $FFFE:3800 | CNTL_TIMER1 | Control Timer 1 | Read/Write |
| $FFFF:3802 | LOAD_TIM1 | Load Timer 1 | Read/Write |
| $FFFF:3804 | READ_TIM1 | Read Timer 1 | Read only |
| $FFFE:6800 | CNTL_TIMER2 | Control Timer 2 | Read/Write |
| $FFFF:6802 | LOAD_TIM2 | Load Timer 2 | Read/Write |
| $FFFF:6804 | READ_TIM2 | Read Timer 2 | Read only |

## 5.14. UART

G2 has two UART ports, UART modem and UART / IrDA. The UART / modem port is used for optional accessories. The UART / IrDA port is used for software debug purposes.

| UART / MODEM PORT ASSIGNMENT | | | |
|---|---|---|---|
| G2 SIGNAL | PIN No. | FUNCTION | I/O |
| TX_MODEM | B9 | Transmit Data | O |
| RX_MODEM | A9 | Receive Data | I |
| DSR_MODEM | D9 | Data Set Ready | I |
| RTS_MODEM | E8 | Request To Send | O |
| CTS_MODEM | C9 | Clear To Send | I |

Registers for the UARTs are located from $FFFF : 5 000 to $FFFF : 5011 (UART / IrDA) and from $FFFF : 5800 to $FFFF : 5811 (UART / modem).

## 5.15. POWER SUPPLIES

### 5.15.1. Introduction

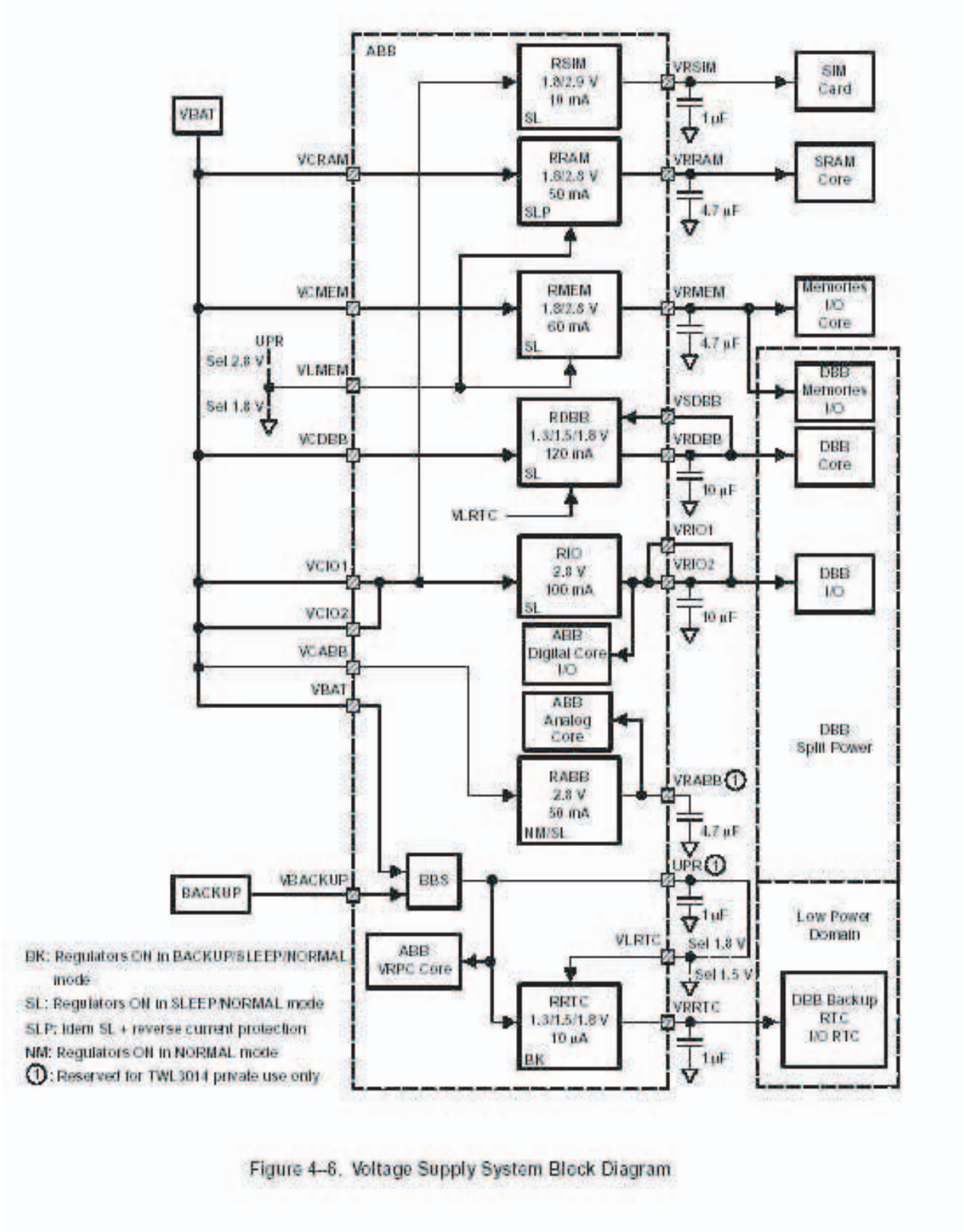



Figure 4–6. Voltage Supply System Block Diagram

The Power Management Block consists of six parts as follows:

1. Power Source
2. Power On/Off Control
3. Power Source Failure detection
4. Voltage Regulation
5. Battery Charging & Monitoring
6. Accessory Control

## 5.15.2. Power Source

The battery comprises a single Lithium-Ion (Li-Ion) cell with a nominal voltage of 3.7 V and 780 mAh capacities. This type of battery has an advantage in weight and size over Nickel Metal Hydride (Ni-MH) cells.

## 5.15.3. Power On / Off Control

The power on sequence can begin when VBAT >2.6 V or VBACKUP >2.6 V. In this state IOTA (U8) is in Power On Condition and internal supply UPR is active. RESPWRONZ signal to G2 (U1) is released high.

If IOTA is in the Power On Condition, one of following conditions starts the Power Up sequence.

- Power key is pushed for more than 30 ms.
- RPWON input goes high to low for more than 30 ms (e.g. accessory is connected or external RTC signal is activated).
- EXTPWR voltage is higher than (VBAT+0.4) V.
- G2 RTC ALARM signal goes high.

The Power Up sequence is as follows:

1. Local Oscillator OSCAS is started (if not already active for debouche operation).
2. IOTA internal band gap reference is activated.
3. If VBAT < 3.2 V after a timeout of 51.2 ms OSCAS is stopped and Power Up sequence is aborted.
4. Charge pump is enabled.
5. All regulators are enabled.
6. Power Up status bit and internal Reset bits are set.
7. ONnOFF signal is set to activate G2.
8. ARM in G2 starts running software using 32 kHz clock, and also starts 13 MHz clock.

The following Power Down sequence can only be started by G2 setting the DEVICE_OFF bit in IOTA or, in emergency case, when VBAT < 2.7 V (or VBAT < Vbackup & VBAT < 2.8 V):

1. If emergency case INT1 is set low by IOTA.
2. IOTA starts an internal 150 µs watchdog timer to allow G2 to shutdown.
3. On_nOff signal is reset to deactivate G2.
4. All regulators are disabled.
5. IOTA internal band gap reference is deactivated.
6. OSCAS is stopped.

### 5.15.4. Voltage Regulation

Each power source is specified as follows.

- VRDBB: Power supply for G2
  - Voltage 1.5 V
  - Current 120 mA max
  - Dropout 100 mV max (load max)
- VRRAM: Power supply for SRAM and G2
  - Voltage 2.8 V
  - Current 50 mA max
  - Dropout 100 mV max (load max)
- VRMEM: Power supply for flash memory, LCD and G2
  - Voltage 2.8 V
  - Current 60 mA max
  - Dropout 100 mV max (load max)
- VRIO: Power supply for Melody and G2
  - Voltage 2.8 V
  - Current 100 mA max
  - Dropout 100 mV max (load max)
- VRABB: Power supply for G2
  - Voltage 2.8 V
  - Current 50 mA max
  - Dropout 100 mV max (load max)
- VRSIM: Power supply for SIM
  - Voltage 2.85 V
  - Current 10 mA max
  - Dropout 100 mV max (load max)
- VRRTC: Power supply for SRAM and G2
  - Voltage 1.8 V
  - Current 30 μA max
  - Dropout 100 mV max (load max)

## 5.16. Battery Charging and Monitoring

### 5.16.1. Charging Current

The status of the LCD battery icon is determined by the value of VBATREG returned from IOTA, as indicated in the table:

| Icon Status | Battery Pack | |
|---|---|---|
| 3 bar | 3.795 V < | |
| 2 bar | 3.727 V< | < 3.795 V |
| 1 bar | 3.619 V< | < 3.727 V |
| 0 bar (Low voltage alarm) | 3.53 V < | < 3.619 V |

The phone will be power down two minutes after generating a Low battery Alarm.

Battery charging is controlled by the CPU within the phone. If external power is detected and the temperature is within specified limits, the charger starts the rapid charge algorithm.

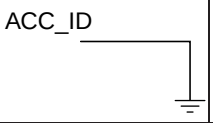
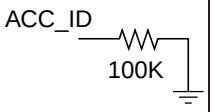
When the battery is fitted, the charging algorithm is determined by constant voltage and constant current control with time, temperature and voltage safeguards. A current limit not greater than the maximum charge current for any battery option must be provided by the external power source.

### 5.16.2. Deeply Discharged Batteries

In the case of deeply discharged batteries, there may not be enough power in the battery to initiate charging. In this case, the charging circuit automatically starts to trickle charge the battery until there is enough power to switch on the phone.

## 5.17. Accessory Control

The telephone can detect accessories connected to the I/O connector by pulsing ACC_PWR high and checking ACC_ID. It can then communicate with the detected peripheral and control set ACC_PWR where required, as detailed in the following table.

| Input | Output | Peripherals |
|---|---|---|
| ACC_ID | ACC_PWR | |
|  | High | Data cable |
|  | High | Digital Camera |

# 6. DISASSEMBLY / REASSEMBLY INSTRUCTIONS

## 6.1. General

This section provides disassembly and reassembly procedures for the main components of the telephone. These assemblies MUST be performed by qualified service personnel at an authorised service centre. The following Warnings and Cautions MUST be observed during all disassembly / reassembly operations:

**WARNING**

The equipment described in this manual contains polarised capacitors utilising liquid electrolyte. These devices are entirely safe provided that neither a short-circuit nor reverse polarity connection is made across the capacitor terminals. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN DAMAGE TO THE EQUIPMENT OR, AT WORST, POSSIBLE INJURY TO PERSONNEL RESULTING FROM ELECTRIC SHOCK OR THE AFFECTED CAPACITOR EXPLODING. EXTREME CARE MUST BE EXERCISED AT ALL TIMES WHEN HANDLING THESE DEVICES.

**Caution**

The equipment described in this manual contains electrostatic devices (ESDs). Damage can occur to these devices if the handling procedures described in Section 4 are not adhered to.

### 6.1.1. ESD Handling Precautions

A working area where ESDs may be handled safely without undue risk of damage from electrostatic discharge, must be available. The area must be equipped as follows:

#### Working Surfaces

All working surfaces must have a dissipative bench mat, safe for use with live equipment, connected via 1M2 resistor (usually built into the lead) to a common ground point.

#### Wrist Strap

A quick release skin contact device with a flexible cord, which has an integral safety resistor of between 5k2 and 1M2, shall be used.

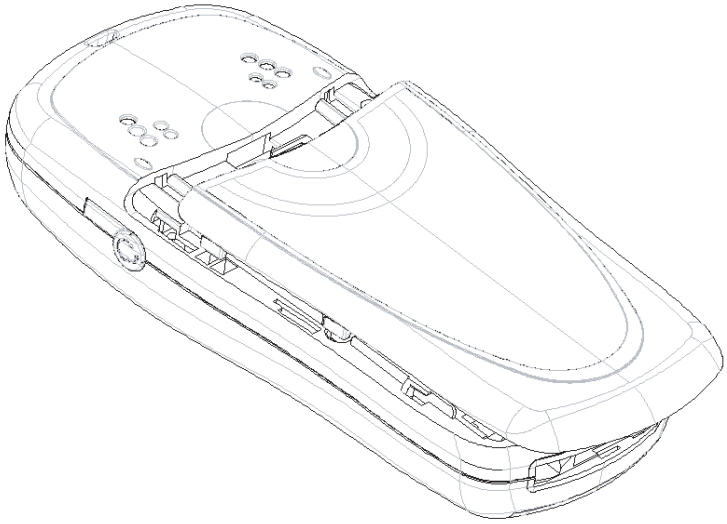
#### Containers

All containers and storage must be of the conductive type.

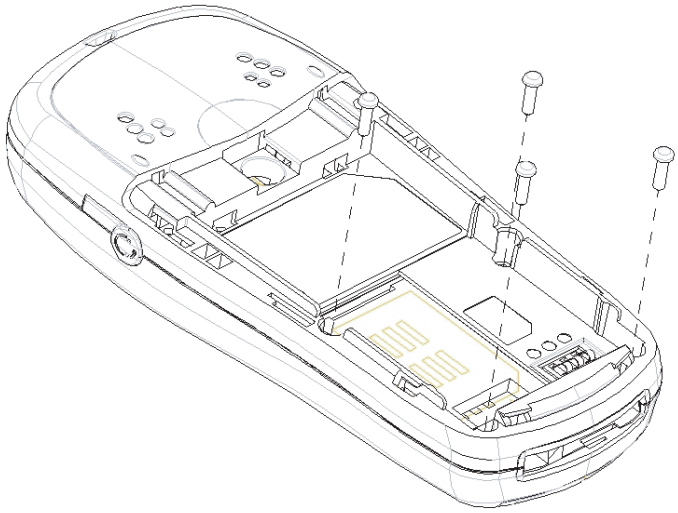
## 6.2. Disassembly

### 6.2.1 Case Removal

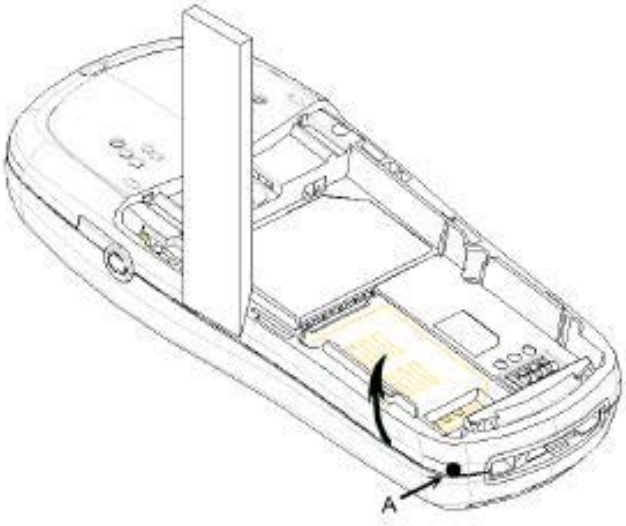
1. Push the battery hook away from the handset and lift out the battery cover. The battery may now be removed from the back of the handset.



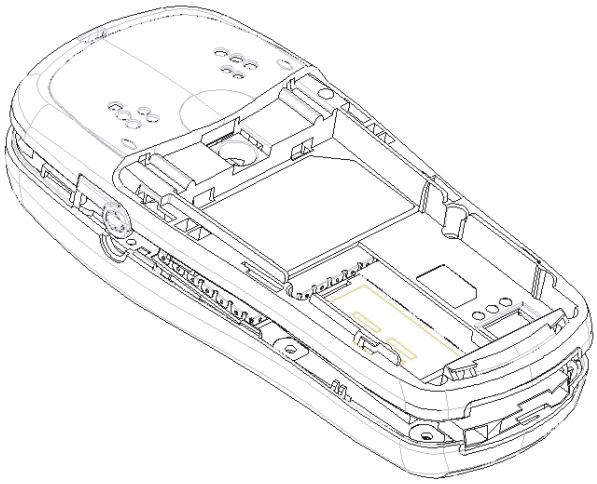
2. Use the T5 screwdriver to remove the four case screws located inside the battery compartment.



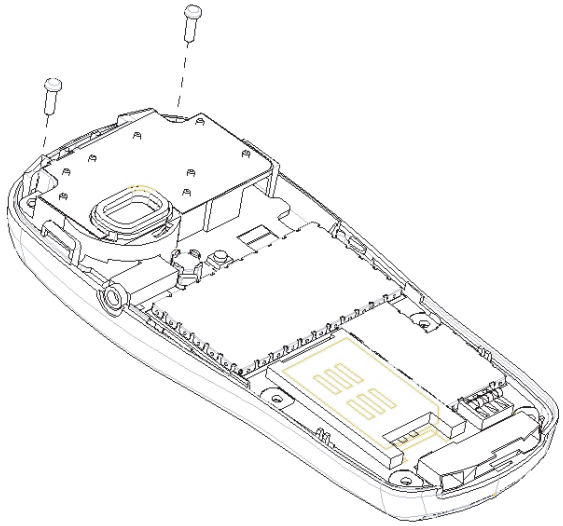
3. Carefully prise apart the case and cover, creating a gep at the base I/O connector. Insert the Case Separation Tool into the gap created, and gently slide the tool in the direction shown, ensuing that the moulded hooks separate all the way up to point ‘A’.



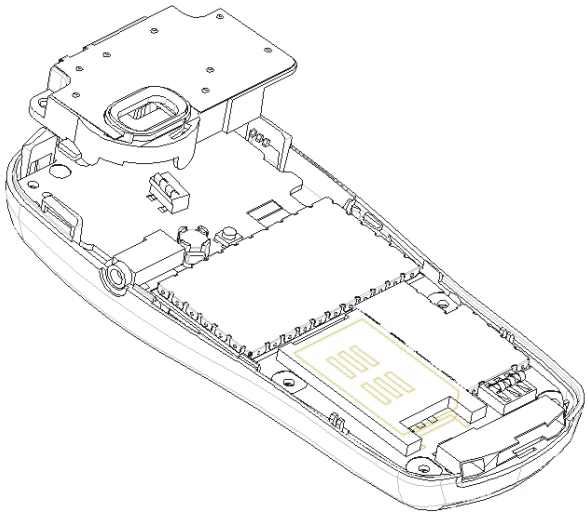
4. Separate by gently twisting the case and cover.



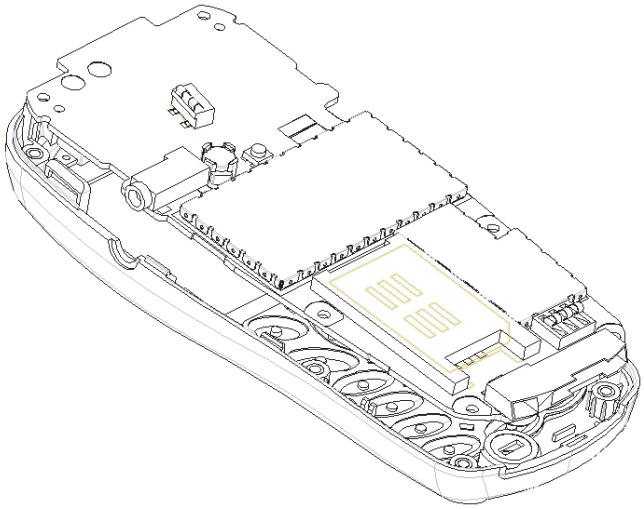
5. Use the T5 screwdriver to remove the two antenna screws located outside the antenna box.



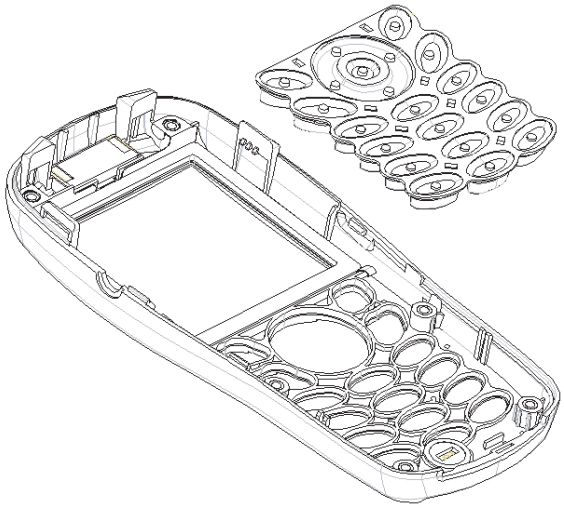
6. Lift the internal antenna assembly from the PCB assembly.



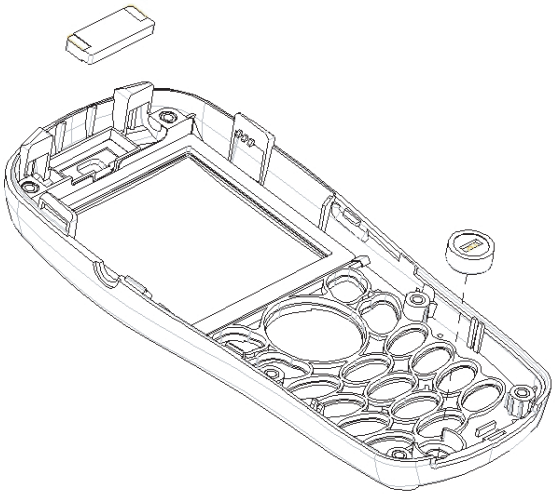
7. Lift the PCB assembly from the upper case.



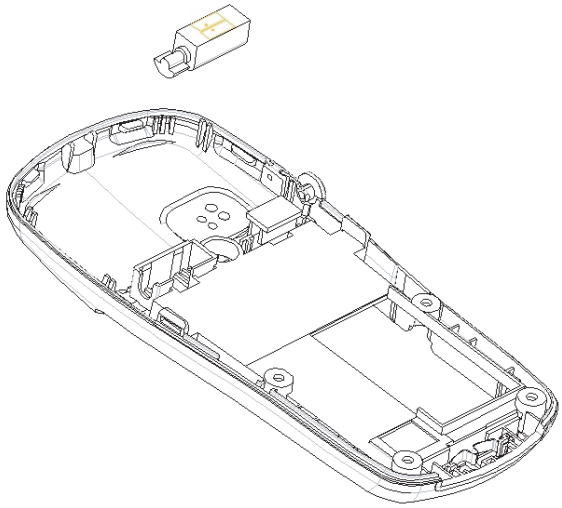
8. Remove the keypad from the upper case.



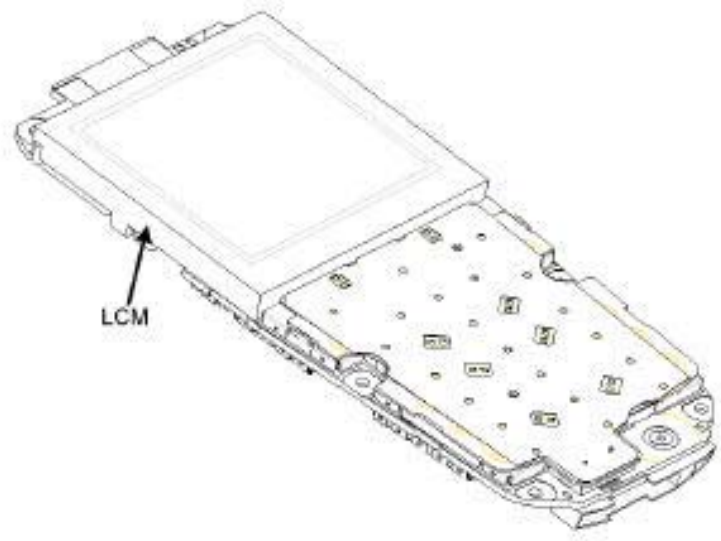
9. Remove the microphone by prizing upward with a small pair of tweezers or similar blunt object through the slot in the side of the microphone holder. Lift the speaker (receiver) from the upper case by inserting a small screwdriver blade or similar blunt object underneath it.



