Nokia Customer Care

Service Manual

RM-42 (Nokia N90)

Mobile Terminal

Part No: (9241872 (Issue 1))

Company Confidential

NOKIA

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	06/2005	J-PH	

Copyright

IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment. Ensure all cables and wires are repositioned correctly.

  Use only approved components as specified in the parts list.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

Please state:

- Title of the Document + Issue Number/Date of publication
- Latest Amendment Number (if applicable)
- Page(s) and/or Figure(s) in error

Please send to:

NOKIA CORPORATION

Nokia Mobile Phones Business Group

Nokia Customer Care

PO Box 86

FIN-24101 SALO

Finland

E-mail: Service.Manuals@nokia.com

Battery information

> **Note:** A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Nokia N90 Service Manual Structure

(This page left intentionally blank.)

1 — General Information

(This page left intentionally blank.)

Table of Contents

List of Tables

List of Figures

(This page left intentionally blank.)

RM-42 product selection

The Nokia RM-42 is a GSM/WCDMA Dual mode hand portable phone supporting EGSM 900/1800/1900 and WCDMA 2100 (UMTS).

The Nokia RM-42 is a 3GPP Release 99 terminal supporting WCDMA, EGPRS and GPRS data bearers. For WCDMA the maximum bit rate is up to 384 kbps for downlink and 128 kbps for uplink with simultaneous CS speech (12.2 kbps). For GSM networks the Nokia RM-42 is a class B terminal with EGPRS multislot class 10 (4 Rx + 1 Tx, 3+2) and GPRS multislot class 10 (4+1, 3+2)

According to GSM standard 05.05 it responds to class 4 (max. 2W) in EGSM 900, class 1 (1W) in DCS 1800 and class 1 in PCS 1900. The Nokia RM-42 supports EGPRS (EDGE) class B as well as Bluetooth 1.1 standard.

The handset has full phase 2 Type Approval and complies with GSM Type Approval. It has full CE approval and FCC approval.

Nokia RM-42 is supporting two way video calls with one integrated swing axis camera. Nokia RM-42 is an MMS (Multimedia Messaging Service) enabled phone with a large bright high-resolution color display and an integrated 2.0 Mega Pixel (effective image size 1.92 Megapixel) digital camera. The MMS implementation follows the OMA MMS standard release 1.2. The WAP 2.0 compatible Browser supports XHTML Mobile Profile (MP) and uses a TCP/IP stack to communicate with a gateway in network.

Nokia RM-42 uses Symbian 8.1a operating system and supports also MIDP Java 2.0 & CLDC1.1, providing a good platform for compelling 3rd party applications.

Figure 1 View of RM-42

RM-42 transceiver features

Displays

Main display:

- · A high resolution, full graphics, TFT (Thin Film Transistor) Active Matrix colour display (262144 colors, 18-bit)
- · Display resolution is 352 x 416 pixels
- · 416 x 352 in landscape view
- · Active area dimensions are 34.85 mm x 41.18 mm (Approx 2.12" Diagonal)

Cover display:

- · A full graphics, TFT (Thin Film Transistor) Active Matrix colour display (65536 colors, 16-bit)
- · Display resolution is 128 x 128 pixels
- · Active area dimensions are 27.69 x 27.69 mm

Both displays are of transflective active matrix type. This means display works as a reflective display (backlight off) in bright light conditions and as a transmissive display (backlight on) in low light conditions.

Camera

Nokia RM-42 has one integrated swing axis digital camera supporting still image and video capture. Same camera is also used for video calls.

Nokia RM-42 camera characteristics are following:

Sensor type:	CMOS
Sensor Photo detectors:	2.0 million
F number/Aperture:	F2.88
Focal length:	f5.5mm (35mm film format equivalent f35mm)
Focus range:	10cm (macro mode) to infinity
Still image resolutions:	1600x1200, 800x600, 640x480
Still image file format:	EXIF (JPEG), *.jpg
Still image compression:	• Low: Q value 50 (typically 80-150kB image file) • Basic: Q value 50 (typically 80-150kB image file) • Normal: Q value 82 (default setting, 200-250kB) • Fine: Q value 94 (approximately 300-700+ kB)
Video resolutions:	352x288 (CIF), 176x144, 128x96. All 15 frames per second.
Video clip length:	30 seconds or free. Maximum clip length in free mode is one hour.
Video file formats:	MPEG-4, .mp4 and 3GPP, *.3gp (mp4: 768kbpss, 3gp: 64kbps in short mode and 128kbps in maximum mode)
Exposure:	Automatic and manual
White balance:	Automatic or adjustable
ISO:	250 - 2000 (Automatic)
Colours:	16.7 million / 24-bit
Capture modes:	Night mode, sequence mode, selftimer

Hardware characteristics

- · Dual mode WCDMA/GSM and triband GSM 900/1800/1900 (WCDMA 2100)
- · Codecs: Decoding: MP3, AAC, Real Audio, WAV, Nokia Ring Tones, AMR, AMR-WB, AMR-NB, AU, MIDI, H.263, JPEG, JPEG2000, EXIF 2.2, GIF 87/89, PNG, BMP (W-BMP), MBM, MPEG-4 Encoding: AMR, AMR-NB, AAC, H.263, JPEG, EXIF 2.2, MPEG-4
- · Main display: 2.1" (34x41mm) up to 262,144 colours TFT Active matrix display, 352x416 pixels
- · Cover display:27.7x27.7mm up to 65,536 colours TFT Active matrix display,128x128pixels
- · Keymat: ITU-T keymat, plastic keys and metal domes
- · Antenna: Internal
- · Ringing vol.: 105 dB from 5cm distance
- · Charging: 2mm jack, or via Pop-Port

- · Headset: Pop-Port connector/Bluetooth connectivity
- · Memory: 35MB internal memory and 64 MB Reduced Size Dual Voltage MultiMediaCard (RS-MMC) in the standard sales package
- · Camera: 2Mpixel (effective resolution 1.92 Mpixel, 1600x1200 pixels)
- · Flash: LED flash integrated to camera unit

UI features

- · High resolution display 352x416 pixels, up to 262,144 colours
- · Landscape oriented user interface for camcorder mode
- · Cover display in Nokia Series 60 phone 128x128 pixels up to 65536 colours
- · Fold and twist form factor combined with rotating camera unit (four axis concept)
- · 2Mpix (effective resolution 1.92Mpixel) autofocus camera
- · MP4 for video recording and playback (MPEG4 & AAC-LC)
- Speaker Independent Name Dialling (SIND)

Sales package

- · Customer Tranceiver
- · Wrist trap
- · Cleaning towel
- · Charger AC-4
- · Charger adapter CA-44 2.5/2mm
- · Battery BL-5B
- · 1-2 Booklets
  - · Users guide(s) 1 languages per package
  - · Club Nokia
  - · Warranty disclaimer
  - · Enhancements
- · Add-on Applications Guide(MMC and CD-ROM)
  - · MMC application and warranty disclaimer
- · Quick Start Guide
- · Sample Image Print
- · MMC Carrying Case
  - · 64MB RS-MMC Memory Card MU-1
  - · Adapter to full size MMC
  - · Label
- · CD-ROM
  - · PC Suite, applications, etc.
- · Stereo headset HDS-3
- · Data cable CA-53 (or DKU-2)
- · Sales box + 3 inner parts

RM-42 mobile enhancements

Table 1 Batteries

Battery	Type	Product code
Battery	BL-5B	

Table 2 Chargers

Chargers	Type	Product code
Fast travel charger (multi-voltage), Australia	ACP-12A	
Fast travel charger (multi-voltage), Argentina	ACP-12AR	
Fast travel charger (multi-voltage), China	ACP-12C	
Fast travel charger (Euro plug), 100- 240 Vac	ACP-12E	
Fast travel charger (US plug), 100-240 Vac	ACP-12US	
Travel charger (multi-voltage), Brazil/Portugal	ACP-12UB	
Fast travel charger, Japan	ACP-12J	
Fast travel charger (gradiente CR1000), Brazil	ACP-12G	
Fast travel charger (UK plug), multi-voltage	ACP-12X	
Retractable travel charger (Europe)	AC-1E	
Retractable travel charger (UK)	AC-1X	
Charging adapter	CA-44	

Table 3 Car accessories

Car accessories	Type	Product code
Headres handsfree	BHF-3	
Plug-in car handsfree	HF-3	
Wireless plug-in car handsfree	HF-6W	
Wireless car kit	CK-1W	
Advanced car kit	CK-7W	
Mobile charger (LCH-12 update)	DC-4	

Table 4 Pop-Port™ accessories

Pop Port ™ accessories	Type	Product code
Boom mono headset	HDB-4	
Fashion stereo headset	HDS-3	
Mono headset	HS-5	
Stereo headset	HS-3	

Pop Port ™ accessories	Type	Product code
Retractable headset	HS-10	
USB data cable	DKU-2	
Loopset	LPS-4	
FM radio headset	HS-2R	

Table 5 Imaging accessories

Imaging accessories	Type	Product code
Nokia remote camera	PT-6	
Image album	PD-1	

Table 6 Bluetooth accessories

Bluetooth accessories	Type	Product code
Wireless headset	HDW-3	
Wireless clip-on headset	HS-21W	
Wireless boom headset	HS-4W	
Wireless headset	HS-11W	
Wireless image headset	HS-13W	
Wireless plug-in car handsfree	HF-6W	
Wireless car kit	CK-1W	
Advanced car kit	CK-7W	
Wireless GPS module	LD-1W	
Wireless keyboard	SU-8W	

Table 7 Other accessories

Other accessories	Type	Product code
64MB MultiMediaCard	MU-1	
128MB MultiMediaCard	MU-2	
256MB MultiMediaCard	MU-9	
512MB MultiMediaCard	MU-12	
Connectivity cable	DKU-2	
Connectivity cable	CA-53	

Technical specifications

RM-42 transceiver general specifications

Unit	Dimensions (L x W x T)	Weight (g)	Volume (cm3)
Transceiver without BL-5B 760mAh Li-ion battery back	112 x 51 x 24	173	126cc

Main RF characteristics for triple-band (GSM900/1800/1900) and WCDMA phones

Parameter	Unit
Cellular system	EGSM900, GSM1800/1900 and WCDMA
Rx frequency band	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA: 2110 - 2170 MHz
Tx frequency band	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA: 1920 - 1980 MHz
Output power	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA -50 ... 21 dBm
Number of RF channels	GSM900: 125
	GSM1800: 375
	GSM1900: 300
Channel spacing	200 kHz
Number of Tx power levels	GSM900: 15
	GSM1800: 16
	GSM1900: 16

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5B	760	up to 3 hrs	up to 12 days

Charging times

ACP-12	LCH-12
1 h	1 h

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-10ºC...+55ºC	Specifications fulfilled
No operation or storage	<-40ºC...>+85ºC	No storage or operation: an attempt may damage the phone.
Charging allowed	-25ºC...+50ºC	
Long term storage conditions	0ºC...+85ºC	

(This page left intentionally blank.)

2 — Parts Lists and Component Layouts

(This page left intentionally blank.)

Table of Contents

List of Tables

List of Figures

(This page left intentionally blank.)

Exploded view

RM-42 exploded view

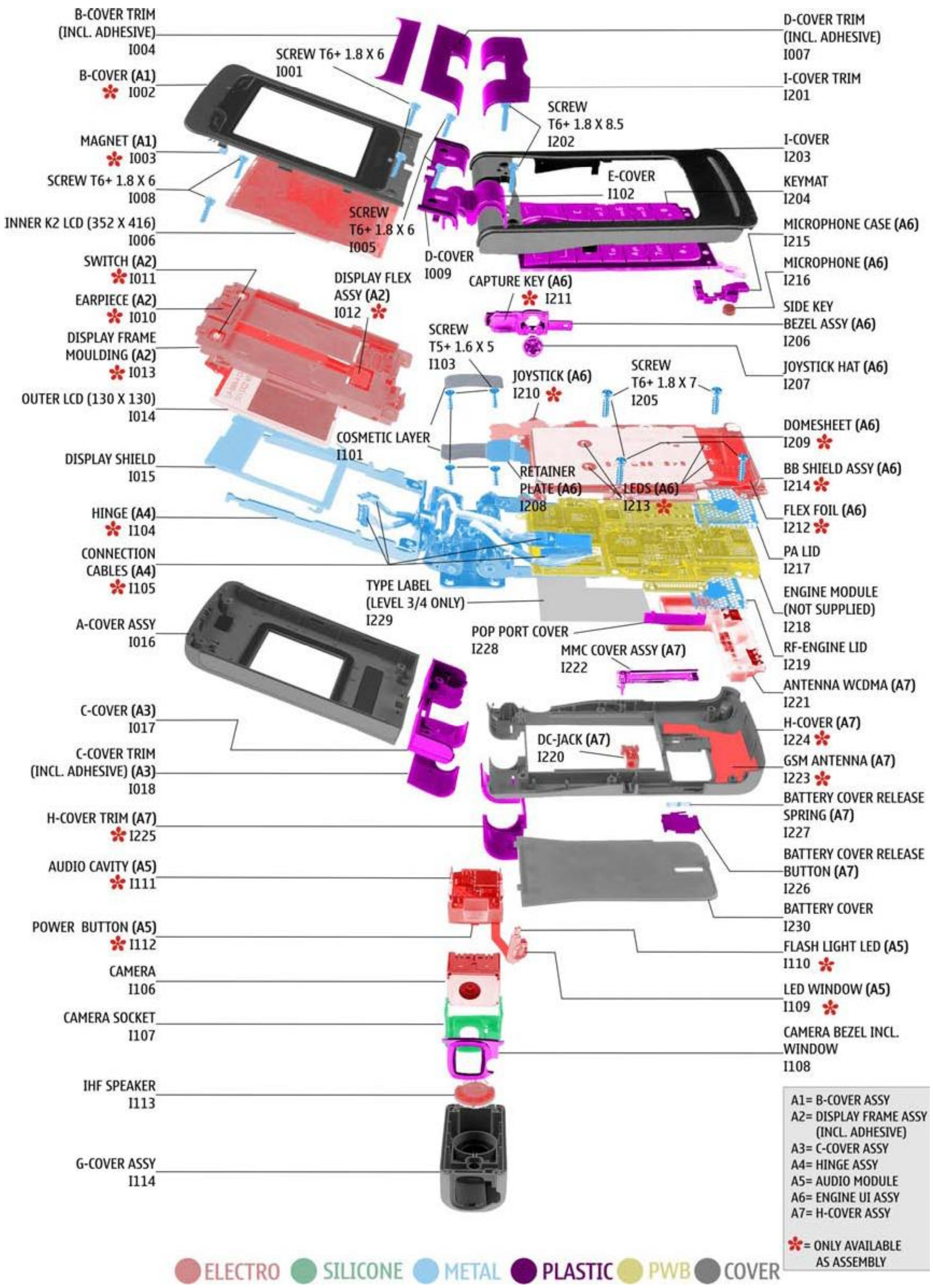
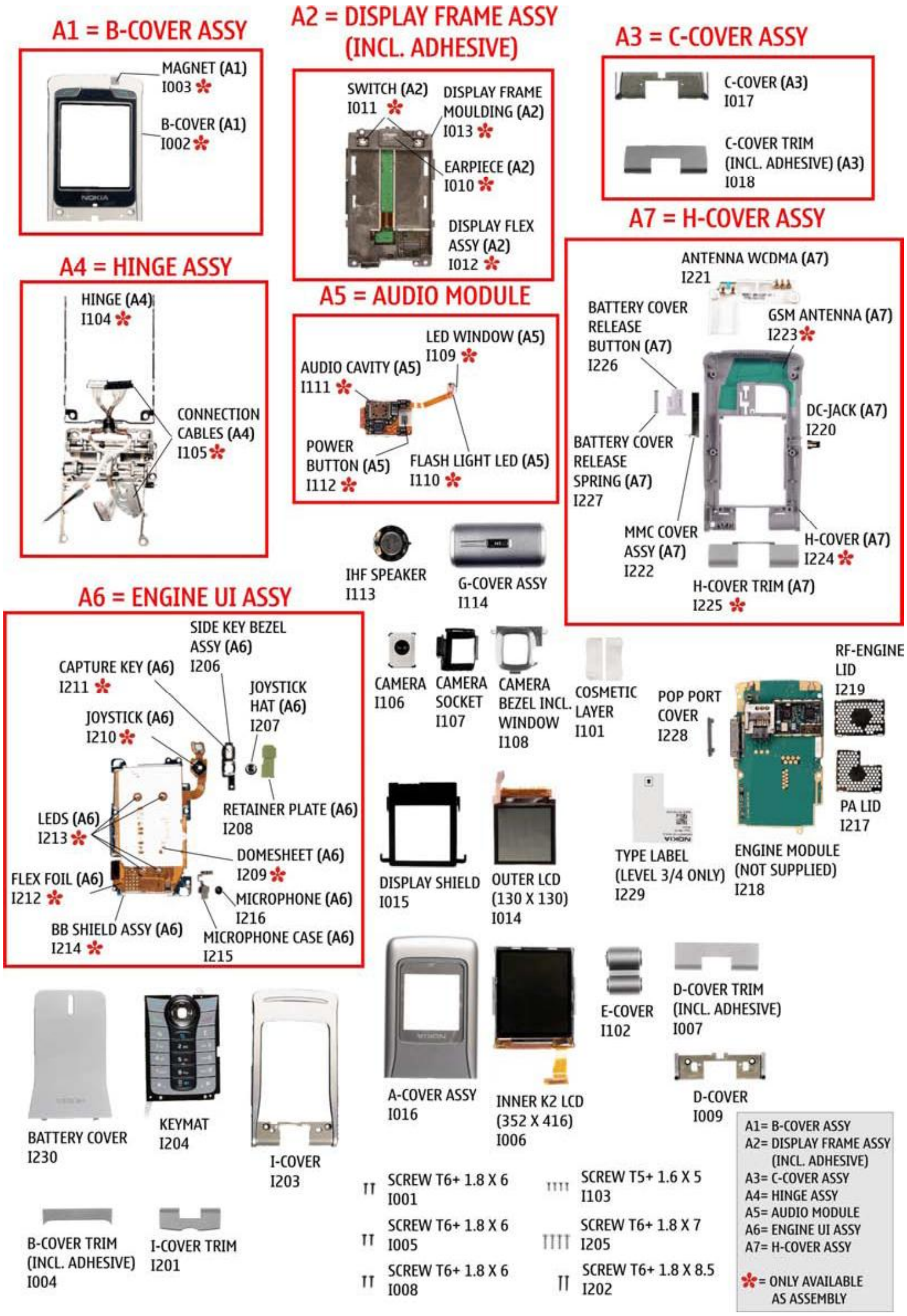


Figure 2 RM-42 exploded view

Parts lists

Mechanical spare parts overview



Mechanical spare parts list

Bold=ASSY

"XXXXXXX" = VARIANTS
"-" = NOT AVAILABLE
"???????" = AVAILABLE AS SPARE PART
I0xx = ITEM codes for upper or mono block
I1xx = ITEM codes for hinge block
I2xx = ITEM codes for lower block
I3xx = ITEM codes for soldered spare parts on the upper, hinge or lower block and not exchangable

ITEM	QTY	PART NO	PART NAME
I001	2	????????	SCREW T6+ 1.8X6
		XXXXXXX	**B-COVER ASSY**
I002	1	XXXXXXX	B-COVER
I003	1	???????	MAGNET
I004	1	???????	B-COVER TRIM (INCL. ADHESIVE
I005	2	???????	SCREW T6+ 1.8X6
I006	1	???????	INNER K2 LCD (352X416)
I007	1	XXXXXXX	D-COVER TRIM (INCL. ADHESIVE)
I008	2	???????	SCREW T6+ 1.8X6
i009	1	???????	D-COVER
		???????	**DISPLAY FRAME ASSY**
I010	1	-	EARPIECE
I011	2	-	SWITCH
I012	1	-	DISPLAY FLEX ASSY
I013	1	-	DISPLAY FRAME MOULDING
I014	1	???????	OUTER LCD (130X130)
I015	1	???????	DISPLAY SHIELD
I016	1	XXXXXXX	A-COVER ASSY
		XXXXXXX	**C-COVER ASSY**
I017	1	???????	C-COVER
I018	1	XXXXXXX	C-COVER TRIM (INCL. ADHESIVE)
I101	2	???????	COSMETIC LAYER
I102	1	XXXXXXX	E-COVER

ITEM	QTY	PART NO	PART NAME
I103	4	???????	SCREW T5+ 1.6X5
		???????	**HINGE ASSY**
I104	1	-	HINGE
I105	1	-	CONNECTION CABLES
I106	1	???????	CAMERA
I107	1	???????	CAMERA SOCKET
I108	1	???????	CAMERA BEZEL INCL. WINDOW
		???????	**AUDIO MODULE**
I109	1	-	LED WINDOW
I110	1	-	FLASH LIGHT LED
I111	1	-	AUDIO CAVITY
I112	1	-	POWER BUTTON
I113	1	???????	IHF SPEAKER
I114	1	XXXXXXX	G-COVER ASSY
I201	1	???????	I-COVER TRIM
I202	2	???????	SCREW T6+ 1.8X8.5
I203	1	XXXXXXX	I-COVER
I204	1	XXXXXXX	KEYMAT
I205	4	???????	SCREW T6+ 1.8X7
		???????	**ENGINE UI ASSY**
I206	1	???????	SIDE KEY BEZEL ASSY
I207	1	???????	JOYSTICK HAT
I208	1	???????	RETAINER PLATE
I209	1	-	DOMESHEET
I210	1	-	JOYSTICK
I211	1	-	CAPTURE KEY
I212	1	-	FLEX FOIL
I213	4	-	LEDS
I214	1	-	BB SHIELD ASSY
I215	1	???????	MICROPHONE CASE
I216	1	???????	MICROPHONE
I217	1	???????	PA LID

ITEM	QTY	PART NO	PART NAME
I218	1	???????	ENGINE MODULE
I219	1	???????	RF-ENGINE LID
		XXXXXXX	**H-COVER ASSY**
I220	1	???????	DC JACK
I221	1	???????	ANTENNA WCDMA
I222	1	???????	MMC COVER ASSY
I223	1	-	GSM ANTENNA
I224	1	-	H-COVER
I225	1	-	H-COVER TRIM
I226	1	???????	BATTERY COVER RELEASE BUTTON
I227	1	???????	BATTERY COVER RELEASE SPRING
I228	1	???????	POP-PORT COVER
I229	1	???????	TYPE LABEL
I230	1	XXXXXXX	BATTERY COVER

Component parts lists

Table 8 Component parts list

Note: For Nokia product codes, please refer to the latest Service Bulletins on the Partner Website (PWS). To ensure you are always using the latest codes, please check the PWS on a daily basis.

Item	Side	Grid ref.		Description and Value			
A7400	Bottom	M	7	SHIELD_040_003698	RF-ENGINE SHIELD ASSY R1107		
A7401	Top	N	5	SHIELD_040_003699	PA-SHIELD ASSY R1107		
I216	Top	P	9	MIC_OBE_415S42_RC3310CL	CLAPTON EMC MICROPHONE MOD -42DB		
B2200	Top	K	5	CRYSTAL_3.3X1.6NR	CRYSTAL 32.768KHZ +-20PPM 12.5PF	32.768kHz	

Item	Side	Grid ref.		Description and Value			
C1470	Top	I	1	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C1471	Top	I	2	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C1472	Top	I	1	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C1473	Top	D	6	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C1474	Bottom	C	1	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C1475	Top	D	4	0402C	Chipcap 5% X7R	3n3	50V
C1476	Top	D	4	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C1477	Top	C	5	0402C	Chipcap X5R 10% 6.3V 0402	220n	6.3V
C1478	Top	C	6	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C1479	Top	J	1	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C1480	Top	K	1	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C1481	Top	K	1	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C1482	Top	D	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C1483	Top	D	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C1484	Top	B	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Description and Value			
C1485	Top	B	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C1486	Top	C	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C1487	Bottom	C	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C1488	Bottom	C	1	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C1489	Top	G	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C1490	Top	G	2	0402C	CHIPCAP NP0 270P J 25V 0402	270p	25V
C2000	Bottom	D	1	0402C	Chipcap 5% NP0	27p	50V
C2001	Bottom	D	1	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2002	Top	K	2	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2003	Top	K	2	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2004	Top	K	2	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2005	Top	J	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2006	Top	J	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2007	Bottom	L	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2008	Bottom	L	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Description and Value			
C2009	Bottom	K	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2010	Bottom	K	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2011	Top	H	2	0402C	CHIPCAP NP0 270P J 25V 0402	270p	25V
C2070	Bottom	L	3	0402C	Chipcap 5% NP0	15p	50V
C2100	Top	L	5	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2101	Top	L	5	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2102	Top	L	6	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C2200	Top	L	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2201	Top	J	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2202	Top	L	5	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2203	Top	K	5	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2204	Top	L	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2205	Top	L	5	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2206	Top	L	5	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2207	Top	J	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V

Item	Side	Grid ref.		Description and Value			
C2208	Top	K	5	0402C	Chipcap 5% NP0	27p	50V
C2209	Top	K	5	0402C	Chipcap 5% NP0	22p	50V
C2210	Top	J	3	0603C	CHIPCAP X5R 1U K 16V 0603	1u0	16V
C2211	Top	J	3	0805C	CHIPCAP X5R 4U7 K 10V 0805	4u7	10V
C2212	Top	K	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2213	Top	I	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2214	Top	L	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2215	Top	I	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2216	Top	J	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2217	Top	I	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2219	Top	J	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2220	Top	K	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2221	Top	K	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2222	Top	K	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2223	Top	L	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Description and Value			
C2224	Top	L	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2225	Top	K	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2226	Top	J	2	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2227	Top	J	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2228	Top	J	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2230	Top	J	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2231	Top	L	3	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C2232	Top	J	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2233	Bottom	M	2	0402C	Chipcap 5% NP0	27p	50V
C2234	Top	J	5	0402C	Chipcap 5% NP0	27p	50V
C2235	Top	L	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2300	Top	J	6	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2301	Top	J	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2302	Top	L	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2303	Top	I	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid ref.		Description and Value			
C2304	Top	J	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2306	Top	I	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2307	Top	I	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2309	Top	I	6	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2312	Top	I	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2313	Top	I	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2314	Top	L	6	0805C	CHIPCAP X5R 4U7 K 25V 0805	4u7	25V
C2315	Top	M	5	0805C	CHIPCAP X5R 4U7 K 25V 0805	4u7	25V
C2700	Bottom	M	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2800	Top	I	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2801	Top	H	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2802	Top	H	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2803	Top	I	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C2804	Top	I	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2805	Top	I	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2806	Top	G	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2807	Top	H	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2808	Top	H	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2809	Top	H	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2810	Top	I	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2811	Top	G	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2812	Top	I	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2813	Top	I	2	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2814	Top	I	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C2815	Top	I	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2816	Top	H	6	0402C	Chipcap 5% NP0	47p	50V
C3000	Top	F	5	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3001	Top	F	5	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3002	Top	F	5	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3003	Top	F	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3004	Top	G	2	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3005	Top	H	2	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3006	Top	H	2	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3007	Top	I	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3008	Top	I	2	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4200	Top	E	9	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4201	Top	F	9	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3

Item	Side	Grid ref.		Description and Value			
C4202	Top	F	9	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C4203	Top	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4400	Bottom	D	1	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4401	Bottom	C	1	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4402	Top	L	2	0402C	Chipcap 5% X7R	1n0	50V
C4403	Top	L	3	0402C	Chipcap 5% X7R	1n0	50V
C4800	Top	D	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4801	Top	G	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4802	Top	G	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4803	Top	D	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4804	Top	G	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4805	Top	D	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4806	Top	E	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C4807	Top	F	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4808	Top	F	5	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4809	Top	G	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4810	Top	G	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4811	Top	F	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4812	Top	G	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4813	Top	G	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C5000	Top	D	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5001	Top	D	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5002	Top	D	8	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5003	Top	D	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C5004	Top	D	8	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5005	Top	D	8	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5200	Top	H	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C6031	Top	H	9	0402C	Chipcap 5% NP0	15p	50V
C6032	Top	H	8	0402L	CHIP COIL 2N2+-0N3 Q30/800M 0402	2n2H	~
C6033	Top	G	9	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C6036	Top	G	8	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6037	Top	G	9	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6038	Top	H	7	0402C	CHIPCAP X5R 1U5 K 4V 0402	1u5	4V
C6039	Top	H	8	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6040	Top	G	9	0402C	CHIPCAP X5R 100N K 10V 0402	100n	10V
C6041	Top	H	8	0402C	CHIPCAP X5R 0U47 K 6.3V 0402	0u47	6V3
C6042	Top	H	8	0402C	CHIPCAP X5R 1U K 6V3 0402	1u0	6.3V
C6043	Top	G	8	0402C	CHIPCAP X5R 0U47 K 6.3V 0402	0u47	6V3

Item	Side	Grid ref.		Description and Value			
C7501	Bottom	M	7	0402C	Chipcap 5% NP0	18p	50V
C7503	Bottom	M	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7504	Bottom	M	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7505	Bottom	L	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7507	Bottom	M	5	0402C	Chipcap 5% NP0	18p	50V
C7508	Bottom	L	5	0402C	Chipcap 5% NP0	18p	50V
C7509	Bottom	M	5	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7512	Top	P	3	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7513	Bottom	L	6	0402C	Chipcap X7R 10% 25V 0402	4n7	25V
C7514	Top	P	3	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7515	Bottom	K	6	0402C	Chipcap 5% NP0	10p	50V
C7516	Bottom	K	6	0402C	Chipcap 5% NP0	150p	50V
C7518	Bottom	N	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7520	Bottom	N	7	0402C	Chipcap 5% NP0	18p	50V
C7522	Bottom	K	5	0402C	Chipcap 5% NP0	150p	50V
C7523	Top	O	3	0402C	Chipcap +-0.25pF NP0	5p6	50V

Item	Side	Grid ref.		Description and Value			
C7524	Bottom	L	5	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7525	Top	O	3	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7526	Bottom	K	7	0402C	Chipcap X7R 5% 16V 0402	10n	16V
C7527	Bottom	M	5	0402C	Chipcap 5% NP0	100p	50V
C7528	Bottom	M	5	0402C	Chipcap 5% NP0	22p	50V
C7529	Bottom	L	6	0402C	Chipcap 5% NP0	100p	50V
C7530	Bottom	L	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7531	Bottom	M	5	0402C	Chipcap 5% NP0	22p	50V
C7532	Bottom	L	6	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7533	Bottom	K	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7534	Bottom	L	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7535	Bottom	L	6	0402C	Chipcap 5% NP0	100p	50V
C7536	Bottom	M	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7537	Top	P	4	0402C	Chipcap 5% NP0	100p	50V
C7538	Top	O	4	0402C	Chipcap 5% NP0	100p	50V
C7539	Top	P	4	0402C	Chipcap 5% NP0	100p	50V
C7540	Bottom	N	9	0402C	Chipcap 5% NP0	18p	50V

Item	Side	Grid ref.		Description and Value			
C7541	Bottom	N	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7542	Bottom	N	9	0402C	Chipcap 5% NP0	18p	50V
C7543	Bottom	N	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7544	Top	M	5	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7545	Top	N	5	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7547	Bottom	N	9	0402C	Chipcap +-0.25pF NP0	1p8	50V
C7548	Bottom	N	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7549	Bottom	N	8	0402C	Chipcap 5% NP0	100p	50V
C7550	Bottom	L	9	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7552	Bottom	L	9	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7553	Bottom	L	9	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7554	Bottom	K	8	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7555	Bottom	K	8	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C7556	Top	N	3	0402C	Chipcap 5% NP0	10p	50V
C7558	Bottom	N	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V

Item	Side	Grid ref.		Description and Value			
C7559	Top	O	4	0402C	Chipcap +-0.25pF NP0	1p0	50V
C7560	Bottom	L	8	0402C	Chipcap X7R 10% 25V 0402	4n7	25V
C7561	Top	N	3	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7562	Bottom	N	9	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C7563	Top	N	3	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7564	Top	O	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C7567	Bottom	M	7	0402C	Chipcap 5% NP0	15p	50V
C7568	Bottom	M	9	0402C	Chipcap 5% NP0	150p	50V
C7569	Top	N	3	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7570	Bottom	L	8	0402C	Chipcap 5% NP0	18p	50V
C7571	Bottom	L	8	0402C	CHIPCAP NP0 330P J 50V 0402	330p	50V
C7573	Bottom	M	9	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7575	Bottom	M	8	0402C	Chipcap 5% NP0	15p	50V
C7576	Top	P	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C7577	Bottom	M	8	0402C	Chipcap 5% NP0	15p	50V
C7578	Top	O	5	0402C	Chipcap 5% NP0	10p	50V

Item	Side	Grid ref.		Description and Value			
C7579	Top	P	6	0402C	Chipcap 5% NP0	10p	50V
C7580	Top	P	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7581	Top	P	3	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7582	Bottom	L	9	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C7583	Top	N	5	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7584	Top	O	3	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7585	Top	O	6	0402C	CHIPCAP NP0 1P0 B 50V 0402	1p0	50V
C7586	Top	O	6	0402C	Chipcap 5% NP0	10p	50V
C7587	Top	O	6	0402C	Chipcap 5% NP0	10p	50V
C7588	Top	N	5	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C7589	Top	N	5	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7590	Top	O	5	0402C	Chipcap 5% NP0	10p	50V
C7591	Top	O	5	0402C	CHIPCAP NP0 470P J 6V3 0402	470p	6V3
C7592	Top	O	5	0402C	Chipcap 5% X7R	3n3	50V
C7593	Top	M	3	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7595	Top	M	4	0402C	Chipcap +-0.25pF NP0	1p2	50V

Item	Side	Grid ref.		Description and Value			
C7596	Bottom	N	6	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7597	Bottom	M	2	TANT_6.3X 3.5_H2.0	CHIPTCAP 100U M 14V 6X3.2X2	100u_14V	14V
C7598	Bottom	K	6	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
D1470	Bottom	B	1	PDSO_G5	OR-GATE 2INPUT 74LVC1G3 2 SC70-5	~	~
D1471	Top	B	5	P_TFBGA12 1	DSP TC39C01XB G 8.0X8.0X1. 2 TFBGA121	~	~
D3000	Top	E	5	PBFREEBG A40_64MB _54MHZ_M AX	FLASH 4MX16 1.8/ 1.8V FBGA44	4Mx16	~
D3001	Top	H	2	SDRAM_11 0MHZ_64M BIT_BGA60 _PBFREE_M AX	SDRAM 4MX16 1.8V/1.8V WBGA60 PBFREE	4Mx16	~
D4400	Top	G	3	DSBGA_5	NOR 2INPUT 74LVC1G0 2 6.5V DSBGA	~	~
D5000	Top	C	7	FBGA133	COMBO 512M DDR +512MNA ND FBGA133 PBFREE	32Mx16/ 64Mx8	~
F2000	Bottom	F	1	0603_FUSE _AVX2MAT S	SM FUSE F 2.0A 32V	2A	~
G7500	Bottom	L	6	VCO_FDK_ WB002	VCO 3610- 4340MHZ 2.7V 15MA	3610- 4340MHz	~

Item	Side	Grid ref.		Description and Value			
G7501	Bottom	L	7	VCTCXO_KT 21P2	VCTCXO 38.4MHZ 2.5V	38.4MHz	~
L1470	Top	I	1	COIL_LQH3 2CN	CHOKE 10U K 0R39 0.45A 1210	10uH	~
L1471	Top	K	1	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L1472	Top	K	1	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2000	Bottom	E	1	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2001	Bottom	K	2	0405_2_M ATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
L2002	Bottom	K	2	0405_2_M ATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
L2003	Bottom	L	2	0405_2_M ATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/ 100MHz	~
L2202	Top	L	3	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2203	Top	J	4	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2204	Top	J	4	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~

Item	Side	Grid ref.		Description and Value			
L2205	Top	J	3	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2206	Top	J	3	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2301	Top	J	6	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2302	Top	K	6	CHOKE_ELL 4LM100MN	CHOKE 10U M 0.69A 0R18 4X4X1.8	10uH	~
L2304	Top	M	5	CHOKE_984 FB	CHOKE 22U M 1R4 0.33A 3.3X3.3X1. 5	22uH	~
L2305	Top	M	6	FERRITE_B K1608	FERRITE BEAD 0R35 68R/ 100MHZ 0603	68R/ 100MHz	~
L4200	Top	D	9	CHOKE_SER 400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L4201	Top	F	9	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L4400	Bottom	D	1	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L4401	Bottom	C	1	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~

Item	Side	Grid ref.		Description and Value			
L5200	Top	G	6	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L6030	Top	G	9	0402L	CHIP COIL 22N J Q28/ 800M 0402	22nH	~
L7400	Top	P	2	0402L	CHIP COIL 5N6 +-0N3 Q28/800M 0402	5n6H	~
L7502	Bottom	L	9	0402L_POL	CHIP COIL 82N J Q17/ 300M 0402	82nH	~
L7503	Bottom	N	9	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L7504	Top	P	3	0402L	CHIP COIL 27N J Q27/ 800M 0402	27nH	~
L7505	Top	P	3	0402L	CHIP COIL 12N J Q31/ 800M 0402	12nH	~
L7506	Top	O	3	0402L	CHIP COIL 12N J Q31/ 800M 0402	12nH	~
L7510	Bottom	M	8	0402L	CHIP COIL 4N7 +-0N3 Q28/800M 0402	4n7H	~
L7511	Bottom	M	7	0402L	CHIP COIL 10N J Q30/ 800M 0402	10nH	~
L7512	Bottom	M	8	0402L	CHIP COIL 4N7 +-0N3 Q28/800M 0402	4n7H	~
L7513	Bottom	N	7	0402L	CHIP COIL 1N8+-0N3 Q31/800M 0402	1n8H	~

Item	Side	Grid ref.		Description and Value			
L7514	Top	P	6	0402L	CHIP COIL 8N2 J Q28/ 800MHZ 0402	8n2H	~
L7515	Top	N	6	CHOKE_SER 400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L7516	Top	M	3	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L7517	Bottom	M	9	0402L	CHIP COIL 1N5 +-0N3 Q33/800M 0402	1n5H	~
N1470	Top	I	2	USMD_10_ 2.458X1.8 99	DC-DC CONV LM2708HT LX-1.57V/ 1.35V USMD10	~	~
N1471	Top	D	5	LLP_6	REG LP3981YD X 2.8/NOPB 0.3A LLP-6	~	2.8V
N2200	Top	K	4	TFBGA_108	RETU 3.02 TSA1GJWE TFBGA108	~	~
N2300	Top	J	5	TFBGA_84_ 6.15X6.15	TAHVO V4.1 LEADFREE TFBGA84 6X6	~	~
N2301	Top	M	6	USMD8_1.6 9X1.69	WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8	~	~
N4200	Top	E	9	USMD_10_ 2.458X1.8 99	DC_DC CONV LM2708H- 1.40V/ 1.09V	~	~

Item	Side	Grid ref.		Description and Value			
N4201	Top	D	6	USMD4_1.3 13X1.033	REG 1.8V 4BUMPS 150MA LQ 40UA USMD4	~	1.8V
N6030	Top	G	8	uBGA63_4. 6X4.6	BRF6150	~	~
N7500	Bottom	M	6	TFBGA_84_ 6.15X6.15	RF ASIC HINKU310 A TFBGA84	~	~
N7501	Bottom	M	8	TFBGA64_ H1.2	RF ASIC VINKU314 A TFBGA64	~	~
N7502	Top	N	4	RITSA_PA_ REL3	PW AMP PF09014B_ CUT5.3 QUADBAN D	~	~
N7503	Top	P	5	PW_AMP_P F57603B	PW AMP PF57603B CUT8.1 1920- 1980MHZ	~	~
N7504	Top	N	5	USMD10_2. 534X2.026	DC CONV SUPA LM2706 PBFREE	~	~
R1470	Top	G	7	0402R	Resistor 5% 63mW	100R	~
R1471	Top	F	7	0402R	Resistor 5% 63mW	100R	~
R1472	Top	G	6	0402R	Resistor 5% 63mW	3k3	~
R1473	Top	G	6	0402R	Resistor 5% 63mW	3k3	~
R1474	Top	G	2	0402R	Resistor 5% 63mW	150R	~
R1475	Top	C	6	0402R	Resistor 5% 63mW	1k0	~
R1476	Top	C	5	0402R	Resistor 5% 63mW	100R	~
R1477	Top	C	5	0402R	Resistor 5% 63mW	100R	~

Item	Side	Grid ref.		Description and Value			
R1478	Bottom	C	1	0402R	Resistor 5% 63mW	2k2	~
R1479	Bottom	C	1	0402R	Resistor 5% 63mW	2k2	~
R1480	Top	G	2	0402R	Chipres 0W06 jumper 0402	0R	~
R1483	Top	D	6	0402R	Resistor 5% 63mW	100k	~
R1484	Top	I	2	0402R	Resistor 5% 63mW	1k0	~
R2000	Top	K	2	0402R	Resistor 5% 63mW	220R	~
R2001	Top	J	2	uBGA11_2.15X1.65	ASIP MIC W/ESD RES +CAP+ZDI BGA11	~	~
R2002	Bottom	K	2	0402R	Resistor 5% 63mW	10R	~
R2003	Bottom	K	2	0402R	Resistor 5% 63mW	10R	~
R2004	Bottom	L	2	0402R	Resistor 5% 63mW	10R	~
R2005	Bottom	L	2	0402R	Resistor 5% 63mW	10R	~
R2006	Bottom	K	2	uBGA5	ASIP 4XESD **PB-FREE** BGA5	~	~
R2007	Top	H	1	uBGA11_1.6X2.15	ASIP SILIC USB OTG / ESD BGA11	~	~
R2008	Top	H	1	0404_RP	RES NETWORK 0W06 220K/120K J 0404	220k/120k	~
R2009	Top	H	1	0402R	Resistor 5% 63mW	100R	~

Item	Side	Grid ref.		Description and Value			
R2070	Bottom	K	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2071	Bottom	K	5	0402_NTH 5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R2100	Top	O	9	FLIP_CHIP_ 8_1.7X1.7	ASIP SINGLE ENDED MICROPHO NE INTERF BGA8	~	~
R2101	Top	L	5	0402R	Resistor 5% 63mW	220R	~
R211	Top	J	5	0402R	Resistor 5% 63mW	47R	~
R2200	Top	L	5	0402R	Resistor 5% 63mW	100k	~
R2201	Top	I	4	0402R	Resistor 5% 63mW	120k	~
R2203	Top	K	5	0402R	Chipres 0W06 5% 0402	3M3	~
R2301	Top	J	6	0402R	Resistor 5% 63mW	4k7	~
R2302	Top	M	6	0402R	Resistor 5% 63mW	10k	~
R2303	Top	L	1	0402R	Resistor 5% 63mW	1k0	~
R2304	Top	L	1	0402R	Resistor 5% 63mW	39R	~
R2305	Top	L	2	0402R	Resistor 5% 63mW	33R	~
R2307	Top	K	2	0402R	Resistor 5% 63mW	39k	~
R2308	Top	K	3	0402R	Resistor 5% 63mW	1k0	~

Item	Side	Grid ref.		Description and Value			
R2700	Bottom	M	4	uBGA8	ASIP EMIF03- SIM01F2 **PB- FREE**	~	~
R3000	Top	F	4	0402R	Resistor 5% 63mW	4k7	~
R4400	Top	L	2	0402R	Chipres 0W06 jumper 0402	0R	~
R4401	Top	L	3	0402R	Chipres 0W06 jumper 0402	0R	~
R4402	Top	G	3	0402R	Resistor 5% 63mW	47R	~
R4800	Top	D	9	0402R	Resistor 5% 63mW	10R	~
R4801	Top	F	9	0402R	Resistor 5% 63mW	100k	~
R4809	Top	F	6	0402R	Resistor 5% 63mW	1k0	~
R5100	Top	F	9	0402R	Resistor 5% 63mW	10k	~
R5200	Top	G	7	uBGA11_1. 62X2.12	ASIP EMIF04- MMC02F2* *PB- FREE**	~	~
R5204	Bottom	E	10	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R7501	Bottom	K	5	0402R	Resistor 5% 63mW	1k0	~
R7503	Bottom	L	8	0402R	Resistor 5% 63mW	4k7	~
R7504	Bottom	M	7	0402R	CHIPRES 0W06 10K F 0402	10k	~

Item	Side	Grid ref.		Description and Value			
R7505	Bottom	K	5	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7506	Top	N	3	0402R	Resistor 5% 63mW	33R	~
R7509	Bottom	K	7	0402R	Resistor 5% 63mW	22k	~
R7512	Top	M	3	0404_RAC1 0	RES NETWORK 0W04 2DB ATT 0404	436R/ 11R6/ 436R	~
R7514	Bottom	N	8	0402R	Resistor 5% 63mW	12k	~
R7516	Top	O	4	0402R	Resistor 5% 63mW	1k0	~
R7517	Top	O	4	0402R	Resistor 5% 63mW	3k3	~
R7518	Top	N	5	0402R	Resistor 5% 63mW	470k	~
R7519	Bottom	M	9	0402R	Resistor 5% 63mW	1k0	~
R7520	Bottom	M	8	0402R	Resistor 5% 63mW	270R	~
R7521	Bottom	N	8	0402R	CHIPRES 0W06 10K F 0402	10k	~
R7522	Top	O	5	0402R	Resistor 5% 63mW	220k	~
R7523	Bottom	M	9	0402R	CHIPRES 0W06 9K1 F 100PPM 0402	9k1	~
R7525	Top	O	5	0402R	Resistor 5% 63mW	10R	~
R7526	Top	O	6	0402R	Resistor 5% 63mW	5k6	~
R7527	Top	O	6	0402R	Resistor 5% 63mW	220R	~
R7528	Bottom	M	9	0402R	Resistor 5% 63mW	470k	~
R7529	Top	O	5	0402R	Resistor 5% 63mW	2k2	~

Item	Side	Grid ref.		Description and Value			
R7530	Top	O	5	0402R	Resistor 5% 63mW	8k2	~
R7531	Top	O	5	0402R	Resistor 5% 63mW	8k2	~
R7534	Top	N	5	0402R	Resistor 5% 63mW	470k	~
S5200	Bottom	H	9	SWITCH_JP S1110_520 1F	SWITCH SPST 5V 0.01A	~	~
T7500	Bottom	N	6	TRANS_LD B15	TRANSF BALUN 2134 +-90MHZ 0805	~	~
T7501	Bottom	L	5	TRANS_LD B15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
T7502	Top	M	3	TRANS_LD B15	TRANSF BALUN 1800 +-100mhz 2x1.25	~	~
T7503	Bottom	K	9	TRANS_LD B15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
V2000	Bottom	E	1	CASE_457	TVS DI 1PMT16AT 3 16V 175W PWRMITE	~	~
V2300	Top	L	6	VMT3_R	TR DTC143ZM N RB=4K7 RBE=47K VMT3	~	~
V2301	Top	K	2	VMT3	TR 2SC5658Q RS N 50V 0A1 0W15 VMT3	~	~

Item	Side	Grid ref.		Description and Value			
V2303	Top	K	2	VMT3	TR 2SC5658Q RS N 50V 0A1 0W15 VMT3	~	~
V7500	Top	O	6	SOT_563	SCHDIX2 RF DETECTOR CT 1PF 0V39 SOT666	~	~
W1	Bottom	J	9	ANTENNA_ G1_BT	MURATA CERAMIC BT ANTENNA G1 SERIES	~	~
I220	Bottom	H	1	CON_JACK_ HR33NK_2 DJA_2S	CONN DC- JACK 2.0MM 3POL SPR 90DEG	~	~
X2001	Bottom	K	1	SYSCON_M Q202_NK_ 14R3	SM SYSTEM CONNECTO R 14POL	~	~
X2061	Bottom	O	3	TRACEABIL ITY_PAD	MODULE ID COMPONEN T 2.8X1.8X0. 3	~	~
X2070	Bottom	K	3	CONN_CY_5 225_1817 H	SM BATTERY CONN 3POLE SPR	~	~
X2700	Bottom	M	4	SIM_CONN_ C707_10M 006_139_2	CONN SIM 2X3POL P2.54	~	~
X4400	Top	E	3	MOLEX_50 0024_500 8	SM CONN 2X25F P0.4 PWB/PWB	~	~
X4401	Top	M	1	MOLEX_51 338_0304	SM CONN BTB 2X15F P0.4	~	~
X5200	Top	K	8	CONN_CT7_ 00220_20 0	CONN MMC 6P RS PUSH- PUSH	~	~

Item	Side	Grid ref.		Description and Value			
X7400	Bottom	O	2	RF_SWITCH _MS_156	SM RF SWITCH MS156 DNS05952 HDC13	~	~
Z1470	Top	J	2	FC6_1.65X 1.15	ASIP 2-CH MIC EMI/ ESD **PB-FREE**	~	~
Z2000	Bottom	I	2	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
Z2001	Bottom	I	2	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
Z2003	Bottom	I	2	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
Z4400	Top	K	1	uBGA25_2. 69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4405	Top	J	1	uBGA25_2. 69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z6030	Top	H	9	EZFVQ42N M77S_V2	LTCC FILT 2441.75 +-41.75MH Z 2.0X1.5	2441.75M Hz	~
Z7500	Top	M	3	FERRITE_FB MJ1608	FERRITE BEAD 0R01 28R/ 100MHZ 0603	28R/ 100MHz	~
Z7501	Bottom	N	5	FILTER_SA W_2.1X1.7 _H0.8	SAW FILTER 2140 +-30MHZ/ 4DB 2X1.6	2140MHz	~

Item	Side	Grid ref.		Description and Value			
Z7502	Top	O	8	DFYK61G9 5LBJCB	DUPL 1920-1980/ 2110-2170MHZ 9X4.3	1920-1980/ 2110-2170MHz	~
Z7503	Top	O	3	ANT_SW_L MSP_0094	ANT.SW +3SAW 880-960/ 1710-1990MHZ	~	~
Z7504	Top	M	4	FILTER_SA W_2.0X1.6 _H0.68	SAW FILTER 897.5 +-17.5MHZ 2X1.6MM	897.5MHz	~
Z7505	Top	P	6	ISOLATOR_ CEZ0047	ISOLATOR 1950 +-30MHZ 13DB 3.35X3.35	~	~
Z7506	Bottom	N	7	FILTER_SA W_2.1X1.7 _H0.9	SAW FILTER 1950 +-30MHZ 2.0X1.6	1950MHz	~
A3000	BTM	D	3	SHIELD_DM C07004	FLASH CAN DMC07004 RM-1	~	~
A6000	BTM	G	3	SHIELD_DM C07003	BT CAN DMC07003 RM-1	~	~
A7000	BTM	L	6	SHIELD_DM C07006	RF ENGINE CAN DMC07006 RM-1	~	~
A7001	BTM	O	9	SHIELD_DM C07007	WDCMA PA CAN DMC07007 RM-1	~	~
A7002	BTM	R	3	SHIELD_DM C07005	GSM PA CAN DMC07005 RM-1	~	~

Item	Side	Grid ref.		Description and Value			
A7003	BTM	M	9	SHIELD_DMD11427	VCO CAN DMD11427 RM-1	~	~
B2200	Top	C	4	CRYSTAL_3.3X1.6	CRYSTAL 32.768KHZ +-20PPM 12.5PF	32.768kHz	~
C1470	BTM	R	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1471	BTM	O	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1472	BTM	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C1473	BTM	D	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2000	BTM	B	9	0402C	Chipcap 5% NP0	27p	50V
C2002	BTM	D	5	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2003	Top	B	5	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2004	Top	B	5	0402C	CERCAP X7R 22N K 16V 0402	22n	16V
C2005	Top	B	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2006	Top	B	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2007	BTM	B	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2008	BTM	A	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Description and Value			
C2009	BTM	C	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2010	BTM	B	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2011	BTM	D	6	0402C	CHIPCAP NP0 270P J 25V 0402	270p	25V
C2012	BTM	B	9	0603C	CHIPCAP X5R 1U K 25V 0603	1u0	25V
C2070	BTM	H	3	TANT_6.3X 3.5_H2.0	CHIPTCAP 100U M 14V 6X3.2X2	100u_14V	14V
C2100	Top	B	5	0402C	CHIPCAP X7R 15N K 16V 0402	15n	16V
C2101	Top	B	5	0402C	CHIPCAP X7R 15N K 16V 0402	15n	16V
C2102	Top	B	5	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C2105	Top	B	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2106	Top	B	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2107	Top	B	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2108	Top	B	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2109	Top	B	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2110	Top	B	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V

Item	Side	Grid ref.		Description and Value			
C2200	Top	B	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2201	Top	D	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2202	Top	C	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2203	Top	C	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2204	Top	B	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2205	Top	B	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2206	Top	B	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2207	Top	D	4	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2208	Top	C	4	0402C	Chipcap 5% NP0	27p	50V
C2209	Top	C	4	0402C	Chipcap 5% NP0	22p	50V
C2210	Top	D	6	0603C	CHIPCAP X5R 1U K 16V 0603	1u0	16V
C2211	Top	C	7	0805C	CHIPCAP X5R 4U7 K 10V 0805	4u7	10V
C2212	Top	C	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2213	Top	E	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2214	Top	D	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid ref.		Description and Value			
C2215	Top	D	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2216	Top	D	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2217	Top	E	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2219	Top	D	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2220	Top	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2221	Top	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2222	Top	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2223	Top	C	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2224	Top	D	5	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2225	Top	D	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2226	Top	C	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2227	Top	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2228	Top	E	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2230	Top	E	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid ref.		Description and Value			
C2231	Top	B	6	0805C	CHIPCAP X5R 10U M 6V3 0805	10U	6V3
C2232	Top	D	6	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2233	BTM	D	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2234	Top	C	4	0402C	Chipcap 5% NP0	27p	50V
C2235	Top	C	3	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2237	Top	E	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2240	Top	E	9	0402C	Chipcap 5% NP0	12p	50V
C2241	Top	D	4	0402C	Chipcap 5% NP0	12p	50V
C2242	Top	E	8	0402C	Chipcap 5% NP0	12p	50V
C2243	Top	F	6	0402C	Chipcap 5% NP0	12p	50V
C2244	Top	F	11	0402C	Chipcap 5% NP0	12p	50V
C2300	Top	C	9	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C2301	Top	C	8	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2302	Top	B	7	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2303	Top	E	8	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2304	Top	C	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Description and Value			
C2306	Top	D	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2307	Top	C	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2309	Top	B	8	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C2312	Top	D	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2313	Top	D	9	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2314	Top	D	10	0805C	CHIPCAP X5R 4U7 K 25V 0805	4u7	25V
C2315	Top	C	10	0805C	CHIPCAP X5R 4U7 K 25V 0805	4u7	25V
C2316	Top	C	8	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C2700	BTM	G	11	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2800	BTM	F	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2801	Top	H	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2802	Top	F	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2803	Top	E	5	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C2804	Top	E	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2805	Top	G	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2806	Top	H	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2807	Top	H	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C2808	Top	H	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2809	BTM	G	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2810	Top	G	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2811	Top	H	5	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2812	Top	E	5	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2813	Top	E	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C2814	Top	F	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C3000	Top	C	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3001	Top	D	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3002	Top	C	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3003	Top	D	4	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3004	Top	E	1	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3005	Top	E	3	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3006	Top	E	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C3007	Top	C	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C3008	Top	D	4	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4200	Top	C	7	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4201	Top	C	7	0805C	CHIPCAP X5R 22U M 6V3 0805	22u	6V3
C4202	Top	D	8	0402C	Chipcap X7R 10% 16V 0402	10n	16V

Item	Side	Grid ref.		Description and Value			
C4400	BTM	O	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4401	BTM	R	5	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4402	BTM	Q	10	0402C	Chipcap 5% NPO	27p	50V
C4800	Top	F	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4801	Top	E	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C4802	Top	E	8	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4803	Top	E	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4804	Top	G	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4805	Top	H	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4806	Top	H	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4807	Top	E	8	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4808	Top	E	8	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C4809	Top	H	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4810	Top	G	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4811	Top	F	6	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4812	Top	E	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C4813	Top	E	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C5000	Top	F	11	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5001	Top	E	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5002	Top	G	11	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5003	Top	F	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5004	Top	E	11	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C5005	Top	E	9	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V

Item	Side	Grid ref.		Description and Value			
C5006	Top	F	11	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C5200	BTM	H	2	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C6031	BTM	F	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6033	BTM	F	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6035	BTM	G	2	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6036	BTM	G	4	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C6042	BTM	G	3	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C6043	BTM	F	3	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C6044	BTM	F	2	0402C	Chipcap 5% NP0	15p	50V
C6045	BTM	G	2	0402C	Chipcap 5% NP0	15p	50V
C6046	BTM	G	1	0402C	Chipcap +-0.25pF NP0	1p0	50V
C6047	BTM	G	2	0603C	CHIPCAP X5R 2U2 K 6V3 0603	2u2	6V3
C6048	BTM	F	2	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7501	BTM	N	7	0402C	Chipcap 5% NP0	18p	50V
C7503	BTM	M	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid ref.		Description and Value			
C7504	BTM	M	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7505	BTM	L	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7507	BTM	M	6	0402C	Chipcap 5% NP0	18p	50V
C7508	BTM	M	6	0402C	Chipcap 5% NP0	18p	50V
C7509	BTM	M	6	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7512	BTM	S	4	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7513	BTM	L	6	0402C	Chipcap X7R 10% 25V 0402	4n7	25V
C7514	BTM	S	4	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7515	BTM	K	7	0402C	Chipcap 5% NP0	10p	50V
C7516	BTM	K	6	0402C	Chipcap 5% NP0	150p	50V
C7518	BTM	N	7	0402C	CHIPCAP X5R 100N M 16V 0402	100n	16V
C7520	BTM	N	7	0402C	Chipcap 5% NP0	18p	50V
C7522	BTM	L	6	0402C	Chipcap 5% NP0	150p	50V
C7523	BTM	R	4	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7524	BTM	K	5	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V

Item	Side	Grid ref.		Description and Value			
C7525	BTM	R	4	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7527	BTM	M	6	0402C	Chipcap 5% NP0	100p	50V
C7528	BTM	M	6	0402C	Chipcap 5% NP0	22p	50V
C7529	BTM	L	7	0402C	Chipcap 5% NP0	100p	50V
C7530	BTM	L	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7531	BTM	M	6	0402C	Chipcap 5% NP0	22p	50V
C7532	BTM	L	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7533	BTM	K	7	0402C	Chipcap X7R 10% 16V 0402	10n	16V
C7534	BTM	M	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7535	BTM	L	6	0402C	Chipcap 5% NP0	100p	50V
C7536	BTM	M	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7541	BTM	K	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7543	BTM	K	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7545	BTM	Q	2	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7547	BTM	J	7	0402C	Chipcap +-0.25pF NP0	1p8	50V
C7548	BTM	J	7	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V

Item	Side	Grid ref.		Description and Value			
C7549	BTM	K	6	0402C	Chipcap 5% NP0	100p	50V
C7550	BTM	I	7	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7552	BTM	I	7	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7553	BTM	I	7	0402C	Chipcap X7R 10% 16V 0402	8n2	16V
C7554	BTM	M	10	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7555	BTM	M	10	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
C7556	BTM	Q	4	0402C	Chipcap 5% NP0	10p	50V
C7558	BTM	J	6	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C7559	BTM	R	2	0402C	Chipcap +-0.25pF NP0	1p0	50V
C7560	BTM	I	7	0402C	Chipcap X7R 10% 25V 0402	4n7	25V
C7561	BTM	Q	4	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7563	BTM	Q	4	0402C	Chipcap +-0.25pF NP0	4p7	50V
C7564	BTM	R	3	0402C	Chipcap X7R 10% 50V 0402	1n0	50V
C7567	BTM	J	6	0402C	Chipcap 5% NP0	15p	50V
C7568	BTM	I	7	0402C	Chipcap 5% NP0	150p	50V

Item	Side	Grid ref.		Description and Value			
C7569	BTM	R	4	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7570	BTM	I	6	0402C	Chipcap 5% NP0	18p	50V
C7571	BTM	L	10	0402C	CHIPCAP NP0 330P J 50V 0402	330p	50V
C7573	BTM	I	7	0603C	CHIPCAP NP0 2N2 G 16V 0603	2n2	16V
C7575	BTM	I	6	0402C	Chipcap 5% NP0	15p	50V
C7577	BTM	I	6	0402C	Chipcap 5% NP0	15p	50V
C7579	BTM	N	11	0402C	Chipcap 5% NP0	10p	50V
C7580	BTM	O	10	0603C	CHIPCAP X5R 1U K 6V3 0603	1u0	6.3V
C7581	BTM	S	4	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7582	BTM	I	7	0402C	Chipcap 5% NP0	100p	50V
C7583	BTM	N	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7584	BTM	S	4	0402C	Chipcap +-0.25pF NP0	5p6	50V
C7585	BTM	O	10	0402C	CHIPCAP NP0 1P0 B 50V 0402	1p0	50V
C7586	BTM	P	9	0402C	Chipcap 5% NP0	10p	50V
C7587	BTM	P	9	0402C	Chipcap 5% NP0	10p	50V
C7589	BTM	O	8	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7590	BTM	O	9	0402C	Chipcap 5% NP0	10p	50V

Item	Side	Grid ref.		Description and Value			
C7591	BTM	N	9	0402C	CHIPCAP NP0 470P J 6V3 0402	470p	6V3
C7592	BTM	N	9	0402C	Chipcap 5% X7R	3n3	50V
C7593	BTM	Q	4	0603C	CHIPCAP X5R 4U7 K 6V3 0603	4u7	6.3V
C7596	BTM	N	6	0402C	Chipcap +-0.25pF NP0	2p7	50V
C7597	BTM	O	4	TANT_6.3X 3.5_H2.0	CHIPTCAP 100U M 14V 6X3.2X2	100u_14V	14V
C7598	BTM	K	7	0402C	CHIPCAP NP0 0P5 C 50V 0402	0p5	50V
D2800	Top	G	4	uBGA_289	RAP3G V2.1E-PA UMC8D F761800B 027 U*BGA	~	~
D3000	BTM	D	3	PBFREEBG A40_64MB _54MHZ_M AX	FLASH 4MX16 1.8/ 1.8V FBGA44	4Mx16	~
D3001	Top	D	2	SDRAM_11 0MHZ_64M BIT_BGA60 _PBFREE_M AX	SDRAM 4MX16 1.8V/1.8V WBGA60 PBFREE	4Mx16	~
D4800	Top	F	7	uBGA_289	HELEN3 PS1.1E F761991A C027 UBGA289	~	~
D5000	Top	F	10	FBGA121_ H1.1	COMBO 256M DDR + 256M NAND FBGA121 PBFREE	256M_DDR / 256M_NAN D	~

Item	Side	Grid ref.		Description and Value			
F2000	BTM	A	9	0603_FUSE_AVX2MATS	SM FUSE F 2.0A 32V	2A	~
G2200	BTM	F	11	BATTER_RB414H	CELL CAPACITOR 0.01MAH 3V3	3V3	~
G7500	BTM	K	6	VCO_FDK_IT_H1.7	VCO 3610-4340MHZ 2.7V 13MA WCDMA FDD	3610-4340MHz	~
G7501	BTM	L	7	NKG3176B_H1.0	VCTCXO 38.4MHZ 2.5V	38.4MHz	~
G7502	BTM	M	9	VCO_FDK_IT_H1.7	VCO 3420-3960MHZ 2.7V 14MA WCDMA FDD	3420-3960MHz	~
L2000	BTM	B	8	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~
L2001	Top	B	6	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2002	BTM	B	4	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2003	BTM	B	4	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2100	Top	U	3	0405_2_MATSU	CHIP BEAD ARRAY 2X1000R 0405	2x1000R/100MHz	~
L2101	Top	B	6	0603_BLM	FERR.BEAD 220R/100M 2A 0R05 0603	220R/100MHz	~

Item	Side	Grid ref.		Description and Value			
L2102	BTM	S	5	COIL_0603 CS	CHIP COIL 56N J Q38/ 250MHZ 0603	56nH	~
L2103	BTM	S	6	COIL_0603 CS	CHIP COIL 56N J Q38/ 250MHZ 0603	56nH	~
L2104	Top	B	6	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2105	Top	B	8	0402L_XL	FERRITE BEAD 220R 0R45 0.3A 0402	220R/ 100MHz	~
L2106	Top	B	8	0402L_XL	FERRITE BEAD 220R 0R45 0.3A 0402	220R/ 100MHz	~
L2202	Top	E	4	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2203	Top	E	5	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2204	Top	D	5	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2205	Top	C	6	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2206	Top	E	5	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~

Item	Side	Grid ref.		Description and Value			
L2207	BTM	E	11	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L2301	Top	B	8	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L2302	Top	B	7	CHOKE_SER 400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L2304	Top	D	10	CHOKE_984 FB	CHOKE 22U M 1R4 0.33A 3.3X3.3X1. 5	22uH	~
L4200	Top	D	7	CHOKE_SER 400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L4201	Top	E	7	0603_BLM	FERR.BEAD 220R/ 100M 2A 0R05 0603	220R/ 100MHz	~
L4400	BTM	O	7	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L4401	BTM	R	5	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L5200	BTM	I	2	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L6031	BTM	G	2	0402L	CHIP COIL 2N7+-0N3 Q29/800M 0402	2n7H	~

Item	Side	Grid ref.		Description and Value			
L6032	BTM	G	2	0402L	CHIP COIL 2N7+-0N3 Q29/800M 0402	2n7H	~
L6033	BTM	F	2	0402L	CHIP COIL 22N J Q28/ 800M 0402	22nH	~
L6034	BTM	F	2	0402L	CHIP COIL 22N J Q28/ 800M 0402	22nH	~
L7502	BTM	I	7	0402L	CHIP COIL 100N J Q16/300M 0402	100nH	~
L7503	BTM	K	7	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L7504	BTM	S	4	0402L	CHIP COIL 27N J Q27/ 800M 0402	27nH	~
L7505	BTM	S	4	0402L	CHIP COIL 12N J Q31/ 800M 0402	12nH	~
L7506	BTM	R	4	0402L	CHIP COIL 12N J Q31/ 800M 0402	12nH	~
L7510	BTM	J	6	0402L	CHIP COIL 4N7 +-0N3 Q28/800M 0402	4n7H	~
L7511	BTM	J	6	0402L	CHIP COIL 10N J Q30/ 800M 0402	10nH	~
L7512	BTM	J	6	0402L	CHIP COIL 4N7 +-0N3 Q28/800M 0402	4n7H	~
L7514	BTM	O	10	0402L	CHIP COIL 8N2 J Q28/ 800MHZ 0402	8n2H	~

Item	Side	Grid ref.		Description and Value			
L7515	BTM	P	9	CHOKE_SER 400	CHOKE 10U 0.8A 0R24 4X4X1.8	10uH	~
L7516	BTM	P	4	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
L7517	BTM	J	7	0402L	CHIP COIL 1N5 +-0N3 Q33/800M 0402	1n5H	~
N1470	BTM	D	5	LLP6	REG LP3990YD X-1.5V LLP-6	~	1.5V
N2200	Top	C	5	TFBGA_108	RETU 3.02 L TSA1GJWE TFBGA108	~	~
N2300	Top	D	8	TFBGA_84_ 6.15X6.15	TAHVO V4.1 TFBGA84 6X6	~	~
N2301	Top	D	10	USMD8_1.6 9X1.69	WHITE LED DRIVER 4LEDS 500MW 8BUMP USMD8	~	~
N4200	Top	C	7	USMD_10_ 2.458X1.8 99	DC_DC CONV LM2708H-1.40V/ 1.09V	~	~
N6030	BTM	G	3	TFBGA84_ H1.0	BC3-ROM WITH BC2 MOULD MATERIAL	~	~
N6031	BTM	G	3	USMD5_1.4 68X1.036	VREG 2.85/ 150MA LP3987-2.85 USMD5	~	2.85V

Item	Side	Grid ref.		Description and Value			
N7500	BTM	M	6	TFBGA_84_ 6.15X6.15	RF ASIC HINKU310 A TFBGA84	~	~
N7501	BTM	J	7	TFBGA64_ H1.2	RF ASIC VINKU314 A TFBGA64	~	~
N7502	BTM	Q	3	RITSA_PA_ REL3	PW AMP RF9292E9. 2 QUADBAN D	~	~
N7503	BTM	O	10	RF9252E2. 1	PW AMP RF9252E8. 2 1920- 1980MHZ	~	~
N7504	BTM	O	9	USMD10_2. 534X2.026	DC CONV SUPA LM2706 PBFREE	~	~
R1470	Top	H	6	0402R	Resistor 5% 63mW	100R	~
R1471	Top	H	6	0402R	Resistor 5% 63mW	100R	~
R1472	Top	H	8	0402R	Resistor 5% 63mW	3k3	~
R1473	Top	H	8	0402R	Resistor 5% 63mW	3k3	~
R1474	Top	G	6	0402R	Resistor 5% 63mW	33R	~
R2000	BTM	D	5	0402R	Resistor 5% 63mW	220R	~
R2001	Top	B	5	uBGA11_2. 15X1.65	ASIP MIC W/ESD RES +CAP+ZDI BGA11	~	~
R2002	BTM	B	4	0402R	Resistor 5% 63mW	10R	~
R2003	BTM	C	4	0402R	Resistor 5% 63mW	10R	~
R2004	BTM	C	4	0402R	Resistor 5% 63mW	10R	~
R2005	BTM	C	4	0402R	Resistor 5% 63mW	10R	~

Item	Side	Grid ref.		Description and Value			
R2006	BTM	B	4	uBGA5	ASIP 4XESD **PB-FREE** BGA5	~	~
R2007	BTM	B	6	uBGA11_1.6X2.1	ASIP SILIC USB OTG / ESD BGA11	~	~
R2009	BTM	C	6	0402R	Resistor 5% 63mW	100R	~
R2010	BTM	C	6	0402R	Resistor 5% 63mW	220k	~
R2011	BTM	D	5	0402R	Resistor 5% 63mW	120k	~
R2012	BTM	D	5	0402R	Resistor 5% 63mW	100k	~
R2013	BTM	D	4	0402R	Resistor 5% 63mW	330R	~
R2014	BTM	D	4	0402R	Resistor 5% 63mW	1M0	~
R2070	BTM	B	8	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2071	Top	C	2	0402_NTH5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R2100	Top	B	5	FLIP_CHIP_8_1.7X1.7	ASIP SINGLE ENDED MICROPHONE INTERF BGA8	~	~
R2101	Top	B	5	0402R	Resistor 5% 63mW	220R	~
R2104	Top	U	4	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~

Item	Side	Grid ref.		Description and Value			
R2105	Top	U	4	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2106	BTM	S	5	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2107	BTM	S	5	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2200	Top	C	4	0402R	Resistor 5% 63mW	100k	~
R2201	Top	D	4	0402R	Resistor 5% 63mW	120k	~
R2202	BTM	E	11	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R2205	Top	C	4	0402R	CHIPRES 0W06 2M2 J 0402	2M2	~
R2301	Top	C	10	0402R	Resistor 5% 63mW	4k7	~
R2302	Top	D	11	0402R	Resistor 5% 63mW	10k	~
R2303	Top	C	10	0402R	Resistor 5% 63mW	1k0	~
R2304	Top	C	10	0402R	Resistor 5% 63mW	39R	~
R2305	Top	E	8	0402R	Resistor 5% 63mW	33R	~
R2700	BTM	E	11	uBGA8	ASIP EMIF03-SIM01F2 **PB-FREE**	~	~
R3000	Top	H	3	0402R	Resistor 5% 63mW	4k7	~

Item	Side	Grid ref.		Description and Value			
R4400	Top	B	4	0402R	Resistor 5% 63mW	470k	~
R4401	Top	C	4	0402R	Resistor 5% 63mW	100k	~
R4402	Top	B	4	0402R	Resistor 5% 63mW	470k	~
R4403	Top	U	4	0402_NTH 5	NTC RES 47K J B=4050 +-3% 0402	47k	~
R4404	BTM	Q	10	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4405	BTM	Q	10	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4406	BTM	Q	2	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R4408	Top	E	1	0603_VAR	CHIP VARISTOR VWM19V VC27V 0603	19V/27V	~
R4409	Top	F	1	0603_VAR	CHIP VARISTOR VWM19V VC27V 0603	19V/27V	~
R4800	Top	F	9	0402R	Resistor 5% 63mW	10R	~
R4809	Top	E	6	0402R	Resistor 5% 63mW	1k0	~
R5100	Top	H	6	0402R	Resistor 5% 63mW	10k	~

Item	Side	Grid ref.		Description and Value			
R5200	BTM	H	2	uBGA11_1.62X2.12	ASIP EMIF04-MMC02F2**PB-FREE**	~	~
R5204	BTM	O	3	0402_VAR	CHIP VARISTOR VWM14V VC50V 0402	14V/50V	~
R6030	BTM	G	3	0402R	Resistor 5% 63mW	10k	~
R6034	BTM	F	2	0402R	CHIPRES 0W06 2R2 J 0402	2R2	~
R7501	BTM	K	6	0402R	Resistor 5% 63mW	1k0	~
R7503	BTM	I	6	0402R	Resistor 5% 63mW	4k7	~
R7504	BTM	M	7	0402R	CHIPRES 0W06 10K F 0402	10k	~
R7505	BTM	L	6	0402R	CHIPRES 0W06 8K2 F 0402	8k2	~
R7506	BTM	Q	4	0402R	Resistor 5% 63mW	270R	~
R7509	BTM	K	7	0402R	Resistor 5% 63mW	22k	~
R7512	BTM	P	4	0404_RAC10	RES NETWORK 0W04 2DB ATT 0404	436R/11R6/436R	~
R7514	BTM	K	6	0402R	Resistor 5% 63mW	12k	~
R7516	BTM	R	3	0402R	Resistor 5% 63mW	1k0	~
R7518	BTM	Q	2	0402R	Resistor 5% 63mW	470k	~
R7519	BTM	J	7	0402R	Resistor 5% 63mW	1k0	~
R7520	BTM	J	6	0402R	Resistor 5% 63mW	270R	~

Item	Side	Grid ref.		Description and Value			
R7521	BTM	J	6	0402R	CHIPRES 0W06 10K F 0402	10k	~
R7522	BTM	N	8	0402R	Resistor 5% 63mW	220k	~
R7523	BTM	I	7	0402R	CHIPRES 0W06 9K1 F 100PPM 0402	9k1	~
R7525	BTM	N	9	0402R	Resistor 5% 63mW	10R	~
R7526	BTM	O	9	0402R	Resistor 5% 63mW	5k6	~
R7527	BTM	O	9	0402R	Resistor 5% 63mW	220R	~
R7528	BTM	J	7	0402R	Resistor 5% 63mW	470k	~
R7529	BTM	O	9	0402R	Resistor 5% 63mW	2k2	~
R7530	BTM	N	9	0402R	Resistor 5% 63mW	8k2	~
R7531	BTM	N	9	0402R	Resistor 5% 63mW	8k2	~
R7534	BTM	R	2	0402R	Resistor 5% 63mW	470k	~
S4400	BTM	R	11	SWITCH_SKRE_II	SM TACT SW TRAV 0.2 4.1X3.55X 1.75	~	~
S4401	BTM	R	2	SWITCH_SKRE_II	SM TACT SW TRAV 0.2 4.1X3.55X 1.75	~	~
S5200	BTM	O	2	SWITCH_SPVN220100	SM SW DETECTOR SPST-NO 5V 1MA	~	~
T7500	BTM	N	6	TRANS_LDB15	TRANSF BALUN 2134 +-90MHZ 0805	~	~

Item	Side	Grid ref.		Description and Value			
T7501	BTM	L	6	TRANS_LDB15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
T7502	BTM	P	3	TRANS_LDB15	TRANSF BALUN 1800 +-100mhz 2x1.25	~	~
T7503	BTM	M	9	TRANS_LDB15	TRANSF BALUN 3800 +-550MHZ 0805	~	~
V2000	BTM	B	8	CASE_457	TVS DI 1PMT16AT3 16V 175W PWRMITE	~	~
V2001	BTM	D	4	SC_75A	MFET 2SK3019 N 30V 0.1A 7R SC-75A	~	~
V2300	Top	D	8	EM3	TR DTC143ZEN RBE4K7/47K 0A1 SC75	~	~
V4400	Top	U	4	PT202MR0MP	DI PHOTO PT202MR0MP 620NM 1.25X2	~	~
V7500	BTM	O	9	SOT_563	SCHDIX2 RF DETECTOR CT 1PF 0V39 SOT666	~	~
X1470	BTM	P	6	SOCKET_DMD10413	CAMERA MOD.SOCKET 2X7POL SPR P1.4	~	~
X2001	BTM	A	6	SYSCON_MQ202_NK_14R3	SM SYSTEM CONNECTOR 14POL	~	~

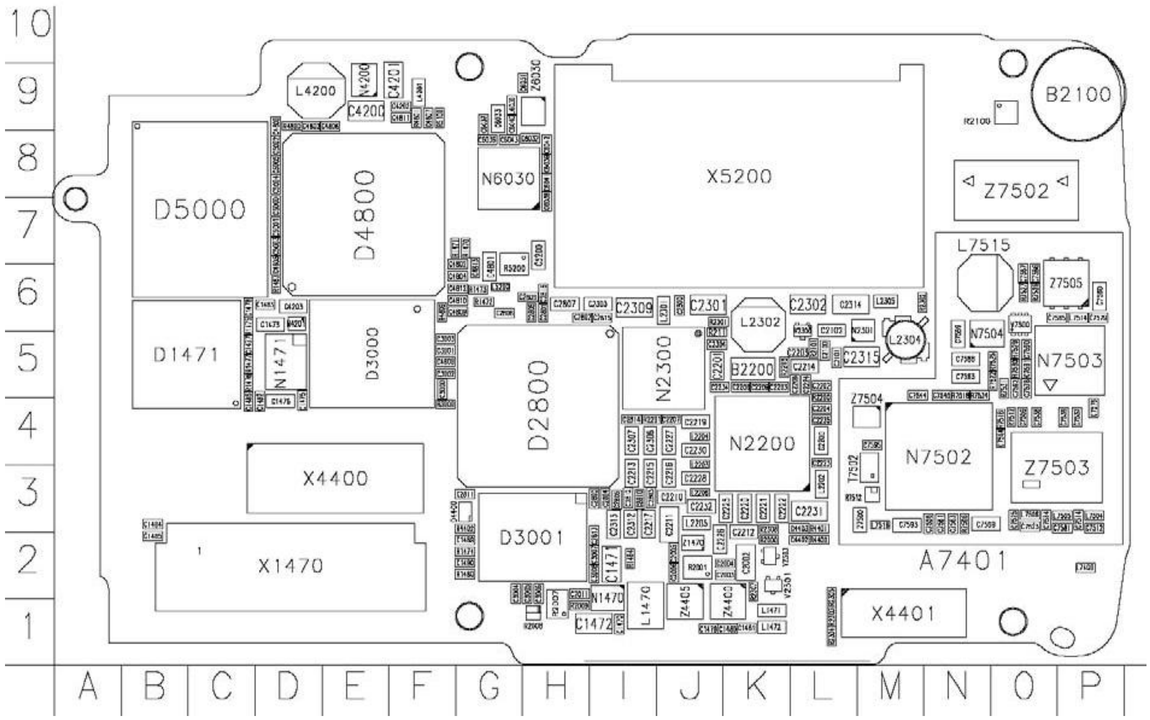
Item	Side	Grid ref.		Description and Value			
X2060	Top	N	11	TRACEABILITY_PAD	MODULE ID COMPONENT 2.8X1.8X0.3	~	~
X2070	BTM	C	8	LYNX_BATT_CONN	SM LYNX BATT.CONN 3POL 12V 2A H7	~	~
X2700	BTM	F	8	SIM_READER_M_C707_10M006_532_2	SM SIM CONN 2X3POL P2.54 15V 0.5A	~	~
X4400	Top	F	2	SMK_4309_B_B_16P_V8	SM CONN 16P SPR P1.3 50V PWB/PWB	~	~
X4401	Top	T	3	JST_R_JAVK_G_1_R3	SM CONN 2X12F P0.4 30V 0.3A PCB/PCB	~	~
X4402	Top	R	9	FORK_SPRING_040_000443_RM_1	FORK SPRING 040-000443 RM-1	~	~
X4403	Top	J	9	FORK_SPRING_040_000443_RM_1	FORK SPRING 040-000443 RM-1	~	~
X4404	Top	R	4	FORK_SPRING_040_000443_RM_1	FORK SPRING 040-000443 RM-1	~	~
X4405	Top	J	4	FORK_SPRING_040_000443_RM_1	FORK SPRING 040-000443 RM-1	~	~
X5200	BTM	L	3	MOLEX_MMC_P03_3D0545_001	CONN SMC RS-MMC 6POL P2.5	~	~

Item	Side	Grid ref.		Description and Value			
Z2000	BTM	B	7	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
Z2001	BTM	B	7	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
Z2003	BTM	B	7	FERRITE_0 402	FERRITE BEAD 0.6R 600R/ 100MHZ 0402	600R/ 100MHz	~
Z4400	Top	H	3	uBGA25_2. 69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4401	Top	G	1	FC6_1.65X 1.15	ASIP 2-CH MIC EMI/ ESD **PB-FREE**	~	~
Z4402	Top	H	9	uBGA25_2. 69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z4403	Top	H	10	uBGA25_2. 69X2.69	ASIP 10-CH ESD EMI FILTER BGA25	~	~
Z6030	BTM	F	1	EZFVQ42N M61S	LTCC FILT 2441.75 +-41.75MH Z 2.5X2	2441.75M Hz	~
Z7500	BTM	P	4	FERRITE_FB MJ1608	FERRITE BEAD 0R01 28R/ 100MHZ 0603	28R/ 100MHz	~
Z7501	BTM	N	6	FILTER_SA W_2.1X1.7 _H0.8	SAW FILTER 2140 +-30MHZ 2.0X1.6X1. 0	2140MHz	~

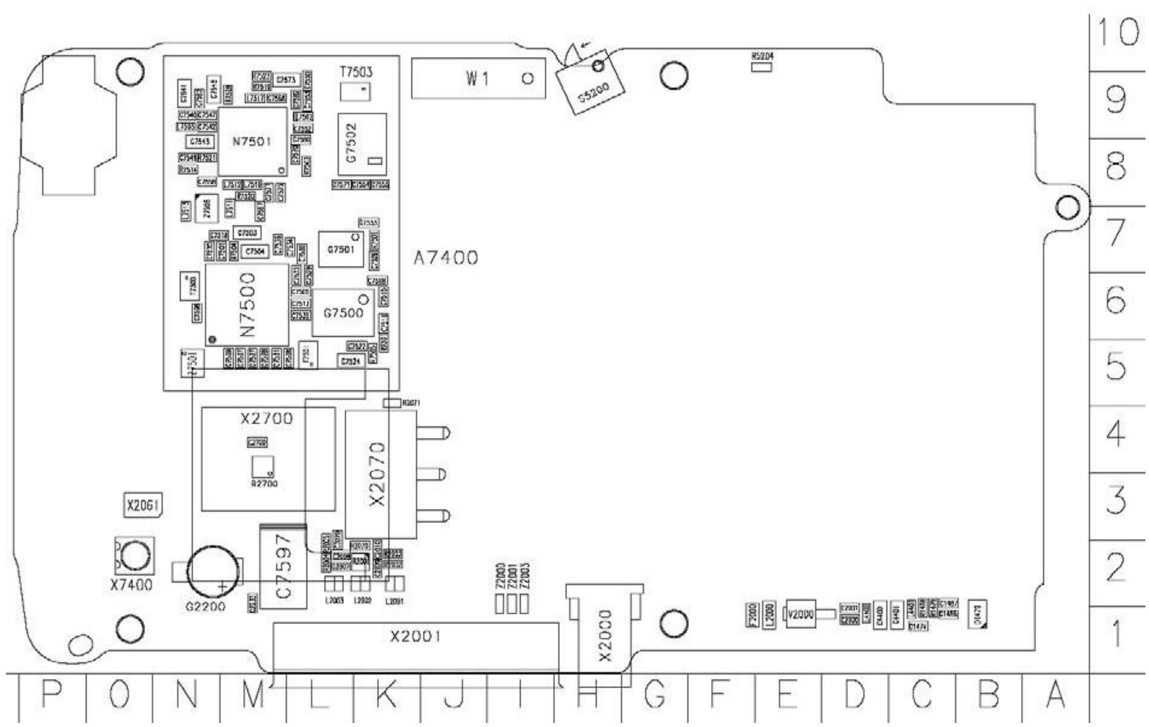
Item	Side	Grid ref.		Description and Value			
Z7502	BTM	Q	9	DFYK61G95LBJCB	DUPL 1920-1980/ 2110-2170MHZ 9X4.3	1920-1980/ 2110-2170MHz	~
Z7503	BTM	S	3	ANT_SW_M043B	ANT.SW +3SAW 880-960/ 1710-1990MHZ	~	~
Z7504	BTM	P	3	FILTER_SAW_2.1X1.7_H0.8	SAW FILTER 897.5 +-17.5MHZ 2.0X1.6	897.5MHz	~
Z7505	BTM	P	10	ISOLATOR_CEZ0047	ISOLATOR 1950 +-30MHZ 13DB 3.3X3.4X1.6	~	~
Z7506	BTM	J	6	FILTER_SAW_2.1X1.7_H0.8	SAW FILTER 1950 +-30MHZ 2.0X1.6X1.0	1950MHz	~

Component layouts

RM-42 component layout - top



RM-42 component layout - bottom



(This page left intentionally blank.)

3 — Service Software Instructions

(This page left intentionally blank.)

Table of Contents

List of Figures

(This page left intentionally blank.)

Phoenix installation steps in brief

Before you begin

Recommended PC HW requirements:

- Computer processor: Pentium 700 MHz or higher
- RAM 256 MB
- Disk space 100-200 MB

Supported operating systems:

- Windows 2000 Service Pack 3 or higher
- Windows XP Service Pack 1 or higher

Context

Phoenix is the service software for reprogramming, testing and tuning the phone.

Phoenix installation contains:

- Service software support for all phone models included in the package
- Flash update package files for programming devices
- All needed drivers for:
  - DK2 dongle
  - DKU-2 USB cable

Note: Separate installation packages for flash update files and drivers are also available, but it is not necessary to use them unless updates appear between Phoenix service software releases. If separate update packages are used, they should be used after Phoenix and data packages have been installed.

The phone model specific data package includes all changing product specific data:

- Product software Binary files
- Files for type label printing
- Validation file for the Faultlog repair data reporting system
- All product specific configuration files for *Phoenix* software components

Note: *Phoenix* service SW and phone data packages should only be used as complete installation packages. Uninstallation should be made from the Windows Control Panel.

To install *Phoenix*, you need to:

Steps

1. Connect a DK2 dongle to your computer.
2. Install the *Phoenix* Service SW.
3. Install the phone-specific Data Package for *Phoenix*.
4. Configure users.
5. Manage connection settings (depends on the tools you are using).

If you use FPS-8:	• Update FPS-8 SW • Activate FPS-8

If you use FPS-10:	• Update FPS-10 SW **Note:** There is no need to activate FPS-10. • Activate SX-4 smart card if you need tuning and testing functions in service software **Note:** When FPS-10 is used only for product SW updates, SX-4 smart card is not needed.

Results

Phoenix is now ready to be used with FPS-8 or FPS-10 flash prommers and other tools as well.

Installing Phoenix

Before you begin

- Check that a dongle is attached to the parallel port of your computer.
- Download the installation package (for example, *phoenix_service_sw_2004_39_x_xx.exe*) to your computer (in *C:\TEMP*, for instance).
- Close all other programs.
- Depending on the operating system, administrator rights may be required to be able to install Phoenix .
- If uninstalling or rebooting is needed at any point, you will be prompted by the InstallShield program.

Context

At some point during the installation procedure you may get the following message:

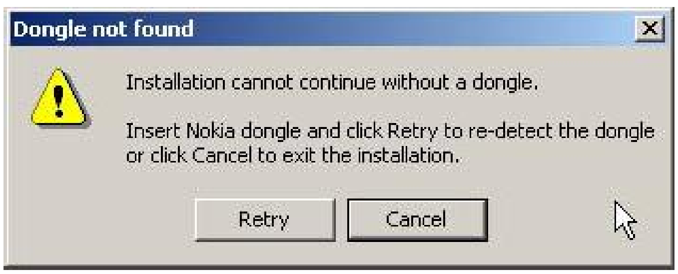


Figure 3 Dongle not found

One possible reason may be a defective or too old PKD-1 dongle (five digit serial number dongle when used with FPS-8/FPS-10 prommers).

First check the COM/parallel ports used! After correcting the problem Installation can be restarted.

For more detailed information, please refer to Phoenix Help files. Each feature in Phoenix has its own Help function, which can be activated while running the program. Press the F1 key or the feature's Help button to activate a Help file.

Steps

1. To start installation, run the application file (for example,*phoenix_service_sw_2004_39_x_xx.exe*).
2. In the *Welcome* dialogue, click Next.

3. Read the disclaimer text carefully and click Yes.

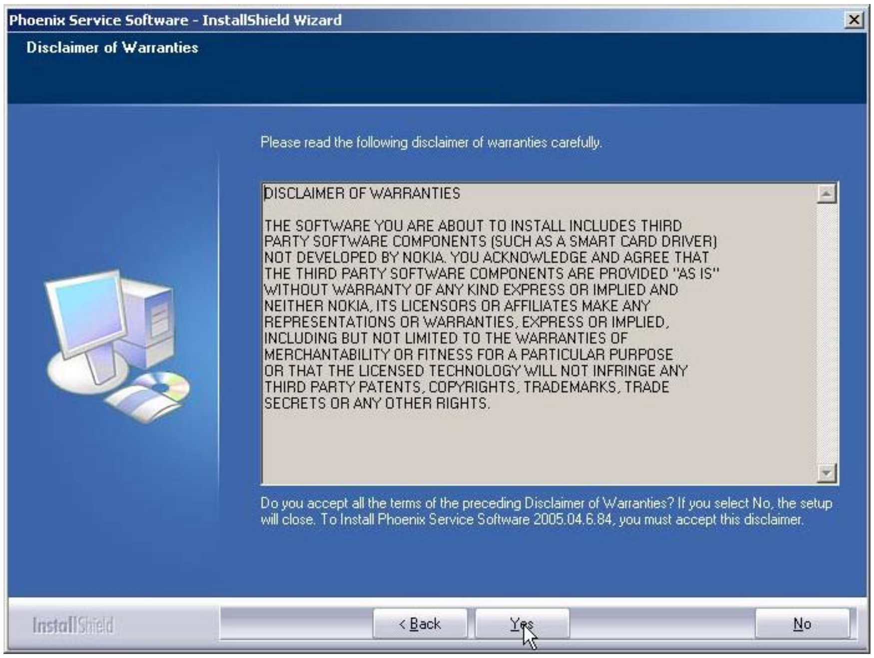


Figure 4 Disclaimer text

4. Choose destination folder.

   The default folder *C:\ProgramFiles\Nokia\Phoenix* is recommended.
5. To continue, click Next.

   To choose another location, click Browse (not recommended).
6. Wait for the components to be copied.

   The progress of the setup is shown in the *Setup Status* window.
7. Wait for the drivers to be installed and updated.

   The process may take several minutes to complete.

   If the operating system does not require rebooting, the PC components are registered right away.

   If the operating system requires restarting your computer, the Install Shield Wizard will notify you about it. Select Yes... to reboot the PC immediately and No... to reboot the PC manually afterwards.

   After the reboot, components are registered and Phoenix is ready for use.

   Note: Phoenix does not work, if components have not been registered.

8. To end installation, click Finish.

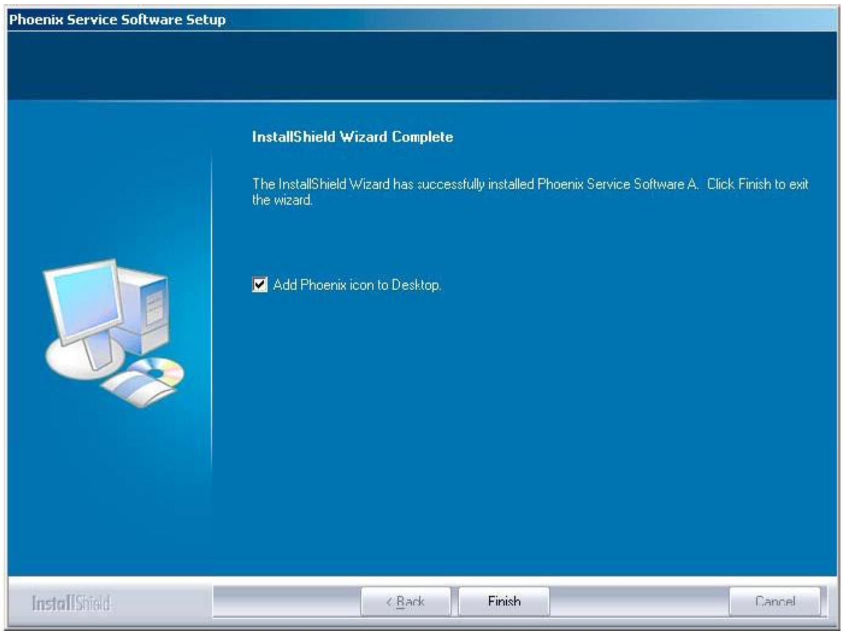


Figure 5 InstallShield Wizard Complete

Phoenix is now ready for use.

Next action

After the installation, Phoenix service software can be used after:

- installing phone model specific data package for Phoenix
- configuring users and connections

FPS-8* and FPS-10 flash prommers can be used after updating their Flash Update Package files.

Updating Phoenix installation

Context

- If you already have the *Phoenix* service software installed on your computer, you need to update the software when new versions are released.

  To update Phoenix, you need to follow the same steps as when installing it for the first time.
- When you updating (for example, from version **a14_2004_16_4_47** to **a15_2004_24_7_55**), the update will take place automatically without uninstallation.
- Always use the latest available versions of both *Phoenix* and the phone-specific data package. Instructions can be found in the phone model specific Technical Bulletins and phone data package *readme.txt* files (shown during installation).
- If you try to update *Phoenix* with the same version you already have (for example, **a15_2004_24_7_55** to **a15_2004_24_7_55**), you are asked if you want to uninstall the existing version. In this case you can choose between a total uninstallation or a repair installation in a similar way when choosing to uninstall the application from the *Windows* Control Panel.
- If you try to install an older version (for example, downgrade from **a15_2004_24_7_55** to **a14_2004_16_4_47**), installation will be interrupted.

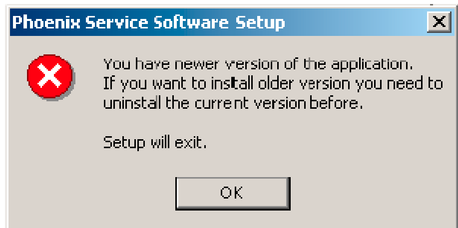


Figure 6 Installation interrupted

- Always follow the instructions on the screen.

Steps

1. Download the installation package to your computer hard disk.
2. Close all other programs.
3. Run the application file (for example, *phoenix_service_sw_2004_39_x_xx.exe*).

Results

A new *Phoenix* version is installed and driver versions are checked and updated.

Uninstalling Phoenix

Context

You can uninstall Phoenix service software manually from the Windows Control Panel.

Steps

1. Open the Windows Control Panel and choose Add/Remove Programs.
2. To uninstall Phoenix, choose *Phoenix Service Software* → *Change/Remove* → *Remove* .

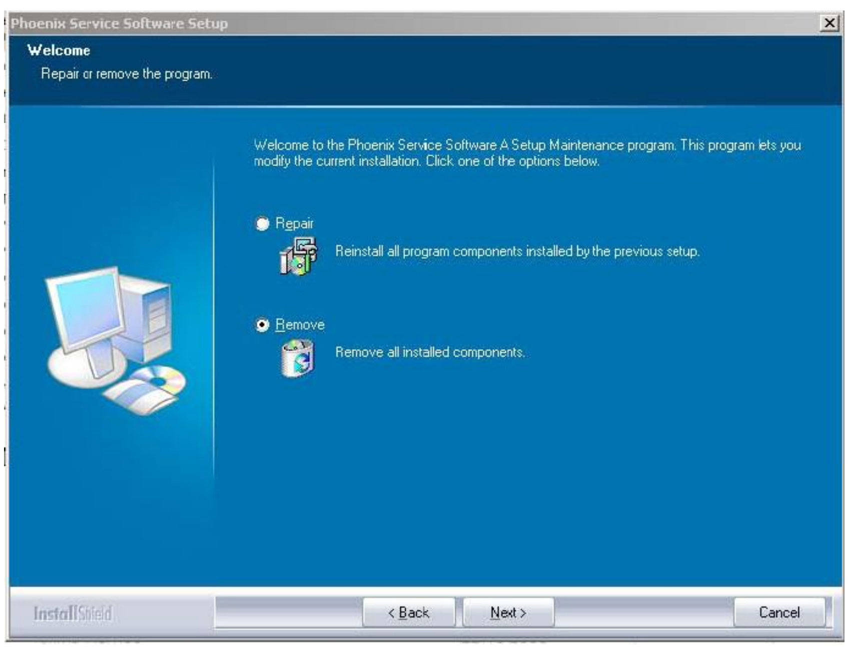


Figure 7 Remove program

The progress of the uninstallation is shown.

3. If the operating system does not require rebooting, click Finish to complete.

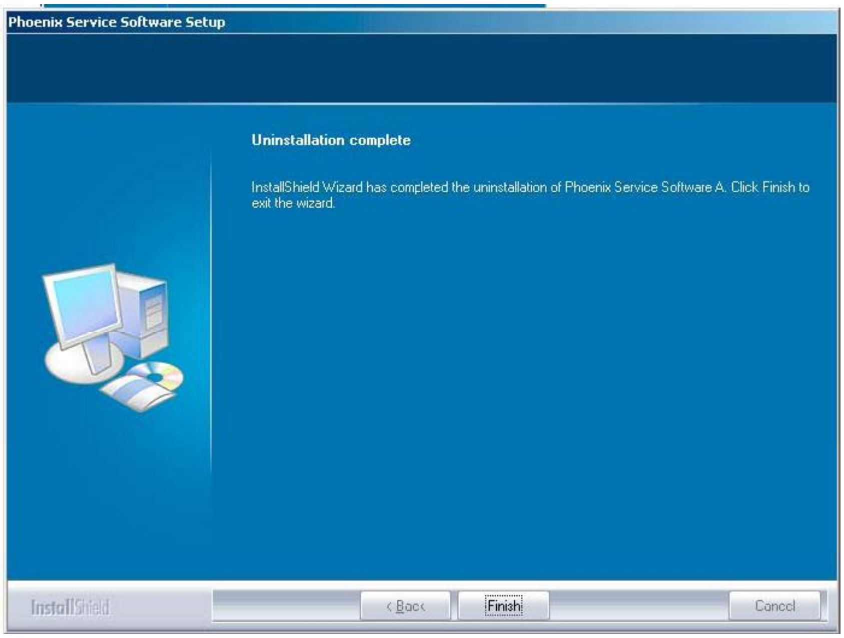


Figure 8 Finish uninstallation

If the operating system requires rebooting, InstallShield Wizard will notify you. Select Yes... to reboot the PC immediately and No... to reboot the PC manually afterwards.

Repairing Phoenix installation

Context

If you experience any problems with the service software or suspect that files have been lost, you can use the repair function before completely reinstalling Phoenix.

Note: The original installation package (for example, *phoenix_service_sw_a15_2004_24_7_55.exe*) must be found on your PC when you run the repair setup.

Steps

1. Open *Windows Control Panel* → *Add/Remove Programs*.
2. Select *Phoenix Service Software* → *Change/Remove*.

3. In the following view, select Repair.

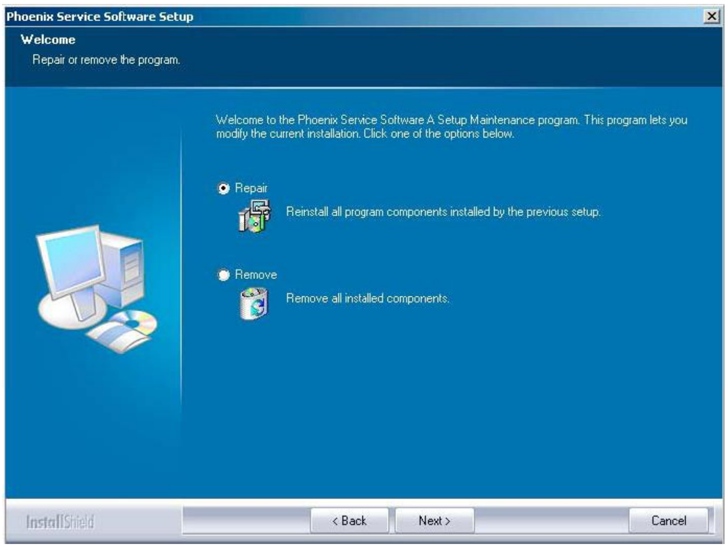


Figure 9 Repair program

Phoenix will now reinstall components and register them.

The procedure is the same as when updating Phoenix.

4. To complete the repair, click Finish.

Phoenix service software data package overview

Each product has its own data package (DP). The product data package contains all product-specific data files to make the Phoenix service software and tools usable with a certain phone model.

The data package contains the following:

- Product software Binary files
- Files for type label printing
- Validation file for the Faultlog repair data reporting system
- All product-specific configuration files for Phoenix software components

Data files are stored under **C:\Program Files\Nokia\Phoenix** (default).

Installing Phoenix data package

Before you begin

- A product-specific data package contains all data enabling the Phoenix service software and tools usable with a certain phone model.
- Check that the dongle is attached to the parallel port of your computer.
- Install Phoenix service SW.
- Download the installation package (for example, XX-XX*_dp_EA_v_1_0.exe) to your computer (for example, in *C:\TEMP*).
- Close all other programs.

(* = type designator of the product)

If you already have Phoenix installed on your computer, you will need to update it when a new version is released.

Note: Very often the Phoenix Service SW and the phone-specific data package for Phoenix come in pairs, meaning that a certain version of Phoenix can only be used with a certain version of the data package. Always use the latest available versions of both. Instructions can be found in phone model specific Technical Bulletins and *readme.txt* files of the data packages.

Steps

1. To start installation, run the application file (for example, *XX-XX_dp_EA_ v_1_0.exe*).
2. Click Next, and wait for the installation files to be extracted.
3. To continue, click Next .

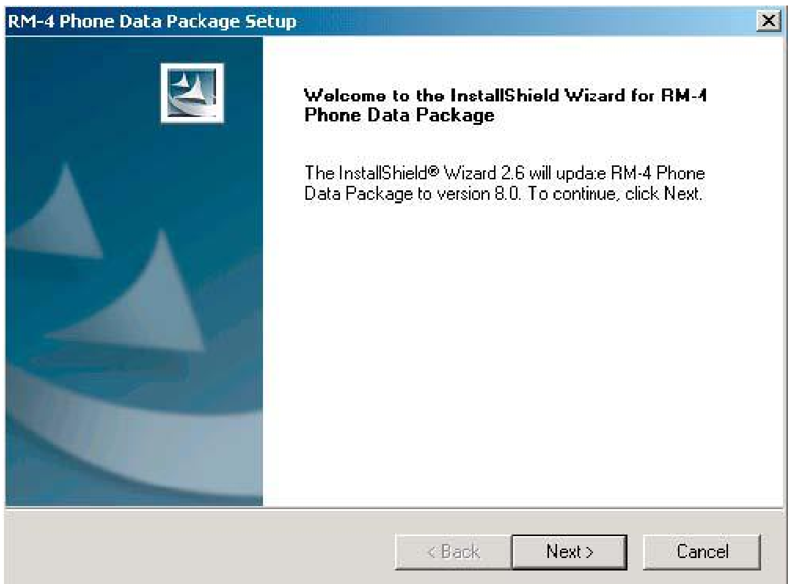


Figure 10 Continue data package installation

In this view you can see the contents of the data package. Read the text carefully. There is information about the Phoenix version required with this data package.

4. To continue, click Next.

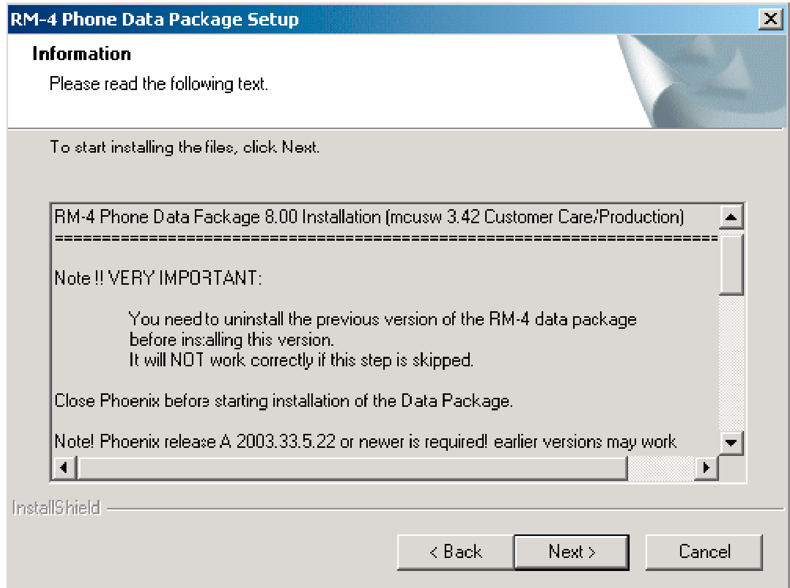


Figure 11 Data package setup information

5. Confirm location and click Next to continue.

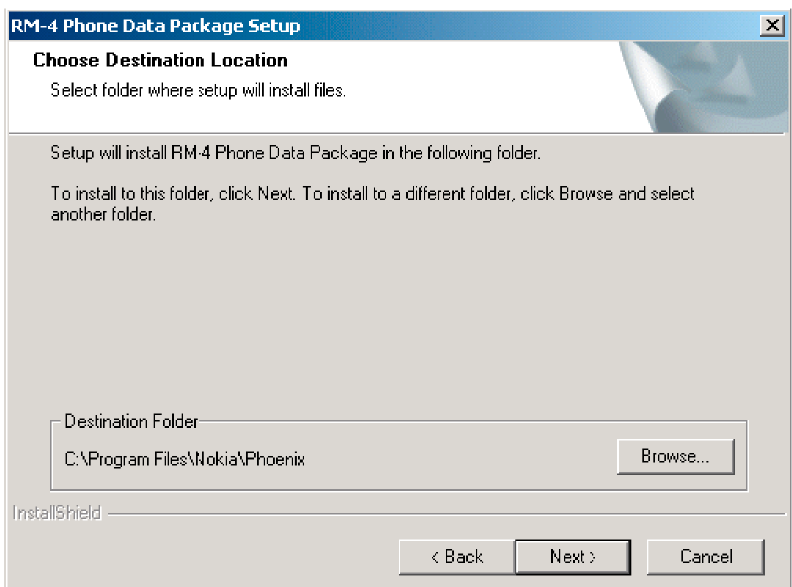


Figure 12 Data package destination folder

The install shield checks where the Phoenix application is installed and the directory is shown.

6. To start copying the files, click Next.

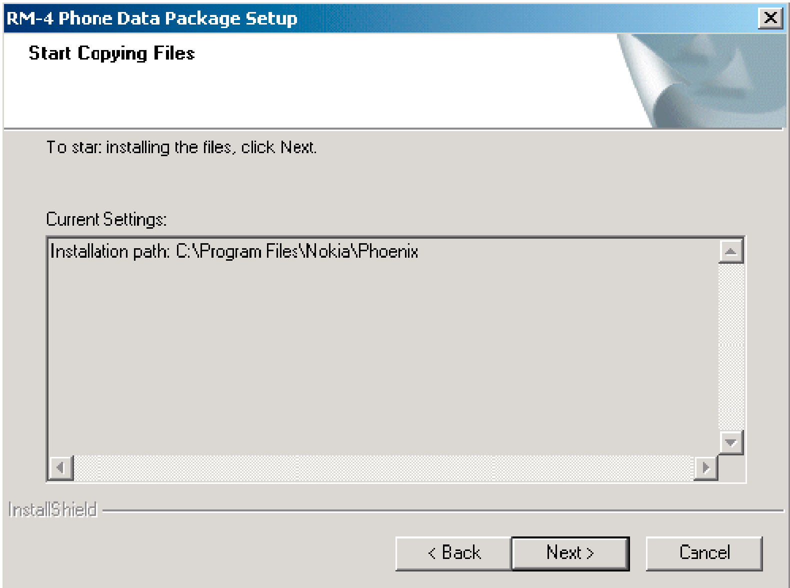


Figure 13 Start copying files

Phone model specific files are installed. Please wait.

7. To complete the installation, click Finish.

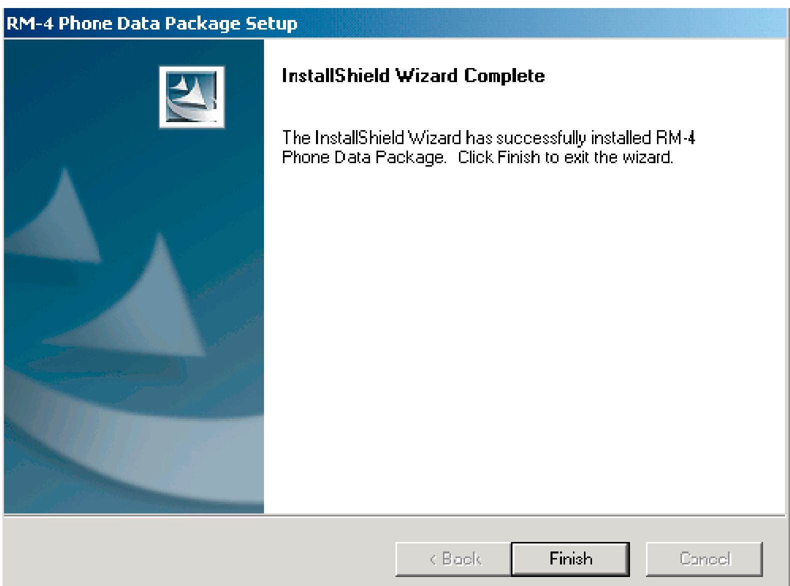


Figure 14 Finish data package installation

You now have all phone model specific files installed in your Phoenix Service SW.

Next action

Phoenix can be used, for example, for flashing phones and printing type labels after:

- Configuring users
- Managing connections

FPS-8* and FPS-10 can be used after updating their Flash Update Package files.

Uninstalling Phoenix data package

Context

If you try to install the same version of the Phoenix data package that you already have, you are asked if you want to uninstall the existing version.

