PAMS Technical Documentation
NSM–1 Series Transceivers

Tuning Instructions

CONTENTS

Tuning Instructions

General

All tuning operations of the NSM–1 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 MBUS 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.

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 with service software; see separate section for instructions on installation and use.

– Service accessories; see equipment setup 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–9P, 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, JBA–4. For servicing the phone with the covers in place the service box should always be used.

When the phone covers are removed the jigs should be used.

For audio measurements connect the audio cable, ADS–1, 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

S0001235
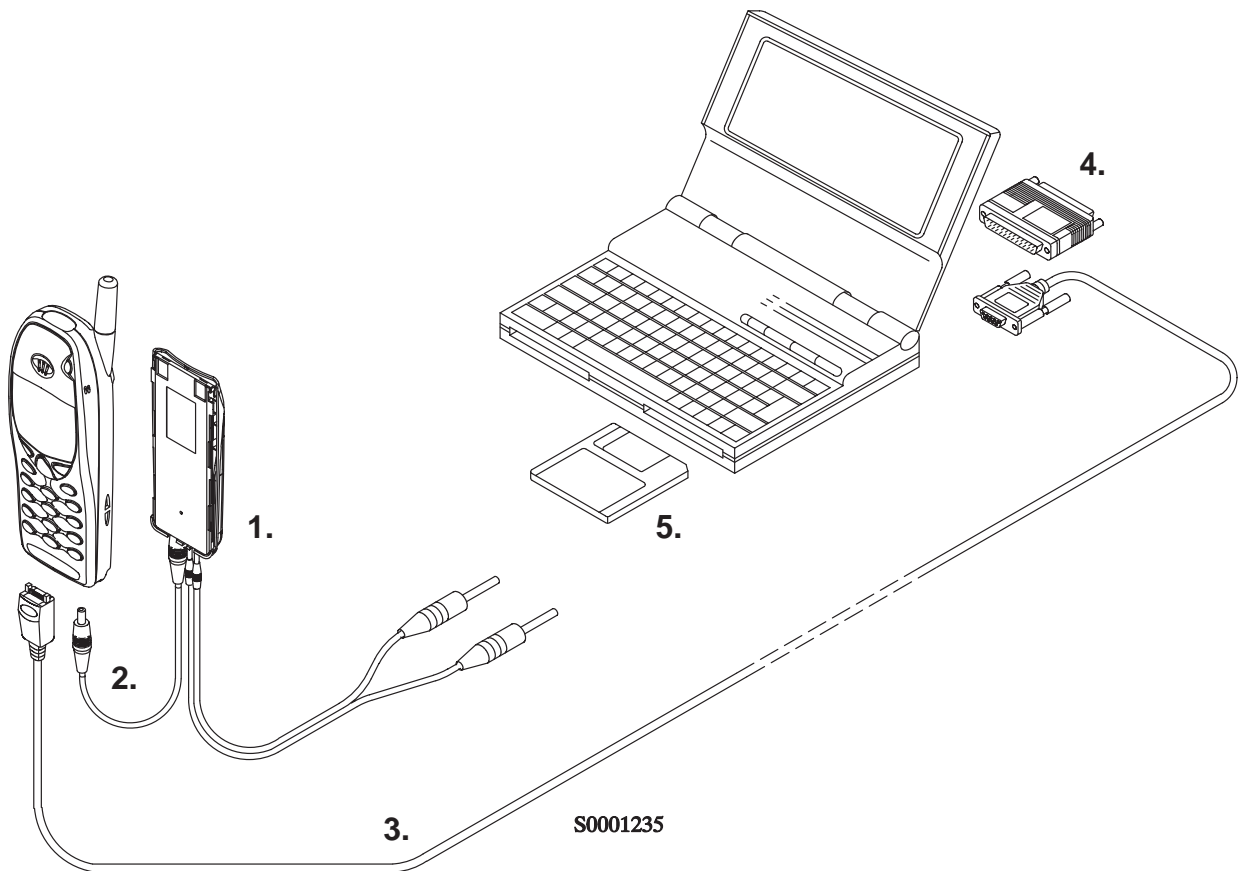
Item:	Service accessory:	Product code:
1	Service Battery BBD–3	0775071
2	DC Cable SCB–3	0730114
3	Service MBUS Cable DAU–9P	0730109
4	Software protection key PKD–1	0750018
5	Service SW diskette 3.5" for WinTesla	0774046
6	Service SW diskette 3.5" for NSM–1	0774080

