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1 Introduction

This document specifies the features of 61xx series Field Test Display. Field Test Display, i.e. engineering test mode, is a configurable software feature which is available through MMI menu.

Field Test Display is useful for testing mobile phones during development or for verifying the operation of the network.

1.1 Changes for 61xx series (compared to 8110I series)

General changes:

- 12 character lines (13 in HD843).
- MNC (Mobile Network Code) in displays 6 and 11 has now 3 digits.
- SIM SCM is used instead of B-memory SCM in displays 17, 52 and 53.

Moved displays

- Display 2 moved to display 3, 3 to 4, 4 to 5 and 5 to 6.

Moved items

- Places of C1 and C2 changed in display 1.
- Reason of last call release copied to display 2

Removed displays:
- Displays that were not implemented in 8110 (i.e. removed only from specification)
  - Display 6: Start latest cell information saving
  - Display 7: Information of the latest and 2nd latest cell/time slot
  - Display 8: Information of the 3rd and 4th latest cell/time slot
  - Display 9: Information of the fifth latest cell/time slot

New items:
- Display 21:
  - Sum of membership function sets beliefs

New displays:
- Display 2: More information of the serving cell
  - items moved from display 1:
    - paging mode
    - maximum number of Random Access retransmission
    - roaming indicator
    - BSIC value
  - Reason of last call release
  - RX quality (full)
  - C2 parameters
  - Hopping flag, MAIO and HSN
- Display 8: HSCSD display 1
- Display 9: HSCSD display 2

2 Using the Field Test Display

When the Field Test Display is active, the phone works in a similar way as without it, except that the arrow buttons (^,v) scroll through the various tests, whereas they would scroll through the memory locations while the Field Test Display is inactive. The test numbers that are not valid are not scrolled.

The Field Test Display appears as a so called soft indicator, which means that it is visible only if there is nothing else to display. For example, once the first digit of a phone number has been dialled, the Field Test Display disappears and the digit appears. After the whole number has been dialled and a call setup has started, the number disappears and the Field Test Display reverts.

When the Field Test Display is active and mobile originated call setup is going, 'CALLING XXXXX' text is not shown. However, if some call divert is active, 'note diverts' text is viewed. When keyguard is active, keyguard texts (or icons) are disabled and Field Test Display is visible. Pressing a key views normal keyguard texts. When user activates the keyguard, keyguard note is shown shortly.

During proper power off (use of power key or RE-CHARGE indication) some valuable data (e.g. the number of current field test display) is stored onto the EEPROM. Next time when the phone is powered on the lastly selected field test display will be automatically re-activated.

2.1 Activating the Field Test Display

The Field Test Display is located at the end of the main menu loop. It is

activated as follows:

- press the Menu button
- scroll in the main menu loop to field test display item (NETWORK MONITOR)
- press the Select button
- enter the index number of the test to be activated at the TEST NUMBER prompt
- confirm with the Ok button

The field test data will then appear in a moment. The index number of the test will appear in the top right corner of the display. If given test number is not valid "No Test" -text will appear to the display.

A quicker way to activate the Field Test Display is to use the menu shortcut. The field test display is the last item in the main menu loop. The shortcut activation of the field test display is done in the following way:

MENU <number of the last item> <number of the desired field test display>

If the last number of the main menu loop is e.g. 8, in order to activate test display number 20, just press Menu, 8, 20 and Ok in a sequence.

See chapter 2.5 for recommendations.

2.2 Deactivating the Field Test Display

The Field Test Display is deactivated as follows:

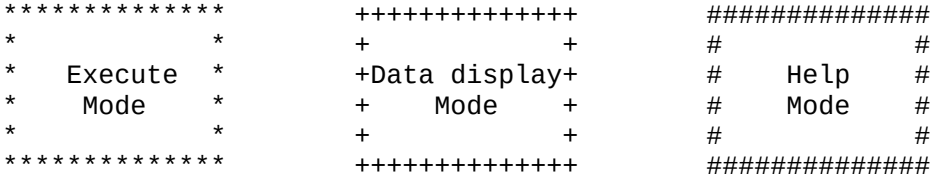
- press the Menu button
- scroll in the main menu loop to field test display item
- press the Select button
- enter 0 at the TEST NUMBER prompt
- confirm with the Ok button

2.3 Field test modes

There are three Field Test Display modes:

- execute mode
- data display mode
- help mode

Different modes are marked in this specification as follows:



The execute mode is entered from the menu as described in 2.1 (either scroll and select or shortcut). If the test index entered pertains to a test that resets a timer (test 80) for example, then the timer is reset as soon as the Ok button has been pressed in the menu, and the data display mode takes over. In other words, the execute mode is of the one-shot type. To run another test in the execute mode, the Field Test

Display menu must be re-activated.

During the data display mode, the field test data (e.g. carrier, power level, cell) is visible on the main display. During the help mode, one screen of instructions is shown for each test to make it easier to identify the test in question. A long press of asterisk (*) is used to toggle between these two modes.

The arrow keys (^,v) offer an easy way to switch to another test without using the menu. However, the data display mode remains, i.e. nothing will be executed or set on although such tests would be passed. This is to prevent the user from accidentally clearing any valuable data. (see 3.7.2 for details and 2.5 for recommendations).
The help mode is also a non-execute mode. Display numbers have been selected in such way that no 5-terminated test number is an execute display.

2.4 Signal and battery levels

When Field Test Display is active, normal signal and battery level bars are visible.

2.5 Reserving SIM SCM locations (recommendations)

When starting to use a SIM-card in a phone with field test displays, it is recommended to put some default data into SIM SCM locations that are used by field test displays. This prevents accidental storing of phone numbers and names into such locations.

SIM SCM location	Recommended number	Recommended text (name)	Location used by display
33	0	BTS TEST	17

Reserving SIM SCM locations is not necessary if the user is sure that he/she will never select these displays using menu shortcut (which executes the display).

In 61xx series (DCT3) phones it is not possible to select the SIM location number where the number and the name will be stored.
So, reserving a SIM location must be done by some PC software or, for example, by 8110i (DCT2) phone.

3 Information on the displays

Length of a field is shown in the display picture by amount of the letters. If a value is not available, 'x' is shown for all the digits. If data to be displayed is shorter than the field reserved to show that data, text is aligned left and numbers right.

3.1 Signalling displays, which can be visible to network operators

Those signalling displays which can be activated by the network operators

are numbered from 1 to 19. Before field test displays are visible, mobile has to be modified. With the normal production mobile field test displays are not working.

3.1.1 Display 1: Information of the serving cell

```
++++++++++++++
+abbb ccc ddd+
+ e ff g mmmm+
+ nnn     ppp+
+    oooo    +
++++++++++++++
```

a — H, if carrier numbers are scrolled when hopping is on. Otherwise ' '.

bbb — When mobile is on TCH: DCH carrier number in decimal. If hopping is on, used channels are scrolled when display is updated.

ccc — rx level in dBm, minus sign not shown if <=-100

ddd — tx power level. If transmitter is on, symbol * is shown in front of the power level value.

e — Time Slot, range is 0 - 7

ff — Timing advance, range is 0 - 63

g — rx quality (sub), range is 0 - 7

mmmm — Radio Link Timeout value. If value is negative, 0 is shown. Maximum value is 64. When mobile is NOT on TCH then xx is shown.

nnn — value of the path loss criterium (C1). Range is -99 - 999.

oooo — type of current channel

- THR0 : TCH HR subchannel 0
- THR1 : TCH HR subchannel 1
- TFR : TCH FR
- TEFR : TCH EFR
- F144 : TCH FR data channel, speed 14.4 kbps
- F96 : TCH FR data channel, speed 9.6 kbps
- F72 : TCH FR data channel, speed 7.2 kbps
- F48 : TCH FR data channel, speed 4.8 kbps
- F24 : TCH FR data channel, speed 2.4 kbps
- H480 : TCH HR data channel, speed 4.8 kbps, subch 0
- H481 : TCH HR data channel, speed 4.8 kbps, subch 1
- H240 : TCH HR data channel, speed 2.4 kbps, subch 0
- H241 : TCH HR data channel, speed 2.4 kbps, subch 1
- FA : TCH FR signalling only (FACCH) channel
- FAH0 : TCH HR signalling only (FACCH) channel, subch 0
- FAH1 : TCH HR signalling only (FACCH) channel, subch 1
- SDCC : SDCCH
- AGCH : AGCH
- CCCH : CCCH
- CBCH : CCCH and cell broadcast receiving on
- BCCH : BCCH
- SEAR : SEARCH
- NSPS : MS is in No Serv Power Save state

ppp — value of the cell reselection criterium (C2). Range is -99 - 999. If phone is phase 1 then C1 value is shown.

