Service Manual

Personal Cellular Telephone

EB-GD93

GSM

Specification

	900 MHz	1800 MHz
Frequency Range	Tx: 890 - 915MHz Rx: 935 - 960 MHz	Tx: 1710 - 1785 MHz Rx: 1805 - 1880 MHz
Tx/Rx frequency separation	45 MHz	95 MHz
RF Channel Bandwidth	200 kHz	
Number of RF channels	124	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	2 W maximum	1 W maximum
Modulation	GMSK (BT = 0.3)	
Connection	8 ch/TDMA	
Voice digitizing	13 kbps RPE-LTP / 13 kps ACLEP / 5.6 kps CELP / VSLEP	
Transmission speed	270.3 kbps	
Diversity	Frequency hopping	
Signal Reception	Double superheterodyne	
Intermediate Frequencies	225 MHz and 45 MHz	
Antenna Terminal Impedance	50 Ω	
Antenna VSWR	<2.1 : 1	
Dimensions	Height: 120 mm Width: 45 mm Depth: 16.4 mm	
Volume	81 ml	
Weight	80 g	
Display	Graphical chip on glass liquid crystal, Alphanumeric, 16 x 4 characters + 2 lines of icons.	
Illumination	4 LEDs for the LCD (7-colour) 8 LEDs for the keypad (Green) 1 LED Incoming call (Green) 1 Charging LED (Red)	
Keys	18-key Keypad, Navigation key, Memo key.	
SIM	Plug-in type only	
External DC Supply Voltage	5.8 V	
Battery	3.7 V nominal, 650mAh, Li-Ion	
Standby Battery Life DRX 9	170 hrs maximum	
Conversation Battery Life PL 7, DTX 50%	210 minutes	

Battery life figures are dependent on network conditions.

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 manual by anyone else could result in serious injury or death.

Panasonic®

Company Liability

This Service Manual is copyright and issued on the strict understanding that it is not be reproduced, copied, or disclosed to any third party, either in whole or in part, without the prior written consent of Matsushita Communication Industrial UK Ltd.

Every care has been taken to ensure that the contents of this manual give an accurate representation of the equipment. However, Matsushita Communication Industrial UK Ltd. accepts no responsibility for inaccuracies which may occur and reserves the right to make changes to specification or design without prior notice.

The information contained in this manual and all rights in any designs disclosed therein, are and remain the exclusive property of Matsushita Communication Industrial UK Ltd.

Other patents applying to material contained in this publication:

BULL CP8 PATENTS

Comments or correspondence concerning this manual should be addressed to:

Customer Support Department,

Matsushita Communication Industrial UK Ltd.,
Colthrop, Thatcham,

Berkshire, RG19 4ZD.
ENGLAND

© 2000 Matsushita Communication Industrial UK Ltd.

WARNINGS AND CAUTIONS

WARNING

The equipment described in this manual contains polarized capacitors utilising liquid electrolyte. These devices are entirely safe provided that neither a short-circuit nor a 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 appropriate handling procedure is not adhered to.

ESD Handling Precautions

A working area where ESDs may be safely handled 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 a 1 MΩ 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 a built in safety resistor of approximately 1 MΩ shall be used. The flexible cord must be attached to a dissipative earth point.

Containers - All containers and storage must be of the conductive type.

Batteries

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.

This page is left intentionally blank.

CONTENTS

This page is left intentionally blank.

1 INTRODUCTION

1.1. Purpose of this 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 the GSM Digital Cellular Network.

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, repair and reassembly of each major component part. 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 enables 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 equipment components, for the ordering of spare / replacement parts.

1.3. Servicing Responsibilities

The procedures described in this manual must be performed by qualified service engineering personnel, at an authorised service centre.

The service engineering personnel are responsible for fault diagnosis and repair of all equipment described in this manual.

This page is intentionally blank.

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

Panasonic Telephone Model GD93 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, GSM 900 and GSM 1800 operation.

3. Tegic T9 Text Entry

4. Voice Ringer

5. Desktop Handsfree function comprising integral echo cancellation and noise suppression.

6. Wireless Application Protocol (WAP) Browser.

7. E-Mail access via Point-to-Point Protocol (PPP).

8. Backup Battery.

9. Seven background display colours.

2.3. Handportable Main Kit

10374-1
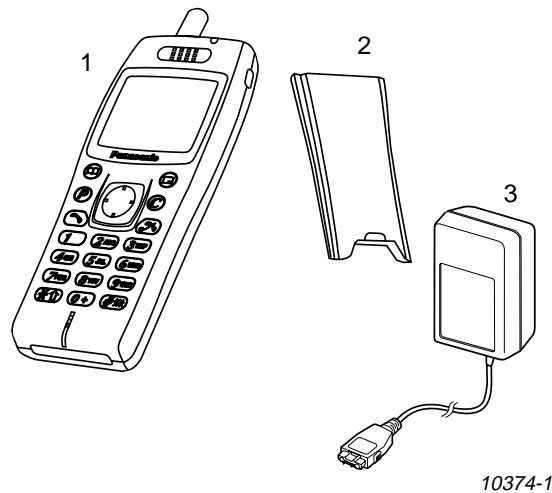
Figure 2.1: Handportable Main Unit Kit Contents

ITEM	DESCRIPTION	PART NUMBER
1	Main Unit GD93	EB-GD93
2	Battery, Standard	EB-BSD93
3	AC Adaptor	EB-CAD92
-	Documentation	See Section 7

This page is intentionally blank.

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 telephones for full operational information.

3.2. LCD Display

The telephone unit has a graphical chip on glass liquid crystal display in conjunction with the following icons:

Figure 3.1: LCD Display

▮▮▮▮	Indicates received signal strength: ▪▮▮▮ strong signal area; ▪▮▮▮ weak signal area.
T	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: ▬ Battery is at full charge; ▭ Battery requires charging; ▭ The battery icon flashes during charging. During car mount use, when the battery is fully charged, the icon will not light.
Menu Icon	Displays a small icon related to the current status of the telephone:
	△ telephone is roaming on a non-home network.
	↳ using the "Call Divert" feature or the telephone has Call-Divert set;
	⋙ shows that vibration alert is switched on;
	⚥ shows that the telephone is in silent mode - no tones;
	✉ flashes to indicate that there are unread text (SMS) messages. Lit when SMS area is full;
	⚷ indicates the telephone is locked;
	ABC shows that the normal character set has been selected;
	ABΓ shows that the Greek character set has been selected;
	AÅÅ shows that the Extended character set has been selected;
	0-9 shows that numbers have been selected for text entry.
Information Icon	Displays a small icon according to the current menu level:
	🕐 indicates the alarm is set.
	▮ indicates the current Phonebook is sourced from the Mobile Phonebook.
	▮ indicates the current Phonebook is sourced from the SIM Phonebook.
✛	Indicates that the navigation key (⊙) can be pressed. Each arrow will light individually to indicate which direction is valid.
Option Area	Pressing the select key (▯) will select the option displayed in the option area of the display.

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.
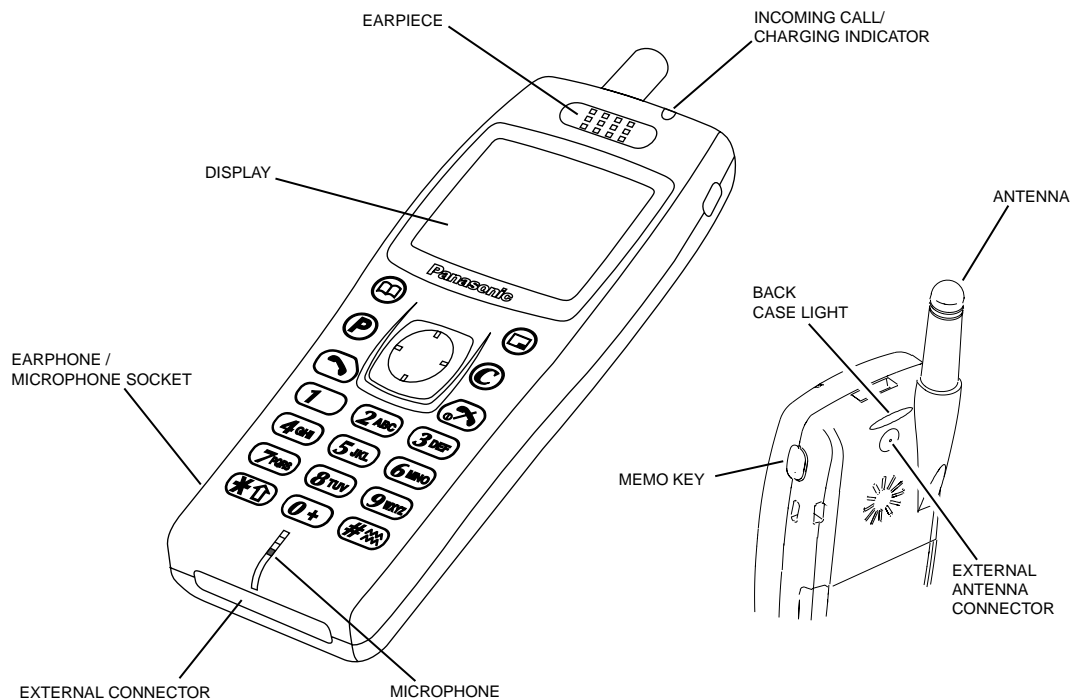
Figure 3.2: Location of Controls

(nav)	Navigation Key. Scrolls through options or features menu and increases or decreases volume.
(select)	Select Key. Selects option shown in the Option Area of the display.
(phonebook)	Phonebook Key. Browses through the Phonebook or stores a number in the Phonebook. Changes the type of characters entered during Alpha Entry.
(P)	Personal Dial Key. Provides instant access to one phone number. Also provides shortcut to WAP Browser.
(send)	Send Key. Makes a call.
(C)	Clear Key. Clears the last digit entered, clears all digits when pressed and held or returns to the previous display.
(end)	End Key. Ends a call or switches the telephone on/off when pressed and held.
(0) to (9)	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 "+".
(vibrator)	Vibrator enable/disable Key. Press and hold to enable or disable the vibrator.

Issue 1
Revision 0   Section 3   MCUK001002C8
– 6 –   Service Manual

3.4. Concept of Operation

There is a close relationship between the Select Key, Navigation Key and display.

Figure 3.3: Concept of Operation

Pressing up and down (⊕) will move the pointer up and down and scroll through more information in the main area of the display.

Pressing left and right (⊖) will scroll through options in the option area of the display. To choose the option press the Select Key (▣).

3.5. Alpha Entry

3.5.1 Character Set / Key Assignments
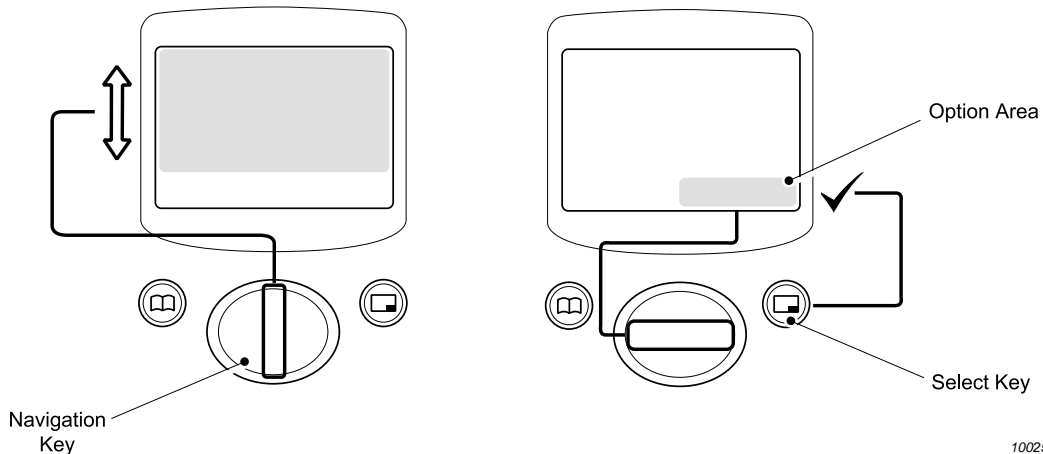
Alpha entry is used to enter alphanumeric characters in to the Phonebook, Short Messages and Greeting Message areas

Key	Character / Operation			Num
	Normal	**Greek**	**Extended**	
1	" @ – , . ; : ! ¡ ? ¿ ( ) ' & % + – / < > = £ $ ¥ ¤ §			1
2	A B C a b c	Α Β Γ	A Ä Å Æ B C Ç a à b c	2
3	D E F d e f	Δ Ε Ζ	D E É F d e è é f	3
4	G H I g h i	Η Θ Ι	G H I g h i ì	4
5	J K L j k l	Κ Λ Μ	J K L j k l	5
6	M N O m n o	Ν Ξ Ο	M N Ñ O Ö ø m n ñ o ò ö	6
7	P Q R S p q r s	Π Ρ Σ	P Q R S p q r s ß	7
8	T U V t u v	Τ Υ Φ	T U Ü V t u ù ü v	8
9	W X Y Z w x y z	Ξ Ψ Ω	W X Y Z w x y z	9
▣	Deletes the character above the cursor, deletes the character to the left when at the end of the line or clears the entire entry when pressed and held.			

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 (AÄÅ), numerals (0–9) and normal characters (ABC) press ▣.

3.5.2 Editing Alpha Entry

Pressing ⊕ will move the cursor up or down one line. Pressing ⊖ will move the cursor left or right one character. 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.

3.6. Incoming Call Line Identification (CLI)

When a call is received the last 6 digits of the CLI information is matched with the phonebook. Therefore an incoming call could match to the wrong phonebook entry.

3.7. Hot Key Dial Source List

The source for Hot Key Dial Numbers is normally 'Phonebook' or 'Service Dial Numbers'. For some OEMs it may be a requirement to store these numbers in Flash-ROM. When the source is the Flash-ROM and the telephone software is updated, the source numbers may be lost. Also, if the user changes the source of the Hot Key Dial numbers, it will not be possible to redirect the source back to Flash-ROM. However, in the event that an OEM would like the Hot Key Dial source to be stored in the Flash-ROM, it is unlikely that the user will have the option to change the Hot Key Dial source.

3.8. Features Menu Structure
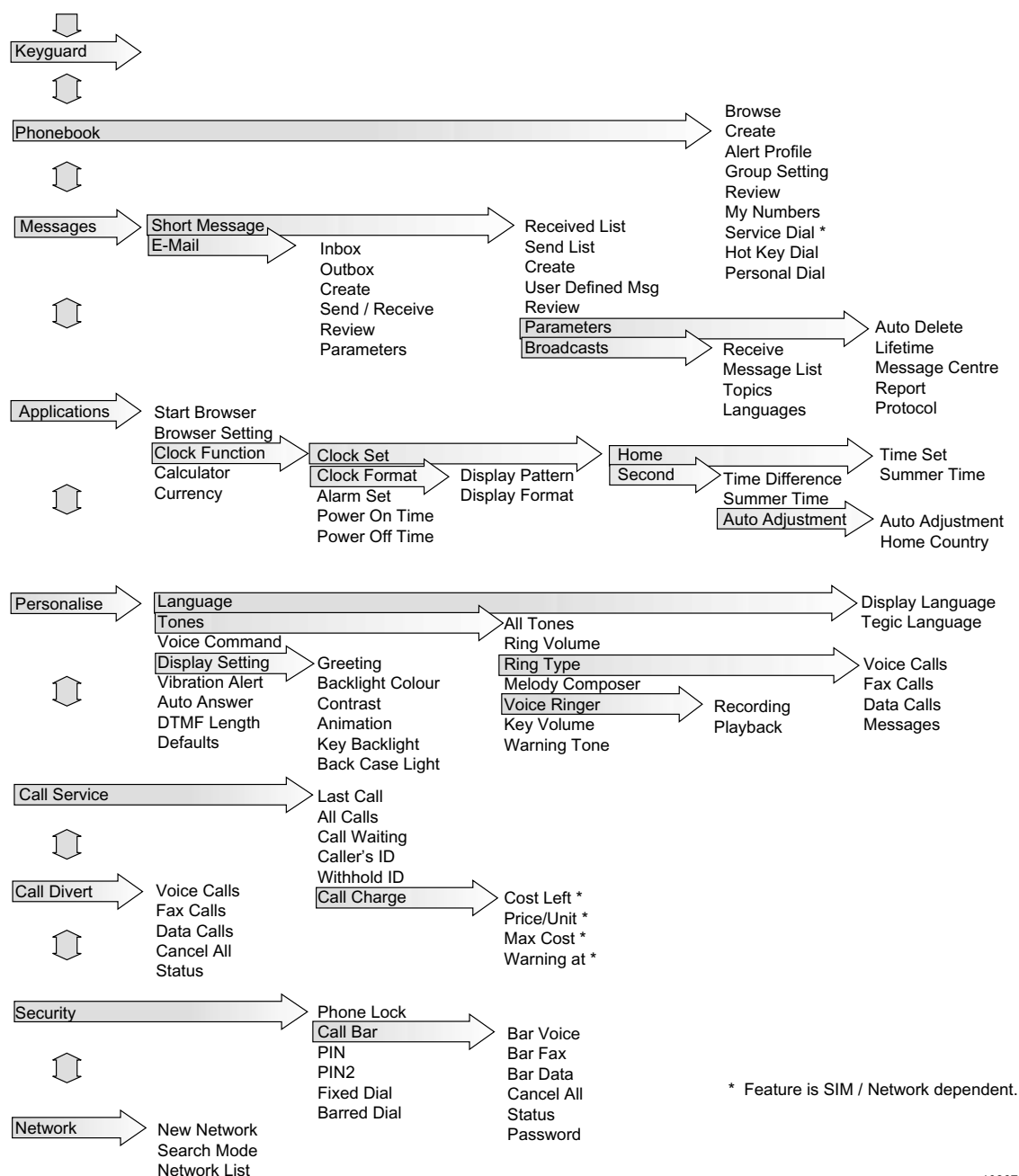
Figure 3.4: Features Menu Structure

3.9. Public Man Machine Interface (MMI)

3.9.1 General

It is possible to operate all GSM telephones in the same way using the Public MMI. The following operations will work with all GSM telephones. However, this information is restricted to those operations supported by the GD93 telephone.

The * and # in the following procedures should be replaced by ⬛ and ⬛ respectively. Also <SND> and <END> should be replaced with ⬛ and ⬛ keys.

3.9.2 Reading the Phonebook Memory Location

<MEMORY LOCATION>

Leading zeros can be left out of the location number, e.g. 007 can be 7.

3.9.3 Presentation of IMEI

* # 0 6 #

3.9.4 Security

Change PIN	* * 0 4 * <OLD PIN> * <NEW PIN> * <NEW PIN> #
Change PIN2	* * 0 4 2 * <OLD PIN2> * <NEW PIN2> * <NEW PIN2> #
Unblock PIN	* * 0 5 * <PIN UNBLOCKING KEY> * <NEW PIN> * <NEW PIN> #
Unblock PIN2	* * 0 5 * <PIN2 UNBLOCKING KEY> * <NEW PIN2> * <NEW PIN2> #

3.9.5 Call Hold

Place a Call on Hold	2 <SND>
Recall a Held Call	2 <SND>
Make a Second Call	<TELEPHONE NUMBER> <SND>
Swap between two Held Calls	2 <SND>
End Held Call	0 <SND>
End Active Call	1 <SND>
Reject Incoming Call	0 <SND>

3.9.6 Call Waiting

Enable Call Waiting	* 4 3 * <SND>
Disable Call Waiting	# 4 3 * <SND>
Call Waiting Status	* # 4 3 * # <SND>

3.9.7   Calling Line Identification

Feature	Service Code
Calling Line Identification Presentation (CLIP)	30
Calling Line Identification Restriction (CLIR)	31
Connected Line Presentation (CLOP)	76
Connected Line Restriction (CLOR)	77

Enable	* <SERVICE CODE> * # <SND>
Disable	# <SERVICE CODE> * # <SND>
Temporary Suppress Identification	# 3 1 # <TELEPHONE NUMBER> <SND>
Temporary Display Identification	* 3 1 # <TELEPHONE NUMBER> <SND>

3.9.8   Telecommunication Services used for Public MMI

Teleservice

Service	MMI Service Code
All teleservices	10
Telephony	11
All data teleservices	12
Facsimile services	13
Short Message Services (SMS)	16
All teleservices except SMS	19
Voice group services	17

Bearer Service

Service	MMI Service Code
All bearer services	20
All asynchronous services	21
All synchronous services	22
All data synchronous services	24
All data asynchronous services	25
All dedicated packet access	26
All dedicated PAD access	27

3.9.9   Call Divert

Call Divert Type	Service Code
Divert all calls	21
Divert all calls if busy	67
Divert calls if no reply	61
Divert if not reachable	62

Set (except "No Reply" Call Bar	* * <SERVICE CODE> * <FORWARD TELEPHONE NUMBER> * <TELECOMMUNICATION SERVICE> # <SND>
Set "No Reply" Call Bar	* * <SERVICE CODE> * <FORWARD TELEPHONE NUMBER> * <TELECOM' SERVICE> * <TIME TO RING (sec)> # <SND>
Clear	# # <SERVICE CODE> * <TELECOMMUNICATION SERVICE> * # <SND>
Status	* * # <SERVICE CODE> * <TELECOMMUNICATION SERVICE> * # <SND>
Clear all Call Diverts	# # 0 0 2 #

3.9.10   Call Bar

Call Ball Type	Service Code
All outgoing calls	33
Outgoing International calls	331
Outgoing International calls except those to the PLMN country	332
All incoming calls	35
Incoming international calls when roaming	351

Set	* <PASSWORD> * <TELECOMMUNICATION SERVICE> # <SND>
Clear	# <TELECOMMUNICATION SERVICE> # <SND>
Status	# <TELECOMMUNICATION SERVICE> # <SND>
Clear all Call Bar Types	# 3 3 0 * <PASSWORD> # <SND>
Change Call Bar Password	* * 0 3 * * <OLD PASSWORD> * <NEW PASSWORD> * <NEW PASSWORD> # <SND>

3.10. Troubleshooting

The user is given the following information and advised to contact the dealer if the problems persist:

Problem	Cause	Remedy
Telephone will not switch on		Check that the battery pack is fully charged and correctly connected to the telephone.
Extremely short battery life for a new battery pack	The network in use and the condition of the battery pack can affect battery life.	Avoid areas of poor reception. Ensure batteries are fully charged. Additionally, for NiMH batteries, ensure batteries are also discharged fully before recharging.
Short battery life for an old battery pack	The battery pack was worn out.	Replace with a new one.
Short battery life for Ni-MH battery pack	The life of the battery pack is affected by improper charging, this is inherent in all Ni-MH batteries.	To maintain maximum performance, always use until the Low Battery Warning appears and then fully recharge the battery pack. To revive a Battery Pack, use the telephone until the Low Battery Warning appears and then fully recharge three times. However, if the battery life still is short, the battery pack has eventually worn out. Replace with a new one.
The battery level indicator ▭ does not light when charging	If a battery is deeply discharged it will take a short time before there is sufficient power in the telephone to light the battery level indicator ▭ .	Leave to charge for several minutes in temperatures between +5°C and +35°C.
Calls cannot be made	The telephone is locked.	Unlock the telephone (Menu: Security: Phone Lock).
	Outgoing calls are barred.	Disable the outgoing call barring (Menu: Security: Call Bar).
	The telephone is not registered to a network.	Move to a coverage area and operate the telephone after it has registered with a network.
Calls cannot be made from Fixed Dial Store		Check that SIM supports Fixed Dial Check if the Fixed Dial is switched on (Menu: Security: Fixed Dial). Check the telephone number is stored in the Fixed Dial.
Calls cannot be received	The telephone is not switched on.	Switch the telephone on.
	Incoming calls are barred.	Disable the incoming call barring (Menu: Security: Call Bar).
	The telephone is not registered to a network.	Move to a coverage area and operate the telephone after it has registered with a network.
Emergency calls cannot be made	User's phone is not in a GSM coverage area.	Check that the antenna symbol ⊤ is displayed. Move to a coverage area and operate the telephone when the antenna symbol is displayed.
Telephone numbers cannot be recalled	The telephone is locked.	Unlock the telephone (Menu: Security: Phone Lock).
	Fixed Dial is switched on.	Switch off Fixed Dial (Menu: Security: Fixed Dial).

