Programs After Market Services (PAMS)
Technical Documentation

SERVICE MANUAL

[NMP Part No. 0275208]

NHE–6 SERIES CELLULAR PHONE

(FOR USE ON THE GSM NETWORK)

NOKIA

MOBILE PHONES

NHE–6 Last update: 08/98

Programs After Market Services (PAMS) Technical Documentation

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 2 part no. 0275387	**08/98**	O Juntunen	**Frontsection, Ch.1** Layout changes, Accessory Overview removed
			04 System Module repaginated, spell checked
			Appendix 1 and 3 New appx. no 1 replaces both
			Accessory overview Removed
			Disassembly instructions updated version
			Troubleshooting instructions Updated version
			Tuning Instructions New pages 1, 2, 5, 12
			Service Software Instructions Updated version

Programs After Market Services (PAMS)
Technical Documentation

CHAPTER 1 – FOREWORD

Introduction

Service Manual Structure: Main Table of Contents

Programs After Market Services (PAMS) Technical Documentation

This section of the service manual (the NHE–6 series Transceiver booklet) describes those areas of the NHE–6 series handportable telephone which are common to all variants. This booklet includes technical information; a technical overview of the transceiver plus detailed descriptions of the main modules and associated parts lists.

The Service Manual is intended for use by qualified service personnel only.

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 Ltd 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: Nokia Mobile Phones Ltd
After Sales Technical Documentation
PO Box 86
24101 SALO
Finland

Programs After Market Services (PAMS)
Technical Documentation

Warnings and Cautions

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 HANDPORTABLE TELEPHONE MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES EG PETROL STATIONS, BLASTING AREAS ETC. PERMISSION MUST BE OBTAINED TO USE THE PHONE IN AIRCRAFT.

3 OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.

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 TELEPHONE 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.

This page intentionally left blank.

Chapter 2

NHE–6 TECHNICAL INFORMATION

CHAPTER 2 – TECHNICAL INFORMATION

Contents

Introduction

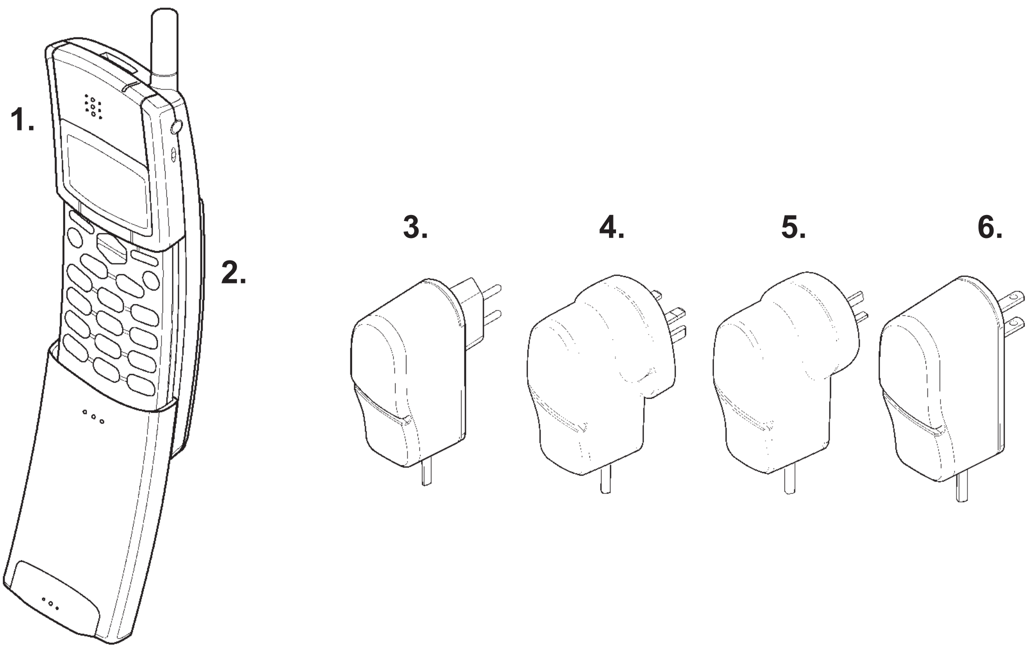
This chapter contains a list of products/modules together with their associated order codes, and details of the performance specifications for the NHE–6 Series Transceiver. The performance specifications are split into general, transmitter and receiver functions.

Product Selection

Handportable

The NHE–6 is a handportable cellular phone for the pan–European GSM network. It is a GSM phase 2 power class 4 transceiver providing 15 power levels with a maximum output power of 2 W.

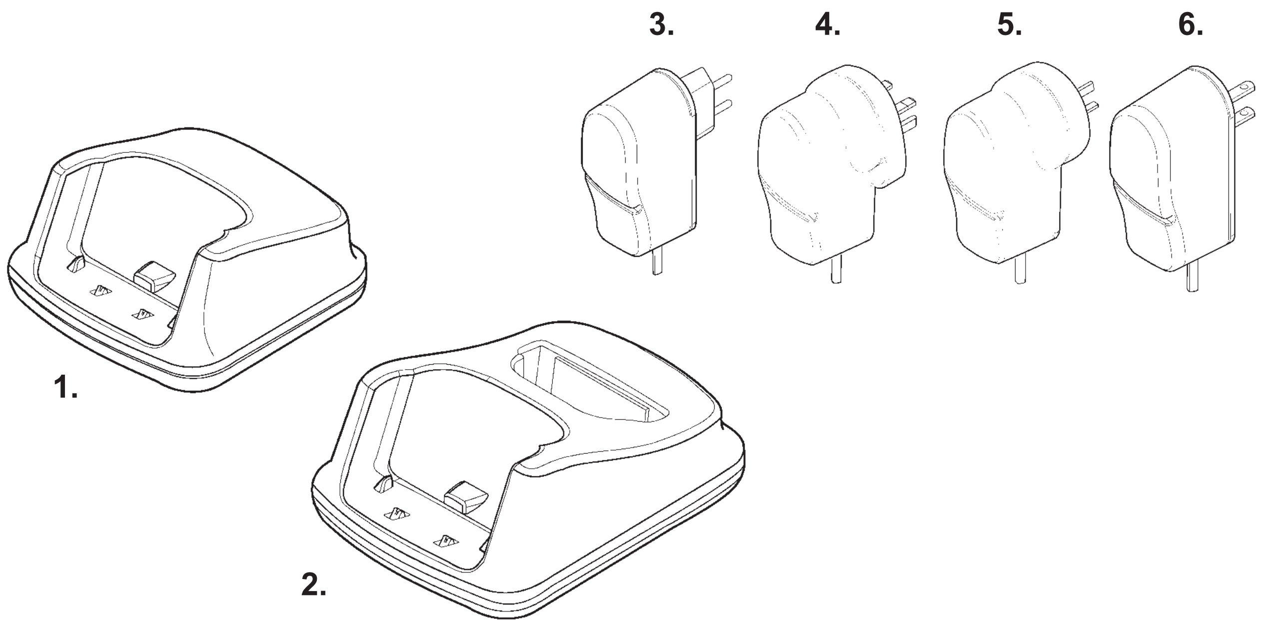
The basic handportable package offers the user a standard battery pack and travel charger for charging from mains. The package contains the following product:



Item/name:	Type:	Product code:
1. Handportable	(see Variant Appendixes)	
2. Standard battery (400 mAh)	BLJ–2	0670129
3. Fast travel charger (Euro plug)	ACH–6E	0675084
4. Fast travel charger (UK plug)	ACH–6X	0675087
5. Fast travel charger (Australia plug)	ACH–6A	0675086
6. Fast travel charger (US plug)	ACH–6U	0675085

Desktop Option

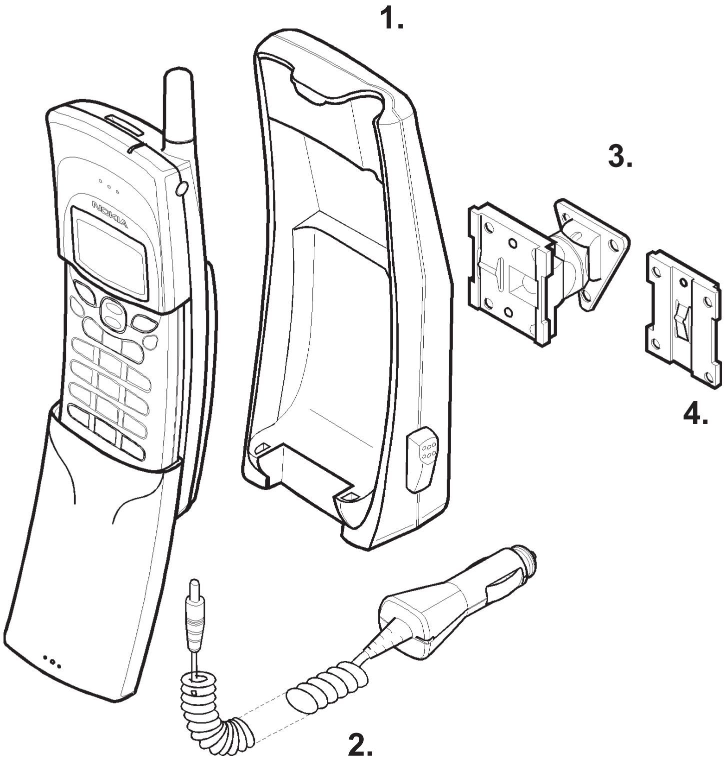
The desktop option allows the user to charge the handportable and spare battery from mains. With this option the user can also discharge the spare battery. The desktop option contains the following product:



Item/name:	Type:	Product code:
1. Light desktop stand	CGH–5	0700036
2. Desktop stand	CGH–6	0675080
3. Fast travel charger (Euro plug)	ACH–6E	0675084
4. Fast travel charger (UK plug)	ACH–6X	0675087
5. Fast travel charger (Australia plug)	ACH–6A	0675086
6. Fast travel charger (US plug)	ACH–6U	0675085

Basic Car Kit Option

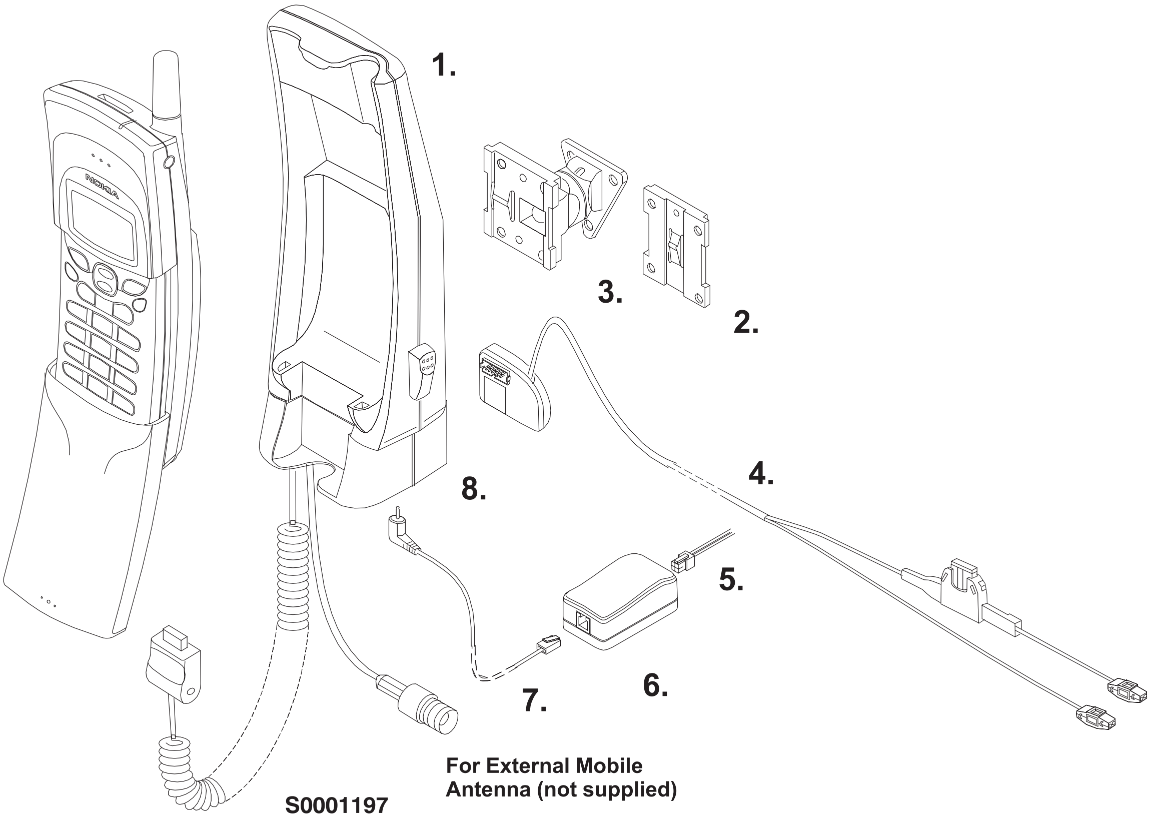
This option (Basic Car Kit) offers a passive cradle and charging functions to the user in the car installation. The light car kit option contains the following product:



Item/name:	Type:	Product code:
1. Mobile holder	MBT–5	0620030
2. Cigarette lighter charger	LCH–6	0675076
3. Swivel plate	HHS–7	0650020
4. Mounting plate	MKE–7	0650007

Extended Car Kit Option

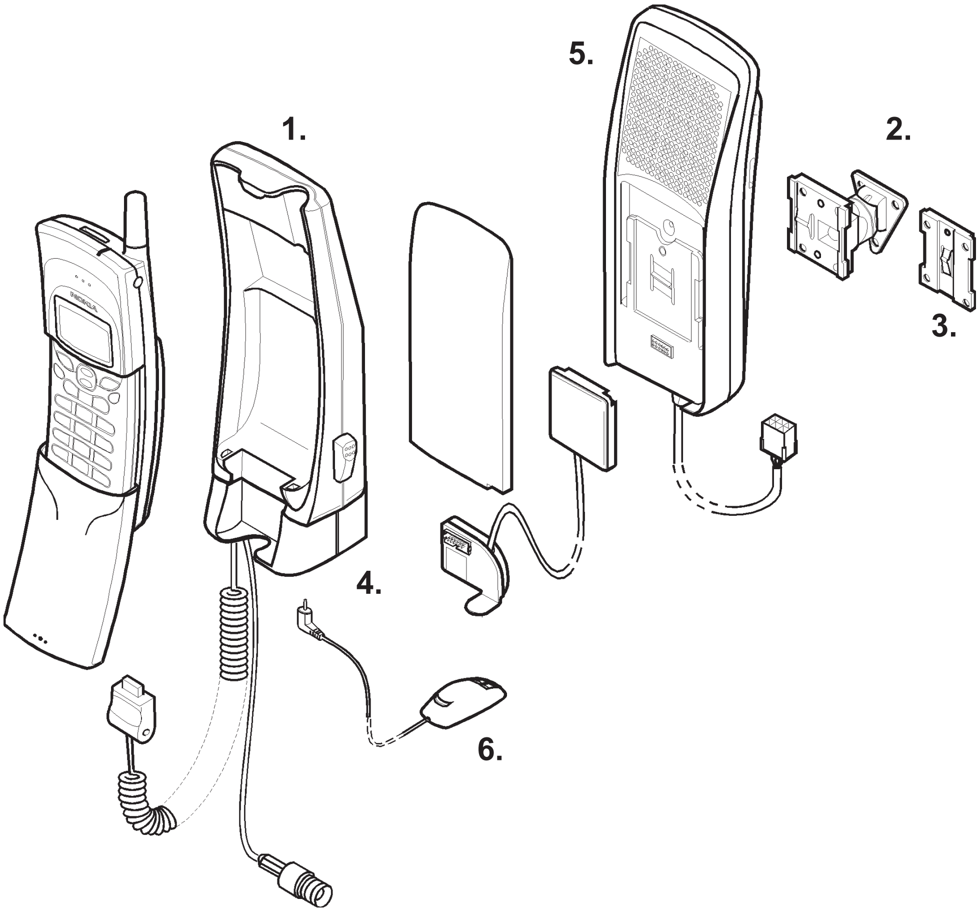
This option (Extended Car Kit) offers a passive cradle and charging functions to the user in the car installation. The light car kit option contains the following product:



Item/name:	Type:	Product code:
1. Phone holder	MBT–5	0620030
2. Mounting plate	MKE–7	0650007
3. Swivel mounting plate	HHS–7	0650020
4. Light guide cable	XLC–1	0730062
5. Output power cable	PCM–5	0730058
6. Fixed mobile charger	LCM–1	0675077
7. Power cable	PCC–2	0730076
8. External antenna unit	AAH–1D	0750077

Complete Car Kit Option

This option (Complete Car Kit) contains the same functions as the light car kit option and also offers full handsfree and external antenna functions. The use of the product can be extended for car use with the following accessories:



Item/name:	Type:	Product code:
1. Mobile holder	MBT–5	0620030
2. Swivel mounting plate	HHS–7	0650020
3. Mounting plate	MKE–7	0650007
4. External antenna unit	AAH–1	0750076
5. Handsfree unit	PHF–3	0694030
6. Handsfree microphone	HFM–7	0690012

Product and Module List

Unit/type:	Product code:	Module code:
Transceiver NHE–6	See variant Appendixes	
Standard Battery BLJ–2 (400 mAh)	0670129	
Extended Battery BLJ–5 (900 mAh)	0670127	
Fast Travel Charger ACH–6X (UK)	0675087	
Fast Travel Charger ACH–6E (EUR)	0675084	
Fast Travel Charger ACH–6A (AUS)	0675086	
Fast Travel Charger ACH–6U (US)	0675085	
Universal Mobile Charger LCH–6	0675076	
Light Desktop Stand CGH–5	0700036	
Desktop Stand CGH–6	0675080	
Mobile Holder MBT–5	0620030	
External Antenna Unit AAH–1	0750076	
Handsfree Unit PHF–3	0694030	
• HF/charger module DC9		0200656
• mechanics MPHF3		0260681
Handsfree Unit with Voice Recognition PHF–4	0694031	
External Antenna Unit for Data AAH–1D	0750077	
Power Cable PCH–4J	0730055	
HF Microphone HFM–7	0690012	
HF Speaker HFS–9	0692007	
Mounting Plate MKE–7	0650007	
Swivel Plate HHS–6	0650019	
Headset HDC–3	0694041	
Headset Adapter HDA–4	0694042	
Headset HDC–2	0694017	
PCMCIA Card DTP–2C		
Data Cable DLH–5	0730059	
Data Cable DAU–4F	0730056	
I.R.Link Module JLP–1	0750079	
I.R.Connector JLC–1	0750078	

Technical Specifications

General Specifications of NHE–6 Series Transceiver

Temperature range (Nominal)	*+5° C to +40° C*
Temperature range (Extreme conditions) –specifiacations fulfilled	*–10° C to +55° C*
Operating time (with BLJ–2)	
• talk time	*up to 80 min* (DTX OFF, 2W) *up to 150 min (0 speech, DTX ON)*
• standby time	*up to 70 hrs*
Battery voltage	*7.2 V*
Nominal current consumption	
• power off mode m(max):	*1.5 mA*
• idle mode (SIM clock OFF)	*4.6 mA (strong field,no neighbours)* *9.1 mA (weak field, 5 weak + 1 strong neighbours)* / paging period 9
• call mode, 2W (typ):	*224 mA* *(50% speech ratio, DTX ON)*
Dimensions (h x w x d) (NOKIA 2)	
• transceiver + BLJ–2	*141 x 48 x 26 mm*
Weight (NOKIA 2)	
• transceiver + BLJ–2	*151 g*
• transceiver + BLJ–5	*181 g*

Electrical Specifications

Transceiver General Features

Cellular system	*Global System for Mobile communications (GSM)*
Number of RF channels	*124*
Number of time domain channels	*81 RF channel*
Duplex spacing	*45 MHz*
Channel spacing	*200 kHz*
Modulation type	*GMSK*

Receiver Branch

Frequency band	*935.2...959.8 MHz*
Type	*linear, 2 IFs*
IF	*71 MHz and 13 MHz*
3 dB bandwith	*± 100 kHz*
Reference noise bandwidth	*270 kHz*
Sensitivity	*–102 dBm RX channel input* *I/Q S/N ratio > 8 dB*
AGC dynamic range	*94 dB, typ*
Receiver gain	*65 dB (voltage gain)*
RF front end gain control range	*40 dB*
2nd IF gain control range	*57 dB*
Input dynamic range	*–102...–10 dBm*
Gain relative accuracy in receiving band	*± 1.5 dB*
Gain relative accuracy on channel	*± 0.4 dB*

Transmitter Branch

Frequency band	*890.2...914.8 MHz*
Type	*Upconversion*
Intermediate frequency	*116 MHz*
Gain control range	*28 dB*
Power class	*4*
Output power	*5–33 dBm/3 mW...2 W*
Power levels	*15 (5...19)*
Power level step size	*2 dB ± 1.5 dB*
Tolerance at 2 W power	*<± 2 dB (ext. temp. ± 2.5 dB)*
Tolerance at other levels (6–15)*	*± 3 dB (ext. temp. ± 4 dB)*
Frequency error	*± 0.1 ppm*
RMS phase error	*< 5°*
Peak phase error	*< 20°*

* Tolerance of levels 16–19 ± 5 dB (ext. temp. ± 6 dB)

This page intentionally left blank.

Chapter 3

NHE–6 TRANSCEIVER OVERVIEW

CHAPTER 2 – TRANSCEIVER OVERVIEW

Contents

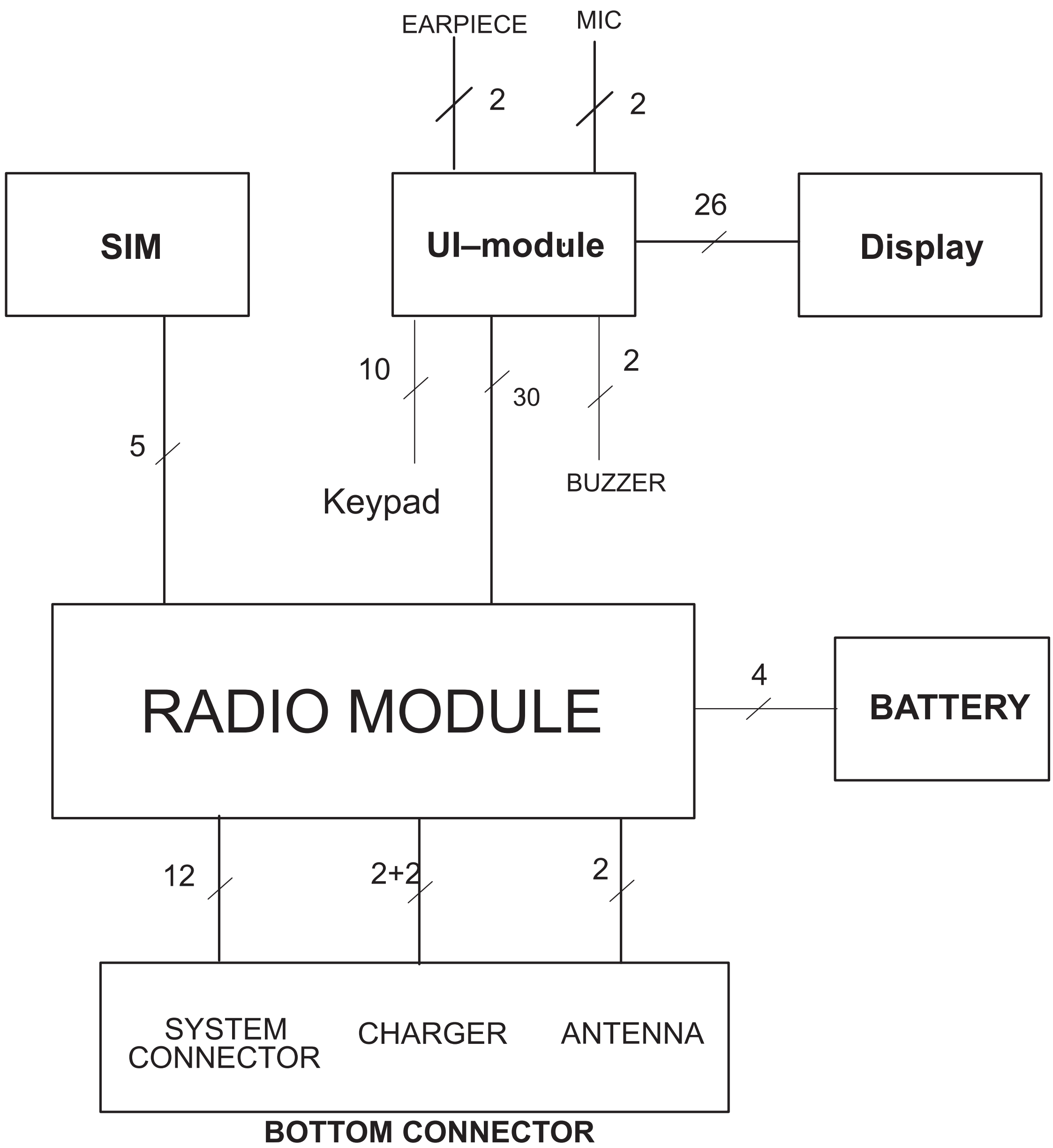
Introduction

The NHE–6 is a radio transceiver unit for the pan–European GSM network. It is a GSM (phase 2) power class 4 transceiver providing 15 power levels with a maximum output power of 2 W.

The transceiver consists of a Radio module (GJ8A), UIF–module (GU8) and assembly parts

The plug–in (small size) SIM (Subscriber Identity Module) card is located inside the phone.

Block Diagram of External Connections



Modes of Operation

There are four different operation modes

– power off mode
– idle mode
– active mode
– local mode

In the power off mode only the circuits needed for power up are supplied.

In the idle mode circuits are in reset, powered down and clocks are stopped as long as possible.

In the active mode all the circuits are supplied with power although some parts might be in the idle state part of the time.

The local mode is used for alignment and testing.

Circuit Description

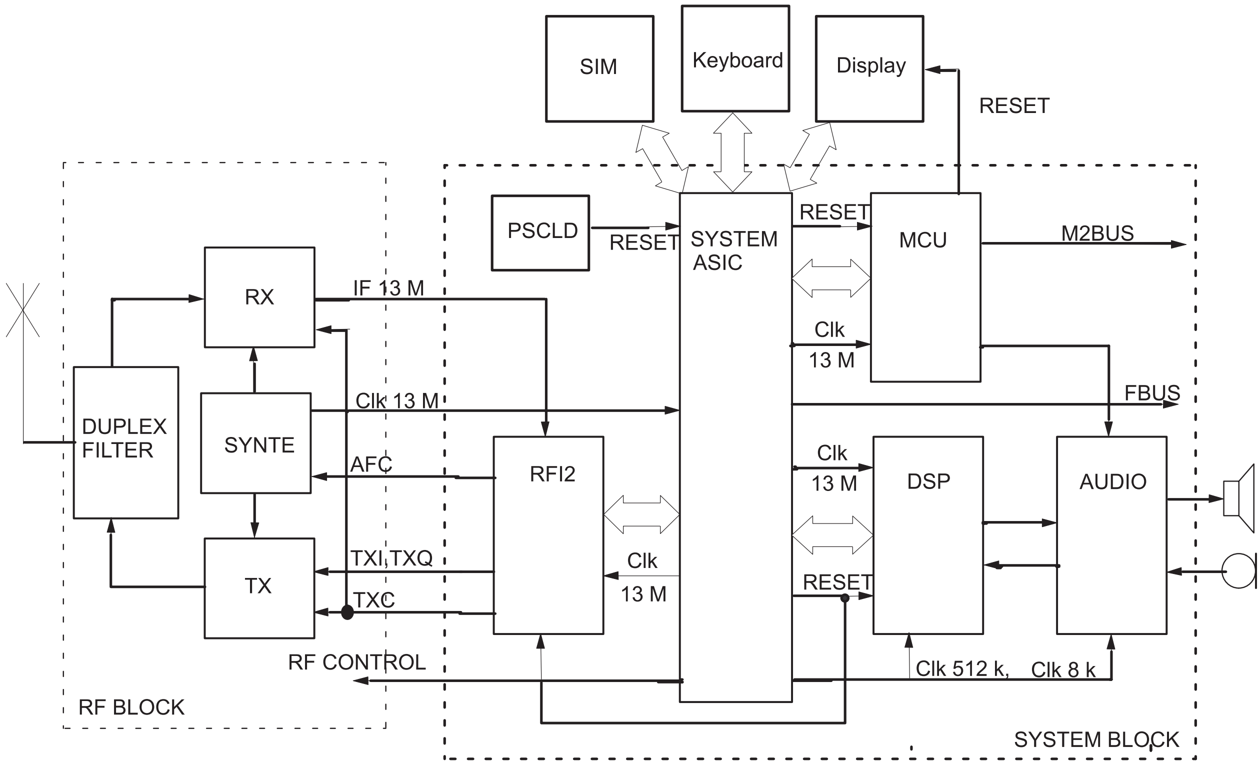
The transceiver electronics consists of the Radio Module (RF + BB blocks), the UI–module and the display module. The UI–module is connected to the Radio Module with a connector and display module is connected to UI–module by solder joint. BB blocks and RF blocks are interconnected with PCB wiring. The Transceiver is connected to accessories via a bottom system connector with charging and accessory control.

The BB blocks provide the MCU and DSP environments, Logic control IC, memories, audio processing and RF control hardware (RFI2). On board power supply circuitry delivers operating voltages for BB blocks. RF blocks have regulators of their own.

The general purpose microcontroller, Hitachi H8/3001, communicates with the DSP, memories and Logic control IC with an 8–bit data bus.

The RF block is designed for a handportable phone which operates in the GSM system. The purpose of the RF block is to receive and demodulate the radio frequency signal from the base station and to transmit a modulated RF signal to the base station.

Block Diagram



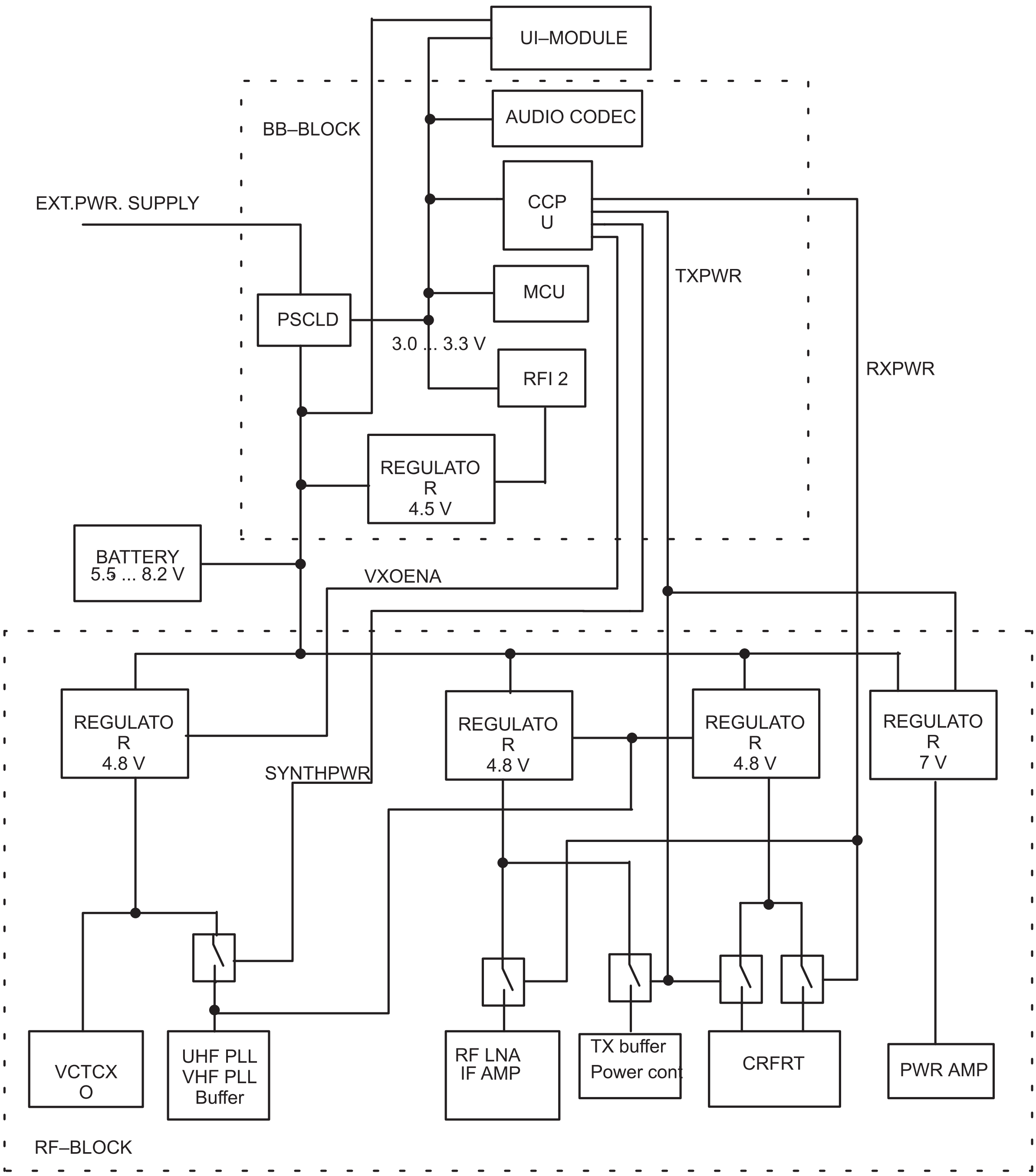
Power Distribution

The power supply is based on the ASIC circuit PSCLD. The chip consists of regulators and control circuits providing functions like power up, reset and watchdog functions. External buffering is required to provide more current.

The MCU and the PSCLD circuits control charging together, detection being carried out by the PSCLD and higher level intelligent control by the MCU. Charger voltages as well as temperature and size of the battery are measured by internal ADC of MCU or RFI (depending on the state of the phone). MCU measures battery voltage via DSP by means of RFI2 internal ADC.

The detailed power distribution diagrams are given in Baseband blocks and RF blocks documents.

Power Distribution Diagram



This page intentionally left blank.

Chapter 4

SYSTEM MODULE

CHAPTER 4 – SYSTEM MODULE

Contents

Introduction

The GJ8A is the RF module of the NHE–6 cellular transceiver. The GJ8A module carries out all the RF and system functions of the transceiver. This module works in the GSM system.

Technical Section

The GJ8A module is constructed on a 1.0 mm thick FR4 eight–layer printed wiring board. The dimensions of the PWB are 126 mm x 43 mm.

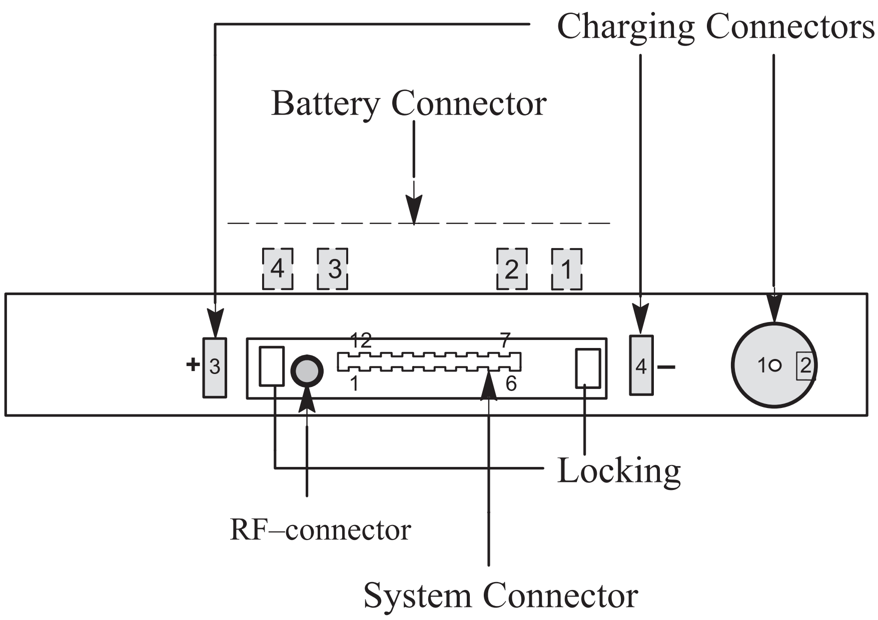
Components are located on both sides of the PWB. The RF components are located on the top end of the PWB. The both sides of the board includes high and low components. The maximum usable height is 5 mm.

EMI leakage is prevented by a metallized plastic (or magnesium) shield A on side 1/8 and a meatallized plastic cover B on side 8/8. The shield A also conducts the heat out of the inner parts of the phone, thus preventing excessive temperature rise.

External and Internal Connections

The system module has two connector, external bottom connector and internal display module connector.

External Connections



System Connector X100

Accessory Connector

Pin:	Name:	Description:
1	GND	Charger/system ground
2	V_OUT	Accessory output supply • min/typ/max: 3.40...10 V (output current 50 mA)
3	XMIC ID	External microphone input and accessory identification • typ/max: 8...50 mV (the maximum value corresponds to 0 dBm network level with input amplifier gain set to 20 dB, typical value is maximum value –16 dB) Accessory identification • 1.7...2.05 V headset adapter connected • 1.15...1.4 V compact handsfree unit connected • 2.22... 2.56 V Infra Red Link connected
4	EXT_RF	External RF control input • min/max: 0...0.5 V External RF in use • min/max: 2.4...3.2 V Internal antenna in use
5	TX	FBUS transmit
6	MBUS	Serial control bus • logic low level: 0...0.5 V • logic high level: 2.4...3.2 V
7	BENA	No connection
8	SGND	Signal ground
9	XEAR	External speaker and mute control • min/nom/max: 0...32...500 mV (typical level corresponds to –16 dBm0 network level with volume control in nominal position 8 dB below maximum. Maximum 0 dBm0 max. volume codec gain –6 dB) • mute on (HF speaker mute): 0...0.5 V d.c. • mute off (HF speaker active): 1.0...1.7 V d.c.
10	HOOK	Hook signal • hook off (handset in use) : 0...0.5 V • hook on, (handset not in use): 2.4...3.2 V
11	RX	FBUS receive • accessory FBUS receive signal,
12	V_IN	Charging supply voltage

Battery Connector

Pin:	Name:	Description:
13	BGND	Battery ground
14	BSI	Battery size indicator (used also for SIM card detection)
15	BTEMP	Battery temperature (used also for vibration alert)
16	VB	Battery voltage • min/typ/max: 5.3...6...10.26 V

Charging connectors

Pin:	Name:	Description:
12,17,19	V_IN	Charging voltage input • ACH–6 min/nom/max: 9.8...10.3...10.8 V • ACH–8 min/nom/max: 12...14...16 V
18, 20	GND	Charger/system ground

UI Connector X101

Pin:	Name:	Description:
1	MICP	Microphone • min/typ/max: 0...2...12.5 mV Connected to Audio Codec Microphone input. The maximum value corresponds to 1 kHz, o dBmO network level input amplifier gain set to 32 dB. Typical value is maximum value –16 dB.
2	MICN	Microphone • min/max: 0...12.5 mV Connected to Audio Codec and over resistor to AGND
3	GND	Ground
4	VL	Display supply • min/max: 3.0...3.2 mV
5	SYSRESETX	Reset, Level sensitive
6	GND	Ground
7	KEYLIGHT	Keyboard Light

Pin:	Name:	Description:
8	LCDLIGHT	Display light
9	BUZZER	PWM signal Buzzer control
10	GND	Ground
11	SLIDEON	Slide indication
12	GENSCLK	Serial clock
13	GENSD	Serial data
14	LCDENX	LCD enable
15	VB	Battery supply
16	XPWRON	Power ON/OFF
17	EARN	Earphone • min/typ/max: 0...14...220 mV. Connected to Audio Codec Inverted Output. Typical level corresponds to –16 dBmO network level with volume control giving nominal RLR (=+2 dB) 8 dB below max. Max level is 0 dBmO with max volume (codec gain –11 dB).
18	EARP	Earphone (see above)
19	CALL_LED	Call indication led
20–25	ROW(0–5)	
26–29	COL(0–4)	
30	GND	Ground

Flash Connector X103

Pin:	Name:	Description:
1	VPP	Flash programming voltage • min/typ/max: 11.4...12...12.6 V (values when VPP active), test point J310
2	FRX	Flash data receive, test point J311
3	FTX	Flash acknowledge transmit, test point J312
4	FCLK	Flash serial clock, test point J313
5	WDDIS	Watchdog disable, signal pulled down to disable watchdog, test point J314
6	GND	Digital ground, test point J315

SIM Connector X102

Pin:	Name:	Description:
1	GND	Ground for SIM
2	VSIM	SIM voltage supply • min/typ/max: 4.8...4.9...5.0 V
3	SDATA	Serial data for SIM
4	SRES	Reset for SIM
5	CLK	Clock for SIM data (clock frequency minimum 1 MHz if clock stopping not allowed)

Baseband Block

Introduction

The GJ8A module is used in GSM products. The baseband is implemented using DCT2 core technology. The baseband is built around one DSP, System ASIC and the MCU. The DSP performs all speech and GSM related signal processing tasks. The baseband power supply is 3V except for the A/D and D/A converters that are the interface to the RF section. The A/D converters used for battery and accessory detection are integrated into the same device as the signal processing converters.

The audio codec is a separate device which is connected to both the DSP and the MCU. The audio codec support the internal and external microphone/earpiece functions. External audio is connected in a dual ended fashion to improve audio quality together with accessories.

The baseband implementation support a 32.768 kHz sleep clock function for power saving. The 32.768 kHz clock is used for timing purposes during inactive periods between paging blocks. This arrangement allows the reference clock, derived from RF to be switched off.

The baseband clock reference is derived from the RF section and the reference frequency is 13 MHz. A low level clipped sinusoidal wave form is fed to the ASIC which acts as the clock distribution circuit. The DSP is running at 39 MHz using an internal PLL. The clock frequency supplied to the DSP is 13 MHz. The MCU bus frequency is the same as the input frequency. The system ASIC provides both 13 MHz and 6.5 MHz as alternative frequencies. The MCU clock frequency is programmable by the MCU. The NHE–6 baseband uses 13 MHz as the MCU operating frequency. The RF A/D, D/A converters are operated using the 13 MHz clock supplied from the system ASIC

The power supply and charging section supplies Lithium type of battery technology. The battery charging unit is designed to accept constant current type of chargers, that are approved by NMP.

The power supply IC contains three different regulators. The output voltage from each regulator is 3.15V nominal. One of the regulator uses an external transistor as the boost transistor.

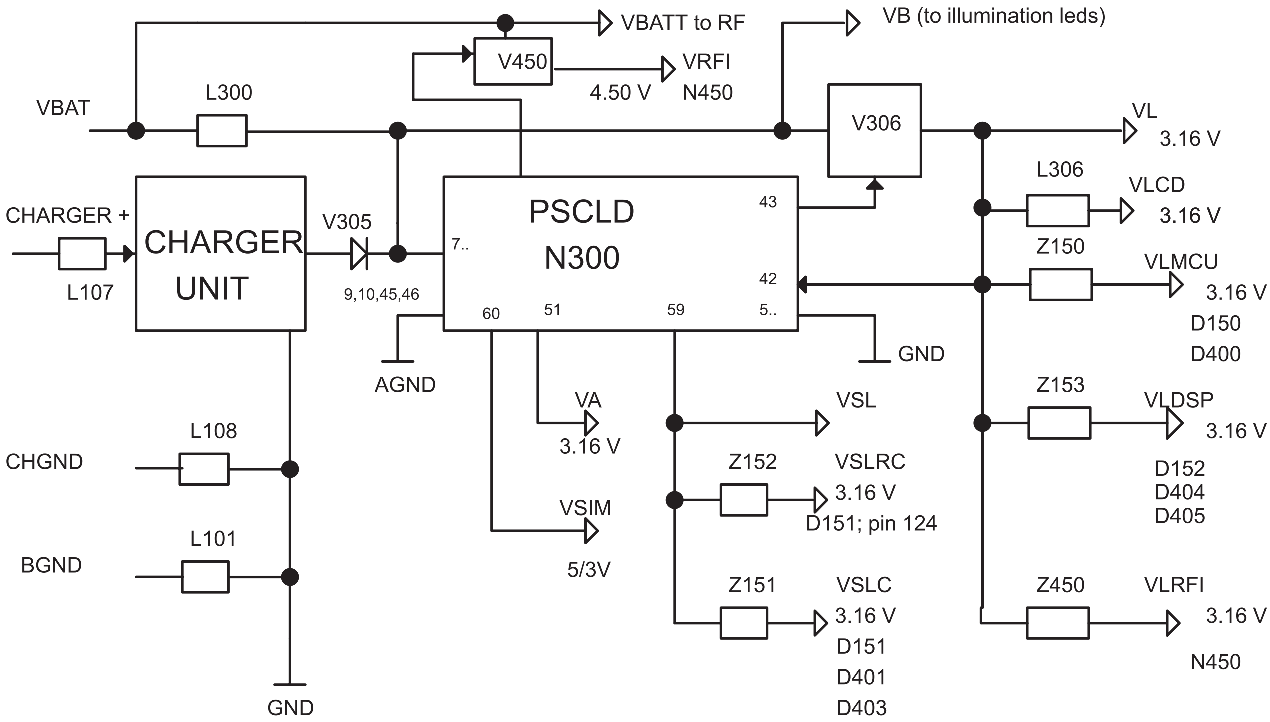
Modes of Operation

The baseband operates in the following Modes

– Active, as during a call or when baseband circuitry is operating
– Sleep, in this mode the clock to the baseband is stopped and timing is kept by the 32.768 kHz oscillator. All Baseband circuits are powered
– Acting dead, in this mode the battery is charged, but only necessary functions for charging are running
– Power off, in this mode all baseband circuits are powered off. The regulator IC N300 is powered

Circuit Description

Power Supply



The power supply for the baseband is the main battery. The main battery consists of 2 LI–ION cells. A charger input is used to charge the battery. Two different chargers can be used for charging the battery. A switch mode type fast charger that can deliver 780 mA and a standard charger that can deliver 265 mA. Both chargers are of constant current type.

The baseband has one power supply circuit, N300 delivering power to the different parts in the baseband. There are two logic power supply and one analog power supply. The analog power supply VA is used for analog circuits such as audio codec, N200 and microphone bias circuitry. Due to the current consumption and the baseband architecture the digital supply is divided into two parts.

Both digital power supply rails from the N300, PSCLD are used to distribute the power dissipation inside N300, PSCLD. The main logic power supply VL has an external power transistor, V306 to handle the power dissipation that will occur when the battery is fully charged or during charging.

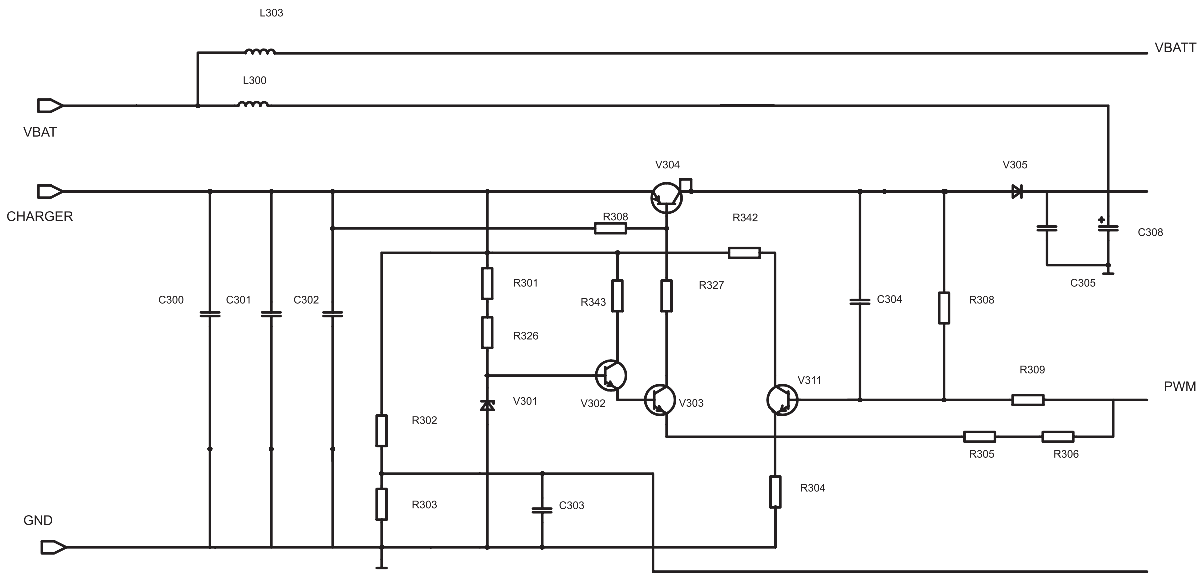
D151, ASIC and the MCU SRAM, D403 are connected to the same logic supply voltage. All other digital circuits are connected to the main digital supply. The analog voltage supply is connected to the audio codec.

Charging Control Switch Functional Description

The charging switch transistor V304 controls the charging current from the charger input to the battery. During charging the transistor is forced in saturation and the voltage drop over the transistor is 0.2–0.4V depending upon the current delivered by the charger. Transistor V304 is controlled by the PWM output from N300, pin 34 via resistors R309, R308 and transistor V311. The output from N300 is of open drain type. When transistor V304 is conducting the output from N300 pin is low. In this case resistors R305 and R306 are connected in parallel with R304. This arrangement increases the base current thru V304 to put it into saturation.

Transistors V304, V302, V303 and V311 forms a simple voltage regulator circuitry. The reference voltage for this circuitry is taken from zener diode V301. The feedback for the regulator is taken from the collector of V304. When the PWM output from N300 is active, low, the feedback voltage is determined by resistors R308 and R309. This arrangement makes the charger control switch circuitry to act as a programmable voltage regulator with two output voltages depending upon the state of the PWM output from N300. When the PWM is inactive, in high impedance the feedback voltage is almost the same as on the collector of V304. Due to the connection the voltage on V303 and V311 emitters are the same. The influence of the current thru R305 and R306 can be neglected in this case.

The charging switch circuit diagram is shown in following figure. The figure is for reference only.



This feedback means that the system regulates the output voltage from V304 in such a way that the base of V303 and V311 are at the same voltage. The voltage on V302 is determined by the V301 zener voltage. The darlington connection of V303 and V302 service two purposes ; 1 the load on the voltage reference V301 is decreased, 2 the output voltage on V304 is decreased by the VBE voltage on V302 which is a wanted feature. The voltage reduction allows a relative temperature stable zener diode to be used and the output voltage from V304 is at a suitable level when the PWM output from N300 is not active.

The circuitry is self starting which means that an empty battery is initially charged by the regulator circuitry around the charging switch transistor. The battery is charged to a voltage of maximum 4.8V. This charging switch circuitry allows for both NiCd, NiMH and Lithium type of batteries to be used.

When the PWM output from N300 is active the feedback voltage is changed due to the presence of R308 and R309. When the PWM is active the charging switch regulator voltage is set to 10.5V maximum. This means that even if the voltage on the charger input exceeds 11.5V the battery voltage will not exceed 10.5 V. This protects N300 from over voltage even if the battery was to be detached while charging.

The RC network C304, R308 and R309 also acts as a delay circuitry when switching from one output voltage to an other. This happens when the PWM output from N300 is pulsing. The reason for the delay is to reduce the surge current that will occur when V304 is put into conducting state. Before V304 is put in conducting state there is a significant voltage drop over V304. The energy is stored in capacitors in the charger and these capacitors must first be drained in order to put the charger in constant current mode. This is done by discharging the capacitors into the battery. The delay caused by C304 will reduce the surge current thru V304 to an acceptable value.

R301 and R326 are used to regulate the zener current. During charging with empty battery the zener voltage might drop due to low zener current but this is no problem since the regulator is operating in constant current mode while charging. The zener voltage is more important when the charger voltage is high or in case that the PWM output from N300 is inactive. In this case the charger idle voltage is present at the charger supply pins.

R300 and R327 together with V304 forms a constant current source. The surge current limitation behavior is frequency dependent since L107 is an inductor. The purpose of these circuits is to reduce the surge current through V304 when it is put in conducting state. Due to the low resistance value required in L107 this arrangement is not very effective and the RC network R308, R309 and C304 contributes more to the surge current reduction.

V305 is a schottky diode that prevents the battery voltage from reverse bias V304 when the charger is not connected. The leakage current for V305 is increasing with increasing temperature and the leakage current is passed to ground via R308, V311 and R304. This arrangement prevents V304 from being reversed biased as the leakage current increases at high temperatures.

Components L107, C300, C301, C302 and L108 forms a filter for EMC attenuation. The circuitry reduces the conductive EMC part from entering the charger cable causing an increase in emission as the cable will act as an antenna.

V100 is a 18V transient suppressor. V100 protects the charger input and in particular V304 for over voltage. The cut off voltage is 18V with a maximum surge voltage up to 25V. V100 also protects the input for wrong polarity since the transient suppressor is bipolar.

Power Supply Regulator PSCLD, N301

The power supply regulators are integrated into the same circuit N300. The power supply IC contains three different regulators. The main digital power supply regulator is implemented using an external power transistor V306. The other two regulators are completely integrated into N300.

PSCLD, N300 External Components

N300 performs the required power on timing. The PSCLD, N300 internal power on and reset timing is defined by the external capacitor C330. This capacitor determines the internal reset delay, which is applied when the PSCLD, N300 is initially powered by applying the battery. The baseband power on delay is determined by C311. With a value of 10 nF the power on delay after a power on request has been active is in the range of 50–150 ms. C310 determines the PSCLD, N300 internal oscillator frequency and the minimum power off time when power is switched off.

The sleep control signal from the ASIC, D151 is connected via PSCLD, N300. During normal operation the baseband sleep function is controlled by the ASIC, D151 but since the ASIC is not power up during the startup phase the sleep signal is controlled by PSCLD, N300 as long as the PURX signal is active. This arrangement ensures that the 13 MHz clock provided from RF to the ASIC, D151 is started and stable before the PURX signal is released and the baseband exits reset. When PURX is inactive, high, sleep control signal is controlled by the ASIC D151.

To improve the performance of the analog voltage regulator VA an external capacitor C329 has been added to improve the PSRR.

N300 requires capacitors on the input power supply as well as on the output from each regulator to keep each regulator stable during different load and temperature conditions. C305 and C308 are the input filtering capacitors. Due to EMC precautions a filter using C305, L300 and C308 has been inserted into the supply rail. This filter reduces the high frequency components present at the battery supply from exiting the baseband into the battery pack. The regulator outputs also have filter capacitors for power supply filtering and regulator stability. A set of different capacitors are used to achieve a high bandwidth in the suppression filter.

PSCLD, N300 Control Bus

The PSCLD, N300 is connected to the baseband common serial control bus, SCONB(5:0). This bus is a serial control bus from the ASIC, D151 to several devices on the baseband. This bus is used by the MCU to control the operation of N300 and other devices connected to the bus. N300 has two internal 8 bit registers and the PWM register used for charging control. The registers contains information for controlling reset levels, charging HW limits, watchdog timer length and watchdog acknowledge.

The control bus is a three wire bus with chip select for each device on the bus and serial clock and data. From PSCLD, N300 point of view the bus is used as write only to PSCLD. It is not possible to read data from PSCLD, N300 by using this bus.

The MCU can program the HW reset levels when the baseband exits/enters reset. The programmed values remains until PSCLD is powered off, the battery is removed. At initial PSCLD, N300 power on the default reset level is used. The default value is 5.1 V with the default hysteresis of 400 mV. This means that reset is exit at 5.5 V when the PSCLD, N300 is powered for the first time.

The watchdog timer length can be programmed by the MCU using the serial control bus. The default watchdog time is 32 s with a 50 % tolerance. The complete baseband is powered off if the watchdog is not acknowledged within the specified time. The watchdog is running while PSCLD, N300 is powering up the system but PURX is active. This arrangement ensures that if for any reason the battery voltage doesn’t increase above the reset level within the watchdog time the system is powered off by the watchdog. This prevents a faulty battery from being charged continuously even if the voltage never exceeds the reset limit. As the time PURX is active is not exactly known, depends upon startup condition, the watchdog is internally acknowledged in PSCLD when PURX is released. This gives the MCU always the same time to respond to the first watchdog acknowledge.

Baseband power off is initiated by the MCU and power off is performed by writing the smallest value to the watchdog timer register. This will power off the baseband within 0.5 ms after the watchdog write operation.

The control bus can also be used to setup the behavior of the N300 regulators during sleep mode, when sleep signal is active low. In order to reduce power during sleep mode two of the three regulators can be switched off. The third regulator, VSL which is kept active then supplies the output of the other regulators. All regulator outputs from PSCLD, N300 are supplied but the current consumption is restricted. It is also possible to keep the VL regulator active during sleep mode in case the power consumption is in excess of what the VSL regulator can deliver in sleep mode to the VL output.

The PSCLD, N300 also contains switches for connecting the charger voltage and the battery voltage to the base band A/D converters. Since the battery voltage is present and the charger voltage might be present in power off the A/D converter signals must be connected using switches. The switch state can be changed by the MCU via the serial control bus. When PURX is active both switches are open to prevent battery/charger voltage from being applied to the baseband measurement circuitry which is powered off. Before any measurement can be performed both switches must be set in not closed mode by MCU.

Charger Detection

A charger is detected if the voltage on N300 pin 41 is higher than 0.5V. The charger voltage is scaled externally to PSCLD, N300 using resistors R302 and R303. With the implemented resistor values the corresponding voltage at the charger input is 2.8V. Due to the multi–function of the charger detection signal from PSCLD, N300 to ASIC, D151 the charger detection line is not forced, active high until PURX is inactive. In case PURX is inactive the charger detection signal is directly passed to D151. The active high on pin 21 generates and interrupt to MCU which then starts the charger detection task in SW.

The reason for not passing the charger detection signal to the ASIC, D151 when PURX is active is the RTC implementation in ASIC, D151. This same signal is used to power up the system if the RTC alarm is activated and the system is power up. Due to this the PSCLD, N300 pin 21 is in input mode as long as PURX is active. Correspondingly at the ASIC end this pin is an output as long as PURX is active. The RTC function needs SW support and is not implemented in NHE–6. The baseband architecture provides for the functionality required.

SIM Interface and Regulator in N300

The SIM card regulator and interface circuitry is integrated into PSCLD, N300. The benefit from this is that the interface circuits are operating from the same supply voltage as the card, avoiding the voltage drop caused by the external switch used in previous designs. The PSCLD, N300 SIM interface also acts as voltage level shifting between the SIM interface in the ASIC, D151 operating at 3V and the card operating at 5V. Interface control in PSCLD is direct from

ASIC, D151 SIM interface using SIM(5:0) bus. The MCU can select the power supply voltage for the SIM using the serial control bus. The default value is 3V which can be changed to 5V by the SIM interface in ASIC, D151. Regulator enable and disable is controlled by the ASIC via SIM(2).

Power Up Sequence

The baseband can be powered up in three different ways.

– When the power switch is pressed input pin 37 to PSCLD, N300 is connected to ground and this switches on the regulators inside PSCLD.

– An other way to power up is to connect the charger. Connecting the charger causes the baseband to power up and start charging the battery.

– The third way to power the system up is to attach the battery.

Power up using Power on Button

This is the most common way to power the system up. This power up is successful if the battery voltage is higher than power on reset level set by the MCU, default value 5.4 V DC in PSCLD, N300. The power up sequence is started when the power on input pin 37 at PSCLD is activated, low. The PSCLD then internally enters the reset state where the regulators are switched on. At this state the PWM output (pin 34) from PSCLD is forced active to support additional power from any charger connected. The sleep control output signal is forced high enabling the regulator to supply the VCO and startup the clock. After the power on reset delay of 50–150 ms PURX is released and the system exits reset. The PWM output is still active until the MCU writes the first value to the PWM register. The watchdog has to be acknowledged within 16 s after that PURX has changed to inactive state

Power Up with Empty Battery using Charger

When the charger is inserted into the DC jack or charger voltage is supplied at the system connector contacts/pins, PSCLD (N300) powers up the baseband. The charging control switch is operating as a linear regulator, the output voltage is 4.5V–5V. This allows the battery to be charged immediately when the charger is connected. This way of operation guarantees successful power up procedure with empty battery. In case of empty battery the only power source is the charger. When the battery has been initially charged and the voltage is higher than the PSCLD, N300 switch on voltage the sleep control signal which is connected to the PSCLD for power saving function sleep mode, enters inactive state, high, to enable the regulator that controls the power supply to the VCO to be started. The ASIC, D151 which normally controls the sleep control line has the sleep output inactive, low as long as the system reset, PURX is active, low, from PSCLD. After a delay of about 5–10 ms the system reset output PURX from PSCLD enters high state. This delay is to ensure that the clock is stable when the ASIC exits reset. The sleep control output from the PSCLD that has been driving an output until now, returns the control to the sleep signal from the ASIC as the PURX signal goes inactive. When the PURX signal goes inactive, high, the charge detection output at PSCLD, that is in input mode when

PURX is active, switches to output and goes high indicating that a charger is present. When the system reset, PURX, goes high the sleep control line is forced inactive, high, by the ASIC, D151 via PSCLD, N300.

Once the system has exited reset the battery is initially charged until the MCU writes a new value to the PWM in PSCLD. If the watchdog is not acknowledged the battery charging is switched off when the PSCLD shuts off the power to the baseband. The PSCLD will not enter the power on mode again until the charger has been extracted and inserted again or the power switch has been pressed. The battery is charged as long as the power on line, PWRONX is active low. This is done to allow the phone to be started manually from the power button when the charger is connected and there is no need to disconnect the charger to get a power up if the battery is empty.

Power On Reset Operation

The system power up reset is generated by the regulator IC, N300. The reset is connected to the ASIC, D151 that is put into reset whenever the reset signal, PURX is low. The ASIC (D151) then resets the DSP (D152) the MCU (D150) and the digital parts in RFI2 (N450). When reset is removed the clock supplied to the ASIC, D151 is enabled inside the ASIC. At this point the 32.768 kHz oscillator signal is not enabled inside the ASIC, since the oscillator is still in the startup phase. To start up the block requiring 32.768 kHz clock the MCU must enable the 32.768 kHz clock. The MCU reset counter is now started and the MCU reset is still kept active, low. 6.5 MHz clock is started to MCU in order to put the MCU(D150) into reset, MCU is a synchronous reset device and needs clock to reset. The reset to MCU is put inactive after 128 MCU clock cycles and MCU is started.

DSP (D152) and RFI2 (N450) reset is kept is kept active when the clock inside the ASIC, D151 is started. 13 MHz clock is started to DSP (D152) and puts it into reset. D152 is a synchronous reset device and requires clock to enter reset. N450 digital parts are reset asynchronously and do not need clock to be supported to enter reset.

As both the MCU, D151 and DSP, D152 are synchronous reset devices all interface signals connected between these devices and ASIC D151 which are used as I/O are set into input mode on the ASIC, D151 side during reset. This avoids bus conflicts to occur before the MCU, D150 and the DSP, D152 are actually reset.

The DSP (D152) and RFI2 (N450) reset signal remains active after that the MCU has exited reset. The MCU write to the ASIC register to disable the DSP reset. This arrangement allows the MCU to reset the DSP, D152 and RFI2, N450 when ever needed. The MCU can put DSP into reset by writing the reset active in the ASIC, D151 register.

MCU

The baseband used a Hitachi H3001 type of MCU. This is a 16–bit internal MCU with 8–bit external data bus. The MCU is capable of addressing up to 16 Mbyte of memory space linearly depending upon the mode of operation. The MCU has a non multiplexed address/data bus which means that memory access can be done using less clock cycles thus improving the performance but also tightening up memory access requirements. The MCU is used in mode 3 which means 8–bit external data bus and 16 Mbyte of address space. The MCU operating frequency is equal to the supplied clock frequency. The MCU has 512 bytes of internal SRAM. The MCU has one serial channel, USART that can operate in synchronous and asynchronous mode. The USART is used in the MBUS implementation. Clock required for the USART is generated by the internal baud rate generator. The MCU has 5 internal timers that can be used for timing generation. Timer TIOCA0 input pin 71 is used for generation of netfree signal from the MBUS receive signal which is connected to the MCU USART receiver input on pin 2.

The reason for generating the MBUS netfree using the counter is the fact that the 32.768 kHz clock that would have been used for this timing is a slow starting oscillator. This means that in production testing the MBUS can not be operated until the netfree counter is operational. As the netfree counter is implemented using the MCU internal counter the netfree counter is available immediately after reset. In the same way the MCU OS timer is operated from an internal timer in the early stage until the 32.768 kHz clock can be enabled and the OS timer provided in the ASIC can be used.

The MCU contains 4 10–bit A/D converters channels that are used for baseband monitoring.

The MCU, D150 has several programmable I/O ports which can be configured by SW. Port 4 which multiplexed with the LSB part of the data bus is used baseband control. In the mode the MCU is operating this port can be used as an I/O port and not as part of the data bus, D0–D7.

MCU Access and Wait State Generation

The MCU can access external devices in 2 state access or 3 state access. In two state access the MCU uses two clock cycles to access data from the external device. In 3 state access the MCU uses 3 clock cycles to access the external device or more if wait states are enabled. The wait state controller can operate in different modes. In this case the programmable wait mode is used. This means that the programmed amount of wait states in the wait control register is inserted when an access is performed to a device located in that area. The complete address space is divided into 8 areas each area covering 2 Mbyte of address space. The access type for each area can be set by bits in the access state control register. Further more the wait state function can be enabled separately for each area by the wait state controller enable register. This means that in 3 state access two types of access can be performed with a fixed setting:

– 3 state access without wait states
– 3 state access with the amount of wait states inserted determined by the wait control register

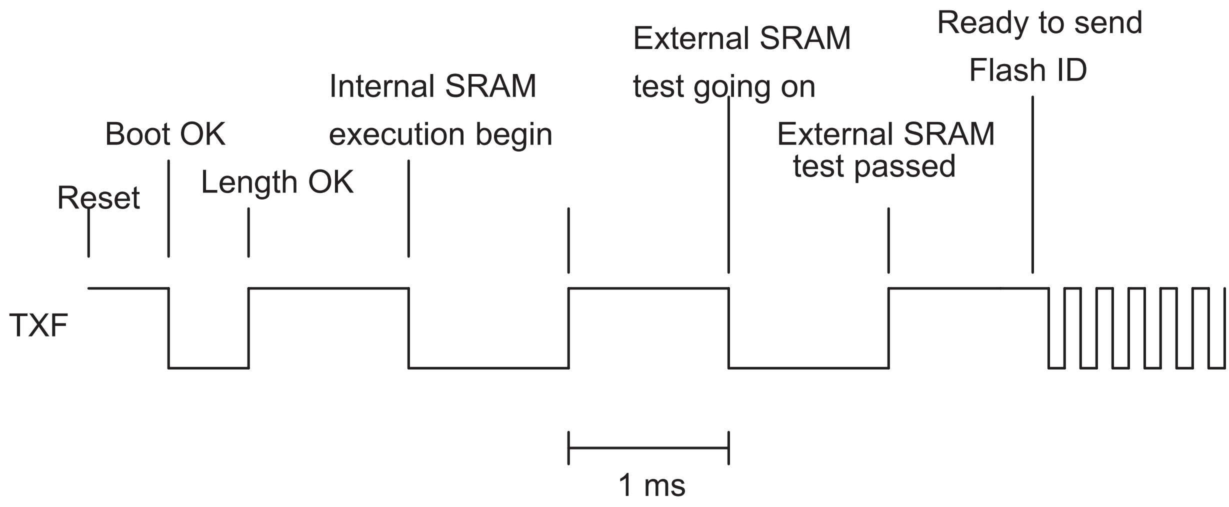
If the wait state controller is not enabled for a 3 state access area no waits states are inserted when accessing that area even if the wait control register contains a value that differs from 0 states.

MCU Flash Loading

MCU Boots from ASIC ROM. The flash loading equipment is connected to the baseband by means of the test connector before the module is cut out from the frame. Updating SW on a final product is done by removing the battery and connect a special battery that contains the necessary contacting elements. The contacts on the baseband board are test points that are accessible when the battery is detached. The power supply for the base band is supplied via the adapter and controlled by the flash programming equipment. The base band module is powered up when the power is connected to the battery contact pins.

The interface lines between the flash prommer and the baseband are in low state when power is not connected by the flash prommer. The data transfer between the flash programming equipment and the base band is synchronous and the clock is generated by the flash prommer. The same USART that is used for MBUS communication is used for the serial synchronous communication. The PSCLD watchdog is disabled when the flash loading battery pack and cable is connected.

After the flash battery pack adapter has been mounted or the test connector has been connected to the board the power to the base band module is connected by the flash prommer or the test equipment. All interface lines are kept low except for the data transmit from the baseband that is in reception mode on the flash prommer side, this signal is called TXF. The MCU boots from ASIC and investigates the status of the synchronous clock line. If the clock input line from the flash prommer is low or no valid SW is located in the flash MCU forces the initially high TXF line low acknowledging to the flash prommer that it is ready to accept data . The flash prommer sends data length, 2 bytes, on the RXF data line to the baseband. The MCU acknowledges the 2 data byte reception by pulling the TXF line high. The flash prommer now transmits the data on the RXF line to the MCU. The MCU loads the data into the internal SRAM. After having received the transferred data correctly MCU puts the TXF line low and jumps into internal SRAM and starts to execute the code. After a guard time of 1 ms the TXF line is put high by the MCU. After 1 ms the TXF is put low indicating that the external SRAM test is going on. After further 1 ms the TXF is put high indicating that external SRAM test has passed. The MCU performs the flash memory identification based upon the identifiers specified in the Flash Programming Specifications. In case of an empty device, identifier locations shows FFH, the flash device code is read and transmitted to the Flash Prommer. The TXF line functional timing is shown in the following diagram.



After that the device mounted on base band has been identified the Flash Prommer down loads the appropriate algorithm to the baseband. The programming algorithm is stored in the external SRAM on the baseband module and after having down loaded the algorithm and data transfer SW, MCU jumps to the external SRAM and starts to execute the code. The MCU now asks the prommer to connect the flash programming power supply. This SW loads the data to be programmed into the flash and implements the programming algorithm that has been down loaded.

Flash Prommer Connection Using Dummy Battery

For MCU SW updating in the field a special battery adapter can be used to connect to the test points which are accessible through SIM opening in the chassis, located behind the battery. Supply voltage must be connected to this dummy battery as well as the flash programming equipment

Flash, D400

A 8 MBit flash is used as the main program memory, D400 the device is 3 V read/program with external 12V VPP for programming. The device is sectored and contains 16 64 kByte blocks. The sector capability is not used in the HD843 application. The speed of the device is 180 ns. The MCU operating at 13 MHz will access the flash in 3 state access, requiring 190 ns access time from the memory.

The flash has a deep power down mode that can be used when the device is not active. There is a requirement for a longer access time if the device is accessed immediately after exiting power down. This requirement is met since the signal controlling the VCO power control is used for this purpose. The flash power down pin, pin 12 is connected to ASIC, D151 pin 130. The reason for connecting it to the ASIC and not direct to the VCO power control signal is that this pin on the ASIC is low as long as the ASIC is in reset. This signal also resets the flash memory as this pin also acts as a power up reset to the memory.

SRAM D402, D403

The baseband is designed to use SRAM size 128kx8. The required speed is 100 ns as the MCU will operate at 13 MHz and the SRAM will be accessed in 3 state access. The SRAM has no battery backup which means that the content is lost even during short power supply disconnections. As shown in the memory map the SRAM is not accessible after boot until the MCU has enabled the SRAM access by writing to the ASIC register.

EEPROM D401

The baseband is designed to use an 8kx8 parallel EEPROM.

The parallel device is connected to the MCU data and address bus. The ASIC generates chip select for the EEPROM. To avoid unwanted EEPROM access there is an EEPROM access bit in the ASIC MCU interface. This bit mus be set to allow for EEPROM access. This bit is cleared by default after reset. After each access this bit should be cleared to prevent unwanted EEPROM access. The parallel device used support page mode writing, 64 byte page. One page can be written by the MCU and after that the internal programming procedure is started. The page write operation is internally timed in the device and consecutive bytes must be written within 150 us. During this operation all interrupts must be disabled.

The device also supports SW protection to prevent accidental write operations to the device. The protection algorithm can be enabled and disabled by writing a predefined sequence to the device. Writing to the device while protected can be done by first writing the key sequence followed by the data.

MCU and Peripherals

MCU Port P4 Usage

MCU, D150 port 4 is used for baseband control.

Port Pin	MCU pin	Control Function	Remark
P40	5	Display driver reset	Active low
P41	6		
P42	7	Call Led Control	
P43	8	External RF Switch input	
P44	9		
P45	10		
P46	11		
P47	12	External accessory Supply voltage control	Active low

MCU Port PB Usage

MCU, D150 port B is used for baseband control.

Port Pin	MCU pin	Control Function	Remark
PB0	77	Information of Sliding cover position	
PB1	76		
PB2	79	External RF output control	
PB3	80		

Baseband A/D Converter Channels usage in N450 and D150

The auxiliary A/D converter channels inside RFI2, N450 are used by MCU to measure battery voltage, charger voltage etc. The A/D converters are accessed by the DSP, D152 via the ASIC, D151. The required resolution is 10 bit. The scaling factor is created using 5% resistors and it is therefore a requirement to have an alignment procedure in the production phase. Each resistor network is supplied with a known input voltage and the measured value is used against the theoretically calculated value. As a result of this operation standard 5% resistors can be used in the voltage scaling circuitry.

The A/D converter used in RFI2, N450 for the measurement are sigma–delta type and the zero value is centered around 50 % of the supply voltage, 1.6V. This means that the A/D converter reading is negative when the input voltage to the converter is less than half of the supply voltage. In calculations the true A/D reading is got by adding 800H to the read value module 4096.

The MCU has 4 10 bit A/D channels which are used in parallel to the channels in N450. The MCU can measure charger voltage, battery size, battery temperature and accessory detection by using it's own converters.

Baseband N450 A/D Converter Channel Usage

Name:	Usage:	Input volt. range	Remark
Chan 0	Battery voltage	5...9 V	Battery voltage when TX is active
Chan 1			
Chan 2			
Chan 3			
Chan 4			
Chan 5	System Board Temp	0...3.2 V	Used to compensate LCD display contrast
Chan 6	REFOUT voltage	0...3.2 V	Reference voltage calibration input
Chan 7	Battery voltage	5...9 V	Battery volt. TX inactive

MCU Baseband A/D Converter Channel Usage

Name:	Usage:	Input volt. range	Remark
Chan 0	Battery temperature	0...3.2 V	
Chan 1	Charger voltage	5...16 V	
Chan 2	Accessory detection	0...3.2 V	
Chan 3	Battery size indicator	0...3.2 V	

Battery Voltage Measurement

The battery voltage is measured using RFI2, N450 A/D converter channel 0 and 7. The converter value supplied from channel 0 is measured when the transmitter is active. This measurement gives the minimum battery voltage. The value from channel 7 is measured when the transmitter is inactive. The battery voltage supplied to the A/D converter input is switched off when the baseband is in power off. The battery voltage measurement voltage is supplied by PSCLD, N300 which performs scaling, the scaling factor is R1(R1+R2), and switch off. The measurement voltage is filtered by a capacitor to achieve an average value that is not depending upon the current consumption behavior of the baseband. To be able to measure the battery voltage during transmission pulse the time constant must be short. The value for the filtering capacitor is set to 10 nF, C319. The scaling factor used to scale the battery voltage must be 1:3, which means that 9V battery voltage will give 3V A/D converter input voltage. The A/D converter value in decimal can be calculated using the following formula:

$A/D = 1023xR1xU_{BAT}/((R1+R2)xU_{ref}) = 1023xU_{BAT}xK$

where K is the scaling factor. $K = R1/((R1+R2)xU_{ref})$.

Charger Voltage Measurement

The charger voltage is measured to determine the type of charger used. MCU A/D converter channel 1 is used for this purpose and MCU /D converter channel 1. The input circuitry to the charger measurement A/D channel implements an LP filter. The input voltage must be scaled before it is fed to the A/D converter input. Due to the high input voltage range scaling is performed outside PSCLD, N300. The scaling factor required is 22/(22+100) = 0.18. The charger voltage measurement switch is integrated into PSCLD, N300. Charger voltage is not supplied to the A/D converter input in power off mode. This is done to protect the A/D converter input in case power is switched off and the charger remains connected to the baseband. The resistor values are different since the scaling factor is larger.

Battery Size Resistor Measurement

The battery size, capacity is determined by measuring the voltage on the BSI pin on the battery pack when the battery is attached to the phone. The auxiliary channel 2 is used for this purpose. The BSI signal is pulled up on the base band using a 47 kohm resistor and the resistor inside the battery pack is reflecting the capacity of the battery. There are two special cases to be detected by the MCU. The first case is the Lithium battery. The Lithium battery has reserved values in the battery size table. Lithium type batteries are all the same from charging point of view. Lithium batteries are charged to a constant voltage and charging is aborted when the predefined voltage is reached. The Lithium battery capacity is a function of the battery voltage. The battery voltage drops linearly as the battery is discharged. The other case that has to be handled is the dummy battery. This battery is used for A/D converter field calibration at service centers and together with a defined voltage on the BTEMP pin on the battery pack to put the baseband into Local mode in production. Battery sizes below 143 mAh will be treated as dummy battery. The battery size A/D converter value can be calculated using the following formula:

A/D = RSI/(RSI+47 kohm)x1023

where RSI is the value of the resistor inside the battery pack.