There is no need to uninstall the older version of a data package, unless instructions to do so are given in the *readme.txt* file of the data package and bulletins related to the release.

Please read all related documents carefully.

Steps

1. To uninstall the data package, click OK Cancel to interrupt the uninstallation.

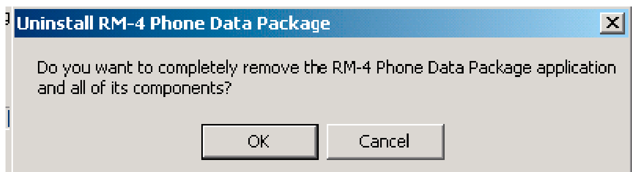


Figure 15 Uninstalling Phoenix data package

2. Once the previously installed data package is uninstalled, click Finish.

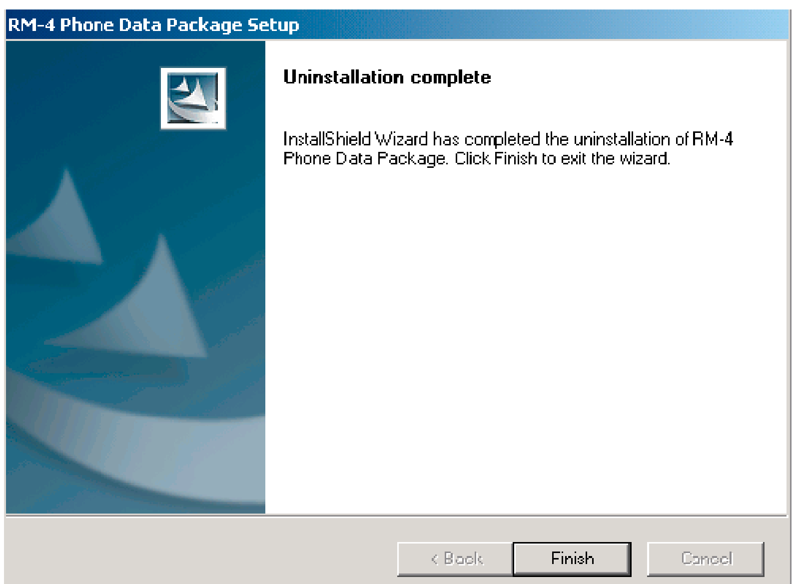


Figure 16 Finishing data package uninstallation

Alternative steps

- You can also uninstall the data package manually from *Windows Control Panel* → *Add/Remove Programs* → *xx-xx * Phone Data Package* . (*= type designator of the phone)

Next action

Run the installation package again to continue installation from the beginning.

Configuring users in Phoenix

Steps

1. Start Phoenix Service SW and log in.

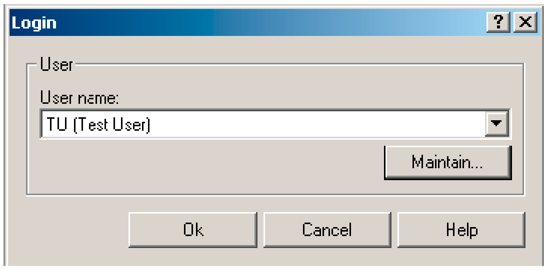


Figure 17 Login

   If the user ID is already configured, choose it from the dropdown list and click OK.

   To add a new user or edit existing ones, click Maintain.

2. To add information for a new user, click New.
3. Type in the name and initials of the user and click OK.

   A new user is now created.

4. Click OK.

   You are now able to login with the user name created.

5. Click OK.

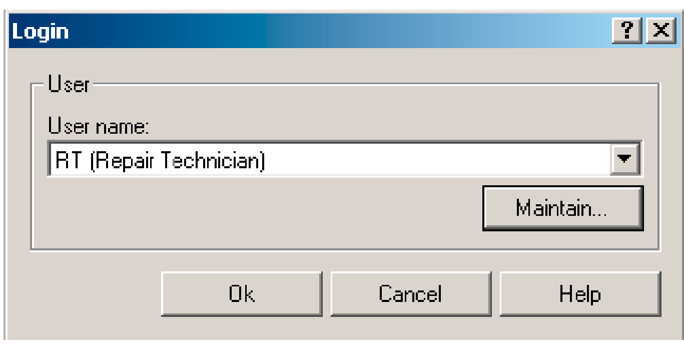


Figure 18 Login, user configured

Managing connections in Phoenix

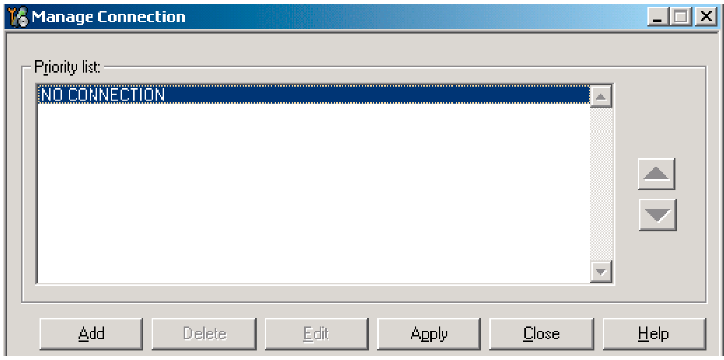
Context

With the Manage Connections feature you can edit and delete existing connections and create new ones.

Steps

1. Start *Phoenix* Service SW and log in.
2. Choose *File* → *Manage Connections*.

3. To add a new connection, click Add, and select if you want to create it manually or by using the Connection Wizard.



In the following dialogs you are asked to select settings for the connection. If you use the Wizard, connect the tools and a phone to your PC and the wizard will automatically try to configure the correct connection.

4. Select Manual mode, and click Next to continue.

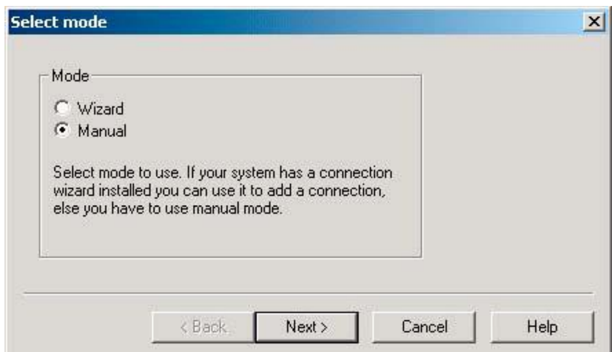


Figure 19 Select Mode: Manual

i For an FPS-10 flash prommer with a **USB Connection**, choose the following connection settings:

- Media: FPS-10 USB
- Device Index: 0
- Serial Num: See Serial No from the label attached to the bottom of your FPS-10
- Active Media: USB

ii For an FPS-10 flash prommer with a **LAN connection**, choose the following connection settings:

- Media: FPS-10 TCP/IP
- Net Serv Name: Select Scan. Choose your own FPS-10 device based on the correct MAC address. See Serial No from the label attached to the bottom of your FPS-10.
- Port Num: Use default value, click Next.
- Protocol Family: Use default value, click Next.
- Socket Type: Use default value, click Next.
- TX Buffer Size: Use default value, click Next.
- RX Buffer Size: Use default value, click Next.

Note: When the phone is connected to a PC for the first time, allow the PC to install the USB device drivers first.

Please note that this may take some time to complete.

After the drivers are installed and if there are problems, check that the USB connection is active from the Windows Control Panel or contact the local PC support.

iii For an FPS-8 flash prommer, choose the following connection settings:

- Media: FPS-8
- Port Num: COM Port where FPS-8 is connected
- COMBOX_DEF_MEDIA: FBUS

iv For a plain **USB connection** choose the following connection settings:

Note: First connect the DKU-2 USB cable between the PC USB port and phone.

- Media: USB

Note: When the phone is connected to a PC for the first time, allow the PC to install the USB device drivers first.

Please note that this may take some time to complete.

After the drivers are installed and if there are problems, check that the USB connection is active from the Windows Control Panel or contact the local PC support.

5. To complete the configuration, click Finish.

   If you are using the Wizard, connect the tools and a phone to your PC and the wizard will automatically try to configure the correct connection. Please note that this may take time because Phoenix will go through all connections on the PC.

6. Click the connection you want to activate and use up/down arrows to move it on top of the list, then click Apply.

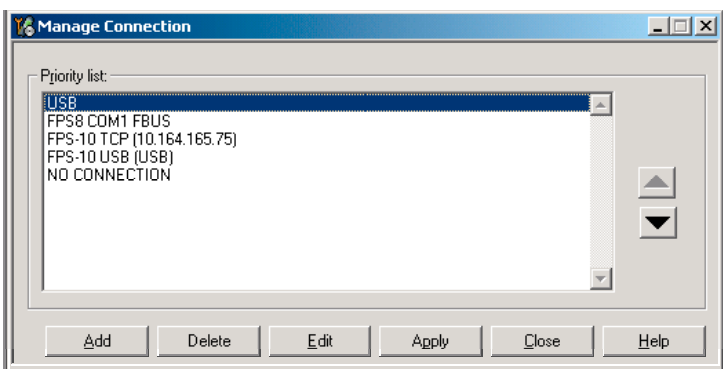


Figure 20 Connections list

The connection is now selected and can be used after closing the *Manage Connections* window.

The selected connection is shown on the right hand bottom corner of the screen.

Figure 21 Connection information

7. To use the selected connection, connect the phone to *Phoenix* with correct service tools, make sure that the phone is switched on and from the File menu, choose Scan Product.

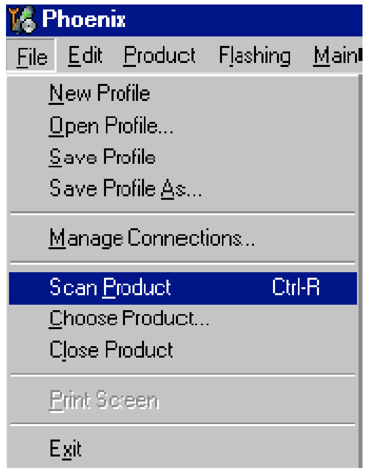


Figure 22 Scan product

Results

The product support module information appears in the status bar:

Figure 23 Product support module information

Installing flash support files for FPS-8 and FPS-10

Before you begin

- Install Phoenix Service SW.
- Install phone model specific data package for Phoenix.
- If you want to update the flash support files, they are delivered in the same installation package with Phoenix or newer Phoenix packages beginning from December 2004. In case you want to update the MCU files, install the latest data package (see Technical Bulletins for information on the latest one). However, normally it is enough to install Phoenix and the phone-specific data package because the Phoenix installation always includes the latest flash update package files for FPS-8 and FPS-10.
- A separate installation package for flash support files is available, and the files can be updated according to this instruction if updates appear between Phoenix/data package releases.

Context

If you are not using a separate installation package, you can skip this section and continue with Updating FPS-8 and FPS-10 flash prommer software (Page 3–22) after installing a new phone data package.

Steps

1. To begin the installation, double-click the flash update file (for example, *flash_update_03_183_0014.exe*).

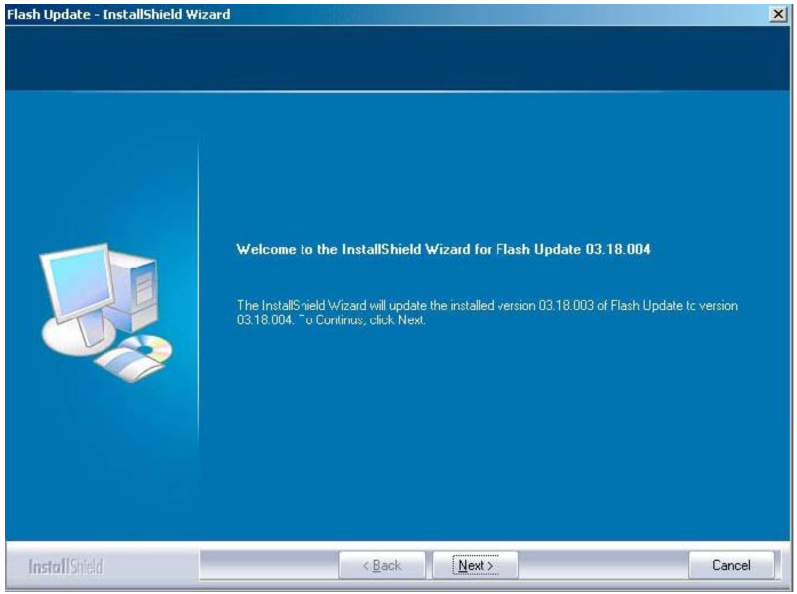


Figure 24 Flash update welcome dialog

   If the same version of Flash Update package already exists, and you want to reinstall it, the previous package is first uninstalled. Restart installation again after uninstallation.

2. If you try to downgrade the existing version to older ones, the setup will be aborted. If there is a need to downgrade the version, uninstall newer files manually from the Windows Control Panel and then rerun the installation.

Figure 25 Flash installation interrupted

   If an older version exists on your PC and it needs to be updated, click Next to continue installation.

3. It is highly recommended to install the files to the default destination folder *C:\Program Files\Nokia \Phoenix*. To continue, click Next.

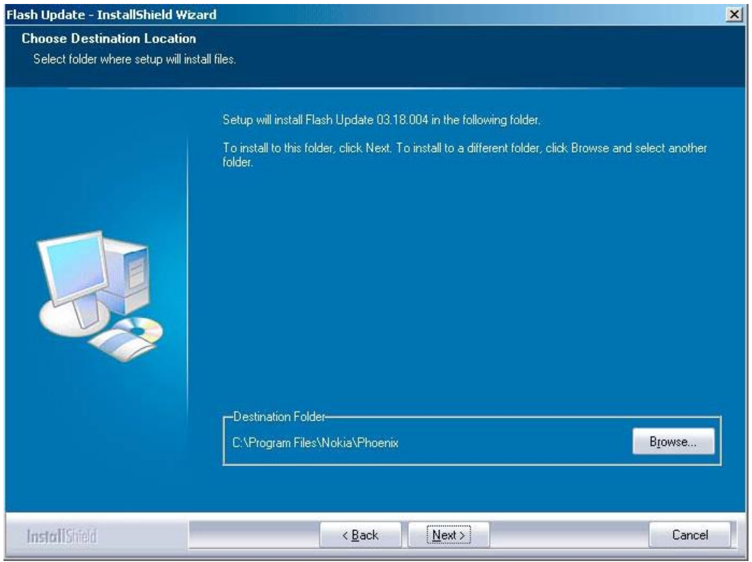


Figure 26 Flash destination folder

When installing the flash update files for the first time, you may choose another location by selecting Browse (not recommended).

4. To complete the installation procedure, click Finish .

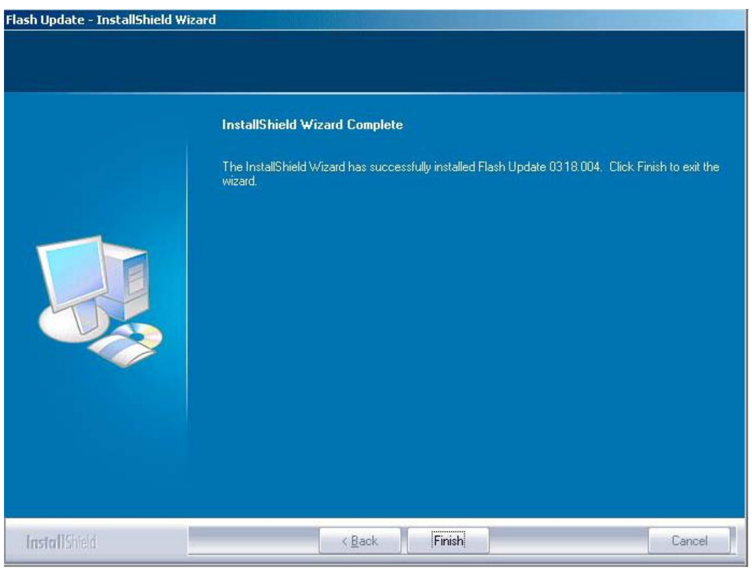


Figure 27 Finish flash update

Next action

FPS-8 and FPS-10 flash prommers must be updated using Phoenix!

Updating FPS-8 and FPS-10 flash prommer software

Steps

1. Start *Phoenix Service Software* and log in, manage connection correctly for your flash prommer.
2. Choose *Maintenance* → *Prommer maintenance* .

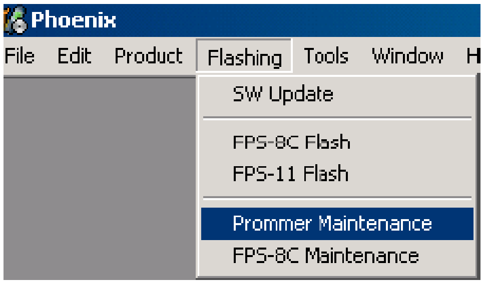


Figure 28 Choosing Prommer maintenance

3. When the new flash update package is installed to computer, you aree asked to update the files to your prommer. To update the files, click Yes.
4. Wait until you are notified that the update has been successful; the procedure will take a couple of minutes. To close the *Prommer Maintenance* window, click OK.

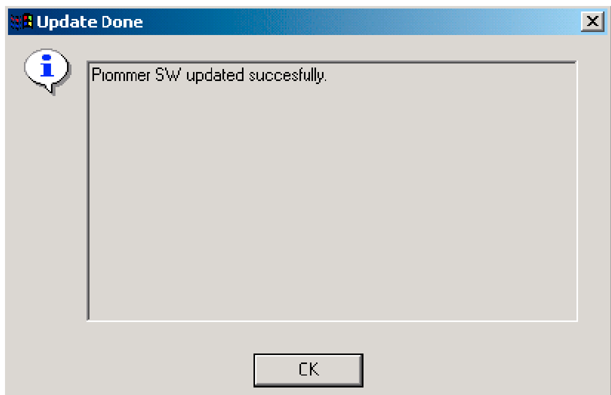


Figure 29 Prommer SW update finished

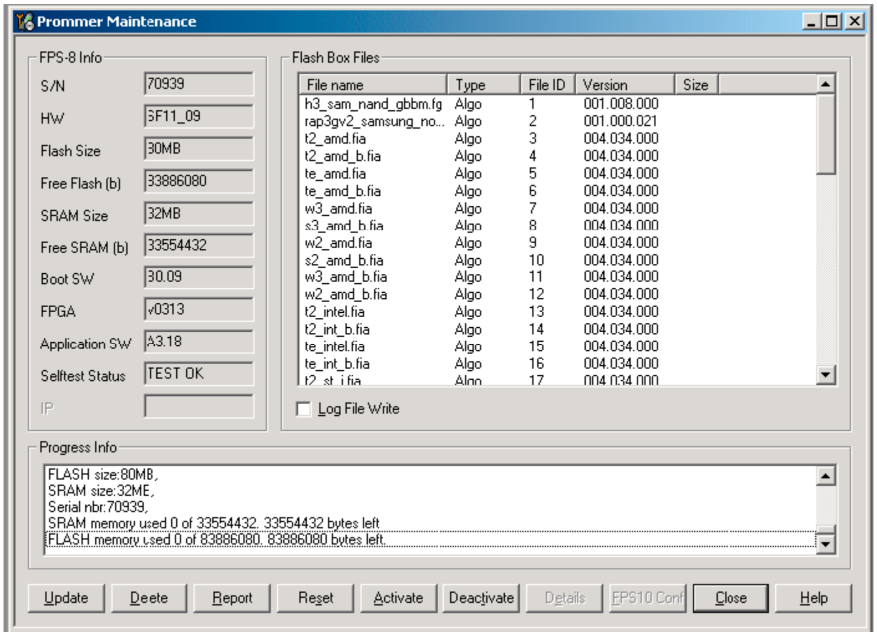


Figure 30 Prommer maintenance window

Alternative steps

- To update the **FPS-8** SW, click theUpdate button and select the appropriate *fps8upd.ini* file in *C:\Program Files\Nokia\Phoenix\Flash*.
- To update the **FPS-10** SW, click the Update button and select the appropriate *fpsxupd.ini* file in *C:\Program Files\Nokia\Phoenix\Flash*.

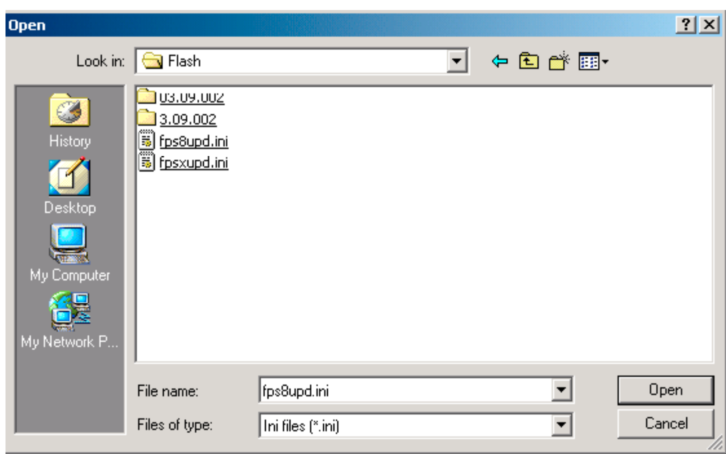


Figure 31 Flash directory window

- All files can be loaded separately to the prommer used. To do this, click the right mouse button in the *Flash box files* window and select the file type to be loaded.

  More information can be found in the Phoenix Help.

Activating FPS-8

Context

Before FPS-8 can be successfully used for phone programming, it must first be activated.

First fill in the *FPS-8 activation request* sheet in the FPS-8 sales package and follow the instructions given.

When activation file is received (for example, *00000.in*), copy it to the *C:\ProgramFiles\Nokia\Phoenix \BoxActivation* directory on your computer (this directory is created when Phoenix is installed).

Steps

1. Start *Phoenix Service Software*.
2. Choose *Maintenance* → *Prommer Maintenance* .

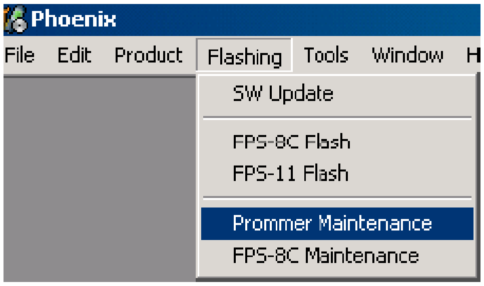


Figure 32 Prommer maintenance

3. In the *Prommer Maintenance* window, click Activate.
4. To find the activation file if you saved it to some other directory on your PC, click Browse.
5. To activate the prommer, select the activation file and click Open.

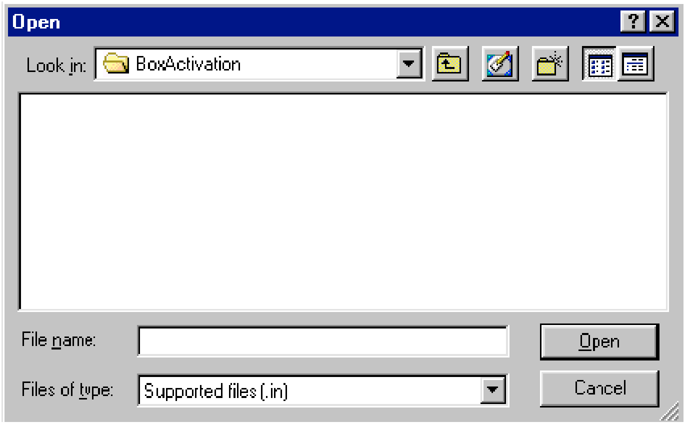


Figure 33 Box activation

6. To complete the activation, restart FPS-8.

Deactivating FPS-8

Context

If there is, for example, a need to send the FPS-8 box for repair, it must be deactivated first.

Steps

1. Start *Phoenix Service Software*.
2. Choose *Maintenance* → *Prommer Maintenance* .
3. In the *Prommer Maintenance* window, click Deactivate.

4. To confirm the deactivation, click Yes.

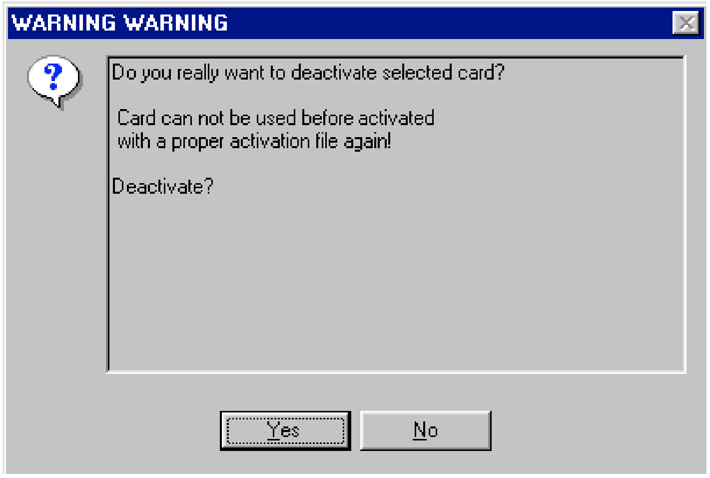


Figure 34 Deactivation warning

The box is deactivated.

5. To complete the deactivation, restart FPS-8.

(This page left intentionally blank.)

4 — Service Tools and Service Concepts

(This page left intentionally blank.)

Table of Contents

List of Figures

(This page left intentionally blank.)

Service tools

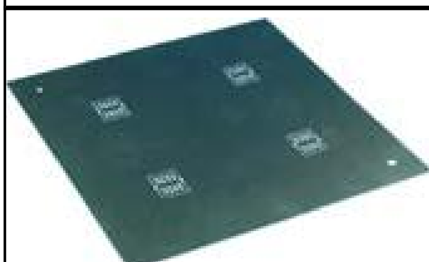
List of Service Tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product , refer to various concepts.

	CA-35S	Power cable	
	CA-53	USB connectivity cable	
	USB to Pop-Port™ connector cable.		
	CU-4	Control unit	
	CU-4 is a general service tool used with a module jig and a flash adapter. CU-4 requires an external 12 V power supply. The unit has the following features: • software controlled via USB • EM calibration function • Forwards FBUS/Flashbus traffic to/from terminal • Forwards USB traffic to/from terminal • software controlled BSI values • regulated VBATT voltage • 2 x USB2.0 connector (Hub) • FBUS and USB connections supported		

	DKU-2	USB connectivity cable	
	USB to Pop-Port™ connector cable.		
	FPS-10	Flash prommer	
	FPS-10 interfaces with: • PC • Control unit • Flash adapter • Smart card FPS-10 flash prommer features: • Flash functionality for BB5 terminals • Smart Card reader for SX-2 or SX-4 • USB traffic forwarding • USB to FBUS/Flashbus conversion • LAN to FBUS/Flashbus and USB conversion • Vusb output switchable by PC command FPS-10 sales package includes: • FPS-10 prommer • Power Supply with 5 country specific cords • USB cable		
	FS-1	Product specific adapter	
	FS-1 is a product specific adapter, compatible with SS-62 and SS-46. It provides galvanic connection to terminal test pads.		

<table>
<tr><td rowspan="2"></td><td>JBT-9</td><td>Bluetooth test and interface box (sales pack)</td><td></td></tr>
<tr><td colspan="3">The JBT-9 test box is a generic device to perform Bluetooth bit error rate testing and doing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and AXS-4 cable in case of cordless testing interface usage.
• JBT-9 testbox, code 0770336
• Installation and warranty information, code 9360613</td></tr>
<tr><td rowspan="2"></td><td>MJ-48</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-48 is meant for component level troubleshooting.
The jig includes an RF interface for GSM, WCDMA and Bluetooth. In addition, it has the following features:
• Provides mechanical interface with Engine module
• Provides galvanic connection to all needed test pads in module
• Multiplexing between USB and FBUS media, controlled by Vusb
• UI test interface
• Audio components: IHF, MIC, earpiece
• Connector for control unit
• Access for Pop-Port™ system connector
Note: Keymat and Engine UI assembly have to be ordered separately.
Note: In the picture CU-4 is connected to MJ-48 . CU-4 is not part of the MJ-48 sales package and has to be ordered separately.</td></tr>
<tr><td rowspan="2"></td><td>MJS-76</td><td>LGA rework jig</td><td></td></tr>
<tr><td colspan="3">This tool is used for LGA type component reworking purposes.</td></tr>
<tr><td rowspan="2"></td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a control unit CU-4 to supply a controlled operating voltage.</td></tr>
</table>

	PKD-1	SW security device	
	SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.		
		RF shield box	
	Because the WCDMA network disturbs the RX side testing of the WCDMA phone and the Tx signal of the WCDMA phone can severely disturb the WCDMA network, a shield box is needed in all testing, tuning and fault finding which requires WCDMA RF signal. The shield box is not an active device, it contains only passive filtering components for RF attenuation.		
	RJ-89	Rework jig	
	RJ-89 is a soldering jig used for soldering and as a rework jig for the engine module.		
	SA-81	RF coupler	
	SA-81 is a coupler for WCDMA / GSM RF testing. It is used together with SS-62 flash adapter base.		
	SES-3	Stencil	
	SES-3 stencil is used with MJS-76 / 0770417 and it supports the PA component. SES-3 is made for reworking purposes used in central service level.		

	SRT-6	Opening tool	
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the product-specific flash adapter and FPS-10.		
	SS-58	Rework tool	
	SS-62	Generic flash adapter base for BB5	
	• generic base for flash adapters and couplers • SS-62 equipped with a clip interlock system • provides standardised interface towards Control Unit • provides RF connection using galvanic connector or coupler • multiplexing between USB and FBUS media, controlled by VUSB		
	SS-67	Assembly jig for mechanics disassembly/ reassembly	

<table>
<tr><td rowspan="2">
</td><td>SX-4</td><td>Smart card</td><td></td></tr>
<tr><td colspan="3">SX-4 is a BB5 security device used to protect critical features in tuning and testing.
SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</td></tr>
<tr><td rowspan="2"></td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
<tr><td rowspan="2"></td><td>XRF-1</td><td>RF cable</td><td></td></tr>
<tr><td colspan="3">The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.
SMA to N-Connector ca. 610mm.
Attenuation for:
• GSM850/900: 0.3+-0.1 dB
• GSM1800/1900: 0.5+-0.1 dB
• WLAN: 0.6+-0.1dB</td></tr>
</table>

Service concepts

Flash concept with FPS-10

Figure 35 Basic flash concept with FPS-10

Item	Description	Type
1	FS-1	Product specific adapter
2	SS-46	Interface adapter
3	CA-35S	Power cable
4	XCS-4	Modular cable
5		Standard USB cable
6	FPS-10	Flash prommer box
7		Standard USB cable
8	PKD-1	SW security device

MJ-48 module jig concept

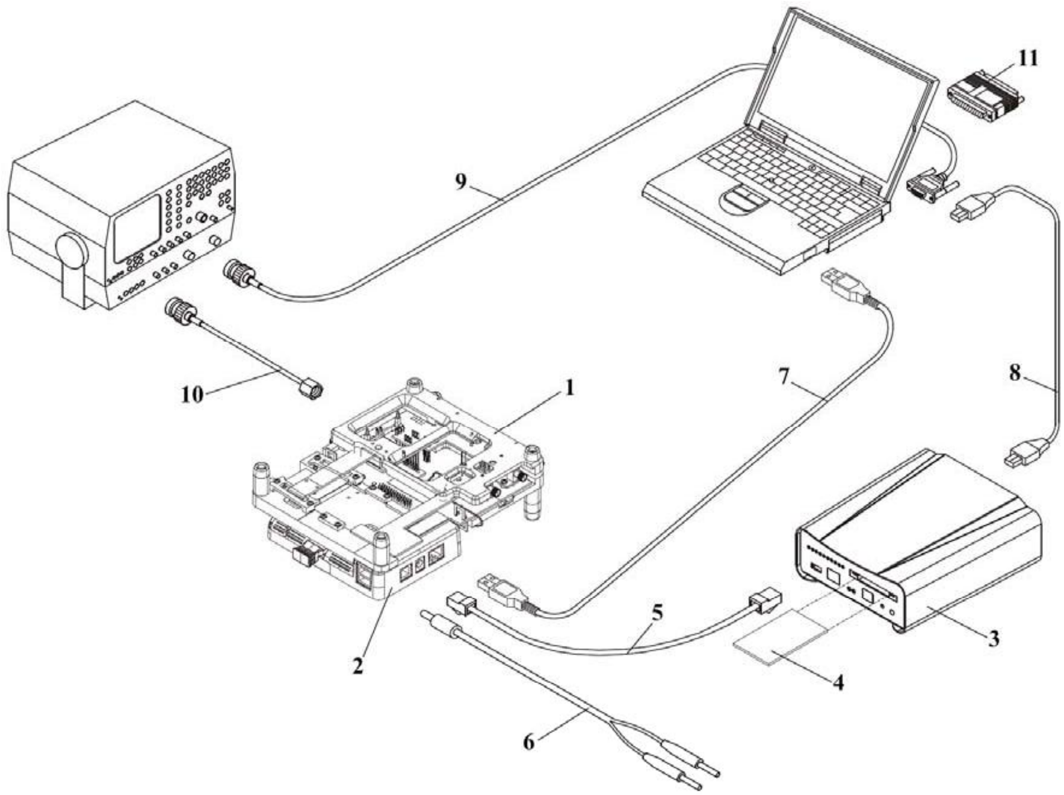


Figure 36 MJ-48 module jig service concept

Item	Type	Description
1	MJ-48	Module jig **Note:** Keymat 9797815 and Engine UI assembly 0211444 have to be ordered separately.
2	CU-4	Control unit
3	FPS-10	Flash prommer box
4	SX-4	Smart card
5	XCS-4	Modular cable
6	PCS-1	DC power cable
7		Standard USB cable
8		Standard USB cable
9		GPIB control cable
10	XRF-1	RF antenna cable
11	PKD-1	SW security device

Item	Type	Description
12		RF shield box

Note: Item 12 not shown in the picture.

POS (Point of Sale) flash concept

Figure 37 POS flash concept

Item	Type	Description
1	DKU-2/CA-53	USB connectivity cable
2	AC-4	Charger

Service concept for RF testing and RF/BB tuning

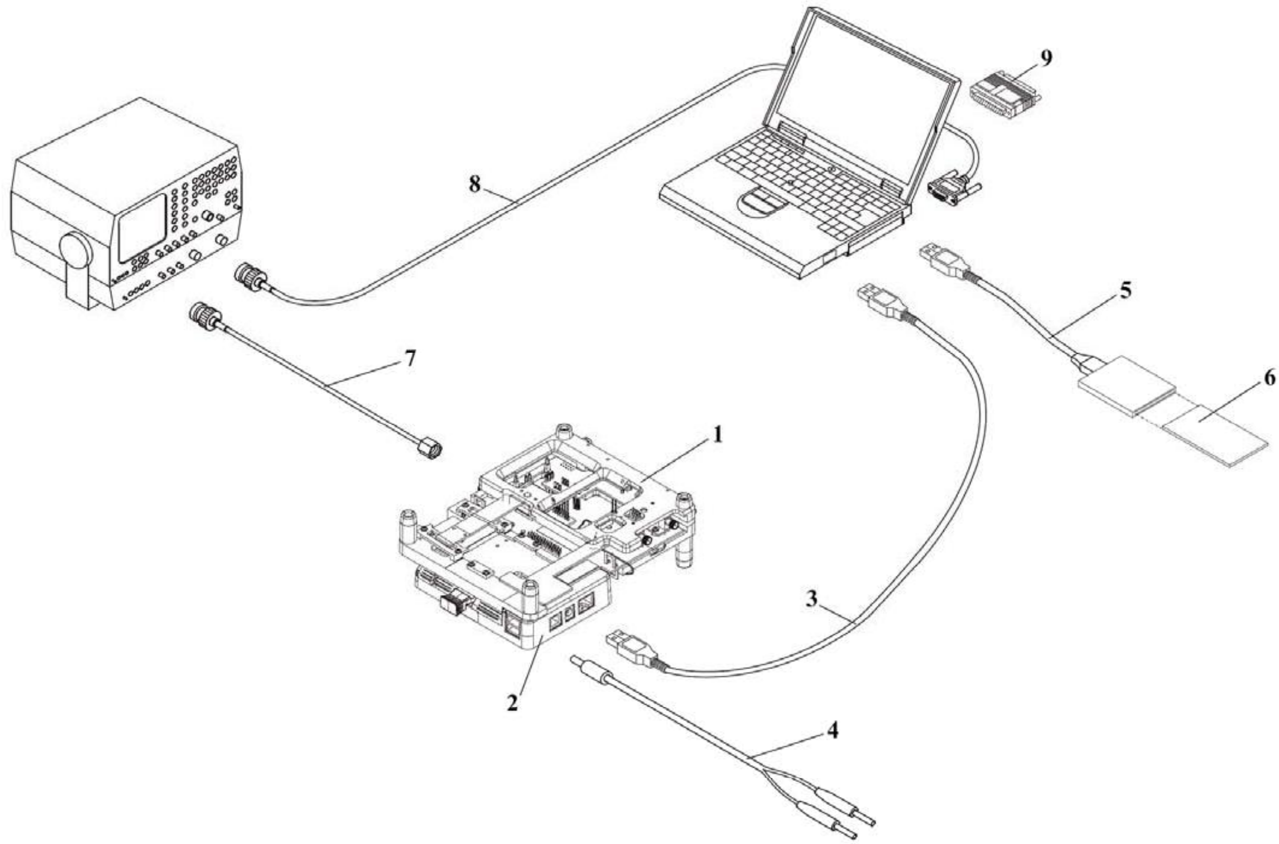


Figure 38 Service concept for RF testing and RF/BB tuning

Item	Description	Type
1	MJ-48	Module jig
2	CU-4	Control unit
3		Standard USB cable
4	PCS-1	DC power cable
5		Standard USB cable + smart card reader
6	SX-4	Smart card
7	XRS-6	RF cable
8		GPIB control cable
9	PKD-1	SW security device
10		RF shield box

Note: Item 10 not shown in the picture.

CU-4 flash concept with FPS-10

Figure 39 CU-4 flash concept with FPS-10

Item	Description	Type
1	FS-1	Product specific adapter
2	CU-4	Control unit
3	PCS-1	Power cable
4	XCS-4	Modular cable
5	FPS-10	Flash prommer box
6		Standard USB cable
7		Standard USB cable
8	PKD-1	SW security device
9	SS-62	Flash adapter base for BB5

RF testing concept with RF coupler

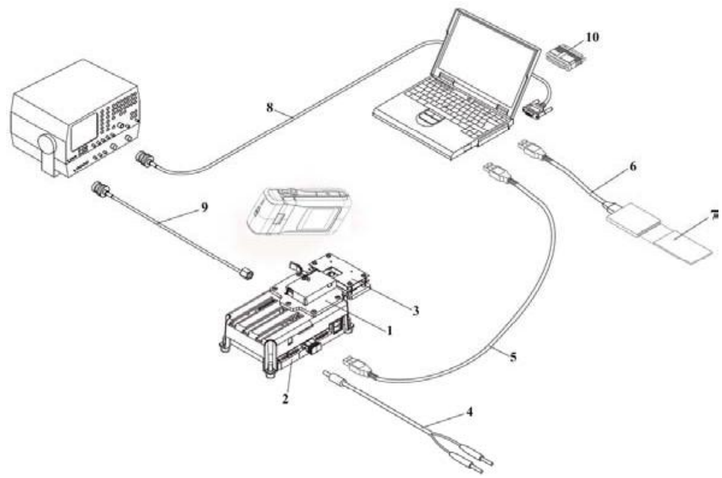


Figure 40 RF testing concept with RF coupler

Item	Type	Description
1	SS-62 + FS-1	Flash adapter base + product specific adapter
2	CU-4	Control unit
3	SA-81	RF coupler
4	PCS-1	Power cable
5		Standard USB cable
6		Standard USB cable + smart card reader
7	SX-4	Smart card
8		GPIB control cable
9	XRS-6	RF cable
10	PKD-1	SW security device
11		RF shield box

Note: Item 11 not shown in the picture.

5 — Disassembly / Reassembly Instructions

(This page left intentionally blank.)

Table of Contents

List of Figures

(This page left intentionally blank.)

General information on RM-42 disassembly / reassembly

Figure 41 Required tools for RM-42 disassembly / reassembly

Reassembly takes place in the reverse order.

Disassembly / reassembly instructions

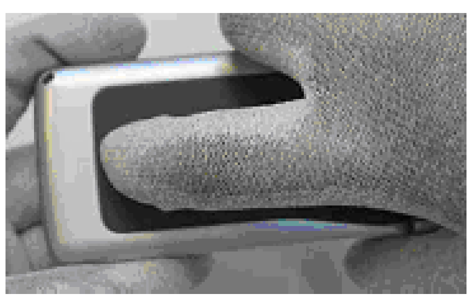
Before you begin

Note: Use the following torque values:

- Camera: 4 pcs. PT1,6 x 5, T5+ 16 Ncm +/-1Ncm. 350 rpm/508U Deprag
- I-cover: 2 pcs. PT1,8 x 8,5 T6+ 22Ncm. 560 rpm. Debrag
- Rest: 19 Ncm +/-1Ncm. 560 rpm 708U Debrag

Steps

1. To remove the **Battery Cover** press the release button and remove the battery cover, Remove pop-port cover if needed.



2. Open the **D-cover trim** carefully by using SRT-6 tool. For assembly, be sure adhesive is good enough or change also **D-cover**.

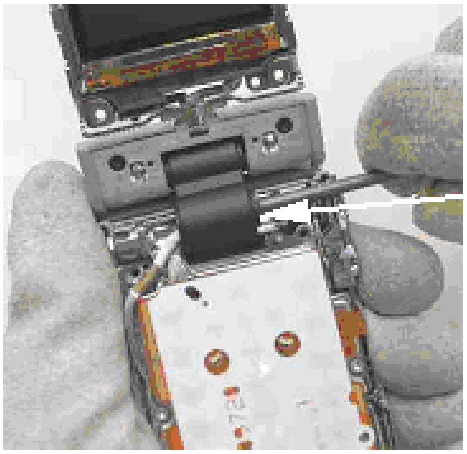
3. Use the SRT-6 (or screwdriver) to open the snaps of the **I-Cover Trim**. Slide SRT-6 (screwdriver) for opening all snaps.

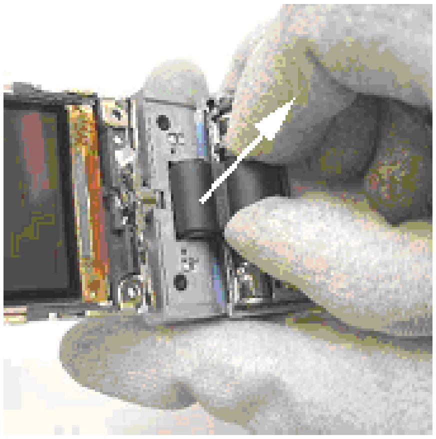
4. Unscrew the two Torx Plus size 6 screws.

5. Use the SRT-6 as a lever to open the snaps of the I-cover assy. Remove the I-cover assy carefully.

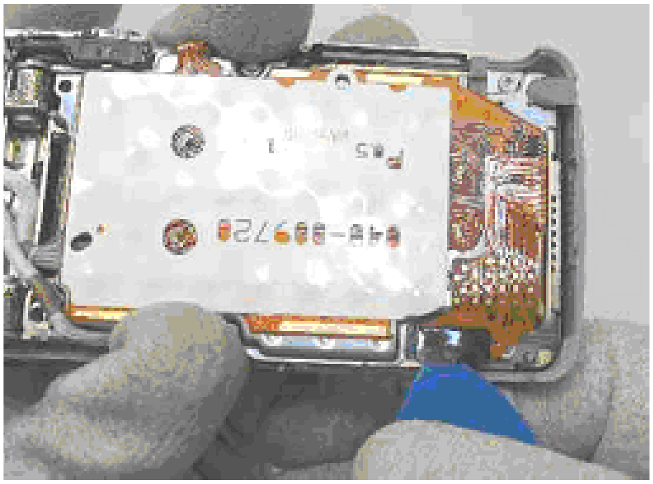
6. Remove **Keymat** carefully. Note not to damage guiding pins.

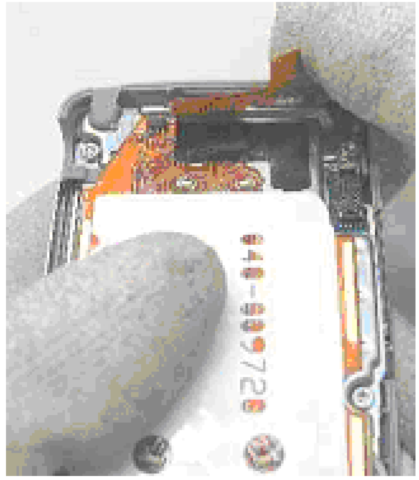
7. Remove **E-cover** with tweezers as shown in the picture.



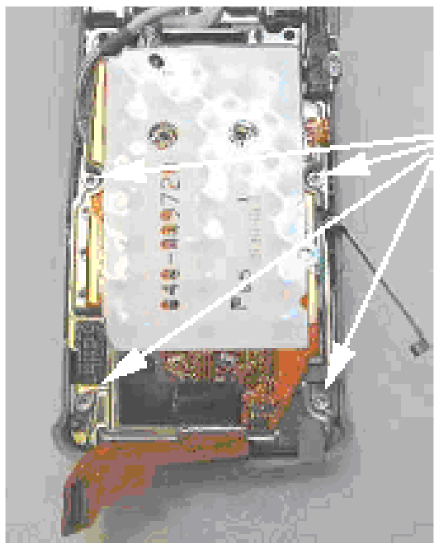


8. Open the flex connector of **Engine UI Assy** carefully by using SRT-6.



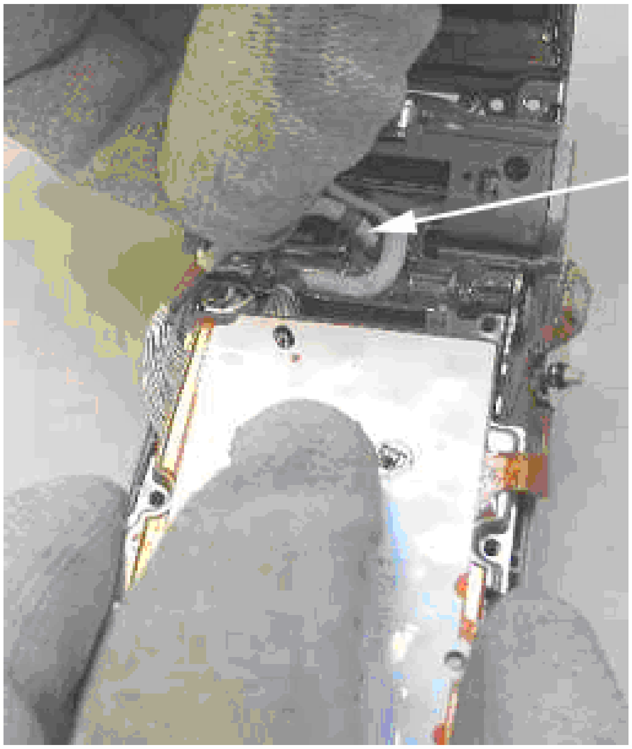


9. Unscrew the four torx Plus size 6 screws of **Engine UI Assy** and open the **MMC Cover Assy**. For assembly, the torque driver with a torque of 18 Ncm has to be used.

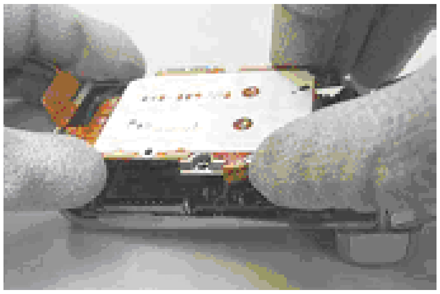


10. Lift the **Side Key Bezel** from **H-cover** carefully. Locking snap.

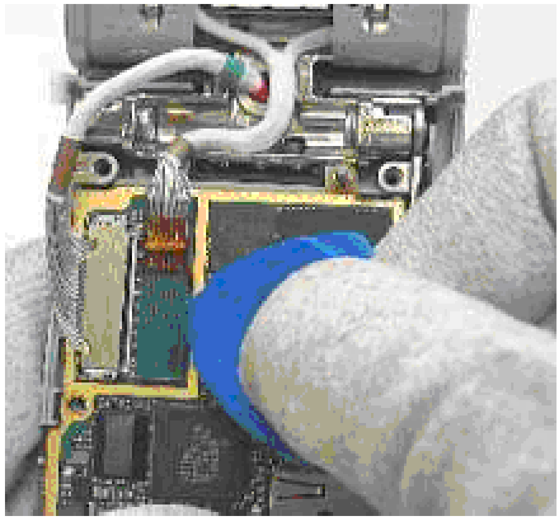
11. Pull coaxcial cable out of the Hinge so far as red mark is visible. Remove cable from abone of **UI Engine Assy.**



12. Remove the **UI Engine Assy** from the guiding pins.

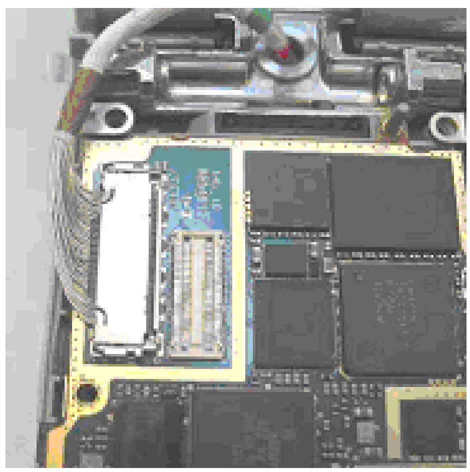


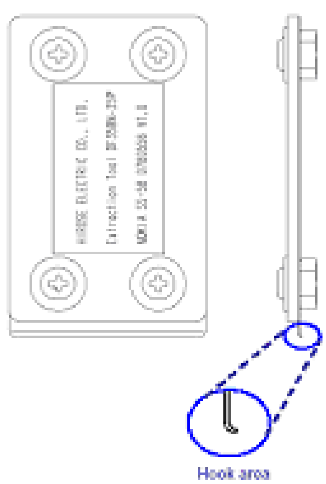
13. Use SRT-6 to open **Display Unit connector**. Be careful not to damage the connector and components next to it.

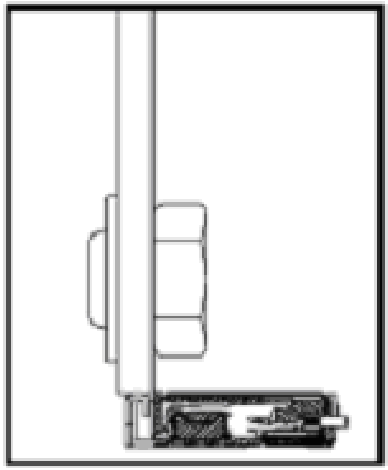


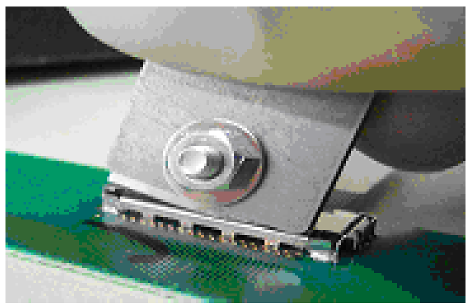
14. Use SS-57 rework tool to open **Camera Module connector**.

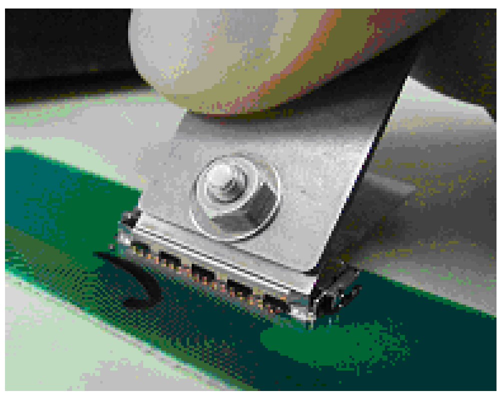
    Note: Notice the SS-57 rework tool instructions.

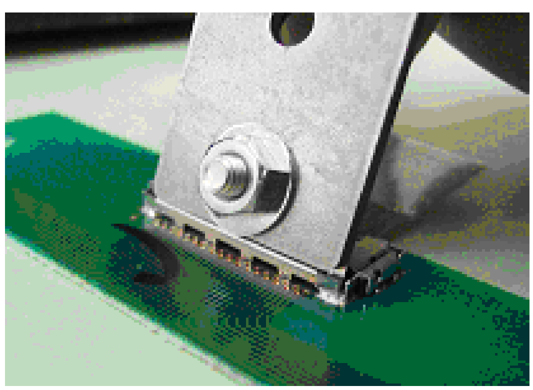




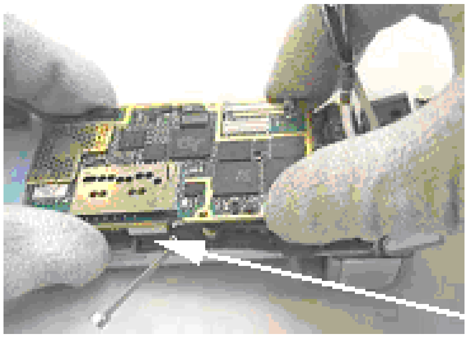




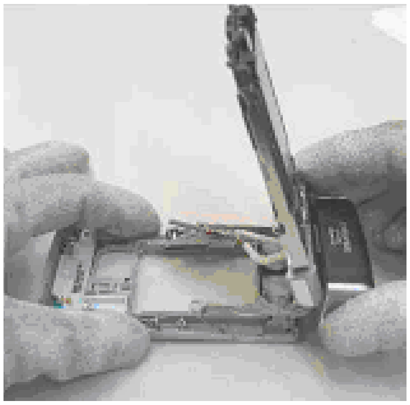




15. Remove the **PWB** carefully. Note not to damage the **MMC Door Switch.**

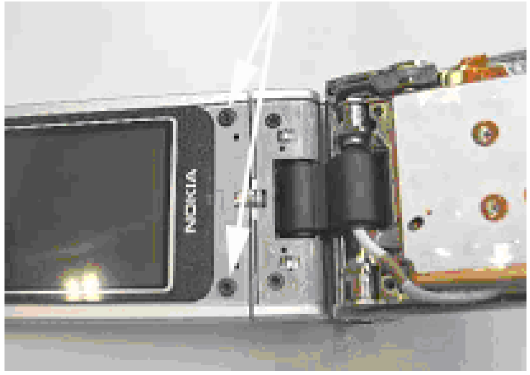


16. Remove **H-cover Assy** carefully from the Hinge bracket

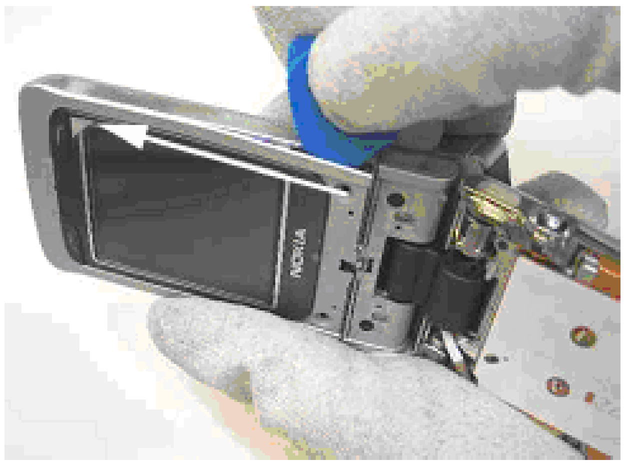


17. Open the**I-cover trim** carefully by using SRT-6 tool. For assembly, every time replace old trim a new one and wipe out adhesive from **B-cover** if necessary.

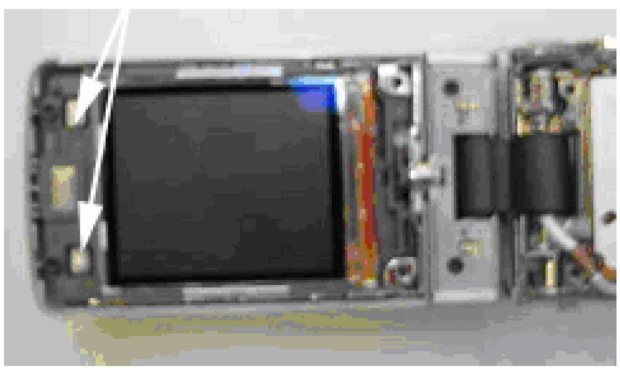
18. Unscrew the two Torx Plus size 6 screws. For assembly, use screwdrive torque 19 Ncm.



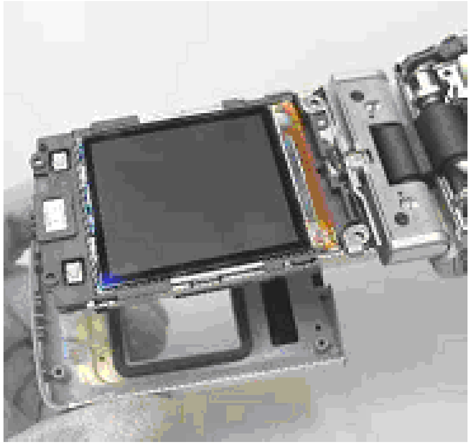
19. Use SRT-6 when removing **B-cover**. Open both sides.



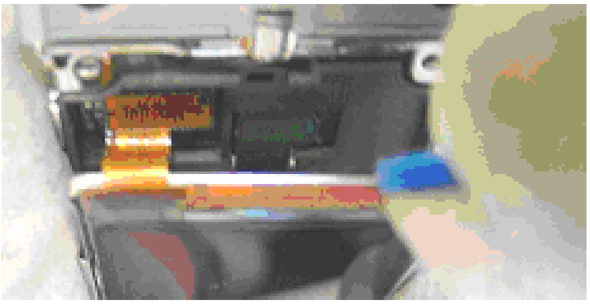
20. Unscrew the two Torx Plus size 6 screws

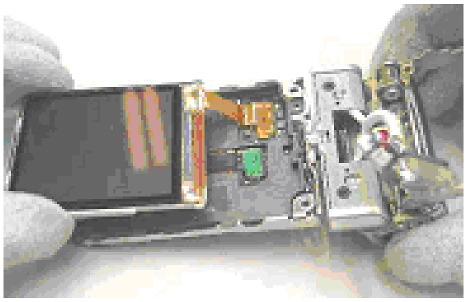


21. Remove **A-cover** by lifting upper part.

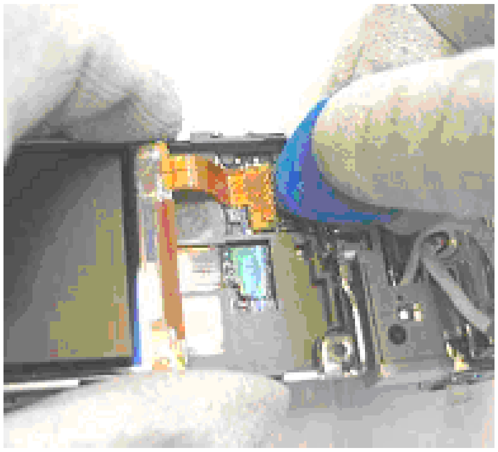


22. Remove **K2 display** by lifting edge of display metal part.

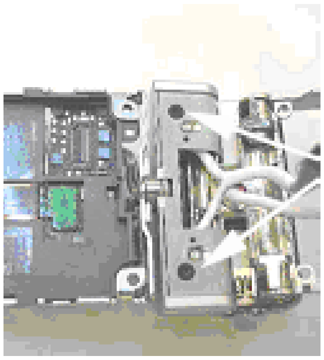




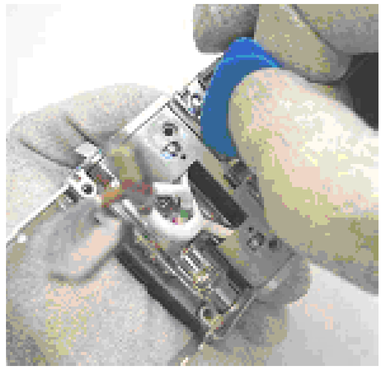
23. Remove **K2 connector** by using SRT-6. Handle **K2 display** gently, it can break easily. For assembly, reverse order, it is not necessary to wipe out adhesive from display frame.



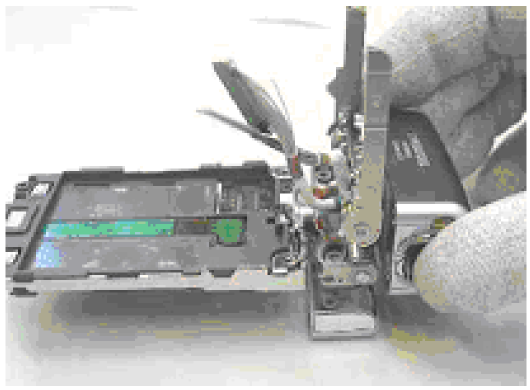
24. Unscrew the two Torx Plus size 6 screws.



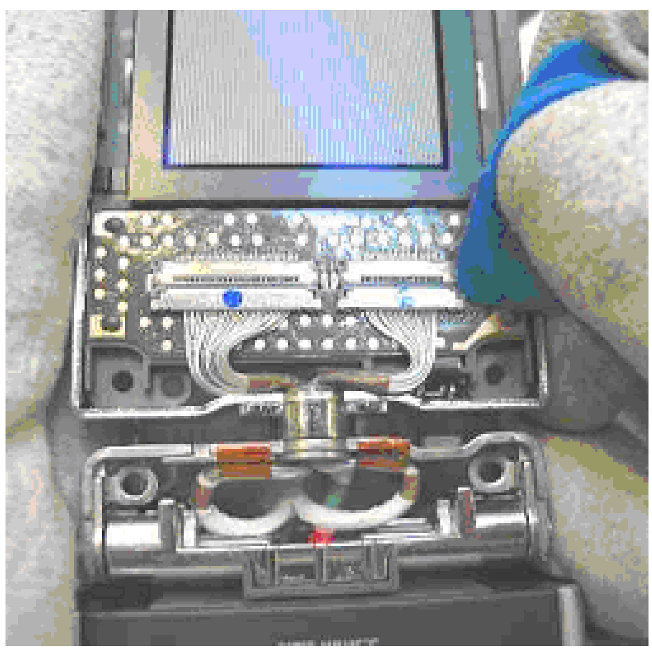
25. Remove **D-cover** by using SRT-6.



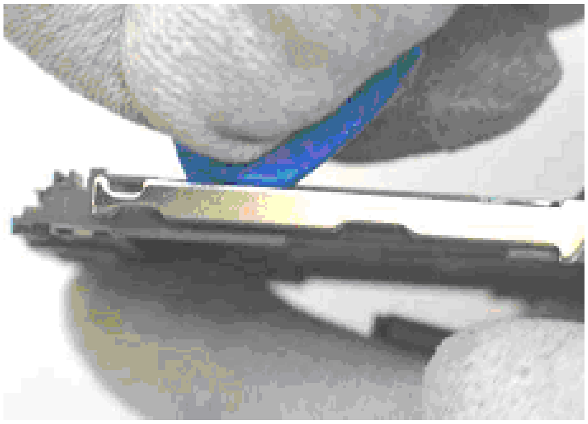
26. Remove **C-cover**.

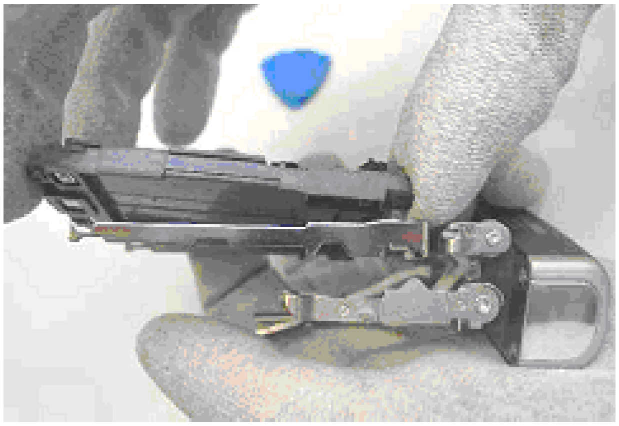


27. Open the micro coax connectors (2 pcs) of the **Display frame assembly** by using SRT-6 (tweezers).

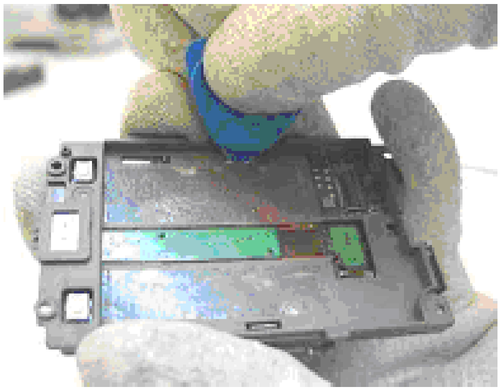


28. Remove hinge's bracket from the **Display Frame Assy**, Note not to bend brackets

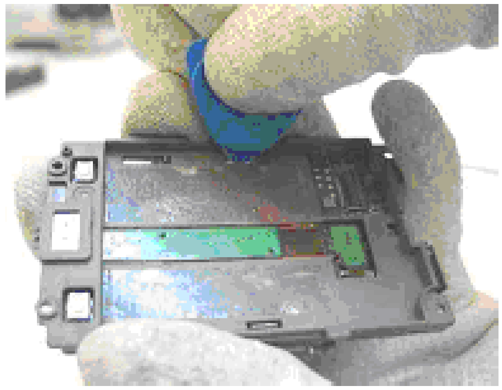




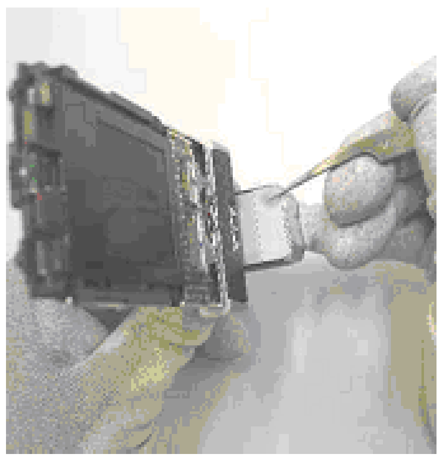
29. Remove **outer display (Jordan) shield** by opening locking snaps using tweezers (SRT-6).



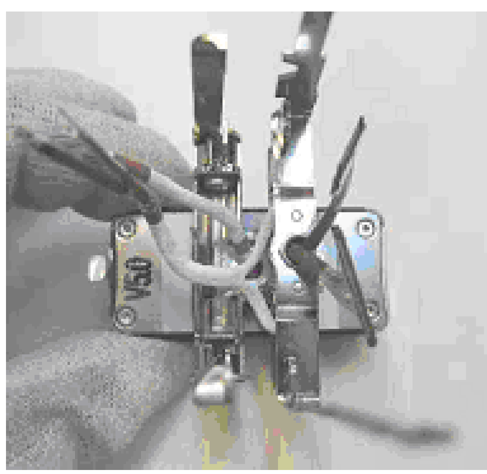
30. Open outer **Display connector** by using SRT-6.



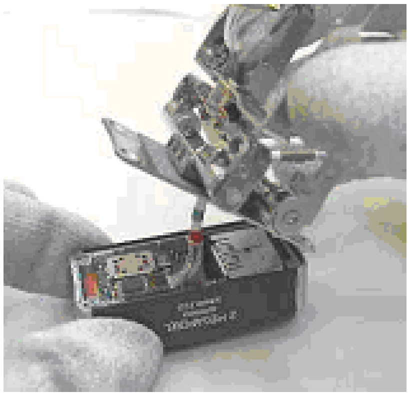
31. Turn camera unit 45 degrees and remove **Cosmetic layers** by using tweezers



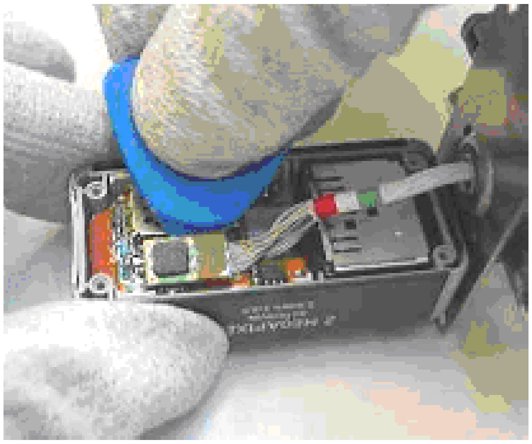
32. Unscrew the four Torx Plus size 5 screws.



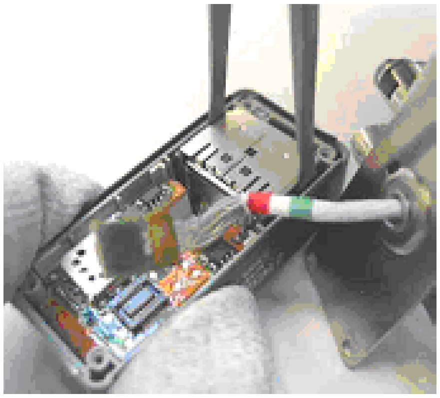
33. Lift **Hinge** out of **G-cover.**



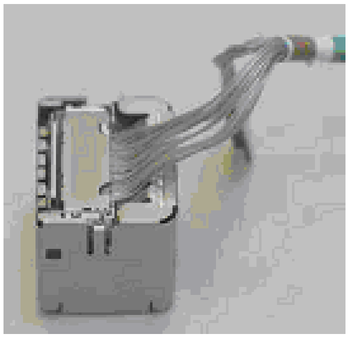
34. Open B-to-B connector by using SRT-6.



35. Lift **Camera Module** out of the **G-cover assy** by using tweezers or screwdriver.



36. Remove camera connector from camera using SS-57 (SS-57 instructions can be found from disassembly instructions of lower part).



(This page left intentionally blank.)

6 — BB Troubleshooting and Manual Tuning Guide

(This page left intentionally blank.)

Table of Contents

List of Tables

List of Figures

Baseband troubleshooting

Context

This section is intended to be a guide for localising and repairing electrical faults. The fault repairing is divided into troubleshooting paths.

The following main troubleshooting tree describes the different baseband troubleshooting paths to be followed in fault situations.

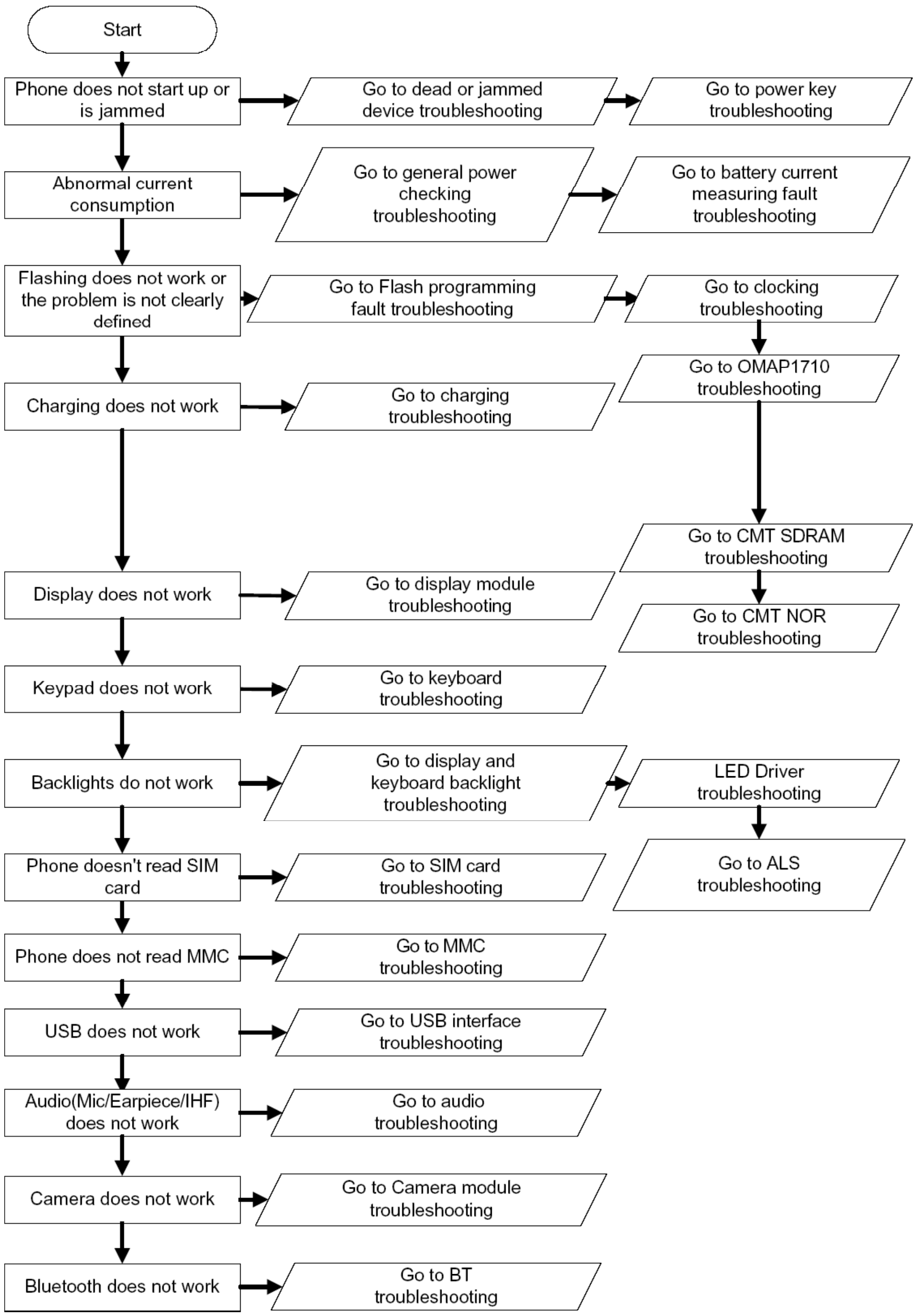
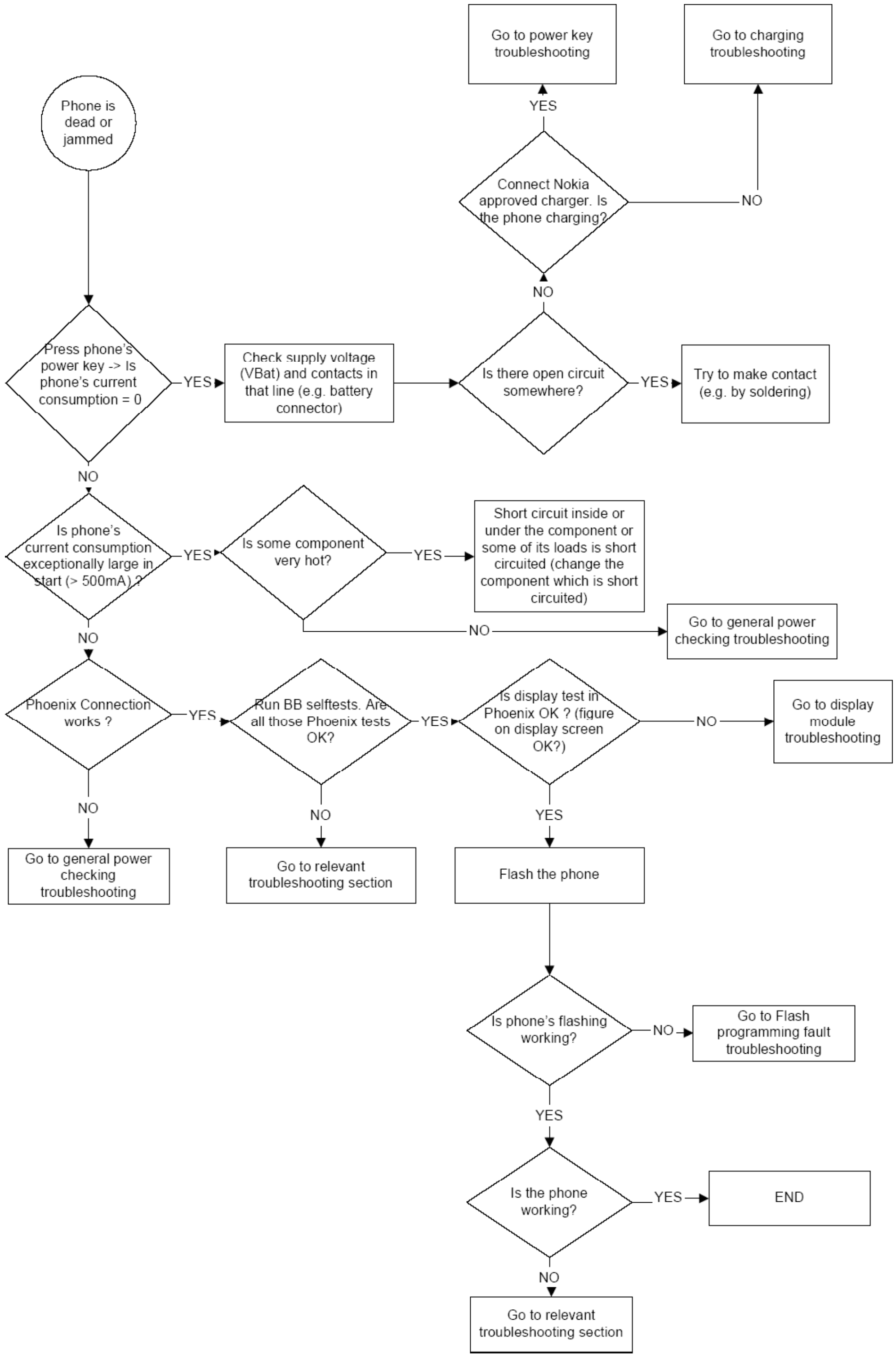
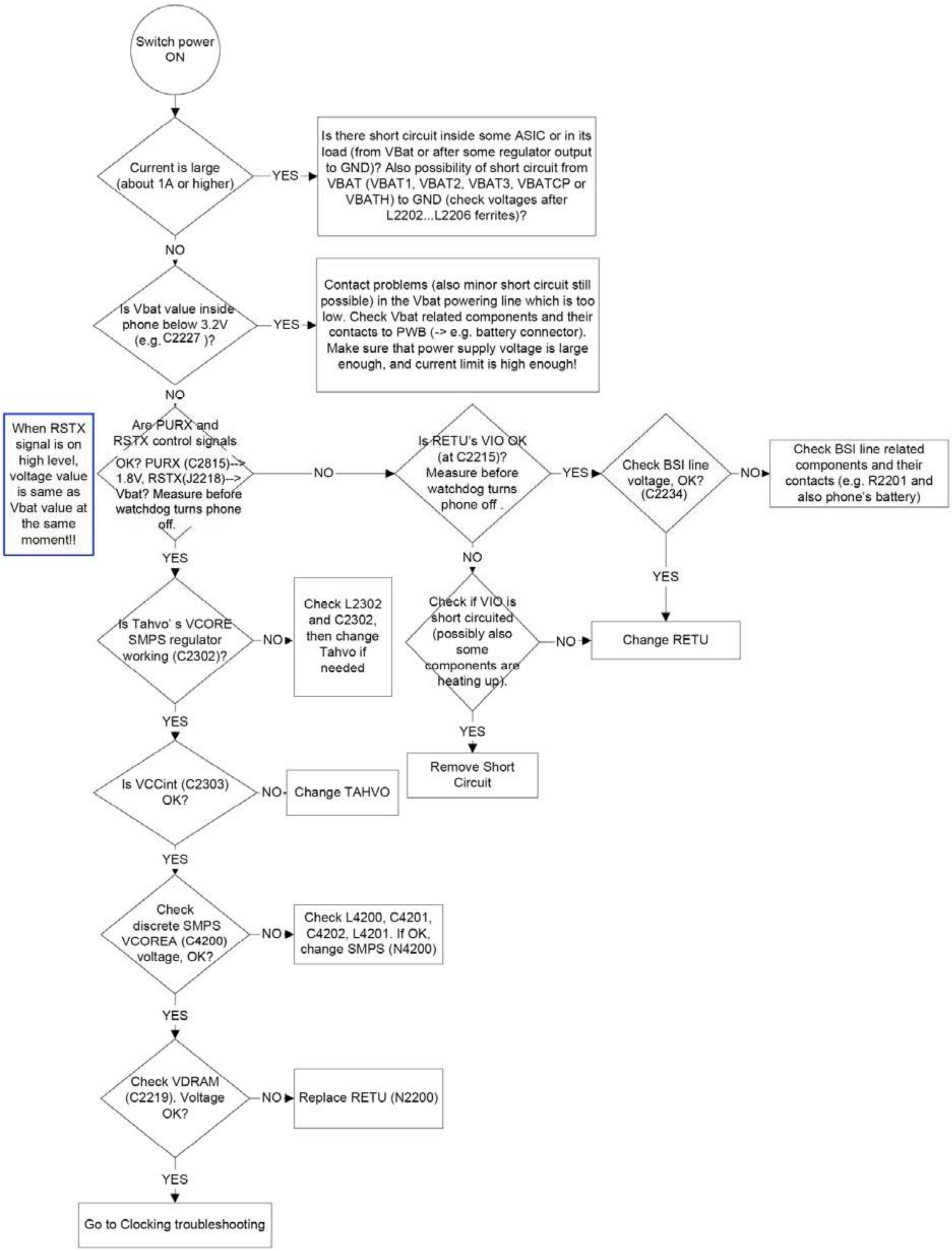


Figure 42 Main troubleshooting tree

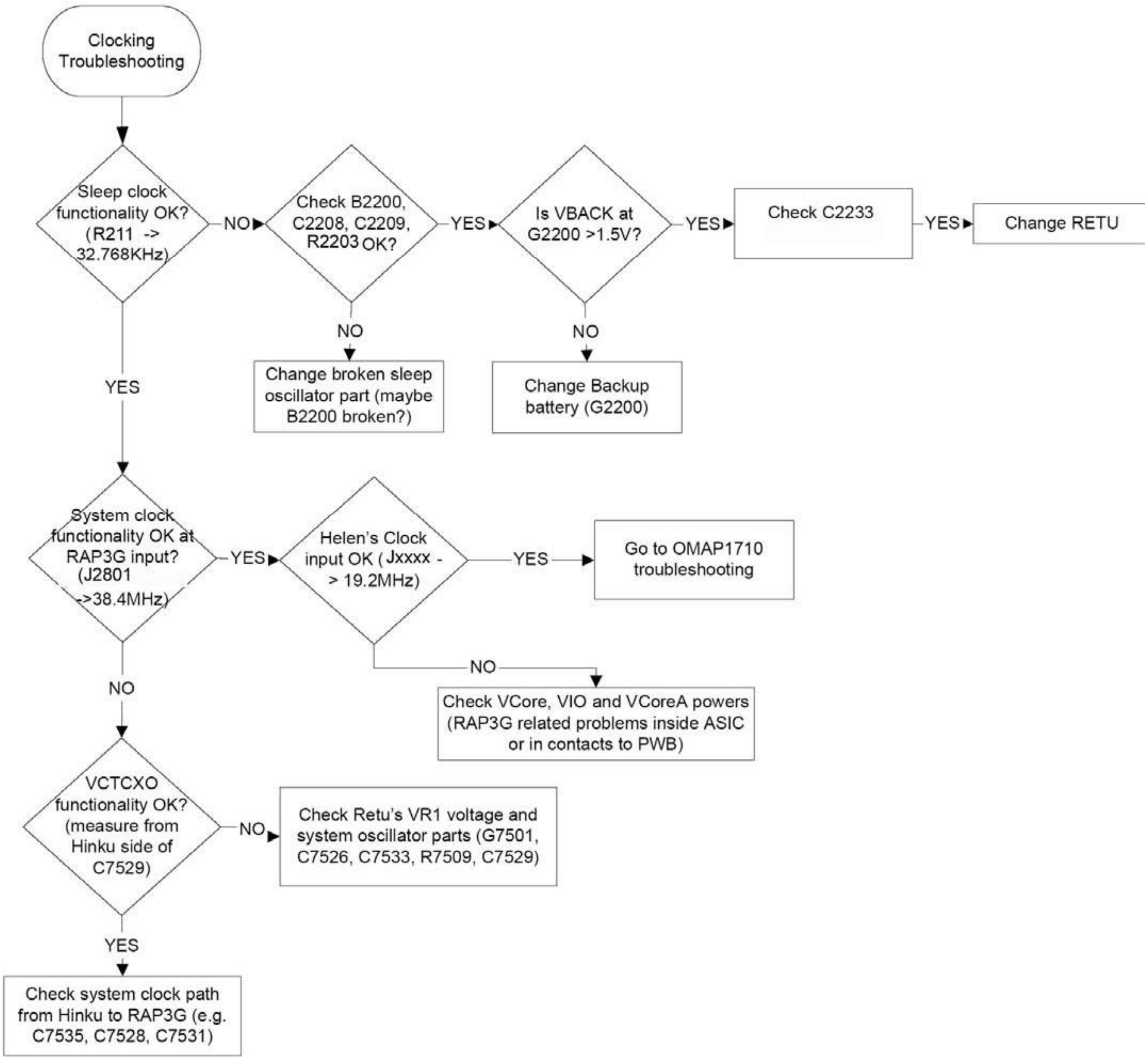
Dead or jammed device troubleshooting



General power checking troubleshooting



Clocking troubleshooting



OMAP1710 troubleshooting

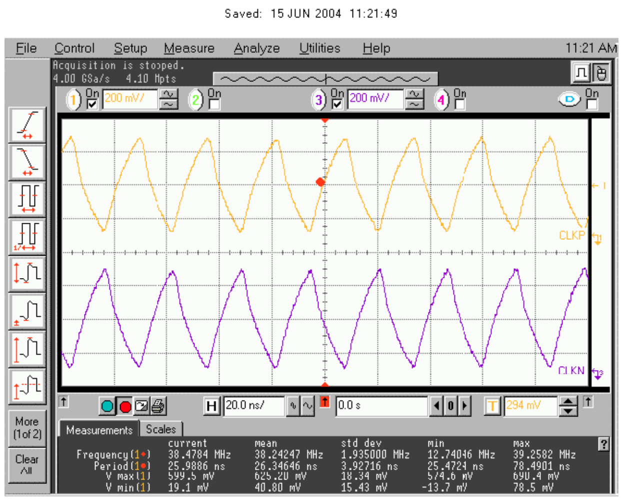


Figure 43 SYSCLK from J2801

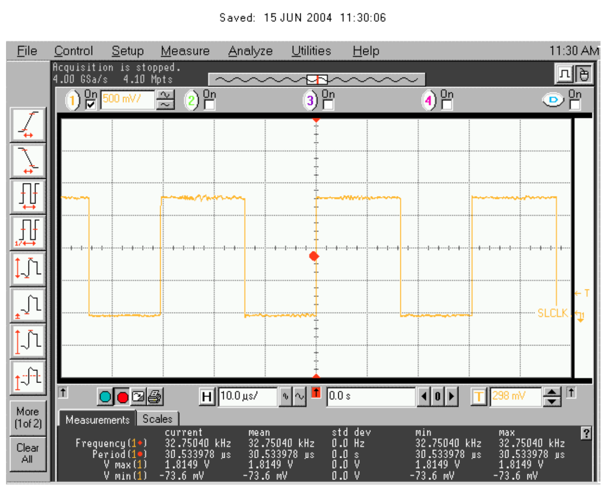
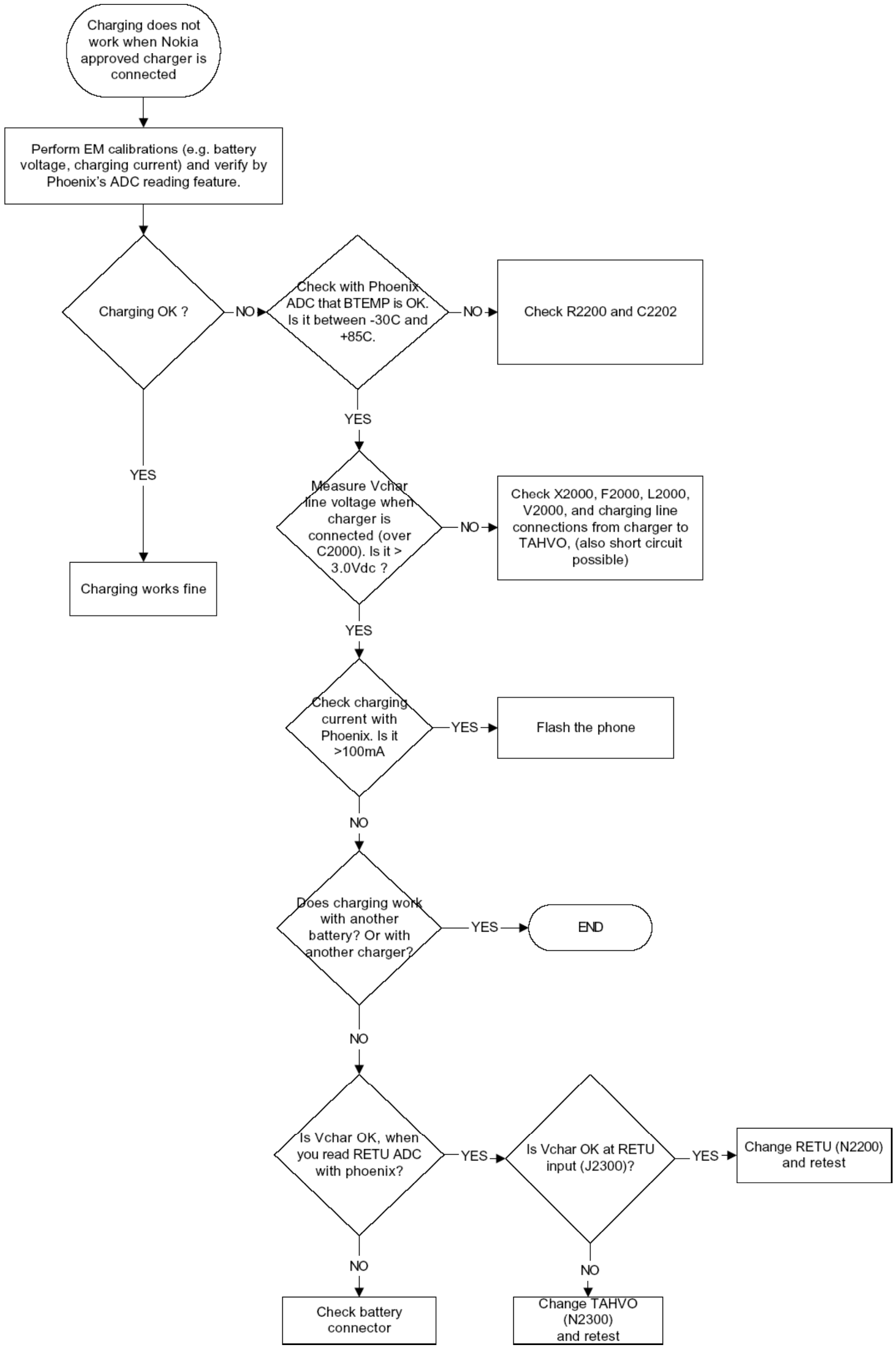
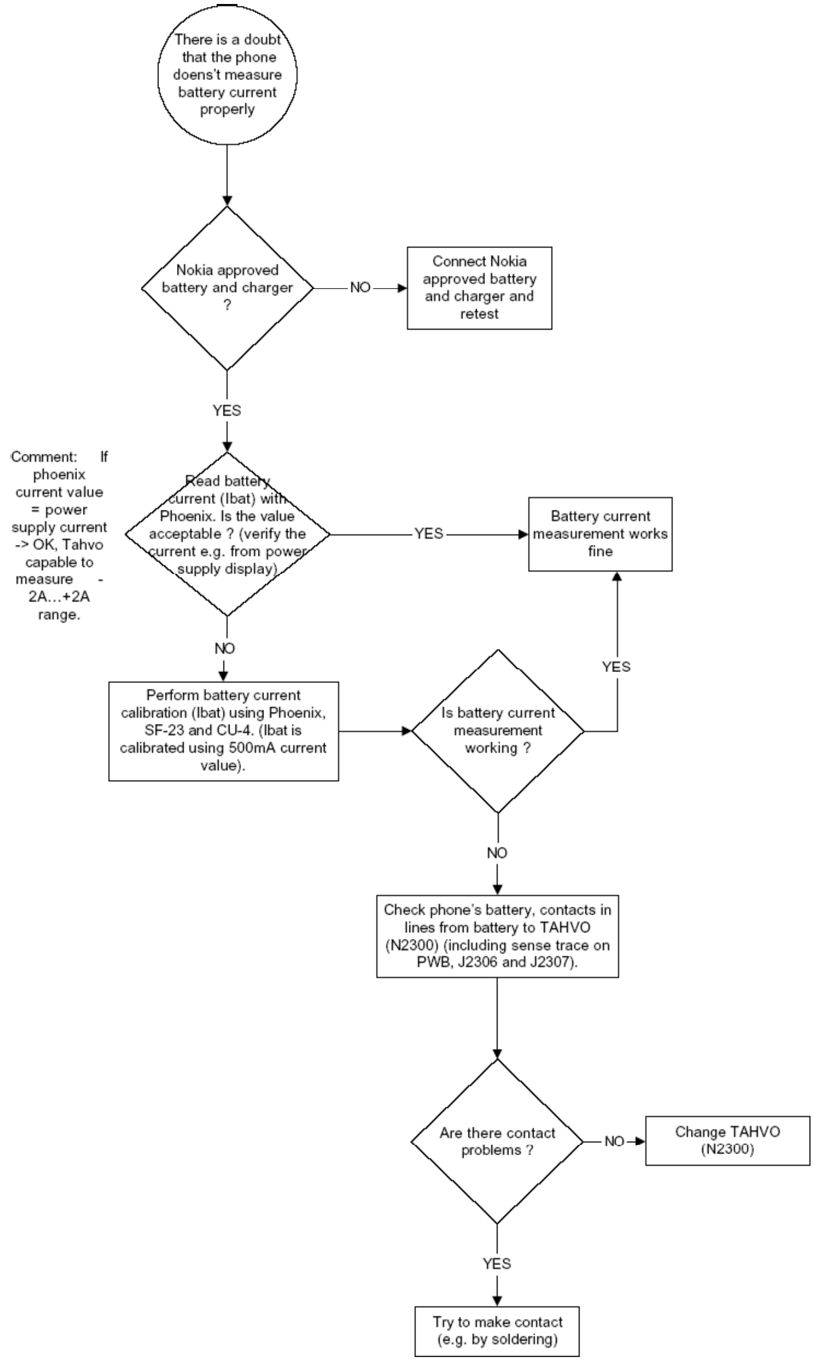


Figure 44 SleepCLK from R211

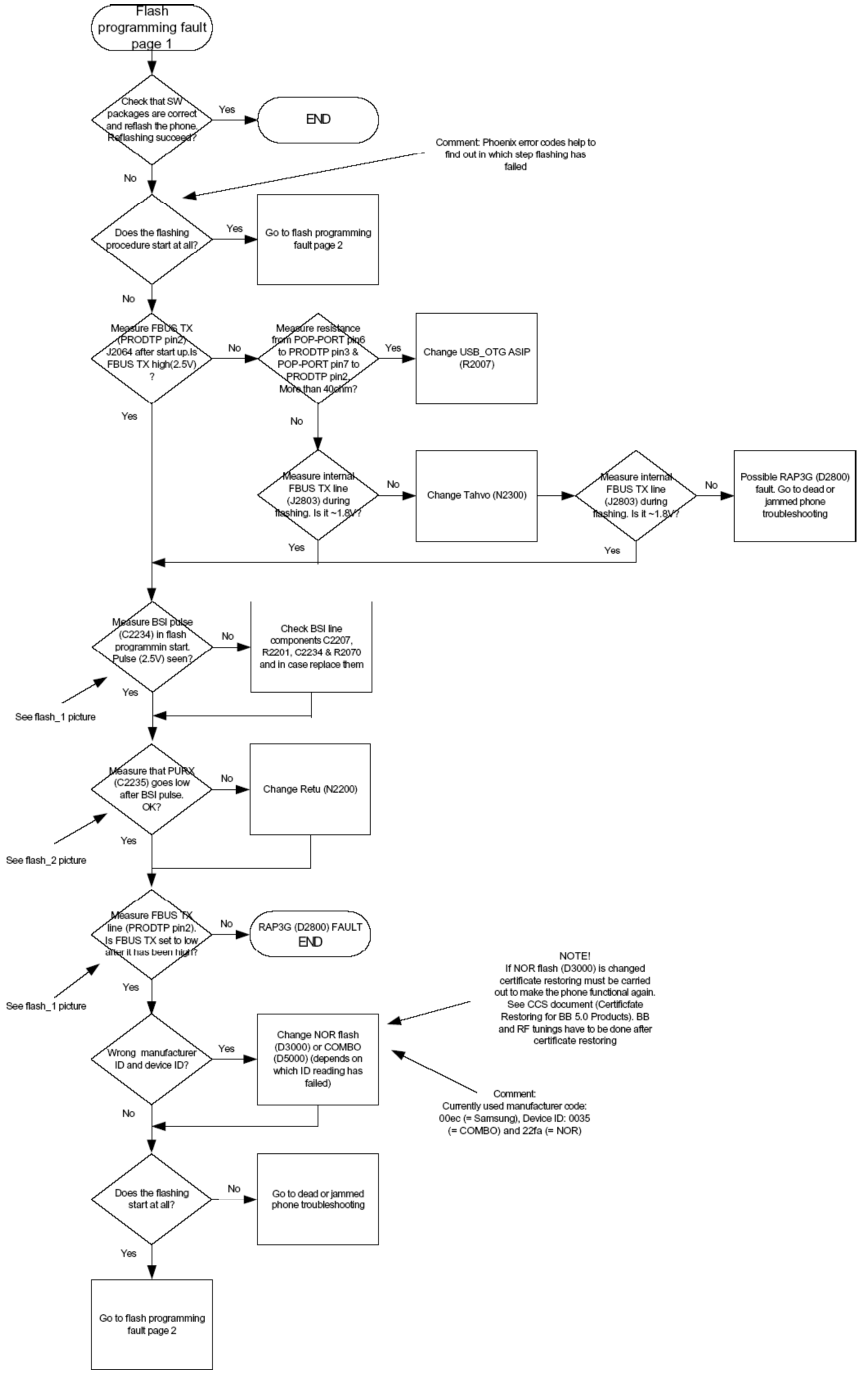
Charging troubleshooting

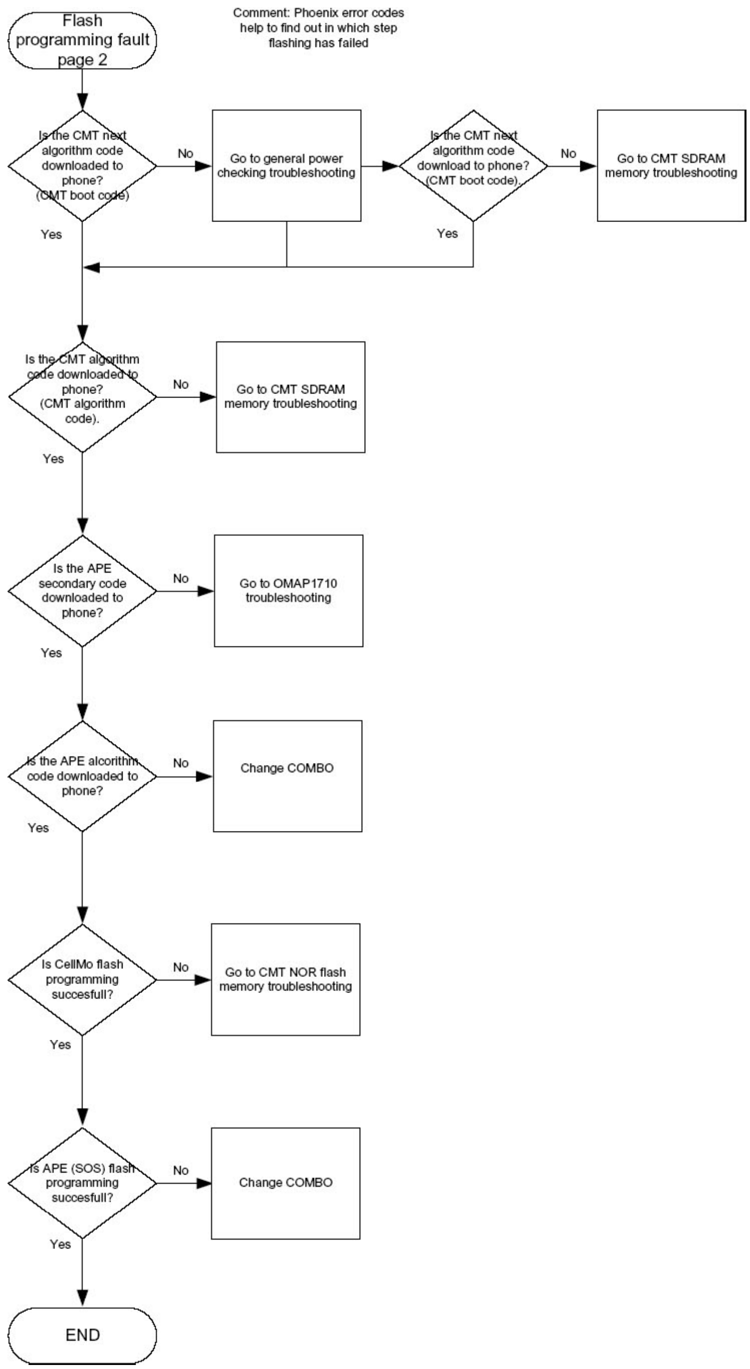


Battery current measuring fault troubleshooting



Flash programming fault troubleshooting




Flash programming fault page 2
Comment: Phoenix error codes help to find out in which step flashing has failed
Is the CMT next algorithm code downloaded to phone? (CMT boot code)
No
Go to general power checking troubleshooting
Is the CMT next algorithm code download to phone? (CMT boot code).
No
Go to CMT SDRAM memory troubleshooting
Yes
Yes
Is the CMT algorithm code downloaded to phone? (CMT algorithm code).
No
Go to CMT SDRAM memory troubleshooting
Yes
Is the APE secondary code downloaded to phone?
No
Go to OMAP1710 troubleshooting
Yes
Is the APE alcorithm code downloaded to phone?
No
Change COMBO
Yes
Is CellMo flash programming succesfull?
No
Go to CMT NOR flash memory troubleshooting
Yes
Is APE (SOS) flash programming succesfull?
No
Change COMBO
Yes
END

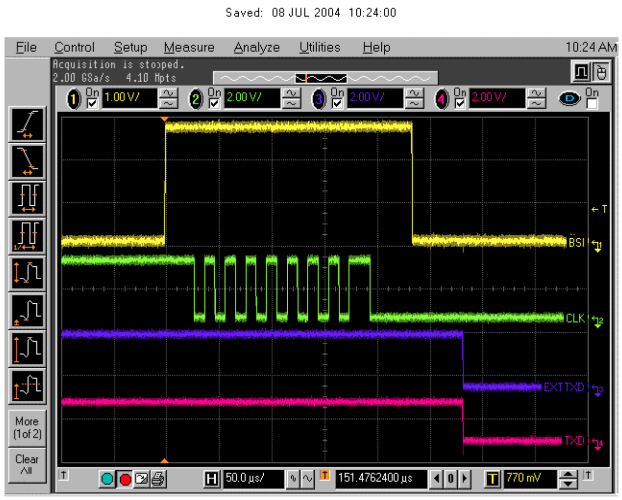


Figure 45 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

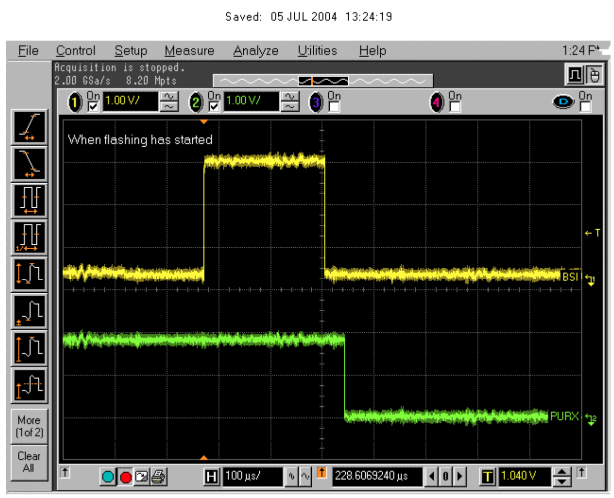
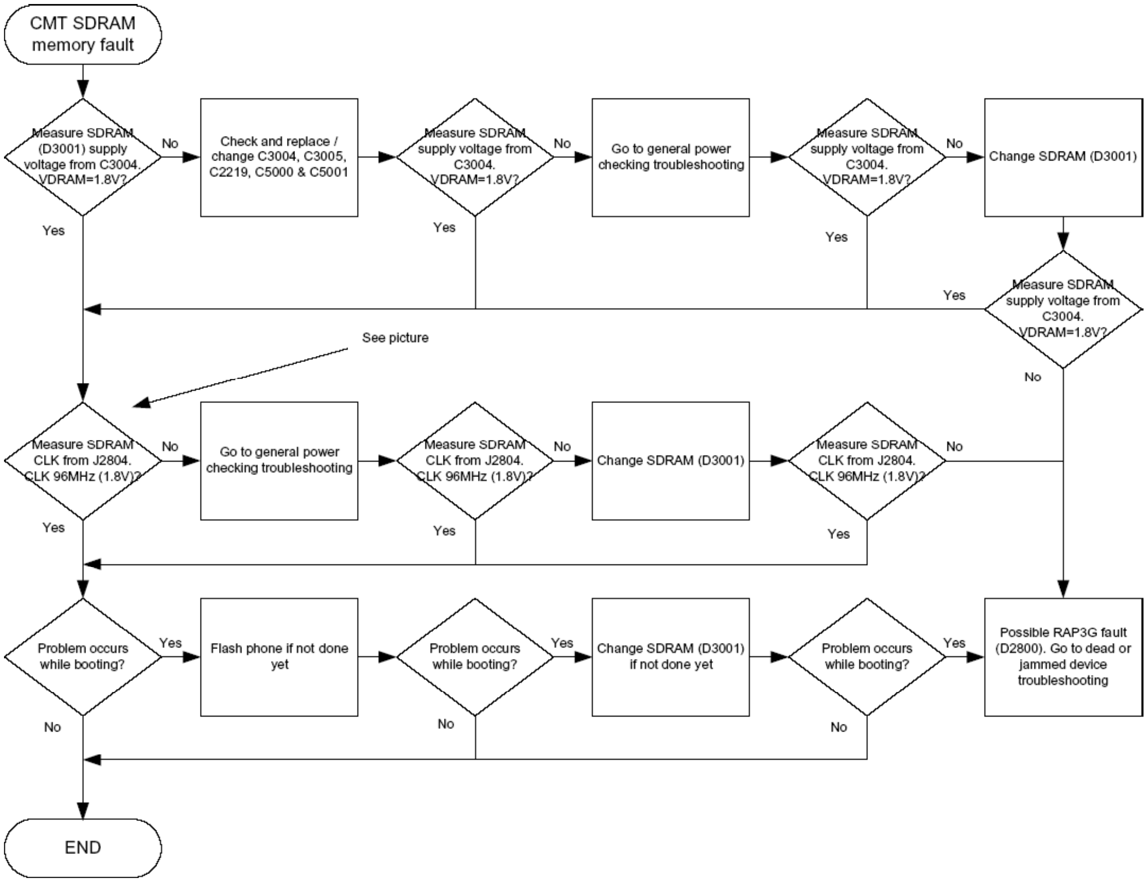


Figure 46 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

CMT SDRAM memory troubleshooting



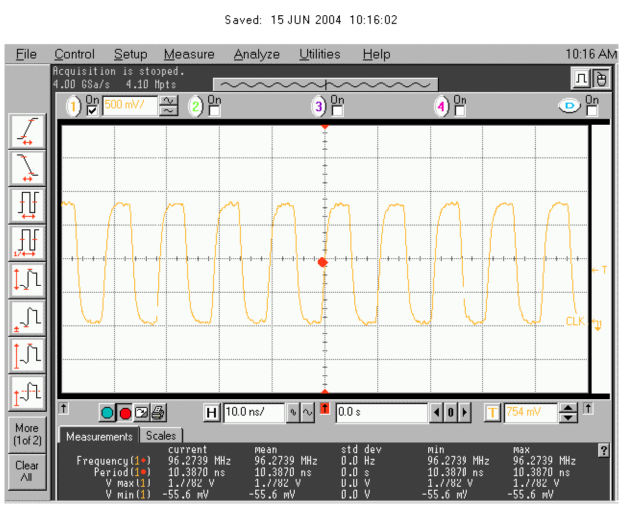
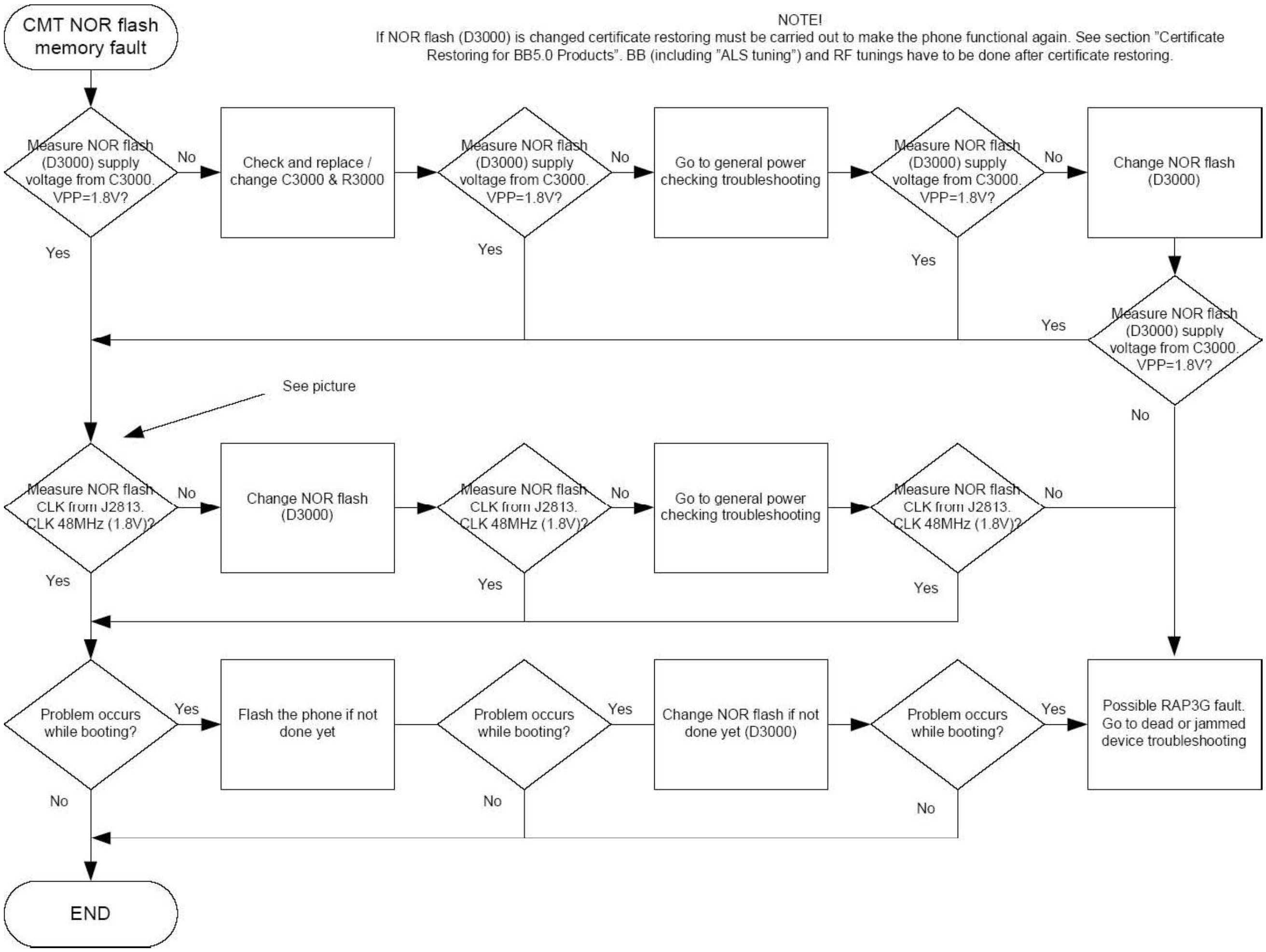


