Nokia Customer Care

Service Manual

RM-588; RM-593; RM-594; RM-625; RM-629 (Nokia 5230; Nokia 5235 Comes With Music; L3&4)

Mobile Terminal

Part No: (Issue 3)

COMPANY CONFIDENTIAL

NOKIA Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Issue 1	09/2009	AP-K	
Issue 2	12/2009	AP-K	New chapters *Service information differences between RM-593 and RM-588*, *Service information differences between RM-594 and RM-588*, *Service information differences between RM-625 and RM-588* and *Service information differences between RM-629 and RM-588* have been added. The new chapters describe the key hardware differences between the RM-588 (RoW) variant and the other variant in question. New section *RF final test* has been added to chapter *RF troubleshooting*. Minor updates to sections *WCDMA receiver troubleshooting*, *WCDMA RX chain activation for manual measurement*, *WCDMA transmitter troubleshooting flowchart* and *Tx AGC & power detector (WCDMA)*.
Issue 3	01/2010	AP-K	New chapter *Service information differences between Nokia 5235 Comes With Music and Nokia 5230* has been added. Chapter *Service tools and service concepts* has been updated by removing sections *Rework jigs and stencils* and *RF testing concept with RF coupler*. DC cable CA-35S has been removed from the *Cables* section.

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.
- 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.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user’s guide for detailed safety instructions. Do not connect incompatible products.

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 Li-Ion 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.

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Nokia 5230; Nokia 5235 Comes With Music; L3&4 Service Manual Structure

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1 — General Information

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Product selection

RM-588 is a GSM/HSDPA/WCDMA tri-mode handportable monoblock phone with a person centric touch UI and an integrated GPS (A-GPS OMA SUPL). It supports EGSM850/900/1800/1900 and WCDMA900/2100 bands, and CSD/HSCSD, GPRS/EGPRS, WCDMA/HSDPA data bearers.

For WCDMA the maximum bit rate is up to 384 kbit/s for downlink and 384 kbit/s for uplink with simultaneous CS speech or CS video (max. 64 kbit/s). The HSDPA peak is 3.6 Mbit/s downlink (with limited use cases).

For GPRS/EGPRS networks the RM-588 is a Class B GPRS/EGPRS MSC 32 (5 Rx + 3 Tx, max sum 6) device, which means a maximum uplink speed of 177 kbit/s and downlink speed of 296 kbit/s. RM-588 also supports Dual Transfer Mode (DTM) for simultaneous voice and packet data connection in GSM/EDGE networks; simple class A, multi slot class 11 (4 Rx + 3 Tx, max sum 5).

RM-588 has a large nHD 3.2"(640 x 360 pixels) colour display (active area 39.6 mm x 70.4 mm) with 16 million colors. It also has a 2.0 megapixel camera.

RM-588 is an MMS (Multimedia Messaging Service) enabled multimedia device. The MMS implementation follows the OMA MMS standard release 1.3. RM-588 also supports the Bluetooth 2.0 + EDR standard.

RM-588 uses a S60 5.0 operating system and supports the full Web Browser for S60, which brings desktop-like Web browsing experience to mobile devices.

RM-588 also supports MIDP Java 2.0, providing a good platform for compelling 3rd party applications.

Figure 1 View of RM-588

Product features and sales package

New hardware characteristics

- Touch screen phone:

- Full touch UI – no physical input or UI navigation keys
- Contacts Bar - Person centric UI
- Media Bar – Easy access to media

Bearers and transport

- WCDMA DL 384kbit/s, UL 384 kbit/s
- HSDPA up to 3.6Mbps
- GPRS/EGPRS Class B, Multi slot class 32 (5 Rx + 3 Tx = 6)
- Dual Transfer Mode (DTM) class A, multi slot class 11 (4 Rx + 3 Tx = 5)

Connectivity

- Integrated GPS (A-GPS OMA SUPL)
- Bluetooth 2.0 (A2DP & AVRCP)
- USB2.0 High Speed with microUSB interface
- MicroSD memory card - support up to 16GB
- 3.5 mm AV connector

Display

- 3.2" nHD (640 x 360 pixels) colour display (active area 39.6 mm x 70.4 mm), up to 16M colors, 16:9 aspect ratio

Imaging and video

- 2.0Mpix camera
- True 16:9 high definition widescreen optimised for mobile entertainment
- Video center for enjoying downloaded and streamed content, WMV support, video feeds (vodcasting) and mobile TV (IP TV)
- Video sharing
- Video streaming (3GPP and CIF)

Music

- MAD1 for hi-fi sound quality
- Podcasting, internet radio, best in class music player on the go
- Superb music player UI, bass booster, stereo widening, loudness
- Stereo music player supporting MP3, SpMidi, AAC, AAC+, eAAC+, WMA
- 3D stereo ringing tones, 64 polyphonic Midi, MP3 tones, video ringing tones
- Stereo FM Radio

Productivity

Context management

- Full OMA client provisioning
- PIM (Calendar + Contacts)
- OTA provisioning & over the air SW update (FOTA)
- Nokia PC Suite connectivity with USB, Bluetooth
- Web Browser (OSS), Java ™ MIDP 2.0, XHTML browsing over TCP/IP

Messaging

- MS, MMS (OMA 1.3)
- Native Email with attachments (push)
- Audio messaging (AMS)

Voice

- Video Sharing
- Speaker independent dialing and voice commands (SIND)

Add-on software framework

- S60 5.0 OS
- Java: MIDP2.0

Additional technical specifications

- Vibrating alert
- 3GPP Rel 5 compliant
- Speech codecs supported: AMR, NB-AMR, FR, EFR

Sales package

- Transceiver RM-588
- Battery (BL-5J)
- Charger (AC-8)
- Stereo Headset (WH-102)
- Plectrum Stylus (CP-306)
- Stylus (NOT in Europe and Eurasia)
- User Guide

Product and module list

Module name	Type code	Notes
System/RF Module	3CB	Main PWB with components
UI Flex Module	2JX	
Upper Flex Module	3CD	

Mobile enhancements

Table 1 Audio

Enhancement	Type
Audio controller	AD-54
Hearing aid	HDA-12

Enhancement	Type
Wired headsets	HS-16
	HS-41
	HS-43
	HS-45 (+ AD-54)
	HS-45
	HS-48
	WH-201
	WH-202
	WH-500
	WH-600
	WH-700
	WH-800

Enhancement	Type
Wireless headsets	BH-102
	BH-103
	BH-212
	BH-303
	BH-500
	BH-501
	BH-703
	BH-804
	BH-904
	HS-24W
	HS-25W
	HS-38W
	HS-51W
	HS-52W
	HS-57W
	HS-58W
	HS-59W
	HS-72W
	HS-76W
	HS-79W
	HS-89W
	HS-91W
	HS-94W
	HS-95W
	HS-96W
	HS-100W

Table 2 Car

Enhancement	Type
FM transmitter	CA-300
Mobile holder	CR-39
	CR-82
	CR-99
	CR-103
Mobile holder mounting device	HH-12

Enhancement	Type
Mobile charger	DC-4
Navigation	Nokia 500 Auto Navigation
Wireless car kit	CK-7W
	CK-15W
	CK-100
	CK-300
Wireless plug-in car handsfree	HF-33W
	HF-200
	HF-300

Table 3 Data

Enhancement	Type
MicroSD card, 512 MB	MU-28
MicroSD card, 1 GB	MU-22
MicroSD card, 2 GB	MU-37
MicroSD card, 4 GB	MU-41
MicroSD card, 8 GB	MU-43
MicroUSB connectivity adapter cable	CA-101

Table 4 Messaging

Enhancement	Type
Wireless keyboard	SU-8W
Digital pen	SU-27W
CP-306 plectrum stylus	CP-306

Table 5 Music

Enhancement	Type
Wireless Audio Gateway	AD-42W
Wireless speakers	MD-5W
	MD-7W
Music speakers	MD-6
	MD-8

Table 6 Navigation

Enhancement	Type
Wireless GPS module	LD-3W
	LD-4W

Table 7 Power

Enhancement	Type
Battery 1320mAh	BL-5J
Charging connectivity cable	CA-126
Charger	AC-4
	AC-5
	AC-6C (+CA-100c)
	AC-8
	DC-1
	DC-8
	DC-9
Charger adapter	CA-44
USB charger	CA-100

Technical specifications

Transceiver general specifications

Unit	Dimensions (L x W x T) (mm)	Weight with battery (g)	Volume (cm3)
Transceiver with BL-5J 1320 mAh Li-Ion battery back	111 x 51.7 x 15.5	115	83

Main RF characteristics for GSM850/900/1800/1900 and WCDMA VIII (900) and WCDMA I (2100) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA VIII (900) and WCDMA I (2100)

Parameter	Unit
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA VIII (900): 925- 960 MHz
	WCDMA I (2100): 2110 - 2170 MHz
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA VIII (900): 880 - 915 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA VIII (900): -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01μW ... 251.2mW
EDGE output power	EDGE850: +5 ... +29dBm/3.2mW ... 794mW
	EDGE900: +5 ... +29dBm/3.2mW ... 794mW
	EDGE1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA VIII (900): 152
	WCDMA I (2100): 277
Channel spacing	200 kHz

Parameter	Unit
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA VIII (900): 75
	WCDMA I (2100): 75

Battery endurance

Battery	Capacity (mAh)	Talk time	Stand-by
BL-5J	1320	Up to 7 h (GSM) Up to 4 h 18 min (WCDMA)	Up to 438 h (GSM) Up to 458 h (WCDMA)

Environmental conditions

Temperature conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15°C...+55°C	Specifications fulfilled
Reduced performance	-25°C...-15°C +55°C...+70°C	Operational for shorts periods only
Intermittent operation	-40°C...-15°C +70°C...+85 °C	Operation not guaranteed but an attempt to operate does not damage the phone.
No operation or storage	<-40°C...>+85°C	No storage or operation: an attempt may damage the phone.
Charging allowed	-25°C...+50°C	
Long term storage conditions	0°C...+85°C	

Humidity

Relative humidity range is 5...95%.

The HW module is not protected against water. Condensed or splashed water might cause malfunction. Any submerge of the phone will cause permanent damage. Long-term high humidity, with condensation, will cause permanent damage because of corrosion.

Vibration

The module should withstand the following vibrations:

- 5 - 10 Hz; +10dB / octave
- 10 - 50 Hz; 5.58 m^2 / s^3 (0.0558 g^2/ Hz)
- 50 - 300 Hz; - 10 dB / octave

ESD strength

Conducted discharge is 8 kV (>10 discharges) and air contact 15 kV (>10 discharges).

The standard for electrostatic discharge is IEC 61000-4-2, and this device fulfils level 4 requirements.

RoHS

This device uses RoHS compliant components and lead-free soldering process.

2 — Service Tools and Service Concepts

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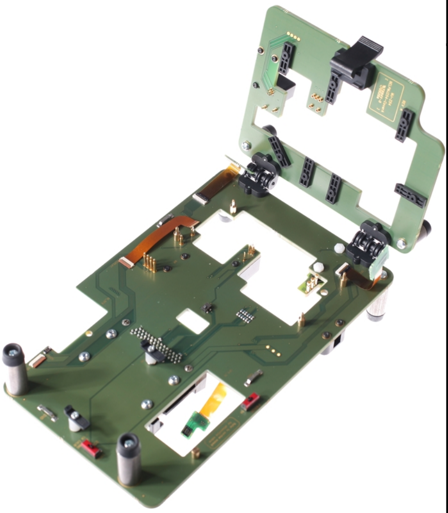
Service tools

Product specific tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-588; RM-593; RM-594; RM-625; RM-629. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

<table>
<tr><td rowspan="2">
</td><td>FS-77</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">For flashing (also dead phones) with SS-46. RF testing and tuning, and EM calibration on ATO level with SS-62 (mechanical locking concept), CU-4 supported.</td></tr>
<tr><td rowspan="2"></td><td>MJ-254</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-254 is meant for troubleshooting, testing, tuning and flashing on the engine level (CU-4 supported).
The jig includes an RF interface for GPS, GSM, WCDMA and Bluetooth.</td></tr>
</table>

RF Shield Box | **Universal RF coupler**

A final test is required after all level 3 repairs and it has to be performed with the assembled phone to ensure the quality of serviced products. The test should be carried out in a RF Shield Box equipped with a universal RF coupler or Nokia designed coupler RF coupler.

Requirements for the RF Shield Box:

- Large enough to accommodate even the most bulky Nokia Phones
- Absorbers must be used inside the box to minimise reflections (e.g. pyramid absorber)
- Shield factor for GSM >60 dB
- Shield factor for WCDMA >80 dB
- RF OUT connector N- or TNC-connector
- Ergonomic design and user safety

Requirements for the universal RF coupler:

- Frequency range: 700 to 2.500 MHz
- Minimum coupling attenuation
- Cradle must fit all Nokia mobile phone types
- Ergonomic design and user safety

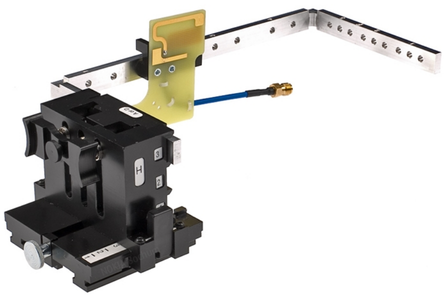
Examples of the possible test set-ups:

- Test set-up with Will'tek Mobile Phone Tester 4403, Shield Box and universal Antenna Coupler.
- Test set-up with R&S Radio Communication Tester CMU-200, Shield Box CMU-Z11 and universal Antenna Coupler CMU-Z10 (Note: Additional PC with CMU-Go SW is necessary for automatic final test.)

For more information, see Technical Bulletin No. SB-201/23.01.06.

RJ-230 | **Soldering jig**

RJ-230 is a soldering jig used for soldering and as a rework jig for the engine module.



SA-131 | **RF coupler**

SA-131 is a RF coupler for GPS testing. It is used together with SS-62.

For more information on how to use the SA-131 with RM-588, see Using SA-131 GPS RF coupler with RM-588 (page 2–7).

	SS-195	Display removal tool	
	SS-195 is used for removing displays.		

Using SA-131 GPS RF coupler with RM-588

Use the following basic SA-131 setup for RM-588:

- 1575.520152 MHz
- -110dbm
- 20db fixed RF attenuator
- 10 db product specific RF attenuation

And use the following settings for the SA-131:

- Base setting: 3
- Sledge setting: 2
- Frame setting: A1
- Coupler setting: B2
- Direction: Down

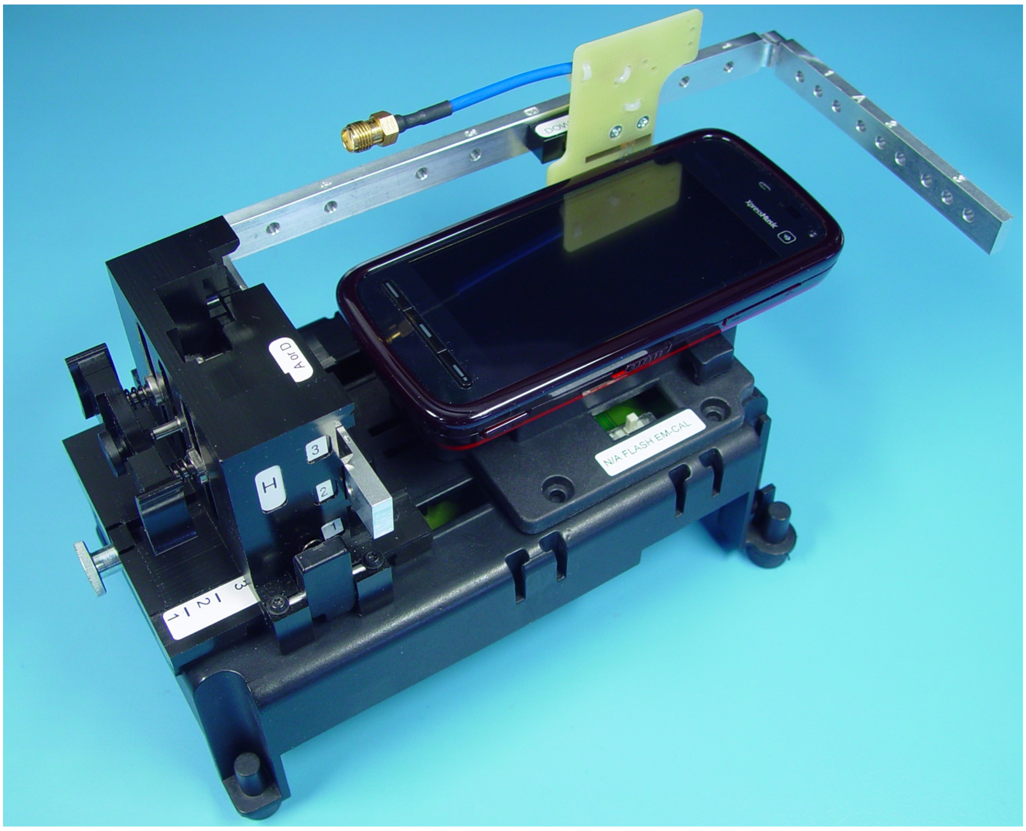


Figure 2 Base and sledge settings for SA-131

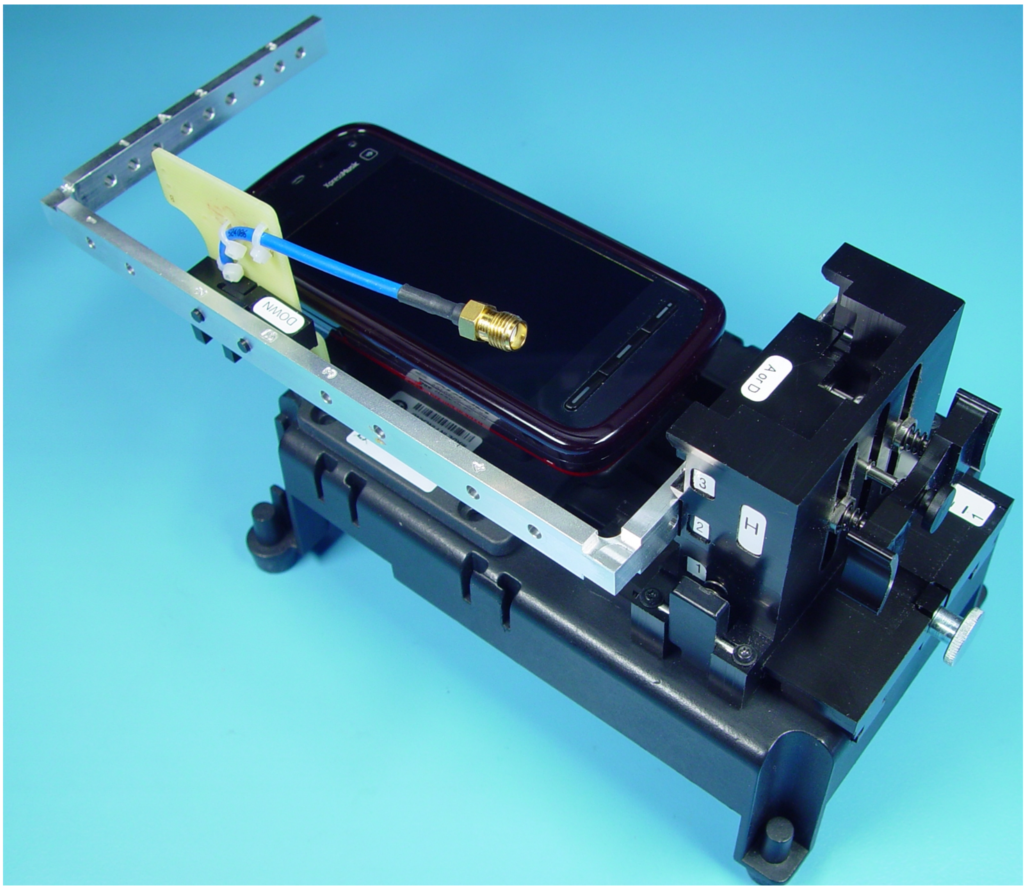


Figure 3 Frame and coupler settings for SA-131

General tools

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-588; RM-593; RM-594; RM-625; RM-629. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

	AC-35	Power supply	
	Universal power supply for FPS-21; included in the FPS-21 sales package. Input 100V...230V 50Hz...60Hz, output voltage of 12 V and output current up to 3 A.		

CU-4

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It 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

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.

2 Connect CU-4 to your PC with a USB cable.

3 Connect supply voltage (12 V)

4 Connect an FBUS cable (if necessary).

5 Start Phoenix service software.

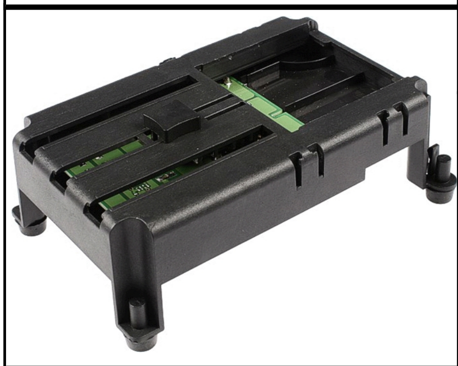
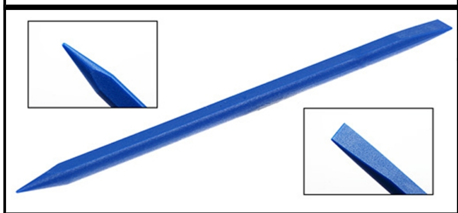
Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

<table>
<tr><td rowspan="2"></td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.

Note: FLS-5 can be used as an alternative to PK-1.</td></tr>
<tr><td rowspan="2"></td><td>FPS-21</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-21 sales package:
• FPS-21 prommer
• AC-35 power supply
• CA-31D USB cable
FPS-21 interfaces:
Front
• Service cable connector
Provides Flashbus, USB and VBAT connections to a mobile device.
• SmartCard socket
A SmartCard is needed to allow DCT-4 generation mobile device programming.
Rear
• DC power input
For connecting the external power supply (AC-35).
• Two USB A type ports (USB1/USB3)
Can be used, for example, for connecting external storage memory devices or mobile devices
• One USB B type device connector (USB2)
For connecting a PC.
• Phone connector
Service cable connection for connecting Flashbus/FLA.
• Ethernet RJ45 type socket (LAN)
For connecting the FPS-21 to LAN.
Inside
• Four SD card memory slots
For internal storage memory.
Note: In order to access the SD memory card slots inside FPS-21, the prommer needs to be opened by removing the front panel, rear panel and heatsink from the prommer body.</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td>JXS-1</td><td>RF shield box</td><td></td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td rowspan="2"></td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2"></td><td>SB-6</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• SB-6 test box
• Installation and warranty information</td></tr>
<tr><td rowspan="2"></td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers.
Note: The SRT-6 is included in the Nokia Standard Toolkit.</td></tr>
</table>

	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-21.		
	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-88	Camera removal tool	
	The camera removal tool SS-88 is used to remove/attach a camera module from/to the camera socket.		
	SS-93	Opening tool	
	SS-93 is used for opening JAE connectors. **Note:** The SS-93 is included in Nokia Standard Toolkit.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-21 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service devices that can be used for testing, error analysis, and repair of product RM-588; RM-593; RM-594; RM-625; RM-629. For the correct use of the service devices, and the best effort of workbench setup, please refer to various concepts.

CA-101	Micro USB cable	

The CA-101 is a USB-to-microUSB data cable that allows connections between the PC and the phone.

CA-31D	USB cable	

The CA-31D USB cable is used to connect FPS-21 to a PC. It is included in the FPS-21 sales package.

CA-58RS	RF tuning cable	

Product-specific adapter cable for RF tuning.

- **Table 8 Attenuation values**

Band	Attenuation Rx/Tx
GSM850/900	0.2...0.3 dB
GSM1800/1900	0.3...0.4 dB
WCDMA900	0.2...0.3 dB
WCDMA2100	0.4...0.6 dB

<table>
<tr><td rowspan="2">
</td><td>CA-89DS</td><td>Cable</td><td></td></tr>
<tr><td colspan="3">Provides VBAT and Flashbus connections to mobile device programming adapters.</td></tr>
<tr><td rowspan="2"></td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Docking station adapters valid for DCT4 products.</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 docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
</table>

	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WCDMA900: 0.3+-0.1 dB • WCDMA2100: 0.6+-0.1dB		

Service concepts

POS (Point of Sale) flash concept

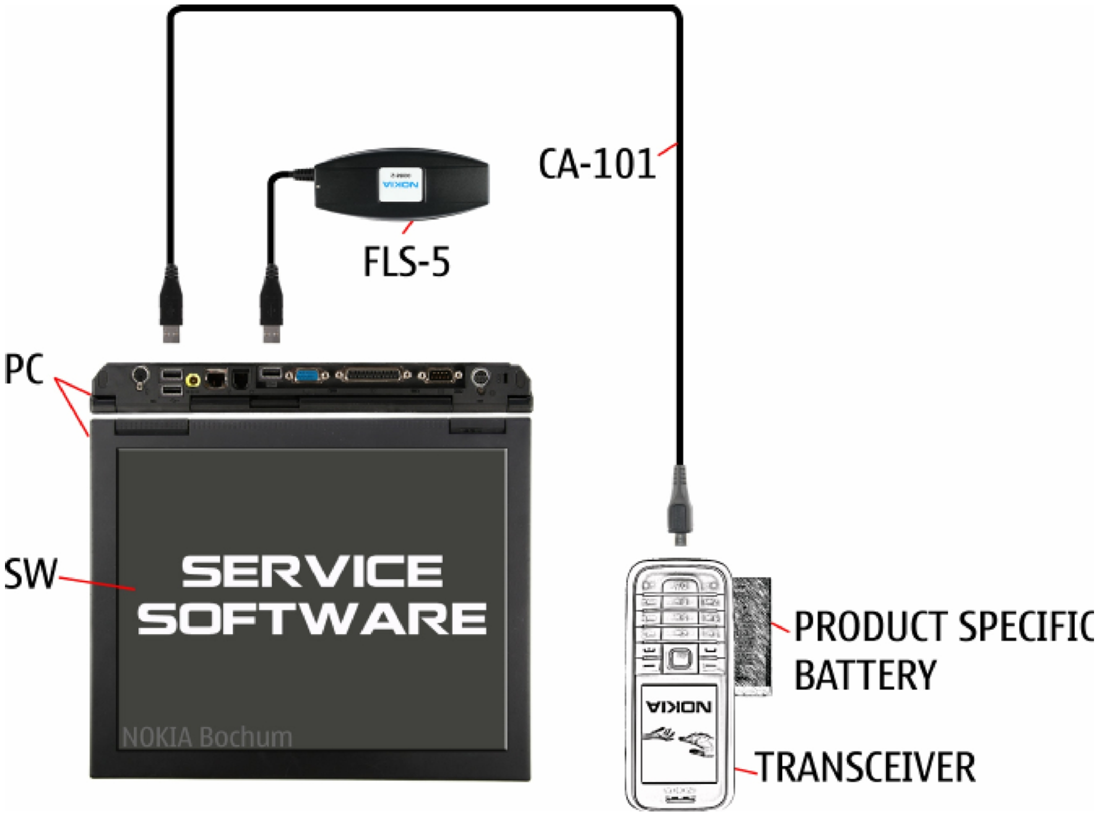


Figure 4 POS flash concept

Type	Description
Product specific tools	
BL-5J	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software

Type	Description
Cables	
CA-101	Micro USB cable

Module jig service concept

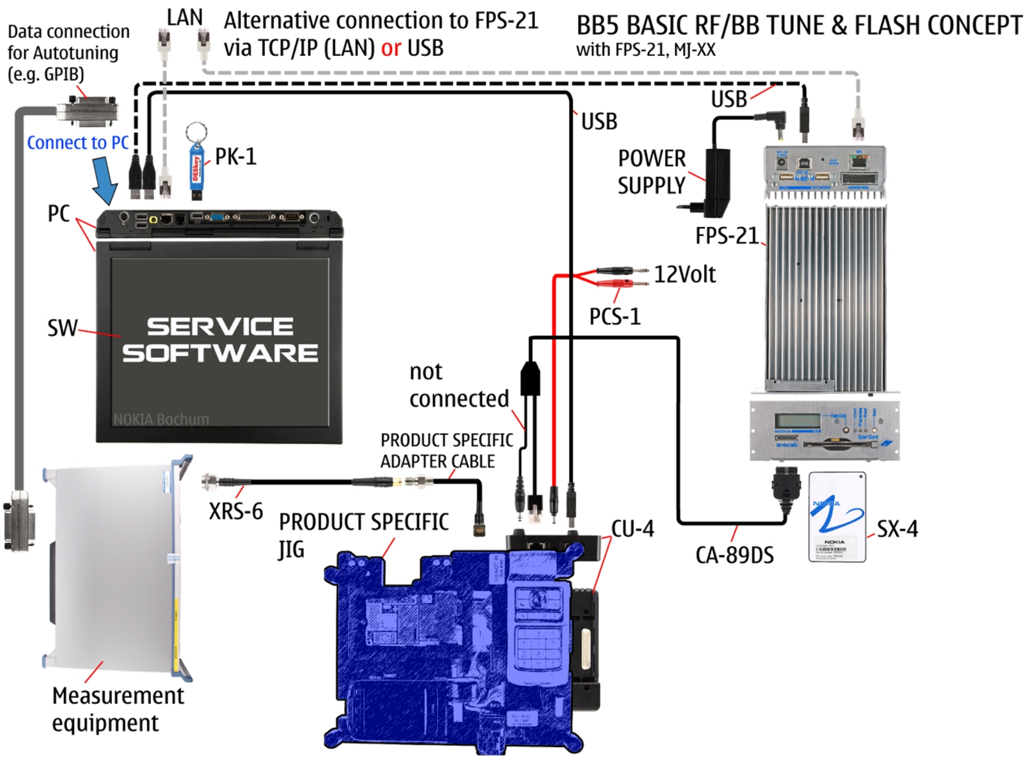


Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-254	Module jig
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
CA-89DS	Service cable
PCS-1	DC power cable
XRS-6	RF cable

Type	Description
	USB cable
	GPIB control cable

CU-4 flash concept with FPS-21

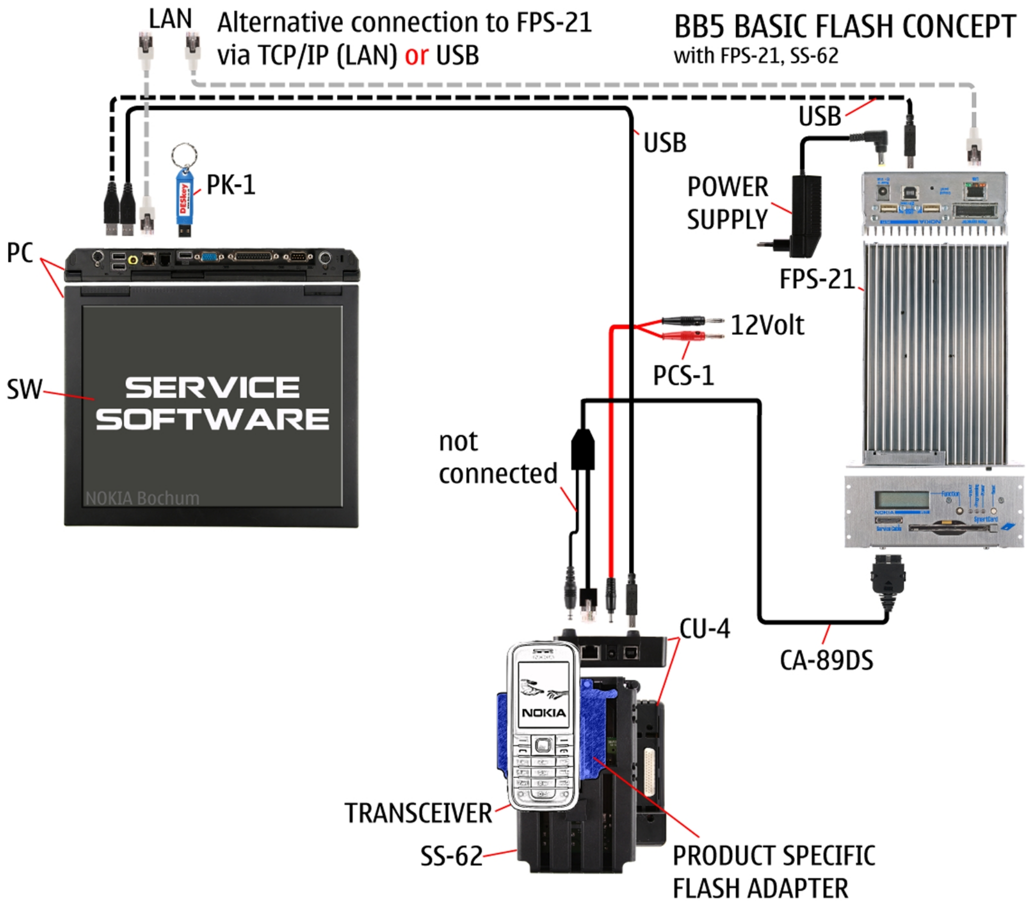


Figure 6 CU-4 flash concept with FPS-21

Type	Description
Product specific devices	
FS-77	Flash adapter
Other devices	
CU-4	Control unit
FPS-21	Flash prommer box
AC-35	Power supply
PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card (for DCT-4 generation mobile device programming)
	PC with Phoenix service software

Type	Description
Cables	
PCS-1	Power cable
CA-89DS	Service cable
	Standard USB cable
	USB cable

Service concept for RF testing and RF/BB tuning

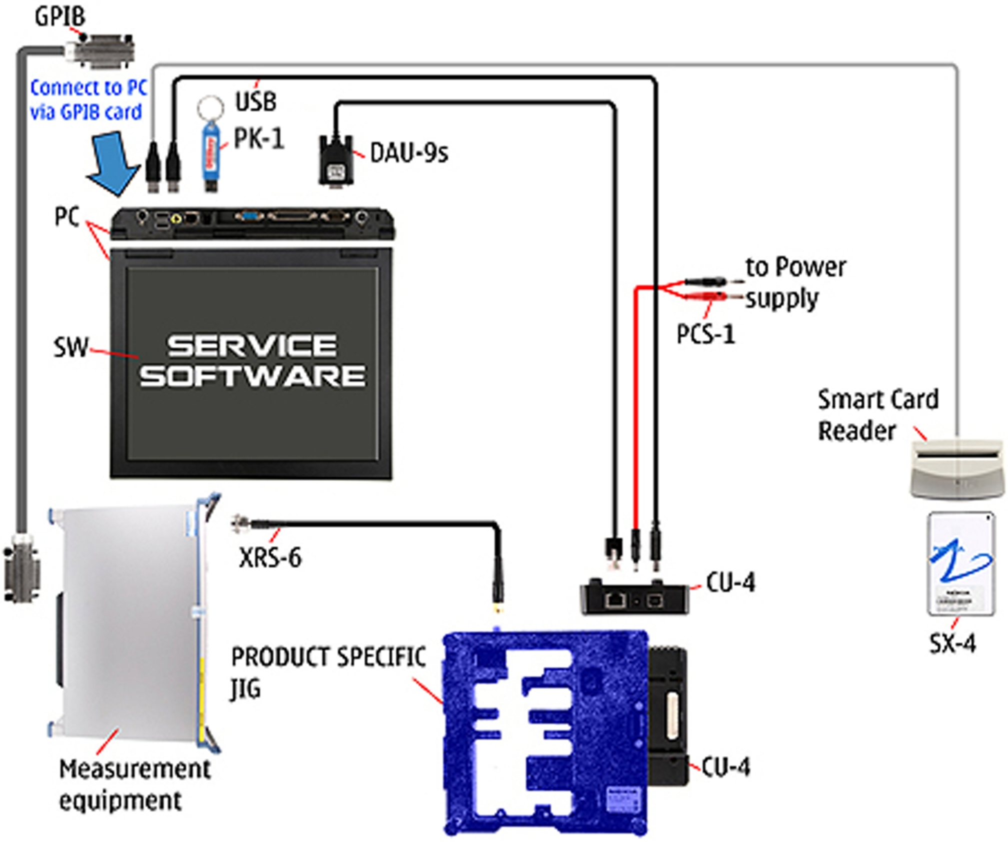


Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-254	Module jig
Other devices	
CU-4	Control unit
PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader

Type	Description
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

GPS testing concept with GPS RF coupler

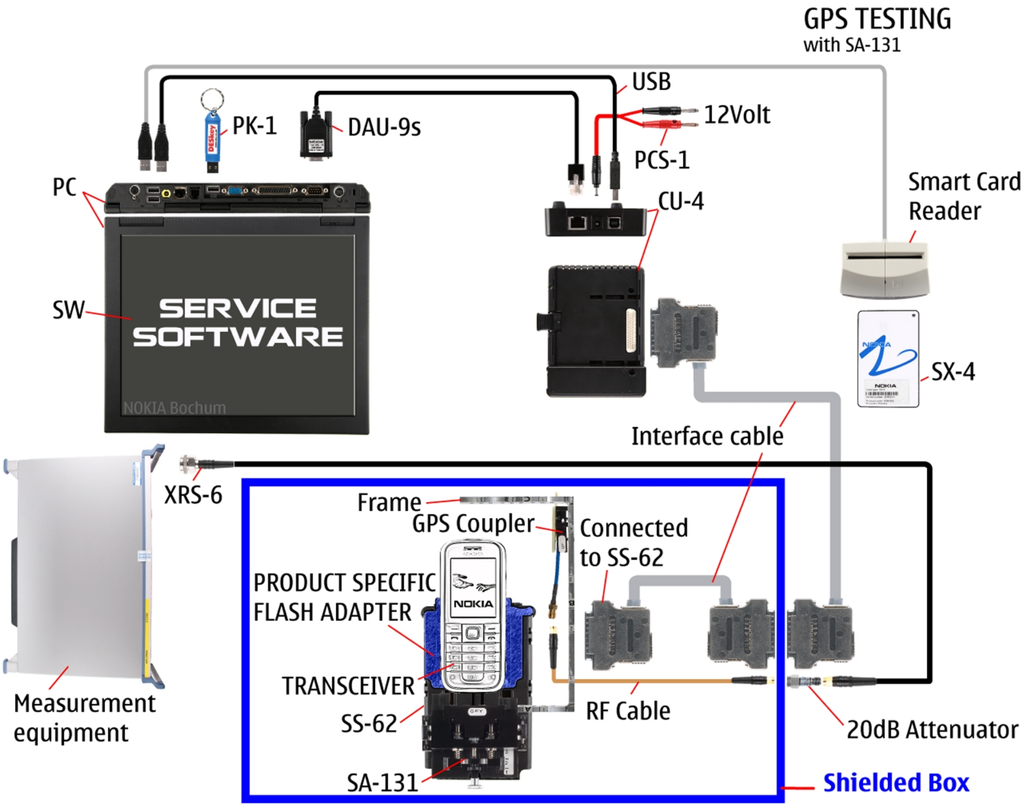


Figure 8 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-77	Flash adapter
SA-131	GPS RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
JXS-1	RF shield box

Type	Description
PK-1	SW security device
SS-62	Flash adapter base
	Smart card reader
	Measurement equipment
	PC with Phoenix service software
Cables	
CA-58RS	RF service cable (product-specific adapter cable)
PCS-1	Power cable
DAU-9S	MBUS cable
XRS-6	RF cable
	20dB attenuator
	Interface cable
	USB cable

Bluetooth testing concept with SB-6

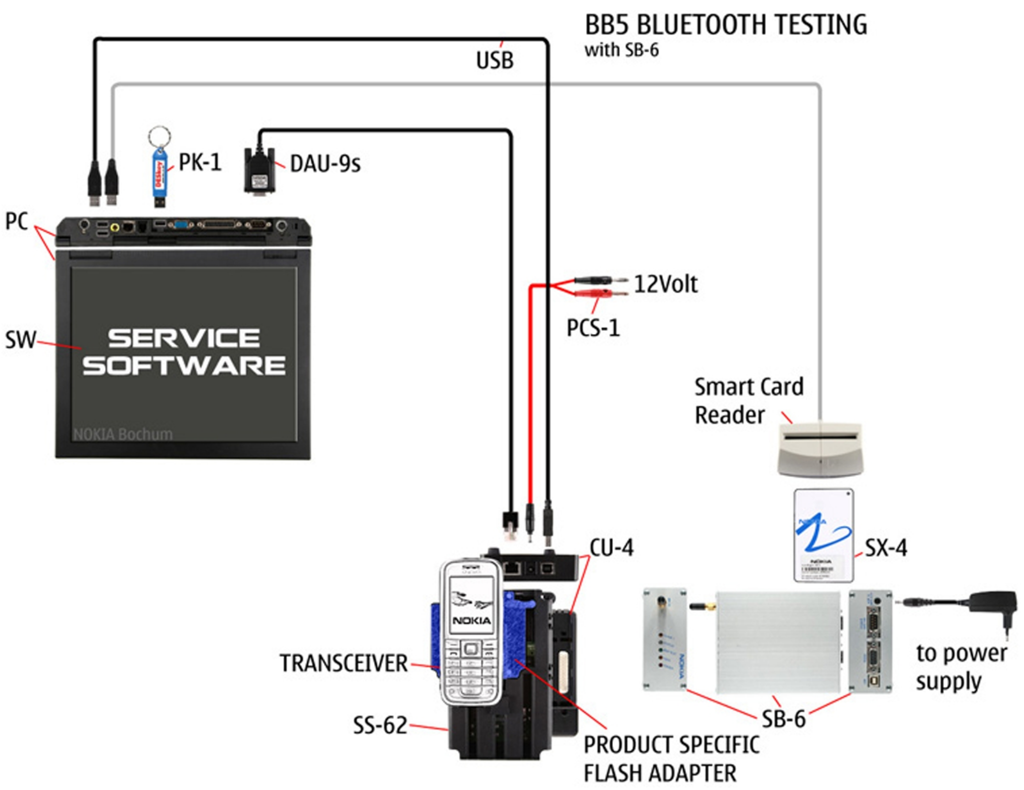


Figure 9 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
FS-77	Flash adapter

Type	Description
Other devices	
CU-4	Control unit
SS-62	Flash adapter base
PK-1	SW security device
SX-4	Smart card
SB-6	Bluetooth test and interface box
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9S	MBUS cable
PCS-1	DC power cable
	USB cable

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3 — BB Troubleshooting and Manual Tuning Guide

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Table of Contents

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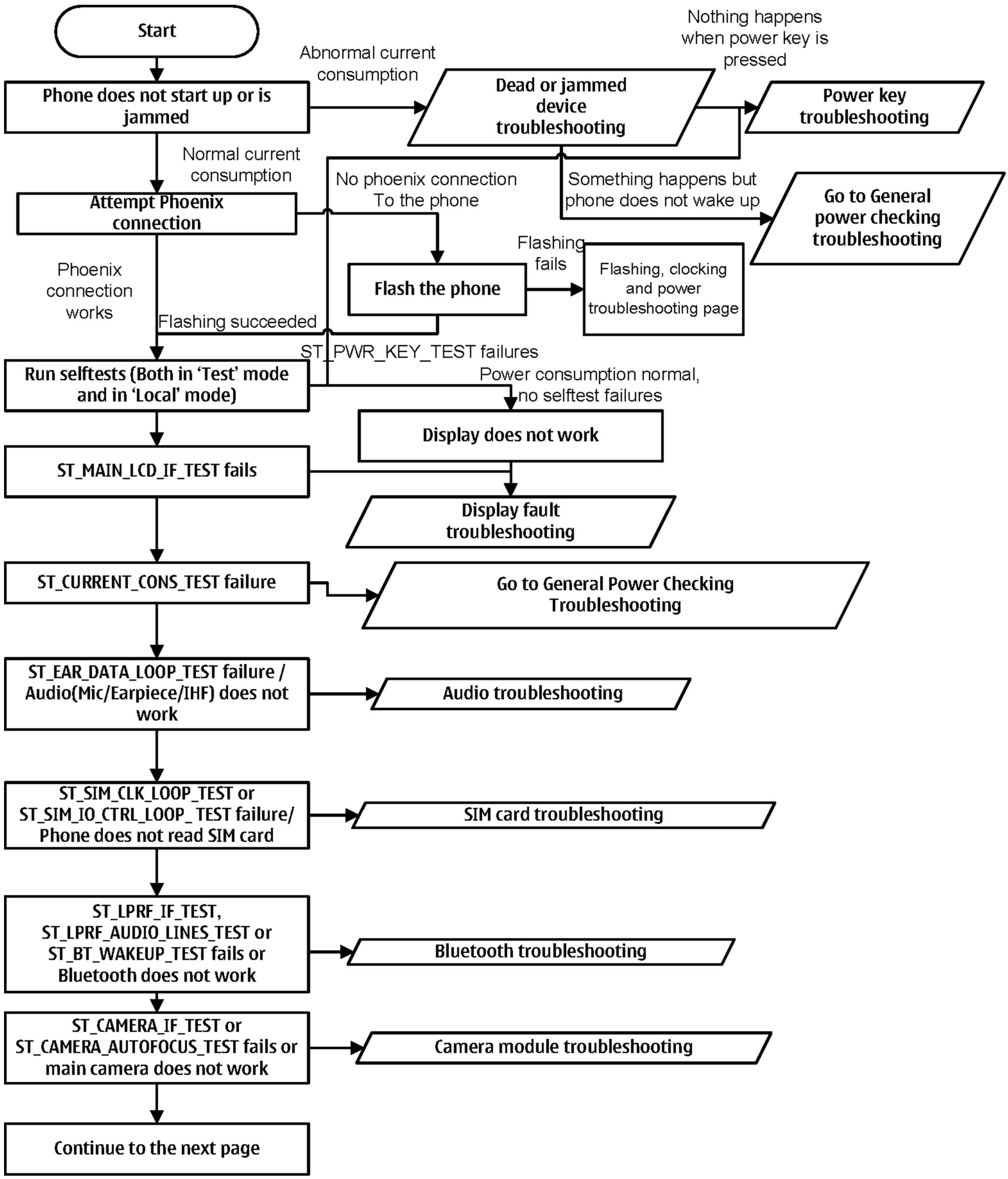
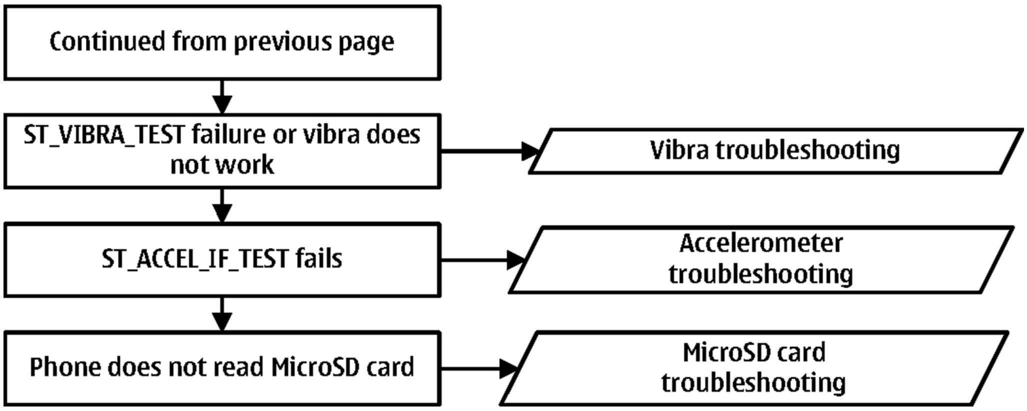
List of Figures

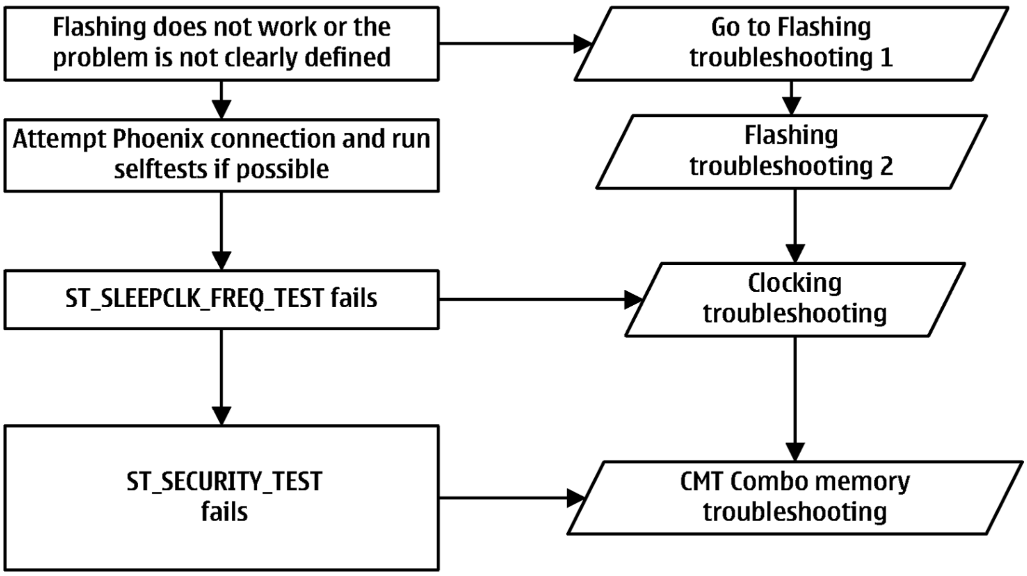
Baseband main troubleshooting

Troubleshooting flow





Flashing, clocking and power troubleshooting



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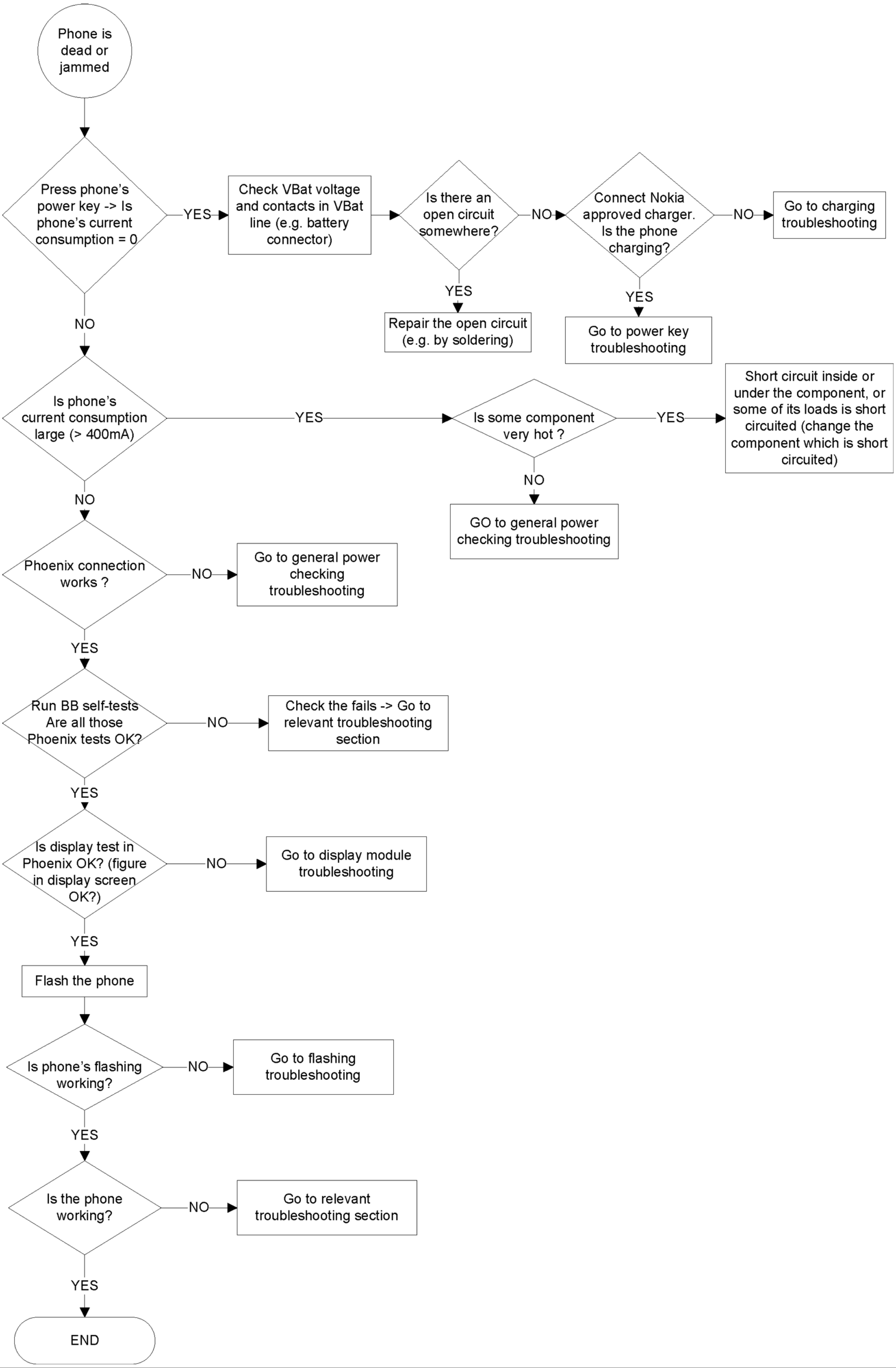
Dead or jammed device troubleshooting

Troubleshooting flow



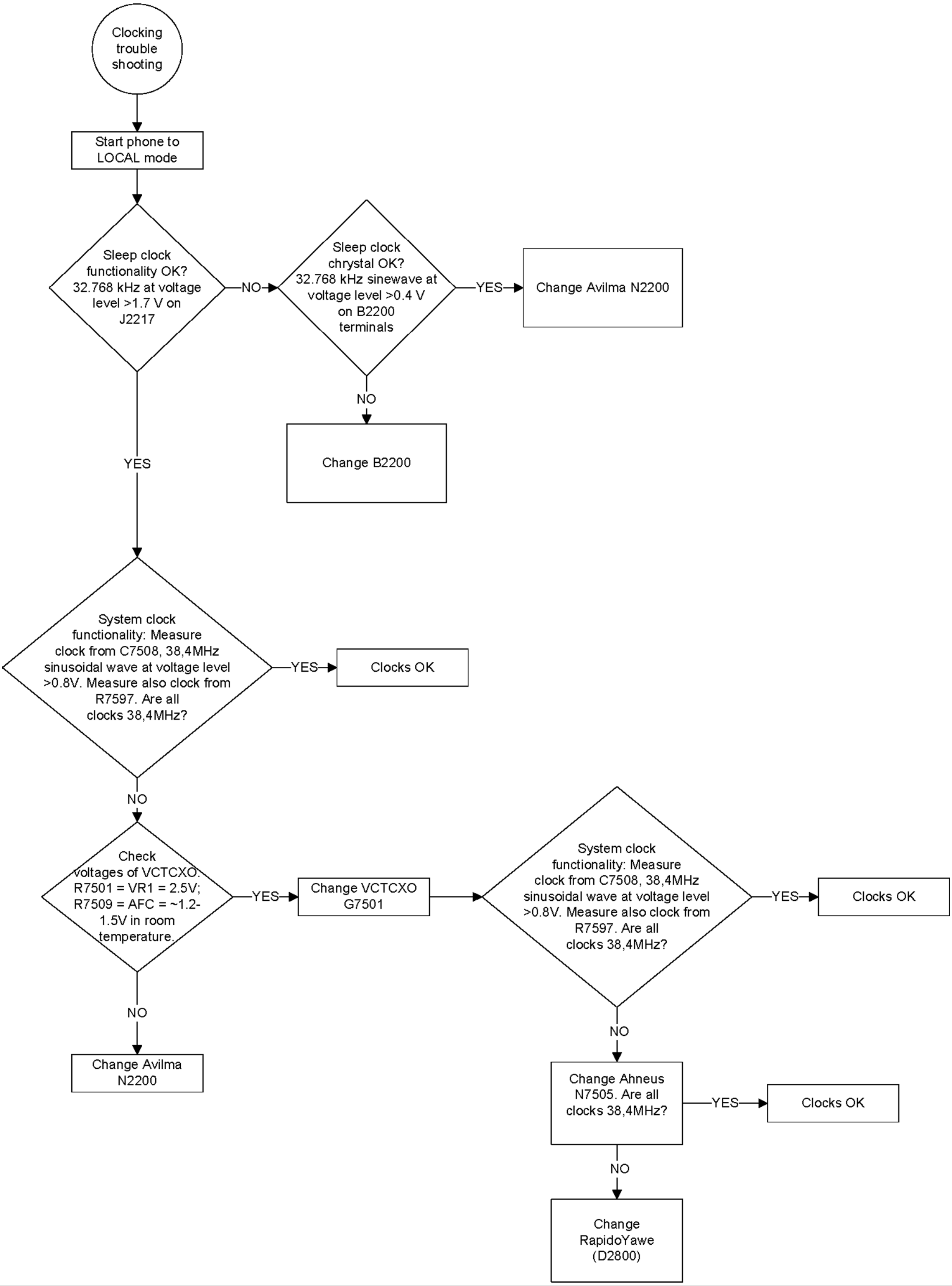
General power checking

General power checking

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes	Supply
VIO_V	AVILMA	ON	ON	1.82	Vilma I/O		VBAT1
VSIM1	AVILMA	ON	ON	1.8/3,0	SIM card		VBAT3
VSIM2	AVILMA	ON	ON	3,0	Digital microphone		VBAT3
VAUX	AVILMA	ON	ON	2.78	Accelerometer, proximity sensor, display		VBAT5
VANA	AVILMA	ON	ON	2.5	Vilma internal		VBAT4
VR1	AVILMA	OFF	ON	2.5	VCTCXO		VBAT4
VRFC	AVILMA	OFF	OFF	1.8	RAPIDO converter		
VRCP1	AVILMA	OFF	OFF	4.75	RF module	RF active	VBATCP
VOUT	BETTY	ON	ON	2,5	Audio switch		VBAT6
VCAM_1V8	LM3677	OFF	OFF	1,8	Camera HWA , LP5952, cameras		VBAT
VCAM_1V3	LP5952	OFF	OFF	1,3	Camera HWA core		LM3677
VCAM_2V8	BH28SA2	OFF	OFF	2,8	Cameras		VBAT
VCORE	TPS62350	ON	ON	1,2	Rapido core		VBAT
VIO	LM3677	ON	ON	1.8	VIO, VDRAM		VBAT
VSD	SD levelsifter	OFF	OFF	2,9	SD card	ON when used	VBAT
LEDOUT	TK65604	OFF			Display backlights		VBAT
LED B,G,R	LP5521	OFF			Keyboard backlights		VBAT
VBAT				3,6			

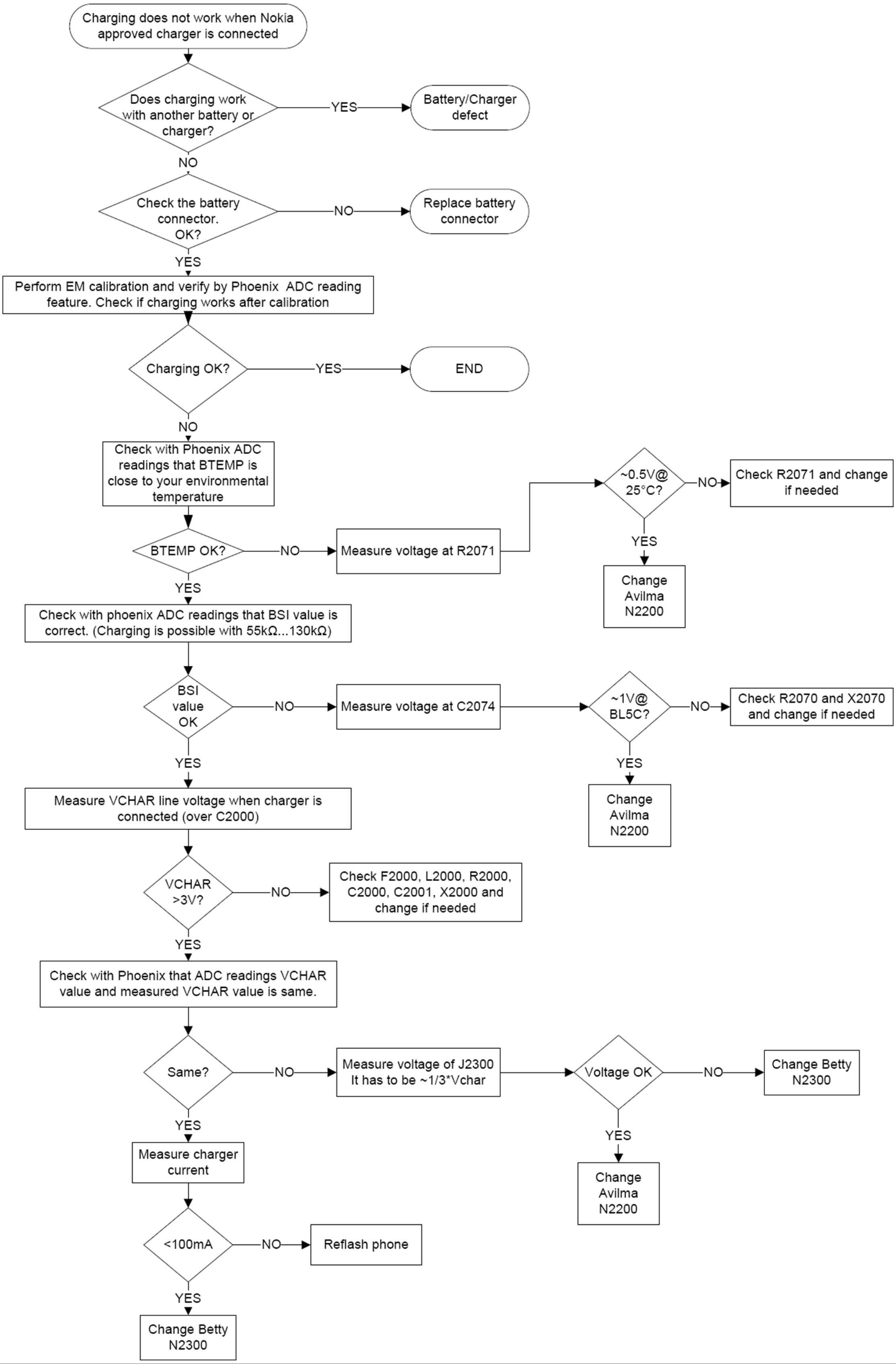
Clocking troubleshooting

Troubleshooting flow



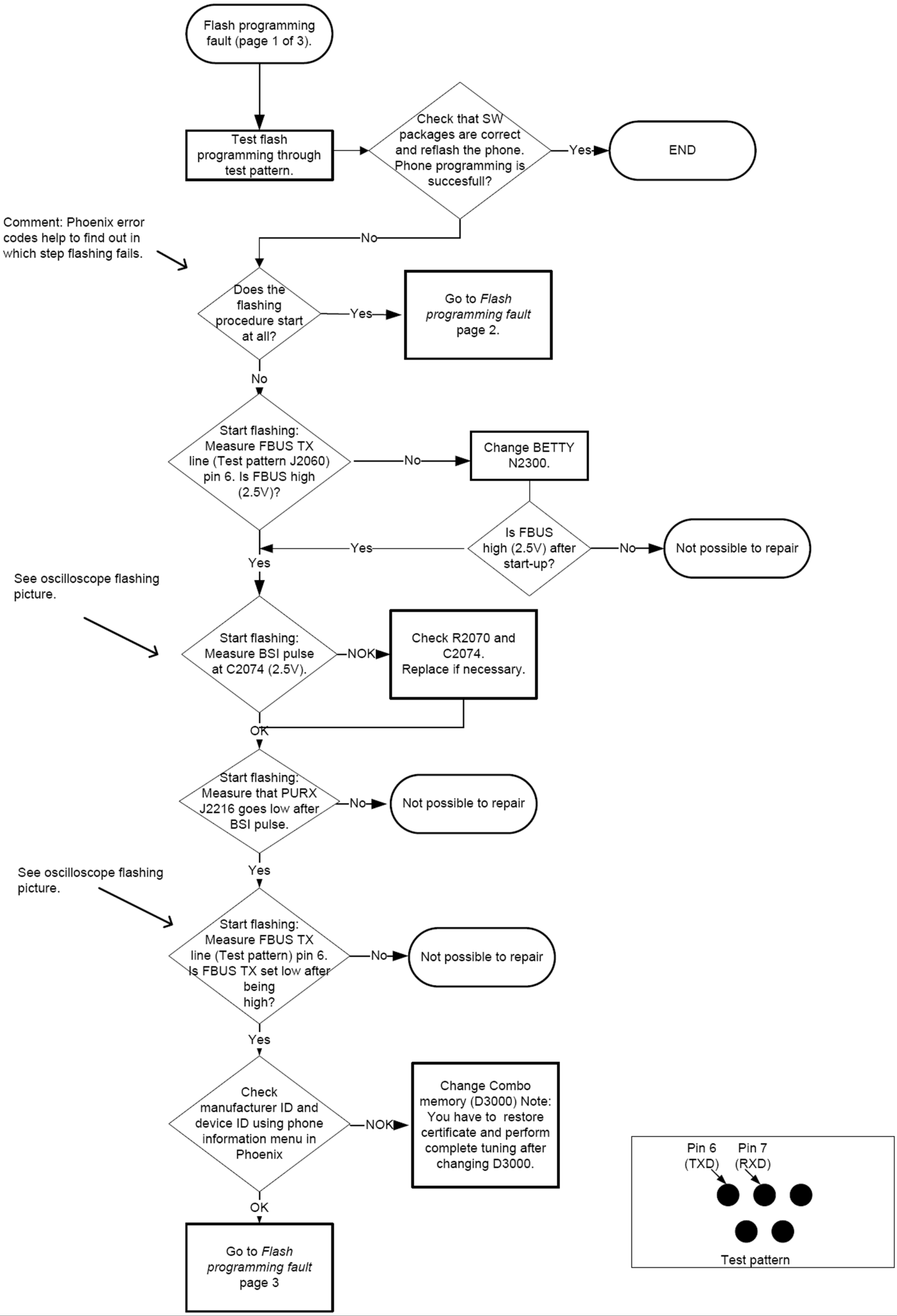
Charging troubleshooting

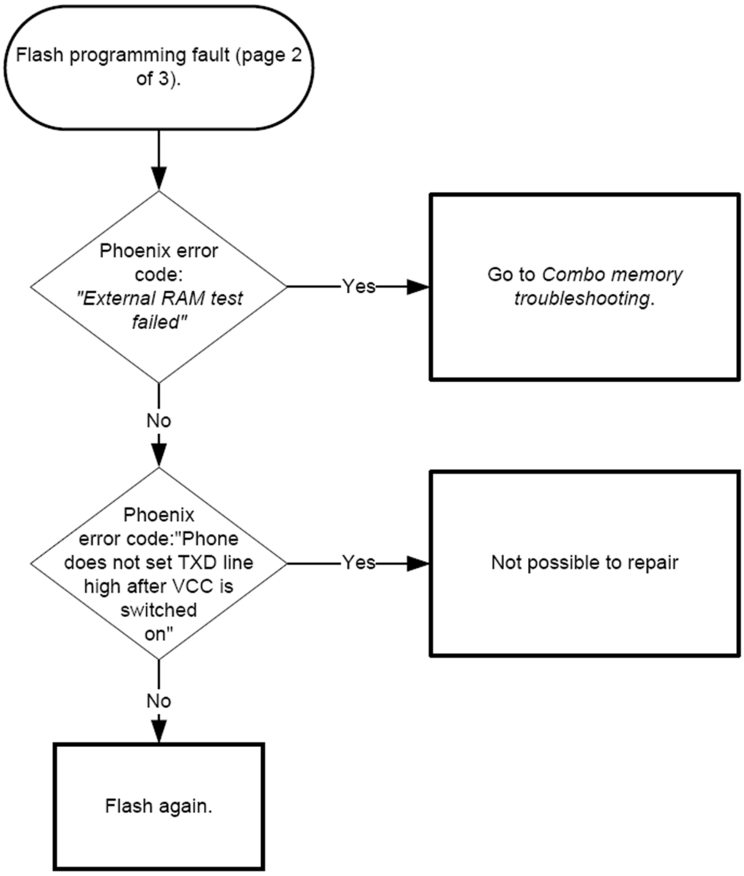
Troubleshooting flow

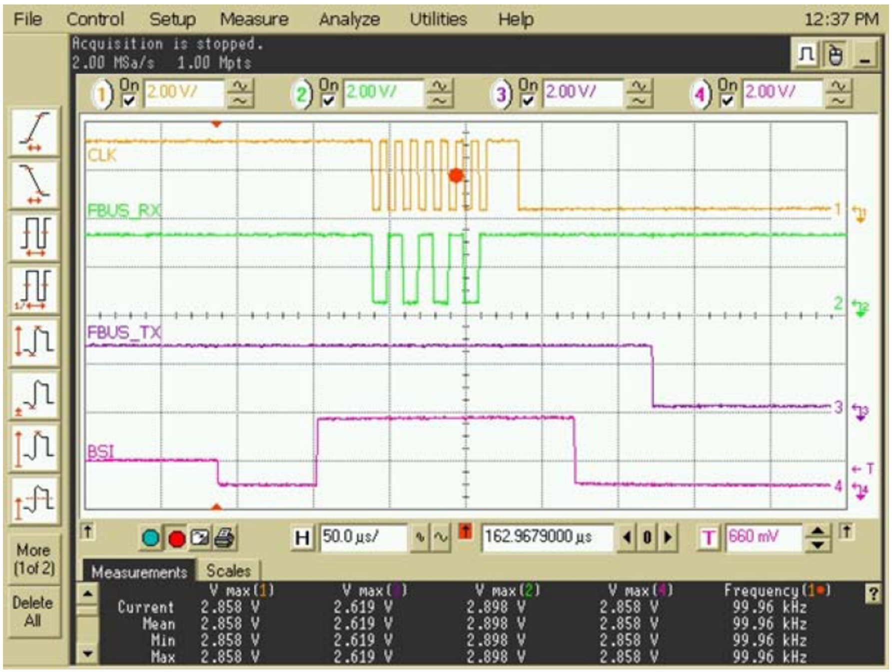


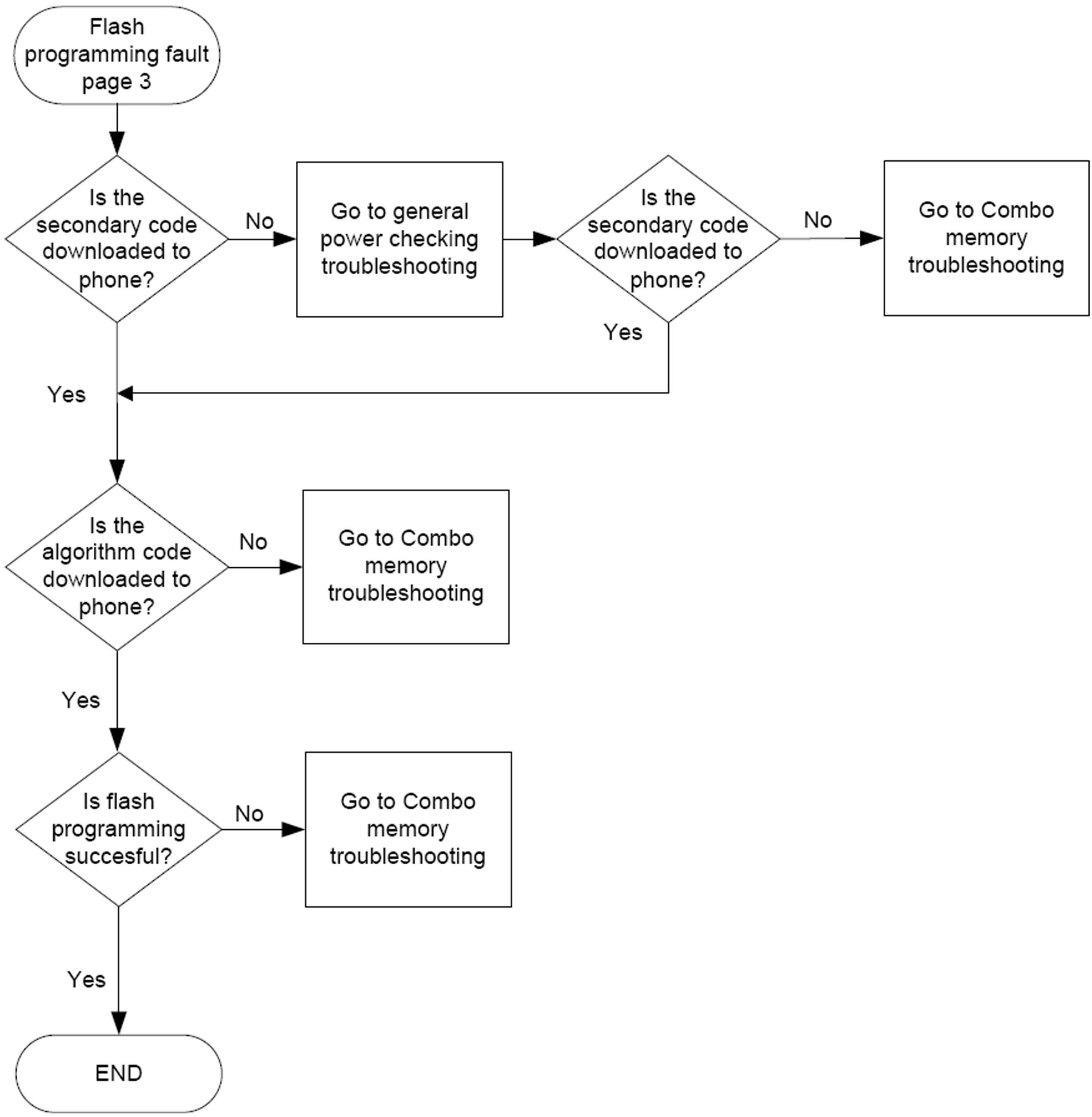
Flash programming troubleshooting

Troubleshooting flow



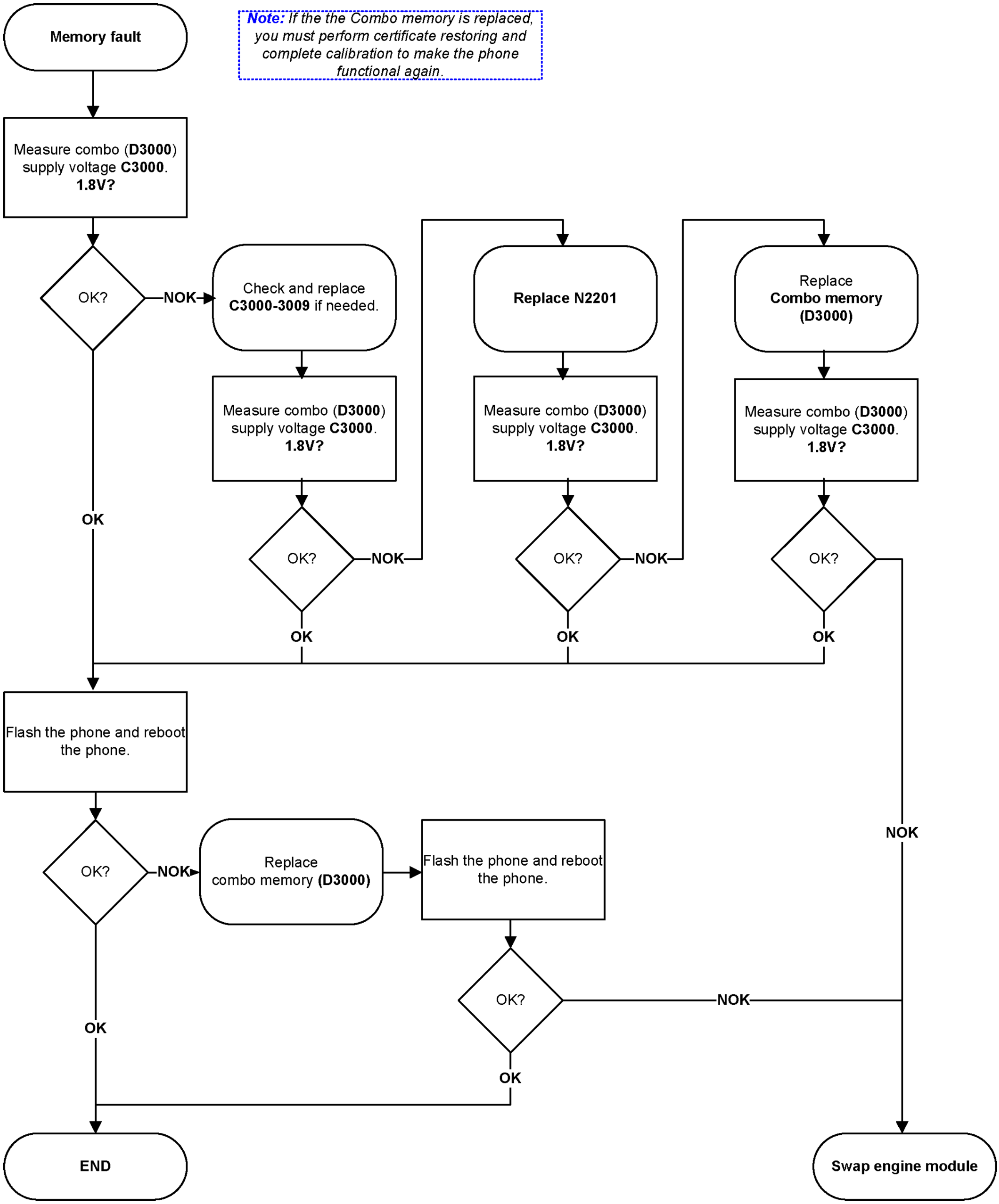

Flash programming fault (page 2 of 3).
Phoenix error code: *"External RAM test failed"*
Yes
Go to *Combo memory troubleshooting*.
No
Phoenix error code:"Phone does not set TXD line high after VCC is switched on"
Yes
Not possible to repair
No
Flash again.


File
Control
Setup
Measure
Analyze
Utilities
Help
12:37 PM
Acquisition is stopped.
2.00 MSa/s 1.00 Mpts
2.00 V/
CLK
FBUS_RX
FBUS_TX
BSI
50.0 µs/
162.9679000 µs
660 mV
Measurements
Scales
More (1 of 2)
Delete All
Current 2.858 V 2.619 V 2.898 V 2.858 V 99.96 kHz
Mean 2.858 V 2.619 V 2.898 V 2.858 V 99.96 kHz
Min 2.858 V 2.619 V 2.898 V 2.858 V 99.96 kHz
Max 2.858 V 2.619 V 2.898 V 2.858 V 99.96 kHz


Flash programming fault page 3
Is the secondary code downloaded to phone?
No
Go to general power checking troubleshooting
Is the secondary code downloaded to phone?
No
Go to Combo memory troubleshooting
Yes
Yes
Is the algorithm code downloaded to phone?
No
Go to Combo memory troubleshooting
Yes
Is flash programming succesful?
No
Go to Combo memory troubleshooting
Yes
END

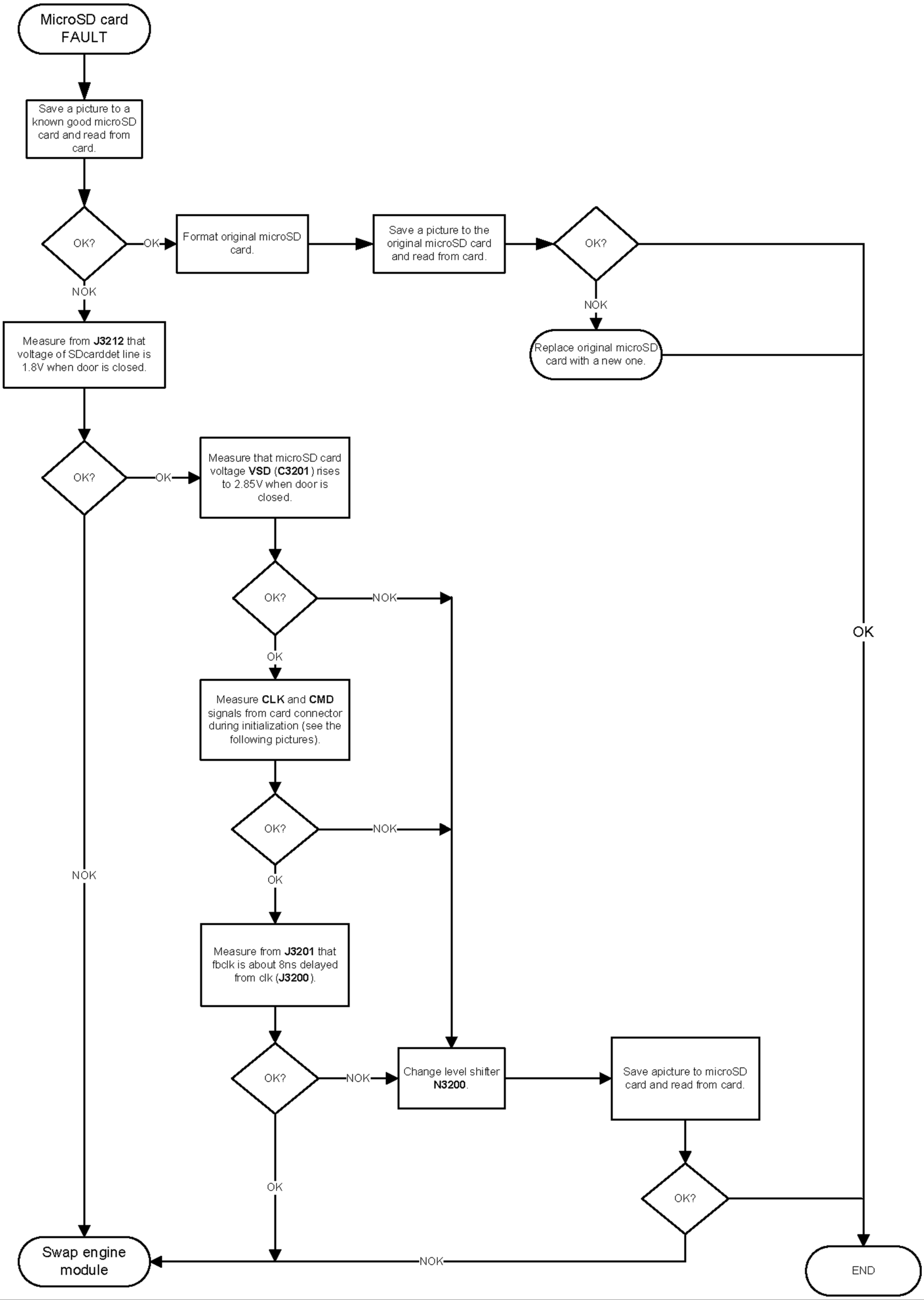
Combo memory troubleshooting

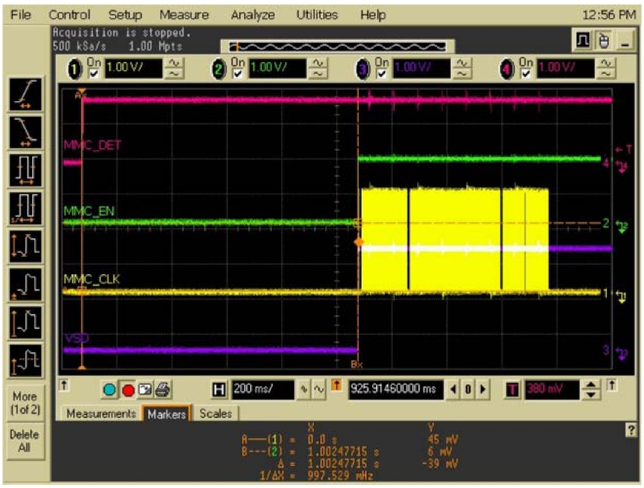
Troubleshooting flow



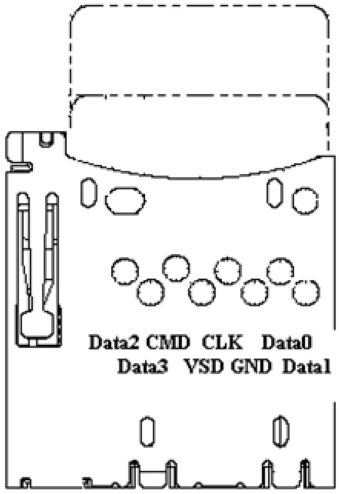
MicroSD card troubleshooting

Troubleshooting flow

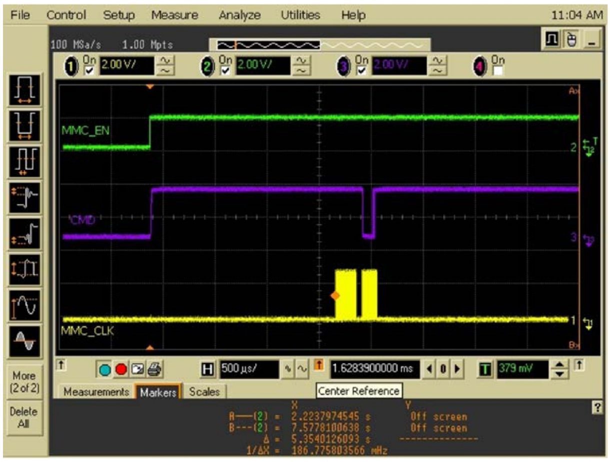




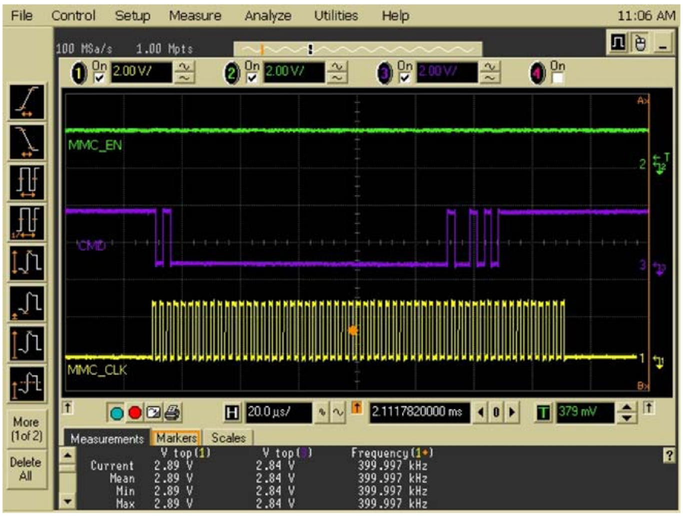
MicroSD interface signals timing when door is closed.



MicroSD connector



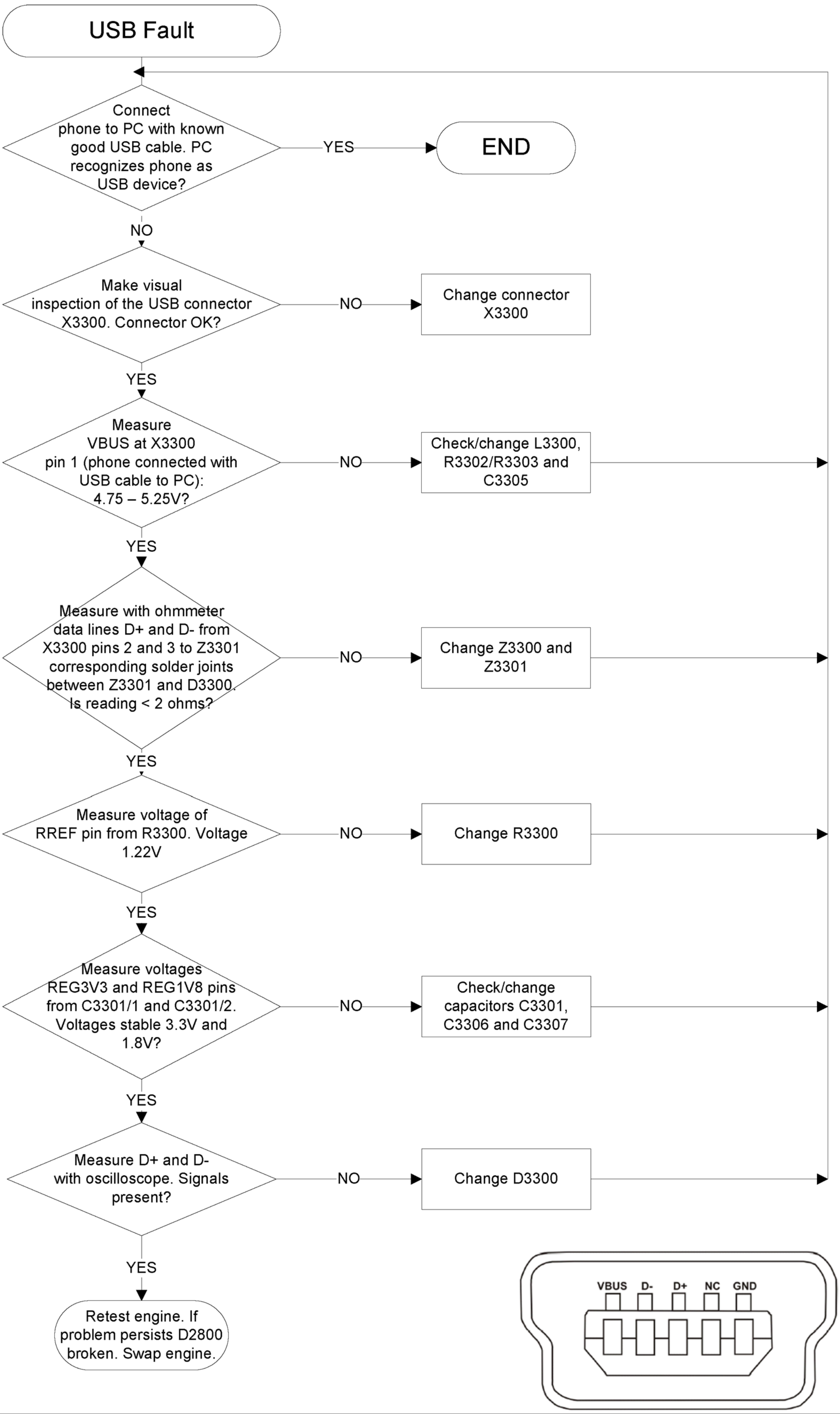
CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector.



