STABILOCK 4031 4032

DECT

Software Option 897 803

Operating Instructions

49_dect Doc. Version: 9712-111-C

Acterna Muenchen GmbH, Gutenbergstr. 2 – 4, D-85737 Ismaning
☎ +49 (89) 9 96 41-0 Fax: +49 (89) 9 96 41-160

Supplement to operating instructions; file under Chapter 10

10

Content

What DECT Can Do 10-5

Software and Hardware Requirements 10-6

What You Get 10-7

Operation of Communication Test Set 10-7
Prompt to press key 10-7
Selecting scroll variables 10-7
Screen messages in continuous text 10-7

Loading DECT 10-8

Choosing between FP and PP Test 10-8

Test Setup 10-10

Preparing to Test 10-12
Settings in DECT SETTINGS mask 10-13
Settings in LIMITS mask 10-18
Settings in basic FP and PP mask 10-19
Searching for carrier 10-21

Starting a Test 10-24
Testing with or without call setup 10-24
Transmitting dummy bearer 10-24
FP test 10-25
PP test 10-25

Evaluating Results 10-26
Special characters as result 10-26
Results in basic mask 10-28
FP test 10-28
PP test 10-33
Measuring FER/BER (frame erasure ratio, bit error ratio) 10-37
Results in MIN-MAX mask 10-38
Results in BURST mask 10-40
Results in ZOOM BURST mask 10-42
Results of ACPM mask (adjacent-channel power measurement) 10-43
Performing audio tests 10-45

Starting DECT Generator 10-46

Calibration 10-47

Polling Results with IEEE Controller 10-50
IEEE programming conventions 10-50

☞ **Differences from earlier software versions:** see Lifeline at end of these instructions.

Appendix A: Pinning of DECT Socket Bu106 10-60
Synchronizing several units 10-61
Timing diagram of synchronization port 10-61
Interface for digital data 10-62
Data rate 32 kbit/s 10-62
Data rate 64 kbit/s 10-63
Data rate 128 kbit/s 10-64
Audio interface 10-65
Microphone 10-65
Loudspeaker 10-65

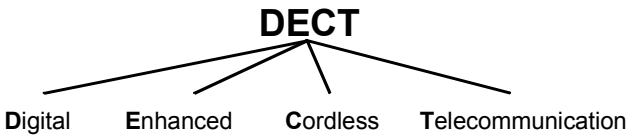
Appendix B: Glossary 10-66

Appendix C: Structure of DECT Frame 10-68

What DECT Can Do

Fitted with the DECT option, the Communication Test Set can test all major functions of DECT systems, both FPs (fixed parts = base stations) and PPs (portable parts = mobiles). The DECT option was designed to the TBR 06 directives of ETSI (European Telecommunications Standards Institute). This guarantees that all tests are performed true to the directives and that the results are perfectly clear. You can make the following tests:

What is tested	
Power	Frequency error
Positive/negative frequency deviation	Frequency drift
Burst length[1)]	Packet jitter
Reference stability (longterm stability, only FP)	Synchronization delay (only FP)
Bit error ratio (BER)	Frame erasure ratio (FER)[1)]
Radio fixed part identifier (RFPI)	Available slots (only FP)
Available carriers (only FP)	Packet transmission accuracy (uplink time, only PP)
ACPM	
1) Not stipulated in TBR 06	



Further reading (published by ETSI)

Radio Equipment and Systems (RES)
Digital European Cordless Telecommunication (DECT)
Reference Document
ETR 015, March 1991

Radio Equipment and Systems (RES)
Digital European Cordless Telecommunication (DECT)
General Terminal Attachment Requirements
prTBR 06, September 1995

Radio Equipment and Systems (RES)
Digital European Cordless Telecommunication (DECT)
Common Interface (CI)
Part 2: Physical Layer (PHL)
prETS300 175-2, July 1995

Radio Equipment and Systems (RES)
Digital European Cordless Telecommunication (DECT)
Common Interface (CI)
Part 3: Medium Access Control (MAC) Layer
prETS300 175-3, July 1995

Software and Hardware Requirements

Unit/option	Version	Where to read version
Software		
FW version STABILOCK 4031	≥ 4.10	Status mask
FW version STABILOCK 4032	≥ 6.10	Status mask
CRT version CRT-MCU	≥ 2.59	Status mask
RF/AF-MCU (STABILOCK 4031) RF/AF-MCU (STABILOCK 4032)	≥ 4.10 ≥ 6.10	Status mask Status mask
Hardware		
DECT plug-in	—	OPTIONS mask, `DIG-MCU: DECT`
Frequency extension 2.3 GHz	≥ 8	HW-REVISIONS mask, `FEX duplex`
FEX RX unit	≥ 1	HW-REVISIONS mask, `FEX RX`

What You Get

- DECT memory card
- DECT plug-in
- IF line
- Operating instructions

Operation of Communication Test Set

This is just a summary of the conventions in these operating instructions for working with the Communication Test Set. DECT abbreviations (eg PP = portable part) are contained in the glossary in the appendix. Detailed instructions on operating the Communication Test Set can be found in Chapters 3 and 4 of the test set manual.

Prompt to press key

[CLEAR]	Notation for keys
(Zoom)	Notation for softkeys (six function keys at bottom edge of screen)

Selecting scroll variables

Locate the scroll field with the cursor keys and repeatedly hit the [UNIT/SCROLL] key. You can also turn the spinwheel slowly (left/right) or alternately hit the plus/minus keys. The scroll field will then show all scroll variables one after the other. The valid variable is the one shown. Confirmation with [ENTER] is not necessary, you can immediately quit the field again.

Screen messages in continuous text

`Offset`	Notation for text to be read from screen

...Following the text `Test mode` the screen shows the number in inverted notation...	`Test mode` is the screen message to be expected when you call up the DECT SETTINGS mask.

Loading DECT

1. Insert the DECT system card in the front panel slot.
2. Call up the DECT basic mask with (AUX)+(DATA).

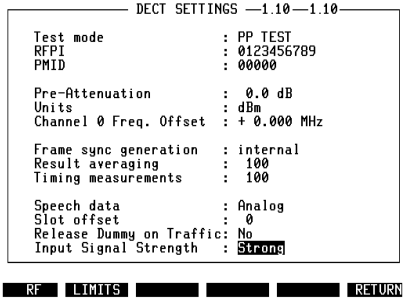
or

1. Insert the DECT system card in the front panel slot.
2. Call up the MEMORY mask with (MEMORY).
3. Place the cursor bar on the SYS file in the FILES ON MEMORY CARD directory.
4. Load the program into the RAM of the Communication Test Set with (RECALL).
5. Hit (AUX) + (DATA) to start the system program.

Choosing between FP and PP Test

1. Call up the DECT SETTINGS mask with (DEF.SET.).
2. Select `FP TEST` or `PP TEST` in the `Test mode` scroll field.
3. Call up the basic mask with (RETURN).

Fig. 10.1:
DECT SETTINGS mask.
Set whether the FP or PP is to be tested in the `Test mode` field.



Basic Settings

Test Setup

You can test either on the radio interface or by cable. But remember that when you test on the radio interface, the power on the input of the Communication Test Set is measured and not the power actually transmitted by the FP or PP.

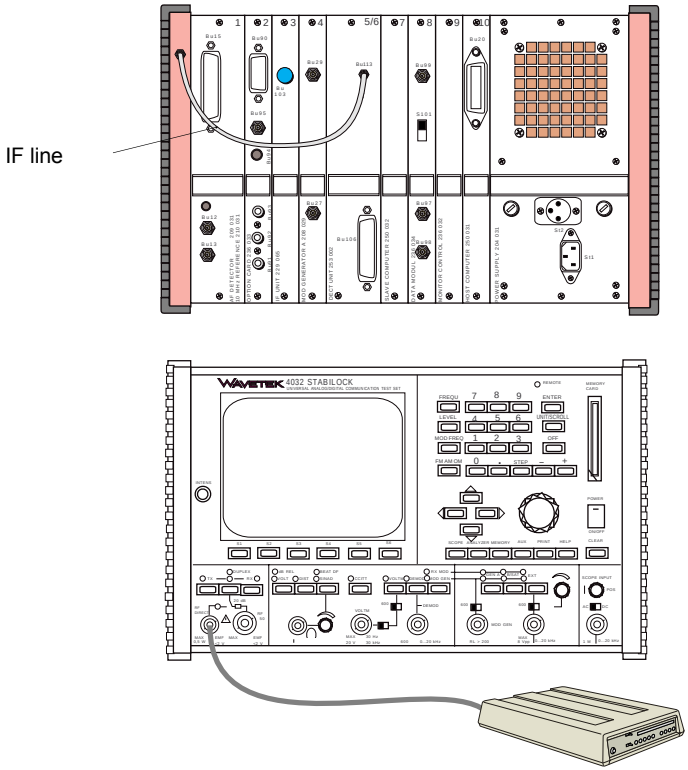


Fig. 10.2: Test setup for FP test. Use the IF line to connect Bu113 (SMB connector) to the MMCX connector on the rear of the Communication Test Set.

Note: If the frame synchronization of the Communication Test Set and of the unit to be tested is driven from an external signal source, measurement of sync port delay and uplink time may be incorrect. This effect can be avoided if the Communication Test Set and the tested unit are synchronized by a common 10-MHz reference.

Synchronizing FPs and Communication Test Sets

If several FPs or Communication Test Sets are working at the same time, they might disturb one another and corrupt the test results. But they can be synchronized to prevent this happening:

Link the synchronization ports (for pinning see Fig. 10.25, page 10-60) of the Communication Test Sets (rear panel of unit, DECT stage 5 and 6) and the synchronization ports of the FPs.

If the FPs have no synchronization port, only one test setup should be in operation at a time.

Preparing to Test

After the DECT software starts, the basic mask is shown. In this mask you can select all other DECT masks.