Figure 47 CMT SDRAM CLK from pin J2804

CMT NOR flash fault troubleshooting



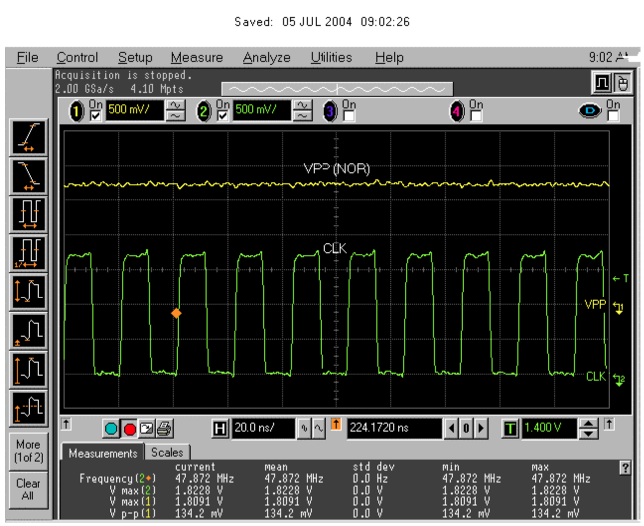
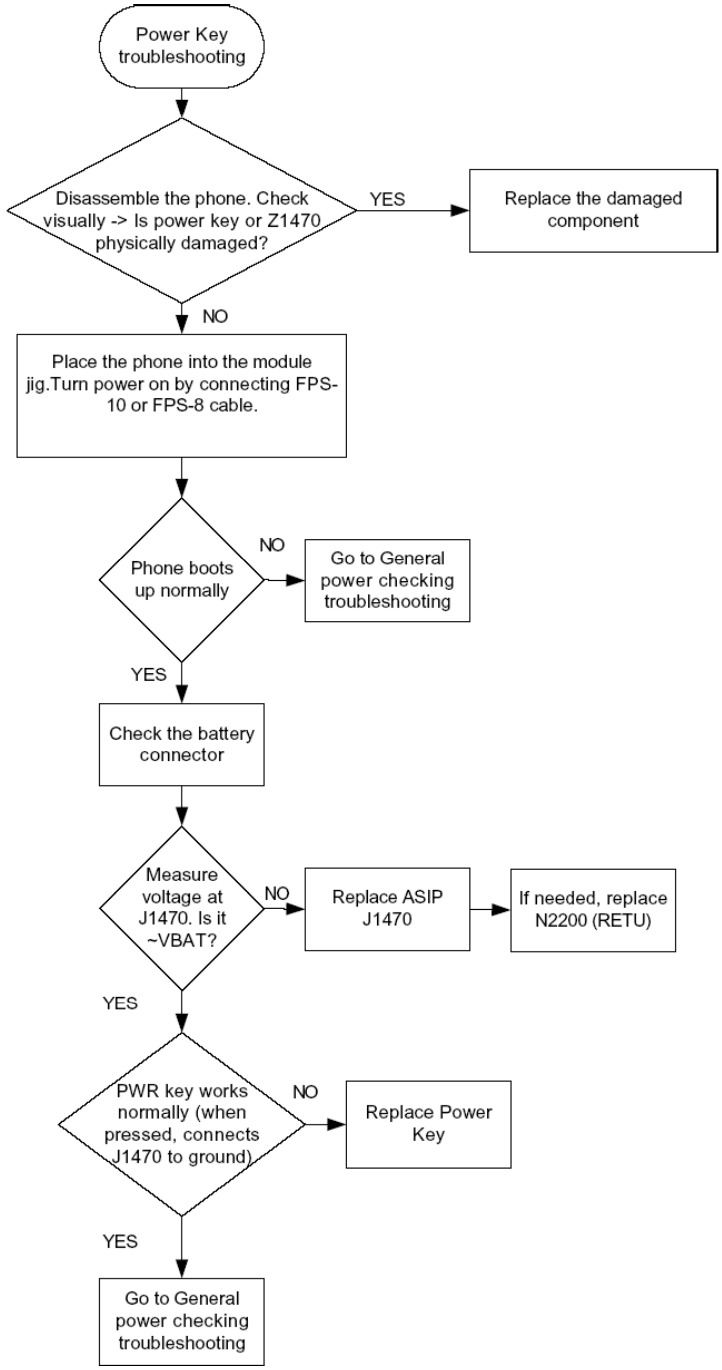
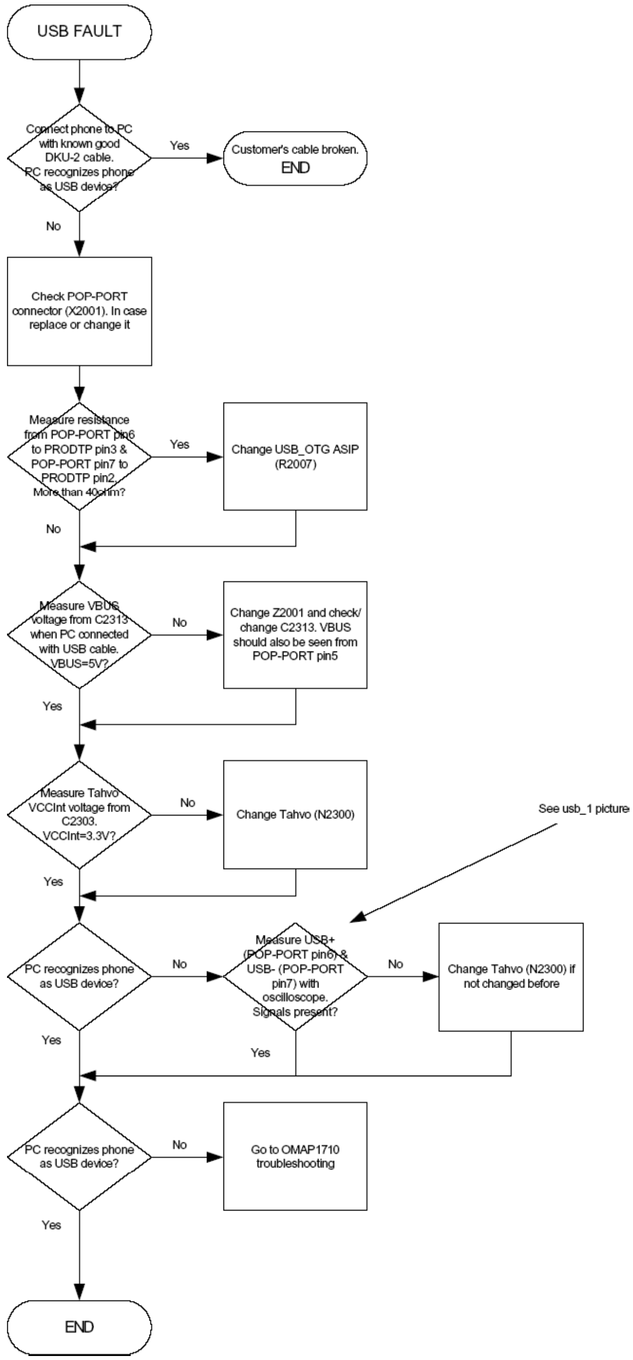


Figure 48 NOR CLK from J2813

Power key troubleshooting



USB interface troubleshooting



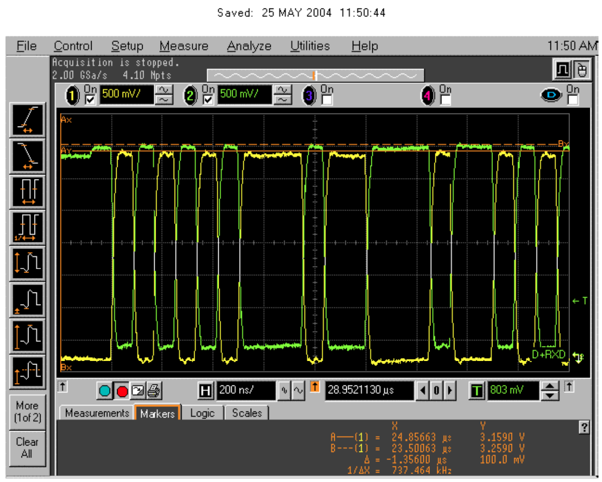
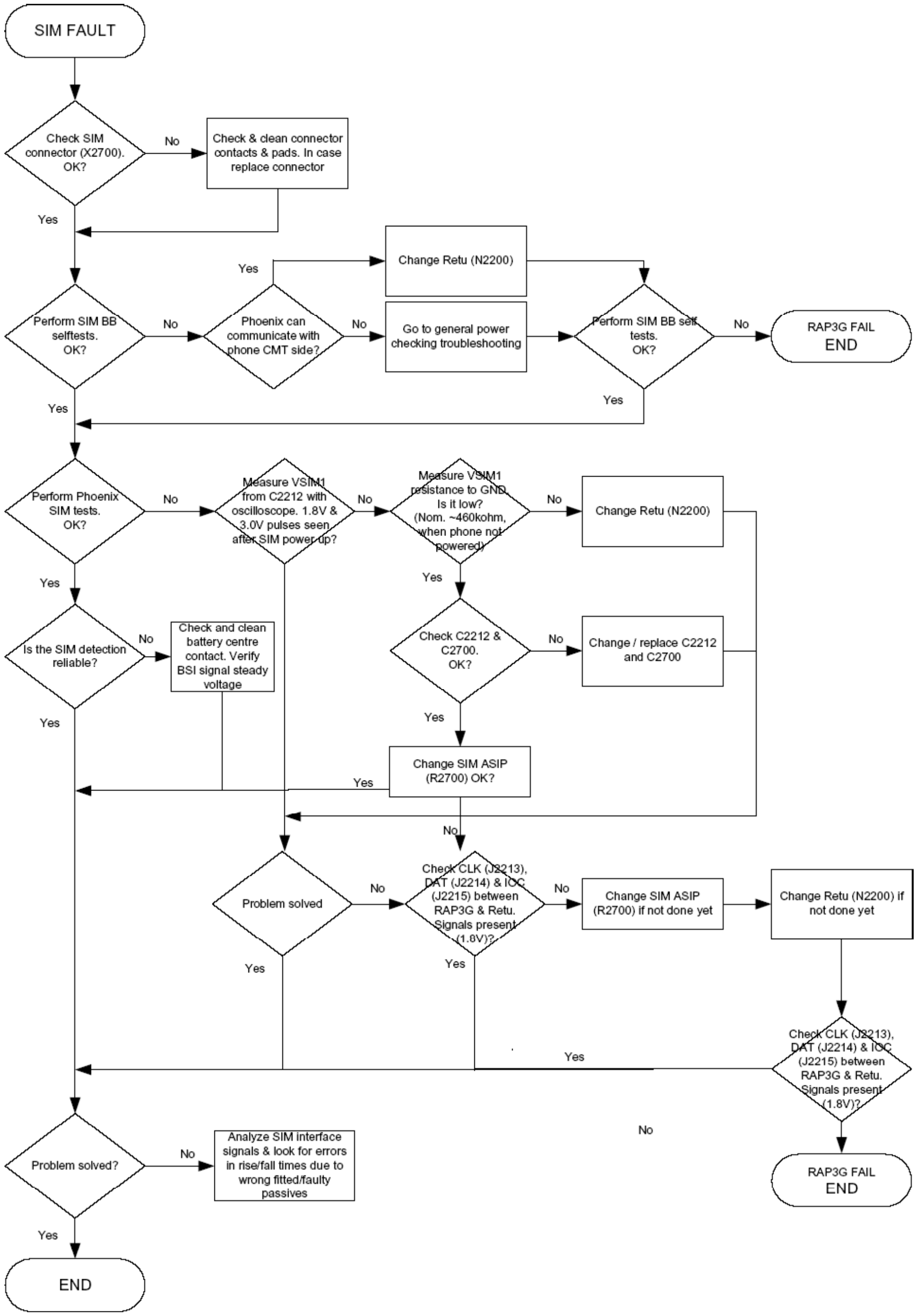
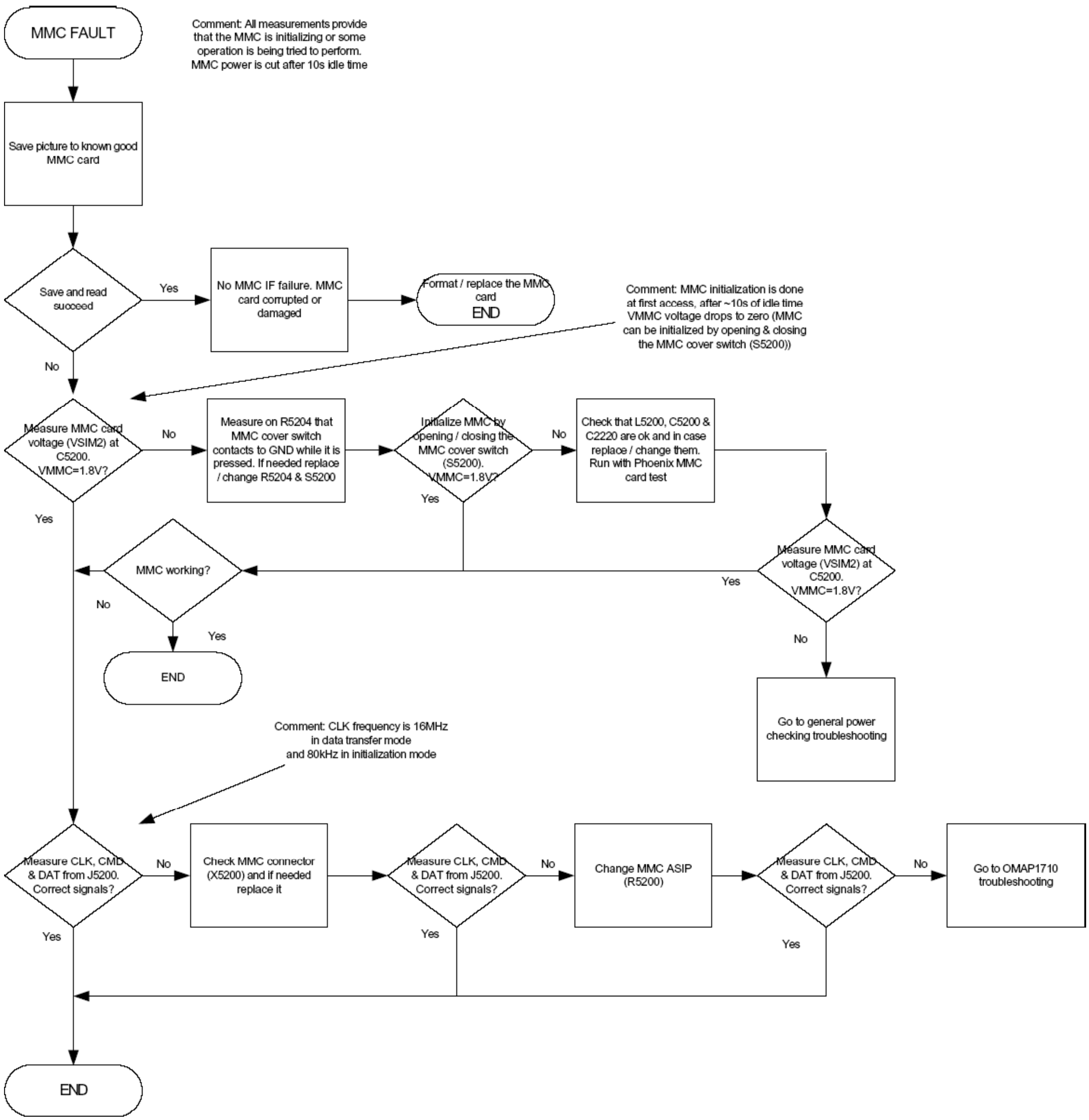


Figure 49 USB 1: D-TXD (POP-PORT pin6) and D+RXD (POP-PORT pin7) voltage levels when USB connected.

SIM card troubleshooting



MMC troubleshooting



Keyboard troubleshooting

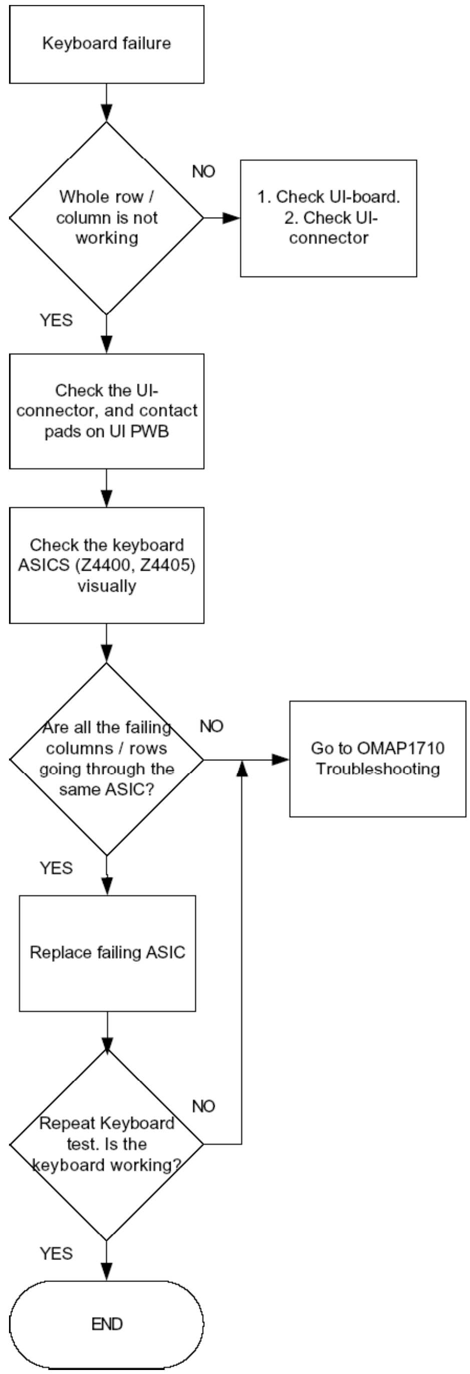
Context

There are two possible failure modes in the keyboard module:

- One or more keys can be stuck, so that the key does not react when a keydome is pressed. This kind of failure is caused by mechanical reasons (dirt, rust).

- Malfunction of several keys at the same time; this happens when one or more rows or columns are failing (shortcut or open connection). For a more detailed description of the keyboard and keymatrix, see section Keyboard (Page 9–22).

If the failure mode is not clear, start with the Keyboard Test in Phoenix.



Display module troubleshooting

General instructions for display troubleshooting

The first step is to verify with a working display that the fault is not on the display module itself. The display module cannot be repaired.

The second step is to check that the cellular engine is working normally. This can be done by connecting the phone to a docking station and starting Phoenix service software. With the help of Phoenix read the phone information to check that also application engine is functioning normally (you should be able to read the APE ID).

After these checks proceed to the display troubleshooting flowcharts. Use the Display Test tool in Phoenix to find the detailed fault mode.

Operating modes of the display

Display is in a normal mode when the phone is in active use.

Display is in a partial idle mode when the phone is in the screen saver mode.

The operating modes of the display can be controlled with the help of Phoenix.

Table 9 Display module troubleshooting cases

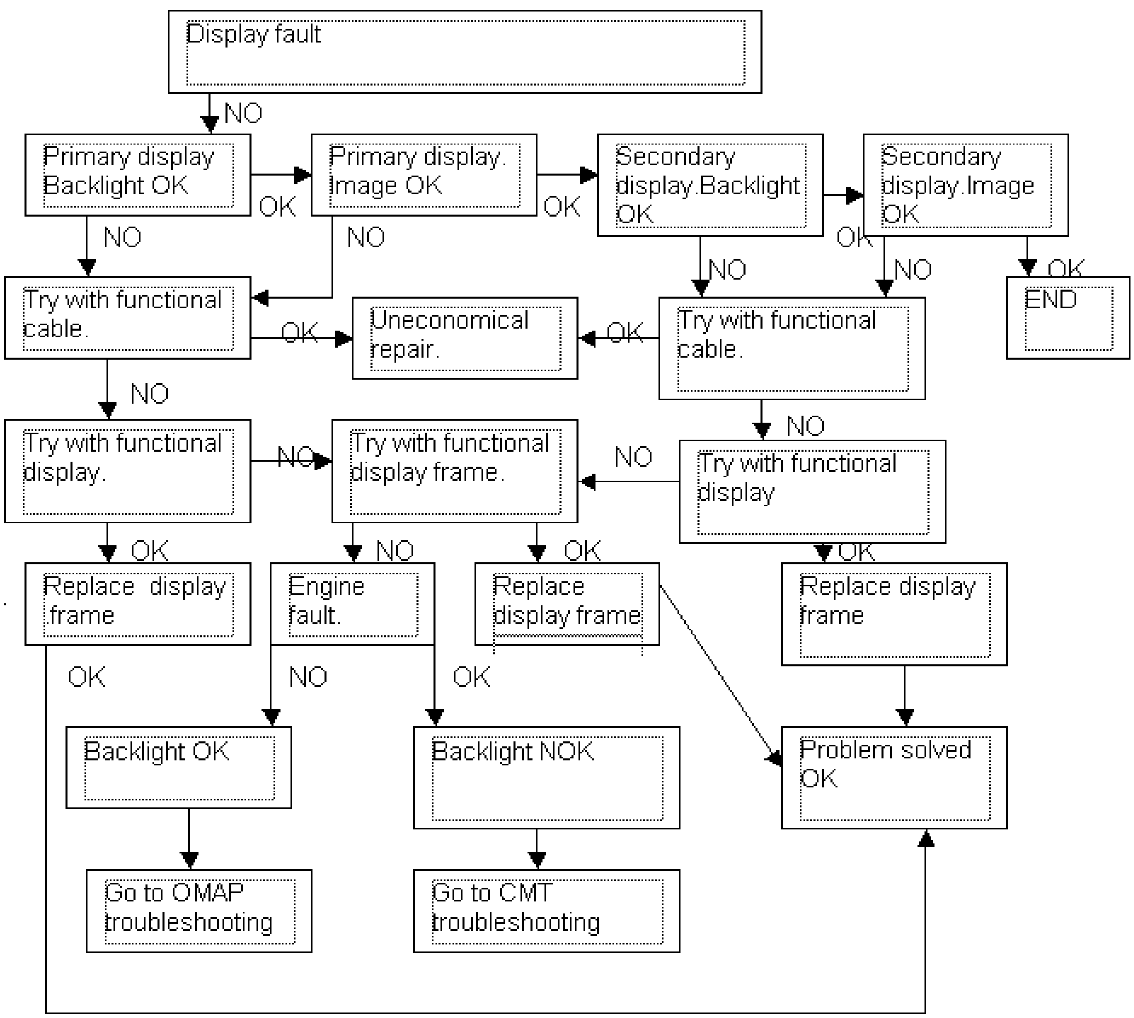
Display blank	There is no image on the display. Display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or part of the image can be missing. If part of image is missing change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. Backlight is also controlled automatically by the ambient light sensor. This means that in case the display is working (image OK) but the backlight is not, follow the Display and keyboard backlight troubleshooting (Page 6–26).
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the table below.

Table 10 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Note: Blinking pixels are not allowed in normal operating temperatures and light conditions.

Display fault troubleshooting



Display and keyboard backlight troubleshooting

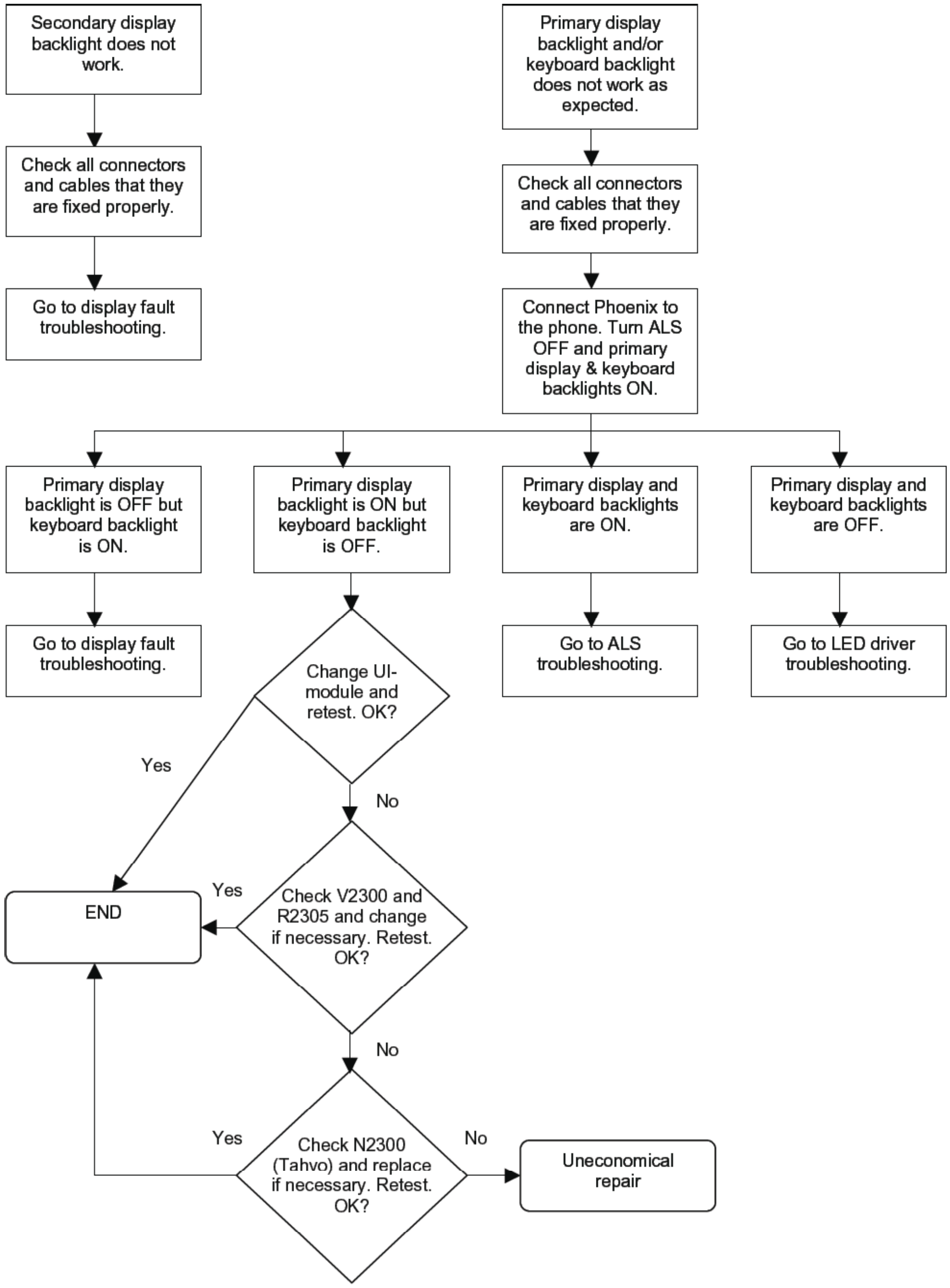
Context

The device has one LED driver that provides current for both display and keyboard backlights.

Keyboard backlights are turned ON only in dark conditions. This is controlled by the Ambient Light Sensor (ALS). Also the brightness of the display is adjusted by the ambient light sensor.

You can enable/disable ALS with the help of Phoenix service software.

Display brightness can be adjusted manually, if ALS is disabled. If the ambient light sensor is enabled, it adjusts the display brightness automatically.



ALS troubleshooting

Context

If a phototransistor is broken, the display frame assy has to be replaced. The display frame assy has to be also replaced if the calibration values are lost by some other reason (e.g. after replacing the NOR memory chip D3000).

If the phototransistor is changed, the calibration value in the phone memory has to be changed to the default value '1'.

Make sure that you have completed Display and keypad backlight troubleshooting (Page 6–26) first before starting ALS troubleshooting.

Here are some hints for ALS troubleshooting; the following troubleshooting diagram refers to these:

- Phoenix LED control tool also shows you luminance. The correct luminance in darkness is <20lx, and in office environment 100-2000lx. The luminance value depends strongly on the light source and the angle of the phone, so these values are only a rough guideline.
- LED driver control voltage measurement points can be found from LED driver troubleshooting (Page 6–30) section. When backlight brightness is set to 100%, both GENOUT-signals are low, and enable PWM is 100%.
- Phoenix has an ambient light sensor calibration tool for changing calibration values. The pull-up resistor calibration is done first:
  a Cover the light guide (upper part of the A Cover).
  b Click 'Start' and 'Write'.
  c Manually change the ambient light sensor value to the default value. There is no special tool for this, but you have to perform calibration normally and then set the "Co-efficient" result to '1' before writing it to the phone memory.

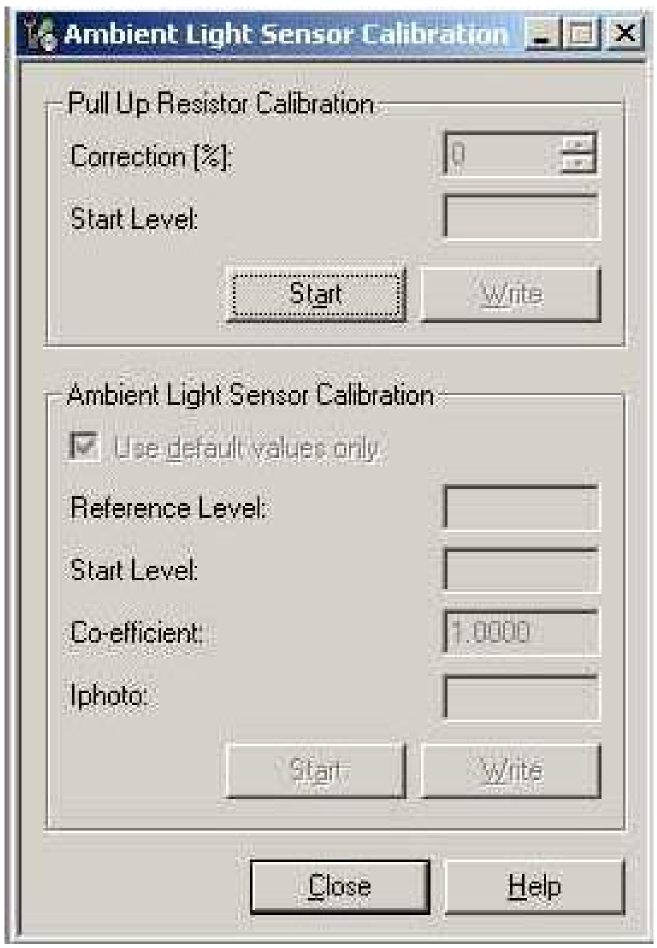
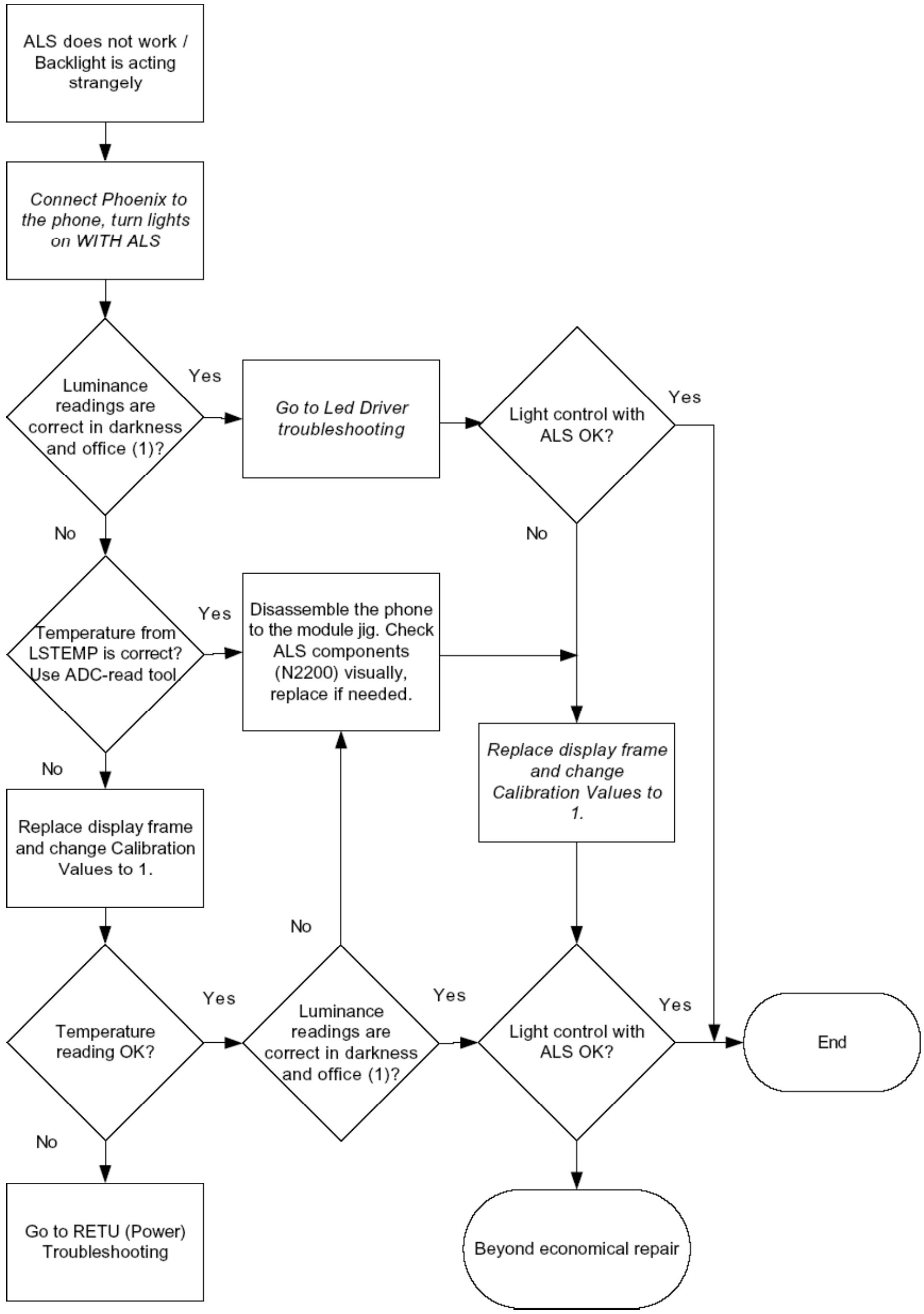
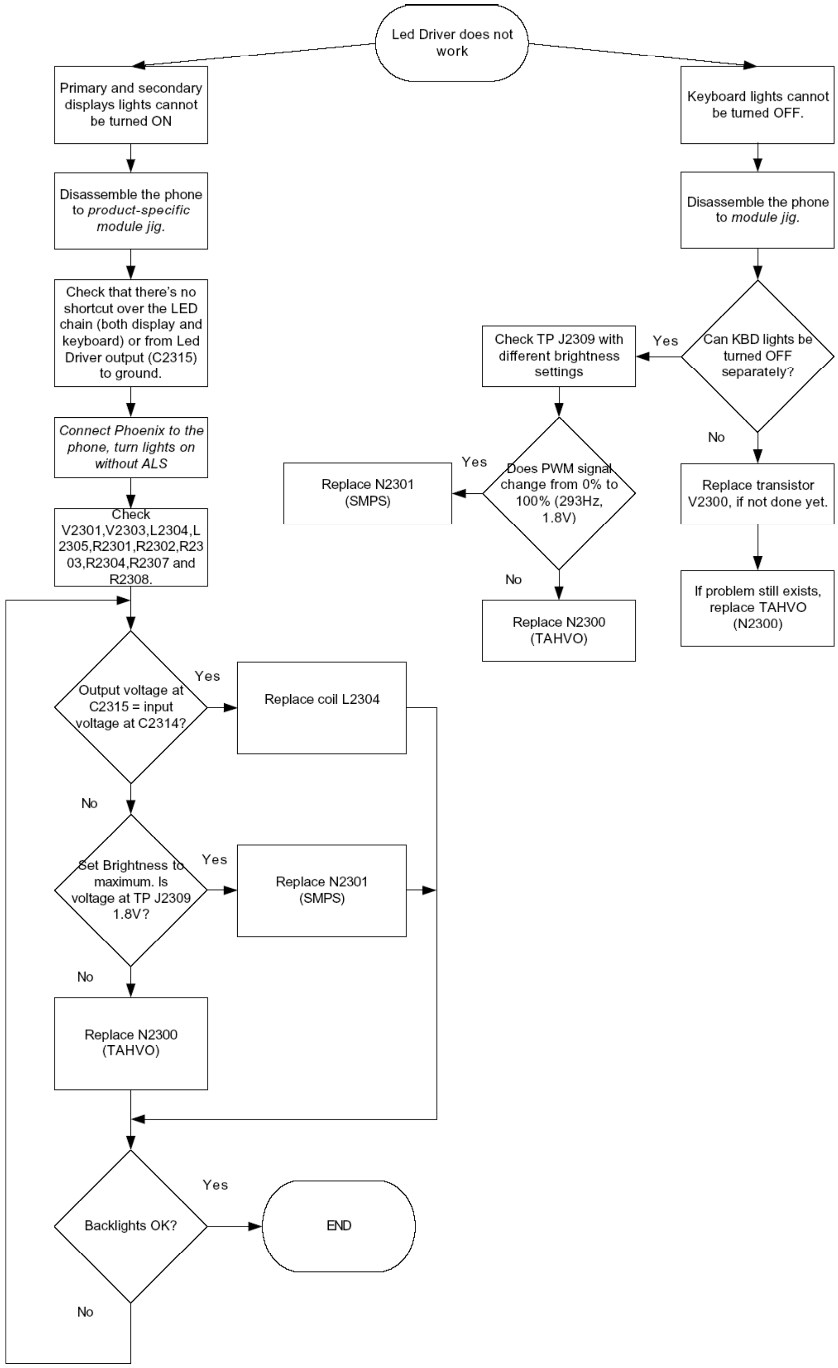


Figure 50 Ambient Light Sensor Calibration window

 Company Confidential 9241872 (Issue 1)


ALS does not work / Backlight is acting strangely
Connect Phoenix to the phone, turn lights on WITH ALS
Luminance readings are correct in darkness and office (1)?
Yes
Go to Led Driver troubleshooting
Light control with ALS OK?
Yes
No
No
Temperature from LSTEMP is correct? Use ADC-read tool
Yes
Disassemble the phone to the module jig. Check ALS components (N2200) visually, replace if needed.
No
Replace display frame and change Calibration Values to 1.
Replace display frame and change Calibration Values to 1.
No
Temperature reading OK?
Yes
Luminance readings are correct in darkness and office (1)?
Yes
Light control with ALS OK?
Yes
End
No
Go to RETU (Power) Troubleshooting
Beyond economical repair

LED driver troubleshooting



Bluetooth troubleshooting

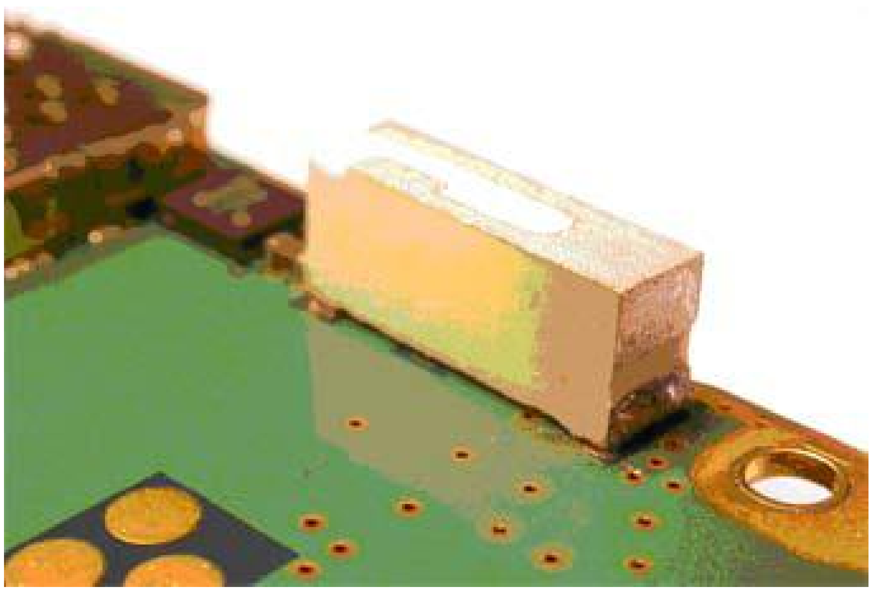
Introduction to Bluetooth troubleshooting

There are two main Bluetooth problems that can occur:

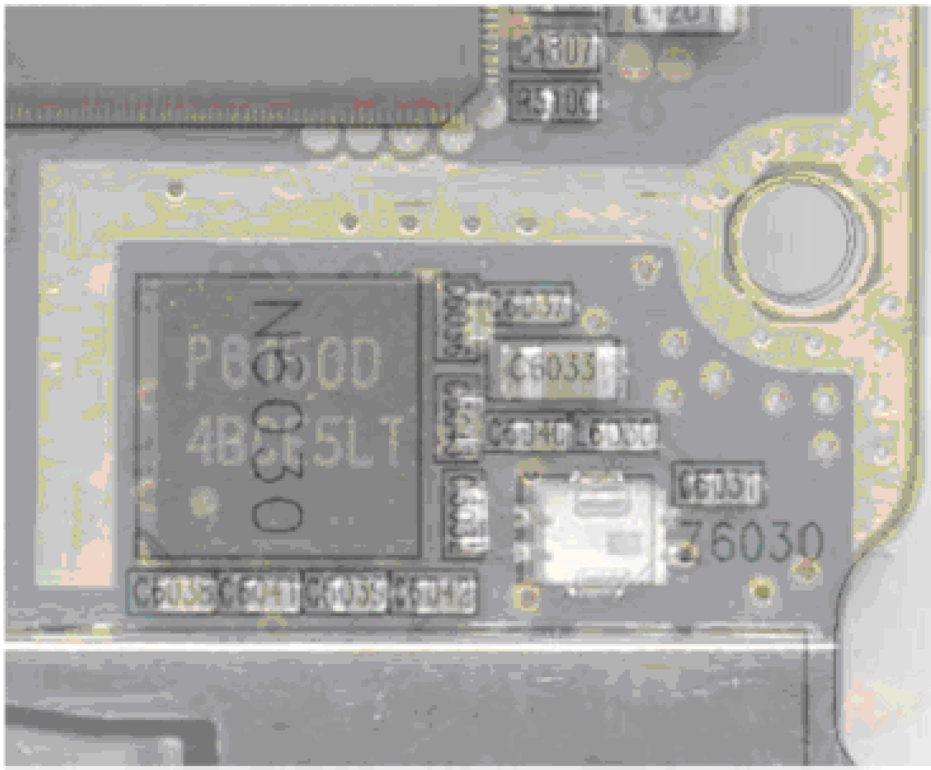
Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB. (see next page for details about BT antenna HW and Mechanics)
A malfunction in the BT ASIC, BB ASICs or Phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component.

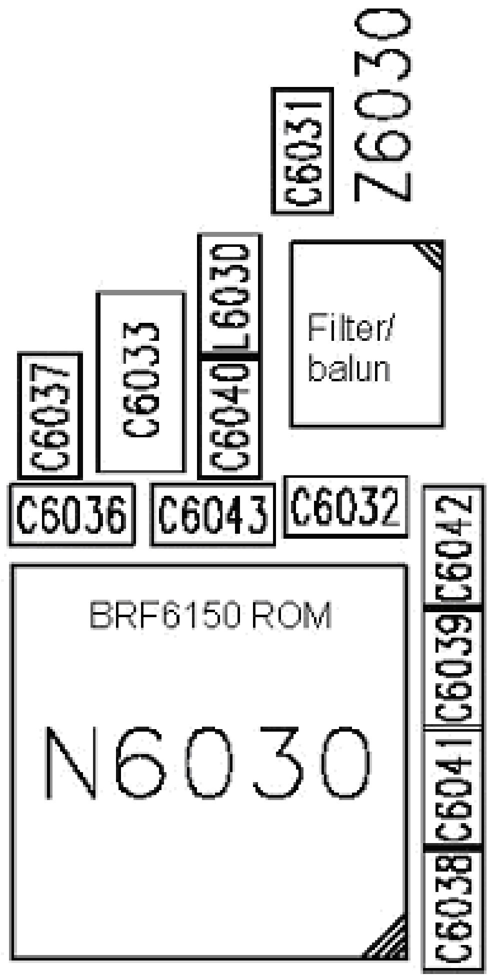
Location of the BT antenna



Bluetooth layout



Bluetooth component layout



Bluetooth settings for Phoenix

Steps

1. Start Phoenix service software.
2. From the File menu, choose Open Product, and then choose the correct type designator from the Product list.
3. Connect the phone to a docking station in the local mode.
4. From the Testing menu, choose Bluetooth LOCALS.
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.
6. In the Bluetooth LOCALS window, write the 12-digit serial number on the "Counterpart BT Device Address" line.

   This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click Run BER Test.

Results

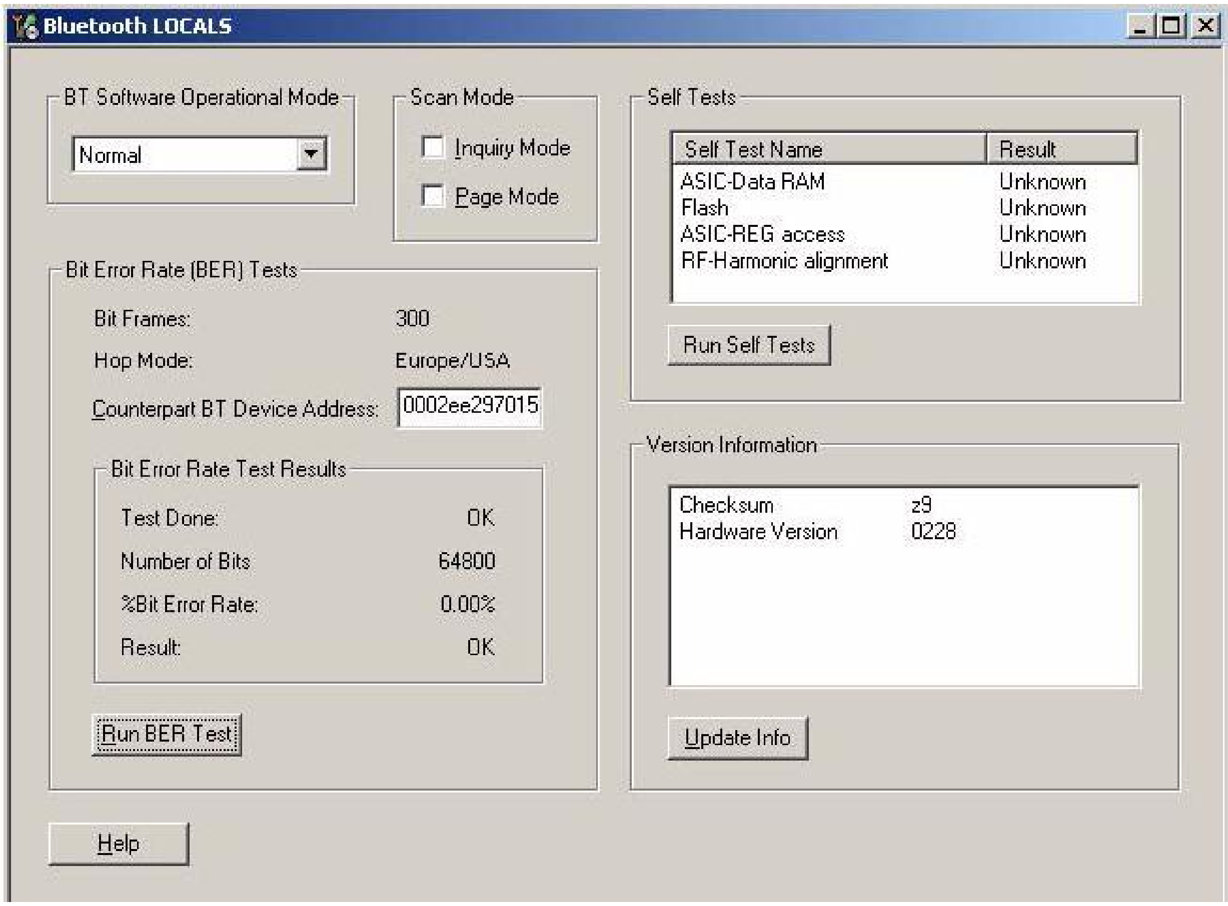


Figure 51 Phoenix settings for Bluetooth troubleshooting

Bluetooth self tests in Phoenix

Steps

1. Start Phoenix service software.
2. From the File menu, choose Open Product, and then choose the correct type designator from the Product list.
3. Connect the phone to a docking station in the local mode.
4. From the Testing menu, choose Self Tests.
5. Choose the following Bluetooth related tests:
   - ST_LPRF_IF_TEST
   - ST_LPRF_AUDIO_LINES_TEST
   - ST_BT_WAKEUP_TEST
6. To run the tests, click Start.

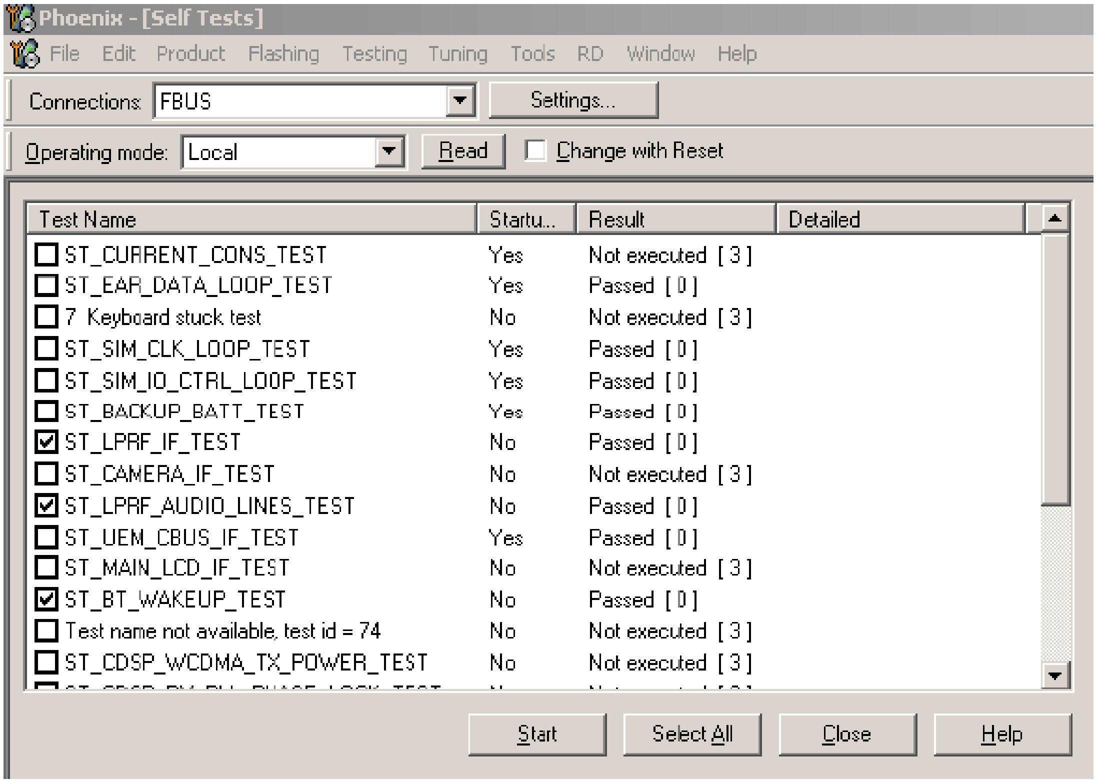
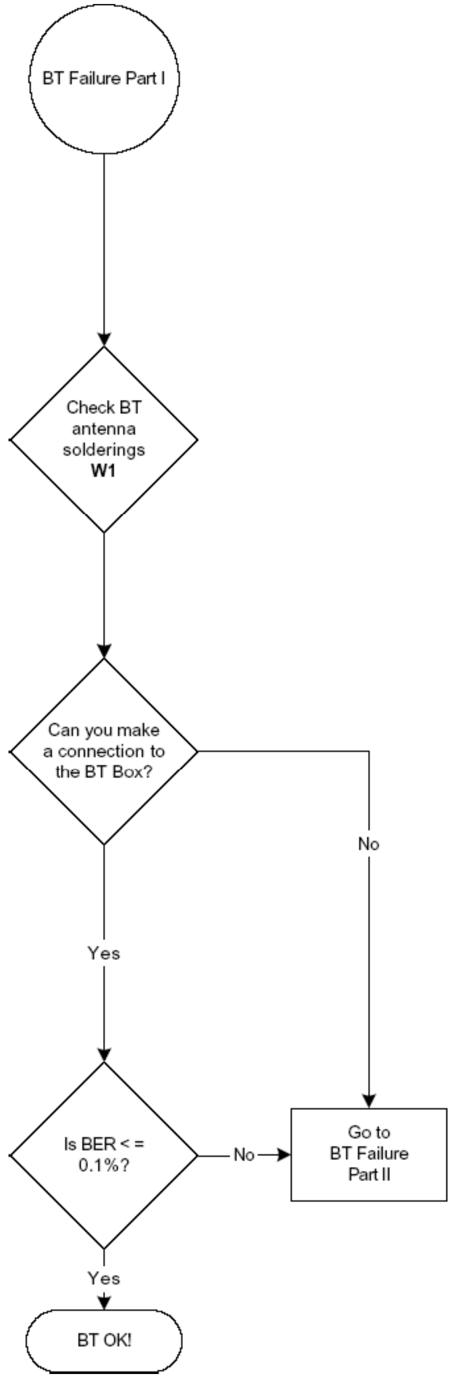
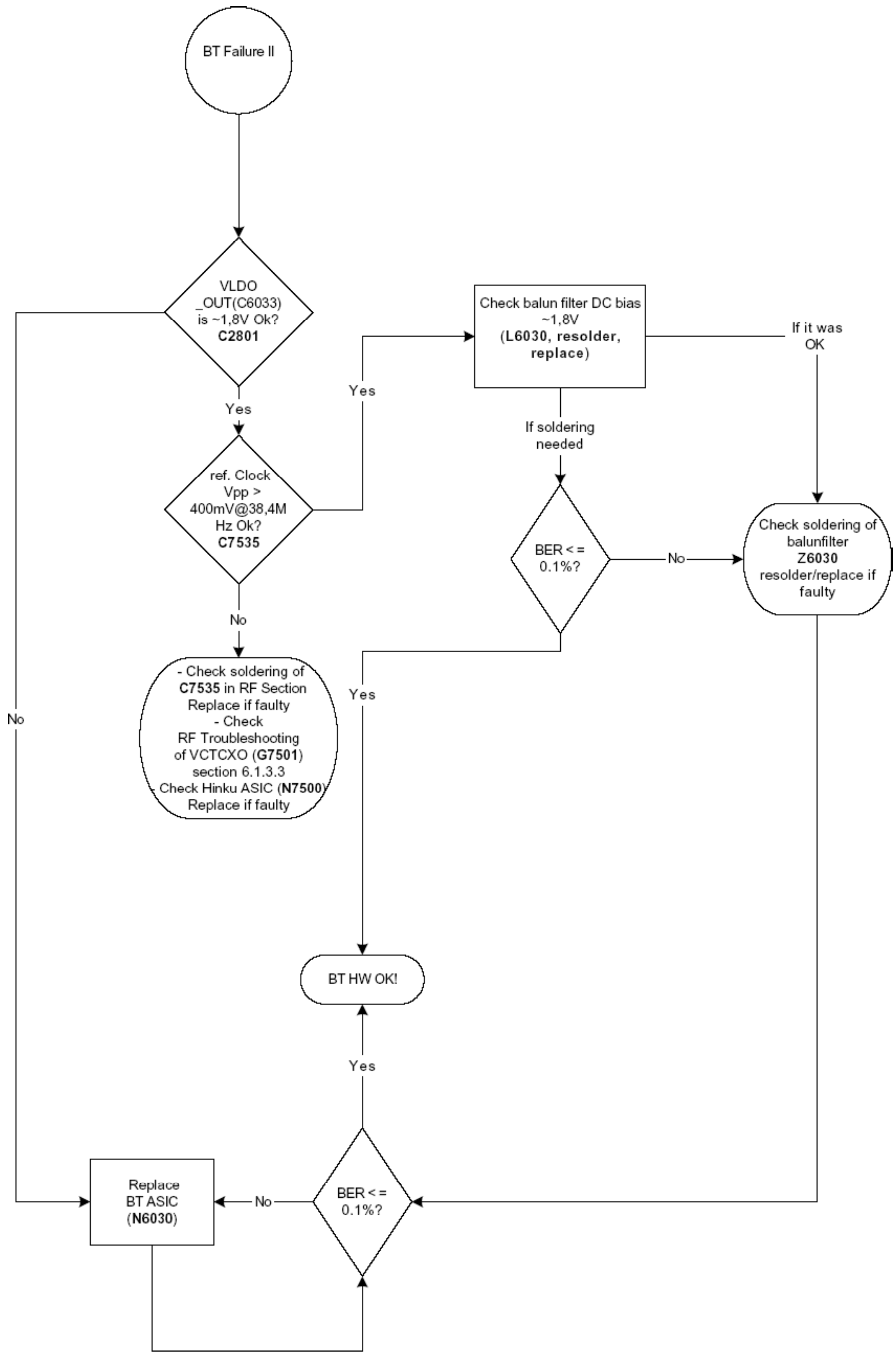


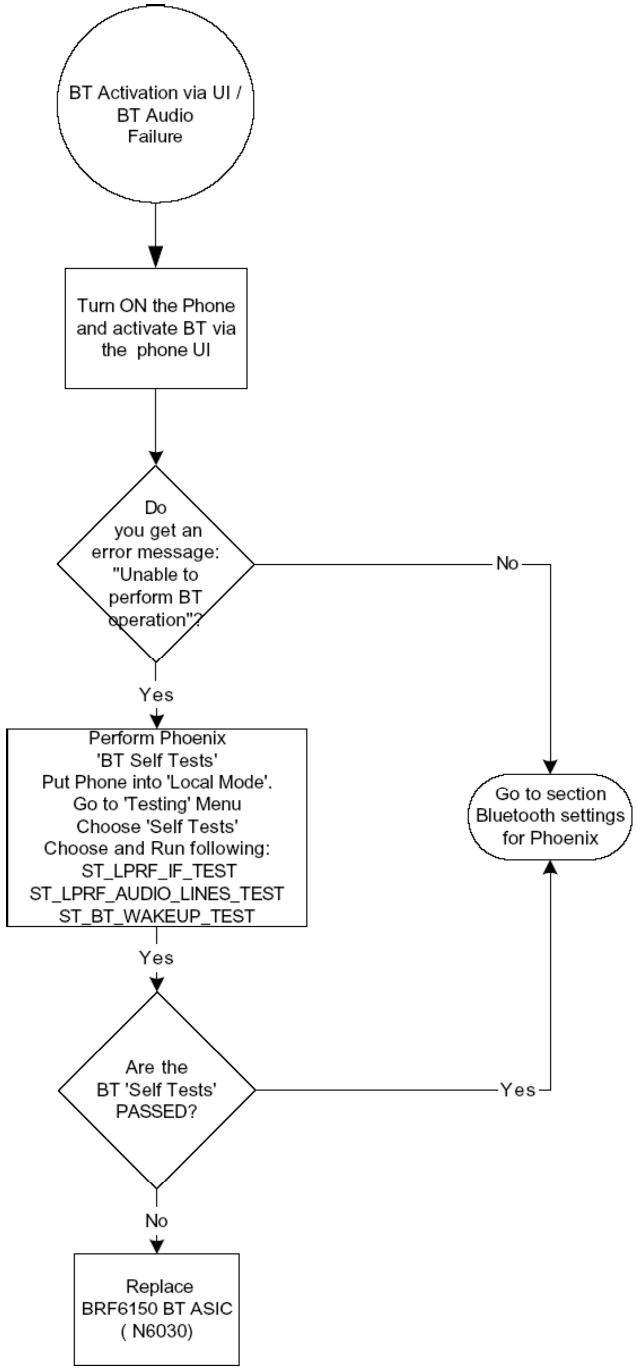
Figure 52 Bluetooth self tests in Phoenix

Bluetooth BER failure troubleshooting




BT Failure II
VLDO _OUT(C6033) is ~1,8V Ok? C2801
No
Yes
ref. Clock Vpp > 400mV@38,4M Hz Ok? C7535
Yes
No
- Check soldering of C7535 in RF Section Replace if faulty - Check RF Troubleshooting of VCTCXO (G7501) section 6.1.3.3 Check Hinku ASIC (N7500) Replace if faulty
Check balun filter DC bias ~1,8V (L6030, resolder, replace)
If it was OK
If soldering needed
BER <= 0.1%?
No
Check soldering of balunfilter Z6030 resolder/replace if faulty
Yes
BT HW OK!
Yes
BER <= 0.1%?
No
Replace BT ASIC (N6030)

BT audio failure troubleshooting



■ Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/ GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Measurement data

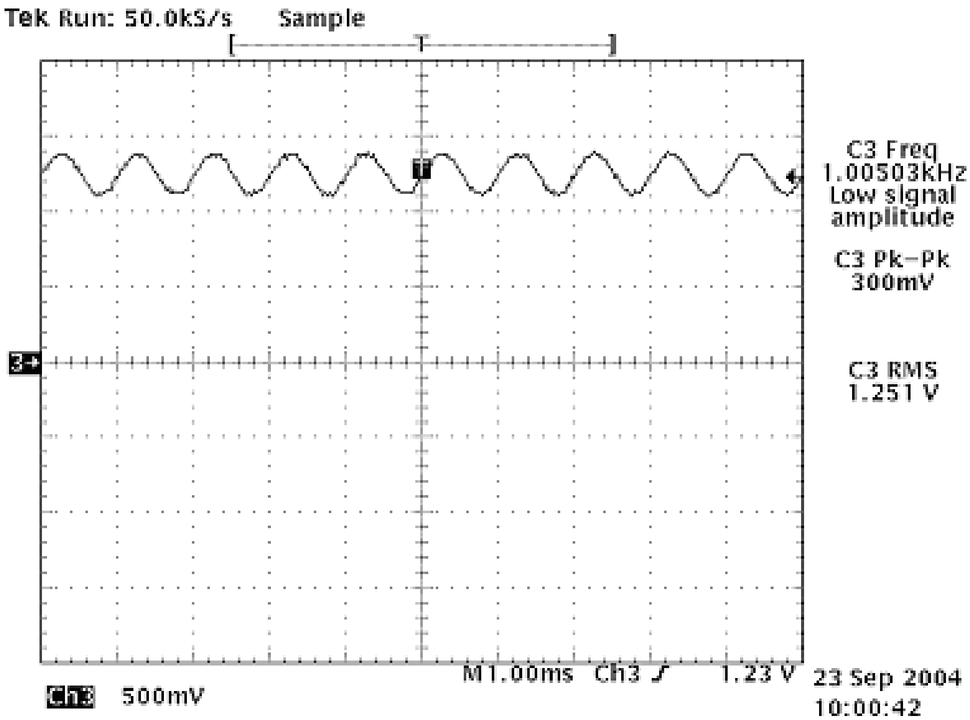
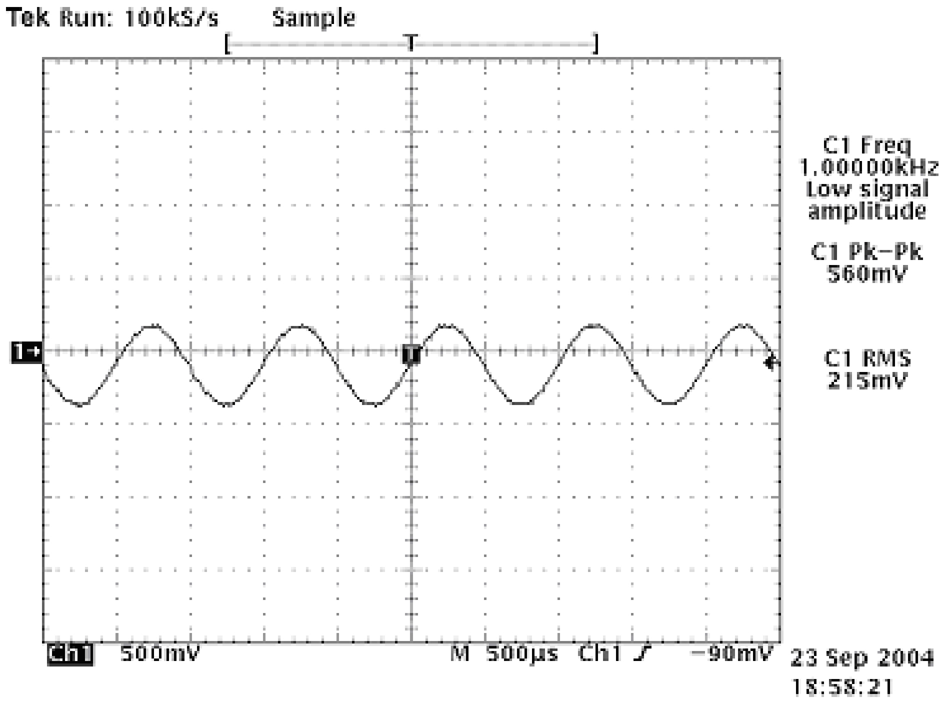


Figure 53 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



Legend

If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 54 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

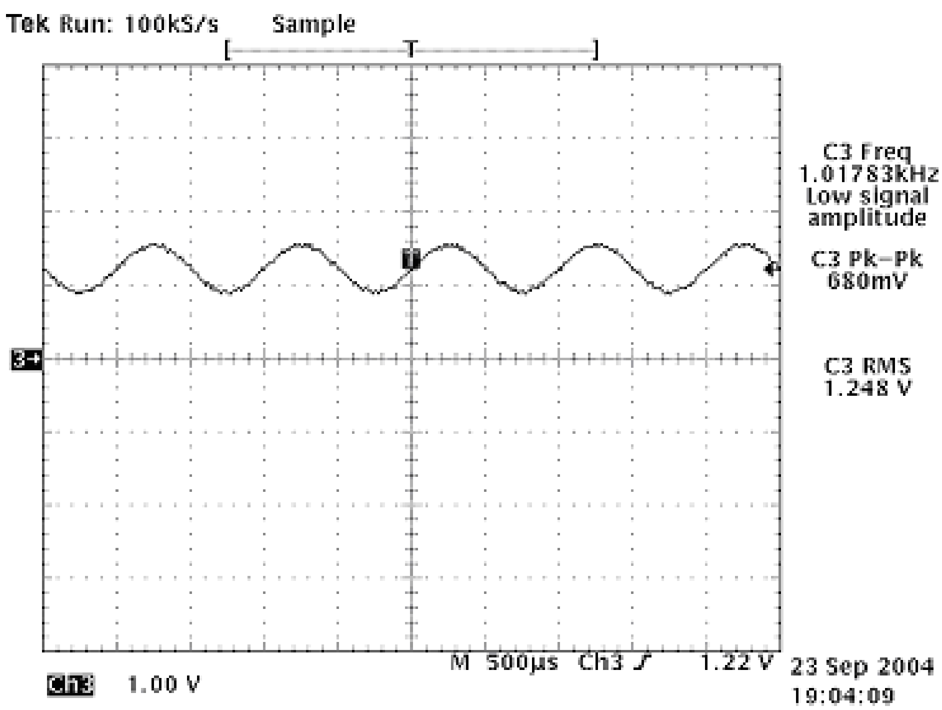
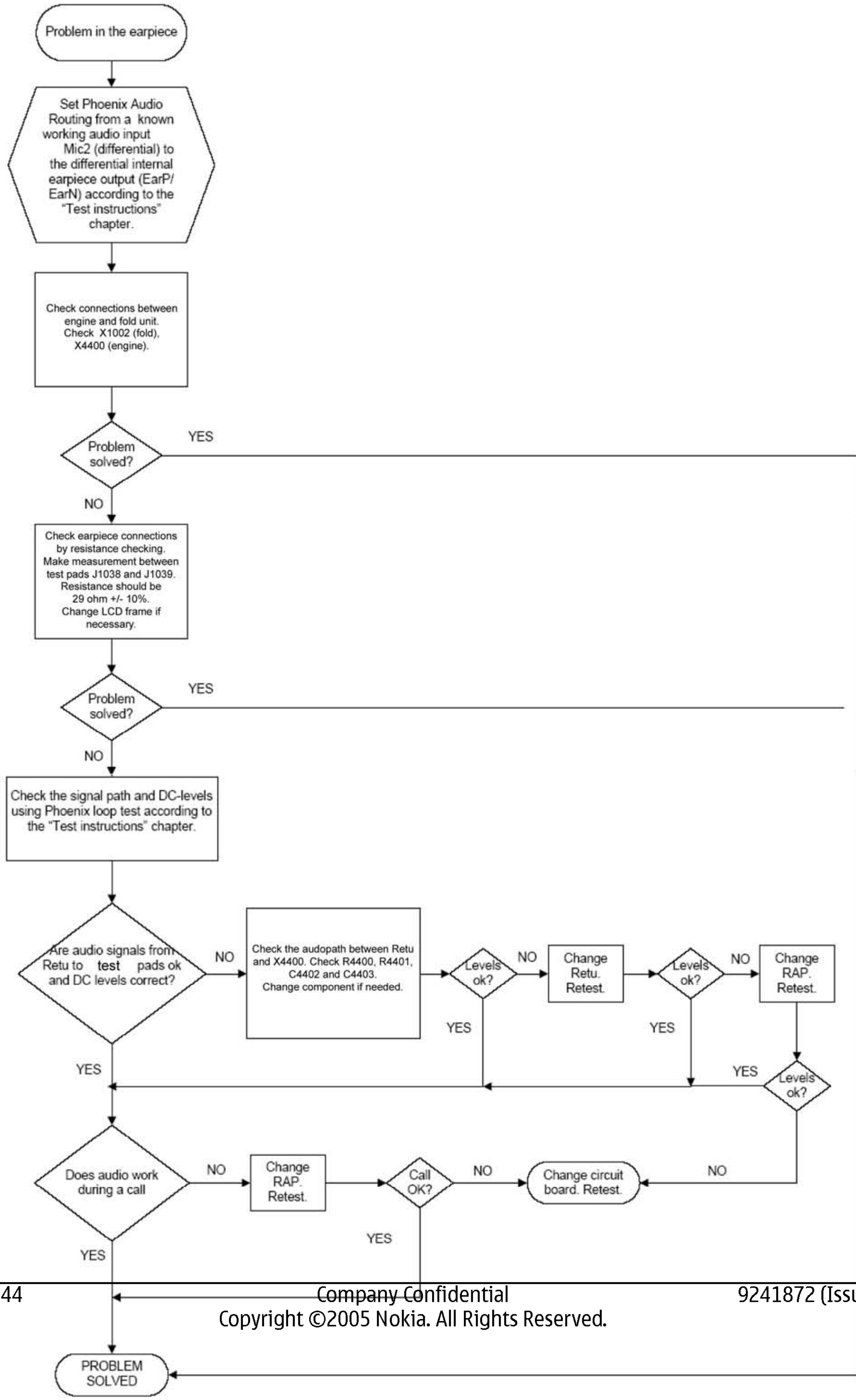


Figure 55 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

Internal earpiece troubleshooting

Before you begin

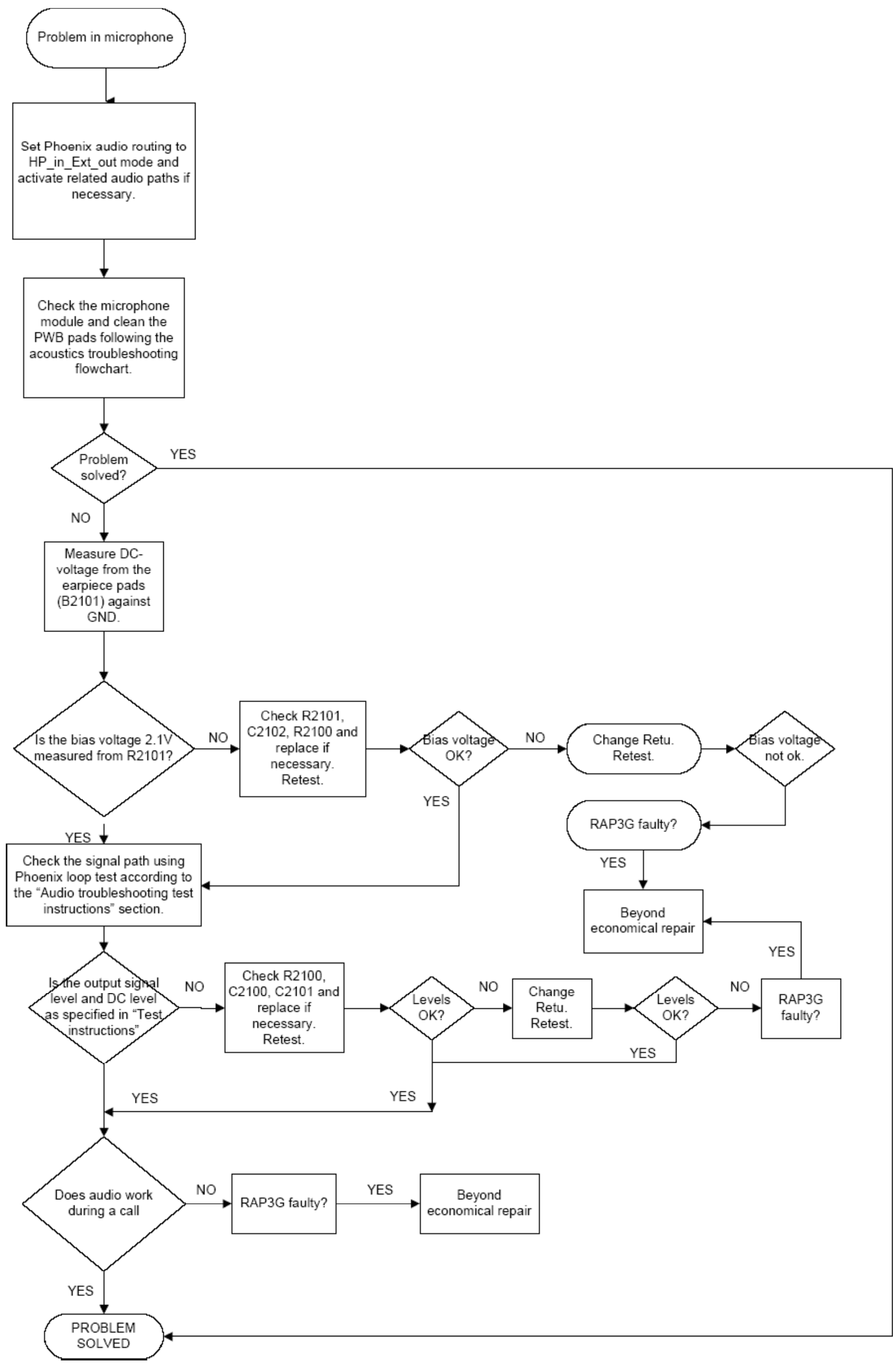
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–38).


Problem in the earpiece
Set Phoenix Audio Routing from a known working audio input Mic2 (differential) to the differential internal earpiece output (EarP/ EarN) according to the "Test instructions" chapter.
Check connections between engine and fold unit. Check X1002 (fold), X4400 (engine).
Problem solved?
YES
NO
Check earpiece connections by resistance checking. Make measurement between test pads J1038 and J1039. Resistance should be 29 ohm +/- 10%. Change LCD frame if necessary.
Problem solved?
YES
NO
Check the signal path and DC-levels using Phoenix loop test according to the "Test instructions" chapter.
Are audio signals from Retu to test pads ok and DC levels correct?
NO
Check the audopath between Retu and X4400. Check R4400, R4401, C4402 and C4403. Change component if needed.
Levels ok?
NO
Change Retu. Retest.
Levels ok?
NO
Change RAP. Retest.
YES
YES
YES
Levels ok?
YES
Does audio work during a call
NO
Change RAP. Retest.
Call OK?
NO
Change circuit board. Retest.
NO
YES
YES
PROBLEM SOLVED

Internal microphone troubleshooting

Before you begin

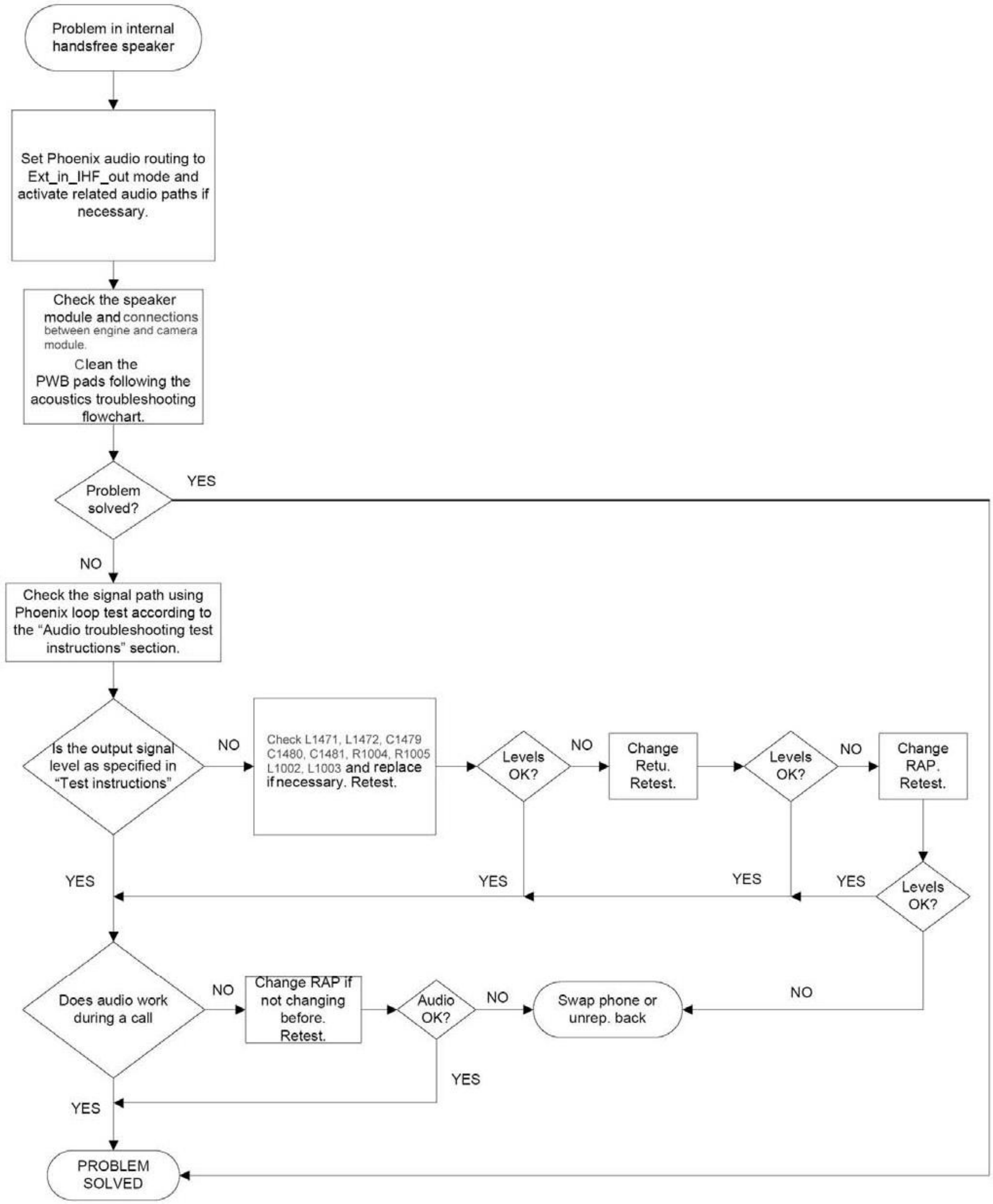
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–38).



IHF troubleshooting

Before you begin

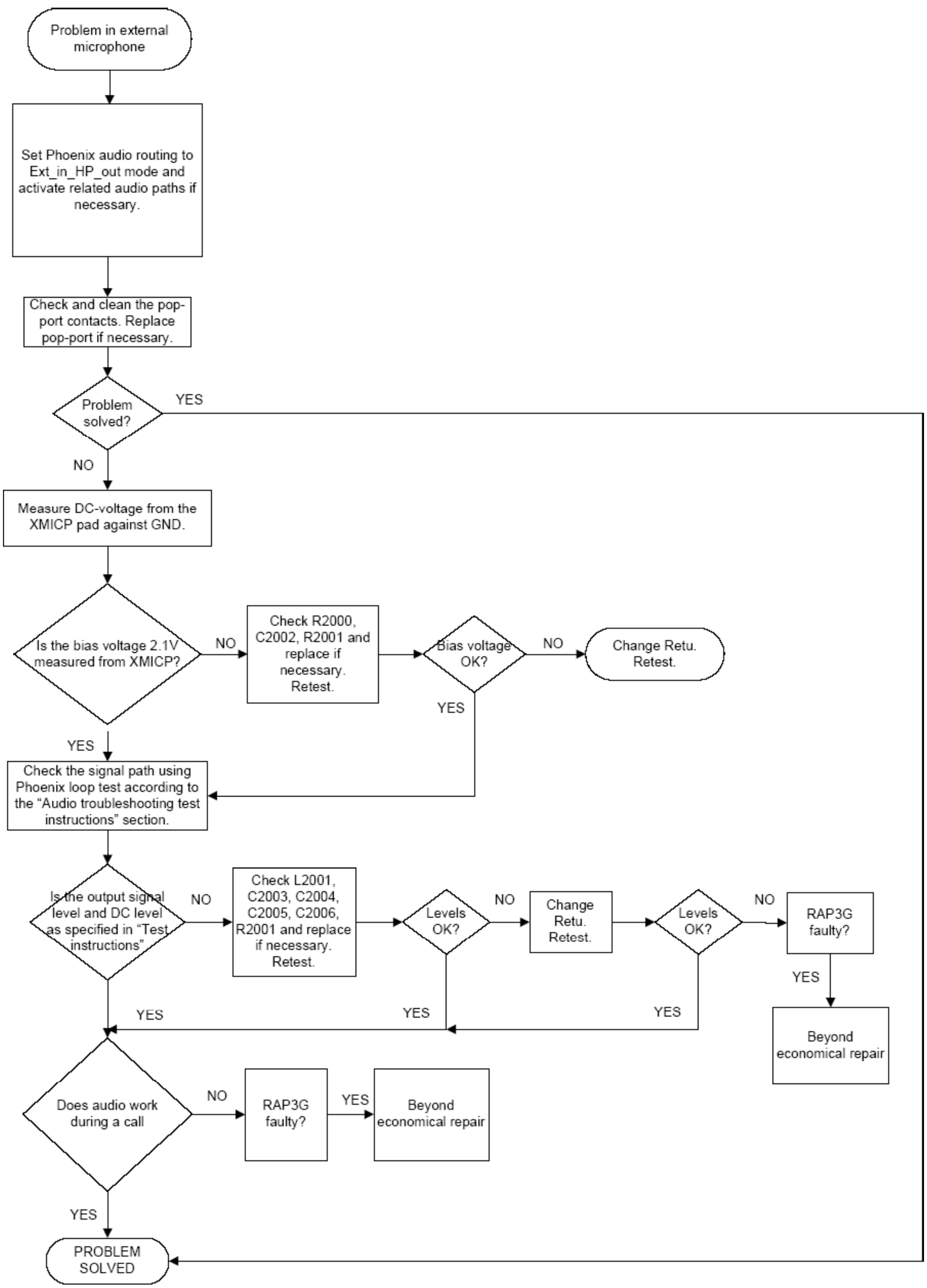
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–38).



External microphone troubleshooting

Before you begin

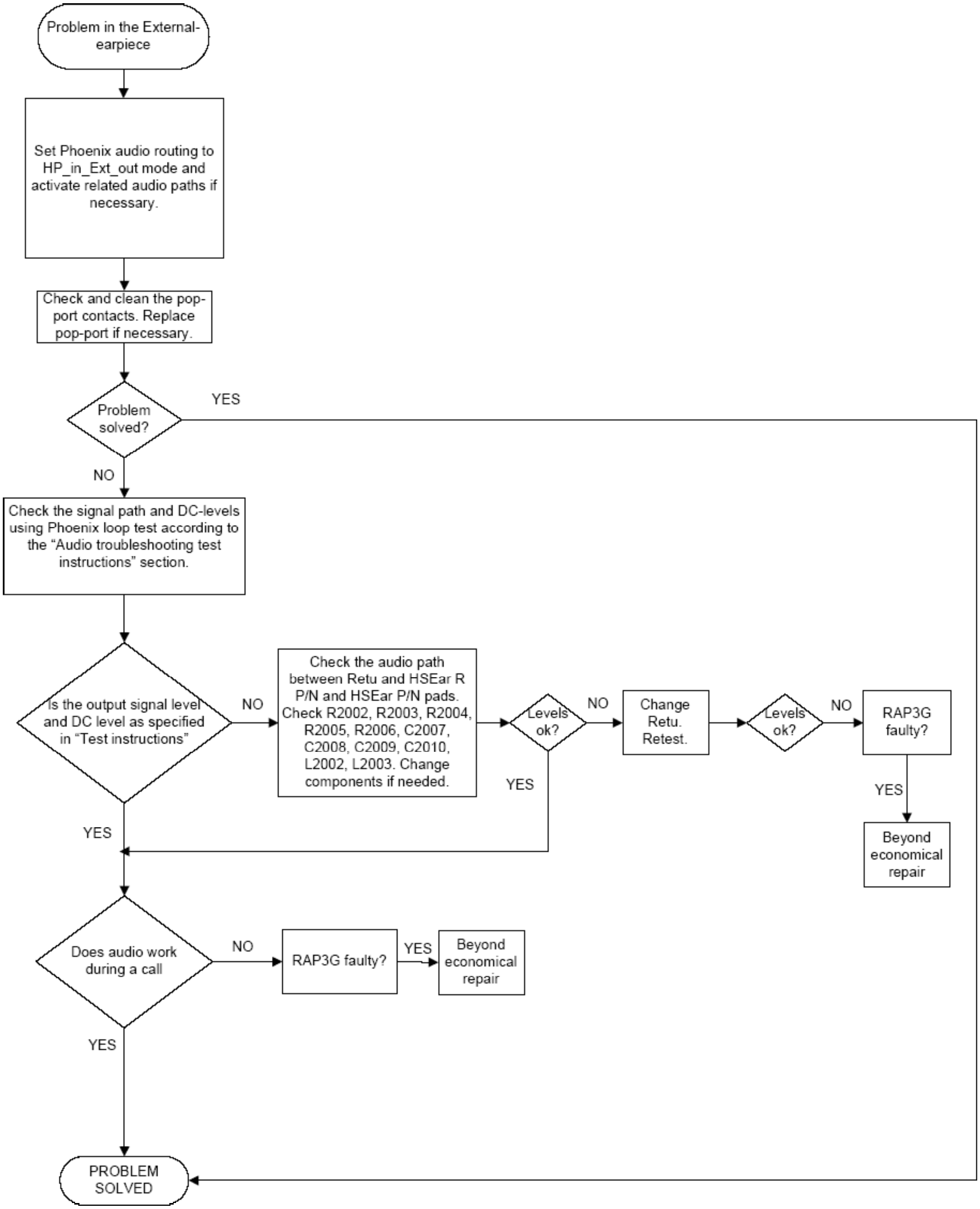
Familiarize yourself with the Audio troubleshooting test instructions (Page 6–38).



External earpiece troubleshooting

Before you begin

Familiarize yourself with the Audio troubleshooting test instructions (Page 6–38).



Baseband manual tuning guide

Energy management calibration

Before you begin

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. From the File menu, choose Scan Product.
4. From the Tuning menu, choose Energy Management Calibration.
5. To show the current values in the phone memory, click Read, and check that communication between the phone and CU-4 works.
6. Check that the CU-4 used check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.
8. Click Calibrate.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click Write to store the new calibration values to the phone permanent memory.

Table 11 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	30
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
IBAT (ICal) Gain	7750	12250

9. Click Read and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click Write and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

(This page left intentionally blank.)

7 — RF Troubleshooting and Manual Tuning Guide

(This page left intentionally blank.)

Table of Contents

List of Tables

List of Figures

Introduction to RF troubleshooting

All measurements should be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

> **Caution:** A mobile phone WCDMA transmitter should never be tested with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in wide area. WCDMA Tx measurements should be performed at least in an RF-shielded box and never with higher Tx power level than 0 dBm! Test full WCDMA Tx power only in RF-shielded environment.
>
> Also all measurements with an RF coupler should be performed in RF shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, it should be checked that there are no transmissions on the same frequencies as used in the tests.

The RF section of the phone is build around two RF ASICS: Rx ASIC N7500 and Tx ASIC N7501. There are also two PA's on board, one for GSM (N7502) and another for WCDMA (N7503).

The WCDMA PA needs variable supply voltage to work properly and therefore there is a switched mode power supply component (N7504) added to the PWB.

Please note that the grounding of the PA module is directly below the PA module. Therefore, it is difficult to check or change the module.

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). N7501, N7500, both PAs and SMPS are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used. All spectrum analyser measurements in this manual are made with a Fluke PM9639/011 10:1 (500 ohm) probe. It is recommended that a similar kind of probe is used for all troubleshooting measurements.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then "GND" pads should be used for the probe ground.

For additional RF troubleshooting instructions, see Appendix A. These instructions include descriptions/ instructions for RF self-tests as well as troubleshooting instructions for various fault cases.

RF key component placement

The RF section of the phone is build around two RF ASICs, Rx ASIC N7500 and Tx ASIC N7501.

There are also two PAs on the board, one for GSM (N7502) and one for WCDMA (N7503). The WCDMA PA needs variable supply voltage to work power efficiently and therefore there is a Switched Mode Power Supply (SMPS) component (N7504) added to the PWB.

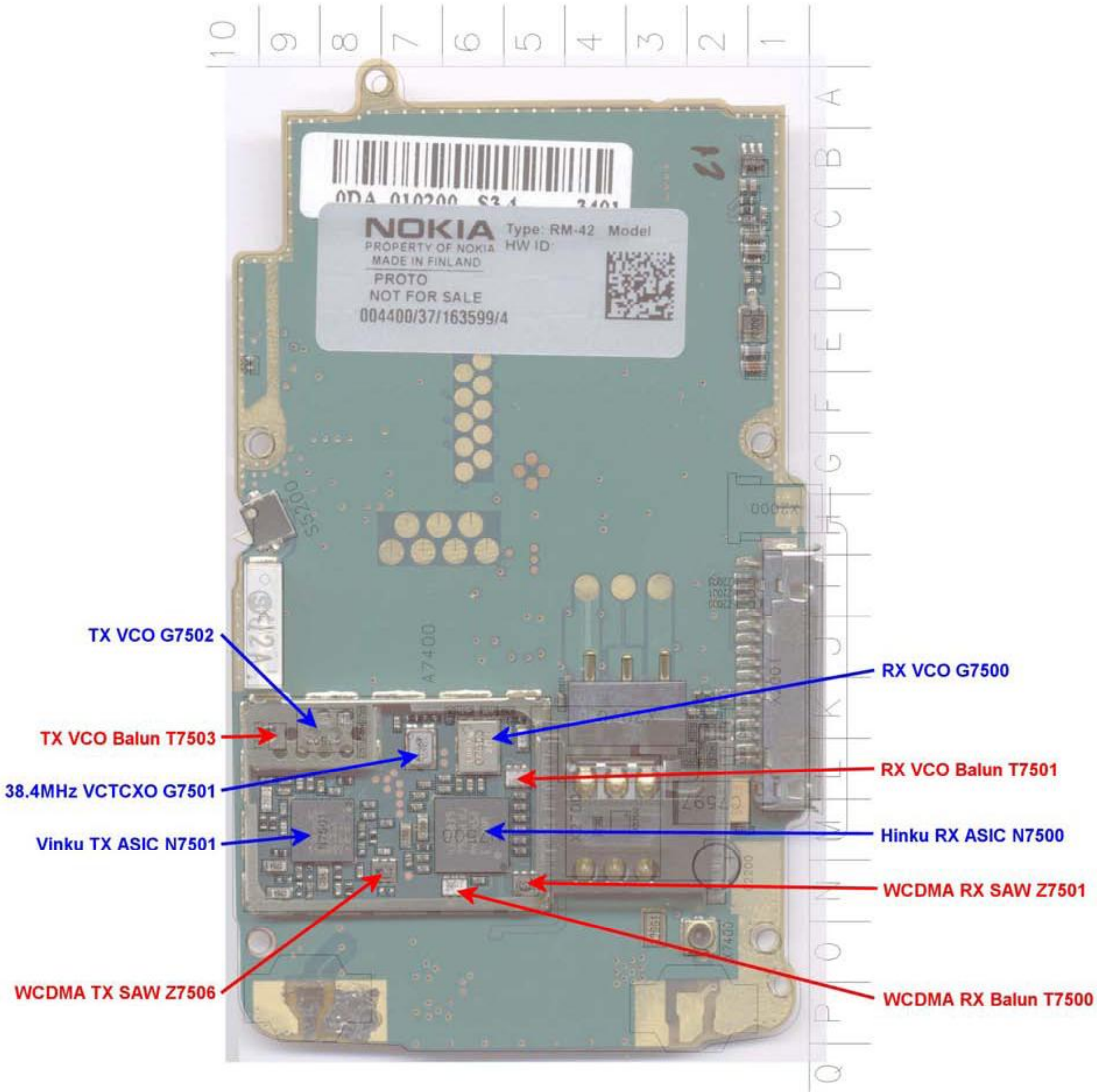


Figure 56 RF key component placement, bottom

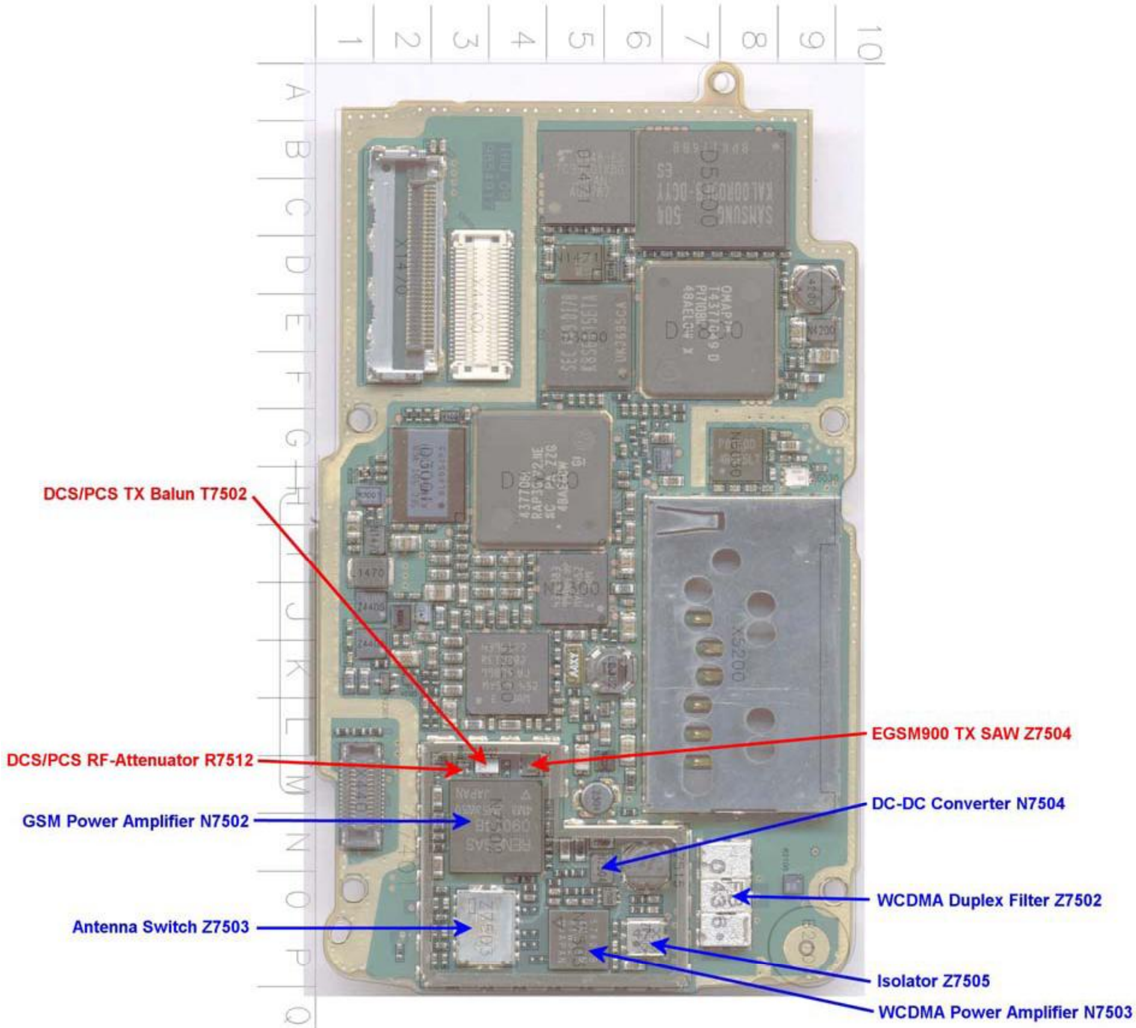


Figure 57 RF key component placement, top

Fault finding test point locations

Test points for spectrum analyzer

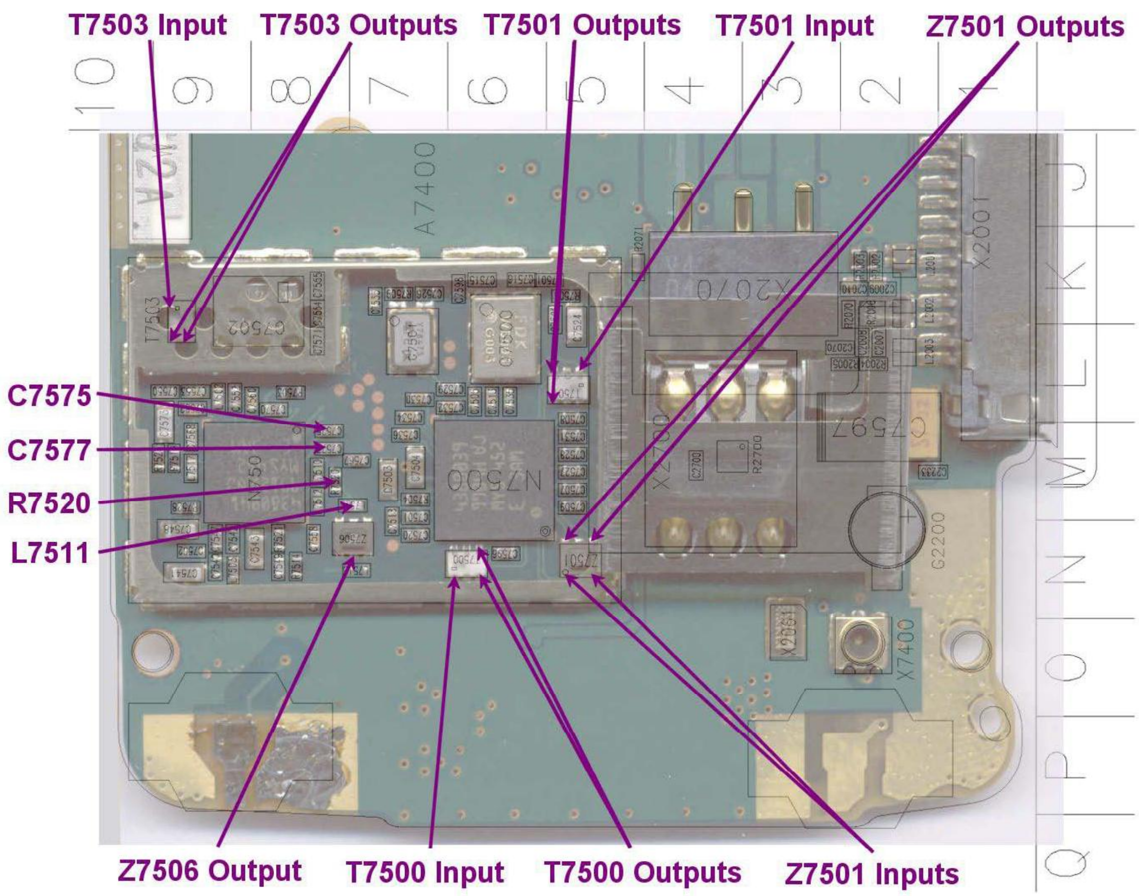


Figure 58 Test point locations for spectrum analyzer, bottom

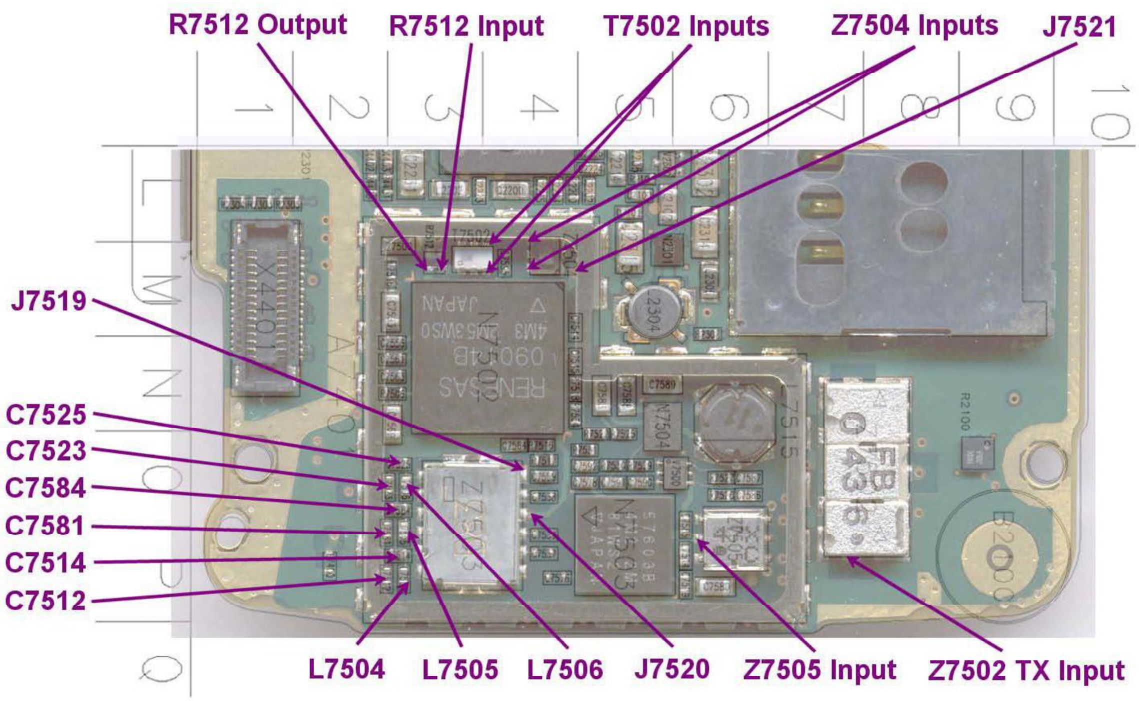


Figure 59 Test point locations for spectrum analyzer, top

Test points for oscilloscope

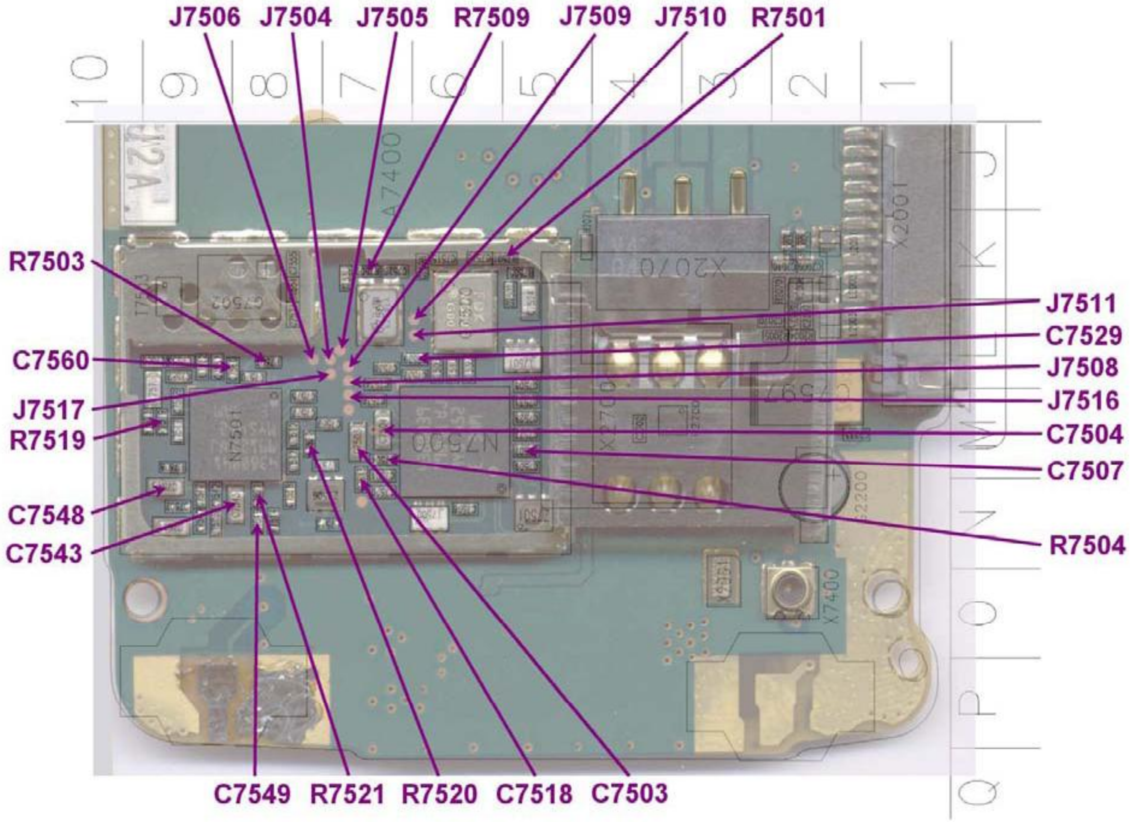


Figure 60 Test points for oscilloscope, bottom

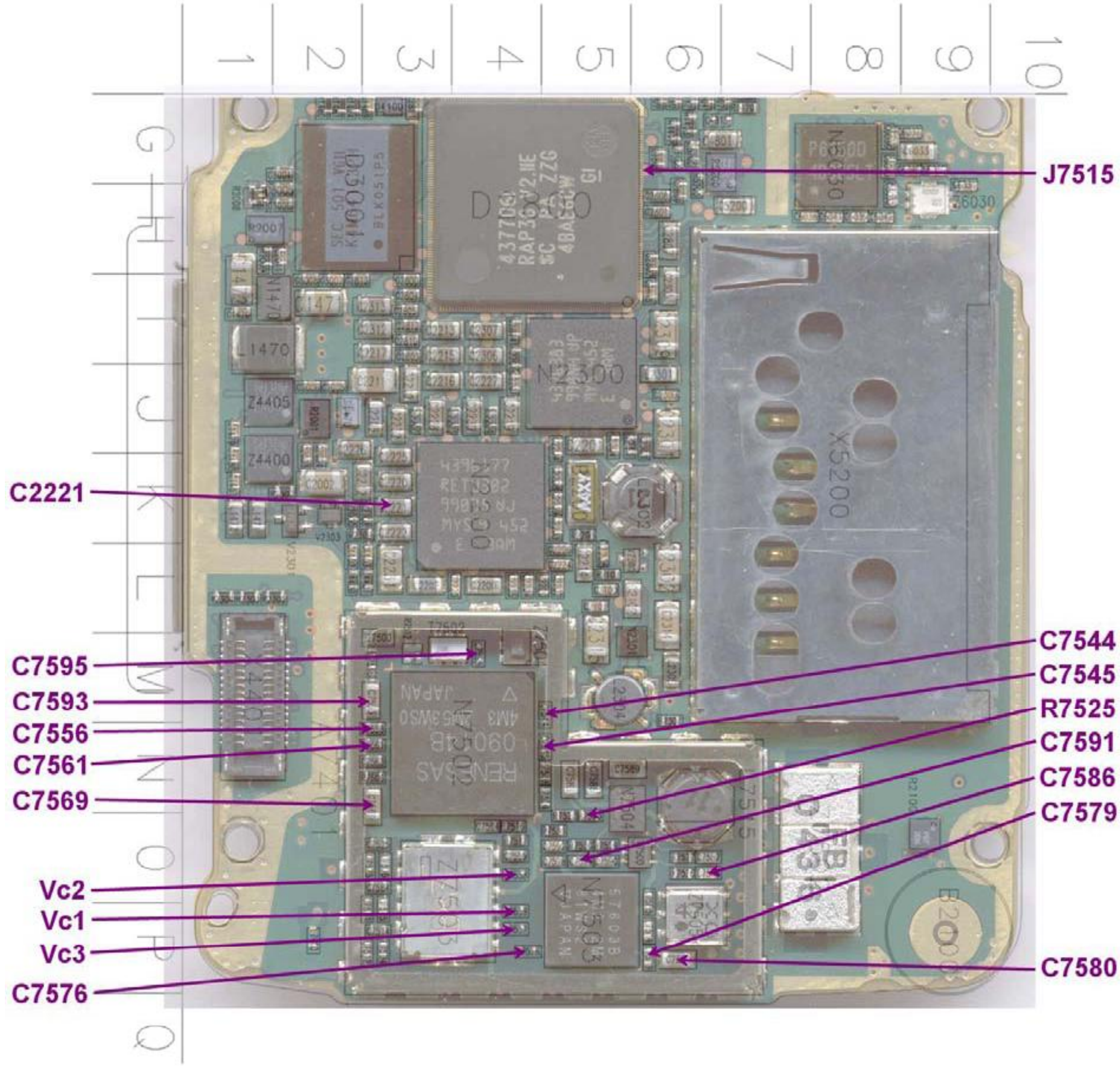


Figure 61 Test points for oscilloscope, top

Receiver troubleshooting

Introduction to Rx troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately. For GSM RSSI measurement, see GSM Rx chain activation for manual measurements / GSM RSSI measurement (Page 7–12), and for the same measurement in WCDMA, see WCDMA RSSI measurement (Page 7–13).