CLK and CMD signals during card initiaisation when card is not inserted. Measured from the microSD connector

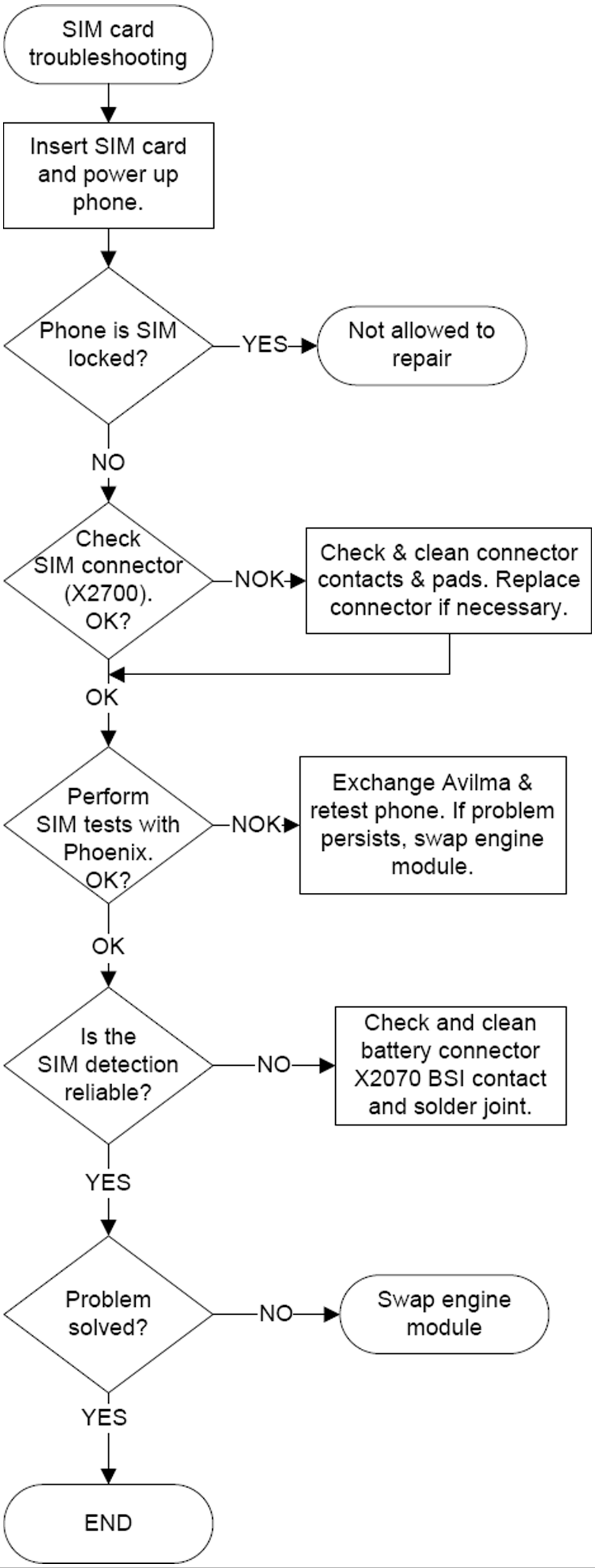
USB troubleshooting

Troubleshooting flow

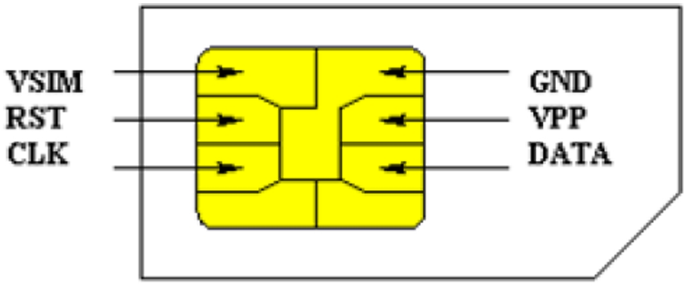


SIM card troubleshooting

Troubleshooting flow



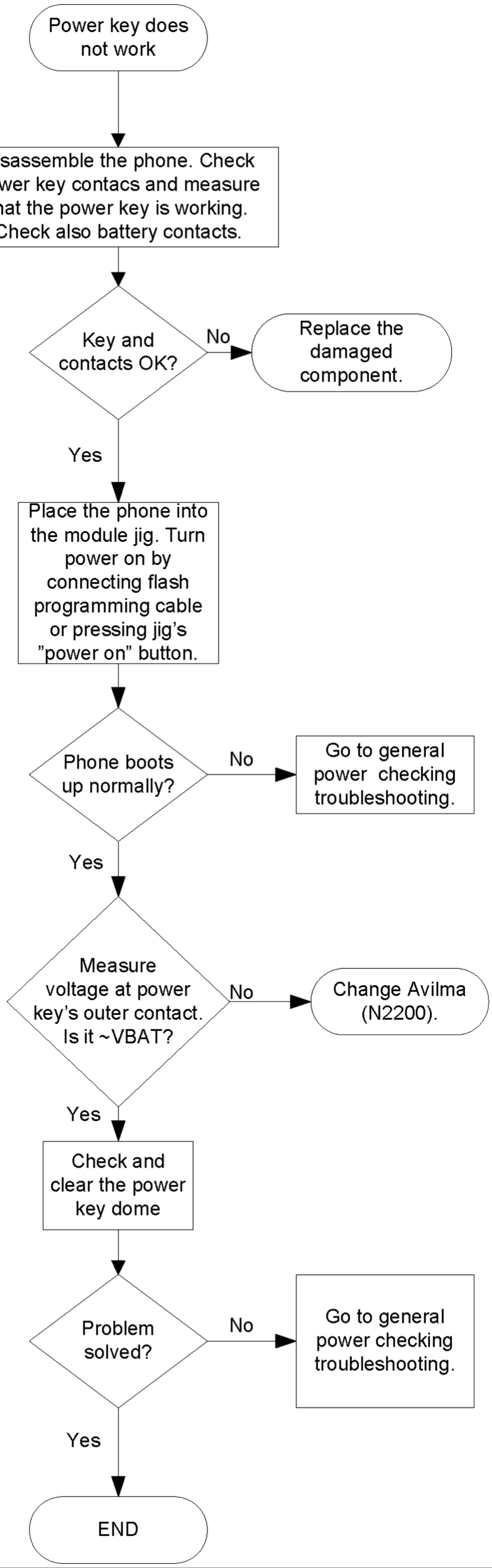
Use module jig when measuring SIM signals. The SIM connector X2700 pins are used as measuring points.



SIM contacts

Power key troubleshooting

Troubleshooting flow



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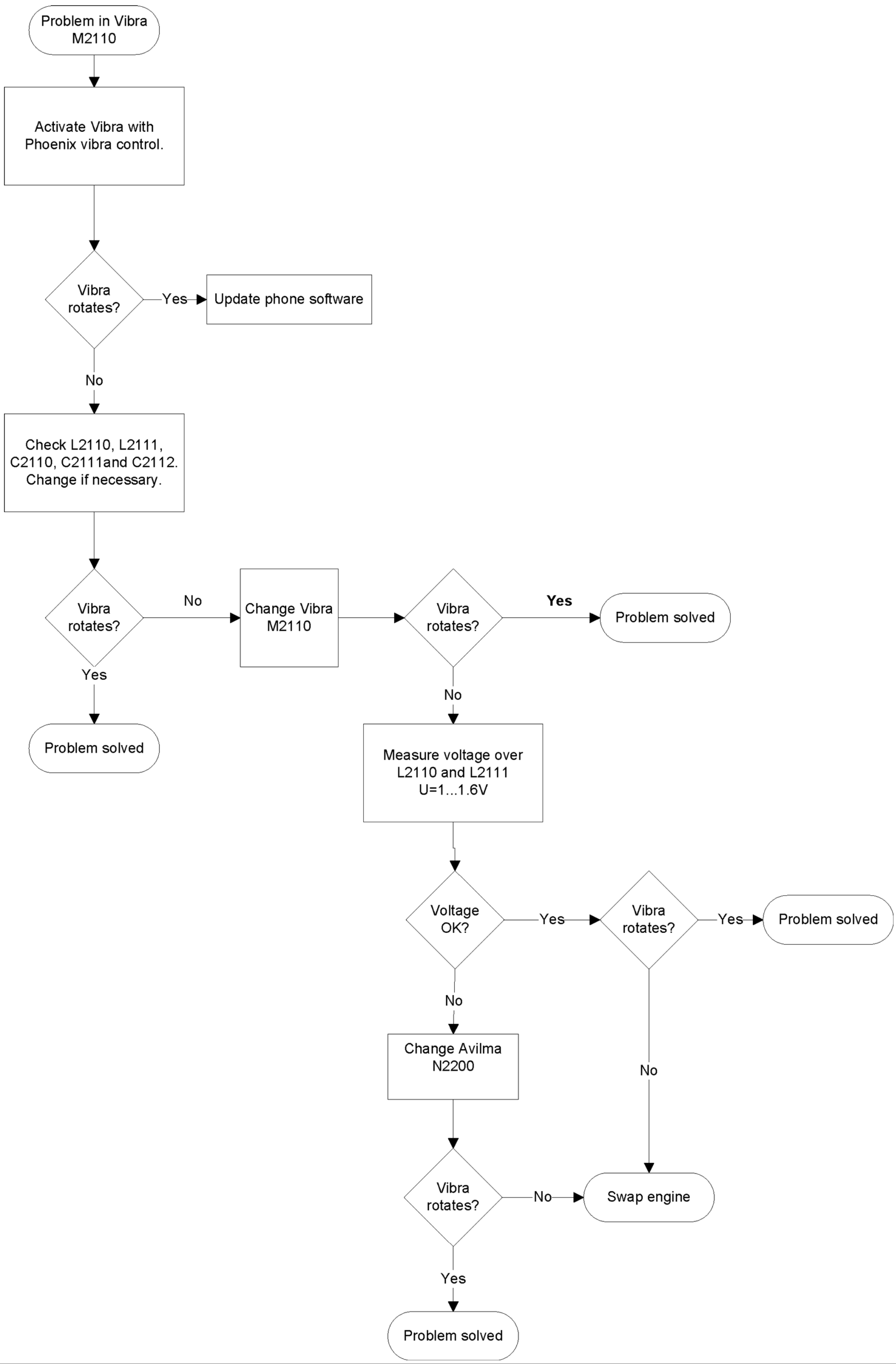
Vibra troubleshooting

Troubleshooting flow

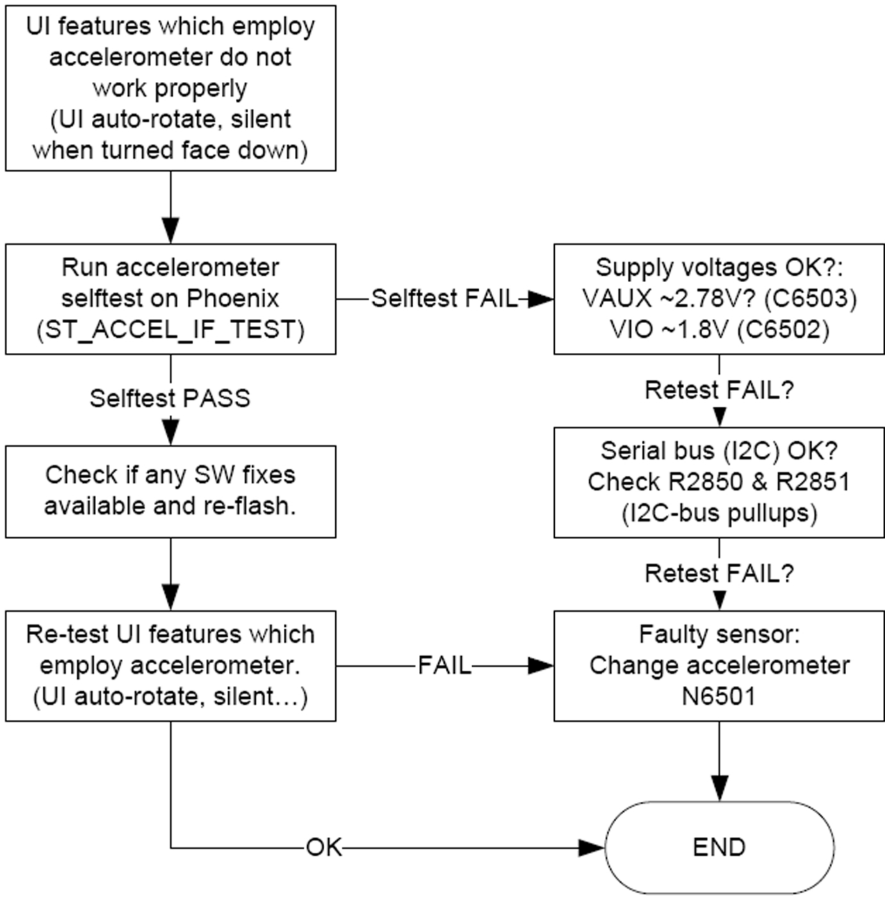


Accelerometer troubleshooting

Troubleshooting flow

Accelerometer selftest: (ST_ACCEL_IF_TEST) verifies the digital parts and the sensor elements inside the component. Selftest is available in LOCAL and TEST modes.

Note! The phone needs to be stable when running the selftest to get correct results. If changes in acceleration are detected by component during the test, it may cause the selftest to fail.



Touch screen troubleshooting

Introduction to touch screen troubleshooting

RM-588 has a resistive touch screen user interface, which means that the device does not have a traditional ITU-T keypad. The key components of the touch screen user interface are:

- Touch window with touch controller (TSC2004)
- Proximity sensor

The resistive touch window is located above the display. It enables finger as well as stylus touch, and it provides tactile feedback. The tactile feedback is implemented by using the same vibra that is used for alerting. The touch controller includes drivers and the control logic to measure touch pressure.

The proximity sensor is attached to the upper flex assembly. It sends out a beam of IR light, and then computes the distance to any nearby objects from the characteristics of the returned (reflected) signal. There is a boot between the sensor and the touch window, which isolates the IR transmitter from the IR receiver by preventing the reflection from the touch window surface.

Proximity sensor troubleshooting

Context

Proximity sensor troubleshooting is broken down into two parts. The main purpose of the automatic check is to identify the fault automatically without any manual checks. If the automatic flow does not provide enough information, a manual check can be done to narrow down the cause of the fault.

Troubleshooting flow

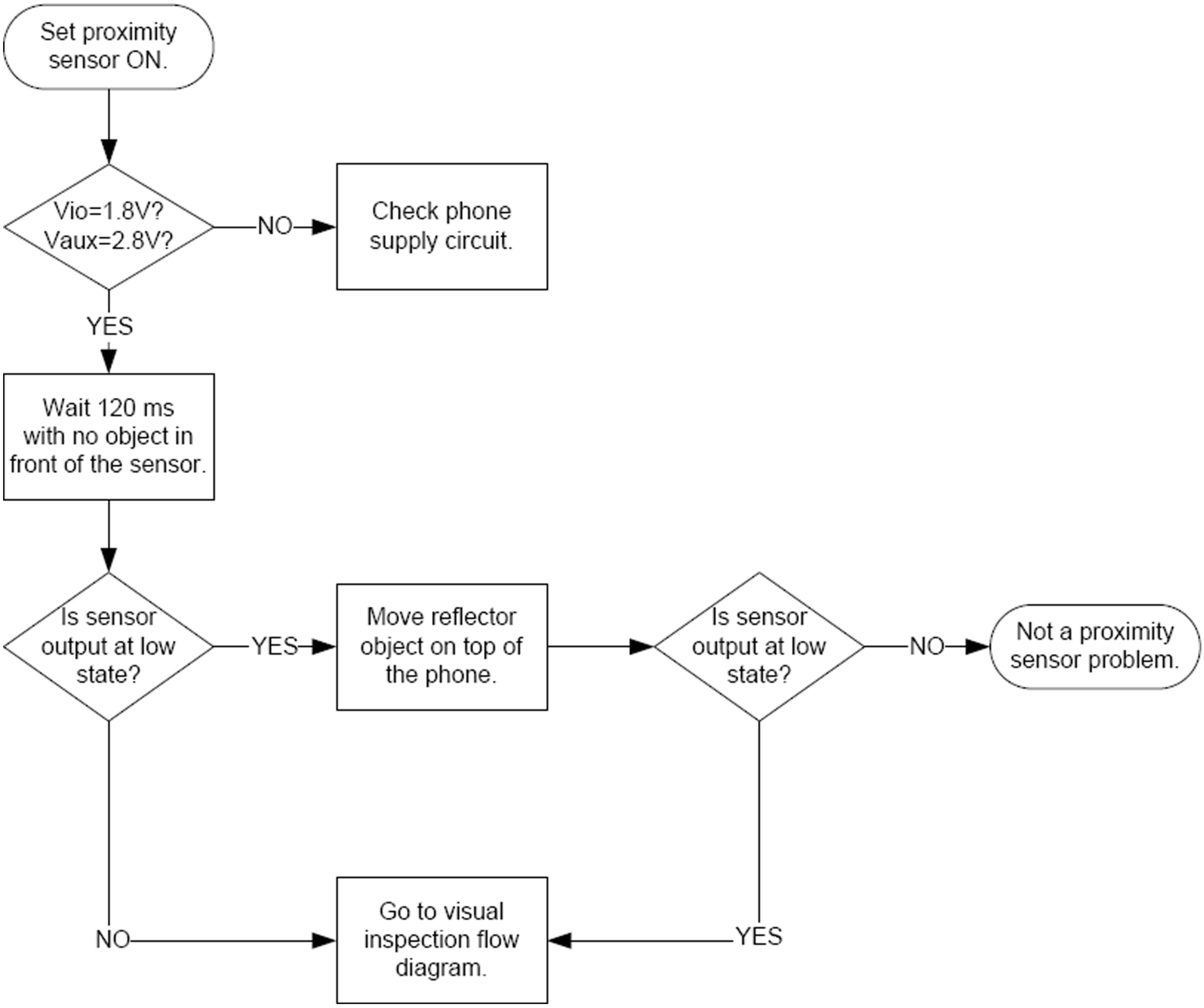


Figure 10 Proximity sensor troubleshooting - part 1

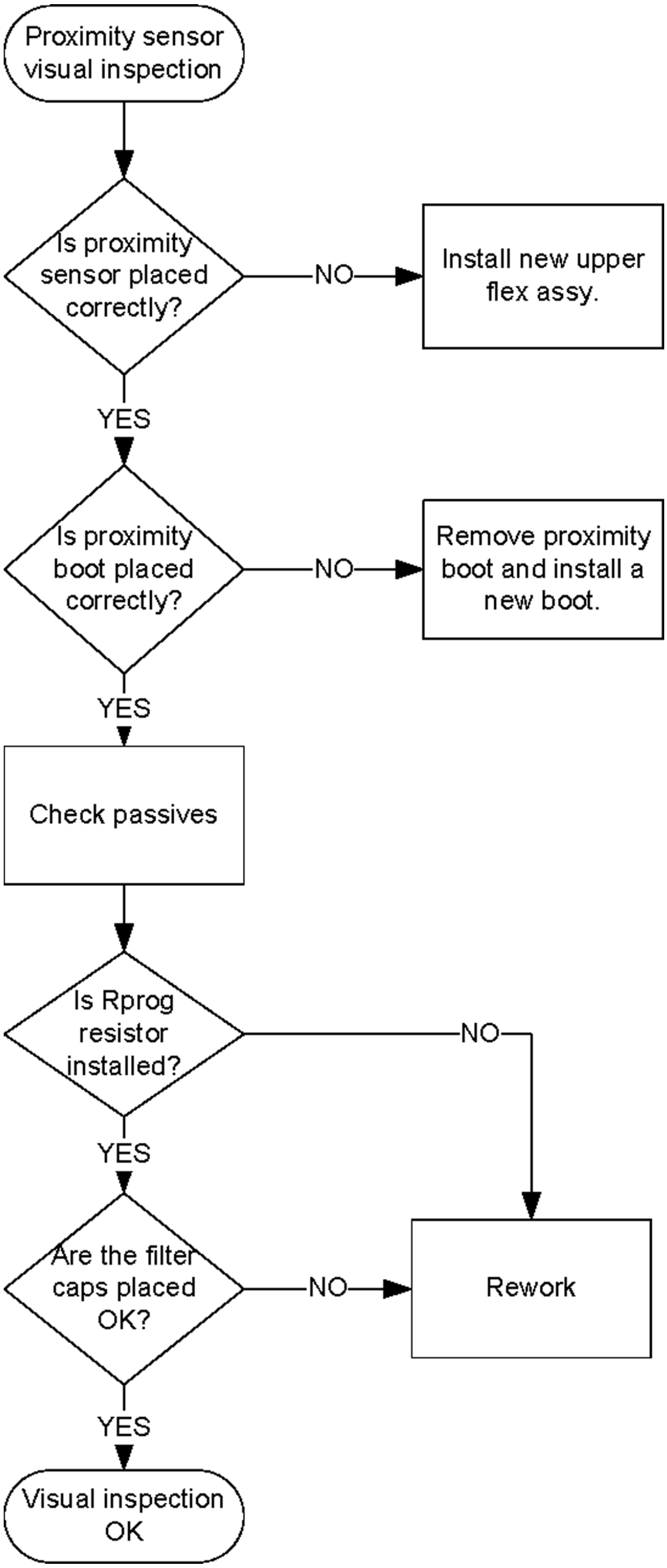


Figure 11 Proximity sensor troubleshooting - part 2

Resistive touch screen troubleshooting

Troubleshooting flow

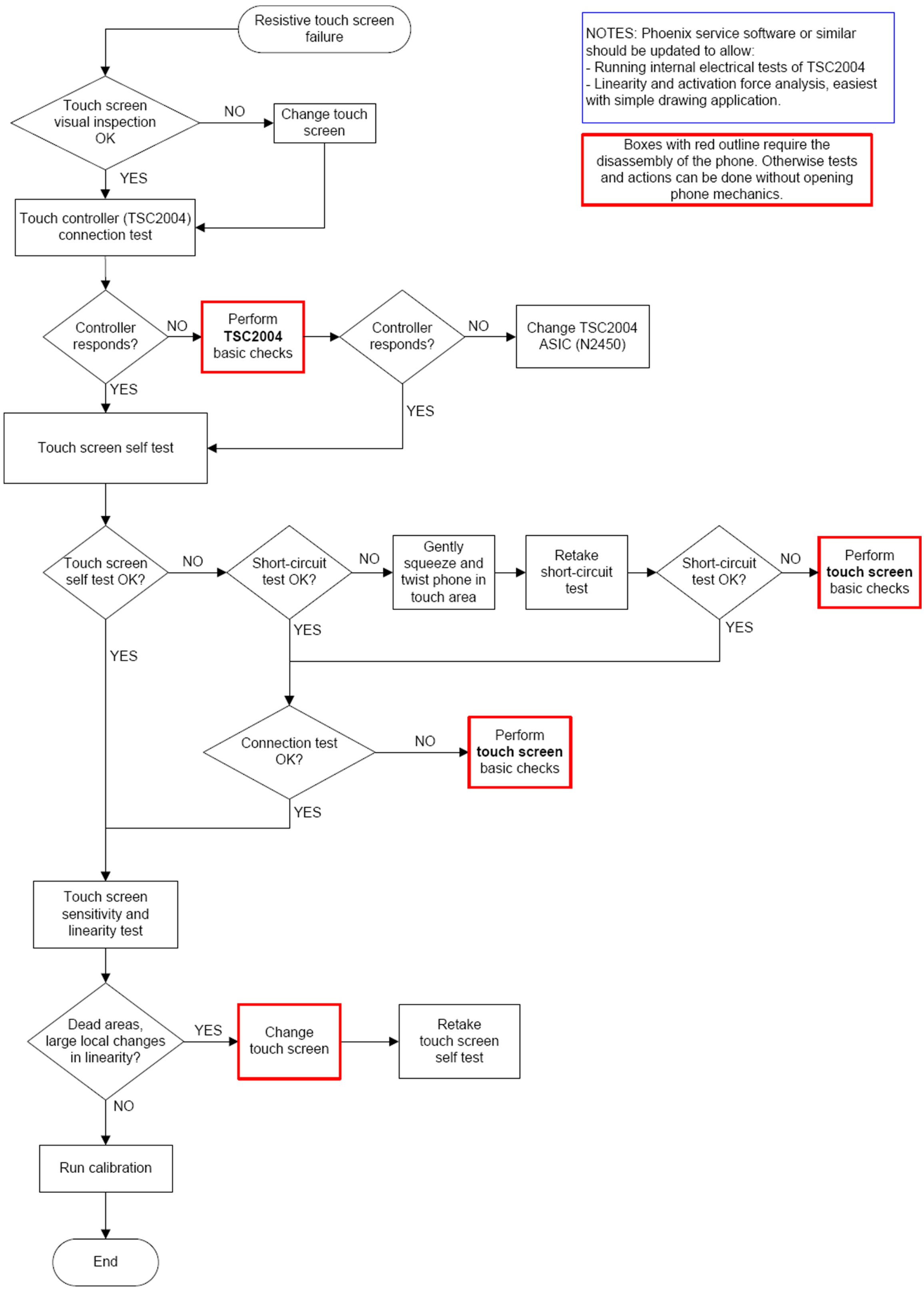


Figure 12 Resistive touch screen troubleshooting

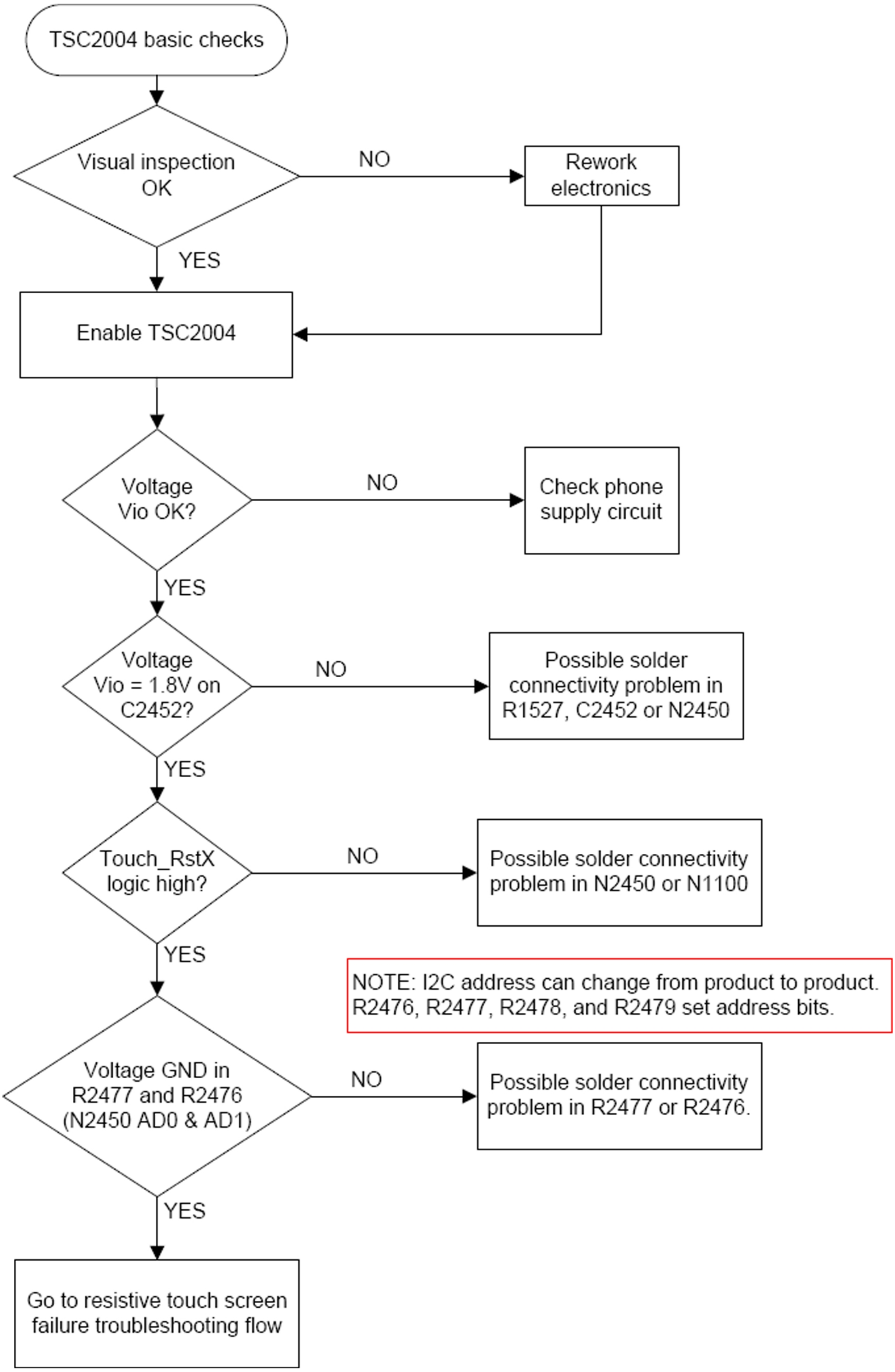


Figure 13 Touch controller basic checks

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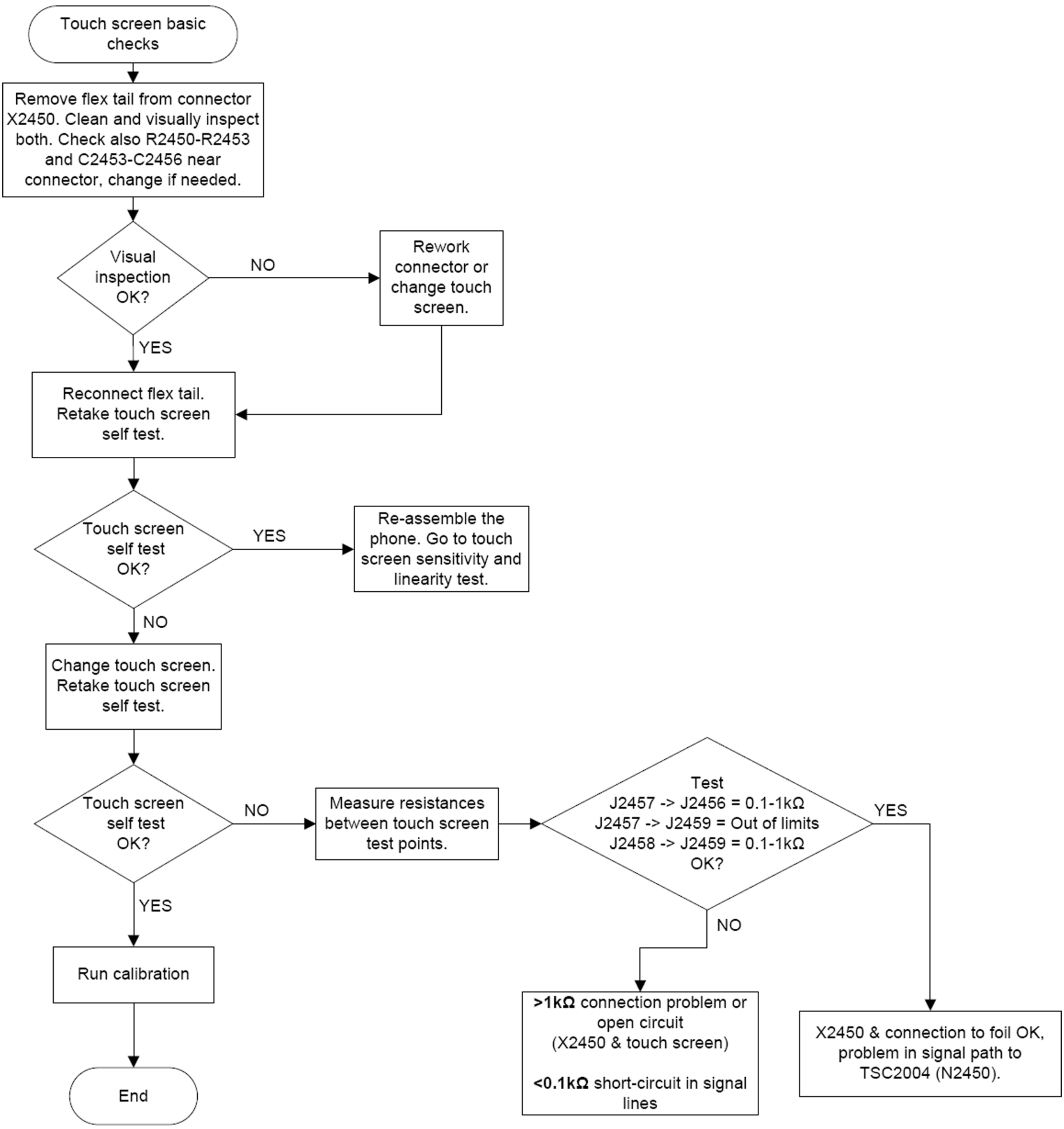


Figure 14 Touch screen basic checks

Hardware keys troubleshooting

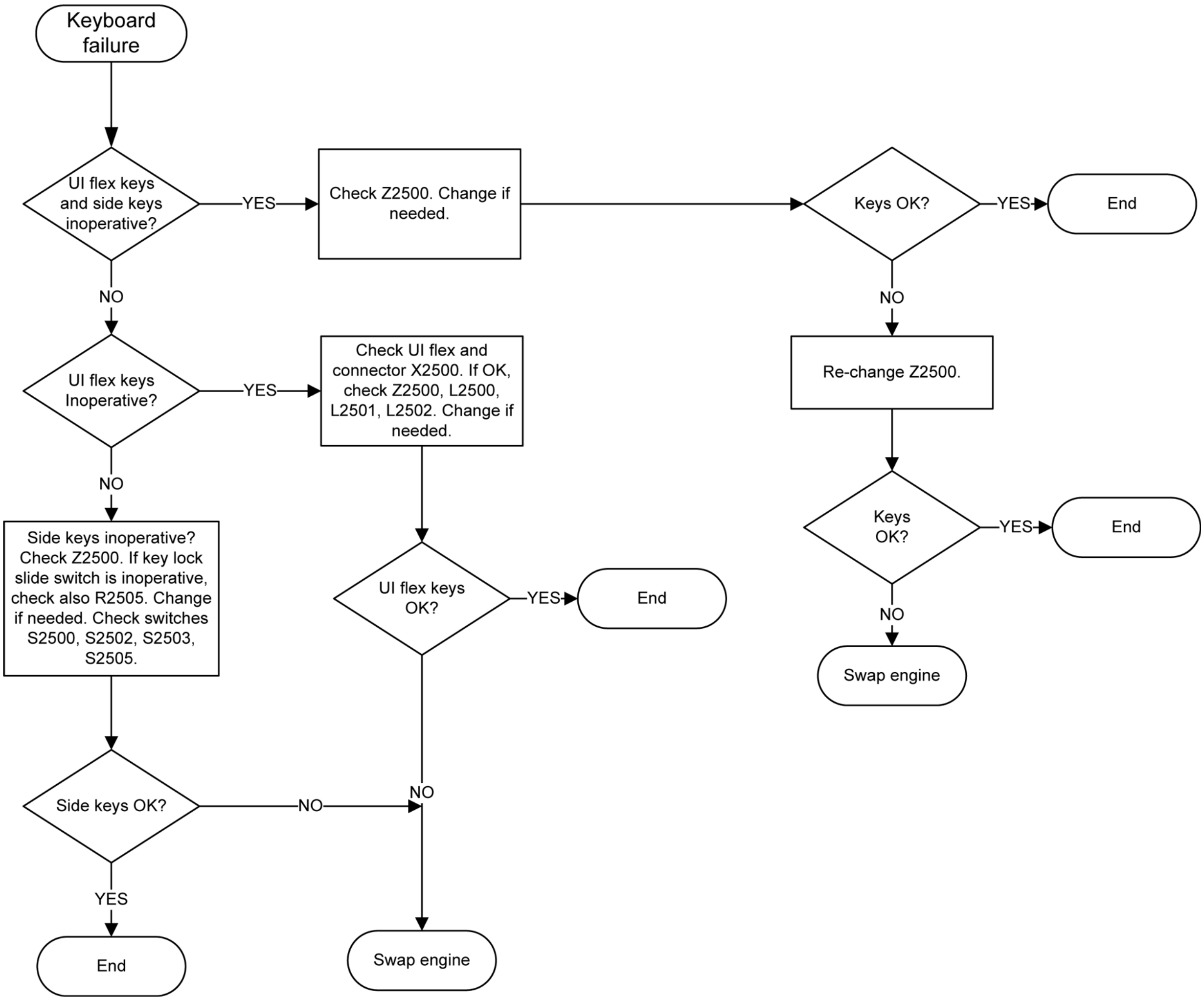
Context

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 (shortcircuit or open connection).

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

Troubleshooting flow



Display module troubleshooting

General instructions for display troubleshooting

Context

- The 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. The 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 a part of the image can be missing. If a part of the 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.
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 following table.

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.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   Note: The display module cannot be repaired.

2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
   - iii Read the phone information to check that the engine is functioning normally (you should be able to read the Phone ID).
3. Proceed to the display troubleshooting flowcharts.

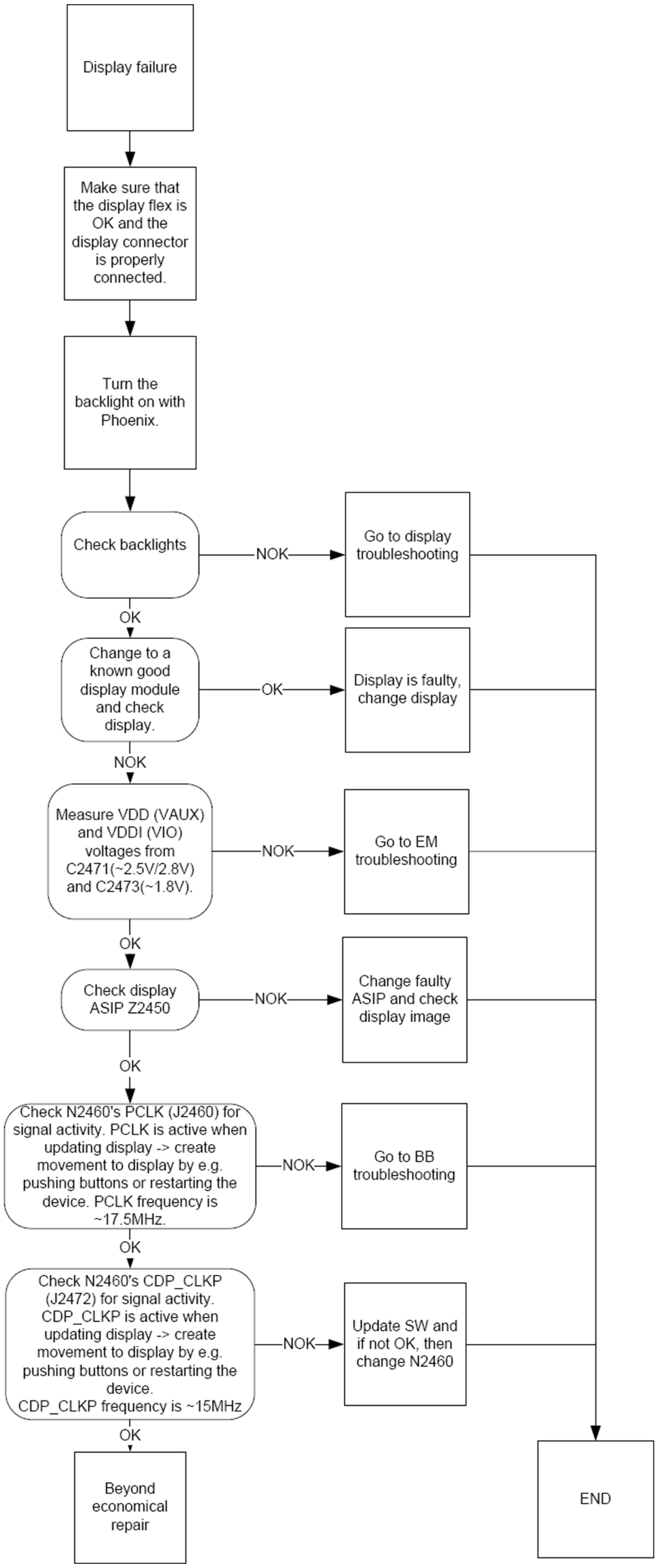
   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Context

Before going to display troubleshooting flow, make sure that the engine is working and starting up correctly. If the problem is in the engine, go to baseband troubleshooting.

Troubleshooting flow



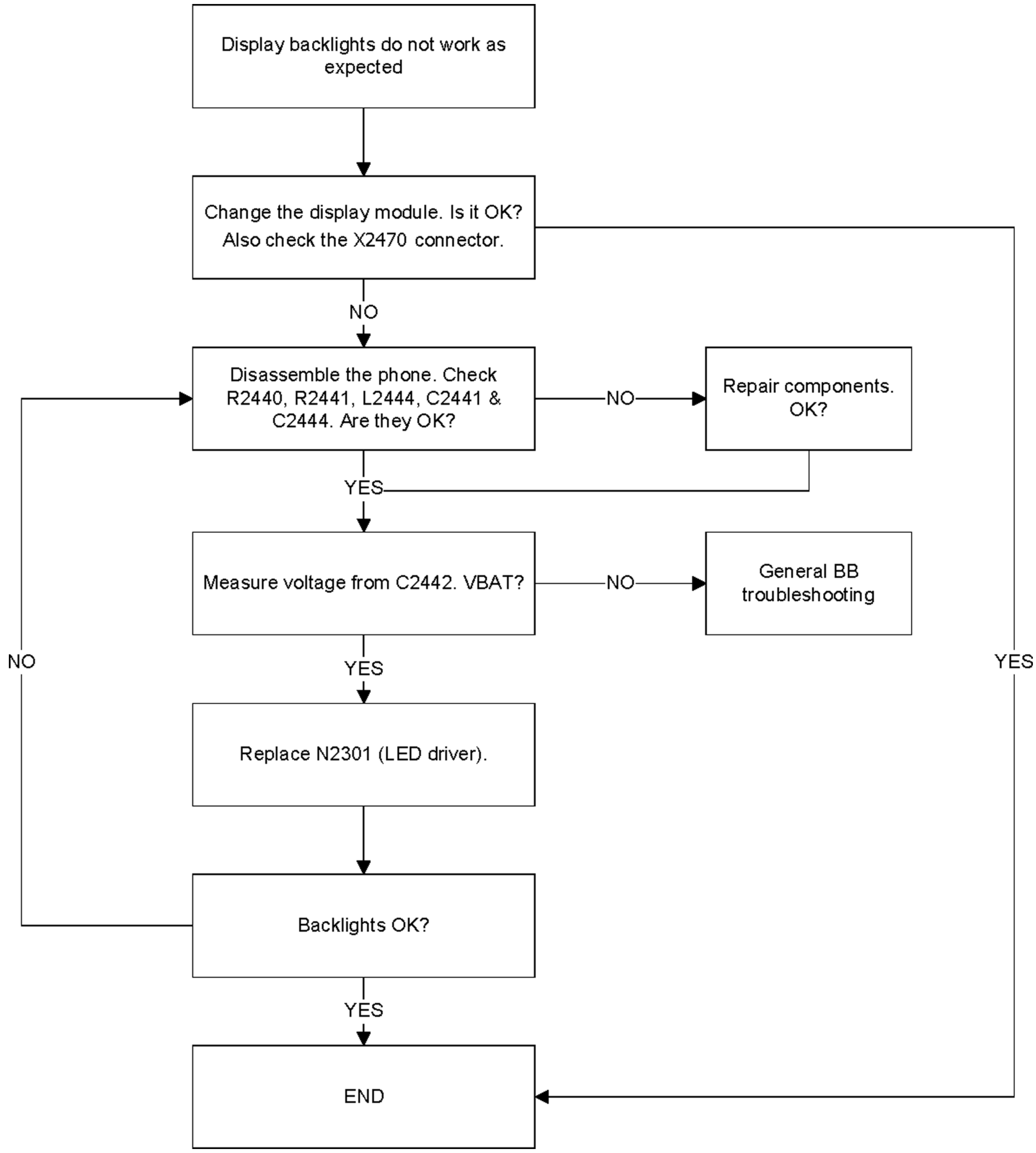
Display backlights troubleshooting

Context

The device has two LED drivers. One of the drivers provides current for the display backlights. The display backlights can be turned ON (100% max.) and OFF (0%) with PWM.

The other LED driver provides current for the keyboard backlights. The keyboard LEDs can be turned ON/OFF separately.

Troubleshooting flow

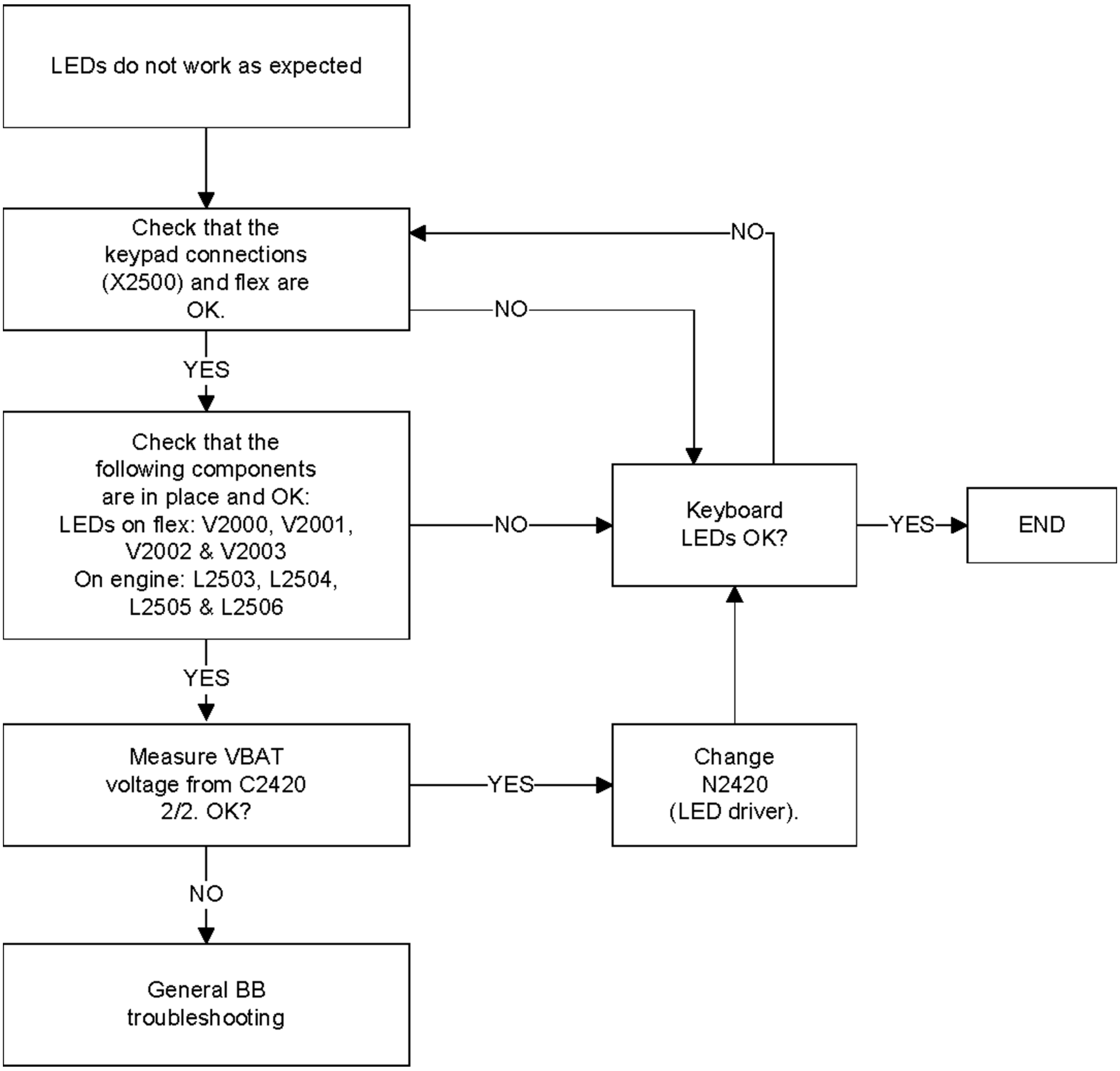


Keyboard LEDs and LED driver troubleshooting

Context

The device has one LED driver that provides current for the keyboard backlights. Brightness can be adjusted manually. Keyboard LEDs can be turned ON/OFF separately.

Troubleshooting flow



GPS troubleshooting

GPS antenna

The GPS antenna is located on the back side of the B-cover (right-hand side, next to the battery).

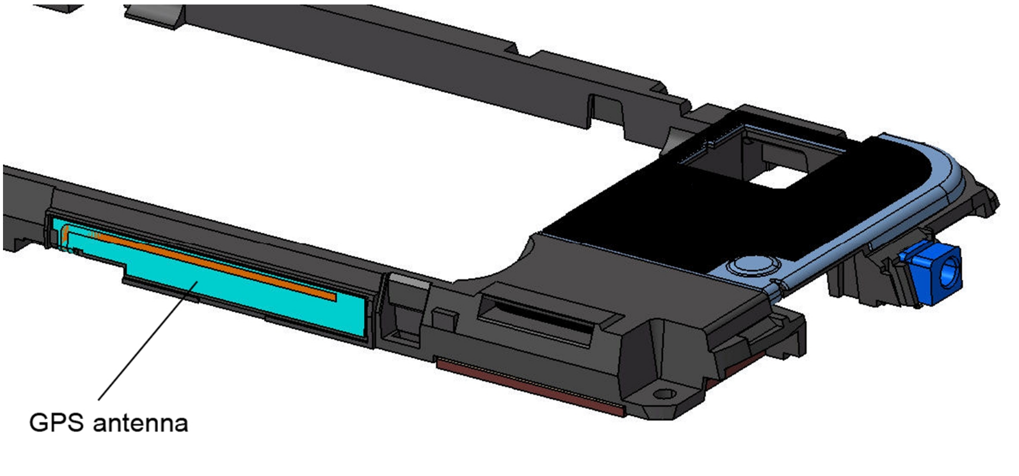


Figure 15 GPS antenna

GPS layout and basic test points

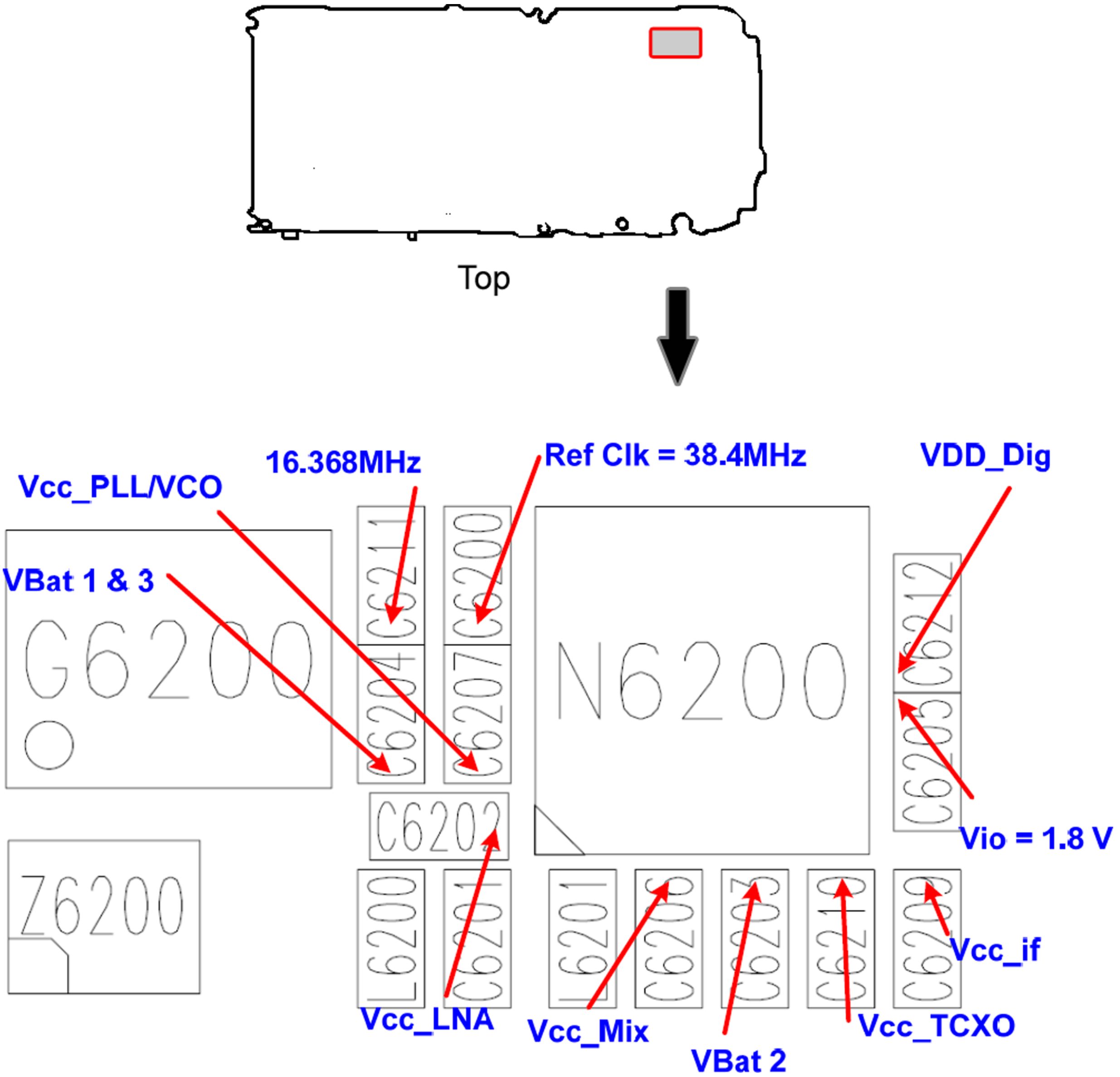


Figure 16 GPS layout and basic test points

VBat, ASIC internal LDO voltages, and clocks are available as shown in figure above. In addition to these, the following GPS signals are available on the test points listed below:

- GPS_En_Reset (J6201)
- U2Tx (J6200, activity on this pin indicates the GPS is operating)

GPS RF test points

The GPS antenna test pads are located on the top side as shown in figure "GPS antenna test pads". Checking for a connection between these two test points will confirm that the antenna is working correctly, as will performing a radiated CW test.

J6280 = GPS Ant

J6281 = GPS Ant Gnd

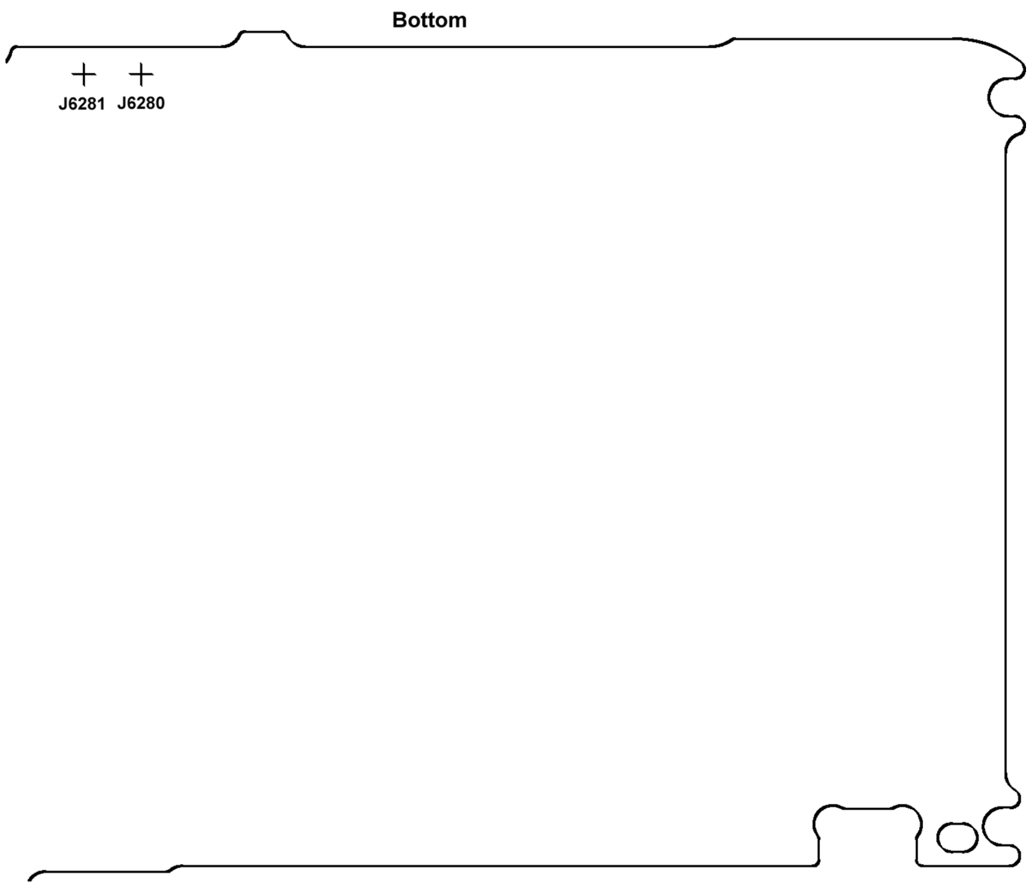


Figure 17 GPS antenna test pads

In order to probe GPS RF test points, inject 1575.52 MHz tone @ -50dBm at the GPS antenna test connector and select **Receiver On**, then probe the GPS RF test points as shown in the figure below. Compare RF levels with a known reference phone.

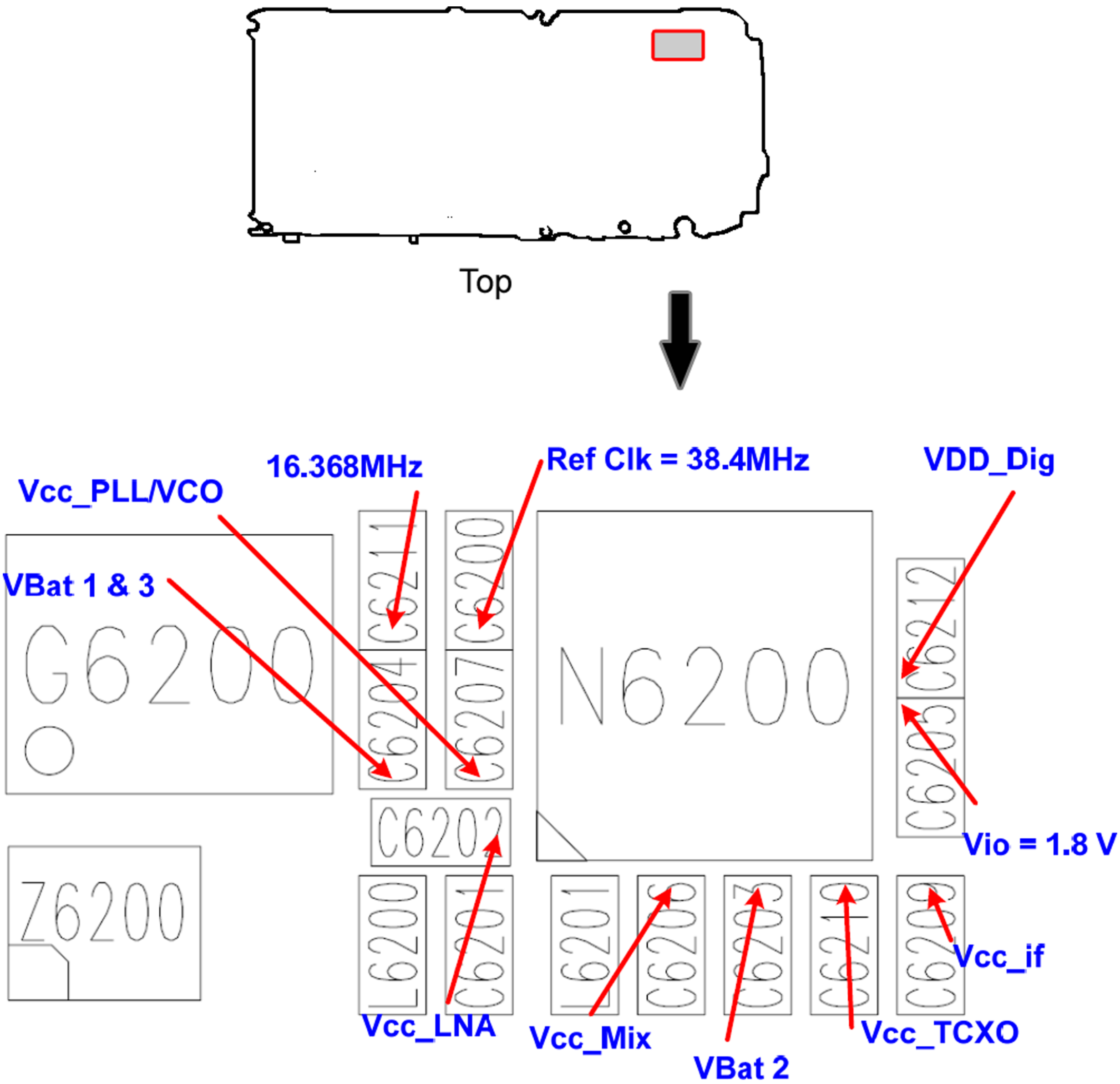


Figure 18 GPS layout and basic test points

GPS settings for Phoenix

GPS control

Context

Use the following to test GPS using Phoenix.

Steps

1. Start Phoenix service software.
2. From the **File** menu, select **Scan Product** and check that the correct product version is displayed.

3. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box, as shown in the figure below, and enables the GPS.

   Select **Idle** to confirm the GPS is enabled and is in idle mode; at this point all clocks should be present, GPS_En_Reset should be high (1.8V), and Vdd_Dig (1.1V), Vcc_TCXO (2.5V) & Vcc_PLL/VCO (1.35V) should be present. Turning **Receiver Action** *On* will turn on all the RF sections of the ASIC and so all LDOs will be on.

   Note: These checks are part of GPS basic checks troubleshooting (page 3–43)

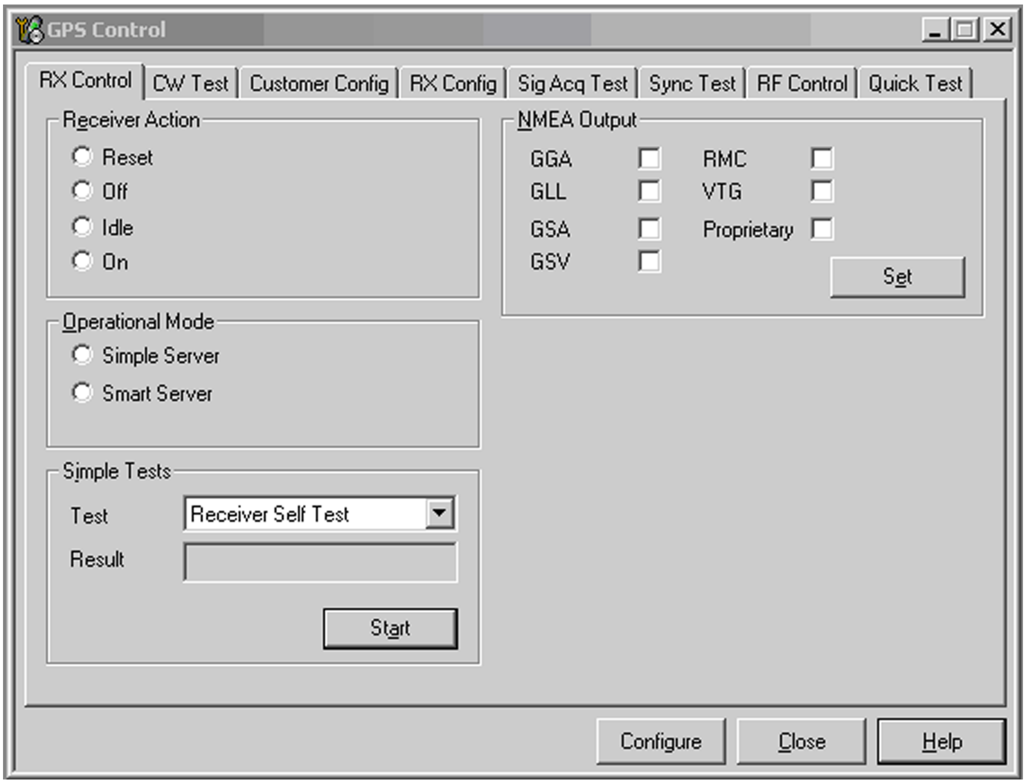


Figure 19 GPS Control dialog box

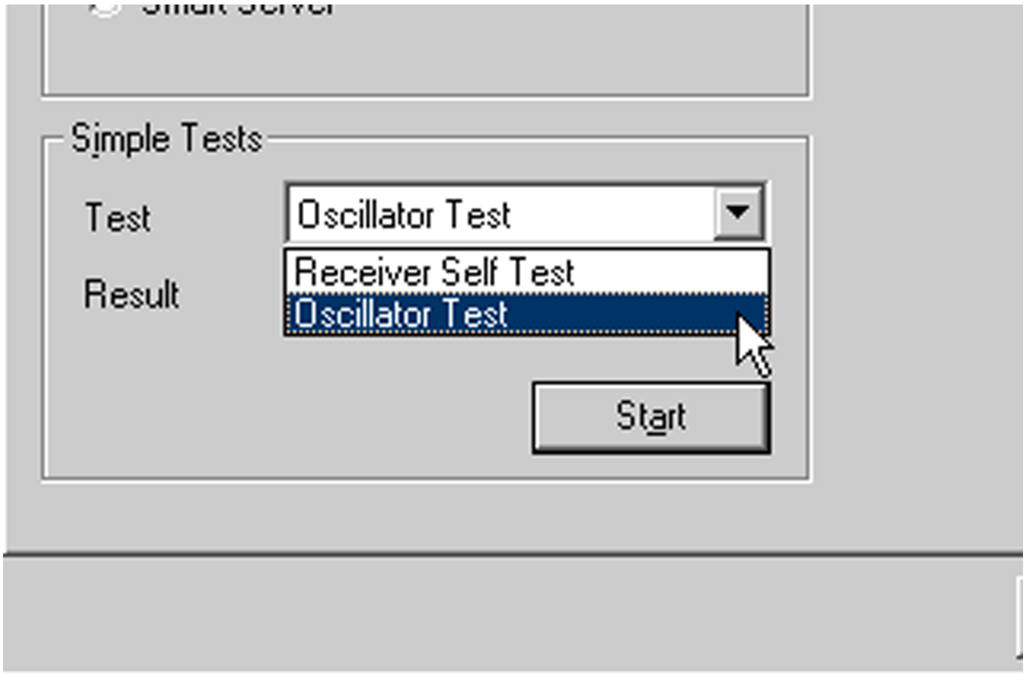


Figure 20 Simple Tests – Oscillator Test & Receiver Self Test

Oscillator test

Context

The 16.368 MHz GPS Clk is compared against the CE Ref Clk and the output is the GPS Clk offset.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *Rx Control* window, go to the **Simple Tests** section, select **Oscillator Test** and click **Start**. The Offset result will be returned and should be within the limits of +- 84Hz.

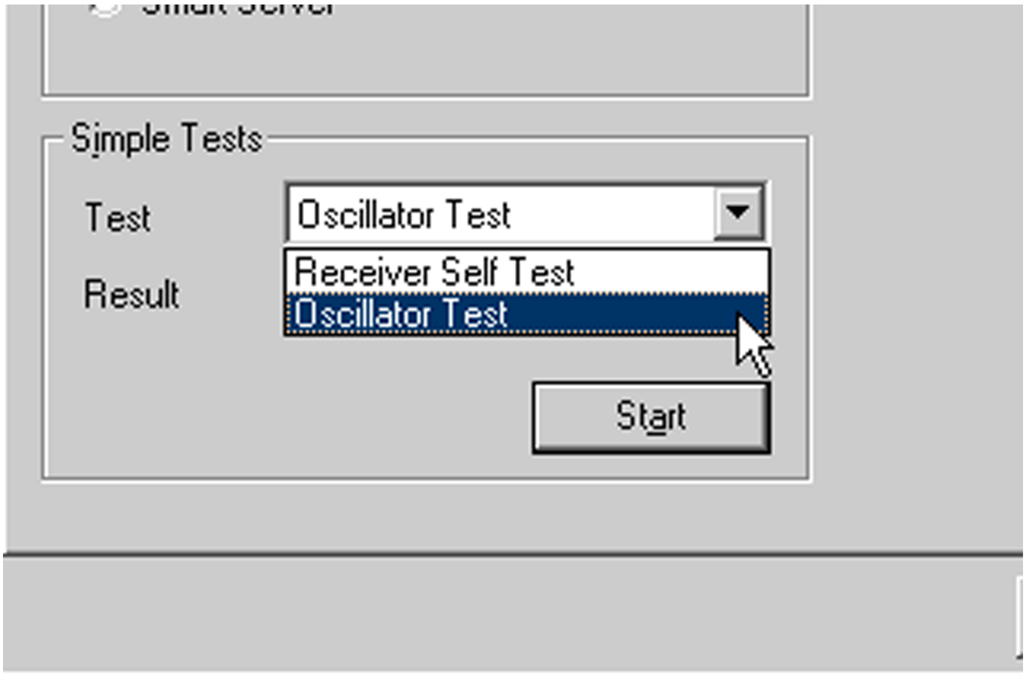


Figure 21 Simple Tests – Oscillator Test

Receiver self test

Context

Receiver self test can be used to check the correct functionality of the receiver core. For the test, GPS software configures internal test source to generate synthetic GPS-like data, processing it in the baseband and writing the results into the channel processor memory. The test compares the data in the channel memory against the expected value and reports a PASS/FAIL status.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *Rx Control* window, go to the **Simple Tests** section, select **Receiver Self Test** and click **Start**. The test returns a PASS/FAIL result.

   > **Note:** The Oscillator Test should not be run after the Receiver Self Test. This sequence of tests may cause the Oscillator test to prolong and result in Phoenix timing out. If you are carrying out both of these tests, run the Oscillator Test first, after which you can run the Receiver Self Test.

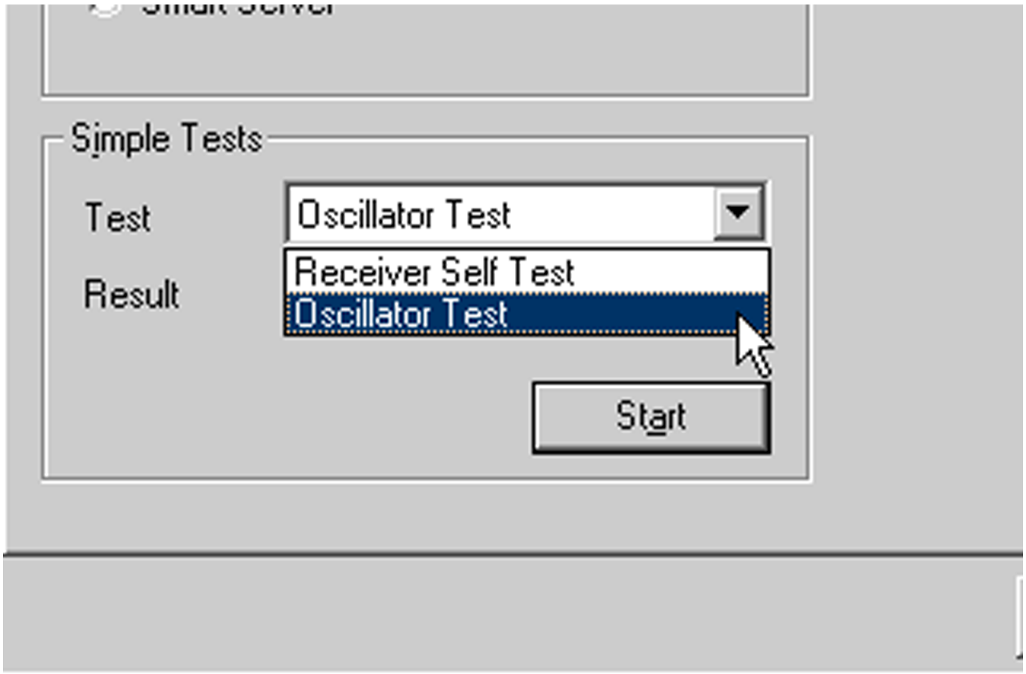


Figure 22 Simple Tests – Receiver Self Test

CW Test

Context

This test reports the SNR of a CW signal input to the GPS antenna port.

Steps

1. Start Phoenix service software.
2. From the **Testing** menu, select **GPS Control**. This opens up *GPS Control* dialogue box and enables the GPS.

   In the *CW Test* window, ensure the input settings are as shown in the figure below. Inject 1575.52 MHz tone at the GPS antenna test connector at a level of -110dBm and click **Start**.

   For Pin = -110dBm and negligible other losses, the expected result ranges are:

   - Galvanic 29.8dB to 38.1dB
   - Radiated 25.8dB to 38.1dB

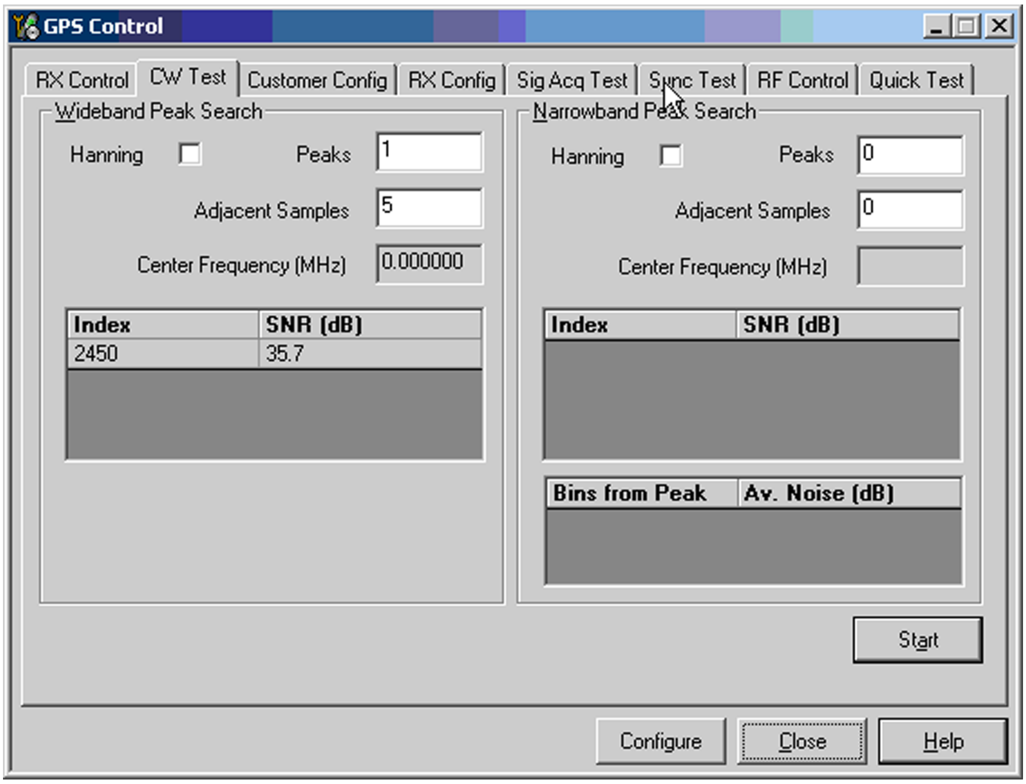


Figure 23 CW Test window

Quick Test window

Because the *Quick Test* runs the *Receiver Self Test* before the *Oscillator Test*, it may cause a timeout on the *Oscillator Test*. It does not necessarily mean that Oscillator Test has failed, but carrying out the Oscillator Test (page 3–38), Receiver Self Test (page 3–39) and CW Test (page 3–40) individually will give more valid results.

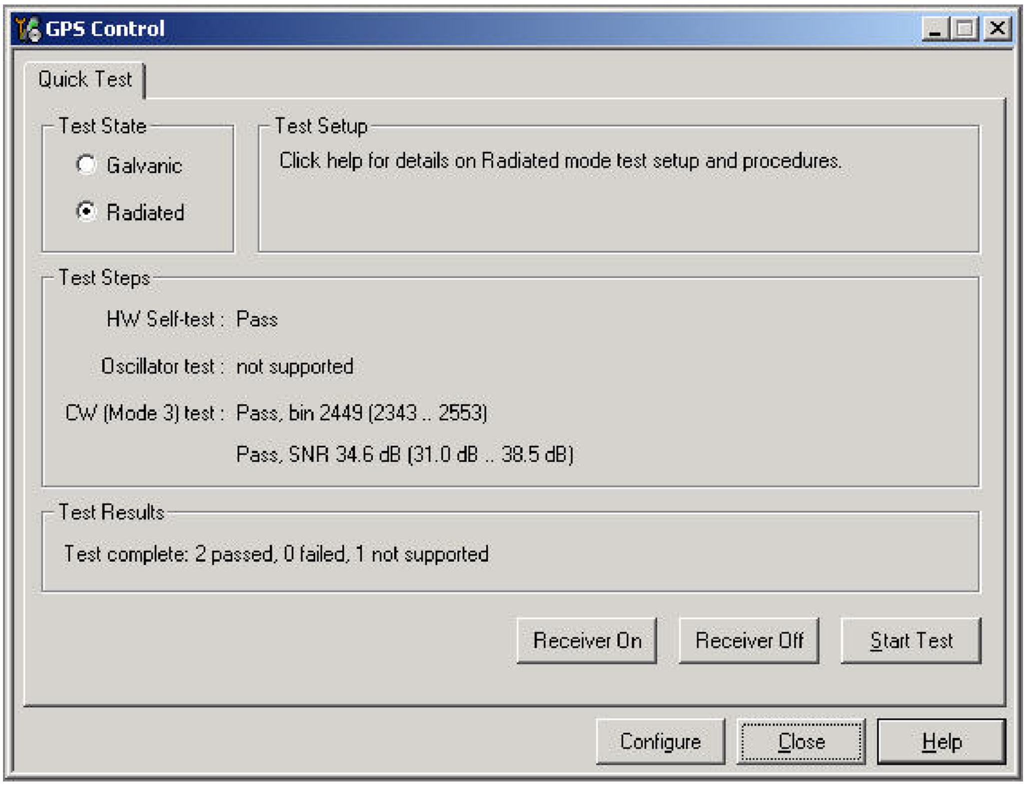


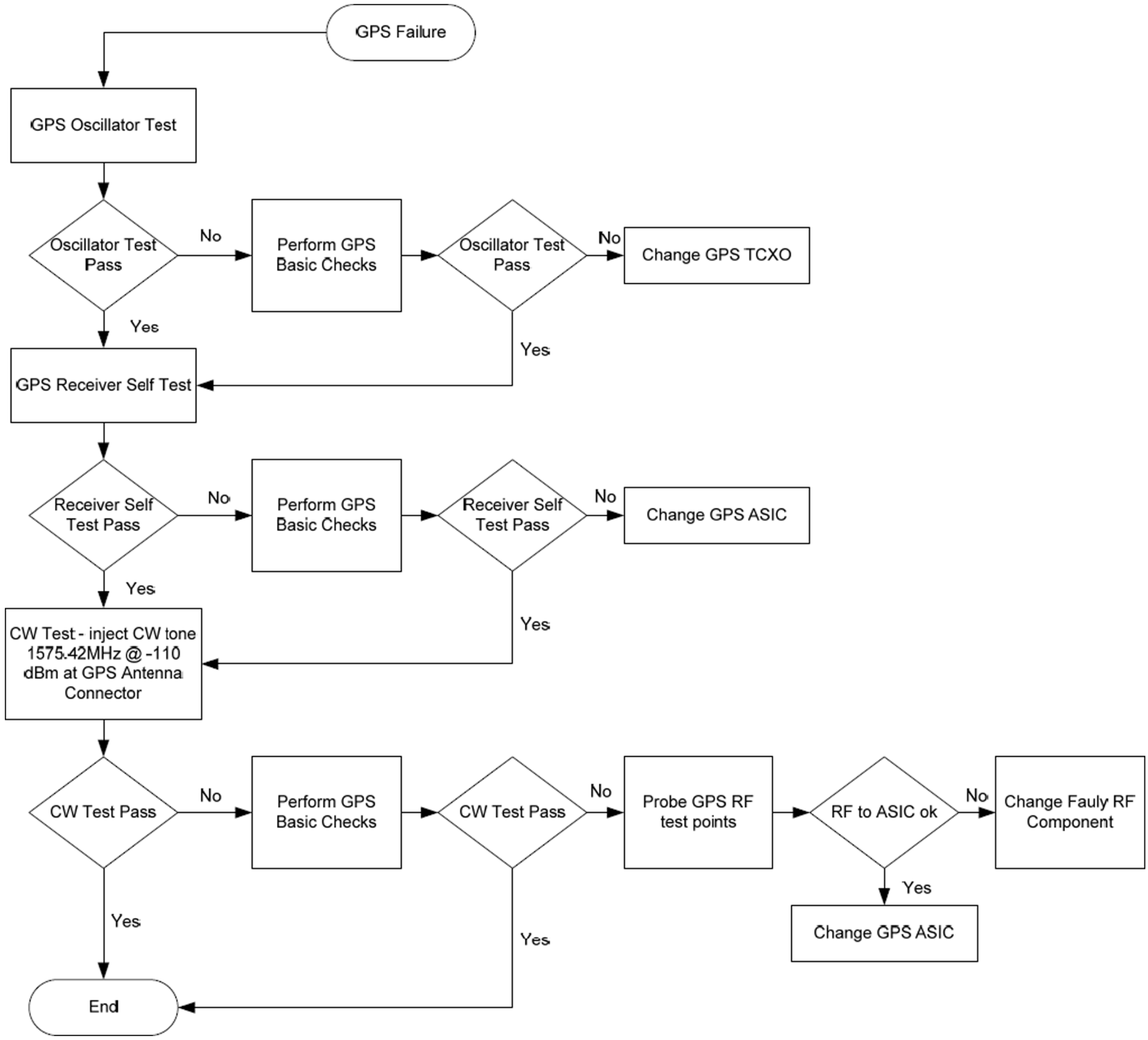
Figure 24 GPS Quick Test window for GPS troubleshooting

GPS failure troubleshooting

Context

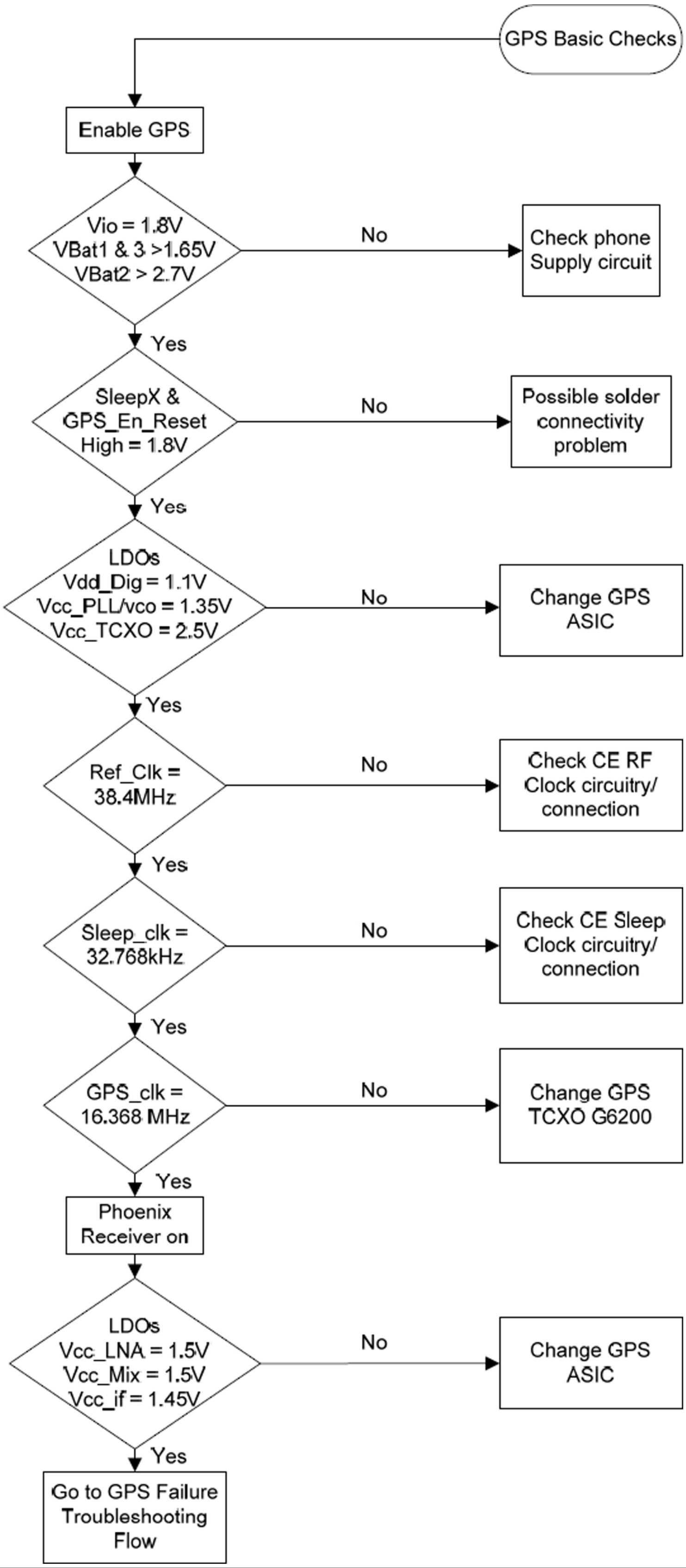
GPS troubleshooting is broken down into two parts: General GPS failure & GPS basic checks. The GPS failure troubleshooting flow can be followed and, where applicable, will feed into the basic checks troubleshooting flow.

Troubleshooting flow



GPS basic checks troubleshooting

Troubleshooting flow



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Bluetooth and FM radio

Bluetooth and FM radio introduction

The Bluetooth and FM radio are combined in the same ASIC, so both features are checked when troubleshooting. The following problems can occur with the Bluetooth and FM radio hardware:

Symptom	Problem	Repair solution
Unable to switch on Bluetooth on phone user interface.	Open circuit solder joints or component failure of BTH/ FM ASIC/module BB ASICs or SMD components.	Replacement of Bluetooth/FM ASIC/ module.
Able to send data file to another Bluetooth device, but unable to hear audio through functional Bluetooth headset.	Open circuit solder joints or component failure of BTH/ FM ASIC/module BB ASICs (PCM interface).	Replacement of Bluetooth/FM ASIC/ module.
Able to turn on Bluetooth on phone user interface, but unable to detect other Bluetooth devices.	Open circuit solder joints or detacted component in Bluetooth antenna circuit.	Repair of Bluetooth antenna circuit.
Able to turn on FM radio and Bluetooth on phone user interface, but unable to detect local FM radio stations with FM headset inserted.	Open circuit solder joints or detached component in FM antenna circuit.	Repair of FM antenna circuit.
Able to perform scans to detect local FM radio stations with functional FM headset inserted, but unable to hear FM audio through headset.	Open circuit solder joints or detached component in FM audio path between Bluetooth/FM ASIC and headset.	Repair of FM audio circuit.

Bluetooth and FM radio component placement

The figure below shows the key component placement for BTHFMRDS2.2D in RM-588.

