Nokia Customer Care

SERVICE MANUAL

Nokia 610 & 616 CarKit Phone (TFE-4/RV-1)

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NOKIA

Company Confidential

Amendment Record Sheet

Amendment Number	Date	Inserted By	Comments
Issue 1.0	Nov. 03	P.Harvey	Approved Issue
Issue 1.1	Dec. 03	P.Harvey	Published Issue
Issue 2.0	Mar. 05	P.Harvey	The introduction of the Nokia 616

IMPORTANT

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

Warnings and Cautions

Please refer to the *product's* user guide for instructions relating to operation, care and maintenance including important safety information. Note also the following:

Warnings:

1. 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.

2. THE *product* MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES EG PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.

3. 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.

4. BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE ALL EQUIPMENT IS SWITCHED OFF.

Cautions:

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

For your safety

QUALIFIED SERVICE
Only qualified personnel should install or repair Nokia equipment.

ACCESSORIES
Use only approved accessories. 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 *product* service points have sufficient ESD protection (against static electricity) when servicing *products*.

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

The product is a product 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 dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.

Do not use or store in dusty, dirty areas. Its moving parts can be damaged.

Do not store in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.

Do not store 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. Rough handling can break internal circuit boards.

Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the product.

Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could cause damage and may violate regulations governing radio devices.

All of the above suggestions apply equally to all the component parts of this product.

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.

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:

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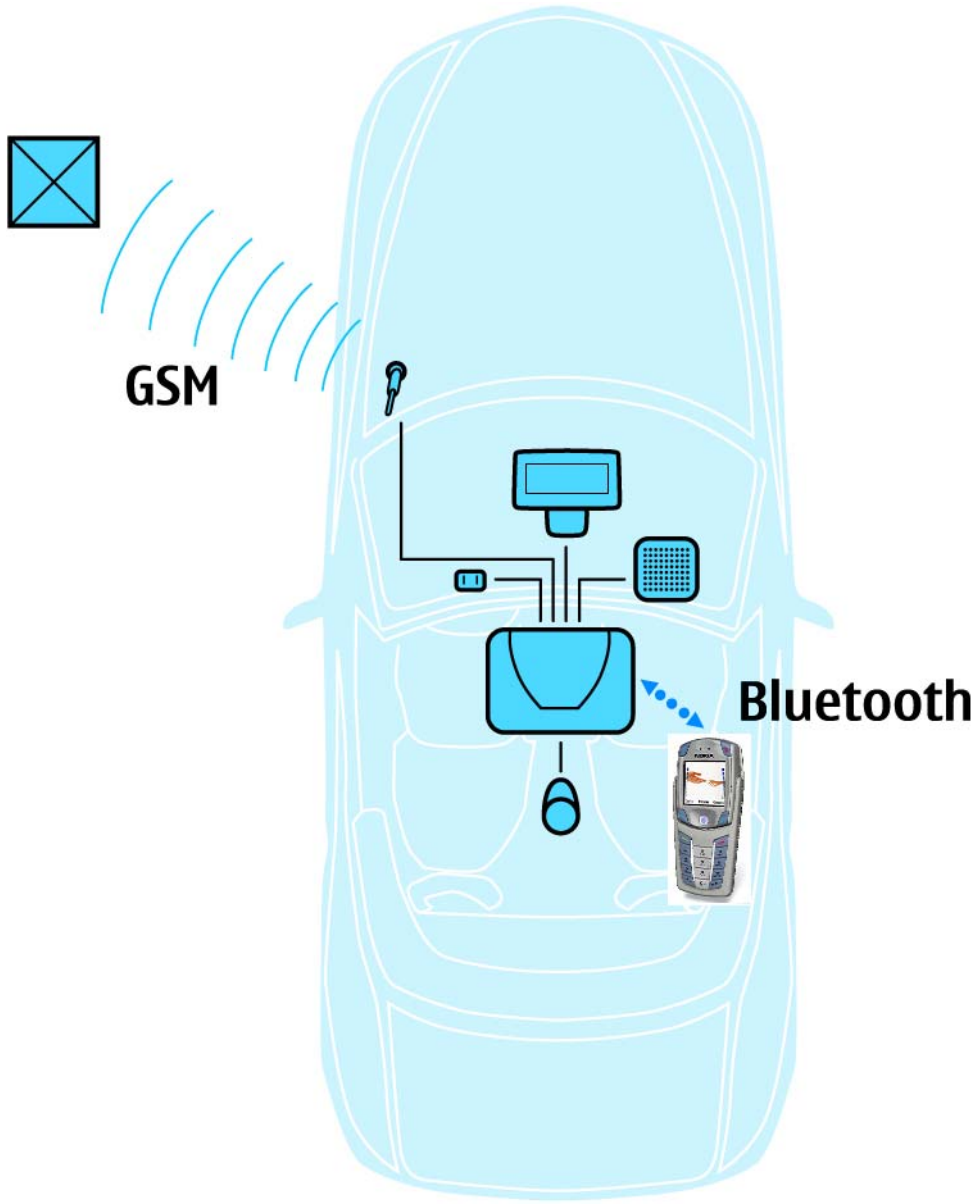
Overall Manual Contents

Nokia Customer Care
Nokia 610 & 616 CarKit Phone (TFE-4/RV-1)

1 - General Information



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Abbreviations

ASIC	Application Specific Integrated Circuit
BT	Bluetooth
DU	Display Unit (SU-11/21)
EB	Engine Board (TF4)
GPRS	General Packet Radio System
HD	Headset
HF	Hands Free
HW	Hardware
ID	Input Device
I/f	Interface
JB	Junction Board (TF5)
PWB	Printed Wired Board
RU	Radio Unit (TFE-4/RV-1)
SIM	Subscriber Identity Module
SW	Software
UI	User Interface

The Product

The TFE-4/RV-1 system is a fully functional car phone that depending on the user's mobile phone capabilities can operate in the following modes:

- As a fully functional car phone accessing the SIM card of a compatible Bluetooth phone using Bluetooth SIM Access Profile, provides the full feature set.
- As a fully functional car phone accessing the SIM card in the Radio Unit of the system, provides the full feature set.
- As a fully functional car kit accessing a compatible mobile phone using Bluetooth Handsfree Profile. However, this offers a reduced feature set.

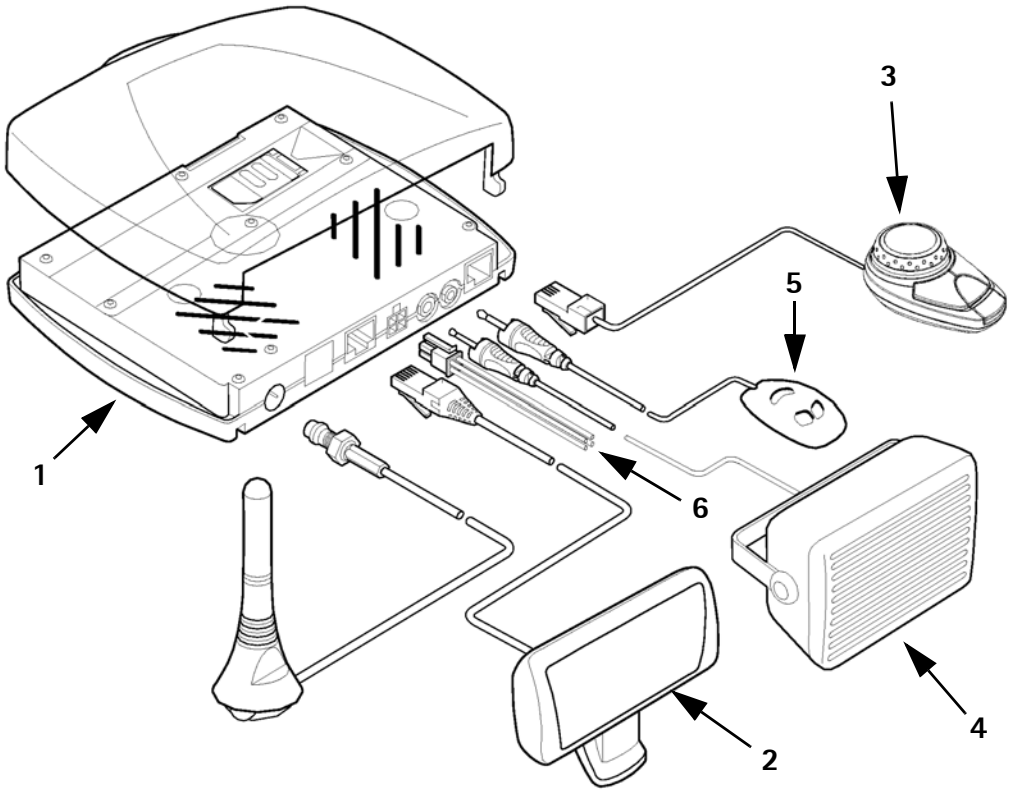

Figure 1: Radio Unit TFE-4

Product Features

(1) Radio Unit TFE-4/RV-1

- Car phone (E)GSM 900 / 1800
- External antenna interface
- Bluetooth (BT)
- CSD, HSCSD, GPRS support via BT I/f
- 12V power supply from car battery
- Ignition sense interface
- Car radio mute interface
- BT SIM Access Profile and BT Handsfree Profile
- Internal SIM reader
- User guided system set up

(2) Display Unit SU-11/21

- Monochrome display with 84 x 24 pixel resolution plus 1 status line with fixed icons
- Active display area 54.7 x 18.7 mm
- Height of capital letter: up to 14 pixel (8.45 mm) SU-11, 9 pixel (5.43 mm) SU-21
- Flexible installation possibilities due to ball joint fixation
- User adjustable background lighting

(3) Input Device CUW-3

- 4 function keys: send, voice activation, end/back/clear, mode switch buttons
- Turn/push wheel for left/right scrolling and menu/select function

Call and message handling

- Voice dialing (SDND), 12 names per user (2x)
- Voice commands (shortcuts to predefined applications, e.g. connect BT headset), 3 commands per user (2x)
- Call from phonebook/last dialed list/call registers
- Favorite list dialing (trained name tags)
- Number dialing
- Accept/reject incoming call
- Ring tone + speaker volume adjustment
- Read SMS
- Write SMS (with HSU-4 Handset only)
- Send predefined SMS templates
- Voice call back to SMS sender
- Audio routing to headset (BT/headset) for privacy mode
- Silent mode

Voice recording

- Record and playback voice memos/notes
- Easy tracking and replay of up to 10 voice memos

List of Units and Modules

Table 1: Units and Modules

Fig.1 Item	Name of unit/module	Type code	Material code 610	Material code 616	Notes
Nokia 610 / 616 CarKit Phone Sales Pack		(TFE-4)	0051904	--------	Basic E&A incl. France, Czech, Slovak, SA and Poland.
			0051903	--------	Ukraine.
			0051901	--------	Russia.
			0051902	--------	Australia
			0086220	--------	Turkey.
			0086407	--------	New Zealand.
		(RV-1)	--------	0518085	Basic E&A incl. France, Czech, Slovak, SA and Poland.
			--------	0520450	Turkey.
			--------	0520451	Russia.
			--------	0520452	Ukraine.
			--------	0520454	APAC/Australia.
			--------	0520455	APAC/New Zealand
(1)	Radio Unit	TFE-4	0514206	--------	Basic E&A
			0514203	--------	Turkey and Ukraine
			0514205	--------	Russia and Poland
			0514204	--------	Australia and New Zealand
		RV-1	--------	0518084	
	Engine Board	TF4	0201914		
	Junction Board	TF5	0051905	0201916	
	Mechanics assembly parts	TFE-4	0262837		TFE-4 RU assembly module
(3)	Input Device	CUW-3	0650058		
(2)	Display Unit	SU-11	0650075	--------	Language pack A
			0650076	--------	Language pack B
			0700112	--------	Language pack C (Orange)
		SU-21A	--------	0700119	Language pack A
		SU-21B	--------	0700720	Language pack B
		SU-21C	--------	0700721	Language pack C
		SU-21D	--------	0700124	Language pack D
	Variant independent				
(4)	Handsfree Loudspeaker	SP-2	0692013		
(5)	Handsfree Microphone	HFM-8	0690016		
(6)	Power Cable	PCU-4	0630478		
	Mounting plate	MKE-1	0260076		For RU and handset
	Compatible Enhancements				
•	Car Handset	HSU4	For privacy calls and SMS writing		
•	Wireless Headset	HDW-2	For privacy calls		
•	Wireless Headset	HS-11W	For privacy calls		
•	Wireless Clip-on Headset	HS-3W	For privacy calls		
•	Wireless Clip-on Headset	HS-21W	For privacy calls		
•	Wireless Boom Headset	HS-4W	For privacy calls		
•	Wireless Image Headset	HS-13W	For privacy calls		

Interconnection Diagram

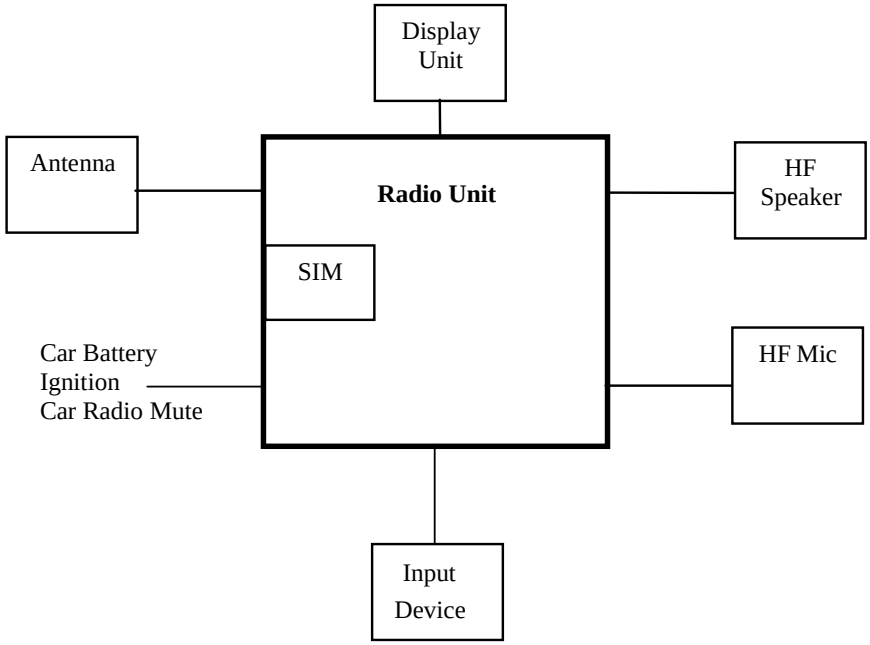

Figure 2: Interconnection Diagram

System Characteristics

Table 2: General RF Specifications

Parameter	Unit
Cellular System	EGSM900, DCS1800
RX Frequency Band	EGSM: 925 - 960 MHz DCS1800: 1805 - 1880 MHz
TX Frequency Band	EGSM: 880 - 915 MHz DCS1800: 1710 - 1785 MHz
Output Power	EGSM900: +5 ...+33 dBm / 3.2 mW ... 2 W DCS1800: +0 ...+30 dBm / 1.0 mW ... 1 W
Number of RF Channels	EGSM: 174 DCS1800: 374
Channel Spacing	200 kHz
Number of TX Power Levels	EGSM900: 15 DCS1800: 16
Typical receiver sensitivity, static channel	-106 dBm, EGSM900 TCH/FS at 2%BER -106 dBm, DCS1800 TCH/FS at 2%BER
Frequency Error, Static Channel	< 0.1 ppm
RMS Phase Error	< 5.0 ^{o}
Peak Phase Error	< 20.0 ^{o}

Mechanical Characteristics

Table 3: Mechanical Characteristics

Unit	Type Code	Dimensions (mm) (W x H x D)	Weight
Engine Board Size	TF4	43 x 126 x 9.2	********
Junction Board Size	TF5	98.6 x 128 x 15	********
Radio Unit	TFE-4/RV-1	140 x 106 x 41	305 g
Input Device	CUW-3	56 x 35 x 24	16.7 g w/o cable
Display Unit	XDW-1R SU-11	79 x 64 x 44 73 x 57 x 30	NA 45.5 g w/o cable
Handsfree Speaker	SP-2	86 x 85 x 60	238 g w/cable
Handsfree Microphone	HFM-8	43 x 24 x 13	37 g w/cable

Electrical Characteristics

Table 4: Supply Voltage

Line Symbol	Parameter	Type	Min.	Typical / Nominal	Max.	Unit / Notes
VBAT	Input from a car battery	Power In	10.8 9	13.5	16 16 27	V DC (full functionality) V DC (reduced functionality) V DC (not working max DC)
					1.5 1	A DC (working) mA DC (sleep mode)

Table 5: Power Consumption

Condition	Current
Active (call)	< 1.5 A
Standbye	< 300 mA
Off	< 1 mA

External Signals and Connections

Table 6: List of external connectors

Connector Name	Conn.	Manufacturer	NMP code / Notes
TFE-4, N610			
GSM antenna connector	X209	CONN_ANT_3412	SM ANT CONN RF FME 50R 400V 3GHZ
Display Unit connector	X103	CON_SS_641010_NF_K	Modular Jack 10POL 90deg UNSH
Car connector	X104	Molex 43045-0421	Micro-Fit 3.0 2x2
Speaker connector	X105	SMK LGY2501-0500E	3.5 mm jack
Microphone connector	X106	SMK LGK2509-0600E	2.5 mm jack
Input device	X107	CON_SS_641010_NF_K	Modular Jack 10POL +K2 Key 1.5A 90deg
RV-1, N616			
GSM antenna connector	X101	IMS 3412.72.1610.001	Antenna connector FME
RS232 Interface	X102	Stewart SS-641010-NF-K1	Modular connector RJ-45 K1
Display Unit connector	X103	Stewart SS-641010-A-NF-RMK4	Modular connector RJ-45 RMK4

Table 6: List of external connectors

Connector Name	Conn.	Manufacturer	NMP code / Notes
Car connector	X104	Molex 43045-0421	Micro-Fit 3.0 2x2
Speaker connector	X105	SMK LGY2501-0500E	3.5 mm jack
Microphone connector	X106	SMK LGK2509-0600E	2.5 mm jack
Input device, Handset and Headset connector	X107	Stewart SS-641010-NF-K2	Modular connector RJ-45 K2

Environmental Conditions

The transceiver is not protected against ingress of water. The transceiver may be instantaneously subjected to splashed or condensed water. Longer-term contact with water will cause permanent damage.

Vibration

Table 7: Temperature ranges

Parameter	Requirement	Test Reference	Duration	Acceptance Criteria
Vibration (random) Operational	10Hz-7m^2/s^3 50Hz-3,5m^2/s^3 60Hz-1,75m^2/s^3 1000Hz-0,06m^2/s^3 combined with gradual change of temperature 1 cycle during 8h	DIN 72300-3 (draft) Env.Hdbk. 4A: Climatic and Mechanics IEC 68-2-64	8h/axis	Normal Performance or Reduced performance
Bump Operational	halfsine 6ms 25g	IEC68-2-29 Eb Env.Hdbk. 4A: Climatic and Mechanics	1000 shocks per 6 directions	Normal Performance
Shock Non-operational	halfsine 6ms 100g	IEC68-2-27	3 shocks per 6 directions	Normal Performance

Temperature

Table 8: Temperature ranges

Condition	Temperature range	Notes
Normal Operation	-10°C to +55°C	Specifications fulfilled
Reduced Operation	-20°C to +70°C	Operational only for short periods.
Intermittent Operation	-30°C to +80°C	Operation not guaranteed but an attempt to operate will not damage the phone.
Storage	-30°C to +80°C	Non operational, 72 h

2 - Parts List & Layouts

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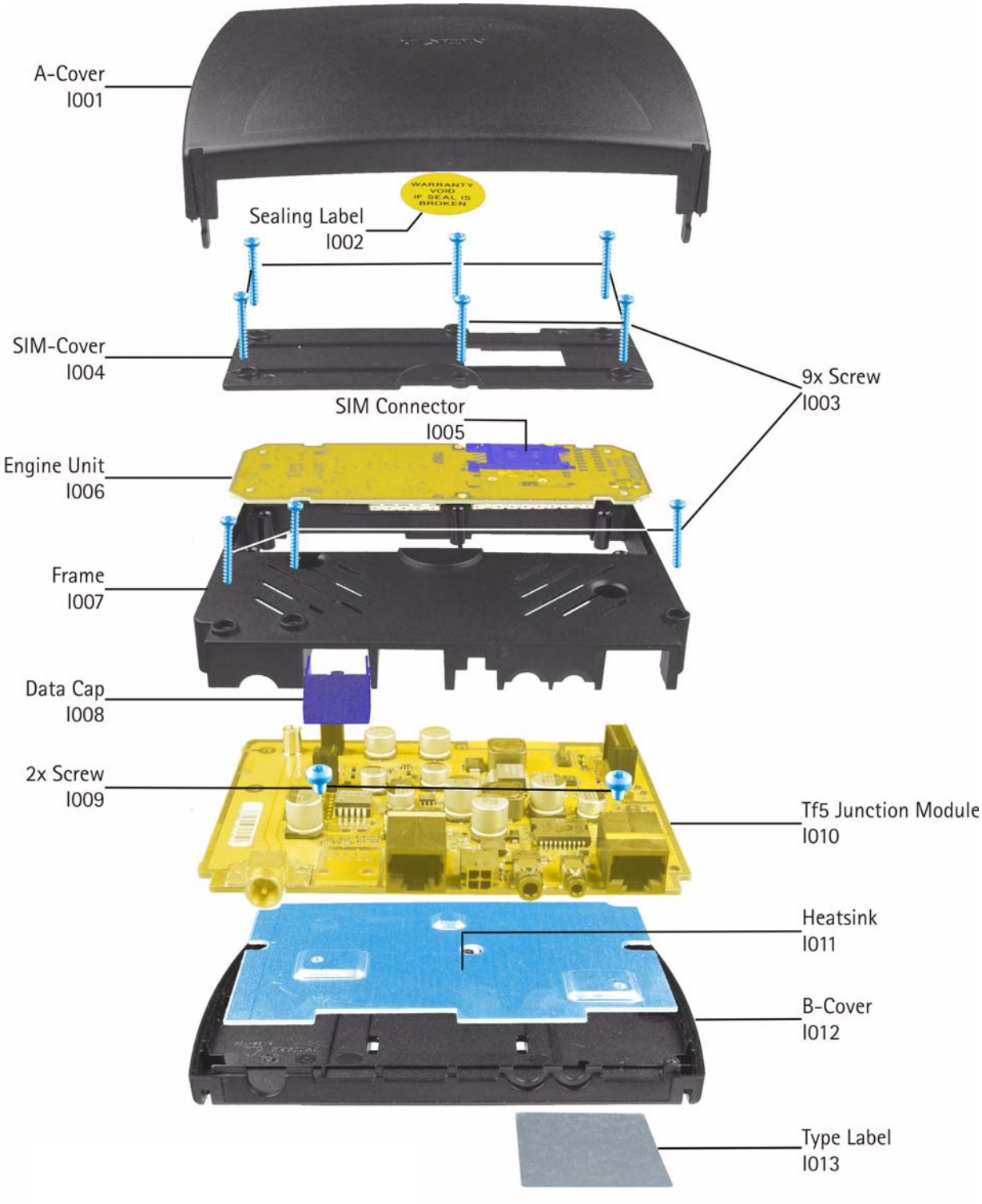
Exploded view of TFE-4 Radio Unit



Assembly Parts List

Item	Qty	Description
I001	1	'A' Cover
I002	1	Warranty Sealing label
I003	9	Screw 2.5 dia. x 20
I004	1	SIM Cover
I005	1	Spring SIM Connector (not illustrated)
I006	1	Engine Unit (TF4 Module (EB))
I007	1	Frame
I008	1	Data Cap
I009	2	Screw 3 dia. x 5 T10
I010	1	Junction Module (TF5 Module (JB))
I011	1	Heatsink
I012	1	'B' Cover
I013	1	Type Label

Parts List for TF4 Module (EB)

PWB Components (tf4-07a)

Item	Location Side, Grid ref			Description and value				Type
A800	Top	D	5	PA-SHIELD ASSY DMC02107 HDA13	~	~	~	SHIELD_DMC02107
B200	Top	P	3	CRYSTAL 32.768KHZ+-30PPM 9PF	32.768kHz	~	~	CRYSTAL_CX_4V
B601	Top	J	8	CRYSTAL 26.0MHZ+-8PPM CL=15.5	26MHz	~	~	CRYSTAL_TSX_8A
C102	Top	Y	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C104	Top	T	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C105	Top	Y	3	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C106	Top	X	3	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C107	Top	Y	4	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C108	Top	Y	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C109	Top	Y	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C110	Top	T	2	Chipcap X7R 10% 50V	1n0	50V	normal,-10%,10%	0402C
C118	Top	V	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C119	Top	W	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C120	Top	W	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C121	Top	W	7	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C122	Top	Y	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C148	Top	N	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C149	Top	N	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C

Item	Location Side, Grid ref			Description and value				Type
C150	Top	W	5	CHIP ARRAY NP0	2x27p	25V	normal,-10%,10%	0405_2_P0.65
C151	Top	U	4	CHIP ARRAY NP0	2x27p	25V	normal,-10%,10%	0405_2_P0.65
C153	Top	U	3	CHIP ARRAY NP0	2x27p	25V	normal,-10%,10%	0405_2_P0.65
C154	Top	U	3	CHIP ARRAY X5R	2x100n	10V	normal,-20%,20%	0405_2_P0.65_AVX
C156	Top	U	3	CHIP ARRAY X5R	2x10n	16V	normal,-10%,10%	0405_2_P0.65_AVX
C159	Top	U	3	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C163	Top	U	2	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C164	Top	T	4	CHIP ARRAY X5R	2x100n	10V	normal,-20%,20%	0405_2_P0.65_AVX
C165	Top	U	3	CHIP ARRAY X5R	2x100n	10V	normal,-20%,20%	0405_2_P0.65_AVX
C166	Top	U	3	CHIP ARRAY X5R	2x33n	10V	normal,-10%,10%	0405_2_P0.65_AVX
C167	Top	V	3	Chipcap X7R 10% 50V	1n0	50V	normal,-10%,10%	0402C
C172	Top	V	3	Chipcap X7R 10% 50V	1n0	50V	normal,-10%,10%	0402C
C182	Top	P	3	CHIP ARRAY X5R	2x100n	10V	normal,-20%,20%	0405_2_P0.65_AVX
C200	Top	P	5	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C201	Top	R	5	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C202	Top	R	5	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C207	Top	N	3	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C208	Top	P	5	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C209	Top	P	2	Chipcap +-0.25pF NP0	5p6	50V	normal,-0.25pF,0.25pF	0402C
C210	Top	P	3	Chipcap +-0.25pF NP0	5p6	50V	normal,-0.25pF,0.25pF	0402C
C218	Top	N	3	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C220	Top	N	3	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C236	Top	N	6	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C237	Top	N	6	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C238	Top	P	5	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C239	Top	O	3	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C240	Top	N	3	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C241	Top	O	2	Chipcap X7R	1n0	50V	normal,-10%,10%	0402C
C242	Top	N	3	Chipcap X7R	1n0	50V	normal,-20%,20%	0402C
C260	Top	Q	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C261	Top	Q	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C262	Top	R	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C263	Top	R	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C264	Top	Q	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C265	Top	R	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C274	Top	O	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C275	Top	P	4	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C276	Top	P	4	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C277	Top	O	3	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C278	Top	O	3	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C

Item	Location Side, Grid ref			Description and value				Type
C279	Top	P	5	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C280	Top	P	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C281	Top	P	5	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C282	Top	O	3	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C283	Top	P	2	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C284	Top	P	3	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C285	Top	O	6	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C286	Top	N	6	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C287	Top	N	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C288	Top	N	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C289	Top	O	6	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C290	Top	P	6	CHIPCAP X5R	1u0	10V	normal,-10%,10%	0603C_H0.95
C291	Top	O	6	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C292	Top	P	6	CHIPCAP X5R	1u0	10V	normal,-10%,10%	0603C_H0.95
C293	Top	P	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C294	Top	O	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C295	Top	N	6	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C296	Top	O	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C297	Top	N	6	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C298	Top	O	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C299	Top	N	7	CHIPCAP X5R	1u0	6.3V	normal,-10%,10%	0603C
C306	Top	F	1	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C307	Top	F	1	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C308	Top	G	1	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C309	Top	G	9	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C310	Top	F	9	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C311	Top	F	9	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C312	Top	G	1	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C313	Top	G	9	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C390	Top	U	5	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C400	Top	P	7	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C401	Top	Q	5	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C402	Top	R	5	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C403	Top	Q	5	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C404	Top	R	5	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C405	Top	R	8	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C420	Top	L	5	Chipcap 5% NP0	12p	50V	normal,-5%,5%	0402C
C450	Top	U	6	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C451	Top	U	6	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C454	Top	S	5	CHIPCAP X7R	100n	16V	normal,-10%,10%	0603_BLM

Item	Location Side, Grid ref			Description and value				Type
C602	Top	L	5	Chipcap ±0.25pF NP0	3p9	50V	normal,-0.25pF, 0.25pF	0402C
C603	Top	M	6	Chipcap X7R	1n0	50V	normal,-10%,10%	0402C
C605	Top	M	5	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C606	Top	J	8	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C607	Top	L	6	CHIPCAP X5R	3u3	6V3	normal,-10%,10%	0805C_H1.35
C610	Top	L	9	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C615	Top	I	8	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C620	Top	H	8	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C622	Top	J	5	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C623	Top	K	6	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C624	Top	J	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C625	Top	K	6	CHIPCAP X5R	1u0	10V	normal,-10%,10%	0603C_H0.95
C626	Top	J	6	Chipcap +-0.25pF NP0	5p6	50V	normal,-0.25pF, 0.25pF	0402C
C627	Top	K	5	CHIPCAP X5R	10u	6.3V	normal,-10%,10%	1206C_H1.8
C628	Top	J	7	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C629	Top	J	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C631	Top	H	6	CHIPCAP NP0	0p5	50V	normal, -0.25p, 0.25p	0402C
C632	Top	I	8	Chipcap X7R	1n0	50V	normal,-10%,10%	0402C
C633	Top	J	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C634	Top	H	7	Chipcap +-0.25pF NP0	2p2	50V	normal,-0.25pF, 0.25pF	0402C
C635	Top	J	7	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C636	Top	J	8	Chipcap X7R	10n	16V	normal,-10%,10%	0402C
C639	Top	C	5	Chipcap 5% NP0	47p	50V	normal,-5%,5%	0402C
C701	Top	B	5	Chipcap 5% NP0	15p	50V	normal,-5%,5%	0402C
C703	Top	B	3	Chipcap X7R	1n0	50V	normal,-10%,10%	0402C
C704	Top	K	7	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C705	Top	K	8	Chipcap 5% NP0	15p	50V	normal,-5%,5%	0402C
C706	Top	J	6	Chipcap 5% NP0	68p	50V	normal,-5%,5%	0402C
C707	Top	J	6	CHIPCAP NP0	2n2	16V	normal,-5%,5%	0603C
C709	Top	M	7	CHIPCAP NP0	180p	25V	normal,-5%,5%	0402C
C710	Top	J	6	CHIPCAP NP0	180p	25V	normal,-5%,5%	0402C
C711	Top	L	7	CHIPCAP NP0	3n9	25V	normal,-5%,5%	0805C_AVX
C712	Top	M	7	CHIPCAP NP0	180p	25V	normal,-5%,5%	0402C
C715	Top	L	6	Chipcap 5% NP0	68p	50V	normal,-5%,5%	0402C
C716	Top	L	6	Chipcap 5% NP0	68p	50V	normal,-5%,5%	0402C
C717	Top	L	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C718	Top	L	6	Chipcap X7R	1n0	50V	normal,-10%,10%	0402C
C721	Top	H	5	Chipcap X7R	1n0	50V	normal,-10%,10%	0402C
C722	Top	H	5	Chipcap 5% NP0	15p	50V	normal,-5%,5%	0402C
C731	Top	I	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C

Item	Location Side, Grid ref			Description and value				Type
C733	Top	I	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C734	Top	I	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C740	Top	K	8	CHIPCAP X5R	3u3	6V3	normal,-10%,10%	0805C_H1.35
C741	Top	M	9	Chipcap +-0.25pF NP0	5p6	50V	normal,-0.25pF, 0.25pF	0402C
C803	Top	D	3	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C804	Top	D	3	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C805	Top	J	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C807	Top	D	6	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C812	Top	D	6	CHIPCAP X5R	1u0	10V	normal,-10%,10%	0603C_H0.95
C813	Top	E	4	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C815	Top	C	6	CHIPTCAP 33U M 16V 6.0X3.2X1.5	33u	16V	normal,-20%,20%	TANT_TPSW2
C816	Top	F	3	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C818	Top	H	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C820	Top	G	4	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C821	Top	G	5	Chipcap +-0.25pF NP0	1p8	50V	normal,-0.25pF,0.25pF	0402C
C822	Top	H	5	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
C823	Top	C	5	CHIPCAP NP0	1p0	50V	normal,-0.1p,0.1p	0402C
C824	Top	H	5	Chipcap +-0.25pF NP0	3p9	50V	normal,-0.25pF,0.25pF	0402C
C825	Top	E	3	CHIPCAP X5R	100n	10V	normal,-10%,10%	0402C
C826	Top	C	5	Chipcap +-0.25pF NP0	8p2	50V	normal,-0.25pF,0.25pF	0402C
C871	Top	I	8	Chipcap 5% NP0	27p	50V	normal,-5%,5%	0402C
D200	Top	O	4	UEM V4.4 W-DOG ENA TO09H TFBGA168	~	~	~	uBGA168
D400	Top	R	7	UPP8M V1.1 F741987A C05 UBGA144	~	~	~	uBGA144_CC
D450	Top	U	7	FLASH 4MX16 1V8/1V8 VTFBGA44	4Mx16	~	~	uBGA40_64MB_4
G701	Top	L	8	VCO 3420-3980MHZ 2.7V 19MA	3420-3980MHz	~	~	VCO_FDK_IT_H1.7
L132	Top	N	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L133	Top	N	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L150	Top	V	3	CHIP BEAD ARRAY	2x1000R/ 100MHz	~	-	0405_2_MATSU
L168	Top	V	2	CHIP BEAD ARRAY	2x1000R/ 100MHz	~	-	0405_2_MATSU
L260	Top	Q	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L261	Top	Q	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L262	Top	R	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L263	Top	R	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L264	Top	Q	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L265	Top	R	2	FERRITE BEAD 0R5	600R/100MHz	~	~	0603_BLM
L603	Top	H	6	CHIP COIL 3N9 +-0N3 Q28/800M	3n9H	~	normal,-0n3,+0n3	0402L
L604	Top	H	6	CHIP COIL 3N9 +-0N3 Q28/800M	3n9H	~	normal,-0n3,+0n3	0402L

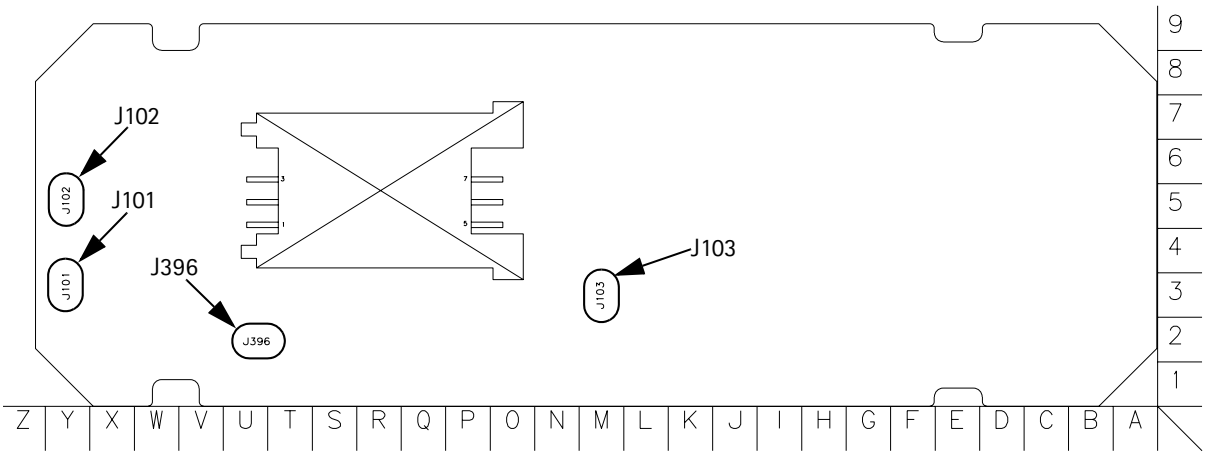
Item	Location Side, Grid ref			Description and value				Type
L606	Top	H	7	CHIP COIL 8N2 J Q28/800MHZ	8n2H	~	normal,-5%,+5%	0402L
L607	Top	H	7	CHIP COIL 8N2 J Q28/800MHZ	8n2H	~	normal,-5%,+5%	0402L
L608	Top	B	5	CHIP COIL 33N J Q7/100MHZ	33nH	~	normal,-5%,+5%	0402_ELJRF
L701	Top	K	7	CHIP COIL 33N J Q7/100MHZ	33nH	~	normal,-5%,+5%	0402_ELJRF
L702	Top	K	8	CHIP COIL 33N J Q7/100MHZ	33nH	~	normal,-5%,+5%	0402_ELJRF
L703	Top	K	7	CHIP COIL 33N J Q7/100MHZ	33nH	~	normal,-5%,+5%	0402_ELJRF
L705	Top	H	6	CHIP COIL 3N3 +-0N3 Q28/800M	3n3H	~	normal,-0n3,+0n3%	0402L
L706	Top	I	6	CHIP COIL 15N J Q30/800M	15nH	~	normal,-5%,5%	0402L
L707	Top	I	6	CHIP COIL 18N J Q29/800M	18nH	~	normal,-5%,5%	0402L
L708	Top	I	6	CHIP COIL 18N J Q29/800M	18nH	~	normal,-5%,5%	0402L
L710	Top	G	6	CHIP COIL 10N J Q30/800M	10nH	~	normal,-5%,5%	0402L
L711	Top	I	5	CHIP COIL 15N J Q30/800M	15nH	~	normal,-5%,5%	0402L
L712	Top	G	5	CHIP COIL 3N9 +-0N3 Q28/800M	3n9H	~	normal,-0n3,+0n3	0402L
L801	Top	C	4	DIR.COUP 897.5/1747.5/1880MHZ	897.5/1747.5/ 1880M	~	~	COUPLER_LDC15D
L805	Top	E	3	FERRITE BEAD 42R/100MHZ	42R/100MHz	~	~	0805_FERRITE
L806	Top	G	5	CHIP COIL 10N J Q30/800M	10nH	~	normal,-5%,5%	0402L
L807	Top	H	5	CHIP COIL 5N6 +-0N3 Q28/800M	5n6H	~	normal,-0n3,+0n3	0402L
L808	Top	C	5	CHIP COIL 5N6 +-0N3 Q28/800M	5n6H	~	normal,-0n3,+0n3	0402L
N601	Top	I	7	MJOELNER RF ASIC S2006 LFBGA80	~	~	~	LFBGA_80
N801	Top	E	5	PW AMP PF08125B GSM900/1800/ 1900	~	~	~	PW_AMP_PA_HDE13A
R100	Top	T	5	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R101	Top	Y	3	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R102	Top	X	3	Resistor 5% 63mW	220k	~	normal,-5%,5%	0402R
R103	Top	T	5	CHIP VARISTOR VWM14V VC50V	14V/50V	~	-	0402_VAR
R104	Top	X	3	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R105	Top	W	5	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R106	Top	W	6	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R107	Top	W	7	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R108	Top	W	7	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R109	Top	Y	7	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R110	Top	Y	6	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R111	Top	Y	5	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R112	Top	Y	4	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R114	Top	T	3	Resistor 5% 63mW	27k	~	normal,-5%,5%	0402R
R115	Top	T	3	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R132	Top	N	7	Chipres 0W06 jumper	0R	~	normal,-,-	0402R
R151	Top	U	3	RES NETWORK 0W06	2x1k0	~	normal,-5%,5%	0404_R_SR
R152	Top	U	2	RES NETWORK 0W06	2x1k0	~	normal,-5%,5%	0404_R_SR

Item	Location Side, Grid ref			Description and value				Type
R154	Top	Q	3	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R165	Top	Q	4	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R166	Top	T	4	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R167	Top	U	3	RES NETWORK 0W06	2x1k0	10V	normal,-20%,20%	0404_R_SR
R182	Top	U	4	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R200	Top	Q	5	CHIPRES 0W5 0R22 J 1210	0R22	~	normal,-5%,5%	1210_R
R202	Top	N	3	RES NETWORK 0W03 4X100K J 0804	4x100k	~	~	EXB28V
R220	Top	N	3	Resistor 5% 63mW	4k7	~	normal,-5%,5%	0402R
R240	Top	N	3	Resistor 5% 63mW	4k7	~	normal,-5%,5%	0402R
R305	Top	N	3	Resistor 5% 63mW	100k	~	normal,-5%,5%	0402R
R306	Top	P	7	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R307	Top	P	8	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R308	Top	F	1	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R309	Top	F	8	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R310	Top	P	8	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R311	Top	P	8	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R312	Top	G	1	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R313	Top	G	8	RES NETWORK 0W06	2x47R	~	normal,-5%,5%	0404_R_SR
R314	Top	P	4	Resistor 5% 63mW	220k	~	normal,-5%,5%	0402R
R386	Top	P	4	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R387	Top	Q	4	CHIP VARISTOR VW14V VC50V	14V/50V	~	-	0402_VAR
R388	Top	S	4	ASIP EMIF03-SIM01 SIM FILTER BGA8	~	~	~	uBGA8
R390	Top	P	4	Resistor 5% 63mW	100k	~	normal,-5%,5%	0402R
R420	Top	L	5	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R422	Top	N	6	Resistor 5% 63mW	27k	~	normal,-5%,5%	0402R
R424	Top	O	9	Resistor 5% 63mW	220k	~	normal,-5%,5%	0402R
R450	Top	S	5	Resistor 5% 63mW	4k7	~	normal,-5%,5%	0402R
R483	Top	W	5	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R484	Top	W	5	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R485	Top	V	5	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R486	Top	W	3	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R487	Top	W	2	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R488	Top	W	2	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R601	Top	L	5	Resistor 5% 63mW	1k5	~	normal,-5%,5%	0402R
R602	Top	L	5	Resistor 5% 63mW	33k	~	normal,-5%,5%	0402R
R603	Top	L	5	Resistor 5% 63mW	15k	~	normal,-5%,5%	0402R
R610	Top	M	5	Resistor 5% 63mW	10R	~	normal,-5%,5%	0402R
R612	Top	I	8	Resistor 5% 63mW	1k0	~	normal,-5%,5%	0402R
R617	Top	J	8	Resistor 5% 63mW	22R	~	normal,-5%,5%	0402R

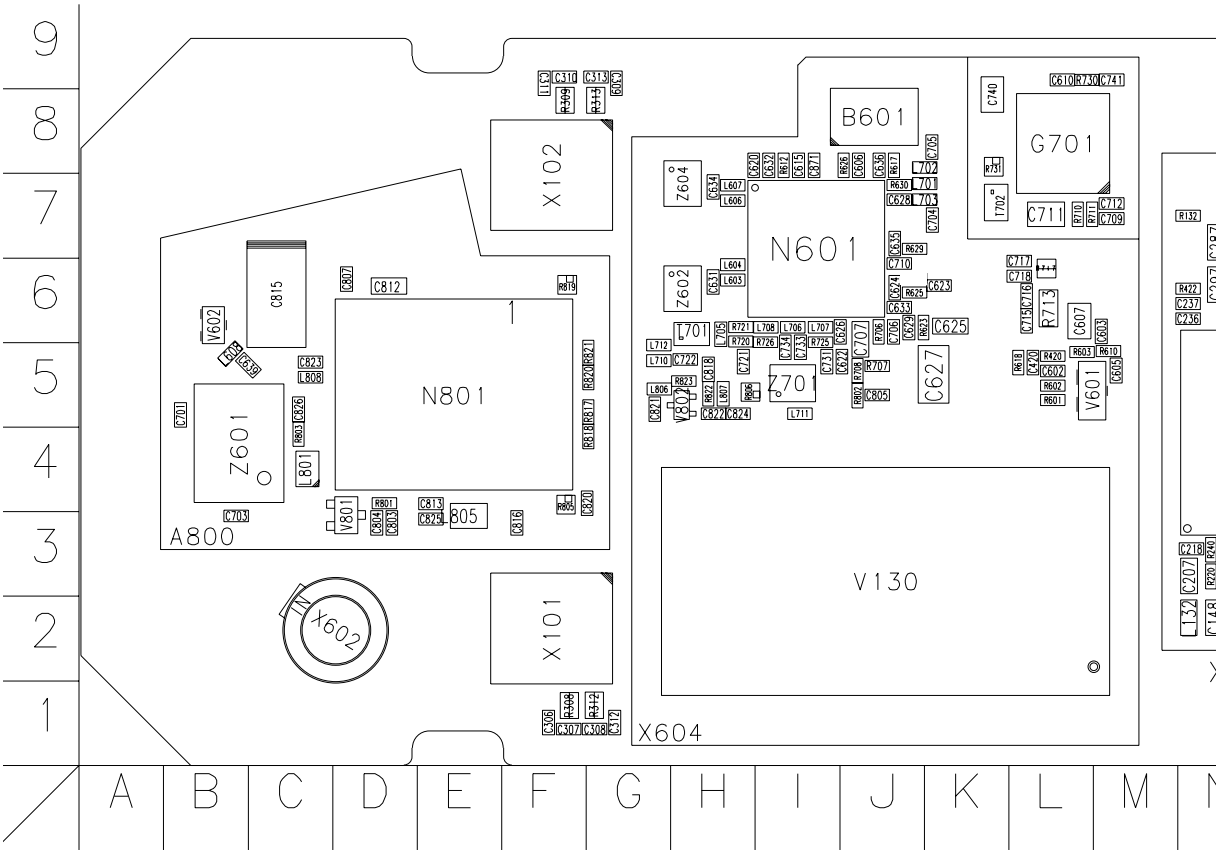
Item	Location Side, Grid ref			Description and value				Type
R618	Top	L	5	Resistor 5% 63mW	560R	~	normal,-5%,5%	0402R
R623	Top	J	6	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R625	Top	J	6	Resistor 5% 63mW	47R	~	normal,-5%,5%	0402R
R626	Top	J	8	Resistor 1% 63mW	2k7	~	normal,-1%,1%	0402R
R629	Top	J	7	Chipres 0W06 5R6 J	5R6	~	normal,-5%,5%	0402R
R630	Top	J	7	Resistor 5% 63mW	330R	~	normal,-5%,5%	0402R
R706	Top	J	6	Resistor 5% 63mW	33k	~	normal,-5%,5%	0402R
R707	Top	J	5	Resistor 5% 63mW	15k	~	normal,-5%,5%	0402R
R708	Top	J	5	Resistor 5% 63mW	4k7	~	normal,-5%,5%	0402R
R710	Top	L	7	CHIPRES 0W06 5K6 F	5k6	~	normal,-1%,1%	0402R
R711	Top	L	7	Resistor 5% 63mW	8k2	~	normal,-5%,5%	0402R
R713	Top	L	6	RES NETWORK 0W06	4x5.6k	~	normal,-5%,5%	MNR04
R717	Top	L	6	RES NETWORK 0W06	2x2k2	~	normal,-5%,5%	MNR02_SR
R720	Top	H	6	Resistor 5% 63mW	82R	~	normal,-5%,5%	0402R
R721	Top	H	6	Resistor 5% 63mW	82R	~	normal,-5%,5%	0402R
R725	Top	I	6	Resistor 5% 63mW	120R	~	normal,-5%,5%	0402R
R726	Top	I	6	Resistor 5% 63mW	120R	~	normal,-5%,5%	0402R
R730	Top	L	9	Chipres 0W06 5R6 J 0402	5R6	~	normal,-5%,5%	0402R
R731	Top	K	8	RES NETWORK 0W04 3DB ATT	292R/17R6/ 292R	~	~	0404_RAC10
R801	Top	D	4	Resistor 5% 63mW	4k7	~	normal,-5%,5%	0402R
R802	Top	J	5	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R803	Top	C	4	Resistor 5% 63mW	47R	~	normal,-5%,5%	0402R
R805	Top	F	4	RES NETWORK 0W04 5DB ATT	178R5/30R4/ 178R5	~	~	0404_RAC10
R806	Top	H	5	RES NETWORK 0W04 3DB ATT	292R/17R6/ 292R	~	~	0404_RAC10
R817	Top	G	5	Resistor 5% 63mW	1k0	~	normal,-5%,5%	0402R
R818	Top	G	4	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R819	Top	F	6	RES NETWORK 0W04 3DB ATT	292R/17R6/ 292R	~	~	0404_RAC10
R820	Top	G	5	Resistor 5% 63mW	1k0	~	normal,-5%,5%	0402R
R821	Top	G	5	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R822	Top	H	5	Resistor 5% 63mW	3k9	~	normal,-5%,5%	0402R
R823	Top	H	5	Resistor 5% 63mW	180R	~	normal,-5%,5%	0402R
T701	Top	H	6	TRANSF BALUN 1800+-100MHZ 2X1.25	~	~	~	TRANS_LDB213
T702	Top	K	7	BALUN TRANS 3.7GHZ+/-300MHZ 0805	~	~	~	TRANS_LDB15
V100	Top	Y	4	ZDIX4 TVS/ESD RSA6.1EN 6V1 SOT353	~	~	~	SOT323_5L

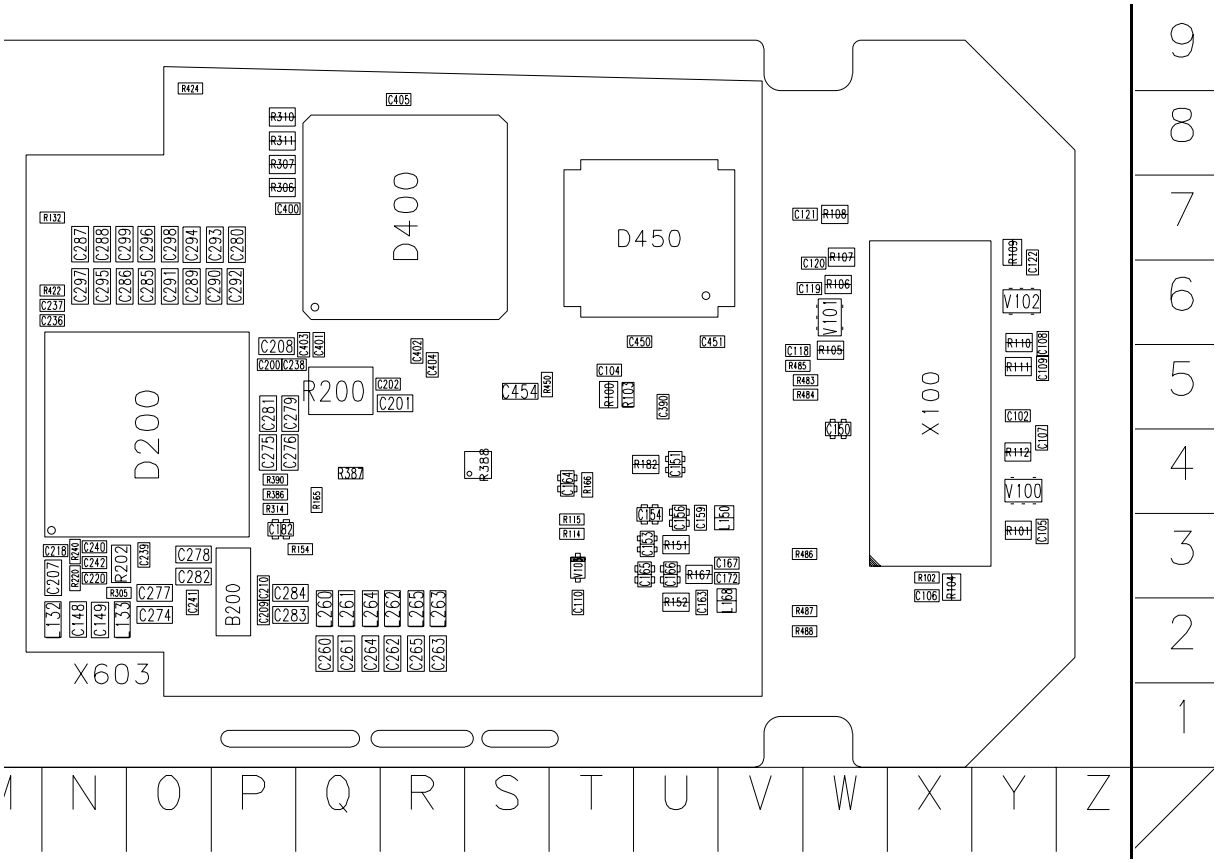
Item	Location Side, Grid ref			Description and value				Type
V101	Top	W	6	ZDIX4 TVS/ESD RSA6.1EN 6V1 SOT353	~	~	~	SOT323_5L
V102	Top	Y	6	ZDIX4 TVS/ESD RSA6.1EN 6V1 SOT353	~	~	~	SOT323_5L
V103	Top	T	3	SCH DI RB521S-30 200MA 35V SOD523	~	~	~	EMD2
V130	Top	J	3	BLUETOOTH LRB-2 MCM PHONE 26X13X2	~	~	~	BT102_X_BLUETOOTH
V601	Top	L	5	Tr NPN 30V 100mA 100MHz SOT323	~	~	~	SOT323_23
V602	Top	B	6	PINDIX2 BAR63-04W 50V 3GHZ SOT323	~	~	~	SOT323
V801	Top	D	3	SCH DIX2 HSMS282C 15V <1PF SOT323	~	~	~	SOT323
V802	Top	H	5	TR NE68119 ***RESERVED HDB12***	~	~	~	SC75
X387	Bot	R	5	Spring Switch SIM CONN 2x2POL	~	~	~	SK_200100693300
X602	Top	D	2	SM COAX CONN M SW 50R 0.4-2GHZ	~	~	~	COAX_SWITCH
X603	Top	R	5	~	~	~	~	FRAME_7_LOIS
X604	Top	J	5	~	~	~	~	FRAME_6_LOIS
Z601	Top	B	4	ANT.SW+3SAW 990/1800/1900MHZ 7X5.3	880-960/1710-1990MHz	~	~	ANT_SW_LM_T118S1E2
Z602	Top	H	6	SAW FILT 1842.5+-37.5MHZ 2.5X2.0	1842.5MHz	~	~	FILTER_SAW_SAFSD
Z604	Top	H	7	SAW FILT 942.5+-17.5MHZ/3.5 2.5X2	942.5MHz	~	~	FILTER_SAW_SAFSD
Z701	Top	I	5	SAW FILT 897.5+-17.5MHZ/3.5 2.5X2	897.5MHz	~	~	FILTER_SAW_SAFSD

Component layout diagram for the Bottom of the TF4



Component layout diagram for the Top of the TF4





Parts List for TF5 Module (JB)

PWB Components

Note: This table is for the N610, the N616 components are identical apart from those identified in the table that follows this one.

Item	Location Grid ref.		Description and value				Type
C107	F	11	EL. CAP. 20% 50V	100u_50V	50V	normal,-20%,20%	ELCAP_SVP_F8
C108	C	11	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C109	D	9	CHIPCAP X7R 100N K	100n	50V	normal,-20%,20%	0805C
C110	Q	17	ELCAP 470U +-20% 6V3 0R025 11.2X10.5	470u_6V3	6.3V	normal,-20%,20%	ELCAP_SVP_F8
C111	Q	14	ELCAP 470U +-20% 6V3 0R025 11.2X10.5	470u_6V3	6.3V	normal,-20%,20%	ELCAP_SVP_F8
C113	Q	10	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C115	F	13	CHIPCAP X7R 220N M	220n	50V	normal,-20%,20%	1206C_H0.95
C116	I	16	ELCAP CHIP 100u M 16V 105C 8X6.3	100u	16V	normal,20%,20%	CASE_MVK_H63
C117	N	11	Cer. cap 10%	10n	50V	normal,-10%,10%	0603C
C118	I	12	EL. CAP. 20% 50V	100u	50V	normal,-20%,20%	ELCAP_SVP_F8
C119	I	7	EL. CAP. 20% 35V	330u	35V	normal,-20%,20%	Sanyo
C120	M	11	CHIPCAP X7R 100N K	100n	50V	normal,-20%,20%	0805C
C122	F	12	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C123	L	13	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C126	J	4	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C128	H	17	CHIPCAP X7R 100N K	100n	50V	normal,-20%,20%	0805C
C129	D	9	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C130	E	13	CHIPCAP NP0 1N0 J	1n0	50V	normal,-5%,5%	0603C
C133	G	19	CHIPCAP X7R 220N M	220n	50V	normal,-20%,20%	1206C_H0.95
C134	G	21	EL. CAP. 20% 50V	100u_50V	50V	normal,-20%,20%	ELCAP_SVP_F8
C135	D	6	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C137	J	5	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C139	L	14	ELCAP CHIP 100u M 16V 105C 8X6.3	100u_16V	16V	normal,20%,20%	CASE_MVK_H63
C140	K	14	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C141	O	12	CHIPCAP NP0 1N0 J	1n0	50V	normal,-5%,5%	0603C
C142	F	16	ELCAP CHIP 100u M 16V 105C 8X6.3	100u_16V	16V	normal,20%,20%	CASE_MVK_H63
C143	L	17	ELCAP CHIP 100u M 16V 105C 8X6.3	100u_16V	16V	normal,20%,20%	CASE_MVK_H63
C145	O	15	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C146	O	17	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C147	O	16	CHIPCAP X7R 100N K	100n	50V	normal,-20%,20%	0805C
C148	F	13	CHIPCAP X7R 220N M	220n	50V	normal,-20%,20%	1206C_H0.95
C149	N	16	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C151	G	18	CHIPCAP X7R 220N M	220n	50V	normal,-20%,20%	1206C_H0.95
C153	E	13	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C154	E	12	CHIPCAP X5R 1U M 50V 1210	1u	50V	normal,-20%,20%	1210C_H2.8
C155	J	13	CHIPCAP X5R 1U M 50V 1210	1u	50V	normal,-20%,20%	1210C_H2.8

Item	Location Grid ref.		Description and value				Type
C156	E	12	CHIPCAP X7R 100N K	100n	50V	normal,-20%,20%	0805C
C157	J	14	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C158	B	11	CHIPCAP X5R 1U M 50V 1210	1u	50V	normal,-20%,20%	1210C_H2.8
C159	B	11	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C160	B	10	Cer. cap 10%	10n	50V	normal,-10%,10%	0603C
C161	L	4	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C162	H	15	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C163	G	17	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C164	B	10	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C165	H	15	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C200	C	6	CHIPCAP X5R 10U K	10u	10V	normal,-10%,10%	1206C_TDK
C201	C	7	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C202	J	3	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C203	H	2	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C204	I	3	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C205	H	2	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C206	O	4	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C207	O	4	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C208	I	3	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C209	I	3	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C210	C	7	CHIPCAP X7R 220N M	220n	50V	normal,-20%,20%	1206C_H0.95
C211	H	3	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C212	H	2	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C213	C	6	CHIPCAP NP0 1N0 J	1n0	50V	normal,-5%,5%	0603C
C214	N	4	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C215	H	3	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C216	H	3	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C217	H	2	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C218	H	3	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C219	H	1	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C220	P	4	Chipcap 5% X7R	1n5	50V	normal,-5%,5%	0402C
C221	H	7	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C222	J	1	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C223	D	8	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C224	C	8	CHIPCAP NP0 1N0 J	1n0	50V	normal,-5%,5%	0603C
C225	H	7	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C226	P	4	Chipcap 5% X7R	1n5	50V	normal,-5%,5%	0402C
C227	H	8	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C228	C	9	CHIPCAP NP0 1N0 J	1n0	50V	normal,-5%,5%	0603C
C229	D	6	CHIPCAP X5R 10U K	10u	10V	normal,-10%,10%	1206C_TDK
C230	E	5	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C

Item	Location Grid ref.		Description and value				Type
C231	F	3	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C234	G	3	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C235	E	4	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C236	F	1	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C238	C	6	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C239	C	7	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C240	J	2	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C241	J	2	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C242	N	4	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C245	J	1	CHIPCAP X5R 100N	100n	10V	normal,-10%,10%	0402C
C246	I	1	CHIPCAP X7R 33N K	33n	10V	normal,-10%,10%	0402C
C247	G	1	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C248	I	2	Chipcap X7R 10%	330p	50V	normal,-10%,10%	0402C
C249	J	3	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C250	I	1	Chipcap X7R 10%	330p	50V	normal,-10%,10%	0402C
C251	I	4	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C252	I	4	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C253	J	3	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C254	F	2	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C255	E	2	CHIPCAP X5R 10U K	10u	10V	normal,-10%,10%	1206C_TDK
C256	H	7	CHIPCAP X7R 100N K	100n	50V	normal,-20%,20%	0805C
C257	D	7	CHIPCAP X7R 100N K	100n	50V	normal, -20%,20%	0805C
C258	I	5	ELCAP CHIP 100u M 16V 105C 8X6.3	100u_16V	16V	normal, -20%,20%	CASE_MVK_H63
C259	I	2	Chipcap X7R 10%	330p	50V	normal,-10%,10%	0402C
C300	R	5	CHIPCAP X5R 1U M 50V 1210	1u	50V	normal,-20%,20%	1210C_H2.8
C301	K	5	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C302	N	8	CHIPCAP X7R 100N K	100n	50V	normal,-20%,20%	0805C
C303	N	7	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C304	L	5	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C305	N	6	CHIPCAP X5R 1U K	1u0	16V	normal,-10%,10%	0603C
C306	K	1	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C307	Q	4	CHIPCAP NP0 1N0 J	1n0	50V	normal,-5%,5%	0603C
C310	Q	5	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C311	K	4	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C312	M	7	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C313	Q	5	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C314	N	5	CHIPCAP X5R 100N K	100n	10V	normal,-10%,10%	0402C
C404	E	15	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C405	E	16	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C406	E	16	Chipcap X7R 10%	10n	16V	normal,-10%,10%	0402C
C407	E	16	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C

Item	Location Grid ref.		Description and value				Type
C408	E	15	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C409	E	15	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C410	E	15	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C411	E	14	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C412	E	14	Chipcap 5% X7R	220p	50V	normal,-5%,5%	0402C
C414	E	2	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
C415	E	2	Chipcap 5% NP0	22p	50V	normal,-5%,5%	0402C
D300	P	6	SN74AHC08D 4X2INPUT AND SO14	~	~	~	SO14N
D301	M	6	CMOS Timer	~	~	~	SO8N
E210	D	22	EXACTALLOY SOLDER PREFORM	~	~	~	ALPHA_SOLDER
L100	C	10	FERRITE BEAD 68R/100MHZ 3A 1206	68R/100MHz	~	_	FERRITE_EXCML32
L101	I	10	CHOKE 33UH M 3.0A 65MR 12X12 SMD	33uH	~	normal,-20%,20%	INDUCTOR_CDRH127
L102	O	9	CHOKE 33UH M 3.0A 65MR 12X12 SMD	33uH	~	normal,-20%,20%	INDUCTOR_CDRH127
L103	H	16	CHOKE 2U2 M 0R07 2.3A 6.6X4.45	2u2H	~	normal,-20%,20%	DS1608C
L104	E	13	FERRITE BEAD 68R/100MHZ 3A 1206	68R/100MHz	~	_	FERRITE_EXCML32
L200	C	7	FERRITE BEAD 0R6	600R/100MHz	~	~	FERRITE_0402
L201	D	8	FERRITE BEAD 68R/100MHZ 3A 1206	68R/100MHz	~	_	FERRITE_EXCML32
L202	D	9	FERRITE BEAD 68R/100MHZ 3A 1206	68R/100MHz	~	_	FERRITE_EXCML32
L203	E	5	FERRITE BEAD 0R6 600R/100M	600R/100MHz	~	~	FERRITE_0402
L204	E	4	FERRITE BEAD 0R6 600R/100M	600R/100MHz	~	~	FERRITE_0402
L205	J	4	FERRITE BEAD 0R6 600R/100M	600R/100MHz	~	_	FERRITE_0402
L207	I	1	CHIP COIL 33N J Q7/100MHZ	33nH	~	normal,-5%,5%	0402_ELJRF
L208	I	3	CHIP COIL 33N J Q7/100MHZ	33nH	~	normal,-5%,5%	0402_ELJRF
L209	I	3	CHIP COIL 33N J Q7/100MHZ	33nH	~	normal,-5%,5%	0402_ELJRF
L401	E	2	FERRITE BEAD 0R6 600R/100M	600R/100MHz	~	normal,-5%,5%	FERRITE_0402
L402	E	2	FERRITE BEAD 0R6 600R/100M	600R/100MHz	~	normal,-5%,5%	FERRITE_0402
N100	J	14	LM2936 VOLT REG 5V 3% 50MA SO8	~	~	~	SO8N
N101	M	9	SW REG 1.2-37V 3A LM2676 TO263-7	~	ADJ	~	TO263_7
N103	I	19	LM2941S 1Z SMD ADJ VOLTAGE	~	~	~	TO_263_5
N104	O	16	VCOMP 15MV LMC7211B SOT23-5	~	~	~	SOT23_5
N200	I	2	4XOPAMP 2.7-12V TS974	~	~	~	SO14N
N201	F	7	TDA7391PD BR AUDIO AMP 32W	~	~	~	PSO_20
N202	F	2	LM4864 AF PW AMP 2.7-5.5V 0W3	~	~	~	SO8S
N300	R	6	LMC7215IM5X COMPARATOR 2-8V	~	~	~	SOT23_5_H1.45
N301	K	5	LMC7215IM5X COMPARATOR 2-8V	~	~	~	SOT23_5_H1.45
N302	M	7	LMC7215IM5X COMPARATOR 2-8V	~	~	~	SOT23_5_H1.45
R102	B	10	CHIP VARISTOR VWM18V VC50V	18V	~	-	0603_VAR
R103	C	12	CHIP VARISTOR VWM18V VC50V	18V	~	-	0603_VAR
R104	L	11	CHIPRES 0W06 2K87 F 200PPM	2k87	~	normal,-1%,1%	0402R
R105	L	4	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R

Item	Location Grid	ref.	Description and value				Type
R106	G	14	Resistor 1% 63mW	220k	~	normal,-1%,1%	0402R
R107	L	11	CHIPRES 0W06 1K1 F 250PPM	1k1	~	normal,-1%,1%	0402R
R109	K	4	Resistor 5% 63mW	100k	~	normal,-5%,5%	0402R
R110	F	13	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R111	L	12	Resistor 1% 63mW	3k9	~	normal,-1%,1%	0402R
R113	F	13	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R114	L	13	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R115	L	13	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R116	L	4	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R120	J	4	Resistor 5% 63mW	100k	~	normal,-5%,5%	0402R
R122	G	20	Chipres 0W06 6k8 F	6k8	~	normal,-1%,1%	0402R
R123	J	4	CHIPRES 0W06 3K3 F	3k3	~	normal,-1%,1%	0402R
R125	J	5	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R126	G	20	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R131	O	12	Resistor 5% 100mW	10R	~	normal,-5%,+5%	0603R
R132	O	18	CHIPRES 0W06 3K3 F	3k3	~	normal,-1%,1%	0402R
R133	N	17	CHIPRES 0W06 150K F 200PPM	150k	~	normal,-1%,1%	0402R
R134	M	17	CHIPRES 0W5 0R1 G	0R1	~	normal,-2%,2%	1210_R
R135	O	15	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R136	O	17	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R137	O	15	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R138	O	15	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R139	N	17	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R140	M	16	Resistor 1% 63mW	220k	~	normal,-1%,1%	0402R
R141	M	15	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R142	L	2	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R143	N	16	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R144	N	15	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R145	F	13	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R146	M	16	Resistor 1% 63mW	220k	~	normal,-1%,1%	0402R
R200	C	6	Resistor 5% 63mW	330R	~	normal,-5%,5%	0402R
R201	J	3	Resistor 5% 63mW	5k6	~	normal,-5%,5%	0402R
R202	C	6	Resistor 5% 63mW	1k8	~	normal,-5%,5%	0402R
R203	O	4	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R205	H	2	CHIPRES 0W06 120K F 200PPM	120k	~	normal,-1%,1%	0402R
R206	J	3	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R207	O	3	Resistor 5% 63mW	3k9	~	normal,-5%,5%	0402R
R208	C	7	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R209	H	2	Chipres 0W06 6k8 F	6k8	~	normal,-1%,1%	0402R
R211	H	3	Chipres 0W06 22k F 200ppm	22k	~	normal,-1%,1%	0402R
R212	H	3	Chipres 0W06 22k F 200ppm	22k	~	normal,-1%,1%	0402R

Item	Location Grid ref.		Description and value				Type
R213	N	4	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R215	H	3	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R216	G	2	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R217	J	2	Chipres 0W06 22k F 200ppm	22k	~	normal,-1%,1%	0402R
R218	J	2	Chipres 0W06 22k F 200ppm	22k	~	normal,-1%,1%	0402R
R219	P	4	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R220	P	4	CHIPRES 0W06 2K87 F 200PPM	2k87	~	normal,-1%,1%	0402R
R221	P	4	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R222	D	7	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R224	G	2	CHIPRES 0W06 10K F	10k	~	normal,-1%,1%	0402R
R226	G	2	CHIPRES 0W06 10K F	10k	~	normal,-1%,1%	0402R
R227	F	3	Chipres 0W06 J	4R7	~	normal,-5%,+5%	0603R
R228	G	3	Chipres 0W06 J	4R7	~	normal,-5%,+5%	0603R
R229	I	1	Chipres 0W06 22k F 200ppm	22k	~	normal,-1%,1%	0402R
R230	I	1	Chipres 0W06 22k F 200ppm	22k	~	normal,-1%,1%	0402R
R231	I	1	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R232	F	1	CHIPRES 0W06 10K F	10k	~	normal,-1%,1%	0402R
R233	J	3	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R234	J	3	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R235	D	5	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R236	D	4	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R300	R	6	CHIPRES 0W06 120K F 200PPM	120k	~	normal,-1%,1%	0402R
R301	R	4	Resistor 1% 63mW	220k	~	normal,-1%,1%	0402R
R302	Q	4	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R303	B	11	Chipres 0W06 22k F 200ppm	22k	~	normal,-1%,1%	0402R
R304	M	7	CHIPRES 0W06 10K F	10k	~	normal,-1%,1%	0402R
R305	R	6	CHIPRES 0W06 120K F 200PPM	120k	~	normal,-1%,1%	0402R
R306	Q	5	CHIPRES 0W06 120K F 200PPM	120k	~	normal,-1%,1%	0402R
R307	M	8	Resistor 5% 63mW	5k6	~	normal,-5%,5%	0402R
R308	N	7	CHIPRES 0W06 10K F	10k	~	normal,-1%,1%	0402R
R309	K	6	Resistor 1% 63mW	220k	~	normal,-1%,1%	0402R
R310	K	6	CHIPRES 0W06 39K F	39k	~	normal,-1%,1%	0603R_ROHM
R311	P	5	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R312	O	5	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R313	N	6	Resistor 1% 63mW	680k	~	normal,-1%,1%	0402R
R314	M	4	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R315	M	4	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R316	M	4	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R317	Q	6	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R318	O	4	CHIPRES 0W06 1K0 F 200PPM	1k0	~	normal,-1%,1%	0402R
R319	M	5	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R

Item	Location Grid	ref.	Description and value				Type
R320	N	6	Resistor 1% 63mW	680k	~	normal,-1%,1%	0402R
R321	K	1	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R322	K	1	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R325	P	4	Resistor 5% 63mW	100k	~	normal,-5%,5%	0402R
R326	O	4	CHIPRES 0W06 2K87 F 200PPM	2k87	~	normal,-1%,1%	0402R
R328	O	4	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R329	M	7	Resistor 5% 63mW	10k	~	normal,-5%,5%	0402R
R404	E	15	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R405	E	16	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R406	E	16	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R407	E	16	VARISTOR ARRAY 2XVWM16V VC50	2XVWM16V	~	~	0405_2
R408	E	15	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R409	E	14	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R410	E	14	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R411	E	14	Resistor 5% 63mW	100R	~	normal,-5%,5%	0402R
R412	E	14	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R416	Q	3	Resistor 5% 63mW	47k	~	normal,-5%,5%	0402R
R419	D	2	VARISTOR ARRAY 2XVWM16V VC50	2XVWM16V	~	~	0405_2
R420	D	4	VARISTOR ARRAY 2XVWM16V VC50	2XVWM16V	~	~	0405_2
V100	D	11	SCH DI 40V 3A DO214AB	~	~	~	DO_214AB
V101	F	10	TVS DI SMAJ30A 30V 5.8A 300W SMA	~	~	~	DO_214AC
V104	H	14	FET RFD8P05SM P 8A 50V 0R3 TO252AA	~	~	~	TO_252AA
V105	F	14	Zener_diode	~	~	~	SOT23
V107	F	12	TR 2SC5658QRS N 50V 0A1 0W15	~	~	~	VMT3
V108	L	12	MFETX2 UM6K1N N 30V 0.1A 7R SC-88	~	~	~	UMT6
V112	J	4	MFETX2 FDG6322C BIP.REPLAC	~	~	~	SOT_363
V113	K	8	TR 2SC5658QRS N 50V 0A1 0W15	~	~	~	VMT3
V115	C	11	TVS DI SMAJ30A 30V 5.8A 300W SMA	~	~	~	DO_214AC
V116	L	4	MFETX2 FDG6322C BIP.REPLAC	~	~	~	SOT_363
V117	O	11	SCH DI 40V 3A	~	~	~	DO_214AB
V118	L	16	FET RFD10P03L P 30V 10A 0.2R	~	~	~	TO_252AA
V119	N	15	SCHDIX2 BAS70-07W 70V 70MA	~	~	~	SOT343_R
V120	L	2	TRX2+RX4 UMH9N 50V 0.1A	~	~	~	SOT_363
V121	K	15	SCH DI RB491D 20V 1A VF<0.45	~	~	~	SC59
V122	N	17	SCHDIX2 BAS70-07W 70V 70MA	~	~	~	SOT343_R
V123	K	7	MFET BUK107-50DL N 50V 0A7	~	~	~	SOT223_SIE
V124	K	8	SCH DI RB491D 20V 1A VF<0.45	~	~	~	SC59
V300	Q	4	SCHDIX2 BAS70-07W 70V 70MA	~	~	~	SOT343_R
V301	P	5	SCHDIX2 BAS70-07W 70V 70MA	~	~	~	SOT343_R
V302	O	5	MFETX2 FDG6322C BIP.REPLAC	~	~	~	SOT_363
V305	M	4	TRX2+RX4 UMH9N 50V 0.1A	~	~	~	SOT_363

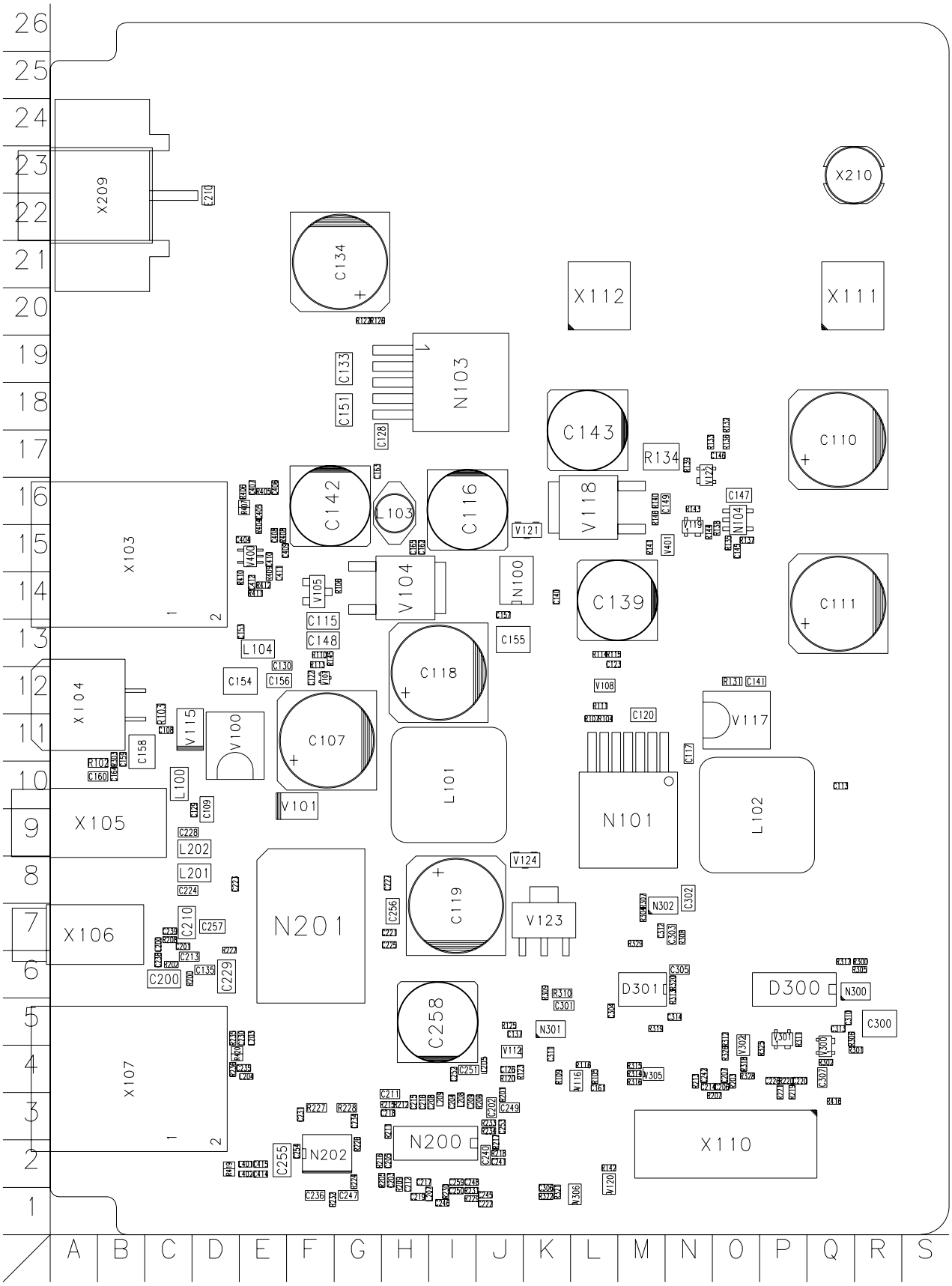
Item	Location Grid ref.		Description and value				Type
V306	L	1	TRX2+RX4 UMH9N 50V 0.1A	~	~	~	SOT_363
V400	E	15	ZDIX4 TVS/ESD RSA6.1EN 6V1	~	~	~	SOT323_5L
V401	N	15	MFETX2 UM6K1N N 30V 0.1A 7R SC-88	~	~	~	UMT6
X103	B	15	MODULAR JACK 10POL 90DEG UNSH	~	~	~	CON_SS_641010_NF_K
X104	A	12	CONN WTB 2X2F P3 250V 5A 90DEG	~	~	~	MOLEX_43045_0421
X105	B	9	SM JACK 3.5MM 12V 1A WTH LOCKING	~	~	~	JACK_T_332866_2
X106	A	7	SM JACK 2.5MM 12V 1A WTH LOCKING	~	~	~	JACK_T_332866_1
X107	B	4	MOD JACK 10POL+K2 KEY 1.5A 90DEG	~	~	~	CON_SS_641010_NF_K
X110	O	2	SM CONN 2X14 SPRING B2B	~	~	~	CONN_58_9158_028_000_028S
X111	Q	20	SM CONN 2X4 SPRING B2B	~	~	~	CONN_58_9158_008_000_029S
X112	L	20	SM CONN 2X4 SPRING B2B	~	~	~	CONN_58_9158_008_000_029S
X209	B	22	SM ANT CONN RF FME 50R 400V 3GHZ	~	~	~	CONN_ANT_3412
X210	Q	23	SM CONN RF PLUG 50R 100V 2GHZ	~	~	~	CONN_IMS_3384

PWB Component differences for N616

Item	Location Grid ref.		Description and value				Type
C110	Q	17	ELCAP 470U +-20% 6V3 0R025 11.2X10.5	470u_6V3	6.3V	normal,-20%,20%	ELCAP_SVP_F8
C111	Q	14	ELCAP 470U +-20% 6V3 0R025 11.2X10.5	470u_6V3	6.3V	normal,-20%,20%	ELCAP_SVP_F8
C119	I	7	EL. CAP. 20% 50V	100u	50V	normal,-20%,20%	Sanyo
R304	M	7	CHIPRES 0W06 10K F	10k	~	normal,-5%,5%	0402R
V113	**Deleted from N616**						

Note: There are No components on bottom side of PWB.

Component layout diagram for the Top of the TF5



3 - Service Software

Table of Contents

Service Software

Quick Guide for Phoenix Service SW Installation

Phoenix Installation Steps in Brief

DCT-4 generation Test and Service Software is called "Phoenix".

These are the basic steps to install the Phoenix:

- Connect a DK2 Dongle or FLS-4S POS Flash Device.
- Install the Phoenix Service SW.
- Install the Data Package for Phoenix.
- Configure users.
- Manage connection settings (depends on the tools you are using).

Phoenix is now ready for FLS-4S Point Of Sales Flash Device use.

If you use FPS-8:

- Update FPS-8 SW.
- Activate FPS-8.
- Update JBV-1 Docking Station SW (only when needed).

Phoenix is now ready to be used also with FPS-8 flash prommer and other tools.

The Phoenix Service Software installation contains:

- Service software support for all phone models included in the package

- Flash update package files for FPS-8* and FLS-4S programming devices
- All needed drivers for: DK2 dongle
  FLS-4S point of sales flash device
  USB devices

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

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

- product software Binary files
- files for type label printing
- validation file for the Faultlog repair data reporting system
- all product specific configuration files for Phoenix software components

Please refer to Service Manual and Service Bulletins for more information concerning phone model specific service tools and equipment setup.

Phoenix Service SW and phone data packages should only be used as complete installation packages. Uninstallation should be made from Windows Control Panel.

Phoenix Service SW

Before installation

- Check that a dongle is attached to the parallel port of your computer.
- Download the installation package (e.g. *phoenix_service_sw_a12_2004_46_4_75.exe*) to your computer (e.g. C:\TEMP).
- Close all other programs.
- Run the application file (e.g. *phoenix_service_sw_a12_2004_46_4_75.exe*) and follow instructions on the screen.

Administrator rights may be required to be able to install Phoenix depending on the Operating System.

If uninstalling or rebooting is needed at any point, you will be prompted by the Install Shield program.

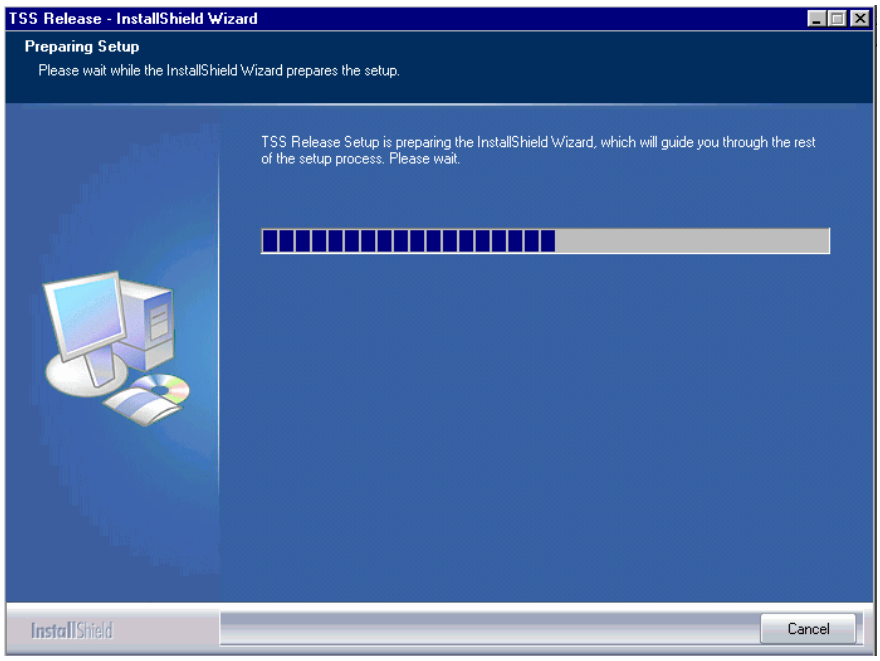
If at any point during the installation you get this message, the dongle is not found and the installation can not continue.

Possible reasons may be defective or too old PKD-1Dongle (five digit serial number dongle when used with FPS-8 Prommer) or that the **FLS-4S** POS Flash Dongle is defective or power to it is not supplied by external charger.

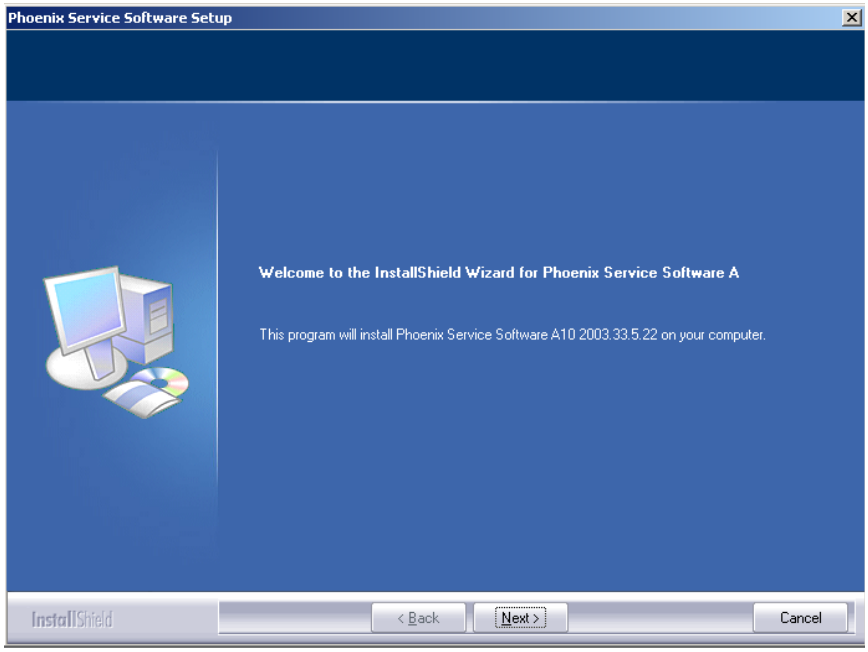
First, check the COM /parallel ports used! After correcting the problem, the installation can be restarted.

Installing Phoenix

Run the *phoenix_service_sw_a12_2004_46_4_75.exe* to start the installation. Install Shield will prepare.

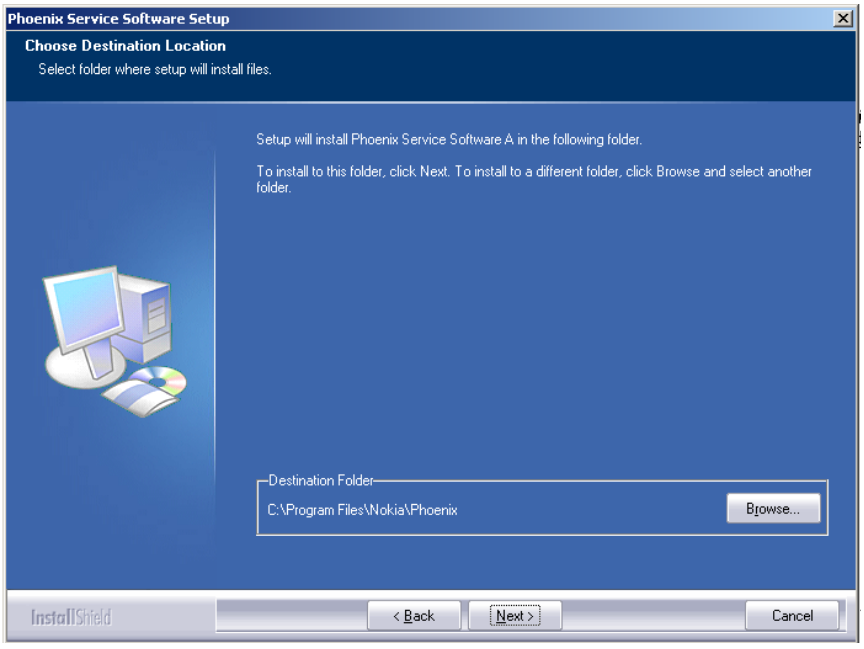


Click "Next" in Welcome dialog to continue.

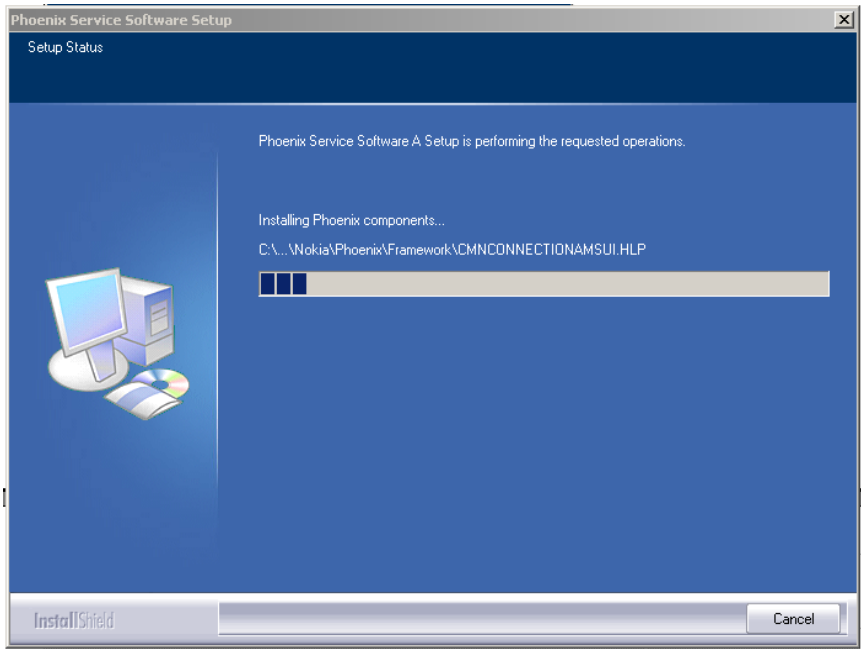


Choose the destination folder, it is recommended to use the default folder *C:\Program-Files\Nokia\Phoenix*.

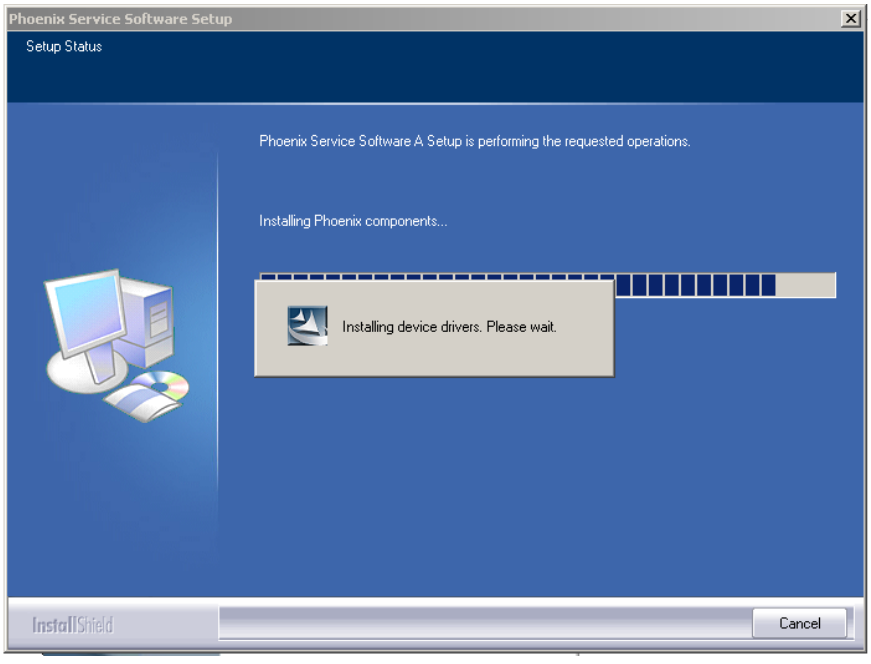
Choose "Next" to continue. You may choose another location by selecting "Browse" (not recommended).



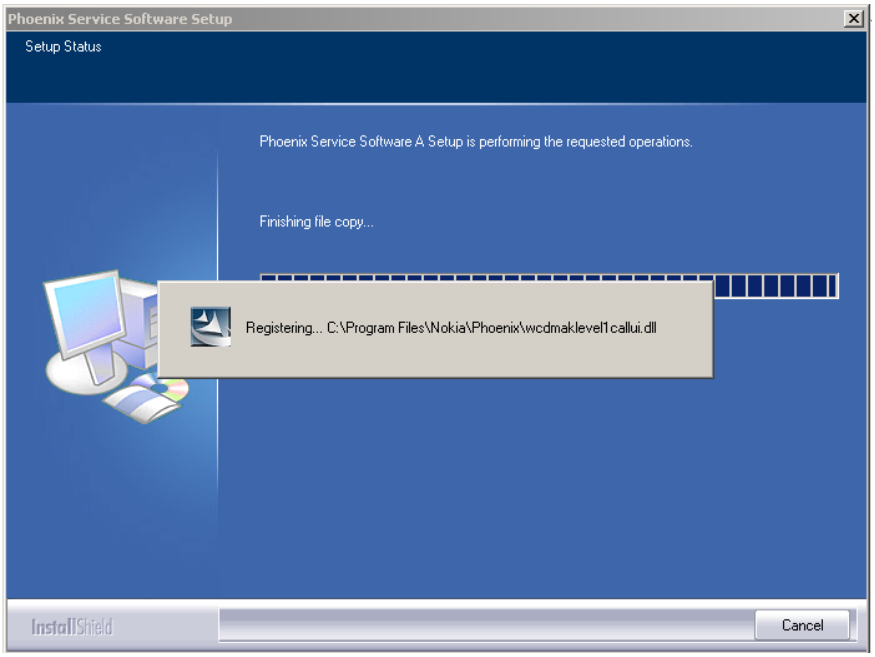
Setup copies the components, progress of the setup is shown. Please wait.



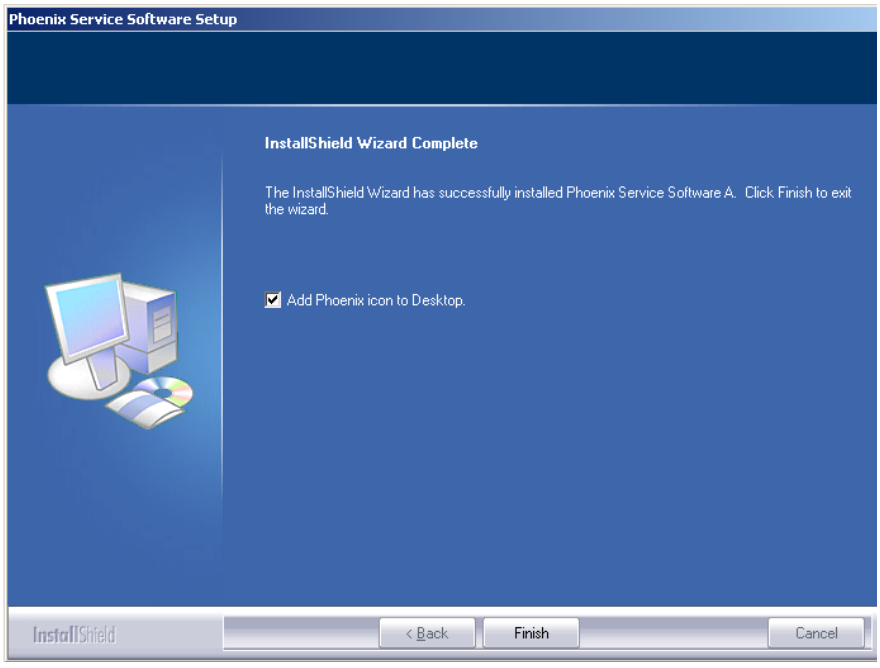
Drivers will be installed and updated, please wait. The process may take several minutes to complete.