Flash Concept for NSM–1

S0001232
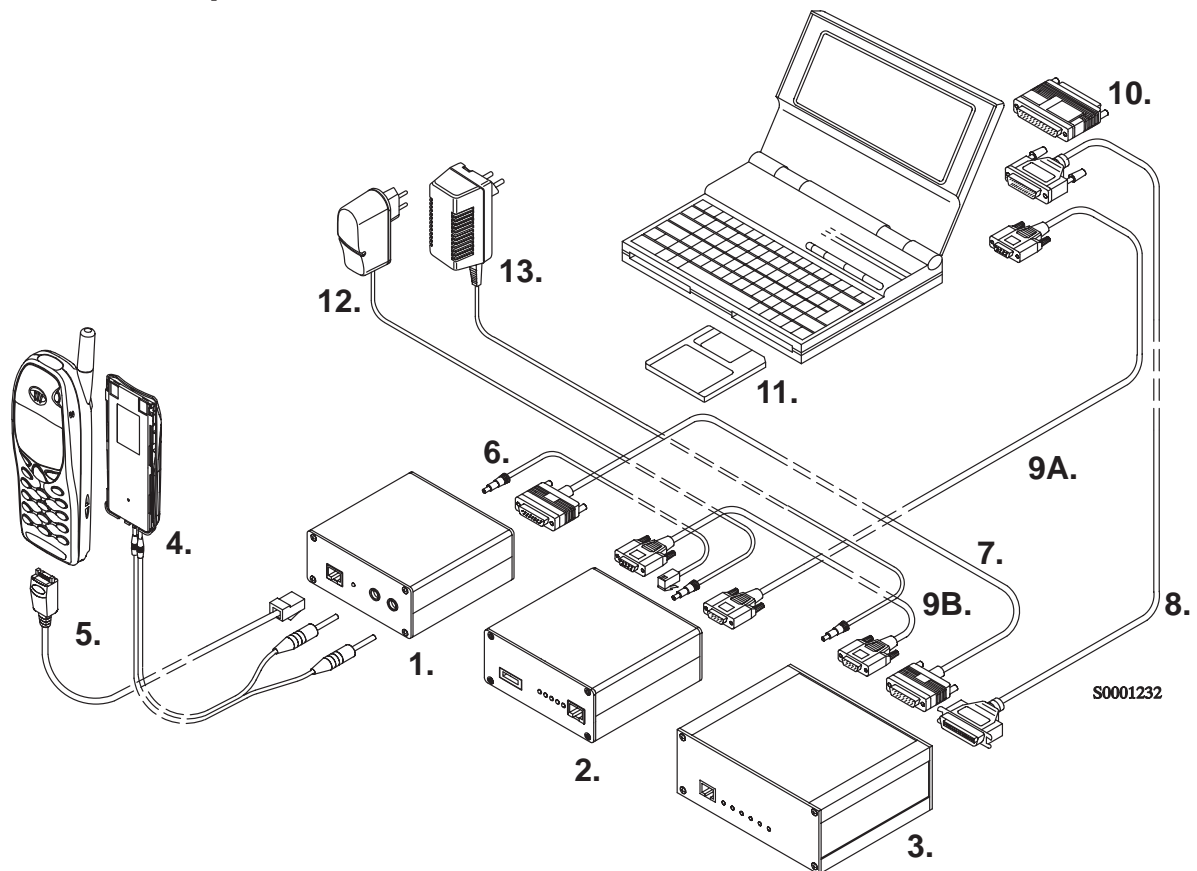
Item:	Service accessory:	Product code:
1	Flash Loading Adapter FLA–5	0080178
2	Flash Security Box TDF–4	0770106
3	Prommer FPS–4S	0085095
4	Service Battery BBD–3	0775071
5	Service Cable SCH–5	0730098
6	DC Cable PCC–1B	0730053
7	D15 – D15 Cable AXS–5	0730091
	(Included in FLA–5 sales pack)	
8	Printer Cable (Included in FPS–4 sales pack)	0730029
9A	D9 – D9 Cable AXS–4	0730090
	(Included in FPS–4 sales pack)	
9B	D9 – D9 Cable AXS–4	0730090
10	Software protection key PKD–1	0750018
11	Service SW diskette 3.5" for NSM–1	0774080
	Service SW diskette 3.5" for WinTesla	0774046
12	Travel Charger ACH–6E (Euro)	0270381
	Travel Charger ACH–6U (USA/Japan)	0270382
	Travel Charger ACH–6X (UK)	0270380
13	AC Charger ACL–3E	0680015
	(Included in FPS–4 sales pack)	