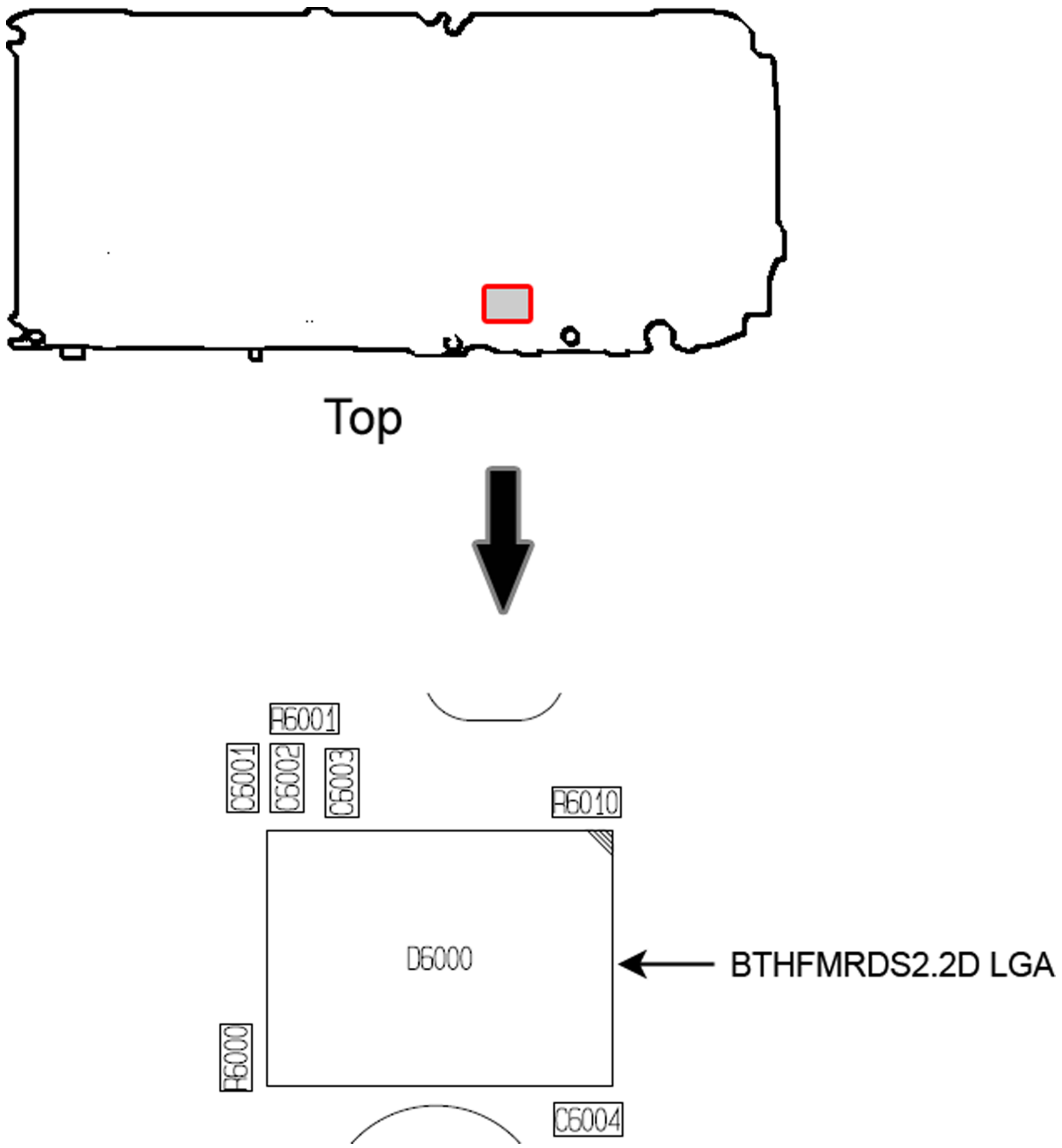


Figure 25 Key component placement for BTHFMRDS2.2D

The Bluetooth antenna is attached to the side of the B-cover.

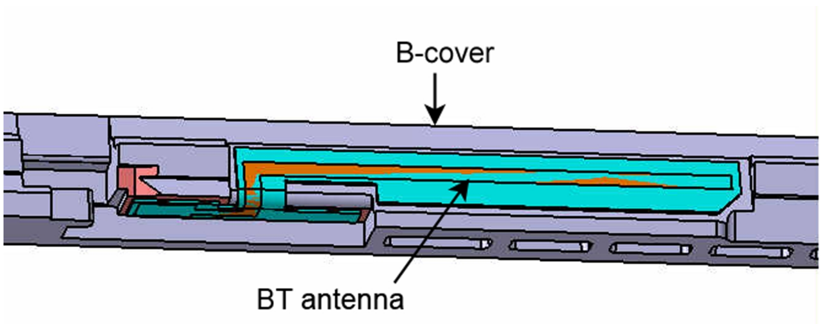


Figure 26 BT antenna

The FM radio audio signal is routed to the headset connector through the BB ASIC shared by the phone audio functions.

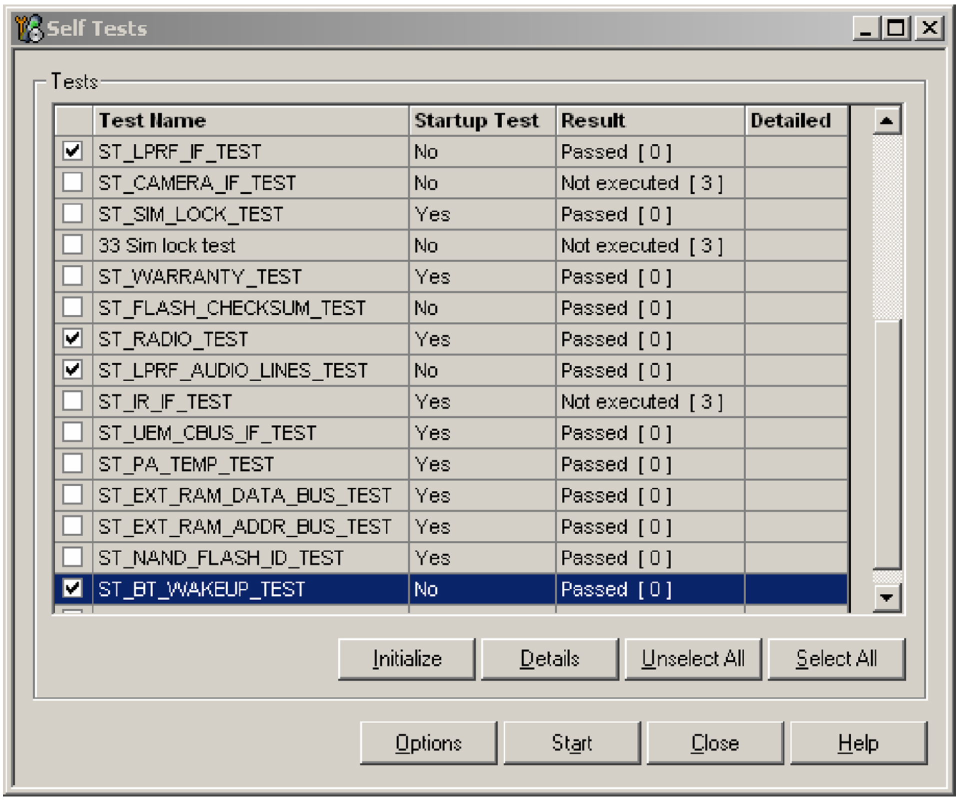
Bluetooth and FM Radio Self Tests

Context

A flash adapter (or phone data cable) connected to a PC with Phoenix service software is required.

Steps

1. Place the phone in the flash adapter.
2. Start Phoenix service software.
3. Choose File → Scan Product.
4. From the Mode drop-down menu, set to Local.
5. Choose Testing → Self Tests.
6. In the Self Tests window check the following Bluetooth and FM Radio tests:
   - ST_LPRF_IF_TEST
   - ST_LPRF_AUDIO_LINES_TEST
   - ST_BT_WAKEUP_TEST
   - ST_RADIO_TEST
7. To run the test, click Start



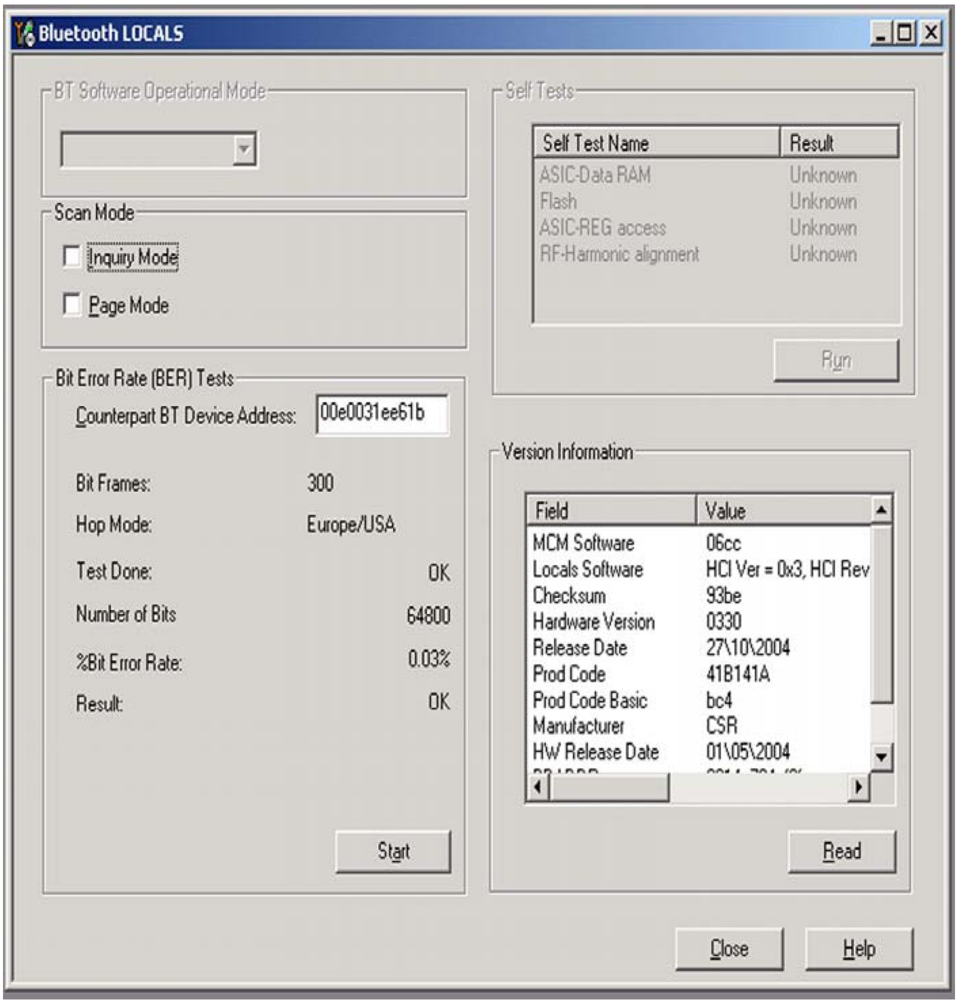
Bluetooth BER test

Context

JBT-9 or SB-6 Bluetooth test box (BT box) is required to perform a BER test. If a BT box is not available, Bluetooth functionality can be checked by transferring a file to another Bluetooth phone.

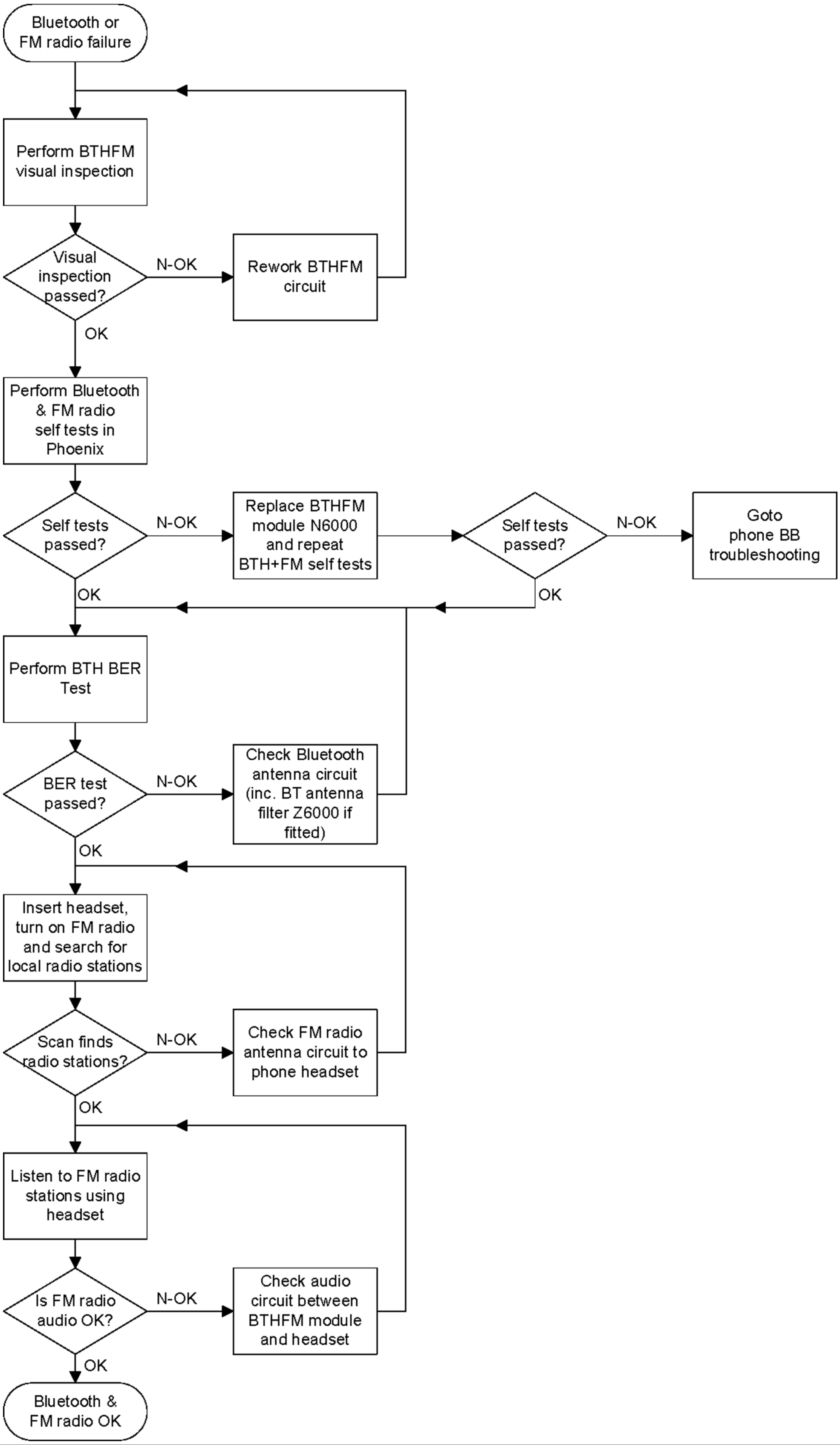
Steps

1. Place the phone in the flash adapter.
2. Start Phoenix service software.
3. Choose **File** → **Scan Product**.
4. Choose **Testing** → **Bluetooth LOCALS**
5. Locate the BT-box serial number (12 digits) found in the type label on the back of the JBT-3, JBT-6, JBT-9, or SB-6 Bluetooth test box.
6. In the Bluetooth LOCALS window, write the 12-digit serial number on the **Counterpart BT Device Address** line.
7. Place the BT-box near (within 10 cm) of the phone and click **Run BER Test**.



Bluetooth and FM radio module troubleshooting

Troubleshooting flow



Audio troubleshooting

Audio troubleshooting test instructions

Single-ended external earpiece and differential 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. Exception to this is a digital microphone, which needs input signal from an external sound source (laptop speaker) to playback eg. 1kHz sine wave from 5cm distance.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V
- Sound source (laptop speaker or B&K type 4231 calibrator)

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
- HP microphone to External earpiece
- Internal microphone is tested using Phoenix self test "ST-DIGIMIC-TEST". If the test result is PASS, the microphone is electrically OK.

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]	Output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Earpiece (AV_in to HP_out)	HS_MIC & GND	EarP & GND EarN & GND	-10	1000	310	1.2	NA
External Mic to Internal handsfree (AV_in to IHF_out)	HS_MIC & GND	J2100 J2101	-6	1000			
Digital Mic to External Earpiece (HP_in to AV_out)	Acoustical input, 1kHz sine wave	HS_EAR_L & GND HS_EAR_R & GND	NA	94 dB SPL	100		NA

Measurement data

Earpiece signal

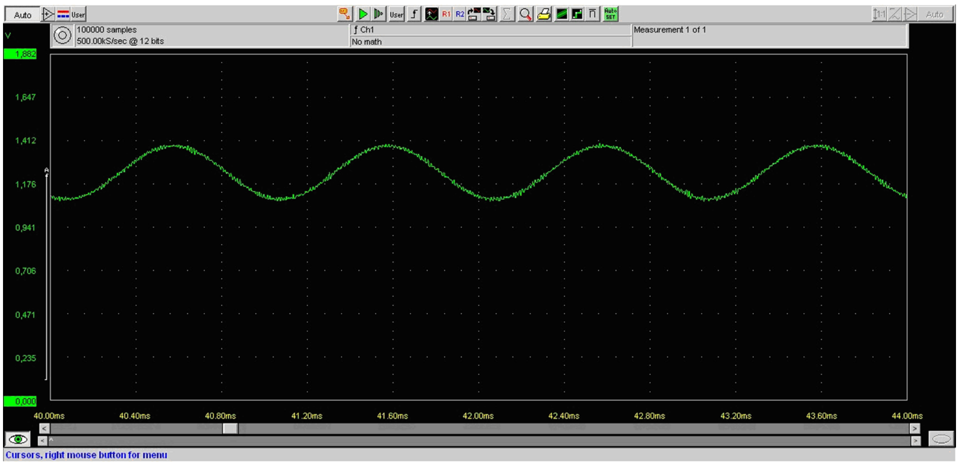


Figure 27 Single-ended output waveform of the AV_in_HP_out measurement when earpiece is connected.

Integrated handsfree signal

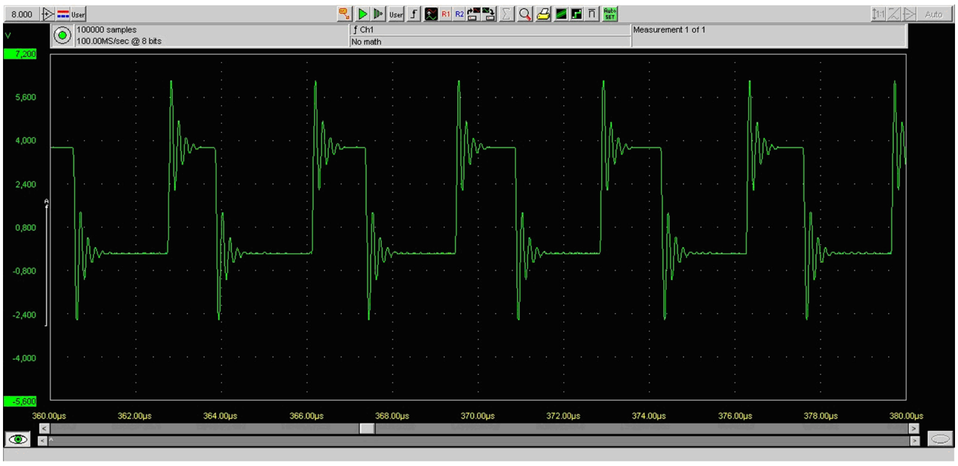


Figure 28 Single-ended output waveform of the AV_in_IHF_out loop measurement when speaker is connected (measured at speaker pads). No filter is used.

External output from AV (acoustic input)

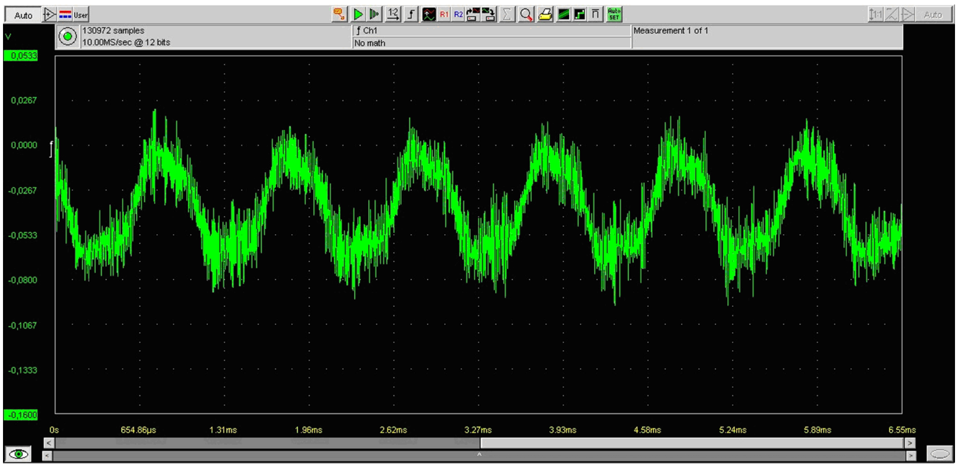
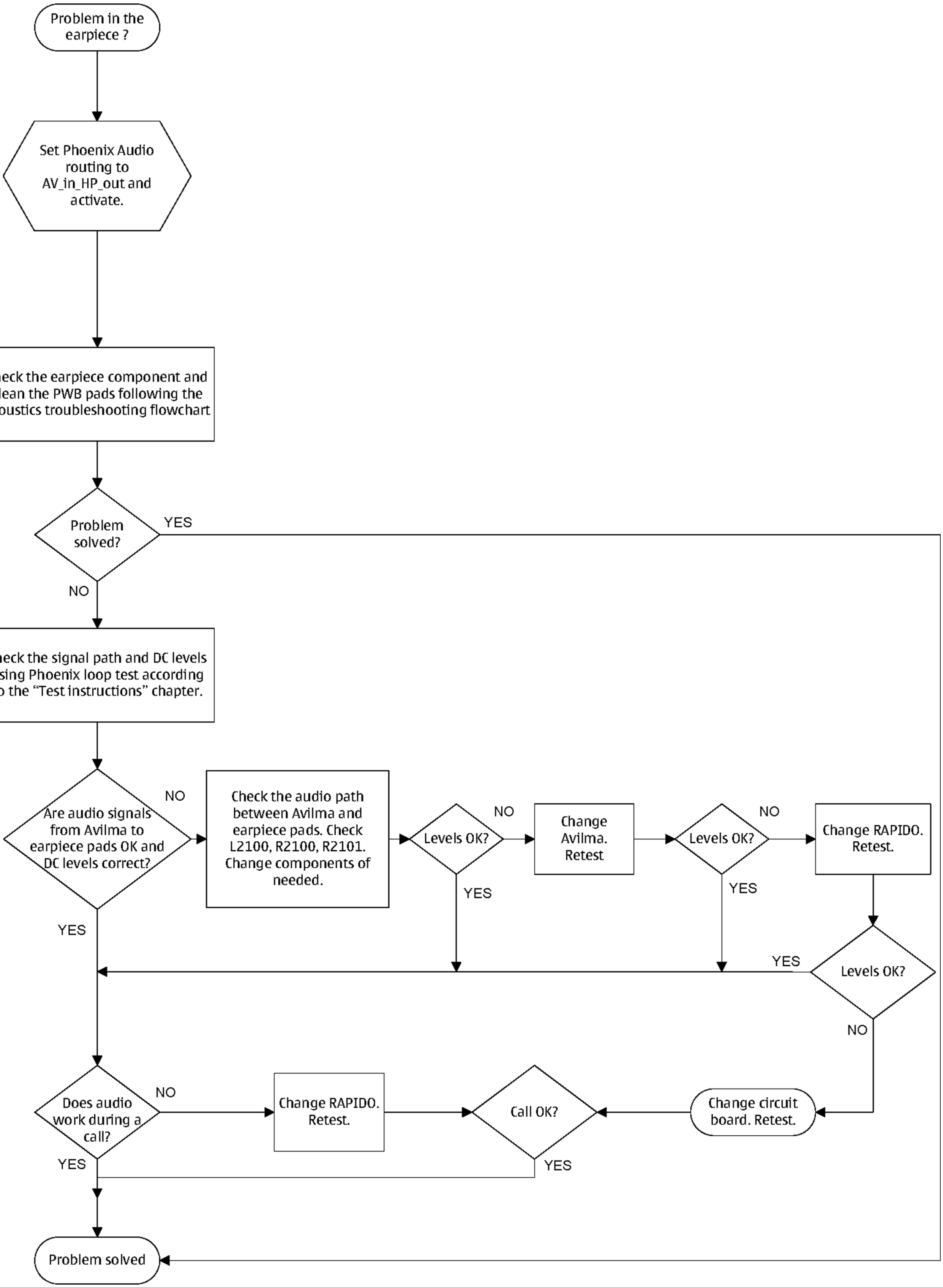


Figure 29 Single-ended output waveform of the HP_in_AV_out loop.

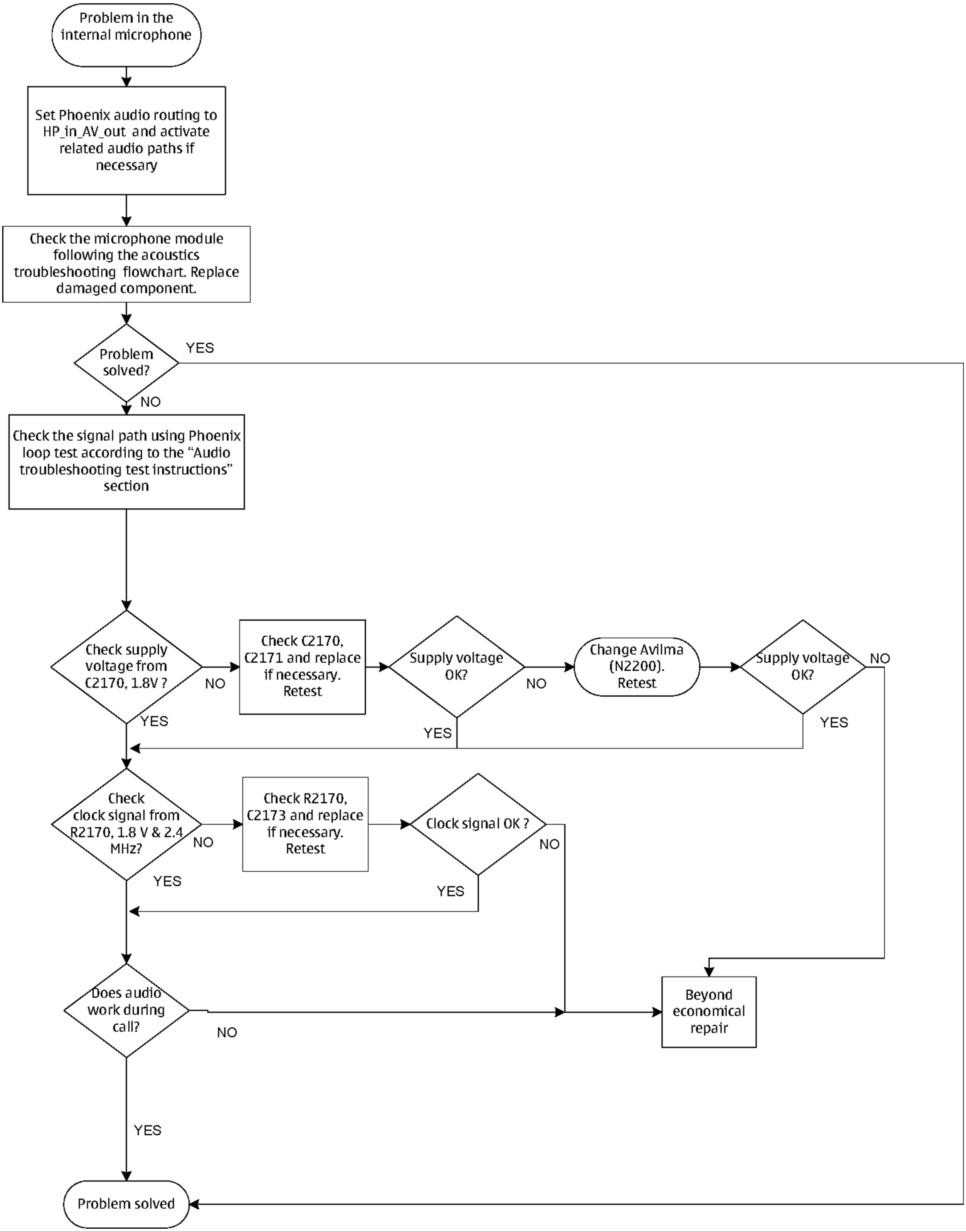
Internal earpiece troubleshooting

Troubleshooting flow



Internal microphone troubleshooting

Troubleshooting flow



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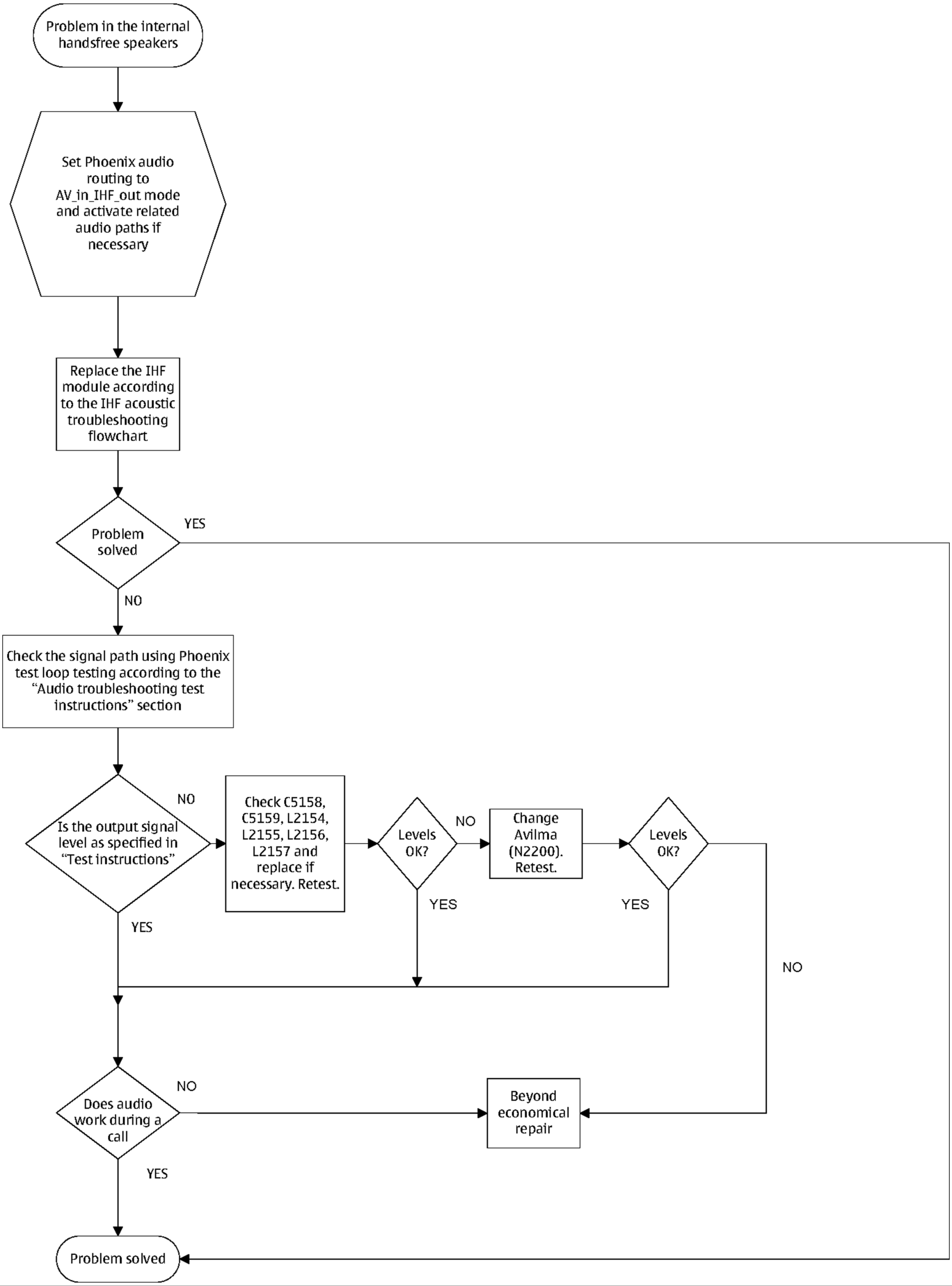
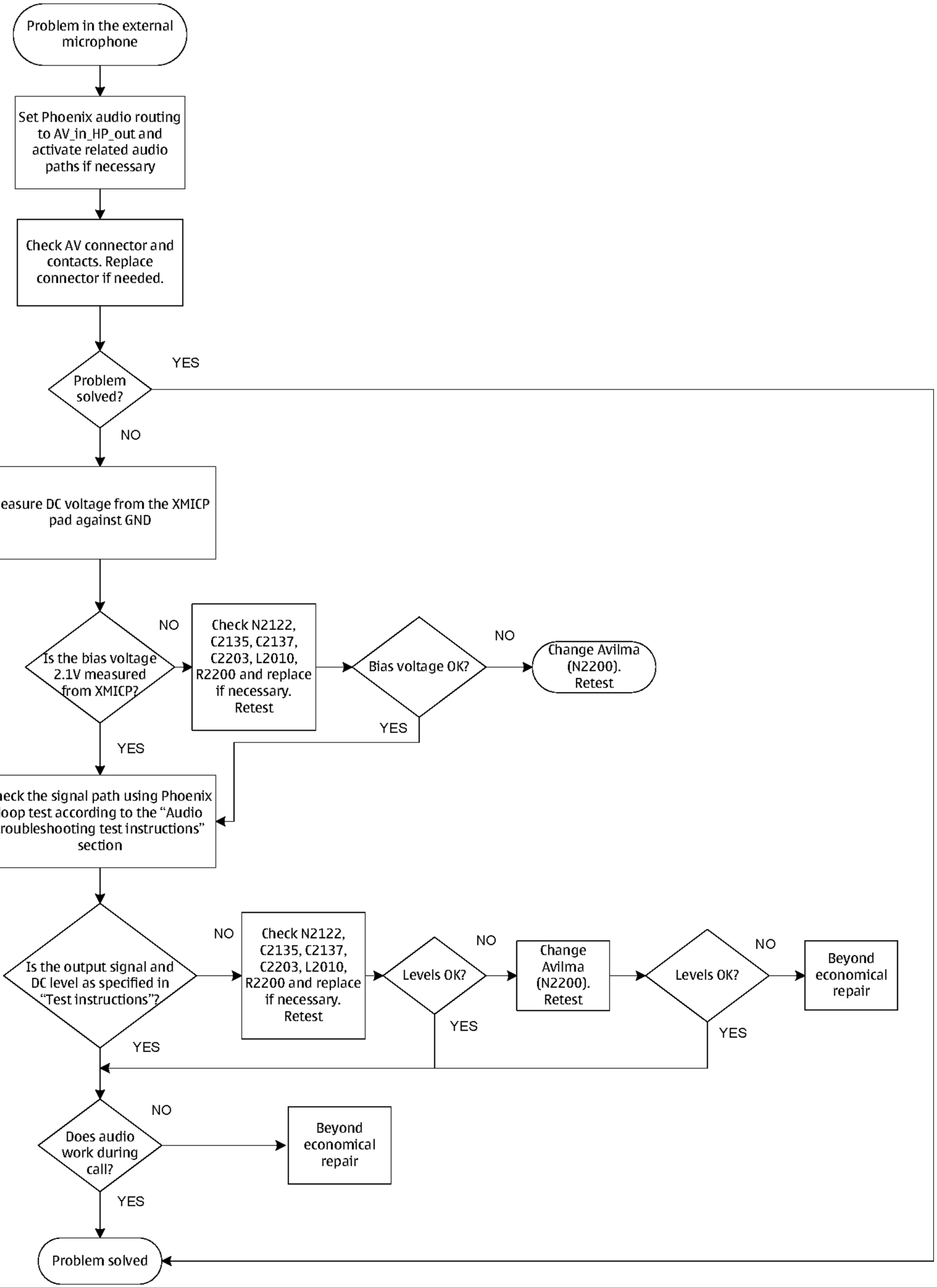
Internal handsfree speaker troubleshooting

Troubleshooting flow



External microphone troubleshooting

Troubleshooting flow



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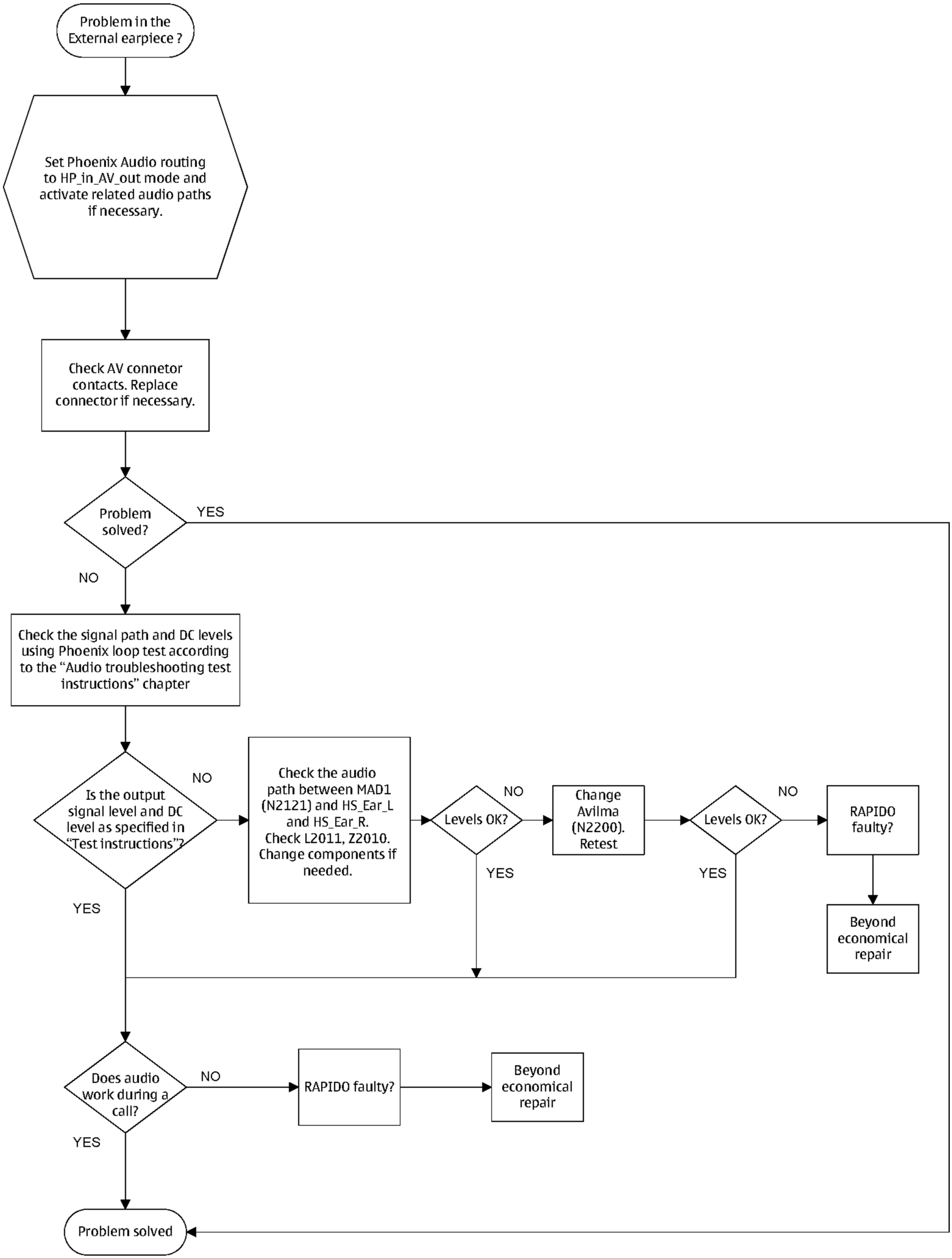
External headset earpiece troubleshooting

Troubleshooting flow



Acoustics troubleshooting

Introduction to acoustics troubleshooting

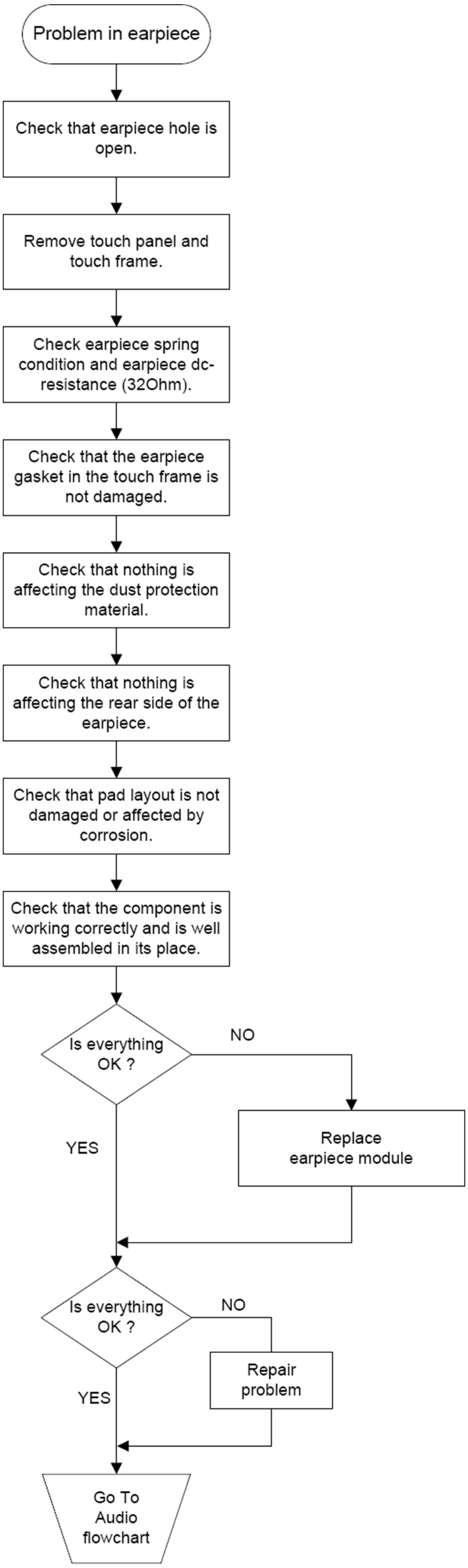
Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by the speaker. The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece radiates through a single hole on the front cover (Touch panel). The sound reproduced from the IHF speaker radiates through a sound hole located at the left side of the phone (when the display is facing the observer) in the battery cover. The microphone sound hole is located at the bottom of the phone.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

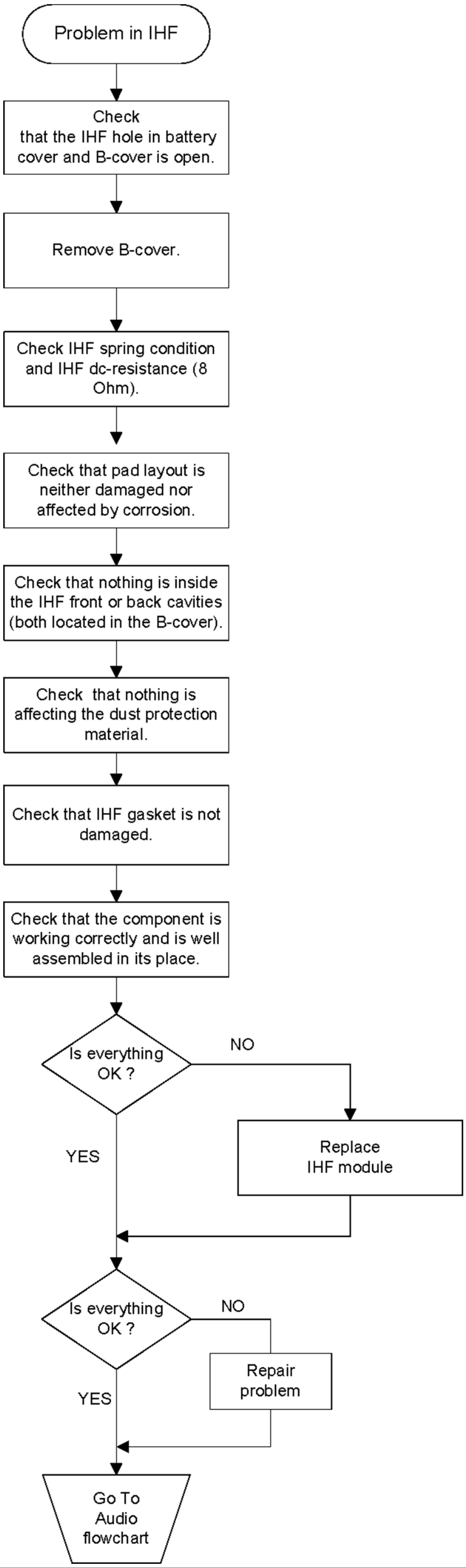
Earpiece troubleshooting

Troubleshooting flow



IHF troubleshooting

Troubleshooting flow



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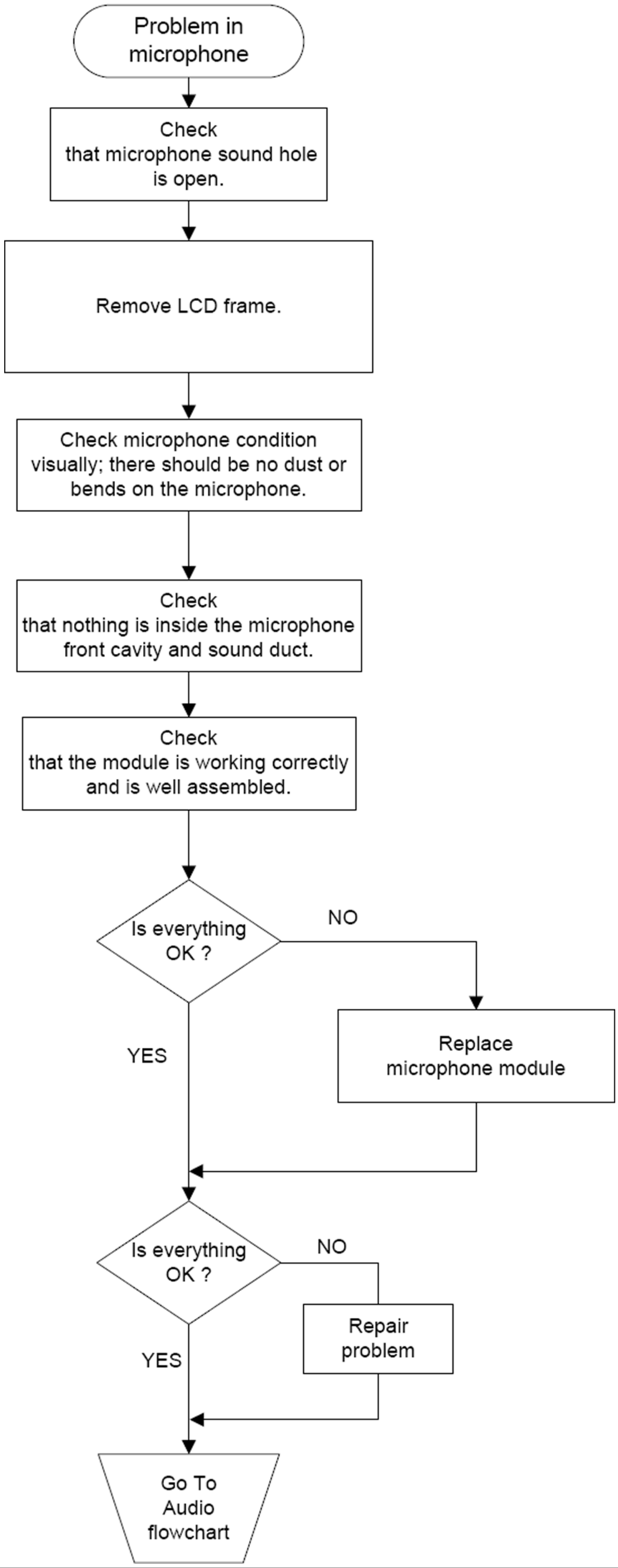
Microphone troubleshooting

Troubleshooting flow



Baseband manual tuning guide

Certificate restoring

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-10 or FPS-21.

  Note: If the COMBO memory of a phone is replaced, the ENO SW must be flashed first before performing the "normal" firmware flashing.

- Execute the certificate restore process in Phoenix.
- Tune the phone completely.

  Note: SX-4 smart card is needed.

- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2008.34.6 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables testing and tuning features)
- External smart card reader
- Activated FPS-10 **OR** FPS-21 flash prommer
- Latest flash update package for FPS-10 or FPS-21 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.

   Note: If the COMBO memory of a phone is replaced, the ENO SW must be flashed first before performing the "normal" firmware flashing.

2. Execute the certificate restore process in Phoenix.

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

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. Choose **File** → **Scan Product.**
4. Choose **Tuning** → **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	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
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.

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4 — RF troubleshooting

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Table of Contents

List of Tables

List of Figures

General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N7505
- Front End Module (FEM) N7520
- WCDMA PA N7540

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

> **Note:** In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

> **Note:** A mobile phone WCDMA transmitter should never be tested with full TX power (only it possible to perform the measurements in a good 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.

> **Note:** All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible without replacing the whole shield frame (i.e. not replaceable). Please refer to the list of Non-replaceable RF components (page 4–8) .

RF key components

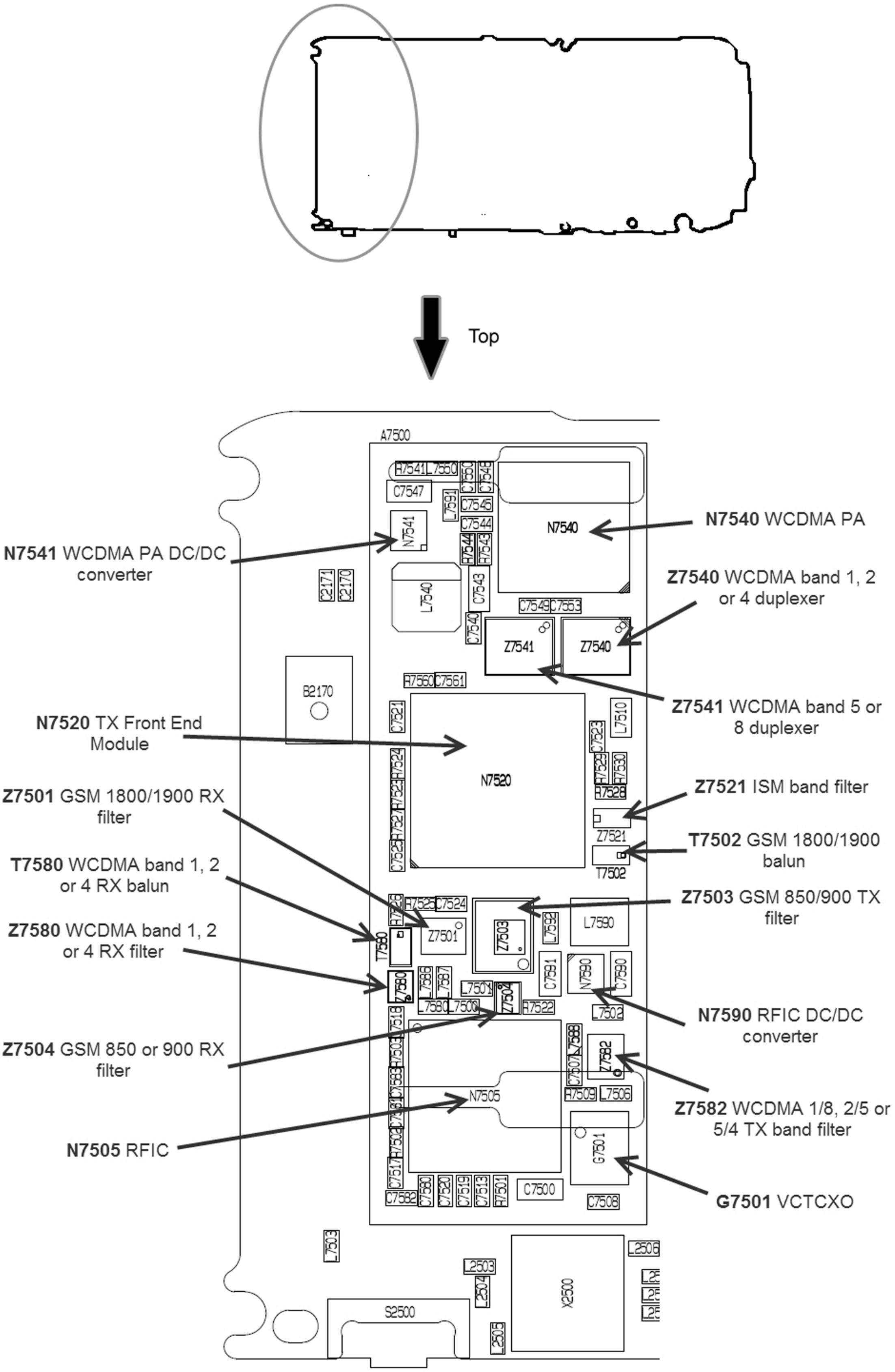


Figure 30 RF key components - top

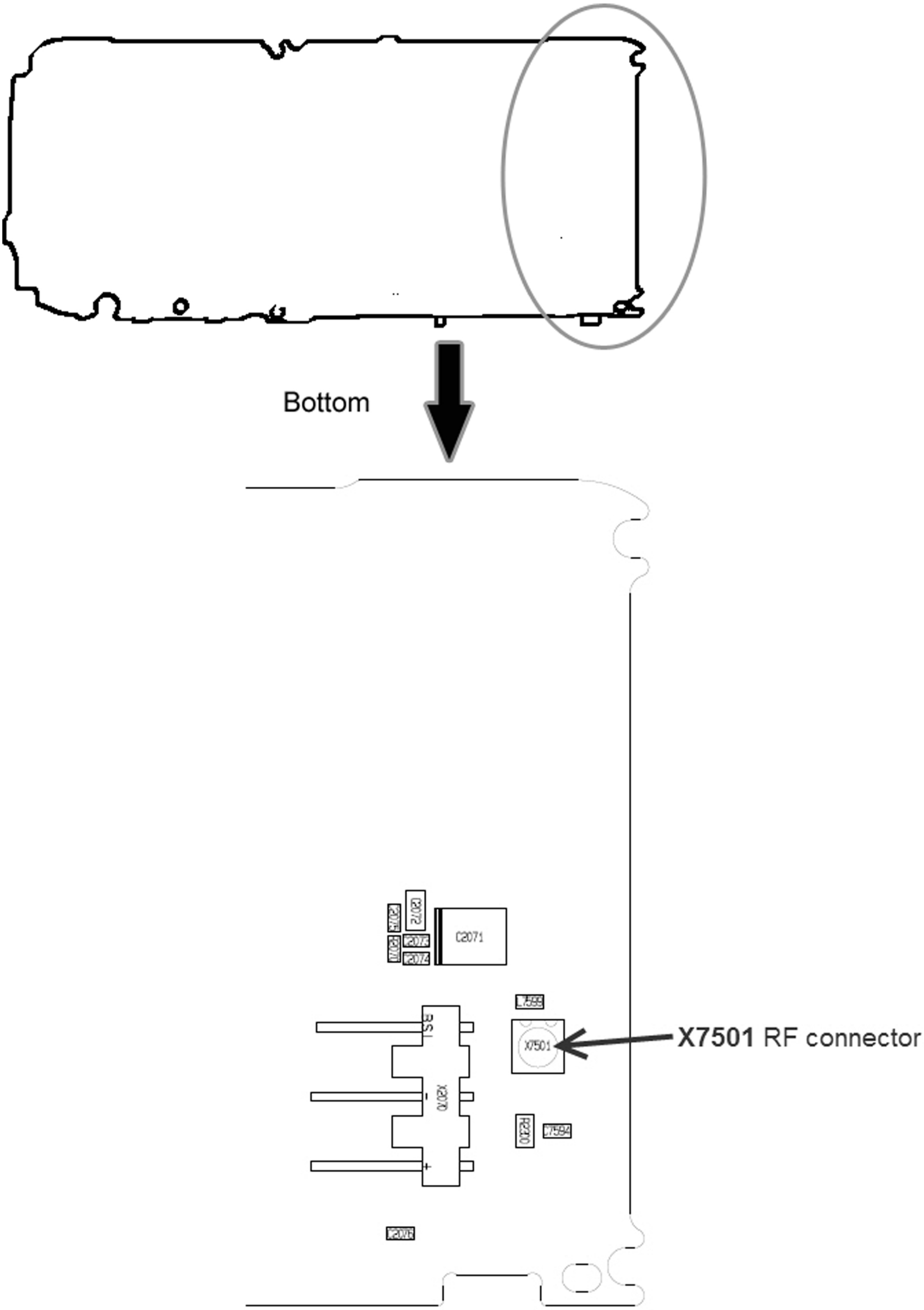
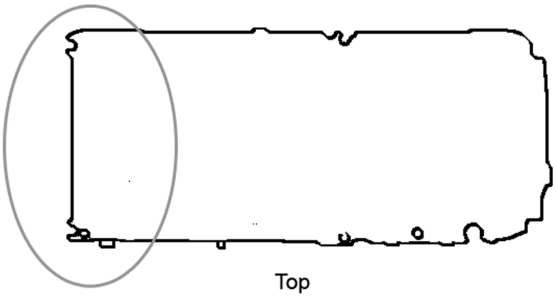


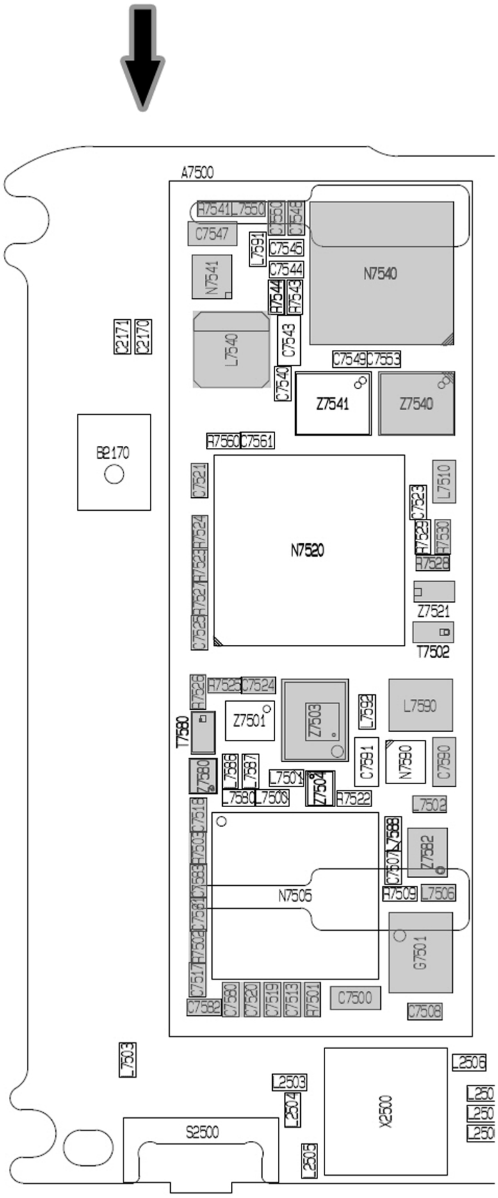
Figure 31 RF key components - bottom

Non-replaceable RF components

Because of their location on the PWB, the following RF components cannot be replaced without replacing the whole shield frame:



Top



Non-replaceable RF components

C7500	N7540
C7508	N7541
C7513	R7501
C7517	R7502
C7518	R7503
C7519	R7523
C7520	R7524
C7521	R7525
C7524	R7526
C7525	R7527
C7547	R7528
C7548	R7530
C7550	R7541
C7580	T7502
C7581	T7580
C7582	Z7503
C7583	Z7521
C7590	Z7540
G7501	Z7580
L7502	Z7582
L7506	
L7510	
L7540	
L7550	
L7590	

Note! The RF components listed above can be replaced only by replacing the whole shield frame.

General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.2 V
3	FEM supply	L7510	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V when transmitting)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7592	3.9 V

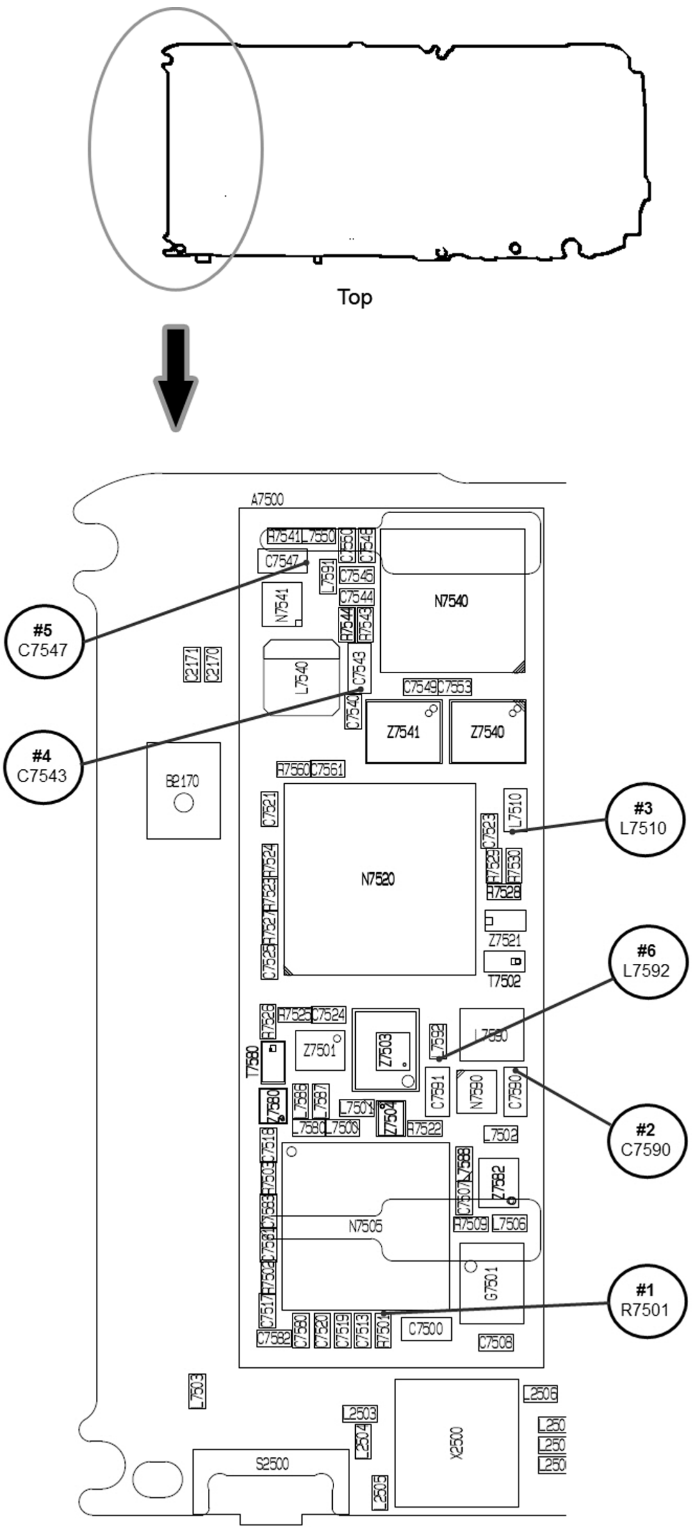


Figure 32 General voltage checking test points

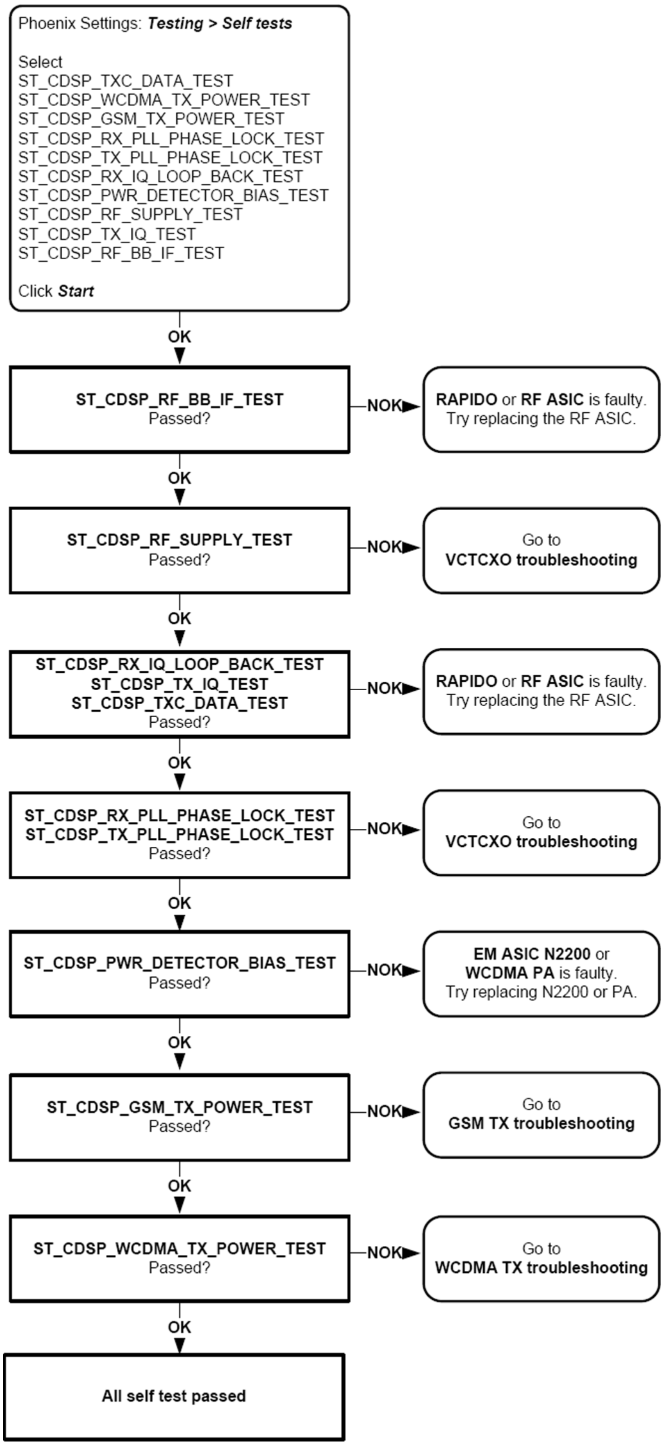
Phoenix self tests

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.* in the baseband troubleshooting section.

Troubleshooting flow



RF final test

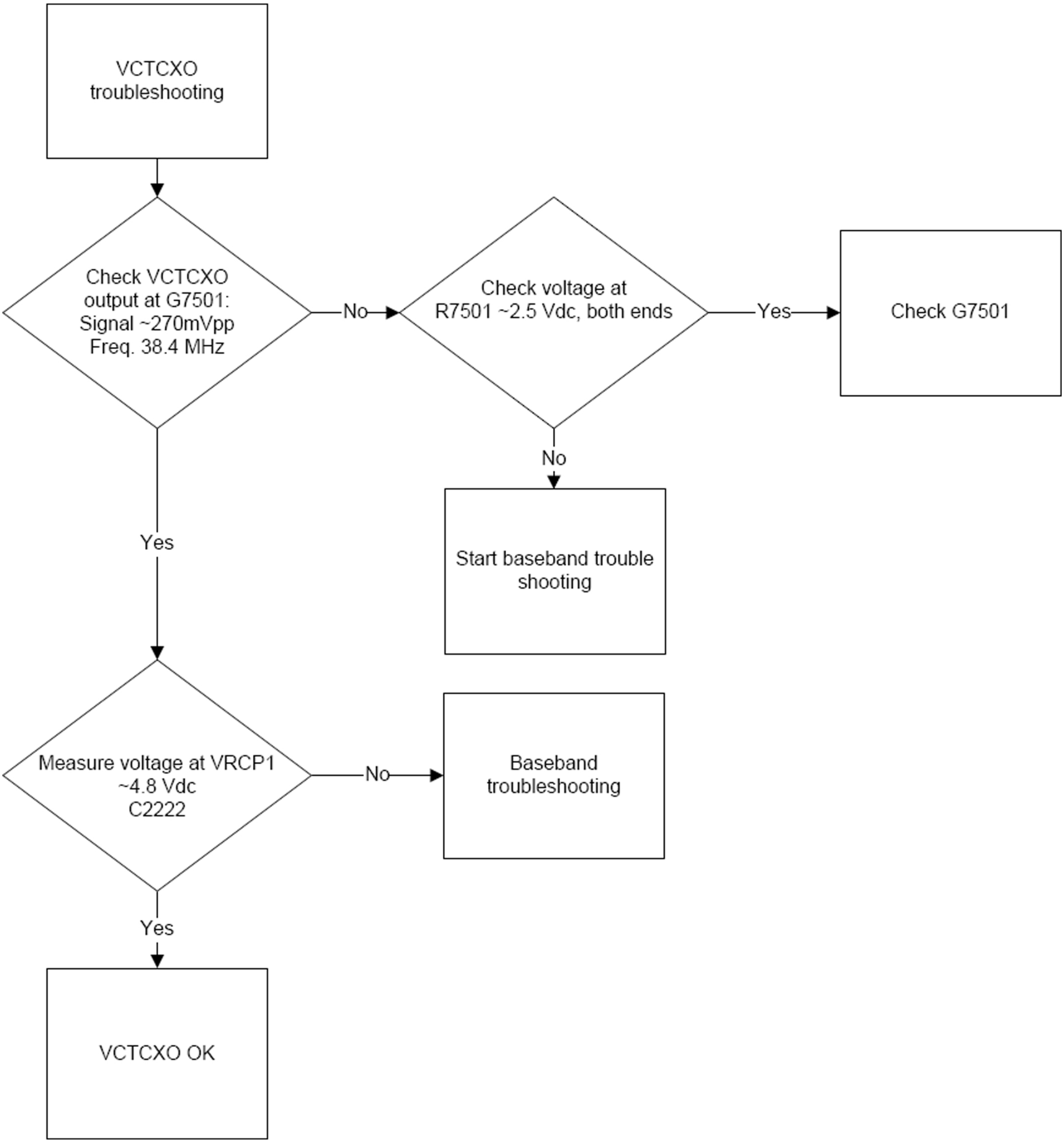
RF final test is an automated measurement which can be used for verifying RF functionality and pinpointing root causes when RF related problems are suspected . It measures all critical RF parameters on every supported RF band (GSM and WCDMA) without making any calibrations or tunings to the transceiver RF TX or RX parts.

It uses the same hardware setup as Autotune (see Autotuning for BB5 (page 4–31) for more infomation). The measurement results are displayed and logged in a result file.

To start RF final test, select **Testing ➔ RF Final Test** from the Phoenix menu.

VCTCXO troubleshooting

Troubleshooting flow



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Receiver troubleshooting

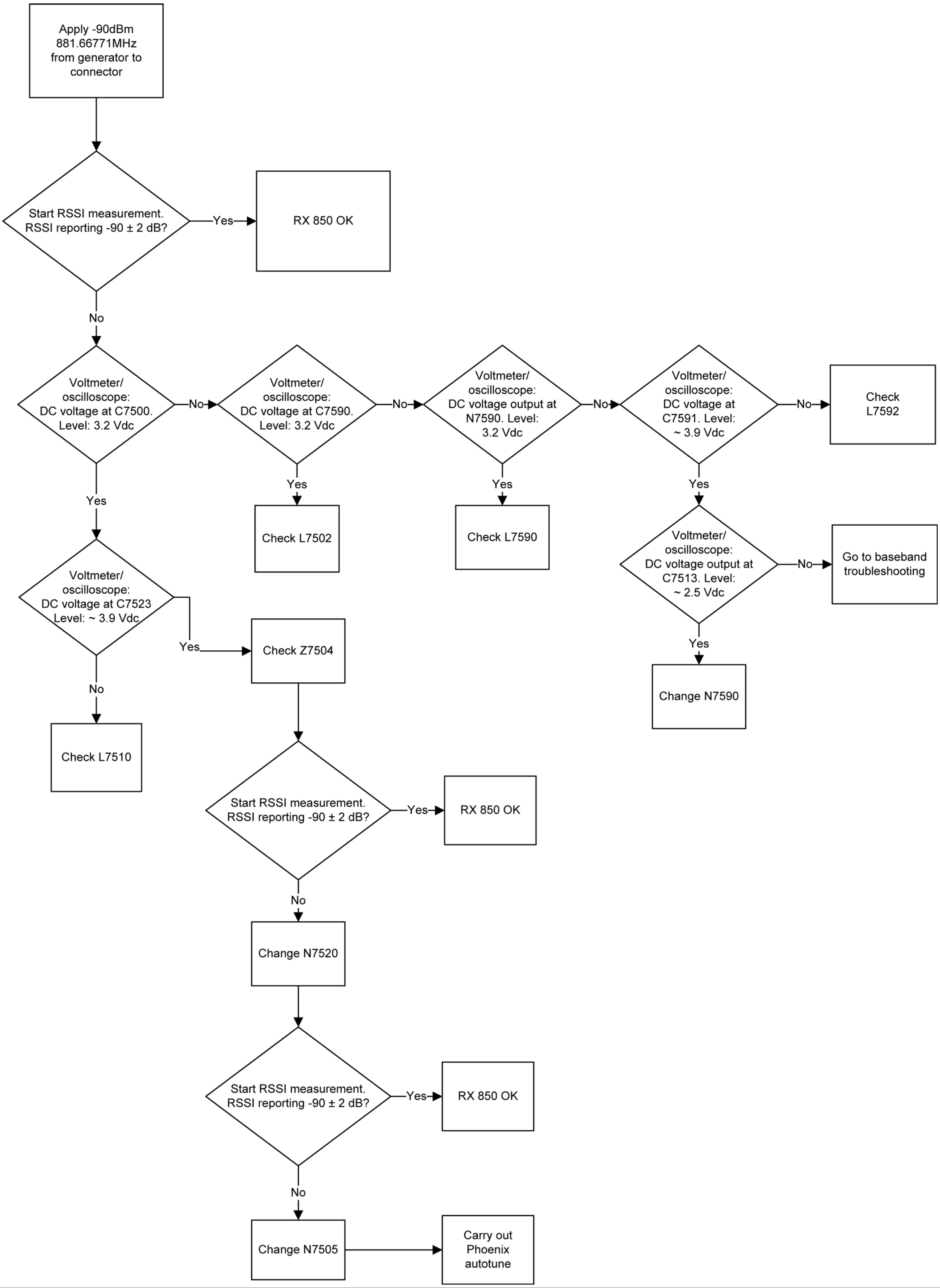
Introduction to receiver (RX) troubleshooting

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

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see GSM RX chain activation for manual measurements / GSM RSSI measurement (page 4–18) . For a similar test in WCDMA mode, see WCDMA RSSI measurement (page 4–21) .

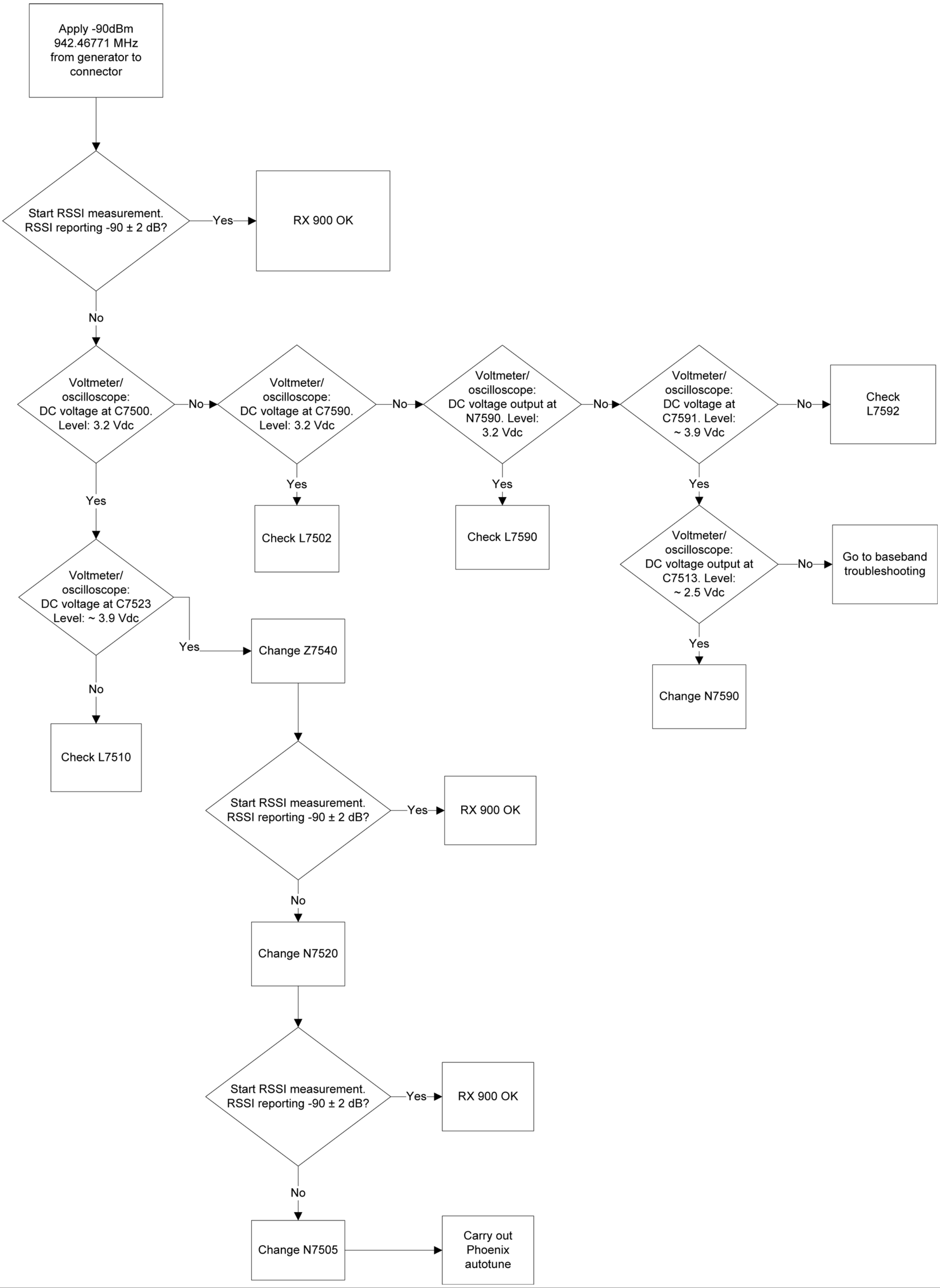
RX GSM850 troubleshooting

Troubleshooting flow



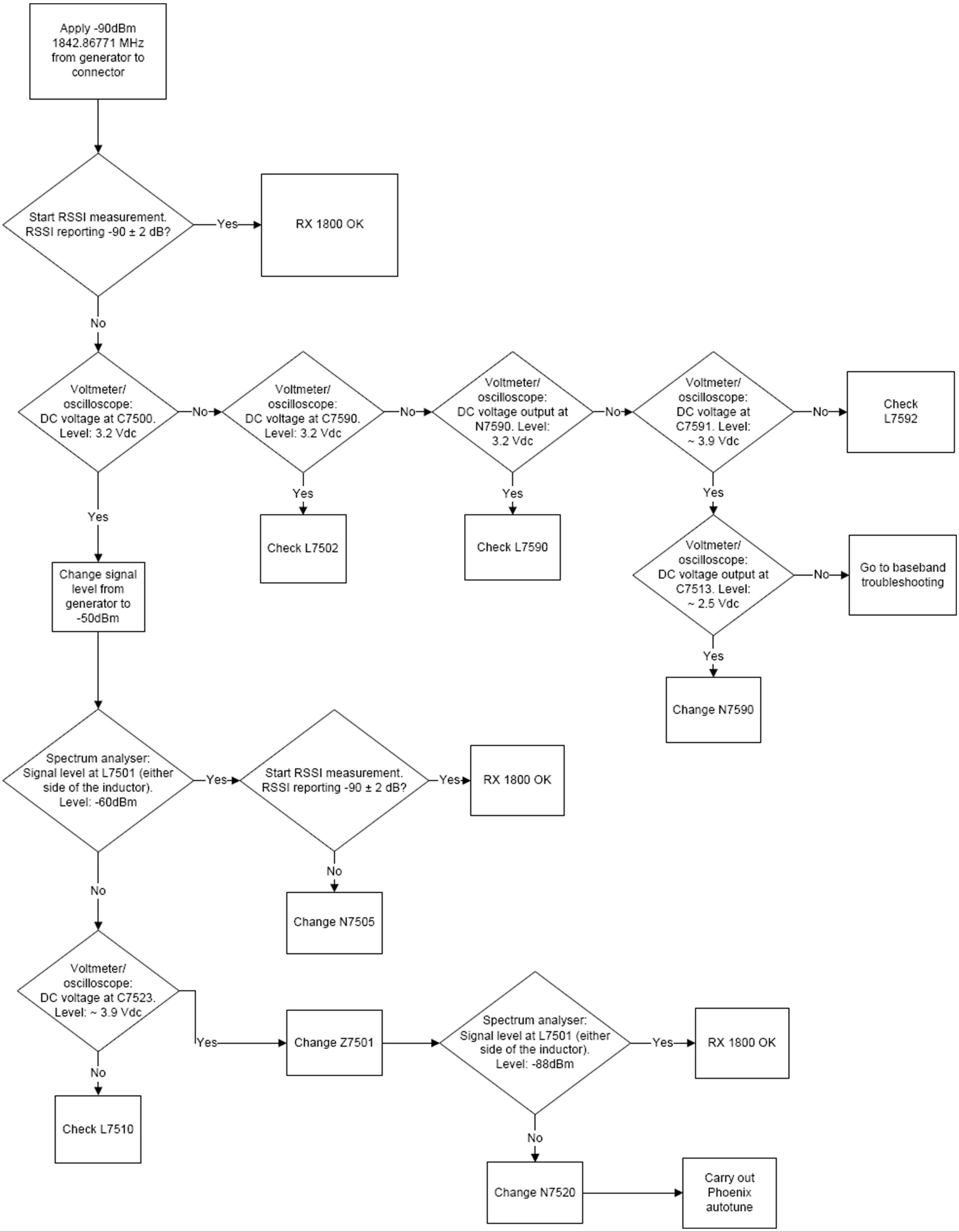
RX GSM900 troubleshooting

Troubleshooting flow



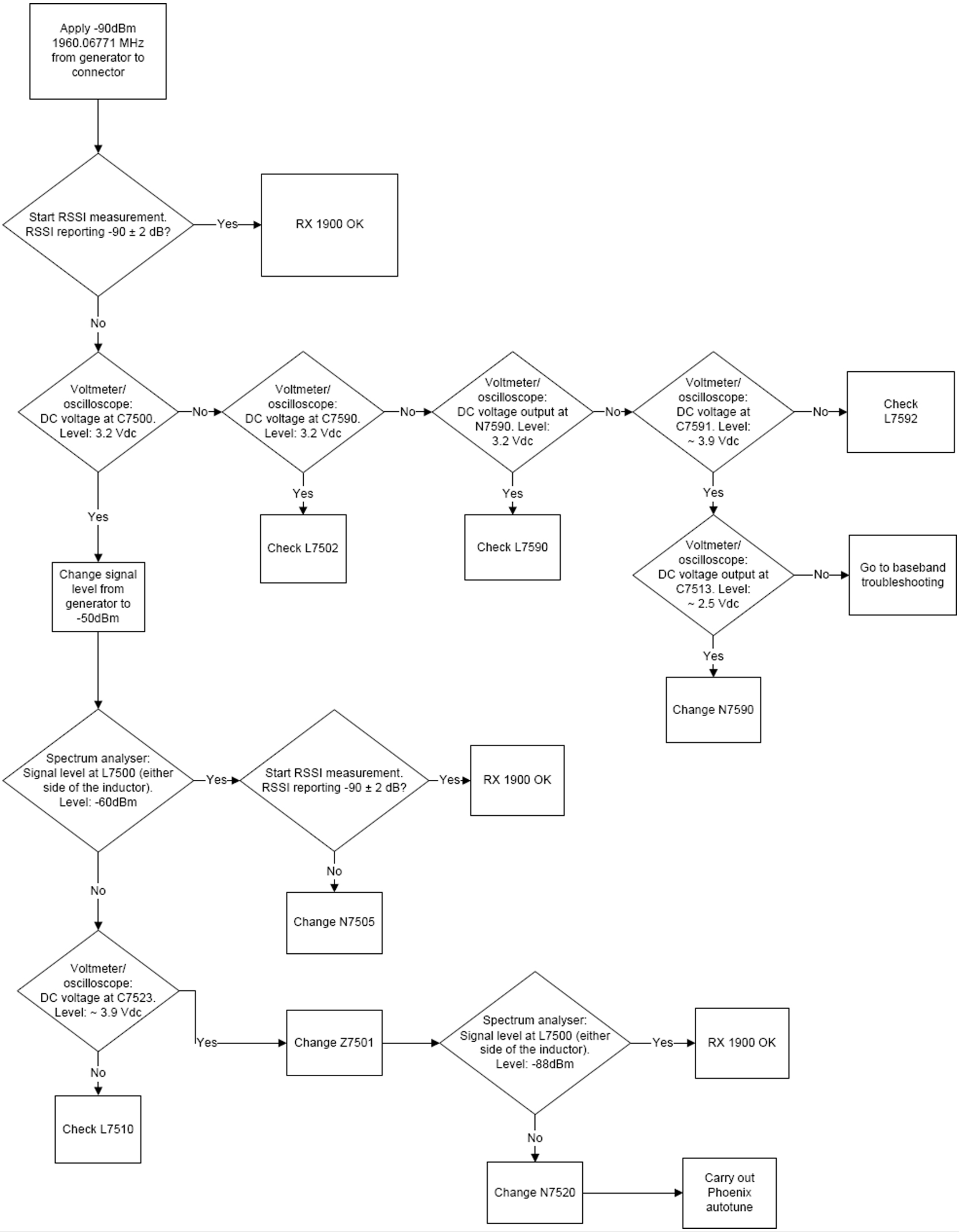
RX GSM1800 troubleshooting

Troubleshooting flow



RX GSM1900 troubleshooting

Troubleshooting flow



GSM RX chain activation for manual measurements/GSM RSSI measurement

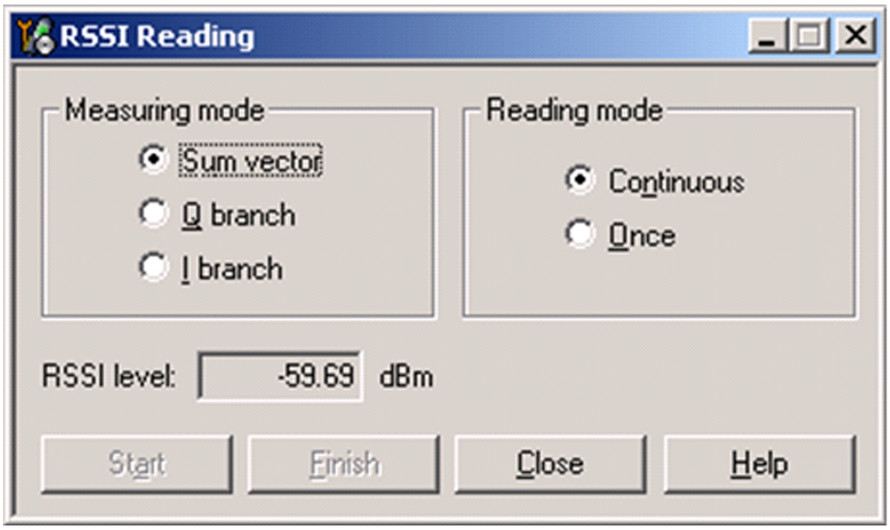
Prerequisites

Make the following settings in Phoenix service software:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771MHz (67.71kHz offset) at -60dBm	942.46771MHz (67.71kHz offset) at -60dBm	1842.86771MHz (67.71kHz offset) at -60dBm	1960.06771MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing** → **GSM** → **RSSI reading**)



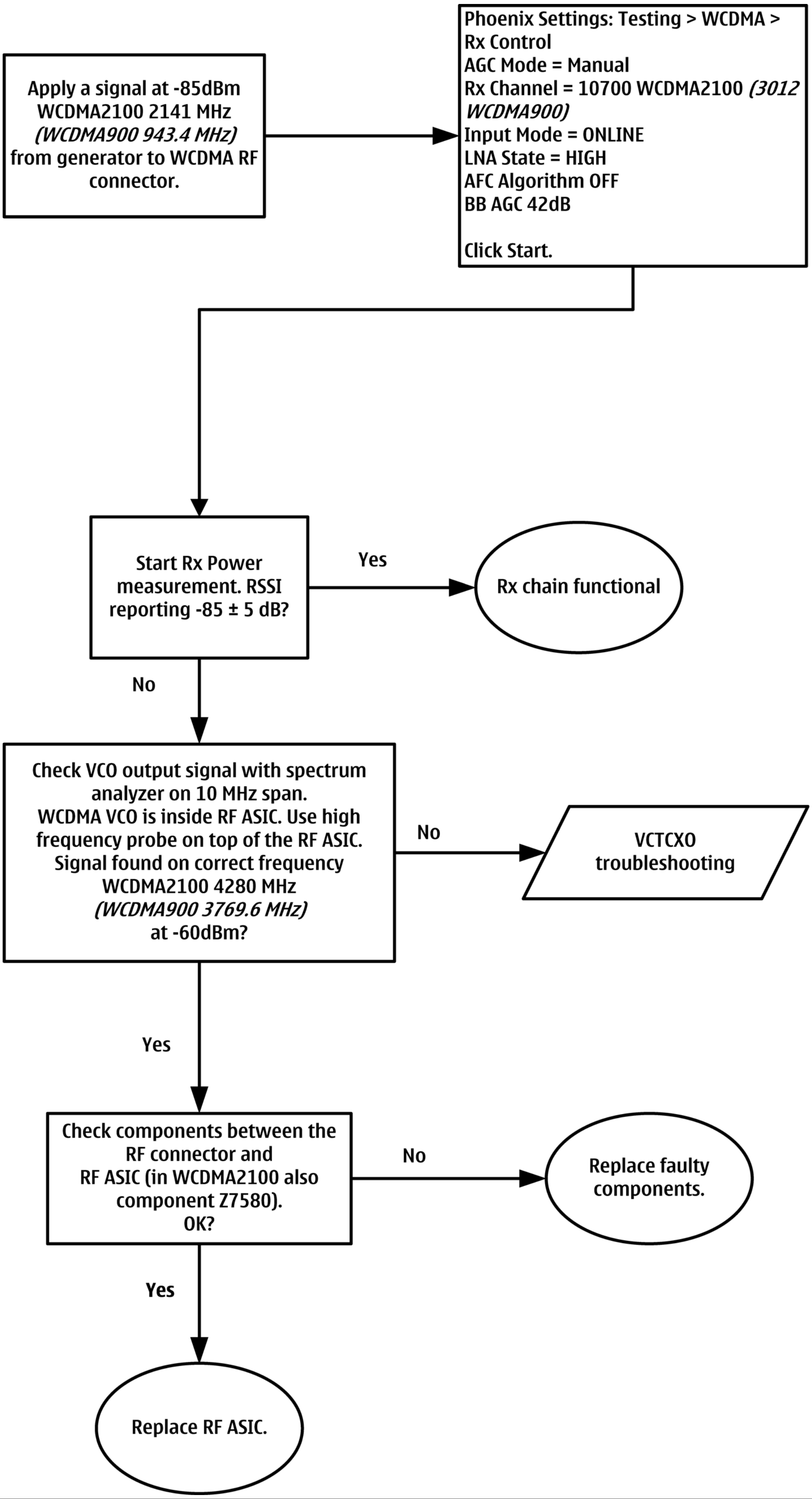
Results

The reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

WCDMA receiver troubleshooting

Troubleshooting flow



WCDMA RX chain activation for manual measurement

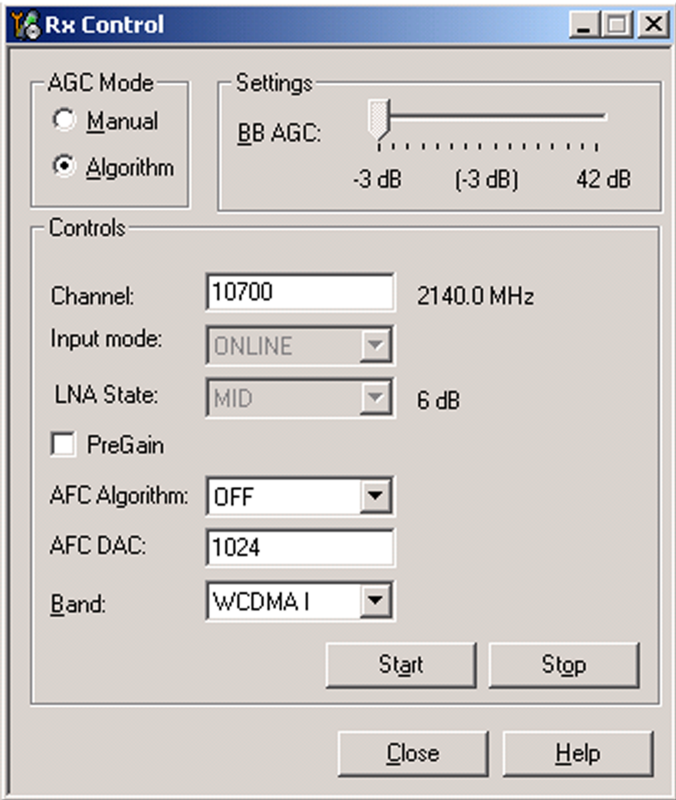
Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA2100	WCDMA900
Phoenix Channel	10700	3012
Signal generator to antenna connector	2140.0 MHz	942.4 MHz
Band	I	VIII

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.
4. Set the following RF generator settings:

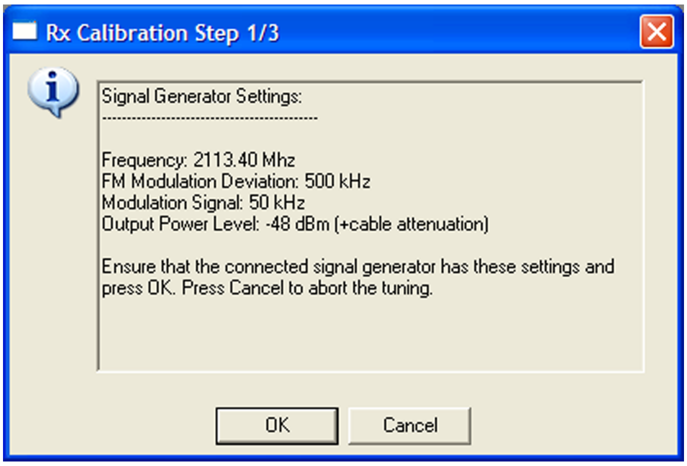


Figure 33 WCDMA RX generator settings

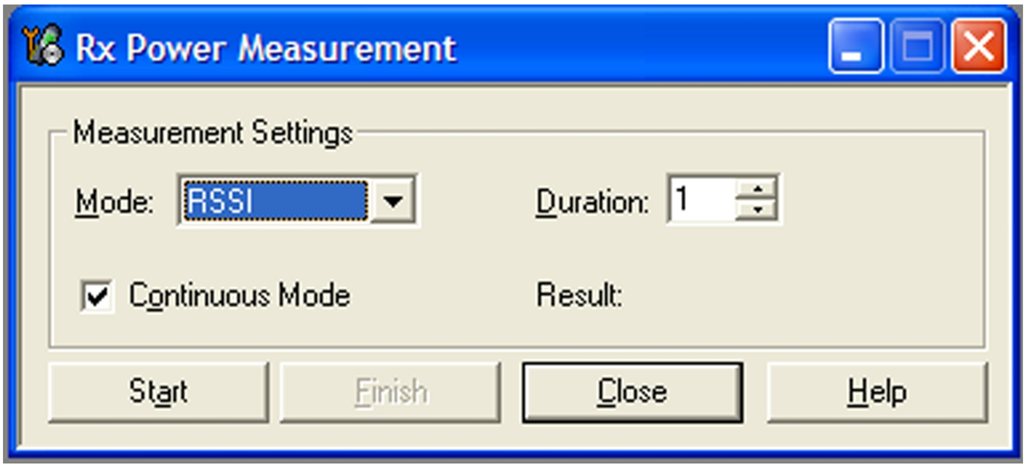
WCDMA RSSI measurement

Prerequisites

WCDMA RX must be activated before RSSI can be measured. For instructions, please refer to WCDMA RX chain activation (page 4– 0) .

