

After Sales Technical Documentation

NHE-5 TUNING INSTRUCTIONS

TUNING INSTRUCTIONS

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Introduction

General

In contrast to earlier second-generation analog cellular phones almost all tuning operations of the NHE-5 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 Sect. 5 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.

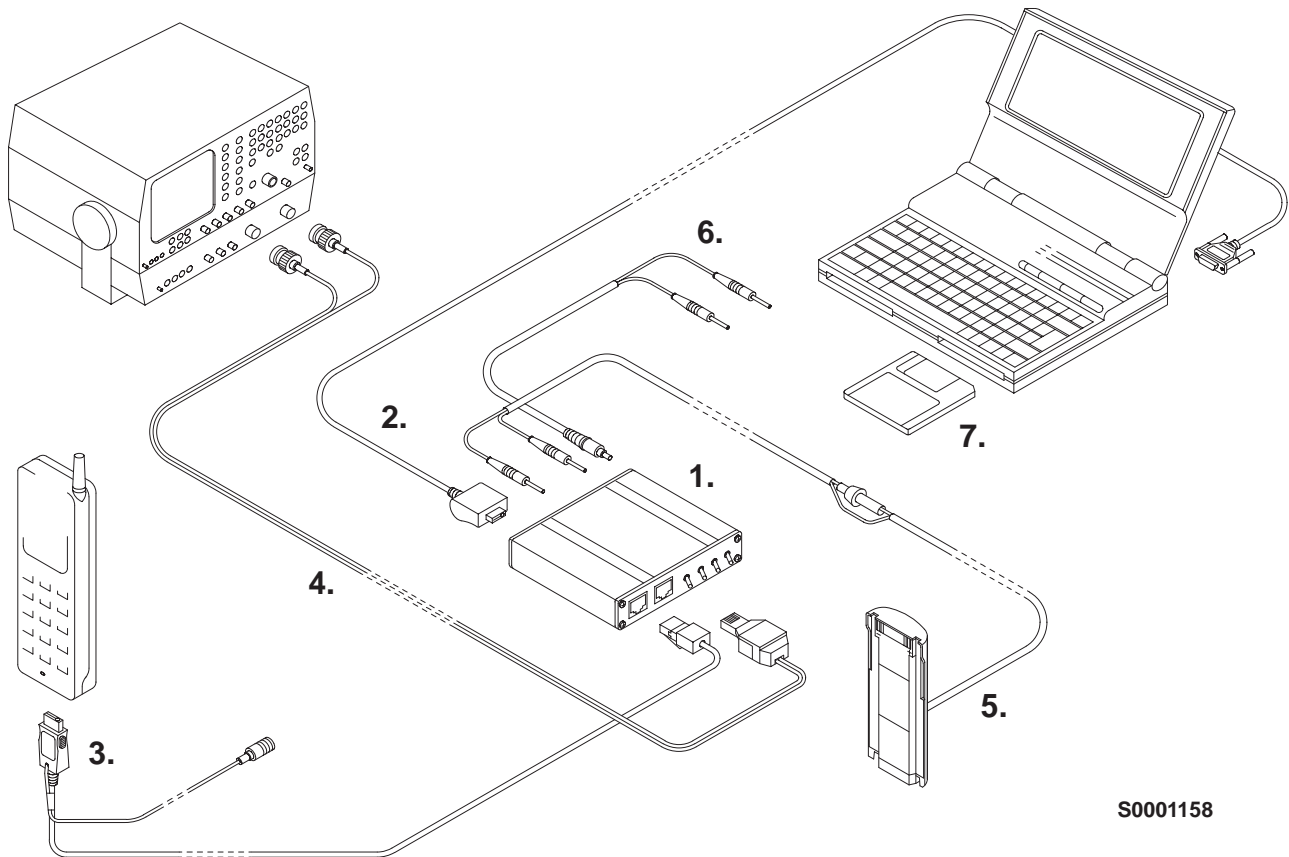
Next connect the M2BUS service cable, DAU-4S, to the serial port (RS-232) of the computer. Attach one end of the service cable to the PC serial port and the other end to the service box, JBU-4. For servicing the phone with the covers in place the service box should always be used.