HELP display:

```
###############
#CH RxL TxPwr#
#TS TA RQ RLT#
# C1      C2 #
#    CHT     #
###############
```

3.1.2 Display 2: More information of the serving cell

```
++++++++++++++
+ aa b c Bdd +
+ ee f       +
+ ggg hh iii +
+ H=j mm nn  +
++++++++++++++
```

aa	paging mode NO : normal paging EX : extended paging RO : paging reorganization SB : same as before
b	maximum number of Random Access retransmission
c	roaming indicator, values are R or empty.
Bdd	Letter B and BSIC value, range is 0 - 63.
ee	Reason of last call release Cause from messages disconnect and release complete.
f	RX quality (full), range is 0 - 7
ggg	Cell reselect offset, range 0 - 126 dB. 0 - 63 * 2 dB. 'xxx' in active mode.
hh	Temporary offset, range 0 - 60 dB. 0 - 7 * 10 dB. 70 dB means infinite time. 'xx' in active mode.
iii	Penalty time, range 0 - 620 s. 0 - 31 * 20 s. 'xxx' in active mode.
j	Hopping channel 0 Single RF channel 1 RF hopping channel
mm	mobile allocation index offset, MAIO Range: 00 to 63 / xx when H=0
nn	hopping sequence number, HSN Range: 00 to 63 / xx when H=0

HELP display:

```
##############
#PM RAR Ro BC#
#RelR QLF    #
#CRO TO PenT #
#H MAIO HSN  #
##############
```

3.1.3 Display 3: Information of the serving cell, 1st and 2nd neighbour

```
++++++++++++++
+aaabbbcccddd+
+aaabbbcccddd+
+aaabbbcccddd+
+    ef gh   +
++++++++++++++
```

1. row: serving cell information
2. row: 1. neighbour information

3. row: 2. neighbour information
4. row, ef: 1. neighbour information
4. row, gh: 2. neighbour information

aaa	carrier number in decimal
bbb	C1 value, range is -99 - 999, displayed only in idle mode. Instead of C1 value, letter 'B' and BSIC value will be displayed in active mode.
ccc	rx level in dBm, minus sign not shown if <=-100
ddd	C2 value, range is -99 - 999
e,g	F is shown if cell is in a forbidden location area otherwise location is empty.
f,h	B is Barred, N is normal priority and L is low priority otherwise location is empty.

HELP display:

```
###############
#SCH C1 rx C2#
#1CH C1 rx C2#
#2CH C1 rx C2#
#    1N 2N   #
###############
```

3.1.4 Display 4: Information of the 3rd, 4th and 5th neighbour

```
+++++++++++++
+aaabbbcccddd+
+aaabbbcccddd+
+aaabbbcccddd+
+  ef gh ij  +
+++++++++++++
```

1. row: 3. neighbour information
2. row: 4. neighbour information
3. row: 5. neighbour information
4. row, ef: 3. neighbour information
4. row, gh: 4. neighbour information
4. row, ij: 5. neighbour information

aaa	carrier number in decimal
bbb	C1 value, range is -99 - 999, displayed only in idle mode. Instead of C1 value, letter 'B' and BSIC value will be displayed in active mode.
ccc	rx level in dBm, minus sign not shown if <=-100
ddd	C2 value, range is -99 - 999
e,g,i	F is shown if cell is in a forbidden location area otherwise location is empty.
f,h,j	B is Barred, N is normal priority and L is low priority otherwise location is empty.

HELP display:

```
###############
#3CH C1 rx C2#
#4CH C1 rx C2#
#5CH C1 rx C2#
#  3N 4N 5N  #
###############
```

3.1.5 Display 5: Information of the 6th, 7th and 8th neighbour

```
++++++++++++++
+aaabbbcccddd+
+aaabbbcccddd+
+aaabbbcccddd+
+  ef gh ij  +
++++++++++++++
```

1. row: 6. neighbour information
2. row: 7. neighbour information
3. row: 8. neighbour information
4. row, ef: 6. neighbour information
4. row, gh: 7. neighbour information
4. row, ij: 8. neighbour information

aaa	carrier number in decimal
bbb	C1 value, range is -99 - 999, displayed only in idle mode. Instead of C1 value, letter 'B' and BSIC value will be displayed in active mode.
ccc	rx level in dBm, minus sign not shown if <=-100
ddd	C2 value, range is -99 - 999
e,g,i	F is shown if cell is in a forbidden location area otherwise location is empty.
f,h,j	B is Barred, N is normal priority and L is low priority otherwise location is empty.

HELP display:

```
###############
#6CH C1 rx C2#
#7CH C1 rx C2#
#8CH C1 rx C2#
#  6N 7N 8N  #
###############
```

3.1.6 Display 6: Network selection display

This display shows the last registered network country code and network code as well as the codes for four forbidden networks and the first 3 preferred networks.

```
++++++++++++++
+aaabb  aaabb+
+aaabb  aaabb+
+aaabb  aaabb+
+aaabb  aaabb+
++++++++++++++
```

If three digit MNC is used (DCS1900), display looks different:

```
++++++++++++++
+aaabbbaaabbb+
+aaabbbaaabbb+
+aaabbbaaabbb+
+aaabbbaaabbb+
++++++++++++++
```

1. row: last registered network - 1st forbidden network
2. row: 1st preferred network   - 2nd forbidden network
3. row: 2nd preferred network   - 3rd forbidden network
4. row: 3rd preferred network   - 4th forbidden network

aaa   country code coded in BCD
bbb   network code coded in BCD, third digit can be 'F'

HELP display:

```
##############
#LReg   1_For#
#1_Pre  2_For#
#2_Pre  3_For#
#3_Pre  4_For#
##############
```

3.1.7 Display 7: System information bits for serving cell.

```
++++++++++++++
+E A H C I BR+
+a b c d e fg+
+ECSC 2Ter MB+
+  h    i   j+
++++++++++++++
```

a   1 is shown if emergency calls are supported, else 0
b   1 is shown if attach-detach-procedure is allowed, else 0
c   1 is shown if half rate channels are supported, else 0
d   1 is shown if C2 values are broadcasted, else 0
e   1 is shown if system information 7 and 8 are broadcasted,
        else 0
f   1 is shown if cell broadcast is supported, else 0
g   1 is shown if re-establishment is supported, else 0

The following items are used only in dualband phones:

h   In idle mode 1 is shown if Early Classmark (ECSC) sending is
        supported, else 0. In dedicated mode (conversation) X is shown.

i   In idle mode 1 is shown if 2-Ter messages are supported,
        else 0. In dedicated mode (conversation) X is shown.

j   MultiBand reporting decimal value (0,1,2,3) is shown if
        supported. This is shown both in idle and dedicated mode.

The following is picked from Phase2+ ETSI GSM 05.08 version 5.4.0,
Section 8.4.3 ""Additional cell reporting requirements for multi
band MS"".

For a multi band MS the number of cells, for each frequency band
supported, which shall be included in the measurement report is
indicated by the parameter, MULTIBAND_REPORTING. The meaning of
different values of the parameter is specified as follows:

Value   Meaning
0 (00) Normal reporting of the six strongest cells, with known and

allowed NCC part of BSIC, irrespective of the band used.

1 (01) The MS shall report the strongest cell, with known and allowed NCC part of BSIC, in each of the frequency bands in the BA list, excluding the frequency band of the serving cell. The remaining positions in the measurement report shall be used for reporting of cells in the band of the serving cell. If there are still remaining positions, these shall be used to report the next strongest identified cells in the other bands irrespective of the band used.

2 (10) The MS shall report the two strongest cells, with known and allowed NCC part of BSIC, in each of the frequency bands in the BA list, excluding the frequency band of the serving cell. The remaining positions in the measurement report shall be used for reporting of cells in the band of the serving cell. If there are still remaining positions, these shall be used to report the next strongest identified cells in the other bands irrespective of the band used.

3 (11) The MS shall report the three strongest cells, with known and allowed NCC part of BSIC, in each of the frequency bands in the BA list, excluding the frequency band of the serving cell. The remaining positions in the measurement report shall be used for reporting of cells in the band of the serving cell. If there are still remaining positions, these shall be used to report the next strongest identified cells in the other bands irrespective of the band used.