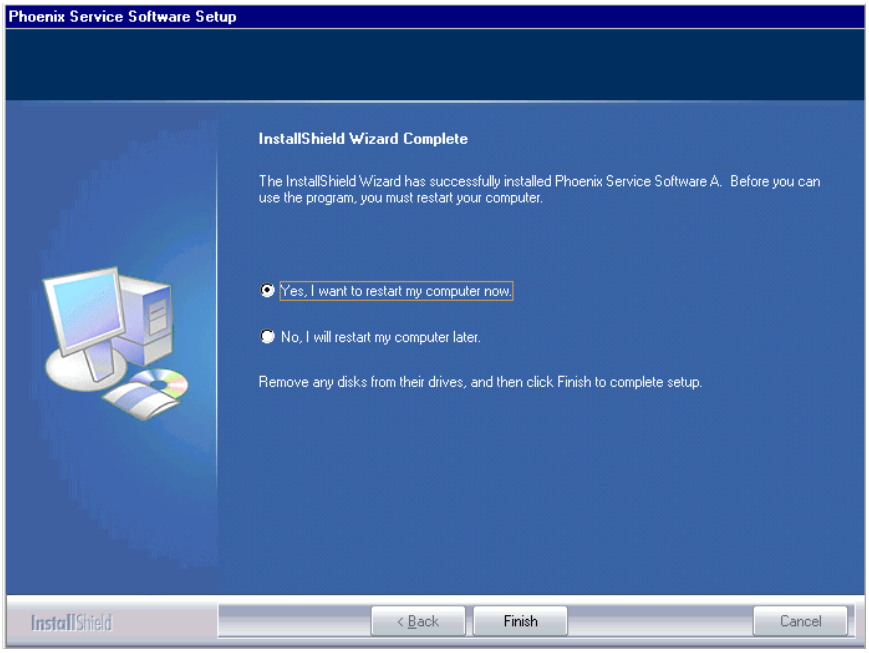
If the operating system does not require rebooting (Windows 2000, XP) the PC components are registered right away.



Click "Finish" to finalize. Phoenix is ready for use.



If the operating system used requires restarting your computer (Windows 98, SE, ME), the Install Shield Wizard will notify you about it. Select "Yes..." to reboot the PC immediately and "No..." to reboot the PC manually afterwards.



After the reboot components are registered and Phoenix is ready for use. Note that Phoenix doesn't work, if components are not registered.

Now the installation of Phoenix Service SW is ready and it can be used after :

- installing Phone model specific Phone Data Package for Phoenix
- configuring users and connections

FLS-4S can be used right away.

FPS-8* can be used after updating Flash Update Package files to it.

Updating Phoenix installation

If you already have the Phoenix Service SW installed on your computer, sooner or later there will be need to update it when new versions are released.

Always use the latest available versions of both the Phoenix Service SW and the Phone Specific Data Package. Instructions can be found in phone model specific Technical Bulletins and Phone Data package readme.txt files (shown during installation).

To update Phoenix, you need to take exactly the same steps as when installing it for the first time.

- Download the installation package to your computer hard disk.

- Close all other programs.
- Run the application file (e.g. *phoenix_service_sw_a12_2004_46_4_75.exe*).

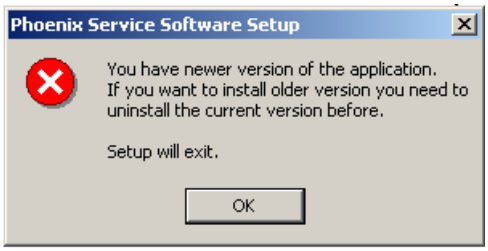
Newer version of Phoenix will be installed.

Driver versions will be checked and if need be, updated.

When you update Phoenix from an old to a new version (e.g. *a11_2003_41_5_28* to *a12_2004_46_4_75*), the update will take place automatically without uninstallation.

If you try to update Phoenix with the same version that you already have (e.g. *a12_2004_46_4_75* to *a12_2004_46_4_75*) you are asked if you want to uninstall the version of Phoenix you have on your PC. In this case, you can choose between total uninstallation and repair just like when you choose to uninstall Phoenix service software from the Windows control panel.

If you try to install an older version (e.g. downgrade from *a12_2003_50_6_35* to *a11_2003_41_5_28* installation will be interrupted.

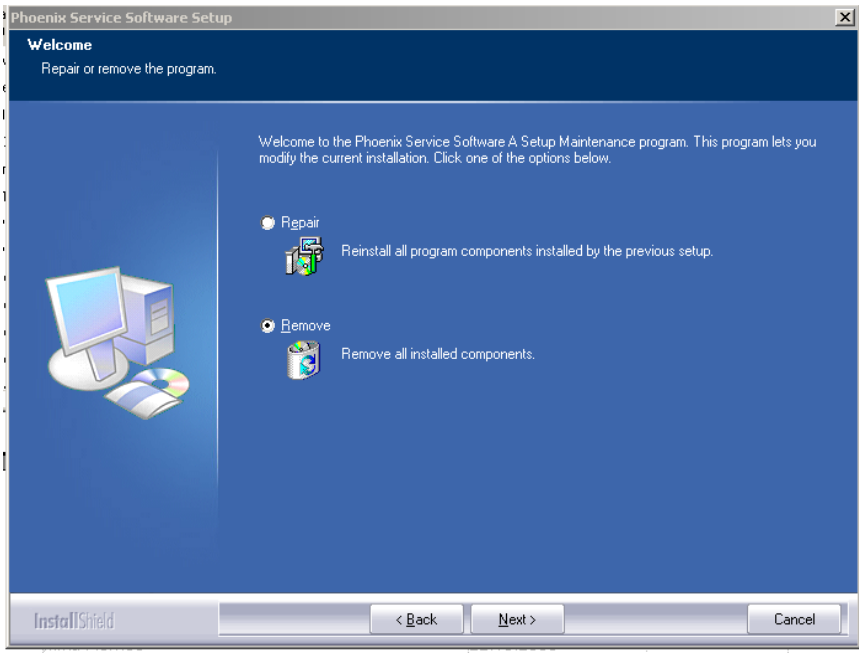


Please always follow the instructions on the screen.

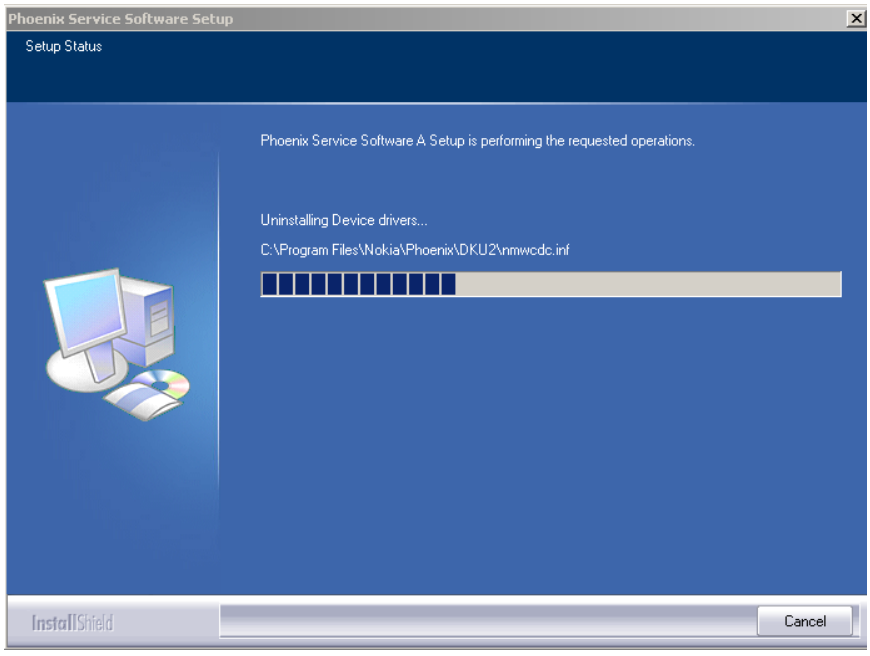
Uninstalling Phoenix

Uninstallation can be done manually from Windows Control Panel - Add / Remove Programs.

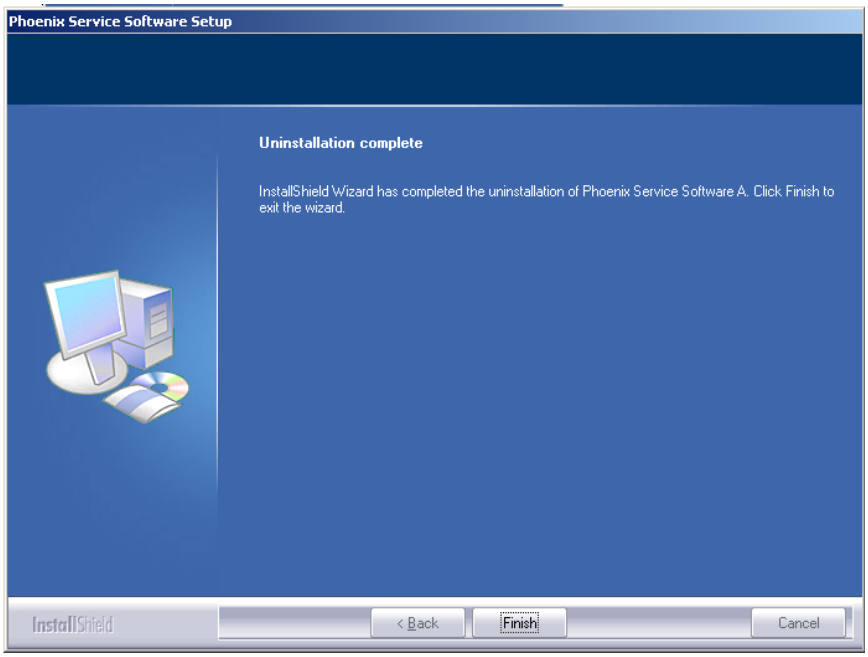
Choose "Phoenix Service Software" and click "Add/Remove". Choose "Remove" to uninstall Phoenix.



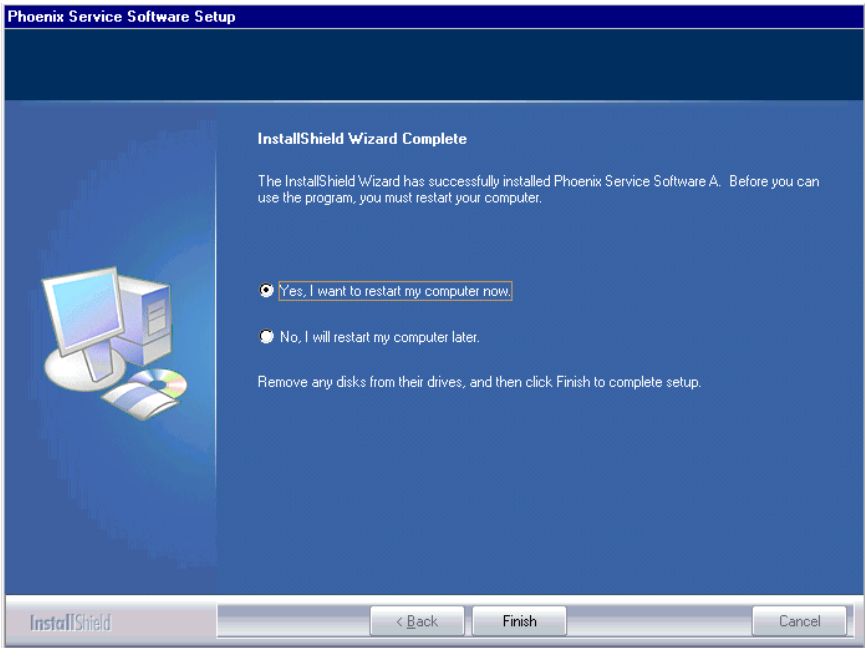
Progress of the uninstallation is shown.



If the operating system does not require rebooting, select "Finish" to complete.



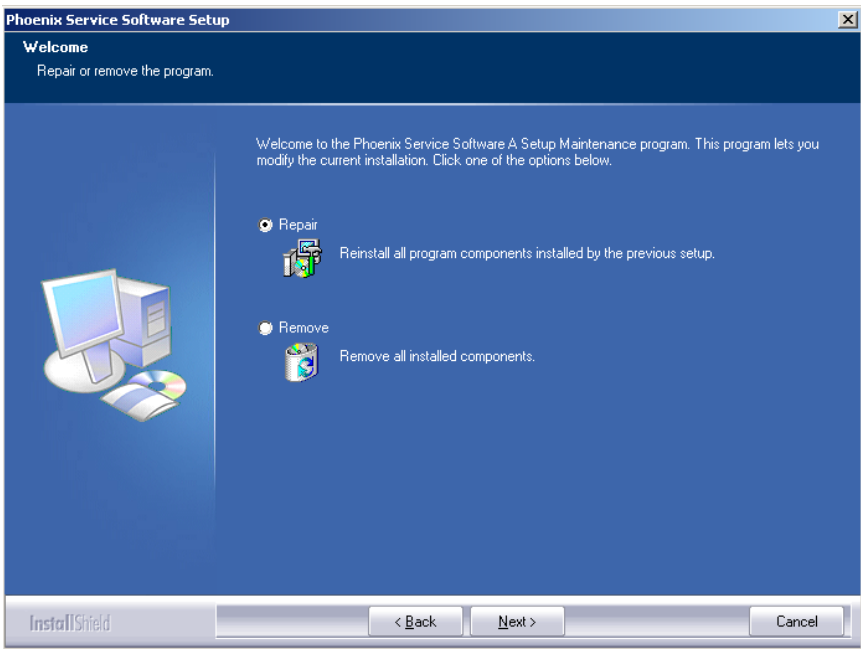
If the operating system used requires rebooting, Install Shield Wizard will notify you about it. Select "Yes..." to reboot the PC immediately and "No..." to reboot the PC manually afterwards._



Repair

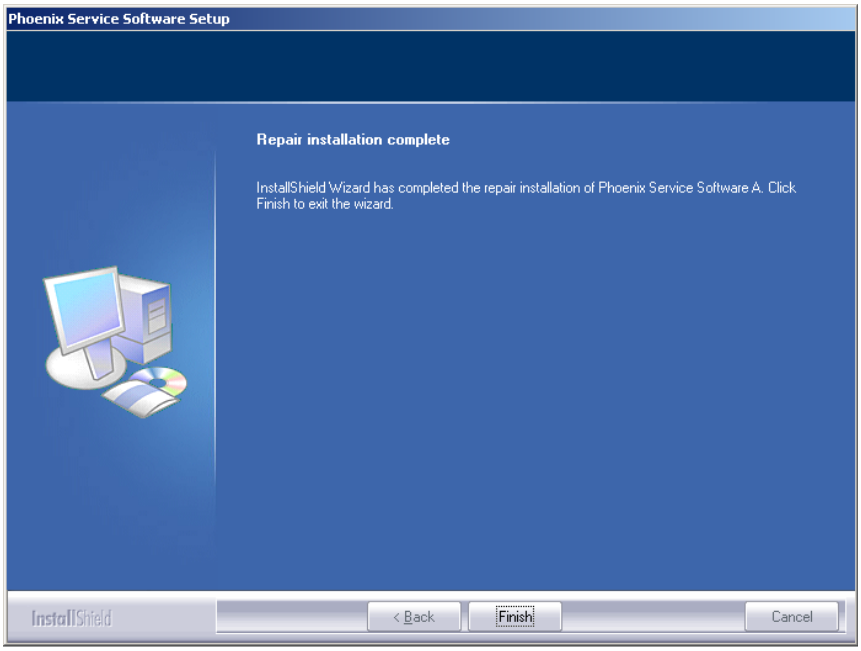
If you experience any problems with the service software or suspect that files have been lost, you can use the repair function before completely reinstalling Phoenix. Note that the original installation package (e.g. *phoenix_service_sw_a12_2004_46_4_75.exe*) must be found on your PC when you run the repair setup.

Run Windows Control Panel - Add / Remove Programs, choose “Phoenix Service Software” and click "Add/Remove". In the following view choose “Repair”.



Phoenix will reinstall components and register them, the procedure is the same as in the update installation.

Choose “Finish” to complete.



Data Package for Phoenix (Product Specific)

Before installation

- Product Data Package contains all product specific data to make the Phoenix Service Software and tools usable with a certain phone model.
- Check that the dongle is attached to the parallel port of your computer.
- Install Phoenix Service SW.
- Download the installation package (e.g. *RV_1_dp_v_2.0_mcusw03.00.exe*) to your computer (e.g. C:\TEMP).
- Close all other programs.
- Run the application file (e.g. *RV-1_dp_v_2.0_mucsw03.00.exe)* and follow instructions on the screen.

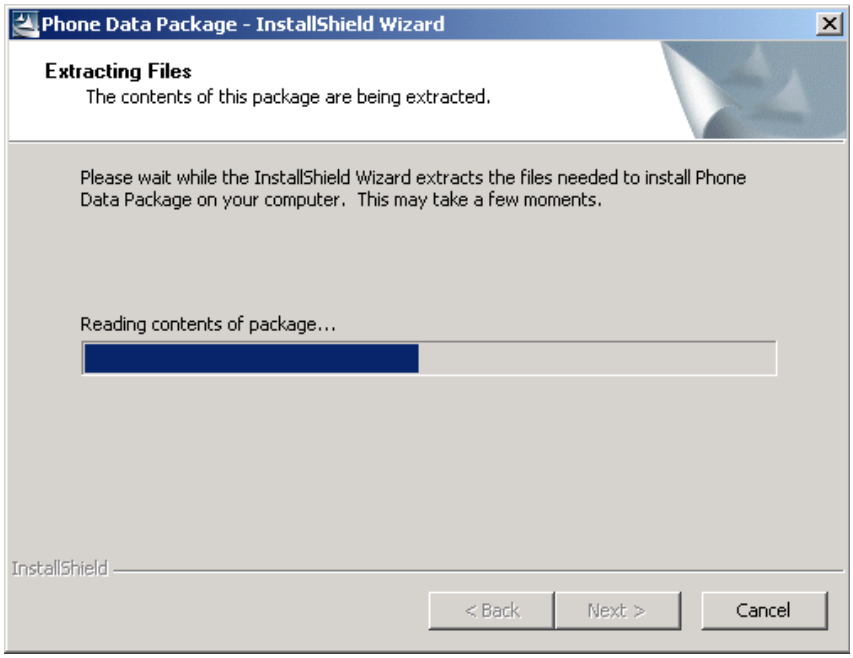
Please note that very often the Phoenix Service SW and the Phone Specific Data Package for Phoenix come in pairs, meaning that certain version of Phoenix can only be used with certain version of Data Package. Always use the latest available versions of both. Instructions can be found in phone model specific Service Bulletins and readme.txt files of the data packages.

Note: All the screenshots are only examples of what one can expect to see, certain information may differ i.e. type designator or SW version etc.

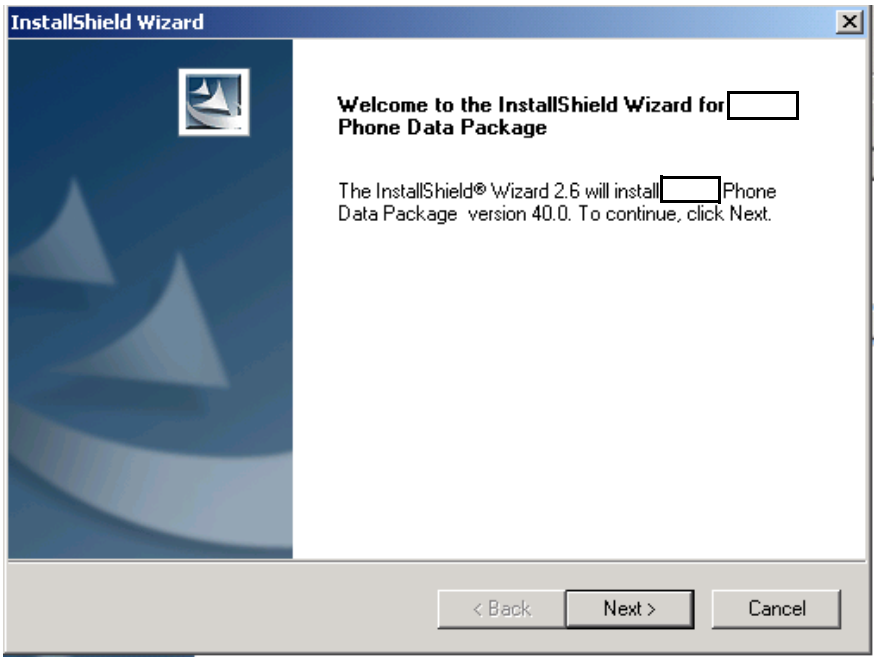
Installing Phoenix data package (product specific)

Run the *RV-1_dp_v_2.0_mucsw03.00.exe* to start the installation.

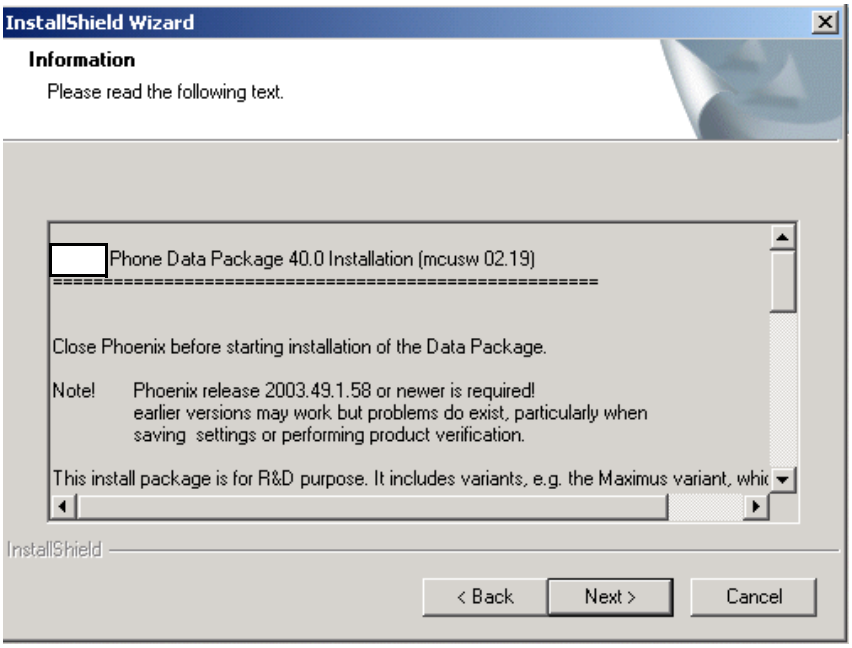
When you choose "Next" the files needed for the installation will be extracted. Please wait.



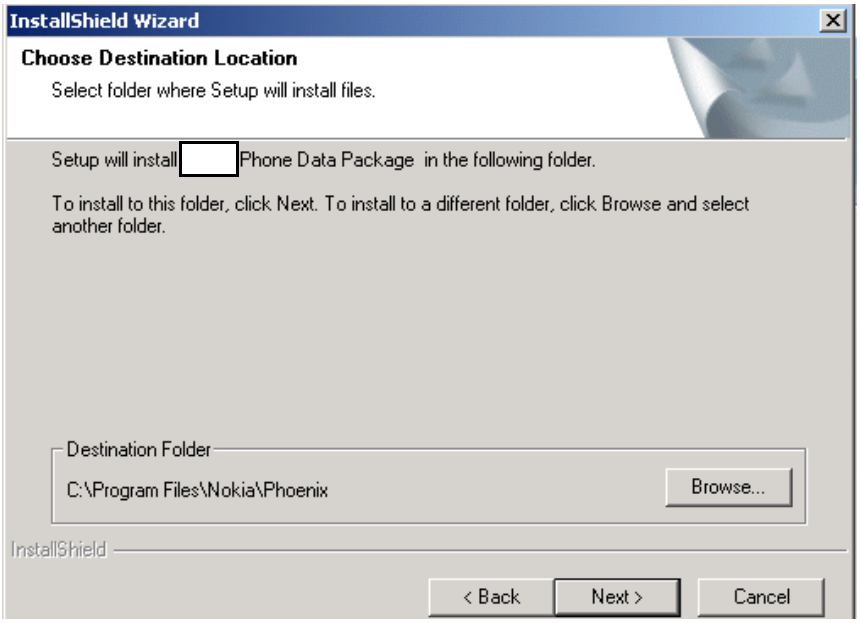
Choose “Next” to continue.



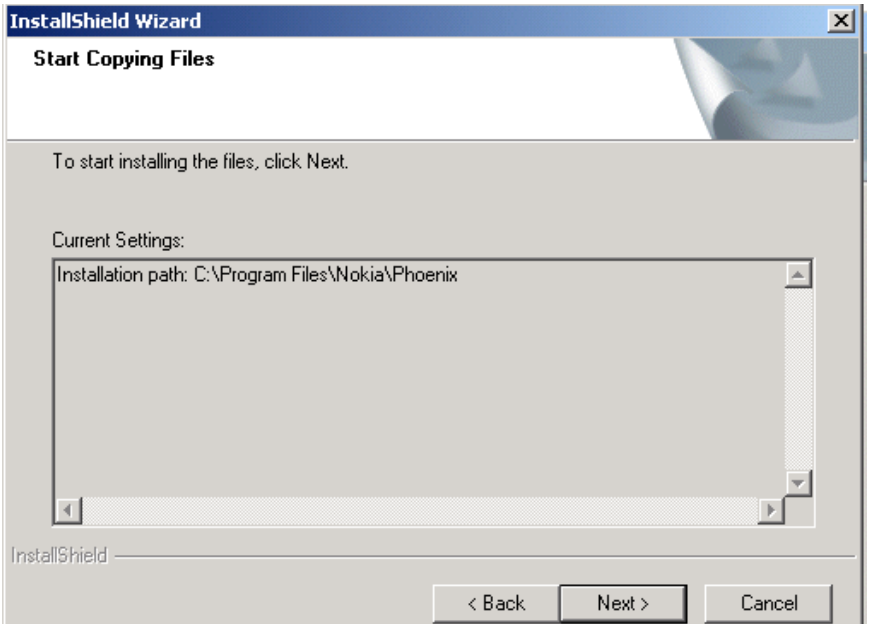
From this view, you can see the contents of the Data Package. **Read the text carefully**. There should be information about the Phoenix version needed with this data package. Choose “Next”.



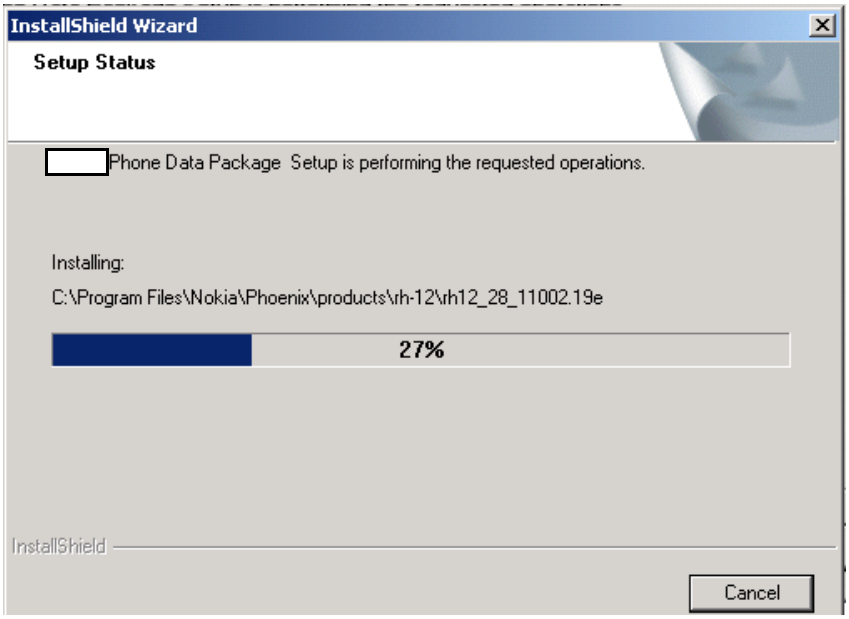
Confirm location and choose “Next” to continue. Install shield checks where the Phoenix application is installed and the directory is shown. Choose “Next” to continue.



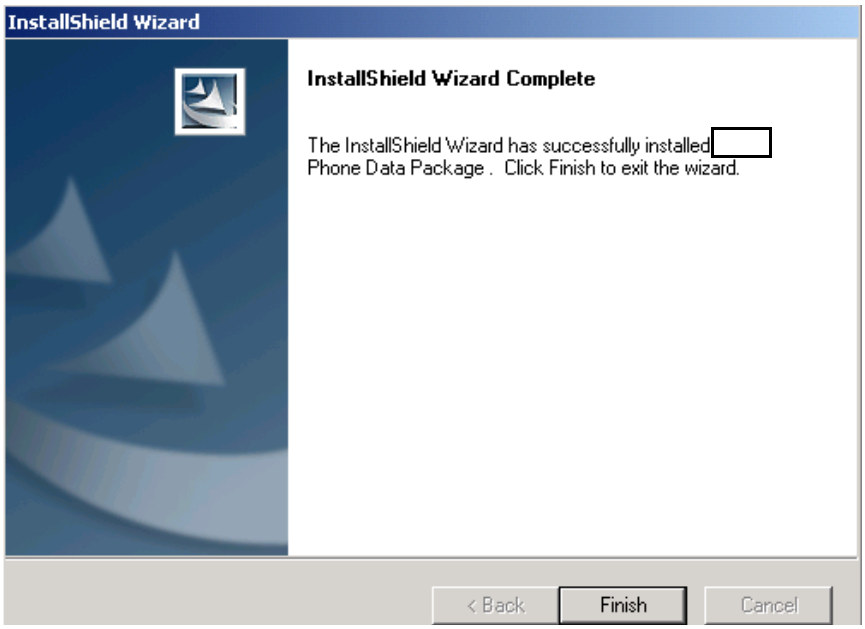
Choose "Next" to start copying the files.



Phone model specific files will be installed. Please wait.



Choose "Finish" to complete the installation.



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

Now Phoenix can be used to for example flash phones and print type labels after:

- configuring users
- managing connections

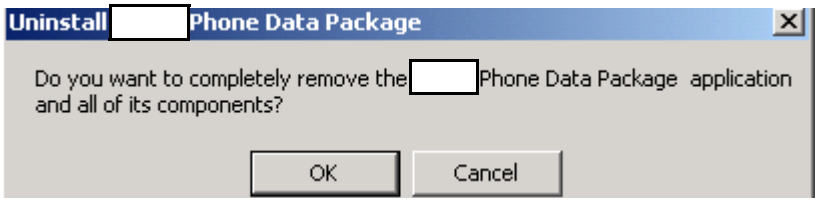
FLS-4S can be used right away.

FPS-8* can be used after updating Flash Update Package files to it.

Uninstalling the data package

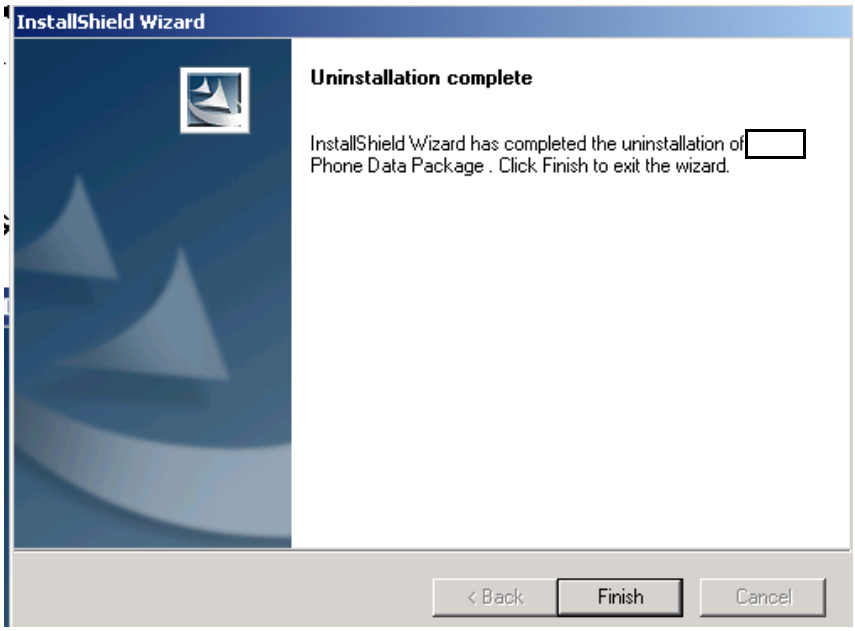
Uninstallation can also be done manually from Windows Control Panel / Add / Remove Programs / "RM-14 Phone Data Package".

If you try to install the same version of Phoenix Data Package that you already have, you are asked if you want to uninstall the version you have on your PC. Answer "OK" to uninstall, "Cancel" if you don't want to uninstall.



Older versions of data packages don't need to be uninstalled unless instructions to do so are given in the readme.txt of the data package and bulletins concerning the release. Please read all related documents carefully.

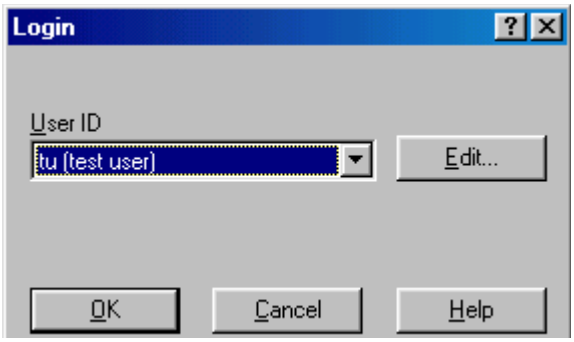
Once the previously installed Data package is uninstalled, choose "Finish".



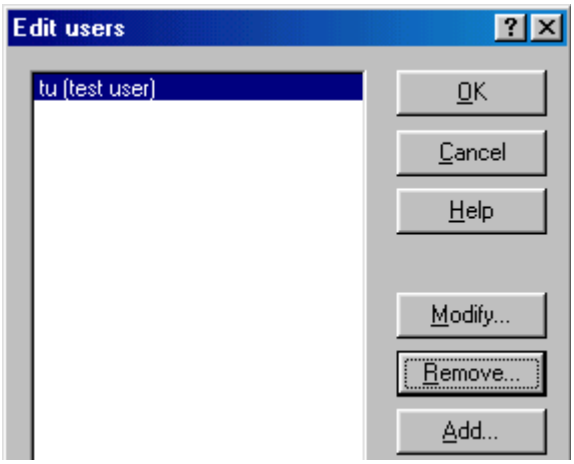
Run the *RV-1_dp_v_2.0_mucsw03.00.exe* again in case you want to continue the installation from the beginning.

Configuring Users

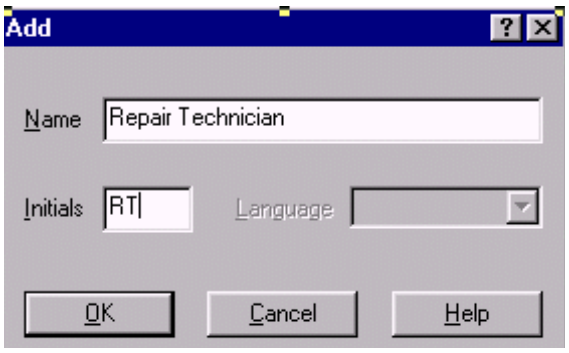
Start Phoenix Service SW and Login. To add new user choose "Edit". If user ID is already configured, choose your own user ID from the list and choose "OK".



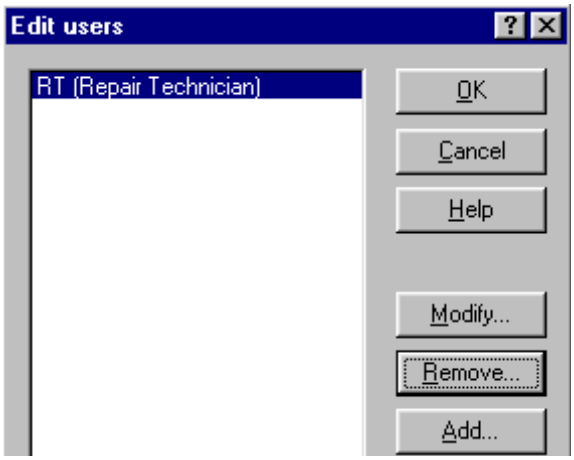
Choose "Add" to continue.



Type in your name and initials to fields and choose "OK".



User has now been created, choose "OK".

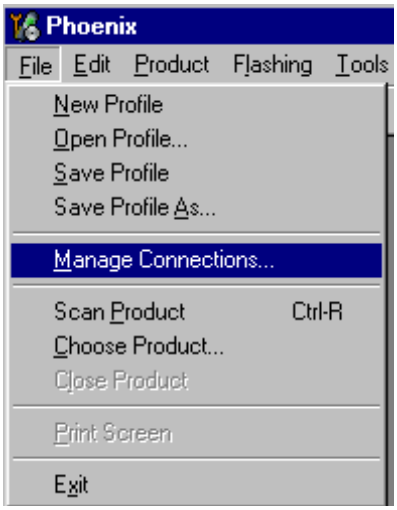


You are now able to login with this username, choose "OK".

Managing Connections

Start Phoenix Service SW and Login.

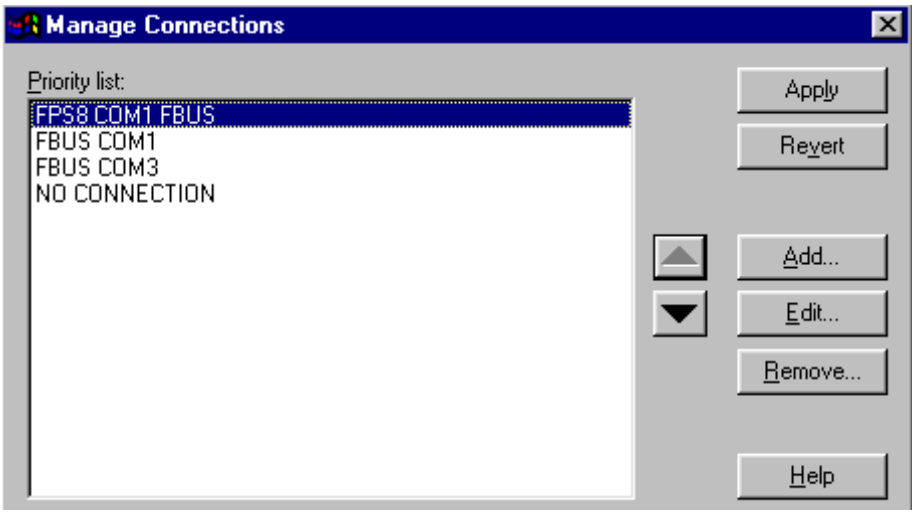
Choose “Manage Connections” From “File” Menu.



Existing connections can be selected , edited, deleted and new ones created by using this dialog.

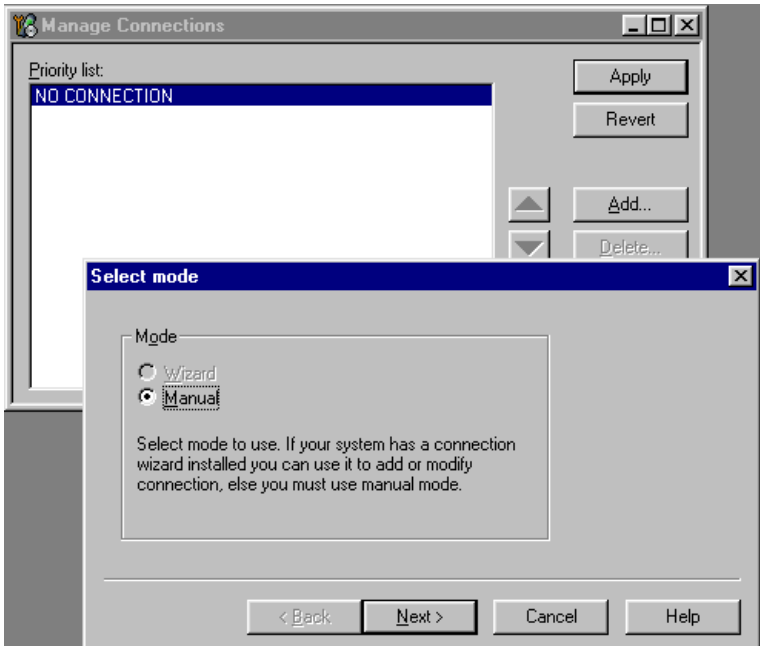
A connection can be created either manually or by using a Connection Wizard.

To add new connection, choose “Add” and select if you want to create it manually or by using the Wizard.



Choose “Next” to continue.

In the next dialogs you will be asked to select some settings for the connection.



Manual Settings

A) For **FLS-4S POS Flash Device** choose the following connection settings

- **Media:** FBUS
- **COM Port:** Virtual COM Port used by FLS-4 **Please check this always!**

(To check please go to Windows / Control Panel / FLS Virtual Port / Configuration)

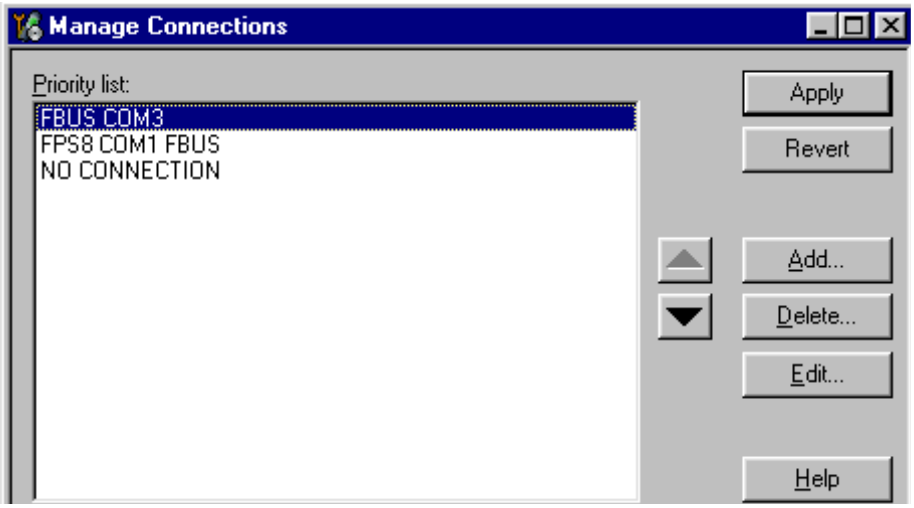
B) For **FPS-8 Flash Prommer** choose the following connection settings:

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

Choose "Finish" to complete.

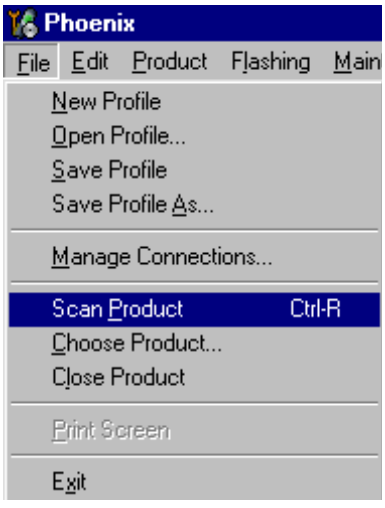
If you use the Wizard, connect the tools and a phone to your PC and the wizard will automatically try to configure the correct connection.

Activate the connection you want to use by clicking it and use up/down arrows to move it on top of the list. Choose "Apply". The connection is now selected and can be used after closing the "Manage Connections" window.



Selected connection will be shown on the right hand bottom corner of the screen.

To use the selected connection, connect the phone to Phoenix with correct service tools, make sure that it is switched on and select "Scan Product".



When Product is found, Phoenix will load product support and when everything is ready, name of the loaded product support module and its version will be shown on the bottom of the screen.

Updating Flash Support Files for FPS-8* and FLS-4*

Before installation

- Install Phoenix Service SW .

- Install phone model Specific Data package for Phoenix.

The flash support files are delivered in the same installation package with Phoenix data packages or newer Phoenix packages beginning from September 2003.

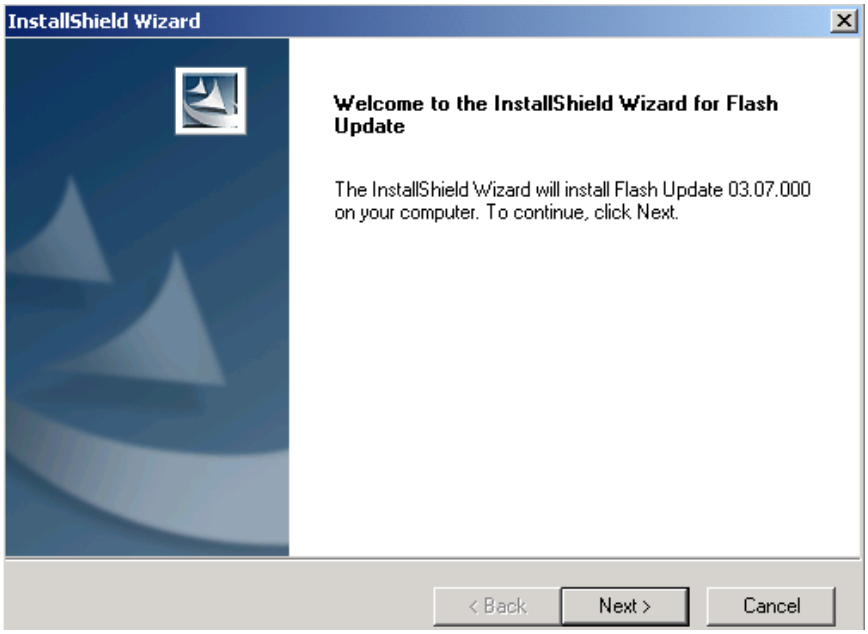
Normally it is enough to install the Phoenix and phone data package only because the Phoenix installation always includes the latest flash update package files for FLS-4S / FPS-8*.

Separate installation package for flash support files is available, and the files can be updated according to these instructions if updates appear between Phoenix / data package releases.

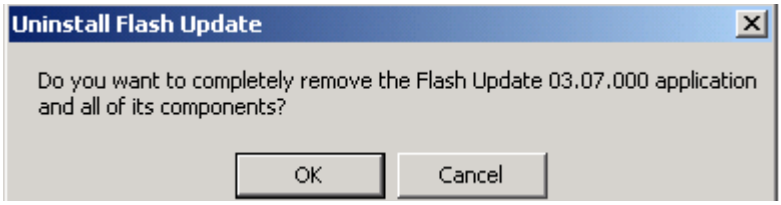
Installing the flash support files (only separate installation package)

If you are not using separate installation package, you can skip this section.

Start by double clicking *flash_update_03_07_000.exe* **. The i**nstallation begins.

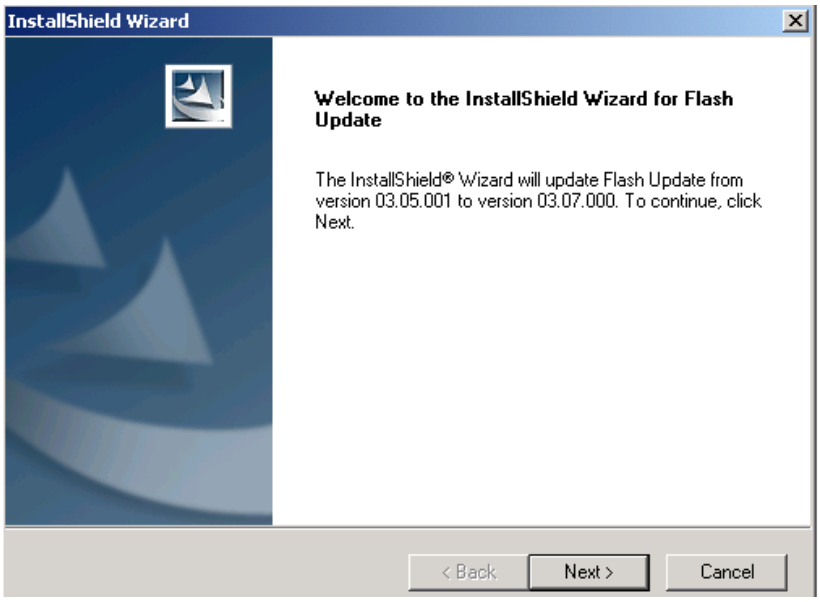


If the same version of Flash Update package already exists, and you want to reinstall them, the previous package is first uninstalled. Restart installation again after that.

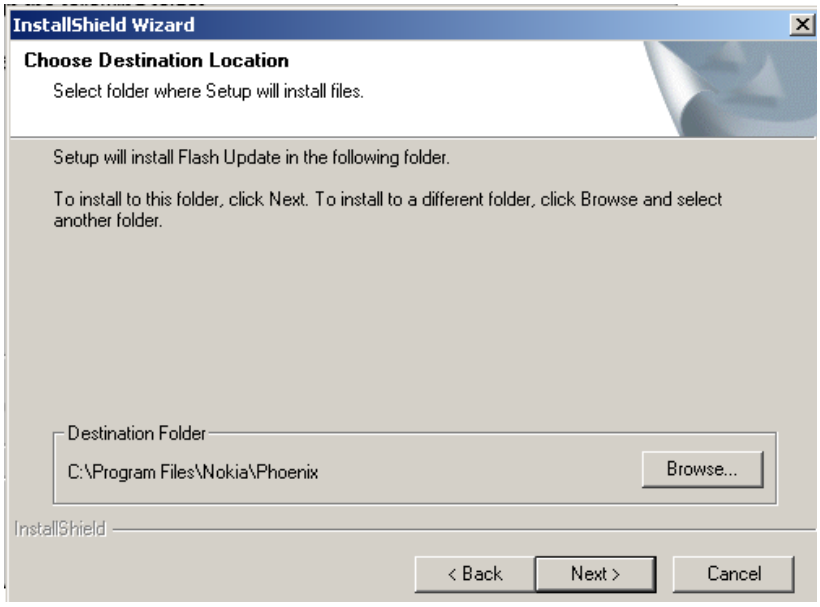


If you try to downgrade the existing version to older ones, the setup will be aborted. If you really want to downgrade, uninstall newer files manually from Control Panel and then re run the installation again.

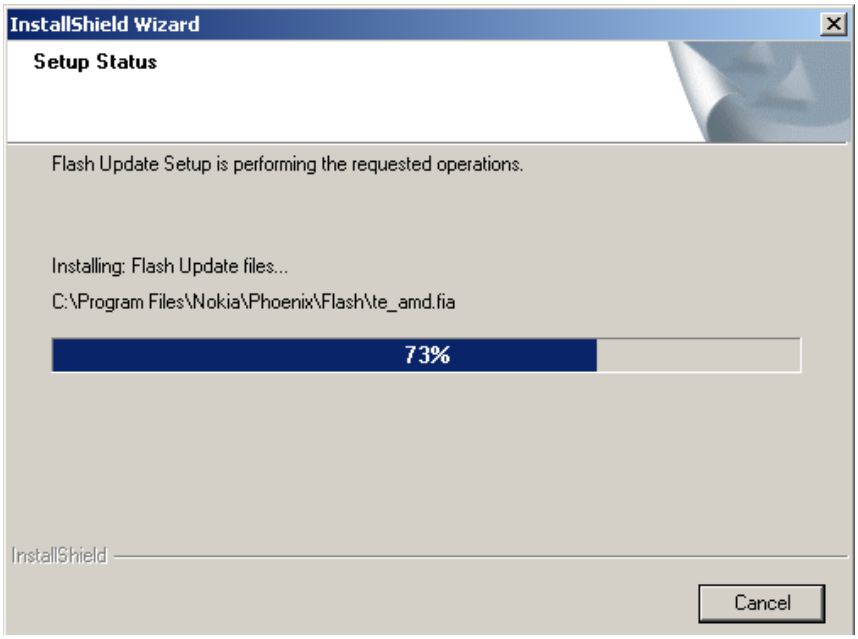
If an older version exists on your PC and it needs to be updated, choose "Next" to continue the installation.



It is **highly** recommended to install the files to the default destination folder *C:\Program Files\Nokia\Phoenix*. Choose "Next" to continue. When installing the flash update files for the first time you may choose another location by selecting "Browse" (not recommended).



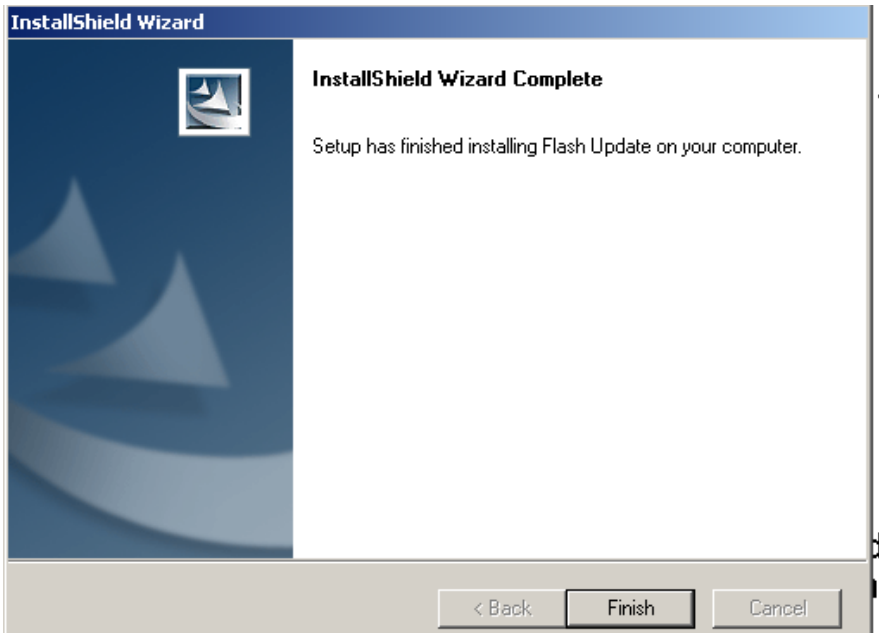
The installation continues.



Choose "Finish" to complete the procedure.

FLS-4 can be used right after Flash Update Package is installed.

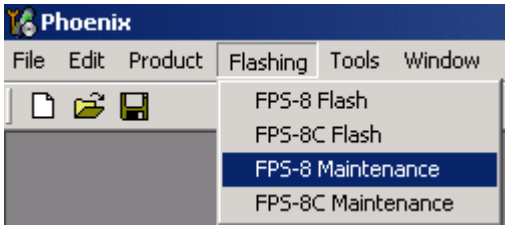
FPS-8* flash prommer must be updated by using Phoenix!



Updating the FPS-8* Flash Prommer SW

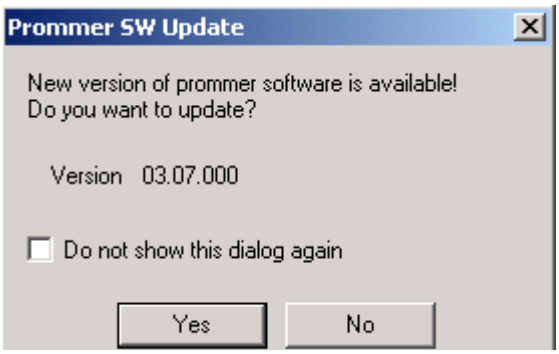
Start Phoenix Service Software and login, manage connection correctly for the FPS-8* flash prommer.

Select "FPS-8 maintenance" from "Flashing" menu.

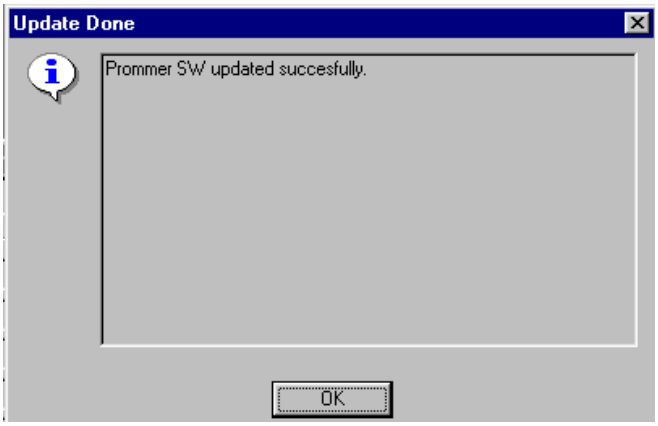


When new FPS-8 flash update package is installed to computer you will be asked to update the files to your FPS-8 Prommer.

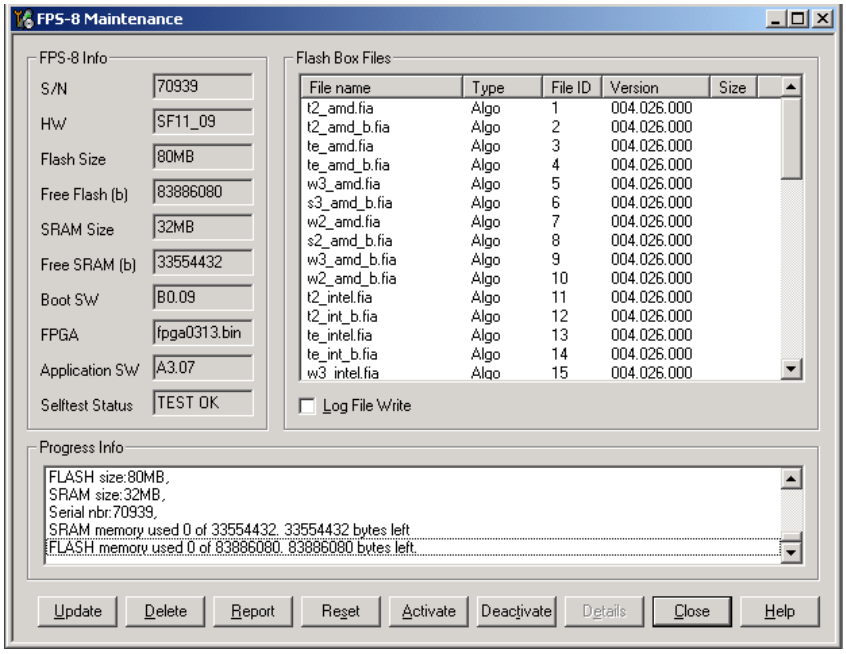
Select "Yes" to update files.



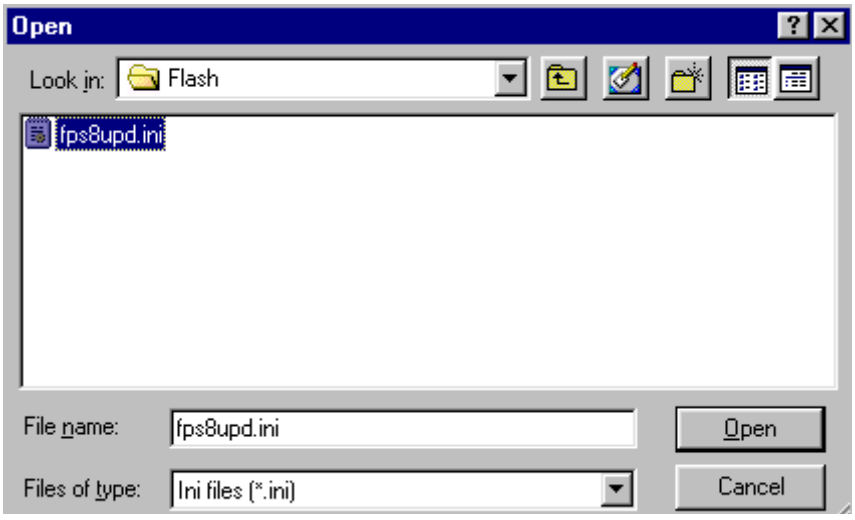
The update procedure takes a couple of minutes, please wait until you are notified that update has been successful. Choose "OK" and close "FPS8 Maintenance" UI.



View after a successful prommer software update.



FPS-8 sw can also be updated by pressing "Update" and selecting appropriate **fps8upd.ini** file under *C:\Program Files\Nokia\Phoenix***Flash**.



All files can be loaded separately to FPS-8. To do this, just press the right mouse button in the "Flash box files" window and select file type to be loaded.

More information and help can be found from "Help" dialog.

Activating and Deactivating FPS-8

- Before the FPS-8 can be successfully used for phone programming, it must be first activated.
- If there is a need to send FPS-8 box to somewhere e.g. for repair, box must be first deactivated.

Activation

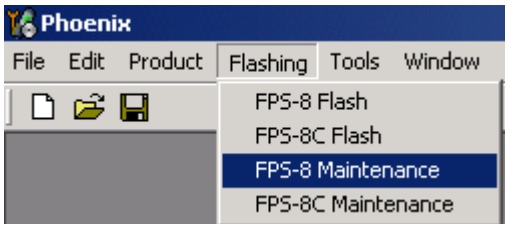
Before FPS-8 can be successfully used for phone programming, it must be first activated.

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

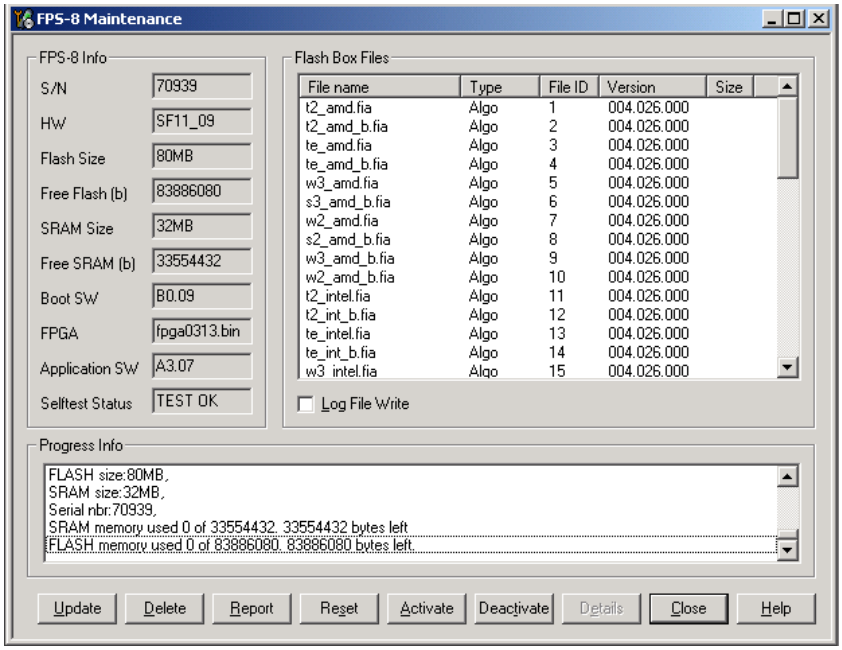
When activation file is received (e.g. 00000.in), copy it to *C:\ProgramFiles\Nokia\Phoenix\BoxActivation* directory on your computer (this directory is created when Phoenix is installed).

Start Phoenix Service Software.

Select "FPS-8 maintenance" from "Flashing" menu.

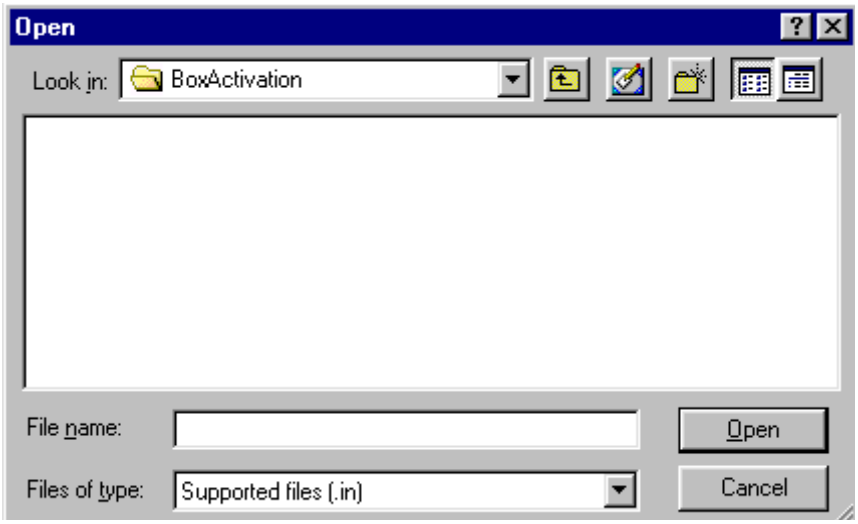


Select "Activate" from the "FPS8 Maintenance" UI. The box will be activated when you choose "**Activate**".



If you want to save the activation file to another directory on your PC, please browse to find it.

The box will be activated when you choose "**Open**".



Turn FPS-8 power off and on to complete the activation.

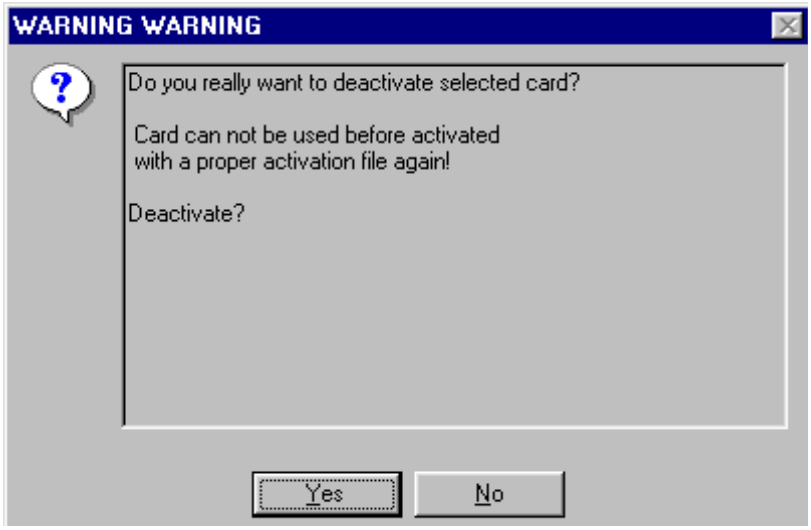
Deactivation

Start Phoenix Service Software.

Select "FPS-8 maintenance from the "Flashing" menu as when activating prommer or updating sw.

Select "**Deactivate**" from the "FPS8 Maintenance" UI.

Confirm Deactivation by choosing "Yes". The box will be deactivated.



Turn FPS-8 power off and on to complete deactivation.

TFE-4/RV-1 Delta Test Description

Basically the TFE-4/RV-1 tests, supported by PHOENIX, are the same as of NHM-7.

Main difference to NHM-7 is, that the 1900MHz band is skipped off.

The following test description refers to the deltas, only.

Delta Test description for POS

For service level 1 and 2 (POS) the following tests (for FLS-4S) are enabled with the Phoenix service software..

- Selftest
- ADC Reading
- Audio Testing
- Digital I/O Testing
- SIM Test

The same tests can also be run with the AMS Service Software release. For Audio Testing there are slight differences which are described later.

Prepare the test setups as described elsewhere in this Service Manual.

Self Test

Refer to Delta test description for AMS Service SW release.

BB ADC-Readings

Refer to Delta test description for AMS Service SW release.

Audio Testing

Test description:

Open the Audio Test Menu from the Testing drop down menu.

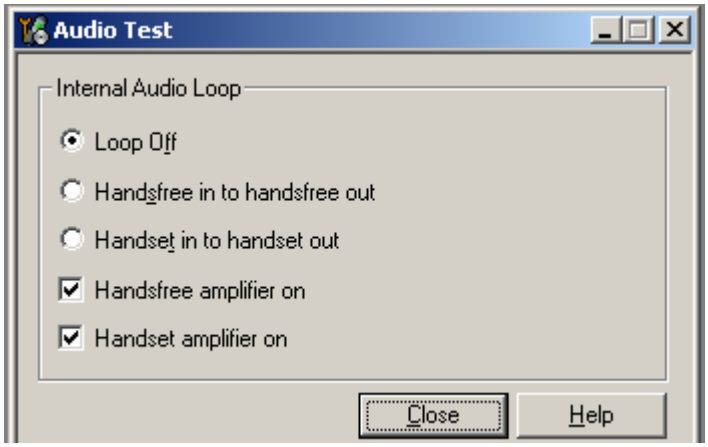


Figure 1: Audio-Test setup

Perform the Test:

Activate the loop to send the HF-Mic (hands free in) signal to HF Speaker (hands free out). When the HF-Mic is connected, blowing into the HF-Microphone shall be hearable in the HF-Speaker.

In a second step, activate the loop to send the HD-Mic (handset in) signal to HD Speaker (handset out). When Headset is connected, blowing into Handset Microphone shall be hearable in the Handset Speaker.

By deactivating the loop no signal should go through.

Digital I/O Tests

Refer to Delta test description for AMS Service SW release.

SIM Test

Refer to Delta test description for AMS Service SW release.

Delta Test description for AMS Service SW release

Self Test

Test description:

Open the Self Test Menu from the Testing drop down menu.

Press the RUN Button to start the test. The test results will be displayed.

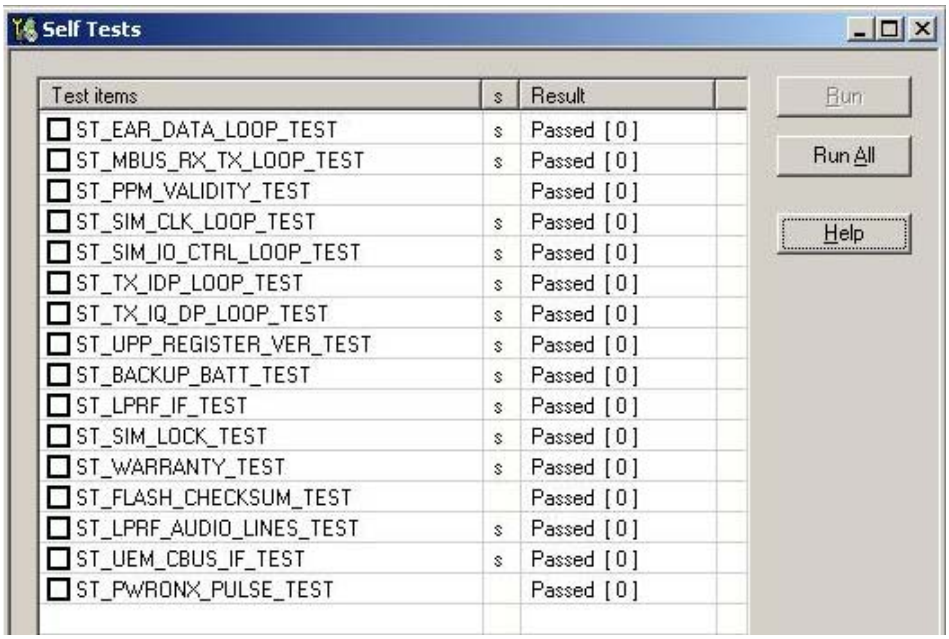


Figure 2: Self-Test setup

BB ADC-Readings

Test description:

Open the ADC Reading Test Menu from the Testing drop down menu.

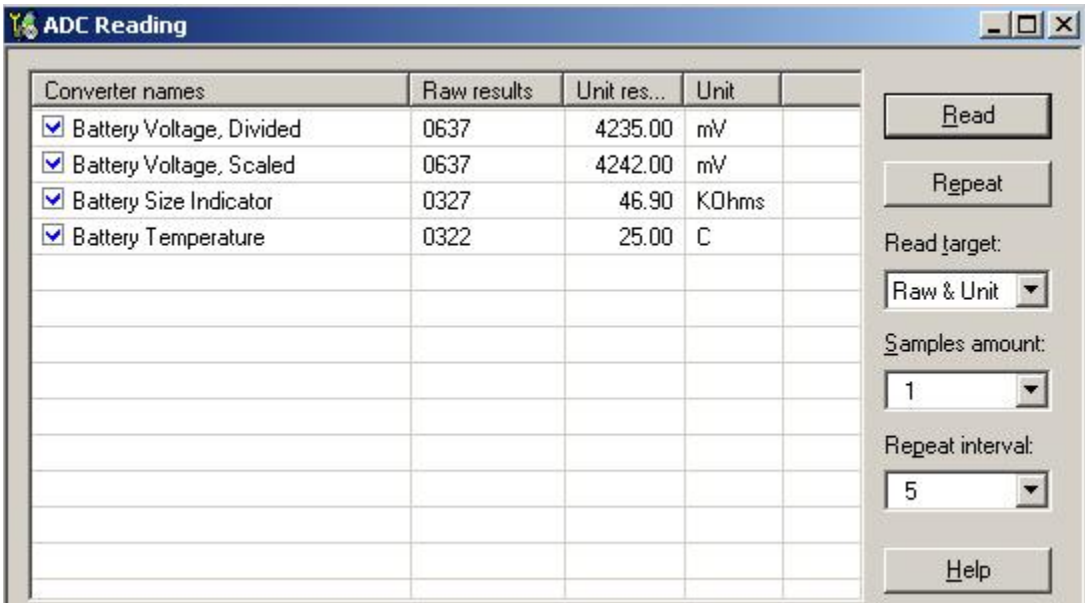


Figure 3: ADC-Readings

Perform the Test:

There are no Base band Alignments to be done, only the AD-Values should be read out to check if the inputs of the AD-Converter have the right levels. The BSI and BTEMP line can be checked with the Local-Mode switch and the VEB-Power (replacement for the Phone battery) voltage can be read out. To control this value the real Voltage should be controlled by Voltage-Meter. The Testing Limits can be seen in Table below:

AD Channel	Local Switch	Low	High
BSI	Normal	44kR FLS-4S: 3K	49kR FLS-4S: 9K
BTEMP	XXX	23°C	27°C
VBAT	XXX	4,1V	4,4V

Audio Testing

Test description:

STEP 1: Prepare Phoenix and Phone:

-Activate Local Mode

Open the Audio Test Menu from the Testing drop down menu.

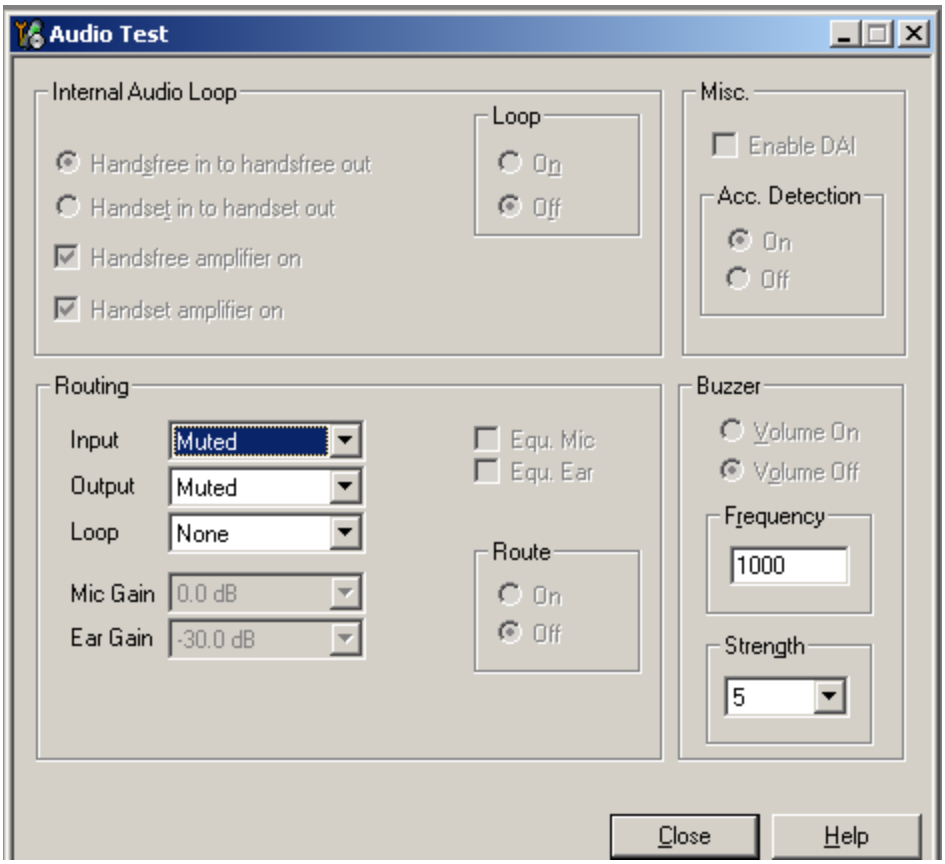


Figure 4: Audio-Test setup

Step 2: Perform the Test:

Basic Setup:

A Loop is switched internally to send the HF-Mic signal to HF Speaker and in second step HDMIC to HD Speaker. Blowing into Microphone shall be hearable in the Speaker. By activating the Hands free-Speaker Mute the Loop has be opened (no signal goes through). When Headset is connected, blowing into Handset Microphone shall be hearable in the Handset Speaker. By activating the Handset-Speaker Mute the Loop has be opened (no signal goes through)

Extended Setup:

Therefore, a Loop is switched internally to send the HF-Mic signal to HF Speaker and in second step HDMIC to HD Speaker. The frequence 1000Hz has to be tested. Additionally the Distortion is to be checked. By activating the Hands free Speaker Mutes or the Handset Speaker Mute options within Digital I/O Tests the regarding Loop has to be open

The Bias Voltage of the HF-MIC is to be measured with Voltmeter (<>5V).

MIC-Path	Frequency	Generator Voltage	Low Limit	Upper Limit
HDMIC	1000	30mV.	440mV (30dB)	705mV (40dB)
HFMIC	1000	50mV	1280mV (15dB)	2050mV (20dB)

Digital I/O Tests

For this test following Workflow is necessary:

Step 1: Prepare Phone and Phoenix

- Start Phone by Ignition Switch on AD-2 Power adapter
- Scan Product, set to local mode
- Open the Digital I/O Test from the Testing drop down menu.

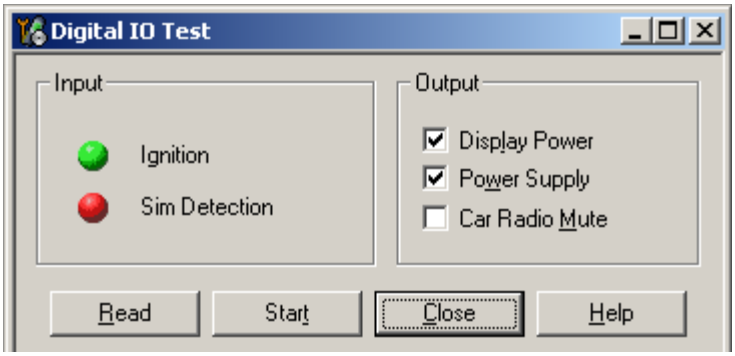


Figure 5: Digital IO Test

Step 2: Do the tests

- Read "Ignition", should be Active
- Activate "Power Supply" option (Alt-o')
- Switch off Ignition sense,
- Read "Ignition", should be inactive now and no error shall occur
- Switch on Ignition Sense on AD-2
- Read again Ignition, should be active now
- Switch on Display Power and connect an Input Device
- Connected Input device should have activated Lights now (alternative measure the Voltage VIDU at Display and Input device connector by voltage meter should be <>0V)
- Deactivate "Display Power" option, Lights of the Input Device should be off now
- Activate CRM option, LED at AD-2 Power adapter should lighten
- Deactivate CRM light should be off now

SIM-TEST

Test description:

SIM-card can be tested by normal Phone call or within Phoenix. This test is supported by the SIM Test.

Open the SIM Test Menu from the Testing drop down menu.

Plug into SIM reader a functioning SIM card and press Update. (TF-4R Device has to be in

Test/Local mode).

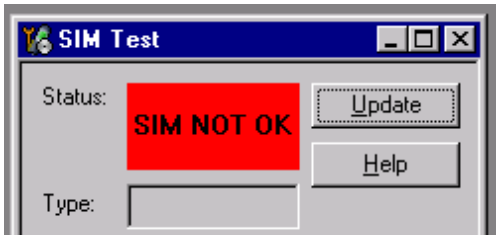


Figure 6: Sim-Test option

Engine module RF-Alignment

Because Engine modules are delivered already fully aligned, only Call tests need to be done (against Tester). To check general Function a Call against Network (think of using a suitable Antenna) should be done.

If the alignment is not as specified, the alignment can be done as with NHM-7.

Nokia Customer Care
Nokia 610 & 616 CarKit Phone (TFE-4/RV-1)

4 - Service Tools

Issue 2.0 Mar/2005

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List of Service Tools

Type Designator	Description	Functionality
FLS-4S	Flash Adapter for EMEA	To flash product SW into the product
		
FPS-8	Flash Prommer	To flash product SW into the product. Service tool for high level service. Power is suplied to the FPS-8 from the ACF-8 . The sales pack contains: • FPS-8 Flash Prommer • FPS-8 Activation sheet • ACF-8 Power Supply • AXS-4 Service Cable (D9-D9) • Printer cable
		
FPS-10	Flash Prommer	To flash product SW into the DCT-4 and BB5 products. Service tool for high level service, can replace the FPS-8 Flash Prommer. The sales pack contains: • FPS-10 Flash Prommer • AC-33 Power Supply and cables • USB Cable CA-31D Note: The FPS-10 requires the following power cables: • JBV-1/DA-18 concept CA-41PS • FLA-41 concept CA-35S
	 backside 	

Type Designator	Description	Functionality
JBT-9	BT Testbox	BER Test
		
CA-35S	Power Cable	Power cable for FPS-10 FLA-41 concept.
		
PCS-1	Power Cable	Connection between Power Supply and MJ-1. Connection between adjustable Power Supply and AD-2.
		
CA-1S	Flash Cable	Connection between FLS-4S or FPS-8 to RU.
		

Type Designator	Description	Functionality
AXS-4	Serial Cable	Connection between JBT-9 to PC.
		
XCS-4	Connection Cable	Connection between FLS-4S or FPS-8 to MJ-1.
		
CA-16UTS	Audio Cable	Service Cable, necessary for audio measurement.
		
CA-29RS	RF Cable	Connection Cable between TFE-4/RV-1 RU and e.g. Radio Communication Tester.
		

Type Designator	Description	Functionality
ACW-4	Power Supply (13.gV, 3.6A)	Power to AD-2.
		
ACP-8E	Power Supply (5.3V, 500mA)	Power to JBT-9
		
ACF-8	Power Supply (6V, 2.1A)	Power to FPS-8. Power to FLS-4S
		

AD-2 Power Adapter (Product Code: 0770632)

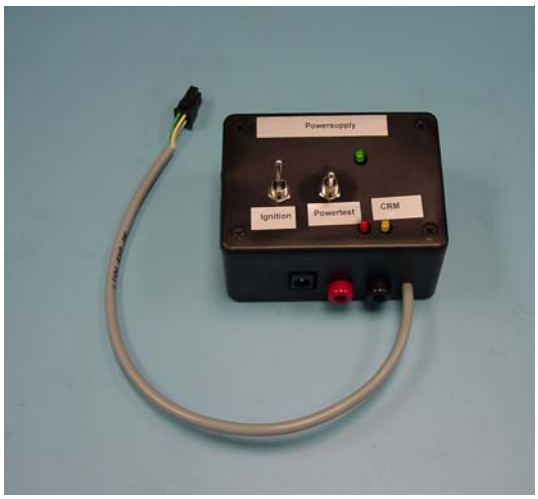
Introduction

The AD-2 (picture1) power adapter provides the TFE-4/RV-1 radio unit with the supply voltage. In addition this device supports the following functions:

Testing of leakage current, Car Radio Mute-functionality.

The main power supply for the AD-2 is the ACW-4. It has to be connected into the main power supply input.

Picture1: AD-2 Power Adapter



Operation Modes

The AD-2 power adpapter supports two modes:

Powertest (Sleep)-Mode:

This mode is active, if the 'IGNITION' switch is in status off and 'POWERTEST' switch is in status on. In this mode the leakage current will be measured. If the leakage current is higher than approximately 5mA, it will be indicated by a LED. Exact measurement of the leakage current is supported by the banana jacks aside of the AD-2 box.

Operational-Mode:

This mode is active when the switch setting of Ignition-Switch is on and the Power test switch is off. With activated Ignition the TFE-4/RV-1 device should start. During Flashing this switch has to be on also.

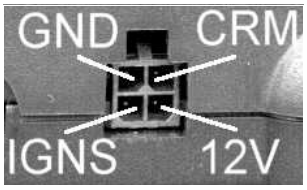
Testing of basic functions is supported by some LEDs, e.g. a dedicated LED indicates that the ACW-4 is connected to AD-2, a further LED checks the status of the CRM output. The IGNS signal can be switched on and off manually.

During a call the CRM-line will be pulled down. This can be checked during GSM Go/ Nogo-Test. This will be indicated by a dedicated CRM-LED.

Table 1: Pin-Layout of the TFE-4/RV-1 Car-Connector

Pin	Line Symbol	Parameter	Type	Min.	Typical	Max.	Unit / Notes
1	VBAT	Input from a car battery	Power In	8.0 10.8	13.2	16 16	V DC (working) V DC (spec. fulfill)
						1.5 1	A DC (working) mA DC (sleep mode)
2	IGNS	Ignition sense low high	I	 8	 13.2 TBD.	1.0 16	VDC VDC kohm / impedance to GND
3	CRM	Car radio mute off off on on on	O	 80 1.0	0 180	 16 220 4.0	mA / open collector output VDC mA / current limiting value Ohm / max load V / at max. current
4	BGND	Car battery ground			0		VDC

Figure 1: Power connector of TFE-4/RV-1 Face-View



MJ-1 Module-Jig (Product Code: 0770631)

Introduction

The purpose of this module jig is to provide a method of applying voltage from an external power supply when the module is out of its mechanics and to support analysis measurements. Furthermore the MCU software can be flashed into the engine module while it is out of its mechanics.

The repair jig provides following functions:

- Fused protection
- Overvoltage protection
- Reverse polarity protection
- ESD protection
- Decoupling capacitors
- Access to exposed components and GSM connector
- Access to internal test points (Jxxx)
- BlueTooth coupler

It is intended that the module jig should be used, under all circumstances, where an external supply to the phone is required while the phone is out of its mechanics.

The supply voltage to the module jig is intended to be: **4.2V** nominal.

Picture 2: MJ-1 modular jig

General Description of the Test PWB

The MJ-1 module jig has one PWB; the Test-PWB.

The Test-PWB connects

- all test points (including the power supply Connection)
- the SIM-Pads of the TF4 PWB
- the RS232 testpattern.

Additionally there are some connectors and a SIM holder mounted on the Test-PWB. The flashing and the M/FBUS control is enabled via standard modular connectors. The Test-PWB is shown in Figure 2.

Furthermore the Modul-Jig is equipped with guiding-needles to guide the engine PWB relative to the Test-PWB.

The engine PWB testpatterns are connected to the Flash-/Audio connectors and to the pin header via needles

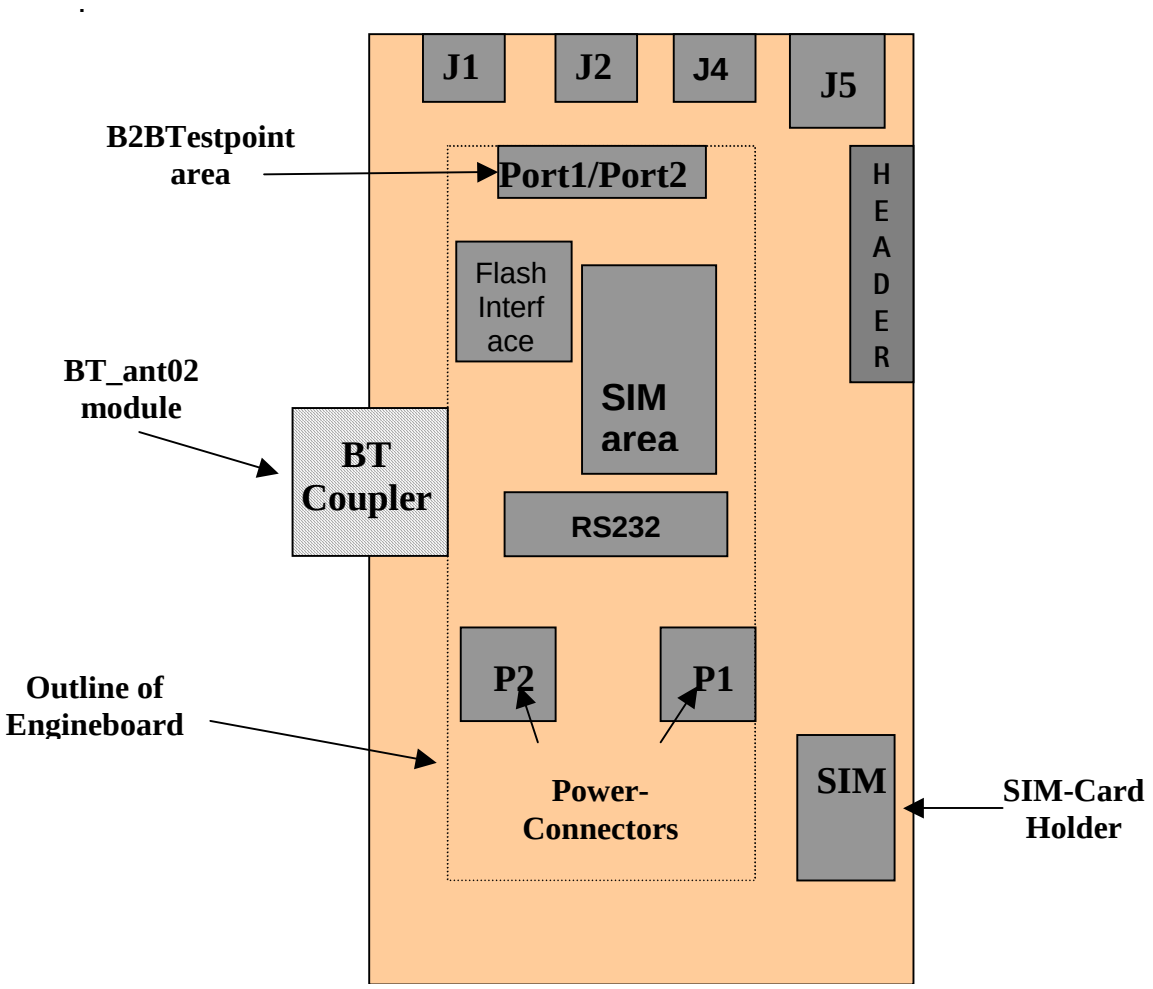


Figure 2: Principle overview of MJ-1 Test-PWB

Connectors on Test-PWB

Table 2: Connectors on Test PWB

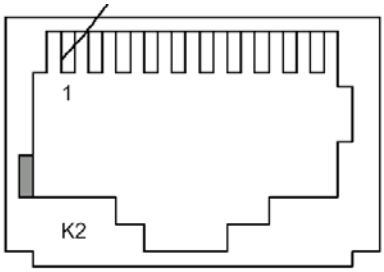
Part number	Pcs	Name of part	Notes
J5	1	DC jack for use with PCS-1 cable	
J1	1	Modular jack 10pole for use with axs-1 cable	For Flash, same as for HDb-13
J3,J4	2	Modular jack 4 pole, for use with Audio cable	For Audio, same as HD connec-tor
	1	SIM holder use with standard SIM card	
S1, (Phone Mode) S2, (Power) S3 (Ignition)	1	Switch	SS-302 B22H06R/Misaki
TP1, 4,5,6	4	GND PIN	

Flash Connector

For the flash connector the standard pinning of the FPS-8 connector has been taken. For the TF4 the VPP, MBUS, FBUS_RX, FBUS_TX and BSI signals are used.

Audio Connector

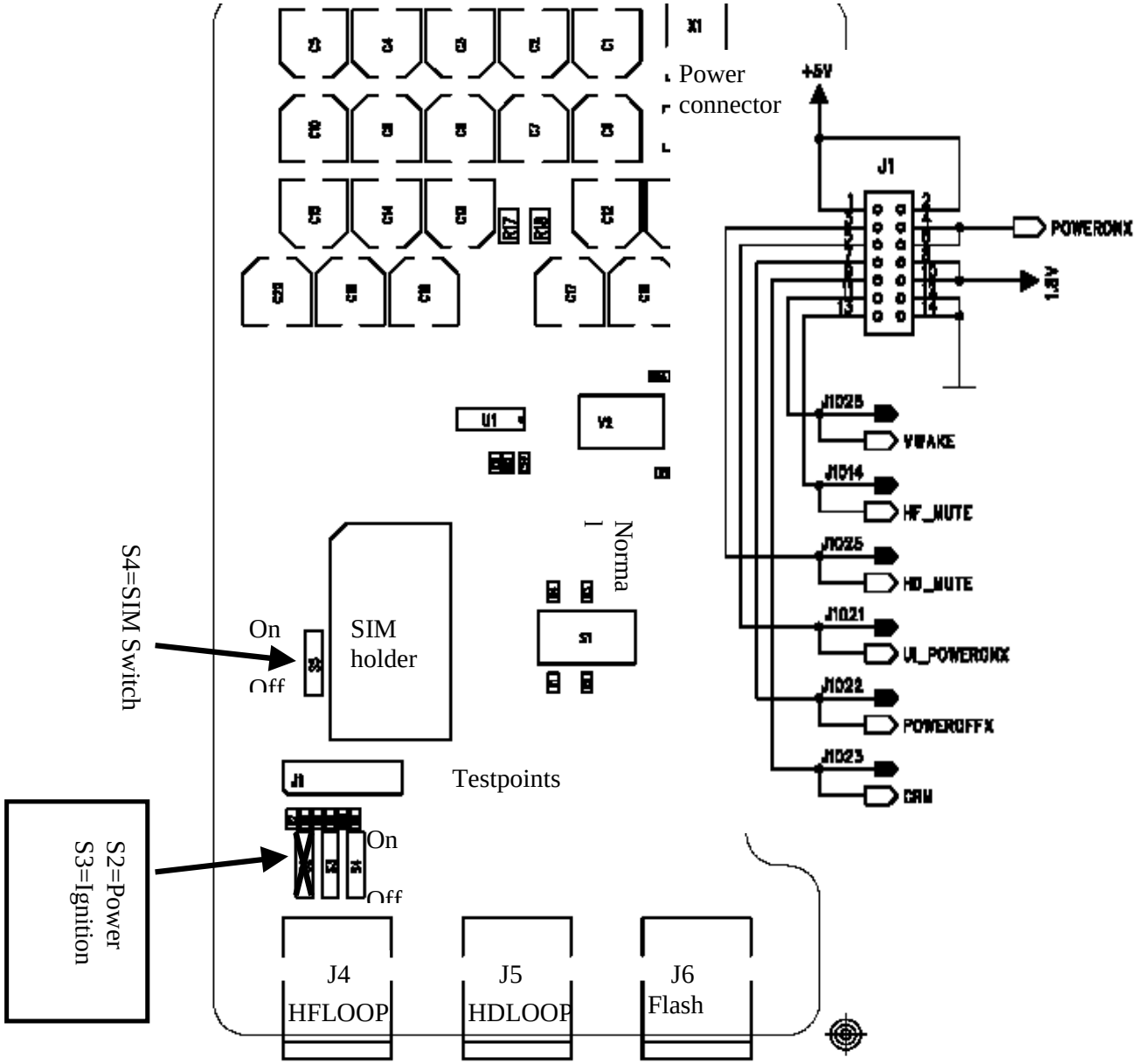
The Audio Connector J3 and J4 have following pinning.