3.11. Important Error Messages

The following table is a list of error messages that may occur during use of the telephone, with a description and suggested course of action:

Error Message	Explanation / Remedy
Area not Allowed	Roaming in the selected area is not allowed.
Network not Allowed	Roaming with the selected network is not allowed.
Security Failure	The network has detected authentication failure because the SIM is not registered with that network. Contact the Service Provider.
SIM Blocked	The SIM is blocked because the wrong PUK has been entered ten times. Contact the Service Provider.
SIM Error	The telephone has detected a problem with the SIM. Switch the telephone off and then back on. If the message does not disappear, contact the Service Provider.
Message Rejected Store Full	A message has been received but the message store is full. To receive messages, delete some of the currently stored messages or set messages to automatically clear (Menu: Messages: Parameters: Auto Delete).
PIN2 Invalidated	The PIN2 is blocked permanently because the wrong PUK2 has been entered 10 times. Services controlled by PIN2 cannot be used. Contact the Service Provider.
Warning Store Full Continue?	The message area is full. New messages cannot be stored until some of the currently stored messages are deleted.
Auto Redial List Full	Redial list of unsuccessfully dialled numbers is full. Switch the telephone off and then on again.

3.12. Security Codes

Code Type	Number of Digits	Description
Personal Identification Number (PIN)	4 to 8	Controls SIM security. Supplied by the service provider.
PIN 2	4 to 8	Controls memory security. Supplied by the service provider.
PIN/PIN 2 Unblocking Key		
(PUK/PUK 2)	8	Used to unblock PIN and PIN 2. A PIN or PIN 2 will become blocked if the wrong PIN or PIN 2 is entered three times. When the blocked PIN or PIN 2 is unblocked, a new PIN or PIN 2 must be entered. If the wrong PUK or PUK 2 is entered 10 times, the cursor SIM will be unusable.
Supplied by the service provider.		
Password	4	Controls the call bar function. If the wrong password is entered three times, this service will be revoked. Supplied by the service provider.
Lock Code	4	Controls telephone security.
Factory set to "0000".		

3.13. SIM Personalisation

3.13.1 Introduction

SIM personalisation will limit the use of the telephone to a single SIM, a SIM supplied by one Network/Sub-network/Service Provider or a SIM purchased by a company (corporation). If a personalised handset contains a SIM that is from a different source, it will display the message "SIM ERROR" when switched on. This personalisation is sometimes referred to as SIM lock or SIM latch.

3.13.2 Testing

To test a personalised handset when the user has not supplied the SIM, a SIM configured for test purposes (e.g. test SIM or soft SIM) should be used. The mobile will recognise that the SIM is for testing purposes only and operate as normal.

3.13.3 Personalisation Function

Personalisation is activated during manufacture and then enabled at a later stage. Enabling/disabling is available by entering a special key sequence immediately after power on. Once the enable/disable menu is shown it is possible to select the type of personalisation. When personalisation is enabled it is only possible to disable it if the mobile contains an illegal SIM and the sixteen digit Control Key (CK) is known. When enabled the CK is withheld from the user and cannot be read, for security reasons.

There are two special key sequences to enter the enable/disable menu:

Key Sequence	Notes
7 4 6 . .	Can only disable personalisation
5 2 8 2 4 . .	Can both enable and disable personalisation

3.13.4 Disabling Procedure

1. 7 4 6 . . or 5 2 8 2 4 . .

2. to point at:
    "SIM" for SIM Personalisation
    "Network" for Network Personalisation
    "Subnetwork" for Subnetwork Personalisation
    "SP" for Service Provider Personalisation or
    "Corporate" for Company Personalisation.

3. .

4. the 16 digit Control Key.

5. .

6. the 16 digit Control Key.

7. .
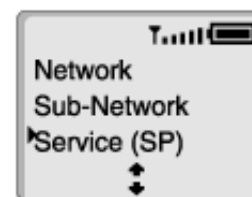
The display will confirm which type of Personalisation has been disabled.

3.13.5 Enabling Procedure

1. 5 2 8 2 4 . .

2. to point at:
    "SIM" for SIM Personalisation
    "Network" for Network Personalisation
    "Subnetwork" for Subnetwork Personalisation
    "SP" for Service Provider Personalisation or
    "Corporate" for Company Personalisation.

3. .

4. the 16 digit Control Key.

5. .

6. the 16 digit Control Key.

7. .

The display will confirm which type of Personalisation has been enabled.

3.14. GSM Services Supported by PC Card

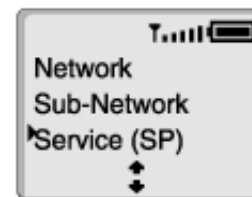| Bearer Service Number	Bearer Service Rate	Access Structure	Access Rate	Information Transfer	Error Correction Options
21	Asynchronous 300 bps	Asynch	300 bps	UDI or modem	T or NT
22	Asynchronous 1.2 kbps	Asynch	1.2 kbps	UDI or modem	T or NT
23	Asynchronous 1200/75 bps	Asynch	1200/75 bps	UDI or modem	T or NT
24	Asynchronous 2.4 kbps	Asynch	2.4 kbps	UDI or modem	T or NT
25	Asynchronous 4.8 kbps	Asynch	4.8 kbps	UDI or modem	T or NT
26	Asynchronous 9.6 kbps	Asynch	9.6 kbps	UDI or modem	T or NT
41	Dedicated PAD Access 300 bps	Asynch	300 bps	UDI	T or NT
42	Dedicated PAD Access 1.2 kbps	Asynch	1.2 kbps	UDI	T or NT
44	Dedicated PAD Access 2.4 kbps	Asynch	2.4 kbps	UDI	T or NT
45	Dedicated PAD Access 4.8 kbps	Asynch	4.8 kbps	UDI	T or NT
46	Dedicated PAD Access 9.6 kbps	Asynch	9.6 kbps	UDI	T or NT

3.15. GSM Network Codes and Names

Country	Access Code	Service or Operator	Phone Display	Network Code		Band
ALBANIA	+355	AMC MOBIL	AMC - AL	276	01	GSM 900
ANDORRA	+376	MOBILAND	STA-MOBILAND	213	03	GSM 900
ARMENIA	+374	ARMGSM	RA-ARMGSM	283	01	GSM 900
AUSTRALIA	+61	MOBILENET	TELSTRA	505	01	GSM 900
		OPTUS Mobile	Yes Optus	505	02	GSM 900
		VODAFONE	AUS VODAFONE	505	03	GSM 900
AUSTRIA	+43	A max.	A max.	232	03	GSM 900
		A1	A1	232	01	GSM 900
		one	one	232	05	GSM 1800
AZERBAIJAN	+994	AZERCELL GSM	AZE-AZERCELL GSM	400	01	GSM 900
BAHREIN	+973	MOBILE PLUS	BHR MOBILE PLUS	426	01	GSM 900
BELGIUM	+32	PROXIMUS	BEL PROXIMUS	206	01	GSM 900
		mobistar	B mobistar	206	10	GSM 900
BOSNIA & HERZEGOVINA	387	PTT-GSMBIH	PTT-GSMBIH	218	90	GSM 900
BULGARIA	+359	M-TEL GSM BG	M-TEL GSM BG	284	01	GSM 900
CAMEROON	+237	CAM CELLNET	CAM CELLNET	624	01	GSM 900
CHINA	+86	CT-GSM	CHINA TELECOM	460	00	GSM 900
		CU-GSM	CHINA UNICOM	460	01	GSM 900
CROATIA	+385	CRONET	HR-CRONET	219	01	GSM 900
		Vip Net GDM d.o.o.	HR VIP	219	10	GSM 900
CYPRUS	+357	CYTAGSM	CY CYTAGSM	280	01	GSM 900
CZECH_REPUBLIC	+42	EUROTEL GSM	EUROTEL-CZ	230	02	GSM 900
		OSKAR	OSKAR	230	03	not known
		Radio Mobil CZE	PAEGAS-CZ	230	01	GSM 900
DENMARK	+45	SONOFON	DK SONOFON	238	02	GSM 900
		TDK-MOBIL	DK TDK-MOBIL	238	01	GSM 900
		Telia DK	Telia DK	238	20	GSM 1800
		mobilix	mobilix	238	30	GSM 1800
EGYPT	+20	EGY CLICK GSM	EGY CLICK GSM	602	02	not known
		MobiNil	MobiNil	602	01	GSM 900
ESTONIA	+372	EMT GSM	EE EMT GSM	248	01	GSM 900
		RADIOLINJA EESTI	EE RLE	248	02	GSM 900

Country	Access Code	Service or Operator	Phone Display	Network Code		Band
ETHIOPIA	+251	ETMTN	ETH-MTN	636	01	GSM 900
FIJI	+679	VODAFONE FIJI	VODAFONE FIJ	542	01	GSM 900
FINLAND	+358	FINNET	FINNET	244	09	GSM 1800
		Finland SONERA	SONERA	244	91	GSM 900
		RADIOLINJA	FI RADIOLINJA	244	05	GSM 900
		Telia	Telia	244	03	GSM 1800
FRANCE	+33	Bouygues	Bouygues	208	20	GSM 1800
		Itineris	F Itineris	208	01	GSM 900
		SFR	F SFR	208	10	GSM 900
FRENCH POLYNESIA	+689	TIKIPHONE	F-VINI	547	20	GSM 900
GERMANY	+49	D2 PRIVAT	D2	262	02	GSM 900
		E-Plus	E-Plus	262	03	GSM 1800
		Telekom Mobilfunk D1	D1-TELEKOM	262	01	GSM 900
		Viag Interkom	D Interkom	262	07	GSM 1800
GIBRALTAR	+350	GIBTEL	GIBTEL GSM	266	01	GSM 900
GREECE	+30	Cosmote	Cosmote	202	01	GSM 1800
		PANAFON	GR PANAFON	202	05	GSM 900
		TELESTET	GR TELESTET	202	10	GSM 900
HONG_KONG	+852	HK SMC	HK SMC	454	06	GSM 900
		HK TELECOM	CAMPERSANDW HKT	454	00	GSM 900
		NEW WORLD	NEW WORLD	454	10	GSM 1800
		Orange	Orange	454	04	GSM 900
		P Plus	P Plus	454	22	GSM 1800
		P-Link	P-Link	454	18	GSM 1800
		PEOPLES	PEOPLES	454	12	GSM 1800
		SUNDAY	SUNDAY	454	16	GSM 1800
HUNGARY HUNGARY HUNGARY	+36	PANNON GSM	H PANNON GSM	216	01	GSM 900
		Vodafone	Vodafone	216	70	not known
		WESTEL 900	H-WESTEL 900	216	30	GSM 900
ICELAND	+354	Postur og simi	IS SIMINN	274	01	GSM 900
INDIA	+91	AirTel	INA-AIRTL	404	10	GSM 900
		BPL MOBILE	BPL MOBILE	404	21	GSM 900
		BPL MOBILE	BPL MOBILE	404	27	GSM 900
		BPL MOBILE	BPL MOBILE	404	43	GSM 900
		BPL MOBILE	BPL MOBILE	404	46	GSM 900
		ESSAR CELLPHONE	ESSAR CELLPHONE	404	11	GSM 900
		INA - TATA CELLULAR	TATA CELLULAR	404	07	GSM 900
		INA-ESCOTEL	INA-ESCOTEL	404	12	GSM 900
		INA-ESCOTEL	INA-ESCOTEL	404	19	GSM 900
		INA-ESCOTEL	INA-ESCOTEL	404	56	GSM 900
		MaxTouch	MaxTouch	404	20	GSM 900
		RPG Cellular	NA RPG	404	41	GSM 900
		SKYCELL	SKYCELL	404	40	GSM 900
INDONESIA	+62	EXCELCOM	IND-EXCELCOM	510	11	GSM 900
		IND SATELINDOCEL	IND SATELINDOCEL	510	01	GSM 900
		TELKOMSEL	IND TELKOMSEL	510	10	GSM 900
IRELAND	+353	EIRCELL-GSM	IRL EIR-GSM	272	01	GSM 900
		IRL - DIGIFONE	IRL DIGIFONE	272	02	GSM 900
ITALY	+39	BLU	I BLU	222	98	GSM 1800
		I WIND	I WIND	222	88	GSM 1800
		OMNITEL	I OMNITEL	222	10	GSM 900
		TELECOM ITALIA MOBIL	I TIM	222	01	GSM 900
JORDAN	+962	Fastlink	Fastlink	416	01	GSM 900
KUWAIT	+965	MTCNet	KT MTCNet	419	02	GSM 900

Country	Access Code	Service or Operator	Phone Display	Network Code		Band
LATVIA LATVIA	+371	BALTEL	LV BALTEL	247	02	GSM 900
		LMT GSM	LV LMT GSM	247	01	GSM 900
LEBANON	+961	Cellis	RL Cellis	415	01	GSM 900
		LibanCell	RL LibanCell	415	03	GSM 900
LESOTHO	+266	VODACOM LESOTHO	VCL COMMS	651	01	GSM 900
LITHUANIA	+370	BITE GSM	LT BITE GSM	246	02	GSM 900
		LITHUANIAN OMNITEL	OMNITEL LT	246	01	GSM 900
LUXEMBOURG	+352	Millicom 1800 -> TANGO	TANGO	270	77	GSM 1800
		LUXGSM	L LUXGSM	270	01	GSM 900
MACAU	+853	TELEMOVEL+	MAC-CTMGSM	455	01	GSM 900
MACEDONIA	+389	MOBIMAK	MKD-MOBIMAK	294	01	GSM 900
MALAWI	+265	CALLPOINT 900	MW CP 900	650	01	GSM 900
MALAYSIA	+60	MY DiGi	MY DiGi	502	16	GSM 1800
		MY TMTOUCH	MY TMTOUCH	502	13	GSM 900
		MY a.d.a.m	MY a.d.a.m	502	17	GSM 900
		MY celcom	MY celcom	502	19	GSM 900
		MY maxis	MY maxis	502	12	GSM 900
MAURITIUS	+230	CELLPLUS	CELLPLUS-MRU	617	01	GSM 900
MOROCCO	+212	ONPTGSM	MOR ONPT GSM	604	01	GSM 900
NAMIBIA	+264	MTC	NAM MTC	649	01	GSM 900
NETHERLANDS	+31	Ben NL	Ben NL	204	16	GSM 1800
		KPN TELECOM	NL KPN TELECOM	204	08	GSM 900
		LIBERTEL	NL LIBERTEL	204	04	GSM 900
		NL Dutchtone	NL Dutchtone	204	20	GSM 1800
		TELFORT	TELFORT	204	12	GSM 1800
NEW_ZEALAND	+64	BELLSOUTH	BELLSOUTH NZ	530	01	GSM 900
NORWAY	+47	NetCom GSM	N NetCom GSM	242	02	GSM 900
		Telenor Mobile	N Telenor Mobil	242	01	GSM 900
OMAN	+968	OMAN MOBILE	OMAN MOBILE	422	02	GSM 900
PHILLIPINES	+63	Globe Telecom	PH GLOBE	515	02	GSM 900
		Islacom	ISLACOM	515	01	GSM 900
PHILLIPINES		Smart Communications	SMART	515	03	GSM 1800
POLAND	+48	ERA GSM	PL-ERA GSM	260	02	GSM 900
		IDEA	IDEA	260	03	GSM 1800
		PL PLUS	PL PLUS	260	01	GSM 900
PORTUGAL	+351	P OPTIMUS	P OPTIMUS	268	03	GSM 1800
		TELECEL	P TELECEL	268	01	GSM 900
		TMN	P TMN	268	06	GSM 900
QATAR	+974	QATARNET	QAT-QATARNET	427	01	GSM 900
RÉUNION	+262	SRR	SFR REUNION	647	10	GSM 900
RUSSIAN FEDERATION	+701	BeeLine	BeeLine	250	99	GSM 1800
		MTS	MTS-RUS	250	01	GSM 900
		North-West GSM	North-West GSM	250	02	GSM 900
SAUDI_ARABIA SAUDI_ARABIA	+966	EAE-ALJAWWAL	EAE-ALJAWWAL	420	07	GSM 900
		MoPTT, DMTS-1	ALJAWWAL	420	01	GSM 900
SEYCHELLES	+248	SEYCHELLES CELLULAR SERVICES	CELLULAR SERVICE	633	01	GSM 900
SINGAPORE	+65	M1-GSM	M1-GSM-SGP	525	03	GSM 900
		ST-GSM	ST-GSM-SGP	525	01	GSM 900
		ST-GSM1800-SGP	ST-GSM1800-SGP	525	02	GSM 1800
SLOVAK REPUBLIC	+42	EUROTEL	SK EUROTEL	231	02	GSM 900
SLOVAKIA		GLOBTEL	SK GLOBTEL	231	01	GSM 900
SLOVENIA	+386	MOBITEL GSM (Slovenia)	SI MOBITEL GSM	293	41	GSM 900

Country	Access Code	Service or Operator	Phone Display	Network Code		Band
SOUTH_AFRICA SOUTH_AFRICA	+27	MTN	MTN-SA	655	10	GSM 900
		VodaCom	VodaCom-SA	655	01	GSM 900
SPAIN	+34	AIRTEL	E AIRTEL	214	01	GSM 900
		AMENA	AMENA	214	03	not known
		MOVISTAR	MOVISTAR	214	02	not known
		MOVISTAR	MOVISTAR	214	07	GSM 900
SRI_LANKA	+94	DIALOG	SRI DIALOG	413	02	GSM 900
SUDAN	+249	SDN MOBITEL	SDN MobiTel	634	01	GSM 900
SWEDEN	+46	COMVIQ	S COMVIQ	240	07	GSM 900
		EUROPOLITAN	S EUROPOLITAN	240	08	GSM 900
		TELIA MOBITEL	TELIA S	240	01	GSM 900
SWITZERLAND SWITZERLAND SWITZERLAND	+41	Orange	Orange	228	03	GSM 900
		SWISS GSM	SWISS GSM	228	01	GSM 900
		diAx Swiss	diAx Swiss	228	02	GSM 900
SYRIA	+963	MOBILE SYRIA	SYR MOBILE SYR	417	09	GSM 900
TAIWAN	+886	Chunghwa	Chunghwa	466	92	GSM 900
		Far EasTone	Far EasTone	466	01	GSM 900
		KGT-ONLINE	KGT-ONLINE	466	88	GSM 1800
		ROC MOBITAI	MOBITAI	466	93	GSM 900
		TUNTEX	TUNTEX	466	06	GSM 1800
		TWN GSM	TWN GSM	466	97	GSM 1800
		TransAsia Telecom GSM	TransAsia GSM	466	99	GSM 900
TANZANIA	+255	Tritel-TZ	Tritel-TZ	640	01	GSM 900
THAILAND	+66	AIS GSM	TH AIS GSM	520	01	GSM 900
		HELLO	HELLO	520	10	GSM 1800
		WP-1800	WP-1800	520	18	GSM 1800
TURKEY TURKEY	+90	PTT TELSIM GSM	TR TELSIM	286	02	GSM 900
		PTT/TURKCELL GSM	TR TURKCELL	286	01	GSM 900
UKRAINE	+380	GOLDEN TELECOM	GOLDEN TELECOM	255	05	GSM 1800
		UA KYIVSTAR	UA KYIVSTAR	255	03	GSM 900
		UA UMC	UA UMC	255	01	GSM 900
		UA WELLCOM	UA WELLCOM	255	02	GSM 900
UNITED ARAB EMIRATES (UAE)	+971	UAE ETISALAT	ETISALAT-G2	424	02	GSM 900
UNITED KINGDOM	+44	BTCellnet	UK BTCELLNET	234	10	GSM 900
		ONE2ONE	one2one	234	30	GSM 1800
		ORANGE	ORANGE	234	33	GSM 1800
		VODAFONE	UK VODAFONE	234	15	GSM 900
(Guernsey)		GUERNSEY TELECOMS	GUERNSEY TEL UK	234	55	GSM 900
(Jersey)		Jersey Telecoms GSM	Jersey Telecoms	234	50	GSM 900
(Isle of Man)		PRONTO GSM	MANX PRONTO GSM	234	58	GSM 900
VIETNAM	+84	Mobi Fone	VN Mobi Fone	452	01	GSM 900

3.16. 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 country	The country in which the home network operates.
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 onto 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. Each country will have at least one network operator.
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.

This page is intentionally blank.

4 DISASSEMBLY / REASSEMBLY INSTRUCTIONS

4.1. 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 a 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 appropriate handling procedure is not adhered to.

4.1.1. 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.
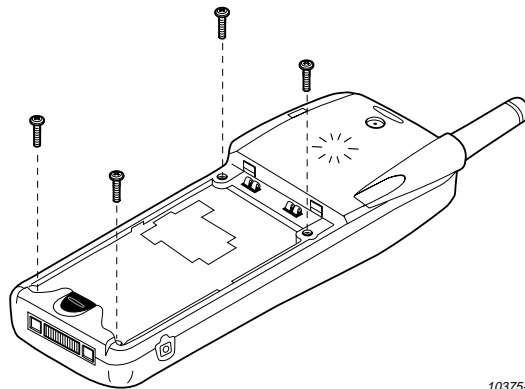
Containers

> All containers and storage must be of the conductive type.

## 4.2. Disassembly

4.2.1 Case Removal

1. Remove the battery from the back of the telephone. Remove the four case screws located inside the battery compartment.

10375-1
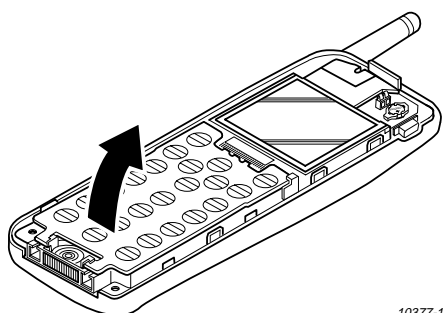
Figure 4.1: Case Screw Removal

2. Remove the cover from the case by pulling from the connector end of the telephone. Care must be taken when separating the case from the cover as the retaining clips may be very stiff. If necessary, re-attach the battery to provide extra support for the case.
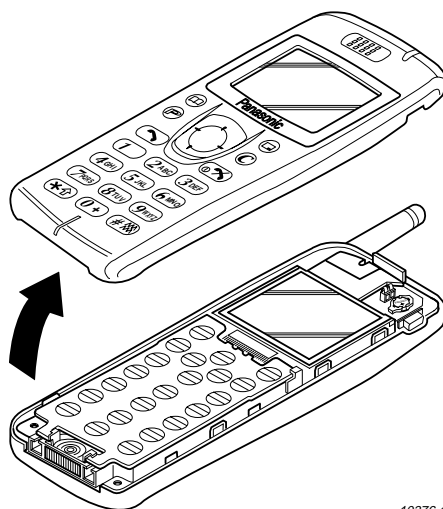
10376-1

Figure 4.2: Case-Cover Separation
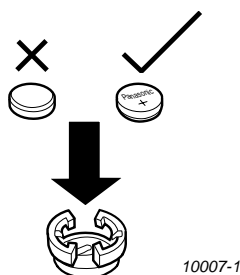
3. Remove the PCB assembly from the cover.