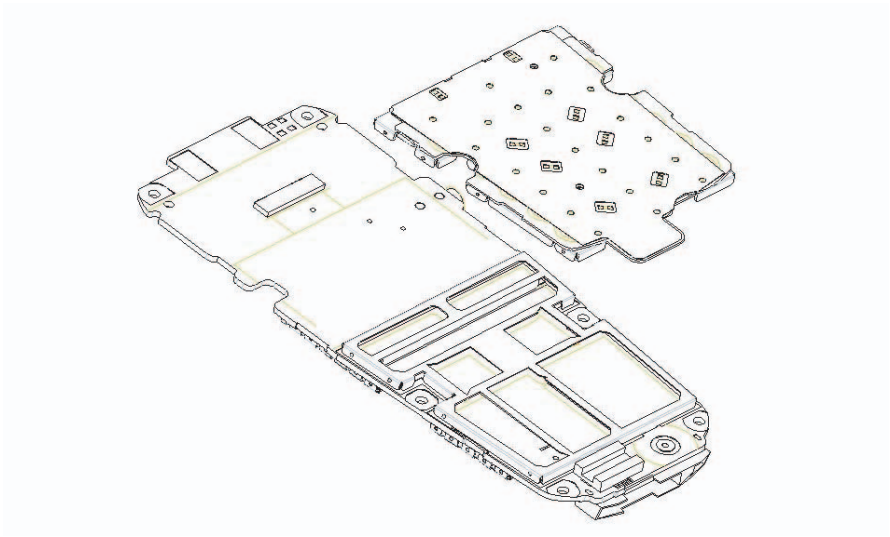
10. The vibrate motor may be lifted from the lower case by gently applying pressure under the spindle / counterweight.



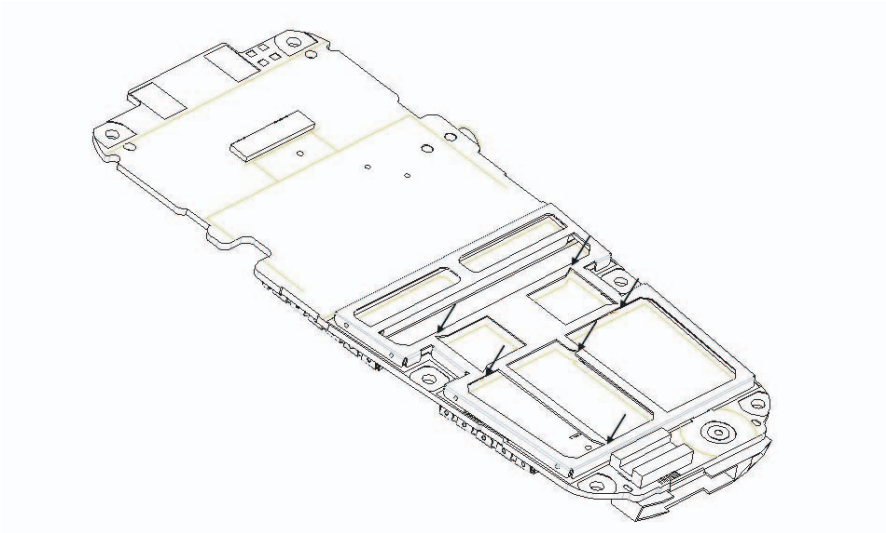
11. Remove LCM bracket from PCB assembly.



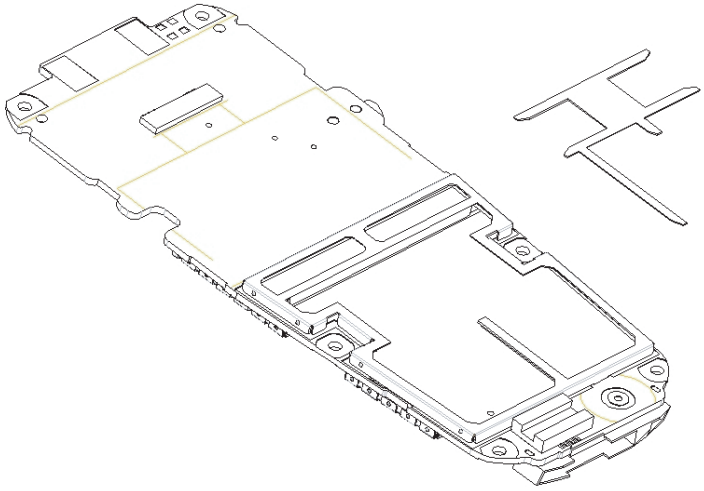

12. Left the MMI by peeling off from the PCB assembly.



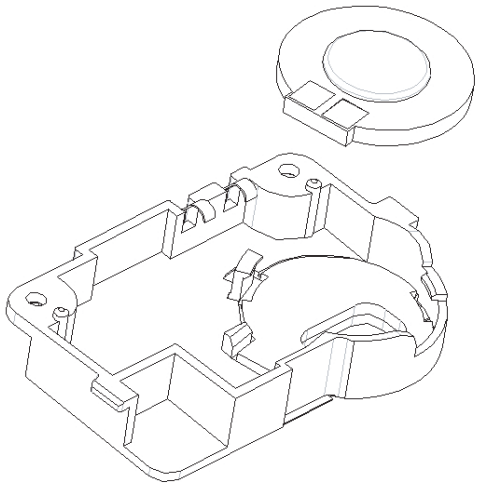
13. To cut 6 points of shielding case as picture.



14. Cutting shielding case as picture.

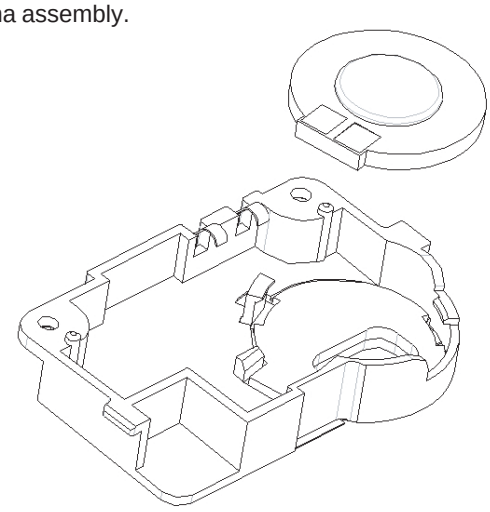


15. Remove speak from internal antenna assemble.

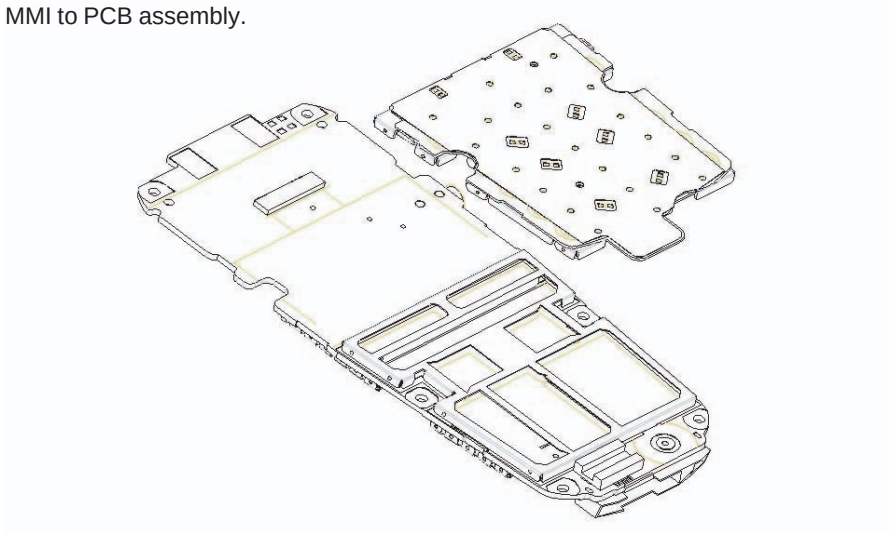


## 6.3. Reassembly

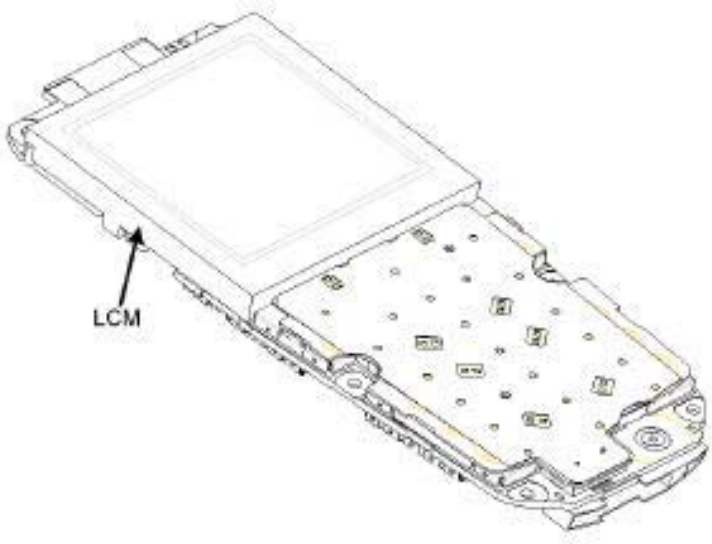
1. Assemble speak to antenna assembly.



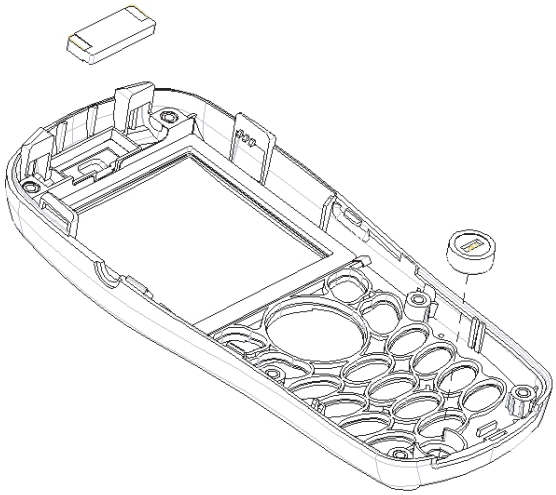
2. Assemble MMI to PCB assembly.



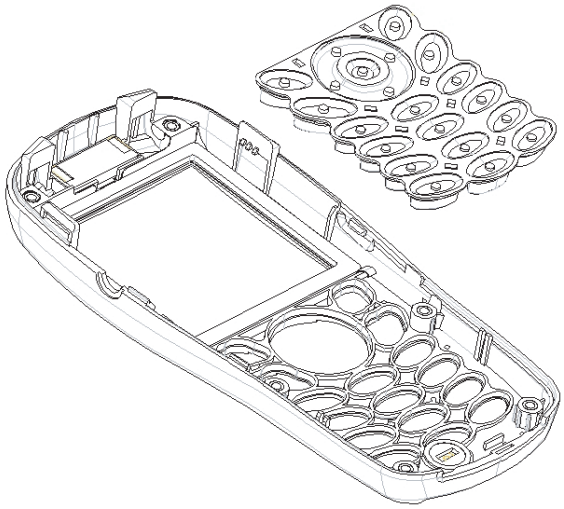
3. Assemble LCM to PCB assembly.



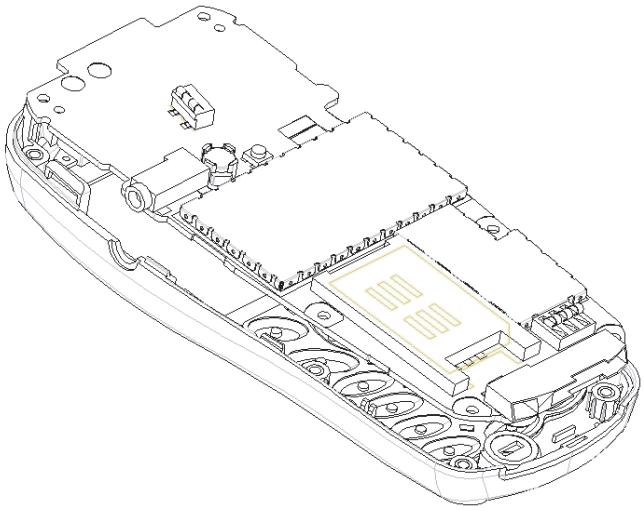
4. Assemble MIC and receiver to upper case assembly.



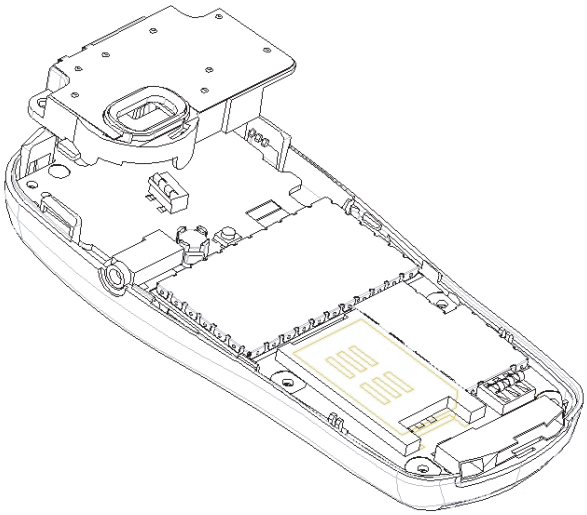
5. Assemble keypad to upper case assembly.



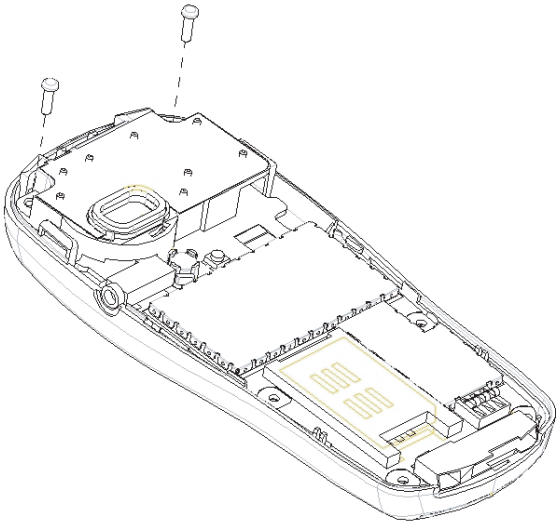
6. Assemble pcb assembly to upper case assembly.



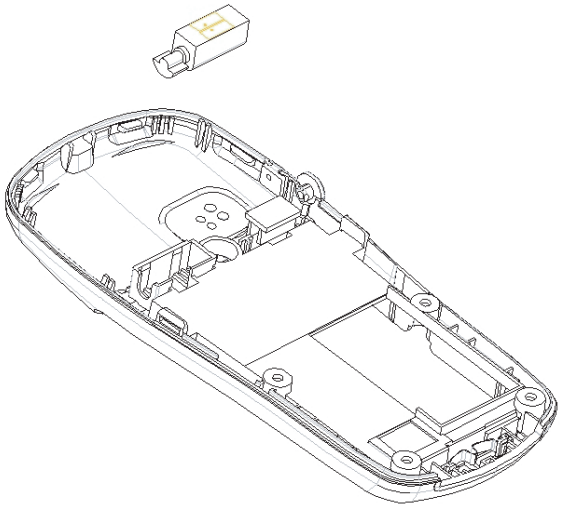
7. Assemble antenna assembly to PCB assembly.



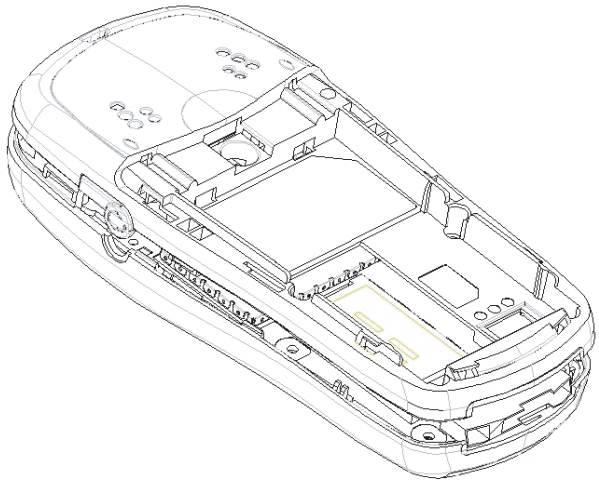
8. Use T5 screwdriver to screwed the two screw located inside the antenna box



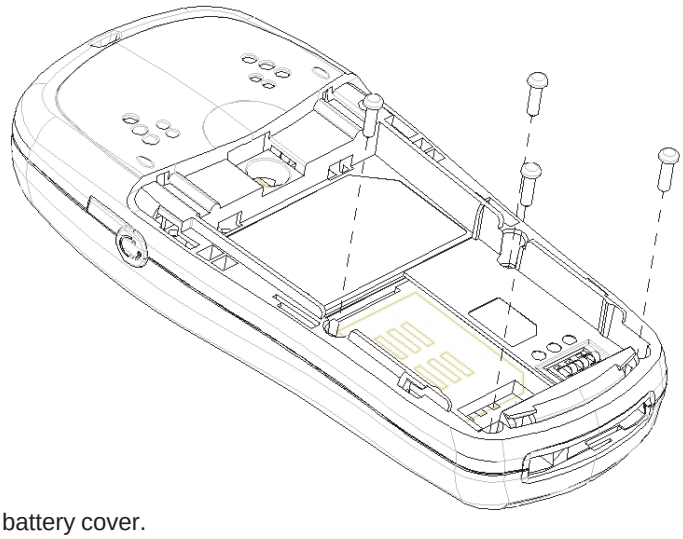
9. Assemble vibrator motor to lower case assembly.



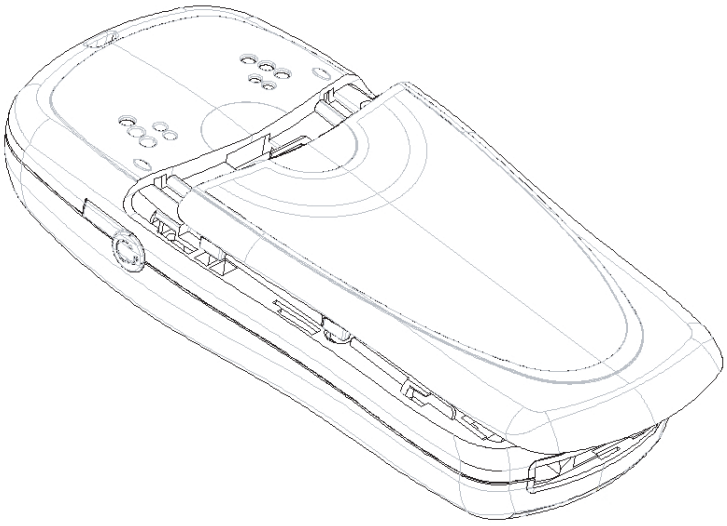
10. Assemble upper case assembly and lower case assembly.



11. Use T5 screwdriver to screwed the four screw located inside the lower case.



12. Push and close the battery cover.



# 7. REPAIR PROCEDURES

## 7.1. Introduction

This section provides information on testing the telephone. Thelayout is as follows:

Section 7.2. : Lead Free (PbF) solder: Identification and repair of PCBs using PbF solder.
Section 7.3. : External testing: describes equipment requirements and general set up procedure.
Section 7.4. : Complete Unit Test Setup: Describes how the items of test equipment are used together and general set up procedure.

Adjustment Procedure are described in Section 8.

## 7.2. Lead Free (PbF) solder

**CAUTION**

The Printed Circuit Board (PCB) used in this telephone has been manufactured using Lead Free solder.
(SPARKLE ECO SOLDE : Part No. ESC F3 M705 0.3)

Lead Free solder has a higher melting point than Lead solder - typically 30 - 40 °C higher. Always use a high temperature soldering iron When using a soldering iron with temperature control, it should be set to 370 ± 10 °C (700 ± 20 °F).

When using lead solder, all PbF solder must be removed from the solder area. Where this is not possible, heat the PbF solder until it melts before applying lead solder.

Avoid over heating PbF solder as it has a tendency to splash at temperatures above 600 °C (1100 °F).

## 7.3. External Testing

### 7.3.1. General Information

The handset can be connected to a compatible personal computer for electronic adjustment and fault diagnosis. This section provides a description of the equipment required to perform those tasks.

Prior to testing and adjustment, the unit should first be disassembled, as detailed in Section 6, and then the PCB connected to the PCB Repair Jig. Fault tracing can be performed on the PCB using suitable test equipment, such as spectrum analysers and oscilloscope.

The unit must be tested and calibrated for all frequency bands (900 MHz and 1900 MHz).

#### Personal Computer (PC)

The PC (IBM compatible) is used as a Unit Under Test controller.

#### Power Supply

Provides 3.8 V DC supply to RF Adaptor and PCB Repair Jig.

## PCB Repair Jig (Part No. PVIPCBJIG)

The PCB Repair Jig provides the necessary connections between the PCB Assembly and external test equipment. It is required for RF calibration.

**Figure 7.1. : PCB Repair Jig**

A cable with SMA female connector is provided to make the RF connection. An SMA to N-Type male adaptor will be required to connect the Repair Jig to the service equipment. Cable loses for the RF connection are 0.5 dBm (GSM 900) and 0.8 dBm (GSM 1800).

A replacement RF Probe for the Repair Jig is available as a spares item.

## RF Adaptor (Part No. PVRFJIG)

The RF Adaptor provides the connections bettween the test equipment and the phone for unit testing.

**Figure 7.2. : RF Adaptor**

A cable with SMA female connector is provided to make the RF connection. An SMA to N-Type male adaptor will be required to connect the Jig to the service equipment. Cable losses for the RF connection are 0.5 dBM (GSM 900) and 0.8 dBM (GSM 1800).

## Data Cable (Part No. 73PV150001W)

The data cable for used to software download and calibration.

**Figure 7.3. : Data Cable**

## RF Cable (Part No. JT00084)

The RF cable provides the necessary connections between the PCB Repair Jig/RF Adapter and external test equipment.

## Case Separation Tool (Part No. JT00059)

The case Separation Tool is used to facilitate separation of the front cover and case.

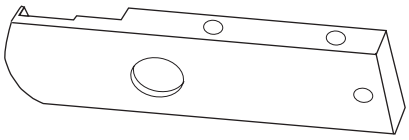


**Figure 7.4. : Case Separation Tool**

## GSM Tester

This unit acts as a base station providing all the necessary GSM signalling requirements and also provides GSM signal measuring facilities.

### Calibration Software

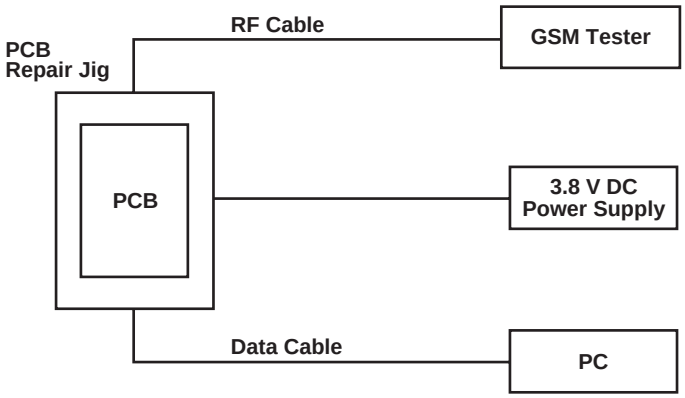
This is the test software for the telephone unit and should be installed onto the personal computer to be used for testing.