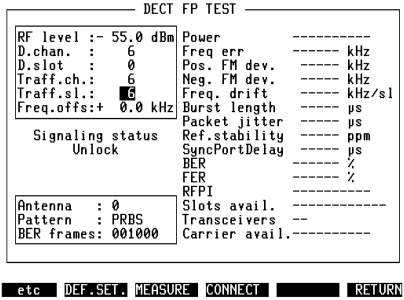


Fig. 10.3: The basic mask after the DECT software starts (setting: FP test)

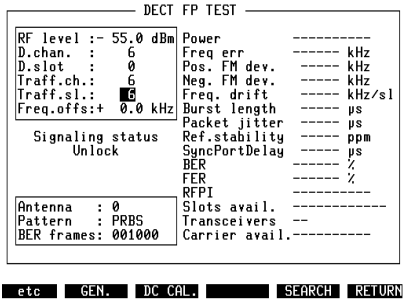


Fig. 10.4: The basic mask with the second softkey level

(etc) Selects the other softkey level.

First softkey level

(DEF.SET.) Calls up the DECT SETTINGS mask.

(MEASURE) Starts the test without a connect procedure (see chapter "Starting a Test", page 10-24).

(CONNECT) Starts the test with a connect procedure (see chapter "Performing a Test", page 10-24).

(RETURN) Calls up one of the three basic masks of the Communication Test Set (TX, RX or DUPLEX).

Second softkey level

(Gen.) Calls up the DECT generator (see chapter "Starting DECT Generator", page 10-46).

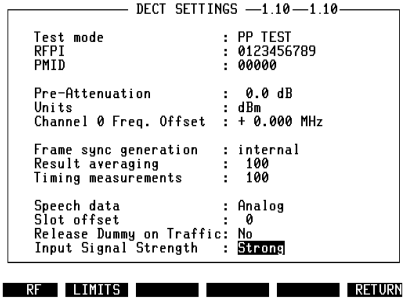
(DC CAL.) Starts calibration (see "Calibration", page 10-47).

(SEARCH) Calls up the SCAN BEARERS mask.

Settings in DECT SETTINGS mask

Call up the DECT SETTINGS mask with (DEF.SET.).

Fig. 10.5:
Basic settings are selected in the DECT SETTINGS mask. (RETURN) returns to the basic mask.



Selecting output socket ((RF DIR) or (RF))

With (RF DIR) all signals of the Communication Test Set are output on the RF DIRECT socket with 20 dB higher level. The RF socket is still the input socket. After (RF DIR) the softkey changes to (RF). (RF) again makes the RF socket the combined input and output socket (without attenuation).

Selecting pass/fail limits

Call up the LIMITS mask with (LIMITS). In this mask you can alter the limits for pass/fail decisions (eg MIN-MAX mask).

Setting test mode

Select `FP TEST` or `PP TEST` in the `Test mode` scroll field.

FP test: Communication Test Set emulates PP.

PP test: Communication Test Set emulates FP.

10

RFPI

Radio fixed part identifier

PP test

The Communication Test Set emulates an FP with the identifier entered in the RFPI field (the RFPI is transmitted in the DB).

FP test

If RFPI = 0000000000 is entered, the Communication Test Set synchronizes to a DB that corresponds to the settings in the fields (basic mask) `D. chan.` and `D. slot`; the RFPI is not checked.
RFPI = FFFFFFFFFF is reserved and may not be entered.
Any other RFPIs: the Communication Test Set synchronizes to a DB that corresponds to the settings in the fields (basic mask) `D. chan.` and `D. slot` and whose RFPI matches the one entered.

PMID

Portable part MAC identifier. With what is entered here the Communication Test Set (emulating the PP) logs on during the FP test. Whether or not the PMID of the FP is evaluated depends on the producer of the FP.

Setting attenuation (`Pre-Attenuation`)

Automatically corrects the measured value (`Power` field) in TX tests with external pre-attenuation (attenuator, line losses, etc).

The actual RF output level is greater by the entered value than the value entered in the `RF level` field. So the `RF level` field (basic mask) shows the value received by the FP (level after external attenuator) and not the value output on the socket of the Communication Test Set.

The default setting of the field is adopted from the `Pre-Attenuation` field of the GENERAL PARAMETERS mask.

Selecting power (`Units`)

If you set `W` in the `Units` scroll field, all power figures are given in watts. `dBm` gives you power figures in dBm.

Frequency offset (`Channel 0 Frequ. Offset`)

This sets the frequency band to be measured on the Communication Test Set. In this way you can test DECT systems that do not work in the standard frequency band (1.88 to 1.9 GHz).

Synchronization (`Frame sync generation`)

The setting in the scroll field shows whether the Communication Test Set or an external unit (FP or another Communication Test Set) generates synchronization timing.

Internal: Communication Test Set generates synchronization timing.
External: external unit generates synchronization timing.

Averaging of several test results (`Result averaging`)

You enter the number of frames to be averaged in the MIN-MAX mask. The average in the MIN-MAX mask is calculated from 90 % of the preceding average and 10 % of the new values (see section "Results in MIN-MAX mask", page 10-38). Example: If field `N` of the DECT SETTINGS mask is set to 20, the new average is calculated from 18 old and two new values.

If the Communication Test Set is controlled by IEEE commands, the figures measured in the first test are not available until after the number of measurements entered in the `Result averaging` field. In the following tests it depends on the GPIB command parameter whether the average is formed from new figures each time or whether the last average is also taken into account.

Averaging in timing measurements (`Timing measurements`)	The number of bursts over which the timing measurement are performed. If 0 is entered, no timing measurements are performed. The following measured figures are influenced by this value: packet jitter, reference stability.
Type of speech data (`Speech Data`)	A scroll field in which you specify the type of speech data. The setting is only effective if `Speech` is set in the `Pattern` field (basic mask). Possible scrolls: **Analog:** an analog signal is either output on the loudspeaker output of the DECT socket (Bu 106) or fed in on the microphone input of the DECT socket. **Digital (lin.):** an audio signal (64 kbit/s, linear) is fed in or tapped on the digital DECT port. **Digital (A law):** an audio signal (64 kbit/s, A-law coded) is fed in or output on the digital DECT port.
Offset of slot 0 (`Slot offset`)	Here you can specify a relative offset of slot 0 referred to the frame synchronization pulse.

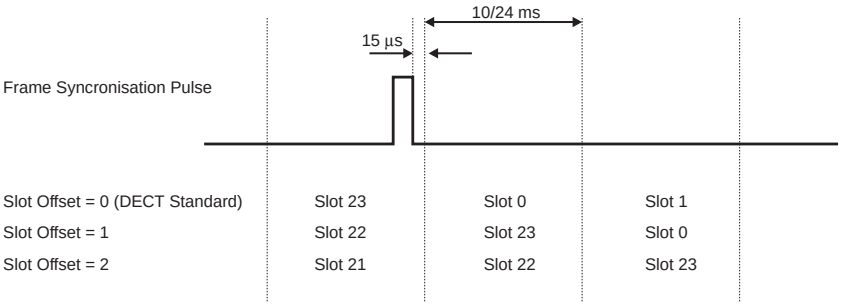


Fig 10.6: Slot offset

Transmitting DB after TB (`Release Dummy on Traffic`)

Only in PP test mode. A scroll field in which you can set whether the Communication Test Set is to transmit a DB after a TB of the PP (scroll entry `No`) or not (scroll entry `Yes`).

If `No` is selected (transmit DB) and a connection on another channel is established, the DB is transmitted on the new channel.

Note: Many PPs need the DB to operate correctly. So if there are problems in testing enter `No` (transmit DB).

Presetting input signal level (`Input Signal Strength`)

This is an indication of the signal level that the Communication Test Set will see when a connection establishment is performed. It allows the Communication Test Set to select an appropriate range, speeding up the procedure. If the signal level is greater than about +4 dBm, `Strong` should be selected. Otherwise (or if the signal level is unknown) use `Weak`.

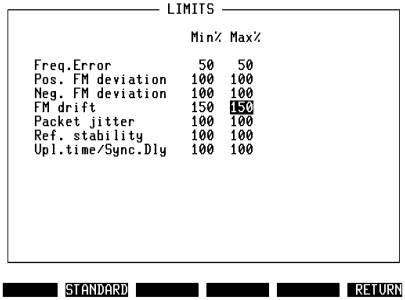
The parameter is relevant in the carrier search function and in PP test mode.

If the parameter is incorrectly chosen, a connection establishment will still succeed. It will just take a little longer.

Settings in LIMITS mask

Call up the LIMITS mask with (LIMITS) from the DECT SETTINGS mask. (RETURN) recalls the DECT SETTINGS mask.

Fig. 10.7:
Limits used by the DECT system program for pass/fail weighting (eg in MIN-MAX mask) can be altered in the LIMITS mask.



Changes of the limits are a percentage of the figures specified in the DECT standard, so an entry of 100 % corresponds to the standard figure.

You can alter the limits for the following measured results:

Limit of measured figure	Field	Limit at 100 %	
		Minimum	**Maximum**
Frequency error	`Freq. Error`	–50 kHz	+50 kHz
Positive frequency deviation Pattern = 11110000 All other patterns	`Pos. FM deviation`	 +259 kHz +202 kHz	 +403 kHz +403 kHz
Negative frequency deviation Pattern = 11110000 All other patterns	`Neg. FM deviation`	 +259 kHz +202 kHz	 +403 kHz +403 kHz
Frequency drift	`FM drift`	–15 kHz/slot	+15 kHz/slot
Packet jitter	`Packet jitter`	–1 µs	+1 µs
Longterm stability	`Ref. stability`	–5 ppm	+5 ppm
Time delay stimmen die Klammern? (packet transmission accuracy (uplink time), synchronization delay)	`Upl. time/Sync. Dly.`	–2 µs	+2 µs

☞ If limits are altered, `non standard` is indicated in the title line of the DECT masks, and pass/fail weighting of measured figures with an altered limit is shown in lower-case letters.