HELP display:

```
###############
#Serving Cell#
#System Info #
#Bits        #
#            #
###############
```

3.1.8 Display 8: not implememnted !

3.1.9 Display 9: not implememnted !

3.1.10 Display 10: Values of paging repeat period, TMSI, periodic location update timer, AFC and AGC

```
++++++++++++++
+TMSIaaaaaaaa+
+T321:bbb/ccc+
+PRP:d  ee ff+
+ ggggg  hhh +
++++++++++++++
```

aaaaaaaa TMSI value in hex format

bbb Current value of T3212 counter (range is 000 - 'ccc', where 1 means 6 min time. So, if this value is 2 less than 'ccc' then next periodic location updating will be made within

	2 * 6 min = 12 minutes.
ccc	Timeout value of T3212 counter (range is 000 - 240, where 1 means 6 min time between location updates and 240 means 240 * 6 min = 24 h between location updates. 000 means that periodic location update is not in use.) This value is received from the network.
d	Value of paging repeat period (range is 2 - 9, when paging is in every second multiframe, mobile takes more current than if it were in every 9th multiframe)
ee	Downlink signalling failure value. If value is negative, 0 is shown. Maximum value is 45. When mobile is on TCH then xx is shown.
ff	Gain value on TCH/SDCCH, range is 0 - 93
ggggg	VCTCXO AFC DAC control, range is -1024 - 1023
hhh	Serving cell channel number

HELP display:

```
###############
#TMSI(hex)    #
#T3212ctr/tim#
#PaRP DSF AGC#
#  AFC    Ch  #
###############
```

3.1.11 Display 11: Network parameters

```
+++++++++++++++
+CC:aaa NCbbb+
+ LAC:ccccc  +
+ CH : dddd  +
+ CID:eeeee  +
+++++++++++++++
```

aaa	MCC value in decimal (MCC=Mobile Country Code)
bbb	MNC value in decimal (MNC=Mobile Network Code) Three digits are shown only in DCS1900. In other systems only two digits are shown.
ccccc	LAC value in decimal (LAC=Location Area Code)
dddd	Serving cell channel number
eeeee	Cell Identifier in decimal format

LAC and CID may be in hex format in some projects.
Or even both decimal and hexadecimal formats may be shown on the same line.

HELP display:

```
###############
# MCC    MNC #
#LocAreaCode #
#ServChannel #
#   CellId   #
###############
```

3.1.12 Display 12: Ciphering, hopping, DTX status and IMSI

```
++++++++++++++
+CIPHER :aaa +
+HOPPING:bbb +
+DTX    :ccc +
+IMSI   :ddd +
++++++++++++++
```

```
aaa     ciphering value, OFF/A51/A52
bbb     hopping value, ON/OFF
ccc     DTX value ON/OFF
ddd     IMSI attach
           ON  : IMSI attach on
           OFF : IMSI attach off
```

These values are updated only on the TCH.

HELP display:

```
###############
#CipherValue #
#HoppingValue#
#DTXValue    #
#IMSIAttach  #
###############
```

3.1.13 Display 13: Uplink DTX switching display

With this display it is possible to change MS to use DTX or not, if BS allows MS to decide it.

This display must be activated from MENU to change DTX state. When MENU is not active and the user is scrolling field test displays with NEXT and PREVIOUS, the DTX state will not change.

```
**************
*aaaaaaaaaa  *
*DTX(DEF):bbb*
*DTX(BS) :ccc*
*            *
**************
```

```
aaaaaaaaaa  status of switched mode.
               DTX:ON    : MS uses DTX
               DTX:OFF   : MS does not use DTX
               DTX:DEF   : MS use default state of DTX.
                           Defined in MS_PAR.H
               NOTALLOWED: BS does not allow MS to decide if it uses
                           DTX or not.
bbb         default state of DTX. Defined in MS_PAR.H
            The value is either ON or OFF
ccc         is DTX value from BS
               MAY : BS allows MS to decide if it uses dtx or not
                     on uplink.
               USE : BS controls MS to use dtx (on uplink)
               NOT : BS controls MS not to use dtx (on uplink)
```

HELP display:

```
##############
#DTXMode     #
#DefaulDTXSta#
#DTXValFromBS#
#            #
##############
```

3.1.14 Display 14: Toggle Screening Indicator

When selected, changes the value of Screening Indicator from 0 to 1 and vice versa.

```
**************                  **************
*  SCREENING *                  *  SCREENING *
*  INDICATOR *                  *  INDICATOR *
*    IS 00   *                  *    IS 01   *
*            *                  *            *
**************                  **************
```

HELP display:

```
##############
#Use menu to #
#  change    #
# Screening  #
# indicator  #
##############
```

3.1.15 Display 17: Switch BTS_TEST status

```
**************                  **************
*            *                  *            *
*  BTS TEST  *                  *  BTS TEST  *
*     ON     *                  *    OFF     *
*            *                  *            *
**************                  **************
```

Mobile is searching only one frequency. Neighbour measurements are not done.

Mobile is behaving normally. Neighbour measurements are done.

This display is used to toggle BTS_TEST status on EEPROM. If BTS_TEST status is set on EEPROM each time the mobile sends a search list it uses only the carrier number stored on SIM SCM-location 33. Also the neighbour information from system information messages is ignored. If the BTS_TEST status is not set, then the value of SIM SCM-location 33 is ignored and the mobile behaves normally (i.e. does the neighbour measurements according the GSM specifications).

To activate BTS tests perform following steps:

- Save desired channel number in SIM SCM-location 33.
- Select display 17 in execute mode
- Switch power off and on

If activation succeeded, there is text "BTS TEST ON" in display 17.

To deactivate BTS tests either select display 17 in execute mode or save number 0 in SIM SCM-location 33 and switch power off and on.

NOTE! The display does not show the value of BTS_TEST status in EEPROM. Although the value is set, bts test can be off. If there is not legal carrier number in SIM location 33 (GSM: 1-124, DCS1800: 512-885) the display shows that bts test is off. Also if the mobile was already registered to some carrier before switching BTS_TEST status, the display can show different value from the one in EEPROM.

See chapter 2.5 for recommendations.

HELP display:

```
###############
#Use menu to #
#toggle BTS  #
#test ON/OFF #
#            #
###############
```

3.1.16 Display 18: Lights status control

If selected, lights are always on, otherwise light status is controlled by UI.

```
**************                  **************
*            *                  *            *
*   LIGHTS   *                  *   LIGHTS   *
*    ON      *                  *    OFF     *
*            *                  *            *
**************                  **************
```

HELP display:

```
###############
#Use menu to #
#  toggle    #
#  lights    #
#  ON/OFF    #
###############
```

3.1.17 Display 19: Toggle Cell Barred Status

```
**************        **************        **************
*            *        *            *        *            *
* CELL BARR  *        * CELL BARR  *        * CELL BARR  *
* ACCEPTED   *        * REVERSE    *        * DISCARD    *
*            *        *            *        *            *
**************        **************        **************
```

This test is meant to be used when some cells are tested prior taking them into commercial use. By setting the barring on in the base station normal GSM phones will not try to register these barred cells. By selecting cell barring reversed, the MS will only use the cells to be tested. However, if at the same time it is wanted that MS will be capable to use normal network cell barring ignored can be set. Display 19 will show the cell barring mode.

NOTE! If a cell has been selected before barring state is changed the selected cell may have different barring state than what the display shows. After reselection the cell barring state is working for sure.

HELP display:

```
##############
#Use menu to #
#toggle cell #
#barr status #
#DIS/ACC/REV #
##############
```

3.2 Charging displays (20 series)

3.2.1 Display 20: General information of the charging status

```
++++++++++++++
+ aaa  bbbbb +
+ Tccc   ddd +
+ Ceee  Wfff +
+ gggg  hhhh +
++++++++++++++
```

aaa Battery voltage in decimal, range is 0.00 - 9.99 V, decimal point is not shown; e.g. 7.19V is shown as 719 on the display

bbbbb Charging mode 5 digit symbol

- xxxxx : Charger not connected or charging disabled.
- Charg : Charging.
- Maint : Maintenance charging.
- Faile : Failure.
- DisCh : Battery discharging going.
- InitC : EM charging is being initialized.
- BatCk : Battery testing is going.
- ChaCk : EM is checking charger.
- CelBr : Charging off because one or more cells broken inside battery.
- BSIFa : Charging off because of battery BSI measurement failed.
- TmpFa : Charging off because of battery NTC measurement failed.
- VolFa : Charging off because charger voltage measurement failed.
- CurFa : Charging off because charger current measurement failed.
- FastC : Fast charging going.
- FullM : Battery full and maintenance going.
- HotM : Battery hot and maintenance going.
- ColdM : Battery cold and maintenance going.
- TxOnC : TX on and Ni charging going.
- TxNoF : TX on, Ni charging going and battery is not full anymore.
- LithC : Charging of Lithium-ion battery.
- LiAFu : PWM level is below the battery full limit.
- LiFul : PWM has been below the battey full limit for a certain time that is specified for battery full.

```
LiTxO : TX on and Li charging going.
LNFTx : TX on, Li charging going and battery is not
        full anymore.
ColdC : Cold charging.
I_Che : Init checks.
L_Che : Li charging checks.
F_Che : Fast charging checks.
M_Che : Maintenace charging checks.
MaBFD : Maintenace BFD charging.
LiDCH : Li-ion DCH charging.
LiHot : Li-ion hot charging.
```

ccc	Battery temperature in centigrade, from -30 to +90. Values for this table can be found from a separate Excel document, stored in <power.battchk>NTC_RES.XLS.
ddd	Charging time. Format is HMM. Timer is automatically reset and started when charger is connected and stopped when battery is full or charger is disconnected.
eee	Charger voltage in decimal, range is 0.0 - 18.7 V, decimal point is not shown.
fff	Charge control output, decimal, range is 000 - 255.
gggg	Lithium battery type (BSI value multiplied by 4), or NiMH battery size.
hhhh	Battery full delay counter. When battery is getting full and charging current is less than predefined limit, this timer will be started. If timer reaches 0, charging will be stopped.