10377-1

Figure 4.3: PCB Assembly Removal

4.2.2   Changing the Backup Battery

Remove the case as previously described. The backup battery is held in a retainer on the Main PCB. Observe polarity when replacing the battery.

10007-1

Figure 4.4: Backup Battery Polarity

4.2.3   Access to Printed Circuit Boards

1. Remove the case as described previously. While applying slight pressure to the side retaining clips, lift the Main PCB away from the chassis.
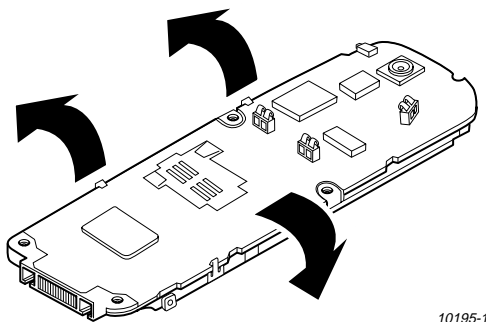
10195-1

Figure 4.5: Main PCB Removal

2. While applying slight pressure to the side retaining clips, slide the Keypad PCB towards the bottom (I/O) connector until it is released from the chassis.
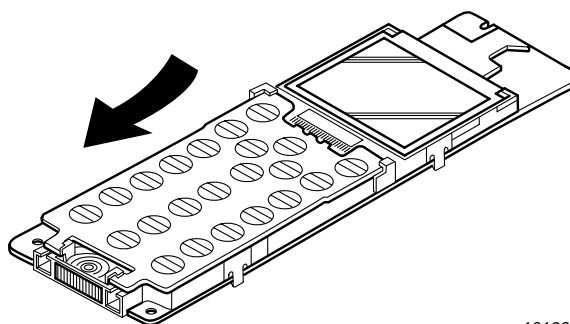
10196-1

Figure 4.6: Key PCB Removal

3. Insert a small screwdriver blade or similar blunt object into the chassis recess to the side of the LCD, and gently prise the LCD from the chassis assembly.
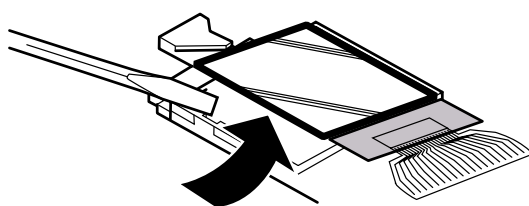
10226-1

Figure 4.7: LCD Removal

4. The Light Guide and Reflector can be removed in turn by prising one side away from the chassis.

4.2.4.   Case-Mounted Components

1.   Remove the keypad membrane by peeling it away from the case front.
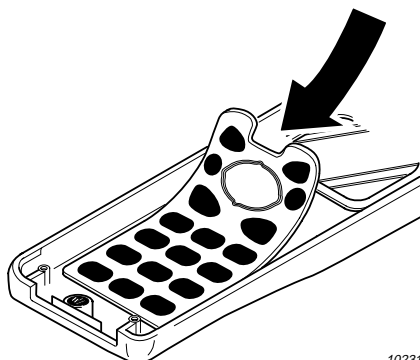
10231-1

Figure 4.8: Keypad Membrane Removal

2.   Remove the microphone assembly by prising upward with a small screwdriver blade or similar blunt object through the slot in the side of the microphone holder.
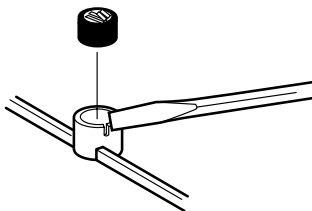
10230-1

Figure 4.9: Removal of Microphone

3.   Unclip the speaker holder and lift out the speaker.
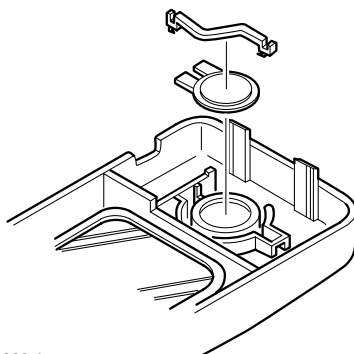
10229-1

Figure 4.10: Speaker Removal

4.   Remove the RF Shield by depressing one of the side retaining clips with a small screwdriver blade or similar blunt object.
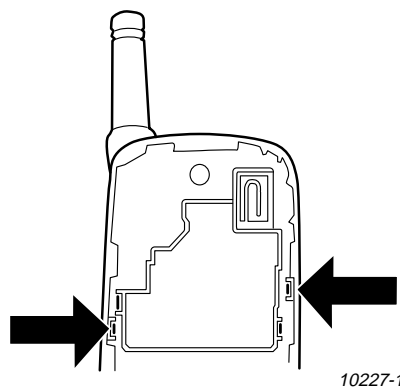
10227-1

Figure 4.11: Removal of RF Shield

5. Once the RF Shield has been removed, the Memo button and Desktop Handsfree (DTHF) speaker may be lifted out from the case.

6. The Vibrate motor may be removed by gently applying pressure under the spindle / counterweight.

10212-2
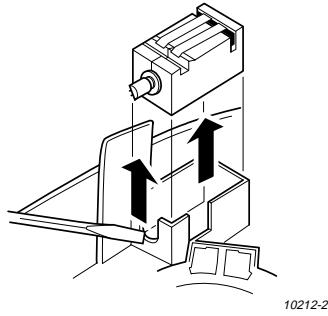
Figure 4.12: Removal of Vibrate Motor

7. Using a small screwdriver blade or similar blunt object, depress the lug on the antenna base in order to release the entire antenna unit.

10228-2
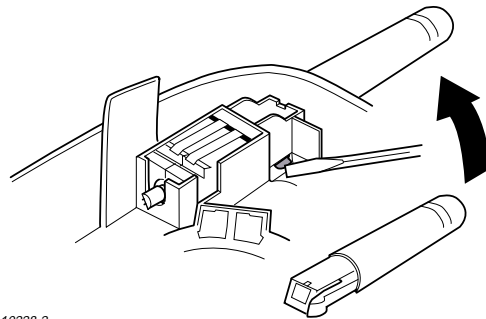
Figure 4.13: Antenna Removal

4.3.   Reassembly

Reassembly is the reverse of disassembly, except that the Keypad PCB should be located in the chassis guides adjacent to the base I/O connector before sliding it in to its normal location.

Ensure that the securing screws are not over-tightened as this may affect the operation of the keypad.

This page is intentionally blank.

5 TECHNICAL SPECIFICATIONS

5.1. Tx Characteristics

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

5.1.1. Frequency Error

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

5.1.2. Modulation Phase Error

RMS: ≤5 °
Peak: ≤20 °

5.1.3. Output RF Spectrum due to Modulation

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

5.1.4. Output RF Spectrum due to Switching Transients

Offset from Centre Frequency (kHz)	Maximum Level (dBm)	
	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 Hz
Video Bandwidth: 100 kHz
Peak Hold

5.1.5. Spurious Emissions at Antenna Connector

Frequency Range	Frequency Offset	Filter Bandwidth	Approximate Video Bandwidth	Limits (dBm)	
				GSM 900	GSM 1800
30 to 50 MHz	-	10 kHz	30 kHz	-36	-36
50 to 500 MHz	-	100 kHz	300 kHz	-36	-36
500 MHz to 1GHz	0 to 1MHz	100 kHz	300 kHz	-36	-36
1 GHz to 4GHz Excl. relevant TX band: P-GSM: 890 to 915 MHz; DCS: 1710 to 1785 MHz	0 to 10 MHz Š 10 MHz Š 20 MHz (offset from edge of relevant TX band)	100 kHz 300 kHz 1 MHz	300 kHz 1 MHz 3 MHz	-30 -30 -30	-36 -36 -36
Relevent TX band: P-GSM: 890 to 915 MHz; DCS: 1710 to 1785 MHz	1.8 to 6.0 MHz (offset from carrier)	30 kHz	100 kHz	-30	-30

5.1.6. Output Level, Dynamic Operation

GSM 900

Power Control Level	Transmitter Output Power (dBm)	Tolerance for Conditions (dB)	
		Normal	Extreme
TBA			

GSM 1800

Power Control Level	Transmitter Output Power (dBm)	Tolerance for Conditions (dB)	
		Normal	Extreme
TBA			

5.1.7. Residual Peak Power

≤70 dBc (BW = 300 kHz)

5.2. Rx Characteristics

5.2.1. Sensitivity

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	Propogation Conditions TUhigh		Propogation Conditions RA		Propogation 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	$6.742*\alpha$	8900					$0.122*\alpha$	164000
class Ib (RBER)	$0.42/\alpha$	1,000,000					$0.41/\alpha$	20,000,000
class II (RBER)	8.33	120,000	7.5	24000	9.333	60000	2.439	8200

The reference sensitivity level is < -102 dBm.

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

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	Propogation Conditions TUhigh		Propogation Conditions RA		Propogation 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)	4.598	13050				
TCH/HS class Ib (BFI=0)	0.404	148500				
TCH/HS class II (BFI=0)	7.725	25500	8500	20000	7600	20000
TCH/HS (UFR)	6.250	9600				
TCH/HSL class Ib ((BFI or UFI)=0)	0.269	227000				

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	Propogation Conditions TUhigh		Propogation Conditions RA		Propogation 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*α	13400					0.122*α	164000
class Ib (RBER)	0.32/α	1,500,000					0.41/α	20,000,000
class II (RBER)	8.333	60,000	7.5	24000	9.333	30000	2.439	8200

The reference sensitivity level is < -102 dBm.

NOTE: *$1 \leq \alpha \leq 1.6$. The value of a can be different for each channel condition but must remain the same for FER and class Ib 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	Propogation Conditions TUhigh		Propogation Conditions RA		Propogation 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)	4.706	12750				
TCH/HS class Ib (BFI=0)	0.426	141000				
TCH/HS class II (BFI=0)	7.725	25500	8735	20000	7600	20000
TCH/HS (UFR)	6.383	9400				
TCH/HSL class Ib ((BFI or UFI)=0)	0.291	206000				

Blocking:

Frequency	Small MS level in dBµVemf()	
	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, and [f1 - f2] = 800 kHz.

6   TEST AND MEASUREMENT

6.1.   Introduction

This section provides information on testing the GD93 telephone. The layout is as follows

1.   Section 6.2 ALIVH PCBs: Description and repair procedures.

2.   Section 6.3 External testing: describes equipment requirements and general set up procedure.

3.   Section 6.4 Complete Unit Test Setup: describes how the items of test equipment are used together and general set up procedure.

4.   Section 6.5 Channel box test commands: provides detailed explanation of the different commands available using the test equipment and channel-box software.

5.   Section 6.6 Adjustment mode: describes adjustments available on the handheld unit.

6.2.   Any-Layer Interstitial Via Hole (ALIVH) PCBs

CAUTION

The telephone handset uses an ALIVH PCB assembly, the substrate of which is hydrophilic. To avoid damaging the ALIVH PCB, the specialist equipment and procedures described below must be employed when replacing suspect or faulty components.

6.2.1.   General Information

To reduce overall size and provide enhanced speech and data performance, an Any-Layer Interstitial Via Hole (ALIVH) PCB is used in this telephone. ALIVH PCBs are multi-layer boards which have an IVH structure in all inter-layers and can provide an inter-layer connection immediately under the land of a component. In addition, the PCB has no through holes and any number of layers can be interconnected.

As the specification and performance characteristics of ALIVH PCBs differ from that of conventional multi-layered boards, special attention is required when handling and repairing these assemblies.

Moisture Absorbency

The ALIVH PWB is more absorbent than a conventional PCB because of the nature of its material. Its aramid substrate is hydrophilic, i.e. it absorbs moisture from the air. If, after having absorbed moisture, the ALIVH PWB is submitted to re-flow or repair process, moisture in the board can suddenly evaporate and cause vapour explosion.

Copper Foil Peel Strength (Land Detachment Resistance)

The ALIVH PCB is slightly less resistant to copper detachment force than conventional boards. Therefore, it is necessary to ensure that solder is melted sufficiently before a component is removed from the board.

Warping Property

The ALIVH PCB has a smaller Young's Modulus and is therefore more pliant than conventional boards. It is important that the ALVIH PCB is not bent when component placement is performed.

6.2.2.   Repair Procedures

To prevent problems caused by moisture absorption, it will be necessary to perform dehydration of ALIVH PCBs in a suitable oven or similar heating device prior to repair. The boards should be heated at 85 °C for a duration of at least ten hours.

The repair should also be performed under the following conditions:

Soldering Iron

The temperature of the tip of the soldering iron should be 350 °C ±10 °C for an application time of five seconds or less.

Removal and re-mounting of components should be performed only once at any component position.

> **Note:**   *To avoid land detachment, do NOT apply excessive force on the soldering iron when heating the board. Ensure that the solder has melted sufficiently to allow component removal without damaging the board.*

Hot-Air Blower

The blower air temperature should be at:

295 °C ±5 °C for an application time of 120 seconds or less,

   or:

395 °C ±5 °C for an application time of 30 seconds or less.

Removal and re-mounting of components should be performed only once at any component position.

> **Note:** To avoid land detachment, do NOT apply excessive force on the soldering iron when heating the board. Ensure that the solder has melted sufficiently to allow component removal without damaging the board.

Re-flowing / Re-touching

1. Re-touching by soldering iron:

HAKKO 928 soldering iron is recommended.

900S-T-B tip for thicker solder joints and 900M-T-LB tip for thinner solder joints are recommended

2. Tip temperature/time

Normal pad : 325±10°C, less than five seconds

Large Pad : 400±10°C, less than five seconds

3. Pressure at solder tip

· Weight of soldering iron, (50gm) + 100gm to 150gm

· Do not exert pressure in the horizontal direction

4. Retouching small components

Pinch the component using two soldering irons and retouch within four seconds

6.3. External Testing

6.3.1. 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.

Testing and adjustment of the handheld unit can be performed with the outer case in place and the cradle connected. For in-depth fault finding the unit should first be disassembled, as detailed in Section 4, and then the PCB Repair Jig used to connect the PCBs together externally as they would be found in normal use. Fault tracing can then be performed on the PCBs using suitable test equipment, such as spectrum analysers and oscilloscopes.

The unit must now be tested and calibrated for both frequency bands (900 MHz and 1800 MHz).

6.3.2. Jigs and Tools

Interface Box (Part No. IFB003 / IFB004)

The Interface box provides:

IFB003: Voltage regulation for +7.2 V, +5.6 V or 4.8 V DC outputs. The +7.2 V switch setting is used as a supply to Li-Ion type batteries (compatible for other products), the 5.6 V switch setting is used for PCB testing and the 4.8 V switch setting is used for testing the complete unit.

Interface Box IFB004 is a later version that provides +4.8 V, +7.2V and +8.2 V DC outputs. It also allows selection of external power via the Interface cable.

RS 232 interface. Ensures that the Unit Under Test is supplied with the correct signal levels and format.

10016-1   FRONT   REAR
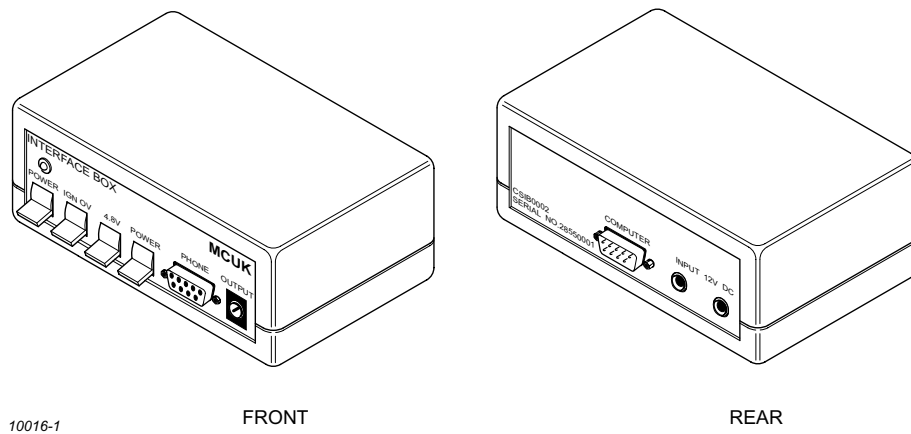
Figure 6.1: Interface Box IFB003 / IFB004

6.3.3. Personal Computer (PC)

The PC (IBM compatible) is used as a Unit Under Test controller. This in conjunction with the channel box software, allows all of the test facilities normally provided through the keypad of the Unit Under Test.

6.3.4. Power Supply

Provides 12 V DC supply to Interface box IFB003 or IFB004.

Test Battery (Part Number JT00042)

Provides 3.6 V DC supply to Interface Box IFB003 or IFB004 to compensate for the current drain when the Unit Under Test is used at full transmit power.

10017-1
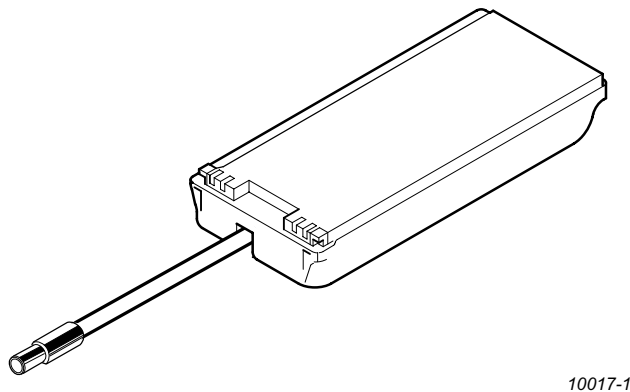
Figure 6.2: Test Battery

PCB Repair Jig (Part No. JT00057)

This unit provides the necessary connections between the Main and Keypad PCBs, and the connections between Main PCB and external test equipment.
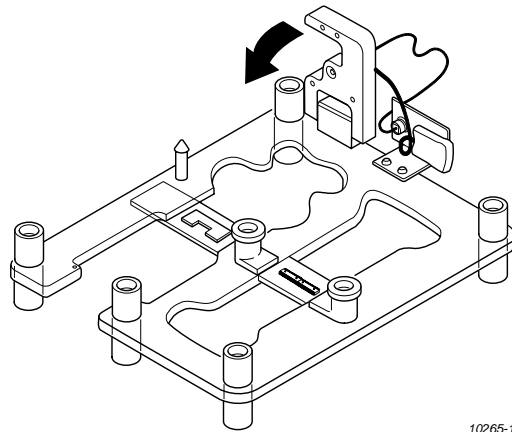
10265-1

Figure 6.3: PCB Repair Jig

RF Adaptor (Part No JT00055)

This unit provides an RF connection between the Unit Under Test and external test equipment.
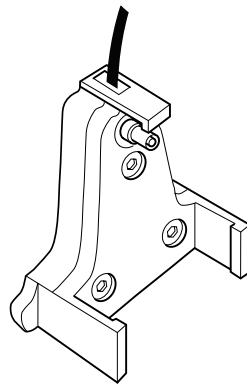
10232-1

Figure 6.4: RF Adaptor

GSM Tester

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

Interface Cable (Part No. JT00043)

The interface cable allows connection between a computer and the Unit Under Test via IFB003 or IFB004.
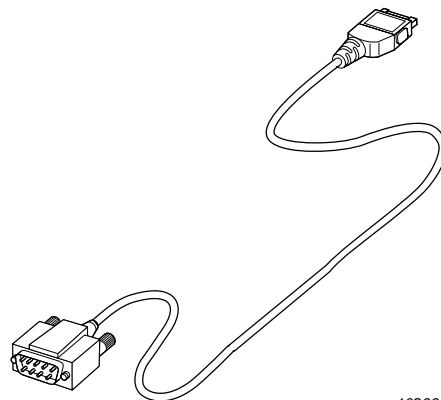
10266-1

Figure 6.5: Interface Cable

Battery Calibration Voltage Control Unit (Part No. JT00010)

The Battery Calibration Voltage Control Unit (BCVCU) provides three voltage levels (3 V, 4.1 V and 0 V) to the Test Battery, and is used during battery calibration checks. It is powered from the Interface Box.
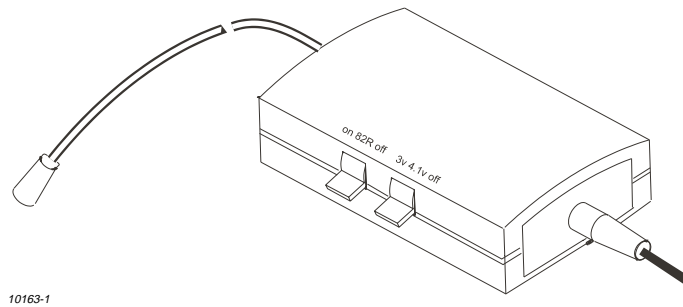
Figure 6.6: Battery Calibration Control Unit

6.3.5.   Channel Box Software

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

6.4.   Complete Unit Setup

+12V POWER SUPPLY

INTERFACE UNIT

PC

RS232

PCB REPAIR JIG

MAIN PCB

(INTERNAL CONNECTOR)