Settings in basic FP and PP mask

`RF level`

The transmit level of the Communication Test Set (including the figure entered in the `Pre-Attenuation` field of the DECT SETTINGS mask).

`D. chan.`
(Channel of DB)

The channel number on which the FP sends the DB. In an FP test the Communication Test Set attempts to synchronize to the DB in this channel.

In a PP test the Communication Test Set sends its DB on this channel.

`D. slot`
(Time slot of DB)

The time slot in which the FP sends the DB. In an FP test the Communication Test Set attempts to synchronize to the DB in this time slot.

An `X` can be entered in the field by (OFF). Then the Communication Test Set synchronizes to the first DB corresponding to the RFPI, regardless of the selected time slot. Once the Communication Test Set has found a DB, the `X` entry is replaced by the time slot of the DB. (If the Communication Test Set is controlled by IEEE commands, this function is initiated by the command WRTVA with the value 24.)

In a PP test the Communication Test Set sends its DB in this time slot.

`Traff. ch.`
(Traffic channel number)

If you hit (CONNECT), the entered channel number defines the channel on which the TB is established. After (MEASURE) the entered channel number defines the channel on which measurement is made.

`Traff. slot`
(Time slot of traffic slot)

If you hit (CONNECT), the TB is established in the entered time slot. After (MEASURE) this time slot is used for measurements. No TB can be set up in time slot 11 or 23. You can enter 11 and 23 in the field, but a connection or TB setup will be terminated by the error message `Invalid Traffic Bearer Slot (Blind Slot)`.

`Freq. offs.`
(Frequency offset)

The offset of the transmit frequency of the Communication Test Set in RX tests.

`Antenna`

If the DECT unit to be tested (PP or FP) has more than one antenna, choose the one on which the unit is to transmit and receive in the `Antenna` field.

`Pattern`
(Selecting bit pattern)

Bit pattern for tests on TCH

Bit pattern	Use (TBR 06)	Remarks
PRBS	BER/FER	511-bit pseudo-random bit pattern, defined in CCITT O.153
10101010	Frequency drift Modulation deviation part 3 and part 4	
11110000	Frequency error Modulation deviation part 1	
1..10..0	Modulation deviation part 2	
Speech	—	Activates the analog or digital speech interface (Bu106). The type of data depends on the setting in the `Speech Data` field of the DECT SETTINGS mask.
Dig.Data	—	Activates the digital data interface (Bu106). The data in the B field of the DECT slot are fetched by the digital data interface or appear on the digital data interface (scrambling is activated).

`BER frames`
(Number of transmitted bursts)

Only for BER measurement. The number of bursts to be transmitted by the Communication Test Set for BER measurement.

Searching for carrier

If the channel on which the FP transmits the DB is unknown, you can look for it with (SEARCH) ((STOP) terminates the search). The Communication Test Set searches through all valid channels and time slots starting with channel 0 up to channel 9.

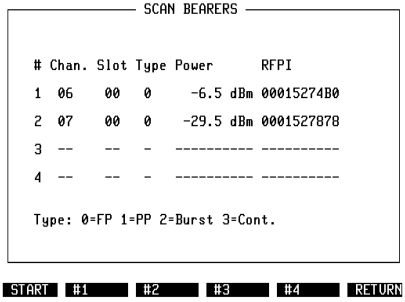
Following the search you can select the FP that is to be tested with softkeys (#1) through (#4). The channel and time slot of the DB and TB are automatically entered in the fields of the basic mask, and for an FP additionally the RFPI. The test mode (DECT SETTINGS mask) is also set.

If another signal is selected, the channel and slot (burst) is entered and PP test mode is selected. The signal can be measured with (MEASURE) in the basic mask.

The data of the four strongest carriers are indicated:

#	Number of carrier
`Chan`	Number of channel
`Slot`	Time slot in which bearer is transmitted
`Type`	Type of signal found 0 = FP 1 = PP 2 = burst 3 = continuous signal
`Power`	Power of burst
`RFPI`	Identifier of transmitting FP (if signal found is DB of an FP)

Fig. 10.8:
Two carriers are detected by the Communication Test Set. The FP that is to be tested can now be selected with (#1) or (#2).



☞ The parameter `Input Signal Strength` in the DECT SETTINGS mask accelerates the search function. If the parameter is set to `Strong`, signal levels above +4 dBm will be detected. If the setting `Weak` is selected, signal levels above –16 dBm will be detected. If the signal level is unknown, select `Weak`.

This page is intentionally left free.

Performing a Test

Starting a Test

Testing with or without call setup

You can start a test with or without first setting up a call.

(CONNECT) This initiates the connect procedure before you test the connected PP or FP. If it is successful, the PP or FP switches to loopback mode (depending on the set pattern; it does not occur for `Speech` and `Dig.Data`). Measurement of the parameters on the TB is then continuous. (STOP) ends measurement.

(MEASURE) If you start measurement without a connect procedure, the Communication Test Set begins to measure on the TB. In FP test mode the Communication Test Set tries to synchronize to a DB before starting measurement. (STOP) ends measurement.

☞ You cannot change the time slot or channel during an established connection.

Transmitting dummy bearer

Only PP test. You can activate or deactivate the dummy bearer before testing. (DB ON) activates the bearer and (DB OFF) deactivates it.

FP test

1. Set FP test (see section "Choosing between FP and PP Test").
2. Make test preparations (see section "Basic Settings").
3. Switch the FP to TBR 06 test mode (procedure depends on FP).
4. Hit (CONNECT) or (MEASURE) ((STOP) ends measurement).

PP test

1. Set PP test (see section "Choosing between FP and PP Test").
2. Make test preparations (see section "Basic Settings").
3. Activate the DB with (DB ON).
4. Switch the PP to TBR 06 test mode (procedure depends on PP).
5. Hit (CONNECT) or (MEASURE) ((STOP) ends measurement).

Evaluating Results

Special characters as result

Normally a result will always consist of a measured figure and its units. But sometimes a measured figure cannot be displayed, because it is outside the measurement range for instance (eg if the level fed in for measuring power is too high).

The following displays are possible:

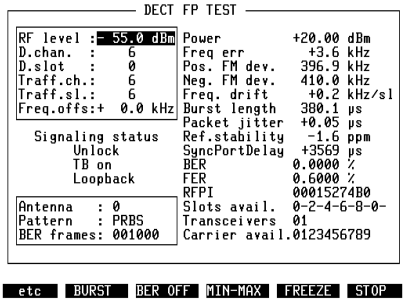
Display	Meaning
>>>	Overflow. The measured figure is bigger than the measurement range. This display appears in the following measurements: Power: Level is too high and cannot be measured despit maximum attenuation Frequ. err. Error > 690 kHz Pos/Neg FM dev. Frequency error > 690 kHz or frequency error+deviation > 720 kHz Burst length: Continuous signal If the measured value is evaluated statistically (MIN-MAX mask), only >>> is displayed there too, and if there is underflow as well, —— is displayed.
<<<	Underflow. The measured figure is smaller than the measurement range. This display appears in the following measurement: Burst length: Measured figure <29 µs If the measured value is evaluated statistically (MIN-MAX mask), only <<< is displayed there too, and if there is overflow as well, —— is displayed.
——	Measurement is not possible, the measured figure is obviously wrong, or no measurement was carried out after the system program started. If the measured value is evaluated statistically (MIN-MAX mask), only —— is displayed there too. This display appears in the following measurements: FM dev. drift: Frequency error > 690 kHz or unsuitable bit sequence Burst length: Beginning or end of burst is outside measurement window Packet jitter: No burst or burst level too low (<–45 dB) Ref. stability: No burst or burst level too low (<–45 dB) Sync port delay: No burst or burst level too low (<–45 dB) Uplink time: No burst or burst level too low (<–45 dB)

Display	Meaning
!(Measured value)	This measurement was not made to TBR 06, but the result is correct (one place missing in display). If the measured value is evaluated statistically (MIN-MAX mask), only !(Measured value) is displayed there too. This display appears in the following measurement: Power: Frequency error+deviation > 500 kHz
?(Measured value)	Inaccurate measurement. Power: Signal level <–40 dBm or Communication Test Set not calibrated or strongly fluctuating level (Communication Test Set could not settle to stable measurement range) Frequ. err. Signal level <–20 dBm or Communication Test Set not calibrated or strongly fluctuating level (Communication Test Set could not settle to stable measurement range) Pos/Neg FM dev. Signal level <–20 dBm or Communication Test Set not calibrated or strongly fluctuating level (Communication Test Set could not settle to stable measurement range) FM dev. drift: Signal level <–20 dBm or Communication Test Set not calibrated or strongly fluctuating level (Communication Test Set could not settle to stable measurement range) or bit pattern is not 10101010 sequence Burst length: Signal level <–40 dBm or signal level too high or Communication Test Set not calibrated or strongly fluctuating level (Communication Test Set could not settle to stable measurement range) Packet jitter: No synchronization sequence found Ref. stability: No synchronization sequence found Sync port delay: No synchronization sequence found Uplink time: No synchronization sequence found

Results in basic mask

FP test

Fig. 10.9:
Basic mask after test



☞ For the assessment of test results, the bit pattern set in the `Pattern` field has to be observed. Some results (eg frequency drift) are only specified for certain bit patterns (see section "Settings in basic FP and PP mask"). Other bit patterns can be set to enable non-specified tests to be performed.