Battery Size and A/D Converter Value

Battery Type	Battery pack resistor	Capacity	BSI volt.	A/D conv value
Dummy	1 kΩ 2 %	<143 mAh	0.07	24 h (36)
Lithium type 1 standard battery	68 kΩ 2 %	400 mAh		25 C (605)
Lithium type 1 extended battery	68 kΩ 2 %	900 mAh		25 C (605)
Lithium type 2	82 kΩ 2 %	400 mAh		28 A (650)

Battery Temperature Measurement

The battery temperature is measured during charging. The BTEMP pin to the battery is pulled up on baseband by a 47 kohm resistor to logic supply voltage, 3.2V. The voltage on the BTEMP pin is a function of the battery pack temperature. Auxiliary A/D channel 3 is used for this purpose. Inside the battery pack there is a 47 kohm NTC resistor to ground. The A/D converter value can be calculated from the following formula:

A/D = RNTC/(RNTC+47 kohm)x1023

where RNTC is the value of the NTC resistor inside the battery pack.

The relationship between different battery temperature, BTEMP voltage and A/D converter values are shown in the table below. Battery temperature is measured from –56 to 76 Centigrade. (9 HEX to 383 HEX)

A/D Converter Values for Different Battery Temperatures

Bat. temp.	NTC value	BTEMP voltage	A/D conv. value
–25	745.60 kΩ	2.96 V	962
0	164.96 kΩ	2.45 V	796
25	47 kΩ	1.58 V	512
50	16.26 kΩ	0.81 V	263
70	7.78 kΩ	0.45 V	145

External Accessory Detection via XMIC/ID –line

Auxiliary A/D channel 4 is used to detect accessories connected to the system connector using the XMIC/ID. To be able to determine which accessory has been connected MCU measures the DC voltage on the XMIC/ID input. The accessory is detected in accordance with the CAP Accessory specifications. The base band has a pull–up resistor network of 32 kohm to VA. The accessory has a pull down. The A/D converter value can be calculated using the following formula:

A/D = (ACCI+10 kohm)/(ACCI+32 kohm)x1023x/3.2 .

where ACCI is the DC input impedance of the accessory device connected to the system connector

The different values for acceptable accessories are given in the following table. The values in the table are calculated using 5 % resistor values and power supply range 3–3.3 V. Due to that the pull up resistor in the XMIC line is divided into two resistors. The voltage at the A/D converter input is different from that on the XMIC.

Accessory Detection Voltage

Acc. type	Acc. resistance	Voltage on A/D converter channel 5 (min/typ/max)	A/D converter value(Dec)
IR Link	100 kΩ	2.43...2.63...2.83	853
Headset	47 kΩ	2.1...2.27...2.40	739
Compact HF	22 kΩ	1.23...1.87...2.03	607

Keyboard Interface

The keypad matrix is located on a UI module Flex PCB and the interface to the base band is by using connector X101. The power on key is also connected to the PSCLD to switch power on. Due to the internal pull up inside PSCLD, N300 to a high voltage, a rectifier, V418 is required in the keypad matrix for the power on keypad to prevent the high voltage to interfere with the keypad matrix.

Series resistors, R261–R264 are implemented in the Column output to reduce the EMI radiation to the UI Flex. Capacitors C257–C260 reduces the EMC radiation and absorbs any ESD produced over an air gap to the keymat. As the serial display driver interface uses ROW5 for data transmission series resistors are needed to prevent keypad or double keypad pressing from interfering with the display communication. In a similar way R265–R269 in the ROW lines reduces the EMI to the UI board. Capacitors C251–C256 implements a LP–filter together with each resistor in the ROW line. The capacitors also absorbs ESD pulses over an air gap to the keymat.

During idle when no keyboard activity is present the MCU sets the column outputs to ”0” and enables the keyboard interrupt. An interrupt is generated when a ROW input is pulled low. Each ROW input on the ASIC, D151 has an internal pull–up. The keyboard interrupt starts up the MCU and the MCU starts the scanning procedure. As there are keypads to be detected outside the matrix the MCU sets all columns to ”1” and reads the ROW inputs if a logic ”0” is read on any ROW this means that one of the 6 possible non matrix keypads has been pressed. If the result was a ”1” on each ROW the MCU writes a ”0” on each column consecutively while the rest of the column outputs are kept in tri–state to allow dual keypad activation to be detected. After that the keyboard scanning is completed and no activity is found the MCU writes ”0” to all columns, enables the keyboard interrupt and enters sleep mode where the clock to the MCU is stopped. A key press will again start up the MCU.

Keyboard and Display Light

The display and keyboard are illuminated by LED's. The light is normally switched on when a keypad is pressed. The rules for light switching are defined in the SW UI specifications. The display and keyboard lights are controlled by the MCU. The LED's are connected two in series to reduce the power consumption. Due to the amount of LED's required for the keyboard and display light they are divided into two groups. Each group has it's own control transistor. The LED switch transistor is connected as a constant current source, which means that the current limiting resistor is put in the emitter circuitry. This arrangement will reduce LED flickering depending upon battery voltage and momentary power consumption of the phone. The LED's are connected straight to the battery voltage. This connection allows two LED's to connected in series. The battery voltage varies a lot depending upon if the battery is charged, full or empty. The switching transistor circuitry is designed to improve this as mentioned earlier.

The light requirement is different for the display and the keyboard. This is one of the reason for splitting the LED control among three transistors. Each LED group can now be set to different LED current thus affecting the illumination. The reason for splitting the LED control is the power dissipation in the control transistor and the current limiting resistor. This is particular the problem during charging when the battery voltage is high.

The LED transistor control lines are coming from PSCLD. The MCU controls these lines by writing to PSCLD using the serial control bus. There are two LED control lines provided by the PSCLD. The display and keyboard light controls are connected to a separate control lines. This means that the keyboard and display light can be controlled separately. The advantage of this is that the power dissipation and heating of the phone can be reduced by only having the required lights switched on.

There is no PWM control on these PSCLD control lines to allow dimming of the keyboard and display lights. These control outputs from PSCLD are low when PSCLD exits reset, lights are off, and MCU then switches them on according to the user settings or user actions.

Audio Control

The audio codec N200 is controlled by the MCU, D150. Digital audio is transferred on the CODECB(5:0). PCM data is clock at 512 kHz from the ASIC and the ASIC also generates 8 kHz synchronization signal for the bus. Data is put out on the bus at the rising edge of the clock and read in at the falling edge. Data from the DSP, D152 to the audio codec, N200 is transmitted as a separate signal from data transmitted from the audio codec, N200 to the DSP, D152. The communication is full duplex synchronous. The transmission is started at the falling edge of the synchronization pulse. 16 bits of data is transmitted after each synchronization pulse.

The 512 kHz clock is generated form 13 MHz using a PLL type of approach which means that the output frequency is not 512 kHz at any moment. The frequency varies as the PLL adjusts the frequency. The average frequency is 512 kHz. The clock is not supplied to the codec when it is not needed. The clock is controlled by both MCU and DSP. DTMF tones are generated by the audio codec and for that purposes the 512 kHz clock is needed. The MCU must switch on the clock before the DTMF generation control data is transmitted on the serial control bus.

The serial control bus uses clock, data and chip select to address the device on the bus. This interface is built in to the ASIC and the MCU writes the destination and data to the ASIC registers. The serial communication is then initiated by the ASIC. Data can be read form the audio codec, N200 via this bus.

Internal Audio

The bias for the internal microphone is generated from the PSCLD, N300 analog output, VA using a bias generator. The bias generation is designed in such a way that common mode signals induced into the microphone capsule wires are suppressed by the input amplifier in the audio codec. The bias generator is controlled by the MCU to save power, the control signal is taken from the audio codec, N200 output latch, pin 26, when the microphone is not used, in idle the bias generator is switched off. The microphone amplifier gain is set by the MCU to match with the used microphone, 35 dB. The microphone amplifier input to the audio codec is a symmetrical input.

The microphone signal is connected to the baseband using filtering to prevent EMC radiation and RF PA signal to interfere with the microphone signal. L201 and C201 forms the first part of this filter in main radio unit. R203 and C202 forms the second part of this filter. A similar filter is used in the negative signal path of the microphone signal. R205 is connected in the ground path for the microphone bias current. R202 supplies the bias current to the microphone from the generator circuitry R201, C200 and V200.

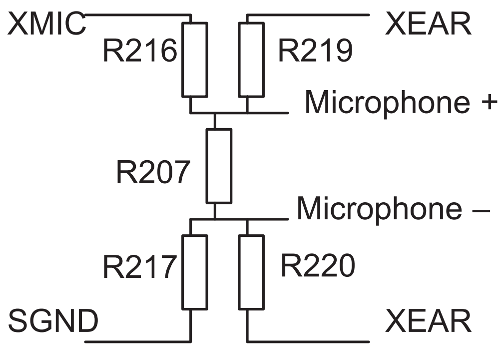
The earpiece amplifier used for the internal earpiece is of differential type and is designed as a bridge amplifier to give the output swing for the required sound pressure. Since the power supply is only 3V a dynamic type ear piece has to be used to achieve the sound pressure. This means that the ear piece is a low impedance type and represents a significant load to the output amplifier. Series inductors are implemented to prevent EMC radiation from the connection on baseband to the earpiece. The same filter also prevents the PA RF field from causing interference in the audio codec, N200 output stage to the earpiece.

The buzzer is controlled by the PWM output provided by the audio codec, N200. Transistors V425 and V403on the UI flex board acts as amplifier and, impedance conversion for the low impedance buzzer. The buzzer is driven from the battery voltage via the V401 regulator circuit. As the buzzer is connected to the baseband via the keyboard connector, the buzzer driving signal BUZZER is EMC protected. As the buzzer is a dynamic one the impedance shows a clear inductance. Therefore a free running diode V413 in UI flex is used to clip the voltage spikes induced in the Buzzer line when the buzzer is switched off.

The buzzer frequency is determined by the internal setup of N200. The frequency is determined by the MCU via the serial control bus. The output level can be adjusted by the PWM function which is attached to the buzzer output in N200.

External Audio

The external microphone audio signal is applied to the baseband system connector and connected to the audio block using signals XMIC and SGND. In order to improve the external audio performance the input circuitry is arranged in a sort of dual ended. A wheatstone type of bridge configuration is created by resistors R216, R217, R219 and R220. The signal is attenuated around 20 dB to not cause distortion in the microphone amplifier. The microphone signal is attenuated by resistors R216, R207 and R217. To allow the external earpiece to be driven dual ended the external microphone signal ground is connected to the negative output of the external audio earpiece amplifier. This means that with reference to audio codec, N200 ground there is a signal level on the SGND line. This arrangement requires that the external microphone amplifier supplies the signal on the SGND line to the XMIC line. With this arrangement the differential voltage over R207 caused by the signal in the SGND line is canceled. There is however a common mode component which is relatively high presented at both the external microphone input pins at the audio codec input, pins 31 and 30. The microphone amplifier has a good common mode rejection ratio but a slight phase shift in the signals will remove the balance. To compensate for this the signal from the external earpiece amplifier positive output, which also feeds the external audio output from the baseband is feed to the remaining resistors in the bridge, R219 and R220. This arrangement will attenuate the common mode signal presented to the microphone amplifier caused by the audio signal in the SGND line. Since the positive output from the audio codec, XEAR signal introduces a DC signal to the microphone amplifier the DC signal on the XMIC and SGND lines are blocked by capacitors C218 and C220.



The external audio output is the XEAR signal on the system connector pin. The XEAR signal is taken from audio codec N200 pin 3. The output impedance is increased to nominal 44 ohms by resistors R214 and R214. Theese resistors prevents the output amplifier from being short circuited even if the pin at the system connector is short circuited. The DC voltage at the XEAR output is used to control the mute function of the accessory. When internal audio is selected the XEAR amplifier in N200 is switched off and the DC voltage at the output on pin 2 is removed. External audio output level is adjusted by the variable gain amplifier in the N200 by MCU via the serial control bus from the ASIC, D151. R118 creates ESD protection for Codec input. L104, C102 and filter creted by R232,C214, C111 and R214 are EMC protection for the XEAR signal at the system connector. This filterering also prevents RF signals induced in the external cables from creating interference in the audio codec output stage.

DSP

The DSP used is the TMS320LC541 .This is 16 bit DSP that can use external and/or internal memory access. The DSP can operate in two modes microprocessor mode or microcontroller mode. The difference between the two modes are that in microprocessor mode the DSP boots from external memory while in the microcontroller mode the DSP boots from internal ROM. The DSP external memory access is devided into data, program and I/O access. The type of access is indicated on three control pins that can be used for memory control.

The DSP, D152 executes code from the internal ROM. The baseband also provides external fast memories for the DSP, D404 and D405. The DSP is capable of addressing 64 kword of memory. The memory area is divided into a code execution area and a data storage area. The code execution area is located at address 8000H–FFFFH. The external memories are arranged in such a way that the DSP can access the external memories both as data storage and code execution. The memory chip select is taken from the memory access strobe signal from the DSP. This means that the memory is active during any memory access. The memories are connected in such a way that the write control is CE controlled write. This means that both the write signal and the output enable signal are active at the same time. This implementation is required since the DSP supports only one signal for write/read control.

The DSP is operating form the 13 MHz clock. In order to get the required performance the frequency is internally increased by a PLL by a factor of 3. The PLL requires a settling time of 50 us after that the clock has been supplied before proper operation is established. This settling counter is inside the DSP although the ASIC, D151 contains a counter that will delay the interrupt with a programmable amount of clock cycles before the interrupt causing the clock to be switched on is presented to the DSP.

The DSP has full control over the clock supplied to it. When the DSP is to enter the sleep mode the clock is switched off by setting a bit in the ASIC register. The clock is automatically switched on when an interrupt is generated.

DSP Interrupts

The DSP supports 4 external interrupts. Three interrupts are used. The ASIC, D151 generates two of the interrupts. One interrupt is generated by RFI2, N450 auxiliary A/D converter. This interrupt is generated when a baseband measurement A/D conversion is completed. The interrupts to the DSP are active low.

DSP Serial Communications Interface

The DSP contains two synchronous serial communications interface. One of the interfaces are used to communicate with the audio codec, N200. The 512 kHz clock required for the data transfer is provided by D151 as well as the 8 kHz synchronization signal. Data is transferred on to lines, RX and TX creating a full duplex connection. Data is presented on the bus on the first rising edge of the clock after the falling edge of the synchronization pulse. Data is read in by each device on the falling edge of clock. Data transfer is 16 bits after each synchronization pulse.

The DSP, D152 has control over the clock provided to the audio codec. The DSP can switch on the clock to start the communication and switch it off when it is not needed. This clock is also under control of MCU, D150 as described in the previous section Audio Control.

The second serial interface is used for debugging and Digital Audio Interface. The ASIC provides the clock and the synchronization for this serial interface as well since the two serial interfaces need to be operated synchronously in case of DAI measurements.

RFI2, N450 Operation

The RFI2, N450 contains the A/D and D/A converters to perform the A/D conversion from the received signal and the D/A converters to perform the conversion for the modulated signal to be supplied to the transmitter section. In addition to this the RFI2 chip also contains the D/A converter for providing AFC voltage to the RF section. This AFC voltage controls the frequency of the 13 MHz VCO which supplies the system clock to the baseband. The RFI2, N450 also contains the D/A converter to control the RF transmitter power control. The power control values are stored in the ASIC, D151 and at the start of each transmission the values are read from the ASIC, D151 to the D/A converter producing the power control pulse. This D/A converter is used during the reception to provide AGC for the receiver RF parts.

One of the A/D converters used for receiver signal conversion can be used as an auxiliary converter that supplies 8 channels for baseband measurement purposes. When the converter is used in this mode each conversion generates an interrupt directly to the DSP. The DSP operates this converter via the ASIC, D151.

Data communication between the ASIC, D151 and RFI2, N450 is carried out on a 12 bit parallel data bus. The ASIC, D151 uses 4 address lines to access RFI2, N450. Depending on the direction of the communication either the write control signal is used to write data to RFI2, N450 or the read signal is used to read data from RFI2, N450. The ASIC, D151 supplies 13 MHz clock to the RFI2, N450. This clock is used as reference for the A/D and D/A converters.

Communication between the ASIC, D151 and the RFI2, N450 is related to the clock.

The RFI2, N450 digital supply is taken from the baseband main digital supply. The analog power supply, 4.5V is generated by a regulator N451 supplied form the VBATT voltage. The analog power supply is always supplied as long as the baseband is powered and VXOENA signal is activated (low).

SIM Interface

The SIM interface is the serial interface between the smart card and the baseband. The SIM interface logic levels are 5V since no 3V technology SIM is yet available. The baseband is designed in such a way that a 3V technology SIM can be used whenever it is available. The SIM interface signals are generated inside the ASIC. The signals coming from the ASIC are converted to 5V levels. The PSCLD circuit is used as the logic voltage conversion circuit for the SIM interface. The PSCLD circuit also contains the voltage regulator for the SIM power supply. The control signals from the ASIC to PSCLD are at 3V level and the signals between PSCLD and the SIM are 5V levels. An additional control line between the ASIC and the PSCLD is used to control the direction of the DATA buffer between the SIM and the PSCLD. In a 3V technology environment this signal is internal to the ASIC only. The pull up resistor required on the SIM DATA line is integrated into the PSCLD and the pull–up is connected to the SIM regulator output inside PSCLD. In idle the DATA line is kept as input by both the SIM and the interface on the base band. The pull–up resistor is keeping the DATA line in it’s high state.

The power up and power down sequences of the SIM interface is performed according to ISO 7816–3. To protect the card from damage when the power supply is removed during power on there is a control signal, CARDDETX, that automatically starts the power down sequence. The CARDDETX information is taken from the battery size indicator signal, BSI, from the battery connector. The battery connector is designed in such a way that the BSI signal contact is disconnected first, while the power is still supplied by the battery, and the battery power contacts are disconnected after that the battery pack has moved a specified distance.

Since the power supply to the SIM is derived from PSCLD also using 3V technology SIM the power supply voltage of the SIM regulator is programmable 3.15/4.8 V. The voltage is selected by using the serial control bus to PSCLD. The default value in PSCLD’s hardware is set to 3.2V nominal.

For cross compatibility reasons the interface is always be started up using 3V. The 3V technology SIM will operate at 5V but a 5V SIM will not always operate at 3V. The supply voltage is switched to 5V if the SIM is needeing that. The SIM has a bit set in a data field indicating it’s capability of 3V or 5V operation.

The DATA signal between the SIM and the PSCLD can be set to operate in two different modes. One mode causes the PSCLD output to force a logic high level on the DATA line when the interface is driving a high level. In this mode the interface output is driving the DATA line actively. In the other mode the DATA line is operating like an open drain circuitry with the difference that during the transition periods high–low, low–high the interface is actively forcing the DATA line. The advantage of this is that the DATA line is acting like an open drain, tri–state, data line but there is no problem with rise times since the data line is actively forced during the transition period. This mode is introduced to cope with data line overshoots that has been discovered during type approval testing. The present solution is to force the data line actively during the byte transmission. In the new mode the data line is not forced actively when the data to be transmitted is high.

The regulator control signal is derived from the ASIC and this signal controls the operation of the SIM power supply regulator inside PSCLD. To ensure that the powered off ASIC doesn't cause any uncontrolled operations at the SIM interface the PSCLD signals to the SIM are forced low when the PURX signal is active, low. This implementation will ensure that the SIM interface can not be activated by any external signal when PSCLD has PURX active. When PURX goes inactive the control of the interface signals are given back to the ASIC signals controlling PSCLD SIM interface operations.

The clock to the SIM can be switched off if the SIM card allows stopping of the clock. The clock can be stopped either in high or low state, determined by the card data. For cards not allowing the clock to be stopped there is a 1.083 MHz clock frequency that can be used to reduce the power consumption while the clock is running. In this case the VCO must be running all the time. When the clock is stopped and the status of the CARDIN signal changes, battery is removed, the clock to the SIM is restarted inside the ASIC and the SIM power down sequence is performed.

To be able to handle current spikes as specified in the SIM interface specifications the SIM regulator output from PSCLD must have a ceramic capacitor off 100 nF connected between the output and ground close to the SIM interface connector. To be able to cope with the fall time requirements and the disconnected contact measurements in type approval the regulator output must be actively pulled down when the regulator is switched off. This active pull–down must work as long as the external battery is connected and the battery voltage is above the PSCLD reset level.

The SIM power on procedure is controlled by the MCU. The MCU can power up the SIM only if the CARDDETX signal is in the inactive state. Once the power up procedure has been started the ASIC takes care of that the power up procedure is performed according to ISO 7816–3.

The SIM interface uses two clock frequencies 3.25 MHz or 1.625 MHz during SIM communication. A 1.083 MHz clock is used during SIM sleep state if the clock is not allowed to be switched off. The data transfer speed in the SIM GSM session is specified to be the supplied clock frequency/372. The ASIC SIM interface supplies all the required clock frequencies as well as the required clock frequency for the UART used in the SIM interface data transmission/reception.

Display Driver Interface

The display driver is Seiko SD1560, located in UI Flex board. The display driver has internal voltage triple circuitry for LCD voltage generation. Capacitors C409 and C420 are used in the voltage converter. Capacitor C 404 is the filtering capacitor for the voltage generator output. Capacitors C400–C403 and C421 are filtering capacitors for the supply voltage to the display driver back plane voltages. Resistor network R416–419 forms the feedback network for setting the contrast for the display. The display driver has internal temperature compensation for the contrast.

The Base Band uses a serial interface to the Seiko LCD driver. The serial interface is designed in the ASIC. The MCU writes data into the serial interface in the ASIC and it is then transmitted to the LCD driver. The LCD driver reset is controlled by the MCU on P40. The display driver reset is low level active. The P40 pin on the MCU has a pull down capacitor, C154 to ensure that the LCD driver reset is low at power up. After exiting reset one of the first tasks for the MCU is to set the P40 to output and low, ”0”. After at least 100 us the reset signal to the display driver is taken high, ”1”. This rising edge reset selects 80XX type MCU interface. The serial interface setting of the driver will override this. After resetting the display driver the MCU starts the initialization procedure using the serial interface in the ASIC, D151.

The MCU first sets up the display driver interface in the ASIC for the serial driver. This enables the interface signals and sets the polarity of the chip select to the driver correct. The next step is to blank the display. This is to be done soon after the power up sequence to ensure that no garbage is output on the display. The normal display test pattern is then written to the display.

Communication with the serial driver takes place on the SCONB(5:0). The display driver requires serial data, serial clock and command/display information during the serial transfer. The display driver has its own chip select which is active during the transfer, there are other devices on the same serial bus as well. The command/display information is transmitted on the keyboard ROW5 output. Due to the fact that the keyboard interface is used during display driver transfers the keyboard activities must be disabled during display driver communication. This means that the column output from the ASIC must be put in high impedance state not to interfere with the data transmission if keypads are pressed.

The timing required for the serial interface is provided by the ASIC and the operation of ROW5 depends upon the display driver interface initialization. For the serial interface it is used for command/display data control. The serial clock is 1.083 MHz.

The serial interface in the ASIC starts the transfer after each write operation to the output buffer. The data transferred is command or data depending upon to which address it is written in the interface. The ASIC sets the control signal on ROW5 accordingly. After that the data has been shifted out from the interface a bit is set in the interface register to tell the MCU that the interface is ready for the next byte. This transmission indicator bit is polled by the MCU and the next byte is written when the output buffer is empty.

The clock to the display driver interface in the ASIC is automatically switched on when a write operation to the interface has taken place. The MCU can force the clock to be continuously on by writing the clock on to the CTSI block. The default assumption is that the MCU forces the clock to be continuously on only when a large amount of data is to be transmitted, such as segment test at power up.

RF Block

Introduction

The GJ8A is the RF module of the NHE–6 cellular transceiver (phase 2). The GJ8A module carries out all the RF and system functions of the transceiver. This module works in the GSM system.

The GJ8A module is constructed on a 1.0 mm thick FR4 eight–layer printed wiring board. The dimensions of the PWB are 126 mm x 43 mm.

Components are located on both sides of the PWB. The RF components are located on the top end of the PWB. The both sides of the board includes high and low components. The maximum usable height is 5 mm.

EMI leakage is prevented by a metallized plastic shield A on side 1/8 and a metallized plastic cover B on side 8/8. The shield A also conducts the heat out of the inner parts of the phone, thus preventing excessive temperature rise.

Receiver

The SW controlled electrical switch connects the signal from the antenna (transceiver antenna or external) to the duplex filter, which rejects the unwanted signals. The received signal is amplified by a discrete low noise preamplifier. The gain of the amplifier is controlled by the AGC control line (PDATA0). The nominal gain of 20 dB is reduced in strong field conditions by about 40 dB. After the preamplifier the signal is filtered by the SAW RF filter. The filter rejects spurious signals coming from the antenna and spurious emissions coming from the receiver unit.

The filtered signal is down converted by the single balanced diode mixer. The first IF is 71 MHz. The first local signal is generated by the UHF synthesizer.

The amplified IF signal is filtered by the SAW IF filter. The filter rejects the adjacent channel signal, intermodulating signals and the second IF image signal. After filtering, the IF signal is fed to the receiver ASIC (CRFRT), which includes the AGC amplifier and the 2nd mixer. The 2nd local signal is generated in the RF ASIC by dividing the VHF signal by four. After mixing the 2nd IF signal is filtered by the SMD 13 MHz ceramic filter and amplified by the differential amplifier of the ASIC. The differential 13 MHz signal is fed through the attenuator circuit to the RF interface circuit RFI2.

Duplex Filter

The duplex filter combines the transmitter and the receiver to the antenna connection. The TX filter rejects the noise power at the RX frequency band and TX harmonic signals. The RX filter rejects blocking and spurious signals coming from the antenna. It protects the receiver of the transmitter power, too.

Pre–Amplifier

The pre–amplifier amplifies the received signal. The performance of the amplifier determines the sensitivity of the receiver.

Parameter	*Value*
Frequency band:	*935–960 Mhz*
Supply voltage (min/max):	*4.5...4.8 V*
Current consumption (typ):	*10 mA*
Insertion gain (min/typ):	*15...20 dB*
Noise figure (max):	*2.0 dB*
Reverse isolation (min):	*15 dB*
Gain reduction (typ):	*40 dB*
IIP3: (min):	*–10 dBm*
Input VSWR; zo=50 Ω (max):	*2.0*
Output VSWR; zo=50 Ω (max):	*2.0*

RF Interstage Filter

The RX interstage filter is an SAW filter. The filter rejects spurious and blocking signals coming from the antenna. It rejects the local oscillator signal leakage, too.

Diode Mixer

The first mixer is a single balanced diode mixer. The mixer consists of a microstripline balun and a ring quad schottky diode. One diode pair is used for the receiver and the other is used for up conversion of the transmitter signal.

Parameter	*Value*
RX frequency range:	*935–960 Mhz*
LO frequency range:	*1006–1031 Mhz*
IF frequency:	*71 Mhz*
Conversion loss (typ/max):	*7...9 dB*
IIP3 (typ):	*5 dBm*
LO – RF isolation (min):	*15.0 dB*
LO power level (max):	*3 dBm*

IF Amplifier

The first IF bipolar transistor amplifier drives up the level of the down converted signal before filtering.

Parameter	*Value*
Operation frequency:	*71 Mhz*
Supply voltage (min/max):	*4.5...4.8 V*
Current consumption (typ):	*18 mA*
Insertion gain (min/typ):	*19...20 dB*
Noise figure (typ):	*3.0 dB*
IIP3 (min):	*–5 dBm*

First IF Filter

The first IF filter makes the part of the channel selectivity of the receiver. It rejects adjacent channel signals (except the 2nd adjacent). It also rejects blocking signals and the 2nd image frequency.

The first IF amplifier is a bipolar transistor amplifier.

Parameter	*Value*
Center frequency:	*71 Mhz*
Operating temperature range	*–20...+80 °C*
Input impedance:	*3.5 kΩ//6.9 pF*
Output impedance:	*3.4 kΩ//6.7 pF*
Insertion loss (typ/max):	*11.5...13.5 dB*
Group delay distortion:	*700...1300 ns*
2 dB bandwidth (min):	± *80 kHz*
3 dB bandwidth (min):	± *120 kHz*
5 dB bandwidth (max):	± *230 kHz*
20 dB bandwidth (max):	± *400 kHz*
30 dB bandwidth (max):	± *600 kHz*
35 dB bandwidth (max):	± *800 kHz*
Spurious rejection at fo ±26 MHz (min):	*60 dB*

Receiver IF Circuit, RX part of CRFRT

The receiver part of CRFRT consists of an AGC amplifier, a mixer and a buffer amplifier for the second IF. The mixer circuit down converts the received signal to the 13 MHz IF frequency. After second IF filter the signal is amplified and fed to baseband circuitry. The supply current can be switched OFF by an external switch.

Parameter	*Value*
Supply voltage (min/typ/max):	*4.27...4.5...4.73 V*
Supply current (typ):	*38 mA*
Input frequency range (min/max):	*45...87 MHz*
Max voltage gain before 2IF filt:	*47 dB*
Min voltage gain before 2IF filt:	*–10 dB*
AGC gain control slope (min/typ/max):	*40...84...120 dB/V*
Absolute gain inaccuracy (min/max):	*–4...4 dB*
Relative gain inaccuracy (max):	*0.8 dB*
Noise figure (max):	*15 max gain*
Mixer output 1 dB comp point (typ):	*1.0* V_{PP}
Gain of the 2nd IF buffer:	*30*
Max output level after 2nd IF buffer (typ):	*1.6* V_{PP}

Second IF Filter

The second IF is filtered by the ceramic filter, which makes the part of the channel selectivity of the receiver.

Parameter	*Value*
Center frequency (typ):	*13.0 MHz*
1 dB bandwidth BW (min):	*± 90 kHz*
5 dB bandwidth (max):	*± 220 kHz*
Insertion loss (max):	*6.0 dB*
Group delay distortion (max):	*1500 ns at BW*
Attenuation fo±400 kHz (min/typ):	*25.0...30 dB*
Attenuation fo±600 kHz (min/typ):	*40.0...45 dB*
Terminating impedance (typ):	*330 Ω*
Operating temperature range (min/max):	*–30...+85 °C*

Transmitter

The synthesized 232 MHz signal is divided by two in the I/Q modulator of the CRFRT. The TX I and Q signals are generated in the RFI2 interface circuit and they are fed differentially to the modulator. The modulated TX IF signal (116 MHz) is amplified by an AGC amplifier. In this application the gain has been set to the maximum level, because the power control has been implemented by the power amplifier.

The TX signal is generated by mixing the UHF VCO signal and the modulated TX IF signal. After mixing the slightly filtered TX signal is amplified by the MMIC amplifier to the level of +5 dBm. The unwanted signals are filtered by the SAW RF filter.

The power amplifier MMIC amplifies the TX signal to the used power level. The maximum output level of the amplifier is 35 dBm, typically.

The power control loop controls the output level of the MMIC power amplifier. The power detector consists of a directional coupler and a diode rectifier. The difference of the power control signal (TXC) and the detected voltage is amplified and used as a control voltage for the power amplifier.

The duplex filter rejects the noise on the receiver band and the harmonic products of the TX signals. The electrical switch connects the signal to the used antenna.

Modulator Circuit, TX part of CRFRT

The modulator of the CRFRT is a quadrature modulator. The input local signal (232 MHz) is divided by two to get accurate 90 degrees phase shifted signals for the I/Q mixer. After mixing the signals are combined and amplified. The output of the IC is single ended and the level is controllable. The maximum output level is 0 dBm, typically.

Parameter	*Value*
Supply voltage (min/max):	*4.27...4.73 V*
Supply current (typ):	*38 mA*

Transmit frequency input	*Value*
LO input frequency (min/max):	*170...400 MHz*
LO input power level (min/typ/max):	*–20...–10...0 dBm*
LO input impedance (min/typ/max):	*70...100...130 Ω*

Modulator Inputs (I/Q):	*Value*
Input bias current, balanced (max):	*100 nA*
External DC reference (min/max):	*2.1...2.6 V*
Differential input swing (min/typ/max):	*0.5...0.8...1.1 V_{pp}*
Differential input offset volt. (min/typ/max):	*0...1.0...3.0 mV*
Input impedance (min):	*200 kΩ*
Gain unbalance (min/max):	*–0.5...0.5 dB*

Modulator Output:	*Value*
Available RF power (min/max):	*–45...0, ZiL=50 kΩ*
Suppression of 3rd order prods (max):	*–35 dB*
Carrier suppression (min):	*35 dB*
Noise floor at saturated Pout (max):	*–125 dBm/Hz*

Upconversion Mixer

The mixer is a single balanced diode mixer. The mixer circuit is the same as used in the receiver. The input signal is a modulated 116 MHz signal coming from the quadrature modulator (part of the CRFRT circuit). The TX signal is filtered by using a microstripline trap for the LO signal before amplification.

Parameter:	*Value*
Input frequency (typ):	*116 MHz*
LO frequency range:	*1006...1031 MHz*
TX frequency (min/max):	*890...915 MHz*
Conversion loss (typ/max):	*7.0...8.0 dB*
IIP3 (min):	*–5.0 dBm*
LO – RF isolation (min):	*20 dB*
LO power level (max):	*3.0 dBm*

TX amplifier

The TX amplifier is a bipolar MMIC amplifier. It amplifies the up converted TX signal to the level required by the power amplifier.

Parameter:	*Value*
Operation frequency range:	*890...915 MHz*
Supply voltage (typ):	*4.5 V*
Current consumption (typ):	*20.0 mA*
Insertion gain (min):	*20 dB*
Output power (typ):	*5.0 dBm*
Noise figure (typ):	*4.0 dB*
Input VSWR (Zo=50 Ω) (max):	*2.0*
Output VSWR (Zo=50 Ω) (max):	*2.0*

TX Interstage Filters

The TX filter rejects the spurious signals generated in the up conversion mixer. It rejects the local and IF signal leakages and broad band noise, too.

Parameter:	*Value*
Terminating impedance:	*50 Ω*
Operating temperature range (min/max):	*–25...+80 °C*
Center frequency (fo) (nom):	*902.5 MHz*
Bandwidth (BW) (min):	*± 12.5 MHz*
Insertion loss at BW (max):	*4.0 dBm*
Ripple at BW (max):	*1.0 dB*
Attenuation DC...845 MHz (min):	*30.0 dB*
Attenuation 845...870 MHz (min):	*20.0 dB*
Attenuation 935...980 MHz (min):	*18.0 dB*
Attenuation 980...1500 MHz (min):	*30.0 dB*
Attenuation 1500...3500 MHz (min):	*15.0 dB*

Power Amplifier

The power amplifier is an integrated 3 stage GaAs MMIC. The device amplifies the TX signal to the desired output level. It has been specified for 6,0 volt operation. The power amplifier includes the negative bias generator for the GaAs FETs.

Parameter:	*Value*
Operating frequency range:	*890...915 MHz*
DC supply voltage Vdd (typ):	*6.0 V*
Current consumption Id (nom):	*.1.0 A*
Output power (min):	*35.0 dBm normal cond.*
Output power (typ):	*34.0 dBm, extreme cond.*
Output power control range (min/max):	*60...80 dB*
Input power (min/typ/max):	*0...1.0...10 dBm*
Efficiency (Po=34.5 dBm) (min/typ):	*45...50 %*
Input VSWR (Zo=50 Ω) (typ):	*2.0*
Noise power (in 30 kHz band, 20 kHz above fo) (typ):	*–90.0 dBm*
Stability, Vdd=6.0 V:	*VSWR 6:1*
Operating case temp. range (min/max):	*–20...+90 °C*

Power control circuit

The power control loop consists of a power detector, a differential amplifier (part of CRFRT) and a buffer amplifier. The power detector is a combination of a directional coupler and a diode rectifier. The difference of the power control signal (TXC) and the detected signal is amplified and used for the output power control.

Parameter:	*Value*
Supply voltage (min/typ/max):	*4.5...4.7...4.9 V*
Supply current (typ):	*15 mA*
Power control range (min):	*20/28 dB, phase I / phase II*
Power control inaccuracy (max):	*±1 dB*
Dynamic range (min):	*60 dB*
Input control voltage range (min/max):	*0.6...3.5 V*
Output control voltage range (min/max):	*1.0...4.0 V*

Frequency Synthesizers

The stable frequency source for the synthesizers and baseband circuits is the voltage controlled temperature compensated crystal oscillator, VCTCXO. The frequency of the VCTCXO is 13 MHz. The frequency of the oscillator is controlled by an AFC voltage, which is generated by the baseband circuits.

The operating frequency range of the UHF synthesizer is from 1006 to 1031 MHz. The UHF signal source is the VCO module. The UHF PLL locks the signal for the accurate frequency and it is used as the down conversion signal for the receiver and the up conversion signal for the transmitter.

The operating frequency of the VHF synthesizer is 232 MHz. This signal is fed to the RF ASIC (CRFRT), where it is used for the I/Q modulation and for the down conversion of the first IF. This 232 MHz signal is divided by four inside the CRFRT before using it as a local signal for the mixer.

VCTCXO

The VCTCXO is a module operating at 13 MHz. The 13 MHz signal is used as a reference frequency of the synthesizers and as a clock frequency for the base band circuits.

Parameter:	*Value*
Operating temperature range (min/max):	*–25...+75°C*
Supply voltage (min/max):	*4.5...4.9 V*
Supply current (max):	*2.0 mA*
Output frequency (typ):	*13 MHz*
Output level (typ):	*1.0 Vpp*
Harmonics (max):	*–3 dBc*
Load (typ):	*10//10 kΩ // pF*
Nominal voltage for center freq. (typ):	*2.1 V*
Frequency control (min/max):	*± 18...±30 ppm*
Control sensitivity (max):	*± 20 ppm/V*

VHF PLL

The VHF PLL consists of the VHF VCO, PLL integrated circuit and loop filter. The output signal is used for the 2nd mixer of the receiver and for the I/Q modulator of the transmitter.

Parameter:	*Value*
Start up setting time (max):	*2 ms*
Phase error (max):	*1 deg., rms*
Sidebands (max)	
• ±1 MHz:	*–70 dBc*
• ±2 MHz:	*–80 dBc*
• ±3 MHz:	*–80 dBc*
• >4 MHz:	*–90 dBc*

VHF VCO + Buffer

The VHF VCO uses a bipolar transistor as an active element and a combination of a chip coil and varactor diode as a resonance circuit. The buffer is combined into the VCO circuit so that they use same supply current.

Parameter:	*Value*
Supply voltage (min/typ/max):	*4.3...4.5...4.7 V*
Control voltage (min/typ/max):	*0.7...2.2...3.8 V*
Supply current (typ/max):	*6.0...8.0 mA*
Operation frequency (typ):	*232 MHz*
Output power level (typ):	*3.0 dBm*
Control voltage sensitivity (min/max):	*8.0...14.0 MHz/V*
Phase noise (max)	
• fo ±600 kHz	*–123 dB*
• fo ±1600 kHz	*–133 dB*
• fo ±3000 kHz	*–143 dB*
Pulling figure (min):	*±1.0 MHz*
Pushing figure (max):	*±1.0 MHz*
Frequency stability (max):	*±3.0 MHz, over temp range –10...+75 °C*
Harmonics (max):	*–5 dBc*
Spurious (max):	*–6 dBc*

UHF PLL

The UHF PLL consists of an UHF VCO module, PLL circuit and a loop filter. This circuit generates the LO signal for the down and the up conversion.

Parameter:	*Value*
Start up setting time (max):	*2 ms*
Settling time ±83 MHz (typ/max):	*600...800 µs*
Phase error (typ/max):	*1.5...3.0 deg, rms*
Sidebands (typ/max)	
• ±200 kHz:	*–53...–40 dB*
• ±400 kHz:	*–63...–50 dB*
• ±600 kHz...1.4 MHz:	*<–69...–66 dB*
• 1.4...3.0 MHz:	*max –76 dB*
• >3.0 MHz:	*max –86 dB*

UHF VCO

The UHF VCO is a module which includes an output amplifier, too.

Parameter:	*Value*
Supply voltage (min/typ/max):	*4.1...4.5...4.9 V*
Control voltage (min/max):	*0.7...3.8 V*
Supply current (typ/max):	*7.5...10.0 mA*
Operation frequency range (min/max):	*1006...1031 MHz*
Output power level (min/max):	*–3.0...3.0 dBm*
Control voltage sensitivity (min/typ/max):	*10.0...13.0...16.0 MHz/V*
Phase noise (typ/max)	
• fo ±600 kHz:	*<–135...–120 dBc/Hz*
• fo ±1600 kHz:	*–130 dBc/Hz*
• fo ±3000 kHz:	*–140 dBc/Hz*
Pulling figure (max):	*±1.0 MHz*
Pushing figure (max):	*±1.0 MHz/V*
Frequency stability (max):	*±3.0 MHz, over temp range –10...+75 °C*
Harmonics (max):	*–15 dBc*
Spurious (max):	*–65 dBc*

UHF VCO Buffer

The buffer amplifies the UHF VCO signal. The output signal is used as the LO signal for the single balanced diode mixer used in the down and up conversion.

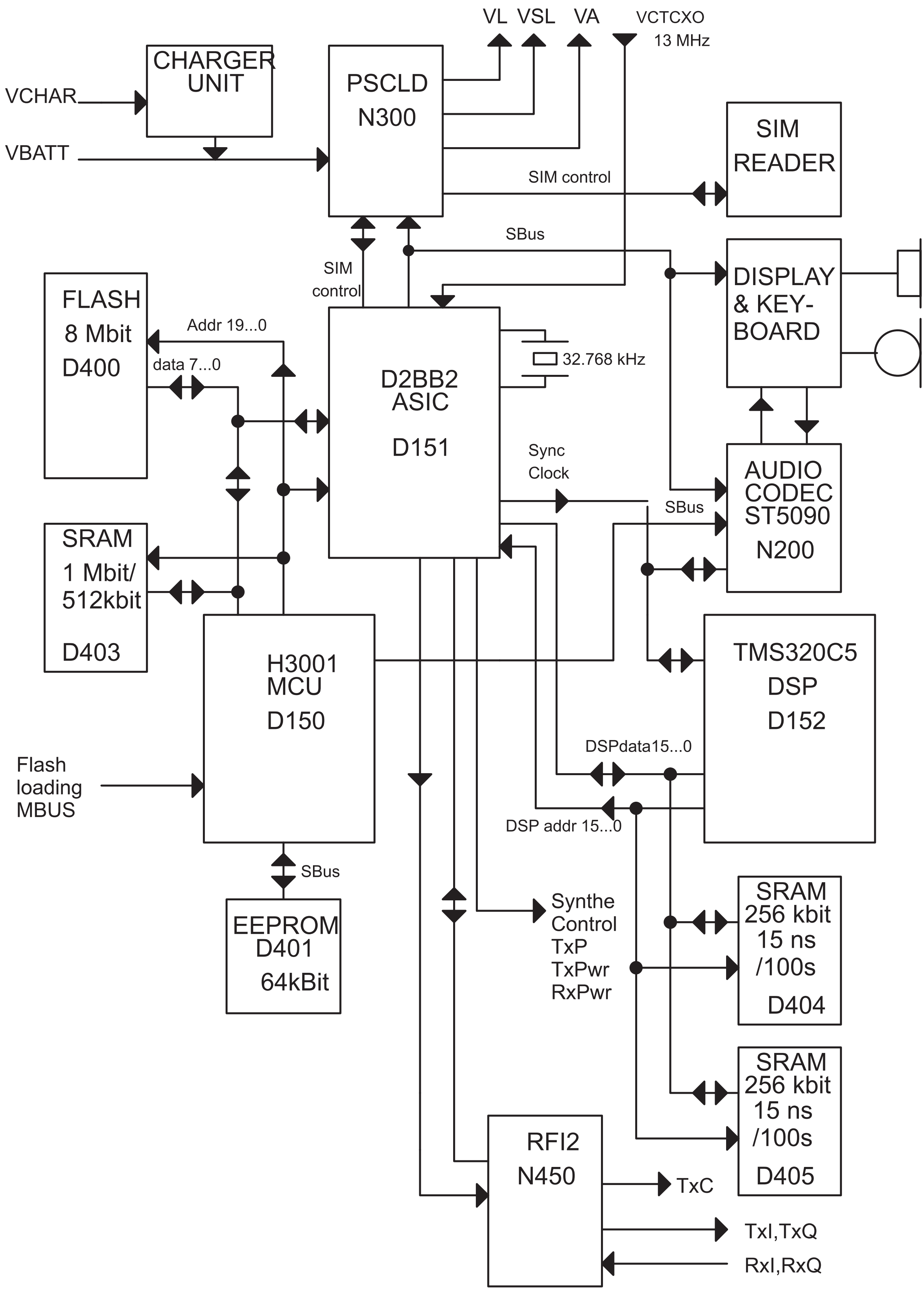
Parameter:	*Value*
Supply voltage (typ):	*4.5 V*
Supply current (typ):	*7.0 mA*
Frequency range (min/max):	*1006...1031 MHz*
Input power (typ):	*–7.0 dBm*
Output power (typ):	*+4.0 dBm*
Harmonics (max):	*–10 dBc*

PLL Circuit

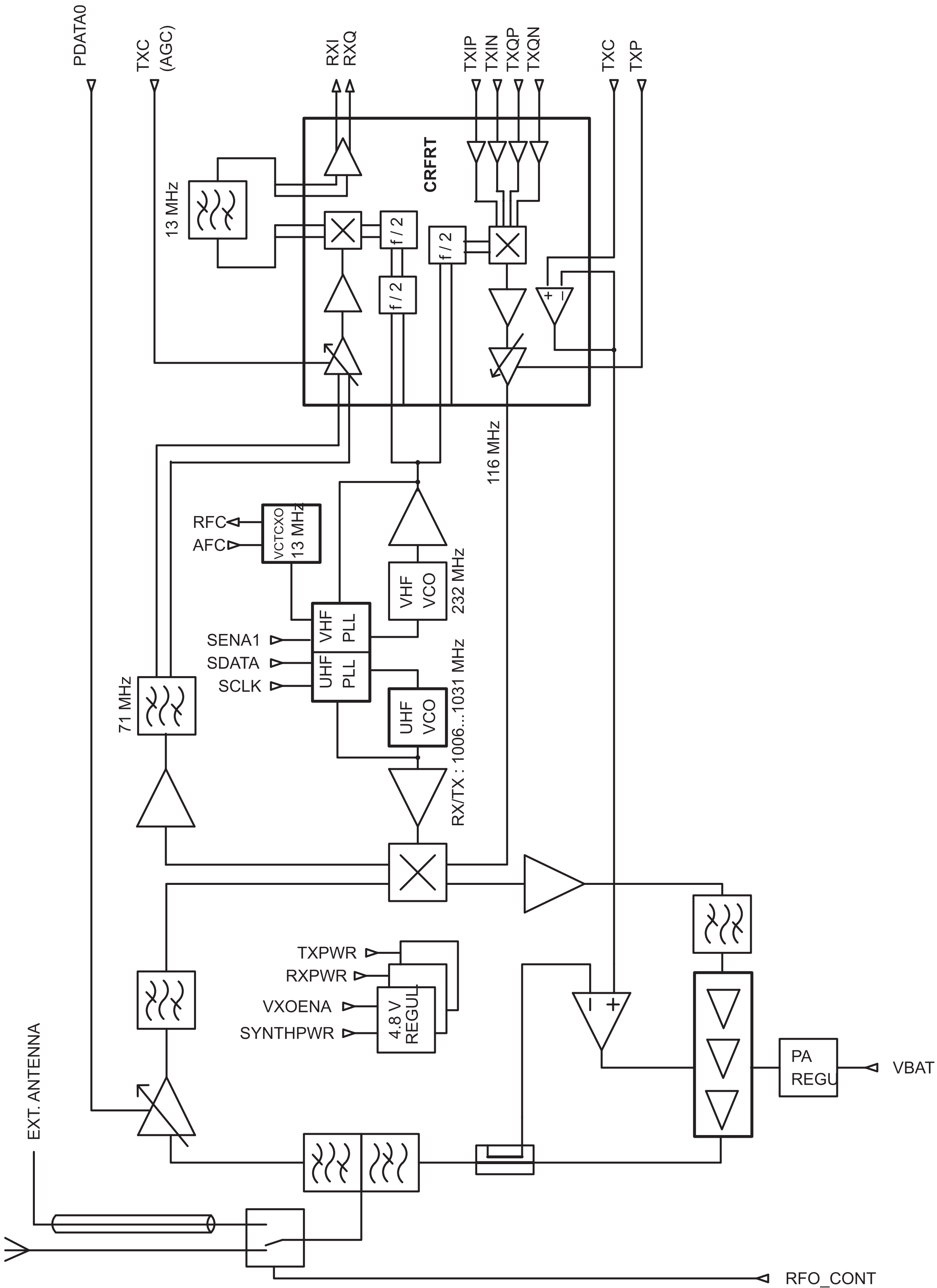
The PLL is National LMX2332. The circuit is a dual frequency synthesizer including both the UHF and VHF synthesizers.

Parameter:	*Value*
Supply voltage (min/max):	*2.7...5.5 V*
Supply current principal synth. (typ):	*8.0 mA*
Supply current auxiliary synth. (typ):	*3.0 mA*
Principal input frequency (min/max):	*100...1200 MHz*
Auxiliary input frequency (min/max):	*50...510 MHz*
Input reference frequency (max):	*40 MHz*
Clocking frequency (max):	*10.0 MHz*
Reference input voltage (min):	*500 mVpp*
Input signal voltage principal s. (min/max):	*–15...+4.0 dBm*
Input signal voltage auxiliary s. (min/max):	*–10...+4.0 dBm*
Phase detector output current tolerance (min/max):	*–20...+20 %*
Phase detector output voltage (min/max):	*0.4 V...Vdd–0.4 V*

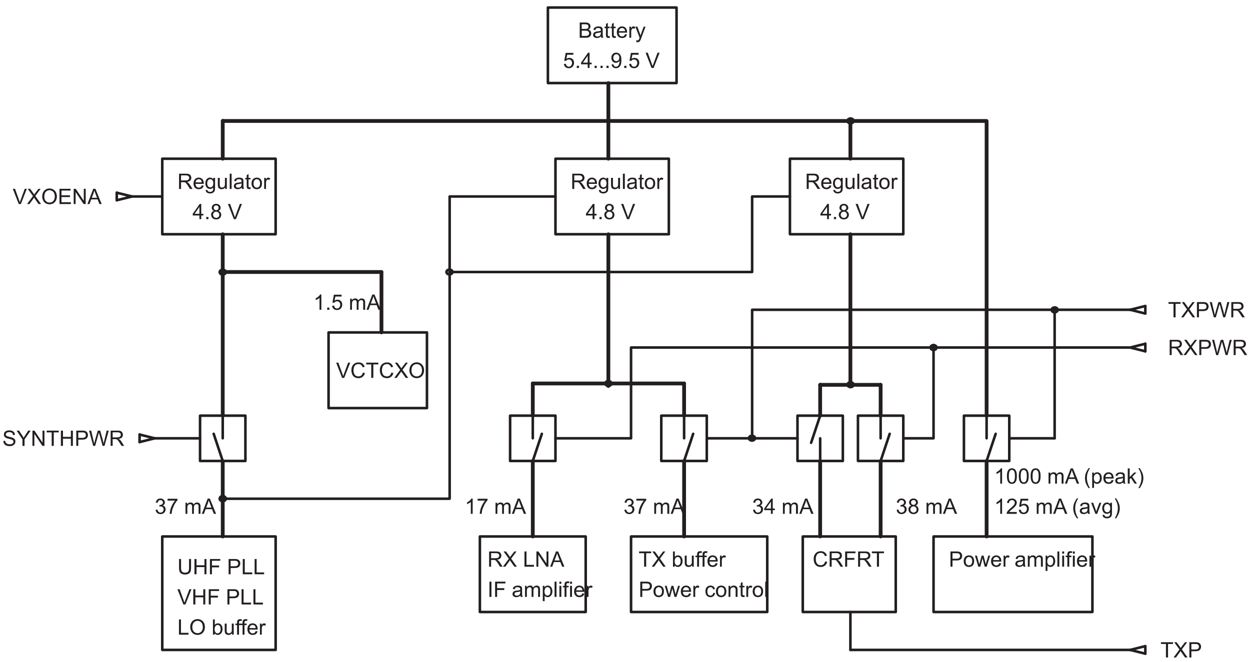
Interconnection Diagram of Baseband



Block Diagram of RF



Power Distribution Diagram of RF



GJ8: Block Diagram of Baseband

GJ8: Circuit Diagram of Power Supply & Charging

GJ8: Circuit Diagram of Central Processing Unit

GJ8: Circuit Diagram of MCU Memory Block

GJ8: Circuit Diagram of Keyboard & Display Interface

GJ8: Circuit Diagram of Audio

GJ8: Circuit Diagram of DSP Memory Block

GJ8: Circuit Diagram of RFI

GJ8: Circuit Diagram of Receiver

GJ8: Circuit Diagram of Transceiver

GJ8: Circuit Diagram of System Connector

Layout Diagrams of GJ8 (Version: 15)

GJ8A: Block Diagram of Baseband

GJ8A: Circuit Diagram of Power Supply & Charging

GJ8A: Circuit Diagram of Central Processing Unit

GJ8A: Circuit Diagram of MCU Memory Block

GJ8A: Circuit Diagram of Keyboard & Display Interface

GJ8A: Circuit Diagram of Audio

GJ8A: Circuit Diagram of DSP Memory Block

GJ8A: Circuit Diagram of RFI

GJ8A: Circuit Diagram of Receiver

GJ8A: Circuit Diagram of Transceiver

GJ8A: Circuit Diagram of System Connector

Layout Diagrams of GJ8A (Version: 02)

Parts list of GJ8 (EDMS Issue 8.8 Code: 0200591 for layout version 15)

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R103	1430001	Chip resistor	100	5 % 0.063 W 0603
R106	1430009	Chip resistor	220	5 % 0.063 W 0603
R308	1430027	Chip resistor	2.43 k	1 % 0.063 W 0603
R309	1430027	Chip resistor	2.43 k	1 % 0.063 W 0603
R216	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R217	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R219	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R220	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R112	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R745	1430693	Chip resistor	5.6	5 % 0.063 W 0402
R746	1430693	Chip resistor	5.6	5 % 0.063 W 0402
R525	1430700	Chip resistor	10	5 % 0.063 W 0402
R558	1430700	Chip resistor	10	5 % 0.063 W 0402
R713	1430700	Chip resistor	10	5 % 0.063 W 0402
R740	1430700	Chip resistor	10	5 % 0.063 W 0402
R506	1430710	Chip resistor	22	5 % 0.063 W 0402
R514	1430710	Chip resistor	22	5 % 0.063 W 0402
R541	1430710	Chip resistor	22	5 % 0.063 W 0402
R595	1430710	Chip resistor	22	5 % 0.063 W 0402
R743	1430710	Chip resistor	22	5 % 0.063 W 0402
R829	1430710	Chip resistor	22	5 % 0.063 W 0402
R831	1430710	Chip resistor	22	5 % 0.063 W 0402
R832	1430710	Chip resistor	22	5 % 0.063 W 0402
R845	1430710	Chip resistor	22	5 % 0.063 W 0402
R847	1430710	Chip resistor	22	5 % 0.063 W 0402
R331	1430714	Chip resistor	33	5 % 0.063 W 0402
R332	1430714	Chip resistor	33	5 % 0.063 W 0402
R151	1430718	Chip resistor	47	5 % 0.063 W 0402
R152	1430718	Chip resistor	47	5 % 0.063 W 0402
R214	1430718	Chip resistor	47	5 % 0.063 W 0402
R218	1430718	Chip resistor	47	5 % 0.063 W 0402
R221	1430718	Chip resistor	47	5 % 0.063 W 0402
R222	1430718	Chip resistor	47	5 % 0.063 W 0402
R324	1430718	Chip resistor	47	5 % 0.063 W 0402
R327	1430718	Chip resistor	47	5 % 0.063 W 0402
R342	1430718	Chip resistor	47	5 % 0.063 W 0402
R453	1430718	Chip resistor	47	5 % 0.063 W 0402
R703	1430718	Chip resistor	47	5 % 0.063 W 0402
R744	1430718	Chip resistor	47	5 % 0.063 W 0402
R115	1430726	Chip resistor	100	5 % 0.063 W 0402
R203	1430726	Chip resistor	100	5 % 0.063 W 0402
R204	1430726	Chip resistor	100	5 % 0.063 W 0402
R305	1430726	Chip resistor	100	5 % 0.063 W 0402

R306	1430726	Chip resistor	100	5 % 0.063 W 0402
R322	1430726	Chip resistor	100	5 % 0.063 W 0402
R323	1430726	Chip resistor	100	5 % 0.063 W 0402
R510	1430726	Chip resistor	100	5 % 0.063 W 0402
R524	1430726	Chip resistor	100	5 % 0.063 W 0402
R570	1430726	Chip resistor	100	5 % 0.063 W 0402
R701	1430726	Chip resistor	100	5 % 0.063 W 0402
R702	1430726	Chip resistor	100	5 % 0.063 W 0402
R784	1430726	Chip resistor	100	5 % 0.063 W 0402
R741	1430726	Chip resistor	100	5 % 0.063 W 0402
R503	1430732	Chip resistor	180	5 % 0.063 W 0402
R742	1430732	Chip resistor	180	5 % 0.063 W 0402
R801	1430732	Chip resistor	180	5 % 0.063 W 0402
R107	1430734	Chip resistor	220	5 % 0.063 W 0402
R502	1430734	Chip resistor	220	5 % 0.063 W 0402
R513	1430734	Chip resistor	220	5 % 0.063 W 0402
R564	1430734	Chip resistor	220	5 % 0.063 W 0402
R568	1430734	Chip resistor	220	5 % 0.063 W 0402
R574	1430734	Chip resistor	220	5 % 0.063 W 0402
R596	1430734	Chip resistor	220	5 % 0.063 W 0402
R781	1430734	Chip resistor	220	5 % 0.063 W 0402
R808	1430734	Chip resistor	220	5 % 0.063 W 0402
R844	1430734	Chip resistor	220	5 % 0.063 W 0402
R559	1430738	Chip resistor	270	5 % 0.063 W 0402
R594	1430738	Chip resistor	270	5 % 0.063 W 0402
R598	1430738	Chip resistor	270	5 % 0.063 W 0402
R557	1430740	Chip resistor	330	5 % 0.063 W 0402
R329	1430744	Chip resistor	470	5 % 0.063 W 0402
R343	1430744	Chip resistor	470	5 % 0.063 W 0402
R547	1430744	Chip resistor	470	5 % 0.063 W 0402
R782	1430746	Chip resistor	560	5 % 0.063 W 0402
R101	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R109	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R150	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R202	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R205	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R261	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R262	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R263	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R264	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R270	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R300	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R301	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R304	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R312	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R314	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R326	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R330	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402

R560	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R562	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R563	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R792	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R834	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R840	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R780	1430756	Chip resistor	1.2 k	5 % 0.063 W 0402
R565	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R783	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R785	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R200	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R207	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R260	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R265	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R266	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R267	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R268	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R269	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R452	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R521	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R522	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R571	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R586	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R609	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R714	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R717	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R795	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R830	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R843	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R523	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R718	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R790	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R794	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R797	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R587	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R584	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R720	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R820	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R821	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R105	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R501	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R511	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R605	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R608	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R791	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R823	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R824	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R825	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402

R841	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R842	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R551	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R553	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R554	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R556	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R715	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R800	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R583	1430776	Chip resistor	8.2 k	5 % 0.063 W 0402
R588	1430776	Chip resistor	8.2 k	5 % 0.063 W 0402
R102	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R104	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R111	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R206	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R208	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R315	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R316	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R317	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R318	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R321	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R458	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R500	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R504	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R505	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R552	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R555	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R573	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R591	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R592	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R597	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R601	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R602	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R604	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R606	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R611	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R712	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R833	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R827	1430780	Chip resistor	12 k	5 % 0.063 W 0402
R828	1430780	Chip resistor	12 k	5 % 0.063 W 0402
R719	1430784	Chip resistor	15 k	5 % 0.063 W 0402
R215	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R303	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R576	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R578	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R580	1430790	Chip resistor	27 k	5 % 0.063 W 0402
R822	1430790	Chip resistor	27 k	5 % 0.063 W 0402
R113	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R572	1430792	Chip resistor	33 k	5 % 0.063 W 0402

R577	1430794	Chip resistor	39 k	5 % 0.063 W 0402
R311	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R313	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R589	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R716	1430800	Chip resistor	68 k	5 % 0.063 W 0402
R114	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R155	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R201	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R302	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R400	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R401	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R402	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R403	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R404	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R405	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R406	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R407	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R408	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R409	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R410	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R411	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R412	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R413	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R414	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R507	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R508	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R603	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R607	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R610	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R612	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R613	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R614	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R456	1430820	Chip resistor	470 k	5 % 0.063 W 0402
R319	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R328	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R512	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R585	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R457	1800659	NTC resistor	47 k	10 % 0.12 W 0805
R116	1825001	Chip varistor vwm18v vc40v	0603	0603
R117	1825001	Chip varistor vwm18v vc40v	0603	0603
R118	1825001	Chip varistor vwm18v vc40v	0603	0603
R725	1825003	Chip varistor vwm5.5v vc15.5	0805	0805
V100	1825007	Chip varistor vwm18v vc39v	1210	1210
C304	2309570	Ceramic cap.		Y5 V 1206
C331	2309570	Ceramic cap.		Y5 V 1206
C821	2310209	Ceramic cap.	2.2 n	5 % 50 V 1206
C823	2310248	Ceramic cap.	4.7 n	5 % 50 V 1206
C317	2310784	Ceramic cap.	100 n	10 % 25 V 0805

C332	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C336	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C450	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C452	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C743	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C746	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C732	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C745	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C225	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C308	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C309	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C335	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C203	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C206	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C219	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C337	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C572	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C210	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C211	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C710	2320518	Ceramic cap.	1.8 p	0.25 % 50 V 0402
C840	2320518	Ceramic cap.	1.8 p	0.25 % 50 V 0402
C500	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C513	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C502	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C506	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C518	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C713	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C721	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C847	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C722	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C825	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C712	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C826	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C862	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C591	2320534	Ceramic cap.	8.2 p	0.25 % 50 V 0402
C850	2320534	Ceramic cap.	8.2 p	0.25 % 50 V 0402
C520	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C718	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C846	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C158	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C159	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C551	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C851	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C107	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C112	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C201	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C204	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C221	2320546	Ceramic cap.	27 p	5 % 50 V 0402

C223	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C229	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C302	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C312	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C314	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C338	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C339	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C505	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C514	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C522	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C590	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C593	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C595	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C711	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C714	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C719	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C723	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C724	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C728	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C742	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C780	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C781	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C782	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C783	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C843	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C845	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C863	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C563	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C564	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C102	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C103	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C104	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C106	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C108	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C152	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C154	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C157	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C162	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C165	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C169	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C170	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C207	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C212	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C215	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C216	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C226	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C250	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C251	2320560	Ceramic cap.	100 p	5 % 50 V 0402

C252	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C253	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C254	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C255	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C256	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C257	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C258	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C259	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C260	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C313	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C460	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C503	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C504	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C516	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C523	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C552	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C553	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C554	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C555	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C557	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C558	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C561	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C716	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C717	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C820	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C822	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C824	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C830	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C833	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C842	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C545	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C546	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C574	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C791	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C213	2320588	Ceramic cap.	1.5 n	5 % 50 V 0402
C217	2320588	Ceramic cap.	1.5 n	5 % 50 V 0402
C573	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C844	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C101	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C151	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C156	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C161	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C164	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C166	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C167	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C168	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C209	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C303	2320620	Ceramic cap.	10 n	5 % 16 V 0402

C306	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C310	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C311	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C315	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C318	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C321	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C323	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C325	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C326	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C333	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C400	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C401	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C402	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C403	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C404	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C405	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C406	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C407	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C454	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C459	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C105	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C153	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C227	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C228	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C301	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C319	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C330	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C517	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C526	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C562	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C568	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C715	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C741	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C744	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C809	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C834	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C849	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C457	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C556	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C559	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C560	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C602	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C603	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C608	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C110	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C111	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C202	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C205	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402

C515	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C525	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C541	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C569	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C570	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C571	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C740	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C784	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C829	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C832	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C854	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C800	2604079	Tantalum cap.	0.22 u	20 % 35 V 3.2x1.6x1.6
C729	2604127	Tantalum cap.	1.0 u	20 % 35 V 3.5x2.8x1.9
C601	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C604	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C605	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C320	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C322	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C324	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C300	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C305	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C160	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C200	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C208	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C218	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C220	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C307	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C316	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C329	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C458	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C806	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C841	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C730	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C731	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C734	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C150	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C155	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C163	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C456	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C828	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C831	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
L523	3608326	Chip coil	330 n	5 % Q=33/50 MHz 1206
L524	3608326	Chip coil	330 n	5 % Q=33/50 MHz 1206
L311	3640011	Filt z>600r/100m 0r6max 0.2a 0805		0805
L312	3640011	Filt z>600r/100m 0r6max 0.2a 0805		0805
L102	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L103	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L104	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603

L105	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L106	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L150	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L152	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L153	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L201	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L202	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L203	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L204	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L205	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L306	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L451	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
L100	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L101	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L107	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L108	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L300	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L712	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L800	3641324	Chip coil	10 u	10 % Q=25/2.52 MHz 1008
L711	3643003	Chip coil	12 n	5 % Q=30/250 MHz 0805
L551	3643021	Chip coil	47 n	5 % Q=40/200 MHz 0805
L841	3643021	Chip coil	47 n	5 % Q=40/200 MHz 0805
L520	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L709	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L710	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L840	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L521	3643037	Chip coil	180 n	5 % Q=35/100 MHz 0805
L545	3643037	Chip coil	180 n	5 % Q=35/100 MHz 0805
L522	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
L543	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
L544	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
V780	4110014	Sch. diode x 2	BAS70–07	70 V 15 mA SOT143
V842	4110018	Cap. diode	BB135	30 V SOD323
V511	4110083	Schdix4 bat15–099r ring	sot143	SOT143
V301	4110130	Zener diode	BZX84	2 % 5.1 V 0.3 W SOT23
V592	4112464	Pindix2 bar64–04 200v 0.1a	sot23	SOT23
V305	4115804	Schottky diode	PRLL5817	20 V 1 A SOD87
V200	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V302	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V303	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V309	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V311	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V608	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V830	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V512	4210011	Transistor	BFS505	npn 15 V 18 mA SOT323
V304	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V306	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V310	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223

V307	4210050	Transistor	DTA114EE	pnp RB V EM3
V308	4210052	Transistor	DTC114EE	npn RB V EM3
V591	4210052	Transistor	DTC114EE	npn RB V EM3
V602	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V604	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V607	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V712	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V520	4210066	Transistor	BFR93AW	npn 12 V 35 mA SOT323
V501	4210074	Transistor	BFP420	npn 4. V SOT343
V791	4211288	MosFet		p–ch 12 V SOT89
V840	4219903	Transistor x 2	BFM505	npn 20 V 20V18 mA SOT363
V711	4219904	Transistor x 2	UMX1	npn 40 V SOT363
V790	4219904	Transistor x 2	UMX1	npn 40 V SOT363
V505	4219922	Transistor x 2		UM6
V580	4219922	Transistor x 2		UM6
V590	4219922	Transistor x 2		UM6
V603	4219922	Transistor x 2		UM6
V606	4219922	Transistor x 2		UM6
N710	4340077	IC, 1.5ghz w/b 30db/1ghz au	PC2710T	AMP
N601	4340081	IC, regulator	TK11248AM	180 mA SS06
N602	4340081	IC, regulator	TK11248AM	180 mA SS06
N603	4340081	IC, regulator	TK11248AM	180 mA SS06
N200	4340131	St5090 audio codec	tqfp44	TQFP44
N451	4340139	IC, regulator	TK11245AM	0.22 A SSO6
N820	4340147	IC, 2xsynth1.2g/510mhz ssop	LMX2332	SSOP20
D404	4340149	IC, SRAM		TSOP28
D405	4340149	IC, SRAM		TSOP28
D400	4340217	Te28f008s3 flash 3.3v 1mx8 tsop40		TSOP40
D150	4340307	IC, MCU		TQFP80
D403	4340333	IC, SRAM		TSOP32
D401	4347667	IC, EEPROM		TSOP28
N711	4350051	IC, pow.amp.		SSOP28BW
G800	4352937	Vco 1006–1031mhz 4.5v/10ma	smd	SMD
N450	4370097	St7523 rfi2 v4.2 tdma codec qfp64		QFP64
D151	4370101	Cf70131 gsm/pcn asic bart sqfp144		SQFP144
D152	4370163	IC, tms320lc541 3v gj7	sqfp1 DSP	SQFP100
N300	4370225	Stt261c pscld e pw supply	tqfp64	TQFP64
N551	4370243	Crfrt_st tx.mod+rxif+pwc	sqfp44	SQFP44
B150	4510003	Crystal	32.768 k	+–20PPM 8x3.8
Z551	4510009	Cer.filt 13+–0.09mhz	7.2x3.2	7.2x3.2
Z505	4510065	Saw filter	947.5+–12.5 M	4X4
Z714	4510067	Saw filter	902.5+–12.5 M	4X4
G801	4510133	VCTCXO	13.00 M	+–5PPM 4.7V 2MA
Z541	4511026	Saw filter	71+–0.08 M	14.2x8.4
Z500	4512061	Dupl 890–915/935–960mhz	20x14	20x14
X102	5409033	Sim card reader ccm04–5004	2x3smd	2x3smd
X100	5469007	Syst.conn 12af+jack+dc dct2	smd	SMD

X101	5469204	SM, conn 2x15 m p0.8 pcb/pcb 2.8	2.8MM
X501	9510262	Antenna clip	3D25516 NHE–6
X500	9780172	Antenna cable w500 dmd00071	
	9854047	PCB GJ8_XX 127.5X43.0X1.0 M8 3/PA	

Parts list of GJ8A (EDMS Issue 4.1 Code: 0201017 for layout version 02)

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R103	1430001	Chip resistor	100	5 % 0.063 W 0603
R106	1430009	Chip resistor	220	5 % 0.063 W 0603
R308	1430027	Chip resistor	2.43 k	1 % 0.063 W 0603
R309	1430027	Chip resistor	2.43 k	1 % 0.063 W 0603
R216	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R217	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R219	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R220	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R112	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R745	1430693	Chip resistor	5.6	5 % 0.063 W 0402
R746	1430693	Chip resistor	5.6	5 % 0.063 W 0402
R525	1430700	Chip resistor	10	5 % 0.063 W 0402
R558	1430700	Chip resistor	10	5 % 0.063 W 0402
R713	1430700	Chip resistor	10	5 % 0.063 W 0402
R740	1430700	Chip resistor	10	5 % 0.063 W 0402
R506	1430710	Chip resistor	22	5 % 0.063 W 0402
R514	1430710	Chip resistor	22	5 % 0.063 W 0402
R541	1430710	Chip resistor	22	5 % 0.063 W 0402
R743	1430710	Chip resistor	22	5 % 0.063 W 0402
R829	1430710	Chip resistor	22	5 % 0.063 W 0402
R831	1430710	Chip resistor	22	5 % 0.063 W 0402
R832	1430710	Chip resistor	22	5 % 0.063 W 0402
R845	1430710	Chip resistor	22	5 % 0.063 W 0402
R847	1430710	Chip resistor	22	5 % 0.063 W 0402
R595	1430710	Chip resistor	22	5 % 0.063 W 0402
R214	1430710	Chip resistor	22	5 % 0.063 W 0402
R218	1430710	Chip resistor	22	5 % 0.063 W 0402
R231	1430710	Chip resistor	22	5 % 0.063 W 0402
R232	1430710	Chip resistor	22	5 % 0.063 W 0402
R331	1430714	Chip resistor	33	5 % 0.063 W 0402
R332	1430714	Chip resistor	33	5 % 0.063 W 0402
R151	1430718	Chip resistor	47	5 % 0.063 W 0402
R152	1430718	Chip resistor	47	5 % 0.063 W 0402
R221	1430718	Chip resistor	47	5 % 0.063 W 0402
R222	1430718	Chip resistor	47	5 % 0.063 W 0402
R324	1430718	Chip resistor	47	5 % 0.063 W 0402
R327	1430718	Chip resistor	47	5 % 0.063 W 0402
R342	1430718	Chip resistor	47	5 % 0.063 W 0402
R453	1430718	Chip resistor	47	5 % 0.063 W 0402
R703	1430718	Chip resistor	47	5 % 0.063 W 0402
R744	1430718	Chip resistor	47	5 % 0.063 W 0402
R115	1430726	Chip resistor	100	5 % 0.063 W 0402
R203	1430726	Chip resistor	100	5 % 0.063 W 0402

R204	1430726	Chip resistor	100	5 % 0.063 W 0402
R305	1430726	Chip resistor	100	5 % 0.063 W 0402
R306	1430726	Chip resistor	100	5 % 0.063 W 0402
R322	1430726	Chip resistor	100	5 % 0.063 W 0402
R323	1430726	Chip resistor	100	5 % 0.063 W 0402
R510	1430726	Chip resistor	100	5 % 0.063 W 0402
R524	1430726	Chip resistor	100	5 % 0.063 W 0402
R570	1430726	Chip resistor	100	5 % 0.063 W 0402
R701	1430726	Chip resistor	100	5 % 0.063 W 0402
R702	1430726	Chip resistor	100	5 % 0.063 W 0402
R781	1430726	Chip resistor	100	5 % 0.063 W 0402
R784	1430726	Chip resistor	100	5 % 0.063 W 0402
R503	1430732	Chip resistor	180	5 % 0.063 W 0402
R801	1430732	Chip resistor	180	5 % 0.063 W 0402
R107	1430734	Chip resistor	220	5 % 0.063 W 0402
R502	1430734	Chip resistor	220	5 % 0.063 W 0402
R513	1430734	Chip resistor	220	5 % 0.063 W 0402
R564	1430734	Chip resistor	220	5 % 0.063 W 0402
R568	1430734	Chip resistor	220	5 % 0.063 W 0402
R574	1430734	Chip resistor	220	5 % 0.063 W 0402
R844	1430734	Chip resistor	220	5 % 0.063 W 0402
R596	1430734	Chip resistor	220	5 % 0.063 W 0402
R521	1430734	Chip resistor	220	5 % 0.063 W 0402
R559	1430738	Chip resistor	270	5 % 0.063 W 0402
R594	1430738	Chip resistor	270	5 % 0.063 W 0402
R598	1430738	Chip resistor	270	5 % 0.063 W 0402
R742	1430738	Chip resistor	270	5 % 0.063 W 0402
R557	1430740	Chip resistor	330	5 % 0.063 W 0402
R329	1430744	Chip resistor	470	5 % 0.063 W 0402
R343	1430744	Chip resistor	470	5 % 0.063 W 0402
R547	1430744	Chip resistor	470	5 % 0.063 W 0402
R741	1430744	Chip resistor	470	5 % 0.063 W 0402
R782	1430746	Chip resistor	560	5 % 0.063 W 0402
R101	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R109	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R202	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R205	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R261	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R262	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R263	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R264	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R270	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R300	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R301	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R304	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R312	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R314	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R326	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402

R330	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R560	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R562	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R563	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R792	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R834	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R840	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R565	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R780	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R783	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R785	1430760	Chip resistor	1.8 k	5 % 0.063 W 0402
R200	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R207	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R260	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R265	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R266	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R267	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R268	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R269	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R452	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R522	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R571	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R586	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R609	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R714	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R717	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R795	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R830	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R843	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R523	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R790	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R794	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R797	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R587	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R584	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R720	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R820	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R821	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R105	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R501	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R511	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R605	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R608	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R718	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R791	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R823	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R824	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R825	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402

R841	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R842	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R153	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R150	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R710	1430772	Chip resistor	5.6 k	5 % 0.063 W 0402
R551	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R553	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R554	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R556	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R715	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R800	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R583	1430776	Chip resistor	8.2 k	5 % 0.063 W 0402
R588	1430776	Chip resistor	8.2 k	5 % 0.063 W 0402
R102	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R104	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R111	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R206	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R208	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R315	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R316	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R317	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R318	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R321	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R458	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R500	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R504	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R505	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R552	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R555	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R573	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R591	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R592	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R597	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R601	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R602	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R604	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R606	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R611	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R712	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R833	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R808	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R827	1430780	Chip resistor	12 k	5 % 0.063 W 0402
R828	1430780	Chip resistor	12 k	5 % 0.063 W 0402
R719	1430784	Chip resistor	15 k	5 % 0.063 W 0402
R215	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R303	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R576	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R580	1430790	Chip resistor	27 k	5 % 0.063 W 0402

R822	1430790	Chip resistor	27 k	5 % 0.063 W 0402
R113	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R572	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R578	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R577	1430794	Chip resistor	39 k	5 % 0.063 W 0402
R311	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R313	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R589	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R716	1430800	Chip resistor	68 k	5 % 0.063 W 0402
R114	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R155	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R201	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R302	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R400	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R401	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R402	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R403	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R404	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R405	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R406	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R407	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R408	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R409	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R410	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R411	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R412	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R413	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R414	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R507	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R508	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R603	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R607	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R610	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R612	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R613	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R614	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R456	1430820	Chip resistor	470 k	5 % 0.063 W 0402
R319	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R328	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R512	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R585	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R457	1800659	NTC resistor	47 k	10 % 0.12 W 0805
R711	1800673	NTC resistor	15 k	10 % 0.12 W 0805
R116	1825001	Chip varistor vwm18v vc40v	0603	0603
R117	1825001	Chip varistor vwm18v vc40v	0603	0603
R118	1825001	Chip varistor vwm18v vc40v	0603	0603
R725	1825003	Chip varistor vwm5.5v vc15.5	0805	0805
V100	1825007	Chip varistor vwm18v vc39v	1210	1210