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

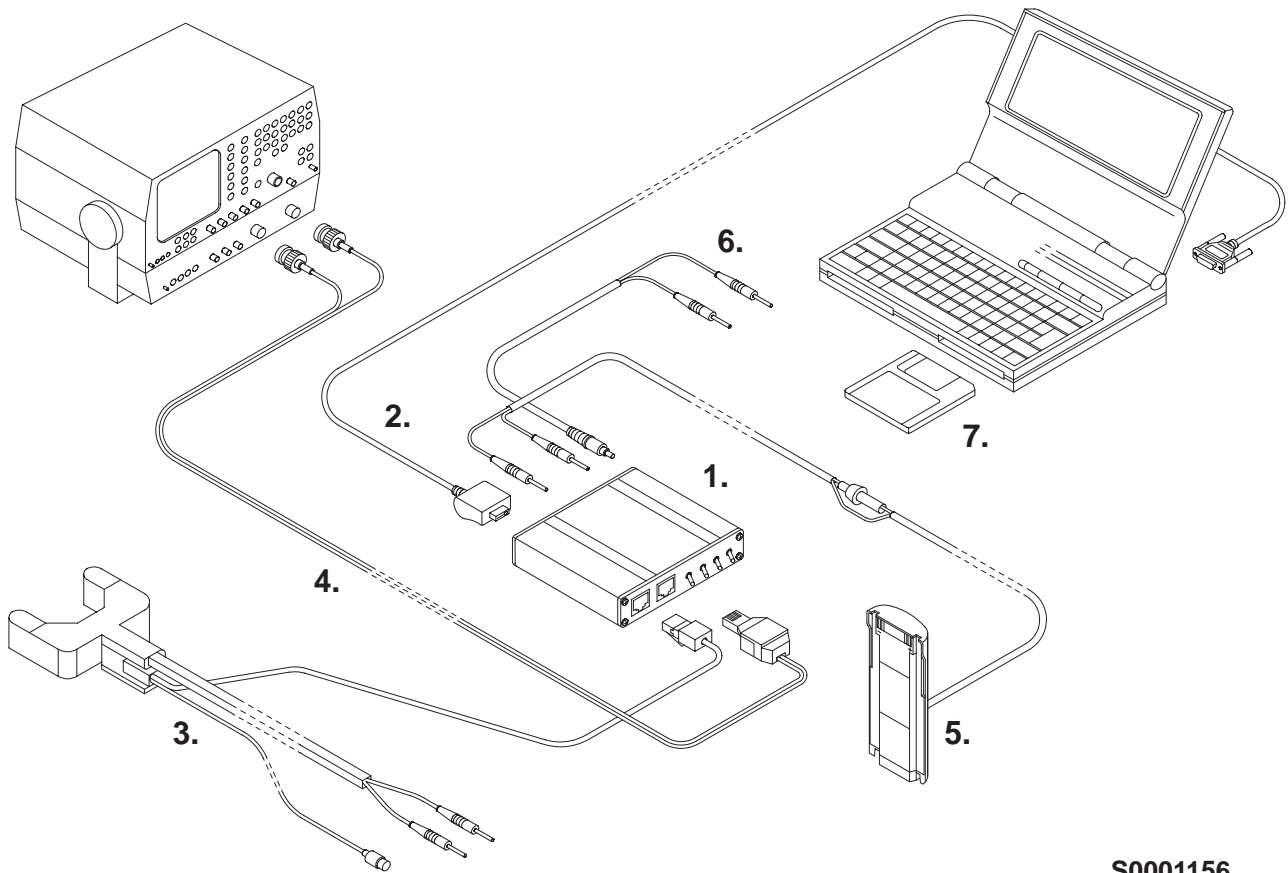


S0001158

| 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-1 | ? |
| 6. | Power connector, PCS-1 | 0730012 |
| 7. | Service software diskette 3.5", | 0774034 |
| - | Service software diskette 5.1/4" | 0774035 |
| - | Software protection key PKD-1 "dongle" | 0750018 |
| - | Antenna adapter, AAT-2 *) | 0310016 |

*) Note: Be very careful when you install the antenna adapter AAT-2. The antenna clip in the phone can be damaged very easily