Measurement	Specified bit pattern
Frequency error	11110000, 101010
Positive and negative frequency deviation	11110000,1...10...0, 101010
Frequency drift	101010
BER, FER	PRBS

Signaling status	Unlock/lock	Indicates whether the Communication Test Set has synchronized to a DB of the FP.
	TB on	The connect procedure on the TB was successful (the Communication Test Set sends a "BEARER_REQUEST" message to the FP and the message "BEARER_CONFIRM" is sent back).
	Loopback	The Communication Test Set switches the FP to loopback mode by the "LOOPBACK_DATA" command and indicates Loopback as the signaling status (only if Speech or Dig. Data is not entered as the bit pattern).
	Failed	Appears when no DB is transmitted by the FP or the connect procedure is unsuccessful.
Power	The power at which the FP transmits (NTP = nominal transmitted power). If a value is entered in the Pre-Attenuation field of the DECT SETTINGS mask or in the Pre-Attenuation field of the GENERAL PARAMETERS mask, the result is automatically corrected by this value.	
Freq. err (Frequency error)	The frequency error of the carrier.	
Pos. FM dev. Neg. FM dev. (Positive and negative frequency deviation)	Positive frequency deviation. Negative frequency deviation.	

`FM drift`
(Frequency drift)

The difference in the frequency per time slot is measured between 14 bits at the beginning and 14 bits at the end of a burst.

Fig. 10.10: Measurement of frequency drift

☞ This measurement is only defined for reference bit pattern 010101... (see TBR 06).

`Burst length`
(Length of burst)

The duration of the burst between the 6-dB points.

`Packet jitter`

The difference between the peak burst spacing and the average burst spacing.

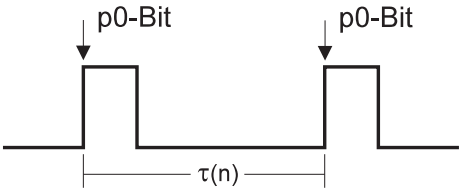


Fig. 10.11: Packet jitter

Formula for calculating packet jitter:

$$\text{Packet jitter} = \left\{ \tau\,(n) - \sum_{N} \frac{\tau\,(n)}{N} \right\}_{max}$$

n: number of current burst
τ: time between two bursts (calculated from one p0 bit to following p0 bit)
N: number of summed bursts (entered in `Timing measurements` field of DECT SETTINGS mask)

`Ref. stability` (Longterm stability)

Measurement of the longterm stability of the reference timing over 10 s as prescribed by TBR 6. But you can set a different figure in the `Timing measurements` field of the DECT SETTINGS mask.

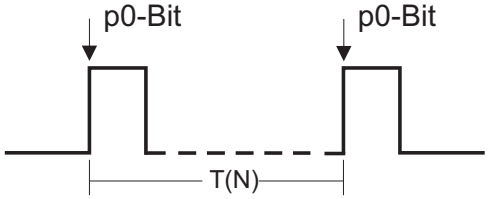


Bild 10.12: Diagram explaining measurement of longterm stability

Formula for calculating longterm stability:

$$\text{Longtermstability} = \frac{T(N)_{Ideal} - T(N)_{Measured}}{T(N)_{Ideal}}$$

$T(N)_{Ideal} = N * 10\ ms$

T: time between first and last burst (calculated from p0 bit of first burst to p0 bit of last burst)

N: number of bursts (entered in `Timing measurements` field of DECT SETTINGS mask)

`Sync Port Delay` Timing of the FP's RF signal relative to the synchronization port signal.

Status information of FP

`RFPI` (Identifier of FP)	This is transmitted by the FP in the system information channel. Up to ten places are possible (ASCII, hexadecimal).
`Slots avail` (Available time slots)	This is transmitted by the FP in the system information channel. A total of twelve time slots are possible. If a time slot is not available, you see a `"–"` instead of the time-slot number.
`Transceivers` (Number of transmitter/ receiver pairs in FP)	Some FPs have more than one transmitter/receiver pair and can therefore maintain more than one connection at a time. Possible values are: – (no FP), 1, 2, 3 and > 3.
`Carrier avail` (Available carriers)	This is transmitted by the FP in the system information channel and decoded after reception of a TB. A total of ten carrier frequencies are available. If a carrier frequency is not available, you see a `"–"` instead of the carrier-frequency number.

PP test

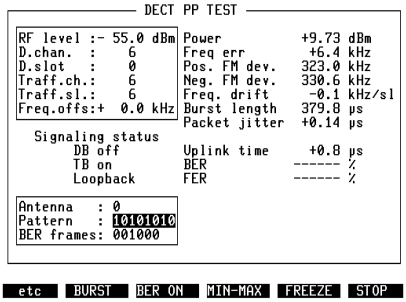


Fig. 10.13:
Basic mask during PP test

☞ For the assessment of test results, the bit pattern set in the `Pattern` field has to be observed. Some results (eg frequency drift) are only specified for certain bit patterns (see section "Settings in basic FP and PP mask"). Other bit patterns can also be set to enable non-specified tests to be performed.

Measurement	Specified bit pattern
Frequency error	11110000, 101010
Positive and negative frequency deviation	11110000,1...10...0, 101010
Frequency drift	101010
BER, FER	PRBS

Signaling status	DB on/off	DB on indicates that a DB is transmitted by the Communication Test Set (DB off if not).
	TB on	The connect procedure on the TB was successful (the Communication Test Set sends a "FORCE_TRANSMIT" message to the PP and the message "BEARER_REQUEST" is sent back).
	Loopback	The Communication Test Set switches the PP to loopback mode by the "LOOPBACK_DATA" command and indicates Loopback as the signaling status (only if Speech or Dig. Data is not entered as the bit pattern).
	Failed	Appears when no bearer is transmitted or the connect procedure is unsuccessful.
Power	The power at which the PP transmits (NTP = nominal transmitted power). If a value is entered in the Pre-Attenuation field of the DECT SETTINGS mask or in the Pre-Attenuation field of the GENERAL PARAMETERS mask, the result is automatically corrected by this value.	
Freq. err (Frequency error)	The frequency error of the carrier.	
Pos. FM dev.	Positive frequency deviation.	
Neg. FM dev.	Negative frequency deviation.	

`FM drift`
(Frequency drift)

The difference in the frequency per time slot is measured between 14 bits at the beginning and 14 bits at the end of a burst.

Fig. 10.14: Measurement of frequency drift

☞ This measurement is only defined for reference bit pattern 010101... (see TBR 06).

`Burst length` Length of burst

`Packet jitter` The difference between the current burst spacing and the average burst spacing.

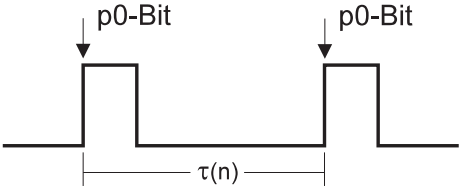


Fig. 10.15: Packet jitter

Formula for calculating packet jitter:

$$\text{Packet jitter} = \left\{ \tau\,(n) - \sum_{N} \frac{\tau\,(n)}{N} \right\}$$

n: number of current burst
τ: time between two bursts (calculated from one p0 bit to following p0 bit)
N: number of summed bursts (entered in `Timing measurements` field of DECT SETTINGS mask)

`Uplink time` (Time delay of PP)	In TBR 06 this is referred to as packet transmission accuracy. The measured figure is the time offset of the PP when transmitting, relative to the Communication Test Set's RF signal.

Measuring FER/BER (frame erasure ratio, bit error ratio)

1. Make test preparations (see section "Basic Settings").
2. Enter the number of frames over which BER is to be measured in the `BER frames` field (> 3000 advisable).
3. Enter the scroll variable `PRBS` in the `Pattern` field (measurement with other bit patterns is possible but then no longer meets specifications).
4. Hit (CONNECT).

   Upon (CONNECT) the FP switches to loopback mode (not if `Speech` is the bit pattern set in the `Pattern` field of the basic mask). BER and FER are measured continuously on the TCH. (BER OFF) ends BER/FER measurement but the connection with the DECT unit is maintained.
5. Activate BER/FER measurement with (BER ON).

☞ The (BER ON) softkey does not appear until you have completed the connect procedure.

Results of BER/FER measurement in basic mask

`BER`

$$BER = \frac{\text{Number on errored bits received}}{\text{Number of bits transmitted}}$$

`FER`

$$FER = \frac{\text{Number of errored frames received}}{\text{Number of frames transmitted}}$$

If the BER of a frame is > 25 %, the frame is considered "erased" (FER > 20 % means that the measurement range is exceeded, ie display: >>>).

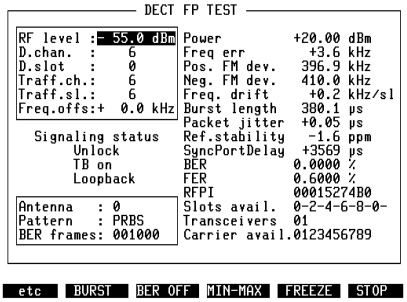


Fig. 10.16:
Basic mask after FER/BER measurement

Results in MIN-MAX mask

The measured results shown in the basic mask appear in this mask as statistics. Call up the mask during an ongoing test with (MIN–MAX).

The measurement rate and thus the number of contributing results are higher than the display rate on the screen. The average is formed from 90 % old values and 10 % new ones. Example: if N = 20 is entered in the `Timing measurements` field of the DECT SETTINGS mask, the average will be composed of 18 old values and two new ones.

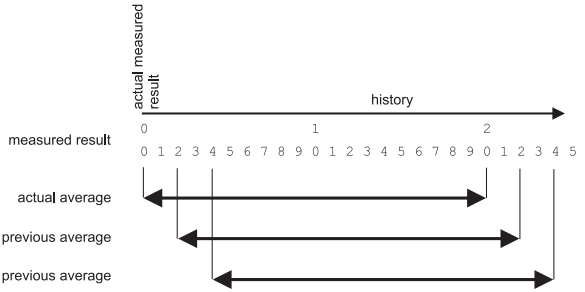


Fig. 10.17: The average is calculated from 90 % of the old and 10 % of the new measured figures (averaging from 20 measured figures takes average from 18 preceding measured figures and last two new measured figures).