Pin No	Signal (J3)	Pin No	Signal (J4)
2	B2BXEARN	2	B2BXEARN
3	B2BXEARP	3	B2BXEARP
4	B2BHFMICN	4	B2BHFMICN
5	B2BHFMICP	5	B2BHFMICP
9	gnd	9	gnd

Note: Pin 1 is at the left side of the PWB connector (Face view).
A K2 coded connector is used

Switches on MJ-1



Startup TF4 within MJ-1

To test the TF4 board, the PWB has to be inserted into the MJ-1-Jig and the locking mechanism has to be closed. Afterwards the Power has to be applied to the power connector of the Jig. Check that S3 (IGNS) is **'on'.** TF4 will startup if the power is applied by S2 (Power Switch).

Operating Mode

The operating mode can be adjusted by the 'Mode Switch' (S1).

Note: operating mode can only be selected during startup. Changing the operating mode switch while the phone is active does not change the operation mode. The Operating mode of an active phone can only be changed by TSS-Software.

SIM Reader

The MJ-1 contains a SIM reader and an external SIM-Switch (S4). When the switch is open, the SIM card is deactivated. To check the SIM interface or to generate a phone call, insert a proper SIM card and close sim holder.

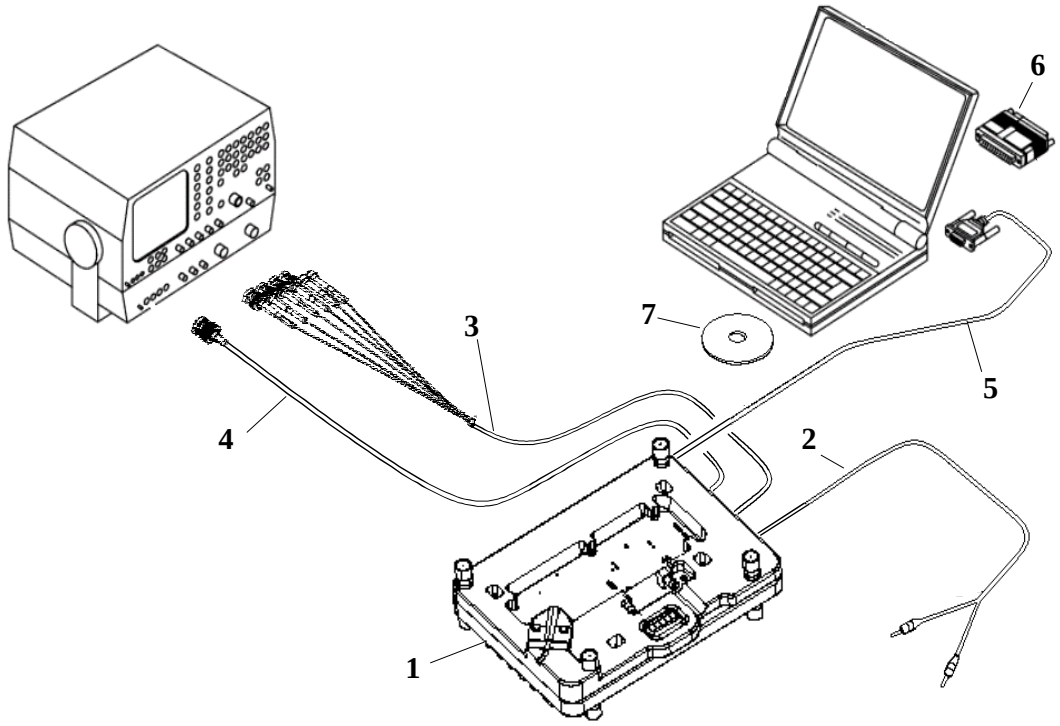
Note: Also the TF4 PWB versions with soldered SIM reader are supported by the MJ-1 Services Tool. In this case the SIM card is to be put inside of the SIM-Holder on the TF4 PWB and the SIM holder on the TF4 PWB is to be locked propperly.

Pin header

Reserved		1	2	Reserved
HD_MUTE	1.8V level output of TF-4	3	4	Poweronx (0.5Hz rectangular signal,4.3V)
UI_POWER	1.8V level output of TF-4	5	6	Poweronx (0.5Hz rectangular signal,4.3V)
Poweroff_X	1.8V level output of TF-4	7	8	1.8V supply of MJ-1
CRM	1.8V level output of TF-4	9	10	1.8V supply of MJ-1
PhonePWR	Supply voltage for phone	11	12	Gnd
HF_Mute	1.8V level output of TF-4	13	14	Gnd

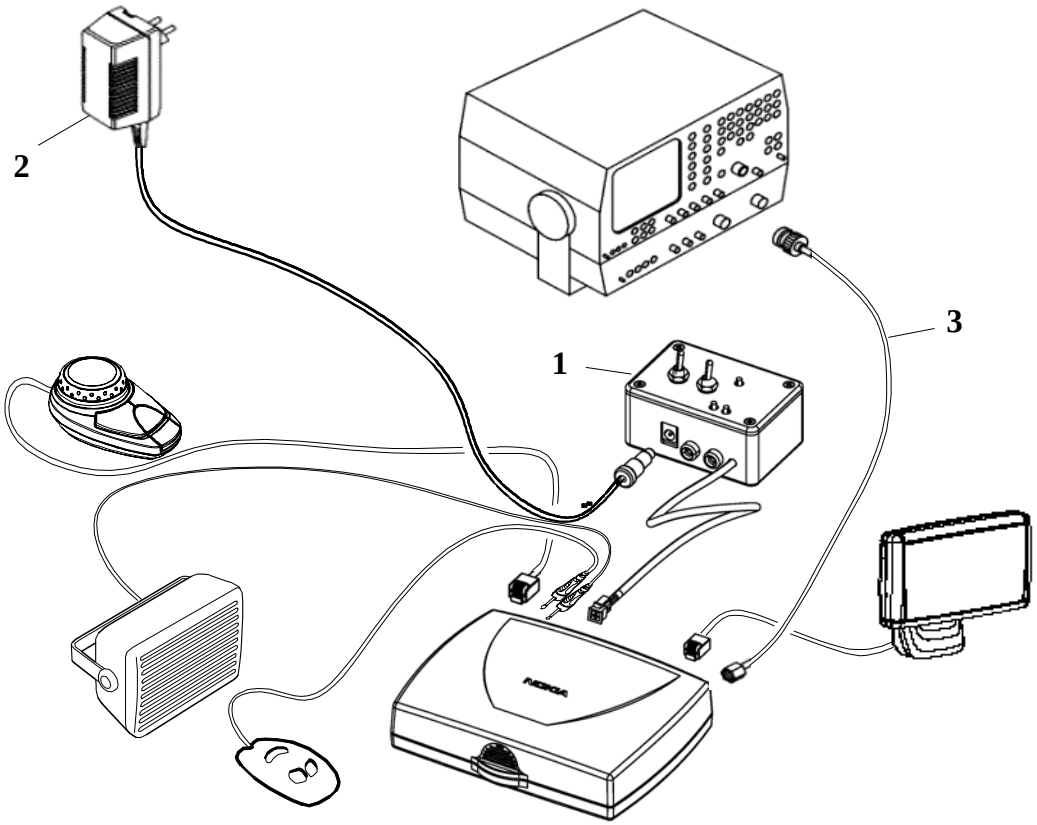
Service test connections

Module Jig concept



Item	Type	Description	Part Code
1	MJ-1	Module Jig	0770631
2	PCS-1	DC Power Cable	0730012
3	CA-16UTS	Audio Test Cable	0730310
4	XRF-1	RF and AM Antenna Cable	0730085
5	DAU-9S	Service Cable	0730108
6	PKD-1	SW Protection Key	0750018
7	~~~~	Service SW	********

Final test setup-RCC (Call simulation with Radio Communication Tester)



Item	Type	Description	Part Code
1	AD-2	Power Adapter	0770632
2	ACW-4	Power Supply for AD-2	0675227
3	CA-29RS	RF Cable	0730320

5 - Disassembly Instructions

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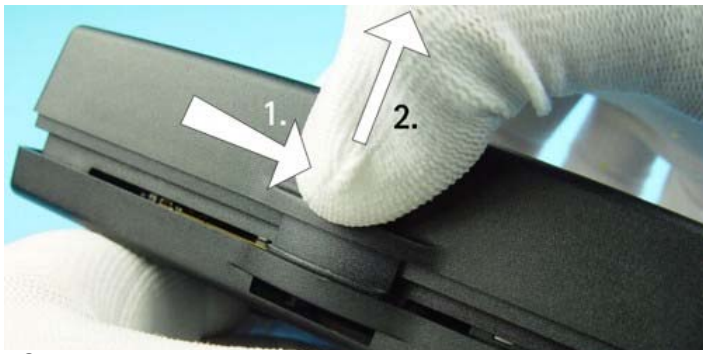
Disassembly Instructions



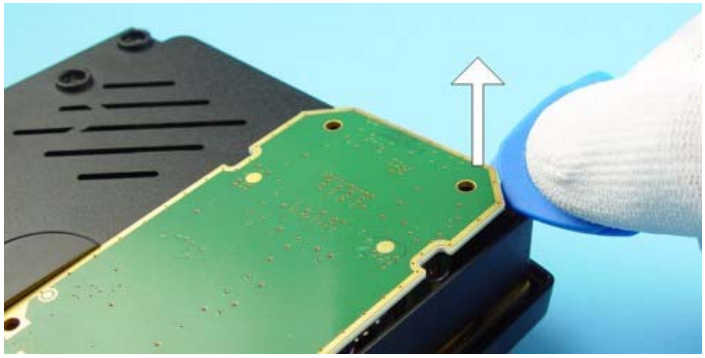
1. Remove 'A' Cover by pressing the Release Button and turn upwards

2. Screw No. 4 can be found under the Warranty Seal Label. Tool SRT-6 can be used to uncover the screw. **Note: Warranty is void if this label is broken.**

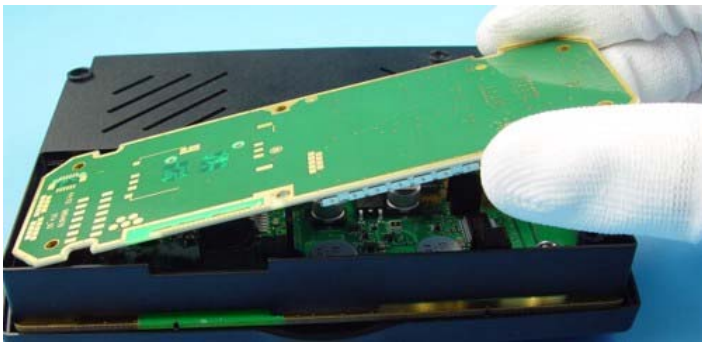
3. Unscrew the nine (9) TORX 8 screws, in the order shown above. **For assembly replace in the same order 1 to 9 with a torque load of 40 Ncm. Once assembled apply a new Warranty Seal label.**

4. Bend the SIM Cover as shown and separate it from the Warranty Seal Label.

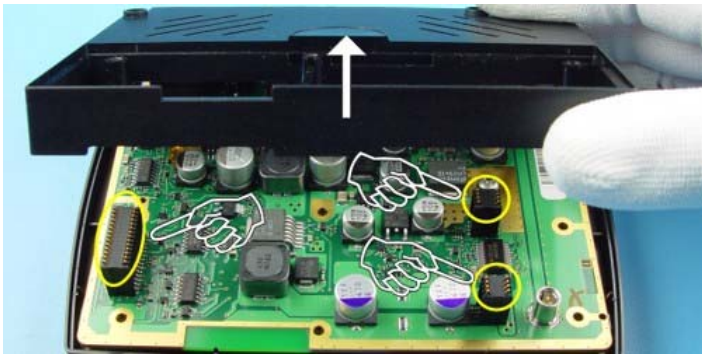
5. Remove the Warranty Seal Label from the frame completely.



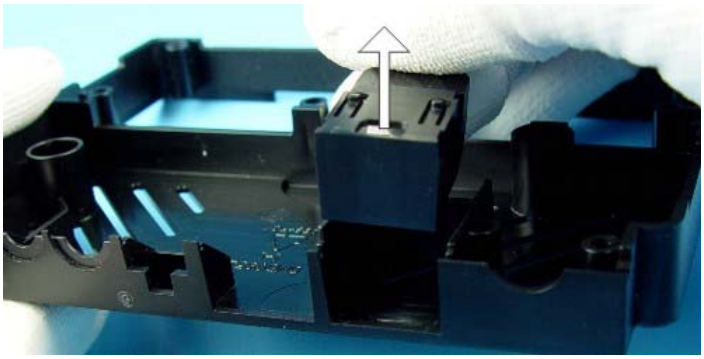
6. Engine Unit and Junction Module are attached to each other through antenna connector. Use SRT-6 to separate the parts as shown.



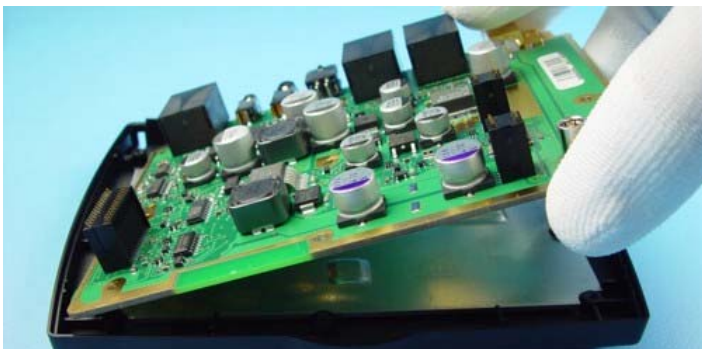
7. Now remove the Engine Unit from the Frame. SIM reader is not soldered and can be removed easily.



8. Remove the Frame. Do not touch the spring contacts.



9. Remove the Data Cap.



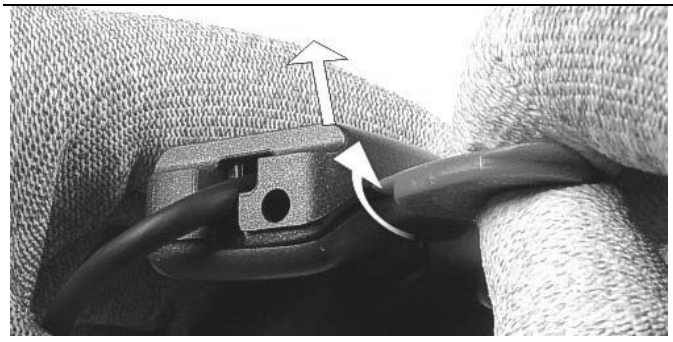
10. Remove the Junction Module with the Heatsink still attached. Note: Junction Module should not be separated from the Heatsink.

Assembly

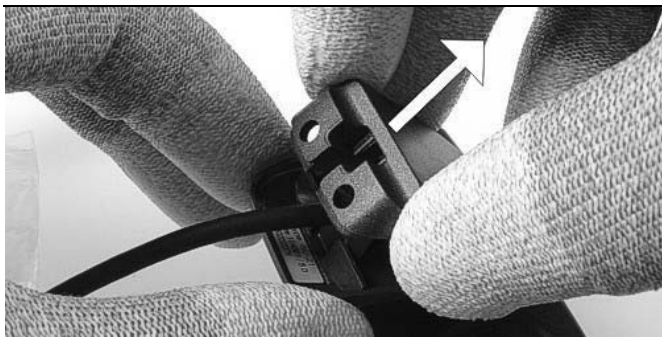
Assembly after service will be carried out in the reverse order of the disassembly.

Note: Before returning device to customer make sure to reseal with a new Warranty Seal label. All remains of the old one must be removed first.

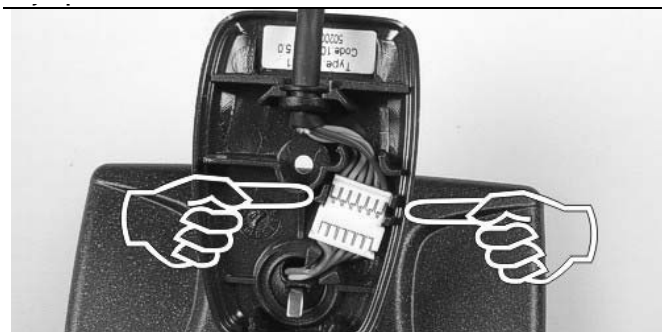
Disassembly Instructions for the SU11/SU21



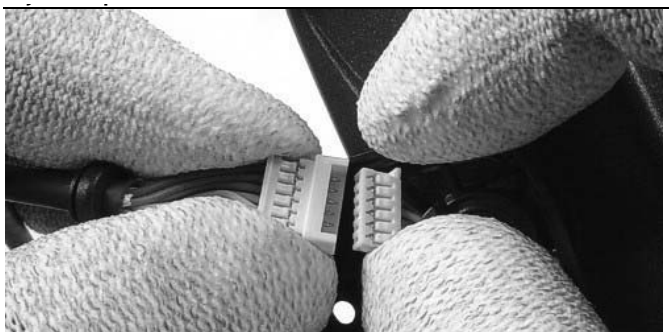
1. Open the cover of the Holder Kit with the SRT-6 tool.



2. Lift up the cover.



3. Note the cable routing and the two guide pins at both sides of the connector.



4. Remove the connector out of the guide pins and disconnect the cable.

Note: For assembly use the reverse order.

Disassembly Instructions for the SIM flap

1. Open the 'A' Cover.

2. Move the SIM flap in the direction shown.

3. Carefully remove the SIM flap.

Note: For assembly use the reverse order.

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6 Troubleshooting & Final testing

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Figures:

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Introduction to TFE-4/RV-1 troubleshooting

This document is intend to be a guide for localizing and repairing electrical faults in the TFE-4/RV-1 device. Firstly there is a brief guide for fault localizing. Then fault repairing is divided into troubleshooting paths.

Before any service operation you must be familiar with the TFE-4/RV-1 product and module level architecture. You have to also be familiar with the TFE-4/RV-1 specified service tools such as the Phoenix service software, flashing tools and software.

General guidelines for TFE-4/RV-1 trouble shooting

Tools needed for troubleshooting

- Service tools (as listed at service tools chapter in service manual)
- Laboratory power supply with current indicator
- Oscilloscope
- Digital multimeter

Low level troubleshooting for Nokia 610/N616

Fault symptom	Source of fault and corrective action											
System doesn't work at all	1	2	3			6						
DU doesn't work/no DU illumination				4	5							
DU blank, illumination OK					5							
Display is stuck						6						
Input-device/HS doesn't work, no illumination but DU is working				4			7					
Speaker doesn't work				4				8				
Microphone doesn't work				4					9			
SW hangs						6						
Bad audio quality										10		
No network connection/no service											11	
No BT connection												12

No	Source of fault	Corrective action
1	The system cable is not connected to the Radio Unit	Check the cable connection
2	The 2A fuse of the system cable is faulty	Replace fuse
3		Check the supply voltage from the car battery
4	The connection cable is not connected	Check the cable connection
5	The Display Unit is faulty	Replace the DU
6	The SW has hung	Disconnect the system cable of the RU and restart
7	The Handset is faulty	Replace Handset
8	The Speaker is faulty	Replace Speaker
9	The Microphone is faulty	Replace Microphone
10		Check Equalizer settings
11		Check connections to antenna
12		Delete pairing, try to pair device again, BT device may be faulty

Test-Setups for Troubleshooting

The following test setups are defined for troubleshooting on TFE-4/RV-1.

- General Test Setup
- Flashing on POS level
- Flashing on RCC level
- Selftest
- BT Test
- ADC Readings
- Audio Testing
- Digital I/O
- SIM Test
- RF Alignment
- Repair jig MJ-1
- Call Test
- PPC's

The following service tools are basically needed to perform the tests.

- PC with Phoenix
- PKD-1 in combination with FPS-8
- FLS-4S Flashdongle
- CA-1S Flashcable
- AD-2 Poweradapter with ACW-4 Powersupply
- Test SIM card/Network SIM card
- MJ-1 Module Jig

General Test Setup (Check Phone Information)

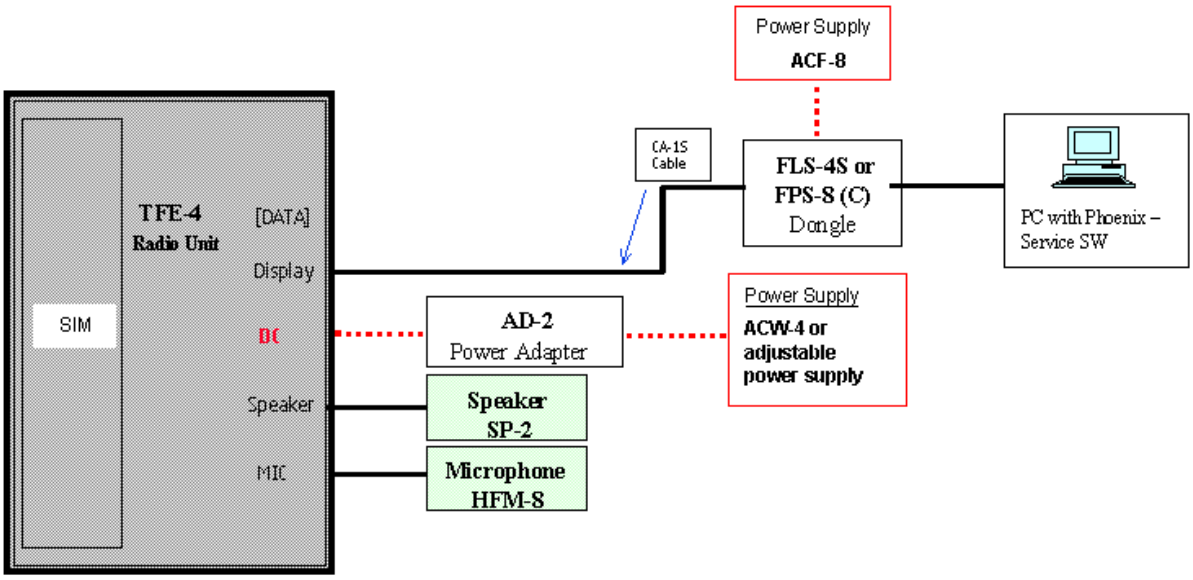
HW-setup

Connect the product specific Flash-cable (CA-1S) to the used dongle (e.g. FLS-4S) and to the Display-Connector of TFE-4/RV-1 (see figure 1)

A power adapter AD-2 is necessary to supply 13.8V to the Radio Unit.

(ACW-4 is the power supply for AD-2 power adapter)

Figure 1: Basic HW-setup

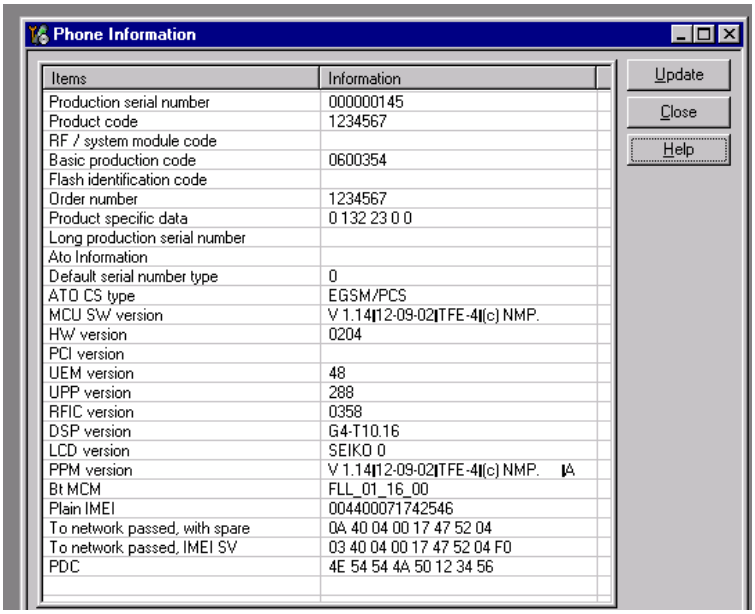


Part No.	Part Name	Description
0770632	AD-2	Power adapter
0730312	CA-1S	Flash cable
0080541	FLS-4S	Flashdongle for EMEA
0080542	FLS-4S	Flashdongle for APAC
0675227	ACW-4	Power supply for AD-2
0774286	Phoenix	Service-SW

Checking Phone Information/IMEI

To read out the phone information/IMEI number, choose 'Product' from the menue bar and select 'Phone Information' from the drop down menue. The information will be read out automatically the first time, or can be forced to be read out by pressing the 'Update' button.

Figure 2: Phone Information



During flashing the default tuning values and product identification parameters are stored into phone's flash memory.

Following constants must be saved to the permanent memory.

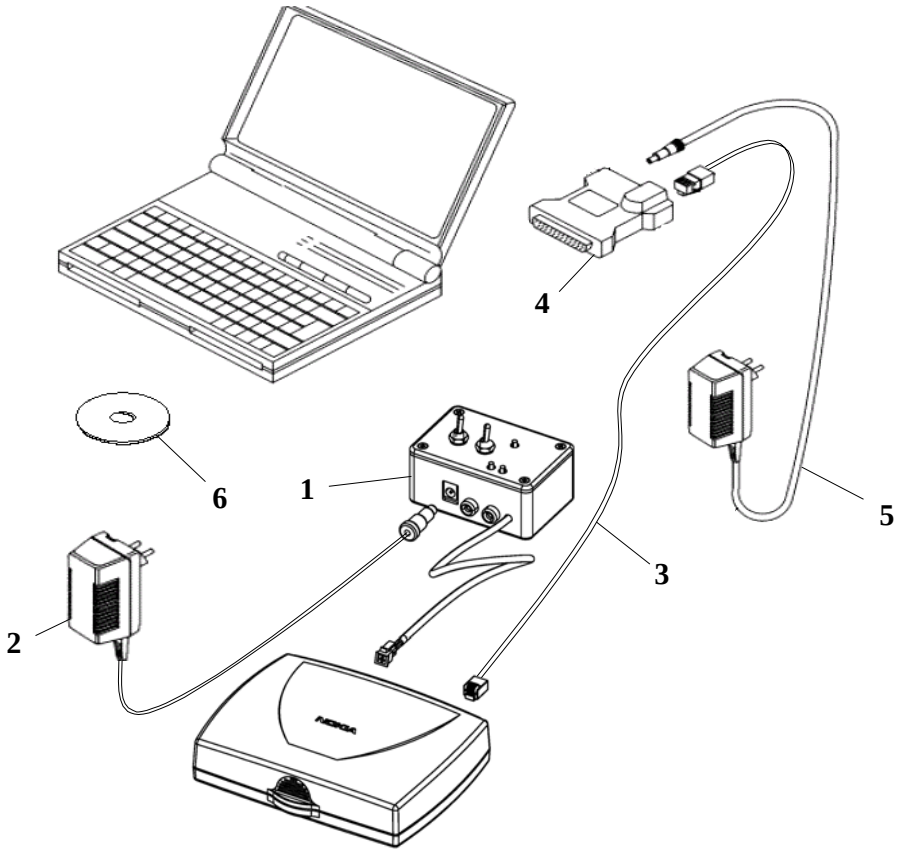
NAME	Digits
Production code	7
Basic production code	7
Flash ID code	5
Order number	7
Production Number	15
HW ID	4

Those should be checked by reading out the Phone Information. Further the IMEI should be checked.

Flashing on POS Level

For POS flashing, prepare the test set up as following:

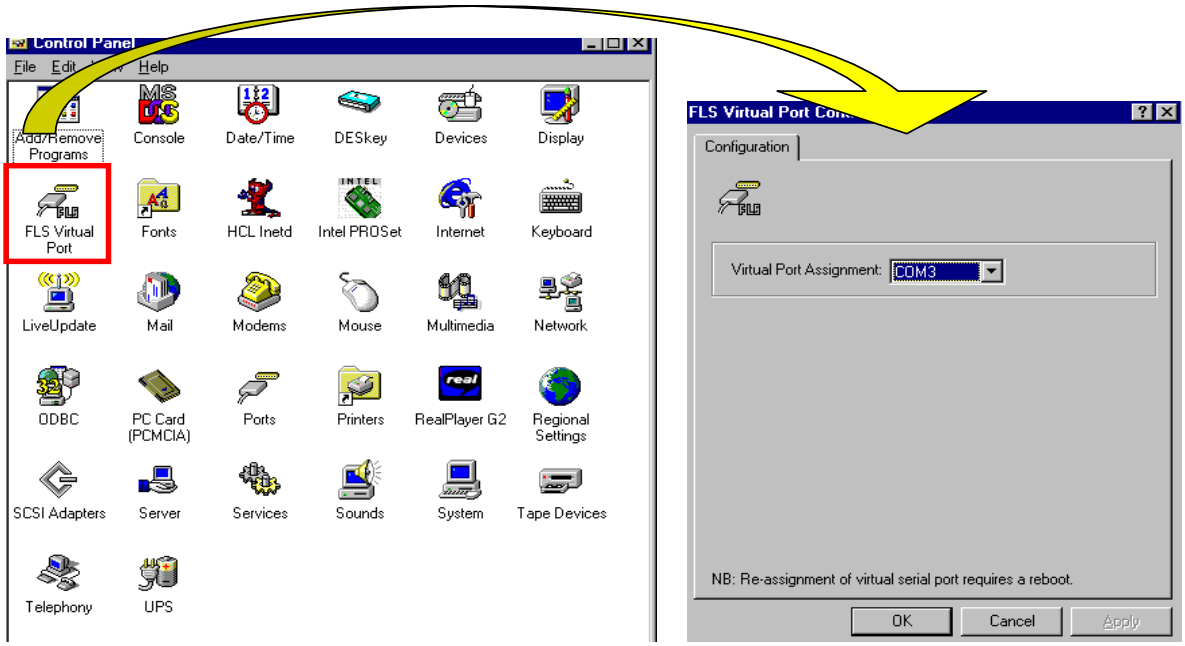
Figure 3: Flash concept via FLS-4S:



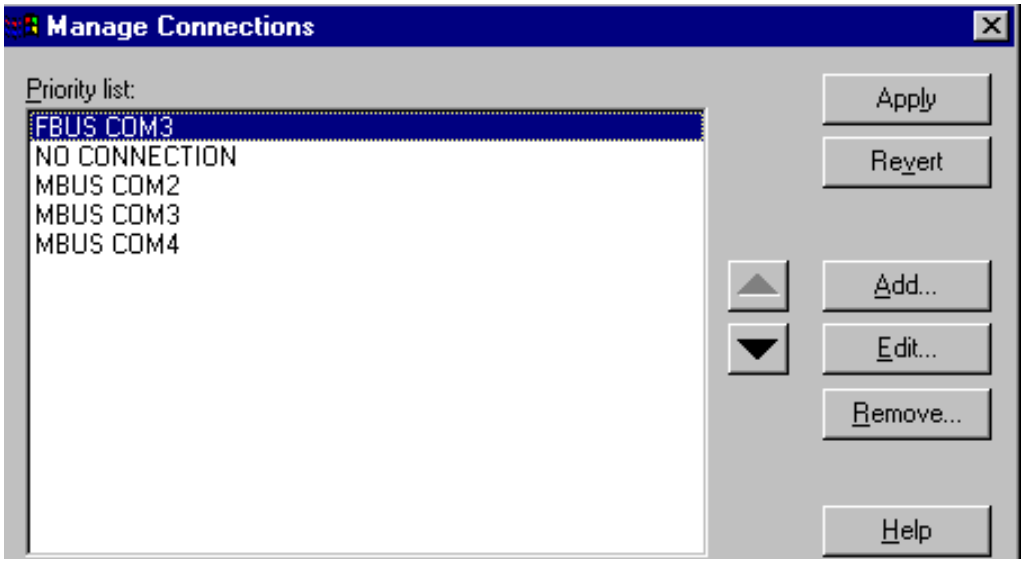
Item	Type	Description	Part Code
1	AD-2	Power Adapter	0770632
2	ACW-4	Power Supply for AD-2	0675227
3	CA-1S	Service Cable	0730312
4	FLS-4S	Flash Adapter for the E/A area	0080541
		Flash Adapter for the APAC area	0080542
5	ACF-8	AC Charger incl. in FLS-4S sales pack	********
6	~~~~	Service SW	********

Service SW Installation Hints

For the setup of the FLS-4S it is to be checked, which COM-Port is used for the FLS-4S. This can be checked in the control-panel within the Windows-Start-Menu/Settings.

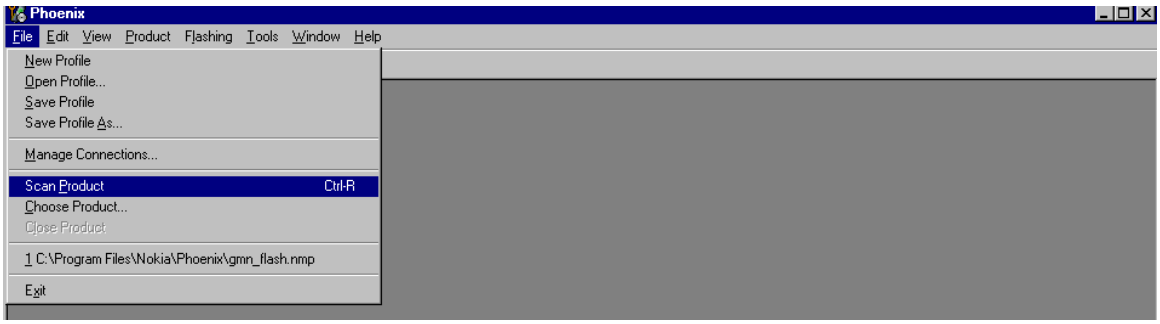


Note, that the FLS-4S will only be detected properly by TSS4 Software, when FBUS-Com-port combination is listed on the Top-position on the priority list of the connections. Otherwise, the phone cannot be scanned successfully. In this case a message will occur "No Product Found".



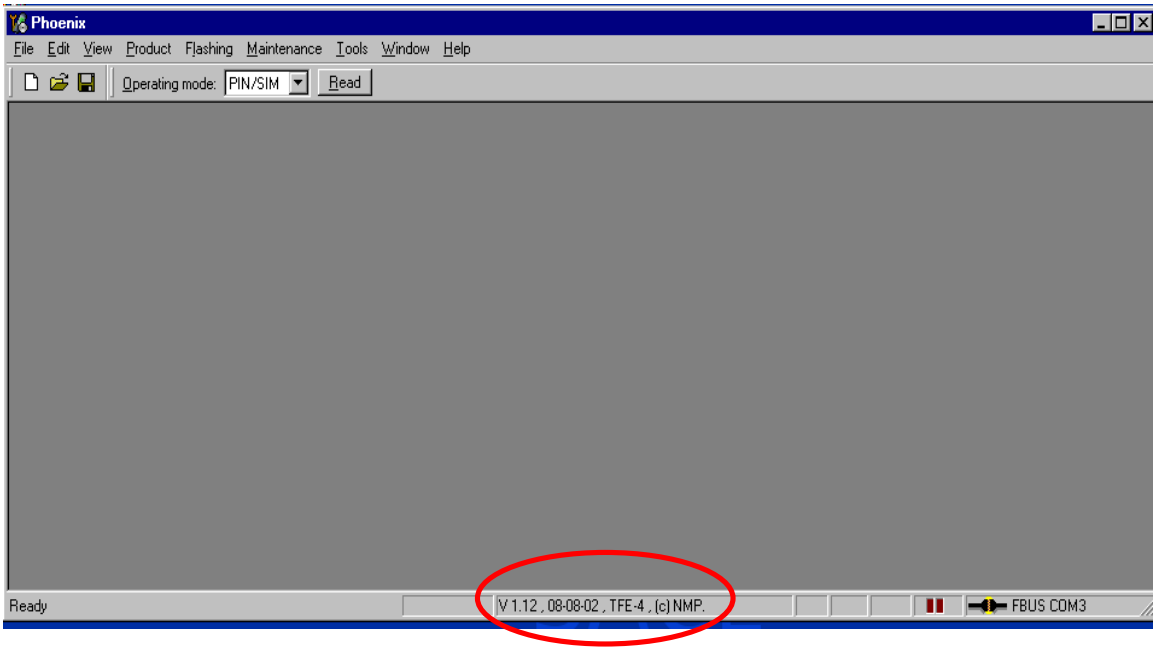
Scanning/Choosing Product

If the Radio Unit is connected correctly and the Phoenix Service Software is started the Product shall be scanned.

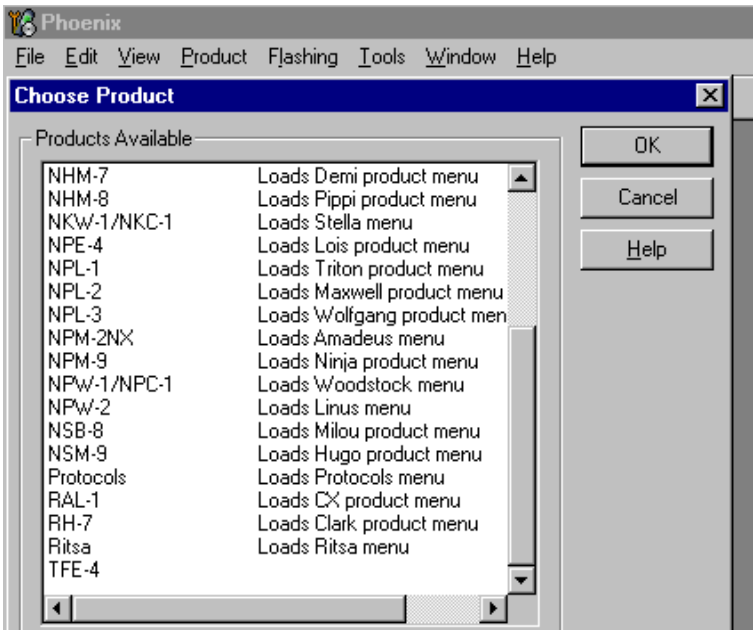


The scanning command can be found under File/Scan Product or can be forced by pressing Ctrl/R. At the bottom-line of the window, TFE-4/RV-1 and the Software-Version, which is currently inside of the Radio Unit will occur.

After a successful scan the Phoenix window will look like this.



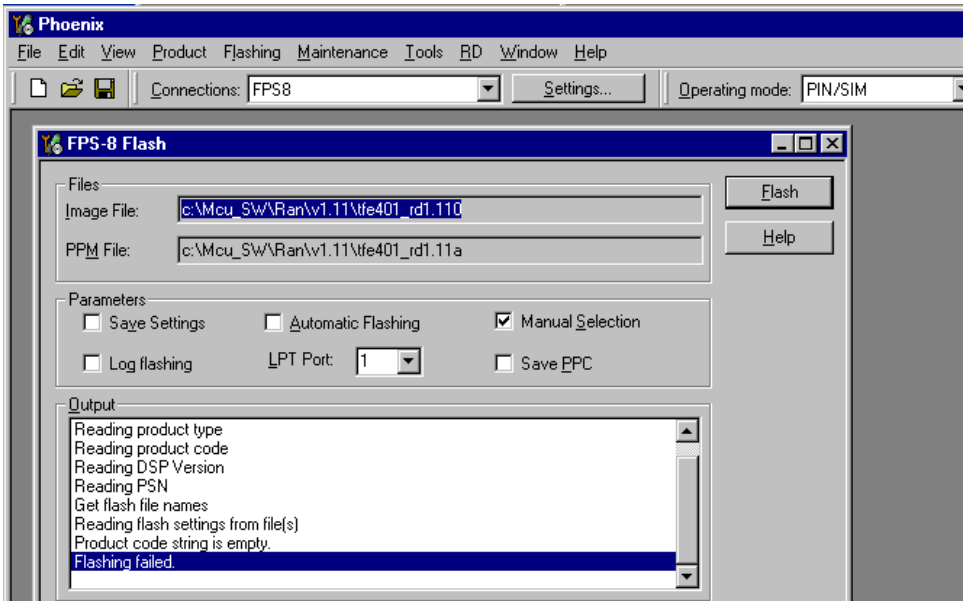
If this does not happen and the Message "No Product " will be shown, the product can be manually selected under choose Product. Choose the Option TFE-4/RV-1 for the TFE-4/RV-1 radio unit.



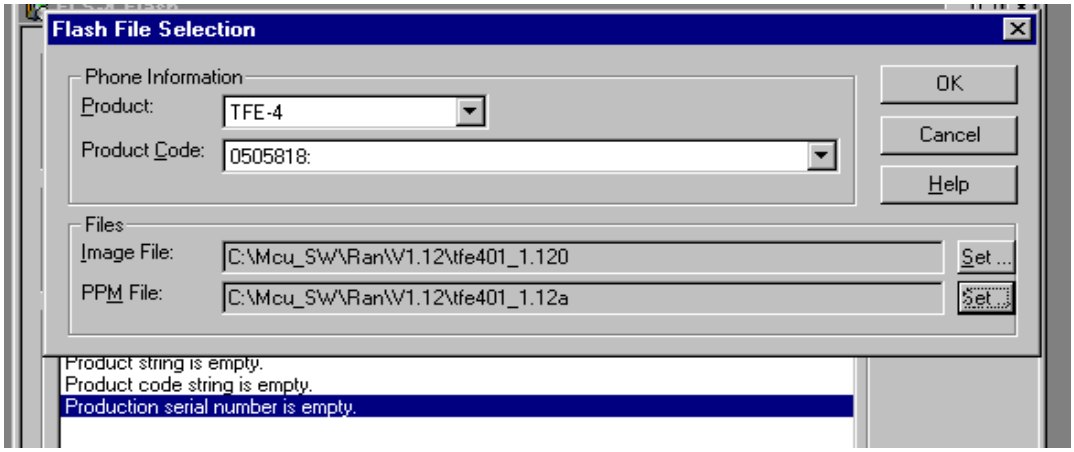
Note, that probably still no software information will be indicated at the bottom line, but the selection for TFE-4/RV-1 is indicated. Additionally the Field for the Operating Mode will be empty.

Flashing

Now the Flashing/FLS-4S option can be opened in the Flashing Menu.



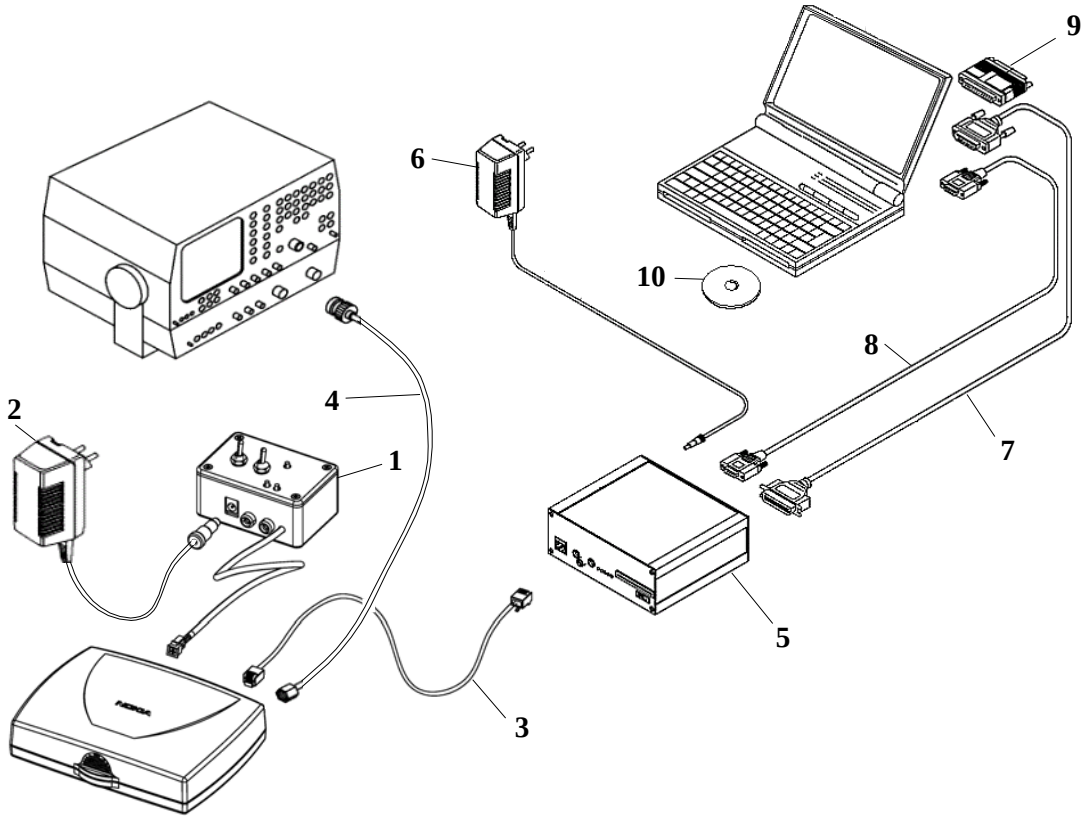
In case that no data package is installed, or the flash is empty, a manual selection can be done. A manual selection can also be done, if the phonetype could not be read out. Check that the right product (TFE-4/RV-1) and the right product code are selected. The flash-files will be selected automatically, if not, they can also be changed by pressing the "set" button to browse for the needed ones.



Flashing on RCC Level

For flashing on RCC level, prepare the test set up as following:

Figure 4: Flash test setup (RF Alignment, Call Test & Flash via FPS-8)



Item	Type	Description	Part Code
1	AD-2	Power Adapter	0770632
2	ACW-4	Power Supply for AD-2	0675227
3	CA-1S	Service Cable	0730312
4	CA-29RS	RF Cable	0730320
5	FPS-8	Flash Prommer	0080321
6	ACF-8	AC Charger incl. in FPS-8 sales pack	********
7	~~~~	Printer Cable incl. in FPS-8 sales pack	0730029
8	AXS-4	D9-D9 Cable incl. in FPS-8 sales pack	0730090
9	PKD-1	SW Protection Key	0750018
10	~~~~	Service SW	********

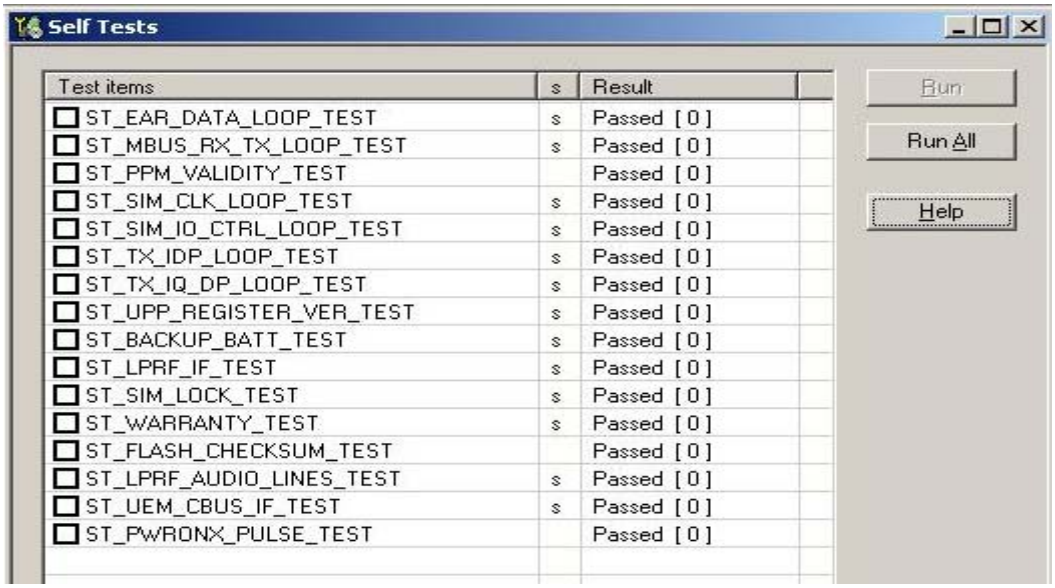
Service SW Installation Hints

Refer to previous section 'Flashing on POS Level'.

Selftest

To run the selftest, choose 'Testing' from the menue bar and select 'Self Tests' from the drop down menue. The test will start by pushing the 'RUN ALL' button. All tests should be passed after the test has been done.

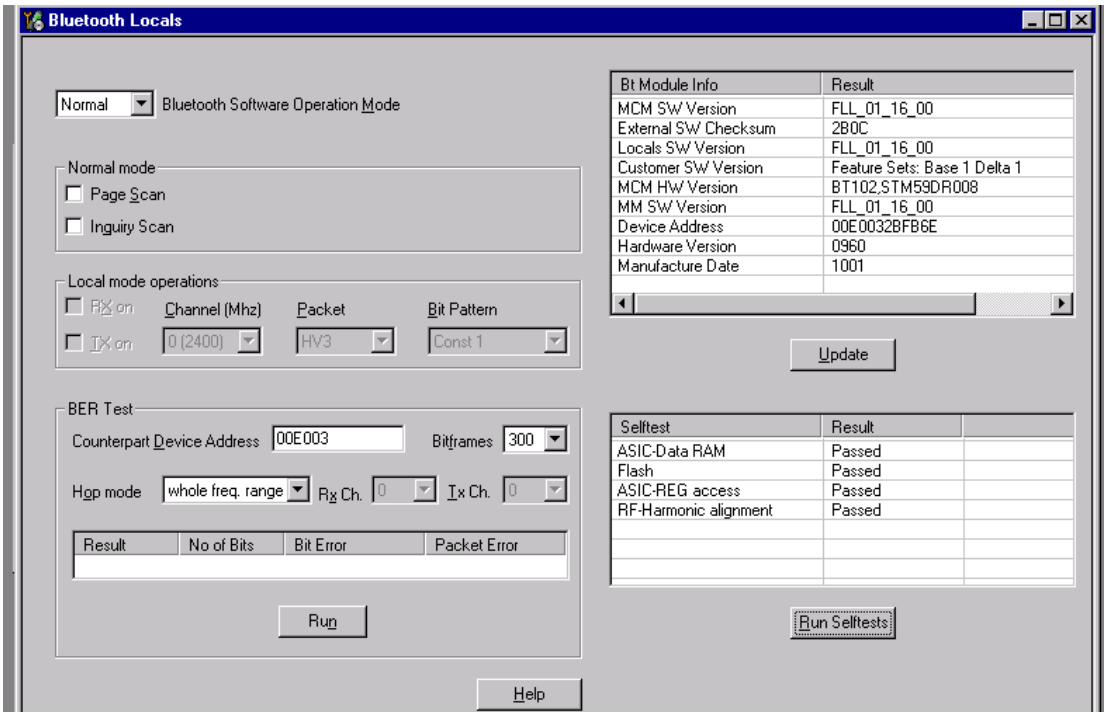
Figure 5: Selftests



Bluetooth Selftest

To run the Bluetooth selftest, choose 'Testing' from the menue bar and select 'Bluetooth Locals' from the drop down menue. The test can be started by pushing the 'Run Selftest' button. All tests should be passed after the test has been done.

Figure 6: Bluetooth Locals



Bluetooth (BER-)Test with JBT-9

The JBT-9 testbox is a generic device to perform Bluetooth Bit Error Rate testing and doing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and AXS-4 cable in case of cordless testing interface usage.

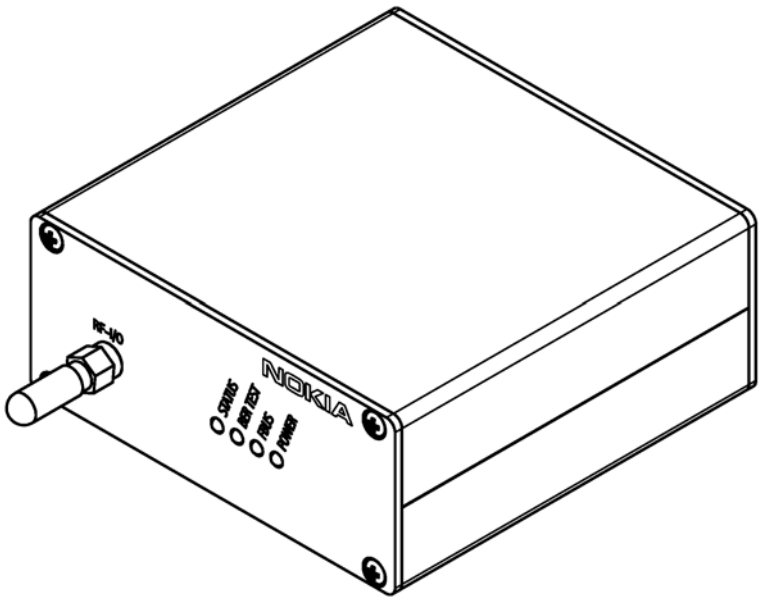
Sales package includes:

- JBT-9 testbox
- SMA stub antenna
- Installation and warranty information

Product Code

JBT-9 sales kit code: 0081490

View of JBT-9 with antenna



HARDWARE INSTRUCTIONS

Hardware needed to use JBT-9

- JBT-9 Bluetooth testbox
- SMA stub antenna (part of sales kit)
- ACP-8x charger (x denotes region, e.g. ACP-8E for Europe)
- Optional AXS-4 serial cable for BT FBUS connection

USE OF JBT-9 STAND-ALONE

The JBT-9 Box can be used **without** any PC connection as loop-back device for BT testing. To verify the products BT functionality, a Bit Error Rate test needs to be performed against JBT-9. The test is controlled and executed by Phoenix service software.

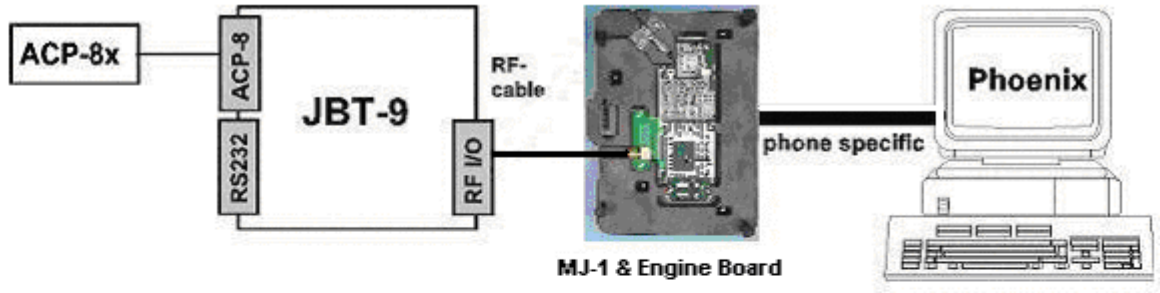
ATTENUATION SETTINGS:

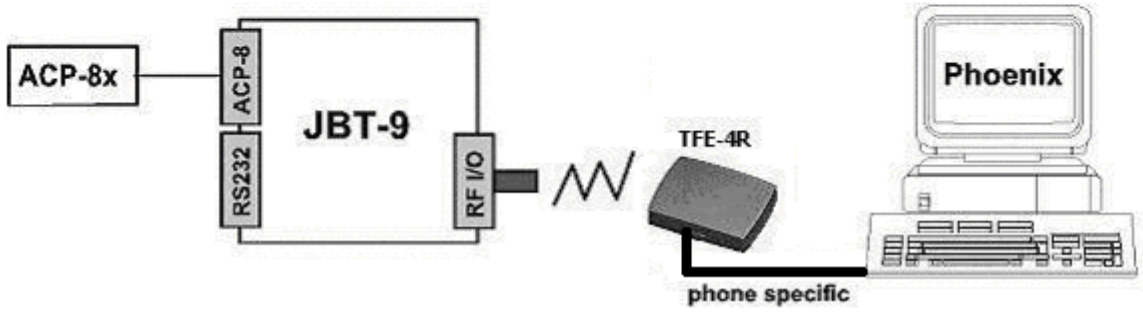
The JBT-9 attenuation is used to reduce the BT RF range. The default factory setting of internal attenuation results in a level of –36dBm (refer to chapter 5). This reduces the typical RF range to less than **0.5 m**. In case that distance is too short to perform tests over the air, the internal attenuation can be changed as described in the JBT-9 sales package user guide.

In case that a service jig is directly connected to the box SMA RF I/O connector, it is recommended to work with the maximum internal attenuation (default factory setting).

NOTE: When the JBT-9 is connected to the PC via AXS-4 serial cable and used as BT service interface, the BT Phoenix driver is controlling the internal attenuation of JBT-9. Details are described in chapter 4.

SETUP FOR BER TESTING

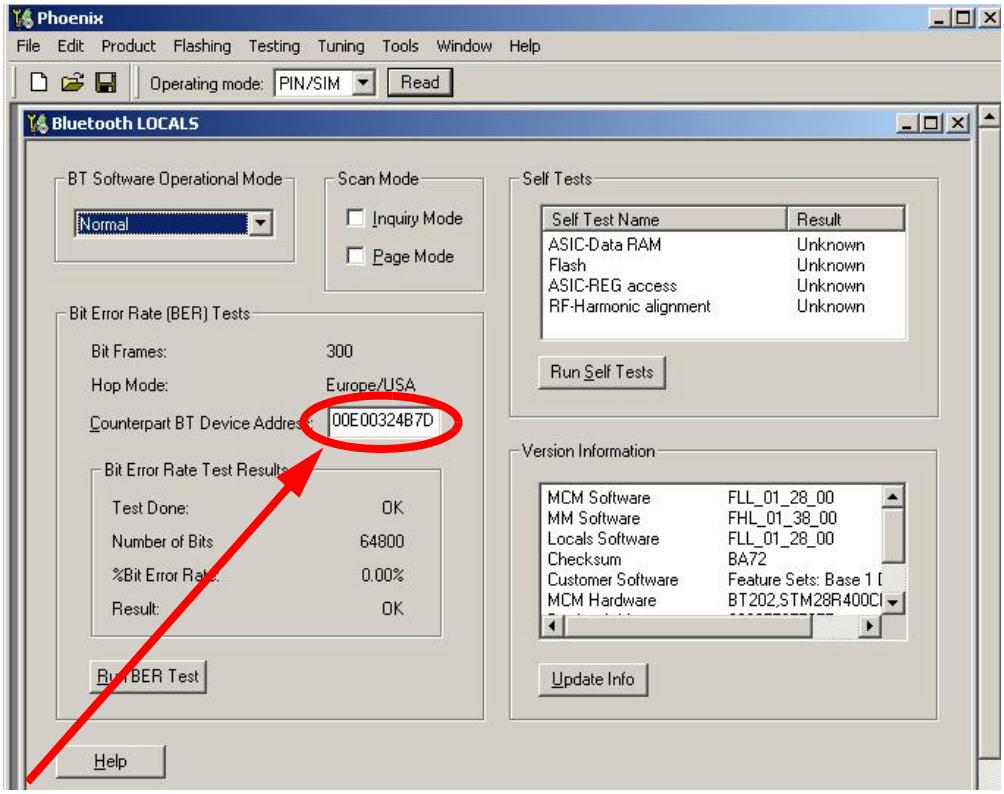




- Connect SMA stub antenna **or** service jigs' BT RF cable to JBT-9's RF/IO connector.
- Connect ACP-8x charger to JBT-9 power connector.
- Make sure that distance between phone and JBT-9 does **not exceed ~ 0.5 m** distance when using default attenuation setting.
- BER test result is OK when BER is less than 0.1%
- Note that the phone connection to the PC is specific to the tested phone. For details refer to the related chapter in the service manual.

TESTING INSTRUCTIONS FOR BER-TESTING

- Make sure that the phone's product support modules are properly loaded by Phoenix SW.
- Choose "Testing" and "Bluetooth Locals".

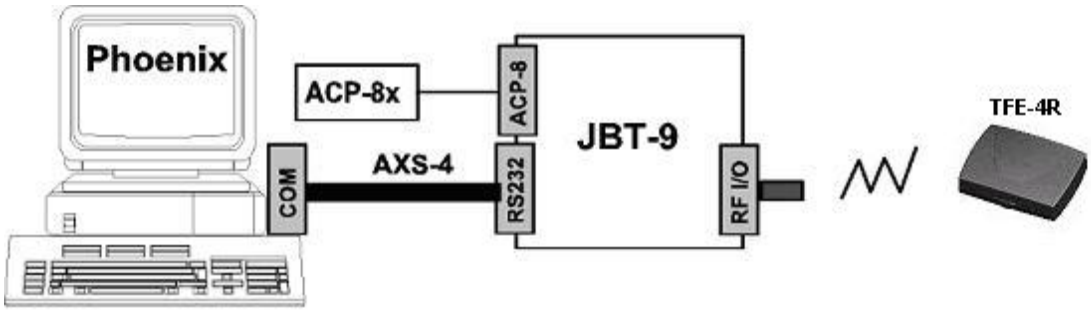


- Enter JBT-9's Ser.No. (12 digits from the type label) in the field "Counterpart Device Address". This has only to be done once as long as JBT-9 will not be changed !
- Standard testing parameters as bit frames, hoping mode and number of bits are default settings by Phoenix. BT Software Operational Mode = Normal Mode.
- Press the "Run BER Test" button to perform the BER test.
- "Test done" means that test has successfully been performed; if Bit Error Rate is </= 0.1% the "Result" will be also displayed as "OK".

ADDITIONAL MENU FUNCTIONS

- BT MCM related selftests can be performed by pressing "Run Self Tests". Result has to be "OK"
- The "Version Information" dialog gives you BT MCM related detail information that could be necessary in case of detailed fault reporting.
- Other settings like "Scan Mode" or "BT Software Operational Mode" are only necessary to change in case of special device analysis in combination with e.g. commercial BT testsystems.

USE OF JBT-9 BLuetooth FBUS INTERFACE

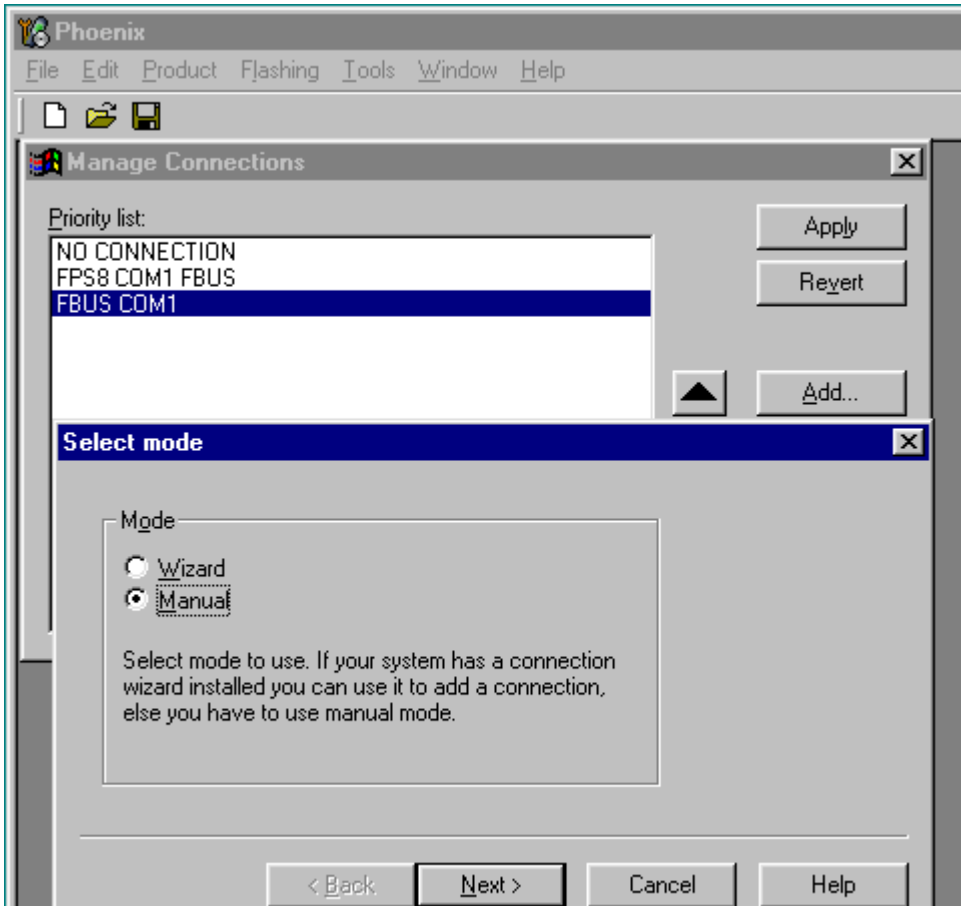


The JBT-9 can be connected to a PC by using an AXS-4 serial cable. The Bluetooth wireless technology can be used to establish a FBUS connection without any cables and line of sight. The phone must be switched on with SIM card and all Phoenix functions are working as long as the phone is in NORMAL mode.

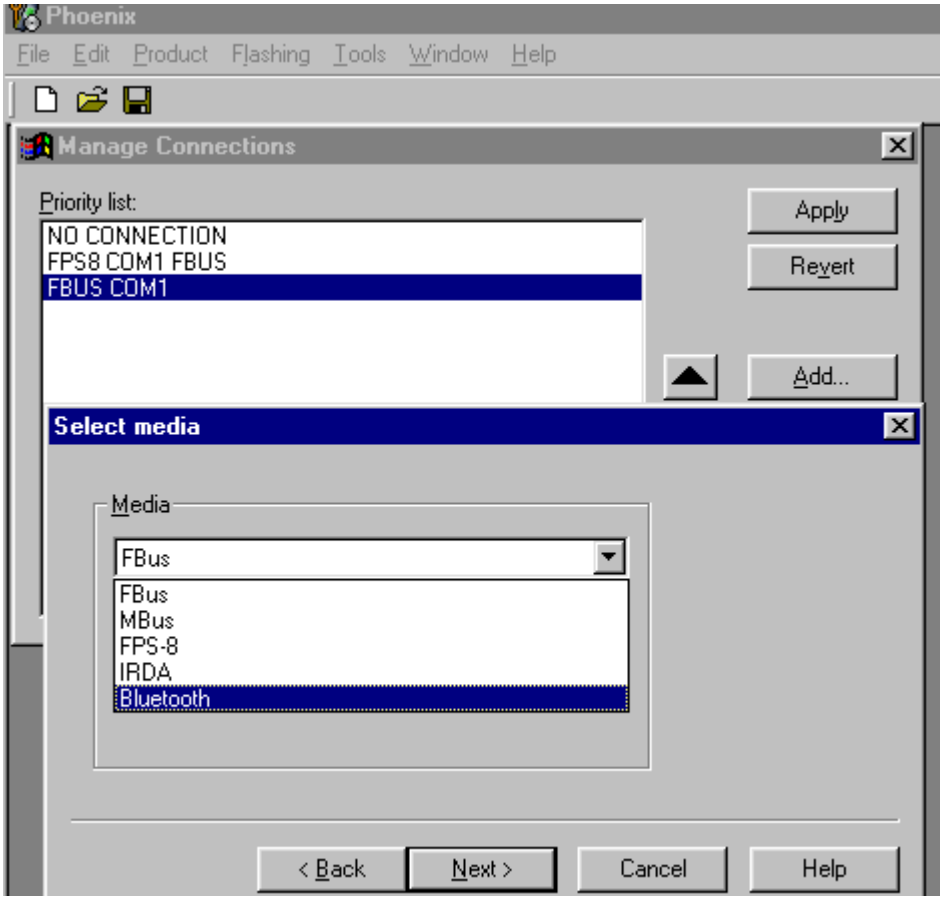
PHOENIX CONNECTION SETUP FOR JBT-9 AS BT FBUS INTERFACE

In Phoenix under the "File", "Manage Connections" menu the Bluetooth connection has to be added.

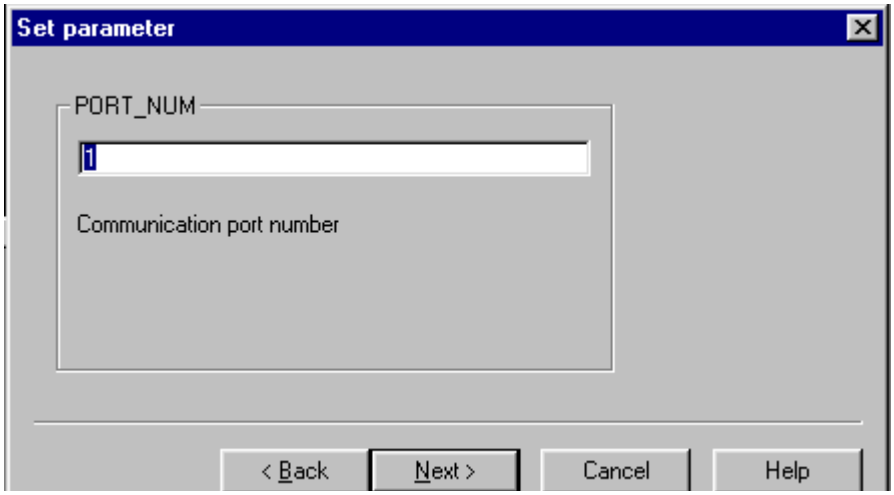
- Push down "Add" button and select the "Manual" mode.



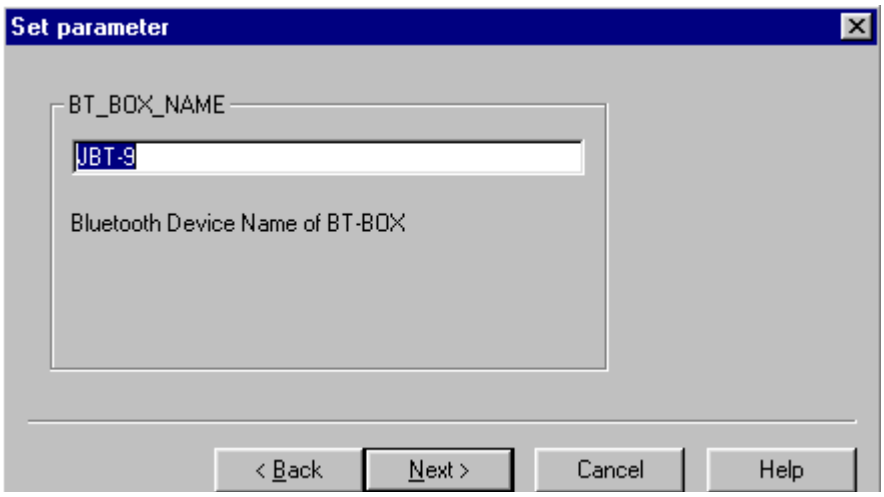
- Select "Bluetooth" as media:



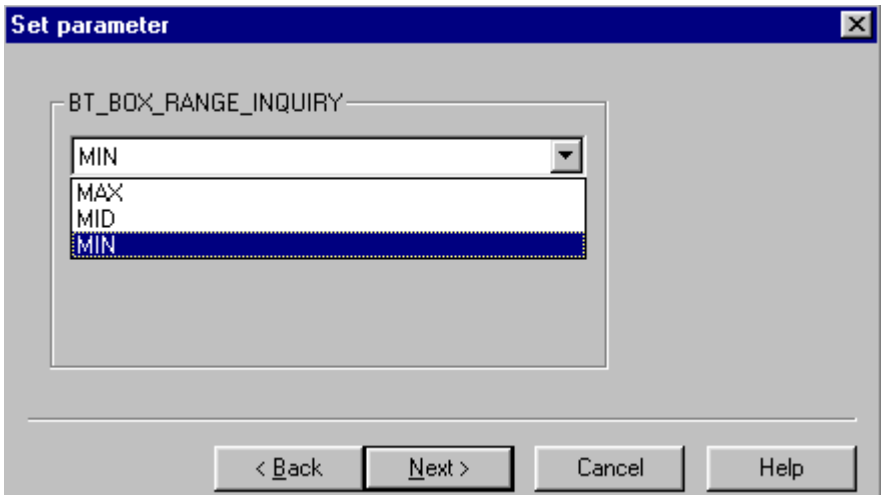
- Set the Port_Num to the serial port where you have been connected the box. Serial port 1 = PORT_NUM 1.



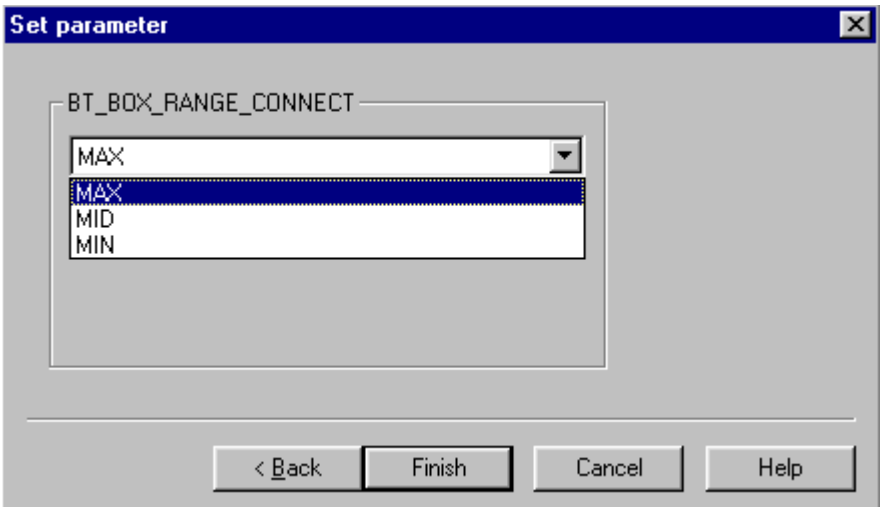
- Give any name to the JBT-9 box. Default setting is "JBT-9". If you have several boxes in range, separate names can be given to prevent any confusion.



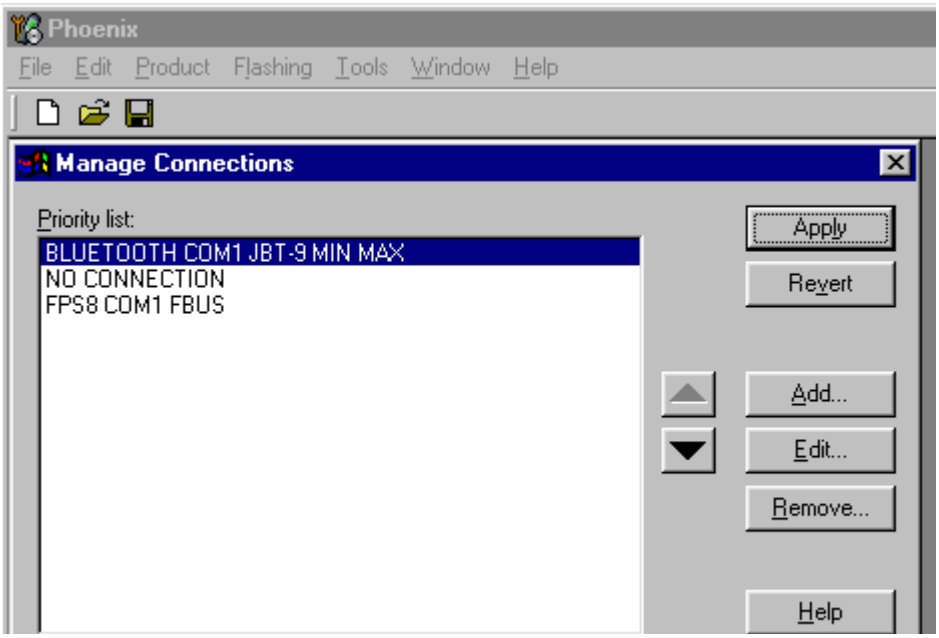
- The JBT-9 box range for inquiry can be changed in the "BT_BOX_RANGE_INQUIRY" parameter setting. Default setting is MIN = minimum range. (0,1 – 0,5 m)



- The JBT-9 box range for connection can be changed in the "BT_BOX_RANGE_INQUIRY" parameter setting. Default setting is MAX = maximum range (> 8 m).



- After the connection parameter settings have been done, the new connection so called e.g."BLUETOOTH COM1 JBT-9 MIN MAX" can be seen in the Priority list of possible connections. It is now important to put this connection on to the top of the list in order to use it. This can be done with the arrow button and afterwards "Apply" button.

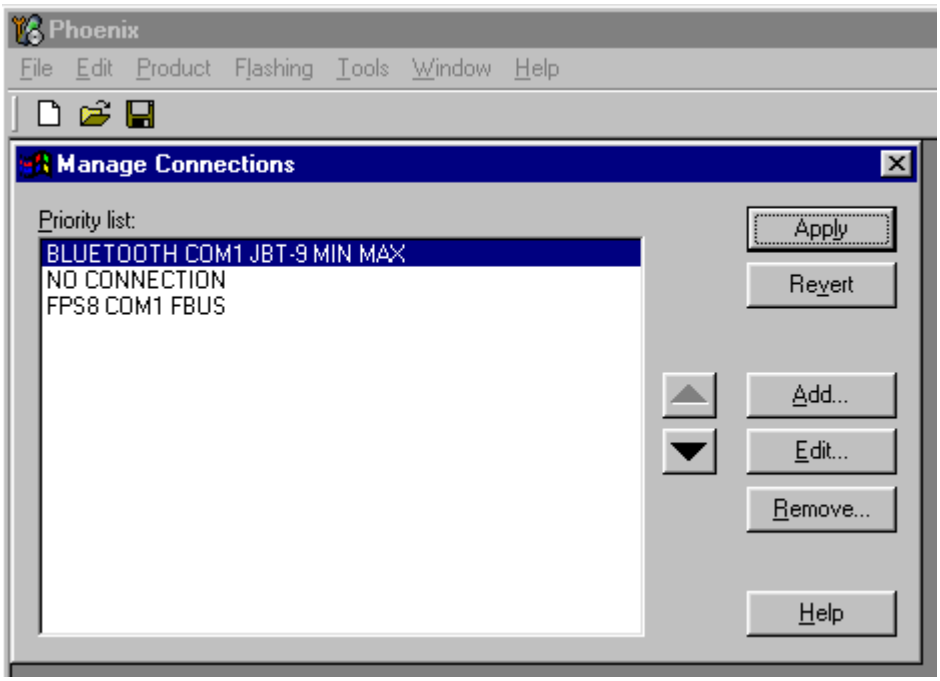


Establish a Bluetooth FBUS conncetion to a phone

Below it is basicly described how to establish a BTFB connection. Depending on the phone UI structure it can slightly differ from this description.

- Switch on the phone and enable the Bluetooth interface in the related sub-menu.
- Press "Apply" in the Phoenix "Manage Connection" menu when the "BLUETOOTH COM1..." connection has been selected and is on the top. The green "BER TEST" LED on the JBT-9 box frontpanel will light up. The JBT-9 box starts an inquiary of all devices in range. First seen device will be asked for connection.

.



- After some seconds the phone will ask you to establish a **first** connection with one specific phjone to JBT-9 box (or how you did name it). If you press "Accept" it will ask you for a passcode of the JBT-9 box.
- The passcode is allways 0000 !
- Then the phone and JBT-9 are connected as long as you don't leave the range, switch off one of the devices or press again "Apply" button in "Manage Connection" menu of Phoenix. All NORMAL mode commands can now been exchanged between phone and Phoenix.
- If you will connect next time same phone to JBT-9 you only have to "Accept" the connection without passcode. It is stored from that time on in the "Paired device list" of the phone. **You can now delete the JBT-9 as device from the pairing list of your phone in the "View paired devices" sub-menu.**

Delete pairing devices via Phoenix:

During connection it is also possible to delete pairing devices and disconnect in one step. This can be done by with the functions "restore factory settings" or "restore service settings".

Attenuation setting via Jumper

Internal possible settings after JBT-9 boot-up are listed below. The precision of the internal attenuation is specified to be +/- 5dBm. During test the attenuation can also be changed via Phoenix SW.

Default attenuation	GPP10	GPP11	RF range	Factory setting
21 dB	Closed (GND)	Open	> 1,5 m	
21 dB	Open	Closed (GND)	> 1,5 m	
7 dB	Open	Open	> 8 m	
36 dB	Closed (GND)	Closed (GND)	> 0,5 m	X

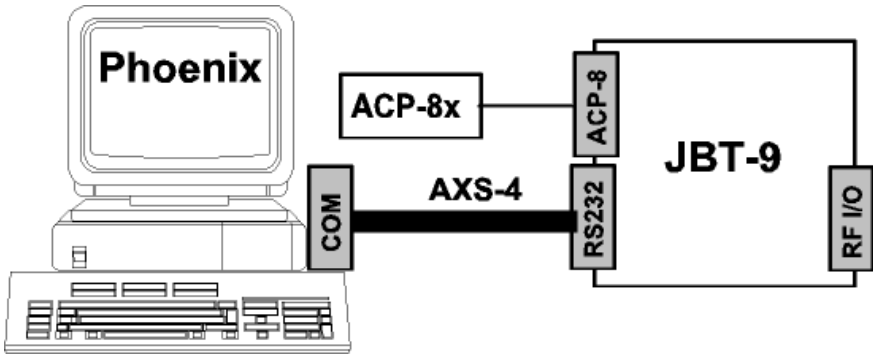
LED Indication of JBT-9

ACTION	STATUS-LED	BER TEST-LED	FBUS-LED	POWER-LED
POWER				ON
FBUS			ON	
INQUIRY		BLINKING		
CONNECTED		ON		
BER-TEST		ON		
LOOP-BACK		ON		
ERROR	ON RED			
BOX READY	ON GREEN			

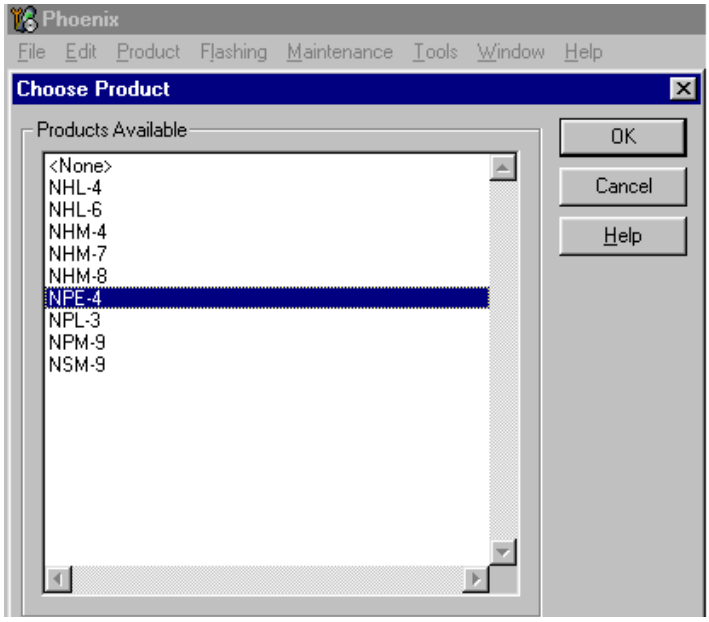
JBT-9 FIRMWARE UPGRADE

The JBT-9 Box SW can be updated by using the "Bluetooth Flasher" as part of PHOENIX service software.

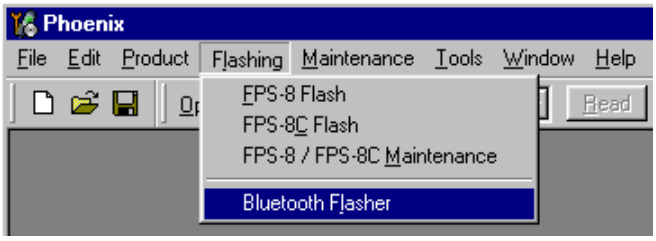
Prepare the equipment setup as shown in picture below:



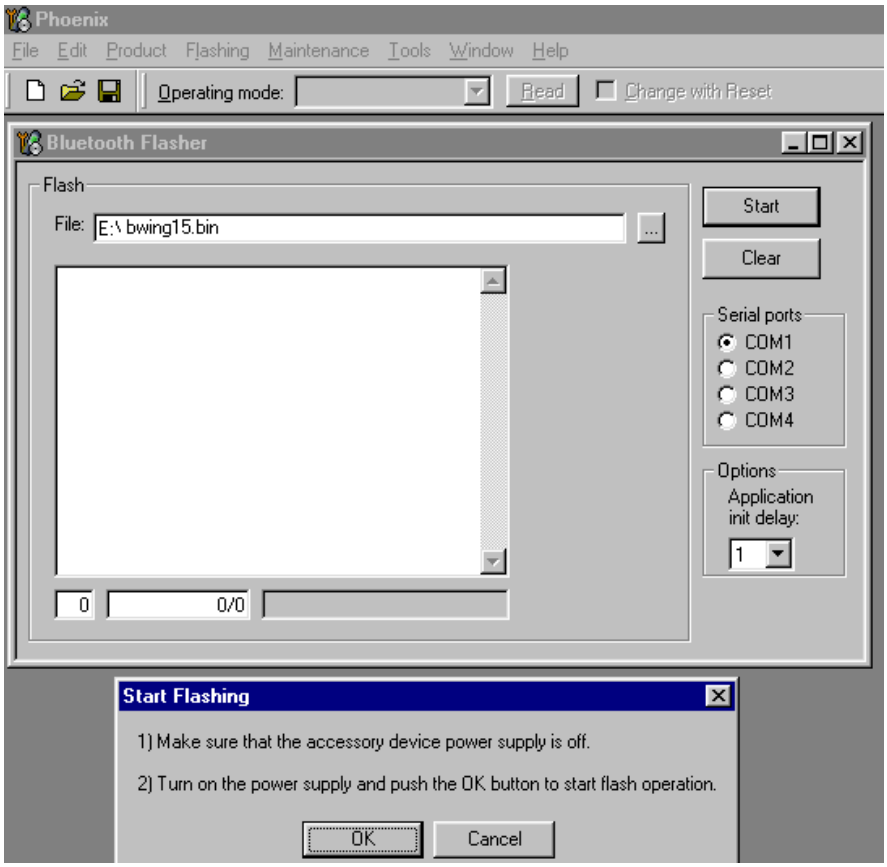
- Start PHOENIX service software incl. installed PKD-1x dongle.
- Make sure that in the actual selected connection is "NO CONNECTION".
- Select any phone with Bluetooth MCM in "**Choose Product**" menu.



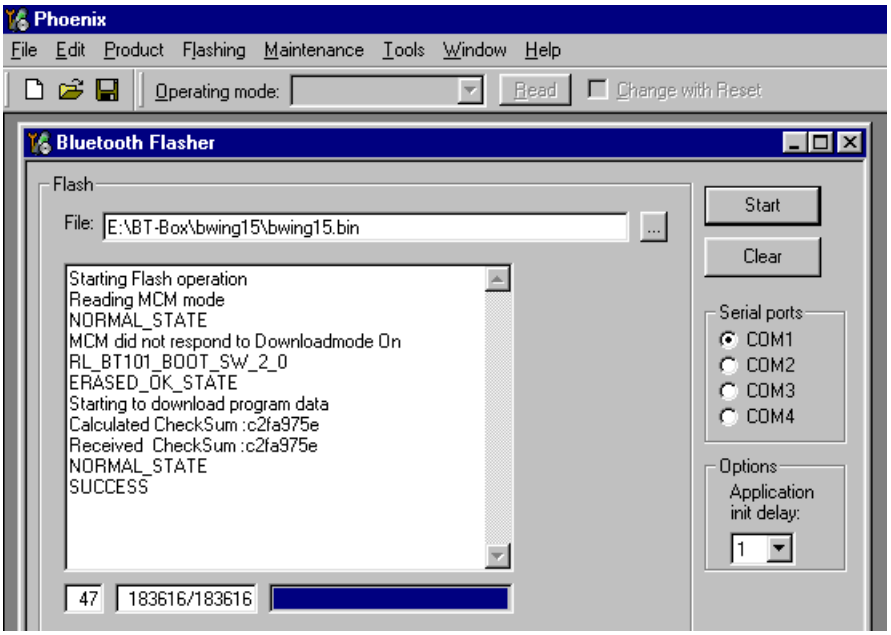
- Open the "**Bluetooth Flasher**" as "**Flashing**" sub-menu.



- Open the Select the correct "bin" file. Check the correct serial port (COM 1-4) port before. Press "**Start**" button and follow the pop-up menu.



- Wait until you get the "SUCCESS" response in the activity-window. The error message "MCM did not respond to Downloadmode On" can be ignored.



Abbreviations

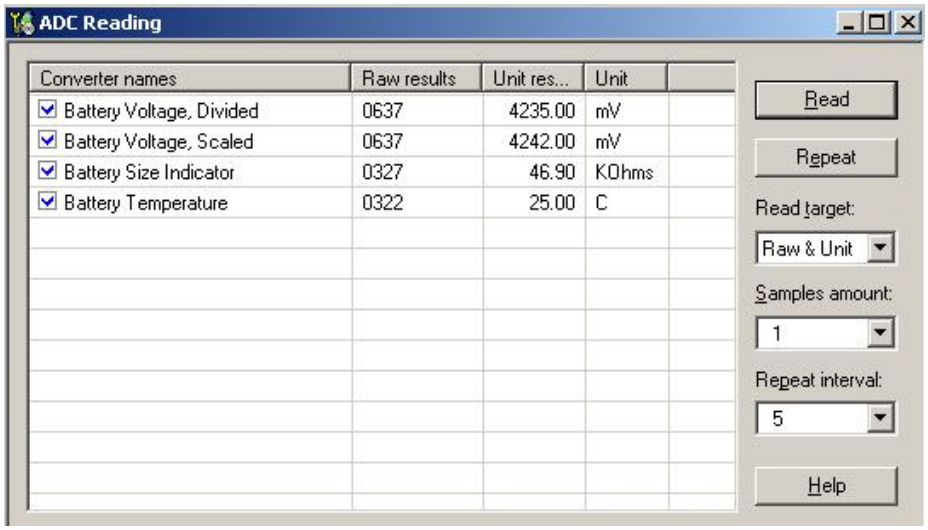
BER	= **B**it **E**rror **R**ate
BT	= **B**luet**o**oth
BTFB	= **B**luet**o**oth **F**-**B**us
COM	= (serial communication port)
FBUS	= (NOKIA proprietary communication bus)
I/O	= **I**nput / **O**utput
MCM	= **M**ulti **C**hip **M**odule
PC	= **P**ersonal **C**omputer
RF	= **R**adio **F**requency
SMA	= (sub miniature RF connector type)
SW	= **S**oft**w**are

ADC-Readings

Test description:

Open the ADC Reading Test Menu from the Testing drop down menu.

Figure 7: ADC-Readings



Perform the Test:

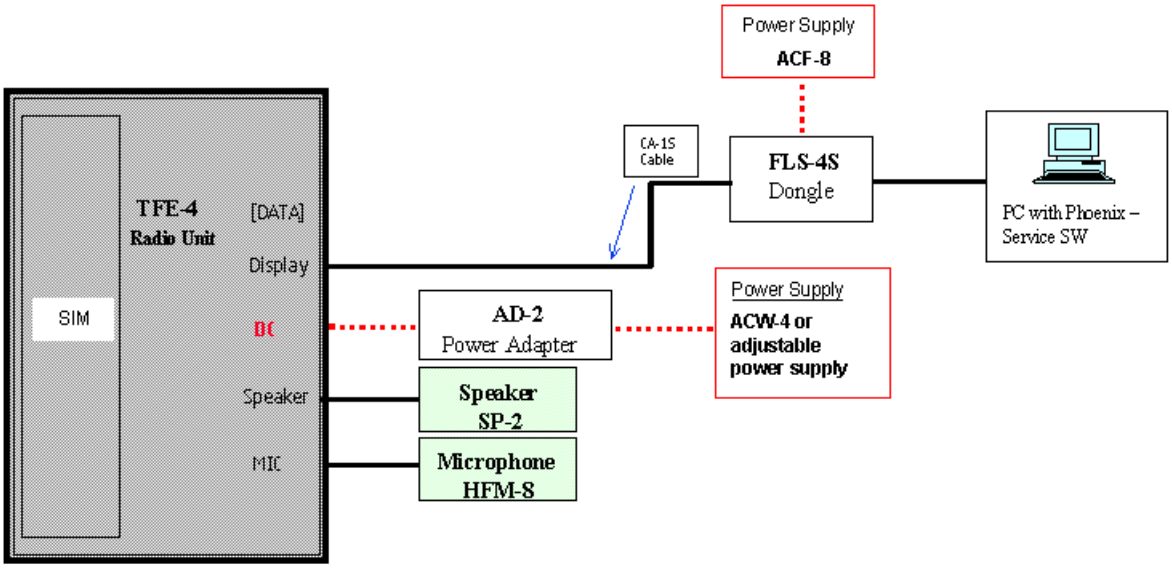
There are no base band alignments to be done; only the AD-Values should be read out to check if the inputs of the AD-Converter have the right levels. The BSI and BTEMP line can be checked with the Local-Mode switch and the VEB-Power (replacement for the Phone battery) voltage can be read out. To control this value the real Voltage should be controlled by Voltage-Meter. The testing limits can be seen in the following Table:

AD Channel	Local Switch	Low	High
BSI	Normal	44kR FLS-4S: 3K	49kR FLS-4S: 9K
BTEMP	XXX	23°C	27°C
VBAT	XXX	4,1V	4,4V

Audio Testing

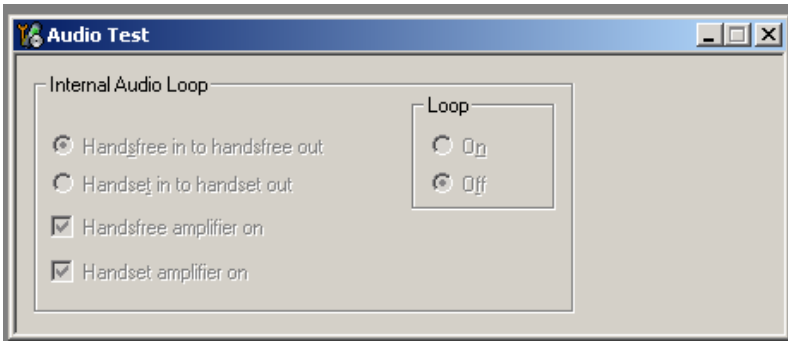
For POS level, prepare the test set up as following:

Figure 8: Basic Audio-Test setup



1 Prepare Service Software
2 Activate Local Mode
3 Open Test menu / Audio Test

Figure 9: Audio-Test setup



Perform the Test:

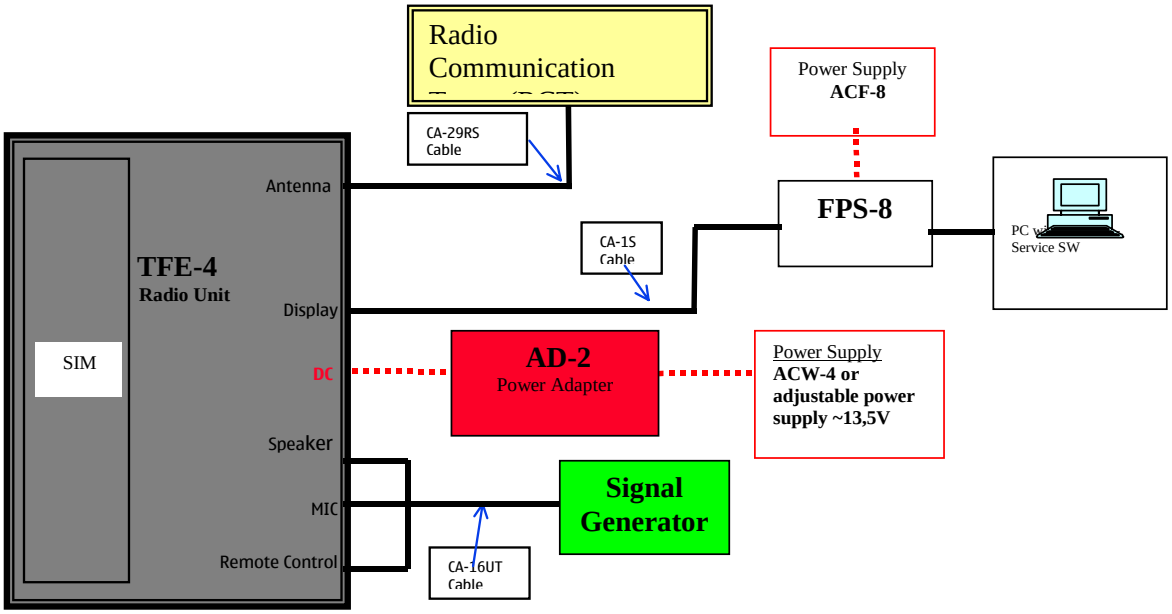
Activate the loop to send the HF-Mic (hands free in) signal to the HF-Speaker (hands free out). When the HF-Mic is connected, blowing into the HF-Microphone shall be hearable in the HF-Speaker.