### T5 Screwdriver (Part No. )

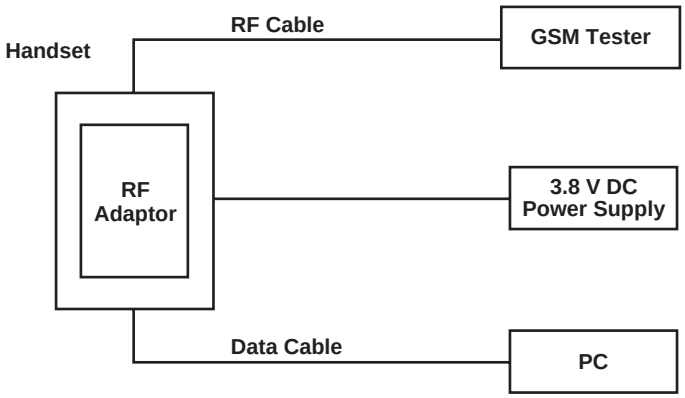
This screwdriver is required to remove the case screws from the phone.

## 7.4. Test Equipment Setup

### 7.4.1. Equipment Required




**PCB TEST SETUP**




**COMPLETE UNIT TEST SETUP**

**Figure 7.5. : Test Connection Diagram**

### IMPORTANT NOTE

To allow accurate measurement of the complete unit the test equipment must be connected as shown,
For testing the handheld unit the following equipment is required:

1. PCB Repair Jig
2. RF Adaptor
3. RF Cable
4. 12 V power supply
5. Personal computer with RS232 interface and running Microsoft Windows® 95, 98, NT, XP or 2000
6. Data Cable
7. GSM test station
8. G60 Service software

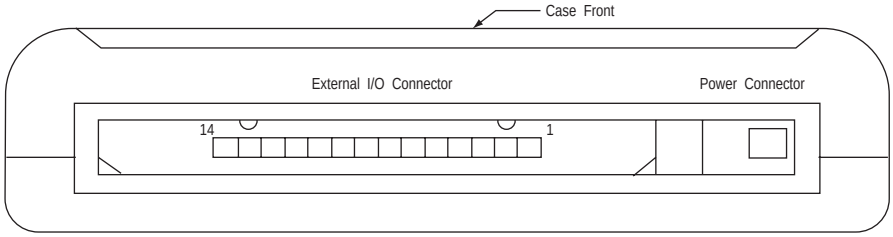
The G60 Service software should be installed onto the main drive of the personal computer.
The RF cable is connected to the GSM test station via suitable adaptor. The 3.8 V supply is connected to the RF Adptor and PCB Repair Jig.

**NOTE:** A suitable test SIM card compatible with the GSM test station will be required.

# 7.5. INTERFACES AND TEST POINTS

## 7.5.1. Interfaces

### ■ External I/O



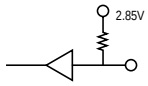
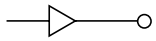
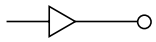
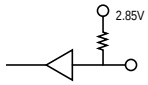
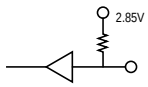
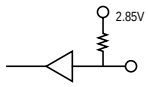
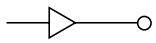
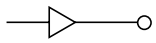
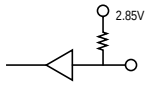
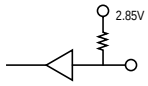
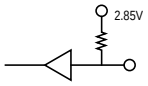
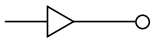

| No. | Name | HH ⟷ EXT | Function | H/H Circuit |
|---|---|---|---|---|
| 1 | DLPWR | ← | Remote power-on |   |
| 2 | Tx_IrDA | → | Transmit data |  |
| 3 | SDO | → | Data out |  |
| 4 | Rx_IrDA | ← | Receive data |   |
| 5 | CTS_MODEM / SDI | ← | Clear to send / Data in |   |
| 6 | RX_MODEM | ← | Receive data |   |
| 7 | TX_MODEM | → | Transmit data |  |
| 8 | RTS_MODEM / nSCS1 | → | Request to send / Chip select1 |  |
| 9 | DSR_MODEM | ← | Data set ready |   |
| 10 | DTR_MODEM | ← | TPU in WATE mode |   |
| 11 | ACC_PWR | ← | Power supply | |

**Figure 7.6. : External I/O Connector**

| No. | Name | HH ⟷ EXT | Function | H/H Circuit |
|---|---|---|---|---|
| 12 | VACCID | ← | Analog input |   |
| 13 | SCLK | → | Serial clock |  |
| 14 | DGND | – | Power supply and digital signal ground |  |

## 7.5.2. LCD Module Interface Signals

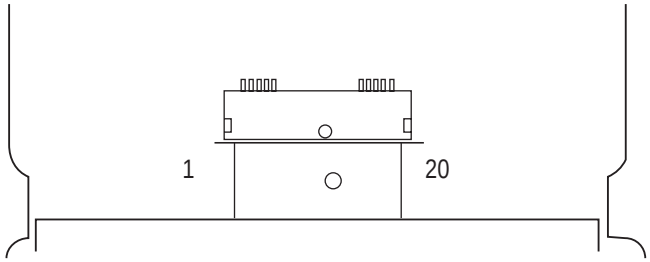



**Figure 7.7. : LCD Connections**

| No. | Name | PCB ⟷ LCD | Function | Connection |
|---|---|---|---|---|
| 1 | LCD_ID | ← | GND (0V) | G2#M10 |
| 2 | nCS | → | Chip select | G2#C1 |
| 3 | nRES | → | Reset | G2#N2 |
| 4 | E | → | Enable | G2#L8 |
| 5 | D7 | → | Data bus | G2#C5 |
| 6 | D6 | → | Data bus | G2#E6 |
| 7 | D5 | → | Data bus | G2#C6 |
| 8 | D4 | → | Data bus | G2#A6 |
| 9 | D3 | → | Data bus | G2#D6 |
| 10 | D2 | → | Data bus | G2#E7 |
| 11 | D1 | → | Data bus | G2#D7 |
| 12 | D0 | → | Data bus | G2#B7 |
| 13 | R/nW | → | Data read/write signal | G2#B2 |
| 14 | A0 | → | Indicates that data entered to D7 to D0 is display data or a command | G2#M4 |
| 15 | CLS | → | Select Built-in CR oscillation for display clock | |
| 16 | TEST1 | – | Test input for IC (not used) | |
| 17 | VDD | → | Power supply for LCD | DC 2.85V |
| 18 | GND | – | System ground | DGND |
| 19 | GND_LED | – | LCD backlight ground | DGND |
| 20 | VCC_LED | → | Power supply for LCD backlight | DC 5V |

### 7.5.3. SIM Interface

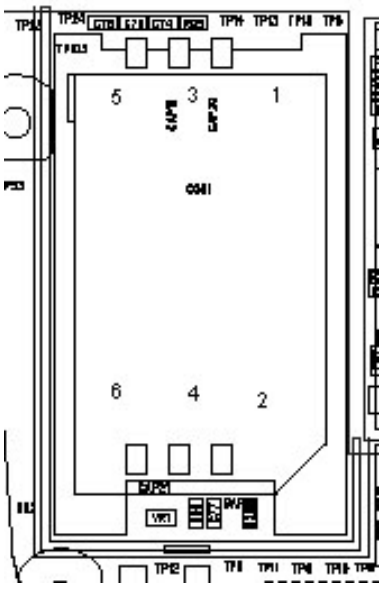



**Figure 7.8. : SIM Connector**

| Pin | Signal |
|---|---|
| 1 | SIM_CLK |
| 2 | SIM_IO |
| 3 | SIM_RST |
| 4 | SIMPWR |
| 5 | SIMPWR |
| 6 | Ground |

### 7.5.4. Battery Connector

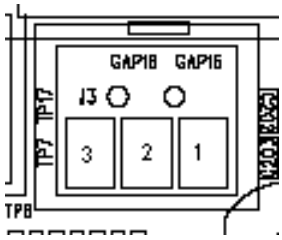



**Figure 7.9. : Battery Connector**

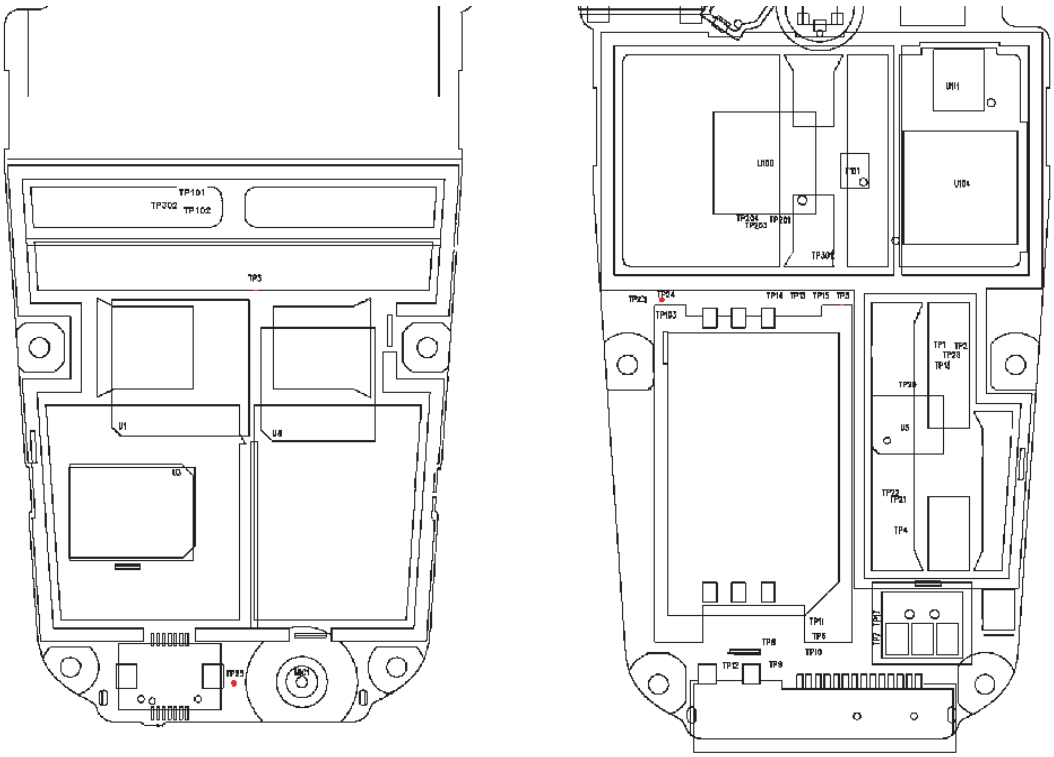
| Pin | Signal |
|---|---|
| 1 | VBAT |
| 2 | BAT_TEMP |
| 3 | Ground |

### 7.5.5. Test Point

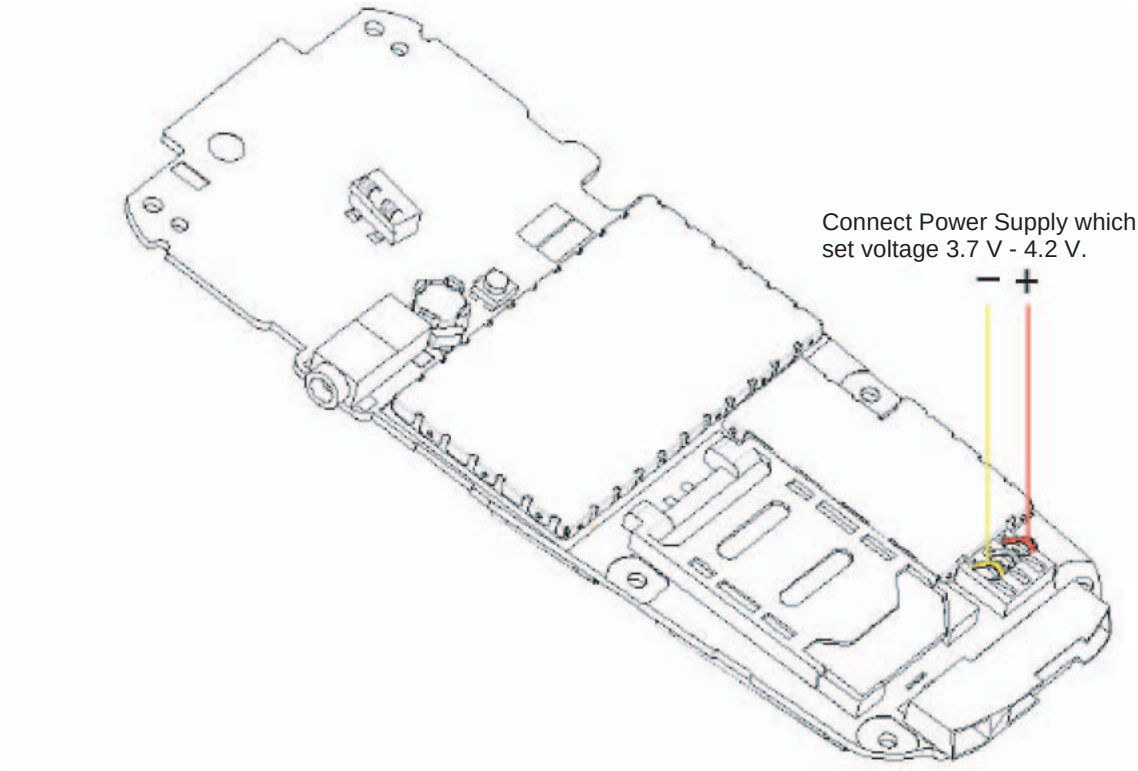
| TP No. | Signal Name |
|---|---|
| Base Band | |
| TP1 | nBSCAN |
| TP2 | CLK32K_OUT |
| TP4 | F-RY/BY |
| TP5 | TDI |
| TP6 | CTS_MODEM |
| TP7 | DTR_MODEM |
| TP8 | DSR_MODEM |
| TP9 | RTS_MODEM / nSCS1 |
| TP10 | TX_MODEM |
| TP11 | RX_MODEM |
| TP12 | VCHG |
| TP13 | TDO |
| TP14 | TCK |
| TP15 | TMS |
| TP17 | BATTEMP |
| TP18 | VBAT |
| TP20 | EXT2 |
| TP21 | EXT1 |
| TP22 | CLK13M_OUT |
| TP23 | BS_TDO |
| TP24 | DLPWR |
| TP25 | PWON |
| TP27 | VBACKUP |
| TP28 | nCS4 |
| TP53 | TESTV |
| RF | |
| TP101 | RF_LE |
| TP102 | RF_CLK |
| TP103 | RF_DAI |
| TP201 | RXIP |
| TP202 | RXIN |
| TP203 | RXQP |
| TP204 | RXQN |
| TP301 | RXENA |
| TP302 | TXENA |

## 7.5.6. Power On

It can power on without MMI by shorting TP24 or TP25 to ground 2 seconds.

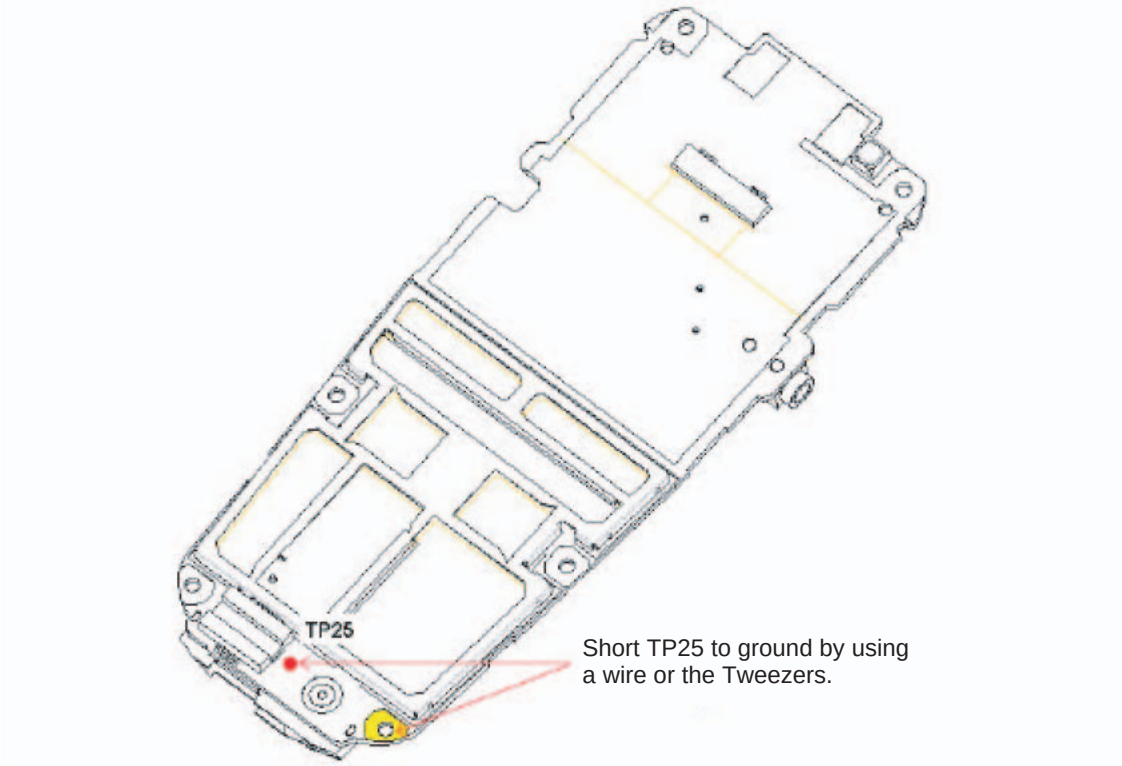


Step 1



Step 2

Short TP25 to ground by using a wire or the Tweezers.



# 8. SOFTWARE DOWNLOAD & ADJUSTMENT PROCEDURES

## 8.1. Overview

Service Tool is an application that integrates the following functions:

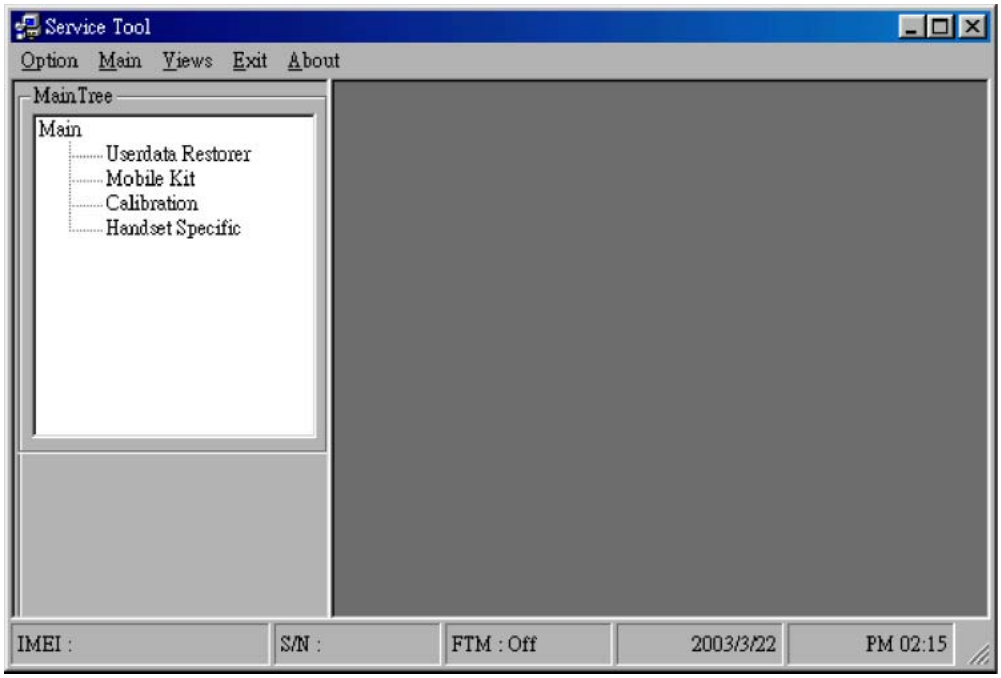
1. Data Reserve function:
   Some data fields (like Phone books, Calibration data…etc) can be stored into files with this function. If the data is lost after re-flashing, we could use this function to restore the original data back to handset.

2. Re-Flash function:
   Download the new version of software or the flex file. The operators could select the new version of software file alone or the flex file alone to download. Or choose both files to download at the same time.

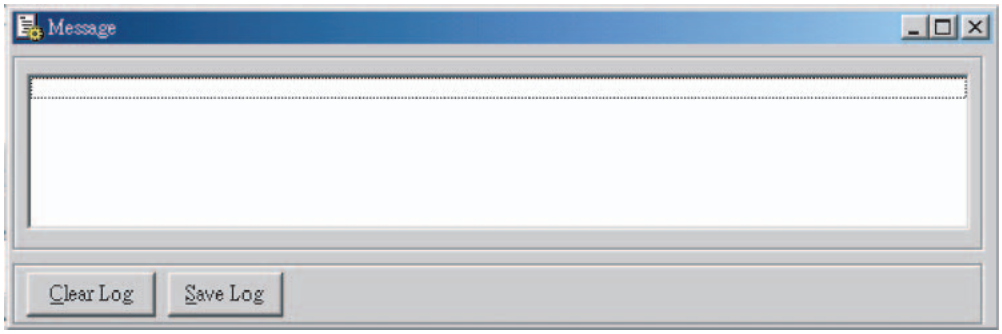
3. Calibration function:
   The operators could calibrate RF parameters or battery ADC values, NTC values using this function.
   Service Tool will be able to run on the Win95, Win98 (1st & 2nd edition), WinNT4.0, Win2K and WinXP platform.

## 8.2. Getting Started

To run the program, just execute the ServiceTool icon on the desktop, and the pop up window will look like:



A message log window also appears at the bottom of the main window to display the processing and status information.

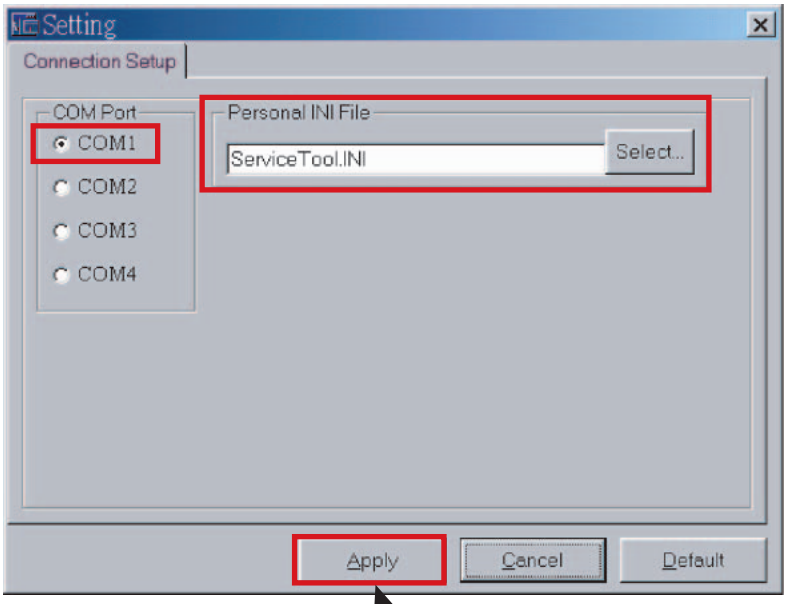



The operator can click the “option” to change the COM port. In order to pre-vent incorrect setting, it has password protection, password is “Compal_PV1” and case-sensitive, anytime you want to change the configuration you need to enter the password.
Setup menu

1). Connection Setup: COM Port

Select the COM port you connect the data cable. Default is COM1.