HELP display:

```
###############
#BatVol ChMod#
#BTemp ChTime#
#ChrgVol PWM #
# BTyp  BFDC #
###############
```

3.2.2 Display 21: Constant voltage charging display

```
+++++++++++++
+ aaaa  bbbb +
+  ccc   ddd +
+  eee   fff +
+            +
+++++++++++++
```

aaaa	Difference between measured voltage and goal voltage, decimal point is not shown.
bbbb	Difference between measured voltage and result of previous measurement (basically same as using change of error), decimal point is not shown.
ccc	Battery up voltage, maximum ripple voltage.
ddd	Battery down voltage, minimum ripple voltage.
eee	Average voltage.
fff	Sum of membership function sets beliefs, range 0.00-9.99, decimal point is not shown; e.g. 1.53 is shown as 153. If sum of 1.00 is reached then battery full indication is given.

HELP display:

```
##############
#MTDif MPDif #
#BUpV  BDownV#
#AverV SumMF #
#            #
##############
```

3.2.3 Display 22: Battery full detection

```
++++++++++++++
+ Eaaa  Cbbb +
+ Dccc  Rddd +
+ Ieee  Afff +
+ Tggg  Vhhh +
++++++++++++++
```

Letters E, C, D, R, I, A, T and V are displayed constantly.

Eaaa DerivCount membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

Cbbb ChargeAmount membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

Dccc VolDiffToMax membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

Rddd VolDropCnt membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

Ieee VolDiffTime membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

Afff AverDiff membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

Tggg Temperature membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

Vhhh Voltage membership function set, range 0.00-1.00, decimal point is not shown; e.g. 0.23 is shown as 023.

HELP display:

```
##############
# DeriC ChAm #
# VDif VDrop #
# VDTi AvDif #
# Temp Volt  #
##############
```

3.2.4 Display 23: Battery monitor and phone state monitor display

```
++++++++++++++
+ aaaa  bbbb +
+ cccc  dddd +
+eee fff gggg+
+hhh iiiijjjj+
++++++++++++++
```

```
aaaa    txon voltage, decimal point not shown (a.aaa mV)
bbbb    txoff voltage, decimal point not shown (b.bbb mV)
cccc    charging current, decimal point not shown (c.ccc mA)
dddd    predicted standby level, decimal point not shown (d.ddd mV)
eee     estimated age for Li-ion battery (0..100, 0=new, 100=old)
fff     battery's percentage level (0..100)
gggg    current consumption indicated by PSM (deci-mA)
hhh     battery's temperature (C) (Only for Li battery)
iiii    charged capacity (mAh) (into battery)
jjjj    tells what is the next capacity target to reach
        next battery bar level (mAh)
```

HELP display:

```
###############
#TxOn   TxOff#
#ChCur  Stdby#
#Age CAP Curr#
#Tmp CmAhTarg#
###############
```

3.3 Device control displays (30 series)

3.3.1 Display 30: Audio API register display

```
++++++++++++++
+ aaaa bbbb  +
+ cccc dddd  +
+ eeee ffff  +
+ gggg hhhh  +
++++++++++++++
```

```
aaaa    API_AUD1_CTRL
bbbb    API_AUD2_CTRL
cccc    API_SIDETONE
dddd    API_AU3
eeee    API_1_TONE
ffff    API_2_TONE
gggg    API_CONFIG
hhhh    API_HF_VOL
```

HELP display:

```
###############
#A1Cnf  A2Cnf#
#  ST   AU3  #
#1Tone  2Tone#
# Conf  HFVol#
###############
```

3.3.2 Display 34: FBUS display

```
++++++++++++++
+aa bb cc dd +
+eee fff ggg +
+hhh iii jjj +
+k           +
++++++++++++++
```

```
aa      current fbus media in hex
bb      last sender dev in hex
cc      last sender media in hex
dd      Next media to be connected. Same as aa if the connection
        is not pending.
eee     fbus parity error counter
fff     fbus framing error counter
ggg     fbus overrun error counter
hhh     fbus alive check counter
iii     RX Sequence number
jjj     TX Sequence number
k       Phone mode: S=slave, H=host
```

HELP display:

```
###############
#CM LD LM NM #
#PEC FEC OEC #
#ACC RXS TXS #
#Mod         #
###############
```

3.3.3 Display 35: Reasons for SW resets

```
+++++++++++++
+ aaaaa      +
+ bbbbbbbb   +
+            +
+            +
+++++++++++++
```

```
aaaaa     last reset reason.
              NORM     : Probably normal power up.
              UNKNO    : Default value, reset reason is unknown.
              HW WD    : ASIC watchdog timeout.
              SWDSP    : DSP recovery reset
              SWSIM    : SIM contact failure reset
              SWIDL    : Idle task not running reset
              STACK    : Task stack overflow
bbbbbbbb  Name of running task before reset.
```

HELP display:

```
###############
#Reset reason#
#Task name   #
#            #
#            #
###############
```

3.3.4 Display 36: Counters for resets

```
+++++++++++++
+ aa  bb  cc +
+ dd  ee  ff +
+            +
+            +
+++++++++++++
```

```
aa      Unknown resets.
```

```
bb      ASIC watchdog resets
cc      DSP recovery resets
dd      SIM contact failure resets
ee      Idle task not running resets
ff      Task stack overflow resets
```

Counters are stored to EEPROM.

HELP display:

```
###############
# UN  WD DSP #
#SIM IDL STK #
#   Reset    #
#  counters  #
###############
```

3.3.5 Display 38: Memory dump

```
+++++++++++++++
+aaaaaaaaaaaa+
+aaaaaaaaaaaa+
+aaaaaaaaaaaa+
+aaaaaaaaaaaa+
+++++++++++++++
```

aaaa.... hex dump of 24 successive memory locations

The start address of the dump is entered as 6 digit address value into SIM alpha memory location #30 .
An example: addres 0x0C89AB -> enter 'name' 0C2089AB into SIM alpha memory location #30.

Dump address is changed only when field test display #38 is selected via menu, changing memory location #30 is not enough!

This display will not be included in offial software, but designers can use it for their own test purposes. Display can be switched on by defining flag DEV_FT_MEMORY_DUMP_IN_USE in ftd_conf.h.

HELP display:

```
###############
#Memory dump #
#            #
#            #
#            #
###############
```

3.3.6 Display 39: Information about reasons for call clearing

```
+++++++++++++++
+ CC: aaaa   +
+ MM: bbbb   +
+ RR: cccc   +
+            +
+++++++++++++++
```

aaaa CC cause value, see section 10.5.4.11/GSM 04.08
'*' is shown in front of cause value if cause is made up by CC layer in MS
bbbb MM cause value, see section 10.5.3.6/GSM 04.08
'*' is shown in front of cause value if cause is made up by MM layer in MS
cccc RR cause value, see section 10.5.2.31/GSM 04.08
'*' is shown in front of cause value if cause is made up by RR layer in MS

All cause values are shown in decimal form.

HELP display:

```
###############
#CC CauseValu#
#MM CauseValu#
#RR CauseValu#
#            #
###############
```

3.4 Handover displays (40 series)

3.4.1 Display 40: Reset handover counters

With this display all timers of the handover display can be reset.

```
**************
*   RESET    *
*  HANDOVER  *
*  COUNTERS  *
*            *
**************
```

HELP display:

```
###############
#  Use menu  #
#  to reset  #
#  handover  #
#  counters  #
###############
```

3.4.2 Display 41: Singleband handover display

```
++++++++++++++
+HandOOK: aaa+
+PrevCh : bbb+
+HONotOK: ccc+
+HOIntra: ddd+
++++++++++++++
```

aaa counter for successful handovers (max. amount 999)
bbb counter for successful back to previous channel attempts
ccc counter for failed handovers
ddd counter for successful intracell handovers or assignments (max. amount 999)

Counters will stop when they reach their maximum. To initialize the counters to zero, select display 40. Also display 60 initializes these counters.