(FREEZE) interrupts the test display and the momentary status is "frozen" for easier observation, although measurement continues in the background. (CONT) brings the display of the ongoing measurement back onscreen.

(RESET) sets the display to zero, ie minimum, maximum and average are freshly calculated.

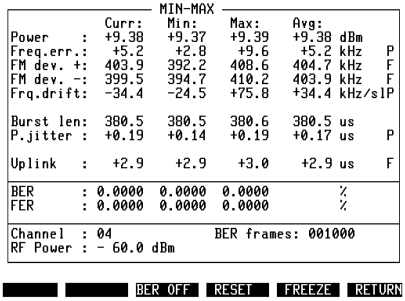
(RETURN) recalls the basic mask.

`Curr` column	The current measured figure.
`Min` column	The minimum figure measured up to this point.
`Max` column	The maximum figure measured up to this point.
`Avg` column	The average of all measured figures.
	Formula for calculating average:
	$\text{Average} = \frac{\text{Sum of all measured figures}}{\text{Number of measured figures}}$

Weighting

Righthand column. Weighting of the lowest and highest measured figures. If a measured figure is outside the specified tolerance, F = Fail is displayed, otherwise P = Pass. If the limits in the LIMITS mask are changed, f and p are displayed and `non standard` is displayed in the mask title.

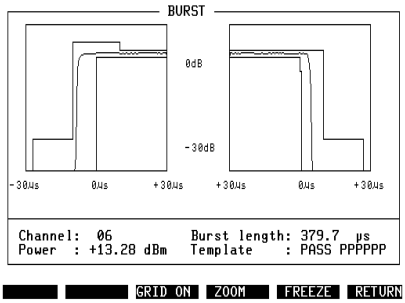
Fig. 10.18:
MIN-MAX mask after PP test



Results in BURST mask

Display of the power/time template of a measured burst. Call up the mask from the basic mask with (BURST).

Fig. 10.19:
The DECT unit has passed the test. All figures are within permissible limits.



☞ The Power/Time template measurements (Burst and Zoom) assume that the unit under test is not using the optional Z-field. If the Z-field is being used, then the measurements may show a FAIL result. Since the use of the Z-field only extends the burst by 4 bits (3.5 µs), this may not always be a problem.

(Zoom) calls up the ZOOM BURST mask.

(FREEZE) interrupts the measurement and the momentary status is "frozen". (RUN) enables the measurement to continue.

(RETURN) recalls the basic mask.

`Channel`	The number of the measured channel.
`Burst length`	The length of the burst.
`Power`	`Power` field. The power measured in sector 4 (see Fig. 10.20).

`Template`
(Weighting)

The first part of the field shows whether the test is passed (Pass) or not (Fail). The second part indicates the results of weighting the individual sectors of the power/time template. P = Pass or F = Fail tells you whether the burst is within specified tolerances. Each sector of the power/time template is weighted separately.

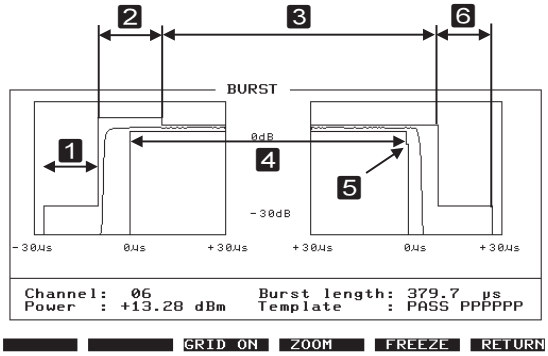


Fig. 10.20:
Division of power/time template into sectors. The tested FP is within the power/time template and has passed the test.

☞ Sectors 1 and 6 of the power/time template are absolutes in TBR 06 (25 µW). All other sectors are specified as relative power figures. But the Communication Test Set also displays sectors 1 and 6 in relative terms, so the display alters here with the level from the unit tested.

Results in ZOOM BURST mask

The ZOOM BURST mask expands sector 4 of the power/time template from the BURST mask. Call it up from the BURST mask with (ZOOM).

(NORMAL) recalls the BURST mask.

(FREEZE) interrupts the measurement and the momentary status is "frozen". (RUN) enables the measurement to continue.

(RETURN) recalls the basic mask.

`Channel`	The number of the measured channel.
`Burst length`	The length of the burst.
`Power`	The power measured in sector 4.

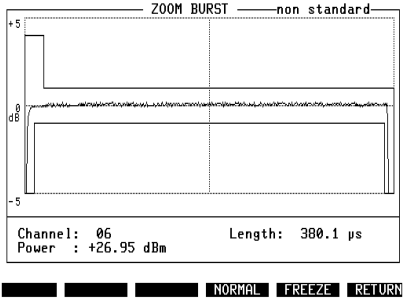


Fig. 10.21:
ZOOM BURST mask

Results of ACPM mask (adjacent-channel power measurement)

Adjacent-channel power is that part of the power radiated into adjacent channels as noise. This noise must not exceed a certain level if channel interference is to be avoided.

(ACPM) calls up the ACPM mask (second level of basic DECT mask).
(RETURN) recalls the basic DECT mask.

`# Channels` A scroll variable defining the number of adjacent channels to be measured.

- 3 Measure in the active channel and in the next channel up and next channel down.
- 5 Measure in the active channel and in the next two channels up and next two channels down.
- 7 Measure in the active channel and in the next three channels up and next three channels down.

`Channel` The number of the adjacent channel relative to the active channel (the channel that actually transmits).

Example: If the active channel is channel 6, then the next adjacent channel down (Channel -1) is channel 5 and the next adjacent channel up (Channel +1) is channel 7.

`Modulation` The mean adjacent-channel power picked up through the modulation in the active channel (the channel that actually transmits). Measurement of the level in the adjacent channel relates to the burst in the active channel. The mean adjacent-channel power of the burst is measured with a bandwidth of 1 MHz and for a duration of 62.5 % of total burst length. Measurement begins on the 36th bit of the burst.

The typical dynamic range of the measurement is 46 dB.

`Transient`

The maximum adjacent-channel power picked up through transients in the active channel (the channel that actually transmits). Measurement of the level in the adjacent channel relates to the burst in the active channel. The maximum burst power is measured with a bandwidth of 1 MHz. Measurement begins 27 µs before the first bit in the burst and ends 27 µs after the last bit.

The typical dynamic range of the measurement is 40 dB.

PASS/FAIL weighting of the channels is defined by the following table:

Channel	**Adjacent-channel power through modulation**		**Adjacent-channel power through transients**	
-3	–47.0 dBm	40.0 nW	–24.0 dBm	4.0 µW
-2	–30.0 dBm	1.0 µW	–14.0 dBm	40.0 µW
-1	–8.0 dBm	160.0 µW	–6.0 dBm	250.0 µW
Active channel	+24.0 dBm	251.2 mW	+27.0 dBm	501.2 mW
+1	–8.0 dBm	160.0 µW	–6.0 dBm	250.0 µW
+2	–30.0 dBm	1.0 µW	–14.0 dBm	40.0 µW
+3	–47.0 dBm	40.0 nW	–24.0 dBm	4.0 µW

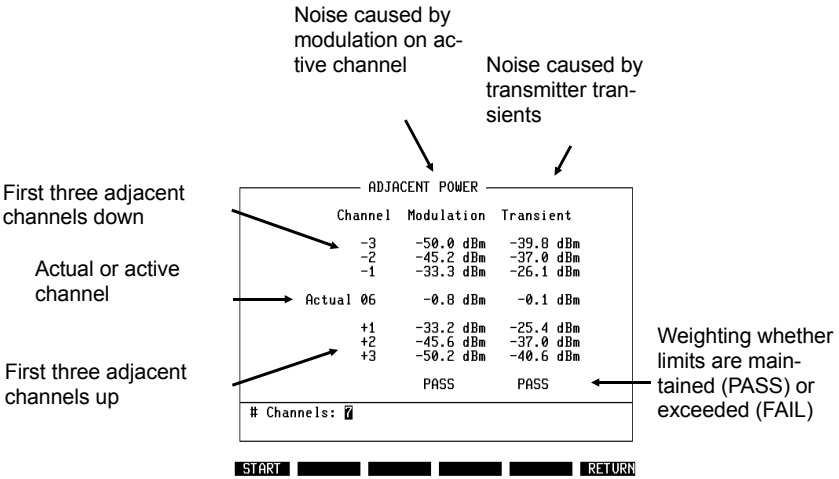
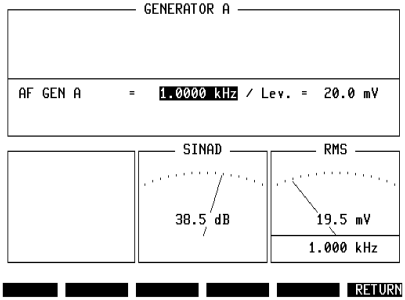


Fig. 10.22: ACPM mask

Performing audio tests

(RMS) switches to the RMS meter (second softkey level of basic DECT mask). Description see Chapter 5, "Standard RX Tests". (RETURN) recalls the basic DECT mask.

Fig. 10.23:
Audio testing is also possible during DECT tests.



To judge the quality of the signal, you can connect the output of the AF generator to an "artificial mouth" or to the analog input (Bu 106). The VOLTM input can be connected either to an "artificial ear" or to the analog output (Bu 106).

After calling up the mask, the generator GEN A is automatically activated and VOLTM is connected. The generator is working as long as it is not manually swiched off (or another mask is activated).

Starting DECT Generator

This generator can produce differently modulated DECT signals. Activate it by (GEN.).

(GEN.) opens a window in which you can make the following settings. It immediately becomes active.

`Channel` The number of the channel on which the generator works.

`RF-Level` The level at which the generator works.

`Pattern` The bit pattern to be modulated. The following are possible: NoBits (an unmodulated signal is output), PRBS (random generated bit sequence), 0000 (sequence of 0s), 1111 (sequence of 1s), 1010, 1100, 111000, 1110000.