Tuning With Covers Off – Using Test–frame JBS–19

S0001236
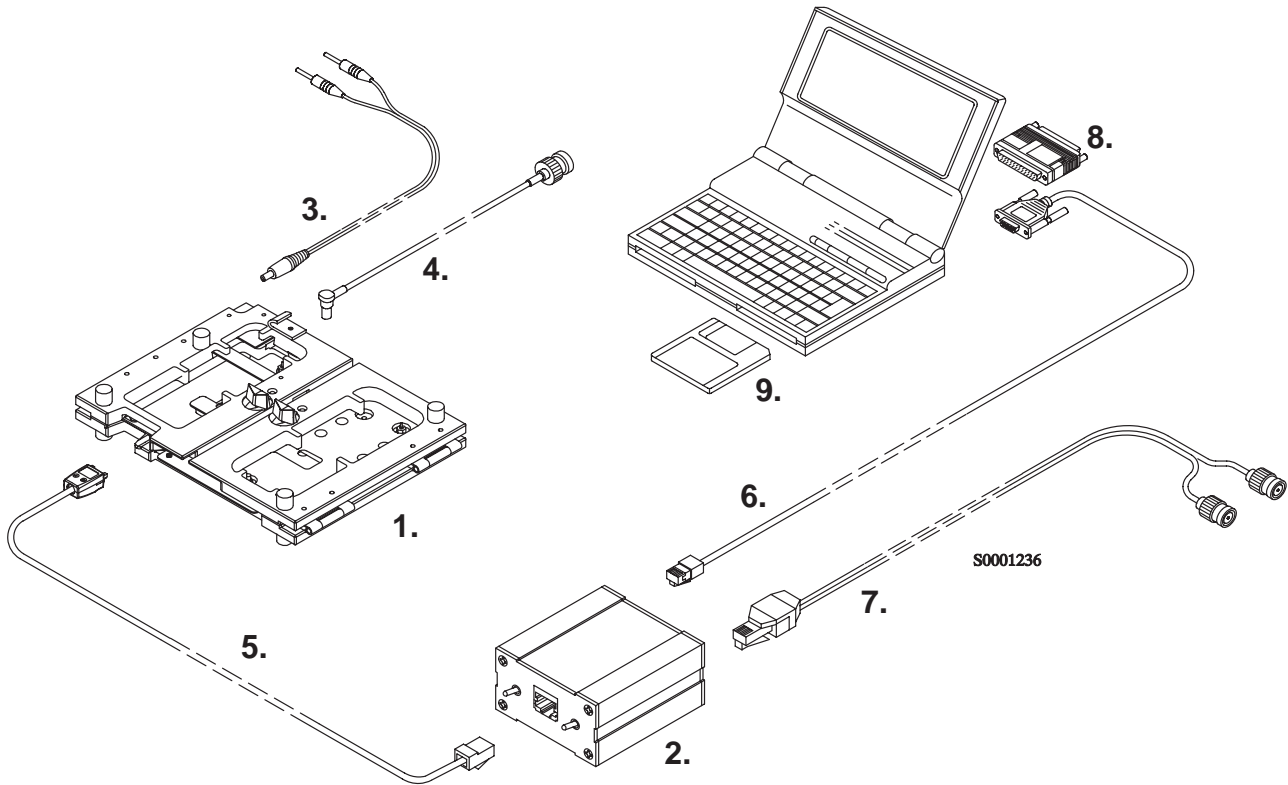
Item:	Service accessory:	Product code:
1	Module Jig JBS–19 *	0770098
	SIM–Card Holder CAH–1	0770112
2	Service Audio Box JBA–4 **	0770094
3	DC Cable PCS–1	0730012
4	External Antenna Cable XRC–1B	0730128
5	Service Cable SCH–5 **	0730098
6	Service MBUS Cable DAU–9S **	0730108
7	Audio Cable ADS–1	0730011
8	Software Protection Key PKD–1	0750018
9	Service SW diskette 3.5" for WinTesla	0774046
	Service SW diskette 3.5" for NSM–1	0774080