HELP display:

```
##############
#HandOvOKCntr#
#PrevChanCntr#
#HandOvNOKCnt#
#HOIntraOKCnt#
##############
```

3.4.2.1 Display 41: Dualband handover display, INTER CELL

```
++++++++++++++
+ aaaa  bbbb +
+ cccc  dddd +
+eeefffgggghhh+
+iiijjjkkklll+
++++++++++++++
```

aaaa counter of successful handovers (max 9999) from GSM to GSM
bbbb counter of successful handovers (max 9999) from DCS to DCS
cccc counter of successful handovers (max 9999) from GSM to DCS
dddd counter of successful handovers (max 9999) from DCS to GSM

eee counter for failed handovers (max 999) from GSM to GSM
fff counter for failed handovers (max 999) from DCS to DCS
ggg counter for failed handovers (max 999) from GSM to DCS
hhh counter for failed handovers (max 999) from DCS to GSM

iii counter of successful back to previous channel attempts (max 999) from GSM to GSM
jjj counter of successful back to previous channel attempts (max 999) from DCS to DCS
kkk counter of successful back to previous channel attempts (max 999) from GSM to DCS
lll counter of successful back to previous channel attempts (max 999) from DCS to GSM

Counters will stop when they reach their maximum. To initialize the counters to zero, select display 40. Also display 60 initializes these counters.

HELP display:

```
##############
#G>G InterD>D#
#G>D  OK  D>G#
#InterHoFail #
# BackToPrev #
##############
```

3.4.3 Display 42: Dualband Handover display, INTRA CELL

```
++++++++++++++
+ aaaa  bbbb +
+ cccc  dddd +
+eeefffgggghhh+
+iiijjjkkklll+
++++++++++++++
```

aaa counter of successful INTRA CELL handovers (max 9999) from GSM to GSM
bbb counter of successful INTRA CELL handovers (max 9999) from DCS to DCS
ccc counter of successful INTRA CELL handovers (max 9999) from GSM to DCS
ddd counter of successful INTRA CELL handovers (max 9999) from DCS to GSM

eee counter of failed INTRA CELL handovers (max 999) from GSM to GSM
fff counter of failed INTRA CELL handovers (max 999) from DCS to DCS
ggg counter of failed INTRA CELL handovers (max 999) from GSM to DCS
hhh counter of failed INTRA CELL handovers (max 999) from DCS to GSM

iii counter of successful back to previous normal INTRA CELL channel attempts (max 999) from GSM to GSM
jjj counter of successful back to previous normal INTRA CELL channel attempts (max 999) from DCS to DCS
kkk counter of successful back to previous normal INTRA CELL channel attempts (max 999) from GSM to DCS
lll counter of successful back to previous normal INTRA CELL channel attempts (max 999) from DCS to GSM

Counters will stop when they reach their maximum. To initialize the counters to zero, select display 40. Also display 60 initializes these counters.

HELP display:

```
###############
#G>G IntraD>D#
#G>D  OK  D>G#
#IntraHoFail #
# BackToPrev #
###############
```

3.4.4 Display 43: L2 display

```
++++++++++++++
+T200MS :aaaa+
+T200BS :bbbb+
+T200MS :cccc+
+T200BS :dddd+
++++++++++++++
```

aaaa GSM: Counts how many times T200 in MS has expired and therefore L2 transmission has been repeated.
bbbb GSM: Counts how many times T200 in BS (network) has expired and therefore L2 transmission has been repeated.

cccc DCS: Counts how many times T200 in MS has expired and therefore L2 transmission has been repeated. (for dualband phones)

dddd DCS: Counts how many times T200 in BS (network) has expired and therefore L2 transmission has been repeated. (for dualband phones)

Counters will stop when they reach their maximum. To initialize the counters to zero, select display 40. Also display 60 initializes these counters.

HELP display:

```
##############
#T200 MS GSM #
#T200 BS GSM #
#T200 MS DCS #
#T200 BS DCS #
##############
```

3.4.5 Display 44: Toggle Revision Level

When selected, changes the value of Revision Level from 0 to 1 and vice versa.

```
**************                  **************
*            *                  *            *
* REVISION   *                  * REVISION   *
*LEVEL IS 00 *                  *LEVEL IS 01 *
*            *                  *            *
**************                  **************
```

HELP display:

```
##############
#Use menu to #
#  change    #
# Revision   #
#  Level     #
##############
```

3.4.6 Display 45: Toggle transmitter functionality

When selected, disables transmitter functionality if enabled and vice versa. New setting is valid until next power off or until new execute of this display.

```
**************
*            *
*TRANSMITTER *
*  XXXXXXXX  *         XXXXXXXX    ENABLED or DISABLED
*            *
**************
```

This FTD can be used to simulate easily situations when the MS can hear the network (i.e. receiving signal is good enough), but the network can not receive any messages from the MS.

Location updating attempts or MO call establishment attempts can be failed (random access failure) by this FTD and field testing of these failures is much easier now.

Next periodic location updating can be checked from the display 10

(chapter 3.1.10) by taking the difference of current T3212 counter value and T3212 timeout value.

HELP display:

```
##############
#Use menu to #
# enable or  #
#  disable   #
#transmitter #
##############
```

3.5 Memory handling (50 series)

3.5.1 Display 51: SIM information

```
++++++++++++++    Example display:   ++++++++++++++
+aaa bbb ccc +                       +3/5  64 YES +
+ dddddddd   +                       +DOWN(UP)    +
+ f g  hh ii +                       + 3 2   9 10 +
+  j   kkkk  +                       +  2   FE01  +
++++++++++++++                       ++++++++++++++
```

aaa	Sim voltage selection type (5, 3 or 3/5)
bbb	Sim baudrate (372, 64, 32 or 0)
ccc	Clock stop allowed, Yes or No
dddd	Clock stop condition, Up or down (preferred)
eee	Clock stopped, Yes or No (NOT IMPLEMENTED)
f	pin1 attempts left (0,1,2,3)
g	pin2 attempts left (0,1,2,3)
hh	puk1 attempts left (0-10)
ii	puk2 attempts left (0-10)
j	ATR retransmission counter (0-9)
kkkk	Transmission frame/parity errors, FE/PE + hexadecimal count

HELP display:

```
##############
#VSel Bau SAl#
#SCond  CStop#
#PIN12  PUK12#
# ATR  FE/PE #
##############
```

3.5.2 Display 52: Read datafield from SIM-card

This display reads a binary datafield from SIM-card to SIM SCM-memory (SCM = Short Code Memory). See chapter 2.5 for recommendations.

Prior using this display the identifier of datafield has to be stored as an alpha-identifier of SCM-location number 34 of SIM-memory. The datafield must be written in hexadecimal notation. The identifiers can be found from the GSM 11.11.

The contents of datafield is stored as a data-identifier of SCM-location number 35 of SIM-memory. The contents are displayed in hexadecimal notation. The maximum length of the datafield is 10 bytes, but the length depends on the name length of the SIM-memory. In case the datafield cannot be read the alpha-identifier of SCM-location is NOT DONE.

The information of how the read succeeded can be read from the SCM-location

36 of SIM-memory and on the display for a short period.

The following results are possible:

OK	datafield was read correctly
NOT BINARY	datafield is either formatted or cyclic
NOT FOUND	datafield was not found from SIM-card
CARD ERROR	something weird happened, card did not respond as expected
NO RIGHTS	not enough rights to read the datafield (PIN2,adm..)
NOT STORED	could not store into the result memory place
NO ADDRESS	Could not read the address from the SCM-location
UNKNOWN	Unidentified error

For the time being following binary datafields exist in SIM. In future there could be more. All of these are not necessarily on all SIM cards.

2FE2 ICC identification	(10 bytes)
6F05 Language preference	(variable length)
6F07 IMSI	(9 bytes)
6F20 Ciphering key Kc	(9 bytes)
6F30 PLMN selector	(variable length)
6F31 HPLMN search period	(1 byte)
6F37 ACM maximum value	(3 bytes)
6F38 SIM service table	(2-4 bytes)
6F41 Price per unit and currency table	(5 bytes)
6F45 Cell broadcast message identifier selection	(variable length)
6F74 Broadcast control channels	(16 bytes)
6F78 Access control class	(2 bytes)
6F7B Forbidden PLMNs	(12 bytes)
6F7E Location information (TMSI,LAI etc.)	(11 bytes)
6FAD Administrative data	(variable length)
6FAE Phase identification	(1 byte)
6F43 SMS status	(variable length)

Next two binary datafields are phase 2+ features which are not currently in use.

6F3E Group Identifier Level 1	(variable length)
6F3F Group Identifier Level 2	(variable length)

3.5.3 Display 53: Write datafield into SIM-card

This display writes data for a binary datafield in SIM-card by using data in SCM-memory of SIM-card. See chapter 2.5 for recommendations.

Prior using this display the identifier of datafield has to be stored as an alpha-identifier of SCM-location number 34 of SIM-memory. The datafield must be written in hexadecimal notation. The identifiers can be found from the GSM 11.11. In addition the data to be stored into SIM-card has to be entered as an alpha-identifier of SCM-location number 35 of SIM-memory. The data has to be stored in hexadecimal notation.

The result of write operation can be seen from the alpha-identifier of SCM-location 36 of SIM-memory and on the display for a short period.

The following results are possible:

OK	datafield was written correctly
NOT BINARY	datafield is either formatted or cyclic
NOT FOUND	datafield was not found from SIM-card
CARD ERROR	something weird happened, card did not respond as expected
NO RIGHTS	not enough rights to write the datafield (PIN2,adm..)