Steps

1. From the Phoenix testing menu, select **WCDMA** → **RX Power measurement**
2. In the RX Power measurement window, select:
   - Mode: RSSI
   - Continuous mode



3. Click **Start** to perform the measurement.

Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.

- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”; in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

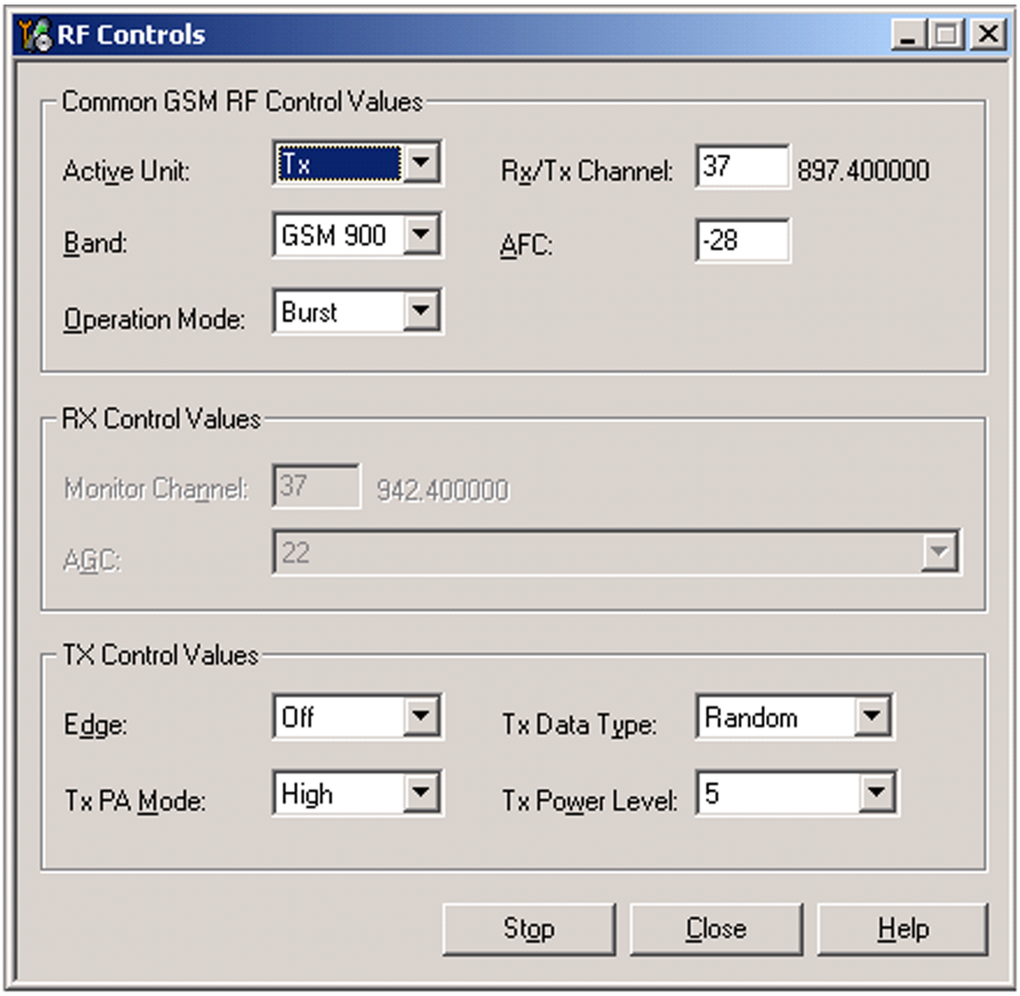
  Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing** → **GSM** → **Rf Controls**).

   Use the following settings:



3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

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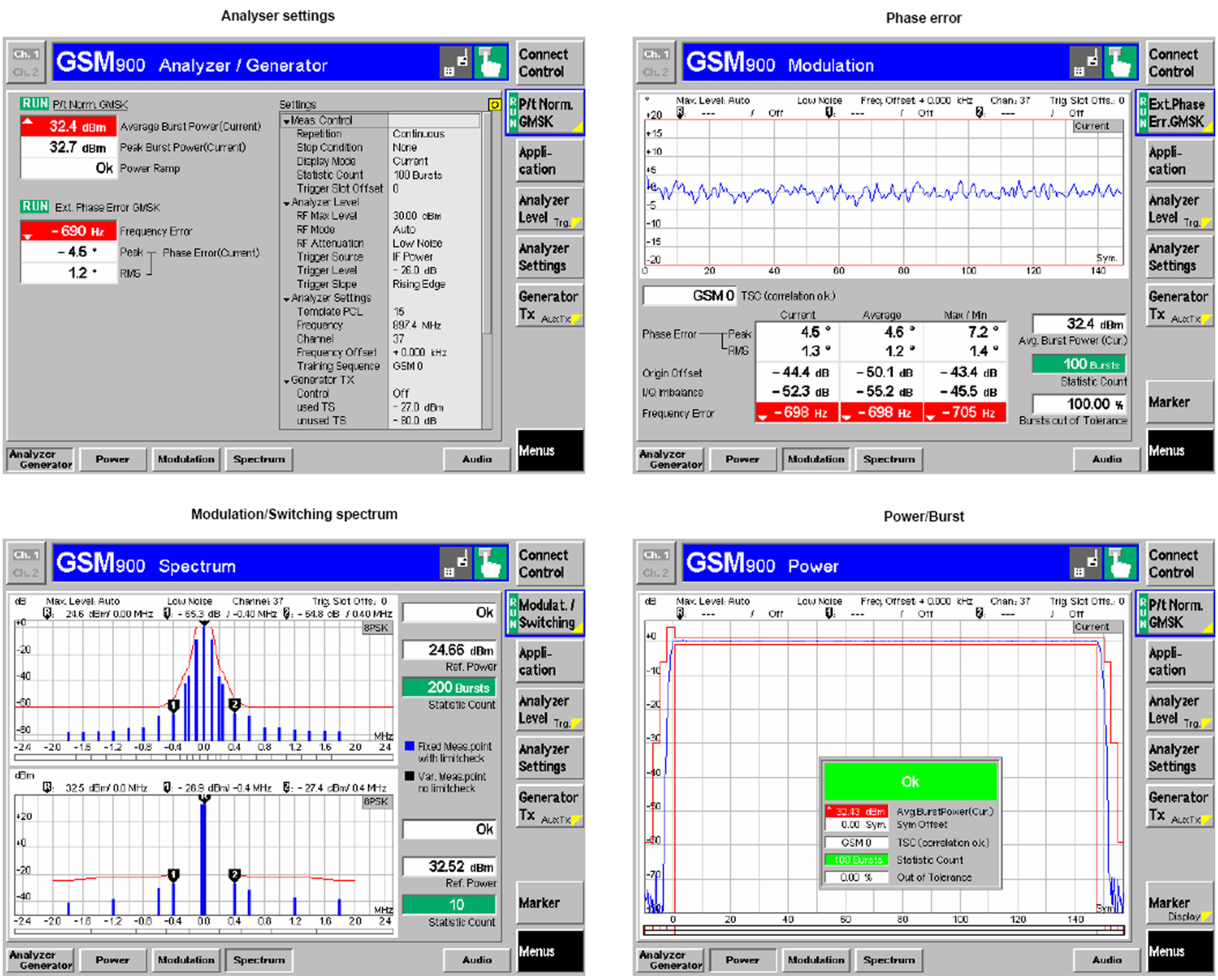


Figure 34 Typical readings

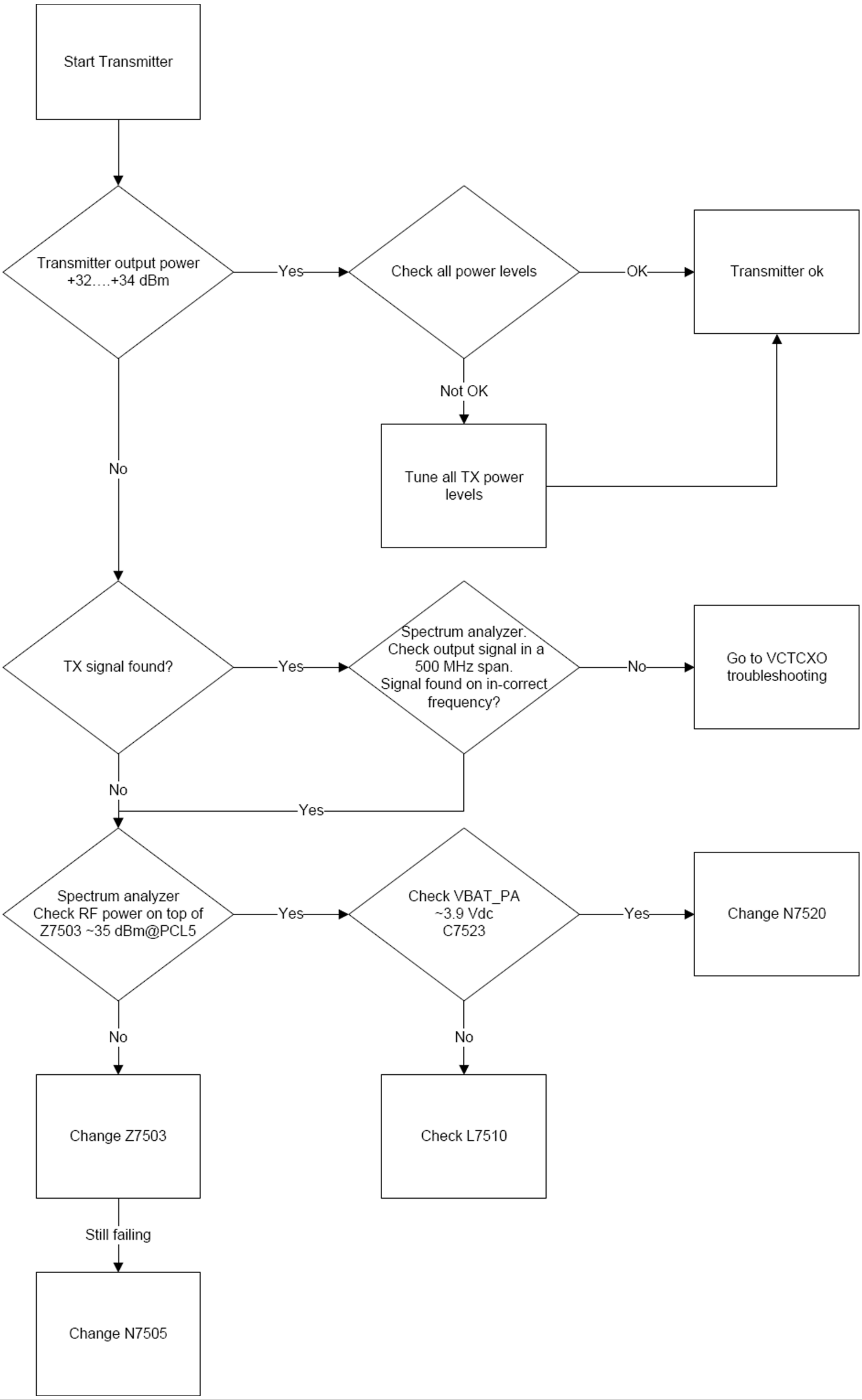
4. Change the power level (RF controls) and make sure the power reading follows accordingly.

Next actions

You can troubleshoot the GSM transmitter for each GSM band separately, one band at a time. If you want to troubleshoot GSM850, GSM1800 or GSM1900, change the band with the RF controls and set the communication analyser accordingly.

TX 850/900 troubleshooting

Troubleshooting flow



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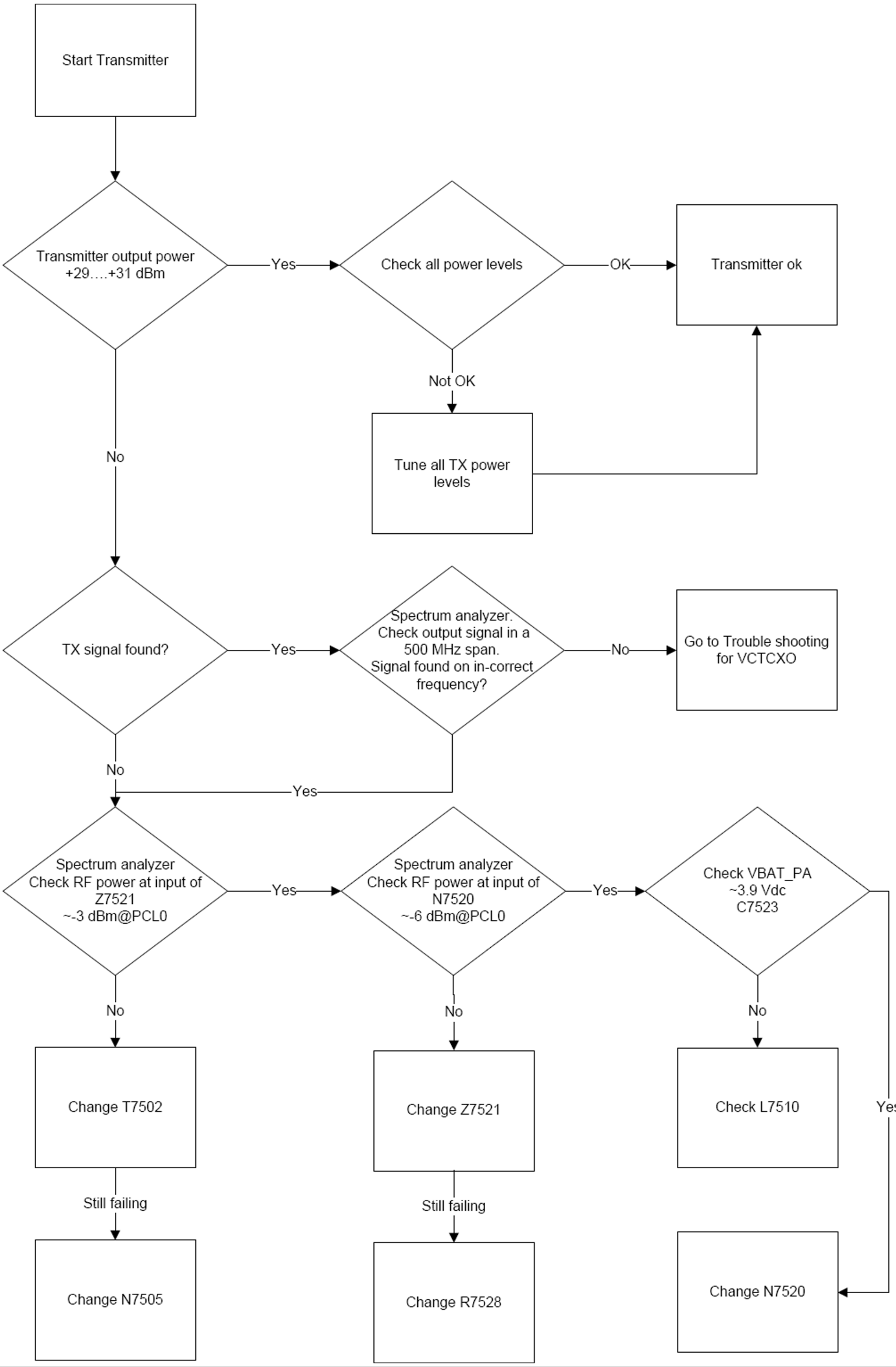
TX 1800/1900 troubleshooting

Troubleshooting flow



Checking antenna functionality

Antenna overview

The RM-588 has a main GSM/WCDMA antenna, a BT antenna and a GPS antenna. All the antennas are attached to the B-cover as illustrated in the figure below.

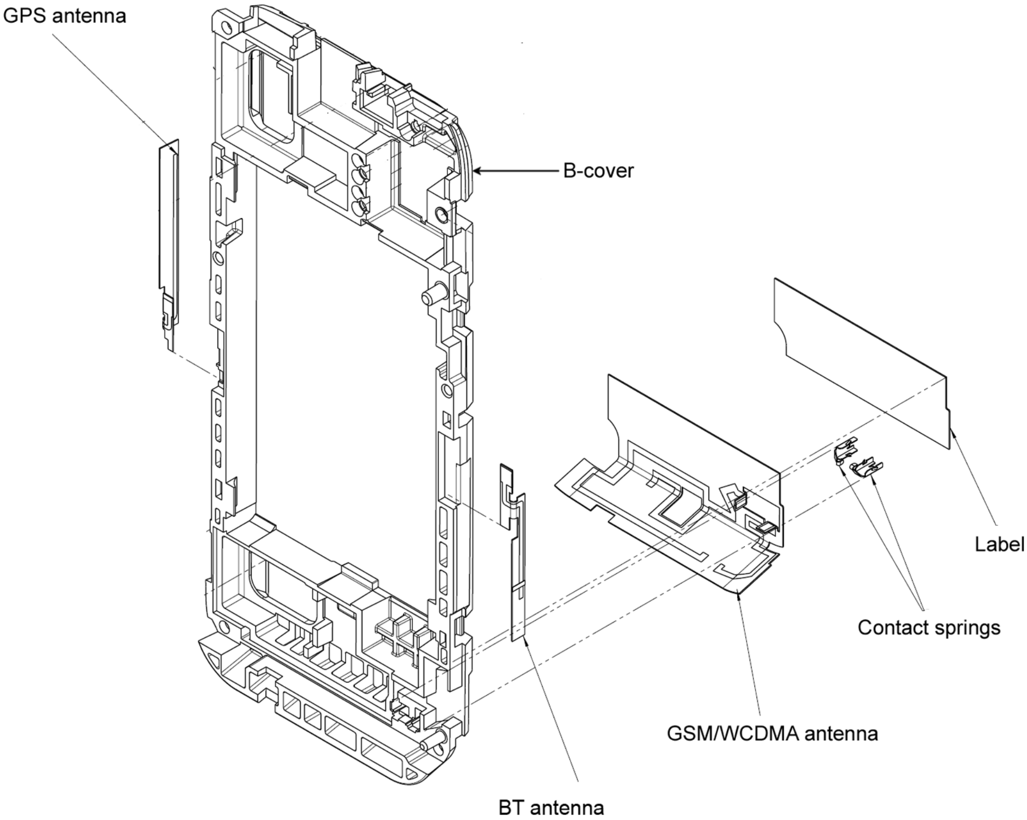


Figure 35 RM-588 antennas

GSM/WCDMA antenna functionality

The main GSM/WCDMA antenna is an IFA (Inverted F Antenna), which is divided into two branches and includes one parasitic element. The antenna is functioning normally when it is properly attached to the B-cover and the contact springs take proper contact to the PWB.

The main antenna functionality must also be checked by measuring the transmitted power with RF coupler at GSM900 channel 124.

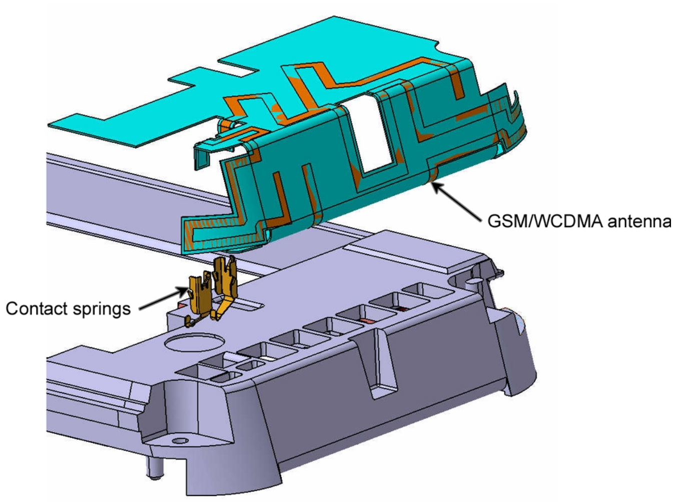


Figure 36 GSM/WCDMA antenna

BT antenna functionality

The BT antenna is an IFA on flex. The antenna is functioning normally when it is properly attached to the B-cover and it takes proper contact to the C-clip on the PWB.

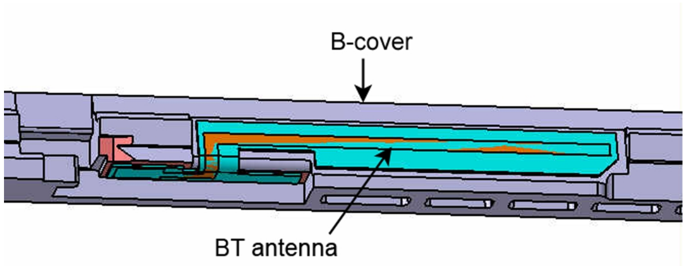


Figure 37 BT antenna

GPS antenna functionality

The GPS antenna is a bended IFA on flex. The antenna is functioning normally when it is properly attached to the B-cover and it takes proper contact to the C-clip on the PWB.

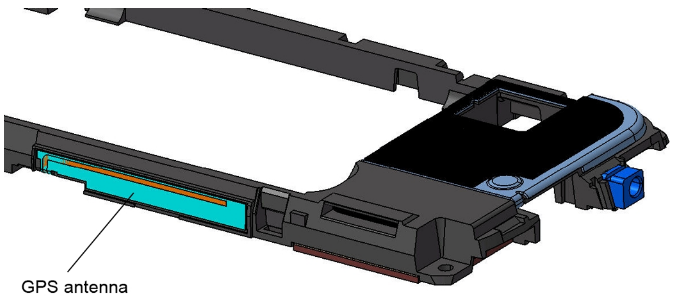


Figure 38 GPS antenna

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing** → **WCDMA** → **TX control** .

3. Use the following settings in the TX control window:

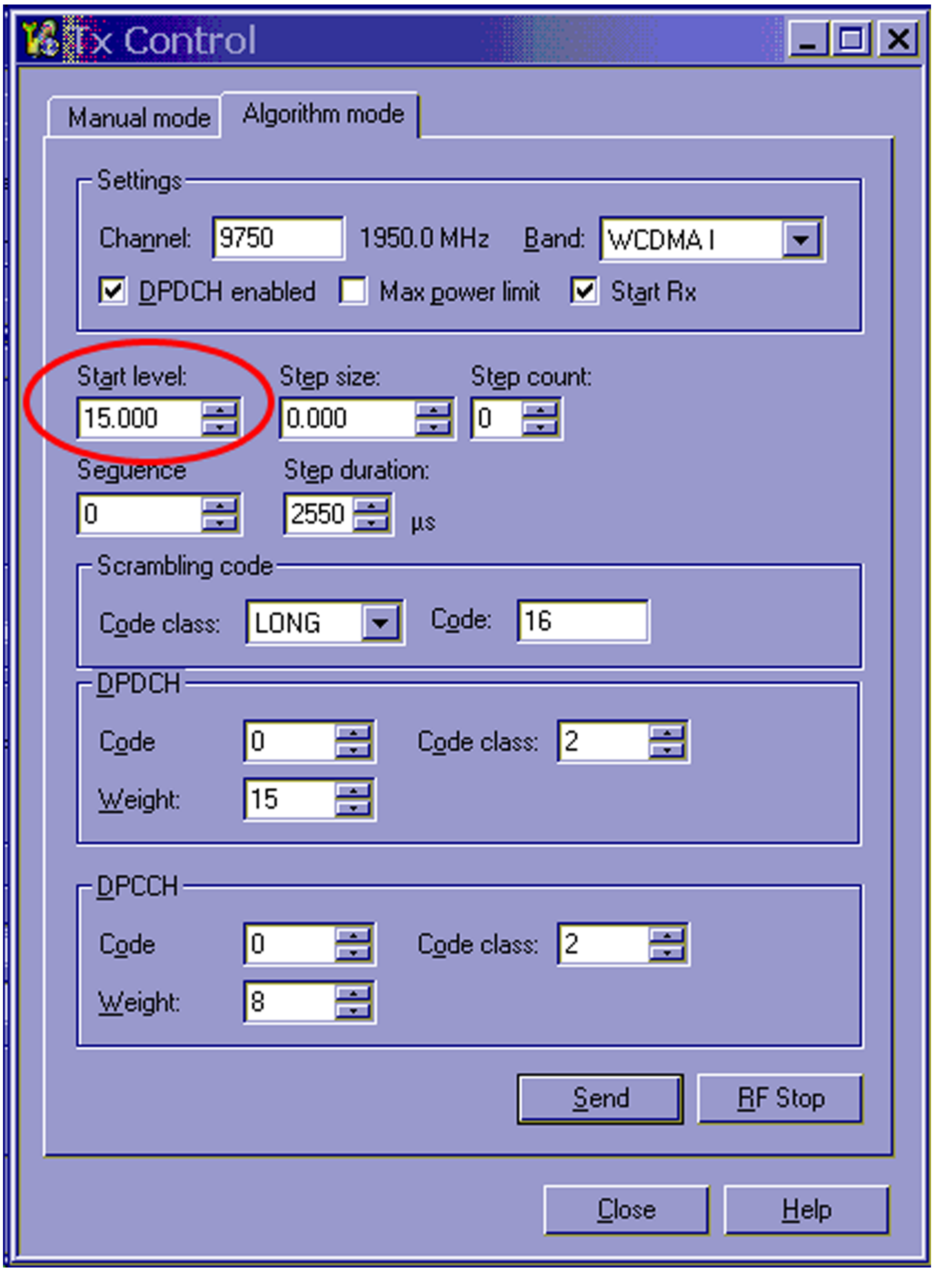


Figure 39 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

5. Use the CMU200 to check the WCDMA power.

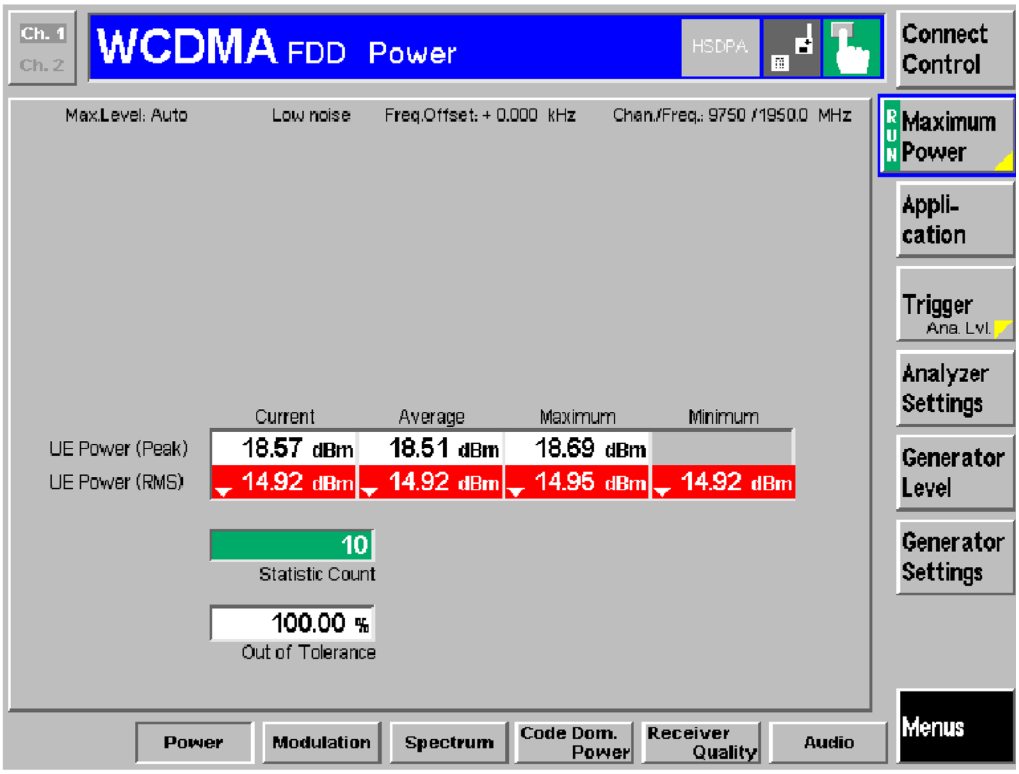
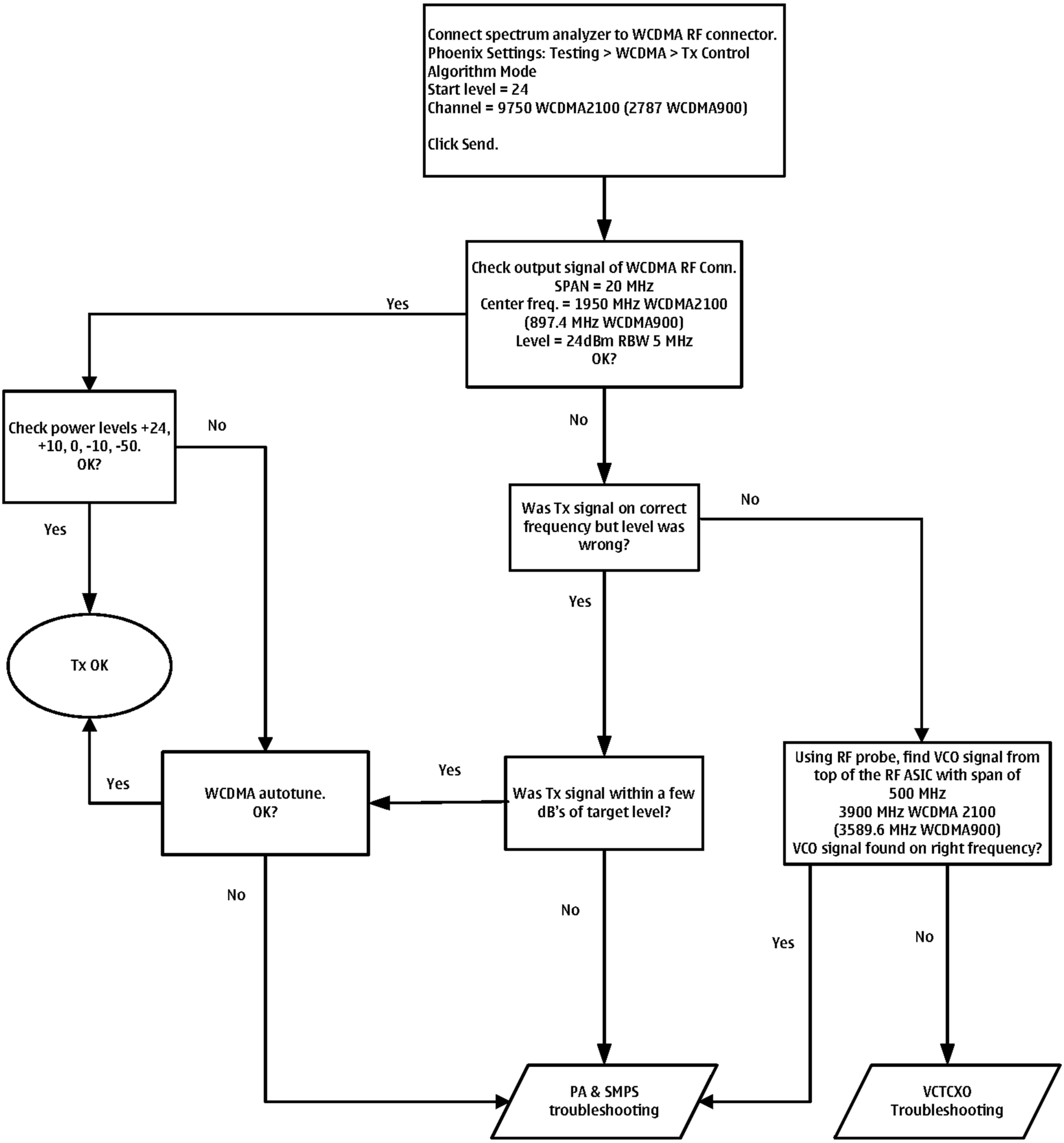


Figure 40 WCDMA power window

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow



RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig, never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

Autotuning for BB5

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRS-6 (RF cable that requires an additional product-specific adapter cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

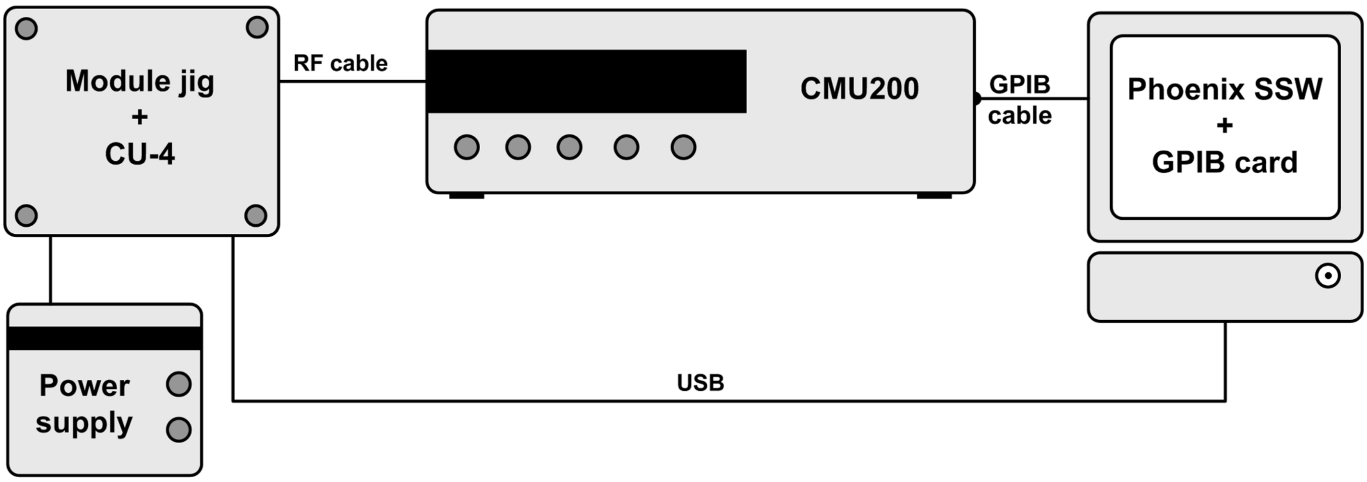


Figure 41 Auto tuning concept with CMU200

Phoenix preparations

Install the phone-specific data package. This defines the phone-specific settings.

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

3 Remember to set the correct attenuation values before autotuning.

4 To start autotuning, click the *Tune* button.

System mode independent manual tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

Table 12 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning** → **Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results

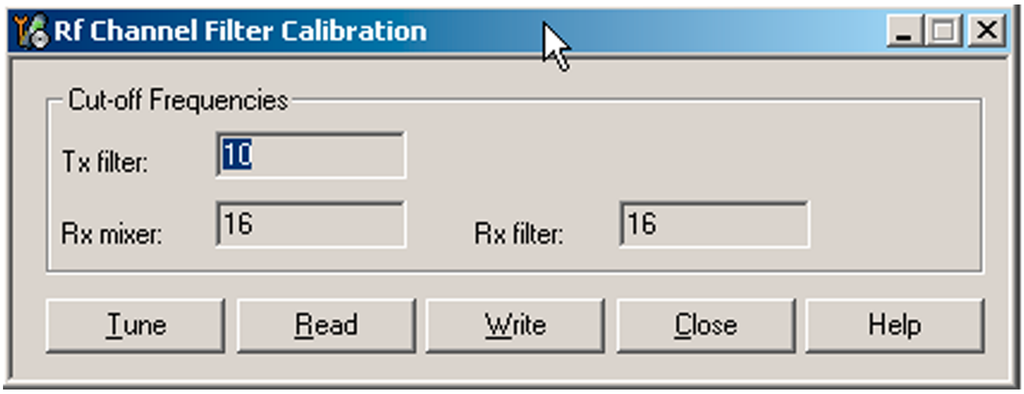


Figure 42 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning** → **PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

GSM receiver tunings

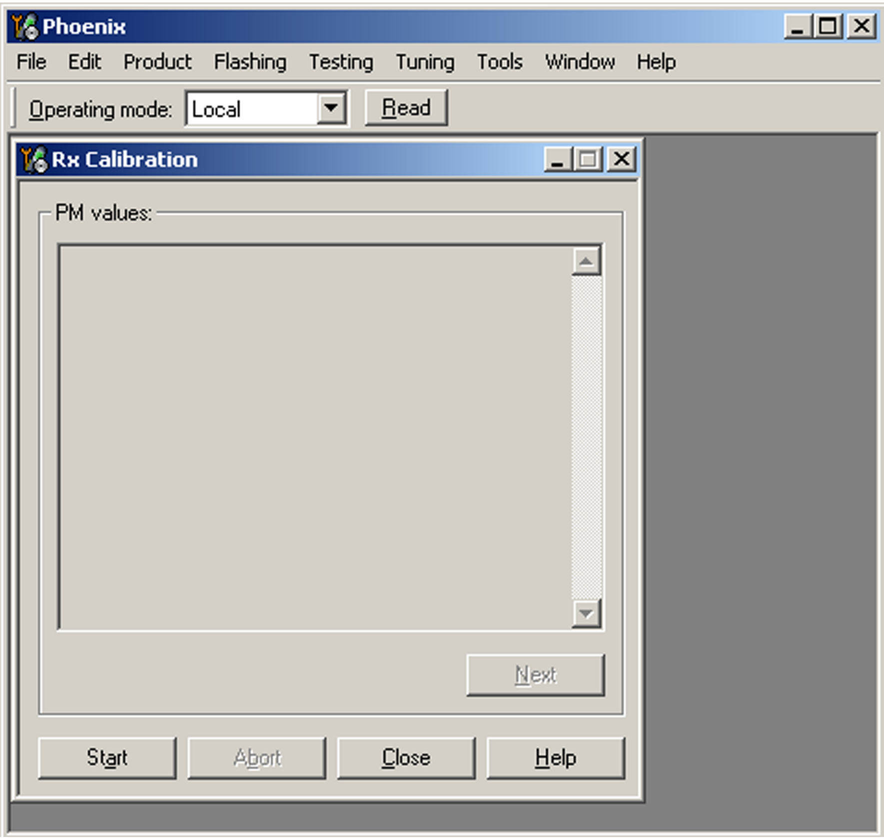
Rx calibration (GSM)

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)

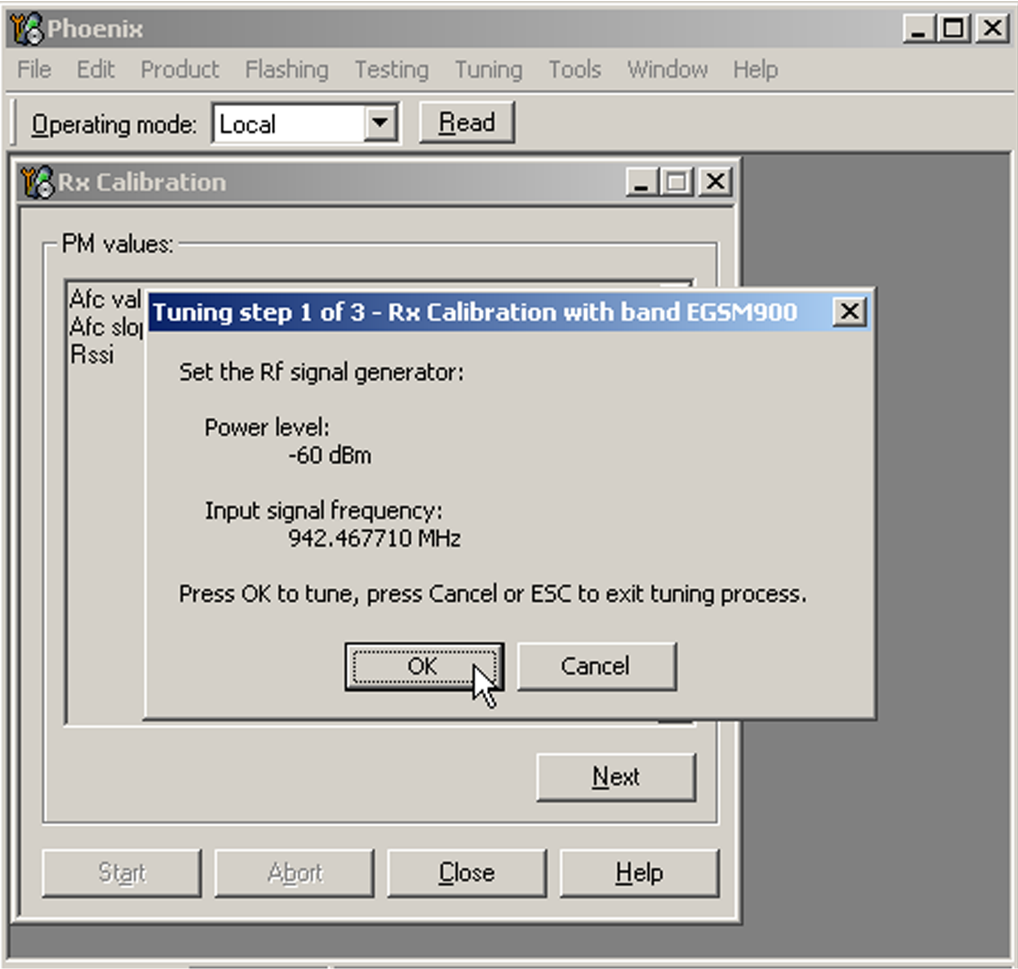
Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning** → **GSM** → **Rx Calibration** .
5. Click **Start**.



6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

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



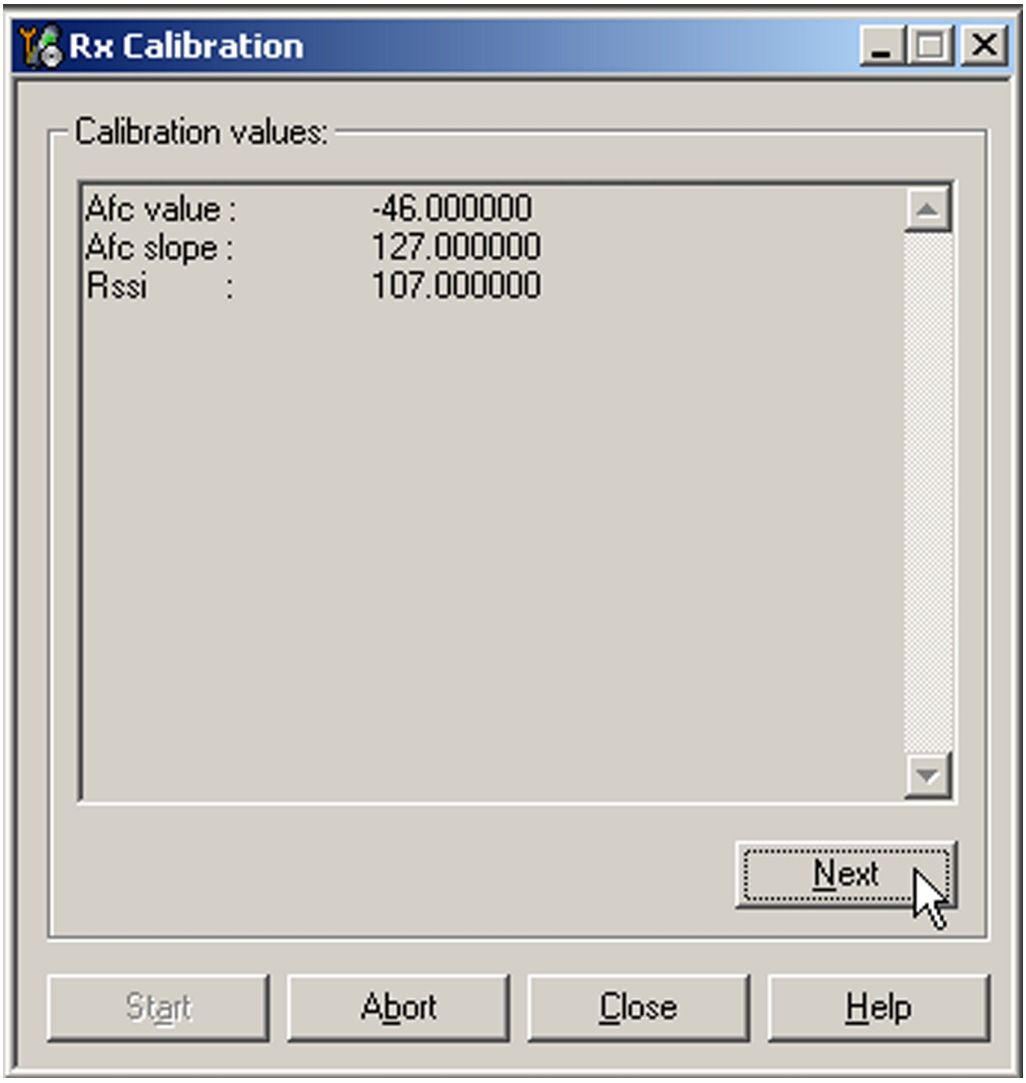
7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

Table 13 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	dB
AFC slope	0	108..121	200	dB
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	dB
AFC slope	0	122	200	dB
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				

	Min	Typ	Max	Unit
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

9. Click **Next** to continue with GSM1800 Rx tuning.



Next actions

Repeat steps 6 to 9 for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

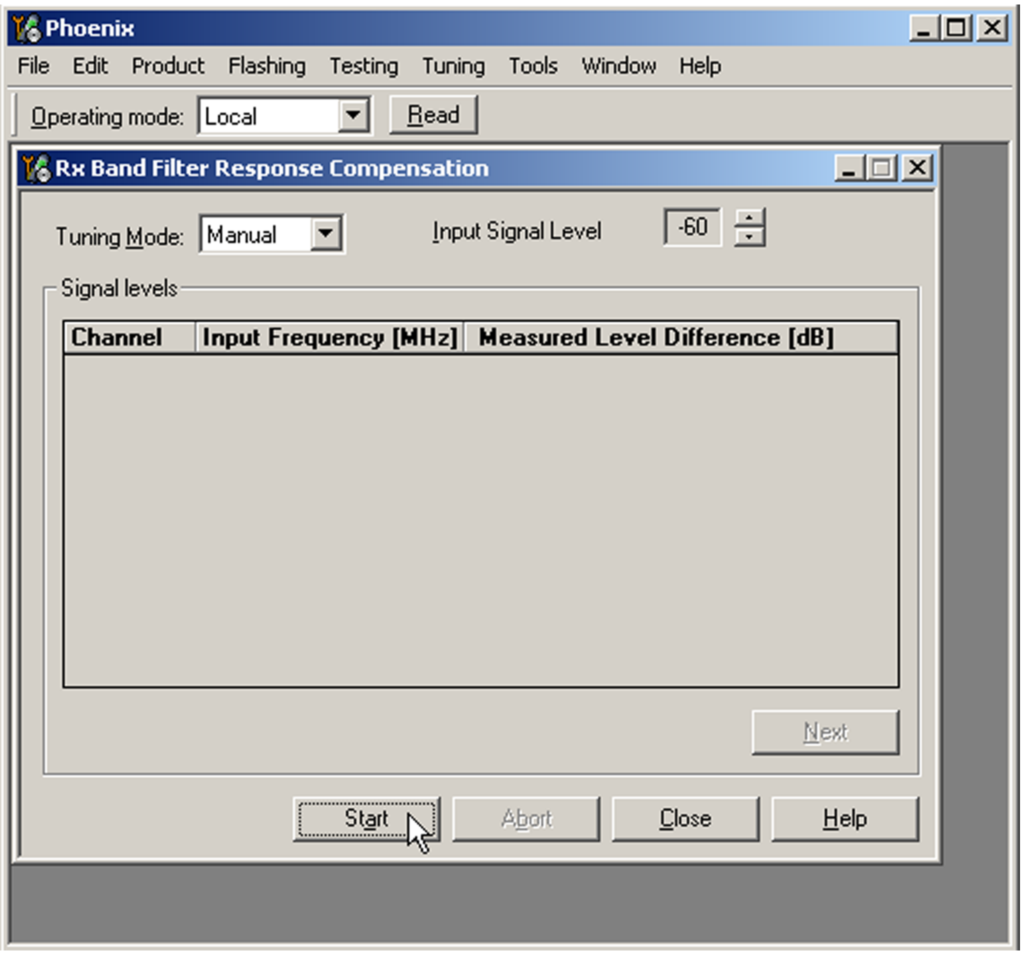
Context

On each GSM Rx band, there is a band filter in front of the RF ASIC 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 the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Select **GSM900** band.
5. Choose **Tuning** → **GSM** → **Rx Band Filter Response Compensation** .
6. Select **Tuning mode: manual**
7. Click **Start**.



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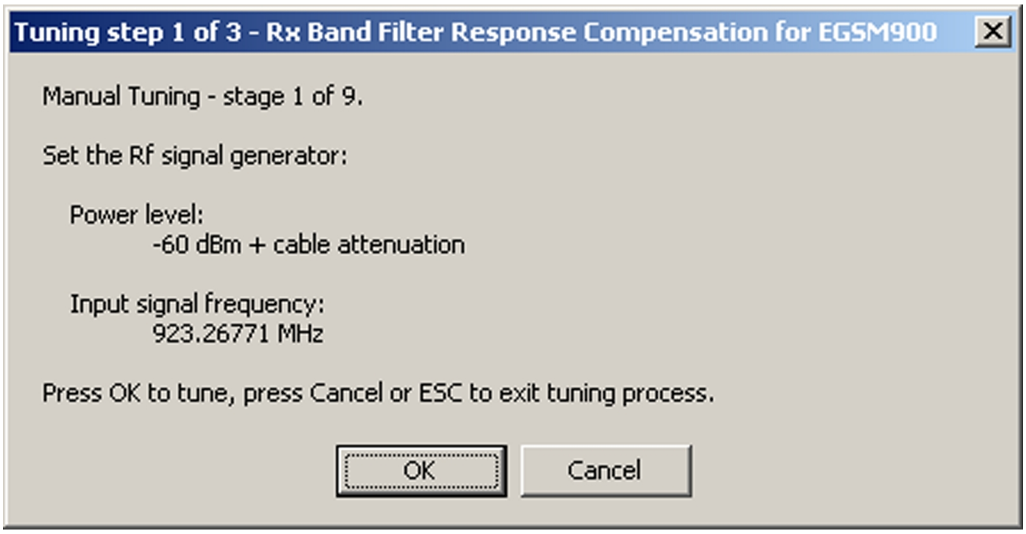
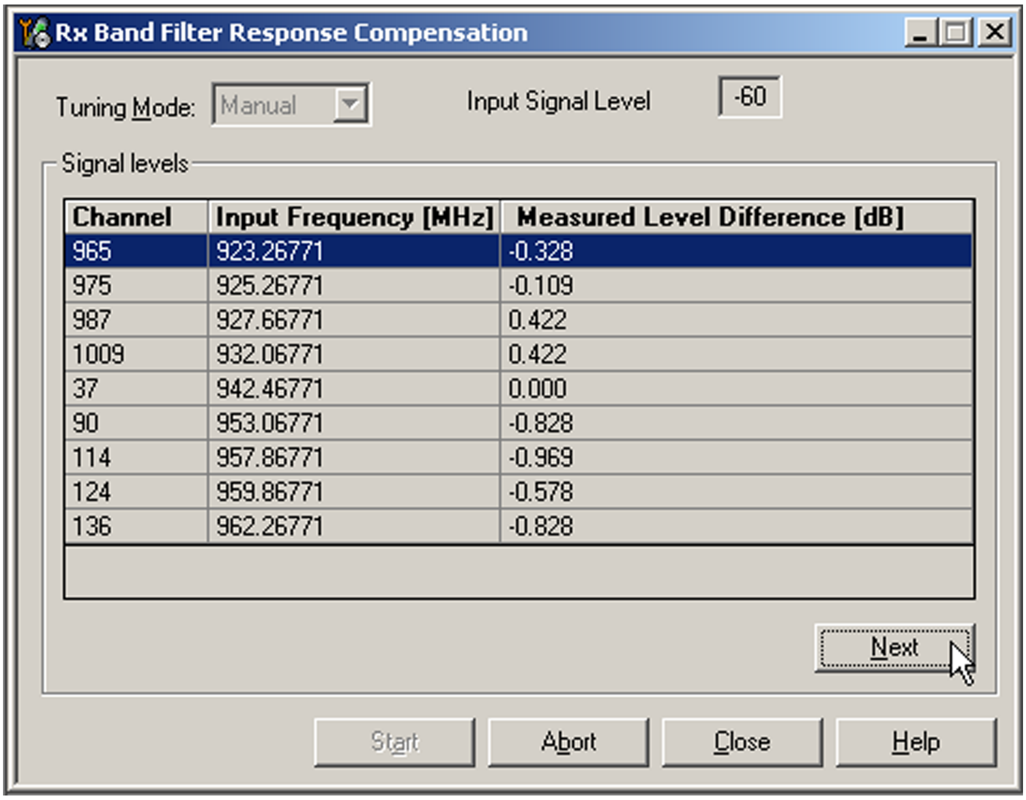
8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.



9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB

	Min	Typ	Max	Unit
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB

	Min	Typ	Max	Unit
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

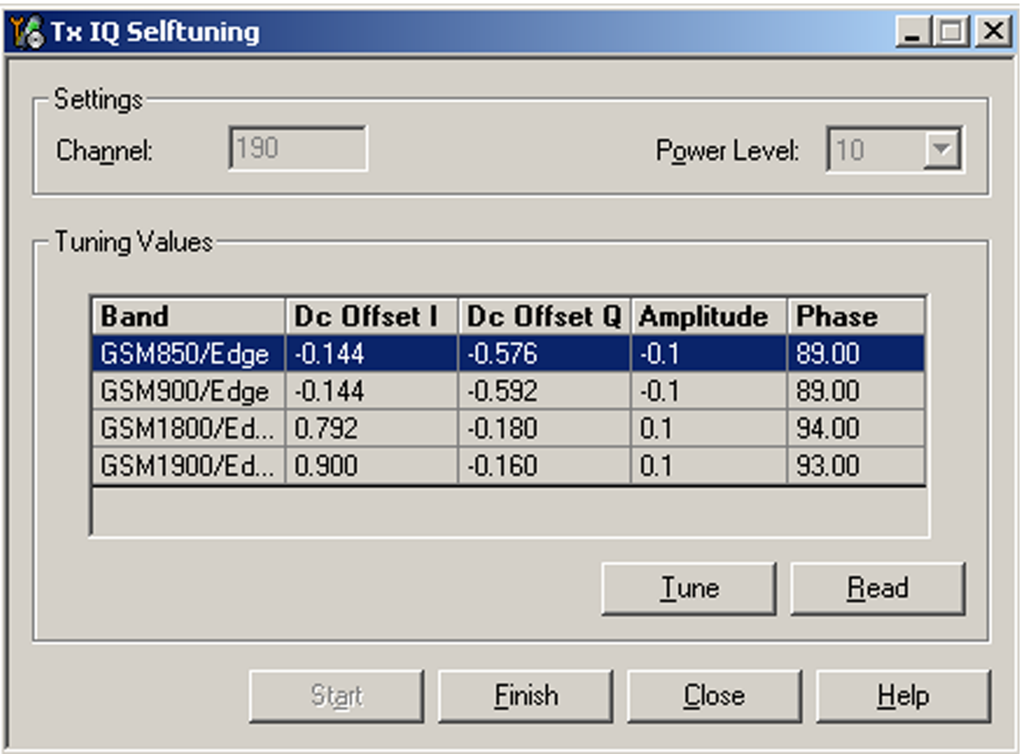
Context

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 balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning → GSM → Tx IQ Tuning** .
4. Select **Mode: Automatic**.



5. Select **Band: GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.

7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click**Finish** and then **Close**.

Next actions

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

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the 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.

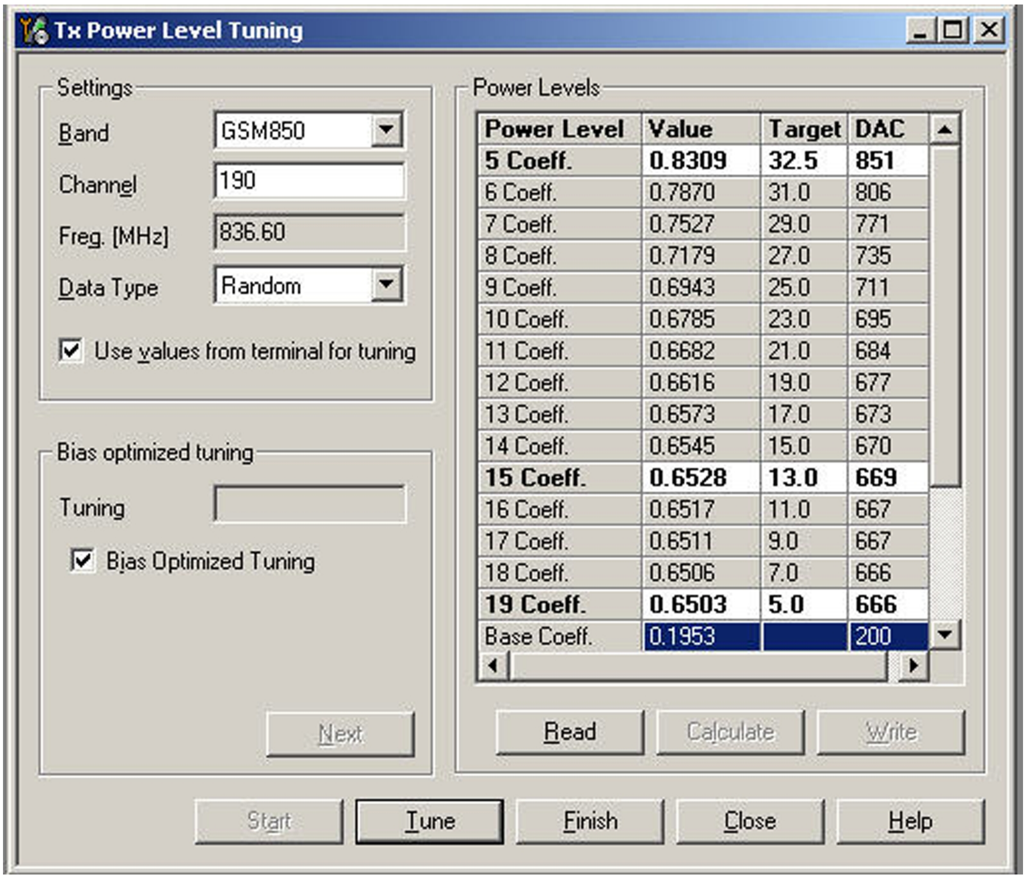
For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

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

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning** → **GSM** → **Tx Power Level Tuning** .

5. Click **Start**.l



6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **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 into account.

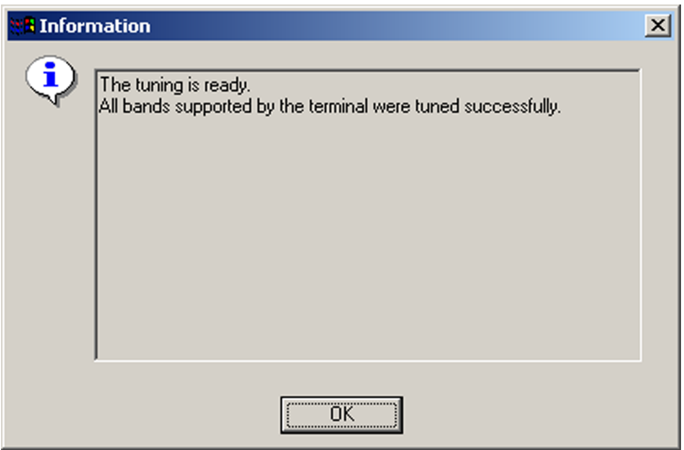
7. Set the tuning targets according to the values in the table below

GMSK	1Slot	2 slot	3 slot
850	32,5	31,0	29,7
900	32,5	30,5	29,0
1800	30,0	30,0	28,2
1900	30,0	27,0	25,2
EDGE	1Slot	2 slot	3 slot
850	26,5	26,5	24,7
900	26,5	26,5	24,7
1800	25	25	23,2
1900	25	25	23,2
WCDMA Band I	23.5 dBm		
WCDMA Band VIII	24 dBm		

8. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
9. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
10. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



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WCDMA receiver tunings

RX calibration (WCDMA)

Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA2100 or WCDMA900".
5. Click **Tune**.
6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.

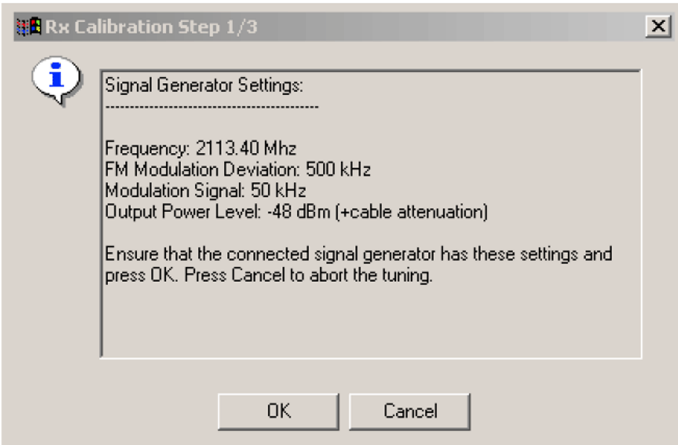
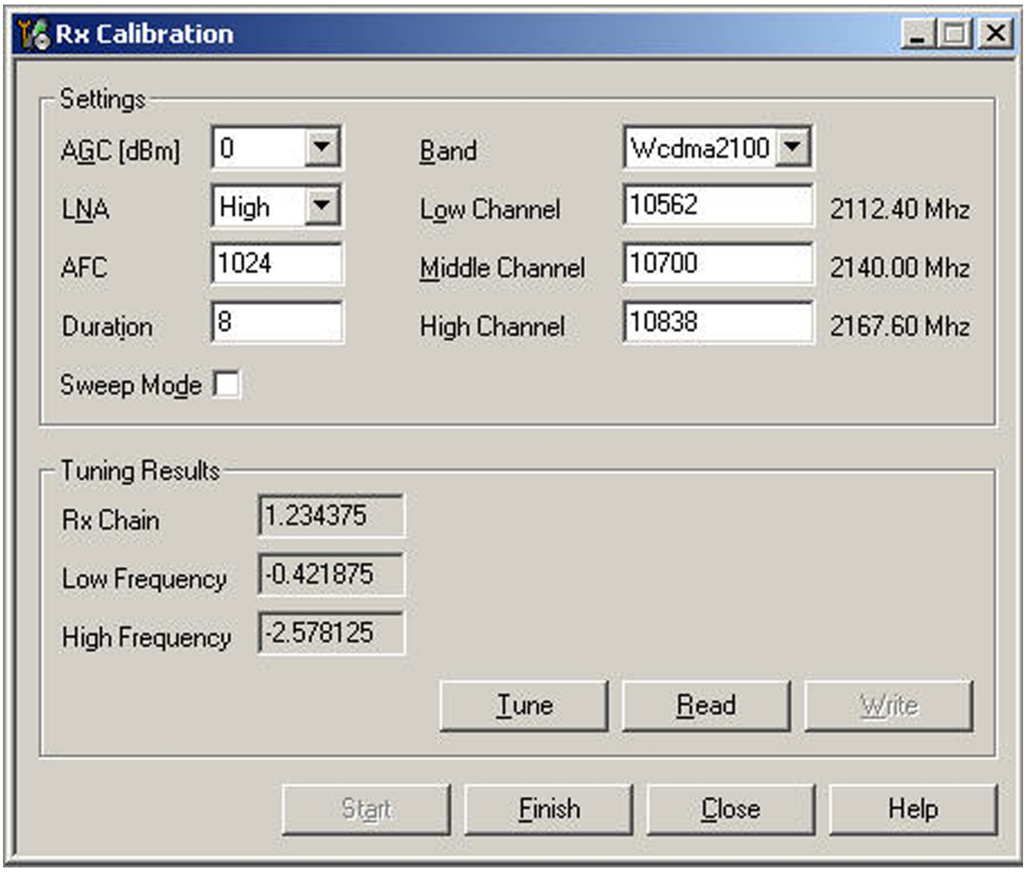


Figure 43 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



8. Ensure Tuning Results are within limits specified in the table below:
   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	2100 or 900	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA2100 or WCDMA900".
- Check the **Sweep Mode** box.
- Click **Tune**.

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- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.

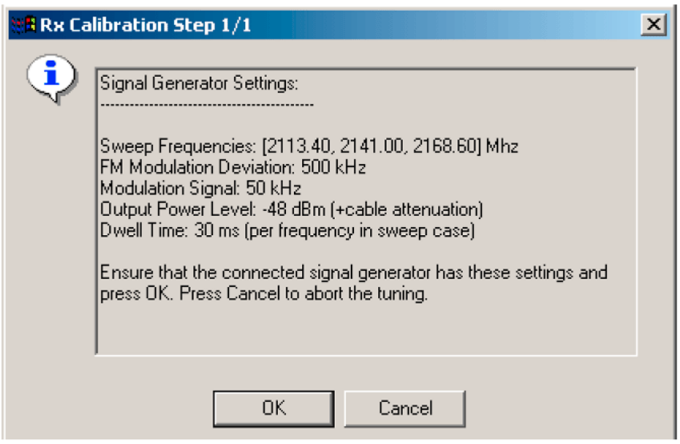


Figure 44 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

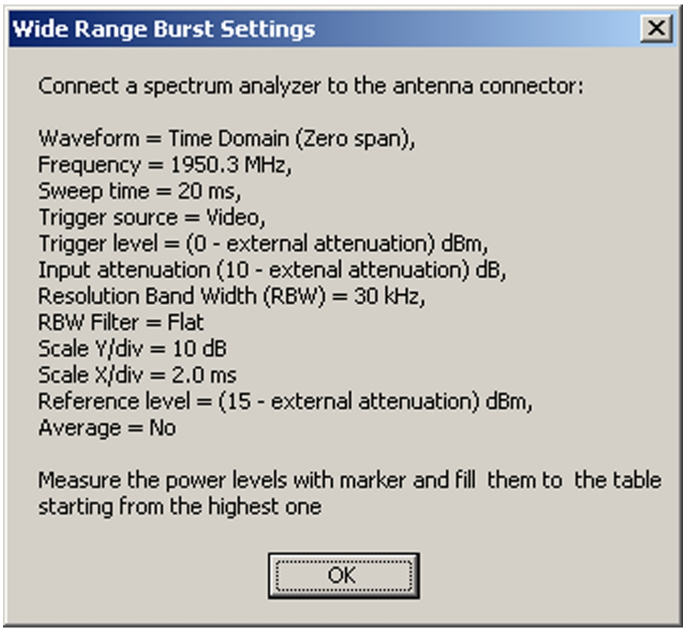
- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

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

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning** → **WCDMA** → **Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).

5. Set up the spectrum analyzer in the following way:



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 after 750 us, the third after 1250 us and so on for 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 spikes on lower levels.

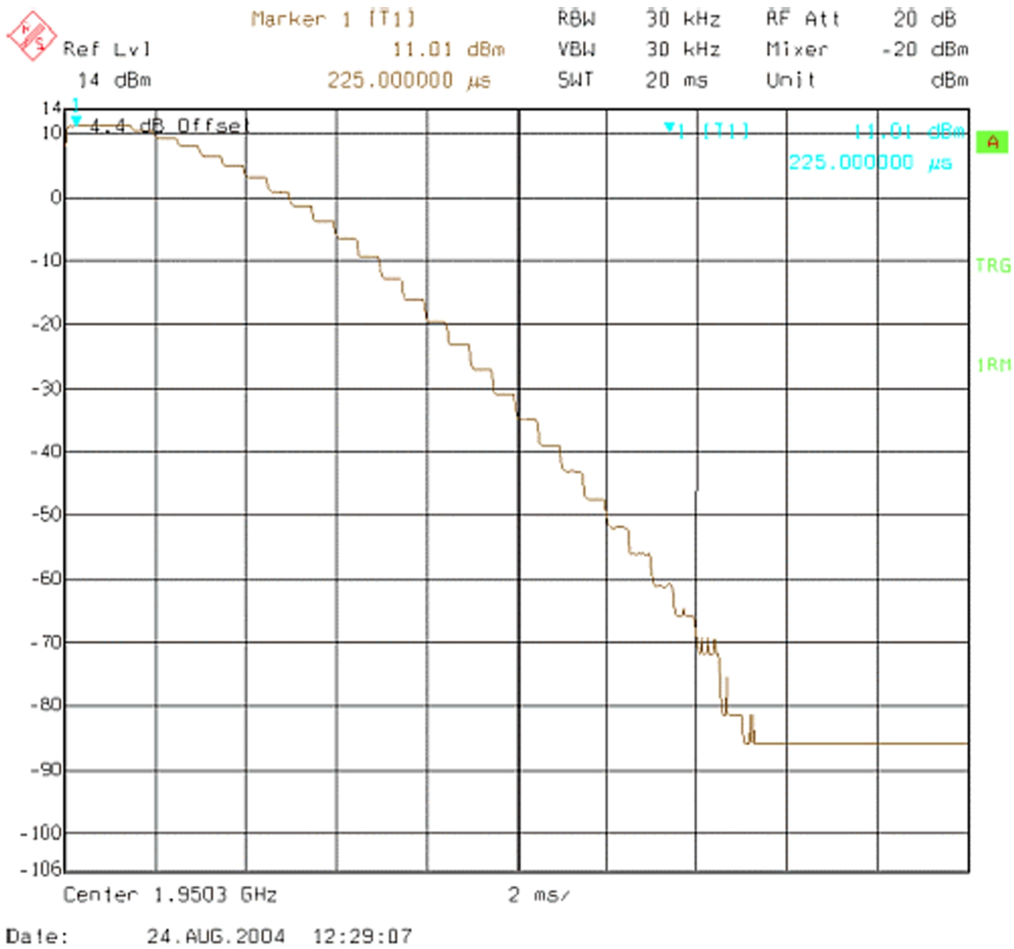
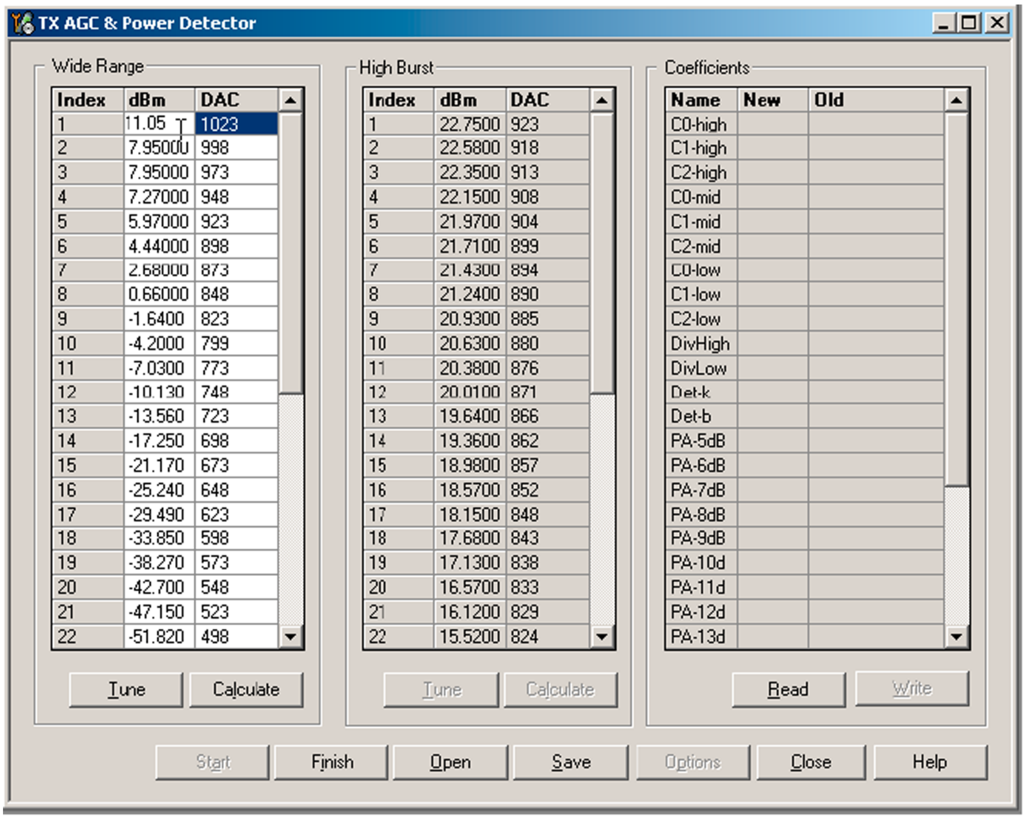
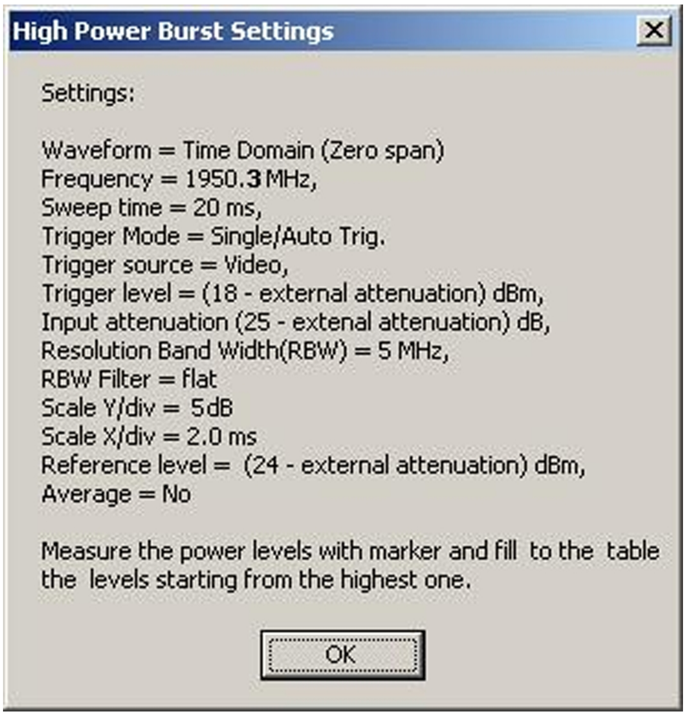


Figure 45 WCDMA power level tuning steps

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. Adjust the spectrum analyzer according to the following settings:



12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

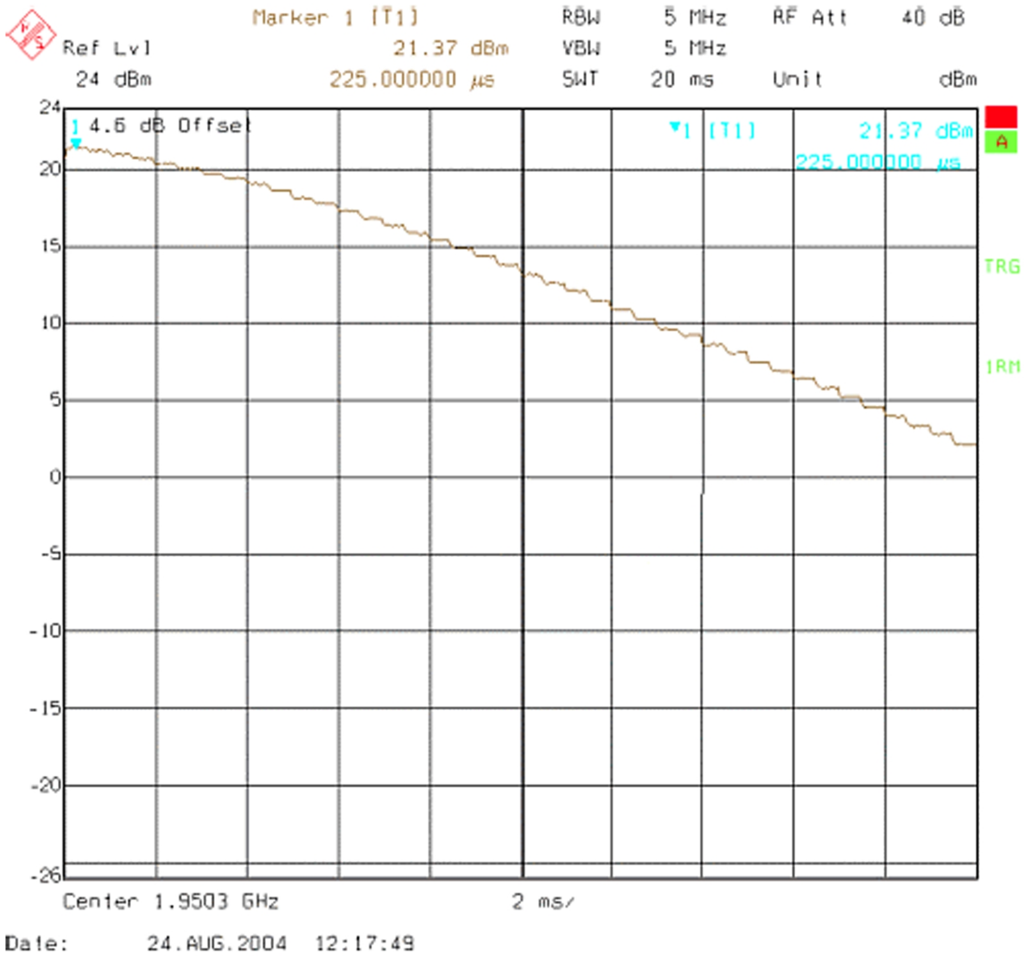


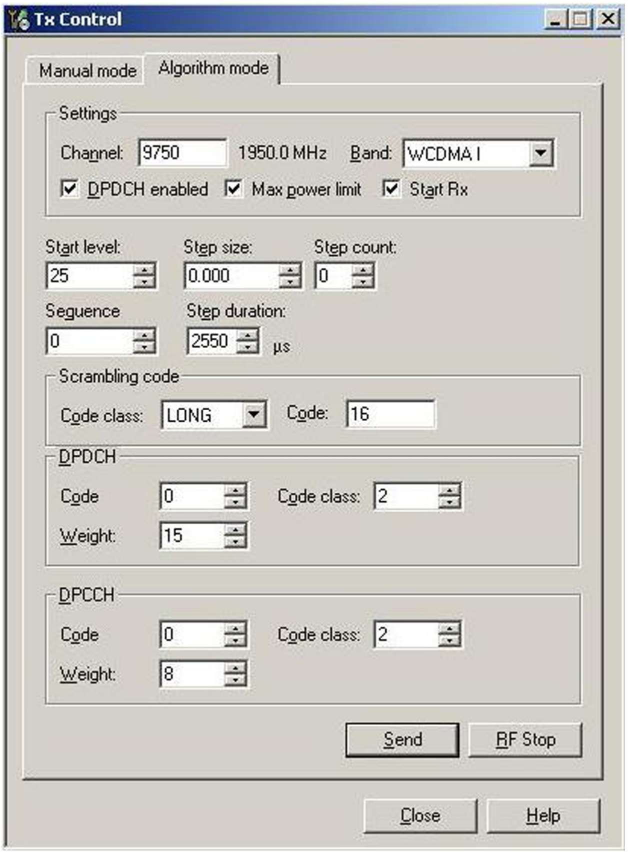
Figure 46 High burst measurement

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

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing** → **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 (WCDMA I)** or **897.4 MHz (WCDMA VIII)**
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** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

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

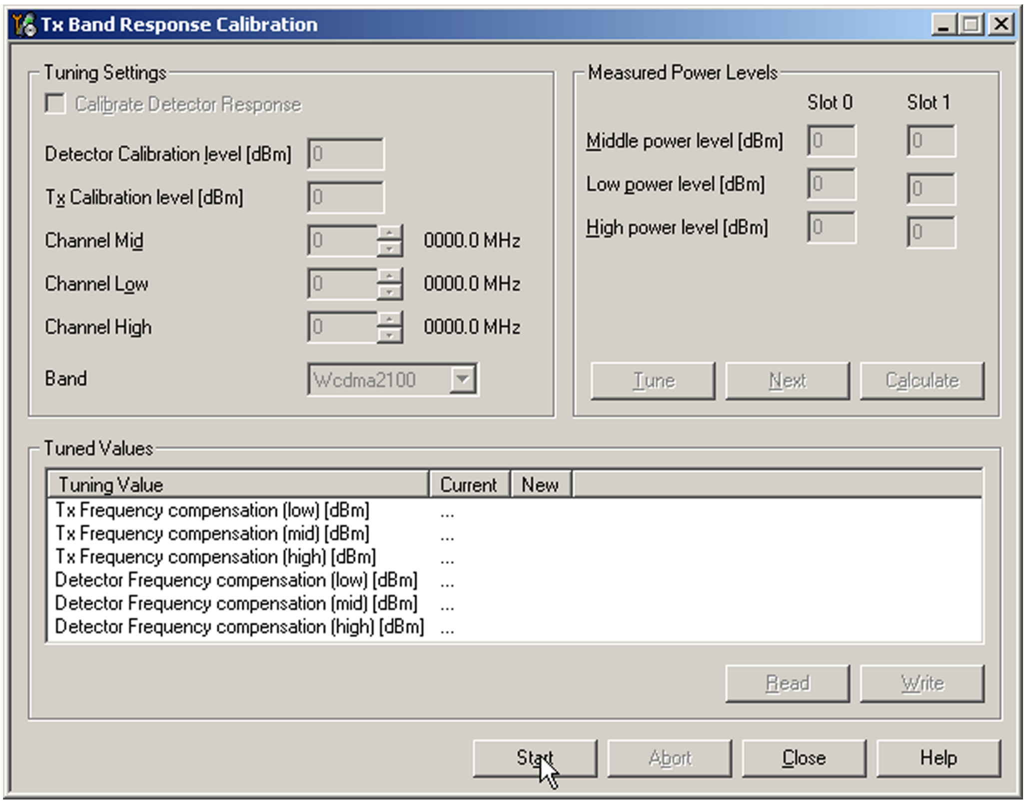
Context

The purpose of this tuning operation is to calibrate the WCDMA Tx performance. It defines the power detector and Tx frequency compensation values. However, before starting this tuning procedure, it is necessary to carry out Tx AGC & Power Detector Calibration tuning. This is because its results will be needed for this tuning operation.

- In the *Tuning Settings* pane, it is possible to edit the numbers of channels used in this tuning operation.
- If the **Calibrate Detector Response** check box is checked, only Tx response is calibrated. Zero is written to the power detector compensation values block in the permanent memory (PM) of the terminal.
- **Detector Calibration level** shows the power level used for calibrating the power detector in this tuning procedure.
- **Tx Calibration level** shows the power level used for calibrating tx frequency in this tuning procedure.
- In the *Measured Power Levels* pane, you can insert the dBm values read from the power meter.
- In the *Tuned Values* pane, the values that are stored in the permanent memory (PM) of the terminal in Current columns are shown.
- New values are added to *New* column when the **Calculate** button is clicked.
- The **Abort** button aborts the tuning operation without saving the tuned values.
- The **Read** button reads the tuned values in the PM of the terminal, and displays them in the *Tuned Values* pane in in the *Current* column.

Steps

1. Start *Phoenix* service software.
2. Choose **File** → **Scan Product** .
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning** → **WCDMA** → **Tx Band Response Calibration** .
5. Click **Start**.



The current values are shown in the *Tuned Values* pane.

6. Click **Tune**.
7. Connect the power meter to the terminal, and set it to **Channel Mid** frequency.
8. Read the values of slot 0 and slot 1 from the power meter and enter them to **Middle power level** fields in the **Measured Power Levels** pane.

   Slot 0 is used for detector calibration and slot 1 for Tx calibration.
9. Click **Next**.
10. Switch the power meter to **Channel Low** frequency.
11. Read the values from the power meter, and enter them to **Low power level** fields.
12. Switch the power meter to **Channel High** frequency.
13. Read the values from the power meter, and enter them to **High power level** fields.
14. Click **Next**.
15. Click **Calculate**.