*)   The nominal operating voltage for JBS–19 is 3.6 V.
         The supply voltage for JBS–19 must never exceed 5.0 V

**)   SCH–5, JBA–4, and DAU–9S can be replaced with DAU–9P

Tuning With Covers Off – using Light Jig JBT–1

S0001237
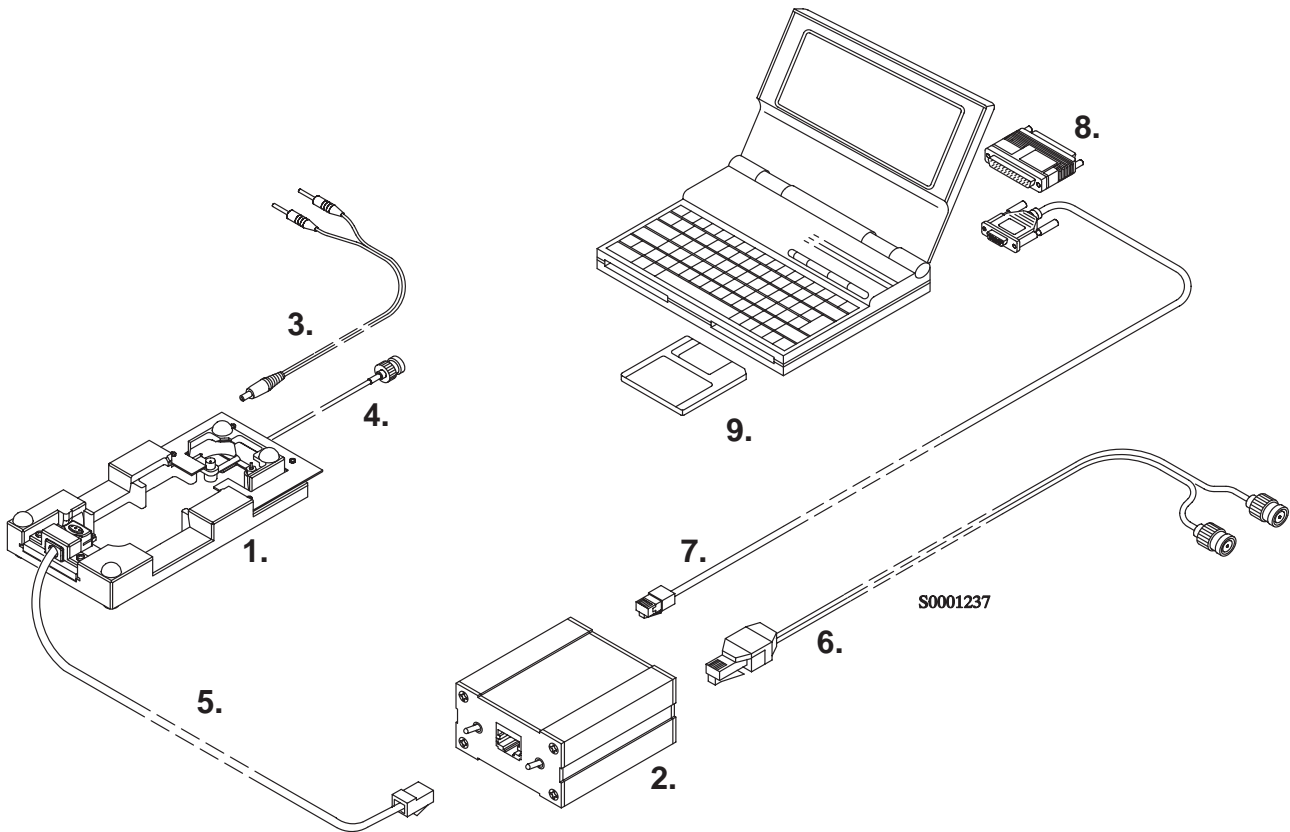
Item:	Service accessory:	Product code:
1	Light Module Jig JBT–1 *	0770109
2	Service Audio Box JBA–4 **	0770094
3	DC Cable PCS–1	0730012
4	External Antenna Cable XRC–1B	0730128
5	Service Cable SCH–5 **	0730098
6	Audio Cable ADS–1	0730011
7	Service MBUS Cable DAU–9S **	0730108
8	Software Protection Key PKD–1	0750018
9	Service SW diskette 3.5" for WinTesla	0774046
	Service SW diskette 3.5" for NSM–1	0774080