In a second step, activate the loop to send the HD-Mic (handset in) signal to the HD-Speaker (handset out). When the headset is connected, blowing into the handset microphone shall be hearable in the handset speaker.

By deactivating the loop no signal should go through.

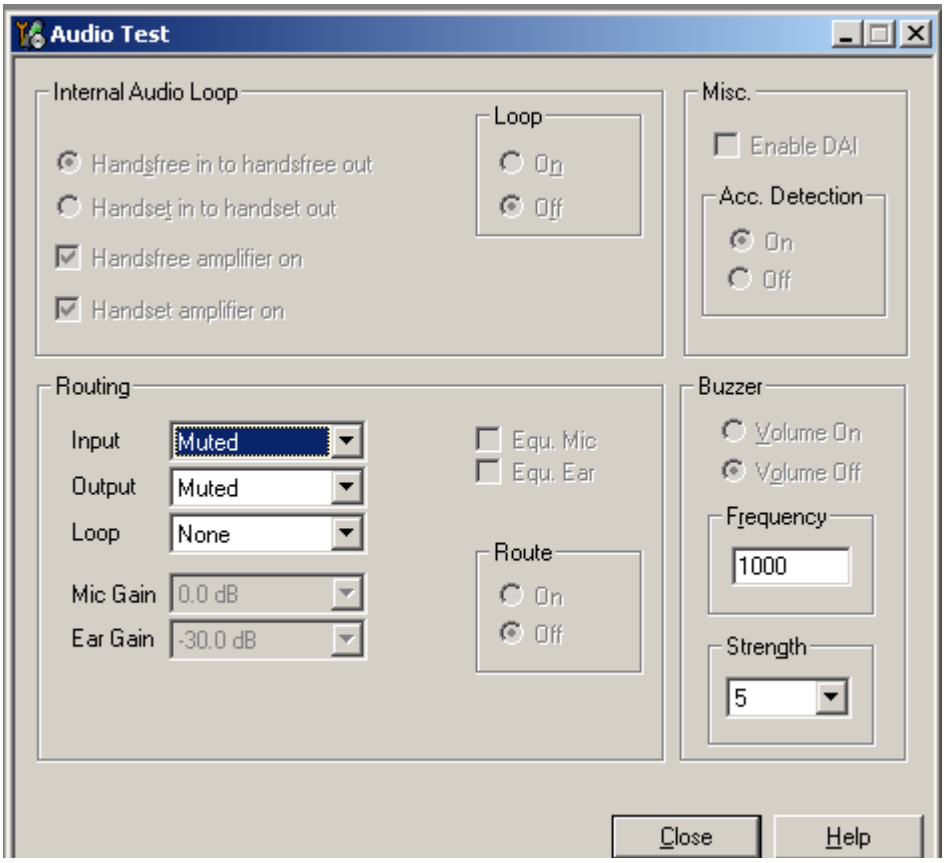
For RCC level, prepare the test set up as following:

Figure 10: Extended Audio-Test setup



1 Prepare Service Software
2 Activate Local Mode
3 Open Test menu / Audio Test

Figure 11: Audio-Test



Perform the Test:

Basic Setup:

A Loop is switched internally to send the HF-Mic signal to the HF-Speaker and in a second step the HDMIC signal to the HD Speaker. Blowing into the microphone shall be hearable in the speaker. By activating the hands free speaker mute, the Loop has to be opened (no signal goes through). When the headset is connected, blowing into handset microphone shall be hearable at the handset speaker. By activating the handset speaker mute, the Loop has to be opened (no signal goes through).

Extended Setup:

In this case, a Loop is switched internally to send the HF-Mic signal to the HF-Speaker and in second step the HD-MIC to the HD-Speaker. The frequence of 1000Hz has to be tested. Additionally the distortion has to be checked. By activating the hands free speaker mute or the handset speaker mute option within the Digital I/O tests the regarding Loop has to be open.

The Bias Voltage of the HF-MIC is to be measured with Voltmeter (<>5V).

MIC-Path	Frequency	Generator Voltage	Low Limit	Upper Limit
HDMIC	1000	30mV.	440mV (30dB)	705mV (40dB)
HFMIC	1000	50mV	1280mV (15dB)	2050mV (20dB)

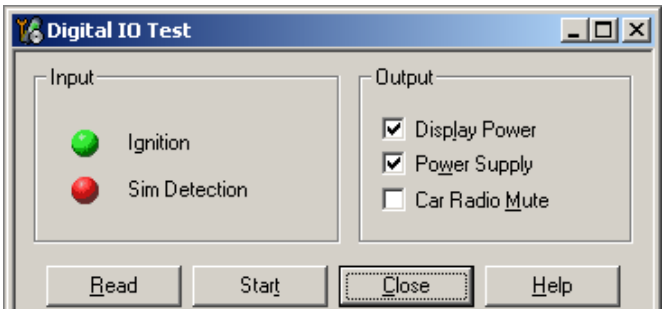
Digital I/O Tests

Prepare the test set up as following:

Step 1: Prepare Phone and Phoenix

- Start Phone by Ignition Switch on AD-2 Power adapter
- Scan Product, set to local mode
- Open the Digital I/O Test from the Testing drop down menu.

Figure 12: Digital IO Test



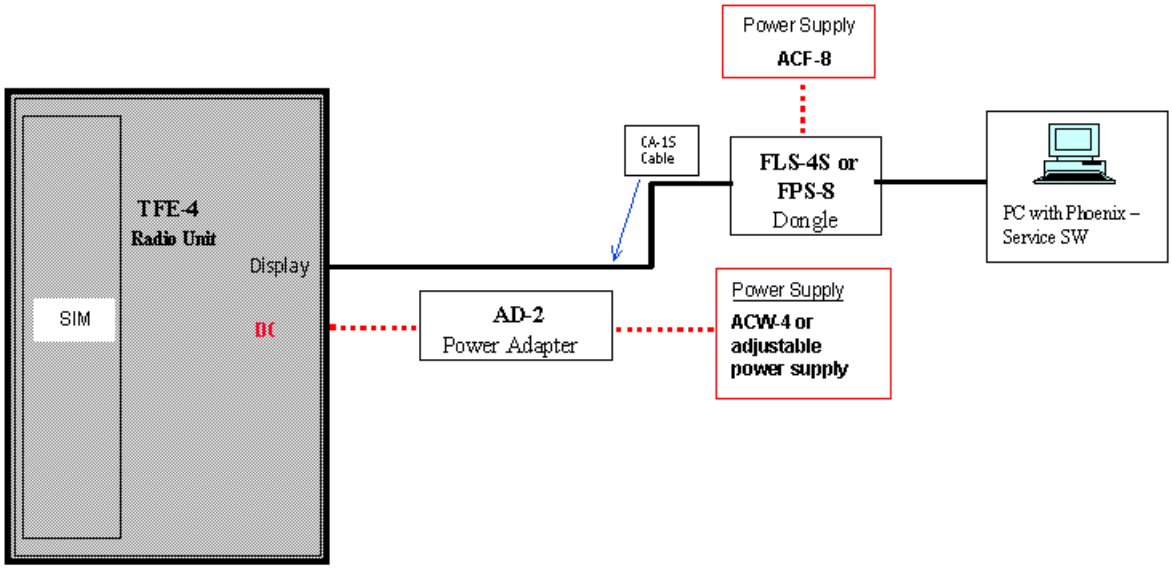
Step 2: Do the tests

- Read "Ignition", should be Active
- Activate "Power Supply" option (Alt-o')
- Switch off Ignition sense,
- Read "Ignition", should be inactive now and no error shall occur
- Switch on Ignition Sense on AD-2
- Read again Ignition, should be active now
- Switch on Display Power and connect an handset
- Connected handset should have activated Lights now (alternative measure the Voltage VIDU at Display and handset connector by voltage meter should be <>0V)
- Deactivate "Display Power" option, Lights of the handset should be off now
- Activate CRM option, LED at AD-2 Power adapter should lighten
- Deactivate CRM light should be off now

SIM-TEST

Prepare the test set up as following:

Figure 13: SIM Test set up



Test description:

The SIM-Card can be tested by a normal phone call against the network, or merely with the service software (Phoenix). Within Phoenix the 'SIM Test' supports this test.

Open the SIM Test Menu from the Testing drop down menu.

Plug a functioning SIM-Card into the SIM reader and press 'Update'. (The TFE-4/RV-1 device has to be in the Test/Local mode).

Figure 14: SIM-Test

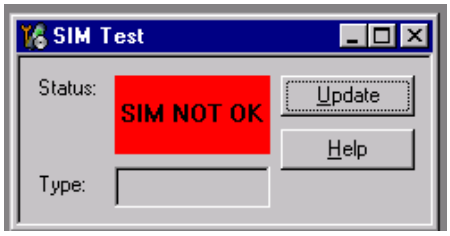
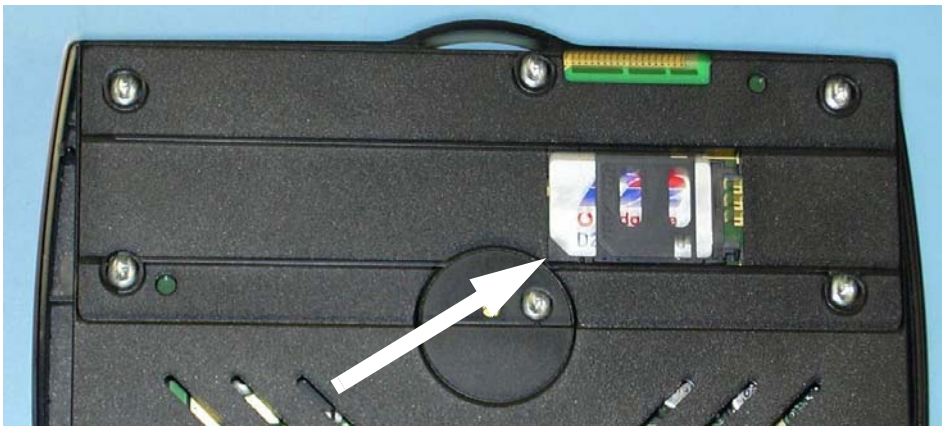


Figure 15: SIM-Card inside TFE-4/RV-1



RF-Alignment

Prepare the test set up as shown in figure 4:

Due to the fact, that the engine modules are delivered as already (fully) aligned, there is no alignment to be done under normal circumstances. To test the devices, a call tests against a tester (see also 'Phonecall with RCT Tester') is a sufficient test to verify that the paramenters are within the specified limits. To check the general functionality, a call against the network (think of using a suitable antenna) should be done.

In case that the alignment is not as specified, the alignment can be done as with NPL-1.

Refer to the Module Jig concept in chapter 4.

The purpose of this repair jig is to provide a method of applying voltage from an external power supply when the module is out of its mechanics and to support analysis measurements.

The repair jig provides following functions:

- Fused protection
- Overvoltage protection
- Reverse polarity protection
- ESD protection
- Decoupling capacitors
- Access to exposed components and GSM connector
- Access to internal test points (Jxxx)
- BlueTooth coupler

It is intended that the repair jig should be used under all circumstances where an external supply to the phone is required to be applied while the phone is out of its mechanics.

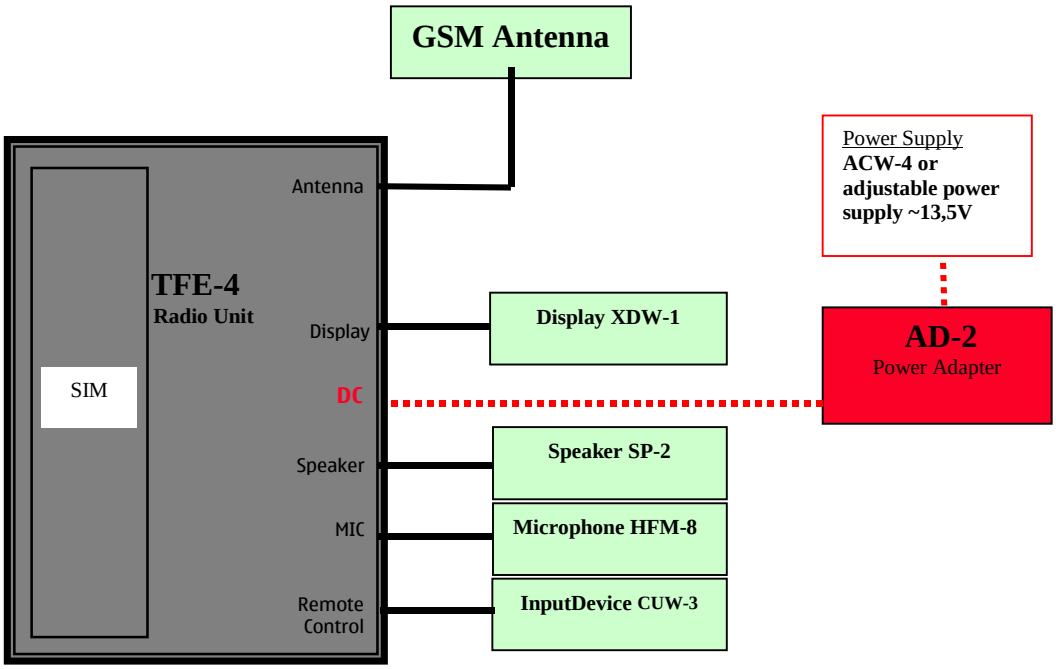
It should be noted that the supply voltage to the repair jig is intended to be nominal supply voltage of **4.2V**

Call Test

Handsfree Call Test

For POS level, prepare the test set up as following:

Figure 16: Handsfree Call Test setup



With this test the car environment can be simulated in the laboratorium environment. The general functionality can be checked with this set up. In addition defective devices can easily be found by replacing them one by one with reference devices.

Refer to Final test setup-RCC in chapter 4.

PPCs

Nokia 610 uses PPC's, known from NPL-2. In addition three new PPC's has been created especially for Nokia 610. The three new PPC'are:

- SIM Insertion Counter
- Backup Power Supply Lost Counter
- Display Unit Contact Lost Counter

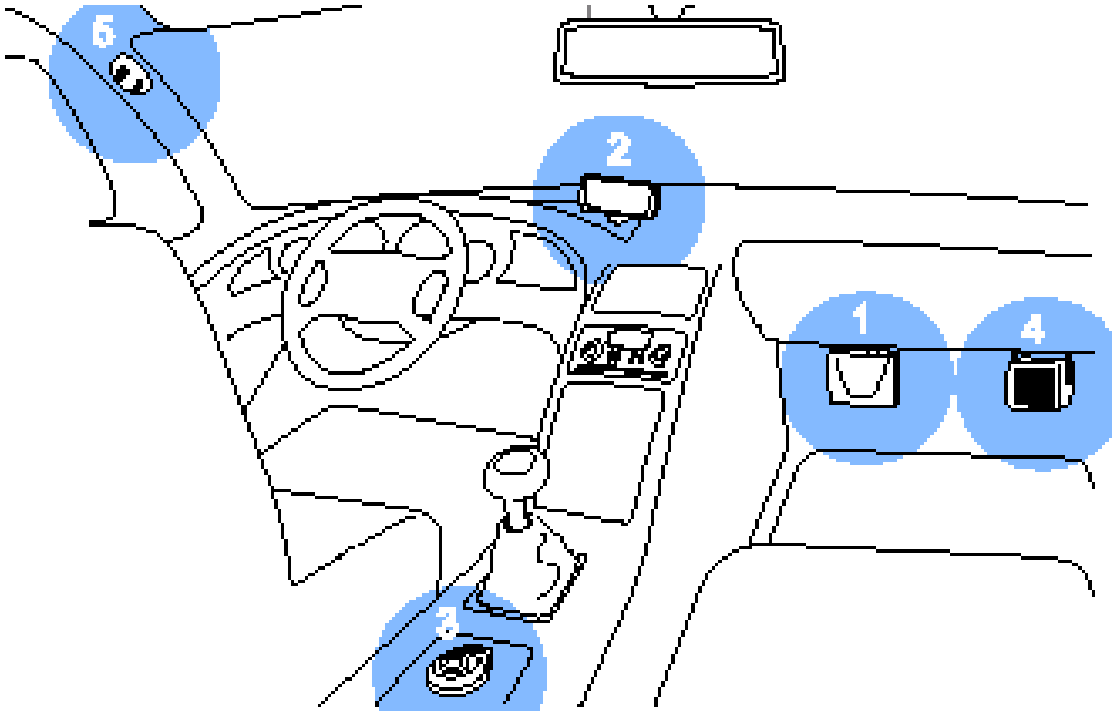
The PPC's can be read out, as known, via Phoenix Service Software and should help to find defects into the product.

7 - Installation

Table of Contents

Installation

The CarKit Phone is designed for installation in motor vehicles. The sales package contains a convenient handsfree feature which allows you to make calls without holding the phone to your ear, a separate input device for ease of use and an easy-to-read display.



Note:

- These instructions are general guidelines which apply for the installation of the CarKit phone in an automobile. However, due to the wide variety of car types and models available on the market, this guide cannot consider the individual technical requirements for any particular vehicle. Contact the vehicle manufacturer for further detailed information about the vehicle in question.

- The CarKit Phone may only be installed by a qualified service technician using the approved original Nokia parts supplied in the sales package. Please note that non-observance of this requirement will result in loss of warranty. End users should remember that the car phone kit comprises complex technical equipment that requires professional installation using special tools and expert know-how.

For important safety information and/or instructions on the operation, care and maintenance of the CarKit phone, see the user's guide.

Safety first

Please read the basic safety set out below before beginning any installation work.

- Make sure that the car ignition is off and disconnect the car battery before beginning with the installation work and ensure that it cannot be reconnected inadvertently.

- Do not smoke when working on the car. Make sure that there is no source of fire or flame nearby.

- Take care not to cause damage to electrical cables, fuel or brake lines or safety equipment during installation work.

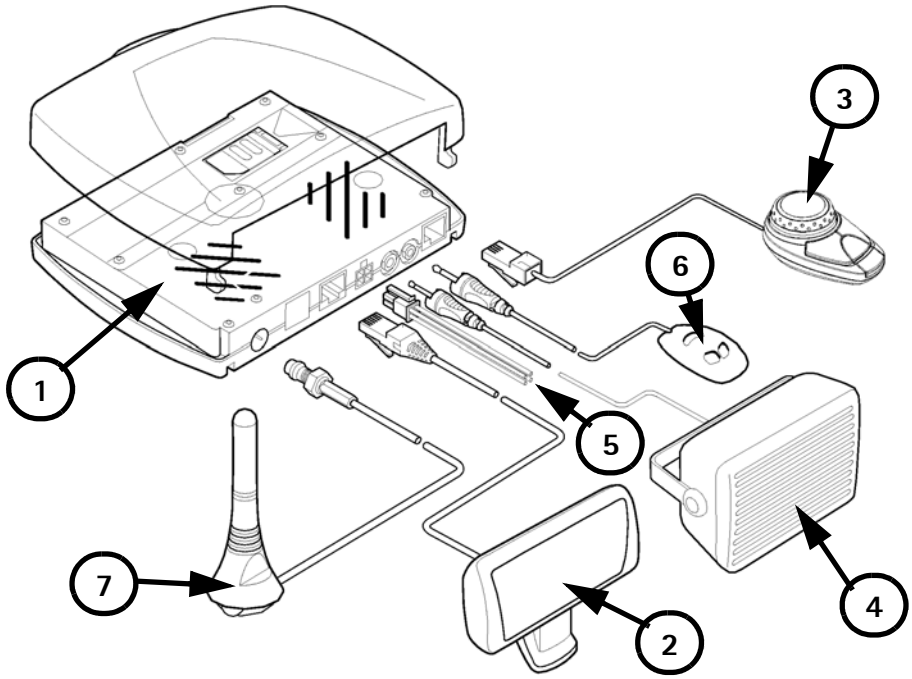
- Make sure not to impact the steering or braking systems or other key systems essential for proper operation of the car when installing CarKit phone equipment. Check to make sure that deployment of the airbag is not blocked or impaired in anyway.

- RF signals may affect improperly installed or inadequately shielded electronic systems in motor vehicles (e.g. electronic fuel injection systems, electronic anti-skid braking systems, electronic speed control systems, airbag systems). Should you note a fault or change in the operation of such a system, contact your car dealer.

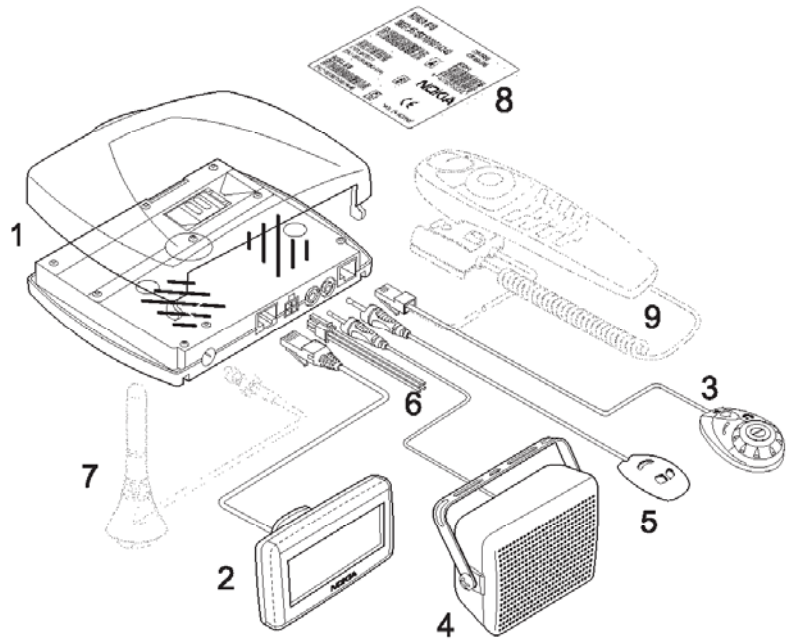
- The CarKit Phone may only be used at an operating voltage of 12V with the minus pole earthed. Failure to observe this requirement will result in damage to the car's electronics system.

- Do not operate your CarKit phone off the car battery for a long period of time, i.e. with the engine switched off, as this may cause your battery to run dry.

- In order to comply with RF exposure requirements for mobile transmitting devices, a minimum separation distance of 20 cm must be maintained between the antenna and all persons.



Nokia 610 CarKit Phone equipment	
Item	Description
1	Radio Unit TFE-4
2	Display Unit SU-11
3	Input Device CUW-3
4	Loudspeaker SP-2
5	Power Cable PCU-4
6	Handsfree Microphone HFM-8
7	GSM Antenna (not supplied)



Nokia 616 CarKit Phone equipment	
Item	Description
1	Radio Unit RV-1
2	Display Unit SU-21
3	Input Device CUW-3
4	Loudspeaker SP-2
5	Handsfree Microphone HFM-8
6	Power Cable PCU-4
7	GSM Antenna (not supplied)
8	Stickers
9	Car Handset HSU-4 (not included)

Mounting

Note: Remember that all equipment must be mounted so that it does not interfere with the operation of the vehicle.

Radio Unit TFE-4/RV-1 (Pos.1)

If desired, the RU may be mounted at a less visible position in the car interior than shown in the illustration. However, ensure that the RU is installed to permit easy access to the SIM card so that it can be changed if necessary and make sure that the cables for the microphone and loudspeaker will reach the places you intend to mount these components. The RU will clip securely onto the bracket supplied if it is mounted correctly.

Note: Mount the RU in such a way that a connection using BT can be established to a compatible device.

Warning:

MAKE SURE THAT THE RU BRACKET SUPPLIED IS MOUNTED IN SUCH A WAY THAT THE RU SLIDES INTO PLACE TOWARDS THE FRONT OF THE CAR OR IS MOUNTED SIDEWAYS. OTHERWISE THE RU MAY BREAK LOOSE IN THE CASE OF AN ACCIDENT AND CAUSE AN INJURY..

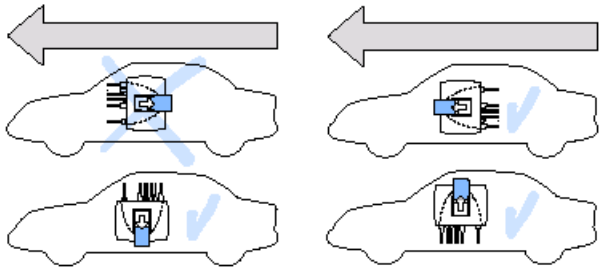


Figure 1: How to mount the RU in the car

Display SU-11/21 (Pos.2)

The mount for the display unit is to be fixed to the dashboard or to any other location in the cockpit area where the display is clearly visible to the user but does not impair control or operation of the vehicle.

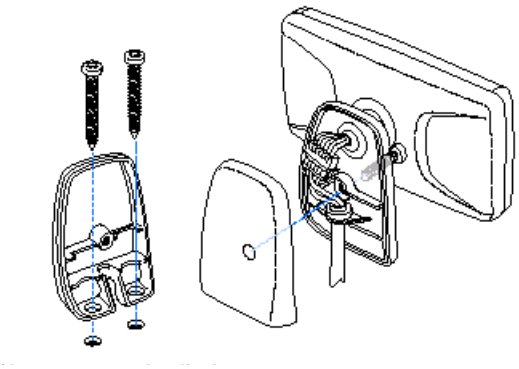


Figure 2: How to mount the Display Unit

Input device CUW-3 (Pos.3)

The Input device is supplied with a mount that is to be fixed in a suitable location where it is easily accessible to the user. As an alternative, the Nokia input device, type HSU-4 may be mounted for use with the CarKit Phone instead. However, take particular care to ensure that the input device will not interfere with the driver's operation of the vehicle. Make sure that the cable will reach to the RU for connection.

Loudspeaker SP-2 (Pos.4)

To ensure good acoustic quality, mount the loudspeaker so that it points in the driver's direction. It is also recommended that the loudspeaker is mounted a minimum distance of 1 metre away from the microphone to avoid feedback.

Microphone HFM-8 (Pos.6)

Note: The use of any microphone other than that supplied may impact the transmission quality.

Mount the handsfree microphone approx. 30 cm from the user's head, and position it so that it points towards the user's mouth. Experience has shown that the best locations are near the rearview mirror or to the left of the sun visor (for lefthand drive vehicles) / to the right of the sun visor (for righthand drive vehicles). Make sure to keep the microphone a minimum distance of 1 metre away from the car phone loudspeaker to avoid feedback.

Take care to mount the microphone so that it is not exposed to air streams from the vents. Microphone cable must not be laid in the heating, ventilation or AC system. Use double-sided adhesive tape to fix the microphone as this will prevent noise from the car body being transmitted into the interior.

When an incoming call is accepted or an outgoing call is connected, the system will automatically mute the car radio and the call will be switched over to the CarKit Phone loudspeaker.

Power Cable PCU-4 (Pos.5)

The power cable connects the CarKit phone to the car's electronics system. See the wiring diagram for exact instructions.

Wiring guidelines

When laying the cables, care should be taken to position them so that they are located as far as possible from the electronics systems installed in the car in order to avoid electromagnetic interference.

Also ensure that cables are placed so that they will not be subjected to mechanical wear and tear (e.g. not laid under car seats or over sharp edges).

GSM Antenna (Pos.7) (not included in the sales package)

The CarKit Phone is designed to be connected to an external GSM antenna. However, if the car is equipped with a radio/GSM antenna with a frequency separating filter, this may be used instead.

If the car does not have a GSM antenna, contact the relevant dealer for information on the best location and for the relevant installation guidelines.

Audio settings

The CarKit Phone supports a variety of options for output over a loudspeaker.

- Direct connection to the supplied SP-2 loudspeaker.
- Connection to a compatible car radio loudspeaker over an additional relay that switches audio output over to the loudspeaker.

- Connection to a compatible car radio loudspeaker via the line-in input of the car radio. The audio level will need to be adjusted suitably if this option is used.

Function Test

After the CarKit Phone has been installed, it needs to be checked to ensure that it is working properly. When testing the operation of the equipment, also check that it has been mounted so that it in no way impairs the driver during operation of the vehicle.

- To make a wireless connection between the CarKit Phone and a compatible accessory with Bluetooth technology, ensure that the devices are within the range necessary for Bluetooth transmission. Remember that external devices need to be supplied with sufficient power for this feature (check the battery pack).

Power Cable PCU-4

Technical Data

Battery voltage	12.6 V DC (10.8 - 16.0 V)	
Current carrying capacity	1.5 A (standby mode 1 mA)	
Transmitting power	EGSM 900	3.2 mW - 2 W
	DCS 1800	1.0 mW - 1 W

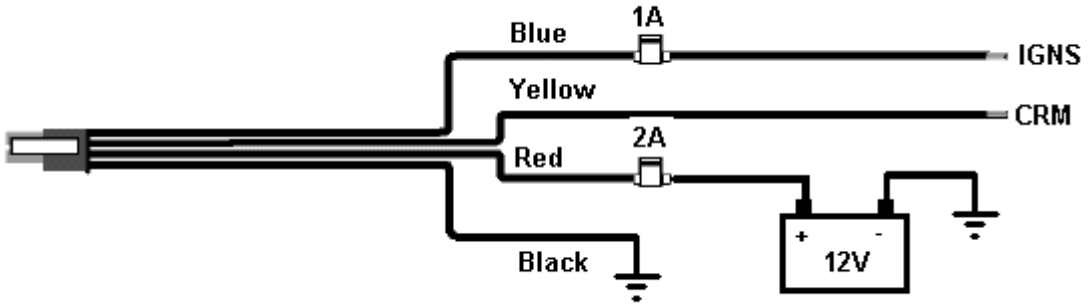


Figure 3: Power Cable PCU-4

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8a - TF5 Technical Information Junction Board

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Technical Information

TFE-4/RV-1, Nokia 610/616 are in-car GSM telephones which are permanently mounted in the vehicle and can be used to make and receive calls like any conventional hand-held GSM phone. The Radio Unit (RU) is powered by the car battery and some parts of the electronics are permanently powered for wakeup functionality. The GSM part of the phone is based around a modified NPL-1 (6310i) phone unit and has a 2W RF transmitter.

The user interface consists of an input device, designated CUW-3, and display unit, designated SU-11 (N610) or SU21 (N616), which are connected to the RU by cable. Audio interface can be via standard Nokia accessories, such as handsfree microphone and speaker units, designated HFM-8 and SP-2, which are connected to the RU by cable.

The power connector is a four-pin connector, which is the entry point for unit power and ground return. It also has a pin for connection to the ignition sense (IGNS) wire in the car loom for detection of wake up functionality. The last pin is for connection to the car radio mute (CRM) wire of the vehicle radio to mute the car radio when a call is incoming or outgoing.

The hands free (HF) microphone connector is an audio jack for connection for the HFM-8 microphone. This hands free microphone allows audio hands-free use of the unit. The hands free speaker connector is complementary to the HF microphone and connects to the SP-2 hands free speaker.

The display units (SU-11/21) are externally designed and manufactured parts, which contain the screen showing the user the current status of the phone unit and allowing setup information to be viewed. The communication between the DU and the RU is done via the FBUS. Power for the display unit is from the same source as that for the input device. The display unit controls the input device via two signal lines, which are looped through the Junction Board (JB). Additional pins of this connector are used for flashing and other production purposes.

The input device (CUW-3) is an externally designed and manufactured part, which allows the user to navigate through the menus shown on the display unit screen. The JB supplies power to the input device though all control of the input device is done by the display unit.

Internal Signals and Connections

Interfacing between the JB and the EB requires level shifting of incoming and outgoing signals to the correct voltage level depending on the destination. The JB devices are based on 5V logic while the EB has both 1.8V and 2.8V devices. Some of the signals used for production testing are already at the correct level and do not need further processing by the JB except for ESD-EMC protection.

User Interface

Display units SU-11/21 provide an 84 x 24 pixel monochrome display with a row of fixed icons on the top and a fixed icon signal bar on the left. The display is connected via external FBus connector to the RU TFE-4/RV-1. For user data input the input device

CUW-3 is connected to the RU.

The UI style is basically a reduced Jack3 style adapted for in-car usage.

Table 1: LCD Characteristics

Technology	CSTN
Display format	84 columns x 24 rows fixed icons on the left for signal strength fixed icons for various functions on top of pixeled area
Illumination Mode	White LED backlight
Numbers of colours	monochrome
Pixel height to width ratio	1:1
Main viewing direction	12 o'clock

Modes of Operation

The system has four different power modes:

- NO_SUPPLY mode
- BACK_UP mode
- POWER_ON mode
- POWER_ON_PDT mode

In addition, there are modes:

- GSM engine off mode
- Local / Test mode

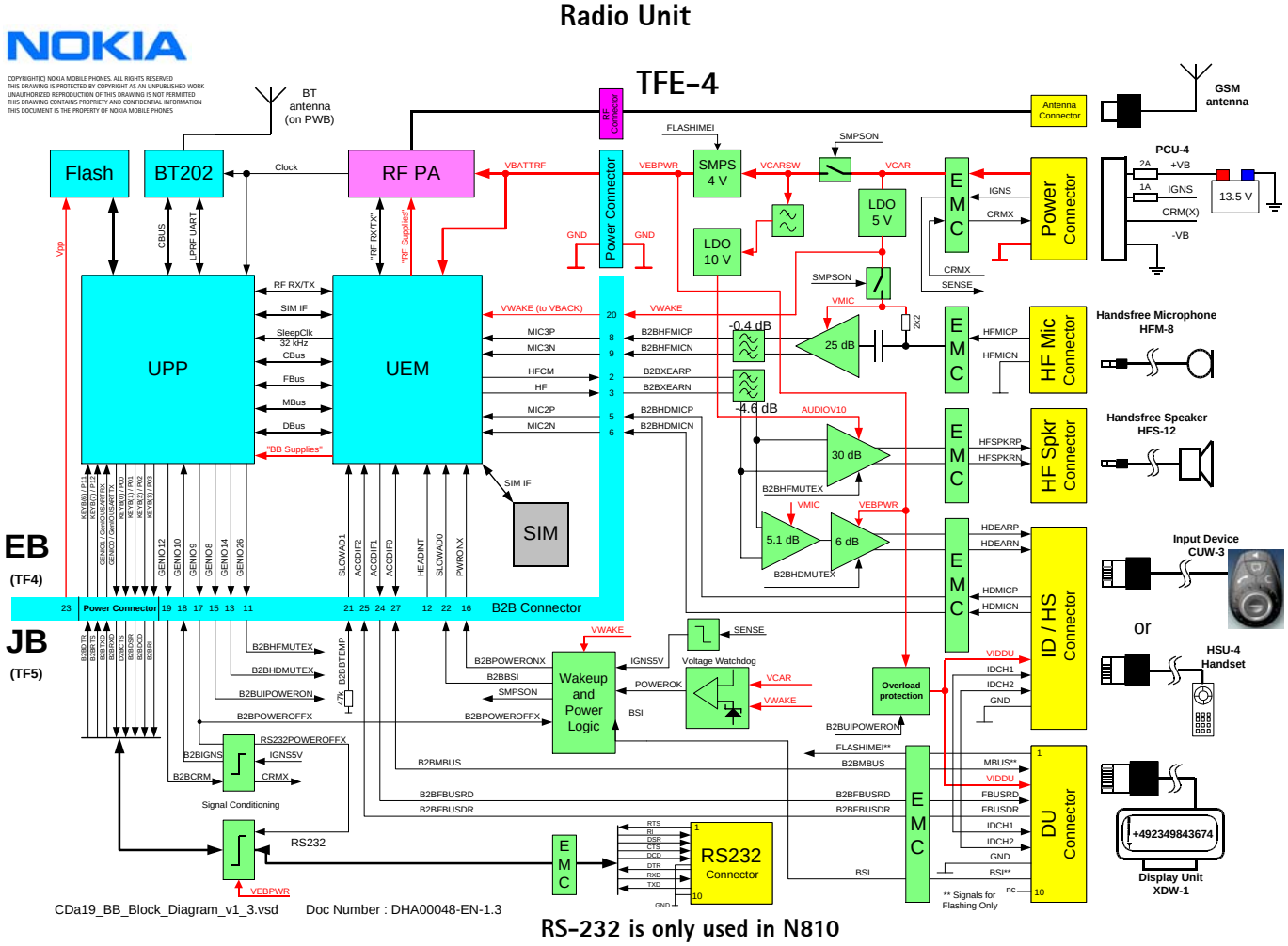
In GSM engine off mode, the GSM engine is switched off but the system remains powered to keep an existing BT connection.

The Local/Test mode is used for alignment and testing.

Functional Description

Block Diagram

Radio Unit



RS-232 is only used in N810

Electrical Module Description

The Nokia 610/616 RU consist of two PWBs, one large board, designated TF5 and known as the JB, carries on it all the cable connector sockets and baseband electronics. It has six external cable connectors for connection of RF antenna, power, audio (2x) and user interface (2x). It also has several electrical connections to the GSM module (mentioned below).

Mounted on top, and connected to the JB, is the smaller GSM PWB which is a modified NPL-1 (6310i) GSM phone module. The GSM PWB is designated TF4 and is known as the Engine Board (EB). The EB has connections to the JB for control, power, ground and RF antenna and one connection to the real world for the SIM card interface.

Power supply to the RU is directly from the car battery via an external fuse. There is also a requirement to monitor the ignition sense (IGNS) signal in the car loom and to have the ability to mute the car radio.

PWBs

TF4 EB module is implemented in an eight layer PWB with low-CTE core and the nominal thickness is 1.0 mm. FR4 build-up layers, micro vias, buried vias and selective OSP coating are utilized.

TF5 JB has 4 layers with standard FR4 technology.

Functional Description of Software

SW Features

TFE-4/RV-1 will implement the following main features:

- Drive-time optimized Car UI based on Jack3 monochrome
- Optimized input device including wheel allowing blind usage during drive time
- GPRS (General Packet Radio Service)
- Bluetooth remote SIM access support for zero hassle usage (Nokia 610/616 only)
- Support of BT headset
- Handsfree capabilities
- Voice commands and voice name tags over handsfree

Introduction

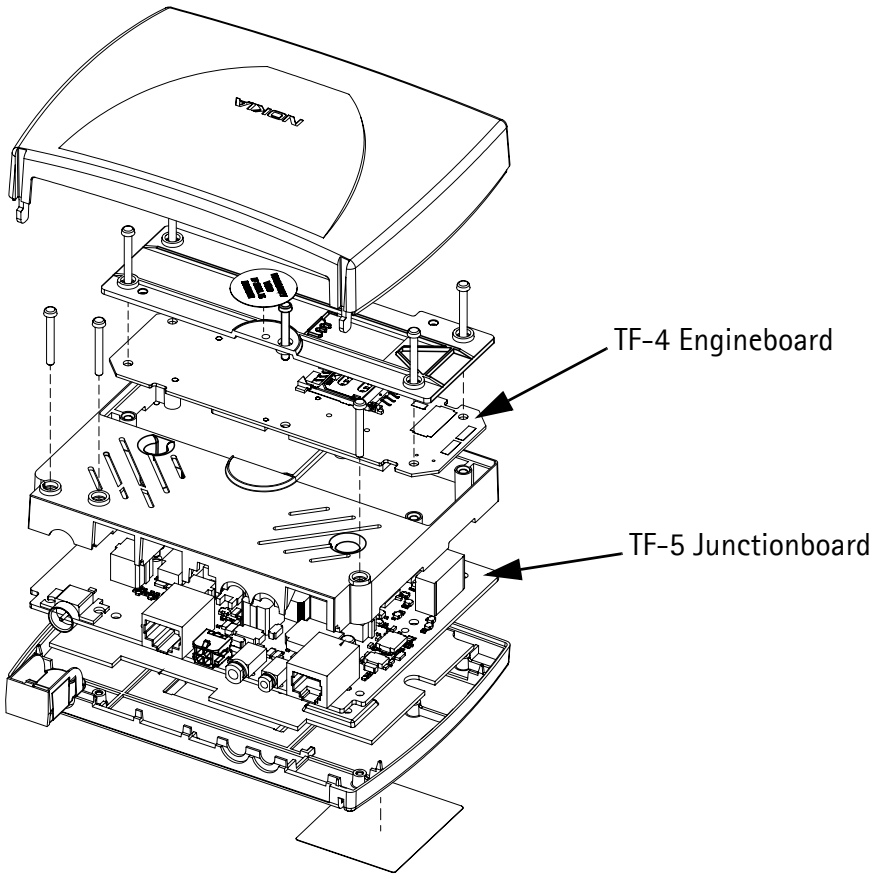


Figure 1: View of TFE-4/RV-1 Radio-Unit

The TF-5 PWB, is called the "Junctionboard" (JB) and the TF-4 PWB, is called the "Engine-board" (EB). The TF4 PWB is very similar to the NPL-1 (6310i) phone PWB and contains the phone itself. The TF5 PWB is responsible for interfacing to the Display-Unit, the Input device as well as to the car environment and the accessories. For this purpose there are Through-Hole Connectors mounted on the TF5 PWB. Both PWBs are only single sided populated. The exploded view of mechanical construction can be seen in Figure 1: View of TFE-4/RV-1 RU.

The PWBs are contacted with three Board-to-Board connectors, two 8-pole connectors and one 28-pole. Those connectors are soldered on the JB with spring connection to the unpopulated side of the TF4 PWB. Additionally an RF-connector is transferring the RF signal between TF-4 Engineboard and external Connector on Junctionboard.

Blockdiagram of Junctionboard

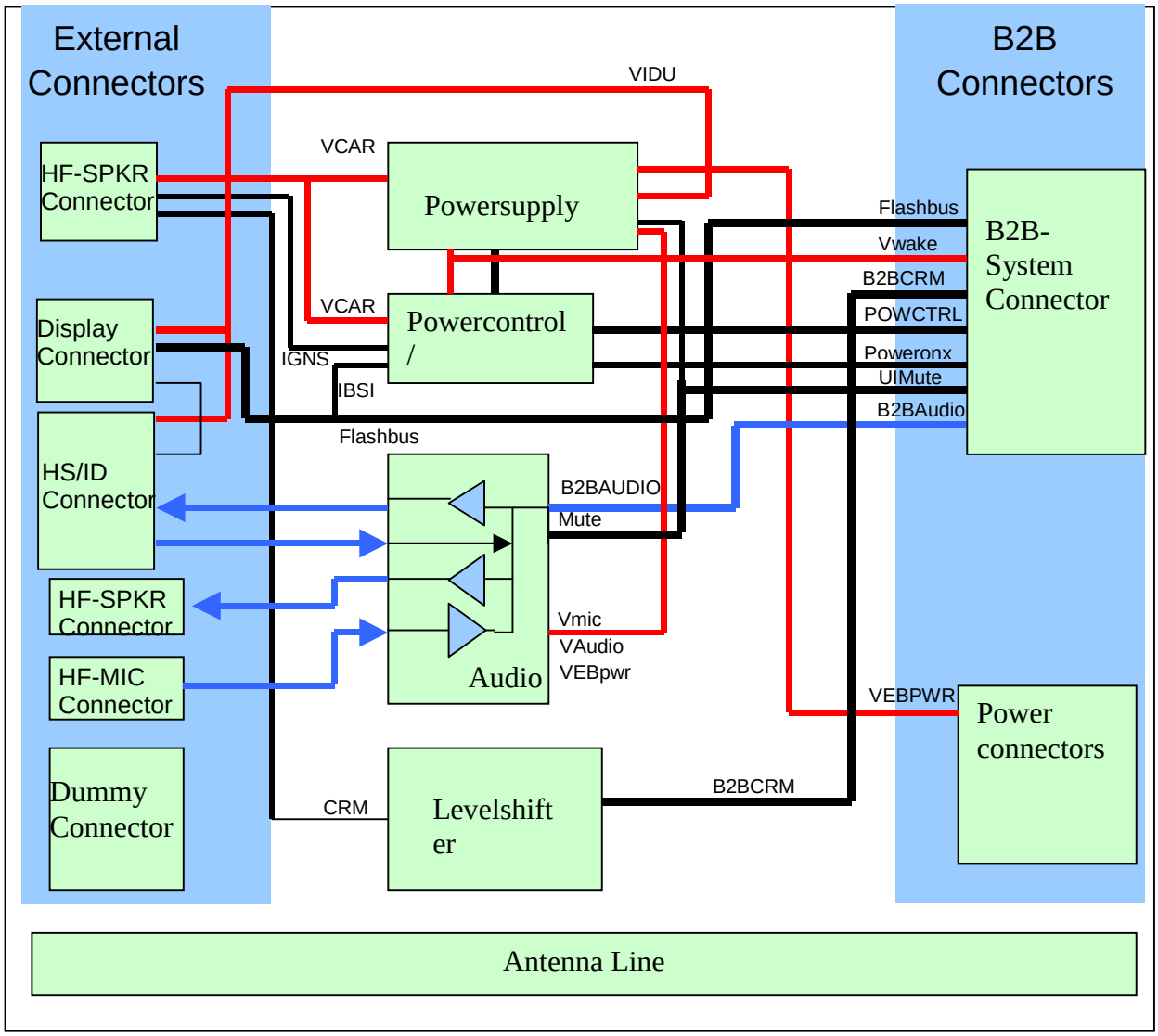


Figure 2: Block Diagram of the Junctionboard

Description of the Powerstates

The Powerup/Powerdown-Behaviour for Nokia 610/616 is done as follows:

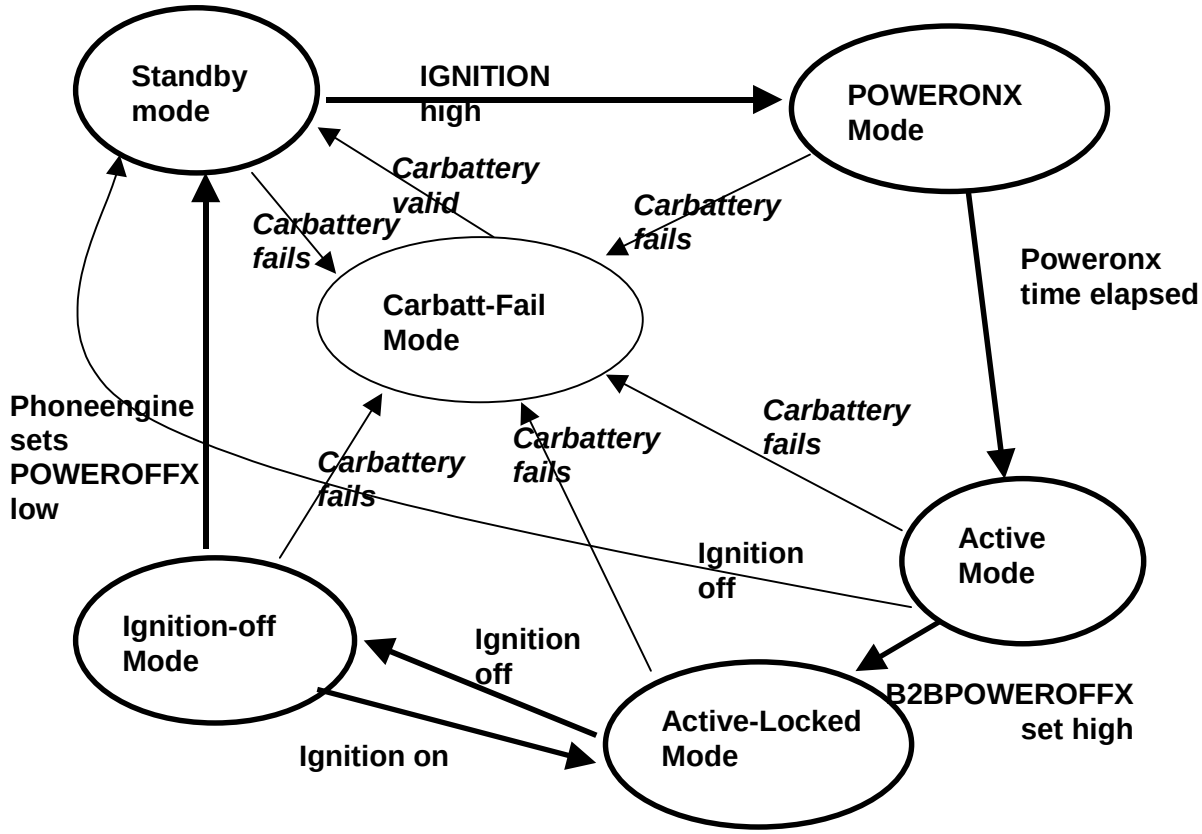


Figure 3: Powerstates of the TFE-4/RV-1 RU

Standby Mode

When the car is standing inactive (ignition is switched off), TFE-4/RV-1 shall be in Standby mode. In this mode TFE-4/RV-1 is not operating. This mode is characterized by very low power consumption (less than 1mA). This state will be reached when TFE-4/RV-1 is connected to Carbattery first time

Active Mode

In active mode the engine-power supply is on and poweronx line is toggled by the poweronx generator. Here the phone is generally full active from Power supply point-of-view. After a short time (determined by Software) the UPP sets the B2BPOWEROFFX line high and this initiates the transition to Active-Locked Mode. In case that Ignition signal is going to low before that, direct transition to sleep mode will happen and the phone engine will be powered off immediately.

Active Locked Mode

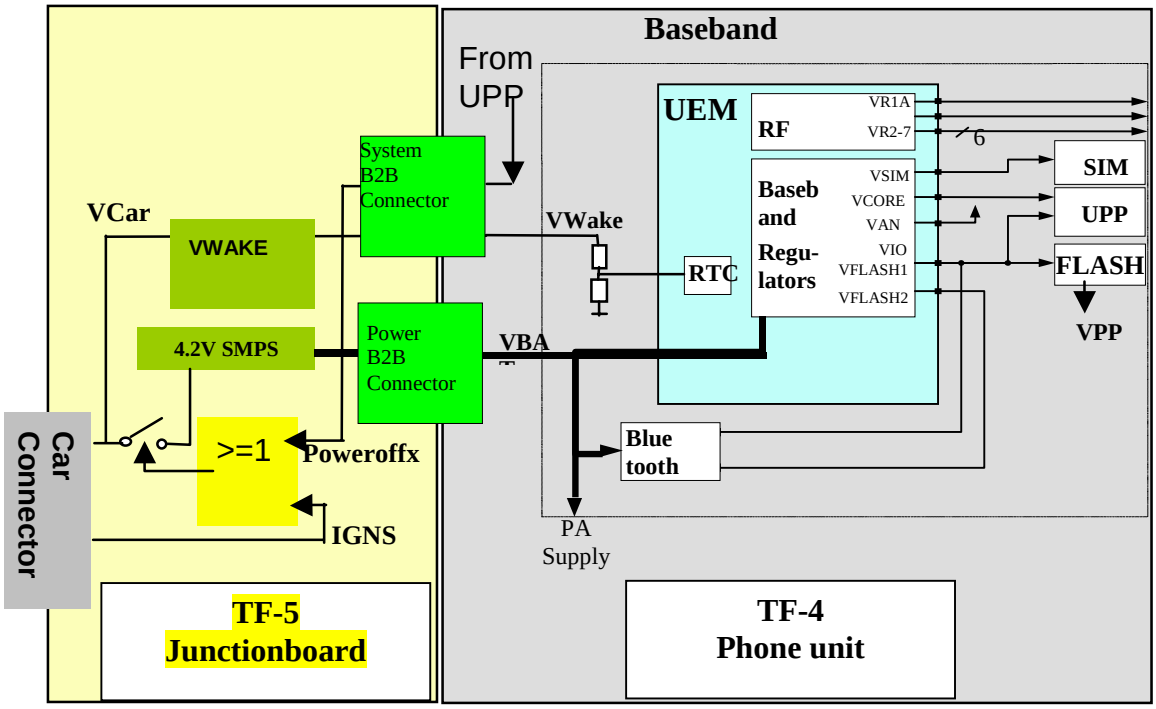
The active locked power mode is same as the active mode but UPP holds B2BPOWEROFFX line high. If the the Ignition signal is going from high to low now, the TFE-4/RV-1 will remain active but a transfer to the ignition-off mode will take place.

Ignition-Off Mode

The ignition-off power mode is same as active mode and active locked power mode, but the power supplies are kept alive because the PowerOffx line is held high by the UPP. This is to enable log-off from GSM network and to enable to continue active phone call when car is switched off. When those tasks are finished, UPP will set Poweroffx line low and the RU will switch to standby mode.

Carbatt-Fail Mode

This mode is reached, when the Carbattery is out of the 'normal' operating range. Like in standby mode all main power supplies are switched off, only power supply for wakeup logic is active.



Description of the Blocks

Power supply

Blockdiagram of Power supply

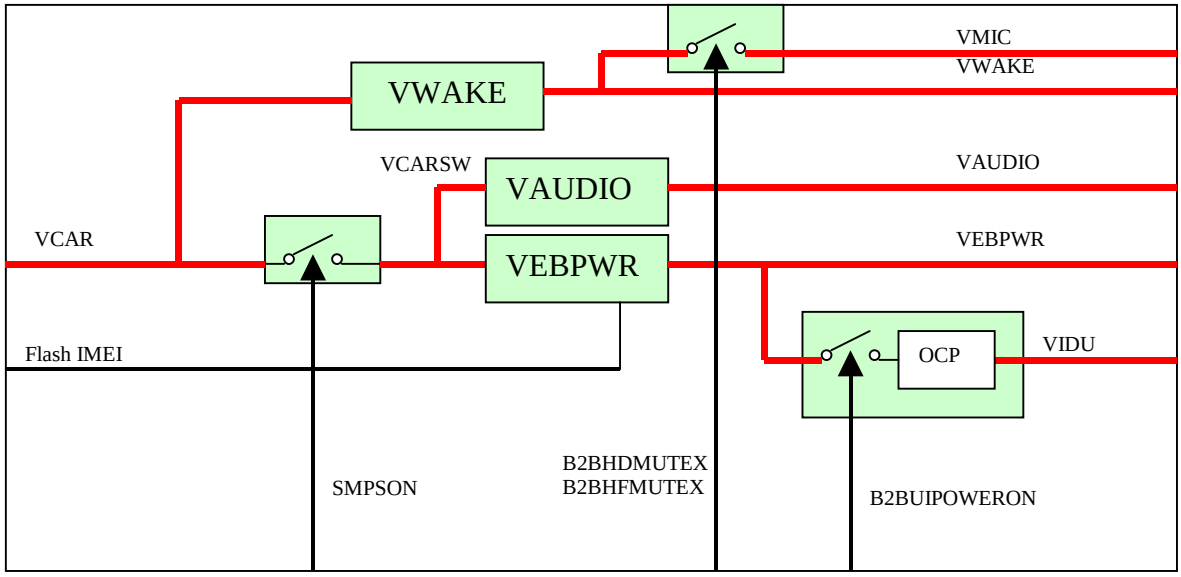


Figure 4: Block diagram of Power Supply-Block

Description of Inputs, Outputs and Block-Internal Lines

Signalname	Description	Range	When Error then .....
Inputs			
VCAR	Protected Carbattery Voltage coming from Car-connector	Defined: 5V..20V Operating: 9..15V	Whole unit will not work
FlashIMEI	Signal for Production Test to increase Engine Power for IMEI flashing	0..1V low 10..14V high	IMEI Flashing will fail on Final-Test (when always low) Or VEBPWR will be too high (when always high)
SMPSON	Signal from Powercontrol block that switches the Powersupplies for active Powermode	Low: (Sleep-mode) 0..1V high (active mode): 4..5V	Unit will not wakeup (when always low) Or Sleepmode current will be too high (when always high)
B2BHDMUTE	HD-Mode control signal	High: 1.6..18V Low: 0..0.5V	Here: VMIC will always be switched on (Sleepmode current too high) (when always high) Or always off (when always low)
B2BHFMUTE	HF-Mode control signal	High: 1.6..18V Low: 0..0.5V	Here: VMIC will always be switched on (Sleepmode current too high) (when always high) Or always off (when always low)

Signalname	Description	Range	When Error then .....
Inputs			
B2BUIPOWERON	UI-Power control signal	High: 1.6..18V Low: 0..0.5V	Here: UIPOWER will always be switched on with VEBPOWER (when always high) Or always off (when always low)
Outputs			
VWAKE	Powersupply for VMIC, Powerup control and Engine-RTC	5V 5%	Unit will not wakeup
VEBPWR	Powersupply for Engine and Headset Poweramplifier	Sleepmode: 0V active: 4.2V 5%	Unit will not wakeup (when always low) Or Sleepmode current will be too high (when always high)
VAudio	Powersupply for Hands-free Poweramplifier		HF Poweramplifier will not work
VMIC	Phantom-Power for HF-Microphone	0V when switched off, else 5V 5%	VMIC invisible on HFMIC connector
VIDDU	Protected Power for Input Device and Display Unit	0V when switched off, else 4V	UIPower or s.c. Protection will not work

Description of the Hardware Realization

The power supply block consists of three power regulators and three power switches.

Vwake/Vmic

Vwake is the power, which supplies all circuitsthat have to be active when car battery is applied. This power path has to be optimized for low leakage current to guarantee the 1mA standby demand. The Voltage VWAKE is used in the Power control block and as Backup-Battery replacement for the EB. When HF-Audiopath is activated, (B2BHFMute is high) the VWAKE power is directed to VMIC

The VWAKE Power supply is realized by a 5V-fixed linear regulator.

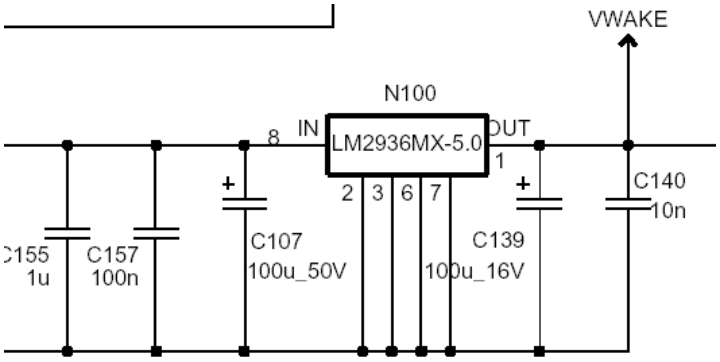


Figure 5: Vwake Power supply

The realization of the VMIC switch is shown in Figure 6 and 7. It is realized by using a double FET and in addition a part of double transistor V306. VMIC is activated when VMICONX is driven to Ground by either B2BHFMutex or B2BHDMutex signal. Those are in active at about 1.8V level and inactive 0V. VMIC can be proved on Test point J115,

B2BHFMutex and B2BHDMuteX can be activated by Test pattern TP416, #1 and #6. VMIC is high, when one of both signals is high (OR logic).

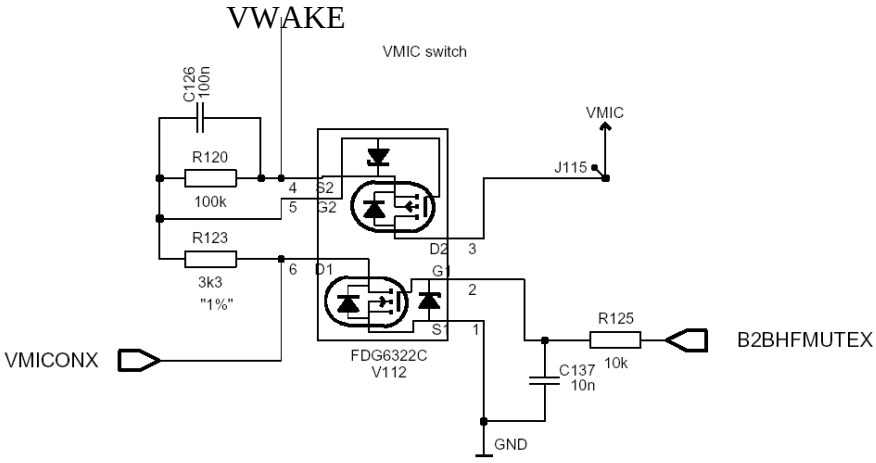


Figure 6: VMIC switch (a) VMICONX driven low by B2BHFMUTEX

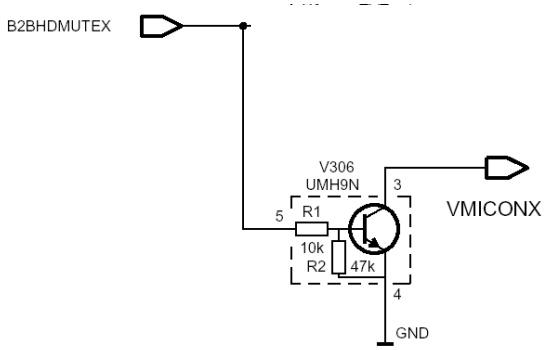


Figure 7: VMIC switch (b) VMICONX driven low by B2BHDMUTEX

Vcar Switch

The Vcar Switch is a power switch that can switch off the car battery voltage (Vcar) in the front Vaudio- and the VEBpwr-regulators. It is used when RU is in standby mode. By using this switch the leakage currents of those voltage regulators are less sensitive for reaching the 1mA standby criteria. Now only this switch is leakage sensitive. The switch is controlled by the SMPSON control line of the Power control/Reset Block. The leakage can be verified by measurement of the Vcarsw voltage when the device is in standby (SMPSON = off). Now the Vcarsw level has to be low (about 0V). This can be verified at test point J113.

The SMPSon signal has values of about 0V during standby and 4V to 5V when powered up. In this case, Vcarswitch has to guarantee low serial resistance to minimize the heat dissipation within V104. This can be verified by applying 3A load at VEBPWR and measuring Vcarsw in this case.

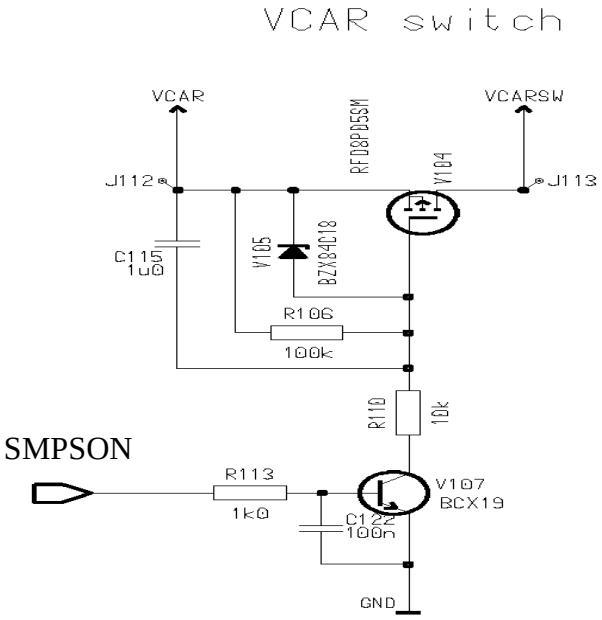


Figure 8: HW-Realization of Vcar Switch

VAudio

The power supply VAudio is used to supply the power amplifier for the HF speaker. It is designed by using low drop-regulator. Even when car voltage falls below 10V, it shall provide a slidely reduced Voltage level against Vcar on VAudio power line.

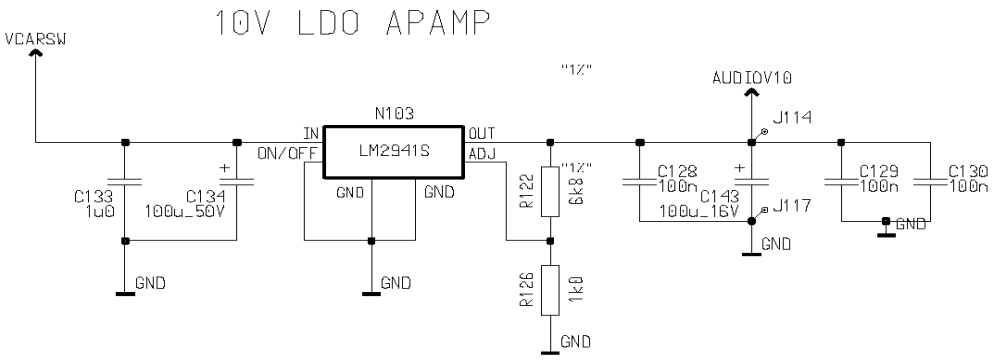


Figure 9: VAudio HW-Realization

To enable this a LDO regulator is used to provide optimized headroom to Vcar. Because the Audio-Amplifier is sensitive regarding power supply-noise, this regulator has to fulfill this demand to enable noise free audio output on HF path. The output voltage is determined by the Resistor net R122 and R126 at 10V 5% accuracy.

VEBpwr

This is used to supply the EB (via the VIDU-switch), the display unit and the input device with power. VEBpwr power supply is able to provide 3A maximum current at 4.2V 5%. The maximum allowed ripple is 50mV because of the Bluetooth ripple-demand. When this demand is not fulfilled the Bit-error rate of the Bluetooth module will increase. This voltage regulator shall not provide exceptional heat dissipation, this is guaranteed by using a switch-mode regulator that is used with internal Switch.

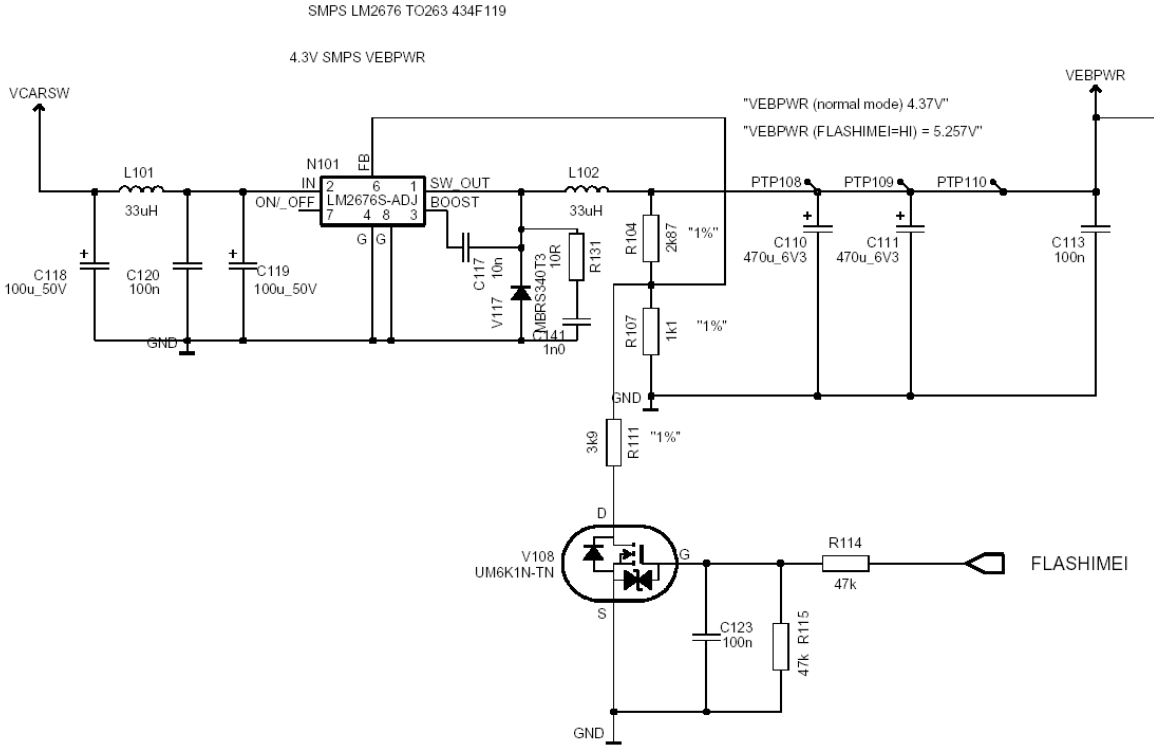


Figure 10: VEBpwr regulator HW realization

Optional the VEBpwr can be shifted to 5.2V by applying 12V(=Vcar) on the Flash-IMEI input. This is enabled by changing the resistor net R104/R107 with additional R111 to Ground. By this the feedback path is changed and the voltage is increased to 5.2V. This higher Voltage is necessary to Flash the IMEI Number into the UEM of the EB.

VIDDU Switch

The VIDDU switch enables the Supply Voltage of the input device and the display unit. This switch is controlled by the B2BUIpoweron line of the EB. This line has 1.8V level in active and 0V in inactive state. Additionally this block shall fulfill backwards protection against Vcarbat and Short-circuit protection against Ground.

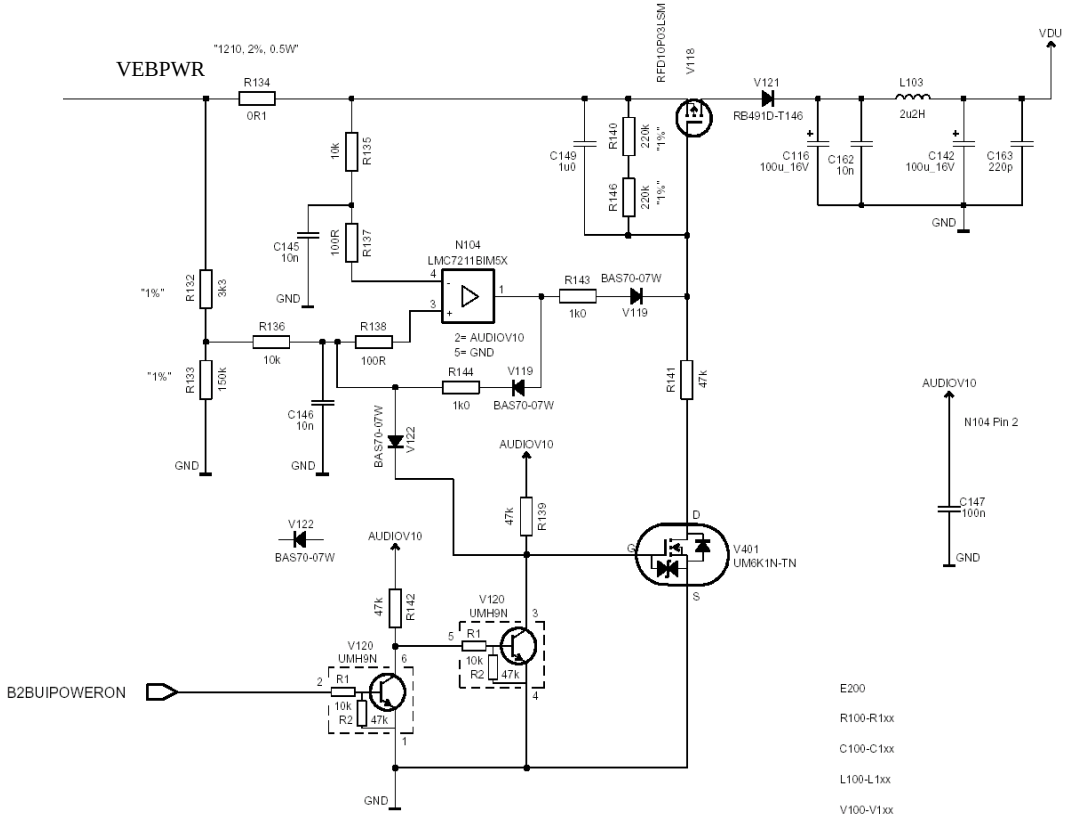


Figure 11: VIDDU switch HW-Realization

V119 is responsible for the backwards protection and R134 is responsible for the overcurrent protection. The voltage difference is sensed by N104 and V129 will switch off V118 when current is too high.

Power control/Reset Block

This block shall provide the right state of the power supplies depending of the status of the Vcar, ignition-sense and the power control line B2BPoweroffx, provided by the EB. Further, it generates the Start-Up pulse on B2BPoweronx line to enable proper starting of the phone engine.

Power control/Reset Blockdiagram

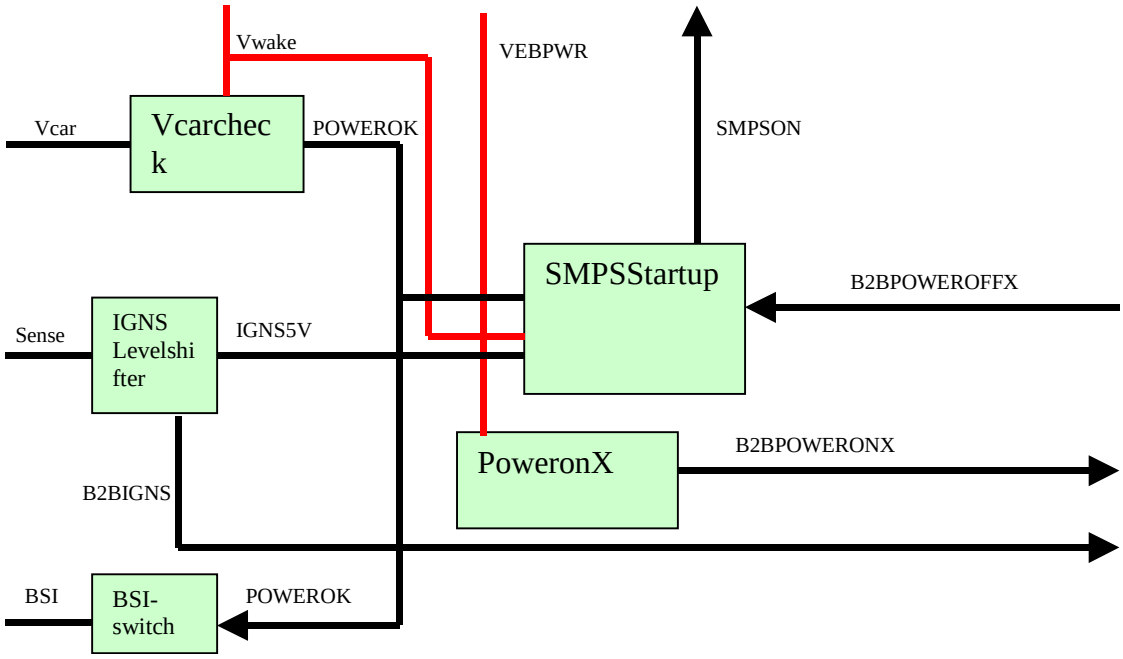


Figure 12: Block diagram of Power control/Reset Block

The Vcar-Check Block is responsible to monitor if the Vcar is within operating range. When the voltage range of the car battery is too high or to low Powerok line will be low and the board will not start up anymore. By holding B2BPOWEROFF high, the Phone-Engine can force the Power supply to switch off when ignition sense input is low. The Poweronx block generates pulses of 0.5Hz, when Vebpwr is active.

Description of Inputs, Outputs and Block-Internal Lines

Signalname	Description	Range	When Error then .....
Inputs			
VCAR	Protected Carbattery Voltage	Defined: 5V..20V Operating: 9..15V	Whole unit will not work
SENSE	Ignition Sense signal from Carconnector	Low: 0..8V high (active mode): 8..28V	Unit will not wakeup (when always low) or sleepmode current will be too high (when always high)
VWAKE	Powersupply for VMIC, Powerup control and Engine-RTC	5V 5%	Unit will not wakeup
B2BPOWEROFFX	Control signal from Engine-board to switch off SMPSon after Ignition is switched off	High: 1.6..18V Low: 0..0.5V	SMPSon will always keep active (when always low) or goes immediately low when ignition is switched off (when always high)

Signalname	Description	Range	When Error then .....
Outputs			
SMPSon	Signal from Powercontrol block that switches the Powersupplies for active Powermode	Low: (sleepmode) 0..1V high (active mode): 4..5V	Unit will not wakeup (when always low) or Sleepmode current will be too high (when always high)
B2BPOWERONX	Reset signal that is toggled by the POWEROX block during startup	Opendrain output (with external pull-up to 2.7V): Active : 0V inactive: 2.7V	Phone-Engine will not wakeup (when always low or always high)
POWEROK	Output signal of the VCAR-Check Block	4..5V if VCAR is within operating range (9..15V), 0..1V when VCAR is out of range	Unit will not wakeup (when always low) or SMPSon will not be deactivated if VCAR is out of range (when always high)
IGNS5V	To 5V Logic level translated Ignition Signal	0V when Sense = off, else 5V 5%	Unit will not wakeup (when always low) or SMPSon will not be deactivated (when always high)
B2BIGNS	To 1.8V Logic level translated Ignition Signal	0V when Sense = off, else 1.6..1.8V	Phoneunit will malfunction
BSI	Opendrain Output which switches 47kR load to Ground when Powerok is active	0V when Powerok, else high impedance	Phoneunit will malfunction (SIM cannot be read), Phone always in Localmode

Description of the HW Realization

Vcar-Check

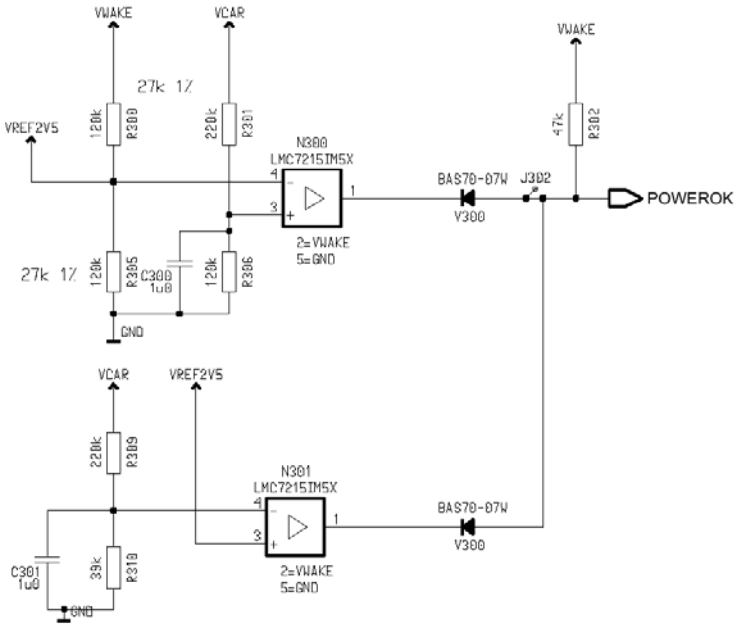


Figure 13: Vcar-Check Realization

This block consists of two comparators, N300 and N301, which checks if the VCAR voltage is in the right operating range. When VCAR is in the right range both comparators will have 5V(=Vwake) at the output. When the Vcar is over the limit of 15V N300 will switch to ground level on output and Powerok will be forced low. The limit is determined by R301/R306 and the reference level of 2.5V(=VWAKE/2) which is provided by the R305/R300 combination.

Same happens when Vcar falls below 9V, in this Case the output of N301 will be forced low and Powerok will be forced to ground. This limit is determined by the combination R309/R310 and the 2.5V reference.

SMPS startup

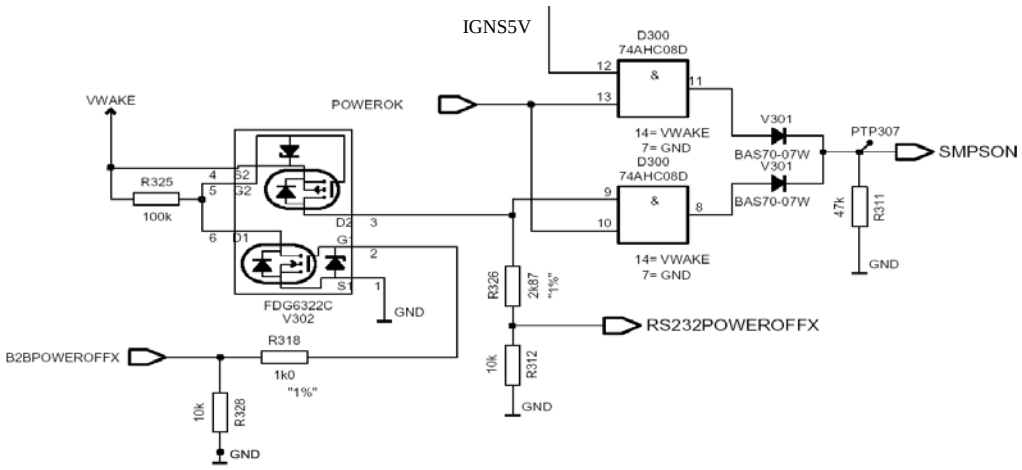


Figure 14: SMPS startup realization

The SMPSon signal is set high (>4V) under two conditions, Powerok is high and ignition sense is active or Powerok is high and B2Bpoweroffx is high. Both conditions are provided by D300 and V301. V302 is responsible for the level shifting of the 1.8V level provided by the phone engine to the 5V logic-level of D300. Further more, the level shifted here, RS232POWEROFFX, which is the 4V translation of B2BPOWEROFFX signal, is generated here

Poweronx

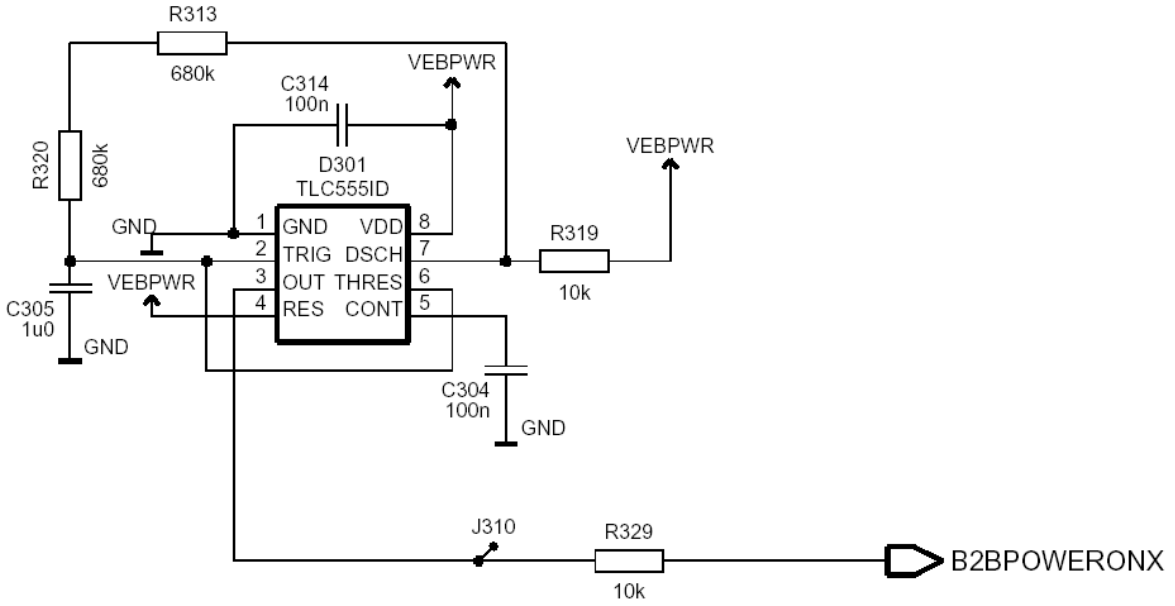


Figure 15: Poweronx realization

The Poweronx function block generates a pulses of 0.5Hz, with a length of approximately 1 second high and 1 second low, when VEBpwr is active. The output voltage is 4.2V (like VEBpwr)..

IGNS Level shifter

This block is responsible to translate the Ignition sense signal, which is 0n 12V level (connected Car battery), to the 5V logic level for the startup logic and to 1.8V level for the phone engine. The comparator N302 cares that the IGNS5V signal is only high when the Sense input is higher than 9V level. The 1.8V level shifter is realized by voltage divider R304/R307.

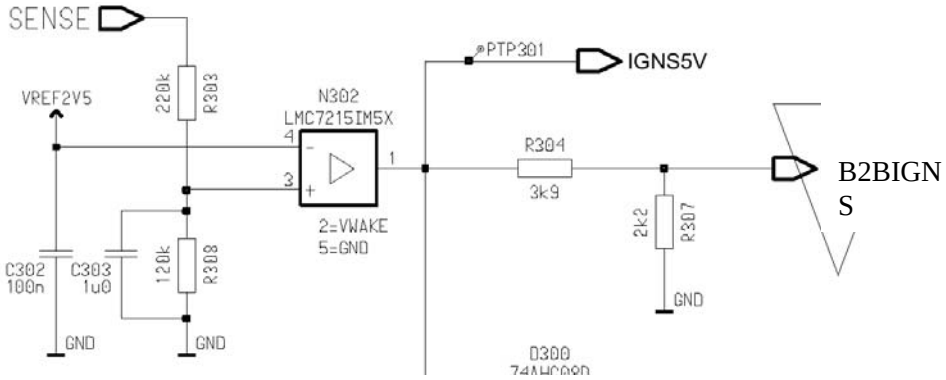


Figure 16: IGNS Levelshifter realization

BSI-Switch

The BSI-Resistor may only be connected to Ground when VCAR is in the correct range (Powerok = active). This is the task of the BSI-switch.

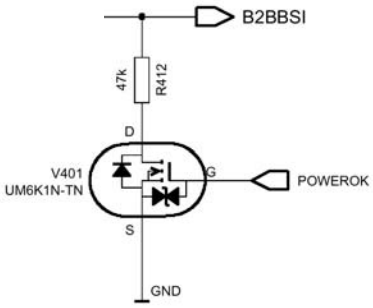


Figure 17: BSI switch

Description of the Audio Block

Block Diagram of the Audio Block

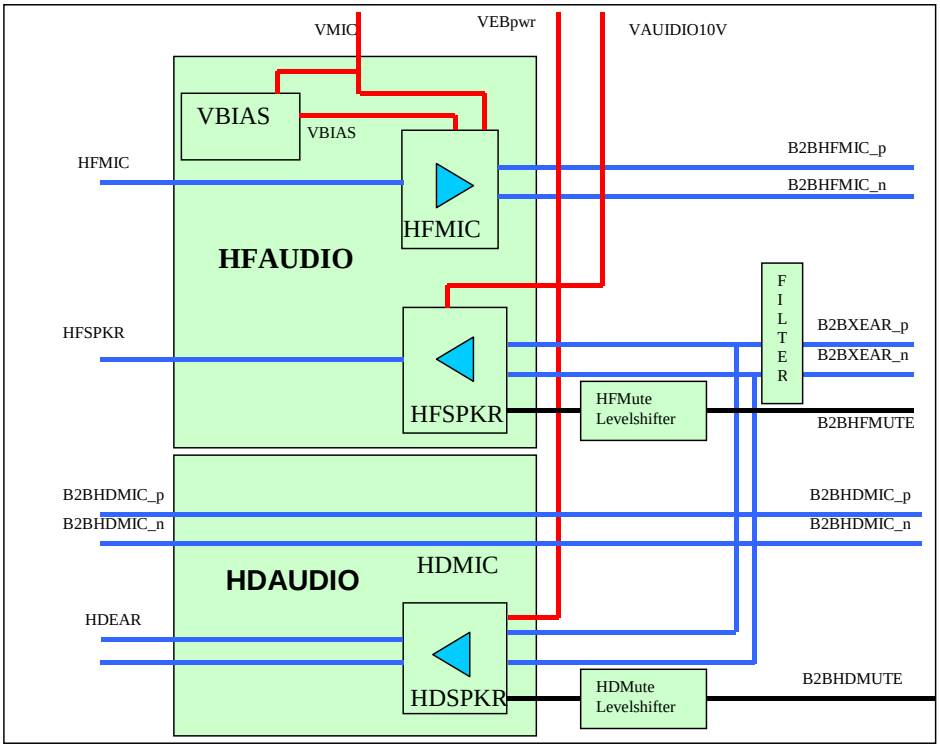


Figure 18: Block Diagram of Audio-Block

The Audio Block consists of two major parts, the HFAudio-Block, which is responsible for the handsfree audio functionality, and the HDAudio-Block, which is responsible for the Headset Audio. Additionally there is a preflight for the B2Bxear lines from the EB and level shifters for the mute lines. HFAudio interfaces single-ended to the microphone and to the speaker. The HDAudio path is implemented with symmetric speaker and microphone lines.

Description of Inputs, Outputs and Block-Internal Lines

Signalname	Description	Range	When Error then .....
Control-Inputs			
B2BHFMUTE	Control Signal to Mute the HF Amplifier and HF Microphone	Low: 0..0.5V high: 1.6..1.8V	HF-Amplifier and HF MIC will be always on (when always low) or both do not work (when always high)
B2BHDMUTE	Control Signal to Mute the HD Amplifier	Low: 0..0.5V high: 1.6..1.8V	HD-Amplifier will be always on (when always low) or does not work (when always high)
Powersupplies			
VMIC	Powersupply for HF-Microphone	5V 5%	HF-MIC Phantom Voltage will not work, VBIAS will be of
VEBPWR	Powersupply for Headset poweramplifier	Sleepmode: 0V active: 4.2V 5%	Headset poweramplifier will not work
VAudio	Powersupply for Handsfree poweramplifier		HF Poweramplifier will not work
Audio-Signals			
B2BXEAR_P B2BXEAR_N	Symmetric Audio Signal generated by phoneengine for HF- and HD-Speaker (Output selected by HDMUTE/ HFMUTE)		No Audio Signal to any Speaker
B2BHDMIC_P B2BHDMIC_N	Symmetric Audio Signal generated by Headset Microphone		No Microphone Signal from Headset
B2BHFMIC_P B2BHFMIC_N	Symmetric Audio Signal generated by Handsfree Microphone Amplifier		No Microphone Signal from Handsfree

Signalname	Description	Range	When Error then .....
HDEAR_P HDEAR_N	Symmetric Audio Signal generated by Headset Speaker Amplifier		No Audio Signal to Headset-Speaker
HFSPKR	Single-ended Audio Signal generated by handsfree Speaker Amplifier		No Audio Signal to Handsfree-Speaker
HFMIC	Single-ended Audio Signal generated by Handsfree Microphone. Gets VMIC as Phantom voltage		No Microphone Signal from Handsfree

Description of the HW Realization

Handsfree Microphone (HFMIC)

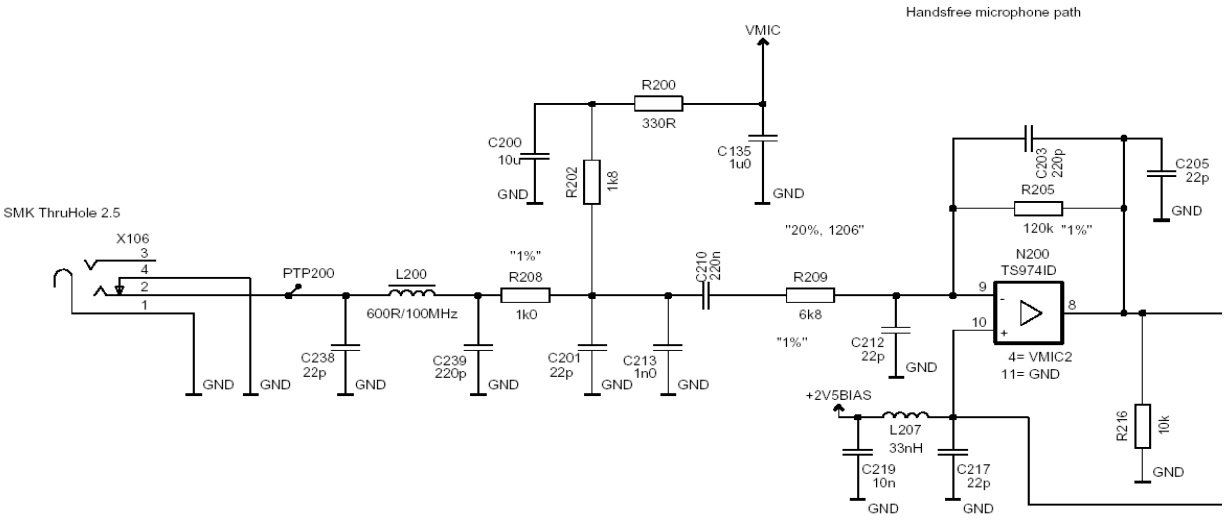


Figure 19: Realization of HFMIC (Part 1)

In Figure 19, the realization of the first part of the HFMIC Block is shown. The microphone is connected to an SMK connector. Afterwards there is some ESR filtering and a Bias voltage is applied to the microphone. In the next stage the signal is multiplied by the amplifier N200. To set Bias level at the positive input of this amplifier the voltage 2Vbias is used.

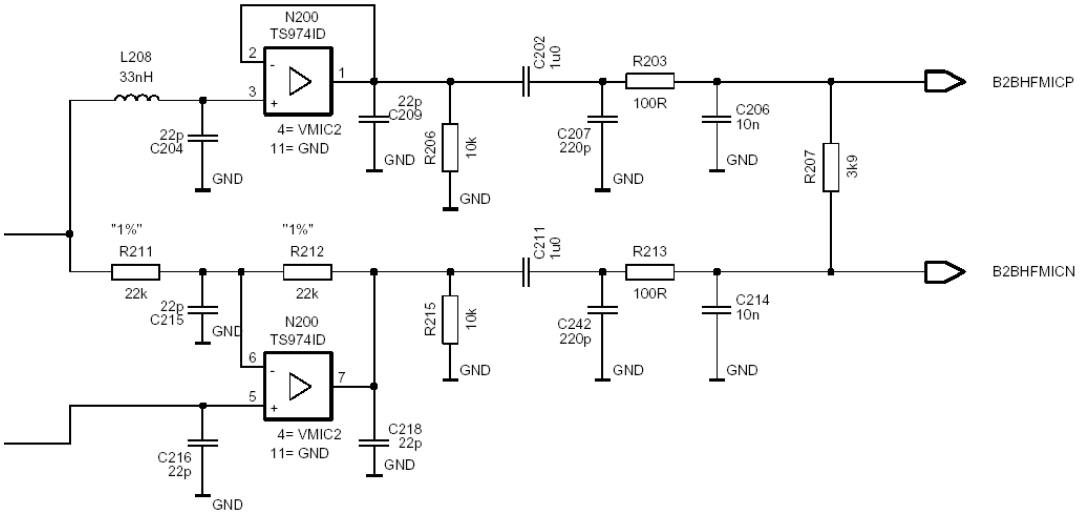


Figure 20: Realization of HFMIC (Part 2)

In the second part the single-sided signal is transferred to symmetric output, which is used by the phone engine.