`Mode` Whether the signal is to be generated continuously (`Cont.`) or if a burst is generated every 10 ms for the duration of an entire full slot (burst).

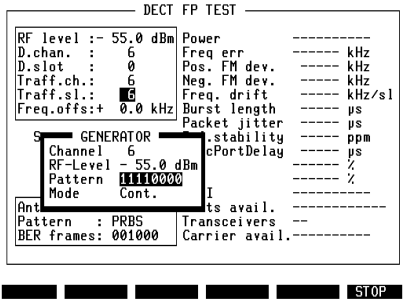


Fig. 10.24:
The DECT generator produces a selectable bit pattern.

Calibration

The Communication Test Set should be calibrated when it has reached its operating temperature (approx. 30 min after powering on), if there has been a marked change in ambient temperature, and shortly before measurements to improve RX quality.

- Disconnect any units connected to the RF or RF DIR socket.

  During calibration the Communication Test Set produces a continuous signal at a level of –40 dBm on the RF socket, or –20 dBm on the RF DIR socket if this is activated.
- Start calibration with (DC CAL.). It then runs automatically.

This page is intentionally left free.

Appendix

Polling Results with IEEE Controller

The Communication Test Set can be worked from an external IEEE controller. For details of using IEEE commands, refer to Chapter 8, section "IEEE Commands".

IEEE programming conventions

Only the first five characters are relevant for identifying an IEEE command (these are emphasized in upper case in a command's name). But you can add any number of characters to a command to make a program more readily understandable (eg `SETDUPLEX` instead of just `SETDU`). No distinction is made between upper and lower case.

Many IEEE commands require entry of parameters. These can be numeric figures with and without units, softkey designations or states (on/off). The parameters necessary for a command are included in its description.

Masks called up by IEEE commands differ on one point from masks called up manually: the meters are *not* activated. The appropriate meter is not interrogated, and briefly activated one time for this purpose, until you issue a measurement job. The meter then shows its result on the display until a new result is produced by the next measurement job.

☞ An IEEE command line must not be more than 100 characters in length.

DECT-specific IEEE commands

SPECIal01,a,bbbb		
Starts measurement and controls averaging of measured figures.		
a = averaging of measured figures	0	The average of the last measurement is considered when calculating a new average, so averages are only reset if the number of measured figures for averaging is changed.
	1	Averages are reset and freshly calculated for each new measurement.
bbbb = number of measured figures to be averaged	0000 through 9999	

SPECIal02

Status query, The Communication Test Set reports the status to the controller.
Output format: aaaa, bb, cc, dd, ee, ff

aaaa = DECT status (16 bits)

Value	Bit no.							
	15	14	13	12	11	10	9	8
0	Synchronization ok	Not used						
1	External synchronization lost							

Value	Bit no.							
	7	6	5	4	3	2	1	0
0	Connec-tion ok	Loopback ok	TB ok	DB ok	No loop-back	No TB	No DB	- Reserved
1	Connec-tion lost	Loopback fault	TB fault	DB fault	Active loopback	Active TB	Active DB	Reserved

bb = number of mask displayed

63	RMS mask				
90	Basic mask	93	Burst	96	MIN-MAX
91	DECT SETTINGS	94	Zoom burst	97	Limits
92	SCAN BEARERS	95	ACPM (not yet available)	98	DECT generator

cc = current softkey level of basic mask

cc	Softkeys					
	Softkey 1	**Softkey 2**	**Softkey 3**	**Softkey 4**	**Softkey 5**	**Softkey 6**
00	(etc)	(DEF.SET)	(MEASURE)	Not assigned	(DB ON)	(RETURN)
01	(etc)	(DEF.SET)	(MEASURE)	(CONNECT)	(DB OFF)	(RETURN)
02	(etc)	(BURST)	(BER ON) (BER OFF)	(MIN-MAX)	(FREEZE) (CONT)	(STOP)
03	(etc)	(RMS)	(ACPM)	Not assigned	Not assigned	(STOP)
04	(etc)	(GEN.)	(DC.CAL)	Not assigned	(SEARCH)	(RETURN)

dd = test mode

00 = PP test	01 = FP test

10

ee = error code DB			
00	OK	12	Signal found but no or wrong RFPI
10	System information not found (RFPI and time-slot number)	13	No DB of FP found in specified time slot
11	No S field found (possibly no FP signal on this carrier)		

ff = error code TB			
00	OK	35	Only FP test. "Bearer Confirm" message could not be received
32	Time-slot numbers of DB and TB are identical (must be different)	36	Only PP test. "Bearer Request" message could not be received
34	Only FP test. FP does not respond on channel on which Communication Test Set expects TB	40	Time slot 11 or 23 entered as current time slot of TB. 11 and 23 can be entered in field, but connection attempt aborts as error

SPECIal03,aaaabbbb	
Sets the `Result averaging` and `Timing measurements` fields of the `DECT SETTINGS` mask. The alteration does not take effect until the measurement is newly started.	
aaaa	Averaging over number of frames set in aaaa (`Result averaging` field)
bbbb	Averaging over number of frames set in bbbb (`Timing measurements` field)

SPECIal04,a,bb...bb	
Transfer of user-defined burst	
a = 1	First part of user-defined burst to follow
a = 2	Second part of user-defined burst to follow
bb..bb	User-defined data (max. 100 characters, ASCII format, hexadecimal)

SPECIal06,±aaa.aa	
Polling of measured level within power/time template	
aaa.aa	Spacing of measured figure from center of time axis in increments of 1 µs Example: offset = 0, measured figure in center of burst offset = –182.29, about first bit for full slot
Result feedback format: ±aaa.aa±bb.b	
±aaa.aa	Spacing of measured figure from center of time axis in increments of 0.1 µs
±bb.b	Level of input signal in dB at point specified by ɔaaa.aa

SPECIal07	
Query of DECT software version number **Feedback format: aaaa,bbbb**	
aaaa	Version number of DECT user surface
bbbb	Version number of DECT module software

SPECIal08,aaaaaaaa	
Transmits ESCAPE message on TB to device under test (only if TB active)	
aaaaaaaa	Parameter of ESCAPE message (8 characters, ASCII format, hexadecimal).

SPECIal99
The DECT software is reset to idle status. Example: if the measurement is being made in PP mode in the BURST mask, the Communication Test Set resets to idle status, active TBs are ended.

Query with RESULt command

Special characters: all special characters displayed onscreen (<<<, >>>, ——, !(measured figure), ?abc), are also used when querying results with RESULt commands (see section "Special characters as result", page 10.26).

Command	String 12345678901234567890	Meaning
Basic mask		
RESULt1	aaaaaaaaaabbbbbb****	a = transmitted power (incl. units) b = frequency error (kHz) * = not used
RESULt2	aaaaabbbbbccccddddd	a = positive deviation (kHz) b = negative deviation (kHz) c = frequency drift (kHz/ms) d = burst length (µs)
RESULt3	aaaaabbbbbcccccc*****	a = packet jitter (µs) b = reference stability (ppm) c = uplink time in PP test, sync port delay in FP test (µs) * = not used
RESULt4	aaaaaabbbbbbcc******	a = BER (%) b = FER (%) c = PP called * = not used
RESULt5	aaaaaaaaaa**********	a = FP identifier
RESULt6	aaaaaaaaaaaa********	a = available time slots
RESULt7	aaaaaaaaaa**********	a = available carriers
SCAN BEARERS mask		
RESULt2 RESULt3	aaaaaaaaaabccdd*eeee eeeeee**************	Signal with strongest level a = transmitted power (incl. units) b = type of signal source 0 = burst of FP 1 = burst of PP 3 = burst without DECT synchronization [Formatierung; siehe Ausdruck] sequence 4 = continuous signal c = time slot d = RF signal channel e = RFPI * = not used

Command	String 12345678901234567890	Meaning
RESULt4 RESULt5	aaaaaaaaaabccdd*eeee eeeeee**********	Signal with second strongest level a = transmitted power (incl. units) b = type of signal source 0 = burst of FP 1 = burst of PP 3 = burst without DECT synchronization sequence 4 = continuous signal c = time slot d = RF signal channel e = RFPI * = not used
RESULt6 RESULt7	aaaaaaaaaabccdd*eeee eeeeee**********	Signal with third strongest level a = transmitted power (incl. units) b = type of signal source 0 = burst of FP 1 = burst of PP 3 = burst without DECT synchronization sequence 4 = continuous signal c = time slot d = RF signal channel e = RFPI * = not used
RESULt8 RESULt9	aaaaaaaaaabccdd*eeee eeeeee**********	Signal with fourth strongest level a = transmitted power (incl. units) b = type of signal source 0 = burst of FP 1 = burst of PP 3 = burst without DECT synchronization sequence 4 = continuous signal c = time slot d = RF signal channel e = RFPI * = not used
Burst and Zoom Burst mask		
RESULt1 thru RESULt7 see basic mask, FP and PP test		
RESULt8	aaaaaaaaaabbbbbc****	a = transmitted power (incl. units) b = burst length (µs) c = weighting (template) * = not used
RESULt9	abcdef**********	a...f = weighting in sector 1 thru 6 of power/time template (P = pass, F = fail) * = not used