2). Select Personal INI File

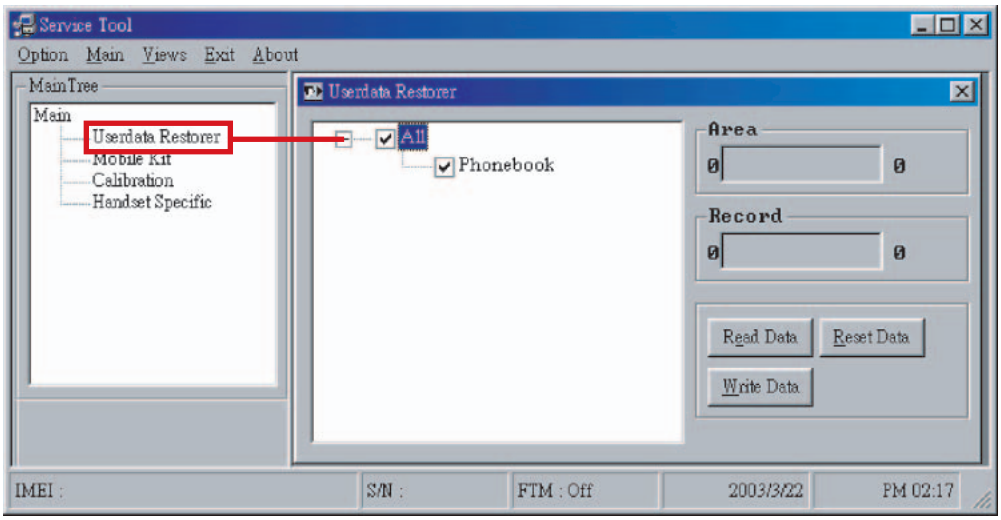



After selecting the correct COM port and Personal INI File, press “Apply” to make the setting enabled.

## 8.3. Function Description

### 8.3.1. Userdata Restorer

To Read / Write User data between MS and PC. Currently only phonebook data are available.



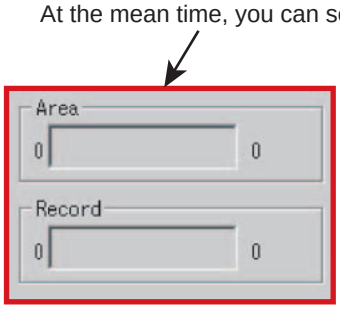

1). Read

1. Select the area you want to read from the “Tree view”.


If “All” is checked, it means all of the items on the tree will be selected automatically for reading purpose. Otherwise you can select the specific items individually.

2. Make sure your handset is correctly connected with your pc, switch on your handset and click the button "Read Data". It will automatically enter Factory Test Mode and start to read data.

Wait for "Reading Data finish" shown on the log list.
At the mean time, you can see the status of process on progress bar.




Note: Before doing any operation of Service Tool (except reflash, reflexing), you need to turn on your handset first. If you have SIM card inserted, it is suggested that to wait until the Network searching complete and then start your operation. If the Network searching takes a long time to finish, the hand-set may enter sleep mode and will not be able to get the command from PC, please press any key to wake up the handset.

3. All the data that have been read from MS will be saved automatically as a file in the assigned folder.

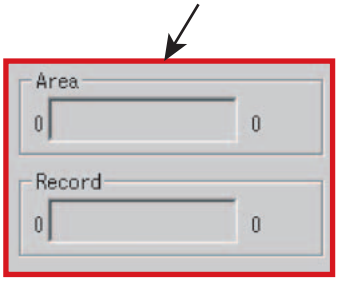
2). Write

1. Select the area you want to write from the “Tree view”.


If “All” is clicked, it means all of the items on the tree will be selected automatically for writing purpose. Otherwise you can select the specific items individually.

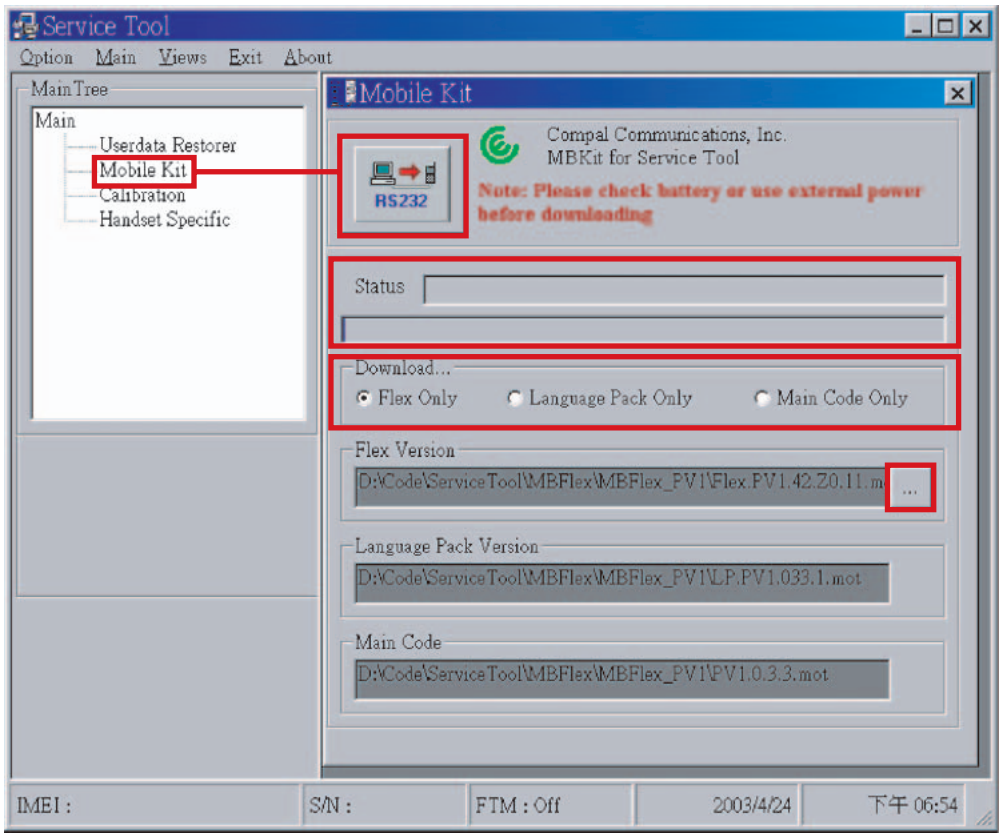
2. Make sure your handset is correctly connected with your pc, switch on your handset and click the button "Write Data". It will automatically enter Factory Test Mode.


Wait for the message "Writing Data finish" shown on the log list.
At the mean time, you can see the status of process on progress bar.




3. Restart the MS to make sure userdata has been written back on.

### 8.3.2. Mobile Kit




1). In “Download” frame, you can choose either Flex Only, Language Pack Only, or Main Code Only, individually.

2). Click “…” to select the desired version of flex file, language pack file, or main code. Please notice that the selected flex, language pack, and main code should be with the same version. Unmatched version of flex, language pack, and main code could make the handset operate abnormally.

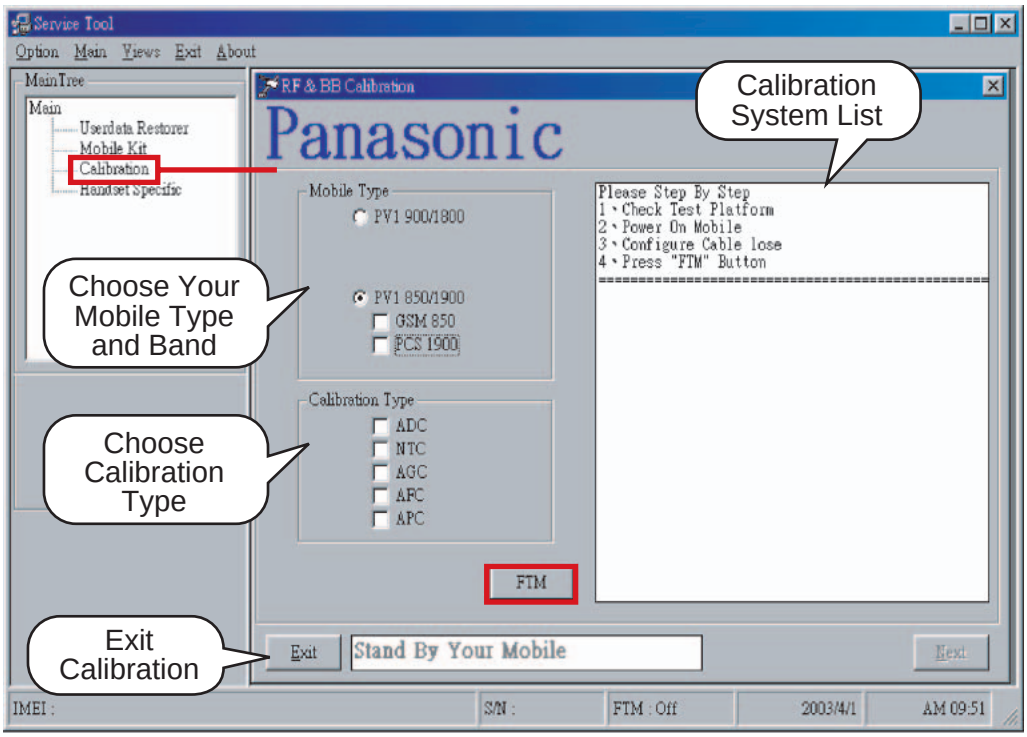
3). To start download, first make sure the phone is connected correctly with PC and switch off the phone. Click button “RS232” to start downloading and you can see the status of the process from the progress bar. After click “OK” and then switch on the phone.

### 8.3.3. Calibration

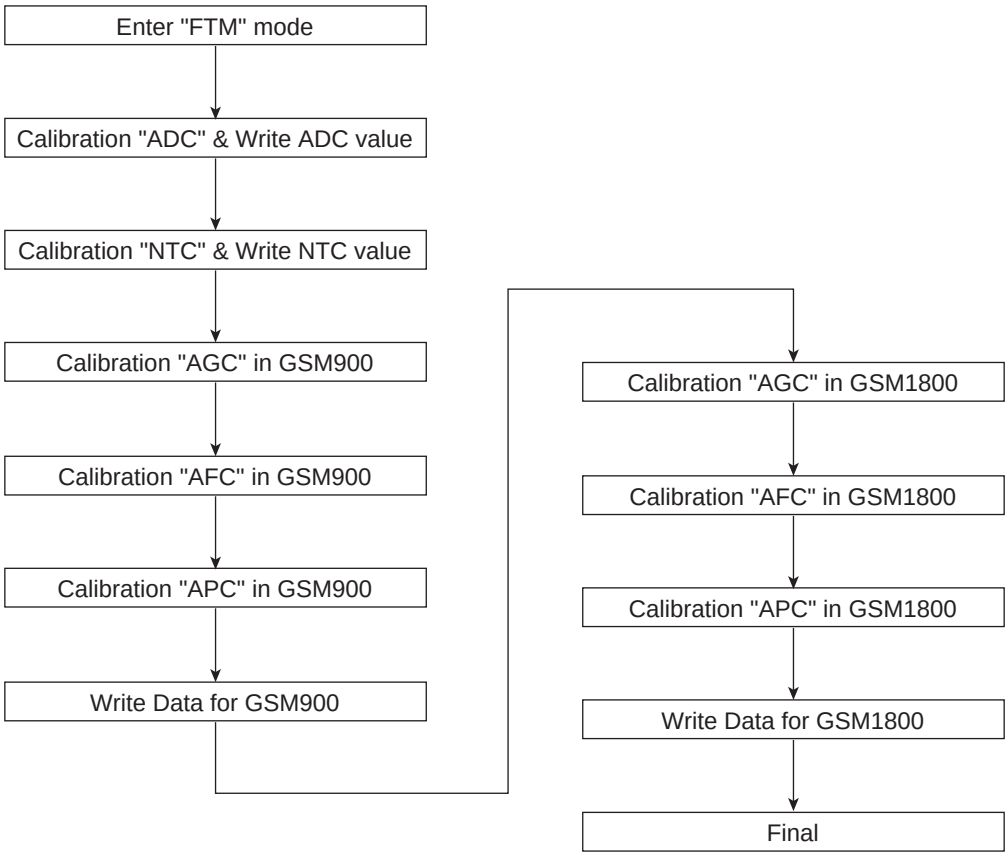
Function Purpose :
ADC : It can calibration battery in 4.2V and 3.4V,or choose one.
NTC : It can calibration battery of temperature in 0¢J and 40¢J or choose one.
AGC : It can calibration gain value.
AFC : It can calibration frequency error and slope.
APC : It can calibration power for each level.

Warning : Before calibration, you must check parameter of instrument. Is it correct?
(Annex notes.1)

1). Snapshot of Calibration Screen



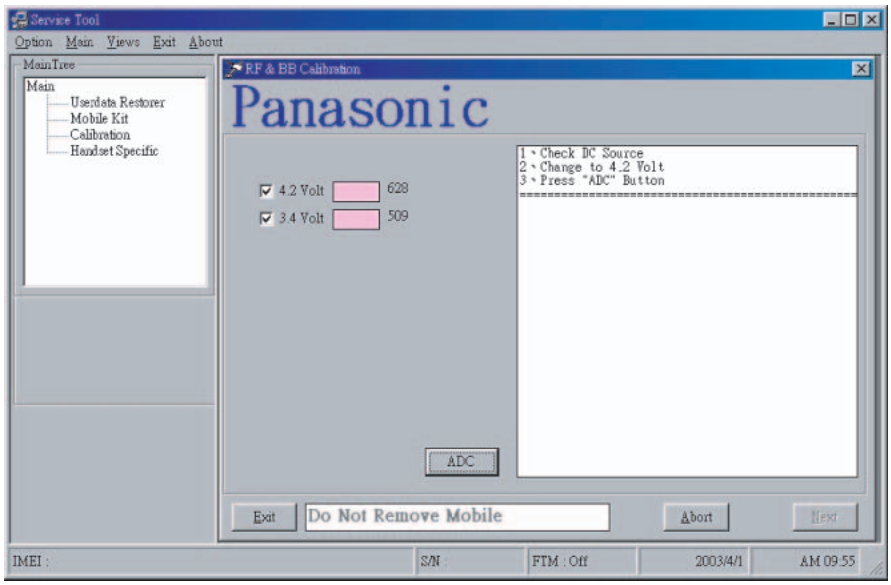

2). Example for Calibration



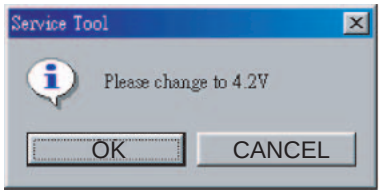
Step 1: Make sure your handset is correctly connected with your PC, switch on your handset and click the button "FTM". It will automatically enter Factory Test Mode and start to read data for calibration.

Step 2: Press “Next” to continue.

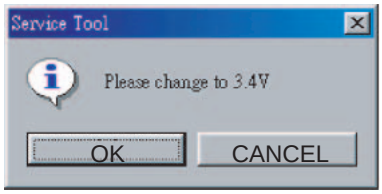
Step 3: Click “ADC” and doing calibration battery.



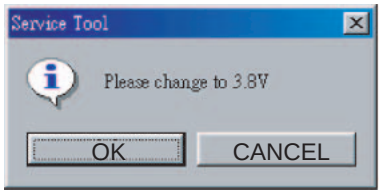

Step 3.1: Change to 4.2 V and click “OK” to start calibration battery in 4.2 V.



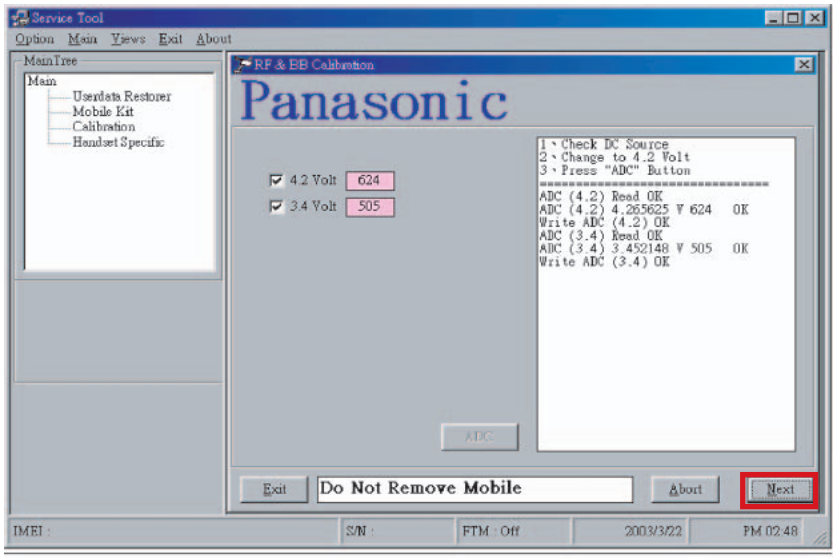

Step 3.2: After Calibration battery in 4.2 V, please turn to 3.4 V and click “OK” to start calibration battery in 3.4V.




Step 3.3: After Calibration battery in 3.4 V, Don’t forget turn to 3.8 V.



Step 3.4: ADC is complete.



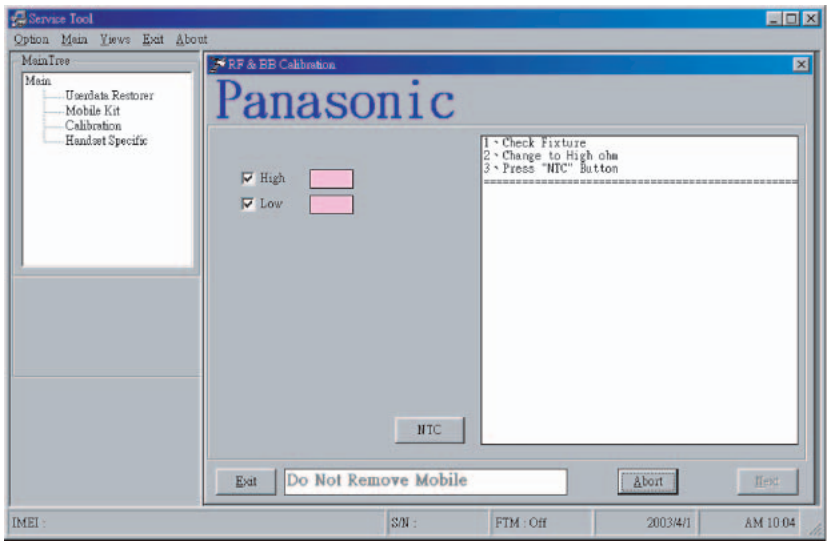

Step 4: Press “Next” to continue.

Step 5: Click “NTC” and doing calibration temperature of battery

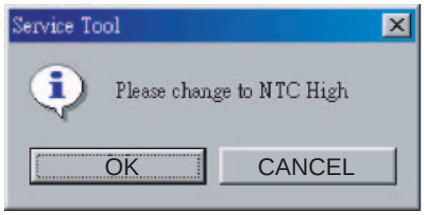
Temp Calibration. NTC is supposed to prevent battery Temp too higher or too lower.

NTC-High (40¢J) approve of range in 233 to 170(6.95Kohm - 4.83Kohm).

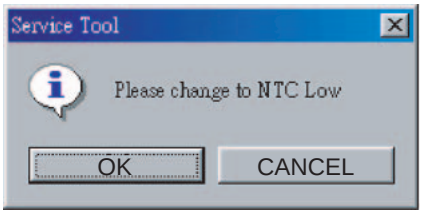
NTC-Low (0¢J) approve of range in 965 to 671(33.9Kohm - 21.6Kohm).




Step 5.1: Change to NTC-High(40¢J) and click “OK” to start calibration temperature of battery in NTC-High(40¢J).



Step 5.2: After calibration battery in NTC-High, please turn to 0¢J and click “OK” to start calibration temperature of battery in NTC-Low (0¢J).

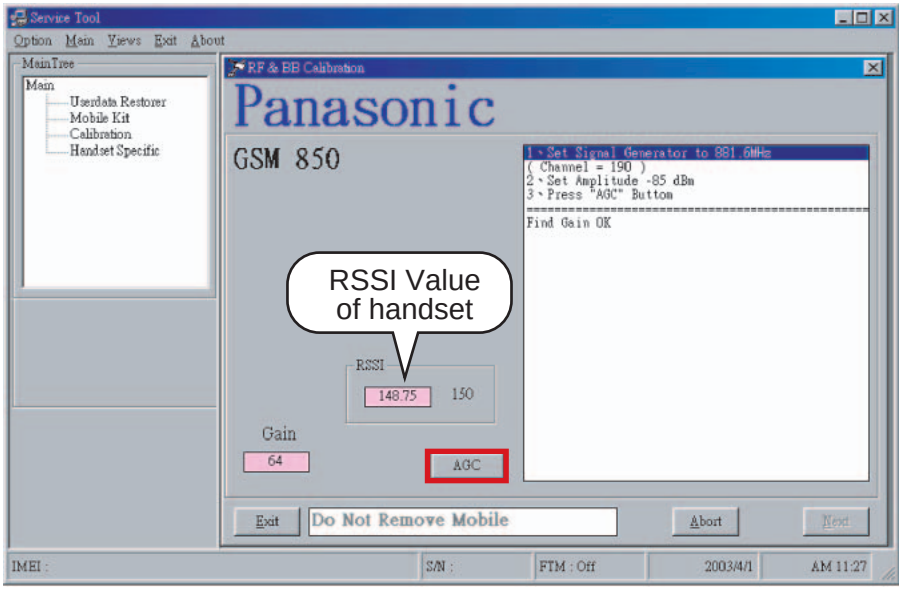



Step 5.3: After calibration NTC-Low, NTC is complete.

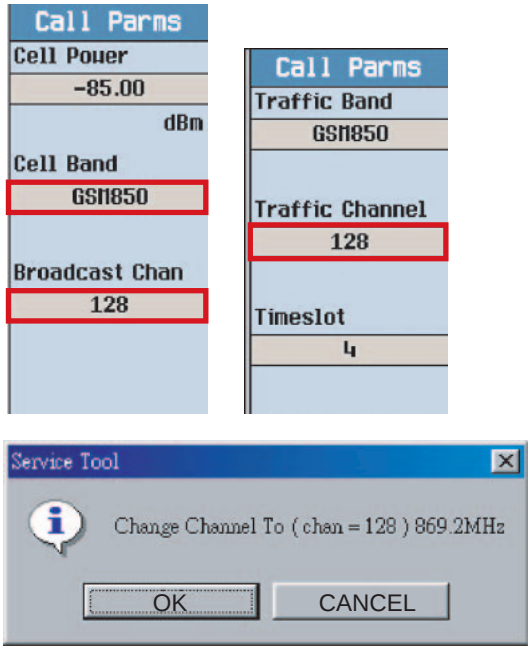

Step 6: Press “Next” to continue.

Step 7: After configure parameter of instrument, Click “AGC”, Find gain value and RSSI of full channel.