Handsfree-Speaker (HFSKR)

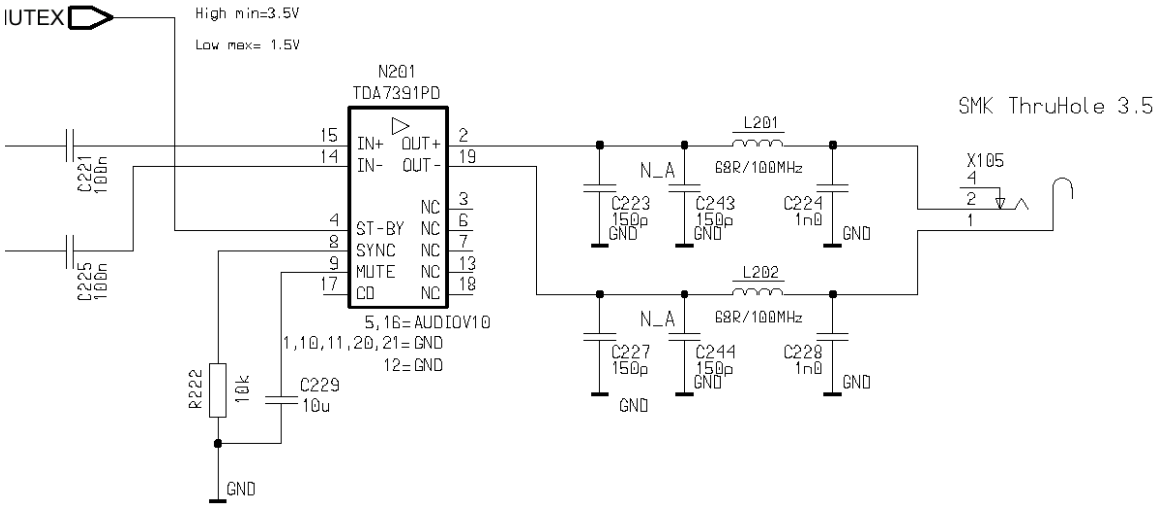


Figure 21: Handsfree Speaker Amplifier Realization

The symmetric signal comes from the prefilter and reaches the symmetric power amplifier. With the HFMute signal coming from the HF-Mute Level-Shifter, the amplifier can be switched on (HSMUTE<1.5 V) or off (HSMUTE = >3.5V).

VBIAS Regulator

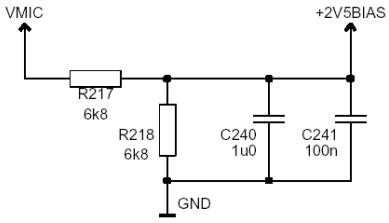


Figure 22: VBIAS Regulator

The VBIAS regulator generates a 2V.5-signal output, which is determined by the resistor net R217/R218. This voltage is used in the HFMIC amplifier.

HF-Mute Level shifter

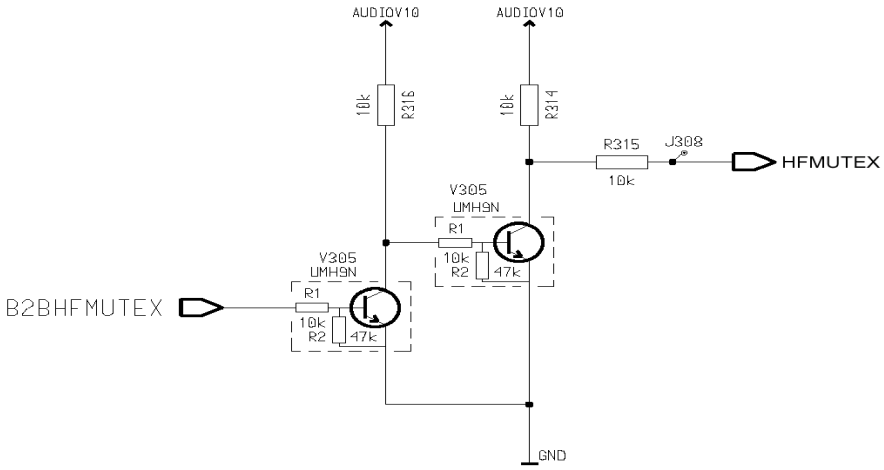


Figure 23: HF-Mute Level shifter

The HF-Mute level shifter transfers the 1.8V signal of the phone engine to the 10V level, which is used by the HF-Power amplifier HFSKR.

Headset Microphone HDMIC

The microphone signal of the HD-Microphone is directly linked from the connector and filters to the B2BHDMIC lines. The Filters can be seen in the connector block.

Headset Speaker Amplifier HDSKR

The headset speaker amplifier is realized by using N202 Boomer amplifier that is supplied by VEBPWR. The Symmetric output of the phone engine transferred in asymmetric signal by N200 and amplified to symmetric output signal within N202. The Amplifier can be muted by setting HDMUTE to high This signal comes from the HDMUTE level shifter.

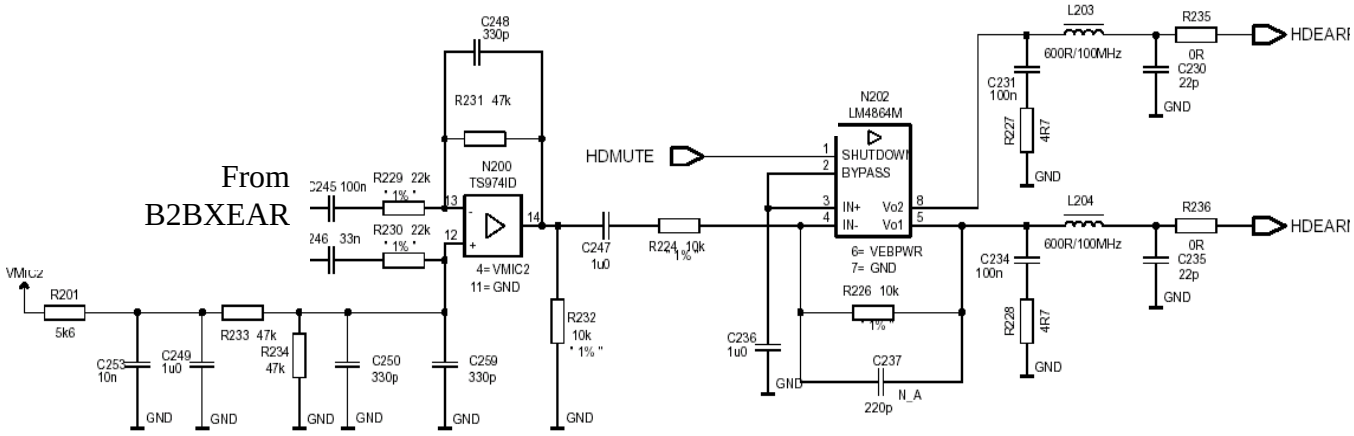


Figure 24: HD-Power amplifier realization

HDMUTE Level shifter

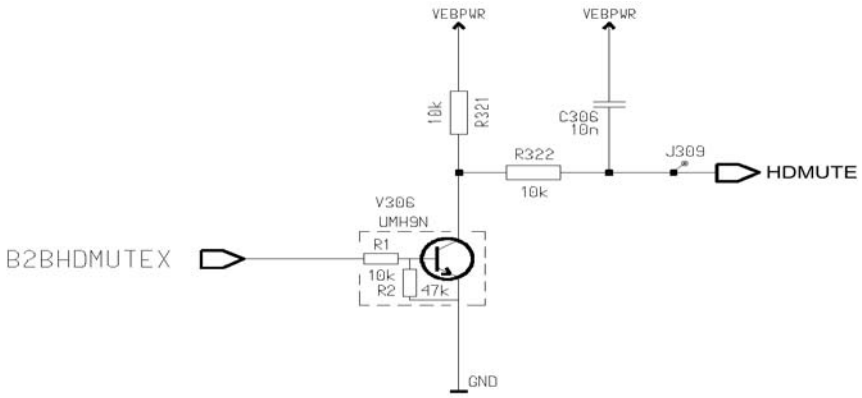


Figure 25: HDMute Level shifter Realization

The B2BHDMUTEX signal, that is used by the phone engine to activate or deactivate the HD-Power amplifier is converted here from 1.8V logic level of the engine to 4.2V level used by the power amplifier. This logic inverts the signal of the control output.

Filter

This part filters the audio signals from EB and mainly cares to close up the symmetric B2BXEAR lines when JB is standalone without phone engine.

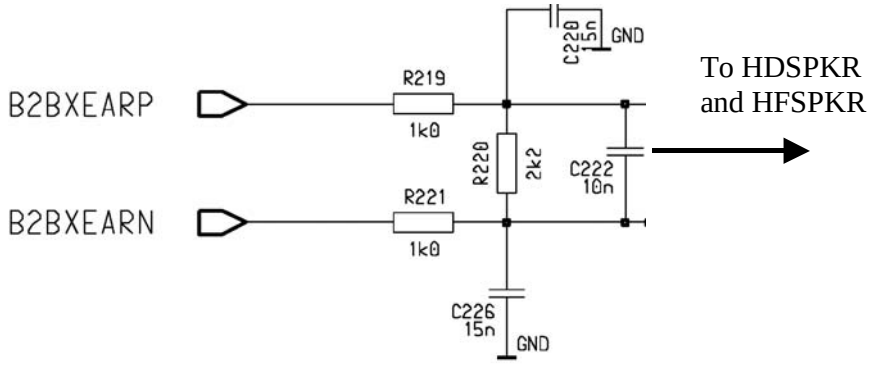


Figure 26: B2BXEAR Filter

Level shifter Description

Block Diagram of Levelshifter Part

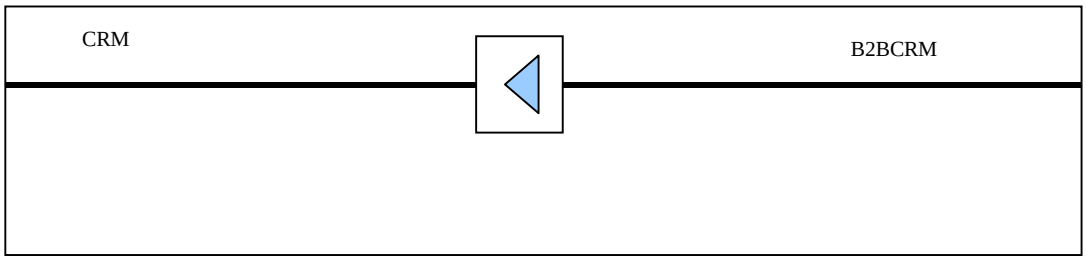


Figure 27: Block-Diagram of Level shifter Block

CRM Levelshifter

This level shifter shall transform the 1.8V signal coming from the phone engine to 13V Vcar level. The CRMX output is drawn within car environment to VCAR by an external resistor of about 200R. This circuit provides overload protection for the case that this resistor value is too low.

Functional Description:

B2BCRM = low

When B2BCRM signal is low, V102, Pin 5 is low. Now VEBPWR reaches over R116 to V123, pin 1 and V123 will be open. That means that CRMx will be held to Vcar high by the external resistor.

B2BCRM = high

When B2BCRM signal is high (1.8V), V102, pin 6 will be drawn by R116 to VEBPWR, because pin 2 is set to ground. Now Base of V123 is connected to VEBPWR via R116, so it will be conducting. CRMX will be drawn to ground.

Short circuit protection:

V123 includes self-protection, which will activate at about 1.2A. The transistor switches off when over current exists. Depending on type of transistor, transistor will activate after some time again, but current will be limited to value of below 1.5A.

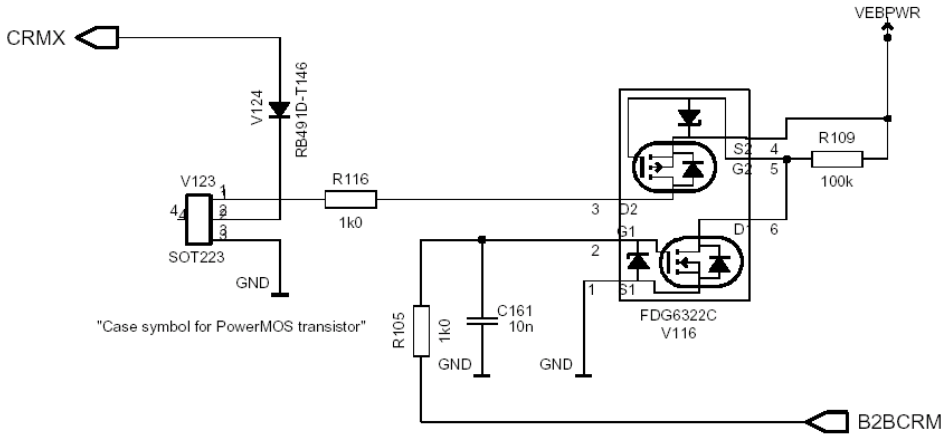


Figure 28: CRM Realization

Antenna Line

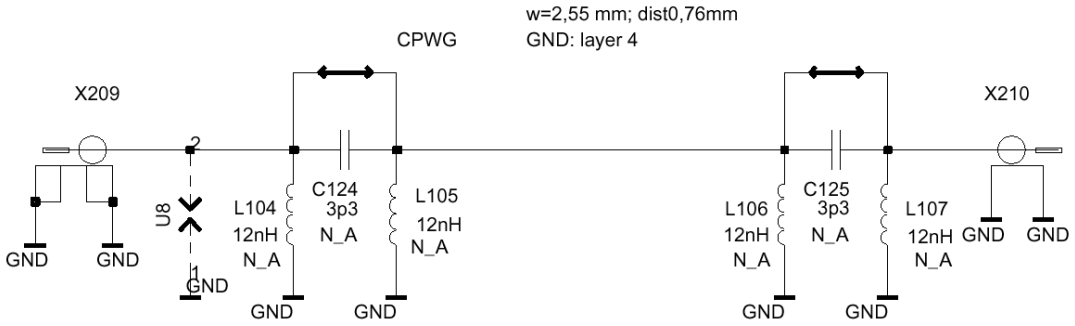


Figure 29: Realization of the Antenna line

Connectors

B2B connectors

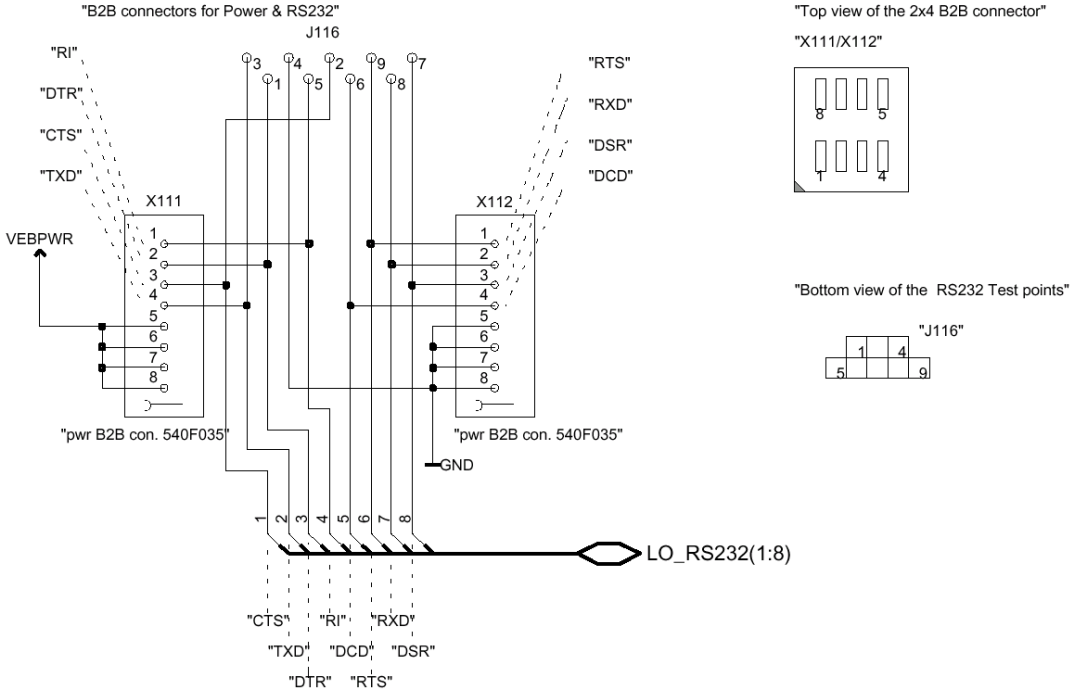


Figure 30: B2B Power Connectors

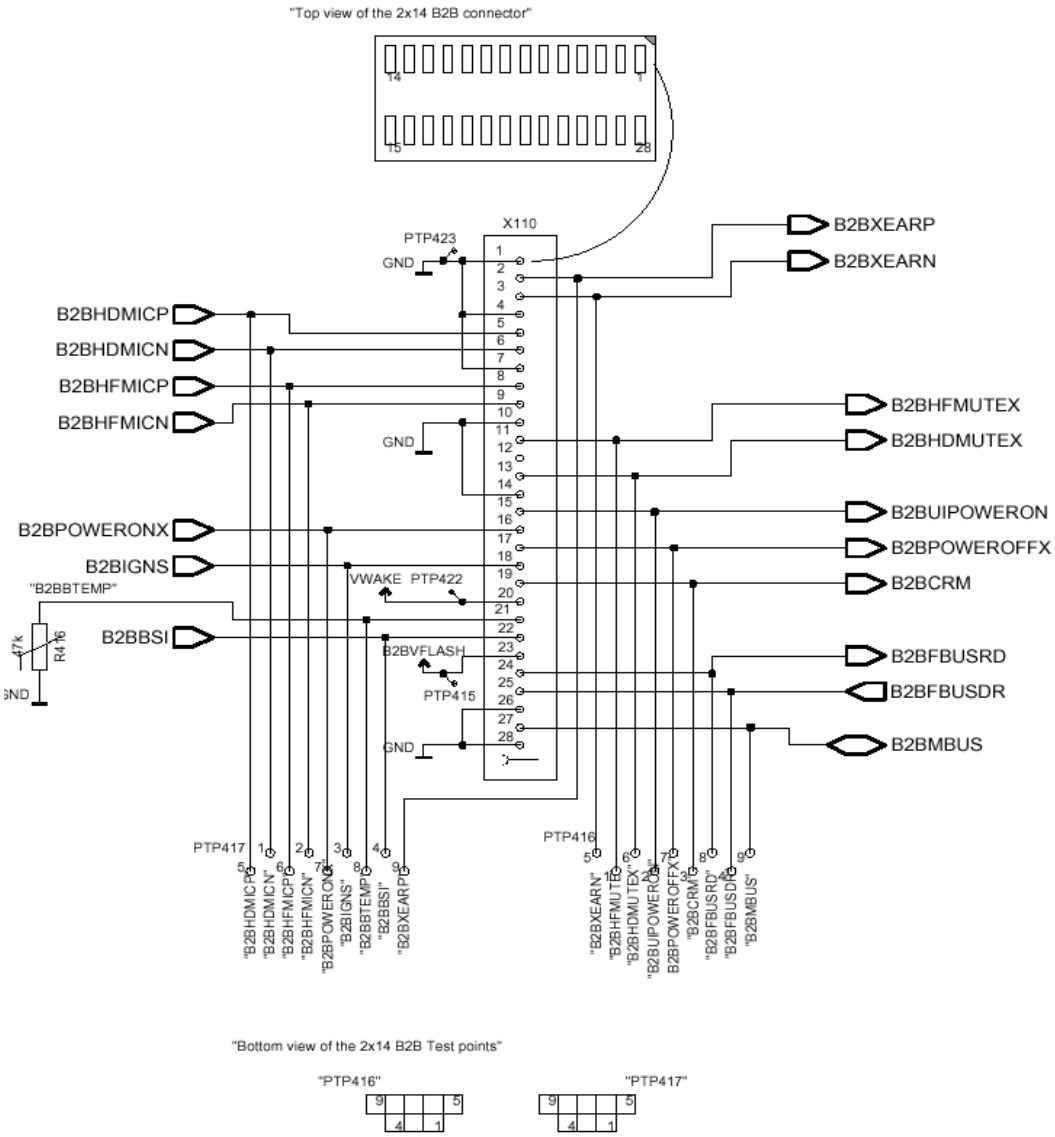


Figure 31: B2B System-Connector

External Connectors

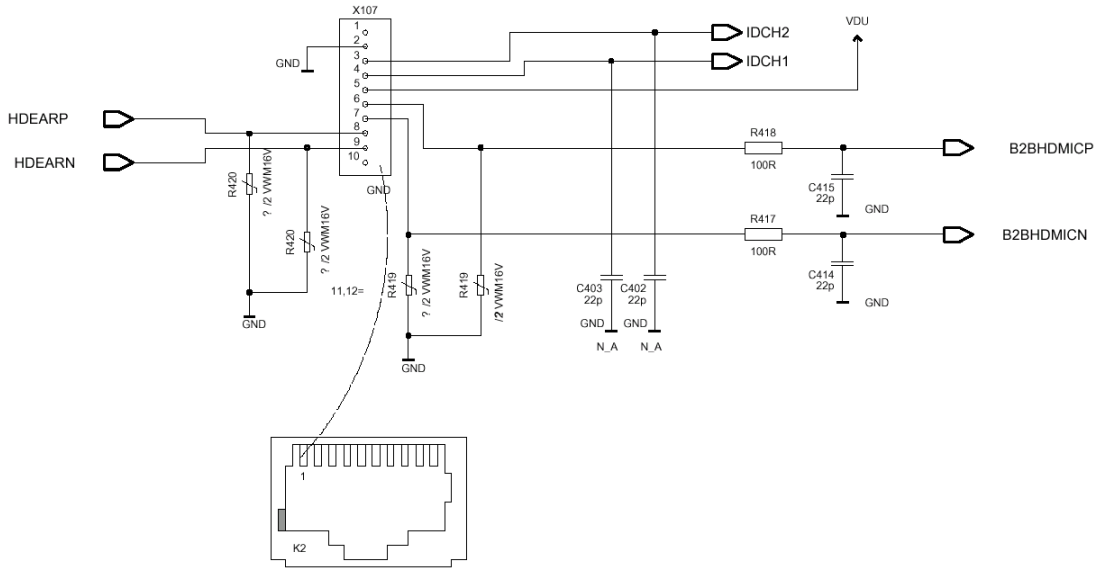


Figure 32: Input Device (ID) connector

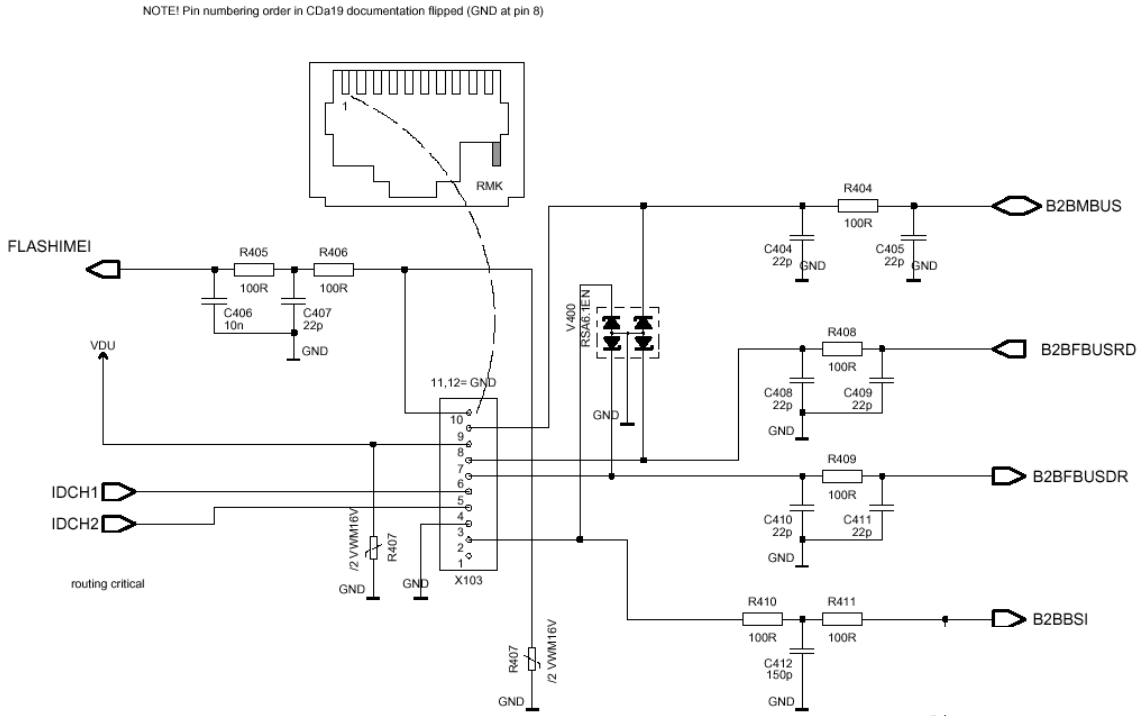


Figure 33: Display-Unit connector

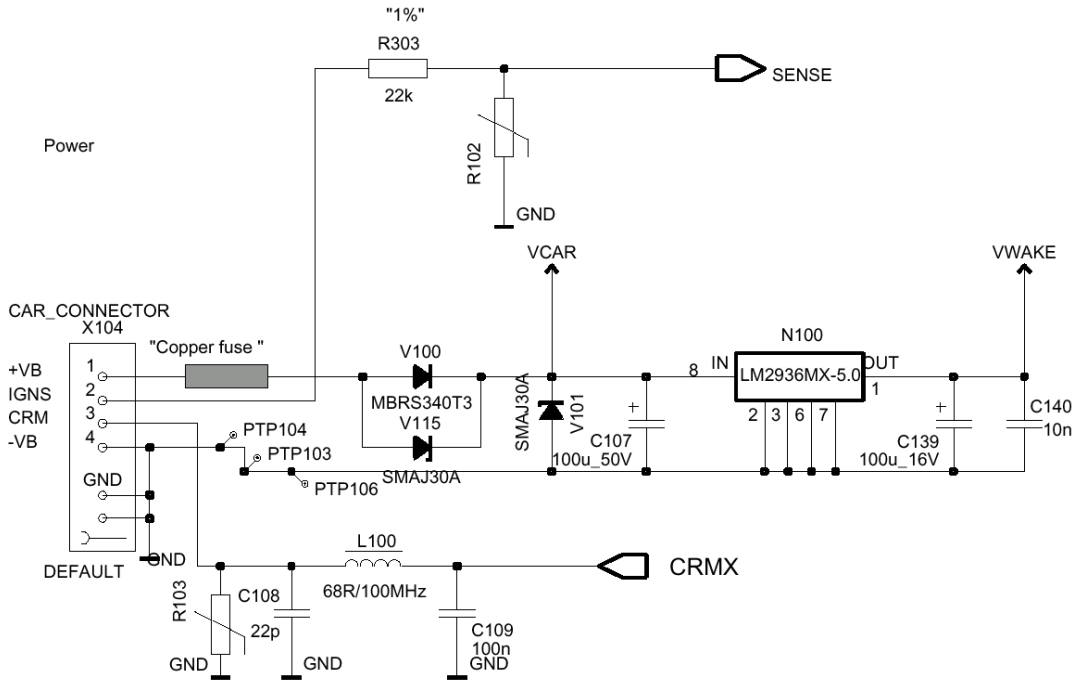


Figure 34: Vcar Connector

8a - TF5 Technical Information Junction Board

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Technical Information

TFE-4/RV-1, Nokia 610/616 are in-car GSM telephones which are permanently mounted in the vehicle and can be used to make and receive calls like any conventional hand-held GSM phone. The Radio Unit (RU) is powered by the car battery and some parts of the electronics are permanently powered for wakeup functionality. The GSM part of the phone is based around a modified NPL-1 (6310i) phone unit and has a 2W RF transmitter.

The user interface consists of an input device, designated CUW-3, and display unit, designated SU-11 (N610) or SU21 (N616), which are connected to the RU by cable. Audio interface can be via standard Nokia accessories, such as handsfree microphone and speaker units, designated HFM-8 and SP-2, which are connected to the RU by cable.

The power connector is a four-pin connector, which is the entry point for unit power and ground return. It also has a pin for connection to the ignition sense (IGNS) wire in the car loom for detection of wake up functionality. The last pin is for connection to the car radio mute (CRM) wire of the vehicle radio to mute the car radio when a call is incoming or outgoing.

The hands free (HF) microphone connector is an audio jack for connection for the HFM-8 microphone. This hands free microphone allows audio hands-free use of the unit. The hands free speaker connector is complementary to the HF microphone and connects to the SP-2 hands free speaker.

The display units (SU-11/21) are externally designed and manufactured parts, which contain the screen showing the user the current status of the phone unit and allowing setup information to be viewed. The communication between the DU and the RU is done via the FBUS. Power for the display unit is from the same source as that for the input device. The display unit controls the input device via two signal lines, which are looped through the Junction Board (JB). Additional pins of this connector are used for flashing and other production purposes.

The input device (CUW-3) is an externally designed and manufactured part, which allows the user to navigate through the menus shown on the display unit screen. The JB supplies power to the input device though all control of the input device is done by the display unit.

Internal Signals and Connections

Interfacing between the JB and the EB requires level shifting of incoming and outgoing signals to the correct voltage level depending on the destination. The JB devices are based on 5V logic while the EB has both 1.8V and 2.8V devices. Some of the signals used for production testing are already at the correct level and do not need further processing by the JB except for ESD-EMC protection.

User Interface

Display units SU-11/21 provide an 84 x 24 pixel monochrome display with a row of fixed icons on the top and a fixed icon signal bar on the left. The display is connected via external FBus connector to the RU TFE-4/RV-1. For user data input the input device

CUW-3 is connected to the RU.

The UI style is basically a reduced Jack3 style adapted for in-car usage.

Table 1: LCD Characteristics

Technology	CSTN
Display format	84 columns x 24 rows fixed icons on the left for signal strength fixed icons for various functions on top of pixeled area
Illumination Mode	White LED backlight
Numbers of colours	monochrome
Pixel height to width ratio	1:1
Main viewing direction	12 o'clock

Modes of Operation

The system has four different power modes:

- NO_SUPPLY mode
- BACK_UP mode
- POWER_ON mode
- POWER_ON_PDT mode

In addition, there are modes:

- GSM engine off mode
- Local / Test mode

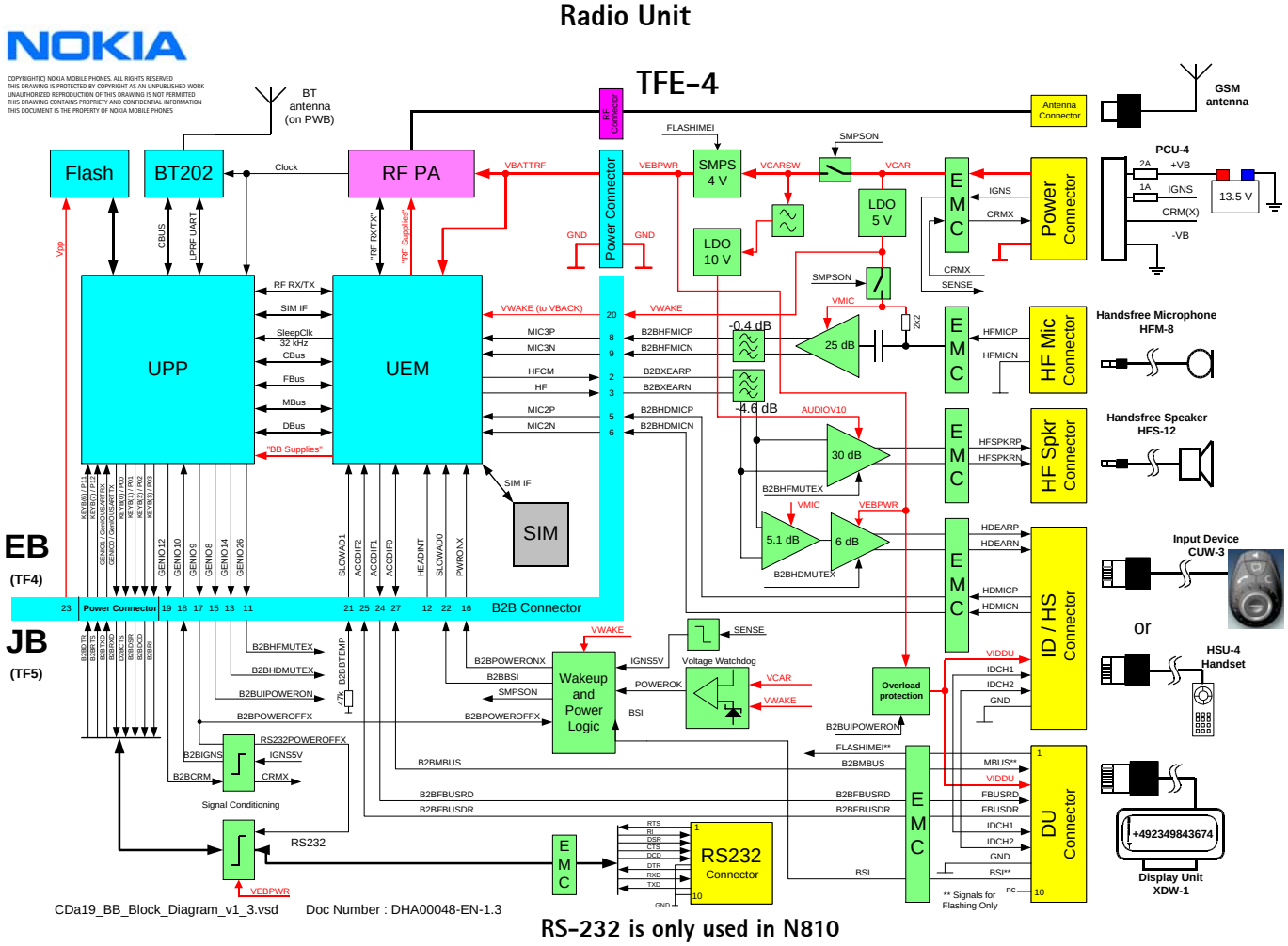
In GSM engine off mode, the GSM engine is switched off but the system remains powered to keep an existing BT connection.

The Local/Test mode is used for alignment and testing.

Functional Description

Block Diagram

Radio Unit



RS-232 is only used in N810

Electrical Module Description

The Nokia 610/616 RU consist of two PWBs, one large board, designated TF5 and known as the JB, carries on it all the cable connector sockets and baseband electronics. It has six external cable connectors for connection of RF antenna, power, audio (2x) and user interface (2x). It also has several electrical connections to the GSM module (mentioned below).

Mounted on top, and connected to the JB, is the smaller GSM PWB which is a modified NPL-1 (6310i) GSM phone module. The GSM PWB is designated TF4 and is known as the Engine Board (EB). The EB has connections to the JB for control, power, ground and RF antenna and one connection to the real world for the SIM card interface.

Power supply to the RU is directly from the car battery via an external fuse. There is also a requirement to monitor the ignition sense (IGNS) signal in the car loom and to have the ability to mute the car radio.

PWBs

TF4 EB module is implemented in an eight layer PWB with low-CTE core and the nominal thickness is 1.0 mm. FR4 build-up layers, micro vias, buried vias and selective OSP coating are utilized.

TF5 JB has 4 layers with standard FR4 technology.

Functional Description of Software

SW Features

TFE-4/RV-1 will implement the following main features:

- Drive-time optimized Car UI based on Jack3 monochrome
- Optimized input device including wheel allowing blind usage during drive time
- GPRS (General Packet Radio Service)
- Bluetooth remote SIM access support for zero hassle usage (Nokia 610/616 only)
- Support of BT headset
- Handsfree capabilities
- Voice commands and voice name tags over handsfree

Introduction

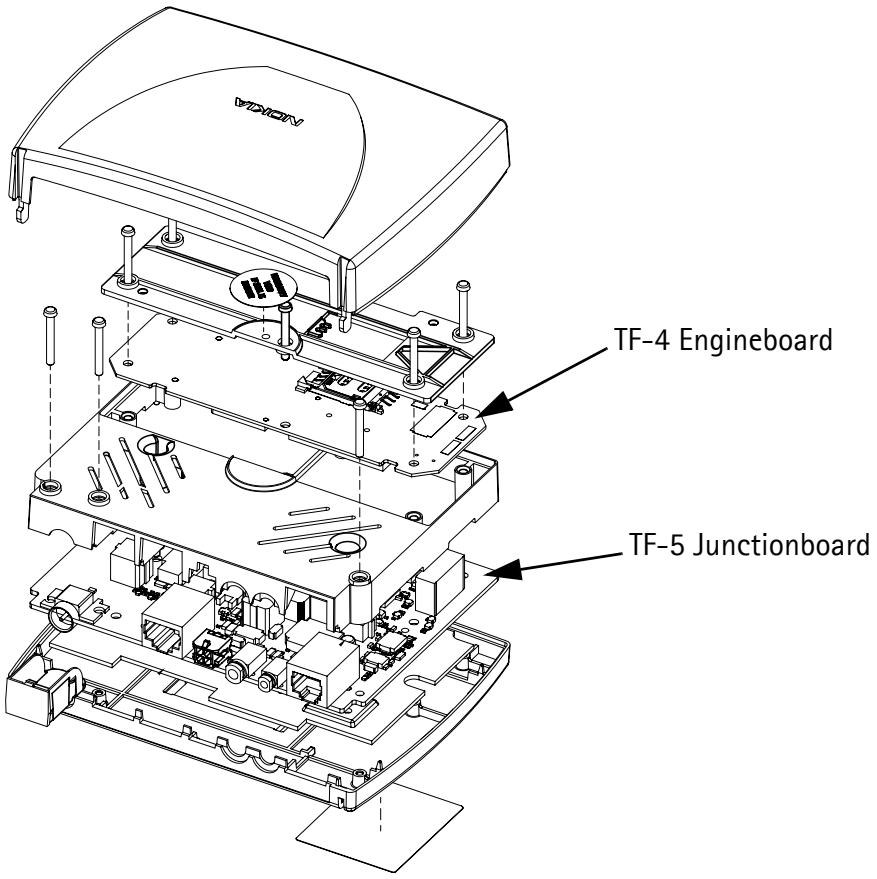


Figure 1: View of TFE-4/RV-1 Radio-Unit

The TF-5 PWB, is called the "Junctionboard" (JB) and the TF-4 PWB, is called the "Engine-board" (EB). The TF4 PWB is very similar to the NPL-1 (6310i) phone PWB and contains the phone itself. The TF5 PWB is responsible for interfacing to the Display-Unit, the Input device as well as to the car environment and the accessories. For this purpose there are Through-Hole Connectors mounted on the TF5 PWB. Both PWBs are only single sided populated. The exploded view of mechanical construction can be seen in Figure 1: View of TFE-4/RV-1 RU.

The PWBs are contacted with three Board-to-Board connectors, two 8-pole connectors and one 28-pole. Those connectors are soldered on the JB with spring connection to the unpopulated side of the TF4 PWB. Additionally an RF-connector is transferring the RF signal between TF-4 Engineboard and external Connector on Junctionboard.

Blockdiagram of Junctionboard

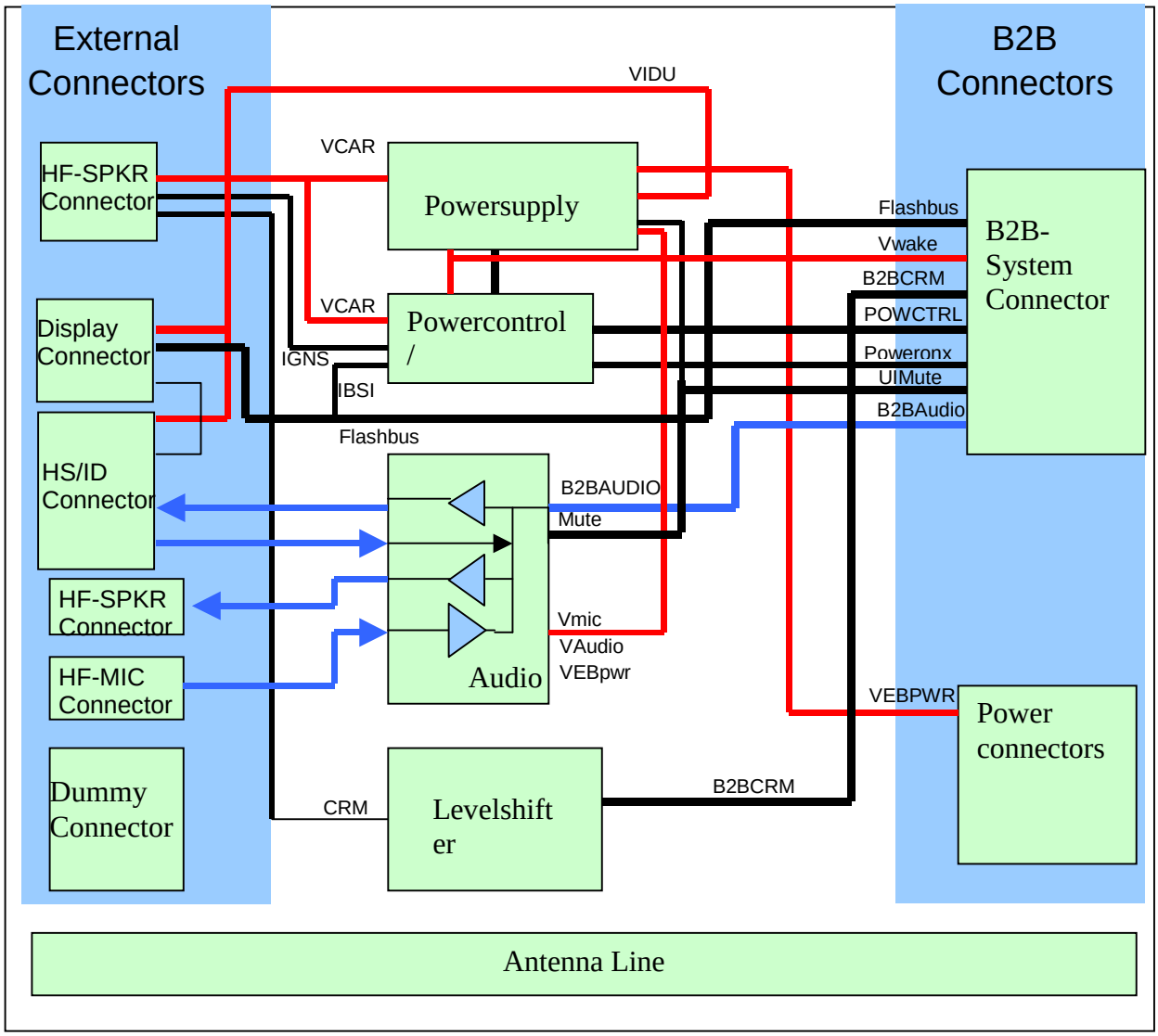


Figure 2: Block Diagram of the Junctionboard

Description of the Powerstates

The Powerup/Powerdown-Behaviour for Nokia 610/616 is done as follows:

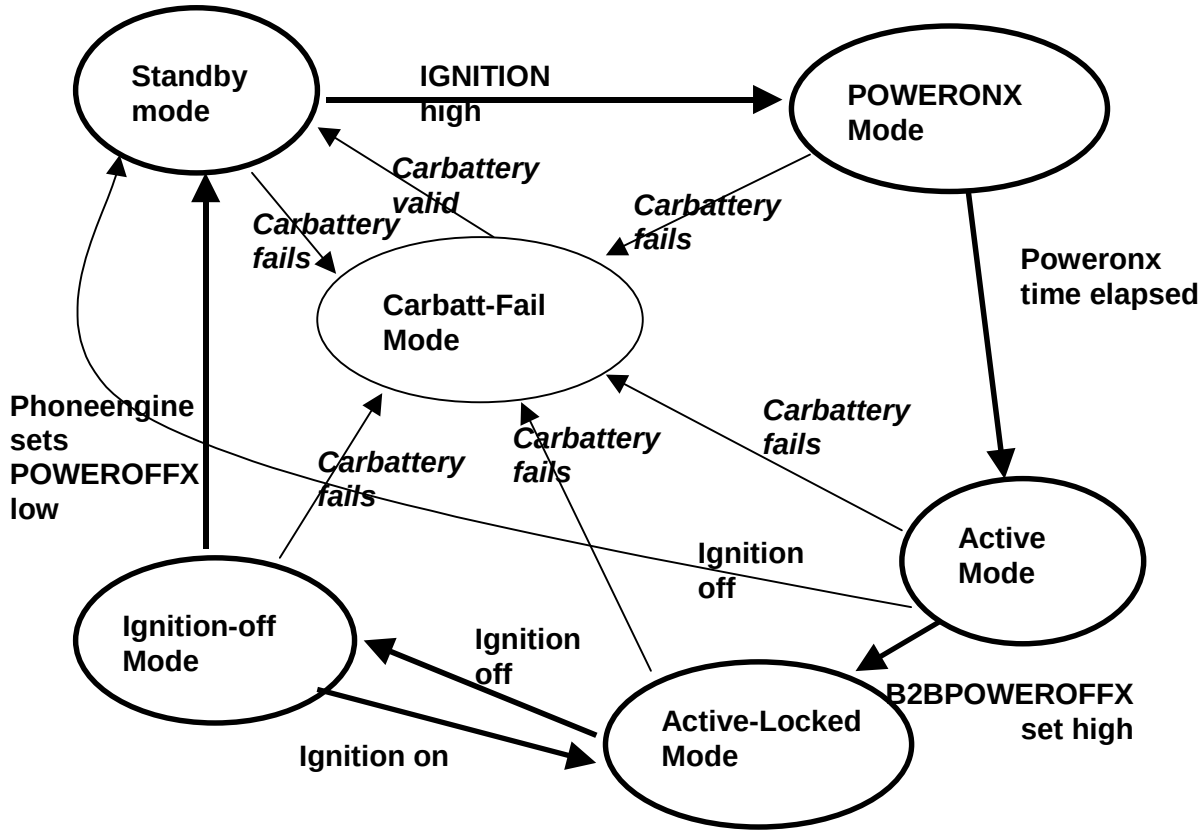


Figure 3: Powerstates of the TFE-4/RV-1 RU

Standby Mode

When the car is standing inactive (ignition is switched off), TFE-4/RV-1 shall be in Standby mode. In this mode TFE-4/RV-1 is not operating. This mode is characterized by very low power consumption (less than 1mA). This state will be reached when TFE-4/RV-1 is connected to Carbattery first time

Active Mode

In active mode the engine-power supply is on and poweronx line is toggled by the poweronx generator. Here the phone is generally full active from Power supply point-of-view. After a short time (determined by Software) the UPP sets the B2BPOWEROFFX line high and this initiates the transition to Active-Locked Mode. In case that Ignition signal is going to low before that, direct transition to sleep mode will happen and the phone engine will be powered off immediately.

Active Locked Mode

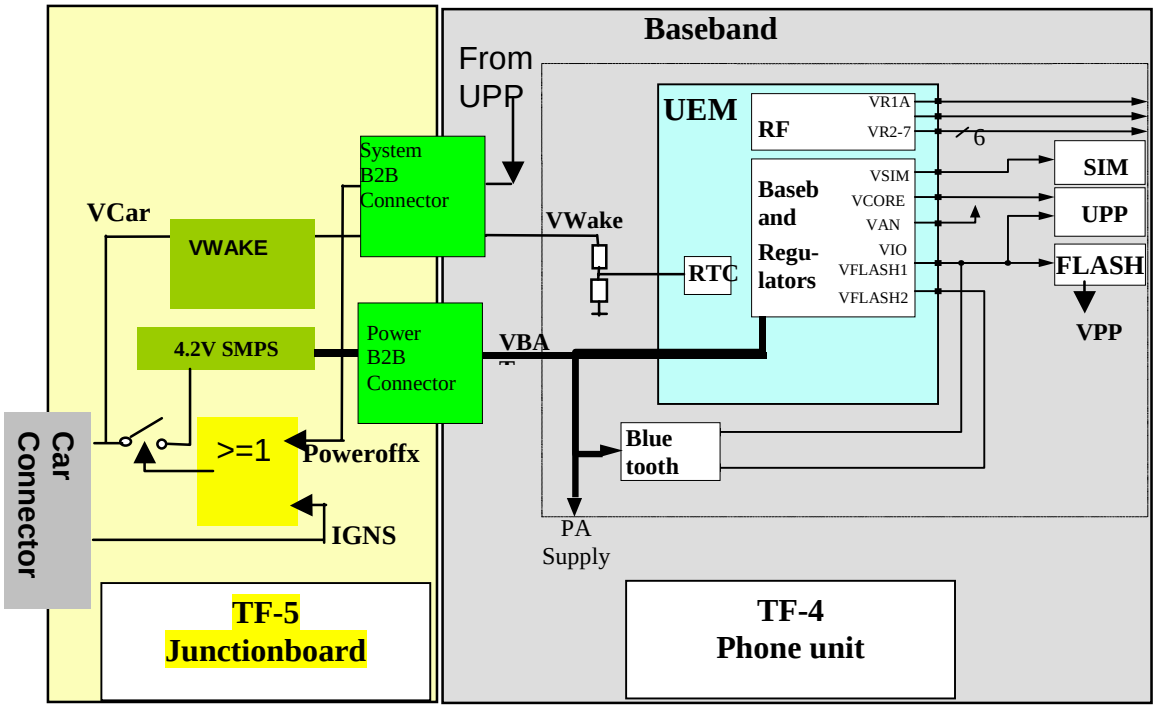
The active locked power mode is same as the active mode but UPP holds B2BPOWEROFFX line high. If the the Ignition signal is going from high to low now, the TFE-4/RV-1 will remain active but a transfer to the ignition-off mode will take place.

Ignition-Off Mode

The ignition-off power mode is same as active mode and active locked power mode, but the power supplies are kept alive because the PowerOffx line is held high by the UPP. This is to enable log-off from GSM network and to enable to continue active phone call when car is switched off. When those tasks are finished, UPP will set Poweroffx line low and the RU will switch to standby mode.

Carbatt-Fail Mode

This mode is reached, when the Carbattery is out of the 'normal' operating range. Like in standby mode all main power supplies are switched off, only power supply for wakeup logic is active.



Description of the Blocks

Power supply

Blockdiagram of Power supply

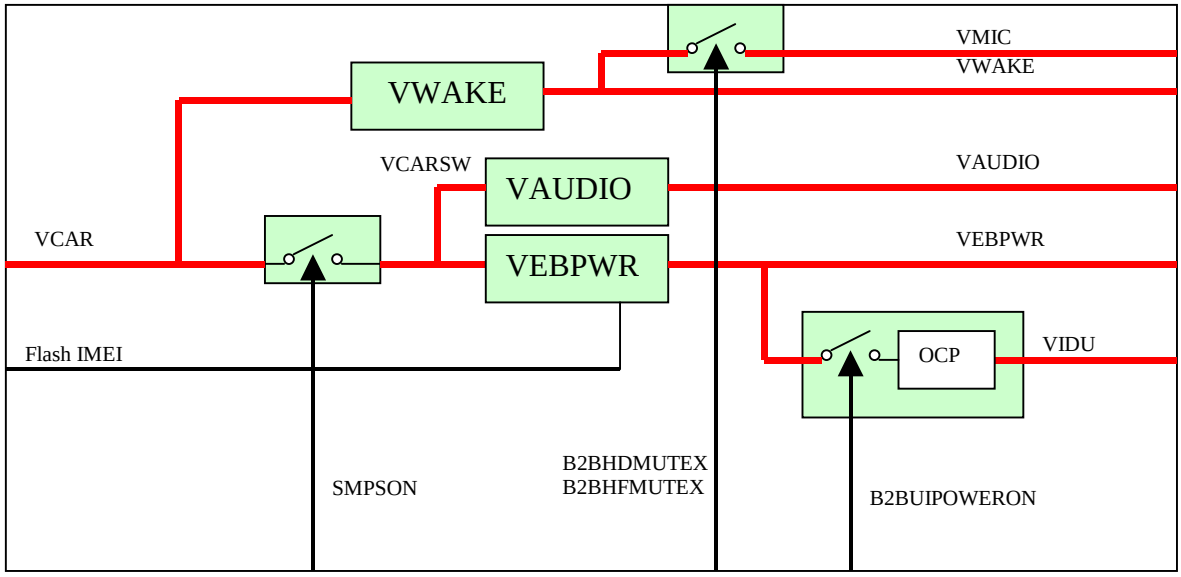


Figure 4: Block diagram of Power Supply-Block

Description of Inputs, Outputs and Block-Internal Lines

Signalname	Description	Range	When Error then .....
Inputs			
VCAR	Protected Carbattery Voltage coming from Car-connector	Defined: 5V..20V Operating: 9..15V	Whole unit will not work
FlashIMEI	Signal for Production Test to increase Engine Power for IMEI flashing	0..1V low 10..14V high	IMEI Flashing will fail on Final-Test (when always low) Or VEBPWR will be too high (when always high)
SMPSON	Signal from Powercontrol block that switches the Powersupplies for active Powermode	Low: (Sleep-mode) 0..1V high (active mode): 4..5V	Unit will not wakeup (when always low) Or Sleepmode current will be too high (when always high)
B2BHDMUTE	HD-Mode control signal	High: 1.6..18V Low: 0..0.5V	Here: VMIC will always be switched on (Sleepmode current too high) (when always high) Or always off (when always low)
B2BHFMUTE	HF-Mode control signal	High: 1.6..18V Low: 0..0.5V	Here: VMIC will always be switched on (Sleepmode current too high) (when always high) Or always off (when always low)

Signalname	Description	Range	When Error then .....
Inputs			
B2BUIPOWERON	UI-Power control signal	High: 1.6..18V Low: 0..0.5V	Here: UIPOWER will always be switched on with VEBPOWER (when always high) Or always off (when always low)
Outputs			
VWAKE	Powersupply for VMIC, Powerup control and Engine-RTC	5V 5%	Unit will not wakeup
VEBPWR	Powersupply for Engine and Headset Poweramplifier	Sleepmode: 0V active: 4.2V 5%	Unit will not wakeup (when always low) Or Sleepmode current will be too high (when always high)
VAudio	Powersupply for Hands-free Poweramplifier		HF Poweramplifier will not work
VMIC	Phantom-Power for HF-Microphone	0V when switched off, else 5V 5%	VMIC invisible on HFMIC connector
VIDDU	Protected Power for Input Device and Display Unit	0V when switched off, else 4V	UIPower or s.c. Protection will not work

Description of the Hardware Realization

The power supply block consists of three power regulators and three power switches.

Vwake/Vmic

Vwake is the power, which supplies all circuitsthat have to be active when car battery is applied. This power path has to be optimized for low leakage current to guarantee the 1mA standby demand. The Voltage VWAKE is used in the Power control block and as Backup-Battery replacement for the EB. When HF-Audiopath is activated, (B2BHFMute is high) the VWAKE power is directed to VMIC

The VWAKE Power supply is realized by a 5V-fixed linear regulator.

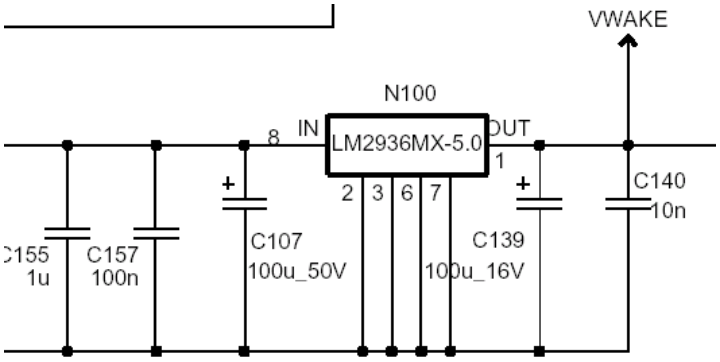


Figure 5: Vwake Power supply

The realization of the VMIC switch is shown in Figure 6 and 7. It is realized by using a double FET and in addition a part of double transistor V306. VMIC is activated when VMICONX is driven to Ground by either B2BHFMutex or B2BHDMutex signal. Those are in active at about 1.8V level and inactive 0V. VMIC can be proved on Test point J115,

B2BHFMutex and B2BHDMuteX can be activated by Test pattern TP416, #1 and #6. VMIC is high, when one of both signals is high (OR logic).

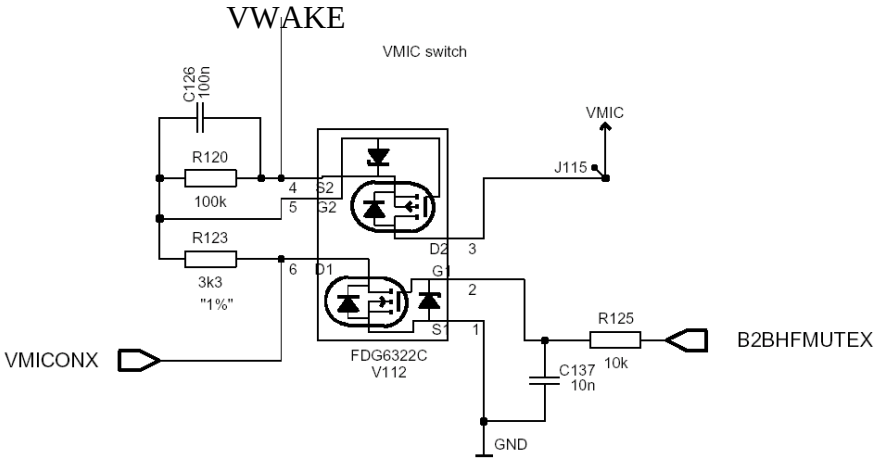


Figure 6: VMIC switch (a) VMICONX driven low by B2BHFMUTEX

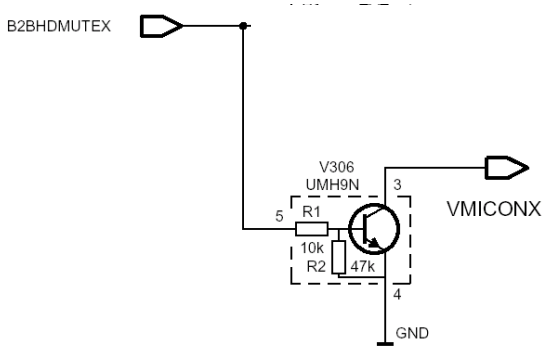


Figure 7: VMIC switch (b) VMICONX driven low by B2BHDMUTEX

Vcar Switch

The Vcar Switch is a power switch that can switch off the car battery voltage (Vcar) in the front Vaudio- and the VEBpwr-regulators. It is used when RU is in standby mode. By using this switch the leakage currents of those voltage regulators are less sensitive for reaching the 1mA standby criteria. Now only this switch is leakage sensitive. The switch is controlled by the SMPSON control line of the Power control/Reset Block. The leakage can be verified by measurement of the Vcarsw voltage when the device is in standby (SMPSON = off). Now the Vcarsw level has to be low (about 0V). This can be verified at test point J113.

The SMPSon signal has values of about 0V during standby and 4V to 5V when powered up. In this case, Vcarswitch has to guarantee low serial resistance to minimize the heat dissipation within V104. This can be verified by applying 3A load at VEBPWR and measuring Vcarsw in this case.

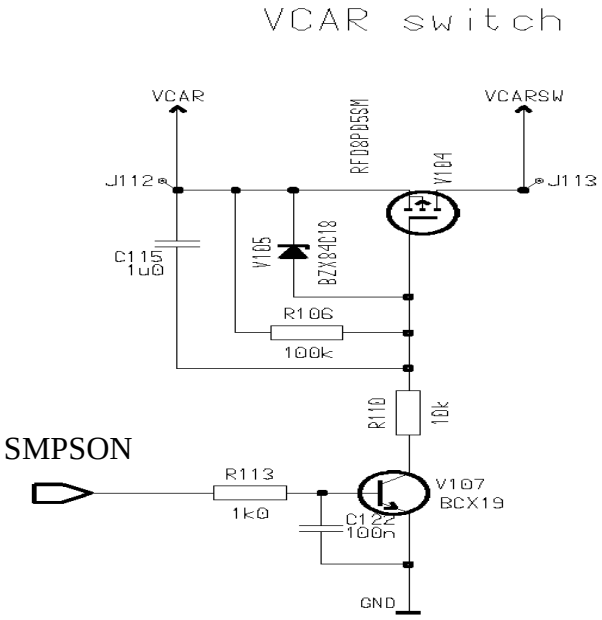


Figure 8: HW-Realization of Vcar Switch

VAudio

The power supply VAudio is used to supply the power amplifier for the HF speaker. It is designed by using low drop-regulator. Even when car voltage falls below 10V, it shall provide a slidely reduced Voltage level against Vcar on VAudio power line.

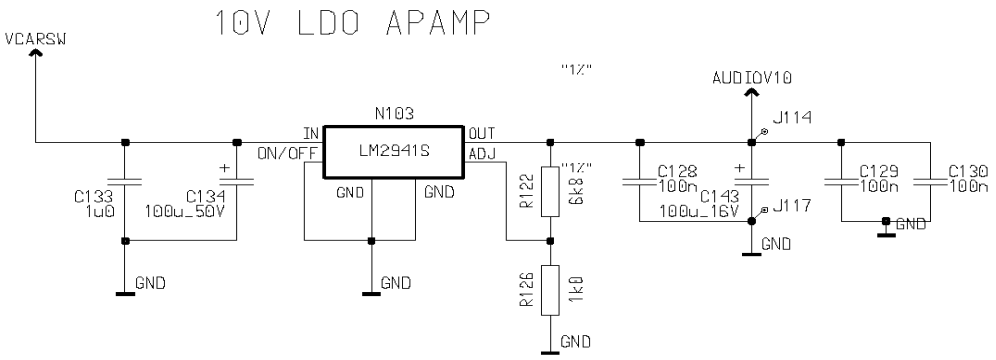


Figure 9: VAudio HW-Realization

To enable this a LDO regulator is used to provide optimized headroom to Vcar. Because the Audio-Amplifier is sensitive regarding power supply-noise, this regulator has to fulfill this demand to enable noise free audio output on HF path. The output voltage is determined by the Resistor net R122 and R126 at 10V 5% accuracy.

VEBpwr

This is used to supply the EB (via the VIDU-switch), the display unit and the input device with power. VEBpwr power supply is able to provide 3A maximum current at 4.2V 5%. The maximum allowed ripple is 50mV because of the Bluetooth ripple-demand. When this demand is not fulfilled the Bit-error rate of the Bluetooth module will increase. This voltage regulator shall not provide exceptional heat dissipation, this is guaranteed by using a switch-mode regulator that is used with internal Switch.

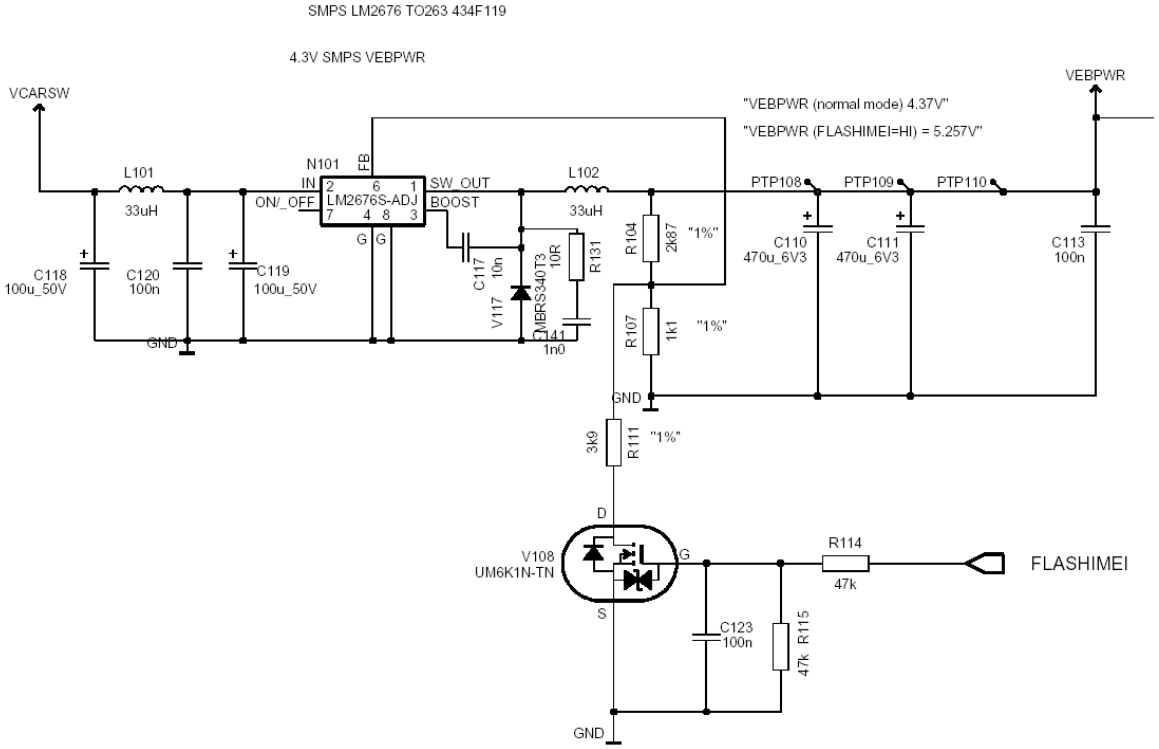


Figure 10: VEBpwr regulator HW realization

Optional the VEBpwr can be shifted to 5.2V by applying 12V(=Vcar) on the Flash-IMEI input. This is enabled by changing the resistor net R104/R107 with additional R111 to Ground. By this the feedback path is changed and the voltage is increased to 5.2V. This higher Voltage is necessary to Flash the IMEI Number into the UEM of the EB.

VIDDU Switch

The VIDDU switch enables the Supply Voltage of the input device and the display unit. This switch is controlled by the B2BUIpoweron line of the EB. This line has 1.8V level in active and 0V in inactive state. Additionally this block shall fulfill backwards protection against Vcarbat and Short-circuit protection against Ground.

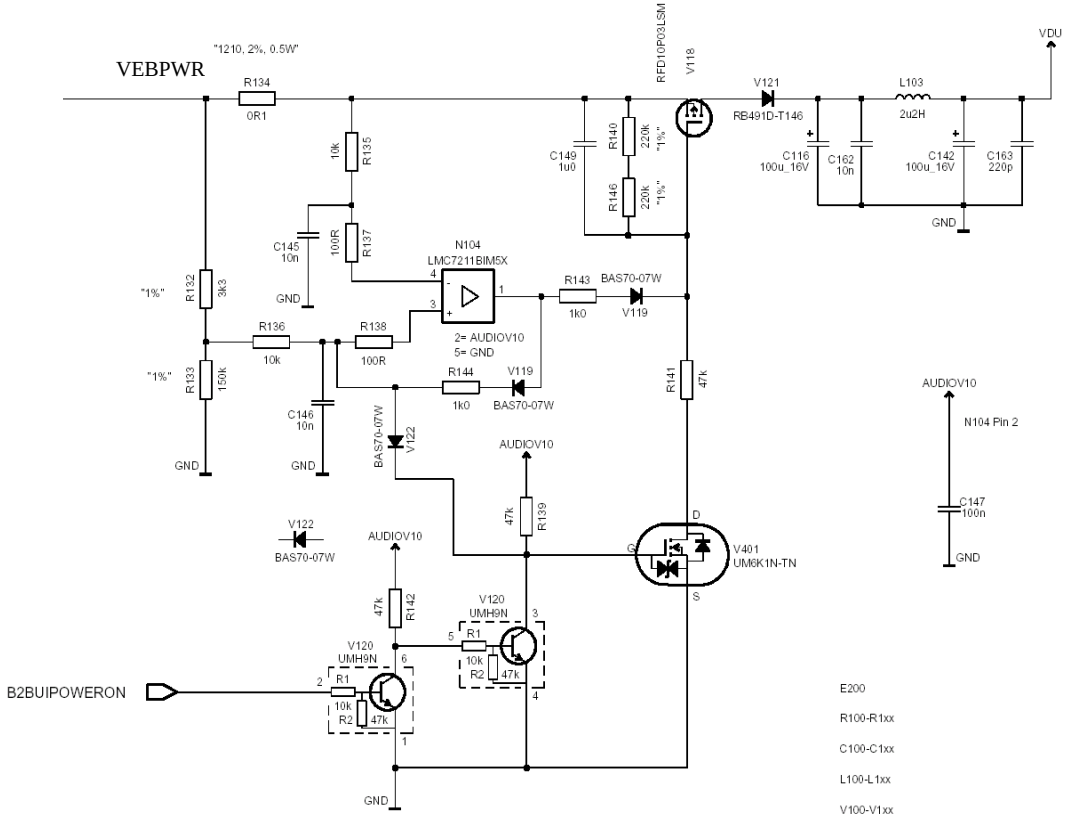


Figure 11: VIDDU switch HW-Realization

V119 is responsible for the backwards protection and R134 is responsible for the overcurrent protection. The voltage difference is sensed by N104 and V129 will switch off V118 when current is too high.

Power control/Reset Block

This block shall provide the right state of the power supplies depending of the status of the Vcar, ignition-sense and the power control line B2BPoweroffx, provided by the EB. Further, it generates the Start-Up pulse on B2BPoweronx line to enable proper starting of the phone engine.

Power control/Reset Blockdiagram

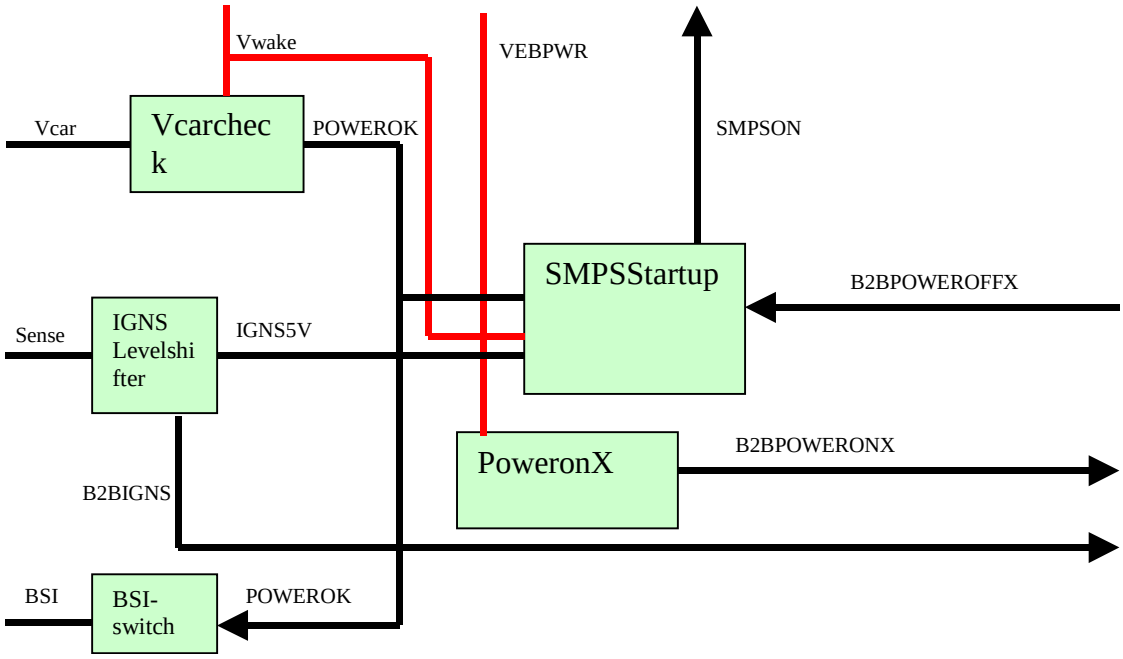


Figure 12: Block diagram of Power control/Reset Block

The Vcar-Check Block is responsible to monitor if the Vcar is within operating range. When the voltage range of the car battery is too high or to low Powerok line will be low and the board will not start up anymore. By holding B2BPOWEROFF high, the Phone-Engine can force the Power supply to switch off when ignition sense input is low. The Poweronx block generates pulses of 0.5Hz, when Vebpwr is active.

Description of Inputs, Outputs and Block-Internal Lines

Signalname	Description	Range	When Error then .....
Inputs			
VCAR	Protected Carbattery Voltage	Defined: 5V..20V Operating: 9..15V	Whole unit will not work
SENSE	Ignition Sense signal from Carconnector	Low: 0..8V high (active mode): 8..28V	Unit will not wakeup (when always low) or sleepmode current will be too high (when always high)
VWAKE	Powersupply for VMIC, Powerup control and Engine-RTC	5V 5%	Unit will not wakeup
B2BPOWEROFFX	Control signal from Engine-board to switch off SMPSon after Ignition is switched off	High: 1.6..18V Low: 0..0.5V	SMPSon will always keep active (when always low) or goes immediately low when ignition is switched off (when always high)

Signalname	Description	Range	When Error then .....
Outputs			
SMPSon	Signal from Powercontrol block that switches the Powersupplies for active Powermode	Low: (sleepmode) 0..1V high (active mode): 4..5V	Unit will not wakeup (when always low) or Sleepmode current will be too high (when always high)
B2BPOWERONX	Reset signal that is toggled by the POWEROX block during startup	Opendrain output (with external pull-up to 2.7V): Active : 0V inactive: 2.7V	Phone-Engine will not wakeup (when always low or always high)
POWEROK	Output signal of the VCAR-Check Block	4..5V if VCAR is within operating range (9..15V), 0..1V when VCAR is out of range	Unit will not wakeup (when always low) or SMPSon will not be deactivated if VCAR is out of range (when always high)
IGNS5V	To 5V Logic level translated Ignition Signal	0V when Sense = off, else 5V 5%	Unit will not wakeup (when always low) or SMPSon will not be deactivated (when always high)
B2BIGNS	To 1.8V Logic level translated Ignition Signal	0V when Sense = off, else 1.6..1.8V	Phoneunit will malfunction
BSI	Opendrain Output which switches 47kR load to Ground when Powerok is active	0V when Powerok, else high impedance	Phoneunit will malfunction (SIM cannot be read), Phone always in Localmode

Description of the HW Realization

Vcar-Check

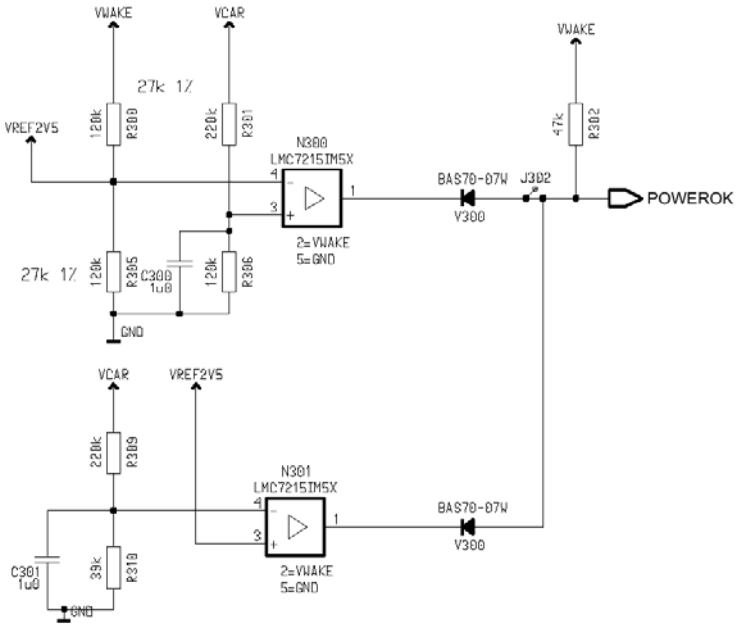


Figure 13: Vcar-Check Realization

This block consists of two comparators, N300 and N301, which checks if the VCAR voltage is in the right operating range. When VCAR is in the right range both comparators will have 5V(=Vwake) at the output. When the Vcar is over the limit of 15V N300 will switch to ground level on output and Powerok will be forced low. The limit is determined by R301/R306 and the reference level of 2.5V(=VWAKE/2) which is provided by the R305/R300 combination.

Same happens when Vcar falls below 9V, in this Case the output of N301 will be forced low and Powerok will be forced to ground. This limit is determined by the combination R309/R310 and the 2.5V reference.

SMPS startup

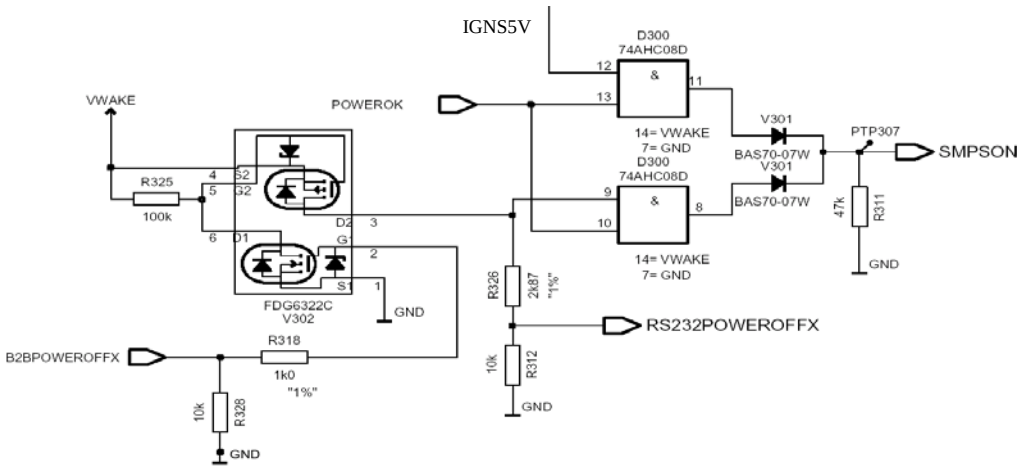


Figure 14: SMPS startup realization

The SMPSon signal is set high (>4V) under two conditions, Powerok is high and ignition sense is active or Powerok is high and B2Bpoweroffx is high. Both conditions are provided by D300 and V301. V302 is responsible for the level shifting of the 1.8V level provided by the phone engine to the 5V logic-level of D300. Further more, the level shifted here, RS232POWEROFFX, which is the 4V translation of B2BPOWEROFFX signal, is generated here

Poweronx

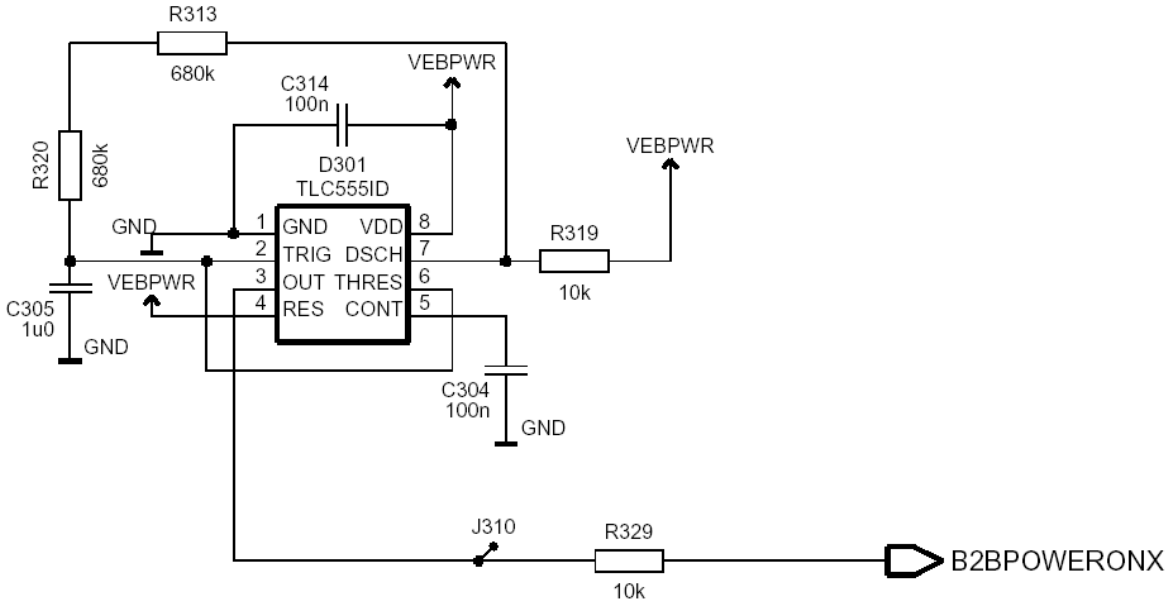


Figure 15: Poweronx realization

The Poweronx function block generates a pulses of 0.5Hz, with a length of approximately 1 second high and 1 second low, when VEBpwr is active. The output voltage is 4.2V (like VEBpwr)..

IGNS Level shifter

This block is responsible to translate the Ignition sense signal, which is 0n 12V level (connected Car battery), to the 5V logic level for the startup logic and to 1.8V level for the phone engine. The comparator N302 cares that the IGNS5V signal is only high when the Sense input is higher than 9V level. The 1.8V level shifter is realized by voltage divider R304/R307.

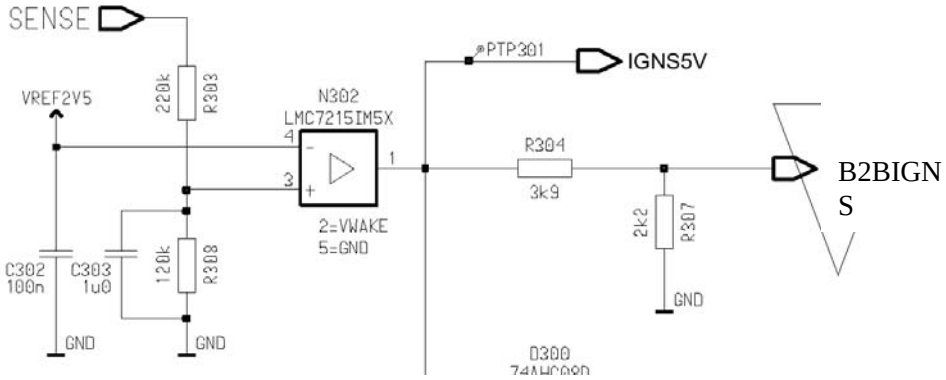


Figure 16: IGNS Levelshifter realization

BSI-Switch

The BSI-Resistor may only be connected to Ground when VCAR is in the correct range (Powerok = active). This is the task of the BSI-switch.

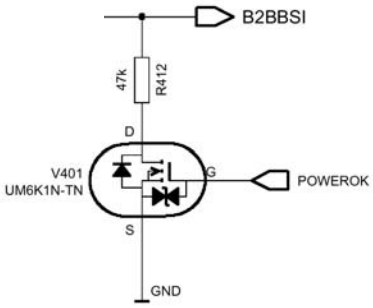


Figure 17: BSI switch

Description of the Audio Block

Block Diagram of the Audio Block

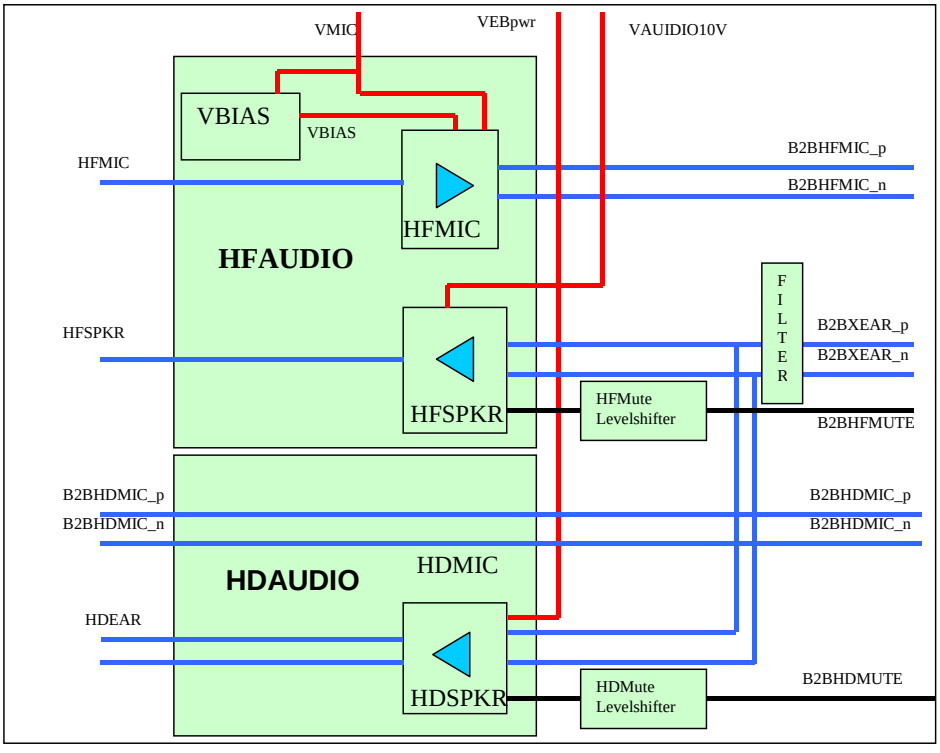


Figure 18: Block Diagram of Audio-Block

The Audio Block consists of two major parts, the HFAudio-Block, which is responsible for the handsfree audio functionality, and the HDAudio-Block, which is responsible for the Headset Audio. Additionally there is a preflight for the B2Bxear lines from the EB and level shifters for the mute lines. HFAudio interfaces single-ended to the microphone and to the speaker. The HDAudio path is implemented with symmetric speaker and microphone lines.

Description of Inputs, Outputs and Block-Internal Lines

Signalname	Description	Range	When Error then .....
Control-Inputs			
B2BHFMUTE	Control Signal to Mute the HF Amplifier and HF Microphone	Low: 0..0.5V high: 1.6..1.8V	HF-Amplifier and HF MIC will be always on (when always low) or both do not work (when always high)
B2BHDMUTE	Control Signal to Mute the HD Amplifier	Low: 0..0.5V high: 1.6..1.8V	HD-Amplifier will be always on (when always low) or does not work (when always high)
Powersupplies			
VMIC	Powersupply for HF-Microphone	5V 5%	HF-MIC Phantom Voltage will not work, VBIAS will be of
VEBPWR	Powersupply for Headset poweramplifier	Sleepmode: 0V active: 4.2V 5%	Headset poweramplifier will not work
VAudio	Powersupply for Handsfree poweramplifier		HF Poweramplifier will not work
Audio-Signals			
B2BXEAR_P B2BXEAR_N	Symmetric Audio Signal generated by phoneengine for HF- and HD-Speaker (Output selected by HDMUTE/ HFMUTE)		No Audio Signal to any Speaker
B2BHDMIC_P B2BHDMIC_N	Symmetric Audio Signal generated by Headset Microphone		No Microphone Signal from Headset
B2BHFMIC_P B2BHFMIC_N	Symmetric Audio Signal generated by Handsfree Microphone Amplifier		No Microphone Signal from Handsfree

Signalname	Description	Range	When Error then .....
HDEAR_P HDEAR_N	Symmetric Audio Signal generated by Headset Speaker Amplifier		No Audio Signal to Headset-Speaker
HFSPKR	Single-ended Audio Signal generated by handsfree Speaker Amplifier		No Audio Signal to Handsfree-Speaker
HFMIC	Single-ended Audio Signal generated by Handsfree Microphone. Gets VMIC as Phantom voltage		No Microphone Signal from Handsfree

Description of the HW Realization

Handsfree Microphone (HFMIC)

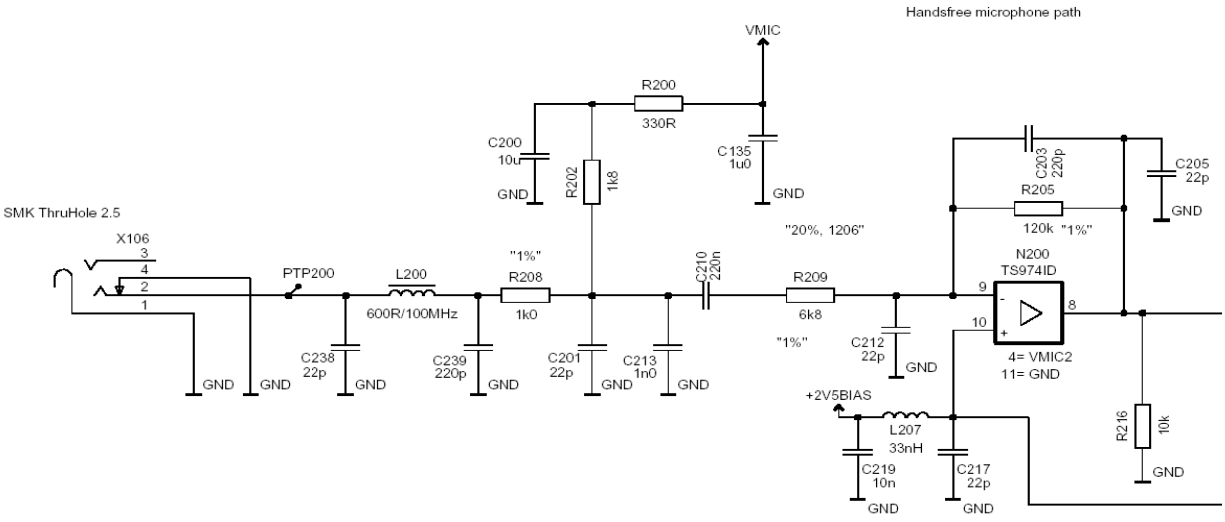


Figure 19: Realization of HFMIC (Part 1)

In Figure 19, the realization of the first part of the HFMIC Block is shown. The microphone is connected to an SMK connector. Afterwards there is some ESR filtering and a Bias voltage is applied to the microphone. In the next stage the signal is multiplied by the amplifier N200. To set Bias level at the positive input of this amplifier the voltage 2Vbias is used.

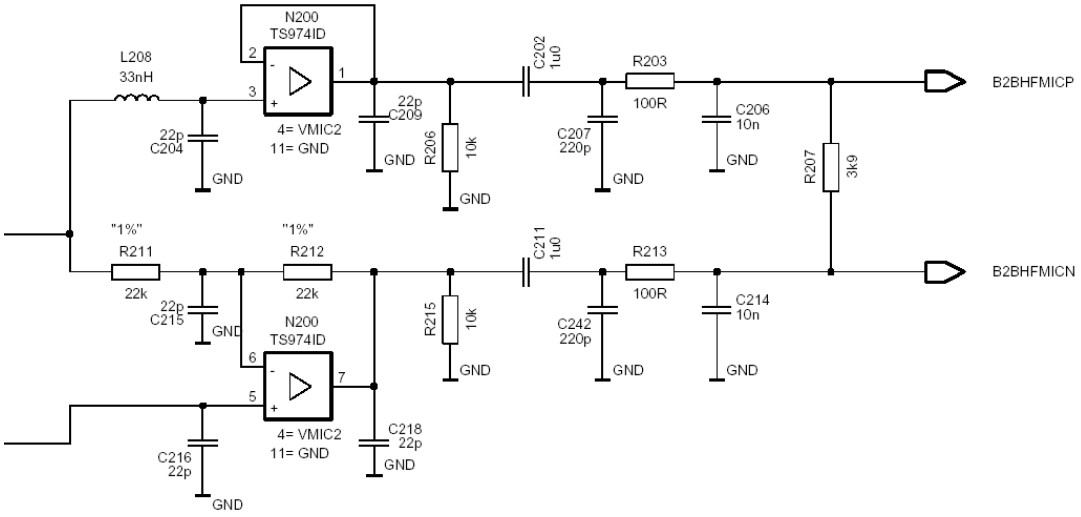


Figure 20: Realization of HFMIC (Part 2)

In the second part the single-sided signal is transferred to symmetric output, which is used by the phone engine.

Handsfree-Speaker (HFSKR)

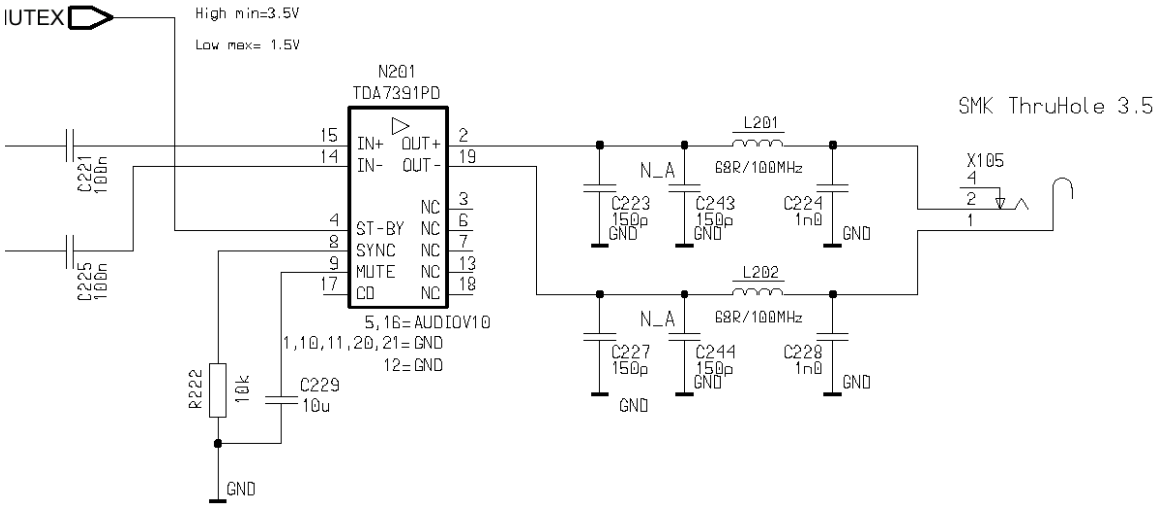


Figure 21: Handsfree Speaker Amplifier Realization

The symmetric signal comes from the prefilter and reaches the symmetric power amplifier. With the HFMute signal coming from the HF-Mute Level-Shifter, the amplifier can be switched on (HSMUTE<1.5 V) or off (HSMUTE = >3.5V).

VBIAS Regulator

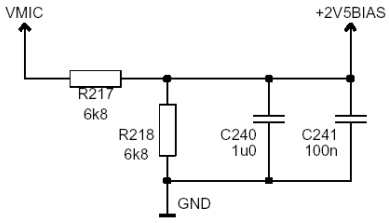


Figure 22: VBIAS Regulator

The VBIAS regulator generates a 2V.5-signal output, which is determined by the resistor net R217/R218. This voltage is used in the HFMIC amplifier.

HF-Mute Level shifter

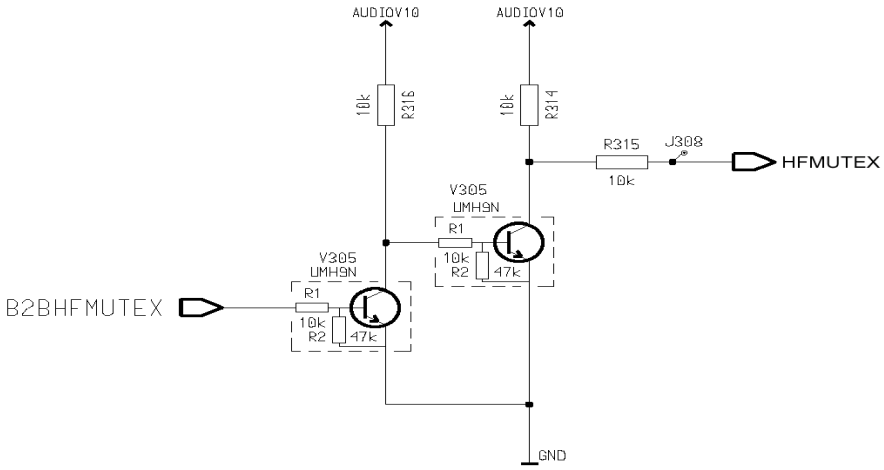


Figure 23: HF-Mute Level shifter

The HF-Mute level shifter transfers the 1.8V signal of the phone engine to the 10V level, which is used by the HF-Power amplifier HFSKR.