C304	2309570	Ceramic cap.		Y5 V 1206
C331	2309570	Ceramic cap.		Y5 V 1206
C821	2310209	Ceramic cap.	2.2 n	5 % 50 V 1206
C823	2310248	Ceramic cap.	4.7 n	5 % 50 V 1206
C317	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C332	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C336	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C450	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C452	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C743	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C732	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C745	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C225	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C308	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C309	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C335	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C203	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C206	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C219	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C337	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C572	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C210	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C211	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C840	2320518	Ceramic cap.	1.8 p	0.25 % 50 V 0402
C710	2320518	Ceramic cap.	1.8 p	0.25 % 50 V 0402
C500	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C513	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C507	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C502	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C506	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C518	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C713	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C721	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C847	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C722	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C825	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C712	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C826	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C862	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C850	2320534	Ceramic cap.	8.2 p	0.25 % 50 V 0402
C591	2320534	Ceramic cap.	8.2 p	0.25 % 50 V 0402
C718	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C846	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C158	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C159	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C551	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C851	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C520	2320538	Ceramic cap.	12 p	5 % 50 V 0402

C843	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C107	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C112	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C201	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C204	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C221	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C223	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C229	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C302	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C312	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C314	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C338	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C339	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C505	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C514	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C522	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C590	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C593	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C595	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C714	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C719	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C723	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C724	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C728	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C742	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C780	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C781	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C782	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C783	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C845	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C863	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C563	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C564	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C711	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C224	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C102	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C103	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C104	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C106	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C108	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C152	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C154	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C157	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C162	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C165	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C169	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C170	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C207	2320560	Ceramic cap.	100 p	5 % 50 V 0402

C212	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C215	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C216	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C226	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C250	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C251	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C252	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C253	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C254	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C255	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C256	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C257	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C258	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C259	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C260	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C313	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C460	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C503	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C504	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C516	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C523	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C552	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C553	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C557	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C558	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C561	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C716	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C717	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C820	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C822	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C824	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C830	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C833	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C842	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C214	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C554	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C555	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C545	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C546	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C574	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C791	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C213	2320588	Ceramic cap.	1.5 n	5 % 50 V 0402
C217	2320588	Ceramic cap.	1.5 n	5 % 50 V 0402
C573	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C844	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C801	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C101	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C151	2320620	Ceramic cap.	10 n	5 % 16 V 0402

C156	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C161	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C164	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C166	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C167	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C168	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C209	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C303	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C306	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C310	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C311	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C315	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C318	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C321	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C323	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C325	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C326	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C333	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C400	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C401	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C402	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C403	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C404	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C405	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C406	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C407	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C454	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C459	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C230	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C110	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C111	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C105	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C153	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C227	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C228	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C301	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C319	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C330	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C517	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C526	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C562	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C568	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C715	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C741	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C744	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C809	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C834	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C849	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402

C171	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C457	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C556	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C559	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C560	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C602	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C603	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C608	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C202	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C205	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C515	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C525	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C541	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C569	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C570	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C571	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C740	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C784	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C829	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C832	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C854	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C800	2604079	Tantalum cap.	0.22 u	20 % 35 V 3.2x1.6x1.6
C729	2604127	Tantalum cap.	1.0 u	20 % 35 V 3.5x2.8x1.9
C601	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C604	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C605	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C320	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C322	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C324	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C300	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C305	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C160	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C200	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C208	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C218	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C220	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C307	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C316	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C329	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C458	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C806	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C841	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C730	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C731	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C734	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C150	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C155	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C163	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2

C456	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C828	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C831	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
L523	3608326	Chip coil	330 n	5 % Q=33/50 MHz 1206
L524	3608326	Chip coil	330 n	5 % Q=33/50 MHz 1206
L311	3640011	Filt z>600r/100m 0r6max 0.2a	0805	0805
L312	3640011	Filt z>600r/100m 0r6max 0.2a	0805	0805
L102	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L103	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L104	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L105	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L106	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L150	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L152	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L153	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L201	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L202	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L203	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L204	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L205	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L306	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L451	3640035	Filt z>450r/100m 0r7max 0.2a	0603	0603
L100	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L101	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L107	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L108	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L300	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L712	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L800	3641324	Chip coil	10 u	10 % Q=25/2.52 MHz 1008
L711	3641522	Chip coil	6 n	20 % Q=50/250 MHz 0805
L500	3643003	Chip coil	12 n	5 % Q=30/250 MHz 0805
L551	3643021	Chip coil	47 n	5 % Q=40/200 MHz 0805
L841	3643021	Chip coil	47 n	5 % Q=40/200 MHz 0805
L520	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L709	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L710	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L840	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L521	3643037	Chip coil	180 n	5 % Q=35/100 MHz 0805
L545	3643037	Chip coil	180 n	5 % Q=35/100 MHz 0805
L522	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
L543	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
L544	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
V780	4110014	Sch. diode x 2	BAS70–07	70 V 15 mA SOT143
V842	4110062	Cap. diode	BB535	30 V 2.1/18.7PFSOD323
V511	4110083	Schdix4 bat15–099r ring	sot143	SOT143
V301	4110130	Zener diode	BZX84	2 % 5.1 V 0.3 W SOT23
V592	4112464	Pindix2 bar64–04 200v 0.1a	sot23	SOT23
V305	4115804	Schottky diode	PRLL5817	20 V 1 A SOD87

V200	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V302	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V303	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V309	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V311	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V608	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V830	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V512	4210011	Transistor	BFS505	npn 15 V 18 mA SOT323
V304	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V306	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V310	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V307	4210050	Transistor	DTA114EE	pnp RB V EM3
V308	4210052	Transistor	DTC114EE	npn RB V EM3
V591	4210052	Transistor	DTC114EE	npn RB V EM3
V602	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V604	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V607	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V712	4210054	Transistor	FMMT589	pnp 30 V 1 A SOT23
V520	4210066	Transistor	BFR93AW	npn 12 V 35 mA SOT323
V150	4210066	Transistor	BFR93AW	npn 12 V 35 mA SOT323
V501	4210074	Transistor	BFP420	npn 4. V SOT343
V791	4211288	MosFet		p–ch 12 V SOT89
V840	4219903	Transistor x 2	BFM505	npn 20 V 20V18 mA SOT363
V711	4219904	Transistor x 2	UMX1	npn 40 V SOT363
V790	4219904	Transistor x 2	UMX1	npn 40 V SOT363
V505	4219922	Transistor x 2		UM6
V580	4219922	Transistor x 2		UM6
V590	4219922	Transistor x 2		UM6
V603	4219922	Transistor x 2		UM6
V606	4219922	Transistor x 2		UM6
N710	4340077	IC, 1.5ghz w/b 30db/1ghz auPC2710T		AMP
N601	4340081	IC, regulator	TK11248AM	180 mA SS06
N602	4340081	IC, regulator	TK11248AM	180 mA SS06
N603	4340081	IC, regulator	TK11248AM	180 mA SS06
N200	4340131	St5090 audio codec	tqfp44	TQFP44
N451	4340139	IC, regulator	TK11245AM	0.22 A SSO6
N820	4340147	IC, 2xsynth1.2g/510mhz ssopLMX2332		SSOP20
D404	4340149	IC, SRAM		TSOP28
D405	4340149	IC, SRAM		TSOP28
D400	4340217	Te28f008s3 flash 3.3v 1mx8 tsop40		TSOP40
D150	4340307	IC, MCU		TQFP80
D403	4340333	IC, SRAM		TSOP32
D401	4347667	IC, EEPROM		TSOP28
N711	4350051	IC, pow.amp.		SSOP28BW
G800	4352937	Vco 1006–1031mhz 4.5v/10ma	smd	SMD
N450	4370097	St7523 rfi2 v4.2 tdma codec qfp64		QFP64
D151	4370101	Cf70131 gsm/pcn asic bart sqfp144		SQFP144

D152	4370163	IC, tms320lc541 3v gj7 sqfp1	DSP	SQFP100
N300	4370223	Stt261c pscld_e pw supply tqfp44		TQFP44
N551	4370243	Crfrt_st tx.mod+rxif+pwc sqfp44		SQFP44
B150	4510003	Crystal	32.768 k	+–20PPM 8x3.8
Z551	4510009	Cer.filt 13+–0.09mhz	7.2x3.2	7.2x3.2
Z505	4510065	Saw filter	947.5+–12.5 M	4X4
Z714	4510067	Saw filter	902.5+–12.5 M	4X4
G801	4510133	VCTCXO	13.00 M	+–5PPM 4.7V 2MA
Z541	4511026	Saw filter	71+–0.08 M	14.2x8.4
Z500	4512061	Dupl 890–915/935–960mhz	20x14	20x14
X102	5409033	Sim card reader ccm04–5004 2x3smd		2x3smd
X100	5469007	Syst.conn 12af+jack+dc dct2	smd	SMD
X101	5469204	SM, conn 2x15 m p0.8 pcb/pcb 2.8		2.8MM
X501	9510262	Antenna clip		3D25516 NHE–6
X500	9780172	Antenna cable w500 dmd00071		
	9854187	PCB GJ8A 127.5X43.0X1.0 M8 3/PA		

Parts list of GJ8A (EDMS Issue 5.4 Code: 0201017 for layout version 05)

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R101	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R102	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R103	1430001	Chip resistor	100	5 % 0.063 W 0603
R104	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R105	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R106	1430009	Chip resistor	220	5 % 0.063 W 0603
R107	1430734	Chip resistor	220	5 % 0.063 W 0402
R109	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R111	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R112	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R113	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R114	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R115	1430726	Chip resistor	100	5 % 0.063 W 0402
R116	1825001	Chip varistor	vwm	18v vc40v 0603
R117	1825001	Chip varistor	vwm	18v vc40v 0603
R118	1825001	Chip varistor	vwm	18v vc40v 0603
R150	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R151	1430718	Chip resistor	47	5 % 0.063 W 0402
R152	1430718	Chip resistor	47	5 % 0.063 W 0402
R153	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R154	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R155	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R200	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R201	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R202	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R203	1430726	Chip resistor	100	5 % 0.063 W 0402
R204	1430726	Chip resistor	100	5 % 0.063 W 0402
R205	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R206	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R207	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R208	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R214	1430710	Chip resistor	22	5 % 0.063 W 0402
R215	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R216	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R217	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R218	1430710	Chip resistor	22	5 % 0.063 W 0402
R219	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R220	1430029	Chip resistor	12.1 k	0.5 % 0.063 W 0603
R221	1430718	Chip resistor	47	5 % 0.063 W 0402
R222	1430718	Chip resistor	47	5 % 0.063 W 0402
R231	1430710	Chip resistor	22	5 % 0.063 W 0402
R232	1430710	Chip resistor	22	5 % 0.063 W 0402
R260	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402

R261	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R262	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R263	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R264	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R265	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R266	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R267	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R268	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R269	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R270	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R300	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R301	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R302	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R303	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R304	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R305	1430726	Chip resistor	100	5 % 0.063 W 0402
R306	1430726	Chip resistor	100	5 % 0.063 W 0402
R308	1430027	Chip resistor	2.43 k	1 % 0.063 W 0603
R309	1430027	Chip resistor	2.43 k	1 % 0.063 W 0603
R311	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R312	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R313	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R314	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R315	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R316	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R317	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R318	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R319	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R321	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R322	1430726	Chip resistor	100	5 % 0.063 W 0402
R323	1430726	Chip resistor	100	5 % 0.063 W 0402
R324	1430718	Chip resistor	47	5 % 0.063 W 0402
R326	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R327	1430718	Chip resistor	47	5 % 0.063 W 0402
R328	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R329	1430744	Chip resistor	470	5 % 0.063 W 0402
R330	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R331	1430714	Chip resistor	33	5 % 0.063 W 0402
R332	1430714	Chip resistor	33	5 % 0.063 W 0402
R342	1430718	Chip resistor	47	5 % 0.063 W 0402
R343	1430744	Chip resistor	470	5 % 0.063 W 0402
R400	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R401	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R402	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R403	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R404	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R405	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R406	1430804	Chip resistor	100 k	5 % 0.063 W 0402

R407	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R408	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R409	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R410	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R411	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R412	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R413	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R414	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R452	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R453	1430718	Chip resistor	47	5 % 0.063 W 0402
R456	1430820	Chip resistor	470 k	5 % 0.063 W 0402
R457	1800659	NTC resistor	47 k	10 % 0.12 W 0805
R458	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R500	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R501	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R502	1430734	Chip resistor	220	5 % 0.063 W 0402
R503	1430732	Chip resistor	180	5 % 0.063 W 0402
R504	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R505	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R506	1430710	Chip resistor	22	5 % 0.063 W 0402
R507	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R508	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R510	1430726	Chip resistor	100	5 % 0.063 W 0402
R511	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R512	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R513	1430734	Chip resistor	220	5 % 0.063 W 0402
R514	1430710	Chip resistor	22	5 % 0.063 W 0402
R521	1430734	Chip resistor	220	5 % 0.063 W 0402
R522	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R523	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R524	1430726	Chip resistor	100	5 % 0.063 W 0402
R525	1430700	Chip resistor	10	5 % 0.063 W 0402
R541	1430710	Chip resistor	22	5 % 0.063 W 0402
R547	1430744	Chip resistor	470	5 % 0.063 W 0402
R551	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R552	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R553	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R554	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R555	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R556	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R557	1430740	Chip resistor	330	5 % 0.063 W 0402
R558	1430700	Chip resistor	10	5 % 0.063 W 0402
R559	1430738	Chip resistor	270	5 % 0.063 W 0402
R560	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R562	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R563	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R564	1430734	Chip resistor	220	5 % 0.063 W 0402
R565	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402

R568	1430734	Chip resistor	220	5 % 0.063 W 0402
R570	1430726	Chip resistor	100	5 % 0.063 W 0402
R571	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R572	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R573	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R574	1430734	Chip resistor	220	5 % 0.063 W 0402
R576	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R577	1430794	Chip resistor	39 k	5 % 0.063 W 0402
R578	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R580	1430790	Chip resistor	27 k	5 % 0.063 W 0402
R583	1430776	Chip resistor	8.2 k	5 % 0.063 W 0402
R584	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R585	1430832	Chip resistor	2.7 k	5 % 0.063 W 0402
R586	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R587	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R588	1430776	Chip resistor	8.2 k	5 % 0.063 W 0402
R589	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R591	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R592	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R594	1430738	Chip resistor	270	5 % 0.063 W 0402
R595	1430710	Chip resistor	22	5 % 0.063 W 0402
R596	1430734	Chip resistor	220	5 % 0.063 W 0402
R597	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R598	1430738	Chip resistor	270	5 % 0.063 W 0402
R601	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R602	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R603	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R604	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R605	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R606	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R607	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R608	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R609	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R610	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R611	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R612	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R613	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R614	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R701	1430726	Chip resistor	100	5 % 0.063 W 0402
R702	1430726	Chip resistor	100	5 % 0.063 W 0402
R703	1430718	Chip resistor	47	5 % 0.063 W 0402
R710	1430772	Chip resistor	5.6 k	5 % 0.063 W 0402
R711	1800673	NTC resistor	15 k	10 % 0.12 W 0805
R712	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R713	1430700	Chip resistor	10	5 % 0.063 W 0402
R714	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R715	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R716	1430800	Chip resistor	68 k	5 % 0.063 W 0402

R717	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R718	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R719	1430784	Chip resistor	15 k	5 % 0.063 W 0402
R720	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R725	1825003	Chip varistor	vwm	5.5v vc15.5 0805
R740	1430700	Chip resistor	10	5 % 0.063 W 0402
R741	1430744	Chip resistor	470	5 % 0.063 W 0402
R742	1430738	Chip resistor	270	5 % 0.063 W 0402
R743	1430710	Chip resistor	22	5 % 0.063 W 0402
R744	1430718	Chip resistor	47	5 % 0.063 W 0402
R745	1430693	Chip resistor	5.6	5 % 0.063 W 0402
R746	1430693	Chip resistor	5.6	5 % 0.063 W 0402
R780	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R781	1430726	Chip resistor	100	5 % 0.063 W 0402
R782	1430746	Chip resistor	560	5 % 0.063 W 0402
R783	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R784	1430726	Chip resistor	100	5 % 0.063 W 0402
R785	1430760	Chip resistor	1.8 k	5 % 0.063 W 0402
R790	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R791	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R792	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R794	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R795	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R797	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R800	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R801	1430732	Chip resistor	180	5 % 0.063 W 0402
R808	1430774	Chip resistor	6.8 k	5 % 0.063 W 0402
R820	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R821	1430766	Chip resistor	3.9 k	5 % 0.063 W 0402
R822	1430790	Chip resistor	27 k	5 % 0.063 W 0402
R823	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R824	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R825	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R827	1430780	Chip resistor	12 k	5 % 0.063 W 0402
R828	1430780	Chip resistor	12 k	5 % 0.063 W 0402
R829	1430710	Chip resistor	22	5 % 0.063 W 0402
R830	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R831	1430710	Chip resistor	22	5 % 0.063 W 0402
R832	1430710	Chip resistor	22	5 % 0.063 W 0402
R833	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R834	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R840	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R841	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R842	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R843	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R844	1430734	Chip resistor	220	5 % 0.063 W 0402
R845	1430710	Chip resistor	22	5 % 0.063 W 0402
R847	1430710	Chip resistor	22	5 % 0.063 W 0402

C101	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C102	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C103	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C104	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C105	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C106	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C107	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C108	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C110	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C111	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C112	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C150	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C151	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C152	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C153	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C154	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C155	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C156	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C157	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C158	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C159	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C160	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C161	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C162	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C163	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C164	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C165	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C166	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C167	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C168	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C169	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C170	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C171	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C200	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C201	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C202	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C203	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C204	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C205	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C206	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C207	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C208	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C209	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C210	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C211	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C212	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C213	2320588	Ceramic cap.	1.5 n	5 % 50 V 0402
C214	2320560	Ceramic cap.	100 p	5 % 50 V 0402

C215	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C216	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C217	2320588	Ceramic cap.	1.5 n	5 % 50 V 0402
C218	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C219	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C220	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C221	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C223	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C224	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C225	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C226	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C227	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C228	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C229	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C230	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C250	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C251	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C252	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C253	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C254	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C255	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C256	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C257	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C258	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C259	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C260	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C300	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C301	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C302	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C303	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C304	2309570	Ceramic cap.		Y5 V 1206
C305	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C306	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C307	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C308	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C309	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C310	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C311	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C312	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C313	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C314	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C315	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C316	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C317	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C318	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C319	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C320	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C321	2320620	Ceramic cap.	10 n	5 % 16 V 0402

C322	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C323	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C324	2610005	Tantalum cap.	10 u	20 % 16 V 3.5x2.8x1.9
C325	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C326	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C329	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C330	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C331	2309570	Ceramic cap.		Y5 V 1206
C332	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C333	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C335	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C336	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C337	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C338	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C339	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C400	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C401	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C402	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C403	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C404	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C405	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C406	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C407	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C450	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C452	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C454	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C456	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C457	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C458	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C459	2320620	Ceramic cap.	10 n	5 % 16 V 0402
C460	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C500	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C502	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C503	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C504	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C505	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C506	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C507	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C509	2320508	Ceramic cap.	1.0 p	0.25 % 50 V 0402
C513	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C514	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C515	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C516	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C517	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C518	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C520	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C522	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C523	2320560	Ceramic cap.	100 p	5 % 50 V 0402

C525	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C526	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C541	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C545	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C546	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C551	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C552	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C553	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C554	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C555	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C556	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C557	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C558	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C559	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C560	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C561	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C562	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C563	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C564	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C568	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C569	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C570	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C571	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C572	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C573	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C574	2320568	Ceramic cap.	220 p	5 % 50 V 0402
C590	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C591	2320534	Ceramic cap.	8.2 p	0.25 % 50 V 0402
C593	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C595	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C601	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C602	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C603	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C604	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C605	2604329	Tantalum cap.	4.7 u	20 % 10 V 3.5x2.8x1.9
C608	2320752	Ceramic cap.	2.2 n	10 % 50 V 0402
C710	2320518	Ceramic cap.	1.8 p	0.25 % 50 V 0402
C711	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C712	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C713	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C714	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C715	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C716	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C717	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C718	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C719	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C721	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C722	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402

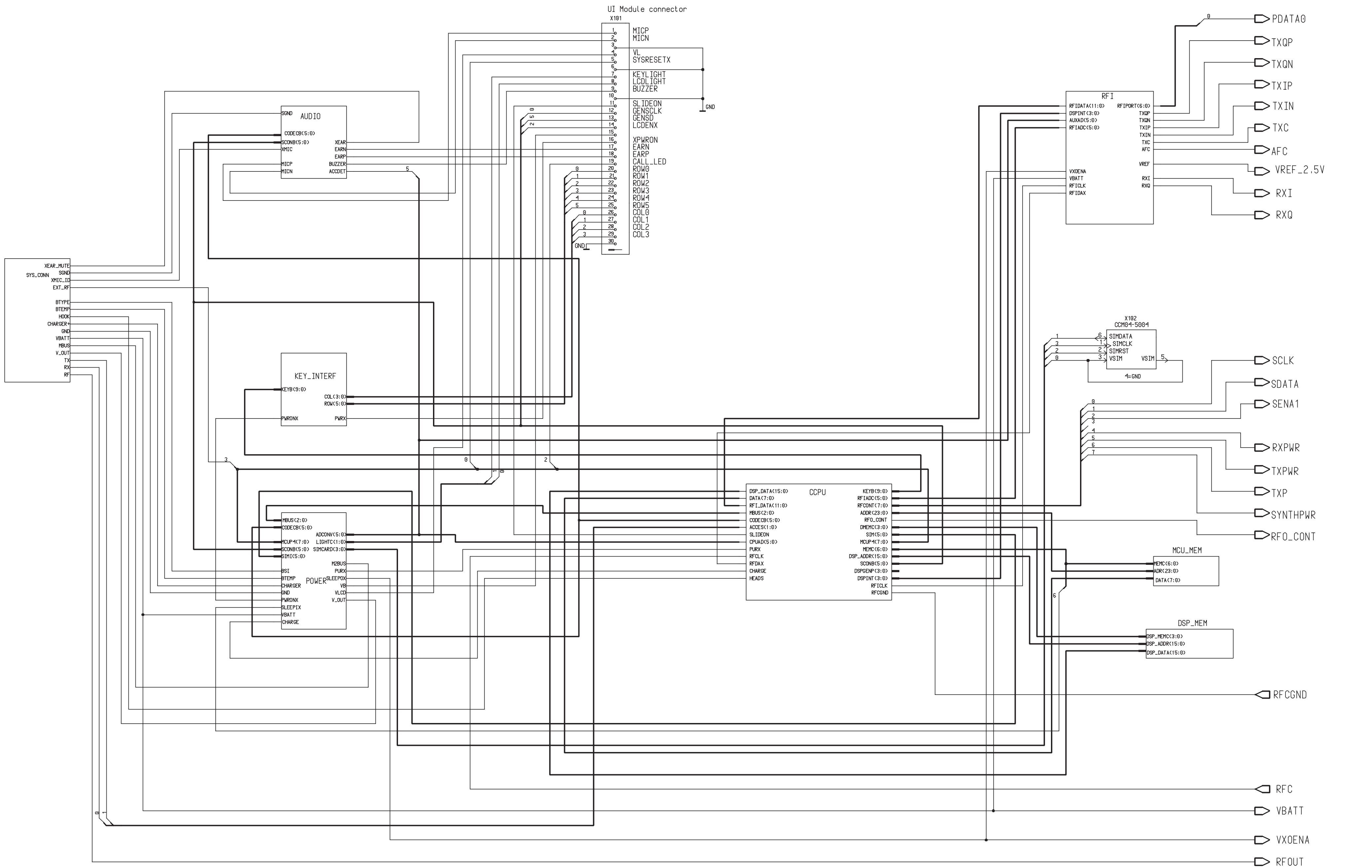
C723	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C724	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C728	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C729	2604127	Tantalum cap.	1.0 u	20 % 35 V 3.5x2.8x1.9
C730	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C731	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C732	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C734	2610125	Tantalum cap.	68 u	20 % 16 V 7.3x4.3x2.9
C740	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C741	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C742	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C743	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C744	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C745	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C780	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C781	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C782	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C783	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C784	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C791	2320584	Ceramic cap.	1.0 n	5 % 50 V 0402
C800	2604079	Tantalum cap.	0.22 u	20 % 35 V 3.2x1.6x1.6
C801	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C806	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C809	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C820	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C821	2310209	Ceramic cap.	2.2 n	5 % 50 V 1206
C822	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C823	2310248	Ceramic cap.	4.7 n	5 % 50 V 1206
C824	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C825	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C826	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C828	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C829	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C830	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C831	2610200	Tantalum cap.	2.2 u	20 % 2.0x1.3x1.2
C832	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C833	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C834	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C840	2320518	Ceramic cap.	1.8 p	0.25 % 50 V 0402
C841	2610100	Tantalum cap.	1 u	20 % 10 V 2.0x1.3x1.2
C842	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C843	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C844	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C845	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C846	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C847	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C849	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C850	2320534	Ceramic cap.	8.2 p	0.25 % 50 V 0402

C851	2320538	Ceramic cap.	12 p	5 % 50 V 0402
C854	2320756	Ceramic cap.	3.3 n	10 % 50 V 0402
C862	2320532	Ceramic cap.	6.8 p	0.25 % 50 V 0402
C863	2320546	Ceramic cap.	27 p	5 % 50 V 0402
L100	3641262	Ferrite bead	30r/100mhz 2a	1206
L101	3641262	Ferrite bead	30r/100mhz 2a	1206
L102	3640035	Filt	z>450r/100m 0r7max 0.2a	0603
L103	3640035	Filt	z>450r/100m 0r7max 0.2a	0603
L104	3640035	Filt	z>450r/100m 0r7max 0.2a	0603
L105	3640035	Filt	z>450r/100m 0r7max 0.2a	0603
L106	3640035	Filt	z>450r/100m 0r7max 0.2a	0603
L107	3641262	Ferrite bead	30r/100mhz 2a	1206
L108	3641262	Ferrite bead	30r/100mhz 2a	1206
L150	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L152	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L153	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L201	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L202	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L203	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L204	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L205	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L300	3641262	Ferrite bead	30r/100mhz 2a	1206
L306	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L311	3640011	Filt z>600r/100m	0r6max 0.2a	0805
L312	3640011	Filt z>600r/100m	0r6max 0.2a	0805
L451	3640035	Filt z>450r/100m	0r7max 0.2a	0603
L500	3643003	Chip coil	12 n	5 % Q=30/250 MHz 0805
L520	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L521	3643037	Chip coil	180 n	5 % Q=35/100 MHz 0805
L522	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
L523	3608326	Chip coil	330 n	5 % Q=33/50 MHz 1206
L524	3608326	Chip coil	330 n	5 % Q=33/50 MHz 1206
L543	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
L544	3643039	Chip coil	220 n	5 % Q=35/100 MHz 0805
L545	3643037	Chip coil	180 n	5 % Q=35/100 MHz 0805
L551	3643021	Chip coil	47 n	5 % Q=40/200 MHz 0805
L709	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L710	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L711	3641522	Chip coil	6 n	20 % Q=50/250 MHz 0805
L712	3641262	Ferrite bead	30r/100mhz 2a	1206
L800	3641324	Chip coil	10 u	10 % Q=25/2.52 MHz 1008
L840	3643023	Chip coil	68 n	5 % Q=40/200 MHz 0805
L841	3643021	Chip coil	47 n	5 % Q=40/200 MHz 0805
B150	4510003	Crystal	32.768 k	+–20PPM 8x3.8
G800	4352937	Vco	1006–1031mhz 4.5v/10ma	SMD
G801	4510133	VCTCXO	13.00 M	+–5PPM 4.7V 2MA
Z500	4512061	Dupl	890–915/935–960mhz	20x14
Z505	4510065	Saw filter	947.5+–12.5 M	4X4

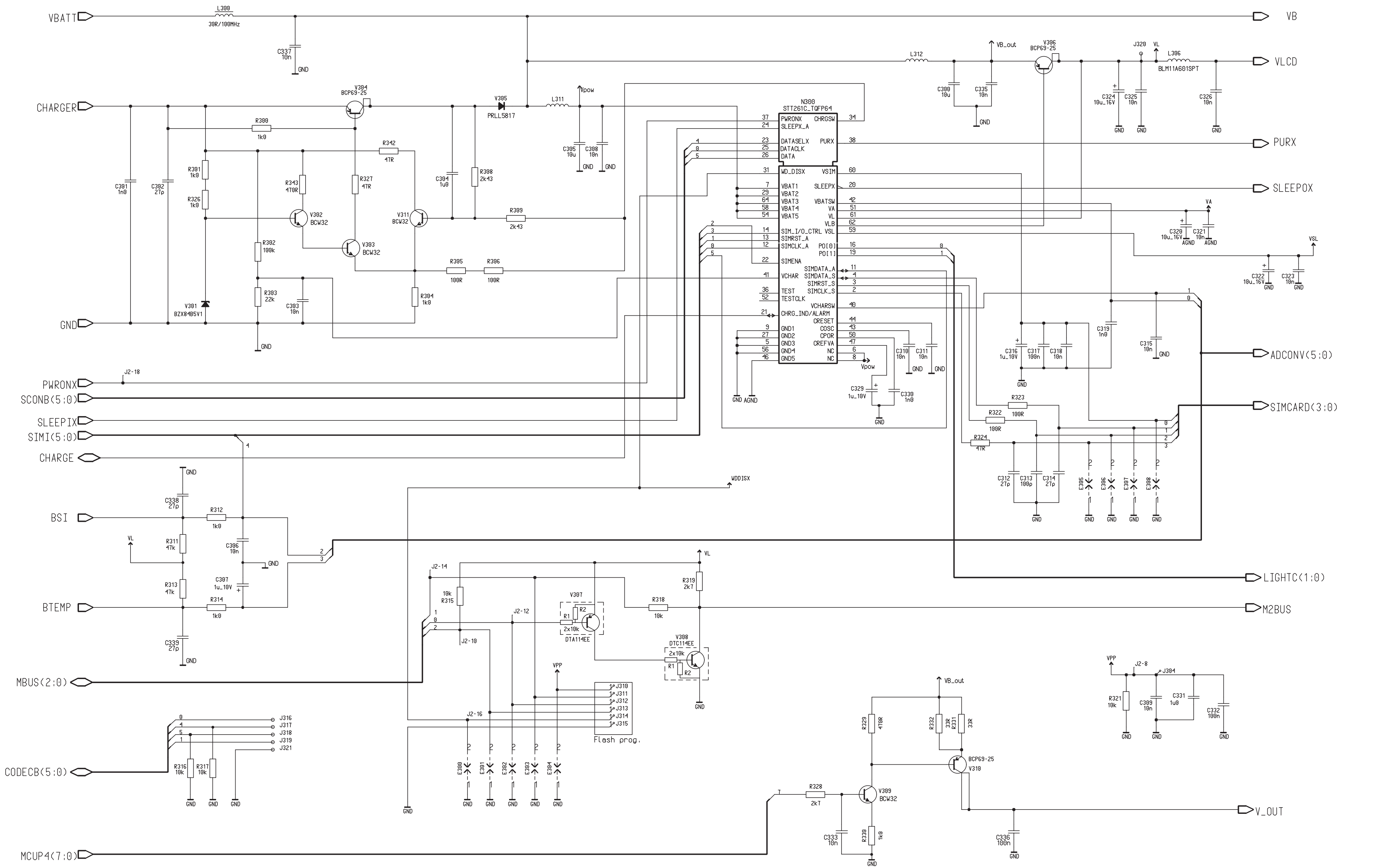
Z541	4511026	Saw filter	71+–0.08 M	14.2x8.4
Z551	4510009	Cer.filt 13+–0.09mhz	7.2x3.2	7.2x3.2
Z714	4510067	Saw filter	902.5+–12.5 M	4X4
V100	1825007	Chip varistor vwm18v vc39v	1210	1210
V150	4210066	Transistor	BFR93AW	npn 12 V 35 mA SOT323
V200	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V301	4110130	Zener diode	BZX84	2 % 5.1 V 0.3 W SOT23
V302	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V303	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V304	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V305	4115804	Schottky diode	PRLL5817	20 V 1 A SOD87
V306	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V307	4210050	Transistor	DTA114EE	pnp RB V EM3
V308	4210052	Transistor	DTC114EE	npn RB V EM3
V309	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V310	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V311	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V501	4210074	Transistor	BFP420	npn 4. V SOT343
V505	4219922	Transistor x 2		UM6
V511	4110083	Schdix4 bat15–099r ring	sot143	SOT143
V512	4210011	Transistor	BFS505	npn 15 V 18 mA SOT323
V520	4210066	Transistor	BFR93AW	npn 12 V 35 mA SOT323
V580	4219922	Transistor x 2		UM6
V590	4219922	Transistor x 2		UM6
V591	4210052	Transistor	DTC114EE	npn RB V EM3
V592	4112464	Pindix2 bar64–04 200v 0.1a	sot23	SOT23
V602	4210054	Transistor		RECOMMENDED***
V603	4219922	Transistor x 2		UM6
V604	4210054	Transistor		RECOMMENDED***
V606	4219922	Transistor x 2		UM6
V607	4210054	Transistor		RECOMMENDED***
V608	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V711	4219904	Transistor x 2	UMX1	npn 40 V SOT363
V712	4210054	Transistor		RECOMMENDED***
V780	4110014	Sch. diode x 2	BAS70–07	70 V 15 mA SOT143
V790	4219904	Transistor x 2	UMX1	npn 40 V SOT363
V791	4211288	MosFet	2SJ31	p–ch 12 V SOT89
V830	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V840	4219903	Transistor x 2	BFM505	npn 20 V 20V18 mA SOT363
V842	4110062	Cap. diode	BB535	30 V 2.1/18.7PFSOD323
D150	4340307	IC, MCU		TQFP80
D151	4370175	F711746	gsm/pcn asic bart	SQFP144
D152	4370359	IC,	tms320lc541b 3v gj7 DSP	SQFP100
D400	4340217	IC, flash mem.		TSOP40
D401	4347667	IC, EEPROM		TSOP28
D403	4340333	IC, SRAM		TSOP32
D404	4340149	IC, SRAM		TSOP28

D405	4340149	IC, SRAM		TSOP28
N200	4370303	St5092	pcm codec/filter	TQFP44
N300	4370223	Stt261c	pscld_e pw supply	TQFP44
N450	4370097	St7523 rfi2	v4.2 tdma codec	QFP64
N451	4340433	IC, regulator	TK11245BMC	4.5 V SOT23L
N551	4370243	Crfrt_st	tx.mod+rxif+pwc	SQFP44
N601	4340419	IC, regulator	TK11248BMC	4.8 V SOT23L
N602	4340419	IC, regulator	TK11248BMC	4.8 V SOT23L
N603	4340419	IC, regulator	TK11248BMC	4.8 V SOT23L
N710	4340077	IC, 1.5ghz	w/b 30db/1ghz a	uPC2710T AMP
N711	4350051	IC, pow.amp.		SSOP28BW
N820	4340147	IC, 2xsynth1.2g/510mhz ssopLMX2332		SSOP20
X100	5469007	Syst.conn	12af+jack+dc dct2	SMD
X101	5469204	SM, conn	2x15 m	p0.8 pcb/pcb 2.8MM
X102	5409033	Sim card reader	ccm04–5004	2x3smd
X500	9780172	Antenna cable	w50	dmd00071
X501	9510262	Antenna clip	3D25516	NHE–6
	9854187	PCB	GJ8A	127.5X43.0X1.0 M8 3/PA

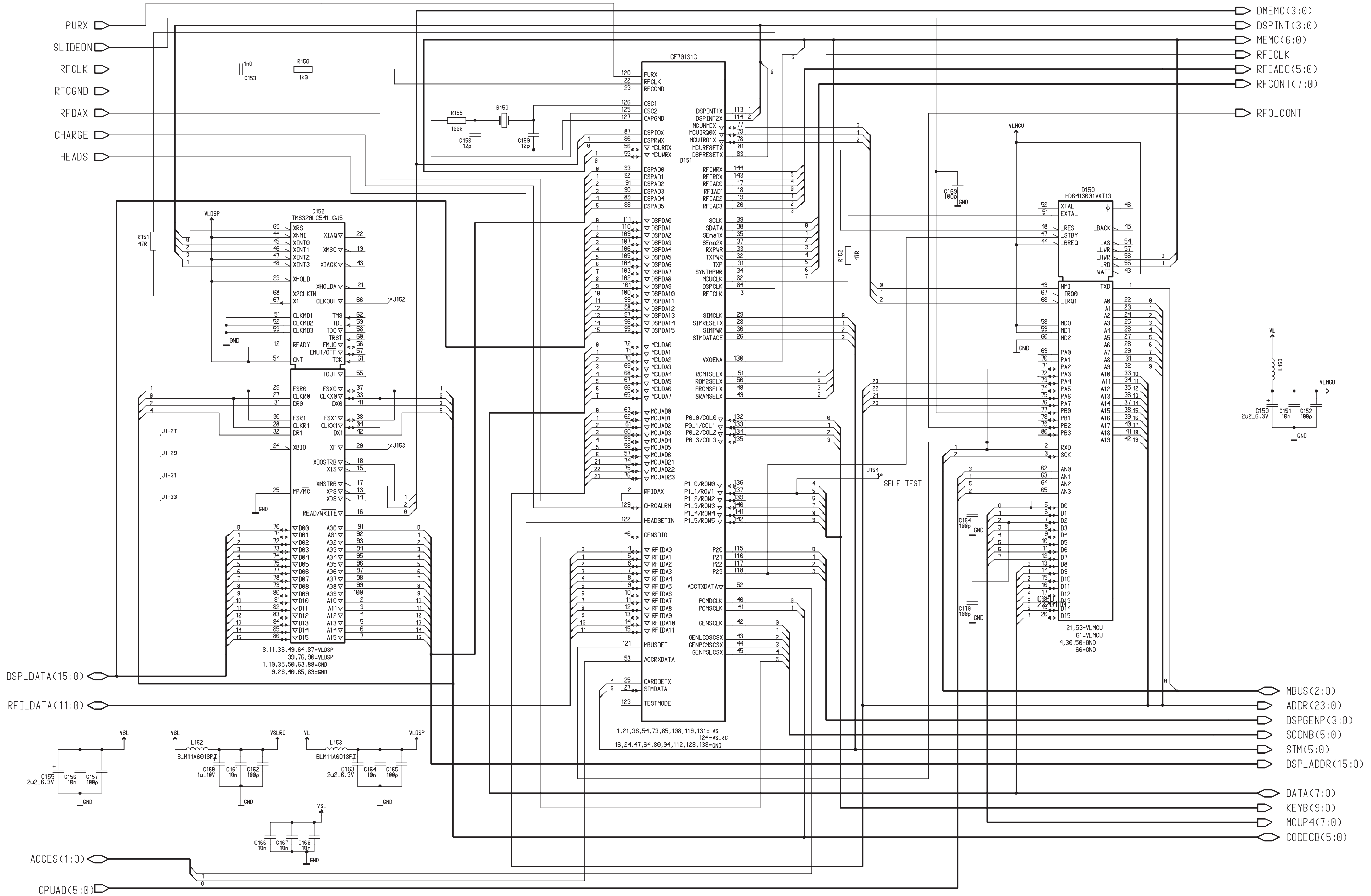
Block Diagram of Baseband (Version: 3.5 ; Edit : 167) for layout version 15



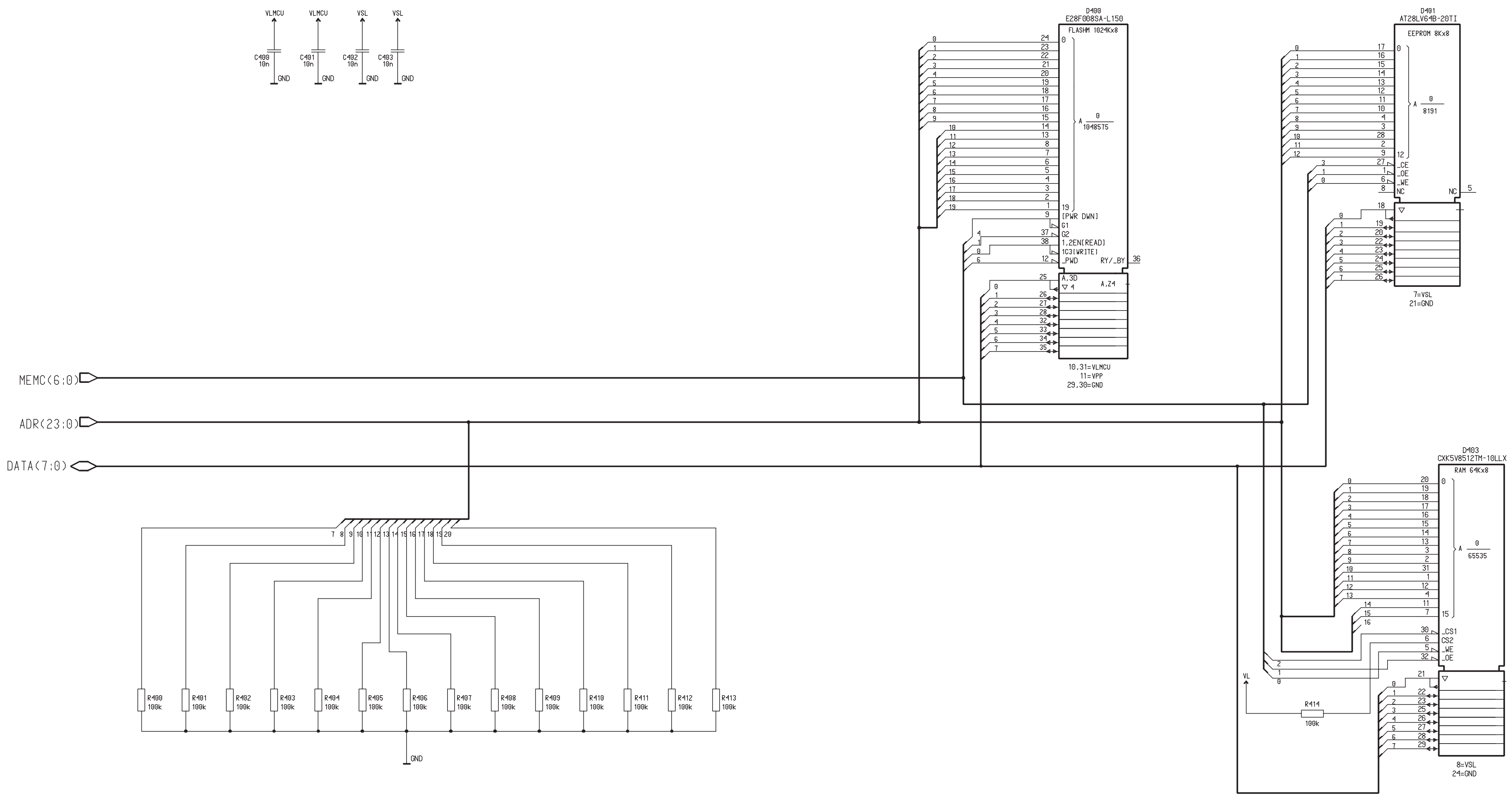
Circuit Diagram of Power Supply & Charging (Version: 3.5 ; Edit:126) for layout version 15



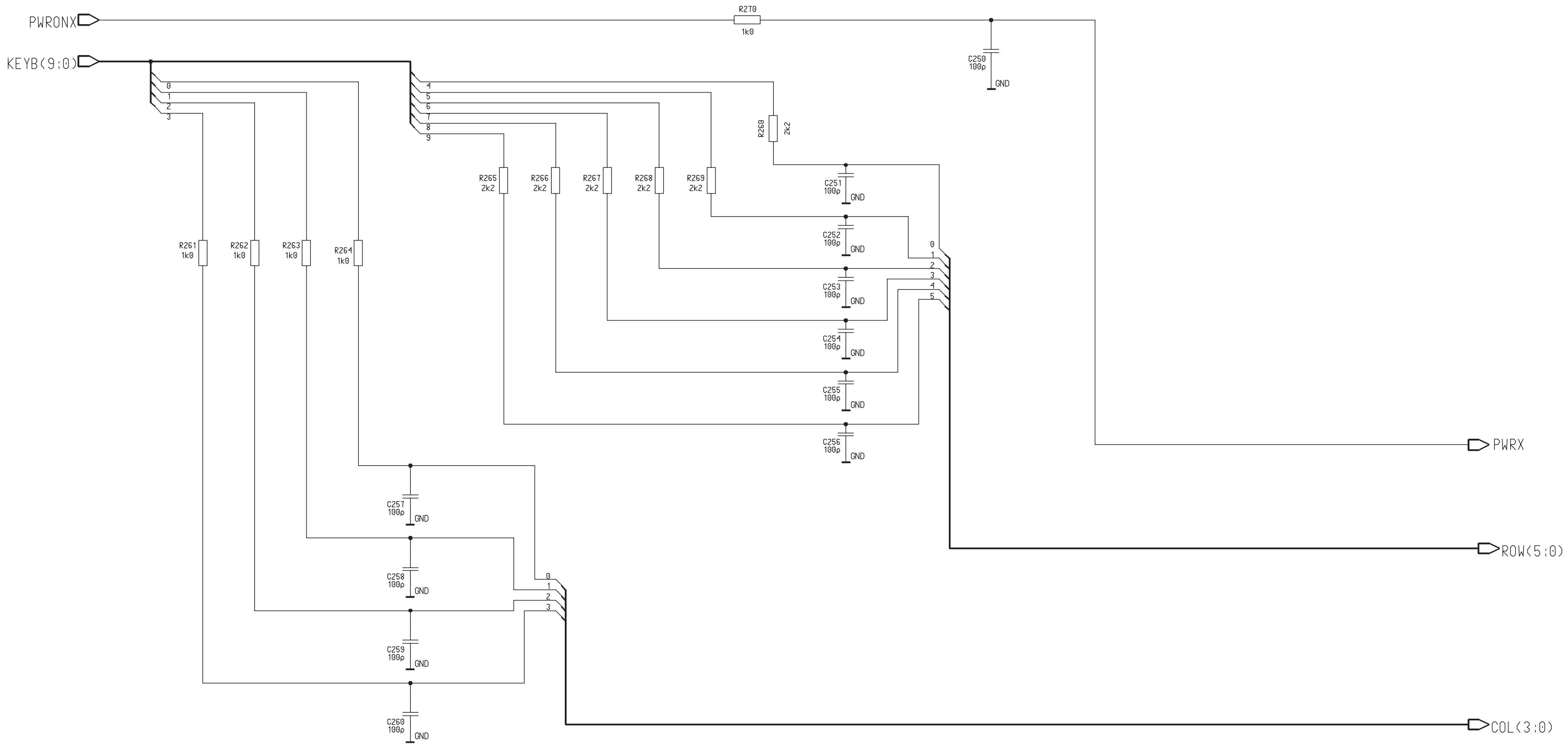
Circuit Diagram of Central Processing Unit (Version: 3.5 ; Edit 145) for layout version 15



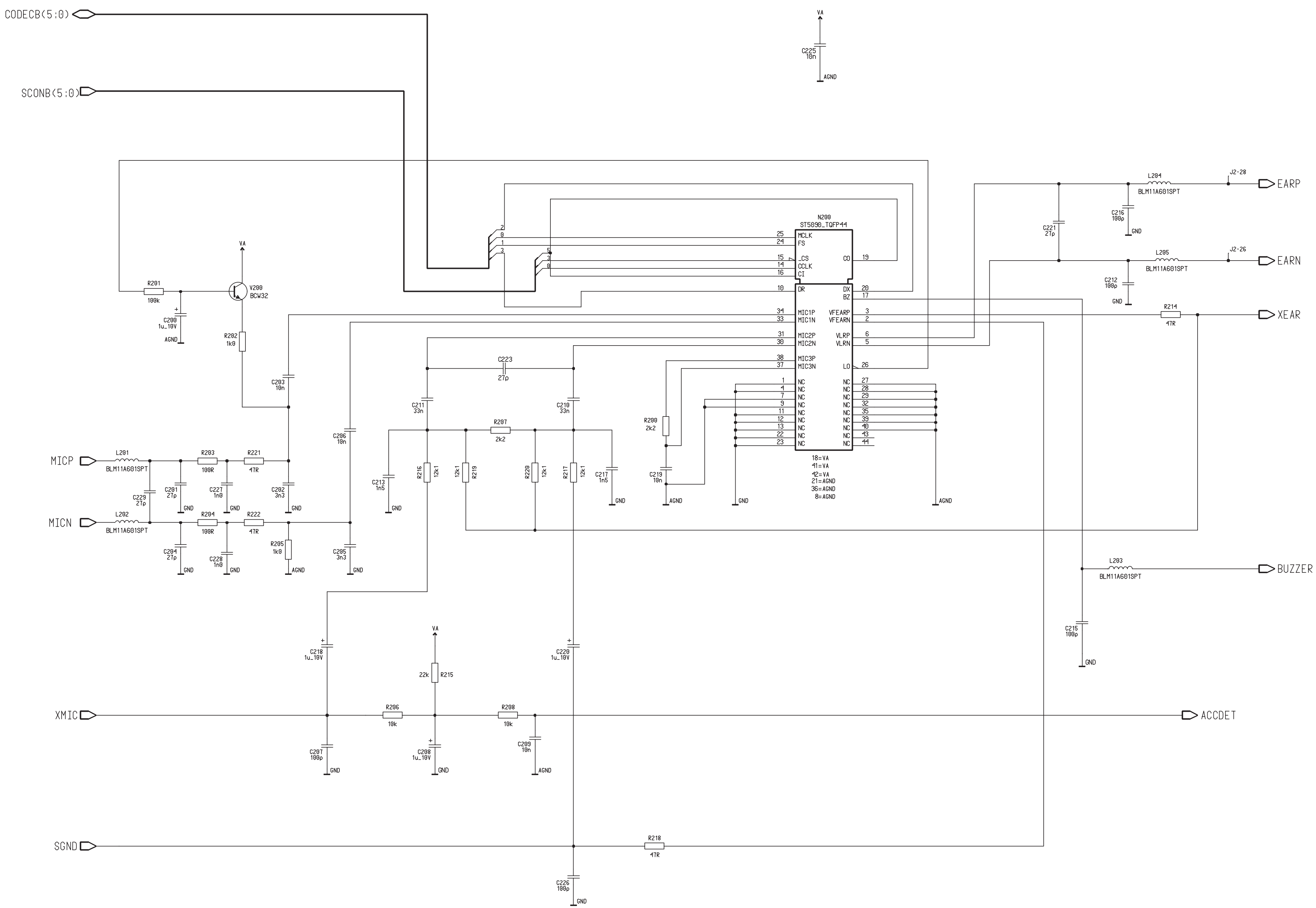
Circuit Diagram of MCU Memory Block (Version: 3.5 ; Edit 53) for layout version 15



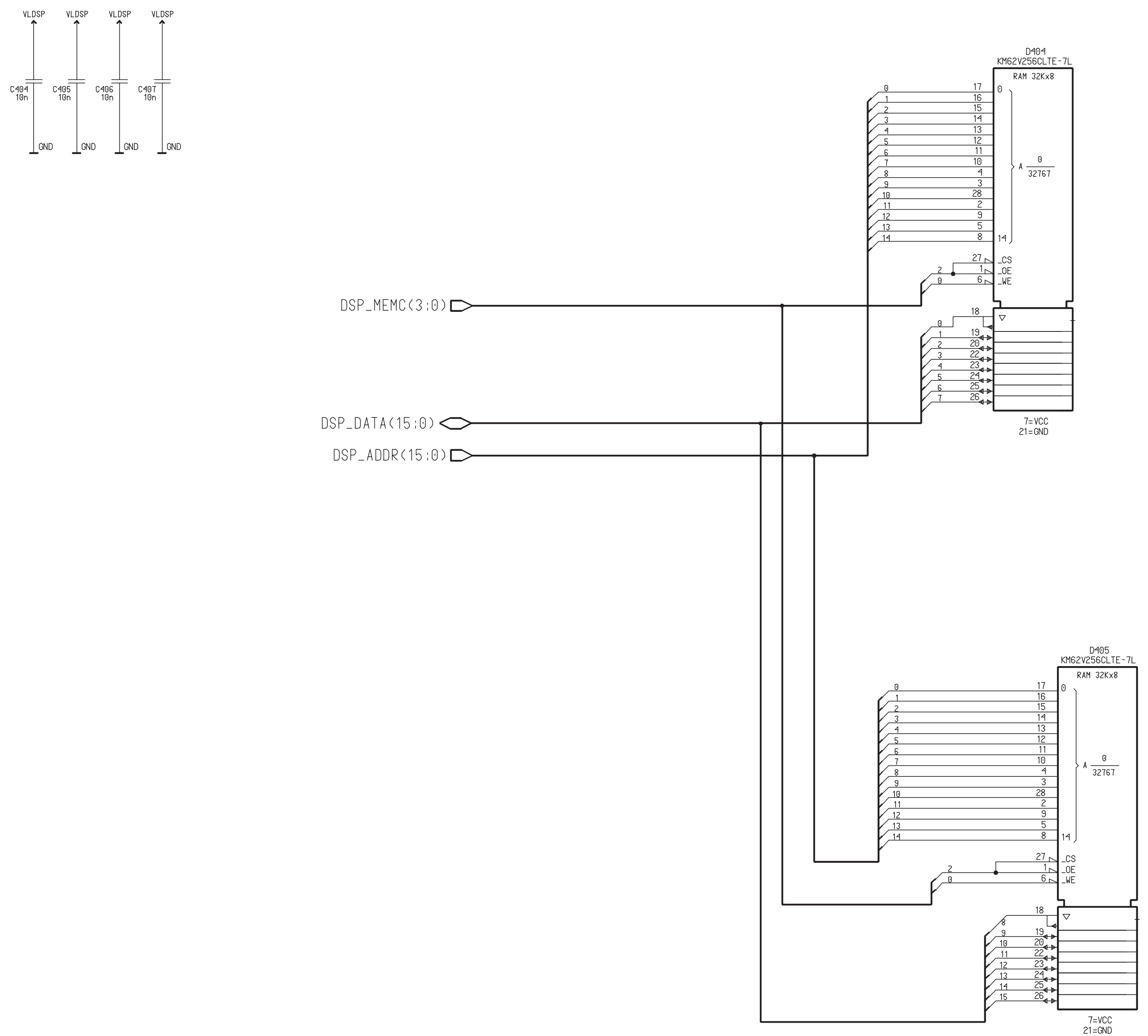
Circuit Diagram of Keyboard and Display Interface (Version: 3.5 ; Edit 45) for layout version 15



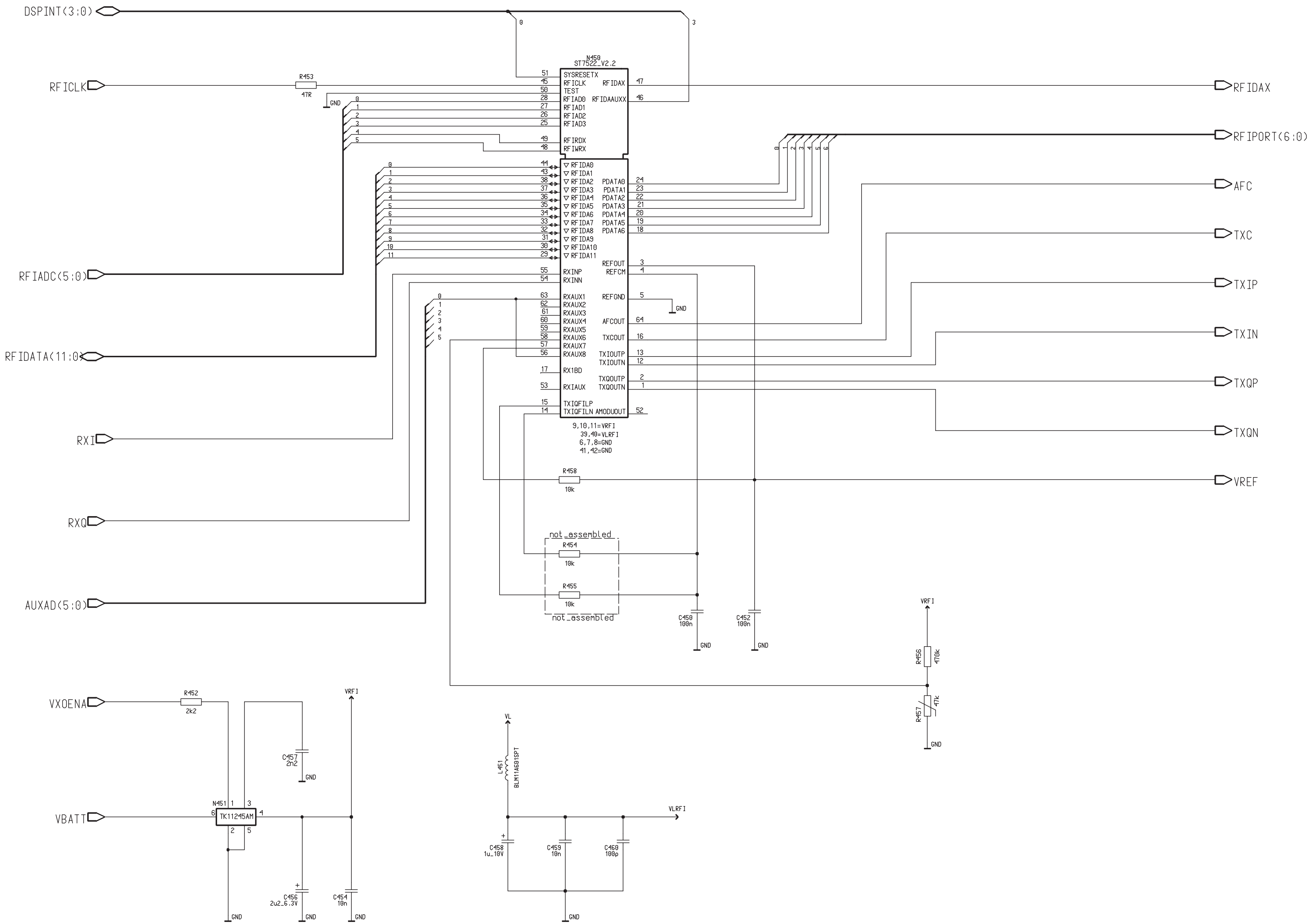
Circuit Diagram of Audio (Version: 3.5 ; Edit 84) for layout version 15



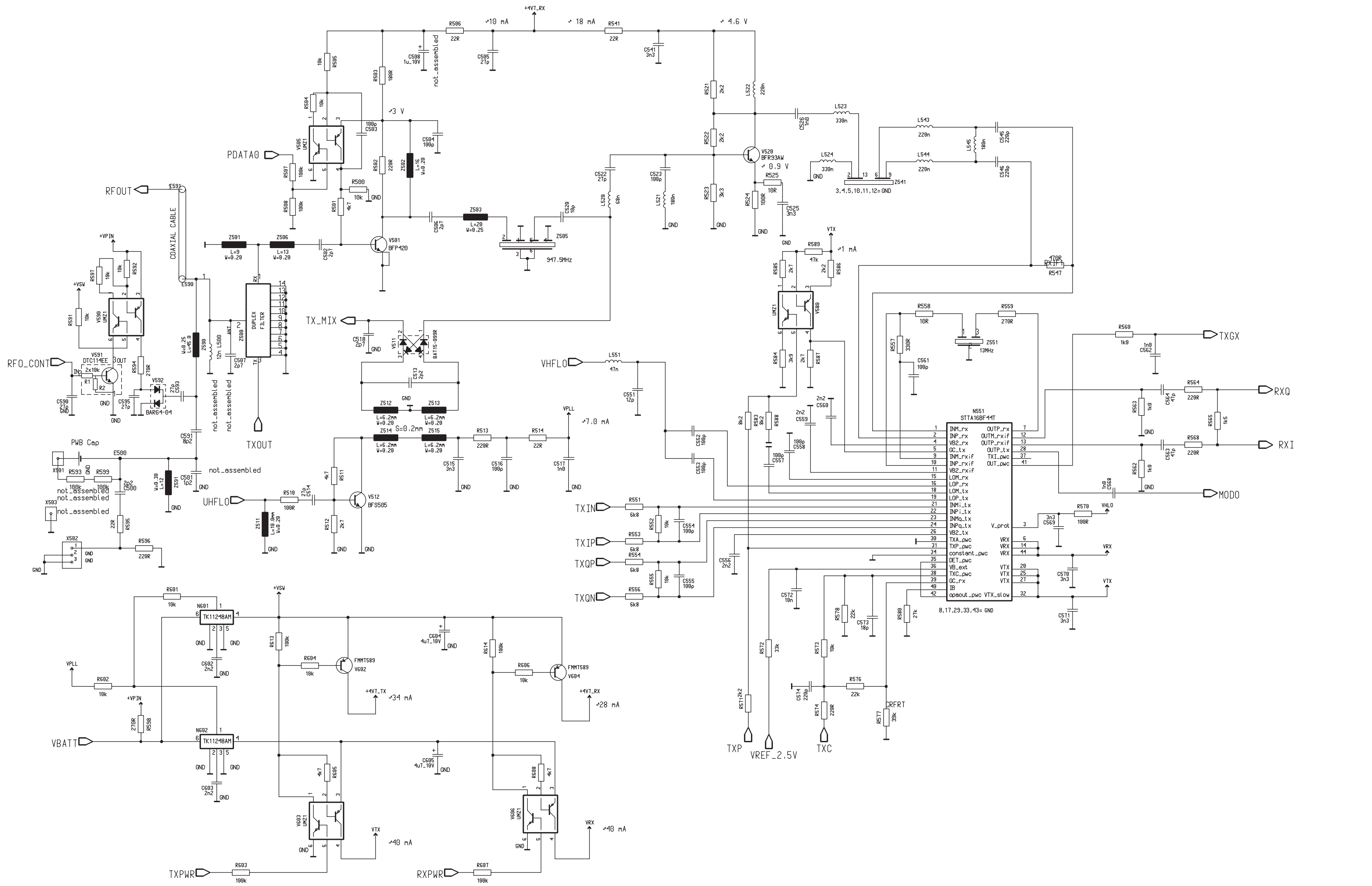
Circuit Diagram of DSP Memory Block (Version: 3.5 ; Edit 45) for layout version 15



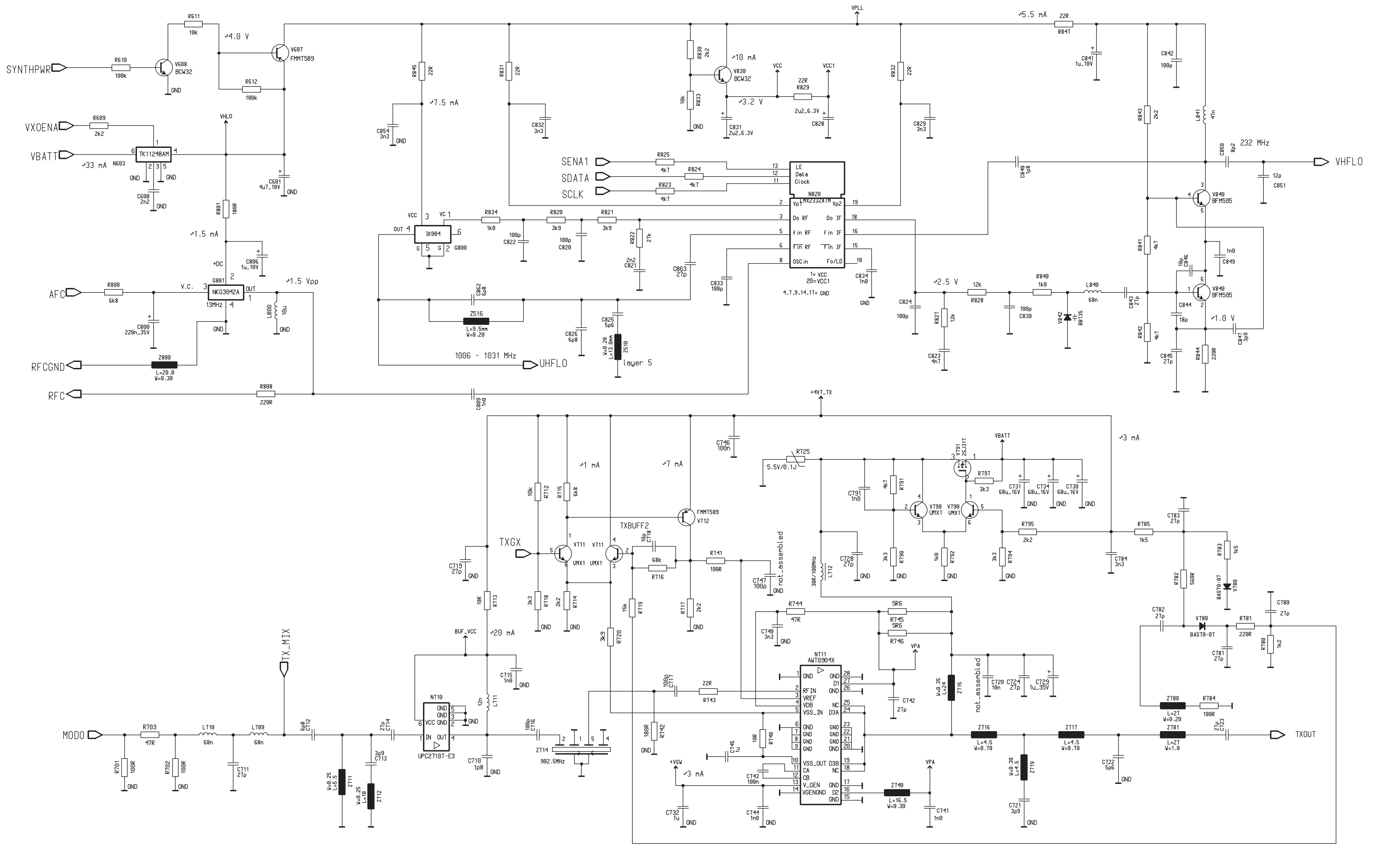
Circuit Diagram of RFI (Version: 3.5 ; Edit 92) for layout version 15



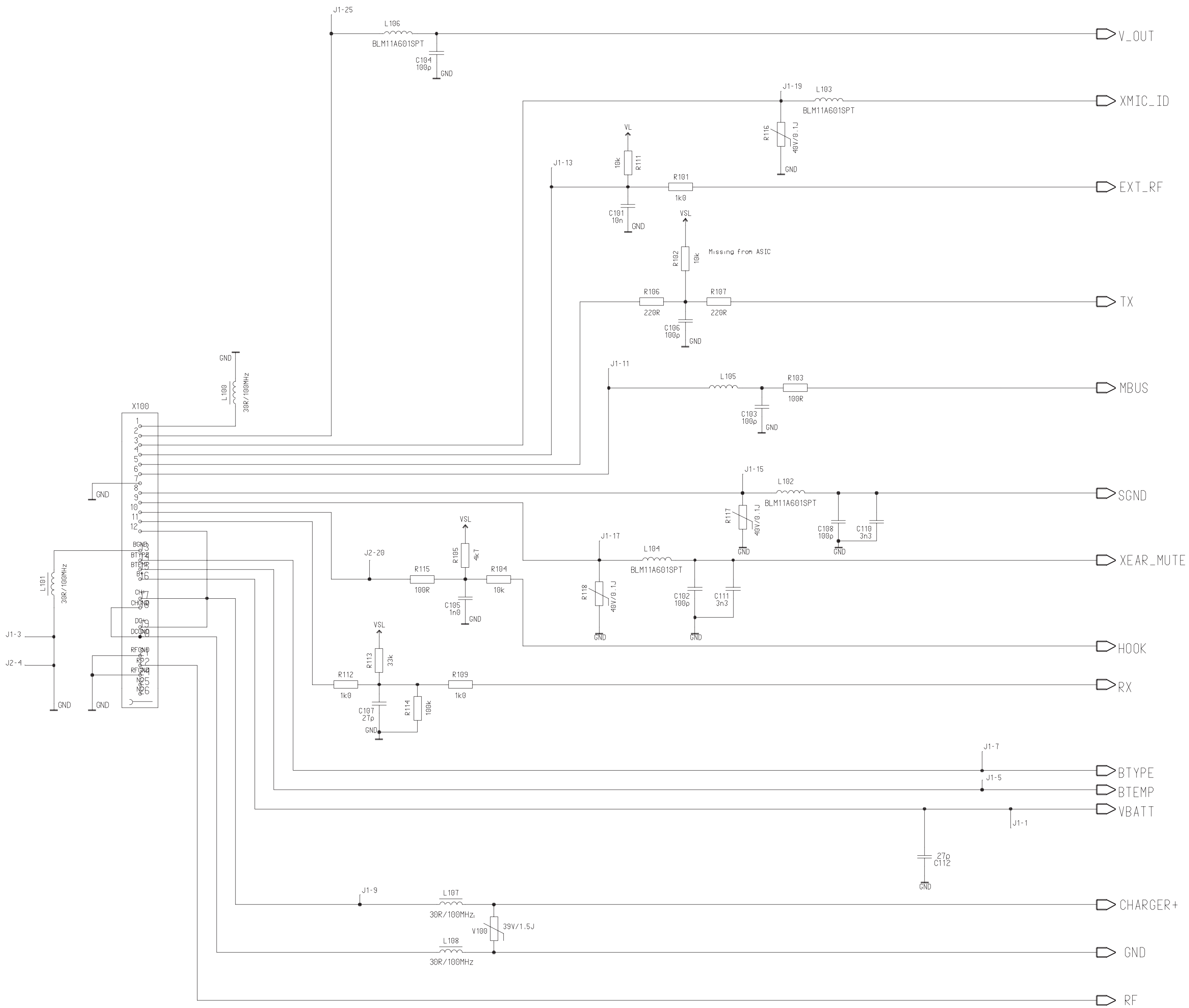
Circuit Diagram of Receiver (Version: J4.2 ; Edit 336) for layout version 15



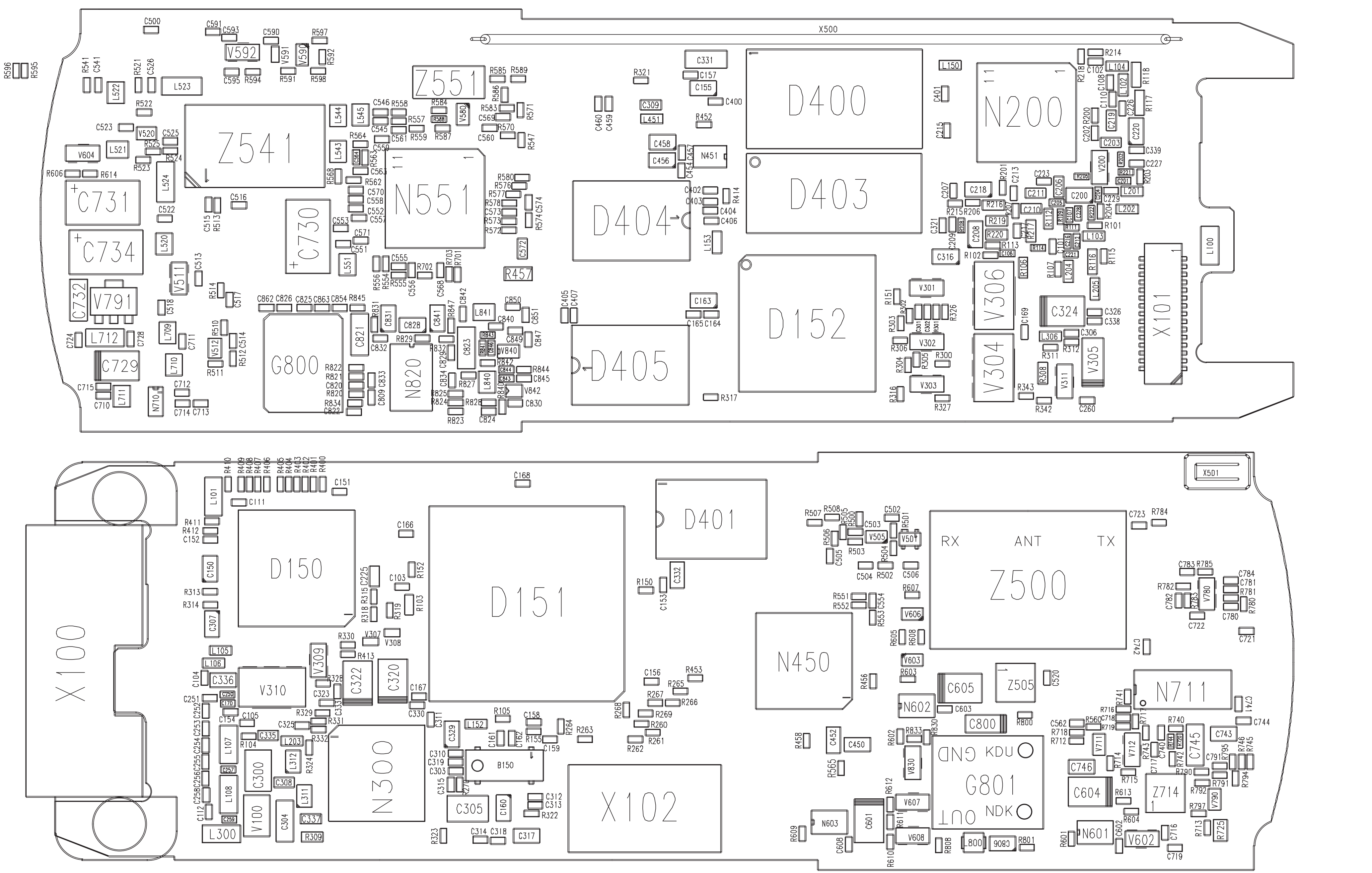
Circuit Diagram of Transmitter (Version: J4.2 ; Edit 350) for layout version 15



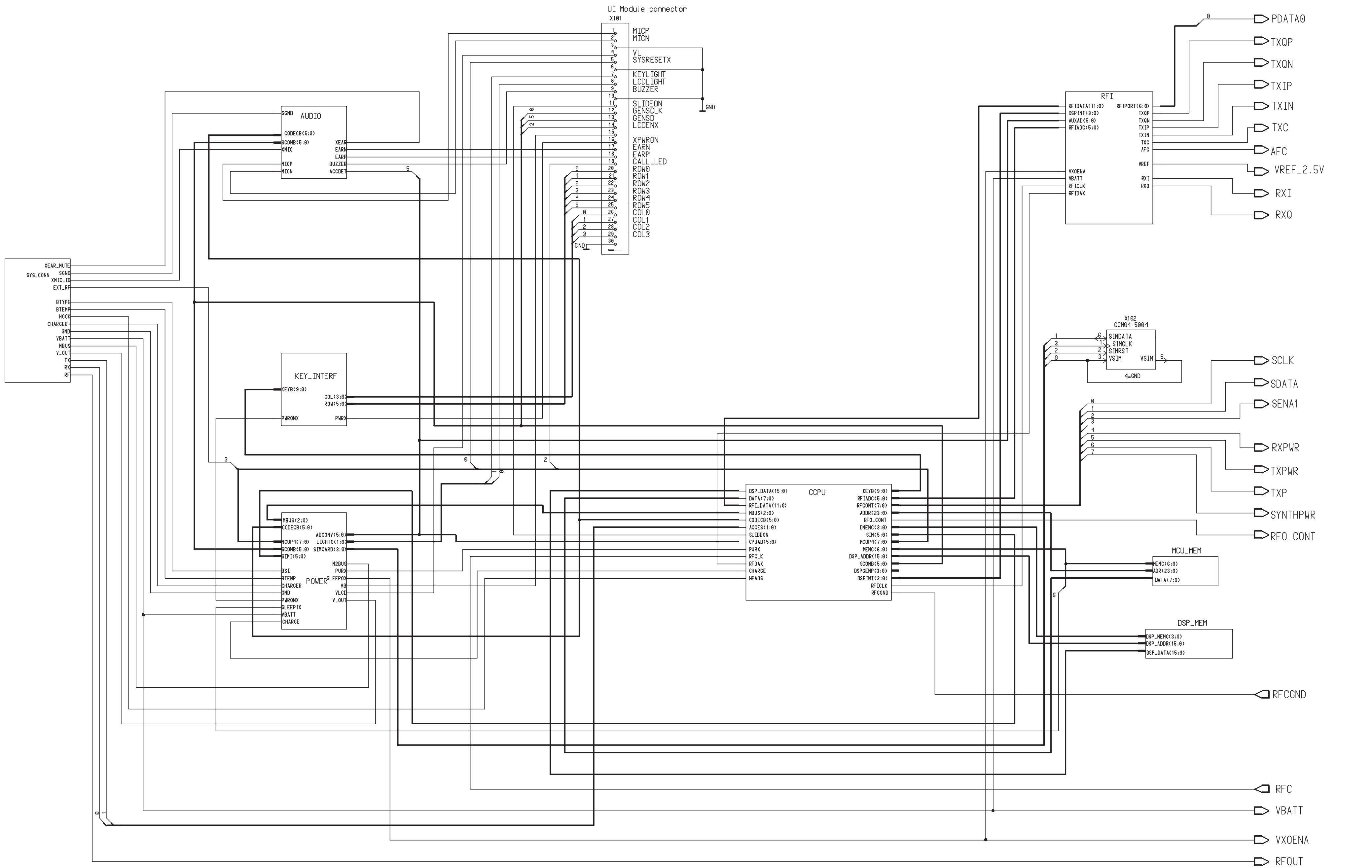
Circuit Diagram of System Connector (Version: 3.5 ; Edit 94) for layout version 15