KEYPAD PCB

RF CABLE

GSM TESTER

PCB TEST SETUP

+12V POWER SUPPLY

INTERFACE UNIT

PC

RS232

RF TEST JIG

UNIT UNDER TEST

GSM TESTER

RF CABLE

COMPLETE UNIT TEST SETUP
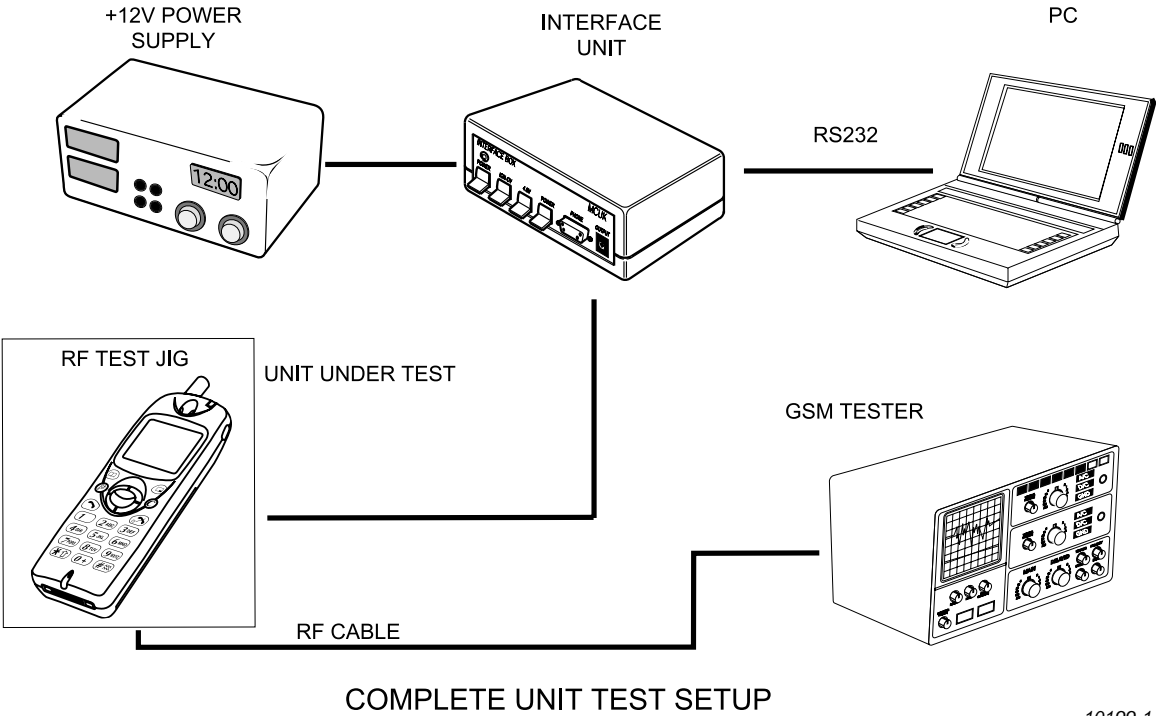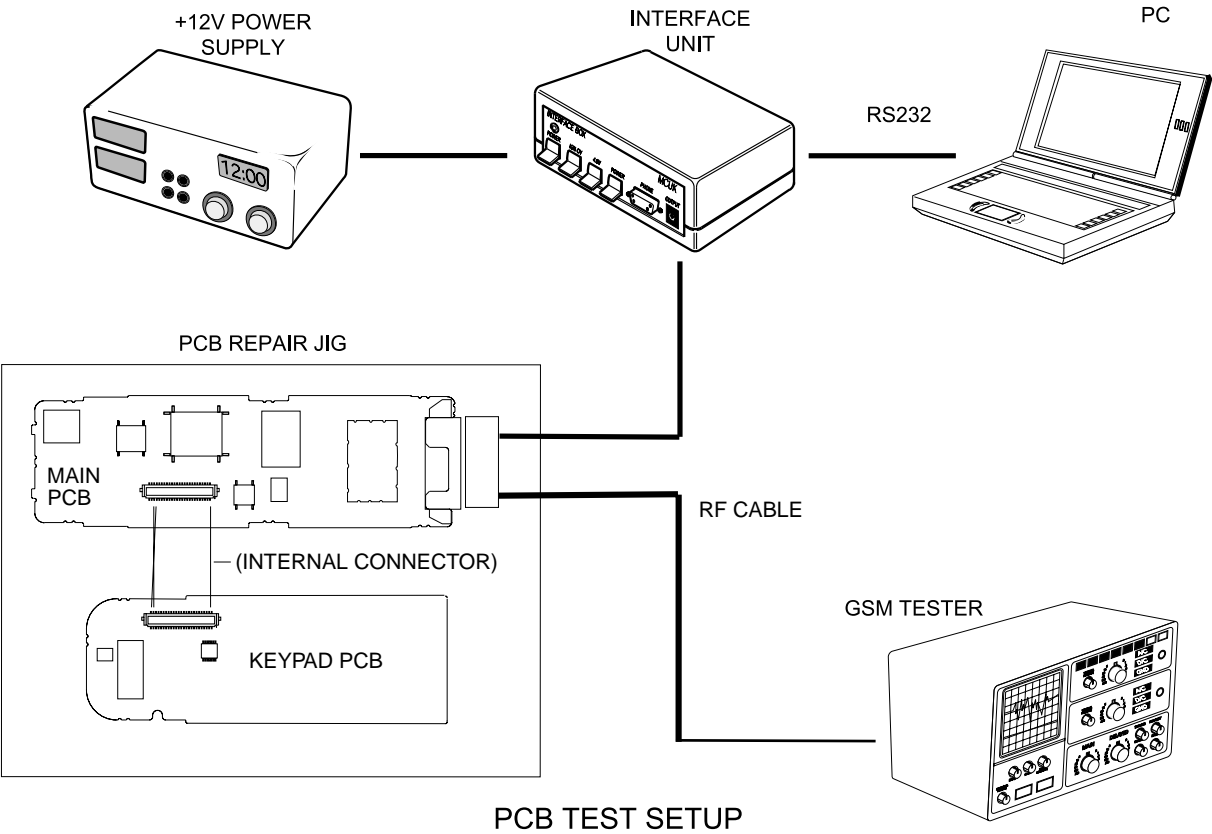
10199-1

Figure 6.7: Complete Unit Test Setup

6.4.1. External Testing Setup Procedure

IMPORTANT NOTE

To allow accurate measurement of the complete unit the test equipment must be connected as shown (Figure 6.6). The PCB Test Setup must be used to enable repair to PCBs. Once repair/replacement is complete, the assembled unit must be tested and calibrated with the jigs and tools connected as shown in Figure 6.7.

Full Test Equipment Requirements

For testing the handheld unit the following equipment is required:

1. Interface box
2. 12 V power supply
3. Personal computer (IBM compatible) with RS232 interface
4. RS232 interface cable (9 pin straight through connection)
5. GSM test station
6. RF Adaptor
7. Interface cable – JT00004

The channel box software (supplied on floppy disk) should be installed onto the main drive of the personal computer.

The RF cable is connected to the GSM test station via a suitable adapter. The 12 V supply is connected to the rear socket of the Interface box.

Two modes are available for testing the handheld unit:

1. Test Mode.

    The Test Mode facility allows various sections of the handheld unit to be individually activated.

2. Normal Mode.

    The Normal Mode facility allows the handheld unit to be powered externally for call origination/receiving operations.

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

Power On into Test Mode

1. Connect the test equipment into test mode configuration.

10238-1

Figure 6.8: External test equipment setup

2. Ensure that the following settings are made:

    a. Interface box IFB003 or IFB004
       Power: UP position
       IGN: UP position
       Mode   DOWN position
       Voltage   Middle Position (7.2 V)

b. Power supply
+12V DC: ON

c. PC
Channel box software loaded and the screen indicating as shown:

Figure 6.9: PC Screen (SCRN10)

3. Press ENTER on the PC keyboard.

4. At the PC press F10.

5. After approximately 1 second, set the Interface Cable switch to ON (position is marked by a dot).

> **NOTE:** *The display will read:*
> *GET STATION*
> *ADDRESS = _ _*
> *INFO = _ _*

The back light will be illuminated and all LEDs will be lit.

Go to Section 6.5 (Channel Box Test Commands) for further testing information.

Power On In Normal Mode

1. Connect the test equipment as shown in the diagram.
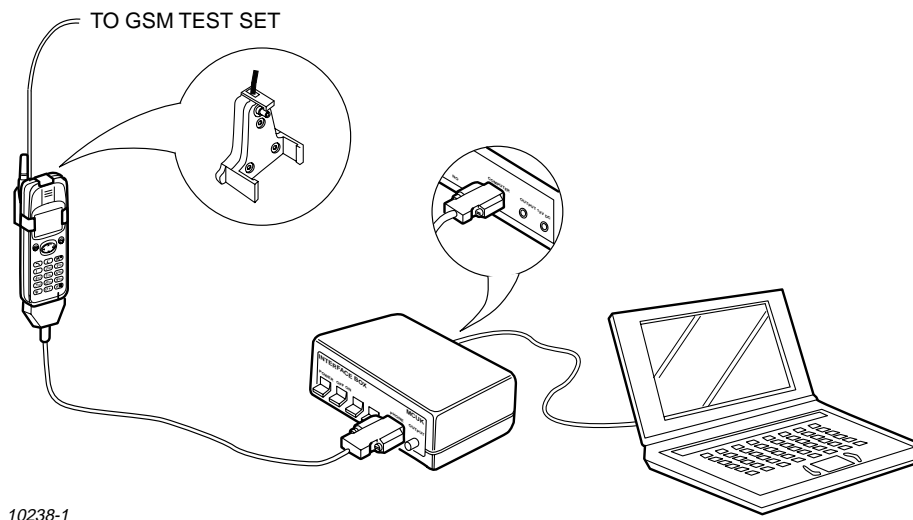
Figure 6.10: External test equipment setup

2. Ensure that the following settings are made:

a. Interface box IFB003 or IFB004
Power: DOWN position
IGN: UP position
MODE: UP position

b. Power supply:
+12V DC:ON

c. PC
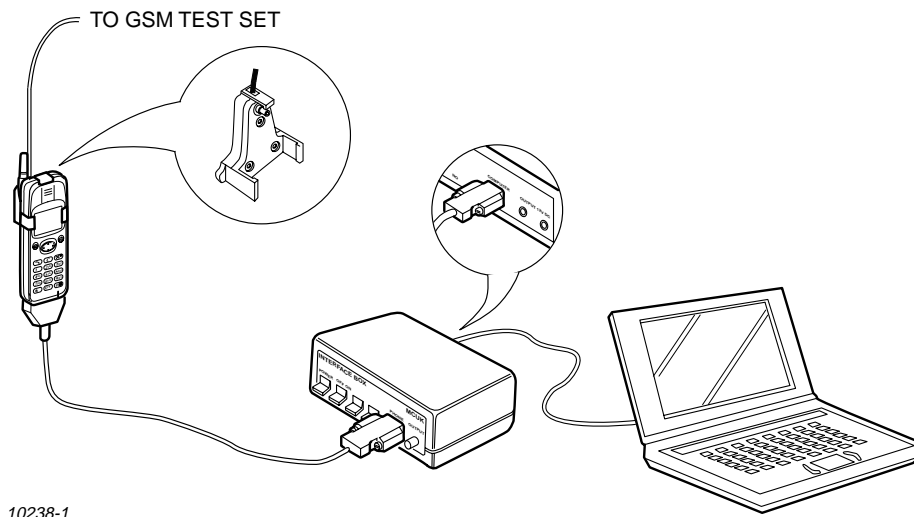Channel box software loaded and the screen indicating as shown:

```
┌─────────────────────────────────┐
│ TEST-SET MODE <CH-BOX>          │
│ NORMAL   MODE <Emulat>          │
│ SOFT-SIM MODE <Emulat>          │
└─────────────────────────────────┘
```

```
[ESC] to END of PROGRAM          10027-1
```

Figure 6.11: PC Screen (SCRN9)

3.   On the PC, select NORMAL MODE and press ENTER.

4.   Press F10 on the PC.

5.   After approximately 1 second, set the interface cable switch to ON (position is marked by a dot).

Entering Call Mode from Test Mode

Ensure that a fully-charged battery is attached to the telephone.

The screen of the PC should resemble the one shown below:

```
<<<  PANASONIC GD93 SERVICE BOX   VER: 1.00   >>>           2000/04/04 09:18:52
INITIALIZE <    INIT>----│SP LOOPBACK<    STOP>----│GET KEYCODE< ENABLE>----│
CHG CH GSM < 62>--------│PATH CONT  <    MOSO>----│CONTROL OUT<ALL OFF>----│
CHG CH DCS <698>--------│TAM CONT nf<PLAYOFF>----│CHECK LCD1 <      P1>----│
POWER LEVEL<   PL 5>----│VOL.BUZZ  <      ON>----│SET ER DISP< ENABLE>----│
TX DATA    <    OFF>----│VOL. SIDE  <    -8dB>----│SOFT SIM   < ENABLE>----│
RSSI (dBm) < CONT>------│VOL. MIC  <     0dB>----│TEST MODE  <    TERM>----│
SET AGC 1  <  +69dB>----│VOL. SP 1  <     0dB>----│SIM STATUS < SHOW>------│
SET AGC 2  <  +35dB>----│VOL. SP 2  <     0dB>----│CHECKSUM   <R-MCP>------│
SET AGC 3  <   +1dB>----│

NOTE: nf = no function

FW VER    [                   ]
IMEI      [004400870366596    ]        ████MOBILE BOOT OK████
PRDCT1    [uÇ               ]
PRDCT2    ['∂♀             ]
ST IN     [                   ]
SIM ID    [NO SIM! RESP = 0   ]
1:END    2:      3:      4:MEM  5:      6:PTDAT 7:UTDAT 8:      9:P OFF 0:P ON
                                                                     10384-1
```

Figure 6.12: PC Screen (SCRN11)

1.   At the PC, change the SOFT SIM field to read <ENABLE>. Press ENTER.

2.   At the PC, change the TEST MODE field to read <TERM>. Press ENTER.

     The UUT will power down and up again. If the UUT is connected to a GSM test set,after a delay of approximately five seconds, the UUT will register service.

3.   To return to test mode, set the SOFT SIM field to <DISABLE> and set the TEST MODE field to <TEST>. Press Enter.

6.5. Channel Box Test Commands

The following table outlines the commands available using the channel box software.

After the telephone unit has been switched on (Section 6.4), use the up / down cursor keys on the PC keyboard to select the channel box command. Use the left / right cursor keys to display the required indication and then press the ENTER key to select the displayed function.

CHANNEL BOX COMMAND	INDICATION	FUNCTION
TEST MODE	<TERM> <ReST>	Terminates test mode. Restarts test mode
INITIALIZE	<INIT>	When RETURN is pressed this will reset the default channel settings.
CHANGE CH GSM	<xxx>	Sets up predefined channel settings for GSM frequencies.
CHANGE CH DCS	<xxx>	Sets up predefined channel settings for DCS frequencies.
POWER LEVEL	<xxx>	Allows a specified power level to be set at the UUT.
TX DATA	<NRL 0> <NRL 1> <NRL R> <ACC R>	Sets TX Modulation to Normal burst DATA all 0s Normal burst DATA all 1s Normal burst DATA all random Access burst DATA random
RSSI (DBM)	<xxx>	Provides an RSSI reading on the User specified channel.
SET AGC 1 SET AGC 2 SET AGC 3	<xxx> <xxx> <xxx>	Allows changes to AGC levels on LOW, MIDDLE, HIGH channels.
SP LOOP BACK	<START> <STOP>	Provides an audio path for use with the GSM test station Sets audio loop-back from TX audio to RX audio without processing by the CODEC
PATH CONT	<MOSO> <MESI> <MESE> <MISI> <MISE>	Sets audio paths: MIC off speaker off MIC external speaker internal MIC external speaker external MIC internal speaker internal MIC internal speaker external
VOL. BUZZ	<xx>	Sets buzzer volume between values 0 to 3 (Min to Max)
VOL. SIDE	<xx>	Sets 4 side tone volume levels between 0dB and -18dB
VOL. MIC	<xx>	Sets 8 MIC volume levels between 26dB and 40dB
VOL. SP1	<xx>	Sets speaker pre-amp volume levels
VOL. SP2	<xx>	Sets speaker volume levels
GET KEY CODE	<ENABLE><DISABLE>	Displays the value of a key pressed on the keypad
CONTROL OUT	<LED R> <LED B> <CHARGE ON> <LED C> <HF ON> <ALL OFF> <ALL ON>	Switches on Incoming LED Switches on Backlight LEDs Switches charge sequence on LCD Switches on Charging LED Switches on handsfree mode Switches off all above Switches on all above
CHECK LCD1	<P1> <P2>	Provides 50% visual display of check pattern on the UUT LCD Provides 50% visual display of check pattern on the UUT LCD
SET ER.DISP	<ENABLE> <DISABLE>	Unit error codes will be displayed on the UUT display Unit error codes will not be displayed on the UUT display
SOFT SIM	<ENABLE> <DISABLE>	With ENABLE set and TEST MODE <TERM> the UUT is removed from test mode and can be placed into call mode

CHANNEL BOX COMMAND	INDICATION	FUNCTION
TEST MODE	<TERM>	With SOFT SIM <ENABLED> the UUT will be removed from test mode and can be placed into a call
SIM STATUS	<SHOW>	Checks and displays the SIM status
CHECK SUM	<SHOW>	Displays the software checksum

6.6. Adjustment Mode

6.6.1. RF Calibration Procedure

> **NOTE:** *See Section 6.2 for a list of the equipment and setup procedures required to perform the following adjustment and calibration procedures.*

The following procedures MUST be performed after replacement or repair of one or both of the PCBs in the handheld unit. Failure to do so may result in incorrect operation of the telephone.

The following adjustments MUST be made on BOARD PAIRS.

There are three distinct calibration procedures to adjust RF performance. These procedures are:

1. Ramping gain (Section 6.6.1)

2. RSSI (Section 6..6.2)

3. I and Q values (Section 6.6.3)

The adjustment data selected during calibration is stored in Flash ROM.


```
<<< PANASONIC GD93 SERVICE BOX    VER: 1.00   >>>              2000/04/04 09:57:39
INITIALIZE <   INIT>----|SP LOOPBACK<    STOP>----|GET KEYCODE< ENABLE>----|
CHG CH GSM < 62>     ACK|PATH CONT  <    MOSO>----|CONTROL OUT<ALL OFF>----|
CHG CH DCS <698>--------|TAM CONT nf<PLAYOFF>----|CHECK LCD1 <     P1>----|
POWER LEVEL<   PL14>ACK |VOL BUZZ   <     ON>----|SET ER DISP< ENABLE>----|
TX DATA    <   NRL R>ACK|VOL SIDE   <   -8dB>----|SOFT SIM   < ENABLE>----|
RSSI (dBm) < CONT>------|VOL MIC    <    0dB>----|TEST MODE  <    TERM>----|
SET AGC 1  < +69dB>----|VOL SP 1    <    0dB>----|SIM STATUS < SHOW>------|
SET AGC 2  < +35dB>----|VOL SP 2    <    0dB>----|CHECKSUM   <R-MCP>------|
SET AGC 3  <  +1dB>----|

    NOTE: nf = no function

FW VER    [                  ]      MOBILE BOOT OK
IMEI      [0044D0870366596   ]      CHG_CH
PRDCT1    [uC                ]      SET_PL14
PRDCT2    ['ðŷ               ]      TX_DAT_NR
ST IN     [                  ]
SIM ID    [NO SIM! RESP = 0  ]
1:END   2:    3:    4:MEM   5:    6:P1DAT 7:V1DAT 8:    9:P OFF 0:P ON
```
10340-1

Figure 6.13: Test software screen

6.6.2. Ramping Gain

The carrier power must be measured and calibrated for each power level at channel 62.

GSM 900

Power Level (PL)	Output Power (dBm)				
	Nominal	Target		Spec	
		Min	Max	Min	Max
5	32.3	32.0	32.6	31.8	32.8
6	30.9	30.4	31.4	30.0	31.8
7	29	28.5	29.5	28	30
8	27	26.5	27.5	26	28
9	25	24.5	25.5	24	26
10	23	22.5	23.5	22	24
11	21	20.5	21.5	20	22
12	19	18.5	19.5	18	20
13	17	16.5	17.5	16	18
14	15	14.5	15.5	14	16
15	13	12.5	13.5	12	14
16	11	10.5	11.5	10	12
17	9	8.5	9.5	8	10
18	7	6.5	7.5	6	8
19	5	4.5	5.5	4	6

GSM 1800

Power Level (PL)	Output Power (dBm)				
	Nominal	Target		Spec	
		Min	Max	Min	Max
0	29.05	28.8	29.3	28.8	29.3
1	27.8	27.3	28.3	27.0	28.8
2	26	25.5	26.5	25	27
3	24	23.5	24.5	23	25
4	22	21.5	22.5	21	23
5	20	19.5	20.5	19	21
6	18	17.5	18.5	17	19
7	16	15.5	16.5	15	17
8	14	13.5	14.5	13	15
9	12	11.5	12.5	11	13
10	10	9.5	10.5	9	11
11	8	7.5	8.5	7	9
12	6	5.5	6.5	5	7
13	4	3.5	4.5	3	5
14	2	1.5	2.5	1	3
15	0	-0.5	0.5	-1	1

The carrier power must be measured and calibrated for each power level at channel 62.

Calibration of output power on each power level

> **NOTE:** To ensure that the telephone operates within set SAR margins, Panasonic recommends that a power meter capable of measurement to an accuracy of ±0.2 dB is used when calibrating power levels. Use of a less accurate power meter may result in the telephone failing to meet SAR standards.

1. Power on the telephone in Test Set Mode.

2. Scroll down the menu until CHANGE CH <62> is highlighted and then press ENTER.

3. Scroll down the menu until PL <5> is highlighted. Use the left and right cursor keys to select <14>. Press ENTER.

4. Scroll down the menu until TX DATA <OFF> is highlighted. Using the left / right cursor keys, highlight <NRL R> and press ENTER.

5. At the power meter, measure the peak power.

6. If measured power is in the range of the target power, then proceed to step 10.

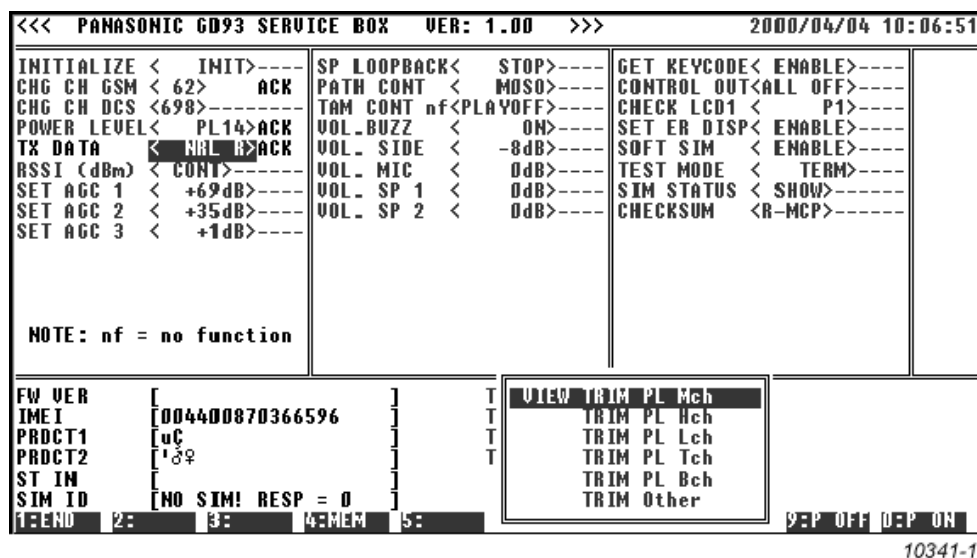7. At the Channel box, press F7 to view the TRIM for the mid-channel.

```
<<<  PANASONIC GD93 SERVICE BOX   VER: 1.00   >>>           2000/04/04 10:06:51
INITIALIZE <    INIT>----  SP LOOPBACK<     STOP>----  GET KEYCODE< ENABLE>----
CHG CH GSM < 62>     ACK  PATH CONT  <     MOSO>----  CONTROL OUT<ALL OFF>----
CHG CH DCS <698>--------  TAM CONT nf<PLAYOFF>----  CHECK LCD1 <       P1>----
POWER LEVEL<   PL14>ACK   VOL.BUZZ   <       ON)----  SET ER DISP< ENABLE>----
TX DATA    <   NRL R>ACK  VOL. SIDE  <    -8dB>----  SOFT SIM   < ENABLE>----
RSSI (dBm) < CONT>------  VOL. MIC   <     0dB>----  TEST MODE  <     TERM>----
SET AGC 1  <  +69dB>----  VOL. SP 1  <     0dB>----  SIM STATUS < SHOW>------
SET AGC 2  <  +35dB>----  VOL. SP 2  <     0dB>----  CHECKSUM   <R-MCP>------
SET AGC 3  <   +1dB>----

  NOTE: nf = no function

FW VER     [                    ]  T  VIEW TRIM PL Mch
IMEI       [004400870366596     ]  T     TRIM PL Hch
PRDCT1     [uÇ                  ]  T     TRIM PL Lch
PRDCT2     ['ठ९                 ]  T     TRIM PL Tch
ST IN      [                    ]        TRIM PL Bch
SIM ID     [NO SIM! RESP = 0              TRIM Other
1:END   2:      3:      4:MEM   5:                      9:P OFF 0:P ON
```
10341-1