Headset Microphone HDMIC

The microphone signal of the HD-Microphone is directly linked from the connector and filters to the B2BHDMIC lines. The Filters can be seen in the connector block.

Headset Speaker Amplifier HDSKR

The headset speaker amplifier is realized by using N202 Boomer amplifier that is supplied by VEBPWR. The Symmetric output of the phone engine transferred in asymmetric signal by N200 and amplified to symmetric output signal within N202. The Amplifier can be muted by setting HDMUTE to high This signal comes from the HDMUTE level shifter.

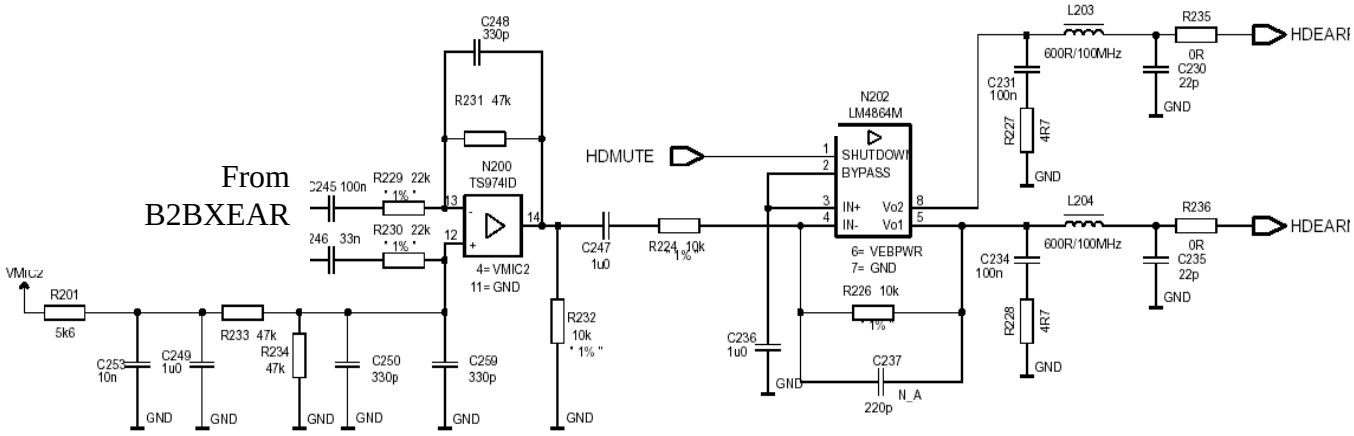


Figure 24: HD-Power amplifier realization

HDMUTE Level shifter

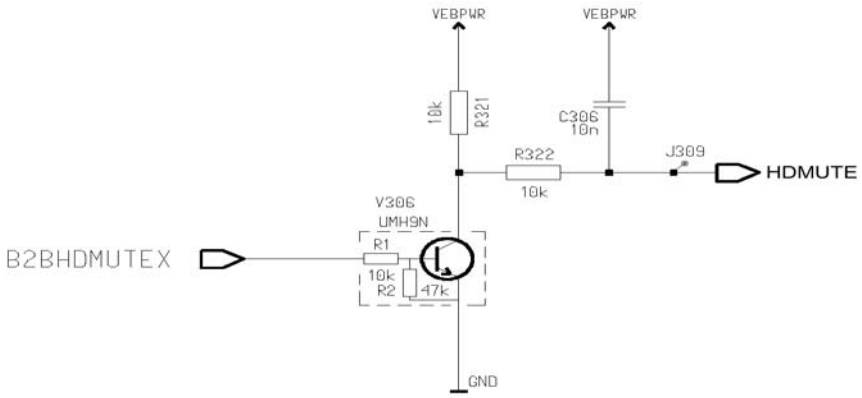


Figure 25: HDMute Level shifter Realization

The B2BHDMUTEX signal, that is used by the phone engine to activate or deactivate the HD-Power amplifier is converted here from 1.8V logic level of the engine to 4.2V level used by the power amplifier. This logic inverts the signal of the control output.

Filter

This part filters the audio signals from EB and mainly cares to close up the symmetric B2BXEAR lines when JB is standalone without phone engine.

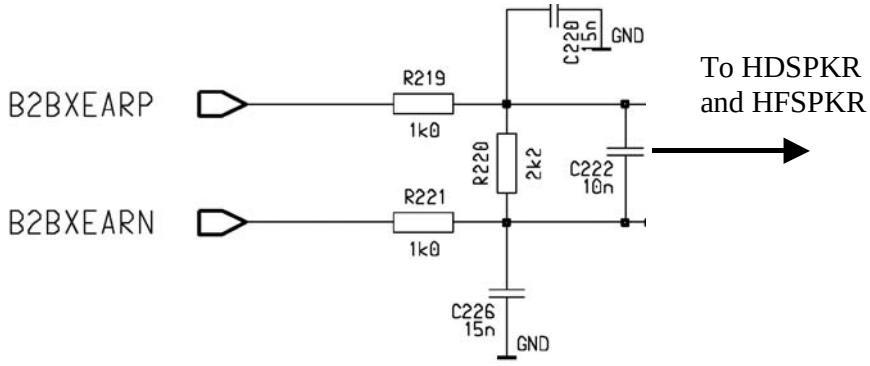


Figure 26: B2BXEAR Filter

Level shifter Description

Block Diagram of Levelshifter Part

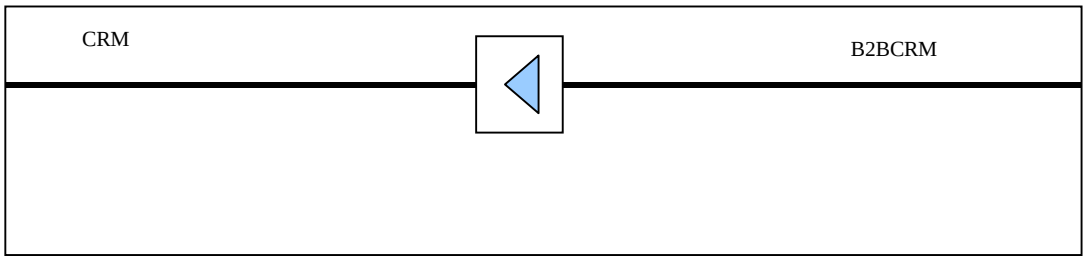


Figure 27: Block-Diagram of Level shifter Block

CRM Levelshifter

This level shifter shall transform the 1.8V signal coming from the phone engine to 13V Vcar level. The CRMX output is drawn within car environment to VCAR by an external resistor of about 200R. This circuit provides overload protection for the case that this resistor value is too low.

Functional Description:

B2BCRM = low

When B2BCRM signal is low, V102, Pin 5 is low. Now VEBPWR reaches over R116 to V123, pin 1 and V123 will be open. That means that CRMx will be held to Vcar high by the external resistor.

B2BCRM = high

When B2BCRM signal is high (1.8V), V102, pin 6 will be drawn by R116 to VEBPWR, because pin 2 is set to ground. Now Base of V123 is connected to VEBPWR via R116, so it will be conducting. CRMX will be drawn to ground.

Short circuit protection:

V123 includes self-protection, which will activate at about 1.2A. The transistor switches off when over current exists. Depending on type of transistor, transistor will activate after some time again, but current will be limited to value of below 1.5A.

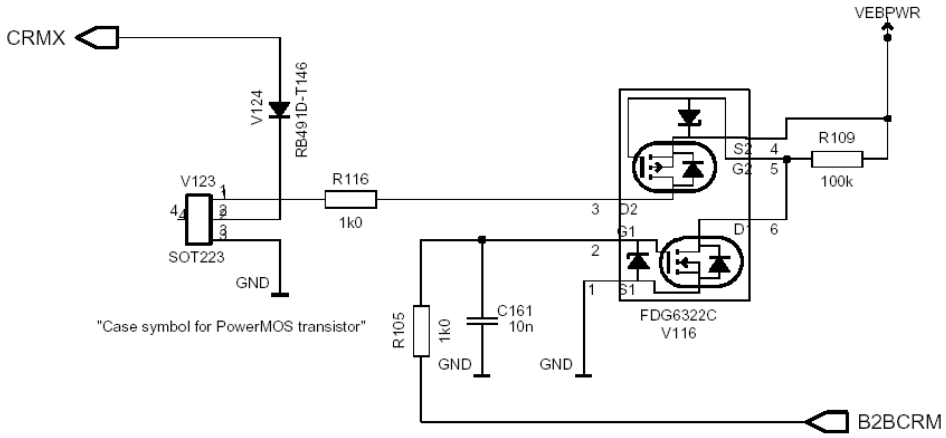


Figure 28: CRM Realization

Antenna Line

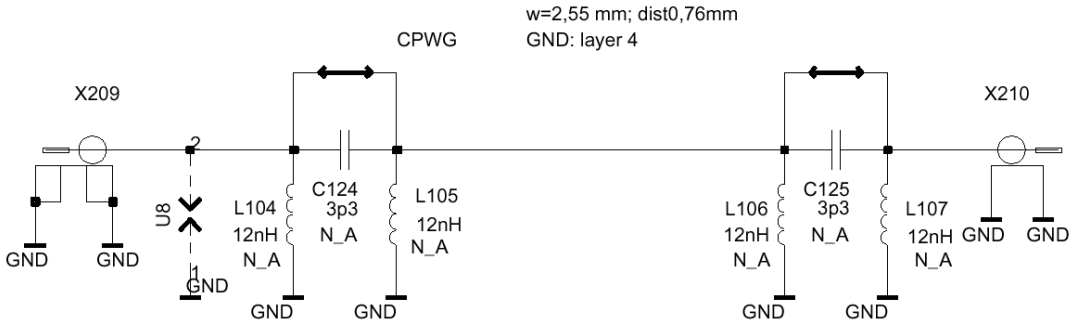


Figure 29: Realization of the Antenna line

Connectors

B2B connectors

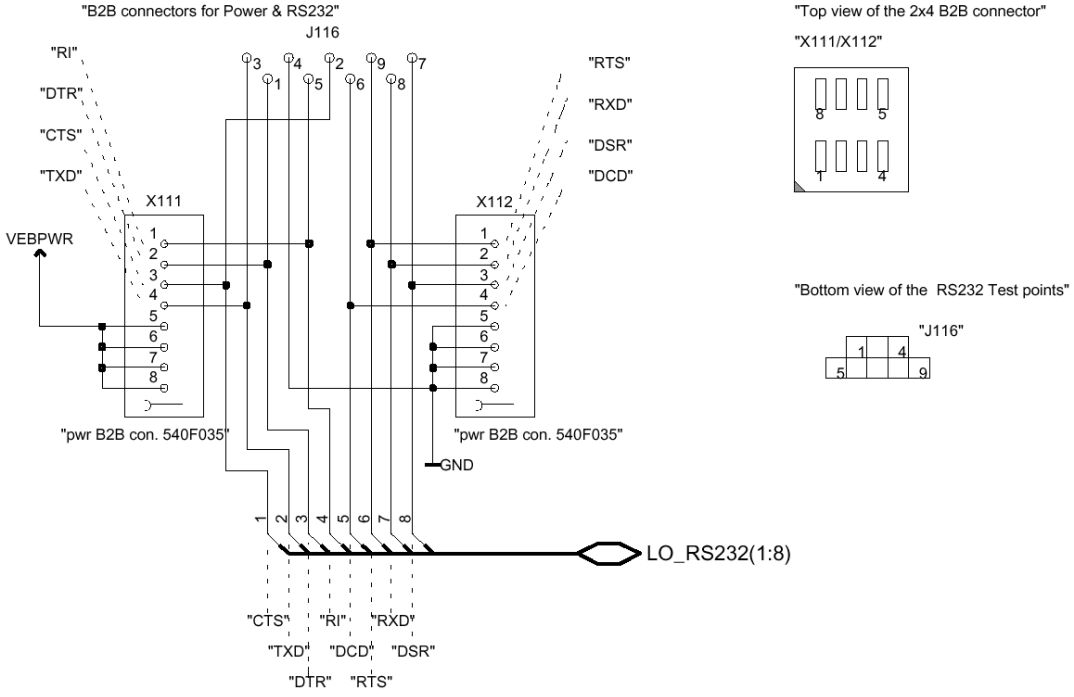


Figure 30: B2B Power Connectors

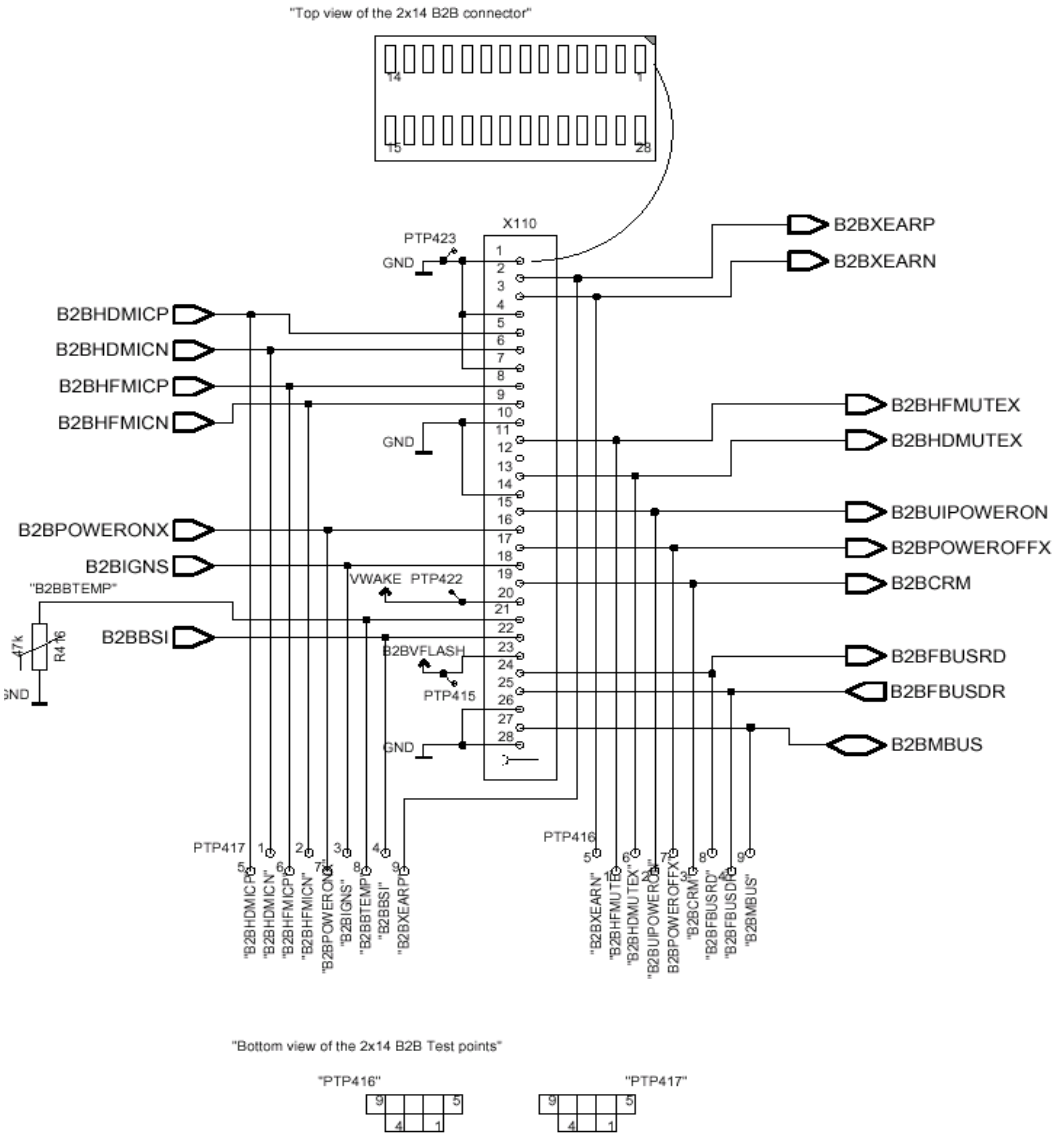


Figure 31: B2B System-Connector

External Connectors

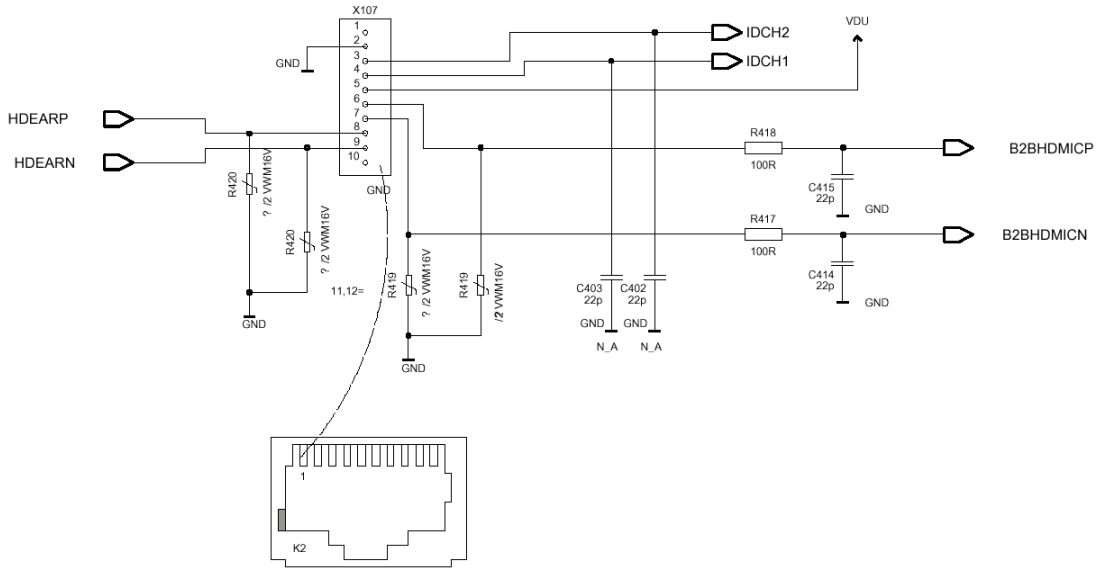


Figure 32: Input Device (ID) connector

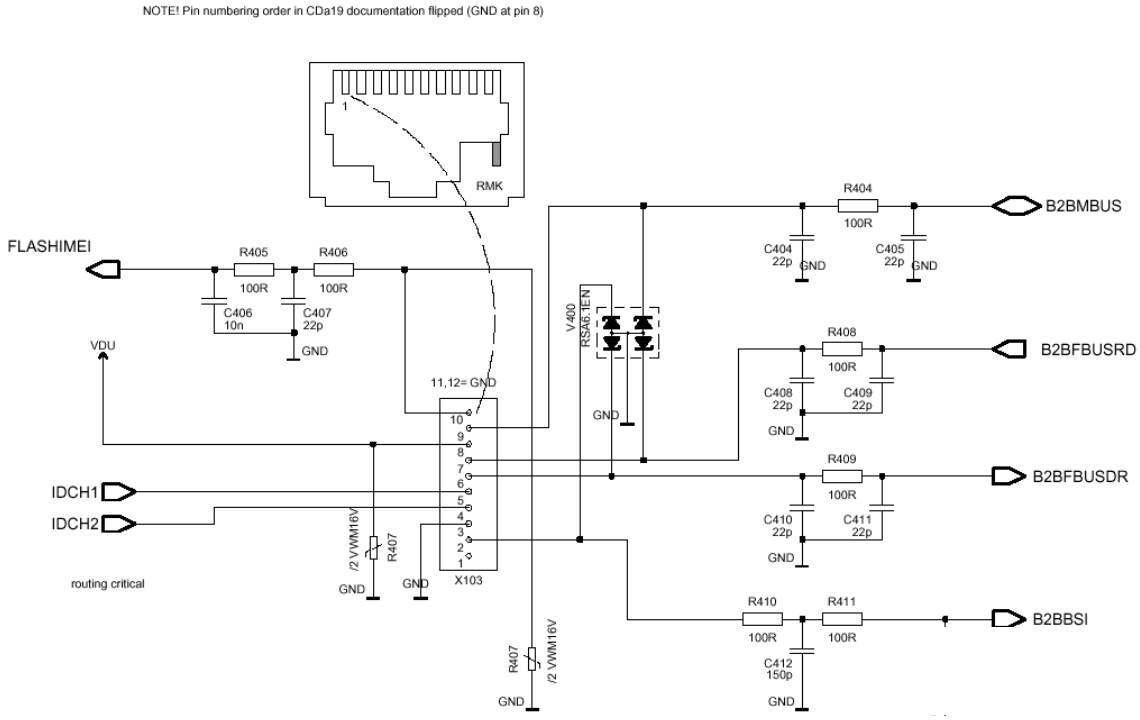


Figure 33: Display-Unit connector

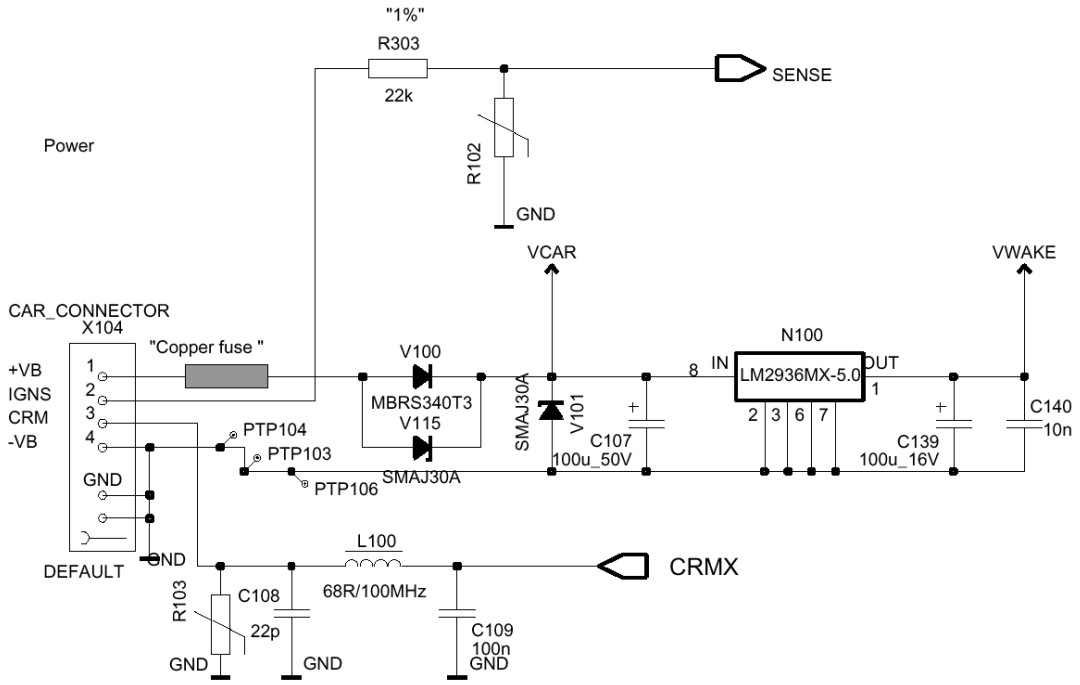


Figure 34: Vcar Connector

8b - TF4 Technical Information Engine Board

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Introduction

This document specifies the Baseband Module of the TF4 Engine Board of the TFE-4/RV-1 (Nokia 610/616) program. The baseband module consists mainly the DCT-4 baseband engine chipset, and the B2B System and Power/RS232 Connector. The PWB is very similar to the NPL-1 Engine PWB. The only difference is, that the UI components, the acoustical parts and the internal antenna are left off. The TF4 phone engine is a Dual-Mode GSM-phone having the DCT4 generation baseband and RF circuitry.

The baseband module is developed, as part of the DCT4 common Baseband, having some product specific blocks of it's own. It is a copy of the NPL-1 product engine. The main difference is the B2B Connectors and the missing UI-Components.

Abbreviations

BACK_UP	UEM state where UEM has backup voltage
BSI	Battery Size Indicator
NO_SUPPLY	UEM state where UEM has no supply what so ever
PWR_OFF	UEM state where phone is off
PWRONX	Signal from power on key. '1' = key pressed.
RESET	UEM state where regulators are enabled
RTC	UEM internal Real Time Clock
SLEEP	UEM power saving state controlled by UPP
SLEEPX	SLEEP control signal from UPP
UEM	Universal Energy Management
UPP	Universal Phone Processor
VBACK	Backup battery voltage
VBAT	Main battery voltage (4.2V)
VCHAR	Charger input voltage
$VCHAR_{DET}$	Charger detection threshold level
V_{MSTR+}, V_{MSTR-}	Master Reset threshold level (2.1 V / 1.9 V)
V_BU_{COFF+}, V_BU_{COFF-}	Backup battery threshold level (3.1 V / 2.8 V)
VRTC	Regulator voltage for RTC
WIS	Warrant Information State

Block diagram of Engine Board

***** Note: RS232 facility is only utilised in the N810 *****

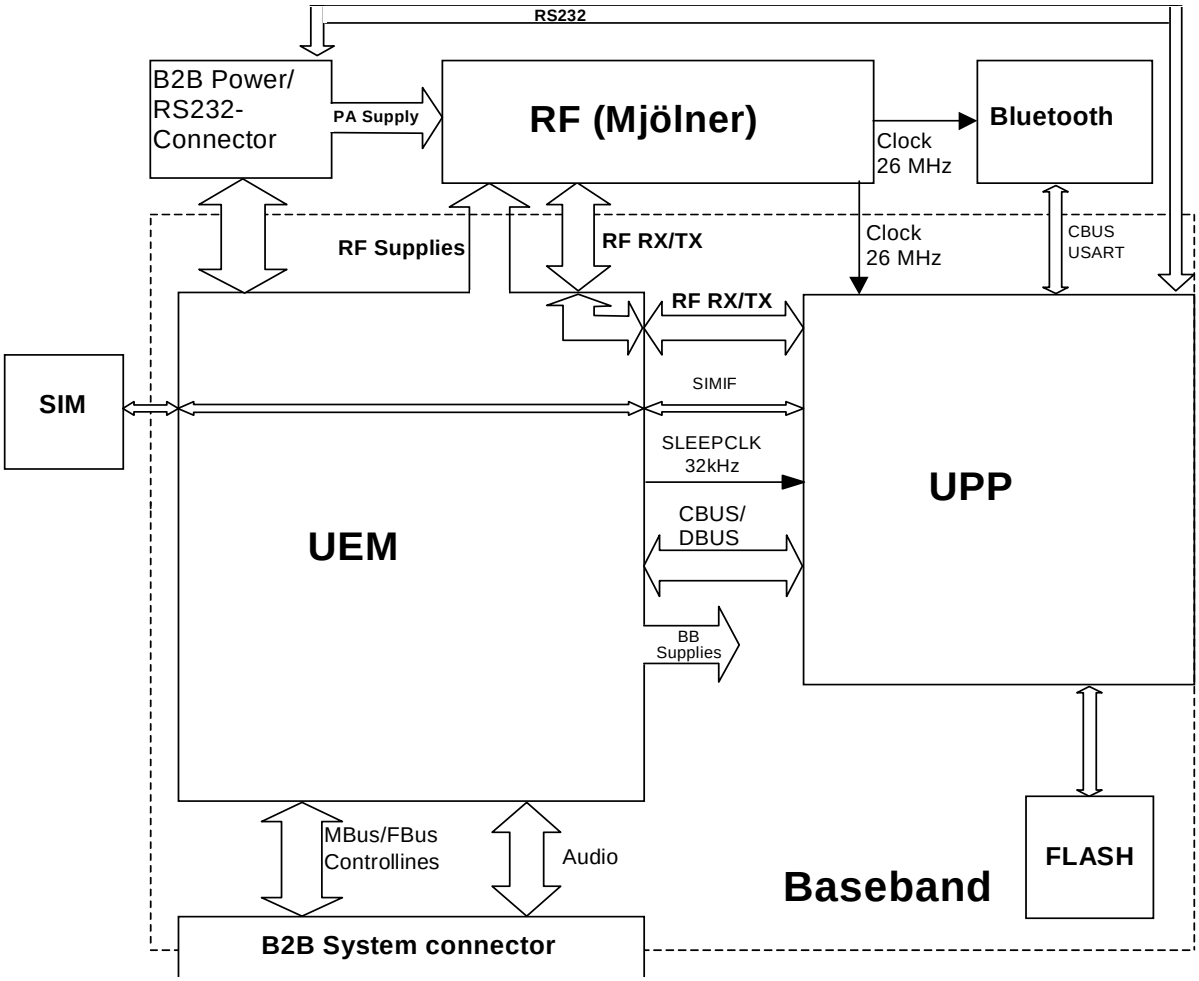


Figure 1: Block Diagram of the Engine Board

A block diagram is shown in Figure 1. The baseband module contains 2 Asics namely the **U**niversal **E**nergy **M**anagement (UEM) and the **U**niversal **P**hone **P**rocessor (UPP). The baseband module furthermore contains the Bluetooth module. The baseband is based on the DCT4 engine program.

The UEM supplies both the baseband module as well as the RF module with a series of voltage regulators. The RF module is supplied with regulated voltages 4.75 V and 2.78 V and the baseband module with 2.78 V and 1.80 V. The UEM is furthermore supplying the baseband SIM interface with a programmable voltage of either 1.8 V or 3.0 V and the core of the UPP is supplied with a programmable voltage of 1.0 V, 1.3 V, 1.5 V or 1.8 V.

The UEM contains a series of PWM sourced drivers. The individual PWM signals are generated internally within the digital part of the UEM and distributed to the drivers.

The UEM contains a real-time clock sliced down from the 32768 Hz crystal oscillator. The 32768 Hz clock is fed to the UPP as a sleep clock.

The communication between the UEM and the UPP is done on the bi-directional CBUS and DBus. The CBUS is controlled by the MCU and can operate at a speed of maximum 1 MHz. The DBus is controlled by the DSP and can operate at a maximum speed of 13 MHz. Both processors are located in the UPP.

UEM

The UEM is one of the two Asics in the baseband module.

UEM Startup/ Powerdown Sequence

The functional behavior of the UEM can be divided into 7 different states. Since the UEM controls the regulated power distribution of the phone, each of these states affects the general functionality of the phone:

- No supply
- Backup
- Power off
- Reset
- Power on
- Sleep
- Protection

Because the Junction Board switches off the Engine Power supply (VEBpwr on junction board, VBAT on the Engine Board) the UEM will be started by Poweron mode. During the Power-Up Sequence the UEM detects that the Poweronx line is pushed to ground by the Junction Board.

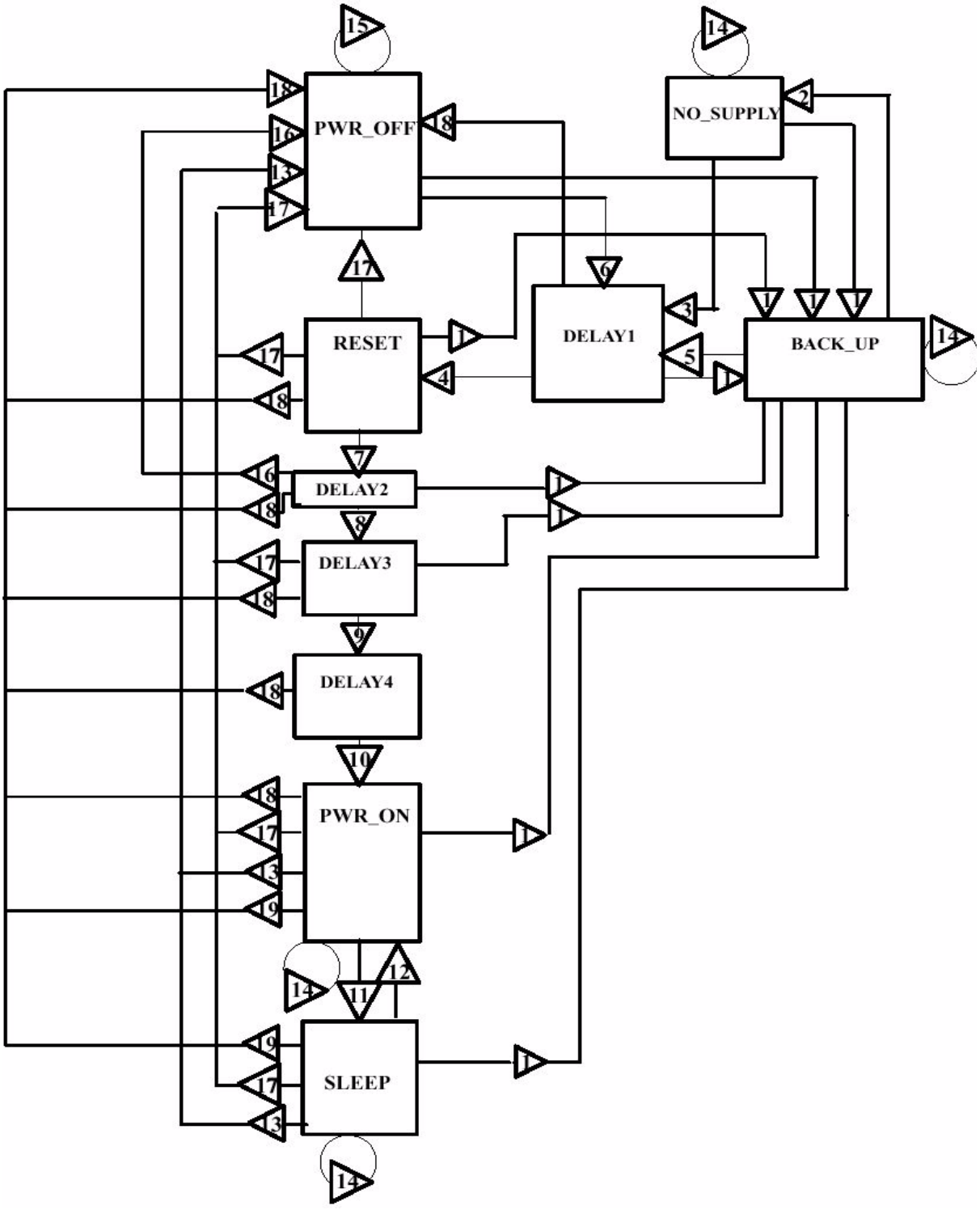


Figure 2: State Diagram of the UEM

The following text explains the status-change reasons, marked with Nr 1-19 within the state diagram. The symbol '↗' means that the voltage rises and '↘' that the voltage drops. '→' Means the result of the conditions set on the left most side.

List of Status-Change Reasons

1 VBAT < V_{MSTR} and VBACK > V_BU_{COFF} → Go to BACK_UP

2 VBAT < V_{MSTR} and VBACK < V_BU_{COFF} → Go to NO_SUPPLY

3 VBAT ↗ V_{MSTR+}. VBACK < V_BU_{COFF} → Go to DELAY1

4 VBAT > V_{MSTR}. DELAY1 elapses → Go to RESET

5 VBAT ↗ V_{MSTR+}. VBACK > V_BU_{COFF} → Go to DELAY1

6 PWRONX = '0' or VCHAR ↗ $VCHAR_{DET+}$ or ALARM = '1' → Go to DELAY1

7 VBAT > V_{COFF+} → Go to DELAY2

8 DELAY2 elapses → Go to DELAY3

9 VBAT > C_{OFF+}. DELAY3 elapses → Go to DELAY4

10 DELAY4 elapses → Go to PWR_ON

11 SLEEPX = '0' → Go to SLEEP

12 SLEEPX = '1' → Go to PWR_ON

13 VBAT ↘ V_{COFF-} and VBAT > V_{MSTR-} → Go to PWR_OFF

14 No change

15 VBAT > V_{MSTR} → Stay in PWR_OFF

16 PWRONX ↗ detection during DELAY2 → Go to PWR_OFF

17 Watchdog elapses (approx. 100 µs) → Go to PWR_OFF

18 Thermal shutdown → Go to PWR_OFF

19 PwrKeyWatchdog (4 sec.) elapses → Go to PWR_OFF

Description of the UEM-States

The different states of the UEM are explained further below:

No supply

In the NO_SUPPLY mode the UEM has no supply voltage (VBAT < V_{MSTR} and VBACK < V_BU_{COFF-}). This mode is due to the fact, that both supply voltages, the main battery and the backup battery, are either disconnected or both discharged to a low voltage level.

The UEM will recover from NO_SUPPLY into RESET mode if the VBAT voltage level rises above the V_{MSTR+} level by either reconnecting the main battery or charge it to such level.

Backup

In BACK_UP mode the main battery is either disconnected or has a low voltage level (VBAT < V_{MSTR-} and VBACK > V_BU_{COFF+}). The regulator VRTC that supplies the real time clock is disabled in BACK_UP mode. Instead the unregulated backup battery voltage VBACK supplies the output of the VRTC. All other regulators are disabled and the phone has no functionality.

The UEM will recover from BACK_UP mode into RESET mode if VBAT rises above V_{MSTR+}.

Power off

In order for the UEM to be in PWR_OFF mode, it must have supply voltage (VBAT > V_{MSTR+}).

The regulator VRTC is enabled and supplying the RTC within the UEM. The UEM will enter RESET mode after a 20 ms delay whenever one of the below listed conditions is logically true:

- The power button is activated
- Charger connection is detected
- RTC alarm is detected
- -> This mode is not used within TF4

Reset

When the UEM enters RESET mode from PWR_OFF mode the watchdog is enabled. If the VBAT fails to rise above the power-up voltage level V_{COFF+} (3.1 V) before the watchdog elapses, the UEM will enter PWR_OFF mode. Otherwise after a 200 ms delay the regulator VFLASH1 will be enabled and after a additional delay of 500 µs the regulators VANA, VIO, VCORE and VR3 will be enabled. All other regulators i.e. VFLASH2, VSIM, VR1, VR2 and VR4 – VR7 are software controlled and disabled by default. After an additional delay of 20 ms the UEM enters PWR_ON mode.

Power on

In PWR_ON the UEM is fully functional in the sense that all internal circuits are powered up or can be by means of software. The UEM will enter PWR_OFF mode if VBAT drops below V_{COOF-} for a period of time longer than 5 µs. The UEM will furthermore enter PWR_OFF mode if either of the watchdogs Operational State Machine (approx. 100 µs), Security (32 sec.) or Power Key (4 sec.) elapses or if any of the regulators triggers the thermal protection circuitry

Sleep

The UEM can be forced into SLEEP mode by the UPP by setting the input SLEEPX low for more than 60 µs. This state is entered when the external UPP activity is low (phone in sleep) and thereby lowering the internal current consumption of the UEM. The regulator VANA is disabled and VR1 – VR7 are either disabled or in low quiescent mode.

From SLEEP the UEM enters PWR_ON if SLEEPX goes high, PWR_OFF mode if watchdog elapses or BACK_UP mode if VBAT drops below V_{MSTR-}.

Protection mode

The UEM has two separate protection limits for over temperature conditions, one for the charging switch and one for the regulators. The temperature circuitry measures the on-chip temperature. In case of charging over temperature, the circuit turns the charging switch off. In case of over temperature in any of the regulators, the UEM powers off.

Description of the Powerstates

Within TFE-4/RV-1 the powerup/powerdown is solved in the following way:

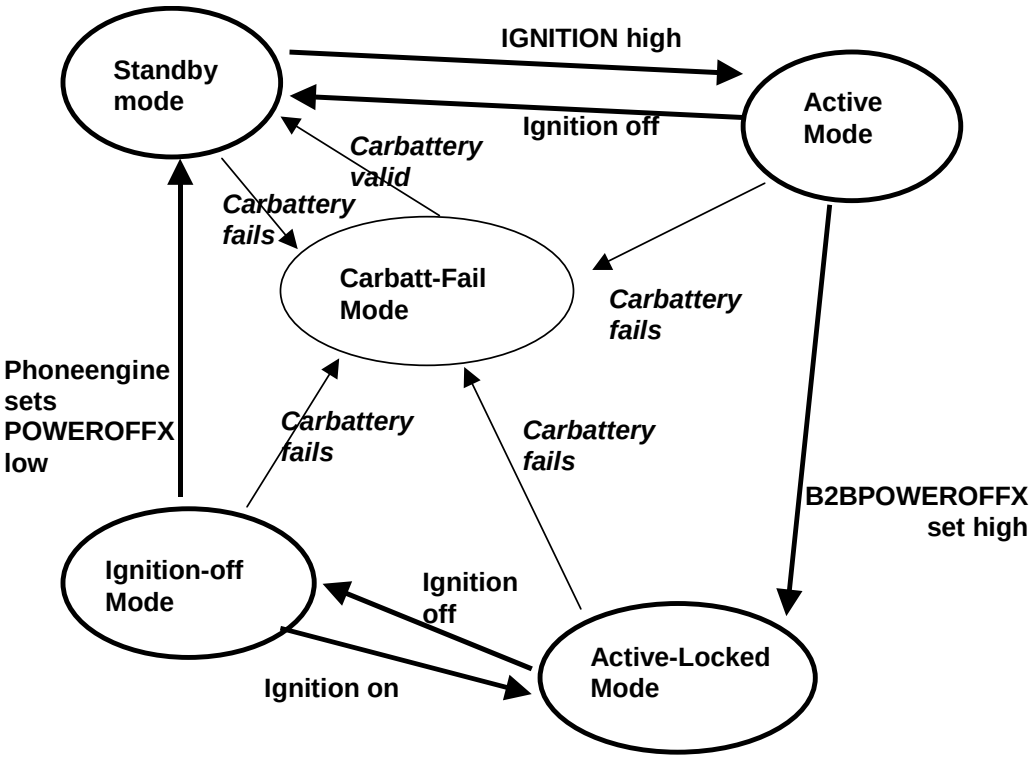


Figure 3: Powerstates of the TFE-4/RV-1 Radio unit

Standby Mode

When the car is inactive (ignition is switched off), TFE-4/RV-1 shall be in Standby mode. In this mode TFE-4/RV-1 is not operating. This mode is characterized by very low power consumption (less than 1mA). This state will be reached when TFE-4/RV-1 is connected to the car battery the first time.

Active Mode

In the active mode, the engine-power supply is on and the poweronx line is toggled by the poweronx generator. Here the phone is generally full active from Power supply point-of-view. After a short time (determined by Software) the UPP sets the B2BPOWEROFFX line high and this initiates the transition to Active-Locked mode. In case that the ignition signal is going to low before that, a direct transition to the sleep mode will happen and the phone engine will be powered off immediately.

Active Locked Mode

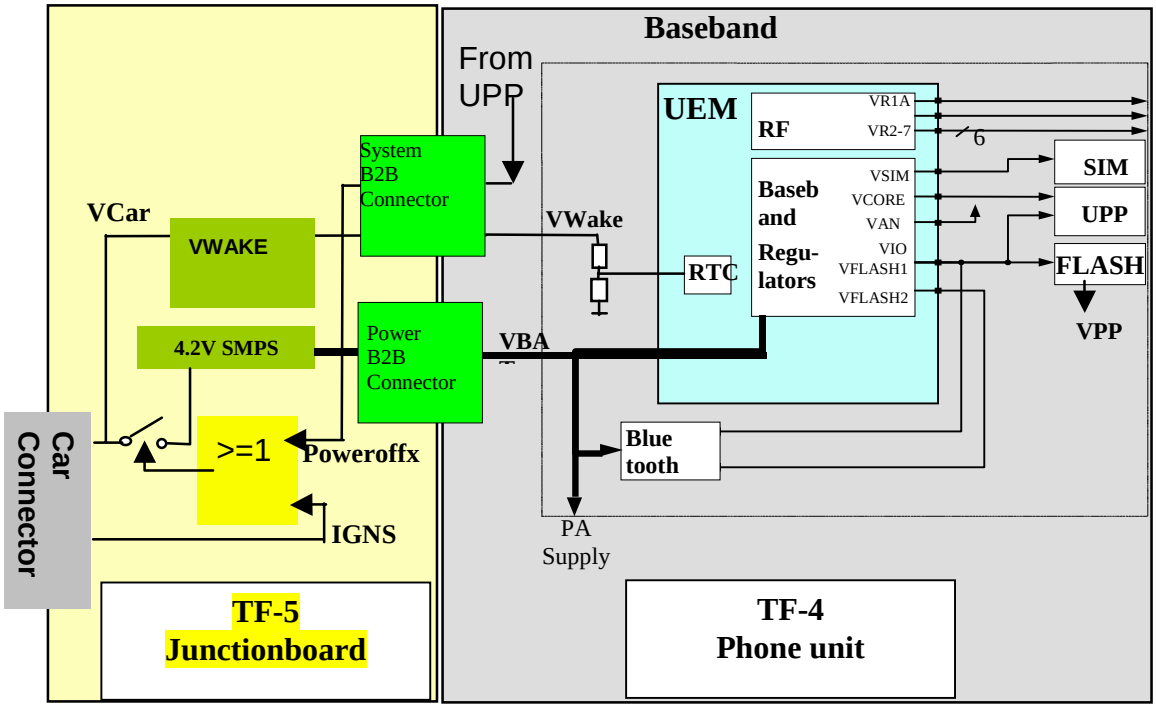
The active locked power mode is the same as the active mode but UPP holds B2BPOWEROFFX line high. If the ignition signal is going from high to low now, the TFE-4/RV-1 will remain active but a transfer to the ignition-off mode will take place.

Ignition-Off Mode

The ignition-off power mode is the same as the active mode and the active locked powermode, but the power supplies are kept alive because the PowerOffx line is hold high by the UPP. That is to enable log-off from GSM network and to enable to continue active phone call when car is switched off. When those tasks are finished, UPP will set Poweroffx line low and the radio unit will switch to standby mode.

Carbatt-Fail Mode

This mode is reached, when the car battery is out of the 'normal' operating range. Like in the standby mode all main power supplies are switched off, only powe rsupply for wakeup logic is active.



UEM Power supplies

Within TF4, the Baseband module is powered via the B2B power connectors, which are located in the area of the battery contacts of the phone engine. The voltage VBAT is regulated by individual regulators, located within the UEM. These regulators supply the different parts of the phone. 8 regulators are dedicated to the RF module of the phone, and 6 to the baseband module.

The VSIM regulator is able to deliver both 1.8 and 3.0 Vdc and thus supporting two different SIM technologies. A register internally in the UEM controls the output of VSIM and can be written to by the MCU via the CBUS. The regulator VCORE is likewise adjust-

able and controlled by register writings by the MCU. VCORE supplies the core of the UPP and can be adjusted on the fly by the MCU if DSP capacity is inadequate. Higher VCORE supply (1.8 V) results in faster core operations in the UPP.

The regulators VANA, VFLASH1 and VIO are solely controlled by the UEM and cannot be en-/disabled by MCU writings. Furthermore, VFLASH1 and VIO are both ON, though in low quiescent mode when the phone is in sleep mode. An output current of 500 µA can be drawn from the VIO regulator and 1.5 mA from the VFLASH1 regulator. VIO supplies the UPP, FLASH and LCD, VFLASH1 supplies LCD, IRDA and the Bluetooth module. VANA is supplying analogue parts internally in the UEM as well as the baseband audio circuitry and pull-up resistors on the input of the UEM slow AD converters.

The regulators VR1A, VR1B, VR2 – VR7 and IPA1 – IPA4 are all controlled by the DSP via the DBus. VR3 – VR7 are controlled by the UEM as well and are disabled in sleep regardless of DSP writings.

VBAT is furthermore distributed, unregulated, to the RF power-amplifier and the BT102 Bluetooth module as well as filters in the baseband module.

The CHACON module is not used on TF4.

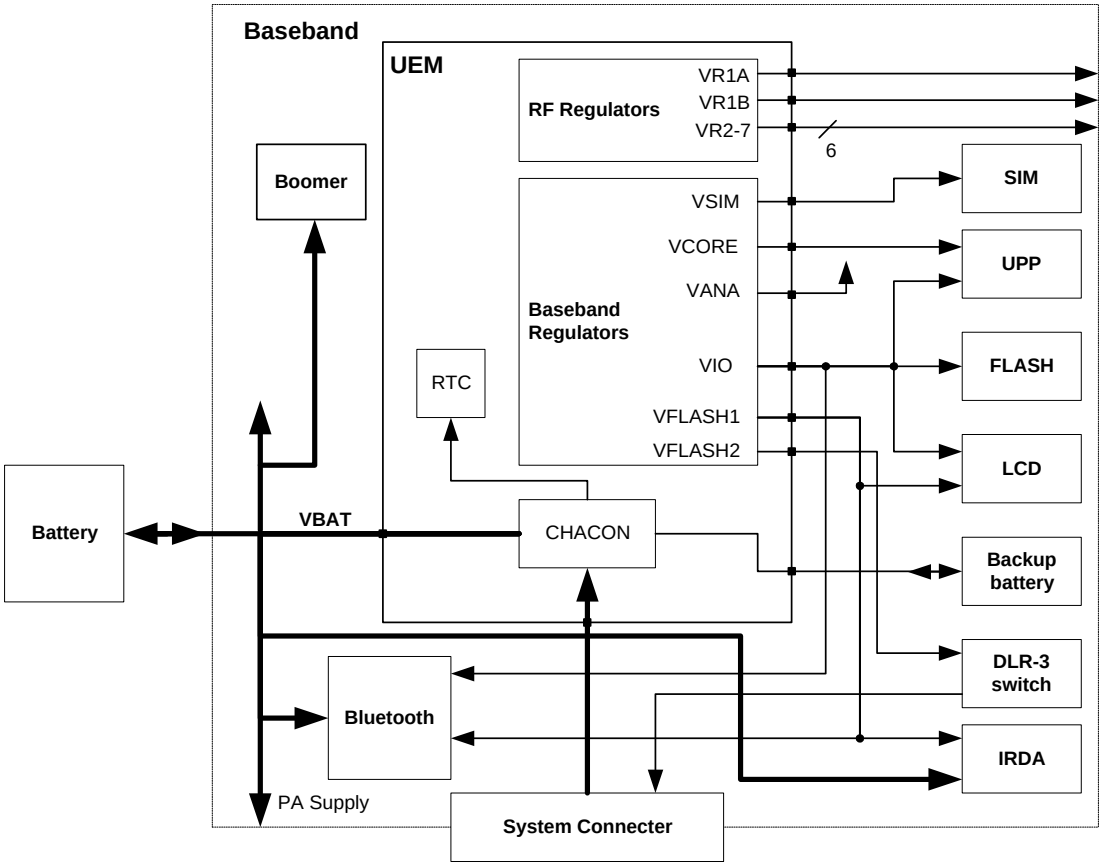


Figure 4: Baseband power distribution

DC characteristics

The figures in Table 1: reflect the specifications of the voltage and current regulators within the UEM.

Table 1: UEM regulator outputs and state in sleep

Regulator	Target	Output Voltage [V]			Output Current [mA]		UEMSLX = '0'[4]
		Min	Typ	Max	Min	Max	
VR1A, VR1B	RF	4.6	4.75	4.9	0	10	Off
VR2[6]	RF	2.70	2.78	2.86	0.1	100	Off or Low Iq
VR3	RF	2.70	2.78	2.86	0.1	20	Off
VR4[2]	RF	2.70	2.78	2.86	0.1	50 0.1	Off
VR5, VR6[2]	RF	2.70	2.78	2.86	0.1	50 0.1	Off
VR7	RF	2.70	2.78	2.86	0.1	45	Off
VrefRF01	RF	1.334	1.35	1.366	-	0.1	On
VrefRF02[1]	RF	1.323	1.35	1.377	-	0.1	On or Off
VIO[2]	BB	1.72	1.8	1.88	0.005 0.005	150 0.500	Low Iq
VSIM[2]	BB	1.745 2.91	1.8 3.0	1.855 3.09	0.005 0.005	25 0.500	Low Iq
VANA	BB	2.70	2.78	2.86	0.005	80	Off
VCORE[3]	BB	1.000 1.235 1.425 1.710	1.053 1.3 1.5 1.8	1.106 1.365 1.575 1.890	0.005 0.005 0.005 0.005	70 85 100 120	Low Iq
		0.974 1.215 1.410 1.692	1.053 1.3 1.5 1.8	1.132 1.365 1.575 1.890	70 85 100 120	200 200 200 200	
VFLASH1	BB	2.70	2.78	2.86	0.005 0.005	70 1.5	Low Iq
VFLASH2[5]	BB	2.70	2.78	2.86	0.005	40	On or Off

1 Controlled by MCU writing to UEM references register.

2 The second current value indicates the maximum possible output current of the regulator when in low quiescent mode.

3 The output voltages are split into two different current categories. The upper part is the lower range of output current, and the lower part is the higher range of output current.

4 UEMSLX is slave to SleepX from the UPP. Sets the UEM into sleep mode.

5 Condition in sleep-mode depends on MCU writings to UEM regulator registers solely.

6 Condition in sleep-mode depends on DSP writings to UEM register.

UPP

The UPP used for TF4 is UPP8Mv1.4 with an expected change to UPP8Mv2.x, both with 8 Mbytes internal RAM. It is clocked by a 26MHz frequency from the RF-chip "Mjölner". The 26MHz-clock frequency is internally sliced down by UPP to 13MHz. This frequency is then inside UPP multiplied to different frequencies, i.e. 145MHz for the DSP core. The UPP can be divided into two functional sections, Body and Brain. Body contains system logic, and Brain contains processor subsystem including DSP, MCU, memories and Bus Controller. The function of the Body is mainly the same as in DCT3 system Logic. The Body is connected to Brain via RHEA bus. The Body and Brain is shown below.

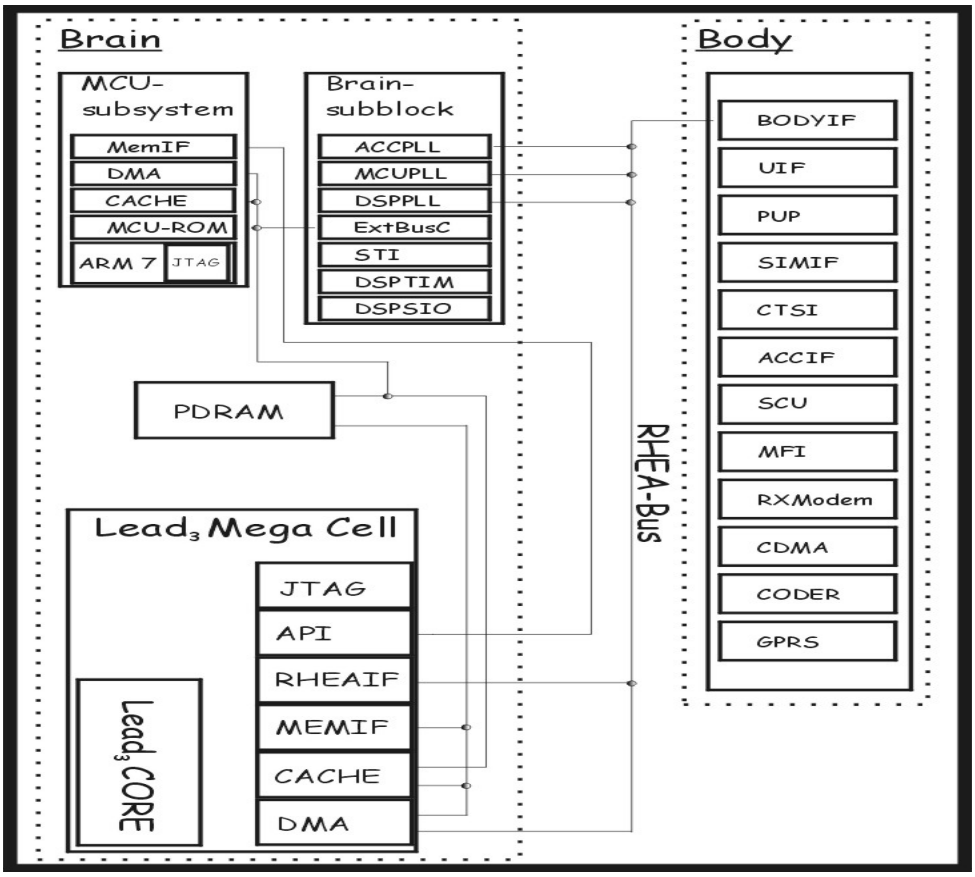


Figure 5: UPP architecture

The DSP inside the Brain is a $Lead_3$ 16–bit DSP core from TI (Texas Interments), with a DMA controller, wait state generator and a program fetch of 32-bits. Furthermore, the DSP core has an instruction-length flexibility of 8 to 48-bits. The maximum frequency for the DSP core is 145MHz for the Triton baseband, although the maximum frequency for the core itself is 400 MHz. The core can do single and dual mac-operations per clock-cycle. This means that the 6310i baseband has a maximum of 290 MIPS (mac-operations) on the DSP-core.

The DSP core has three different RAM-banks; cache RAM, dual access RAM for storing and manipulating data and last, single access RAM for storing and manipulating SW variables. All the RAM-banks have a 145 MHz clock and 32-bit organization. It has also an ARM port interface, which is used for MCU/DSP message transfer (API).

The MCU consist of a 16/32–bit RISC core (ARM7). The block has a small ROM (768x32 bits) for MCU boot code. It interfaces to DSP through the 8Mbit PDRAM. The MCU has it own sectors in the RAM as well as the DSP. RAM blocks or sectors are divided into the following:

4 x 64Kbytes for the DSP and MCU.

4 x 64KB Banks, MCU only.

2 x 4KB Banks, for the DSP, and MCU.

The rest of the PDRAM is used for program code, mainly GPRS SW.

Bluetooth

TF4 has a Bluetooth module BT102 that receives and transmit at 2.4GHz. This module enables the phone to communicate via a radio link with other Bluetooth units e.g. head-sets, carkits or printers or to use a linked phone via SAP-link as remote SIM-card. The Bluetooth module is itself made as a multilayer PWB – covering all the needed Asics and discrete components – with a shielding frame- and lid. The module is soldered onto the phone PWB in the same way as other SMD components.

BT102 Flash programming

The *Bluetooth MCM* SW needs to be programmed when the module is assembled into the phone. This is implemented by interleaving so that code data is being transferred to the BT102 while the main flash is performing the internal programming of the phone SW.

The figure below illustrates the set-up used for BT102 flash programming.

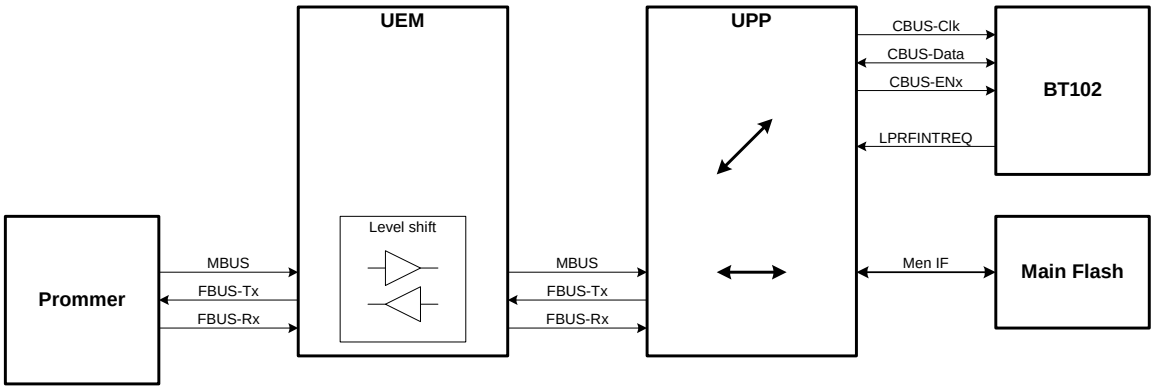


Figure 6: BT102 flash programming

BT-HW interface

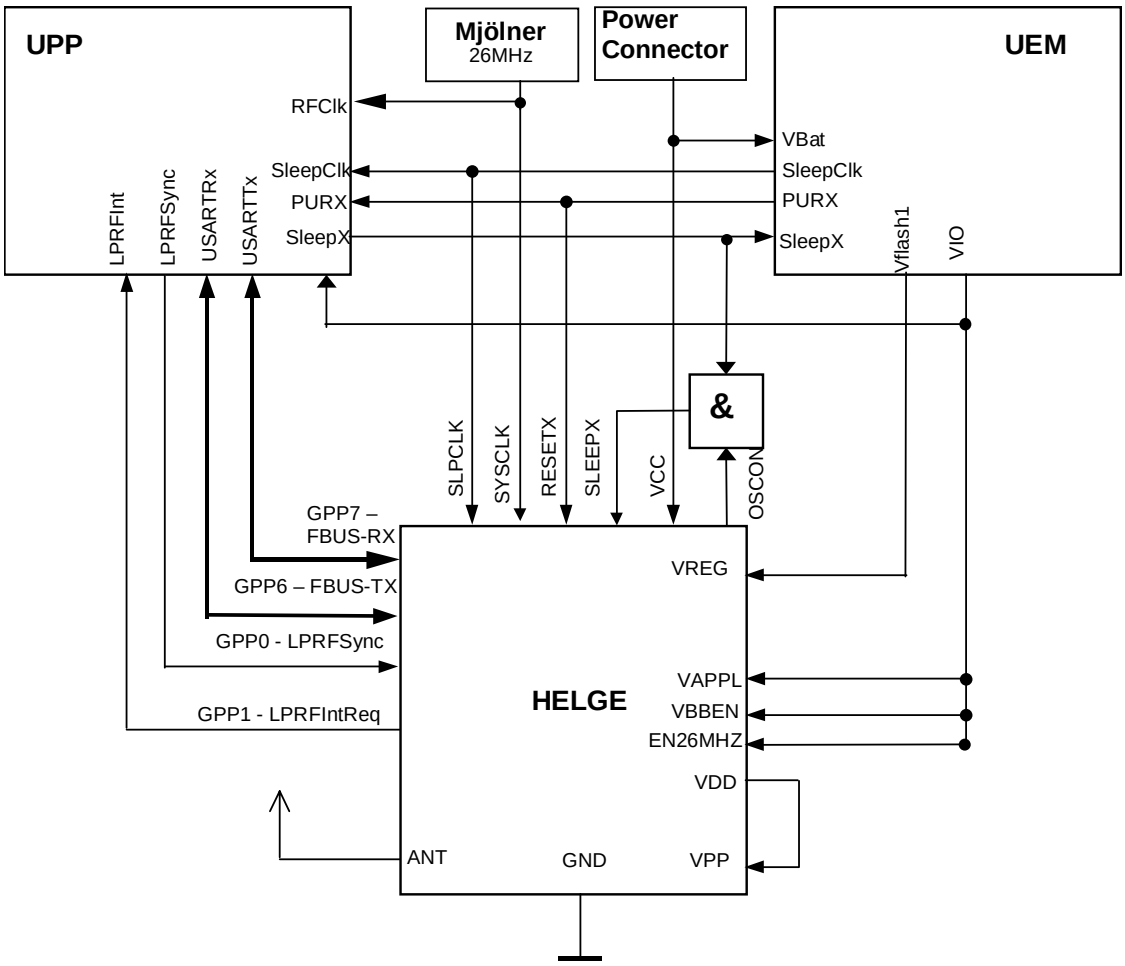


Figure 7: BT102 HW interface

The following table describes the signals covering the interface between the BT module and the engine. The signal names are referring to the NPL-1 schematic diagram.

Table 2: BT – BB interface description

Signal name MCM pin #	From	To	Para-meter	Min.	Typ.	Max.	Unit	Notes
RESET								
RESETX 44	UEM PURX	MCM	Logic "1"	1.40		1.80	V	BB reset
			Logic "0"	0		0.20	V	
Clock input								
SYSCLCK 50	RF	MCM	Signal amplitude	0.30		0.80	Vpp	System clock input
			Frequency		26		MHz	
EN26MHZ 18	UEM Vio	MCM	Voltage	1.40		1.80	V	Defines system clock. "1" = 26 MHz

Table 2: BT – BB interface description

Signal name MCM pin #	From	To	Para-meter	Min.	Typ.	Max.	Unit	Notes
SLPCLK 26	UEM Sleep-Clk	MCM	Logic "1"	1.26		1.80	V	Sleep clock input
			Logic "0"	0		0.54	V	
			Frequency	32763	32768	32773	Hz	
Power control								
VBBEN 49	UEM Vio	MCM	Voltage	1.40		1.80	V	Stan2 regulators enable
SLEEPX 48	AND circuit	MCM	Logic "1"	1.40		1.80	V	Active mode = "1"
			Logic "0"	0		0.20	V	
OSCON 31	MCM	AND circuit	Logic "1"	1.40		1.80	V	Reflects MCM status. Active mode = "1"
			Logic "0"	0		0.20	V	
GND 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 16, 17, 13, 14, 15, 19, 24, 29, 33, 39, 43, 47, 51, 56			Voltage		0		V	Ground reference
VCC 52, 53, 54	Vbatt	MCM	Voltage	2.95		5.20	V	Main power supply input
VREG 6	UEM Vflash1	MCM	Voltage	2.70		2.86	V	Regulated power supply input
VDD 45	MCM	MCM VPP	Voltage		1.80		V	Supply for VPP
VPP 41	MCM VDD	MCM	Voltage		1.80		V	Programming voltage supply
VAPPL 32	UEM Vio	MCM	Voltage		1.80		V	Supply for application IF
RF air								
ANT 12	MCM	BT ant.	Impedance		50		Ω	Antenna pin
General purpose I/O								
GPP0 38	MCM	LPRF Sync	Logic "1"	1.26		1.80	V	
			Logic "0"	0		0.54	V	
GPP1 37	MCM	LPRF Int	Logic "1"	1.26		1.80	V	
			Logic "0"	0		0.54	V	
GPP6 28	MCM	USART Rx	Logic "1"	1.26		1.80	V	
			Logic "0"	0		0.54	V	

Table 2: BT – BB interface description

Signal name MCM pin #	From	To	Para-meter	Min.	Typ.	Max.	Unit	Notes
GPP7 27	MCM	USART Tx	Logic "1"	1.26		1.80	V	
			Logic "0"	0		0.54	V	
GPP10 36	CBUS Clk	MCM	Logic "1"	1.26		1.80	V	
			Logic "0"	0		0.54	V	
GPP11 35	CBUS Da	MCM	Logic "1"	1.26		1.80	V	
			Logic "0"	0		0.54	V	
CENX 34	CBUS ENx	MCM	Logic "1"	1.26		1.80	V	
			Logic "0"	0		0.54	V	

SIM

TFE-4/RV-1 uses a product specific SIM-card reader (SIM reader) which has spring contacts to PWB contact area. Electrical connection to the SIM card is similar to other DCT4 products. The SIM interface is split between UEM and UPP (see Figure 8 below). This has been done in order to reduce the amount of interconnections on the SIM interface between the UPP and the UEM. The SIM interface control logic and UART is integrated into the UPP. The SIM interface start-up and power down sequence, including timing and reset generation is implemented in UEM. The SIM interface in the UPP supports the SIM speed enhancement features, which improves the data transfer rate in the SIM interface.

The UEM provides the SIM interface logic level shifting between UPP SIM interface logic levels of 1.8V and the SIM interface. The SIM interface can be programmed to support 3V and 1.8V SIM cards, 5V cards are not supported. A register in the UEM selects the SIM supply voltage. It is only allowed to change the SIM supply voltage when the SIM IF is powered down.

There are two reasons to disable SIM access, SIMCardDet (for SIM-switch) and BSI. If the BSI goes low, the power down sequence is automatically initiated by UEM. The Battery Type contact signal (BSI) is used to recognize if the Power supply is suddenly removed from Radio-Unit via Powerok-line on Junction board. The SIMIF will then force all the connections low, i.e. SIMRST, SIMCLK, SIMDATA and VSIM. A comparator inside the UEM does the monitoring of the BSI signal. The comparator offset is such that the comparator output does not alter state as long as the battery is connected. The BSI comparator threshold level is 2.1 V with 75 mV hysteresis.

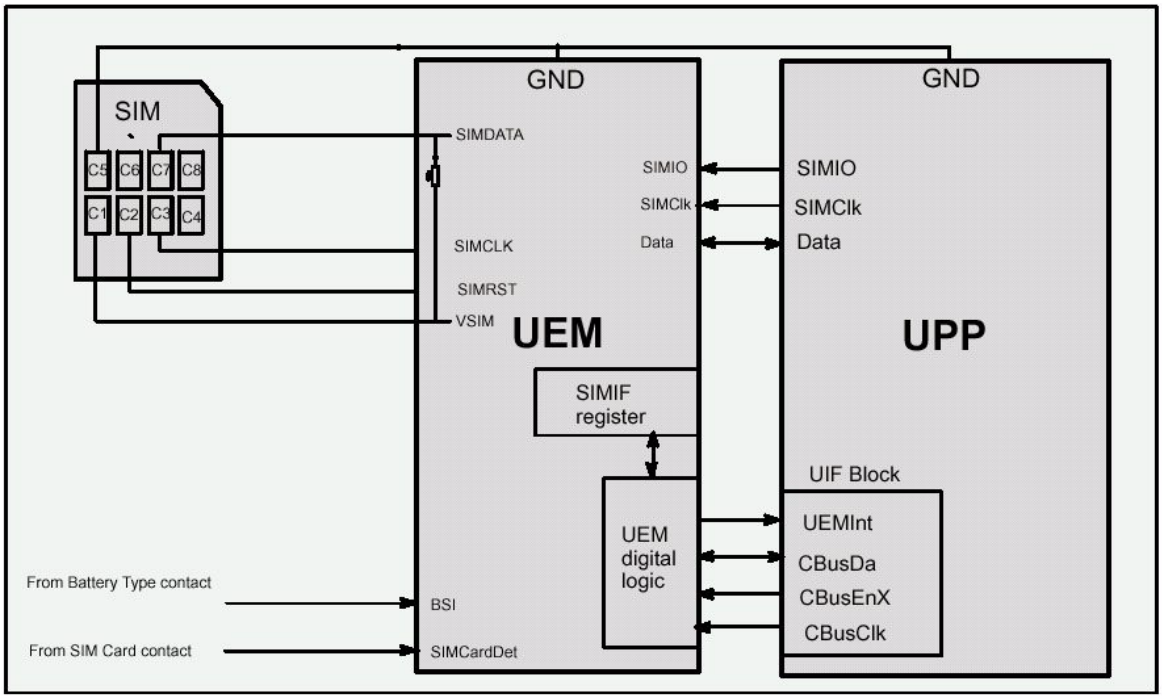


Figure 8: UPP, UEM and SIM Connections

Table 3: SIM Connector Interface

Pin	Name	Parameter	Min	Typ	Max	Unit	Notes
1	SIMCLK	Frequency T_{rise}/T_{fall}	1.05	3.25	3.36 26	MHz ns	SIM clock
2	SIMRST	V_{oh} V_{ol}	0.9*VSIM 0		VSIM 0.15*VSIM	V	SIM reset
3	VSIM	3V SIM Card	2.8	3.0	3.2 25	V mA	Supply voltage Icc, 4MHz
		1.8V SIM Card	1.6	1.8	2.0 25	V mA	Supply voltage Icc, 4MHz
4	GND	GND	0		0	V	Ground
6	DATA	V_{oh} V_{ol} V_{ih} V_{il}	0.9*VSIM 0 0.7*VSIM 0		VSIM 0.15*VSIM VSIM 0.15*VSIM	V	SIM data Trise/Tfall max 1us

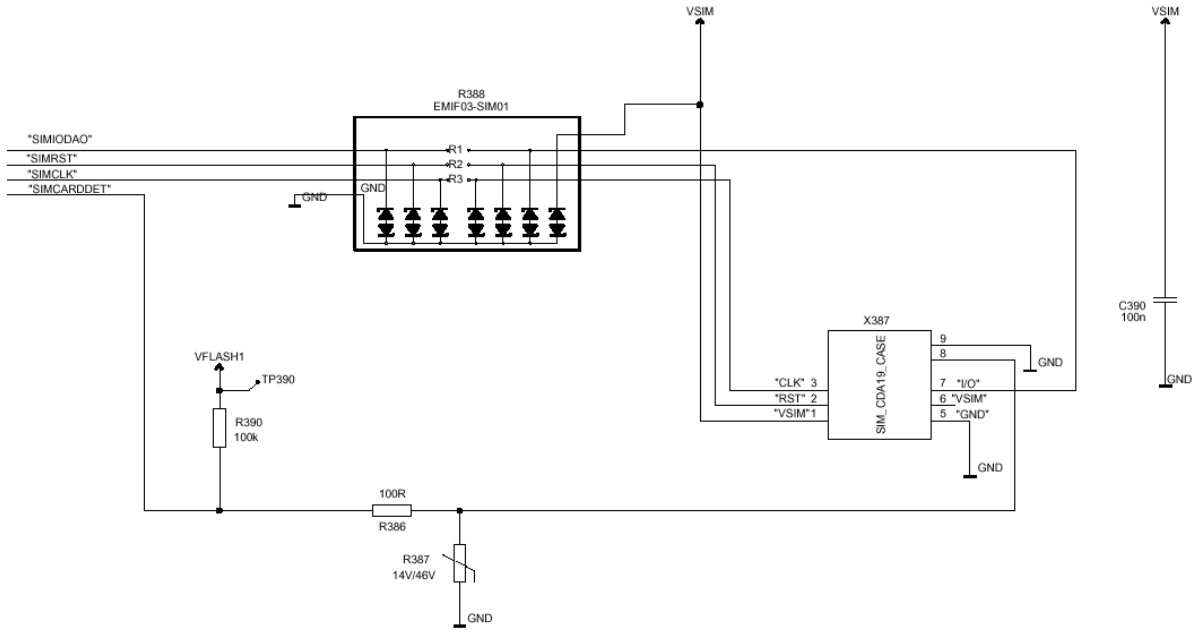
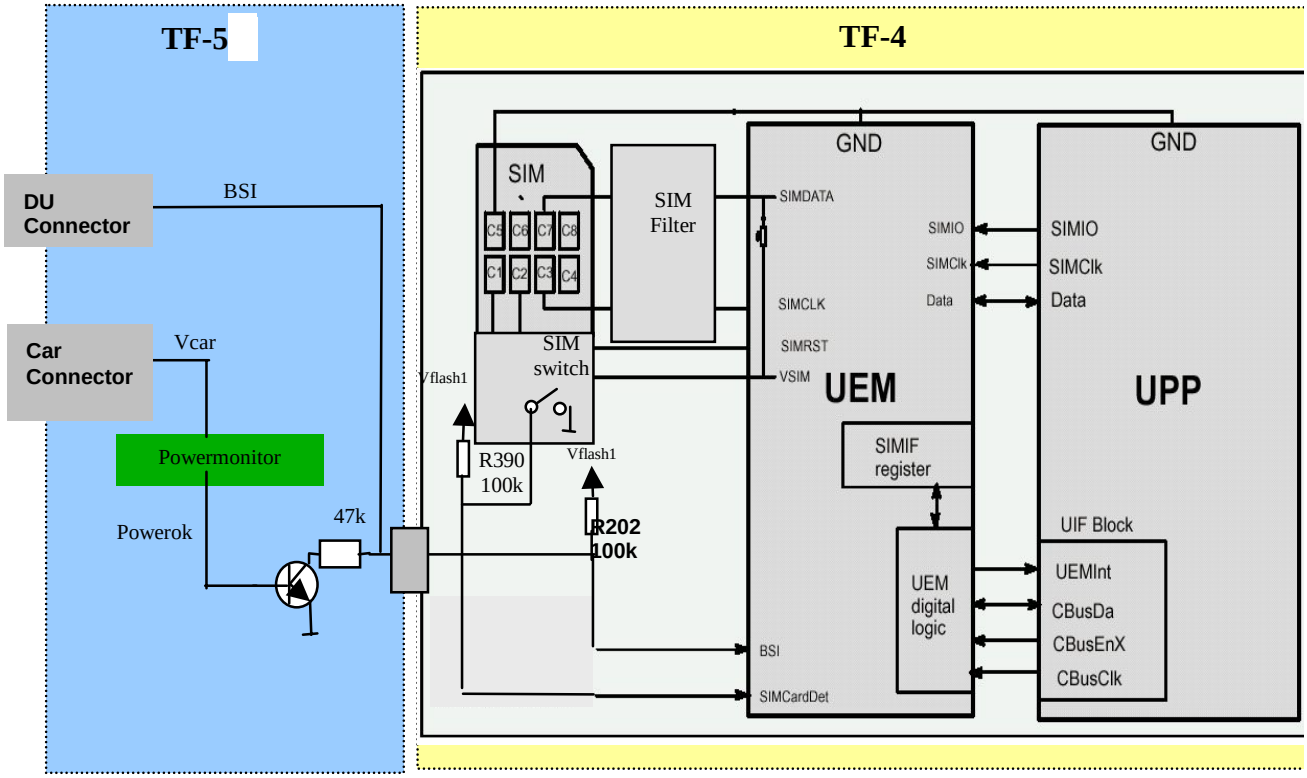


Figure 9: Nokia 610/616 specific SIM Realization



Within TFE-4/RV-1 there is a protection mechanism used to protect the Simcard when the car battery is out of range. The 47K pulldown resistor on BSI will be only activated when The car battery is in the right range. If not the BSI input of the UEM is driven against Vflash1 by R202 on the engineboard. In this case the SIM card is disabled imme-

diately.

Slow AD-Concept

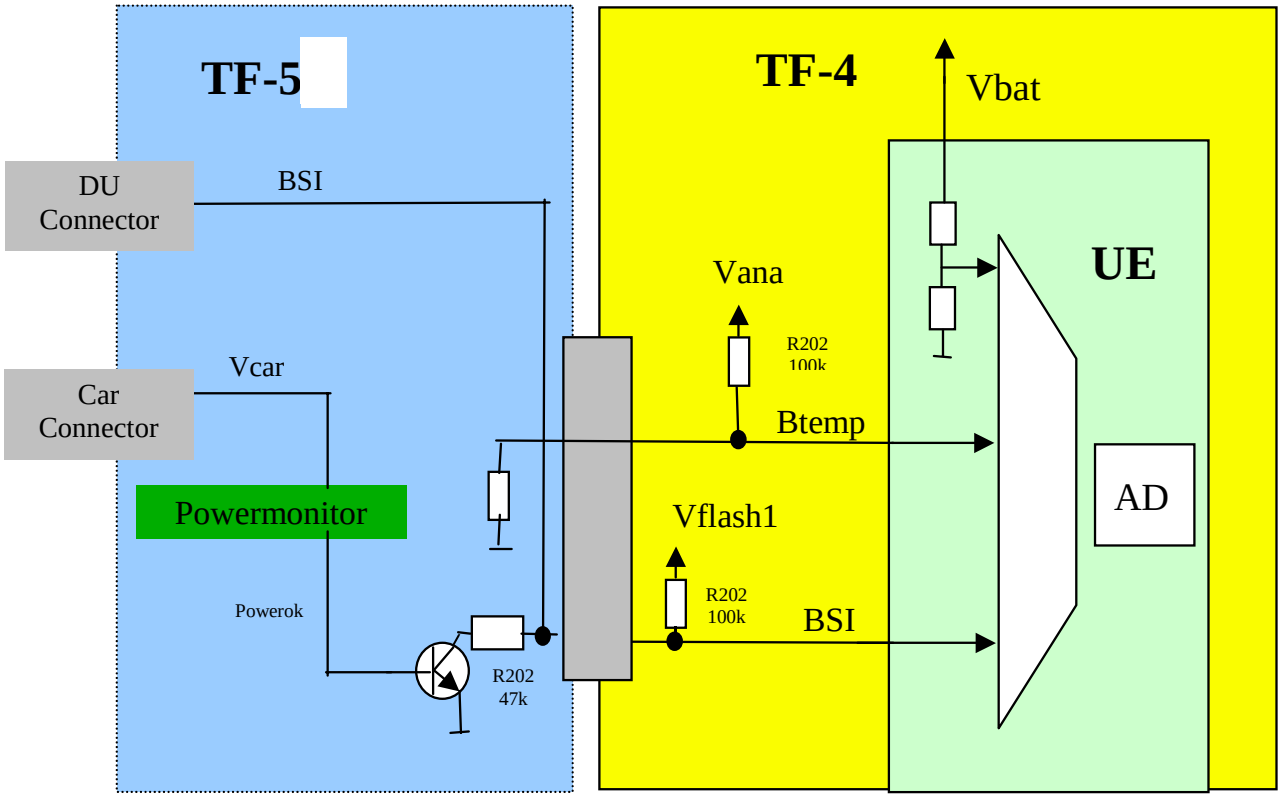
In TFE-4/RV-1 the Slow ADCs of the UEM are only used for general status information for which only low accuracy is needed. By this reason no calibration of the slow ADCs is needed and by this reason the regarding calibration menu of phoenix is deactivated. Only three AD-Converters of the UEM are activated on TFE-4/RV-1 (which can be read out by the phoenix ADC-Readings) those are used in following way:

VBAT: this voltage monitors the voltage level of the TF-4 power supply, which is applied, via the power-b2b connectors.

Btemp: there is a fixed resistor 47k mounted on TF-5 junction board. This in combination with the 100kR pull-up-resistor will result in a BTEMP reading of typically 25°C (±3°C)

BSI: this input is used to monitor if the car battery voltage is in right level or to start the TFE-4/RV-1 in local mode. There are three ranges BSI input can have:

BSI Resistor Range	Resulting operation mode
0..10kR:	TFE-4/RV-1 will start in local mode when external resistor of <10k is applied before car battery/ignition is activated
10kR-100kR (47kR typically):	This is the normal operating mode
>100kR :	The car battery has wrong range; by this the BSI resistor of 47kR is not connected to ground. Due to that the phone software can detect that the car battery is not in the right range. This is used to disable Simcard for protection purposes.



Memory description

The TF4 baseband consists of 64Mbit (8MB) external flash memory. Access to the flash is performed as 16-bit access in order to improve the data rate on the bus.

The purpose of the memory interface is to reduce the amount of connections by multiplexing the address and data bus on to the same signals. If the memory address space is more than 16 bits, which is the case, then 16-bit data can be multiplexed on the address inputs. This requires the memory to store the address during the first cycle in the access as described in Figure 10.

In addition to this, the system provides a Power Save signal (PS), which is used to reduce the switching on the external bus between the memory and the UPP. In case of writing to the flash, the UPP provides the information on the PS signal, and in case data is read from the flash, the memory provides the status of the PS signal. The PS signal is used to indicate if data should be inverted at the receiver end. If PS = "1" the data shall be inverted at the receiver end before it is stored/processed. The PS-signal will be described more in details in section Power saving signal (PS).

Furthermore the memory is capable of handle burst-mode (multiplexed address/data-bus) and memory blocking, which is controlled by the UPP.

Read cycle.

The read cycle is initiated by first applying the address to the multiplexed address/data-bus. The address is latched at the rising edge of the AVD-signal. The memory device cap-

tures the address/data bus-state at point B. The captured data is compared on a bit by bit base (MSB–MSB, LSB–LSB), with the data inside memory. If the comparison shows more equal bits than unequal bits, the data is not inverted before it is send out on the address/ data bus as output data. The result of the comparison is indicated, by using the PS signal before the data is read (at point C) by the Bus Controller. This allows the receiving device to invert the data before it is read into a register. The valid PS signal needs to be available in advance before the actual read operation takes place.

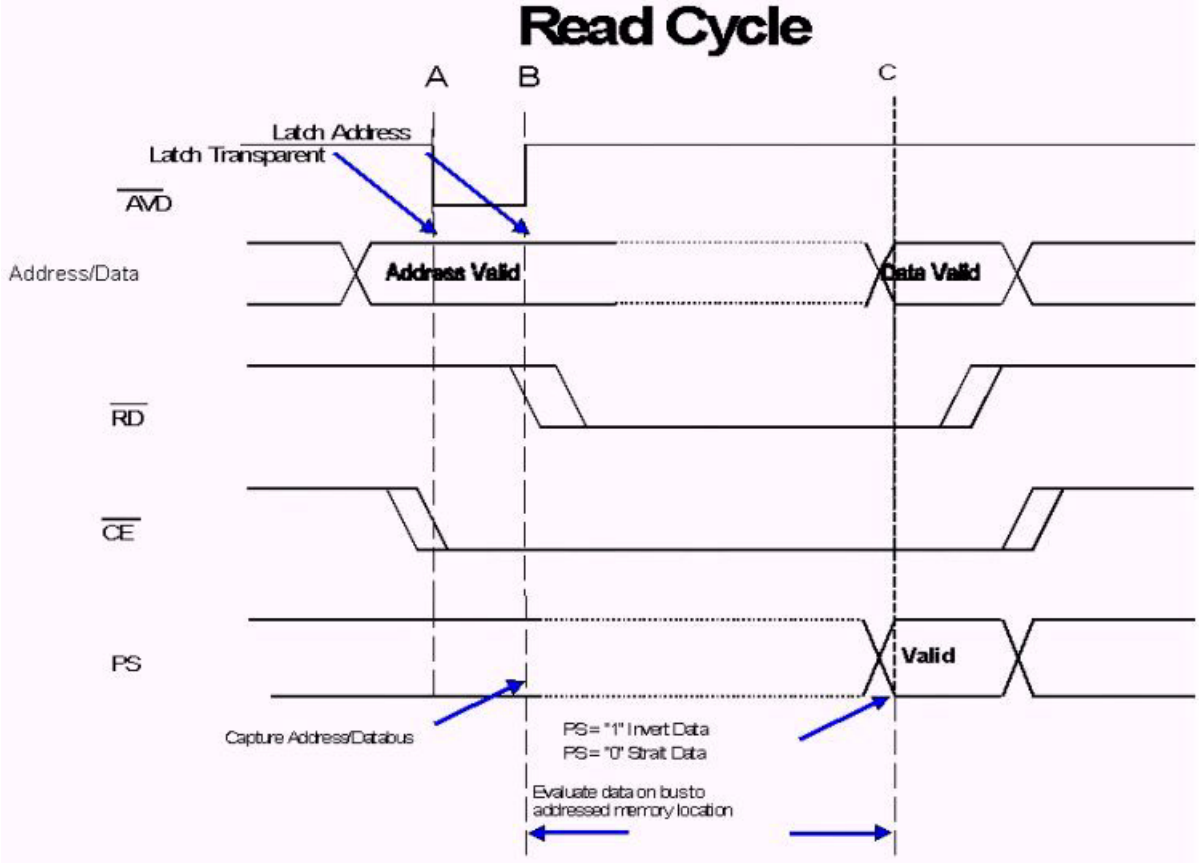


Figure 10: Basic reading (Random access)

Write cycle.

The write cycle is initiated by first applying the address to the multiplexed address/data bus and to the address lines Axx-A16, (Axx is the MSB address for that memory density). The address latch is transparent from A to B. The address is latched at the rising edge of the AVD signal. Latching address Axx-A16 is mandatory. The random access time is measured from a stable address, falling-edge of AVD or falling-edge of CE which ever occurs last. No clock is provided for a random access. The below figure shows a basic write waveform.

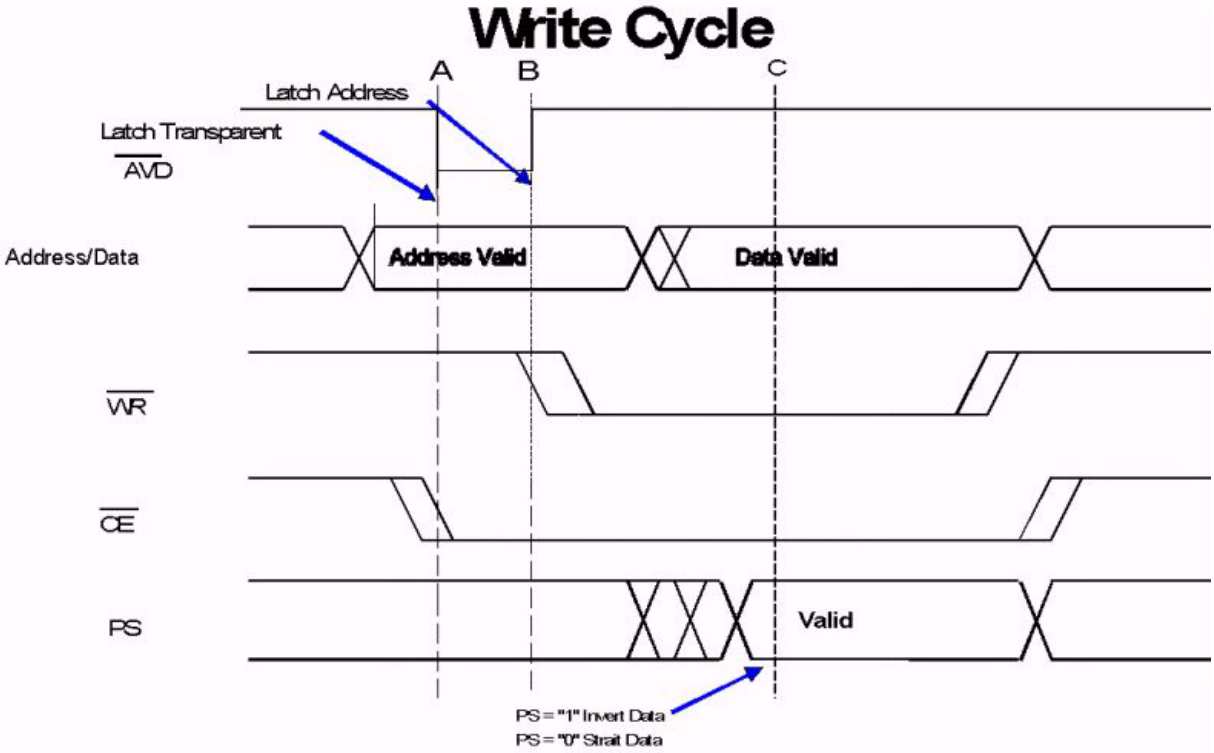


Figure 11: Write Cycle to Flash

Power saving signal (PS).

In order to reduce the power consumption on the bus a Power Save function is introduced. This function reduces the amount of switching on the external bus. Power is consumed in a digital system when a signal changes state. The power is consumed when the capacitive load is either charged or discharged. The capacitive load is introduced by the interconnection itself and of cause by the input at the receiving device. Internally in digital circuits the capacitive load is lower, than at the interconnect level at the printed circuit board. Therefore it is an advantage if the amount of changes on the external interconnection, i.e. between two digital circuits, can be minimized. Therefore on a wide bus like an address/data bus in a microprocessor system, power is saved, if the data to be transmitted on the external bus, causes a minimum amount of transitions. This can be achieved by comparing the previously data on the bus, with the data to be transmitted, and *if* inverting the data to be transmitted causes less transitions to be performed on the external bus, the data is inverted, before it is output on the data bus. To inform that the data is inverted, a control signal is used to inform the receiving device, that the data must be inverted before any further processing. Data on the address/data bus is bit wise compared which means that the data previously on D0 (D0e) is compared with the new data to be output on D0 (D0i). If the two data elements are the same (D0e=D0i) a logic "0" is indicated to the comparing device. If the two data elements are not the same (D0e=NOT(D0i)) a logic "1" is indicated to the comparing device. If there are more equal signal than unequal signals on the address/data bus, the new data is not inverted before it is sent out on the bus. If there are more unequal than equal data on the address/data bus, the data is inverted before it is sent out on the bus. The status whether the data that is presented on the address/data bus is inverted or not, is indicated by a separate signal

to the memory device. If the data on the bus is not inverted this power control signal (PS), is at logic "0" state. If the data that is presented on the bus is inverted, this is indicated by PS = logic "1". This PS signal is a common signal for all the devices connected to the address/memory bus. The transmitting device uses the PS signal to indicate non-inverted or inverted data. As only one device at a time, can present data on the address/data bus, this signal is shared and only one additional control signal PS is needed for the address/data bus, although the data bus may be connected to several devices. The below figure shows how this PS-signal actually works.

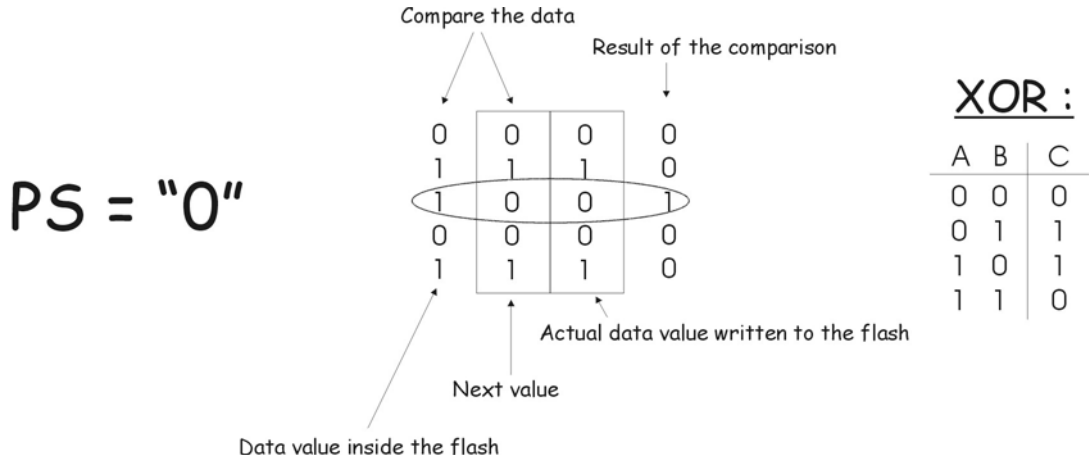


Figure 12: Truth Table for PS=0

The data is compared by using an XOR-function. The result can be seen above. In Figure 12 there is more equal bits than unequal bits, so therefor the data is not inverted before it is sent out to the flash. This means that the PS-signal is "0". The next scenario shows the opposite situation.

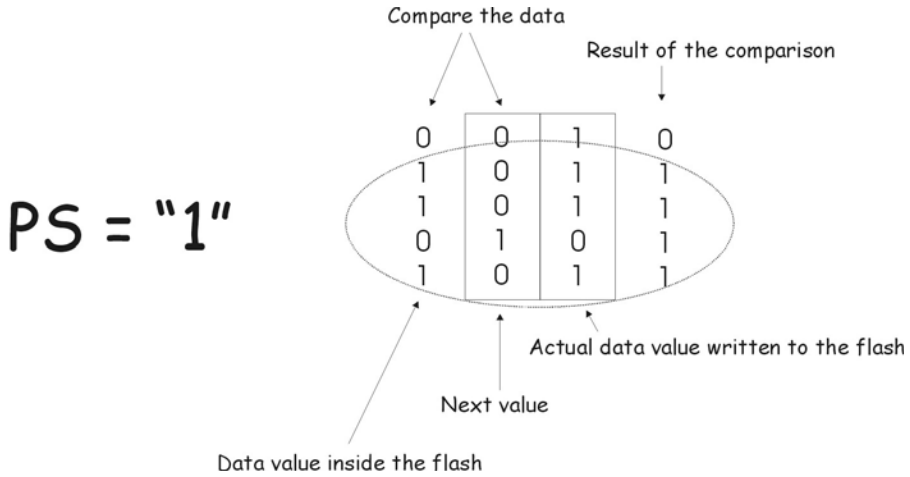


Figure 13: Truth Table for PS=1

The comparison shows more unequal bits than equal bits, and the bits are inverted on the bus.

The power save (PS) function is only active in burst mode due to delay in the readings (Random access). If it were used in random access, it would have introduced a delay of 10 – 15 ns. The PS is not activated in the first access in the burst, only from the second access in the burst.