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

See Also

- WCDMA Rx chain activation for manual measurement (Page 7–12)

GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either real GSM signal or CW signal that is 67.771kHz up from the carrier frequency.

Steps

1. Start *Phoenix* service software.
2. From the Testing menu, choose GSM and RSSI Reading.
3. Setup RF signal generator for channel frequency +67.771kHz CW mode with –80dBm signal.
   Alternatively set cellular tester downlink channel to the appropriate channel.
4. In the RSSI Reading window, select the appropriate band and channel.

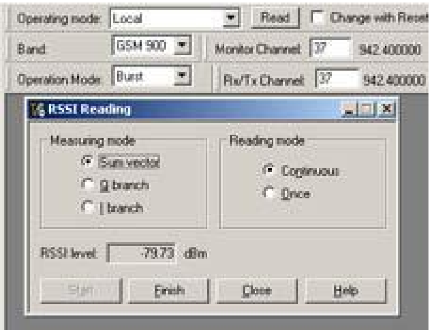


Figure 62 RSSI Reading window

5. To start measurement/activate GSM Rx chain, click the Start button.

Results

RSSI reading values of the selected band and channel are displayed.

WCDMA Rx chain activation for manual measurement

Steps

1. Start *Phoenix* service software.
2. From the Testing menu, choose WCDMA and Rx Control.

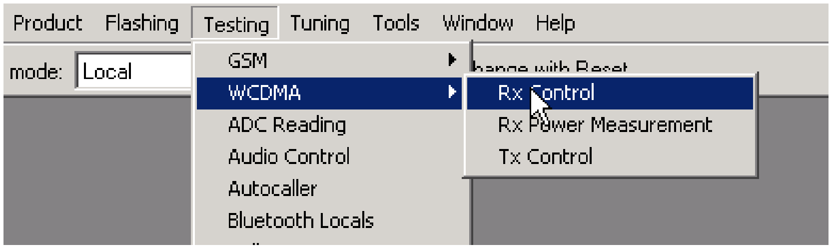


Figure 63 Activating Rx Control window in Phoenix

3. In the Rx Control window:

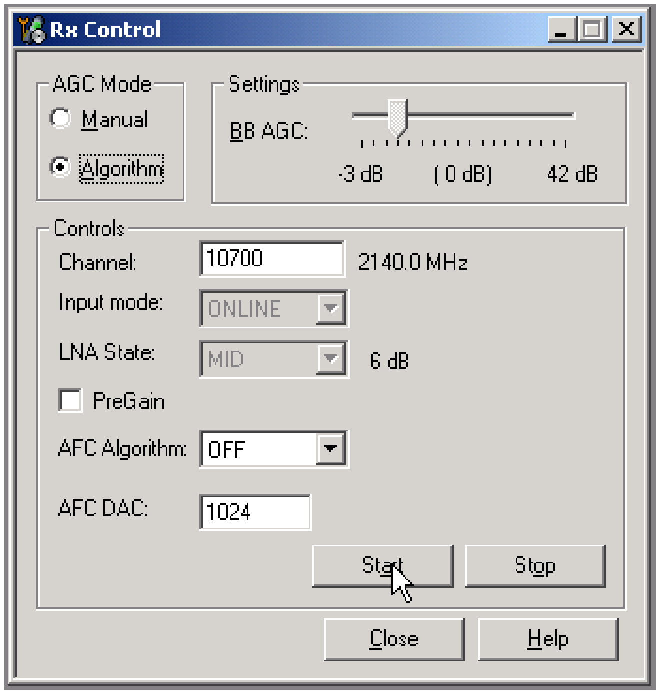


Figure 64 Rx Control window

- From the AGC Mode pane, select Algorithm.
- Set Channel to 10700.
- Set AFC Algorithm to OFF (Default = OFF).

Next action

When settings are ready, click Start to activate them.

If settings are changed later on (for example, you give a new channel number), you will need to click Stop and Start again.

Note: Clicking Stop also disables Tx Control if that was active!

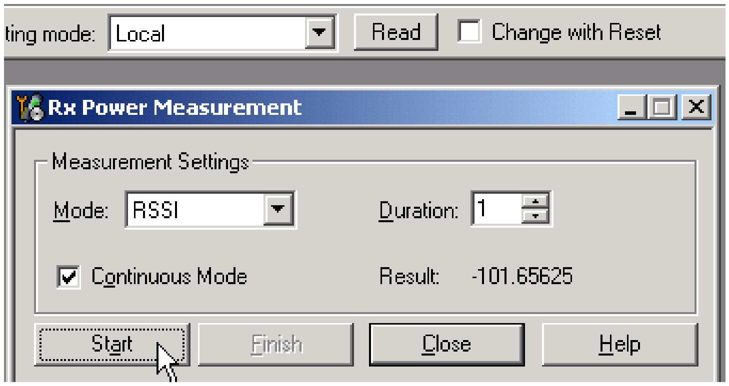
WCDMA RSSI measurement

Before you begin

WCDMA Rx must be activated before RSSI can be measured. See WCDMA Rx chain activation for manual measurement (Page 7–12).

Steps

1. From the Testing menu in Phoenix, choose WCDMA -> Rx Power Measurement.
2. In the Rx Power Measurement window, choose the following settings:
   - Mode: RSSI
   - Continuous Mode



3. To perform the measurement, click Start.

Transmitter troubleshooting

General instructions for Tx troubleshooting

Context

- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls" and in WCDMA transmitter testing the best tool is "Tx Control"..
- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software. The first section is for the EGSM900/GSM1800/GSM1900 bands and the latter for WCDMA.

> **Caution:** Never activate the GSM or WCDMA transmitter without a proper antenna load. There should be always 50 ohm load connected to the RF connector (antenna, RF-measurement equipment or at least 2 watts dummy load), otherwise GSM or WCDMA PA may be damaged.

Steps

1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-8 flash prommer with a modular cable.

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect a DC power supply to a module jig (MJ-48).

   > **Note:** When repairing or tuning a transmitter, use an external DC supply with at least 3 A current capability.
   >
   > Set the DC supply voltage to 3.9 V and set the jumper connector on the test jig's **reg.pass** switch to “ON” position.
3. Connect an RF cable between the RF connector of the module test jig (MJ-48) and measurement equipment or alternatively use a 50 ohms (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM or WCDMA PA may be damaged.

   > **Note:** There are three antenna connectors in the module jig:
   >
   > - one for GSM
   > - one for WCDMA
   > - one for Bluetooth

Make sure that all connections are made to the correct RF connector.

Normally a spectrum analyser is used as measurement equipment.

Note: The maximum input power of a spectrum analyser is +30 dBm.

To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set Tx on.

   i Set the phone module to the test jig and start *Phoenix service software*.

   ii Initialize connection to the phone. (With FPS-8 use FBUS driver when using DAU-9S and COMBOX driver).

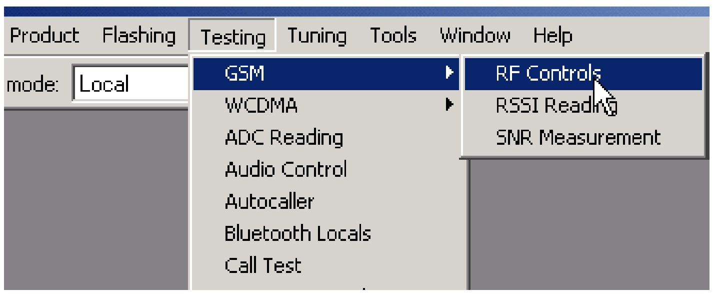
   iii From the File menu, choose product: *File -> Choose Product -> xx-x** (* = type designator of the phone).

   iv From the toolbar, set operating mode to “Local”.

Alternative steps

- EGSM900/DCS1800/PCS1900 troubleshooting

  i From the Testing menu, activate the *RF Controls* window: *Maintenance -> Testing -> GSM -> RF Controls* .



  ii In the *RF Controls* window:

  - Select band “GSM900” or “GSM1800” or “GSM1900” (Default = “GSM900”).
  - Set Active unit to “Tx” (Default = “Rx”).
  - Set Operation mode to “Burst” (Default = “Burst”).
  - Set Tx data type to “All1” (Default = “All1”).
  - Set Rx/Tx channel to 37 on GSM900 band or 700 on GSM1800 band or 661 on GSM1900 (Defaults).
  - Set Edge to “Off” (Default).
  - Set Tx PA mode to “Free” (Default).
  - Set power level to 5 (Default = 19) on GSM900 or to 0 (Default = 15) on GSM1800 or GSM1900.

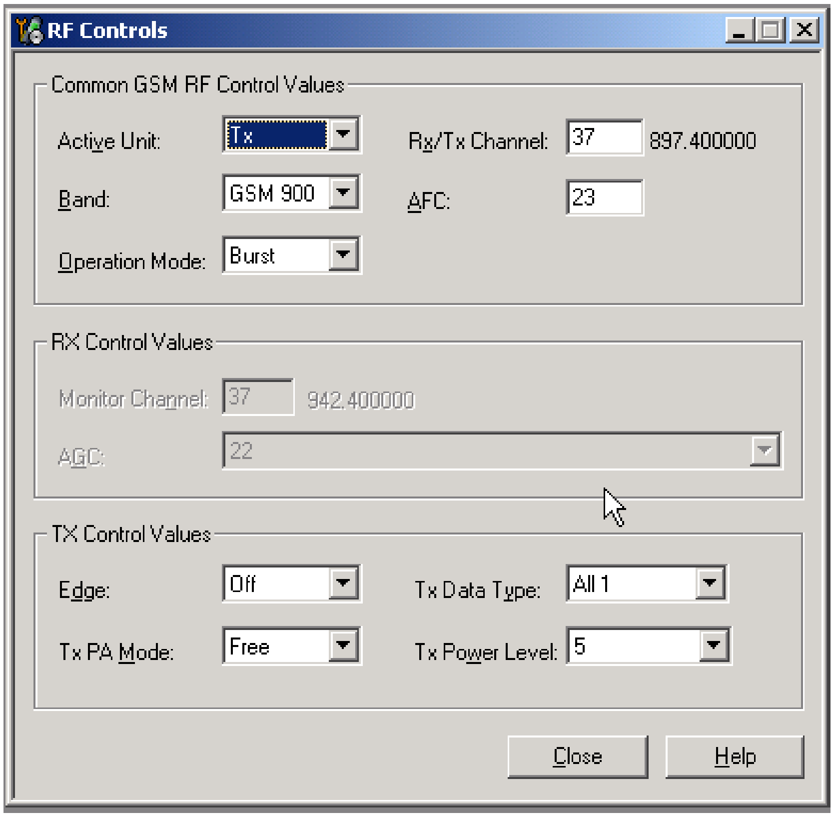
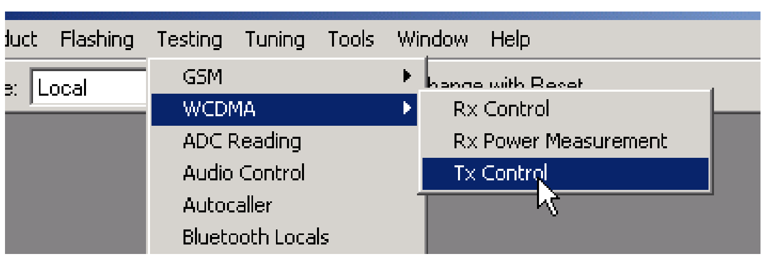


Figure 65 RF Controls window

- WCDMA troubleshooting

i From Product/System Mode menu, choose "WCDMA" to Selected System Mode and click Write

ii From the Testing menu, activate the *Tx Control* window: *Maintenance -> Testing -> WCDMA -> Tx Control* .



iii In the *Tx Control* window:

- Select the *Algorithm mode* tab.
- Set Start level to “0” dBm (Default = “0”).
- Set Step size, Step count and Sequence to “0” (Default = “0”).
- Set Scrambling code class to “LONG” (Default = “LONG”).
- Set Scrambling code to “16” (Default = “16”).
- Set DPDCH Code number to “0”, Code class to “2” and Weight to “15” (Defaults).
- Set DPCCH Code number to “0”, Code class to "2" and Weight to “8” (Defaults).
- Set DPDCH enabled (Default).
- Set Channel to 9750.

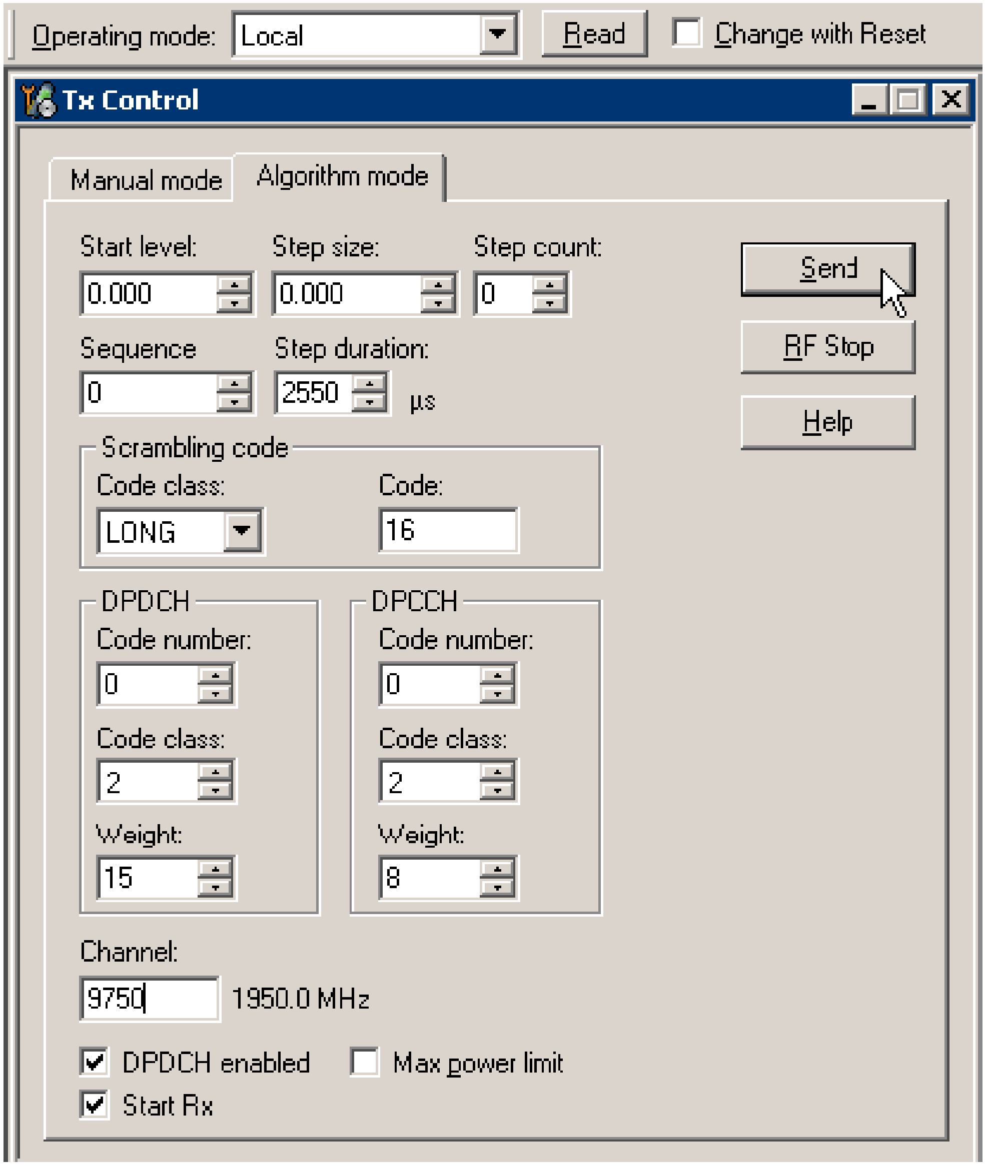


Figure 66 Tx Control window

Next action

When settings are done, click “Send” to enable them.

If you change the settings (e.g. give a new channel number), you need to click “Stop” and “Send” again.

Checking antenna functionality

The main antenna has two separate antenna elements: GSM and WCDMA antennas.

In the GSM antenna, there is one Feed and two GND contacts.

In the WCDMA antenna, there is one Feed and one GND contact.

The GSM and WCDMA antenna contacts are directly coupled together ie. DC resistance between the feed and ground connection is about zero ohms.

Figure 67 Antenna frame, contact springs and WCDMA antenna

Figure 68 GSM antenna radiator

The WCDMA antenna is working correctly when it is visually intact and DC resistance between the contact springs is about zero ohms. The GSM antenna works when the flex film is intact and contact springs are assembled in the frame as figures above and below show.

Bluetooth antenna

Bluetooth antenna is a ceramic chip antenna assembled on the engine PWB. The antenna is working properly if it has been assembled in correct position and if solder joints of the antenna are all right and the antenna is intact.

RF tunings

Introduction to RF tunings

Phone RF is tuned in production. There is no reason to do the re-calibration unless:

- One or more of the RF components is changed
- FLASH Memory chip (D3000) is changed or otherwise corrupted.

RF calibration is always performed with the help of module jig MJ-48. Whenever possible, automatic tuning system should be used.

If manual tuning is used, only relevant tunings should be performed. Refer to the table below:

Changed component	Perform following tunings
Tx RF ASIC Vinku (N7501)	RF Channel Filter Calibration, Tx IQ Tuning, Tx Power Level Tuning, Temperature Sensor Calibration, TX AGC & Power Detector, Tx Band Response Calibration, Tx LO Leakage
RX RF ASIC Hinku (N7500)	RF Channel Filter Calibration, Rx Calibration, Rx Band Filter Response Compensation, Rx AM Suppression, Rx AGC Alignment, Rx Band Response Calibration
Any component in the GSM TX RF chain before the PA	Tx IQ Tuning, Tx Power Level Tuning
Any component in the GSM TX RF chain after the PA or PA	Tx Power Level Tuning
Any component in the WCDMA TX RF chain before the PA	Tx AGC & Power Detector, Tx Band Response Calibration, Tx LO Leakage
Any component in the WCDMA TX RX chain after the PA, PA, power detector or PA switch mode power supply	Tx AGC & Power Detector, Tx Band Response Calibration, PA Detection
Any component in the GSM RX chain	Rx Calibration, RX Band Filter Response Compensation, RX AM Suppression
Any component in the WCDMA RX chain	Rx AGC Alignment, RX Band Response Calibration

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken in account when the phone is tuned. As all the RF losses are frequency dependent, the user have to be very careful and understand the measurement setup. Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. In the following table there are RF attenuations of the module jig, MJ-48:

Band	Attenuation
GSM900	0.1 dB
GSM1800	0.2 dB
GSM1900	0.2 dB
WCDMA TX WCDMA RX	0.3 dB 0.4 dB

RF autotuning with CMU200

Before you begin

Recommended test set-up:

- Windows 2000 PC
- CMU200 communication tester
- USB to GPIB converter from National Instruments. Order information: 778416-01 GPIB-USB-B, NI-488.2 for Windows 2000/XP/Me/98.

Before you can use the auto-tune feature, the GPIB driver from the GPIB card vendor must be installed and running.

Then the auto tune **.ini** file must be in a correct place: **C:\Program Files\Nokia\Phoenix\products\xx-x*\autotune_xx-x*.ini** (**= indicates the type designator of the phone, e.g. RM-42*)

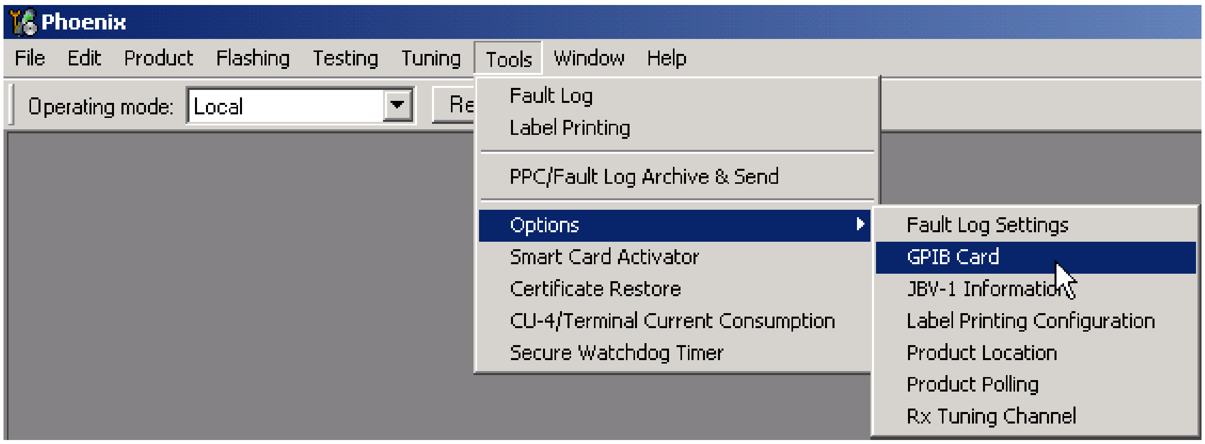
Context

It is possible to perform an automatic RF tuning with the aid of CMU200. Autotuning covers all RF tunings that are needed to perform after RF component repairs.

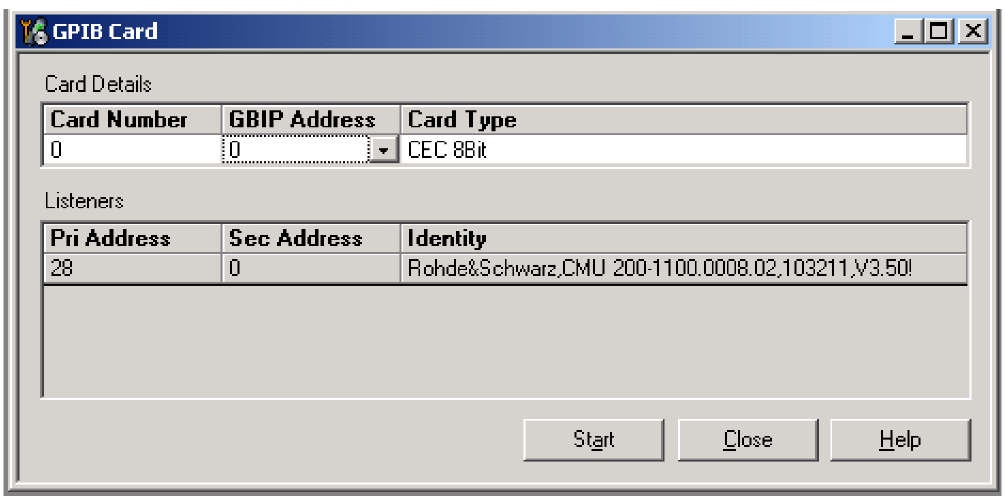
Note: Do not perform RF autotuning "just for sure". Phones are tuned in the production and RF tuning may performed only after component repairs or if the RF tuning information is lost.

Steps

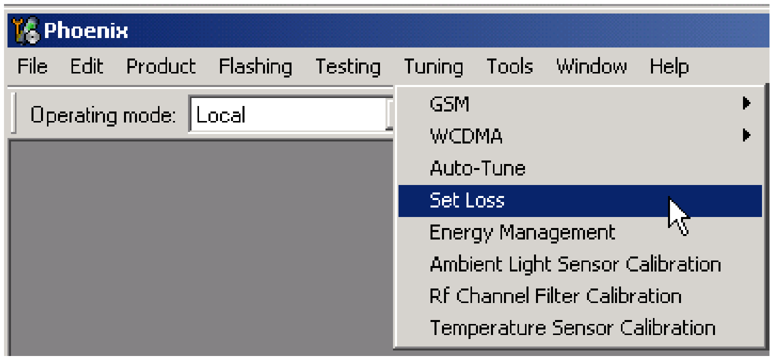
1. Connect CMU200 to the GPIB bus.
2. From the Tools menu in Phoenix, choose Options -> GPIB Card.



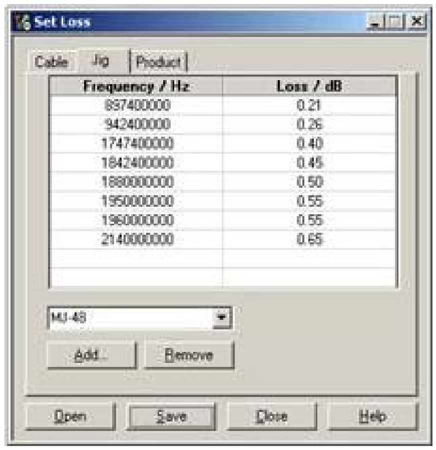
3. In the Card Type line, select CEC8Bit, then click Start.
   After clicking Start, the name of the CMU200 communication tester appears in the list of found Listeners.



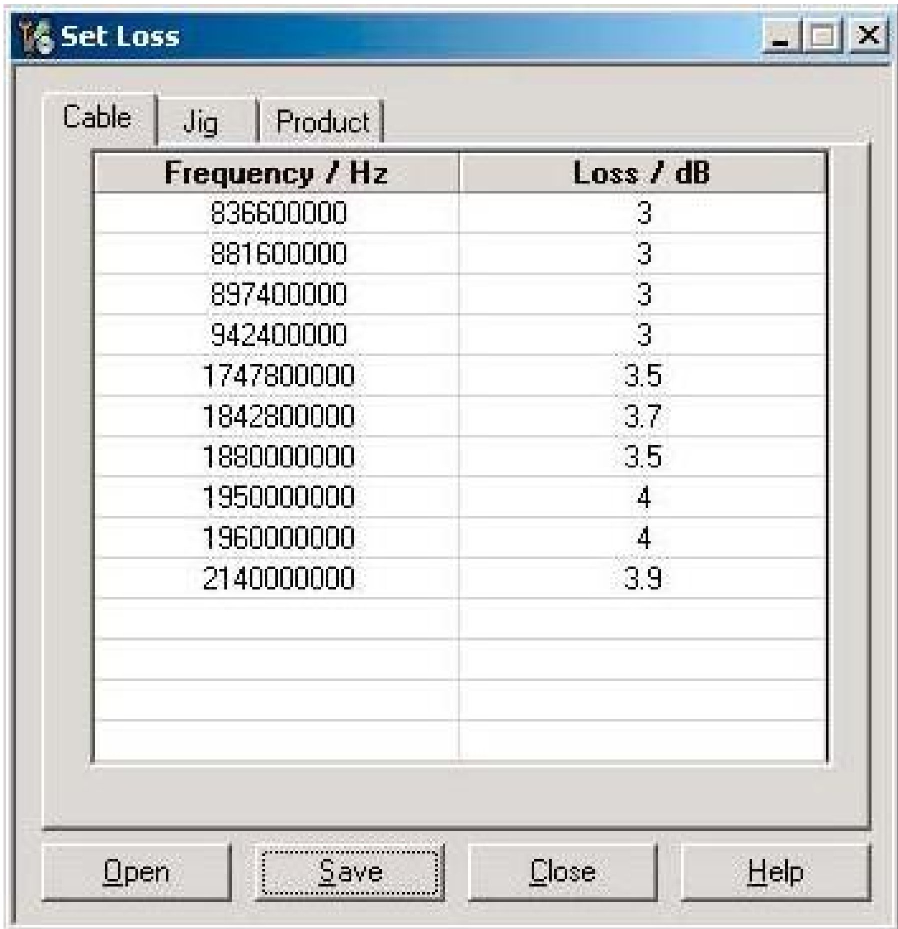
4. To specify the cable loss from module jig to CMU200, choose Set Loss from the Tuning menu.



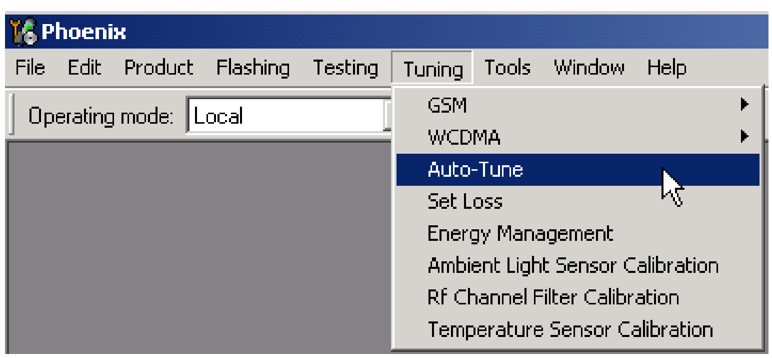
5. In the Set Loss window, click the Jig tab and select the right jig for the phone.



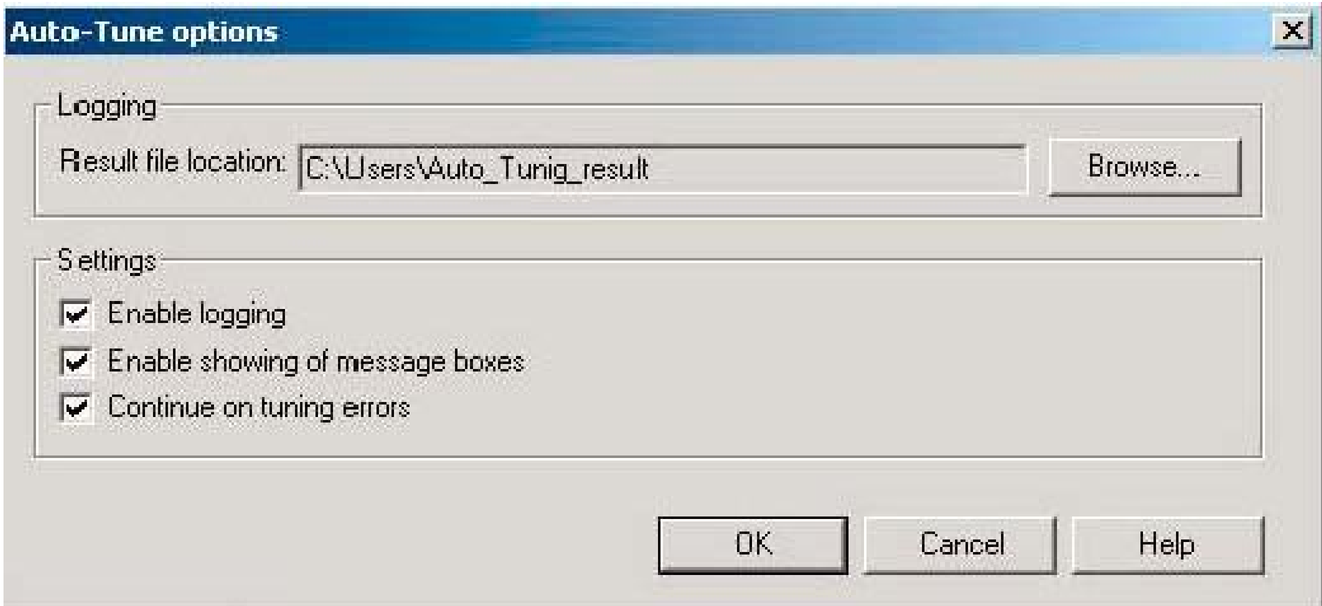
6. Click the Cable tab and add the extra cable attenuation.



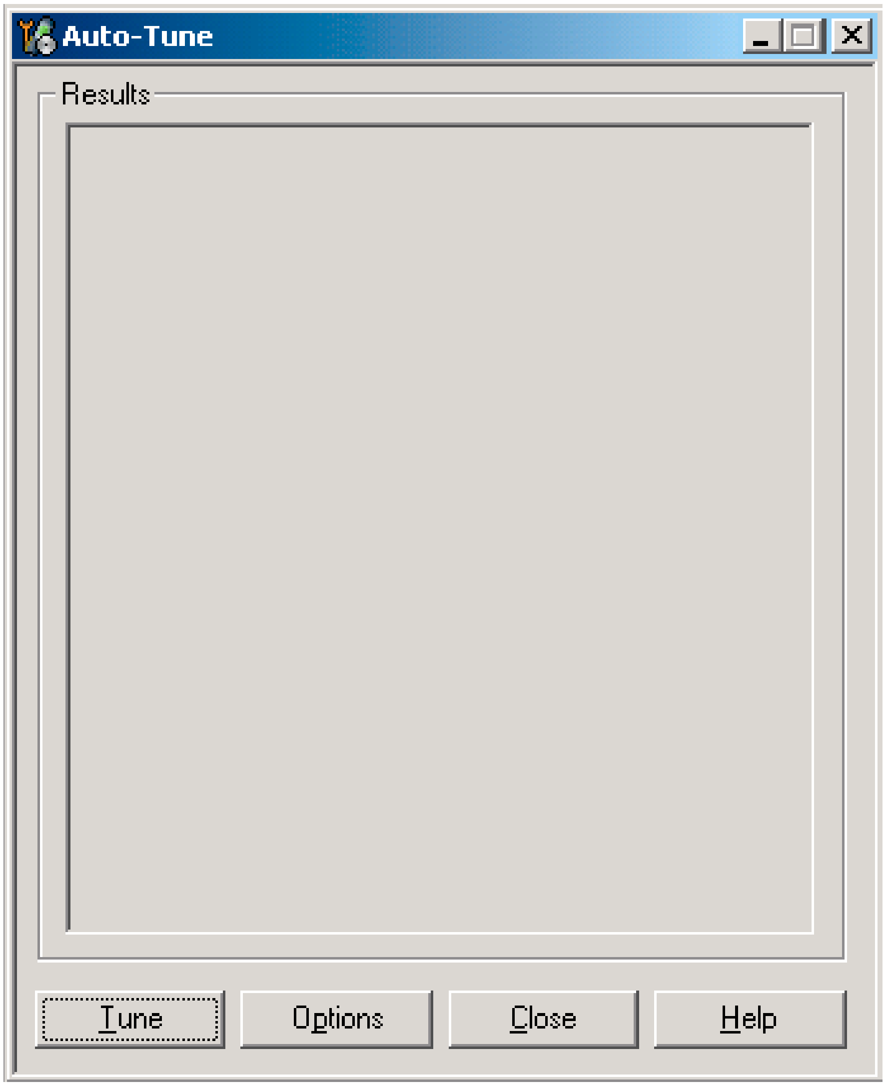
7. To start autotuning, choose Auto-Tune from the Tuning menu.



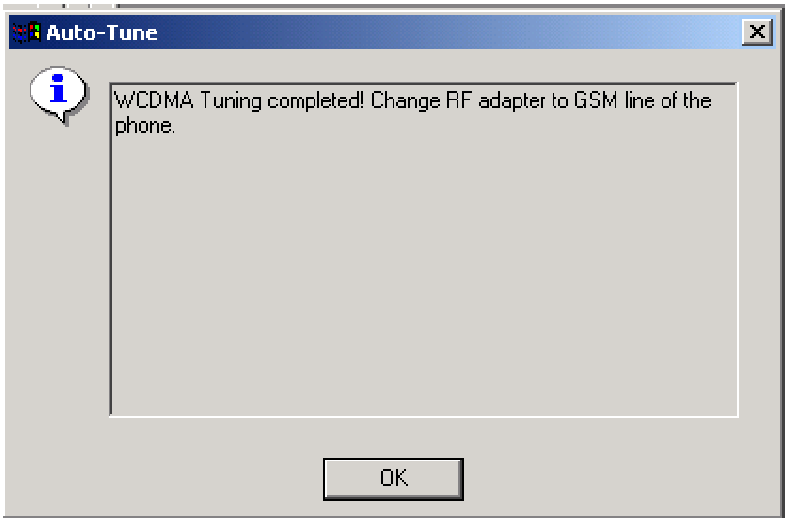
8. In the Auto-Tune window, click Options.
9. In the Auto-Tune options window, see that the "Enable showing of messages" check box is checked. Then click OK.



10. Connect the phone's WCDMA RF port to CMU200 and click Tune.



11. Change the phone's RF adapter from WCDMA port to GSM port. Then to complete the RF autotuning, click OK.



Results

"Autotuning completed successfully" message appears.

System mode independent manual tunings

RF channel filter calibration

Context

Rx channel filter calibration tunes Rx and Tx ASICs' internal low pass filters that limit the bandwidth of BB IQ signals.

One common calibration is made for GSM and WCDMA.

Table 12 RF channel filter calibration tuning limits

	Min	Typ	Max
TX filter	0	10	31
RX filter	0	16	31

Steps

1. From the dropdown menus, set "Operating mode" to Local.
2. From the Product menu, choose "System mode" and then choose WCDMA, GSM or Dual and click Write.
3. From the Tuning menu, choose *RF Channel Filter Calibration*.
4. Click Tune.
5. Click Write.

   Saves tuned values to the PMM area.
6. To close the tuning window, click Close.

Results

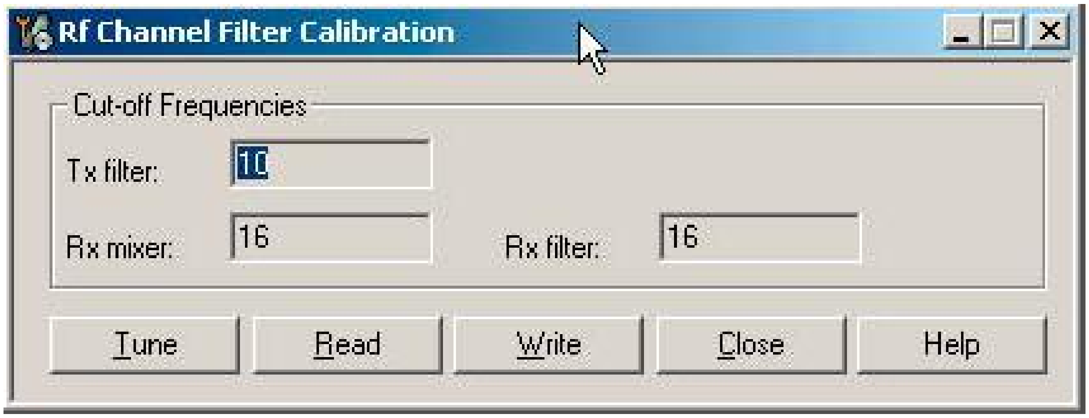


Figure 69 RF channel filter calibration typical values

PA detection

Context

PA detection procedure asks DSP to detect which PA manufacturer is used for GSM and WCDMA PAs.

If PA is changed or if PMM data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the dropdown menus, set "Operating mode" to Local.
2. From the Product menu, choose "System mode" and then choose WCDMA, GSM or Dual and click Write.
3. From the Tuning menu, choose PA Detection.
4. Click Tune.
5. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
6. To end the procedure, click Close.

Temperature sensor calibration

Context

There is a temperature sensor integrated into VINKU ASIC. VINKU provides DC-voltage, which is temperature dependent.

Temperature sensor calibration is done in room temperature, in which offset caused by VINKU variation and AD-converter inside RETU are nullified.

The module is able to do this calibration by itself, no external equipment is needed.

The temperature of the module and components must be 23 +/-2 degrees.

Steps

1. From the dropdown menus, set "Operating mode" to Local.
2. From the Product menu, choose "System mode" and then choose WCDMA, GSM or Dual and click Write.
3. From the Tuning menu, choose WCDMA -> Temperature Sensor Calibration.

4. Click Tune.

Table 13 Temperature sensor calibration tuning limits

Min	Typ	Max	Unit
-20	-4	20	^{0}C

A popup window appears asking: “Save Values to PM”. Click “Yes”

5. To finish the calibration, click Close.

GSM receiver tunings

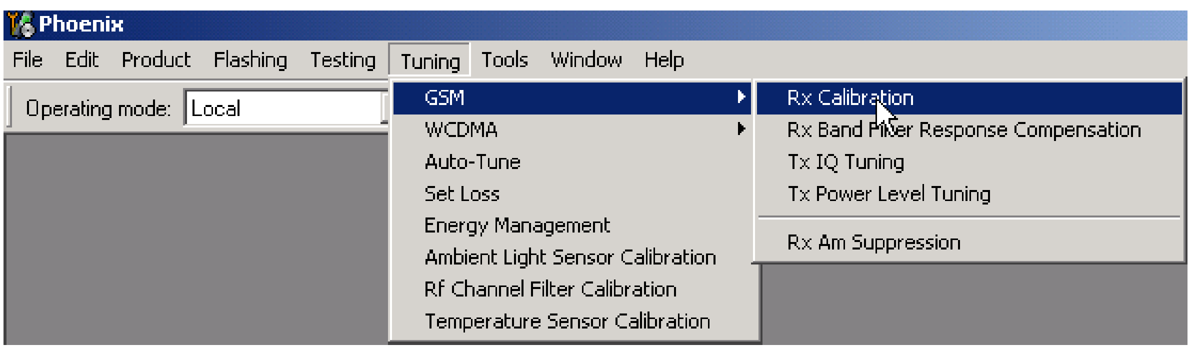
Rx calibration (GSM)

Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

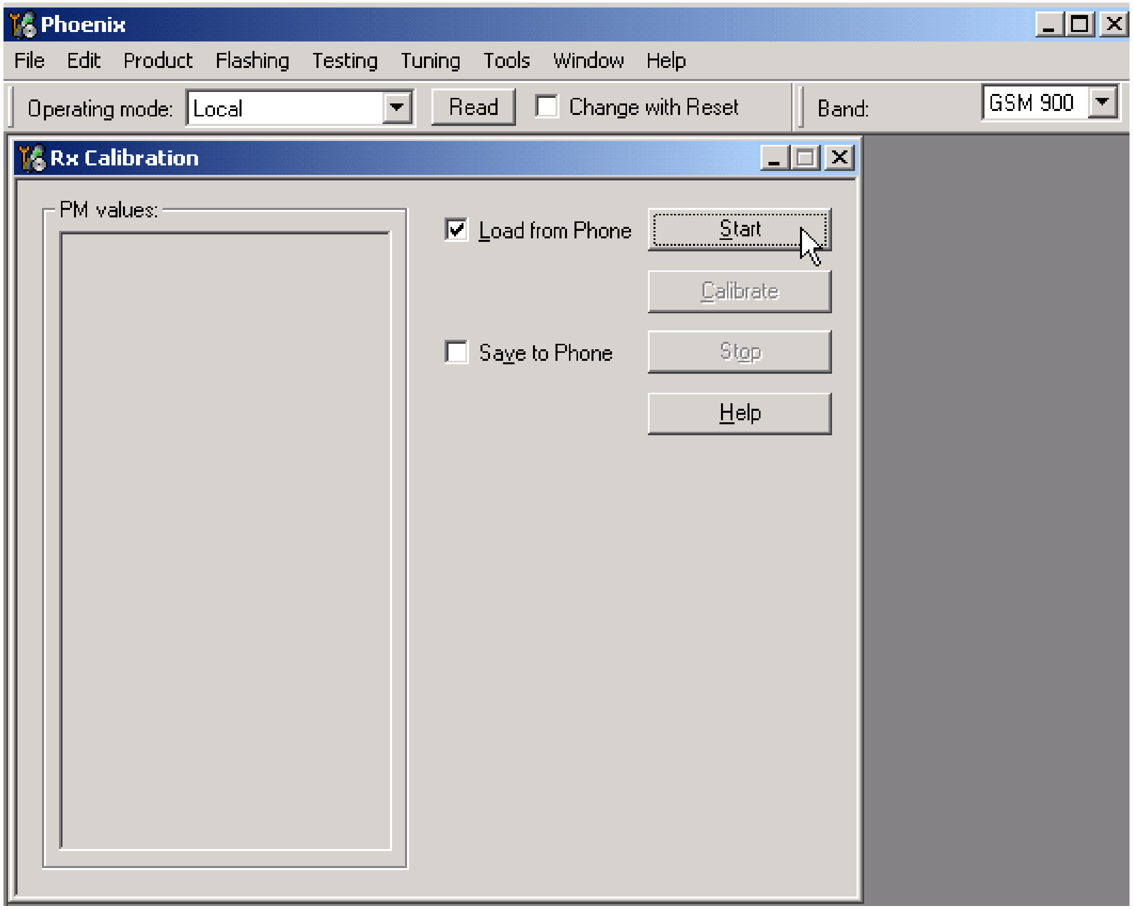
Steps

1. Connect module jig’s GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local.
3. From the Product menu, choose "System mode" and then choose WCDMA, GSM or Dual and click Write.
4. From the Tuning menu, choose GSM -> Rx Calibration.

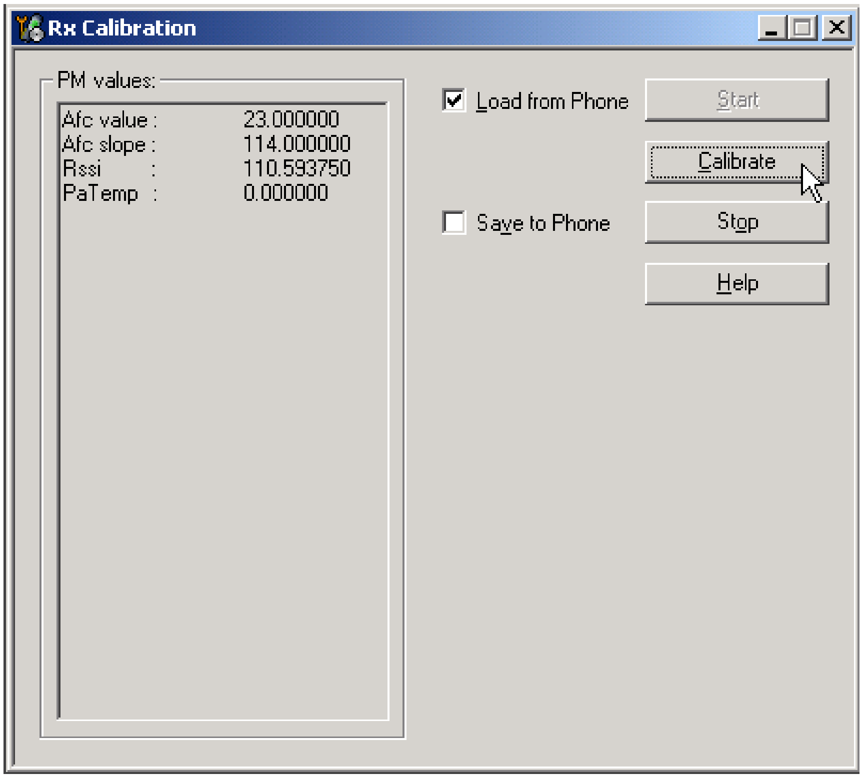


5. Check the “Load from Phone” check box and clear the “Save to Phone” checkbox.
6. From the Band dropdown menu, choose GSM900.

7. Click Start (if it not active already).

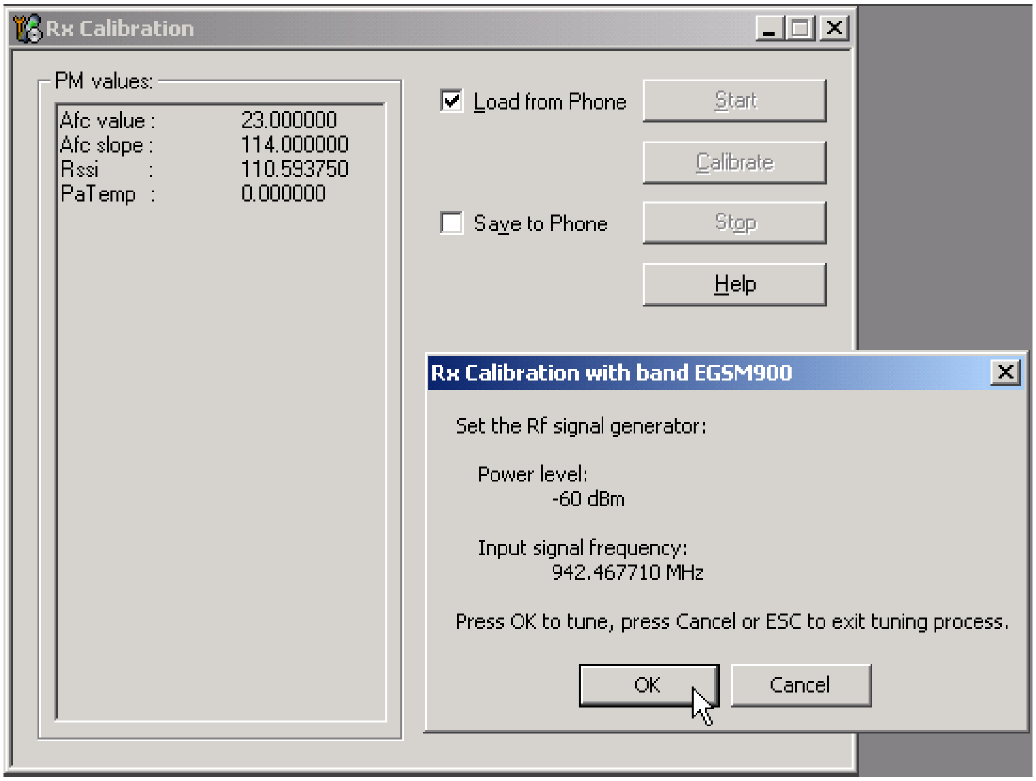


8. Click Calibrate.



9. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Calibration with band EGSM900" popup window.

   The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation!

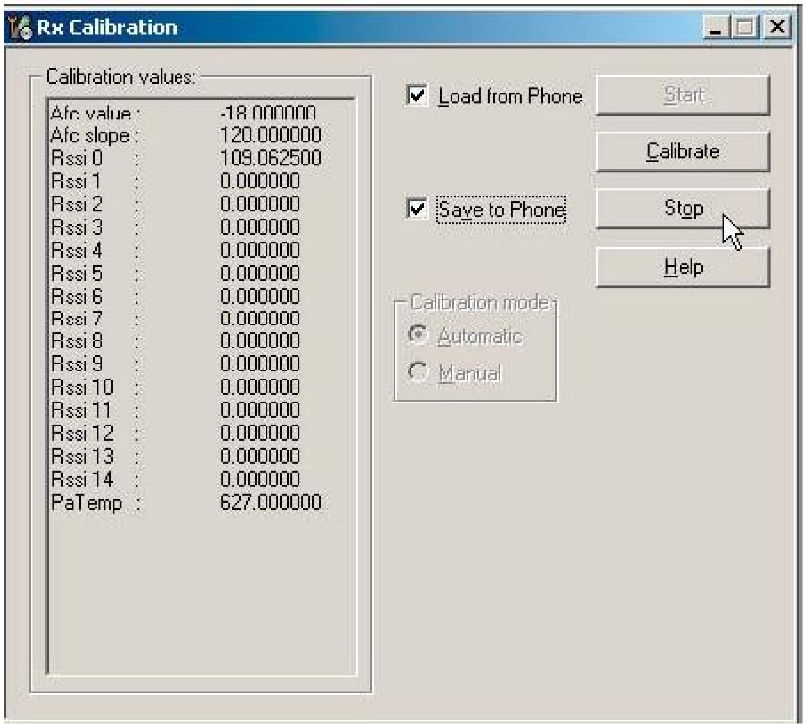


10. To perform tuning, click OK.
11. Check that the tuning values are within the limits specified in this table:

Table 14 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM900				
AFC Value	-200	-105 62	200	
AFC slope	0	122	200	
RSSI0	106	107 110	114	dB
GSM1800				
RSSI0	104	104 109	114	dB
GSM1900				
RSSI0	104	104 109	114	dB

12. To save values to the phone, check the "Save to Phone" check box and click Stop.



Next action

Repeat steps 3 to 8 for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Before you begin

Rx calibration must be done before the Rx Band Filter Response Compensation

Context

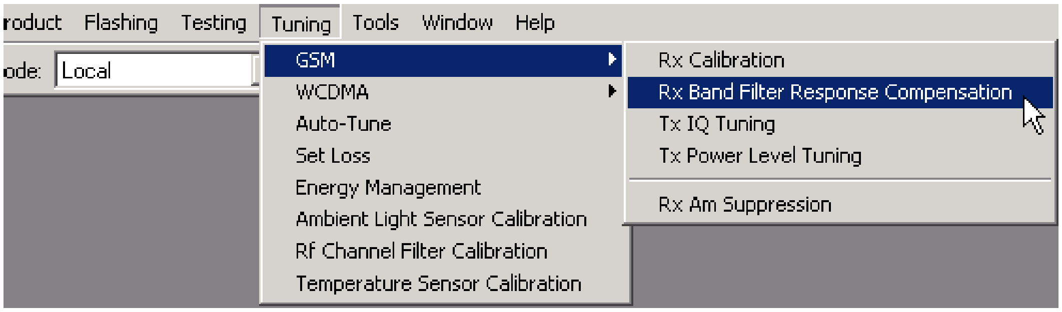
In each GSM Rx band, there's a band rejecting filter in front of HINKU front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

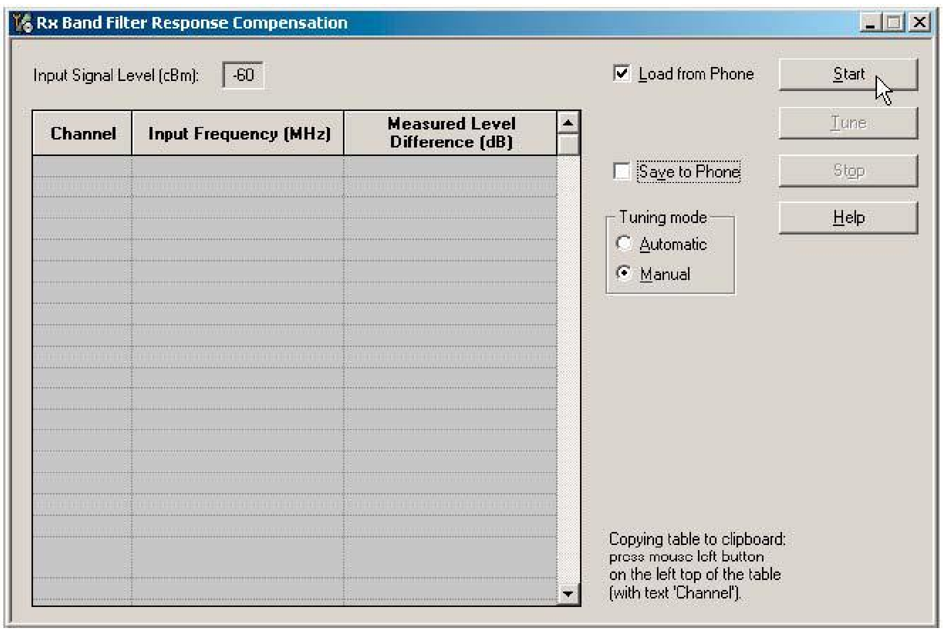
Steps

1. Connect module jig's GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local.
3. From the Product menu, choose "System mode" and then choose WCDMA, GSM or Dual and click Write.

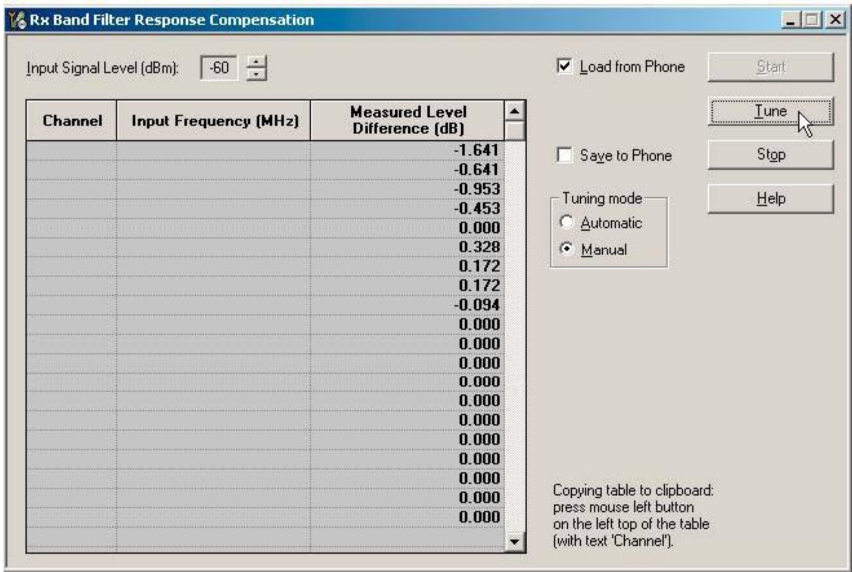
4. From the Tuning menu, choose GSM -> Rx Band Filter Response Compensation.



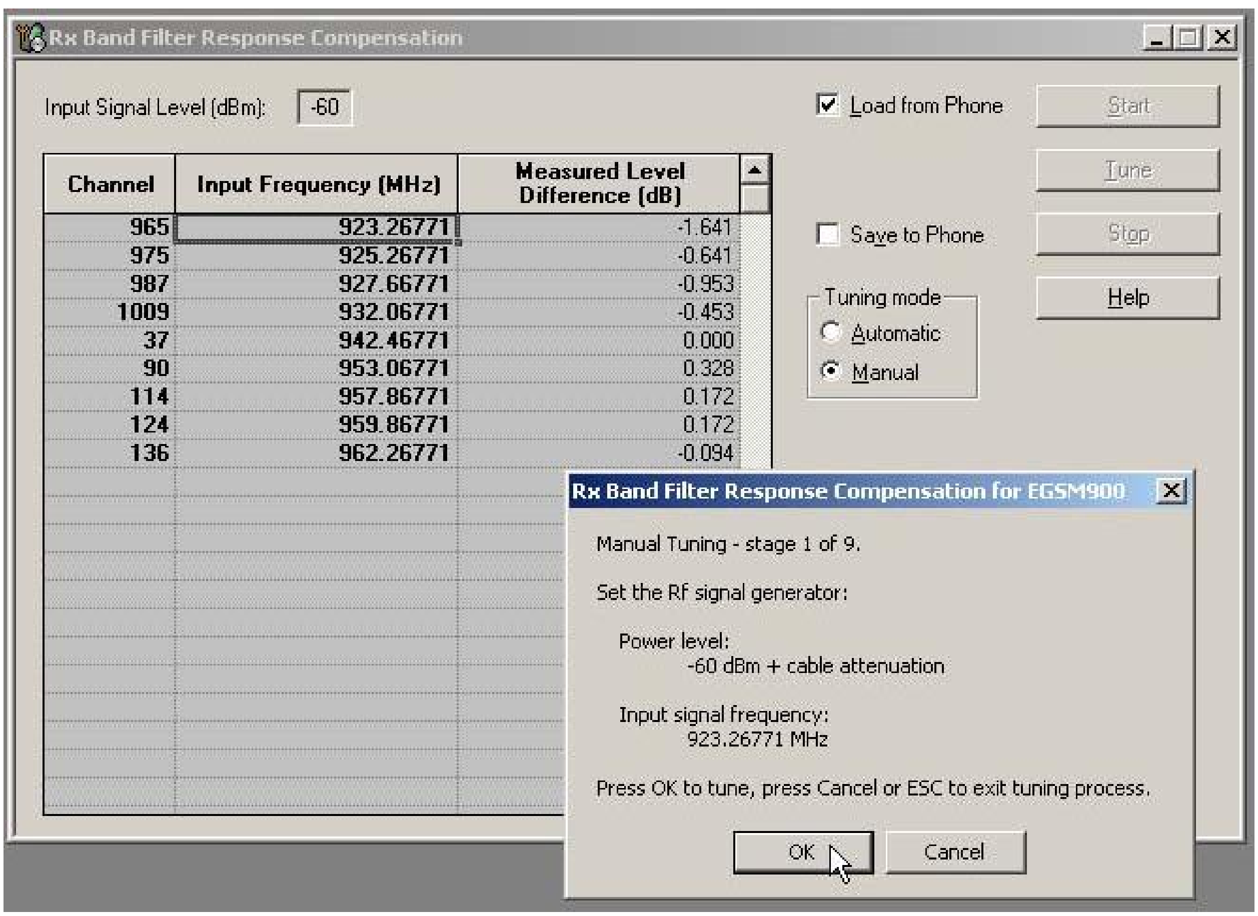
5. Check “Manual” and “Load from Phone” check boxes. Clear “Save to Phone” check box
6. Click Start.



7. Click Tune.



8. Connect signal generator to the phone and set frequency and amplitude as instructed in the "Rx Band Filter Response Compensation for EGSM900" popup window.



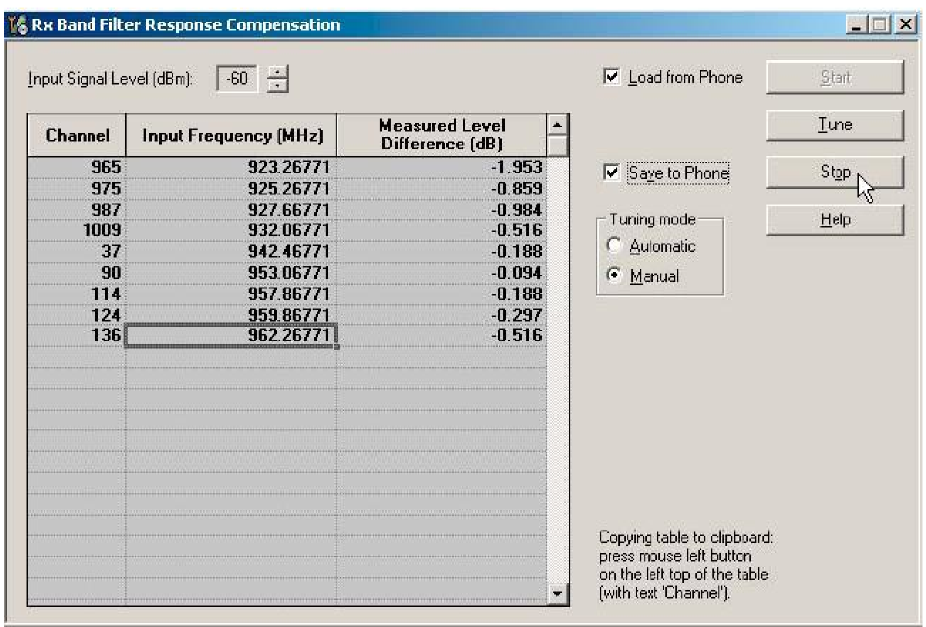
9. To perform tuning, click OK.

10. Go through all 9 frequencies.
11. Check that the tuning values are within the limits specified in this table:

	Min	Typ	Max	Unit
GSM900				
Ch. 965 / 923.26771 MHz	-10	-1	5	dB
Ch. 975 / 925.26771 MHz	-3	0	5	dB
Ch. 987 / 927.66771 MHz	-3	0	5	dB
Ch. 1009 / 932.06771 MHz	-3	0	5	dB
Ch. 37 / 942.46771 MHz	-3	0	5	dB
Ch. 90 / 953.06771 MHz	-3	0	5	dB
Ch. 114 / 957.86771 MHz	-3	0	5	dB
Ch. 124 / 959.86771 MHz	-3	0	5	dB
Ch. 136 / 962.26771 MHz	-10	-1	5	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-10	-1	5	dB
Ch. 512 / 1805.26771 MHz	-3	0	5	dB
Ch. 535 / 1809.86771 MHz	-3	0	5	dB
Ch. 606 / 1824.06771 MHz	-3	0	5	dB
Ch. 700 / 1842.86771 MHz	-3	0	5	dB
Ch. 791 / 1861.06771 MHz	-3	0	5	dB
Ch. 870 / 1876.86771 MHz	-3	0	5	dB
Ch. 885 / 1879.86771 MHz	-3	0	5	dB
Ch. 908 / 1884.46771 MHz	-10	-1	5	dB

	Min	Typ	Max	Unit
GSM1900				
Ch. 496 / 1927.06771 MHz	-10	-1	5	dB
Ch. 512 / 1930.26771 MHz	-3	0	5	dB
Ch. 537 / 1935.26771 MHz	-3	0	5	dB
Ch. 586 / 1945.06771 MHz	-3	0	5	dB
Ch. 661 / 1960.06771 MHz	-3	0	5	dB
Ch. 736 / 1975.06771 MHz	-3	0	5	dB
Ch. 794 / 1986.66771 MHz	-3	0	5	dB
Ch. 810 / 1989.86771 MHz	-3	0	5	dB
Ch. 835 / 1994.86771 MHz	-10	-1	5	dB

12. Check the "Save to Phone" check box and click Stop if the values are within the limits.



Next action

Repeat the steps 4 to 10 for GSM1800 and GSM1900.

Rx AM suppression (GSM)

Context

Rx AM suppression is used to tune the AM suppression capabilities of the GSM receiver.

AM suppression is related to ability of the receiver to operate when there is disturbing AM modulated signal near the received channel signal frequency.

RFIC has tunable compensation circuit which has an effect on the AM suppression ability.

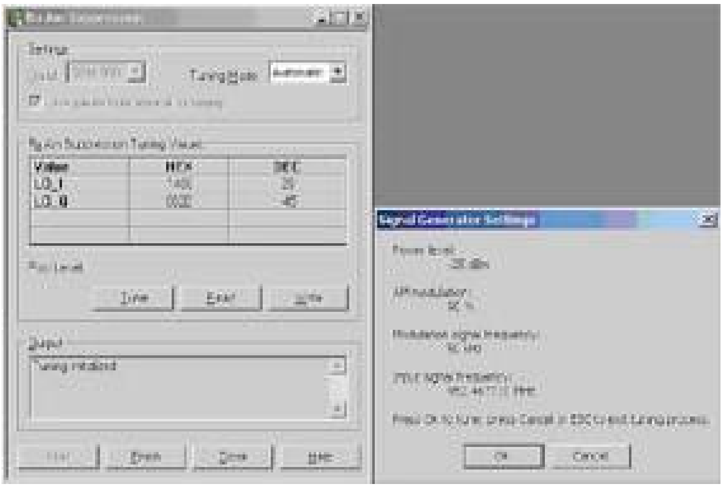
In the tuning, a continuous useful signal + AM modulated signal 10MHz above current channel is fed to the antenna. RFIC control word values are iterated until a minimum RSSI signal is found.

Steps

1. Connect module jig's GSM connector to signal generator.
2. From the dropdown menus, set "Operating mode" to Local.
3. From the Product menu, choose "System mode" and then choose WCDMA, GSM or Dual and click Write.
4. From the Tuning menu, choose GSM -> Rx AM Suppression.
5. From the droptown menus, set "Band" to GSM 900 and set "Tuning Mode" to Automatic.
6. Connect signal generator to phone according to the frequency and modulation parameters displayed in the tuning window:

Frequency	952.46771MHz / 1852.86771MHz / 1970.06771 MHz (depending on the band used)
Power level	-25 dBm / -26 dBm / -29 dBm (increase by cable and jig attenuations)
Modulation	AM
AM modulation depth	90%
Modulation signal	50 kHz sinewave (or 15 kHz if 50 kHz is not available)

7. Click Start.



8. Click Tune.

9. Check that RSSI level value is between the limits presented in this table. If not, try clicking the Tune button again.

Table 15 RSSI level values

Band	Min	Max	Unit
GSM900	-115	-90	dB
GSM1800	-115	-85	dB
GSM1900	-115	-100	dB

10. Make sure that the "Save to Phone" check box is checked and click Stop.

Next action

Repeat steps 3 to 7 for GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

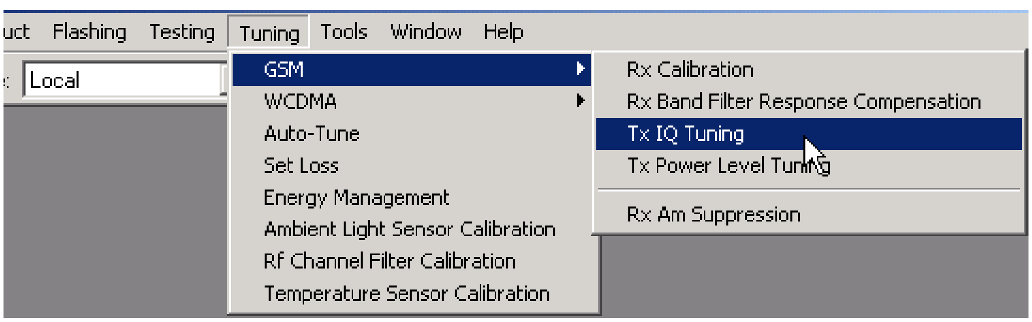
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning tuning balances the I and Q branches.

Tx IQ tuning must be performed on all GSM bands. GSM1900 uses the same values as GSM1800.

Steps

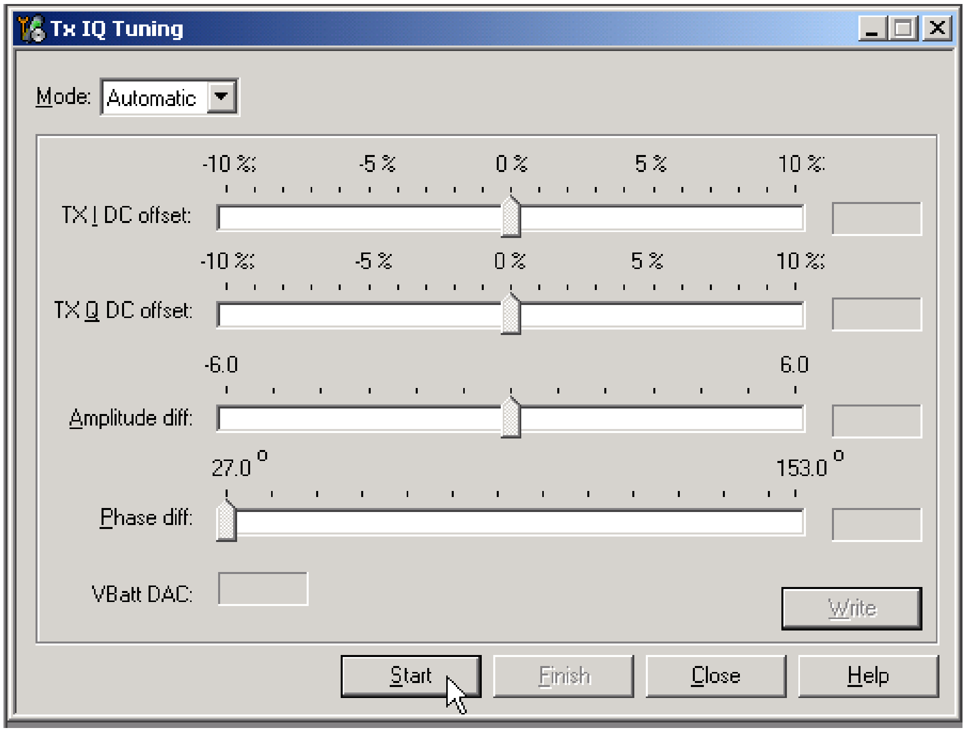
1. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
2. From the Tuning menu, choose GSM -> Tx IQ Tuning.



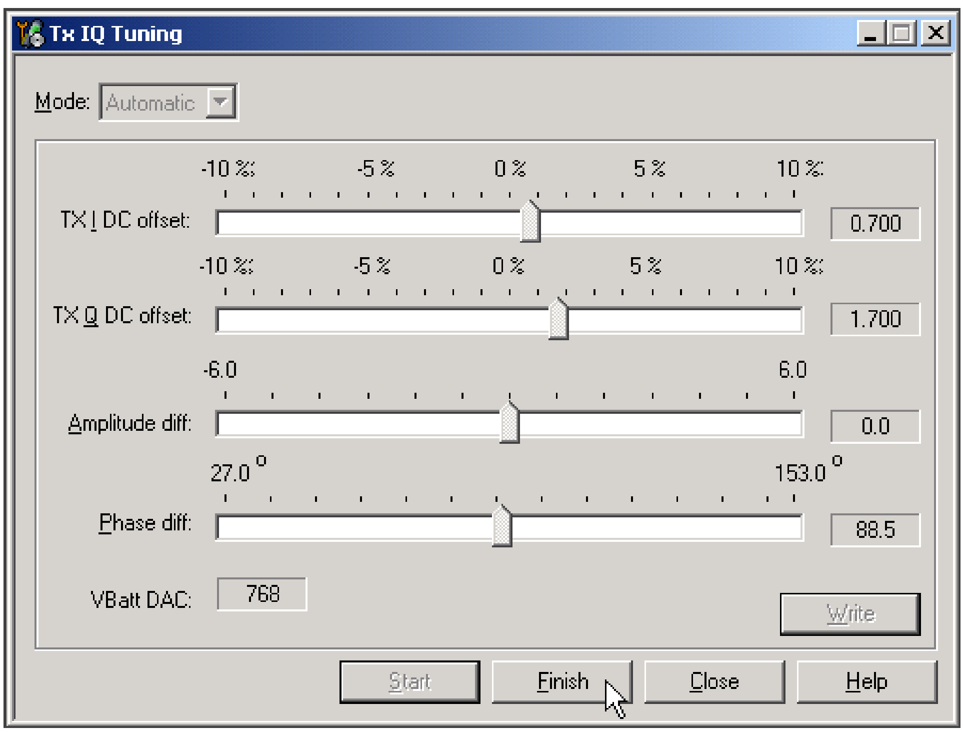
3. Set Mode to Automatic and Edge to Off.
4. Click Start.

   Wait until automatic tuning has finished and moved the sliders.

   Values are written to the phone memory automatically.



5. When the values have been written to the phone memory, click the Finish button to end the tuning.



6. Change band to GSM1800 and repeat steps 4 to 5.
7. Change band to GSM1900 and repeat steps 4 to 5.
8. To close the tuning window, click Close.

Next action

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the table below. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM900				
I DC offset / Q DC offset	-6	-4...+4	6	dB
Ampl	-1	0	1	dB
Phase	85	90	95	dB
GSM1800/GSM1900				
I/Q DC	-6	-0.5...+0.5	6	dB
Ampl	-1	0	1	dB
Phase	95	100	110	dB

Tx power level tuning (GSM)

Context

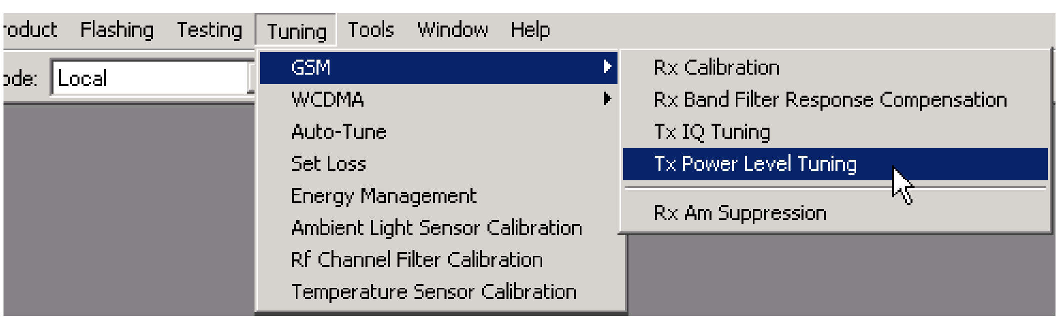
Because of variations at IC process and discrete component values, actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. From the dropdown menus, set "Operating mode" to Local, "System mode" to GSM, and Band to GSM900.
3. From the Tuning menu, choose GSM -> Tx Power Level Tuning.



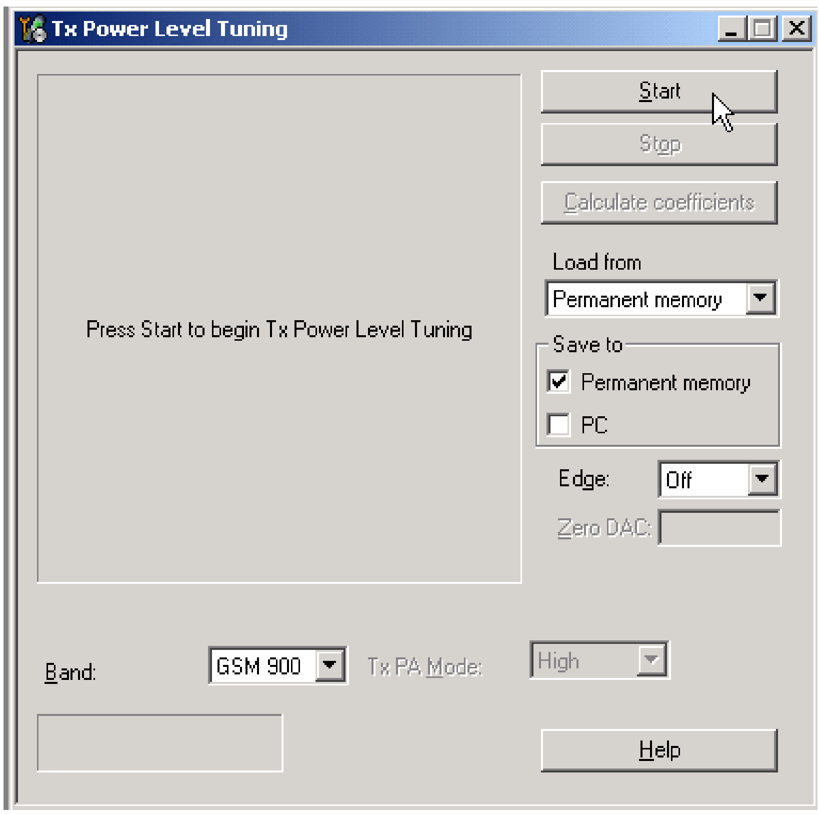
4. Set Mode to Automatic and Edge to Off.
5. Set the spectrum analyzer for power level tuning:

Frequency	channel frequency (897.4MHz GSM900, 1747.8MHz GSM1800, 1880MHz GSM1900)

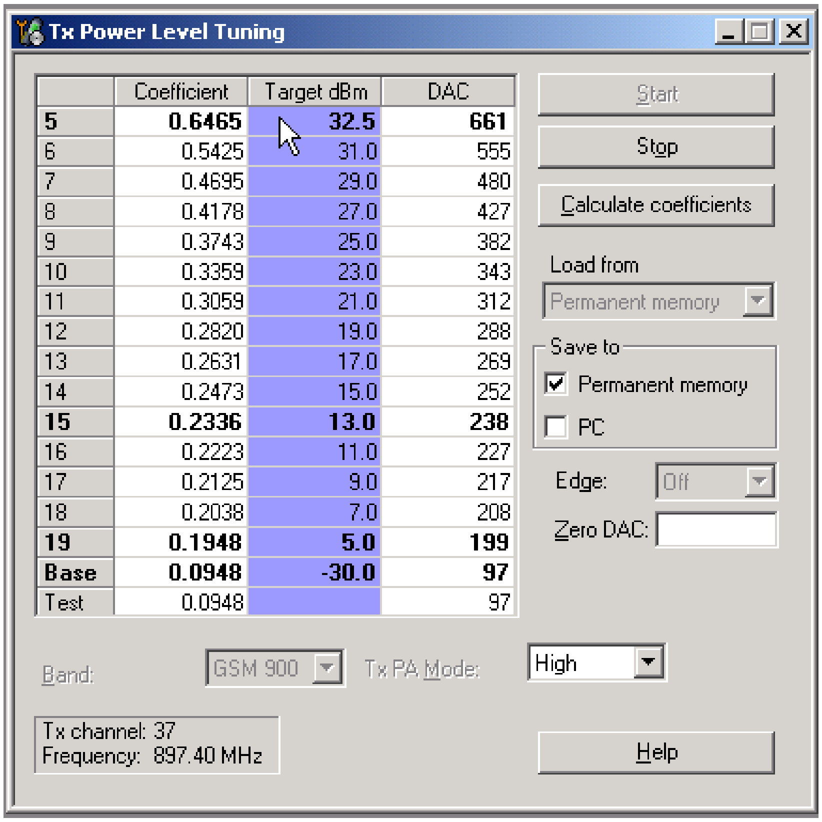
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations in the account!

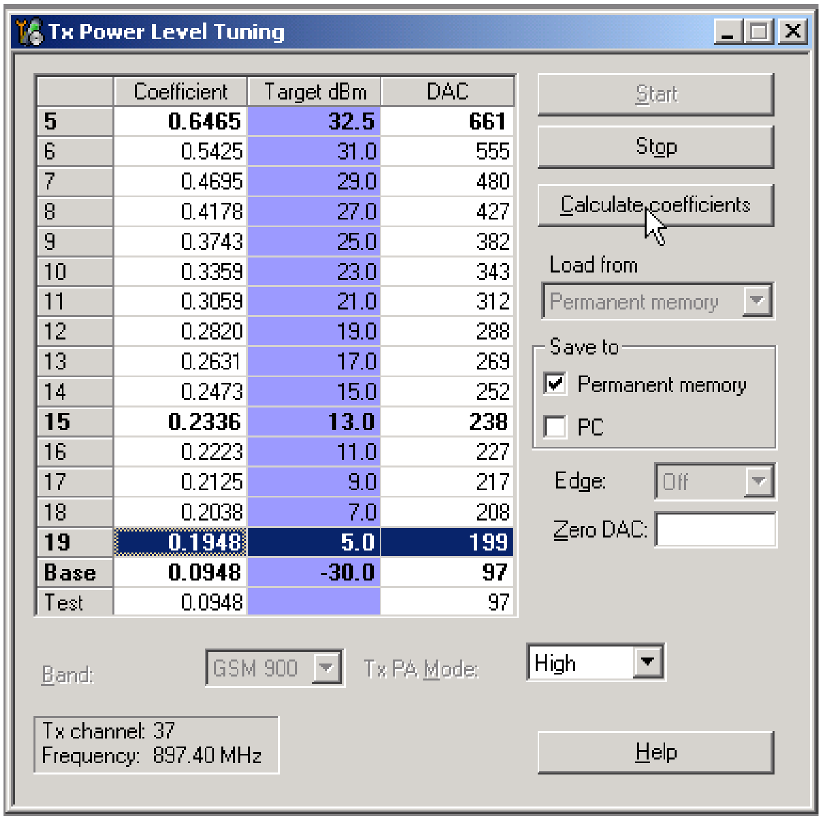
6. Click Start.



7. Adjust power levels 5, 15 and 19 to correspond the "Target dBm" column by pressing + or – keys.



8. Click Calculate Coefficients.

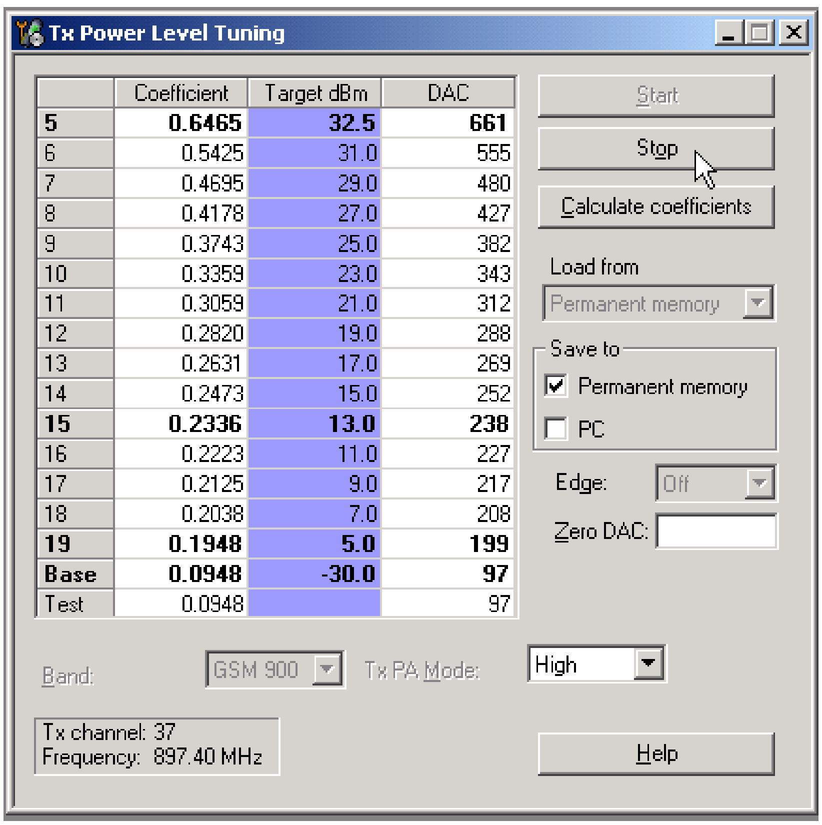


9. Check that the coeffiecient values are within the limits specified in the following table.

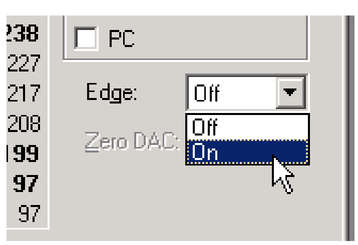
	Min	Typ	Max
GSM900 EDGE off			
PL5 coefficient	0.380	0.460	0.73
PL15 coefficient		0.234	
PL19 coefficient	0.12	0.195	0.3
GSM900 EDGE on			
PL8 coefficient	0.330	0.380	0.6
PL15 coefficient		0.247	
PL19 coefficient	0.12	0.204	0.3
GSM1800 EDGE off			
PL0 coefficient	0.380	0.450	0.7
PL11 coefficient		0.219	
PL15 coefficient	0.12	0.185	0.3
GSM1800 EDGE on			
PL2 coefficient	0.330	0.394	0.6
PL11 coefficient		0.23	

	Min	Typ	Max
PL15 coefficient	0.12	0.194	0.3
GSM1900 EDGE off			
PL0 coefficient	0.380	0.450	0.7
PL11 coefficient		0.218	
PL15 coefficient	0.12	0.184	0.3
GSM1900 EDGE on			
PL2 coefficient	0.330	0.390	0.6
PL11 coefficient		0.23	
PL15 coefficient	0.12	0.193	0.3

If the values are within the limits, check that the "Save to Phone Permanent Memory" check box is checked and click Stop.



10. Set **Edge** mode on and start tuning again. Change video averaging to 50.



11. Tune EDGE power levels to the corresponding target power levels.

    Only power levels **8**, **15** and **19** are tuned in GSM900 and **2**, **10** and **15** in GSM1800/1900. The rest are calculated by clicking the Calculate Coefficients button. Check the coefficients against the RF tuning limits table presented in Step 9.
12. When the tuning is completed, click Stop.

Next action

Repeat steps 4 to 9 for GSM1800 and GSM1900. On those bands only power levels **0**, **11** and **15** need to be tuned.

WCDMA receiver tunings

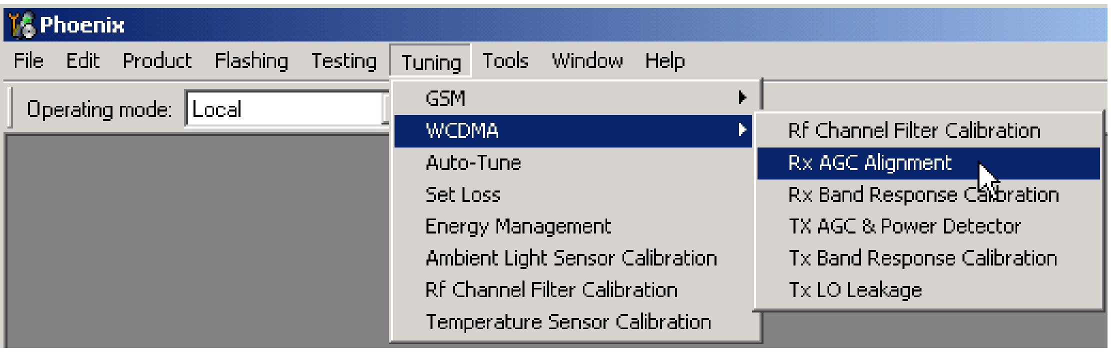
Rx AGC alignment (WCDMA)

Context

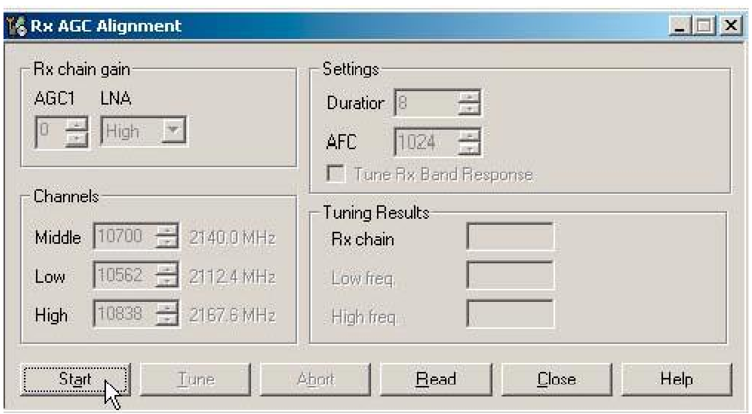
Rx AGC alignment tuning is used to find out the real gain values of the WCDMA Rx AGC system and converters.

Steps

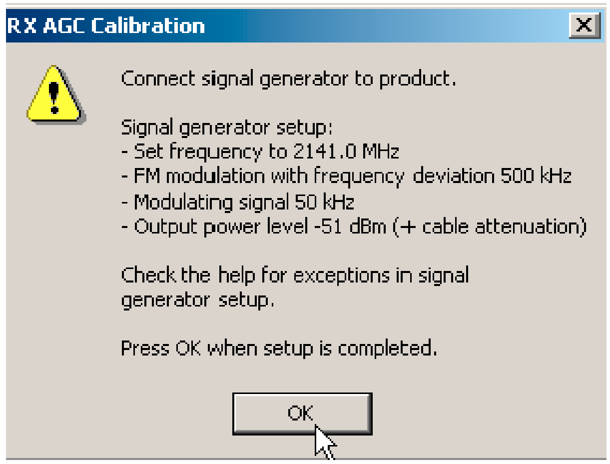
1. From the dropdown menus, set "Operating mode" to Local and "System mode" to WCDMA.
2. From the Tuning menu, choose WCDMA -> Rx AGC Alignment.



3. Click Start and Tune.



4. Setup the signal generator to correspond the values in the "RX AGC Calibration" pop-up window and click OK:



Frequency:	2141MHz
Level:	–51 dBm + cable and adapter attenuations
Modulation:	FM
Deviation:	500 kHz
Modulation frequency:	50 kHz

5. Check that the “Rx Chain” value in “Tuning Results” is within the limits presented in the table below.

	Min	Typ	Max	Unit
RX chain	-6	1.5 3.5	6	dB
Low freq	-5	-0.7 4.0	5	
High freq	-5	-0.7 4.0	5	

6. If the Rx gain is acceptable, click Yes to save the results to the phone.
7. To close the tuning window, click Close.

Rx band response calibration (WCDMA)

Context

There is a band rejecting filter for each WCDMA Rx band between the front end LNA and the mixer of HINKU. The amplitude ripple caused by this filter causes ripple to the RSSI measurement and therefore Rx band response calibration is needed.

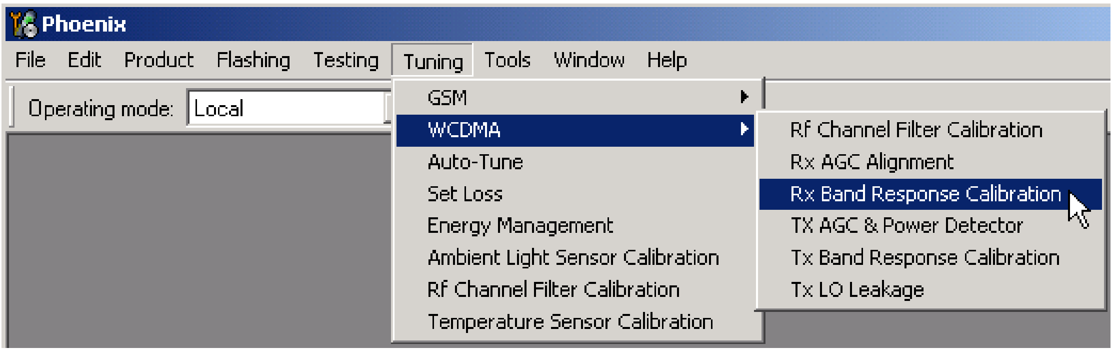
Rx band response calibration can be done in two different ways. If the signal generator in use supports frequency sweep table, the calibration can be done as a part of Rx calibration. If not, it is possible to calibrate all the necessary frequencies one by one.

The first set of steps shows how to perform the calibration without the signal generator sweep feature and the alternative steps give instructions how to perform the calibration if the signal generator supports frequency sweeps and the calibration can be performed within Rx AGC calibration.

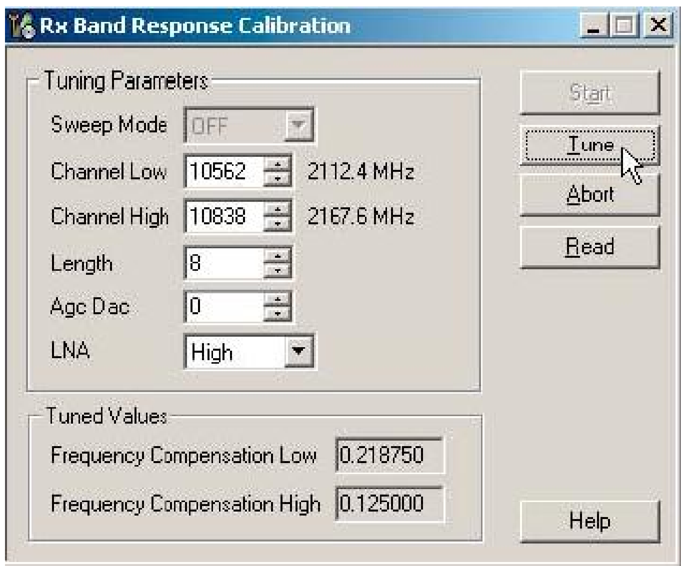
Steps

1. From the "Operating mode" dropdown menu, set mode to "Local".

2. From the Tuning menu choose WCDMA -> Rx Band Response Calibration.



3. Click Start and Tune.

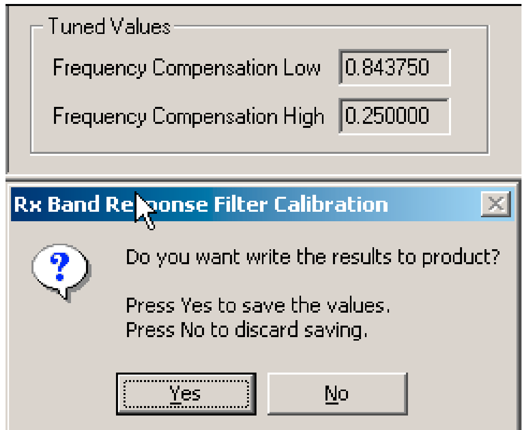


4. Setup the signal generator to correspond the values in the pop-up window:

Frequency:	2113.4MHz
Level:	–48 dBm + cable and adapter attenuations
Modulation:	FM
Deviation:	500 kHz
Modulation frequency:	50 kHz

5. Click OK.
6. Change frequency to 2166.6 MHz and click OK.
7. Check that the tuned values are within the limits specified in the table below:

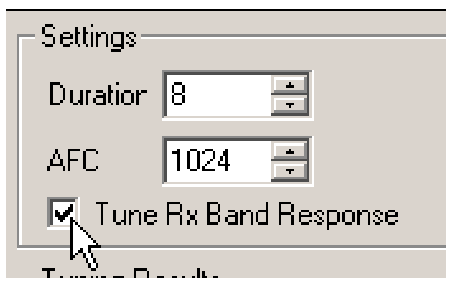
	Min	Max
Frequency compensation low	-5	+5
Frequency compensation high	-5	+5



8. If the values are OK, click Yes to save the values.
9. Close the tuning window.

Alternative steps

- From the "Operating mode" dropdown menu, set mode to "Local".
- From the Tuning menu, choose WCDMA -> Rx AGC Alignment.
- Click Start.
- Check the “Tune Rx Band Response” checkbox and click Tune.



- Setup the signal generator according to the values in the pop-up window:

Frequency list:	2113.4 MHz, 2141 MHz and 2166.6 MHz
Dwell time:	2 ms
Sweep control:	Automatic continuous sweep
Level:	–48 dBm + cable and adapter attenuations
Modulation:	FM
Deviation:	500 kHz
Modulation frequency:	50 kHz

- Click OK.
- Check that the “Rx chain” , “Low freq.” and “High freq.” values in the Tuning Results window are within the limits presented in the following table.

	Min	Typ	Max	Unit
Rx chain	-6	1.5... 3.5	6	dB
Low freq	-5	-0.7...4.0	5	
High freq	-5	-0.7...4.0	5	

- If the Rx gain is acceptable, click Yes to save the results to the phone.
- To end the calibration, click Close.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

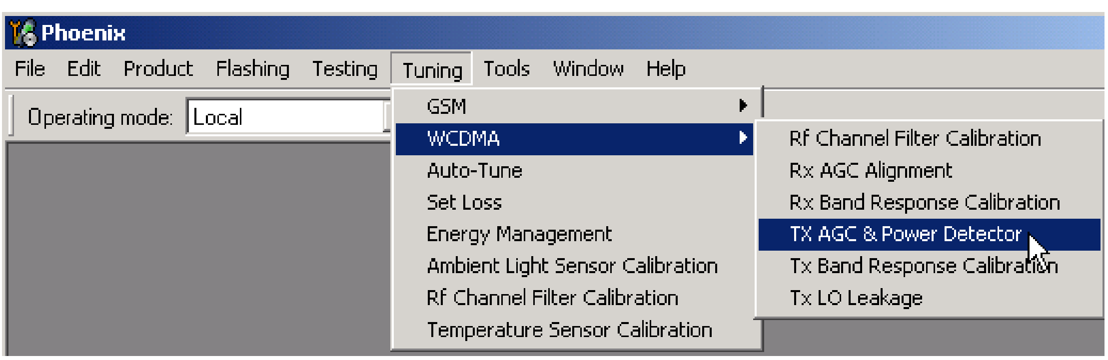
Tx AGC & power detector tuning has two purposes:

- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

There are two ways to perform the tuning. For an alternative method, see Alternative steps.

Steps

1. From the "Operating mode" dropdown menu, set mode to "Local". NOTE! After tuning is done change system mode back to Dual by choosing "Free" to Selected Sytem Mode and click Write.'
2. From the Tuning menu, choose WCDMA -> Tx AGC & Power Detector.



3. Click Start.
4. In the "Wide Range" pane, click Tune (the leftmost Tune button).
5. Setup the spectrum analyzer in the following way:

Center frequency:	**1950.3 MHz**

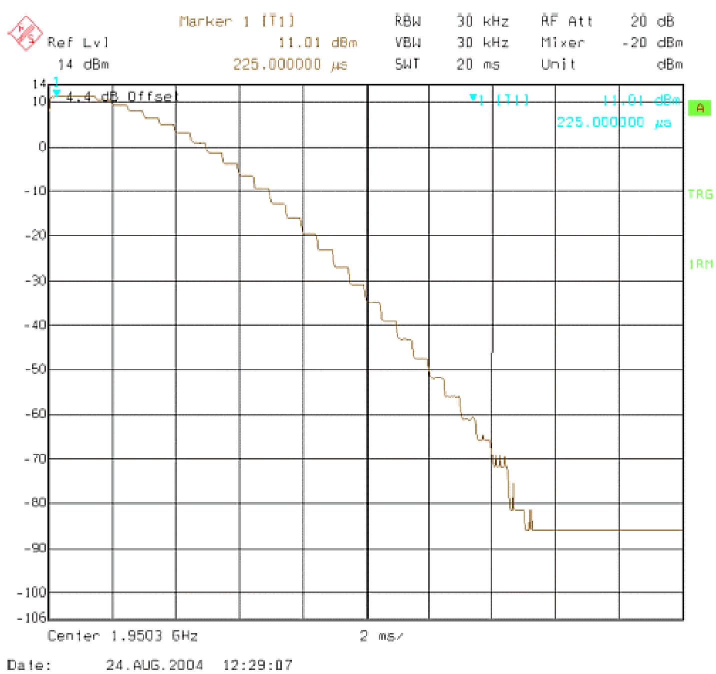
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**14 dBm**
Input attenuation:	(20 dB) To minimize the noise floor, manually select as small value as possible for the mentioned reference level .
Resolution bandwidth:	30 kHz
Video bandwidth:	30 kHz
Sweep time:	20 ms
Detector:	**RMS detector**
Average:	No
Trigger:	Video
Trigger level:	0 dBm
Marker:	250 us
Marker step:	500 us

6. After setting the spectrum analyzer, click OK.
7. Measure the power levels with a marker.

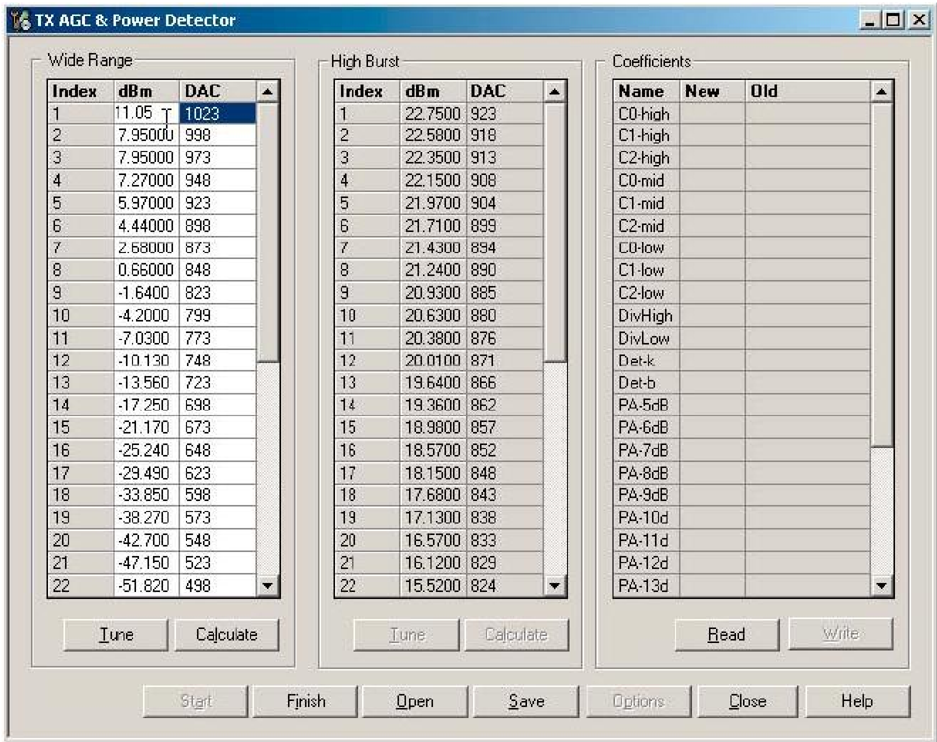
   Take the first measurement from 250 us after the trigger, the second from 750 us, the third on 1225 us and so on in every 500 us until the table is filled.

   Note: It must be possible to measure power levels down to –68 dBm. The measured power levels must be monotonously decreasing.

   Make sure that the marker is not measuring the level of noise spike on lower levels.



8. Fill in the power level values (in dBm) to the Wide Range table.



9. In the "Wide Range pane", click Calculate.
10. In the "High Burst" pane, click Tune.
11. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950 MHz**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz
Sweep time:	20 ms
Detector:	**RMS detector**
Average:	No
Trigger:	Video
Trigger level:	0 dBm
Marker:	250 us
Marker step:	500 us

12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second from 750 us, third on 1225 us and so on in every 500 us until the table is filled.

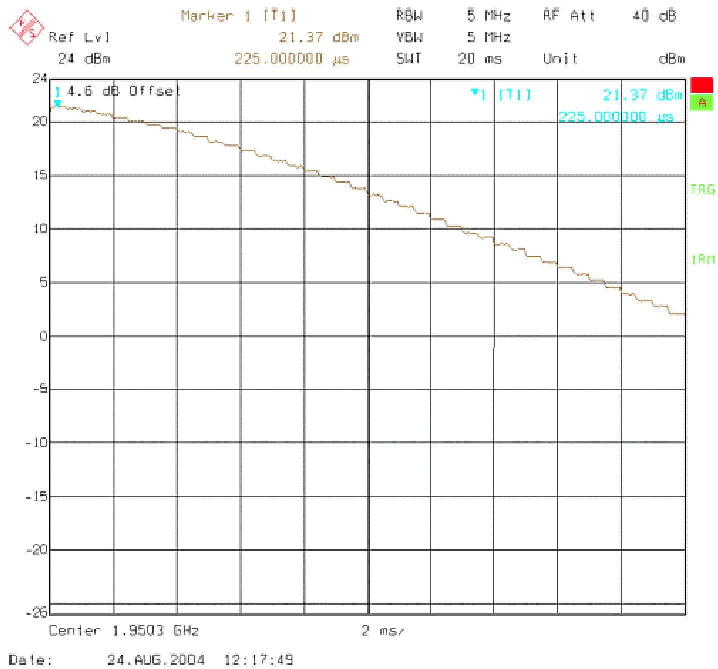


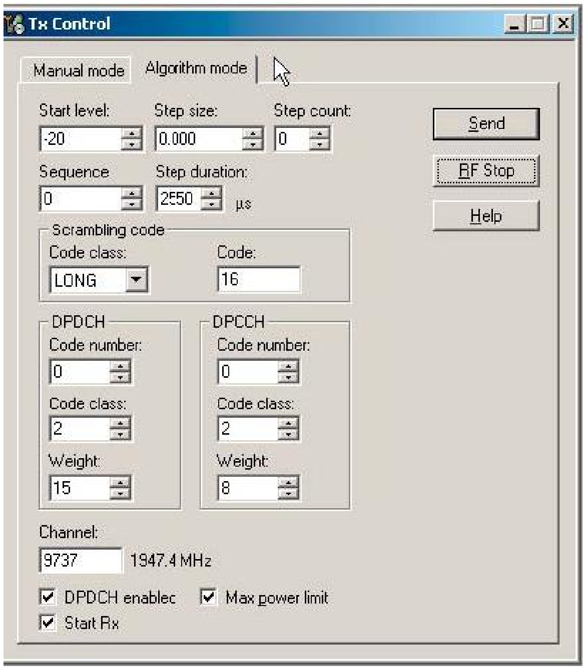
Figure 70 High burst measurement

13. In the "High Burst" pane, click Calculate.
14. Check that the calculated values are within the limits specified in the following table:

	Min	Max
C0-high	-0.5	5
C1-high	-50	50
C2-high	400	900
C0-mid	-0.7	0.7
C1-mid	0	50
C2-mid	400	900
C0-low	-4	4
C1-low	-400	440
C2-low	-10000	15000
Det-k	0	800
Det-b	-1000	1000

15. To save the coefficients to the phone, click Write.
16. To close the tuning window, click Close.
17. From the Testing menu, choose WCDMA -> Tx Control.

18. Select the Algorithm mode tab.



19. Write the target power level 25 dBm to the "Start level" line and check the "Max power limit" check box (detector calibration check).
20. Setup the spectrum analyzer with the following settings:

Center frequency:	**1950.0 MHz**
Span:	0 Hz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	**24 dBm or -20 dBm depending on the level measured**
Input attenuation:	Automatic
Resolution bandwidth:	5 MHz
Video bandwidth:	5 MHz
Sweep time:	20 ms
Detector:	**RMS detector**
Average:	No
Trigger:	Free run

21. Click Send.
22. Measure the WCDMA output power.

    It should be around 21 dBm.
23. Click RF Stop and uncheck the "Max power limit" checkbox.
24. Repeat steps 19 to 23 for levels +19, +7, 0, -20 and –40 dBm levels.

    The measured output power may not differ more than +-2 dB from the requested value at level +19dBm and no more than +-4dB on lower levels.

Remember to stop the RF before sending new data.

Alternative steps

- Measure the wide range levels normally and write down the levels that are possible to measure.
- Click Finish.
- Click Options.
- Change the first wide range DAC value to 573 and change the number of tuning steps to 21.
- Change the spectrum analyzer reference level to –20 dBm and adjust the input attenuator to the lowest value possible.
- In the "Wide Range" pane, click Tune and fill in the rest of values starting from the 19th level.

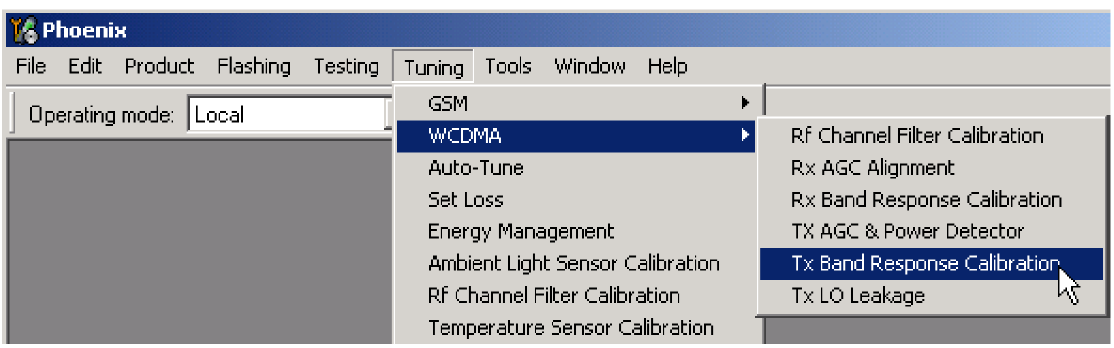
Tx band response calibration (WCDMA)

Context

Tx band response calibration is required to get compensation parameters for DSP algorithm in order for it to handle frequency response variations (caused by SAW filter, PA and duplexer unidealities) in open loop power control and maximum power limitation situations.