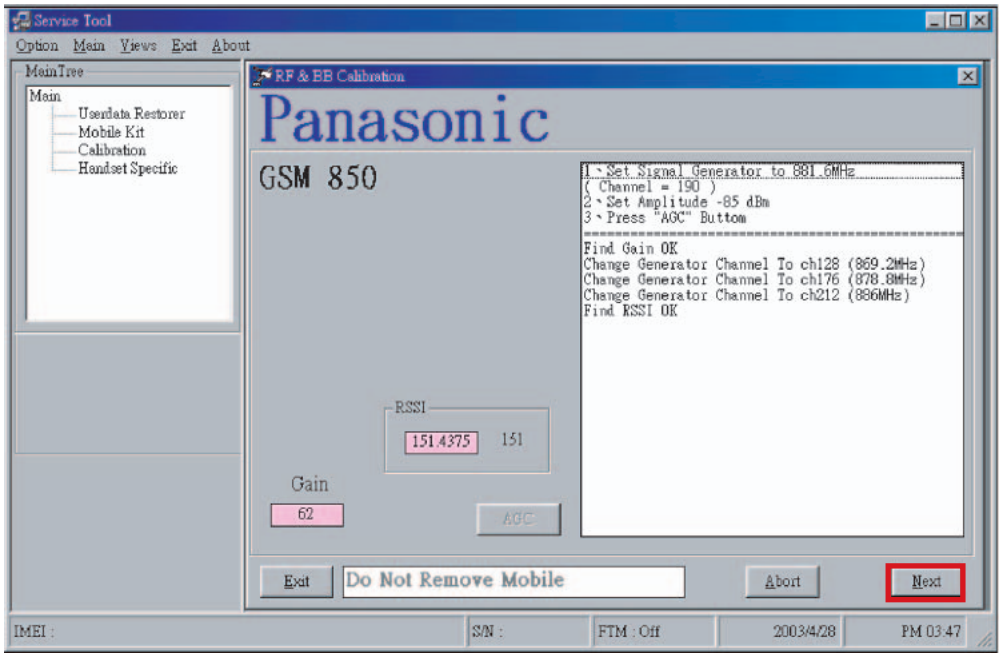
In this Case, If you use CMU200, please see Annex notes 2-1 to Configure.
If you use HP8960, please see Annex notes 2-2 to Configure.



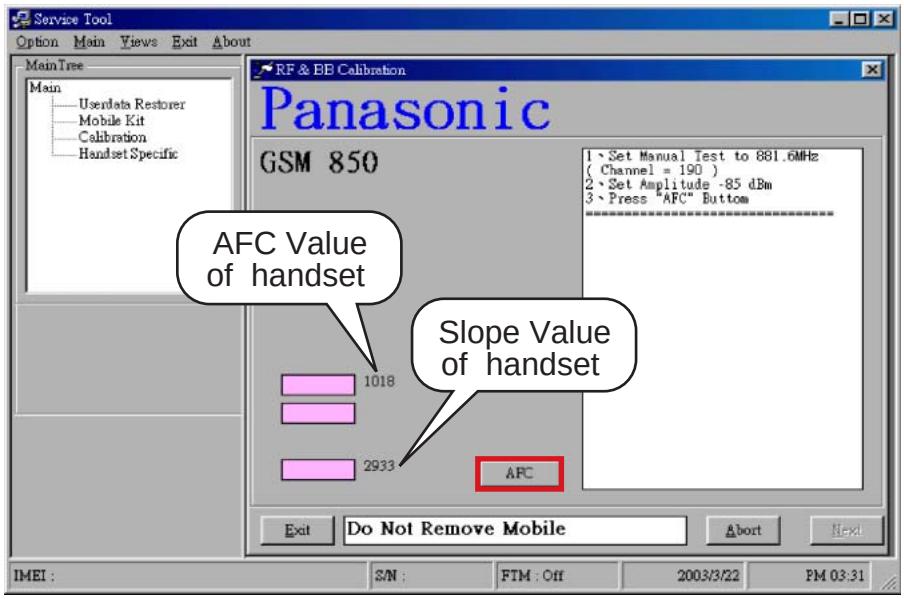
Step 8: After find gain value, change channel (Generator channel) to RSSI value, press "OK" to next channel.
(In this case, channel 128, channel 176, channel 212).



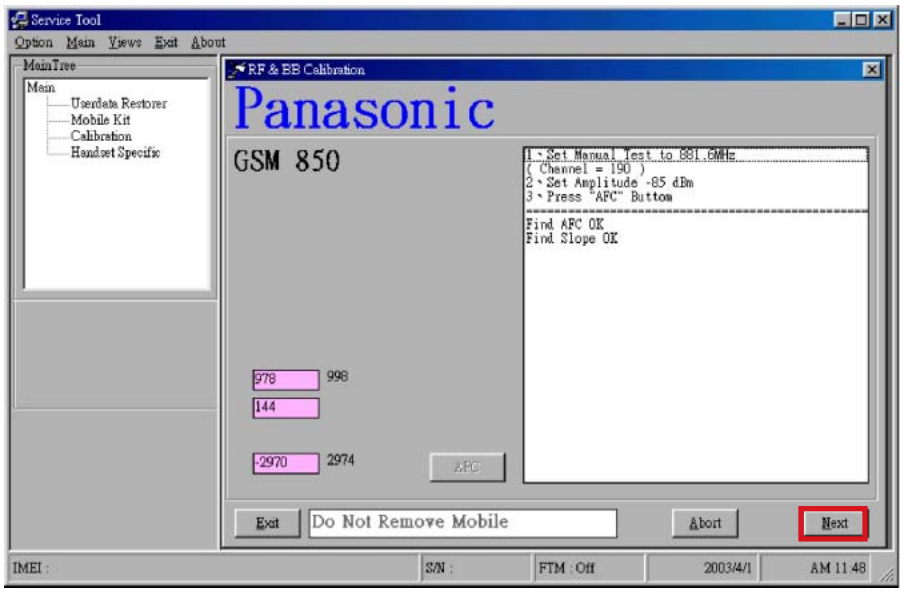

Step 9: AGC calibration is complete, press "Next" to continue.



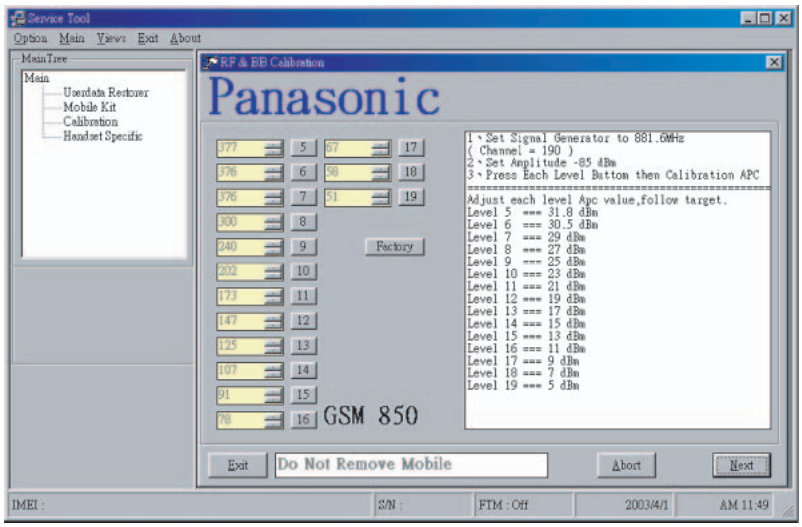
Step 10: After configure parameter of instrument, Click “AFC” and doing AFC cali-bration.
In this Case, If you use CMU200, please see Annex notes 2-1 to Configure.
If you use HP8960, please see Annex notes 2-2 to Configure.



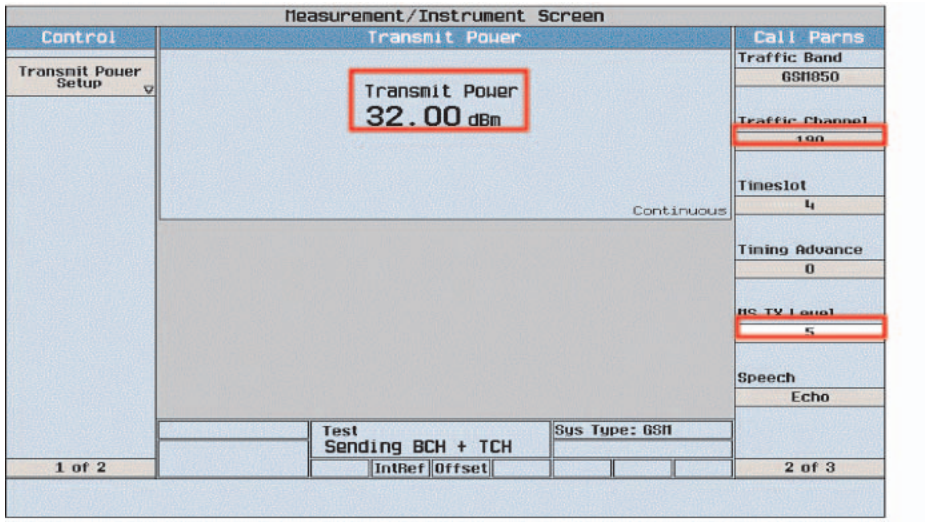

Step 11: AFC calibration is complete, press “Next” to continue.



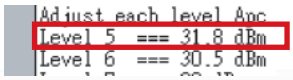
Step 12: After configure parameter of instrument, Click “APC” and doing APC calibration.
(“factory” key : Return APC value each level of the handset.)
In this Case, if you use CMU200, please see Annex notes3-1 to Configure.
If you use HP8960 ,please see Annex notes3-2 to Configure°G

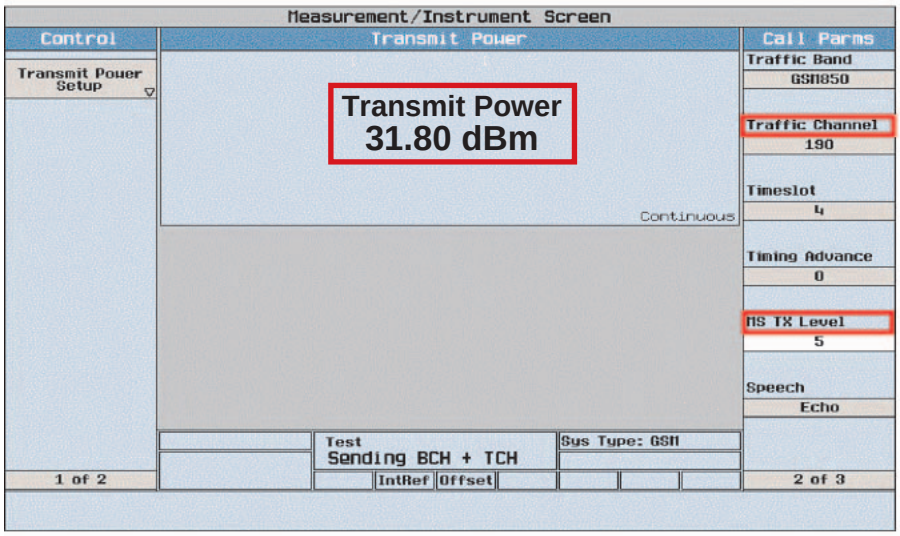



Step 13: You can click each number button to each level to transmit power, and you must reference right table to each level of power. If parameter is good, press “Next” to continue.
Our Operation Level 5 and Level 6 to examples(HP8960)
In Level 5, I must adjust to decrease, it's strong.
In Level 6, I must adjust to increase, it's young.

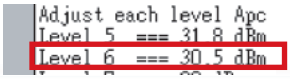

Lv 5 Match

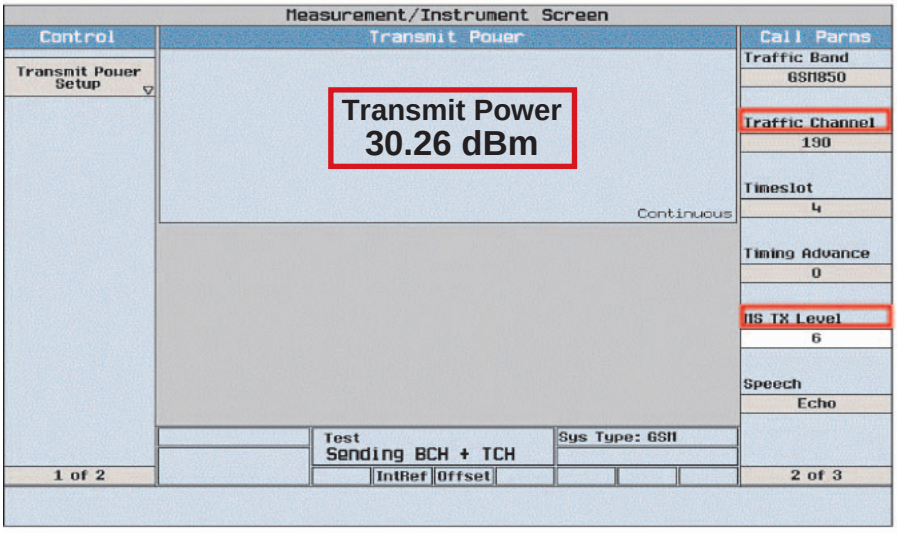




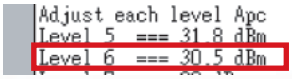
Lv 6 Not Match

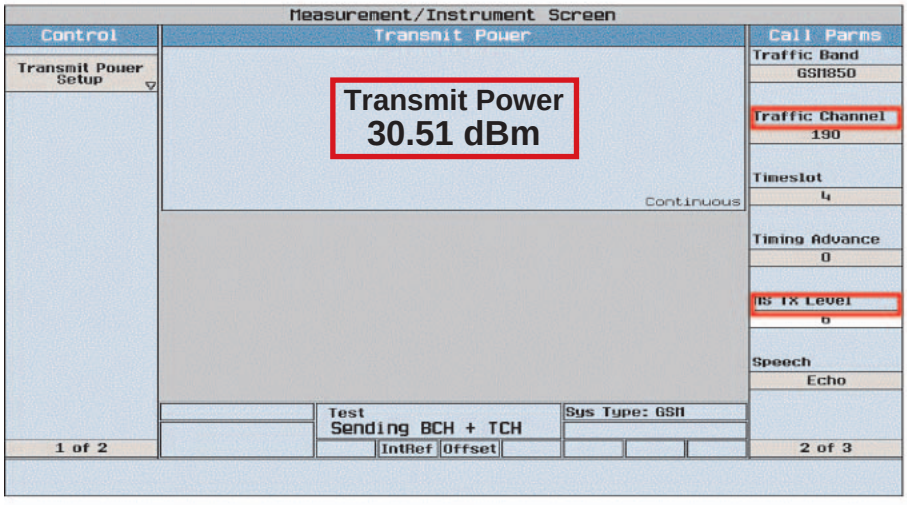


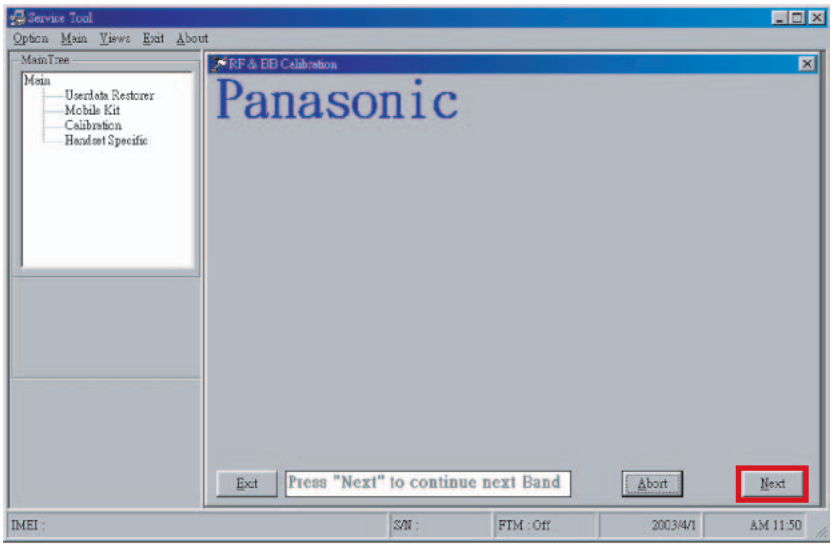


Lv 6 Match

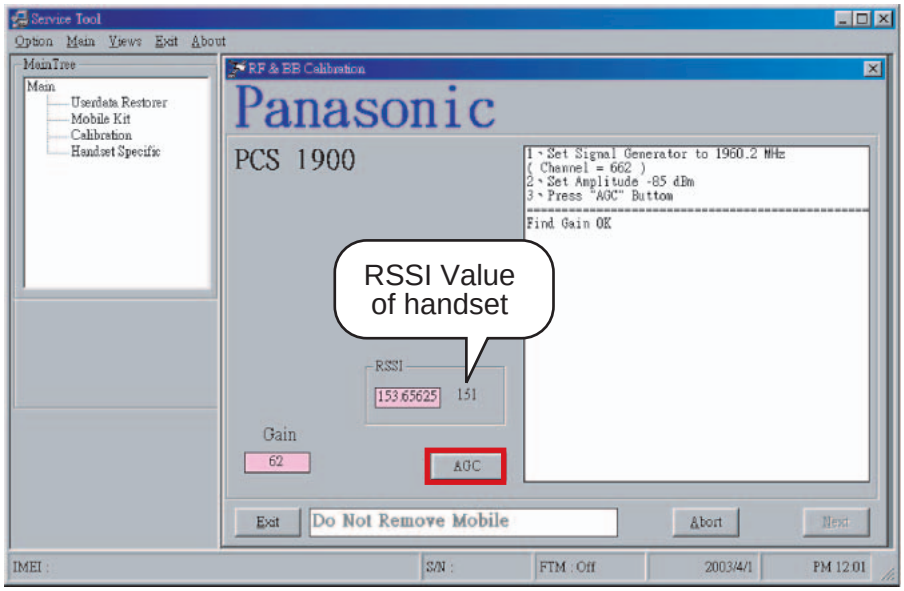


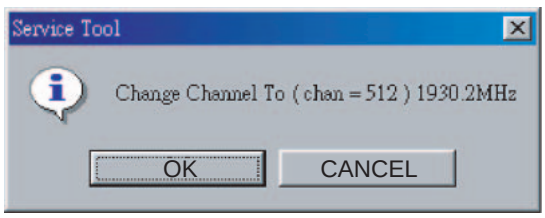
Step 14: Write data (GSM850) to the handset and press “Next” to continue.



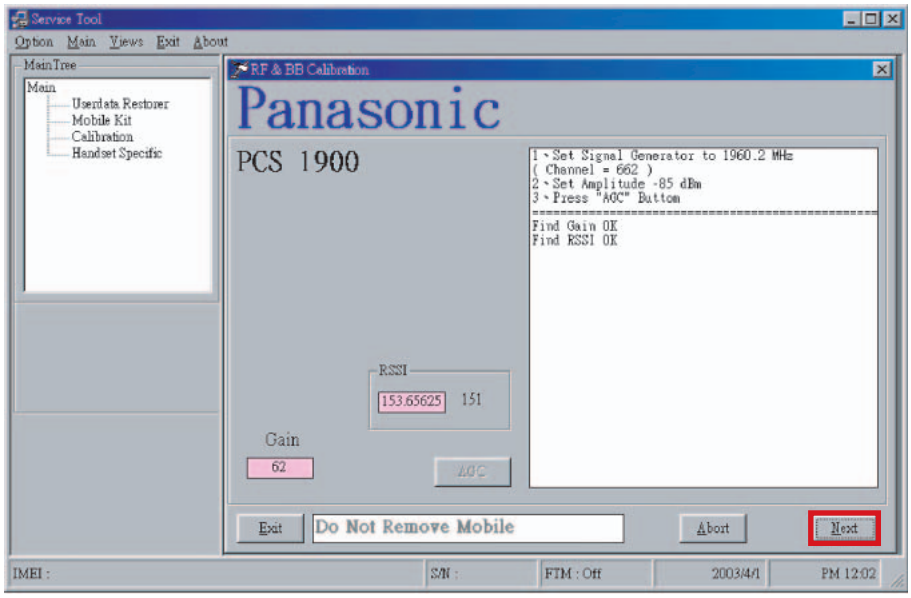

Step 15: After configure parameter of instrument, Click “AGC”, Find gain value and RSSI of full channel.



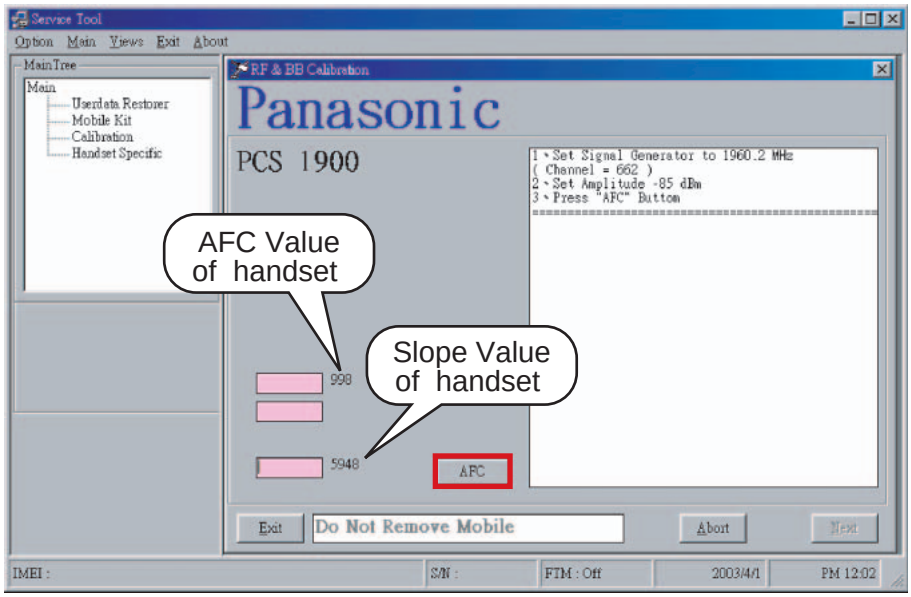

Step 16: After find gain value, change channel to RSSI value, press “OK” to next channel.
(In this case, channel 512 - 810 step 12 ).



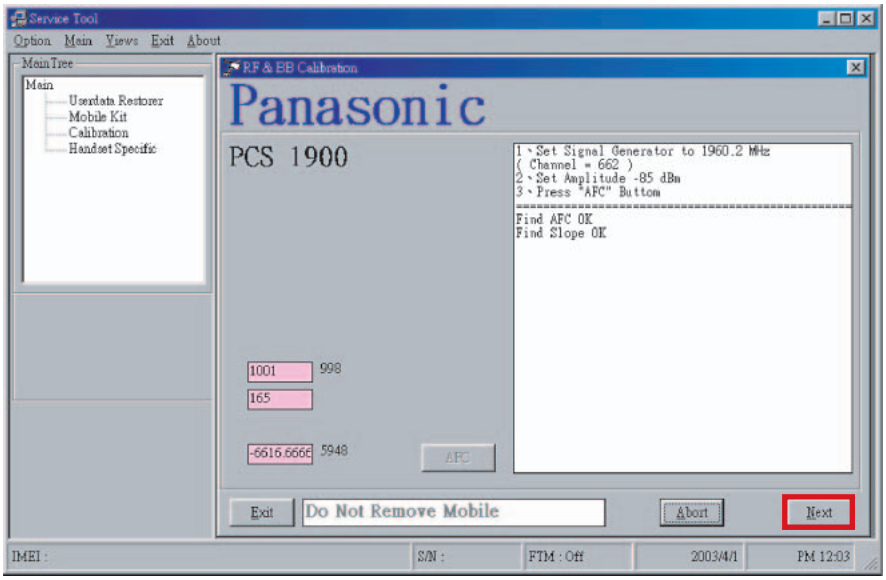
Step 17: AGC calibration is complete, press “Next” to continue.