    The tuned values are shown in the *Tuned Values* pane in the *New* column.
16. 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

17. To save the tuned values to the terminal, click **Write**.
18. Close the *Tx Band Response Calibration* window.

Tx LO leakage (WCDMA)

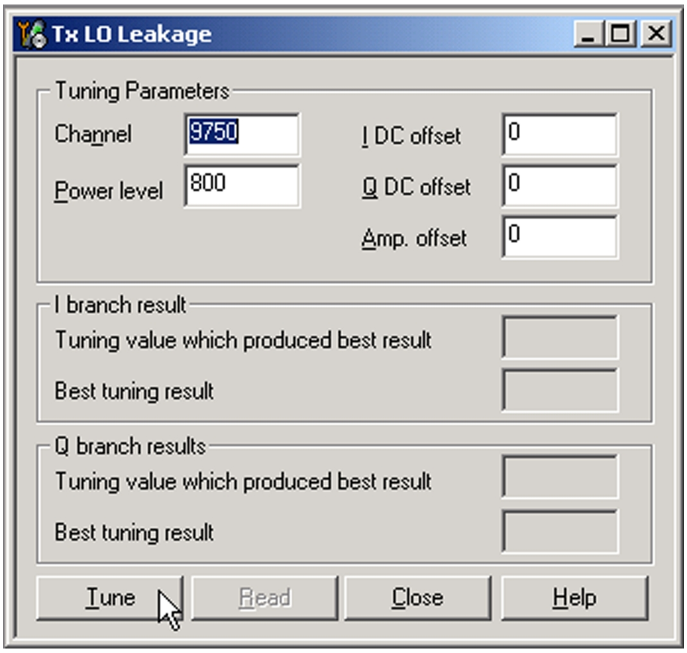
Context

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** drop-down menu, set mode to **Local**.
2. Choose **Tuning** → **WCDMA** → **Tx LO Leakage** .
3. Click **Tune**.



4. To end the tuning, click **Close**.

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5 — Camera Module Troubleshooting

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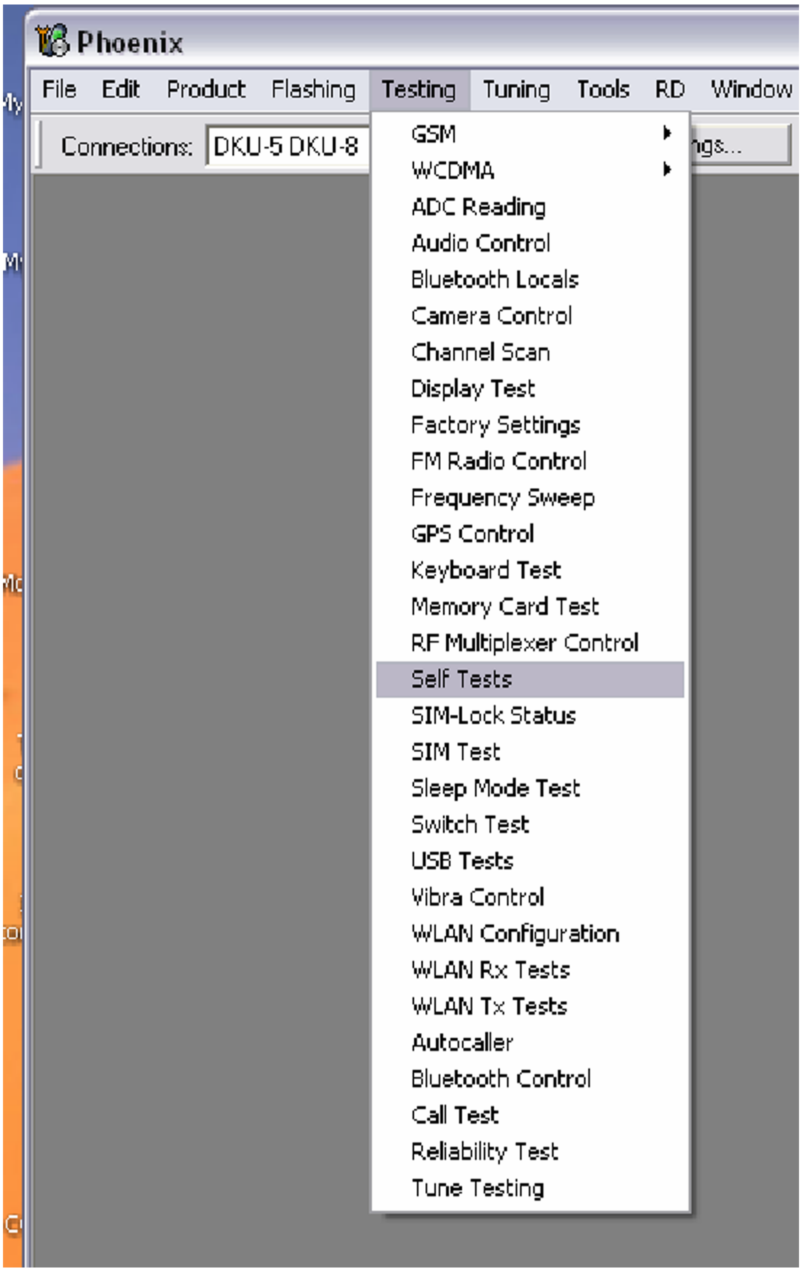
Camera tests for Phoenix

Steps

1. The self tests can be executed from Phoenix test software. Connect the device to Phoenix, and select **Self Tests** from the **Testing** menu.



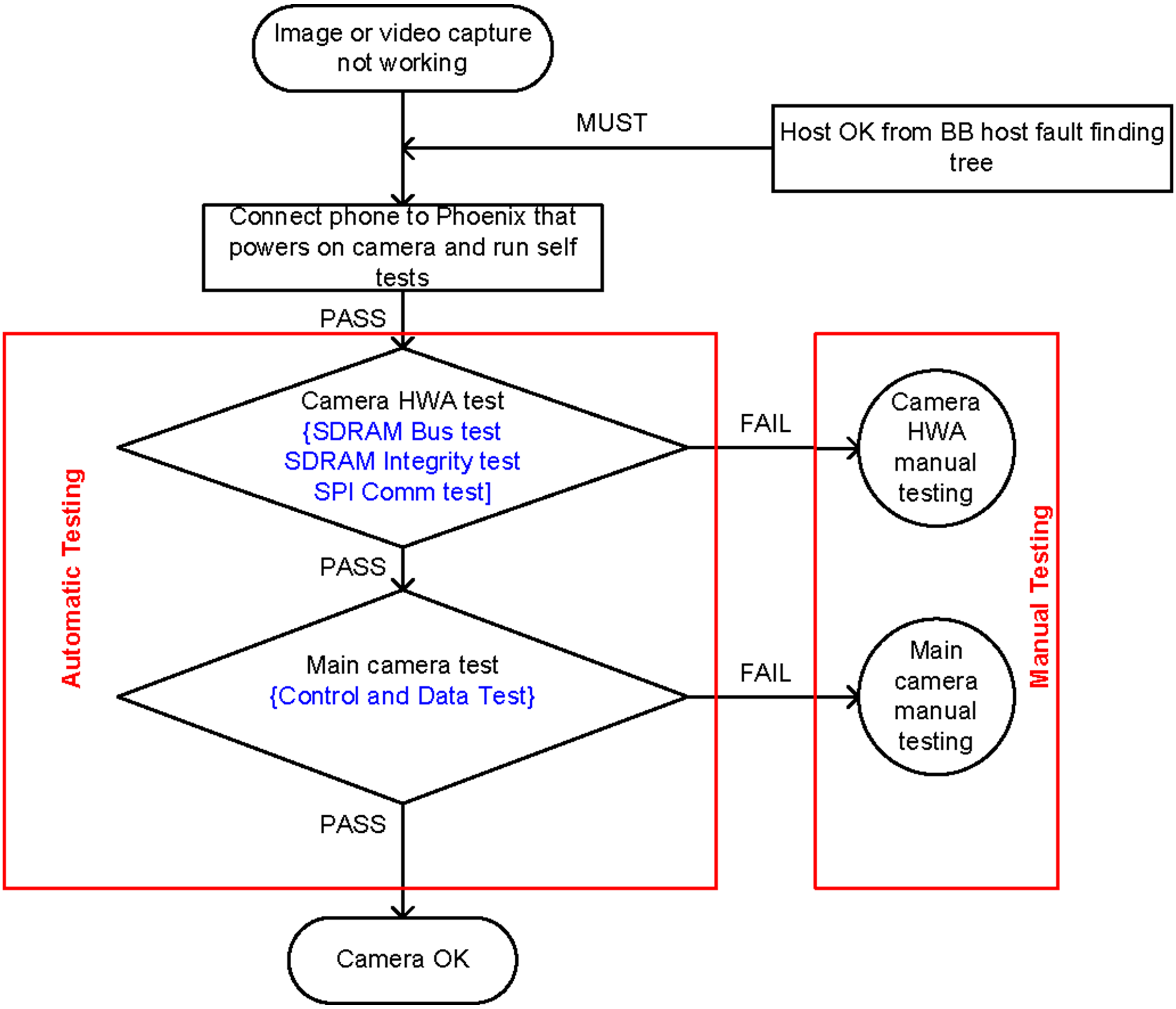
2. The following selection of tests will open (the visibility of the different tests depends on the device in question).

Camera failure troubleshooting overview

Context

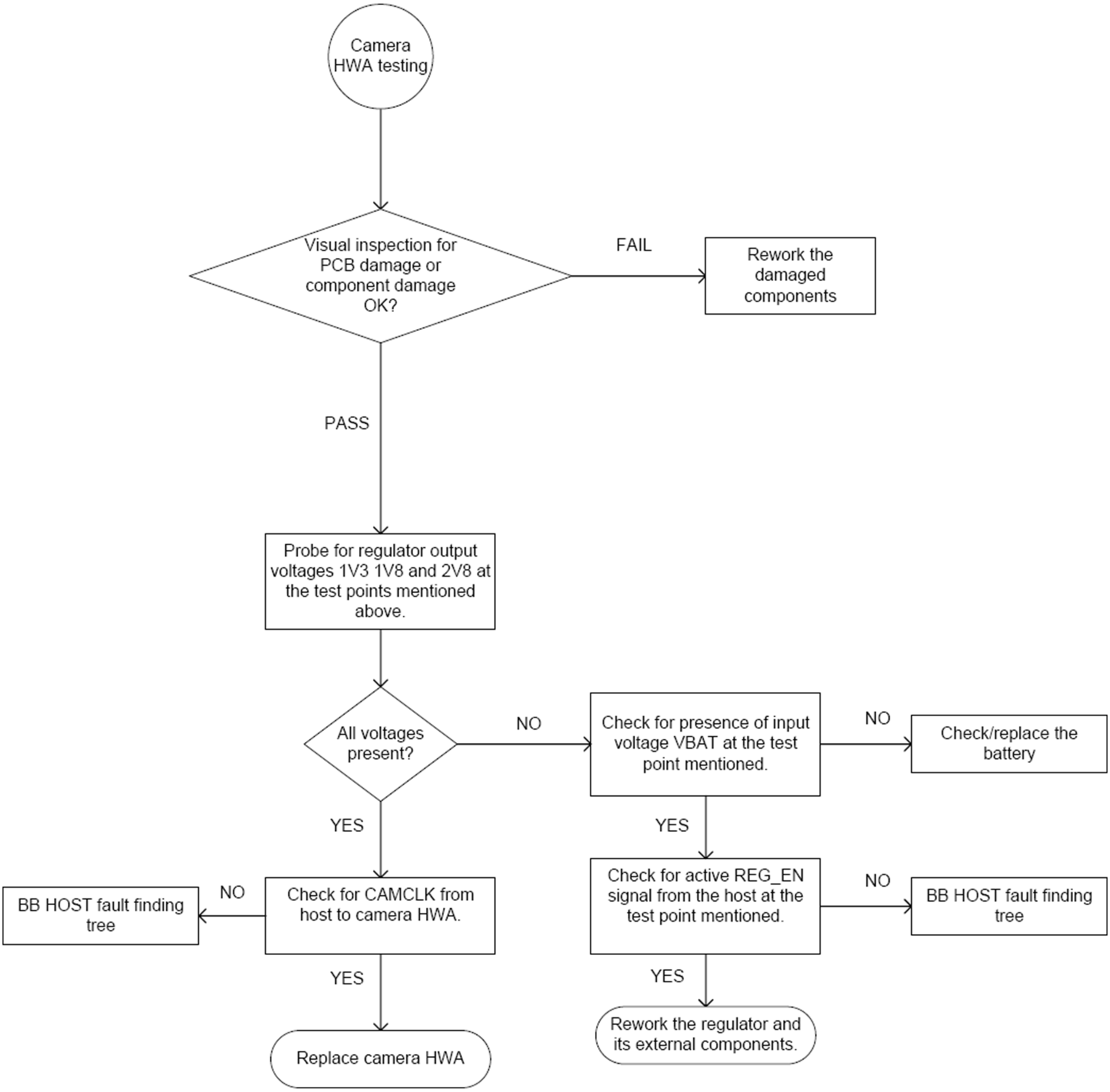
The camera troubleshooting is broken down into 2 parts: Automatic and manual check. The main purpose of the automatic check is to try and identify the fault automatically without any manual checks. If the automatic check does not provide enough information, manual check can be performed to narrow down the fault.

Troubleshooting flow



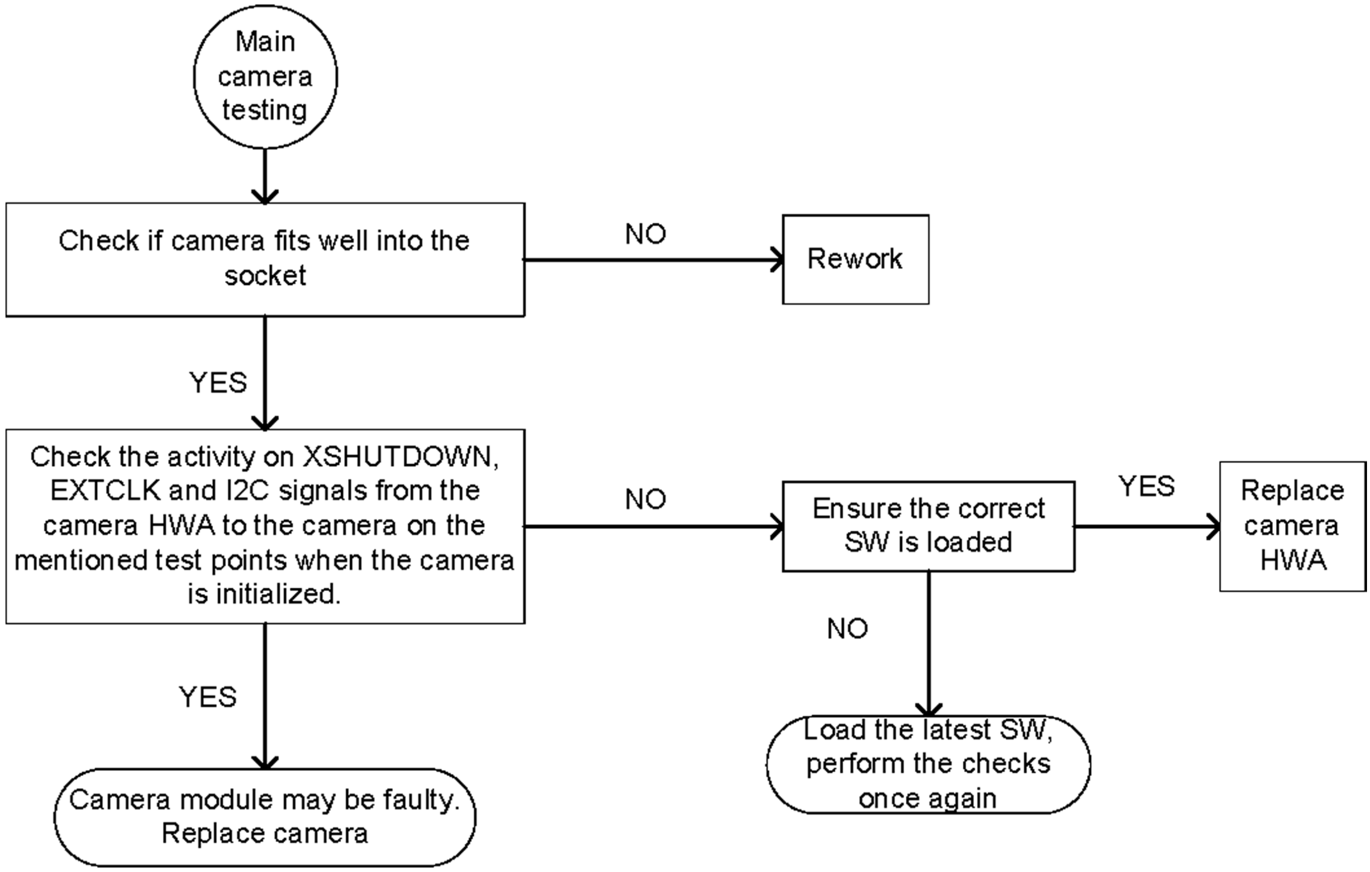
Camera HWA failure troubleshooting

Troubleshooting flow



Main camera failure troubleshooting

Troubleshooting flow



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6 — System Module and User Interface

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Introduction

Phone description

RapidoYawe is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE.

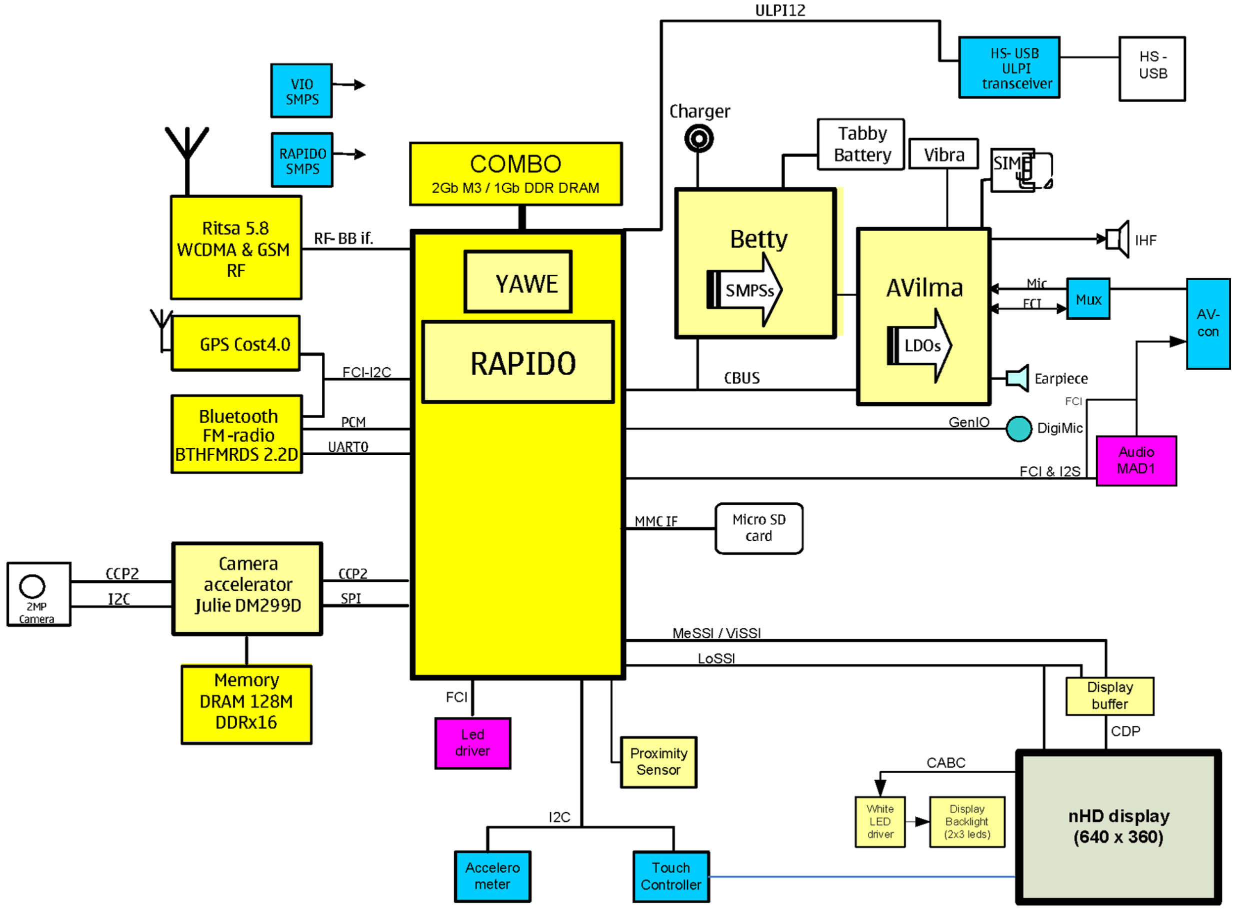
Avilma is mainly the audio ASIC in the phone and Betty is basically the energy management controller for the phone.

Bluetooth and FM radio are physically integrated in one single ASIC.

Key components

Function	Description	Item ref
Baseband ASIC	Avilma Betty	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RapidoYawe	D2800
Main camera accelerator	Julie DM299D	N1400
PA GSM	Front end module (FEM), quad band	N7520
PA WCDMA		N7540
Oscillators	VCTCXO 32.768 kHz crystall oscillator	G7501 B2200
Memory	1Gb DDR DRAM + 2Gb M3 NAND Flash Combo	D3000
FM radio	BTHFMRDS2.2D module	N6000
Bluetooth	BTHFMRDS2.2D module	N6000
Battery	BL-5J	
Battery connector	Tabby blade interface	X2070
RF connector		X7501
Accelerometer		N6501
GPS	GPS ASIC GPS5350	N6200
Touch screen controller (TSC2004)		N2450

System module block diagram



Energy management

Battery and charging

BL-5J battery

The phone is powered by a 3-pole BL-5J S-pack 1320 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

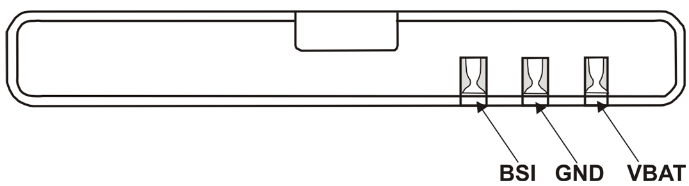


Figure 47 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

Figure 48 Small (right) and wide (left) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) BETTY and AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-5J S-pack battery is used.

Table 14 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage (fast charging)	4.230	
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.15	In call
Sw shutdown	3.3	In idle
Min Operating Voltage		

Voltage	Voltage [V]	Condition
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

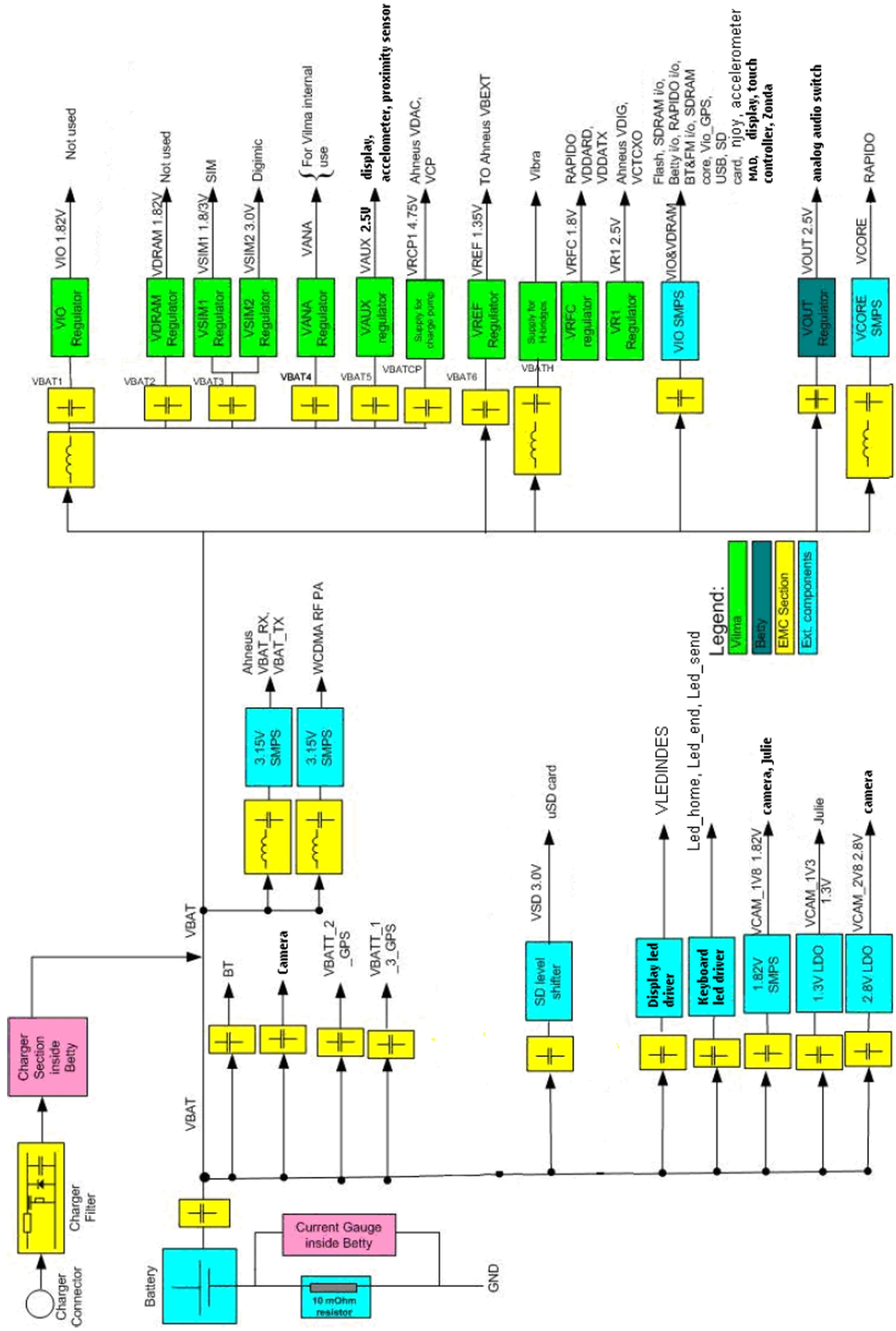
When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY 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. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Power distribution



Clocking scheme

In BB5, 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 AVILMA with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAPIDO for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAPIDO to BETTY. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from AHNEUS ASIC to BT module.

CLK600. The clock source is internal RC oscillator in BETTY (during the power-up sequence) or RAPIDO SMPS Clk.

Bluetooth

Bluetooth module BTHFMRDS2.2D provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Bluetooth can also be used as a wireless link between a personal computer and the phone.

Bluetooth connects directly to the Rapido with UART (universal asynchronous reveiver / transmitter). Control signals are connected to Rapido's genios (BT_Wakeup, UART_Wakeup, Reset.) Bluetooth digital audio is connected to Rapido via PCM interface.

Clock source for Bluetooth module is AHNEUS ASIC. 38.4MHz clock is used as a sysclk for BT module.

BTHFMRDS2.2D is using VIO 1.8V as its only power source..

The Bluetooth is physically integrated with the FM radio into the same module.

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.

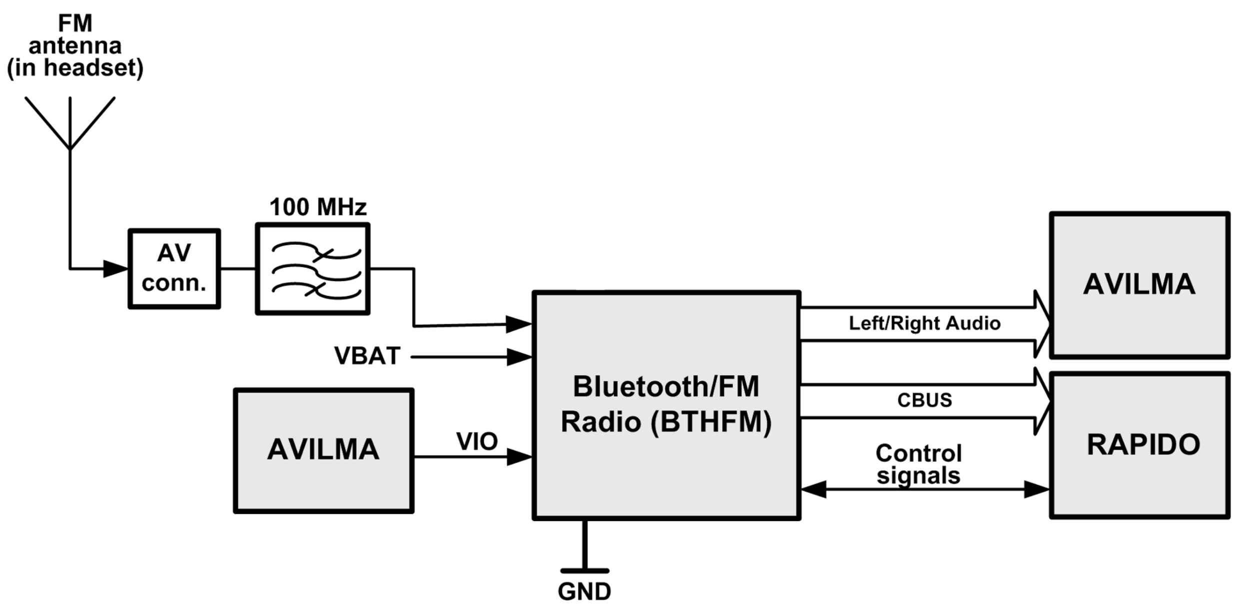


Figure 49 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as elements of the antenna, and no other antenna is needed for FM radio reception.

The radio has an automatic band search function, which can search for a strong station.

High-speed USB

The device can transmit and receive USB data at high-speed (480 Mbit/s), full-speed (12 Mbit/s) and low-speed (1.5Mbit/s).

The USB connection is implemented using D3300 ULPI high-speed USB transceiver and the ULPI interface from Cellular ASIC D2800. External interface is the micro B connector X3300.

The interface between D3300 USB transceiver and micro B receptacle is standard USB interface specified in Universal Serial Bus specification Rev. 2.0.

The USB transfers signal and power over four-wire interface, which carries differential data, Vbus and GND.

Signalling occurs over differential data line D+ and D-. The clock is transmitted encoded along with the differential data. ESD protection is done with USB ASIP Z3300. VBUS (+5V) is provided by the host device.

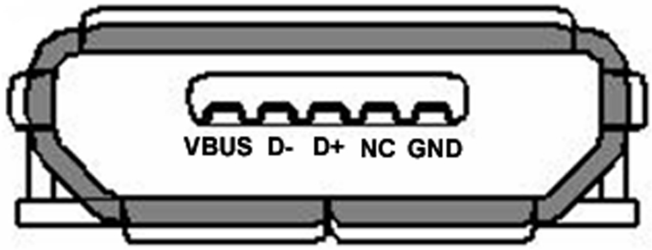


Figure 50 Micro B receptacle

CBUS interface

CBUS is a "main" system control bus in BB5. RAPIDO controls the functionality of EM ASICs AVilma (N2200) and Betty (N2300) with CBUS.

CBUS is a four-wire half-duplex master-slave interface. In HW51 CBUS clock frequency is 4.39 MHz.

FBUS

USB and FBUS have multiplexed interface between EM ASIC (2300) and RAPIDO.

ECI interface

The ECI (Enhancement Control Interface) is a point-to-point, bi-directional, single line serial bus.

The purpose of the ECI is to identify and authenticate the accessory, and to act as a data bus (intended for control purposes) between the phone and the accessory .

Charger interface

Charging control and charge switch are situated in EM ASIC (N2300).

If the temperature rises too high and the thermal protection is activated, EM ASIC (N2300) goes to protection mode.

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAPIDO and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

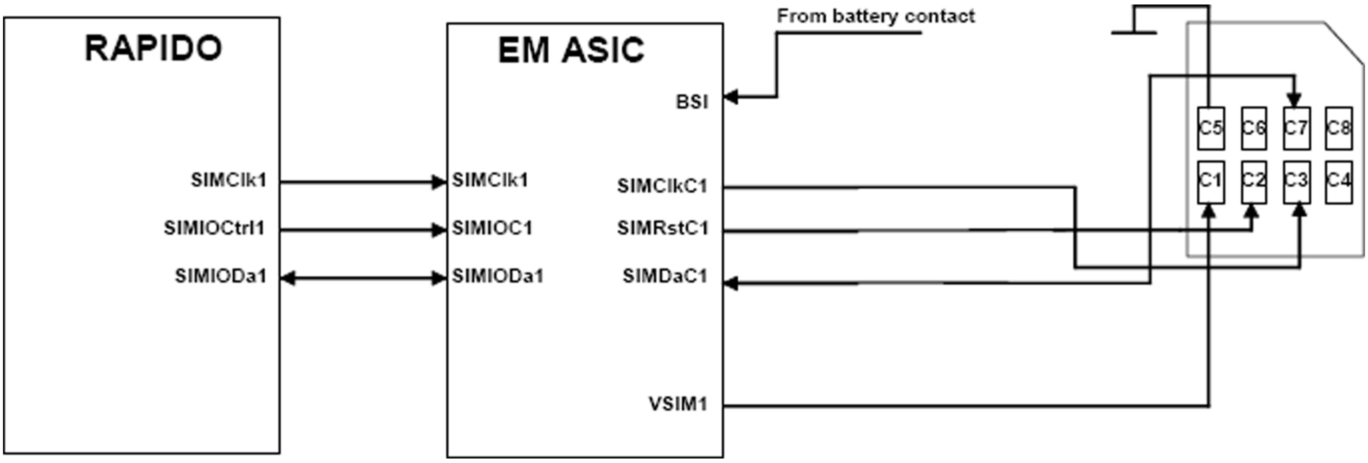
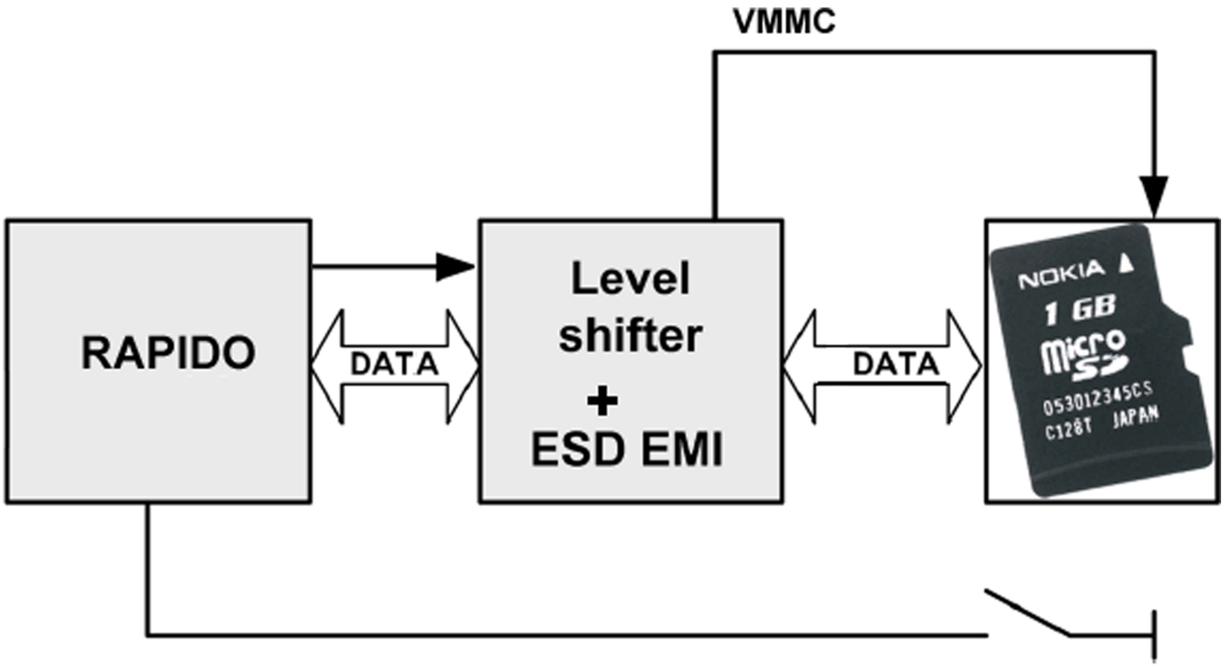


Figure 51 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The EM ASIC SIM1 interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

µSD card interface



The µSD card is connected to the engine by an external level shifter with an ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The µSD card door state is detected by a detect switch. When the door is open, the µSD card is powered off. Hot swap is supported, which means that the card may be plugged in/out at any time, without removing the battery.

Accelerometer

The 3-dimensional accelerometer measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock.

The features using accelerometer in RM-588 are:

- Turn-to-mute (ringing tone & alarm)
- UI auto rotate
- Gaming control

The accelerometer (N6501) is connected to I2C. One GENIO is reserved for interrupt.

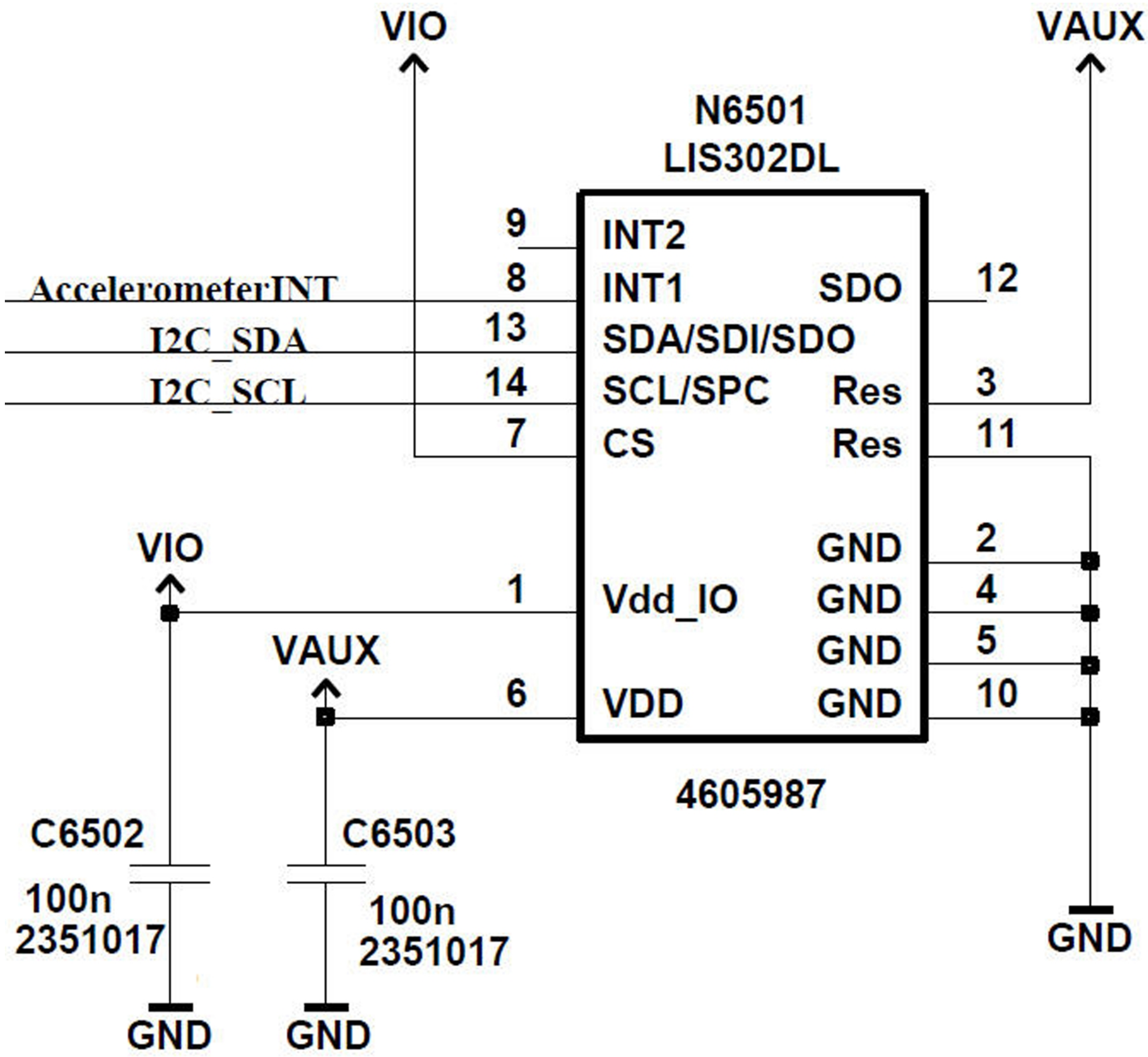


Figure 52 Accelerometer schematics

GPS interface

Functional description

The device includes an inbuilt GPS receiver and it works as a stand-alone positioning device.

The GPS solution provides a full GPS HW and SW engine for devices capable of operation in all GPS modes:

- Autonomous (standalone) - no communication with network is required for GPS fix
- MS based - the device receives aiding information from the network and computes fix internally
- MS assisted - the device receives aiding information from the network and computes pseudorange measurements. The measurements are then sent back to the network for the fix calculation.

At the heart of the GPS solution is GPS5350 GPS receiver IC, which has GPS RF receiver and GPS BB processor integrated into a single IC. RF section performs down conversion, filtering and IF sampling, whereas BB section contains an enhanced version of multimode GPS with twelve hardware matched filters, post detection logic and an ARM controller core.

The features of the GPS solution include:

- 12 channels
- Integrated regulators for RF and BB (including external LNA)
- Direct connection to a battery
- Fast clock calibration through availability of 261MHz clock from RF PLL
- Improved tracking and Hot start (TTFF) reacquisition performance
- Advanced Power Management and Host Wakeup capability.

The I2C interface handles data transfer between GPS and the Rapido. GPS uses the CE RF system clock to calibrate its own GPS Clk.

GPS has three clock sources:

- 16.368MHz clock from a dedicated TCXO (G6200)
- 38.4MHz reference clock from Ahneus RF ASIC
- 32.768kHz Sleepclk

The GPS module is powered from VIO 1.8V and VBAT.

Block diagram

The following block diagram shows how the GPS module is connected to the host side.

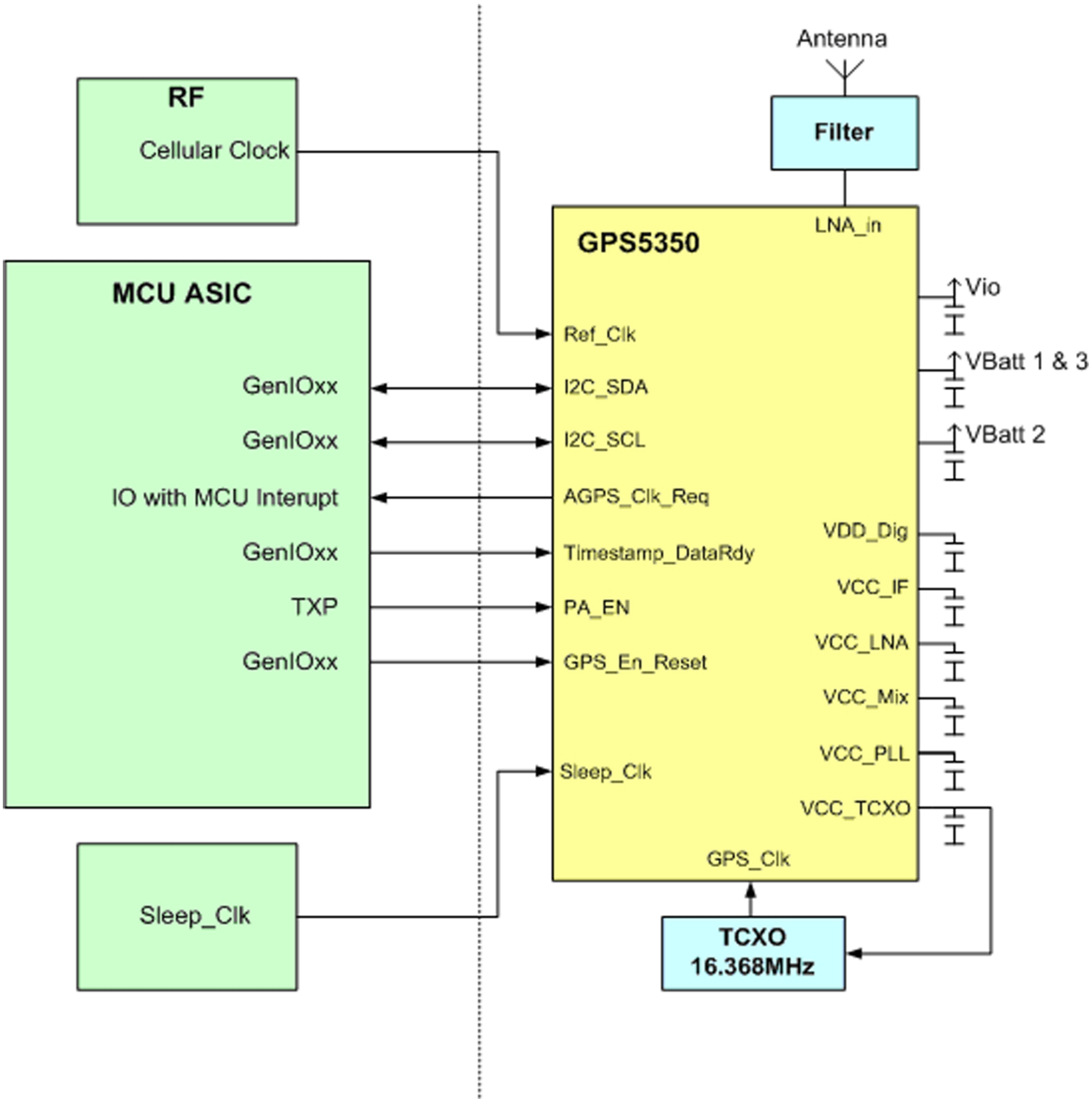


Figure 53 Block diagram of the GPS system

Interface signals

Signal name	I/O	Function
RF		
ANT_GPS	I	GPS antenna port
LNA_In	I	GPS ASIC RF input
Clocking		
REF_CLK	I	Reference Clock = RF Cellular clock, Min $0.2V_{pk\text{-}pk}$
GPS_CLK	I	Connection of 16.368MHz GPS TCXO
RTC_CLK	I	Cellular engine 32768 Hz sleep clock
Control		
GPS_EN_RESET	I	GPS engine reset

Signal name	I/O	Function
AGPS_CLK_REQ	O	MCU Interrupt when GPS requires CE to be awake (Host Wakeup)
IO_TIMESTAMP_DATARDY	I	Strobe for accurately marking in real time, timing information from the cellular engine. DATARDY indication to download code through synchronous operation from cellular engine.
IO_PA_EN	I	Used to implement PA blanking when cellular PA is ON
Comms		
I2C_SCL_U1TX	B	I2C clk line
I2C_SDA_U1RX	B	I2C data line
Power		
VDDS	P	Cellular engine I/O supply
VBatt 1 & 3	P	Phone battery power or SMPS power
VBatt 2	P	Phone battery power
VSS	P	Ground plane

Camera concept

Imaging characteristics

The imaging and video baseband subsystem contains the complete imaging system for the cameras. The main features of the imaging and video baseband subsystem are:

- Hardware acceleration for image processing
- Support for the 2.0 megapixel main camera

Key components

Julie DM299D imaging accelerator (N1400)

The imaging video baseband is implemented using the Julie DM299D processor. The Julie DM299D processor is a hardware accelerator for imaging and video applications. This processor controls all the cameras and flashes in the system.

This processor is controlled by Rapido via SPI interface. The boot code is downloaded into Julie DM299D external memory via the SPI interface at power on. Further application code (self test, image capture, video capture) is transferred depending on the usage case.

Video and still image data is passed to the Rapido for display & storage after processing over a CCP bus (CCP_CMT).

2.0 megapixel main camera

The camera module is SMIA85 compliant and is configured by the Julie DM299D using I2C control bus. Image data is transferred to the Julie DM299D over a CCP balanced bus (HIRES_CCP).

Powering

The camera subsystem is powered from 1.3V, 1.8V and 2.8V and is generated internally in the subsystem from the VBAT. These supplies are turned off/on by the host processor using the GPIO (Julie_REG_EN), depending in the camera usage.

Block diagram

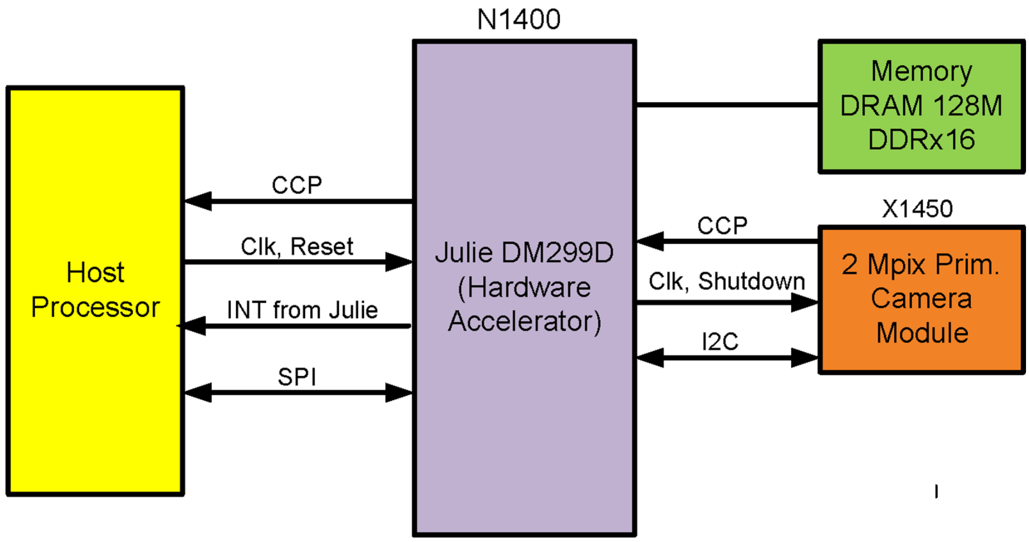


Figure 54 Imaging and video subsystem block diagram

Imaging HWA

This device uses a separate imaging and video engine. Its main ASIC is DM299D processor (N1400), which compresses and decodes camera pictures and video stream. It is connected to the Rapido with a CCP2 serial interface for data, and SPI interface for control commands.

The 2.0 megapixel camera module (X1450, SMIA socket) is connected to the DM299D with CCP2 interface . The I2C bus is used as a control interface for the camera.

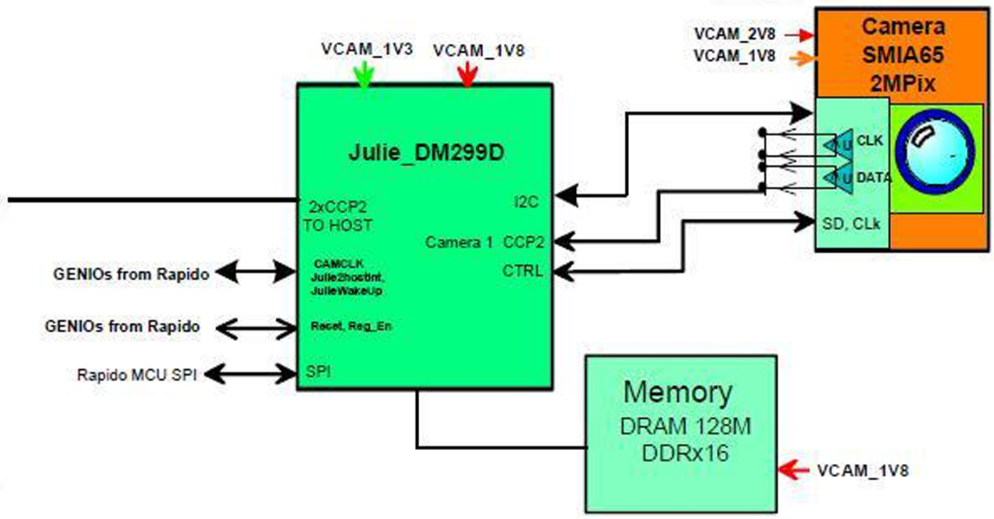


Figure 55 Imaging HWA block diagram

User interface

Resistive touch screen

Proximity sensor

The proximity sensor is used to turn off the touch input, when the phone is against user's ear during call. This prevents accidental touch signals that could happen when, for example, user's cheek touches the phone.

The main parts of the proximity sensor subsystem are:

- Proximity sensor
- Proximity boot (mechanical part)

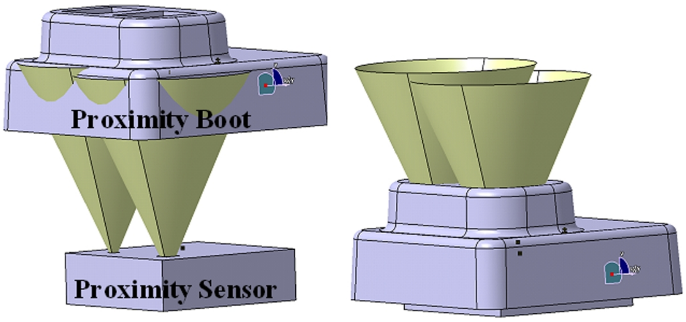


Figure 56 Proximity sensor and boot

The proximity sensor is located on the upper flex assembly.

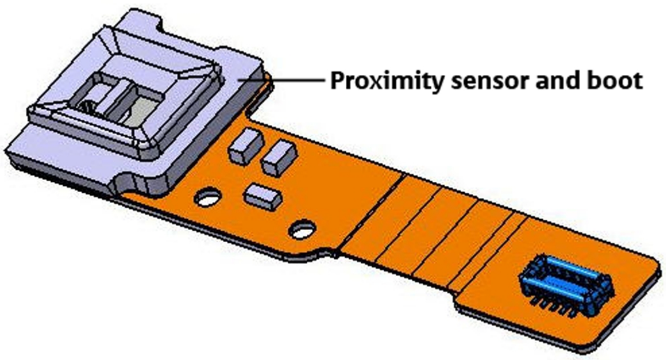


Figure 57 Proximity sensor and boot location

Features

The Proximity sensor has following features:

- 2.8V
- 1.8V compatible IOs
- Low power consumption
- 20 mm working area
- Factory calibrated, no calibration required in care
- Pb free/RoHS compliancy

The proximity sensor works by sending out a beam of IR light, and then computing the distance to any nearby objects from characteristics of the returned (reflected) signal. When the object is under 20 mm distance detection will happen and output will go to high state (1.8V).

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Reference design

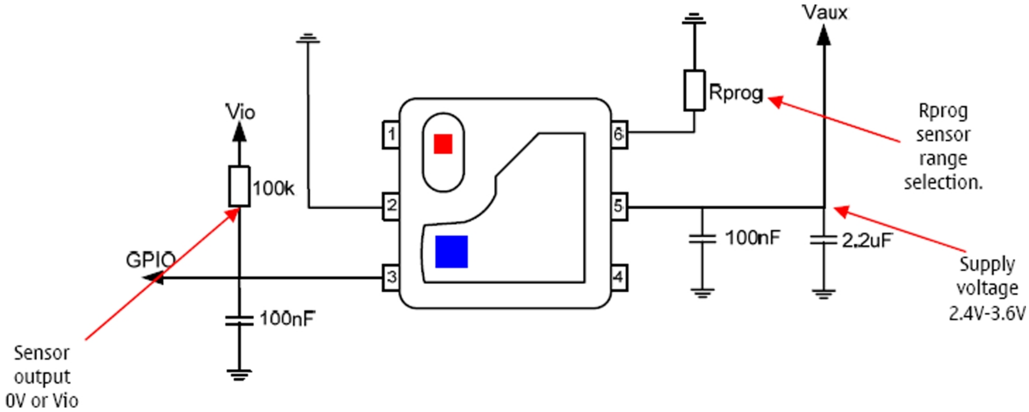


Figure 58 Proximity sensor reference design and measurement points

Pin	Signal name	Description
1	Anode LED	No connection
2	GND	Ground
3	OUT	Sensor output (0V or 1.8V Push-Pull)
4	TEST	No connection
5	VCC	Supply voltage (2.4V - 2.8V)
6	Rprog	Program resistor

Touch screen controller

TSC2004 (N2450) is a touch screen controller for resistive touch pads. It contains a complete ultralow-power, 12-bit, analog-to-digital (A/D) resistive touch screen converter, including drivers and control logic to measure touch pressure.

It also has embedded pre-processing function to reduce the output bus load. The host interface in TSC2004 is I2C.

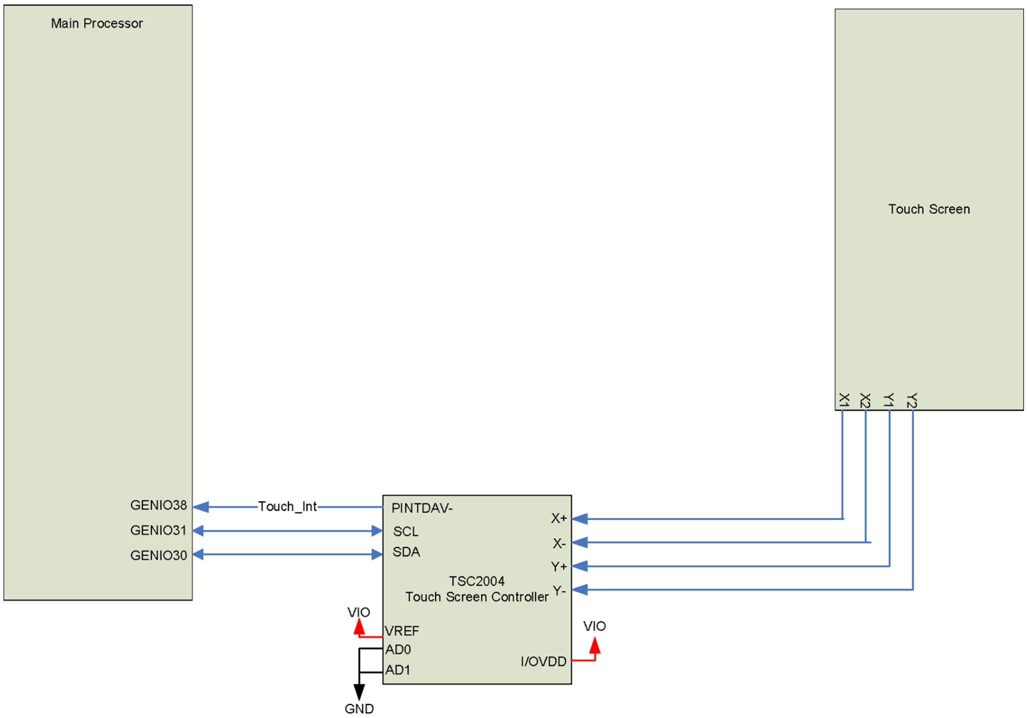


Figure 59 Touch screen controller

Display

Display

Rapido has an external display buffer with 8Mbit display RAM. The input interfaces for display buffer are ViSSI-12 for image data and LoSSI for commands.

The data interface between display buffer and display is CDP (Compact Display Port), display commands are sent by LoSSI interface. The display backlight control is controlled by the display.

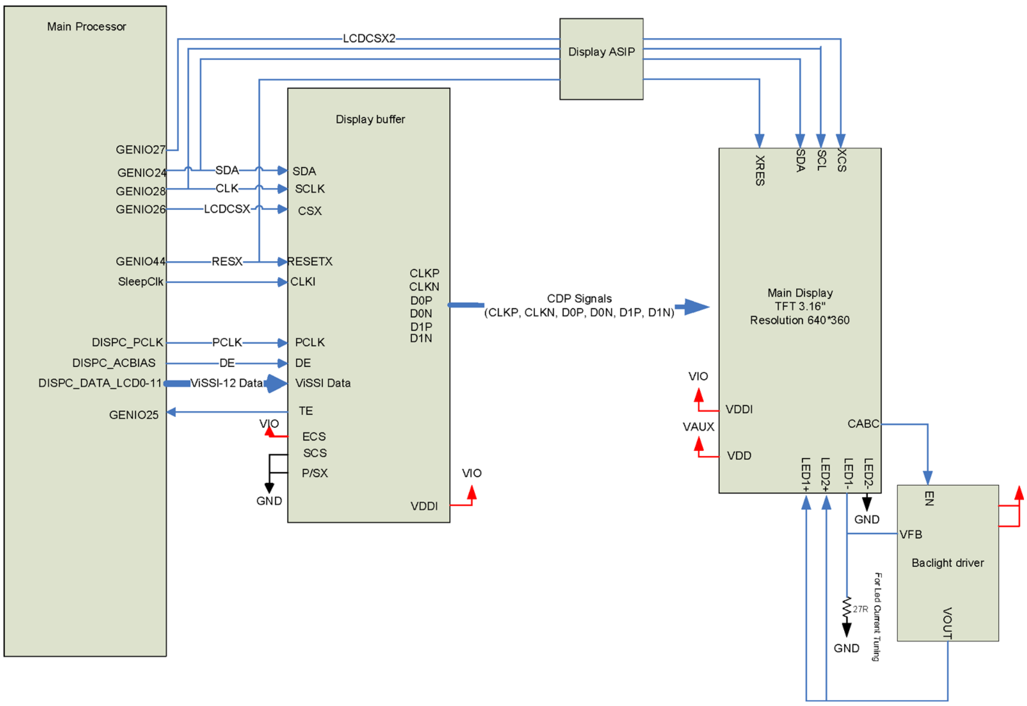


Figure 60 Display block diagram

Backlight and illumination

This device has two backlighting systems; one for the display and one for the HW keys.

Backlighting for HW keys

The LP5521 LED contoller is used for backlightning the HW keys . There is one LP5521 in the reference HW making it possible to have up to three LED zones. It can also drive the RGB LED.

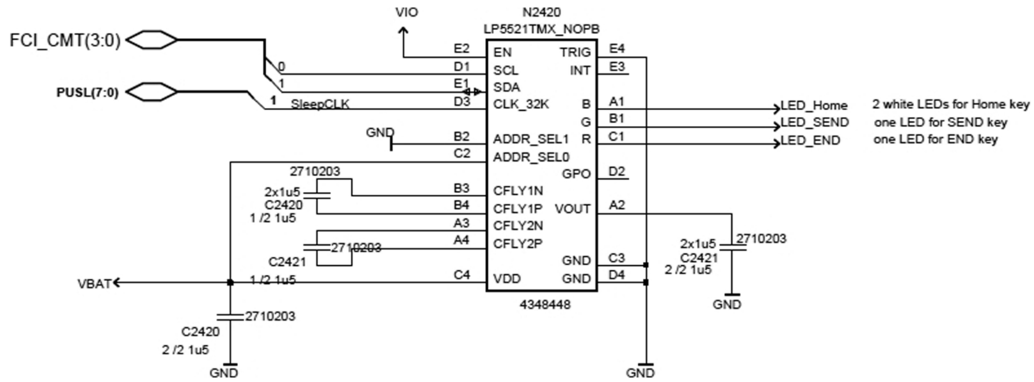


Figure 61 Backlight control for HW keys

Display backlights

Display backlights consist of two LED chains, each containing three LEDs in series powered by TK65604 switching mode power supply. Display backlight brightness is controlled by the CABC signal.

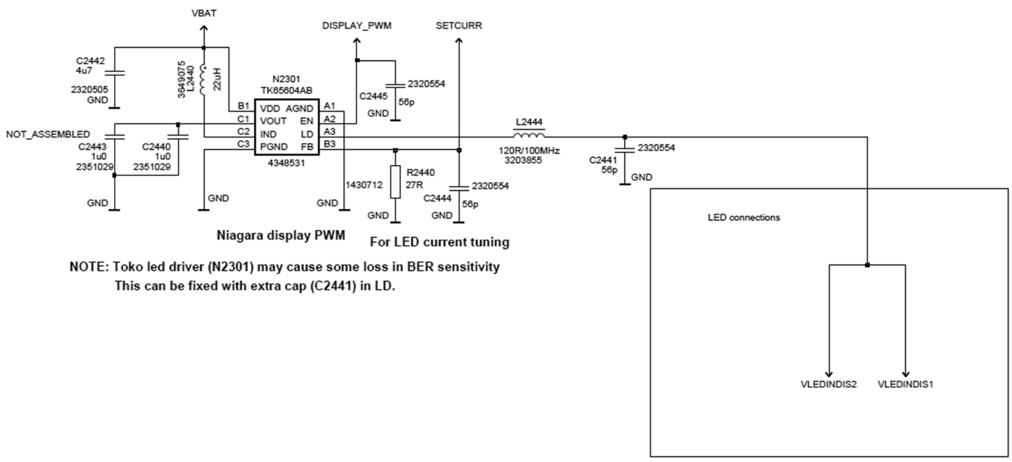


Figure 62 Display backlighting system

ASICs

RAPIDOYAWE

RAPIDOYAWE ASIC (D2800) is a die-stacked Processor (RAPIDO) with 3G HDSPA logic (YAWE). RAM memory is integrated into RAPIDO.

EM ASIC N2300 (Betty)

The EM ASIC (N2300) includes the following functional blocks:

- Core supply generation
- Charge control circuitry

- Level shifter and regulator for USB/FBUS
- Current gauge for battery current measuring
- Digital interface (CBUS)

EM ASIC N2200 (Avilma)

The EM ASIC (N2200) 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)

EMC ASIP (Appcation Specified Integrated Passive) is stacked on top of Vilma (hence called AVilma). It includes biasing passives for microphones and EMC filters for SIM, microphones etc.

Device memories

Combo memory

The memory consists of DDR SDRAM and MuxedMassMemory (M3)(NAND) combined into a single package. Memory capacity is 1Gb DDR and 2Gb M3.

Audio concept

Audio HW architecture

The functional core of the audio hardware is built around three ASICs: RAPIDOYAWE engine ASIC, mixed signal ASIC Avilma and D/A converter MAD1.

MAD1 converts digital audio data to analogue signal and provides it for the accessory connector.

AVilma provides analogue signal for earpiece and for D-class audio amplifier TPA2012D2, which drives the integrated stereo handsfree speakers.

There are three audio transducers:

- Earpiece
- One speaker
- Digital EMC microphone

Avilma provides an output for the dynamic vibra component.

All wired audio accessories are connected to the AV accessory connector.

The Bluetooth audio and FM radio module, which is connected to the RAPIDOYAWE, supports Bluetooth audio and FM radio functionality.

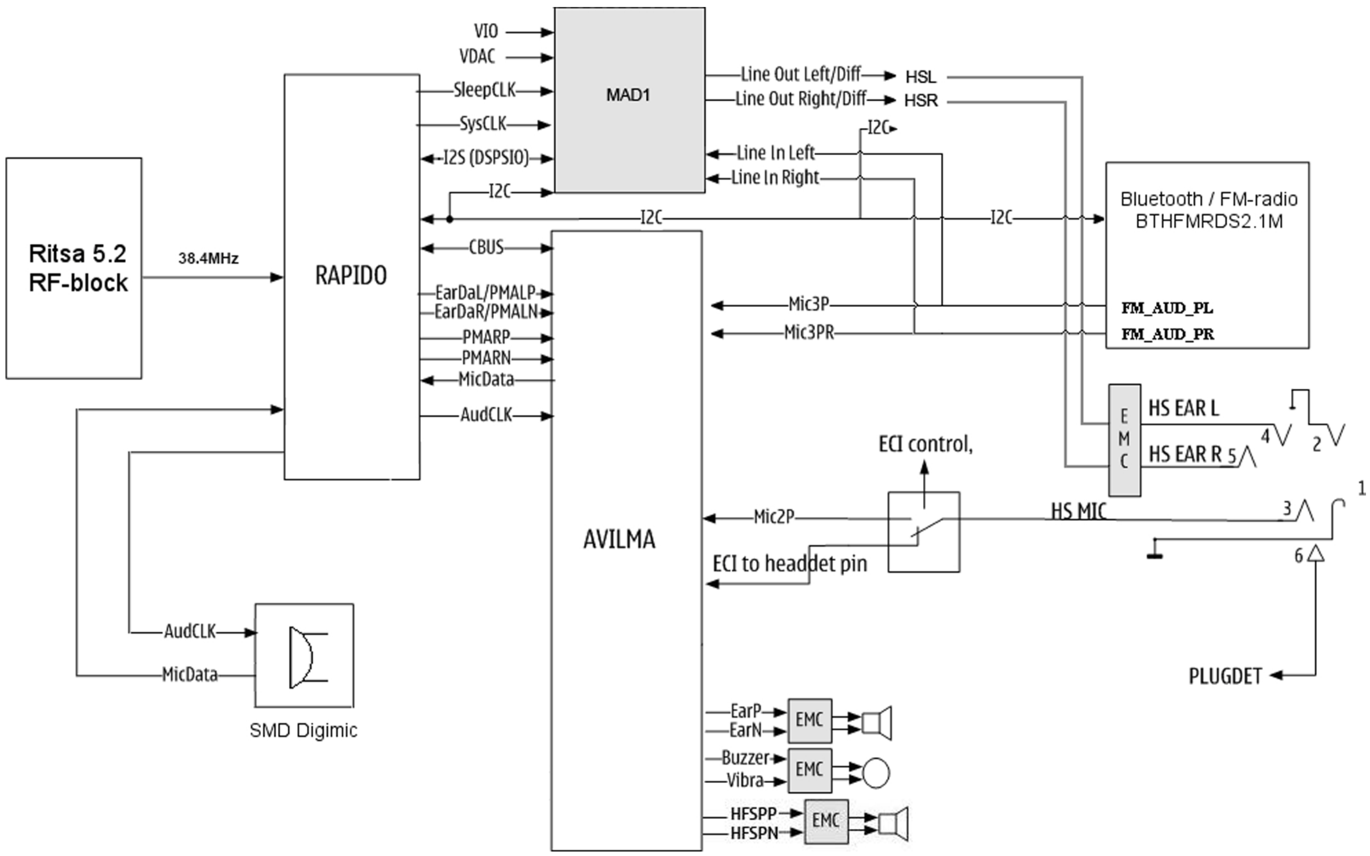


Figure 63 Audio block diagram

Internal microphone

The internal microphone is used for HandPortable (HP) and Internal HandsFree (IHF) call modes. A digital MEMS microphone data and clock line are connected to RAPIDOYAWE and the operating voltage 3V is received from Avilma.

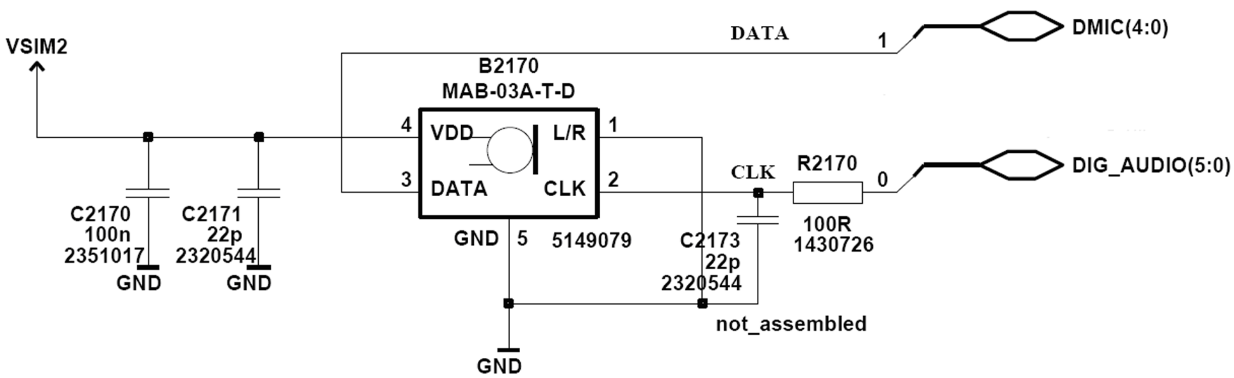


Figure 64 Internal microphone

External microphone

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

External microphone circuitry is biased by Avilma ASIC MicB2 bias voltage output. The circuitry provides an asymmetrical connection for the microphone from the AV connector, XMICP to Avilma ASIC input, mic2p and XMICN, to GND.

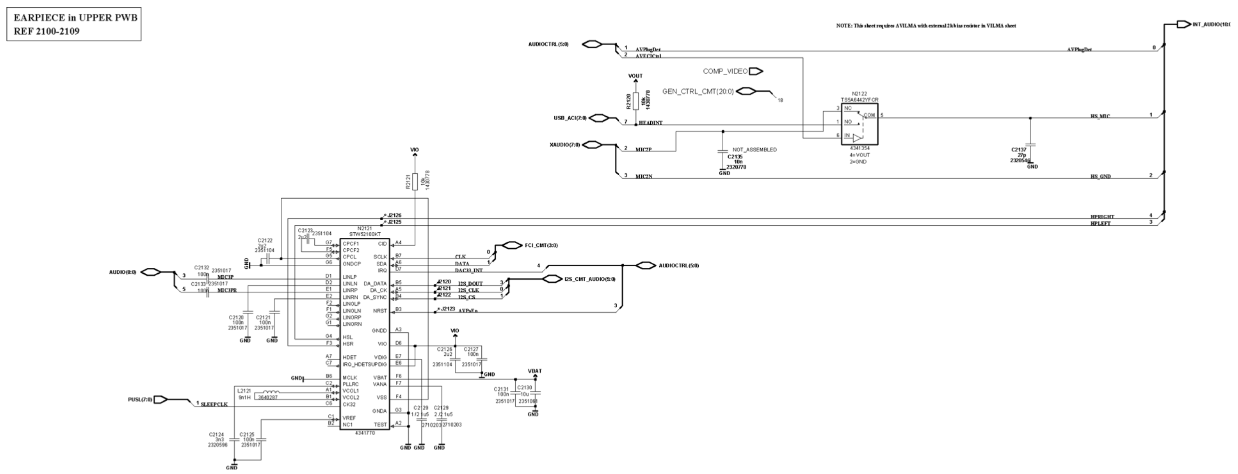


Figure 65 External earpiece and microphone circuitry

Internal earpiece

Internal earpiece is used for the HandPortable (HP) call mode. The earpiece capsule is connected to Avilma ASIC's differential output EarP and EarN.

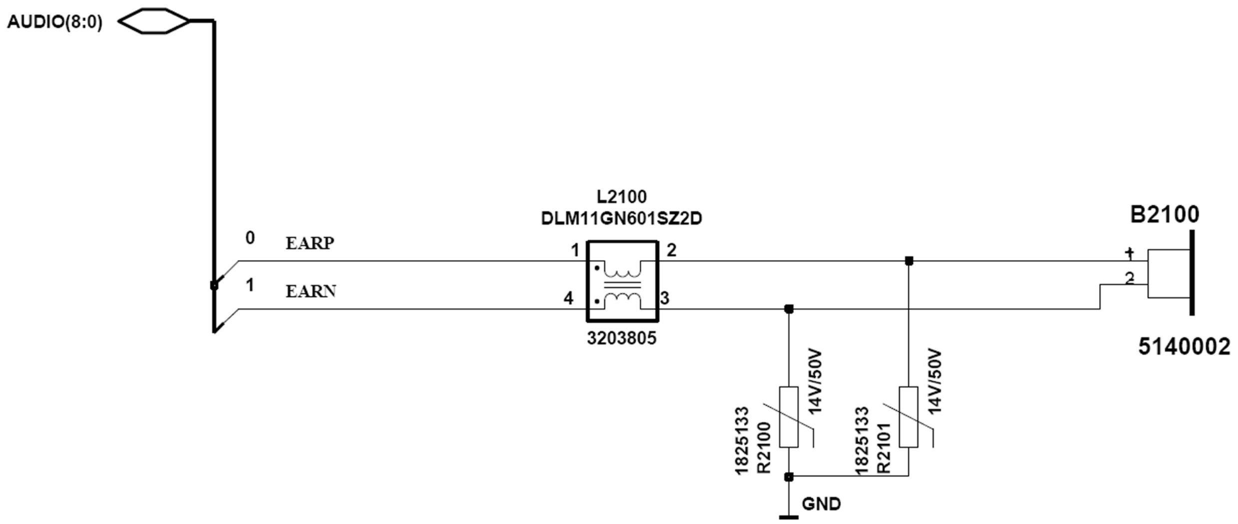


Figure 66 Internal earpiece circuitry

Internal speakers

The internal speaker is used for Internal HandsFree (IHF) call mode, video call, ringing tones, FM radio and music listening.

The IHF speaker is connected to Avilma ASIC's output HFSPP and HFSPN.

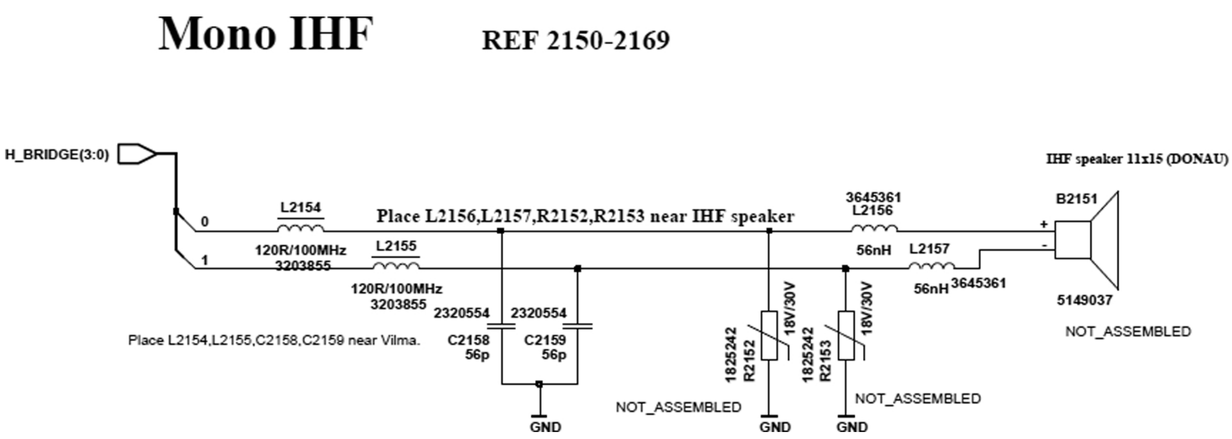


Figure 67 Internal speaker's circuitry

External earpiece

Galvanic accessories are connected to the AV connector.

Accessory audio mode is automatically enabled/disabled during connection/disconnection of dedicated phone accessories.

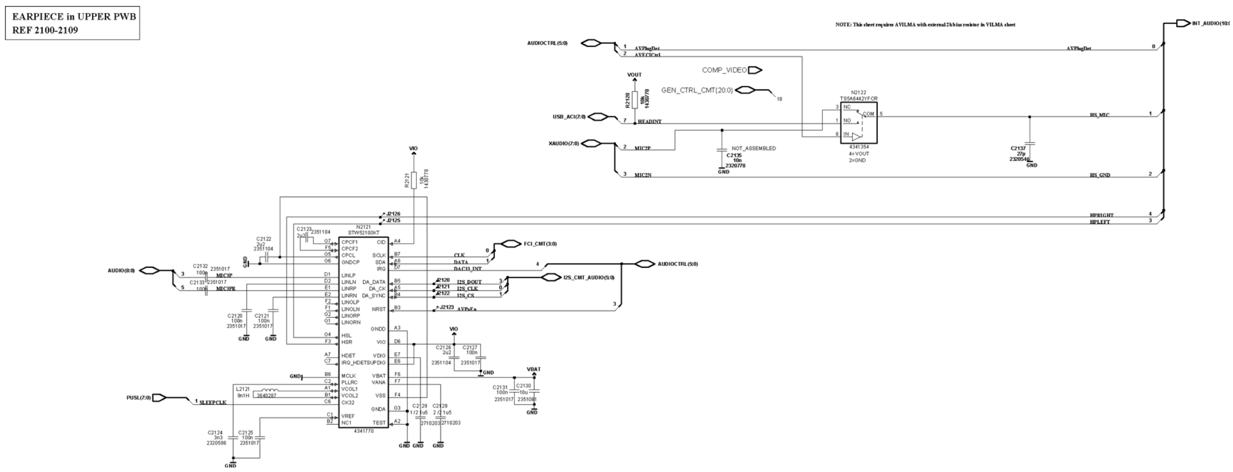


Figure 68 External earpiece and microphone circuitry

Vibra

Vibra is used for the vibra alarm function.

The vibra motor is connected to the Avilma ASIC VibraP and VibraN Pulse Width Modulated (PWM) outputs.

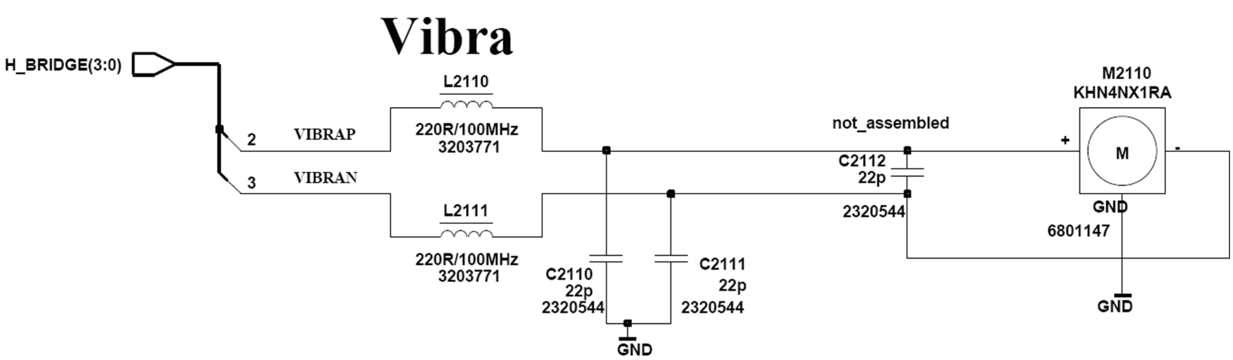


Figure 69 Vibra circuitry

AV connector

The following features are supported by the engine accessory interface:

- PlugDet signal is grounded when 3.5mm plug is inserted into the AV connector
- Audio output (stereo headset/headphones having the impedance >16ohm)
  - MAD1 signal source which includes headset amplifier
- Audio input (mono microphone from headset)
  - Analogue microphone output Mic2P to AVilma
- Control data (ECI)
  - Used by AVilma/RAPIDOYAWE for accessory identification when the 3.5mm plug is detected
- Connects FM receiver to headphones, which serve as FM antenna
  - Lines 4 & 5, through the bandpass filter

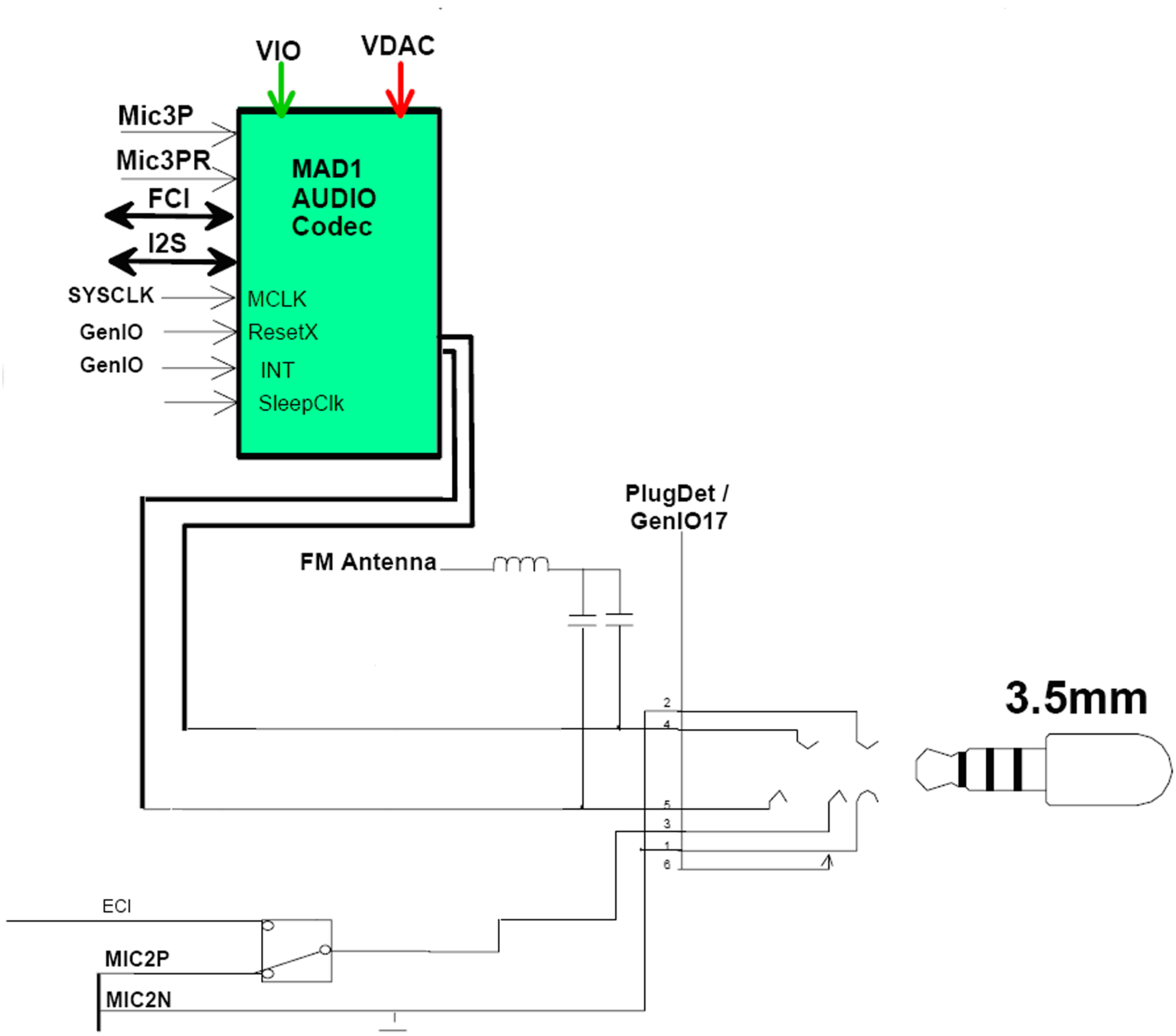


Figure 70 Accessory (AV) connector with MAD1 audio enhancement

Baseband technical specifications

External interfaces

Name of Connection	Connector reference
USB	X3300 (on engine PWB)
Charger	X2000
Headset/AV	X2010 (on engine PWB)
SIM	X2700 (on engine PWB)
MicroSD	X3200 (on engine PWB)
Battery connection	X2070 (on engine PWB)

SIM IF connections

Pin	Signal	I/O	Engine connection		Notes
C1	VSIM	Out	EM ASIC N2200	VSIM1	Supply voltage to SIM card, 1.8V or 3.0V.
C2	SIMRST	Out	EM ASIC N2200	SIM1Rst	Reset signal to SIM card
C3	SIMCLK	Out	EM ASIC N2200	SIM1ClkC	Clock signal to SIM card
C5	GND	-	GND		Ground
C7	SIMDATA	In/Out	EM ASIC N2200	SIM1DaC	Data input / output
SW	SIM_DET	In	EM ASIC N2200	SIMDetX	Removal detection

Charging interface connections & electrical characteristics

Table 15 Charging interface connections

Pin	Signal	I/O	Engine connection		Notes
1	Vchar	In	N2300	VCharIn1, 2	Charging voltage / charger detection, Center pin
2	Charge GND		Ground		Charger ground

Table 16 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	

Internal interfaces

Name of Connection	Connector reference
Earpiece	B5000
Display connector	X2470
Keypad connector	X2500
IHF speaker	B2151
Main camera connector	X1450
Microphone	B2170 (on engine PWB)
Vibra	M2110
Touchpad connector	X2450

RF description

Block diagram

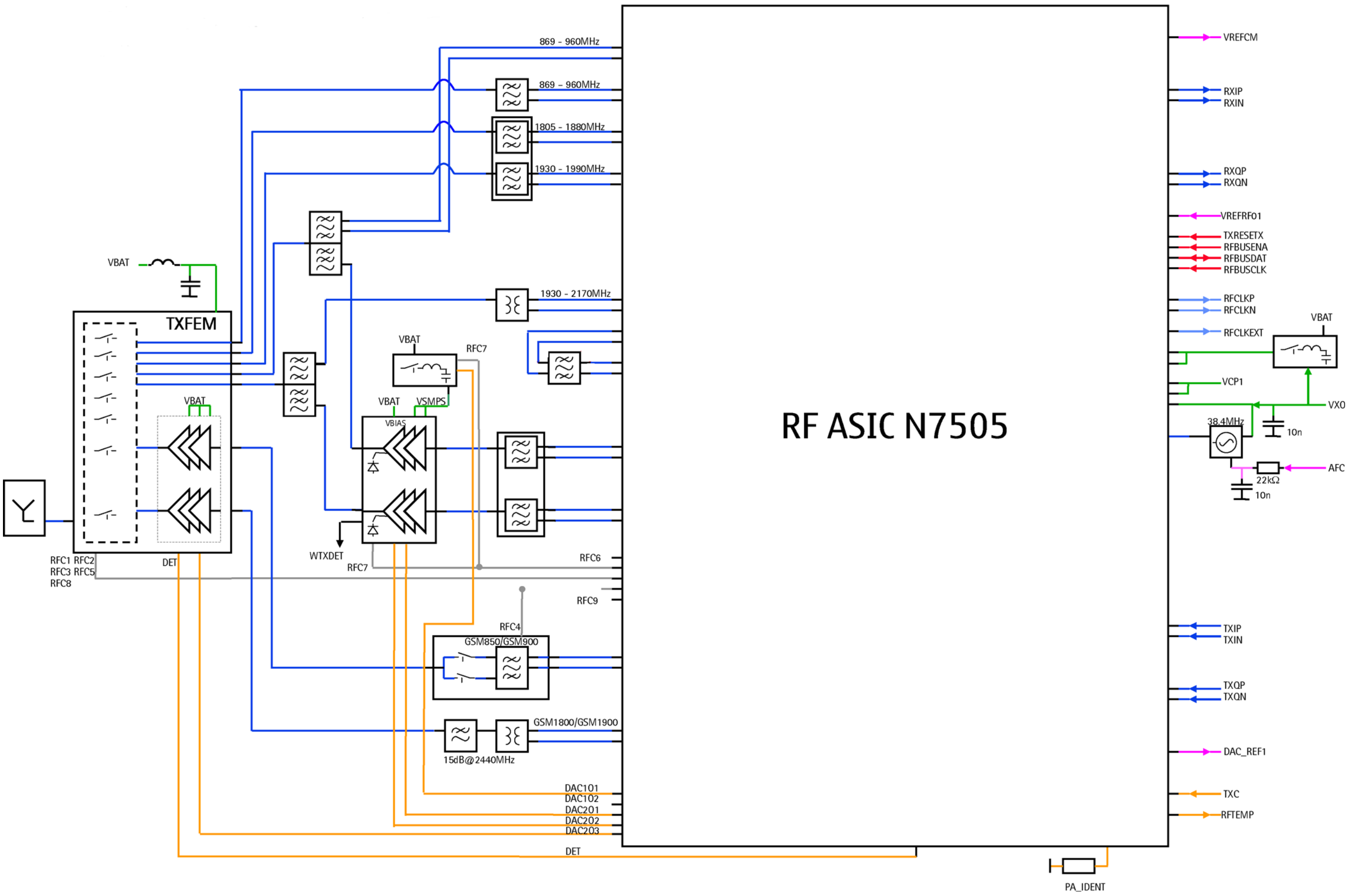


Figure 71 RF block diagram using RF ASIC N7505

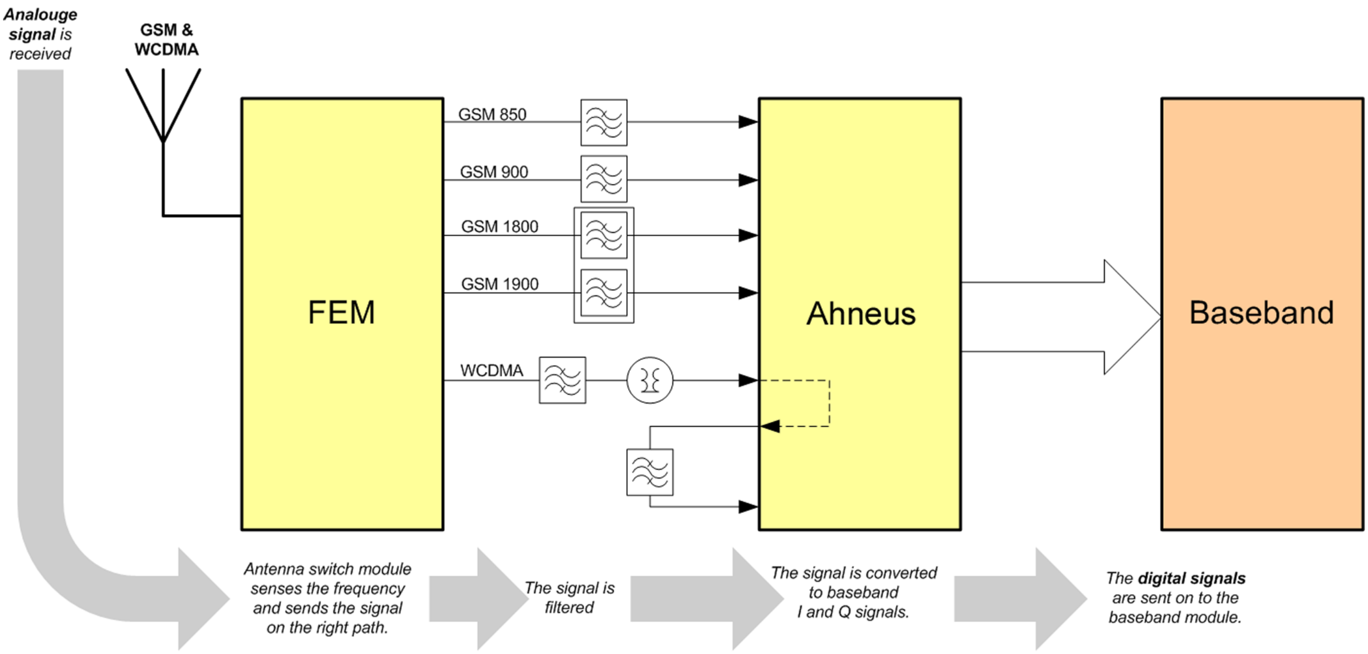
The RF block diagram uses RF ASIC N7505 that performs the RF back-end functions of receive and transmit function of the cellular transceiver.