Steps

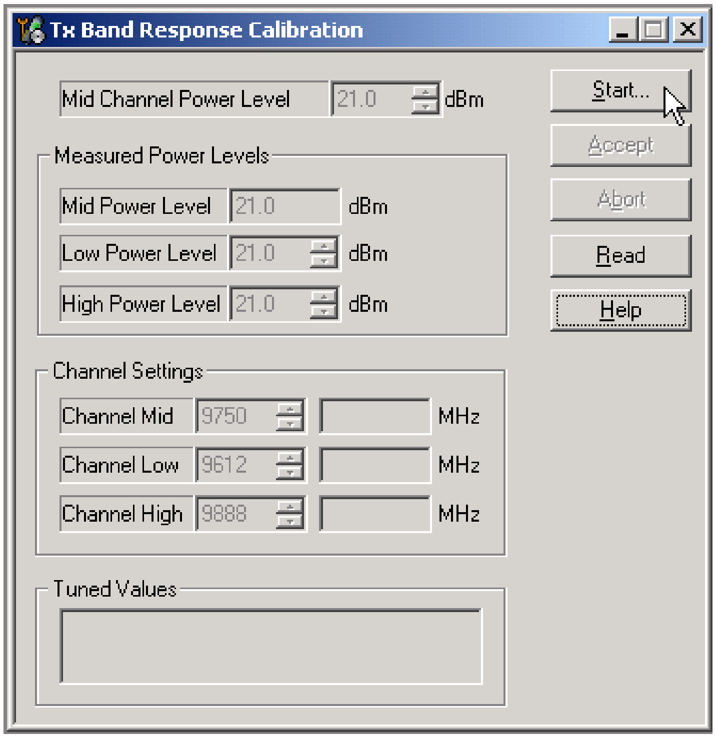
1. From the "Operating mode" dropdown menu, set mode to "Local". NOTE! After tuning is done change system mode back to Dual by choosing "Free" to Selected System Mode and click Write.'
2. From the Tuning menu, choose WCDMA -> Tx Band Response Calibration.



3. Setup the spectrum analyzer according to the following settings:

Frequency:	1950.3 MHz
Span:	100 MHz
Reference level offset:	Cable attenuations + adapter attenuation
Reference level:	30 dBm
Input attenuation:	Default
Resolution bandwidth:	more than 4.7 MHz (i.e. 5MHz)
Video bandwidth:	more than 4.7 MHz (i.e. 5MHz)
Trigger:	Free run
Markers:	1922.4 MHz, 1950.0 MHz and 1977.6 MHz

4. Click Start and OK.



5. Adjust the "Mid Channel Power Level" to 21.0 dBm.
6. Click Accept and OK.
7. Read the marker power level on the low channel and fill it in to the “Low Power Level” line.
8. Click Accept and OK.
9. Read the marker power level on the high channel and fill it in to the “High Power Level” line.
10. Click Accept.
11. Check that the tuned values are within the limits presented in the following table. If they are OK, click Yes.

	Min	Max
Tx Freq Comp (the first and last value)	-4	+4

12. Close the tuning window.

Tx LO leakage (WCDMA)

Context

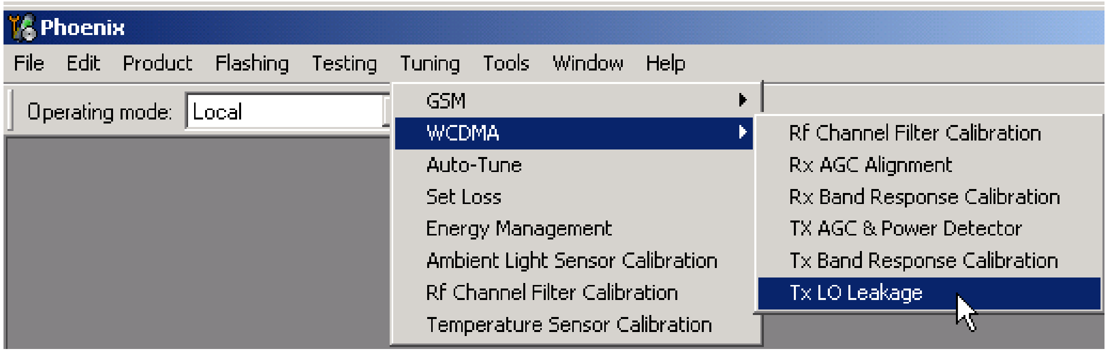
The purpose of Tx LO leakage tuning is to minimize the carrier leakage of the IQ-modulator which is caused by the DC offset voltages in the Tx IQ-signal lines and in the actual IQ-modulator.

The tuning improves WCDMA Tx AGC dynamics at low power levels. A self-calibration routine selects the best combination for internal control words in order to produce minimum LO leakage.

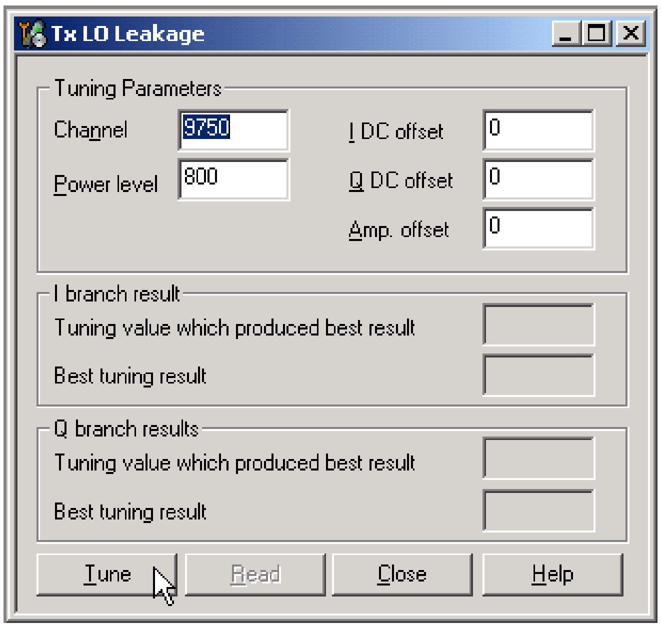
Steps

1. From the "Operating mode" dropdown menu, set mode to "Local" from Product/System Mode menu, choose "WCDMA" to Selected System Mode and click Write. NOTE! After tuning is done change system mode back to Dual by choosing "Free" to Selected System Mode and click Write.

2. From the Tuning menu, choose WCDMA -> Tx LO Leakage.



3. Click Tune.



4. To end the tuning, click Close.

RF engine shield opening and closing instructions

Opening and closing the RF engine shield

Caution: Because the RF shields prevent signals leaking outside and possible interference to other devices, it is important that if the shield needs to be opened, it must be closed very carefully.

Note: If you need to remove the RF engine shield lid, always replace it with a new one.

Context

The RF engine shield of the RM-42 transceiver is located under the SIM connector and because of that is awkward to replace.

See the following instructions on how to open and close the shield correctly, without removing the SIM connector.

Steps

1. Open the lock pins by spreading them outwards from the shield lid.

Figure 71 Opening the lock pins

2. Carefully pick the shield lid up and move it to the antenna pads' direction.
3. Bend one of the lock pins and the area around it (see the following two figures) 90 degrees up to the same level as the shield lid. But beware that the shield itself will not bend!

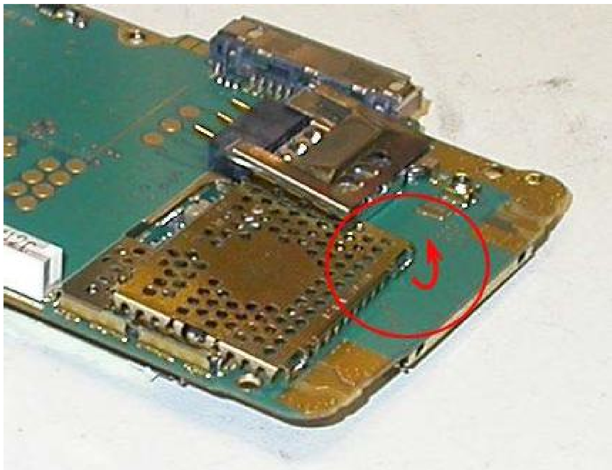


Figure 72 Bending the lock pin and the area around it

4. Slide the shield lid carefully to the direction of the type label, over the bluetooth antenna.

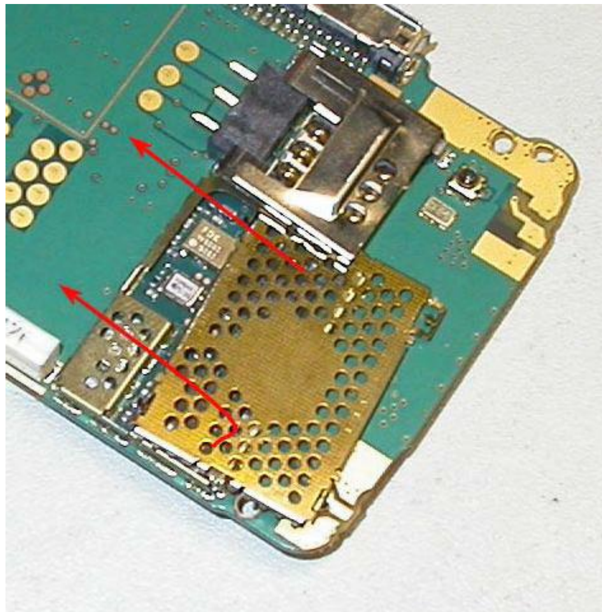


Figure 73 Sliding the shield lid

5. Now the shield lid is removed and the measurement and repair work can begin.

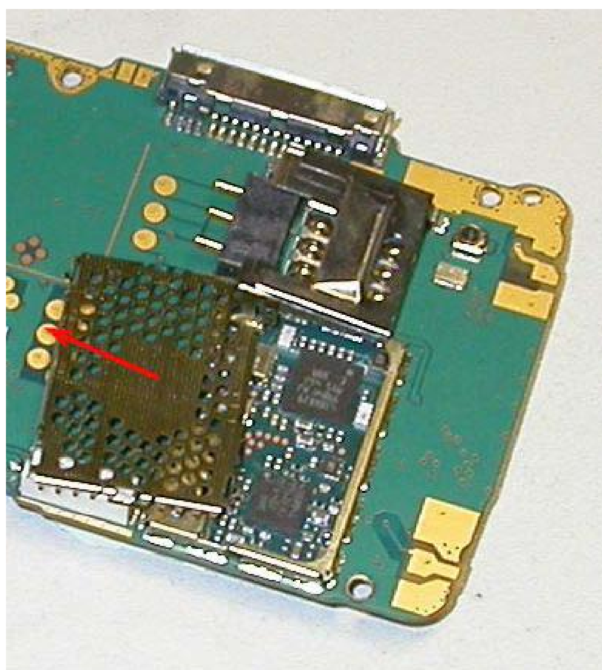


Figure 74 Removing the shield lid

6. Bend the lock pins back to the same level as the sides of the shield lid.

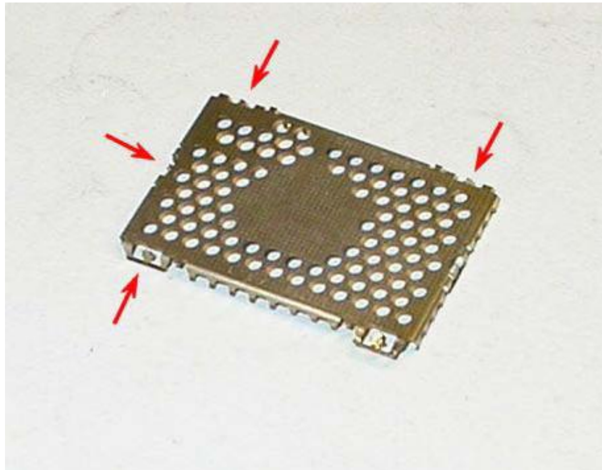


Figure 75 Bending the lock pins

7. Squeeze every side of the shield lid a little bit to the inside of the shield lid, for example with the back of a tweezers. Be very careful that the shield itself does not bend.

   Note: It is very important to do the tightening in order to prevent any signal leakage!

Figure 76 Squeezing the sides of the shield lid

8. Slide the shield lid over the bluetooth antenna to the direction of the antenna pads. Just like in step four, but in reverse direction.

9. Bend the bent lock pin and the area around it to the same level as the side of shield lid. Be very careful that the shield itself does not bend.

Figure 77 Bending the lock pin and the area around it

10. Slide the shield lid over the shield frame and push it in place for example with your thumb or the back of a tweezers.

Figure 78 The shield lid in place

11. Ensure that all lock pins are in place and the shield lid is properly attached to the shield frame.

Note: Make sure that there is no gap between the shield lid and the frame!

(This page left intentionally blank.)

Appendix A: Additional RF Troubleshooting Instructions

Table of Contents

1. USING THESE INSTRUCTIONS

The following sections include lots of headings and subheadings that are asking simple positive style questions.

For example heading 4.2 asks if the phone does measure RSSI-values correctly in GSM-bands. If the answer is “Yes” then user should go to the next heading on the same level (heading number that has as many decimal numbers as the heading 4.2) In our example case moving to the section 4.3. If the answer is “No” then user should go to one heading level deeper in hierarchical system meaning the section 4.2.1 in our example case.

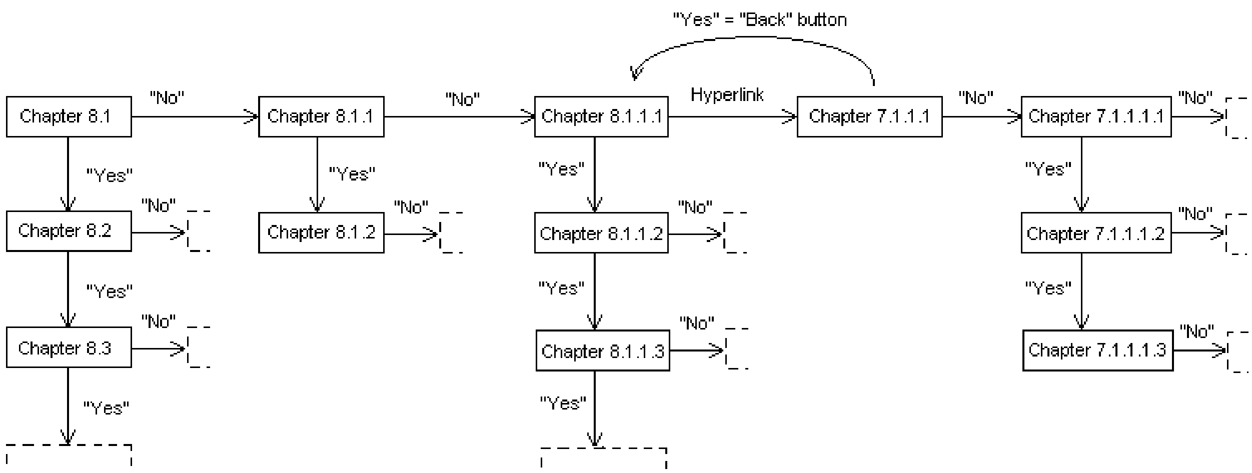


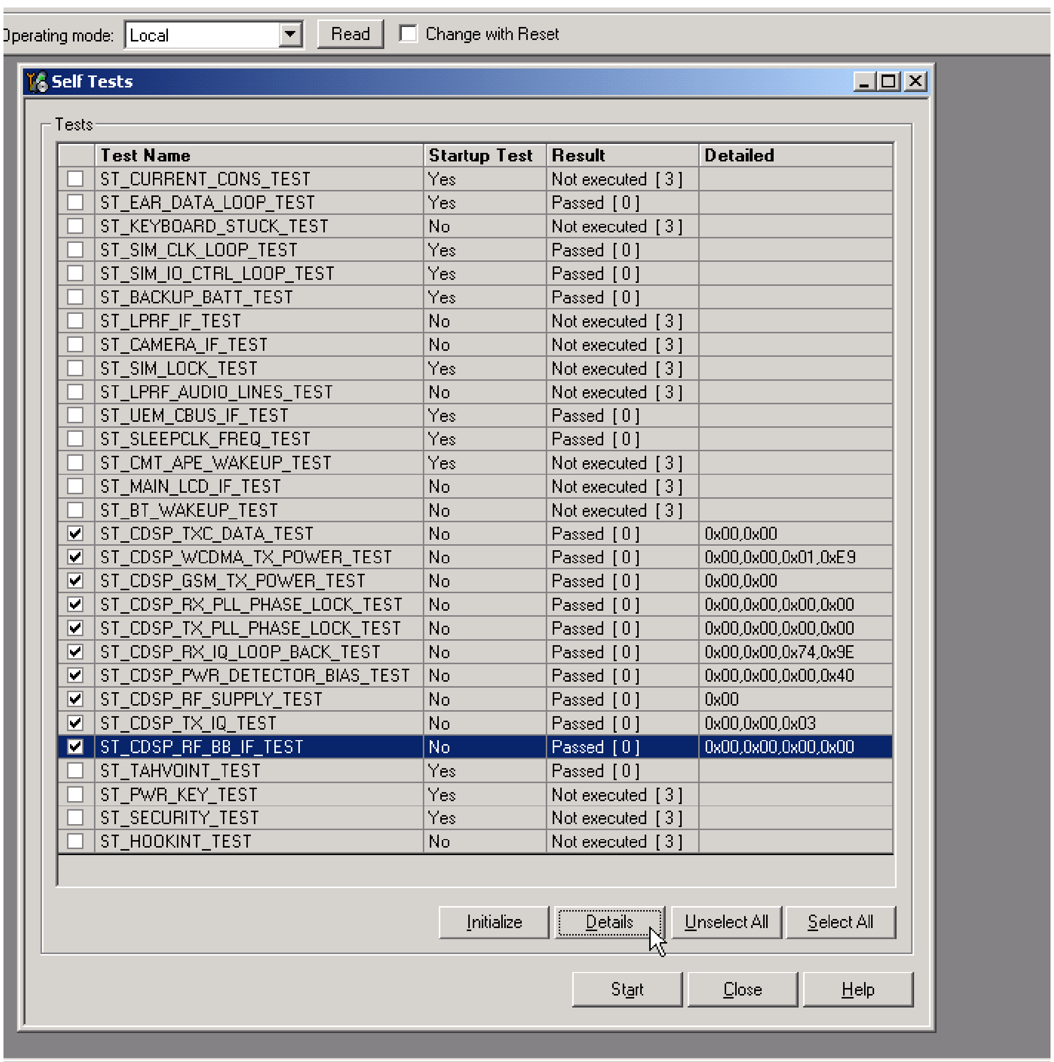
Figure 1 Use of this troubleshooting manual presented with an example. Notice that real section numbers are not used.

2. RF SELF TESTS

The RF part of the device is equipped with self test functionality which tests most of RF-BB interface signals and some parts of RF circuitry. Self tests are designed to detect faults on some critical parts, but they can not prove that everything is OK even if all the self tests are passed.

Self-tests can be run with Phoenix service software. Tests can return pass/fail result and detailed measurement data and error codes in fail case. Select “Testing” -> “Self Tests” from the Phoenix menu. Select appropriate RF self tests and run them with “Start”-button. Notice that self tests should be run in “Local”-mode (change “Operating Mode” to “Local” in Phoenix before running self tests). For service tool usage instructions refer to the “Service Software” and “Service Tools and Service Concepts” sections.

NOTICE! Perform WCDMA transmitter self test (ST_CDSP_WCDMA_TX_POWER_TEST) always in an RF shielded environment (for example in an RF-shield box).

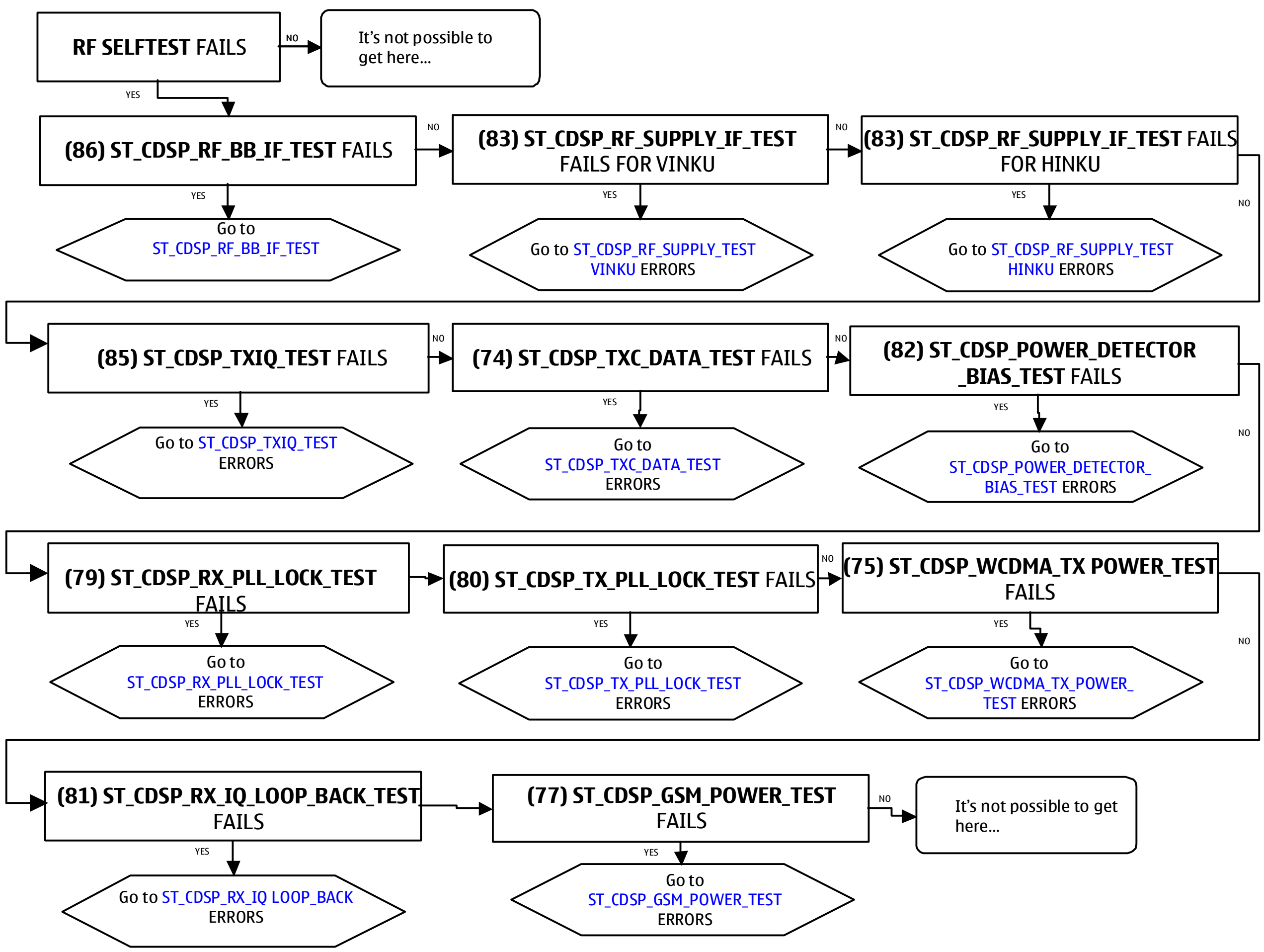


Test Name	Startup Test	Result	Detailed
ST_CURRENT_CONS_TEST	Yes	Not executed [3]	
ST_EAR_DATA_LOOP_TEST	Yes	Passed [0]	
ST_KEYBOARD_STUCK_TEST	No	Not executed [3]	
ST_SIM_CLK_LOOP_TEST	Yes	Passed [0]	
ST_SIM_IO_CTRL_LOOP_TEST	Yes	Passed [0]	
ST_BACKUP_BATT_TEST	Yes	Passed [0]	
ST_LPRF_IF_TEST	No	Not executed [3]	
ST_CAMERA_IF_TEST	No	Not executed [3]	
ST_SIM_LOCK_TEST	Yes	Not executed [3]	
ST_LPRF_AUDIO_LINES_TEST	No	Not executed [3]	
ST_UEM_CBUS_IF_TEST	Yes	Passed [0]	
ST_SLEEPCLK_FREQ_TEST	Yes	Passed [0]	
ST_CMT_APE_WAKEUP_TEST	Yes	Not executed [3]	
ST_MAIN_LCD_IF_TEST	No	Not executed [3]	
ST_BT_WAKEUP_TEST	No	Not executed [3]	
ST_CDSP_TXC_DATA_TEST	No	Passed [0]	0x00,0x00
ST_CDSP_WCDMA_TX_POWER_TEST	No	Passed [0]	0x00,0x00,0x01,0xE9
ST_CDSP_GSM_TX_POWER_TEST	No	Passed [0]	0x00,0x00
ST_CDSP_RX_PLL_PHASE_LOCK_TEST	No	Passed [0]	0x00,0x00,0x00,0x00
ST_CDSP_TX_PLL_PHASE_LOCK_TEST	No	Passed [0]	0x00,0x00,0x00,0x00
ST_CDSP_RX_IQ_LOOP_BACK_TEST	No	Passed [0]	0x00,0x00,0x74,0x9E
ST_CDSP_PWR_DETECTOR_BIAS_TEST	No	Passed [0]	0x00,0x00,0x00,0x40
ST_CDSP_RF_SUPPLY_TEST	No	Passed [0]	0x00
ST_CDSP_TX_IQ_TEST	No	Passed [0]	0x00,0x00,0x03
ST_CDSP_RF_BB_IF_TEST	No	Passed [0]	0x00,0x00,0x00,0x00
ST_TAHVOINT_TEST	Yes	Passed [0]	
ST_PWR_KEY_TEST	Yes	Not executed [3]	
ST_SECURITY_TEST	Yes	Not executed [3]	
ST_HOOKINT_TEST	No	Not executed [3]	

If one or more self tests show fail results (for example: "minor" or "fatal") more detailed error codes can be read from the phone with "Details" button. Error codes are shown in hexadecimal format, but notice that all returned hexadecimal values are not necessarily useful in RF troubleshooting because some of the self tests return also different kind of measurement information together with "real" error codes. If self tests are not passed, please refer to following subchapters for detailed troubleshooting information.

IMPORTANT!

In order to use these self-tests most efficiently, it is very important that the tests are performed in certain order (or at least the error data is analyzed in this order). The tests are designed so that by performing them in this order it is easy to find the problematic component without any redundant checks. The following flowchart is based on that idea (i.e. if RFBUS fails, there is no need to spend time wondering why there is no power at TX).



2.1 RF-BB interface (ST_CDSP_RF_BB_IF_TEST)

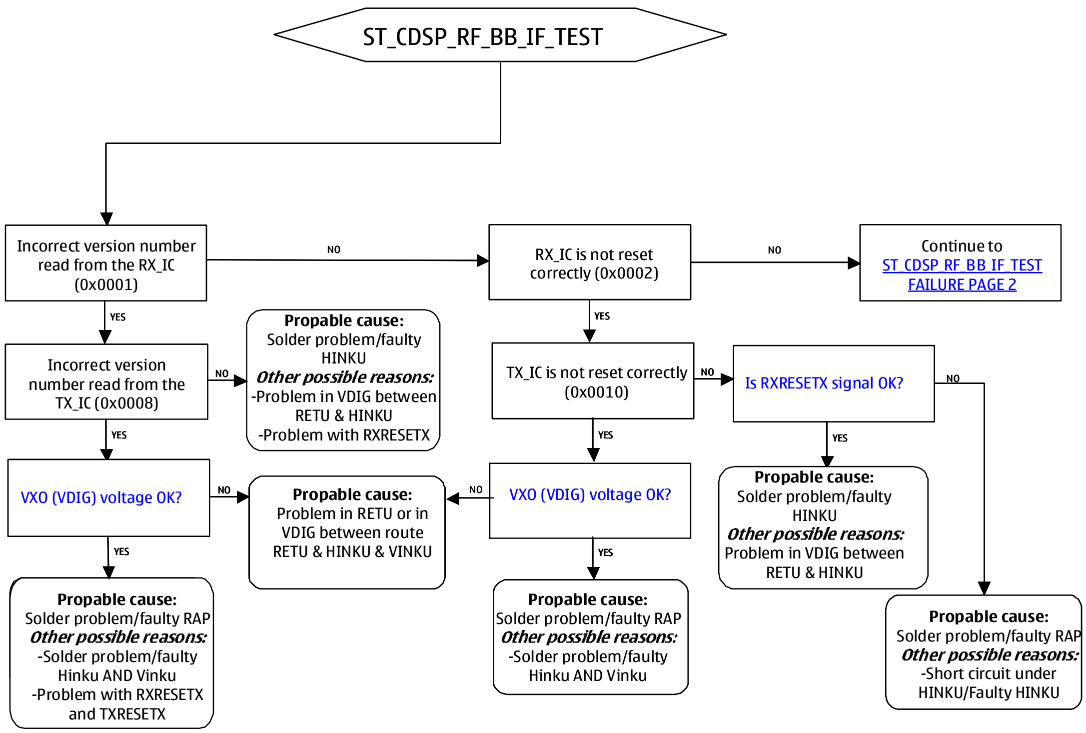
RF_BB_IF test (86) tests the functionality of the RAP3G/HINKU/VINKU serial interface & reset lines. If this test fails, it means that there's a problem programming Hinku and or Vinku and all of the following tests cannot give correct data.

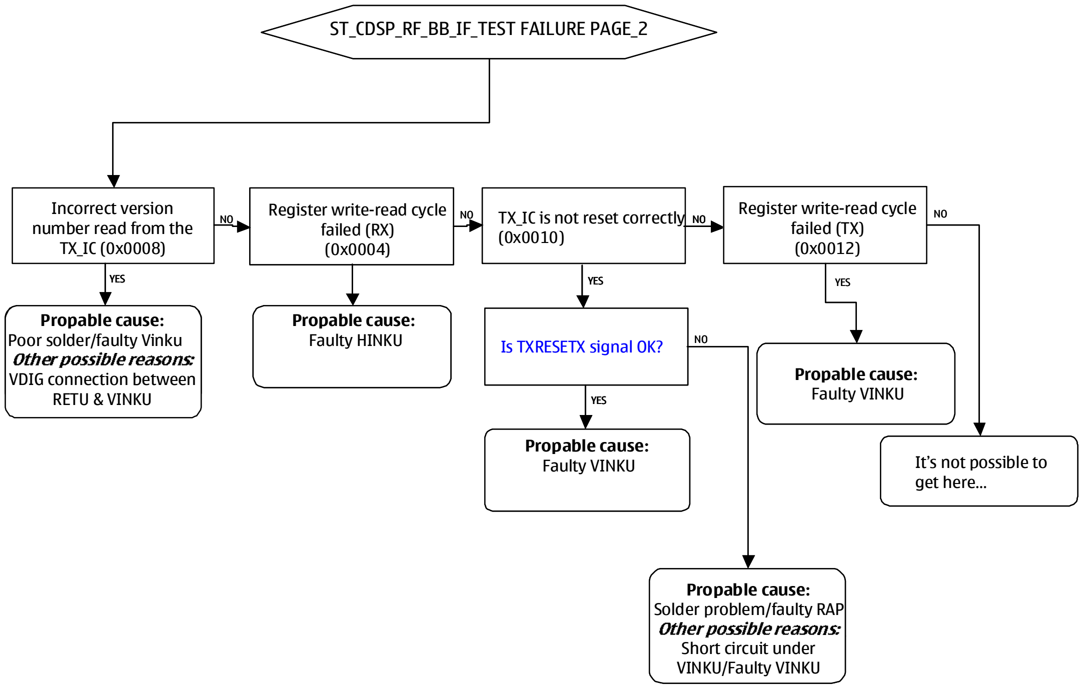
Tested signals: VBAT_ASIC, VDIG, VREFRF01, VXO, RFBUSDAT, RFBUSCLK, RFBUSENA, RXRESETX, TXRESETX

Error code for this self test is given in format:

- *0xyy, 0xzz*

,where 0xyy, 0xzz part is the total error code: 0xyyzz





Please, refer to chapter Error Code Interpretation Examples if more information about error code interpretation is needed.

2.2 Supply test for Hinku and Vinku (ST_CDSP_RF_SUPPLY_TEST)

This self test includes two different RF-supply self tests…one for Vinku and one for Hinku:

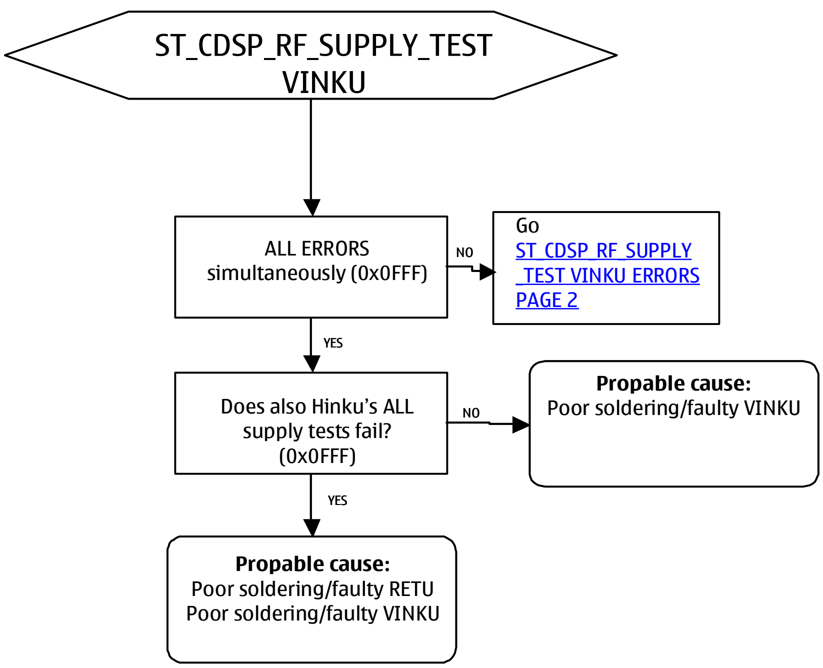
RF_SUPPLY_TEST (VINKU) (83) tests the functionality of Vinku's bias block, regulators, reference voltage line and, supply connections.
If these fail, all other Vinku tests can/will fail. Also many Hinku tests can be affected and can't be trusted.

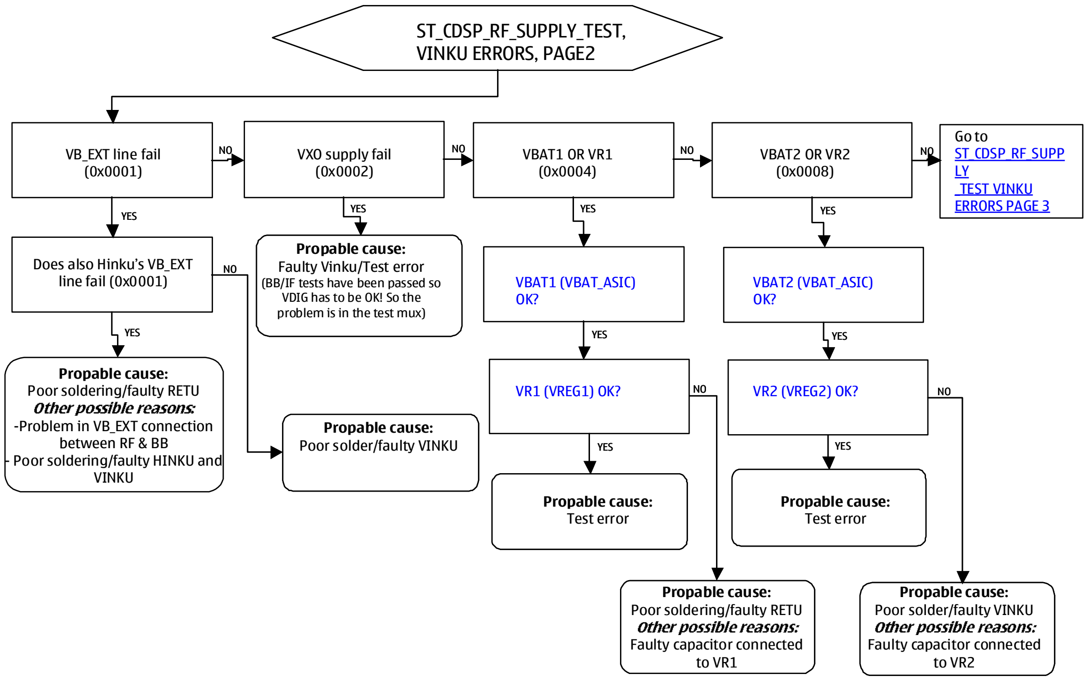
RF_SUPPLY_TEST (HINKU) (83) tests the functionality of Hinku's bias block, regulators, reference voltage line and, supply connections.
If these fail, all other Hinku tests can/will fail and can't be trusted.
Error code for this self test is given in format:

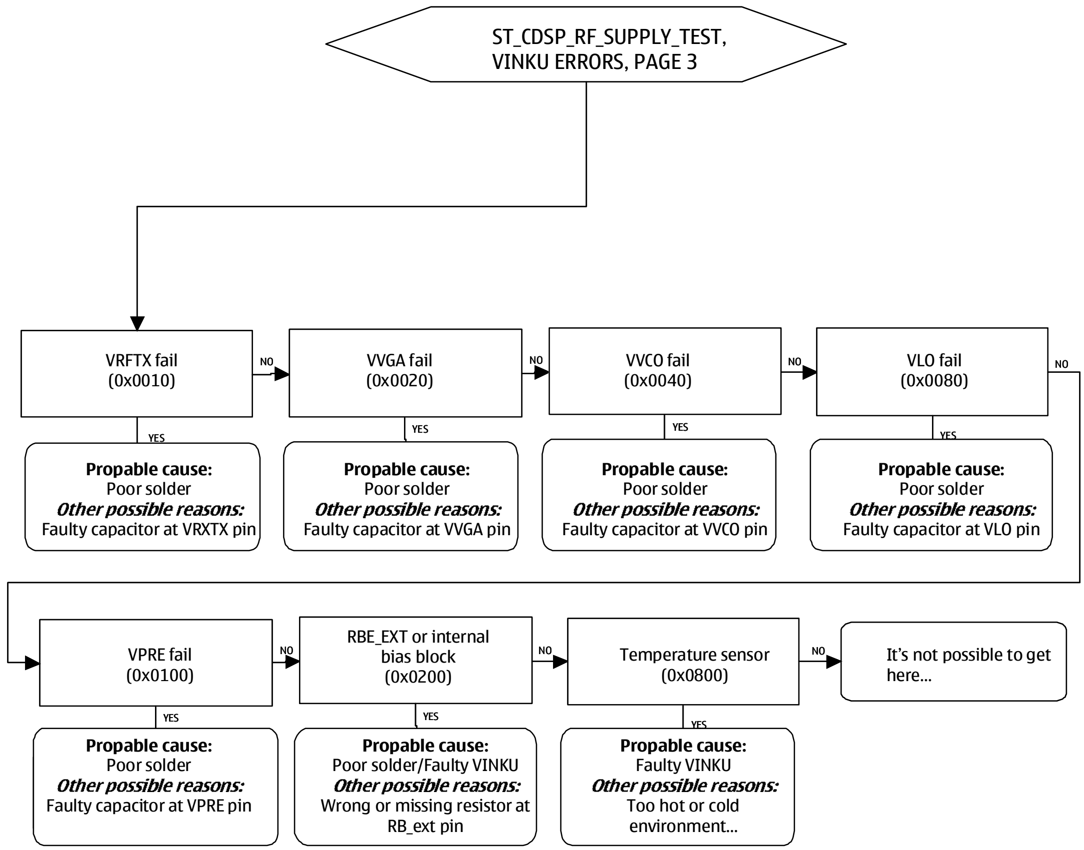
- *0xyy, 0xyy, 0xzz, 0xzz, MeasResult1, MeasResult2, …*

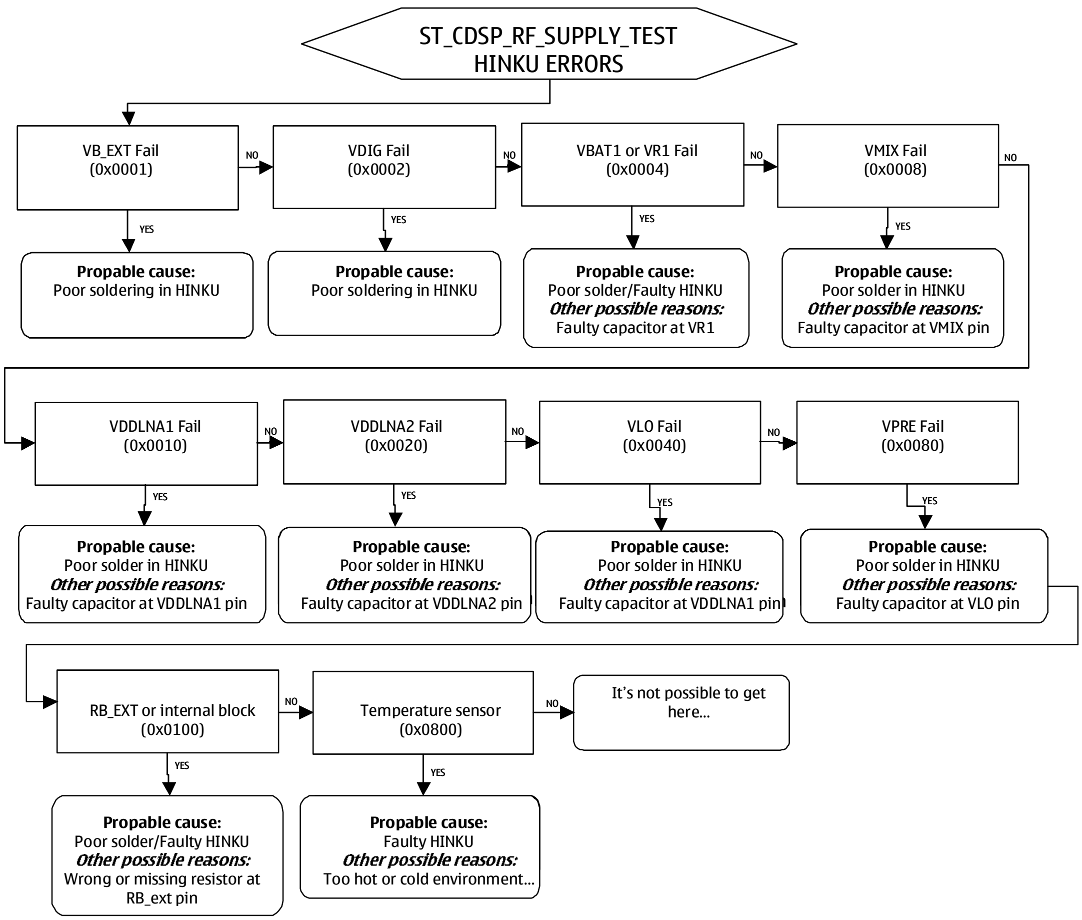
,where 0xyy, 0xyy part is the main part of the error code for Vinku TX ASIC: 0xyyyy

and 0xzz, 0xzz is the main part of the error code for Hinku TX ASIC: 0xzzzz




ST_CDSP_RF_SUPPLY_TEST, VINKU ERRORS, PAGE2
VB_EXT line fail (0x0001)
NO
VXO supply fail (0x0002)
NO
VBAT1 OR VR1 (0x0004)
NO
VBAT2 OR VR2 (0x0008)
NO
Go to ST_CDSP_RF_SUPPLY_TEST_VINKU ERRORS PAGE 3
YES
Does also Hinku's VB_EXT line fail (0x0001)
NO
YES
Propable cause: Faulty Vinku/Test error (BB/IF tests have been passed so VDIG has to be OK! So the problem is in the test mux)
YES
VBAT1 (VBAT_ASIC) OK?
YES
VBAT2 (VBAT_ASIC) OK?
YES
Propable cause: Poor soldering/faulty RETU Other possible reasons: -Problem in VB_EXT connection between RF & BB - Poor soldering/faulty HINKU and VINKU
Propable cause: Poor solder/faulty VINKU
VR1 (VREG1) OK?
NO
YES
VR2 (VREG2) OK?
NO
YES
Propable cause: Test error
Propable cause: Test error
Propable cause: Poor soldering/faulty RETU Other possible reasons: Faulty capacitor connected to VR1
Propable cause: Poor solder/faulty VINKU Other possible reasons: Faulty capacitor connected to VR2


ST_CDSP_RF_SUPPLY_TEST,
VINKU ERRORS, PAGE 3
VRFTX fail
(0x0010)
NO
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VRXTX pin
VVGA fail
(0x0020)
NO
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VVGA pin
VVCO fail
(0x0040)
NO
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VVCO pin
VLO fail
(0x0080)
NO
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VLO pin
VPRE fail
(0x0100)
NO
YES
Propable cause:
Poor solder
Other possible reasons:
Faulty capacitor at VPRE pin
RBE_EXT or internal
bias block
(0x0200)
NO
YES
Propable cause:
Poor solder/Faulty VINKU
Other possible reasons:
Wrong or missing resistor at
RB_ext pin
Temperature sensor
(0x0800)
NO
YES
Propable cause:
Faulty VINKU
Other possible reasons:
Too hot or cold
environment...
It's not possible to get
here...



Please, refer to chapter Error Code Interpretation Examples if more information about error code interpretation is needed.

2.3 TX IQ self test (ST_CDSP_TX_IQ_TEST)

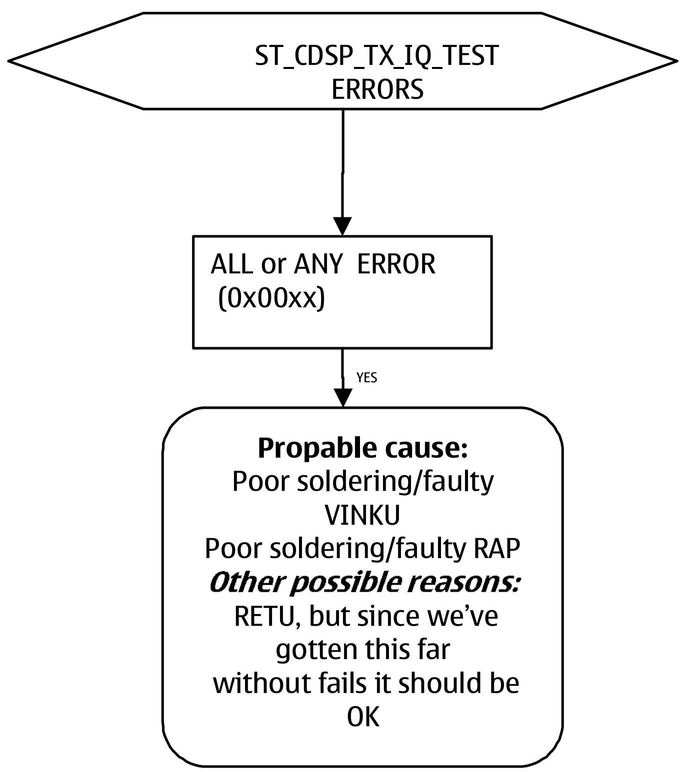
TX_IQ_TEST (85) checks that the TXIQ lines between RAP & Vinku are properly connected. If this fails also power tests and RXIQ loopback will fail.

Tested signals: VBAT_ASIC, TXIP, TXIQ, TXQP, TXQN, DAC_REF1, RFBUS

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz is the main part of the error code: 0xyyzz



2.4 TXC Data test (ST_TXC_DATA_TEST)

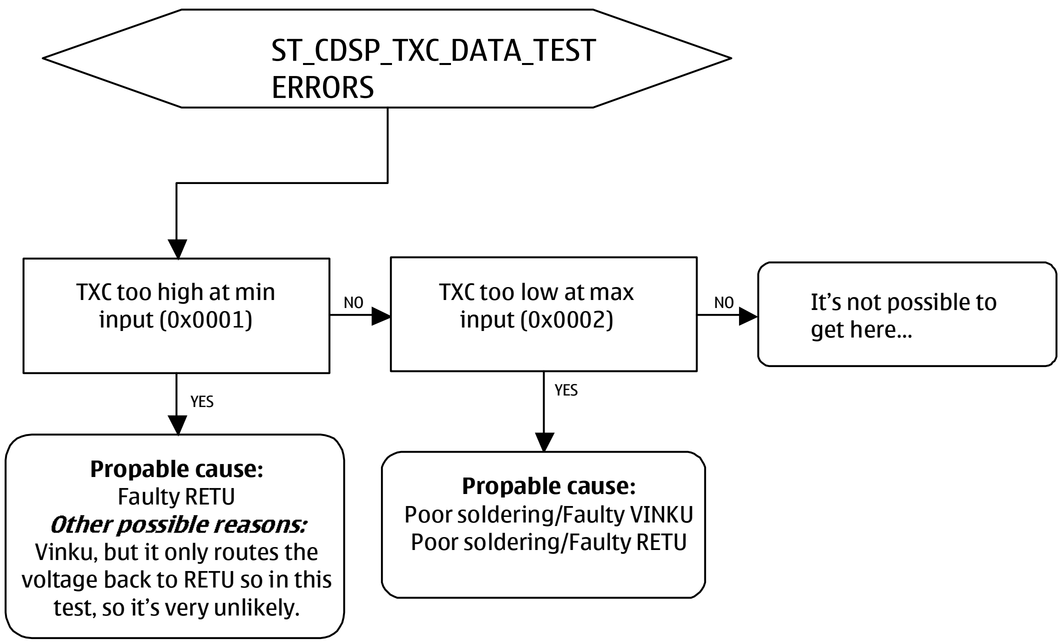
TXC_DATA_TEST (74) tests that the TXC line between RETU & VINKU is properly connected. If this fails also TX power tests will fail.

Test covers: TxC power control signal, Retu (N2200), RFBUS, Vinku (N7501), VBAT_ASIC

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz



2.5 WCDMA power detector biasing self test (ST_CDSP_PWR_DETECTOR_BIAS_TEST)

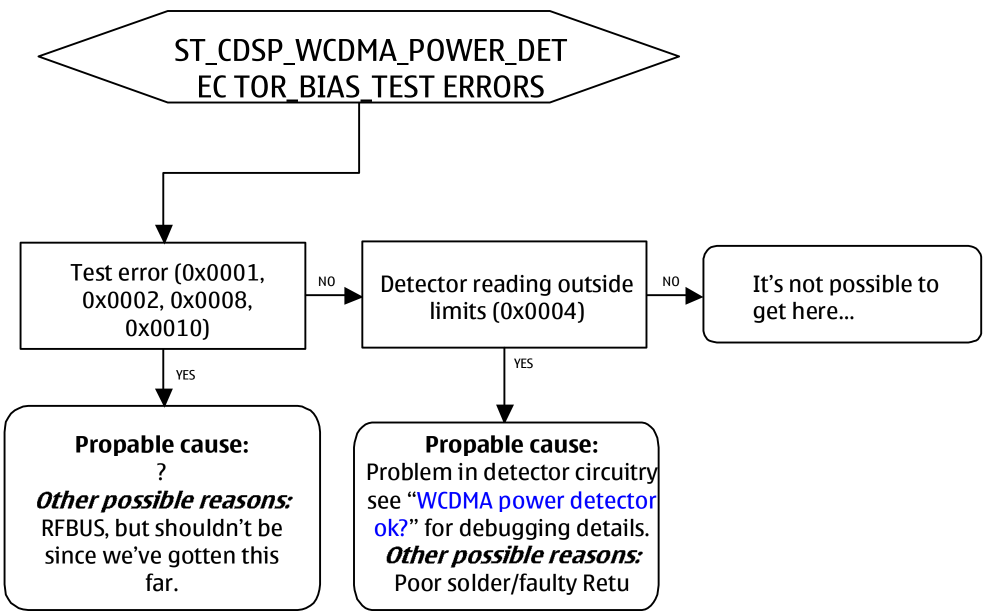
POWER_DETECTOR_BIAS_TEST (82) tests the biasing of the power detector.
If this fails, also the power tests will fail/can't be trusted.

Test covers: Vinku (N7501) WCDMA power detector biasing circuit functionality, Retu (N2200) WTXDET input. RFBUS, VBAT_ASIC

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz



Please, refer to chapter Error Code Interpretation Examples if more information about error code interpretation is needed.

2.5.1 WCDMA power detector ok?

Follow these instructions if it's needed to check WCDMA power detector functionality. Please notice that WCDMA power detector is used only in maximum TX power limiting and WCDMA PA supply voltage controlling purposes.

- WCDMA transmitter has to be active before measurements. Procedure is explained in chapter "Transmitter troubleshooting".

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7531.
- WTXDET signal should be constant DC-voltage. Voltage level should change if TX power is changed. Vcontrol is lower on lower power levels and higher if higher power levels are used.
- WTXDET should be about 325 mV with power level +10 dBm, about 1.03 V with power level +21 dBm and about 150 mV when power levels below 0 dBm are used.
- **NOTICE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.**
- If WTXDET –signal is not as expected follow the same troubleshooting instructions as in: Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?

2.6 RX PLL phase lock self test (ST_CDSP_RX_PLL_PHASE_LOCK_TEST)

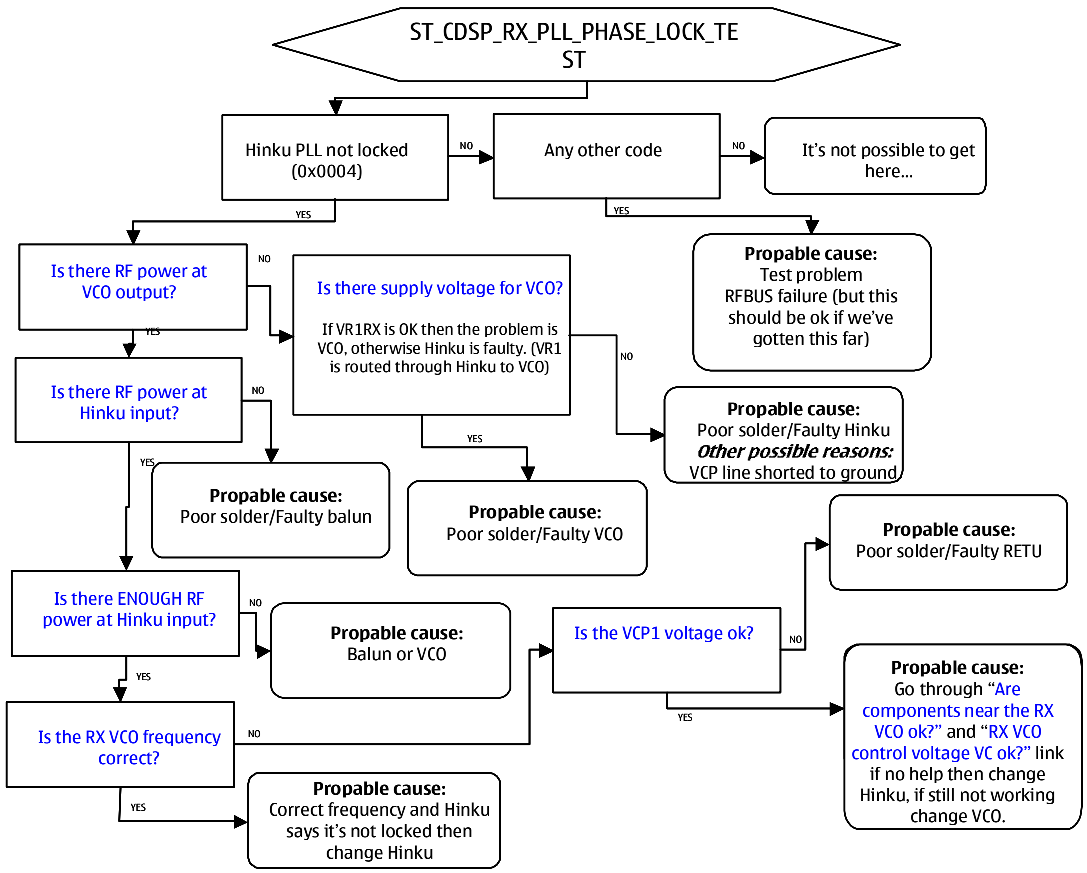
RX_PLL_LOCK_TEST (79) tests the functionality of RX PLL. If this fails, none of the RX related measurements cannot be trusted.

Tested signals: VBAT_ASIC, VDIG, VR1, VR1RX, VCP1, RFBUSDAT, RFBUSCLK, RFBUSENA, RXRESETX

Error code for this self test is given in format:

- *0xyy, 0xzz*

,where 0xyy, 0xzz part is the total error code: 0xyyzz



2.7 TX PLL phase lock self test (ST_CDSP_TX_PLL_PHASE_LOCK_TEST)

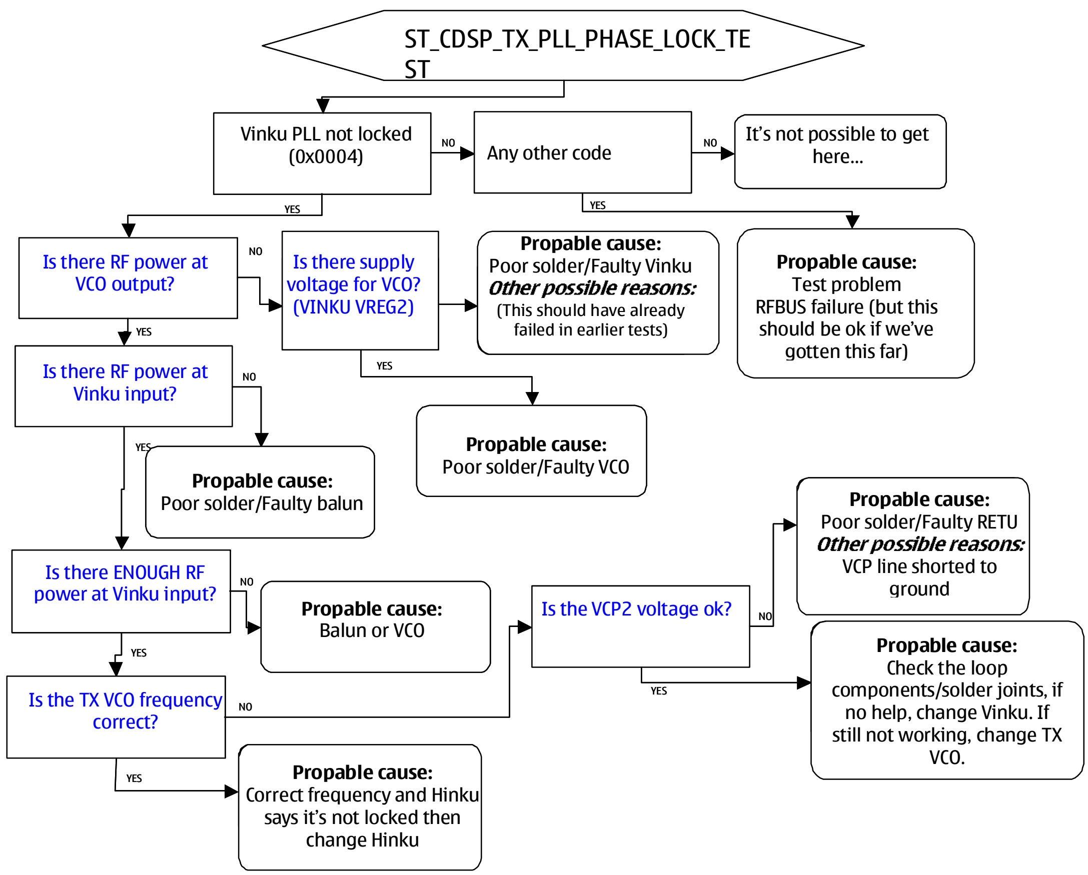
TX_PLL_LOCK_TEST (80) tests the functionality of RX PLL. If this fails also the TX power tests will fail.

Tested signals: VBAT_ASIC, VDIG, VR1, VCP2, RFBUSDAT, RFBUSCLK, RFBUSENA, TXRESETX

Error code for this self test is given in format:

- *0xyy, 0xzz*

,where 0xyy, 0xzz part is the total error code: 0xyyzz



2.8 WCDMA transmitter self test (ST_CDSP_WCDMA_TX_POWER_TEST)

TX_WCDMA_POWER_TEST (75) checks the output power of the WCDMA transmitter.

Test covers: Modulator, Vinku (N7501) IC gain stages, IC output supply components, TX filter, WCDMA PA (N7503), DCDC-converter (N7504), RFBUS, VBAT_ASIC, VBAT_PA

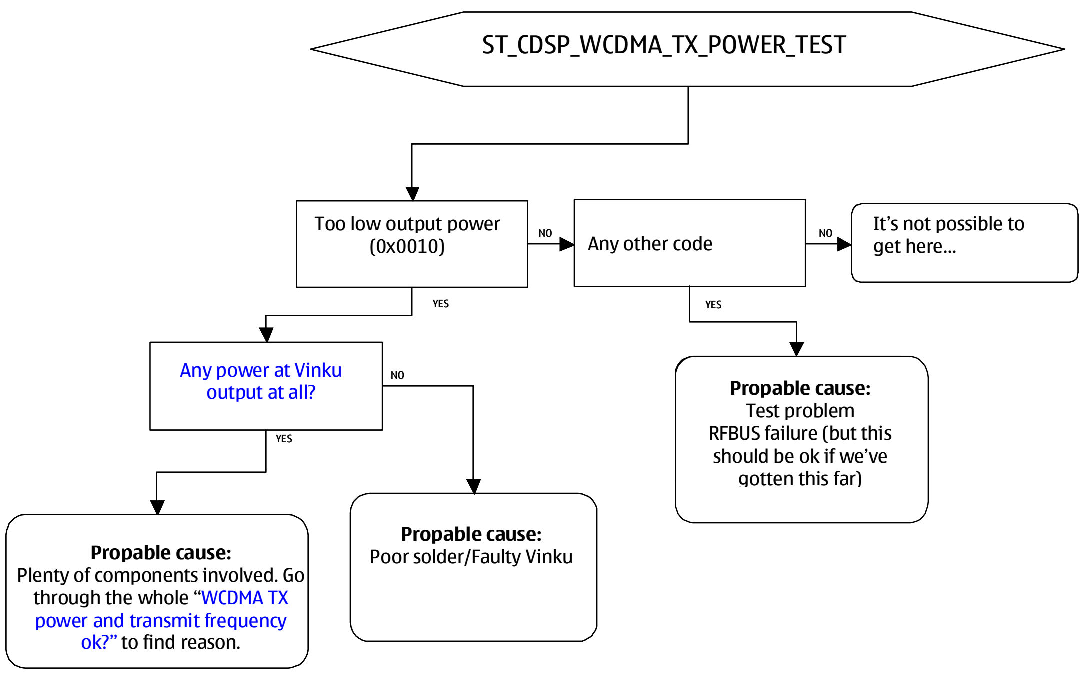
Test does not cover: Circulator (Z7505), duplexer (Z7502), and antenna

To prevent network interference, the phone must be in an RF shield box, when this test is run!

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz



2.9 RX IQ loop back self test (ST_CDSP_RX_IQ_LOOP_BACK_TEST)

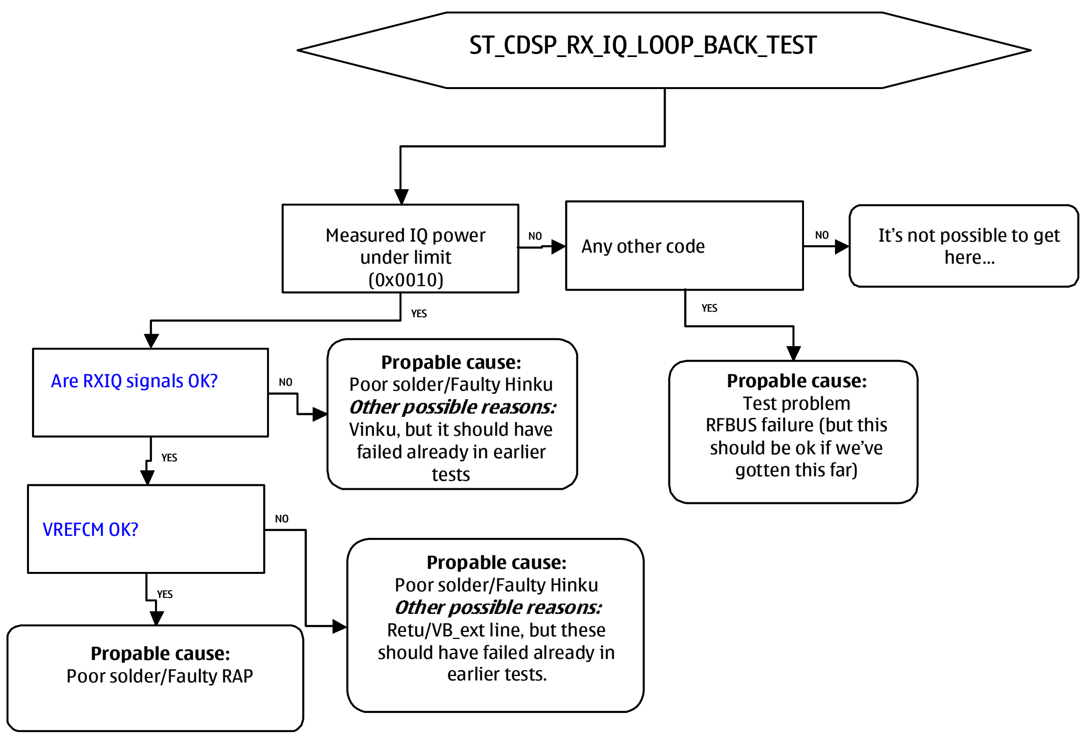
RX_IQ_LOOPBACK (81) tests that the RXI lines & VREFCM line between RAP & HINKU are connected.

Tested signals: VBAT_ASIC, RXQP, RXQN, RXIP, RXIN, VREFCM, TXIP, TXIN, RFBUS

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz



2.10 GSM transmitter self test (ST_CDSP_GSM_TX_POWER_TEST)

TX_GSM_POWER_TEST (77) checks the output power of the GSM transmitter.

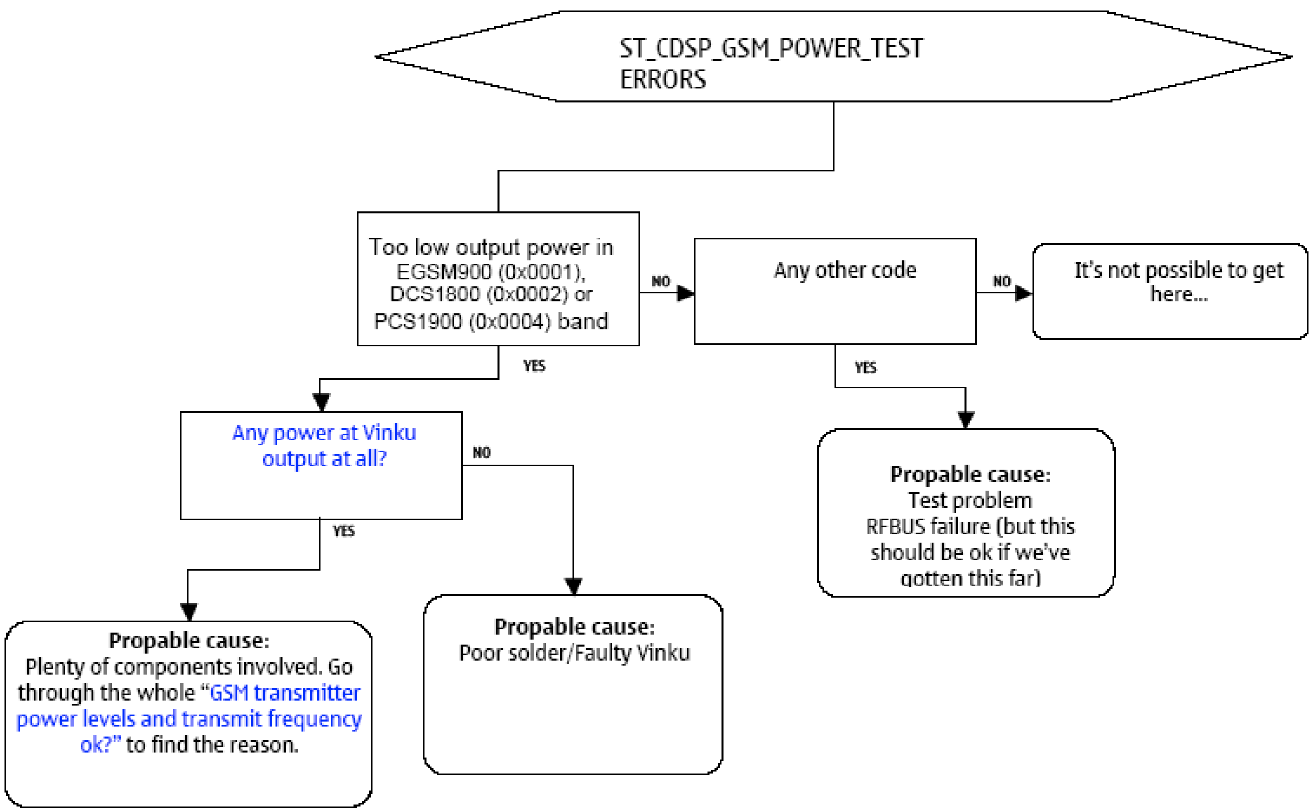
Test covers: RFIC Vinku (N7501), modulator, IC gain control stages, filter/balun solder joints, GSM PA (N7502), PA bias lines & DACs, RFBUS, TX power detector functionality, VBAT_ASIC, VBAT_PA.

Test does not cover: Antenna functionality, RX/TX-switch functionality, and TX signal quality

Error code for this self test is given in format:

- *0xyy, 0xzz, MeasResult1, MeasResult2, ...*

,where 0xyy, 0xzz part is the main part of the error code: 0xyyzz



2.11 Error Code Interpretation Examples

This section presents three different examples of RF error code interpretation.

2.11.1 Example 1

ST_CDSP_RX_PLL_PHASE_LOCK self test gives “Fatal” result with error code: 0x00, 0x04

This means that the total error code is “0x004” (“0000 0000 0000 0100” in binary format) and if we look a flowchart in section RX PLL phase lock self test (ST_CDSP_RX_PLL_PHASE_LOCK_TEST) the meaning for the code is “*Hinku PLL is not locked*”.

2.11.2 Example 2

Some of the self-tests can return multiple errors at the same time.

For example: RF-BB interface (ST_CDSP_RF_BB_IF_TEST) self test gives “Fatal” result with error code: 0x00, 0x09, ...

This means that the total error code without measurement values is “0x0009” and this is the same as “0000 0000 0000 1001” in binary format. If we look closer there are multiple errors (2) found:

Bit mask “---- ---- ---- ---1” = “0x0001”

Bit mask “---- ---- ---- 1---“ = “0x0008”

Troubleshooting can be continued with RF-BB interface (ST_CDSP_RF_BB_IF_TEST) flowchart because there are errors with two error codes: 0x0001 and 0x0008.

2.11.3 Example 3

Supply test for Hinku and Vinku (ST_CDSP_RF_SUPPLY_TEST) is slightly different self test from others because there are both Vinku and Hinku errors shown in the same error code (*The format for error code is explained in section Supply test for Hinku and Vinku*).

For example: ST_CDSP_RF_SUPPLY_TEST gives “Fatal” result with error code: 0x0B, 0xBC, 0x00, 0x00, ...

This error code means that there are probably no errors in Hinku RX ASIC supply voltages because the main part of the error code for Hinku is 0x00, 0x00 (=0x0000) and means the same as “no errors”.

Anyway, there are many errors with Vinku TX ASIC supply voltages. The main part of the error code for Vinku is 0x0B, 0xBC and that’s the same as “101110111100” in binary format. If we look closer there are multiple (8) errors found:

Bit mask “---- ---- ---- -1--“ = “0x0004”

Bit mask “---- ---- ---- 1---“ = “0x0008”

Bit mask “---- ---- ---1 ----“ = “0x0010”

Bit mask “---- ---- --1- ----“ = “0x0020”

Bit mask “---- ---- 1--- ----“ = ”0x0080”

Bit mask “---- ---1 ---- ----“ = “0x0100”

Bit mask “---- --1- ---- ----“ = ”0x0200”

Bit mask “---- 1--- ---- ----“ = ”0x0800”

Troubleshooting can be continued with ST_CDSP_RF_SUPPLY_TEST VINKU flowchart because there are errors with eight VINKU error codes.

Typically this kind of error occurs if there is no VBAT_ASIC voltage coming to the Vinku TX ASIC at all or the ASIC is poorly soldered to the PWB (All voltages that are somehow related to VBAT_ASIC are causing errors).

3. DOES THE PHONE REGISTER TO THE NETWORK AND MAKE A CALL (GSM)?

- Test against a GSM communication tester or real GSM network with a proper SIM.

3.1 GSM transmitter power levels and transmit frequency ok?

- Attach the phone to the product specific test jig and a spectrum analyser to the RF-coupler. Coupler attenuation should be also taken into account during measurements.
- Set GSM Tx ON. Procedure is explained in section “Transmitter troubleshooting”.
- Spectrum analyser centre frequency should be set according the used TX channel (See section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 1 MHz, Span 0 MHz, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Test at least the maximum and minimum power levels:

- EGSM900: The maximum power level is “5” (31 – 34 dBm, typ. value +33 dBm)

  The minimum power level is “19” (3 – 7 dBm, typ. value +5 dBm)
- GSM1800: The maximum power level is “0” (28 – 32 dBm, typ. value +30 dBm)

  The minimum power level is “15” (-2 - +2 dBm, typ. value +0 dBm)
- GSM1900: The maximum power level is “0” (28 – 32 dBm, typ. value +30 dBm)

  The minimum power level is “15” (-2 - +2 dBm, typ. value +0 dBm)

- If power is not as expected separate the phone into parts and place to the module jig. Connect the spectrum analyser to the module jig GSM RF connector and measure power levels again (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

- Power levels ok in the module jig: Antenna or antenna connection bad. Replace the antenna
- Power levels still wrong or no TX signal found at all: Continue troubleshooting

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If the signal is found to be on wrong frequency or frequency is not stabile, see section 3.1.3. "GSM transmitter frequency correct".

3.1.1 Does GSM TX transmit RF-power at all?

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If signal is found to be on wrong frequency or frequency is not stabile, see section, 3.1.3. "GSM transmitter frequency correct".

3.1.1.1 Is Vinku (N7501) transmitting RF-power at all?

- GSM transmitter has to be active before Vinku's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- EGSM900:

- Connect the RF probe to Z7504 input. The level should be about the same on both input pins. Check output level with at least the maximum (5) and the minimum (19) power levels.

- Maximum power level – Output level should be about -15...-25 dBm

- Minimum power level – Output level should be about -45...-55 dBm

- GSM1800/GSM1900:

- Connect the RF probe to C7577 or C7575. The level should be about the same on both capacitors. Check output level with at least the maximum (0) and the minimum (15) power levels.

- Maximum power level – Output level should be about -25...-35 dBm

- Minimum power level – Output level should be about -55...-65 dBm

- Check if output levels of Vinku are as expected.

- **NOTE! If VINKU output RF-power is totally missing just in one or two GSM-bands, typically this means that Vinku ASIC (N7501) is faulty or the ASIC is badly soldered. For example: VINKU is not transmitting at all in EGSM900-band but TX-power is ok in other GSM-bands. Then it's quite clear that VINKU (N7501) is faulty or badly soldered and the component should be replaced.**

3.1.1.1.1 RF operating voltage VBAT_ASIC?

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to C7503 (or C7501, C7541)

- VBAT_ASIC voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.1.1.1.1 Ferrite inductor L7503 ok?

- Check that component is in place and solder joints are ok

- Measure voltage from the both ends of L7503. Is it faulty or is there short circuit in RF end?

- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.1.1.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements". Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don't necessarily look like in figures mentioned below.

- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:

- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in section 6.5.9.3 "RFBUSDAT (GSM RX)"

- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in sections 6.5.9.1 "RFUSCLK (GSM RX)" and 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"

- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in section 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"

- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

3.1.1.1.2.1 RAP3G (or Vinku or Hinku) faulty?

- RAP3G (D2800) cannot be replaced.

3.1.1.1.3 Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section "Transmitter troubleshooting."

- Measurements can be done with an oscilloscope and a probe.

- VREG1: Connect the probe to C7543

- VREG2: Connect the probe to C7548 (or C7547)

- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.1.1.1.3.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.1.1.1.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.1.1.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after the measurement.

3.1.1.1.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.1.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.1.1.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

3.1.1.1.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.1.1.3.1.3.1 Is R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.1.1.1.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not

help go to the next step.

3.1.1.1.3.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.1.1.3.1.4 Replace Vinku (N7501)

3.1.1.1.3.2 Are capacitors in Vinku (N7501) regulator lines working correctly?

VREG1: C7543

VREG2: C7547, C7548, C7554, C7555, C7553, C7552, C7558 and C7567

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that regulator lines are not short-circuited to the ground. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.1.3.3 TX VCO (G7502) ok?

3.1.1.1.3.4 Replace Vinku (N7501)

3.1.1.1.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.1.1.4.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.1.1.1.4.2 Replace Retu

3.1.1.1.4.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.1.1.1.5 VCP2-voltage ok?

- GSM transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

3.1.1.1.5.1 C7550 and C2221 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VCP2-line is short-circuited to the ground. If short-circuit is found replace C7550 and C2221. If this does not help go to the next steps.

3.1.1.1.5.2 Retu ok?

3.1.1.1.5.3 Vinku (N7501) ok?

3.1.1.1.6 Is there RF power in the TX VCO output at all?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done also without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The correct VCO frequency can be found in section "Frequency mappings". The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.1.1.6.1 TX VCO operating voltage VREG2 (VR2) ok?

- See section "Vinku (N7501) regulator voltages VREG1, VREG2 ok?"

3.1.1.1.6.2 Replace TX VCO (G7502)

3.1.1.1.7 Is TX VCO RF-signal coming to the Vinku at all?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.1.1.7.1 Replace balun T7503

3.1.1.1.8 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3. "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.1.1.1.9 Is there TXC-signal coming to Vinku ASIC (N7501)?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level first to the maximum ("5" in EGSM900 and "0" in GSM1800/GSM1900)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 6.5.2 "TXC in GSM mode (DC Offset 0 V)" (EGSM900 TX power level 5) and voltage levels should be roughly:

- EGSM900: 1.8 V while TX burst and 0 V otherwise.
- GSM1800/GSM1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level ("19" in EGSM and "15" in GSM1800/GSM1900)
- Typical TX control voltage TXC levels should be now about:

- EGSM900: 1.0 V while TX burst and 0 V otherwise.
- GSM1800/GSM1900: 0.7 V while TX burst and 0 V otherwise.

3.1.1.1.9.1 R7514 in place?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7514 resistance value with an ohmmeter

3.1.1.1.9.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7549is not short-circuited. If short-circuit is found replace the capacitor.

3.1.1.1.9.3 Retu ok?

3.1.1.1.10 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1. "VCTCXO Output (DC Offset 1.24 V)"..

3.1.1.1.10.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.1.1.10.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.1.1.1.10.1.2 Replace Retu

3.1.1.1.10.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.1.1.1.10.2 BB AFC-voltage ok?

- See section "BB AFC-voltage ok?"

3.1.1.1.10.3 Replace VCTCXO G7501

3.1.1.1.11 Replace Vinku (N7501)

3.1.1.2 Is there RF-power in the GSM PA (N7502) input at all?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“5” in EGSM900 and “0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and

sweep time at least 2.5 seconds.

- EGSM900: Connect the probe to J7521 (test point). The RF level should be roughly -15...-20 dBm.
- GSM1800 or GSM1900: Connect the probe to R7512 output. The RF level should be roughly -20...-30 dBm.

3.1.1.2.1 EGSM900: Replace SAW Z7504

3.1.1.2.2 GSM1800/GSM1900: Is Vinku (N7501) output RF-signal coming to the T7502 (Balun)?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”. Set TX power level to the maximum (“0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to T7502 input. There are two input ports in T7502 because the input port is balanced. The RF level should be roughly -25 dBm in both inputs.

3.1.1.2.2.1 Matching components ok?

GSM1800/GSM1900: C7575 and C7577

- Check that components are in place and solder joints are ok
- GSM1800 and GSM1900: Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7575 and C7577 are not short-circuited. If short-circuit is found replace the faulty capacitor.

3.1.1.2.3 GSM1800/GSM1900: Is there RF power in the balun (T7502) output at all?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”. Set TX power level to the maximum (“0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to R7512 input. The RF level should be roughly -20...-30 dBm.

3.1.1.2.3.1 Replace balun T7502

3.1.1.2.4 GSM1800/GSM1900: Replace attenuator R7512

3.1.1.3 Does GSM PA (N7502) transmit RF-power at all?

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the minimum ("19" in EGSM900 and "15" in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900: Connect the probe to J7520 (test point). The RF level should be about -16…-17 dBm.
- GSM1800 or GSM1900: Connect the probe to J7519 (test point). The RF level should be roughly -29…-30 dBm in both bands.

3.1.1.3.1 GSM PA (N7502) operating voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7593
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V

3.1.1.3.1.1 PA operating voltage VBAT_PA ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.1.3.1.1.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.1.3.1.2 C7593 ok?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

3.1.1.3.1.3 Replace inductor L7516

- If replacing does not help, replace GSM PA (N7502)

3.1.1.3.2 Are bias currents coming correctly to the GSM PA (N7502)?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 "Icont_21/Icont_22 (DC offset 1.2V)" when measured with an oscilloscope and a probe. Check both currents.

- GSM1800 or GSM1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 when measured with an oscilloscope and a probe. Check both currents.

3.1.1.3.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.1.1.3.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.1.3.2.3 Replace Vinku (N7501)

3.1.1.3.3 Replace PA (N7502)

3.1.1.4 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use “RF Controls” window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in section “Transmitter troubleshooting”. GSM RX activation is described in section “GSM RX chain activation for manual measurements”.
- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. “Hi” means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. “Lo” means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed
- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations from section “Test point locations”). Notice: these test points are PWB pads for three non-assembled capacitors.

Switch mode	Vc1	Vc2	Vc3
EGSM_RX	Lo	Lo	Lo
DCS_RX	Lo	Lo	Lo
PCS_RX	Lo	Lo	Hi
EGSM_TX	Hi	Lo	Lo
DCS/PCS_TX	Lo	Hi	Hi

3.1.1.4.1 Replace Hinku (N7500)

3.1.1.5 Replace antenna Switch Z7503

3.1.2 Does GSM TX transmit enough RF-power and power levels otherwise ok?

3.1.2.1 Is Vinku ASIC (N7501) transmitting correct RF-power?

- GSM transmitter has to be active before Vinku’s output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”). Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900:

- Connect the RF probe to Z7504 input. The level should be about the same on both input pins. Check output level with at least the maximum (5) and the minimum (19) power levels.
- Maximum power level – Output level should be about -15...-25 dBm
- Minimum power level – Output level should be about -45...-55 dBm

- GSM1800/GSM1900:

- Connect the RF probe to C7577 or C7575. The level should be about the same on both capacitors. Check output level with at least the maximum (0) and the minimum (15) power levels.

- Maximum power level – Output level should be about -25...-35 dBm

- Minimum power level – Output level should be about -55...-65 dBm

- Check if output levels of Vinku are as expected.

- NOTE! **If VINKU ASIC is transmitting wrong TX power just in one or two GSM-bands, typically this means that Vinku ASIC (N7501) is faulty or the ASIC is badly soldered. Of course SAW-filter Z7504 or balun T7502 can be also faulty/badly soldered and causing short-circuit, but probability to this is quite low. For example: VINKU is transmitting too low power in EGSM900-band but TX-power is ok in other GSM-bands. Then it's almost clear that VINKU (N7501) is faulty or badly soldered and the component should be replaced.**

3.1.2.1.1 RF operating voltage VBAT_ASIC ok?

- See section "RF operating voltage VBAT_ASIC ok?"

3.1.2.1.2 Are Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- GSM transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurements can be done with an oscilloscope and a probe.

- VREG1: Connect the probe to C7543

- VREG2: Connect the probe to C7548 (or C7547)

- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.1.2.1.2.1 Vinku (N7501) RB_EXT voltage ok?

- GSM transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to R7521.

- RB_EXT voltage should be 1.325 – 1.375 V.

3.1.2.1.2.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to R7503.

- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.2.1.2.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after the measurement.

3.1.2.1.2.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.2.1.2.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.2.1.2.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

3.1.2.1.2.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.1.2.1.2.1.3.1 Is R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.1.2.1.2.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.1.2.1.2.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

3.1.2.1.2.2 Replace Vinku (N7501)

3.1.2.1.3 Are TX-IQ signal waveforms looking correct?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 ST_CDSP_TX_IQ_TEST these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.1.2.1.4 Is the TXC-signal coming to Vinku ASIC (N7501) OK? Is signal level correct?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level first to the maximum ("5" in EGSM900 and "0" in GSM1800/GSM1900)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- Typical TX control voltage TXC timing should look somehow similar to figure 6.5.2 "TXC in GSM mode (DC offset 0 V)" (EGSM900 TX power level 5) and voltage levels should be roughly:

- EGSM900: 1.8 V while TX burst and 0 V otherwise.
- GSM1800/GSM1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level ("19" in EGSM and "15" in GSM1800/GSM1900)
- Typical TX control voltage TXC levels should be now about:

- EGSM900: 1.0 V while TX burst and 0 V otherwise.

- GSM1800/GSM1900: 0.7 V while TX burst and 0 V otherwise.

3.1.2.1.4.1 R7514 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R514 resistance value with an ohmmeter

3.1.2.1.4.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check with an ohmmeter that C7549 is not short-circuited.

3.1.2.1.4.3 Retu ok?

3.1.2.1.5 Does GSM PA (N7502) get correct DET_SW_G -voltage from Vinku ASIC (N7501)?

- GSM transmitter has to be active before DET_SW_G voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7595 pad. Notice: C7595 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- DET_SW_G voltage should be about 2.8 V while TX burst and 0 V otherwise.

3.1.2.1.5.1 C7595 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check with an ohmmeter that C7595 is not short-circuited.

3.1.2.1.5.2 Replace Vinku (N7501)

3.1.2.1.6 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor.
- Check R7516 resistance value with an ohmmeter and replace resistor if needed.

3.1.2.1.7 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.2.1.7.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.2.1.7.1.1 Replace TX VCO G7502

3.1.2.1.7.2 Replace balun T7503

3.1.2.1.8 Replace Vinku (N7501) or GSM PA (N7502)

- If the output level of Vinku is higher than wanted then replace GSM PA (N7502). Otherwise replace TX ASIC Vinku (N7501).

3.1.2.2 Does GSM PA (N7502) have enough RF-power in its input?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“5” in EGSM900 and “0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900: Connect the probe to J7521 (test point). The RF level should be roughly -15...-20 dBm.
- GSM1800 or GSM1900: Connect the probe to R7512 output. The RF level should be roughly -20...-30 dBm.

3.1.2.2.1 EGSM900: Replace SAW Z7504

3.1.2.2.2 GSM1800/GSM1900: Is Vinku (N7501) output RF-signal coming correctly to the T7502 (Balun)?

- GSM transmitter has to be active before measurements Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to T7502 input. There are two input ports in T7502 because the input port is balanced. The RF level should be roughly -25 dBm in both inputs.

3.1.2.2.2.1 Matching components ok?

GSM1800/GSM1900: C7575 and C7577

- Check that components are in place and solder joints are ok
- GSM1800 and GSM1900: Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7575 and C7577 are not short-circuited. If short-circuit is found replace the faulty capacitor.

3.1.2.2.3 GSM1800/GSM1900: Is there correct RF power in the balun (T7502) output?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the maximum (“0” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- GSM1800 or GSM1900: Connect the probe to R7512 input. The RF level should be roughly -20...-30 dBm.

3.1.2.2.3.1 Replace balun T7502

3.1.2.2.4 GSM1800/GSM1900: Replace attenuator R7512

3.1.2.3 GSM PA (N7502) transmitting correct RF-power?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to the minimum (“19” in EGSM900 and “15” in GSM1800/GSM1900)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- EGSM900: Connect the probe to J7520 (test point). The RF level should be about -16...-17 dBm.
- GSM1800 or GSM1900: Connect the probe to J7519 (test point). The RF level should be roughly -29...-30 dBm in both bands.

3.1.2.3.1 GSM PA (N7502) operating voltage ok?

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to C7593
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.2.3.1.1 PA operating voltage VBAT_PA ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

3.1.2.3.1.1.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.2.3.1.2 C7593 ok?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

3.1.2.3.1.3 Replace inductor L7516

- If replacing doesn't help then replace GSM PA (N7502)

3.1.2.3.2 Are bias currents coming correctly to the GSM PA (N7502)? Level ok?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 "Icont_21/Icont_22 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

- GSM1800 or GSM1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 “Icont_31/Icont_32 (DC Offset 1.2 V)” when measured with an oscilloscope and a probe. Check both currents.

3.1.2.3.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.1.2.3.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

3.1.2.3.2.3 Replace Vinku (N7501) or GSM PA (N7502)

3.1.2.3.3 Replace GSM PA (N7502)

3.1.2.4 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use “RF Controls” window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in section “Transmitter troubleshooting”. GSM RX activation is described in section “GSM RX chain activation for manual measurements”.
- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. “Hi” means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. “Lo” means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed
- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations, see section “Test point locations). Notice: these test points are PWB pads for three non-assembled capacitors.

Switch mode	Vc1	Vc2	Vc3
EGSM_RX	Lo	Lo	Lo
DCS_RX	Lo	Lo	Lo
PCS_RX	Lo	Lo	Hi
EGSM_TX	Hi	Lo	Lo
DCS/PCS_TX	Lo	Hi	Hi

3.1.2.4.1 Replace Hinku (N7500)

3.1.2.5 Replace antenna Switch Z7503

3.1.2.6 Replace antenna switch Z7503

3.1.3 GSM transmitter frequency correct?

- Connect a spectrum analyser to the module test jig's RF connector.
- Set GSM Tx ON. Procedure is explained in section "Transmitter troubleshooting".
- Check if the frequency of the GSM transmitter is as expected. If output signal is not found try to use 500 MHz span setting.

  The correct TX frequency is shown in Phoenix "RF Controls (GSM)" window and can be found also in see section "Frequency mappings". If the frequency is not found at all then go to 3.1.1 "Does GSM TX transmit RF-power at all?"

3.1.3.1 Is TX VCO frequency as expected?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). This method can be used only to check that the TX VCO is alive. It won't expose if the T7503 is broken or the output level of the VCO is too low. Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.3.1.1 C7543, C7548 and L7517 ok?

- These components should be checked if TX VCO frequency is not stable and TX PLL frequency not locked.
- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

3.1.3.1.2 TX VCO control voltage VC ok?

- GSM transmitter has to be active before TX VCO control voltage VC can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7519.
- Typical TX VCO control voltage VC should look somehow similar to figure 6.5.3 "TX VC in GSM mode (DC offset 1.8V). DC voltage level should change if TX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

3.1.3.1.2.1 VCP2-voltage ok?

- GSM transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

3.1.3.1.2.1.1 C7550 and C2221 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VCP2-line is short-circuited to the ground. If short-circuit is found replace C7550 and C2221. If this does not help go to the next steps.

3.1.3.1.2.1.2 Retu ok?

3.1.3.1.2.1.3 Vinku (N7501) ok?

3.1.3.1.2.2 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.1.3.1.2.3 Balun T7503 ok?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is

not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.3.1.2.4 Components near TX VCO ok?

C7571, R7519, R7523, C7573 and C7568 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

3.1.3.1.2.5 Replace Vinku (N7501) or TX VCO (G7502) or both

3.1.3.1.3 Replace TX VCO G7502

3.1.3.2 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.1.3.2.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider

span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.1.3.2.1.1 Replace TX VCO G7502

3.1.3.2.2 Replace balun T7503

3.1.3.3 VCTCXO frequency and output level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.1.3.3.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.1.3.3.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.1.3.3.1.2 Replace Retu

3.1.3.3.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.1.3.3.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.1.3.3.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is

found replace C7533. If this does not help then go to the next steps.

3.1.3.3.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

3.1.3.3.2.3 Replace Retu

3.1.3.3.3 Replace VCTCXO G7501

3.2 Does the phone give realistic RSSI-values?

Attach the phone to the product specific test jig and a signal generator to the RF-coupler. Coupler attenuation should be also taken into account during measurements.

Use the signal generator to supply -90 dBm RF-level (unmodulated signal) to the phone via the antenna coupler. Set generator RF-level to -90 dBm + cable and coupler attenuation. This measurement should be performed in a RF-shielded environment because existing GSM-network base stations can disturb this measurement otherwise.

- Set RF-generator frequency as following:

- EGSM900: 942.46771 MHz (channel 37)

- GSM1800: 1842.86771 MHz (channel 700)

- GSM1900: 1960.06771 MHz (channel 661)

- Use Phoenix testing & tuning software to perform GSM receiver activation and RSSI measurement for proper channels. Procedure is explained in section “GSM RX chain activation for manual measurements” (Start “Testing” -> “GSM” -> “RSSI Reading” tool in Phoenix. Select the correct band and channel).

- “RSSI Reading” -tool should show quite exact -90 dBm RSSI level. Remember to take into account attenuation between the phone and signal generator. Test also Q and I branches separately. Signal level in both I and Q lines should be about -93 dBm

- Increase signal generator RF level to -60 dBm. Phoenix ”RSSI Reading” tool should show now quite exact RSSI level -60 dBm. Test also Q and I branches separately. Signal level in both I and Q lines should be about -63 dBm

- If RSSI-levels are not as expected separate the phone into parts and place to the module jig. Connect the signal generator to the module jig GSM RF connector (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.2.1 Is Hinku (N7500) ASIC receiving RF-power correctly from the GSM-antenna connector?

- GSM receiver has to be active before measurements. Procedure is explained in section “GSM RX chain activation for manual measurements.”

- Connect an RF-generator to the GSM-antenna connector
- Set RF-generator frequency as following:

- EGSM900: 942.46771 MHz
- GSM1800: 1842.86771 MHz
- GSM1900: 1960.06771 MHz

- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW and VBW = 10 kHz, Span = 0 kHz, sweep time 5 ms.
- RF-signals in this measurement are pulsed and video triggering is needed in the spectrum analyser (software dependent issue. With some phone softwares these signals are constant in "Local" mode and triggering is not needed)
- EGSM900: Connect the probe to C7512 or C7514. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.
- GSM1800: Connect the probe to C7581 or C7584. The RF level should be roughly -85…-90 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.
- GSM1900: Connect the probe to C7523 or C7525. The RF level should be roughly -85…-90 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both capacitors. Remember to select the correct band also in Phoenix.
- **NOTE! If RSSI-values are correct only in one or two GSM-bands but RX ASIC HINKU (N7500) is receiving RF-power correctly from the GSM antenna connector in all three GSM-bands, typically this means that Hinku ASIC (N7500) is faulty or the ASIC is badly soldered. For example: RSSI-values are not realistic in EGSM900-band but are ok in other bands and HINKU is receiving RF-power correctly in all bands. Then it's quite clear that HINKU (N7500) is faulty or badly soldered and the component should be replaced.**

3.2.1.1 Is Z7503 (antenna switch) working correctly?

- GSM receiver has to be active before measurements. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Connect an RF-generator to the GSM-antenna connector
- Set RF-generator frequency as following:

- EGSM900: 942.46771 MHz (Channel 37)
- GSM1800: 1842.86771 MHz (Channel 700)
- GSM1900: 1960.06771 MHz (Channel 661)

- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW and VBW = 10 kHz, Span = 0 kHz, sweep time 5 ms.

- RF-signals in this measurement are pulsed and video triggering is needed in the spectrum analyser (software dependent issue. With some phone softwares these signals are constant in “Local” mode and triggering is not needed).
- EGSM900: Connect the probe to L7504. The RF level should be roughly -75 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.
- GSM1800: Connect the probe to L7505. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.
- GSM1900: Connect the probe to L7506. The RF level should be roughly -85 dBm during RX period when input signal in GSM antenna connector is -50 dBm. RF-levels should be about the same on both ends of the inductor. Remember to select the correct band also in Phoenix.

3.2.1.1.1 Are control voltages VC1, VC2 and VC3 coming correctly to the antenna switch (Z7503)?

- Use “RF Controls” window in Phoenix test software to activate the GSM transmitter and to select the wanted GSM band. Procedure is explained in section “Transmitter troubleshooting”. GSM RX activation is described in section “GSM RX chain activation for manual measurements”.
- Use an oscilloscope and probe to find out if antenna switch control lines are working according to table shown below. “Hi” means that there is 2.4 – 2.8 V control voltage level in the corresponding control line. “Lo” means levels 0 – 0.2 V. Remember to trigger the oscilloscope because control voltages VC1, VC2 and VC3 are pulsed
- Connect the probe to correct test points to measure VC1, VC2 and VC3 voltages (check test point locations, see section “Test point locations”). Notice: these test points are PWB pads for three non-assembled
capacitors.

Switch mode	Vc1	Vc2	Vc3
EGSM_RX	Lo	Lo	Lo
DCS_RX	Lo	Lo	Lo
PCS_RX	Lo	Lo	Hi
EGSM_TX	Hi	Lo	Lo
DCS/PCS_TX	Lo	Hi	Hi

3.2.1.1.1.1 Replace Hinku (N7500)

3.2.1.1.2 Replace antenna switch Z7503

3.2.1.2 Are matching components in place and working correctly?

EGSM900: C7512, C7514 and L7504

GSM1800: C7581, C7584 and L7505

GSM1900: C7523, C7525 and L7506

- Check that components are in place and solder joints are ok
- Use an ohmmeter to check that inductors are conducting DC.
- Replace matching components

3.2.2 Are RX-IQ signal waveforms and levels correct?

- Measurements can be done with an oscilloscope, a probe and signal generator.
- GSM receiver has to be active before RX IQ-signals can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Apply –70 dBm RF signal from a signal generator to the module jig antenna connector and use following frequencies:

- EGSM900: 942.46771 MHz (Channel 37)
- GSM1800: 1842.86771 MHz (Channel 700)
- GSM1900: 1960.06771 MHz (Channel 661)

- Remember to change correct RX channels also to Phoenix “RF controls” window!
- Check RX I and RX Q -signals in following test points:

- RX I (positive): Connect the probe to test point J7508
- RX I (negative): Connect the probe to test point J7509
- RX Q (positive): Connect the probe to test point J7510
- RX Q (negative): Connect the probe to test point J7511

- The correct RX IQ-signal is shown in figure 6.5.6 "GSM RX IQ (DC Offset 0.4 V)". Level of all four IQ-signals should be about the same and RX IQ-signal frequency should be 67.71 kHz (lower detail figure). The phase shift between I- and Q-signals should be 90 degrees.

3.2.2.1 RF operating voltage VBAT_ASIC ok?

- See section “RF operating voltage VBAT_ASIC ok?”

3.2.2.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”. Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don’t necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:

- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in figures in section 6.5.9.3 “RFBUSDAT (GSM RX)”.

- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in section 6.5.9.1 "RFBUSCLK (GSM RX)" and 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"

- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in section 6.5.9.2 "RFBUSCLK and RFBUSENA (GSM RX)"

- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

3.2.2.2.1 RAP3G (or Vinku or Hinku) faulty?

- RAP3G (D2800) cannot be replaced.

3.2.2.3 Hinku (N7500) regulator voltage VR1 ok?

- GSM receiver has to be active before Hinku's VR1 voltage can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".

- Measurements can be done with an oscilloscope and a probe.

- Connect the probe to C7504 (or C7505)

- VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.2.2.3.1 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to R7504.

- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.2.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to R7503.

- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

3.2.2.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.2.2.3.1.1.2 Retu ok?

3.2.2.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R521 and R504 resistance values with an ohmmeter.

3.2.2.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.2.2.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.1.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

3.2.2.3.1.4 Replace Hinku (N7500)

3.2.2.3.2 Are capacitors in Hinku (N7500) regulator lines working correctly?

C7504, C7515, C7509, C7508, C7596, C7598 and C7505

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.3.3 RX VCO G7500 ok?

3.2.2.3.4 Replace Hinku (N7500)

3.2.2.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.2.2.4.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.2.2.4.2 Replace Retu

3.2.2.4.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.2.2.5 VCP1-voltage ok?

- GSM receiver has to be active before VCP1 voltage can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

3.2.2.5.1 C7507 and C2222 working properly?

- Check that the components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C507 and C2222 are not short-circuited.

3.2.2.5.2 Retu ok?

3.2.2.5.3 Hinku (N7500) ok?

3.2.2.6 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.2.2.6.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.2.2.6.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.2.2.6.1.2 Replace Retu

3.2.2.6.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.2.2.6.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.2.2.6.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

3.2.2.6.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

3.2.2.6.2.3 Replace Retu

3.2.2.6.3 Replace VCTCXO G7501

3.2.2.7 Is there RF power in the RX VCO output at all?

- GSM receiver has to be active before RX VCO’s output frequency and output level can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre

frequency should be set according the used RX channel (see section “Frequency mappings”).

- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

3.2.2.7.1 RX VCO operating voltage VR1 RX ok?

- GSM receiver has to be active before Hinku’s VR1 voltage can be measured. Procedure is explained in GSM RX chain activation for manual measurements.
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7504 (or C7505) VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

3.2.2.7.1.1 Hinku (N7500) regulator voltage VR1 ok?

- See section “Hinku (N7500) regulator voltage VR1 ok?”

3.2.2.7.1.2 Replace Hinku (N7500)

3.2.2.7.2 Replace RX VCO (G7500)

3.2.2.8 Is RX VCO RF-signal coming to the Hinku at all?

- GSM receiver has to be active before RX VCO’s output frequency and output level can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.8.1 Replace balun T7501

3.2.2.9 Is RX VCO frequency as expected?

- GSM receiver has to be active before RX VCO’s output frequency and output level can be measured.

Procedure is explained in section “GSM RX chain activation for manual measurements”.

- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

3.2.2.9.1 RX VCO control voltage VC ok?

- GSM receiver has to be active before RX VCO control voltage VC can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7501.
- Typical RX VCO control voltage VC should look somehow similar to figure 6.5.7 (GSM mode). VC voltage should be between 0.7 - 3.8 V. DC voltage level should change if RX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

3.2.2.9.1.1 VCP1-voltage ok?

- GSM receiver has to be active before VCP1 voltage can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

3.2.2.9.1.1.1 C7507 and C2222 working properly?

- Check that the components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C507 and C2222 are not short-circuited.

3.2.2.9.1.1.2 Retu ok?

3.2.2.9.1.1.3 Hinku (N7500) ok?

3.2.2.9.1.2 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku’s RB_EXT voltage can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”.

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.2.9.1.2.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.9.1.2.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

3.2.2.9.1.2.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.9.1.2.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.2.2.9.1.2.1.2 Retu ok?

3.2.2.9.1.2.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R521 and R504 resistance values with an ohmmeter.

3.2.2.9.1.2.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.2.9.1.2.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.2.2.9.1.2.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok

- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.2.9.1.2.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

3.2.2.9.1.2.4 Replace Hinku (N7500)

3.2.2.9.1.3 Balun T7501 ok?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.9.1.4 Are components near the RX VCO ok?

R7501, C7516, R7505, C7524 and C7522 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

3.2.2.9.1.5 Replace Hinku (N7500) or RX VCO (G7500) or both

3.2.2.9.2 Replace RX VCO G7500

3.2.2.10 Is RX VCO signal level in the T7501 output high enough?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm in

both output lines. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

3.2.2.10.1 RX VCO G7500 output level high enough?

- GSM receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings").
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during RX is active (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. Output level of the VCO should be about -20...-30 dBm.

3.2.2.10.1.1 Replace RX VCO G7500

3.2.2.10.2 Replace balun T7501

3.2.2.11 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.2.2.11.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.2.2.11.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.2.2.11.1.2 Replace Retu

3.2.2.11.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.2.2.11.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix "RF Controls" tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

3.2.2.11.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

3.2.2.11.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

3.2.2.11.2.3 Replace Retu

3.2.2.11.3 Replace VCTCXO G7501

3.2.2.12 Replace Hinku ASIC (N7500)

3.2.3 Is RAP3G ASIC getting ok VREFCM-signal from Hinku (N7500)? Signal level ok?

- GSM receiver has to be active before VREFCM signal can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to J7516.
- VREFCM voltage should be about 780 mV (continuous voltage).

3.2.3.1 Hinku (N7500) RB_EXT voltage ok?

- GSM receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.

- RB_EXT voltage should be 1.325 – 1.375 V.

3.2.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

3.2.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.2.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

3.2.3.1.1.2 Retu ok?

3.2.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R521 and R504 resistance values with an ohmmeter.

3.2.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

3.2.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

3.2.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not

help go to the next step.

3.2.3.1.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

3.2.3.1.4 Replace Hinku (N7500)

3.2.3.2 Replace Hinku (N7500)

- Also RAP3G can be faulty but it's not possible to replace this component

3.2.4 RAP3G faulty?

- Not possible to replace!

3.3 GSM Transmitter phase error ok?

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting". Change TX data type to "Random" in Phoenix.
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Trigger to TX burst midamble should be used.
- Attach the phone to the product specific test jig and the RF-measurement device to the RF-coupler. Coupler attenuation should be also taken into account during measurements.
- The RMS Phase error shall not be greater than 5° and the peak phase error not greater than 20°.
- If phase error is not as expected separate the phone into parts and place to the module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.3.1 Are capacitors in Vinku REG1 and REG2 lines in place?

C7554, C7555 and C7547 (GSM1800 and GSM1900: also C7552)

- Check that components are in place and solder joints are ok

3.3.2 Are capacitors in GSM PA power supply line in place?

- C7569 and C7583
- Check that component is in place and solder joints are ok

3.3.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.3.4 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".

- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.3.4.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO’s output frequency and output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.3.4.1.1 Replace TX VCO G7502

3.3.4.2 Replace balun T7503

3.3.5 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

3.3.5.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

3.3.5.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

3.3.5.1.2 Replace Retu

3.3.5.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

3.3.5.2 BB AFC-voltage ok?

- See section "BB AFC-voltage ok?"

3.3.5.3 Replace VCTCXO G7501

3.4 GSM (GMSK) modulation spectrum ok?

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Settings have to be done according to the 3GPP specifications. Modulation spectrum measurement is possible to perform also with a spectrum analyser, but in this case measurement settings have to be done manually.
- Attach the phone to the product specific test jig and the RF-test device to the RF-coupler. Coupler attenuation should be also taken into account during measurements.

- Set TX Data Type to “Random” in Phoenix
- Enter correct “Centre frequency” to the spectrum analyser (see section “Frequency mappings”) and “Span” should be set to 2 MHz. “RBW” and “VBW” should be set to 30 kHz.
- Select a correct attenuator in the spectrum analyser and set “reference level offset” according attenuation between the phone and the spectrum analyser.
- Enter “Sweep time” at least to 2.5 s.
- Check that the TX power is not over the specification limits in following offsets (tables below). If the measurement is performed with a spectrum analyser according above settings then there may be 1 to 3 dB exceeding with some limit values. This is caused because above settings are meant only for fast modulation spectrum checking and are not exactly done according 3GPP specification.

EGSM900/GSM1800:

Offset (kHz)	100	200	250	400	≥ 600 < 1 800
Limit (dBc)	+0,5	-30	-33	-60	-60

GSM1900:

Offset (kHz)	100	200	250	400	≥ 600 < 1 200	≥ 1 200 < 1 800
Limit (dBc)	+0,5	-30	-33	-60	-60	-60

One example of measured GSM Modulation Spectrum in EGSM900 band is presented in figure 6.5.8 "TX Modulation spectrum (GSM)"..

- If modulation spectrum is not as expected separate the phone into parts and place to the module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.4.1 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor. Check R7516 resistance value with an ohmmeter and replace resistor if needed.

3.4.2 Does GSM PA (N7502) get correct bias currents? Is the level of bias currents ok?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:

- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 "Icont_21/Icont_22 (DC Offset 1.2 V)", when measured with an oscilloscope and a probe. Check both currents.

- GSM1800 or GSM1900:

- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB

Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 "Icont_31/Icont_32 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

3.4.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.4.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.4.2.3 Replace Vinku (N7501)

3.4.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

3.4.4 Is TX VCO signal level in the T7503 output high enough?

- GSM transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines during GSM TX burst. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

3.4.4.1 TX VCO G7502 output level high enough?

- GSM transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").

- Spectrum analyser RBW and VBW = 1 MHz, Span = 0, sweep time 1 ms. Notice that GSM transmission has pulsed nature and VCO output power should be measured during TX burst (triggering needed). Another possibility is to use following settings: RBW = VBW = 1 MHz, Span 200 kHz and sweep time at least 2.5 seconds.

- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm during GSM TX burst.

3.4.4.1.1 Replace TX VCO G7502

3.4.4.2 Replace balun T7503

3.4.5 Replace Vinku (N7501) or GSM PA (N7502) or both

3.5 TX power vs. time ok?

This section means situation when GSM TX power levels are ok, but burst timing is not correct or power changes during TX burst.

- GSM transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”. ***Note!*** *It is probably needed to change the Tx Data Type in Phoenix to “Random” before this measurement can be performed.*

- Measurement can be done with a GSM transmitter tester or other GSM communication tester. Attach the phone to the product specific test jig and the measurement device to the RF-coupler. Coupler attenuation should be also taken into account during measurements.

- If TX power vs. time is not as expected separate the phone into parts and place to the module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

3.5.1 Is the TXC-signal coming to Vinku ASIC (N7501) OK?

- GSM transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section “Transmitter troubleshooting”.

- Set TX power level first to the maximum (“5” in EGSM900 and “0” in GSM1800/GSM1900)

- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to C7549

- Typical TX control voltage TXC timing should look somehow similar to figure 6.5.2 "TXC in GSM mode (DC Offset 0 V)" (EGSM900 TX power level 5) and voltage levels should be roughly:

- EGSM900: 1.8 V while TX burst and 0 V otherwise.

- GSM1800/GSM1900: 1.8 V while TX burst and 0 V otherwise.

- Change the TX to the minimum power level ("19" in EGSM and "15" in GSM1800/GSM1900)
- Typical TX control voltage TXC levels should be now about:
- EGSM900: 1.0 V while TX burst and 0 V otherwise.
- GSM1800/GSM1900: 0.7 V while TX burst and 0 V otherwise.

3.5.1.1 R7514 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R514 resistance value with an ohmmeter

3.5.1.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check with an ohmmeter that C7549 is not short-circuited.

3.5.1.3 Retu ok?

3.5.2 Does GSM PA (N7502) get correct bias currents? Is the level of bias currents ok?

EGSM: Icont_21 and Icont_22
GSM1800/GSM1900: Icont_31 and Icont_32

- GSM transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to the maximum ("5" in EGSM900 and "0" in GSM1800/GSM1900)
- Measurements can be done with an oscilloscope and a VOLTAGE probe.
- EGSM900:
- Connect the probe to C7545 or C7544. Notice: C7544 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
- Typical full TX power bias currents (Icont_21 and Icont_22) should look somehow similar to figure 6.5.4 "Icont_21/Icont_22 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.
- GSM1800 or GSM1900:
- Connect the probe to C7561 or C7556. Notice: C7556 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB
- Typical full TX power bias currents (Icont_31 and Icont_32) should look somehow similar to figure 6.5.5 "Icont_31/Icont_32 (DC Offset 1.2 V)" when measured with an oscilloscope and a probe. Check both currents.