Figure 6.14: Power level view 1

8. Select VIEW TRIM PL MCH, and make a note of this value.

```
<<<  PANASONIC GD93 SERVICE BOX   VER: 1.00   >>>           2000/04/04 10:06:51
INITIALIZE <    INIT>----  SP LOOPBACK<           ┌─── M ch ───┐
CHG CH GSM < 62>     ACK  PATH CONT  <       PL5  GSM =   78    PL0  DCS =  91
CHG CH DCS <698>--------  TAM CONT nf<PLA      PL6  GSM =   72    PL1  DCS = 202
POWER LEVEL<   PL14>ACK   VOL.BUZZ   <         PL7  GSM =   26    PL2  DCS = 190
TX DATA    <   NRL R>ACK  VOL. SIDE  <         PL8  GSM =   38    PL3  DCS =  54
RSSI (dBm) < CONT>------  VOL. MIC   <         PL9  GSM =  209    PL4  DCS =  58
SET AGC 1  <  +69dB>----  VOL. SP 1  <         PL10 GSM =   29    PL5  DCS = 190
SET AGC 2  <  +35dB>----  VOL. SP 2  <         PL11 GSM =  126    PL6  DCS = 178
SET AGC 3  <   +1dB>----                        PL12 GSM =   73    PL7  DCS = 219
                                               PL13 GSM =  109    PL8  DCS = 146
                                               PL14 GSM =   14    PL9  DCS = 191
                                               PL15 GSM =  221    PL10 DCS =  81
                                               PL16 GSM =   87    PL11 DCS = 190
  NOTE: nf = no function                        PL17 GSM =  226    PL12 DCS =  86
                                               PL18 GSM =  243    PL13 DCS = 190
FW VER     [                    ]              PL19 GSM =   56    PL14 DCS = 221
IMEI       [004400870366596     ]                                 PL15 DCS = 159
PRDCT1     [uÇ                  ]
PRDCT2     ['ठ९                 ]
ST IN      [                    ]
                HIT ANY KEY
1:END   2:      3:      4:MEM   5:        6:PTDAT 7:VTDAT 8:      9:P OFF 0:P ON
```
10342-1

Figure 6.15: Power level 2

9. Perform the following calculation and make a note of the result:

    New Trim Value = Old TrimValue + (Required Power - Measured Power) x Change per dB
                   (step 5)   (table)   (step 2)   (table)

10. At the Channel box, press F6 to program the TRIM for the mid-channel.

Figure 6.16: Power level selection 1

11. Select PROGRAM TRIM PL MCH GSM.

Figure 6.17: Power level selection 2

12. Highlight the PL14 fieldand press ENTER.

```
<<< PANASONIC GD93 SERVICE BOX   VER: 1.00   >>>      2000/04/04 10:28:09

INITIALIZE <    INIT>----  SP LOOPBACK<    STOP>----  GET KEYCODE< ENABLE>----
CHG CH GSM < 62>     ACK   PATH CONT  <    MOSO>----  CONTROL OUT<ALL OFF>----
CHG CH DCS <698>--------   TAM CONT nf<PLAYOFF>----  CHECK LCD1 <     P1>----
POWER LEVEL<    PL14>ACK   VOL.BUZZ   <      ON>----  SET ER DISP< ENABLE>----
TX DATA    <  NHL H>ACK    VOL. SIDE  <    -8dB>----  SOFT SIM   < ENABLE>----
RSSI (dBm) < CONT>------   VOL. MIC   <     0dB>----  TEST MODE  <    TERM>----
SET AGC 1  <   +69dB>----  VOL. SP 1  <     0dB>----  SIM STATUS < SHOW>------
SET AGC 2  <   +35dB>----  VOL. SP 2  <     0dB>----  CHECKSUM   <R-MCP>------
SET AGC 3  <    +1dB>----



   NOTE: nf = no function


FW VER      [                  ]
IMEI        [004400870366596   ]      PL14 GAIN GSM
PRDCT1      [uC                ]      Mch PL14 GSM GAIN [0-255][_   ]
PRDCT2      ['ô♀              ]
ST IN       [                  ]
SIM ID      [NO SIM! RESP = 0  ]
1:END   2:      3:      4:MEM   5:      6:PTDAT 7:VTDAT 8:      9:P OFF 0:P ON
```
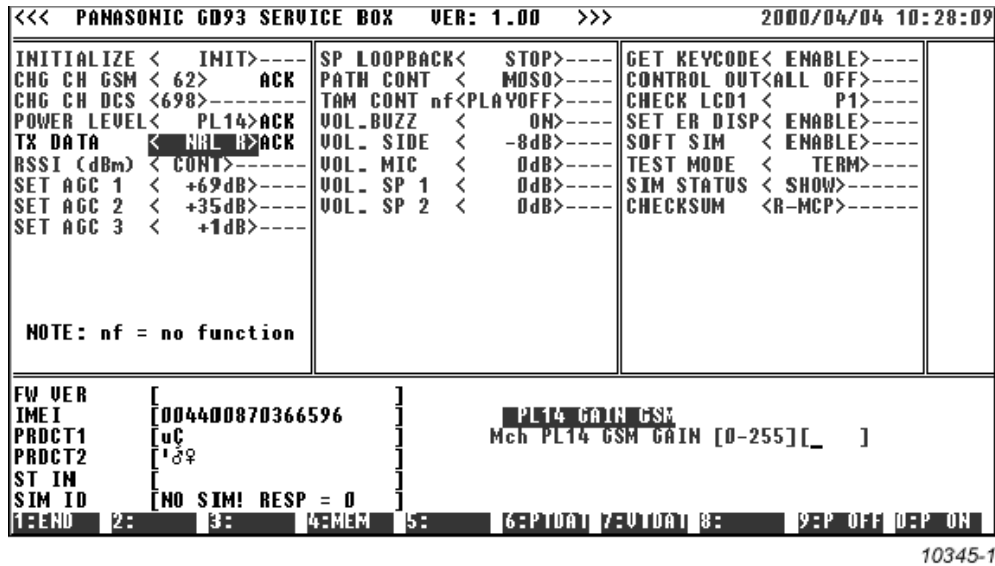
10345-1

Figure 6.18: Power level selection 3

13. Enter the value calculated in step 9 into the data field and then press ENTER.

14. Press ESC.

15. Re-measure the peak power.

16. Repeat steps 5 to 14 for the remaining power levels, in the following order:

    PL6, PL9, and PL19.
    Power levels between PL9 and PL6.
    Power levels between PL14 and PL9.
    Power levels between PL19 and PL14.

17. Calibrate PL15 (limits ±0.2 dB).

18. After calibrating at channel 62, the carrier power must be measured and calibrated at LOW and HIGH channels as shown in the table below.

Channel	GSM 900	GSM 1800
Bottom	-	512
Low	1	(698)
Mid	62	698
High	124	(698)
Top	-	885

19. Repeat steps 2 to 14 for the GSM 1800 settings in the following order:

    PL10 (limits ±0.5 dB).
    PL1, PL5, and PL15.
    Power levels between PL1 and PL4.
    Power levels between PL15 and PL10.
    Power level PL0 (limits ±0.2 dB).

20. Save TRIM data.

6.6.3. RSSI

This procedure describes the calibration of RSSI on the mid-channel. This procedure must also be carried out for low / bottom channel and high / top channel.

The procedure is as follows:

1. Power the telephone into Test Set mode in the service channel box.

2. Connect the telephone to the GSM Test Set and apply a carrier frequency of 68 kHz (for channel 60 = 947.00 MHz) at an input level of -90 dBm.

3. At the channel box, highlight CHANGE CH, and, using the left / right cursor keys, select CH <60>. Press ENTER.

4. Highlight the SET AGC1 field and change the set value to 45 dB. Press ENTER.

5. Highlight the RSSI dBm <> field and press ENTER

Figure 6.19: RSSI dB field

6. If the measured power is not -90 ±1, then make the following calculation:

    RSSI offset value = [-(90 + MEASURED RSSI VALUE)] x 2
    =[-90 - MEASURED RSSI VALUE] x 2,

    for example [-(90 + (95))] x 2
    = [-90 - (-95)] x 2
    = 10

    Record the result.

7. At the channelbox, press F7 to view data.
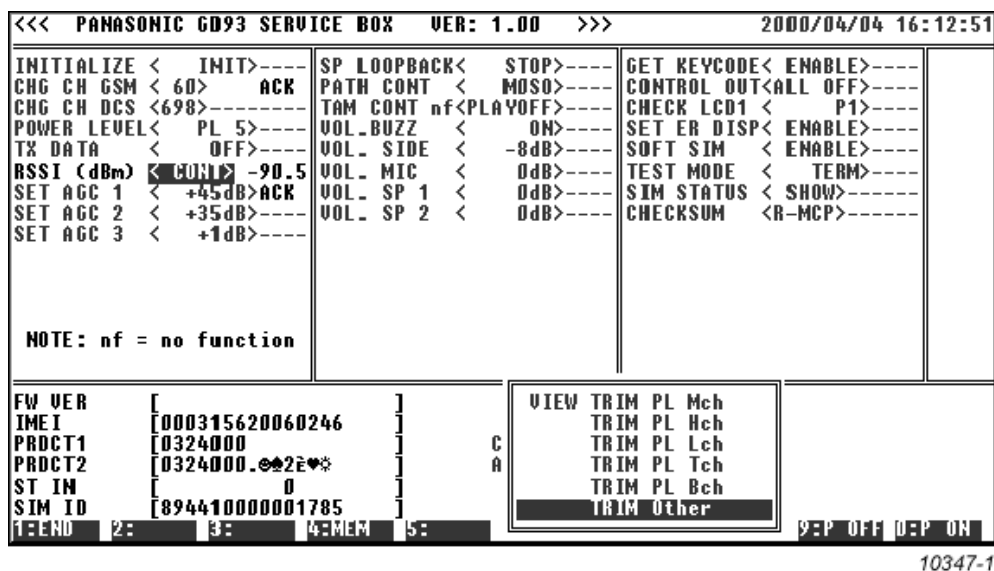
Figure 6.20: RSSI reading 1

8. Select TRIM OTHER and make a note of the RSSI COMP GSM reading.
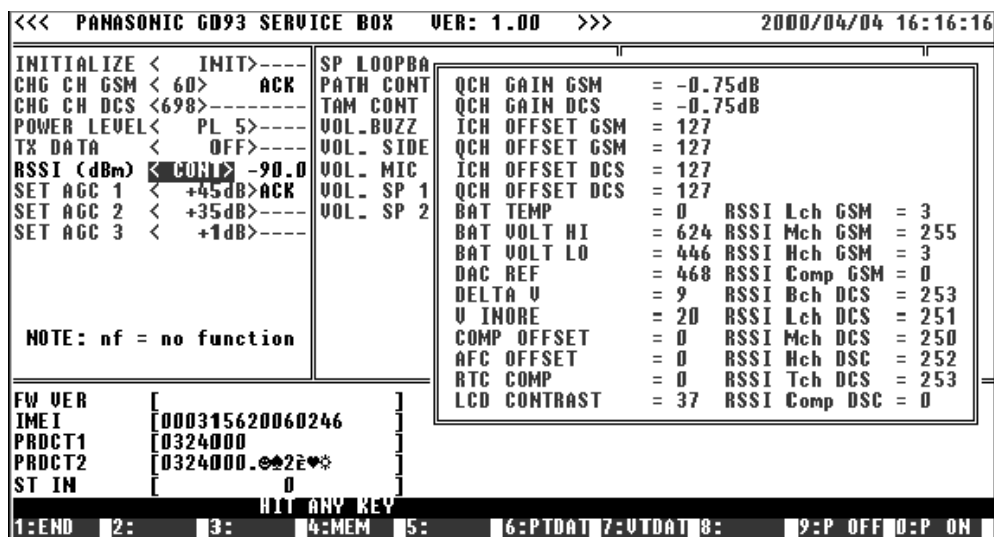
Figure 6.21: RSSI reading 2

9. Press ESC.

10. At the Channel box, press F6 to program data.

```
<<<  PANASONIC GD93 SERVICE BOX   VER: 1.00   >>>        2000/04/04 16:19:58

INITIALIZE <   IMIT>---- SP LOOPBACK<    STOP>---- GET KEYCODE< ENABLE>----
CHG CH GSM < 60>    ACK  PATH CONT  <    MOSO>---- CONTROL OUT<ALL OFF>----
CHG CH DCS <698>-------- TAM CONT nf<PLAYOFF>---- CHECK LCD1 <      P1>----
POWER LEVEL<   PL 5>---- VOL.BUZZ   <      ON>---- SET ER DISP< ENABLE>----
TX DATA    <    OFF>---- VOL. SIDE  <    -8dB>---- SOFT SIM   < ENABLE>----
RSSI (dBm) < CONT> -90.0 VOL. MIC   <     0dB>---- TEST MODE  <    TERM>----
SET AGC 1  < +45dB>ACK   VOL. SP 1  <     0dB>---- SIM STATUS < SHOW>------
SET AGC 2  < +35dB>----  VOL. SP 2  <     0dB>---- CHECKSUM     <R-MCP>------
SET AGC 3  <  +1dB>----

                                      PROG TRIM PL Mch GSM
                                           TRIM PL Hch GSM
                                           TRIM PL Lch GSM
                                           TRIM PL Mch DCS
                                           TRIM PL Hch DCS
   NOTE: nf = no function                  TRIM PL Lch DCS
                                           TRIM PL Tch DCS
                                           TRIM PL Bch DCS
FW VER     [            ]                   TRIM RSSI
IMEI       [000315620060246   ]            TRIM Other
PRDCT1     [0324000          ]
PRDCT2     [0324000.●♠2è♥☼    ]
ST IN      [        0         ]
SIM ID     [894410000001785   ]
1:END  2:     3:     4:MEM   5:     6:PTDAT 7:VTDAT 8:      9:P OFF 0:P ON
```

10349-1

Figure 6.22: RSSI reading 3

11. Select TRIM RSSI and press ENTER.

12. Highlight RSSI Mch GSM and press ENTER.

13. Make the following calculation:
    RSSI Offset Value (step 8) + reading noted in step 6.
    Enter the result in to the RSSI Mch field.

14. Press ENTER.

15. Press ESC.

16. Measure the RSSI level again by highlighting the RSSI dBm field again and press ENTER.

17. Repeat steps 6 to 16 for both low / bottom and high / top channels.

Channel	GSM 900
Low / bottom	1
Mid	60
High / top	111

18. Repeat steps 6 to 16 for GSM 1800 on the following channels with the SET AGC 1 field set to 51 dB:

Channel	GSM 1800
Bottom / low	512
Mid	650
High / top	885

19. Save TRIM Data.

6.6.4. Battery Calibration

Preliminaries

There are three procedures to calibrating the battery, voltage, temperature and charging calibration. A Battery Calibration Voltage Control Unit (BCVCU) is used to provide the necessary voltage levels for these checks. The BCVCU replaces the two regulated power supplies and 82 Ohm resistor required to caibrate previous mobile products.

1. Connect the telephone, test battery, BCVCU and Interface Box as shown in the diagram below.
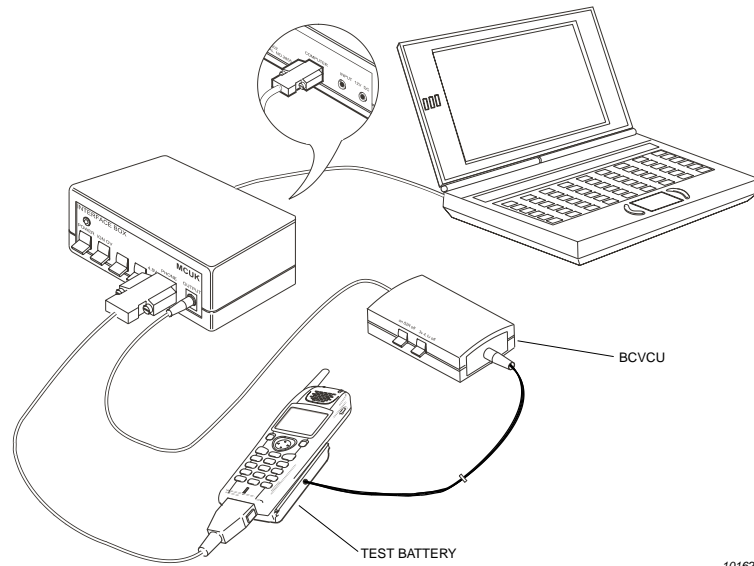
Figure 6.23: Battery calibration test conections

2. Set the Interface box to POWER ON, IGN and EXT PWR OFF.

Voltage Calibration

1. Enter Test-Set mode in Service Channel Box.

Figure 6.24: Battery calibration 1

2. Press F4 and select VIEW ADC LINES.

3. Observe the ADIN1 value. This value is BAT VOLT HIGH. If this reading is outside the range 564 - 664, then there is a fault and further investigation is required. Otherwise, record this value for later use.

10354-1
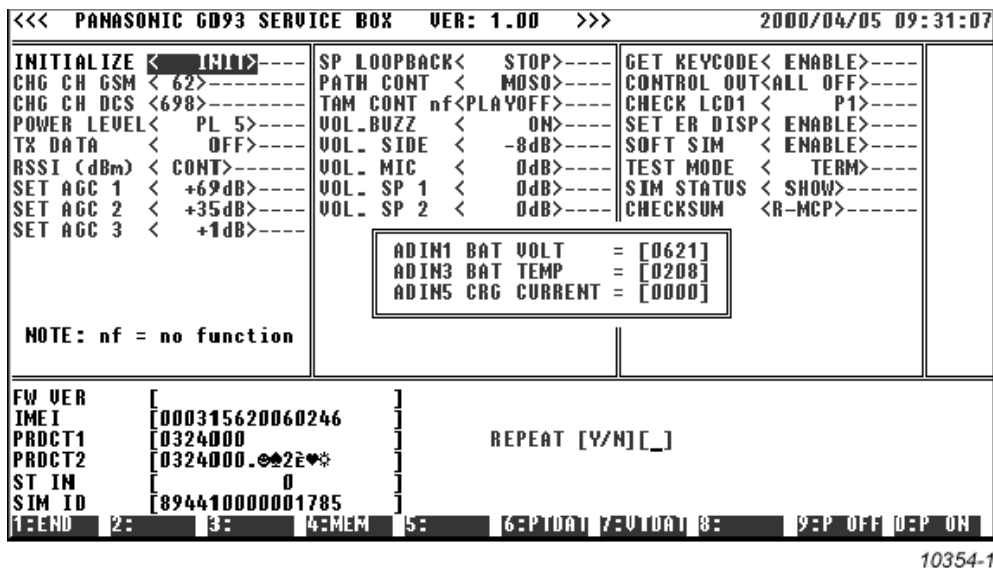
Figure 6.25: Battery calibration 2

4. Set VBAT to 3.0 V by selecting 3.0 V on the BCVCU.

5. On the PC, press 'Y' and then ENTER.

6. Check the ADIN1 reading again - this is the BAT VOLT LOW value. If the reading is outside the range 390 - 490, there is a fault and further investigation is required. Otherwise, record this value for use later.

7. Press 'N' in the {repeat yes / no box}, then press ENTER.

8. Press F6. Scroll down to, and select TRIM OTHER.

9. Scroll down to, and select BAT VOLT HIGH. Enter the value recorded in step 3.

10355-1
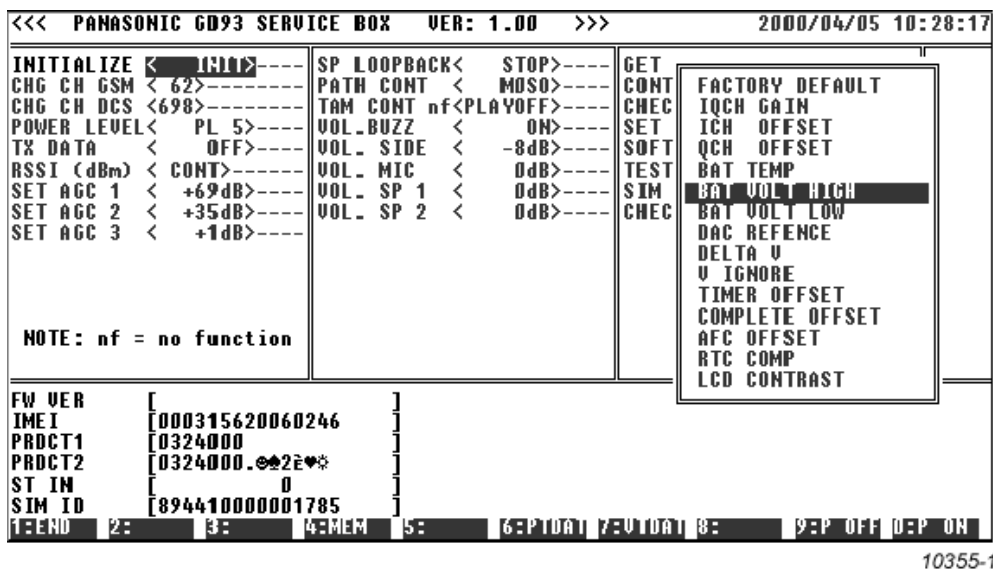
Figure 6.26: Battery Calibration 3

10. Press F6. Scroll down to TRIM OTHER and press ENTER.

11. Highlight BAT VOLT HIGH and press ENTER. Type in the value recorded in step 6.

```
<<<  PANASONIC GD93 SERVICE BOX   VER: 1.00   >>>        2000/04/05 10:28:17
INITIALIZE <    INIT>----  SP LOOPBACK<    STOP>----  GET KEYCODE< ENABLE>----
CHG CH GSM < 62>--------   PATH CONT  <    MOSO>----  CONTROL OUT<ALL OFF>----
CHG CH DCS <698>--------   TAM CONT nf<PLAYOFF>----  CHECK LCD1 <      P1>----
POWER LEVEL<   PL 5>----   VOL.BUZZ   <      ON>----  SET ER DISP< ENABLE>----
TX DATA    <    OFF>----   VOL. SIDE  <    -8dB>----  SOFT SIM   < ENABLE>----
RSSI (dBm) < CONT>------   VOL. MIC   <     0dB>----  TEST MODE  <    TERM>----
SET AGC 1  <  +69dB>----   VOL. SP 1  <     0dB>----  SIM STATUS < SHOW>----
SET AGC 2  <  +35dB>----   VOL. SP 2  <     0dB>----  CHECKSUM    <R-MCP>------
SET AGC 3  <   +1dB>----


       NOTE: nf = no function


FW VER     [                    ]
IMEI       [000315620060246     ]        BAT VOLT LOW
PRDCT1     [0324000             ]        VBAT LO [0-9999][    ]
PRDCT2     [0324000.            ]
ST IN      [          0         ]
SIM ID     [894410000001785     ]
1:END   2:      3:      4:MEM   5:      6:P1DAT 7:V1DAT 8:      9:P OFF 0:P ON
```
10356-1

Figure 6.27: Battery calibration 4

12. Set the BCVCU to 12 V.

Temperature Calibration

1. Ensure that VBAT is set to 4.1 V. Check that EXT PWR and IGN on the Interface Box is set to OFF.

2. Scroll up the menu until CONTROL OUT is highlighted. Using the left / right cursor keys, highlight AADC ON and then press ENTER.