In particular in burst mode it is important to keep the performance. In order to reduce complexity in the memory, the power save function does not apply to the address. This means that the address will always be presented in its true value. This means that the memory do not have to manage the inversion of the address. In case of burst access it is possible to reduce the power on the external bus by comparing the contents of the data in the burst, not with the data on the bus. This results in that the random access data is presented on the bus, as such but the following data in the burst is presented using the power save function. By pipelining the power save information in this manner the additional delay caused by the comparison logic is removed.

Memory block.

The memory or flash is organized in four Banks, A, B, C and D. Bank A and B each contain eight 8 Kword sectors and thirty-one 32 Kword sectors. Bank C and D each contain thirty-two 32 Kword sectors. The total sector Architecture is eight 8 Kword sectors and one hundred twenty-six 32 Kword sectors.

Block locking.

To prevent accidental writings to some of the sectors in the flash, block locking has to be used. This can, depending on the vendor, bee implemented by using different methods. AMD and Intel are the to only vendors that Triton is going to use for the flash purpose. AMD and Intel will implement their block locking in the following way.

Intel: The locking scheme offers two levels of protection. The first allows software-only control of block locking (useful for frequently changed data blocks) while the second requires hardware interaction before locking can be changed (protects infrequently changed code blocks). For this purpose, a dedicated pin called WP is used. The WP-pin or signal is only controlled by the hardware.

Lock block:

The blocks' default power-up or reset status is locked. Locked blocks are fully protected from alteration. Attempted program or erase operations to a locked block will return an error in a status register inside the flash. A locked block's status can be changed to unlocked or lock-down using the appropriate software commands. Writing the "Lock block command" sequence can lock an unlocked block.

Unlock block:

Unlocked blocks can be programmed or erased. All unlocked blocks return to the locked state when the phone is or powered down. An unlocked block's status can be changed to the locked or locked-down state using the appropriate software commands. A locked block can be unlocked by writing a "unlock block command" sequence, if the block is not locked-down.

Lock-down block.

Locked-down blocks are protected from program and erase operations (just like locked blocks), but software commands alone cannot change their protection status. A locked-down block can only be unlocked when the WP-signal is high. When the WP-signal goes low, all locked-down blocks revert to locked. A locked or unlocked block can be locked-down by writing a "Lock-Down Block command" sequence. Locked-down blocks revert to the locked state at device reset or power-down.

AMD: All blocks have a locking latch and upon power up all blocks are locked. To unlock a block a command sequence must be written, once the command unlock sequence is written the SW can unlock as many blocks as required by entering the block address while keeping a specific address high. If the address is taken to low, the block will be locked instead of unlocked. The SW locking is similar to the Intel SW locking.

The AMD flash does also have the same hardware lock as Intel. The signal or pin is called WP (write protect). The blocks are locked if WP is set to low. If the WP-signal is set high then the SW can control the locking of the blocks. Finally, if the VPP pin is set to low all blocks are locked.

Read While Write (RWW).

The device is capable of reading data from one Bank of the memory while programming or erasing in the other Bank of the memory. An erase operation may also be suspend to read from or program to another location within the same Bank (except the sector being erased).

Burst mode.

The flash device supports burst-mode. The purpose is to improve the date rate between the flash and the UPP. The burst-mode can only be used for read operations. It is possible to access the memory in burst-mode over the entire memory except for the 8 x 8 Kbytes sectors. When using burst-mode at least 4 word (4*16bits) is read from the flash. A read operation from the flash, normally first set-up the address, and then the UPP will get the data from this particular address. The address has to be set-up or sent to the flash ever time the UPP wants to read from the flash. By using burst-mode the address only needs to be sent one time, then flash will keep sending data as long as there is a clock-signal.

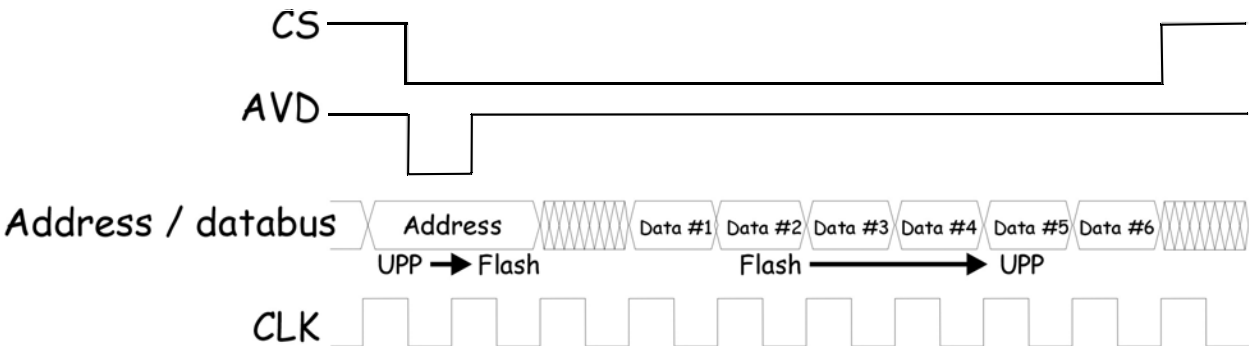


Figure 14: Description of Burst-Mode access

Burst-mode reading from the flash. Note that the address only is sent ones. The flash keeps sending data to the UPP as long as the CS-signal and CLK are valid.

Absolute maximum ratings (AMD 64Mbit).

Table 4: Absolute maximum ratings for AMD 64 Mbit

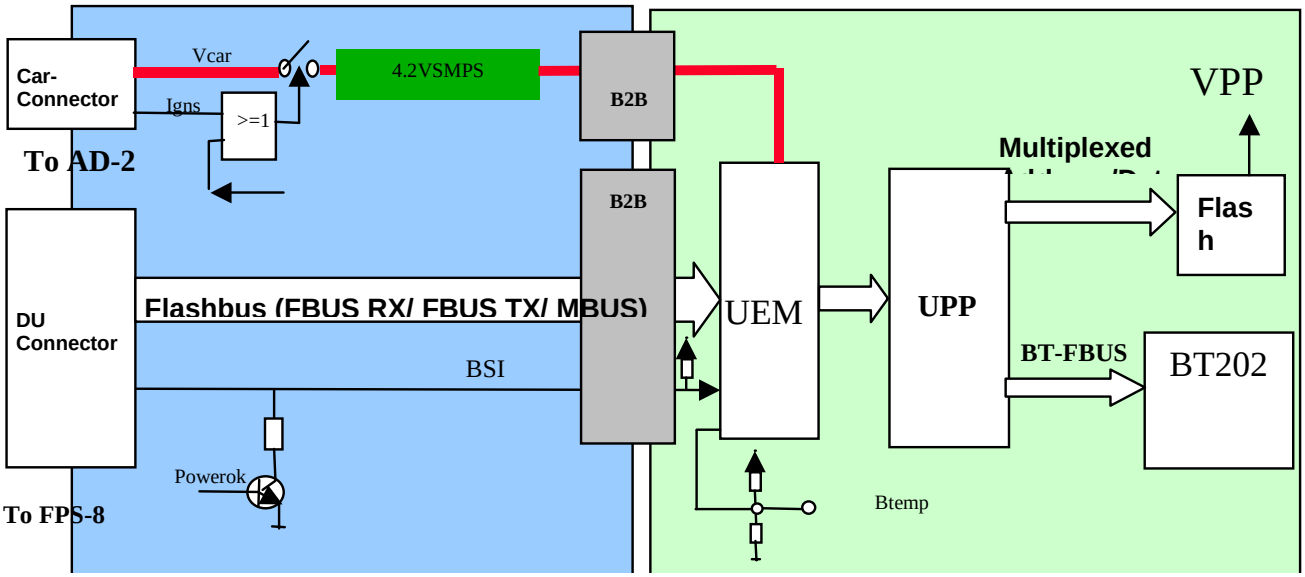
Parameter	Rating	Remarks
Supply voltage (V_{cc}) (operational voltage is: 1.7 –1.9)	-0,5 V to +4,0 Volt	*Minimum DC voltage on input or I/O pins is -0.5 V*
VPP and RESET	-0.5 V to +12.5 Volt	*Minimum DC input voltage on pins VPP, and RESET is -0.5 V*
Output Short Circuit Current	100 mA	*No more than one output may be shorted to ground at a time. Duration of the short circuit should not be greater than one second.*
Voltage with Respect to Ground. All pins except VPP and RESET	0.5 V to V_{cc} + 0.5 Volt	*Minimum DC voltage on input or I/O pins is -0.5 V*

Absolute maximum ratings (INTEL 64Mbit).

Table 5: Absolute maximum ratings for INTEL 64 Mbit

Parameter	Rating	Remarks
Voltage on any pin (except Vpp, Vpp)	-0.5V to +2.45V	See reference for details
Vpp Voltage	-0.2V to +14V	
Vcc and Vccq	-0.2V to +2.45V	
Output short circuit current	100mA	

Flash programming.



For TFE-4/RV-1 SW update is possible by using TFE-4/RV-1 specific Flash cable, which can be connected at one side to the display unit connector and with the other side to the FLS-4S or FPS-8. Because FLS-4S and FPS-8 only support phone compatible output voltages an extra power supply for 12V is needed, and the AD-2 power adapter. To enable flashing the power test has to be disabled on the AD-2 and ignition switch has to be active. With FPS-8 (when flashcable is connected properly) and active radio unit can be seen when MBUS LED is off. When power supply is switched off (or power connector is disconnected) the MBUS light of FPS-8 will lighten. Unfortunately this cannot be detected by FLS-4S.

In some cases a slow blinking MBUS LED can be seen, generally this can be ignored but this shows that there is a major bug within the phone memory. But even in this case flashing can be initiated in normal way, just by choosing the TFE-4/RV-1 product within TSS software and starting flashing.

The complete Flashbus including BSI-Line is directed via the TF5R PWB to the system Bord-2-Bord connector and the phone PWB will get power via the power bord2bord connectors. The actual programming is indicated to the UPP by using the MBUS_RX signal between the UPP and the UEM. The MBUS signal from the UEM to the flash prommer (FPS8 box) is used as clock for the synchronous communication. The flash prommer keeps the MBUS line low during UPP boot, to indicate that the flash prommer is connected. If the UPP MBUS_RX signal is low on UPP, the MCU enters flash programming mode. If the signal is high, the MCU starts loading software from the flash.

The VPP is not directed outside to connectors, so this option only can be used with MJ-1, when the production testpattern of TF-4 is accessible.

Flash concept on TF-4

Like all DCT-4 products, the TF4 Engine PWB thee MCU only waits a specified time. In order to avoid accidental entry to the "flash programming mode", to get input data from the flash prommer. If the timer expires without any data being received, the MCU will continue the boot sequence. The MBUS signal from UEM to the external connection is used as clock during flash programming. This means that flash-programming clock is supplied to the UPP on the MBUS_RX signal. The flash prommer indicates to the UEM that flash programming/reprogramming by writing an 8-bit password to the UEM. The data is transmitted on the FBUS_RX line and the UEM clocks the data on the FBUS_RX line into a shift register. When the 8-bits have been shifted in the register, the FPS8-box generates a falling-edge on the BSI line. This loads the shift register content in the UEM into a compare register. These 8-bits will be compared in a register to see if they match the "secret" default value inside the UEM. At this point the flash prommer must pull the MBUS signal to UEM low, in order to indicate to the MCU that the flash prommer is connected. The UEM reset-state machine performs a reset to the system (PURX low for 10–100 ms). The UEM "flash-programming mode" is valid until MCU sets a bit in the UEM register, which indicates the "end of flash programming". Setting this bit also clears the compare register in the UEM previously loaded, at the falling edge of the BSI signal. During the "flash-programming mode" the UEM watchdog is disabled. When the bit is set it indicates "end of flash programming" and it resets the UEM watchdog timer to it's default value. Clearing the flash programming bit also causes the UEM to generate a

reset to the UPP. The BSI signal is used to load the value into the compare register. In order to avoid spurious loading of the register, the BSI signal will be gated during UEM "master-reset", and during "power-on" when PURX is active. The BSI signal should not change state during normal operation unless the battery is extracted, in this case the BSI signal will be pulled high, note a falling edge is required to load the compare register.

MBus

The default data transmission speed of MBus is 9.6 kbit/s. during flash programming, UEM's digital section generates a "Flash mode" signal. This will set-up the MBus line so that it only can be used for input, and the clock signal from the prommer can be connected. When the FPS8 prommer box is connected to the MBus, the transmission speed is increased up to 6.5 Mbit/s. The data speed can be changed by the SW algorithm inside the box, but the maximum speed is 6.5 Mbit/s.

Table 6: MBus interface

Signal	Parameter	Min	Typ	Max	Unit
Mbus	V_{IH}	1.95	2.78	3.0	Volt
	V_{IL}	0	0.2	0.83	
	V_{OH}	1.95	2.78	2.83	
	V_{OL}	0	0.2	0.83	

FBUS

FBUS is an asynchronous data bus having separate TX and RX signals. Default bit rate of the bus is 115.2 Kbit/s. FBUS is mainly used for controlling the phone in the production and for interface to PC via DLR-3 or DAU-9P. Secondly, it can be used for flashing purpose after the production phase.

Table 7: FBUS interface

Signal	Parameter	Min	Typ	Max	Unit
FBUS_RX	V_{IH}	1.95	2.78	3.0	Volt
	V_{IL}	0	0.2	0.83	
FBUS_TX	V_{OH}	1.95	2.78	2.83	
	V_{OL}	0	0.2	0.83	

MCU Boot.

When the MCU boots, it looks for flash programming indication by reading the status on the MBUS signal. If this signal is pulled low the MCU sets up the UART in synchronous mode, and indicates to the flash prommer, by setting FBUS_TX low, that it is ready to accept the secondary boot-code. All flash programming related SW that is downloaded is done so to the UPP internal MCU SRAM. The MCU also ends up in "flash programming mode", if the contents of the flash is empty (reading FFH from the first memory location in the flash).

Flash Identifiers.

Due to that DCT4 supports many different manufacturers; NMP needs to have so called flash identifiers. The flash identifier tells the MCU which HW environment it is working in, and also block size and configuration of the flash.

First Word.

The word contains the information about the number of flash devices connected to the UPP. It is possible to setup the UPP so that it supports two devices. The MSB bit in the word indicates the amount of flash devices used by the baseband. The amount of wait states for the random access is specified over 3-bits in this word. The amount of wait states is specified related to the system clock used in that system. The MCU PLL factor is also specified in this word (2-bits).

Second Word.

This word contains information about flash sectors available for EEPROM emulation. If no RWW capability is indicated, this field then contains information of the serial EEPROM that is used in the system.

Third Word.

This word contains similar information as the first word but for the second flash if such is used.

Fourth Word.

This word contains information about the sector configuration of the second flash.

Fifth Word.

This word contains information of the external SRAM if it is available on the baseband, the size of it and the amount of wait states to be used when accessing it.

Audio

Within TFE-4/RV-1 the Audio signaling is realized as follows:

On the Phone Engine the Digital Signal Processor is within the UPP. It is linked to the Codec, that is inside of the UEM, via digital serial Audio-Bus.

There are two analog signals for Microphones and one signal for the speakers going out of the Codec, which will go over the Engine Audio Filter to the B2B connector. On the Junctionboard the Speaker amplifier is selected by the UPP-MCU pins HDMute or HFMute, which are also linked over the B2B connector.

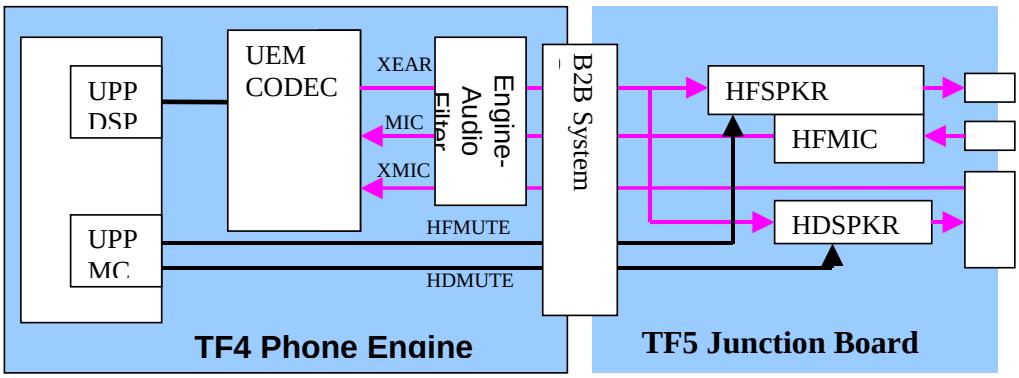


Figure 15: Block Diagram for TFE-1/RV-1 Audio Solution

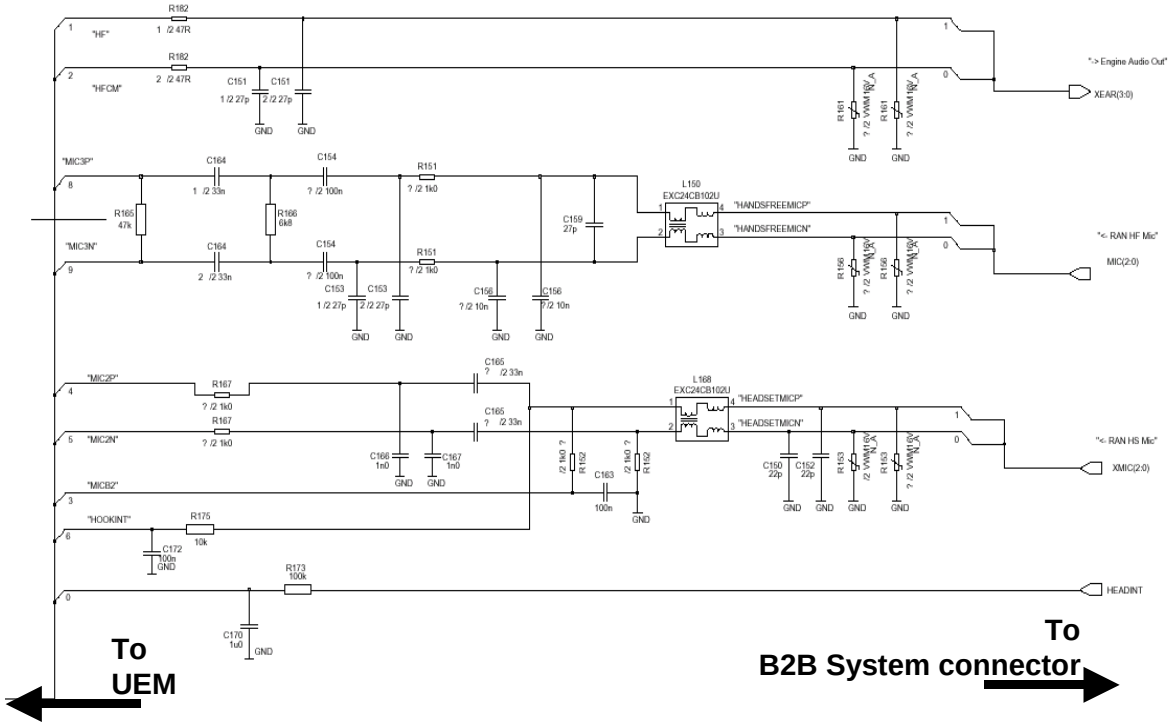


Figure 16: TFE-1/RV-1 specific realization of the Engine Audio filters

B2B-System connector

Block Diagram

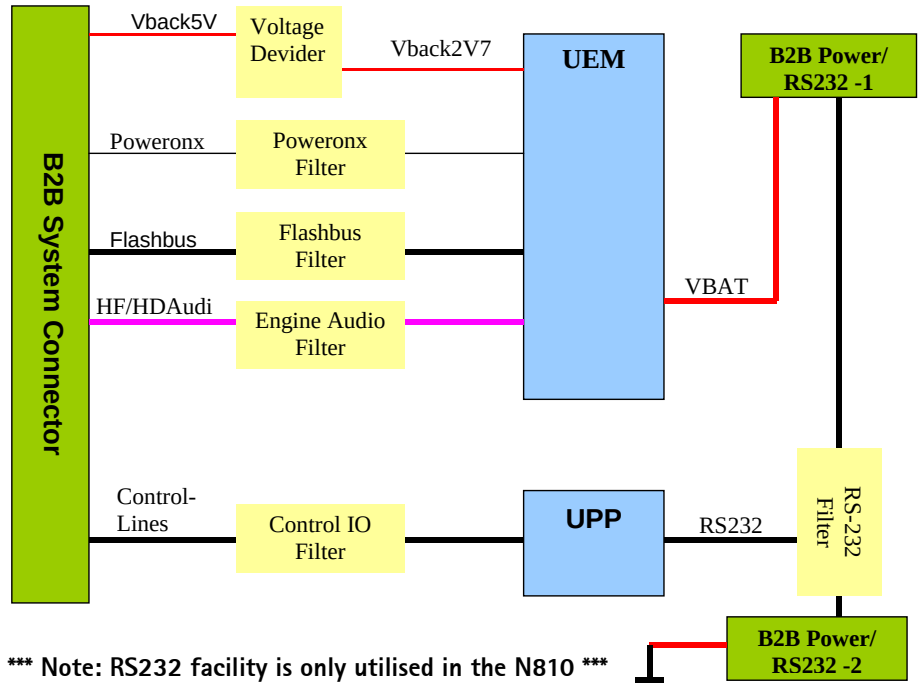
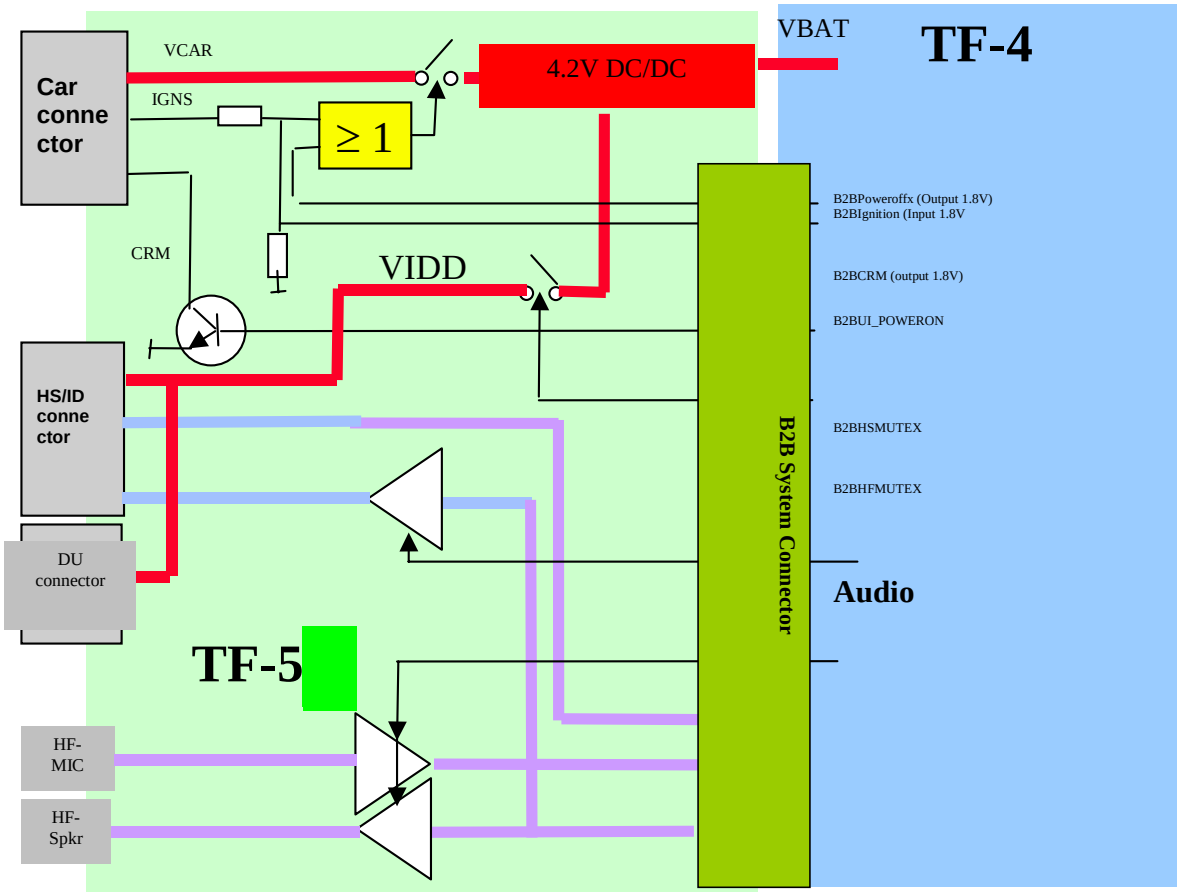


Figure 17: Block Diagram of B2B-Connection



HW Realization

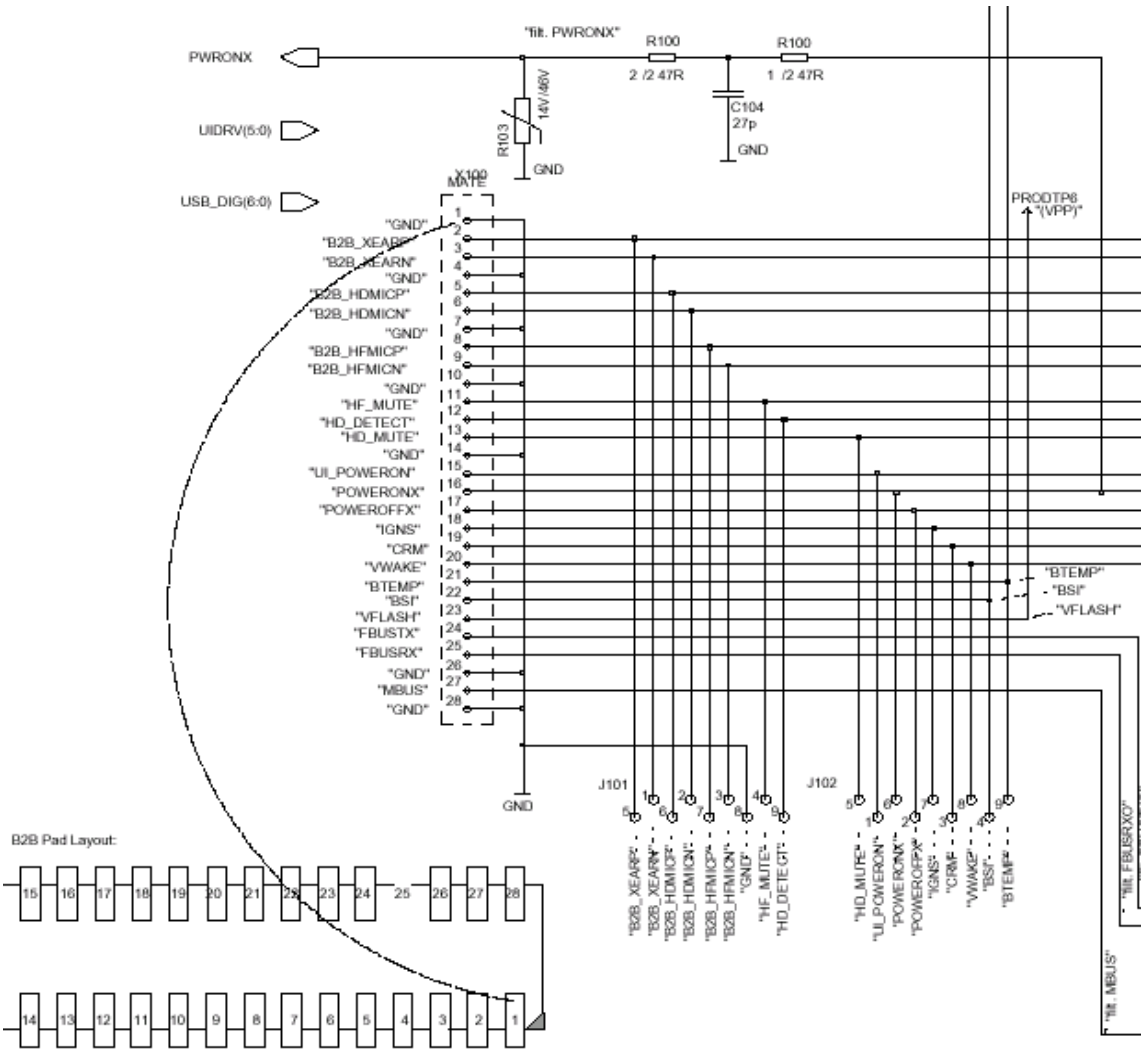


Figure 18: B2B System-Connector

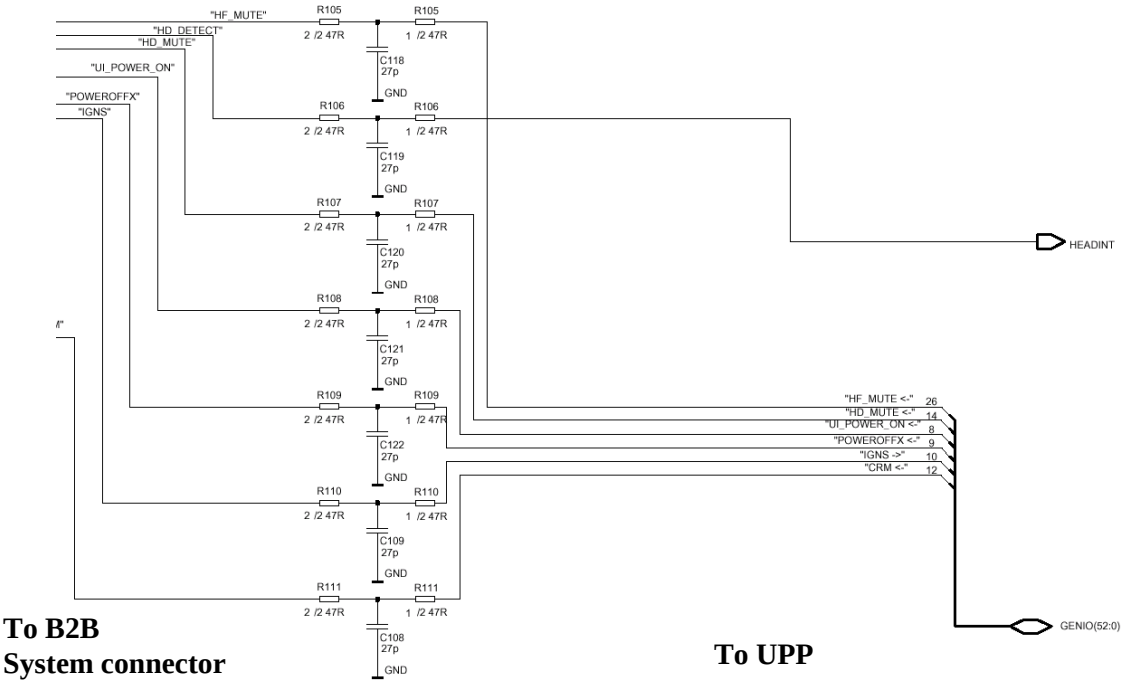


Figure 19: Realization of Control-IO Filter

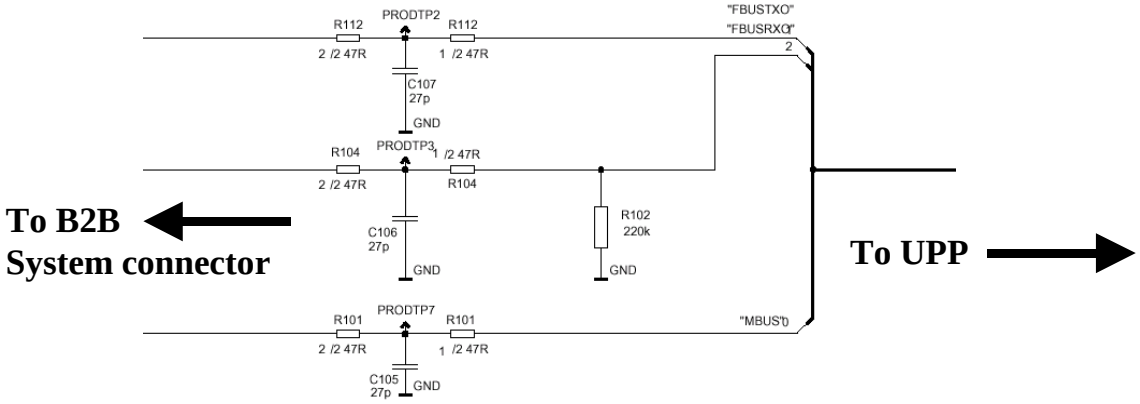


Figure 20: Realization of Flash Filter

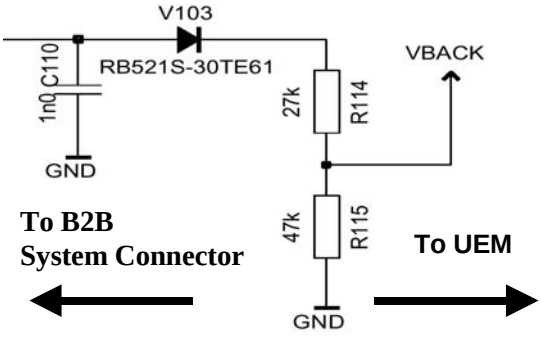


Figure 21: VBACK Voltage divider

Description of BB self tests

ST_EAR_DATA_LOOP_TEST

This function tests the connection of EarData and MicData signals between UPP and UEM. If there is no connection the result is ST_NO_SIGNAL. If there is short circuit the result is ST_SHORT_CIRCUIT.

If everything is OK the result is ST_OK.

ST_MBUS_RX_TX_LOOP_TEST

This function tests the connection of MBusTx and MBusRx signals between UPP and UEM. If everything is ok the result is ST_OK. If there is no connection the result is ST_NO_SIGNAL.

ST_SIM_CLK_LOOP_TEST

This function tests the connection of SimClk and SimIODa signals between UPP and UEM. This test requires also that SimIOCtrl signal can be set to high state. (See also st_sim_io_ctrl_loop_test.) If everything is OK the result is ST_OK. If there is no connection the result is ST_NO_SIGNAL. If there is short circuit the result is ST_SHORT_CIRCUIT.

ST_SIM_IO_CTRL_LOOP_TEST:

This function tests the connection of SimIOCtrl and SimIODa signals between UPP and UEM. This test requires also that SimClk signal state can be switched. (See also st_sim_clk_loop_test.) If everything is OK the result is ST_OK. If there is no connection the result is ST_NO_SIGNAL.

ST_SLEEP_X_LOOP_TEST

This function tests the connection of SleepX and SleepClk signals between UPP and UEM. UEM_V2 or later required. If everything is OK the result is ST_OK. If there is no connection the result is ST_NO_SIGNAL.

ST_TX_IDP_LOOP_TEST

This function tests the connection of TxIdp and RxIdp signals between UPP and UEM. UEM_V2 or later required. If everything is OK the result is ST_OK. If there is no connection the result is ST_NO_SIGNAL. If there is short circuit the result is ST_SHORT_CIRCUIT.

ST_TX_IQ_DP_LOOP_TEST

This function tests the connection of TxQdp and RxQdp signals between UPP and UEM. UEM_V2 or later required. If everything is OK the result is ST_OK. If there is no connection the result is ST_NO_SIGNAL. If there is short circuit the result is ST_SHORT_CIRCUIT.

ST_UPP_REGISTER_VER_TEST

This function compares the ASIC version to the compilation flag. Major ASIC version in UPP version register is compared against ASIC version compilation flag. If the version is correct the result is ST_OK. If the version is wrong the result is ST_FAIL.

ST_RF_CHIP_ID_TEST

This is the product specific selftest. Each product makes their own implementation. This test should check that the ID register on the RF Chip can be read and it contains reasonable value. Usually this is done by asking RF Chip ID from DSP. In short, this tests the RFBUS lines (data, clock, enable) between the UPP and RF part.

ST_WARRANTY_TEST

This function tests the Warranty Information State (WIS). If WIS is not WT_INFO_STATE_DEF the result is ST_OK. If WIS is WT_INFO_STATE_DEF the result is ST_FAIL.

ST_FLASH_CHECKSUM_TEST

This function calculates the checksum over flash ROM areas and checksum is compared to pre-calculated checksum in flash header. If checksums are same the result is ST_OK. If checksums are not same the result is ST_FAIL.

ST_UEM_CBUS_IF_TEST

This function tests that the connection to UEM via CBUS is working. First the value is written to UEM register and then it is read back. Then the written and read values are compared together. If the values are same, the result is ST_OK. If the values are not same, the result is ST_FAIL. So basically this tests the CBUS lines (data, clock, enable) between UEM and UPP.

ST_PPM_VALIDITY_TEST

This function shall test the PPM validity.

ST_UPP_REGISTER_VER_TEST

This function compares the Asic version to the compilation flag. Major Asic version in UPP version register is compared against Asic version compilation flag.

ST_BACKUP_BATT_TEST

This function tests if the backup battery was OK during power-up. This is the VWAKE Voltage provided by the Junctionboard and supported by System-B2B connector

ST_SIM_LOCK_TEST

This function shall test the SIM Lock.

ST_LPRF_AUDIO_LINES_TEST

Here the audio lines to the Bluetooth module shall be tested.

RF Troubleshooting

Abbreviations in fault finding charts

BB	Baseband
DCS/PCN	GSM1800
EGSM	Extended GSM900
ESD	Electro Static Discharge
GPRS	General Packed Radio Service
HSCSD	High Speed Circuit Switched Data
LO	Local Oscillator
PA	Power Amplifier
PWB	Printed Wired Board
PLL	Phase Locked Loop
RF	Radio Frequency
RX	Receiver
SA	Spectrum analyzer
TX	Transmitter
UHF	Ultra High Frequency
VCO	Voltage controlled oscillator
VHF	Very High Frequency

Introduction

Two types of measurements have to be done for repair of the phone boards:

- RF measurements shall be done using a Spectrum Analyzer together with a high-frequency probe. (Note, that signal will be significantly attenuated). Correct attenuation can be checked by using a "good" phone board, for example.
- LF (Low frequency) and DC measurements shall be done with a an oscilloscope together with an 10:1 probe.

Always make sure that the measurement set-up is calibrated when measuring RF parameters at the RF connector. Remember to include the correct losses in the module repair jig and the connecting cable when realigning the phone. **Most RF semiconductors are static discharge sensitive.** ESD protection must be taken into account during repair (ground straps and ESD soldering irons).

Rx calibration done via Phoenix software is temperature dependent because of calibration of 26 MHz reference oscillator (VCXO). According to Mjoelner specification ambient temperature has to be in a range from 22°C to 36°C.

Apart from key-components described in this document there are a lot of discrete components (resistors, inductors and capacitors) for which troubleshooting is done by checking if soldering of the component is done properly and checking if the component is missing from PWB. Capacitors can be checked for short-circuiting and resistors for value by means of an ohm-meter, but be aware in-circuit measurements should be evaluated carefully. In the following both, the name EGSM and EGSM900 will be used for the low

band. DCS or PCN and GSM1800 will be used for the high band.

RF Component placement

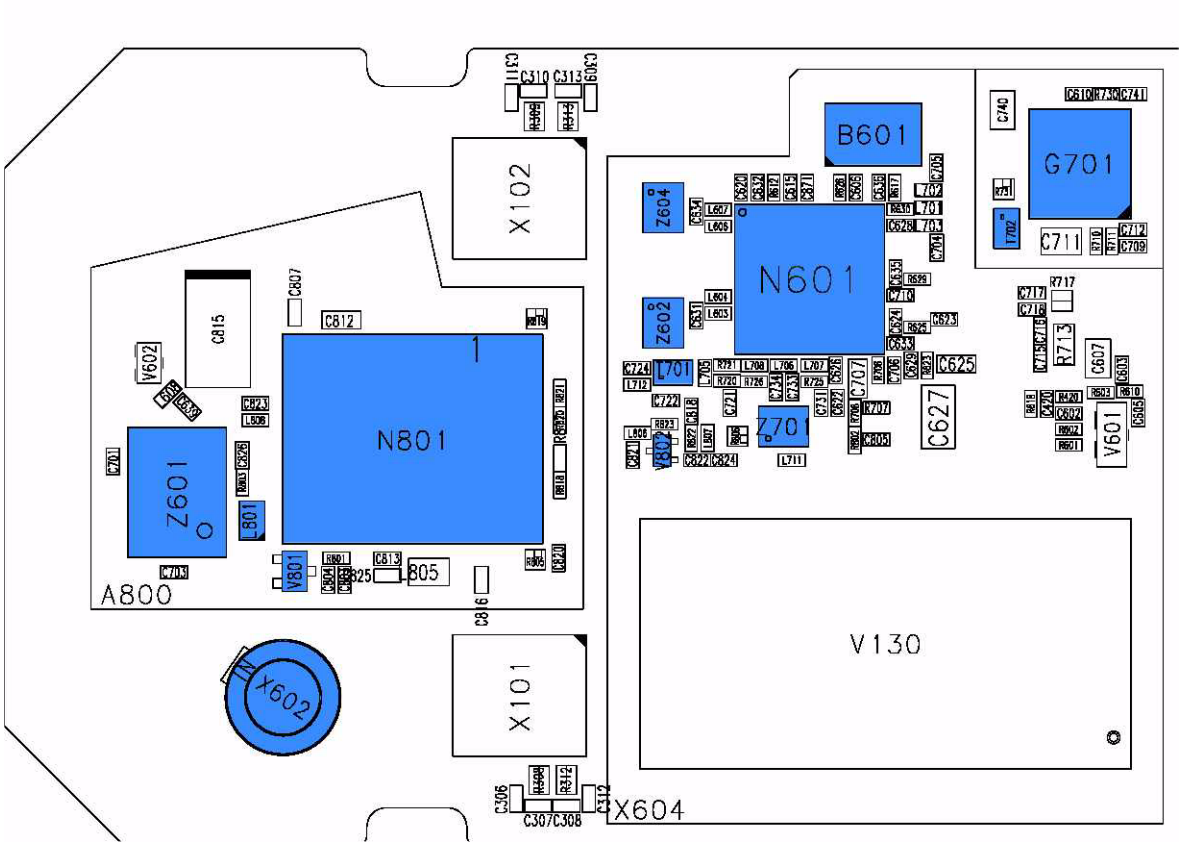


Figure 22: RF key components placement

Reference number	Name
N601	Mjoelner RF ASIC
B601	26 MHz Xtal
Z602	GSM1800 RX SAW
Z604	EGSM RX SAW filter
Z701	EGSM TX SAW filter
T701	GSM1800/GSM1900 TX Balun
V802	EGSM Pre-amplifier
G701	3.7 GHz VCO
T702	VCO Balun
X602	RF (Board to Board) Connector
L801	Directional Coupler
V801	Detector Diode
N801	Power Amplifier

RF Measurement points

RF Supply points

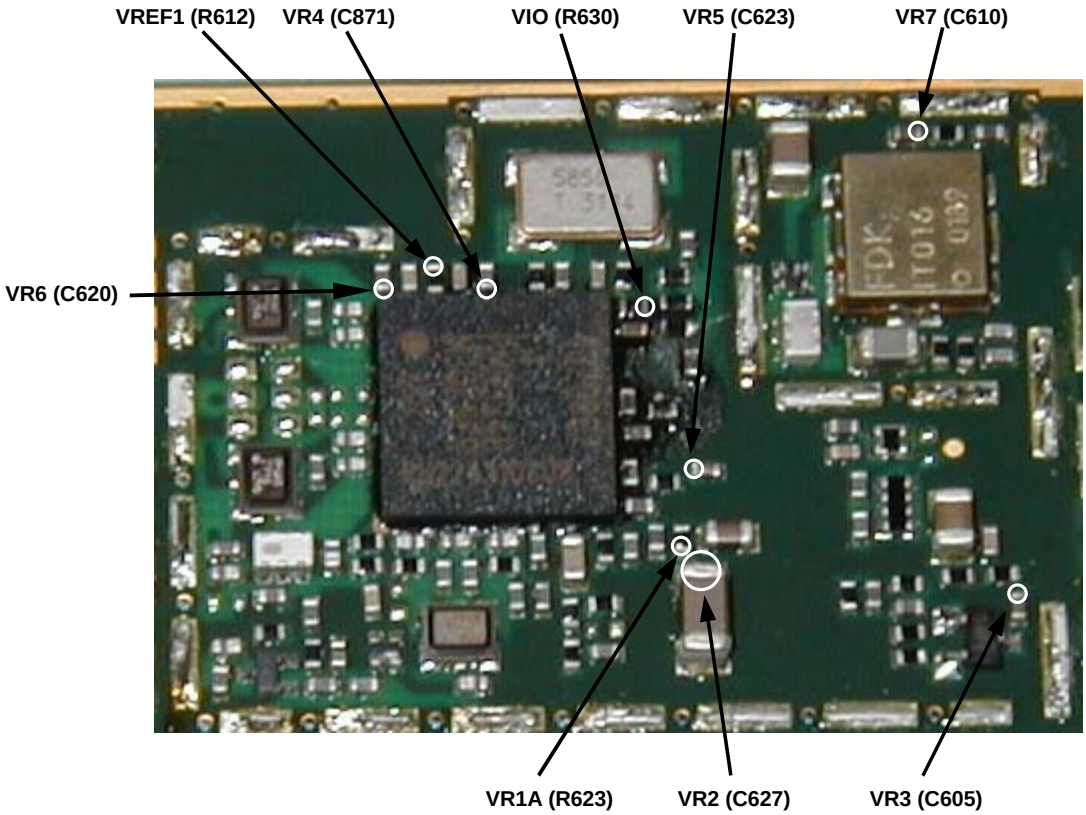


Figure 23: RF Supply points inside Mjoelner can

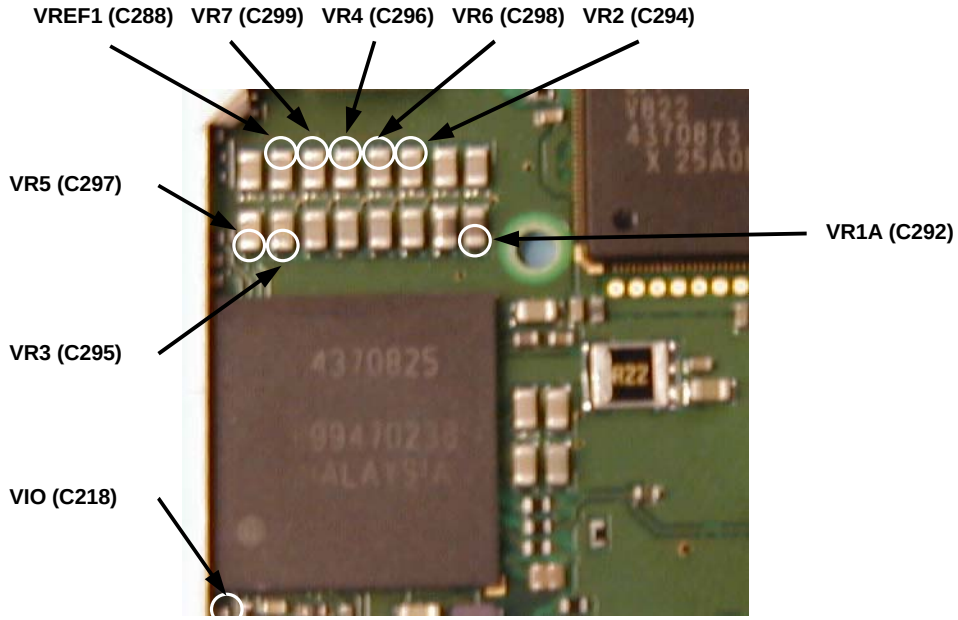


Figure 24: RF Supply points inside and can

RF power supplies are generated in the UEM and can be measured either in the Mjoelner can or in the baseband can. Circles mark the measurement points in the pictures. Measurement of VR7 inside Mjoelner can requires removal of RF shielding frame. Therefore, VR7 shall be measured inside base band can.

Measurement points in the receiver

Measurement points are shown in the pictures below.

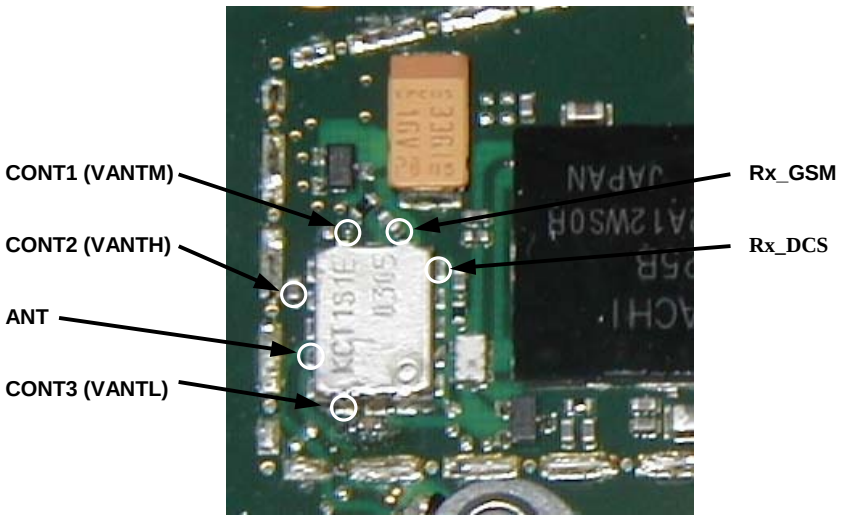


Figure 25: RX measurement points at antenna switch module

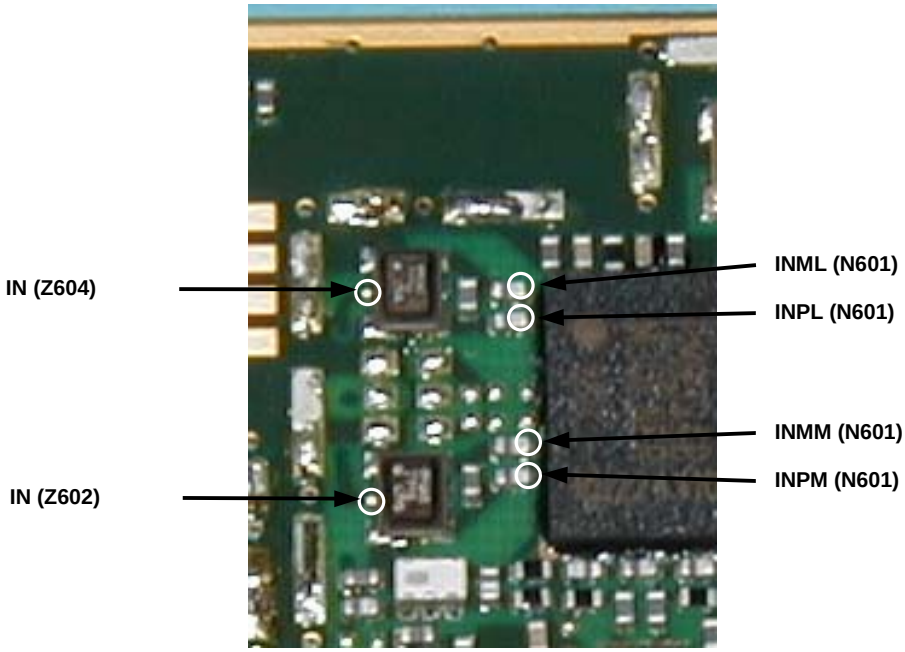


Figure 26: RX measurement points at RX SAW filters and Mjoelner RF ASIC

There are no specific test points to measure RX I/Q signals. If necessary, RXIINN and RXQINN signals can be measured by removing the solder resist on top of the vias. Shown in the following picture.

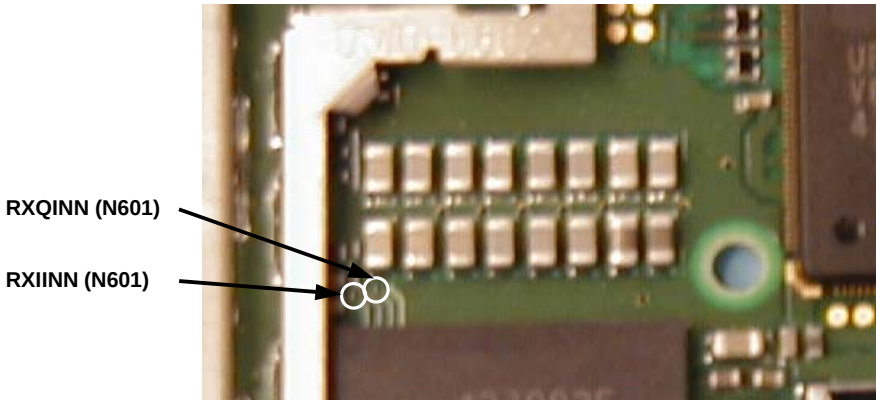


Figure 27: RX measurement points inside BB can (RXIINN, RXQINN)

Measurement points in the transmitter

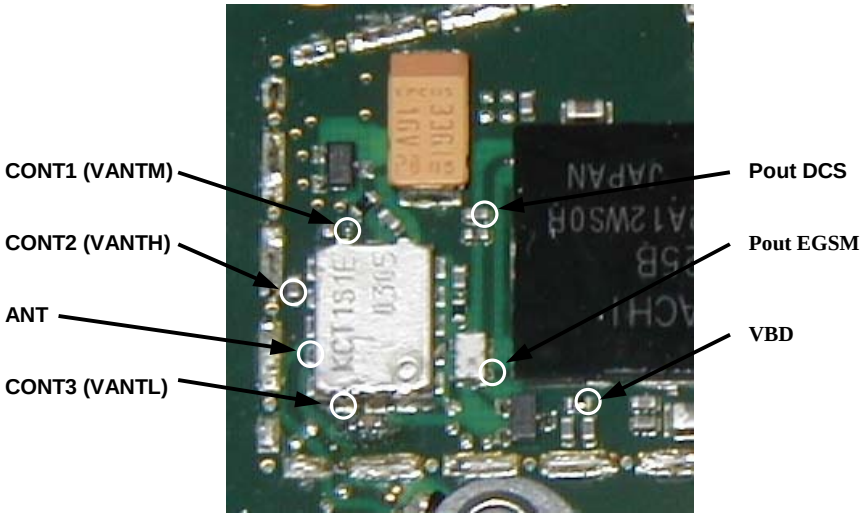


Figure 28: TX measurement points inside the PA can

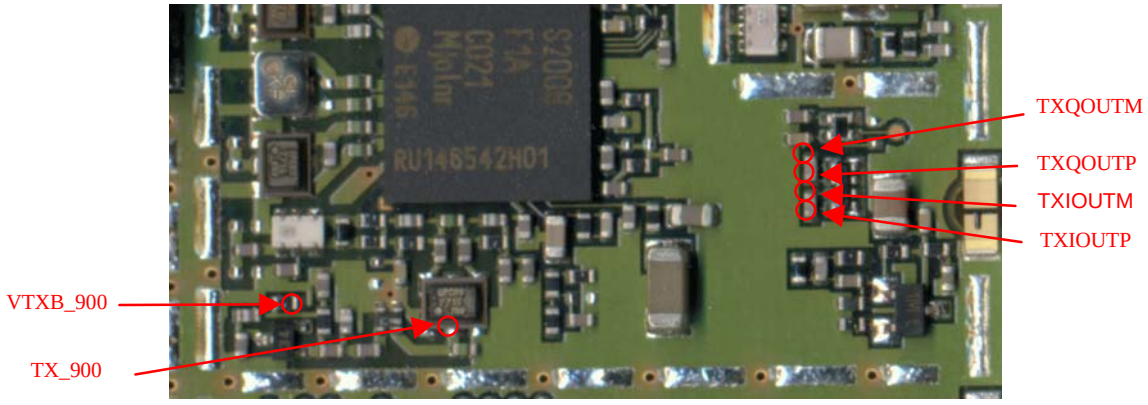


Figure 29: TX measurements points inside the Mjölner can

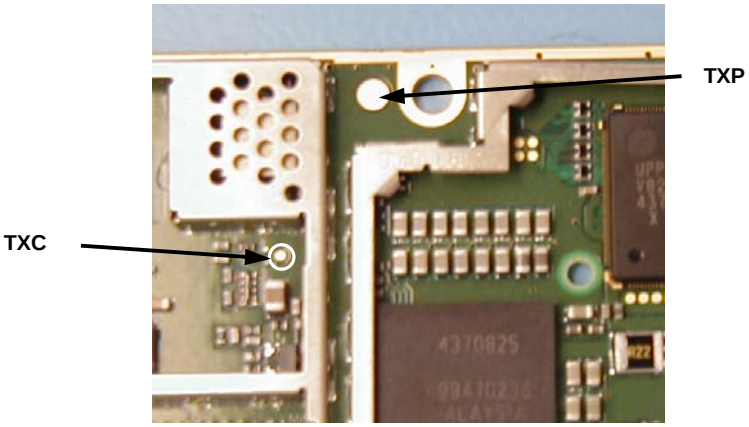


Figure 30: TX measurements points for TXC, TXP signals

RF in general

The RF part is a dual-band direct conversion transceiver. Using direct conversion no intermediate frequencies are used for up- or down- conversion.

The VCO is set to either twice or four times (depending on the band used) the wanted RX or TX frequency. The VCO frequency is divided by either 2 or 4 and fed to the mixers (down-conversion) or modulators (up-conversion). Up- or down- conversion is done in one step, directly between RF frequency and DC. All up and down-conversion takes place in the RF ASIC named Mjoelner (N601).

The Mjoelner RF ASIC also contains the PLL and LNAs for all used bands. A DC control section is responsible to power and/or control EGSM TX buffer, detector and antenna switch. The Mjoelner RF ASIC is controlled via a serial bus.

It contains an integrated VCXO which uses an external 26 MHz Xtal. No analogue AFC signal is needed. AFC is done via the serial interface of Mjoelner.

For the interface between Mjoelner RF ASIC and UPP and Bluetooth an 26 MHz reference clock is used. An external 26 MHz reference clock buffer is used to drive Bluetooth module.

The RF supports HSCSD (High Speed Circuit Switched Data) and GPRS (General Packed Radio Service), meaning multi-slot operation. This will not require special equipment or procedures in repair situations.

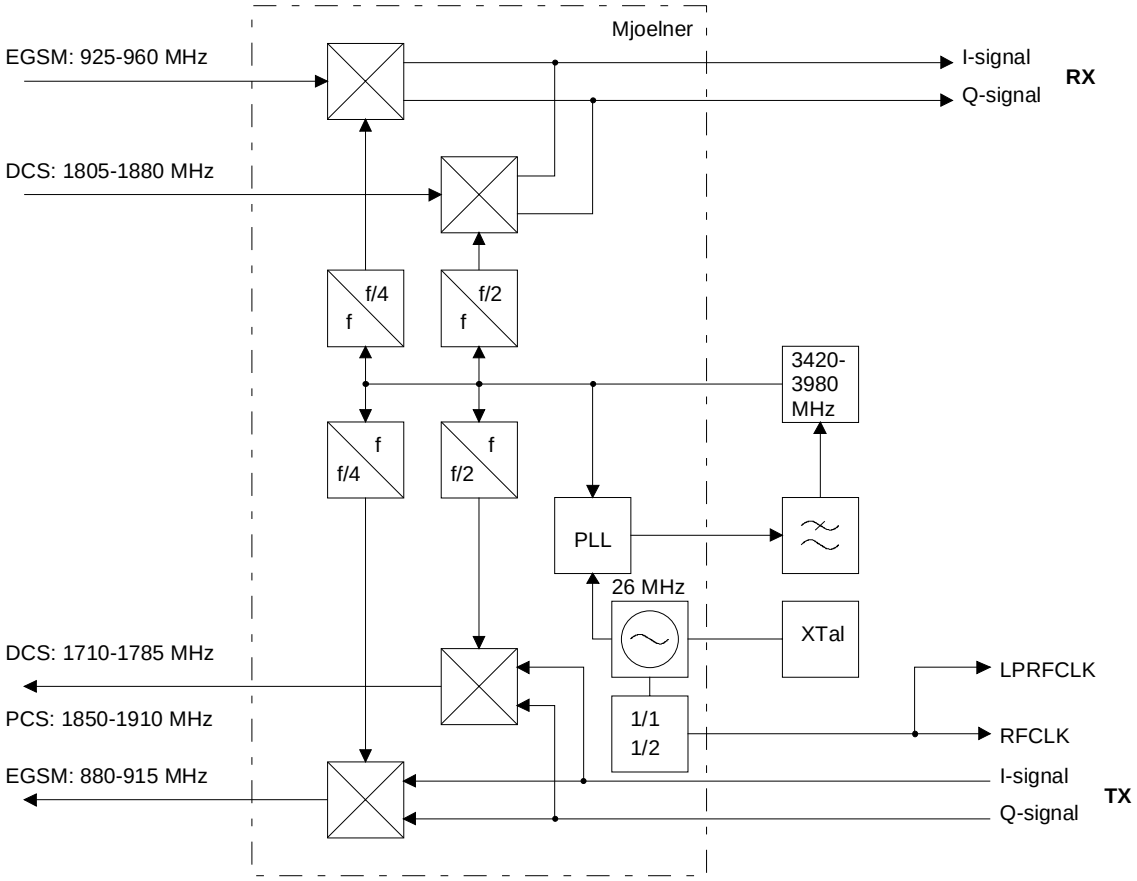


Figure 31: RF frequency plan

On next page the RF block diagram is shown. Voltage supplies are marked with dotted lines.

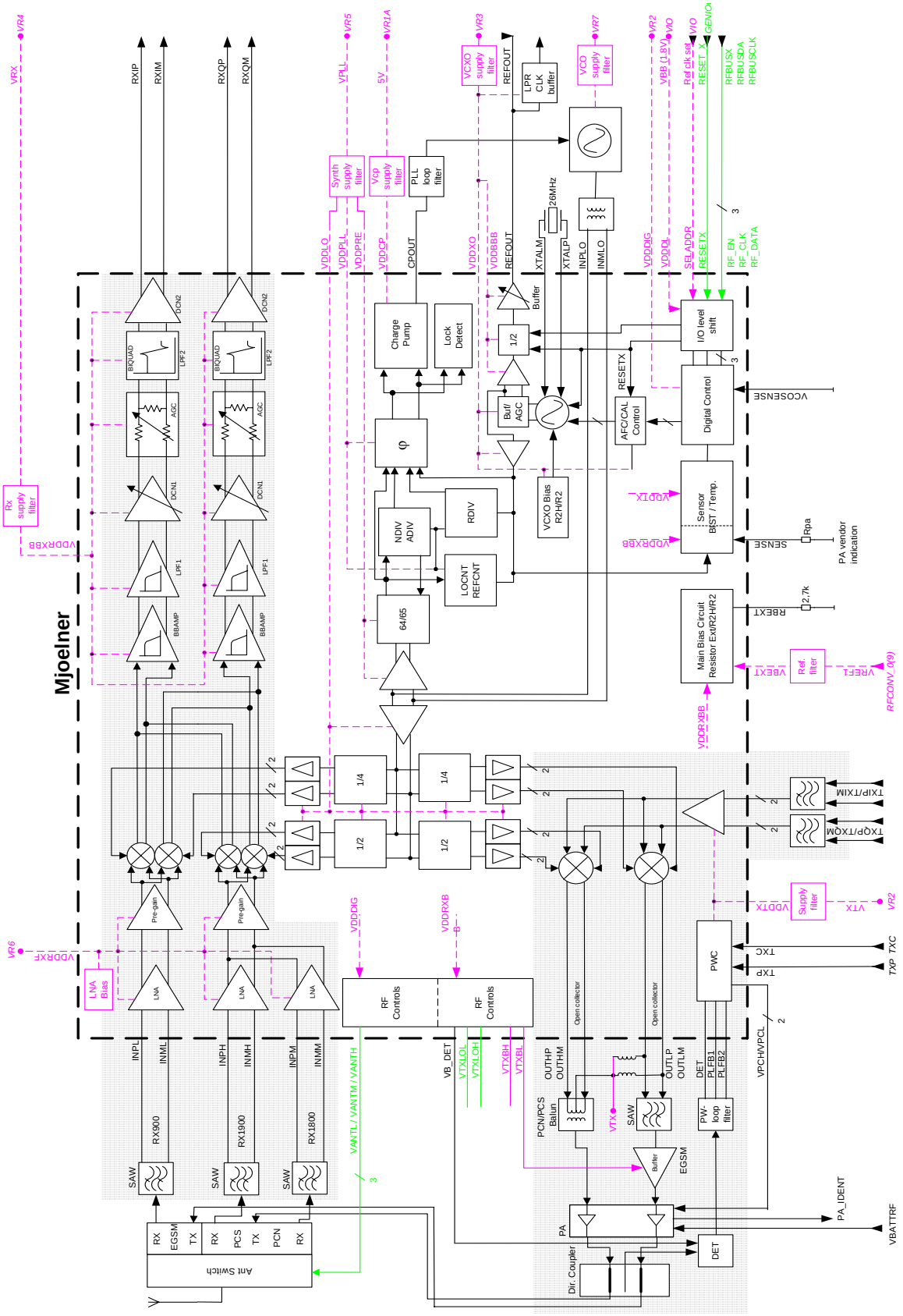


Figure 32: RF block diagram

RF Power Supply Configuration

All power supplies for the RF Unit are generated in the UEM IC (D200). All RF supplies can be checked either in Mjoelner can or in BB can. The power supply configuration used is shown in the block diagram below. Values of voltages are given as nominal outputs of UEM. Currents are typical values.

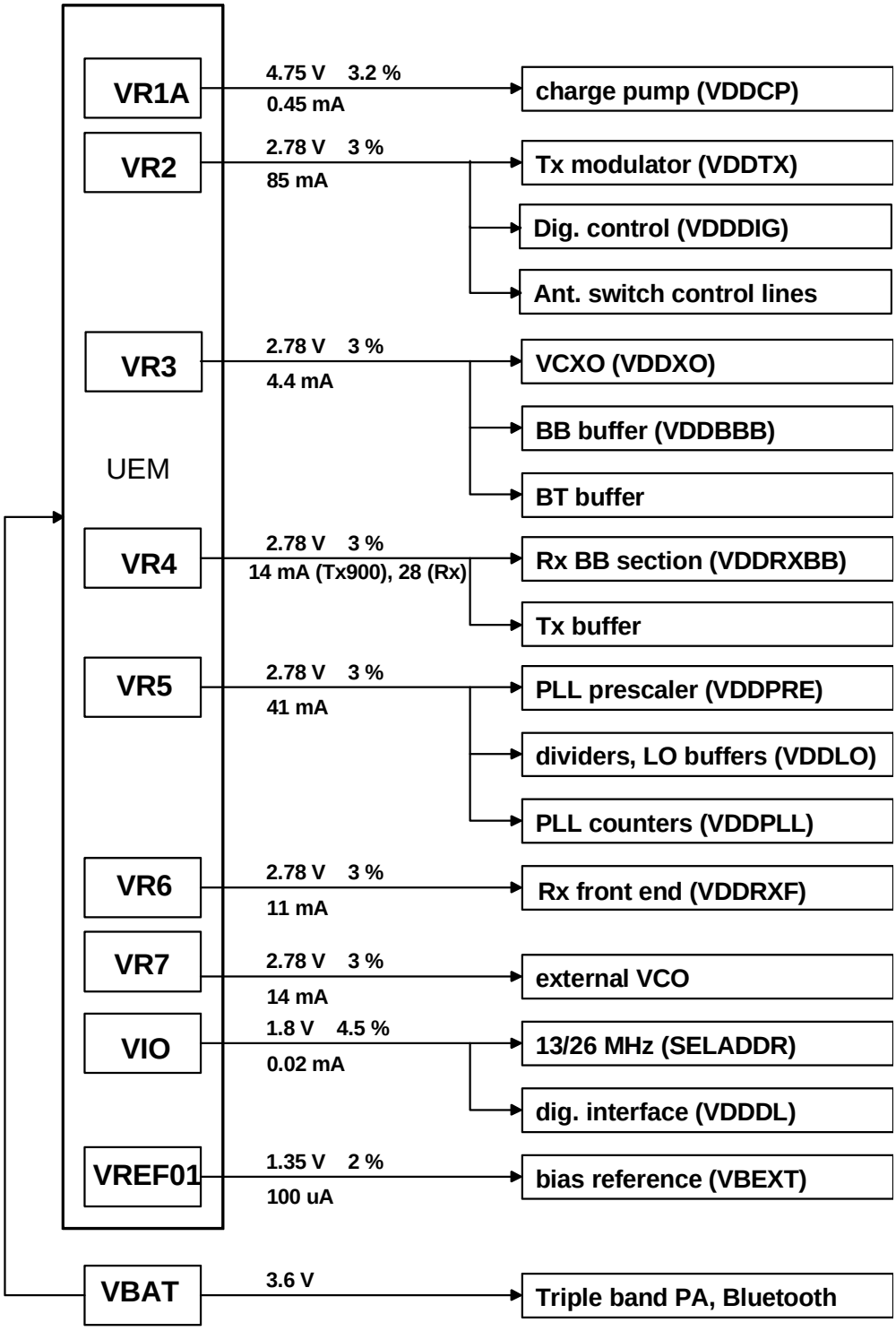


Figure 33: RF Power distribution diagram

Receiver

General instructions for RX troubleshooting

Connect the MJ1-EB containing the phone to a PC e.g. with DAU-9X cable and Dongle. Follow the following instructions.

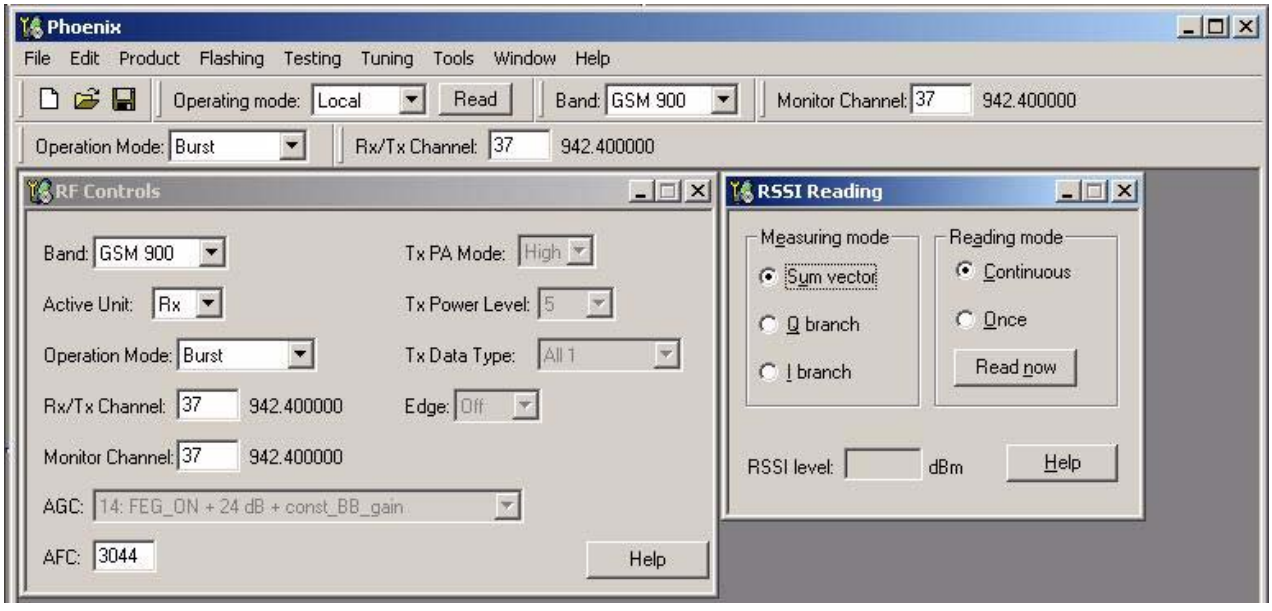
Measuring RX I/Q signals using RSSI reading

Step 1: Setting up Phone and Phoenix

- Start Phoenix Service Software
- Open the FBUS connection
- Select File /Scan Product (Ctrl-R)
- Wait until phone information shows in the lower right corner of the screen.
- Set operating mode to local mode

Step 2: Execute the measurement

- Select Maintenance/ Testing/ RF Controls
- Wait until the RF Controls window pops up
- Select Band GSM 900 or GMS1800
  Active unit RX
  Operation mode **Burst**
  RX/TX Channel 37 or 700 or 661
- Select Maintenance/Testing/RSSI reading
- The screen should now look like this:



- Apply a signal with a frequency of
  EGSM : 942.467 MHz (channel 37 + 67.710kHz offset)
  GSM1800 : 1842.867 MHz (channel 700 + 67.710kHz offset)

and a power level of -80dBm to the RF-connector (remember to compensate for cable attenuation).

- In RSSI reading window click on Read now. **The resulting RSSI level should be about -79,5 dBm in the low band and 79,3 dBm in the high band.**

Measuring RX performance using SNR Measurement

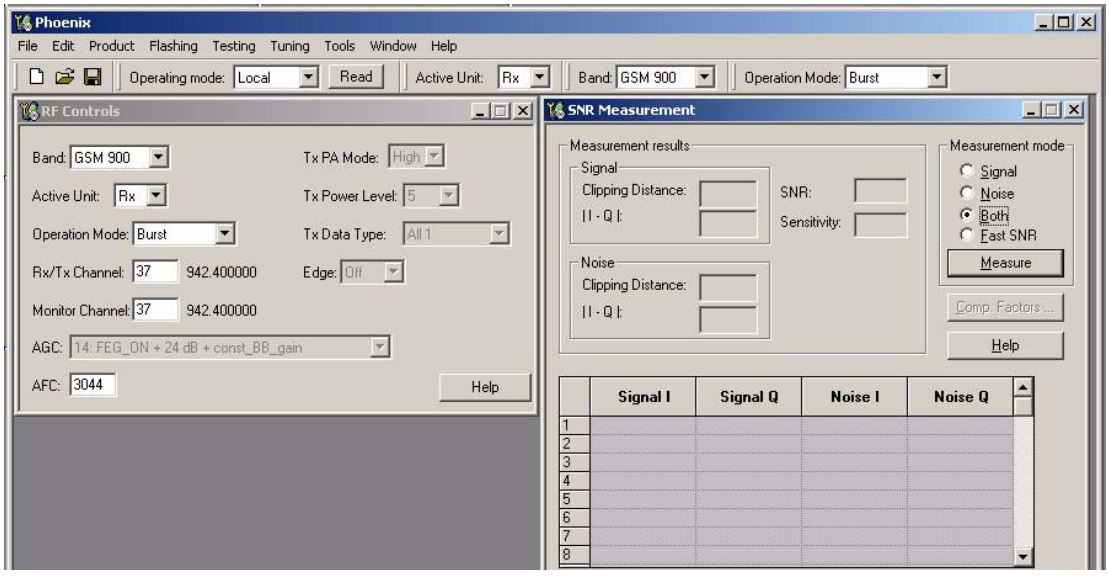
Step 1: Setting up Phone and Phoenix

- Start Phoenix Service Software
- Open the FBUS connection
- Select File /Scan Product (Ctrl-R)
- Wait until phone information shows in the lower right corner of the screen.
- Set operating mode to local mode
- Activate RF-Controls
- Select Maintenance/ Testing/ RF Controls Wait until the RF Controls window pops up
- Select

Band	GSM 900 or GMS1800
Active unit	RX
Operation mode	**Burst**
RX/TX Channel	37 or 700

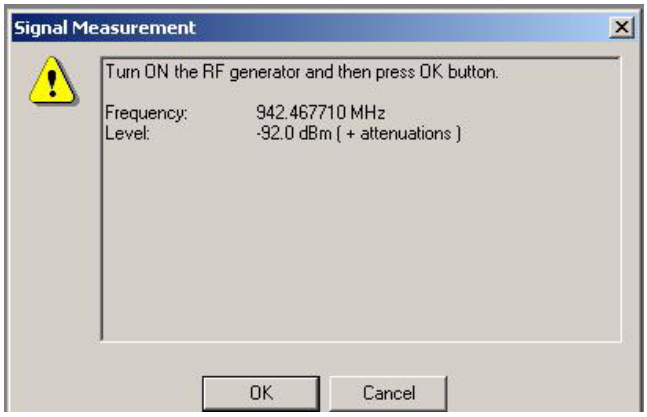
Step 2: Doing SNR Measurement

- Select Maintenance /Testing/SNR Measurement
- Select Fast SNR-Radio Button
- The setup should now look like this:



- Choose relevant band (EGSM900 / GSM1800)

- Press measure. A window pops up, e.g. for EGSM900 band:



- Connect an external signal generator to the RF connector of the phone and set the generator as told in the window, accounting care for external cable losses.
- Press ok and the window closes.
- Read the SNR result. SNR should be: **EGM900 >20dB**
  GSM1800 >18dB

Measuring front end power levels using Spectrum analyzer

Spectrum Analyzer (SA) level values depend on the probe type and should be validated using a good sample. The levels that are given here are measured using a resistive probe (50Ohm semi-rigid cable).

Step 1: Setting up Phone and Phoenix

- Start Phoenix Service Software
- Open the FBUS connection
- Select File /Scan Product (Ctrl-R)
- Wait until phone information shows in the lower right corner of the screen.
- Set operating mode to local mode

Step 2: Activate RF-Controls

- Select Maintenance/ Testing/ RF Controls. Wait until the RF Controls window pops up
- Select

Band	GSM 900 or GMS1800
Active unit	RX
Operation mode	**Continuous**
RX/TX Channel	37 or 700

Step 3: Doing the Measurement

Please refer to the fault finding chart for proper levels at different test points.

Measuring analogue RX I/Q signal voltages using Oscilloscope

Measuring with an oscilloscope on "RXIINN" or "RXQINN" is recommended only if RSSI

reading does not provide enough information. No dedicated test points exist for RX I and Q signals, but they can be accessed by probing on via hole plating. Input level = -80dBm

Step 1: Setting up Phone and Phoenix

- Start Phoenix Service Software
- Open the FBUS connection
- Select File /Scan Product (Ctrl-R)
- Wait until phone information shows in the lower right corner of the screen.
- Set operating mode to local mode

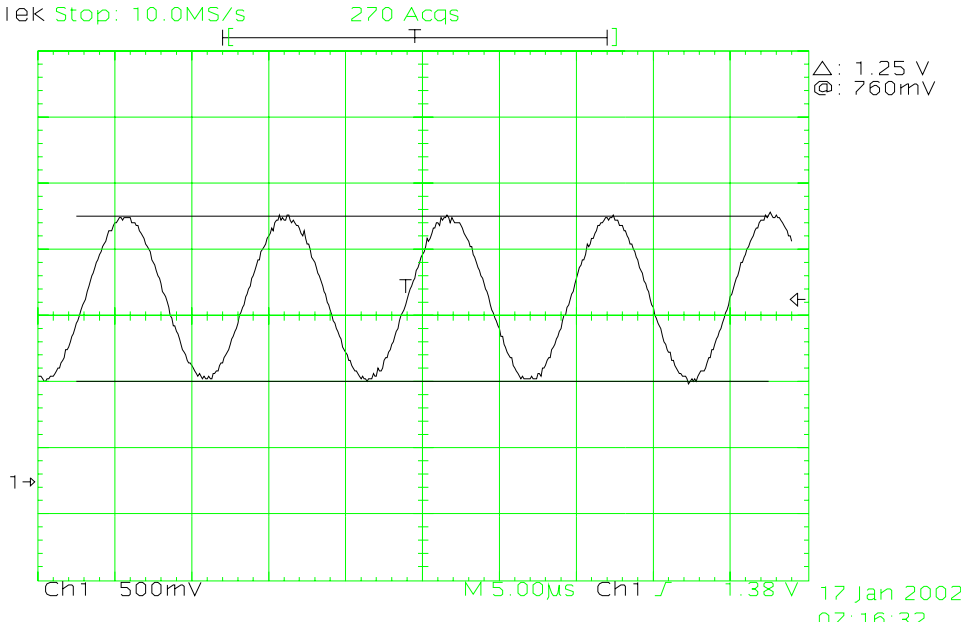
Step 2: Activate RF-Controls

- Select Maintenance/ Testing/ RF Controls
- Wait until the RF Controls window pops up
- Select

Band	GSM 900 or GMS1800
Active unit	RX
Operation mode	**Continuous**
RX/TX Channel	37 or 700 or 661
AGC	14

Step 3: Doing the Measurement

The following result should be seen with a working EGSM receiver:



Signal amplitude	1.25V
DC offset	1,35V
Frequency	67kHz

Fault finding chart for the receiver

The phone layout does not have dedicated test points for the analogue differential RX I and Q signals (RXIINP, RXIINN, RXQINP, RXQINN) from Mjoelner RF ASIC to UEM. The BB part is used to measure those signals by means of RSSI reading. It is assumed that correct calibration of RSSI reading has been carried out. RSSIreading [dBm] = 20log(U_{BB}) + $AGC_{calibrated}$

Therefore, don't calibrate a defective phone before the phone error has been found.

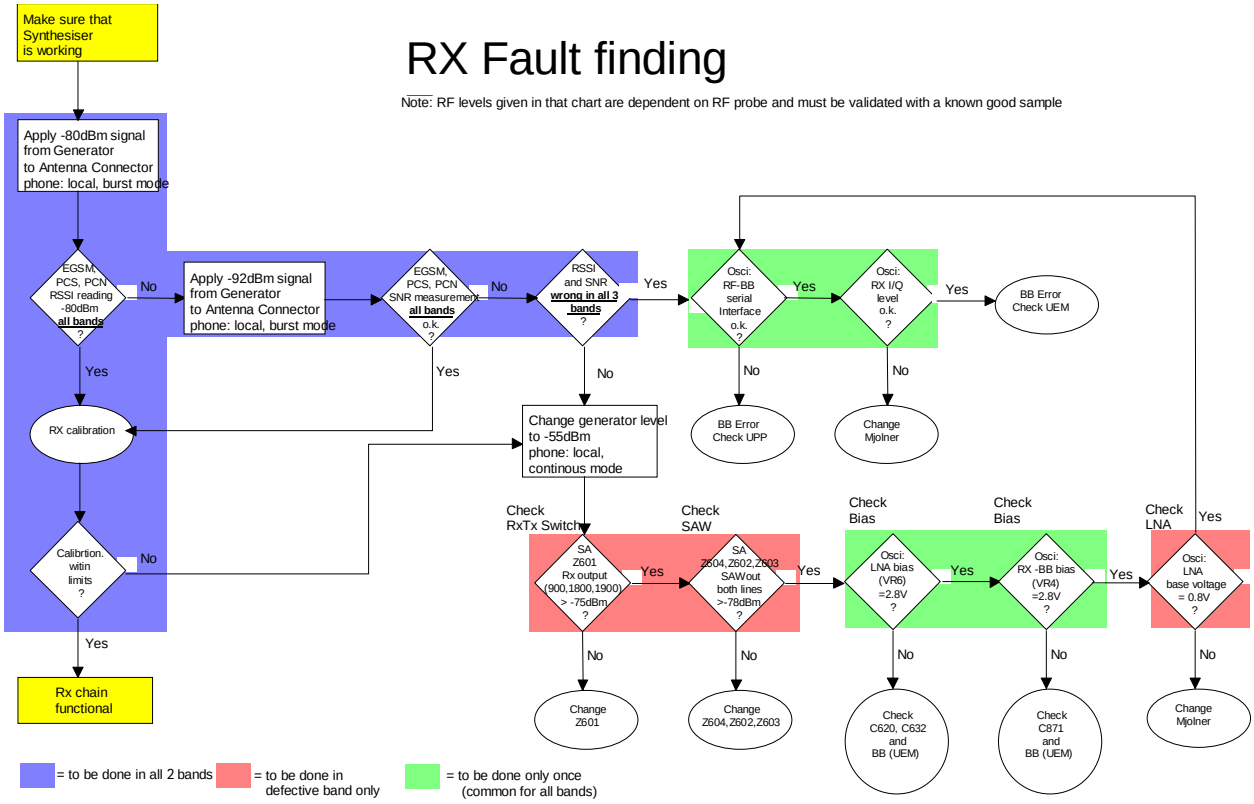
When a defective phone has been calibrated, a possible error in RX front end might be masked. In that case one can have a reasonable RSSI reading, although the front end shows excessive losses. To rule this out do the following:

Check if AGC calibration is within limits

Check if SNR reading is OK.

Use an Oscilloscope to check levels of "RXIINN" and "RXQINN".

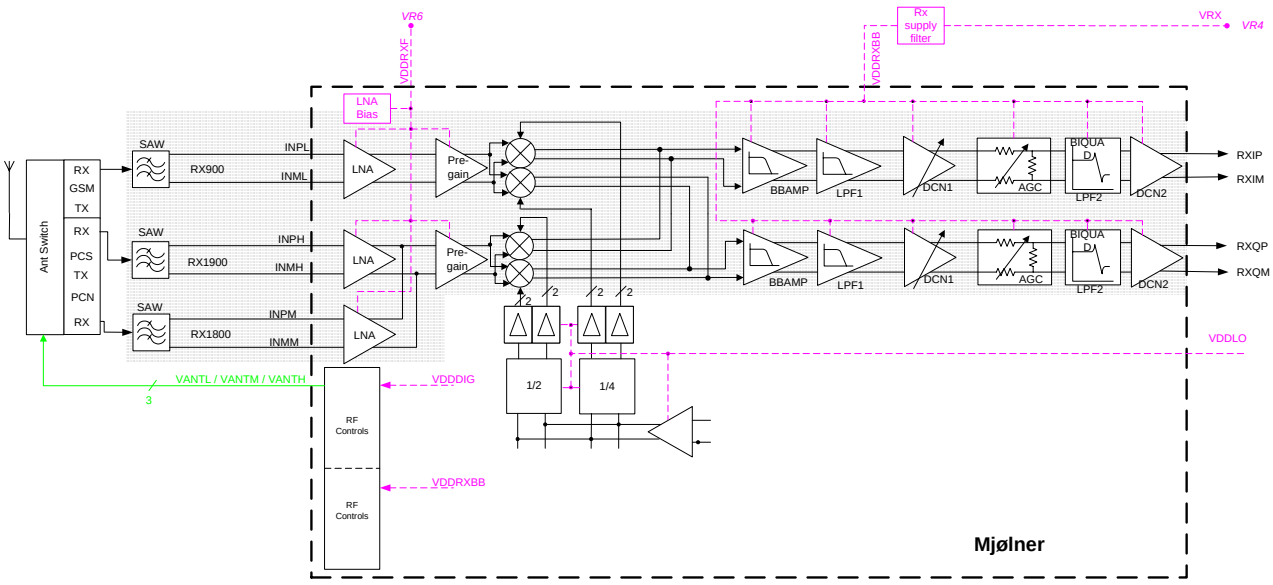
If RX and TX path are faulty it has to be checked that synthesizer is working. If it does, then check path from RF connector X602 to antenna switch Z601 (see RX fault finding "Check RXTX switch")



Rx Signal paths

The signal paths of the receiver are shown in following block diagram. Note that the pic-

ture shows EGSM900 (EGSM) receiver (top) and GSM1800 (DCS/PCN) receiver. The GSM 1900 is not used within TF-4.



Antenna switch (RX/TX Switch)

From the antenna connector (X602) the signal is fed to the RX/TX switch (Z601).

The RX/TX switch (Z601) works as duplexer. EGSM900 input signals pass to GSM_Rx output. GSM1800 input signals pass to PCN_Rx output. From RX1-GSM output of the antenna switch the RX signal is routed in the inner layers of the PWB to the EGSM900 SAW filter (Z604). From RX2-DCS output the GSM1800 RX signal is routed to the GSM1800 SAW filter (Z602). The RX/TX switch with routed lines has following typical insertion losses:

1.3dB@EGSM900, and 1.6dB@GSM1800.

Front-end

The RX front end includes two SAW filters (EGSM900 (Z604), GSM1800 (Z602)). Each of the SAW filters is matched with a differential matching circuit (LC-type) to the corresponding LNA input of Mjoelner RF ASIC (N601). The SAW filters provide out-of-band blocking immunity, the integrated LNAs provide the front-end gains. Each of the SAW filters has a single-ended input and a balanced output which provides a balanced RX signal to the corresponding input of the Mjoelner RF ASIC. The SAW filters have maximum insertion losses of 3.5dB at EGSM900 and 4.0dB at GSM1800 .

RX paths of Mjoelner RF ASIC

The balanced RX signal is amplified by the integrated LNA and the subsequent Pre-Gain stage. After amplification the RX signal is down-converted with a LO signal coming from the local oscillator.

The RX paths of Mjoelner RF ASIC consist of following building blocks:

- Separate LNAs for each of the two bands: EGSM900 and GSM1800.

- Two PREGAIN amplifiers, one for EGSM900 and one for GSM1800.
- Two passive I/Q mixers (MIX), one for EGSM900 and one for GSM1800.

The resulting BB signal is further amplified in the BB chain. For this purpose no external circuitry is required:

- Base band amplifiers (BBAMP1). That amplifiers implement the initial channel filtering.
- Low pass filters (LPF1).
- DC compensation / AGC amplifiers (DCN1). They implement gain steps from 0dB to 24dB in 6dB steps.
- Attenuators (AGC). They implement gain steps from -48dB to 0dB in 6dB steps, yielding a total gain range of 72dB together with DCN1.
- Bi-quad filters (LPF2).
- DC compensation amplifiers (DCN2).

The differential base band outputs are internally DC coupled and can be connected directly to the ADC inputs of the RF converter chip. The common mode level is set equal to the VBEXT reference voltage.

EGSM (EGSM900) Transmitter

General instructions for EGSM TX troubleshooting

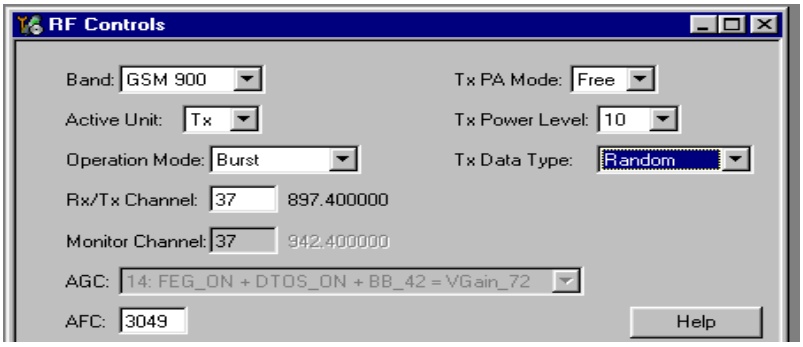
Apply a RF-cable to the RF-connector and connected to the measurement equipment (GSM Test equipment, Powermeter, Spectrum Analyzer, or similar). Be sure to use at least a 10dB attenuator, otherwise the results may be incorrect.

Step 1: Setting up Phone and Phoenix

- Start Phoenix Service Software
- Open the FBUS connection
- Select File /Scan Product (Ctrl-R)
- Wait until phone information shows in the lower right corner of the screen.
- Set operating mode to local mode
- Activate RF-Controls
- Select Maintenance/ Testing/ RF Controls. Wait until the RF Controls window pops up
- Select:

Band	GSM 900
Active unit	TX
Operation mode	Burst
RX/TX Channel	37
TX PA Mode	Free
TX Power Level	10
TX Data Type	Random

The setup should now look like this:



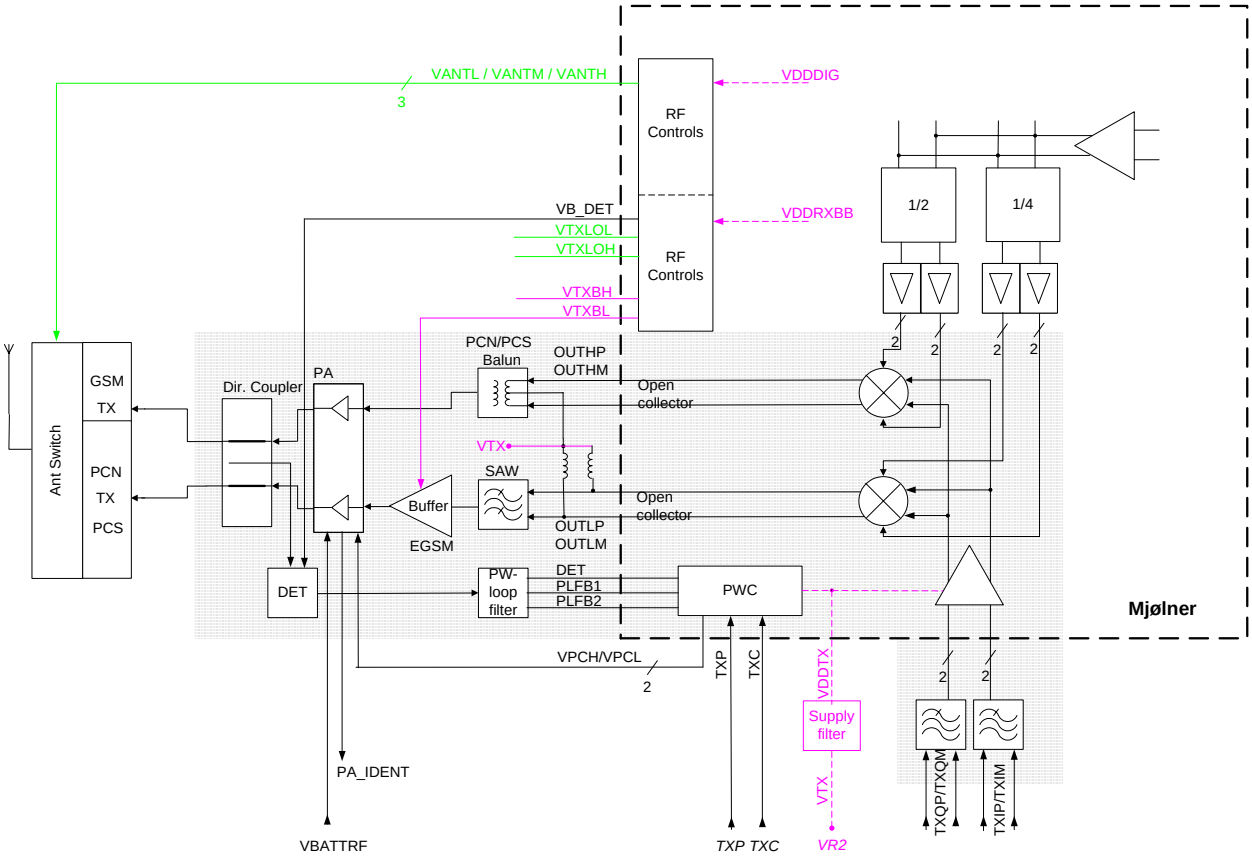
Step 2: Doing the Measurement

Now the measurement equipment should measure the following output signal from the phone: P_{out} = +23dBm @ 897.4MHz

If this is not the case, then go to the TX Troubleshooting section of this document for troubleshooting.

TX path of the transmitted EGSM900 signal

The components can be grouped into blocks and drawn as shown below. Note that the picture shows both EGSM900 transmitter (lower) and GSM1800 transmitter (upper).



EGSM900 TX path of Mjoelner RF ASIC

The balanced TX signal is provided by the base band to the Mjoelner RF ASIC. The TX paths of the Mjoelner RF ASIC include mainly two RF modulators for up-conversion of the base band signals, one for EGSM900 and one for GSM1800. The base band signal is modulated with the LO signal corresponding to the wanted TX channel. The GSM TX output of the Mjoelner RF ASIC is a balanced signal.

At the output of the Mjoelner RFASIC the signal is fed to the EGSM TX SAW filter (Balanced to single ended), a 3 dB pad, and the 900 MHz buffer to the PA EGSM input.