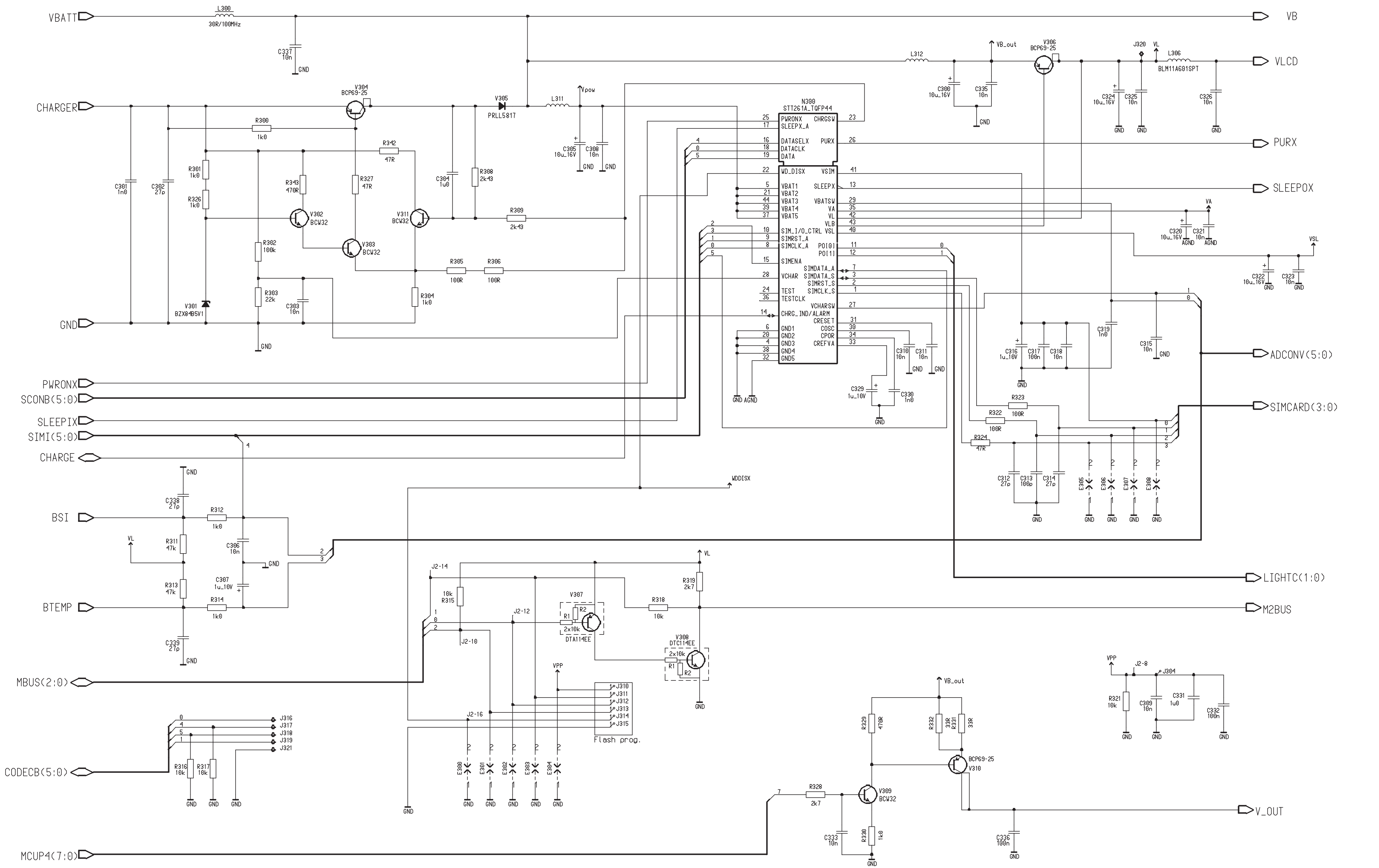
Layout Diagrams of GJ8 (Version: 15)



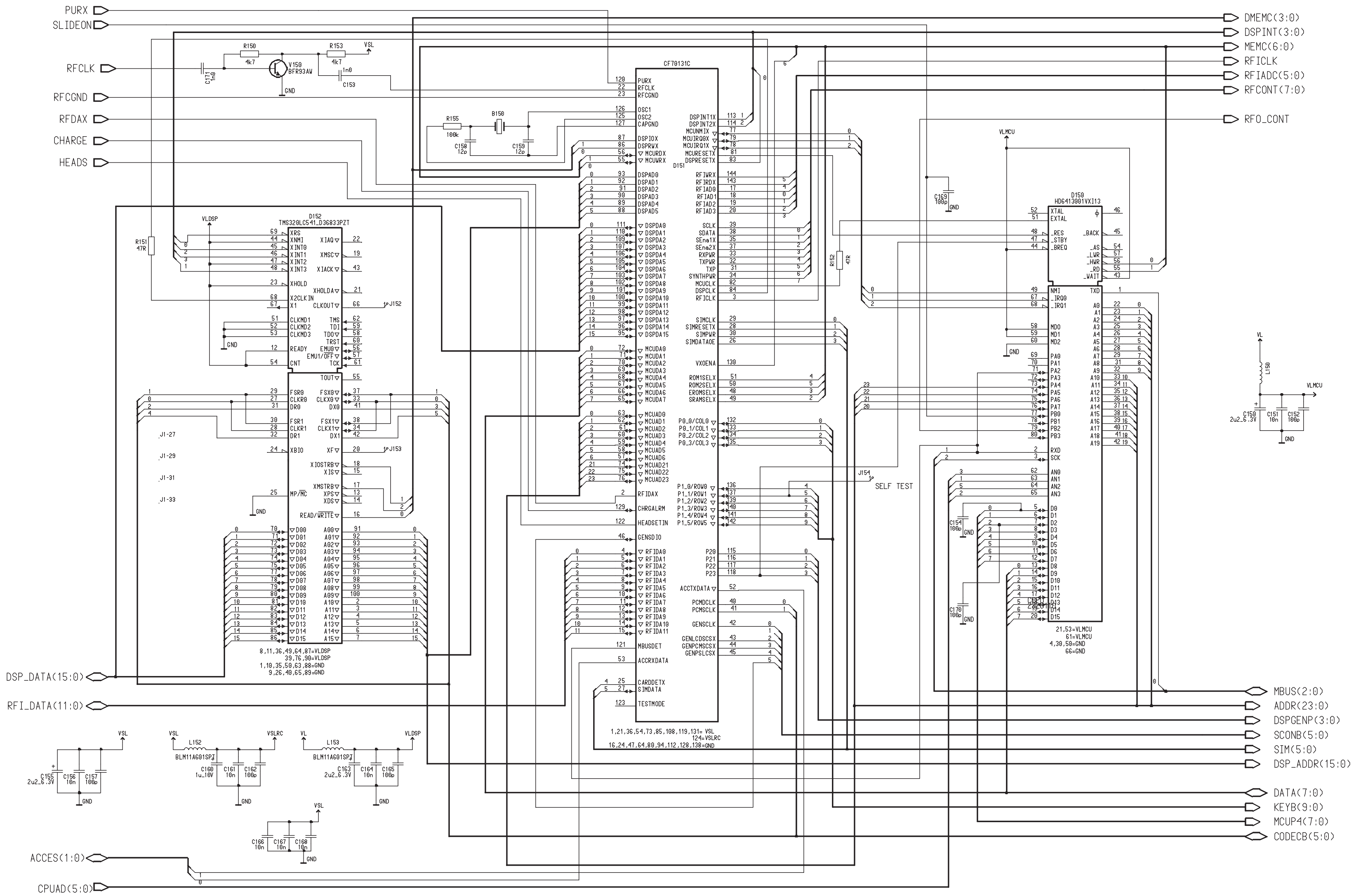
Block Diagram of Baseband (GJ8A) (Version: 3.5 ; Edit : 169) for layout version 02



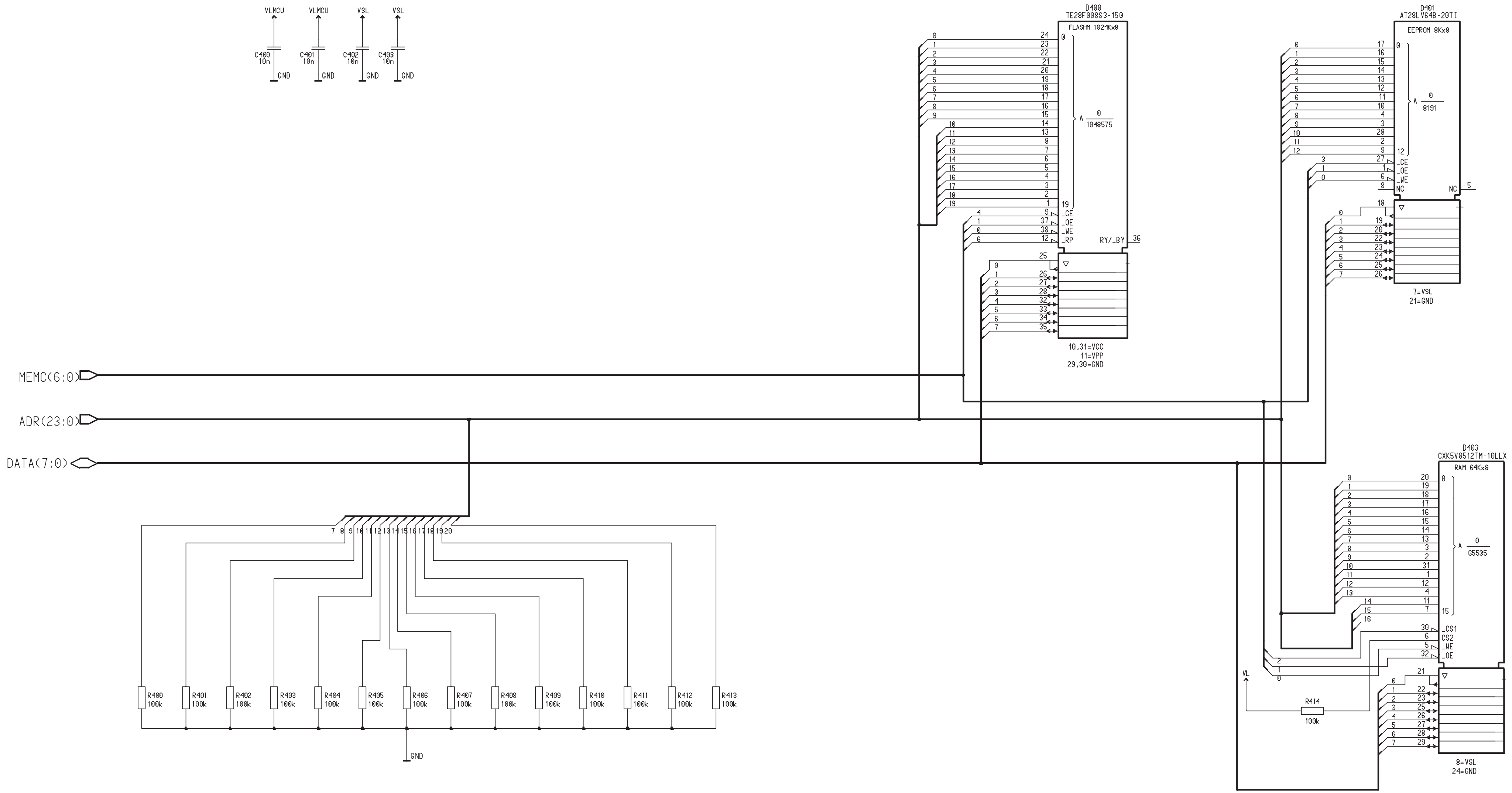
Circuit Diagram of Power Supply & Charging (GJ8A) (Version: 3.5 ; Edit:127) for layout version 02



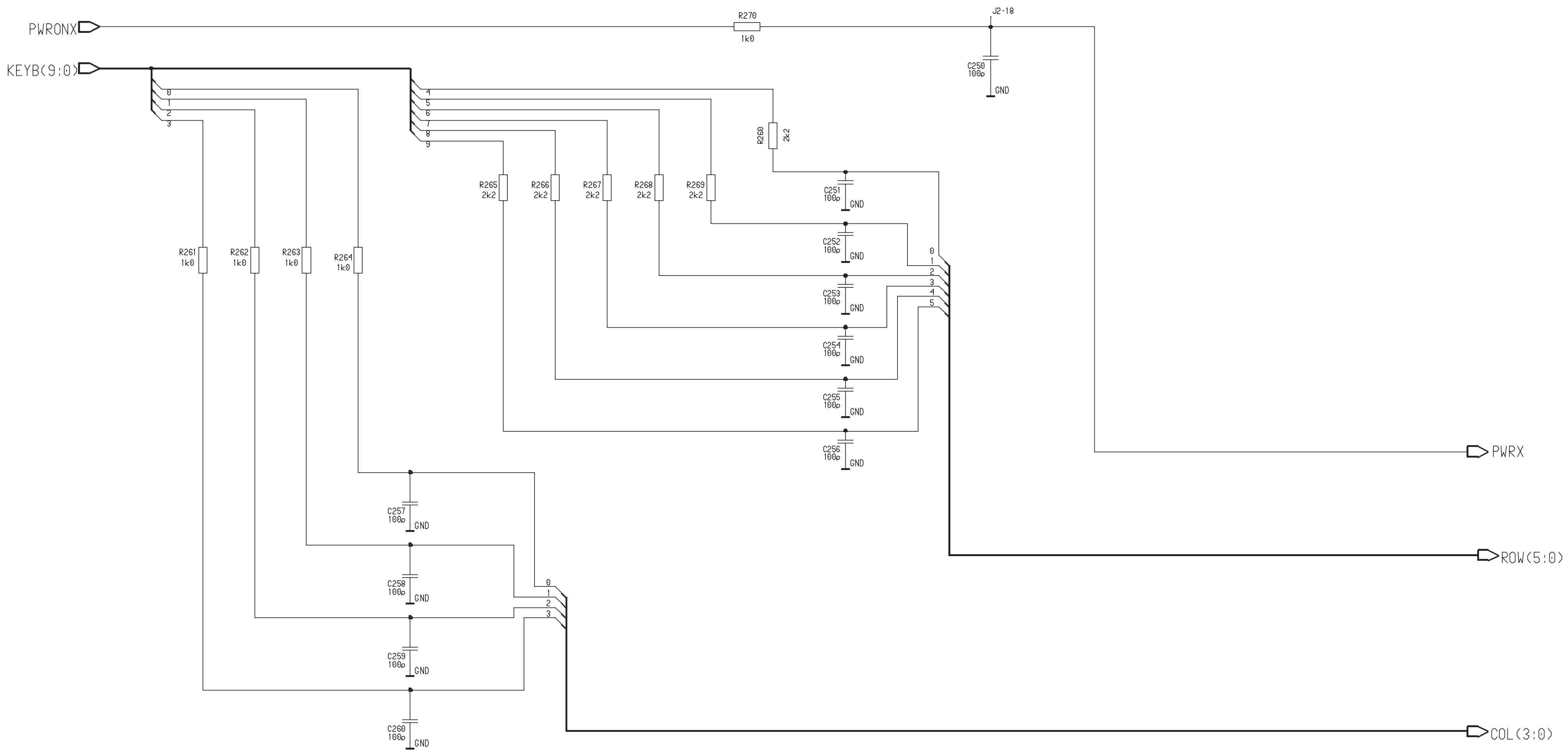
Circuit Diagram of Central Processing Unit (GJ8A) (Version: 3.5 ; Edit 149) for layout version 02



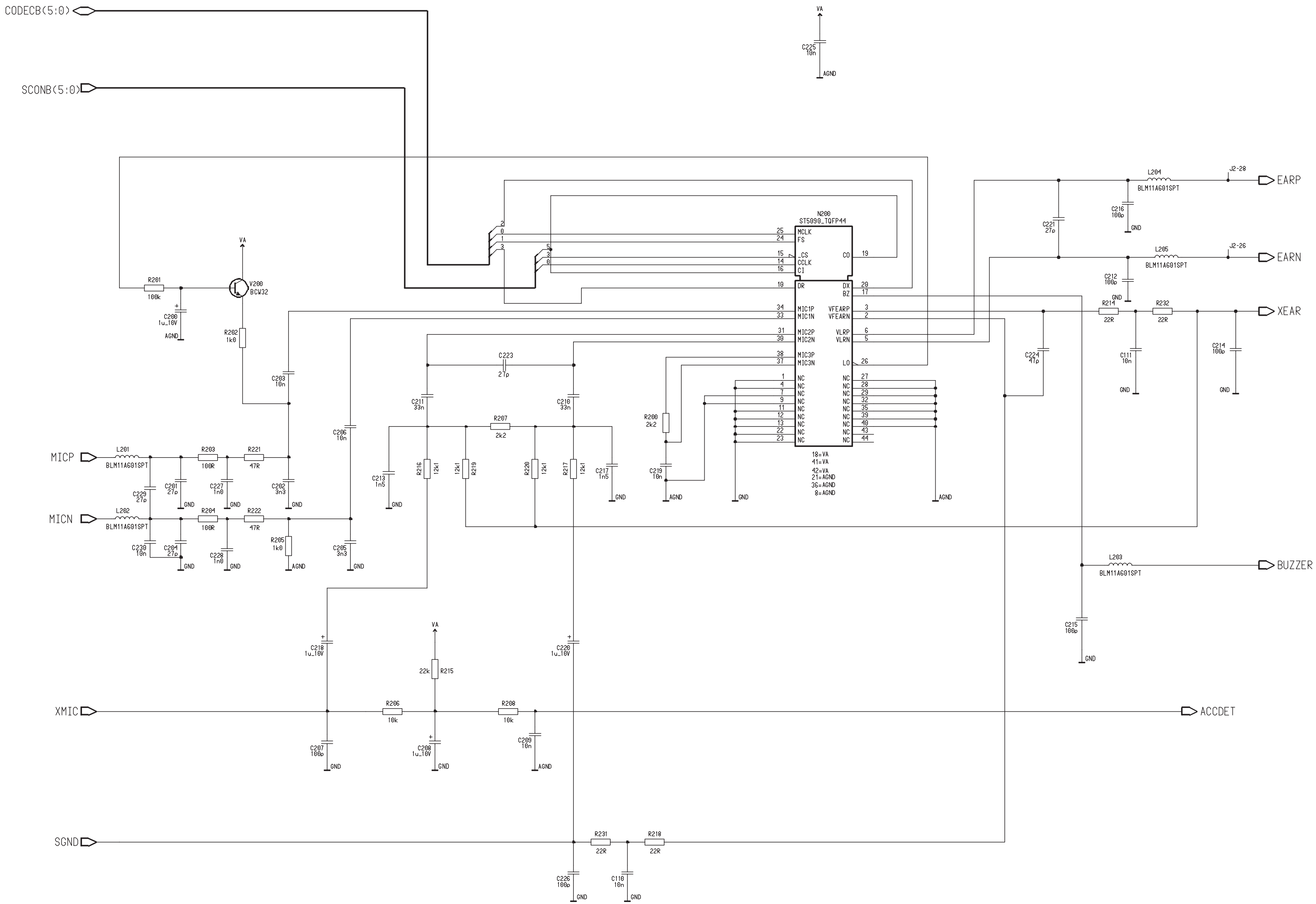
Circuit Diagram of MCU Memory Block (GJ8A) (Version: 3.5 ; Edit 55) for layout version 02



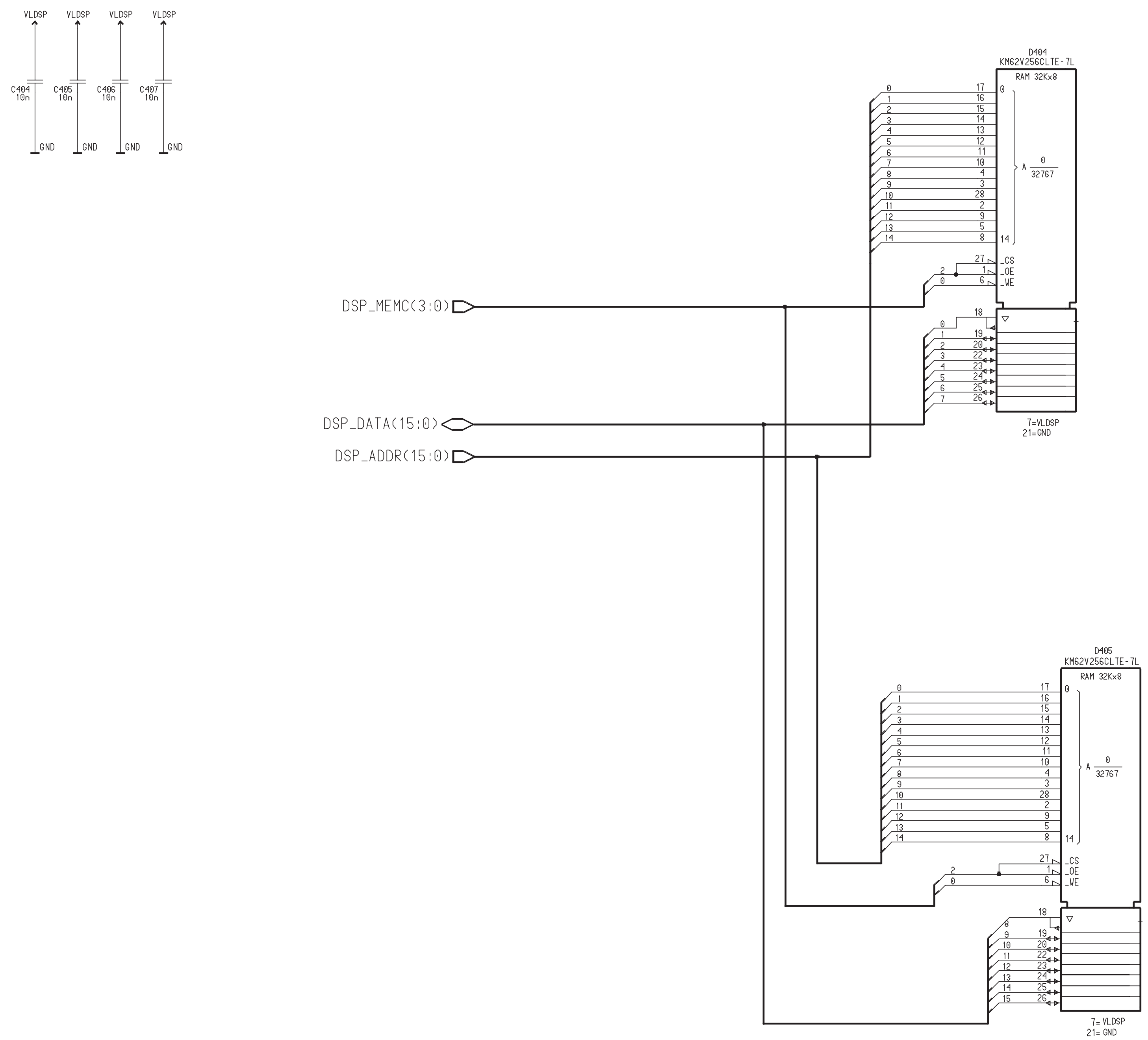
Circuit Diagram of Keyboard and Display Interface (GJ8A) (Version: 3.5 ; Edit 47) for layout version 02



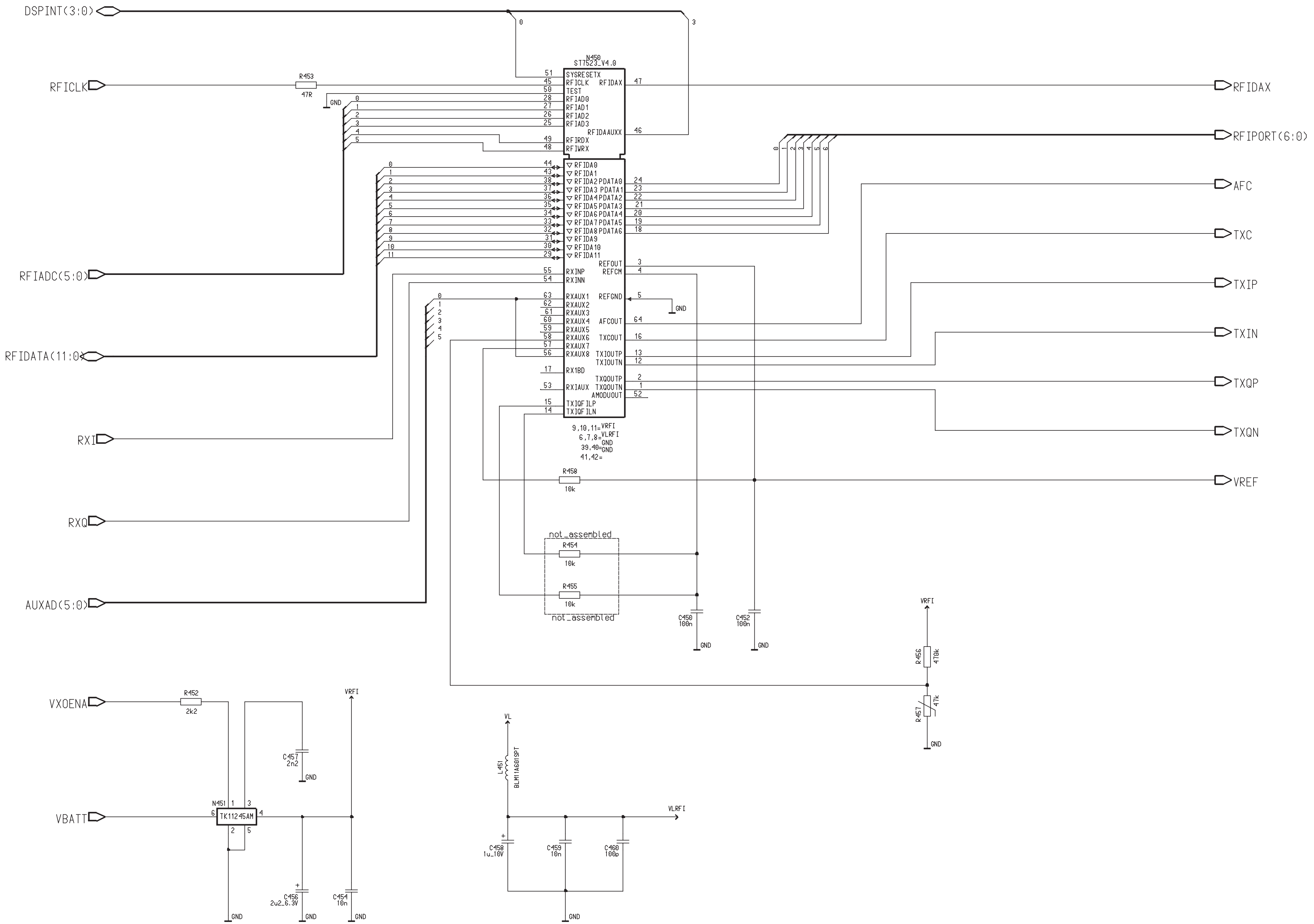
Circuit Diagram of Audio (GJ8A) (Version: 3.5 ; Edit 89) for layout version 02



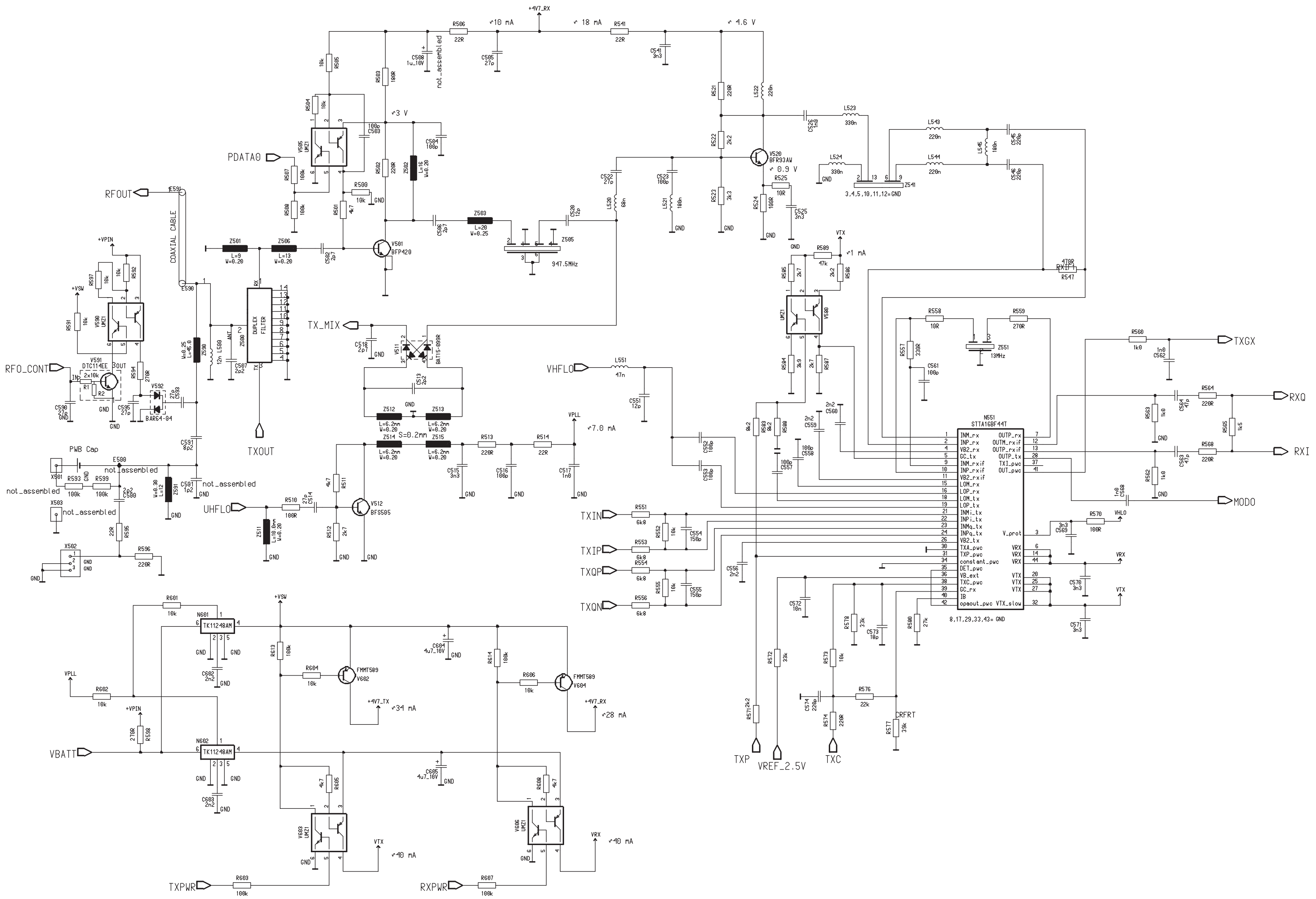
Circuit Diagram of DSP Memory Block (GJ8A) (Version: 3.5 ; Edit 46) for layout version 02



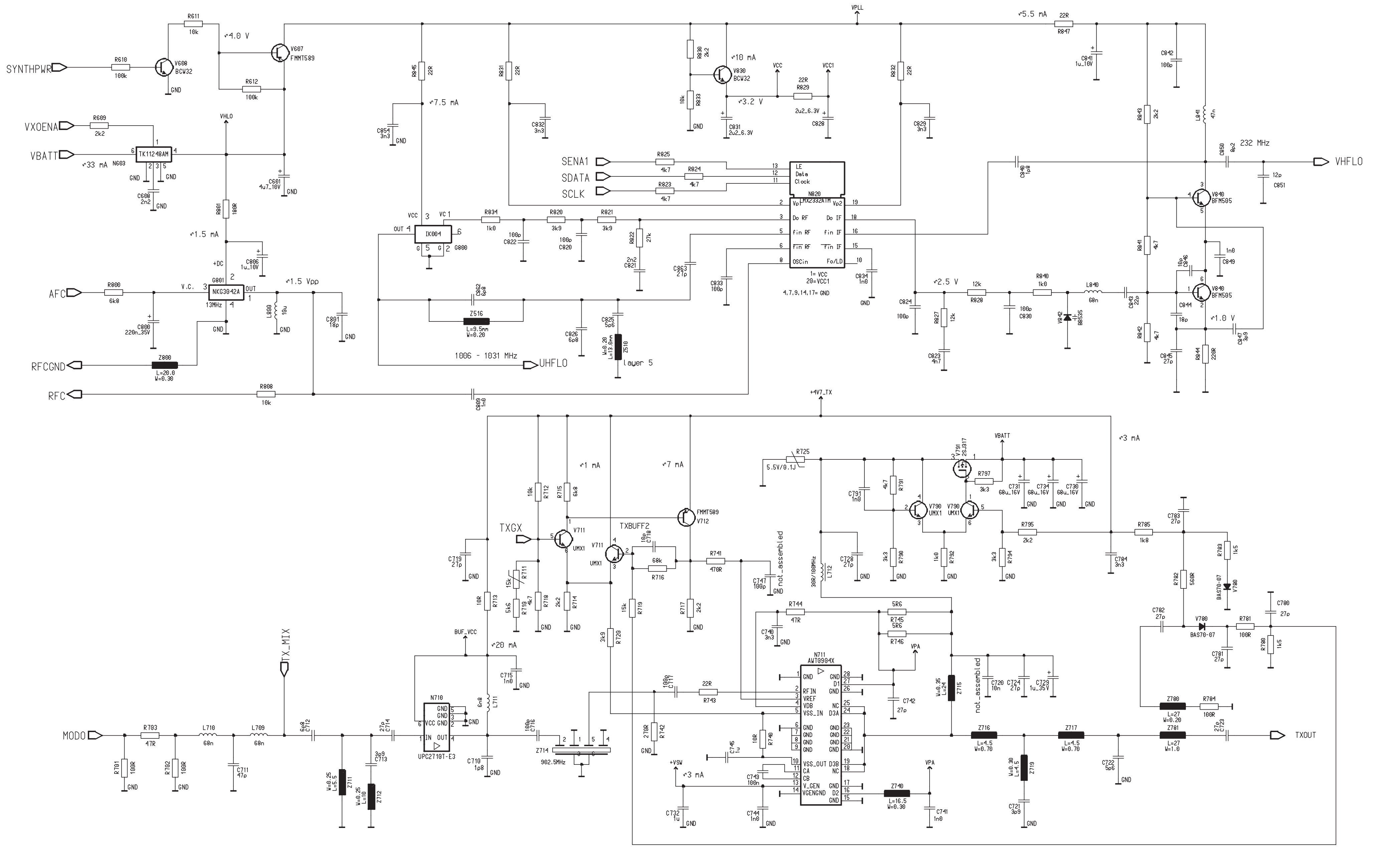
Circuit Diagram of RFI (GJ8A) (Version: 3.5 ; Edit 94) for layout version 02



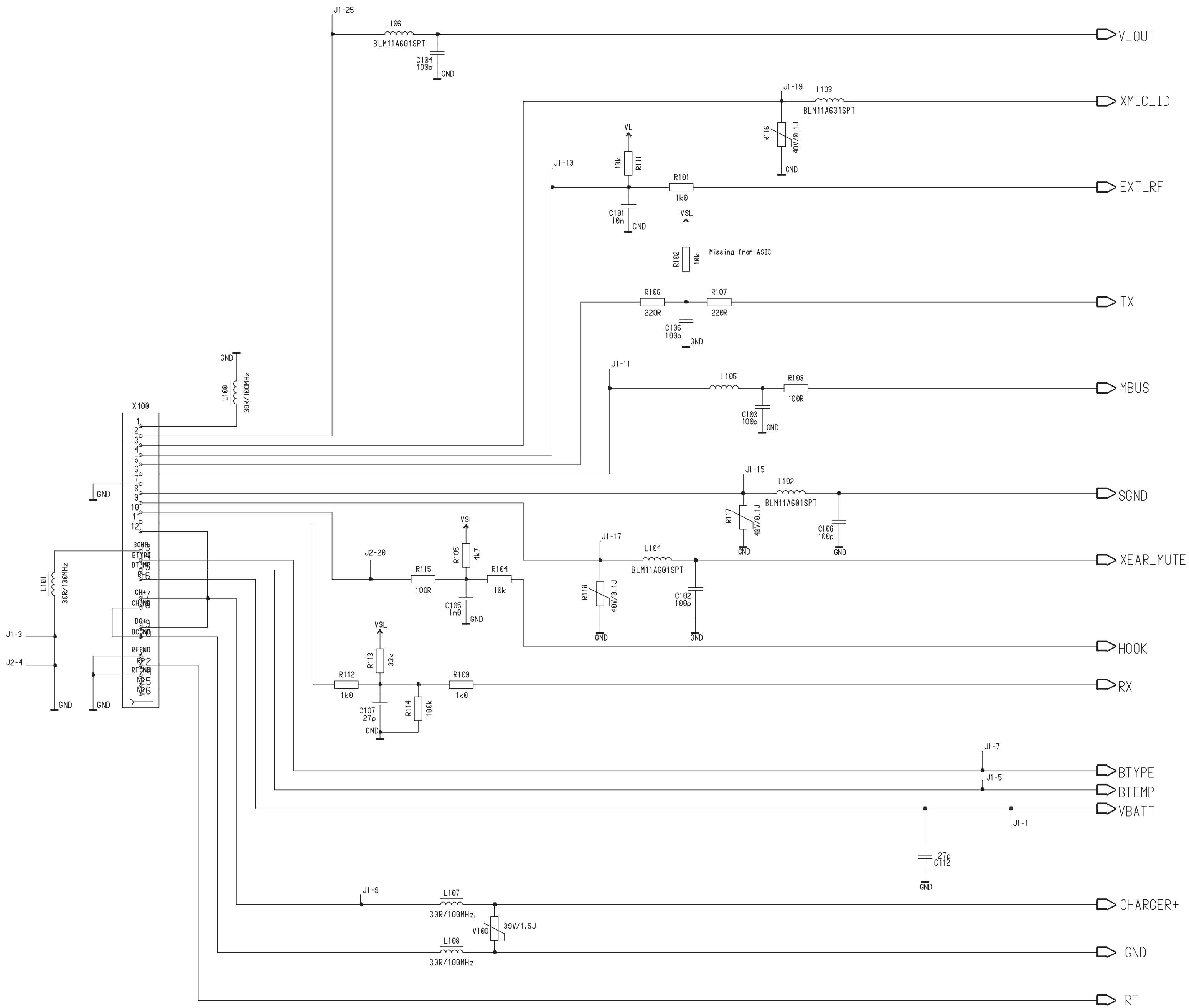
Circuit Diagram of Receiver (GJ8A) (Version: J22.7A ; Edit 344) for layout version 02



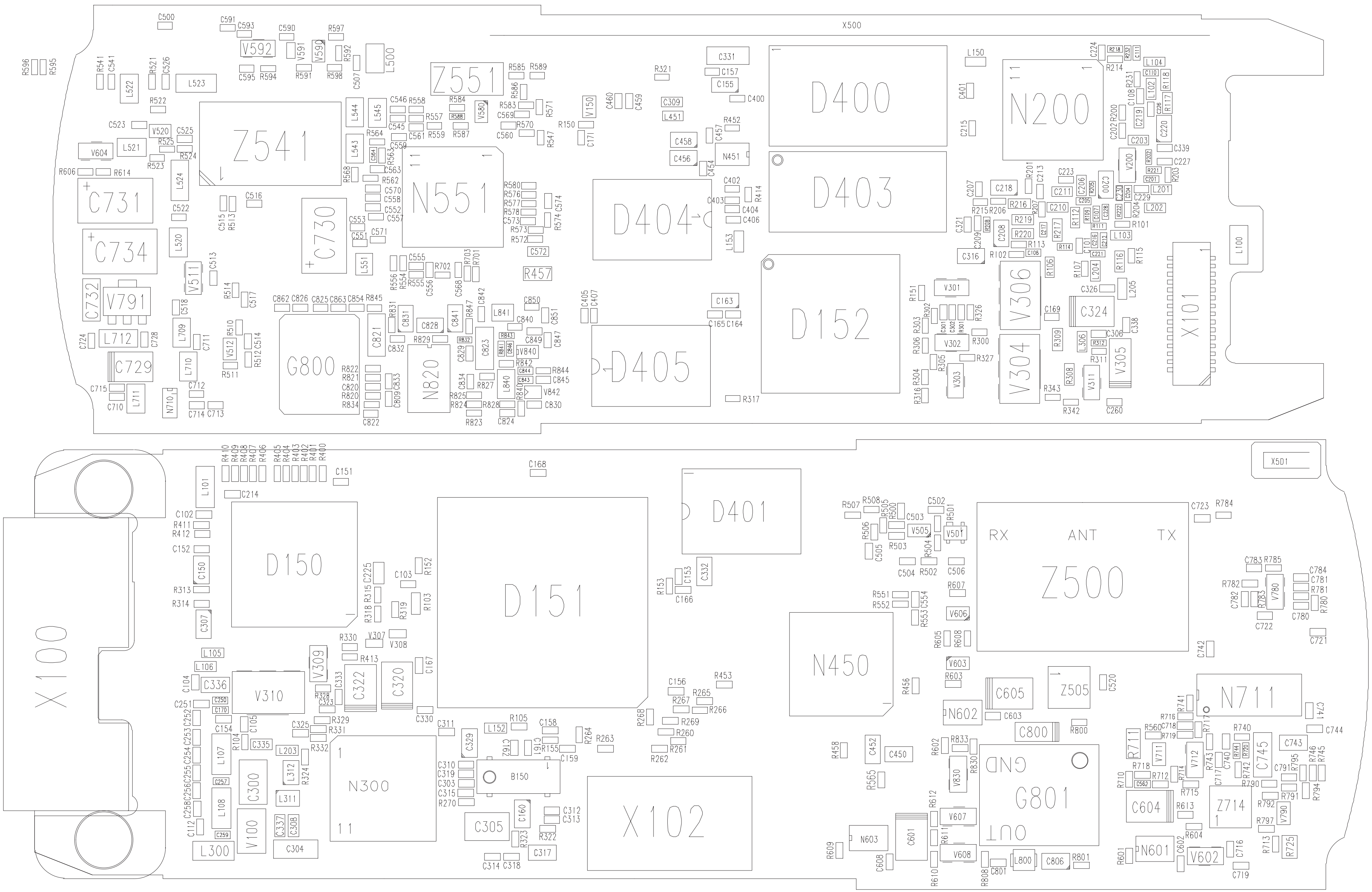
Circuit Diagram of Transmitter (GJ8A) (Version: J22.7A ; Edit 360) for layout version 02



Circuit Diagram of System Connector (GJ8A) (Version: 3.5 ; Edit 96) for layout version 02



Layout Diagrams of GJ8A (Version: 02)



Chapter 5

UIF MODULE GU8

CHAPTER 5 – UIF MODULE GU8

Contents

Introduction

This document describes the UIF module GU8. GU8 is used in both GSM (NHE–6) and PCN (NHK–6) transceivers.

External Signal and Connections

There are two connectors in this module: X401 (the Display Module Connector) and X400 (UIF Connector)

UIF Module Main Connector, X400

Pin/Conn	Line Symbol	Notes
1/X400	MICP	Positive Mic terminal • min/typ/max : 0...2...12.5 mVAC
2/X400	MICN	Negative Mic terminal • min/typ/max : 0...2...12.5 mVAC
3,6,30/X400	GND	Digital ground
4/X400	VL	Logic voltage • min/typ/max : 3.0...3.16...3.3 V
5/X400	SYSRESET X	Reset for display driver
7/X400	KEYLIGHT	Keymat backlights OFF • min/typ/max : 0...0...0.2 V Keymat backlights ON • min/typ/max : 2.8...3.16...3.3 V
8/X400	LCDLIGHT	LCD backlights OFF • min/typ/max : 0...0...0.2 V LCD backlights ON • min/typ/max : 2.8...3.16...3.3 V
9/X400	BUZZER	Ground
10/X400	GND	
11/X400	SLIDEON	Slide pos. sensing • min/max : 0...3.3 V
12/X400	GENSCLK	Display data clk LOW • min/typ/max : 0...0...0.6 V Display data clk HIGH • min/typ/max : 2.4...3.16...3.3 V

Pin/Conn	Line Symbol	Notes
13/X400	GENSD	Display data line LOW • min/typ/max : 0...0...0.6 V Display data line HIGH • min/typ/max : 2.4...3.16...3.3 V
14/X400	LCDENX	Display driver Enable • min/typ/max : 0...0...0.9 V Display driver Disable • min/typ/max : 2.4...3.16...3.3 V
15/X400	VB	Battery voltage • min/typ/max : 5.3...6.0...10.26 V
16/X400	XPWRON	Power key free, pull up in PSCLD • min/typ/max : 5.3...6.0...10.26 V Power key pressed • min/max : 0...0.4 V
17/X400	EARN	Negative Earpiece Terminal • min/typ/max : 0...14...220 mVAC
18/X400	EARP	Positive Earpiece Terminal • min/typ/max : 0...14...220 mVAC
19/X400	CALL_LED	Call indicator LED OFF • min/typ/max : 0...0...0.4 V Call indicator LED ON • min/typ/max : 2.4...3.16...3.3 V
20–25/X400	UIF(0:5)	LCD driving and keyboard ROW reading
26–29/X400	COL(0:3)	Column scan for key matrix

LCD Display Module Connector X401

Pin/Conn	Line symbol	Signal description
1/X401	V5	LCD driver supply voltage
2/X401	V4	LCD driver supply voltage
3/X401	V3	LCD driver supply voltage
4/X401	V2	LCD driver supply voltage
5/X401	V1	LCD driver supply voltage
6/X401	VDD	Supply voltage
7/X401	VR	Voltage adjustment pin
8/X401	VOUT	DC/DC voltage converter capacitor
9/X401	CAP2–	DC/DC voltage converter capacitor

Pin/Conn	Line symbol	Signal description
10/X401	CAP2+	DC/DC voltage converter capacitor
11/X401	CAP1–	DC/DC voltage converter capacitor
12/X401	CAP1+	DC/DC voltage converter capacitor
13/X401	GND	Ground
14/X401	OSC1	Feedback resistor of built–in osc.
15/X401	OSC2	Feedback resistor of built–in osc.
16/X401	GND	Ground
17/X401	A0	Control/display data flag input
18/X401	C86	μP interface select input
19/X401	CS2	Chip select input
20/X401	CS1	Chip select input
21/X401	P/S	Parallel/serial data input select
22/X401	SI	Serial data input
23/X401	SCL	Serial clock input
24/X401	RES	Reset
25/X401	VDD	Supply voltage

Technical Outline

Mechanics

The modules are made from a single flexible printed circuit board – loaded with SMD components. A Flexible PCB was used for a number of reasons:

– The material is only 0.3mm thick – so the phone's height buildup can be kept to a minimum.
– The Volume and Power keys wiring can be folded to fit in the phone during assembly – since the circuit is flexible.
– Bending of UI–module

The major mechanical parts on the UIF assembly include the following:

– Display Module: LCD, LCD driver TAB circuit & Light–guide.
– Main Keydome assembly: Adhesive film holding 20 metal dome clickers
– Volume Keydome assembly: Adhesive film holding 2 metal dome clickers .
– Power Keydome assembly: Adhesive film holding 1 metal dome clicker
– Acoustic Components: Microphone and speaker connection to UI–board by using spring contacts

Electronics

The following sections of circuitry are included on the Flexi:

- Microphone Circuit
- Speaker Circuit
- Buzzer Circuit
- LCD Display Module
- LCD voltage divider circuit.
- Keyboard & Display lighting circuits
- Keyboard switch matrix.
- Power & Volume control switch matrix.
- Slide position sensing circuit.

Functional Description

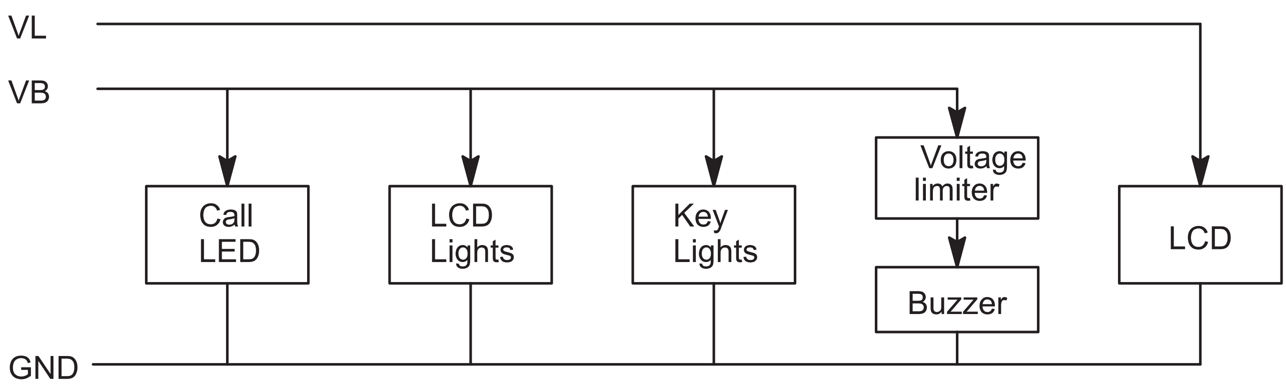
Circuit Description

The module is connected with 30 pin connector (X400) to the system board.

The module includes following main functional blocks:

- Keyboard
- Illumination
- audio block
    - microphone pads
    - earpiece pads
    - buzzer
- LCD interface
- Slide position sensing

Power Distribution



Led Drivers

The keyboard illumination is achieved by using two transistors (BCX19) wired as simple constant current sinks. Both transistors supply six LED‘s, so the keyboard is illuminated with 12 LED‘s. The bases of the two transistor are wired together and controlled by MCU via PSCLD. The led current is fixed by the values of R401 and R402 and the ratio of R411 to R413.

The display illumination operates in a similar way to the keyboard drivers, but only one transistors (V402) is used to drive six leds. The current in this case is defined by the value of R414 and the ratio of R412 to R404.

Call Indicator

The Call LED is fed from a simple emitter follower (V400). The led current is fixed by the value of R400.

Buzzer Driver

The buzzer is driven from NPN transistors (V403 and V425), which act as a buffer for a CMOS output signal applied at BUZZER.

The ringing volume is controlled by pulse width modulation.

The diode V413 prevents damage to the transistors when they switch off, absorbing the stored energy in the buzzer inductance and suppressing large positive going spikes on the transistor collectors.

Audio Circuitry

The microphone is routed through RF–suppression to UIF–connector X400 (pins 1 and 2)

The earpiece is routed directly to UIF– connector X400 (pins 17 and 18).

RF Suppression

Small value ceramic capacitors are fitted to audio lines to avoid problems with rf interference. In microphone lines, C406, C407, C412, C413, L1 and L2 trap common mode noise. Capacitors C410 and C411 have been placed near the earpiece pads.

Keyboard Scanning and Display Driver Control

COL(0–3) are used as column lines on keyboard. UIF(0–5) are used as row lines. UIF5 is also multiplexed with the display driver control signal.

When a key is pressed, the system ASIC gets an interrupt from a row and the MCU starts scanning. One column at a time is written to LOW and rows are used to read which key it was.

LCD Module

The LCD module includes the LCD and the display driver. The driver TAB has been connected to the LCD. The display driver type is SED1560 from SEIKO EPSON. It has an internal clock oscillator and a negative voltage generator to generate a negative rail required for operation. The oscillator frequency is fixed by the resistance from pins 16 to 17 of LCD– connector X401, with the value of R415, the frequency should be about 18kHz

The display driver is connected to the system board with a serial data bus. Data input is enabled when CS1 is LOW. A0 is control/display data flag input. Incoming data is control data when A0 is LOW, and display data when A0 is HIGH. Serial data is read on the rising edge of SCL. On every eight clock pulse, the data is transferred from the shift register and processed as 8–bit parallel data. A0 is read on the rising edge of every eight clock signal.

Circuit Diagram of GU8

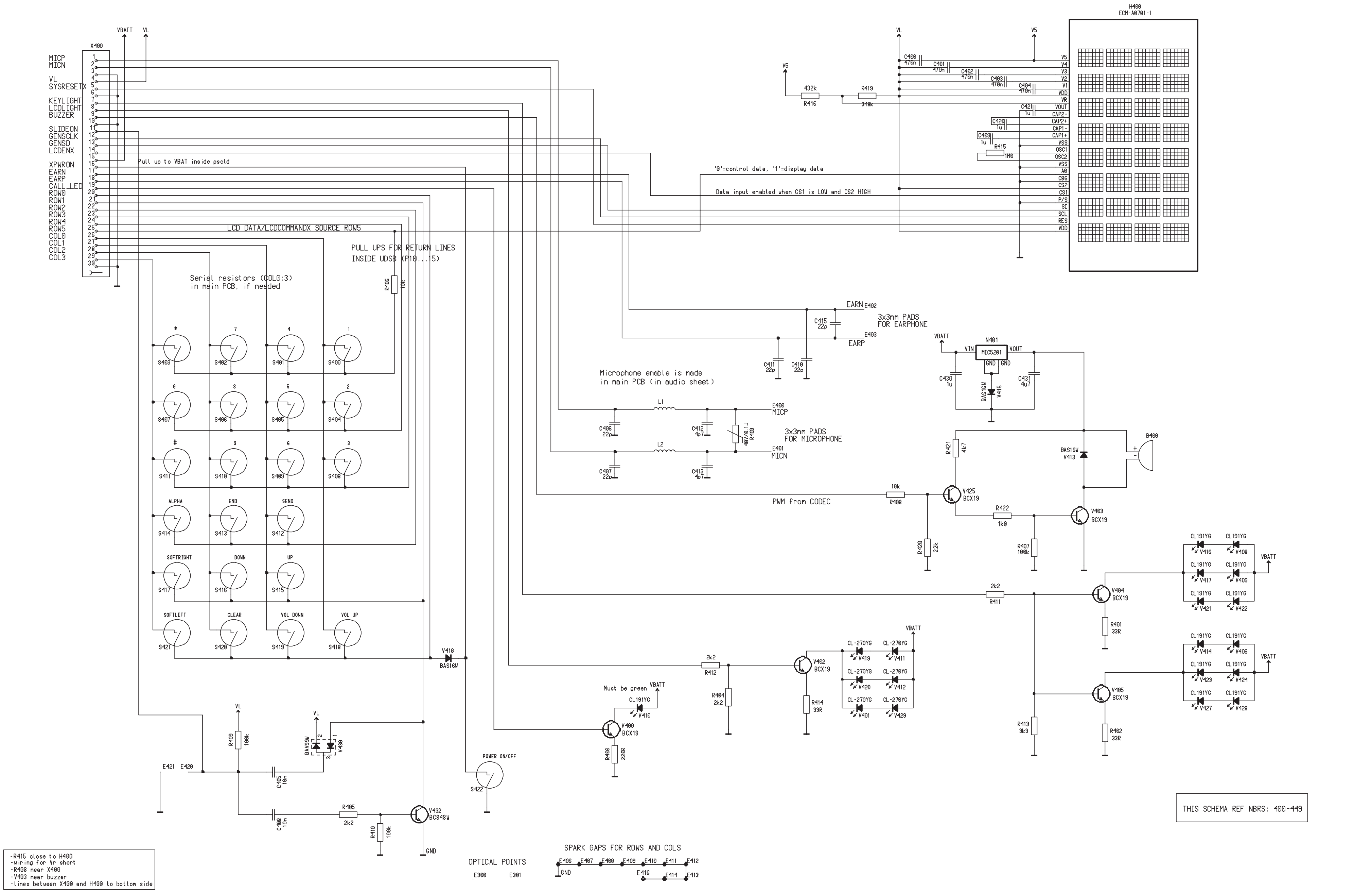
Layout Diagram of GU8

Parts List of GU8 (EDMS issue: 1.9)   Code: 0200558

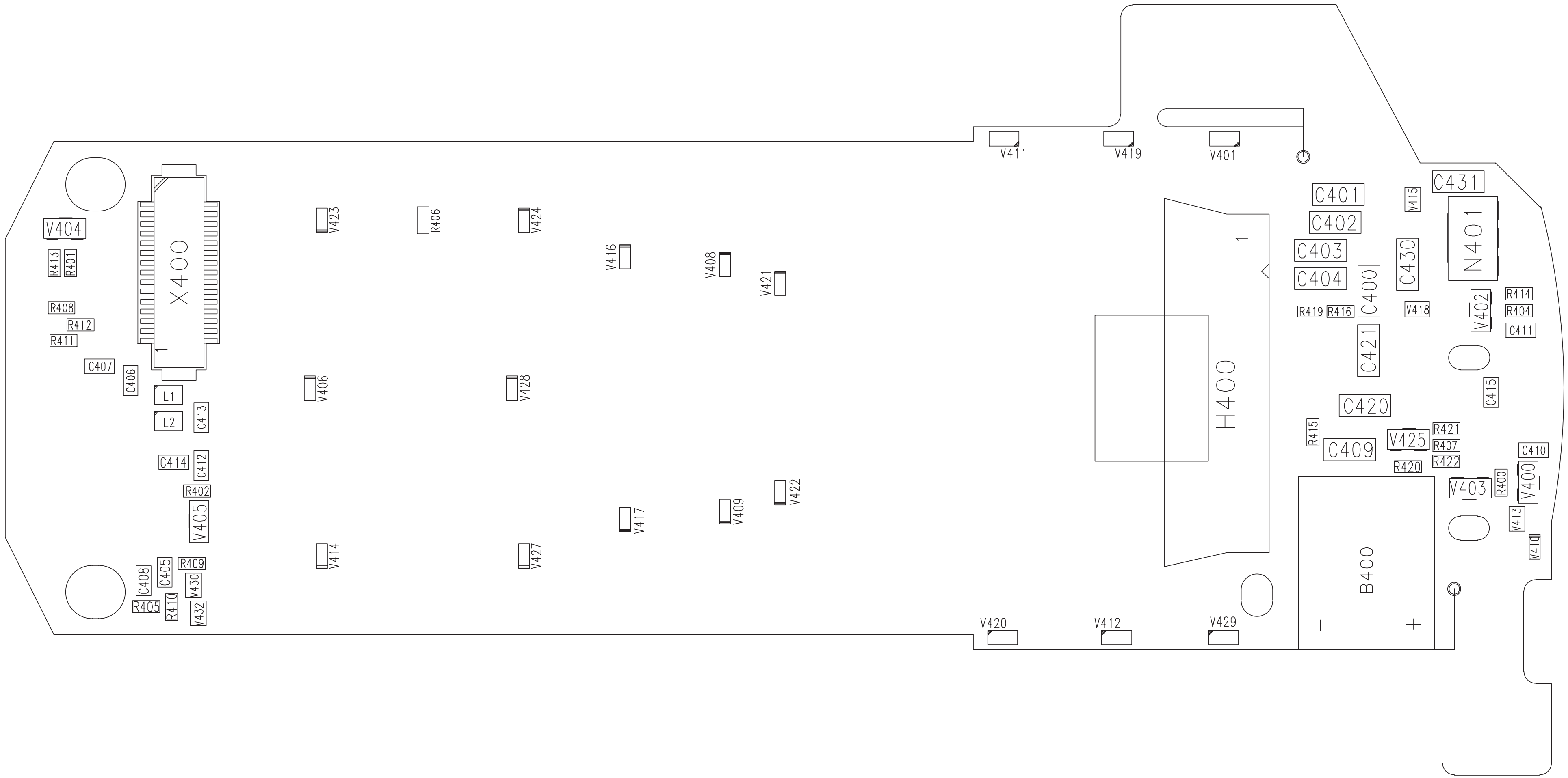
ITEM	CODE	DESCRIPTION	VALUE	TYPE
R400	1430009	Chip resistor	220	5 % 0.063 W 0603
R422	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R404	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R411	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R412	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R405	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R413	1430047	Chip resistor	3.3 k	5 % 0.063 W 0603
R406	1430047	Chip resistor	3.3 k	5 % 0.063 W 0603
R421	1430051	Chip resistor	4.7 k	5 % 0.063 W 0603
R408	1430065	Chip resistor	10 k	5 % 0.063 W 0603
R420	1430071	Chip resistor	22 k	5 % 0.063 W 0603
R409	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R407	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R410	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R415	1430111	Chip resistor	1.0 M	5 % 0.063 W 0603
R419	1430113	Chip resistor	348 k	1 % 0.063 W 0603
R401	1430163	Chip resistor	33	5 % 0.063 W 0603
R402	1430163	Chip resistor	33	5 % 0.063 W 0603
R414	1430163	Chip resistor	33	5 % 0.063 W 0603
R416	1430199	Chip resistor	432 k	1 % 0.063 W 0603
R403	1825001	Chip varistor vwm18v vc40v	0603	0603
C400	2310408	Ceramic cap.		Y5 V 1206
C401	2310408	Ceramic cap.		Y5 V 1206
C402	2310408	Ceramic cap.		Y5 V 1206
C403	2310408	Ceramic cap.		Y5 V 1206
C404	2310408	Ceramic cap.		Y5 V 1206
C431	2312293	Ceramic cap.		Y5 V 1206
C430	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C409	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C420	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C421	2312410	Ceramic cap.	1.0 u	10 % 16 V 1206
C412	2320027	Ceramic cap.	4.7 p	0.25 % 50 V 0603
C413	2320027	Ceramic cap.	4.7 p	0.25 % 50 V 0603
C406	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C407	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C410	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C411	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C415	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C405	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C408	2320110	Ceramic cap.	10 n	10 % 50 V 0603
L001	3640011	Filt z>600r/100m 0r6max 0.2a 0805		0805
L002	3640011	Filt z>600r/100m 0r6max 0.2a 0805		0805
V413	4110070	Diode	BAS16W	75 V 0.25 A SOT323

V418	4110070	Diode	BAS16W	75 V 0.25 A SOT323
V415	4110070	Diode	BAS16W	75 V 0.25 A SOT323
V430	4110072	Diode x 2	BAV99W	70 V 0.2 A SOT323
V400	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V402	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V404	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V405	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V403	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V425	4200836	Transistor	BCX19	npn 50 V 0.5 A SOT23
V432	4210100	Transistor	BC848W	npn 30 V SOT323
N401	4340065	Mic5201 regld 5v 0.2a 1%	sot223	SOT223
H400	4850073	IC, lcd+driver graphic do	DSL/HD843	DOTM
V401	4860005	Led	Green	0603
V411	4860005	Led	Green	0603
V412	4860005	Led	Green	0603
V419	4860005	Led	Green	0603
V420	4860005	Led	Green	0603
V429	4860005	Led	Green	0603
V406	4864389	Led		0603
V408	4864389	Led		0603
V409	4864389	Led		0603
V410	4864389	Led		0603
V414	4864389	Led		0603
V416	4864389	Led		0603
V417	4864389	Led		0603
V421	4864389	Led		0603
V422	4864389	Led		0603
V423	4864389	Led		0603
V424	4864389	Led		0603
V427	4864389	Led		0603
V428	4864389	Led		0603
B400	5140029	SM, d buzzer 94db 5vdc40r	14x11	14x11x3
X400	5469288	SM, conn 2x15 f p0.8 pcb/pcb 2.8		2.8MM
	9460168	Reflector dmc00050 nhc–6		
	9460217	Buzzer gasket dmd02853 nhe–6 gu		GU8
	9790163	Volyme keypad dmd000097		
	9790164	Power keypad dmc00009 nhe–6		
	9795018	Keydomes		4C25593 NHE–6
	9795019	Keydomes		4C25596 NHE–6
	9855024	PCB FLEX GU8 202.5X135.9 D 3/PA		
	9855024	PC board	FLEX	gu8 202.5x135.9 d 3/pa

Circuit Diagram of GU8 (Version: 8.0 Edit: 89)



Layout Diagram of GU8 (Version 09)



Appendix 1
TRANSCEIVER NHE–6NX
VARIANTS

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 2	**08/98**	O Juntunen	Appx.1 and 3 merged, App.2 never existed

NHE–6 Transceiver

This page intentionally left blank.

Introduction

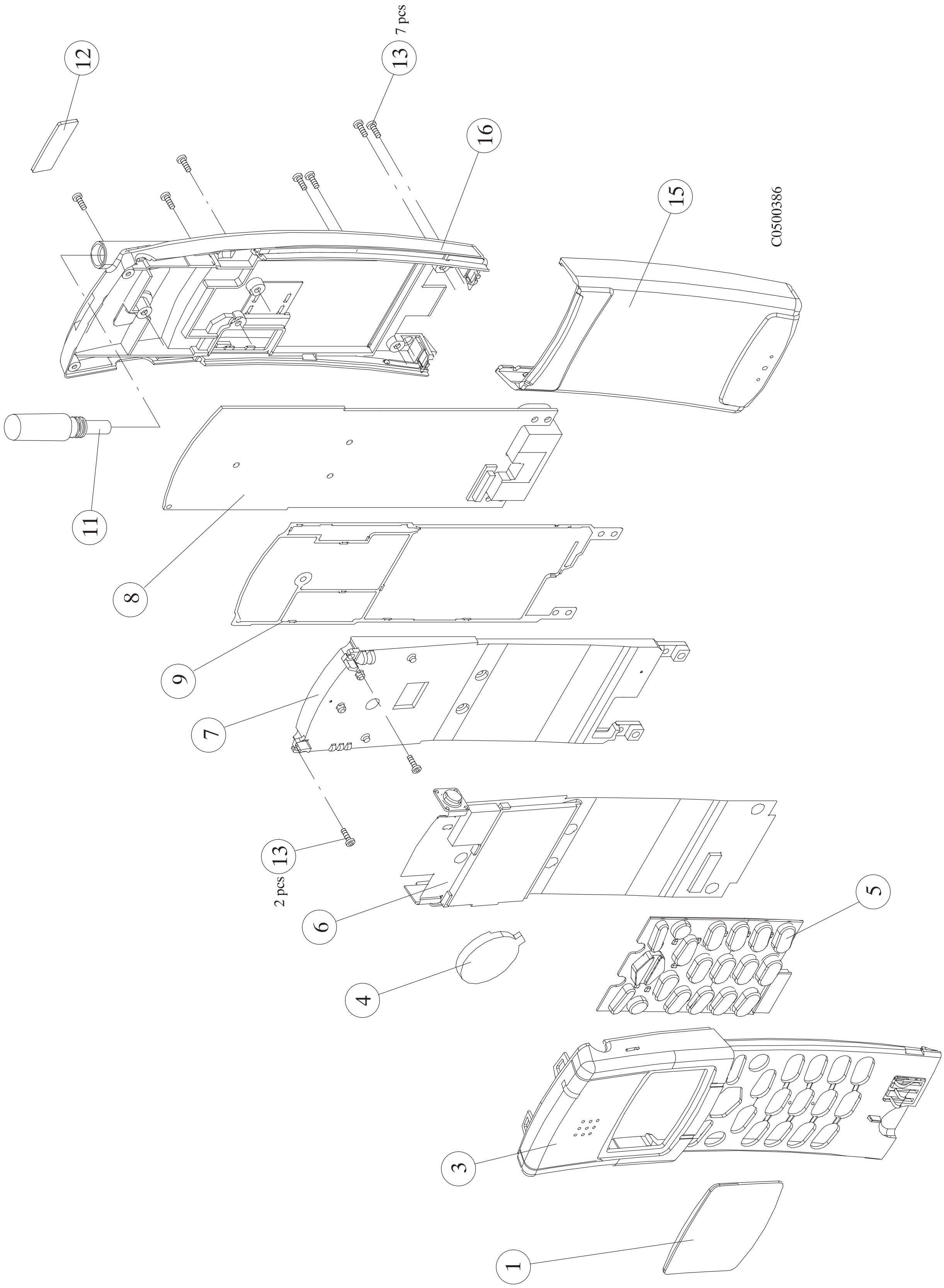
General

The NHE–6NX transceiver variant is described here.

Product and Module List of NHE–6NX

Unit/type:	Product code:	Module code:
Transceiver NHE–6NX	0500386	
• system module GJ8		0200591
• UIF module GU8		0200558
• MCU SW Module		0240265
• mechanics MNHE6NX		0260563

Exploded View of Transceiver NHE–6NX



Assembly Parts of Transceiver NHE–6NX

ITEM	Q'TY	CODE	DESCRIPTION	VALUE, TYPE
1		9457311	Window	DMC00010
		9457937	Window (i–version)	DMC01189
3		9457293	Front cover	DMC00063
4		5140035	Speaker and spring	32 Ω 20 mm;
5		9790165	Keypad	DMC00007
6		0200558	UIF module GU8	
7		9460182	Shield	DMC00098
8		0200591	RF/System module GJ8	
9		9510341	Metal gasket	DMD01567
11		0660126	Antenna Helical GSM 890–960 MHz	
12		9430106	Logo plateDMD00356	
13	9	6190003	Screw	M1.6x6
15		9457314	Slide cover	DMC00049
16		9460181	Back part	DMC00099
		9790164	Power keypad	DMC00009
		9790163	Volume keypad	DMD00097
		9380535	Continuous sheet (print acc.	DMP00381)
		9450581	Connector cover	3D 25768
		9480285	Buzzer gasket	DMD01180

This page intentionally left blank.

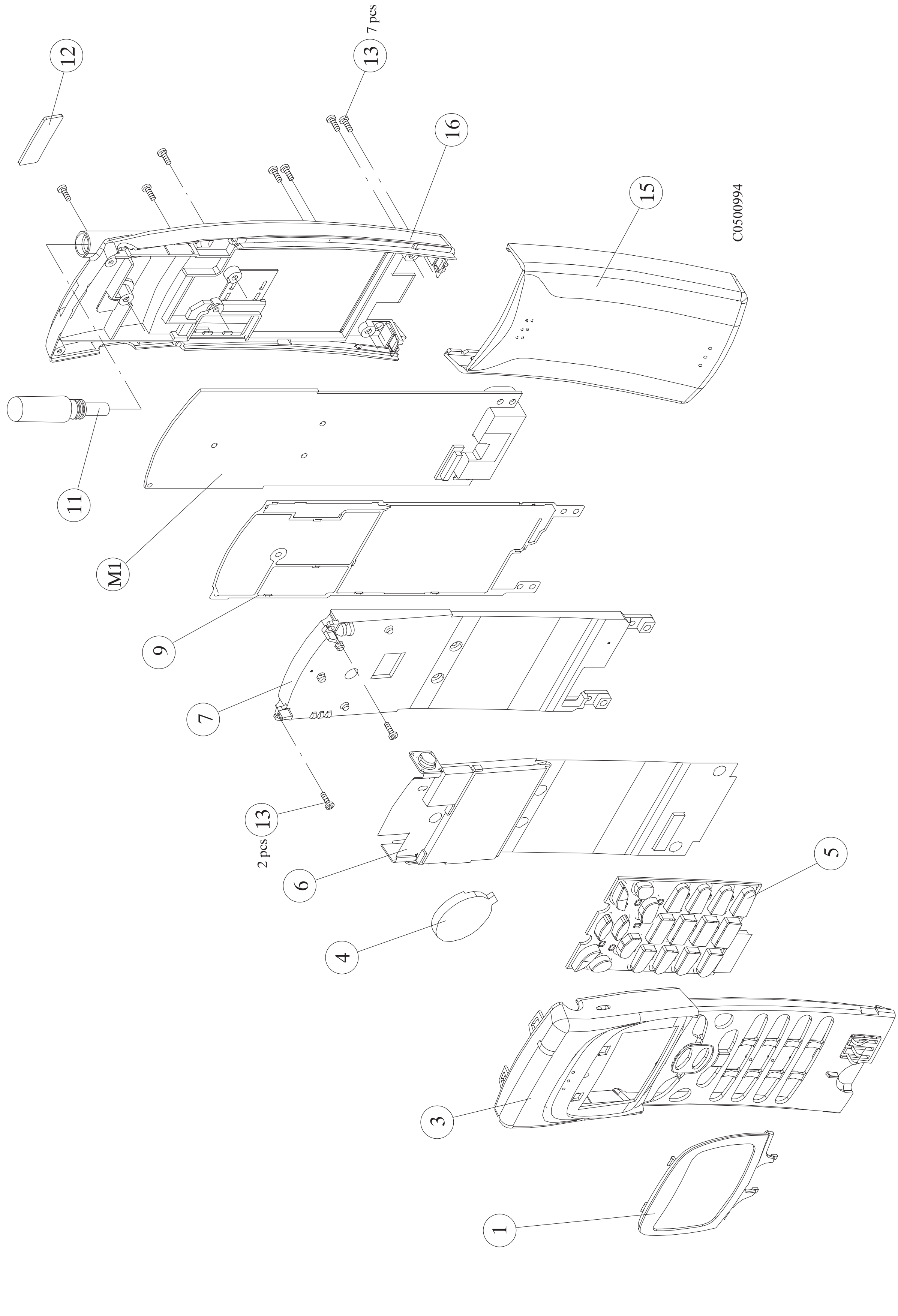
Introduction to Transceiver NHE–6BM

The NHE–6BM transceiver, together with battery pack ensures all the desirable features e.g. alphanumeric display and keypad, menu–control, shortcode memory, retractable antenna etc. are available in a very small and light cellular handportable.

Product and Module List of NHE–6BM

Unit/type:	Product code:	Module code:
Transceiver NHE–6BM	0500994	
• system module GJ8A		0201017
• UIF module GU8		0200558
• MCU SW Module		0240363
• mechanics MNHE6BX		0260838

Exploded View of Transceiver NHE–6BM



Assembly Parts of Transceiver NHE–6BM

ITEM	Q'TY	CODE	DESCRIPTION	VALUE, TYPE
1		9457862	Window	DMC00954
1		9457937	Window	DMC01189
3		9457362	A–cover assembly	DMC00198
4		5140035	Dynamic earpiece capsule	32Ω 20 mm
5		9790205	Printed keymat	DMC00204
6		0200558	UIF module	GU8
7		9460182	Shield	DMC00098
M1		0201017	RF/System module	GJ8A
9		9510341	Metal gasket	DMD01567
11		0660126	Antenna Helical GSM 890–960 MHz	
12		9430106	Logo plate	DMD00356
13	9	6190003	Screw M1.6x6	DMD00525 T6
15		9457359	Slide assembly style–2	DMC00193
16		9460181	Back part	DMC00099
		9380535	Continuous sheet (print acc.	DMP0001913)
		9790164	Power keypad	DMC00009
		9790163	Volume keypad	DMD00097
		9450581	Connector cover	3D 25768
		9480285	Buzzer gasket	DMD01180

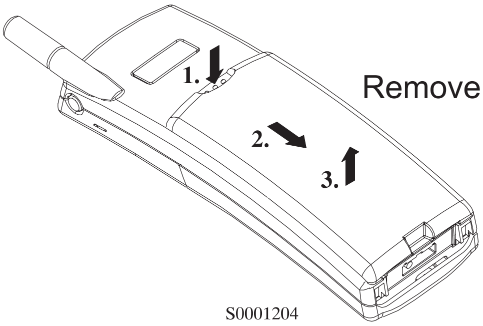
This page intentionally left blank.

NHE–6/NHK–6 DISASSEMBLY INSTRUCTIONS

AMENDMENT RECORD SHEET

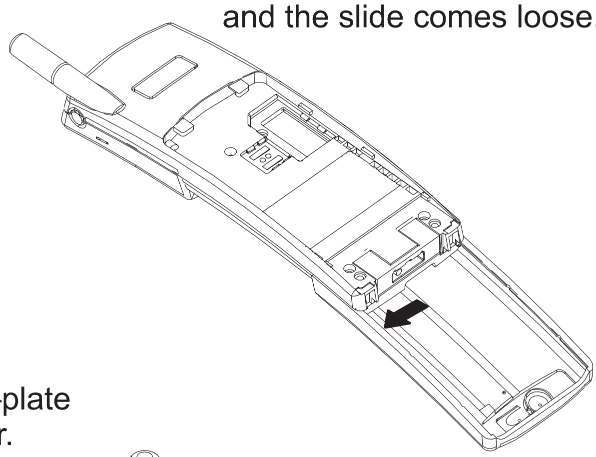
Amendment Number	Date	Inserted By	Comments
Issue 2	**12/97**	J Rantala	Torque info added on p.3 & p.4 font case mounting added, repaginated

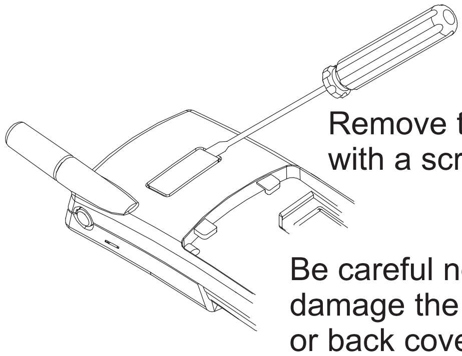
Disassembly Instructions



Remove the battery.

Open the slide. Push lightly to the direction of the arrow and the slide comes loose.