3. Press F4 and select VIEW ADC LINES.

4. Check the value for ADIN3 (BAT TEMP). If the value is outside the range 168 - 248, then there is a fault and further investigation is required. Otherwise, subtract this value from the theoretical value of 208 and record the result for later use.
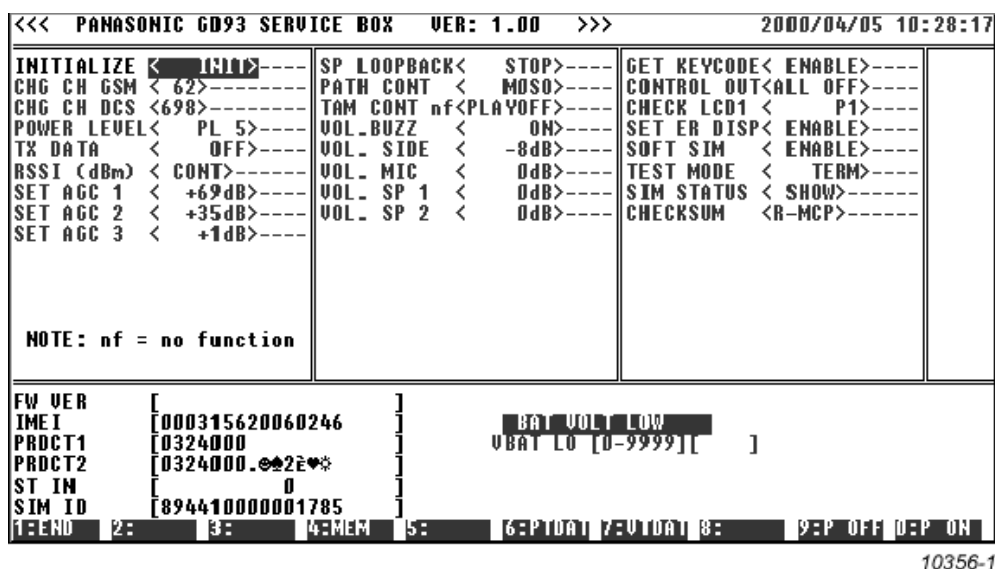
```
<<<  PANASONIC GD93 SERVICE BOX   VER: 1.00   >>>        2000/04/05 11:11:21
INITIALIZE <    INIT>----  SP LOOPBACK<    STOP>----  GET KEYCODE< ENABLE>----
CHG CH GSM < 62>--------   PATH CONT  <    MOSO>----  CONTROL OUT<ALL OFF>----
CHG CH DCS <698>--------   TAM CONT nf<PLAYOFF>----  CHECK LCD1 <      P1>----
POWER LEVEL<   PL 5>----   VOL.BUZZ   <      ON>----  SET ER DISP< ENABLE>----
TX DATA    <    OFF>----   VOL. SIDE  <    -8dB>----  SOFT SIM   < ENABLE>----
RSSI (dBm) < CONT>------   VOL. MIC   <     0dB>----  TEST MODE  <    TERM>----
SET AGC 1  <  +69dB>----   VOL. SP 1  <     0dB>----  SIM STATUS < SHOW>----
SET AGC 2  <  +35dB>----   VOL. SP 2  <     0dB>----  CHECKSUM    <R-MCP>------
SET AGC 3  <   +1dB>----       ADIN1 BAT VOLT  = [0621]
                              ADIN3 BAT TEMP   = [0208]
                              ADIN5 CRG CURRENT = [0000]
       NOTE: nf = no function


FW VER     [                    ]
IMEI       [000315620060246     ]
PRDCT1     [0324000             ]        REPEAT [Y/N][ ]
PRDCT2     [0324000.            ]
ST IN      [          0         ]
SIM ID     [894410000001785     ]
1:END   2:      3:      4:MEM   5:      6:P1DAT 7:V1DAT 8:      9:P OFF 0:P ON
```
10357-1

Figure 6.28: Temperature calibration 1

5. Press 'N' in the {repeat yes/no box}, then press ENTER.

6. Press F6. Scroll down and highlight TRIM OTHER. Press ENTER.

7. Highlight BAT TEMP and press ENTER to select. Enter the value recorded in step 4.

Figure 6.29: Temperature calibration 2

Charging Calibration

1. On the Interface Box, ensure that the EXT PWR switch is ON. Check that the BCVCU 82 Ohms switch is set to ON.

2. Holding down the Shift key, press F4. Select PROG CHARG-DAC DATA.

Figure 6.30: Charging calibration 1

3. Enter a value of 439.

4. Highlight CNTROL OUT and, using the left / right cursor keys, select CHAR ON. Press ENTER.

10360-1
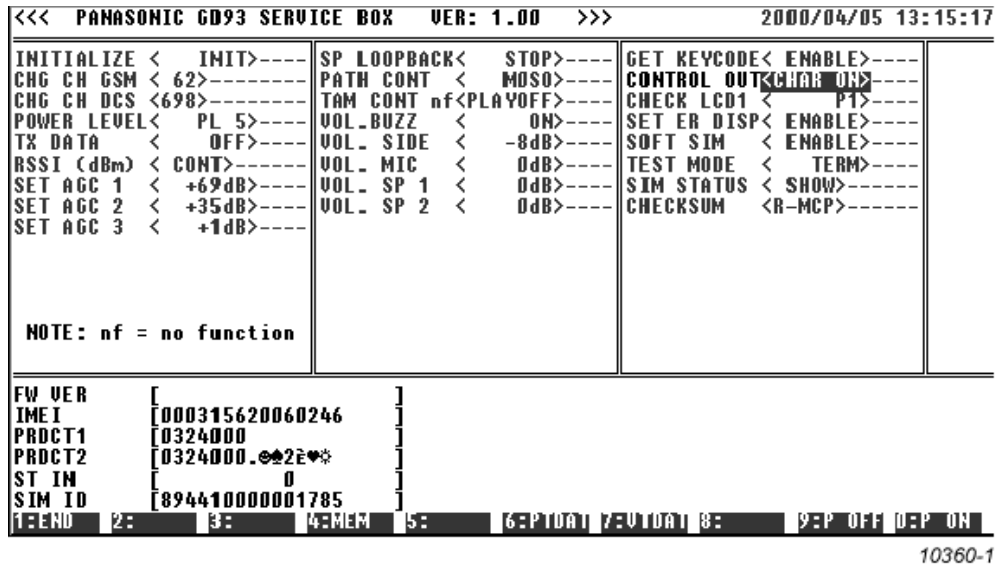
Figure 6.31: Charging Calibration 2

5. Disconnect VBAT by setting the BCVCU Voltage switch to OFF.

6. Measure the voltage across the Test Battery terminals. If the voltage is within the range 4.2 V ±5 mV, proceed to step 11. Otherwise, calculate the difference (DAC STEP) as follows:

    difference = (measured voltage - 4.2 V) / 7.4 mV

7. Press Shift + F4.

8. Scroll down and select PROG CHARG-DAC DATA and enter the value calculated by subtracting the value recorded in step 6 from the initial CHARG-DAC DATA value (439).

9. Repeat steps 6 to 8 until the measured voltage is 4.2 V ±5 mV.

10. If the final value is outside the range 342 - 542, then there is a fault and further investigation is required. Otherwise, record the value for use later.

11. Press F6. Highlight TRIM OTHER and press ENTER. Highlight DAC REFERENCE and press ENTER.

10361-1
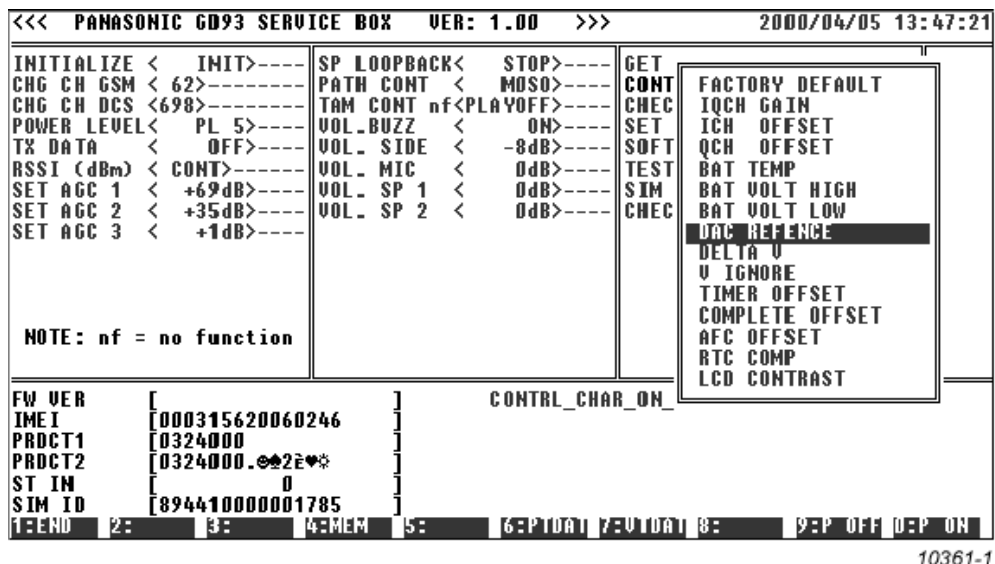
Figure 6.32: Charging calibration 3

12. Enter the value recorded in step 10.

10362-1

Figure 6.33: Charging calibration 4

Current Charging ADC Calibration

It is important to monitor the current when charging the Li-ion battery, both to protect against over-current and to determine when charging is complete. The telephone uses the VCC3 and MADC (ICHG) connections of OMEGA to measure charging current as an amplified voltage across a sense resistor.

>   *NOTE:* This calibration procedure MUST be carried out once Charging Voltage calibration has been completed.

1.   Press F4 and select VIEW ADC LINES. Read ADIN5 (CRG CURRENT) and record this value.

10363-1

Figure 6.34: ADC Calibration

2.   If this value is outside the range 101 - 251, then there is a fault and further investigation is required. Otherwise, calculate the difference between the recorded value and the theoretical value of 161. Record this value for use later.

3.   Press F6 and select TRIM OTHER. Select COMP OFFSET and enter the value recorded in step 2.

4.   Press F9. Wait for the prompt "Saving EV Trim data" to disappear, turn OFF the power supplies and disconnect the telephone.

7 REPLACEMENT PARTS LIST

7.1. Exploded Diagrams

7.1.1. Case and Cover Assemblies
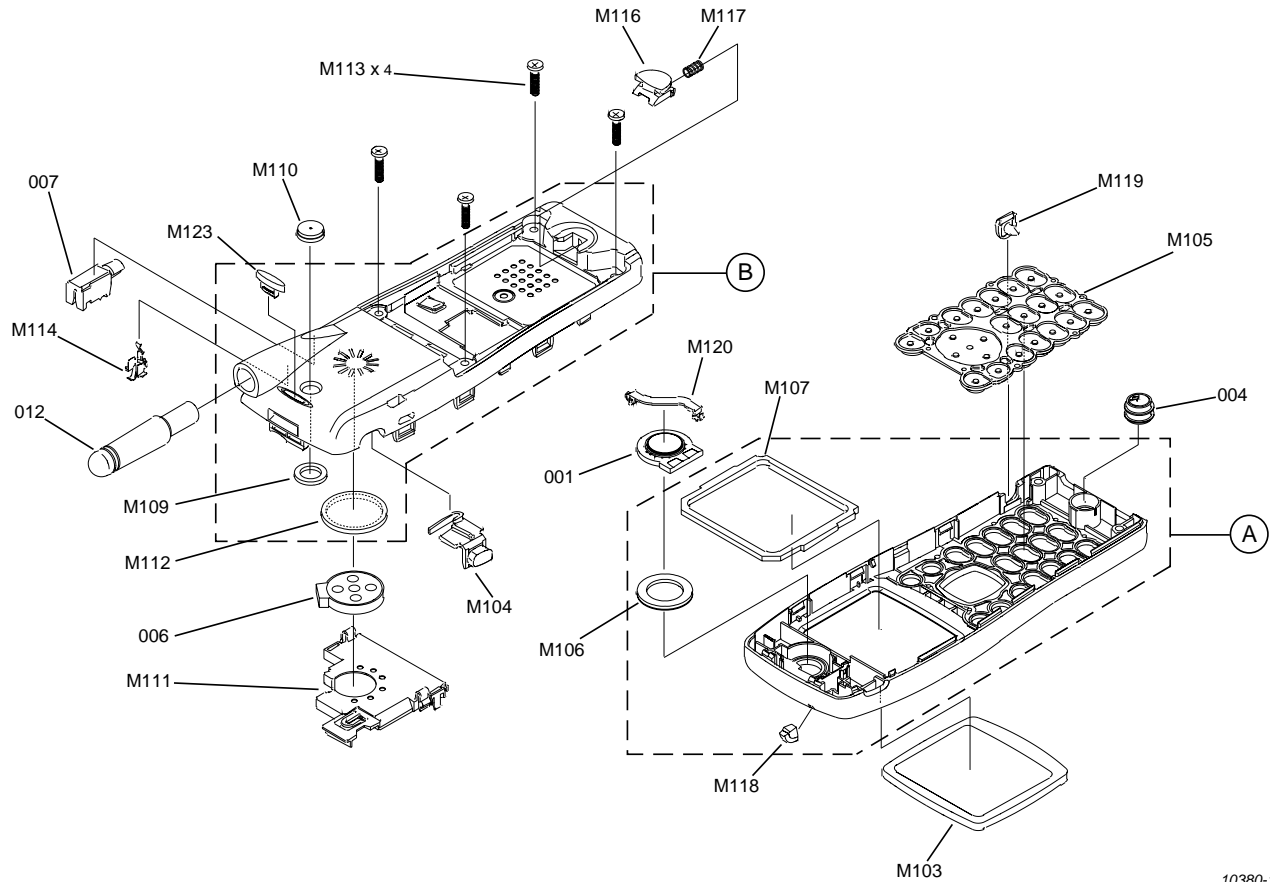
Figure 7.1: Case Parts

10380-1

Ref	Part Number	Description
A	**GD93CVR01Y**	**Front Cover Assy, Silver**
A	**GD93CVR01T**	**Front Cover Assy, Titanium**
	includes:	
	RECEIVER CUSHION (M106)	
	LCD CUSHION (M107)	
	ALERT LED LENS (M118)	
B	**GD93CAS01Y**	**Case Assembly, Silver**
B	**GD93CAS01T**	**Case Assembly, Titanium**
	includes:	
	RF CONNECTOR CUSHION (M109)	
	SPEAKER CUSHION (M112)	
	BACK CASE LENS (M123)	
M103	2EA575AAAA	LCD PANEL
M104	2CA517AAAA	MEMO KEY, GREY
M105	6TA558AAAA	KEYPAD, GREY
M110	6RA507AADA	RF CONNECTOR CAP, GREY

Ref	Part Number	Description
M111	4JA587A	RF SHIELD CASE
M113	3Z70054B	SCREW, M1.6 x 6mm
M114	4HA532A	ANTENNA CONTACT
M116	2AA503AABA	BATTERY HOOK, GREY
M117	4N70042A	HOOK SPRING
M118	2QA588A	ALERT LED LENS
M119	4CA520AABA	H/S JACK CAP, GREY
M120	2RA592A	RECEIVER HOLDER
001	HH76016A	RECEIVER
004	9ZA791A	MICROPHONE UNIT
006	HS76006A	DTHF SPEAKER
007	BD76012A	VIBRATE MOTOR UNIT
012	AN76097AABA	ANTENNA, LIGHT GREY

7.1.2.   Sub-Assemblies

10381-1

Figure 7.2: Sub-Assemblies

Ref	Part Number	Description
A	See Section 7.2.1	MAIN BOARD ASSEMBLY
B	LNLU100211	CHASSIS
Comprising:		
M121	2QA590A	LIGHT PIPE
M122	6DA526A	REFLECTOR SHEET
M124	2QA591A	CUSHION, REFLECTOR
M127	6JA758A	CHASSIS CUSHION
M128	6JA759A	CHASSIS CUSHION-2
C	GD93KPCB01	KEYPAD PCB ASSEMBLY
M125	6JA771A	LCD TAPE

Ref	Part Number	Description
002	AA7603A	LCD MODULE
003	PY76036B	INTER-BOARD CONNECTOR
005	PY6037B	EXTERNAL RF CONNECTOR
008	4FA018ZAJ	BTM CONNECTOR
009	JA76026A	I/O CONNECTOR
010	JC76001A	H/S JACK SOCKET
011	EVQPSR02K	MEMO KEY SWITCH
015	ML616S	BACK-UP BATTERY
016	K3ZZ00200009	BACK-UP BATTERY HOLDER
017	PY70641A	BATTERY / SPEAKER CONNECTOR
018	JS76002A	SIM CONNECTOR

7.2. Printed Circuit Boards (PCBs)

7.2.1. Main PCB: Variants

Model EB-GD93		Name: Main PCB Variants
Ref	Part Number	Description
	GD93BRD001	MAIN PCB STANDARD PROGRAM
	GD93BRD002	MAIN PCB BINARING PROGRAM
	GD93BRD003	MAIN PCB CELCOM PROGRAM
	GD93BRD004	MAIN PCB AIRTEL PROGRAM
	GD93BRD005	MAIN PCB EUROTEL PROGRAM
	GD93BRD006	MAIN PCB MOVISTAR PROGRAM
	GD93BRD007	MAIN PCB S.F.R. PROGRAM
	GD93BRD008	MAIN PCB WESTEL PROGRAM
	GD93BRD009	MAIN PCB HUTCHISON PROGRAM
	GD93BRD010	MAIN PCB PLUS GSM PROGRAM
	GD93BRD011	MAIN PCB TURKCELL PROGRAM
	GD93BRD012	MAIN PCB FRANCETEL PROGRAM
	GD93BRD013	MAIN PCB FT FTMS PROGRAM
	GD93BRD014	MAIN PCB TELESTET PROGRAM
	GD93BRD015	MAIN PCB ACTIVA PROGRAM
	GD93BRD016	MAIN PCB TMN PROGRAM
	GD93BRD017	MAIN PCB PANNON PROGRAM
	GD93BRD018	MAIN PCB VODACOM PROGRAM
	GD93BRD019	MAIN PCB NETCOM PROGRAM
	GD93BRD020	MAIN PCB K.P.N. PROGRAM
	GD93BRD021	MAIN PCB MOBILCOM PROGRAM
	GD93BRD022	MAIN PCB TELESTRA PROGRAM

Model EB-GD93		Name: Main PCB Variants
Ref	Part Number	Description
	GD93BRD023	MAIN PCB E.R.A. PROGRAM
	GD93BRD024	MAIN PCB PAYT VODAFONE PROGRAM
	GD93BRD025	MAIN PCB CHINESE ENABLED PROGRAM
	GD93BRD026	MAIN PCB TMN PROGRAM
	GD93BRD027	MAIN PCB PAEGAS PROGRAM
	GD93BRD028	MAIN PCB EUROTEL CZ CONTRACT PROGR
	GD93BRD029	MAIN PCB MOVISTAR ACTIVA PROGRAM
	GD93BRD030	MAIN PCB DIGIFONE PROGRAM
	GD93BRD031	MAIN PCB SFR CONTRACT PROGRAM
	GD93BRD032	MAIN PCB SFR PRE-PAID PROGRAM
	GD93BRD033	MAIN PCB AIRTEL PRE-PAID PROGRAM
	GD93BRD034	MAIN PCB SONOFON PROGRAM
	GD93BRD035	MAIN PCB SINGTEL PROGRAM

MCUK0010002C8
Service Manual

Section 7
– 58 –

Issue 1
Revision 0

REPLACEMENT PARTS LIST

7.2.2. GD93 Main PCB

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
C101	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	F2
C104	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	E2
C105	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	E2
C106	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	F1
C107	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	F1
C108	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	A4
C109	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	F2
C112	F1G1HR50A391	CAP CER 0.5pF +/-0.25pF 50V NP	F2
C113	F1G1H2R0A391	CAP CER 2pF +/-0.25pF 50V NP0	A3
C114	F1G1H2R0A391	CAP CER 2pF +/-0.25pF 50V NP0	A3
C116	F3F1A1560001	CAP TANT 15uF 20% 10V SMD CASE	E2
C117	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	E2
C118	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	E2
C122	F1G1H3R0A442	CAP CER 3pF +/-0.25pF 50V NP0	B4
C123	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	E2
C125	ECUE1E681KBQ	CAP CER 680pF 10% 25V X7R SMD	D2
C127	F3F1A1060005	CAP TANT 10uF 20% 10V SMD CASE	B4
C129	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	B4
C131	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	D2
C132	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	E1
C133	F1G1H270A409	CAP CER 27pF 5% 50V NP0 SMD 10	B3
C134	F1G1H3R0A442	CAP CER 3pF +/-0.25pF 50V NP0	E1
C135	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	E1
C136	F1G1H3R0A442	CAP CER 3pF +/-0.25pF 50V NP0	B4
C137	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	E1
C138	F1H1E223A029	CAP CER 22nF 10% 25V X7R SMD 1	E1
C139	ECUE1H391KBQ	CAP CER 390pF 10% 50V X7R SMD	B3
C141	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B3
C142	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B3

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
C143	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	B3
C144	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B3
C145	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B3
C146	F1G1H3R0A442	CAP CER 3pF +/-0.25pF 50V NP0	B3
C148	F1G1C1030002	CAP CER 10nF 10% 16V X7R SMD 1	B3
C152	ECUE1H121JCQ	CAP CER 120pF 5% 50V NP0 SMD 1	E1
C153	ECUE1H121JCQ	CAP CER 120pF 5% 50V NP0 SMD 1	E1
C154	ECUE1H151JCQ	CAP CER 150pF 5% 50V NP0 SMD 1	E1
C155	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	E1
C156	F1G1H1R5A391	CAP CER 1.5pF +/-0.25pF 50V NP	E1
C157	F1G1H6R0A406	CAP CER 6pF +/-0.5pF 50V NP0 S	E1
C158	ECUE1E221KBQ	CAP CER 220pF 10% 25V X7R SMD	E1
C159	F1G1H1R5A391	CAP CER 1.5pF +/-0.25pF 50V NP	E1
C161	F1G1C1030002	CAP CER 10nF 10% 16V X7R SMD 1	E1
C162	ECUE1E681KBQ	CAP CER 680pF 10% 25V X7R SMD	E1
C163	ECUE1E681KBQ	CAP CER 680pF 10% 25V X7R SMD	E1
C164	ECUE1E221KBQ	CAP CER 220pF 10% 25V X7R SMD	E1
C201	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	B3
C202	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	F1
C204	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	B3
C205	F1G1H3R0A442	CAP CER 3pF +/-0.25pF 50V NP0	B4
C206	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	B4
C207	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4
C208	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	B4
C209	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4
C211	F1G1H2R0A391	CAP CER 2pF +/-0.25pF 50V NP0	B4
C211	G1CR22J00006	INDUCTOR 220nH 5% SMD 1608	B4
C212	F1G1H4R0A404	CAP CER 4pF +/-0.25pF 50V NP0	B4
C213	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	B4
C214	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4
C215	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	B4