*) The nominal operating voltage for JBT–1 is 3.6 V.
    The supply voltage for JBT–1 must never exceed 5.0 V

**) SCH–5, JBA–4, and DAU–9S can be replaced with DAU–9P

Warranty Transfer

S0001234
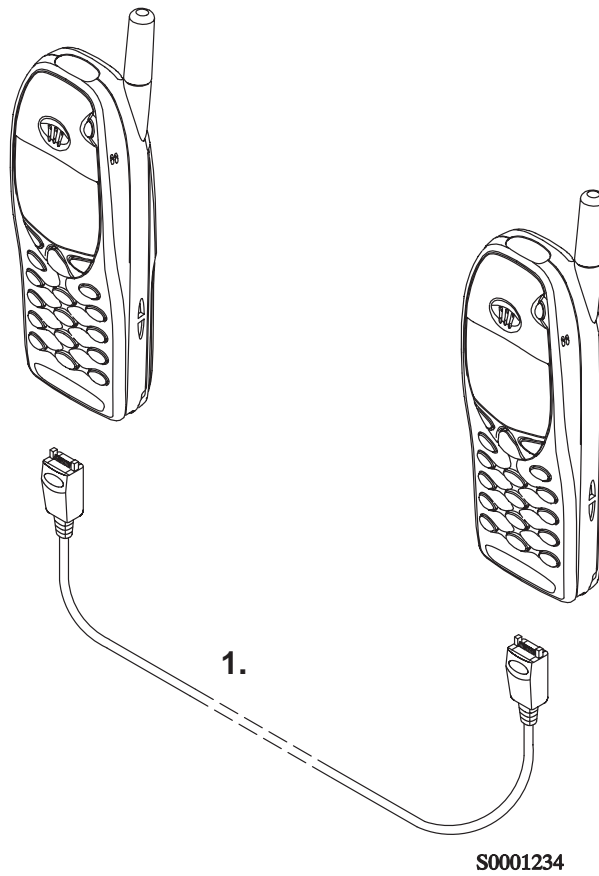
Item:	Service accessory:	Product code:
1	Warranty Cable SCH–6	0730099

Tuning Steps

1. RX Calibration (AGC + AFC)

Procedure

Follow the steps described in chapter "Service Software Instructions" section "RX calibration... command".

Software reports the following:

AFC init value
AFC slope
PSW slope
AGC DAC values and the corresponding voltages for each gain step (0 - 57 dB)

Limits for the reported values

If everything went well the reported values should **approximately** be the following:

Parameter	Low limit	High limit
AFC init value	–80	80
AFC slope	130	230
PSW slope	250	350
AGC 0 dB	400	640
AGC 57 dB	100	300
Difference between the two neighbour AGC steps	10	20

Troubleshooting

If the calibration does not succeed the software normally reports "Unable to read data from phone" or "Failed to set high reference" or "Failed to set low reference".