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different routes, being handled by different components. The principle of GSM and WCDMA is the same.

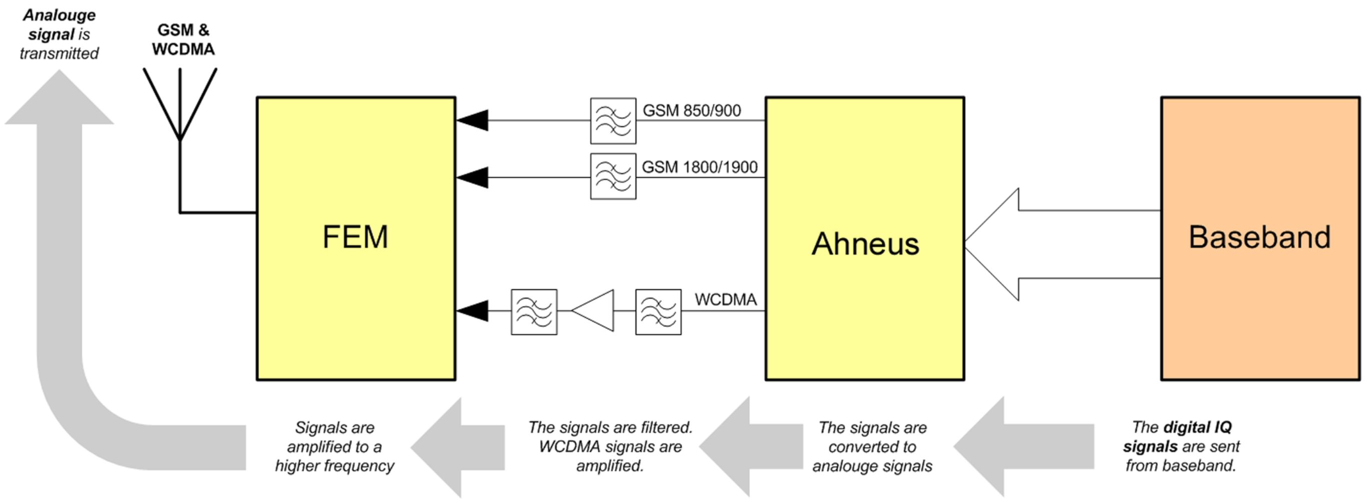


Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwidth of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals pass different components, the principles of the transmission is the same.



Frequency mappings

GSM850 frequencies

CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX	CH	TX	RX	VCO TX	VCO RX
128	824.2	869.2	3296.8	3476.8	170	832.6	877.6	3330.4	3510.4	212	841.0	886.0	3364.0	3544.0
129	824.4	869.4	3297.6	3477.6	171	832.8	877.8	3331.2	3511.2	213	841.2	886.2	3364.8	3544.8
130	824.6	869.6	3298.4	3478.4	172	833.0	878.0	3332.0	3512.0	214	841.4	886.4	3365.6	3545.6
131	824.8	869.8	3299.2	3479.2	173	833.2	878.2	3332.8	3512.8	215	841.6	886.6	3366.4	3546.4
132	825.0	870.0	3300.0	3480.0	174	833.4	878.4	3333.6	3513.6	216	841.8	886.8	3367.2	3547.2
133	825.2	870.2	3300.8	3480.8	175	833.6	878.6	3334.4	3514.4	217	842.0	887.0	3368.0	3548.0
134	825.4	870.4	3301.6	3481.6	176	833.8	878.8	3335.2	3515.2	218	842.2	887.2	3368.8	3548.8
135	825.6	870.6	3302.4	3482.4	177	834.0	879.0	3336.0	3516.0	219	842.4	887.4	3369.6	3549.6
136	825.8	870.8	3303.2	3483.2	178	834.2	879.2	3336.8	3516.8	220	842.6	887.6	3370.4	3550.4
137	826.0	871.0	3304.0	3484.0	179	834.4	879.4	3337.6	3517.6	221	842.8	887.8	3371.2	3551.2
138	826.2	871.2	3304.8	3484.8	180	834.6	879.6	3338.4	3518.4	222	843.0	888.0	3372.0	3552.0
139	826.4	871.4	3305.6	3485.6	181	834.8	879.8	3339.2	3519.2	223	843.2	888.2	3372.8	3552.8
140	826.6	871.6	3306.4	3486.4	182	835.0	880.0	3340.0	3520.0	224	843.4	888.4	3373.6	3553.6
141	826.8	871.8	3307.2	3487.2	183	835.2	880.2	3340.8	3520.8	225	843.6	888.6	3374.4	3554.4
142	827.0	872.0	3308.0	3488.0	184	835.4	880.4	3341.6	3521.6	226	843.8	888.8	3375.2	3555.2
143	827.2	872.2	3308.8	3488.8	185	835.6	880.6	3342.4	3522.4	227	844.0	889.0	3376.0	3556.0
144	827.4	872.4	3309.6	3489.6	186	835.8	880.8	3343.2	3523.2	228	844.2	889.2	3376.8	3556.8
145	827.6	872.6	3310.4	3490.4	187	836.0	881.0	3344.0	3524.0	229	844.4	889.4	3377.6	3557.6
146	827.8	872.8	3311.2	3491.2	188	836.2	881.2	3344.8	3524.8	230	844.6	889.6	3378.4	3558.4
147	828.0	873.0	3312.0	3492.0	189	836.4	881.4	3345.6	3525.6	231	844.8	889.8	3379.2	3559.2
148	828.2	873.2	3312.8	3492.8	190	836.6	881.6	3346.4	3526.4	232	845.0	890.0	3380.0	3560.0
149	828.4	873.4	3313.6	3493.6	191	836.8	881.8	3347.2	3527.2	233	845.2	890.2	3380.8	3560.8
150	828.6	873.6	3314.4	3494.4	192	837.0	882.0	3348.0	3528.0	234	845.4	890.4	3381.6	3561.6
151	828.8	873.8	3315.2	3495.2	193	837.2	882.2	3348.8	3528.8	235	845.6	890.6	3382.4	3562.4
152	829.0	874.0	3316.0	3496.0	194	837.4	882.4	3349.6	3529.6	236	845.8	890.8	3383.2	3563.2
153	829.2	874.2	3316.8	3496.8	195	837.6	882.6	3350.4	3530.4	237	846.0	891.0	3384.0	3564.0
154	829.4	874.4	3317.6	3497.6	196	837.8	882.8	3351.2	3531.2	238	846.2	891.2	3384.8	3564.8
155	829.6	874.6	3318.4	3498.4	197	838.0	883.0	3352.0	3532.0	239	846.4	891.4	3385.6	3565.6
156	829.8	874.8	3319.2	3499.2	198	838.2	883.2	3352.8	3532.8	240	846.6	891.6	3386.4	3566.4
157	830.0	875.0	3320.0	3500.0	199	838.4	883.4	3353.6	3533.6	241	846.8	891.8	3387.2	3567.2
158	830.2	875.2	3320.8	3500.8	200	838.6	883.6	3354.4	3534.4	242	847.0	892.0	3388.0	3568.0
159	830.4	875.4	3321.6	3501.6	201	838.8	883.8	3355.2	3535.2	243	847.2	892.2	3388.8	3568.8
160	830.6	875.6	3322.4	3502.4	202	839.0	884.0	3356.0	3536.0	244	847.4	892.4	3389.6	3569.6
161	830.8	875.8	3323.2	3503.2	203	839.2	884.2	3356.8	3536.8	245	847.6	892.6	3390.4	3570.4
162	831.0	876.0	3324.0	3504.0	204	839.4	884.4	3357.6	3537.6	246	847.8	892.8	3391.2	3571.2
163	831.2	876.2	3324.8	3504.8	205	839.6	884.6	3358.4	3538.4	247	848.0	893.0	3392.0	3572.0
164	831.4	876.4	3325.6	3505.6	206	839.8	884.8	3359.2	3539.2	248	848.2	893.2	3392.8	3572.8
165	831.6	876.6	3326.4	3506.4	207	840.0	885.0	3360.0	3540.0	249	848.4	893.4	3393.6	3573.6
166	831.8	876.8	3327.2	3507.2	208	840.2	885.2	3360.8	3540.8	250	848.6	893.6	3394.4	3574.4
167	832.0	877.0	3328.0	3508.0	209	840.4	885.4	3361.6	3541.6	251	848.8	893.8	3395.2	3575.2

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
512	1710.2	1805.2	3420.4	3610.4	606	1729.0	1824.0	3458.0	3648.0	700	1747.8	1842.8	3495.6	3685.6	793	1766.4	1861.4	3532.8	3722.8
513	1710.4	1805.4	3420.8	3610.8	607	1729.2	1824.2	3458.4	3648.4	701	1748.0	1843.0	3496.0	3686.0	794	1766.6	1861.6	3533.2	3723.2
514	1710.6	1805.6	3421.2	3611.2	608	1729.4	1824.4	3458.8	3648.8	702	1748.2	1843.2	3496.4	3686.4	795	1766.8	1861.8	3533.6	3723.6
515	1710.8	1805.8	3421.6	3611.6	609	1729.6	1824.6	3459.2	3649.2	703	1748.4	1843.4	3496.8	3686.8	796	1767.0	1862.0	3534.0	3724.0
516	1711.0	1806.0	3422.0	3612.0	610	1729.8	1824.8	3459.6	3649.6	704	1748.6	1843.6	3497.2	3687.2	797	1767.2	1862.2	3534.4	3724.4
517	1711.2	1806.2	3422.4	3612.4	611	1730.0	1825.0	3460.0	3650.0	705	1748.8	1843.8	3497.6	3687.6	798	1767.4	1862.4	3534.8	3724.8
518	1711.4	1806.4	3422.8	3612.8	612	1730.2	1825.2	3460.4	3650.4	706	1749.0	1844.0	3498.0	3688.0	799	1767.6	1862.6	3535.2	3725.2
519	1711.6	1806.6	3423.2	3613.2	613	1730.4	1825.4	3460.8	3650.8	707	1749.2	1844.2	3498.4	3688.4	800	1767.8	1862.8	3535.6	3725.6
520	1711.8	1806.8	3423.6	3613.6	614	1730.6	1825.6	3461.2	3651.2	708	1749.4	1844.4	3498.8	3688.8	801	1768.0	1863.0	3536.0	3726.0
521	1712.0	1807.0	3424.0	3614.0	615	1730.8	1825.8	3461.6	3651.6	709	1749.6	1844.6	3499.2	3689.2	802	1768.2	1863.2	3536.4	3726.4
522	1712.2	1807.2	3424.4	3614.4	616	1731.0	1826.0	3462.0	3652.0	710	1749.8	1844.8	3499.6	3689.6	803	1768.4	1863.4	3536.8	3726.8
523	1712.4	1807.4	3424.8	3614.8	617	1731.2	1826.2	3462.4	3652.4	711	1750.0	1845.0	3500.0	3690.0	804	1768.6	1863.6	3537.2	3727.2
524	1712.6	1807.6	3425.2	3615.2	618	1731.4	1826.4	3462.8	3652.8	712	1750.2	1845.2	3500.4	3690.4	805	1768.8	1863.8	3537.6	3727.6
525	1712.8	1807.8	3425.6	3615.6	619	1731.6	1826.6	3463.2	3653.2	713	1750.4	1845.4	3500.8	3690.8	806	1769.0	1864.0	3538.0	3728.0
526	1713.0	1808.0	3426.0	3616.0	620	1731.8	1826.8	3463.6	3653.6	714	1750.6	1845.6	3501.2	3691.2	807	1769.2	1864.2	3538.4	3728.4
527	1713.2	1808.2	3426.4	3616.4	621	1732.0	1827.0	3464.0	3654.0	715	1750.8	1845.8	3501.6	3691.6	808	1769.4	1864.4	3538.8	3728.8
528	1713.4	1808.4	3426.8	3616.8	622	1732.2	1827.2	3464.4	3654.4	716	1751.0	1846.0	3502.0	3692.0	809	1769.6	1864.6	3539.2	3729.2
529	1713.6	1808.6	3427.2	3617.2	623	1732.4	1827.4	3464.8	3654.8	717	1751.2	1846.2	3502.4	3692.4	810	1769.8	1864.8	3539.6	3729.6
530	1713.8	1808.8	3427.6	3617.6	624	1732.6	1827.6	3465.2	3655.2	718	1751.4	1846.4	3502.8	3692.8	811	1770.0	1865.0	3540.0	3730.0
531	1714.0	1809.0	3428.0	3618.0	625	1732.8	1827.8	3465.6	3655.6	719	1751.6	1846.6	3503.2	3693.2	812	1770.2	1865.2	3540.4	3730.4
532	1714.2	1809.2	3428.4	3618.4	626	1733.0	1828.0	3466.0	3656.0	720	1751.8	1846.8	3503.6	3693.6	813	1770.4	1865.4	3540.8	3730.8
533	1714.4	1809.4	3428.8	3618.8	627	1733.2	1828.2	3466.4	3656.4	721	1752.0	1847.0	3504.0	3694.0	814	1770.6	1865.6	3541.2	3731.2
534	1714.6	1809.6	3429.2	3619.2	628	1733.4	1828.4	3466.8	3656.8	722	1752.2	1847.2	3504.4	3694.4	815	1770.8	1865.8	3541.6	3731.6
535	1714.8	1809.8	3429.6	3619.6	629	1733.6	1828.6	3467.2	3657.2	723	1752.4	1847.4	3504.8	3694.8	816	1771.0	1866.0	3542.0	3732.0
536	1715.0	1810.0	3430.0	3620.0	630	1733.8	1828.8	3467.6	3657.6	724	1752.6	1847.6	3505.2	3695.2	817	1771.2	1866.2	3542.4	3732.4
537	1715.2	1810.2	3430.4	3620.4	631	1734.0	1829.0	3468.0	3658.0	725	1752.8	1847.8	3505.6	3695.6	818	1771.4	1866.4	3542.8	3732.8
538	1715.4	1810.4	3430.8	3620.8	632	1734.2	1829.2	3468.4	3658.4	726	1753.0	1848.0	3506.0	3696.0	819	1771.6	1866.6	3543.2	3733.2
539	1715.6	1810.6	3431.2	3621.2	633	1734.4	1829.4	3468.8	3658.8	727	1753.2	1848.2	3506.4	3696.4	820	1771.8	1866.8	3543.6	3733.6
540	1715.8	1810.8	3431.6	3621.6	634	1734.6	1829.6	3469.2	3659.2	728	1753.4	1848.4	3506.8	3696.8	821	1772.0	1867.0	3544.0	3734.0
541	1716.0	1811.0	3432.0	3622.0	635	1734.8	1829.8	3469.6	3659.6	729	1753.6	1848.6	3507.2	3697.2	822	1772.2	1867.2	3544.4	3734.4
542	1716.2	1811.2	3432.4	3622.4	636	1735.0	1830.0	3470.0	3660.0	730	1753.8	1848.8	3507.6	3697.6	823	1772.4	1867.4	3544.8	3734.8
543	1716.4	1811.4	3432.8	3622.8	637	1735.2	1830.2	3470.4	3660.4	731	1754.0	1849.0	3508.0	3698.0	824	1772.6	1867.6	3545.2	3735.2
544	1716.6	1811.6	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	825	1772.8	1867.8	3545.6	3735.6
545	1716.8	1811.8	3433.6	3623.6	639	1735.6	1830.6	3471.2	3661.2	733	1754.4	1849.4	3508.8	3698.8	826	1773.0	1868.0	3546.0	3736.0
546	1717.0	1812.0	3434.0	3624.0	640	1735.8	1830.8	3471.6	3661.6	734	1754.6	1849.6	3509.2	3699.2	827	1773.2	1868.2	3546.4	3736.4
547	1717.2	1812.2	3434.4	3624.4	641	1736.0	1831.0	3472.0	3662.0	735	1754.8	1849.8	3509.6	3699.6	828	1773.4	1868.4	3546.8	3736.8
548	1717.4	1812.4	3434.8	3624.8	642	1736.2	1831.2	3472.4	3662.4	736	1755.0	1850.0	3510.0	3700.0	829	1773.6	1868.6	3547.2	3737.2
549	1717.6	1812.6	3435.2	3625.2	643	1736.4	1831.4	3472.8	3662.8	737	1755.2	1850.2	3510.4	3700.4	830	1773.8	1868.8	3547.6	3737.6
550	1717.8	1812.8	3435.6	3625.6	644	1736.6	1831.6	3473.2	3663.2	738	1755.4	1850.4	3510.8	3700.8	831	1774.0	1869.0	3548.0	3738.0
551	1718.0	1813.0	3436.0	3626.0	645	1736.8	1831.8	3473.6	3663.6	739	1755.6	1850.6	3511.2	3701.2	832	1774.2	1869.2	3548.4	3738.4
552	1718.2	1813.2	3436.4	3626.4	646	1737.0	1832.0	3474.0	3664.0	740	1755.8	1850.8	3511.6	3701.6	833	1774.4	1869.4	3548.8	3738.8
553	1718.4	1813.4	3436.8	3626.8	647	1737.2	1832.2	3474.4	3664.4	741	1756.0	1851.0	3512.0	3702.0	834	1774.6	1869.6	3549.2	3739.2
554	1718.6	1813.6	3437.2	3627.2	648	1737.4	1832.4	3474.8	3664.8	742	1756.2	1851.2	3512.4	3702.4	835	1774.8	1869.8	3549.6	3739.6
555	1718.8	1813.8	3437.6	3627.6	649	1737.6	1832.6	3475.2	3665.2	743	1756.4	1851.4	3512.8	3702.8	836	1775.0	1870.0	3550.0	3740.0
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	744	1756.6	1851.6	3513.2	3703.2	837	1775.2	1870.2	3550.4	3740.4
557	1719.2	1814.2	3438.4	3628.4	651	1738.0	1833.0	3476.0	3666.0	745	1756.8	1851.8	3513.6	3703.6	838	1775.4	1870.4	3550.8	3740.8
558	1719.4	1814.4	3438.8	3628.8	652	1738.2	1833.2	3476.4	3666.4	746	1757.0	1852.0	3514.0	3704.0	839	1775.6	1870.6	3551.2	3741.2
559	1719.6	1814.6	3439.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	840	1775.8	1870.8	3551.6	3741.6
560	1719.8	1814.8	3439.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	841	1776.0	1871.0	3552.0	3742.0
561	1720.0	1815.0	3440.0	3630.0	655	1738.8	1833.8	3477.6	3667.6	749	1757.6	1852.6	3515.2	3705.2	842	1776.2	1871.2	3552.4	3742.4
562	1720.2	1815.2	3440.4	3630.4	656	1739.0	1834.0	3478.0	3668.0	750	1757.8	1852.8	3515.6	3705.6	843	1776.4	1871.4	3552.8	3742.8
563	1720.4	1815.4	3440.8	3630.8	657	1739.2	1834.2	3478.4	3668.4	751	1758.0	1853.0	3516.0	3706.0	844	1776.6	1871.6	3553.2	3743.2
564	1720.6	1815.6	3441.2	3631.2	658	1739.4	1834.4	3478.8	3668.8	752	1758.2	1853.2	3516.4	3706.4	845	1776.8	1871.8	3553.6	3743.6
565	1720.8	1815.8	3441.6	3631.6	659	1739.6	1834.6	3479.2	3669.2	753	1758.4	1853.4	3516.8	3706.8	846	1777.0	1872.0	3554.0	3744.0
566	1721.0	1816.0	3442.0	3632.0	660	1739.8	1834.8	3479.6	3669.6	754	1758.6	1853.6	3517.2	3707.2	847	1777.2	1872.2	3554.4	3744.4
567	1721.2	1816.2	3442.4	3632.4	661	1740.0	1835.0	3480.0	3670.0	755	1758.8	1853.8	3517.6	3707.6	848	1777.4	1872.4	3554.8	3744.8
568	1721.4	1816.4	3442.8	3632.8	662	1740.2	1835.2	3480.4	3670.4	756	1759.0	1854.0	3518.0	3708.0	849	1777.6	1872.6	3555.2	3745.2
569	1721.6	1816.6	3443.2	3633.2	663	1740.4	1835.4	3480.8	3670.8	757	1759.2	1854.2	3518.4	3708.4	850	1777.8	1872.8	3555.6	3745.6
570	1721.8	1816.8	3443.6	3633.6	664	1740.6	1835.6	3481.2	3671.2	758	1759.4	1854.4	3518.8	3708.8	851	1778.0	1873.0	3556.0	3746.0
571	1722.0	1817.0	3444.0	3634.0	665	1740.8	1835.8	3481.6	3671.6	759	1759.6	1854.6	3519.2	3709.2	852	1778.2	1873.2	3556.4	3746.4
572	1722.2	1817.2	3444.4	3634.4	666	1741.0	1836.0	3482.0	3672.0	760	1759.8	1854.8	3519.6	3709.6	853	1778.4	1873.4	3556.8	3746.8
573	1722.4	1817.4	3444.8	3634.8	667	1741.2	1836.2	3482.4	3672.4	761	1760.0	1855.0	3520.0	3710.0	854	1778.6	1873.6	3557.2	3747.2
574	1722.6	1817.6	3445.2	3635.2	668	1741.4	1836.4	3482.8	3672.8	762	1760.2	1855.2	3520.4	3710.4	855	1778.8	1873.8	3557.6	3747.6
575	1722.8	1817.8	3445.6	3635.6	669	1741.6	1836.6	3483.2	3673.2	763	1760.4	1855.4	3520.8	3710.8	856	1779.0	1874.0	3558.0	3748.0
576	1723.0	1818.0	3446.0	3636.0	670	1741.8	1836.8	3483.6	3673.6	764	1760.6	1855.6	3521.2	3711.2	857	1779.2	1874.2	3558.4	3748.4
577	1723.2	1818.2	3446.4	3636.4	671	1742.0	1837.0	3484.0	3674.0	765	1760.8	1855.8	3521.6	3711.6	858	1779.4	1874.4	3558.8	3748.8
578	1723.4	1818.4	3446.8	3636.8	672	1742.2	1837.2	3484.4	3674.4	766	1761.0	1856.0	3522.0	3712.0	859	1779.6	1874.6	3559.2	3749.2
579	1723.6	1818.6	3447.2	3637.2	673	1742.4	1837.4	3484.8	3674.8	767	1761.2	1856.2	3522.4	3712.4	860	1779.8	1874.8	3559.6	3749.6
580	1723.8	1818.8	3447.6	3637.6	674	1742.6	1837.6	3485.2	3675.2	768	1761.4	1856.4	3522.8	3712.8	861	1780.0	1875.0	3560.0	3750.0
581	1724.0	1819.0	3448.0	3638.0	675	1742.8	1837.8	3485.6	3675.6	769	1761.6	1856.6	3523.2	3713.2	862	1780.2	1875.2	3560.4	3750.4
582	1724.2	1819.2	3448.4	3638.4	676	1743.0	1838.0	3486.0	3676.0	770	1761.8	1856.8	3523.6	3713.6	863	1780.4	1875.4	3560.8	3750.8
583	1724.4	1819.4	3448.8	3638.8	677	1743.2	1838.2	3486.4	3676.4	771	1762.0	1857.0	3524.0	3714.0	864	1780.6	1875.6	3561.2	3751.2
584	1724.6	1819.6	3449.2	3639.2	678	1743.4	1838.4	3486.8	3676.8	772	1762.2	1857.2	3524.4	3714.4	865	1780.8	1875.8	3561.6	3751.6
585	1724.8	1819.8	3449.6	3639.6	679	1743.6	1838.6	3487.2	3677.2	773	1762.4	1857.4	3524.8	3714.8	866	1781.0	1876.0	3562.0	3752.0
586	1725.0	1820.0	3450.0	3640.0	680	1743.8	1838.8	3487.6	3677.6	774	1762.6	1857.6	3525.2	3715.2	867	1781.2	1876.2	3562.4	3752.4
587	1725.2	1820.2	3450.4	3640.4	681	1744.0	1839.0	3488.0	3678.0	775	1762.8	1857.8	3525.6	3715.6	868	1781.4	1876.4	3562.8	3752.8
588	1725.4	1820.4	3450.8	3640.8	682	1744.2	1839.2	3488.4	3678.4	776	1763.0	1858.0	3526.0	3716.0	869	1781.6	1876.6	3563.2	3753.2
589	1725.6	1820.6	3451.2	3641.2	683	1744.4	1839.4	3488.8	3678.8	777	1763.2	1858.2	3526.4	3716.4	870	1781.8	1876.8	3563.6	3753.6
590	1725.8	1820.8	3451.6	3641.6	684	1744.6	1839.6	3489.2	3679.2	778	1763.4	1858.4	3526.8	3716.8	871	1782.0	1877.0	3564.0	3754.0
591	1726.0	1821.0	3452.0	3642.0	685	1744.8	1839.8	3489.6	3679.6	779	1763.6	1858.6	3527.2	3717.2	872	1782.2	1877.2	3564.4	3754.4
592	1726.2	1821.2	3452.4	3642.4	686	1745.0	1840.0	3490.0	3680.0	780	1763.8	1858.8	3527.6	3717.6	873	1782.4	1877.4	3564.8	3754.8
593	1726.4	1821.4	3452.8	3642.8	687	1745.2	1840.2	3490.4	3680.4	781	1764.0	1859.0	3528.0	3718.0	874	1782.6	1877.6	3565.2	3755.2
594	1726.6	1821.6	3453.2	3643.2	688	1745.4	1840.4	3490.8	3680.8	782	1764.2	1859.2	3528.4	3718.4	875	1782.8	1877.8	3565.6	3755.6
595	1726.8	1821.8	3453.6	3643.6	689	1745.6	1840.6	3491.2	3681.2	783	1764.4	1859.4	3528.8	3718.8	876	1783.0	1878.0	3566.0	3756.0
596	1727.0	1822.0	3454.0	3644.0	690	1745.8	1840.8	3491.6	3681.6	784	1764.6	1859.6	3529.2	3719.2	877	1783.2	1878.2	3566.4	3756.4
597	1727.2	1822.2	3454.4	3644.4	691	1746.0	1841.0	3492.0	3682.0	785	1764.8	1859.8	3529.6	3719.6	878	1783.4	1878.4	3566.8	3756.8
598	1727.4	1822.4	3454.8	3644.8	692	1746.2	1841.2	3492.4	3682.4	786	1765.0	1860.0	3530.0	3720.0	879	1783.6	1878.6	3567.2	3757.2
599	1727.6	1822.6	3455.2	3645.2	693	1746.4	1841.4	3492.8	3682.8	787	1765.2	1860.2	3530.4	3720.4	880	1783.8	1878.8	3567.6	3757.6
600	1727.8	1822.8	3455.6	3645.6	694	1746.6	1841.6	3493.2	3683.2	788	1765.4	1860.4	3530.8	3720.8	881	1784.0	1879.0	3568.0	3758.0
601	1728.0	1823.0	3456.0	3646.0	695	1746.8	1841.8	3493.6	3683.6	789	1765.6	1860.6	3531.2	3721.2	882	1784.2	1879.2	3568.4	3758.4
602	1728.2	1823.2	3456.4	3646.4	696	1747.0	1842.0	3494.0	3684.0	790	1765.8	1860.8	3531.6	3721.6	883	1784.4	1879.4	3568.8	3758.8
603	1728.4	1823.4	3456.8	3646.8	697	1747.2	1842.2	3494.4	3684.4	791	1766.0	1861.0	3532.0	3722.0	884	1784.6	1879.6	3569.2	3759.2
604	1728.6	1823.6	3457.2	3647.2	698	1747.4	1842.4	3494.8	3684.8	792	1766.2	1861.2	3532.4	3722.4	885	1784.8	1879.8	3569.6	3759.6
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2										

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 2100 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 2100 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
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			

WCDMA VIII (900) frequencies

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2712	882,4	3529,6	2937	927,4	3709,6
2713	882,6	3530,4	2938	927,6	3710,4
2714	882,8	3531,2	2939	927,8	3711,2
2715	883	3532	2940	928	3712
2716	883,2	3532,8	2941	928,2	3712,8
2717	883,4	3533,6	2942	928,4	3713,6
2718	883,6	3534,4	2943	928,6	3714,4
2719	883,8	3535,2	2944	928,8	3715,2
2720	884	3536	2945	929	3716
2721	884,2	3536,8	2946	929,2	3716,8
2722	884,4	3537,6	2947	929,4	3717,6
2723	884,6	3538,4	2948	929,6	3718,4
2724	884,8	3539,2	2949	929,8	3719,2
2725	885	3540	2950	930	3720
2726	885,2	3540,8	2951	930,2	3720,8
2727	885,4	3541,6	2952	930,4	3721,6
2728	885,6	3542,4	2953	930,6	3722,4
2729	885,8	3543,2	2954	930,8	3723,2
2730	886	3544	2955	931	3724
2731	886,2	3544,8	2956	931,2	3724,8
2732	886,4	3545,6	2957	931,4	3725,6
2733	886,6	3546,4	2958	931,6	3726,4
2734	886,8	3547,2	2959	931,8	3727,2
2735	887	3548	2960	932	3728
2736	887,2	3548,8	2961	932,2	3728,8
2737	887,4	3549,6	2962	932,4	3729,6
2738	887,6	3550,4	2963	932,6	3730,4
2739	887,8	3551,2	2964	932,8	3731,2
2740	888	3552	2965	933	3732
2741	888,2	3552,8	2966	933,2	3732,8
2742	888,4	3553,6	2967	933,4	3733,6
2743	888,6	3554,4	2968	933,6	3734,4
2744	888,8	3555,2	2969	933,8	3735,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2745	889	3556	2970	934	3736
2746	889,2	3556,8	2971	934,2	3736,8
2747	889,4	3557,6	2972	934,4	3737,6
2748	889,6	3558,4	2973	934,6	3738,4
2749	889,8	3559,2	2974	934,8	3739,2
2750	890	3560	2975	935	3740
2751	890,2	3560,8	2976	935,2	3740,8
2752	890,4	3561,6	2977	935,4	3741,6
2753	890,6	3562,4	2978	935,6	3742,4
2754	890,8	3563,2	2979	935,8	3743,2
2755	891	3564	2980	936	3744
2756	891,2	3564,8	2981	936,2	3744,8
2757	891,4	3565,6	2982	936,4	3745,6
2758	891,6	3566,4	2983	936,6	3746,4
2759	891,8	3567,2	2984	936,8	3747,2
2760	892	3568	2985	937	3748
2761	892,2	3568,8	2986	937,2	3748,8
2762	892,4	3569,6	2987	937,4	3749,6
2763	892,6	3570,4	2988	937,6	3750,4
2764	892,8	3571,2	2989	937,8	3751,2
2765	893	3572	2990	938	3752
2766	893,2	3572,8	2991	938,2	3752,8
2767	893,4	3573,6	2992	938,4	3753,6
2768	893,6	3574,4	2993	938,6	3754,4
2769	893,8	3575,2	2994	938,8	3755,2
2770	894	3576	2995	939	3756
2771	894,2	3576,8	2996	939,2	3756,8
2772	894,4	3577,6	2997	939,4	3757,6
2773	894,6	3578,4	2998	939,6	3758,4
2774	894,8	3579,2	2999	939,8	3759,2
2775	895	3580	3000	940	3760
2776	895,2	3580,8	3001	940,2	3760,8
2777	895,4	3581,6	3002	940,4	3761,6
2778	895,6	3582,4	3003	940,6	3762,4
2779	895,8	3583,2	3004	940,8	3763,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2780	896	3584	3005	941	3764
2781	896,2	3584,8	3006	941,2	3764,8
2782	896,4	3585,6	3007	941,4	3765,6
2783	896,6	3586,4	3008	941,6	3766,4
2784	896,8	3587,2	3009	941,8	3767,2
2785	897	3588	3010	942	3768
2786	897,2	3588,8	3011	942,2	3768,8
2787	897,4	3589,6	3012	942,4	3769,6
2788	897,6	3590,4	3013	942,6	3770,4
2789	897,8	3591,2	3014	942,8	3771,2
2790	898	3592	3015	943	3772
2791	898,2	3592,8	3016	943,2	3772,8
2792	898,4	3593,6	3017	943,4	3773,6
2793	898,6	3594,4	3018	943,6	3774,4
2794	898,8	3595,2	3019	943,8	3775,2
2795	899	3596	3020	944	3776
2796	899,2	3596,8	3021	944,2	3776,8
2797	899,4	3597,6	3022	944,4	3777,6
2798	899,6	3598,4	3023	944,6	3778,4
2799	899,8	3599,2	3024	944,8	3779,2
2800	900	3600	3025	945	3780
2801	900,2	3600,8	3026	945,2	3780,8
2802	900,4	3601,6	3027	945,4	3781,6
2803	900,6	3602,4	3028	945,6	3782,4
2804	900,8	3603,2	3029	945,8	3783,2
2805	901	3604	3030	946	3784
2806	901,2	3604,8	3031	946,2	3784,8
2807	901,4	3605,6	3032	946,4	3785,6
2808	901,6	3606,4	3033	946,6	3786,4
2809	901,8	3607,2	3034	946,8	3787,2
2810	902	3608	3035	947	3788
2811	902,2	3608,8	3036	947,2	3788,8
2812	902,4	3609,6	3037	947,4	3789,6
2813	902,6	3610,4	3038	947,6	3790,4
2814	902,8	3611,2	3039	947,8	3791,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2815	903	3612	3040	948	3792
2816	903,2	3612,8	3041	948,2	3792,8
2817	903,4	3613,6	3042	948,4	3793,6
2818	903,6	3614,4	3043	948,6	3794,4
2819	903,8	3615,2	3044	948,8	3795,2
2820	904	3616	3045	949	3796
2821	904,2	3616,8	3046	949,2	3796,8
2822	904,4	3617,6	3047	949,4	3797,6
2823	904,6	3618,4	3048	949,6	3798,4
2824	904,8	3619,2	3049	949,8	3799,2
2825	905	3620	3050	950	3800
2826	905,2	3620,8	3051	950,2	3800,8
2827	905,4	3621,6	3052	950,4	3801,6
2828	905,6	3622,4	3053	950,6	3802,4
2829	905,8	3623,2	3054	950,8	3803,2
2830	906	3624	3055	951	3804
2831	906,2	3624,8	3056	951,2	3804,8
2832	906,4	3625,6	3057	951,4	3805,6
2833	906,6	3626,4	3058	951,6	3806,4
2834	906,8	3627,2	3059	951,8	3807,2
2835	907	3628	3060	952	3808
2836	907,2	3628,8	3061	952,2	3808,8
2837	907,4	3629,6	3062	952,4	3809,6
2838	907,6	3630,4	3063	952,6	3810,4
2839	907,8	3631,2	3064	952,8	3811,2
2840	908	3632	3065	953	3812
2841	908,2	3632,8	3066	953,2	3812,8
2842	908,4	3633,6	3067	953,4	3813,6
2843	908,6	3634,4	3068	953,6	3814,4
2844	908,8	3635,2	3069	953,8	3815,2
2845	909	3636	3070	954	3816
2846	909,2	3636,8	3071	954,2	3816,8
2847	909,4	3637,6	3072	954,4	3817,6
2848	909,6	3638,4	3073	954,6	3818,4
2849	909,8	3639,2	3074	954,8	3819,2

Uplink CH (TX)	Freq (MHz)	VCO (MHz)	Downlink CH (RX)	Freq (MHz)	VCO (MHz)
2850	910	3640	3075	955	3820
2851	910,2	3640,8	3076	955,2	3820,8
2852	910,4	3641,6	3077	955,4	3821,6
2853	910,6	3642,4	3078	955,6	3822,4
2854	910,8	3643,2	3079	955,8	3823,2
2855	911	3644	3080	956	3824
2856	911,2	3644,8	3081	956,2	3824,8
2857	911,4	3645,6	3082	956,4	3825,6
2858	911,6	3646,4	3083	956,6	3826,4
2859	911,8	3647,2	3084	956,8	3827,2
2860	912	3648	3085	957	3828
2861	912,2	3648,8	3086	957,2	3828,8
2862	912,4	3649,6	3087	957,4	3829,6
2863	912,6	3650,4	3088	957,6	3830,4

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7 — Service information differences between RM-593 and RM-588

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General information

RM-593 product data

RM-593 is a TMO US WCDMA band variant (850/1700-2100) of the Nokia 5230.

The key product data differences between the RM-593 and RM-588 are described below.

Connectivity

Table 17 Remote connectivity

Operating bands	RM-593: EGSM 850/900/1800/1900, WCDMA/HSDPA 850/1700-2100 (V/IV)

Sales package

- Transceiver RM-593
- Battery (BL-5J)
- Charger (AC-8)
- Stereo Headset (WH-102)
- Plectrum Stylus (CP-306)
- Stylus
- User Guide

Product and module list

Module name	Type code	Notes
System/RF module	3CB	
UI Flex Module	2JX	
Upper Flex Module	3CD	

Main RF characteristics for GSM 850/900/1800/1900, WCDMA V (850) and WCDMA IV (1700-2100) phones

Parameter	Unit
Cellular system	GSM 850, EGSM 900, GSM 1800/1900 WCDMA V (850), WCDMA IV (1700-2100)
Rx frequency band	GSM 850: 869 - 894 MHz
	EGSM 900: 925 - 960 MHz
	GSM 1800: 1805 - 1880 MHz
	GSM 1900: 1930 - 1990 MHz
	WCDMA V (850): 869 - 894 MHz
	WCDMA IV (1700-2100): 2110 - 2155 MHz

Parameter	Unit
Tx frequency band	GSM 850: 824 - 849 MHz
	EGSM 900: 880 - 915 MHz
	GSM 1800: 1710 - 1785 MHz
	GSM 1900: 1850 - 1910 MHz
	WCDMA V (850): 824 - 849 MHz
	WCDMA IV (1700-2100): 1710 - 1755 MHz
Output power	GSM 850: +5 ...+33dBm/3.2mW ... 2W
	GSM 900: +5 ... +33dBm/3.2mW ... 2W
	GSM 1800: +0 ... +30dBm/1.0mW ... 1W
	GSM 1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA V (850): -50 ... +24 dBm/0.01µW ... 251.2mW
	WCDMA IV (1700-2100): -50 ... +24 dBm/0.01µW ... 251.2mW
EDGE output power	EDGE 850: +5 ... +27dBm/3.2mW ... 500mW
	EDGE 900: +5 ... +27dBm/3.2mW ... 500mW
	EDGE 1800: +0 ... +26dBm/1.0mW ... 400mW
	EDGE 1900:+0 ... +26dBm/1.0mW ... 400mW
Number of RF channels	GSM 850: 124
	GSM 900: 174
	GSM 1800: 374
	GSM 1900: 299
	WCDMA V (850): 108
	WCDMA IV (1700-2100): 211
Channel spacing	200 kHz
Number of Tx power levels	GSM 850: 15
	GSM 900: 15
	GSM 1800: 16
	GSM 1900: 16
	WCDMA V (850): 75
	WCDMA IV (1700-2100): 75

BB troubleshooting

PWB markings in RM-593 and RM-588

Mechanically RM-593 and RM-588 are identical and therefore the HW differences are noticeable only by taking a closer look at the PWB. As illustrated in the figure below, there are two quick ways to identify the variants from each other.

The first way is from the type designator on the type label and the second one is from the solder markings on the PWB.

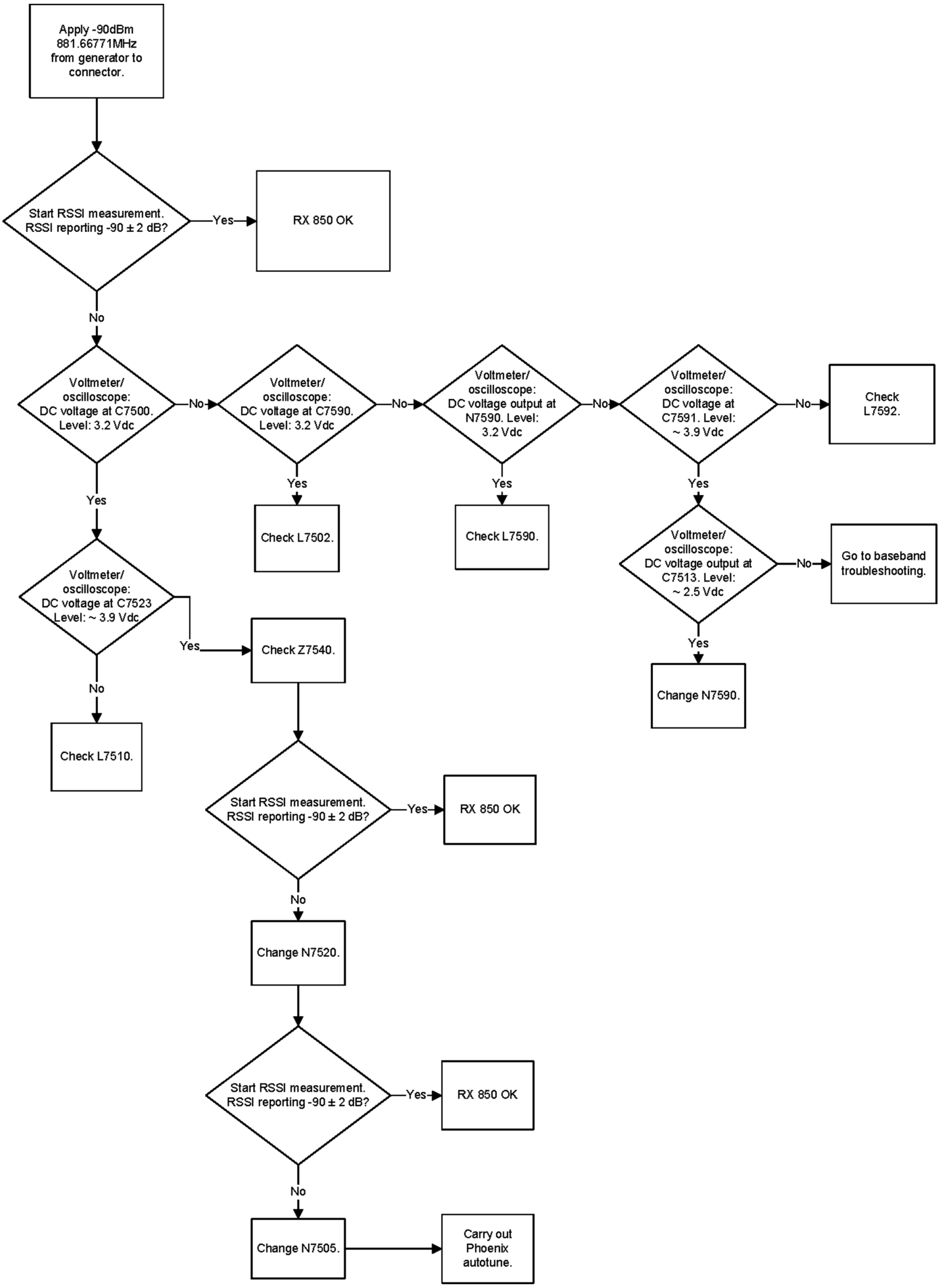
RM-593 has a solder marking above the letter **T**. There are no solder markings above the other letters (**B**, **L** or **R**). RM-588 has a solder marking above the letter **R** and no solder markings above the other letters (**B**, **T** or **L**)

Figure 72 PWB markings in RM-593 and RM-588

RF troubleshooting

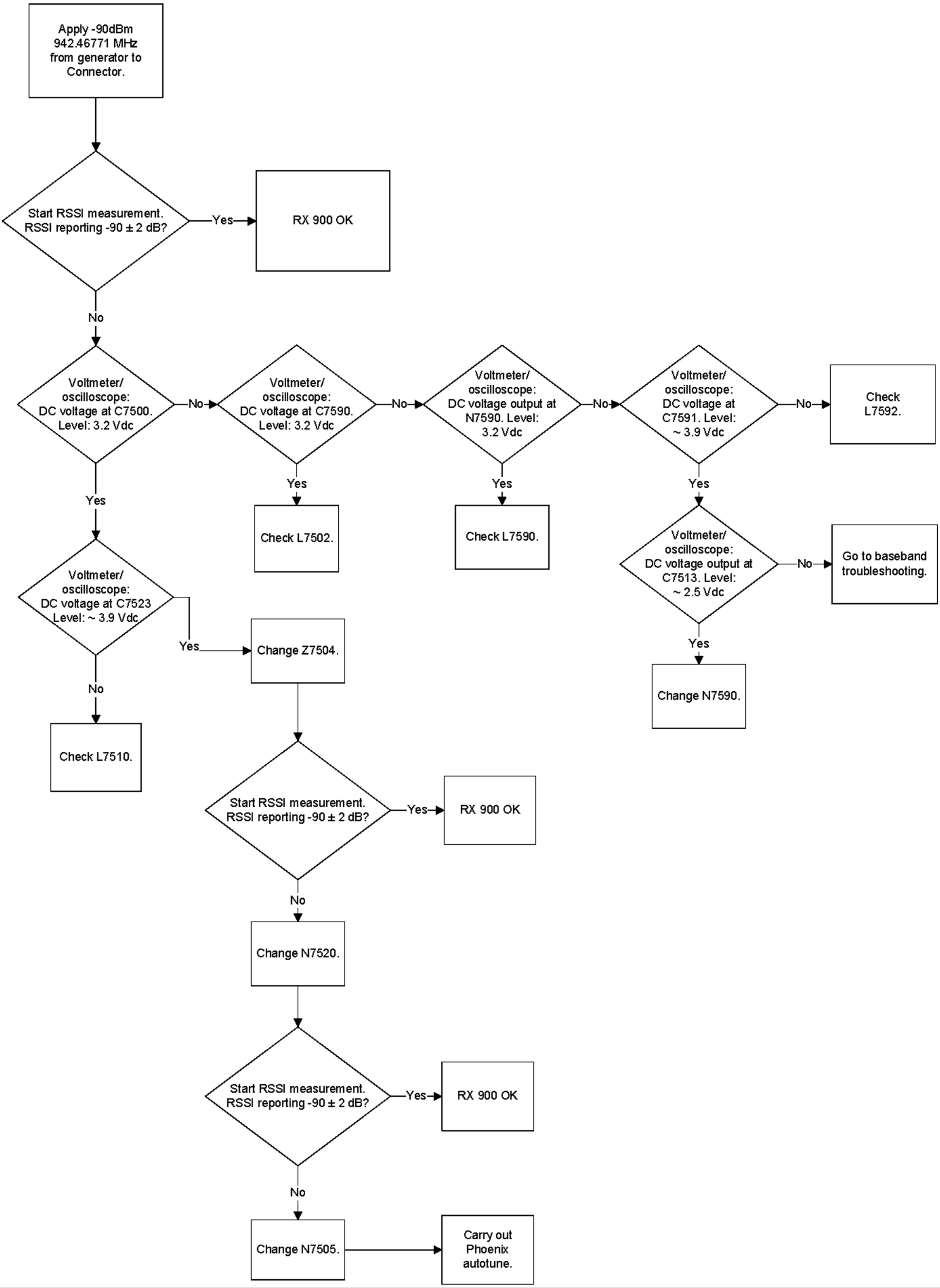
RX GSM850 troubleshooting

Troubleshooting flow



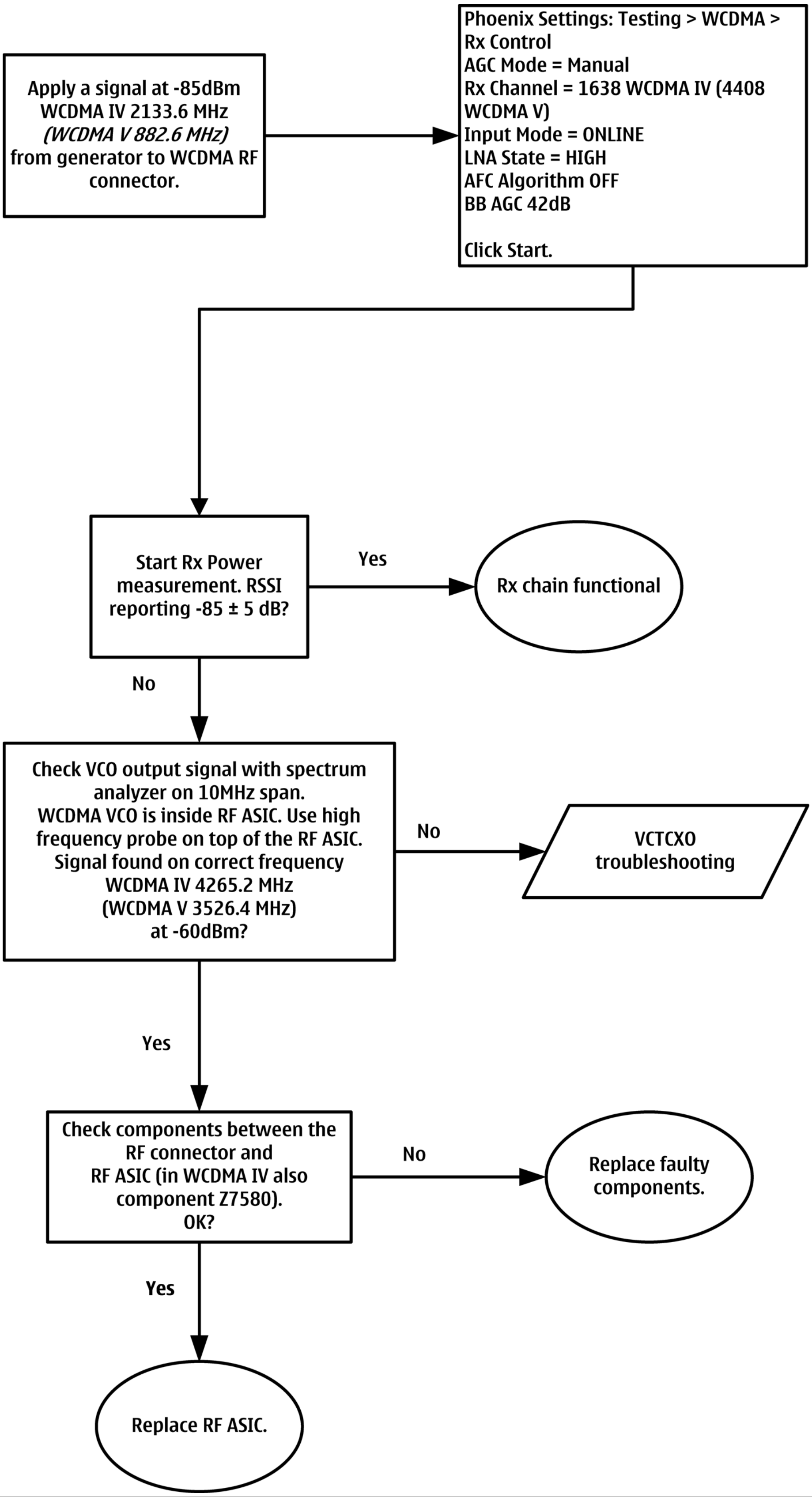
RX GSM900 troubleshooting

Troubleshooting flow



WCDMA receiver troubleshooting

Troubleshooting flow



WCDMA RX chain activation for manual measurement

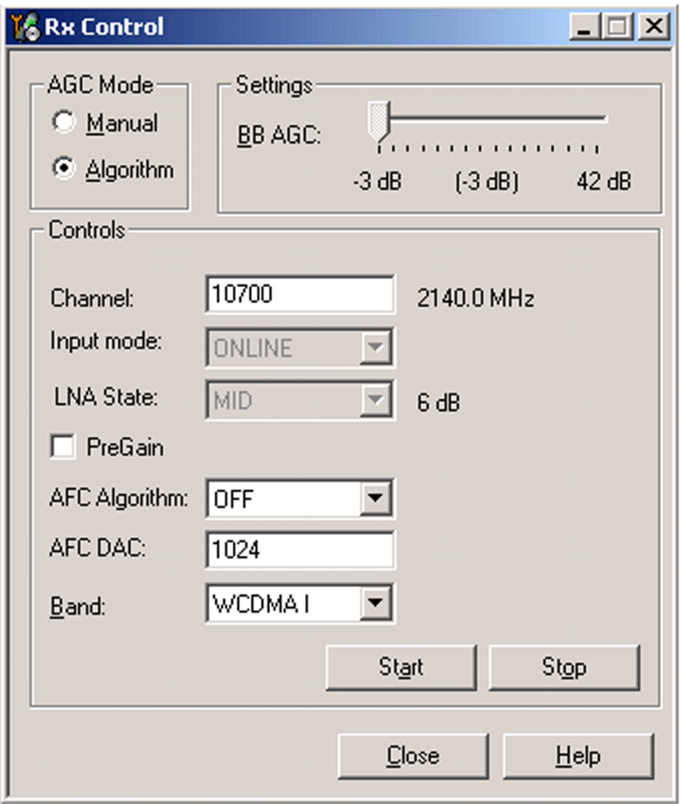
Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA 1700/2100	WCDMA 850
Phoenix Channel	1638	4408
Signal generator to antenna connector	2132.6 MHz	881.6 MHz
Band	IV	V

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

4. Set the following RF generator settings:

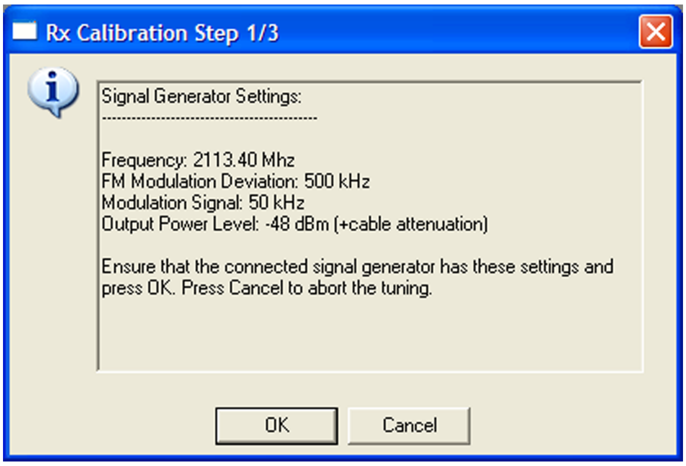


Figure 73 WCDMA RX generator settings

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing** → **WCDMA** → **TX control** .
3. Use the following settings in the TX control window:

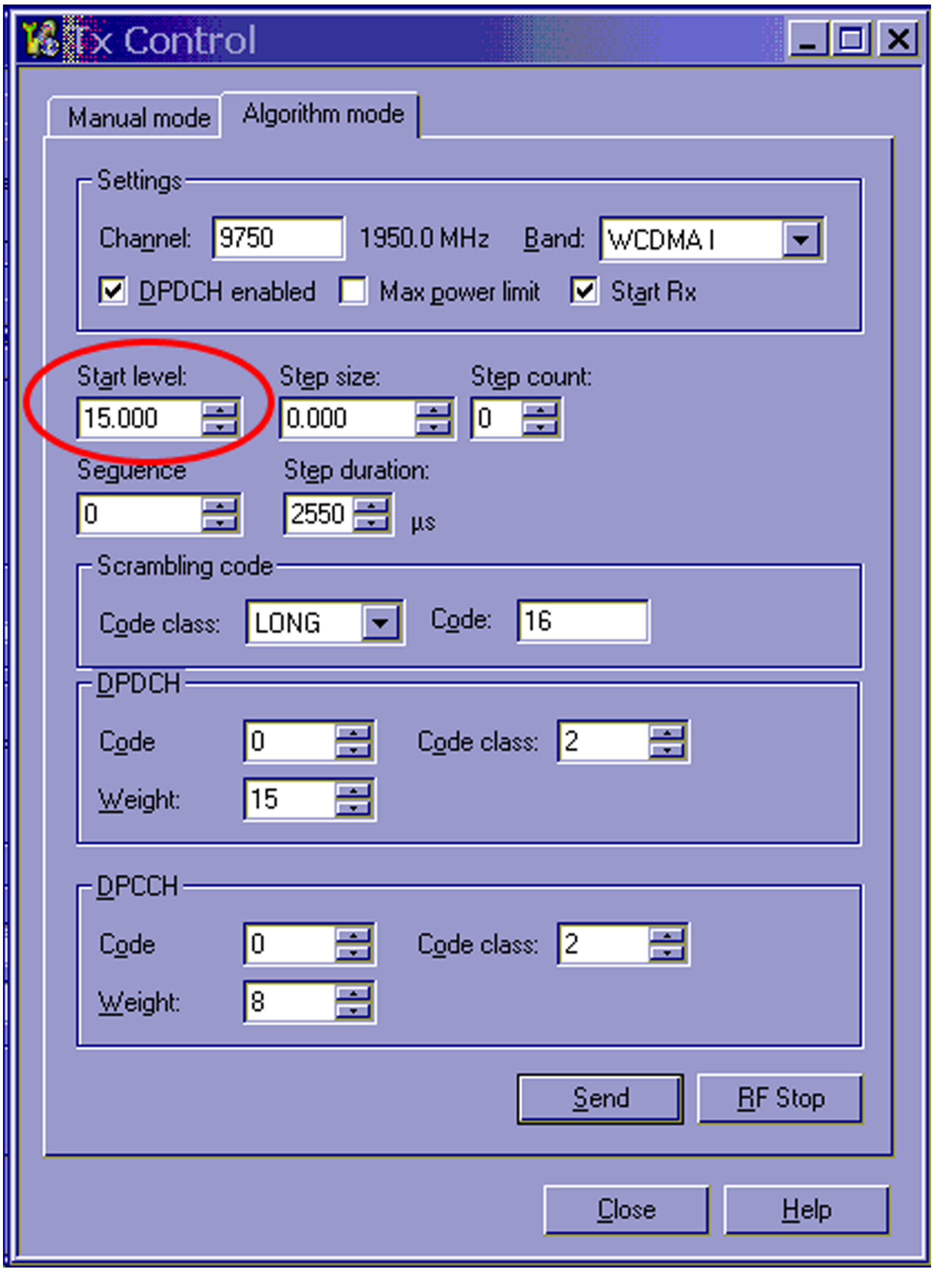


Figure 74 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

5. Use the CMU200 to check the WCDMA power.

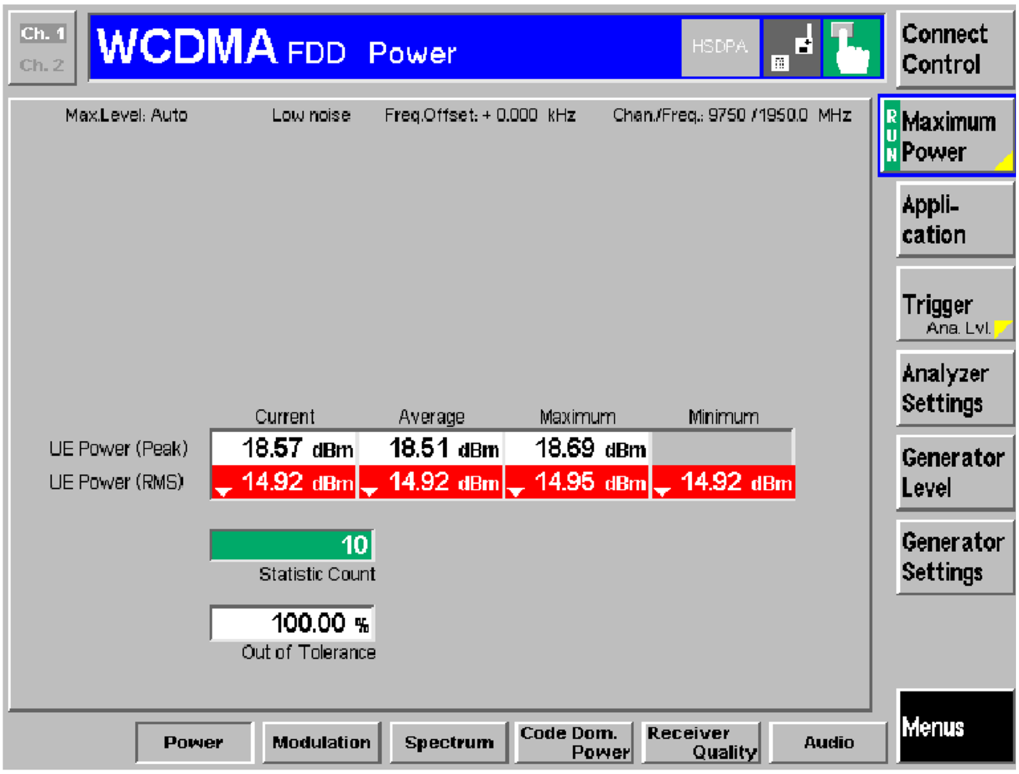


Figure 75 WCDMA power window

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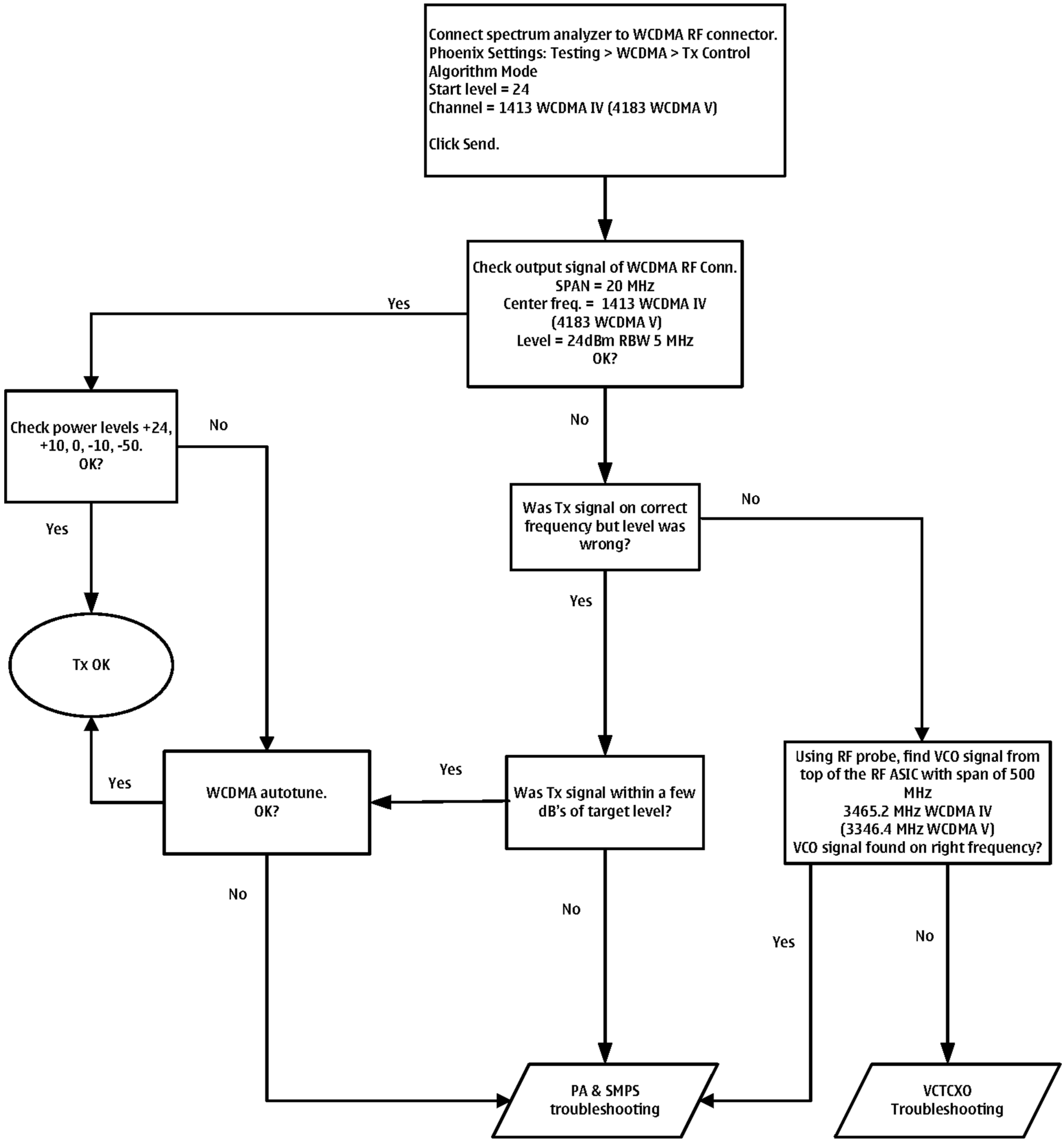
WCDMA transmitter troubleshooting flowchart

Troubleshooting flow



Tx power level tuning (GSM)

Context

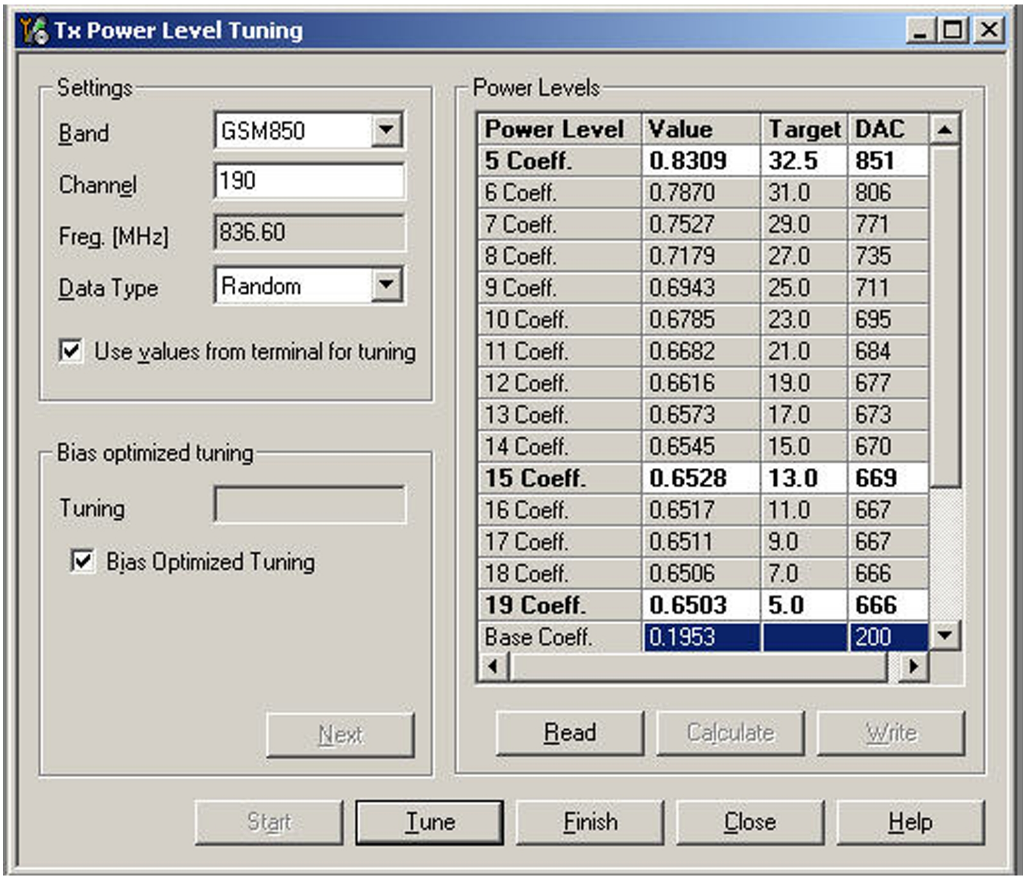
Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

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. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning** → **GSM** → **Tx Power Level Tuning** .
5. Click **Start**.l



6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **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 into account.

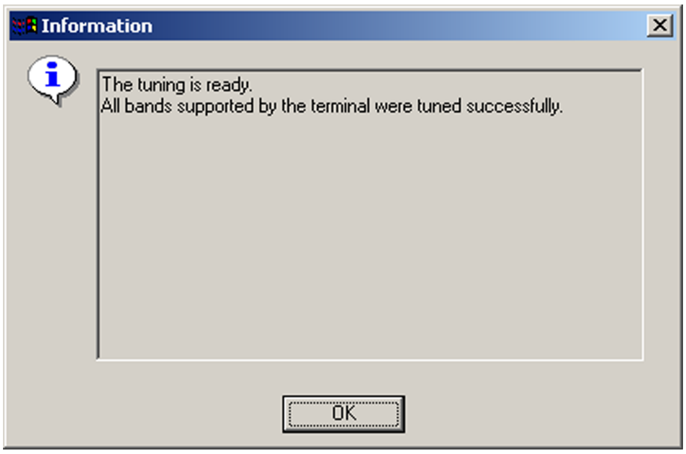
7. Set the tuning targets according to the values in the table below

GMSK	1Slot	2 slot	3 slot
850	32,5	31,0	29,7
900	32,5	30,5	29,0
1800	30,0	30,0	28,2
1900	30,0	27,0	25,2
EDGE	1Slot	2 slot	3 slot
850	26,5	26,5	24,7
900	26,5	26,5	24,7
1800	25	25	23,2
1900	25	25	23,2
WCDMA Band IV	23.0dBm		
WCDMA Band V	23.5dBm		

8. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
9. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
10. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



WCDMA receiver tunings

RX calibration (WCDMA)

Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA IV (1700/2100) or WCDMA V (850)".
5. Click **Tune**.

6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.

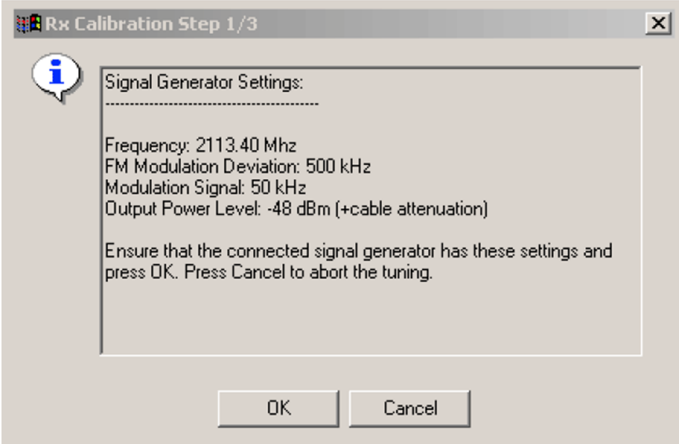
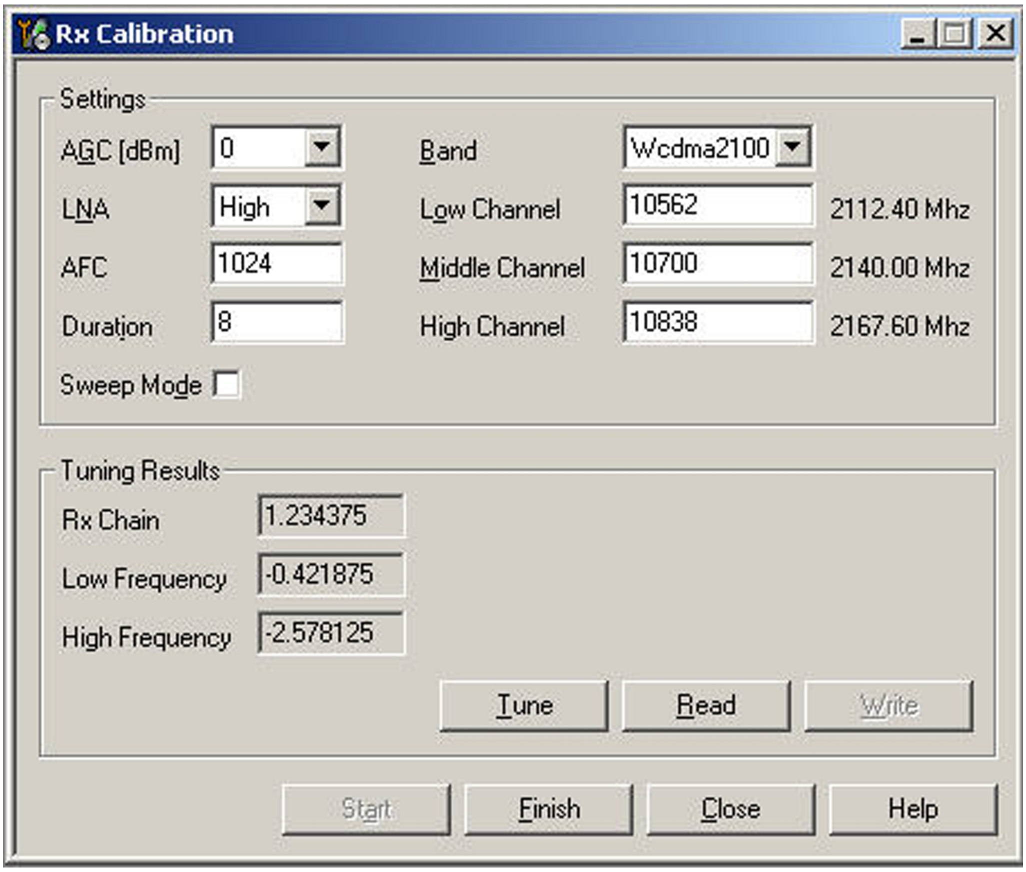


Figure 76 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



8. Ensure Tuning Results are within limits specified in the table below:
   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	1700/2100 or 850	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA IV (1700/2100) or WCDMA V (850)".
- Check the **Sweep Mode** box.
- Click **Tune**.
- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.

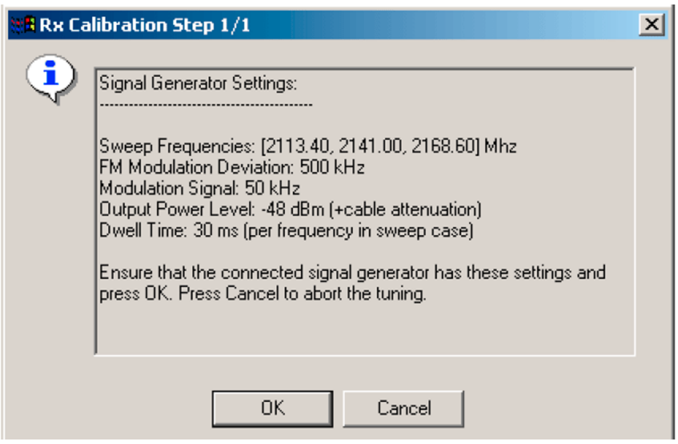


Figure 77 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

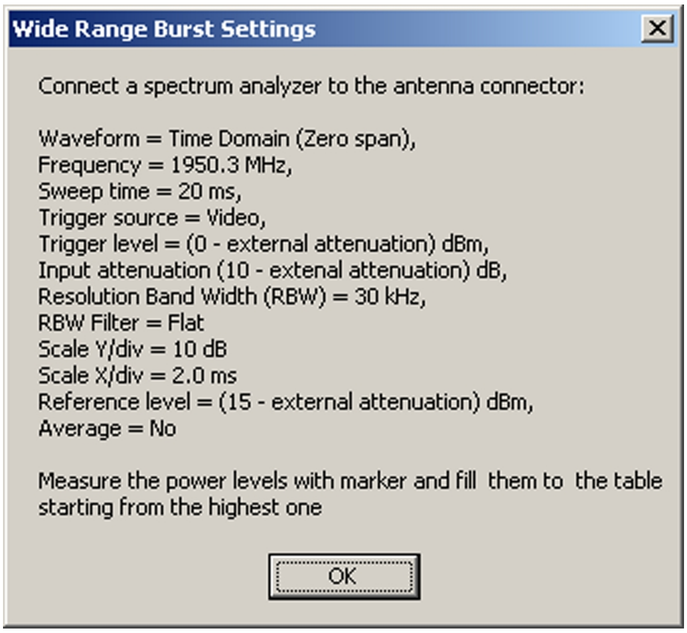
- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

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

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

2. Choose **Tuning → WCDMA → Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).
5. Set up the spectrum analyzer in the following way:



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 after 750 us, the third after 1250 us and so on for 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 spikes on lower levels.

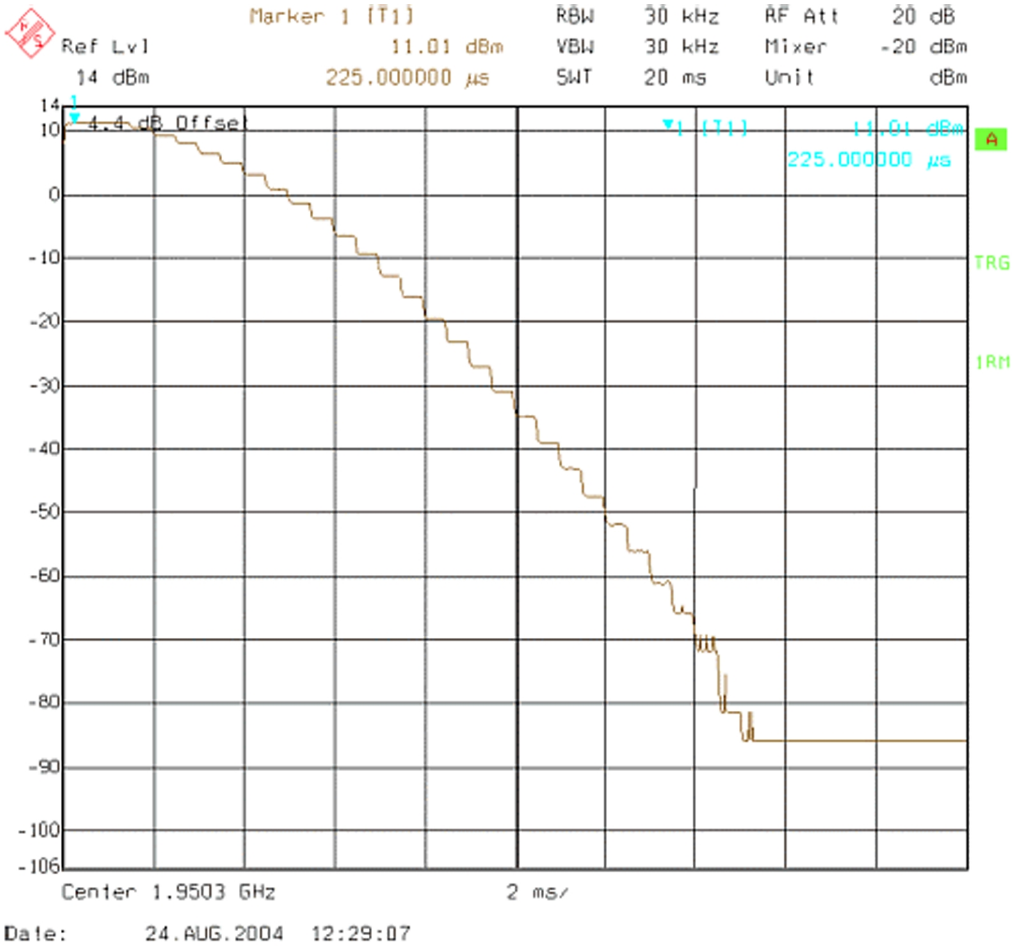


Figure 78 WCDMA power level tuning steps

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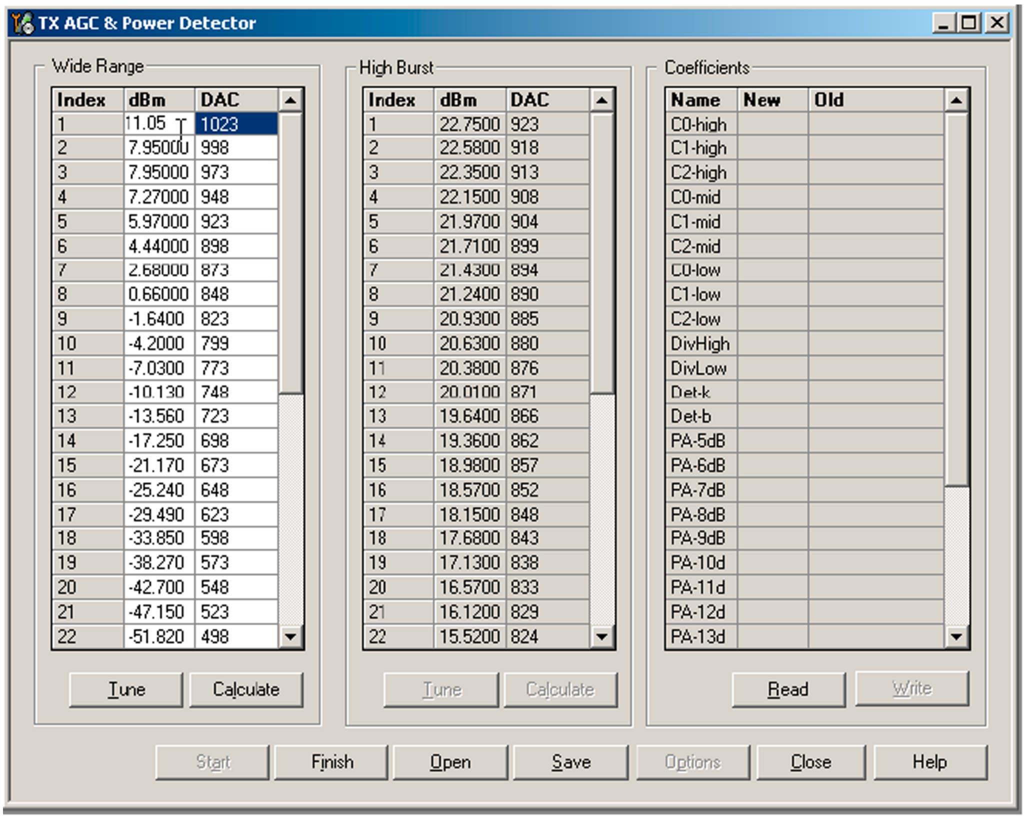
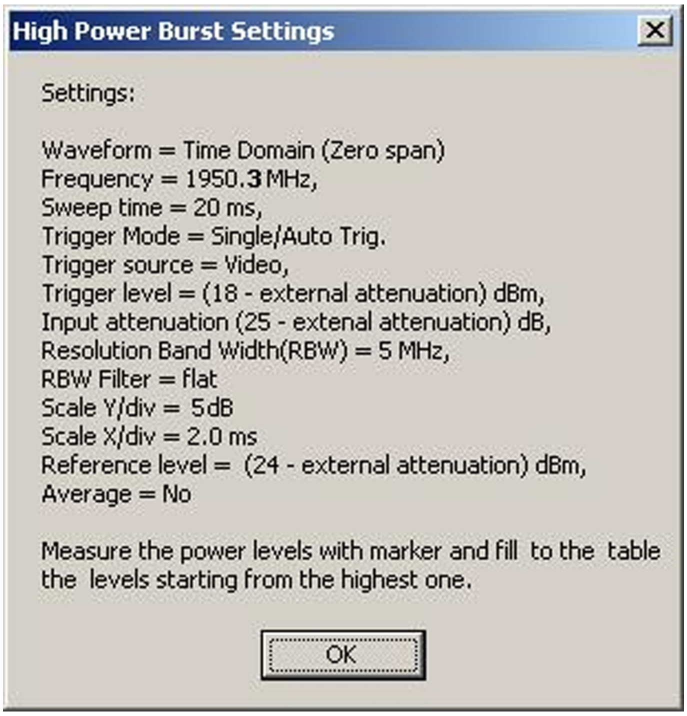
8. Fill in the power level values (in dBm) to the *Wide Range* table.