Model EB-GD93		Name: GD93 Main PCB		Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes	Ref	Part Number	Description	Notes
C216	F1G1H2R0A391	CAP CER 2pF +/-0.25pF 50V NP0	B4	C316	ECUE1H151JCQ	CAP CER 150pF 5% 50V NP0 SMD 1	C4
C217	F1G1H1R5A391	CAP CER 1.5pF +/-0.25pF 50V NP	B4	C320	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	C3
C219	F1G1H2R0A391	CAP CER 2pF +/-0.25pF 50V NP0	B4	C321	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	C3
C223	F1G1H2R0A391	CAP CER 2pF +/-0.25pF 50V NP0	B4	C322	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	B3
C224	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	B4	C323	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B3
C225	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4	C324	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	B3
C226	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4	C353	F1G1C1030002	CAP CER 10nF 10% 16V X7R SMD 1	C3
C227	F1G1H2R0A391	CAP CER 2pF +/-0.25pF 50V NP0	B4	C355	F1G1E1020001	CAP CER 1nF 10% 25V X7R SMD 10	C4
C228	F1G1H5R0A404	CAP CER 5pF +/-0.25pF 50V NP0	C4	C357	F1G1C1030002	CAP CER 10nF 10% 16V X7R SMD 1	C3
C229	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	C4	C358	F1G1E1020001	CAP CER 1nF 10% 25V X7R SMD 10	C3
C230	F1G1H6R0A406	CAP CER 6pF +/-0.5pF 50V NP0 S	C4	C360	ECUE1H680JCQ	CAP CER 68pF 5% 50V NP0 SMD 10	C3
C231	F1G1H6R0A406	CAP CER 6pF +/-0.5pF 50V NP0 S	C4	C392	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	
C232	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B3	C401	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	D2
C234	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4	C402	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	D2
C235	ECUE1H151JCQ	CAP CER 150pF 5% 50V NP0 SMD 1	B4	C403	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	D1
C236	F1G1H1R0A391	CAP CER 1pF +/-0.25pF 50V NP0	C4	C404	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	D1
C301	ECUE1H122KBQ	CAP CER 1.2nF 10% 50V X7R SMD	C4	C405	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	D1
C302	F1J1E1030005	CAP CER 10nF 10% 25V X7R SMD 2	C3	C406	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	D1
C303	F1G1H3R0A442	CAP CER 3pF +/-0.25pF 50V NP0	B3	C407	F1G1H3R0A442	CAP CER 3pF +/-0.25pF 50V NP0	C4
C304	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B3	C408	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	C4
C305	ECUE1E221KBQ	CAP CER 220pF 10% 25V X7R SMD	B3	C409	F3F1A1060005	CAP TANT 10uF 20% 10V SMD CASE	C4
C306	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	B3	C410	F1G1H5R0A404	CAP CER 5pF +/-0.25pF 50V NP0	D2
C307	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	B3	C605	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	D1
C308	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4	C606	F1H1A1050019	CAP CER 1uF 10% 10V X7R SMD 16	D3
C309	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	C4	C607	F1H1A1050019	CAP CER 1uF 10% 10V X7R SMD 16	D3
C310	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	B4	C608	F1H1A1050019	CAP CER 1uF 10% 10V X7R SMD 16	D3
C311	F1G1E1020001	CAP CER 1nF 10% 25V X7R SMD 10	B4	C609	F1H1A1050019	CAP CER 1uF 10% 10V X7R SMD 16	C4
C312	F1G1C1030002	CAP CER 10nF 10% 16V X7R SMD 1	C4	C610	F1H1A1050019	CAP CER 1uF 10% 10V X7R SMD 16	C3
C313	F1G1E1820001	CAP CER 1.8nF 10% 25V X7R SMD	C4	C611	F1J1A1050011	CAP CER 1uF 10% 10V X5R SMD 20	D3
C314	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	C4	C612	F1J1A1050011	CAP CER 1uF 10% 10V X5R SMD 20	D3
C315	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	C4	C613	F1J1A1050011	CAP CER 1uF 10% 10V X5R SMD 20	D4

Model EB-GD93		Name: GD93 Main PCB		Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes	Ref	Part Number	Description	Notes
C614	F1J1A1050011	CAP CER 1uF 10% 10V X5R SMD 20	D4	C649	F1G1H150A409	CAP CER 15pF 5% 50V NP0 SMD 10	B2
C615	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	E3	C650	F1G1H270A409	CAP CER 27pF 5% 50V NP0 SMD 10	A3
C616	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C1	C651	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	A3
C617	F1G1E2720001	CAP CER 2.7nF 10% 25V X7R SMD	E3	C652	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	A3
C618	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	E3	C654	F1G1H270A409	CAP CER 27pF 5% 50V NP0 SMD 10	A3
C619	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	E3	C657	F1G1C3330001	CAP CER 33nF 10% 16V X5R SMD 1	B2
C620	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B1	C658	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	B2
C621	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C1	C660	F1G1C3330001	CAP CER 33nF 10% 16V X5R SMD 1	B2
C622	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	D3	C661	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	E4
C623	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	E3	C662	F1J1A4750004	CAP CER 4.7uF -20+80% 10V Y5V	E4
C624	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	D3	C663	F1H1A224A006	CAP CER 220nF 10% 10V X7R SMD	E3
C625	F3E0G2260003	CAP TANT 22uF 20% 4V SMD CASE	D3	C664	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	C1
C626	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	D3	C668	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C1
C627	F3E1A4750001	CAP TANT 4.7uF 20% 10V SMD CAS	D3	C669	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2
C628	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	D3	C671	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	D4
C630	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	A3	C672	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	E4
C631	F1G1H100A406	CAP CER 10pF +/-0.5pF 50V NP0	A3	C674	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	E4
C632	F1G1E2220001	CAP CER 2.2nF 10% 25V X7R SMD	D3	C675	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	E4
C633	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	A1	C676	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	D4
C634	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	A1	C677	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	A1
C635	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	E3	C678	F3F1A1560001	CAP TANT 15uF 20% 10V SMD CASE	D4
C638	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2	C681	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2
C639	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F4	C683	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C2
C640	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F3	C685	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2
C641	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F4	C687	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2
C642	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2	C689	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C2
C643	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F3	C691	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C4
C644	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F4	C696	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	A1
C645	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	A3	C699	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	A1
C646	F1G1H6R0A406	CAP CER 6pF +/-0.5pF 50V NP0 S	A2	C700	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	A1
C647	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2	C701	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	D3

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
C702	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	A1
C703	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	A1
C704	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	F4
C705	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F4
C706	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	A2
C707	ECUE1H101JCQ	CAP CER 100pF 5% 50V NP0 SMD 1	A2
C708	ECUE1E331KBQ	CAP CER 330pF 10% 25V X7R SMD	A2
C709	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	A4
C710	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	E4
C711	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F4
C713	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	B2
C714	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C1
C716	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	C1
C717	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F4
C721	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	D3
C722	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	B1
C723	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	B1
C724	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	B1
C725	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	D1
C726	ECUE1H330JCQ	CAP CER 33pF 5% 50V NP0 SMD 10	E3
C727	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	F4
C728	F1H0J1050009	CAP CER 1uF 10% 6.3V X5R SMD 1	E3
C729	F1G1A104A012	CAP CER 100nF 10% 10V X5R SMD	D4
C730	F1G1H220A409	CAP CER 22pF 5% 50V NP0 SMD 10	D2
C902	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	E3
C903	ECUE1H470JCQ	CAP CER 47pF 5% 50V NP0 SMD 10	E3
C999	ECST0JZ106R	CAP TANT 10uF 20% 6.3V SMD CAS	E4
CN101	PY76037A	CONNECTOR RF (FOR GD52/92)	F1
CN601	PY76036B	CONNECTOR BOARD TO BOARD 33 PI	D4
CN602	JC76001A	CONNECTOR AUDIO JACK SKT 2.5mm	F3
CN603	K3ZZ00200009	HOLDER FOR BATTERY CELL	A4

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
CN604	JA76026A	CONNECTOR I/O 14 WAY SMD	A1
CN605	PY76041A	CONNECTOR BATTERY 2 PIN 2A SMD	F1
CN606	PY76041A	CONNECTOR BATTERY 2 PIN 2A SMD	D2
CN607	PY76041A	CONNECTOR BATTERY 2 PIN 2A SMD	D1
D602	MAZS0470GL	DIODE MAZS0470G ZENER 4.7V SMD	A3
D603	MAZS0470GL	DIODE MAZS0470G ZENER 4.7V SMD	A3
D604	B0BD6R800004	DIODE UMZ6.8EN ZENER 6.8V QUAD	D4
D605	B0JCMC000004	DIODE RB491DT146 SCHOTTKY 20V	D4
D608	MAZS0750ML	DIODE MAZS0750ML ZENER 7.5V SM	A2
D609	B0BD6R800004	DIODE UMZ6.8EN ZENER 6.8V QUAD	A1
D610	B0BD6R800004	DIODE UMZ6.8EN ZENER 6.8V QUAD	A2
D612	MAZS0750ML	DIODE MAZS0750ML ZENER 7.5V SM	A2
D614	B0JCDD000001	DIODE RB521S-30 SCHOTTKY 30V 2	A2
D618	MAZS0470GL	DIODE MAZS0470G ZENER 4.7V SMD	A1
D619	MA2S11100L	DIODE MA2S111 80V 100mA SMD SS	A3
D620	MAZS0470GL	DIODE MAZS0470G ZENER 4.7V SMD	F3
D621	MAZS0470GL	DIODE MAZS0470G ZENER 4.7V SMD	F3
D623	B0JCDC000001	DIODE RB520S-30 SCHOTTKY 30V 2	E4
D624	B0JCDD000001	DIODE RB521S-30 SCHOTTKY 30V 2	E4
D625	B0JCDD000001	DIODE RB521S-30 SCHOTTKY 30V 2	C1
D626	B0JCDC000001	DIODE RB520S-30 SCHOTTKY 30V 2	D3
D627	B0JCDC000001	DIODE RB520S-30 SCHOTTKY 30V 2	F3
D628	B0JCDC000001	DIODE RB520S-30 SCHOTTKY 30V 2	F4
D629	B0JDAE000003	DIODE RB715W SCHOTTKY 40V 30mA	
DS601	LNJ717W800MC	DIODE LNJ717W800MC LED GREEN/O	C3
DS603	LNJ115W8PRA	DIODE LED GREEN/RED 10mA SMD 1	A4
DS901	B3AEB0000007	DIODE LED BLUE DB1111C-13-TR S	F1
E101	B9Z000000018	COUPLER 897.5 MHz SMD 2012 6PI	E2
FL101	EXCML16A270U	SUPPRESSOR EMI 27 OHM 4A SMD 1	B4
FL102	EXCML16A270U	SUPPRESSOR EMI 27 OHM 4A SMD 1	E2

MCUK0010O2C8
Service Manual

Section 7
– 62 –

Issue 1
Revision 0

REPLACEMENT PARTS LIST

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
FL201	EFCH9418MTYF	FILTER SAW RX GSM/PCN SMD	B3
FL202	J0E1847B0002	FILTER DUAL LC RX SMD	B4
FL203	EFCH225MDQA2	FILTER IF SAW 225MHz SMD	C4
FL601	J0JAC0000011	SUPPRESSOR EMI FERRITE 1K OHM	A1
L102	G1C3N9Z00004	INDUCTOR 3.9nH +/-0.3nH SMD 10	E2
L104	G1C33NJ00009	INDUCTOR 33nH 5% SMD 1005	
L105	ELJRE3N3DF2	INDUCTOR 3.3nH +/-0.3nH SMD 16	A3
L108	G1C10NJ00008	INDUCTOR 10nH 5% SMD 1005	
L151	G1C5N6Z00005	INDUCTOR 5.6nH +/-0.3nH SMD 10	E1
L152	G1C15NJ00008	INDUCTOR 15nH 5% SMD 1005	E1
L201	G1C10NJ00008	INDUCTOR 10nH 5% SMD 1005	B3
L203	G1C2N7Z00007	INDUCTOR 2.7nH +/-0.3nH SMD 10	B4
L204	G1C8N2J00004	INDUCTOR 8.2nH 5% SMD 1005	B4
L205	G1C6N8J00004	INDUCTOR 6.8nH 5% SMD 1005	B4
L206	G1C5N6Z00005	INDUCTOR 5.6nH +/-0.3nH SMD 10	B4
L208	G1C5N6Z00005	INDUCTOR 5.6nH +/-0.3nH SMD 10	B4
L209	G1C82NJ00010	INDUCTOR 82nH 5% SMD 1005	B4
L210	G1C82NJ00010	INDUCTOR 82nH 5% SMD 1005	B4
L212	ELJRE56NJF3	INDUCTOR 56nH 5% SMD 1608	C4
L213	ELJRER12JF3	INDUCTOR 120nH 5% SMD 1608	C4
L214	G1CR10J00010	INDUCTOR 100nH 5% SMD 1005	C4
L215	G1C3N3Z00005	INDUCTOR 3.3nH +/-0.3nH SMD 10	B4
L217	G1C15NJ00008	INDUCTOR 15nH 5% SMD 1005	
L218	ELJRE82NJF3	INDUCTOR 82nH 5% SMD 1608	B4
L219	G1CR18J00004	INDUCTOR 180nH 5% SMD 1608	C4
L220	ELJRER12JF3	INDUCTOR 120nH 5% SMD 1608	C4
L303	G1C39NJ00009	INDUCTOR 39nH 5% SMD 1005	B3
L601	ELJRE82NJF3	INDUCTOR 82nH 5% SMD 1608	D3
L603	ELJRE82NJF3	INDUCTOR 82nH 5% SMD 1608	A3
L604	ELJRE82NJF3	INDUCTOR 82nH 5% SMD 1608	A3
L605	G1C82NJ00010	INDUCTOR 82nH 5% SMD 1005	A3

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
L606	G1C82NJ00010	INDUCTOR 82nH 5% SMD 1005	A3
M603	4FA018AZAJ	CONNECTOR 2 PIN CONTACT	A4
Q103	B1GKCFLL0006	TRANSISTOR UMD2N DUAL SMD UMT6	B3
Q104	B1GKCFLL0006	TRANSISTOR UMD2N DUAL SMD UMT6	B3
Q106	XP0338900L	TRANSISTOR XP03389 NPN/PNP 10K	B3
Q301	B1GKCFJJ0006	TRANSISTOR UMC3NTR PNP+NPN SMD	E1
Q601	2SD15110FL	TRANSISTOR 2SD15110FL NPN HFE=	F1
Q602	B1DHDC000006	TRANSISTOR SI3443DV MOSFET 20V	D4
Q603	B1GBCFJJ0024	TRANSISTOR DTC114EMT2L NPN 2x1	B1
Q604	B1GBCFNN0015	TRANSISTOR DTC144EM NPN 47K SM	B1
Q901	B1GBCFLL0001	TRANSISTOR DTC124EETTL NPN 50V	A3
R101	ERJ2GEJ470X	RES 47 OHM 5% 1/16W SMD 1005	E2
R102	ERJ2GEJ470X	RES 47 OHM 5% 1/16W SMD 1005	F2
R104	ERJ2GEJ821X	RES 820 OHM 5% 1/16W SMD 1005	D2
R105	ERJ2GEJ4R7X	RES 4.7 OHM 5% 1/16W SMD 1005	D2
R106	ERJ2GEJ821X	RES 820 OHM 5% 1/16W SMD 1005	D2
R109	ERJ2GEJ223X	RES 22K OHM 5% 1/16W SMD 1005	B3
R110	ERJ2GEJ122X	RES 1.2K OHM 5% 1/16W SMD 1005	B3
R111	ERJ2GEJ223X	RES 22K OHM 5% 1/16W SMD 1005	B3
R112	ERJ2GEJ122X	RES 1.2K OHM 5% 1/16W SMD 1005	B3
R114	ERJ2GEJ271X	RES 270 OHM 5% 1/16W SMD 1005	E2
R115	ERJ2GEJ561X	RES 560 OHM 5% 1/16W SMD 1005	E1
R116	ERJ2GEJ270X	RES 27 OHM 5% 1/16W SMD 1005	E1
R117	ERJ2GEJ153X	RES 15K OHM 5% 1/16W SMD 1005	B3
R118	ERJ2GEJ392X	RES 3.9K OHM 5% 1/16W SMD 1005	B3
R119	ERJ2GEJ392X	RES 3.9K OHM 5% 1/16W SMD 1005	B3
R120	ERJ2GEJ153X	RES 15K OHM 5% 1/16W SMD 1005	B3
R121	ERJ2GEJ392X	RES 3.9K OHM 5% 1/16W SMD 1005	B3
R122	ERJ2GEJ392X	RES 3.9K OHM 5% 1/16W SMD 1005	B3
R123	ERJ2GEJ123X	RES 12K OHM 5% 1/16W SMD 1005	B3

Model EB-GD93		Name: GD93 Main PCB		Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes	Ref	Part Number	Description	Notes
R124	ERJ2GEJ223X	RES 22K OHM 5% 1/16W SMD 1005	B3	R603	ERJ2GEJ101X	RES 100 OHM 5% 1/16W SMD 1005	D4
R150	ERJ2GEJ121X	RES 120 OHM 5% 1/16W SMD 1005	E2	R604	ERJ2GEJ101X	RES 100 OHM 5% 1/16W SMD 1005	D4
R151	ERJ2GEJ680X	RES 68 OHM 5% 1/16W SMD 1005	E2	R605	ERJ2GEJ101X	RES 100 OHM 5% 1/16W SMD 1005	D4
R152	ERJ2GEJ680X	RES 68 OHM 5% 1/16W SMD 1005	E2	R606	ERJ2GEJ121X	RES 120 OHM 5% 1/16W SMD 1005	D1
R153	ERJ2GEJ181X	RES 180 OHM 5% 1/16W SMD 1005	E2	R607	ERJ2GEJ121X	RES 120 OHM 5% 1/16W SMD 1005	D1
R153	ERJ2GEJ223X	RES 22K OHM 5% 1/16W SMD 1005	E2	R608	ERJ2GEJ121X	RES 120 OHM 5% 1/16W SMD 1005	D1
R154	ERJ2GEJ680X	RES 68 OHM 5% 1/16W SMD 1005	E2	R612	ERJ2GEJ471X	RES 470 OHM 5% 1/16W SMD 1005	D1
R155	ERJ2GEJ680X	RES 68 OHM 5% 1/16W SMD 1005	E2	R613	ERJ2GEJ181X	RES 180 OHM 5% 1/16W SMD 1005	D1
R157	ERJ2GEJ103X	RES 10K OHM 5% 1/16W SMD 1005	E1	R614	ERJ2GEJ153X	RES 15K OHM 5% 1/16W SMD 1005	E4
R158	ERJ2GEJ103X	RES 10K OHM 5% 1/16W SMD 1005	E1	R615	ERJ2GEJ222X	RES 2.2K OHM 5% 1/16W SMD 1005	E4
R159	ERJ2GEJ273X	RES 27K OHM 5% 1/16W SMD 1005	E1	R616	ERJ2GEJ222X	RES 2.2K OHM 5% 1/16W SMD 1005	E4
R160	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	E1	R617	ERJ2GEJ222X	RES 2.2K OHM 5% 1/16W SMD 1005	E3
R161	ERJ2GEJ333X	RES 33K 5% 1/16W SMD 1005	E1	R618	ERJ2GEJ223X	RES 22K OHM 5% 1/16W SMD 1005	D3
R163	ERJ2GEJ153X	RES 15K OHM 5% 1/16W SMD 1005	E1	R619	ERJ2GEJ562X	RES 5.6K OHM 5% 1/16W SMD 1005	D3
R301	ERJ2GEJ332X	RES 3.3K OHM 5% 1/16W SMD 1005	C3	R620	ERJ2GEJ150X	RES 15 OHM 5% 1/16W SMD 1005	A1
R302	ERJ2GEJ562X	RES 5.6K OHM 5% 1/16W SMD 1005	C3	R621	ERJ2GEJ102X	RES 1K OHM 5% 1/16W SMD 1005	E4
R304	ERJ2GEJ150X	RES 15 OHM 5% 1/16W SMD 1005	B3	R622	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	F3
R305	ERJ2GEJ470X	RES 47 OHM 5% 1/16W SMD 1005	B4	R623	ERJ3RED105V	RES 1M OHM 0.5% 1/16W SMD 1608	D1
R306	ERJ2GEJ4R7X	RES 4.7 OHM 5% 1/16W SMD 1005	B3	R624	ERJ3RED274V	RES 270K OHM 0.5% 1/16W SMD 16	D1
R307	ERJ2GEJ821X	RES 820 OHM 5% 1/16W SMD 1005	B3	R625	ERJ2GEJ222X	RES 2.2K OHM 5% 1/16W SMD 1005	A3
R308	ERJ2GEJ821X	RES 820 OHM 5% 1/16W SMD 1005	B3	R626	ERJ2GEJ393X	RES 39K OHM 5% 1/16W SMD 1005	A3
R309	ERJ2GEJ222X	RES 2.2K OHM 5% 1/16W SMD 1005	C4	R627	ERJ2GEJ124X	RES 120K OHM 5% 1/16W SMD 1005	
R310	ERJ2GEJ152X	RES 1.5K OHM 5% 1/16W SMD 1005	C4	R628	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	F3
R312	ERJ2GEJ120X	RES 12 OHM 5% 1/16W SMD 1005		R630	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	C2
R313	ERJ2GEJ270X	RES 27 OHM 5% 1/16W SMD 1005	C4	R631	ERJ2GEJ224X	RES 220K OHM 5% 1/16W SMD 1005	B2
R314	ERJ2GEJ471X	RES 470 OHM 5% 1/16W SMD 1005		R632	ERJ2GEJ120X	RES 12 OHM 5% 1/16W SMD 1005	A3
R315	ERJ2GEJ471X	RES 470 OHM 5% 1/16W SMD 1005		R633	ERJ2GEJ120X	RES 12 OHM 5% 1/16W SMD 1005	A3
R350	ERJ2GEJ472X	RES 4.7K OHM 5% 1/16W SMD 1005	C3	R634	ERJ2GEJ152X	RES 1.5K OHM 5% 1/16W SMD 1005	B2
R353	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	C3	R635	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	E4
R601	ERJ2GEJ101X	RES 100 OHM 5% 1/16W SMD 1005	D4	R636	ERJ2GEJ152X	RES 1.5K OHM 5% 1/16W SMD 1005	B2
R602	ERJ2GEJ101X	RES 100 OHM 5% 1/16W SMD 1005	D4	R637	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	E4

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
R639	ERJ2GEJ223X	RES 22K OHM 5% 1/16W SMD 1005	C2
R640	ERJ2GE0R00X	RES JUMPER 0 OHM 1A SMD 1005	C2
R641	ERJ2GEJ470X	RES 47 OHM 5% 1/16W SMD 1005	C2
R643	ERJ2GEJ223X	RES 22K OHM 5% 1/16W SMD 1005	C2
R644	ERJ6RSFR15V	RES 0.15 OHM 1% 1/10W SMD 2012	D4
R645	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	D1
R646	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	C4
R647	ERJ2GEJ561X	RES 560 OHM 5% 1/16W SMD 1005	A1
R648	ERJ2GEJ103X	RES 10K OHM 5% 1/16W SMD 1005	A1
R649	ERJ2GEJ332X	RES 3.3K OHM 5% 1/16W SMD 1005	A1
R650	ERJ2GEJ681X	RES 680 OHM 5% 1/16W SMD 1005	F4
R651	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	A1
R652	EXB24V331JX	RES NETWORK 330 OHMx2 5% 1/16W	A1
R654	EXB24V331JX	RES NETWORK 330 OHMx2 5% 1/16W	A2
R656	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	A2
R657	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	A2
R660	ERJ2GEJ473X	RES 47K OHM 5% 1/16W SMD 1005	C2
R664	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	F4
R669	ERJ2GEJ331X	RES 330 OHM 5% 1/16W SMD 1005	B1
R674	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	F4
R675	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	F4
R676	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	A2
R679	ERJ2GEJ103X	RES 10K OHM 5% 1/16W SMD 1005	B2
R680	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	B2
R683	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	E4
R684	ERJ2GEJ472X	RES 4.7K OHM 5% 1/16W SMD 1005	F4
R685	ERJ2GEJ181X	RES 180 OHM 5% 1/16W SMD 1005	F3
R686	ERJ2GEJ4R7X	RES 4.7 OHM 5% 1/16W SMD 1005	C1
R687	ERJ2GEJ4R7X	RES 4.7 OHM 5% 1/16W SMD 1005	C1
R688	ERJ2GEJ4R7X	RES 4.7 OHM 5% 1/16W SMD 1005	A2
R689	ERJ2GEJ4R7X	RES 4.7 OHM 5% 1/16W SMD 1005	A2