DATA ERROR	the data contents in SCM-location is coded wrongly
NOT STORED	could not store into the result memory place
NO ADDRESS	Could not read the address from the SCM-location
UNKNOWN	Unidentified error

NOTE! The data is merely written into SIM-card. So even if you change for example forbidden PLMNs the change will take effect only after switching power-off and on.

```
**************
*   Write    *
* data field *
*from SIM-SCM*
*  to SIM    *
**************
```

HELP display:

```
###############
#Use menu to #
#Write data  #
#field to SIM#
#             #
###############
```

3.5.4 Display 54: Block display 1

```
+++++++++++++++
+aa bb  aa bb+
+aa bb  aa bb+
+aa bb  aa bb+
+aa bb  aa bb+
+++++++++++++++
```

1. row: Block set 1, block set 2
2. row: Block set 3, block set 4
3. row: Block set 5, block set 6
4. row: Block set 7, block set 8

aa	Number of reserved blocks
bb	Number of free blocks in worst case

HELP display:

```
###############
#ResF1  ResF2#
#ResF3  ResF4#
#ResF5  ResF6#
#ResF7  ResF8#
###############
```

3.5.5 Display 55: Block display 2

```
+++++++++++++++
+aa bb  aa bb+
+aa bb  aa bb+
+aa bb  aa bb+
+aa bb  aa bb+
+++++++++++++++
```

```
1. row: Block set 9,  block set 10
2. row: Block set 11, block set 12
3. row: Block set 13, block set 14
4. row: Block set 15, block set 16

aaa      Number of reserved blocks
bbb      Number of free blocks in worst case


HELP display:

##############
#ResF9 ResF10#
#ResF11ResF12#
#ResF13ResF14#
#ResF15ResF16#
##############
```

3.5.6 Display 56: Block display 3

```
++++++++++++++
+ aaaaaa bbb +
+ cccccccc   +
+            +
+            +
++++++++++++++

aaaaaa   Pointer to memory where double deallocation was called, in hex
         format.
bbb      Counter for failed deallocations.
cccccccc Name of task which last tried to double deallocate a block.

         Note: This display is only valid when the counter for failed
         deallocations is not zero.


HELP display:

##############
# Ptr   Cntr #
# Task       #
#            #
#            #
##############
```

3.5.7 Display 57: Memory status before reset

```
++++++++++++++
+aaaaaaaaaaaa+
+aaaaa...    +
+bbbbbbbb    +
+            +
++++++++++++++

aaaaaa... Status of each stack before reset. First position contains
          the status of stack 0, second position the status of
          stack 1 and so on. The last position contains the status
          of System stack. Number of stacks depends on the current
          configuration of SW. Possible values for each stack are:
              0 : status OK, no overflow
              1 : status not OK, stack overflow,
bbbbbbb   Status of each block set before reset. First position
```

contains the status of block set 1, second position the status of block set 2 and so on. Possible values for each block set are:

0 : status OK
1 : block set full
2 : (de)allocation error or total memory corruption

Note: This display is only valid when a unknown or a stack overflow interrupt has occured.

HELP display:

```
##############
# Status of  #
# stacks     #
# Block sets #
#            #
##############
```

3.6 Test counter displays (60 series)

3.6.1 Display 60: Reset counters to zero

With this display all counters of the field test display can be reset (i.e. all counters in 40 and 60 series).

```
**************
* FIELD TEST *
*  DISPLAY   *
*  COUNTERS  *
*   RESET    *
**************
```

HELP display:

```
##############
#Use menu to #
#reset field #
#test display#
# counters   #
##############
```

3.6.2 Display 61: Search and reselection counter display

```
++++++++++++++
+NOPSW  :aaaa+
+SYNCR  :bbbb+
+RESELEC:cccc+
+             +
++++++++++++++
```

aaaa counter for MDI_NO_PSW_FOUND message received from DSP in hexadecimal form.

bbbb counter for synchronization measurement attempts in decimal form. If counter value is over 9999 then four x are shown.

cccc counter for cell reselections in hexadecimal form.

On poweroff the values of the counter displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to

zero, select display 60. Counters are automatically reset to zero when they exceed their maximum value.

HELP display:

```
##############
#PSWMesgCntr #
#SyncMeasCntr#
#CellReselCtr#
#            #
##############
```

3.6.2.1 Display 61: Dualband search and reselection counter display

```
++++++++++++++
+aaaaa  bbbbb+
+ccccc  ddddd+
+eeeee  fffff+
+ggggg  hhhhh+
++++++++++++++
```

aaaaa GSM counter for MDI_NO_PSW_FOUND message received from DSP in decimal form (max 99999).

bbbbb DCS counter for MDI_NO_PSW_FOUND message received from DSP in decimal form (max 99999).

ccccc GSM counter for synchronization measurement attempts in decimal form. If counter value is over 99999 then five x are shown.

ddddd DCS counter for synchronization measurement attempts in decimal form. If counter value is over 99999 then five x are shown.

eeeee counter for GSM->GSM cell reselections in decimal form (max 99999).

fffff counter for DCS->DCS cell reselections in decimal form (max 99999).

ggggg counter for GSM->DCS cell reselections in decimal form (max 99999).

hhhhh counter for DCS->GSM cell reselections in decimal form (max 99999).

On power off the values of the counter displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to zero, select display 60. Counters are automatically reset to zero when they exceed their maximum value.

HELP display:

```
##############
#NOPswGSM DCS#
#Sync GSM DCS#
#reselG>G D>D#
#reselG>D D>G#
##############
```

3.6.3 Display 62: Neighbour measurement counter display

```
++++++++++++++
+ PSW  :aaaa +
+ SYNCR:bbbb +
+ BCCH :cccc +
+ BCCHE:dddd +
++++++++++++++
```

aaaa counter for neighbour PSW measurement attempts
bbbb counter for neighbour synchronization measurement attempts
cccc counter for neighbour BCCH measurement attempts
dddd counter for neighbour BCCH Ext measurement attempts

Counter values are shown in hexadecimal form.

On poweroff the values of the counter displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to zero, select display 60. Counters are automatically reset to zero when they exceed their maximum value.

HELP display:

```
###############
#NeghbrPSWCtr#
#SyncMeasCntr#
#BCCHMeasAtmp#
#BCCHExtMeAtm#
###############
```

3.6.4 Display 63: Call attempts counters

```
++++++++++++++
+  aa    bb  +
+  ccc   ddd +
+  eee   fff +
+            +
++++++++++++++
```

aa Reason of last call release
    Cause from messages disconnect and release complete
bb Direction of last call release
    UN : Unknown
    MO : Mobile originated
    MT : Mobile terminated
    IN : Internal (ME CS sw)
ccc count of all MO call attempts made
ddd count of succeeded MO calls
eee count of all call setups received
fff count of succeeded MT calls

On poweroff the values of the counter displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to zero, select display 60. Counters are automatically reset to zero when they exceed their maximum value.

HELP display:

```
###############
#CalRel RelDi#
#MOCAtmp MOOK#
#AllMT   MTOK#
#            #
###############
```

3.6.5 Display 64: Location update attempts counters

```
++++++++++++++
+ aa bbb ccc +
+ dd eee fff +
+            +
+            +
++++++++++++++
```

aa	Reason of last normal location update failure
bbb	count of normal location update attempts
ccc	count of succeeded normal location updates
dd	Reason of last periodic or IMSI attach location update failure
eee	count of all periodic and IMSI attach location update attempts
fff	count of succeeded periodic and IMSI attach location updates

On poweroff the values of the counter displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to zero, select display 60. Counters are automatically reset to zero when they exceed their maximum value.

HELP display:

```
###############
#Nfai NL NLOK#
#PFai PL PLOK#
# Loc update #
#  counters  #
###############
```

3.6.6 Display 65: SMS attempts counters

```
++++++++++++++
+ aa bbb ccc +
+ dd eee fff +
+ gggg       +
+            +
++++++++++++++
```

aa	Reason of last sending failure
bbb	Count of all MO short message attempts
ccc	Count of succeeded MO short message attempts
dd	Reason of last receiving failure
eee	Count of all MT short message attempts
fff	Count of succeeded MT short message attempts
gggg	Count of all received cell broadcast schedule messages

On poweroff the values of the counter displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to zero, select display 60. Counters are automatically reset to zero when they exceed their maximum value.

HELP display:

```
###############
#SFai MO MOOK#
#RFai MT MTOK#
#Sched Msgs  #
#SMS counters#
###############
```

3.6.7 Display 66: SMS timeout counters

```
++++++++++++++
+ aaa bbb cc +
+ ddd eee ff +
+            +
+            +
++++++++++++++
```

aaa	Counter for TR1M timeouts
bbb	Counter for TR2M timeouts
cc	Counter for TRAM timeouts
ddd	Counter for TC1M timeouts
eee	Counter for TC2M timeouts
ff	Counter for CB schedule timeouts

On poweroff the values of the counter displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to zero, select display 60. Counters are automatically reset to zero when they exceed their maximum value.