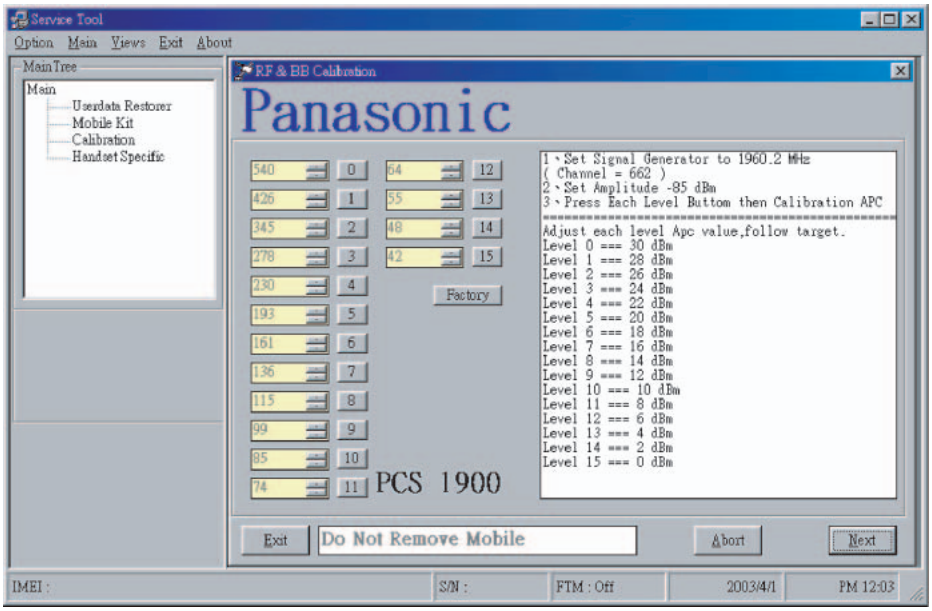

Step 18: After configure parameter of instrument, Click “AFC” and doing AFC calibration.



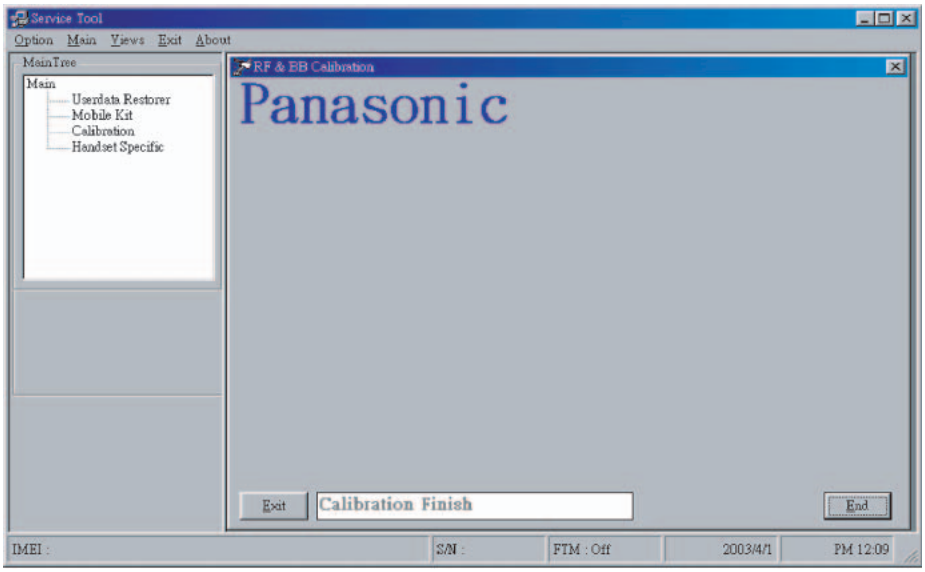

Step 19: AFC calibration is complete, press “Next” to continue.



Step 20: You can click each number button to each level to transmit power, and you must reference right table to each level of power. If parameter is good, press “Next” to continue.




Step 21: Write data (PCS1900) to the handset and press “End” to finish in this procedure.

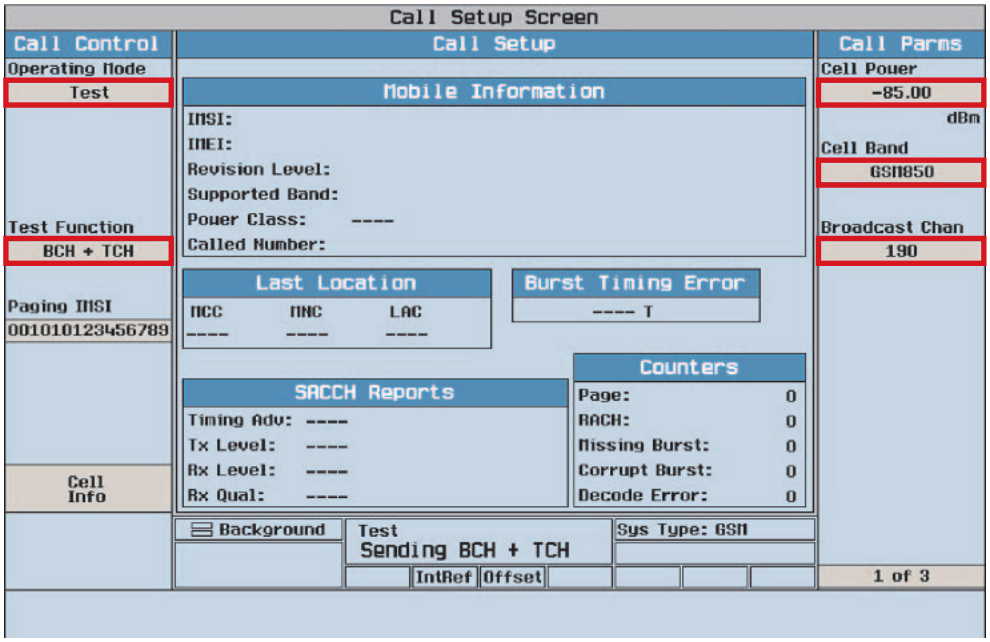


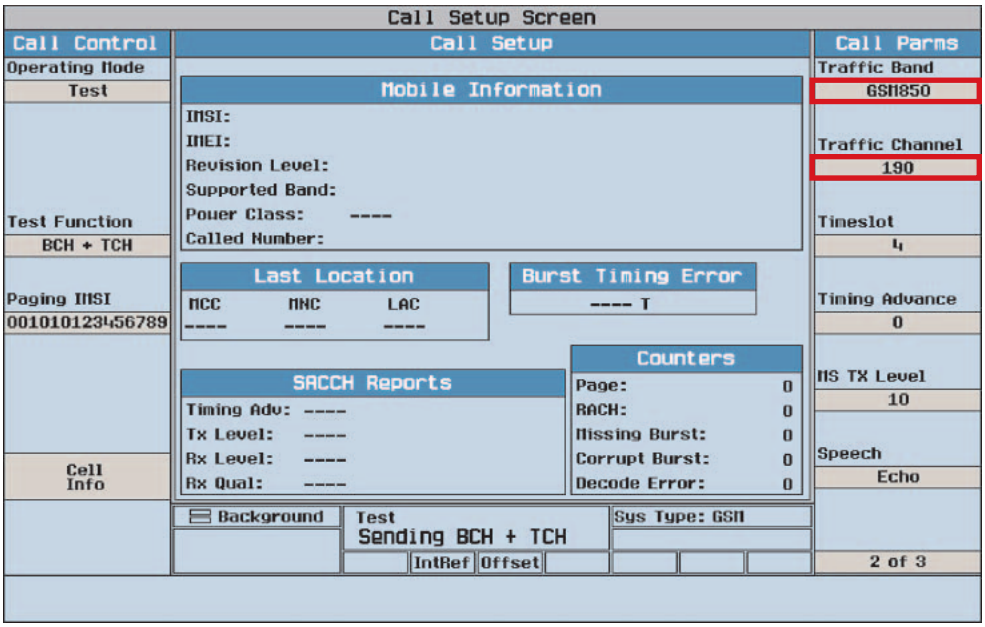
Annex notes 1

| Test Set | AGC | AFC | APC |
|---|---|---|---|
| HP8960 | 1. Test mode (Bch+Tch)<br>2. Cell power –85 dBm<br>3. Cell band<br>4. Broadcast channel<br>5. Cable lose | 1. Test mode (Bch+Tch)<br>2. Cell power –85 dBm<br>3. Cell band<br>4. Broadcast channel<br>5. Cable lose | 1. Test mode (Bch+Tch)<br>2. Cell power –85 dBm<br>3. Cell band<br>4. Broadcast channel<br>5. Cable lose<br>6. MS Tx level |
| CMU200 | 1. Analyzer/Generator<br>2. RF level used –85 dBm<br>Unsed –20 dBm<br>3. RF channel<br>4. Transmission :<br>Continuous<br>5. Cable lose | 1. Analyzer/Generator<br>2. RF level used –85 dBm<br>Unsed –20 dBm<br>3. RF channel<br>4. Transmission :<br>Continuous<br>5. Cable lose | 1. Analyzer/Generator<br>2. RF level used –85 dBm<br>Unsed –20 dBm<br>3. RF channel<br>4. Transmission : Burst<br>5. Cable lose<br>6. Training Sequence : Off |
| CMD55 | 1. Module Test<br>2. RF GEN.<br>3. Freq/RF Chan<br>4. RF level –85 dBm<br>5. Ramp Off<br>6. Cable lose | 1. Module Test<br>2. Control channel.<br>3. RF level –85 dBm<br>4. Cable lose | 1. Module Test<br>2. Trigger Mode : Power<br>3. Peak power : wide<br>4. RF level –85 dBm<br>5. Freq/RF Chan<br>6. Cable lose |

Annex notes2-1: (CMU200)
1.Change to GSM850 Analyzer/Generator (Non-Signaling mode).
2.Change RF level Used TS –85 dBm and RF level Unused TS –20 dBm in Generator. And turn on Generator.
3.Change channel to ch190 in Generator.(GSM900: ch62, GSM1800: ch699, GSM1900: ch662)
4.Change channel to ch190 in Analyzer.(GSM900: ch62, GSM1800: ch699, GSM1900: ch662)
5.Change Transmission mode to “Continuous”.
6.Change cable lose of AF/RF.

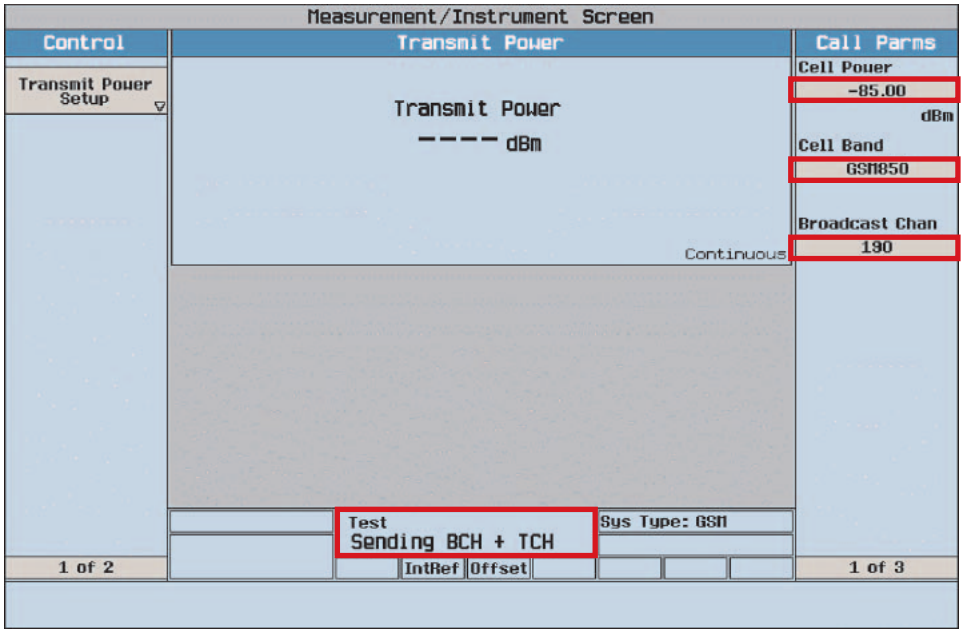
Annex notes 2-2: (AGC, AFC) Please Configure as follows (HP8960)

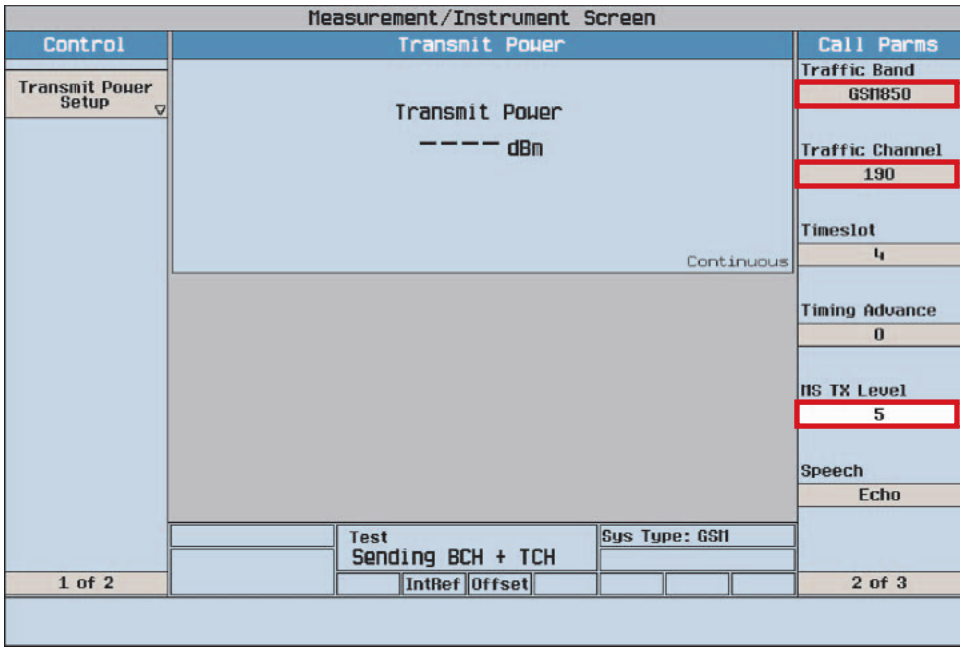




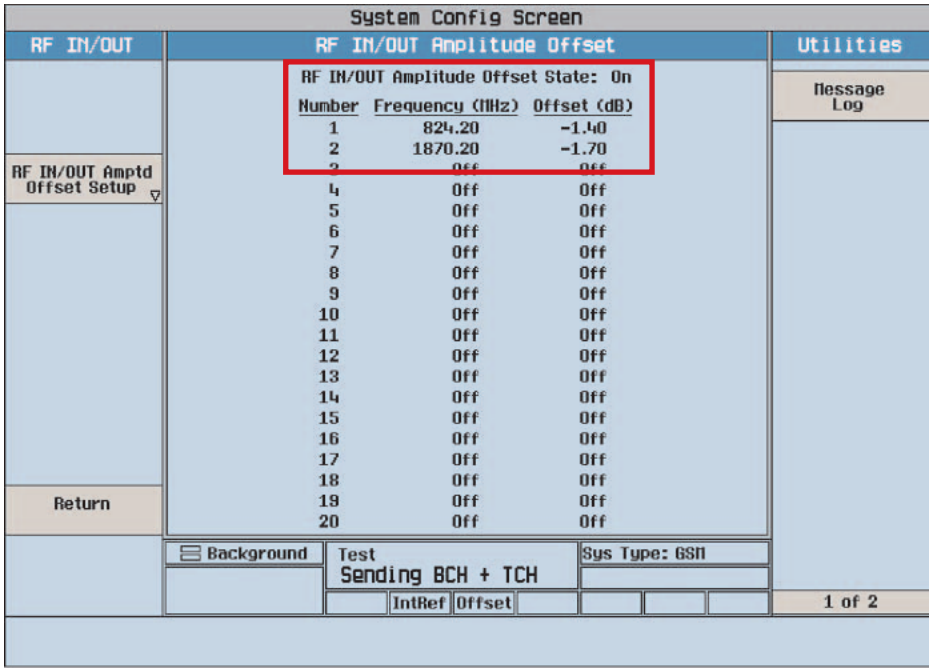

Annex notes3-1: (APC) Please Configure as follows (CMU200).
1.Change to GSM850 Analyzer/Generator (Non-Signaling mode).
2.Change RF level Used TS –85dBm and RF level Unused TS –20dBm in Generator. And turn “ON” Generator.
3.Change channel to ch190 in Generator. (GSM900: ch62, GSM1800: ch699, GSM1900: ch662)
4.Change channel to ch190 in Analyzer. (GSM900: ch62, GSM1800: ch699, GSM1900: ch662)
5.Change Transmission mode to “Continuous”.
6.Change Training Sequence to “OFF” in Analyzer.
7.Change cable lose of AF/RF.

Annex notes3-2: (APC) Please Configure as follows (HP8960)



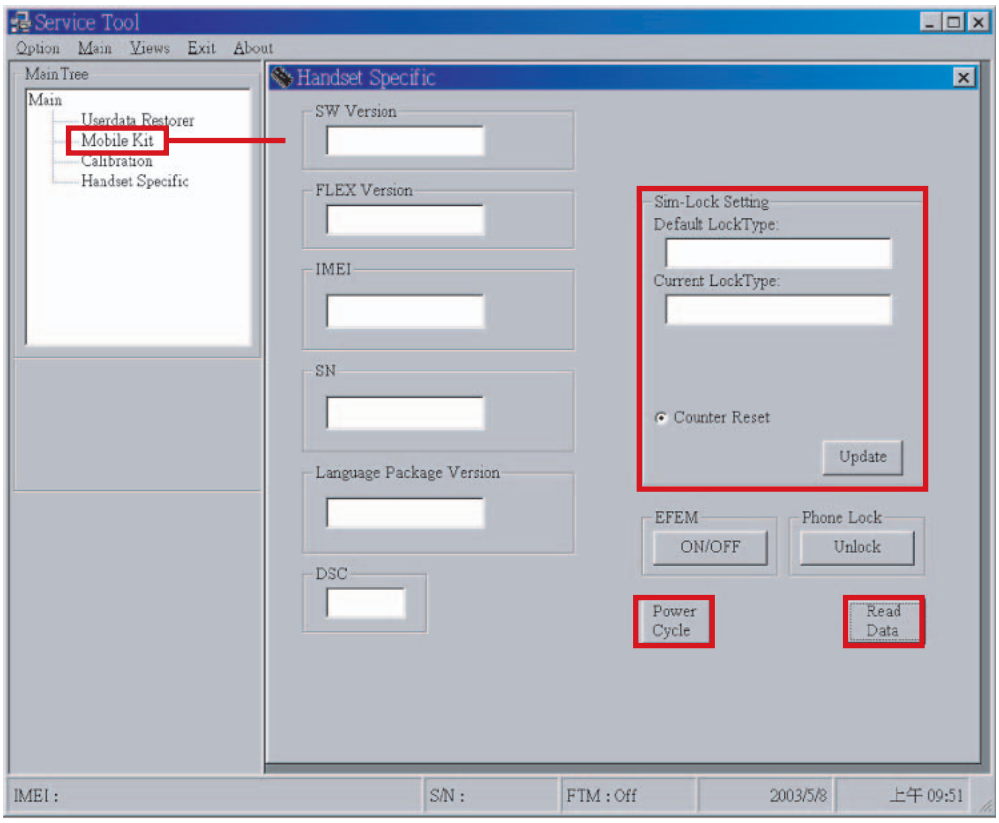



Modify Cable lose



## 8.3.4. Handset Specific Data

To Read and Update handset specific data, first of all, make sure your handset is correctly connected with your pc and switch on your handset




● To read data from handset: Click button “Read Data”

● Sim-Lock Setting:

- ■ Default Lock Type: This field will show the default Lock type of the sub-sidy lock. (Read only)
- ■ Current Lock Type: This field will show the current Lock type of the sub-sidy lock. (Read only)
- ■ 1 option for SIM-lock update:
  Counter Reset: This is to reset the SIM Lock retry counter to the subsidy lock default setting.
  To do this just click the radio button “Counter Reset” and then click the “Update” button in “Sim-Lock Setting” area.

● EFEM: You can toggle the on/off of EFEM by click the “ON/OFF” button

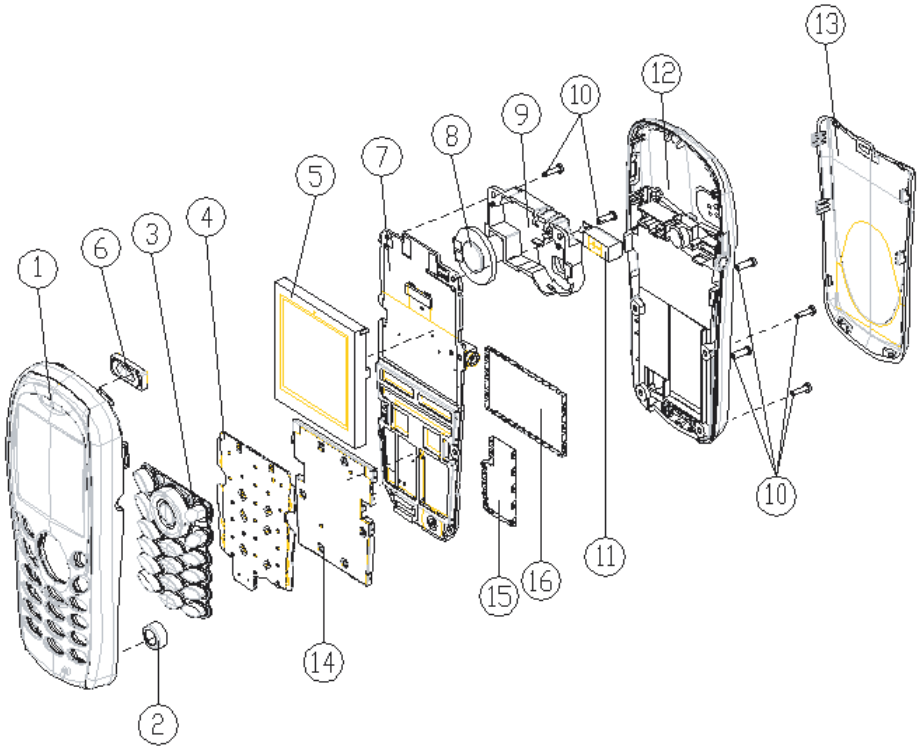
● Phone Lock: If the phone is locked by the user, click “Unlock” will unlock the phone and the password will reset to default “0000”.

● Press “Power Cycle” to exit the Factory Test Mode and handset will restart.

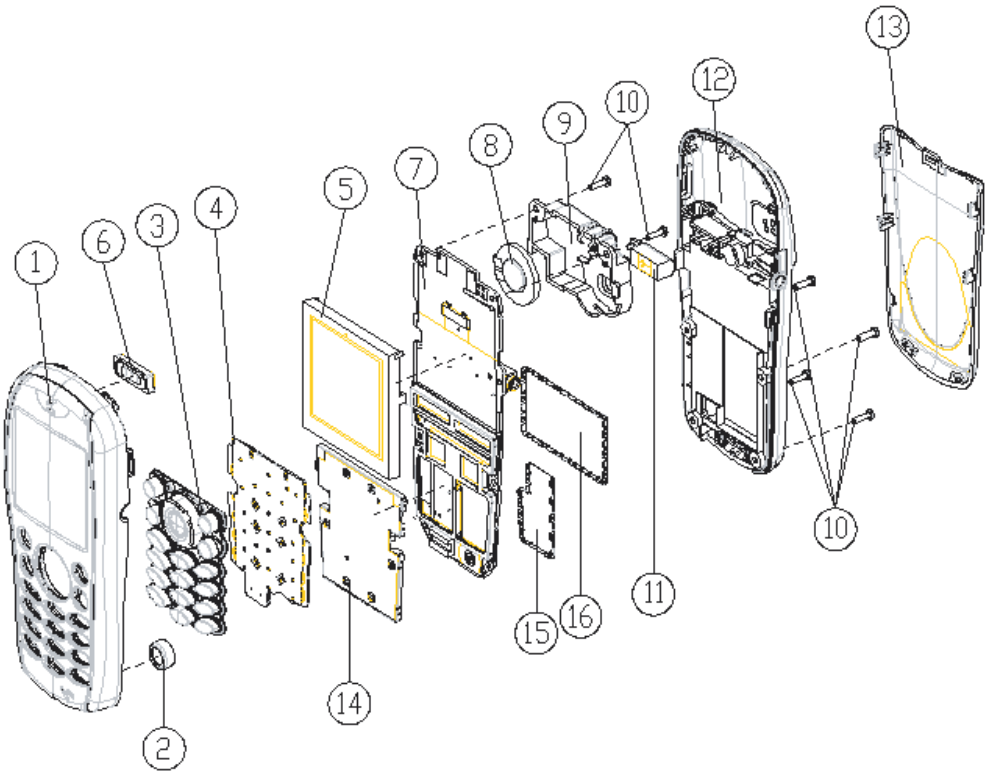
● DSC: If the handset has DSC flex, it will display “Flex ON”. Otherwise it will display “Flex OFF”.