3.5.2.1 Vinku (N7501) RB_EXT voltage ok?

- See section "Vinku (N7501) RB_EXT voltage ok?"

3.5.2.2 Are capacitors in GSM PA (N7502) bias lines working correctly?

EGSM: Icont_21 missing – Replace Vinku
Icont_22 missing – C7545 short-circuited?
GSM1800/GSM1900: Icont_31 missing – C7556 short-circuited?
Icont_32 missing – C7561 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

3.5.2.3 Replace Vinku (N7501)

3.5.3 Does GSM PA (N7502) get correct DET_SW_G -voltage from Vinku ASIC (N7501)?

- GSM transmitter has to be active before DET_SW_G voltage can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7595. Notice: C7595 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- DET_SW_G voltage should be about 2.8 V while TX burst and 0 V otherwise.

3.5.3.1 Replace Vinku (N7501)

3.5.4 Are components in GSM power control loop in place and working ok?

R7516 and C7559

- Disconnect the power supply from the phone and use an ohmmeter to check that C7559 is not short-circuited. If short-circuit is found replace the capacitor.
- Check R7516 resistance value with an ohmmeter and replace resistor if needed.

4. DOES THE PHONE REGISTER TO THE NETWORK AND MAKE A CALL (WCDMA)?

- Test against a WCDMA communication tester or real WCDMA network with a proper SIM.

4.1 WCDMA TX power and transmit frequency ok?

- Attach the phone to the product specific test jig and a spectrum analyser to the RF-coupler. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shielded box.
- Close the shield box hatch.
- Set WCDMA TX ON. Procedure is explained in section “Transmitter troubleshooting”.
- Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Test at power level 21 dBm

- The output power should be +17 – +23 dBm, typical value 21 dBm.

- Remember to select “Stop RF” in Phoenix before opening the shield box hatch.
- If power is not as expected separate the phone into parts and place to the module jig. Connect a spectrum analyser to the module jig WCDMA RF connector and measure TX power again (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

- TX power ok in the module jig: Antenna or antenna connection bad. Replace the antenna
- TX power still wrong or no TX signal found at all: Continue troubleshooting

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If signal is found to be on wrong frequency, see section, 4.1.3."WCDMA transmitter frequency correct?".

4.1.1 Does the WCDMA TX transmit RF-power at all?

- If TX signal is not found at all use wider span setting and check if the transmitter is transmitting on wrong frequency. If signal is found to be on wrong frequency, see section 4.1.3. "WCDMA transmitter frequency correct?".

4.1.1.1 Is Vinku (N7501) transmitting RF-power at all?

- WCDMA transmitter has to be active before Vinku’s output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).

- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the RF probe to R7520. The RF-level should be about the same on both ends of the resistor. Check output level with 0 dBm power level (Set start level “0” to Phoenix).
- Power level “0” – Output level should be about -40...-48 dBm

4.1.1.1.1 RF operating voltage VBAT_ASIC ok?

- See section “RF operating voltage VBAT_ASIC ok?”

4.1.1.1.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in section “GSM RX chain activation for manual measurements”. Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don’t necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:
- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in section 6.5.9.3 “RFBUSDAT (GSM RX)”
- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in sections 6.5.9.1 “RFBUSCLK (GSM RX)” and 6.5.9.2 “RFBUSCLK and RFBUSENA (GSM RX)”
- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in section 6.5.9.2 “RFBUSCLK and RFBUSENA (GSM RX)”
- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.
- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.

4.1.1.1.2.1 RAP3G (or Vinku or Hinku) faulty?

- RAP3G (D2800) cannot be replaced.

4.1.1.1.3 Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- WCDMA transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)

- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.1.1.1.3.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.1.1.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.1.1.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after measurement.

4.1.1.1.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.1.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.1.1.3.1.1.2 Retu ok?

4.1.1.1.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.1.1.1.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.1.1.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.1.1.1.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.1.3.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.1.1.3.1.4 Replace Vinku (N7501)

4.1.1.1.3.2 Are capacitors in Vinku (N7501) regulator lines working correctly?

VREG1: C7543

VREG2: C7547, C7548, C7554, C7555, C7553, C7552, C7558 and C7567

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that regulator lines are not short-circuited to the ground. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.1.3.3 TX VCO (G7502) ok?

4.1.1.1.3.4 Replace Vinku (N7501)

4.1.1.1.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.1.1.1.4.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

4.1.1.1.4.2 Replace Retu

4.1.1.1.4.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

4.1.1.1.5 VCP2-voltage ok?

- WCDMA transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

4.1.1.1.5.1 C7550 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7550 is not short-circuited. If short-circuit is found replace the capacitor mentioned above. If this does not help go to the next step.

4.1.1.1.5.2 Retu ok?

4.1.1.1.5.3 Vinku (N7501) ok?

4.1.1.1.6 Is there RF power in the TX VCO output at all?

- WCDMA transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). This method can be used only to check that the TX VCO is alive. Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The correct VCO frequency can be found in see section “Frequency mappings”. The output level of the VCO should be about -25 dBm.

4.1.1.1.6.1 TX VCO operating voltage VREG2 (VR2) ok?

- See section 4.1.1.1.3 “Vinku (N7501) regulator voltages VREG1, VREG2 ok?”

4.1.1.1.6.2 Replace TX VCO (G7502)

4.1.1.1.7 Is TX VCO RF-signal coming to the Vinku at all?

- WCDMA transmitter has to be active before TX VCO’s output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”). RBW

and VBW = 1 MHz, Span ≤ 200 kHz.

- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.1.1.1.7.1 Replace balun T7503

4.1.1.1.8 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3. "ST_CDSP_TX_IQ_TEST" these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

4.1.1.1.9 Is the TXC-signal coming to Vinku ASIC (N7501) OK?

- WCDMA transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to -50 dBm (Set start level "-50" to Phoenix)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- TX control voltage TXC should be constant DC-voltage between 0.1 - 2.3 V. Voltage level should change if TX power is changed. TXC is lower on lower power levels and higher if higher power levels are used.
- TXC voltage should be about 1.0 V with power level -50 dBm and about 1.5 V with power level 0 dBm.

4.1.1.1.9.1 R7514 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7514 resistance value with an ohmmeter

4.1.1.1.9.2 C7549 working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7549 is not short-circuited.

4.1.1.1.9.3 Retu ok?

4.1.1.1.10 WCDMA-modulator supply voltage (VREG2) ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7520
- DC voltage level should be 2.65 – 2.86 V in both R7520 pads. Typical value is 2.7 V.

4.1.1.1.10.1 Inductors L7512 and L7510 in place and working correctly?

- Disconnect the power supply from the phone and use an ohmmeter to check that L7510 and L7512 are conducting DC.

4.1.1.1.11 VCTCXO frequency and output level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

4.1.1.1.11.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.1.1.1.11.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

4.1.1.1.11.1.2 Replace Retu

4.1.1.1.11.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

4.1.1.1.11.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix "RF Controls" tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

4.1.1.1.11.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok

- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

4.1.1.1.11.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

4.1.1.1.11.2.3 Replace Retu

4.1.1.1.11.3 Replace VCTCXO G7501

4.1.1.1.12 Replace Vinku (N7501)

4.1.1.2 Is there RF-power in the WCDMA PA (N7503) input at all?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span $\leq$ 2 MHz, sweep time 100 ms
- Connect the probe to Z7506 output. The RF level should be roughly -40...-48 dBm.

4.1.1.2.1 Is Vinku (N7501) output RF-signal coming correctly to the Z7506 (SAW filter)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span $\leq$ 2 MHz, sweep time 100 ms
- Connect the RF probe to L7511. The RF-level should be about the same on both ends of the inductor. Check the level with 0 dBm power level (Set start level “0” to Phoenix).
- Power level “0” – Vinku output level should be about -40...-48 dBm

4.1.1.2.1.1 Inductor L7511 and resistor R7520 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7520 resistance value with an

ohmmeter.

- If resistance of R7520 is correct then replace L7511.

4.1.1.3 Is WCDMA PA (N7503) transmitting RF-power at all?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms
- Connect the probe to Z7505 input. The RF level should be roughly -16...-28 dBm.

4.1.1.3.1 Does WCDMA PA (N7503) get operating voltage Vcc12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7525
- Vcc12 voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.1.3.1.1 R7525 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7525 resistance value with an ohmmeter

4.1.1.3.1.2 PA operating voltage VBAT_PA ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.1.3.1.2.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

4.1.1.3.2 Does WCDMA PA (N7503) get operating voltage Vcc11?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to -40 dBm (Set start level to "-40.0" in Phoenix)
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7580.
- Vcc11 voltage level should be about 1.5 V. The same voltage level should be measured also with all power levels smaller than about 10 dBm. Vcc11 is about 3.3 V with the highest power (21 dBm). NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.1.3.2.1 L7515, C7589 and C7580 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that L7515 is conducting DC.
- Use an ohmmeter also to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

4.1.1.3.2.2 Does SMPS N7504 get operating voltage Vdd (=VBAT_PA)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- VBAT_PA voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.1.3.2.3 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.1.1.3.2.3.1 Replace Vinku (N7501)

4.1.1.3.2.4 Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7591.
- Vcontrol signal should be constant DC-voltage. Voltage level should change if TX power is changed. Vcontrol is lower on lower power levels and higher if higher power levels are used.
- Vcontrol should be about 570 mV with power level +10 dBm, about 2.0 V with power level +21 dBm and about 200 mV when power levels below 0 dBm are used. NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.1.3.2.4.1 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.1.1.3.2.4.1.1 Replace Vinku (N7501)

4.1.1.3.2.4.2 Check WCDMA power detector components – In place and value correct?

Components L7514, C7585, V7500, R7526, C7586, R7527, C7587, C7590, R7529, R7530, C7591, R7531 and C7592.

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter
- Use an ohmmeter also to check that L7514 is conducting DC.

4.1.1.3.2.5 Replace SMPS N7504

4.1.1.3.3 Does WCDMA PA (N7503) get bias currents Icont11 and Icont12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to -40 dBm (Set start level to “-40.0” in phoenix)
- Measurements can be done with an oscilloscope and a probe.

- Connect the probe to C7579
- WCDMA PA bias current Icont_12 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.
- Connect the probe to C7576 pad. Notice: C7576 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- WCDMA PA bias current Icont_11 should look as a constant 2.5 - 2.6 V DC-voltage with all power

levels.

4.1.1.3.3.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.1.3.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.1.3.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after measurement.

4.1.1.3.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.3.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.1.3.3.1.1.2 Retu ok?

4.1.1.3.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.1.1.3.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.1.3.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.1.1.3.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.1.3.3.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.1.3.3.1.4 Replace Vinku (N7501)

4.1.1.3.3.2 Is capacitor C7579 in WCDMA PA (N7503) bias line working correctly?

Icont_12 missing – C7579 short-circuited?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor. If this does not help go to the next step.

4.1.1.3.3.3 Replace Vinku (N7501) or WCDMA PA (N7503)

4.1.1.3.4 Replace PA (N7503)

4.1.1.4 Does duplex-filter (Z7502) get correct RF-power level from WCDMA PA (N7503)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span $\leq$ 2 MHz, sweep time 100 ms
- Connect the probe to Z7502 TX input. The RF level should be roughly -20...-30 dBm.

4.1.1.4.1 Replace isolator Z7505

4.1.1.5 Replace duplex-filter Z7502

4.1.2 Does WCDMA TX transmit enough RF-power and power levels otherwise ok?

4.1.2.1 Is Vinku ASIC (N7501) transmitting correct RF-power?

- WCDMA transmitter has to be active before Vinku’s output level can be measured. Procedure is explained in section “Transmitter troubleshooting”.

- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Connect the RF probe to R7520. The RF-level should be about the same on both ends of the resistor. Check output level with 0 dBm (“0”) power level.

\- Power level (“0”) – Output level should be about -45...-48 dBm

- Check if output levels of Vinku are as expected.

4.1.2.1.1 RF operating voltage VBAT_ASIC ok?

- See section “RF operating voltage VBAT_ASIC ok?”

4.1.2.1.2 Vinku (N7501) regulator voltages VREG1, VREG2 ok?

- WCDMA transmitter has to be active before VREG1 and VREG2 voltages can be measured. Procedure is explained in section “Transmitter troubleshooting”. Measurements can be done with an oscilloscope and a probe.
- VREG1: Connect the probe to C7543
- VREG2: Connect the probe to C7548 (or C7547)
- VREG1 and VREG2 voltage levels should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.1.2.1.2.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku’s RB_EXT voltage can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.2.1.2.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.2.1.2.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after measurement.

4.1.2.1.2.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.2.1.2.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.2.1.2.1.1.2 Retu ok?

4.1.2.1.2.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.1.2.1.2.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.2.1.2.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.1.2.1.2.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.2.1.2.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.2.1.2.2 Replace Vinku (N7501)

4.1.2.1.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 “ST_CDSP_TX_IQ_TEST” these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

4.1.2.1.4 Is the TXC-signal coming to Vinku ASIC (N7501) OK? Is signal level correct?

- WCDMA transmitter has to be active before TX control voltage TXC can be measured. Procedure is explained in section “Transmitter troubleshooting”.

- Set TX power level to -50 dBm (Set start level "-50" to Phoenix)
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7549
- TX control voltage TXC should be constant DC-voltage between 0.1 - 2.3 V. Voltage level should change if TX power is changed. TXC is lower on lower power levels and higher if higher power levels are used.
- TXC voltage should be about 1.0 V with power level -50 dBm and about 1.5 V with power level 0 dBm.

4.1.2.1.4.1 R7514 resistance value correct?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7514 resistance value with an ohmmeter

4.1.2.1.4.2 C7549 ok?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7549 is not short-circuited.

4.1.2.1.4.3 Retu ok?

4.1.2.1.5 Does Vinku (N7501) WCDMA-modulator get correct supply voltage (VREG2)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7520
- DC voltage level should be 2.65 – 2.86 V in both R7520 pads. Typical value is 2.7 V.

4.1.2.1.5.1 Inductors L7512 and L7510 in place and working correctly?

- Disconnect the power supply from the phone and use an ohmmeter to check that L7510 and L7512 are conducting DC.

4.1.2.1.6 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW

and VBW = 1 MHz, Span ≤ 200 kHz.

- Check the level of the VCO frequency in T7503 outputs. The level should be about -30…-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.1.2.1.6.1 TX VCO G7502 output level high enough?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.

4.1.2.1.6.1.1 Replace TX VCO G7502

4.1.2.1.6.2 Replace balun T7503

4.1.2.1.7 Replace Vinku (N7501)

4.1.2.2 Is there correct RF-power in the WCDMA PA (N7503) input?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to 0 dBm (Set start level "0" to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the probe to Z7506 output. The RF level should be roughly -40…-48 dBm.

4.1.2.2.1 Is Vinku (N7501) output RF-signal coming correctly to the Z7506 (SAW filter)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to 0 dBm (Set start level "0" to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings").

- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the RF probe to L7511. The RF-level should be about the same on both ends of the inductor. Check the level with 0 dBm power level (Set start level “0” to Phoenix).
- Power level “0” – Vinku output level should be about -40...-48 dBm

4.1.2.2.1.1 Inductor L7511 and resistor R7520 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7520 resistance value with an ohmmeter.
- If resistance of R7520 is correct then replace L7511.

4.1.2.3 Does WCDMA PA (N7503) transmit correct RF-power?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”).
- Spectrum analyser RBW = VBW = 10 MHz, Span ≤ 2 MHz, sweep time 100 ms.
- Connect the probe to Z7505 input. The RF level should be roughly -16...-28 dBm.

4.1.2.3.1 Does WCDMA PA (N7503) get correct operating voltage Vcc12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7525
- Vcc12 voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.2.3.1.1 R7525 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7525 resistance value with an ohmmeter

4.1.2.3.1.2 PA operating voltage VBAT_PA ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- Voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.2.3.1.2.1 Ferrite Z7500 ok?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

4.1.2.3.2 Does WCDMA PA (N7503) get correct operating voltage Vcc11?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to -40 dBm (Set start level to "-40.0" in Phoenix)
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7580.
- Vcc11 voltage level should be about 1.5 V. The same voltage level should be measured also with all power levels smaller than about 10 dBm. Vcc11 is about 3.3 V with the highest power (21 dBm). NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.2.3.2.1 L7515, C7589 and C7580 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that L7515 is conducting DC.
- Use an ohmmeter also to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

4.1.2.3.2.2 Does SMPS N7504 get operating voltage Vdd (=VBAT_PA)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- VBAT_PA voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.1.2.3.2.3 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.

- Voltage level should be about 2.78 V.

4.1.2.3.2.3.1 Replace Vinku (N7501)

4.1.2.3.2.4 Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7591.
- Vcontrol signal should be constant DC-voltage. Voltage level should change if TX power is changed. Vcontrol is lower on lower power levels and higher if higher power levels are used.
- Vcontrol should be about 570 mV with power level +10 dBm, about 2.0 V with power level +21 dBm and about 200 mV when power levels below 0 dBm are used. NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.1.2.3.2.4.1 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.1.2.3.2.4.1.1 Replace Vinku (N7501)

4.1.2.3.2.4.2 Check WCDMA power detector components – In place and value correct?

Components L7514, C7585, V7500, R7526, C7586, R7527, C7587, C7590, R7529, R7530, C7591, R7531 and C7592.

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter
- Use an ohmmeter to check that L7514 is conducting DC.
- Use a diode meter to make sure that diodes inside V7500 are working correctly.

4.1.2.3.2.5 Replace SMPS N7504

4.1.2.3.3 Does WCDMA PA (N7503) get bias currents Icont11 and Icont12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to -40 dBm (Set start level to “-40.0” in phoenix)

- Measurements can be done with an oscilloscope and a probe.

- Connect the probe to C7579
- WCDMA PA bias current Icont_12 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.
- Connect the probe to C7576 pad. Notice: C7576 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.
- WCDMA PA bias current Icont_11 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.

4.1.2.3.3.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.2.3.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.2.3.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after measurement.

4.1.2.3.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.2.3.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.2.3.3.1.1.2 Retu ok?

4.1.2.3.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.1.2.3.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.2.3.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.1.2.3.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.2.3.3.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.2.3.3.1.4 Replace Vinku (N7501)

4.1.2.3.3.2 Is capacitor C7579 in WCDMA PA (N7503) bias line working correctly?

Icont_12 – C7579 short-circuited?

- Check that the capacitor is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor.

4.1.2.3.3.3 Replace Vinku (N7501) or WCDMA PA (N7503)

4.1.2.3.4 Replace PA (N7503)

4.1.2.4 Does duplex-filter (Z7502) get correct RF-power from WCDMA PA (N7503)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section “Transmitter troubleshooting”.
- Set TX power level to 0 dBm (Set start level “0” to Phoenix)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency setting to the spectrum analyser. Spectrum analyser centre frequency should be set according the used TX channel (see section “Frequency mappings”)
- Spectrum analyser RBW = VBW = 10 MHz, Span $\leq$ 2 MHz, sweep time 100 ms
- Connect the probe to Z7502 TX input. The RF level should be roughly -20...-30 dBm.

4.1.2.4.1 Replace isolator Z7505

4.1.2.5 Replace duplex-filter Z502

4.1.3 WCDMA transmitter frequency correct?

- Connect a spectrum analyser to the module test jig RF connector.
- Set WCDMA Tx ON. Procedure is explained in section "Transmitter troubleshooting".
- Check if the frequency of the transmitter is as expected. If output signal is not found try to use 500 MHz span setting.

  The correct TX frequency is shown in Phoenix "Tx Control (WCDMA)" window and can be found also in see section "Frequency mappings". If the frequency is not found at all then go to 4.1.1"Does the WCDMA TX transmit RF-power at all?"

4.1.3.1 Is TX VCO frequency as expected?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing. *Quick VCO alive check can be done without removing the RF shield. The RF probe should be placed as near the TX VCO output as possible (Put the head of the probe carefully inside the VCO can through the holes of the shield). This method can be used only to check that the TX VCO is alive. It won't expose if the T7503 is broken or the output level of the VCO is too low. Remember to use low RF Attenuator value in the spectrum analyser with this method.*
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.

4.1.3.1.1 C7543, C7548 and L7517 ok?

- These components should be checked if TX VCO frequency is not stable and TX PLL frequency not locked.
- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that inductor is conducting DC.

4.1.3.1.2 TX VCO control voltage VC ok?

- WCDMA transmitter has to be active before TX VCO control voltage VC can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.

- Connect the probe to R7519.
- TX VCO control voltage VC should be constant DC-voltage between 0.7 - 3.8 V. DC voltage level should change if TX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

4.1.3.1.2.1 VCP2-voltage ok?

- WCDMA transmitter has to be active before VCP2 voltage can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C2221 (or C7550).
- VCP2 voltage should be about 4.75 V.

4.1.3.1.2.1.1 C7550 short-circuited?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C7550 is not short-circuited. If short-circuit is found replace the capacitor mentioned above. If this does not help go to the next step.

4.1.3.1.2.1.2 Retu ok?

4.1.3.1.2.1.3 Vinku (N7501) ok?

4.1.3.1.2.2 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku’s RB_EXT voltage can be measured. Procedure is explained in section “Transmitter troubleshooting”.
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.1.3.1.2.2.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.3.1.2.2.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after measurement.

4.1.3.1.2.2.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.3.1.2.2.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.3.1.2.2.1.2 Retu ok?

4.1.3.1.2.2.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.1.3.1.2.2.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.1.3.1.2.2.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.1.3.1.2.2.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.1.3.1.2.2.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

4.1.3.1.2.2.4 Replace Vinku (N7501)

4.1.3.1.2.3 Balun T7503 ok?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the TX VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level

is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.1.3.1.2.4 Are components near the TX VCO ok?

C7571, R7519, R7523, C7573 and C7568 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

4.1.3.1.2.5 Replace Vinku (N7501) or TX VCO (G7502) or both

4.1.3.1.3 Replace TX VCO G7502

4.1.3.2 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.1.3.2.1 TX VCO G7502 output level high enough?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.

4.1.3.2.1.1 Replace TX VCO G7502

4.1.3.2.2 Replace balun T7503

4.1.3.3 VCTCXO frequency and output level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24V)".

4.1.3.3.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.1.3.3.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

4.1.3.3.1.2 Replace Retu

4.1.3.3.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

4.1.3.3.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

4.1.3.3.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

4.1.3.3.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

4.1.3.3.2.3 Replace Retu

4.1.3.3.3 Replace VCTCXO G7501

4.2 Does the phone give realistic RSSI-values?

Attach the phone to the product specific test jig and a signal generator to the RF-coupler. Coupler attenuation should be also taken into account during measurements.

Use the signal generator to supply -90 dBm RF-level to the phone via the antenna coupler. Set generator RF-level to -90 dBm + Cable and coupler attenuation. This measurement should be performed in a RF-shielded environment because existing WCDMA-network base stations can disturb this measurement otherwise.

- Set RF-generator frequency to 2141.0 MHz (unmodulated signal).
- Use Phoenix testing & tuning software to perform WCDMA receiver activation and RSSI measurement for channel 10700. Procedure is explained in sections "WCDMA RX chain activation for manual measurement" and "WCDMA RSSI measurement".
- "Rx Power Measurement" tool should show quite exact -90 dBm RSSI level. Remember to take into account attenuation between the phone and signal generator.
- Increase signal generator RF level to -60 dBm. Phoenix "Rx Power Measurement" tool should show now quite exact RSSI level -60 dBm.
- If RSSI-levels are not as expected separate the phone into parts and place to the module jig. Connect the signal generator to the module jig WCDMA RF connector (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

4.2.1 Is Hinku ASIC (N7500) receiving RF-power correctly from the WCDMA-antenna connector?

- WCDMA receiver has to be active before measurements. Procedure is explained in section "Receiver troubleshooting".
- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to T7500 output. There are two output pins because of balanced output. The RF level should be roughly -85...-90 dBm in both output pads when input signal level in WCDMA antenna connector is -50 dBm.

4.2.1.1 Does duplex-filter (Z7502) work properly?

- WCDMA receiver has to be active before measurements. Procedure is explained in section

"Receiver troubleshooting".

- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to the T7500 input. The RF level should be roughly -80...-85 dBm in the input pad when input signal level in WCDMA antenna connector is -50 dBm.

4.2.1.1.1 Replace filter Z7502

4.2.1.2 Replace balun T7500

4.2.2 Hinku WCDMA LNA output ok?

- WCDMA receiver has to be active before measurements. Procedure is explained in section "Receiver troubleshooting".
- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to the Z7501 input. The RF level should be roughly -65...-70 dBm in both input pads when input signal level in WCDMA antenna connector is -50 dBm.

4.2.2.1 Replace Hinku N7500

4.2.3 WCDMA SAW Z7501 in place and working correctly?

- WCDMA receiver has to be active before measurements. Procedure is explained in section "Receiver troubleshooting".
- Connect an RF-generator to the WCDMA-antenna connector
- Set RF-generator frequency to 2141.0 MHz (unmodulated signal)
- Measurements can be done with a spectrum analyser and an RF probe. Remember to make correct frequency settings to the spectrum analyser (Centre frequency should be set to the same frequency as the RF-generator). RBW = VBW = 10 kHz, Span = 0, sweep time = 100 ms.
- Connect the probe to the Z7501 output. The RF level should be roughly -70...-75 dBm in both output pads when input signal level in WCDMA antenna connector is -50 dBm.

4.2.3.1 Replace SAW Z7501

4.2.4 Are RX-IQ signal waveforms and levels correct?

- Measurements can be done with an oscilloscope, a probe and signal generator.
- WCDMA receiver has to be active before RX IQ-signals can be measured. Procedure is explained in section "Receiver troubleshooting".
- Apply –50 dBm RF-signal (unmodulated) from a signal generator to the module jig antenna connector and use frequency 2140.0 MHz (Channel 10700)
- Remember to change the correct RX channel also to Phoenix "RX control" window!
- Check RX I and RX Q -signals in following test points:
- RX I (positive): Connect the probe to test point J7508
- RX I (negative): Connect the probe to test point J7509
- RX Q (positive): Connect the probe to test point J7510
- RX Q (negative): Connect the probe to test point J7511
- Signal in all four test points should be about the same. Output should be a sine wave with frequency 100 kHz and amplitude about 650 mV.
- Change the signal generator to frequency 2142.0 MHz (Channel 10710)
- Signal in all four test points should be about the same. Output should be a sine wave with frequency 2.0 MHz and amplitude about 550 mV.

4.2.4.1 RF operating voltage VBAT_ASIC ok?

- See section "RF operating voltage VBAT_ASIC ok?"

4.2.4.2 RFBUS signals ok?

- GSM receiver has to be active before RFBUS signals can be measured. Procedure is explained in section "GSM RX chain activation for manual measurements". Also WCDMA/GSM transmitter and WCDMA receiver activation can be used for the measurement but then RFBUS -signals don't necessarily look like in figures mentioned below.
- Measurements can be performed with an oscilloscope and a probe. Check all five RF BUS signals:
- *RFBUSDAT*: Connect the probe to J7504. Typical RFBUSDAT -signal is shown in section 6.5.9.3 "RFBUSDAT (GSM RX)".
- *RFBUSCLK*: Connect the probe to J7505. Typical RFBUSCLK -signal is shown in figures "RFBUSCLK (GSM RX)" and "RBUSCLK and RFBUSENA (GSM RX)".
- *RFBUSENA*: Connect the probe to J7506. Typical RFBUSENA -signal is shown in the figure "RFBUSCLK and RFBUSENA (GSM RX)".
- *RXRESETX*: Connect the probe to J7515. RXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal should be about 0 V before transceiver activation.
- *TXRESETX*: Connect the probe to J7517. TXRESETX -signal is a constant 2 V DC-signal after GSM or WCDMA transceiver has been activated the first time after phone boot up. The level of this signal

should be about 0 V before transceiver activation.

4.2.4.2.1 RAP3G (or Vinku or Hinku) faulty?

- RAP3G (D2800) cannot be replaced.

4.2.4.3 Hinku (N7500) regulator voltage VR1 ok?

- WCDMA receiver has to be active before Hinku's VR1 voltage can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7504 (or C7505)
- VR1 voltage level should be 2.65 – 2.86 V. Typical value is 2.7 V.

4.2.4.3.1 Hinku (N7500) RB_EXT voltage ok?

- WCDMA receiver has to be active before Hinku's RB_EXT voltage can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7504.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.2.4.3.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.2.4.3.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

Remember to solder a new component to R7503 pads after measurement.

4.2.4.3.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.2.4.3.1.1.1.2 Replace Vinku (N7501) or Hinku (N7500) or both

4.2.4.3.1.1.2 Retu ok?

4.2.4.3.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.2.4.3.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.2.4.3.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.2.4.3.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.2.4.3.1.3.3 Replace Hinku (N7500) or Vinku (N7501) or both

4.2.4.3.1.4 Replace Hinku (N7500)

4.2.4.3.2 Are capacitors in Hinku (N7500) regulator lines working correctly?

C7504, C7515, C7509, C7508, C7596, C7598 and C7505

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.2.4.3.3 RX VCO G7500 ok?

4.2.4.3.4 Replace Hinku (N7500)

4.2.4.4 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.2.4.4.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

4.2.4.4.2 Replace Retu

4.2.4.4.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

4.2.4.5 VCP1-voltage ok?

- WCDMA receiver has to be active before VCP1 voltage can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

4.2.4.5.1 C7507 and C2222 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors C7507 and C2222 are not short-circuited. If short-circuit is found replace faulty capacitor. If this does not help go to the next steps.

4.2.4.5.2 Retu ok?

4.2.4.5.3 Hinku (N7500) ok?

4.2.4.6 Is there RF power in the RX VCO output at all?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings". RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

4.2.4.6.1 RX VCO operating voltage VR1 RX ok?

- WCDMA receiver has to be active before Hinku's VR1RX voltage can be measured. Procedure is explained in section "Receiver troubleshooting"

- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7515 (or C7598)
- VR1RX voltage level should be continuous 2.65 - 2.86 V in WCDMA mode. Typical value is 2.7 V.

4.2.4.6.1.1 Hinku (N7500) regulator voltage VR1 ok?

- See section "Hinku (N7500) regulator voltage VR1 ok?"

4.2.4.6.1.2 Replace Hinku (N7500)

4.2.4.6.2 Replace RX VCO (G7500)

4.2.4.7 Is RX VCO RF-signal coming to the Hinku at all?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm. If the signal level is correct in the input (-20...-30 dBm) but output level is not as expected then replace T7501.

4.2.4.7.1 Replace balun T7501

4.2.4.8 Is RX VCO frequency as expected?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

4.2.4.8.1 RX VCO control voltage VC ok?

- WCDMA receiver has to be active before RX VCO control voltage VC can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7501.
- RX VCO control voltage VC should be constant DC-voltage between 0.7 - 3.8 V. Voltage level should

change if RX channel is changed. VC is lower on lower channels and higher if higher channel numbers are used.

4.2.4.8.1.1 VCP1-voltage ok?

- WCDMA receiver has to be active before VCP1 voltage can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7507.
- VCP1 voltage should be about 4.75 V.

4.2.4.8.1.1.1 C7507 and C2222 working properly?

- Check that the components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that C507 and C2222 are not short-circuited.

4.2.4.8.1.1.2 Retu ok?

4.2.4.8.1.1.3 Hinku (N7500) ok?

4.2.4.8.1.2 Balun T7501 ok?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

4.2.4.8.1.3 Are components near the RX VCO ok?

R7501, C7516, R7505, C7524 and C7522 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter.
- Use an ohmmeter to check also that capacitors are not short-circuited

4.2.4.8.1.4 Replace Hinku (N7500) or RX VCO (G7500) or both

4.2.4.8.2 Replace RX VCO G7500

4.2.4.9 Is RX VCO signal level in the T7501 output high enough?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7501 outputs. The level should be about -25...-35 dBm. If the signal level is correct in the input (about -20...-30 dBm) but output level is not as expected then replace T7501.

4.2.4.9.1 RX VCO G7500 output level high enough?

- WCDMA receiver has to be active before RX VCO's output frequency and output level can be measured. Procedure is explained in section "Receiver troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used RX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7501 input.
- Check if the frequency of the RX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -20...-30 dBm.

4.2.4.9.1.1 Replace RX VCO G7500

4.2.4.9.2 Replace balun T7501

4.2.4.10 Are capacitors C7530, C7532, C7534 and C7536 in place?

- Check that components are in place and solder joints are ok

4.2.4.11 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24V)".

4.2.4.11.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

4.2.4.11.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

4.2.4.11.1.2 Replace Retu

4.2.4.11.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

4.2.4.11.2 BB AFC-voltage ok?

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to R7509 (or C7533)
- AFC-voltage may vary between 0.1 - 2.3 V. Typical value is 1.2 V. Phoenix “RF Controls” tool can be used to change the AFC value. Voltage level should be about 0.1 V with AFC value -1024 and about 2.3 V with AFC value 1023.

4.2.4.11.2.1 Low pass filter components R7509 and C7533 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7509 resistance value with an ohmmeter.
- Use an ohmmeter to find out also if the AFC-line is short-circuited to the ground. If short-circuit is found replace C7533. If this does not help then go to the next steps.

4.2.4.11.2.2 VCTCXO ok?

- Remove R7509. If AFC-voltage is correct after removing then replace faulty VCTCXO G7501 and solder R7509 (new component) back to the PWB

4.2.4.11.2.3 Replace Retu

4.2.4.11.3 Replace VCTCXO G7501

4.2.5 Does RAP3G ASIC get ok VREFCM-signal from Hinku (N7500)? Signal level ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to J7516.
- VREFCM voltage should be about 780 mV (continuous voltage).

4.2.5.1 Hinku (N7500) RB_EXT voltage ok?

- See section "Hinku (N7501) RB_EXT voltage ok?"

4.2.5.2 Replace Hinku (N7500)

- Also RAP3G can be faulty but it's not possible to replace this component

4.2.6 RAP3G faulty?

- Not possible to replace!

4.3 WCDMA modulation spectrum and ACLR ok?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with a WCDMA transmitter tester or other WCDMA communication tester. Settings have to be done according to the 3GPP specifications. Modulation spectrum and ACLR measurements are possible to perform also with a spectrum analyser, but in this case measurement settings have to be done manually according to the 3GPP specifications.
- Attach the phone to the product specific test jig and a spectrum analyser or other RF-measurement device to the RF-coupler. Coupler attenuation should be also taken into account during measurements.
- If modulation spectrum is not as expected separate the phone into parts and place to the module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

4.3.1 Does N7504 give correct voltage level (Vcc11) to the WCDMA PA (N7503)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to -40 dBm (Set start level to "-40.0" in Phoenix)
- Measurements can be done with an oscilloscope and a probe.
- Connect the probe to C7580.
- Vcc11 voltage level should be about 1.5 V. The same voltage level should be measured also with all power levels smaller than about 10 dBm. Vcc11 is about 3.3 V with the highest power (21 dBm). NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.3.1.1 L7515, C7589 and C7580 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that L7515 is conducting DC.
- Use an ohmmeter also to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above.

4.3.1.2 Does SMPS N7504 get operating voltage Vdd (=VBAT_PA)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section

"Transmitter troubleshooting".

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7569 (or C7564, C7583)
- VBAT_PA voltage level should be 3.05 – 5.4 V. Typical value is 4.0 V.

4.3.1.3 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.3.1.3.1 Replace Vinku (N7501)

4.3.1.4 Does SMPS get correct control voltage from the WCDMA power detector (signal Vcontrol)?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7591.
- Vcontrol signal should be constant DC-voltage. Voltage level should change if TX power is changed. Vcontrol is lower on lower power levels and higher if higher power levels are used.
- Vcontrol should be about 570 mV with power level +10 dBm, about 2.0 V with power level +21 dBm and about 200 mV when power levels below 0 dBm are used. NOTE: Perform WCDMA transmitter tests with > 0 dBm power only in RF shielded environment.

4.3.1.4.1 Is there correct DET_SW_W –voltage coming from Vinku ASIC (N7501)?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7586.
- Voltage level should be about 2.78 V.

4.3.1.4.1.1 Replace Vinku (N7501)

4.3.1.4.2 Check WCDMA power detector components – In place and value correct?

Components L7514, C7585, V7500, R7526, C7586, R7527, C7587, C7590, R7529, R7530, C7591, R7531 and C7592.

- Check that components are in place and solder joints are ok

- Disconnect the power supply from the phone and check resistors resistance values with an ohmmeter
- Use an ohmmeter also to check that L7514 is conducting DC.

4.3.1.5 Replace SMPS N7504

4.3.2 Does WCDMA PA (N7503) get correct bias currents Icont11 and Icont12?

- WCDMA transmitter has to be active before measurements. Procedure is explained in section "Transmitter troubleshooting".
- Set TX power level to -40 dBm (Set start level to "-40.0" in phoenix)
- Measurements can be done with an oscilloscope and a probe.

- Connect the probe to C7579
- WCDMA PA bias current Icont_12 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.
- Connect the probe to C7576 pad. Notice: C7576 is a non-assembled component so the probe should be connected to the pad that can be still found from the PWB.

- WCDMA PA bias current Icont_11 should look as a constant 2.5 - 2.6 V DC-voltage with all power levels.

4.3.2.1 Vinku (N7501) RB_EXT voltage ok?

- WCDMA transmitter has to be active before Vinku's RB_EXT voltage can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7521.
- RB_EXT voltage should be 1.325 – 1.375 V.

4.3.2.1.1 VREFRF01-voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to R7503.
- VREFRF01 voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.3.2.1.1.1 Desolder R7503. Is VREFRF01 voltage still wrong?

- Remember to solder a new component to R7503 pads after measurement.

4.3.2.1.1.1.1 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok

- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.3.2.1.1.1.1.1 Replace Vinku (N7501) or Hinku (N7500) or both

4.3.2.1.1.1.2 Retu ok?

4.3.2.1.2 R7521 and R7504 in place and working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and check R7521 and R7504 resistance values with an ohmmeter.

4.3.2.1.3 VB_EXT voltage ok?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7518.
- VB_EXT voltage should be 1.325 – 1.375 V. Typical value is 1.35 V.

4.3.2.1.3.1 R7503 in place and working correctly?

- Check that the component is in place and solder joints are ok
- Disconnect the power supply from the phone and check R7503 resistance value with an ohmmeter

4.3.2.1.3.2 Capacitors C7518, C7520 and C7570 working correctly?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that capacitors are not short-circuited. If short-circuit is found replace capacitors mentioned above. If this does not help go to the next step.

4.3.2.1.3.3 Replace Vinku (N7501) or Hinku (N7500) or both

4.3.2.1.4 Replace Vinku (N7501)

4.3.2.2 Is capacitor C7579 in WCDMA PA (N7503) bias line working correctly?

Icont_12 missing – C7579 short-circuited?

- Check that component is in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to check that the capacitor is not short-circuited. If short-circuit is found replace the capacitor. If this does not help go to the next step.

4.3.2.3 Replace Vinku (N7501) or WCDMA PA (N7503)

4.3.3 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in 2.3 "ST_CDSP_TX_IQ_TEST " these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

4.3.4 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

4.3.4.1 TX VCO G7502 output level high enough?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.

4.3.4.1.1 Replace TX VCO G7502

4.3.4.2 Replace balun T7503

4.3.5 Replace Vinku (N7501) or WCDMA PA (N7503) or both

5. DOES THE PHONE HAVE A RELIABLE CONNECTION TO THE NETWORK (GSM)?

This section refers to a situation when the phone registers to the GSM-network and is capable to make a call, but the call is not reliable even if the GSM-network field strength is strong. The phone call is maybe disconnected or interrupted.

5.1 GSM receiver Bit Error Rate (BER) ok?

- This test needs a GSM communication tester and if there is no that kind of tester available continue troubleshooting in section 3.2 "Does the phone give realistic RSSI-values?".
- Attach the phone to the product specific test jig and a GSM communication tester to the RF-coupler. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shielded box.
- Close the shield box hatch.
- Make a GSM call against the tester
- Settings to the tester have to be done according to the 3GPP specifications:

- Set base station downlink power to -102 dBm

- Bit Error Rate should be less than 2 %

5.1.1 Does the phone give realistic RSSI-values?

- See section 3.2. "Does the phone give realistic RSSI-values?"

5.1.2 Hinku (N7500) or RAP3G (D2800) faulty?

- RAP3G is not possible to replace

5.2 GSM transmitter power levels and transmit frequency ok?

- See section 3.1. "GSM transmitter power levels and transmit frequency ok?"

5.3 GSM Transmitter phase error ok?

- See section 3.3. "GSM Transmitter phase error ok?"

5.4 GSM (GMSK) modulation spectrum ok?

- See section 3.4. "GSM (GMSK) modulation spectrum ok?"

5.5 TX power vs. time ok?

- See section 3.5. "TX power vs. time ok?"

6. DOES THE PHONE HAVE A RELIABLE CONNECTION TO THE NETWORK (WCDMA)?

This section means situation when the phone registers to the WCDMA-network and is capable to make a call, but the call is not reliable even if WCDMA-network field strength is strong. The phone call is maybe disconnected or interrupted.

6.1 WCDMA receiver Bit Error Rate (BER) ok?

- This test needs a WCDMA communication tester and if there is no that kind of tester available continue troubleshooting in section 4.2 "Does the phone give realistic RSSI-values?".
- Attach the phone to the product specific test jig and a WCDMA communication tester to the RF-coupler. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shielded box.
- Close the shield box hatch.
- Make a WCDMA call against the tester
- Settings to the tester have to be done according to the 3GPP specifications:

- Set base station output level (Îor) to -106.7 dBm / 3.84 MHz
- Set DPCH_Ec level to -117 dBm / 3.84 MHz

- Bit Error Rate should be less than 0.1 %

6.1.1 Does the phone give realistic RSSI-values?

- See section 4.2 "Does the phone give realistic RSSI-values?"

6.1.2 Hinku (N7500) or RAP3G (D2800) faulty?

- RAP3G is not possible to replace

6.2 WCDMA TX power and transmit frequency ok?

- See section 4.1. "WCDMA TX power and transmit frequency ok?"

6.3 WCDMA Transmitter error vector magnitude ok?

- This test needs a WCDMA communication tester and if there is no that kind of tester available continue troubleshooting in section 4.3 "WCDMA modulation spectrum and ACLR ok?"
- Attach the phone to the product specific test jig and the WCDMA communication tester to the RF-coupler. Coupler attenuation should be also taken into account during measurements. This measurement should be done in an RF shielded box.
- Close the shield box hatch.
- Make a WCDMA call against the tester
- The Error Vector Magnitude shall not exceed 17.5 % with power levels ≥ –20 dBm.
- If Error Vector Magnitude is not as expected separate the phone into parts and place to the module jig (*Notice that there are three antenna connectors in the module jig, one for GSM, one for WCDMA and one for Bluetooth. Make sure that all connections are made to the correct RF-connector*).

6.3.1 Is capacitor C7579 in WCDMA PA (N7503) bias line in place?

- Check that the component is in place and solder joints are ok

6.3.2 Are capacitors in Vinku REG1 and REG2 lines in place?

C7554, C7555 and C7547

- Check that components are in place and solder joints are ok

6.3.3 Are capacitors in WCDMA PA power supply lines in place?

C7569 and C7583

- Check that components are in place and solder joints are ok

6.3.4 Are TX-IQ signals ok?

- These current mode signals are not possible to measure, but are tested with self-tests. So if there is no fail in section 2.3. "ST_CDSP_TX_IQ_TEST " these signals should be ok. Otherwise Vinku (N7501) or RAP3G (D2800) is faulty. Notice that it is not possible to replace RAP3G ASIC.

6.3.5 Is TX VCO signal level in the T7503 output high enough?

- WCDMA transmitter has to be active before TX VCO's output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Check the level of the VCO frequency in T7503 outputs. The level should be about -30...-35 dBm in both output lines. If the signal level is correct in the input (about -25 dBm) but output level is not as expected then replace T7503. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.

6.3.5.1 TX VCO G7502 output level high enough?

- WCDMA transmitter has to be active before TX VCO's output frequency and output level can be measured. Procedure is explained in section "Transmitter troubleshooting".
- Measurements can be done with a spectrum analyser and an RF probe. Spectrum analyser centre frequency should be set according the used TX channel (see section "Frequency mappings"). RBW and VBW = 1 MHz, Span ≤ 200 kHz.
- Connect the RF probe to the T7503 input. VCO shield has to be removed before measurement. Remember to solder the shield back after the phone repairing.
- Check if the frequency of the TX VCO is as expected. If the VCO signal is not found try to use wider span setting. The output level of the VCO should be about -25 dBm.

6.3.5.1.1 Replace TX VCO G7502

6.3.5.2 Replace balun T7503

6.3.6 VCTCXO frequency and output level correct?

- Measurement can be done with an oscilloscope and a probe.
- Connect the probe to C7529 (or C7582)
- The frequency of the VCTCXO should be quite exactly 38.4 MHz and level about 0.5 - 0.9 Vpp. Example of the correct VCTCXO output signal is presented in figure 6.5.1 "VCTCXO Output (DC Offset 1.24 V)".

6.3.6.1 VXO-voltage ok? (=Vdig).

- Measurement can be done with an oscilloscope and a probe
- Connect the probe to C7560 (or C7526, C7513)
- VXO-voltage should be about 2.5 V

6.3.6.1.1 C7560, C7513, C7526 and C2214 ok?

- Check that components are in place and solder joints are ok
- Disconnect the power supply from the phone and use an ohmmeter to find out if the VXO-line is short-circuited to the ground. If short-circuit is found replace C7560, C7513, C7526 and C2214. If replacing does not help then go to the next steps.

6.3.6.1.2 Replace Retu

6.3.6.1.3 Replace Hinku (N7500) or Vinku (N7501) or VCTCXO (G7501) or all three components

6.3.6.2 BB AFC-voltage ok?

- See section "BB AFC-voltage ok?"

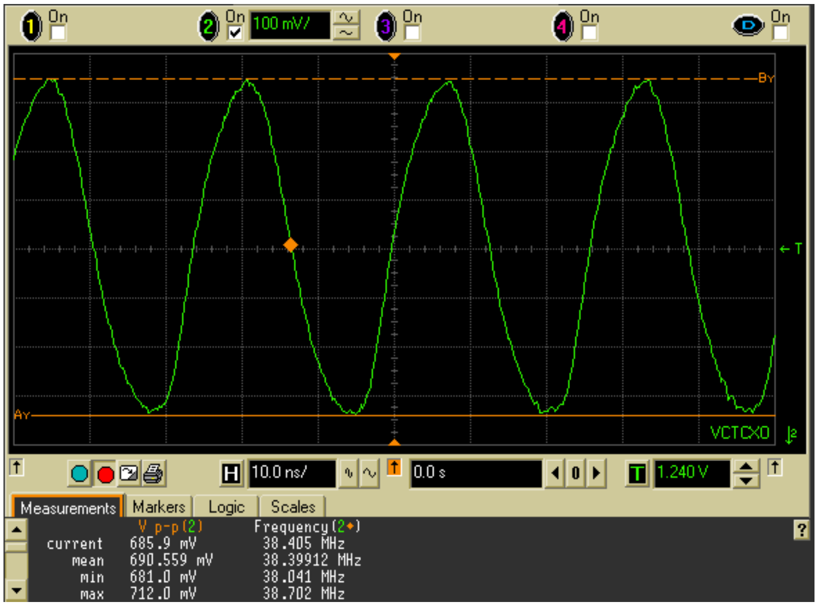
6.3.6.3 Replace VCTCXO G7501

6.4 WCDMA modulation spectrum and ACLR ok?

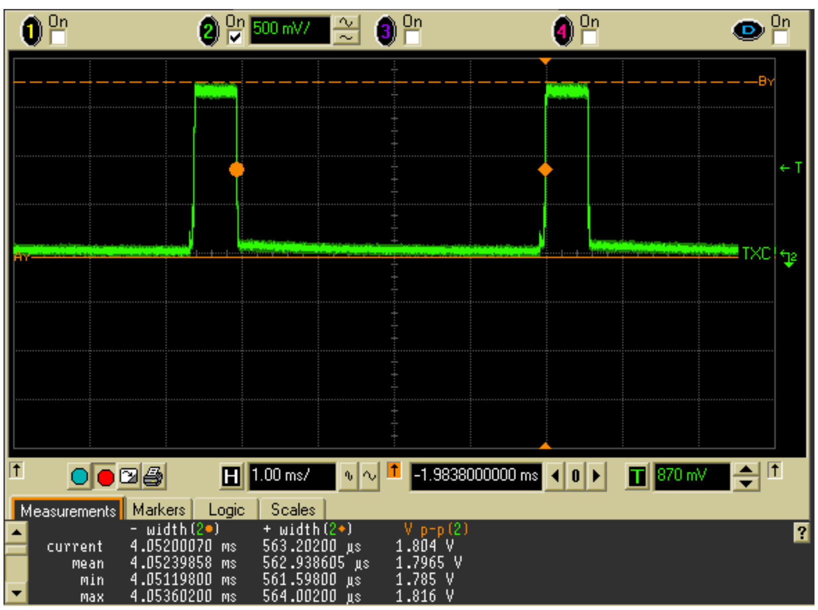
- See section 4.3 "WCDMA modulation spectrum and ACLR ok?"

6.5 Troubleshooting pictures

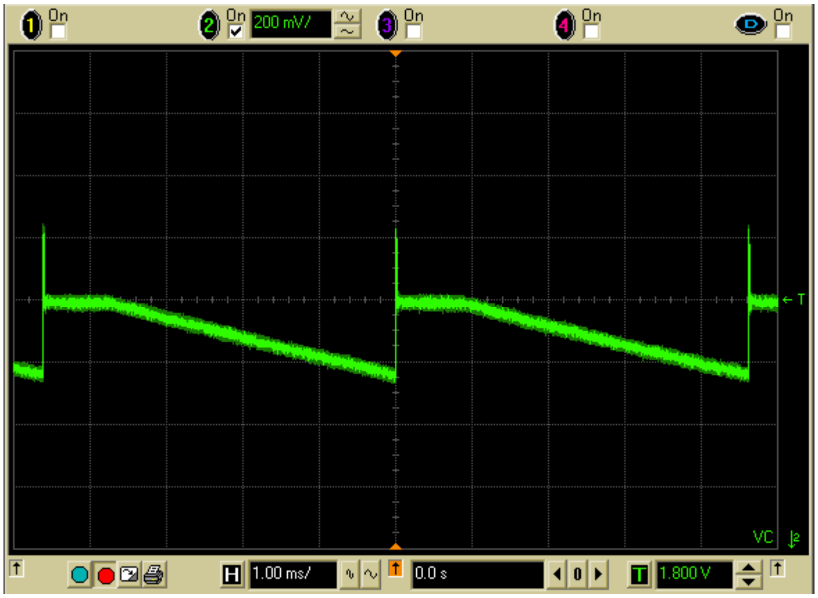
6.5.1 VCTCXO Output (DC Offset 1.24 V)



6.5.2 TXC in GSM mode (DC Offset 0 V)

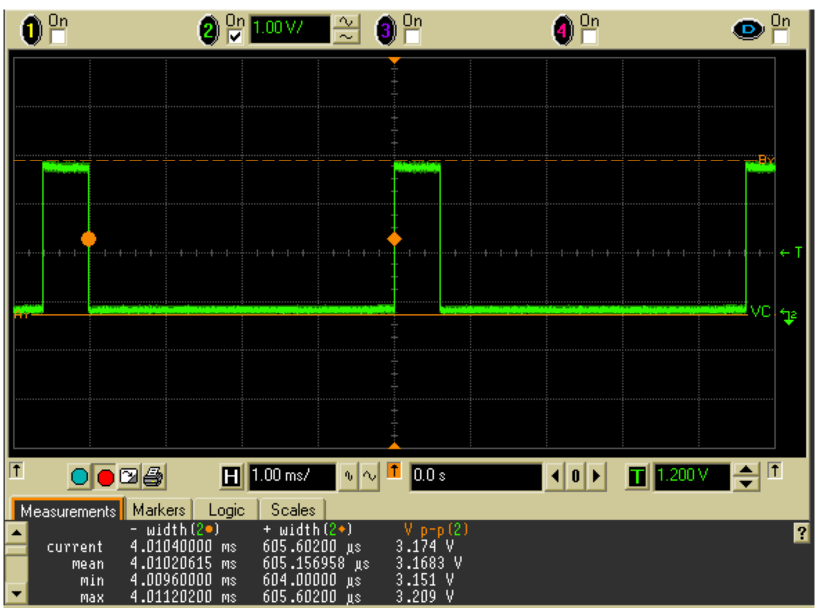


6.5.3 TX VC in GSM mode (DC Offset 1.8 V)

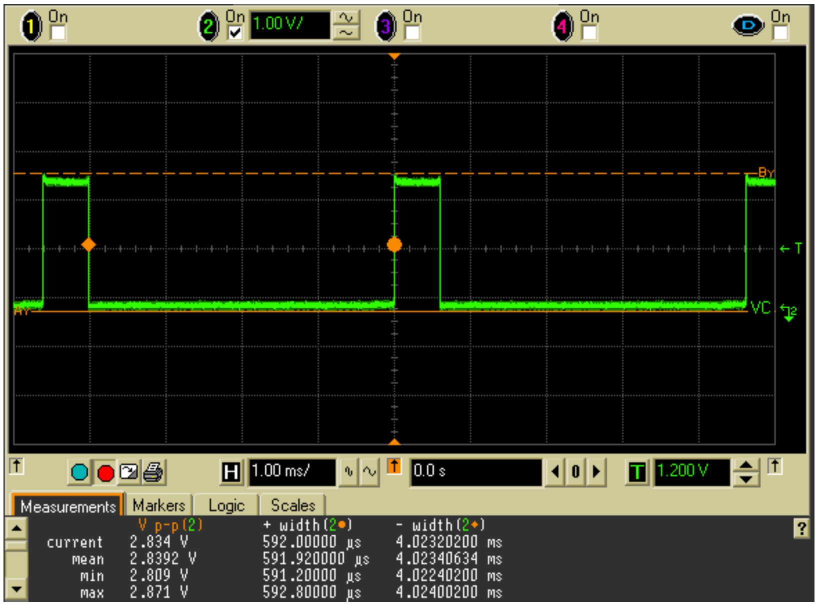


DC value changes if channel or band is changed. Upper figure has been taken in EGSM900 band and on channel 37.

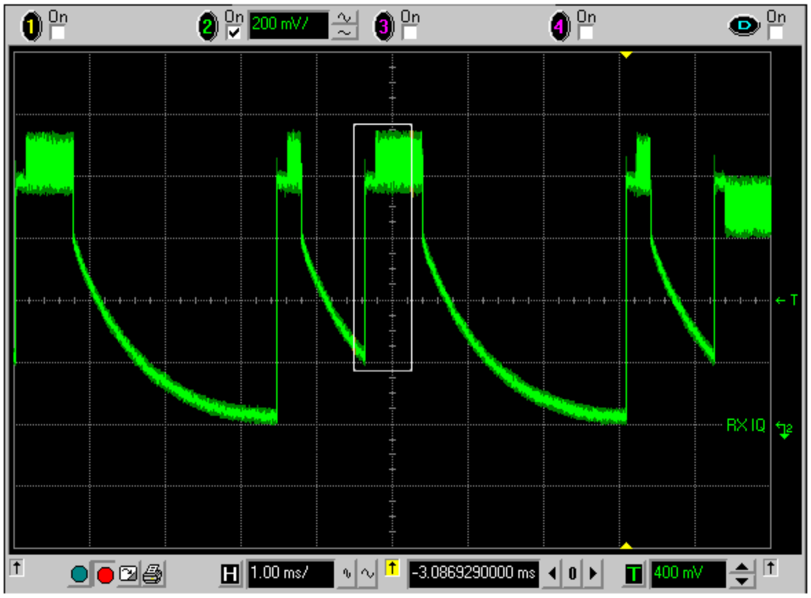
6.5.4 Icont_21/Icont_22 (DC Offset 1.2 V)

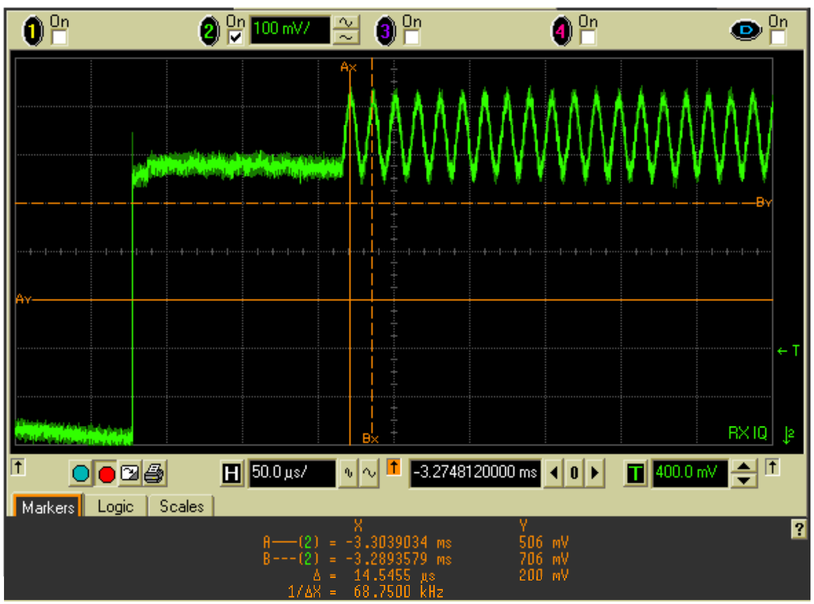


6.5.5 Icont_31/Icont_32 (DC Offset 1.2 V)



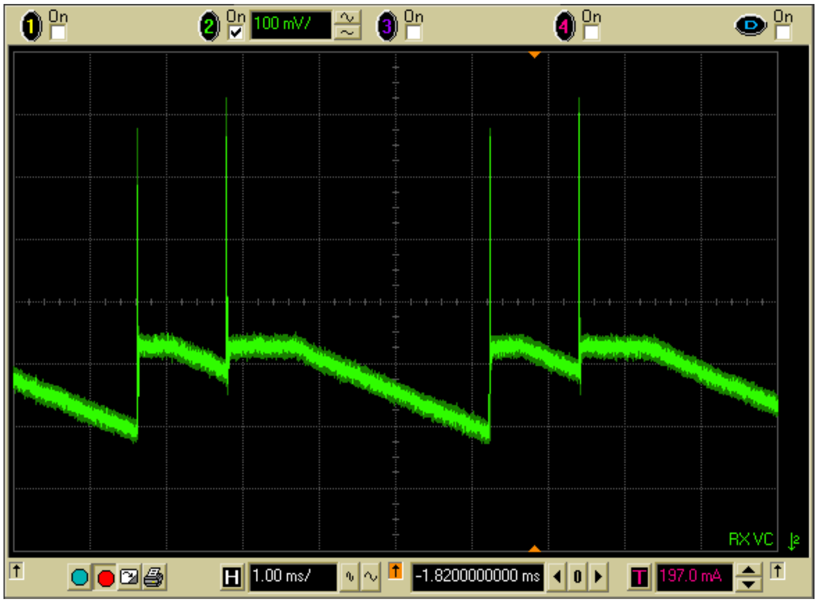
6.5.6 GSM RX IQ (DC Offset 0.4 V)





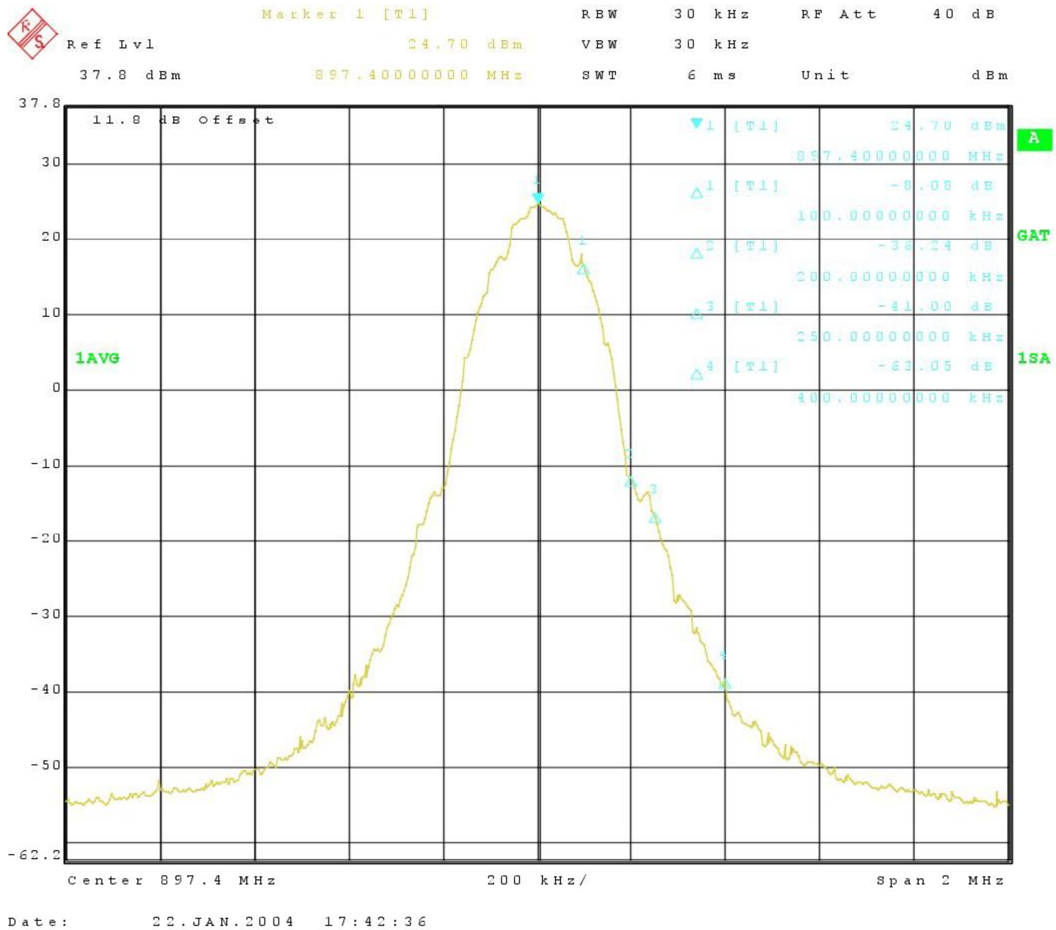
The lower figure is a detail from the upper figure (detail area marked with a white box).

6.5.7 RX VC in GSM mode (DC Offset 1.5 V)



DC value changes if channel or band is changed. Upper figure has been taken in EGSM900 band and on channel 37.

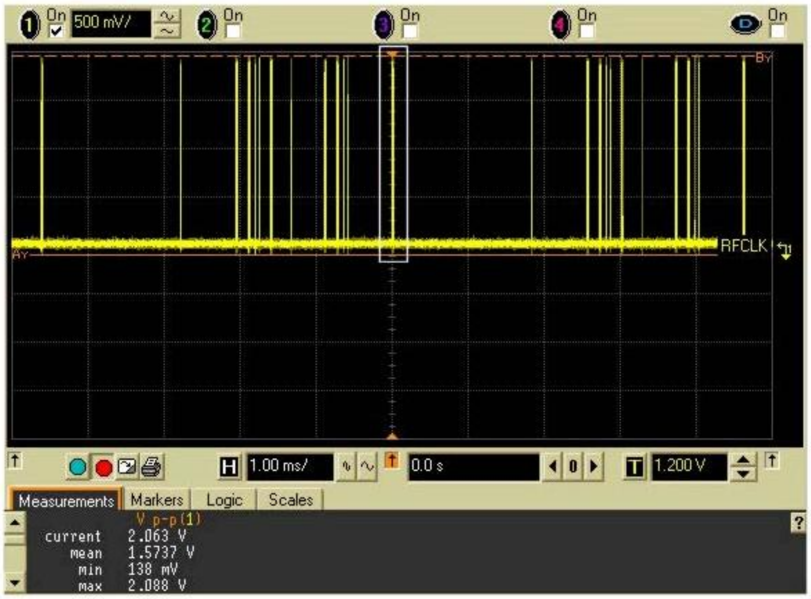
6.5.8 TX Modulation spectrum (GSM)

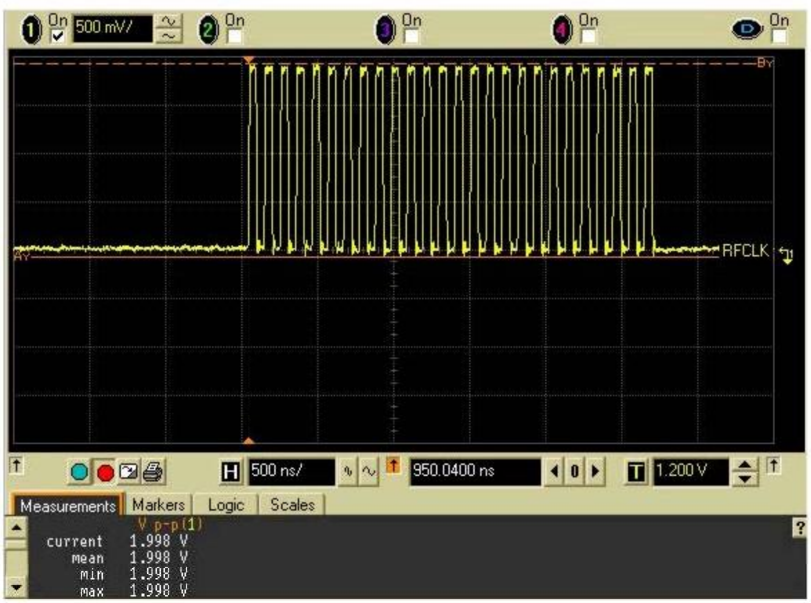


Example of the TX modulation spectrum (GMSK) in EGSM900 band.

6.5.9 RFBUS

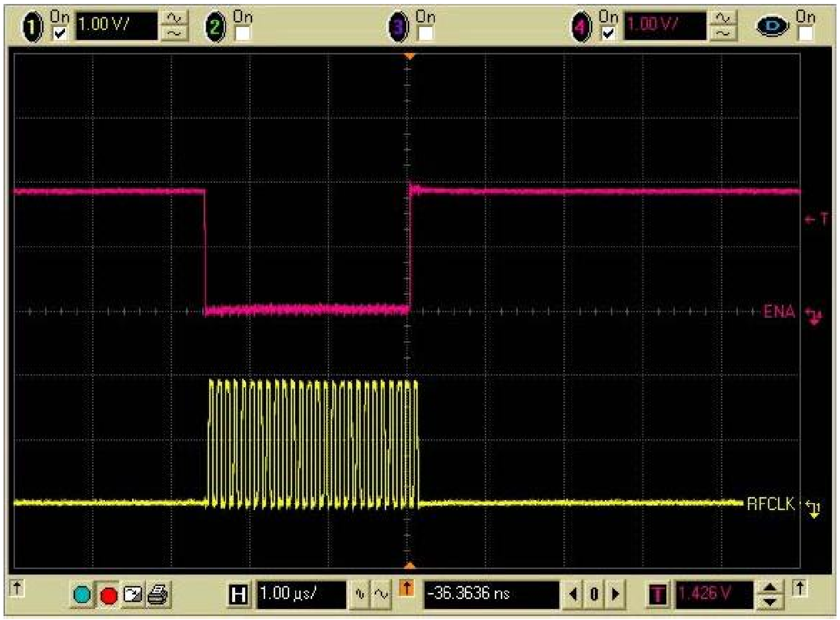
6.5.9.1 RFBUSCLK (GSM RX)



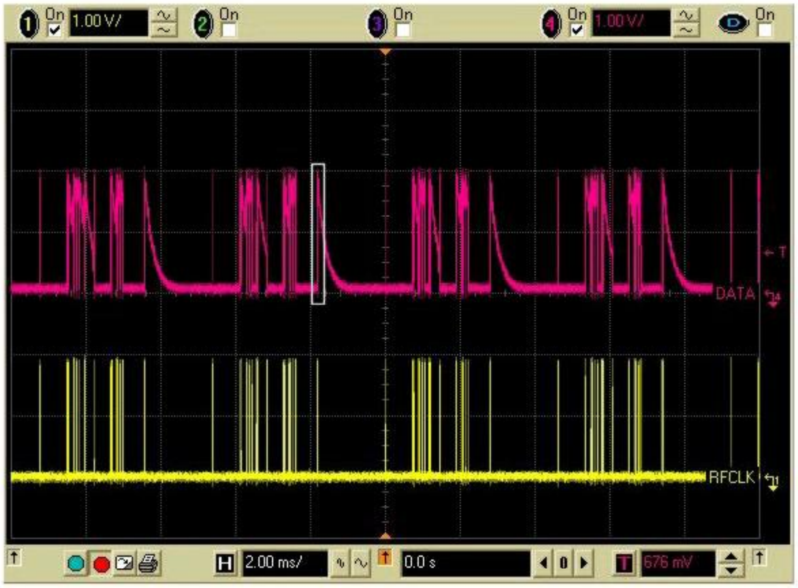


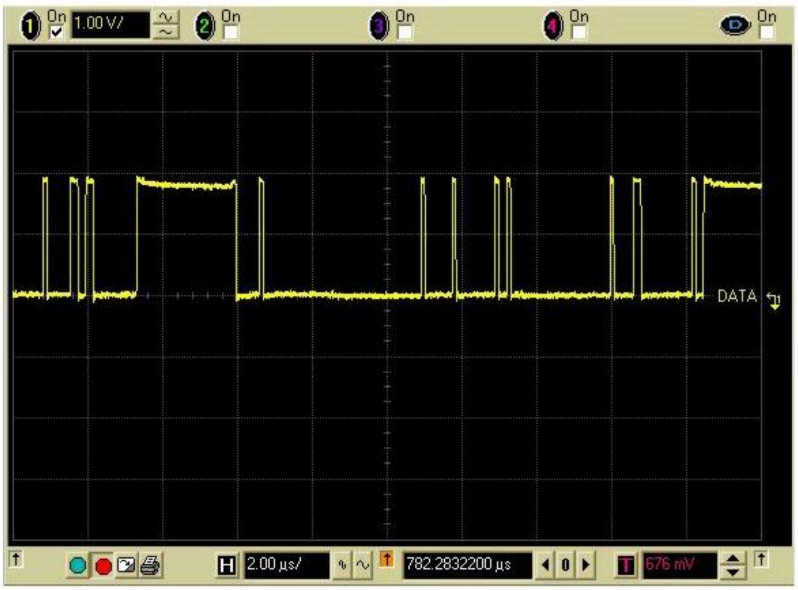
The lower figure is a detail from the upper figure (detail area marked with a white box).

6.5.9.2 RFBUSCLK and RFBUSENA (GSM RX)



6.5.9.3 RFBUSDAT (GSM RX)





The lower figure is a detail from the upper figure (detail area marked with a white box).

(This page left intentionally blank.)

8 — Camera Module Troubleshooting

(This page left intentionally blank.)

Table of Contents

List of Figures

(This page left intentionally blank.)

Introduction to camera module troubleshooting

Background, tools and terminology

Faults or complaints in camera operation can be roughly categorised into three subgroups:

1 Camera is not functional at all; no image can be taken.

2 Images can be taken but there is nothing recognizable in them.

3 Images can be taken and they are recognizable but for some reason the quality of images is seriously degraded, or customer complains about image quality..

Image quality is very hard to measure quantitatively, and even comparative measurements are difficult (comparing two images) to do, if the difference is small. Especially if the user is not satisfied with his/her device's image quality, and tells, for example, that the images are not sharp, it is fairly difficult to accurately test the device and get an exact figure which would tell whether the device is functioning properly.

Often subjective evaluation has to be used for finding out if a certain property of the camera is acceptable or not. Some training or experience of a correctly operating reference device may be needed in order to detect what actually is wrong, or is there anything wrong at all.

It is easy for the user to take bad images in bad conditions. Therefore the camera operation has to be checked always in constant conditions (lighting, temperature) or by using a second, known-to-be good device as reference. Experience helps significantly in analysing image quality.

Terms

Autofocus	Camera module contains lens movement mechanics for focus adjustment. Autofocus enables camera to take sharp images of objects positioned between 10cm to infinity. During AF the viewfinder image will be momentarily blurred as the camera searches for the right focus setting.
Dynamic range	Camera's ability to capture details in dark and bright areas of the scene simultaneously. See "Image taken against light (Page)" for an example.
Exposure time	Camera modules use silicon sensor to collect light and for forming an image. The imaging process roughly corresponds to traditional film photography, in which exposure time means the time during which the film is exposed to light coming through optics. Increasing the time will allow for more light hitting the film and thus results in brighter image. The operation principle is exactly the same with silicon sensor, but the shutter functionality is handled electronically i.e. there is no mechanical moving parts like in film cameras.
Flicker	Phenomenon, which is caused by pulsating in scene lighting, typically appearing as wide horizontal stripes in an image.
Noise	Variation of response between pixels with same level of input illumination. See "Noisy image (Page)" for an example.
Resolution	Usually the amount of pixels in the camera sensor; for example, RM-42 has a 1600 x 1200 pixel sensor resolution. In some occasions the term resolution is used for describing the sharpness of the images.
Sensitivity	Camera module's sensitivity to light. In equivalent illumination conditions, a less sensitive camera needs a longer exposure time to gather enough light in forming a good image. Analogous to ISO speed in photographic film.

Sharpness	Good quality images are 'sharp' or 'crisp', meaning that image details are well visible in the picture. However, certain issues, such as non-idealities in optics, cause image blurring, making objects in picture to appear 'soft'. Each camera type typically has its own level of performance.

The effect of image taking conditions on image quality

There are some factors, which may cause poor image quality, if not taken into account by the end user when shooting images, and thus may result in complaints. The items listed are normal to camera operation and are not a reason for changing the camera module.

Autofocus

When the camera is focusing a lens is moved inside the module to give the sharpest possible image. This camera module is specified to operate satisfactorily from 10 cm to infinite distance of scene objects. Trying to photograph objects closer than 10 cm is likely to result in a blurred out of focus image. The lack of sharpness is first visible in full resolution (1600 x 1200) images. Images taken very close to the subject, a limited depth of focus will be visible, that is the upper or lower parts of the image may be out of focus. This is normal; do not change the camera module.

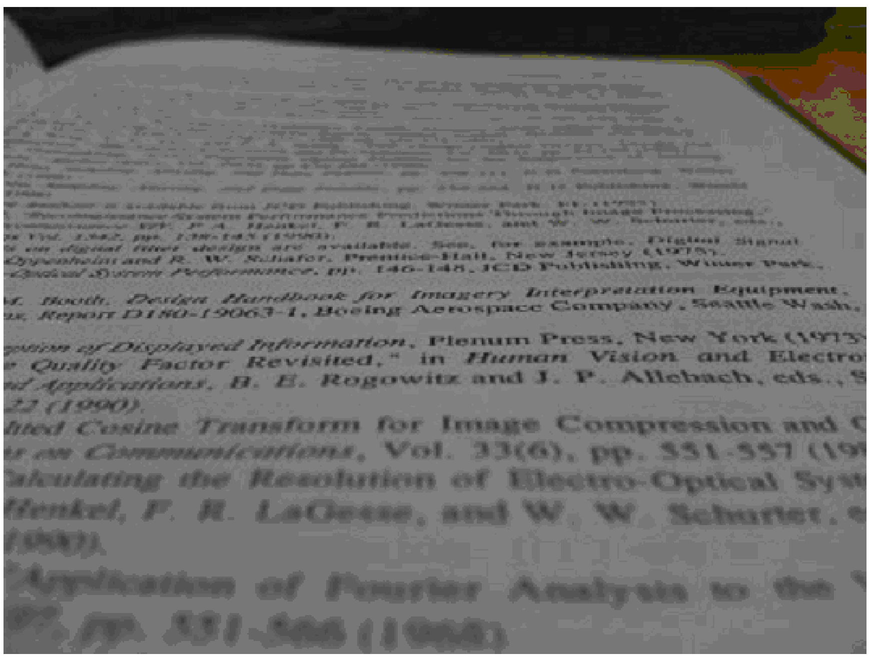


Figure 79 Only center part of image is in focus due to limited depth of focus

The amount of light available

In dim conditions camera runs out of sensitivity. The exposure time is long (especially in the night mode) and the risk of getting shaken (= blurred) images increases. In addition, image noise level grows. The maximum exposure time in the night mode is ¼ seconds. Therefore, images need to be taken with extreme care and by supporting the phone when the amount of light reflected from the target is low. Because of the longer exposure time and larger gain value, noise level increases in low light conditions. Sometimes blurring may even occur in daytime, if the image is taken very carelessly. See the figure below for an example. This is normal; do not change the camera module.

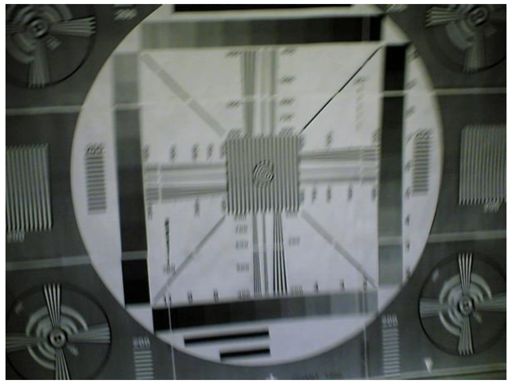


Figure 80 Blurring caused by shaking hands

Movement in bright light

If an image is taken of moving objects or if the device is used in a moving vehicle, object 'skewing' or 'tilting' may occur. This phenomenon is fundamental to most CMOS camera types, and usually cannot be avoided. The movement of camera or object sometimes cause blurring indoors or in dim lighting conditions because of long exposure time. This is normal; do not change the camera module.

Figure 81 Near objects get skewed when taking images from a moving vehicle

Temperature

High temperatures inside the mobile phone cause more noise to appear in images. For example, in +70 degrees (Celsius), the noise level may be very high, and it further grows if the conditions are dim. If the phone processor has been heavily loaded for a long time before taking an image, the phone might have considerably higher temperature inside than in the surrounding environment. This is also normal to camera operation; do not change the camera module.

Figure 82 Noisy image taken in +70 degrees Celsius

Phone display

If the display contrast is set too dark, the image quality degrades: the images may be very dark depending on the setting. If the display contrast is set too bright, image contrast appears bad and "faint". This problem is solved by setting the display contrast correctly. This is normal behaviour; do not change the camera module.

Basic rules of photography (especially shooting against light)

Because of dynamic range limitations, taking images against bright light might cause either saturated image or the actual target appear too dark. In practice, this means that when taking an image indoors and having, for example, a window behind the object, the result is usually poor. This is normal behaviour; do not change the camera module.

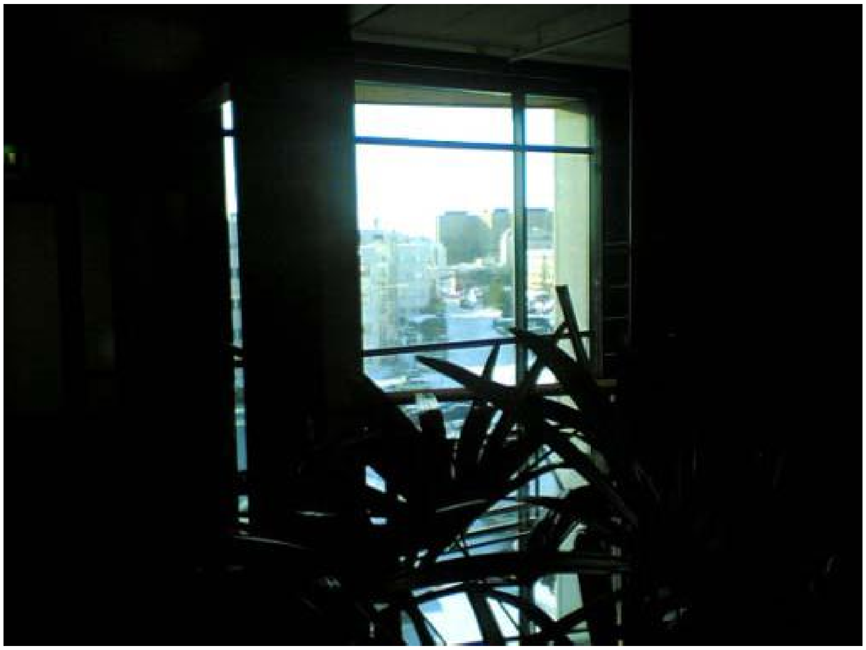


Figure 83 Image taken against light

Flicker

In some occasions a bright fluorescent light may cause flicker in the viewfinder and captured image. This phenomenon may also be a result, if images are taken indoors under the mismatch of 50/60 Hz electricity network frequency. The electricity frequency used is automatically detected by the camera module. In some very few countries, both 50 and 60 Hz networks are present and thus probability for the phenomenon increases. Flickering occurs also under high artificial illumination level. This is normal behaviour; do not change the camera module.

Figure 84 Flicker in an image; object illuminated by strong fluorescent light

Bright light outside of image view

Especially the sun can cause clearly visible lens glare phenomenon and poor contrast in images. This happens because of undesired reflections inside the camera optics. Generally this kind of reflections are common in all optical systems. This is normal behaviour; do not change the camera module.

Figure 85 A lens reflection effect caused by sunshine

Examples of good quality images

Figure 86 Good image taken indoors

Figure 87 Good image taken outdoors

Image quality analysis

Possible faults in image quality

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems may be expected to appear:

- Dust (black spots)
- Lack of sharpness
- Bit errors

In addition, there are many other kinds of possibilities for getting bad image quality, but those are ruled out from the scope of this document since the probability of their appearance is going to be minimized by production testing.

Testing for dust in camera module

Context

For detecting these kinds of problems, take an image of a uniform white surface and analyse it in full resolution. A good quality PC monitor is preferred for analysis. Search carefully, since finding these defects is not always easy. Figure "Effects of dust on optical path" is an example image containing easily detectable dust problems.

When taking a white image, use uniformly lightened white paper or white wall. One possibility is to use uniform light but in this case make sure that the camera image is not flickering when taking the test image. In case flickering happens, try to reduce illumination level. Use JPEG image format for analysing, and set the image quality parameter to ‘High Quality’.

Black spots in an image are caused by dirt particles trapped inside the optical system. Clearly visible and sharp edged black dots in an image are typically dust particles on the image sensor. These spots are searched for in the manufacturing phase, but it is possible that the camera body cavity contains a particle, which may move onto the image sensor active surface, for example, when the phone is dropped. Thus it is also possible that the problem will disappear before the phone is brought to service. The camera should be replaced if the problem is present when the service technician analyses the phone.

If a dust particle is lying on the infrared filter surface on either side, they are hard to locate because they are out of focus, and appear in the image as large, grayish and fading-edge 'blobs'. Sometimes they are invisible to the eye, and thus the user probably does not notice them at all. However, it is possible that a larger particle disturbs the user, causing need for service.

Figure 88 Effects of dust on optical path

If large dust particles get trapped on top of the lens surface in the cavity between camera window and lens, they will cause image blurring and poor contrast. The dust gasket between the window and lens should prevent any particles from getting into the cavity after the manufacturing phase.

If dust particles are found on the sensor, this is classified as a manufacturing error of the module and the camera should be replaced. Any particles inside the cavity between the protection window and lens have most probably been trapped there in the assembly phase at a Nokia factory. Unauthorized disassembling of the product can also be the root of the problem. However, in most cases it should be possible to remove the particle(s) by using clean compressed air. Never wipe the lens surface before trying compressed air; the possibility of damaging the lens is substantial. Always check the image sharpness after removing dust.

Testing camera image sharpness

Context

If pictures taken with a device are claimed to be blurry, there are five possible sources for the problem:

1 The protection window is fingerprinted, soiled, dirty, visibly scratched or broken.

2 The camera module has failed to focus correctly, producing a blurred image.

3 User has tried to take pictures in too dark conditions, and images are blurred due to handshake or movement. This is no cause to replace camera module.

4 There is dirt between the protection window and camera lens.

5 The protection window is defective. This can be either a manufacturing failure or caused by the user. The window should be changed.

 Company Confidential

A quantitative analysis of sharpness is very difficult to conduct in any other environment than optics laboratory. Therefore, subjective analysis should be used.

If no visible defects (items 1-4) are found, a couple of test images should be taken. Generally, a well-illuminated typical indoor scene, such as the one in Figure "Good image taken indoors (Page)", can be used as a target. The main considerations are:

- The camera module has to be given time to focus correctly. Correct focusing is normally indicated with a flashing icon or green bracket in the viewfinder. During focusing the image in the viewfinder will move slightly back and fourth, this is normal and shows that the lens unit is moving. During the movement a faint sound can be heard from the camera head.
- The protection window has to be clean.
- The amount of light (300 – 600 lux (bright office lighting)) is sufficient.
- The scene should contain, for example, small objects for checking sharpness. Their distance should be 1 – 2 meters.
- If possible, compare the image to another image of the same scene, taken with a different device. Note that the reference device has to be a similar Nokia phone.

There are several conditions in which AF operation is challenging for the camera module, these include:

- Low light scenes and night mode
- Scenes with low contrast
- Fast-moving objects

Under low light and night mode the AF function is slower than under good light, it may even fail to find correct focus position. Low contrast scenes and fast moving objects may also slow down or cause AF to fail. This is normal operation and no cause to replace camera.

AF operation may be tested by taking images of objects at different distances. Good distances are 20 cm, 60 cm and infinity (>3 m). Any LED or xenon flashes should not be used while taking the images.

The taken images should be analysed on PC screen at 100% scaling simultaneously with reference image. Pay attention to the computer display settings; at least 65000 colours (16 bit) have to be used. 256 (8-bit) colour setting is not sufficient, and true colour (24 bit, 16 million colours) or 32 bit (full colour) setting is recommended.

If there appears to be a clearly noticeable difference between the reference image and the test images, the module might have faulty lens. In this case, the module should be changed. Always re-check the resolution after changing the camera. If a different module produces the same result, the fault is probably in camera window. Check the window by looking carefully through it when replacing the module. As references Figure "Good image taken indoors (Page)" and Figure "Good image taken outdoors (Page)" can be used. Another possibility is to use service point comparison phone if available.

Effects of dirty or defective camera lens protection window

The following series of images demonstrates the effects of fingerprints on the camera protection window.

> **Note:** The effects of any dirt in images can vary very much; it may be difficult to judge if the window has been dirty when some image has been taken or if something else has been wrong. That is why the cleanness of the protection window should always be checked and the window should be wiped clean with a suitable cloth.

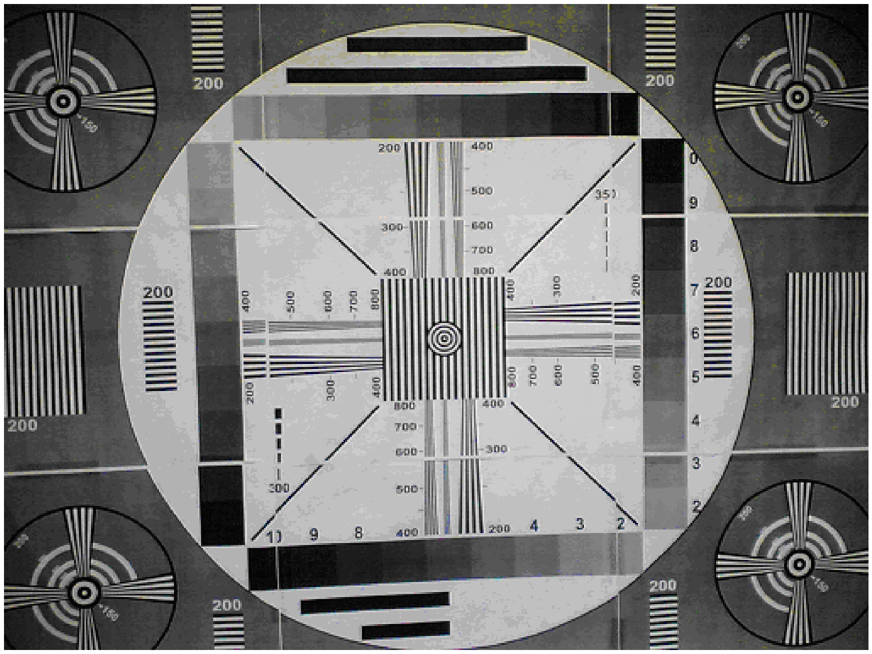


Figure 89 Image taken with clear protection window

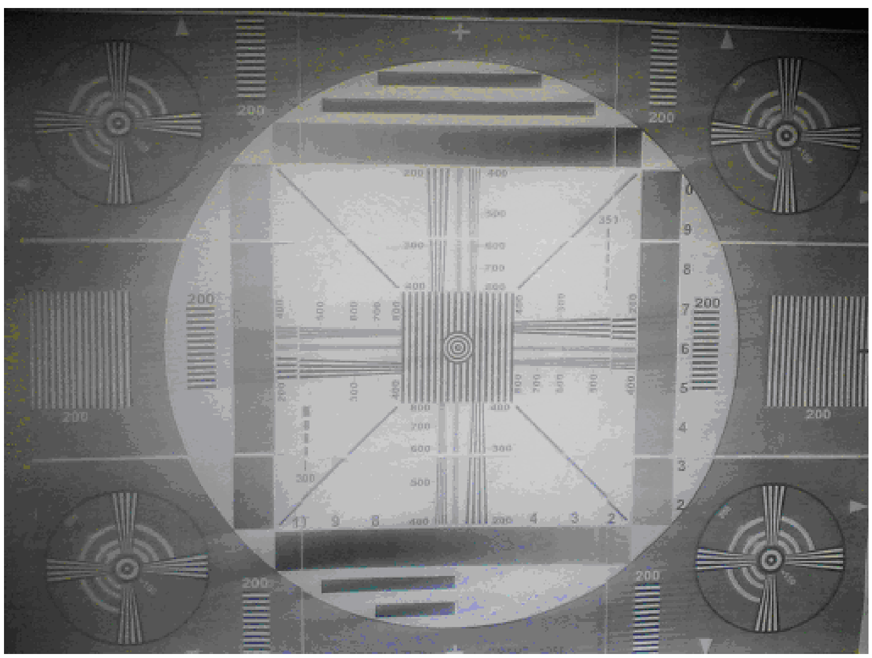


Figure 90 Image taken with greasy protection window

Bright point light sources might cause images that have flares around the light source if the protection window is dirty. A smeared fingerprint may be hard to see on the protective window but if will affect the image quality. These flares can be avoided by cleaning the window with a suitable cloth.

Figure 91 Image of point light sources taken with a clean protective window

Figure 92 Image of point light sources taken with a dirty (finger print) protective window

Image bit errors

Bit errors are image defects caused by data transmission errors between the camera module and the phone baseband and/or errors inside the camera module.

Usually bit errors can be easily detected in images, and they are best visible in full resolution images. A good practice is to use a uniform white test target when analysing these errors. The errors are clearly visible, colourful sharp dots or lines in camera images. See the following figure.

Figure 93 Bit errors caused by JPEG compression

One type of bit error is a lack of bit depth. In this case, the image is almost totally black under normal conditions, and only senses something in very highly illuminated environments. Typically this is a contact problem between the camera module and the phone main PWB. You should check the camera assembly and connector contacts.

If the fault is in the camera module, bit errors are typically visible only when using some specific image resolution. For example, in case of a viewfinder fault, the error might exist but is not visible in a full size image.

Faulty pixels in images

Faulty pixels are pixels that do not respond to light in the same way as the pixels around them. There are three main types of faulty pixels, dead, stuck and hot pixels.

Dead pixels are always black or significantly darker than their surrounding. Dead pixels appear as black spots in all lightning conditions. Camera modules producing images with dead pixels that are clearly noticeable should be replaced.

If the pixel remains always saturated to its maximum value it is stuck. Stuck pixels may appear as red, green, blue or white spots in all lightning conditions. Camera modules producing images with one or more stuck pixels should be replaced.

Hot pixels are pixels that easily saturate in dim light conditions. It is normal to get a lot of noise and hot pixels in night conditions or otherwise dark conditions. The hot pixels should disappear when the ambient light is increased, but may still appear in darker areas of an otherwise well illuminated scene.

When examining an image for defect pixels test images should be viewed as 100% enlargements on a PC monitor.

Figure 94 Enlargement of a hot pixel

Flash photography problems

Use of flash device may affect the image in many ways.

- White balance errors. The image may get a wrong tone due to mixing of flash colour temperature and ambient lightning. This is unwanted but normal feature.
- Dust reflections. Dust or water drops in front of the flash unit may reflect strongly to the camera sensor. See the following figure.

More detailed information of flash photography problems can be found in the document “LED flash service manual”.

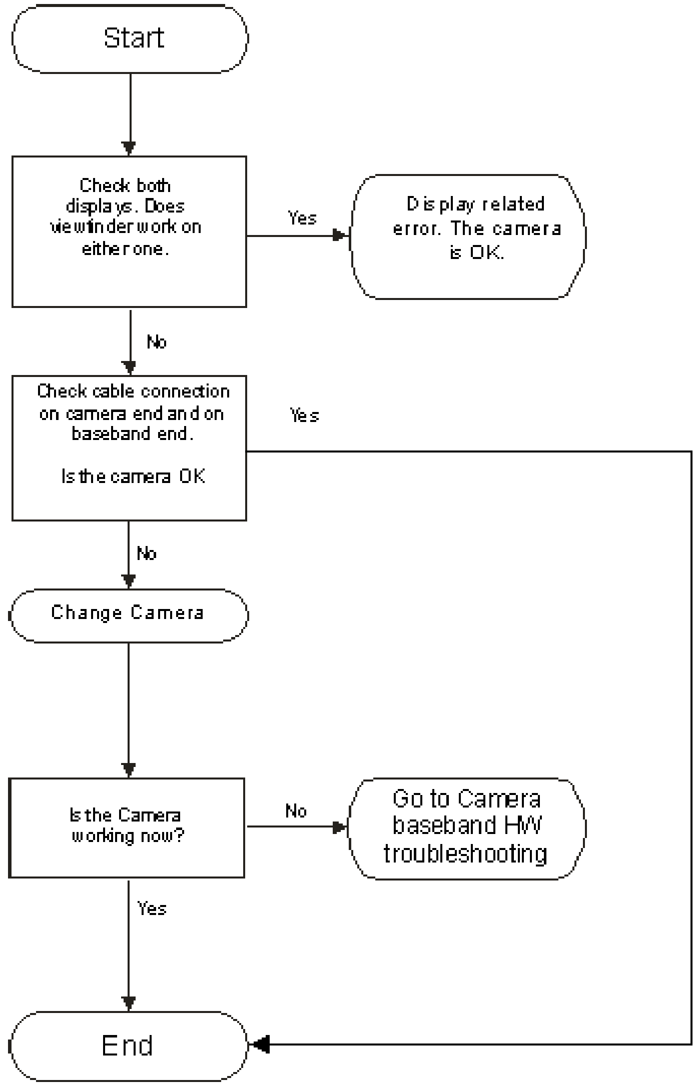
Figure 95 Light from the flash has reflected on particles in front of the camera

Camera troubleshooting flowcharts

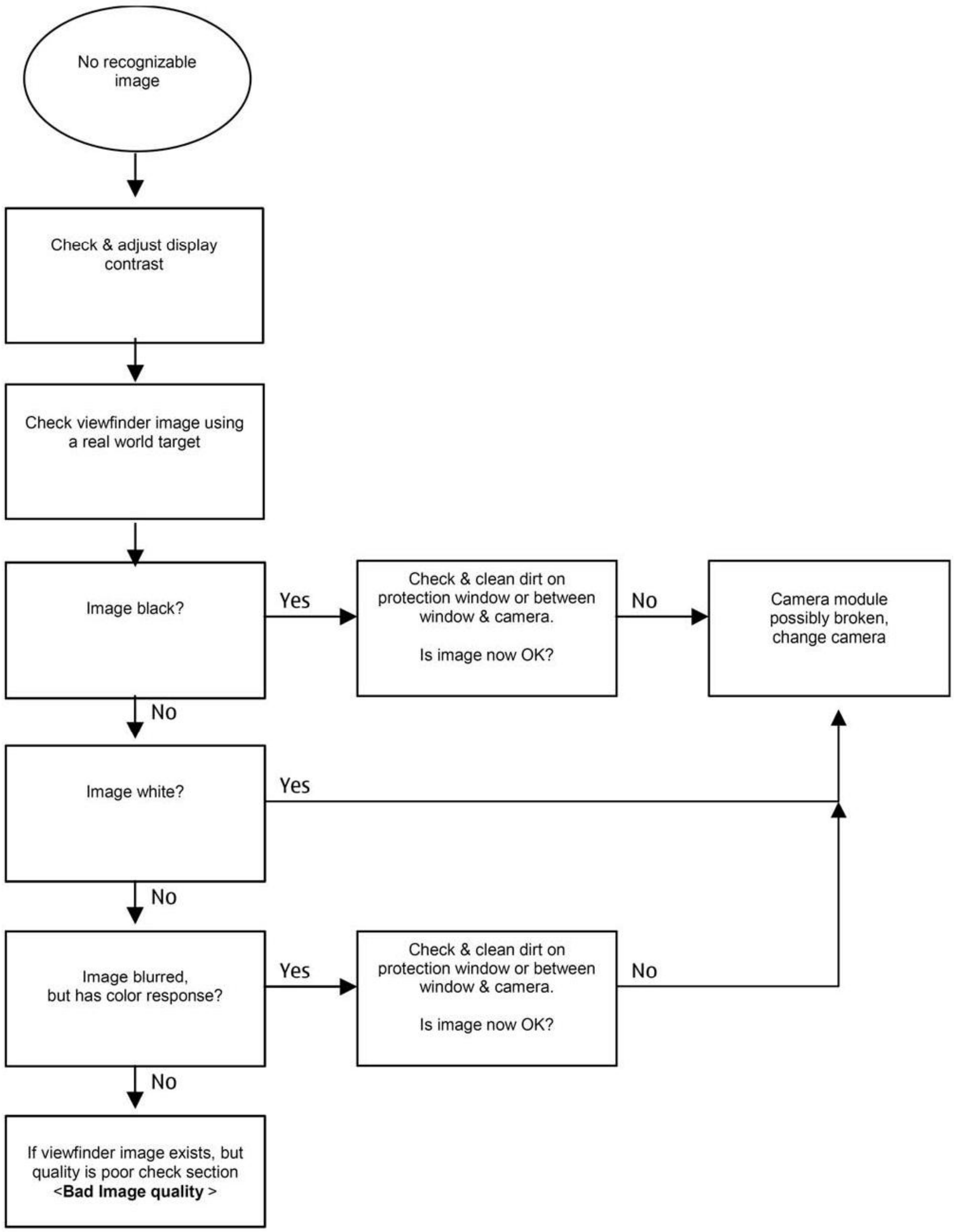
Camera hardware failure message troubleshooting

Context

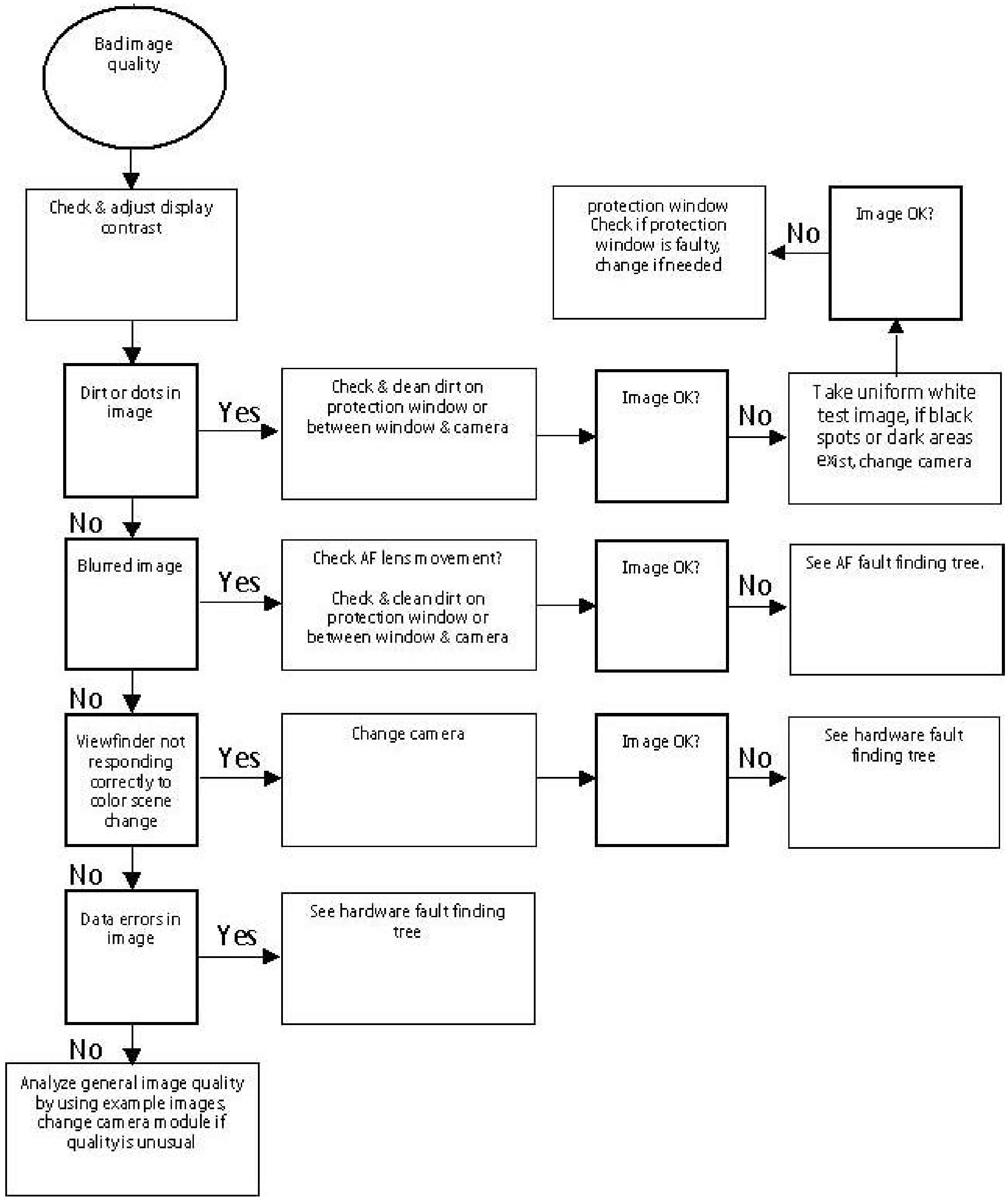
If you get a hardware failure message when using the camera, follow the next troubleshooting flowchart.


Start
Check both displays. Does viewfinder work on either one.
Yes
Display related error. The camera is OK.
No
Check cable connection on camera end and on baseband end.
Is the camera OK
Yes
No
Change Camera
Is the Camera working now?
No
Go to Camera baseband HW troubleshooting
Yes
End

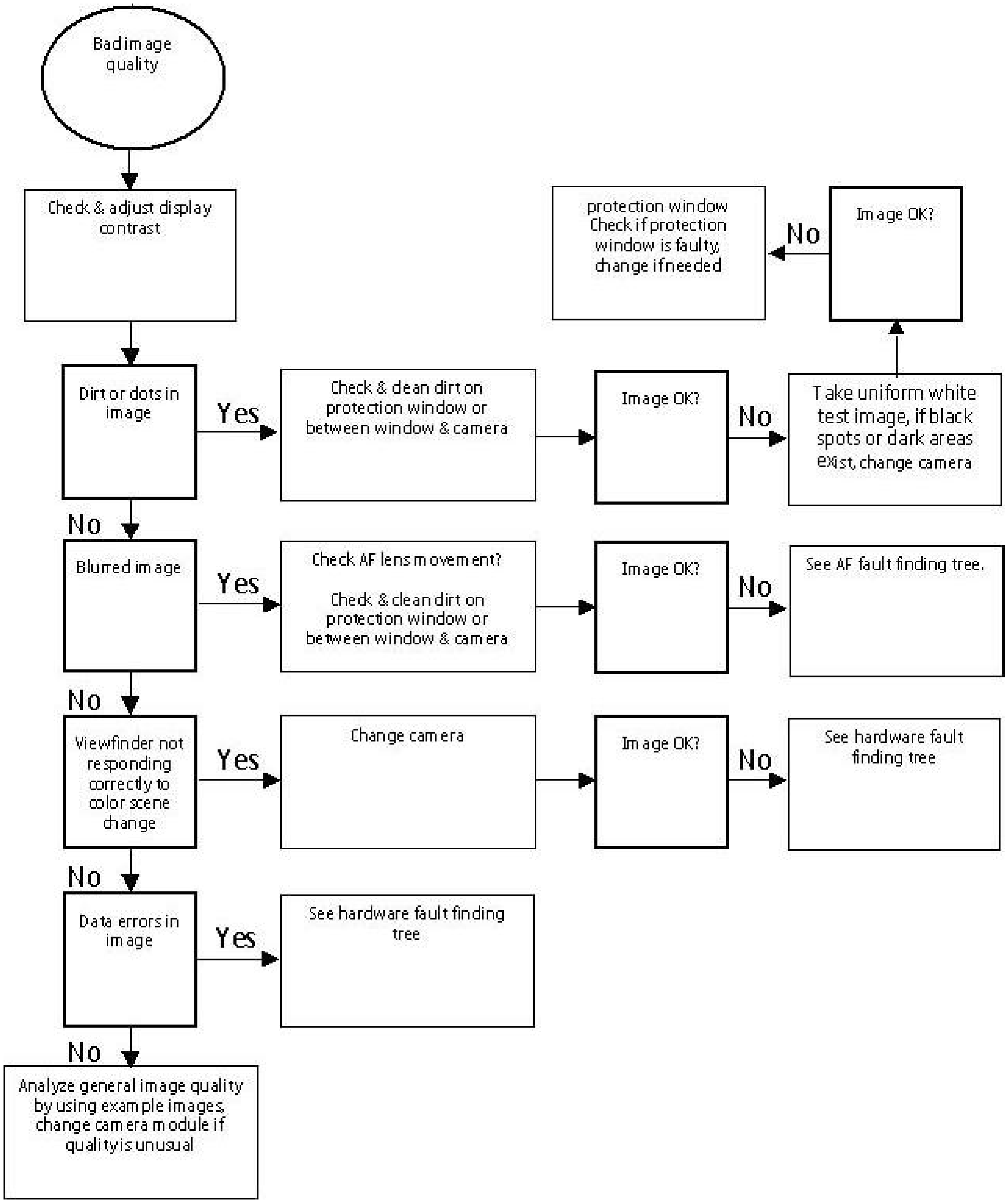
Camera viewfinder troubleshooting



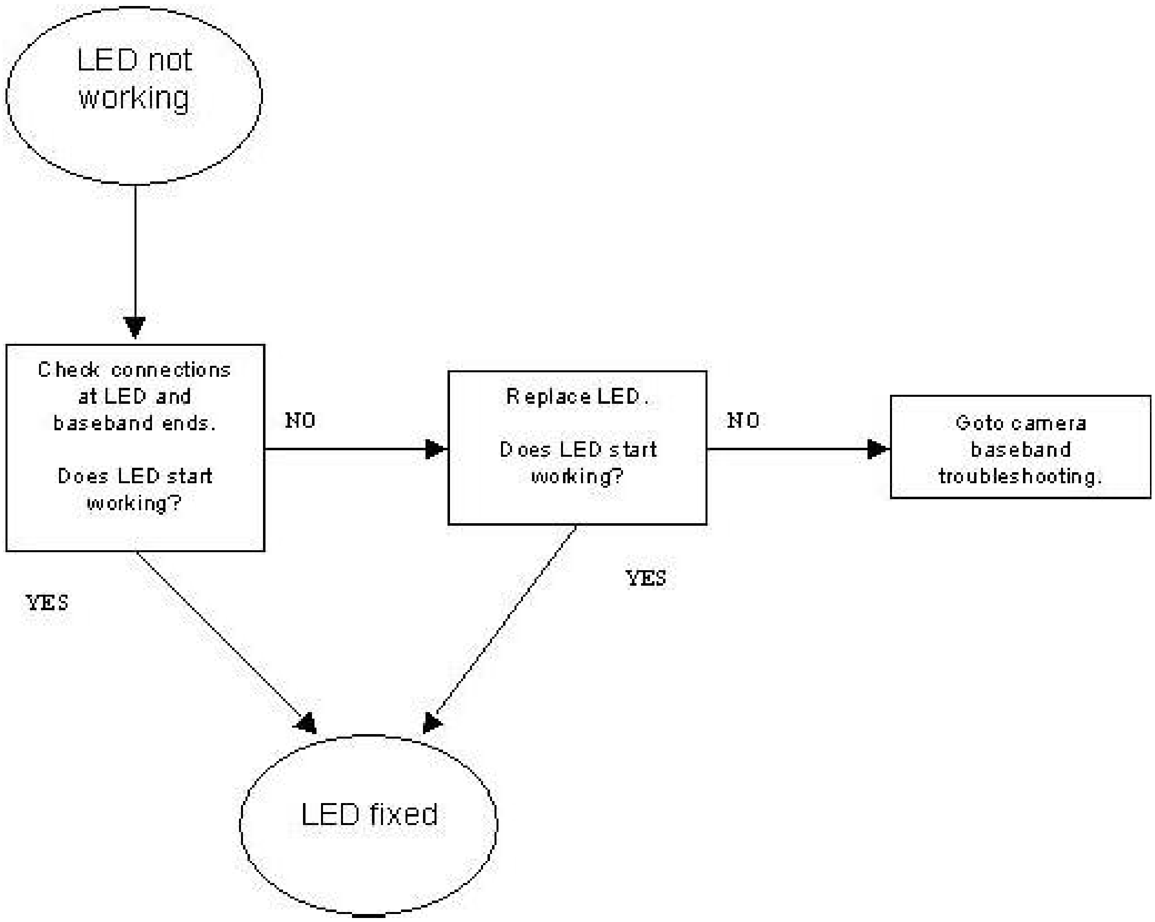
Bad camera image quality troubleshooting



Bad camera image quality troubleshooting



Camera LED flash troubleshooting



(This page left intentionally blank.)

9 — System Module

(This page left intentionally blank.)

Table of Contents

List of Tables

List of Figures

(This page left intentionally blank.)

Baseband description

System module block diagram

The device consists of three different main units: engine unit, display unit and camera unit. The engine unit contains most of the baseband and RF components. The display unit contains main display, sub-display and associated components. The camera unit consists of camera head, flash led and associated components.