In this case check first the basic functionality of the receiver chain: RF generator frequency set as in the calibration and level for example to the high reference value.

Then go to the RSSI reading menu (under RF controls). If the reading is very low there is something broken in the receiver and must be found by measuring voltages and signal levels at different places (information of these can be found elsewhere in this manual).

If the RSSI reading seems to be within 5 - 10 dB the same as the RF input level check that the VCTCXO (G650) frequency is close enough the

wanted frequency. This is most easiest done by measuring the UHF VCO (G550) frequency because the absolute value of the deviation is biggest there. In the GSM mid channel the UHF–VCO frequency should be 2040.0 MHz. If the deviation is bigger than about +/–20 kHz it is probable that the VCTCXO is not operating correctly.

If both of these (RSSI reading and the frequency) seem to be correct and calibration still fails the most probable reason is that there is a little lack of gain somewhere or the AGC gain control slope in N600 is out of the limits.

This can be verified by changing the generator reference levels from the demanded ones in the calibration procedure in 1 dB steps up and down. If the calibration goes through with some reference levels the corrective action is most probably changing N500 or N600.

2. Alignment of Transmitter Power Levels

Equipment:

Pulsed power meter or spectrum analyzer and 10 dB attenuator.
Voltage source set to 3.6 V.

The following **settings** for the spectrum analyzer are recommended when aligning the power levels: zero span, resolution and video bandwidths 1 MHz, input attenuation 40 dB, sweep time 1 ms, video triggering.

NOTE! If spectrum analyzer is used in power level alignment the reading needs to be calibrated with a power meter after every power up.

Procedure:

Follow the instructions given in chapter "Service Software Instructions" section "TX power... command".
For GSM the alignment channel is 60 (902 MHz) and for PCN 700 (1747.8 MHz). The side channels for GSM are 1 (890.2 MHz) and 124 (914.8 MHz) and for PCN 512 (1710.2 MHz) and 885 (1784.8 MHz).

Targets in dBm:

Power level	GSM	PCN
0		29.5
1		28
2		26
3		24
4		22
5	32.5	20
6	31	18
7	29	16
8	27	14
9	25	12
10	23	10
11	21	8
12	19	6.5
13	17	5
14	15	3.5
15	13	2
16	11	
17	9	
18	7	
19	5	
Base	–20	–15

It is recommended that all the power levels are separately aligned although there is a possibility to align only three and calculate the rest. This is due to the fact that the calculation is not accurate enough, especially for PCN lowest power levels where the targets are NSM–1 specific.

NOTE! Base level **must** be adjusted manually because the calculation most often fails.

3. I/Q Modulator Alignments

I/Q modulator alignments are performed in PCN band. If GSM band has been selected and I/Q alignment is started, the service software asks to change to PCN band. If the user wants to continue in GSM, the adjusted values can only be saved to PC memory, not to phone's EEPROM. After changing to PCN band values from PC memory are available, and if the modulator adjustment is good, also the values can be saved to phone's EEPROM. See chapter "Service Software Instructions" and section "TX I/Q... command" for further information.

Procedure:

Connect the spectrum analyzer to the phone antenna connector. The recommended spectrum analyzer settings are: span 200 kHz, resolution BW 10 kHz, video BW 1 kHz, sweep 500 ms, input attenuation 30 dB.

– From *RF controls* menu make sure that TX data type is 1.

– Go to *TX I/Q tuning* menu. The alignment channel for PCN is 700 (1747.8 MHz).

– Select the "TX I DC offset" option and adjust the level of the centre frequency (CHF) to minimum.

– Select the "TX Q DC offset" option and adjust the level of the CHF again to minimum.

– After finding both minima change "TX I DC offset" by step or two from the current value to both directions to see, whether better minimum can be found for CHF.

– Select the "Amplitude Difference" option and adjust the level of the unwanted sideband CHF + 67.71 kHz to minimum.