9. In the *Wide Range* pane, click **Calculate**.
10. In the *High Burst* pane, click **Tune**.
11. Adjust the spectrum analyzer according to the following settings:



12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

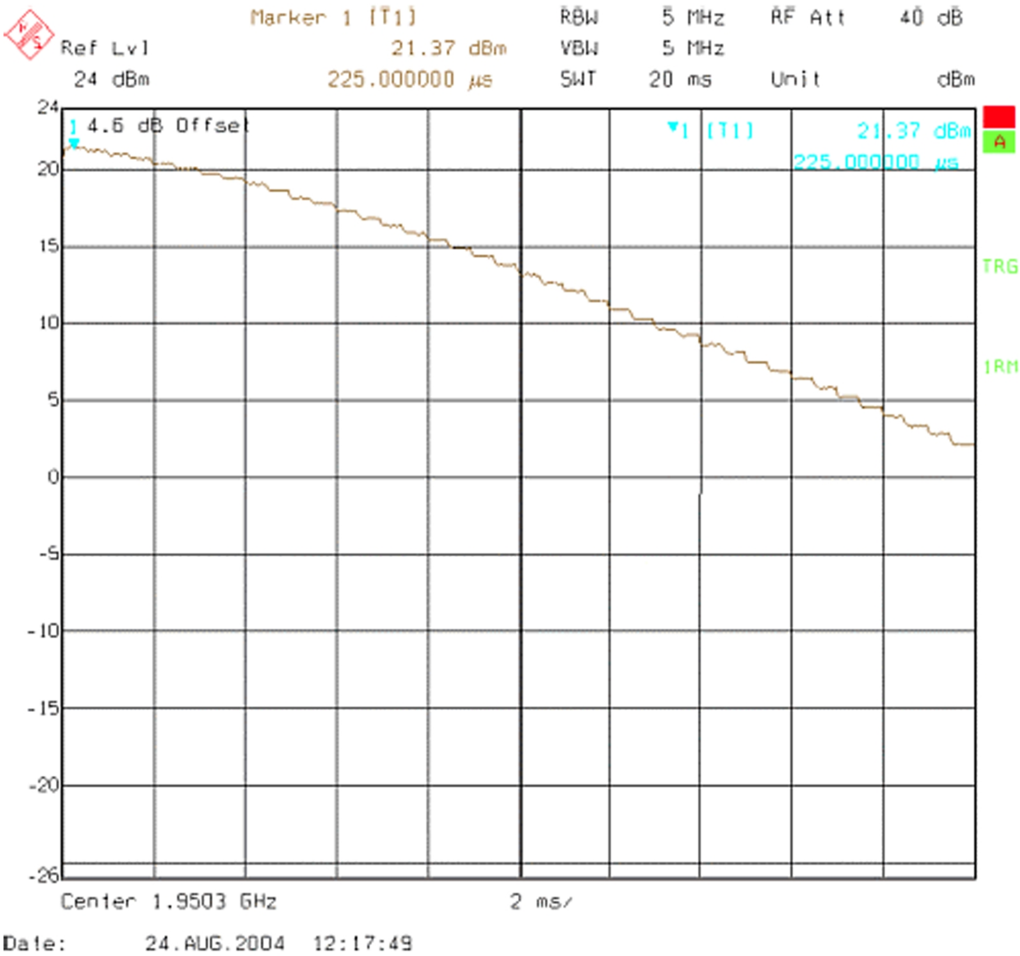


Figure 79 High burst measurement

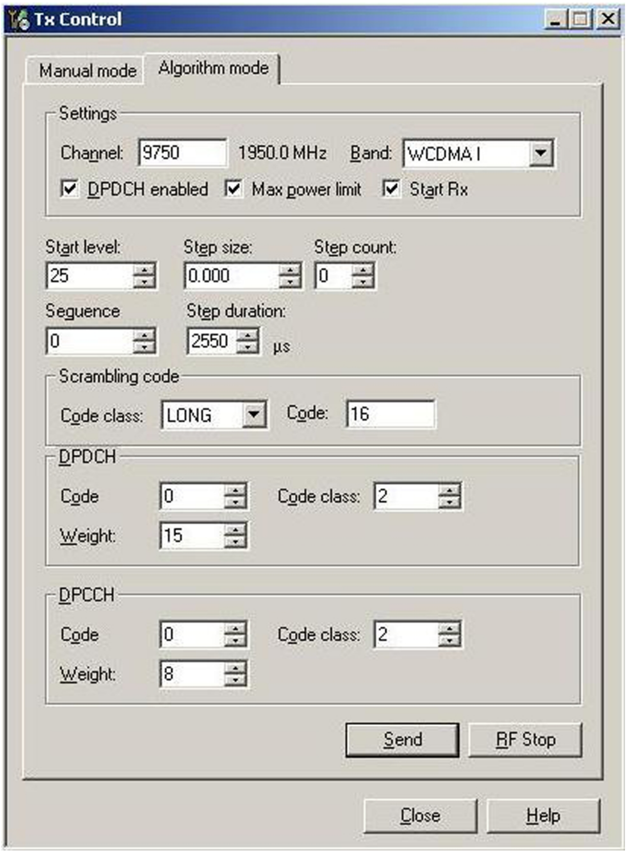
13. In the *High Burst* pane, click **Calculate**.

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

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing** → **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:	**1732.6 MHz (WCDMA IV)** or **836.6 MHz (WCDMA V)**
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** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

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

System module

WCDMA V (850) frequencies

TX CH	RX CH	TX	RX	VCO TX	VCO RX
4132	4357	826.4	871.4	3305.6	3485.6
782	1007	826.5	871.5	3306.0	3486.0
4133	4358	826.6	871.6	3306.4	3486.4
4134	4359	826.8	871.8	3307.2	3487.2
4135	4360	827.0	872.0	3308.0	3488.0
4136	4361	827.2	872.2	3308.8	3488.8
4137	4362	827.4	872.4	3309.6	3489.6
787	1012	827.5	872.5	3310.0	3490.0
4138	4363	827.6	872.6	3310.4	3490.4
4139	4364	827.8	872.8	3311.2	3491.2
4140	4365	828.0	873.0	3312.0	3492.0
4141	4366	828.2	873.2	3312.8	3492.8
4142	4367	828.4	873.4	3313.6	3493.6
4143	4368	828.6	873.6	3314.4	3494.4
4144	4369	828.8	873.8	3315.2	3495.2
4145	4370	829.0	874.0	3316.0	3496.0
4146	4371	829.2	874.2	3316.8	3496.8
4147	4372	829.4	874.4	3317.6	3497.6
4148	4373	829.6	874.6	3318.4	3498.4
4149	4374	829.8	874.8	3319.2	3499.2
4150	4375	830.0	875.0	3320.0	3500.0
4151	4376	830.2	875.2	3320.8	3500.8
4152	4377	830.4	875.4	3321.6	3501.6
4153	4378	830.6	875.6	3322.4	3502.4
4154	4379	830.8	875.8	3323.2	3503.2
4155	4380	831.0	876.0	3324.0	3504.0
4156	4381	831.2	876.2	3324.8	3504.8
4157	4382	831.4	876.4	3325.6	3505.6
807	1032	831.5	876.5	3326.0	3506.0
4158	4383	831.6	876.6	3326.4	3506.4
4159	4384	831.8	876.8	3327.2	3507.2
4160	4385	832.0	877.0	3328.0	3508.0
4161	4386	832.2	877.2	3328.8	3508.8
4162	4387	832.4	877.4	3329.6	3509.6
812	1037	832.5	877.5	3330.0	3510.0
4163	4388	832.6	877.6	3330.4	3510.4
4164	4389	832.8	877.8	3331.2	3511.2
4165	4390	833.0	878.0	3332.0	3512.0
4166	4391	833.2	878.2	3332.8	3512.8
4167	4392	833.4	878.4	3333.6	3513.6
4168	4393	833.6	878.6	3334.4	3514.4
4169	4394	833.8	878.8	3335.2	3515.2
4170	4395	834.0	879.0	3336.0	3516.0
4171	4396	834.2	879.2	3336.8	3516.8
4172	4397	834.4	879.4	3337.6	3517.6
4173	4398	834.6	879.6	3338.4	3518.4
4174	4399	834.8	879.8	3339.2	3519.2
4175	4400	835.0	880.0	3340.0	3520.0
4176	4401	835.2	880.2	3340.8	3520.8
4177	4402	835.4	880.4	3341.6	3521.6
4178	4403	835.6	880.6	3342.4	3522.4
4179	4404	835.8	880.8	3343.2	3523.2
4180	4405	836.0	881.0	3344.0	3524.0
4181	4406	836.2	881.2	3344.8	3524.8

TX CH	RX CH	TX	RX	VCO TX	VCO RX
4182	4407	836.4	881.4	3345.6	3525.6
4183	4408	836.6	881.6	3346.4	3526.4
4184	4409	836.8	881.8	3347.2	3527.2
4185	4410	837.0	882.0	3348.0	3528.0
4186	4411	837.2	882.2	3348.8	3528.8
4187	4412	837.4	882.4	3349.6	3529.6
837	1062	837.5	882.5	3350.0	3530.0
4188	4413	837.6	882.6	3350.4	3530.4
4189	4414	837.8	882.8	3351.2	3531.2
4190	4415	838.0	883.0	3352.0	3532.0
4191	4416	838.2	883.2	3352.8	3532.8
4192	4417	838.4	883.4	3353.6	3533.6
4193	4418	838.6	883.6	3354.4	3534.4
4194	4419	838.8	883.8	3355.2	3535.2
4195	4420	839.0	884.0	3356.0	3536.0
4196	4421	839.2	884.2	3356.8	3536.8
4197	4422	839.4	884.4	3357.6	3537.6
4198	4423	839.6	884.6	3358.4	3538.4
4199	4424	839.8	884.8	3359.2	3539.2
4200	4425	840.0	885.0	3360.0	3540.0
4201	4426	840.2	885.2	3360.8	3540.8
4202	4427	840.4	885.4	3361.6	3541.6
4203	4428	840.6	885.6	3362.4	3542.4
4204	4429	840.8	885.8	3363.2	3543.2
4205	4430	841.0	886.0	3364.0	3544.0
4206	4431	841.2	886.2	3364.8	3544.8
4207	4432	841.4	886.4	3365.6	3545.6
4208	4433	841.6	886.6	3366.4	3546.4
4209	4434	841.8	886.8	3367.2	3547.2
4210	4435	842.0	887.0	3368.0	3548.0
4211	4436	842.2	887.2	3368.8	3548.8
4212	4437	842.4	887.4	3369.6	3549.6
862	1087	842.5	887.5	3370.0	3550.0
4213	4438	842.6	887.6	3370.4	3550.4
4214	4439	842.8	887.8	3371.2	3551.2
4215	4440	843.0	888.0	3372.0	3552.0
4216	4441	843.2	888.2	3372.8	3552.8
4217	4442	843.4	888.4	3373.6	3553.6
4218	4443	843.6	888.6	3374.4	3554.4
4219	4444	843.8	888.8	3375.2	3555.2
4220	4445	844.0	889.0	3376.0	3556.0
4221	4446	844.2	889.2	3376.8	3556.8
4222	4447	844.4	889.4	3377.6	3557.6
4223	4448	844.6	889.6	3378.4	3558.4
4224	4449	844.8	889.8	3379.2	3559.2
4225	4450	845.0	890.0	3380.0	3560.0
4226	4451	845.2	890.2	3380.8	3560.8
4227	4452	845.4	890.4	3381.6	3561.6
4228	4453	845.6	890.6	3382.4	3562.4
4229	4454	845.8	890.8	3383.2	3563.2
4230	4455	846.0	891.0	3384.0	3564.0
4231	4456	846.2	891.2	3384.8	3564.8
4232	4457	846.4	891.4	3385.6	3565.6
4233	4458	846.6	891.6	3386.4	3566.4

WCDMA IV (1700-2100) frequencies

TX CH	RX CH	TX (MHz)	RX (MHz)	TX VCO (MHz)	RX VCO (MHz)
1312	1537	1712.4	2112.4	3424.8	4224.8
1313	1538	1712.6	2112.6	3425.2	4225.2
1314	1539	1712.8	2112.8	3425.6	4225.6
1315	1540	1713.0	2113.0	3426.0	4226.0
1316	1541	1713.2	2113.2	3426.4	4226.4
1317	1542	1713.4	2113.4	3426.8	4226.8
1318	1543	1713.6	2113.6	3427.2	4227.2
1319	1544	1713.8	2113.8	3427.6	4227.6
1320	1545	1714.0	2114.0	3428.0	4228.0
1321	1546	1714.2	2114.2	3428.4	4228.4
1322	1547	1714.4	2114.4	3428.8	4228.8
1323	1548	1714.6	2114.6	3429.2	4229.2
1324	1549	1714.8	2114.8	3429.6	4229.6
1325	1550	1715.0	2115.0	3430.0	4230.0
1326	1551	1715.2	2115.2	3430.4	4230.4
1327	1552	1715.4	2115.4	3430.8	4230.8
1328	1553	1715.6	2115.6	3431.2	4231.2
1329	1554	1715.8	2115.8	3431.6	4231.6
1330	1555	1716.0	2116.0	3432.0	4232.0
1331	1556	1716.2	2116.2	3432.4	4232.4
1332	1557	1716.4	2116.4	3432.8	4232.8
1333	1558	1716.6	2116.6	3433.2	4233.2
1334	1559	1716.8	2116.8	3433.6	4233.6
1335	1560	1717.0	2117.0	3434.0	4234.0
1336	1561	1717.2	2117.2	3434.4	4234.4
1337	1562	1717.4	2117.4	3434.8	4234.8
1338	1563	1717.6	2117.6	3435.2	4235.2
1339	1564	1717.8	2117.8	3435.6	4235.6
1340	1565	1718.0	2118.0	3436.0	4236.0
1341	1566	1718.2	2118.2	3436.4	4236.4
1342	1567	1718.4	2118.4	3436.8	4236.8
1343	1568	1718.6	2118.6	3437.2	4237.2
1344	1569	1718.8	2118.8	3437.6	4237.6
1345	1570	1719.0	2119.0	3438.0	4238.0
1346	1571	1719.2	2119.2	3438.4	4238.4
1347	1572	1719.4	2119.4	3438.8	4238.8
1348	1573	1719.6	2119.6	3439.2	4239.2
1349	1574	1719.8	2119.8	3439.6	4239.6
1350	1575	1720.0	2120.0	3440.0	4240.0
1351	1576	1720.2	2120.2	3440.4	4240.4
1352	1577	1720.4	2120.4	3440.8	4240.8
1353	1578	1720.6	2120.6	3441.2	4241.2
1354	1579	1720.8	2120.8	3441.6	4241.6
1355	1580	1721.0	2121.0	3442.0	4242.0
1356	1581	1721.2	2121.2	3442.4	4242.4
1357	1582	1721.4	2121.4	3442.8	4242.8
1358	1583	1721.6	2121.6	3443.2	4243.2
1359	1584	1721.8	2121.8	3443.6	4243.6
1360	1585	1722.0	2122.0	3444.0	4244.0
1361	1586	1722.2	2122.2	3444.4	4244.4
1362	1587	1722.4	2122.4	3444.8	4244.8
1363	1588	1722.6	2122.6	3445.2	4245.2
1364	1589	1722.8	2122.8	3445.6	4245.6
1365	1590	1723.0	2123.0	3446.0	4246.0
1366	1591	1723.2	2123.2	3446.4	4246.4
1367	1592	1723.4	2123.4	3446.8	4246.8
1368	1593	1723.6	2123.6	3447.2	4247.2
1369	1594	1723.8	2123.8	3447.6	4247.6
1370	1595	1724.0	2124.0	3448.0	4248.0
1371	1596	1724.2	2124.2	3448.4	4248.4
1372	1597	1724.4	2124.4	3448.8	4248.8
1373	1598	1724.6	2124.6	3449.2	4249.2
1374	1599	1724.8	2124.8	3449.6	4249.6
1375	1600	1725.0	2125.0	3450.0	4250.0
1376	1601	1725.2	2125.2	3450.4	4250.4
1377	1602	1725.4	2125.4	3450.8	4250.8
1378	1603	1725.6	2125.6	3451.2	4251.2
1379	1604	1725.8	2125.8	3451.6	4251.6
1380	1605	1726.0	2126.0	3452.0	4252.0
1381	1606	1726.2	2126.2	3452.4	4252.4
1382	1607	1726.4	2126.4	3452.8	4252.8
1383	1608	1726.6	2126.6	3453.2	4253.2
1384	1609	1726.8	2126.8	3453.6	4253.6
1385	1610	1727.0	2127.0	3454.0	4254.0
1386	1611	1727.2	2127.2	3454.4	4254.4
1387	1612	1727.4	2127.4	3454.8	4254.8
1388	1613	1727.6	2127.6	3455.2	4255.2
1389	1614	1727.8	2127.8	3455.6	4255.6
1390	1615	1728.0	2128.0	3456.0	4256.0
1391	1616	1728.2	2128.2	3456.4	4256.4
1392	1617	1728.4	2128.4	3456.8	4256.8
1393	1618	1728.6	2128.6	3457.2	4257.2
1394	1619	1728.8	2128.8	3457.6	4257.6
1395	1620	1729.0	2129.0	3458.0	4258.0
1396	1621	1729.2	2129.2	3458.4	4258.4
1397	1622	1729.4	2129.4	3458.8	4258.8
1398	1623	1729.6	2129.6	3459.2	4259.2
1399	1624	1729.8	2129.8	3459.6	4259.6
1400	1625	1730.0	2130.0	3460.0	4260.0
1401	1626	1730.2	2130.2	3460.4	4260.4
1402	1627	1730.4	2130.4	3460.8	4260.8
1403	1628	1730.6	2130.6	3461.2	4261.2
1404	1629	1730.8	2130.8	3461.6	4261.6
1405	1630	1731.0	2131.0	3462.0	4262.0
1406	1631	1731.2	2131.2	3462.4	4262.4
1407	1632	1731.4	2131.4	3462.8	4262.8
1408	1633	1731.6	2131.6	3463.2	4263.2
1409	1634	1731.8	2131.8	3463.6	4263.6
1410	1635	1732.0	2132.0	3464.0	4264.0
1411	1636	1732.2	2132.2	3464.4	4264.4
1412	1637	1732.4	2132.4	3464.8	4264.8
1413	1638	1732.6	2132.6	3465.2	4265.2
1414	1639	1732.8	2132.8	3465.6	4265.6
1415	1640	1733.0	2133.0	3466.0	4266.0
1416	1641	1733.2	2133.2	3466.4	4266.4
1417	1642	1733.4	2133.4	3466.8	4266.8
1418	1643	1733.6	2133.6	3467.2	4267.2
1419	1644	1733.8	2133.8	3467.6	4267.6
1420	1645	1734.0	2134.0	3468.0	4268.0
1421	1646	1734.2	2134.2	3468.4	4268.4
1422	1647	1734.4	2134.4	3468.8	4268.8
1423	1648	1734.6	2134.6	3469.2	4269.2
1424	1649	1734.8	2134.8	3469.6	4269.6
1425	1650	1735.0	2135.0	3470.0	4270.0
1426	1651	1735.2	2135.2	3470.4	4270.4
1427	1652	1735.4	2135.4	3470.8	4270.8
1428	1653	1735.6	2135.6	3471.2	4271.2
1429	1654	1735.8	2135.8	3471.6	4271.6
1430	1655	1736.0	2136.0	3472.0	4272.0
1431	1656	1736.2	2136.2	3472.4	4272.4
1432	1657	1736.4	2136.4	3472.8	4272.8
1433	1658	1736.6	2136.6	3473.2	4273.2
1434	1659	1736.8	2136.8	3473.6	4273.6
1435	1660	1737.0	2137.0	3474.0	4274.0
1436	1661	1737.2	2137.2	3474.4	4274.4
1437	1662	1737.4	2137.4	3474.8	4274.8
1438	1663	1737.6	2137.6	3475.2	4275.2
1439	1664	1737.8	2137.8	3475.6	4275.6
1440	1665	1738.0	2138.0	3476.0	4276.0
1441	1666	1738.2	2138.2	3476.4	4276.4
1442	1667	1738.4	2138.4	3476.8	4276.8
1443	1668	1738.6	2138.6	3477.2	4277.2
1444	1669	1738.8	2138.8	3477.6	4277.6
1445	1670	1739.0	2139.0	3478.0	4278.0
1446	1671	1739.2	2139.2	3478.4	4278.4
1447	1672	1739.4	2139.4	3478.8	4278.8
1448	1673	1739.6	2139.6	3479.2	4279.2
1449	1674	1739.8	2139.8	3479.6	4279.6
1450	1675	1740.0	2140.0	3480.0	4280.0
1451	1676	1740.2	2140.2	3480.4	4280.4
1452	1677	1740.4	2140.4	3480.8	4280.8
1453	1678	1740.6	2140.6	3481.2	4281.2
1454	1679	1740.8	2140.8	3481.6	4281.6
1455	1680	1741.0	2141.0	3482.0	4282.0
1456	1681	1741.2	2141.2	3482.4	4282.4
1457	1682	1741.4	2141.4	3482.8	4282.8
1458	1683	1741.6	2141.6	3483.2	4283.2
1459	1684	1741.8	2141.8	3483.6	4283.6
1460	1685	1742.0	2142.0	3484.0	4284.0
1461	1686	1742.2	2142.2	3484.4	4284.4
1462	1687	1742.4	2142.4	3484.8	4284.8
1463	1688	1742.6	2142.6	3485.2	4285.2
1464	1689	1742.8	2142.8	3485.6	4285.6
1465	1690	1743.0	2143.0	3486.0	4286.0
1466	1691	1743.2	2143.2	3486.4	4286.4
1467	1692	1743.4	2143.4	3486.8	4286.8
1468	1693	1743.6	2143.6	3487.2	4287.2
1469	1694	1743.8	2143.8	3487.6	4287.6
1470	1695	1744.0	2144.0	3488.0	4288.0
1471	1696	1744.2	2144.2	3488.4	4288.4
1472	1697	1744.4	2144.4	3488.8	4288.8
1473	1698	1744.6	2144.6	3489.2	4289.2
1474	1699	1744.8	2144.8	3489.6	4289.6
1475	1700	1745.0	2145.0	3490.0	4290.0
1476	1701	1745.2	2145.2	3490.4	4290.4
1477	1702	1745.4	2145.4	3490.8	4290.8
1478	1703	1745.6	2145.6	3491.2	4291.2
1479	1704	1745.8	2145.8	3491.6	4291.6
1480	1705	1746.0	2146.0	3492.0	4292.0
1481	1706	1746.2	2146.2	3492.4	4292.4
1482	1707	1746.4	2146.4	3492.8	4292.8
1483	1708	1746.6	2146.6	3493.2	4293.2
1484	1709	1746.8	2146.8	3493.6	4293.6
1485	1710	1747.0	2147.0	3494.0	4294.0
1486	1711	1747.2	2147.2	3494.4	4294.4
1487	1712	1747.4	2147.4	3494.8	4294.8
1488	1713	1747.6	2147.6	3495.2	4295.2
1489	1714	1747.8	2147.8	3495.6	4295.6
1490	1715	1748.0	2148.0	3496.0	4296.0
1491	1716	1748.2	2148.2	3496.4	4296.4
1492	1717	1748.4	2148.4	3496.8	4296.8
1493	1718	1748.6	2148.6	3497.2	4297.2
1494	1719	1748.8	2148.8	3497.6	4297.6
1495	1720	1749.0	2149.0	3498.0	4298.0
1496	1721	1749.2	2149.2	3498.4	4298.4
1497	1722	1749.4	2149.4	3498.8	4298.8
1498	1723	1749.6	2149.6	3499.2	4299.2
1499	1724	1749.8	2149.8	3499.6	4299.6
1500	1725	1750.0	2150.0	3500.0	4300.0
1501	1726	1750.2	2150.2	3500.4	4300.4
1502	1727	1750.4	2150.4	3500.8	4300.8
1503	1728	1750.6	2150.6	3501.2	4301.2
1504	1729	1750.8	2150.8	3501.6	4301.6
1505	1730	1751.0	2151.0	3502.0	4302.0
1506	1731	1751.2	2151.2	3502.4	4302.4
1507	1732	1751.4	2151.4	3502.8	4302.8
1508	1733	1751.6	2151.6	3503.2	4303.2
1509	1734	1751.8	2151.8	3503.6	4303.6
1510	1735	1752.0	2152.0	3504.0	4304.0
1511	1736	1752.2	2152.2	3504.4	4304.4
1512	1737	1752.4	2152.4	3504.8	4304.8
1513	1738	1752.6	2152.6	3505.2	4305.2
1662	1887	1712.5	2112.5	3425.0	4225.0
1687	1912	1717.5	2117.5	3435.0	4235.0
1712	1937	1722.5	2122.5	3445.0	4245.0
1737	1962	1727.5	2127.5	3455.0	4255.0
1762	1987	1732.5	2132.5	3465.0	4265.0
1787	2012	1737.5	2137.5	3475.0	4275.0
1812	2037	1742.5	2142.5	3485.0	4285.0
1837	2062	1747.5	2147.5	3495.0	4295.0
1862	2087	1752.5	2152.5	3505.0	4305.0

8 — Service information differences between RM-594 and RM-588

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General information

RM-594 product data

RM-594 is a WCDMA band variant (850/1900) of the Nokia 5230.

The key product data differences between the RM-594 and RM-588 are described below.

Connectivity

Table 18 Remote connectivity

Operating bands	RM-594: EGSM 850/900/1800/1900, WCDMA/HSDPA 850/1900 (V/II)

Sales package

- Transceiver RM-594
- Battery (BL-5J)
- Charger (AC-8)
- Stereo Headset (WH-102)
- Plectrum Stylus (CP-306)
- Stylus
- User Guide

Product and module list

Module name	Type code	Notes
System/RF module	3CB	
UI Flex Module	2JX	
Upper Flex Module	3CD	

Main RF characteristics for GSM850/900/1800/1900, WCDMA V (850) and WCDMA II (1900) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850) and WCDMA II (1900)
Rx frequency band	GSM850: 869 - 894MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA 850: 869 - 894 MHz
	WCDMA 1900: 1930 - 1990 MHz

Parameter	Unit
Tx frequency band	GSM850: 824 - 849MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA 850: 824 - 849 MHz
	WCDMA 1900: 1850 - 1910 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA 850: -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA 1900: -50 ... +21 dBm/0.01μW ... 125.9mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA 850: 108
	WCDMA 1900: 289
Channel spacing	GSM: 200 kHz (WCDMA 1900 200 kHz)
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA 850: 75
	WCDMA 1900: 75

BB troubleshooting

PWB markings in RM-594 and RM-588

Mechanically RM-594 and RM-588 are identical and therefore the HW differences are noticeable only by taking a closer look at the PWB. As illustrated in the figure below, there are two quick ways to identify variants from each other.

The first way is from the type designator on the type label and the second one is from the solder markings on the PWB.

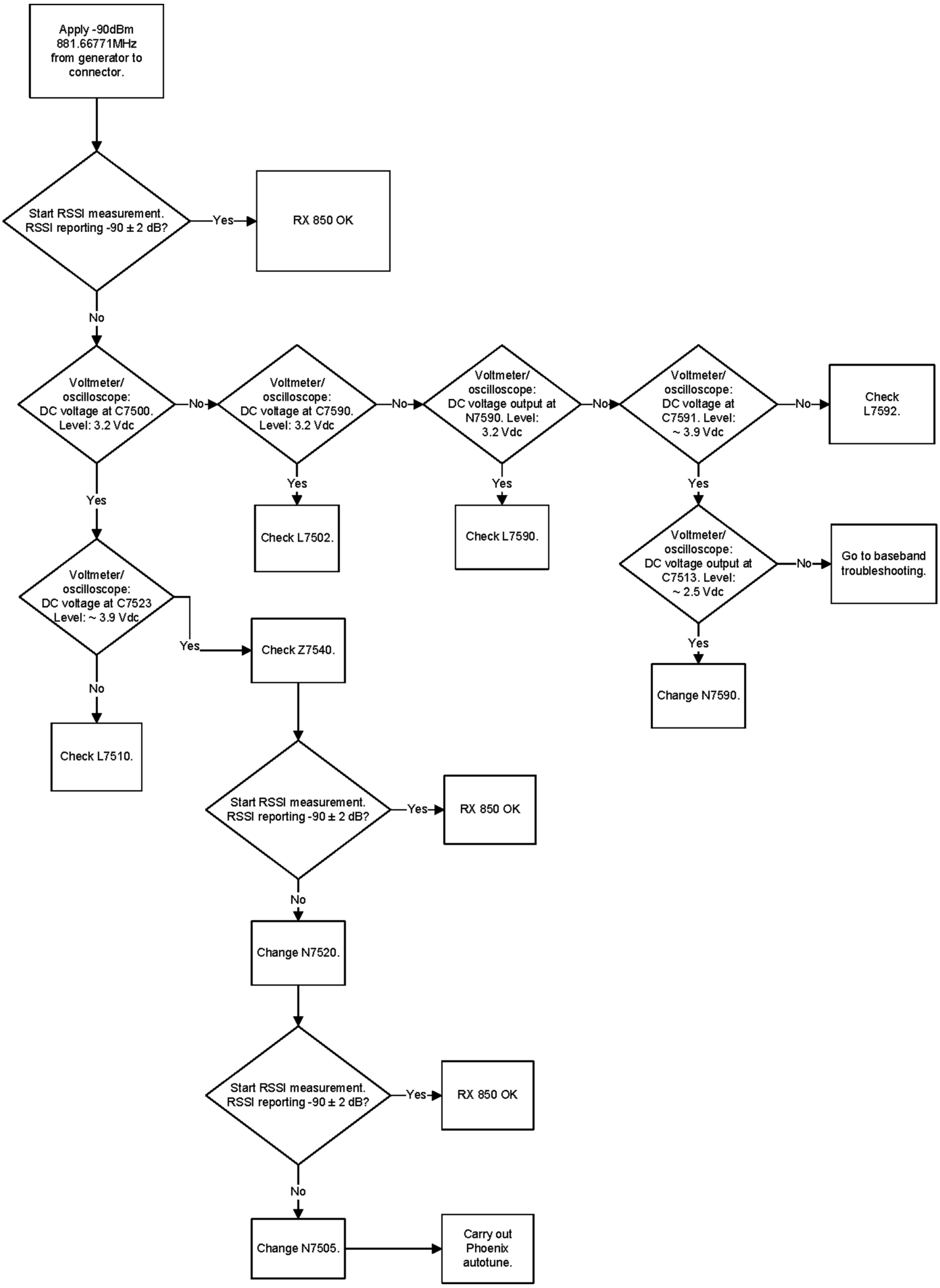
RM-594 has a solder marking above the letter **L**. There are no solder markings above the other letters (**B**, **T** or **R**). RM-588 has a solder marking above the letter **R** and no solder markings above the other letters (**B**, **T** or **L**).

Figure 80 PWB markings in RM-594 and RM-588

RF troubleshooting

RX GSM850 troubleshooting

Troubleshooting flow



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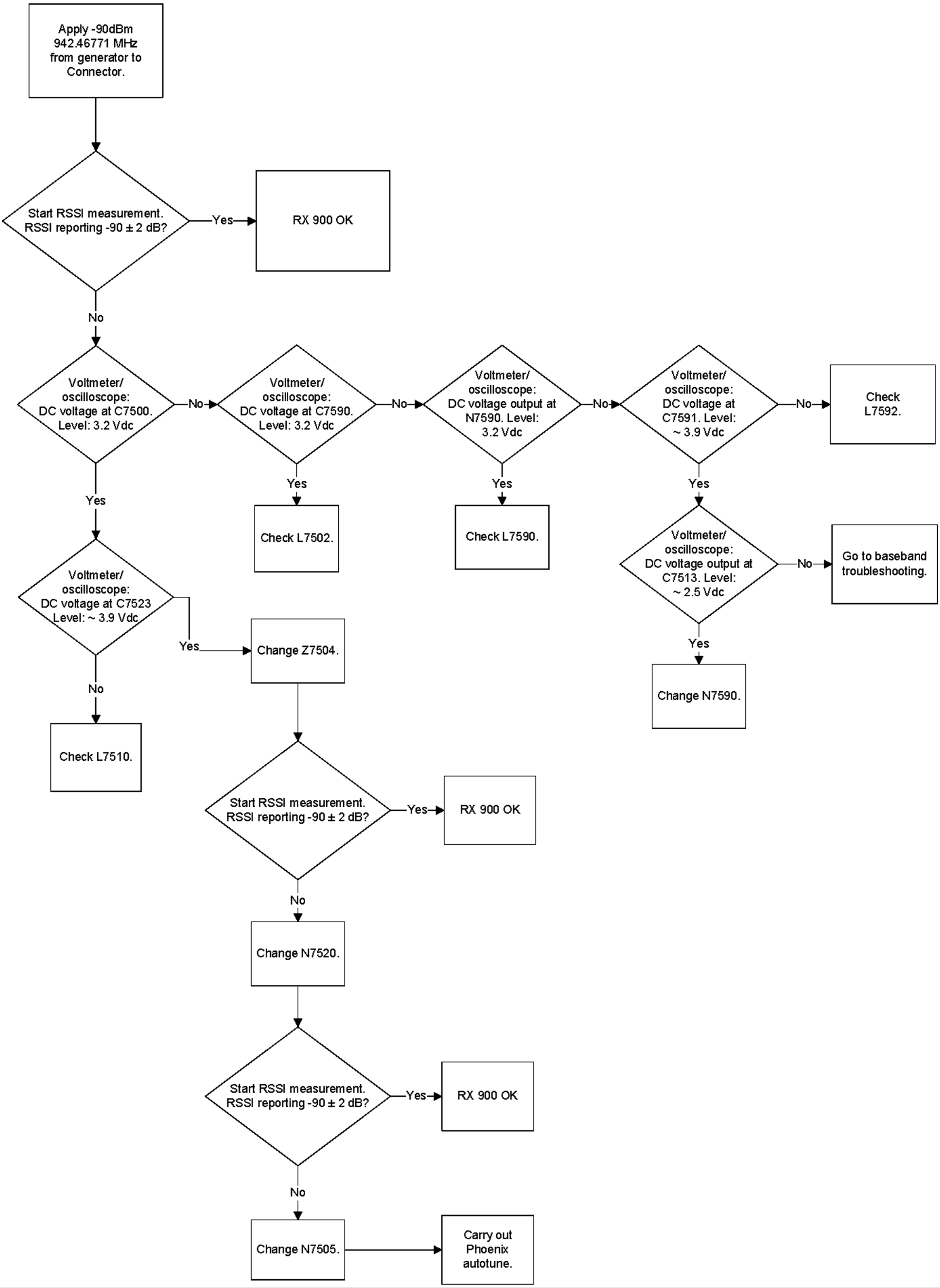
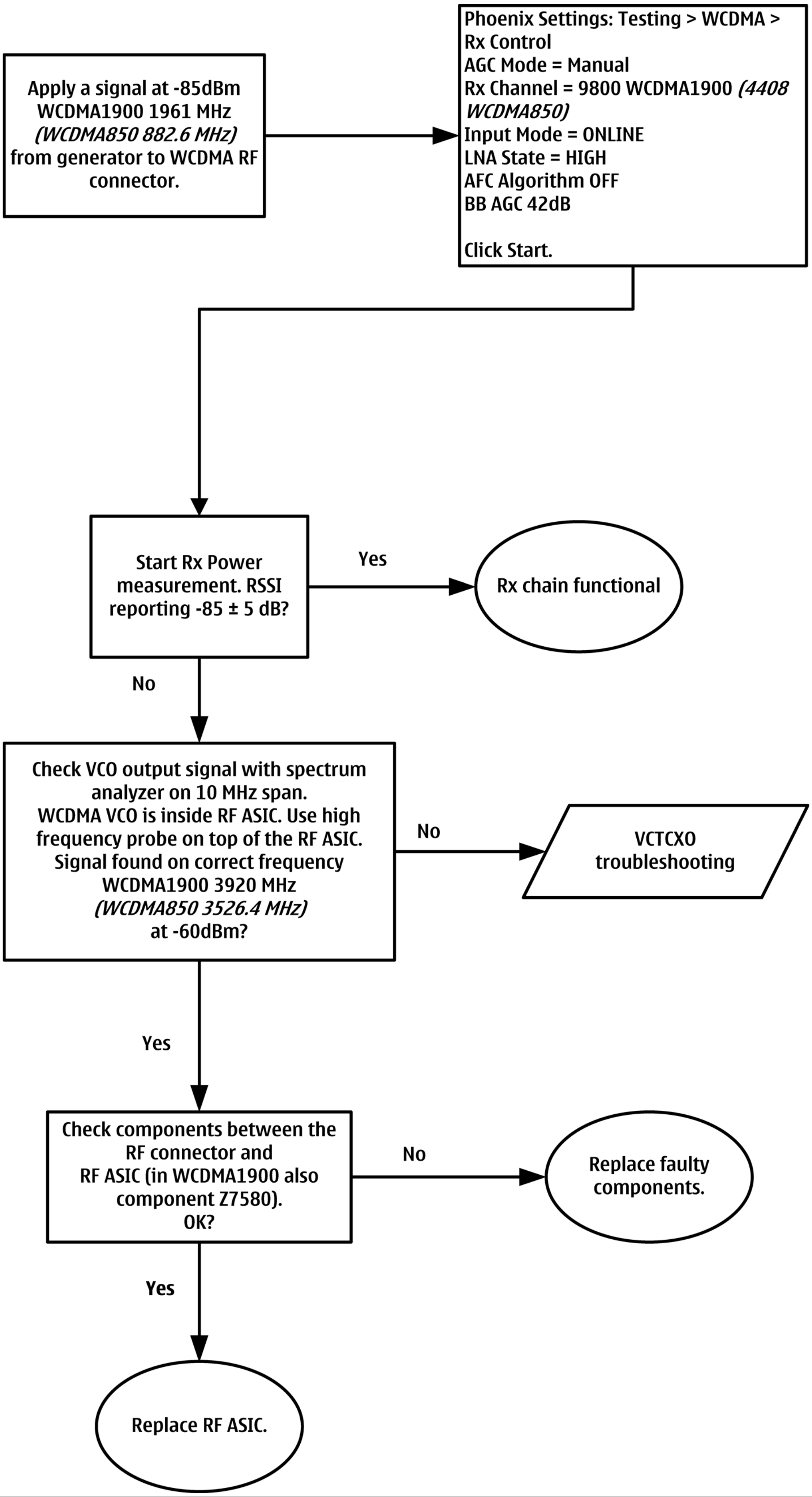
RX GSM900 troubleshooting

Troubleshooting flow



WCDMA receiver troubleshooting

Troubleshooting flow



WCDMA RX chain activation for manual measurement

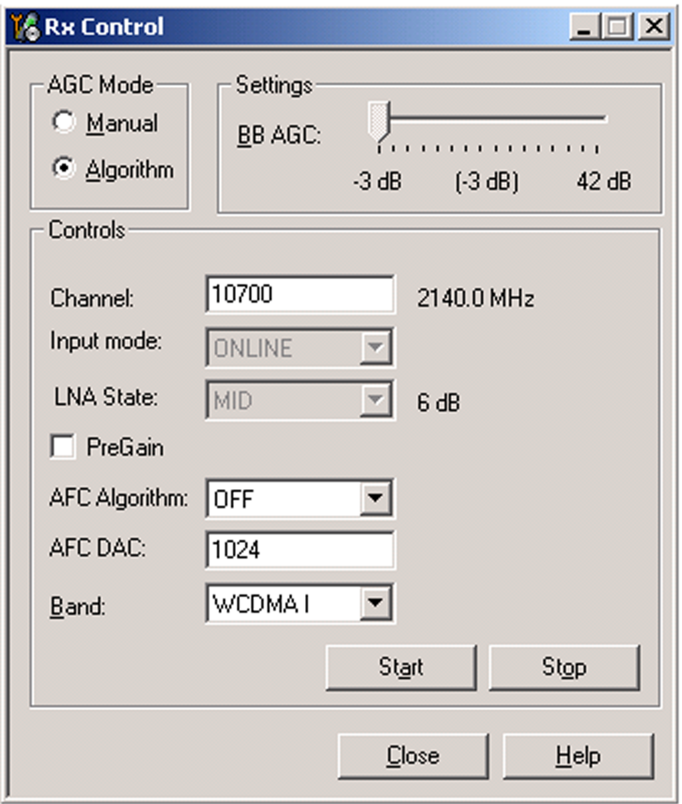
Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA1900	WCDMA850
Phoenix Channel	9800	4408
Signal generator to antenna connector	1960.0 MHz	881.6 MHz
Band	II	V

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.
4. Set the following RF generator settings:

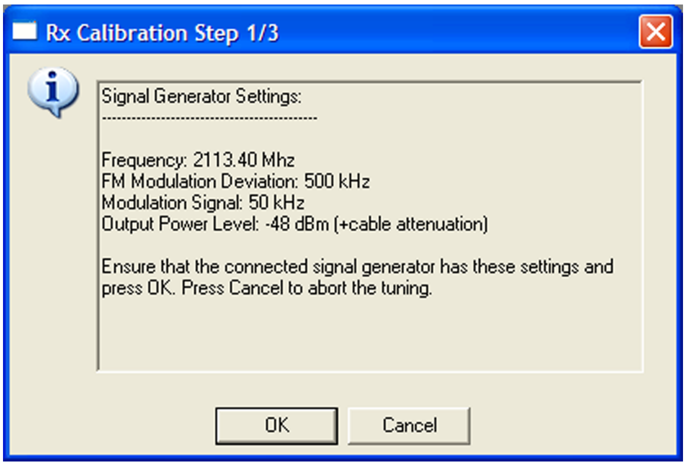


Figure 81 WCDMA RX generator settings

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing** → **WCDMA** → **TX control** .
3. Use the following settings in the TX control window:

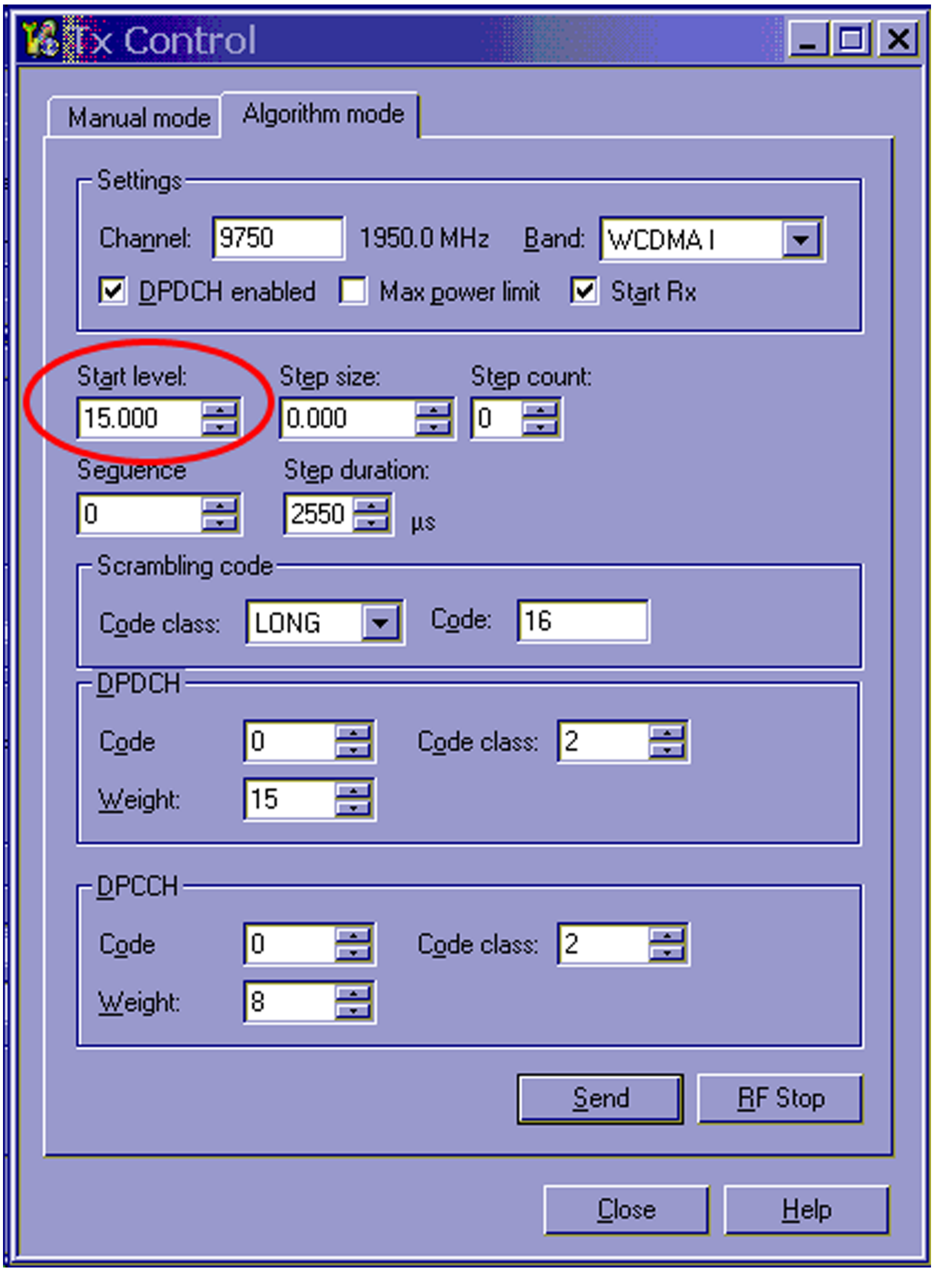


Figure 82 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

5. Use the CMU200 to check the WCDMA power.

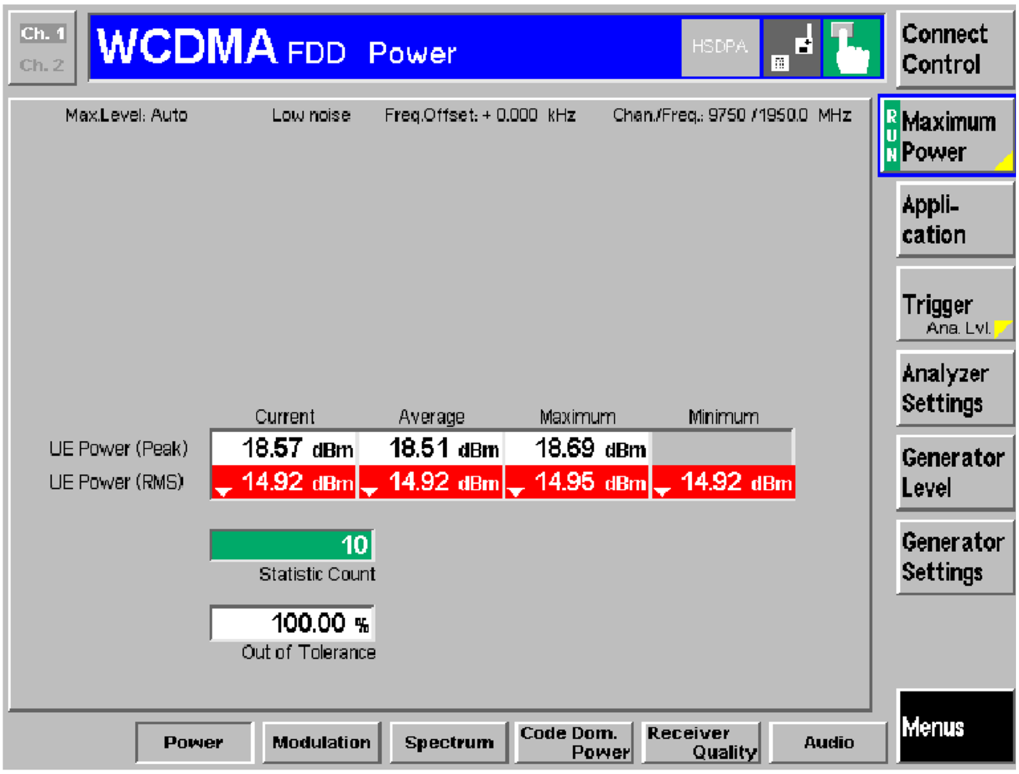
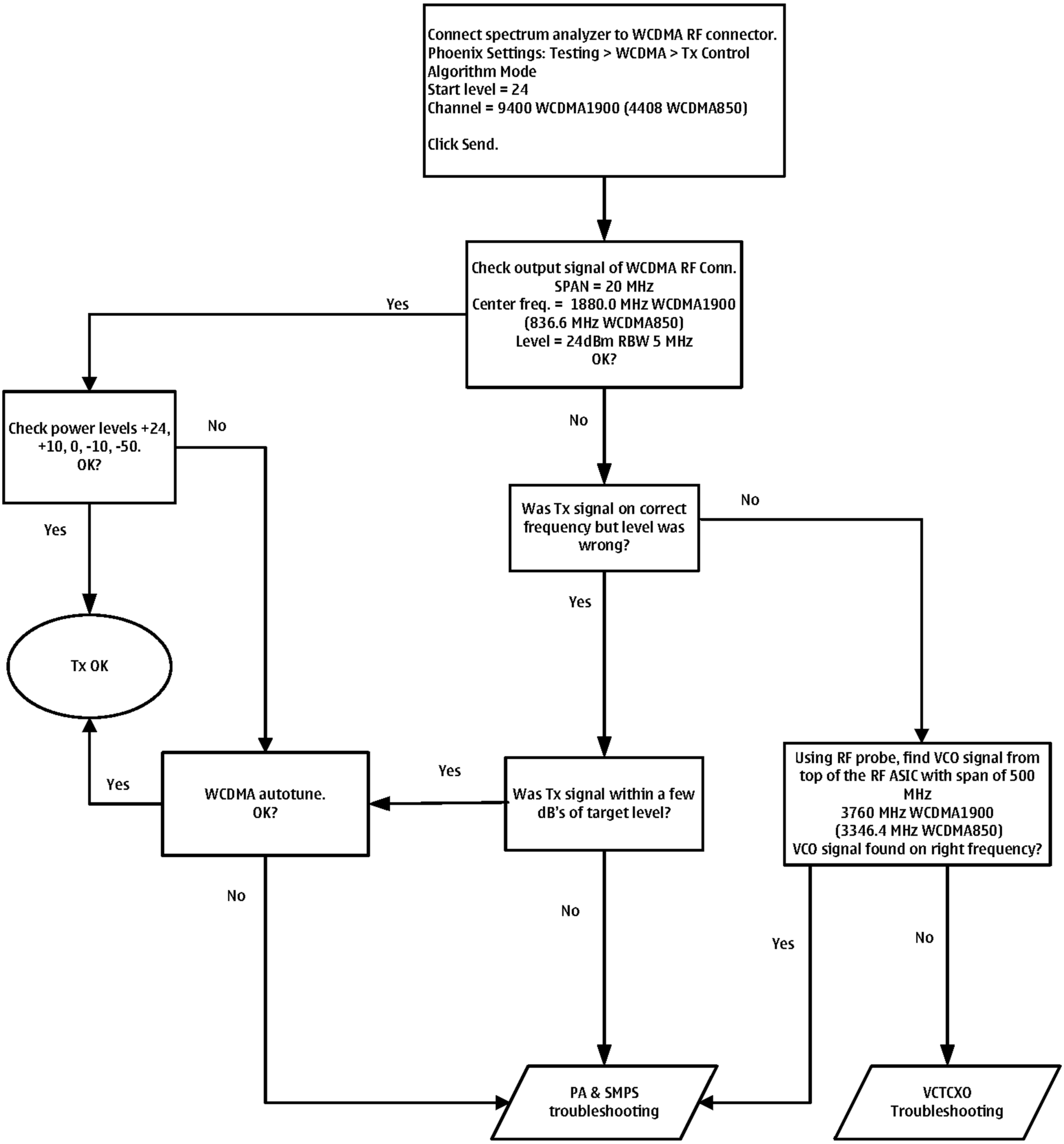


Figure 83 WCDMA power window

WCDMA transmitter troubleshooting flowchart

Troubleshooting flow



Tx power level tuning (GSM)

Context

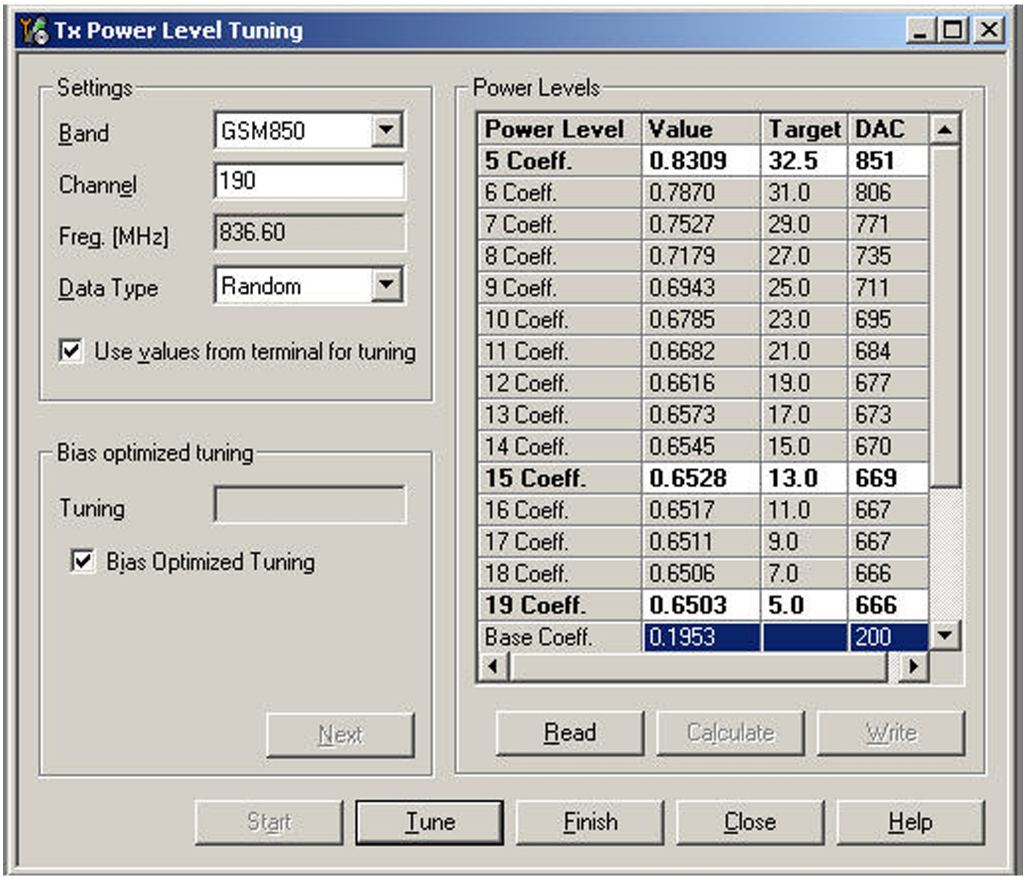
Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

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. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning** → **GSM** → **Tx Power Level Tuning** .
5. Click **Start**.l



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6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **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 into account.

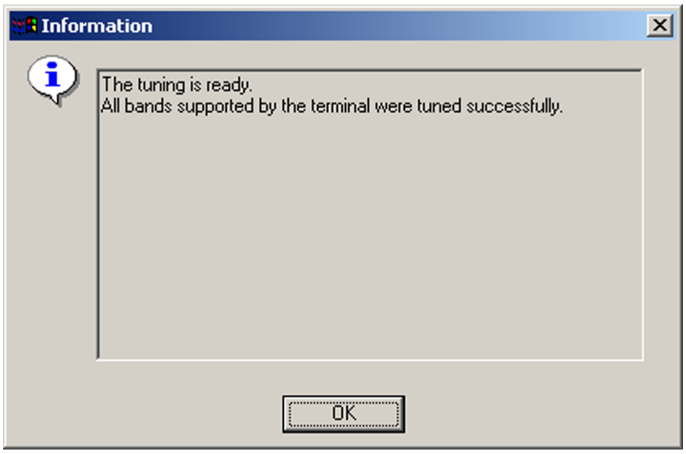
7. Set the tuning targets according to the values in the table below

GMSK	1Slot	2 slot	3 slot
850	32,5	31,0	29,7
900	32,5	30,5	29,0
1800	30,0	30,0	28,2
1900	30,0	27,0	25,2
EDGE	1Slot	2 slot	3 slot
850	26,5	26,5	24,7
900	26,5	26,5	24,7
1800	25	25	23,2
1900	25	25	23,2
WCDMA Band II	21.0 dBm		
WCDMA Band V	23.5 dBm		

8. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
9. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
10. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



WCDMA receiver tunings

RX calibration (WCDMA)

Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA1900 or WCDMA850".
5. Click **Tune**.

6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.

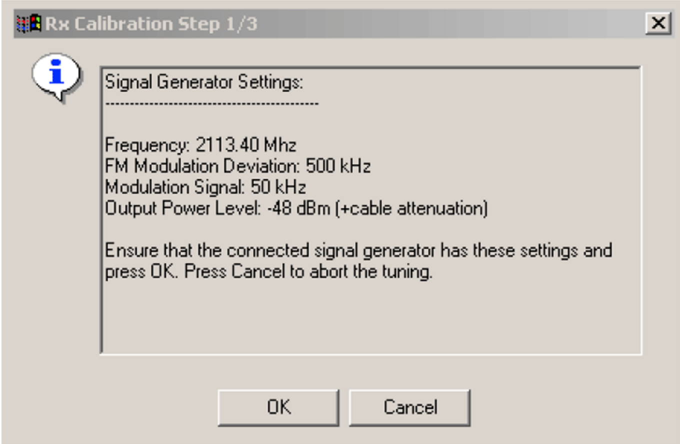
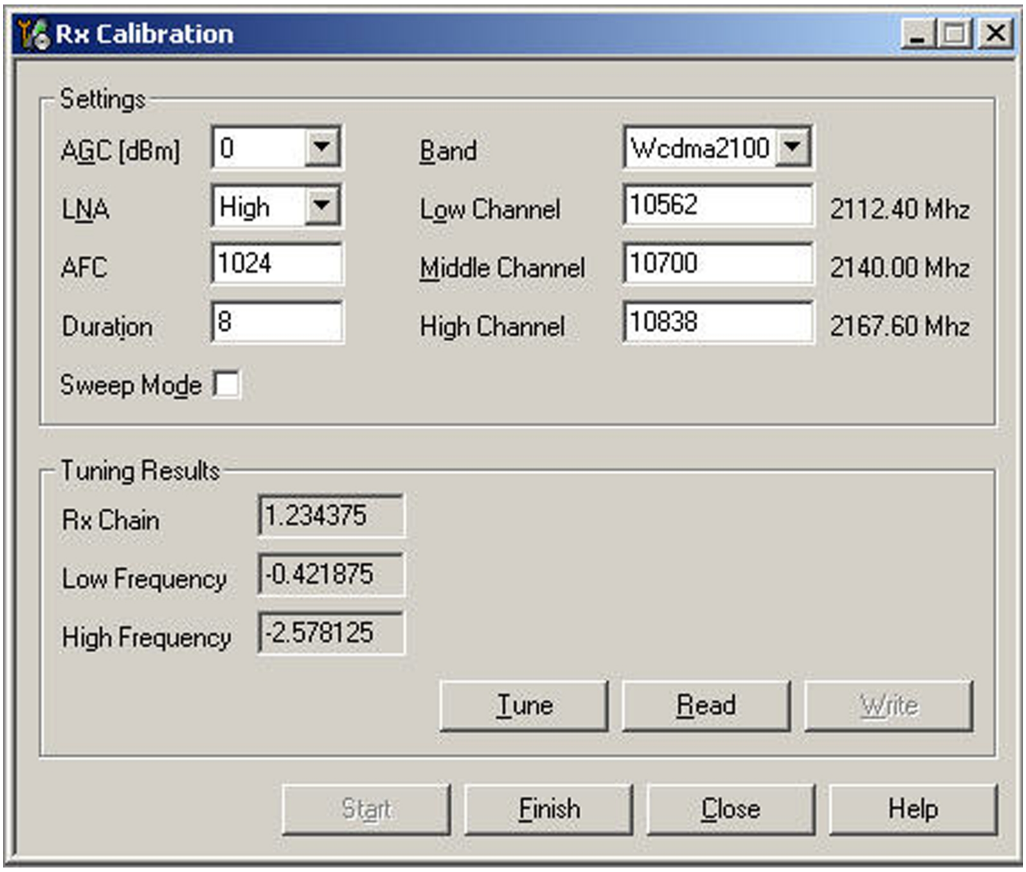


Figure 84 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



8. Ensure Tuning Results are within limits specified in the table below:

   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	1900 or 850	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA1900 or WCDMA850".
- Check the **Sweep Mode** box.
- Click **Tune**.
- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.

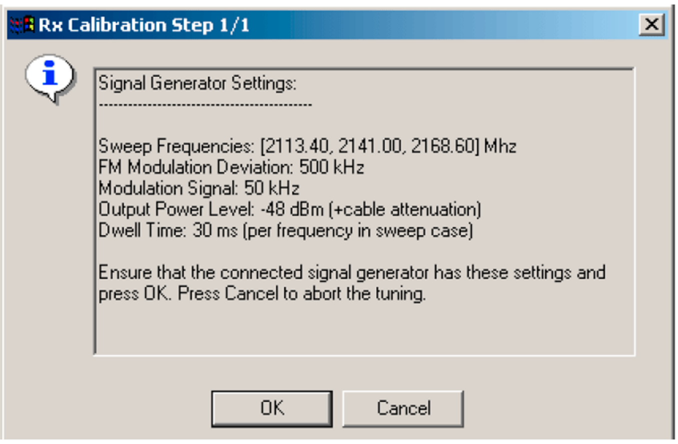


Figure 85 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

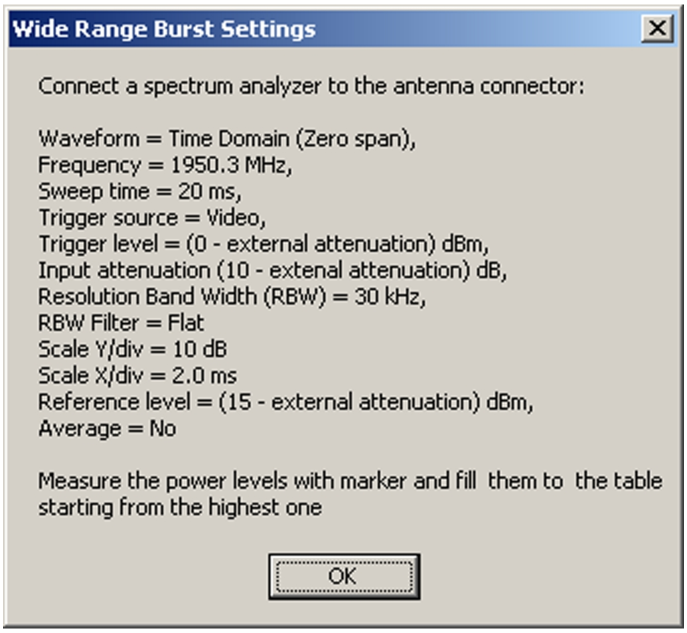
- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

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

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

2. Choose **Tuning** → **WCDMA** → **Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).
5. Set up the spectrum analyzer in the following way:



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 after 750 us, the third after 1250 us and so on for 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 spikes on lower levels.

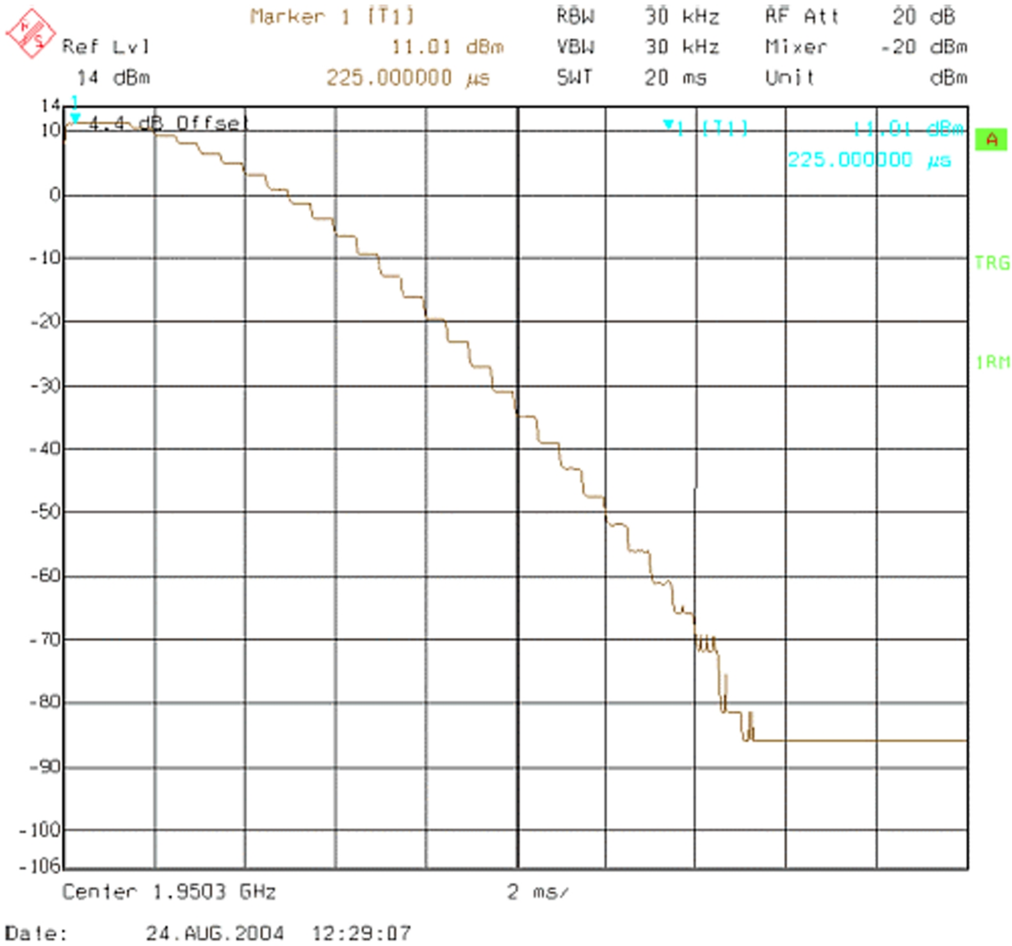
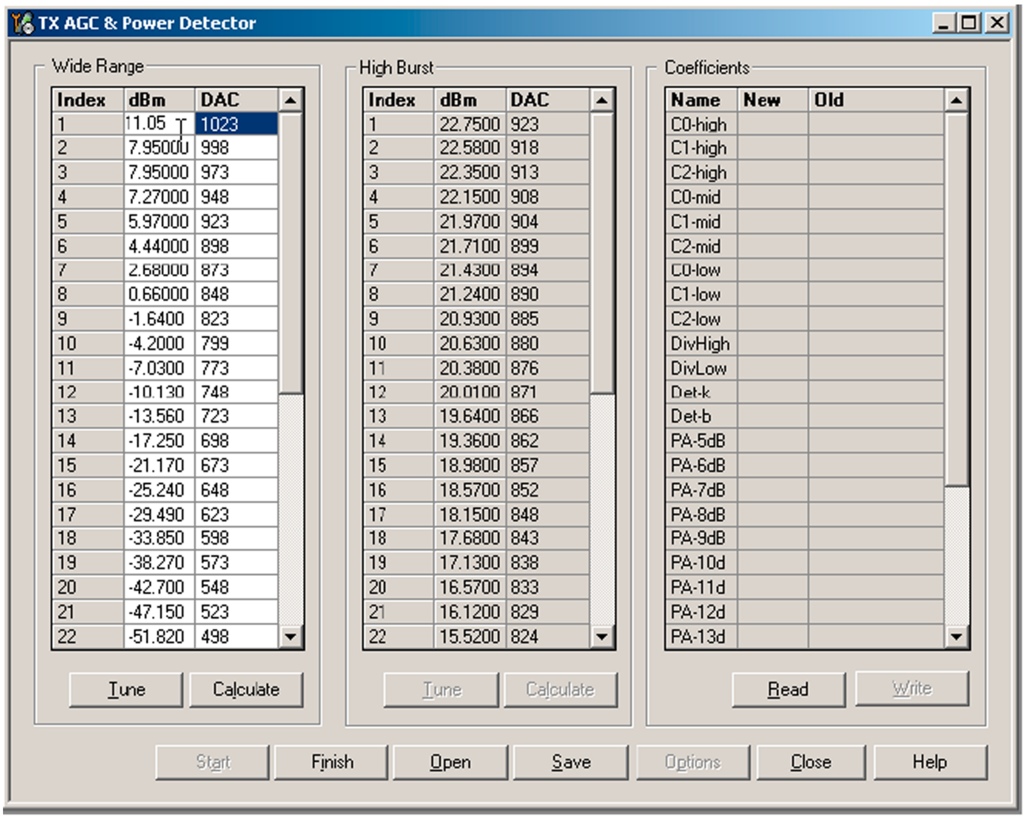
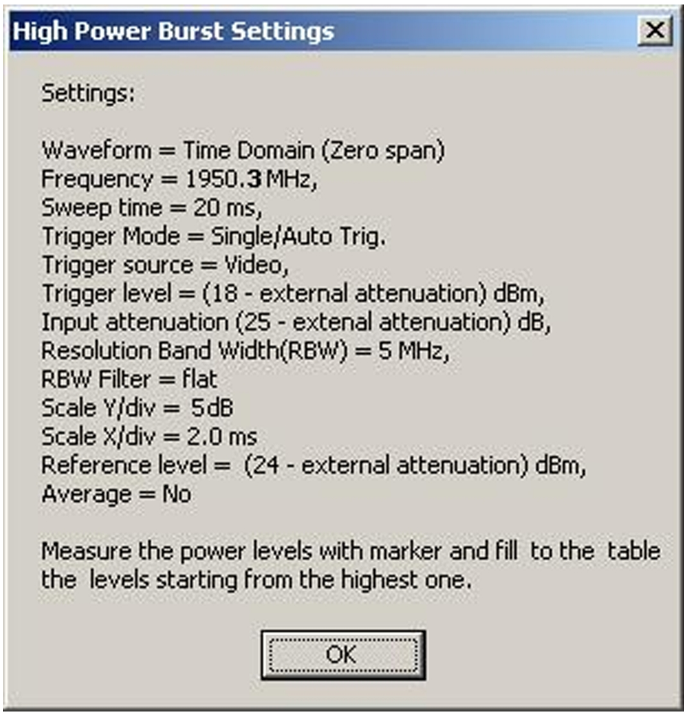


Figure 86 WCDMA power level tuning steps

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. Adjust the spectrum analyzer according to the following settings:



12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

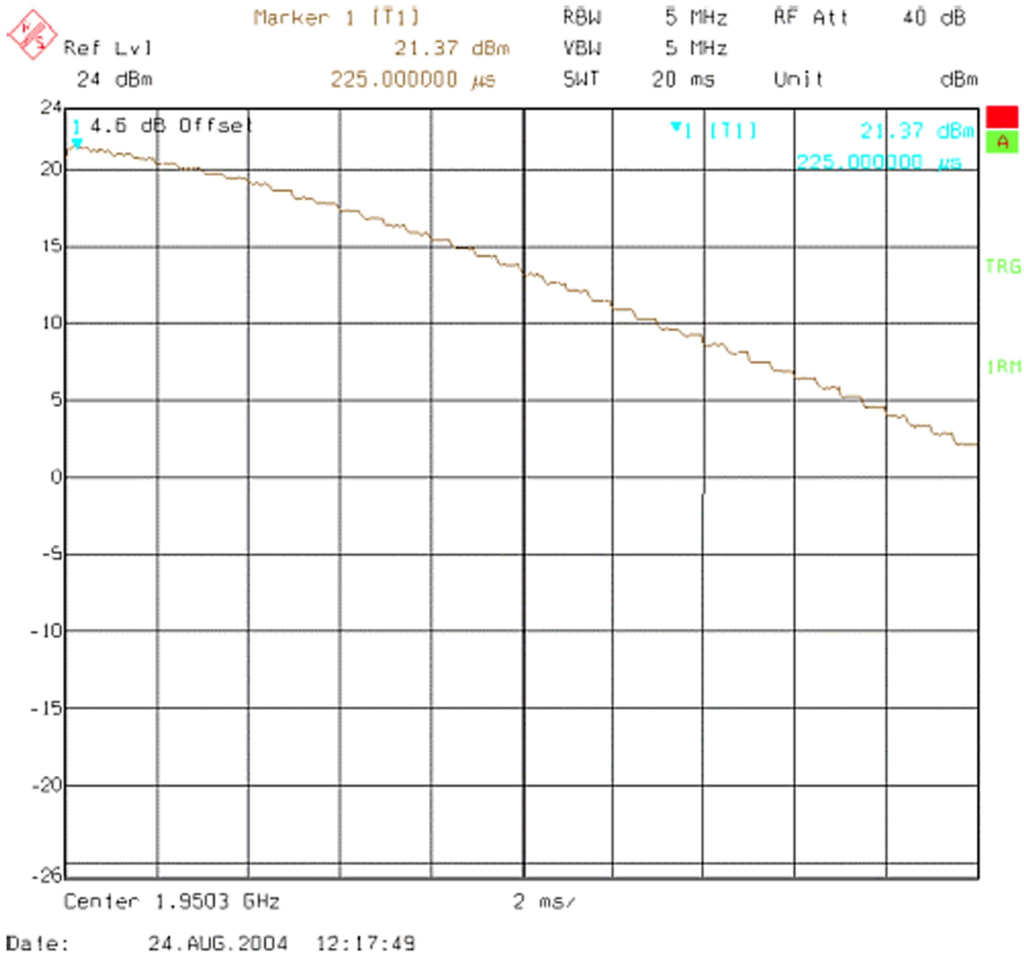


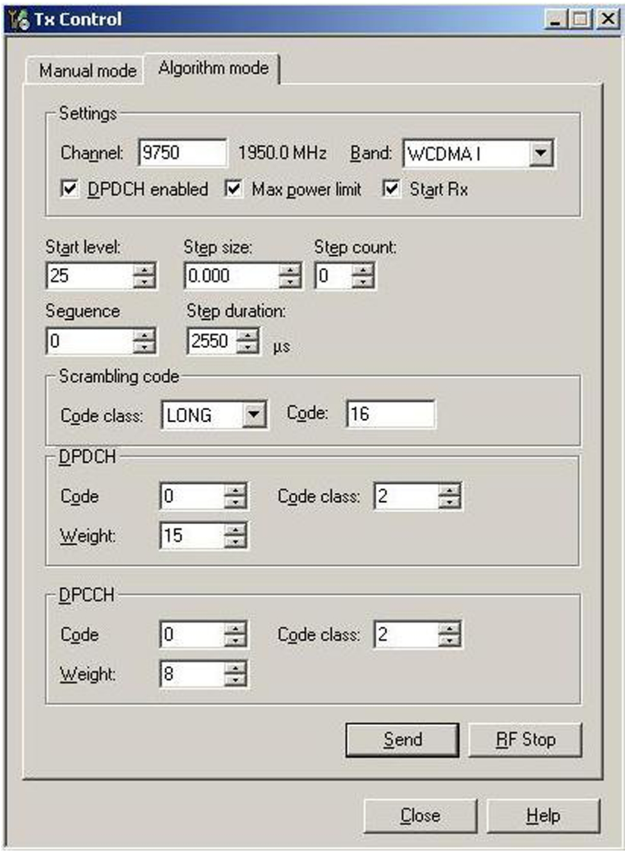
Figure 87 High burst measurement

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

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing** → **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:	**1880.0 MHz (WCDMA II)** or **836.6 MHz (WCDMA V**
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** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

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

■ System module

WCDMA V (850) frequencies

TX CH	RX CH	TX	RX	VCO TX	VCO RX
4132	4357	826.4	871.4	3305.6	3485.6
782	1007	826.5	871.5	3306.0	3486.0
4133	4358	826.6	871.6	3306.4	3486.4
4134	4359	826.8	871.8	3307.2	3487.2
4135	4360	827.0	872.0	3308.0	3488.0
4136	4361	827.2	872.2	3308.8	3488.8
4137	4362	827.4	872.4	3309.6	3489.6
787	1012	827.5	872.5	3310.0	3490.0
4138	4363	827.6	872.6	3310.4	3490.4
4139	4364	827.8	872.8	3311.2	3491.2
4140	4365	828.0	873.0	3312.0	3492.0
4141	4366	828.2	873.2	3312.8	3492.8
4142	4367	828.4	873.4	3313.6	3493.6
4143	4368	828.6	873.6	3314.4	3494.4
4144	4369	828.8	873.8	3315.2	3495.2
4145	4370	829.0	874.0	3316.0	3496.0
4146	4371	829.2	874.2	3316.8	3496.8
4147	4372	829.4	874.4	3317.6	3497.6
4148	4373	829.6	874.6	3318.4	3498.4
4149	4374	829.8	874.8	3319.2	3499.2
4150	4375	830.0	875.0	3320.0	3500.0
4151	4376	830.2	875.2	3320.8	3500.8
4152	4377	830.4	875.4	3321.6	3501.6
4153	4378	830.6	875.6	3322.4	3502.4
4154	4379	830.8	875.8	3323.2	3503.2
4155	4380	831.0	876.0	3324.0	3504.0
4156	4381	831.2	876.2	3324.8	3504.8
4157	4382	831.4	876.4	3325.6	3505.6
807	1032	831.5	876.5	3326.0	3506.0
4158	4383	831.6	876.6	3326.4	3506.4
4159	4384	831.8	876.8	3327.2	3507.2
4160	4385	832.0	877.0	3328.0	3508.0
4161	4386	832.2	877.2	3328.8	3508.8
4162	4387	832.4	877.4	3329.6	3509.6
812	1037	832.5	877.5	3330.0	3510.0
4163	4388	832.6	877.6	3330.4	3510.4
4164	4389	832.8	877.8	3331.2	3511.2
4165	4390	833.0	878.0	3332.0	3512.0
4166	4391	833.2	878.2	3332.8	3512.8
4167	4392	833.4	878.4	3333.6	3513.6
4168	4393	833.6	878.6	3334.4	3514.4
4169	4394	833.8	878.8	3335.2	3515.2
4170	4395	834.0	879.0	3336.0	3516.0
4171	4396	834.2	879.2	3336.8	3516.8
4172	4397	834.4	879.4	3337.6	3517.6
4173	4398	834.6	879.6	3338.4	3518.4
4174	4399	834.8	879.8	3339.2	3519.2
4175	4400	835.0	880.0	3340.0	3520.0
4176	4401	835.2	880.2	3340.8	3520.8
4177	4402	835.4	880.4	3341.6	3521.6
4178	4403	835.6	880.6	3342.4	3522.4
4179	4404	835.8	880.8	3343.2	3523.2
4180	4405	836.0	881.0	3344.0	3524.0
4181	4406	836.2	881.2	3344.8	3524.8

TX CH	RX CH	TX	RX	VCO TX	VCO RX
4182	4407	836.4	881.4	3345.6	3525.6
4183	4408	836.6	881.6	3346.4	3526.4
4184	4409	836.8	881.8	3347.2	3527.2
4185	4410	837.0	882.0	3348.0	3528.0
4186	4411	837.2	882.2	3348.8	3528.8
4187	4412	837.4	882.4	3349.6	3529.6
837	1062	837.5	882.5	3350.0	3530.0
4188	4413	837.6	882.6	3350.4	3530.4
4189	4414	837.8	882.8	3351.2	3531.2
4190	4415	838.0	883.0	3352.0	3532.0
4191	4416	838.2	883.2	3352.8	3532.8
4192	4417	838.4	883.4	3353.6	3533.6
4193	4418	838.6	883.6	3354.4	3534.4
4194	4419	838.8	883.8	3355.2	3535.2
4195	4420	839.0	884.0	3356.0	3536.0
4196	4421	839.2	884.2	3356.8	3536.8
4197	4422	839.4	884.4	3357.6	3537.6
4198	4423	839.6	884.6	3358.4	3538.4
4199	4424	839.8	884.8	3359.2	3539.2
4200	4425	840.0	885.0	3360.0	3540.0
4201	4426	840.2	885.2	3360.8	3540.8
4202	4427	840.4	885.4	3361.6	3541.6
4203	4428	840.6	885.6	3362.4	3542.4
4204	4429	840.8	885.8	3363.2	3543.2
4205	4430	841.0	886.0	3364.0	3544.0
4206	4431	841.2	886.2	3364.8	3544.8
4207	4432	841.4	886.4	3365.6	3545.6
4208	4433	841.6	886.6	3366.4	3546.4
4209	4434	841.8	886.8	3367.2	3547.2
4210	4435	842.0	887.0	3368.0	3548.0
4211	4436	842.2	887.2	3368.8	3548.8
4212	4437	842.4	887.4	3369.6	3549.6
862	1087	842.5	887.5	3370.0	3550.0
4213	4438	842.6	887.6	3370.4	3550.4
4214	4439	842.8	887.8	3371.2	3551.2
4215	4440	843.0	888.0	3372.0	3552.0
4216	4441	843.2	888.2	3372.8	3552.8
4217	4442	843.4	888.4	3373.6	3553.6
4218	4443	843.6	888.6	3374.4	3554.4
4219	4444	843.8	888.8	3375.2	3555.2
4220	4445	844.0	889.0	3376.0	3556.0
4221	4446	844.2	889.2	3376.8	3556.8
4222	4447	844.4	889.4	3377.6	3557.6
4223	4448	844.6	889.6	3378.4	3558.4
4224	4449	844.8	889.8	3379.2	3559.2
4225	4450	845.0	890.0	3380.0	3560.0
4226	4451	845.2	890.2	3380.8	3560.8
4227	4452	845.4	890.4	3381.6	3561.6
4228	4453	845.6	890.6	3382.4	3562.4
4229	4454	845.8	890.8	3383.2	3563.2
4230	4455	846.0	891.0	3384.0	3564.0
4231	4456	846.2	891.2	3384.8	3564.8
4232	4457	846.4	891.4	3385.6	3565.6
4233	4458	846.6	891.6	3386.4	3566.4

WCDMA 1900 Rx frequencies

CH	Rx	VCO	CH	Rx	VCO	CH	Rx	VCO	CH	Rx	VCO	CH	Rx	VCO
9662	1932.4	3864.8	9718	1943.6	3887.2	9774	1954.8	3909.6	9830	1966.0	3932.0	9886	1977.2	3954.4
9663	1932.6	3865.2	9719	1943.8	3887.6	9775	1955.0	3910.0	9831	1966.2	3932.4	9887	1977.4	3954.8
9664	1932.8	3865.6	9720	1944.0	3888.0	9776	1955.2	3910.4	9832	1966.4	3932.8	9888	1977.6	3955.2
9665	1933.0	3866.0	9721	1944.2	3888.4	9777	1955.4	3910.8	9833	1966.6	3933.2	9889	1977.8	3955.6
9666	1933.2	3866.4	9722	1944.4	3888.8	9778	1955.6	3911.2	9834	1966.8	3933.6	9890	1978.0	3956.0
9667	1933.4	3866.8	9723	1944.6	3889.2	9779	1955.8	3911.6	9835	1967.0	3934.0	9891	1978.2	3956.4
9668	1933.6	3867.2	9724	1944.8	3889.6	9780	1956.0	3912.0	9836	1967.2	3934.4	9892	1978.4	3956.8
9669	1933.8	3867.6	9725	1945.0	3890.0	9781	1956.2	3912.4	9837	1967.4	3934.8	9893	1978.6	3957.2
9670	1934.0	3868.0	9726	1945.2	3890.4	9782	1956.4	3912.8	9838	1967.6	3935.2	9894	1978.8	3957.6
9671	1934.2	3868.4	9727	1945.4	3890.8	9783	1956.6	3913.2	9839	1967.8	3935.6	9895	1979.0	3958.0
9672	1934.4	3868.8	9728	1945.6	3891.2	9784	1956.8	3913.6	9840	1968.0	3936.0	9896	1979.2	3958.4
9673	1934.6	3869.2	9729	1945.8	3891.6	9785	1957.0	3914.0	9841	1968.2	3936.4	9897	1979.4	3958.8
9674	1934.8	3869.6	9730	1946.0	3892.0	9786	1957.2	3914.4	9842	1968.4	3936.8	9898	1979.6	3959.2
9675	1935.0	3870.0	9731	1946.2	3892.4	9787	1957.4	3914.8	9843	1968.6	3937.2	9899	1979.8	3959.6
9676	1935.2	3870.4	9732	1946.4	3892.8	9788	1957.6	3915.2	9844	1968.8	3937.6	9900	1980.0	3960.0
9677	1935.4	3870.8	9733	1946.6	3893.2	9789	1957.8	3915.6	9845	1969.0	3938.0	9901	1980.2	3960.4
9678	1935.6	3871.2	9734	1946.8	3893.6	9790	1958.0	3916.0	9846	1969.2	3938.4	9902	1980.4	3960.8
9679	1935.8	3871.6	9735	1947.0	3894.0	9791	1958.2	3916.4	9847	1969.4	3938.8	9903	1980.6	3961.2
9680	1936.0	3872.0	9736	1947.2	3894.4	9792	1958.4	3916.8	9848	1969.6	3939.2	9904	1980.8	3961.6
9681	1936.2	3872.4	9737	1947.4	3894.8	9793	1958.6	3917.2	9849	1969.8	3939.6	9905	1981.0	3962.0
9682	1936.4	3872.8	9738	1947.6	3895.2	9794	1958.8	3917.6	9850	1970.0	3940.0	9906	1981.2	3962.4
9683	1936.6	3873.2	9739	1947.8	3895.6	9795	1959.0	3918.0	9851	1970.2	3940.4	9907	1981.4	3962.8
9684	1936.8	3873.6	9740	1948.0	3896.0	9796	1959.2	3918.4	9852	1970.4	3940.8	9908	1981.6	3963.2
9685	1937.0	3874.0	9741	1948.2	3896.4	9797	1959.4	3918.8	9853	1970.6	3941.2	9909	1981.8	3963.6
9686	1937.2	3874.4	9742	1948.4	3896.8	9798	1959.6	3919.2	9854	1970.8	3941.6	9910	1982.0	3964.0
9687	1937.4	3874.8	9743	1948.6	3897.2	9799	1959.8	3919.6	9855	1971.0	3942.0	9911	1982.2	3964.4
9688	1937.6	3875.2	9744	1948.8	3897.6	9800	1960.0	3920.0	9856	1971.2	3942.4	9912	1982.4	3964.8
9689	1937.8	3875.6	9745	1949.0	3898.0	9801	1960.2	3920.4	9857	1971.4	3942.8	9913	1982.6	3965.2
9690	1938.0	3876.0	9746	1949.2	3898.4	9802	1960.4	3920.8	9858	1971.6	3943.2	9914	1982.8	3965.6
9691	1938.2	3876.4	9747	1949.4	3898.8	9803	1960.6	3921.2	9859	1971.8	3943.6	9915	1983.0	3966.0
9692	1938.4	3876.8	9748	1949.6	3899.2	9804	1960.8	3921.6	9860	1972.0	3944.0	9916	1983.2	3966.4
9693	1938.6	3877.2	9749	1949.8	3899.6	9805	1961.0	3922.0	9861	1972.2	3944.4	9917	1983.4	3966.8
9694	1938.8	3877.6	9750	1950.0	3900.0	9806	1961.2	3922.4	9862	1972.4	3944.8	9918	1983.6	3967.2
9695	1939.0	3878.0	9751	1950.2	3900.4	9807	1961.4	3922.8	9863	1972.6	3945.2	9919	1983.8	3967.6
9696	1939.2	3878.4	9752	1950.4	3900.8	9808	1961.6	3923.2	9864	1972.8	3945.6	9920	1984.0	3968.0
9697	1939.4	3878.8	9753	1950.6	3901.2	9809	1961.8	3923.6	9865	1973.0	3946.0	9921	1984.2	3968.4
9698	1939.6	3879.2	9754	1950.8	3901.6	9810	1962.0	3924.0	9866	1973.2	3946.4	9922	1984.4	3968.8
9699	1939.8	3879.6	9755	1951.0	3902.0	9811	1962.2	3924.4	9867	1973.4	3946.8	9923	1984.6	3969.2
9700	1940.0	3880.0	9756	1951.2	3902.4	9812	1962.4	3924.8	9868	1973.6	3947.2	9924	1984.8	3969.6
9701	1940.2	3880.4	9757	1951.4	3902.8	9813	1962.6	3925.2	9869	1973.8	3947.6	9925	1985.0	3970.0
9702	1940.4	3880.8	9758	1951.6	3903.2	9814	1962.8	3925.6	9870	1974.0	3948.0	9926	1985.2	3970.4
9703	1940.6	3881.2	9759	1951.8	3903.6	9815	1963.0	3926.0	9871	1974.2	3948.4	9927	1985.4	3970.8
9704	1940.8	3881.6	9760	1952.0	3904.0	9816	1963.2	3926.4	9872	1974.4	3948.8	9928	1985.6	3971.2
9705	1941.0	3882.0	9761	1952.2	3904.4	9817	1963.4	3926.8	9873	1974.6	3949.2	9929	1985.8	3971.6
9706	1941.2	3882.4	9762	1952.4	3904.8	9818	1963.6	3927.2	9874	1974.8	3949.6	9930	1986.0	3972.0
9707	1941.4	3882.8	9763	1952.6	3905.2	9819	1963.8	3927.6	9875	1975.0	3950.0	9931	1986.2	3972.4
9708	1941.6	3883.2	9764	1952.8	3905.6	9820	1964.0	3928.0	9876	1975.2	3950.4	9932	1986.4	3972.8
9709	1941.8	3883.6	9765	1953.0	3906.0	9821	1964.2	3928.4	9877	1975.4	3950.8	9933	1986.6	3973.2
9710	1942.0	3884.0	9766	1953.2	3906.4	9822	1964.4	3928.8	9878	1975.6	3951.2	9934	1986.8	3973.6
9711	1942.2	3884.4	9767	1953.4	3906.8	9823	1964.6	3929.2	9879	1975.8	3951.6	9935	1987.0	3974.0
9712	1942.4	3884.8	9768	1953.6	3907.2	9824	1964.8	3929.6	9880	1976.0	3952.0	9936	1987.2	3974.4
9713	1942.6	3885.2	9769	1953.8	3907.6	9825	1965.0	3930.0	9881	1976.2	3952.4	9937	1987.4	3974.8
9714	1942.8	3885.6	9770	1954.0	3908.0	9826	1965.2	3930.4	9882	1976.4	3952.8	9938	1987.6	3975.2
9715	1943.0	3886.0	9771	1954.2	3908.4	9827	1965.4	3930.8	9883	1976.6	3953.2			
9716	1943.2	3886.4	9772	1954.4	3908.8	9828	1965.6	3931.2	9884	1976.8	3953.6			
9717	1943.4	3886.8	9773	1954.6	3909.2	9829	1965.8	3931.6	9885	1977.0	3954.0			

WCDMA 1900 Tx frequencies

Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx	Ch	Tx	VCO Tx
9262	1852.4	3704.8	9332	1866.4	3732.8	9401	1880.2	3760.4	9470	1894	3788
12	1852.5	3705	9333	1866.6	3733.2	9402	1880.4	3760.8	9471	1894.2	3788.4
9263	1852.6	3705.2	9334	1866.8	3733.6	9403	1880.6	3761.2	9472	1894.4	3788.8
9264	1852.8	3705.6	9335	1867	3734	9404	1880.8	3761.6	9473	1894.6	3789.2
9265	1853	3706	9336	1867.2	3734.4	9405	1881	3762	9474	1894.8	3789.6
9266	1853.2	3706.4	9337	1867.4	3734.8	9406	1881.2	3762.4	9475	1895	3790
9267	1853.4	3706.8	87	1867.5	3735	9407	1881.4	3762.8	9476	1895.2	3790.4
9268	1853.6	3707.2	9338	1867.6	3735.2	9408	1881.6	3763.2	9477	1895.4	3790.8
9269	1853.8	3707.6	9339	1867.8	3735.6	9409	1881.8	3763.6	9478	1895.6	3791.2
9270	1854	3708	9340	1868	3736	9410	1882	3764	9479	1895.8	3791.6
9271	1854.2	3708.4	9341	1868.2	3736.4	9411	1882.2	3764.4	9480	1896	3792
9272	1854.4	3708.8	9342	1868.4	3736.8	9412	1882.4	3764.8	9481	1896.2	3792.4
9273	1854.6	3709.2	9343	1868.6	3737.2	162	1882.5	3765	9482	1896.4	3792.8
9274	1854.8	3709.6	9344	1868.8	3737.6	9413	1882.6	3765.2	9483	1896.6	3793.2
9275	1855	3710	9345	1869	3738	9414	1882.8	3765.6	9484	1896.8	3793.6
9276	1855.2	3710.4	9346	1869.2	3738.4	9415	1883	3766	9485	1897	3794
9277	1855.4	3710.8	9347	1869.4	3738.8	9416	1883.2	3766.4	9486	1897.2	3794.4
9278	1855.6	3711.2	9348	1869.6	3739.2	9417	1883.4	3766.8	9487	1897.4	3794.8
9279	1855.8	3711.6	9349	1869.8	3739.6	9418	1883.6	3767.2	237	1897.5	3795
9280	1856	3712	9350	1870	3740	9419	1883.8	3767.6	9488	1897.6	3795.2
9281	1856.2	3712.4	9351	1870.2	3740.4	9420	1884	3768	9489	1897.8	3795.6
9282	1856.4	3712.8	9352	1870.4	3740.8	9421	1884.2	3768.4	9490	1898	3796
9283	1856.6	3713.2	9353	1870.6	3741.2	9422	1884.4	3768.8	9491	1898.2	3796.4
9284	1856.8	3713.6	9354	1870.8	3741.6	9423	1884.6	3769.2	9492	1898.4	3796.8
9285	1857	3714	9355	1871	3742	9424	1884.8	3769.6	9493	1898.6	3797.2
9286	1857.2	3714.4	9356	1871.2	3742.4	9425	1885	3770	9494	1898.8	3797.6
9287	1857.4	3714.8	9357	1871.4	3742.8	9426	1885.2	3770.4	9495	1899	3798
37	1857.5	3715	9358	1871.6	3743.2	9427	1885.4	3770.8	9496	1899.2	3798.4
9288	1857.6	3715.2	9359	1871.8	3743.6	9428	1885.6	3771.2	9497	1899.4	3798.8
9289	1857.8	3715.6	9360	1872	3744	9429	1885.8	3771.6	9498	1899.6	3799.2
9290	1858	3716	9361	1872.2	3744.4	9430	1886	3772	9499	1899.8	3799.6
9291	1858.2	3716.4	9362	1872.4	3744.8	9431	1886.2	3772.4	9500	1900	3800
9292	1858.4	3716.8	112	1872.5	3745	9432	1886.4	3772.8	9501	1900.2	3800.4
9293	1858.6	3717.2	9363	1872.6	3745.2	9433	1886.6	3773.2	9502	1900.4	3800.8
9294	1858.8	3717.6	9364	1872.8	3745.6	9434	1886.8	3773.6	9503	1900.6	3801.2
9295	1859	3718	9365	1873	3746	9435	1887	3774	9504	1900.8	3801.6
9296	1859.2	3718.4	9366	1873.2	3746.4	9436	1887.2	3774.4	9505	1901	3802
9297	1859.4	3718.8	9367	1873.4	3746.8	9437	1887.4	3774.8	9506	1901.2	3802.4
9298	1859.6	3719.2	9368	1873.6	3747.2	187	1887.5	3775	9507	1901.4	3802.8
9299	1859.8	3719.6	9369	1873.8	3747.6	9438	1887.6	3775.2	9508	1901.6	3803.2
9300	1860	3720	9370	1874	3748	9439	1887.8	3775.6	9509	1901.8	3803.6
9301	1860.2	3720.4	9371	1874.2	3748.4	9440	1888	3776	9510	1902	3804
9302	1860.4	3720.8	9372	1874.4	3748.8	9441	1888.2	3776.4	9511	1902.2	3804.4
9303	1860.6	3721.2	9373	1874.6	3749.2	9442	1888.4	3776.8	9512	1902.4	3804.8
9304	1860.8	3721.6	9374	1874.8	3749.6	9443	1888.6	3777.2	262	1902.5	3805
9305	1861	3722	9375	1875	3750	9444	1888.8	3777.6	9513	1902.6	3805.2
9306	1861.2	3722.4	9376	1875.2	3750.4	9445	1889	3778	9514	1902.8	3805.6
9307	1861.4	3722.8	9377	1875.4	3750.8	9446	1889.2	3778.4	9515	1903	3806
9308	1861.6	3723.2	9378	1875.6	3751.2	9447	1889.4	3778.8	9516	1903.2	3806.4
9309	1861.8	3723.6	9379	1875.8	3751.6	9448	1889.6	3779.2	9517	1903.4	3806.8
9310	1862	3724	9380	1876	3752	9449	1889.8	3779.6	9518	1903.6	3807.2
9311	1862.2	3724.4	9381	1876.2	3752.4	9450	1890	3780	9519	1903.8	3807.6
9312	1862.4	3724.8	9382	1876.4	3752.8	9451	1890.2	3780.4	9520	1904	3808
62	1862.5	3725	9383	1876.6	3753.2	9452	1890.4	3780.8	9521	1904.2	3808.4
9313	1862.6	3725.2	9384	1876.8	3753.6	9453	1890.6	3781.2	9522	1904.4	3808.8
9314	1862.8	3725.6	9385	1877	3754	9454	1890.8	3781.6	9523	1904.6	3809.2
9315	1863	3726	9386	1877.2	3754.4	9455	1891	3782	9524	1904.8	3809.6
9316	1863.2	3726.4	9387	1877.4	3754.8	9456	1891.2	3782.4	9525	1905	3810
9317	1863.4	3726.8	137	1877.5	3755	9457	1891.4	3782.8	9526	1905.2	3810.4
9318	1863.6	3727.2	9388	1877.6	3755.2	9458	1891.6	3783.2	9527	1905.4	3810.8
9319	1863.8	3727.6	9389	1877.8	3755.6	9459	1891.8	3783.6	9528	1905.6	3811.2
9320	1864	3728	9390	1878	3756	9460	1892	3784	9529	1905.8	3811.6
9321	1864.2	3728.4	9391	1878.2	3756.4	9461	1892.2	3784.4	9530	1906	3812
9322	1864.4	3728.8	9392	1878.4	3756.8	9462	1892.4	3784.8	9531	1906.2	3812.4
9323	1864.6	3729.2	9393	1878.6	3757.2	212	1892.5	3785	9532	1906.4	3812.8
9324	1864.8	3729.6	9394	1878.8	3757.6	9463	1892.6	3785.2	9533	1906.6	3813.2
9325	1865	3730	9395	1879	3758	9464	1892.8	3785.6	9534	1906.8	3813.6
9326	1865.2	3730.4	9396	1879.2	3758.4	9465	1893	3786	9535	1907	3814
9327	1865.4	3730.8	9397	1879.4	3758.8	9466	1893.2	3786.4	9536	1907.2	3814.4
9328	1865.6	3731.2	9398	1879.6	3759.2	9467	1893.4	3786.8	9537	1907.4	3814.8
9329	1865.8	3731.6	9399	1879.8	3759.6	9468	1893.6	3787.2	287	1907.5	3815
9330	1866	3732	9400	1880	3760	9469	1893.8	3787.6	9538	1907.6	3815.2
9331	1866.2	3732.4									

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9 — Service information differences between RM-625 and RM-588

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RM-625 product data

RM-625 is a 2G variant of the Nokia 5230. The key product data differences between the RM-625 (2G) and RM-588 (3G) are described below.