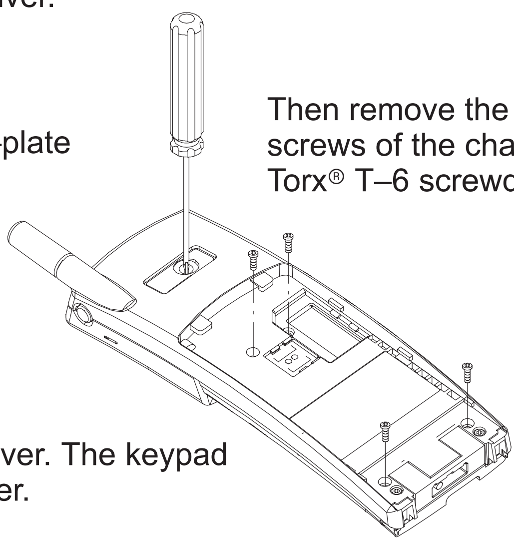




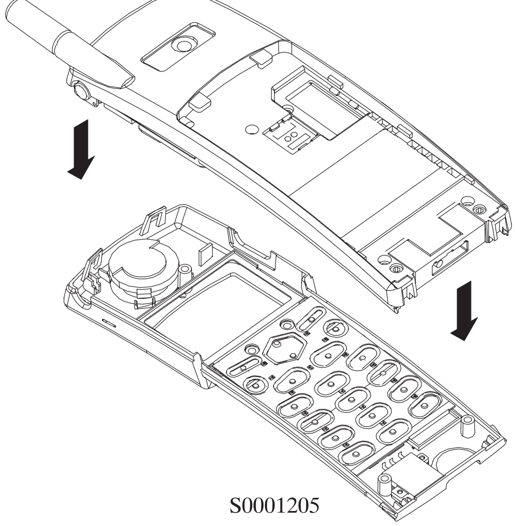
Remove the logo–plate with a screw driver.

Be careful not to damage the logo–plate or back cover.

Then remove the five screws of the chassis with Torx® T–6 screwdriver.

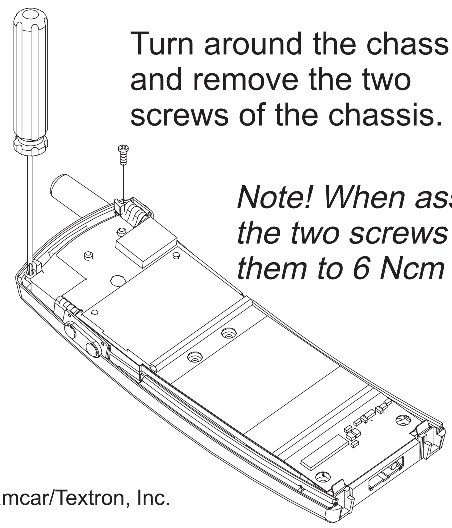


Remove the front cover. The keypad follows the front cover.

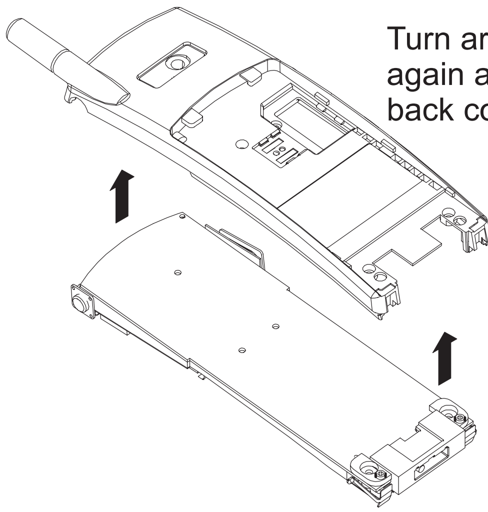


Turn around the chassis and remove the two screws of the chassis.

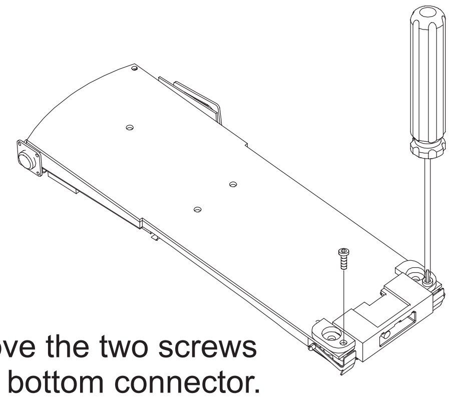
Note! When assembling the two screws tighten them to 6 Ncm torque.



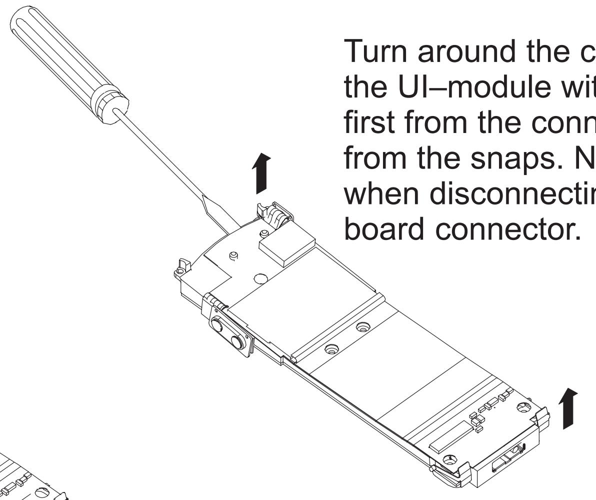
Torx® is trademark of Camcar/Textron, Inc.



Turn around the chassis again and remove the back cover.

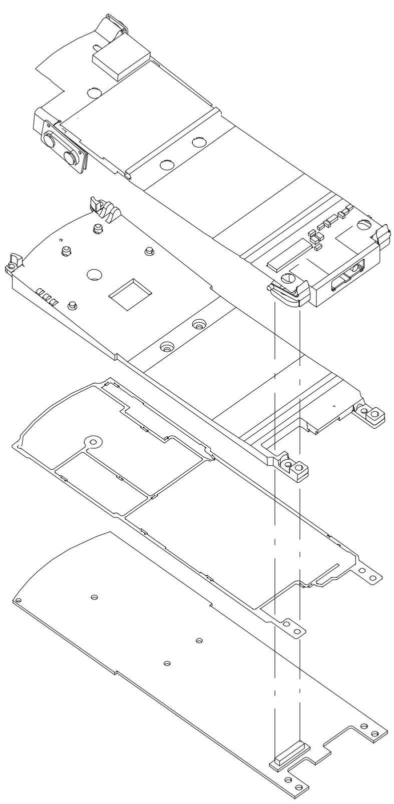


Remove the two screws of the bottom connector.



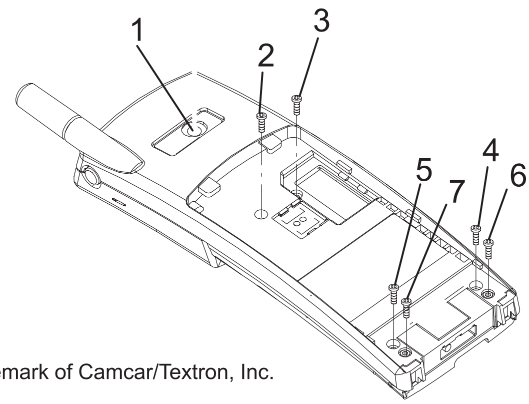
Turn around the chassis and remove the UI–module with a screw driver, first from the connector and then from the snaps. Note: Be careful when disconnecting the board–to–board connector.

S0001206



Now the parts can be separated.

Note! In assembly of the seven Torx® T–6 screws use tightening order below. Drive the screws to torque of 0.20 ± 0.02Nm.



Torx® is trademark of Camcar/Textron, Inc.

Front Cover Installation

NOTE: If A–cover does not include the speaker, follow instruction in section: Speaker Installation.

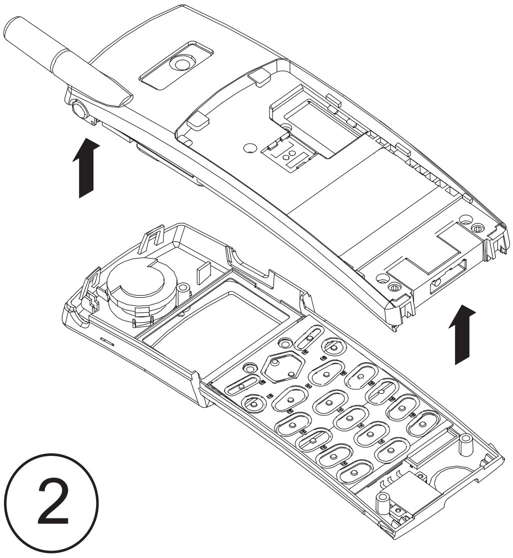
1

Check that inside of the window is free of dust or rubbish.

Place the keypad in Front Cover and then press front and back cover together.

Make sure that:

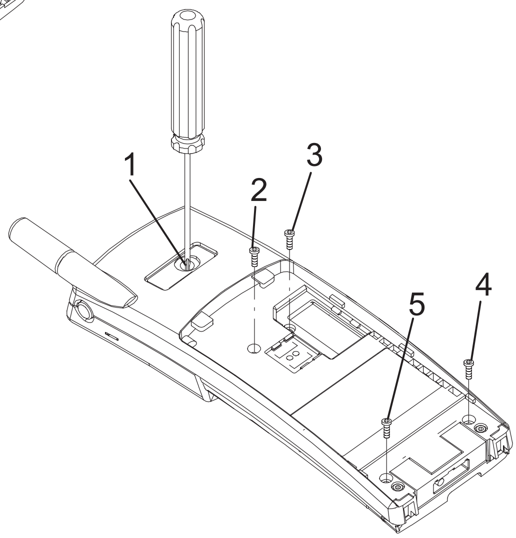
1 Snaps at upper end lock to each other securely.
2 Power or volume keys are not squashed between front and back cover.
3 Buzzer sound hole isn't blocked by the buzzer gasket.



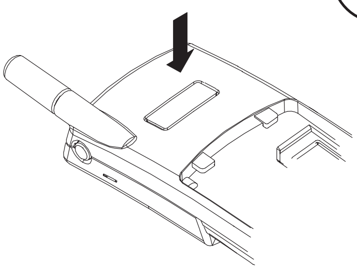
2

Screw on five Torx® T–6 screws to torque 0.20 ± 0.02Nm

Screw them on at order shown right.



3



If logo–plate slot at back cover has any glue residues, remove them.

Install logo–plate and press it firmly onto the back cover by fingers.

Use of a new logo–plate is recommended to ensure good adhesion to back cover.

Torx® is trademark of Camcar/Textron, Inc.

This page intentionally left blank.

NHE–6 & NHK–6 INSTALLATION INSTRUCTIONS

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments

NHE–6 & NHK–6 INSTALLATION INSTRUCTIONS

Contents

Introduction

General

This installation guide has been prepared to provide the basic information necessary to install car kits. This guide is not intended to be definitive, because different types and models of vehicle will require different installation work. The information given is for general guidance only.

The terms of warranty demand that this car kit be installed by an experienced installation facility. An end user should never attempt to install this car kit without professional assistance as the installation requires special tools and knowledge.

Please refer to the telephone’s user guide for instructions on the telephone’s operation, care and maintenance, including important safety information.

Note: Read the warnings below before beginning the installation procedure.

WARNINGS

1 **ENSURE THAT THE VEHICLE BATTERY IS DISCONNECTED BEFORE YOU START THE INSTALLATION PROCEDURE, AND THAT IT REMAINS DISCONNECTED DURING THE PROCEDURE.**

2 **DO NOT SMOKE OR USE OPEN FLAMES WHEN WORKING NEAR THE VEHICLE’S FUEL SYSTEM.**

3 **ENSURE THAT ELECTRICAL CABLES, HYDRAULIC LINES AND FUEL LINES ARE NOT DAMAGED DURING INSTALLATION.**

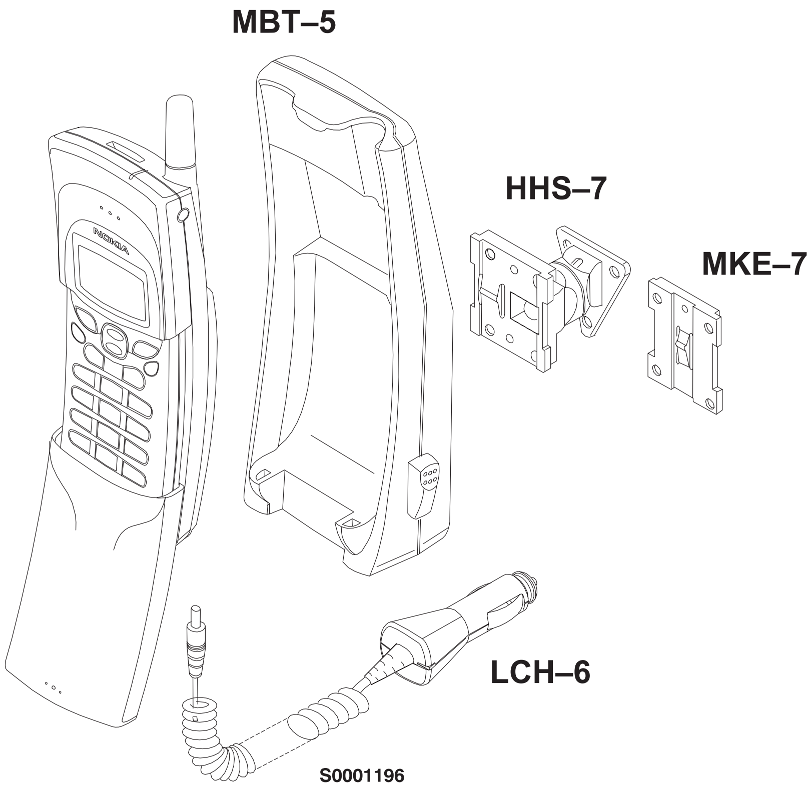
4 **ENSURE THAT NORMAL CONTROL AND OPERATION OF THE VEHICLE IS NOT IMPAIRED BY THE INSTALLATION, PARTICULARLY THE BRAKES AND STEERING.**

5 **ALTHOUGH ELECTRONIC SPEED CONTROL, ABS ANTI–LOCK BRAKE AND FUEL INJECTION SYSTEMS ARE RELATIVELY IMMUNE TO MALFUNCTION CAUSED BY NEARBY RADIO TRANSMISSIONS, SHOULD YOU EXPERIENCE FALSE OPERATION OF THESE SYSTEMS OR ARE IN ANY DOUBT WHATSOEVER AS TO THEIR FUNCTIONALITY, PLEASE CONSULT THE VEHICLE DEALER.**

6 **THE CAR KIT IS SUITABLE FOR USE ONLY IN VEHICLES WITH A 11..32 V NEGATIVE GROUNDING. USE ON OTHER SUPPLY VOLTAGES OR ALTERNATIVE POLARITY WILL DAMAGE THE EQUIPMENT.**

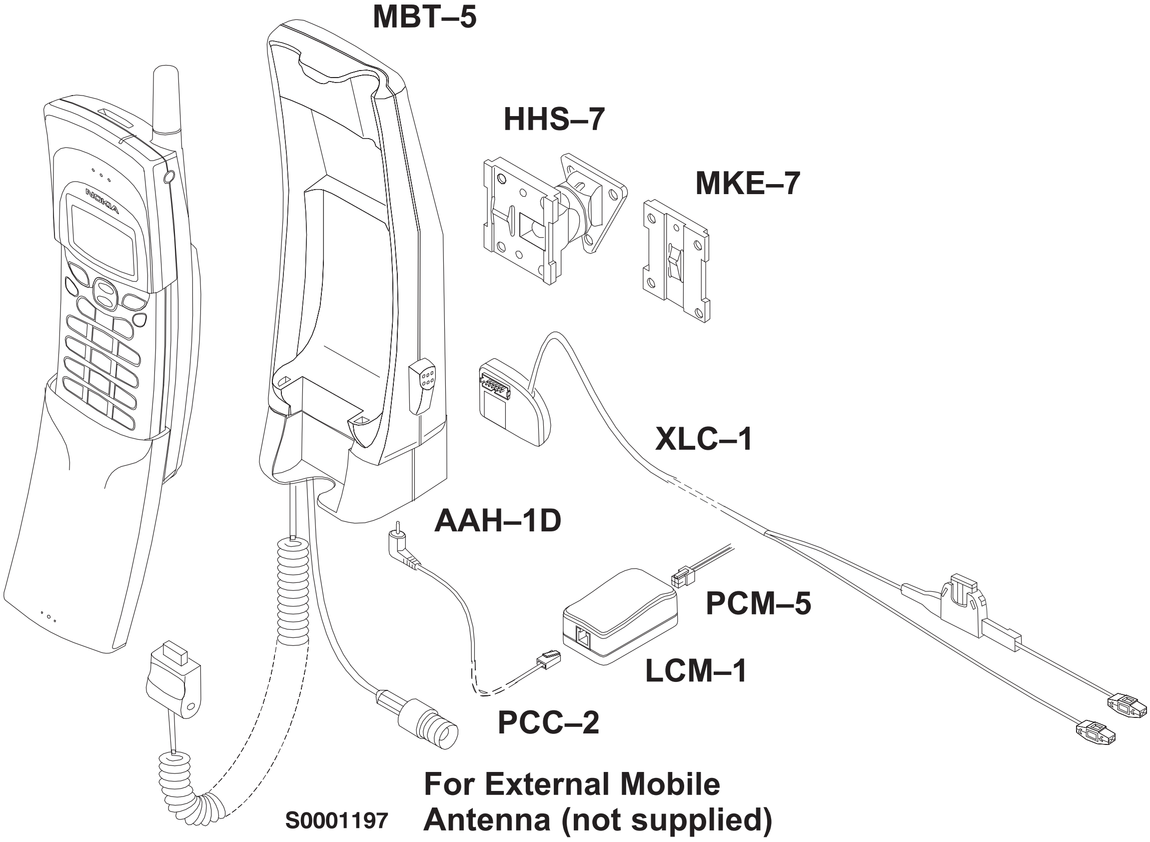
7 **THE PHONE SHOULD NOT BE LEFT SWITCHED ON FOR EXTENDED PERIODS WITHOUT RUNNING THE VEHICLE’S ENGINE. FAILURE TO COMPLY COULD DRAIN THE VEHICLE’S BATTERY.**

Basic Car Kit (CARK–48)



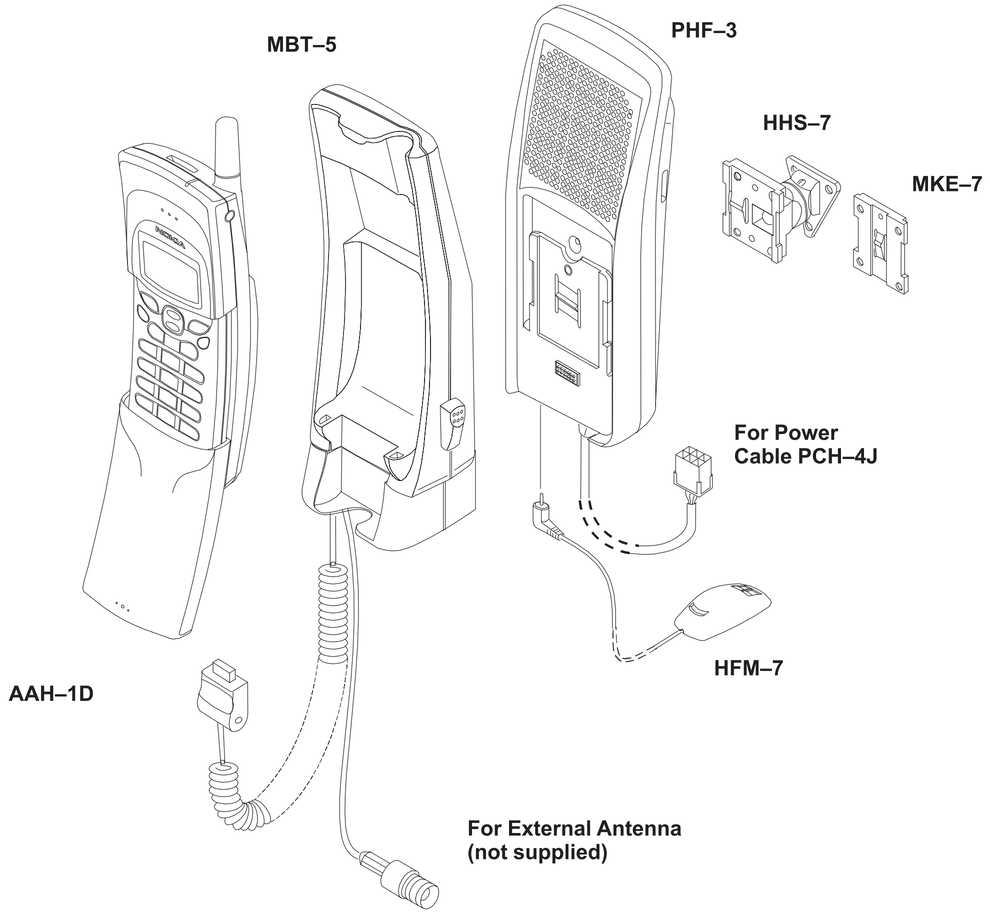
Product Name:	Type:	Code:
Phone Holder	MBT–5	0620030
Mounting Plate	MKE–7	0650021
Swivel Mounting Plate	HHS–7	0650020
Universal Mobile Charger	LCH–6	0675076

Extended Car Kit (CARK–51)



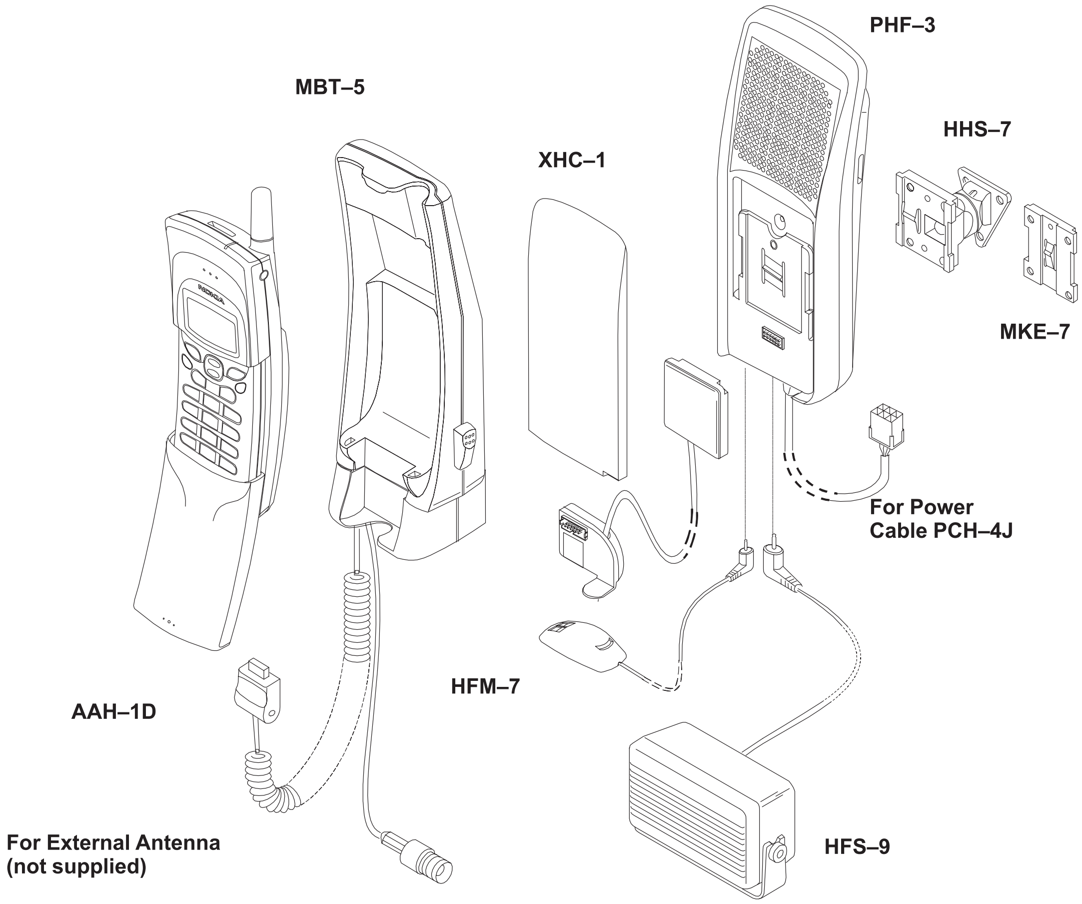
Product Name:	Type:	Code:
Phone Holder	MBT–5	0620030
Mounting Plate	MKE–7	0650021
Swivel Mounting Plate	HHS–7	0650020
External Antenna Unit	AAH–1D	0750077
Universal Mobile Charger	LCH–6	0675076
Fixed Mobile Charger	LCM–1	0675077
Power Cable	PCM–5	0730058
Light Guide Cable	XLC–1	0730062

Complete Car Kit (CARK–68)



Product Name:	Type:	Code:
Phone Holder	MBT–5	0620030
Standard Handsfree Unit	PHF–3	0694030
Mounting Plate	MKE–7	0650021
Swivel Mounting Plate	HHS–7	0650020
Power Cable	PCH–4J	0730055
External Antenna Unit	AAH–1D	0750077
Handsfree Microphone	HFM–7	0690012

Professional Car Kit (CARK–74)



Product Name:	Type:	Code:
Phone Holder	MBT–5	0620030
Standard Handsfree Unit	PHF–3	0694030
Mounting Plate	MKE–7	0650021
Swivel Mounting Plate	HHS–7	0650020
Power Cable	PCH–4J	0730055
External Antenna Unit	AAH–1D	0750077
Handsfree Microphone	HFM–7	0690002
Handsfree Speaker	HFS–9	0690012
Extension Cable	XHC–1	0730060

Component Parts

Mounting Plate MKE–7 and Swivel Mounting Plate HHS–7

MKE–7 is a fixed position mounting plate; HHS–7 is a swivel mounting plate which allows for adjustable fixing. Both two mounting plates are interchangeable.

Phone Holder MBT–5

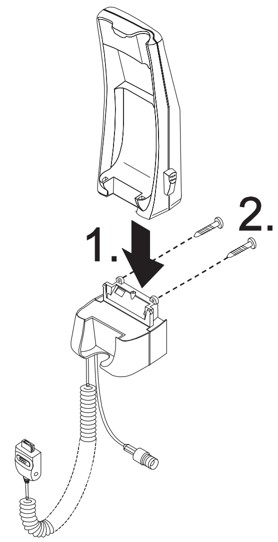
The phone holder allows the phone to be firmly located in a convenient position. The phone holder is attached to the vehicle's interior using mounting plate MKE–7 or alternatively swivel mounting plate HHS–7. The mounting must be secured with a screw (delivered with MKE–7/HHS–7).

Universal Mobile Charger LCH–6

The universal mobile charger enables the phone to be charged via the vehicle's cigarette lighter socket. The charger connects to the phone via a d.c. jack socket located on the base of phone. The supply voltage may vary between 11 and 32 V.

External Antenna Unit AAH–1D

The external antenna unit allows an external antenna to be connected to the phone's antenna when the phone is located in the mobile holder. The external antenna unit is fastened to the bottom of the phone holder as shown below.



Power is supplied either from the vehicle's battery via the fixed mobile charger, LCM–1 or from the cigarette lighter socket via the universal mobile charger, LCH–6 (not supplied).

Fixed Mobile Charger LCM–1

The fixed mobile charger provides a power supply for the external antenna unit and the mobile phone.

Output Power Cable PCC–2

The output power cable connects the fixed mobile charger to the external antenna unit.

Power Cable PCM–5

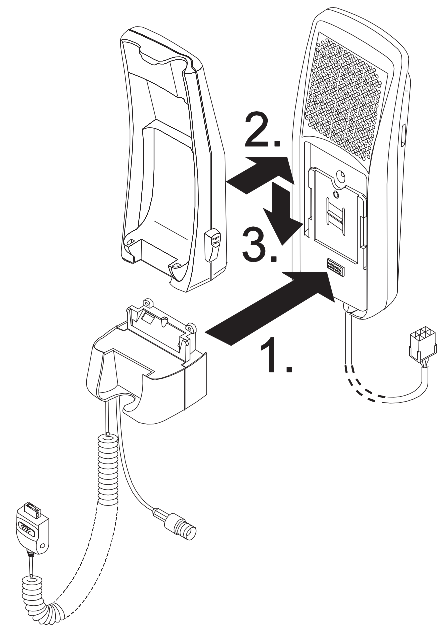
The power cable connects the fixed mobile charger, LCM–1, to the vehicle's power supply. The red wire must be connected to the + voltage supply controlled by the vehicle's ignition key via the supplied fused connector. The black wire must be attached to a good negative GND connection.

Standard Handsfree Unit PHF–3

The standard handsfree unit enables the phone to operate in handsfree mode. The unit is attached to the vehicle interior using mounting plate MKE–7, or swivel mounting plate HHS–7. The mounting must be secured with a screw (delivered with MKE–7/HHS–7). A temporary installation can be achieved using installation belts (not supplied).

Power is supplied from the vehicle's battery via the power cable PCH–4J. The standard handsfree unit provides the power supply to the phone via the system connector.

The HF microphone, HFM–7, connects to the MIC socket. The phone holder can be attached to the standard handsfree unit as shown.



Power Cable PCH–4J

The power cable connects the standard handsfree unit, PHF–3, to the vehicle's power supply. The red wire must be connected to the + voltage on the vehicle's battery via the supplied fused connector. The black wire must be attached to a good negative GND connection.

The blue ignition sense (IGNS) wire is connected to +12 V voltage controlled by the vehicle's ignition key via the supplied fused connector. See section ”Ignition Sense”.

The yellow wire is used for car radio muting (XCRM). The line goes down to 0 volts during a call. See section ”Car Radio Muting”.

The green wire is used for motor antenna (AMC). The voltage in this output is +12 V whenever the phone is on. See section ”Antenna Motor Control”.

Handsfree Microphone HFM–7

The HF microphone connects directly to the standard handsfree unit (to MIC socket).

Extension Cable XHC–1 (optional for PHF–3)

The extension cable allows a phone holder and an external antenna unit together to be connected to the standard handsfree unit when the unit is located on the place apart from the others. Ensure PHF–3 is located so that the incoming voice from the internal speaker is loud enough.

External Mobile Antenna (not supplied)

The external antenna unit is designed to operate with a high quality external antenna. However, due to many different types of antennas being available, an antenna is NOT included as part of this kit. Please, consult the dealer to find out which is the most suitable antena type for your installation.

Installation

There are some important aspects that require special attention in positioning car kit accessories.

The positioning of the phone holder is the most important factor when trying to achieve the most comfortable position for the user. The location of the holder should be selected so that the visibility of the phone’s display is good under all lighting conditions, but not so that the driver’s attention is easily distracted. The holder should be located so that the driver can easily reach the keypad. Under no circumstances should the holder prevent the driver from controlling or operating the vehicle in any way or observing traffic.

The fixed mobile charger can be installed in a hidden location, since there is no need to disconnect cables during normal operation. Ensure the location does not subject the unit and cables to moisture or mechanical pressure. Also remember clean the mounting tape location properly before installing.

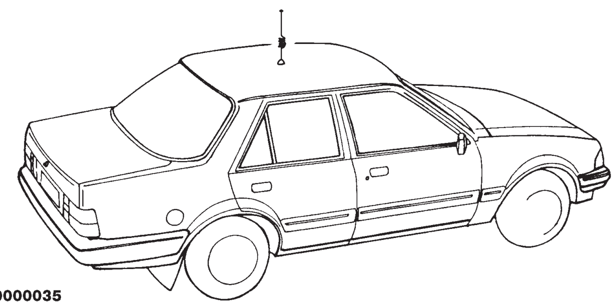
The handsfree microphone can be installed on the driver’s sunvisor or the A–pillar. Ensure the microphone is as close to the driver’s mouth as possible, and attached to a surface that is mechanically quiet. The microphone should be mounted at least 3 ft/1 m away from the handsfree unit speaker to avoid acoustic feedback. See separate microphone installation guide.

Ensure cables are routed as far away as possible from the vehicle’s electronic systems (refer to WARNINGS). Also ensure cables are not subjected to undue mechanical stress e.g. under seats or against sharp edges. The external antenna adapter should always be connected to the antenna via a non–radiating cable (e.g. coax).

The most important component of the installation is the antenna. The location of the antenna as well the quality of the antenna and its installation have a considerable influence to the overall performance of the whole system. Therefore it is necessary to emphasize some aspects, which too often have caused unnecessary service work.

The best place for the antenna is the rooftop. The overall performance of a rooftop antenna is clearly superior to any other antenna type or location. The Antenna shall be mounted in a position such that no part of human body will normally rest too close to any part of the antenna unless there is a an intervening metallic screen, for example, the metallic roof.

- highest place in the car
- proper ground place
- omnidirectional radiation pattern
- minimum risk for disturbances
- user safety



S0000035

After drilling the hole for the antenna remember to clean the hole from the drilling swarf, so that surface is even. This is needed in order to ensure proper and reliable connection between the ground plane and the antenna. After cleaning it is advised to apply some rust–proofing compound to the hole.

Mount the base of the antenna tightly to its place. Consult the antennas manuals for determing the maximum bending angle before attempting any bending operation.

To avoid drilling a hole in the vehicle's bodywork, a glass–mounted antenna can be chosen and located on the rear window of the vehicle.

Try to route the antenna cable so that possible sources of disturbances are avoided, as well anti–skid brake systems. The shorter the antenna cable, the smaller the attenuation, and the better the performance of the antenna. The antenna coupler should always be connected to the antenna via a non–radiating cable (e.g. coax).

Most of the antennas today have adapted the minigrimp connector system which eliminates the need for special grimping tools and connectors. If however the purchased antenna has traditional connectors, use only proper connectors and tools. The antenna coupler uses TNC–female type antenna connector for reasons of reliability and attennuation.

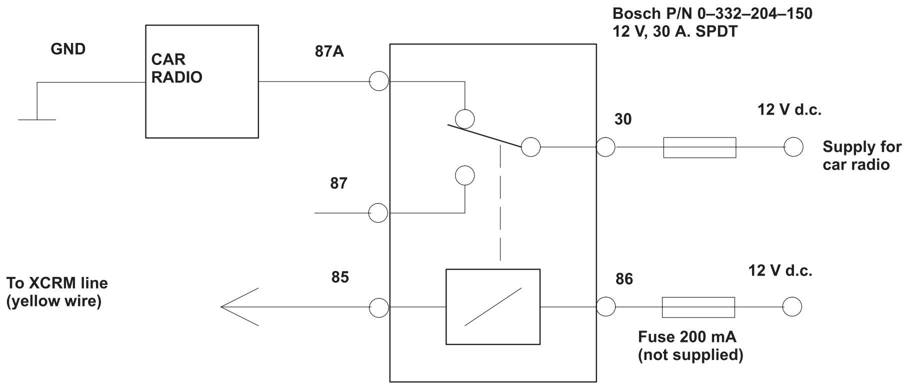
Ignition Sense IGNS

The ignition sense feature prevents your car kit from draining the car battery by executing an auto power off in 20 seconds after the ignition key has been turned off. The blue wire of the power cable is used for the ignition sense feature. The use of ignition sense is recommended to prevent accidental draining of the car's battery. The wire is connected via a 1 A fuse to a 12/24 volt potential that is controlled by the ignition key. Do not connect it directly to the high voltage sections of the ignition circuit.

Car Radio Muting CRM

The car kit offers a feature that can mute the car radio automatically during a conversation. This feature is convenient and provides for safer handsfree operation. The car radio muting feature is based on a grounded line, so it means that in standby, the yellow wire (XCRM) is not grounded and car radio works normally, but during a call, line is grounded and car radio is muted. Note that an auxiliary relay or muting unit must be used when the car radio doesn't have a mute feature available.

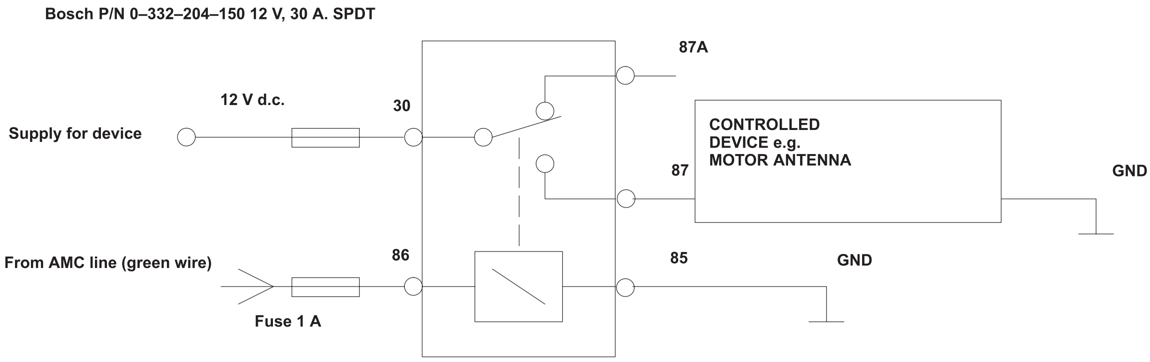
When a relay is used, connect in series with the car radio main supply. A 200 mA fuse should be used to protect the XCRM output in event of a short circuit. Some radios have separate supplies for amplifiers and motors, and another for memory backup purposes. Very often these radios also have a secret code system, which activates itself if a break in the memory supply is detected. Be careful when installing the relay not to break the memory supply (usually marked ACC or +MEM), but to install the relay in the main supply feed.



Another possibility is to use a special muting unit, which mutes the radio by connecting load resistors to the speaker lines of the car radio.

Antenna Motor Control AMC

The antenna motor control offers a feature, green wire of the system cable (AMC), that may be used to control different devices on and off. The voltage in this output is +12 V whenever the phone is on. If the phone is turned off, the voltage disappears. The maximum output current is 200 mA, therefore for example motorized antenna must be controlled via a relay, see picture below.



All installations should take into account any special requirements of the customer. However, should the customer require an installation that is illegal or unsafe these facts must be pointed out to the customer and a policy of non–compliance adopted.

Testing

Once installed, the equipment should be tested to ensure that it is operating satisfactorily and that the position of the units does not impair on the driver’s ability to control and operate the vehicle in any way.

Use the phone to make a call when the vehicle is parked with the engine running. During the call, switch off the engine. Ensure that the phone is operational with the engine running and with the engine switched off. For operating information refer to the ’Owner’s Manual’ supplied with the phone.

This page intentionally left blank.

NHE–6/NHK–6
NON–SERVICEABLE
ACCESSORIES

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments

NHE–6/NHK–6 NON–SERVICEABLE ACCESSORIES

Contents

List of Non–Serviceable Accessories

Battery Pack BLJ–2

The BLJ–2 is a Li–ion light battery back to provide an acceptable level of performance in a package (ie including phone) weighing 151 g.

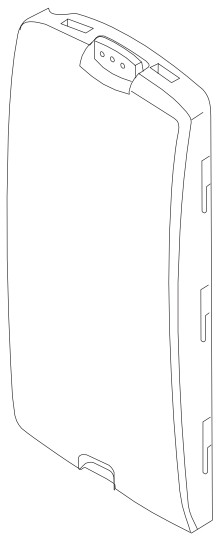
Product Code

Battery pack BLJ–2:	*0670129*

Specification

Dimensions (h x w x d):	*92 x 44 x 12 mm*
Weight:	*47 g*
Capacity:	*400 mAh*

View of Battery Pack



Battery Pack BLJ–5

The BLJ–5 Li–ion extended battery pack provides the best compromise between weight and performance for the average user. An extended package (i.e. including phone) weighs 181 g.

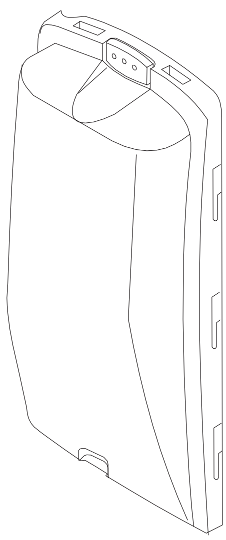
Product Codes

Battery pack BLJ–5 :	*0670127*

Specification

Dimensions (h x w x d):	*92 x 44 x 22 mm*
Weight:	*76 g*
Capacity:	*900 mAh*

View of Battery Pack



Fast & Light Charger ACH–6

Extremely light, functionally designed fast & light charger charges your phone battery quickly.

Plug the charger into a wall outlet and connect the connector to the bottom of your phone. When not using the charger, you can wrap the cord around it and attach the loose end to the slot on top.

The charging time is approximately 45 minutes for the 470 mAh battery. Check the charging status on the phone display. You can use your phone also while charging.

Operating within voltage range 90 V...250 V AC (50 Hz...60 Hz), fast & light charger is practically current independent in normal office and household use. Like standard charger, fast & light charger is compatible with all battery options and is available with different wall plugs.

The fast & light charger can also be used with basic stand and desktop stand.

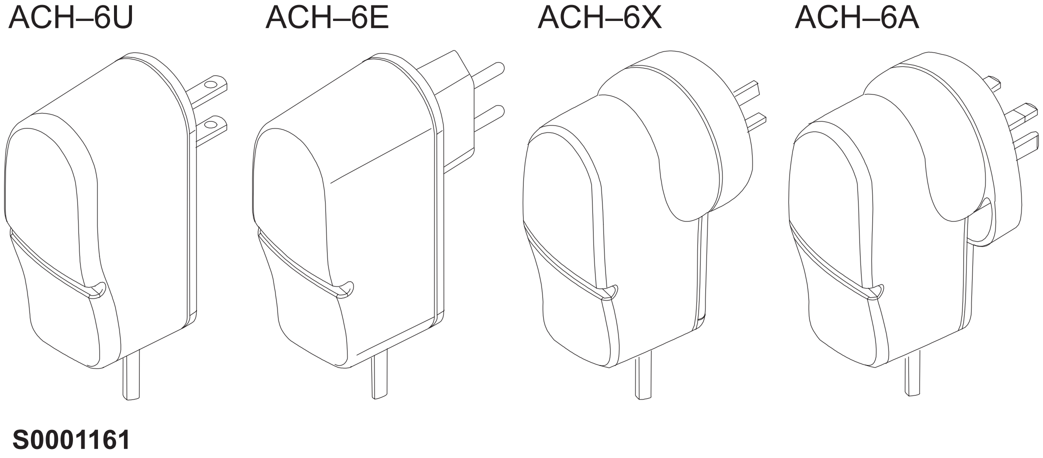
Product Codes

Fast & light charger ACH–6U (USA plug):	*0675085*
Fast & light charger ACH–6E (Euro plug):	*0675084*
Fast & light charger ACH–6X (UK plug):	*0675087*
Fast & light charger ACH–6A (Austr. plug):	*0675086*
Output cable PCC–1 (supplied with ACH–6):	*0730076*

Specification

Dimensions (h x w x d):	*75 x 29 x 42 mm (without plug)*
Weight:	*< 150 g*
Output cable length:	*1950 mm*
Mains plug type:	*see picture*
Output connectors:	*3.0 mm standard d.c. plug*
Protection:	*output current limiting, max. 870 mA output voltage limiting, max. 11 V (unloaded)*
Input voltage:	*90 to 250 V*

View of Fast & Light Chargers



Light Desktop Stand CGH–5

This charging stand is an economical choice for users who wish to have their phone close at hand, always ready for calls.

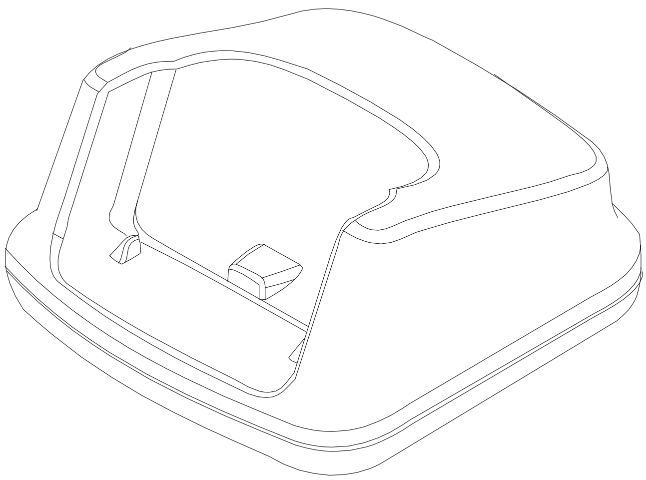
Product Code

Basic stand CGH–5:	*0700036*

Specification

Dimensions (h x w x d):	*42 x 75 x 80 mm*
Weight:	*38 g*
Connections:	*3.0 mm d.c. jack*
Charge control:	*none*
Maximum input voltage:	*16 V*
Maximum input current:	*820 mA / 10.8 V*
Protection:	*no damage if short circuit in output*

View of Light Desktop Stand



Desktop Stand CGH–6

The desktop stand provides mounting place for both the phone and a spare battery.

Charging order is the phone battery first, and then the spare battery. Check the charging status of the phone battery on the phone display.

Compatible with all battery options, the desktop stand is used together with the standard charger or fast & light charger. Charging times for the 470 mAh battery are approximately 45 min or 2 h 30, respectively.

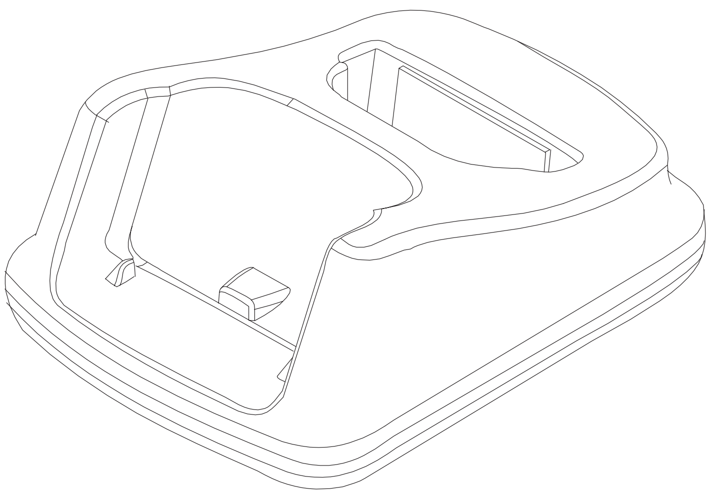
Product Code

Desktop stand CGH–6:	*0675080*

Specification

Dimensions (h x w x d):	*42 x 75 x 100 mm*
Weight:	*70 g*
Connections:	*3.0 mm d.c. jack*
Charge control:	*cell voltage (peak or negative change), time control, cell temperature*
Operation input voltage:	*9...16 V*
Max. input current:	*780 mA*
Discharge current:	*330 mA*
Discharge end voltage:	*4 V*
Protection:	*no damage if short circuit in output*

View of Desktop Stand



Mobile Holder MBT–5

Designed to fit and complement your car's interiors, phone holder holds your phone firmly in place by its three–point hold and stiff structure.

The mobile holder is attached to the vehicle's interior using mounting plate, MKE–7 or alternatively swivel mounting plates, HHS–6 or HHS–7.

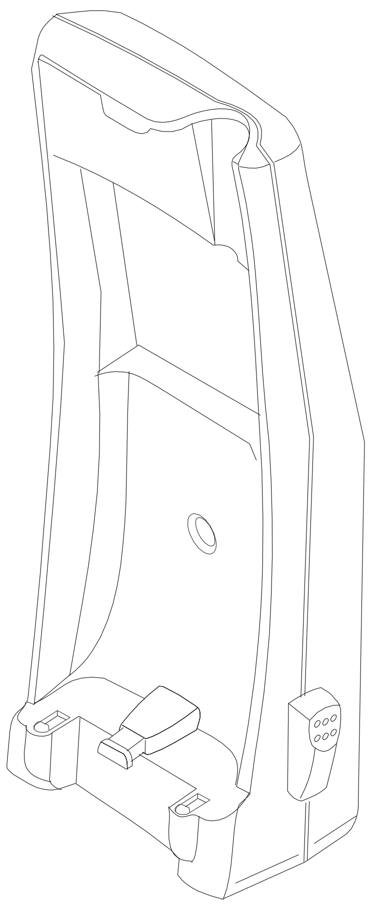
Product Code

Mobile holder MBT–5:	*0620030*

Specification

Dimensions (h x w x d):	*121 x 60 x 45 mm*
Weight:	*70 g*

View of Mobile Holder



Mounting Plate MKE–7

The MKE–7 mounting plate provides a method of fixing the phone holder, the compact handsfree unit or the handset to the vehicle interior.

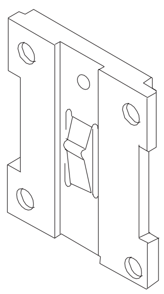
Product Code

Mounting plate MKE–7:	*0650021*

Specification

Dimensions (h x w x d):	*7.3 x 45 x 48 mm*
Weight:	*8 g*

View of Mounting Plate



G0650021

Swivel Mounting Plate HHS–7

The HHS–7 swivel mounting plate provides an alternative (to MKE–7) method of locating the phone holder, the basic handsfree unit or the handset.

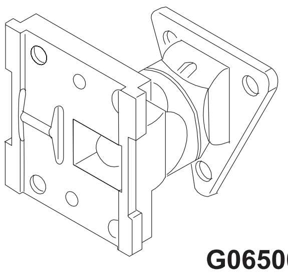
Product Code

Swivel mounting plate HHS–7:	*0650020*

Specification

Dimensions (h x w x d):	*20 x 44 x 48 mm*
Weight:	*30 g*

View of Swivel Mounting Plate



G0650020

Universal Mobile Charger LCH–6

The universal mobile charger ensures your phone is always ready for use wherever you travel. This small charger's functional design fits well to most car lighters and interiors.

The charging time for the 470 mAh battery is about 45 minutes, and you can use your phone freely during charging.

A green light indicates that the cigarette lighter charger is ready for charging. Check the charging status on the phone display. The input voltage can be 12 or 24 V d.c., negative grounding.

Universal mobile charger can be used with all car accessories provided for your phone.

Avoid prolonged charging with universal mobile charger when the car engine is not running; this may cause the battery of your car to drain. Note also that in some cars the cigarette lighter plug is not provided with electricity if the ignition is switched off. Verify that the green led light is lit.

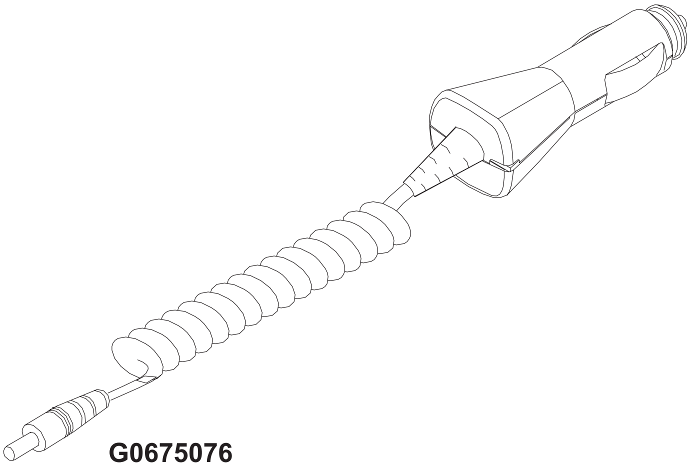
Product Code

Universal mobile charger LCH–6:	*0675076*

Specification

Dimensions (h x w x d):	*29 x 35 x 84 mm*
Weight:	*< 70 g*
Cable length:	*465 mm curly cable*
Connectors	
• input:	*D 21/23 mm*
• output:	*3.0 mm standard d.c. plug*
Protection:	*input fused, output current limit*
Voltage	
• input:	*11.3...35 V*
• output (nominal):	*10.3 V*
Nominal output current:	*780 mA*
Charging into empty battery:	*>= 300 mA*

View of Universal Mobile Charger



G0675076

Fixed Mobile Charger LCM–1

The fixed mobile charger powers your phone from the car battery when the ignition is switched on and leaves the cigarette lighter vacant.

You can use the fixed mobile charger in any vehicle with a 12 or 24 V d.c. connection, negative grounding.

The charging time for the 470 mAh battery is only about 45 minutes.

Fixed mobile charger housing has a four pin connector for power cable, and on the opposite end a connector for the output cable, which connects the fixed mobile charger directly to the d.c. connector of your phone or to the basic handsfree unit.

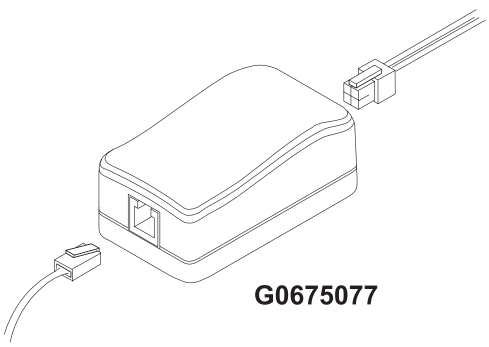
Product Code

Fixed mobile charger LCM–1:	*0675077*
Output cable PCC–1 (supplied with LCM–1):	*0730076*

Specification

Dimensions (h x w x d):	*27 x 36 x 65 mm*
Weight:	*< 70 g*
Output cable length:	*1950 mm*
Protection:	*input fused, output current limit*
Voltage	
• input:	*11.3...32 V*
• output (nominal):	*10.3 V*
Output current nominal:	*780 mA*
Charging into empty battery:	*>= 300 mA*

View of Fixed Mobile Charger



G0675077

Power Cable PCM–5

The power cable connects the fixed mobile charger, LCM–1, to the vehicle's power supply. The red wire must be connected to the + voltage supply controlled by the vehicle's ignition key via the supplied fused connector. The black wire must be attached to a good negative GND connection.

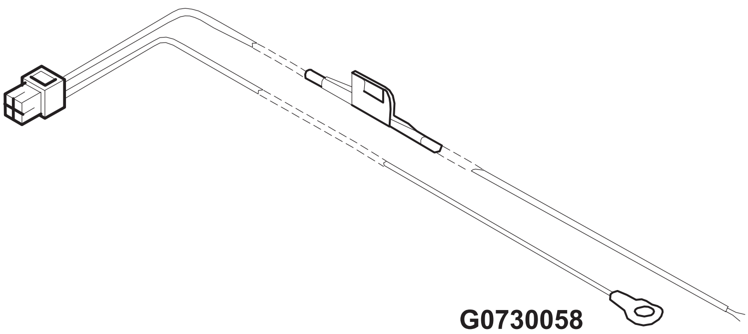
Product Code

Power cable PCM–5:	*0730058*

Specification

Weight:	*74 ±5 g*
Cable length	
• red wire:	*2500 ±100 mm*
• black wire:	*2000 ±50 mm*
Max current via contacts:	*1 A*

View of Power Cable



Headset HDC–2

Compact and functional, headset kit HDXK–7 (headset adapter HDA–3 and headset HDC–2) provides you with a convenient handsfree facility which you can use anywhere.

Connect headset adapter HDA–3 to the bottom of your phone, and plug the headset HDC–2 to the adapter.

In car use, you can connect the headset directly to the basic handsfree unit. (The headset adapter is not required under this configuration.) When used with external antenna adapter, this combination provides you with handsfree operation, privacy and optimum reception quality. When the headset is connected, the HF loudspeaker and microphone are disabled.

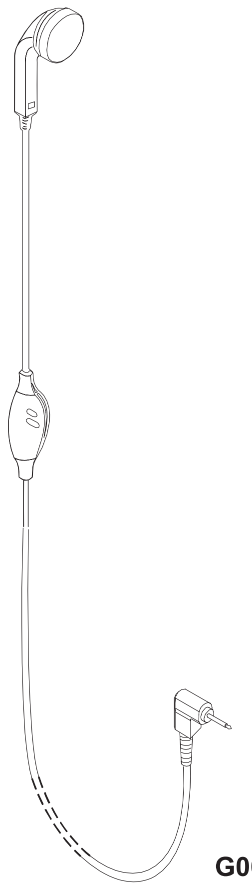
Product Code

Headset HDC–2:	*0694017*

Specification

Cord length :	*1500 ±50 mm*
Weight:	*13 g*
Microphone sensitivity:	*–46.5 ±5 dB (0 dB = 1 V/Pa at 1 kHz)*
Microphone directionality:	*Omni–directional*
Microphone supply voltage:	*5 V*
Earphone rated/max input:	*1 mW/5 mW*
Earphone sound pressure:	*106 ±5 dB (at 1 kHz, 1 mW)*
Impedance	
• microphone:	*max 2.2 kΩ at 1 kHz*
• earphone:	*32 ±7 Ω*

View of Headset



G0694017

Headset Adapter HDA–4

The headset adapter provides connections between the headset, power supply and the phone. The adapter plugs into the base of the phone.

Note: When using the headset adapter, connect your charger to the adapter if you need to charge your phone.

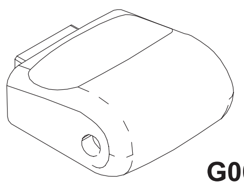
Product Code

Headset adapter HDA–4:	*0694042*

Specification

Dimensions (h x w x d):	*28 x 29 x 13.3 mm*
Weight:	*10 g*
Gain	
• microphone:	*33.5 dB*
• earphone:	*0 dB*
Sound pressure	
• microphone:	*–16...+3 dBPa (0 dBPa = 94 dB spl)*
• earphone:	*0 dBPa...+23 dBPa*
Level at headset connector:	
• microphone:	*1.3...11.6 mV*
• earphone:	*16...220 mV*

View of Headset Adapter



G0694029

Handsfree Microphone HFM–7

The HFM–7 microphone forms part of compact handsfree unit.

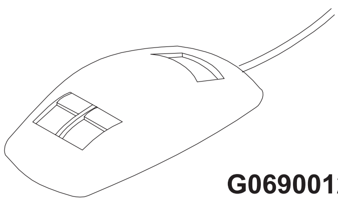
Product Code

Handsfree microphone HFM–7:	*0690012*

Specification

Dimensions (h x w x d):	*16 x 24 x 43 mm*
Cable length:	*3.0 m*
Holders:	*double sided tape and screws*
Connector:	*2.5 mm plug, angle type*
Sensitivity curve:	*hypercardioid*
Bias supply voltage:	*1.5...8 V*
Bias supply current:	*100...500 µA*
Acoustical operating range (THD<1 %):	*35...110 dB SPL (–56...+16 dBa)*
Sensitivity:	*–41±4 dBV/Pa at 1 kHz, front signal (measured with mic assembled on hard plate, 30 x 30 cm)*
Noise (IHF–A weighting):	*<9 µV*

View of Handsfree Microphone



G0690012

External Antenna Unit AAH–1

The external antenna unit allows an external antenna to be capacitively coupled to the phone's antenna when the phone is located in the mobile holder. The external antenna adapter is fastened to the top of the holder with two screws.

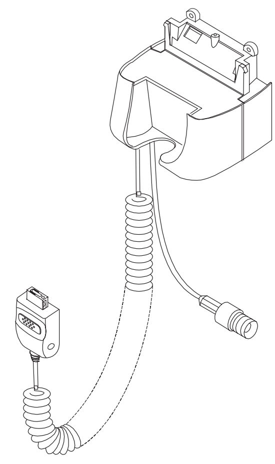
Product Code

External antenna adapter AAH–1:	*0750077*

Specification

Dimensions (h x w x d):	*49 x 60 x 45*
Weight:	*170 g*
Connection:	*Mini UHF/50 Ω*
Cable length:	*750 mm coaxial cable*
Insertion loss:	*< 4 dB*

View of Antenna Unit



This page intentionally left blank.

This page intentionally left blank.

COMPACT HANDSFREE UNIT PHF–3

Original 03/97

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments

COMPACT HANDFREE UNIT PHF–3

Contents

Introduction

General

The PHF–3 is a handsfree unit for handportable (NHE–6 and NHK–6) phones. It provides rapid charging for the phone and a possibility to use HF–operation. The PHF–3 cannot be connected directly to the phone but via the external antenna unit AAH–1D and mobile holder MBT–5 or other devices that provide the HF connector.

Technical Summary

Operation

The PHF–3 has external connections to car battery, ignition sense, car radio muting, external microphone and external speaker. The unit has a HF–connector that provides an interface to the phone via external antenna unit. The connection can be made directly or using the extension cable between PHF–3 and AAH–1D. There is also an internal speaker inside the handsfree unit.

The unit consists of a switching mode rapid charger, HF–speaker and HF–microphone amplifiers, volume control circuit, voltage regulators, control circuit (microprocessor) and a CAP compatible interface.

The PHF–3 is always connected to the car battery. To save the car battery, PHF–3 goes in to the sleep mode if the car is not running and/or the phone is not connected.

List of Modules

Name of Module:	Material Code:
HF speaker module DC9	0200656
Assembly parts MPHF–3	0260681

Basic Specifications

Function:	Value:
Input voltage	11.3 ... 16 V
Current consumption	2 A dc max
Power source	car battery

Modes of Operation

Phone not connected (sleep mode):

When the phone is not connected the current consumption of the device has been minimized. The switching mode power supply (SMPS) and audio circuits has been turned off. PHF–3 is only waiting a phone to be connected.

Phone connected (active mode):

When the phone is connected to the PHF–3 it goes into the active mode. In the active mode the device provides charging current to the phone via SMPS. It also can provide hands free call option using the internal or the external speaker (if connected) and the external microphone. If more private call wants to be made, the phone itself can be used as a handset without losing the external antenna connection.

The phone controls all the basic functions of PHF–3 that are required for making calls. In the active mode the PHF–3 follows the commands received from the phone via mbus.

PHF–3 also provides car radio mute function during call. This is possible only in those radios which support that function.

PHF–3 can control the mobile antenna motor if it is installed to the car.

External Signals and Connections

D.C. Supply Connector X100

Pin:	Signal name:	Function:
1, 2	+VB	Input from car battery • min/max voltage: 8.0...13.5...16 V dc
3	IGNS	Ignition sense low • max 1.8 V Ignition sense high • min/nom/max 8...13.5...32 V
4	CRM	Car radio mute off • nom 0 mA / open collector output • max 16 V Car radio mute on • nom 150 mA / current limiting value • nom/max 12...15.5 V / at max. current
5	AMC	Antenna motor control off • nom 0 mA / open collector output Car radio mute on • nom 150 mA / current limiting value • nom/max 12...15.5 V / at max. current
6,7,8	GND	Ground

System Connector X400

Pin	Signal name:	Function:
1	GND	Digital ground
2	XMIC	Microphone signal • nominal voltage: 60 mVrms
3	MBUS	MBUS line low • min/max voltage: 0...0.5 V MBUS line high • min/max voltage: 2.4...3.2 V
4	SGND	Signal ground
5	XEAR	Speaker signal • typ voltage: 60 mV
6	IGNS	Ignition sense • typ voltage: 13.5 V

Pin	Signal name:	Function:
7,8	+VC	Supply voltage • typ/max voltage: 10.3...10.8 V / unloaded • typ/max current: 780...832 mA / current limit
9...12	GND	Ground

External Microphone Connector X200

Pin:	Signal name:	Function:
1	GND	Ground
2	HFMIC	Microphone signal typ voltage: 0 V Microphone bias typ voltage: 2.5 V dc

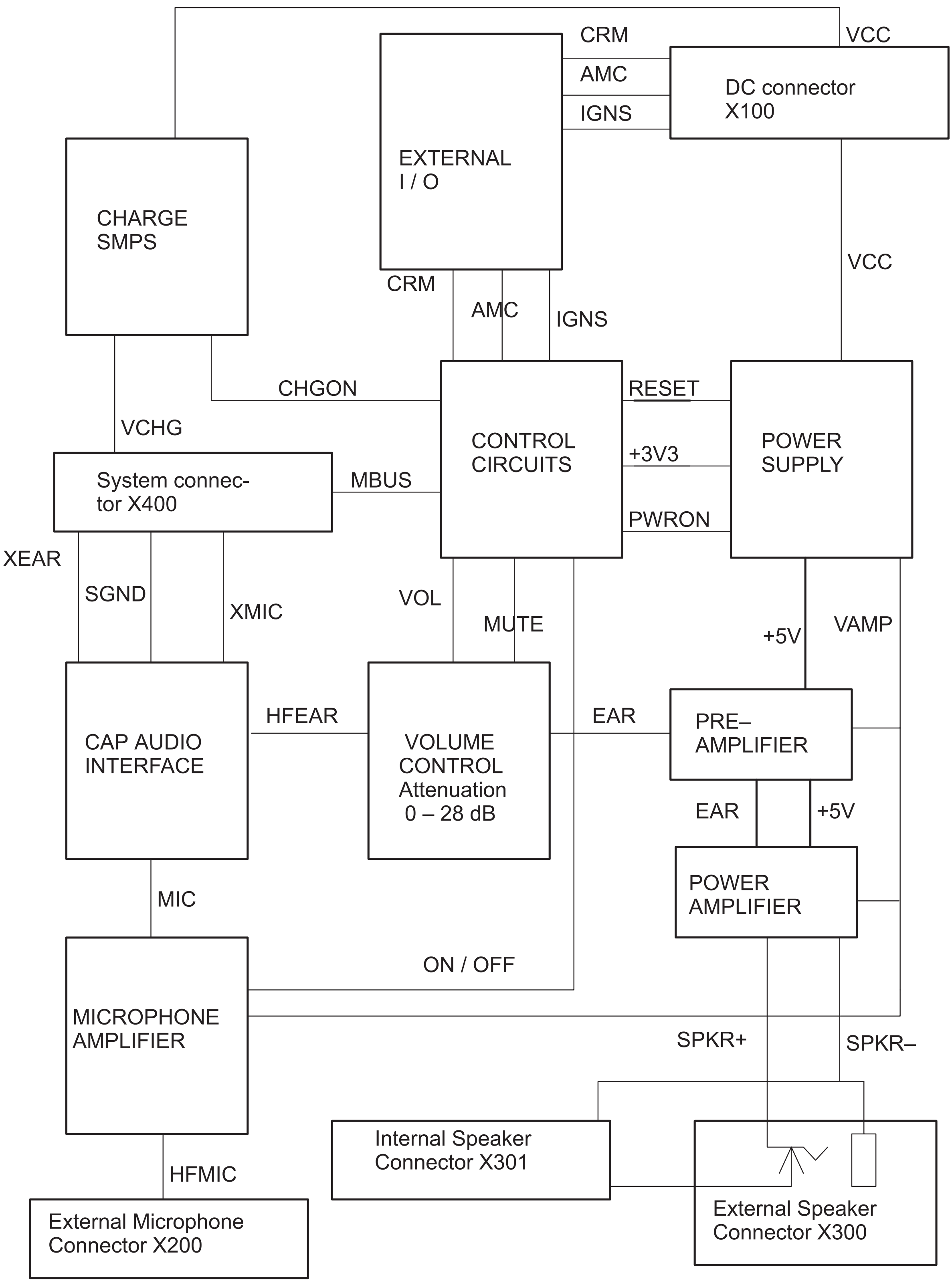
External Speaker Connector X300

Pin:	Signal name:	Notes:
1	Speaker –	8 Ω speaker, 3.2 mm jack
2	Speaker +	

Circuit Description

The circuit blocks are described in the following subsections. Refer to block diagram in next section. The complexity for each block is given. Note that every operational amplifier are calculated as a component whereas there actually might be several amplifiers in one physical (IC) component.

Block Diagram



Audio Interface

This block converts signal levels and also provides single–ended to differential and level conversions as well as hook pulldown and device identification.

Power Supply

The circuits provides regulated operation voltages to every block. It regulates +3V3 for the operating voltage of MCU, +10V for operating voltage to audio amplifiers, +5V for bias voltage to audio amplifiers and for the microphone. +2V is for bias voltage to audio attenuation switches. The power supply voltages has been designed to achieve maximum ripple voltage rejection.

Microphone Amplifier

This block is a high performance handsfree microphone amplifier. The microphone and microphone amplifier are biased from the +5V. +10V is used as operating voltage for the amplifier. The amplifier gain is 30 dB nominal and input impedance is 2 kΩ. The output AC voltage is about 100 mV. The output impedance is as low as possible. The circuit performs the sum operation with minimum phase shift. The amplifier can be muted with the MCU. When microphone is not connected, the input of the microphone amplifier is grounded.

Xear Amplifier

The circuit performs differential to single–ended conversion of incoming audio signal. The circuit gain is 0 dB. Output DC bias in XEAR line is 1.8 V, input is AC coupled and the stage tolerates about ± 1.5 V combined common mode and differential mode input swing without clipping.

Volume Control and Mute

The circuit is the audio attenuator. Attenuation is performed with operational amplifiers and audio switches. The circuit performs 8 different audio levels (one is mute). Attenuation is adjustable with 4 dB steps from 0 dB to 28 dB and mute. MCU controls attenuation switches with 4 IO–lines, where one of them is the mute.

Speaker Amplifiers

The Preamplifier
The preamplifier is an AC coupled single ended input stage for the power amplifier. The preamplifier makes most of the XEAR signal amplifying. It uses the +10 V operating voltage and it is biased to +5 V. Preamplifier has a fixed gain.

The Power amplifier (PA)
The power amplifier is am AC coupled full bridge output stage with fixed gain. It's output impedance is 8 Ω and it is also biased to +5 V. Operating voltage is + 10 V. The both speaker outputs SP+ and SP– are connected to the internal speaker connector via the external speaker connector. When the external speaker is connected, the internal speaker is then muted.

Total gain for both pre– and power amplifier is about 28 dB. Maximum output power with the internal speaker is 1.6 W and 3.1 W with the external speaker.

Charger

Charger is the switching mode power supply type. The nominal output voltage of charger is 10.2 V without load. Limits of the output voltage with all tolerances are 9.3 V to 10.8 V. Nominal output current is 780 mA and limits with tolerance are 714 mA to 832 mA. MCU controls functioning of the charger and checks the output voltage. Charger is short circuit protected.

Control Circuit (MCU)

Micro controller unit (MCU) controls all the functions of the PHF–3. It communicates with the phone by using the MBUS–line. It has an 8–bit AD–converter and several IO–lines to control functioning of the other blocks.

External I/O and AD–converters

This block is used to measure specified voltages. It also controls the mobile antenna motor (AMC) and the car radio mute (CMR). Specified voltages are car battery voltage +VB, ignition sense voltage (IGNS) and phone charging voltage +VC. For CRM and AMC current are also controlled by this block.

Connectors

There are 4 external connectors to other units, and one internal speaker connector. These external connectors are the car connector, the system connector, the microphone connector and the speaker connector.

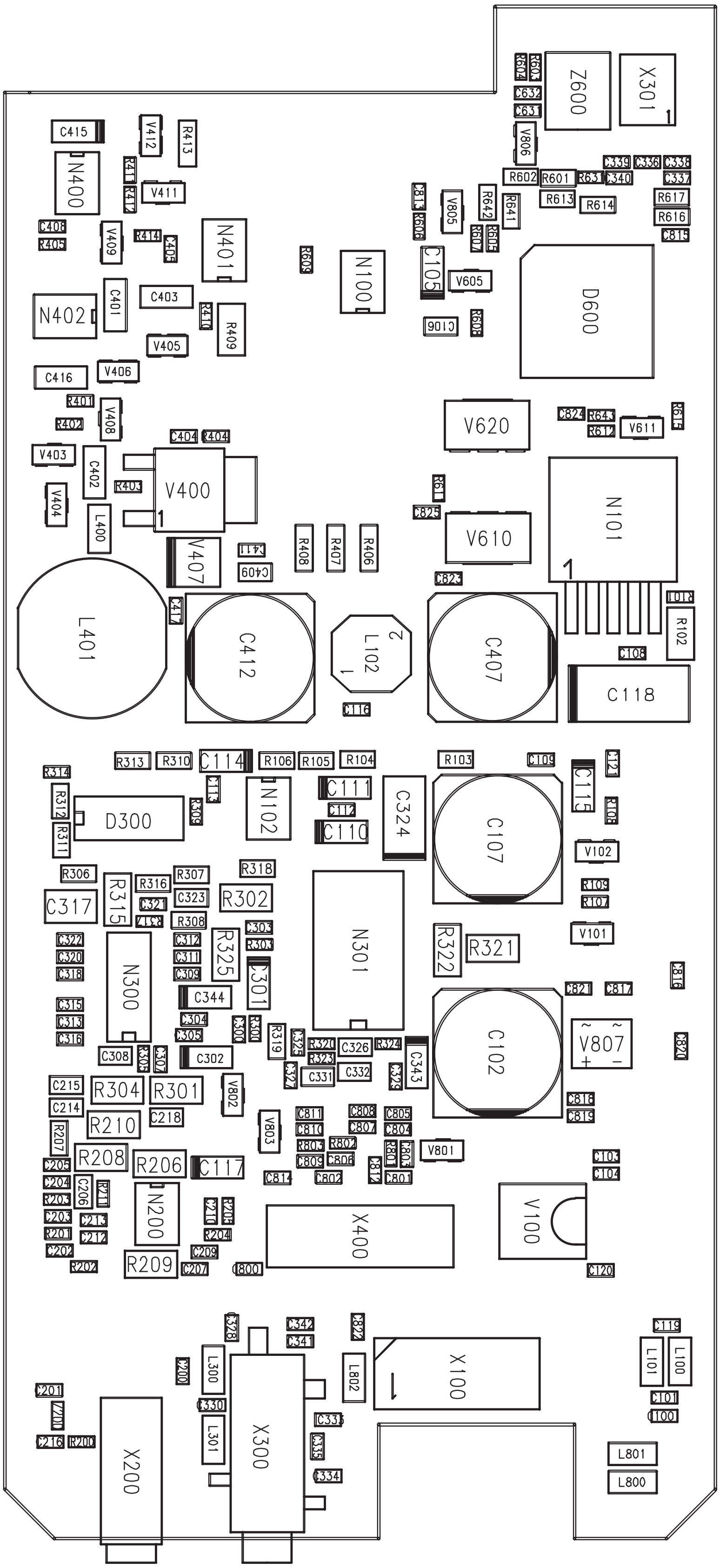
Input Protection

The purpose of the input protection is to prevent ESD, RF and high or negative input voltages to damage the module. Contacts that are subject to ESD are protected with diode pairs. All inputs are protected from RF.