Equipment Setup For Tuning A Phone With Removing Covers



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| Item: | Service accessory: | Product code: |
|-------|--|---------------|
| 1. | Service box, JBU-4 | 0770041 |
| 2. | M2BUS adapter cable, DAU-4S | 0730057 |
| 3. | Module jig, JBS-14 | 0770049 |
| 4. | Audio cable, ADS-1 | 0730011 |
| 5. | Dummy battery, BBS-1 | ? |
| 6. | Power connector, PCS-1 | 0730012 |
| 7. | Service software diskette 3.5", | 0774034 |
| - | Service software diskette 5.1/4" | 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-5 Service PCLocals 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 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:

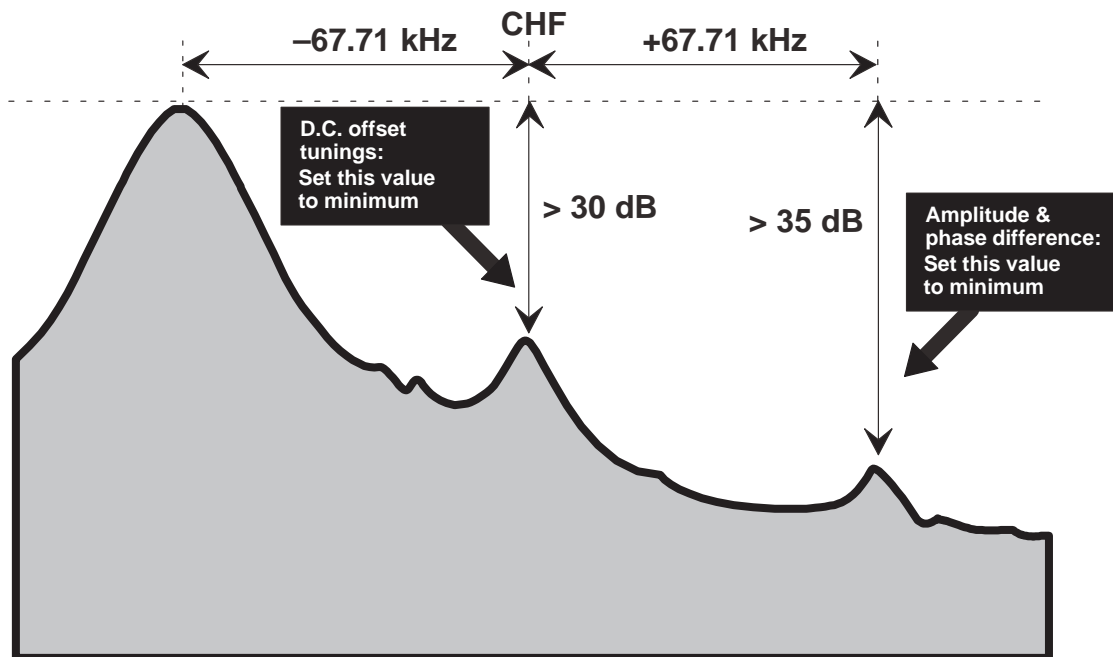
- Select *Tuning* → *AFC*...
- Set RF generator frequency 947.067710 MHz at level –55 dBm + RF cable attenuation.
- Check that "Cont. mode channel" is 60
- The measurement result should be;
 - Low over < -20 kHz
 - Middle ± 3.0 kHz (depends on generator frequency accuracy)
 - High below > 20 kHz
- Press *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 15, Cont. mode 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 \leftarrow and \rightarrow buttons.
- The amplitude difference between CHF -67.7 kHz and CHF should be $>30\text{ dB}$.
- Select option "TX Q d.c. offset".
- Adjust the level of signal CHF to minimum by varying D/A converter value with \leftarrow and \rightarrow keys.

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- 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 6.0 V.
- Connect pulse power meter or spectrum analyzer to antenna connector.
- Check that continuous mode channel 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=6.0 V, CH60) |
|-------------|---|
| 5 | 33 |
| 13 | 17 |
| 15 | 13 |

- 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 BBS-1.
- 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...*
- In case the phone covers are not removed replace the standard battery of the phone with the dummy battery BBS-1.
- 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.

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