HELP display:

```
###############
#TR1 TR2 TRA #
#TC1 TC2 SCH #
#SMS timeout #
#  counters  #
###############
```

3.7 Timer and audio displays (70 series)

3.7.1 Display 70: Temporary counters of DSP

```
++++++++++++++
+ aaaa bbbb  +
+ cccc dddd  +
+ eeee ffff  +
+ gggg hhhh  +
++++++++++++++
```

aaaa	Contents of API memory location r_dsp2ftd+0 in hex format
bbbb	Contents of API memory location r_dsp2ftd+1 in hex format
cccc	Contents of API memory location r_dsp2ftd+2 in hex format
dddd	Contents of API memory location r_dsp2ftd+3 in hex format
eeee	Contents of API memory location r_dsp2ftd+4 in hex format
ffff	Contents of API memory location r_dsp2ftd+5 in hex format
gggg	Contents of API memory location r_dsp2ftd+6 in hex format
hhhh	Contents of API memory location r_dsp2ftd+7 in hex format

The display is to be used by special debugging DSP SW which can put some useful information to the memory locations on API RAM.

When this display is selected then MCU copies the contents of those memory locations into display with format specified above.

HELP display:

```
##############
# Temporary  #
#DSP counters#
#(R DSP2FTD) #
#            #
##############
```

3.7.2 Display 71: Control DSP audio enhancements 1

```
**************
*AUDIO       *
*ENHANCEMENT *
*DISPLAY 1   *
*    XXXXX   *
**************
```

XXXXX Control word for DSP Audio Enhancements in decimal format. The control word is sent to the DSP in mdi audio configure message.

Prior using this display the control word must be written to location 31 of SIM-card in decimal format.

Then the display 71 is choosen from the menu (EXECUTE MODE). The control word is then sent to the DSP in mdi audio configure message immediately. Mdi audio configure message is also sent every time when this display is entered using arrow keys and previous display was 72.

Used together with display 72, this display makes rapid on/off switching of audio DSP algorithms possible. Switching with arrow keys is possible only after this display or display 72 has been selected from the menu. This prevents accidental on/off switching of algorithms when browsing displays by arrow keys. Entered values are not saved to EEPROM.

See chapter 2.5 for recommendations.

HELP display:

```
##############
#Use menu to #
#control DSP #
#   audio    #
#enhancements#
##############
```

3.7.3 Display 72: Control DSP audio enhancements 2

```
**************
*AUDIO       *
*ENHANCEMENT *
*DISPLAY 2   *
*    XXXXX   *
**************
```

XXXXX Control word for DSP Audio Enhancements in decimal format. The control word is sent to the DSP in mdi audio configure message.

Prior using this display the control word is written to SCM-location 32 of SIM-card in decimal format.

Then the display 72 is choosen from the menu (EXECUTE MODE).
The control word is then sent to the DSP in mdi audio configure message immediately. Mdi audio configure message is also sent every time when this display is entered using arrow keys and previous display was 72.

Used together with display 71, this display makes rapid on/off switching of audio DSP algorithms possible. Switching with arrow keys is possible only after this display or display 71 has been selected from the menu. This prevents accidental on/off switching of algorithms when browsing displays by arrow keys. Entered values are not saved to EEPROM.

See chapter 2.5 for recommendations.

HELP display:

```
###############
#Use menu to #
#control DSP #
#   audio    #
#enhancements#
###############
```

3.7.4 Display 73: Generic display for DSP Audio Enhancements

```
++++++++++++++    Example display:   ++++++++++++++
+ aaa bb  aaa+                       + 101 00  408+
+cccc bb cccc+                       +BCDE 88 7FFF+
+cccc bb cccc+                       +0001 FF 0003+
+ cccc cccc  +                       +  DEAD DEFA +
++++++++++++++                       ++++++++++++++
```

aaa General dB value, e.g. signal level in dB.
decimal point and sign is not shown, ie. -10.5 is show 105.
bb General byte value, used for combined flags. Value is in hex format.
cccc General hex value.

The display is reset and restarted when call is taken (if FT display counters are enabled). When call is terminated the display is frozen to show last values. Display values will not be saved to the EEPROM.

HELP display:

```
###############
#DB1  B1  DB2#
#HEX1 B2 HEX2#
#HEX3 B3 HEX4#
#  HEX5 HEX6 #
###############
```

3.7.5 Display 74: DSP audio enhancements 1 (DRC)

```
++++++++++++++    Example display:   ++++++++++++++
+  aaa  bbb  +                      +  101  408  +
+       ccc  +                      +       480  +
+  dd    ee  +                      +  01    03  +
+           +                      +           +
++++++++++++++                      ++++++++++++++
```

aaa	Downlink signal level in dB, calculated using DRC level measuring block. Decimal point and sign is not shown, ie. -10.5 is show 105.
bbb	Uplink signal level in dB, calculated using DRC level measuring block. Decimal point and sign is not shown, ie. -10.5 is show 105.
ccc	Background noise signal level in dB, calculated using DRC level measuring block, decimal point and sign is not shown, ie. -10.5 is show 105.
dd	Downlink DRC table value, shown in decimal integer, two digits.
ee	Uplink DRC table value, decimal integer, two digits.

The display is reset and restarted when call is taken (if FT display counters are enabled). When call is terminated the display is frozen to show last values. Display values will not be saved to the EEPROM.

HELP display:

```
###############
#DSigL USigL #
#      NseLvl#
# DTbl  UTbl #
#            #
###############
```

3.7.6 Display 75: Audio path status

```
++++++++++++++
+Mod:aaaaaaaa+
+AudReq: bbbb+
+AccMod: cccc+
+H2Path: dd  +
++++++++++++++
```

aaaaa	external audio status, values are: HP, HF, HEADSET, EXT and HP_OFFHO
bbbb	audio_request bitmap in hex, contents (masks) are specified in AUD_DATA.H
cccc	Accessory audio mode
dd	HFU-2 path

HELP display:

```
###############
#ExtAudStatus#
#AudioRequest#
#AccessoryMod#
#HFU2Path    #
###############
```

3.7.7 Display 76: Ear (= downlink) audio display

```
++++++++++++++    Example display:   ++++++++++++++
+ Vaa  Pbbb  +                       + V0A  P125  +
+ Cccc CAddd +                       + C000 CA001 +
+PAeee       +                       +PA353       +
+            +                       +            +
++++++++++++++                       ++++++++++++++
```

aa Volume level.
bbb Peak value of downlink audio signal during last frame in dB, decimal point and sign is not shown, ie. -10.5 is show 105.
ccc Cut off counter value of last frame. This counter counts how many samples are saturated during last frame.
ddd Moving average of cut off counter, decimal point and sign is not shown, ie. -10.5 is show 105.
eee Moving average of peak levels.

The display is reset and restarted when call is taken (if FT display counters are enabled). When call is terminated the display is frozen to show last values. Display values will not be saved to the EEPROM.

HELP display:

```
###############
#EVol PeakVal#
#CutOff COAve#
#PkAver      #
#            #
###############
```

3.7.8 Display 77: Microphone (= uplink) audio display

```
++++++++++++++    Example display:   ++++++++++++++
+ Paaa  Abbb +                       + P303  A225 +
+ Cccc CAddd +                       + C023 CA003 +
+            +                       +            +
+            +                       +            +
++++++++++++++                       ++++++++++++++
```

aaa Peak value of uplink audio signal during last frame in dB decimal point and sign is not shown, ie. -10.5 is show 105.
bbb Moving average of peak levels, decimal point and sign is not shown, ie. -10.5 is show 105.
ccc Cut off counter value of last frame. This counter counts how many samples are saturated during last frame.
ddd Moving average of cut off counter

The display is reset and restarted when call is taken (if FT display counters are enabled). When call is terminated the display is frozen to show last values. Display values will not be saved to the EEPROM.