Circuit Diagram of DC9

Circuit Diagram of DC9

Layout Diagram of DC9 (version 08)



Parts List of DC9 (EDMS Issue 8.2 Code 0200656)

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R101	1430051	Chip resistor	4.7 k	5 % 0.063 W 0603
R102	1415960	Melf resistor	33.2 k	1 % 0.2 W 0204
R103	1414283	Chip resistor	100 k	1 % 0.1 W 0805
R104	1414283	Chip resistor	100 k	1 % 0.1 W 0805
R105	1414283	Chip resistor	100 k	1 % 0.1 W 0805
R106	1414533	Chip resistor	56 k	1 % 0.1 W 0805
R107	1430079	Chip resistor	47 k	5 % 0.063 W 0603
R108	1430079	Chip resistor	47 k	5 % 0.063 W 0603
R109	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R200	1430167	Chip resistor	47	5 % 0.063 W 0603
R201	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R202	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R203	1430047	Chip resistor	3.3 k	5 % 0.063 W 0603
R204	1430071	Chip resistor	22 k	5 % 0.063 W 0603
R205	1430095	Chip resistor	220 k	5 % 0.063 W 0603
R206	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R207	1414283	Chip resistor	100 k	1 % 0.1 W 0805
R208	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R209	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R210	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R211	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R300	1430051	Chip resistor	4.7 k	5 % 0.063 W 0603
R301	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R302	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R304	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R305	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R306	1414533	Chip resistor	56 k	1 % 0.1 W 0805
R307	1414283	Chip resistor	100 k	1 % 0.1 W 0805
R308	1414283	Chip resistor	100 k	1 % 0.1 W 0805
R309	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R310	1414283	Chip resistor	100 k	1 % 0.1 W 0805
R311	1414300	Chip resistor	68 k	1 % 0.1 W 0805
R312	1414452	Chip resistor	10 k	1 % 0.1 W 0805
R313	1414533	Chip resistor	56 k	1 % 0.1 W 0805
R314	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R315	1415784	Melf resistor	4.75 k	1 % 0.2 W 0204
R316	1414533	Chip resistor	56 k	1 % 0.1 W 0805
R317	1430043	Chip resistor	2.2 k	5 % 0.063 W 0603
R318	1414276	Chip resistor	47 k	1 % 0.1 W 0805
R319	1414533	Chip resistor	56 k	1 % 0.1 W 0805
R320	1430159	Chip resistor	22	5 % 0.063 W 0603
R321	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R322	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204

R323	1430142	Chip resistor	4.7	5 % 0.063 W 0603
R324	1430142	Chip resistor	4.7	5 % 0.063 W 0603
R325	1415939	Melf resistor	22.1 k	1 % 0.2 W 0204
R401	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R402	1430051	Chip resistor	4.7 k	5 % 0.063 W 0603
R403	1430159	Chip resistor	22	5 % 0.063 W 0603
R404	1430159	Chip resistor	22	5 % 0.063 W 0603
R405	1430051	Chip resistor	4.7 k	5 % 0.063 W 0603
R406	1421101	Melf resistor	1.5	1 % 0.2 W 0204
R407	1421101	Melf resistor	1.5	1 % 0.2 W 0204
R408	1421101	Melf resistor	1.5	1 % 0.2 W 0204
R409	1415600	Melf resistor	1.0 k	1 % 0.2 W 0204
R410	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R411	1430065	Chip resistor	10 k	5 % 0.063 W 0603
R412	1430065	Chip resistor	10 k	5 % 0.063 W 0603
R413	1421103	Melf resistor	3.16 k	1 % 0.2 W 0204
R414	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R601	1414536	Chip resistor	200 k	1 % 0.1 W 0805
R602	1414276	Chip resistor	47 k	1 % 0.1 W 0805
R603	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R604	1430081	Chip resistor	56 k	5 % 0.063 W 0603
R605	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R606	1430159	Chip resistor	22	5 % 0.063 W 0603
R607	1430087	Chip resistor	100 k	5 % 0.063 W 0603
R608	1430065	Chip resistor	10 k	5 % 0.063 W 0603
R609	1430065	Chip resistor	10 k	5 % 0.063 W 0603
R611	1430065	Chip resistor	10 k	5 % 0.063 W 0603
R612	1430055	Chip resistor	6.8 k	5 % 0.063 W 0603
R613	1414536	Chip resistor	200 k	1 % 0.1 W 0805
R614	1414276	Chip resistor	47 k	1 % 0.1 W 0805
R615	1430035	Chip resistor	1.0 k	5 % 0.063 W 0603
R616	1414536	Chip resistor	200 k	1 % 0.1 W 0805
R617	1414276	Chip resistor	47 k	1 % 0.1 W 0805
R631	1430051	Chip resistor	4.7 k	5 % 0.063 W 0603
R641	1414276	Chip resistor	47 k	1 % 0.1 W 0805
R642	1414536	Chip resistor	200 k	1 % 0.1 W 0805
R643	1430055	Chip resistor	6.8 k	5 % 0.063 W 0603
R801	1430001	Chip resistor	100	5 % 0.063 W 0603
R802	1430001	Chip resistor	100	5 % 0.063 W 0603
R803	1430001	Chip resistor	100	5 % 0.063 W 0603
R806	1430095	Chip resistor	220 k	5 % 0.063 W 0603
C100	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C101	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C102	2517850	Electrol. cap.	220 u	20 % 35 V 10x10
C103	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C104	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C105	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C106	2310784	Ceramic cap.	100 n	10 % 25 V 0805

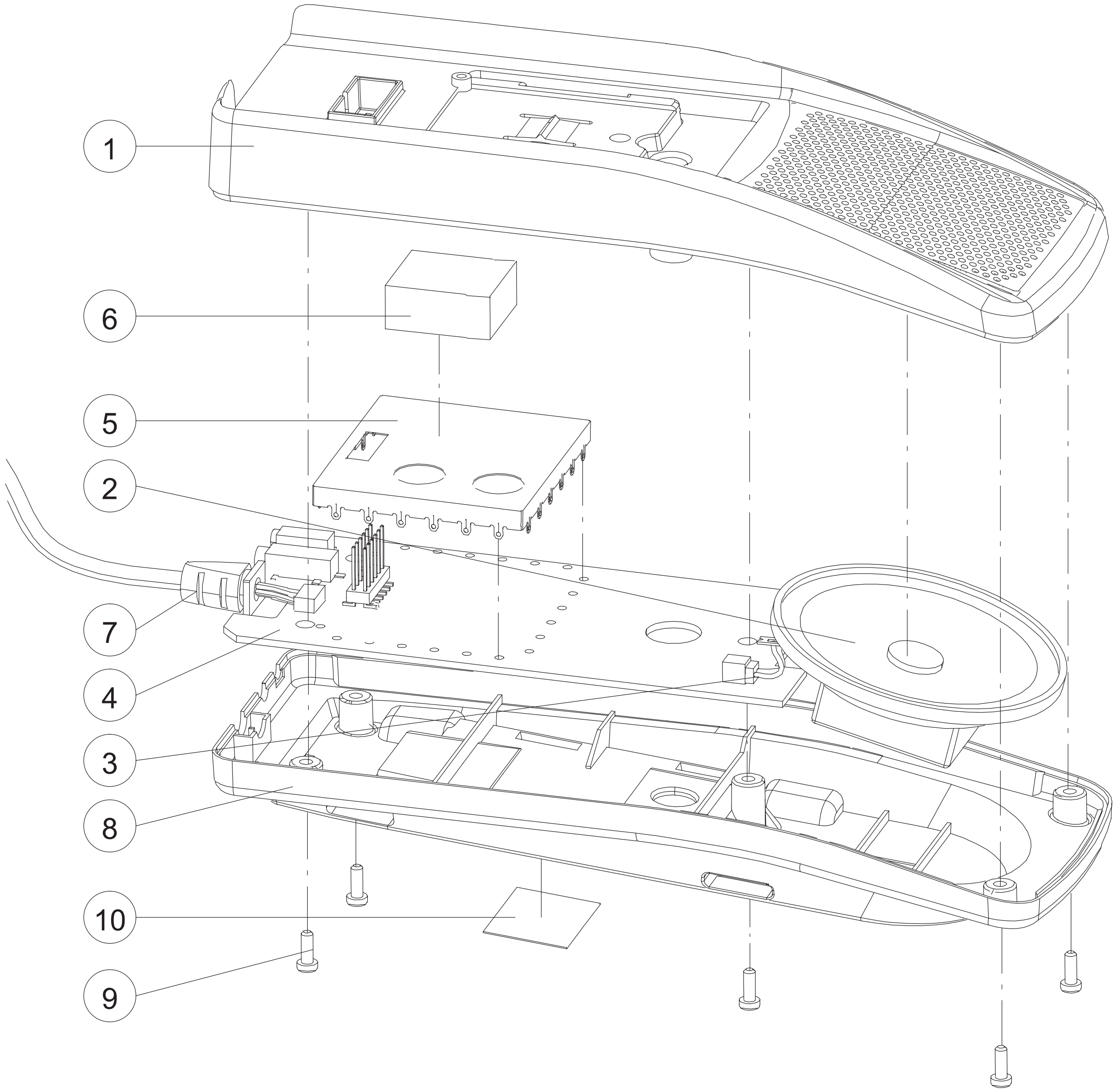
C107	2517850	Electrol. cap.	220 u	20 % 35 V 10x10
C108	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C109	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C110	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C111	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C112	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C113	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C114	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C115	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C116	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C117	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C118	2604110	Tantalum cap.	10 u	20 % 25 V 7.3x4.4x2.8
C119	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C120	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C121	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C200	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C201	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C202	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C203	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C204	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C205	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C206	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C207	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C210	2320071	Ceramic cap.	330 p	5 % 50 V 0603
C212	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C213	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C214	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C215	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C216	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C218	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C300	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C301	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C302	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C304	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C305	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C307	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C308	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C309	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C312	2320075	Ceramic cap.	470 p	5 % 50 V 0603
C315	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C316	2320075	Ceramic cap.	470 p	5 % 50 V 0603
C317	2312292	Ceramic cap.	470 n	20 % Y5 V 1210
C318	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C321	2320075	Ceramic cap.	470 p	5 % 50 V 0603
C322	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C323	2340014	Ceramic cap.	47 n	10 % 25 V 0805
C324	2604431	Tantalum cap.	10 u	20 % 16 V 6.0x3.2x2.5
C325	2320079	Ceramic cap.	680 p	5 % 50 V 0603

C326	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C327	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C328	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C329	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C330	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C331	2312208	Ceramic cap.	15 n	10 % 50 V 0805
C332	2312208	Ceramic cap.	15 n	10 % 50 V 0805
C333	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C334	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C335	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C336	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C337	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C338	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C339	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C340	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C341	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C342	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C343	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C344	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C401	2309517	Ceramic cap.	100 n	10 % 50 V 1206
C402	2309517	Ceramic cap.	100 n	10 % 50 V 1206
C403	2309517	Ceramic cap.	100 n	10 % 50 V 1206
C404	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C405	2320107	Ceramic cap.	10 n	5 % 50 V 0603
C407	2517850	Electrol. cap.	220 u	20 % 35 V 10x10
C408	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C409	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C411	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C412	2517850	Electrol. cap.	220 u	20 % 35 V 10x10
C415	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.6
C416	2309517	Ceramic cap.	100 n	10 % 50 V 1206
C631	2320059	Ceramic cap.	100 p	5 % 50 V 0603
C632	2320059	Ceramic cap.	100 p	5 % 50 V 0603
C800	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C803	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C804	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C805	2320083	Ceramic cap.	1.0 n	5 % 50 V 0603
C807	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C808	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C809	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C810	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C811	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C812	2320043	Ceramic cap.	22 p	5 % 50 V 0603
C813	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C814	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C815	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C816	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C817	2320063	Ceramic cap.	150 p	5 % 50 V 0603

C818	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C819	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C820	2320091	Ceramic cap.	2.2 n	5 % 50 V 0603
C821	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C822	2320110	Ceramic cap.	10 n	10 % 50 V 0603
C823	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C824	2320063	Ceramic cap.	150 p	5 % 50 V 0603
C825	2320063	Ceramic cap.	150 p	5 % 50 V 0603
L100	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L101	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L102	3640027	Chip coil	22 u	20 % 0.81 A 6.2x6.6x3
L300	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L301	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L400	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L401	3640039	Chip coil		1.26 A 12x13x6
L800	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L801	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
L802	3641262	Ferrite bead 30r/100mhz 2a	1206	1206
Z200	3640035	Filt z>450r/100m 0r7max 0.2a 0603		0603
Z600	4507733	Cer.reson 1.0mhz+–0.5% 8.0x5.0smd		8.0x5.0smd
V100	4113933	Trans. supr.	18V	3000 W DO214AB
V101	4200909	Transistor	BC858B/BCW30	pnp 30 V 100 mA SOT23
V102	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V400	4215954	MosFet	RFD14N05	n–ch 50 V 10 A TO252
V403	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V404	4200909	Transistor	BC858B/BCW30	pnp 30 V 100 mA SOT23
V405	4108639	Diode x 2	BAS28	75 V 250 mA SOT143
V406	4108639	Diode x 2	BAS28	75 V 250 mA SOT143
V407	4110074	Schottky diode	STPS340U	40 V 3 A SOD6
V408	4110208	Zener diode	BZX84	5 % 24 V 0.3 W SOT23
V409	4110150	Zener diode	BZX84	2 % 10 V 0.3 W SOT23
V411	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V412	4108639	Diode x 2	BAS28	75 V 250 mA SOT143
V605	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V610	4210020	Transistor	BCP69–25	pnp 20 V 1 A SOT223
V611	4200917	Transistor	BC848B/BCW32	npn 30 V 100 mA SOT23
V620	4210096	Transistor	BCP54	npn 45 V 1.5 A SOT223
V805	4100285	Diode x 2	BAV99	70 V 200 mA SER.SOT23
V806	4100285	Diode x 2	BAV99	70 V 200 mA SER.SOT23
V807	4103003	Diode	BRIDGE	600 V 0.5 A MBS
D300	4309488	IC, 4 x bi.switch	74HC4066	SO14S
D600	4370037	IC, MCU	uPD78081GB–513	QFP44
N100	4340067	IC, regulator	LP2951	3.3 V 100 mA
N101	4340127	Mic29152 reg ld adj 1.5a to263–5		TO263–5
N102	4301199	IC, 2 x op.amp.	LM2904	SO8S
N200	4301199	IC, 2 x op.amp.	LM2904	SO8S
N300	4301182	IC, 2 x op.amp.	LM2902	SO14S
N301	4340125	L2726 2xop.amp pw5w1a 4–28v so20w		SO20W

N400	4340067	IC, regulator	LP2951	3.3 V 100 mA
N401	4301199	IC, 2 x op.amp.	LM2904	SO8S
N402	4305236	IC, 2 x comp.	LM2903	SO8S
X100	5416638	Connector 8–pole right angle 1.5		1.5
X200	5200005	Stereo jack + switch 2.5mm. hosid		HOSID
X300	5409035	Jack stereo 3.5mm	smd	SMD
X301	5416640	Pin header m1x2 p1.5 90deg 1a0r02		1A0R02
X400	5440007	12 pins connector for phf–3 and p		P
P001	9854136	PC board	DC9	54x118x1.6mm d 3/panel
	9854136	PCB DC9 54X118X1.6MM D 3/PANEL		

Exploded View of PHF–3

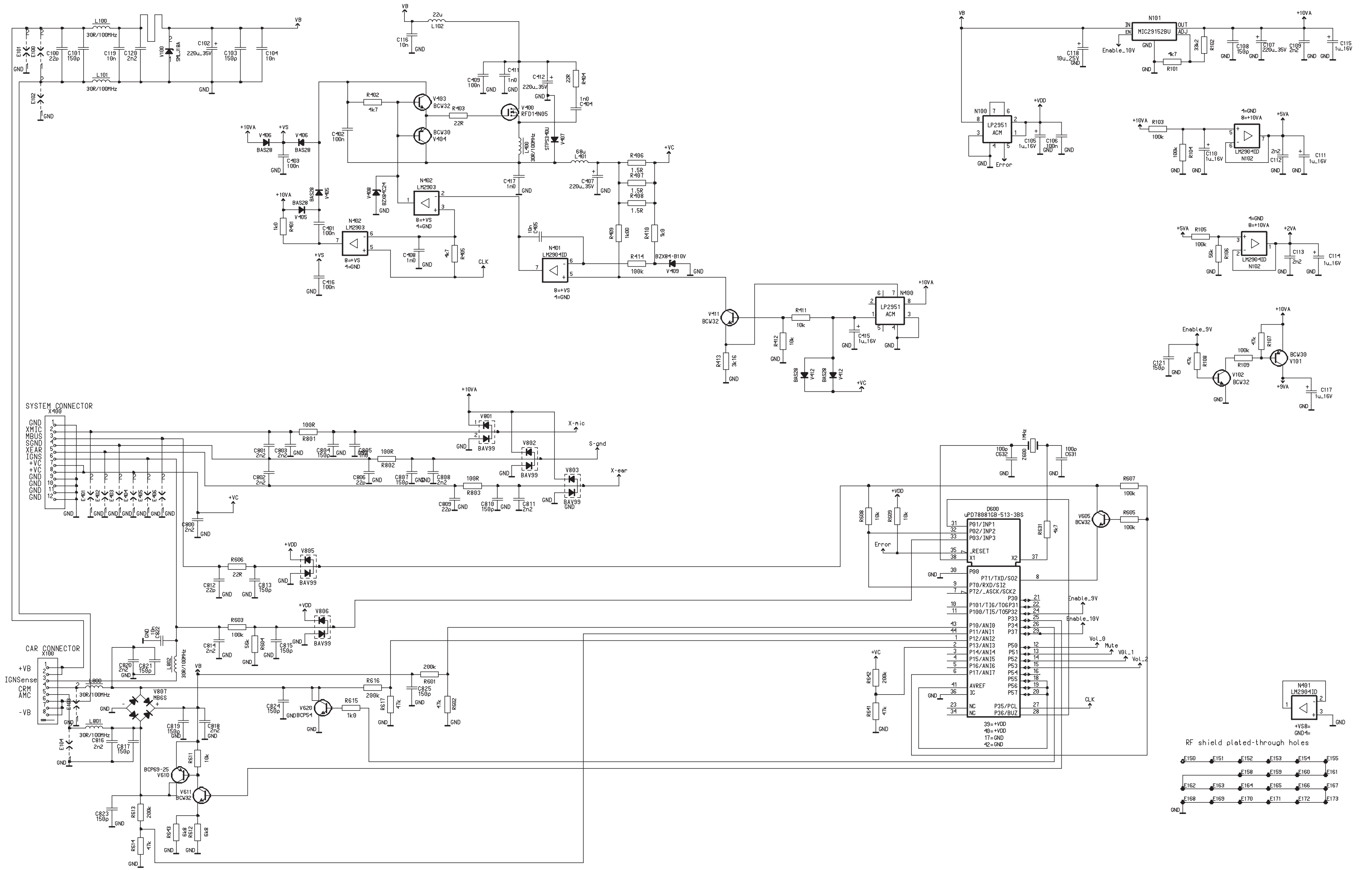


Assembly Parts

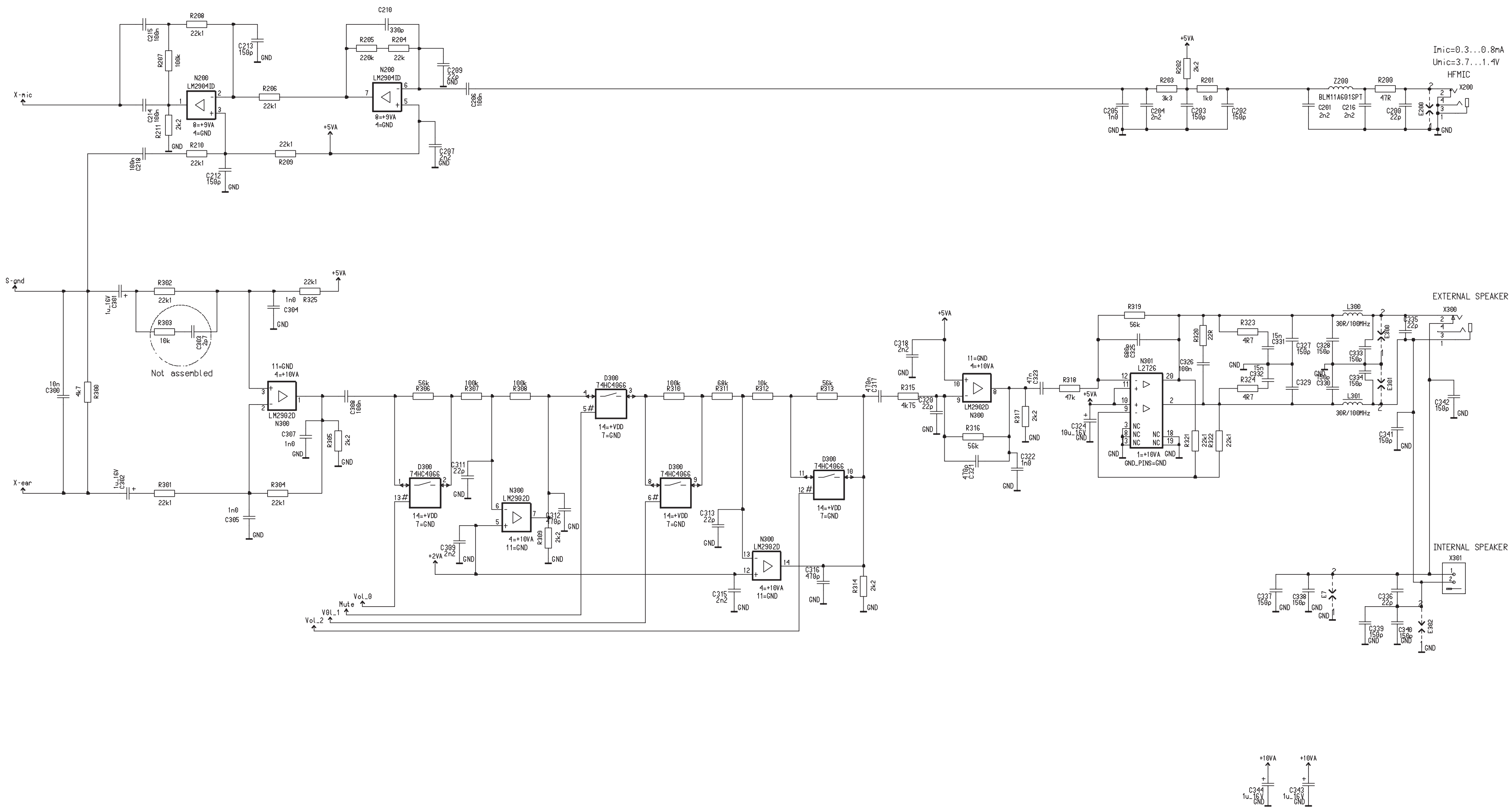
ITEM	Q'TY	CODE	DESCRIPTION	VALUE, TYPE
1		9450720	Front cover	DMD00351
2		5140013	Loudspeaker	1W 15R d64mm h19mm
3		5400994	Connector	2 pole + 2 wire f
4		0200656	HF speaker module DC9	
5		9510333	RF shield	DMD01230
6		9480290	Acoustic foam	DMD01270
7		9780166	Power adapter cable	DMJ00016
8		9450719	Back cover	DMD00352
9	5	6291928	PT screw KB25X7	WN1412 FeZn blk
10		9380154	Label blank	4D22419 23.8X17.5

This page intentionally left blank.

Circuit Diagram of DC9, SMPS and control circuits (Version: 8.0 Edit: 145)



Circuit Diagram of DC9, audio and mic amplifiers (Version: 8.0 Edit: 24)



NHE–6/NHK–6
SERVICE
ACCESSORIES

Original 04/97

NMP Part No. 0275218

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments

NHE–6/NHK–6 SERVICE ACCESSORIES

Contents

List of Service Accessories

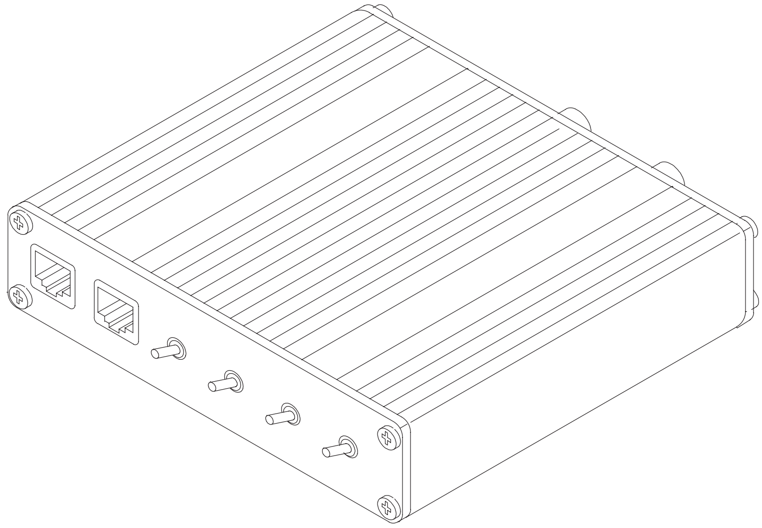
Service Box JBU–4

Service box provides convenient test enviroment (regulated power supply, M2BUS, preset battery reference voltage, external RF connection; not used in NHE–5/NHK–5, audio test loops) in one box.

Product Code

Service Box JBU–4: 0770041

View of JBU–4



G0770041

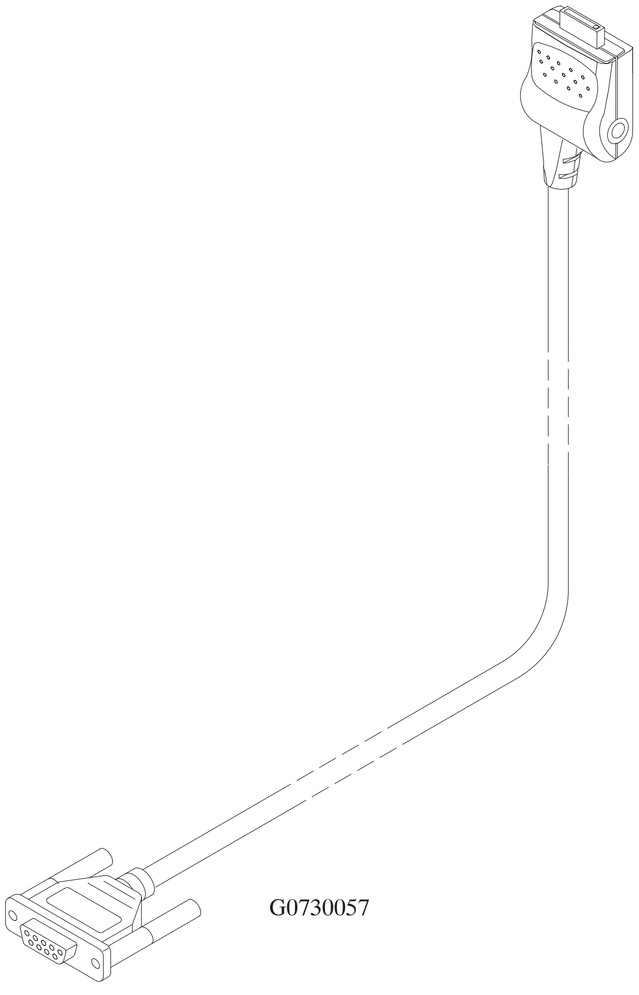
MBUS Cable DAU–4S

DAU–4S is connected between the phone and the serial (COM) port of the PC. It matches the MBUS data bus signals to the serial data bus of the computer.

Product code

MBUS Cable DAU–4S: 0730057

View of DAU–4S



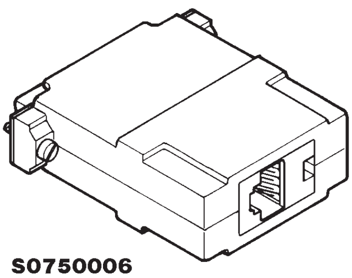
PC/MBUS Adapter DAU–2T

DAU–2 can be used instead of DAU–4S as RS232 to MBUS converter.

Product Code

PC/MBUS Adapter DAU–2T: 0750006

View of DAU–2T



S0750006

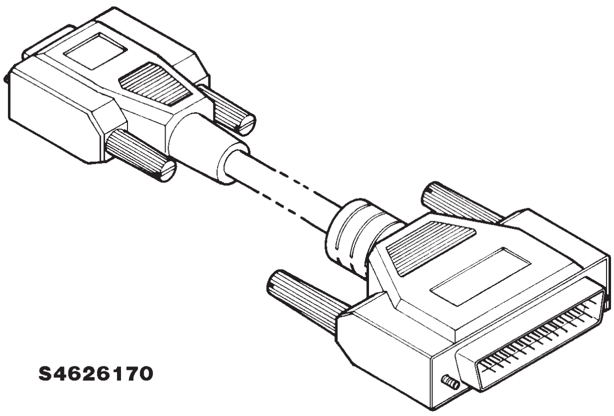
D9/D25 RS–232 Adapter

Suitable adapter between DAU–2T and computers having 9 pin D connector as a serial port.

Product Code

D9/D25 RS–232 Adapter: 4626170

View of Adapter



S4626170

Service Cables SCS–4 and SCS–4B

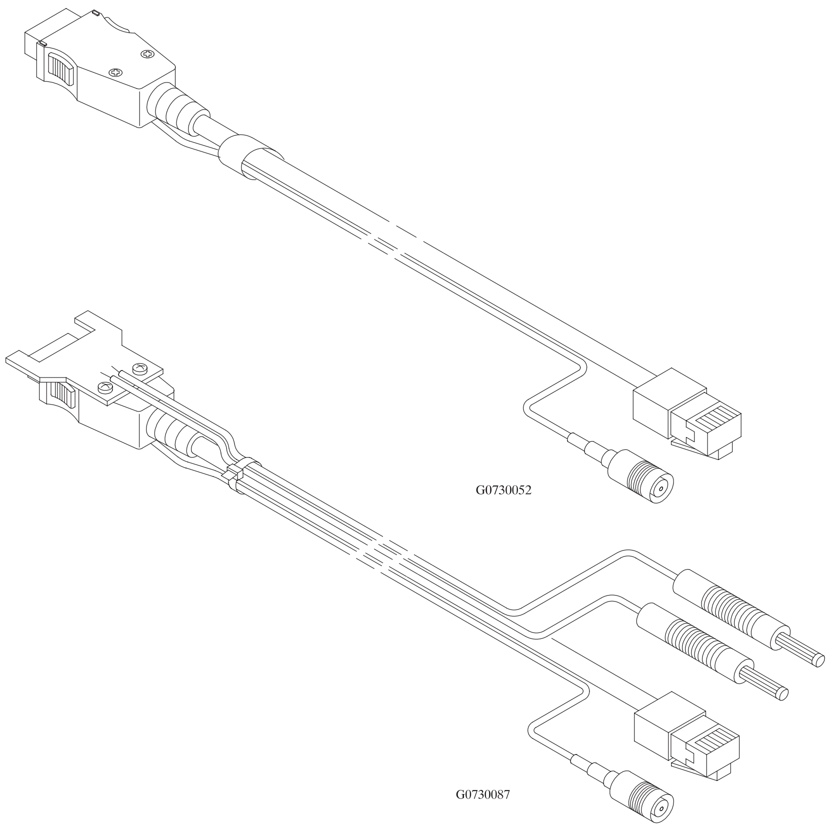
Service cable SCS–4 is an adapter routing RF signal from phone bottom connector to BNC connector. It also contains modular connector that can be used to service purpoces.

Service cable SCS–4B have same functions as service cable SCS–4 but enables also power connection to phone.

Product code

Service Cable SCS–4:	0730052
Service Cable SCS–4B:	0730087

View of SCS–4 and SCS–4B



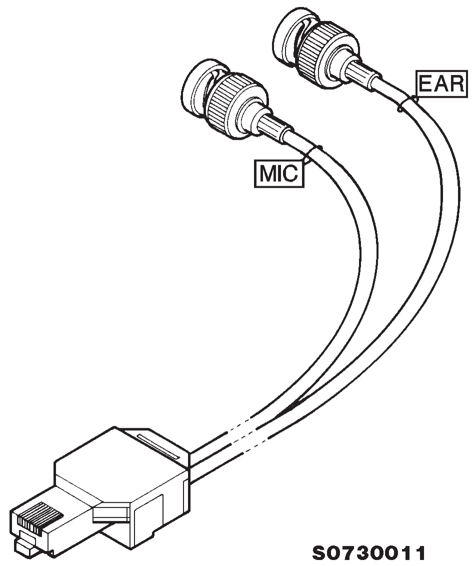
Audio Cable ADS–1

Audio cable is an adapter routing AF signals (MIC/EAR) from 8 pin modular connector to two BNC connectors.

Product code

Audio Cable ADS–1: 0730011

View of ADS–1



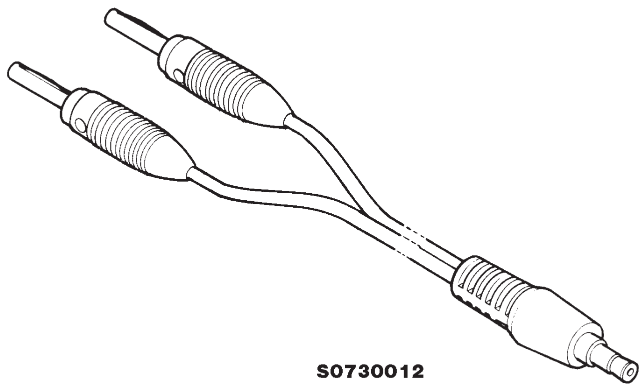
Power Connector PCS–1

Suitable adapter between JBU–4 and the power supply.

Product code

Power Connector PCS–1: 0730012

View of PCS–1



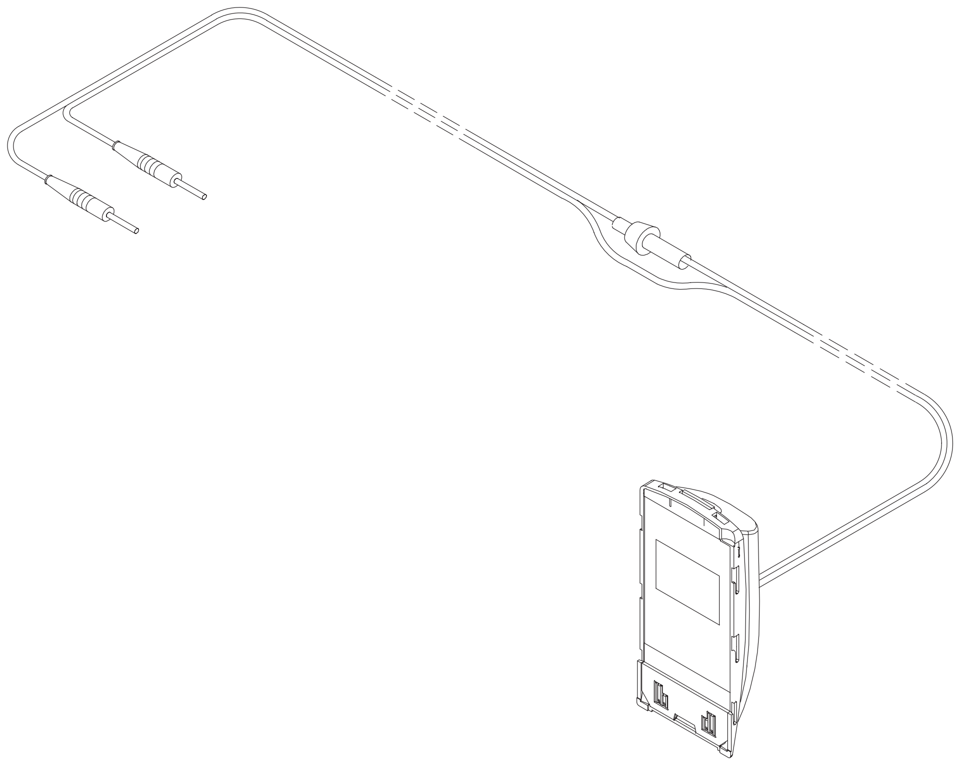
Service Battery BBS–2

Service battery is convenient device when the battery reference voltage is to be programmed. JBU–4 has a voltage setting for supplying specified reference voltage needed for this programming. Of course the service battery can be used to substitute the normal battery also during normal testing, and optionally the input d.c. may be taken from some external power supply. However, one should take care not to exceed the voltage rating of the phone.

Product code

Service Battery BBS–2:	0775055

View of Service Battery



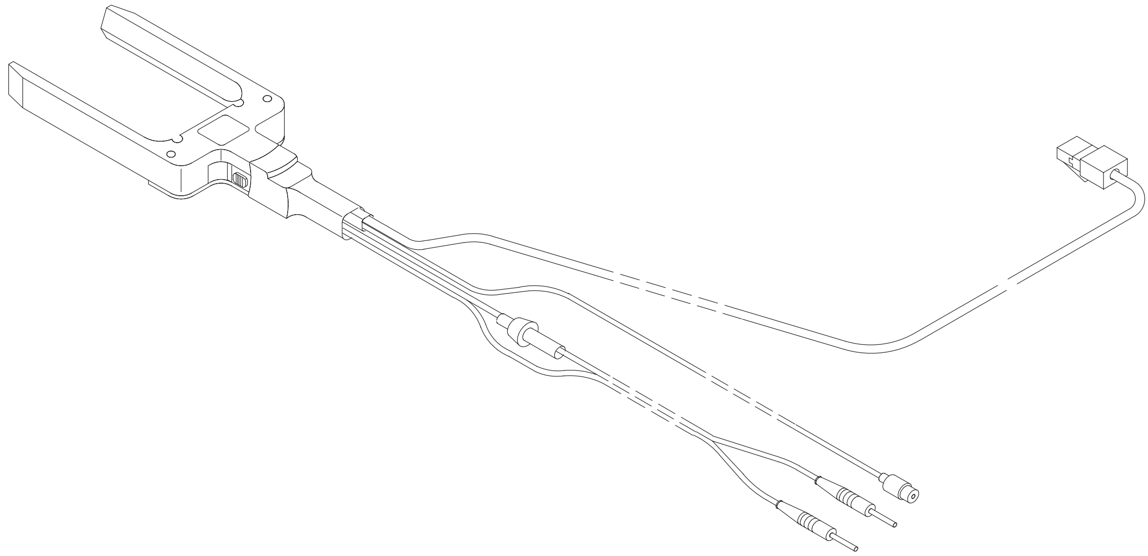
Module Jig JBS–18

The module jig is for service use. Component level service operations and measurements to open PCB board can be done through that frame.

Product code

Test Module Jig JBS–18: 0770070

View of Module Jig



SW Security Device ”Dongle” PKD–1

SW security device ”Dongle” is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Whitout the dongle present it is not possible to use the service software. Printer or any such device can be connected to the PC through the dongle if needed.

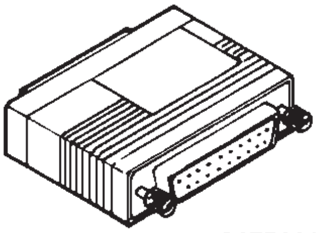
Caution: *Make sure thet you have switched off the PC and the printer before making connections!*

Caution: *Do not connected the PKD–1 to the serial port. You may damage your PKD–1!*

Product Code

SW Security Device PKD–1: 0750018

View of SW Security Device



G0750018

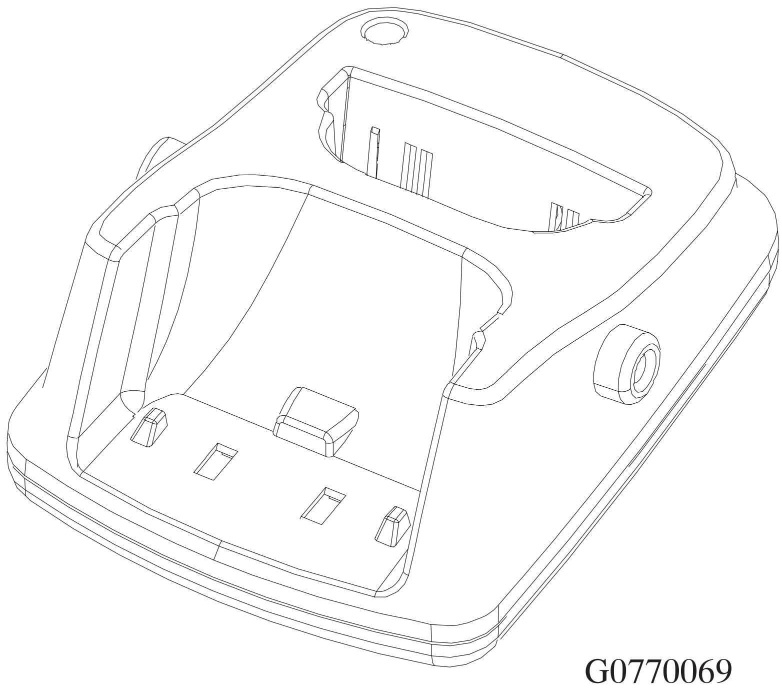
Battery Adapter CGH–6S

Battery adapter CGH–6S together external battery capacity meter offers a way to check battery capacity. Please note that Li–Ion batteries have internal protection circuitry to prevent deep discharge.

Product Code

Battery Adapter CGH–6S: 0770069

View of Battery Adapter



G0770069

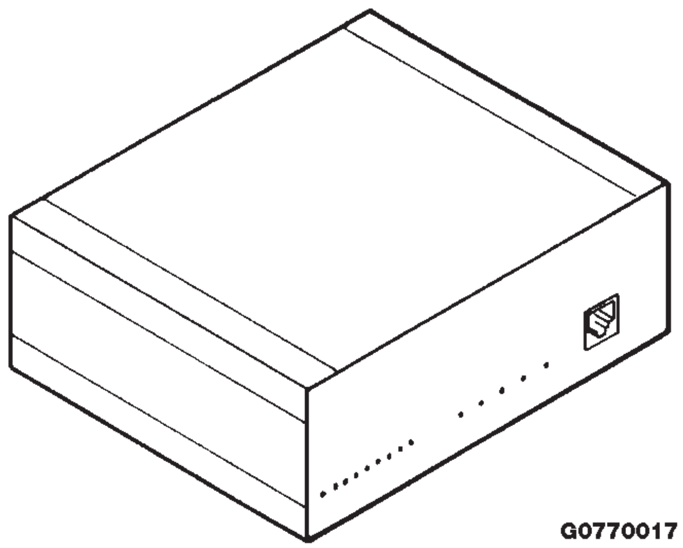
Flash Prommer FPS–4

Flash prommer is used to update the main software of the phone, should that some day become necessary. Updating is done by first loading the new MCU software from PC to the FLASH prommer and then loading the new SW from prommer to the phone. When updating more than one phone in a row, the new MCU SW must be loaded to the prommer only in the beginning.

Product Code

Flash Prommer FPS–4: 0750090

View of FPS–4



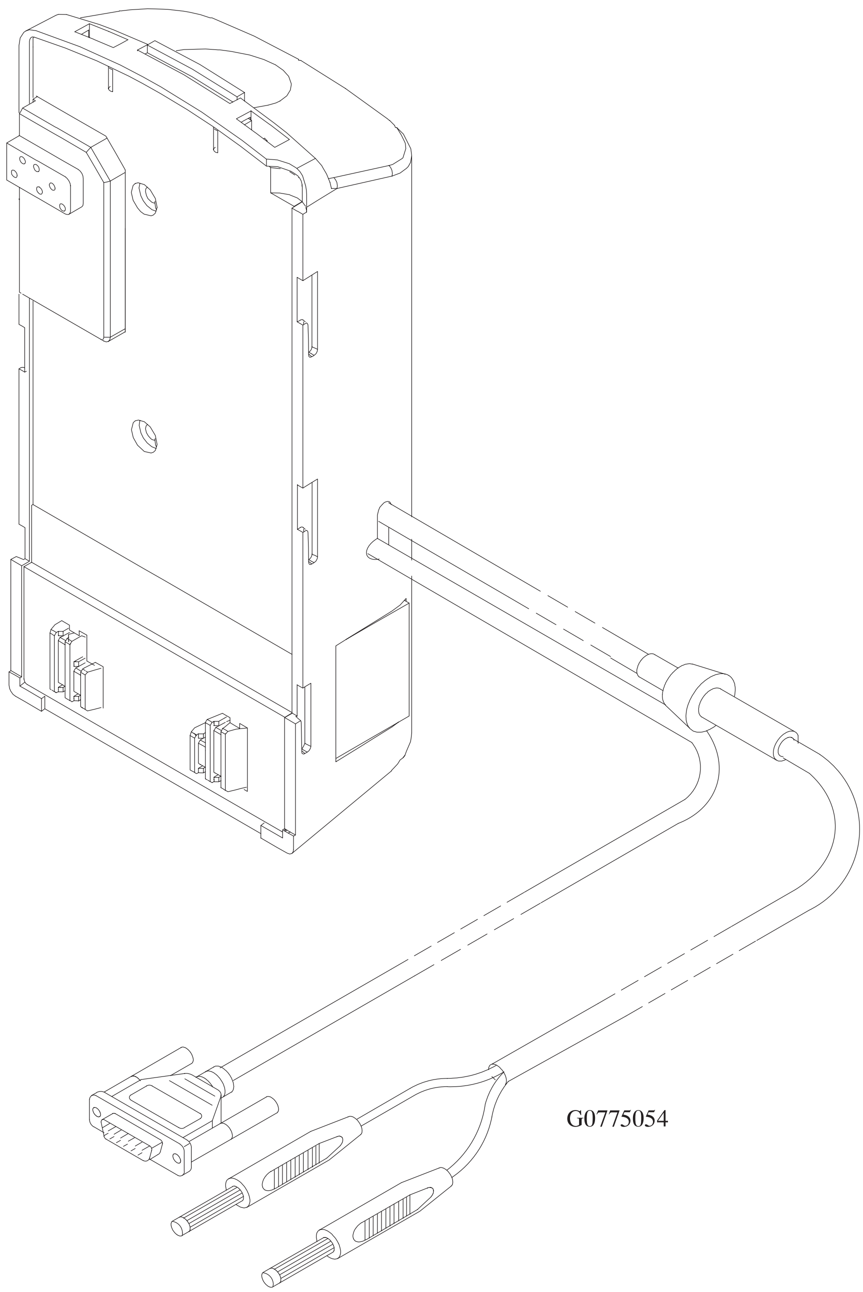
Flash Loading Adapter FLA–3

The flash loading adapter is made to be used either via flash prommer FPS–4 or light flash prommer FPS–6. The flash loading adapter also offers same function as the service battery.

Product Code

Flash Loading Adapter FLA–3: 0775054

View of



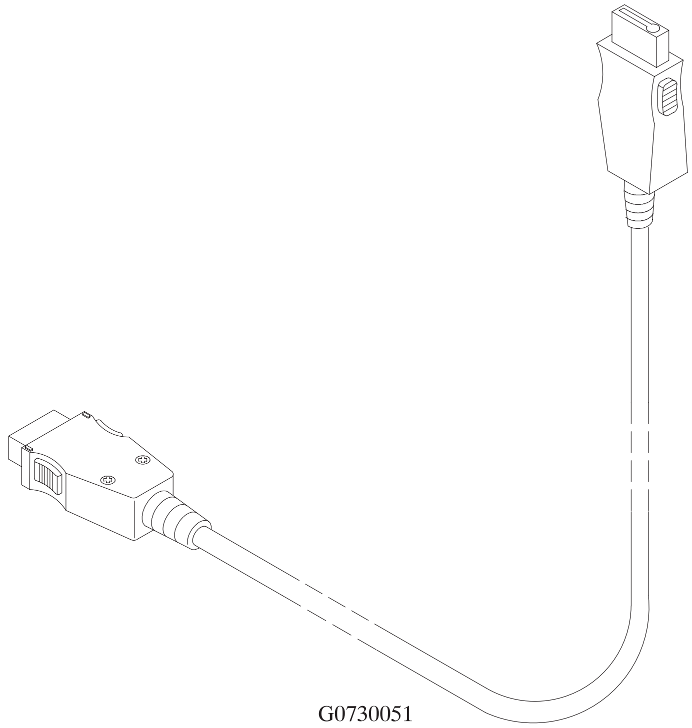
System Cable SCH–3

System cable SCH–3 is a cable between two phones. SCH–3 provides transferring data (stored phone numbers etc.) from one phone to another.

Product Code

System Cable SCH–3: 0730051

View of SCH–3



This page intentionally left blank.

NHE/K–5/6
SERVICE SOFTWARE
INSTRUCTIONS

Original 10/97

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 2	**10/97**	J Rantala	Updated version Removed: Noise Sensitivity Phone Identity
Issue 2	**08/98**	O Juntunen	Pages 35, 48 updated figures page 49 list of tests updated

NHE/K–5/6 SERVICE SOFTWARE INSTRUCTIONS

Contents

Introduction

General

The NHE/K–5 NHE/K–6 Service Software is specially designed to facilitate the servicing of sixth generation cellular telephones.

The software can be used to control the phone according to the user's requirements merely by entering commands via the keyboard or mouse of a PC connected to the phone.

NMP PAMS shall notify service personnel about future upgrades via Technical Bulletins. Software upgrades will be available from your local NMP outlet or the Internet.

Minimum Required Servicing Equipment

– Computer: with Intel 486/33 MHz or newer compatible CPU, with one unused serial port (COM1 or COM2*), one parallel port (LPT1), hard disk recommended.
– Memory: 4 MB or more
– Operating System: DOS Version 5 & Microsoft Windows 3.11 or later
– Display: VGA based display (640 x 480)
– PC Locals program: for 3.5" disk (product code: 0774034)
– Software Protection Key PKD–1 (product code 0750018)
– M2BUS interface cable DAU–4S (product code 0730057)

*) Note: A number of PC's of an older generation use the Intel, National Semiconductor, or United Microelectronics IC 8250 as the serial port UART. This is a comparatively inefficient circuit for current purposes and does not necessarily support the M2BUS adapter at 9600 baud. The newer UART's NS16450 and NS16550AF of National Semiconductor offer solutions for these problems.

Mechanical Connections

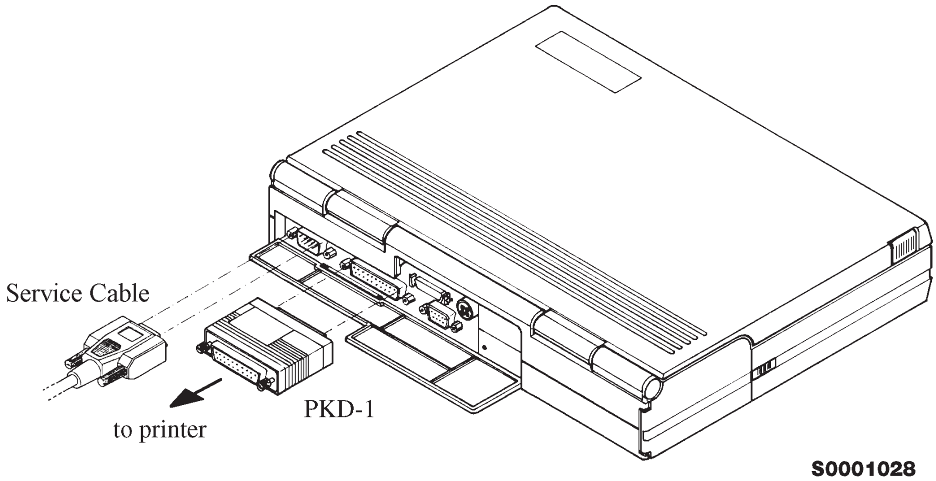
Caution: Ensure that you have switched off the PC and the printer before making connections !

Caution: Do not connect the PKD–1 to the serial port. This could damage the PKD–1 !

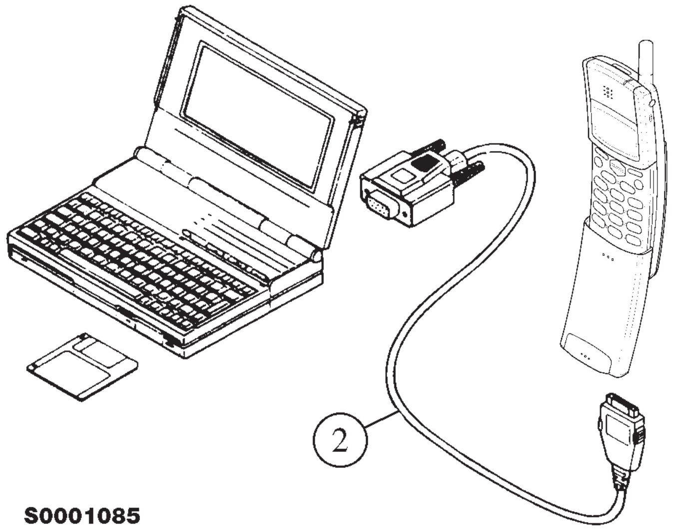
The software controls the phone via a separate adapter connected to the serial port of the PC and to the telephone's M2BUS (DAU–4S and XCM–1).

Attach the protection key PKD–1 to parallel port one (25–pin female D–connector) of the PC. When connecting the PKD–1 to the parallel port be sure that you insert the PC end of the PKD–1 to the PC (male side). If you use a printer on parallel port one, place the PKD–1 between the PC and your printer cable.

The PKD–1 should not effect devices working with it. If some errors occur (errors in printing are possible) please try printing without the PKD–1. If printing is OK without the PKD–1 please contact your dealer. We will offer you a new PKD–1 in exchange for your old one.



Attach one end of the M2BUS interface cable, DAU–4S (2), to the PC serial port and the other end to the bottom connector of the phone.



Start Up Procedure

Start the phone by pressing the power–on button of the handset. Switch PC power on.

To installing software, proceed as follows:

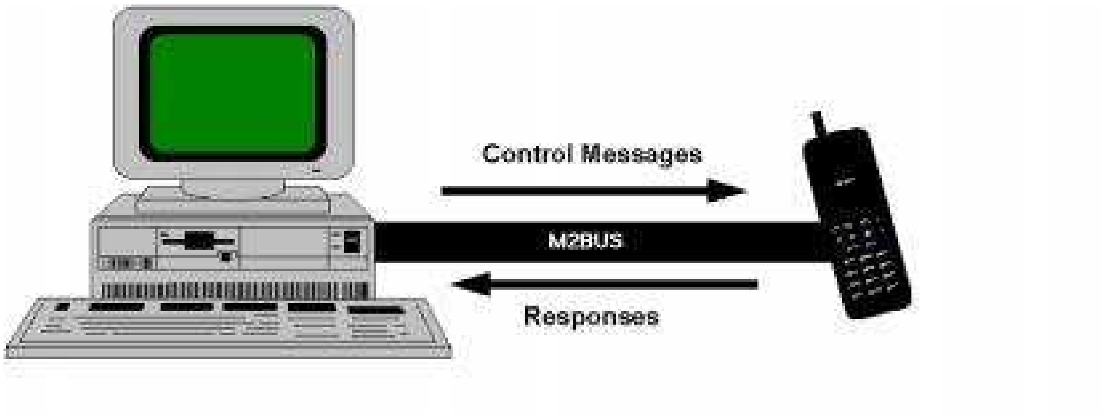
1. Insert Service Software disk into drive A of your PC	
2. Start Windows:	**type *WIN* and press *Enter***
3. Start Installing program:	**select *File –> Run* from Program Manager menu, then type *A:INSTALL* and press *OK* button**
4. Follow Installation Software instructions	

Introduction to Service Software Package User Interface

This chapter gives a short description of the Service Software properties.

Service Software/Hardware Enviroment

To run the Service Software, a parallel port software protection device (PKD–1) has to be connected. The user can use the Service Software functions for testing all supported Phone Types. The functions send messages from the PC to the phone, receives results and show them on the PC display. The messages are sent via a low level NMP proprietary bus protocol. An example bus is an M2BUS interface, which needs M2BUS adapter (DAU–2) connected to the PC RS–232 port and special M2BUS cable.



The recommended minimum hardware standard to run the Service Software package is any computer which is 386 33Mhz or greater with at least 4 MB of memory and VGA type display (640x480). This assumes that only the Service Software package is active, i.e. other Windows packages are not running in the background.

Note: if the Service Software is to be run on a laptop, the power saving feature MUST be switched off.

Service Software Enviroment

Service Software user interface is intended for Microsoft Windows 3.1x environment running in enhanced mode. For those who are familiar with Windows environment this application will be easy to use. Detailed information about Windows and application usage can be found from Ref 3– Microsoft Windows Version 3.1 Users Guide chapter one (Windows Basics) and chapter two (Application Basics).

As an ordinary Windows application, the main idea in the user interface is that selections are made with menus, push buttons and shortcut keys. Selections can be done by using keyboard and/or mouse. When messages from phone are received, they cause display updating in special display windows. There is always a status bar displayed at the bottom of the main window which contains information about current actions.

Service Software Executables

Only one executable is needed – WinTesla.

For NHE/K–5/6 there are two DLL’s:

– Functionality DLL is NHEK56.DLL

– User Interface DLL is NHEK56EN.DLL or NHK5EN.DLL

Command Line Parameters

There are NO command line parameters.

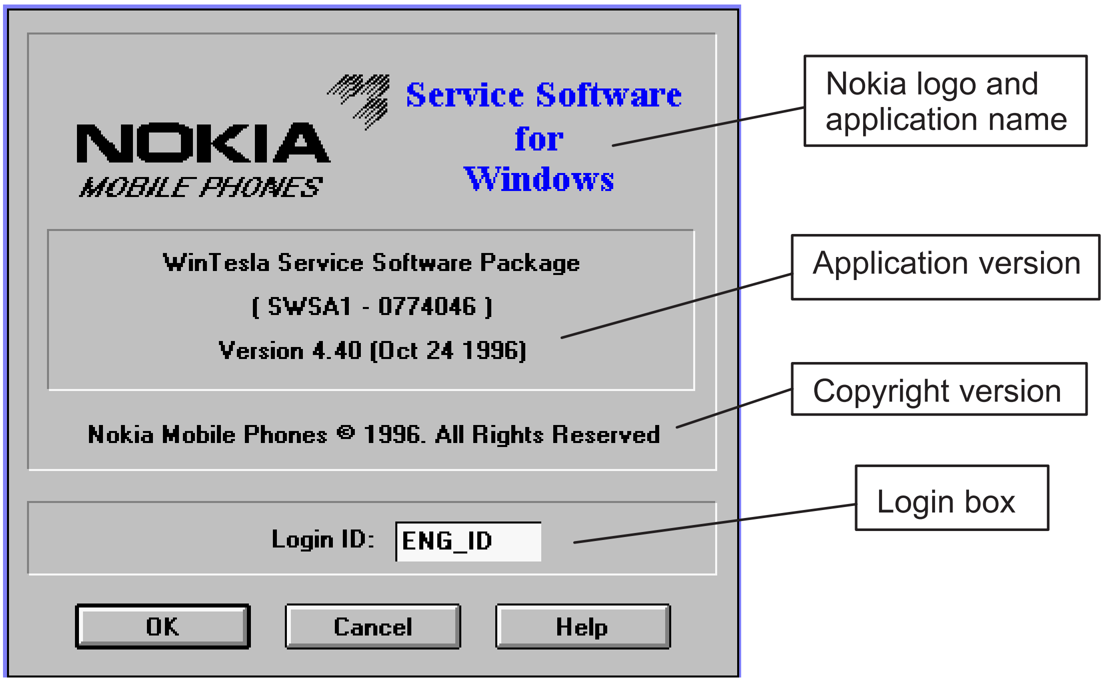
Common Properties of the User Interface

This chapter describes how the User Interface CLF must appear to the user.

The User Interface MUST be capable of being driven without the use of a mouse, as the service engineer rarely has space on the bench to use a mouse.

Login Dialog

When the Service Software application is invoked, by checking on the Service Software icon, the **Login** dialog box will be displayed on the screen.



Nokia logo and application name bitmap (–)

Displays Nokia logo and name of the application.

Application version static text (–)

Contains the name and version of the application.

Copyright notice static text (–)

Copyright is informed as: “**Nokia Mobile Phones (c) 1996. All Rights Reserved**”.

Login Box edit box (–)

The user Login ID edit box, where the user enters his faultlog user name. (See Faultlog User Guide)

OK button (default key)

The user name is stored in memory and the dialog box is closed. When the dialog box is closed, the application starts.

Cancel button (ESC)

The Dialog box is closed and application is started, but the Faultlog feature is disabled.

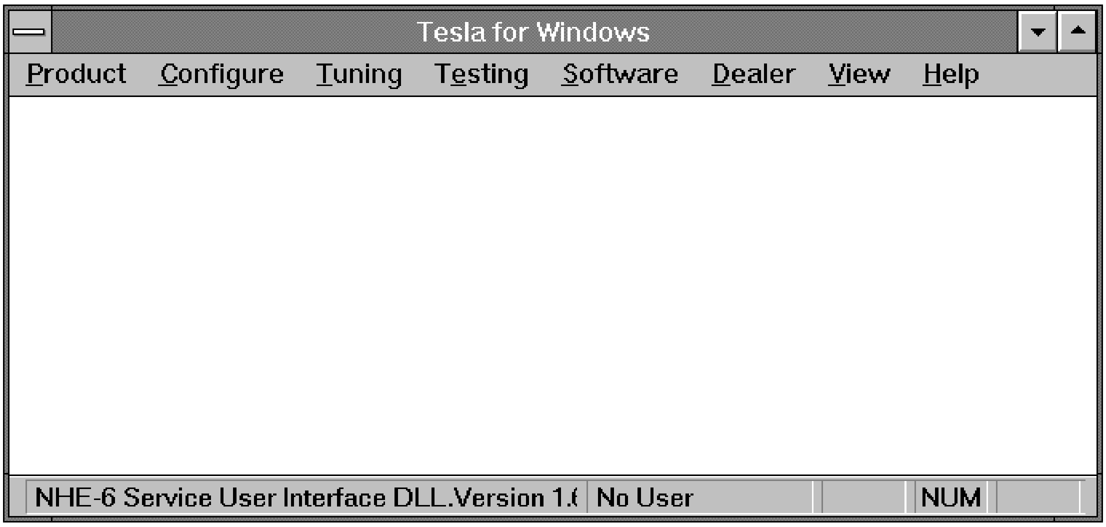
Help button (F1)

Activates the Windows Help application and displays context sensitive Help.

Main Window

The application supports a *Multiple Document Interface (MDI).* However, the service software interface will present a *Single Document Interface (SDI)* appearance.

Note: MDI is to allow for future expansion, e.g. R&D features.



Title bar

The *title bar* is located at the top of the window.

A title bar contains the following elements:

- Application Control–menu button
- Maximise button
- Minimise button
- Name of the application
- Restore button

The properties of these elements and their usage is described in Ref 3– Microsoft Windows Version 3.1 Users Guide chapter one (Windows Basics) and chapter two (Application Basics).

Menu bar

The *menu bar* is below the title bar and contains all available menu selections. The menu bar is a dynamic element and is dependent on the dongle type fitted, and whether a phone is connected.

Underlined characters in menu names and options indicates that the menu selection can be done by pressing *Alt*+ underlined character. Options can also be selected by activating menu bar with *Alt*– key (or *F10* key) and using arrow–keys to highlight the desired menu. In that case, selection is done by pressing *Enter*.

Menus can also be selected by using the mouse as described in Ref 3–Microsoft Windows Version 3.1 Users Guide

Status bar

The *status bar* is displayed at the bottom of the Service Software main window. The status bar contains information about the menu selections and events.

The left area of the status bar describes the actions of menu items as the user uses the arrow keys to navigate through menus.

The status bar texts are explained in detailed in each of command's description.

The right areas of the status bar indicate which of the following keys are latched down:

Indicator	Description
USER	Entered Login ID.
CAP	The Caps Lock key is latched down.
NUM	The Num Lock key is latched down.
SCRL	The Scroll Lock key is latched down.

Tool bar

The *tool bar* is NOT defined and will not be implemented until specified by this document.

Menu Bar

The Service Software package will have two menu bar configurations. The first, is an abbreviated version that contains the minimum number of menus that allows package configurations when a phone is NOT connected. The second is described below:

The menu bar MUST only contain the follow menus for the Service Software package when a phone is connected:

- Product*
- Configure*
- Tuning
- Testing
- Software
- Dealer
- View
- Help*

* – always displayed, even if no phone is connected.

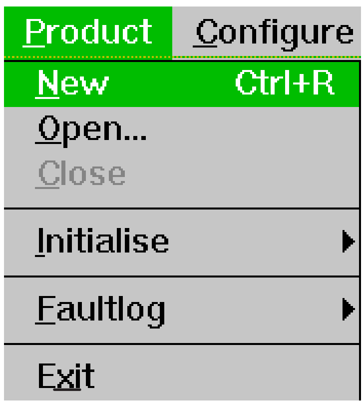
A menu is broken down into sections that are indicated with menu separators. Each sections identifies a logical difference from itself and other sections, i.e. between transmitter and receiver. Any items that are required to be added to a menu lists will be added on the bottom of the appropriate menu section list. If a new item is to be added which is common to two or more phone types, then that menu item will become a common menu item.

The menu lists will use the Microsoft [...] symbol after an item name to indicate that selecting that item will NOT initiate an operation immediately, i.e. a dialog box will be displayed for the user to select options or type in data and press the OK button before the operation is performed.

Product

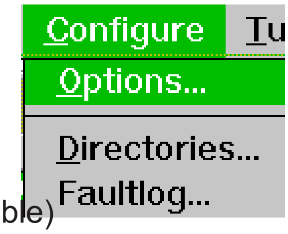
The Product menu contains the following menu items:

- New Ctrl+R
- Open...
- Close
- Initialize
  - Normal Mode F5
  - Local Mode Shift+F5
- Faultlog
  - Activate Faultlog... F9
  - Edit Faultlog...
- Exit Alt+F4



Configure

The Configure menu contains the following menu items:

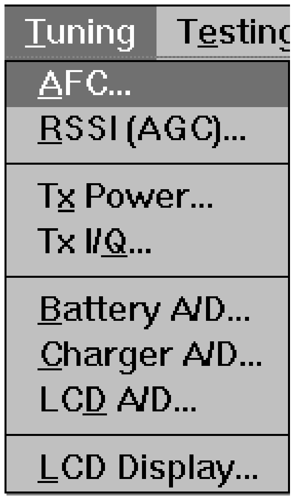


- Options...
- Directories...
- Faultlog...
- Phone Type Specific configuration items (where applicable)

Tuning

The Tuning menu contains the following menu sections:

- Receiver
- Transmitter
- Voltages
- Phone Type Specific tuning items (where applicable)



An example Tuning menu is shown below:

- AFC...
- RSSI (AGC)...
- Tx Power...
- Tx I/Q...
- Battery A/D
- Charger A/D...
- LCD A/D...
- LCD Display...

Additional menu items may be added within the sections according to the phone type being tuned, e.g. a Charger tuning menu item will be added after the Battery tuning item, but not in the Transmitter tuning section.

Testing

The Testing menu contains the following menu sections:

- Quick Tests
- Digital
- User Interface Flexi
- Transmitter
- Receiver
- Automatic Tests
- Phone Type Specific testing items (where applicable)

An example Testing menu is shown below:

- Quick Testing (RF)...
- RSSI Reading ...
- Self Tests
- ADC Readings
- Audio
- Display
- Call Simulation...

Additional menu items may be added within the sections according to the phone type being tested.

Where a menu item consists of more than one test, a pop–up menu may be added to identify the appropriate sub–tests, e.g. there may be two receiver tests required for a particular phone type (Bit Error Rate and RSSI Monitoring). These will be shown as a popup from the Receiver menu item.

Software

The Software menu contains the following menu sections:

- Phone Numbers
- Flashing
- Phone Type Specific software items (where applicable)

An example Software menu is shown below:

- Product Profile...
- Start Up Self–tests...
- Set Default Values
- Network Settings...
- Warranty State...
- Service Numbers...
- Flash Phone...

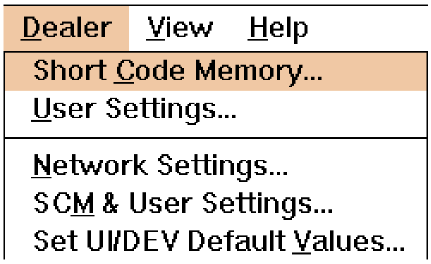
Dealer

The Dealer menu contains the following menu sections:

- Phone UI Data Editors
- Phone UI Data Transfer
- Phone Re–Initialization Functions
- Subscriber Data
- Phone Type Specific dealer items (where applicable)

An example Dealer menu is shown below:

- Short Code Memory...
- User Settings...
- Network Settings...
- SCM & User settings ...
- Set UI/DEV Default Values ...



View

The View menu contains the following sections:

- Service Windows
- Production Windows (where applicable)
- R&D Windows (where applicable)

An example View menu is shown below:

- Quick/RF Info...
- Phone Identity...

Phone Identity Window

The Phone Identity window should contain, as a minimum, the following data:

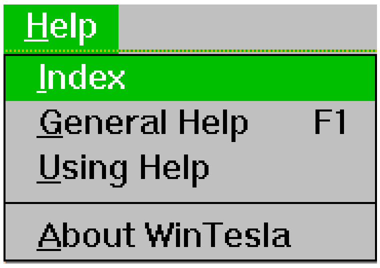
- Software Version(s)
- Hardware Version(s)
- Serial Number(s)
- Product Code

This window will only be used as a display window and therefore will not allow editing of the displayed data. This window will not contain any controls other than a scroll bar.

Help

The Help menu contains the following menu items:

- Index
- General Help
- Using Help
- About WinTesla



Mouse Cursors

The standards Windows pointer will be used as the mouse cursor.

During time consuming tasks e.g. communication to phone, an hour glass will be shown informing the user that a task is in progress. The application uses the hour glass cursor to inform user that the application has taken the control and any actions from user will be ignored.

When a function is initiated, the hour glass will be displayed and when the function has finished the mouse pointer will return to normal.

Reserved Keys

The following Hot keys and Short Cut keys are reserved either as Microsoft standard keys or as part of the Common Look and Feel specified by this document.

Short Cut Function Keys

Key	Description	Defined by
F1	Context Sensitive Help	Microsoft
F5	Normal Mode	NMP
Shift+F5	Local Mode	NMP
F9	Activate Faultlog	NMP
F10	Goto Menu Bar	Microsoft
Ctrl+F4	Close Active Window	Microsoft

Alt Hot Keys

Key	Description	Defined by
Alt+F4	Exit Active Application	Microsoft
Alt+H	Help	Microsoft

Ctrl Hot Keys

Key	Description	Defined by
Ctrl+N	File – New	Microsoft
Ctrl+O	File – Open	Microsoft
Ctrl+P	File – Print	Microsoft
Ctrl+R	Product – New	NMP

Shift Hot Keys

Key	Description	Defined by
Shift+F5	Local Mode	NMP

Key Strokes

Key	Description	Defined by
Alt+P	Product Menu	NMP
Alt+P,N	New	NMP
Alt+P,O	Open	NMP
Alt+P,C	Close	NMP
Alt+P,I	Initialize Pop–up	NMP
Alt+P,I,N	Normal Mode	NMP
Alt+P,I,L	Local Mode	NMP
Alt+P,F	Faultlog Pop–up	NMP
Alt+P,F,A	Activate Faultlog	NMP
Alt+P,F,E	Edit Faultlog	NMP
Alt+P,E	Exit Application	NMP
Alt+C	Configure	NMP
Alt+C,O	Option	NMP
Alt+C,D	Directories	NMP
Alt+C,F	Faultlog	NMP
Alt+T	Tuning Menu	NMP
Alt+T,A	AFC	NMP
Alt+T,R	RSSI(AGC)	NMP
Alt+T,X	Tx Power	NMP
Alt+T,Q	Tx I/Q	NMP
Alt+T,B	Battery	NMP
Alt+T,C	Charger	NMP
Alt+T,D	LCD A/D	NMP
Alt+T,L	LCD Display	NMP
Alt+E	Testing Menu	NMP
Alt+E,Q	Quick Testing RF	NMP
Alt+E,R	RSSI Reading	NMP

Alt+E,S	Self Tests	NMP
Alt+E,A	ADC Readings	NMP
Alt+E,U	Audio	NMP
Alt+E,D	Display	NMP
Alt+E,C	Call Simulation	NMP
Alt+S	Software Menu	NMP
Alt+S,I	Phone Identity	NMP
Alt+S,P	Product Profile	NMP
Alt+S,S	Start–up Self Tests	NMP
Alt+S,V	Set Default Values	NMP
Alt+S,N	Network Settings	NMP
Alt+S,W	Warranty State	NMP
Alt+S,B	Service Numbers	NMP
Alt+S,F	Flash Phone	NMP
Alt+D	Dealer Menu	NMP
Alt+D,C	Short Code Memory	NMP
Alt+D,U	User Settings	NMP
Alt+D,V	Set UI Default Values	NMP
Alt+V	View Menu	NMP
Alt+V,Q	Quick/RF Info	NMP
Alt+V,P	Phone Identity	NMP
Alt+H	Help Menu	Microsoft
Alt+H,I	Index	Microsoft
Alt+H,G	General Help	Microsoft
Alt+H,U	Using Help	Microsoft
Alt+H,A	About WinTesla	Microsoft

Help Functions

The Help User Interface will be the standard Windows help tool called WinHelp.

The context sensitive help is activated with **F1**–key. Help contains also Using Help which describes how to use help facility. Refer to the Windows manual for detailed description on the Windows Help.

Dialog boxes

The Service Software application uses many different dialog boxes. Dialog boxes are used to display data and prompt the user for input.

Dialog boxes are opened from menus or with shortcut keys. Dialog boxes have different properties but some features are common.

All service dialog boxes must be modal, that is, the user will not be able to start another operation without first closing the present dialog box.

All dialog boxes will contain the following entities:

– Help button

– Title bar

– At least one button other than Help

– Application Control–menu Button

Common Dialog boxes

This sections describes the common dialog boxes used in the Service Software package, and the context in which they will be used.

Note Message Box

When the user has made an illegal selection, a *note message box* dialog will be opened and message text is displayed. The message box is also opened when the program has some information for the user. The size of the dialog box may vary. An information dialog box is recognized by the **!**–icon.

The dialog box will also contain an OK button and a Help button.

OK button (default key):

Acknowledge displayed information and continue. The dialog box is closed after selection.

Help button (Alt+H):

Opens context sensitive help as F1–key does.

Query Message Box

Confirmations and questions are asked in *a query message box*. A query dialog box is recognized by the **?**–icon.

The dialog box will also contain a Yes button, a No button, and a Help button.

Yes button (Alt+Y or Y) (default key):

Accepts confirmation or question.

No button (Alt+N or N):

Denies confirmation or question.

Help button (Alt+H):

Opens context sensitive help as F1–key does.

The buttons may also be OK and Cancel. The operation of these buttons are the same as in the Note dialog box.

Error Message Box

Error message dialog boxes use the Stop–icon. When a “Stop”–dialog box is shown, the current operation is terminated.

The dialog box has a description about the failed operation and reason. Pressing F1 (Help) application opens the appropriate help topic that gives information about recommended actions.

The dialog box will also contain an OK button and a Help button.

OK button (default key):

Acknowledges displayed information and terminate current operation. The dialog box is closed after selection.

Help button (Alt+H):

Open context sensitive help as F1–key does.

Custom Dialog boxes

All custom dialog boxes will contain the predefined buttons as defined below in the section – *Buttons.* However, it is recognised that features may require additional button types, but the addition of these non–standard buttons should be carefully considered to minimise any inconsistencies between implementations.

The buttons will be positioned down the right–hand side of the dialog boxes. The default action will be **OK**, except where that default action could result in an irretrievable failure.

All tuning dialogs that contain tuning results, will display the old tuned data read from the phone before the tuning was performed, as well as the newly tuned data.

List boxes will be used to display lists of data, such as tuning data, test results etc.

The use of Radio buttons should be limited and carefully considered. The use of radio buttons defines the number of possible choices available to the user, which may be acceptable for one project, but not for another.

Buttons

All buttons must be the Microsoft style of buttons.

In general, the default button will be the OK button, the Close button or the Yes button, but this will depend on the context of the dialog box that the button is associated with.

OK button:

Accepts and validates entered settings and values and closes the dialog. If the values have not been changed, then no action will be taken. The status bar will reflect the status. The user should only be queried, if the settings or values accepted will over–write data that CAN NOT be reproduced.

A greyed **OK** button indicates that settings selected by the user are not acceptable.

Close button:

Closes the current dialog box. Does not send or store anything and closes the dialog. The Close button is only used for dialogs that do not set or change any data.

Cancel button (Esc):

Cancel operation. Does not send or store anything and closes the dialog box.

A greyed **Cancel** button indicates that it is not possible to quit from this dialog box.

Yes button (ALT+Y or Y):

Replies Yes to a question asked of the user.

No button (ALT+N or N):

Replies No to a question asked of the user.

Help button (ALT+H):

Opens context sensitive help as F1–key does.

Reporting Status

The status bar will be used to report the present status to the user. When a feature is initiated, the status bar will be updated with a brief description of the function. The status bar will also be updated at key points in a time consuming function.

If an error is to be reported to the user, it will be displayed in the status bar as well as displayed in a common error dialog box. This will mean the user is not delayed from progressing on to the next operation unless an error occurs, in which case, the user will have to acknowledge the error by pressing the OK button.

NHE/K–5 & NHE/K–6 Specific Features

Menu Bar

The Service Software's menus adopts the menu structure specified by CLF.

Product

New command

Activation	Status Bar Text
Alt, P, N Ctrl+R	Rescan a new phone

This command scans a new product. When phone is found a product specific functionality module is loaded. If no phone or wrong phone/cellular type is detected, functionality is unloaded and user is informed.

This function is also started automatically when the application is started. The user can also specify a regular poll which enables the WinTesla application to scan the new phone periodically. If the phone is still the same, no changes are done. If the phone is changed (with same phone type only the serial number is changed), the phone will be initialized to a normal mode. If the phone is changed to a different phone type, the current dlls are unloaded and new ones are loaded for that phone.

The initialization routine checks the phone's cellular type (GSM/PCN), and if an unsupported phone is detected, the WinTesla application does not load the dlls.

If quick info view is open, the window will be automatically updated.

If phone identification view is open, the window will be automatically updated.

Open... command

Activation	Status Bar Text
Alt, P, O	Force load phone specific functionality

Enables the user to force load specific phone's WinTesla dll's.

Close command

Activation	Status Bar Text
Alt, P, C	Close loaded functionality

Closes loaded functionality and sends reset to phone if dlls are loaded by Open command.

Initialize command

Activation	Status Bar Text
Alt, P, I	–

Opens a submenu which contains the following options:

Normal Mode

Activation	Status Bar Text
Alt, P, I, N F5	Initializes phone to normal mode

When normal mode has been activated or program has been started, self–test results will be asked from MCU. If any fault was found in the tests, an error message is shown. If normal mode has been set successfully (no self test error has been found), and paging listening has been started, the used AFC value is requested from MS.

The Initialization routine checks the phone’s cellular type (GSM/PCN) and if an unsupported phone is detected, the application unloads the dlls.

If phone identification view is open, the window will be automatically updated. Also if RF Information Window is open it will be updated to quick info view.

Local Mode

Activation	Status Bar Text
Alt, P, I, L Shift+F5	Initialises phone to local mode

Selection will change the MS state to *local*. When local mode is selected the phone is controlled to the local mode so that special actions can be made (for example RF tunings).

Faultlog

Activation	Status Bar Text
Alt, P, F	–

Opens a submenu which contains following options:

Activate Faultlog...

Activation	Status Bar Text
Alt, P, F, A F9	Activates faultlogging

Edit Faultlog...

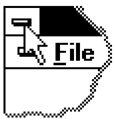
Activation	Status Bar Text
Alt, P, F, E	Activates faultlog editing

Note! This documentation will be updated as soon as WinTesla integration is ready.

Exit command

Activation	Status Bar Text
Alt, P, X	Exit application
Alt + F4	

Double click the application's Control menu button:



This command ends the Service Software session.

Configure

Options... command

Activation	Status Bar Text
Alt, C, O	Edit Service Software options

The **Options** dialog box contains the following items:

Language drop down list.

Current password edit box:

New Password edit box:

Retype Password edit box:

User ID edit box.

M2BUS Com Port drop down list.

Automatic Rescan edit box.

Note! This documentation will be updated as soon as WinTesla integration is ready.

Directories... command

Activation	Status Bar Text
Alt, C, D	Edit directory settings

The **Directories** dialog box contains the following items:

ID Data edit box:

Logs edit box:

Fault log file(s) edit box:

Data Validation file(s) edit box:

Flash images edit box:

Blow failures edit box:

Note! This documentation will be updated as soon as WinTesla integration is ready.