Table below lists the main HW modules inside the main units and Figure 1 shows the interconnections and block diagram of the units.

Name of module	Type code	Notes
Engine Module	1HU	Engine PWB with components
Display PWB	1LB	Display PWB with components. Part of the Display frame assembly.
Engine Flex	1JS	Keyboard flex with components. Part of the Engine UI assembly.
Display FPC	1JT	Display unit flex with components. Part of the Display frame assembly.
Camera Flex	1JU	Camera unit flex with components. Part of the Audio module.
Camera Module		Unagi 2MP camera head
Main Display Module		K2
2nd Display Module		Jordan

Note: In this description, user interface HW covers display, camera, keyboard, keyboard backlight and ALS.

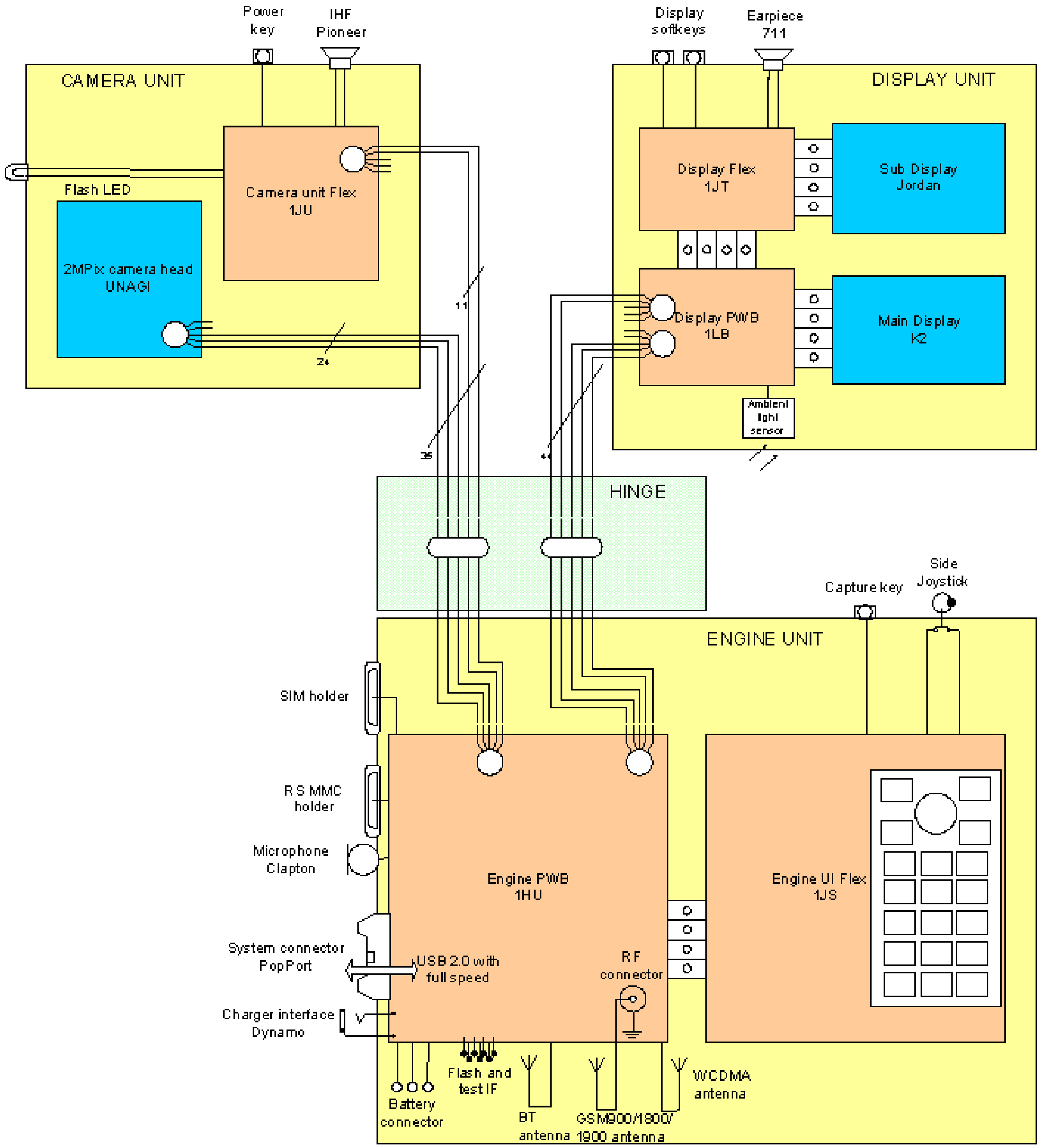


Figure 96 Internal and external connections diagram

Baseband functional description

Digital baseband consists of ISA based modem and SYMBIAN based application sections. Modem functionality is in RAP3G and Helen2/3 acts as a platform for SYMBIAN applications.

Modem section consists of RAP3G ASIC with NOR FLASH and SDRAM memory as the core. RAP3G supports cellular protocols of WCDMA (3GPP R-4) and GSM (minimum EDGE glass 10, GPRS phase2). Modem SDRAM memory have 64Mbits of memory and NOR flash have 64Mbits of memory. RAP3G operates with the system clock of 38.4 MHz, which comes from the VCTCXO.

Application section includes Helen3 ASIC with DDR/NAND combo memory as the core. Stacked DDR/NAND application memory has 512Mbits of DDR memory and 512Mbits of flash memory. Helen3 uses 19.2MHz clock, which comes from the RAP3G divided by two from the 38.4 MHz system clock.

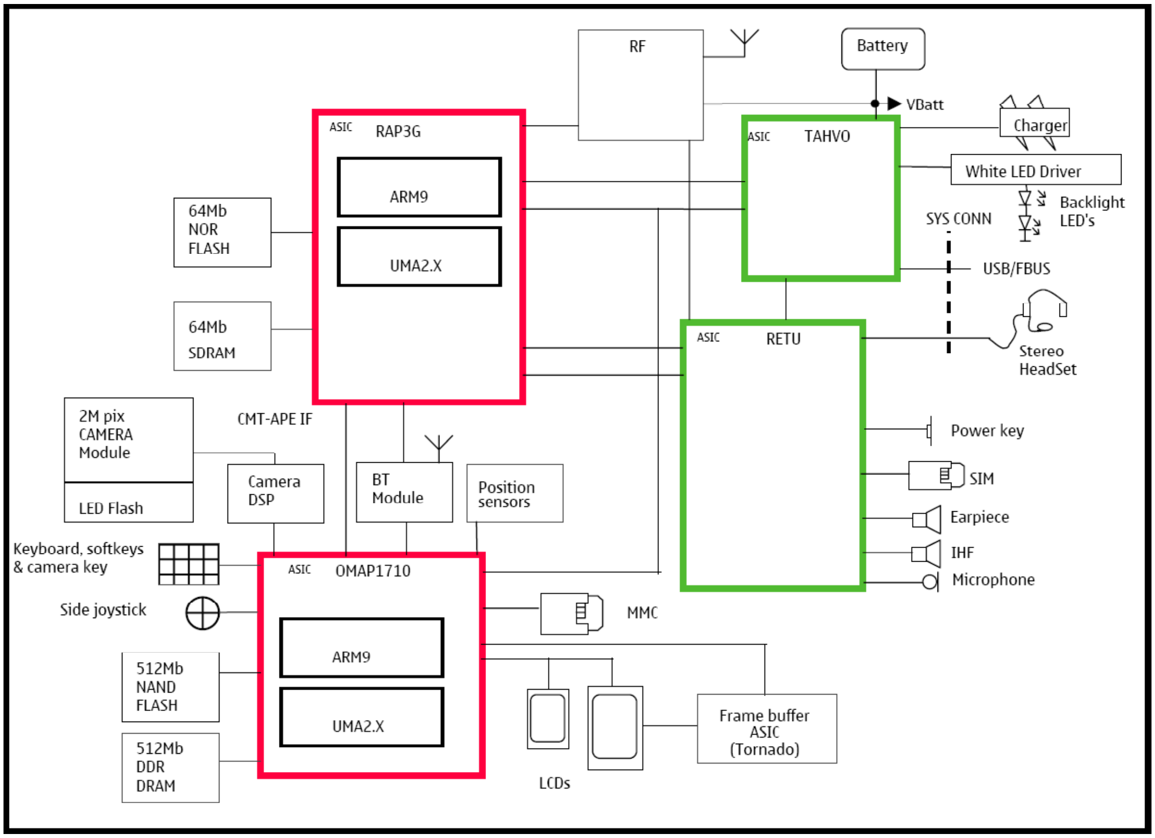


Figure 97 Functional block diagram

Helen3 processor (OMAP1710) is also called as an application ASIC because it is processing application SW and handles the UI SW. It consists of OMAP3.3 and peripheral subsystems like camera-, display- and keyboard driver blocks.

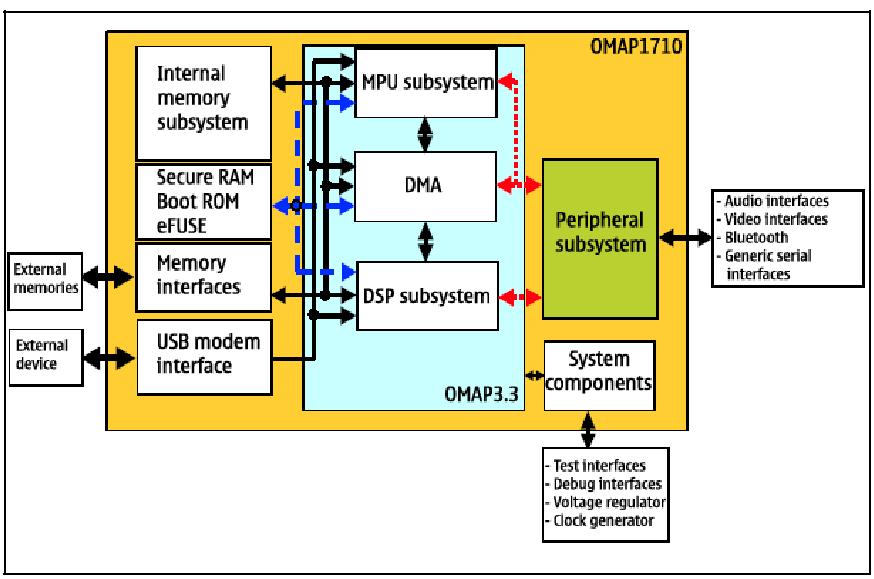


Figure 98 Helen3 high level block diagram

OMAP3.3 consists of ARM926 (MPU subsystem), TMS320C55x (DSP subsystem), DMA and OMAP3.3s internal peripherals.

Helen3s MPU subsystem is based on an ARM926EJ. MPU is able to perform most of the application operations on the chip.

System DMA: This component is mainly used to help the MPU and DSP perform data memory transfer-specific tasks, leaving more available MIPS for both processors.

The DSP subsystem is based on a TMS320C55x™ DSP core, which is responsible for intensive data computing tasks like real-time audio and video handling on application side. E.g. voice recording.

Internal memory subsystem: This subsystem is composed of a single port SRAM.

Secure modules: OMAP1710 contains a set of several components, including ROM, a single port SRAM, and eFUSE cells. These components enable the system to support secure applications.

Memory interfaces: The memory interfaces define the system memory access organization of OMAP1710.

USB & modem interface: These two modules enable the platform to support a universal serial link and a dedicated modem interface, enabling a high data transfer rate between the modem and the application chip.

System components: System components are group of modules responsible for managing system interactions such as interrupt, clock control and idle.

Peripheral subsystem: The peripheral subsystem defines all the components used to interface OMAP1710 with specific external devices such as camera, keyboard, display etc.

Absolute maximum ratings

Signal	Min	Nom	Max	Unit	Notes
Battery voltage (idle)	-0.3		+4.5	V	Battery voltage maximum value is specified during charging is active
Battery voltage (Call)	+3.2		+4.3	V	Battery voltage maximum value is specified during charging is active
Charger input voltage	-0.3		+16V	V	
Back-Up supply voltage	0	2.5	2.7	V	Maximum capacity of the backup power supply assumed to be 15 µAh.

Phone modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below RETU master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over RETU master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. In this mode certain regulators are enabled and after they and RFClk have stabilized, the system reset (PurX) is released and PWR_ON mode entered. RESET mode uses 32kHz clock to count the REST mode delay (typically 16ms).

Mode	Description
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low. There are in principle three different sleep modes: • OMAP1710 sleep • RAP3G sleep • OMAP and RAP3G sleep (deep sleep) In SLEEP mode RETU's regulators VIO, VDRAM, VSIM1, VSIM2, VAUX and Vana are in low quiescent current mode (output voltages still present but regulators will not give as much current out). Other regulators including VR1 supplying system clock oscillator are disabled. In SLEEP mode, TAHVO VCORE SMPS regulator is in low quiescent current mode (if sleep mode is not internally disabled). Linear regulator VOUT state depends on the accessory connected to the system connector (Pop-Port), if there is any.
FLASHING	FLASHING mode is for SW downloading. FLASHING mode is not really a RETU or TAHVO state but rather a system state. From RETU and TAHVO point of view, it is like PWR_ON. The state is entered from PWR_ON. It is possible to use external voltage (VPP) during flashing to speed up the process (provided that the memory components support the feature).

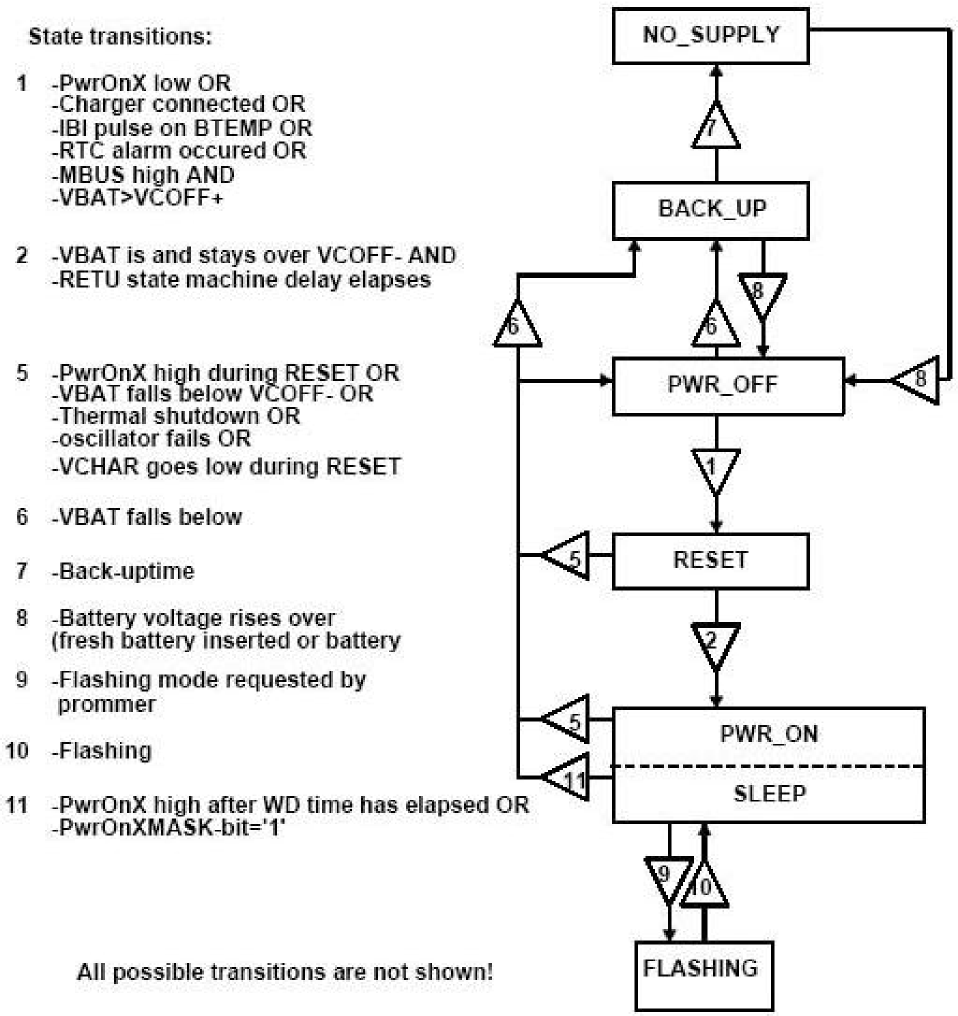


Figure 99 State diagram

Voltage limits

Parameter	Description	Value
VMSTR	Master reset threshold (RETU)	2.2V (typ.)
VMSTR+	Threshold for charging, rising (TAHVO)	2.1V (typ.)
VMSTR-	Threshold for charging, falling (TAHVO)	1.9V (typ.)
VCOFF+	Hardware cutoff (rising)	2.9V (typ.)
VCOFF-	Hardware cutoff (falling)	2.6V (typ.)
SWCOFF	SW cutoff limit	~3.2V

The master reset threshold controls the internal reset of Retu / (Tahvo). If battery voltage is above VMSTR, Tahvo's charging control logic is alive. Also, RTC is active and supplied from the main battery. Above VMSTR, Tahvo allows the system to be powered on although this may not succeed due to voltage drops during start up. SW can also consider battery voltage too low for operation and power down the system.

Power key

The system boots up when power key is pressed (adequate battery voltage, VBAT, present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). Power on key is connected to Retu ASIC via PWRONX signal.

Power distribution

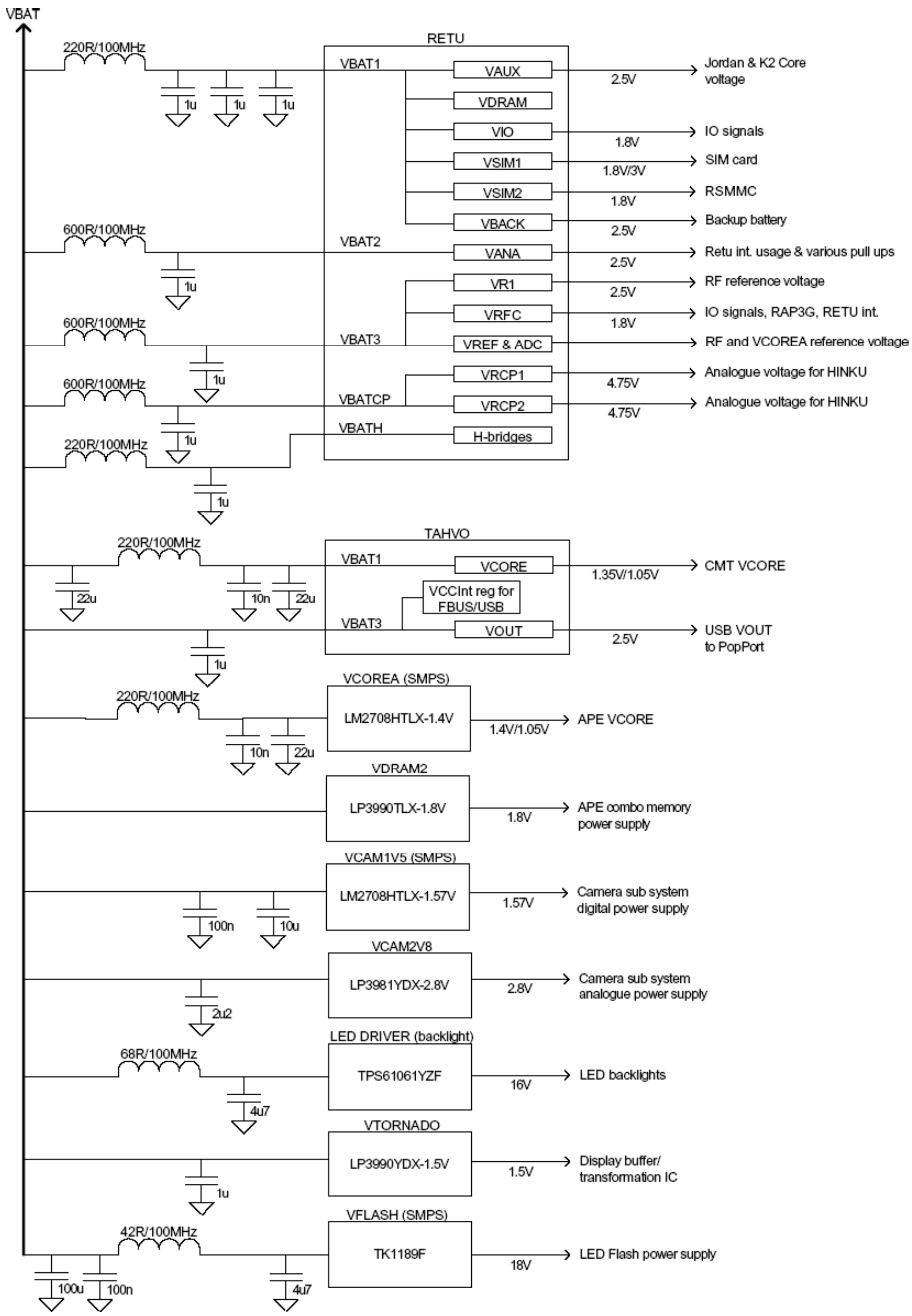


Figure 100 Power distribution diagram

Power supply components:

- RETU
- TAHVO
- Helen VCORE SMPS
- BT

- LDO
- camera LDO
- backlight SMPS

All the above are powered by the main battery voltage.

Battery voltage is also used on the RF side for power amplifiers (GSM PA & WCDMA PA) and for RF ASICs Hinku (Rx) & Vinku(Tx).

Discrete power supplies are used to generate 2.8V for BT, 1.5V for the camera module, 1.3V/1.5V for Helen3 and 18V for backlight LEDs.

The device supports both 1.8V/3V SIM cards which are powered by RETU / VSIM1. RETUs VSIM2 is used to power RS MMC 1.8V only. USB accessories which needs power from the device are powered by TAHVO / VOUT.

Because LED driver in TAHVO is not used, the external SMPS is used instead. External LED SMPS is still controlled by TAHVO and powered by battery voltage.

System power-up

After inserting the main battery, regulators started by HW are enabled. SW checks, if there is some reason to keep the power on. If not, the system is set to power off state by watchdog. Power up can be caused by the following reasons:

- Power key is pressed
- Charger is connected
- RTC alarm occurs
- MBUS wake-up

After that:

- Retu activates sleep clock and VANA, VDRAM, VIO and VR1 regulators.
- Voltage appearing at Retu's RSTX pin is used for enabling Tahvo ASIC.
- Tahvo enables VCORE regulator and its internal RC-oscillator (600kHz).
- VCTCXO regulator is set ON and RF clock (main system clock) is started to produce.
- Retu will release PURX ~ 16ms after power up is enabled (the RF clock is then stable enough).
- Synchronizing clock (2.4MHz) for Tahvo is started to be produced. After PURX is released and two rising edges of 2.4MHz synchronous clock have been detected in SMPSClk input Tahvo is starting to use that instead of 600kHz internal RC-oscillator.
- HW start-up procedure has been finalized and the system is up and running. Now it is possible for SW to switch ON other needed regulators.

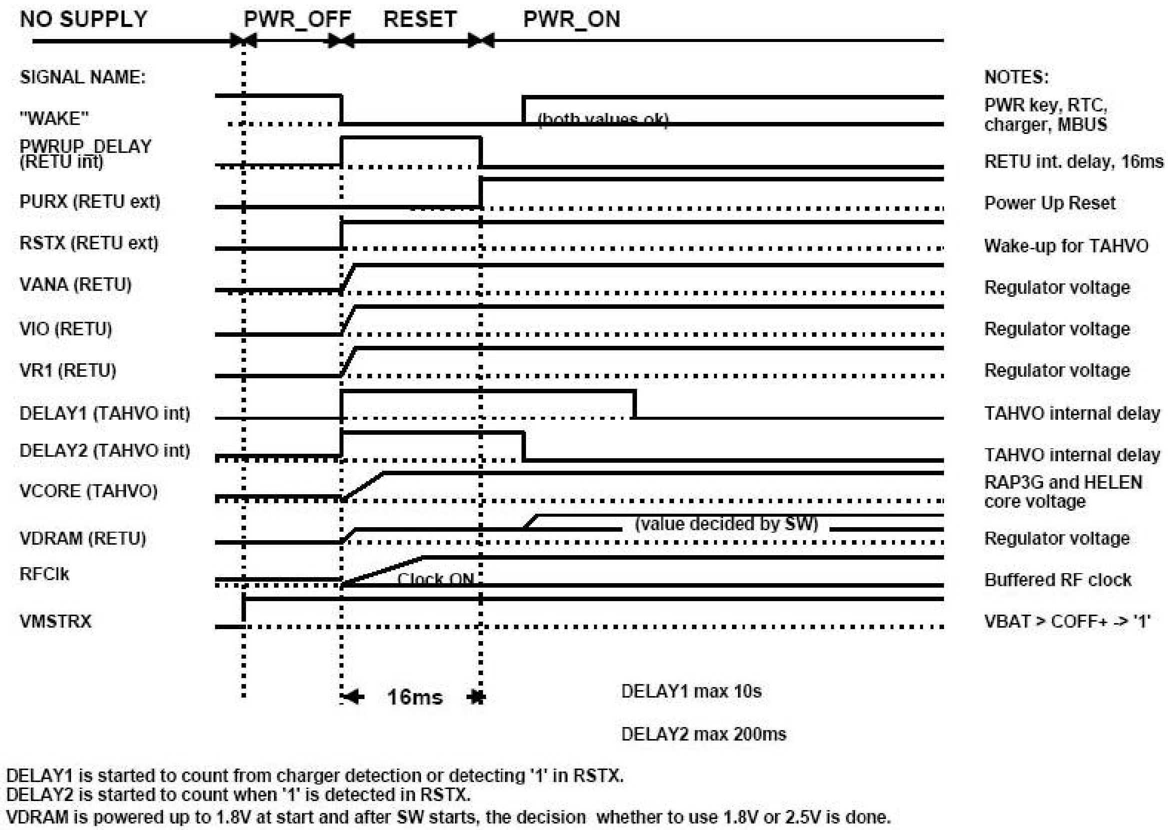


Figure 101 System start-up timing

Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by RETU with an external crystal.

RF clock is generated only when VCTCXO is powered on by RETU regulator. Regulator itself is activated by SleepX signals from both RAP3G and Helen3. When both CPUs are on sleep, RF clock is stopped.

RF clock is used by RAP3G that then provides (divided) 19.2MHz SysClk further to Helen3 and Tornado. There is a separate clock buffer for Tornado clock. Both RAPG and Helen3 have internal PLLs which then create clock signals for other peripheral devices/interfaces like RS MMC, SIM, CCP, I2C and memories.

32k Sleep Clock is always powered on after startup. Sleep clock is used by RAP3G and OMAP for low-power operation.

SMPS Clk is 2.4MHz clock line from RAP3G to Tahvo used for switch mode regulator synchronizing in active mode. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4MHz signal from Hinku ASIC to BT module.

CLK600 is 600KHz signal from Tahvo to APE VCORE SMPS. The clock source is internal RC oscillator in Tahvo (during the power-up sequence) or RAP3G SMPS Clk divided by 4 after the power-up sequence.

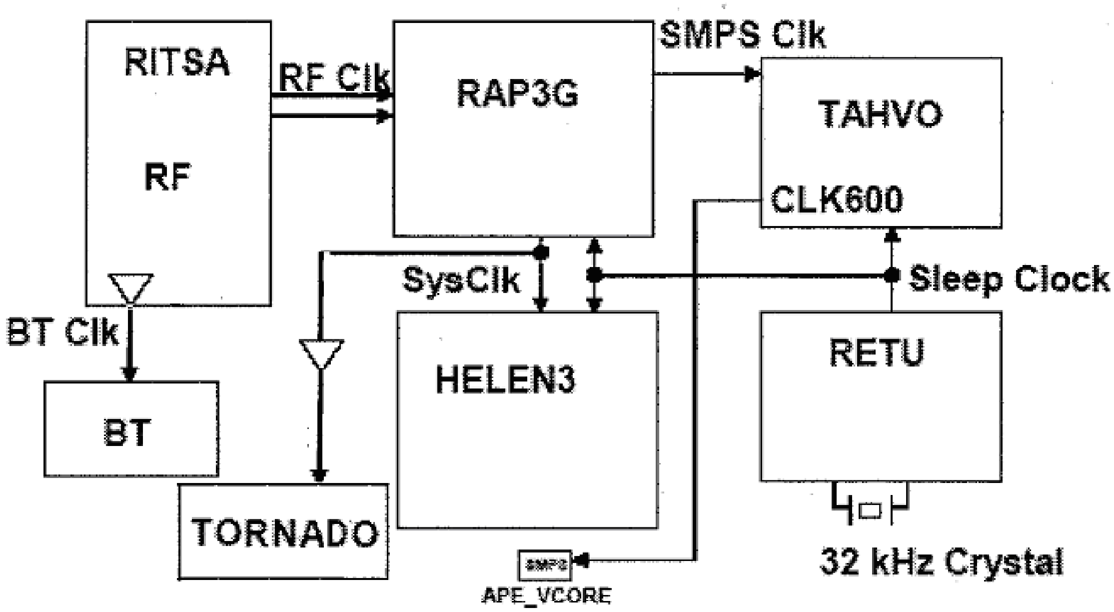


Figure 102 Clocking scheme

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units. The system provides a radio link that offers a high degree of flexibility to support various applications and product scenarios. Data and control interface for a low power RF module is provided. Data rate is regulated between the master and the slave.

The device Bluetooth is based on TI's BRF6150 BT ASIC..

The UART1 interface handles the transfer of control and data information between Helen3 and the BT system (BRF6150).

The PCM interface is used for audio data transfer between RAP3G and the BT system (BRF6150).

USB

USB (Universal Serial Bus) provides a wired connectivity between a USB host PC and peripheral devices.

USB is a differential serial bus for USB devices. USB controller (RAP3G) supports USB specification revision 2.0 with full speed USB (12 Mbps). The device is connected to the USB host through the Pop-Port™ connector. The USB bus is hot plugged capable, which means that USB devices may be plugged in/out at any time.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. SIM interface consists of internal interface between RAP3G and Retu and an external interface between Retu and SIM contacts. SIM interface functionality is located in RAP3G while Retu takes care of power up/down, card detection, ATR counting and level shifting. For Retu external SIM IF connections, see SIM interface connections (Page 9–34).

Retu handles SIM card detection and the detection method is based on the BSI line. Due to location of the SIM card removal of the battery causes quick power down of the SIM IF. The Retu SIM1 interface supports both the 1.8V and 3.0V SIM cards. SIM interface voltage is first 1.8V when the SIM card is inserted and if the card does not response to the ATR (Answer To Reset) 3V interface voltage is used. The data communication between the card and the phone is asynchronous half duplex and the clock supplied to cards is 1-5MHz, which is 3.2MHz by default (in GSM system). The data baud rate is SIM card clock frequency divided by 372 (by default), 64, 32 or 16.

RS MMC interface

The device has one slot for reduced size (24mm x 18mm x 1.4mm multimedia card. The device supports RS MMC hot insertion so it is possible to remove/insert the card when the phone is powered on.

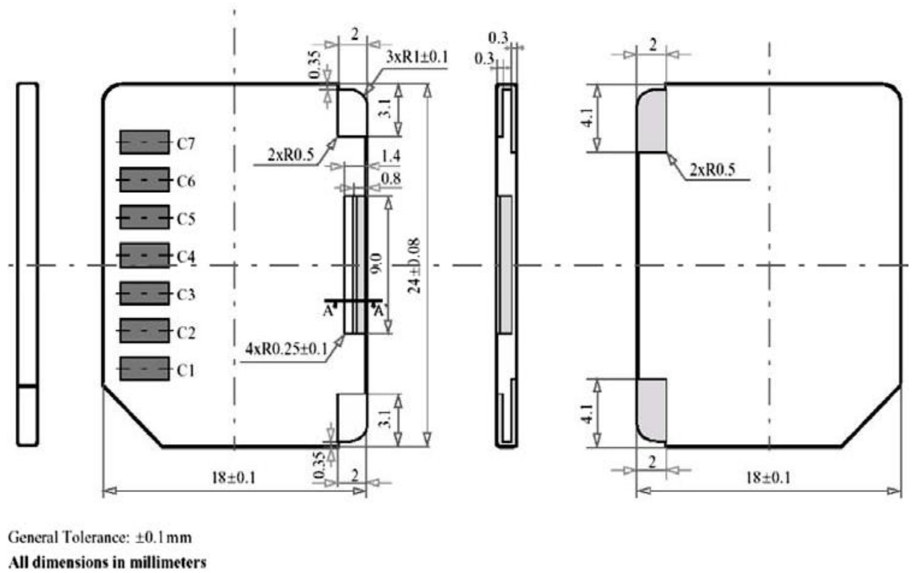


Figure 103 Reduced size MMC

RS MMC card is connected to the Helen3 processor MMC/SDIO2 (1.8V) interface. MMC interface is shown in the following figure:

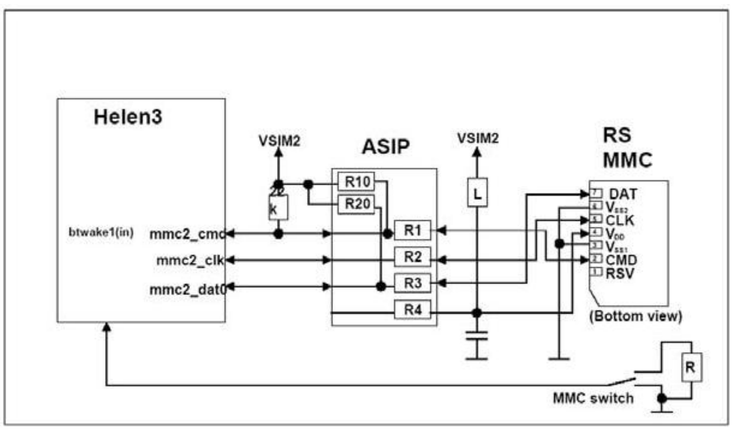


Figure 104 MMC interface

The basic multimedia card concept is based on the following communication signals CLK, CMD and DAT. With each cycle of the CLK signal one bit transfer on the DAT and CMD line is done. The maximum CLK frequency is 20MHz (specified in multimedia card specification). Maximum used CLK frequency at the time is 16MHz. CMD is a bi-directional command channel used for card initialization and data transfer commands. CMD signal has two operational modes open-drain and push-pull mode. Open-drain mode is used for card initialization and push-pull mode for fast command transfer. CMD commands are sent by the host and CMD responses are sent by the card. DAT is a bi-directional data channel, which operates at push-pull mode.

The detection of RS MMC card removal/insertion is done via RS MMC cover switch. Removing RS MMC while writing to RS MMC may corrupt data in RS MMC. RS MMC cover switch gives an interrupt to the SW while the cover is opened or closed. After RS MMC cover lid opening (RS MMC SW signal is connected to GND via cover switch) the SW power down the RS MMC card and switches off the RS MMC power supply (VSIM2). When the RS MMC cover lid is closed (RS MMC SW signal is internally connected in Helen3 to 1.8V) the card should be identified if card exists.

See Also

- RS MMC interface connections (Page 9–35)

Battery interface

The battery interface supports NMP Lynx battery interface for the BL-5B battery. This interface consists of three connectors: VBAT, BSI and GND. BSI line is used to recognize battery capacity by a battery internal pull down resistor.

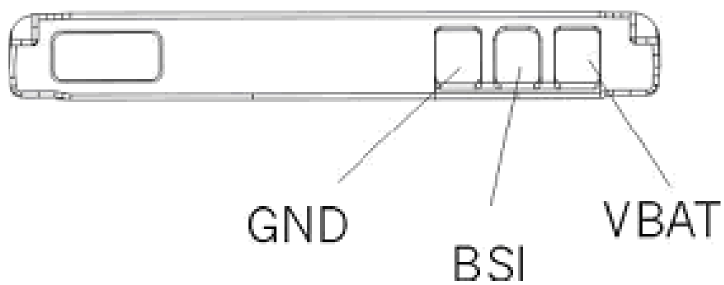


Figure 105 Battery pin order

Battery temperature is estimated by measuring separate battery temperature NTC via BTEMP line, which is located on the transceiver PWB, in a place where phone temperature is most stabile.

For service purposes the device SW can be forced into local mode by using pull down resistors connected to the BSI line.

See Also

- Battery connector and interface connections & electrical characteristics (Page 9–36)

Camera interface

The device uses a Unagi camera module and separate camera DSP. Unagi is a 2Mpixel camera with Auto focusing feature. AF mechanics are moved by SIDM through four PWM controlled wires from camera DSP. Sensor resolution of Unagi camera is 1600 x 1200. Unagi camera is placed to the moving camera head with Flash LED. Camera DSP is placed to engine board. The following figure shows the block diagram where two CCP bus are used to transfer image data from Unagi camera to camera DSP and from camera DSP to engine. Control interfaces for camera system are two bi-directional I2C busses, where I2C1 is an SW implemented interface. Unagi camera is connected to engine by 24 micro coaxial cables through hinge.

Two camera regulators N1470 and N1471 powers the camera system. Vcam1V5 power core parts of sensor and camera DSP. Vcam2V8 is for interfaces of camera and camera DSP. Both regulators have their own enable signals. When both of these signals are turned on High Level, the camera system enters the operation mode. When both eneble signals are turned on Low Level, the camera system enters the power off mode. Extclk signal feeds system clock for camera module and camera DSP. Flash LED strobe signal from camera DSP is used to trigger flash LED for still imaging..

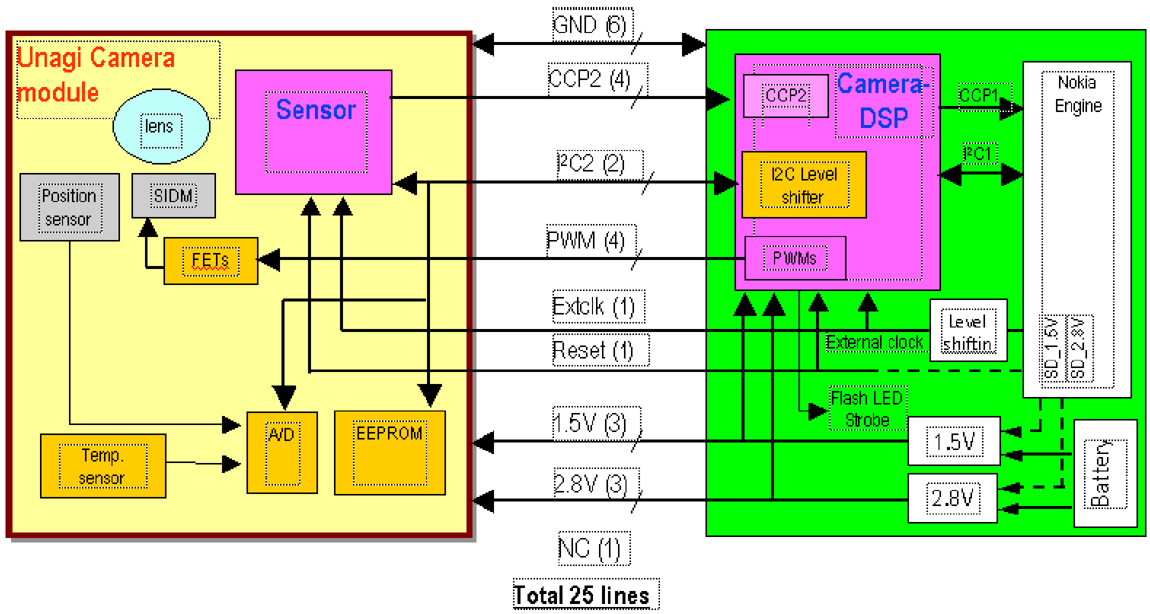


Figure 106 Block diagram of camera system

User interface

Display interface

Display module mechanical concept

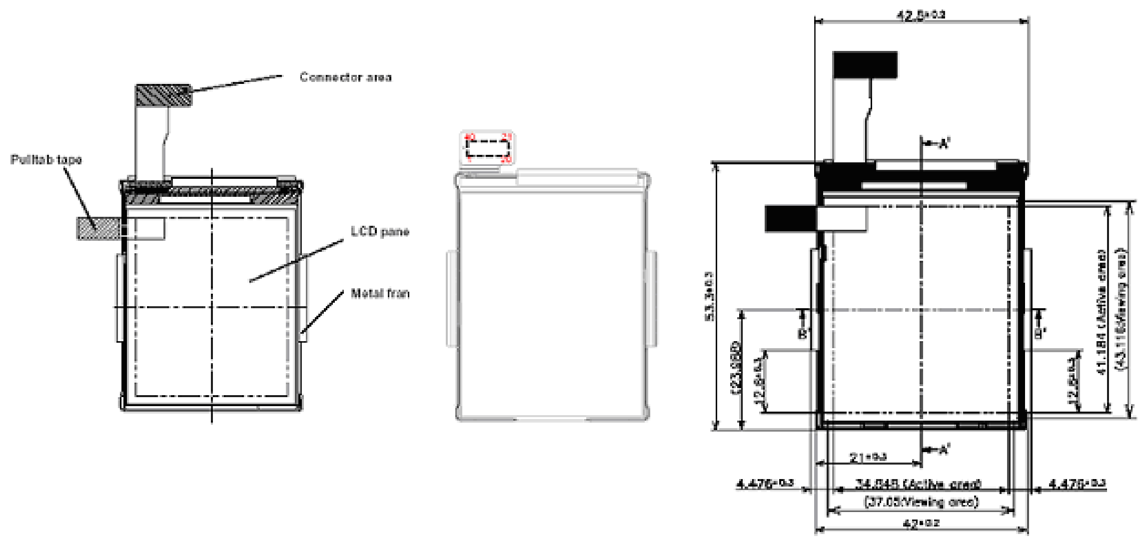


Figure 107 General diagram of the main LCD display module

Main display features:

- Display is Series 60 display with format of 352 x 416 pixels.
- Maximum number of colours 262144 (18 bits)
- Backlight unit is provided, so the transflective display can be used both in reflective mode and in transmissive mode. Luminance of the display module is typically 200 nits.

- Partial display function enables power saving by pausing display process on part of the screen. Partial mode size is 50 lines x 352 pixels and only 8 colors are used.
- S60 ViSSI interface is used between the display module and the engine HW to transfer display data. LoSSI part of this interface is used to transfer display commands.
- S60 command functions (Display controlling functions and power controlling functions) are available.
- LCD display driver IC is mounted on the display glass panel. Other external components (Power IC, EEPROM and passive components) on the display module are located on the FPWB of the display module and the usage of these is depending on the supplier.
- FPWB design is done in such a way that length minimized and thickness minimized display modules can be done by using the same flex. Flex is just folded differently in these two cases.

The module includes:

- FPWB including connector, discretes and driver circuits necessary
- Display panel (glass)
- Drivers including display controller and 352 x 50 x 3 bits RAM
- Lighting system: light guide, LEDs and necessary optical sheet
- Supporting mechanics
- Metal frame (stainless steel)
- Plastic frame (ABS/ PC)

The interconnection between the LCD module and the Nokia engine is implemented with a 40-pin board-to-board connector.

K2 Display is controlled via LoSSi and MeSSi-16 interface by Helen3. All LoSSi and MeSSi-16 signals go through micro coaxial cables to the fold part. On fold part Messi-16 signals go through the EMC filtering ASIPs to Tornado ASIC where MeSSi is converted to ViSSi-18 interface. ViSSi-18 signals go through the EMC filtering ASIPs to K2. LoSSi signals go through the EMC filtering ASIPs to K2 display. See the figure below:

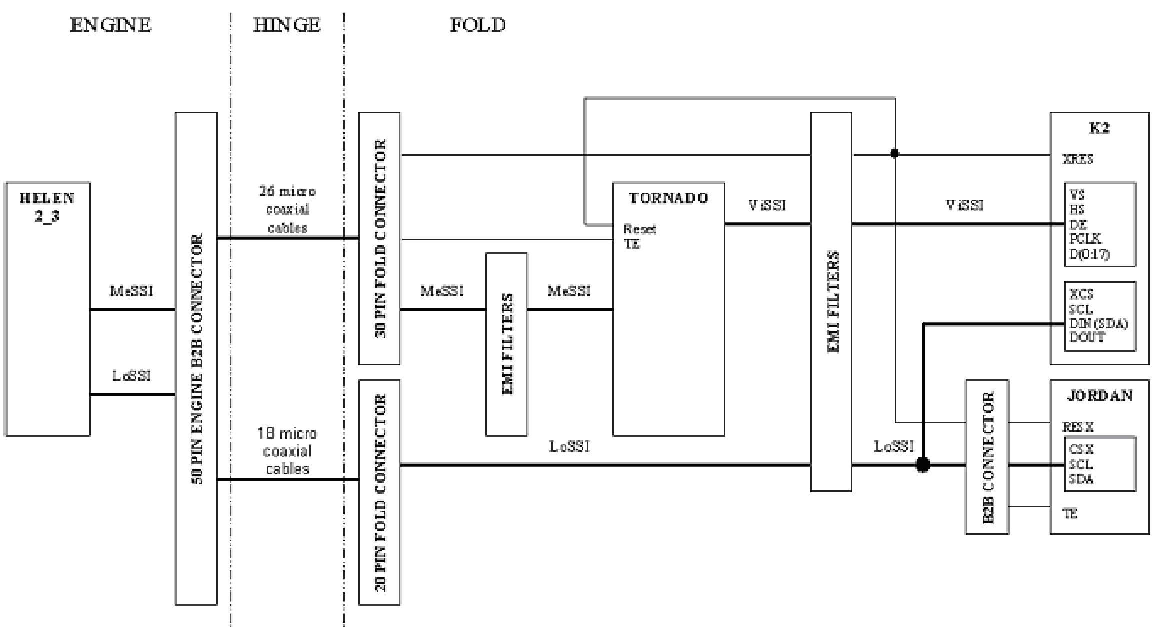


Figure 108 LoSSi signals in RM-42

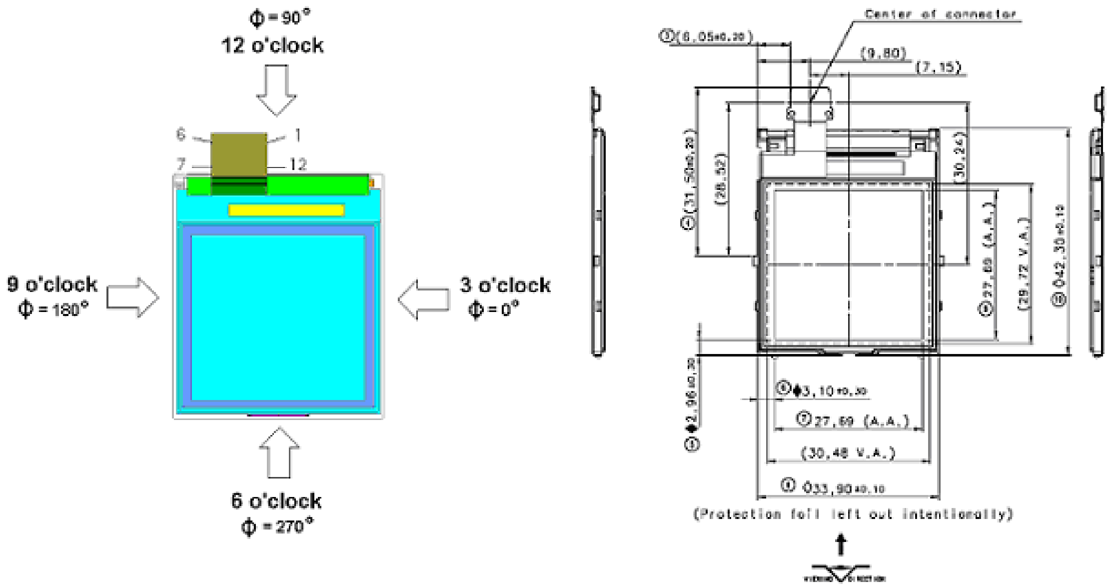


Figure 109 General diagram of the sub-display module

Sub-display features:

- Display is Series 40 display with format of 128 x 128 pixels.
- Maximum number of colors is 65 536 (16 bits).
- Backlight unit is provided, so the transflective display can be used both in reflective mode and in transmissive mode.
- 9-bit serial interface is used between the display module and the engine HW to transfer display data. LoSSI interface is used to transfer display commands.
- S40 command functions (Display controlling functions and power controlling functions) are available.
- LCD display driver IC is mounted on the display glass panel. Other external components (Power IC, EEPROM and passive components) on the display module are located on the FPWB of the display module

The module includes:

- FPC foil including connector and required passive/active components.
- Display panel (glass) with COG driver including display controller and 132 x132 x16 bit RAM
- Illumination system: backlight module, which includes lightguide with white casing, optical sheets and 3 white LEDs.
- Plastic holder frame

The interconnection between the LCD module and display flex is implemented with 12-pin board-to-board connector.

The display module is equipped with bi-directional 9-bit serial interface

Jordan display is controlled via LoSSi interface by Helen3. All LoSSi signals go through the EMC filtering ASIPs to Jordan display.

Display modules do not require any tunings in service.

Keyboard

The device keyboard is connected to the main PWB with a board-to-board connector.

The keymatrix has seven rows and five columns. The SW application keys on the Fold PWB and the capture key are connected to the same keymatrix. Joystick is connected to GPIOs of OMAP.

Table 16 Keymatrix

Row	Col3	Col2	Col1	Col0	Col4	Col5
Row0	Right	Left	Right soft key	Left soft key	rsoft_fold	lsoft_fold
Row1	Down	Up	Send	Select	Captkeyhalf	Captkeyfull
Row2	8	3	2	7		
Row3	6	1		5		
Row4	#		*	9		
Row5	4		Reserved for Charlie use	End		
Row6	Apps	Clear	Edit	0		
Row7						

Joystick function	GPIO
Right	GPIO49
Down	GPIO50
Left	GPIO51
Up	GPIO52
Select	GPIO53

Engine flex connector pin configuration

Signal name	X4401 Pin #	X4400 Pin #
Col0	10	
Col1	21	
Col2	18	
Col3	13	
Col4	22	40
Col5	23	41
Row0	9	39
Row1	7	
Row2	28	
Row3	27	
Row4	12	
Row5	11	
Row6	8	
Joystick_Right	14	
Joystick_Down	20	

Signal name	X4401 Pin #	X4400 Pin #
Joystick_Left	19	
Joystick_Up	15	
Joystick_Push	17	
VLEDOUT2	1	
SETCURR2	2	

Display and keyboard backlight

The device has one Led Driver (SMPS) that is used to drive both displays and keyboard LEDs. LEDs on display modules and on keyboard are connected so that there are 4 LEDs on K2 (in series), 3 LEDs on Jordan (in series) and 4 LEDs on keyboard (in series). These circuits are connected parallel to Led Driver output.

Current adjustment of the driver is done from the display LED branch, and keyboard current also depends on the display brightness.

In a typical use case, keyboard LEDs are turned ON only in dark ambient lighting conditions.

K2 and Jordan backlights can´t be turned on at the same time.

Control signals for LED driver are:

	From	To	Voltage	Function
GenOut1	TAHVO	R2302 (10k)	0V / 1.8V	Maximum current control (0V ->max curr.)
GenOut2	TAHVO	R2301 (4k7)	0V / 1.8V	
PWM	TAHVO	J2309, N2301	PWM 0%-100%, 1.8V	Current PWM control (16 steps)
GenOut3	TAHVO	V2300	0V / 1.8V	Keyboard LEDs ON (1.8V) /OFF (0V)
GenIO46	Rap3G	-->	BLS	Display backlight select (1 = K2 backlights on, 0 = Jordan backlights on)

ALS interface

Ambient Light Sensor (ALS) is located in the fold part of the phone. It consists of a lightguide (part of front cover), components of 1LB PWB: phototransistor (V1000)+ resistor (R1006), NTC + resistors (R1004, R1005, R1007) and RETU EM ASIC (N2200)on 1HU PWB (Gromit engine). Information of ambient lighting is used to control the backlights of the phone:

- Keypad lighting is switched on only when environment is dark / dim
- Display backlights are dimmed, when environment is dark / dim

Ambient light sensor itself is a photo transistor which is temperature-compensated by an external NTC resistor. Retu with its ADC reads the light sensor (LS) and temperature (LST) results.

ALS calibration is not possible in the service points. It is replaced by using selected phototransistors as spare parts.

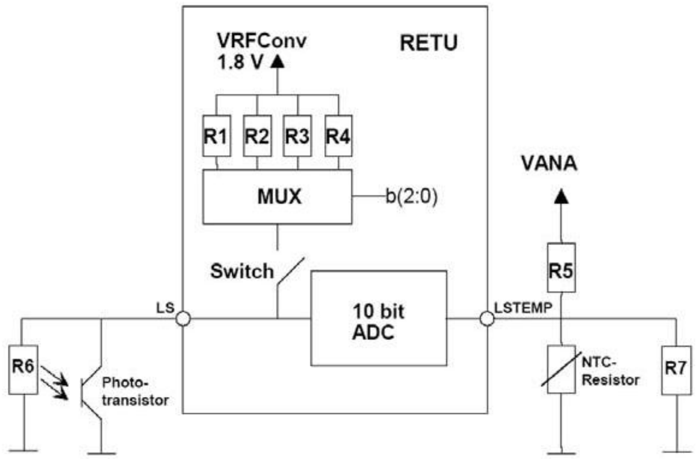


Figure 110 ALS HW implementation

Table 17 ALS resistor values

Symbol	R1	R2	R3	R4	R5	R6	R7	NTC-res
Value	5 kOhm	15 kOhm	30 kOhm	50 kOhm	470 kOhm	100 kohm	470 kohm	47 kOhm

ASICs

RAP3G ASIC

RAP3G ASIC is a 3G Radio Application Processor. RAM memory is integrated into RAP3G.

In general RAP3G consists of three separate parts:

- Processor subsystem (PSS) that includes the main processor and related functions
- MCU peripherals that are mainly controlled by MCU
- DSP peripherals that are mainly controlled by DSP

RAP3G core voltage (1.4V) is generated from Tahvo VCORE and I/O voltage (1.8V) is from Retu VIO. The core voltage in sleep mode is lowered to 1.05V.

Retu EM ASIC

Retu EM ASIC includes the following functional blocks:

- Start up logic and reset control
- Charger detection
- Battery voltage monitoring
- 32.768kHz clock with external crystal
- Real time clock with external backup battery
- SIM card interface
- Stereo audio codecs and amplifiers
- A/D converter
- Regulators
- Vibra interface
- Digital interface (CBUS)

Tahvo EM ASIC

Tahvo EM ASIC includes the. following functional blocks:

- Core supply generation
- Charge control circuitry
- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- External LED driver control interface
- Digital interface (CBUS)

Device memories

RAP3G memories NOR flash and SDRAM

Modem memory consists of 64 Mbit SDRAM and 64 Mbit NOR flash memories.

SDRAM is a dynamic memory for ISA SW.

NOR is used for ISA SW code and PMM data and CDSP SW code.

16-bit wide SDRAM interface consists of DDR SDRAM controller from ARM, DCDL/DLLs and wrapper logic. 32-bit wide flash interface is implemented by using EMC module.

SDRAM core voltage (1.8V) is generated from Retu VDRAM and I/O voltage (1.8V) is from VIO. NOR flash uses VIO for both core and I/O voltages.

Combo memory

The application memory of the device consists of NAND/DDR combo memory. Stacked DDR/NAND application memory has 512 Mbit of DDR memory and 512 Mbit of flash memory. DDR DRAM memory is stacked above the NAND flash.

OMAP includes a 16-bit dedicated memory interface called external memory interface fast (EMIFF). This is used to support interface for DDR memory. OMAP 1710 provides also NAND flash controller located on the shared peripheral bus, providing support for 8-bit NAND flash. The interface requires an 8-bit address bus multiplexed with 8-bit data bus and several control signals.

Core voltage for DDR is 1.8V, which is generated by discrete LDO (LP3990ITLX). 1.8V (VIO) is for DDR I/O voltage. Both NAND core and I/O voltages are 1.8V generated by VIO.

■ Audio concept

Audio HW architecture

The functional core of the audio hardware is built around two ASICs: RAP 3G CMT engine ASIC and the mixed-signal ASIC Retu.

Retu provides an interface for the transducers and the accessory connector. Because audio amplifiers are also integrated into Retu, the only discrete electronics components needed for audio paths are audio filtering components and EMC/ESD components.

There are three audio transducers:

- 7x 11mm dynamic earpiece
- 16mm dynamic speaker
- electret microphone module

All galvanic audio accessories are connected to the Pop-Port™ accessory connector.

A Bluetooth module that is connected to RAP3G supports Bluetooth audio functionality.

There is a separate application ASIC, Helen 3 (OMAP 1710) for Symbian applications..

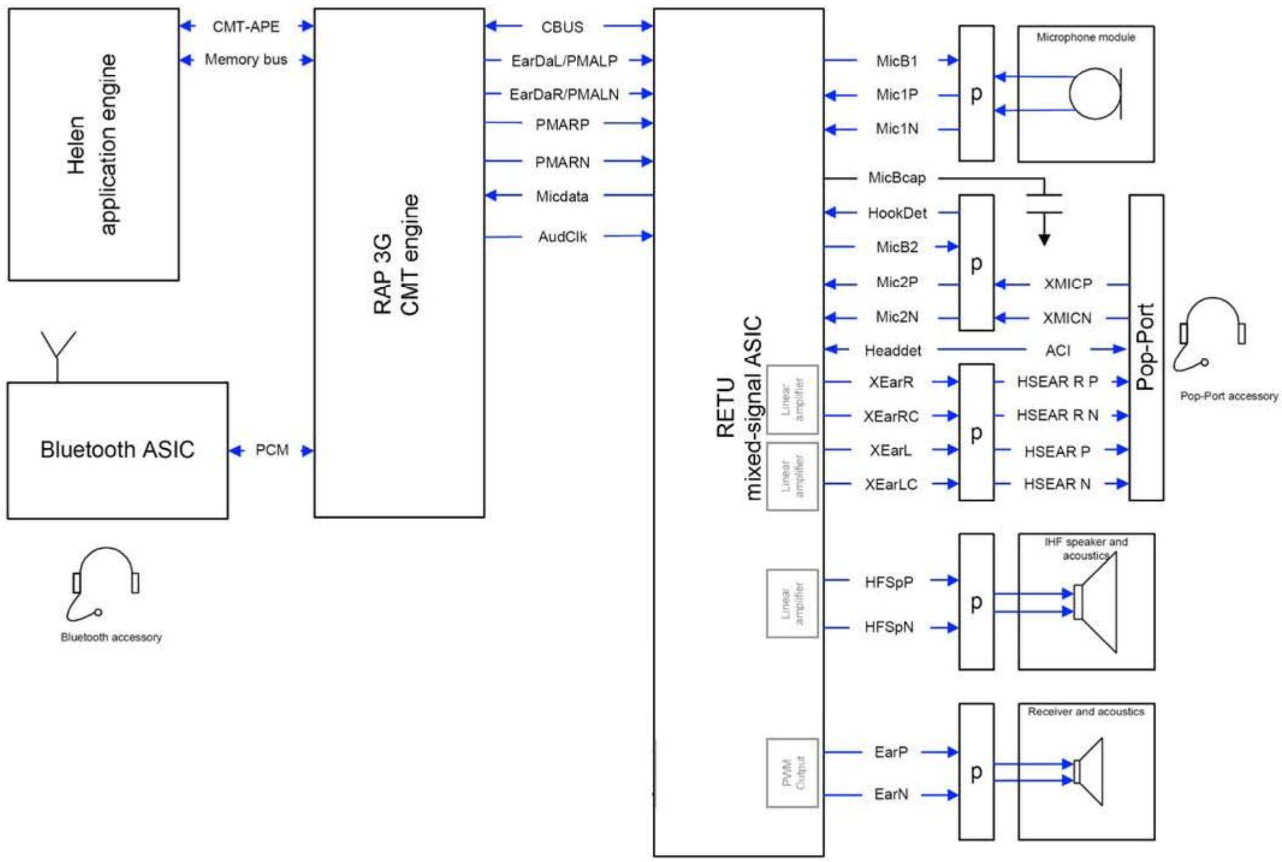


Figure 111 Audio block diagram

Internal microphone

Internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes.

An analogue electret microphone is connected to Retu ASIC's Mic1P and Mic1N inputs via asymmetric electrical connection.

The microphone is biased by Retu ASIC MicB1 bias voltage output.

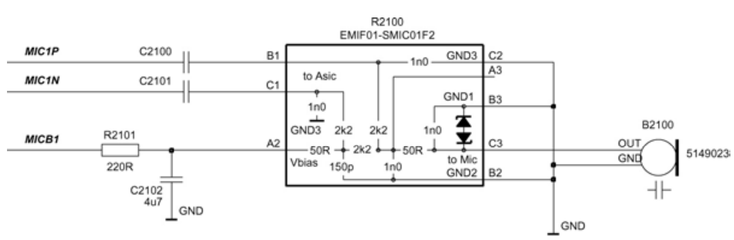


Figure 112 Internal microphone circuitry

External microphone

Galvanic accessories are connected to the system connector (Pop-Port^{TM}).

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by Retu ASIC MicB2 bias voltage output. The circuitry provides a symmetrical connection for the microphone from the Pop-Port™connections, XMICN and XMICP, to Retu ASIC inputs, Mic2P and Mic2N.

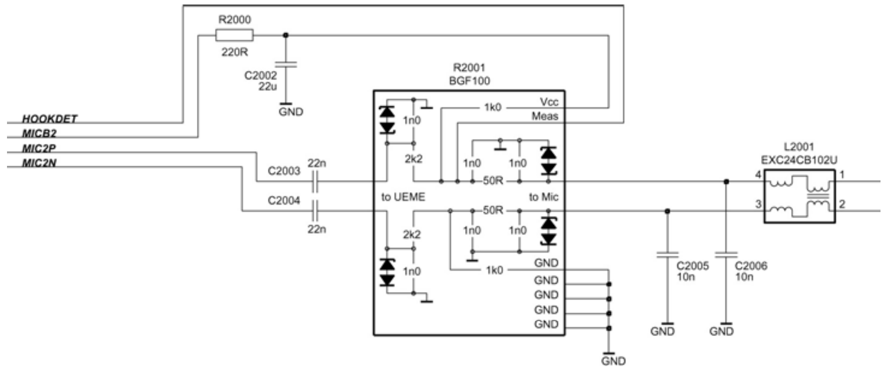


Figure 113 External microphone circuitry (Pop-Port connects to the right side)

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. A dynamic 7 x 11mm earpiece capsule is connected to Retu ASIC's differential output EarP and EarN.

Earpiece capsule is assembled to fold unit (inside of display frame), but some filter components are also in engine PWB.

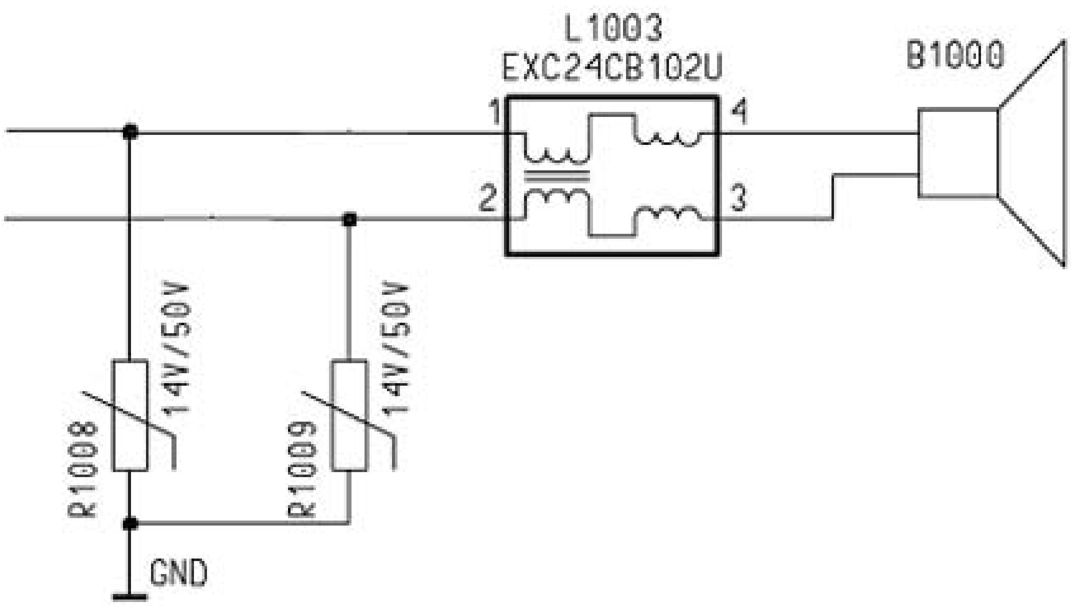


Figure 114 Internal earpiece circuitry

Internal speaker

Internal speaker is used for Internal HandsFree (IHF) call mode.

A dynamic 16mm speaker is connected to Retu ASIC's outputs HFSpP and HFSpN.

IHF amplifier integrated in Retu is a Digital Pulse Modulated Amplifier (DPMA).

Speaker is assembled to camera unit, but some filter components are also in engine PWB.

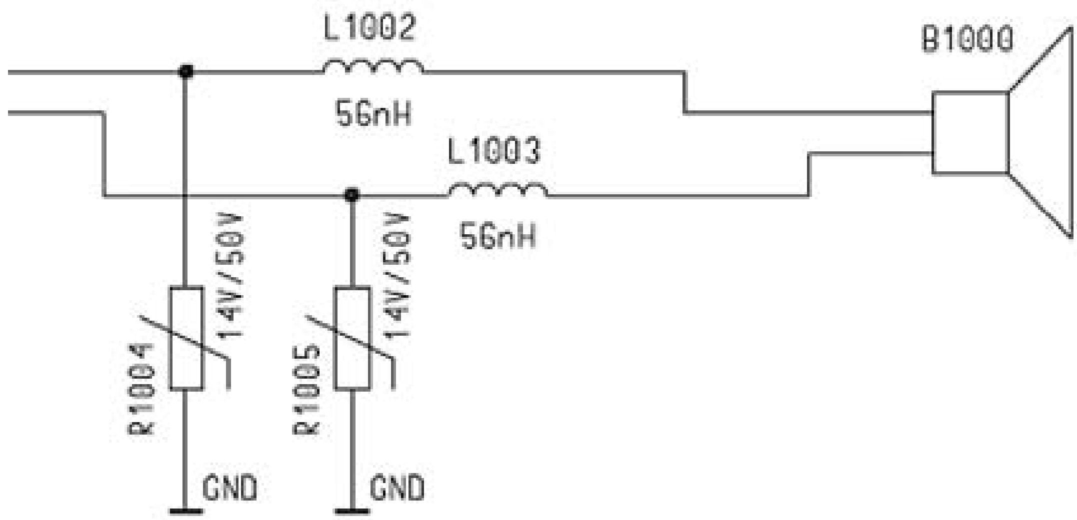


Figure 115 Internal speaker circuitry

External earpiece

Galvanic accessories are connected to the system connector (Pop-Port™).

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

Retu ASIC provides two output channels in either single-ended or differential format. Retu ASIC outputs XearL and XearLC form the left channel audio output and XearR and XearRC the right channel audio output. XearLC and XearRC are the ground pins if the output works in a single-ended operation.

On the Pop-Port side, HSEAR P and HSEAR N form the left channel output and HSEAR R P and HSEAR R N the right channel output. Respectively, HSEAR N and HSEAR R N are the ground pins if the output works in a single-ended operation.

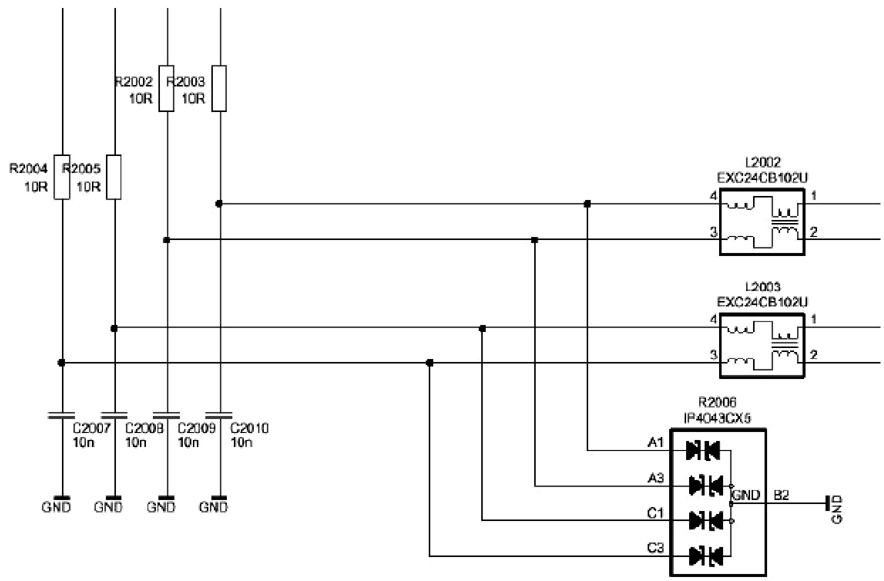


Figure 116 External earpiece circuitry (Pop-Port connected on the right)

Pop-port^{TM} connector

Pop-Port^{TM} connector provides a fully differential 4–wire stereo line-level output connection and fully differential 2-wire mono line-level or microphone level input connection.

The handsfree driver in Retu is meant for the headset.

The output is driven in a fully differential mode. In the fully differential mode, the handsfree pin is the negative output and the HFCM pin is the positive output. The gain of the handsfree driver in the differential mode is 6 dB.

The earpiece and headset signals are multiplexed so that the outputs cannot be used simultaneously.

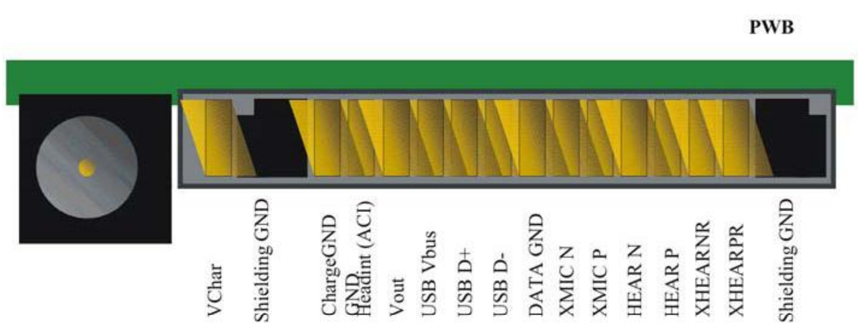


Figure 117 External audio connector

Table 18 Audio connector pin assignments

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
1/ Charge	V Charge	DC	0-9V/ 0.85A		
2/ GND	Charge GND	-	0.85A	100mΩ (PWB+ conn.)	

Pin #/ Signal name	Signal description	Spectral range	Voltage/ Current levels	Max or nominal serial impedance	Notes
3/ ACI	ACI	1kbits/s	Digital 0 / 2.5-2.78V	47Ω	Insertion & removal detection
4/ Vout	DC out	DC	2.78V 70 mA 2.5V 90mA	100mΩ (PWB+ conn.)	200mW
9 / XMIC N	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
10 / XMIC P	Audio in	300-8k	1Vpp & 2.5-2.78VDC		
11 / HEAR N	Audio out	20-20k	1Vpp	10Ω	
12 / HEAR P	Audio out	20-20k	1Vpp	10Ω	
13 / HEAR R N	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono
14 / HEAR R P	Audio out	20-20k	1Vpp	10Ω	Not conn. in mono

Baseband technical specifications

External interfaces

Name of Connection	Connector reference
USB	X2001
Charger	X2000
Headset	X2001
SIM	X2700
RS MMC	X5200
Battery connector	X2070

ACI interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Accessory detection						
Headset detection threshold		1.75	1.9	2.05	V	Retu specific
Headset detection hysteresis			25		mV	

Description	Parameter	Min	Typ	Max	Unit	Notes
Headset detection pull ups		1	2	4	uA	
After Mbus is switched to HeadDet						
High-level input voltage (VDDS = 1.8V)	V_{IH}	0.7 x V_{DDS}		V_{DDS}	V	RAP3G specific
Low-level input voltage	V_{IL}	0		0.3 x V_{DDS}	V	
High-level output voltage	V_{OH}	0.8 x V_{DDS}		V_{DDS}	V	
Low-level output voltage	V_{OL}	0		0.22 x VDDS	V	
Rise/fall time	tR/tF			25	ns	

VOUT electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vout regulator for external accessories	VOUT	2.43	2.57	V	Max load 90mA

USB IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Absolute maximum voltage on D+ and D-	$V_{D+/D-}$	-1	4.6	V	USB specification revision 2.0
Supply voltage	VBUS	4.4	5.25	V	
Supply current:					
Functioning	I_{VBUS}		100	mA	
Suspended	I_{VBUS}		500	uA	
Unconfigured	I_{VBUS}		100	mA	

Description	Parameter	Min	Max	Unit	Notes
High-level input voltage:				V	
High (driven)	V_{IH}	2			
High (floating)	V_{IHZ}	2.7	3.6		
Low-level input voltage	V_{IL}		0.8	V	
Differential input sensitivity	V_{DI}	0.2		V	|(D+) - (D-)|
Differential input voltage range	V_{CM}	0.8	2.5	V	Included VDI range
Low-level output voltage	V_{OL}	0	0.3	V	
High-level output voltage (driven)	V_{OH}	2.8	3.6	V	
Output signal crossover voltage	V_{CRS}	1.3	2	V	

FBUS interface electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
High-level input voltage	V_{IH}	0.7 x V_{DDSHV2}	V_{DDSHV2}	V	Helen2/3 specific
Low-level Input voltage	V_{IL}	0	0.3 x V_{DDSHV2}	V	
High-level output voltage	V_{OH}	0.8 x V_{DDSHV2}	V_{DDSHV2}	V	
Low-level output voltage	V_{OL}	0	0.22 x V_{DDSHV2}	V	
Rise/fall time	tR/tF	0	25	ns	
(VDDSHV2 = 1.8V)					

Headset hook detection interface (XMICN) electrical characteristics

Description	Min	Typ	Max	Unit	Notes
Hook detection threshold 1	1.25	1.35	1.45	V	Two fixed thresholds inside Retu. Selectable by SW
Hook detection threshold 2	0.5	0.6	0.7	V	
Hook detection hysteresis		25		mV	
Hook detection pull ups	1	2	4	uA	

Audio signal electrical characteristics

Description	Parameter	Typ	Unit	Notes
XMIC N	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
XMIC P	Audio in	1	V_{pp}	DC Offset 2.5-2.78V
HSEAR N	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR P	Audio out	1	V_{pp}	10Ω nominal serial impedance
HSEAR R N	Audio out	1	V_{pp}	10Ω nominal serial impedance
				Not connected in mono
HSEAR R P	Audio out	1	V_{pp}	10Ω nominal serial impedance
				Not connected in mono

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	SIMCLK	Out	Retu	SIM1ClkC	Clock signal to SIM card
C2	SIMRST	Out	Retu	SIM1Rst	Reset signal to SIM card
C3	VSIM	Out	Retu	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C5	SIMDATA	In/Out	Retu	SIM1DaC	Data input / output

Pin	Signal	I/O	Engine connection		Notes
C7	GND	-	GND		Ground

RS MMC interface connections

Pin	Signal	I/O	Engine connection		Notes
1	RSV		NC	NC	Reserved for future use
2	CMD	<->	Helen2/3	MMC2_CMD	Command/ Response
3	Vss1		GND		Ground
4	V_{DD}	<-	Retu	VSIM2	VSIM2, supply voltage 1.8 (Max 70mA)
5	CLK	<-	Helen2/3	MMC2_CLK	External clock for the MMC card, Max 20 MHz
6	Vss2		GND		Ground
7	DAT	<->	Helen2/3	MMC2_DAT0	Bi-directional data bus
-	MMCDET	->	Helen2/3	btwake1(in) [P10]	MMC card detect

Charger connector and charging interface connections & electrical characteristics

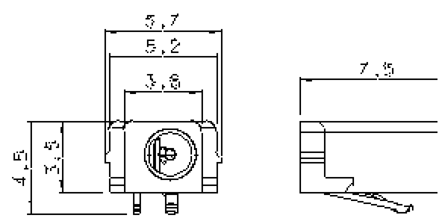


Figure 118 Charger connector

Table 19 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	Tahvo	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 20 Charging IF electrical characteristics

Description	Parameter	Min	Max	Unit	Notes
Vchar	V Charge	0	9	V	Center pin
Vchar	I Charge		0.85	A	Center pin
Charge GND			0.85	A	
Threshold for charging, rising (TAHVO)	V_{MSTR+}	2.1		V	Typical value
Threshold for charging, falling (TAHVO)	V_{MSTR-}	1.9		V	Typical value

Battery connector and interface connections & electrical characteristics

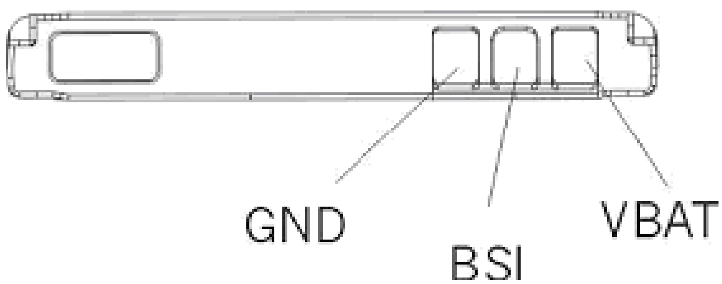


Figure 119 Battery connector

Table 21 Battery interface connections

Pin	Signal	I/O	Engine connection		Notes
1	VBAT	->	Retu	VBAT	Battery voltage
2	BSI	->	Retu	BSI	Battery size indication (fixed resistor inside the battery pack)
3	GND		GND		Ground

Table 22 Battery IF electrical characteristics

Description	Parameter	Max	Unit
Operation voltage	V_{IN}	4.23	VDC
Current rating	I_{IN}	0.9	A

Internal interfaces

Name of Connection	Connector reference	Notes
Fold unit connector	X4400	

Name of Connection	Connector reference	Notes
Keyboard connector	X4401	
Camera	X1470	Unagi

Keyboard connector

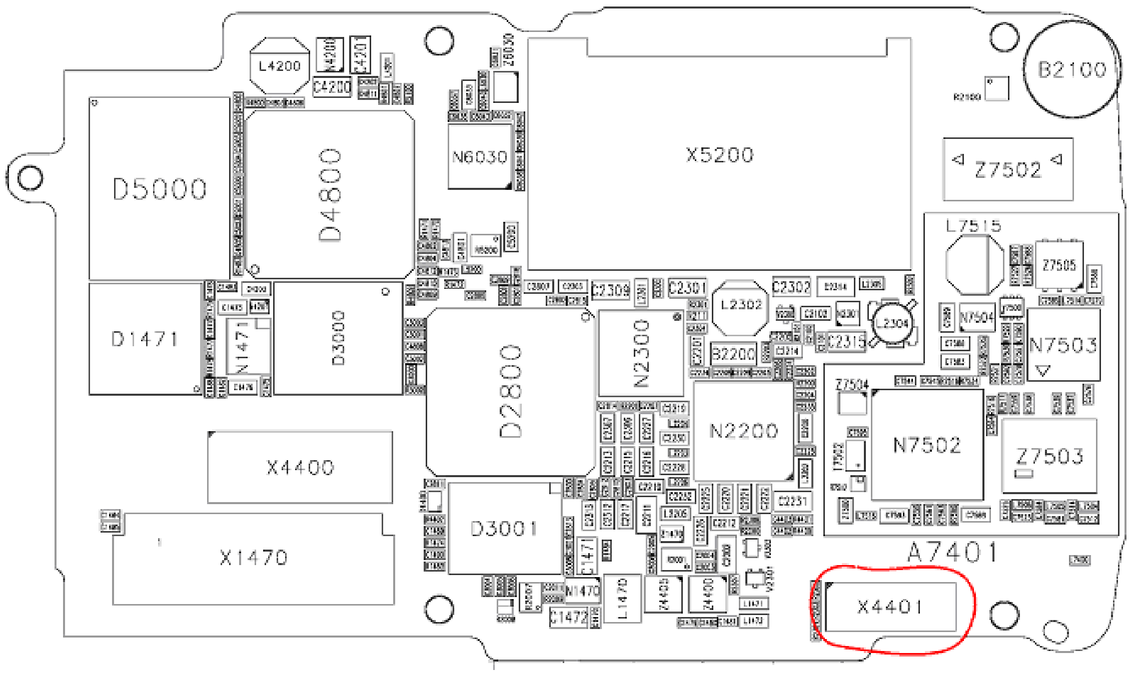


Figure 120 Keyboard connector

Table 23 User interface connections

Pin	Signal	I/O	Engine connection		Notes
1	GND		GND		
2	LED+	<-	N2301	VLEDOUT2	Discrete Backlight SMPS (controlled by Tahvo)
3	Col2	->	Helen3	Kbc_2	
4	LED-	->	R2305 + V2300	SETCURR2	Serial resistor + Transistor switch (controlled by Tahvo)
5	Col1	->	Helen3	Kbc_1	Voice switch connection
6	GND		GND		
7	Row3	->	Helen3	Kbr_3	

Pin	Signal	I/O	Engine connection		Notes
8	Row2	->	Helen3	Kbr_2	
9	Row1	->	Helen3	Kbr_1	
10	Row6	->	Helen3	Kbr_6	
11	Row0	->	Helen3	Kbr_0	
12	Col0	->	Helen3	Kbc_0	
13	Row5	->	Helen3	Kbr_5	Voice switch connection
14	Row4	->	Helen3	Kbr_4	
15	GND		GND		
16	Col3	->	Helen3	Kbc_3	

Keyboard interface electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
High-level input voltage	V_{IH}	0.65* V_{DDS}	V_{DDS}	0.3+ V_{DDS}	V	Row
Low-level input voltage	V_{IL}	-0.3	0	0.35* V_{DDS}	V	Row
High-level output voltage	V_{OH}	1.62	V_{DDS}	1.98	V	Column
Low-level output voltage	V_{OL}		0	0.45	V	Column
(VDDS = 1.8V)						

Fold unit connector

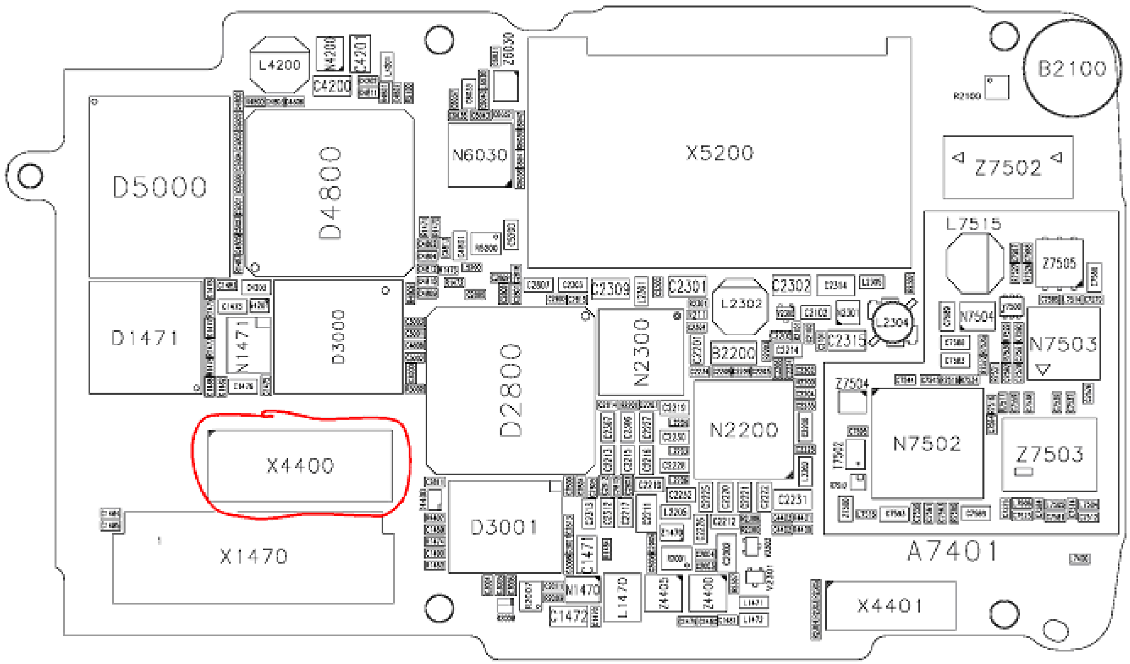


Figure 121 Fold unit connector

Engine B2B connector pin #	Signal name	Cable number	Fold connector	Fold connector pin #	Signal name
1	**GND**		30 pin fold connector	**1**	**GND**
2	**GND**		30 pin fold connector	**2**	**GND**
3	MD0	1	30 pin fold connector	3	MD0
4	MD1	2	30 pin fold connector	4	MD1
5	MD2	3	30 pin fold connector	5	MD2
6	MD3	4	30 pin fold connector	6	MD3
7	MD4	5	30 pin fold connector	7	MD4
8	MD5	6	30 pin fold connector	8	MD5
9	MD6	7	30 pin fold connector	9	MD6
10	MD7	8	30 pin fold connector	10	MD7
11	MD8	9	30 pin fold connector	11	MD8
12	MD9	10	30 pin fold connector	12	MD9
13	MD10	11	30 pin fold connector	13	MD10
14	MD11	12	30 pin fold connector	14	MD11
15	MD12	13	30 pin fold connector	15	MD12
16	MD13	14	30 pin fold connector	16	MD13
17	MD14	15	30 pin fold connector	17	MD14
18	MD15	16	30 pin fold connector	18	MD15
19	CS_T	17	30 pin fold connector	19	CS_T
20	WE_T	18	30 pin fold connector	20	WE_T
21	RD_T	19	30 pin fold connector	21	RD_T
22	DC_T	20	30 pin fold connector	22	DC_T
23	Reset	21	30 pin fold connector	23	Reset
24	CLKI_T	22	30 pin fold connector	24	CLKI_T
25	**GND**				
26	**GND**				
27	TE_K2	23	30 pin fold connector	25	TE_K2
28	VEN	24	30 pin fold connector	26	VEN
29	ALSC	25	30 pin fold connector	27	ALSC
30	ALSTEMP	26	30 pin fold connector	28	ALSTEMP
			30 pin fold connector	29	**GND**
			30 pin fold connector	30	**GND**
			20 pin fold connector	1	**GND**
31	Earp	27	20 pin fold connector	2	Earp
32	Earn	28	20 pin fold connector	3	Earn
33	CS_J	29	20 pin fold connector	4	CS_J
34	CS_K2	30	20 pin fold connector	5	CS_K2
35	SDA	31	20 pin fold connector	6	SDA
36	DOUT_K2	32	20 pin fold connector	7	DOUT_K2
37	SCL	33	20 pin fold connector	8	SCL
38	HallQ	34	20 pin fold connector	9	HallQ
39	Row0	35	20 pin fold connector	10	Row0
40	Col4	36	20 pin fold connector	11	Col4
41	Col5	37	20 pin fold connector	12	Col5
42	VIO	38	20 pin fold connector	13	VIO
43	VAUX	39	20 pin fold connector	14	VAUX
44	VBAT	40	20 pin fold connector	15	VBAT
45	VANA	41	20 pin fold connector	16	VANA
46	SETCURR_K2	42	20 pin fold connector	17	SETCURR_K2
47	VLEDOUT1	43	20 pin fold connector	18	VLEDOUT1
48	SETCURR_J	44	20 pin fold connector	19	SETCURR_J
49	**GND**				
50	**GND**		20 pin fold connector	**20**	**GND**

Figure 122 Connections between fold unit and engine board

Camera interface connections and electrical characteristics

Table 24 Interface signals between RM-42 BB and Toshiba camera DSP

Source pin name / function	Source	Destination	Destination pin name / function	Description
DOUTP	TSB DSP	Helen	ccpdap	CCP1 differential data +, output
DOUTM	TSB DSP	Helen	ccpdan	CCP1 differential data -, output
CLKOUTP	TSB DSP	Helen	CCP(3:0) CLK_P	CCP1 differential clock +, output
CLKOUTM	TSB DSP	Helen	CCP(3:0) CLK_N	CCP1 differential clock -, output
GPIO62	Helen	TSB DSP	SDA1	I^2C1 serial data from/to Helen
GPIO11	Helen	TSB DSP	SCL1	I^2C1 serial clock from/to Helen
cam_clk	Helen	TSB DSP	CLK	External clock
GPIO6	Helen	TSB DSP	RESET	Reset
ADRSEL	-	-	-	I^2C Address selector for TSB DSP (hardcoded)
PVDD15		-		1,5V power supply
RVDD28		-		2,8V power supply
LVDDR28R		-		2,8V power supply
LVDDR28D		-		2,8V power supply
MPUIO1	Helen	Regulator	EN	1,5V regulator enable
GPIO41	Helen	Regulator	VEN	2,8V regulator enable

Unagi camera module uses Stobe + and Strobe instead of Clock. D+ and D-.

Table 25 Interface signals between Toshiba camera DSP and Unagi 2Mpix AF camera module

Source pin name / function	Source	Destination	Destination pin name / function	Description
Dout+	Unagi	TSB DSP	DINP	CCP2 diff. data +, from camera
Dout-	Unagi	TSB DSP	DINM	CCP2 diff. data -, from camera

Source pin name / function	Source	Destination	Destination pin name / function	Description
Sout+	Unagi	TSB DSP	CLKINP	CCP2 differential Strobe + *
Sout-	Unagi	TSB DSP	CLKINM	CCP2 differential Strobe - *
SDA2	TSB DSP	Unagi	SDA	I^2C2 serial data to/ from Unagi
SCL2	TSB DSP	Unagi	SCL	I^2C2 serial clock to/ from Unagi
PWM1P	TSB DSP	Unagi	PWMA	PWMa output for AF SIDM
PWM1M	TSB DSP	Unagi	PWMB	PWMb output for AF SIDM
PWM2P	TSB DSP	Unagi	PWMC	PWMc output for AF SIDM
PWM2M	TSB DSP	Unagi	PWMD	PWMd output for AF SIDM
STPLS	TSB DSP	Flash driver	Flash enable	Strobe to flash led driver
GND		-		Ground
VDDI		-		1,5V power supply
VDDI		-		1,5V power supply
VDDI		-		1,5V power supply
VDD				2,8V power supply
VDD				2,8V power supply
VDD				2,8V power supply
GND		-		Ground
cam_clk	Helen	Unagi	CLK	External clock from Helen
GPIO6	Helen	Unagi	RESET	Reset

*) Unagi camera module uses Stobe + and Strobe instead of Clock. D+ and D-.

Table 26 Unagi Camera CCP IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Common mode voltage	VCMF	0.8	0.9	1	V	-1

Description	Parameter	Min	Typ	Max	Unit	Notes
Differential voltage swing	VOD	100	150	200	mV	-2
Operating frequency	fCLK	1		200	MHz	SW controls frequency
Differential rise and fall time		300		800	ps	-3

Note:

- Common mode voltage is a mean value of high and low states of one single-ended signal.
- Differential voltage swing is differential amplitude between signals of differential pair.
- Differential transitions should be only measured with good equipment (bandwith > 1GHz), otherwise results will seem too slow.

Table 27 Unagi Camera supply voltage characteristics

Description	Parameter	Min	Typ	Max	Unit
Camera analog voltage	VDD	2.6	2.8	2.9	V
Camera digital voltage	VDDI	1.4	1.5	1.6V	V

Table 28 Unagi Camera control IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
ExtClk	VIH square wave	0.8 x VDD	-	VDD	V	High-level input voltage
ExtClk	VIL square wave	0	-	0.54	V	Low-level input voltage
ExtClk	p-p sinusoidal wave	0.5	-	1.2	V	Sinusoidal mode voltage swing
ExtClk	Frequency		9.6		MHz	SW controlled frequency
SDA, SCL	VIH	0.7 x VDD	1.8	VDD	V	High-level input voltage
SDA, SCL	VIL	0	-	0.54	V	Low-level input voltage

Description	Parameter	Min	Typ	Max	Unit	Notes
SDA	VOL	0	-	0.4	V	Low-level output voltage
RST	VIH	1.5	1.8	VDD	V	High-level input voltage
RST	VIL	0	-	0.54	V	Low-level input voltage
PWM a, b, c, d	VIH	2.5			V	High-level input voltage
PWM a, b, c, d	VIL			0.3	V	Low-level input voltage

Table 29 Camera DSP supply voltage characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Camera DSP analog voltage	VDD	2.6	2.8	3.0	V	
Camera DSP digital voltage	VDDI	1.4	1.5	1.6	V	

Table 30 Camera DSP control IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
ExtClk	VIH square wave	VDD x 0.8	-	VDD	V	High-level input voltage
ExtClk	VIL square wave	0	-	0.22 x VDD	V	Low-level input voltage
ExtClk	p-p sinusoidal wave	0.5	-	1.2	V	Sinusoidal mode voltage swing
ExtClk	Frequency		9.6		MHz	SW controlled frequency
SDA1, SCL1, SDA2, SCL2	VIH	1.5	1.8	VDD	V	High-level input voltage

Description	Parameter	Min	Typ	Max	Unit	Notes
SDA1, SCL1, SDA2, SCL2	VIL	0	-	0.54	V	Low-level input voltage
SDA	VOL	0	-	0.4	V	Low-level output voltage
RST	VIH	1.5	1.8	VDD	V	High-level input voltage
RST	VIL	0	-	0.2 x VDD	V	Low-level input voltage
STPLS	VOH	0.8 x VDD	-	VDD	V	High-level output voltage
STPLS	VOL	0	-	0.2 x VDD	V	Low-level output voltage
PWM1P, PWM1M, PWM2P, PWM2M	VOH	0.8 x VDD	-	VDD	V	High-level output voltage
PWM1P, PWM1M, PWM2P, PWM2M	VOL	0	-	0.2 x VDD	V	Low-level output voltage

Table 31 Camera DSP CCP IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Common mode voltage	VCMF	0.8	0.9	1.0	V	-1
Differential voltage swing	VOD	100	150	200	mV	-2
Operating frequency	fCLK	1		200	MHz	
Differential rise and fall time		300		800	ps	-3
Clock duty cycle		40	50	60	%	

Note:

- Common mode voltage is a mean value of high and low states of one single-ended signal.
- Differential voltage swing is differential amplitude between signals of differential pair.
- Differential transitions should be only measured with good equipment (bandwith > 1GHz), otherwise results will seem too slow.

Table 32 Camera system regulators IF electrical characteristics

Description	Parameter	Min	Typ	Max	Unit	Notes
Vcam1V5 regulator enable	VOH				V	Helen3 GPIO High-level output voltage
Vcam1V5 regulator enable	VOL				V	Helen3 GPIO Low-level output voltage
Vcam2V8 regulator enable	VOH				V	Helen3 GPIO High-level output voltage
Vcam2V8 regulator enable	VOL				V	Helen3 GPIO Low-level output voltage

Back-up battery interface connections and electrical characteristics

Table 33 Back-up battery connections

Pin name	I/O	Connection	Notes
L2207, VBack	->	Retu, VBack	Back-up battery G2200 is connected to RETU via coil

Table 34 Back-up battery electrical characteristics

Description	Parameter	Min	Typ	Max	Unit
Back-Up Battery Voltage	Vback	0	2.5	2.7	V

RF description

Introduction to receiver functionality

Receiver functions are implemented in RF ASIC N7500.

The receiver is a linear direct conversion receiver consisting of separate front ends (LNA and demodulator) for each supported system.

After the demodulators, the signal paths are combined to one common BB path.

WCDMA receiver

In the WCDMA mode, the received signal is fed from the antenna to the duplex filter. After the duplex filter the signal goes via balun to the integrated LNA residing in N7500. After the LNA, the signal goes trough an off chip band pass SAW filter. The main task of the filter is to attenuate the Tx signal which is leaking trough the duplex filter and amplified by LNA.

After filtering, the signal goes to the down conversion mixer, which converts the signal into baseband I and Q signals (90 degrees phase shift). After the demodulator output there is a RC low pass filter with f0 of ca. 1.5 MHz. It is effectively part of the BB selectivity filtering.

At BB frequency the signal is amplified and fed to a low pass filter giving the selectivity of the receiver. The filters need RC constants, which suffer of process variations. Therefore the integrated resistors are adjustable by digital control word.

Rx channel filter must be calibrated with automatic routine whenever N7500 IC is changed to a phone.

In the WCDMA mode, the corner frequency of the filter is set to ca. 2.1MHz. The filter is followed by an AGC amplifier with adjustable gain. Signal is further amplified before it is fed to balanced analogue IQ output pins. Analogue output pins are accompanied by reference voltage output, which sets the DC level for the AD converter in BB ASIC RAP3G.

The gain of the Rx chain can be adjusted in multiple phases. The first adjustable gain is in LNA which has low, mid and high gain settings and isolation mode. After the mixer, there are adjustable gains (AGC) inside the N7500 IC.

The last stage of the RF Rx chain is an output buffer which feeds the signal and a reference voltage (VREFCM) to BB ASIC. The AGC stages are used to maintain the voltage swing at the input of the AD converters at an adequate level.

The gain of the Rx chain is measured in production at one RF frequency and power level, so that RSSI reporting gets calibrated. If N7500 IC is changed this calibration needs to be performed.

GSM receiver

As GSM900, GSM1800 and GSM1900 Rx branches are functionally identical, the following description is applicable to all of them.

The received signal goes from the GSM antenna to the antenna switch module. The switch module contains PIN diode switches for a band and Rx/Tx selection and also Rx SAW filters.

The antenna switch module is followed by integrated LNAs residing in N7500.

The LNAs are followed by demodulators which downconvert the signal to baseband I and Q signals.

After the down conversion mixer, the Rx chain is similar to WCDMA Rx. Channel select filter is set to 115 kHz in the GSM mode.

In the GSM mode, the DC compensation is carried out before the reception slot.

During an operation called DCN1 a sample of the DC level of the signal is stored in sufficiently large off chip capacitors. During reception, information is in turn used for subtracting the DC information from the input signal of the AGC amplifier.

DCN0 operation is carried out to discharge any charge from the capacitors before DCN1. This guarantees that the starting point for the DC compensation is always the same.

See Also

- WCDMA receiver (Page 9–47)

Introduction to transmitter functionality

Transmitter functions are implemented in the RF ASIC N7501. It contains a BB frequency low pass filter, which is tunable according to the signal bandwidth of the system in use.

In addition, N7501 contains separate RF paths comprising a final frequency IQ modulator and VGA amplifiers.

In order to eliminate the effect of process variations on the low pass filter characteristics, a tuning procedure is carried out in production. The same tunings must be performed if the RF ASIC N7501 is changed.

WCDMA transmitter

In the transmitter side, an analogue I/Q modulated signal is received from the digital baseband into N7501 and fed through the low pass filter.

The corner frequency of the filter is set to approximately 3 MHz.

After the filter the signal is fed to the IQ modulator, which converts the signal to final Tx frequency. There are two separate I/Q modulators. One for WCDMA and another for EGSM900 and GSM1800/1900 signals.

The modulator is followed by two VGA stages giving 85 dB of gain control range. The signal then exits N7501 via a balanced line. In order to attenuate the out of band noise of the transmitter the signal is band pass filtered by a SAW filter before it is fed to the WCDMA PA module.

After the PA the transmitted WCDMA signal is fed through an isolator and a duplex filter to the antenna.

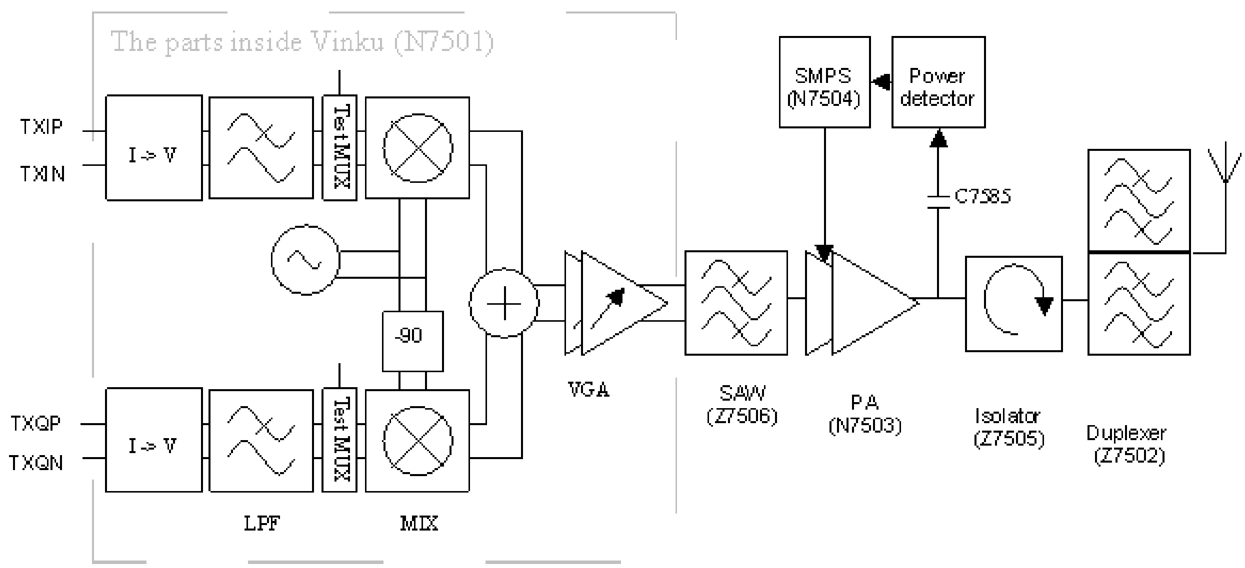


Figure 123 WCDMA transmitter

WCDMA power control

WCDMA Tx power control is accomplished by the two VGA amplifier stages in N7501 Tx ASIC.

The VGAs have a common temperature compensation circuit and one voltage mode analogue input for gain control (TXC).

The gain of VGA amplifier chain is controlled by a DA converter in BB. The same DA converter is shared by GSM Tx power control function.

It is required that phone can measure its output power in high power levels. A sample of the output power is taken by a capacitor between the power amplifier and the isolator and fed to a diode power detector. The output of the detector is low pass filtered and the voltage is then AD converted in BB. The power detector circuitry is calibrated in manufacturing.

Another function of the detector voltage is to steer the DC/DC converter, which is providing a variable supply voltage for the WCDMA PA.

WCDMA PA module

WCDMA PA is housed in a separate module having

- a variable supply voltage input for the amplifier stages (Vcc11),
- a battery supply voltage for the bias circuits (Vcc12),
- and two bias current inputs.

Bias currents are generated by 5-bit DA converters in N7501 RF ASIC. The converters are controlled by BB via RFBus.

In production the PA quiescent current is set according to PA vendor's specifications. If another PA is changed to the phone, this setting must be set again.

The bias currents are also used as PA on/off controls. The structure of the WCDMA PA is shown in the following figure. The supply voltage for the output stage is got from a DCDC converter in order to improve the efficiency at low power levels.

PA DCDC converter

The control of the DCDC converter is fed back from the power detector circuit.

The DCDC converter limits the lowest supply voltage to 1.5 V. At highest power levels the DCDC converter output settles nominally to 3.2 V.

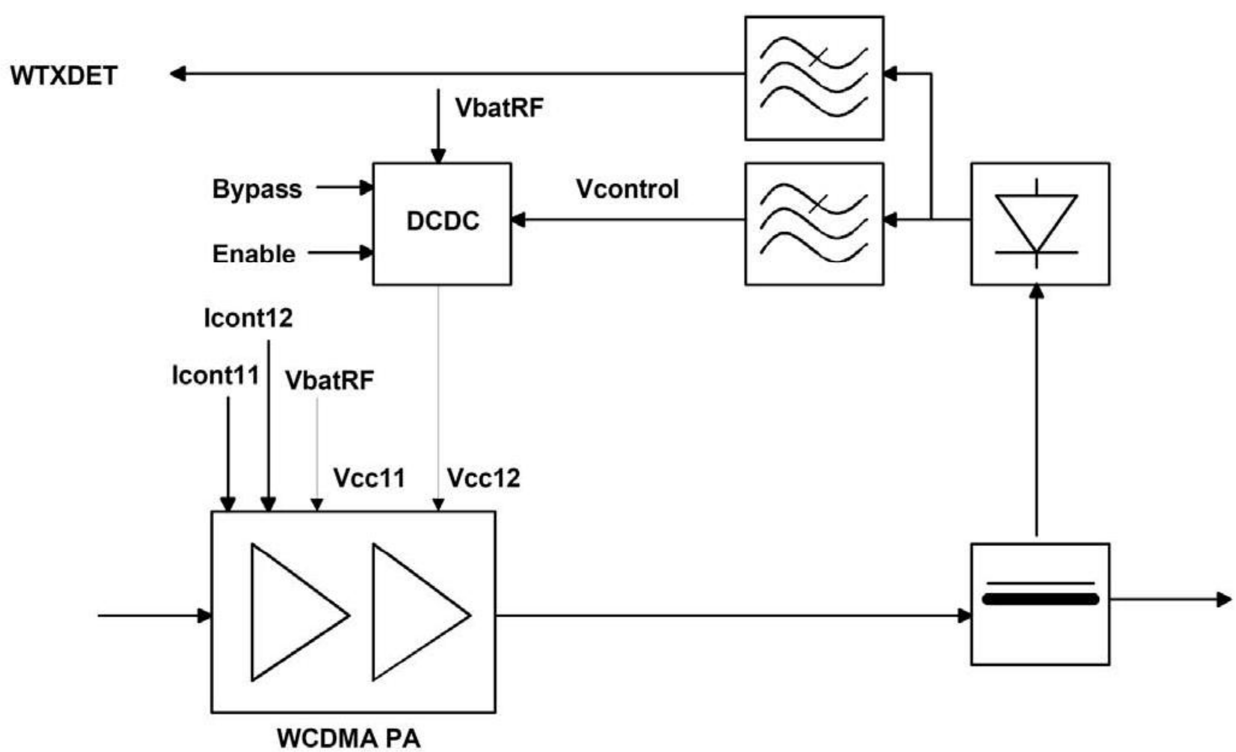


Figure 124 Block diagram of DCDC converter and WCDMA PA

GSM transmitter

An analogue IQ modulated signal is received to N7501 from digital BB.

The signal is first low pass filtered with filter corner frequency set to approximately 200 kHz. After the filter, the signal is routed to the GSM modulator.

The appropriate routing after the modulator is selected by biasing either EGSM900 (/GSM850) or GSM1800/1900 variable gain amplifier. The amplifier gives 40 dB of power control dynamic range.

After the VGA stage the signal exits N7501. In case of GSM1800/1900 the signal goes directly to the GSM PA module. In case of EGSM900 (and GSM850), the PA module is preceded by a SAW filter. After the filter, the signal is fed to GSM PA module. Finally the signal is routed via antenna switch to the antenna.

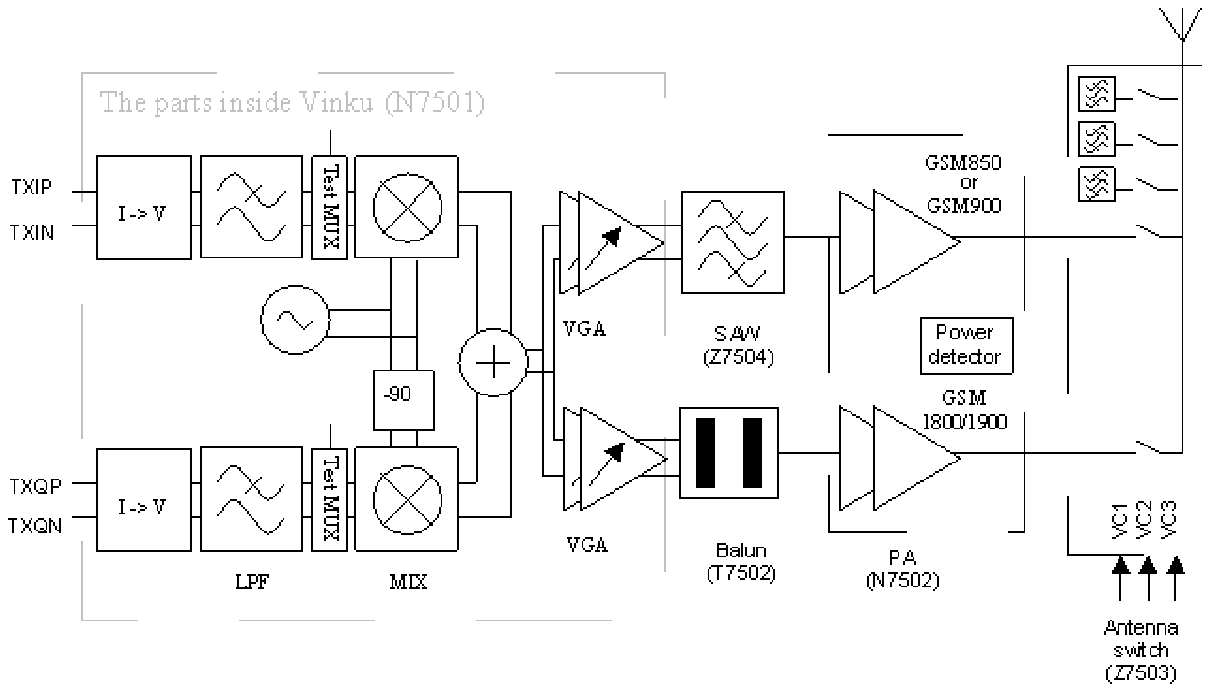


Figure 125 GSM transmitter

GSM power control

A closed control loop comprise an integrated power detector (in PA module) and an error amplifier. The error amplifier resides in N7501, and it controls the transmitter power of GSM.

Detector output from the PA gives a DC level proportional to the output power. The DC voltage is fed to the negative input of the error amplifier, where it is compared to the level of the reference signal, TXC. TXC is got from the BB circuitry. The output of the error amplifier is fed to a buffer amplifier, which in turn steers the VGA amplifier.

The TXC signal also contains the output power ramp waveform, which is optimized in order to meet the transient spectrum and burst timing requirements. PA is switched on and off by changing the bias currents. As a result the output power ramping and final power level of the transmitter are set in a controlled manner.

During EDGE operation 8-PSK modulation is utilized. In the 8-PSK modulation, there are envelope variations during the data transmission. This presents extra requirement to the linearity of the PA. Therefore the PA is set to a dedicated EDGE mode by setting a specific mode control signal up (Vmode). The bias currents are also adjusted in order to improve the linearity.