HELP display:

```
###############
#MicPeak MAve#
#CutOff COAve#
#            #
#            #
###############
```

3.7.9 Display 78: DSP audio enhancements (AEC)

```
++++++++++++++
+aaa bbb ccc +
+ddd eee fff +
+ggg h i jjj +
+ kkkk llll  +
++++++++++++++
```

aaa	Electro-acoustic attenuation of echo from DSP point of view in dB. Decimal point and sign is not shown. E.g. -10.5dB would be displayed as "105", -0.5 dB would be displayed as " 5". 20*log10(Q15)
bbb	Adaptive attenuation of echo. Decimal point is not shown. 20*log10(Q15)
ccc	Total echo return loss. Decimal point is not shown. 20*log10(Q15)
ddd	RX attenuator gain in dB. Decimal point and sign is not shown. 20*log10(Q15 aec_rx_gain)
eee	TX attenuator gain in dB. Decimal point and sign is not shown. 20*log10(Q15 aec_tx_gain)
fff	Gain limit for RX and TX. Decimal point and sign is not shown. 20*log10(Q15 aec_gain_limit)
ggg	Tx noise level in dB. Decimal point and sign is not shown. 20*log10(Q15 aec_tx_noise)
h	Adaptive filter status. (Q0 aec_nlms_state) (bit UPDATE << 2) | (bit NLMS2 << 1) | (bit NLMS1)
i	Comfort noise generation (0 or 1) (Q0 AEC_TX_COMF_GEN)
jjj	AEC mode. (byte Q0 s_AEC_mode)
kkkk	Shows 16 last RX VAD decisions in HEX format. Hex(Q0 aec_rx_vadreg)
llll	Shows 16 last TX VAD decisions in HEX format. Hex(Q0 aec_tx_vadreg)

HELP display:

```
###############
#EAA Ada ERL #
#RxG TxG GLi #
#TxN Sta Mod #
# RVAD TVAD  #
###############
```

3.7.10 Display 79: Audio equalizer display

```
++++++++++++++    Example display:   ++++++++++++++
+aaaaa bbbbb +                       +12345 54321 +
+ccccc ddddd +                       + 2353 46187 +
+-ee.e -ff.f +                       +-46.5 -27.4 +
+            +                       +            +
++++++++++++++                       ++++++++++++++
```

aaaaa	Saturated samples before microphone equalizer in decimal 16 bit unsigned integer format.
bbbbb	Saturated samples after microphone equalizer in decimal 16 bit unsigned integer format.
ccccc	Saturated samples before earpiece equalizer in decimal 16 bit unsigned integer format.
ddddd	Saturated samples after earpiece equalizer in decimal 16 bit unsigned integer format.

-ee.e Level of the microphone signal level detector in dB format. Requires log10 function in MCU. 16 bit signed value in DSP, 0 dB = 32768.
-ff.f Level of the signal after earpiece equalizer in dB format. Requires log10 function in MCU. 16 bit signed value in DSP, 0 dB = 32768.

The display is reset and restarted when call is taken. When call is terminated the display is frozen to show last values. Display will not be saved to EEPROM. Saturated sample counters aaaaa - ddddd are counted in DSP and only the new counter value is sent to MCU. The microphone and earpiece signal levels are calculated in DSP and it sends the linear values to MCU which makes the linear to dB transformation (20*log10(x)) for the level values.

HELP display:

```
##############
#MiCutB MiCTA#
#EpCutB EPCTA#
#MicLev EarLv#
#            #
##############
```

3.8 SW information and counters (80 series)

3.8.1 Display 80: Reset timers to zero and restart them

With this display all timers of the display 82 can be reset.

```
**************
*            *
*   TIMERS   *
*   RESET    *
*            *
**************
```

HELP display:

```
##############
#  Use menu  #
#  to reset  #
# field test #
#   timers   #
##############
```

The timers will be automatically reset after the battery has been fully charged and the charger is disconnected. Thus it's not always necessary to use the display 80.

3.8.2 Display 81: Enable or disable timers

This display will start or stop the timers.

```
**************
*            *
*   TIMERS   *
*  XXXXXXXX  *         XXXXXXXX    ENABLED or DISABLED
*            *
**************
```

On power off the values of the timer displays are stored onto the EEPROM, where they will be read during power on. To initialize the counters to zero, use display 80. Timers will be automatically disabled when recharge battery message is reached.

Also the current state of timer disabling/enabling is stored onto the EEPROM.

HELP display:

```
##############
#Use menu to #
#control test#
#  display   #
#  timers    #
##############
```

3.8.3 Display 82: Test timer display

```
++++++++++++++
+aaaaa bbbbb +
+ccccc ddddd +
+ TIMERS eee +
+            +
++++++++++++++
```

aaaaa	timer for how long the phone has been powered on
bbbbb	timer for how long the phone has been in service
ccccc	timer for NO-SERV POWER-SAVE state
ddddd	timer for how long the transmitter has been on
eee	state of timers, ON/OFF

All the values are shown in one minute resolution. The accuracy of the timers is about one second. The display uses following format for timers: HHHMM where HHH is hours and MM is minutes. All timers of this display will be reset if the charger is disconnected from the mobile with fully charged battery. The maximum value of the timers is 99 h 59 min. When 'powered on' timer has reached value 9959, all timers will be stopped.

NOTE: When the maxium usage time of the phone is required (e.g. idle time measurement) then ALL field test displays must be deactivated! See chapted 2.2 how to deactivate the field test displays.

HELP display:

```
##############
#PwrOn InServ#
#NSPS  TxON  #
#   Timers   #
#   Status   #
##############
```

3.8.4 Display 83: Control of task information displays

```
**************
*            *
* SHOW TASK  *
* XXXXXXXXX  *   XXXXXXXXX is "STACKS", "MSG BUFS" or "FAST BUFS"
*            *
**************
```

Shows what information about tasks is currently shown in displays 84 - 87.

To select the type of information select this display via menu. Type is changed in order STACKS -> MSG BUFS -> FAST BUFS -> STACKS. So, if STACKS is currently displayed and you want to see FAST BUFS, you have to select this display twice via menu.

"STACKS" shows free stack space in worst case.
"MSG BUFS" shows the peak number of pending messages.
"FAST BUFS" shows the peak number of pending fast messages.

HELP display:

```
###############
#Use menu to #
#select shown#
# task info  #
#            #
###############
```

3.8.5 Display 84: Information of task numbers 0 - 7

```
++++++++++++++
+ aaaa bbbb  +
+ cccc dddd  +
+ eeee ffff  +
+ gggg hhhh  +
++++++++++++++

aaaa    task 0
bbbb    task 1
cccc    task 2
dddd    task 3
eeee    task 4
ffff    task 5
gggg    task 6
hhhh    task 7
```

Numbers tell how many stack memory locations have been empty in the worst case. So, if number is zero, stack has been full.

Values are not stored to EEPROM.

HELP display:

Task names are listed on help display.

3.8.6 Display 85: Information of task numbers 8 - 15

```
++++++++++++++
+ aaaa bbbb  +
+ cccc dddd  +
+ eeee ffff  +
+ gggg hhhh  +
++++++++++++++
```

```
aaaa    task 8
bbbb    task 9
cccc    task 10
dddd    task 11
eeee    task 12
ffff    task 13
gggg    task 14
hhhh    task 15
```

Values are not stored to EEPROM.

HELP display:

Task names are listed on help display.

3.8.7 Display 86: Information of task numbers 16 - 23

```
++++++++++++++
+ aaaa bbbb  +
+ cccc dddd  +
+ eeee ffff  +
+            +
++++++++++++++
```

```
aaaa    task 16
bbbb    task 17
cccc    task 18
dddd    task 19
eeee    task 20
ffff    task 21
gggg    task 22
hhhh    task 23
```

Values are not stored to EEPROM.

HELP display:

Task names are listed on help display.

3.8.8 Display 87: Information of OS_SYSTEM_STACK

```
++++++++++++++
+ aaaa  bbbb +
+            +
+            +
+            +
++++++++++++++
```

```
aaaa    OS_SYSTEM_STACK
```

Values are not stored to EEPROM.

HELP display:

```
###############
#  FIQ  IRQ  #
#            #
#            #
#            #
###############
```

3.8.9 Display 88: Information of the current MCU and DSP software versions

```
**************
*aaaaa bbbbbb*
*Date  cccccc*
*ChkSum dddd *
*eeeeeeeeeeee*
**************
```

```
aaaaa        version number of MCU SW (e.g. 2.081)
bbbbbb       PPM version (e.g. 2.081B)
cccccc       date of version.c (e.g. 960128 means 28. January 1996)
dddd         MCU SW checksum
eeeeeeeeeeee version of DSP software
```

HELP display:

```
###############
#MCUSW  PPM  #
#MCUSW_Date  #
#MCU_Checksum#
#DSP_Version #
###############
```

3.9 Project specific displays (90 series)

Projects can use displays 90-95 for their own purposes.
Project specific displays are not described in this specification.

3.10 Setting without display (240 series)

3.10.1 Display 240: Zero and start counters.

Following actions performed:

```
reset handover counters (display 40)
reset counters to zero  (display 60)
reset timers            (display 80)
enable timers           (display 81)
```

The active field test display is not affected.

3.10.2 Display 241: Disable field test display.

The field test display is totally disabled by writing the EEPROM value.

3.10.3 Display 242: Disable RD field test displays.

The R&D field test displays are disabled by writing the EEPROM value.
So only the displays 1-19 are active after this command.
The active field test display is not affected.

3.10.4 Display 245: Clear OS postmortem dump information.

To clear OS postmortem dump information displays, i.e. only display 57 in DCT3.
The active field test display is not affected.