EGSM900 TX path of the Power Amplifier (PA)

The PA EGSM900 part has a maximum output power of app. 35 dBm. The EGSM900 output is controlled by the power control loop. From the EGSM900 output of the PA the RF signal is fed through the directional coupler (one of the power control loop components) to the antenna switch.

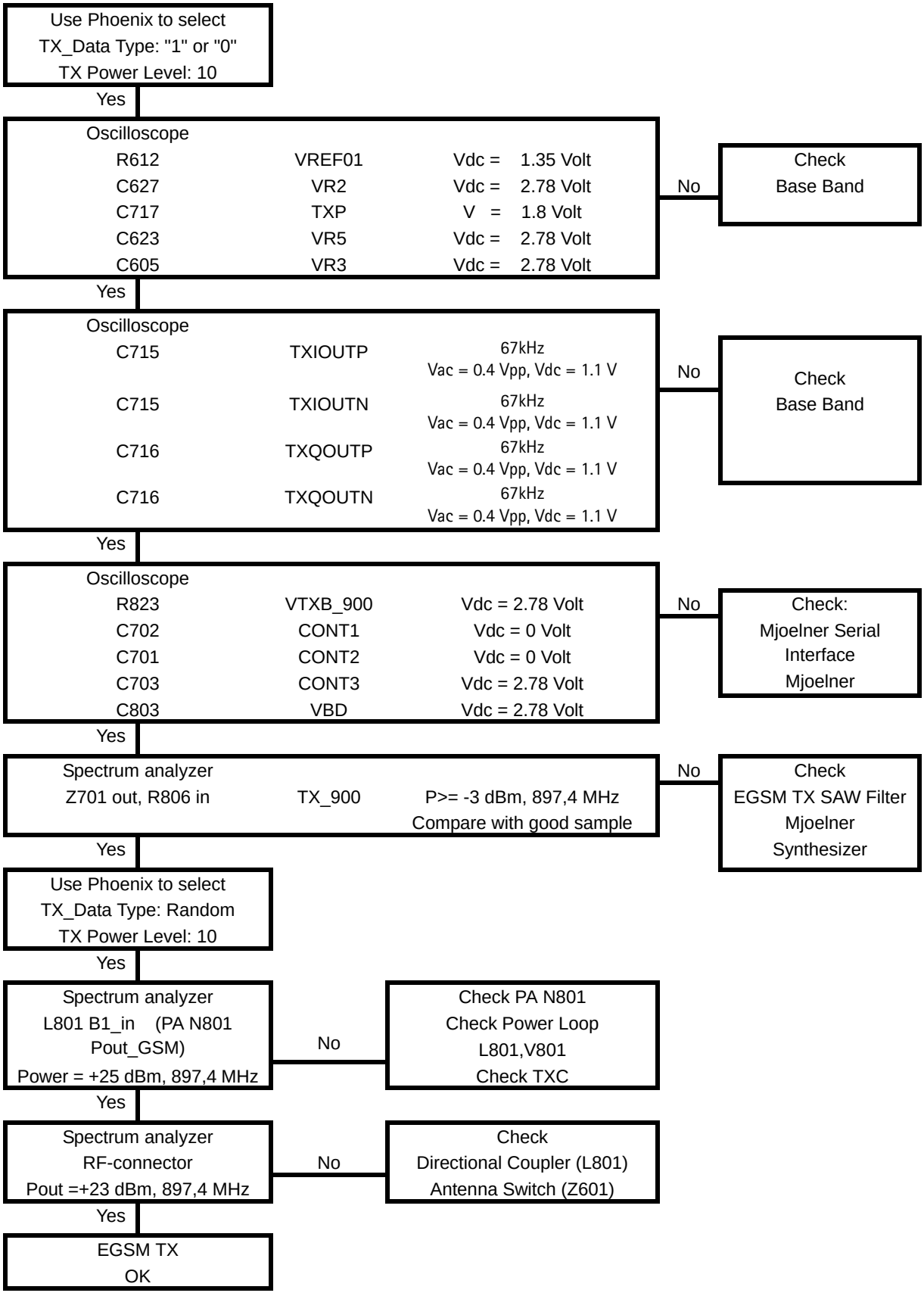
Antenna Switch (TX/RX switch)

The antenna Switch works as a duplexer for the RX and TX signals. Additionally, it suppresses the EGSM900 TX harmonics generated by the PA. The antenna switch is controlled by the Mjoelner RF ASIC using the control signals CONT1, CONT2 and CONT3. The following table shows the possible different states.

CONT1 [Volt]	CONT2 [Volt]	CONT3 [Volt]	EGSM Rx	DCS Rx	EGSM Tx	DCS/PCS Tx
0	0	0	X			
0	0	0		X		
0	0	2.7			X	
2.7	0	0				X

Fault finding chart for EGSM900 transmitter

The TXP signal is intended to be used as trigger, a test point is provided.



GSM1800 (DCS/PCN) Transmitter

General instructions for GSM1800 TX troubleshooting

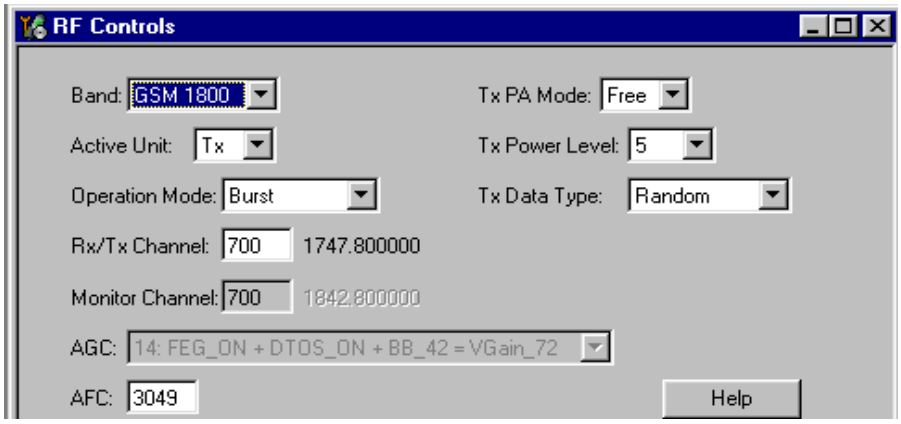
Apply a RF-cable to the RF-connector and connected to measurement equipment (GSM Test equipment, Powermeter, Spectrum Analyzer, or similar). Be sure to use at least a 10-dB attenuator, otherwise the results may be incorrect.

Step 1: Setting up Phone and Phoenix

- Start Phoenix Service Software
- Open the FBUS connection
- Select File /Scan Product (Ctrl-R)
- Wait until phone information shows in the lower right corner of the screen.
- Set operating mode to local mode
- Activate RF-Controls
- Select Maintenance/ Testing/ RF Controls. Wait until the RF Controls window pops up
- Select:

Band	GSM1800
Active unit	TX
Operation mode	Burst
RX/TX Channel	700
TX PA Mode	Free
TX Power Level	5
TX Data Type	Random

The setup should now look like this:

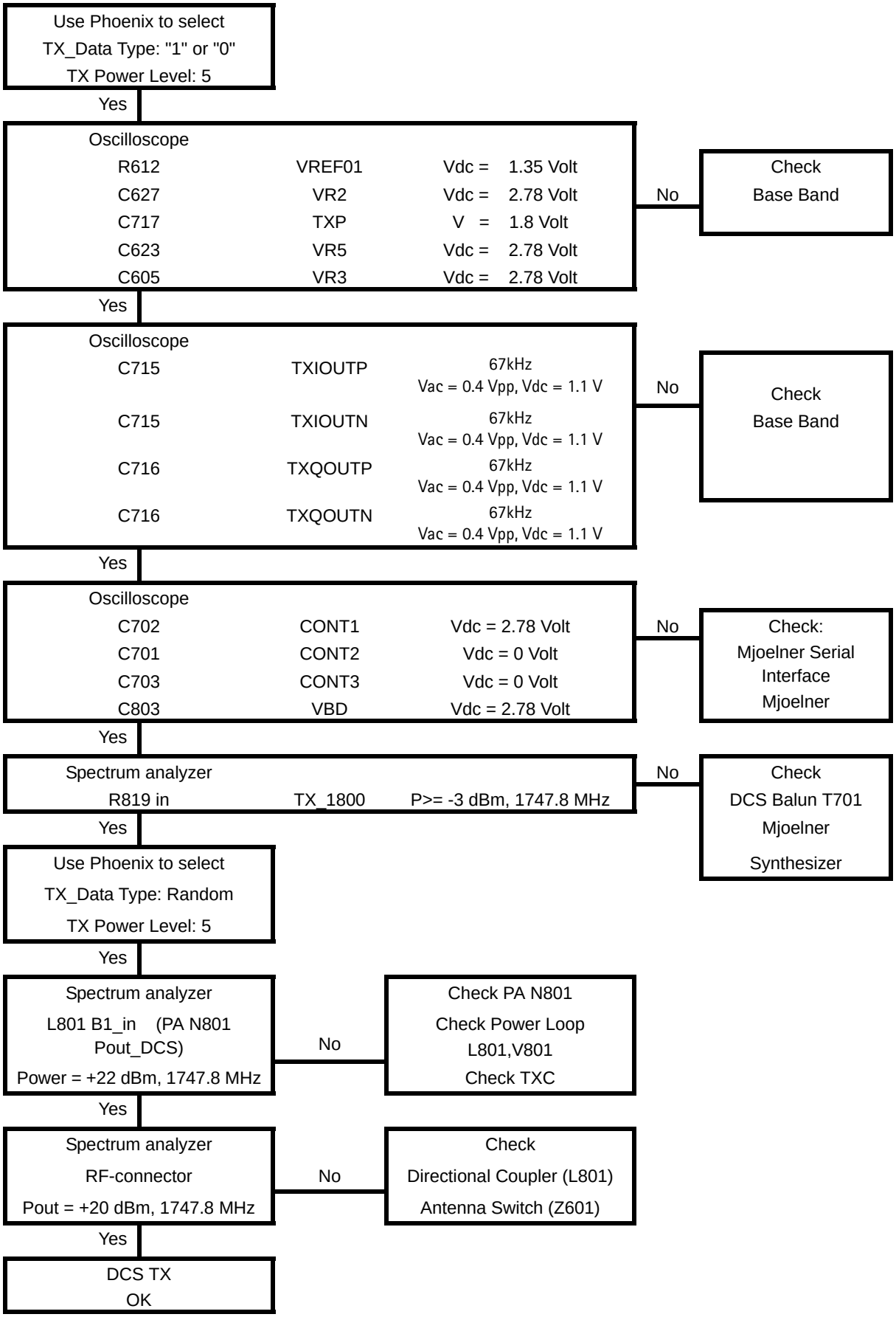


Step 2: Doing the Measurement

Now the measurement equipment should measure the following output signal from the phone. P_{out} = +20dBm @ 1747.8MHz

If this is not the case, then go to the TX Troubleshooting section of this document for troubleshooting.

Fault finding chart for GSM1800 transmitter



TF-4 Synthesizer

There is only one PLL synthesizer generating frequencies for both Rx and TX and for all two bands (EGSM900 and GSM1800). VCO frequency is divided by 2 or by 4 in Mjoelner depending on which band is active.

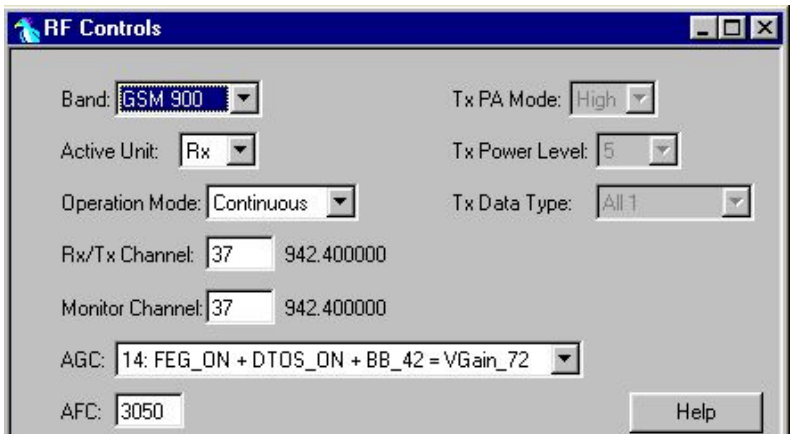
General instructions for Synthesizer troubleshooting

Step 1: Setting up Phone and Phoenix

- Start Phoenix Service Software
- Open the FBUS connection
- Select File /Scan Product (Ctrl-R)
- Wait until phone information shows in the lower right corner of the screen.
- Set operating mode to local mode
- Activate RF-Controls
- Select Maintenance/ Testing/ RF Controls
  Wait until the RF Controls window pops up
- Select:

Band	GSM 900 or GMS1800
Active unit	RX
Operation mode	Continuous
RX/TX Channel	37 or 700

The setup should now look like this:



Step 2: Doing the Measurement

Since VCO chamber is completely shielded, it is not easy to measure frequency of 3769.6MHz at the output of the VCO (G701) using a resistive probe and a spectrum analyzer. It is possible to measure tuning voltage at charge pump output (C710) easily. For f_{VCO} = 3769.6MHz the tuning voltage should be $2.3V_{DC}$ .. $2.8V_{DC}$ (Tuning sensitivity of VCO is 240MHz/V typ.).

If this is not the case, then go to section 1.4 of this document for troubleshooting.

26 MHz reference oscillator (VCXO)

The 26 MHz reference oscillator (VCXO) is part of Mjoelner RF-ASIC (N601). It requires only an external 26 MHz Xtal (B601) as external circuitry. The reference oscillator has three functions:

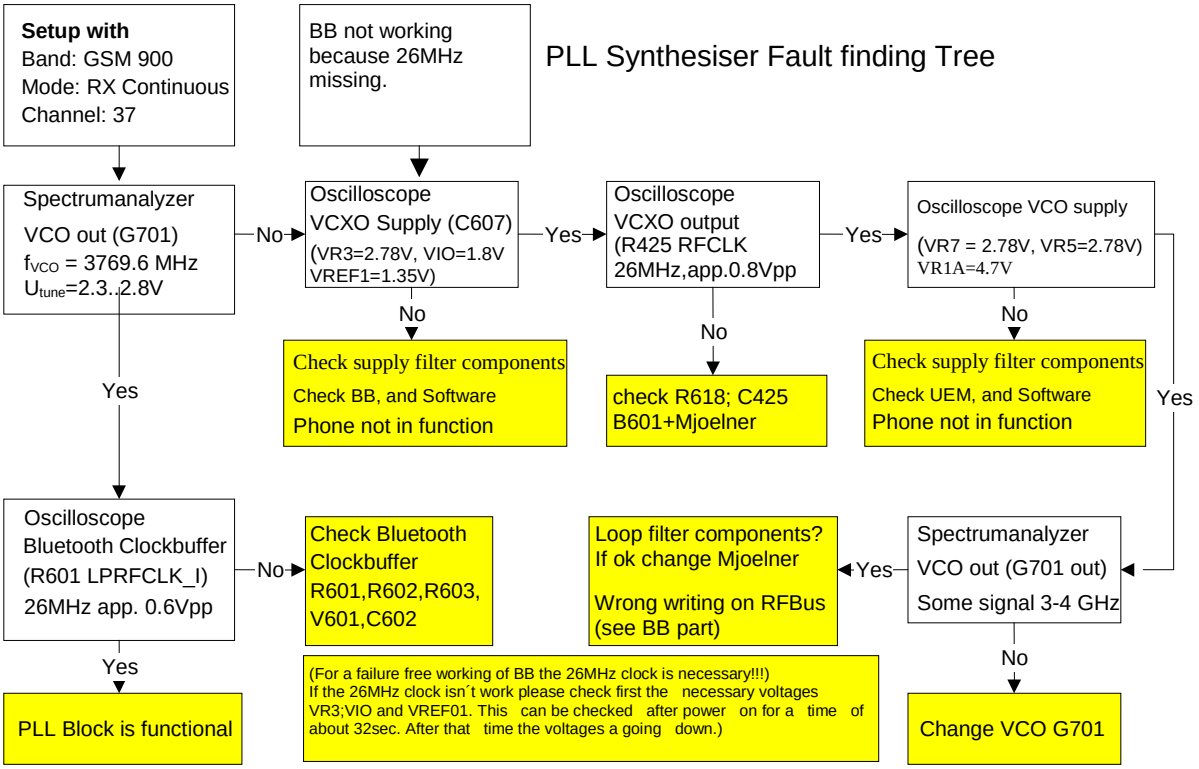
- Reference frequency for the PLL synthesizer.
- System clock for BB (RFClk_I = 26 MHz).
- 26 MHz Reference clock (LPRFClk_I) for Bluetooth Module (V130) via buffer V601.

For a successful initial synchronization, the 26MHz frequency of the VCXO must be calibrated accurately. Therefore, a **VCXO-calibration (cal)** value is written via the serial Bus into the RefOSCCAL register of Mjoelner and an additional bit in the RefOSCCntl register of the Mjoelner. That is necessary for the rough calibration of the VCXO. The VCXO is fine tuned by programming the AFC value via the serial bus of Mjoelner. The necessary AFC value is written into the RefOSCAFC register inside the Mjoelner.

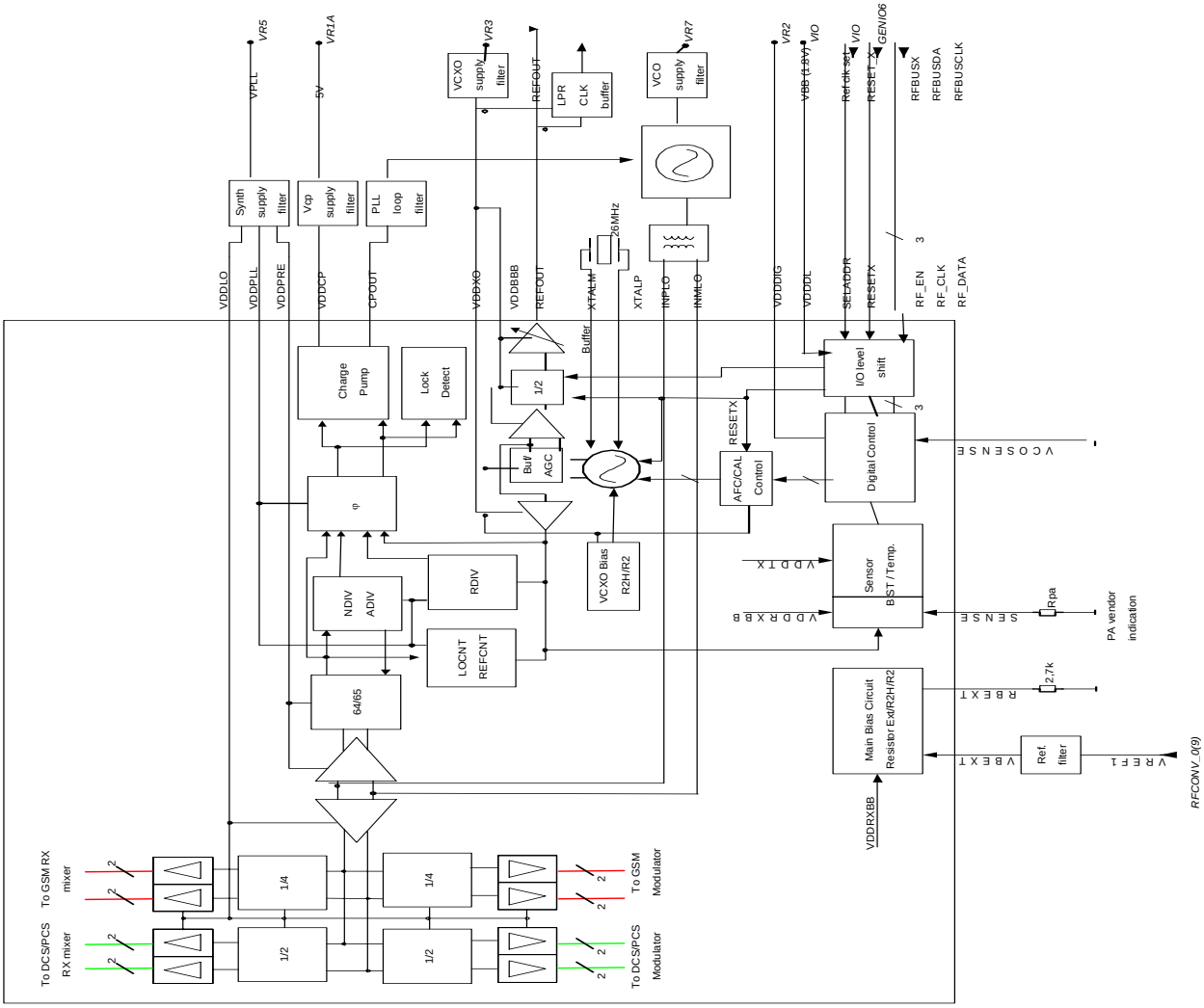
VCO

The VCO has to generate frequencies in the range from 3420MHz to 3840MHz for the PLL. The frequency of the VCO signal is divided by 2 or by 4 in Mjoelner RF-ASIC. Generate the frequency of all channels in EGSM900, GSM1800 (both RX and TX). Frequency of the VCO is controlled by DC voltage (Vc) the output of the PLL loop filter. Range of Vc when PLL is operating is 0.7V– 3.8V. Typical tuning sensitivity of the VCO is 240MHz/V. Even if PLL is not working (Vc out of range) there should be a frequency at the output of the VCO, between 3 and 4 GHz (if the VCO itself is ok).

Fault finding chart for PLL Synthesizer

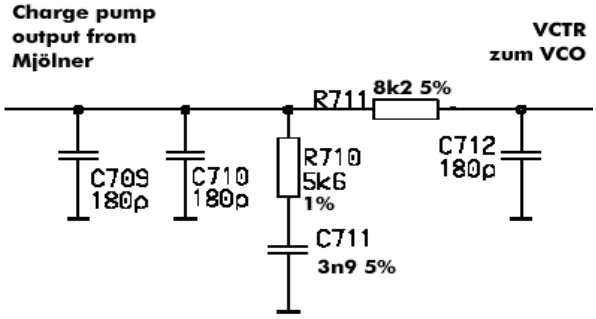


It is important to note that the power supply of the VCXO (VR3) is only switched 'OFF' in the so-called 'Deep Sleep Mode' and power supply of VCO (G701 VR7) is switched 'OFF' in so-called 'Sleep Mode'.

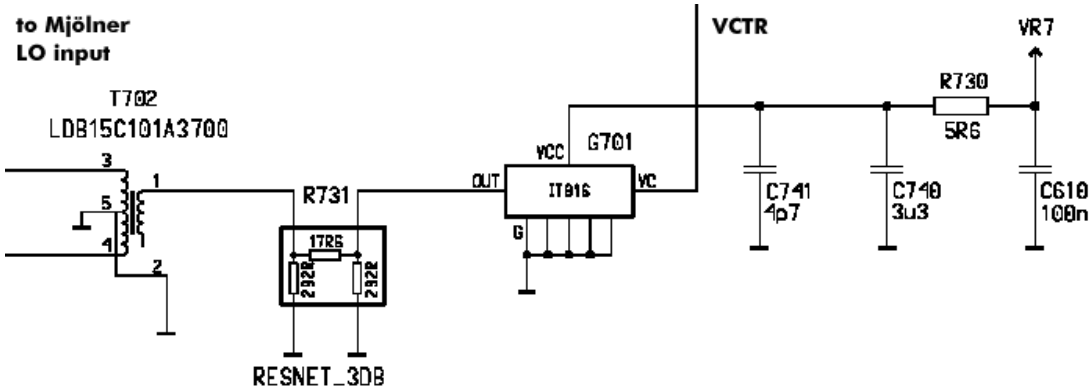


PLL Powersupply

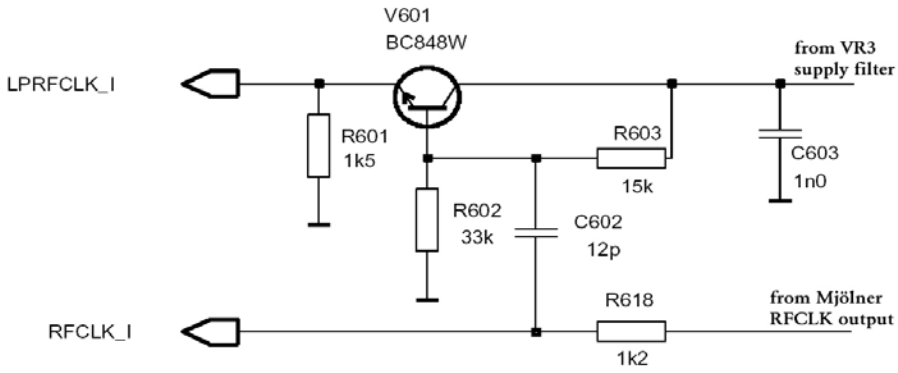
Loopfilter



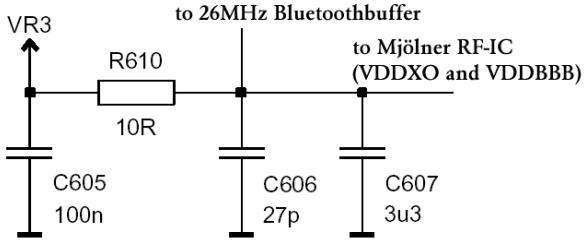
VCO and VCO power supply



26MHz Bluetooth buffer



VR3 supply filter



Frequency lists

EGSM900

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	3717.4	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	3838.2
					62	902.4	947.4	3609.6	3789.6	124	914.8	959.8	3659.2	3839.2

GSM1800

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	794	1766.6	1861.6	3533.2	3723.2
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	795	1766.8	1861.8	3533.6	3723.6
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	796	1767.0	1862.0	3534.0	3724.0
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	797	1767.2	1862.2	3534.4	3724.4
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	798	1767.4	1862.4	3534.8	3724.8
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	799	1767.6	1862.6	3535.2	3725.2
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	800	1767.8	1862.8	3535.6	3725.6
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	801	1768.0	1863.0	3536.0	3726.0
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	802	1768.2	1863.2	3536.4	3726.4
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	803	1768.4	1863.4	3536.8	3726.8
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	804	1768.6	1863.6	3537.2	3727.2
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	805	1768.8	1863.8	3537.6	3727.6
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	806	1769.0	1864.0	3538.0	3728.0
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	807	1769.2	1864.2	3538.4	3728.4
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	808	1769.4	1864.4	3538.8	3728.8
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	809	1769.6	1864.6	3539.2	3729.2
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	810	1769.8	1864.8	3539.6	3729.6
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	811	1770.0	1865.0	3540.0	3730.0
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	812	1770.2	1865.2	3540.4	3730.4
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	813	1770.4	1865.4	3540.8	3730.8
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	814	1770.6	1865.6	3541.2	3731.2
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	815	1770.8	1865.8	3541.6	3731.6
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	816	1771.0	1866.0	3542.0	3732.0
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	817	1771.2	1866.2	3542.4	3732.4
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	818	1771.4	1866.4	3542.8	3732.8
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	819	1771.6	1866.6	3543.2	3733.2
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	820	1771.8	1866.8	3543.6	3733.6
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	821	1772.0	1867.0	3544.0	3734.0
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	822	1772.2	1867.2	3544.4	3734.4
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	823	1772.4	1867.4	3544.8	3734.8
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	824	1772.6	1867.6	3545.2	3735.2
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	825	1772.8	1867.8	3545.6	3735.6
544	1716.6	1811.5	3433.2	3623.2	638	1735.4	1830.4	3470.8	3660.8	732	1754.2	1849.2	3508.4	3698.4	826	1773.0	1868.0	3546.0	3736.0
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	827	1773.2	1868.2	3546.4	3736.4
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	828	1773.4	1868.4	3546.8	3736.8
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	829	1773.6	1868.6	3547.2	3737.2
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	830	1773.8	1868.8	3547.6	3737.6
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	831	1774.0	1869.0	3548.0	3738.0
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	832	1774.2	1869.2	3548.4	3738.4
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	833	1774,4	1869.4	3548.8	3738.8
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	834	1774.6	1869.6	3549.2	3739.2
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	835	1774.8	1869.8	3549.6	3739.6
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	836	1775.0	1870.0	3550.0	3740.0
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	837	1775.2	1870.2	3550.4	3740.4
556	1719.0	1814.0	3438.0	3628.0	650	1737.8	1832.8	3475.6	3665.6	754	1756.6	1851.6	3513.2	3703.2	838	1775.4	1870.4	3550.8	3740.8
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	839	1775.6	1870.6	3551.2	3741.2
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	840	1775.8	1870.8	3551.6	3741.6
559	1719.6	1814.6	3449.2	3629.2	653	1738.4	1833.4	3476.8	3666.8	747	1757.2	1852.2	3514.4	3704.4	841	1776.0	1871.0	3552.0	3742.0
560	1719.8	1814.8	3449.6	3629.6	654	1738.6	1833.6	3477.2	3667.2	748	1757.4	1852.4	3514.8	3704.8	842	1776.2	1871.2	3552.4	3742.4
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	843	1776.4	1871.4	3552.8	3742.8
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	844	1776.6	1871.6	3553.2	3743.2
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	845	1776.8	1871.8	3553.6	3743.6
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	846	1777.0	1872.0	3554.0	3744.0
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	847	1777.2	1872.2	3554.4	3744.4
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	848	1777.4	1872.4	3554.8	3744.8
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	849	1777.6	1872.6	3555.2	3745.2
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	850	1777.8	1872.8	3555.6	3745.6
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	851	1778.0	1873.0	3556.0	3746.0
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	852	1778.2	1873.2	3556.4	3746.4
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	853	1778.4	1873.4	3556.8	3746.8
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	854	1778.6	1873.6	3557.2	3747.2
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	855	1778.8	1873.8	3557.6	3747.6
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	856	1779.0	1874.0	3558.0	3748.0
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	857	1779.2	1874.2	3558.4	3748.4
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	858	1779.4	1874.4	3558.8	3748.8
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	859	1779.6	1874.6	3559.2	3749.2
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	860	1779.8	1874.8	3559.6	3749.6
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	861	1780.0	1875.0	3560.0	3750.0
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	862	1780.2	1875.2	3560.4	3750.4
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	863	1780.4	1875.4	3560.8	3750.8
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	864	1780.6	1875.6	3561.2	3751.2
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	865	1780.8	1875.8	3561.6	3751.6
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	866	1781.0	1876.0	3562.0	3752.0
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	867	1781.2	1876.2	3562.4	3752.4
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	868	1781.4	1876.4	3562.8	3752.8
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	869	1781.6	1876.6	3563.2	3753.2
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	870	1781.8	1876.8	3563.6	3753.6
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	871	1782.0	1877.0	3564.0	3754.0
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	872	1782.2	1877.2	3564.4	3754.4
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	873	1782.4	1877.4	3564.8	3754.8
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	874	1782.6	1877.6	3565.2	3755.2
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	875	1782.8	1877.8	3565.6	3755.6
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	876	1783.0	1878.0	3566.0	3756.0
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	877	1783.2	1878.2	3566.4	3756.4
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	878	1783.4	1878.4	3566.8	3756.8
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	879	1783.6	1878.6	3567.2	3757.2
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	880	1783.8	1878.8	3567.6	3757.6
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	881	1784.0	1879.0	3568.0	3758.0
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	882	1784.2	1879.2	3568.4	3758.4
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	883	1784.4	1879.4	3568.8	3758.8
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	884	1784.6	1879.6	3569.2	3759.2
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	885	1784.8	1879.8	3569.6	3759.6
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					
605	1728.8	1823.8	3457.6	3647.6	699	1747.6	1842.6	3495.2	3685.2	793	1766.4	1861.4	3532.8	3722.8					

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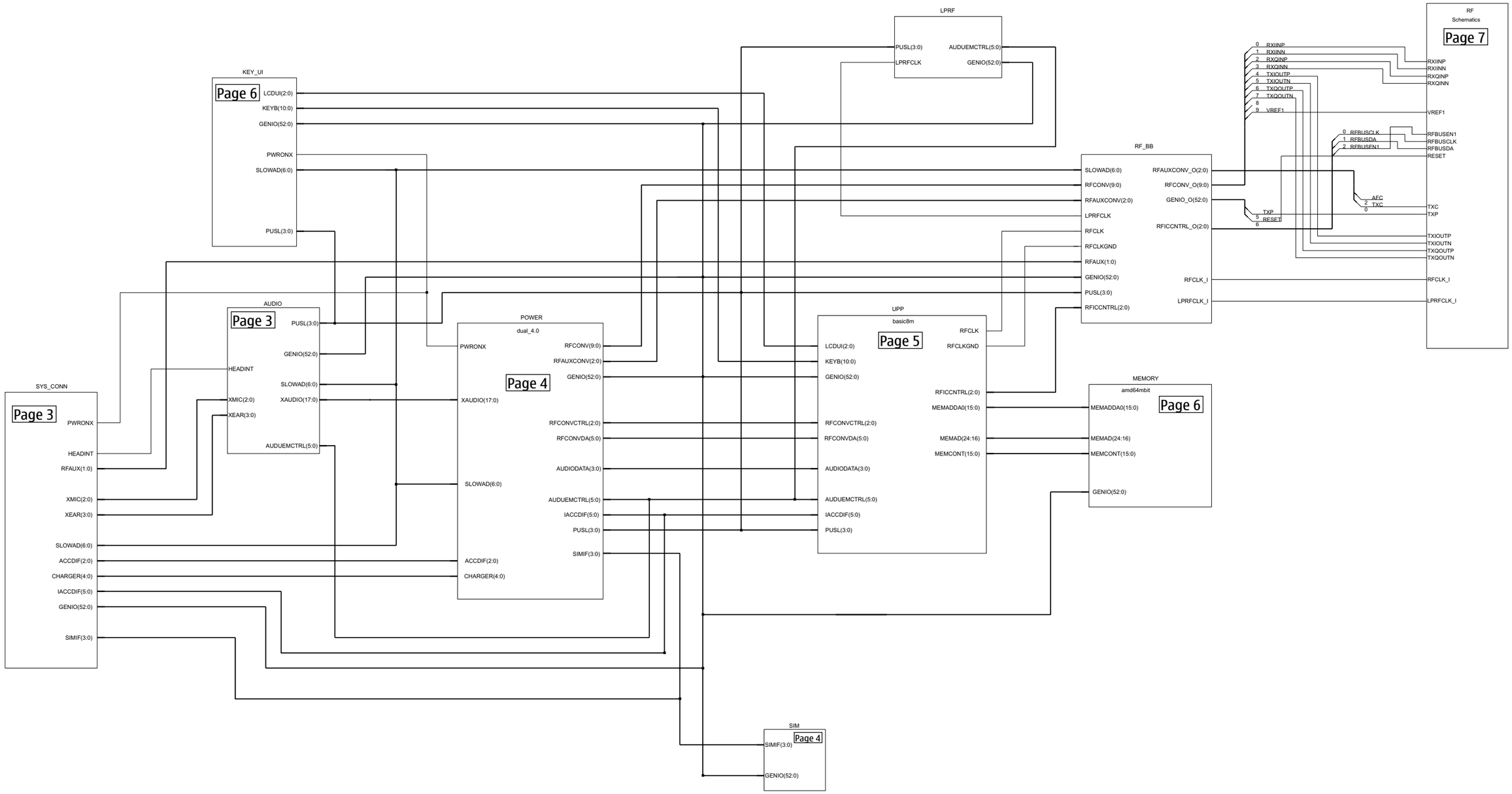
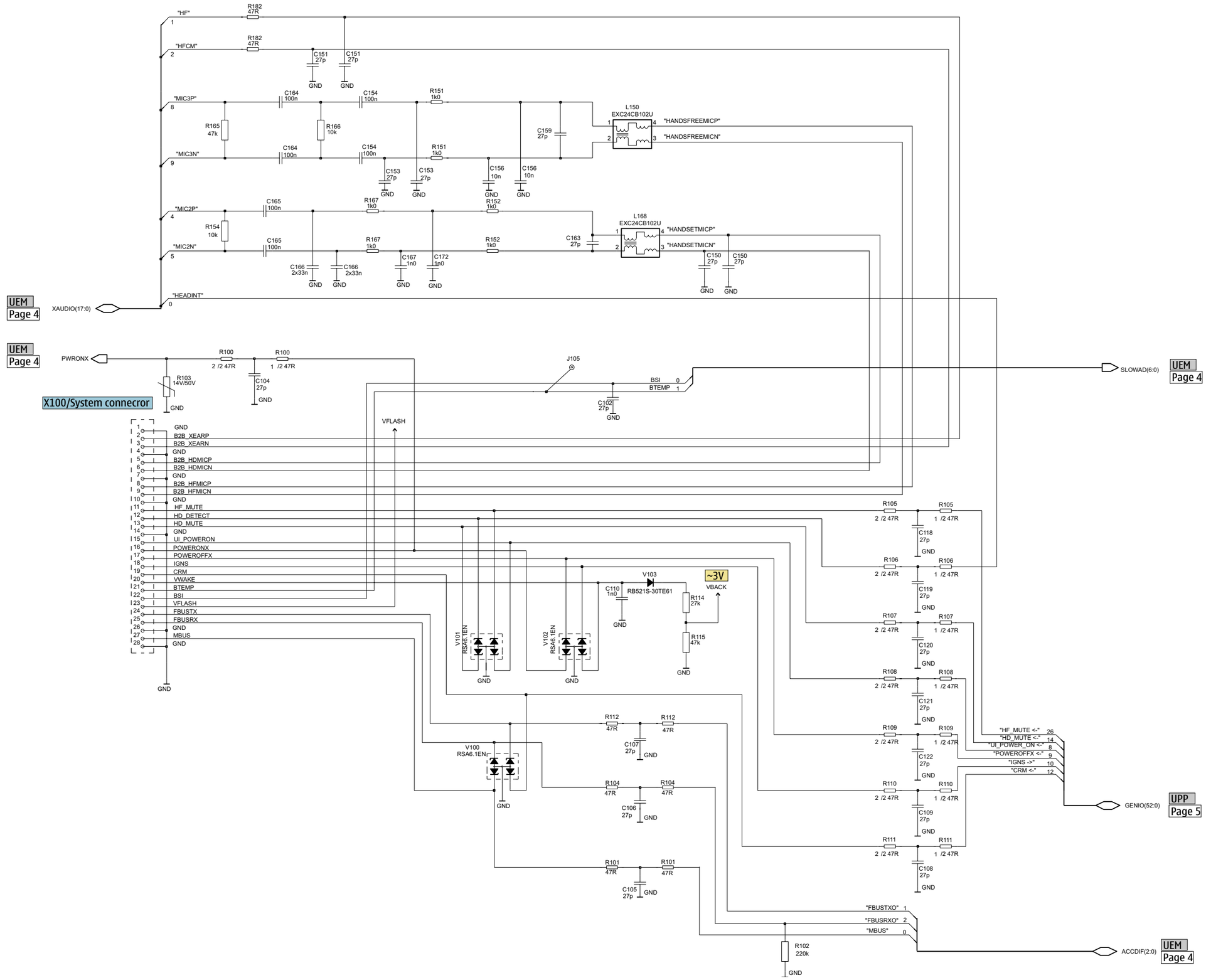
9 - SCHEMATICS AND COMPONENT FINDER FOR TF4_05 AND TF5_06

Table of Contents

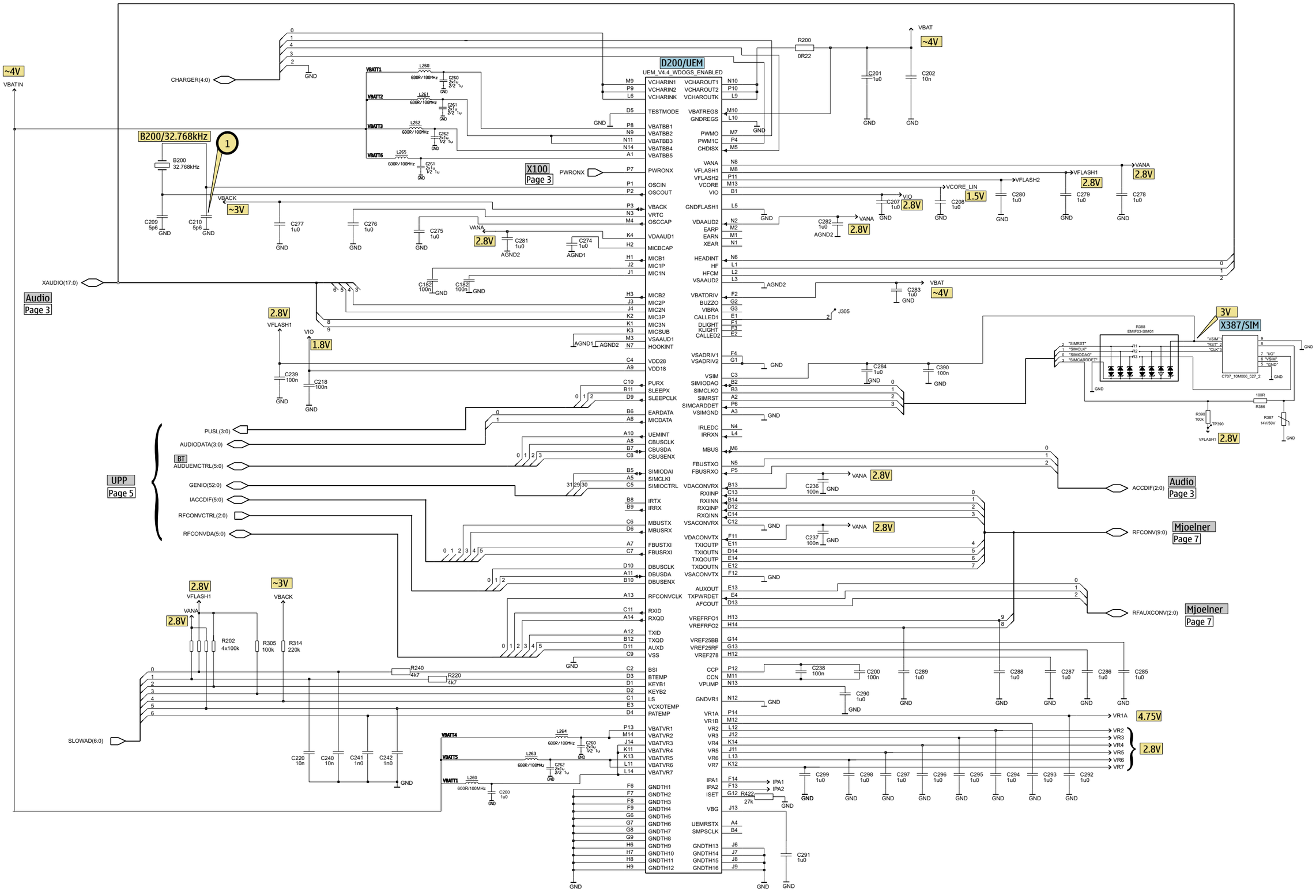
Title: DCT-4 common baseband



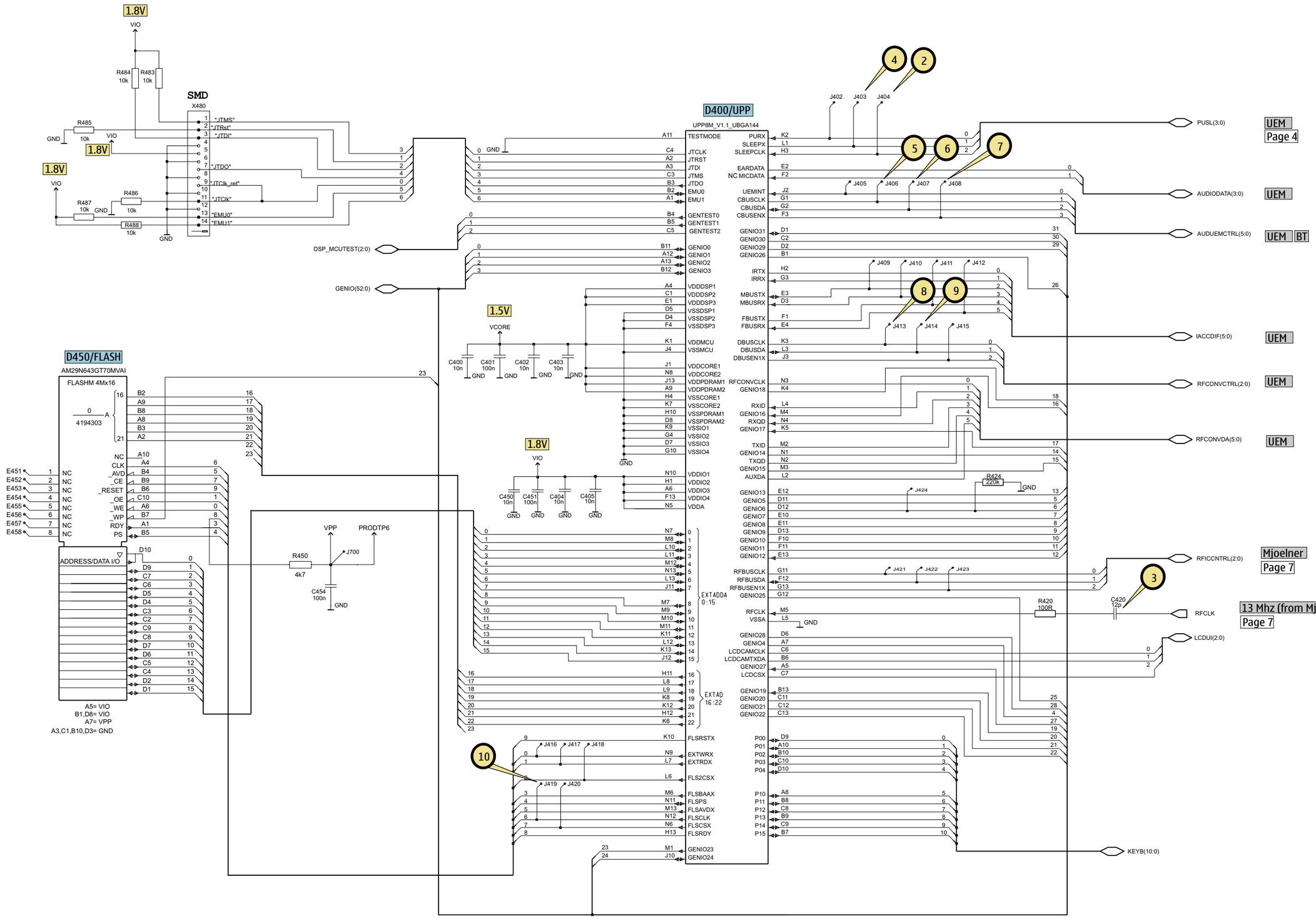
Title: System connector



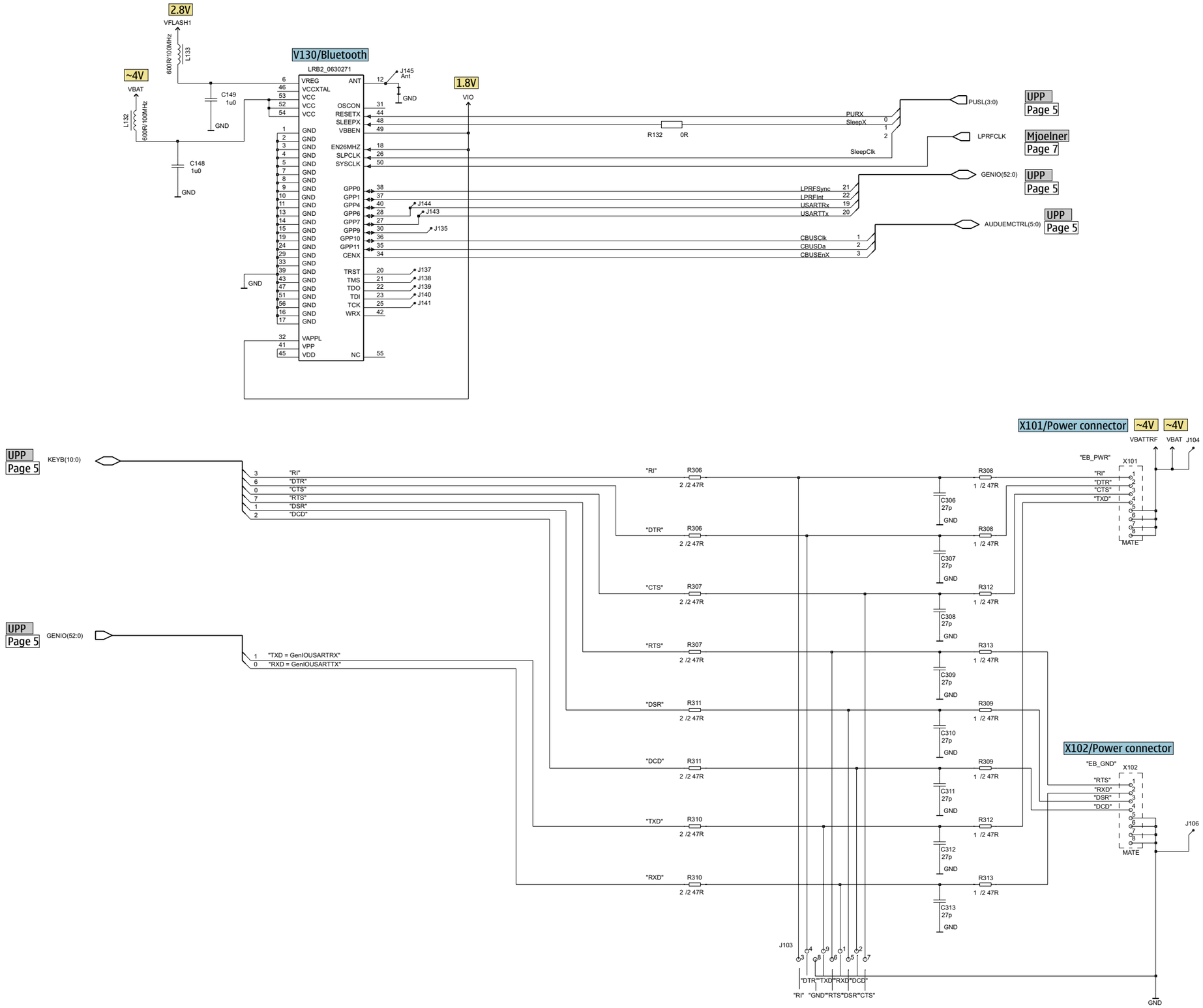
Title: UEME, SIM



Title: UPP, Combo memory



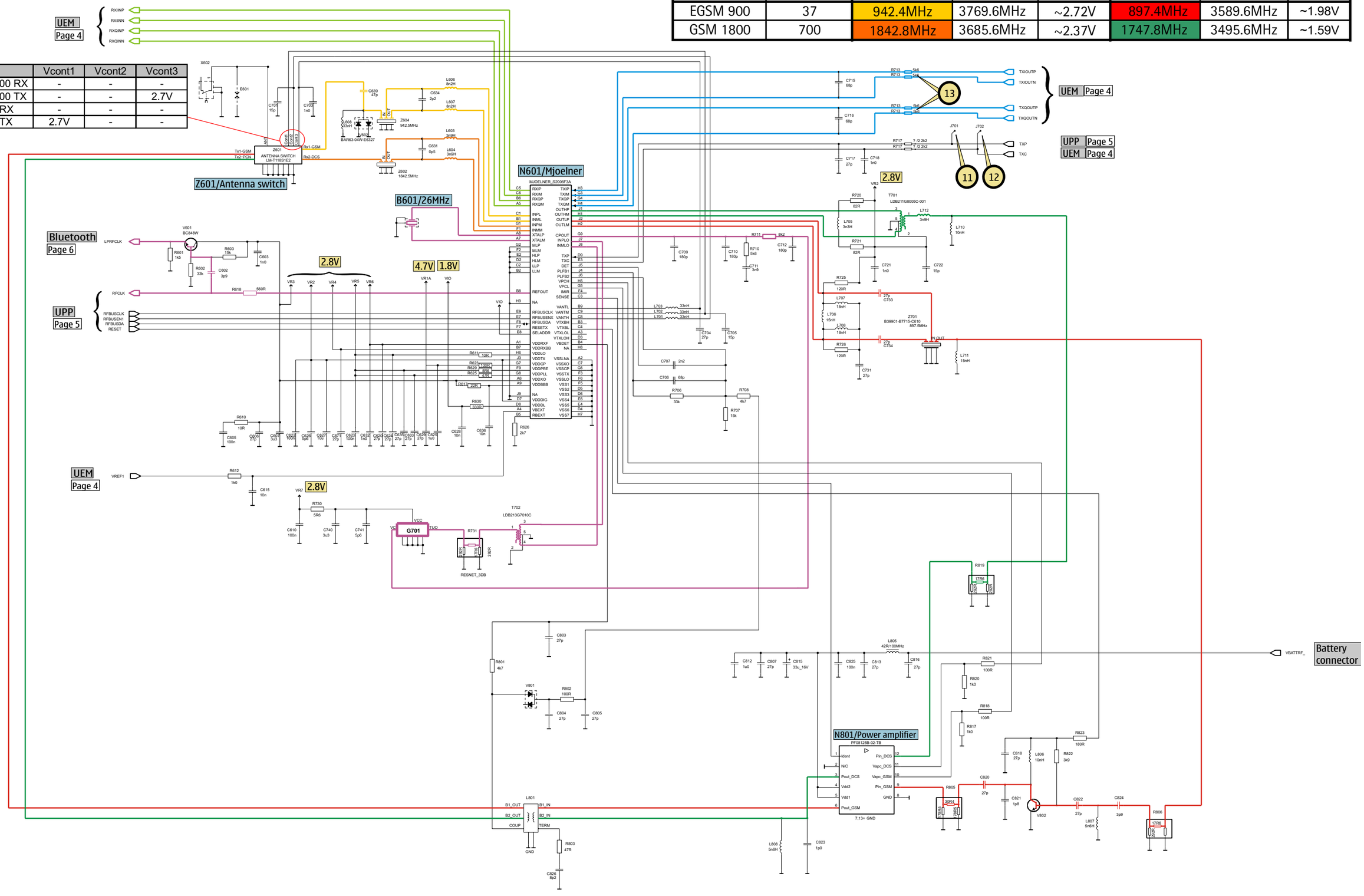
Title: Bluetooth, Power connectors



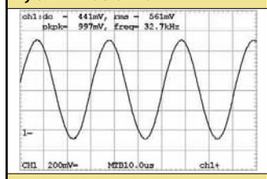
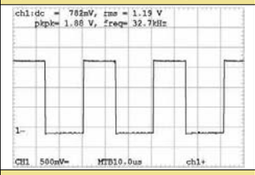
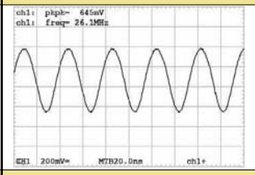
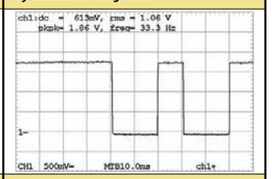
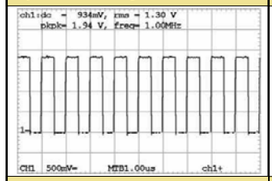
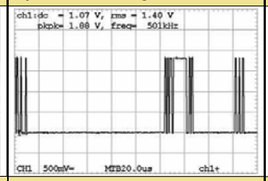
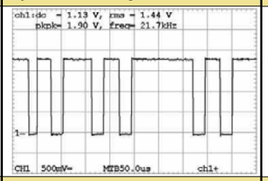
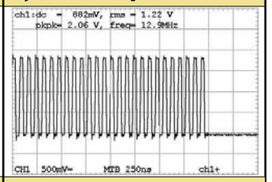
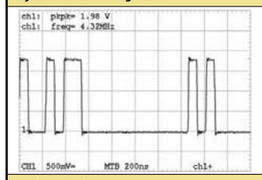
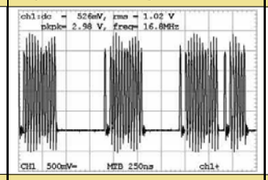
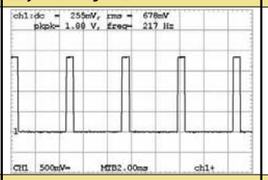
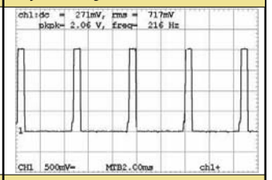
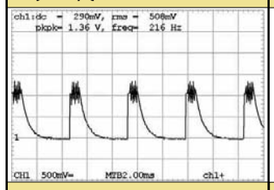
Title: RF part

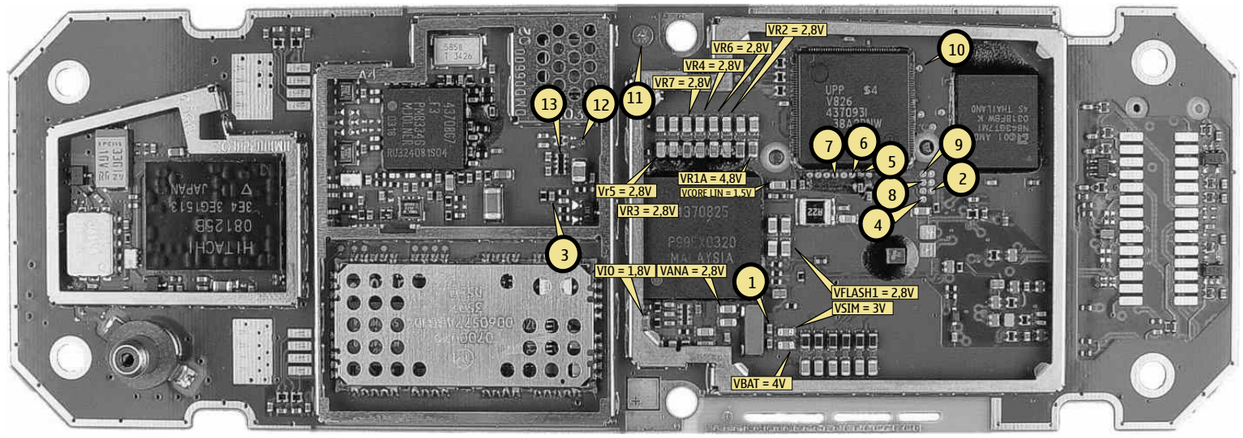
Band	Channel	RX	VCO/RX	VC/RX	TX	VCO/TX	VC/TX
EGSM 900	37	942.4MHz	3769.6MHz	~2.72V	897.4MHz	3589.6MHz	~1.98V
GSM 1800	700	1842.8MHz	3685.6MHz	~2.37V	1747.8MHz	3495.6MHz	~1.59V

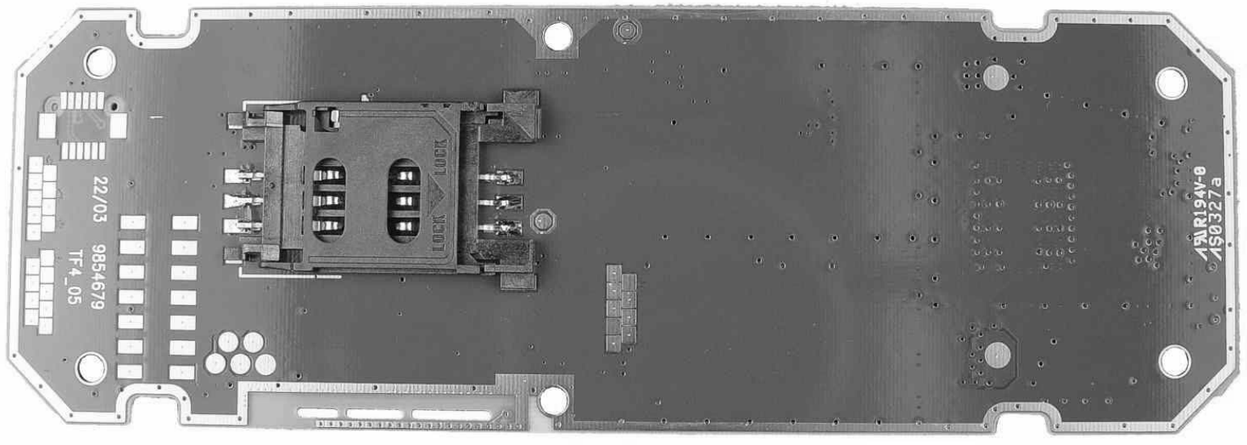
	Vcont1	Vcont2	Vcont3
GSM850/900 RX	-	-	-
GSM850/900 TX	-	-	2.7V
GSM1800 RX	-	-	-
GSM1800 TX	2.7V	-	-



Title: Signal overview

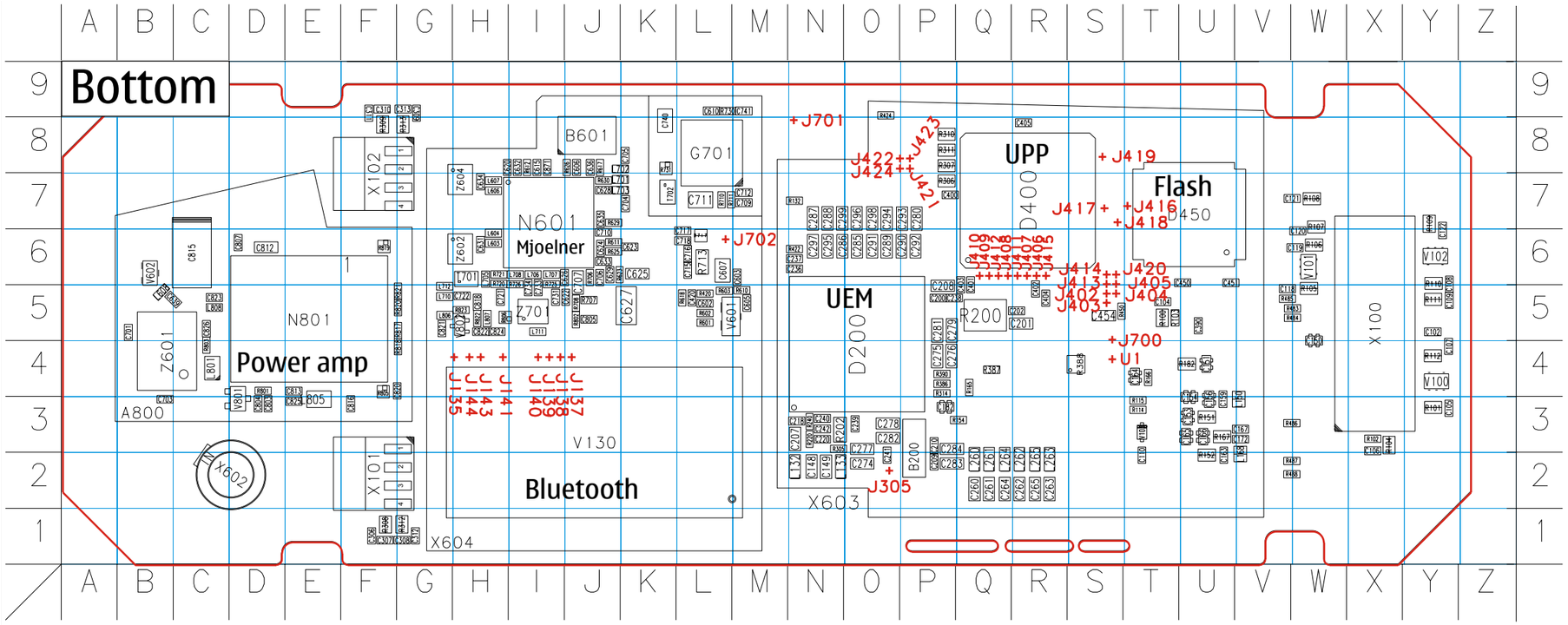
1) 32kHz at C210	2) 32kHz SLEEPCLK at J404	3) 26MHz RFCLK at C420	4) SLEEPX at J403
			
5) CBUSCLK at J406	**6) CBUSDATA at J407**	**7) CBUSENX at J408**	**8) DBUSCLK at J413**
			
9) DBUSDA at J414	**10) FLASHCLK at J419**	**11) TXP at J701**	**12) TXC at J702**
			
13) TX I/Q at R713			
			

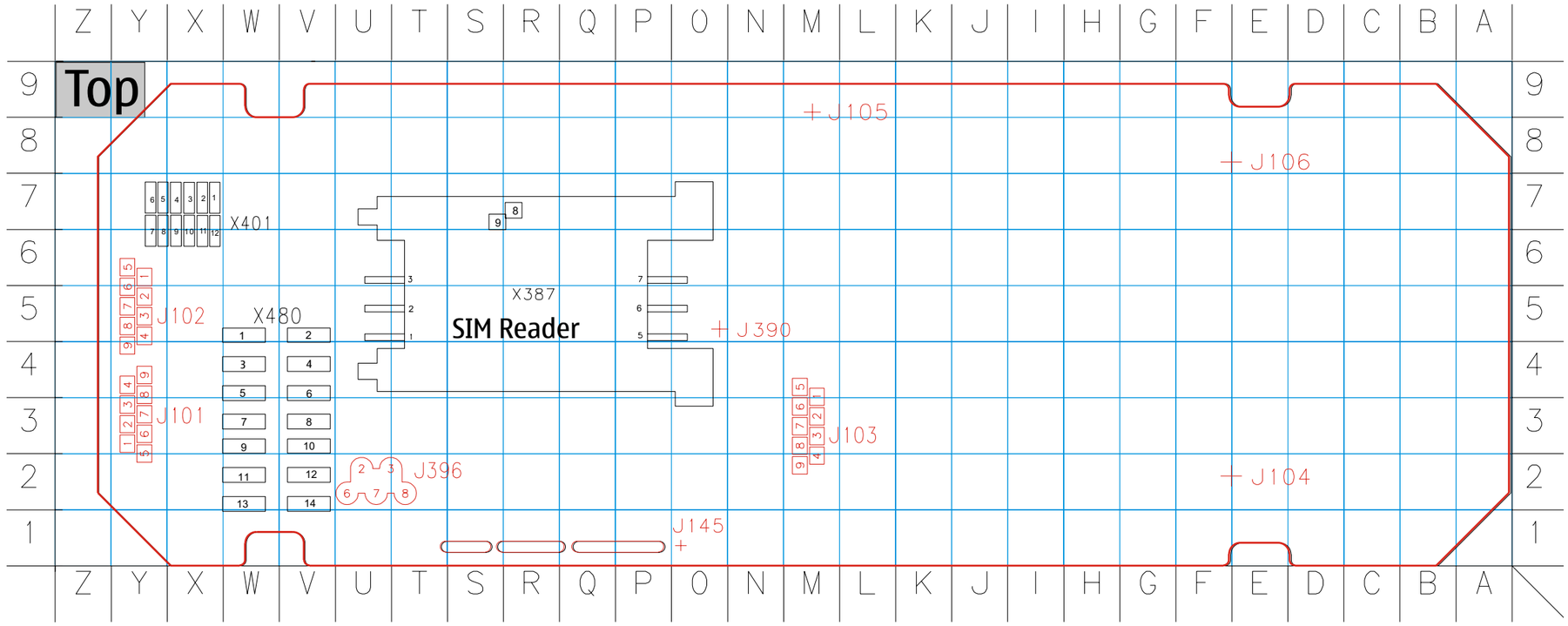




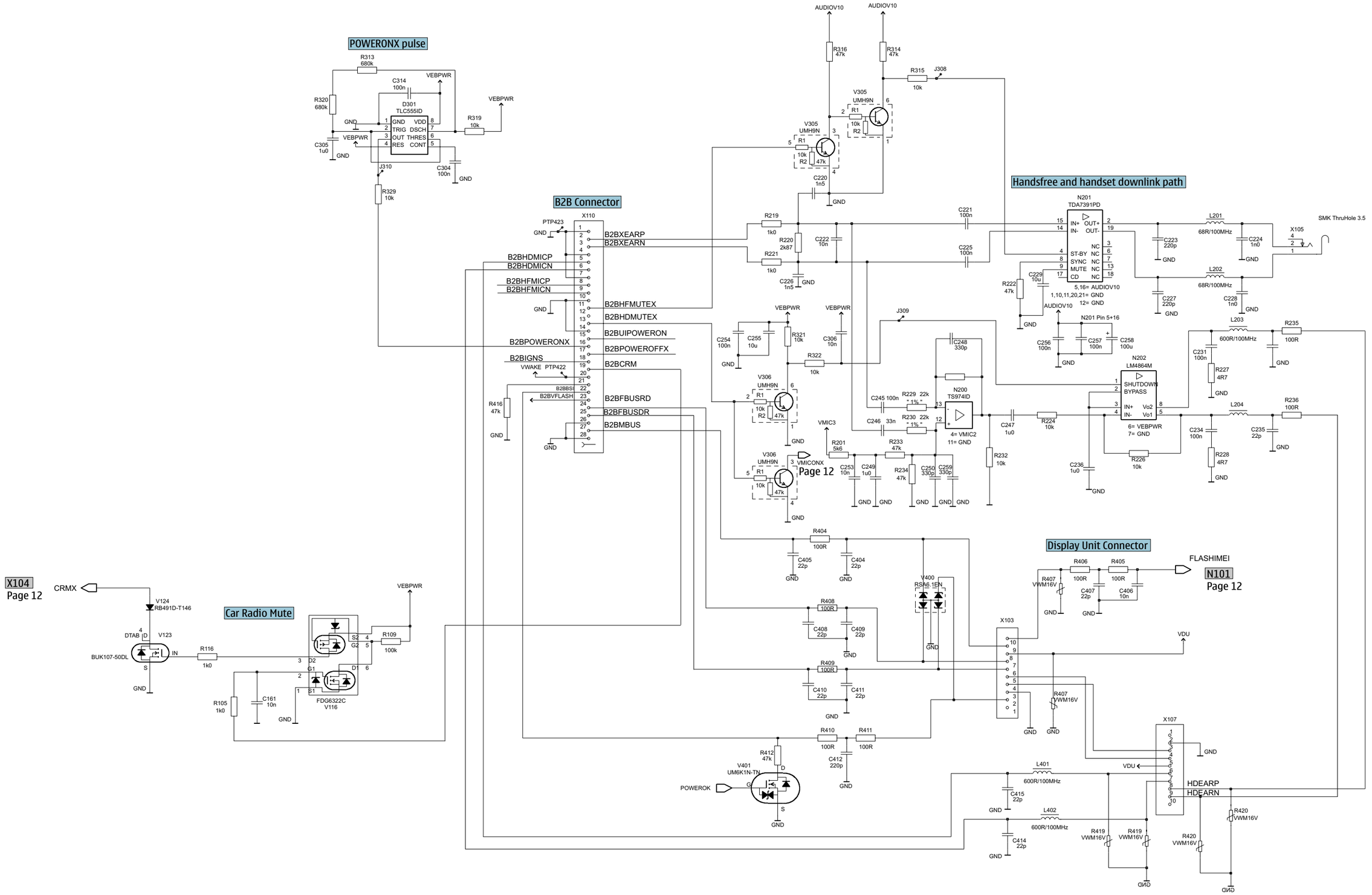
TTitle: Component finder TF4_05

A		C281	P5	C704	K7	J405	S5	R105	W5	R711	L7
A800	D5	C282	O3	C705	K8	J406	R6	R106	W6	R713	L6
B		C283	P2	C706	J6	J407	R6	R107	W7	R717	L6
B200	P3	C284	P3	C707	J6	J408	Q6	R108	W7	R720	H6
B601	J8	C285	O6	C709	M7	J409	Q6	R109	Y7	R721	H6
C		C286	N6	C710	J6	J410	Q6	R110	Y6	R725	I6
C102	Y5	C287	N7	C711	L7	J411	R6	R111	Y5	R726	I6
C104	T5	C288	N7	C712	M7	J412	Q6	R112	Y4	R730	L9
C105	Y3	C289	O6	C715	L6	J413	S6	R114	T3	R731	K8
C106	X3	C290	P6	C716	L6	J414	S6	R115	T3	R801	D4
C107	Y4	C291	O6	C717	L6	J415	R6	R132	N7	R802	J5
C108	Y5	C292	P6	C718	L6	J416	T7	R151	U3	R803	C4
C109	Y6	C293	P7	C721	H5	J417	S7	R152	U2	R805	F4
C110	T2	C294	O7	C722	H5	J418	S7	R154	Q3	R806	H5
C118	V5	C295	N6	C731	I5	J419	S8	R165	Q4	R817	G5
C119	W6	C296	O7	C733	I5	J420	S6	R166	T4	R818	G4
C120	W6	C297	N6	C734	I5	J421	P8	R167	U3	R819	F6
C121	W7	C298	O7	C740	K8	J422	P8	R182	U4	R820	G5
C122	Y6	C299	N7	C741	M9	J423	P8	R200	Q5	R821	G5
C148	N2	C306	F1	C803	D3	J424	P8	R202	N3	R822	H5
C149	N2	C307	F1	C804	D3	J700	S5	R220	N3	R823	H5
C150	W5	C308	G1	C805	J5	J701	N8	R240	N3	**T**	
C151	U4	C309	G9	C807	D6	J702	L6	R305	N3	T701	H6
C153	U3	C310	F9	C812	D6	**L**		R306	P7	T702	K7
C154	U3	C311	F9	C813	E4	L132	N2	R307	P8	**V**	
C156	U3	C312	G1	C815	C6	L133	N2	R308	F1	V100	Y4
C159	U3	C313	G9	C816	F3	L150	V3	R309	F8	V101	W6
C163	U2	C390	U5	C818	H5	L168	V2	R310	P8	V102	Y6
C164	T4	C400	P7	C820	G4	L260	Q2	R311	P8	V103	T3
C165	U3	C401	Q5	C821	G5	L261	Q2	R312	G1	V130	J3
C166	U3	C402	R5	C822	H5	L262	R2	R313	G8	V601	L5
C167	V3	C403	Q5	C823	C5	L263	R2	R314	P4	V602	B6
C172	V3	C404	R5	C824	H5	L264	Q2	R386	P4	V801	D3
C182	P3	C405	R8	C825	E3	L265	R2	R387	Q4	V802	H5
C200	P5	C420	L5	C826	C5	L603	H6	R388	S4	**X**	
C201	R5	C450	U6	C871	I8	L604	H6	R390	P4	X100	X5
C202	R5	C451	U6	**D**		L606	H7	R420	L5	X101	F2
C207	N3	C454	S5	D200	O4	L607	H7	R422	N6	X102	F7
C208	P5	C602	L5	D400	R7	L608	B5	R424	O9	X387	R5
C209	P2	C603	M6	D450	U7	L701	K7	R450	S5	X401	X7
C210	P3	C605	M5	**G**		L702	K8	R483	W5	X480	W3
C218	N3	C606	J8	G701	L8	L703	K7	R484	W5	X602	D2
C220	N3	C607	L6	**J**		L705	H6	R485	V5	X603	R5
C236	N6	C610	L9	J101	Y3	L706	I6	R486	W3	X604	J5
C237	N6	C615	I8	J102	Y5	L707	I6	R487	W2	**Z**	
C238	P5	C620	H8	J103	M3	L708	I6	R488	W2	Z601	B4
C239	O3	C622	J5	J104	E2	L710	G5	R601	L5	Z602	H6
C240	N3	C623	K6	J105	M9	L711	I5	R602	L5	Z604	H7
C241	O2	C624	J6	J106	E8	L712	G5	R603	L5	Z701	I5
C242	N3	C625	K6	J135	H4	L801	C4	R610	M5		
C260	Q2	C626	J6	J137	J4	L805	E3	R611	J6		
C261	Q2	C627	K5	J138	I4	L806	G5	R612	I8		
C262	R2	C628	J7	J139	I4	L807	H5	R617	J8		
C263	R2	C629	J6	J140	I4	L808	C5	R618	L5		
C264	Q2	C631	H6	J141	H4	**N**		R623	J6		
C265	R2	C632	I8	J143	H4	N601	I7	R625	J6		
C274	O2	C633	J6	J144	H4	N801	E5	R626	J8		
C275	P4	C634	H7	J145	O1	**R**		R629	J7		
C276	P4	C635	J7	J305	O2	R100	T5	R630	J7		
C277	O3	C636	J8	J396	U2	R101	Y3	R706	J6		
C278	O3	C639	C5	J402	S5	R102	X3	R707	J5		
C279	P5	C701	B5	J403	S5	R103	T5	R708	J5		
C280	P7	C703	B3	J404	S5	R104	X3	R710	L7		



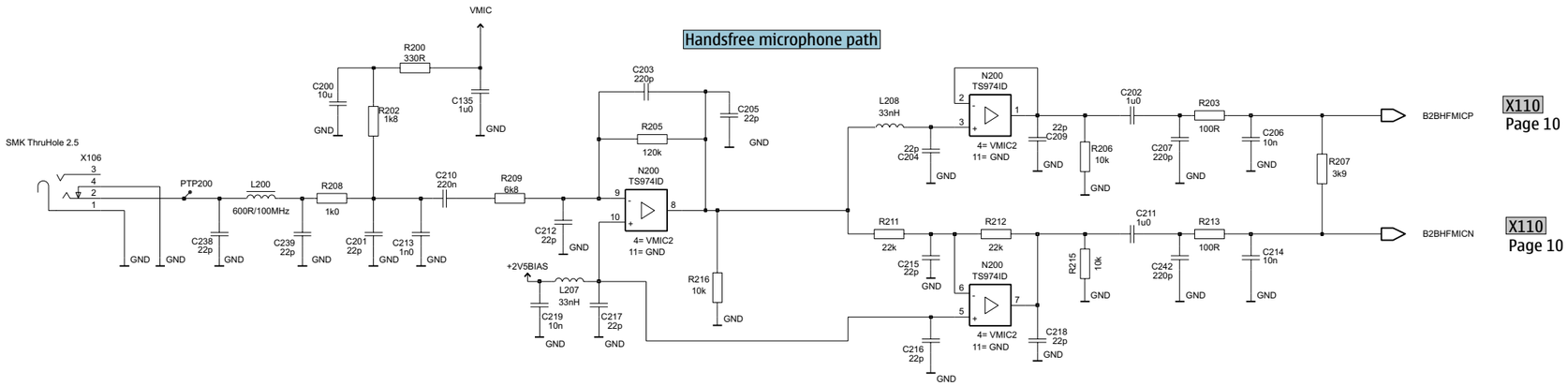


Title: Car Radio mute, Display, Handset

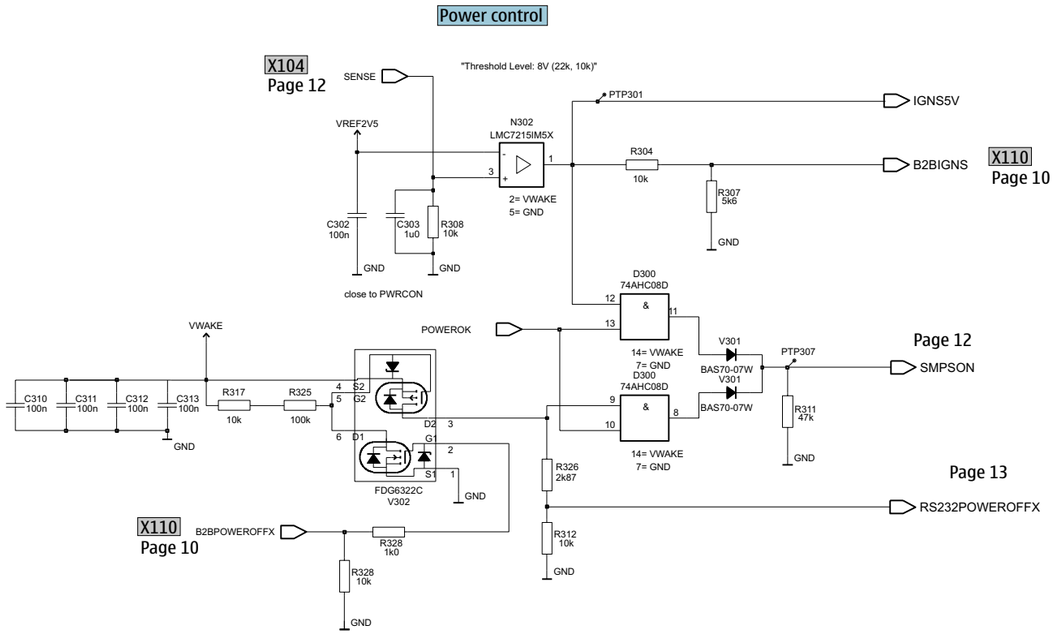


Title: Power, Microphone

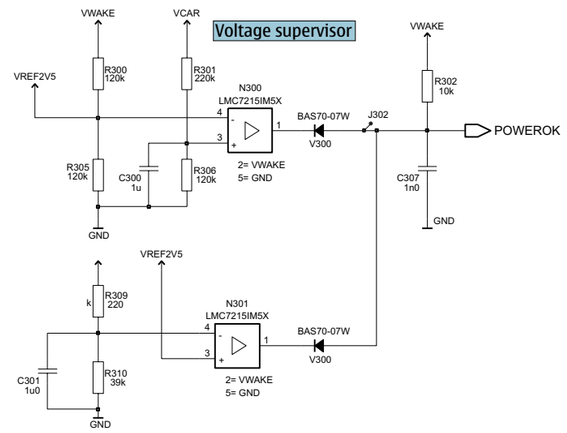
Handsfree microphone path

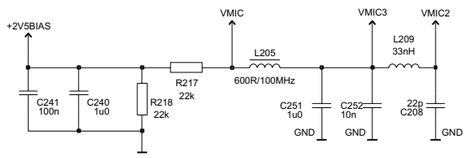


Power control

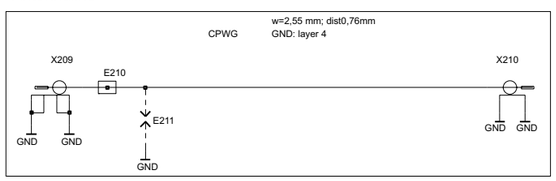


Voltage supervisor

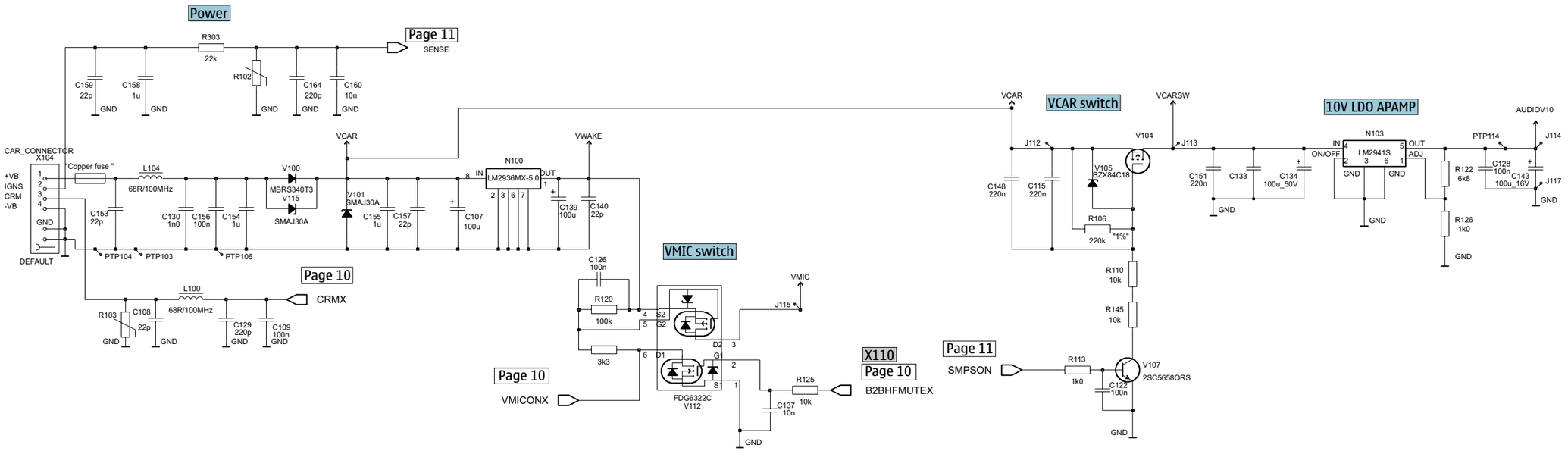


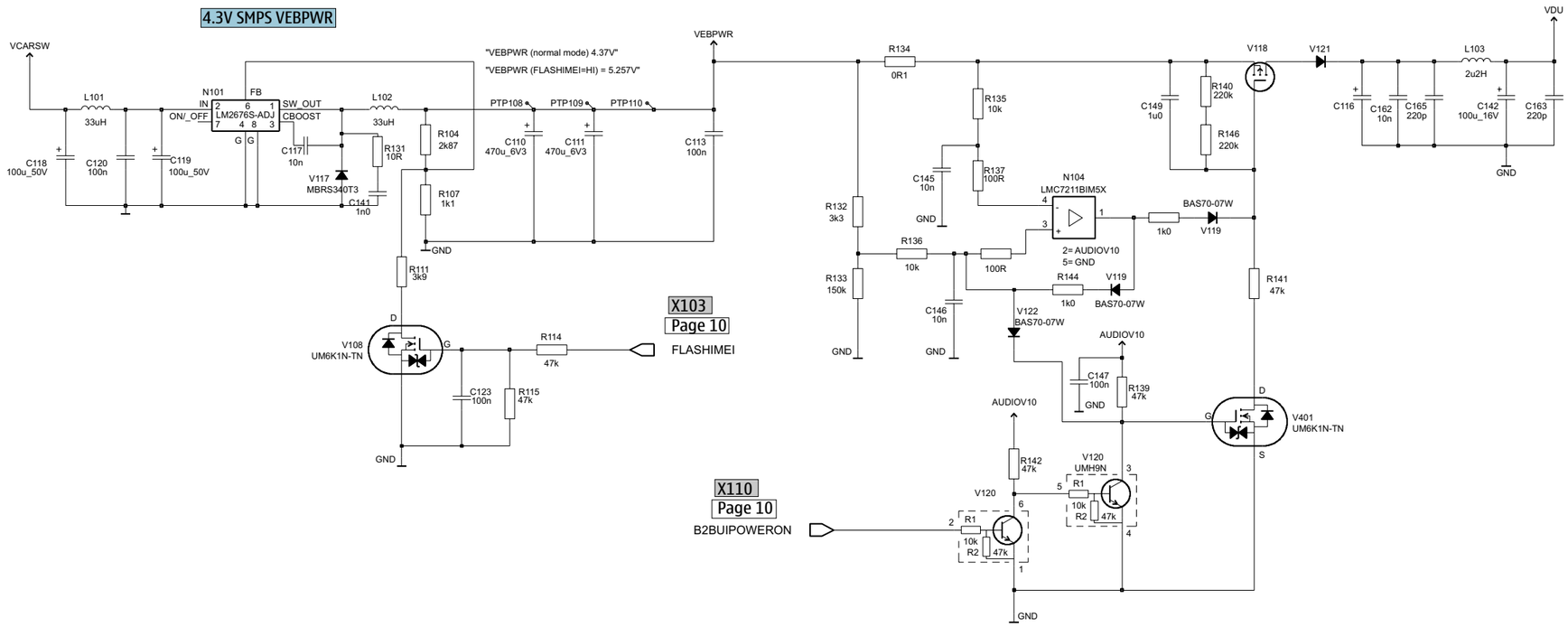


Antennaline

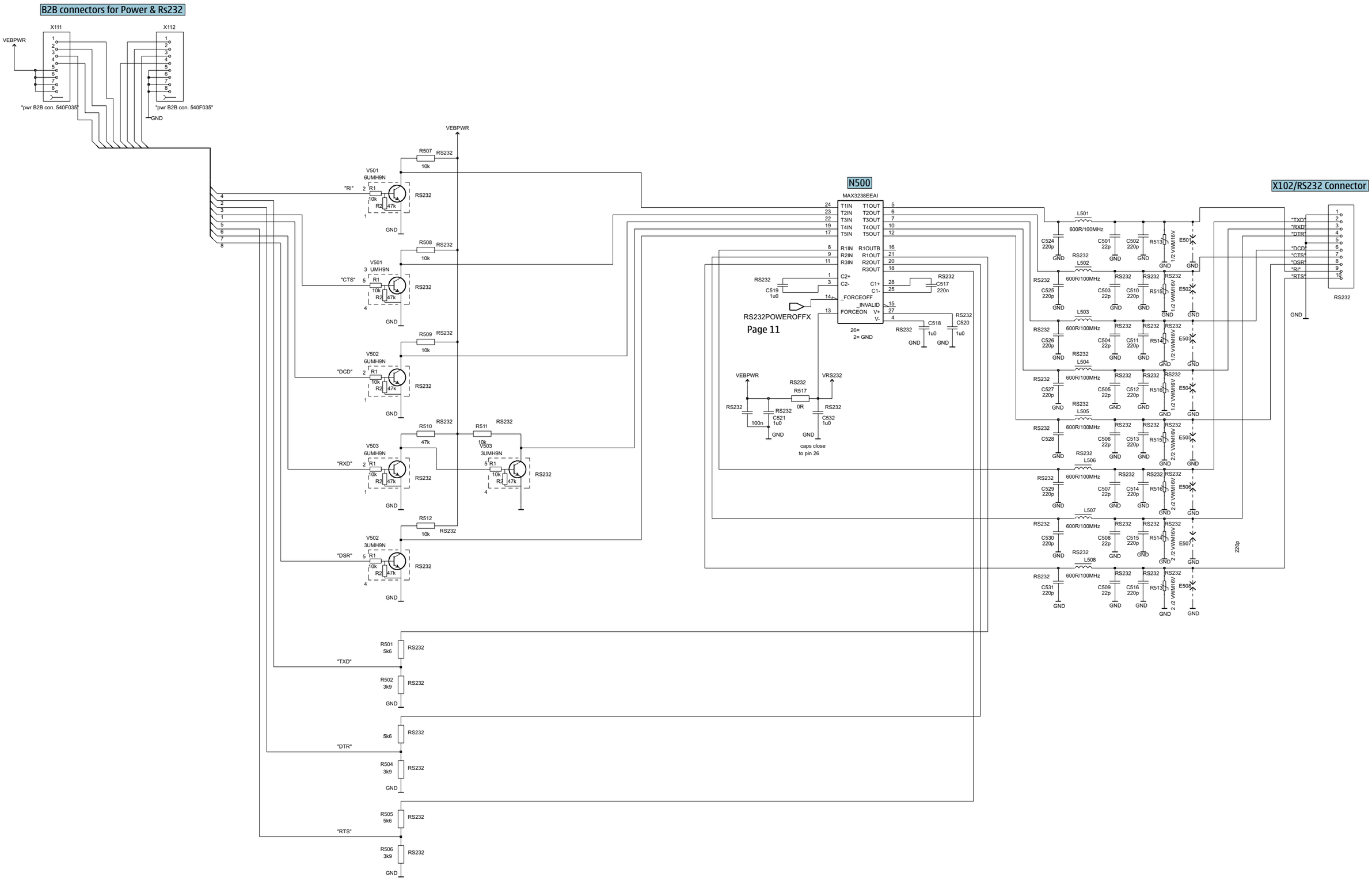


Title: Power





Title: RS232 connection



Title: Component finder TF5_06

C		C216	H3	D		R142	L2	R329	M7
C107	F11	C217	H2	D300	P6	R143	N16	R404	E15
C108	C11	C218	H3	D301	M6	R144	N15	R405	E16
C109	D9	C219	H1	E		R145	F13	R406	E16
C110	Q17	C220	P4	E210	D22	R146	M16	R407	E16
C111	Q14	C221	H7	L		R200	C6	R408	E15
C113	Q10	C222	J1	L100	C10	R201	J3	R409	E14
C115	F13	C223	D8	L101	I10	R202	C6	R410	E14
C116	I16	C224	C8	L102	O9	R203	O4	R411	E14
C117	N11	C225	H7	L103	H16	R205	H2	R412	E14
C118	I12	C226	P4	L104	E13	R206	J3	R416	Q3
C119	I7	C227	H8	L200	C7	R207	O3	R419	D2
C120	M11	C228	C9	L201	D8	R208	C7	R420	D4
C122	F12	C229	D6	L202	D9	R209	H2	V	
C123	L13	C230	E5	L203	E5	R211	H3	V100	D11
C126	J4	C231	F3	L204	E4	R212	H3	V101	F10
C128	H17	C234	G3	L205	J4	R213	N4	V104	H14
C129	D9	C235	E4	L207	I1	R215	H3	V105	F14
C130	E13	C236	F1	L208	I3	R216	G2	V107	F12
C133	G19	C238	C6	L209	I3	R217	J2	V108	L12
C134	G21	C239	C7	L401	E2	R218	J2	V112	J4
C135	D6	C240	J2	L402	E2	R219	P4	V115	C11
C137	J5	C241	J2	N		R220	P4	V116	L4
C139	L14	C242	N4	N100	J14	R221	P4	V117	O11
C140	K14	C245	J1	N101	M9	R222	D7	V118	L16
C141	O12	C246	I1	N103	I19	R224	G2	V119	N15
C142	F16	C247	G1	N104	O16	R226	G2	V120	L2
C143	L17	C248	I2	N200	I2	R227	F3	V121	K15
C145	O15	C249	J3	N201	F7	R228	G3	V122	N17
C146	O17	C250	I1	N202	F2	R229	I1	V123	K7
C147	O16	C251	I4	N300	R6	R230	I1	V124	K8
C148	F13	C252	I4	N301	K5	R231	I1	V300	Q4
C149	N16	C253	J3	N302	M7	R232	F1	V301	P5
C151	G18	C254	F2	R		R233	J3	V302	O5
C153	E13	C255	E2	R102	B10	R234	J3	V305	M4
C154	E12	C256	H7	R103	C12	R235	D5	V306	L1
C155	J13	C257	D7	R104	L11	R236	D4	V400	E15
C156	E12	C258	I5	R105	L4	R300	R6	V401	N15
C157	J14	C259	I2	R106	G14	R301	R4	X	
C158	B11	C300	R5	R107	L11	R302	Q4	X103	B15
C159	B11	C301	K5	R109	K4	R303	B11	X104	A12
C160	B10	C302	N8	R110	F13	R304	M7	X105	B9
C161	L4	C303	N7	R111	L12	R305	R6	X106	A7
C162	H15	C304	L5	R113	F13	R306	Q5	X107	B4
C163	G17	C305	N6	R114	L13	R307	M8	X110	O2
C164	B10	C306	K1	R115	L13	R308	N7	X111	Q20
C165	H15	C307	Q4	R116	L4	R309	K6	X112	L20
C200	C6	C310	Q5	R120	J4	R310	K6	X209	B22
C201	C7	C311	K4	R122	G20	R311	P5	X210	Q23
C202	J3	C312	M7	R123	J4	R312	O5		
C203	H2	C313	Q5	R125	J5	R313	N6		
C204	I3	C314	N5	R126	G20	R314	M4		
C205	H2	C404	E15	R131	O12	R315	M4		
C206	O4	C405	E16	R132	O18	R316	M4		
C207	O4	C406	E16	R133	N17	R317	Q6		
C208	I3	C407	E16	R134	M17	R318	O4		
C209	I3	C408	E15	R135	O15	R319	M5		
C210	C7	C409	E15	R136	O17	R320	N6		
C211	H3	C410	E15	R137	O15	R321	K1		
C212	H2	C411	E14	R138	O15	R322	K1		
C213	C6	C412	E14	R139	N17	R325	P4		
C214	N4	C414	E2	R140	M16	R326	O4		
C215	H3	C415	E2	R141	M15	R328	O4