# 9. REPLACEMENT PARTS LIST

## 9.1. Case and Cover Parts




| REF NO. | PART NO. | PART NAME & SPECIFICATION |
|---|---|---|
| 1 | 7806330R01W | UPPER CASE ASS'Y & LENS (SILVER) |
| 2 | 2222211102W | MIC UNIT |
| 3 | 3104PV1305W | DIAL-KEY SILVER WHITE 18K EU |
| 4 | 7806310R01W | MMI+METAL DOME |
| 5 | 7630025001W | LCD MODULE ASS'Y |
| 6 | 2240501003W | RECEIVER |
| 7 | 7806320R01W | PCB ASSY 900/1800 |
| | 7806320R02W | PCB ASSY 850/1900 |
| 8 | 2240117001W | SPEAKER |
| 9 | 23A1PV1002W | ANTENNA ASS'Y 900/1800 |
| | 23A1PV1004W | ANTENNA ASS'Y 850/1900 |
| 10 | 3501655202W | SCREW |
| 11 | 3930411501W | VIBRATOR |
| 12 | 2512PV1002W | LOWER CASE ASS'Y SILVER |
| 13 | 252APV1001W | BATTERY COVER SILVER |
| 14 | 3052PV1001W | SHIELD COVER |
| 15 | 3052PV1003W | SHIELD COVER |
| 16 | 3052PV1003W | SHIELD COVER |




| REF NO. | PART NO. | PART NAME & SPECIFICATION |
|---|---|---|
| 1 | 7806330R02W | UPPER CASE ASS'Y & LENS (CHROME METAL) |
| 2 | 2222211102W | MIC UNIT |
| 3 | 3104PV1306W | DIAL-KEY LIGHT SILVER E SIN |
| | 3104PV1303W | DIAL-KEY LIGHT SILVER MC HKG |
| | 3104PV1304W | DIAL-KEY LIGHT SILVER C TWN |
| | 3104PV1308W | DIAL-KEY LIGHT SILVER TA THAI |
| 4 | 7806310R01W | MMI+METAL DOME |
| 5 | 7630025001W | LCD MODULE ASS'Y |
| 6 | 2240501003W | RECEIVER |
| 7 | 7806320R01W | PCB ASS'Y 900/1800 |
| | 7806320R02W | PCB ASS'Y 850/1900 |
| 8 | 2240117001W | SPEAKER |
| 9 | 23A1PV1002W | ANTENNA ASS'Y 900/1800 |
| | 23A1PV1004W | ANTENNA ASS'Y 850/1900 |
| 10 | 3501655202W | SCREW |
| 11 | 3930411501W | VIBRATOR |
| 12 | 2512PV1002W | LOWER CASE ASS'Y |
| 13 | 252APV1001W | BATTERY COVER |
| 14 | 3052PV1001W | SHIELD COVER |
| 15 | 3052PV1003W | SHIELD COVER |
| 16 | 3052PV1003W | SHIELD COVER |

# 9.2. Main PCB Assembly

| Cct Ref | Part No. | Part Name & Description | | Grid |
|---|---|---|---|---|
| 1 | 2211360001W | BATTERY BUTTON CELL | | |
| BQ1 | 1805585012W | TRANSISTOR 2SC5585 EMT3 | | |
| BT1 | 2316006021W | HOLDER FOR BACKUP BATTERY | | |
| C1 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C2 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C3 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C4 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C5 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C7 | 1310026111W | CERAMIC CAPACITOR | 10pF 50V | |
| C8 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C9 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C10 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C11 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C12 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C13 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C14 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C15 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C16 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C17 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C18 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C19 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C21 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C22 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C23 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C24 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C25 | 1347156311W | CERAMIC CAPACITOR | 470pF 50V | |
| C26 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C27 | 1310562821W | CERAMIC CAPACITOR | 1uF 10V | |
| C28 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C29 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C30 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C31 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| C32 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C33 | 1322452321W | CERAMIC CAPACITOR | 220nF 10V | |
| C34 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C35 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C36 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C37 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C38 | 1310353311W | CERAMIC CAPACITOR | 10nF 16V | |
| C39 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C40 | 1310562821W | CERAMIC CAPACITOR | 1uF 10V | |
| C41 | 1310562821W | CERAMIC CAPACITOR | 1uF 10V | |
| C42 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C43 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C44 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C45 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C46 | 1310562821W | CERAMIC CAPACITOR | 1uF 10V | |
| C47 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C48 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C49 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C50 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C51 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C52 | 1312046111W | CERAMIC CAPACITOR | 12pF 50V | |
| C53 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C54 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C55 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C56 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C57 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C59 | 1333373411W | CERAMIC CAPACITOR | 33nF 16V | |
| C60 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |

| Cct Ref | Part No. | Part Name & Description | | Grid |
|---|---|---|---|---|
| C61 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C62 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C63 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C67 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C69 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C70 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C71 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C72 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C74 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C75 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C76 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C77 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C78 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C79 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C80 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C81 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C82 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C83 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C84 | 1315146111W | CERAMIC CAPACITOR | 150pF 50V | |
| C85 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C86 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C87 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C88 | 1310473411W | CERAMIC CAPACITOR | 100pF 50V | |
| C89 | 1333373411W | CERAMIC CAPACITOR | 33nF 16V | |
| C90 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C91 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C92 | 1347156311W | CERAMIC CAPACITOR | 470pF 50V | |
| C93 | 1310562821W | CERAMIC CAPACITOR | 1uF 10V | |
| C94 | 1310562821W | CERAMIC CAPACITOR | 1uF 10V | |
| C95 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C97 | 1347562831W | CERAMIC CAPACITOR | 4.7uF 10V | |
| C98 | 1347562831W | CERAMIC CAPACITOR | 4.7uF 10V | |
| C99 | 1347562831W | CERAMIC CAPACITOR | 4.7uF 10V | |
| C100 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C101 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C102 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C103 | 1347471411W | CERAMIC CAPACITOR | 470nF 6.3V | |
| C104 | 1347471411W | CERAMIC CAPACITOR | 470nF 6.3V | |
| C105 | 1310562821W | CERAMIC CAPACITOR | 1uF 10V | |
| C106 | 1368156311W | CERAMIC CAPACITOR | 680pF 50V | |
| C108 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C110 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C111 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C112 | 1310651231W | CERAMIC CAPACITOR | 10uF 10V | |
| C113 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C115 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C116 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C117 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C118 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C119 | 132R716111W | CERAMIC CAPACITOR | 2.7pF 50V | |
| C120 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C121 | 0733014111W | FIXED RESISTOR | 33 1/16W | |
| C122 | 1368156311W | CERAMIC CAPACITOR | 680pF 50V | |
| C123 | 1322146111W | CERAMIC CAPACITOR | 220pF 50V | |
| C124 | 1339046111W | CERAMIC CAPACITOR | 39pF 50V | |
| C125 | 1339046111W | CERAMIC CAPACITOR | 39pF 50V | |
| C126 | 1282211112W | FILM CAPACITOR | 8.2nF 16V | |
| C127 | 1239211112W | FILM CAPACITOR | 3.9nF 16V | |
| C129 | 1310256311W | CERAMIC CAPACITOR | 1nF 50V | |

| Cct Ref | Part No. | Part Name & Description | | Grid |
|---|---|---|---|---|
| C130 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C132 | 111002N112W | INDUCTOR | 10nH | |
| C135 | 134R716111W | CERAMIC CAPACITOR | 4.7pF 50V | |
| C136 | 1310256311W | CERAMIC CAPACITOR | 1nF 50V | |
| C137 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C138 | 1318046111W | CERAMIC CAPACITOR | 18pF 50V | |
| C140 | 1310026111W | CERAMIC CAPACITOR | 10pF 50V | |
| C143 | 132R716111W | CERAMIC CAPACITOR | 2.7pF 50V | |
| C144 | 134R716111W | CERAMIC CAPACITOR | 4.7pF 50V | |
| C145 | 1347156311W | CERAMIC CAPACITOR | 470pF 50V | |
| C146 | 1347156311W | CERAMIC CAPACITOR | 470pF 50V | |
| C147 | 1310353311W | CERAMIC CAPACITOR | 10nF 16V | |
| C148 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C149 | 1333256311W | CERAMIC CAPACITOR | 3.3nF 50V | |
| C150 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C151 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| C152 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C154 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C155 | 1310146111W | CERAMIC CAPACITOR | 100pF 50V | |
| C157 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C158 | 1310026111W | CERAMIC CAPACITOR | 10pF 50V | |
| C159 | 1310256311W | CERAMIC CAPACITOR | 1nF 50V | |
| C160 | 1310256311W | CERAMIC CAPACITOR | 1nF 50V | |
| C161 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C161 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C162 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C163 | 130R516111W | CERAMIC CAPACITOR | 0.5pF 50V | |
| C165 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C169 | 131R016111W | CERAMIC CAPACITOR | 1pF 50V | |
| C175 | 1318046111W | CERAMIC CAPACITOR | 18pF 50V | |
| C179 | 1410721221W | TANTALUM CAPACITOR | 100uF 6.3V | |
| C182 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C183 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C189 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C196 | 1310353311W | CERAMIC CAPACITOR | 10nF 16V | |
| C197 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C198 | 1318046111W | CERAMIC CAPACITOR | 18pF 50V | |
| C200 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C201 | 131R016111W | CERAMIC CAPACITOR | 1pF 50V | |
| C202 | 132R716111W | CERAMIC CAPACITOR | 2.7pF 50V | |
| C203 | 134R716111W | CERAMIC CAPACITOR | 4.7pF 50V | |
| C204 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C205 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C206 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C207 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C208 | 1322046111W | CERAMIC CAPACITOR | 22pF 50 | |
| C209 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C210 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C211 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C212 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C215 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C216 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C217 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C218 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C220 | 1310473411W | CERAMIC CAPACITOR | 100nF 16V | |
| C221 | 1333046111W | CERAMIC CAPACITOR | 33pF 50V | |
| C222 | 1333046111W | CERAMIC CAPACITOR 33pF 50V | | |
| C223 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C224 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C225 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |

| Cct Ref | Part No. | Part Name & Description | | Grid |
|---|---|---|---|---|
| C226 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| C240 | 1322046111W | CERAMIC CAPACITOR | 22pF 50V | |
| CON1 | 2304005041W | CONNECTOR SIM 6 PIN | | |
| D1 | 1720016001W | SCHK DIODE RB160M-30 PMDU ROHM | | |
| D4 | 1700520023W | S/DIODE RB520S-30 SC79 | | |
| D5 | 1700400013W | DIODE 1SS400 SC-79 | | |
| EF1 | 2090005001W | ESD EMIF01-10005W5 SOT323-5L | | |
| EF2 | 2090005001W | ESD EMIF01-10005W5 SOT323-5L | | |
| F101 | 2020942015W | FILTER B4230 E-GSM/DCS EPCOS | | |
| H52 | 2306019201W | CONNECTOR FPC | | |
| J1 | 2305033831W | CONNECTOR I/O 14 PIN | | |
| J2 | 2308000164W | CONNECTOR BTB | | |
| J3 | 2303350331W | CONNECTOR BATTERY | | |
| J4 | 2311003051W | AUDIOJACK D=2.6-H=3.2 | | |
| JP1 | 2302001561W | RF SWITCH MS-156 HRS 4PIN | | |
| L1 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| L2 | 111012N111W | INDUCTOR | 100nH | |
| L3 | 086R801521W | CF FIXED RESISTOR | 6.8O 1/10W | |
| L4 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| L5 | 1100601011W | BEAD HZ0603C601R-00 | | |
| L6 | 116802N121W | INDUCTOR | 68nH | |
| L7 | 116802N121W | INDUCTOR | 68nH | |
| L8 | 116802N111W | INDUCTOR | 68nH | |
| L9 | 116802N121W | INDUCTOR | 68nH | |
| L101 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| L104 | 113R31N111W | INDUCTOR | 3.3nH | |
| L106 | 118202N111W | INDUCTOR | 82nH | |
| L107 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| L108 | 113R31N111W | INDUCTOR | 3.3nH | |
| L109 | 114R71N111W | INDUCTOR | 4.7nH | |
| L110 | 118R22N111W | INDUCTOR | 8.2nH | |
| L111 | 111502N111W | INDUCTOR | 15nH | |
| L114 | 112R71N111W | INDUCTOR | 2.7nH | |
| L115 | 111012N111W | INDUCTOR | 100nH | |
| L116 | 111812N121W | INDUCTOR | 180nH | |
| L120 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| L166 | 111812N121W | INDUCTOR | 180nH | |
| LS1 | 2332000601W | CONNECTOR SPEAKER | | |
| Q3 | 1810201801W | TRANSISTOR 2SA2018 EMT3 | | |
| Q4 | 1810461701W | TRANSISTOR 2SC4617 EMT3 | | |
| R1 | 0710314111W | FIXED RESISTOR | 10K 1/16W | |
| R2 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R3 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R4 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R5 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R6 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R7 | 0722414111W | FIXED RESISTOR | 220K 1/16W | |
| R8 | 0751214111W | SPECIAL FIXED RESISTOR | 5.1K 1/16W | |
| R9 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R10 | 0739012141W | CF FIXED RESISTOR | 47O 1/4W | |
| R11 | 0722414111W | FIXED RESISTOR | 220K 1/16W | |
| R12 | 0722414111W | FIXED RESISTOR | 220K 1/16W | |
| R13 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R15 | 0722214111W | FIXED RESISTOR | 2.2K 1/16W | |
| R18 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R23 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R24 | 0722414111W | FIXED RESISTOR | 220K 1/16W | |
| R25 | 0768314111W | FIXED RESISTOR | 68K 1/16W | |
| R26 | 0720314111W | FIXED RESISTOR | 20K 1/16W | |
| R27 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |

| Cct Ref | Part No. | Part Name & Description | | Grid |
|---|---|---|---|---|
| R28 | 0733214111W | FIXED RESISTOR | 3.3K 1/16W | |
| R29 | 0722414111W | FIXED RESISTOR | 220K 1/16W | |
| R31 | 0722214111W | FIXED RESISTOR | 2.2K 1/16W | |
| R32 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R33 | 0756014111W | SPECIAL FIXED RESISTOR | 56 1/16W | |
| R34 | 0733214111W | FIXED RESISTOR | 3.3K 1/16W | |
| R35 | 0747314111W | FIXED RESISTOR | 47K 1/16W | |
| R36 | 0710314111W | FIXED RESISTOR | 10K 1/16W | |
| R37 | 0710114111W | FIXED RESISTOR | 100 1/16W | |
| R40 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R41 | 0710314111W | FIXED RESISTOR | 10K 1/16W | |
| R42 | 0710314111W | FIXED RESISTOR | 10K 1/16W | |
| R43 | 0710114111W | FIXED RESISTOR | 100 1/16W | |
| R44 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R45 | 08R1501131W | CF FIXED RESISTOR | 0.15O 1/4W | |
| R47 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R48 | 0810031311W | FIXED RESISTOR | 100K 1/16W | |
| R52 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R53 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R55 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R56 | 0720314111W | FIXED RESISTOR | 20K 1/16W | |
| R57 | 0733114111W | FIXED RESISTOR | 330O 1/16W | |
| R58 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R59 | 0733114111W | FIXED RESISTOR | 330O 1/16W | |
| R60 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R61 | 0739014111W | SPECIAL FIXED RESISTOR | 39O 1/16W | |
| R62 | 0739014111W | SPECIAL FIXED RESISTOR | 39O 1/16W | |
| R63 | 1020110821W | ROW RESISTOR | 200O 8P4R | |
| R64 | 1020110821W | ROW RESISTOR | 200O 8P4R | |
| R65 | 0715214111W | FIXED RESISTOR | 1.5K 1/16W | |
| R67 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R68 | 074R714111W | FIXED RESISTOR | 4.7O 1/16W | |
| R69 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R72 | 0720314111W | FIXED RESISTOR | 20K 1/16W | |
| R74 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R75 | 0710314111W | FIXED RESISTOR | 10K 1/16W | |
| R77 | 0722214111W | FIXED RESISTOR | 2.2K 1/16W | |
| R78 | 0710014111W | FIXED RESISTOR | 10O 1/16W | |
| R79 | 072R214111W | CF FIXED RESISTOR | 2.2O 1/16W | |
| R80 | 0710414111W | FIXED RESISTOR | 100K 1/16W | |
| R85 | 0722314111W | CF FIXED RESISTOR | 22K 1/16W | |
| R94 | 0739014111W | SPECIAL FIXED RESISTOR | 39O 1/16W | |
| R95 | 0739014111W | SPECIAL FIXED RESISTOR | 39O 1/16W | |
| R100 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R103 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| R106 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R109 | 0756214111W | FIXED RESISTOR | 5.6K 1/16W | |
| R110 | 0722114111W | SPECIAL FIXED RESISTOR | 220 1/16W | |
| R111 | 0720214111W | FIXED RESISTOR | 2K 1/16W | |
| R112 | 0751114111W | FIXED RESISTOR | 510O 1/16W | |
| R113 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R117 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R118 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R119 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R120 | 0720114111W | FIXED RESISTOR | 200O 1/16W | |
| R121 | 0720114111W | FIXED RESISTOR | 200O 1/16W | |
| R122 | 0710014111W | FIXED RESISTOR | 10O 1/16W | |
| R124 | 0824011311W | FIXED RESISTOR | 2.4K 1/16W | |
| R125 | 0718014111W | FIXED RESISTOR | 18 1/16W | |
| R126 | 0839021311W | CF FIXED RESISTOR | 39K 1/16W | |

| Cct Ref | Part No. | Part Name & Description | | Grid |
|---|---|---|---|---|
| R127 | 0824011311W | FIXED RESISTOR | 2.4K 1/16W | |
| R128 | 0733214111W | FIXED RESISTOR | 3.3K 1/16W | |
| R129 | 0710014111W | FIXED RESISTOR | 10O 1/16W | |
| R131 | 0710514111W | SPECIAL FIXED RESISTOR | 1M 1/16W | |
| R132 | 0733214111W | FIXED RESISTOR | 3.3K 1/16W | |
| R133 | 0733214111W | FIXED RESISTOR | 3.3K 1/16W | |
| R141 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R142 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R143 | 0733214111W | FIXED RESISTOR | 3.3K 1/16W | |
| R150 | 0751014111W | CF FIXED RESISTOR | 51O 1/16W | |
| R180 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R181 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R190 | 07R0014111W | FIXED RESISTOR | 0O 1/16W | |
| R200 | 1068230411W | ROW RESISTOR | 6.8K 4P2R | |
| R201 | 1068230411W | ROW RESISTOR | 6.8K 4P2R | |
| R202 | 0718114111W | FIXED RESISTOR | 180O 1/16W | |
| R204 | 0718114111W | FIXED RESISTOR | 180O 1/16W | |
| R206 | 0710214111W | FIXED RESISTOR | 1K 1/16W | |
| RR1 | 1010110411W | ROW RESISTOR | 100O 4PIN | |
| RR2 | 1010110411W | ROW RESISTOR | 100O 4PIN | |
| RR3 | 1010110411W | ROW RESISTOR | 100O 4PIN | |
| RR4 | 1010110411W | ROW RESISTOR | 100O 4PIN | |
| U1 | | | | |
| U2 | 1623276333W | CRYSTAL 32.768KHz 12.5pF 2 | | |
| U3 | | | | |
| U4 | 0440398501W | IC LowDropOut LP3985IM5X | | |
| U5 | | | | |
| U6 | 1830000202W | DUAL TRANSISTOR EMD2 EMT6 | | |
| U7 | 04D0315701W | IC SWITCH NC7SB3157 6PIN | | |
| U8 | | | | |
| U9 | 04D0315701W | IC SWITCH NC7SB3157 6PIN | | |
| U10 | 1820032601W | TRANSISTOR FDG326P MOSFET | | |
| U11 | 0450311001W | IC Inverter AAT3110GU | | |
| U100 | | | | |
| U102 | 0440080501W | IC LDO TAR8D05K | | |
| U103 | 0440080501W | IC LDO TAR8D05K | | |
| U104 | | | | |
| U106 | 1610018001W | TCXO KT18B 13.00MHz | | |
| U107 | 0470290501W | TRANSISTOR RN2905FE | | |
| U108 | 0300004051W | BUFFER TC7SZU04AFE | | |
| U110 | 0470290202W | TRANSISTOR RN2902FE | | |
| U111 | | | | |
| VR1 | 2012002931W | VARISTOR MLVS-0402-M07 20A 9V | | |
| VR2 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR3 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR4 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR5 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR6 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR7 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR8 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR9 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR10 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR11 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR12 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR13 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR14 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR15 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR16 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR17 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |
| VR18 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | | |

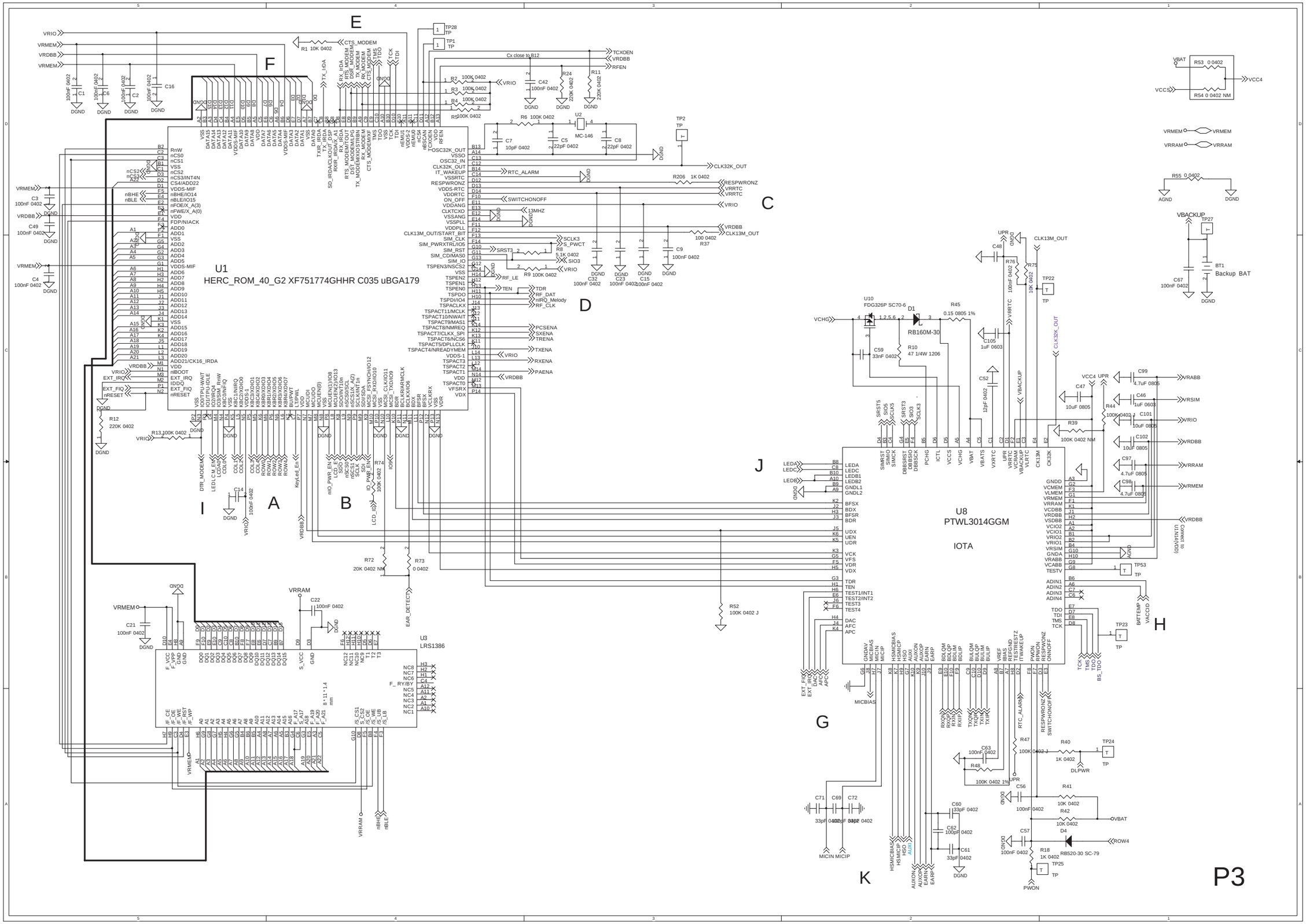
# 9.3. MMI PCB (Key PCB) Assembly

| Cct Ref | Part No. | Part Name & Description | Grid |
|---|---|---|---|
| VR19 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | |
| VR20 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | |
| VR21 | 2012002931W | VARISTOR MLVS-0402-M07 20A 9V | |
| VR22 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | |
| VR23 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | |

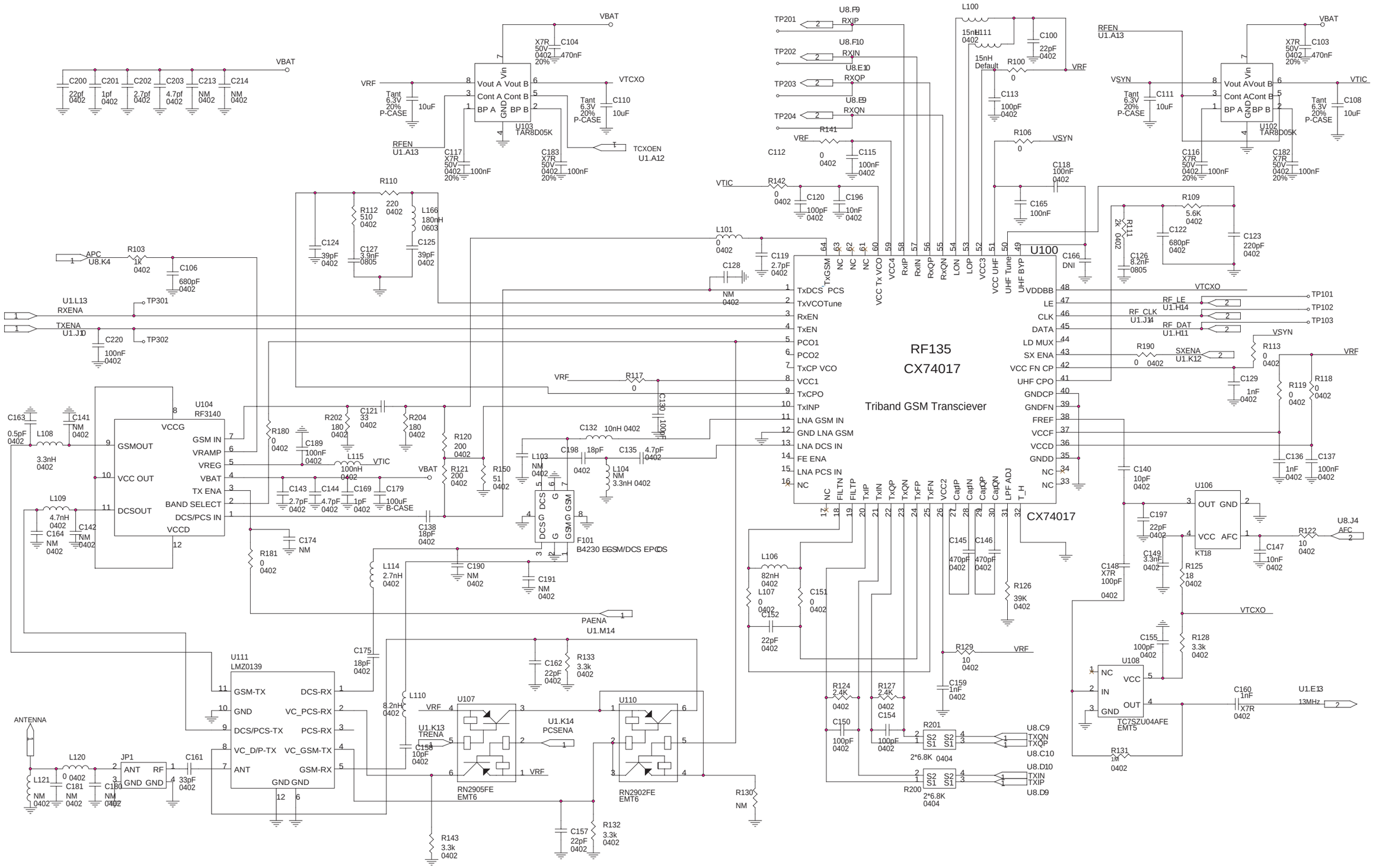
| Cct Ref | Part No. | Part Name & Description | Grid |
|---|---|---|---|
| C1 | 1333373411W | CERAMIC CAPACITOR 33nF 16V | |
| C2 | 1333373411W | CERAMIC CAPACITOR 33nF 16V | |
| C3 | 1333373411W | CERAMIC CAPACITOR 33nF 16V | |
| C4 | 1333373411W | CERAMIC CAPACITOR 33nF 16V | |
| C5 | 1333373411W | CERAMIC CAPACITOR 33nF 16V | |
| C6 | 1310473411W | CERAMIC CAPACITOR 100nF 16V | |
| D2 | 1770019201W | LED LTST-C192KGKT GREEN | |
| D3 | 1770019201W | LED LTST-C192KGKT GREEN | |
| D4 | 1770019201W | LED LTST-C192KGKT GREEN | |
| D5 | 1770019201W | LED LTST-C192KGKT GREEN | |
| D6 | 1770019201W | LED LTST-C192KGKT GREEN | |
| D7 | 1770019201W | LED LTST-C192KGKT GREEN | |
| D8 | 1770019201W | LED LTST-C192KGKT GREEN | |
| D9 | 1770019201W | LED LTST-C192KGKT GREEN | |
| J1 | 2308000162W | CONNECTOR BTB DF16(2.0)-14DP-0.5V(29) | |
| VR1 | 2012002331W | VARISTOR MLVS-0402-M04 20A 5.5V 0 | |

# 10. CIRCUIT DIAGRAM

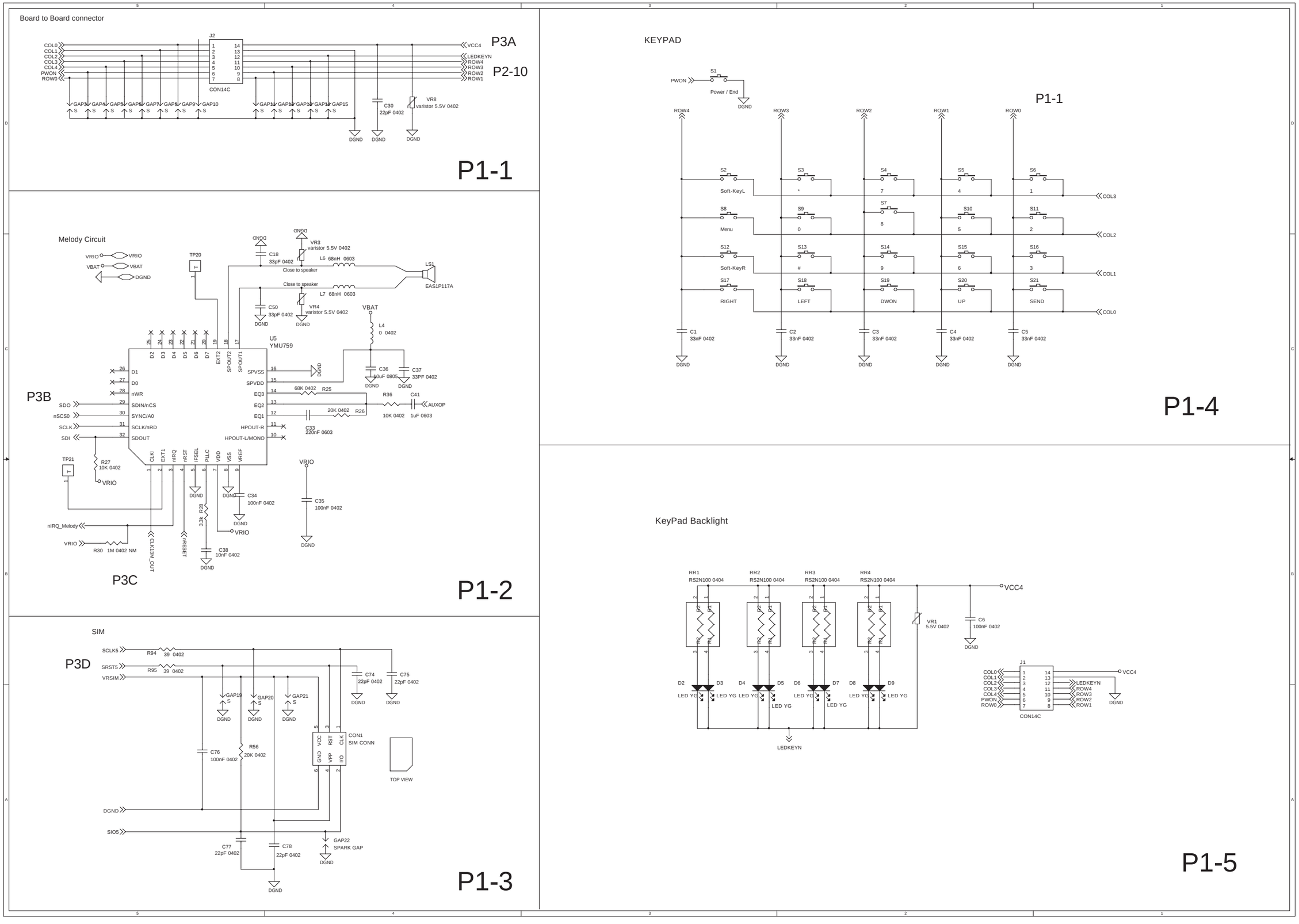
## 10.1. Circuit Diagram of Base Band



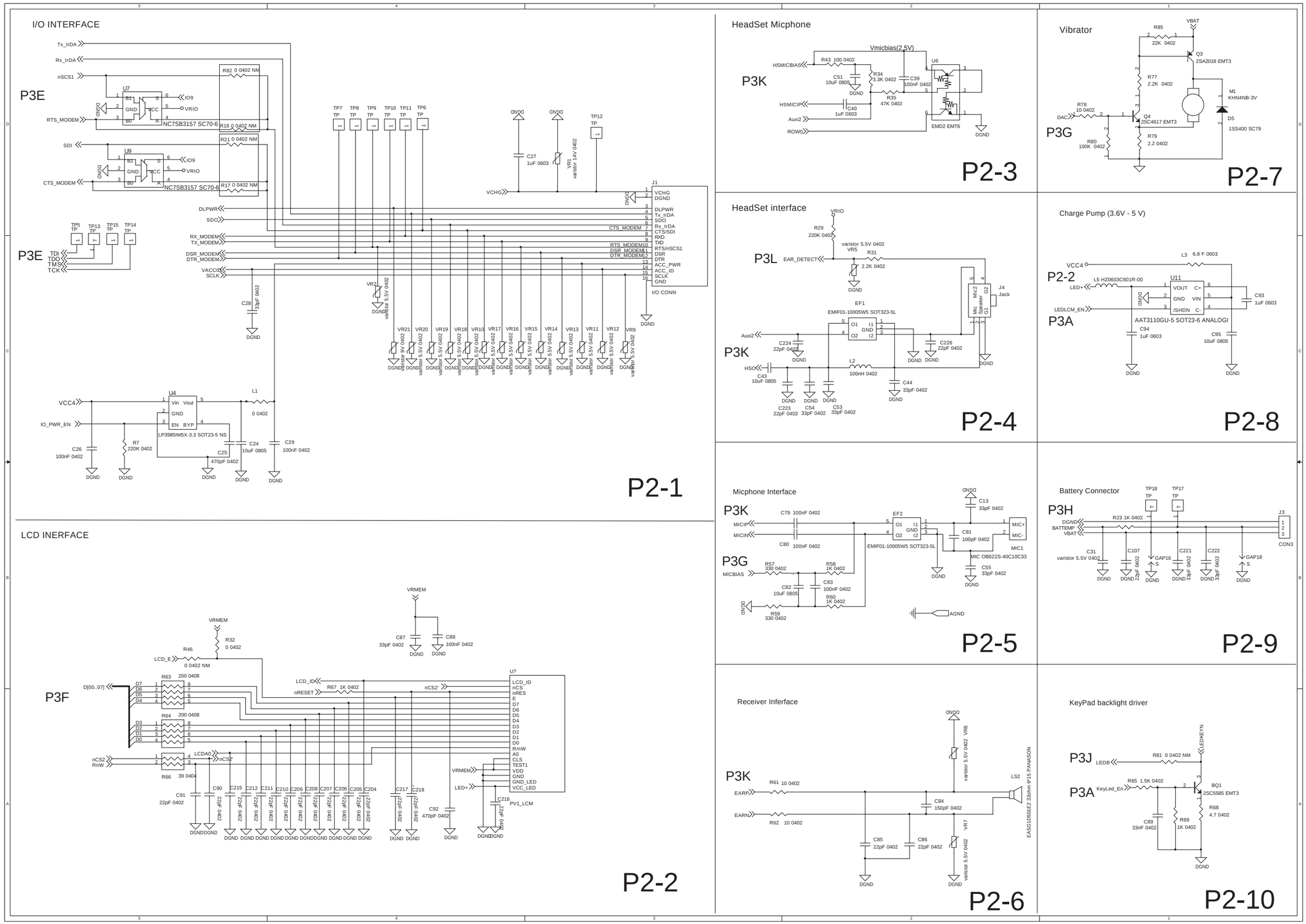
## 10.2. Circuit Diagram of RF Band



# 10.3. Circuit Diagram of Other 1

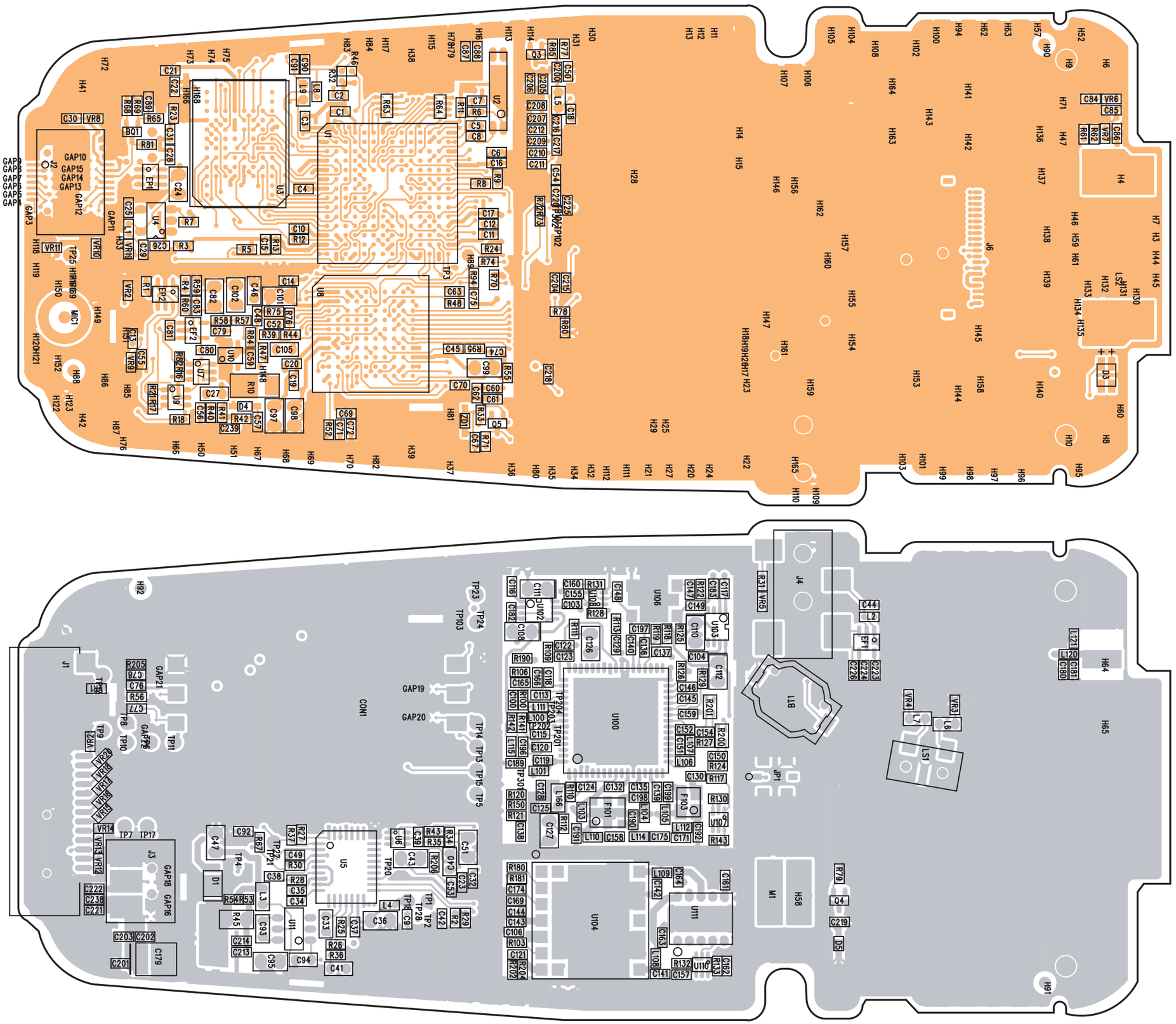


## 10.4. Circuit Diagram of Other 2

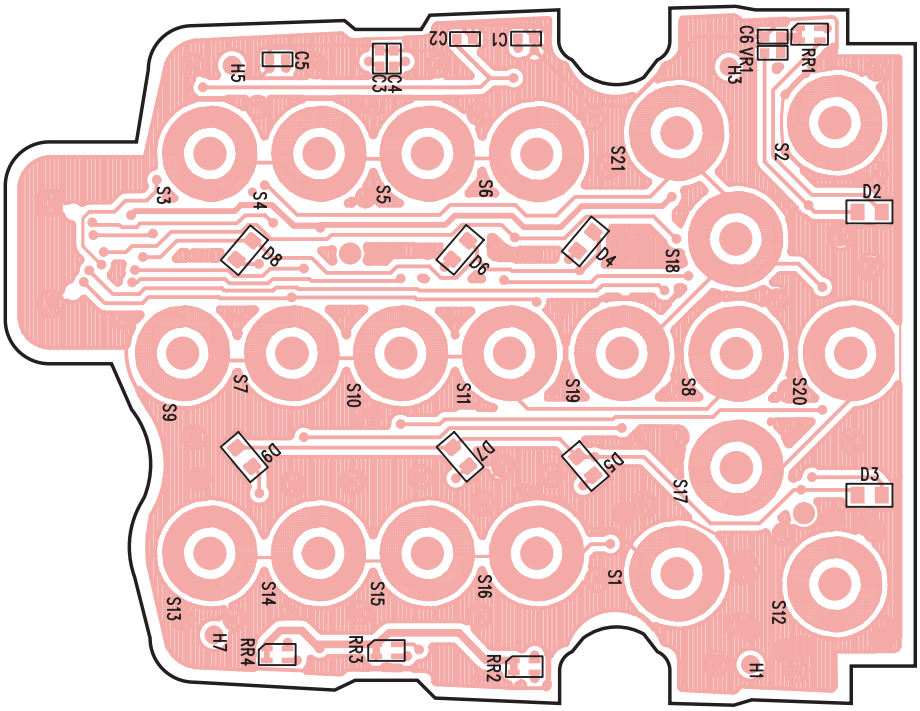


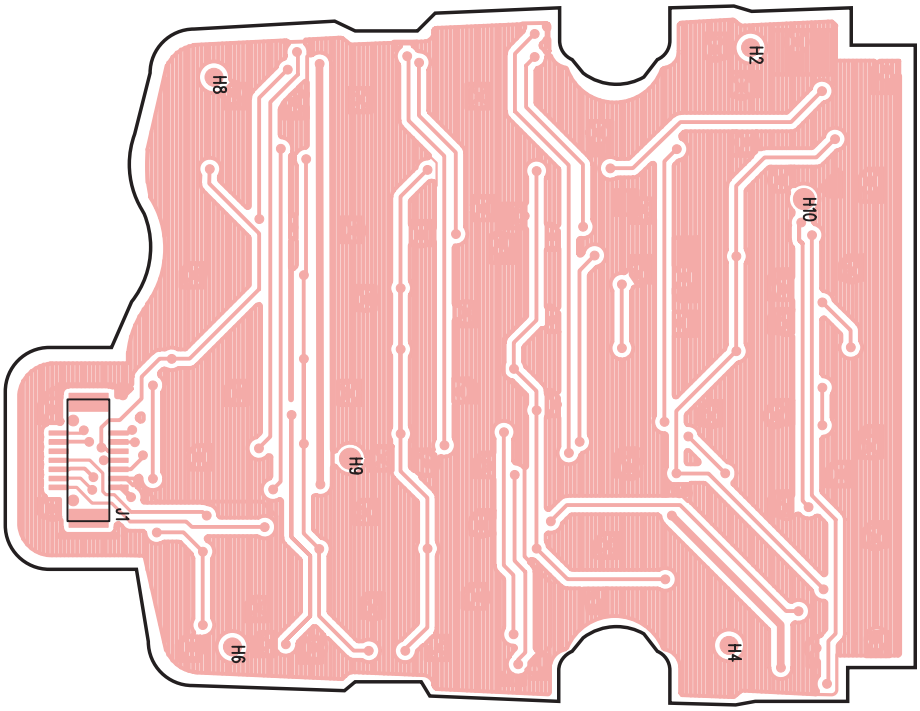
# 11. LAYOUT DIAGRAMS

## 11.1. Main PCB



## 11.2. Key PCB


C5
C4
C3
C2
C1
C6
VR1
RR1
H5
H3
S21
S2
S3
S4
S5
S6
D2
D8
D6
D4
S18
S7
S10
S11
S19
S8
S20
S9
D9
D7
D5
S17
D3
S13
S14
S15
S16
S1
S12
H7
RR4
RR3
RR2
H1


H8
H2
H10
H9
J1
H6
H4