Command	String 12345678901234567890	Meaning
MIN-MAX mask		
RESULt1	aaaaaaaaaabbbbbbbbbb	a = actual power (incl. units) b = minimum power (incl. units)
RESULt2	aaaaaaaaaabbbbbbbbbb	a = maximum power (incl. units) b = average power (incl. units)
RESULt3	aaaaaabbbbbbccccccc**	a = actual frequency error (kHz) b = minimum frequency error (kHz) c = maximum frequency error (kHz) * = not used
RESULt4	aaaaaa**********	a = average frequency error (kHz) * = not used
RESULt5	aaaaabbbbbcccccddddd	a = actual positive deviation (kHz) b = minimum positive deviation (kHz) c = maximum positive deviation (kHz) d = average positive deviation (kHz)
RESULt6	aaaaabbbbbcccccddddd	a = actual negative deviation (kHz) b = minimum negative deviation (kHz) c = maximum negative deviation (kHz) d = average negative deviation (kHz)
RESULt7	aaaaabbbbbcccccddddd	a = actual frequency drift (kHz/slot) b = minimum frequency drift (kHz/slot) c = maximum frequency drift (kHz/slot) d = average frequency drift (kHz/slot)
RESULt8	aaaaabbbbbcccccddddd	a = actual burst length (µs) b = minimum burst length (µs) c = maximum burst length (µs) d = average burst length (µs)
RESULt9	aaaaabbbbbcccccddddd	a = actual packet jitter (µs) b = minimum packet jitter (µs) c = maximum packet jitter (µs) d = average packet jitter (µs)
RESULtA	aaaaabbbbbcccccddddd	a = actual reference stability (ppm) b = minimum reference stability (ppm) c = maximum reference stability (ppm) d = average reference stability (ppm)
RESULtB	aaaaaabbbbbbccccccc**	a = actual packet transmission accuracy (uplink time (µs)/actual synchronization delay (µs)) b = minimum packet transmission accuracy (uplink time (µs)/minimum synchronization delay (µs)) c = maximum packet transmission accuracy (uplink time (µs)/maximum synchronization delay (µs)) * = not used

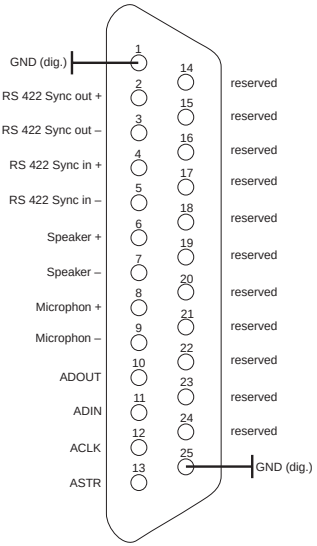
Command	String 12345678901234567890	Meaning
RESULtC	aaaaaabbbbbbcccccc**	a = average packet transmission accuracy (uplink time (µs)/average synchronization delay (µs) b = actual BER (%) c = minimum BER (%) * = not used
RESULtD	aaaaaabbbbbbcccccc**	a = maximum BER (%) b = average BER (%) c = actual FER (%) * = not used
RESULtE	aaaaaabbbbbbcccccc**	a = minimum FER (%) b = maximum FER (%) c = average FER (%) * = not used
RESULtF	*abcdefg**********	Weighting (P = pass and limits are standard (TBR 06) F = fail and limits are standard (TBR 06)) "p" = pass and limits were altered in LIMITS mask "f" = fail and limits were altered in LIMITS mask a = frequency error b = positive frequency deviation c = negative frequency deviation d = frequency drift e = packet jitter f = reference stability g = packet transmission accuracy (uplink time/ synchronization delay) * = not used

Command	String 12345678901234567890	Meaning
ACPM mask		
RESULt1	aaaaaaaaaabbbbbbbbbb	Adjacent-channel power through modulation a = active channel b = first adjacent channel down (Channel -1)
RESULt2	aaaaaaaaaabbbbbbbbbb	Adjacent-channel power through modulation a = first adjacent channel up (Channel +1) b = second adjacent channel down (Channel -2)
RESULt3	aaaaaaaaaabbbbbbbbbb	Adjacent-channel power through modulation a = second adjacent channel up (Channel +2) b = third adjacent channel down (Channel -3)
RESULt4	aaaaaaaaaabbbbbbbbbb	Adjacent-channel power through modulation a = third adjacent channel up (Channel +3) Adjacent-channel power through transients b = active channel
RESULt5	aaaaaaaaaabbbbbbbbbb	Adjacent-channel power through transients a = first adjacent channel down (Channel -1) b = first adjacent channel up (Channel +1)
RESULt6	aaaaaaaaaabbbbbbbbbb	Adjacent-channel power through transients a = second adjacent channel down (Channel -2) b = second adjacent channel up (Channel +2)
RESULt7	aaaaaaaaaabbbbbbbbbb	Adjacent-channel power through transients a = third adjacent channel down (Channel -3) b = third adjacent channel up (Channel +3)

Command	String 12345678901234567890	Meaning
RESULt8	********************	* = not used
RESULt9	aaaabbbb**********	Weighting (P = pass, F = fail) a = modulation (P/F) b = transient (P/F) * = not used

Appendix A: Pinning of DECT Socket Bu106

Fig. 10.25:
Pinning of DECT socket (Bu106)



Pin	Assignment	Meaning
1, 25	GND (dig.)	Ground
2, 3	RS-422 Sync out	Positive and negative synchronization output
4, 5	RS-422 Sync in	Positive and negative synchronization input
6, 7	Speaker	Positive and negative loudspeaker output
8, 9	Microphone	Positive and negative microphone input
10	ADOUT	Digital output for speech codec (ADPCM) or for serial B data field
11	ADIN	Digital input for speech codec (ADPCM) or for serial B data field
12	ACLK	ADPCM or data clock signal Falling edge: data fetched on ADIN by Communication Test Set Rising edge: data can be fetched on ADOUT
13	ASTR	8-kHz synchronization signal (normal mode) or B data field (transparent mode)
14 thru 24	Reserved	Internally wired pins, not to be used in applications

Synchronizing several units

Maximum number of synchronized units: 35 slaves + 1 master
Maximum line length between synchronized units: 1 km

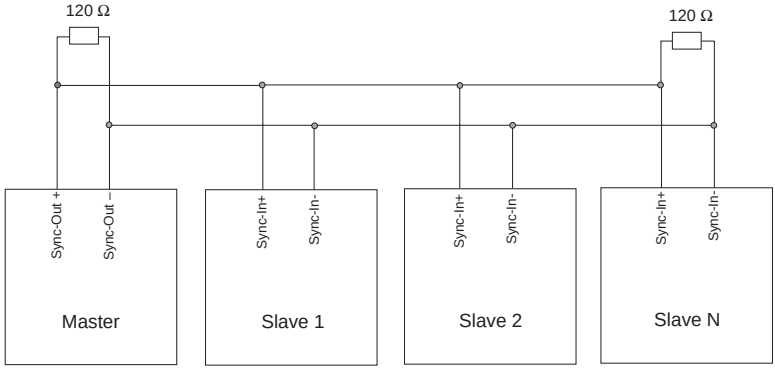


Fig. 10.26: Up to 35 slaves and one master can be synchronized. Important: the synchronization line must be terminated with a 120-Ω resistor on the first unit (master) and the last unit. It is not necessary for the master to be the first unit in the row.

Timing diagram of synchronization port

The synchronization port of the Communication Test Set is designed as an RS-422 interface as specified in the DECT standard.
Data only appear on the synchronization outputs (SYNC_OUT+ and SYNC_OUT–) of the Communication Test Set if it is declared the master. If it is configured as a slave, the synchronization outputs are high-impedance.

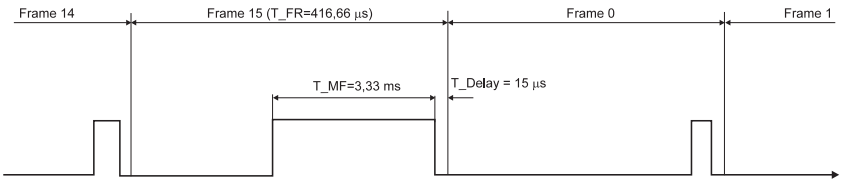


Fig. 10.27:
Timing diagram of the synchronization port. The timing for SYNCOUT and SYNCIN is identical. For identifying frame 1 to 15 the duration of the sync pulse may be between 5 µs and 1 ms, for frame 0 between 2 and 5 ms. But the time between the falling edge of the sync signal and the next frame must be precisely 15 µs.

Interface for digital data

Assignment	Pin	Meaning
ADOUT	10	Digital output for speech codec (ADPCM) or for serial B data field
ADIN	11	Digital input for speech codec (ADPCM) or for serial B data field
ACLK	12	ADPCM or data clock signal Falling edge: data fetched on ADIN by Communication Test Set Rising edge: data can be fetched on ADOUT
ASTR	13	8-kHz synchronization signal (normal mode) or B field data (transparent mode)

Data rate 32 kbit/s

Settings in DECT SETTINGS mask
`Speech data`: not necessary
Settings in basic mask
`Pattern: Dig. Data`

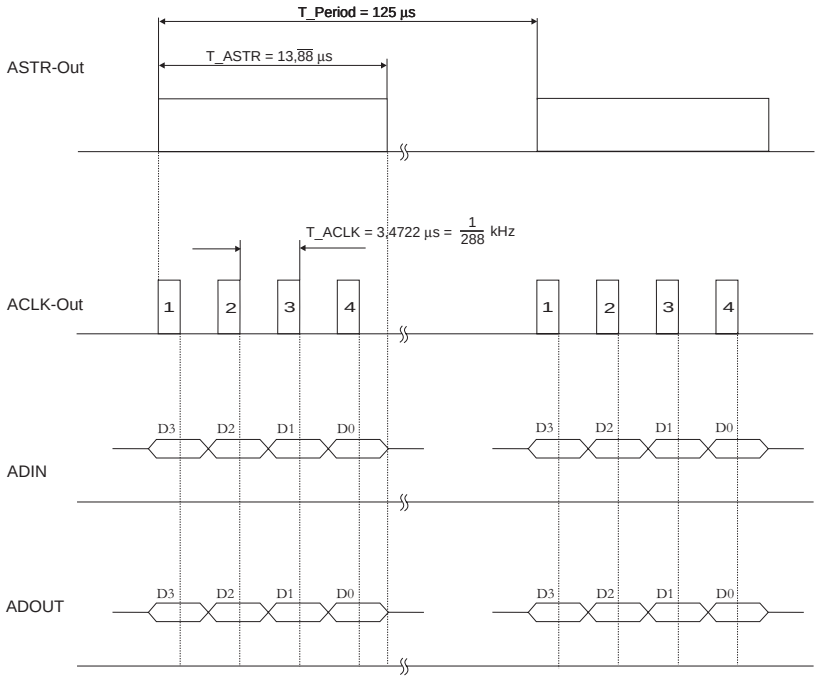


Fig. 10.28: Timing diagram for the digital interface. The clock pulse is not continuous but in packets of four clock cycles. The period of ACLK is 3.4722 µs. ASTR-Out is High during clock packets (13.88 µs), the period of ASTR-Out is 125 µs. So the data rate is 32 kbit/s.