Because of the 8-PSK modulation, the power control loop has to be opened during the data transmission in EDGE mode. Otherwise a part of the envelope variations could be canceled out by control loop and signal information contents and spectrum would be deteriorated. Loop is opened with a dedicated TXA-signal via RFBus. When the power is ramped up, a modulating bit sequence producing a constant envelope waveform is used and the power control loop is closed. Once the wanted power level has been reached, the loop is opened and the power control voltage is kept constant by a capacitor integrated to N7501 Tx ASIC. When the active part of the burst is over, the loop is again closed and the power is ramped down. The TXA signal is disabled during GMSK transmission.

Power control loop is enabled and disabled by writing an appropriate register in N7501 RF ASIC. In case of dual slot transmission, the output power is ramped down between the consecutive slots.

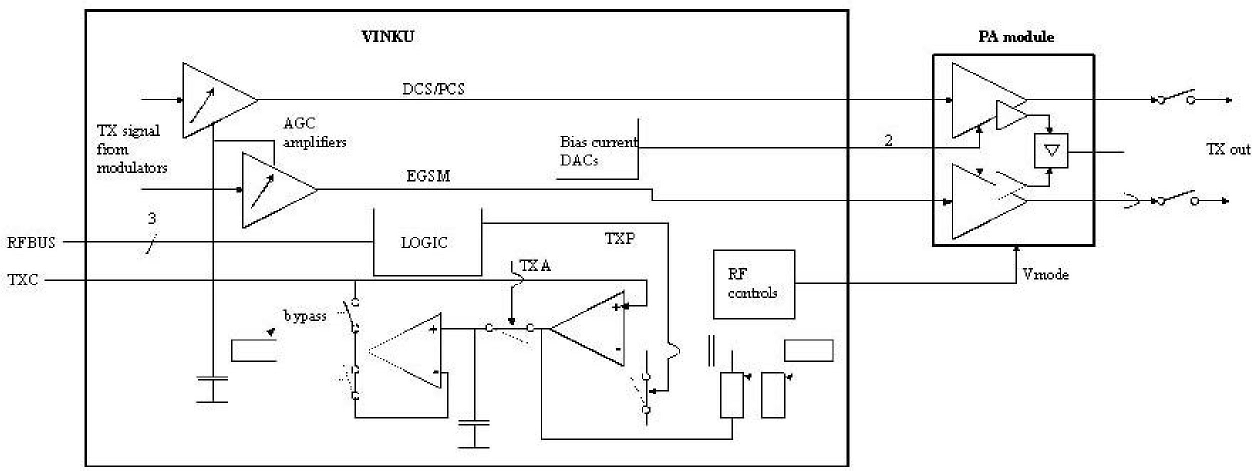


Figure 126 GSM/EDGE power control topology and control signals

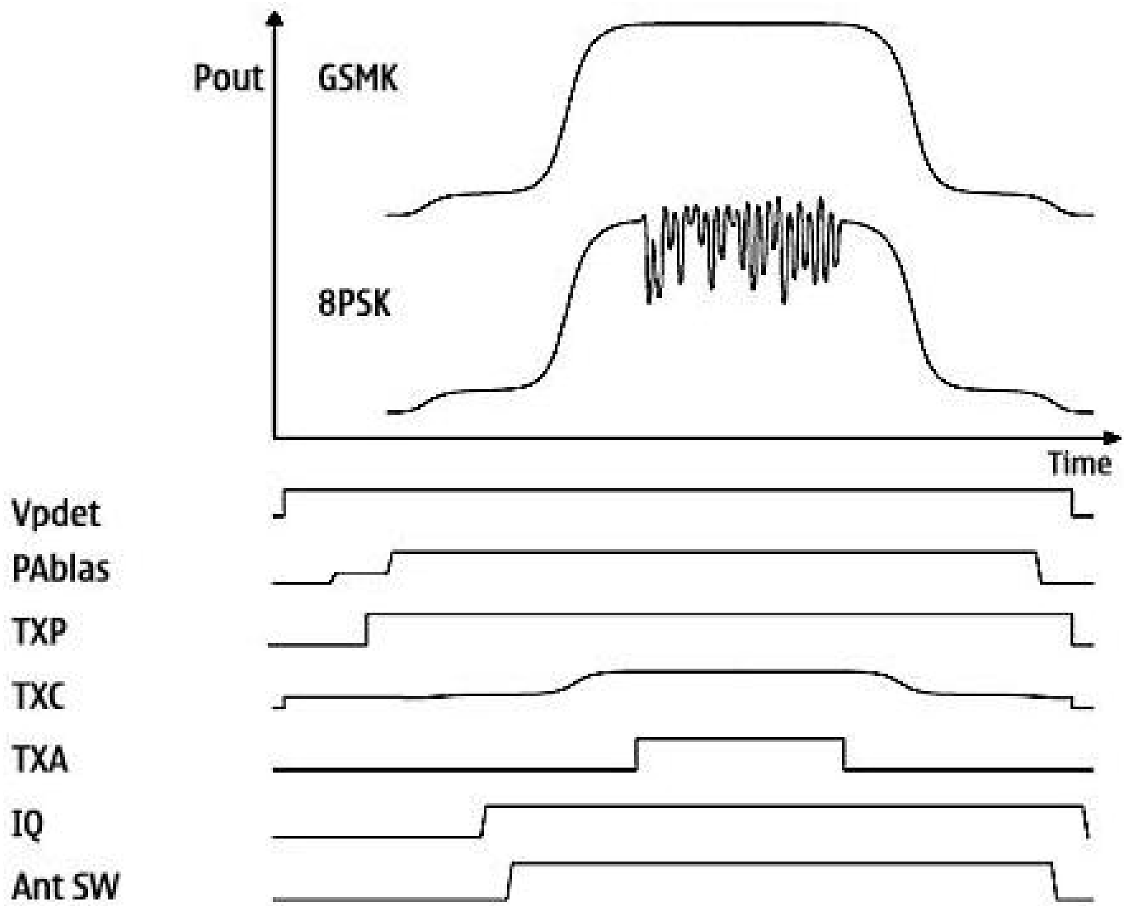


Figure 127 Power control signal usage in GSM (GMSK) and EDGE (8PSK) transmission

Note: Timings are not shown accurately in the previous figure.

GSM PA module

A single GSM/EDGE PA module contains two separate amplifier chains, one for EGSM900 (and GSM850) and another for GSM1800/1900. Both amplifiers have a battery supply connection and two bias current inputs. The bias current for final amplifier stage is adjusted according the power level in use in order to optimise efficiency. The bias currents are also used as on/off switching signals for PAs.

In the EDGE mode, PA linearity has to be higher than in GMSK mode because of envelope variations of the 8-PSK modulations. This is achieved by increasing the bias currents compared to the GMSK mode and setting a dedicated Vmode control signal up. Increasing bias currents improves the linearity of the amplifiers, but it also tends to unnecessarily increase the gain of the PA. Vmode control aims to keep the gain of the amplifiers down.

The bias current needed for the maximum and the lowest output powers is specified by a PA manufacturer. The current for the intermediate power levels is then linearly adjusted between these two values.

Frequency synthesizers

RF has separate synthesizers for Rx and Tx. Both synthesizers consist of:

- PLL
- loop filter
- VCO
- balun

The VCO frequencies are locked by PLLs into a reference oscillator, VCTCXO.

The PLLs are located in N7500 and N7501 respectively and controlled via RFBus. PLL charge pump charges or discharges the integrator capacitor in the loop filter depending on the phase of the measured frequency compared to the phase of the reference frequency. The integrator output voltage is connected to the control input of the VCO.

The VCOs operate at the channel frequency multiplied by two in the upper bands (for example, GSM1800/1900/ WCDMA) and by four in EGSM900 (and GSM850, if applicable). The required frequency dividers required for modulators are integrated in N7501 and those for demodulators in N7500. The dividers are controlled via RFBus.

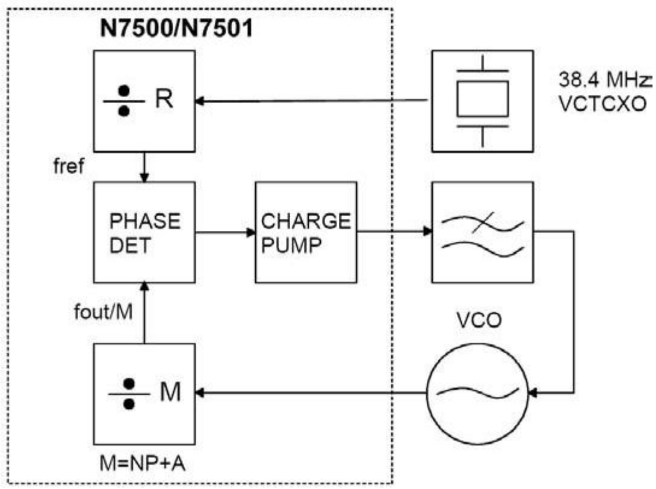


Figure 128 Phase locked loop in N7500 and N7501 (PLL)

Reference oscillators

As a reference oscillator for the frequency synthesizers a 38.4MHz VCTCXO (voltage controlled temperature compensated crystal oscillator) is used.

The output signal of the VCTCXO is directly connected to both N7500 and N7501 where it's used as synthesizer reference. N7500 also contains a balanced buffered output for supplying the clock signal to the digital BB ASIC and a single ended buffer for Bluetooth.

The frequency of the reference oscillator is locked into the frequency of the base station with the help of an AFC voltage, which is generated in BB by DSP and converted by dedicated DAC.

Regulators

N7500 and N7501 contain integrated regulators to supply regulated voltages for their internal circuitry and other RF parts. Rx VCO supply is got via a switch from N7500 VR1 regulator. VCO can be switched on and off by controlling the switch via RFBus.

Supply voltage for the VCTCXO is provided by a BB mixed mode ASIC. The same supply is used for reference clock input buffers (in N7500 and N7501), output buffers (from N7500 to BB) and for the digital control blocks of both RF ASICs. When the VCTCXO regulator is set active, the control blocks of the RF ASICs also wake up. After that the integrated regulators can be controlled via RFBus.

Other supplies, like 4.7V supply for PLL charge pumps and bias reference (VREFRF01) are also provided by the BB mixed mode ASIC.

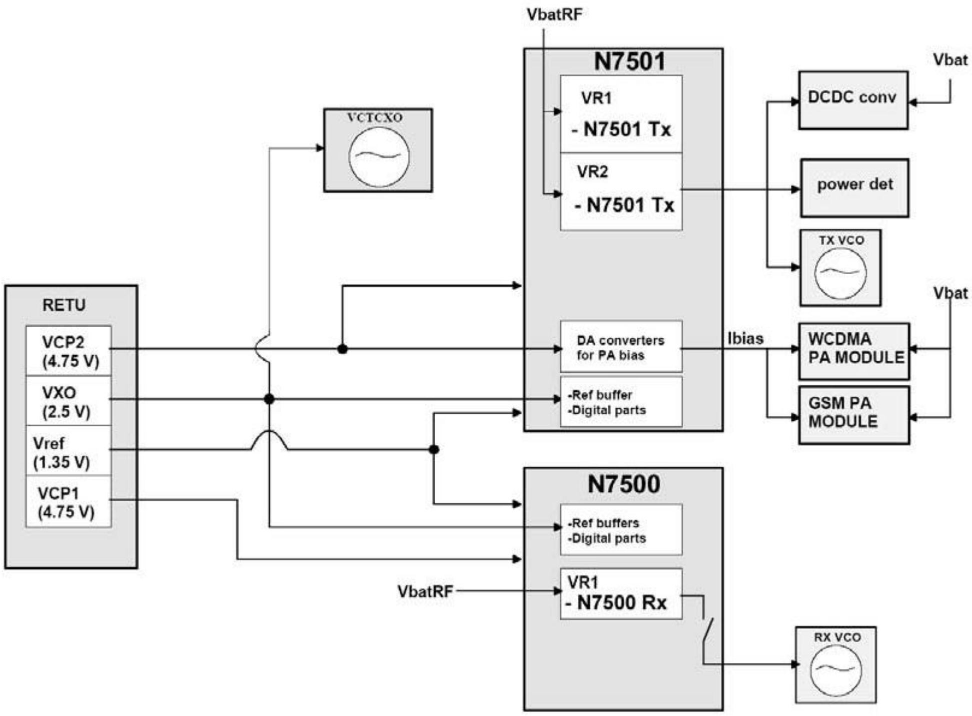


Figure 129 RF supply connections from the BB mixed mode ASIC

Frequency mappings

EGSM900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
975	880,2	925,2	3520,8	3700,8	1	890,2	935,2	3560,8	3740,8	63	902,6	947,6	3610,4	3790,4
976	880,4	925,4	3521,6	3701,6	2	890,4	935,4	3561,6	3741,6	64	902,8	947,8	3611,2	3791,2
977	880,6	925,6	3522,4	3702,4	3	890,6	935,6	3562,4	3742,4	65	903,0	948,0	3612,0	3792,0
978	880,8	925,8	3523,2	3703,2	4	890,8	935,8	3563,2	3743,2	66	903,2	948,2	3612,8	3792,8
979	881,0	926,0	3524,0	3704,0	5	891,0	936,0	3564,0	3744,0	67	903,4	948,4	3613,6	3793,6
980	881,2	926,2	3524,8	3704,8	6	891,2	936,2	3564,8	3744,8	68	903,6	948,6	3614,4	3794,4
981	881,4	926,4	3525,6	3705,6	7	891,4	936,4	3565,6	3745,6	69	903,8	948,8	3615,2	3795,2
982	881,6	926,6	3526,4	3706,4	8	891,6	936,6	3566,4	3746,4	70	904,0	949,0	3616,0	3796,0
983	881,8	926,8	3527,2	3707,2	9	891,8	936,8	3567,2	3747,2	71	904,2	949,2	3616,8	3796,8
984	882,0	927,0	3528,0	3708,0	10	892,0	937,0	3568,0	3748,0	72	904,4	949,4	3617,6	3797,6
985	882,2	927,2	3528,8	3708,8	11	892,2	937,2	3568,8	3748,8	73	904,6	949,6	3618,4	3798,4
986	882,4	927,4	3529,6	3709,6	12	892,4	937,4	3569,6	3749,6	74	904,8	949,8	3619,2	3799,2
987	882,6	927,6	3530,4	3710,4	13	892,6	937,6	3570,4	3750,4	75	905,0	950,0	3620,0	3800,0
988	882,8	927,8	3531,2	3711,2	14	892,8	937,8	3571,2	3751,2	76	905,2	950,2	3620,8	3800,8
989	883,0	928,0	3532,0	3712,0	15	893,0	938,0	3572,0	3752,0	77	905,4	950,4	3621,6	3801,6
990	883,2	928,2	3532,8	3712,8	16	893,2	938,2	3572,8	3752,8	78	905,6	950,6	3622,4	3802,4
991	883,4	928,4	3533,6	3713,6	17	893,4	938,4	3573,6	3753,6	79	905,8	950,8	3623,2	3803,2
992	883,6	928,6	3534,4	3714,4	18	893,6	938,6	3574,4	3754,4	80	906,0	951,0	3624,0	3804,0
993	883,8	928,8	3535,2	3715,2	19	893,8	938,8	3575,2	3755,2	81	906,2	951,2	3624,8	3804,8
994	884,0	929,0	3536,0	3716,0	20	894,0	939,0	3576,0	3756,0	82	906,4	951,4	3625,6	3805,6
995	884,2	929,2	3536,8	3716,8	21	894,2	939,2	3576,8	3756,8	83	906,6	951,6	3626,4	3806,4
996	884,4	929,4	3537,6	3717,6	22	894,4	939,4	3577,6	3757,6	84	906,8	951,8	3627,2	3807,2
997	884,6	929,6	3538,4	3718,4	23	894,6	939,6	3578,4	3758,4	85	907,0	952,0	3628,0	3808,0
998	884,8	929,8	3539,2	3719,2	24	894,8	939,8	3579,2	3759,2	86	907,2	952,2	3628,8	3808,8
999	885,0	930,0	3540,0	3720,0	25	895,0	940,0	3580,0	3760,0	87	907,4	952,4	3629,6	3809,6
1000	885,2	930,2	3540,8	3720,8	26	895,2	940,2	3580,8	3760,8	88	907,6	952,6	3630,4	3810,4
1001	885,4	930,4	3541,6	3721,6	27	895,4	940,4	3581,6	3761,6	89	907,8	952,8	3631,2	3811,2
1002	885,6	930,6	3542,4	3722,4	28	895,6	940,6	3582,4	3762,4	90	908,0	953,0	3632,0	3812,0
1003	885,8	930,8	3543,2	3723,2	29	895,8	940,8	3583,2	3763,2	91	908,2	953,2	3632,8	3812,8
1004	886,0	931,0	3544,0	3724,0	30	896,0	941,0	3584,0	3764,0	92	908,4	953,4	3633,6	3813,6
1005	886,2	931,2	3544,8	3724,8	31	896,2	941,2	3584,8	3764,8	93	908,6	953,6	3634,4	3814,4
1006	886,4	931,4	3545,6	3725,6	32	896,4	941,4	3585,6	3765,6	94	908,8	953,8	3635,2	3815,2
1007	886,6	931,6	3546,4	3726,4	33	896,6	941,6	3586,4	3766,4	95	909,0	954,0	3636,0	3816,0
1008	886,8	931,8	3547,2	3727,2	34	896,8	941,8	3587,2	3767,2	96	909,2	954,2	3636,8	3816,8
1009	887,0	932,0	3548,0	3728,0	35	897,0	942,0	3588,0	3768,0	97	909,4	954,4	3637,6	3817,6
1010	887,2	932,2	3548,8	3728,8	36	897,2	942,2	3588,8	3768,8	98	909,6	954,6	3638,4	3818,4
1011	887,4	932,4	3549,6	3729,6	37	897,4	942,4	3589,6	3769,6	99	909,8	954,8	3639,2	3819,2
1012	887,6	932,6	3550,4	3730,4	38	897,6	942,6	3590,4	3770,4	100	910,0	955,0	3640,0	3820,0
1013	887,8	932,8	3551,2	3731,2	39	897,8	942,8	3591,2	3771,2	101	910,2	955,2	3640,8	3820,8
1014	888,0	933,0	3552,0	3732,0	40	898,0	943,0	3592,0	3772,0	102	910,4	955,4	3641,6	3821,6
1015	888,2	933,2	3552,8	3732,8	41	898,2	943,2	3592,8	3772,8	103	910,6	955,6	3642,4	3822,4
1016	888,4	933,4	3553,6	3733,6	42	898,4	943,4	3593,6	3773,6	104	910,8	955,8	3643,2	3823,2
1017	888,6	933,6	3554,4	3734,4	43	898,6	943,6	3594,4	3774,4	105	911,0	956,0	3644,0	3824,0
1018	888,8	933,8	3555,2	3735,2	44	898,8	943,8	3595,2	3775,2	106	911,2	956,2	3644,8	3824,8
1019	889,0	934,0	3556,0	3736,0	45	899,0	944,0	3596,0	3776,0	107	911,4	956,4	3645,6	3825,6
1020	889,2	934,2	3556,8	3736,8	46	899,2	944,2	3596,8	3776,8	108	911,6	956,6	3646,4	3826,4
1021	889,4	934,4	3557,6	3737,6	47	899,4	944,4	3597,6	3777,6	109	911,8	956,8	3647,2	3827,2
1022	889,6	934,6	3558,4	3738,4	48	899,6	944,6	3598,4	3778,4	110	912,0	957,0	3648,0	3828,0
1023	889,8	934,8	3559,2	3739,2	49	899,8	944,8	3599,2	3779,2	111	912,2	957,2	3648,8	3828,8
0	890,0	935,0	3560,0	3740,0	50	900,0	945,0	3600,0	3780,0	112	912,4	957,4	3649,6	3829,6
					51	900,2	945,2	3600,8	3780,8	113	912,6	957,6	3650,4	3830,4
					52	900,4	945,4	3601,6	3781,6	114	912,8	957,8	3651,2	3831,2
					53	900,6	945,6	3602,4	3782,4	115	913,0	958,0	3652,0	3832,0
					54	900,8	945,8	3603,2	3783,2	116	913,2	958,2	3652,8	3832,8
					55	901,0	946,0	3604,0	3784,0	117	913,4	958,4	3653,6	3833,6
					56	901,2	946,2	3604,8	3784,8	118	913,6	958,6	3654,4	3834,4
					57	901,4	946,4	3605,6	3785,6	119	913,8	958,8	3655,2	3835,2
					58	901,6	946,6	3606,4	3786,4	120	914,0	959,0	3656,0	3836,0
					59	901,8	946,8	3607,2	3787,2	121	914,2	959,2	3656,8	3836,8
					60	902,0	947,0	3608,0	3788,0	122	914,4	959,4	3657,6	3837,6
					61	902,2	947,2	3608,8	3788,8	123	914,6	959,6	3658,4	3838,4
					62	902,4	947,4	3609,6	3789,6	124	914,8	959,8	3659,2	3839,2

GSM1800 frequencies

Ch	TX	RX	VCO TX	VCO RX	Ch	TX	RX	VCO TX	VCO RX	Ch	TX	RX	VCO TX	VCO RX	Ch	TX	RX	VCO TX	VCO RX
547	1717.2	1812.2	3434.4	3624.4	625	1732.8	1827.8	3465.6	3655.6	712	1750.2	1845.2	3500.4	3690.4	799	1767.6	1862.6	3535.2	3725.2
548	1717.4	1812.4	3434.8	3624.8	626	1733.0	1828.0	3466.0	3656.0	713	1750.4	1845.4	3500.8	3690.8	800	1767.8	1862.8	3535.6	3725.6
549	1717.6	1812.6	3435.2	3625.2	627	1733.2	1828.2	3466.4	3656.4	714	1750.6	1845.6	3501.2	3691.2	801	1768.0	1863.0	3536.0	3726.0
550	1717.8	1812.8	3435.6	3625.6	628	1733.4	1828.4	3466.8	3656.8	715	1750.8	1845.8	3501.6	3691.6	802	1768.2	1863.2	3536.4	3726.4
551	1718.0	1813.0	3436.0	3626.0	629	1733.6	1828.6	3467.2	3657.2	716	1751.0	1846.0	3502.0	3692.0	803	1768.4	1863.4	3536.8	3726.8
552	1718.2	1813.2	3436.4	3626.4	630	1733.8	1828.8	3467.6	3657.6	717	1751.2	1846.2	3502.4	3692.4	804	1768.6	1863.6	3537.2	3727.2
553	1718.4	1813.4	3436.8	3626.8	631	1734.0	1829.0	3468.0	3658.0	718	1751.4	1846.4	3502.8	3692.8	805	1768.8	1863.8	3537.6	3727.6
554	1718.6	1813.6	3437.2	3627.2	632	1734.2	1829.2	3468.4	3658.4	719	1751.6	1846.6	3503.2	3693.2	806	1769.0	1864.0	3538.0	3728.0
555	1718.8	1813.8	3437.6	3627.6	633	1734.4	1829.4	3468.8	3658.8	720	1751.8	1846.8	3503.6	3693.6	807	1769.2	1864.2	3538.4	3728.4
556	1719.0	1814.0	3438.0	3628.0	634	1734.6	1829.6	3469.2	3659.2	721	1752.0	1847.0	3504.0	3694.0	808	1769.4	1864.4	3538.8	3728.8
557	1719.2	1814.2	3438.4	3628.4	635	1734.8	1829.8	3469.6	3659.6	722	1752.2	1847.2	3504.4	3694.4	809	1769.6	1864.6	3539.2	3729.2
558	1719.4	1814.4	3438.8	3628.8	636	1735.0	1830.0	3470.0	3660.0	723	1752.4	1847.4	3504.8	3694.8	810	1769.8	1864.8	3539.6	3729.6
559	1719.6	1814.6	3439.2	3629.2	637	1735.2	1830.2	3470.4	3660.4	724	1752.6	1847.6	3505.2	3695.2	811	1770.0	1865.0	3540.0	3730.0
560	1719.8	1814.8	3439.6	3629.6	638	1735.4	1830.4	3470.8	3660.8	725	1752.8	1847.8	3505.6	3695.6	812	1770.2	1865.2	3540.4	3730.4
561	1720.0	1815.0	3440.0	3630.0	639	1735.6	1830.6	3471.2	3661.2	726	1753.0	1848.0	3506.0	3696.0	813	1770.4	1865.4	3540.8	3730.8
562	1720.2	1815.2	3440.4	3630.4	640	1735.8	1830.8	3471.6	3661.6	727	1753.2	1848.2	3506.4	3696.4	814	1770.6	1865.6	3541.2	3731.2
563	1720.4	1815.4	3440.8	3630.8	641	1736.0	1831.0	3472.0	3662.0	728	1753.4	1848.4	3506.8	3696.8	815	1770.8	1865.8	3541.6	3731.6
564	1720.6	1815.6	3441.2	3631.2	642	1736.2	1831.2	3472.4	3662.4	729	1753.6	1848.6	3507.2	3697.2	816	1771.0	1866.0	3542.0	3732.0
565	1720.8	1815.8	3441.6	3631.6	643	1736.4	1831.4	3472.8	3662.8	730	1753.8	1848.8	3507.6	3697.6	817	1771.2	1866.2	3542.4	3732.4
566	1721.0	1816.0	3442.0	3632.0	644	1736.6	1831.6	3473.2	3663.2	731	1754.0	1849.0	3508.0	3698.0	818	1771.4	1866.4	3542.8	3732.8
567	1721.2	1816.2	3442.4	3632.4	645	1736.8	1831.8	3473.6	3663.6	732	1754.2	1849.2	3508.4	3698.4	819	1771.6	1866.6	3543.2	3733.2
568	1721.4	1816.4	3442.8	3632.8	646	1737.0	1832.0	3474.0	3664.0	733	1754.4	1849.4	3508.8	3698.8	820	1771.8	1866.8	3543.6	3733.6
569	1721.6	1816.6	3443.2	3633.2	647	1737.2	1832.2	3474.4	3664.4	734	1754.6	1849.6	3509.2	3699.2	821	1772.0	1867.0	3544.0	3734.0
570	1721.8	1816.8	3443.6	3633.6	648	1737.4	1832.4	3474.8	3664.8	735	1754.8	1849.8	3509.6	3699.6	822	1772.2	1867.2	3544.4	3734.4
571	1722.0	1817.0	3444.0	3634.0	649	1737.6	1832.6	3475.2	3665.2	736	1755.0	1850.0	3510.0	3700.0	823	1772.4	1867.4	3544.8	3734.8
572	1722.2	1817.2	3444.4	3634.4	650	1737.8	1832.8	3475.6	3665.6	737	1755.2	1850.2	3510.4	3700.4	824	1772.6	1867.6	3545.2	3735.2
573	1722.4	1817.4	3444.8	3634.8	651	1738.0	1833.0	3476.0	3666.0	738	1755.4	1850.4	3510.8	3700.8	825	1772.8	1867.8	3545.6	3735.6
574	1722.6	1817.6	3445.2	3635.2	652	1738.2	1833.2	3476.4	3666.4	739	1755.6	1850.6	3511.2	3701.2	826	1773.0	1868.0	3546.0	3736.0
575	1722.8	1817.8	3445.6	3635.6	653	1738.4	1833.4	3476.8	3666.8	740	1755.8	1850.8	3511.6	3701.6	827	1773.2	1868.2	3546.4	3736.4
576	1723.0	1818.0	3446.0	3636.0	654	1738.6	1833.6	3477.2	3667.2	741	1756.0	1851.0	3512.0	3702.0	828	1773.4	1868.4	3546.8	3736.8
577	1723.2	1818.2	3446.4	3636.4	655	1738.8	1833.8	3477.6	3667.6	742	1756.2	1851.2	3512.4	3702.4	829	1773.6	1868.6	3547.2	3737.2
578	1723.4	1818.4	3446.8	3636.8	656	1739.0	1834.0	3478.0	3668.0	743	1756.4	1851.4	3512.8	3702.8	830	1773.8	1868.8	3547.6	3737.6
579	1723.6	1818.6	3447.2	3637.2	657	1739.2	1834.2	3478.4	3668.4	744	1756.6	1851.6	3513.2	3703.2	831	1774.0	1869.0	3548.0	3738.0
580	1723.8	1818.8	3447.6	3637.6	658	1739.4	1834.4	3478.8	3668.8	745	1756.8	1851.8	3513.6	3703.6	832	1774.2	1869.2	3548.4	3738.4
581	1724.0	1819.0	3448.0	3638.0	659	1739.6	1834.6	3479.2	3669.2	746	1757.0	1852.0	3514.0	3704.0	833	1774.4	1869.4	3548.8	3738.8
582	1724.2	1819.2	3448.4	3638.4	660	1739.8	1834.8	3479.6	3669.6	747	1757.2	1852.2	3514.4	3704.4	834	1774.6	1869.6	3549.2	3739.2
583	1724.4	1819.4	3448.8	3638.8	661	1740.0	1835.0	3480.0	3670.0	748	1757.4	1852.4	3514.8	3704.8	835	1774.8	1869.8	3549.6	3739.6
584	1724.6	1819.6	3449.2	3639.2	662	1740.2	1835.2	3480.4	3670.4	749	1757.6	1852.6	3515.2	3705.2	836	1775.0	1870.0	3550.0	3740.0
585	1724.8	1819.8	3449.6	3639.6	663	1740.4	1835.4	3480.8	3670.8	750	1757.8	1852.8	3515.6	3705.6	837	1775.2	1870.2	3550.4	3740.4
586	1725.0	1820.0	3450.0	3640.0	664	1740.6	1835.6	3481.2	3671.2	751	1758.0	1853.0	3516.0	3706.0	838	1775.4	1870.4	3550.8	3740.8
587	1725.2	1820.2	3450.4	3640.4	665	1740.8	1835.8	3481.6	3671.6	752	1758.2	1853.2	3516.4	3706.4	839	1775.6	1870.6	3551.2	3741.2
588	1725.4	1820.4	3450.8	3640.8	666	1741.0	1836.0	3482.0	3672.0	753	1758.4	1853.4	3516.8	3706.8	840	1775.8	1870.8	3551.6	3741.6
589	1725.6	1820.6	3451.2	3641.2	667	1741.2	1836.2	3482.4	3672.4	754	1758.6	1853.6	3517.2	3707.2	841	1776.0	1871.0	3552.0	3742.0
590	1725.8	1820.8	3451.6	3641.6	668	1741.4	1836.4	3482.8	3672.8	755	1758.8	1853.8	3517.6	3707.6	842	1776.2	1871.2	3552.4	3742.4
591	1726.0	1821.0	3452.0	3642.0	669	1741.6	1836.6	3483.2	3673.2	756	1759.0	1854.0	3518.0	3708.0	843	1776.4	1871.4	3552.8	3742.8
592	1726.2	1821.2	3452.4	3642.4	670	1741.8	1836.8	3483.6	3673.6	757	1759.2	1854.2	3518.4	3708.4	844	1776.6	1871.6	3553.2	3743.2
593	1726.4	1821.4	3452.8	3642.8	671	1742.0	1837.0	3484.0	3674.0	758	1759.4	1854.4	3518.8	3708.8	845	1776.8	1871.8	3553.6	3743.6
594	1726.6	1821.6	3453.2	3643.2	672	1742.2	1837.2	3484.4	3674.4	759	1759.6	1854.6	3519.2	3709.2	846	1777.0	1872.0	3554.0	3744.0
595	1726.8	1821.8	3453.6	3643.6	673	1742.4	1837.4	3484.8	3674.8	760	1759.8	1854.8	3519.6	3709.6	847	1777.2	1872.2	3554.4	3744.4
596	1727.0	1822.0	3454.0	3644.0	674	1742.6	1837.6	3485.2	3675.2	761	1760.0	1855.0	3520.0	3710.0	848	1777.4	1872.4	3554.8	3744.8
597	1727.2	1822.2	3454.4	3644.4	675	1742.8	1837.8	3485.6	3675.6	762	1760.2	1855.2	3520.4	3710.4	849	1777.6	1872.6	3555.2	3745.2
598	1727.4	1822.4	3454.8	3644.8	676	1743.0	1838.0	3486.0	3676.0	763	1760.4	1855.4	3520.8	3710.8	850	1777.8	1872.8	3555.6	3745.6
599	1727.6	1822.6	3455.2	3645.2	677	1743.2	1838.2	3486.4	3676.4	764	1760.6	1855.6	3521.2	3711.2	851	1778.0	1873.0	3556.0	3746.0
600	1727.8	1822.8	3455.6	3645.6	678	1743.4	1838.4	3486.8	3676.8	765	1760.8	1855.8	3521.6	3711.6	852	1778.2	1873.2	3556.4	3746.4
601	1728.0	1823.0	3456.0	3646.0	679	1743.6	1838.6	3487.2	3677.2	766	1761.0	1856.0	3522.0	3712.0	853	1778.4	1873.4	3556.8	3746.8
602	1728.2	1823.2	3456.4	3646.4	680	1743.8	1838.8	3487.6	3677.6	767	1761.2	1856.2	3522.4	3712.4	854	1778.6	1873.6	3557.2	3747.2
603	1728.4	1823.4	3456.8	3646.8	681	1744.0	1839.0	3488.0	3678.0	768	1761.4	1856.4	3522.8	3712.8	855	1778.8	1873.8	3557.6	3747.6
604	1728.6	1823.6	3457.2	3647.2	682	1744.2	1839.2	3488.4	3678.4	769	1761.6	1856.6	3523.2	3713.2	856	1779.0	1874.0	3558.0	3748.0
605	1728.8	1823.8	3457.6	3647.6	683	1744.4	1839.4	3488.8	3678.8	770	1761.8	1856.8	3523.6	3713.6	857	1779.2	1874.2	3558.4	3748.4
606	1729.0	1824.0	3458.0	3648.0	684	1744.6	1839.6	3489.2	3679.2	771	1762.0	1857.0	3524.0	3714.0	858	1779.4	1874.4	3558.8	3748.8
607	1729.2	1824.2	3458.4	3648.4	685	1744.8	1839.8	3489.6	3679.6	772	1762.2	1857.2	3524.4	3714.4	859	1779.6	1874.6	3559.2	3749.2
608	1729.4	1824.4	3458.8	3648.8	686	1745.0	1840.0	3490.0	3680.0	773	1762.4	1857.4	3524.8	3714.8	860	1779.8	1874.8	3559.6	3749.6
609	1729.6	1824.6	3459.2	3649.2	687	1745.2	1840.2	3490.4	3680.4	774	1762.6	1857.6	3525.2	3715.2	861	1780.0	1875.0	3560.0	3750.0
610	1729.8	1824.8	3459.6	3649.6	688	1745.4	1840.4	3490.8	3680.8	775	1762.8	1857.8	3525.6	3715.6	862	1780.2	1875.2	3560.4	3750.4
611	1730.0	1825.0	3460.0	3650.0	689	1745.6	1840.6	3491.2	3681.2	776	1763.0	1858.0	3526.0	3716.0	863	1780.4	1875.4	3560.8	3750.8
612	1730.2	1825.2	3460.4	3650.4	690	1745.8	1840.8	3491.6	3681.6	777	1763.2	1858.2	3526.4	3716.4	864	1780.6	1875.6	3561.2	3751.2
613	1730.4	1825.4	3460.8	3650.8	691	1746.0	1841.0	3492.0	3682.0	778	1763.4	1858.4	3526.8	3716.8	865	1780.8	1875.8	3561.6	3751.6
614	1730.6	1825.6	3461.2	3651.2	692	1746.2	1841.2	3492.4	3682.4	779	1763.6	1858.6	3527.2	3717.2	866	1781.0	1876.0	3562.0	3752.0
615	1730.8	1825.8	3461.6	3651.6	693	1746.4	1841.4	3492.8	3682.8	780	1763.8	1858.8	3527.6	3717.6	867	1781.2	1876.2	3562.4	3752.4
616	1731.0	1826.0	3462.0	3652.0	694	1746.6	1841.6	3493.2	3683.2	781	1764.0	1859.0	3528.0	3718.0	868	1781.4	1876.4	3562.8	3752.8
617	1731.2	1826.2	3462.4	3652.4	695	1746.8	1841.8	3493.6	3683.6	782	1764.2	1859.2	3528.4	3718.4	869	1781.6	1876.6	3563.2	3753.2
618	1731.4	1826.4	3462.8	3652.8	696	1747.0	1842.0	3494.0	3684.0	783	1764.4	1859.4	3528.8	3718.8	870	1781.8	1876.8	3563.6	3753.6
619	1731.6	1826.6	3463.2	3653.2	697	1747.2	1842.2	3494.4	3684.4	784	1764.6	1859.6	3529.2	3719.2	871	1782.0	1877.0	3564.0	3754.0
620	1731.8	1826.8	3463.6	3653.6	698	1747.4	1842.4	3494.8	3684.8	785	1764.8	1859.8	3529.6	3719.6	872	1782.2	1877.2	3564.4	3754.4
621	1732.0	1827.0	3464.0	3654.0	699	1747.6	1842.6	3495.2	3685.2	786	1765.0	1860.0	3530.0	3720.0	873	1782.4	1877.4	3564.8	3754.8
622	1732.2	1827.2	3464.4	3654.4	700	1747.8	1842.8	3495.6	3685.6	787	1765.2	1860.2	3530.4	3720.4	874	1782.6	1877.6	3565.2	3755.2
623	1732.4	1827.4	3464.8	3654.8	701	1748.0	1843.0	3496.0	3686.0	788	1765.4	1860.4	3530.8	3720.8	875	1782.8	1877.8	3565.6	3755.6
624	1732.6	1827.6	3465.2	3655.2	702	1748.2	1843.2	3496.4	3686.4	789	1765.6	1860.6	3531.2	3721.2	876	1783.0	1878.0	3566.0	3756.0
					703	1748.4	1843.4	3496.8	3686.8	790	1765.8	1860.8	3531.6	3721.6	877	1783.2	1878.2	3566.4	3756.4
					704	1748.6	1843.6	3497.2	3687.2	791	1766.0	1861.0	3532.0	3722.0	878	1783.4	1878.4	3566.8	3756.8
					705	1748.8	1843.8	3497.6	3687.6	792	1766.2	1861.2	3532.4	3722.4	879	1783.6	1878.6	3567.2	3757.2
					706	1749.0	1844.0	3498.0	3688.0	793	1766.4	1861.4	3532.8	3722.8	880	1783.8	1878.8	3567.6	3757.6
					707	1749.2	1844.2	3498.4	3688.4	794	1766.6	1861.6	3533.2	3723.2	881	1784.0	1879.0	3568.0	3758.0
					708	1749.4	1844.4	3498.8	3688.8	795	1766.8	1861.8	3533.6	3723.6	882	1784.2	1879.2	3568.4	3758.4
					709	1749.6	1844.6	3499.2	3689.2	796	1767.0	1862.0	3534.0	3724.0	883	1784.4	1879.4	3568.8	3758.8
					710	1749.8	1844.8	3499.6	3689.6	797	1767.2	1862.2	3534.4	3724.4	884	1784.6	1879.6	3569.2	3759.2
					711	1750.0	1845.0	3500.0	3690.0	798	1767.4	1862.4	3534.8	3724.8	885	1784.8	1879.8	3569.6	3759.6

GSM1900 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
512	1850,2	1930,2	3700,4	3860,4	606	1869,0	1949,0	3738,0	3898,0	700	1887,8	1967,8	3775,6	3935,6	794	1906,6	1986,6	3813,2	3973,2
513	1850,4	1930,4	3700,8	3860,8	607	1869,2	1949,2	3738,4	3898,4	701	1888,0	1968,0	3776,0	3936,0	795	1906,8	1986,8	3813,6	3973,6
514	1850,6	1930,6	3701,2	3861,2	608	1869,4	1949,4	3738,8	3898,8	702	1888,2	1968,2	3776,4	3936,4	796	1907,0	1987,0	3814,0	3974,0
515	1850,8	1930,8	3701,6	3861,6	609	1869,6	1949,6	3739,2	3899,2	703	1888,4	1968,4	3776,8	3936,8	797	1907,2	1987,2	3814,4	3974,4
516	1851,0	1931,0	3702,0	3862,0	610	1869,8	1949,8	3739,6	3899,6	704	1888,6	1968,6	3777,2	3937,2	798	1907,4	1987,4	3814,8	3974,8
517	1851,2	1931,2	3702,4	3862,4	611	1870,0	1950,0	3740,0	3900,0	705	1888,8	1968,8	3777,6	3937,6	799	1907,6	1987,6	3815,2	3975,2
518	1851,4	1931,4	3702,8	3862,8	612	1870,2	1950,2	3740,4	3900,4	706	1889,0	1969,0	3778,0	3938,0	800	1907,8	1987,8	3815,6	3975,6
519	1851,6	1931,6	3703,2	3863,2	613	1870,4	1950,4	3740,8	3900,8	707	1889,2	1969,2	3778,4	3938,4	801	1908,0	1988,0	3816,0	3976,0
520	1851,8	1931,8	3703,6	3863,6	614	1870,6	1950,6	3741,2	3901,2	708	1889,4	1969,4	3778,8	3938,8	802	1908,2	1988,2	3816,4	3976,4
521	1852,0	1932,0	3704,0	3864,0	615	1870,8	1950,8	3741,6	3901,6	709	1889,6	1969,6	3779,2	3939,2	803	1908,4	1988,4	3816,8	3976,8
522	1852,2	1932,2	3704,4	3864,4	616	1871,0	1951,0	3742,0	3902,0	710	1889,8	1969,8	3779,6	3939,6	804	1908,6	1988,6	3817,2	3977,2
523	1852,4	1932,4	3704,8	3864,8	617	1871,2	1951,2	3742,4	3902,4	711	1890,0	1970,0	3780,0	3940,0	805	1908,8	1988,8	3817,6	3977,6
524	1852,6	1932,6	3705,2	3865,2	618	1871,4	1951,4	3742,8	3902,8	712	1890,2	1970,2	3780,4	3940,4	806	1909,0	1989,0	3818,0	3978,0
525	1852,8	1932,8	3705,6	3865,6	619	1871,6	1951,6	3743,2	3903,2	713	1890,4	1970,4	3780,8	3940,8	807	1909,2	1989,2	3818,4	3978,4
526	1853,0	1933,0	3706,0	3866,0	620	1871,8	1951,8	3743,6	3903,6	714	1890,6	1970,6	3781,2	3941,2	808	1909,4	1989,4	3818,8	3978,8
527	1853,2	1933,2	3706,4	3866,4	621	1872,0	1952,0	3744,0	3904,0	715	1890,8	1970,8	3781,6	3941,6	809	1909,6	1989,6	3819,2	3979,2
528	1853,4	1933,4	3706,8	3866,8	622	1872,2	1952,2	3744,4	3904,4	716	1891,0	1971,0	3782,0	3942,0	810	1909,8	1989,8	3819,6	3979,6
529	1853,6	1933,6	3707,2	3867,2	623	1872,4	1952,4	3744,8	3904,8	717	1891,2	1971,2	3782,4	3942,4					
530	1853,8	1933,8	3707,6	3867,6	624	1872,6	1952,6	3745,2	3905,2	718	1891,4	1971,4	3782,8	3942,8					
531	1854,0	1934,0	3708,0	3868,0	625	1872,8	1952,8	3745,6	3905,6	719	1891,6	1971,6	3783,2	3943,2					
532	1854,2	1934,2	3708,4	3868,4	626	1873,0	1953,0	3746,0	3906,0	720	1891,8	1971,8	3783,6	3943,6					
533	1854,4	1934,4	3708,8	3868,8	627	1873,2	1953,2	3746,4	3906,4	721	1892,0	1972,0	3784,0	3944,0					
534	1854,6	1934,6	3709,2	3869,2	628	1873,4	1953,4	3746,8	3906,8	722	1892,2	1972,2	3784,4	3944,4					
535	1854,8	1934,8	3709,6	3869,6	629	1873,6	1953,6	3747,2	3907,2	723	1892,4	1972,4	3784,8	3944,8					
536	1855,0	1935,0	3710,0	3870,0	630	1873,8	1953,8	3747,6	3907,6	724	1892,6	1972,6	3785,2	3945,2					
537	1855,2	1935,2	3710,4	3870,4	631	1874,0	1954,0	3748,0	3908,0	725	1892,8	1972,8	3785,6	3945,6					
538	1855,4	1935,4	3710,8	3870,8	632	1874,2	1954,2	3748,4	3908,4	726	1893,0	1973,0	3786,0	3946,0					
539	1855,6	1935,6	3711,2	3871,2	633	1874,4	1954,4	3748,8	3908,8	727	1893,2	1973,2	3786,4	3946,4					
540	1855,8	1935,8	3711,6	3871,6	634	1874,6	1954,6	3749,2	3909,2	728	1893,4	1973,4	3786,8	3946,8					
541	1856,0	1936,0	3712,0	3872,0	635	1874,8	1954,8	3749,6	3909,6	729	1893,6	1973,6	3787,2	3947,2					
542	1856,2	1936,2	3712,4	3872,4	636	1875,0	1955,0	3750,0	3910,0	730	1893,8	1973,8	3787,6	3947,6					
543	1856,4	1936,4	3712,8	3872,8	637	1875,2	1955,2	3750,4	3910,4	731	1894,0	1974,0	3788,0	3948,0					
544	1856,6	1936,6	3713,2	3873,2	638	1875,4	1955,4	3750,8	3910,8	732	1894,2	1974,2	3788,4	3948,4					
545	1856,8	1936,8	3713,6	3873,6	639	1875,6	1955,6	3751,2	3911,2	733	1894,4	1974,4	3788,8	3948,8					
546	1857,0	1937,0	3714,0	3874,0	640	1875,8	1955,8	3751,6	3911,6	734	1894,6	1974,6	3789,2	3949,2					
547	1857,2	1937,2	3714,4	3874,4	641	1876,0	1956,0	3752,0	3912,0	735	1894,8	1974,8	3789,6	3949,6					
548	1857,4	1937,4	3714,8	3874,8	642	1876,2	1956,2	3752,4	3912,4	736	1895,0	1975,0	3790,0	3950,0					
549	1857,6	1937,6	3715,2	3875,2	643	1876,4	1956,4	3752,8	3912,8	737	1895,2	1975,2	3790,4	3950,4					
550	1857,8	1937,8	3715,6	3875,6	644	1876,6	1956,6	3753,2	3913,2	738	1895,4	1975,4	3790,8	3950,8					
551	1858,0	1938,0	3716,0	3876,0	645	1876,8	1956,8	3753,6	3913,6	739	1895,6	1975,6	3791,2	3951,2					
552	1858,2	1938,2	3716,4	3876,4	646	1877,0	1957,0	3754,0	3914,0	740	1895,8	1975,8	3791,6	3951,6					
553	1858,4	1938,4	3716,8	3876,8	647	1877,2	1957,2	3754,4	3914,4	741	1896,0	1976,0	3792,0	3952,0					
554	1858,6	1938,6	3717,2	3877,2	648	1877,4	1957,4	3754,8	3914,8	742	1896,2	1976,2	3792,4	3952,4					
555	1858,8	1938,8	3717,6	3877,6	649	1877,6	1957,6	3755,2	3915,2	743	1896,4	1976,4	3792,8	3952,8					
556	1859,0	1939,0	3718,0	3878,0	650	1877,8	1957,8	3755,6	3915,6	744	1896,6	1976,6	3793,2	3953,2					
557	1859,2	1939,2	3718,4	3878,4	651	1878,0	1958,0	3756,0	3916,0	745	1896,8	1976,8	3793,6	3953,6					
558	1859,4	1939,4	3718,8	3878,8	652	1878,2	1958,2	3756,4	3916,4	746	1897,0	1977,0	3794,0	3954,0					
559	1859,6	1939,6	3719,2	3879,2	653	1878,4	1958,4	3756,8	3916,8	747	1897,2	1977,2	3794,4	3954,4					
560	1859,8	1939,8	3719,6	3879,6	654	1878,6	1958,6	3757,2	3917,2	748	1897,4	1977,4	3794,8	3954,8					
561	1860,0	1940,0	3720,0	3880,0	655	1878,8	1958,8	3757,6	3917,6	749	1897,6	1977,6	3795,2	3955,2					
562	1860,2	1940,2	3720,4	3880,4	656	1879,0	1959,0	3758,0	3918,0	750	1897,8	1977,8	3795,6	3955,6					
563	1860,4	1940,4	3720,8	3880,8	657	1879,2	1959,2	3758,4	3918,4	751	1898,0	1978,0	3796,0	3956,0					
564	1860,6	1940,6	3721,2	3881,2	658	1879,4	1959,4	3758,8	3918,8	752	1898,2	1978,2	3796,4	3956,4					
565	1860,8	1940,8	3721,6	3881,6	659	1879,6	1959,6	3759,2	3919,2	753	1898,4	1978,4	3796,8	3956,8					
566	1861,0	1941,0	3722,0	3882,0	660	1879,8	1959,8	3759,6	3919,6	754	1898,6	1978,6	3797,2	3957,2					
567	1861,2	1941,2	3722,4	3882,4	661	1880,0	1960,0	3760,0	3920,0	755	1898,8	1978,8	3797,6	3957,6					
568	1861,4	1941,4	3722,8	3882,8	662	1880,2	1960,2	3760,4	3920,4	756	1899,0	1979,0	3798,0	3958,0					
569	1861,6	1941,6	3723,2	3883,2	663	1880,4	1960,4	3760,8	3920,8	757	1899,2	1979,2	3798,4	3958,4					
570	1861,8	1941,8	3723,6	3883,6	664	1880,6	1960,6	3761,2	3921,2	758	1899,4	1979,4	3798,8	3958,8					
571	1862,0	1942,0	3724,0	3884,0	665	1880,8	1960,8	3761,6	3921,6	759	1899,6	1979,6	3799,2	3959,2					
572	1862,2	1942,2	3724,4	3884,4	666	1881,0	1961,0	3762,0	3922,0	760	1899,8	1979,8	3799,6	3959,6					
573	1862,4	1942,4	3724,8	3884,8	667	1881,2	1961,2	3762,4	3922,4	761	1900,0	1980,0	3800,0	3960,0					
574	1862,6	1942,6	3725,2	3885,2	668	1881,4	1961,4	3762,8	3922,8	762	1900,2	1980,2	3800,4	3960,4					
575	1862,8	1942,8	3725,6	3885,6	669	1881,6	1961,6	3763,2	3923,2	763	1900,4	1980,4	3800,8	3960,8					
576	1863,0	1943,0	3726,0	3886,0	670	1881,8	1961,8	3763,6	3923,6	764	1900,6	1980,6	3801,2	3961,2					
577	1863,2	1943,2	3726,4	3886,4	671	1882,0	1962,0	3764,0	3924,0	765	1900,8	1980,8	3801,6	3961,6					
578	1863,4	1943,4	3726,8	3886,8	672	1882,2	1962,2	3764,4	3924,4	766	1901,0	1981,0	3802,0	3962,0					
579	1863,6	1943,6	3727,2	3887,2	673	1882,4	1962,4	3764,8	3924,8	767	1901,2	1981,2	3802,4	3962,4					
580	1863,8	1943,8	3727,6	3887,6	674	1882,6	1962,6	3765,2	3925,2	768	1901,4	1981,4	3802,8	3962,8					
581	1864,0	1944,0	3728,0	3888,0	675	1882,8	1962,8	3765,6	3925,6	769	1901,6	1981,6	3803,2	3963,2					
582	1864,2	1944,2	3728,4	3888,4	676	1883,0	1963,0	3766,0	3926,0	770	1901,8	1981,8	3803,6	3963,6					
583	1864,4	1944,4	3728,8	3888,8	677	1883,2	1963,2	3766,4	3926,4	771	1902,0	1982,0	3804,0	3964,0					
584	1864,6	1944,6	3729,2	3889,2	678	1883,4	1963,4	3766,8	3926,8	772	1902,2	1982,2	3804,4	3964,4					
585	1864,8	1944,8	3729,6	3889,6	679	1883,6	1963,6	3767,2	3927,2	773	1902,4	1982,4	3804,8	3964,8					
586	1865,0	1945,0	3730,0	3890,0	680	1883,8	1963,8	3767,6	3927,6	774	1902,6	1982,6	3805,2	3965,2					
587	1865,2	1945,2	3730,4	3890,4	681	1884,0	1964,0	3768,0	3928,0	775	1902,8	1982,8	3805,6	3965,6					
588	1865,4	1945,4	3730,8	3890,8	682	1884,2	1964,2	3768,4	3928,4	776	1903,0	1983,0	3806,0	3966,0					
589	1865,6	1945,6	3731,2	3891,2	683	1884,4	1964,4	3768,8	3928,8	777	1903,2	1983,2	3806,4	3966,4					
590	1865,8	1945,8	3731,6	3891,6	684	1884,6	1964,6	3769,2	3929,2	778	1903,4	1983,4	3806,8	3966,8					
591	1866,0	1946,0	3732,0	3892,0	685	1884,8	1964,8	3769,6	3929,6	779	1903,6	1983,6	3807,2	3967,2					
592	1866,2	1946,2	3732,4	3892,4	686	1885,0	1965,0	3770,0	3930,0	780	1903,8	1983,8	3807,6	3967,6					
593	1866,4	1946,4	3732,8	3892,8	687	1885,2	1965,2	3770,4	3930,4	781	1904,0	1984,0	3808,0	3968,0					
594	1866,6	1946,6	3733,2	3893,2	688	1885,4	1965,4	3770,8	3930,8	782	1904,2	1984,2	3808,4	3968,4					
595	1866,8	1946,8	3733,6	3893,6	689	1885,6	1965,6	3771,2	3931,2	783	1904,4	1984,4	3808,8	3968,8					
596	1867,0	1947,0	3734,0	3894,0	690	1885,8	1965,8	3771,6	3931,6	784	1904,6	1984,6	3809,2	3969,2					
597	1867,2	1947,2	3734,4	3894,4	691	1886,0	1966,0	3772,0	3932,0	785	1904,8	1984,8	3809,6	3969,6					
598	1867,4	1947,4	3734,8	3894,8	692	1886,2	1966,2	3772,4	3932,4	786	1905,0	1985,0	3810,0	3970,0					
599	1867,6	1947,6	3735,2	3895,2	693	1886,4	1966,4	3772,8	3932,8	787	1905,2	1985,2	3810,4	3970,4					
600	1867,8	1947,8	3735,6	3895,6	694	1886,6	1966,6	3773,2	3933,2	788	1905,4	1985,4	3810,8	3970,8					
601	1868,0	1948,0	3736,0	3896,0	695	1886,8	1966,8	3773,6	3933,6	789	1905,6	1985,6	3811,2	3971,2					
602	1868,2	1948,2	3736,4	3896,4	696	1887,0	1967,0	3774,0	3934,0	790	1905,8	1985,8	3811,6	3971,6					
603	1868,4	1948,4	3736,8	3896,8	697	1887,2	1967,2	3774,4	3934,4	791	1906,0	1986,0	3812,0	3972,0					
604	1868,6	1948,6	3737,2	3897,2	698	1887,4	1967,4	3774,8	3934,8	792	1906,2	1986,2	3812,4	3972,4					
605	1868,8	1948,8	3737,6	3897,6	699	1887,6	1967,6	3775,2	3935,2	793	1906,4	1986,4	3812,8	3972,8					

WCDMA Rx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
10562	2112.4	4224.8	10625	2125	4250	10688	2137.6	4275.2	10751	2150.2	4300.4	10814	2162.8	4325.6
10563	2112.6	4225.2	10626	2125.2	4250.4	10689	2137.8	4275.6	10752	2150.4	4300.8	10815	2163	4326
10564	2112.8	4225.6	10627	2125.4	4250.8	10690	2138	4276	10753	2150.6	4301.2	10816	2163.2	4326.4
10565	2113	4226	10628	2125.6	4251.2	10691	2138.2	4276.4	10754	2150.8	4301.6	10817	2163.4	4326.8
10566	2113.2	4226.4	10629	2125.8	4251.6	10692	2138.4	4276.8	10755	2151	4302	10818	2163.6	4327.2
10567	2113.4	4226.8	10630	2126	4252	10693	2138.6	4277.2	10756	2151.2	4302.4	10819	2163.8	4327.6
10568	2113.6	4227.2	10631	2126.2	4252.4	10694	2138.8	4277.6	10757	2151.4	4302.8	10820	2164	4328
10569	2113.8	4227.6	10632	2126.4	4252.8	10695	2139	4278	10758	2151.6	4303.2	10821	2164.2	4328.4
10570	2114	4228	10633	2126.6	4253.2	10696	2139.2	4278.4	10759	2151.8	4303.6	10822	2164.4	4328.8
10571	2114.2	4228.4	10634	2126.8	4253.6	10697	2139.4	4278.8	10760	2152	4304	10823	2164.6	4329.2
10572	2114.4	4228.8	10635	2127	4254	10698	2139.6	4279.2	10761	2152.2	4304.4	10824	2164.8	4329.6
10573	2114.6	4229.2	10636	2127.2	4254.4	10699	2139.8	4279.6	10762	2152.4	4304.8	10825	2165	4330
10574	2114.8	4229.6	10637	2127.4	4254.8	10700	2140	4280	10763	2152.6	4305.2	10826	2165.2	4330.4
10575	2115	4230	10638	2127.6	4255.2	10701	2140.2	4280.4	10764	2152.8	4305.6	10827	2165.4	4330.8
10576	2115.2	4230.4	10639	2127.8	4255.6	10702	2140.4	4280.8	10765	2153	4306	10828	2165.6	4331.2
10577	2115.4	4230.8	10640	2128	4256	10703	2140.6	4281.2	10766	2153.2	4306.4	10829	2165.8	4331.6
10578	2115.6	4231.2	10641	2128.2	4256.4	10704	2140.8	4281.6	10767	2153.4	4306.8	10830	2166	4332
10579	2115.8	4231.6	10642	2128.4	4256.8	10705	2141	4282	10768	2153.6	4307.2	10831	2166.2	4332.4
10580	2116	4232	10643	2128.6	4257.2	10706	2141.2	4282.4	10769	2153.8	4307.6	10832	2166.4	4332.8
10581	2116.2	4232.4	10644	2128.8	4257.6	10707	2141.4	4282.8	10770	2154	4308	10833	2166.6	4333.2
10582	2116.4	4232.8	10645	2129	4258	10708	2141.6	4283.2	10771	2154.2	4308.4	10834	2166.8	4333.6
10583	2116.6	4233.2	10646	2129.2	4258.4	10709	2141.8	4283.6	10772	2154.4	4308.8	10835	2167	4334
10584	2116.8	4233.6	10647	2129.4	4258.8	10710	2142	4284	10773	2154.6	4309.2	10836	2167.2	4334.4
10585	2117	4234	10648	2129.6	4259.2	10711	2142.2	4284.4	10774	2154.8	4309.6	10837	2167.4	4334.8
10586	2117.2	4234.4	10649	2129.8	4259.6	10712	2142.4	4284.8	10775	2155	4310	10838	2167.6	4335.2
10587	2117.4	4234.8	10650	2130	4260	10713	2142.6	4285.2	10776	2155.2	4310.4			
10588	2117.6	4235.2	10651	2130.2	4260.4	10714	2142.8	4285.6	10777	2155.4	4310.8			
10589	2117.8	4235.6	10652	2130.4	4260.8	10715	2143	4286	10778	2155.6	4311.2			
10590	2118	4236	10653	2130.6	4261.2	10716	2143.2	4286.4	10779	2155.8	4311.6			
10591	2118.2	4236.4	10654	2130.8	4261.6	10717	2143.4	4286.8	10780	2156	4312			
10592	2118.4	4236.8	10655	2131	4262	10718	2143.6	4287.2	10781	2156.2	4312.4			
10593	2118.6	4237.2	10656	2131.2	4262.4	10719	2143.8	4287.6	10782	2156.4	4312.8			
10594	2118.8	4237.6	10657	2131.4	4262.8	10720	2144	4288	10783	2156.6	4313.2			
10595	2119	4238	10658	2131.6	4263.2	10721	2144.2	4288.4	10784	2156.8	4313.6			
10596	2119.2	4238.4	10659	2131.8	4263.6	10722	2144.4	4288.8	10785	2157	4314			
10597	2119.4	4238.8	10660	2132	4264	10723	2144.6	4289.2	10786	2157.2	4314.4			
10598	2119.6	4239.2	10661	2132.2	4264.4	10724	2144.8	4289.6	10787	2157.4	4314.8			
10599	2119.8	4239.6	10662	2132.4	4264.8	10725	2145	4290	10788	2157.6	4315.2			
10600	2120	4240	10663	2132.6	4265.2	10726	2145.2	4290.4	10789	2157.8	4315.6			
10601	2120.2	4240.4	10664	2132.8	4265.6	10727	2145.4	4290.8	10790	2158	4316			
10602	2120.4	4240.8	10665	2133	4266	10728	2145.6	4291.2	10791	2158.2	4316.4			
10603	2120.6	4241.2	10666	2133.2	4266.4	10729	2145.8	4291.6	10792	2158.4	4316.8			
10604	2120.8	4241.6	10667	2133.4	4266.8	10730	2146	4292	10793	2158.6	4317.2			
10605	2121	4242	10668	2133.6	4267.2	10731	2146.2	4292.4	10794	2158.8	4317.6			
10606	2121.2	4242.4	10669	2133.8	4267.6	10732	2146.4	4292.8	10795	2159	4318			
10607	2121.4	4242.8	10670	2134	4268	10733	2146.6	4293.2	10796	2159.2	4318.4			
10608	2121.6	4243.2	10671	2134.2	4268.4	10734	2146.8	4293.6	10797	2159.4	4318.8			
10609	2121.8	4243.6	10672	2134.4	4268.8	10735	2147	4294	10798	2159.6	4319.2			
10610	2122	4244	10673	2134.6	4269.2	10736	2147.2	4294.4	10799	2159.8	4319.6			
10611	2122.2	4244.4	10674	2134.8	4269.6	10737	2147.4	4294.8	10800	2160	4320			
10612	2122.4	4244.8	10675	2135	4270	10738	2147.6	4295.2	10801	2160.2	4320.4			
10613	2122.6	4245.2	10676	2135.2	4270.4	10739	2147.8	4295.6	10802	2160.4	4320.8			
10614	2122.8	4245.6	10677	2135.4	4270.8	10740	2148	4296	10803	2160.6	4321.2			
10615	2123	4246	10678	2135.6	4271.2	10741	2148.2	4296.4	10804	2160.8	4321.6			
10616	2123.2	4246.4	10679	2135.8	4271.6	10742	2148.4	4296.8	10805	2161	4322			
10617	2123.4	4246.8	10680	2136	4272	10743	2148.6	4297.2	10806	2161.2	4322.4			
10618	2123.6	4247.2	10681	2136.2	4272.4	10744	2148.8	4297.6	10807	2161.4	4322.8			
10619	2123.8	4247.6	10682	2136.4	4272.8	10745	2149	4298	10808	2161.6	4323.2			
10620	2124	4248	10683	2136.6	4273.2	10746	2149.2	4298.4	10809	2161.8	4323.6			
10621	2124.2	4248.4	10684	2136.8	4273.6	10747	2149.4	4298.8	10810	2162	4324			
10622	2124.4	4248.8	10685	2137	4274	10748	2149.6	4299.2	10811	2162.2	4324.4			
10623	2124.6	4249.2	10686	2137.2	4274.4	10749	2149.8	4299.6	10812	2162.4	4324.8			
10624	2124.8	4249.6	10687	2137.4	4274.8	10750	2150	4300	10813	2162.6	4325.2			

WCDMA Tx frequencies

Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX	Ch	RX	VCO RX
9612	1922.4	3844.8	9671	1934.2	3868.4	9730	1946	3892	9789	1957.8	3915.6	9848	1969.6	3939.2
9613	1922.6	3845.2	9672	1934.4	3868.8	9731	1946.2	3892.4	9790	1958	3916	9849	1969.8	3939.6
9614	1922.8	3845.6	9673	1934.6	3869.2	9732	1946.4	3892.8	9791	1958.2	3916.4	9850	1970	3940
9615	1923	3846	9674	1934.8	3869.6	9733	1946.6	3893.2	9792	1958.4	3916.8	9851	1970.2	3940.4
9616	1923.2	3846.4	9675	1935	3870	9734	1946.8	3893.6	9793	1958.6	3917.2	9852	1970.4	3940.8
9617	1923.4	3846.8	9676	1935.2	3870.4	9735	1947	3894	9794	1958.8	3917.6	9853	1970.6	3941.2
9618	1923.6	3847.2	9677	1935.4	3870.8	9736	1947.2	3894.4	9795	1959	3918	9854	1970.8	3941.6
9619	1923.8	3847.6	9678	1935.6	3871.2	9737	1947.4	3894.8	9796	1959.2	3918.4	9855	1971	3942
9620	1924	3848	9679	1935.8	3871.6	9738	1947.6	3895.2	9797	1959.4	3918.8	9856	1971.2	3942.4
9621	1924.2	3848.4	9680	1936	3872	9739	1947.8	3895.6	9798	1959.6	3919.2	9857	1971.4	3942.8
9622	1924.4	3848.8	9681	1936.2	3872.4	9740	1948	3896	9799	1959.8	3919.6	9858	1971.6	3943.2
9623	1924.6	3849.2	9682	1936.4	3872.8	9741	1948.2	3896.4	9800	1960	3920	9859	1971.8	3943.6
9624	1924.8	3849.6	9683	1936.6	3873.2	9742	1948.4	3896.8	9801	1960.2	3920.4	9860	1972	3944
9625	1925	3850	9684	1936.8	3873.6	9743	1948.6	3897.2	9802	1960.4	3920.8	9861	1972.2	3944.4
9626	1925.2	3850.4	9685	1937	3874	9744	1948.8	3897.6	9803	1960.6	3921.2	9862	1972.4	3944.8
9627	1925.4	3850.8	9686	1937.2	3874.4	9745	1949	3898	9804	1960.8	3921.6	9863	1972.6	3945.2
9628	1925.6	3851.2	9687	1937.4	3874.8	9746	1949.2	3898.4	9805	1961	3922	9864	1972.8	3945.6
9629	1925.8	3851.6	9688	1937.6	3875.2	9747	1949.4	3898.8	9806	1961.2	3922.4	9865	1973	3946
9630	1926	3852	9689	1937.8	3875.6	9748	1949.6	3899.2	9807	1961.4	3922.8	9866	1973.2	3946.4
9631	1926.2	3852.4	9690	1938	3876	9749	1949.8	3899.6	9808	1961.6	3923.2	9867	1973.4	3946.8
9632	1926.4	3852.8	9691	1938.2	3876.4	9750	1950	3900	9809	1961.8	3923.6	9868	1973.6	3947.2
9633	1926.6	3853.2	9692	1938.4	3876.8	9751	1950.2	3900.4	9810	1962	3924	9869	1973.8	3947.6
9634	1926.8	3853.6	9693	1938.6	3877.2	9752	1950.4	3900.8	9811	1962.2	3924.4	9870	1974	3948
9635	1927	3854	9694	1938.8	3877.6	9753	1950.6	3901.2	9812	1962.4	3924.8	9871	1974.2	3948.4
9636	1927.2	3854.4	9695	1939	3878	9754	1950.8	3901.6	9813	1962.6	3925.2	9872	1974.4	3948.8
9637	1927.4	3854.8	9696	1939.2	3878.4	9755	1951	3902	9814	1962.8	3925.6	9873	1974.6	3949.2
9638	1927.6	3855.2	9697	1939.4	3878.8	9756	1951.2	3902.4	9815	1963	3926	9874	1974.8	3949.6
9639	1927.8	3855.6	9698	1939.6	3879.2	9757	1951.4	3902.8	9816	1963.2	3926.4	9875	1975	3950
9640	1928	3856	9699	1939.8	3879.6	9758	1951.6	3903.2	9817	1963.4	3926.8	9876	1975.2	3950.4
9641	1928.2	3856.4	9700	1940	3880	9759	1951.8	3903.6	9818	1963.6	3927.2	9877	1975.4	3950.8
9642	1928.4	3856.8	9701	1940.2	3880.4	9760	1952	3904	9819	1963.8	3927.6	9878	1975.6	3951.2
9643	1928.6	3857.2	9702	1940.4	3880.8	9761	1952.2	3904.4	9820	1964	3928	9879	1975.8	3951.6
9644	1928.8	3857.6	9703	1940.6	3881.2	9762	1952.4	3904.8	9821	1964.2	3928.4	9880	1976	3952
9645	1929	3858	9704	1940.8	3881.6	9763	1952.6	3905.2	9822	1964.4	3928.8	9881	1976.2	3952.4
9646	1929.2	3858.4	9705	1941	3882	9764	1952.8	3905.6	9823	1964.6	3929.2	9882	1976.4	3952.8
9647	1929.4	3858.8	9706	1941.2	3882.4	9765	1953	3906	9824	1964.8	3929.6	9883	1976.6	3953.2
9648	1929.6	3859.2	9707	1941.4	3882.8	9766	1953.2	3906.4	9825	1965	3930	9884	1976.8	3953.6
9649	1929.8	3859.6	9708	1941.6	3883.2	9767	1953.4	3906.8	9826	1965.2	3930.4	9885	1977	3954
9650	1930	3860	9709	1941.8	3883.6	9768	1953.6	3907.2	9827	1965.4	3930.8	9886	1977.2	3954.4
9651	1930.2	3860.4	9710	1942	3884	9769	1953.8	3907.6	9828	1965.6	3931.2	9887	1977.4	3954.8
9652	1930.4	3860.8	9711	1942.2	3884.4	9770	1954	3908	9829	1965.8	3931.6	9888	1977.6	3955.2
9653	1930.6	3861.2	9712	1942.4	3884.8	9771	1954.2	3908.4	9830	1966	3932			
9654	1930.8	3861.6	9713	1942.6	3885.2	9772	1954.4	3908.8	9831	1966.2	3932.4			
9655	1931	3862	9714	1942.8	3885.6	9773	1954.6	3909.2	9832	1966.4	3932.8			
9656	1931.2	3862.4	9715	1943	3886	9774	1954.8	3909.6	9833	1966.6	3933.2			
9657	1931.4	3862.8	9716	1943.2	3886.4	9775	1955	3910	9834	1966.8	3933.6			
9658	1931.6	3863.2	9717	1943.4	3886.8	9776	1955.2	3910.4	9835	1967	3934			
9659	1931.8	3863.6	9718	1943.6	3887.2	9777	1955.4	3910.8	9836	1967.2	3934.4			
9660	1932	3864	9719	1943.8	3887.6	9778	1955.6	3911.2	9837	1967.4	3934.8			
9661	1932.2	3864.4	9720	1944	3888	9779	1955.8	3911.6	9838	1967.6	3935.2			
9662	1932.4	3864.8	9721	1944.2	3888.4	9780	1956	3912	9839	1967.8	3935.6			
9663	1932.6	3865.2	9722	1944.4	3888.8	9781	1956.2	3912.4	9840	1968	3936			
9664	1932.8	3865.6	9723	1944.6	3889.2	9782	1956.4	3912.8	9841	1968.2	3936.4			
9665	1933	3866	9724	1944.8	3889.6	9783	1956.6	3913.2	9842	1968.4	3936.8			
9666	1933.2	3866.4	9725	1945	3890	9784	1956.8	3913.6	9843	1968.6	3937.2			
9667	1933.4	3866.8	9726	1945.2	3890.4	9785	1957	3914	9844	1968.8	3937.6			
9668	1933.6	3867.2	9727	1945.4	3890.8	9786	1957.2	3914.4	9845	1969	3938			
9669	1933.8	3867.6	9728	1945.6	3891.2	9787	1957.4	3914.8	9846	1969.2	3938.4			
9670	1934	3868	9729	1945.8	3891.6	9788	1957.6	3915.2	9847	1969.4	3938.8			

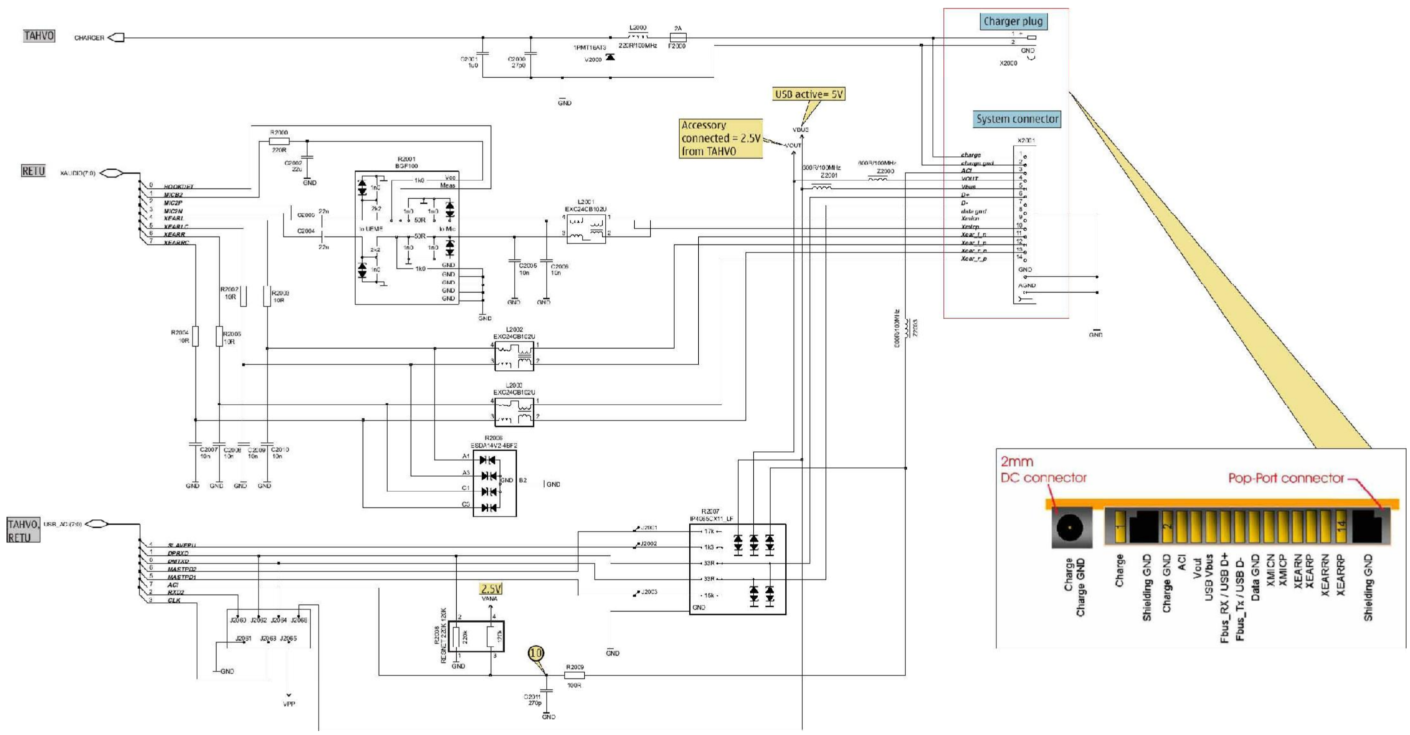
(This page left intentionally blank.)

10 — Schematics

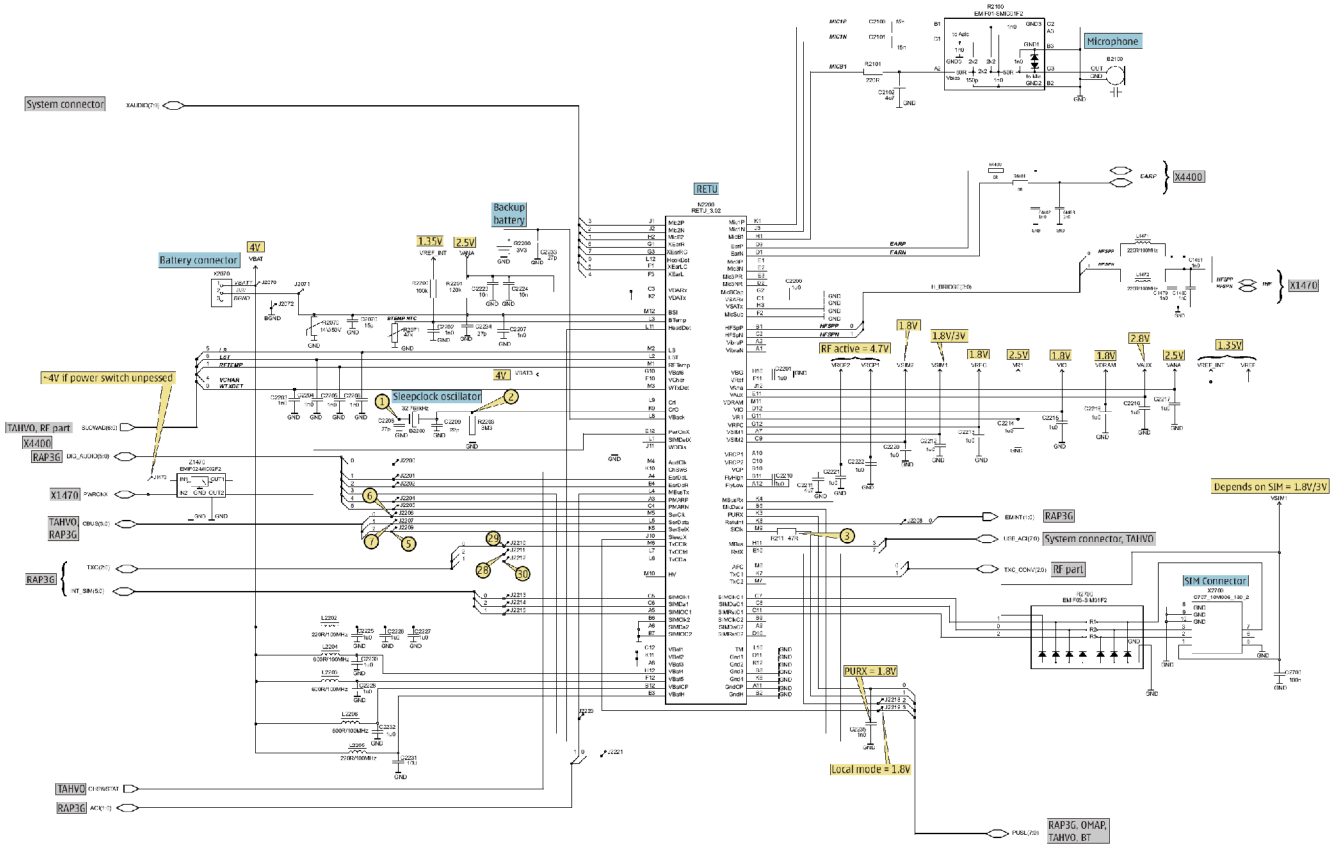
(This page left intentionally blank.)

Table of Contents

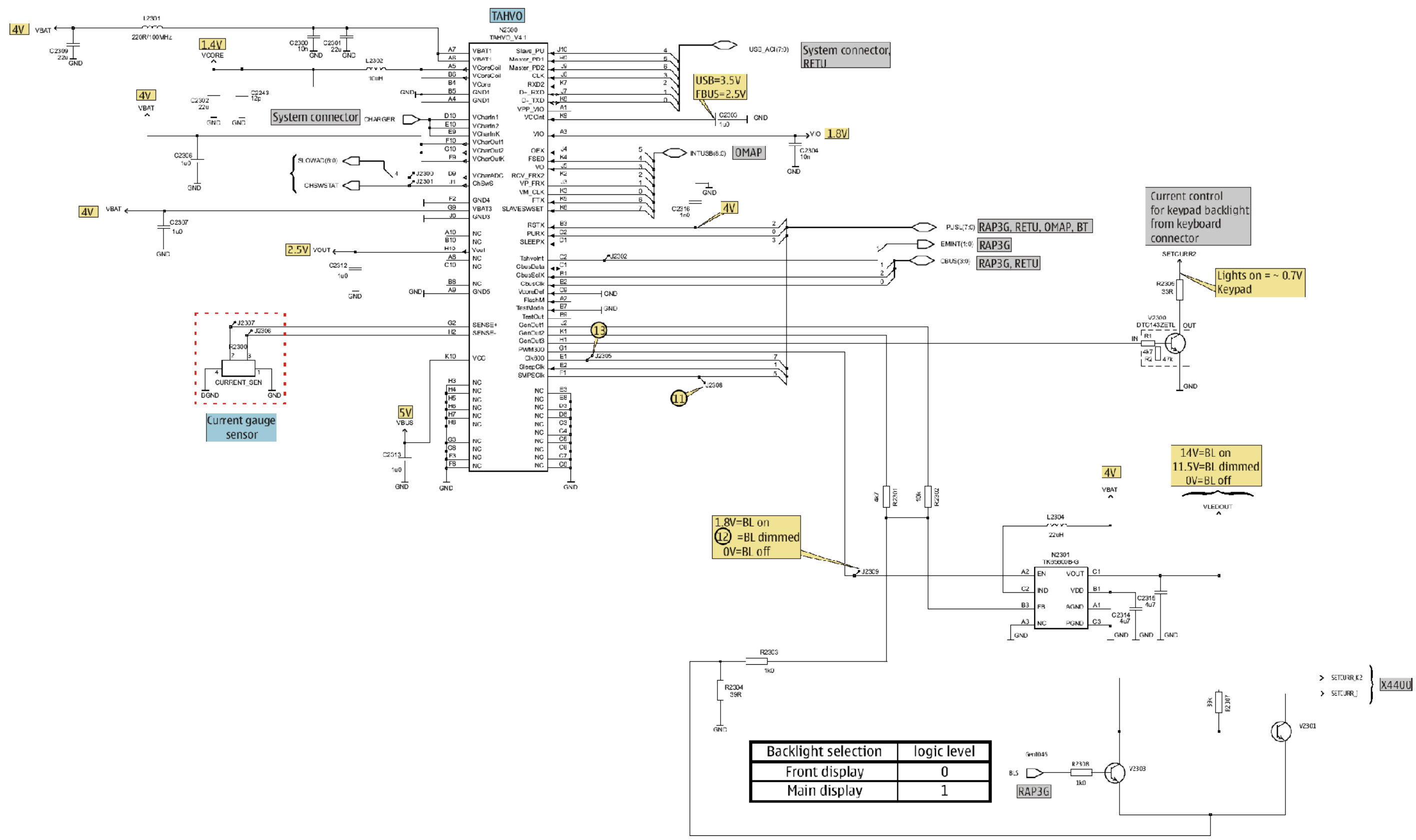
System connector



RETU, SIM, Audio

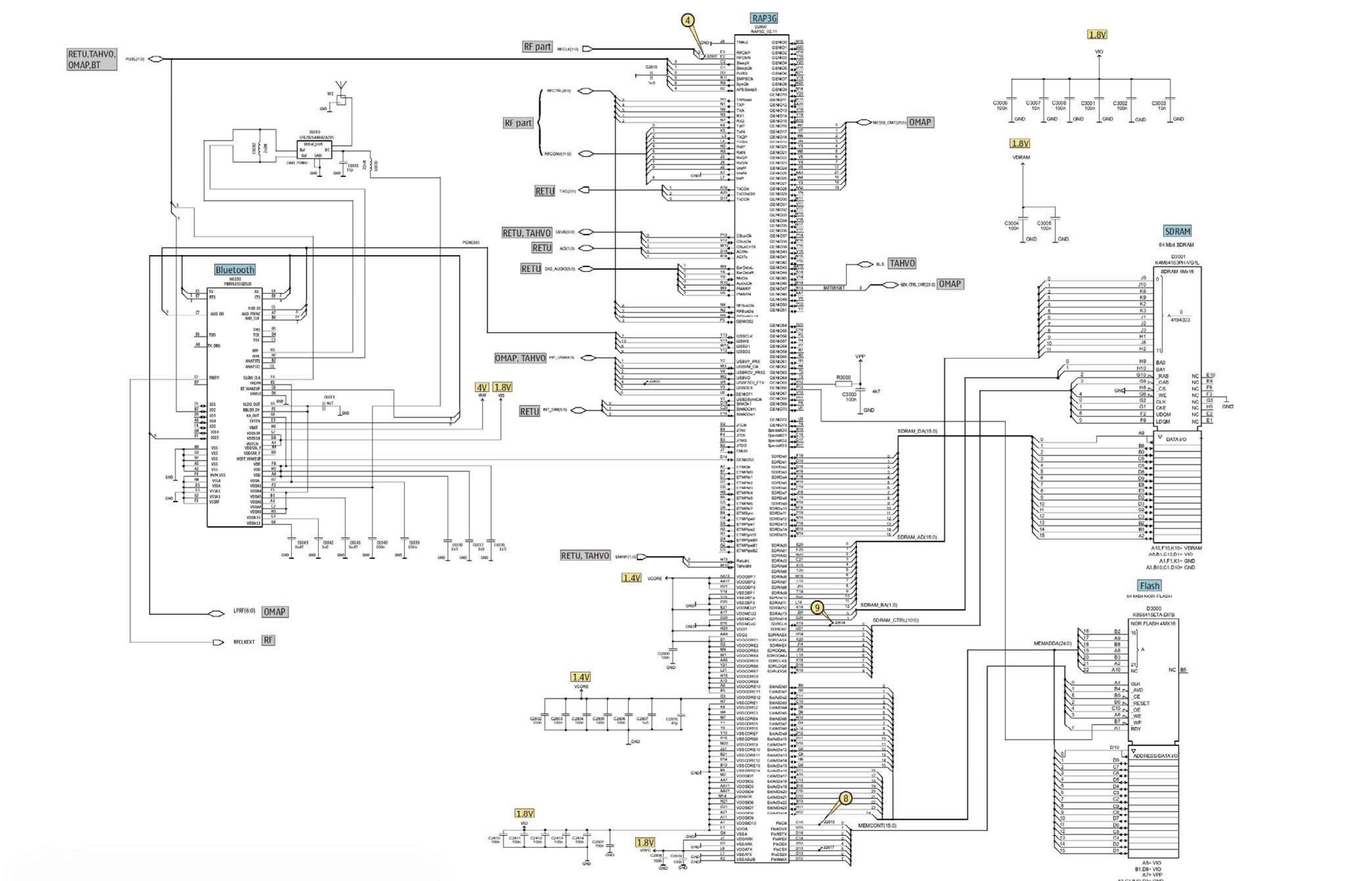


■ TAHVO

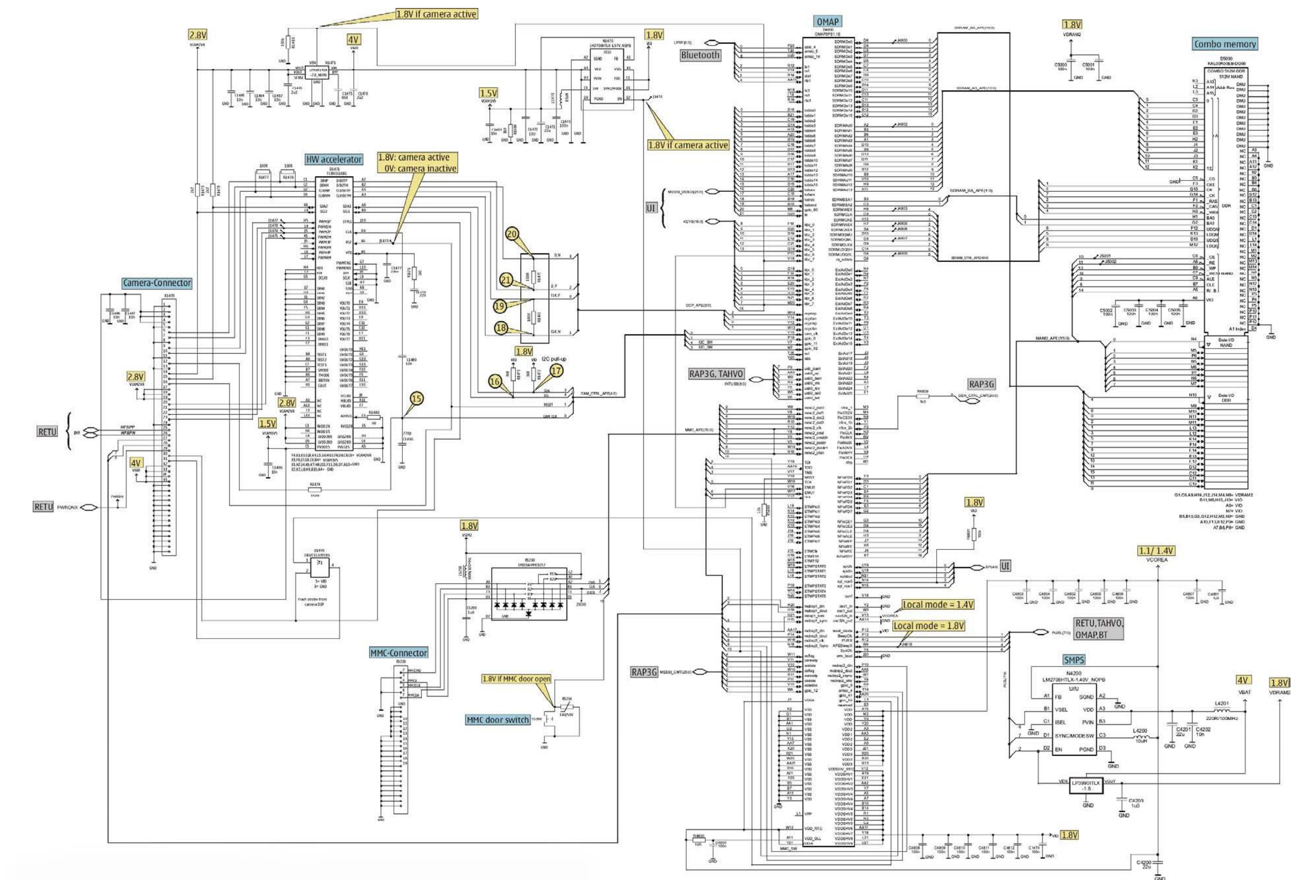


Backlight selection	logic level
Front display	0
Main display	1

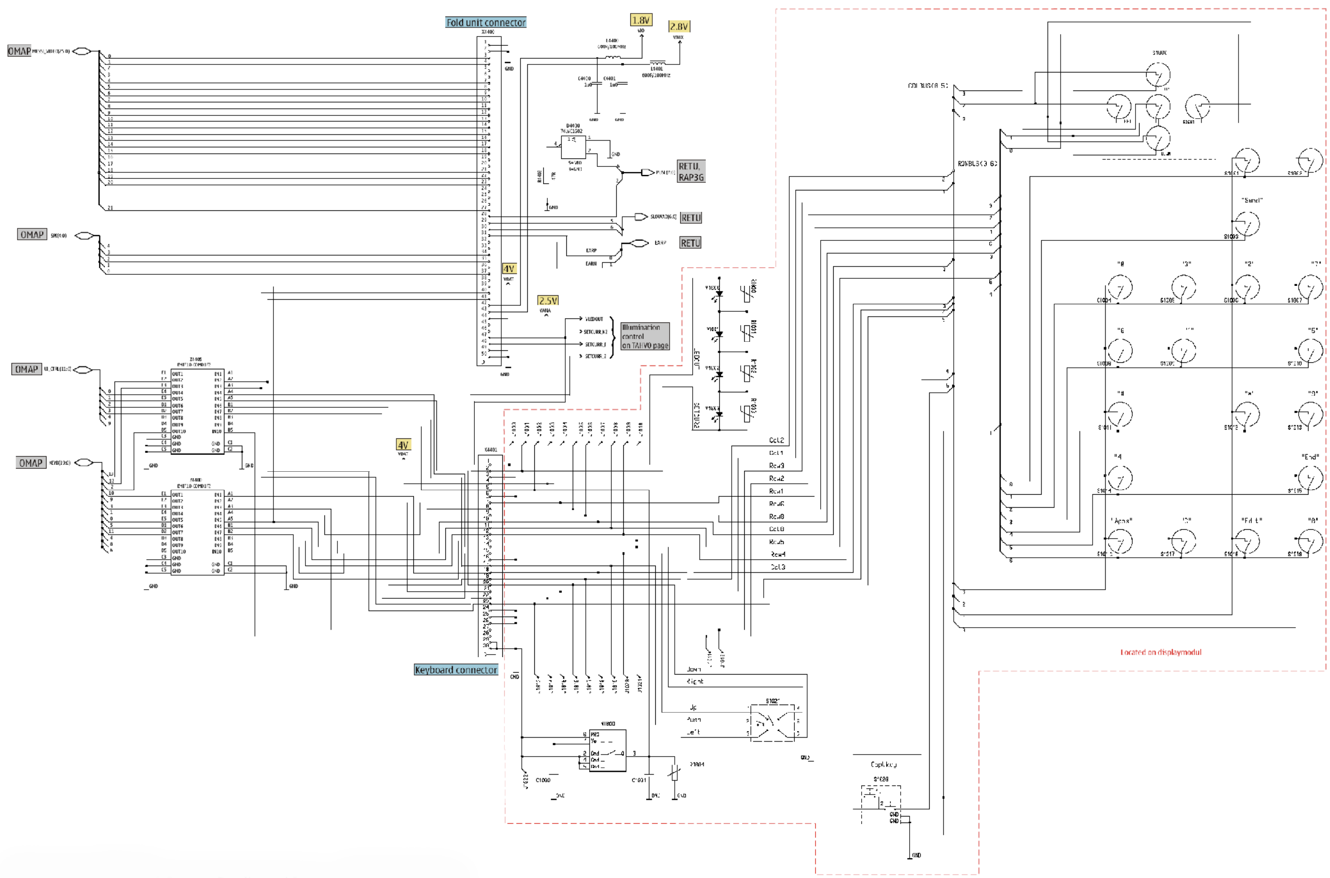
RAP3G, SDRAM, Flash, Bluetooth



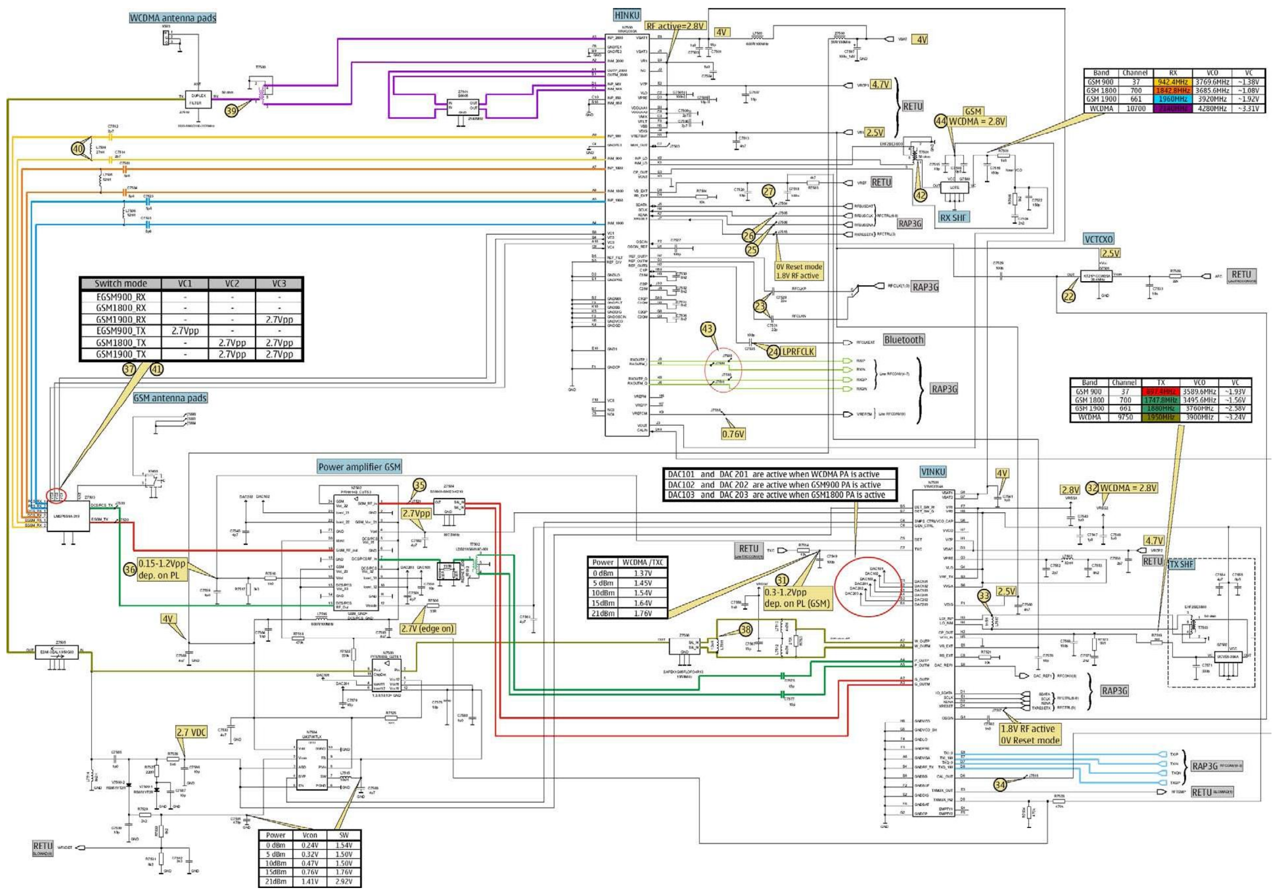
OMAP, Combo memory, Camera, MMC



B to B Connections



RF part



Band	Channel	RX	VCO	VC
GSM 900	37	942.4MHz	3769.6MHz	~1.38V
GSM 1800	700	1842.8MHz	3685.6MHz	~1.08V
GSM 1900	661	1960MHz	3920MHz	~1.92V
WCDMA	10700	[illegible]	4280MHz	~3.31V

Switch mode	VC1	VC2	VC3
EGSM900_RX	-	-	-
GSM1800_RX	-	-	-
GSM1900_RX	-	-	2.7Vpp
EGSM900_TX	2.7Vpp	-	-
GSM1800_TX	-	2.7Vpp	2.7Vpp
GSM1900_TX	-	2.7Vpp	2.7Vpp

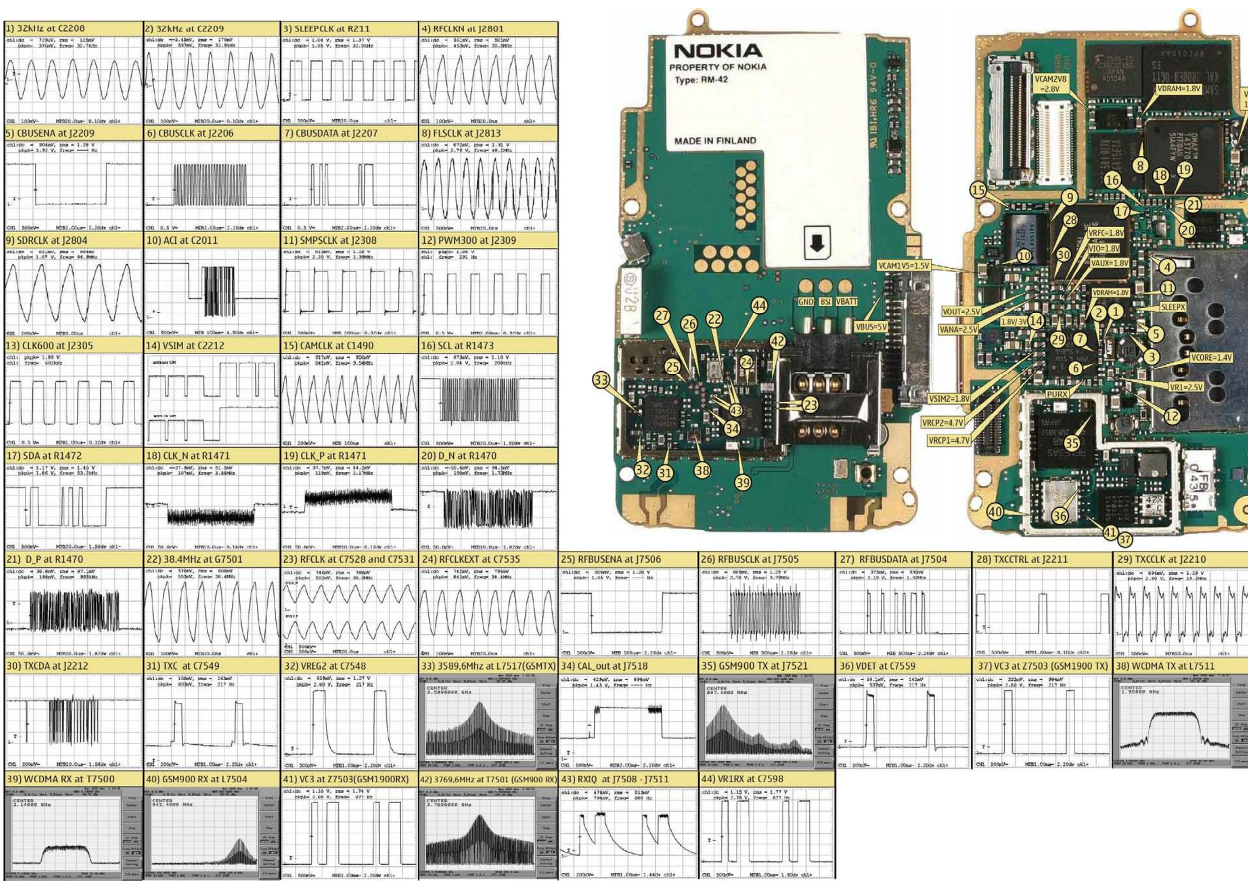
Band	Channel	TX	VCO	VC
GSM 900	37	897.4MHz	3589.6MHz	~1.93V
GSM 1800	700	1747.8MHz	3495.6MHz	~1.56V
GSM 1900	661	1880MHz	3760MHz	~2.58V
WCDMA	9750	1950MHz	3900MHz	~3.24V

Power	WCDMA /TXC
0 dBm	1.37V
5 dBm	1.45V
10dBm	1.54V
15dBm	1.64V
21dBm	1.76V

Power	Vcon	SW
0 dBm	0.24V	1.54V
5 dBm	0.32V	1.50V
10dBm	0.47V	1.50V
15dBm	0.76V	1.76V
21dBm	1.41V	2.92V

Company Confidential

Signal overview



Company Confidential

Component finder

B		C2227	J4	C4812	G6	C7558	N8	J2064	I6	J5004	P3	L7517	M9	R7501	K5
B2100	P9	C2228	J3	C4813	G6	C7559	O4	J2065	H6	J5100	F8	N		R7503	L8
B2200	K5	C2230	J4	C5000	D7	C7560	L8	J2066	I6	J5101	F9	N1470	I2	R7504	M7
C		C2231	L3	C5001	D7	C7561	N3	J2070	I3	J5102	F8	N1471	D5	R7505	K5
C1470	I1	C2232	J3	C5002	D8	C7562	N9	J2071	I3	J5103	F8	N2200	K4	R7506	N3
C1471	I2	C2233	M2	C5003	D7	C7563	N3	J2072	I4	J5104	F6	N2300	J5	R7509	K7
C1472	I1	C2234	J5	C5004	D8	C7564	O4	J2200	L4	J5105	F8	N2301	M6	R7512	M3
C1473	D6	C2235	L4	C5005	D8	C7567	M7	J2201	J5	J5106	F6	N4200	E9	R7514	N8
C1474	C1	C2300	J6	C5200	H7	C7568	M9	J2202	L3	J5107	G6	N4201	D6	R7516	O4
C1475	D4	C2301	J6	C6031	H9	C7569	N3	J2204	G5	J5108	F8	N6030	G8	R7517	O4
C1476	D4	C2302	L6	C6032	H8	C7570	L8	J2205	I4	J5109	F8	N7500	M6	R7518	N5
C1477	C5	C2303	I6	C6033	G9	C7571	L8	J2206	K5	J5110	F9	N7501	M8	R7519	M9
C1478	C6	C2304	J5	C6036	G8	C7573	M9	J2207	K5	J5200	G7	N7502	N4	R7520	M8
C1479	J1	C2306	I4	C6037	G9	C7575	M8	J2208	J4	J7503	N7	N7503	P5	R7521	N8
C1480	K1	C2307	I4	C6038	H7	C7576	P4	J2209	J6	J7504	L7	N7504	N5	R7522	O5
C1481	K1	C2309	I6	C6039	H8	C7577	M8	J2210	J3	J7505	L7	R		R7523	M9
C1482	D4	C2312	I3	C6040	G9	C7578	O5	J2211	H3	J7506	L8	R1470	G7	R7525	O5
C1483	D6	C2313	I3	C6041	H8	C7579	P6	J2212	I3	J7508	L7	R1471	F7	R7526	O6
C1484	B3	C2314	L6	C6042	H8	C7580	P6	J2213	I4	J7509	L7	R1472	G6	R7527	O6
C1485	B2	C2315	M5	C6043	G8	C7581	P3	J2214	J3	J7510	L6	R1473	G6	R7528	M9
C1486	C4	C2700	M4	C7501	M7	C7582	L9	J2215	K3	J7511	L6	R1474	G2	R7529	O5
C1487	C2	C2800	I3	C7503	M7	C7583	N5	J2218	E9	J7515	G5	R1475	C6	R7530	O5
C1488	C1	C2801	H6	C7504	M7	C7584	O3	J2219	J6	J7516	M7	R1476	C5	R7531	O5
C1489	G2	C2802	H6	C7505	L6	C7585	O6	J2220	I4	J7517	L7	R1477	C5	R7534	N5
C1490	G2	C2803	I3	C7507	M5	C7586	O6	J2221	I4	J7518	M7	R1478	C1	S	
C2000	D1	C2804	I3	C7508	L5	C7587	O6	J2300	J4	J7519	O4	R1479	C1	S5200	H9
C2001	D1	C2805	I3	C7509	M5	C7588	N5	J2301	I6	J7520	O4	R1480	G2	T	
C2002	K2	C2806	G6	C7512	P3	C7589	N5	J2302	I5	J7521	M5	R1483	D6	T7500	N6
C2003	K2	C2807	H6	C7513	L6	C7590	O5	J2305	E9	U1	G6	R1484	I2	T7501	L5
C2004	K2	C2808	H6	C7514	P3	C7591	O5	J2308	I6	L		R2000	K2	T7502	M3
C2005	J2	C2809	H6	C7515	K6	C7592	O5	J2309	L5	L1470	I1	R2001	J2	T7503	K9
C2006	J2	C2810	I3	C7516	K6	C7593	M3	J2801	H6	L1471	K1	R2002	K2	V	
C2007	L2	C2811	G3	C7518	N7	C7595	M4	J2802	G3	L1472	K1	R2003	K2	V2000	E1
C2008	L2	C2812	I3	C7520	N7	C7596	N6	J2803	G6	L2000	E1	R2004	L2	V2300	L6
C2009	K2	C2813	I2	C7522	K5	C7597	M2	J2804	G3	L2001	K2	R2005	L2	V2301	K2
C2010	K2	C2814	I4	C7523	O3	C7598	K6	J2813	E6	L2002	K2	R2006	K2	V2303	K2
C2011	H2	C2815	I6	C7524	L5	D		J2817	I4	L2003	L2	R2007	H1	V7500	O6
C2070	L3	C2816	H6	C7525	O3	D1470	B1	J3100	I5	L2202	L3	R2008	H1	W	
C2100	L5	C3000	F5	C7526	K7	D1471	B5	J3101	I6	L2203	J4	R2009	H1	W1	J9
C2101	L5	C3001	F5	C7527	M5	D2800	H4	J3102	I5	L2204	J4	R2070	K2	X	
C2102	L6	C3002	F5	C7528	M5	D3000	E5	J3103	I5	L2205	J3	R2071	K5	X1470	D2
C2200	L4	C3003	F5	C7529	L6	D3001	H2	J3104	I5	L2206	J3	R2100	O9	X2000	H1
C2201	J5	C3004	G2	C7530	L7	D4400	G3	J3105	I5	L2301	J6	R2101	L5	X2001	K1
C2202	L5	C3005	H2	C7531	M5	D4800	E7	J3106	H6	L2302	K6	R211	J5	X2061	O3
C2203	K5	C3006	H2	C7532	L6	D5000	C7	J3107	E6	L2304	M5	R2200	L5	X2070	K3
C2204	L4	C3007	I2	C7533	K7	F		J3108	F6	L2305	M6	R2201	I4	X2700	M4
C2205	L5	C3008	I2	C7534	L7	F2000	F1	J3109	F6	L4200	D9	R2203	K5	X4400	E3
C2206	L5	C4200	E9	C7535	L6	G		J3110	H5	L4201	F9	R2301	J6	X4401	M1
C2207	J4	C4201	F9	C7536	M7	G2200	N2	J3112	G6	L4400	D1	R2302	M6	X5200	K8
C2208	K5	C4202	F9	C7537	P4	G7500	L6	J3113	G6	L4401	C1	R2303	L1	X7400	O2
C2209	K5	C4203	D6	C7538	O4	G7501	L7	J3114	F6	L5200	G6	R2304	L1	Z	
C2210	J3	C4400	D1	C7539	P4	G7502	K8	J3115	G5	L6030	G9	R2305	L2	Z1470	J2
C2211	J3	C4401	C1	C7540	N9	J		J3116	G5	L7400	P2	R2307	K2	Z2000	I2
C2212	K3	C4402	L2	C7541	N9	J1470	J2	J3117	G5	L7502	L9	R2308	K3	Z2001	I2
C2213	I3	C4403	L3	C7542	N9	J1471	C4	J3118	G5	L7503	N9	R2700	M4	Z2003	I2
C2214	L5	C4800	D9	C7543	N8	J1472	C4	J4800	B6	L7504	P3	R3000	F4	Z4400	K1
C2215	I3	C4801	G6	C7544	M5	J1473	C4	J4802	B6	L7505	P3	R4400	L2	Z4405	J1
C2216	J3	C4802	G7	C7545	N5	J1474	C4	J4803	B7	L7506	O3	R4401	L3	Z6030	H9
C2217	I3	C4803	D9	C7547	N9	J1475	C4	J4805	B7	L7510	M8	R4402	G3	Z7500	M3
C2219	J4	C4804	G6	C7548	N9	J1476	G2	J4806	D6	L7511	M7	R4800	D9	Z7501	N5
C2220	K3	C4805	D6	C7549	N8	J2001	I3	J4807	D7	L7512	M8	R4801	F9	Z7502	O8
C2221	K3	C4806	E9	C7550	L9	J2002	H1	J4808	B7	L7513	N7	R4809	F6	Z7503	O3
C2222	K3	C4807	F9	C7552	L9	J2003	H2	J4818	H6	L7514	P6	R5100	F9	Z7504	M4
C2223	L4	C4808	F5	C7553	L9	J2060	I7	J5000	P2	L7515	N6	R5200	G7	Z7505	P6
C2224	L5	C4809	G6	C7554	K8	J2061	H7	J5001	B8	L7516	M3	R5204	E10	Z7506	N7
C2225	K3	C4810	G6	C7555	K8	J2062	I7	J5002	B8						
C2226	J2	C4811	F9	C7556	N3	J2063	H7	J5003	P2