Faultlog... command

Activation	Status Bar Text
Alt, C, F	Edit faultlog settings

The **Faultlog** dialog box contains the following items:

Fault log enabled/disabled radio buttons:

Allow Manual Entry enabled/disabled radio buttons:

Automatic fault log prompting enabled 1/Disabled 2 radio buttons:

Station identity edit box:

Country of Repair edit box:

Warranty period months edit box / drop down list:

Maximum Time to repair edit box:

Note! This documentation will be updated as soon as WinTesla integration is ready.

Tuning

The tuning menu offers functions for ME adjustments.

AFC... command

Activation	Status Bar Text
Alt, T, A	Open an AFC diagram dialog box

Starts AFC tuning.

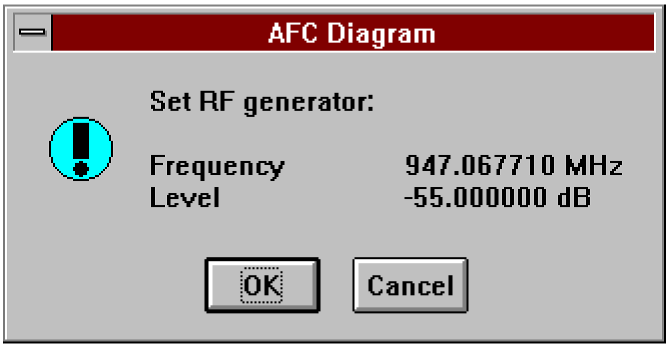
The following are automatically selected when this tuning function is activated:

Active Unit = RX

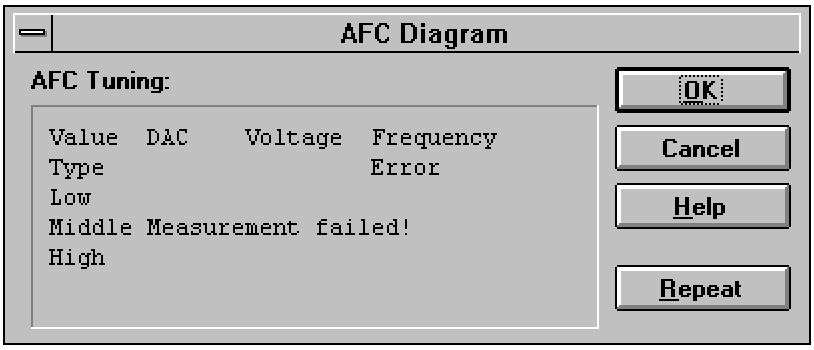
Operation mode = Continuous

Update RF Information window

Before tuning is stared, the user is requested to set signal generator to specified input level (read from .INI file).



The **AFC Diagram** dialog box will open when user accepts request:



The **AFC Diagram** dialog box contains the following items:

Repeat button (Alt+R):

The measurement can be started again by pressing Repeat button.

OK button (Alt+O):

The dialog box is closed, and tuning *is saved* to phone.

Cancel button (Esc):

Dialog is closed and tuning *is not saved* to phone.

The D/A converter range (DAC) is from +1023 to –1024 and voltage range is from 0.3 V to 3.9 V (voltage precision is 0.01 V).

The frequency error range is from –134 kHz to +134 kHz with the precision 0.1 kHz. The rounding is made to the closest value.

After exiting with the Cancel button, the following are reset to the values which were selected before this adjustment.

Active Unit

Operation mode

Update RF Information window

The AFC is also reset to its previous value after exiting with the Cancel button.

RSSI (AGC)... command

Activation	Status Bar Text
Alt, T, R	Open **RSSI Calibration** dialog box

Starts RSSI calibration.

The following are automatically selected when this tuning function is activated:

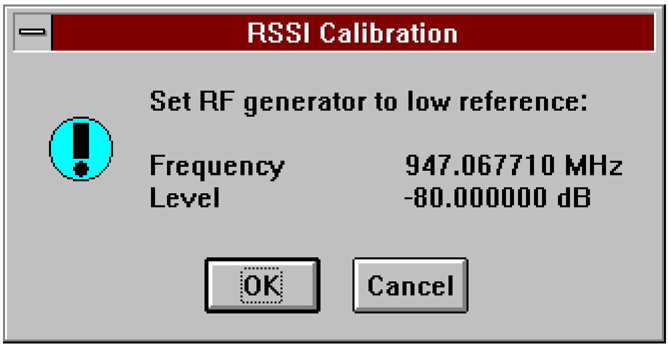
Active Unit = RX

Operation Mode = Continuous

Update RF Information window

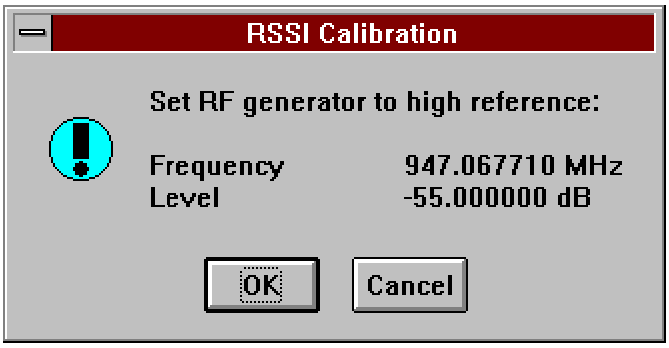
The measurement is started automatically when RSSI calibration is entered. The measurement is done in five steps:

1. The user is requested to set signal generator to low input level (read from .INI file).



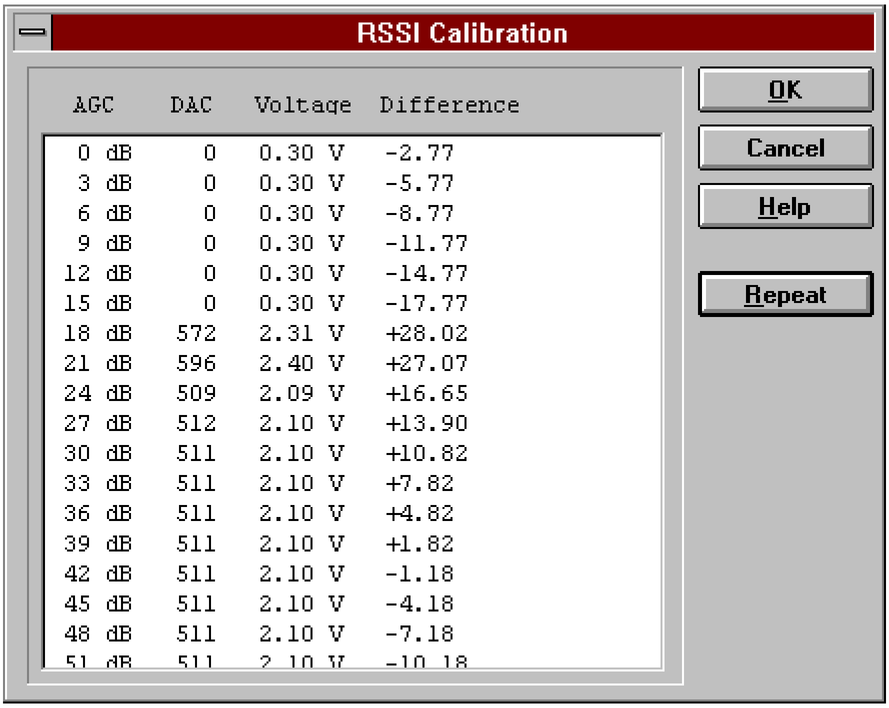
2. Measurement with low input level is executed.

3. The user is requested to set signal generator to high input level (read from .INI file).



4. Measurement with high input level is executed.

5. The **RSSI Calibration** dialog box will be updated when previous steps are done.



The **RSSI Calibration** dialog box contains the following items:

AGC List box (Alt+A):

Gain code DAC can have values from 0 to 1023 and voltage from 0.26 V to 3.86 V (voltage precision is 0.01 V). Note that the needed input signal level is also shown.

The difference column shows the difference between tuned DAC values and mean straight line calculated from part slopes in dBs (see /1/). This can be calculated when all measurement results have been received from phone.

Repeat button (Alt+R):

The measurement can be started again by pressing this button.

OK button (Alt+O):

The dialog box is closed, and tuning *is saved* to phone.

Cancel button (Esc):

The dialog box is closed and tuning *is not saved* to phone.

When calibration is ended, the DAC value check is made, and if it is unsuccessful, an error message is shown. The test checks if all DAC values are in the same order as AGC values in the table.

After exiting with the Cancel button, the following are reset to the values which were selected before this adjustment.

Active Unit

Operation Mode

Update RF Information window

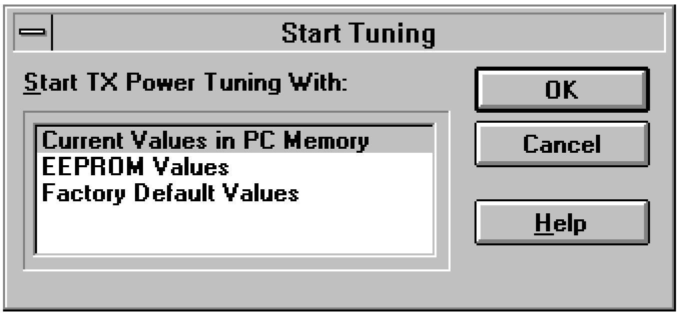
The exit and the use of AGC–control values is done the same way as exit from power level tuning and power coefficient use:

TX Power... command

Activation	Status Bar Text
Alt, T, X	Open **TX Power Tuning** dialog box

Starts TX power tuning.

The user is first requested to select with which values tuning is started in the **Start Tuning** dialog box.



The **Start Tuning** dialog box contains the following items:

Start Tuning With list box (Alt+S):

Current Values in PC memory

Tuning values are loaded from the program's internal memory.

EEPROM Values

Tuning values are loaded from ME's EEPROM.

Factory Default Values

Tuning values are loaded from ME's flash.

The following are automatically selected when this tuning function is activated:

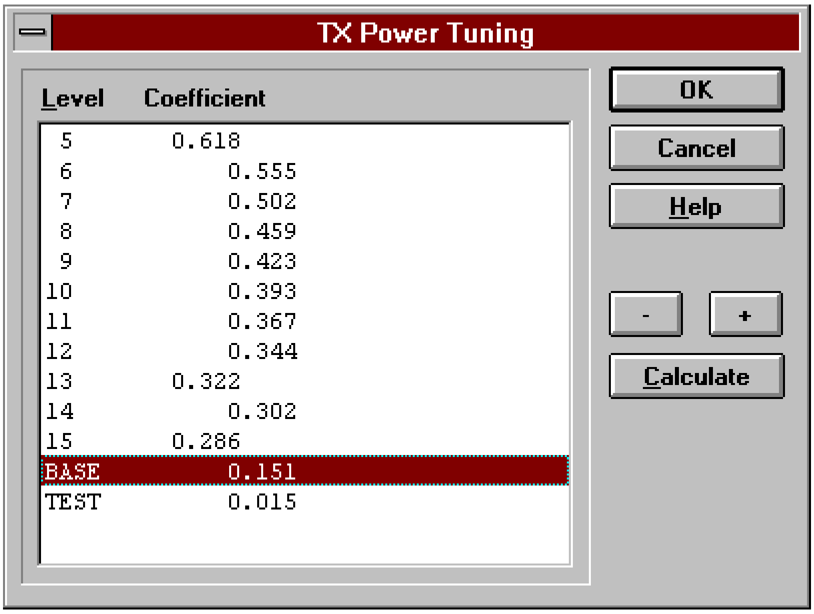
– Active Unit = TX

– the BASE power level is selected

– Operation mode = Burst

NHE/K–6 Specific: If the application detects a phase 2 phone, following dialog box is displayed:

The **TX Power Tuning** dialog box will be activated automatically after value selection.



The **TX Power Tuning** dialog box contains the following items:

Power Level & Coefficients list box (Alt+P):

The power is presented in GSM values (5..15) or PCN values (0...10). The base power is selected automatically when the dialog box is opened. The test value is reset to 0.035 when the program is started. The test value is not saved to the EEPROM. The test value can be changed during tuning as other power coefficients and the program remembers its value when tuning function is activated later again.

If there are more power levels in the phone than can fit into the window, the window is scrollable. When the phone is initialized, the program asks the number of power levels used in the phone.

Only four power coefficients (Base, biggest, third smallest and smallest) are needed to tune and the rest of them are calculated.

The tuning position is highlighted and can be tuned with +/– keys or left/right cursor keys.

NHE/K–6 Specific: If the application detects a phase 2 phone, the list box will also contain phase 2 power levels.

Calculate button (Alt+C):

The calculation is activated with this button. The power coefficients which are calculated from the tuned coefficients are displayed on the different columns than the others. All values can be tuned if needed.

+/– buttons (+/–):

The + and – buttons will cause power changing by 0.25dB steps (D/A converter control value ratio is 1.0292). When these keys are used, the coefficient value is updated on the tuning window.

OK button (Enter):

The dialog box is closed, and tuning *is saved* to phone.

Cancel button (Esc):

The dialog box is closed, and tuning *is not saved* to phone.

When selections are used, the power value checking is made and if it is unsuccessful, an error message is shown. The test checks that all power coefficients are in descending order (same order as power levels).

If the power tuning function is ended and EEPROM values are not received or EEPROM fault is noticed, an error message is shown.

When all power coefficients have such values that they don't cause any error messages, the dialog box will close. The last selected tuning power will be used after exit.

Because the stored power level range is larger than the number of used power levels, the unused levels should be set to nearest possible power level. (For example in GSM the levels 2–4 are not used, so they are set to same value as level 5).

When this tuning function is ended, the following is automatically selected:

Active Unit = RX

TX I/Q... command

Activation	Status Bar Text
Alt, T, Q	Open the **TX I/Q Tuning** dialog box

This function is used for tuning TX I and Q branch DC offset, amplitude difference and phase difference.

The function opens the same **Start Tuning** dialog box as with TX Power Tuning.

When this function is activated the following are automatically selected:

Active Unit = TX

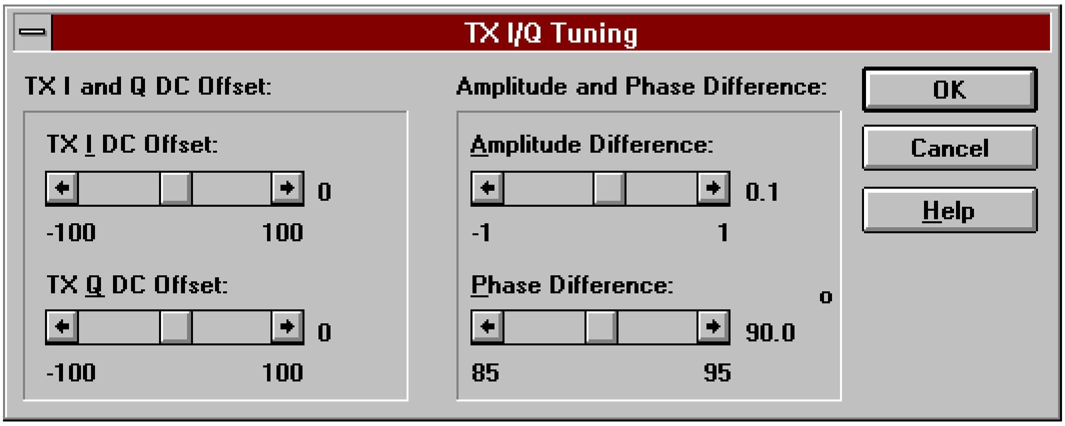
Operation Mode = Burst

TX Power Level = 10(GSM); 5(PCN)

If TX Data Type = RANDOM => TX Data Type = 1

Update RF Information window

The **TX I/Q Tuning** dialog box is opened.



The **TX I/Q Tuning** dialog box contains the following items:

Tune TX I DC Offset scroll bar (Alt+I):

The DC Offset is shown in percent (%) from the ± maximum value. 0% means that there is no DC. The value range is –100%...100%. The value is rounded to the nearest integer value.

Tune TX Q DC Offset scroll bar (Alt+Q):

The operation of this function is the same as one above, except with this selection the Q branch DC Offset is tuned. The value range is –100%...100%. The value is rounded to the nearest integer value.

Tune Amplitude Difference scroll bar (Alt+A):

When this selection is made, the user can increase or decrease the amplitude difference in 0.1 dB steps. The value range is –1...1.

Tune Phase Difference scroll bar (Alt+P):

When this selection is made, the user can increase or decrease the phase difference in 0.5° steps. The current phase difference is shown in the tuning window with numbers and bar figure. The value range is –85...95.

OK button (Enter):

The dialog box is closed, and tuning *is saved* to phone.

Cancel button (Esc):

The dialog box is closed, and tuning *is not saved* to phone.

After each value change, the new value is sent to the phone.

The following will be automatically selected when the TX I / Q tuning function is ended:

Active Unit = RX

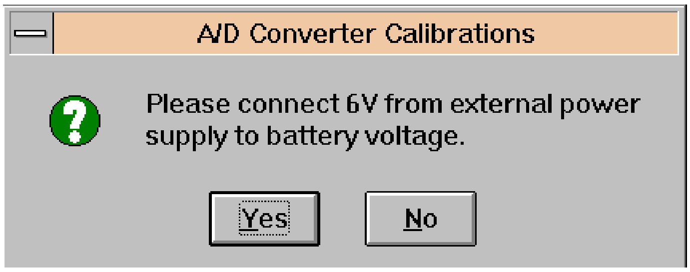
Update RF Information window

Battery A/D... command

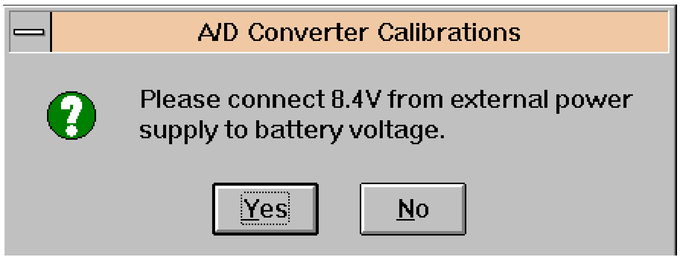
Activation	Status Bar Text
Alt, T, B	Calibrate battery voltage

This function is for battery a/d tuning.

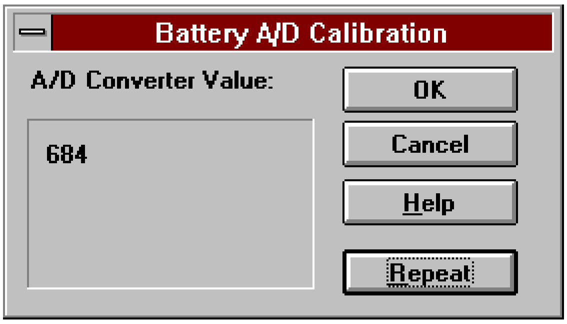
Before **battery a/d** tuning is started, a voltage setting request is shown to the user:



NHE/K–6 Specific: Additional voltage setting request is shown to the user:



When an external power is connected, and the user selects OK to continue, the application measures a/d converter and displays the **Battery A/D Calibration** dialog box.



The **Battery A/D Calibration** dialog box contains the following items:

Repeat button (Alt+R):

Makes measurement again.

OK button (Enter):

The dialog box is closed, and tuning *is saved* to phone.

Cancel button (Esc):

The dialog box is closed, and tuning *is not saved* to phone.

Charger A/D... command

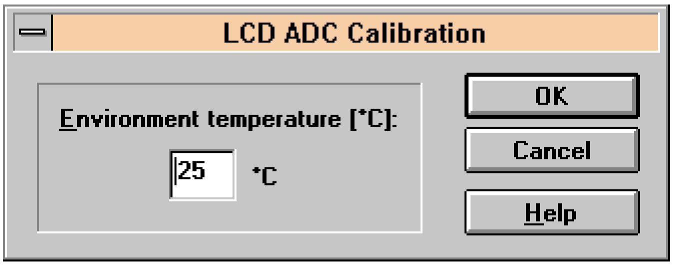
Activation	Status Bar Text
Alt, T, C	Calibrate charger voltage

Works in the same way as the previous Battery A/D calibration.

LCD A/D... command

Activation	Status Bar Text
Alt, T, T, D	Calibrate LCD temperature A/D

This function is for LCD ADC Calibration. Function opens the following dialog box.



The **LCD ADC Calibration** dialog box contains the following items:

Environment Temperature [°C]: edit box:

The user can change the environment temperature in the range 0 – 80°C.

OK button (ENTER):

Closes the dialog box and saves the measured value to EEPROM.

Cancel button (ESC):

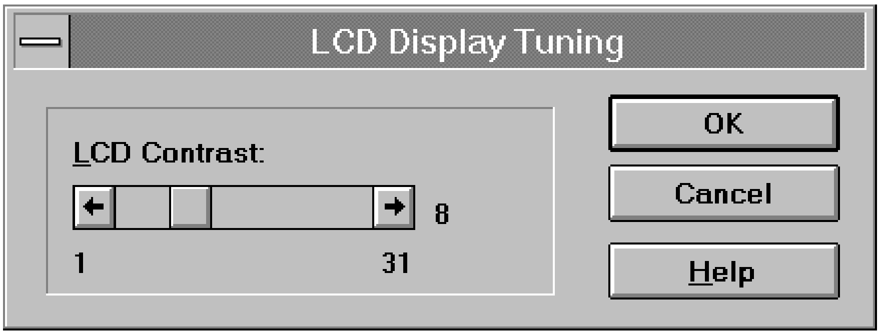
Closes the dialog box and *does not* do any calibrations.

LCD Display... command

Activation	Status Bar Text
Alt, T, T, L	Tune LCD display contrast

This function is used for quick LCD display contrast tuning.

The command opens the **LCD Display Tuning** dialog box, which contains tools for tuning.



The **LCD Display Tuning** dialog box contains the following items:

LCD Contrast scrollbar (ALT+L):

Enables user to tune display contrast between 1 and 31.

OK button (ENTER):

The dialog box is closed and tuning is saved to phone.

Cancel button (ESC):

The dialog box is closed and tuning *is not saved* to phone.

Testing

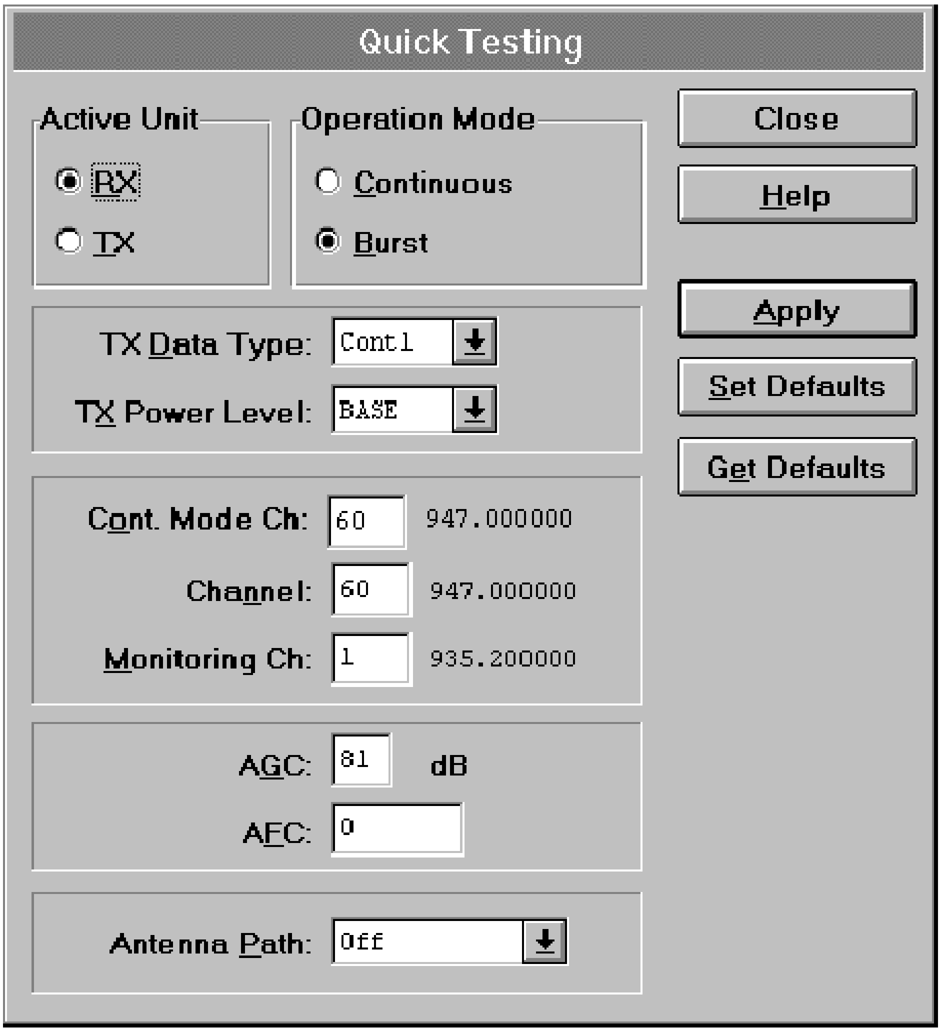
The **Testing** sub menu offers functions for ME testing.

Quick Testing (RF)... command

Activation	Status Bar Text
Alt, E, Q	Open the **Quick Testing** dialog box

This function is used for quick RF testing.

The command opens the **Quick Testing** dialog box, which contains data for testing and adjustments.



The **Quick Testing** dialog box contains the following items:

Active Unit group:

RX radio button (Alt+R):

When *RX* is selected, the next functions are made:

Data transmission is deactivated

TX power is deactivated

If operation mode is continuous,

– AGC is controlled

– RX continuous mode channel is activated

RF Information window is updated

The RX value is always given as default.

Note! The function is activated immediately, Apply is not needed.

TX radio button (Alt+T):

When *TX* is selected, the next functions are made:

Data transmission is activated

If operation mode is continuous, TX continuous mode channel is activated

If operation mode is burst, TX power is activated

RF Information window is updated

Note! the function is activated immediately, Apply is not needed.

Operation Mode group:

Continuous radio button (Alt+C):

When *continuous* selection is used,

Synthesiser is set to constant frequency

Synthesiser channel number is as given with Continuous Mode Channel selection

If Active Unit is TX, data (selected with TX Data Type) is sent

transmitter power is not connected

If Active Unit is RX, AGC is controlled

Note! The function is activated immediately, Apply is not needed.

Burst radio button (Alt+B):

When *burst* selection is used, the synthesiser is controlled by using GSM/PCN receiving/transmission/measuring synthesiser. Control sequence synthesiser channel numbers are as given with Channel/ Monitoring Channel selections if Active Unit is TX, data (selected with TX Data Type) is sent, and the TX power is connected

Note! The function is activated immediately, Apply is not needed.

TX Data Type drop list (Alt+D):

This list changes the transmission data type. The list consists of the following options: 0, 1, and Random. After Random, data selection 0 is used. If Operating Mode is *continuous*, TX Data Type Random causes different data sending than in burst mode.

TX Power Level edit box (Alt+T):

With this value it is possible to change the transmission power. The user can give the needed GSM/PCN power value (5..15/0...10) or select the test value, which is tuned with TX power tuning function. The test value is found at the end of the list.

TX Power has the value *OFF* and is disabled (*greyed*) when the active unit is RX or TX power as GSM or PCN value. When the TX power is tuned with test value (smallest value), the TX Power has the value *TEST*.

Channel edit box (Alt+H):

The user can enter here the channel number that is used for both transmission and receiving. The frequency of the selected channel is shown after selection.

Monitoring Channel edit box (Alt+M):

This field selects neighbouring monitoring channel. The frequency of the selected channel is shown after selection.

Continuous Mode Channel edit box (Alt+C):

To this edit box the user can type the continuous mode channel which may have all GSM channel numbers (1..124) or PCN channel numbers (512...885).

The used frequency depends on the Active Unit. If the Active Unit is RX, then RX frequency is used, else TX frequency. The frequency of the selected channel is shown after selection.

AGC edit box (Alt+G):

This selection allows user to edit the AGC absolute value (value from A/D converter). The AGC can have values from 0dB to 93dB in 3dB steps in GSM, and from 0dB to 81dB in PCN.

The AGC value is shown only when its value is controlled by the PC. When the Active Unit has value RX and Operation Mode is continuous, AGC is controlled by the PC except when next adjustment functions are activated:

RSSI Calibration

AFC Diagram

AFC edit box (Alt+F):

This selection allows the user to edit the AFC D/A converter value. The AFC can have values from –1024 to 1023.

The AFC value is the last measured AFC D/A converter value (11 bit 2–complement value is used with decimal digits). If the AFC results are not received, no text is shown. The AFC value is neither shown in the next situations i.e. when AFC is not controlled by PC:

AFC Diagram

Apply button (Alt+A):

Accepts entered values and validates them. After validation, the application sends corresponding messages to ME. Closes the dialog box, and updates Info Window.

Note: Active Unit and Operation mode command do not use the Apply button, as they are activated immediately.

Set Defaults button (ALT+S):

Sets current values as default Quick Test values.

Get Defaults button (ALT+E):

Gets default Quick Test values as current values.

NHE/K–6 Specific:

Antenna Path drop list (ALT+P)

Enables switching for antenna path between normal antenna and system cable.

The following are automatically done when the Quick testing function is ended:

Active Unit = RX

Update RF Information window

The next table shows the dialog box's properties in different situations:

ACTIVE UNIT = TX:

- TX Data Type: Updated
- AGC values: Greyed
- Monitoring Channel: Greyed
- OPERATION MODE = BURST:
  - TX Power Level: Updated
  - Continuous Mode Channel: Greyed
  - Channel: Updated
- OPERATION MODE = CONT.:
  - TX Power Level: OFF, Greyed
  - Continuous Mode Channel: Updated
  - Channel: Greyed

ACTIVE UNIT = RX:

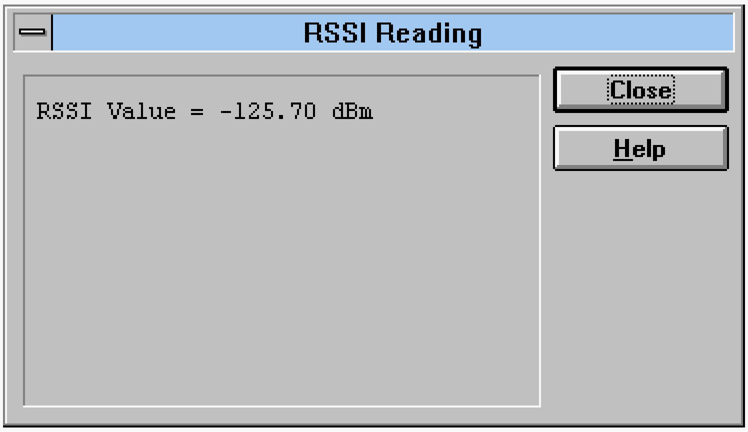
- TX Data Type: Greyed
- TX Power Level: OFF, Greyed
- OPERATION MODE = BURST:
  - AGC values: Greyed
  - Continuous Mode Channel: Greyed
  - Channel: Updated
  - Monitoring Channel: Updated
- OPERATION MODE = CONT:
  - AGC values: Updated
  - Continuous Mode Channel: Updated
  - Channel: Greyed
  - Monitoring Channel: Greyed

RSSI Reading... command

Activation	Status Bar Text
Alt, E, R	Open RSSI Reading dialog box

The command is used for reading RSSI values.

When the selection is made, the test result will be shown to the user in the **RSSI Reading** dialog box:

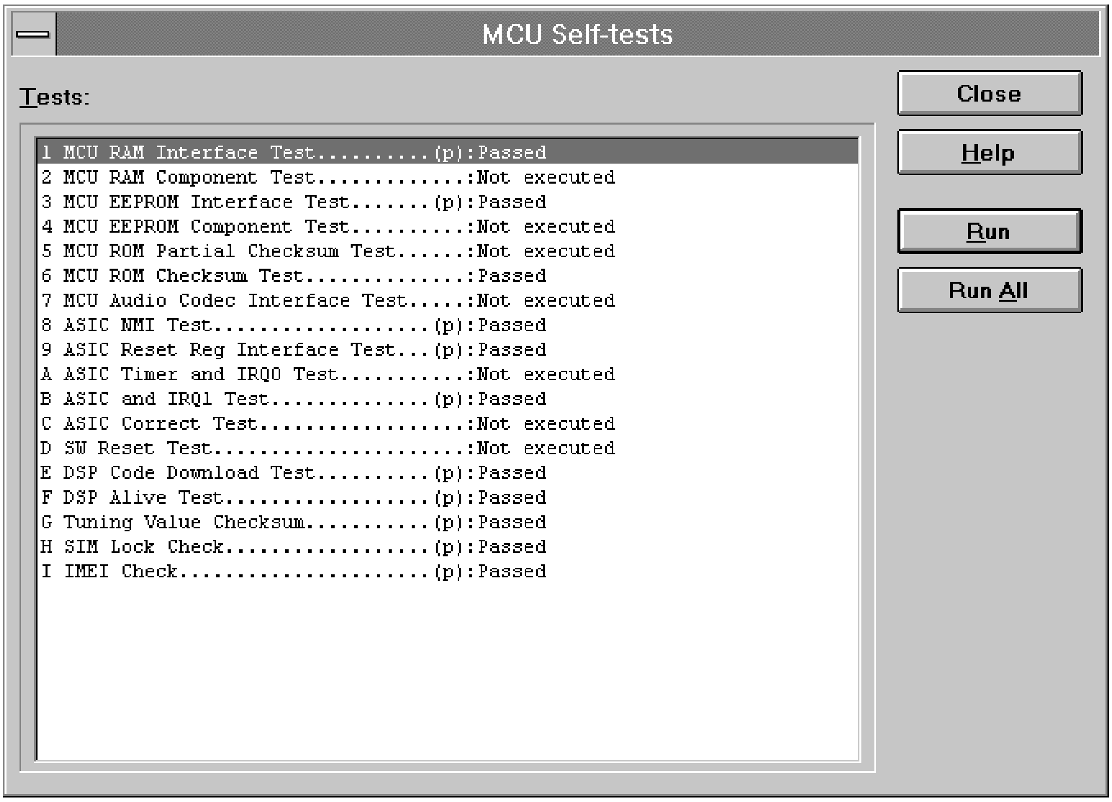


Self Tests... command

Activation	Status Bar Text
Alt, E, S	Open MCU Self–tests dialog box

The command is used for reading self test results and running self tests.

When the selection is made, the test result is read from ME. The test result will be shown to the user within the **MCU Self–test** dialog box.



The **MCU Self–test** dialog box contains the following items:

Tests list box (Alt+T):

The field ”(p)” in the screen example means that the test is also run in power up.
The field “/s)” means that this test is selectable one.

Test states are updated according to results received from the phone. Possible test states will be one of the following:

Passed

Failed

No response

Not executed

RUNNING....

Run button (Alt+R):

The user can select desired test from list and hit **Run** button. When user selects test to be run, the text *RUNNING...* is shown in the test state field, and test is run. When results are received, the test state field is updated according to the result.

If no response was received in the defined time, a *error message box* will be shown and the test state is changed to *No response*.

Run All button (Alt+A):

The user can run all listed tests. The text *RUNNING...* is shown in the test state field, and test is run. When results are received, the test state field is updated according to the result. When the state field is updated, the application moves to the next test and repeats previous cycle.

Supported Self Tests

1 MCU RAM Interface Test..........:

2 MCU RAM Component Test..........:(used for Phase1 phones only)

3 MCU EEPROM Interface Test.......:

4 MCU ROM Partial Checksum Test...::(used for Phase1 phones only)

5 MCU ROM Checksum Test...........:

6 MCU Audio Codec Interface Test..:

7 ASIC NMI Test...................:

8 ASIC Reset Reg Interface Test...:

9 ASIC Timer and IRQ0 Test........:

A ASIC and IRQ1 Test..............:

B ASIC Correct Test...............:

C SW Reset Test...................:

D DSP Code Download Test..........:

E DSP Alive Test..................:

F Tuning Value Checksum...........:

G SIM Lock Check..................:

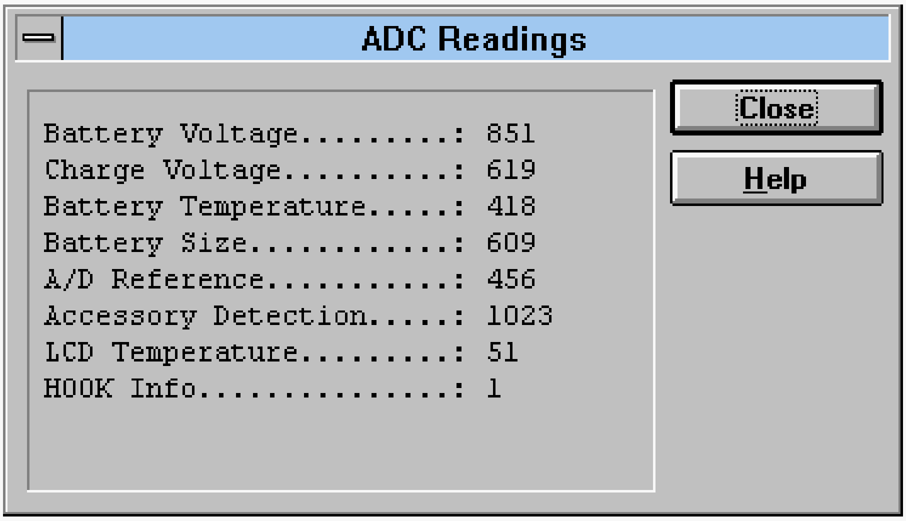
H IMEI Check......................:

ADC Readings... command

Activation	Status Bar Text
Alt, E, A	Open the **ADC Readings** dialog box

The command is used to read and show A/D values from phone.

The command opens the **ADC Readings** dialog box:



The **ADC Readings** dialog box has static text fields where measurements are updated to the window every one second.

A/D Readings

The following a/d readings are measured:

Battery Voltage . . . . :

Charge Voltage . . . . :

Battery Temperature . . . . :

Battery Size . . . . :

A/D Reference. . . . . :

Accessory Detection. . . . .:

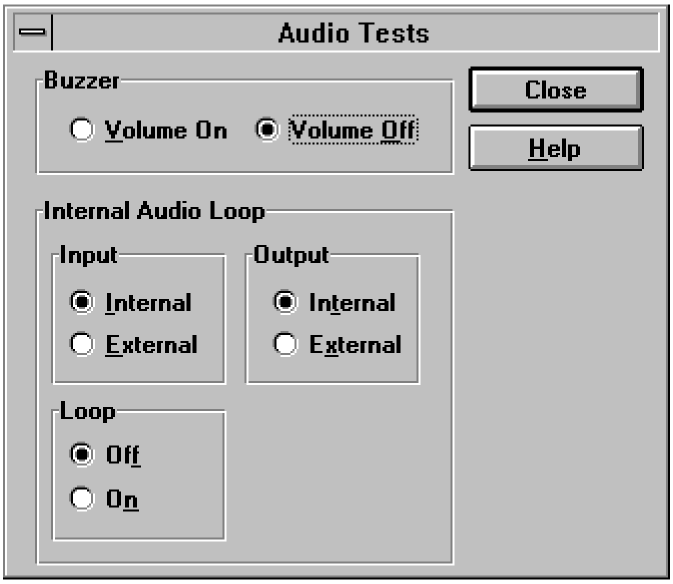
LCD Temperature . . . . :

Hook Info . . . . :

Audio... command

Activation	Status Bar Text
Alt, E, U	Open Audio Tests dialog box

The command is used for making audio tests in the **Audio Tests** dialog box.



The **Audio Tests** dialog box contains following items:

Buzzer group:

The next two different values can be selected for Buzzer volume:

Volume On radio button (ALT+V):

Turns buzzer on.

Volume Off radio button (ALT+O):

Turns buzzer off.

Internal Audio Loop group:

Input group:

The next two different values can be selected for input:

Internal radio button (Alt+I):

Switches to internal input.

External radio button (Alt+I):

Switches to external input.

Output group:

The next two different values can be selected for output:

Internal radio button (Alt+T):

Switches to internal output.

External radio button (Alt+X):

Switches to external output.

Loop group:

The next two different values can be selected for loop:

Off radio button (Alt+F):

Turns audio loop off.

On radio button (Alt+N):

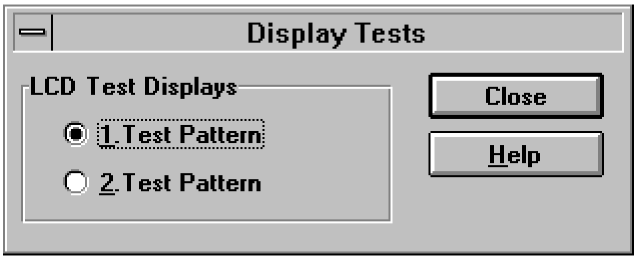
Turns audio loop on.

When the dialog box is closed, the Buzzer Volume is always switched off. The internal audio loop is also turned off.

Display... command

Activation	Status Bar Text
Alt, E, D	Open Display Tests dialog box

This command is used for making display tests in the **Display Tests** dialog box.



The **Display Tests** dialog box contains the following items:

1. Test Pattern radio button (Alt+1):

In test display 1 half of the indicators are displayed, and the display is filled with chessboard letters.

2. Test Pattern radio button (Alt+2):

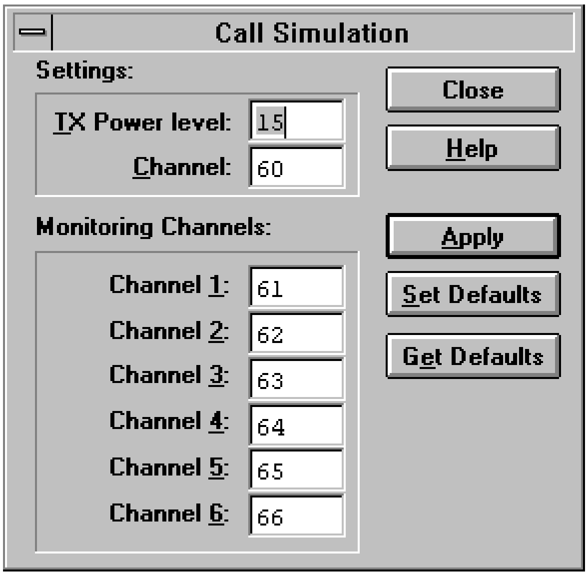
In test display 2 the remainder (from test 1) of the indicators are displayed, and the display is filled with inverse chessboard letters.

When the dialog box is closed, the phone LCD display is cleared.

Call Simulation.. command

Activation	Status Bar Text
Alt, E, C	Open Call Simulation dialog box

The command is used for making call simulation. The function opens the **Call Simulation** dialog box.



The **Call Simulation** dialog box contains the following items:

TX Power Level edit box (Alt+T):

All power levels can be selected. This updates same parameter as **TX Power Level** in the **RF–Controls** dialog box. Note that TEST value cannot be selected. If TEST value was in use when Call simulation menu selected, power level is changed to smallest value.

Channel edit box (Alt+C):

This tells the normal operating RF channel number. Normal GSM/ PCN channel numbers can be selected. Same channel is used both for transmission and receiving. This updates same parameter as **Channel** in the **RF–Controls** dialog box.

Monitoring Channels group:

Channel 1,2,3,4,5,6 edit box (Alt+1,2,...):

Channels for monitoring are specified with these six selections. All GSM/PCN channel numbers can be used. If more than one selection has same number, the monitoring channel list (neighbour list) will have less than 6 selected channels. The minimum number of monitoring channels is one (all channels have same value). The monitoring channel can also have same value as normal operating channel.

The first monitoring channel updates the same parameters as **Monitoring Channel** in the **RF–Controls** dialog box.

Apply button (Alt+A):

Validates and sends entered data to ME.

Set Defaults button (ALT+S):

Sets current values as default Call Simulation values.

Get Defaults button (ALT+E):

Gets default Call Simulation values as current values.

Software

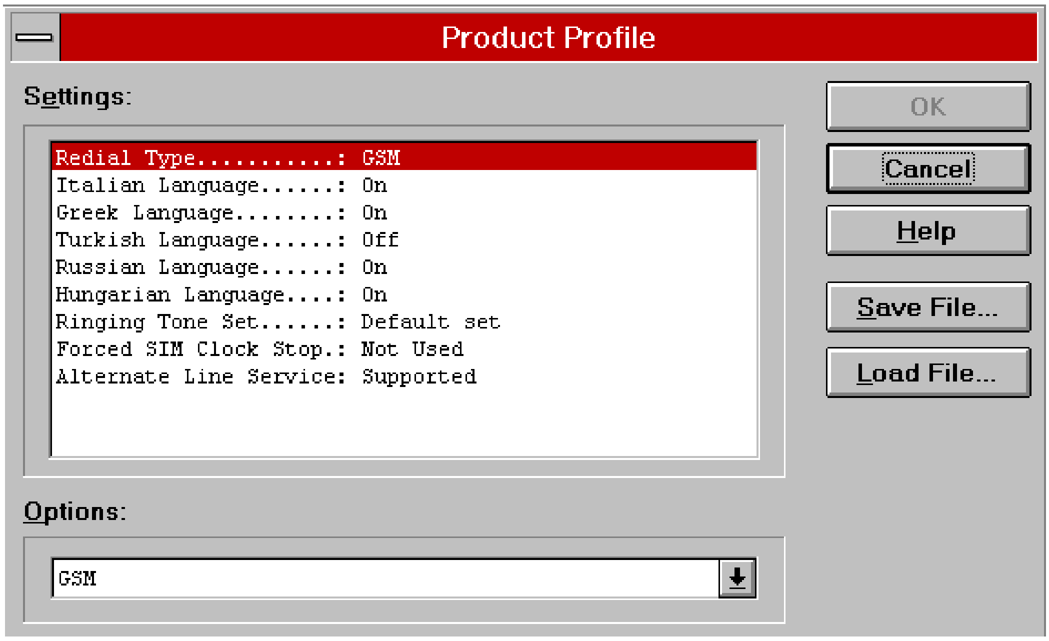
The settings sub menu offers functions for Mobile Equipment mode and memory settings.

Product Profile... command

Activation	Status Bar Text
Alt, S, P	Open **Product Profile** Settings dialog box

The function is used for making product profile settings.

When the command is activated, the product profile information is read from the EEPROM and **the Product Profile** dialog box is opened.



The **Product Profile** dialog box contains the following items:

Settings list box (Alt+E):

A list where the user can select desired setting.

The user can toggle settings with following **Options** drop list, or by double clicking the desired setting in list box.

Options drop list (Alt+O):

List allows user to set options to each setting listed in the **Settings** list box. Possible options per setting are:

OK button (ENTER)

Selections are accepted and saved to EEPROM.

Cancel button (ESC)

Selections are ignored and control is returned back to main menu.

Save File... button

Allows the user to save settings to file. Opens a standard windows **File Save** dialog box.

Load File... button

Allows the user to load the settings from a file. Opens a standard windows **File Open** dialog box.

NHE/K–5 Product Profile Settings

The following settings are available:

Russian Language	On/Off
Italian Language	On/Off
Greek Language	On/Off
Turkish Language	On/Off
Keypad Type	Nokia Design 1/2/OEM
Redial Type	GSM, Non GSM
CO SMS Appearance	Normal/Enhanced
Service Numbers	Available/Not Available
Forced SIM Clock stop	On/Off

See the NHE–5/NHK–5 Product Profile Specification for more info.

Note! When forced SIM Clock Stop is switched ON, stand–by time is increased consideraby

NHE/K–6 Product Profile Settings

The following settings are available:

Redial Type	GSM, Non GSM

Italian Language	On/Off
Greek Language	On/Off
Turkish Language	On/Off
Russian Language	On/Off
Hungarian Language	On/Off
Ringing Tone Set	Default Set/Set 1
Forced SIM Clock stop	On/Off
Alternate Line Service	Supported/Not Supported

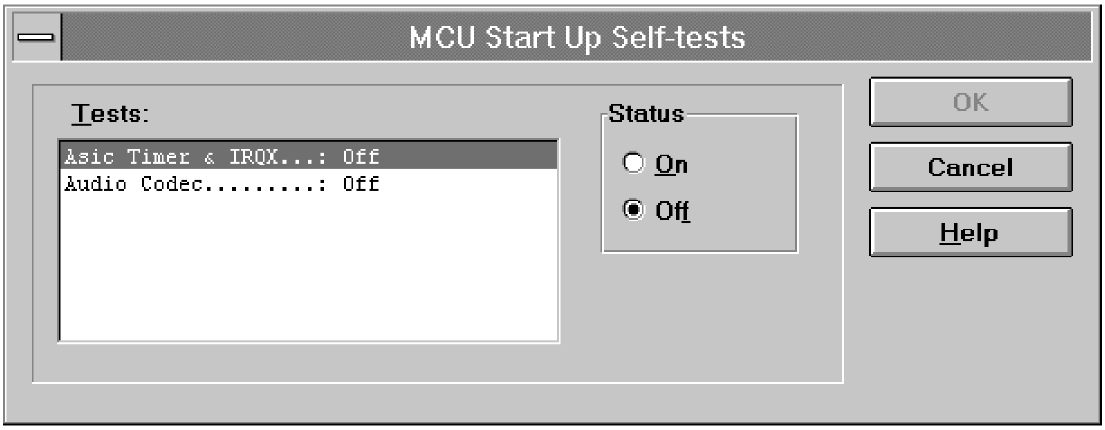
See the NHE–6/NHK–6 Product Profile Specification for more info.

Note! When forced SIM Clock Stop is switched ON, stand–by time is increased consideraby

Start Up Self–tests... command

Activation	Status Bar Text
Alt, S, S	Open **MCU Start Up Self–tests** dialog box

The function is used for changing the state of the EEPROM selectable tests in the **MCU Start Up Self–tests** dialog box.



The **MCU Start Up Self–tests** dialog box contains the following items:

Tests list box (Alt+T):

When dialog box is opened, the previous values will be read from the MCU EEPROM and shown on the list box.

Status group:

When radio button **On** is selected, the test will be run every time when automatic start up self–tests are activated (e.g. in power up).

OK button (Enter)

Selections are accepted and saved to EEPROM. A power up routine is made to phone.

Cancel button (Esc)

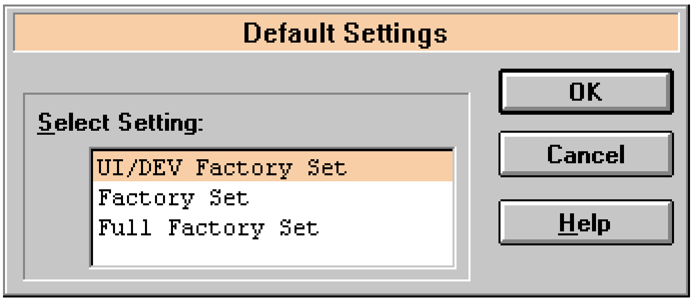
Selections are ignored and control is returned back to main menu.

Set Default Values... command

Activation	Status Bar Text
Alt, S, V	Set factory default values

The command is used for resetting default values to phone's EEPROM.

After selection, the following Default Settings dialog box is opened:



The **Default Settings** dialog box contains the following items:

Select Settings list box (Alt+S):

Enables user to select set to be reset: UI/DEV Factory Set, Factory Set or Full Factory Set.

OK button (Enter)

Closes the dialog box and writes the selected set to the EEPROM of the phone.

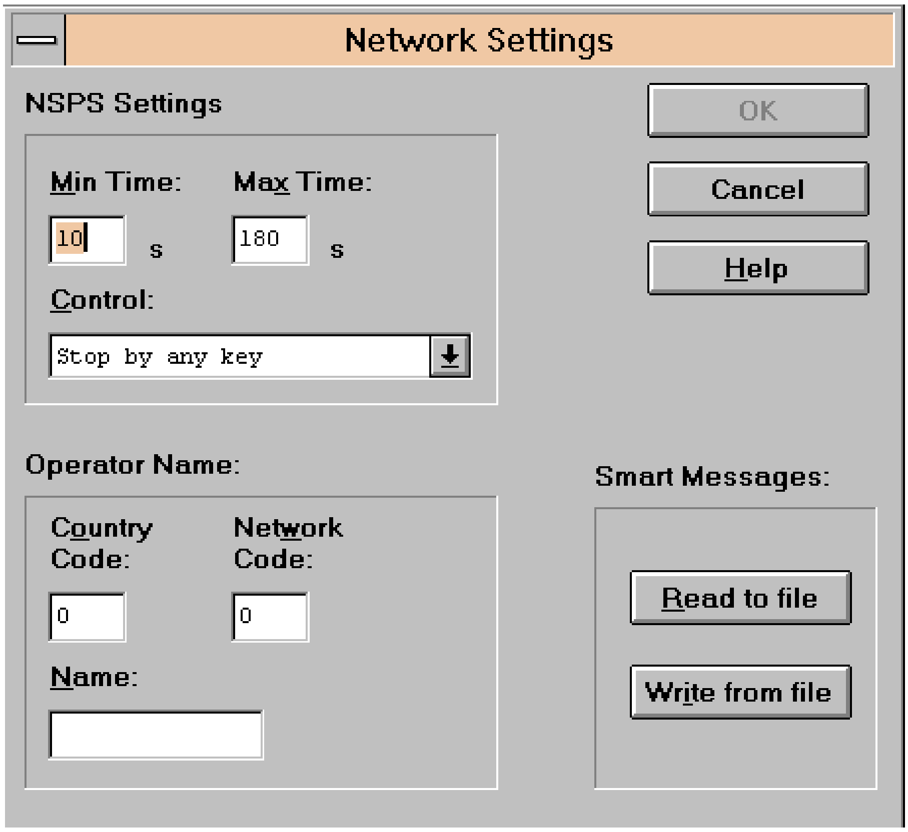
Cancel button (Esc)

Closes the dialog box and *does not* write settings to the phone.

Network Settings... command

Activation	Status Bar Text
Alt, S, N	Open **Network Settings** dialog box

After selection the following **Network Settings** dialog is opened:



The **Network Settings** dialog contains the following items:

NSPS Settings group:

Min Time edit box (ALT+M):

Minimum time for NSPS.

Max Time edit box (ALT+X):

Maximum time for NSPS.

Control drop list (ALT+C):

NSPS Control values:

– Stop by send key

– Stop by any key

– No key control

– NSPS not supported

Custom Operator Name group:

Country Code:

Specified country code

Network Code:

Specified network code

Name:

Name of the operator matching with country and network code. Length for operator name is 8 characters for NHE/K–5, and 10 characters for NHE/K–6.

NHE/K–6 Specific:

Smart Messages group:

If the application detects a phase 2 phone, in **Smart Messages** section following 2 buttons are available:

Read to file:

Phone's Smart Message options are read from the phone to a user defined file.

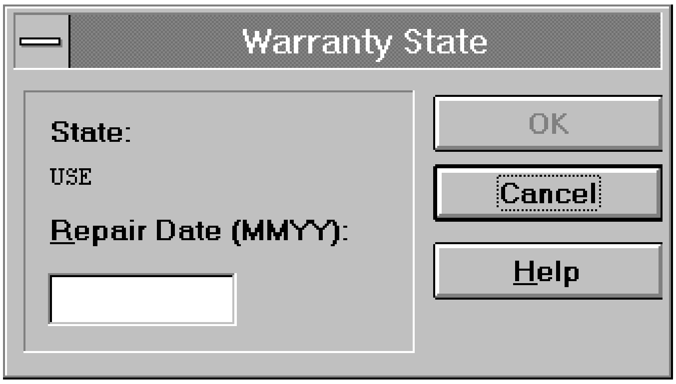
Write from file:

Smart Message options are read from a file to the phone.

Warranty State... command

Activation	Status Bar Text
Alt, S, W	Opens the **Warranty State** dialog box.

This command is used for setting the Phone's Warranty State. The function opens the following **Warranty State** dialog box.



The Warranty State dialog box contains the following items:

State: static text:

USE

For normal phones.

DEFECTIVE

For phones which are being swapped. Warranty and other information is transferred to the working phone.

EXCHANGE

For phones which are already repaired from DEFECTIVE ones.

Repair Date edit box (Alt+R):

Format is MMYY (Where MM is month and YY two last digits of the year). The date is read from PC's clock. This is enabled only if state is DEFECTIVE.

OK button (ENTER):

Closes the dialog box, and saves the Warranty State to the phone. This button should be enabled only when phone is DEFECTIVE and repair date is entered.

Cancel button (ESC):

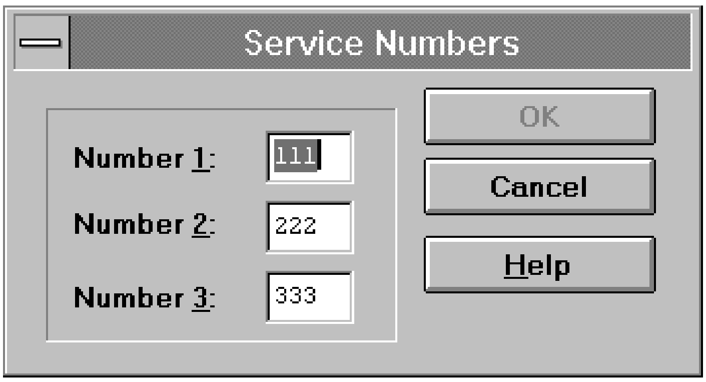
Closes the dialog box, and does not save the Warranty State to the phone.

Service Numbers... command

NHE/K–5 Specific only:

Activation	Status Bar Text
Alt, S, B	Opens the **Service Numbers** dialog box.

This command is used for setting the phone's Service Numbers. This feature is available only in few countries. The function opens the following **Service Numbers** dialog box.



The **Service Numbers** dialog box contains the following items:

Number 1,2,3 edit fields:

Contains Service Numbers which can be called by pressing 1,2 and 3 numbers in keypad for prolonged time period. Service numbers are 3 digits long.

OK button (ENTER):

Closes the dialog box, and saves the numbers to the phone.

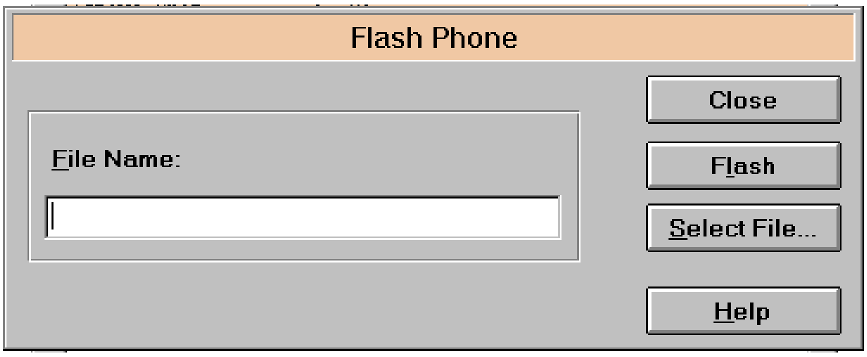
Cancel button (ESC):

Closes the dialog box, and *does not* save the numbers to the phone.

Flash Phone... command

Activation	Status Bar Text
Alt, S, F	Opens the **Flash Phone** dialog box.

This command is used to flash the phone. The function opens the following **Flash Phone** dialog box.



The **Flash Phone** dialog box contains the following items:

Close button (ESC):

Closes the dialog box, and *does not* flash the phone.

Flash button (Alt+L):

Transfers the specified file to the phone.

Select File button :

Allows selection of the flash file.

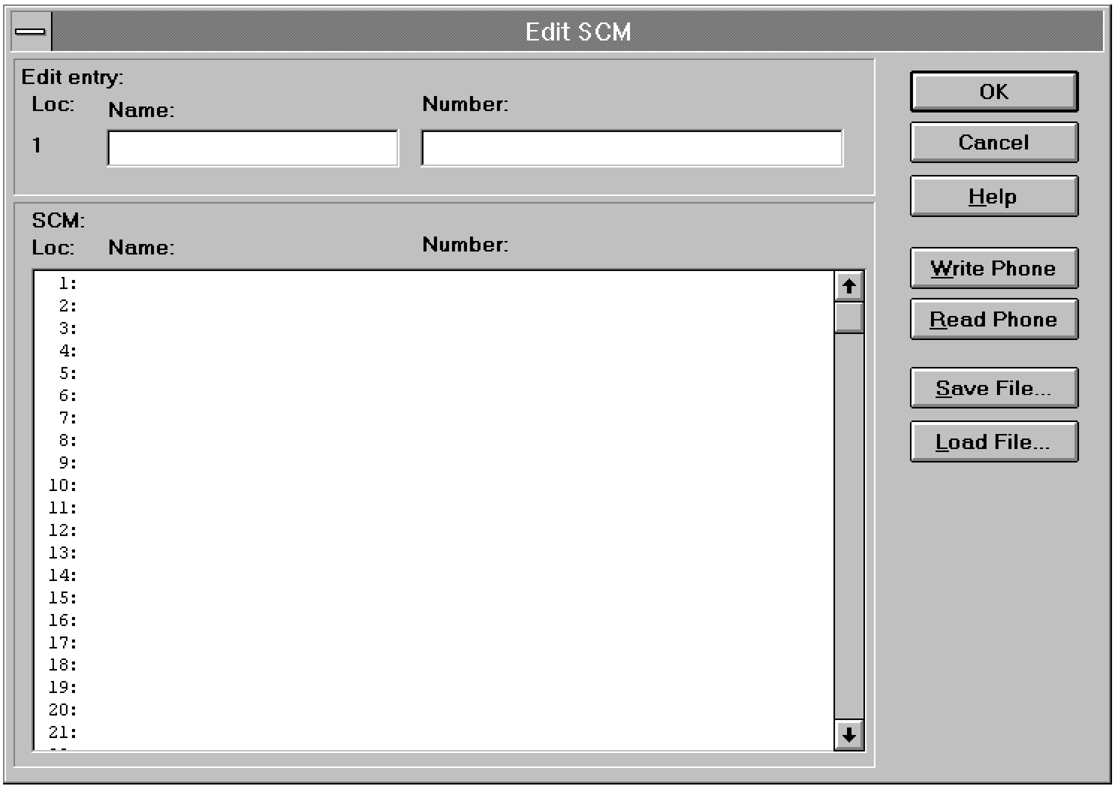
Dealer

The dealer sub menu offers functions for Mobile Equipment settings for dealers.

Short Code Memory... command

Activation	Status Bar Text
Alt, D, C	Opens the **Edit SCM** dialog box.

This command is used for reading, storing and modifying the SCM values. The function opens the following **Edit SCM** dialog box:



The **Edit SCM** dialog box contains the following items:

Loc static text:

Displays current location.

Name edit box (ALT+A):

Edit the Name.

Number edit box (ALT+N):

Edit the number.

SCM list box (ALT+C):

List for available names and numbers.

Write Phone... button (ALT+W):

Write SCM values to phone and checks the validity of names and numbers.

Read Phone... button (ALT+R):

Read SCM values from phone.

Save File... button (ALT+S):

Opens a default Windows **File Save As** dialog box, and asks for a filename where to save SCM values.

Load File... button (ALT+L):

Opens a default Windows **File Open** dialog and asks for a filename where from to load SCM values. Checks the validity of names and numbers.

User Settings... command

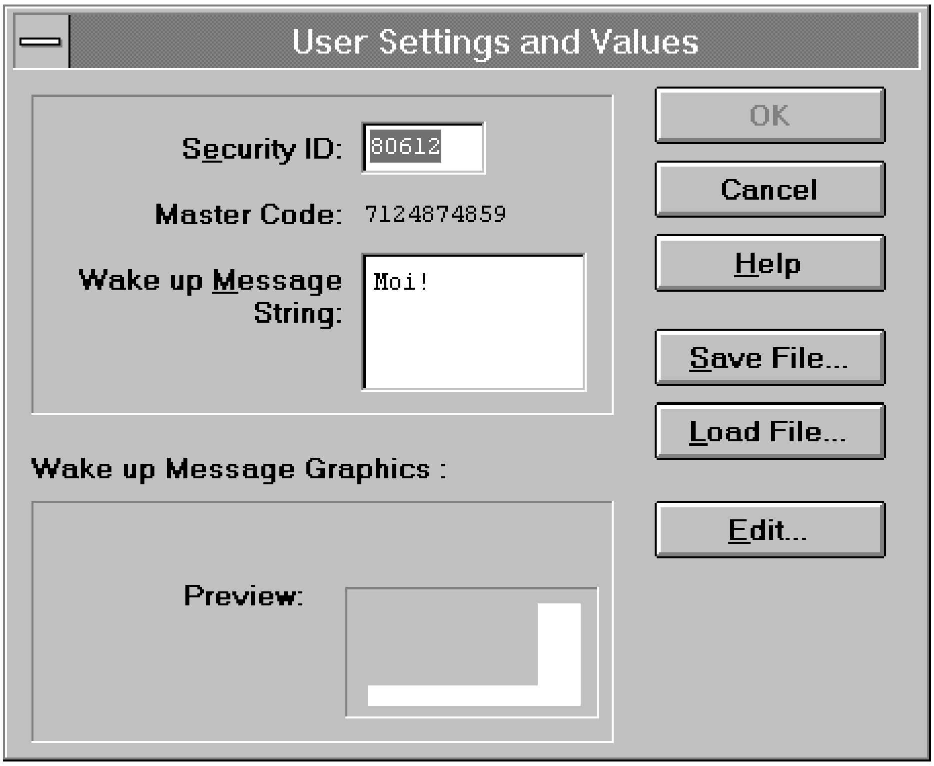
Activation	Status Bar Text
Alt, D, U	Open **User Settings and Values** dialog box

This command is used to read, store, and modify the user settings and values.

After menu selection, the program responds with a *query* dialog box: “Read user settings from phone?”. If user answers **Yes**, all needed user settings will be read from the ME, including menu settings. If a reading error happens, an *error* dialog box is shown. If reading is successful, the **User Settings and Values** dialog box is opened:

For NHE/K–5:

For NHE/K–6:



The **User Settings and Values** dialog box contains the following items:

Security ID edit box (Alt+E):

Edit the security code which is saved to the ME memory together with other user settings and values. Only digits are accepted for Security code. Length must be 5 digits.

Master Code static:

Code is 10 digits length and it is read only.

Wake up Message edit box (Alt+M):

Edit Wake up message. The wake up message name can have up to 16 characters.

Save File... button (Alt+S):

Opens a default Windows **File Save As** dialog box and asks filename where to save user settings and values.

Load File... button (Alt+L):

Opens a default Windows **File Open** dialog box and asks filename where from load user settings and values.

For NHE/K–6:

Preview image:

This image area shows the current wake up message graphics bitmap.

Edit button (ALT+E):

The user can launch the MS Windows Paint Brush application with current bmp file and edit it.

Data entered in the dialog box is checked for validity before it is sent to the phone. If the application finds wrong characters from the Wake up message, the application will inform the user, and request correction. The information window is shown during writing. The window tells how much time it will approximately take to write values.

When all values are sent and responses received, waiting window is removed and **User Settings and Values** is back in control. The waiting state can be broken with **Cancel** (Esc) button. If writing to the ME is broken, only part of the values in the ME may be changed.

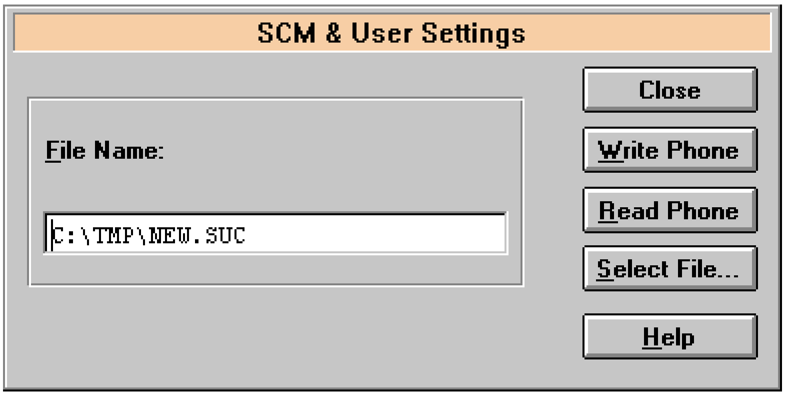
Both save file and load file function has default name which is previously used name. For instance if user data was saved to file USERA.USR and read function is activated the default value is USERA.USR.

SCM & User Settings... command

Activation	Status Bar Text
Alt, D, M	Open SCM & User Setttings dialog box.

This command is used to get SCM and user settings from phone to file and vice versa. When settings are read from the phone, all user settings are read from the phone and saved to file, in NHE/K–6 phones the graphical wake up message and SCM are also saved. When settings are written to the phone, all user settings except master code are loaded from file, in NHE/K–6 phones graphical wake up message and SCM are also loaded.

When data is written to or read from the phone, a waiting dialog box is shown.



The **SCM & User Setttings** dialog box contains the following items:

File Name edit box (ALT+F):

The user can edit the file name or select another file with the Open File dialog box. When the dialog box is opened, it contains the name of the previously saved or loaded file. Note that for NHE/K–6 phones the graphical wake up message is saved in its own file. If for example other settings iare saved to the file **c:\tmp\default.suc**, then the grapical wake up message is saved to file **c:\tmp\default.bmp**.

Close... button (ESC):

Closes the dialog box.

Write Phone... button (ALT+W):

Loads settings from file and writes them to phone.

Read Phone... button (ALT+R):

Reads settings from phone and writes them to file.

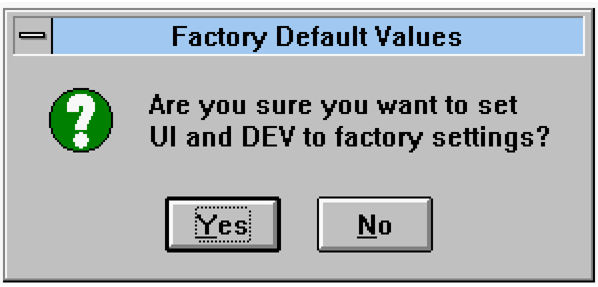
Select File... button (ALT+S):

Opens the Open File dialog box, with which the user can select the file that contains the data to be loaded to ME, or the file to which data is saved from ME. If the user selects OK button, the name of the selected file is copied to the File Name edit field.

Set UI/DEV Default Values... command

Activation	Status Bar Text
Alt, D, V	Reset phone to UI and DEV factory settings

After selection, the application asks for confirmation: “Are you sure you want to reset UI and DEV to factory settings?”. If Yes is answered, default settings are reset to the phone.

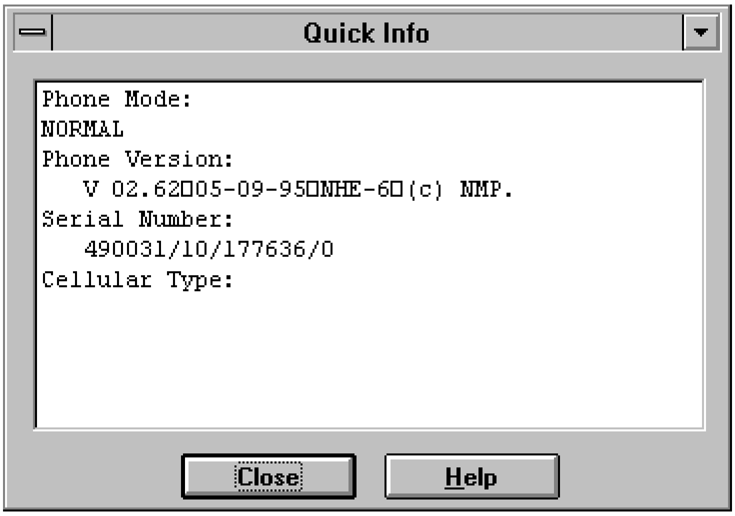


View

Quick/RF Info... command

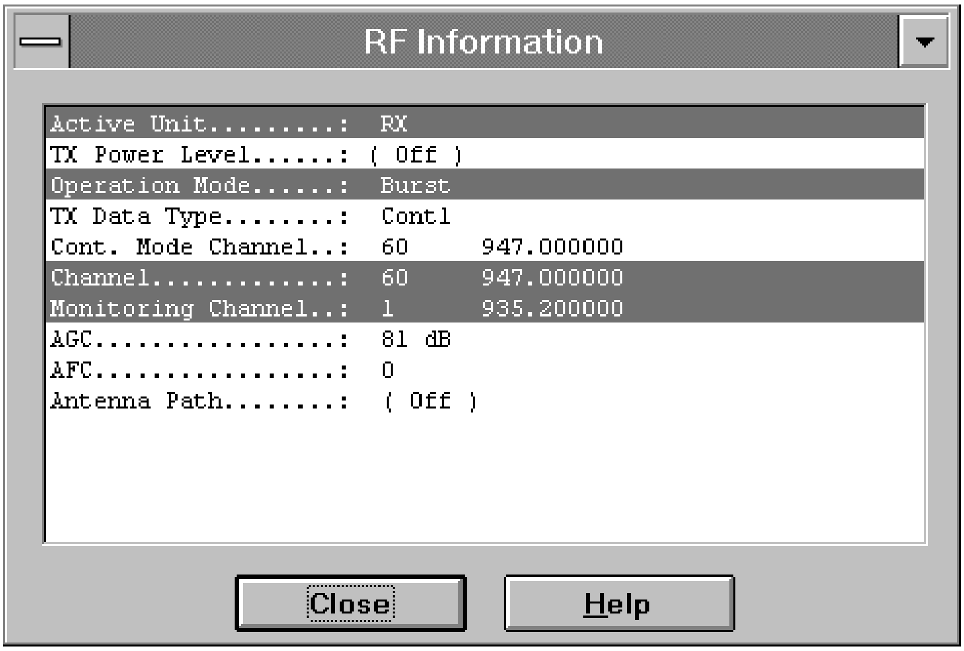
Activation	Status Bar Text
Alt, V, Q	View Quick/RF information

If phone is in *normal* mode, the following **Quick Info** is shown:



Note! Special conditions (For example, if the phone's SIM lock is ON) cause this dialog box to change color to make this special condition clear to the user.

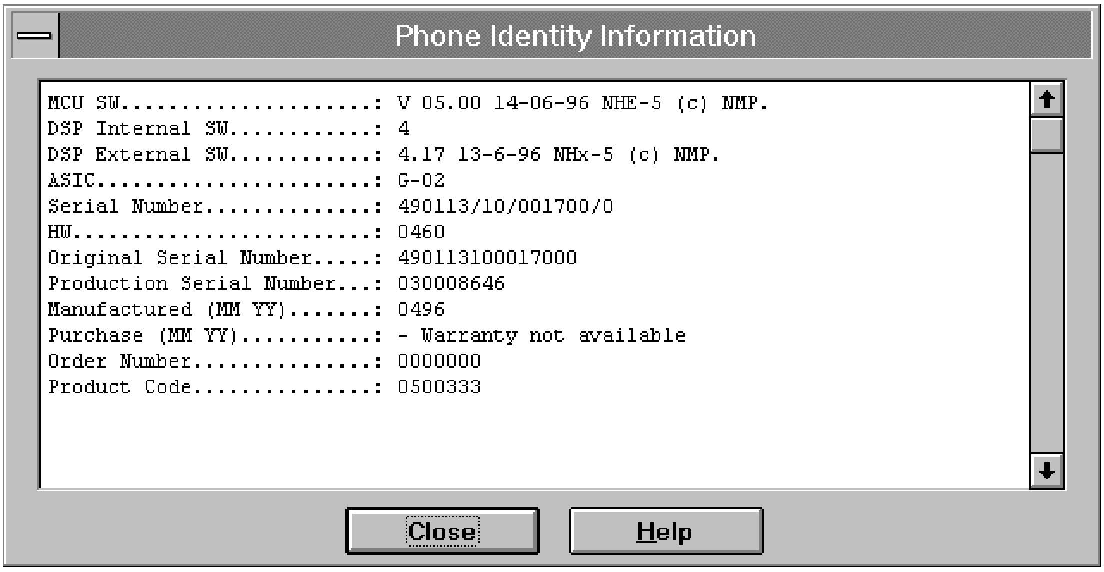
If the phone is in local mode, the following **RF Information** is shown. Information is shown in a modeless dialog box which may be left open during other operations. It is also updated when ever needed.



Phone Identity... command

Activation	Status Bar Text
Alt, V, P	View phone identity

The command opens the **Phone Identity Information** dialog box, which shows identification information. Information is shown in a modeless dialog box, which may be left open during other operations. It is also updated when ever needed.



Help

The Help menu offers commands which provide assistance with this application:.

Index command

Activation	Status Bar Text
Alt, H, I	Provide general instructions on using help

The command displays the opening screen of Help. From the opening screen, the user can jump to step–by–step instructions for using Service Software and various types of reference information.

Once Help is opened, the user can click the Contents button whenever he wants to return to the opening screen.