Data rate 64 kbit/s

Settings in DECT SETTINGS mask

`Speech data: Digital (A law)`

Settings in basic mask

`Pattern: Speech`

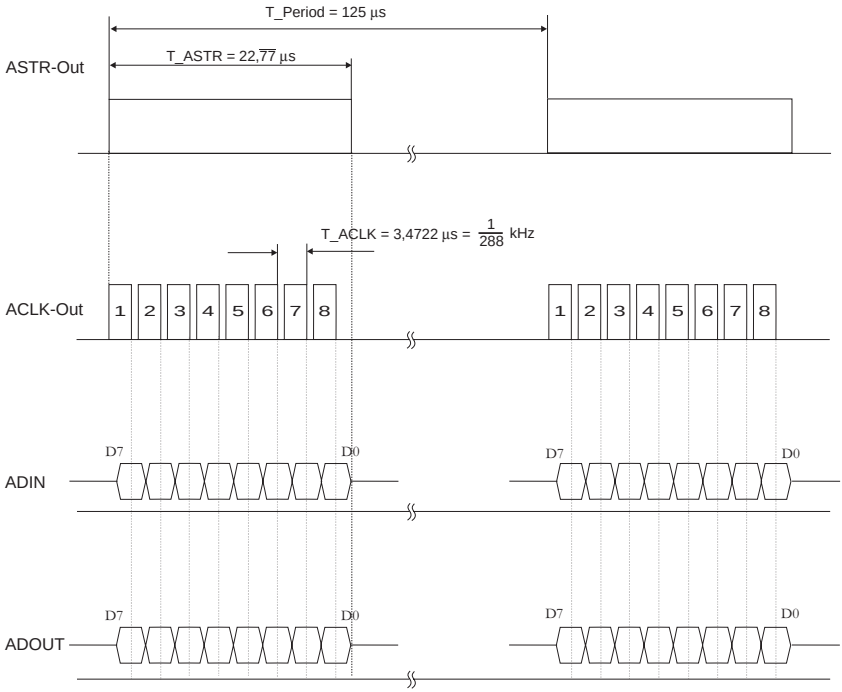


Fig. 10.29: Timing diagram for the digital interface. The clock pulse is not continuous but in packets of eight clock cycles. So the data rate is 64 kbit/s.

Data rate 128 kbit/s

Settings in DECT SETTINGS mask

`Speech data: Digital (lin.)`

Settings in basic mask

`Pattern: Speech`

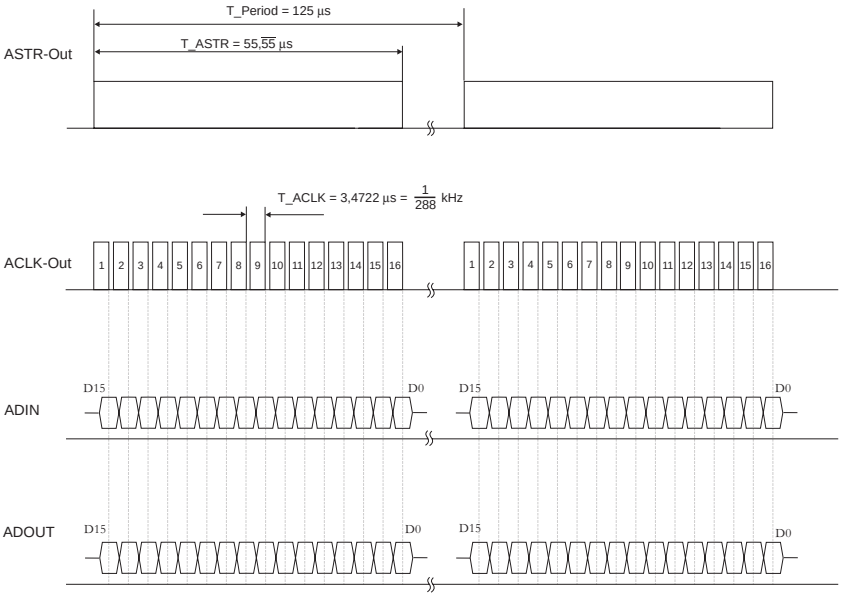


Fig. 10.30: Timing diagram for the digital interface. The clock pulse is not continuous but in packets of 16 clock cycles. So the data rate is 128 kbit/s.

Audio interface

Pins Speaker+, Speaker–, Microphone+ and Microphone– are available for input and output of audio signals.

The inputs and outputs are balanced.

☞ On the microphone input there is a bias voltage, necessary for standard microphones. So this input must not be connected to a unit (eg sinewave generator) that has no balanced output without a coupling capacitor or transformer.

Microphone

Impedance on microphone input	6.4 kΩ.
Input level in range	225-375 $mV_{\underline{rms}}$
Typical	300 $mV_{\underline{rms}}$ 375 $mV_{\underline{rms}}$ should not be exceeded otherwise input will be overdriven

Loudspeaker

Output impedance	220 Ω
Output voltage in range	600-1025 $mV_{\underline{rms}}$ (into 1-MΩ load)
Typical	800 $mV_{\underline{rms}}$ (into 1-MΩ load)

The output is shortcircuit-proof.
Load capacitance should be < 100 pF.

Caution: The loudspeaker terminal requires a balanced connection (not grounded). An unbalanced connection produces distortion. If the VOLTM socket of the Communication Test Set is used, the balance slide switch should be set to SYM.

Appendix B: Glossary

ADPCM Adaptive differential pulse code modulation
A technique used in DECT to reduce analog data (CCITT G.726)

BER Bit error ratio

$$\text{BER} = \frac{\text{Number of errored bits received}}{\text{Number of bits transmitted}}$$

CTR Common technical regulation, a valid document ratified by all ETSI members

dBm Power figure referred to 1 mW

DECT Digital Enhanced Cordless Telecommunication

ETSI European Telecommunications Standards Institute

FER Frame erasure ratio

$$\text{FER} = \frac{\text{Number of errored frames received}}{\text{Number of frames transmitted}}$$

FP Fixed part, ie base station

FT Fixed radio termination, containing only elements of DECT CI standard (eg layer 1 and selection of elements of layers 2 and 3)

GAP Generic access profile

GFSK Gaussian frequency-shift keying

GIP DECT GSM interworking profile

NTP Nominal transmitted power

PAP Public access profile, part of DECT common interface (CI) standard regulating interaction of FPs and PPs

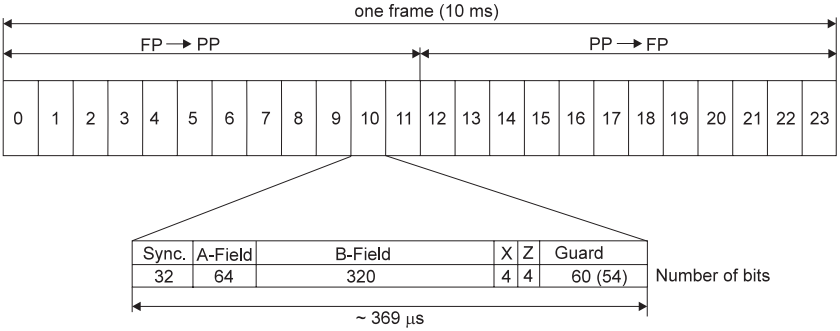
PP Portable part, ie mobile

RFP Radio fixed part, subunit of FP with connection to antenna system

RFPI Radio fixed part identifier

TB	Traffic bearer
TBR	Technical basis for regulation, ie CTR yet to be ratified
TDD	Time-division duplex
WRS	Wireless relay station, combination of FP and PP for relaying information from one DECT system to another

Appendix C: Structure of DECT Frame



Sync.: Synchronisation
A-Field: Signaling
B-Field: User Data
X: Parity check
Z: Copy of X-Field (optional)
Guard: Guard bits (60 bit without, 54 bit with Z-Field)

Fig. 10.31: Structure of DECT frame

Lifeline

The chronological lifeline tells you what modifications have been made to the software (SW) and the operating instructions. After a software update the lifeline helps you to find out quickly about all major changes (see code) in the updated operating instructions that are supplied.

Code: C = Correction, IN = Important Note, NF = New Feature

SW	Doc. Version	Δ pages	Code	Changes
1.00	9608-100-A	no		First edition
1.00	9609-100-B	no	C	Debugging in manual
1.10	9703-110-A	10-43	NF	ACPM added
		10-17	NF	Parameter `Input Signal Strength` added
		10-19	NF	Parameter for dummy bearer time slot added
		some	C	Bugfixes in manual and software
1.10	9706-110-B	10-56	C	RESULt7, change kHz/ms to kHz/slot.
1.11	9707-111-A	no	C	Bugfixes in software.
		no	C	Audio interface "sidetone" now disabled.
		no	C	ACPM in FP test mode now works correctly.
		no	NF	Search function has been accelerated.
1.11	9710-111-B	10-17 10-21	C	Description of accelerated search function added.
		10-40	C	3.5 ms changed to 3.5 µs.
1.11	9712-111-C	10-21	C	Documentation corrected.