– Select the "Phase Difference" option and dajust the level of CHF + 67.71 kHz again to minimum.

– After all the minima have been found press "Save" button to store the values to phone EEPROM.

Targets:

The level of the centre frequency CHF should be at least **30 dB** down to the wanted sideband CHF - 67.71 kHz.

The level of the unwanted sideband CHF + 67.71 kHz should be at least **35 dB** down to the wanted sideband CHF - 67.71 kHz.

Alignment verification in GSM band:

– Go to *Product —> Initialize —> Normal mode.* This is needed to give a SW reset for the phone. Which in turn is needed to get the aligned I/Q values in use.

– Go to *Product —> Band —> GSM*

– Go to *RF controls* menu and start transmission on channel 60, power level 10, TX data type 1.

– Check the levels of CHF and CHF + 67.71 kHz. **Both the levels should be at least 30 dB down** to the wanted sideband CHF - 67.71 kHz. If both or either of the specifications is not met adjust the the required values (I and Q DC offsets for CHF and amplitude and phase for CHF + 67.71kHz) to meet the specifications.
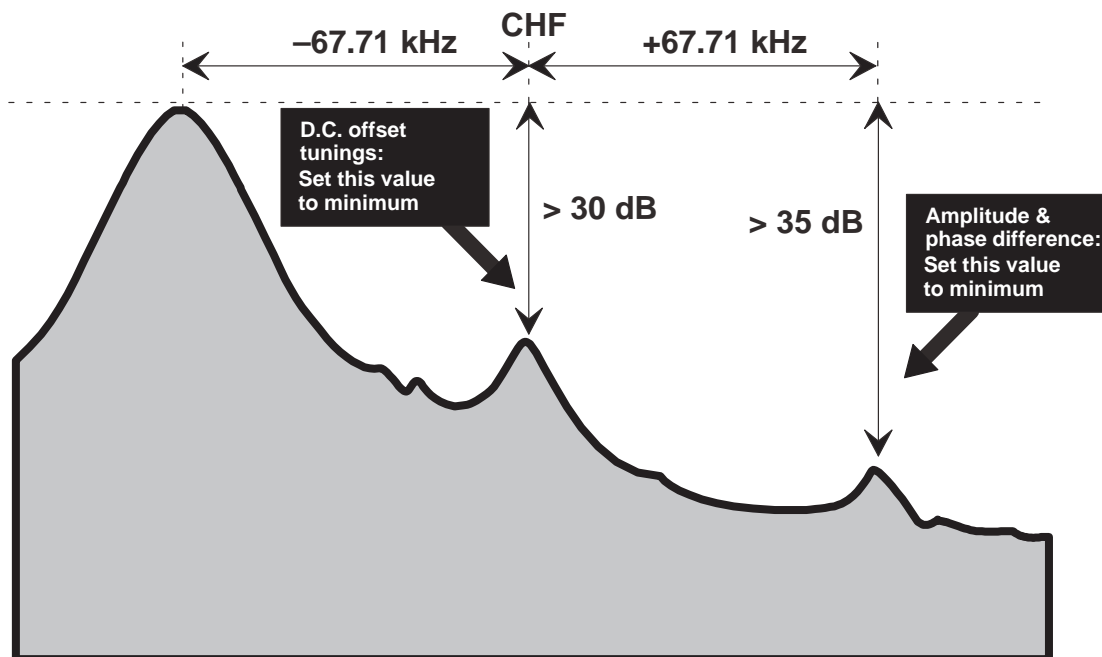
– Store the results in PC memory.

– Go to *Product —> Band —> PCN* and then to *TX I/Q Tuning* to check the alignment with the values which are in PC memory. If the specifications are not met in PCN the solution is to find compromise values which are not optimum for either bands but still meet the specifications.

– If the PCN band alignment is good with the values from PC memory, the TX I/Q tuning procedure can be stopped by pressing the "Save" button.

4. Energy Management Calibration

See chapter "Service Software Instructions" and section "Tuning – Energy Management Calibration... command" for further information.