Backup battery

RM-625 includes an RTC backup battery.

Connectivity

Operating bands	RM-625: EGSM 850/900/1800/1900 (no WCDMA/HSDPA)
Integrated GPS	RM-625: No GPS

Sales package

- Transceiver RM-625
- Battery (BL-5J)
- Charger (AC-8)
- Stereo Headset (WH-102)
- Plectrum Stylus (CP-306)
- Stylus
- User Guide

Product and module list

Module name	Type code	Notes
System/RF Module	3DM	Main PWB with components for RM-625
UI Flex Module	2JX	
Upper Flex Module	3CD	

BB troubleshooting

PWB markings in RM-625 and RM-588

Mechanically RM-625 and RM-588 are identical and therefore the HW differences are noticeable only by taking a closer look at the PWB. As illustrated in the figure below, the markings on the PWB enable quick differentiation between the two variants.

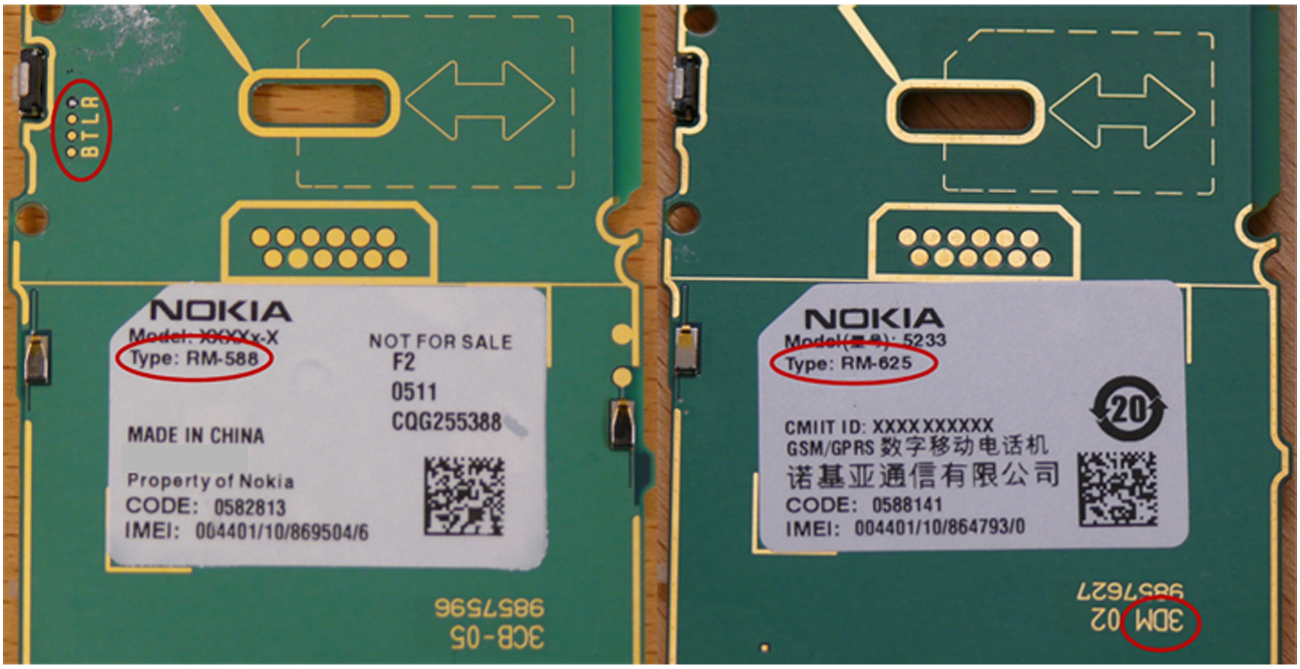


Figure 88 PWB markings in RM-625 and RM-588

RF troubleshooting

RM-625 RF block

As RM-625 is a 2G variant of the RM-588, there are no WCDMA RF components in the RF block of the RM-625. For example, the following WCDMA RF components are not assembled in RM-625:

- N7540 WCDMA PA
- N7541 WCDMA PA DC/DC converter
- Z7582 WCDMA dual TX SAW filter
- Z7580 WCDMA RX SAW filter

The graphics below illustrate the RF block component placement differences between RM-625 and RM-588.

RM-625 RF block

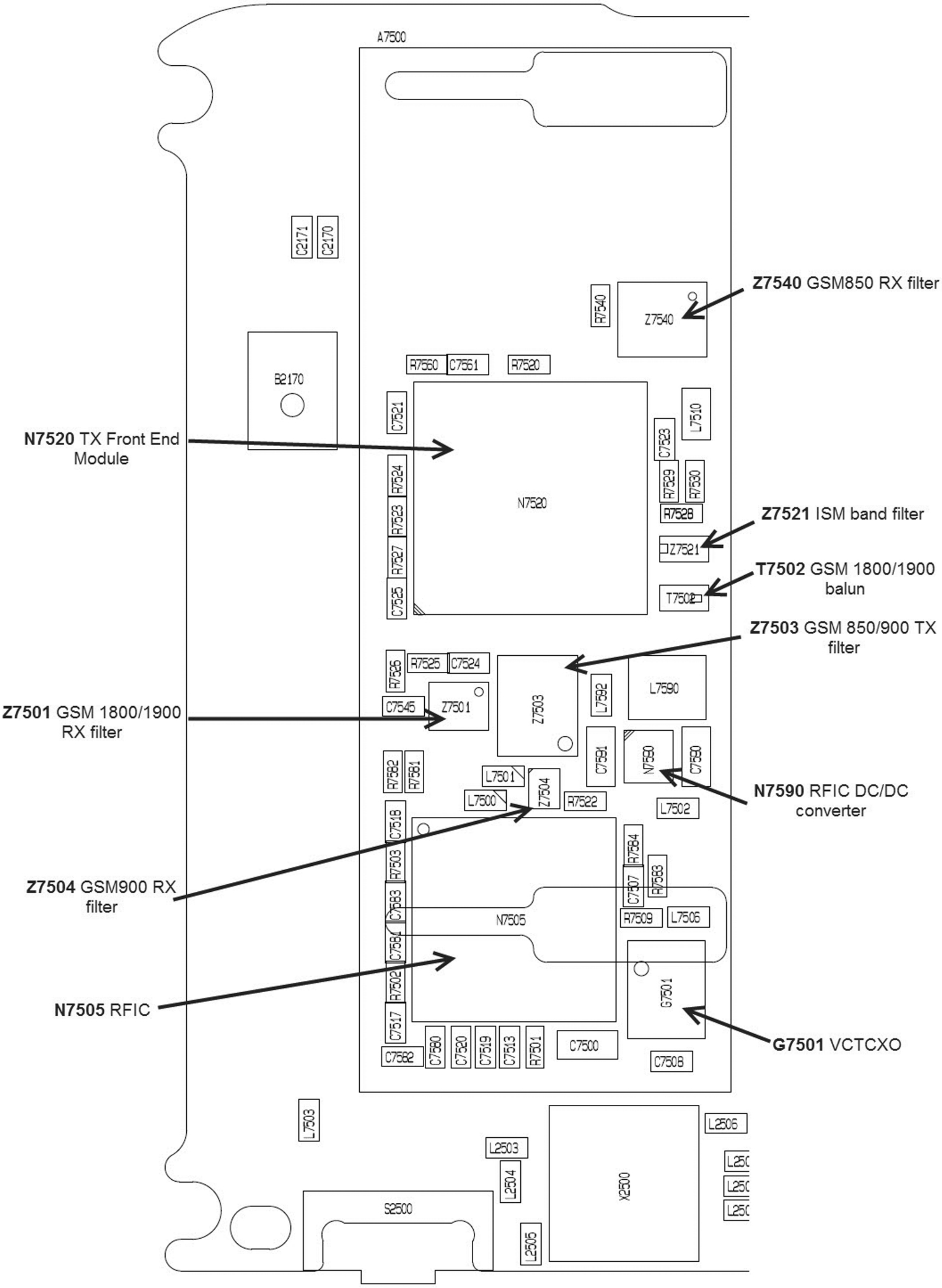


Figure 89 RM-625 RF key components - top

RM-588 RF block

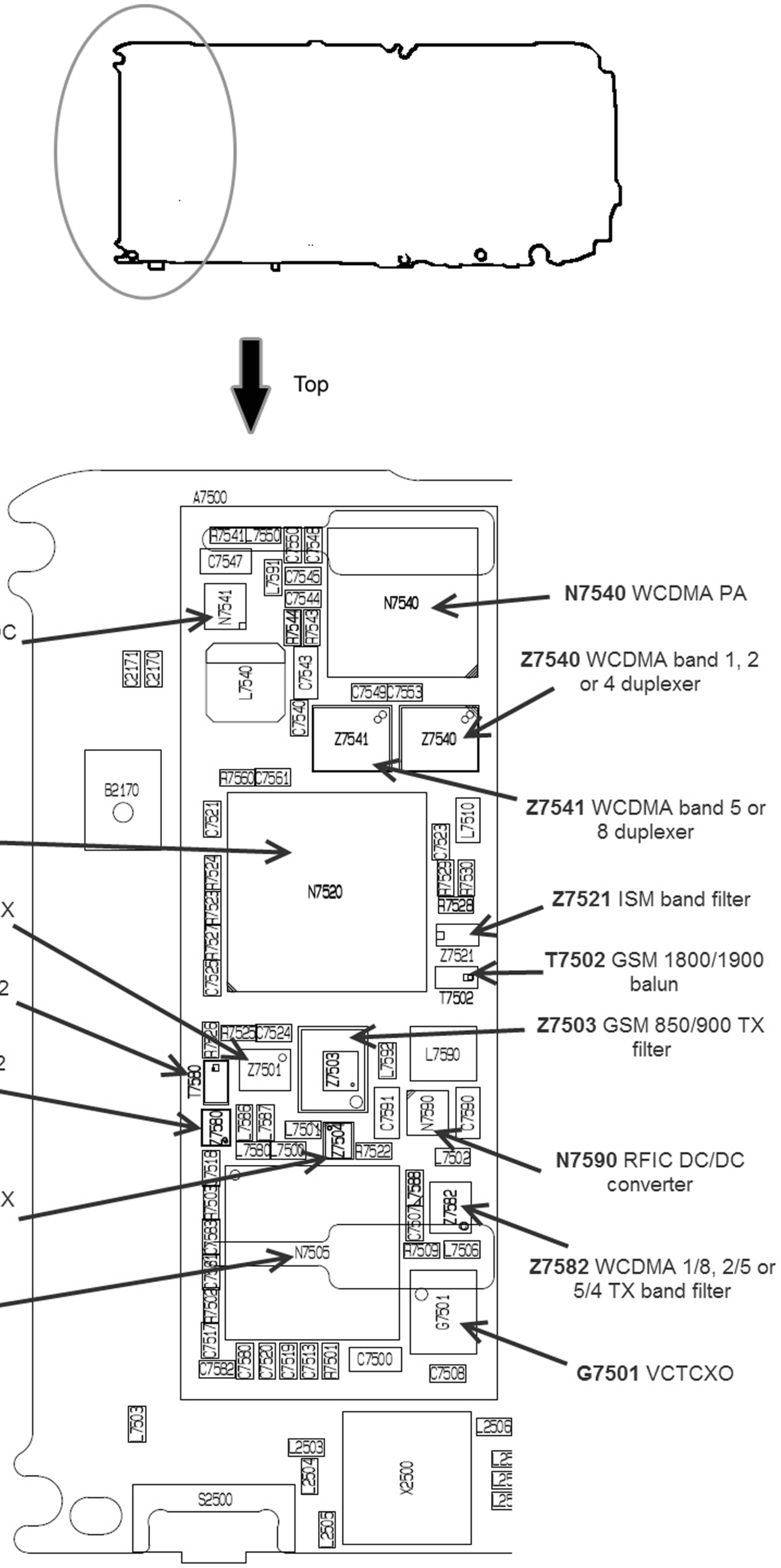
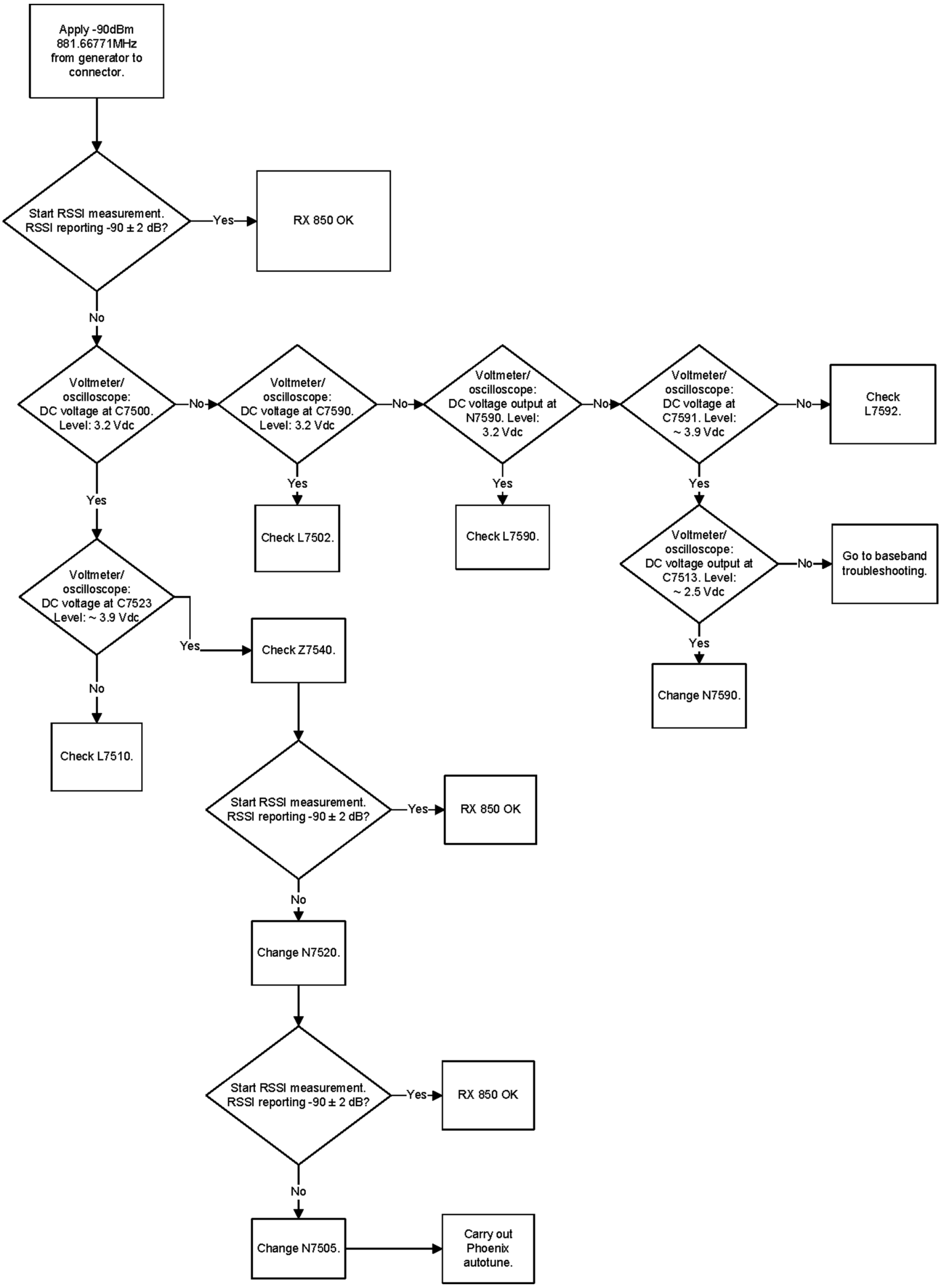


Figure 90 RM-588 RF key components - top

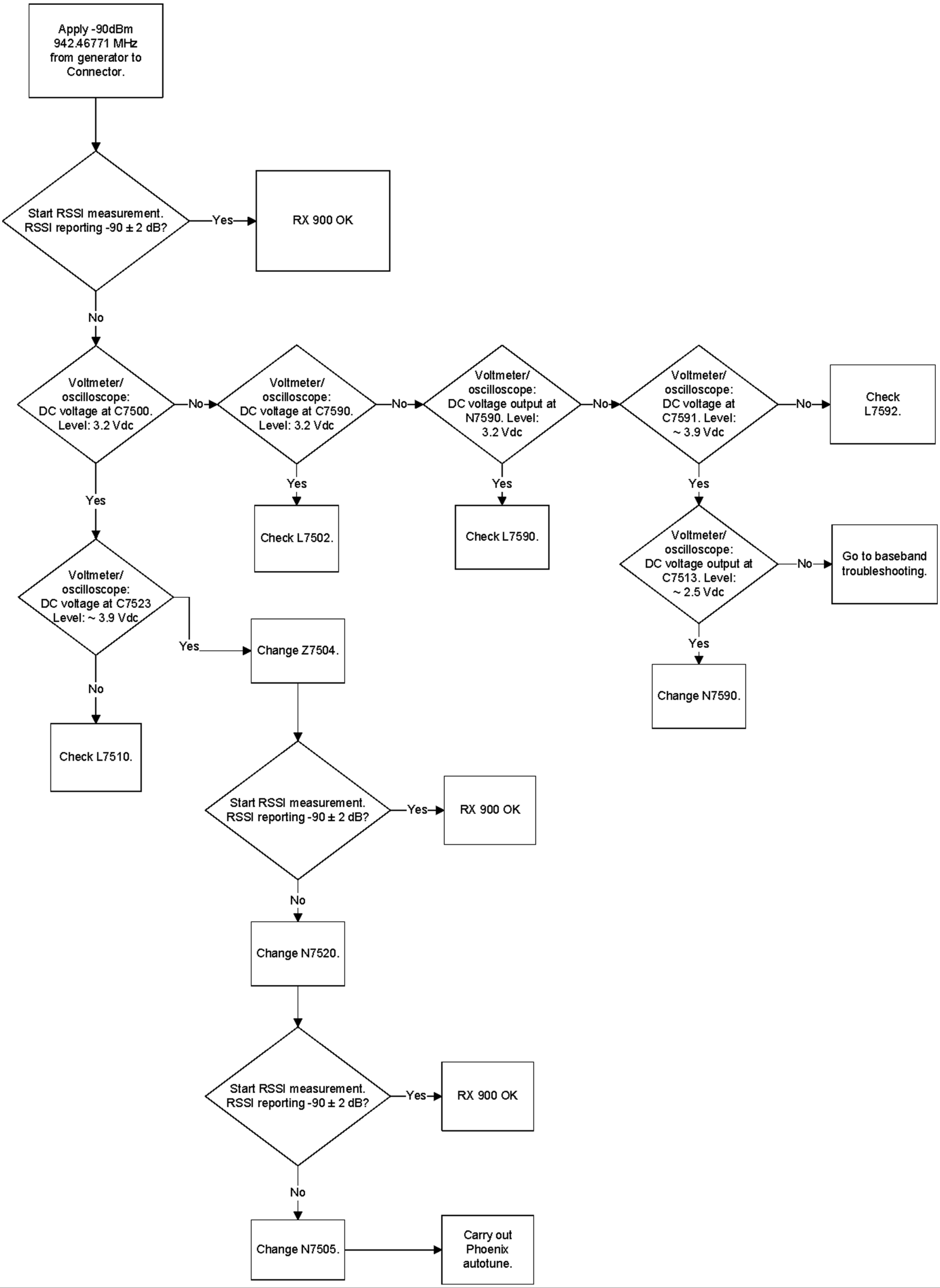
RX GSM850 troubleshooting

Troubleshooting flow



RX GSM900 troubleshooting

Troubleshooting flow



10 — Service information differences between RM-629 and RM-588

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General information

RM-629 product data

RM-629 is a WCDMA band variant (850/2100) of the Nokia 5230.

The key product data differences between the RM-629 and RM-588 are described below.

Connectivity

Table 19 Remote connectivity

Operating bands	RM-629: EGSM 850/900/1800/1900, WCDMA/HSDPA 850/2100 (V/I)

Sales package

- Transceiver RM-629
- Battery (BL-5J)
- Charger (AC-8)
- Stereo Headset (WH-102)
- Plectrum Stylus (CP-306)
- Stylus
- User Guide

Product and module list

Module name	Type code	Notes
System/RF module	3CB	
UI Flex Module	2JX	
Upper Flex Module	3CD	

Main RF characteristics for GSM850/900/1800/1900 and WCDMA V (850) and WCDMA I (2100) phones

Parameter	Unit
Cellular system	GSM850, EGSM900, GSM1800/1900, WCDMA V (850) and WCDMA I (2100)
Rx frequency band	GSM850: 869 - 894 MHz
	EGSM900: 925 - 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA V (850): 869 - 894 MHz
	WCDMA I (2100): 2110 - 2170 MHz

Parameter	Unit
Tx frequency band	GSM850: 824 - 849 MHz
	EGSM900: 880 - 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA V (850): 824 - 849 MHz
	WCDMA I (2100): 1920 - 1980 MHz
Output power	GSM850: +5 ...+33dBm/3.2mW ... 2W
	GSM900: +5 ... +33dBm/3.2mW ... 2W
	GSM1800: +0 ... +30dBm/1.0mW ... 1W
	GSM1900: +0 ... +30dBm/1.0mW ... 1W
	WCDMA V (850): -50 ... +24 dBm/0.01μW ... 251.2mW
	WCDMA I (2100): -50 ... +24 dBm/0.01μW ... 251.2mW
Number of RF channels	GSM850: 124
	GSM900: 174
	GSM1800: 374
	GSM1900: 299
	WCDMA V (850): 108
	WCDMA I (2100): 277
Channel spacing	200 kHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA V (850): 75
	WCDMA I (2100): 75

BB troubleshooting

PWB markings in RM-629 and RM-588

Mechanically RM-629 and RM-588 are identical and therefore the HW differences are noticeable only by taking a closer look at the PWB. As illustrated in the figure below, there are two quick ways to identify variants from each other.

The first way is from the type designator on the type label and the second one is from the solder markings on the PWB.

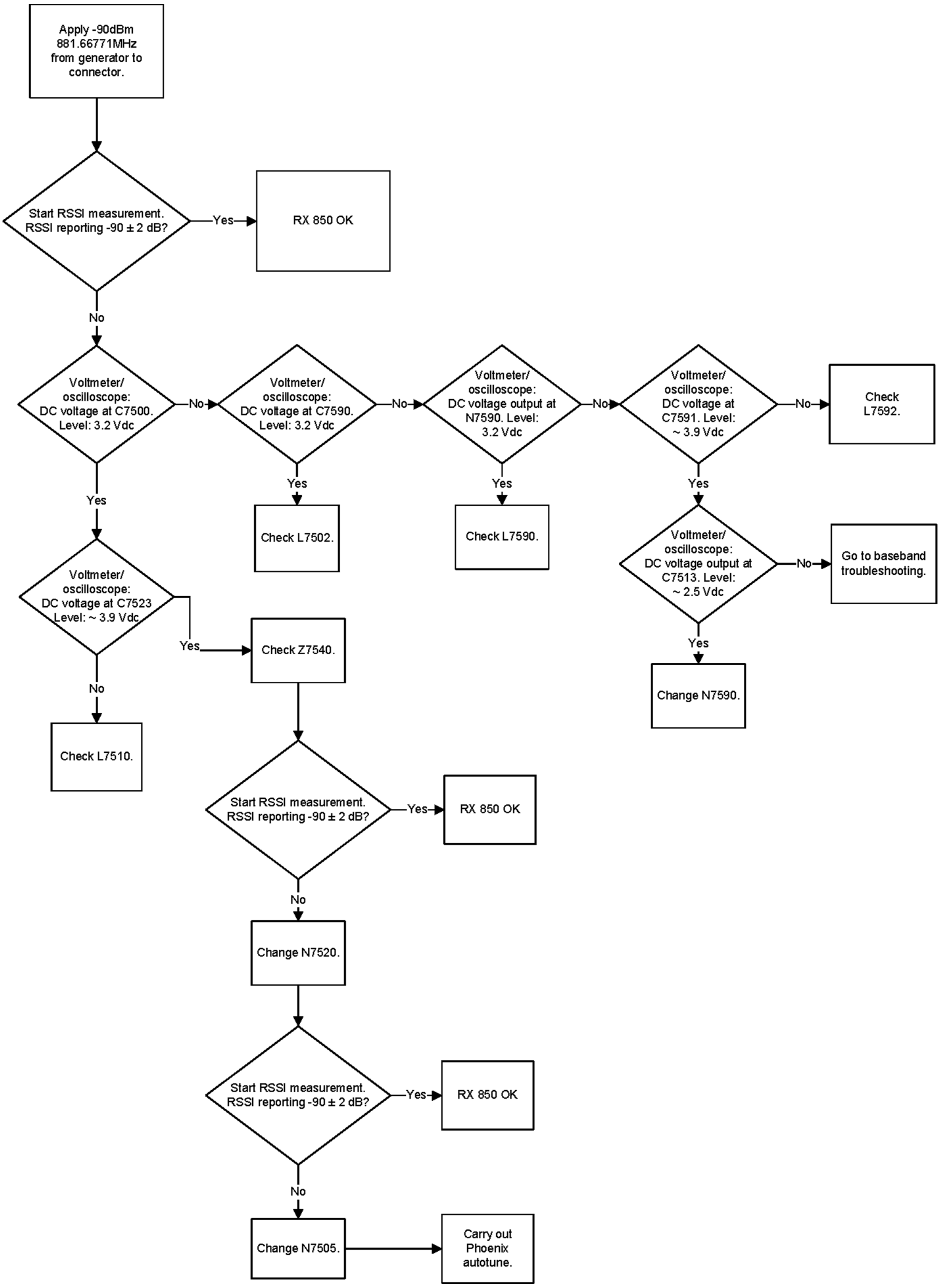
RM-629 has a solder marking above the letter **B**. There are no solder markings above the other letters (**T**, **L** or **R**). RM-588 has a solder marking above the letter **R** and no solder markings above the other letters (**B**, **T** or **L**).

Figure 91 PWB markings in RM-629 and RM-588

RF troubleshooting

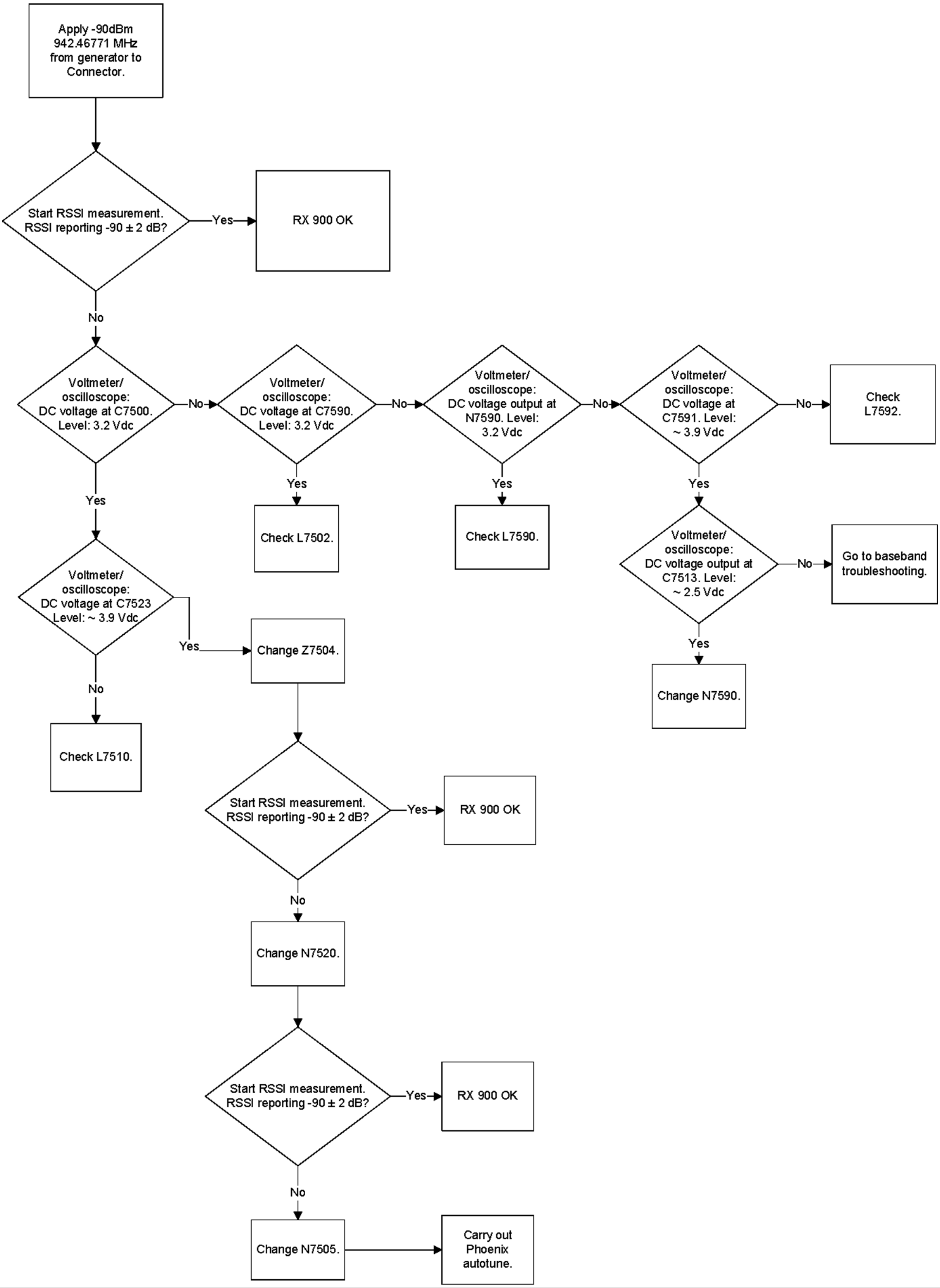
RX GSM850 troubleshooting

Troubleshooting flow



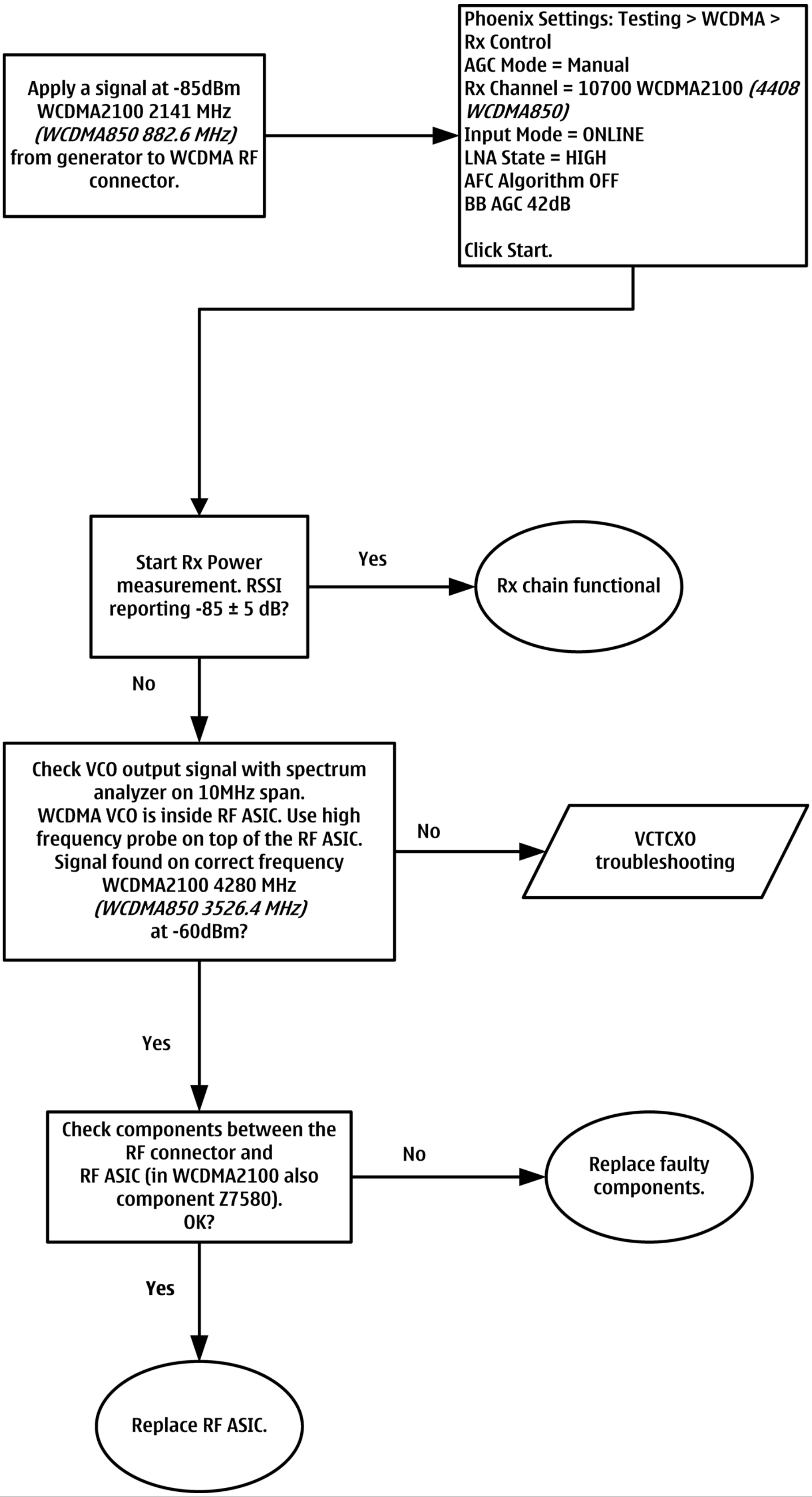
RX GSM900 troubleshooting

Troubleshooting flow



WCDMA receiver troubleshooting

Troubleshooting flow



WCDMA RX chain activation for manual measurement

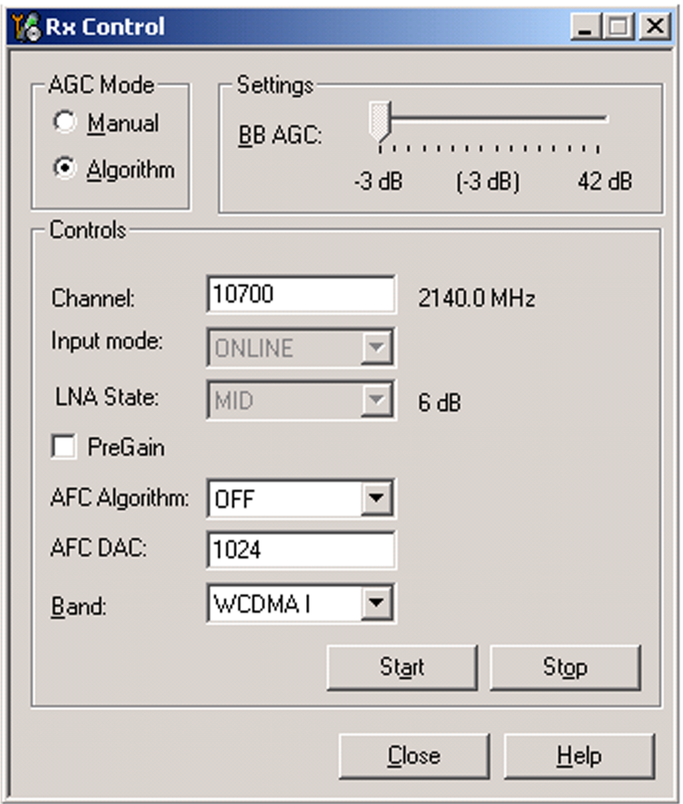
Prerequisites

Make the following settings in Phoenix service software:

Setting	WCDMA2100	WCDMA850
Phoenix Channel	10700	4408
Signal generator to antenna connector	2140.0 MHz	881.6 MHz
Band	I	V

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

4. Set the following RF generator settings:

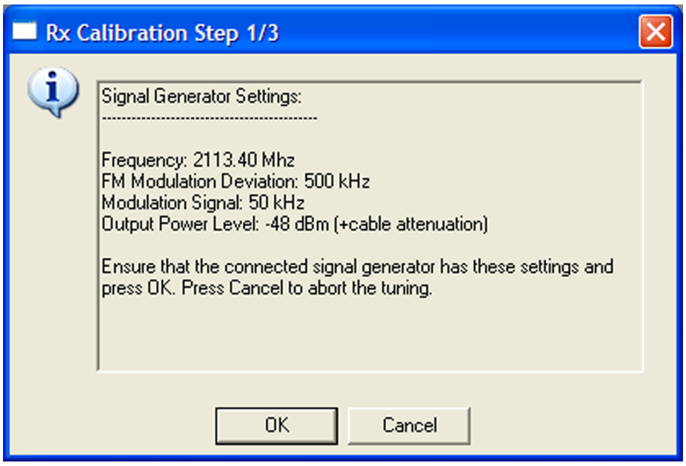


Figure 92 WCDMA RX generator settings

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing** → **WCDMA** → **TX control** .
3. Use the following settings in the TX control window:

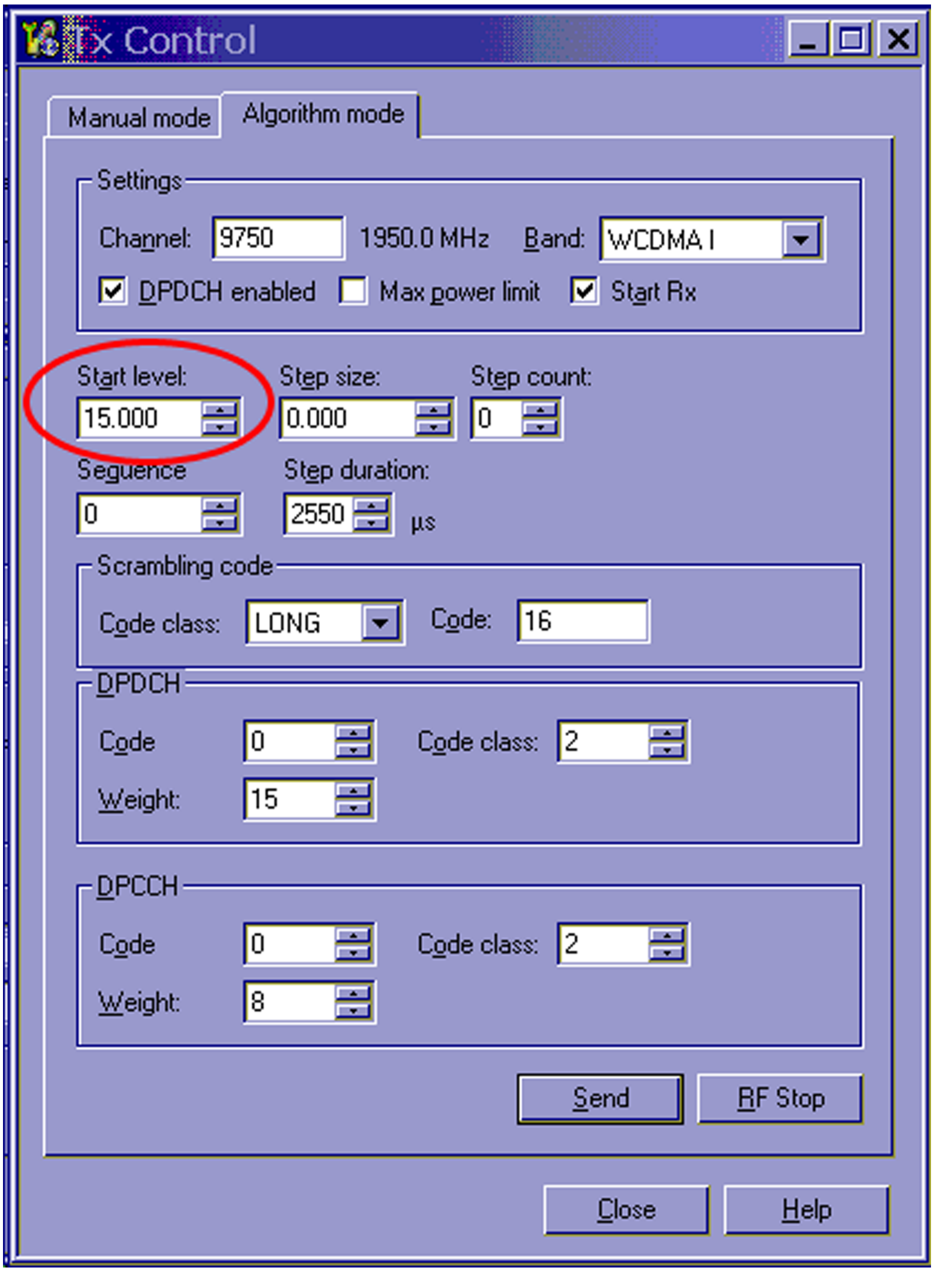


Figure 93 Phoenix WCDMA TX control window

Note: Use the **Start level** option to set the TX power level.

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.

5. Use the CMU200 to check the WCDMA power.

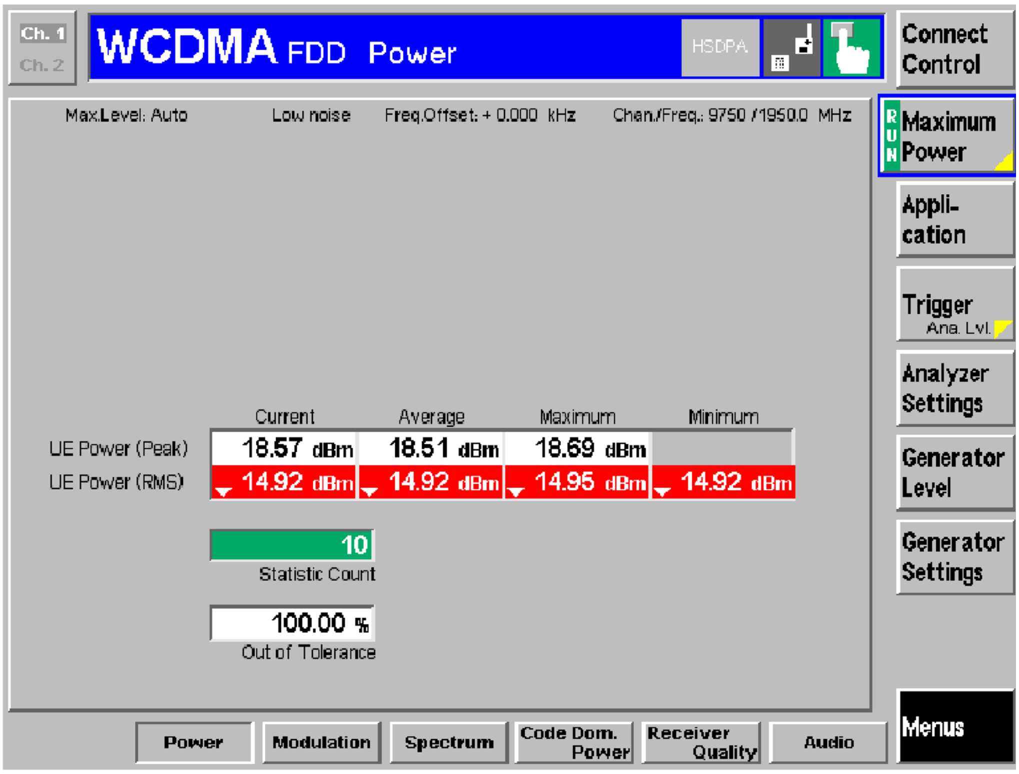


Figure 94 WCDMA power window

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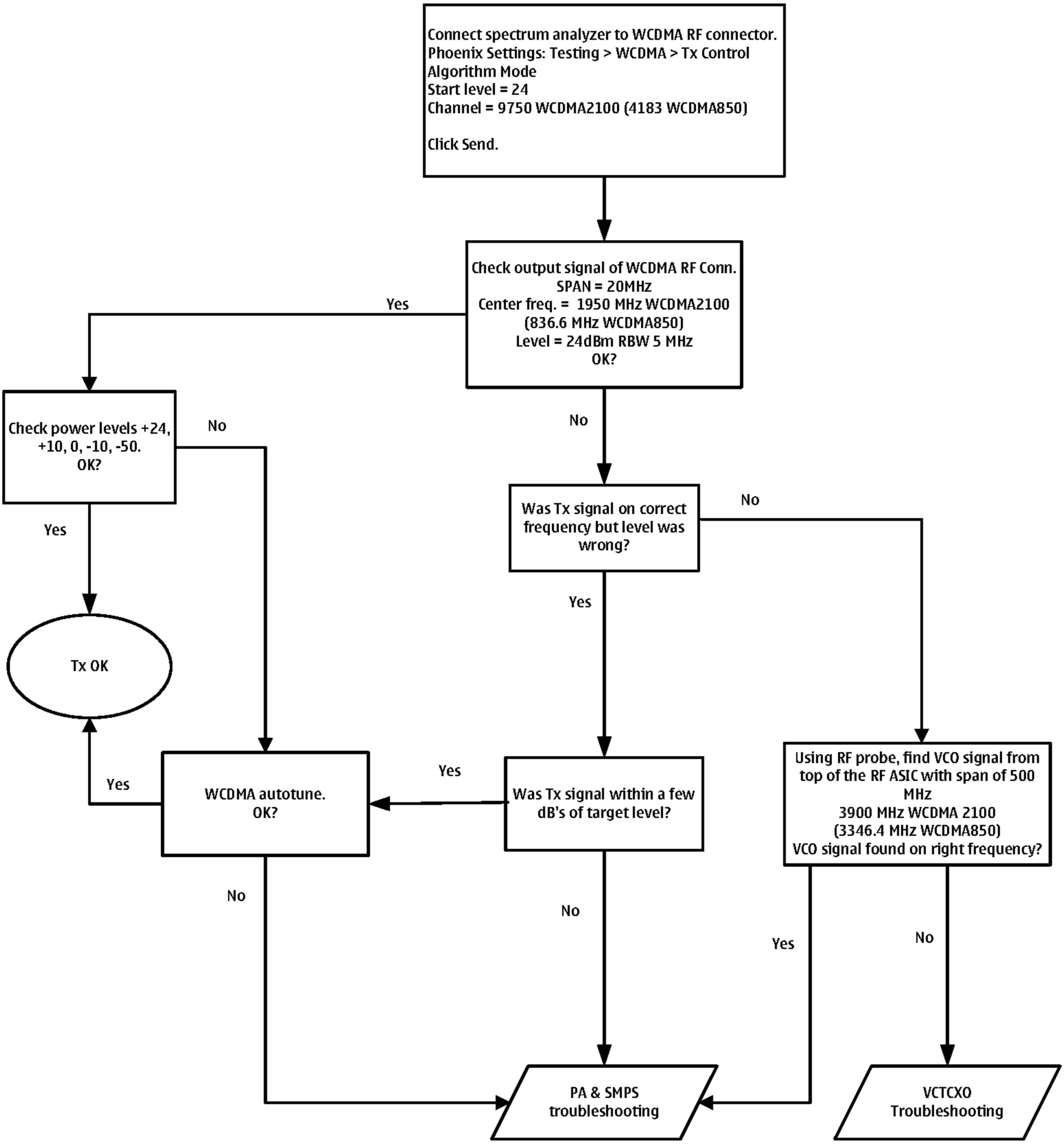
WCDMA transmitter troubleshooting flowchart

Troubleshooting flow



Tx power level tuning (GSM)

Context

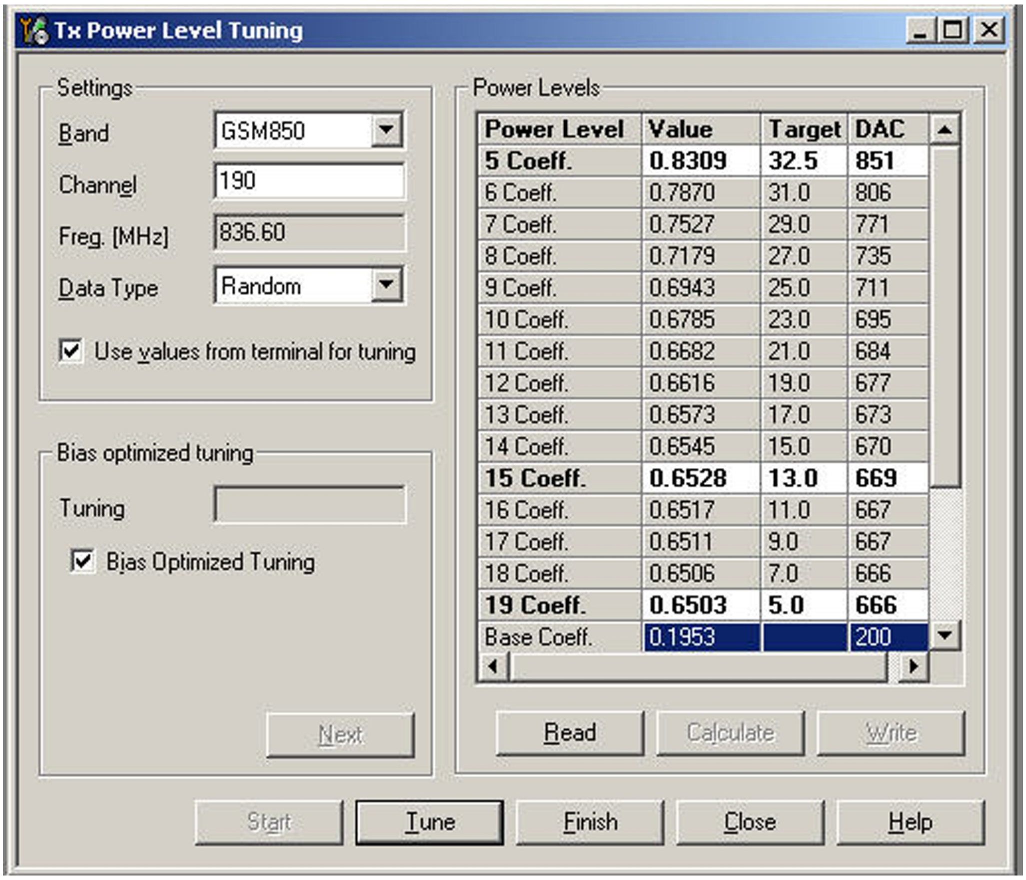
Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

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. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning** → **GSM** → **Tx Power Level Tuning** .
5. Click **Start**.l



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6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **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 into account.

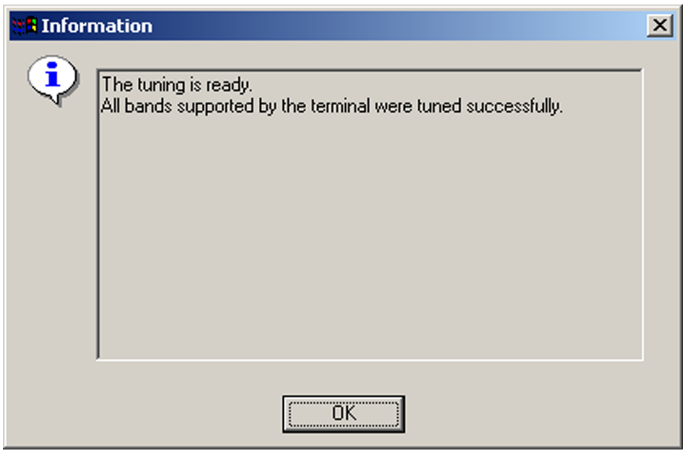
7. Set the tuning targets according to the values in the table below

GMSK	1Slot	2 slot	3 slot
850	32,5	31,0	29,7
900	32,5	30,5	29,0
1800	30,0	30,0	28,2
1900	30,0	27,0	25,2
EDGE	1Slot	2 slot	3 slot
850	26,5	26,5	24,7
900	26,5	26,5	24,7
1800	25	25	23,2
1900	25	25	23,2
WCDMA Band I	23.5 dBm		
WCDMA Band V	23.5 dBm		

8. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
9. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
10. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



WCDMA receiver tunings

RX calibration (WCDMA)

Context

Rx calibration tuning routine calculates the real gain values of the WCDMA Rx AGC system. There is also a SAW filter between front end LNA and mixer in the receive chain, which causes ripple in the RSSI measurement, this is calibrated out. The SAW filter is intergated into RF ASIC N7500.

Rx calibration can be done in two different ways, manual tune and sweep mode tune. If the signal generator in use supports frequency sweep table, the calibration is done in one step.

Steps

1. For manual tuning, set mode to **Local** in the **Operating Mode** dropdown menu.
2. In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
3. Click **Start**.
4. Select Band "WCDMA2100 or WCDMA850".
5. Click **Tune**.

6. Setup the signal generator to correspond with the values on the, *Rx Calibration* pop-up window and click **OK**.

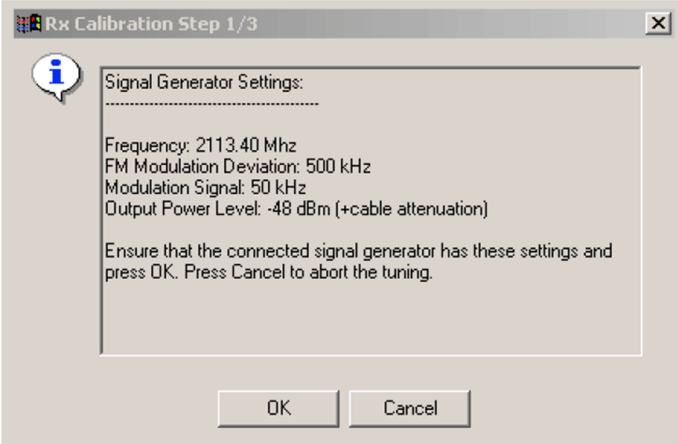
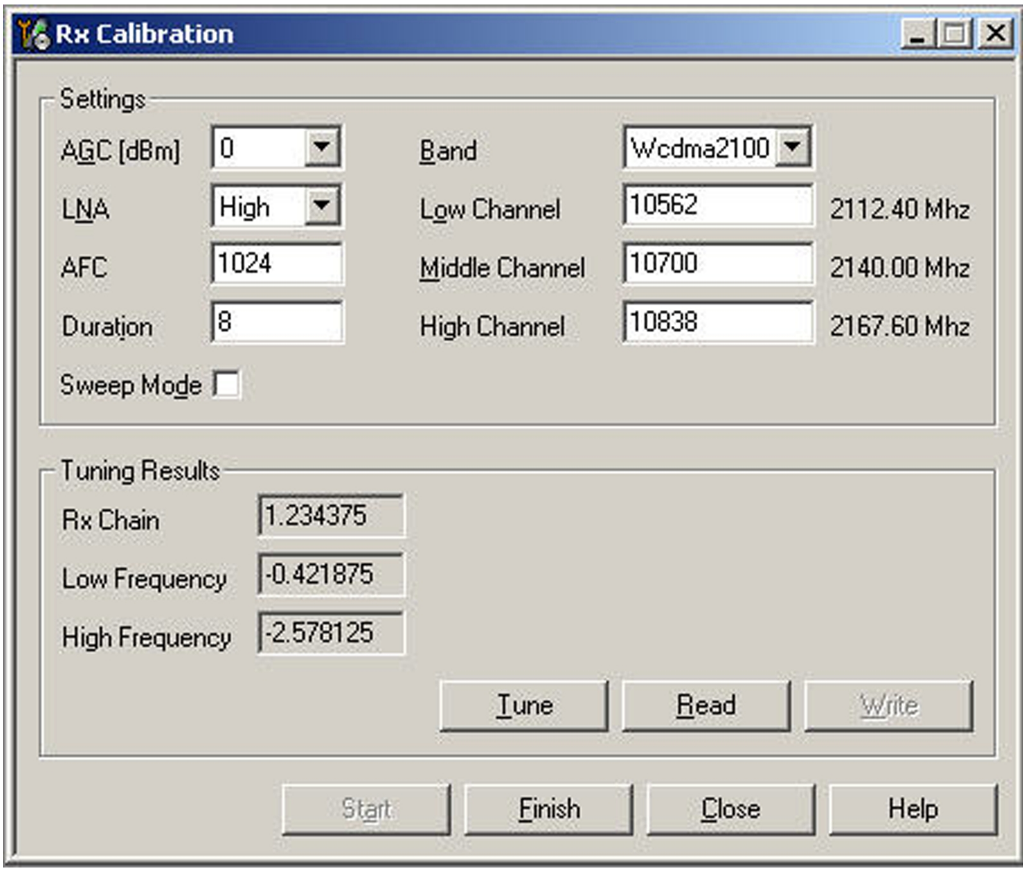


Figure 95 Pop-up window for WCDMA2100

7. Repeat step 6. for Middle and High channels.



8. Ensure Tuning Results are within limits specified in the table below:

   If values are OK, click **Write** to save the values.

	Band	Min	Typ	Max	Unit
Rx chain	2100 or 850	-6	1.5 to 3.5	6	dB
Low Frequency		-5	-0.7 to 4.0	5	
High Frequency		-5	-0.7 to 4.0	5	

Alternative steps

- For sweep mode tuning, set **Mode** to **Local** in the **Operating Mode** dropdown menu.
- In the **Tuning** menu, choose **WCDMA** → **Rx Calibration** .
- Click **Start**.
- Select **Band**, "WCDMA2100 or WCDMA850".
- Check the **Sweep Mode** box.
- Click **Tune**.
- Setup the signal generator to correspond with the values on the *Rx Calibration* pop-up window and click **OK**.

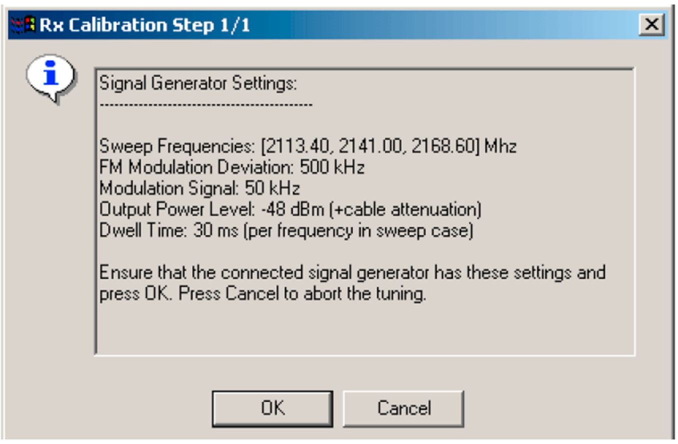


Figure 96 Pop-up window for WCDMA2100

- Ensure Tuning Results are within limits specified in the table above: If values are OK, click **Write** to save the values to the phone.
- Close the tuning window.

WCDMA transmitter tunings

Tx AGC & power detector (WCDMA)

Context

Tx AGC & power detector tuning has two purposes:

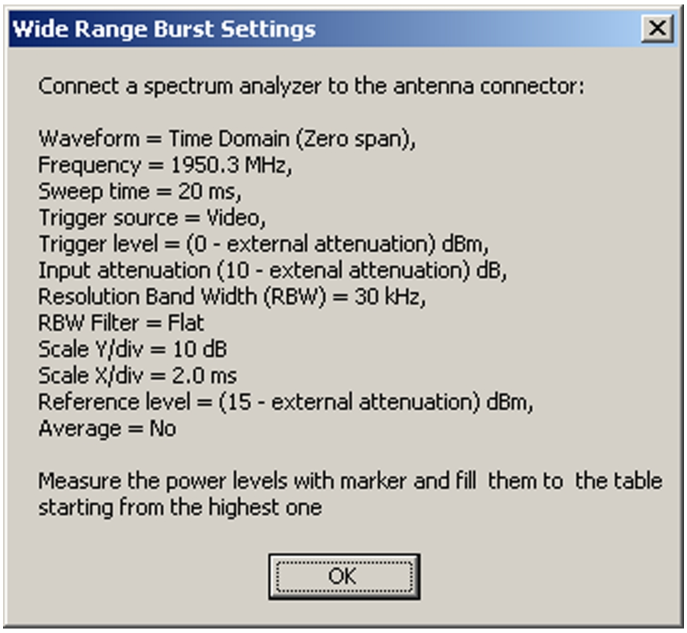
- to enable the phone to select the correct TxC value accurately in order to produce the required RF level
- to enable the phone to measure its own transmitter power accurately

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

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.

2. Choose **Tuning** → **WCDMA** → **Tx AGC & Power Detector.**
3. Click **Start**.
4. In the *Wide Range* pane, click **Tune** (the leftmost **Tune** button).
5. Set up the spectrum analyzer in the following way:



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 after 750 us, the third after 1250 us and so on for 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 spikes on lower levels.

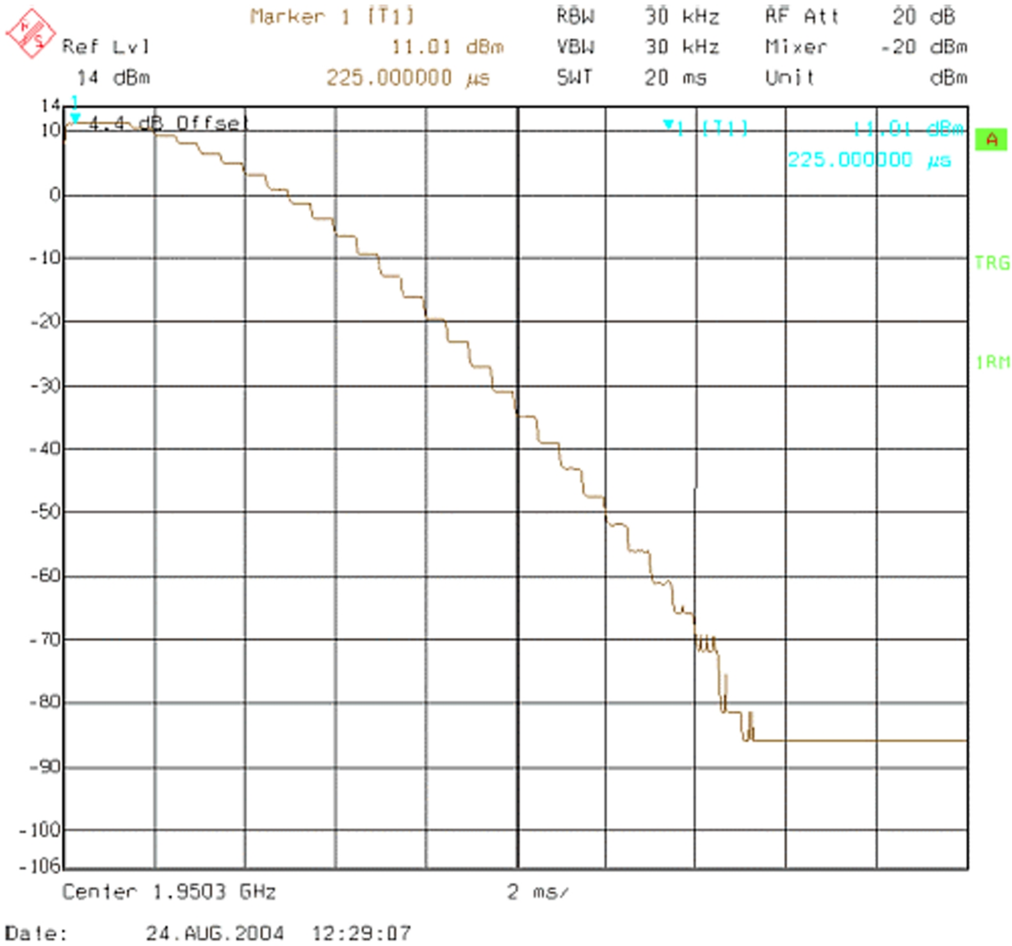
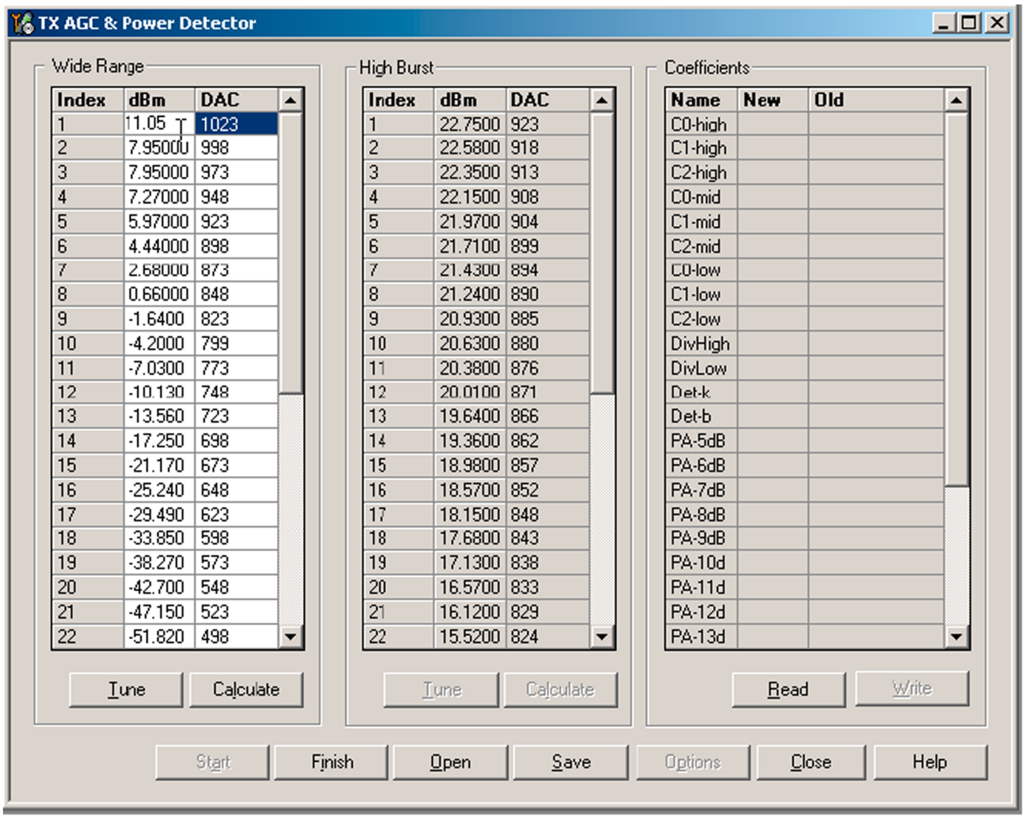
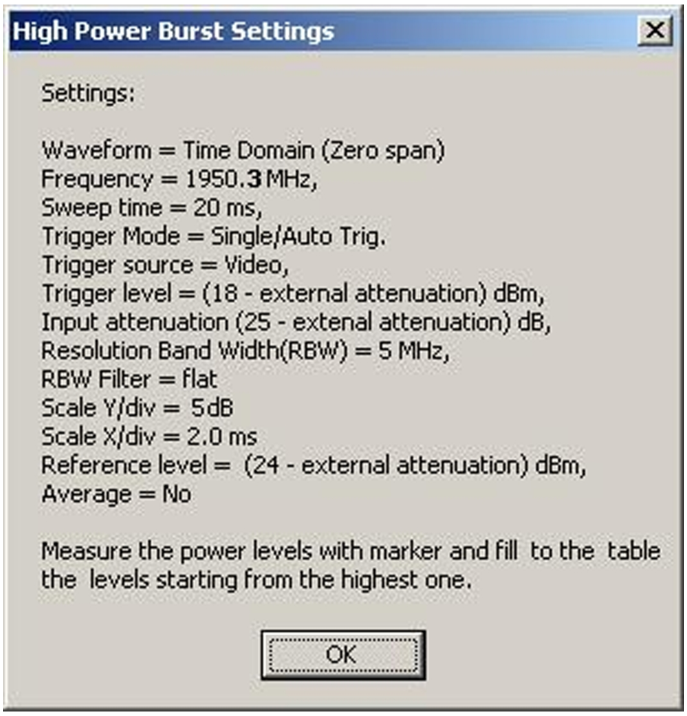


Figure 97 WCDMA power level tuning steps

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. Adjust the spectrum analyzer according to the following settings:



12. Measure the power levels with a marker.

    Take the first measurement from 250 us after the trigger, the second after 750 us, the third after 1220 us and so on for every 500 us until the table is filled.

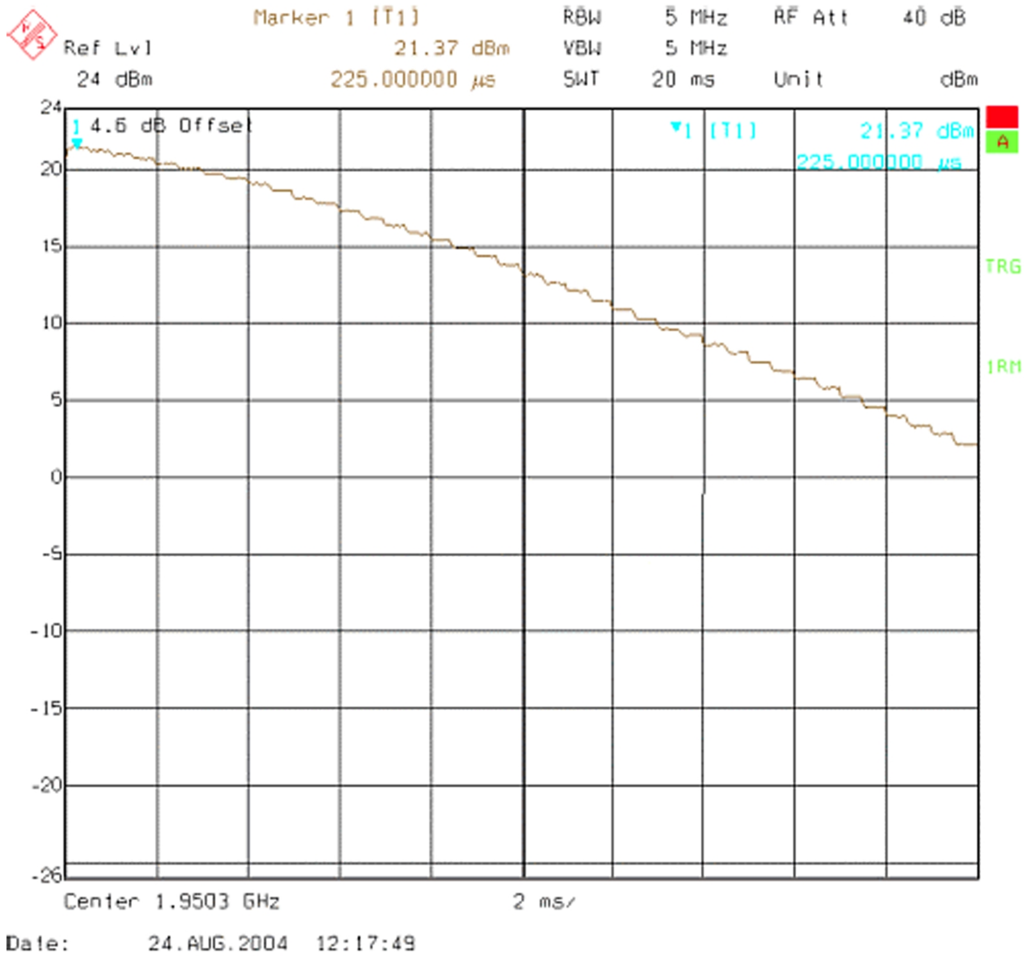


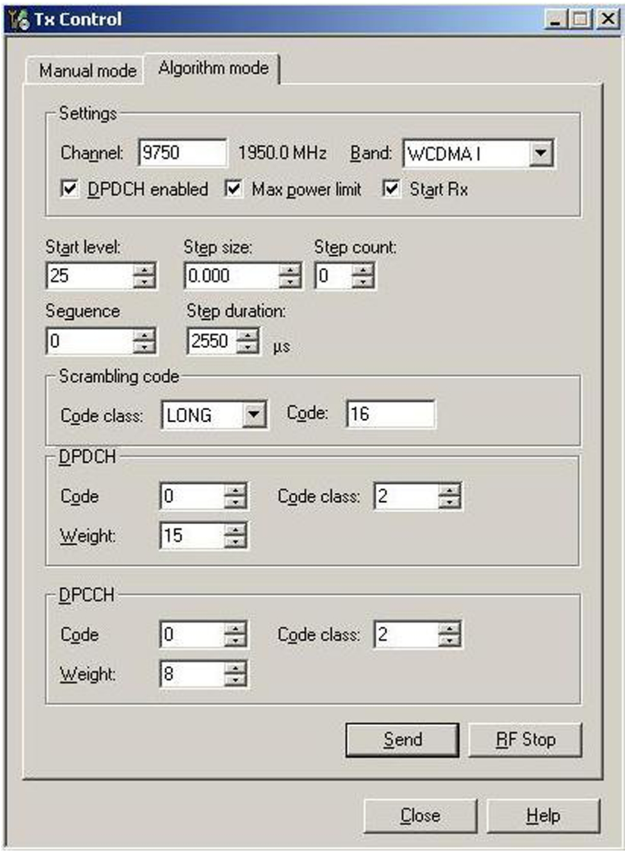
Figure 98 High burst measurement

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

	Min	Max
Det-k	100	220
Det-b	0	150

15. To save the coefficients to the phone, click **Write**.
16. To close the *Tx AGC & Power Detector* window, click **Close**.
17. Choose **Testing** → **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 (WCDMA I)** or **836.6 MHz (WCDMA V)**
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** check box.
24. Repeat steps **19** to **23** for levels +19, +7, 0, -20 and –40 dBm.

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

System module

WCDMA V (850) frequencies

TX CH	RX CH	TX	RX	VCO TX	VCO RX	TX CH	RX CH	TX	RX	VCO TX	VCO RX
4132	4357	826.4	871.4	3305.6	3485.6	4182	4407	836.4	881.4	3345.6	3525.6
782	1007	826.5	871.5	3306.0	3486.0	4183	4408	836.6	881.6	3346.4	3526.4
4133	4358	826.6	871.6	3306.4	3486.4	4184	4409	836.8	881.8	3347.2	3527.2
4134	4359	826.8	871.8	3307.2	3487.2	4185	4410	837.0	882.0	3348.0	3528.0
4135	4360	827.0	872.0	3308.0	3488.0	4186	4411	837.2	882.2	3348.8	3528.8
4136	4361	827.2	872.2	3308.8	3488.8	4187	4412	837.4	882.4	3349.6	3529.6
4137	4362	827.4	872.4	3309.6	3489.6	837	1062	837.5	882.5	3350.0	3530.0
787	1012	827.5	872.5	3310.0	3490.0	4188	4413	837.6	882.6	3350.4	3530.4
4138	4363	827.6	872.6	3310.4	3490.4	4189	4414	837.8	882.8	3351.2	3531.2
4139	4364	827.8	872.8	3311.2	3491.2	4190	4415	838.0	883.0	3352.0	3532.0
4140	4365	828.0	873.0	3312.0	3492.0	4191	4416	838.2	883.2	3352.8	3532.8
4141	4366	828.2	873.2	3312.8	3492.8	4192	4417	838.4	883.4	3353.6	3533.6
4142	4367	828.4	873.4	3313.6	3493.6	4193	4418	838.6	883.6	3354.4	3534.4
4143	4368	828.6	873.6	3314.4	3494.4	4194	4419	838.8	883.8	3355.2	3535.2
4144	4369	828.8	873.8	3315.2	3495.2	4195	4420	839.0	884.0	3356.0	3536.0
4145	4370	829.0	874.0	3316.0	3496.0	4196	4421	839.2	884.2	3356.8	3536.8
4146	4371	829.2	874.2	3316.8	3496.8	4197	4422	839.4	884.4	3357.6	3537.6
4147	4372	829.4	874.4	3317.6	3497.6	4198	4423	839.6	884.6	3358.4	3538.4
4148	4373	829.6	874.6	3318.4	3498.4	4199	4424	839.8	884.8	3359.2	3539.2
4149	4374	829.8	874.8	3319.2	3499.2	4200	4425	840.0	885.0	3360.0	3540.0
4150	4375	830.0	875.0	3320.0	3500.0	4201	4426	840.2	885.2	3360.8	3540.8
4151	4376	830.2	875.2	3320.8	3500.8	4202	4427	840.4	885.4	3361.6	3541.6
4152	4377	830.4	875.4	3321.6	3501.6	4203	4428	840.6	885.6	3362.4	3542.4
4153	4378	830.6	875.6	3322.4	3502.4	4204	4429	840.8	885.8	3363.2	3543.2
4154	4379	830.8	875.8	3323.2	3503.2	4205	4430	841.0	886.0	3364.0	3544.0
4155	4380	831.0	876.0	3324.0	3504.0	4206	4431	841.2	886.2	3364.8	3544.8
4156	4381	831.2	876.2	3324.8	3504.8	4207	4432	841.4	886.4	3365.6	3545.6
4157	4382	831.4	876.4	3325.6	3505.6	4208	4433	841.6	886.6	3366.4	3546.4
807	1032	831.5	876.5	3326.0	3506.0	4209	4434	841.8	886.8	3367.2	3547.2
4158	4383	831.6	876.6	3326.4	3506.4	4210	4435	842.0	887.0	3368.0	3548.0
4159	4384	831.8	876.8	3327.2	3507.2	4211	4436	842.2	887.2	3368.8	3548.8
4160	4385	832.0	877.0	3328.0	3508.0	4212	4437	842.4	887.4	3369.6	3549.6
4161	4386	832.2	877.2	3328.8	3508.8	862	1087	842.5	887.5	3370.0	3550.0
4162	4387	832.4	877.4	3329.6	3509.6	4213	4438	842.6	887.6	3370.4	3550.4
812	1037	832.5	877.5	3330.0	3510.0	4214	4439	842.8	887.8	3371.2	3551.2
4163	4388	832.6	877.6	3330.4	3510.4	4215	4440	843.0	888.0	3372.0	3552.0
4164	4389	832.8	877.8	3331.2	3511.2	4216	4441	843.2	888.2	3372.8	3552.8
4165	4390	833.0	878.0	3332.0	3512.0	4217	4442	843.4	888.4	3373.6	3553.6
4166	4391	833.2	878.2	3332.8	3512.8	4218	4443	843.6	888.6	3374.4	3554.4
4167	4392	833.4	878.4	3333.6	3513.6	4219	4444	843.8	888.8	3375.2	3555.2
4168	4393	833.6	878.6	3334.4	3514.4	4220	4445	844.0	889.0	3376.0	3556.0
4169	4394	833.8	878.8	3335.2	3515.2	4221	4446	844.2	889.2	3376.8	3556.8
4170	4395	834.0	879.0	3336.0	3516.0	4222	4447	844.4	889.4	3377.6	3557.6
4171	4396	834.2	879.2	3336.8	3516.8	4223	4448	844.6	889.6	3378.4	3558.4
4172	4397	834.4	879.4	3337.6	3517.6	4224	4449	844.8	889.8	3379.2	3559.2
4173	4398	834.6	879.6	3338.4	3518.4	4225	4450	845.0	890.0	3380.0	3560.0
4174	4399	834.8	879.8	3339.2	3519.2	4226	4451	845.2	890.2	3380.8	3560.8
4175	4400	835.0	880.0	3340.0	3520.0	4227	4452	845.4	890.4	3381.6	3561.6
4176	4401	835.2	880.2	3340.8	3520.8	4228	4453	845.6	890.6	3382.4	3562.4
4177	4402	835.4	880.4	3341.6	3521.6	4229	4454	845.8	890.8	3383.2	3563.2
4178	4403	835.6	880.6	3342.4	3522.4	4230	4455	846.0	891.0	3384.0	3564.0
4179	4404	835.8	880.8	3343.2	3523.2	4231	4456	846.2	891.2	3384.8	3564.8
4180	4405	836.0	881.0	3344.0	3524.0	4232	4457	846.4	891.4	3385.6	3565.6
4181	4406	836.2	881.2	3344.8	3524.8	4233	4458	846.6	891.6	3386.4	3566.4

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11 — Service information differences between Nokia 5235 Comes With Music and Nokia 5230

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Table of Contents

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General information

Product data differences between Nokia 5235 Comes With Music and Nokia 5230 variants

Nokia 5235 Comes With Music variants RM-588, RM-594 and RM-629 are variants of the Nokia 5230.

The key product differences between the Nokia 5235 Comes With Music and Nokia 5230 are described in the table below.

Product data	Nokia 5235 Comes With Music RM-588, RM-594, RM-629	Nokia 5230 RM-588, RM-594, RM-625 (2G) RM-629
Comes with Music bundle	Yes Music Store icon in Homescreen	No
A-cover colour	Ice blue	Silver or black
Battery cover colour	Matt white or matt black	Red, Dark Silver, Pink, Yellow, Blue
Side band colour	Matt white or matt black	White or black
Camera bezel colour	Ice Blue	Silver
Games	One	Two
Headset in Sales package	WH-701	WH-102

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Glossary

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A/D-converter	Analogue-to-digital converter
ACI	Accessory Control Interface
ADC	Analogue-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BA	Board Assembly
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic (type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2, UEME and Zocus
CCP	Compact Camera Port
CDMA	Code division multiple access
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSD	Circuit-switched data
CSR	Cambridge silicon radio
CSTN	Colour Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo

DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package
DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DTM	Dual Transfer Mode
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evolution
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FM	Frequency Modulation
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HSDPA	High-speed downlink packet access
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity

IR	Infrared
IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out
LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
MP3	Compressed audio file format developed by Moving Picture Experts Group
MTP	Multipoint-to-point connection
NFC	Near field communication
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PCM	Pulse Code Modulation
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board

PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RDS	Radio Data Service
RF	Radio Frequency
RF PopPort ™	Reduced function PopPort ™ interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multimedia Card
RSS	Web content Syndication Format
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)
RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCP/IP	Transmission control protocol/Internet protocol
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPnP	Universal Plug and Play
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC

USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
VF	View Finder
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WCDMA	Wideband code division multiple access
WD	Watchdog
WLAN	Wireless local area network
XHTML	Extensible hypertext markup language
Zocus	Current sensor (used to monitor the current flow to and from the battery)

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