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
R690	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	C1
R691	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	C1
R692	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	A1
R694	ERJ2GEJ104X	RES 100K OHM 5% 1/16W SMD 1005	F3
R695	ERJ2GEJ473X	RES 47K OHM 5% 1/16W SMD 1005	F4
R696	ERJ2GE0R00X	RES JUMPER 0 OHM 1A SMD 1005	B1
R901	ERJ2GEJ681X	RES 680 OHM 5% 1/16W SMD 1005	D1
R902	ERJ2GE0R00X	RES JUMPER 0 OHM 1A SMD 1005	E3
R904	ERJ2GEJ183X	RES 18K OHM 5% 1/16W SMD 1005	A3
R905	ERJ2GEJ221X	RES 220 OHM 5% 1/16W SMD 1005	F1
R998	ERJ3GEY0R00V	RES JUMPER 0 OHM 1A SMD 1608	
R999	ERJ2GEJ102X	RES 1K OHM 5% 1/16W SMD 1005	B2
S601	EVQPSR02K	SWITCH TACTILE	F2
U101	C5CB00000023	PA PF08103B-02-TB DUAL GSM/DCS	E2
U102	J2FZ00000002	DIPLEXER ANT SW GSM/DCS SMD	F2
U103	UY76130A	VCO TX 9.1mmx7.0mm SMD	E1
U104	C1CB00000982	IC HD155133TF01EB TX/RX PLL BR	B4
U105	EHFFD1729	COUPLER 1.747 GHz SMD 2012 6PI	
U150	C1CB00000870	IC HD155171NPEL DUAL BAND APC	E1
U301	UY76129A	VCO RF SMD 9.1mm x 7.0mm	B3
U302	UY76165A	VCO IF 538-566MHz SMD	C3
U350	TX76001A	TCVCXO 13MHz SMD 7.0x5.0x1.7 4	C3
U351	C0JBAB000007	IC TC7S04FU INVERTER SMD SSOP5	C3
U401	C0DBZFC00004	IC R5320G001A VOLTAGE REGULATO	C3
U601	UY76158A	IC HERCULES WITH 2M SRAM 0.8mm	F4
U602	C1CB00000992	IC OMEGA 3.5 0.8mm PITCH SMD B	E4
U604	UY76159A	IC ACCESSORY ASIC 0.4mm PITCH	E3
U605	C3BBJG000004	IC UPD442012LGY-B85X-MJH 2M SR	B1
U606	C0EBF0000042	IC S-80833ANNP-EDX-T2 VOL DET	F3
U607	C0JBAZ001190	IC RV5C348B RTC OUTPUT ENABLED	E4

Model EB-GD93		Name: GD93 Main PCB	
Ref	Part Number	Description	Notes
U608	C0JBAA000099	IC TC7S08FU AND GATE SMD SSOP5	E4
U609	C0EBD0000030	IC S-80824ANNP-EDM-T2 VOL DET	F3
U610	C0DBZGB00015	IC RQ5RW30AATR VOLTAGE REG SMD	F4
X608	JS76002A	CONNECTOR SIM HOLDER GSM 6 PIN	C2
Y601	H0J327200022	CRYSTAL 32.768KHz SMD 7.0x1.5x	E4

7.2.3. Keypad PCB

Model EB-GD93		Name: GD93 Keypad PCB	
Ref	Part Number	Description	Notes
D801	MA2S11100L	DIODE MA2S111 80V 100mA SMD SS	
DS801	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
DS802	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
DS803	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
DS804	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
DS805	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
DS806	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
DS807	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
DS808	LNJ312G8J0MC	DIODE LED GREEN 2.2V 22mA SMD	
R801	EXB24V181JX	RES NETWORK 180 OHMx2 5% 1/16W	
R802	EXB24V181JX	RES NETWORK 180 OHMx2 5% 1/16W	
R803	EXB24V181JX	RES NETWORK 180 OHMx2 5% 1/16W	
R804	EXB24V181JX	RES NETWORK 180 OHMx2 5% 1/16W	

7.3. Refurbishment Kits

7.3.1. GD93

Model EB-GD93		Name: Refurbishment Kits	
Ref	Part Number	Description	Notes
	9R9300B	REFURBISHMENT KIT, BLUE	
	9R9300T	REFURBISHMENT KIT, TITANIUM GREY	

7.4. Repair Jigs and Tools

Model EB-GD93		Name: Jigs and Tools	
Ref	Part Number	Description	Notes
	IFB004	INTERFACE BOX	
	JT00010	BATTERY CALIBRATION VCU	
	JT00042	GD93TEST BATTERY	
	JT00043	INTERFACE CABLE	
	JT00055	GD93 RF ADAPTOR	
	JT00057	GD93 PCB TEST JIG	

7.5. Printed Material

7.5.1. Document Packs

NOTE: *Document Packs consist of language-specific User Guide, Quick Start and Warranty Guide where applicable.*

Model EB-GD93		Name: Document Packs
Ref	Part Number	Description
	GD93DPK01	ARABIC, ENGLISH
	GD93DPK02	CZECH
	GD93DPK03	DANISH, GERMAN, EU WARRANTY
	GD93DPK04	DANISH EU WARRANTY
	GD93DPK05	DUTCH, FRENCH, GERMAN, EU WARRANTY
	GD93DPK06	DUTCH, EU WARRANTY
	GD93DPK07	not used
	GD93DPK08	ENGLISH, FRENCH
	GD93DPK09	ENGLISH, GERMAN, EU WARRANTY
	GD93DPK10	ENGLISH, EU WARRANTY,ACCY CARD UK
	GD93DPK11	ENGLISH, EU WARRANTY
	GD93DPK12	ENGLISH
	GD93DPK13	FINNISH, SWEDISH, EU WARRANTY
	GD93DPK14	FRENCH, GERMAN,ITALIAN, EU WARRANTY
	GD93DPK15	FRENCH, EU WARRANTY
	GD93DPK16	GERMAN, EU WARRANTY
	GD93DPK17	GREEK, EU WARRANTY
	GD93DPK18	HUNGARIAN
	GD93DPK19	ITALIAN, EU WARRANTY
	GD93DPK20	NORWEGIAN, EU WARRANTY
	GD93DPK21	POLISH
	GD93DPK22	PORTUGUESE, EU WARRANTY

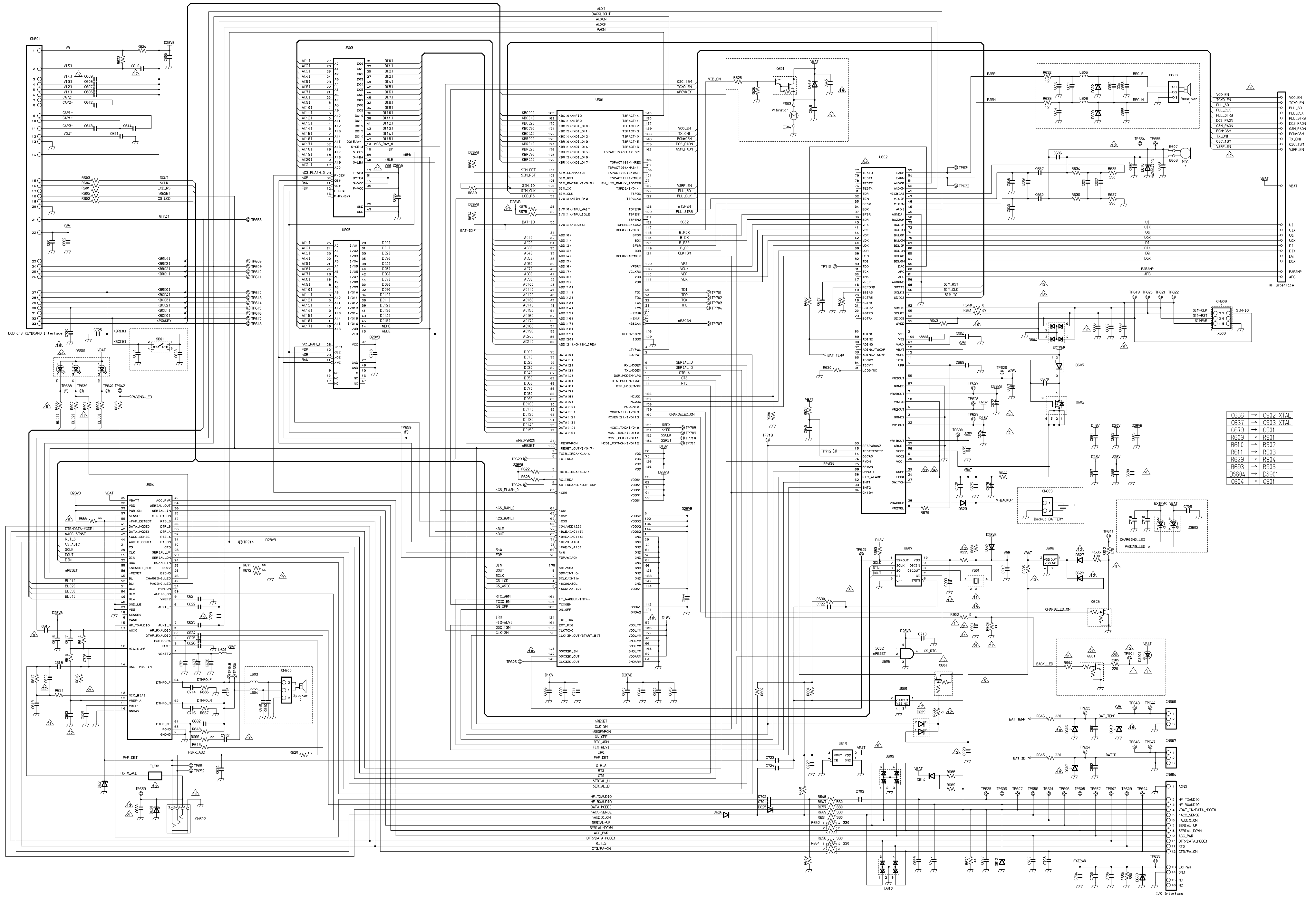| Model EB-GD93		Name: Document Packs
Ref	Part Number	Description
	GD93DPK23	RUSSIAN
	GD93DPK24	SPANISH, EU WARRANTY
	GD93DPK25	SWEDISH, EU WARRANTY
	GD93DPK26	TURKISH, EU WARRANTY

7.5.2. Identification of Individual Instructions

On the rear cover of each manual there is a part number. The suffix to this number is the issue level of the manual. For example, the part number for the English GD93 Instruction is 7LC043A, where the final 'A' shows the manual is issue 'A'.
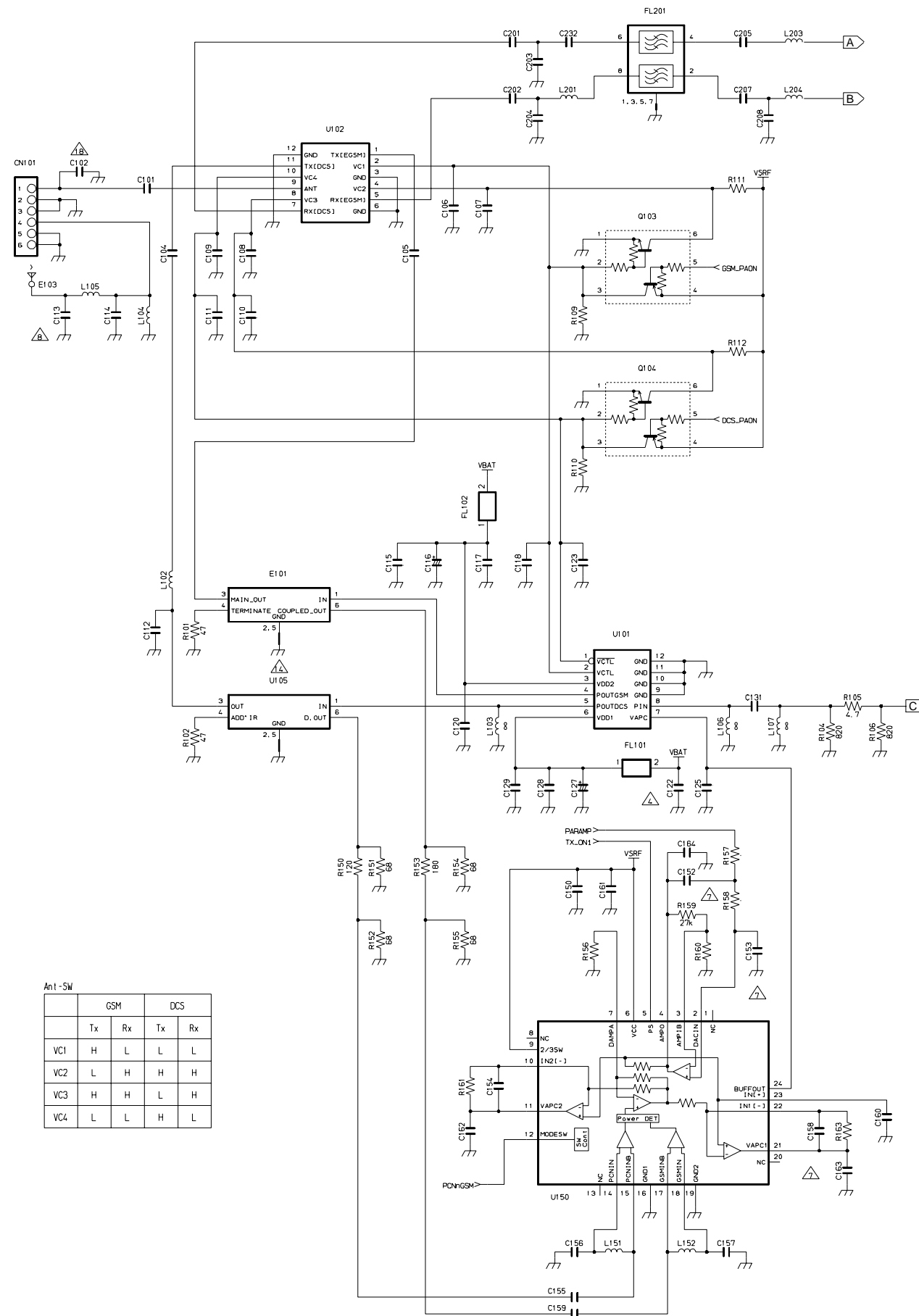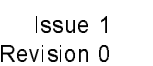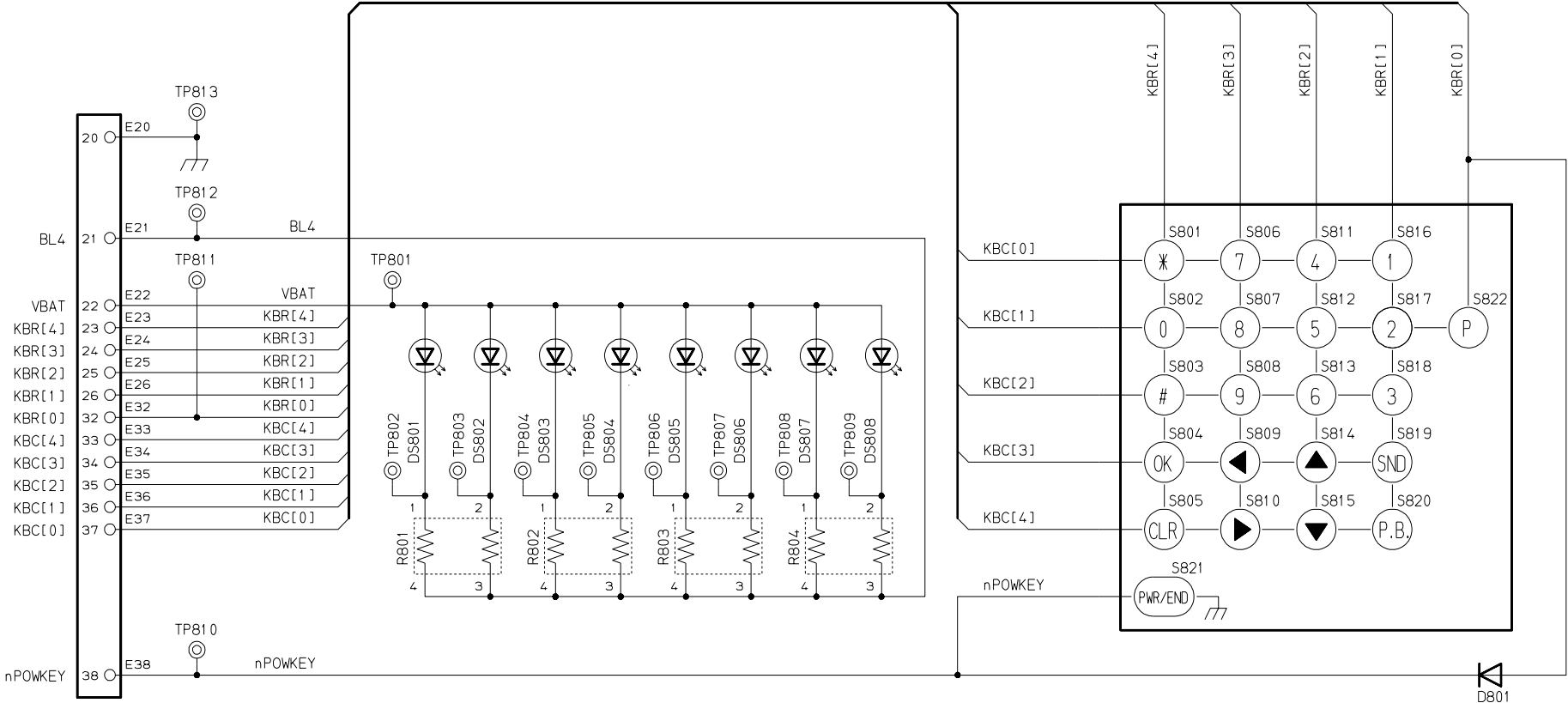
8 CIRCUIT DIAGRAMS

8.1 Main PCB - Logic

8.2 Main PCB: RF (Sheet 1 of 2)

8.3. Main PCB: RF (Sheet 2 of 2)

TP813

TP812

TP811

TP801

20 E20

21 E21   BL4   BL4

BL4

22 E22   VBAT   VBAT
VBAT
KBR[4]   23 E23   KBR[4]
KBR[3]   24 E24   KBR[3]
KBR[2]   25 E25   KBR[2]
KBR[1]   26 E26   KBR[1]
KBR[0]   32 E32   KBR[0]
KBC[4]   33 E33   KBC[4]
KBC[3]   34 E34   KBC[3]
KBC[2]   35 E35   KBC[2]
KBC[1]   36 E36   KBC[1]
KBC[0]   37 E37   KBC[0]

TP802 DS801   TP803 DS802   TP804 DS803   TP805 DS804   TP806 DS805   TP807 DS806   TP808 DS807   TP809 DS808

R801   R802   R803   R804

TP810

nPOWKEY 38 E38   nPOWKEY

nPOWKEY

KBR[4] KBR[3] KBR[2] KBR[1] KBR[0]

KBC[0]   S801   S806   S811   S816
              *   7   4   1

KBC[1]   S802   S807   S812   S817   S822
              0   8   5   2   P

KBC[2]   S803   S808   S813   S818
              #   9   6   3

KBC[3]   S804   S809   S814   S819
              OK   ◀   ▲   SND

KBC[4]   S805   S810   S815   S820
              CLR   ▶   ▼   P.B.

S821
PWR/END

D801
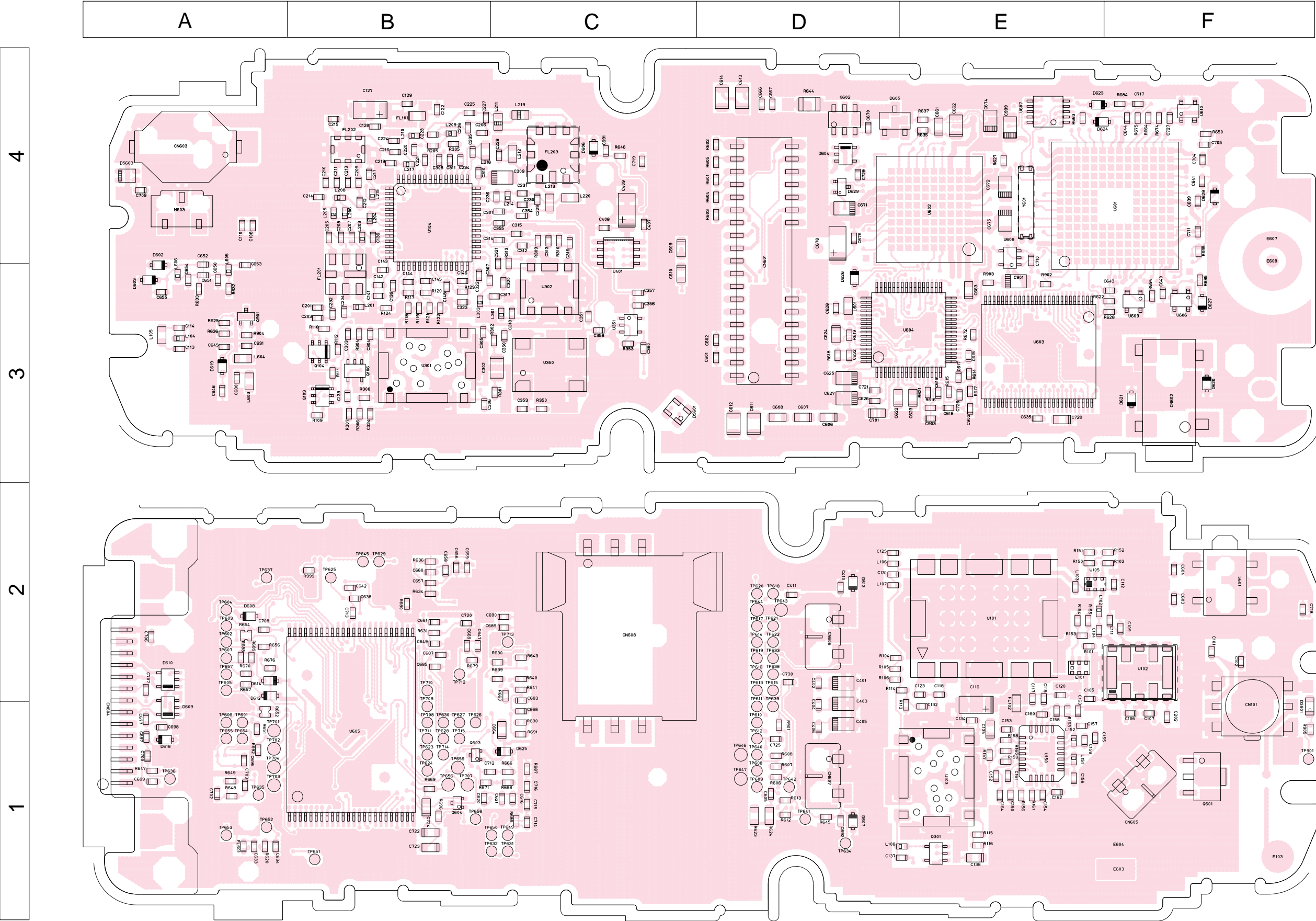
This page is intentionally blank

9 LAYOUT DIAGRAMS

9.1. Main PCB

9.2. Keypad PCB