General help command

Activation	Status Bar Text
Alt, H, G	General help

Using Help command

Item	Activation	Status Bar Text
Using Help	Alt, H, U SHIFT F1	Display using help system information

About... command

Activation	Status Bar Text
Alt, H, A	Displays the version number of this application

See **Login Dialog.**

Initialization File

The service software has its own initialization file which has the extension .INI. The Initialization file is TESLA.INI and includes all the following selections (in mentioned menus or dialog boxes) and parameters:

RF Controls dialog box ([NHE/K–5 RF])

Channel (Channel =)

Continuous Mode Channel (Cont Mode Channel =)

Monitoring Channel (Monitoring Channel =)

AFC (AFC =)

AGC (AGC =)

Data Type (DataType=)

Power Level (PowerLevel =)

DLL Filenames (NHE–5 and identical NHE–6)

User Interface (UserInterface=)

Functionality (Functionality=)

RSSI Dialog box (NHE–5LEVELS and identical NHE–6LEVELS)

AFC Level (AfcLevel=)

RSSI Low (RssiLow=)

RSSI High (RssiHigh=)

AFC Level (AfcLevel=)

Appendix 1, Vocabulary

Appreviation	Description
API	Application Programming Interface
ASIC	Custom circuit which for instance controls communication between MCU and DSP
CLF	Common Look and Field
DATA	DATA interface module
DAU–4S	M2BUS – RS–232 adapter
DCT2	Digital Core Technology Second Generation
DLL	Dynamic Link Library
DSP	Digital signal processor which controls radio interface and speech coding/decoding
EEPROM	Memory for adjustment parameters (Electrically Erasable and Programmable Read Only Memory)
IMEI	International Mobile Equipment Identification code
M2BUS	Serial communication bus which can be connected to accessory devices and test PC
MCU	Master Control Unit processor
MDI	MCU DSP Interface; message interface via ASIC registers
ME	Mobile Equipment
MFC	Microsoft Foundation Class library
MS	Mobile Station
MTI	Message Transfer Interface
PC	IBM PS/AT or compatible personal computer
PCBOX	Local Net driver SW for PC
PCI	Phone Controlling Interface SW for PC
PKD	Parallel Port Software Protection Device
RF	Radio Frequency parts
RFI	Radio Frequency Interface circuit
SW	Software
UI	User Interface

This page intentionally left blank.

NHE–6 TROUBLE–SHOOTING INSTRUCTIONS

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 2	**09/97**	J Rantala	p.4: PC specification p.5: Note

NHE–6 TROUBLESHOOTING INSTRUCTIONS

Contents

Introduction

General

The purpose is to define the faulty module block, and then to locate the faulty component. The trouble shooting diagram has been planned so that the fault, whatever it is, can be found by as simple measurements as possible.

The flow charts give you the overview of the blocks. The purpose is that you proceed through the flow diagram so that, if your answer is YES for the asked question, go straight to the next level, but if your answer is NO, you have to go the subbranch.

Required servicing equipment:

– PC for Service Software with 486 CPU or newer
– Power supply (2.0 A)
– Digital multimeter
– Oscilloscope
– Spectrum analyzer
– Signal generator
– RF cables
– Modular cable
– RS232/MBUS adapter
– HP8922H or equivalent
– RF measuring chassis

The Troubleshooting for NHE–6 consist of a series of checks according to the following flow charts.

Baseband Troubleshooting

The following hints should facilitate finding the cause of the problem when the circuitry seems to be faulty. This trouble shooting guide is divided into the following sections.

1. Phone is totally dead
2. Flash programming doesn‘t work
3. Power doesn‘t stay on or the phone is jammed
4. Display information: Contact Service
5. Phone doesn‘t register to the network or phone doesn‘t make a call.
6. Plug in SIM card is out of order (insert SIM card or card rejected).
7. Audio fault.

The first thing to do is carry out a thorough visual check of the module. Ensure in particular that:

a) there is not any mechanical damage
b) soldered joints are OK

Note: Pin numbers marked as bold characters (in brackets) are for PSCLD TQFP44 package !

Phone is Totally Dead

Trouble shooting diagram for this fault is represented below. Check at first that the battery back is OK and it is not empty. This kind of fault has been limited around the system connector (X100) and the PSCLD (N300).

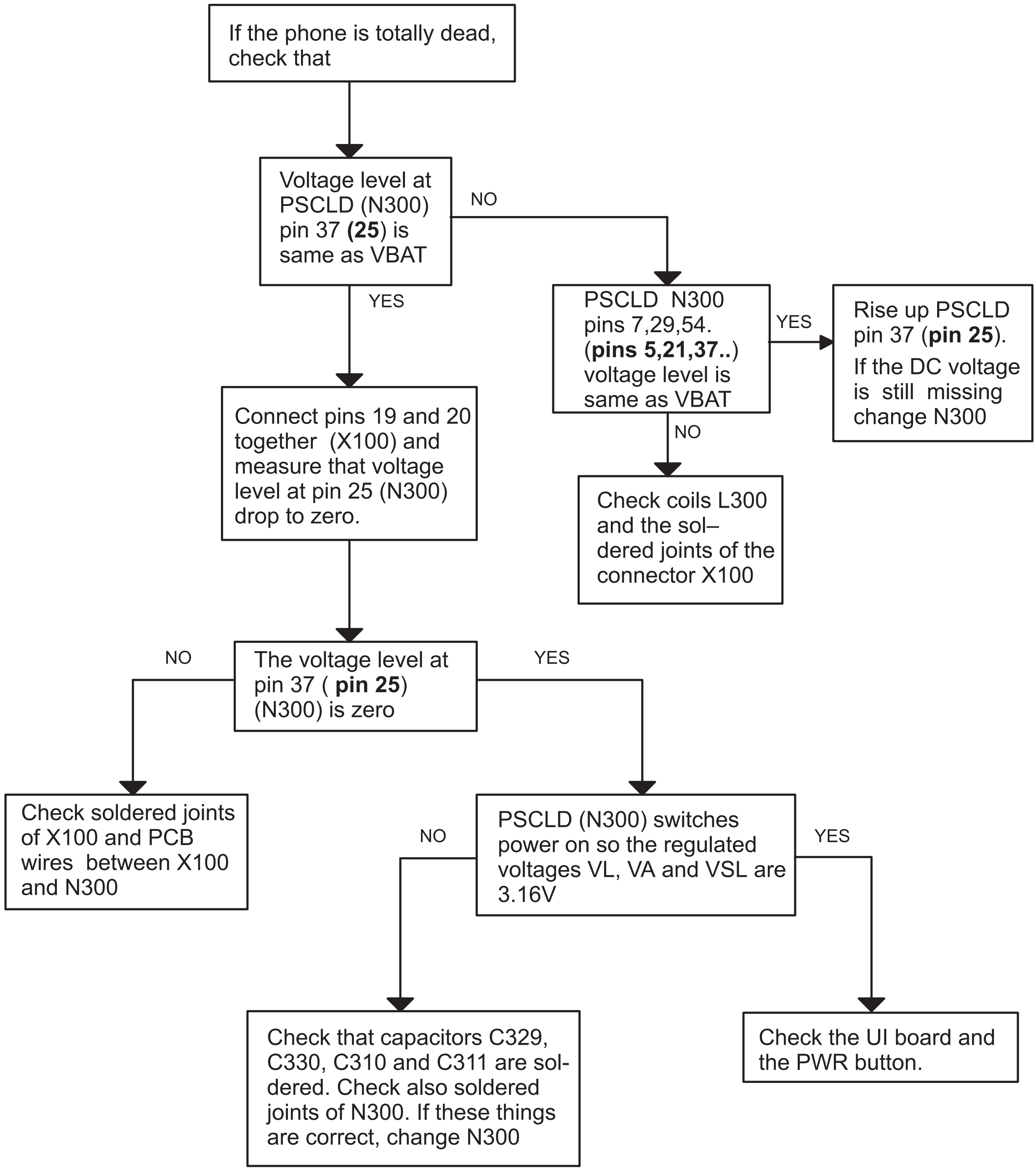


Figure 1. Trouble shooting diagrams for HD843

Flash Programming doesn‘t work

The flash loading is handled via these components. Thus a fault in other components (DSP, RFI) can not prevent the flash loading.

In error cases, the flash prommer can give some information about the fault. The fault information messages could be:

– MCU doesn‘t boot
– MCU flash Vpp error
– Serial data line failure
– Serial clock line failure
– External RAM fault
– Algorithm file or alias ID don‘t find

In cases where the flash programming doesn‘t succeed, it is possibile to test the interface between the ASIC and the MCU. This test is useful to perform when the fault information is: MCU doesn‘t boot or Serial clock line failure.

The test procedure is following:

1. Connect a short circuit wire between Asic pins 137 and gnd.
2. Switch power on.
3. If the reset line of the MCU rises up, the interface is OK. Otherwise the reset line stays low.

Notice that this test can be used to find only short circuits, not open pins. This test also indicates that the 32 kHz clock is running, because the test logic is performed using 32 kHz clock oscillator.

Flash programming doesn‘t work

Output voltages of PSCLD (N300) are 3.16 V (VL, VA, VSL)

NO: Check the soldered joints of N300. If OK, change N300

YES

Master Reset (Purx), PSCLD pin 38 (**pin 26**) is ”1” (3.16 V)

NO: Rise up pin 38 (**pin 26**). If the logic evel is still ”0”, check soldered joints of N300. If OK, change N300.

YES

Master clock input, ASIC (D151) pin 22 is 13 MHz, 1 Vpp, sine wave with 1 V DC level

NO: Check components R150 and C156. If they are OK, check the VCXO block. One must remember that the control signal for the VCXO is taken from the baseband (see figure 6)

YES

Clock signal at the input of MCU, pin 51 is 6.5 MHz square wave.

NO: Check resistor R152. Check the soldered joints of ASIC. If OK, change ASIC

YES

MCU Reset input, pin 48 is ”1”

NO: Rise up MCU pin 48. If the logic level is still ”0”, check the soldered joints of the ASIC. If OK, change ASIC.

YES

Check that the following lines are correct.

1. Vpp line from J310 to FLASH (D400) pin 11
   Normal fault information: MCU FLASH Vpp error
2. FRX line from J311 to MCU (D150) pin 2
   Normal fault information: Serial data line failure
3. FTX line from J312 to MCU (D150) pin 1
   Normal fault information: MCU doesn‘t boot
4. FCLK line from J313 to MCU (D150) pin 3.
   Check R315 also.
   Normal fault information: Serial clock line failure
5. WDDIS line from J314 to PSCLD (N300) pin 31 (**pin22**)
6. GND , J315 is connected to ground

In cases that fault information is
a) MCU doesn‘t boot
b) Clock line serial failure
the ASIC self test function can be used

1. Connect a short circuit wire between Asic pin 137 and GND
2. Switch power on and measure the state of the MCU Reset line (pin 48)

If the Reset line rises up to ”1” state there are not short circuits

Reset is ”0”

There is a short circuit between the pins.
Check circuits: D150, D151, D400, D403

Reset is ”1”

Check that there are not open pins
in components: D150, D151, D400, D402

In case that fault information is:
External RAM fault
Check the pins of SRAM (D403)

Check also the control lines of SRAM:
WrX, RdX from MCU;
RAMCS from ASIC

In case that fault information is:
Algorithm file or alias ID don‘t
find, ID is unkwon etc.
Check pins of the FLASH (D400)

Check also the control lines of FLASH:
WrX, RdX from MCU
CSelX, PwrDown from ASIC

Power Doesn‘t Stay On or the Phone is Jammed

If a fault has come after the flash programming, there are most probably open pins in IC‘s.

The soldered joints of IC‘s : D150 (MCU), D151 (ASIC), N300(PSCLD), D400 (FLASH), D403 (SRAM) are useful to check at first.

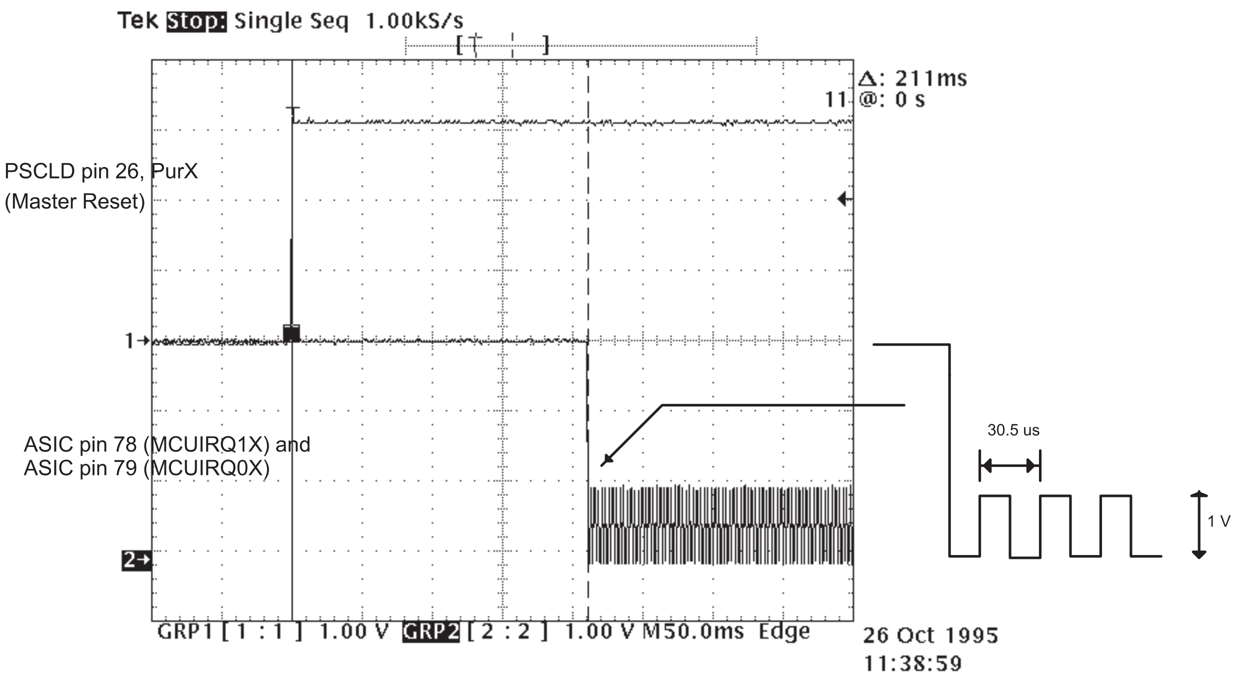
Normally, the power will switch off after 30 seconds, if the watchdog of the PSCLD can not be served by software. The power off function can be prevented by connecting a short circuit wire from the PSCLD pin31 (**pin 22**) (WDDIS) to the ground.

If the power switches off after 1..2 seconds, the pins of PSCLD and the PSCLD‘s auxiliary components must be checked.

If the phone is jammed, and no other reason has been found, the function of the 32 kHz clock oscillator must be checked. This can be done by setting the phone to the ASIC self test mode.

1. Connect a short circuit wire between Asic pin 137 and GND.
2. Make a short circuit between the ASIC pins 78 and 79.
3. Switch power on.
4. Measure the signal by oscilloscope at pins 78, 79 (ASIC).

The Function of the 32 kHz Clock Oscillator in Test Circumstances



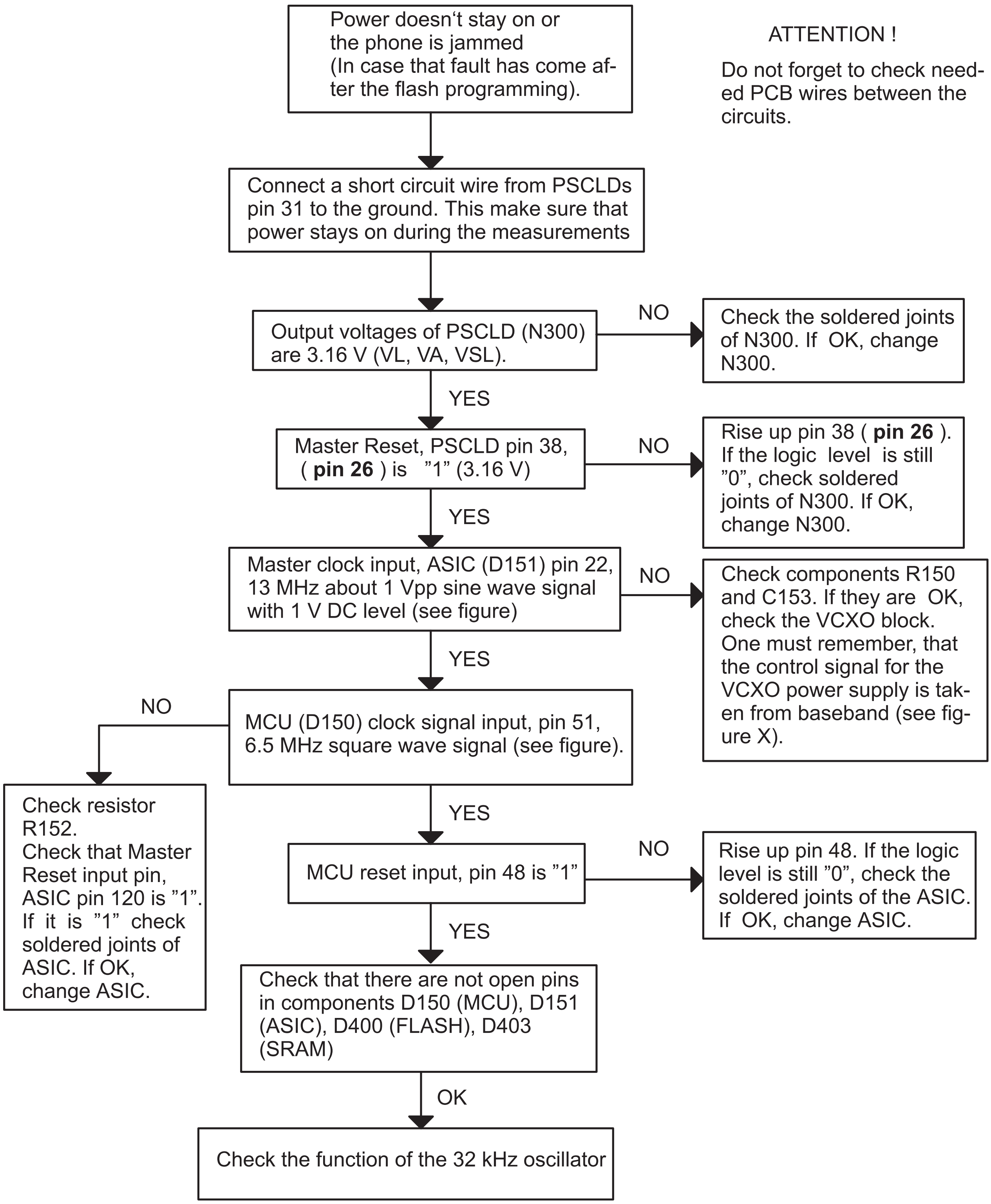
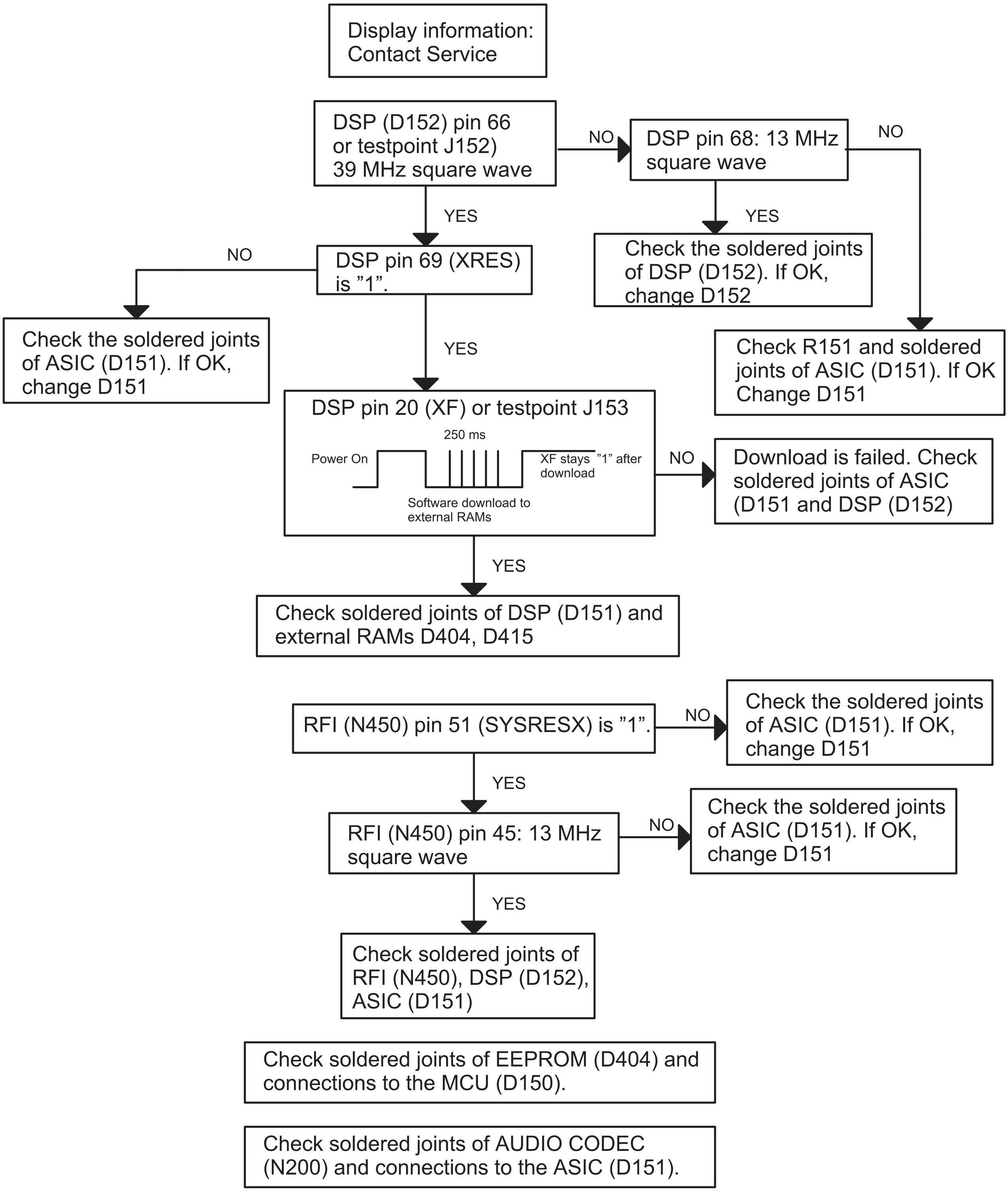


Figure 2. Trouble shooting HD843, Power doesn‘t stay on

Display Information: Contact Service

MCU is able to run and the watchdog of the PSCLD (N300) can be served.

In principle, the fault for contact service information can be found around ASIC (D151), DSP (D152), RFI (N450), EEPROM (D404) or AUDIO CODEC (N200).



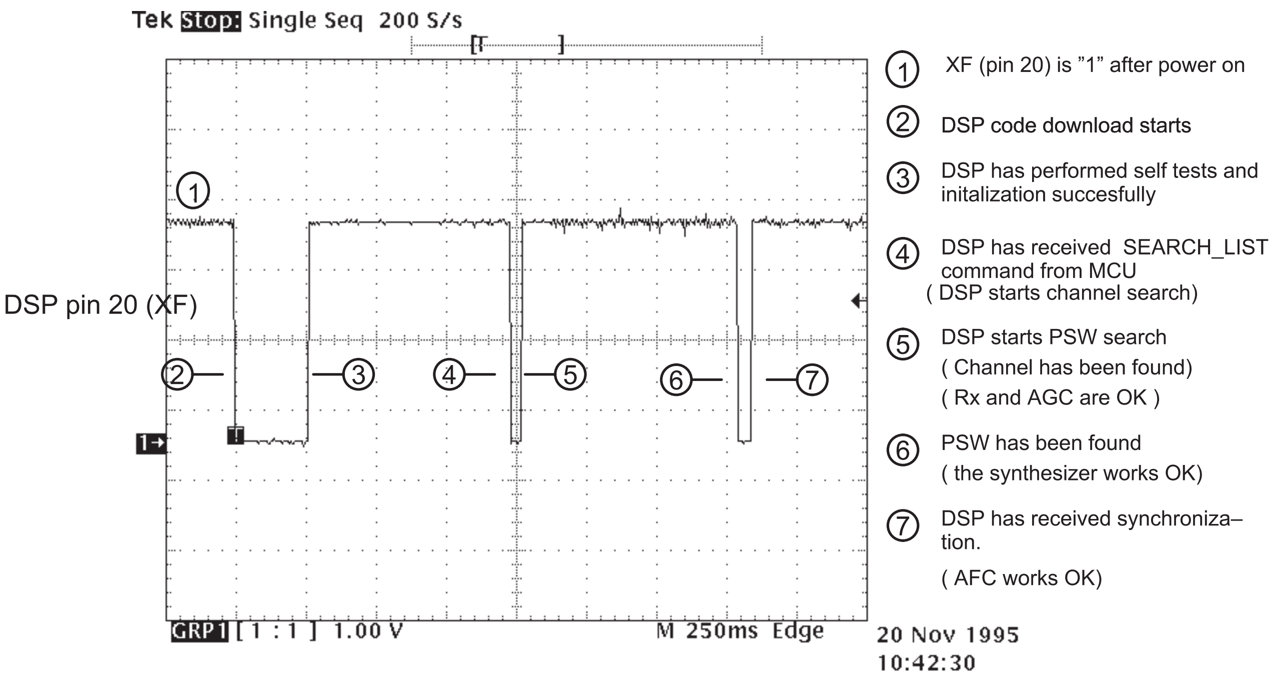
The Phone Doesn‘t Register to The Network (no serv) or Phone Doesn‘t Make a Call

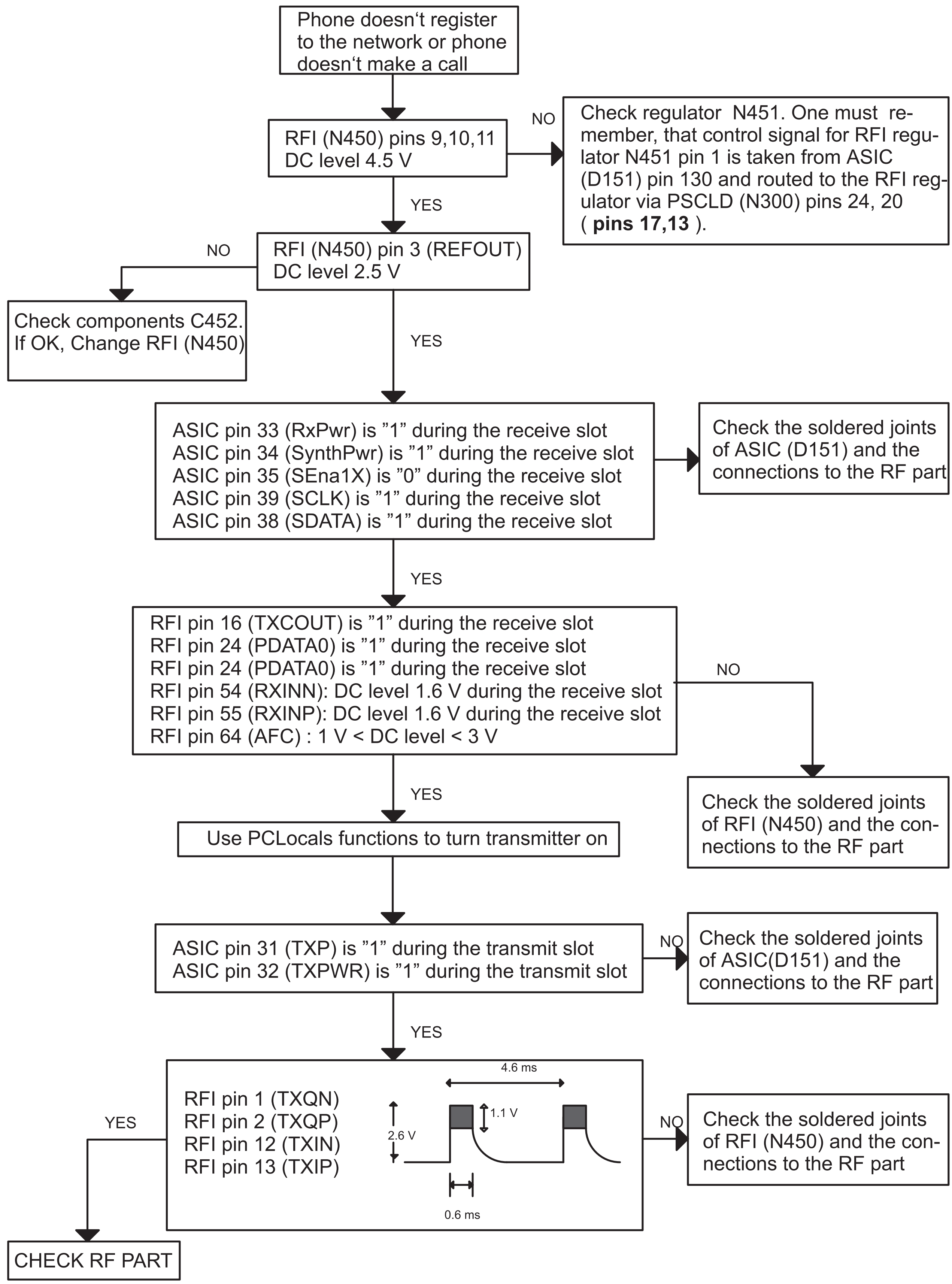
If the phone doesn‘t register to the network or the phone doesn‘t make a call, the reason for this could be either the baseband or the RF part. The phone can be set to wanted mode by WinTesla software and try to find reason for fault.

The control lines for RF are supplied both the ASIC (D151) and the RFI (N450). The ASIC handles digital control lines (between ”0” = 0 V and ”1” = 3.16 V) and the RFI handles analog control lines and proper input and output signals.

The DSP uses its external flag outpin (XF pin 20) as an indicator of its operation state. During power up, DSP signals all completed functions by changing the state of the XF pin.

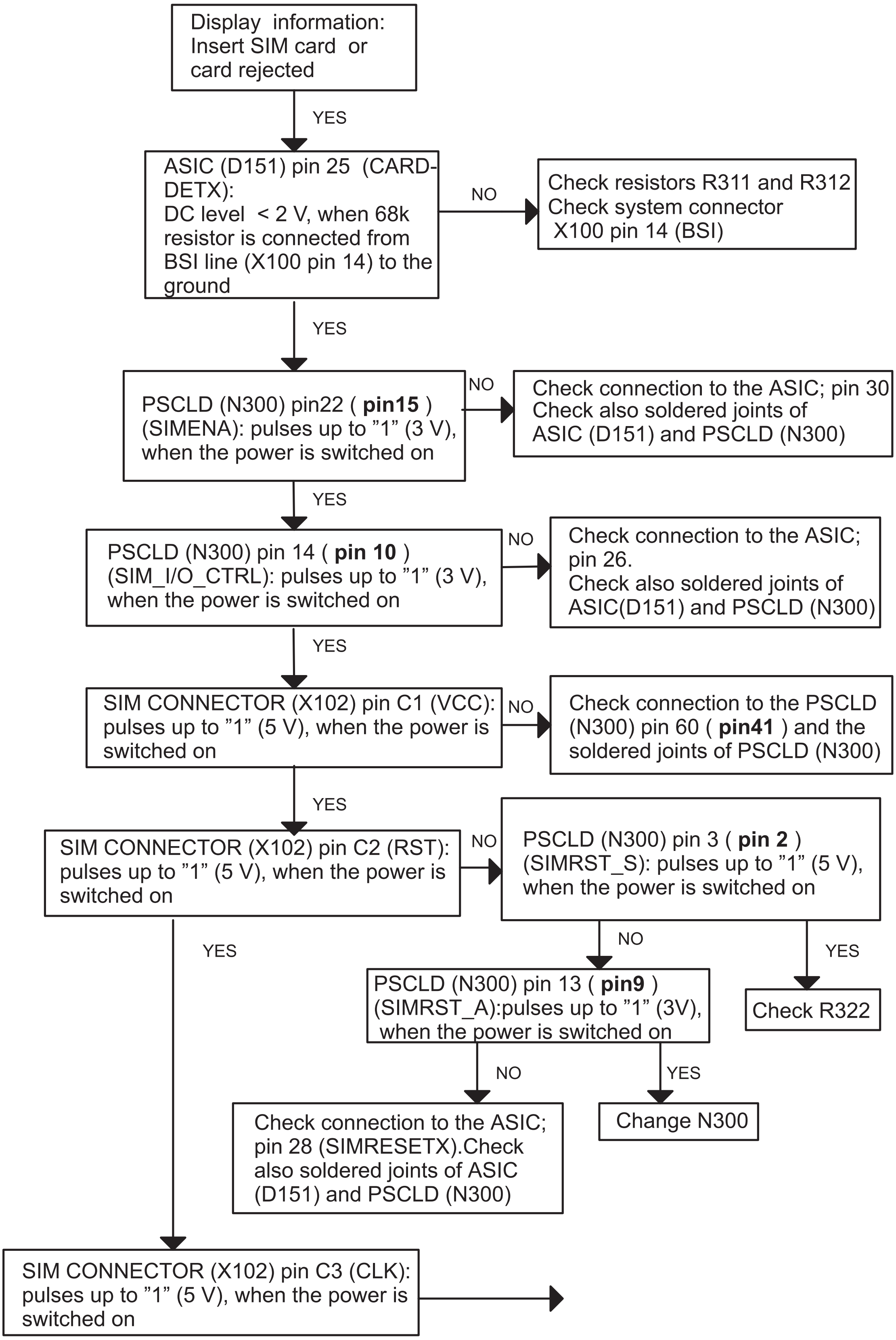
The States of The DSP after Power On

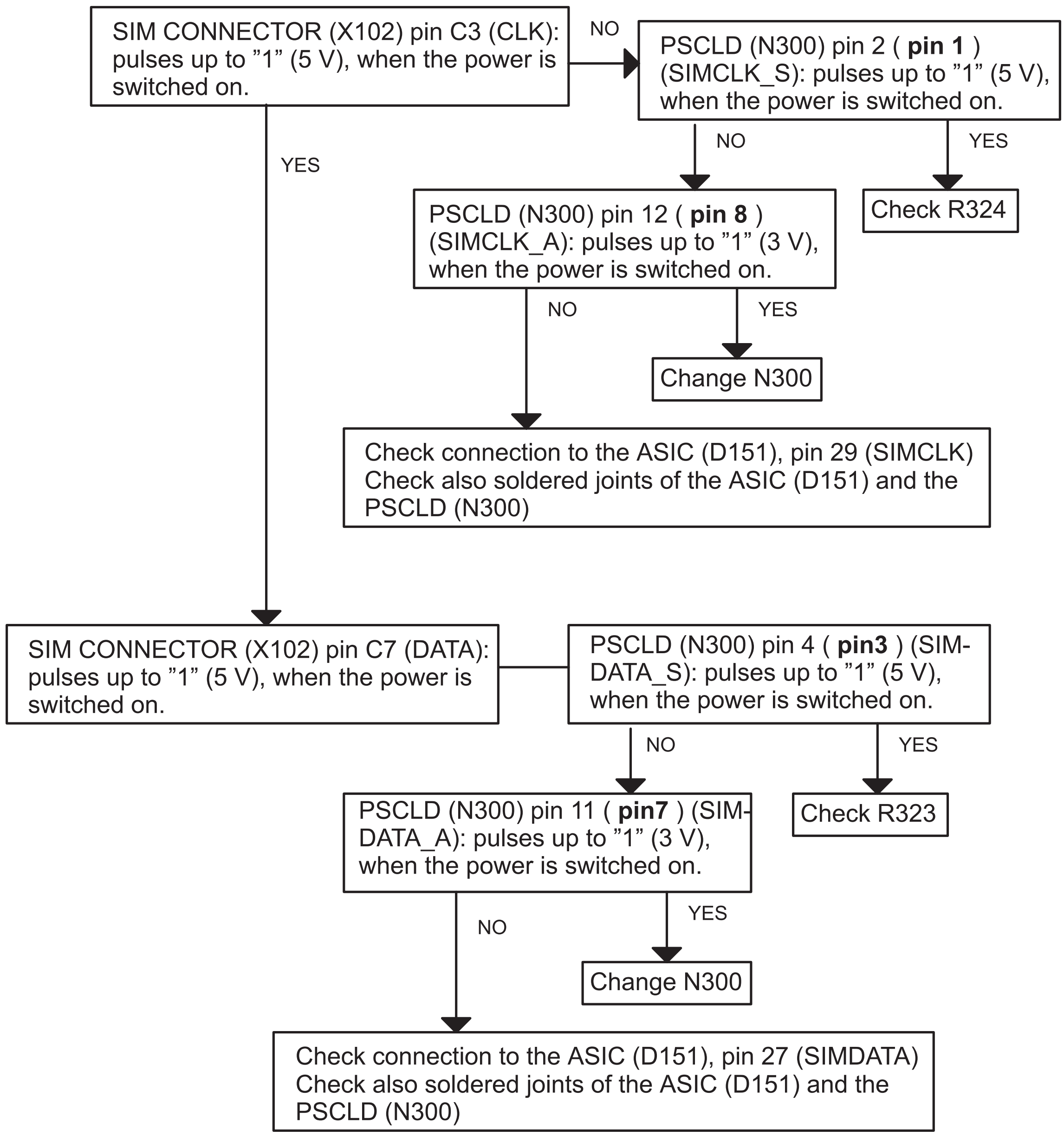



Phone doesn‘t register to the network or phone doesn‘t make a call
RFI (N450) pins 9,10,11 DC level 4.5 V
NO
Check regulator N451. One must remember, that control signal for RFI regulator N451 pin 1 is taken from ASIC (D151) pin 130 and routed to the RFI regulator via PSCLD (N300) pins 24, 20 (**pins 17,13**).
YES
RFI (N450) pin 3 (REFOUT) DC level 2.5 V
NO
Check components C452. If OK, Change RFI (N450)
YES
ASIC pin 33 (RxPwr) is ”1” during the receive slot
ASIC pin 34 (SynthPwr) is ”1” during the receive slot
ASIC pin 35 (SEna1X) is ”0” during the receive slot
ASIC pin 39 (SCLK) is ”1” during the receive slot
ASIC pin 38 (SDATA) is ”1” during the receive slot
Check the soldered joints of ASIC (D151) and the connections to the RF part
YES
RFI pin 16 (TXCOUT) is ”1” during the receive slot
RFI pin 24 (PDATA0) is ”1” during the receive slot
RFI pin 24 (PDATA0) is ”1” during the receive slot
RFI pin 54 (RXINN): DC level 1.6 V during the receive slot
RFI pin 55 (RXINP): DC level 1.6 V during the receive slot
RFI pin 64 (AFC) : 1 V < DC level < 3 V
NO
Check the soldered joints of RFI (N450) and the connections to the RF part
YES
Use PCLocals functions to turn transmitter on
ASIC pin 31 (TXP) is ”1” during the transmit slot
ASIC pin 32 (TXPWR) is ”1” during the transmit slot
NO
Check the soldered joints of ASIC(D151) and the connections to the RF part
YES
RFI pin 1 (TXQN)
RFI pin 2 (TXQP)
RFI pin 12 (TXIN)
RFI pin 13 (TXIP)
4.6 ms
1.1 V
2.6 V
0.6 ms
YES
CHECK RF PART
NO
Check the soldered joints of RFI (N450) and the connections to the RF part

SIM Card is Out of Order (Insert SIM Card or Card Rejected)

The hardware of the SIM interface from the ASIC (D151) to the SIM connector (X102) can be tested without SIM card. When the power is switched on and if the BSI line is grounded by resistor, all the used lines (VSIM, RST, CLK, DATA) rises up to ”1” (5 V) four times. Thus the fault can be found without SIM card most of the cases.


Display information: Insert SIM card or card rejected
YES
ASIC (D151) pin 25 (CARD-DETX): DC level < 2 V, when 68k resistor is connected from BSI line (X100 pin 14) to the ground
NO
Check resistors R311 and R312 Check system connector X100 pin 14 (BSI)
YES
PSCLD (N300) pin22 (**pin15**) (SIMENA): pulses up to ”1” (3 V), when the power is switched on
NO
Check connection to the ASIC; pin 30 Check also soldered joints of ASIC (D151) and PSCLD (N300)
YES
PSCLD (N300) pin 14 (**pin 10**) (SIM_I/O_CTRL): pulses up to ”1” (3 V), when the power is switched on
NO
Check connection to the ASIC; pin 26. Check also soldered joints of ASIC(D151) and PSCLD (N300)
YES
SIM CONNECTOR (X102) pin C1 (VCC): pulses up to ”1” (5 V), when the power is switched on
NO
Check connection to the PSCLD (N300) pin 60 (**pin41**) and the soldered joints of PSCLD (N300)
YES
SIM CONNECTOR (X102) pin C2 (RST): pulses up to ”1” (5 V), when the power is switched on
NO
PSCLD (N300) pin 3 (**pin 2**) (SIMRST_S): pulses up to ”1” (5 V), when the power is switched on
NO
YES
PSCLD (N300) pin 13 (**pin9**) (SIMRST_A):pulses up to ”1” (3V), when the power is switched on
Check R322
NO
YES
Check connection to the ASIC; pin 28 (SIMRESETX).Check also soldered joints of ASIC (D151) and PSCLD (N300)
Change N300
YES
SIM CONNECTOR (X102) pin C3 (CLK): pulses up to ”1” (5 V), when the power is switched on

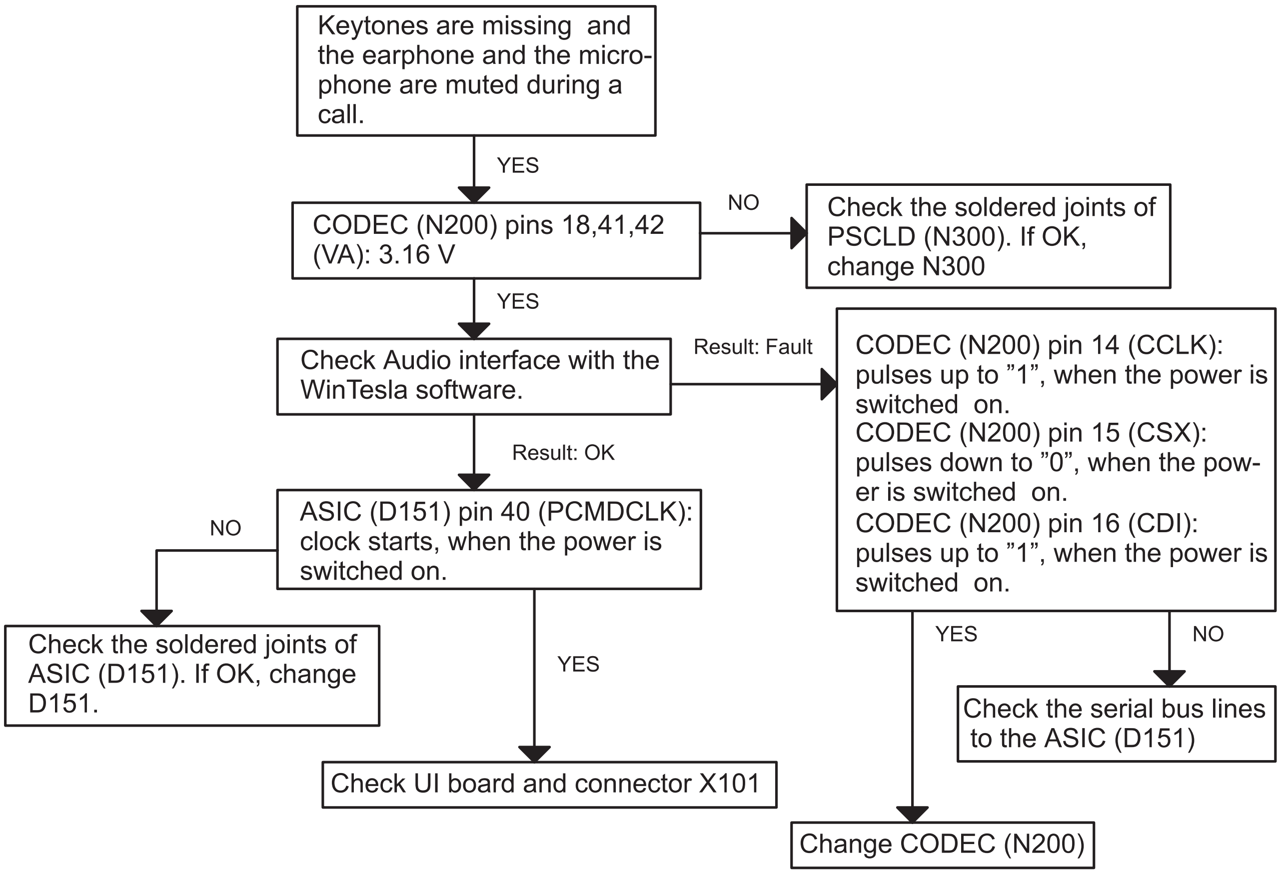

SIM CONNECTOR (X102) pin C3 (CLK): pulses up to ”1” (5 V), when the power is switched on.
NO
PSCLD (N300) pin 2 (**pin 1**) (SIMCLK_S): pulses up to ”1” (5 V), when the power is switched on.
YES
NO
YES
PSCLD (N300) pin 12 (**pin 8**) (SIMCLK_A): pulses up to ”1” (3 V), when the power is switched on.
Check R324
NO
YES
Change N300
Check connection to the ASIC (D151), pin 29 (SIMCLK) Check also soldered joints of the ASIC (D151) and the PSCLD (N300)
SIM CONNECTOR (X102) pin C7 (DATA): pulses up to ”1” (5 V), when the power is switched on.
PSCLD (N300) pin 4 (**pin3**) (SIM-DATA_S): pulses up to ”1” (5 V), when the power is switched on.
NO
YES
PSCLD (N300) pin 11 (**pin7**) (SIM-DATA_A): pulses up to ”1” (3 V), when the power is switched on.
Check R323
NO
YES
Change N300
Check connection to the ASIC (D151), pin 27 (SIMDATA) Check also soldered joints of the ASIC (D151) and the PSCLD (N300)

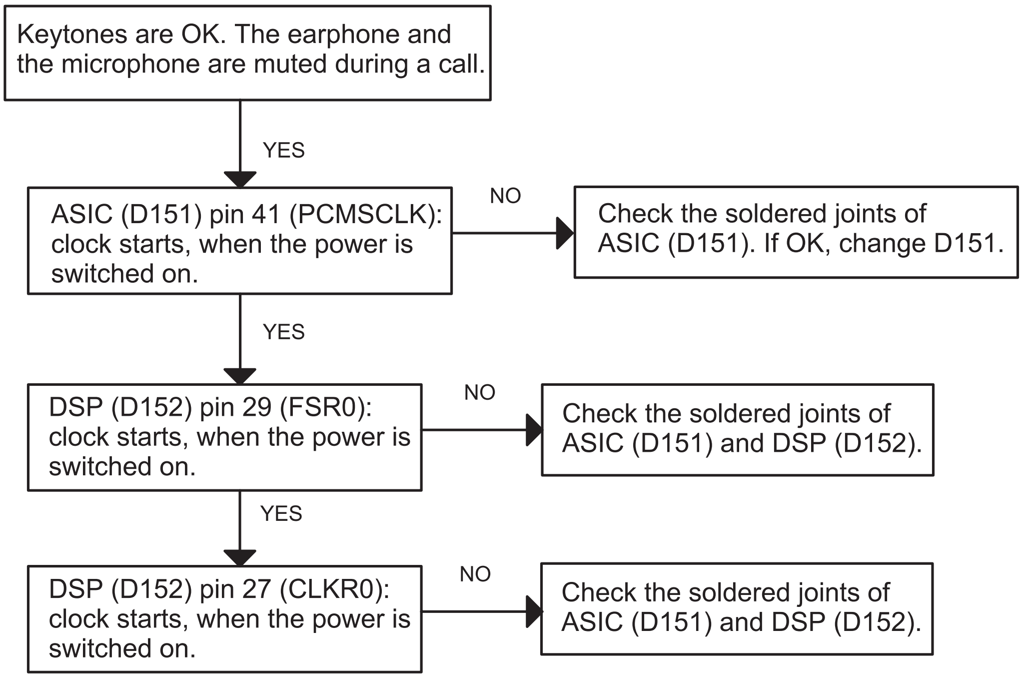
Audio Fault

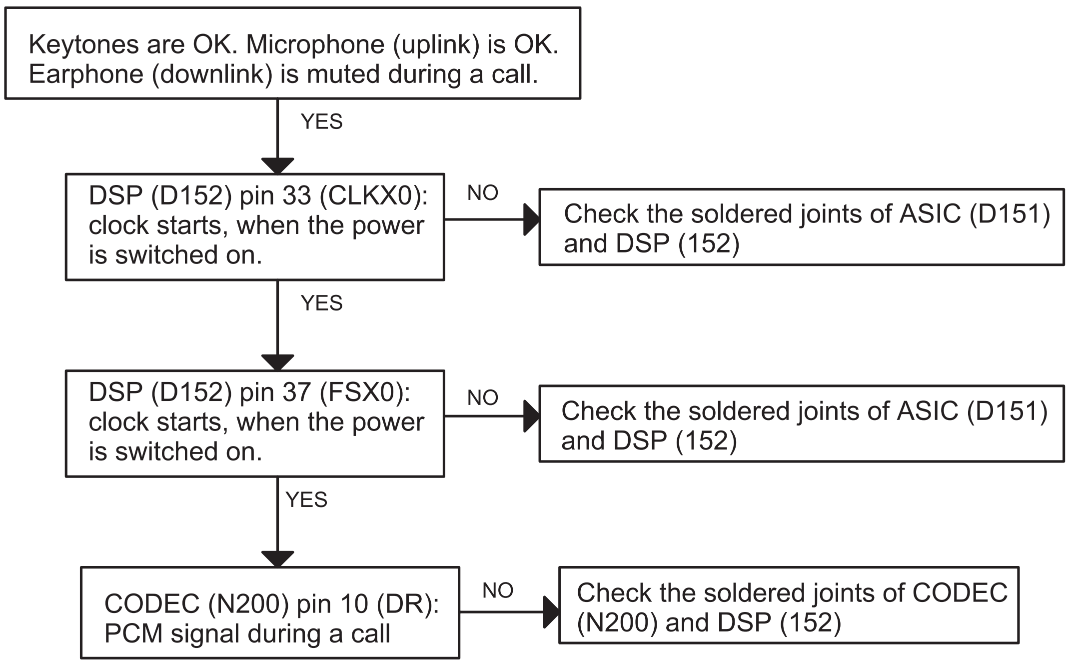
In cases that audio routings are totally muted, a fault could be in the serial bus. This serial bus is used for PSCLD (N300) and for Display driver also, so if the PSCLD and the display are OK, there are open pins in the AUDIO CODEC (N200) or the AUDIO CODEC is faulty.

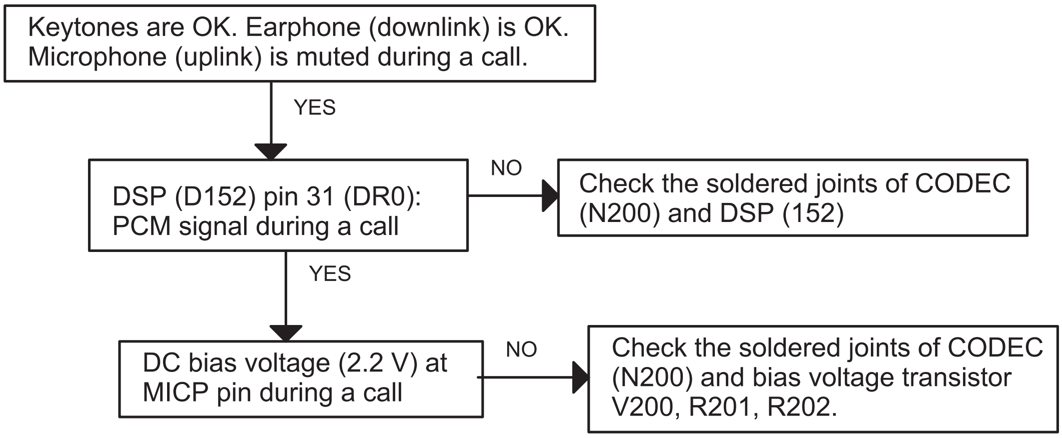
Serial bus faults can be found with WinTesla software (self test).

Other possibilities are that PCM clock and sync lines are open. CODEC (N200), ASIC (D151) and DSP (D152) must be checked.




Keytones are OK. The earphone and the microphone are muted during a call.
YES
ASIC (D151) pin 41 (PCMSCLK): clock starts, when the power is switched on.
NO
Check the soldered joints of ASIC (D151). If OK, change D151.
YES
DSP (D152) pin 29 (FSR0): clock starts, when the power is switched on.
NO
Check the soldered joints of ASIC (D151) and DSP (D152).
YES
DSP (D152) pin 27 (CLKR0): clock starts, when the power is switched on.
NO
Check the soldered joints of ASIC (D151) and DSP (D152).


Keytones are OK. Microphone (uplink) is OK. Earphone (downlink) is muted during a call.
YES
DSP (D152) pin 33 (CLKX0): clock starts, when the power is switched on.
NO
Check the soldered joints of ASIC (D151) and DSP (152)
YES
DSP (D152) pin 37 (FSX0): clock starts, when the power is switched on.
NO
Check the soldered joints of ASIC (D151) and DSP (152)
YES
CODEC (N200) pin 10 (DR): PCM signal during a call
NO
Check the soldered joints of CODEC (N200) and DSP (152)

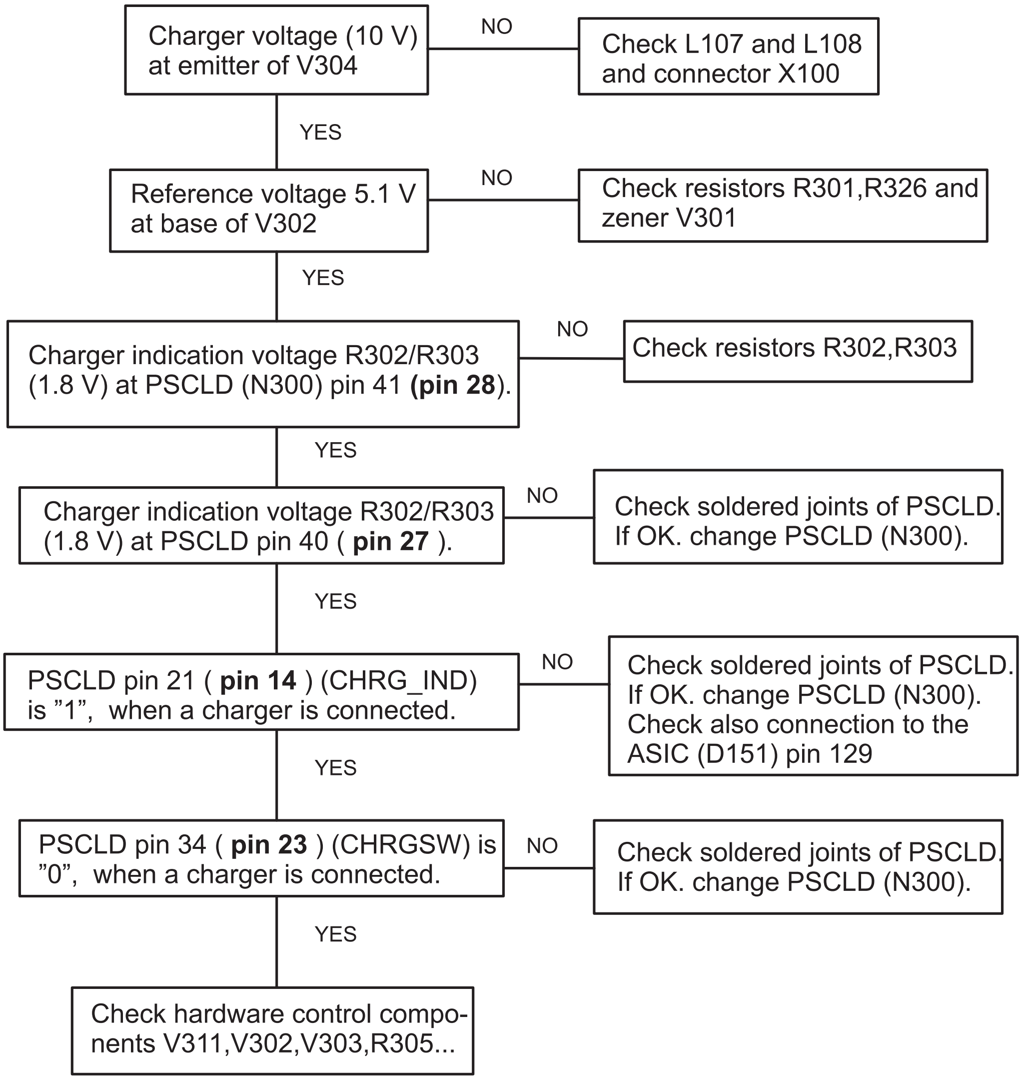

Keytones are OK. Earphone (downlink) is OK.
Microphone (uplink) is muted during a call.
YES
DSP (D152) pin 31 (DR0):
PCM signal during a call
NO
Check the soldered joints of CODEC
(N200) and DSP (152)
YES
DC bias voltage (2.2 V) at
MICP pin during a call
NO
Check the soldered joints of CODEC
(N200) and bias voltage transistor
V200, R201, R202.

Charging Fault

Two different kind of faults can be distinguished from each other:
1. No information at all on the display when a charger is connected.
2. Display information: Not charging.

1. In case that information on the display is not given when a charger is connected, indicates that PSCLD (N300) pin 21 **(pin 14)** can not change the level of the CHRG_IND line (0 –> 1), or the input pin of the ASIC (D151) pin 126 is unconnected.

2. If the display information is: Not charging, the charger indication has been done, but the hardware control unit can not control the charging switch transistor V304.



UIF Module troubleshooting

UIF– connector

– if flex seems not to work, first check the condition of the B–B– connector

LCD

1. LCD does not work
– check the voltages VL and V5
2. Missing rows in LCD
– check if there are breaks on LCD glass. If yes, change the module.

Microphone

1. Mic does not work
– check connectors (board–to–board and slide conn.)
– check L1, L2 and UIF connector pins 1 and 2.
– change the front cover or SLIDE if needed

Earpiece

1. Earpiece does not work
– Send tone to earpiece
– if no sound emitted, check the spring contacts of earpiece
– change Earpiece if needed

Buzzer

1. Buzzer does not work
– check the voltage VB
– send tone to buzzer, connect PWM signal to BUZZER line
– if no sound emitted, check the solder pads of the buzzer
– measure that transistor V403 operates
– change buzzer or transistors if needed

Keyboard and display LEDs and Call LED

1. Keyboard LEDs do not work
– check the voltage VB
– connect KEYLIGHT line to logical HIGH and measure, that control transistors V404 and V405 operate
– check the solder pads of LEDs
– change LED or transistor if needed

2. Display LEDs do not work
– check the voltage VB
– connect LCDLIGHT line to logical HIGH and measure, that control transistor V402 operates
– check the solder pads of LEDs
– change LED or transistor if needed

3. Call LED does not work
– check the voltage VB
– connect CALL_LED line to logical HIGH and measure, that control transistor V400 operate
– check the solder pads of LED
– change LED or transistor if needed

This page intentionally left blank.

NHE–6 TUNING INSTRUCTIONS

Original 09/97

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 2	**09/97**	**J Rantala**	p.5 PC spex
Issue 2	**09/97**	**J Rantala**	p.12 Power levels

TUNING INSTRUCTIONS

Contents

Introduction

General

Almost all tuning operations of the NHE–6 are carried out using the service software. The service software turns the phone into the locals mode, in which the phone can be outwardly controlled via the M2BUS interface.

Tuning is based on the software communicating with the D/A and A/D converters of the phone. In some instances the phone processor will also calculate the required correction parameter.

The tuning values of the phone reside on the EEPROM. The contents of the EEPROM can be read by the service software and saved as a file. This is advisable when there is need to retain that information, e.g. in view of replacement of the circuit. The program also enables writing the default parameters on the EEPROM, in which case all tuning steps should be carried out.

N.B. **During tuning, proceed as follows:**

– Take care not to damage sensitive measuring instruments with excessive RF power.

– Carry out all tuning steps in the shortest possible time to avoid excessive heating of RF units.

– Perform all tuning steps in the order presented.

– Never try to mask a fault by tuning it out!

Required Equipment

– PC/AT computer with service software; see separate section for instructions on installation and use.

– M2BUS adapter DAU–4S and other service accessories; see equipment set-up pictures.

– Multimeter or DVM.

– GSM radio telephone test station or separate measuring equipment as follows:

  – RF generator

  – pulse power meter

  – spectrum analyzer

  – attenuator and branching unit

Equipment Setup

Caution: *Make sure that you have switched off the PC and the printer before making connections !*

Caution: *Do not connect the PKD–1 key to the serial port. You may damage your PKD–1 !*

Attach the protection key PKD–1 to parallel port one (25–pin female D–connector) of the PC. When connecting the PKD–1 to the parallel port be sure that you insert the PC end of the PKD–1 to the PC (male side). If you use a printer on parallel port one, place the PKD–1 between the PC and your printer cable.

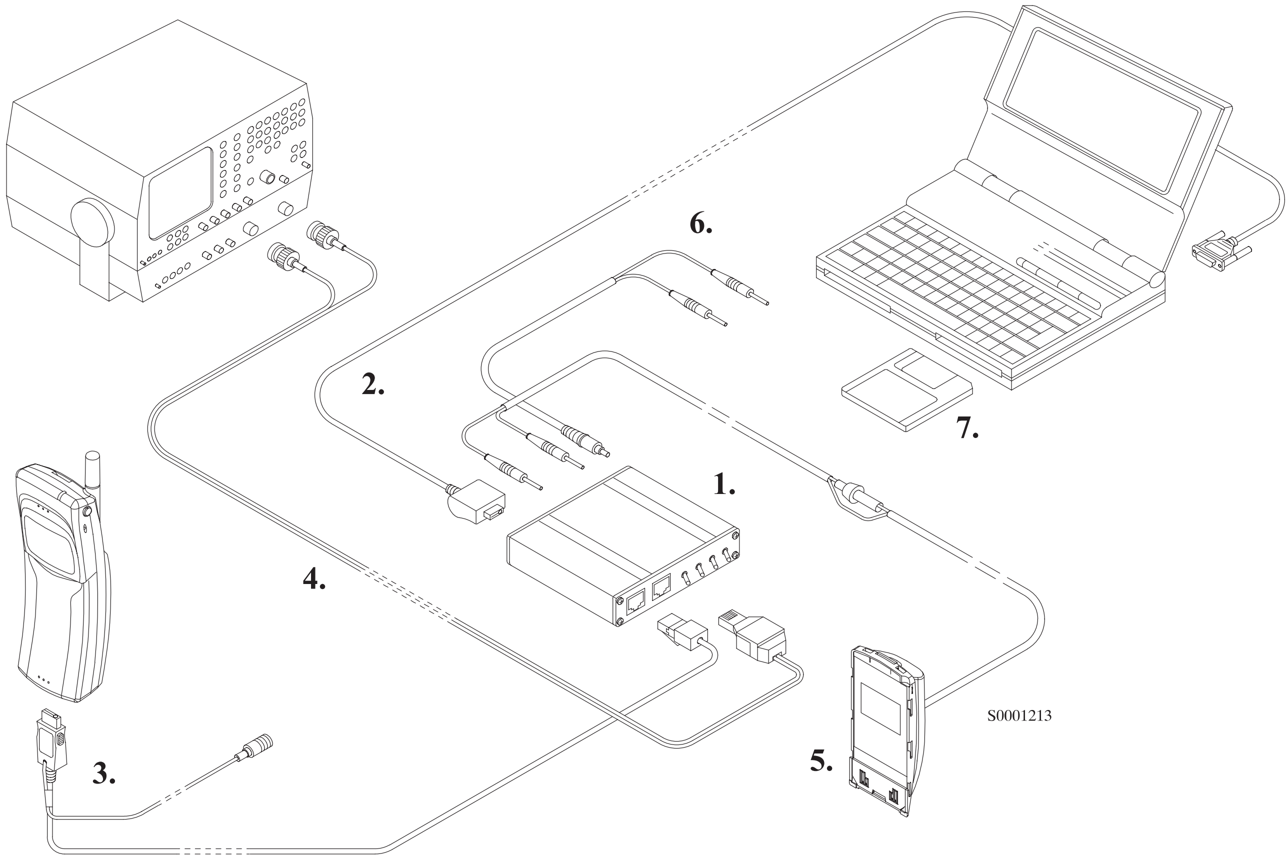
Next connect the M2BUS service cable, DAU–4S, to the serial port (RS–232) of the computer. Attach one end of the service cable to the PC serial port and the other end to the service box, JBU–4. For servicing the phone with the covers in place the service box should always be used.

The RF cable should be connected between the RF connector of the test set and the appropriate connector on JBU–4. When the phone covers are removed the RF connection on the extension cable should be used instead.

For audio measurements connect the service cable, SCS–4, as follows:

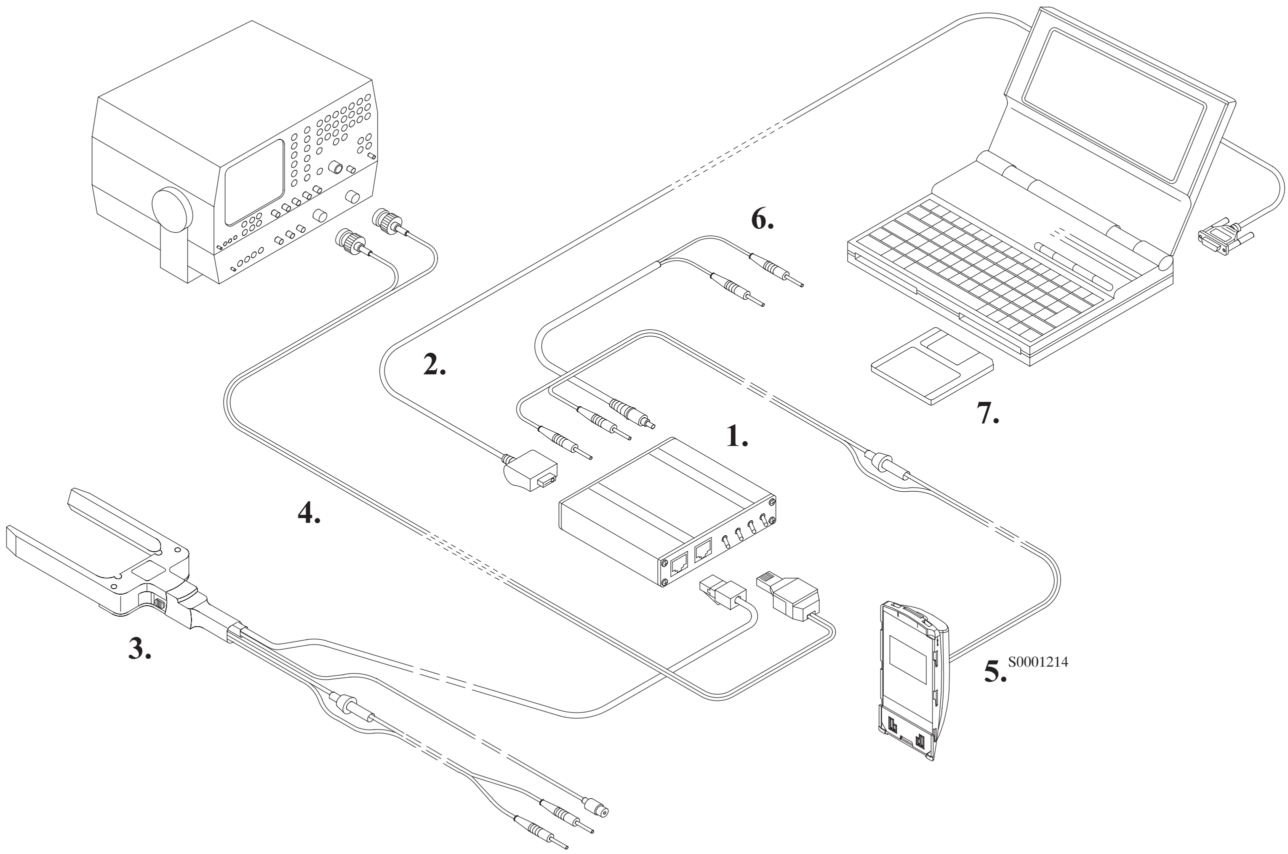
– EAR line to AF INPUT of test equipment
– MIC line to MOD GEN OUTPUT of test equipment

Equipment Setup for Tuning a Phone without Removing Covers



Item:	Service accessory:	Product code:
1.	Service box, JBU–4	0770041
2.	M2BUS adapter cable, DAU–4S	0730057
3.	Service cable, SCS–4	0730052
4.	Audio cable, ADS–1	0730011
5.	Service battery, BBS–2	0775055
6.	Power connector, PCS–1	0730012
7.	Service software diskette 3.5“	0774034
–	Service software diskette 5.25“	0774035
–	Software protections key PKD–1 ”dongle”	0750018

Equipment Setup for Tuning a Phone with Covers Removed



Item:	Service accessory:	Product code:
1.	Service box, JBU–4	0770041
2.	M2BUS adapter cable, DAU–4S	0730057
3.	Module jig, JBS–18	0770070
4.	Audio cable, ADS–1	0730011
5.	Service battery, BBS–2	0775055
6.	Power connector, PCS–1	0730012
7.	Service software diskette 3.5‘‘	0774034
–	Service software diskette 5.25‘‘	0774035
–	Software protection key PKD–1 ”dongle”	0750018

Starting The Software

The software is delivered on a diskette and is copy protected with a dongle. The software must be installed on the hard disk, see installation instructions in Service Software User's Guide.

Starting steps:

- Start Windows
- Open NMP Service Software Group
- Start software by double–clicking NHE–6 Service Software icon
- When Login windows appears press *OK* button
- Choose from main menu *Product –> New.*

Tuning Steps

1. RSSI Reference Signal Level Storage

Reference value for the received signal strength meter are program tuned.

RSSI reference signal level programming:

– Select *Tuning –> RSSI (AGC)....*
– Connect RF generator to antenna connector at 947.067710 MHz.
– Adjust signal generator level to –80 dBm + cable attenuation.
– Press *OK* button
– Adjust signal generator level to –55 dBm + cable attenuation.
– Press *OK* button.
– Values difference should be below ±3.0 dB.
– Press *OK* button.

2. AFC Diagram Storage

This tuning is used to calibrate the automatic frequency control range.

AFC tuning:

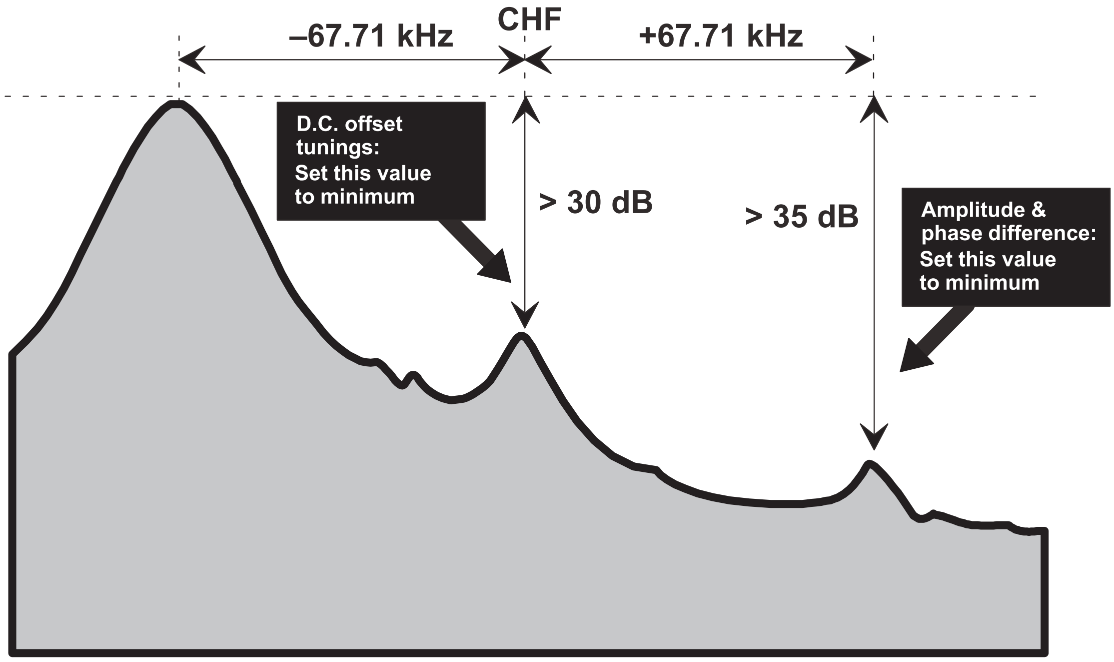
– Select *Tuning –> AFC...*
– Set RF generator frequency 947.067710 MHz at level –55 dBm + RF cable attenuation.
– Check that ”Cont. mode channel” is 60
– The measurement result should be;
    - Low > –20 kHz
    - Middle ±3.0 kHz (depends on generator frequency accuracy)
    - High < 20 kHz
– Press *OK* button.

3. I/Q Modulator Amplitude Balance and Phase Shift Tuning

The purpose of this tuning operation is to adjust the I/Q modulator d.c. offsets and the I/Q modulator amplitude balance and phase shift.

I/Q modulator d.c. offsets, amplitude balance and phase shift tuning:

– Select *Tuning –> TX I/Q...*
– Select I/Q tuning values from PC's memory, phone's EEPROM or factory default values.
– Connect spectrum analyzer (with attenuator if needed) to phone antenna connector.
– Check that TX power level is level 10, channel is 60 and TX data type is 1.
– Adjust spectrum analyzer centre frequency to 902 MHz, Span 200 kHz, Res BW 10 kHz, Video BW 1 kHz and Sweep time 0.5 s.



– Select option "TX I d.c. offset".
– Adjust the level of centre frequency (CHF signal) to minimum by varying D/A converter value with <– and –> buttons.
– The amplitude difference between CHF–67.7 kHz and CHF should be >30 dB.
– Select option "TX Q d.c. offset".
– Adjust the level of signal CHF to minimum by varying D/A converter value with <– and –> keys.

– Select option ”Tune Amplitude Difference”.
– Adjust the level of signal CHF+67.7 kHz (902.06777 MHz) to minimum by varying D/A converter value with <– and –> keys.
– The amplitude difference between CHF+67.7 kHz and CHF–67 kHz should be >35 dB.
– Select option ”Tune Phase Difference”.
– Adjust the level of signal CHF+67.7 kHz to minimum by varying D/A converter value with <– and –> keys.
– When values are correct press *OK* button.

4. Tuning of Transmitter Power Levels

This adjustment loads the power levels of the phone transmitter into the EEPROM. When doing this, a pulse power meter or spectrum analyzer must be used.

Power levels programming:

– Select *Tuning –> TX Power...*

– Select I/Q tuning values from PC's memory, phone's EEPROM or factory default values.

– Set power supply voltage to 7.2 V.

– Connect pulse power meter or spectrum analyzer to antenna connector.

– Check that channel is 60.

– Adjust the power level (levels 5, 13 and 15) with + and – buttons and change levels with ↑ and ↓ keys.

Power level	**Tuning P_{OUT}/dBm (VB=7.2 V, CH60)**
5	32.8
13	17.5
15	14.2

NHE–6BM Power Levels:

– Adjust the power level (levels 5, 17 and 19) with + and – buttons and change levels with ↑ and ↓ keys.

Power level	**Tuning P_{OUT}/dBm (VB=7.2 V, CH60)**
Base	5 *tune first!*
5	33
17	11.2
19	8.5

– Press *Calculate* button to calculate all other levels.

– Once all TX levels are correct, press *OK* button.

5. Charge Voltage Adjustment

A reference value for charge voltage is set by using an accurate 6.0 V supply.

Calibration of the charge voltage:

- Select *Tuning –> Charger A/D...*
- In case the phone covers are not removed replace the standard battery of the phone with the service battery.
- Apply +6 V to VCHARG line.
- Software reads 6 V, A/D reading fed to phone VCHARG line.
- Store charge voltage value to phone EEPROM by pressing *OK* button.

6. Battery Voltage Adjustment

A reference value for battery are calibrated by using an accurate 6 V supply.

Calibration of the A/D converter channels:

- Select *Tuning –> Battery A/D...*
- Replace the standard battery of the phone with the dummy battery.
- Apply +6 V to service battery.
- Software reads 6 V, A/D reading fed to phone VBAT line.
- Store correct value to phone EEPROM by pressing *OK* button.

NHE–6BM Battery Voltage Adjustment:

- Select *Tuning –> Battery A/D...*
- Replace the standard battery of the phone with the dummy battery.
- Apply +6 V to service battery.
- Software reads 6 V, A/D reading fed to phone VBAT line.
- Store correct value to phone EEPROM by pressing *OK* button.
- Apply +8.4 V to service battery.
- Software reads 8.4 V, A/D reading fed to phone VBAT line.
- Store correct value to phone EEPROM by pressing *OK* button.

7. LCD Calibration

This adjustment is used to calibrate the contrast of the display, and should only be performed if necessary.

Tuning of the LDC display:

- Select *Tuning –> LCD A/D...*

– Enter the actual environment temperature and press *OK* button.
(The LCD must be calibrated at a temperature of 25 ±1 degrees centigrade).

– Select *Tuning –> Display...*

– Adjust the value between 2 and 19 for the best contrast. The default value is ”8”, as shown on the service software.

– At the lowest value, there may be nothing visible on the display, while at the highest value, the main display area will be completely black.

– At the point at which the value is correct, the display should show a black section on the left of the main display area, and nothing in the section on the right of the main display area. No icons should be visible when the display is correctly calibrated.

– Once the right value is selected, press OK button.

Example of correct calibration: