Contents

2   Manual Operation

The DECT Digital Radiocommunication Tester CMD60 is easy and convenient to operate despite the wide variety of test functions it offers.

If you are working with the CMD60 for the first time and wish to get familiarized quickly with DECT measurements, you should start with section 2.1. In this section, you will be guided through a complete test of a fixed part (DECT base station) and a portable part (DECT handset).

Section 2.4 describes all manual control functions. Starting from the main menu, all menus are described completely in a logical order.

2.1   Getting Started

Section 2.1 is mainly intended for users that work with the CMD60 for the first time. First it is described how to connect a DUT (device under test) and then guides the user step by step through the most important DECT tests (synchronization, call setup, etc).

To get acquainted quickly with the CMD60 and its wide variety of measurement functions, we recommend that you work with the CMD60 together with a DECT fixed part (FP) or a DECT portable part (PP) while going through section 2.1. If an FP is used, you can skip subsection 2.1.3, if a PP is used, you can skip subsection 2.1.2. If both a DECT PP and FP are to be tested, it is expedient to start with the FP.

For each step, additional information is given on the opposite page (eg under ①). The contents and layout of this section are practice-oriented. It provides important information not only on the CMD60 but also on the DECT system.

For further information on menus and keys please refer to section 2.2.

2.1.1 Connection of CMD60
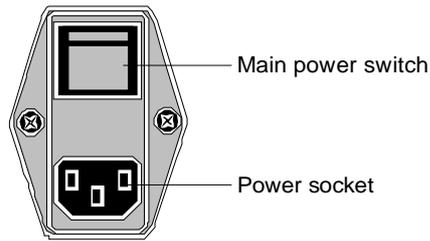
Step 1

Plug power cable into power socket on the rear and connect CMD60 to AC supply ①.

Switch on CMD60 with main power switch on the rear ②.

Main power switch

Power socket

Step 2

Connect N socket RF IN/OUT of CMD60 with antenna connector of PP or FP. Alternatively, an antenna can be connected to the N socket for coupling via the air interface ③.
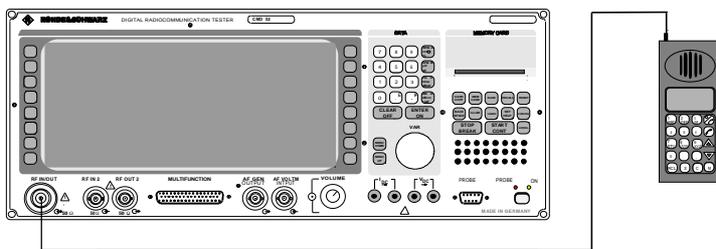
Step 3

Switch on CMD60 with power switch on the front ④.

Select the contrast for the display ⑤.

Selection of contrast

Power switch

The following mask will appear on CMD60.

```
ADDIT.
MEAS.

MANUAL        Digital              CONFIG
TEST                               MENU
          Radiocommunication
MODULE
TEST            Tester

AUTO
TEST

                                   GAP
               CMD        ON OFF    MODE

                          PP FP     TEST
                                    MODE
```

Additional Information

Step 1

① **Connection to AC supply**
The CMD60 automatically detects and adapts itself to the available AC supply (voltage ranges: 90 to 132 VAC and 180 to 265 VAC, 47 to 440 Hz).

Main power switch on rear of unit
② If the main power switch on the rear of the unit is set to OFF, the complete unit is disconnected from the AC supply. If the main power switch is set to ON, the unit is in the standby mode or in operation, depending on the position of the power switch on the front of the unit. With the power switch in position ON, the optional OCXO reference oscillator is supplied with operating voltage.

Step 2

③ **RF connection**
Normally, no direct RF connection is provided for DECT PPs and FPs. For coupling via the air interface, an antenna suitable for the DECT band is to be used (1900 MHz). For an accurate measurement of the NTP (normal transmitted power) and the BER (bit error rate) it is important to know the coupling attenuation.

Step 3

④ **Power switch on front of unit**
With the power switch on the front, the unit can be set to standby or to operation.

Standby:
Only the optional OCXO reference oscillator is supplied with operating voltage. The yellow LED (STANDBY) lights.

Operation:
All modules of the unit are supplied with operating voltage. The green LED (ON) lights.

⑤ **Contrast**
The contrast of the display can be set with the rotary knob CONTRAST on the front of the unit. The setting depends on the viewing angle of the user relative to the unit and may have to be readjusted from time to time.

2.1.2   Synchronization and Call Setup to Fixed Part (FP)

```
┌──────┬─────────────────────────────────────┬──────┐
│ADDIT.│                                     │      │
│MEAS. │                                     │      │
├──────┤                                     │CONFIG│
│MANUAL│        Digital                      │MENU  │
│TEST  │                                     ├──────┤
├──────┤   Radiocommunication                │      │
│MODULE│                                     │      │
│TEST  │        Tester                       ├──────┤
├──────┤                                     │      │
│AUTO  │                                     │      │
│TEST  │         CMD            ON OFF        │GAP   │
├──────┤                                     │MODE  │
│      │                       PP FP         ├──────┤
│      │                                     │TEST  │
│      │                                     │MODE  │
├──────┤                                     ├──────┤
│      │                                     │      │
│      │                                     │      │
└──────┴─────────────────────────────────────┴──────┘
```

Step 1

Press softkey TEST MODE until "FP" is displayed in inverse video, which indicates that the mode is active.

Press the GAP MODE softkey until OFF is displayed in inverse video, ie until the GAP mode is deactivated.

Press softkey MANUAL TEST. CMD60 changes to menu SIGNALLING FP-TEST and searches for a dummy bearer signal ①.

Step 2

```
┌──────────┬──────────────────────────────────────┬────────┐
│ADDIT.    │ SIGNALLING FP-TEST                    │        │
│MEAS.     │                                       │        │
├──────────┼──────────────────────────────────────┼────────┤
│CONNECT/  │ USED RF CONNECTOR:    RF IN/OUT       │        │
│EXT.ATT.  │   Ext. Attenuation:      0.0 dB       │        │
│          │                         0000418320    │RFPI    │
├──────────┤                                       ├────────┤
│          │                         00000         │PMID    │
├──────────┤                                       ├────────┤
│          │ Signalling Status:  [ LOCKED ]        │        │
│          │                                       ├────────┤
│          │ Dummy Slot:         [      0 ]     8  │TRAFFIC │
│          │                                       │SLOT    │
├──────────┤ Dummy Carrier:      [      1 ]     0  ├────────┤
│ACCEPT    │                                       │TRAFFIC │
│RFPI      │ Detected RFPI:    [ 0000418320 ]      │CARRIER │
├──────────┤                                       ├────────┤
│SET RFPI  │                          -40.0 dBm    │RF LEVEL│
│FOR PP    │                                       │        │
├──────────┼──────────────────────────────────────┼────────┤
│MODE      │ [LOOPBACK] NORMAL ECHO  Press key to  │SETUP   │
│          │                      setup connection │CONNECT.│
└──────────┴──────────────────────────────────────┴────────┘
```

Switch on the FP and set it to the DECT test mode ②.

When CMD60 has found the dummy bearer signal of the FP under test, this is indicated by LOCKED in the field "Signalling Status". In addition, information on the channel number and time slot ③ of the dummy bearer and on the RFPI ④ of the FP are indicated.

If softkey ACCEPT RFPI is pressed, CMD60 uses the same RFPI as the FP. Some FPs additionally require a specific PMID ⑤.

Press softkey RF LEVEL, enter -40 and confirm with ENTER, or turn spinwheel until -40 dBm is indicated.

Step 3

Now a call can be set up by pressing softkey SETUP CONNECT.
After a successful call setup ⑥, CMD60 is in the status CONNECTION ESTABLISHED (see section 2.1.4).

Additional Information

Step 1

① **Dummy bearer**
The dummy bearer is a signal sent by the FP to which PPs (and also CMD60 if used as a PP) can synchronize. The signal is transmitted at the DECT clock of 10 ms and contains information for synchronization between FP and PP and for authentication, ie for verification if a call setup is permissible between a specific pair of FP and PP (or FP and CMD60 if the latter is used as a PP).

Step 2

② **DECT test mode**
For tests on DECT systems, the FP must be set to a special test mode for a successful call setup. In this mode, the FP accepts test messages it otherwise ignores. The procedure for activating the test mode varies from unit to unit. In the case of some FPs, the paging button must be kept pressed for a specified period of time during switch-on, other FPs require a special test software to be loaded via an interface. Relevant information is to be obtained from the manufacturer in each case.

③ **Slot**
Please note that the slot numbers of the dummy bearer and of the traffic bearer (permissible values are 0 to 11 for both) are not identical. Moreover, adjacent slots (eg 5 and 6 or 11 and 0) are permissible only if the channel numbers of the dummy bearer and the traffic bearer are identical. Some FPs can set up a call only on even-numbered slots, others only on odd-numbered slots. If required, the value for TRAFFIC SLOT is to be changed.

④ **RFPI**
The "Radio Fixed Part Identity" is a number that unambiguously identifies a fixed part. A call setup between a PP and an FP is possible only if the RFPI stored in the PP coincides with that of the FP.

⑤ **PMID**
The "Portable Part MAC Identity" is an identification number of the portable part. Most FPs accept any PMID in the DECT test mode. The PMID of a PP can be determined during call setup by means of the PP test (see section 2.1.4 - Step 1).

Step 3

⑥ **Call setup**
The requirements for a successful call setup are described in section 2.4.2.3.

2.1.2.1   Synchronization and Call Setup to FP in the GAP Mode

Step 1

Press the TEST MODE softkey until FP is displayed in inverse video which indicates that the mode is active.
Press the GAP MODE softkey until ON is displayed in inverse video and the GAP mode is active.
Press the MANUAL TEST softkey. This opens the SIGNALLING FP-TEST menu where CMD60 searches for a dummy bearer signal ①.

Step 2
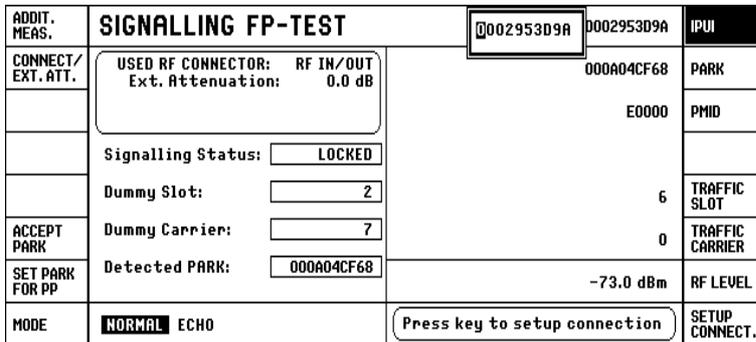
Switch on the FP without activating the DECT test mode. ②

When CMD60 has found the dummy bearer signal of the FP to be tested, LOCKED is displayed in the Signalling Status field. Information on the channel number and timeslot of the dummy bearer and the PARK   ③ of the FP are displayed in addition.

When the ACCEPT PARK softkey is pressed, CMD60 uses the same PARK as the FP. Some FPs additionally require a correct PMID.

The correct IPUI ④ is also needed in the GAP mode.

Press the RF LEVEL softkey, enter -40 and confirm with ENTER or turn the spinwheel until -40 dBm is displayed.

Step 3

A call can now be set up by pressing the SETUP CONNECT softkey.
After a successful call setup ⑤, CMD60 is in the CONNECTION ESTABLISHED status (see section 2.1.4).

Additional information

Step 1

① **Dummy bearer**
The dummy bearer in the GAP mode does not differ significantly from that in the test mode (see section 2.1.2).

Step 2

② **GAP mode**
After power-up, a DECT GAP unit is automatically in the GAP mode unless the DECT test mode has been activated. In the GAP mode the unit uses the normal signalling procedure of the GAP standard and ignores all test messages defined for the DECT test mode.

③ **PARK**
The "portable access rights key" is a code permitting the portable part to establish a connection only to specific fixed parts. The FP identifies itself by the ARI (access rights identity) contained in the PARK. CMD60 only uses PARKs of this class which are identical with the RFPI (see section 2.1.2).

④ **IPUI**
The IPUI (international portable user identity) is a number which unambiguously identifies the portable part. A fixed part can establish a connection to a portable part only if it knows the PP's IPUI. For a successful call setup one of the IPUIs stored in the fixed part must be entered.

Step 3

⑤ **Call setup**
The requirements for a successful call setup are described in section 2.4.2.4.

2.1.3 Synchronization and Call Setup to Portable Part (PP)

ADDIT. MEAS.		CONFIG MENU
MANUAL TEST	Digital Radiocommunication Tester	
MODULE TEST		
AUTO TEST		
	CMD ON **OFF** GAP MODE	
	PP FP TEST MODE	

Step 1

Press softkey TEST MODE, until "PP" is displayed in inverse video, which indicates that the mode is active.

Press the GAP MODE softkey until OFF is displayed in inverse video, ie until the GAP mode is deactivated.

Press softkey MANUAL TEST. CMD60 changes to menu SIG-NALLING PP-TEST and generates a dummy bearer signal ①.

Step 2

ADDIT. MEAS.	**SIGNALLING PP-TEST**		
CONNECT/ EXT.ATT.	USED RF CONNECTOR: RF IN/OUT Ext. Attenuation: 0.0 dB	001446C30 001446C30	RFPI
		0	DUMMY SLOT
		0	DUMMY CARRIER
	Wait for mobile synchronization before setup the connection ...	2	TRAFFIC SLOT
		0	TRAFFIC CARRIER
		−40.0 dBm	RF LEVEL
MODE	**LOOPBACK** NORMAL ECHO	Press key to setup connection	SETUP CONNECT.

Press softkey RFPI and enter RFPI number of portable part ②. Confirm the number by pressing hardkey ENTER.

Press softkey RF LEVEL, enter -40 and confirm with ENTER, or turn spinwheel until -40 dBm is indicated.

Switch on PP and set it to DECT test mode ③.

Wait until the PP indicates that it has synchronized to the FP ④.

Step 3

After synchronization ④, a call setup can be made. For this, press softkey SETUP CON-NECT.

After successful call setup ⑤, CMD60 is in the status CON-NECTION ESTABLISHED (see section 2.1.4).

Additional Information

Step 1

① **Dummy bearer**
The dummy bearer is a signal sent by the FP (in this case CMD60) to which the PP can synchronize. The signal is transmitted at the DECT clock of 10 ms and contains information for synchronization between FP and PP and for authentication, ie for verification if a call setup is permissible between a specific pair of FP and PP. In the default state, the dummy bearer is transmitted on channel 0 (softkey DUMMY CARRIER) in time slot 0 (softkey DUMMY SLOT).

Step 2

② **RFPI**
The "Radio Fixed Part Identity" is a number that unambiguously identifies a fixed part, which is CMD60 is in this case. A call setup between the PP and the FP is possible only if the RFPI stored in the PP coincides with that of the FP. If the RFPI of the PP is not known, it can be determined from the associated FP as shown in section 2.1.2, Step 2.

③ **DECT test mode**
For tests on DECT systems, the PP must be set to a special test mode for a successful call setup. In this mode, the PP accepts test messages it otherwise ignores. The procedure for activating the test mode varies from unit to unit. In the case of some PPs, a specific key combination must be pressed during switch-on, others require a sequence of keys to be pressed after switch-on or a special test software to be loaded via an interface. Relevant information is to be obtained from the manufacturer in each case.

④ **Synchronization**
Synchronization is understood to mean that the PP has received the dummy bearer (see ①) of the FP correctly, that it has the same RFPI (see ②) as the FP and has taken over the timing information from the FP. Indication of synchronization varies from PP to PP. In most cases synchronization is indicated by a symbol on the display of the PP. *Only then is it possible to set up a call.* Since the DECT system does not provide for any further sync status information, it is basically not possible for a tester to recognize if a PP is synchronized or not.

Step 3

⑤ **Call setup**
In the default status of CMD60, call setup is performed on channel 0 (softkey TRAFFIC CARRIER) in slot 2 (softkey TRAFFIC SLOT).

2.1.3.1 Synchronization and Call Setup to PP in the GAP Mode

Step 1

Press the TEST MODE softkey until PP is displayed in inverse video which indicates that the mode is active.
Press the GAP MODE softkey until ON is displayed in inverse video and the GAP mode is active.

Press the MANUAL TEST softkey. CMD60 changes to the SIGNALLING PP-TEST menu, where it generates a dummy bearer signal ①.

Step 2

Press the PARK softkey and enter the PARK number of the portable part ②. Confirm the entry with the ENTER key. Enter also the IPUI ③ of the portable part.

Press the RF LEVEL softkey, enter -40 and confirm with ENTER or turn the spinwheel until -40 dBm is displayed.

Switch the PP on without setting it to the DECT test mode ④.

Wait until the PP indicates that it has synchronized to the FP ⑤.

Step 3

After synchronization, a call can be set up ⑥ from the portable part by picking up the handset or by pressing the SETUP CONNECT softkey.

After a successful call setup, CMD60 is in the CONNECTION ESTABLISHED status (see section 2.1.4).

Additional information

Step 1

① **Dummy bearer**
The dummy bearer in the GAP mode does not differ significantly from that in the test mode (see section 2.1.3).

Step 2

② **PARK**
The "portable access rights key" is a code permitting the portable part to establish a connection only to specific fixed parts. The FP (here CMD60) identifies itself by the ARI (access rights identity) contained in the PARK. CMD60 only uses PARKs of the class which are identical with the RFPI (see section 2.1.3).

③ **IPUI**
The IPUI (international portable user identity) is a code which unambiguously identifies the portable part. A fixed part can establish a connection to a portable part only if it knows the PP's IPUI. For a successful call setup the IPUI of the portable part must be known.

④ **GAP mode**
After power-up, a DECT GAP unit is automatically in the GAP mode unless the DECT test mode has been activated. In the GAP mode the unit uses the normal signalling procedure of the GAP standard and ignores all test messages defined for the DECT test mode.

⑤ **Synchronization**
Synchronization means that the PP has received the dummy bearer (see ①) of the FP correctly, that one of its PARKs (see ②) contains the received ARI and that it has taken over the timing information from the FP. Indication of the sync status varies from PP to PP. In most cases synchronization is indicated by a symbol on the PP display. ***Only then is it possible to set up a call.*** Since the DECT signalling does not provide for any further sync status information, it is basically not possible for a tester to recognize if a PP is synchronized or not.

Step 3

⑥ **Call setup**
In the GAP mode the call is always set up from the portable part. A connection is established when the PP is picked up. An incoming call can however be simulated by pressing the SETUP CONNECT softkey. In this case the PP rings. The channel/slot combination for this call is determined by the PP and cannot be defined by CMD60.
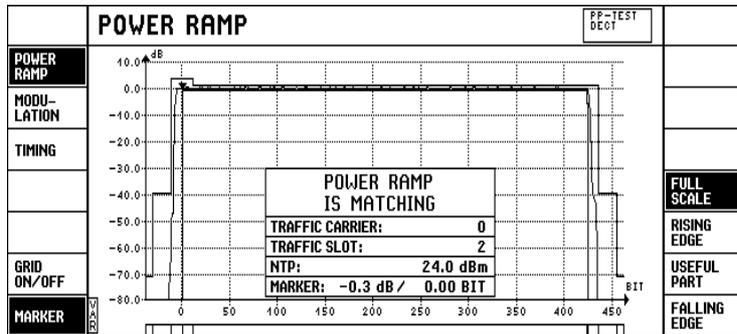
2.1.4   DECT Transmitter Measurements on Portable Parts and Fixed Parts

ADDIT. MEAS.	**CONNECTION ESTABLISHED**			PP-TEST DECT GAP	
POWER RAMP	Traffic Slot:	9		7000000000	ESCAPE SEQUENCE
MODU-LATION	Traffic Carrier:	1	Detected PMID:	E3D9A	
TIMING	NTP:	24.0 dBm			
	Freq. Offset:	-3 kHz			
	Max. +/- B-Field Modulation:	+363 kHz			
		-363 kHz			
				-73.0 dBm	RF LEVEL
					BEARER RELEASE

Step 1

The most important transmitter parameters are measured already in the menu CONNECTION ESTABLISHED: power (NTP) ①, frequency offset ② and maximum modulation deviation ③. If a tolerance is exceeded, the associated measured value is displayed in inverse video. In the PP test, the PMID ④ of the PP is indicated. Note that the softkey for the BER measurement (see 2.1.5) is not available in the GAP mode.

	POWER RAMP		PP-TEST DECT	
POWER RAMP	10.0 ┤dB			
MODU-LATION	0.0			
TIMING	-10.0			
	-20.0			
	-30.0			FULL SCALE
	-40.0	POWER RAMP IS MATCHING		RISING EDGE
	-50.0	TRAFFIC CARRIER: 0		
	-60.0	TRAFFIC SLOT: 2		USEFUL PART
GRID ON/OFF	-70.0	NTP: 24.0 dBm		
	-80.0	MARKER: -0.3 dB / 0.00 BIT	BIT	FALLING EDGE
MARKER	0 50 100 150 200 250 300 350 400 450			

Step 2

On pressing softkey POWER RAMP, the power versus time can be measured. Parts of the power ramp can be magnified with softkeys RISING EDGE, USEFUL PART and FALLING EDGE. When softkey MARKER is pressed, a marker can be moved along the test trace by turning the spinwheel, the position being indicated in bits and the relative power referred to the measured NTP being indicated in dB ⑤. Tolerances and test parameters can be set for each measurement. For this, press hardkey CONFIG on the right of the front panel. CMD60 then goes to an intermediate menu from where the configuration menu can be called with softkey POWER. Press softkey DYNAMIC to activate HIGH. Start a new measurement with MENU UP: a test trace with a wider dynamic range will be displayed ⑥. With AVERAGE (BURSTS), the number of bursts is displayed over which the power (NTP) is averaged ⑦. With STOP CONDITION, the condition for the end of the measurement is defined ⑧.

	TX TEST CONFIGURATION	PP-TEST DECT	
POWER			
MODU-LATION			
TIMING			

DEFAULT VALUES	**POWER RAMP CONFIGURATION**		PP-TEST DECT	
	C	D	20 (nW)	A (ABS.)
	NTP		25 (uW)	B (ABS.)
LOWER NTP	20.0 dBm	E F	4.0 dB	C (REL.)
UPPER NTP	25.0 dBm	B	1.0 dB	D (REL.)
	B	B	-1.0 dB	E (REL.)
AVERAGE (BURSTS)	10	A A	-6.0 dB	F (REL.)
DYNAMIC	LOW **HIGH**			
STOP COND.	**NONE** OUT OF TOL SINGLE SHOT			

Additional Information

Step 1

① **NTP**
The NTP (normal transmit power) is the power in dBm averaged over the DECT burst.

② **Frequency offset**
The frequency offset is obtained as the average value of the demodulated signal over the B field (see step 3) for a selectable number of received bursts.

③ **Modulation deviation**
The modulation deviation is the positive and negative maximum deviation from the average value of the demodulated signal over the B field for a selectable number of received bursts.

④ **PMID**
The "Portable Part MAC Identity" is an identification number for the portable part.

Step 2

⑤ **Bit P0**
The first bit of the burst is derived from the demodulated signal by detecting the sync word (sync field, see step 3). Bit P0 determines the timing of the power ramp within the tolerance limits.

⑥ **HIGH DYNAMIC**
If HIGH is selected, two bursts of different input sensitivity are measured and displayed simultaneously. With this function it can be checked if the level outside the burst meets the relevant requirements.

⑦ **AVERAGE BURSTS**
The setting made here is also valid for the measurements made in menu CONNECTION ESTABLISHED and for modulation measurements.

⑧ **STOP CONDITION**
You can select if a measurement is to be performed continuously (NONE), if only one measurement is to be performed (SINGLE SHOT) or if the measurement is to be stopped on exceeding a tolerance limit (OUT OF TOL).

When a measurement has been stopped, it can be restarted by pressing the associated softkey (POWER RAMP in this case).

Fields of a burst

Step 3
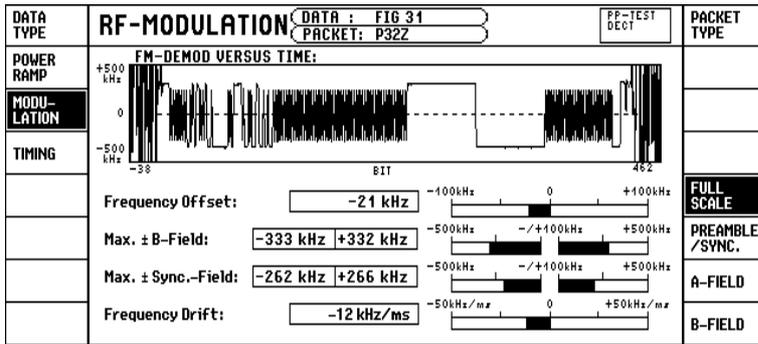
The modulation measurement menu can be called from one of menus CONNECTION ESTABLISHED or POWER RAMP by pressing MODULATION.

Same as in CONNECTION ESTABLISHED, the measured frequency offset and modulation deviation ("Max. ±B-Field") are displayed. Moreover, the modulation deviation over the preamble ① and the frequency drift ② are measured.
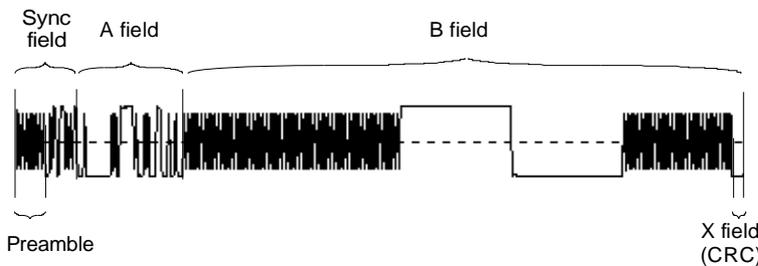
Upon pressing softkey DATA TYPE, the data pattern can be changed by means of the spin-wheel ③.
Various DECT packet types ④ can be set with the aid of the PACKET TYPE softkey.
Parts of the test trace can be magnified with softkeys PREAMBLE/SYNC., A-FIELD and B-FIELD ⑤.
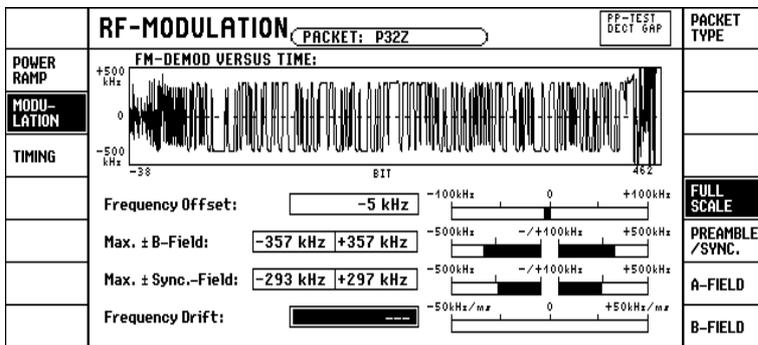
In the GAP mode the DATA TYPE softkey is disabled and the tested instrument sends a random data pattern. This can be seen from the graphics display. Because of the random pattern the frequency drift cannot be evaluated and is not displayed.

Step 4
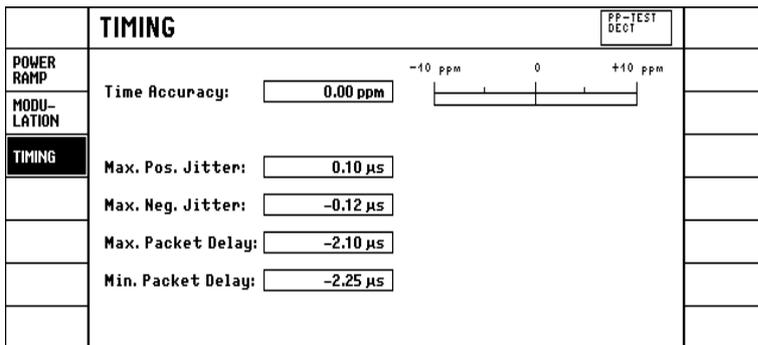
The timing measurement menu can be called by pressing TIMING. In this menu, the timing accuracy ⑥, jitter ⑦ and, in the PP test, the packet delay ⑧ can be measured.

After completion of the measurement, press MENU UP to return to the menu CONNECTION ESTABLISHED.

Additional Information

Step 3

① **Preamble**
The preamble consists of the first 16 bits of a burst with the modulation 010101...

② **Frequency drift**
The frequency drift is understood to be the frequency variation within a burst. The average modulation deviation is formed from the middle 14 bits of the 16 bits of the preamble and also from the first 14 bits of the last 16 bits of the B field. The difference between the two average values is weighted with a constant, yielding the frequency drift in kHz/ms. Frequency drift measurements are possible only for data patterns ending with the sequence "zero-one". This applies to "FIG31" and "01010101".

③ **Data pattern (data type)**
After call setup, the CMD60 sets the DUT to the loopback mode. In this mode, the DUT returns the received data to the CMD60.

The following patterns can be selected: "FIG31", "01010101", "00110011...", "00001111...", "PSRBS" and "SPRBS". "FIG31" is a sequence of 128 alternating bits (0101..), 64 ones, 64 zeroes and 64 alternating bits. "PSRBS" is a sequence of pseudo random numbers with a repetition period of $2^{11}-1$ bits. "SPRBS" is a sequence of pseudo random numbers repeated in every burst. Measurement of the frequency drift is possible only with the two first-named patterns.

④ **Packet type**
The DECT standard defines various packet types. They differ by the information data rate as well as by extensions at the beginning (prolonged preamble) and end (Z field) of the normal packet. CMD60 is able to handle the standard type P32 with prolonged preamble (PP32), Z field (P32Z) or both (PP32Z). With prolonged preamble selected, the first 16 bits (preamble) of the packet are doubled. The Z field is a repetition of the last four bits (X field) at the packet end.

⑤ **Display ranges**
The selection of a specific display range has no effect on the measurement.

Step 4

⑥ **Timing accuracy**
This is understood to be the accuracy of the time interval between two successive bursts relative to the nominal value of 10 ms (see example below). This parameter is measured and averaged over a selectable number of bursts.

⑦ **Jitter**
Maximum and minimum interval between two successive bursts minus the average interval (see example below).

⑧ **Packet delay (PP test only)**
Maximum and minimum interval between bursts of CMD60 as FP and bursts of PP under test minus 5 ms.

Example:

a: maximum interval between two bursts
b: average interval between two bursts
c: minimum interval between two bursts
d: maximum interval between FP and PP
e: minimum interval between FP and PP

Timing accuracy:	(b - 10 ms) / 10 ms * 1 000 000 [ppm]
Max. pos. jitter:	a - b
Max. neg. jitter:	c - b
Max. packet delay:	d - 5 ms
Min. packet delay:	e - 5 ms
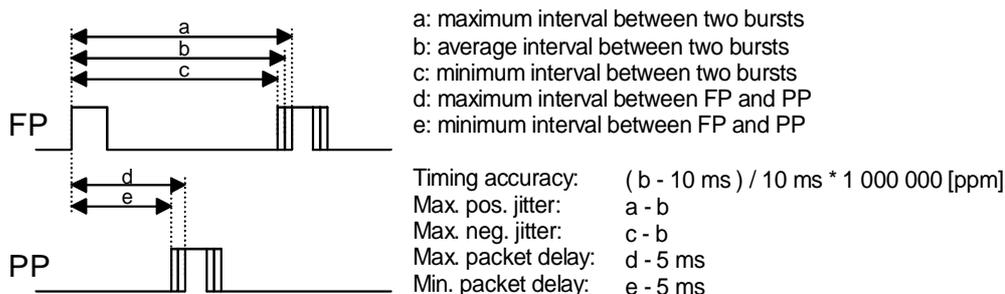
2.1.5   DECT Receiver Measurements on Portable Parts and Fixed Parts

```
┌─────────────────────────────────────────────────────────┐
│  BIT ERROR RATE   (DATA TYPE: PSRBS )        │PP-TEST │  │
│                                               │DECT    │  │
│ ┌───┐                                    -73.0 dBm  RF LEVEL│
│ │BER│  Current BER:    [    0 ppm]                       │
│ └───┘                             MULTI BEARER (Slots):   │
│        Current FER:    [    0 ppm]   0  1  ▣  3  4  5     │
│                                      6  7  8  9 10 11     │
│        Longterm BER:   [    0 ppm]                        │
│                               ┌──────────────────────────┐│
│        Longterm FER:   [    0 ppm]│ TEST SETUP:          ││
│                               │                          ││
│        Eval. Window           │ EVAL.WINDOW: 100 * [320 Bit]│
│        Indicator:  [███    ]  │             (1.00 s)     ││
│                    0    1.00 s│                          ││
│        ┌──────────────────┐   │ STOP CONDITION:          ││
│        │ TEST IS RUNNING  │   │    NONE                  ││
│        └──────────────────┘   └──────────────────────────┘│
└─────────────────────────────────────────────────────────┘
```

Step 1

The BER measurement menu can be called from menu CON-NECTION ESTABLISHED by pressing softkey BER.

NOTE: A BER measurement cannot be performed in the GAP mode.

In this measurement, the bits received are compared with the bits transmitted. The ratio of the number of erroneous bits and the total number of bits received yields the bit error rate BER ①. The frame erasure rate FER is the ratio of erroneous frames to total frames ②.

"Current BER/FER" indicates the current values ③, "Longterm BER/FER" the values averaged over a time window ("Evaluation Window") selectable in the con-figuration menu.

Upon pressing RF LEVEL, the transmit power of CMD60 can be varied with the spinwheel to examine the effect of the power level received by the DUT on the bit error rate and the frame era-sure rate.

Additional Information

Step 1

① **BER (bit error rate)**
The bits of invalid frames are not taken into account in the BER measurement (see ②).

② **FER (frame erasure rate)**
If 25% or more of all bits of a frame is erroneous, the frame is declared invalid and taken into account in the FER and not in the BER.

③ **Current BER / FER**
Average value formed over the last approximately 33 bursts.

2.2 Menu Structure

The following diagrams show the structures of the operating, configuration and autotest menus of the CMD60. The connections between operating and configuration menus are not presented here for reasons of clarity.
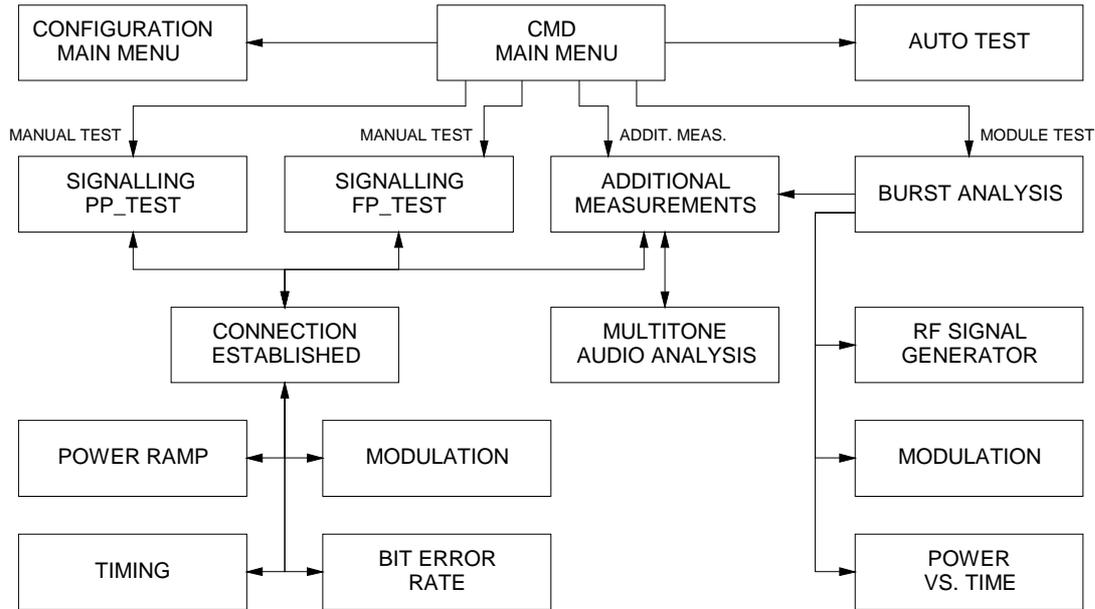

Fig. 2.2-1   Structure of operating menus of CMD60
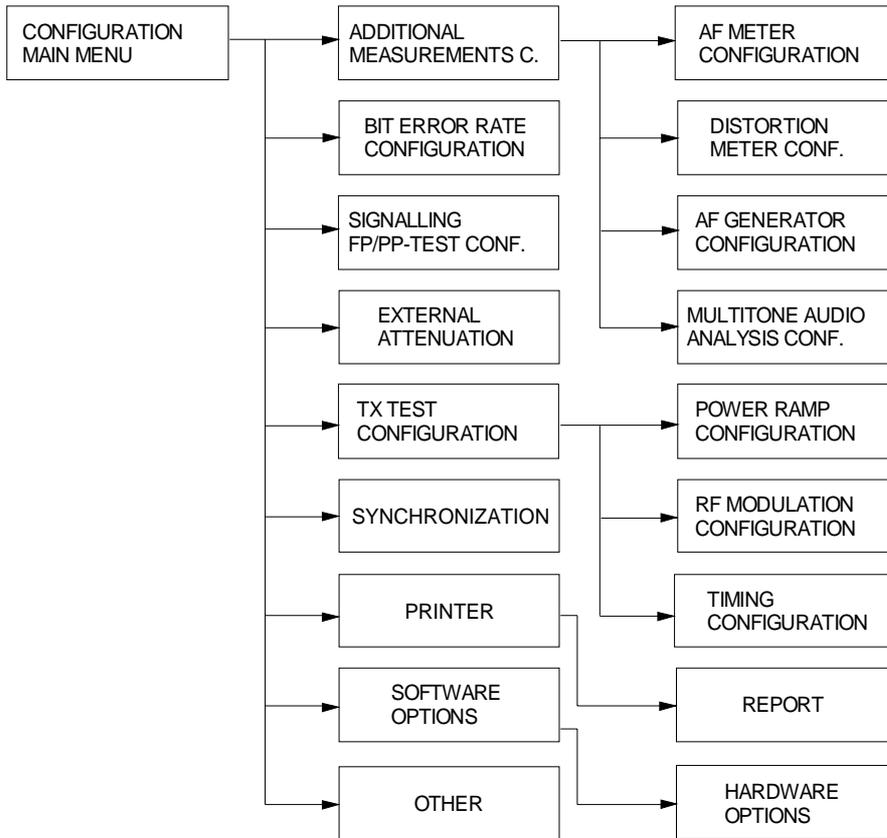
Fig. 2.2-2   Structure of configuration menus of CMD60
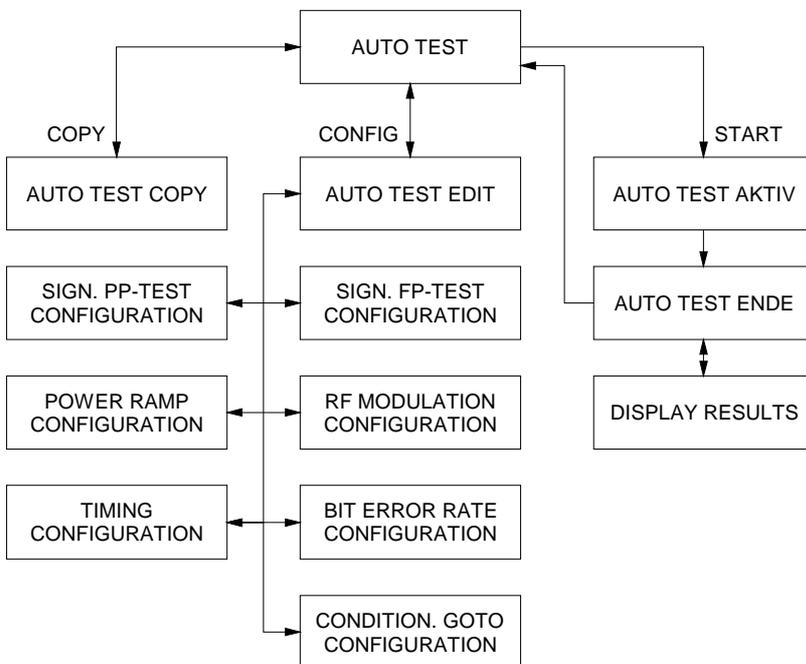
Fig. 2.2-3   Structure of autotest menus of CMD60

2.3   Basic Operating Instructions and Storage of Parameters

The controls used for data entry into the CMD60 are explained below:

Numerical input

Data entry is only possible if the respective softkey is shown in inverse video (white text on black background). The softkey appears in inverse video when it is activated. If a VAR symbol appears on the softkey, data can be entered alternatively using the spinwheel VAR.

- Turning the spinwheel VAR directly increases or reduces the setting value.

- On actuation of a number key, an input window is opened up, allowing the entry of further digits (or the hexadecimal letters A to F). The hardkey BACKSPACE deletes the last digit, CLEAR deletes the entire entry, STOP BREAK closes the input window without having transferred the value. ENTER is used to terminate the entry and transfer the value.

- In some cases, the entry can also be terminated by means of the unit keys, the entered value being transferred together with the desired unit, eg

    | 1 | | 5 | | dBm | ⇒   15 dBm

    When using the ENTER key, the currently set unit is used.

    | 1 | | 8 | | ENTER | ⇒   18 dBm

    The conversion of units is possible by pressing the respective unit key.

    Channel 0   ⇒ | MHz | ⇒   1897.344 MHz

1 out of n selection with softkeys

On actuation of a softkey, it appears in inverse video and the corresponding selection is made.

Loop toggle

Two or more operating states are displayed next to a softkey. The active status is shown inversely. The operating status can be changed by pressing the associated softkey (repeatedly if necessary).

Selection with confirmation

After activation of a softkey, any possible setting can be made with the spinwheel. The setting becomes effective by pressing the ENTER key.

Text input

Alphanumeric text entries (eg USER CONFIG) are made via a PC-AT keyboard connected to the rear of the instrument. Alternatively, characters can also be entered directly. The selection of characters is made using the spinwheel, the cursor position is changed using START (to the left) and LOCAL (to the right). The character left to the cursor is deleted using BACKSPACE.

Hardkeys

CONFIG

In addition to the measurement menus, there are many configuration menus, which permit the definition and variation of parameters for measurements and default settings. These configuration menus are selected either directly via the configuration tree or in the respective context by pressing the CONFIG hardkey.

MENU
UP

This key permits changing to the next higher menu. For example, it can be used to leave configuration menus, measurement menus or help menus.

MENU
HOME

This key permits direct return to the main menu.

HARD
COPY

After actuation of this key, the current screen contents is output to a connected printer. The appropriate printer driver is to be selected before in the printer configuration menu ("PRINTER").

RESET

On actuation of the RESET key, the following picture appears:


```
RESET DATA
```

"ALL DATA" resets all parameters.
"WITHOUT REMOTE" resets all parameters
without the IEEE ADDRESS and the RS232 configuration.
"MENU UP" will leave the menu without changing any data.

ALL
DATA

WITHOUT
REMOTE
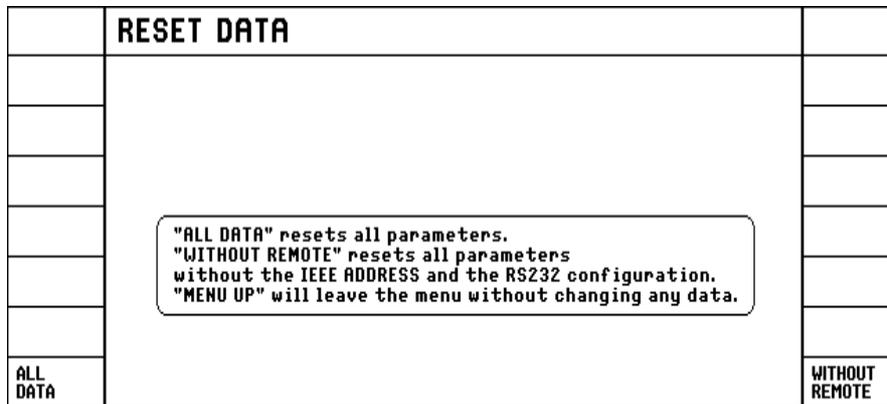
Fig. 2.3-1   RESET DATA menu

With the functions offered in this menu, the user can set the CMD60 to a defined initial status.

| ALL DATA | All internal parameters including the remote registers are reset. |

| WITHOUT REMOTE | All internal parameters except the remote registers are reset. This function is useful in the remote-control mode, for example, to prevent an interruption of the remote-control connection. |

If no reset is to be performed, the menu can be left using the keys MENU HOME or MENU UP. After triggering the two reset functions, a change is made to the main menu.

USER

By actuating the USER key, the user list is called up:

	USER		
USER 1	MUSTERMANN	MUSTERFRAU	USER 8
USER 2	MUELLER	MY DATA	USER 9
USER 3	MAYER		USER 10
USER 4	SCHMIDT		USER 11
USER 5	UNKNOWN		USER 12
USER 6	NOT KNOWN		USER 13
USER 7	NOBODY		USER 14

Fig. 2.3-2   USER menu

The SAVE/RECALL functions in the CMD60 can be used by different users (max. 14) independently of each other. Thus, every user can store his own settings under names selected by himself. The menu can be left using the keys MENU HOME or MENU UP.

The user names are entered in an extra configuration menu. This menu can be selected from the USER menu (Fig. 2.3-2) by pressing the CONFIG key:

	CONFIGURATION		
USER 1	MUSTERMANN	MUSTERFRAU	USER 8
USER 2	MUELLER	MY DATA	USER 9
USER 3	MAYER		USER 10
USER 4	SCHMIDT DR.NO.█		USER 11
USER 5	UNKNOWN		USER 12
USER 6	NOT KNOWN		USER 13
USER 7	NOBODY		USER 14

Fig. 2.3-3   CONFIGURATION (USER) menu

After activating the associated softkey, the user name can be entered numerically via the keypad and confirmed using the ENTER key. If an external AT keyboard is connected (rear of instrument), the entry can also be made alphanumerically. Alternatively, the selection of characters can be made using the spinwheel (see text input). For returning to the USER menu (Fig. 2.3-2), the MENU UP key is used.

SAVE/RECALL functions

Instrument settings, eg RF signal generator settings or tolerance values can be stored using this function. These settings can be recalled at a later date.

SAVE

By pressing the SAVE key, the following menu is called up:

	SAVE	USER 1 MUSTERMANN		
1	FILE_XYZ	FREE	8
2	SETTING 1	FREE	9
3	FREE		10
4	FREE	FREE	11
5	FREE	FREE	12
6	SETTING 5	SPECIAL	13
7	FREE	MEMCARD **INTERN**	MEMORY

Fig. 2.3-4   SAVE menu

1

to

13

By pressing one of these softkeys, the current instrument setting is stored under the name indicated next to the softkey. The name can be entered in the configuration menu in Fig. 2.3-5.

MEMORY

If INTERN is active, the setting is stored on the harddisk of CMD60. The name for the setting can be entered in the configuration menu in Fig. 2.3-5.
If MEMCARD is active, the instrument setting is stored on a memory card (only with Options CMD-B6 and CMD-B62). Storage is performed in this way irrespective of the selected user (USER).

The menu can be left with key MENU HOME or MENU UP.

After pressing the CONFIG key in the SAVE menu (Fig. 2.3-4), the configuration menu for entering the memory name is called up:

	CONFIGURATION			
1	FILE_XYZ	FREE	8
2	SETTING 1	FREE	9
3	FREE	Test 1.7.95	10
4	FREE	FREE	11
5	FREE	FREE	12
6	SETTING 5	SPECIAL	13
7	FREE		

Fig. 2.3-5   CONFIGURATION (SAVE) menu

The name under which a setting is to be stored can be entered numerically via the keypad after activation of the associated softkey and is confirmed with the ENTER key. If an external AT keyboard is connected (rear of instrument), an alphanumerical entry is also possible. Alternatively, characters can be entered using the spinwheel (see text input).

NOTE:
If settings are stored on the memory card, the configured name is also stored as directory name.

To return to the SAVE menu (Fig. 2.3-4), press the MENU UP key.

RECALL

By actuating the RECALL key, the following menu is called up:

DEFAULT VALUES	RECALL	USER 1	MUSTERMANN		
1	FILE_XYZ			FREE	8
2	SETTING 1			FREE	9
3	FREE				10
4	FREE			FREE	11
5	FREE			FREE	12
6	SETTING 5			SPECIAL	13
7	FREE		MEMCARD	**INTERN**	MEMORY

Fig. 2.3-6   RECALL menu

DEFAULT VALUES	All settings are reset to the default values.

1 to 13	By actuating one of these softkeys, the instrument setting with the name next to the softkey is loaded. The instrument then continues operation with the activated setting and tolerance values.
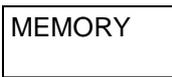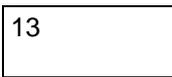
MEMORY	If INTERN is active, the setting is loaded from the harddisk of the CMD60. This is done separately for each user. The currently selected user (USER) is indicated in the upper status line. User names can be entered in the configuration menu in Fig. 2.3-5.

If MEMCARD is active, the instrument setting is read from a memory card (only with Options CMD-B6 and CMD-B62). Settings are loaded in this way irrespective of the selected user (USER).

NOTE:
Reading of the memory card contents is started when the menu is entered. When changing the card, the menu is to be left temporarily for reasons of consistency.

ILLUM

The brightness of the display can be varied in three steps.

BACK SPACE

The character last entered in a text window is deleted.

KEY HELP

Display of brief description of hardkeys.

2.4 Description of Operating Menus

After switch-on and initialization of the instrument, the main menu appears. Measurement functions can be selected by pressing the associated softkeys.

2.4.1 Main Menu

Fig. 2.4-1   Main menu

Return to the main menu can be made from any other menu by pressing the hardkey MENU HOME.

ADDIT. MEAS.	The menu ADDITIONAL MEASUREMENTS is called up (only with Option CMD-B41). This menu permits AF measurements to be performed (see sections 2.4.5 and 2.5.5).
MANUAL TEST	Depending on the selected DUT (PP-TEST or FP-TEST), you can go to the DECT signalling menus (manual operation). Depending on the mode selected, the CMD60 simulates a fixed part (in the PP-TEST) or a portable part (in the FP-TEST) (see sections 2.4.2 and 2.4.3).
MODULE TEST	This mode permits measurements on modules or DECT systems without requiring a call setup (see Section 2.4.4).
AUTO TEST	The autotest enables automatic sequences of measurement steps without any remote control function (see section 2.6).
CONFIG MENU	The configuration main menu is called up (see section 2.5.1). Apart from this softkey, the hardkey CONFIG also permits entering context-sensitive configuration menus.
GAP MODE	Selects the signalling mode for testing the DUT. With ON selected, normal signalling is used, with OFF selected, a test mode signalling is used which can handle only a limited set of test messages. With OFF selected, the DUT has to be set to the DECT test mode. This is a device-specific procedure and should be enquired from the manufacturer.
TEST MODE	Selection of a portable part (PP) or a fixed part (FP) as DUT. By subsequent actuation of the softkeys MANUAL TEST, the menu SIGNALLING PP-TEST or SIGNALLING FP-TEST is called up.

2.4.2   Manual Test

In this test mode, PPs (portable parts) and FPs (fixed parts) are tested manually with call setup. Depending on the selected mode (PP-TEST or FP-TEST), a change is made from the main menu to one of the menus SIGNALLING PP-TEST or SIGNALLING FP-TEST by actuating the softkey MANUAL TEST.

2.4.2.1   Menu SIGNALLING PP-TEST

In this menu, the CMD60 sends a dummy bearer signal for synchronization of the PP (portable part) as DUT. As a prerequisite for successful synchronization, the RFPI (Radio Fixed Part Identity) for the FP (fixed part) simulated by the CMD60 must be entered correctly. If this identification number is not known, it can be derived from the corresponding FP in the menu SIGNALLING FP-TEST (section 2.4.2.2).

Prior to the call setup, the PP under test is set to the test mode so that it can respond to test messages. This is done in different ways depending on the instrument (information to be obtained from the manufacturer). The display indicating whether the PP has synchronized is also instrument-specific.

When the PP has synchronized to the CMD60, a call setup can be made by actuating the softkey SETUP CONNECT.

If an external reference frequency and/or the SLAVE mode has been set in the menu SYNCHRONIZATION, a warning is output in the top right corner of this menu.

Fig. 2.4-2   Menu SIGNALLING PP-TEST

| ADDIT. MEAS. | The menu ADDITIONAL MEASUREMENTS is called (only with Option CMD-B41). This menu permits AF measurements to be performed (see sections 2.4.5 and 2.5.5). |

| CONNECT/ EXT. ATT. | This softkey is used to go to a configuration menu, in which the RF connectors and correction values for attenuation on external paths can be entered (see section 2.5.4.1). The values set are indicated in the SIGNALLING PP-TEST menu. |

MODE

Various modes of connection can be selected:

- LOOPBACK: the DUT (device under test) is set to the loopback mode in order to return the transmitted data without modification. This is the prerequisite for modulation and bit error rate measurements.

- NORMAL: the DUT converts the received data in the CODEC and passes them on to the loudspeaker. Signals recorded via the microphone are also converted and sent to the CMD60. The associated audio signals are available at the 50-contact socket of the CMD60. This mode permits audio measurements to be performed (microphone, loudspeaker, converter).

  NOTE:
  Not all portable parts permit audio connections in the test mode. Therefore, it may happen that the NORMAL and ECHO mode do not have the desired result.

- ECHO: the signals applied to the microphone are sent to the CMD60, delayed by one second, returned to the DUT and output at its loudspeaker. This mode permits fast qualitative testing of the DUT.

  NOTE:
  Not all portable parts permit audio connections in the test mode. Therefore, it may happen that NORMAL and ECHO mode do not have the desired result.

RFPI

Input of the Radio Fixed Part Identity. This is the identification number of the fixed part to be simulated. If the number is not known, it can be derived from the corresponding FP in the menu SIGNALLING FP-TEST (section 2.4.2.2).

As a prerequisite for a successful synchronization of the PP, the RFPI must be entered correctly.

DUMMY
SLOT

Input of the slot number of the dummy bearer to be transmitted. Permissible values are 0 to 11. It should however be noted that the slot values of dummy bearer and traffic bearer are not identical. Besides, adjacent slot values (eg 5 and 6; even 11 and 0 are adjacent) are permissible only if the channel numbers of dummy bearer and traffic bearer are identical.

DUMMY
CARRIER

Input of the channel number of the dummy bearer to be transmitted. Channel numbers from 0 to 9 are permissible. If the slot values of dummy bearer and traffic bearer are adjacent, the channel numbers of dummy bearer and traffic bearer must coincide. The assignment of channel numbers to the frequencies used is shown in the table below.

TRAFFIC
SLOT

Input of the slot number of the traffic bearer with call setup. Permissible values are 0 to 11. It should however be noted that the slot values of dummy bearer and traffic bearer are not identical. Besides, adjacent slot values (eg 5 and 6, even 11 and 0 are adjacent) are permissible only if the channel numbers of dummy bearer and traffic bearer are identical.

| TRAFFIC CARRIER | Input of the channel number of the traffic Carrier with call setup. Channel numbers from 0 to 9 are possible. If the slot values of dummy bearer and traffic bearer are adjacent, the channel numbers of dummy bearer and traffic bearer must coincide. The assignment of channel numbers to the frequencies used is shown in the table below. |

| RF LEVEL | Setting of the transmit power from -40 dBm to 100 dBm (referred to RF IN/OUT) in steps of 0.1 dB. |

| SETUP CONNECT. | Call setup and change to the menu CONNECTION ESTABLISHED. Please note that the call setup is successful only if the PP under test has been set to the device-specific test mode and has synchronized to the CMD60. This is indicated on the PP. |

Assignment of DECT channel numbers to frequencies

The following table shows the frequencies used in DECT in MHz. To enable simultaneous operation of a larger number of test stations and/or keeping up the telephone operation with DECT systems, the CMD60 permits to make use of extended channels. By varying the value CARRIER # OFFSET in the menu SIGNALLING PP/FP-TEST CONFIGURATION (see sections 2.5.2.1 and 2.5.2.2), it is possible to vary the assignment of the channel numbers to the frequencies by half the DECT channel spacing. This is an extension to DECT. Values for CARRIER # OFFSET unequal to zero are indicated in the menus SIGNALLING PP-TEST and SIGNALLING FP-TEST.

NOTE:
To make use of the feature of extended channels of the CMD60, the devices under test must be able to perform the same frequency assignment (exceeding DECT).

Channel	0	1	2	3	4	5	6	7	8	9
Offset -3	1902.528	1900.800	1899.072	1897.344	1895.616	1893.888	1892.160	1890.432	1888.704	1886.976
-2.5	1901.664	1899.936	1898.208	1896.480	1894.752	1893.024	1891.296	1889.568	1887.840	1886.112
-2	1900.800	1899.072	1897.344	1895.616	1893.888	1892.160	1890.432	1888.704	1886.976	1885.248
-1.5	1899.936	1898.208	1896.480	1894.752	1893.024	1891.296	1889.568	1887.840	1886.112	1884.384
-1	1899.072	1897.344	1895.616	1893.888	1892.160	1890.432	1888.704	1886.976	1885.248	1883.520
-0.5	1898.208	1896.480	1894.752	1893.024	1891.296	1889.568	1887.840	1886.112	1884.384	1882.656
0	**1897.344**	**1895.616**	**1893.888**	**1892.160**	**1890.432**	**1888.704**	**1886.976**	**1885.248**	**1883.520**	**1881.792**
0.5	1896.480	1894.752	1893.024	1891.296	1889.568	1887.840	1886.112	1884.384	1882.656	1880.928
1	1895.616	1893.888	1892.160	1890.432	1888.704	1886.976	1885.248	1883.520	1881.792	1880.064
1.5	1894.752	1893.024	1891.296	1889.568	1887.840	1886.112	1884.384	1882.656	1880.928	1879.200
2	1893.888	1892.160	1890.432	1888.704	1886.976	1885.248	1883.520	1881.792	1880.064	1878.336
2.5	1893.024	1891.296	1889.568	1887.840	1886.112	1884.384	1882.656	1880.928	1879.200	1877.472
3	1892.160	1890.432	1888.704	1886.976	1885.248	1883.520	1881.792	1880.064	1878.336	1876.608

Table 2.4-1: Channel/frequency assignment on CMD60

2.4.2.2 Menu SIGNALLING PP TEST in the GAP mode

In this menu, CMD60 sends the dummy bearer signal required for synchronizing the PP (portable part) as a DUT. However, a prerequisite for a successful synchronization is the correct entry of the PARK (portable access rights key) of the PP to be tested, which enables the CMD60 to send a suitable ARI (access rights identity) which is included in the PARK (Note: CMD60 only uses class A PARKs and ARIs). The IPUI (international portable user identity) of the PP must also be entered. If the PARK is not known, it can be obtained in the SIGNALLING FP-TEST menu, also in the GAP mode, from the corresponding FP.

A call can be set up as soon as the PP has synchronized to the CMD60. The indication whether the PP has synchronized or not is device-specific. Press the SETUP CONNECT softkey to simulate an incoming call and to cause the PP to ring. Press the key with the handset icon (pick up) on the PP to establish a connection. The call can also be set up directly from the PP without previously pressing the SETUP CONNECT key. This has no effect on the subsequent measurements.

ADDIT. MEAS.	SIGNALLING PP-TEST		0002953D9A	IPUI
CONNECT/ EXT.ATT.	USED RF CONNECTOR: RF IN/OUT Ext. Attenuation: 0.0 dB		000A04CF68	PARK
			0	DUMMY SLOT
			0	DUMMY CARRIER
	Wait for mobile synchronization before setup the connection ...			
			−50.0 dBm VAR	RF LEVEL
MODE	NORMAL ECHO		Press key to setup connection	SETUP CONNECT.

Fig. 2.4-3   Menu SIGNALLING PP-TEST GAP-MODE

Most of the softkey functions of this menu are identical with those described in section 2.4.2.1. The differences encountered in the GAP mode are described below. Note that in the GAP mode the PP decides about channel and slot used for a call setup. For this reason the TRAFFIC SLOT and TRAFFIC CARRIER softkeys are not longer available.

MODE

Different connect modes are available:

- NORMAL

  The DUT converts the received data in its CODEC and forwards them to the loudspeaker. Signals picked up by the microphone are also converted and sent to the CMD60. The corresponding audio signals are available at the 50-contact female connector of CMD60. In this mode, audio measurements (microphone, loudspeaker, converter) can be performed.

- ECHO

  The signals picked up by the microphone are sent to the CMD60 where they are delayed by one second, returned to the DUT and output at the DUT loudspeaker. In this mode a fast quality test of the DUT can be performed.

- The LOOPBACK setting of the normal SIGNALLING PP-TEST menu uses a message of the DECT test mode. This setting is therefore not available in the GAP mode and BER measurements cannot be performed.

IPUI

Entry of "international portable user identity". This is a number permitting an unambiguous identification of the PP.

A correctly entered IPUI is a precondition for a successful call setup.

PARK

Entry of "portable access rights key". It includes information on the access rights of the FP to be simulated. IF the PARK is not known, it can be obtained from the corresponding FP in the SIGNALLING FP-TEST menu (see section 2.4.2.4).

A correctly entered PARK is a precondition for the successful synchronization of the PP.

DUMMY
SLOT

Entry of slot number of dummy bearer to be sent. Permissible values are 0 to 11.

DUMMY
CARRIER

Entry of channel number of dummy bearer to be sent. Channel numbers from 0 to 9 can be entered. The assignment of the channel numbers to the frequencies to be used can be looked up in Table 2.4-1.

SETUP
CONNECT.

Simulation of an incoming call which causes the PP to ring. The connection is established when the PP is picked up even without prior pressing of SETUP CONNECT.

2.4.2.3 Menu SIGNALLING FP-TEST

In this menu, the CMD60 attempts to synchronize to the dummy bearer signal of the fixed part under test. The signalling status indicates LOCKED if the synchronization is successful, otherwise UNLOCKED. If the synchronization is successful, the slot, channel and RFPI of the FP to which the CMD60 has synchronized remain indicated.

If a value unequal to zero has been selected for CARRIER # OFFSET, this is indicated in the menu.

A successful call setup is possible only if the following conditions are met:

- The FP under test is set to the test mode and can thus respond to test messages. The way how to do this varies from instrument to instrument (information to be obtained from manufacturer).

- Signalling status: LOCKED

- The set RFPI (Radio Fixed Part Identity) and the detected RFPI correspond to each other.

- A PMID (Portable Part MAC Identity) accepted by the FP has been entered. Most FPs accept any PMID in the test mode. If necessary, the PMID of a PP corresponding to the FP can be derived from the menu CONNECTION ESTABLISHED in the PP-TEST.

- The value set for TRAFFIC SLOT is unequal to the value for DUMMY SLOT. If the slots are adjacent (eg 5 and 6, even 11 and 0 are adjacent), the values for TRAFFIC CARRIER and DUMMY CARRIER must be identical.

   NOTE:
   The values of the dummy bearer may change.

- The FP under test must be able to set up a traffic bearer with the selected slot/carrier pair. Many FPs accept even slot values only.

- The transmit power set is sufficiently high for the call setup.

If an external reference frequency has been set in the menu SYNCHRONIZATION, a warning is output in the top right corner of this menu.

A call setup can be started by means of softkeys SETUP CONNECT..

NOTE:
Synchronization is performed continuously even after activating the softkey SETUP CONNECT. It is thus ensured that only one connection to the FP with the set RFPI is made if signals from several FPs are received.

ADDIT. MEAS.	SIGNALLING FP-TEST		
CONNECT/ EXT.ATT.	USED RF CONNECTOR: RF IN/OUT Ext. Attenuation: 0.0 dB	0002501997	RFPI
		D1A2C	PMID
	Signalling Status: LOCKED		
	Dummy Slot: 3	0	TRAFFIC SLOT
ACCEPT RFPI	Dummy Carrier: 7	0	TRAFFIC CARRIER
SET RFPI FOR PP	Detected RFPI: 6162636465	−50.0 dBm	RF LEVEL
MODE	**LOOPBACK** NORMAL ECHO	Press key to setup connection	SETUP CONNECT.

Fig. 2.4-4 Menu SIGNALLING FP-TEST

ADDIT.
MEAS.

The menu ADDITIONAL MEASUREMENTS is called (only with Option CMD-B41). This menu permits AF measurements to be performed (see sections 2.4.5 and 2.5.5).

CONNECT/
EXT. ATT.

This softkey is used to go to a configuration menu in which the RF connectors and correction values for attenuation on external paths can be entered (see section 2.5.4.1). The selected values are indicated in the menu SIGNALLING FP-TEST.

ACCEPT
RFPI

The currently displayed value for "Detected RFPI" is accepted as RFPI setting.

SET RFPI
FOR PP

The currently displayed value for "Detected RFPI" is accepted as RFPI setting in the menu SIGNALLING PP-TEST (see section 2.4.2.1).

MODE

Various modes of connection can be selected:

- LOOPBACK: the DUT is set to the loopback mode in order to return the transmitted data without modification. This is a prerequisite for modulation and bit error rate measurements.

- NORMAL: the DUT converts the received data in its ADPCM. Recorded data are also converted and sent to the CMD60. The associated audio signals are available at the 50-contact socket of the CMD60. In this mode, audio measurements (converter) can be performed (see note for ECHO).

  NOTE:
  Not all fixed parts permit audio connections in the test mode. Therefore, it may happen that the NORMAL and ECHO modes do not have the desired result. The NORMAL and ECHO modes are more useful for portable parts than for fixed parts.

- ECHO: the signals applied to the FP are sent to the CMD60, delayed by one second and returned to the DUT. This mode permits fast qualitative testing of the DUT.

  NOTE:
  Not all fixed parts permit audio connections in the test mode. Therefore, it may happen that the NORMAL and ECHO modes do not have the desired result. The NORMAL and ECHO modes are more useful for portable parts than for fixed parts.

RFPI

Input of the "Radio Fixed Part Identity". This is an identification number of the fixed part under test. A successful call setup is possible only if the values of the selected and the received RFPI are identical.

PMID

Input of the "Portable Part MAC Identity". This is the identification number of the portable part to be simulated. Most FPs accept any PMID in the test mode. If necessary, the PMID of a portable part corresponding to the FP can be read from the menu CONNECTION ESTABLISHED in the PP-TEST.

| TRAFFIC SLOT | Input of the slot number of the traffic bearer on call setup. Permissible values are 0 to 11. It should be noted however that the slot values of dummy bearer and traffic bearer are not identical. Besides, adjacent slot values (eg 5 and 6, even 11 and 0 are adjacent) are permissible only if the channel numbers of dummy bearer and traffic bearer are identical. |

The FP under test must be able to set up a traffic bearer for the indicated slot value. Many FPs accept even slot values only.

NOTE:
The values of the DUMMY SLOT may change.

| TRAFFIC CARRIER | Input of the channel number of the traffic bearer on call setup. Channel numbers from 0 to 9 are possible. If the slot values of dummy bearer and traffic bearer are adjacent, the channel numbers of dummy bearer and traffic bearer must correspond to each other. The assignment of channel numbers to the frequencies used is indicated in section 2.4.2.1. |

| RF LEVEL | Setting of the transmit power from -40 dBm to -100 dBm (referred to RF IN/OUT) in steps of 0.1 dB. |

| SETUP CONNECT. | Call setup and change to the menu CONNECTION ESTABLISHED. Please note that a successful call setup is possible only if the above-mentioned conditions are met. |

2.4.2.4   Menu SIGNALLING FP TEST in the GAP mode

In this menu, CMD60 attempts to synchronize to the dummy bearer signal of the FP to be tested. With successful synchronization, the signalling status LOCKED is indicated, otherwise UNLOCKED. Once synchronization is achieved, the slot, channel and PARK of the FP to which the CMD60 has synchronized are also indicated.

A note is displayed in the menu if a value other than zero has been set for CARRIER # OFFSET.

The following requirements have to be met for a successful call setup:

- Signalling status: LOCKED

- The set IPUI (international portable user identity) corresponds to the PP associated with the FP.

- The set PARK (portable access rights key) and the detected PARK are identical.

- A PMID (portable part MAC identity, ie the identification number of the PP) is entered which is accepted by the FP. Most of the FPs accept any PMID. The PMID of a PP associated with the FP may be looked up in the CONNECTION-ESTABLISHED menu of the PP-TEST.

- The value set for TRAFFIC SLOT is unequal to the Dummy Slot value. If the slots are next to each other (eg 5 and 6 or 11 and 0), identical values have to be set for TRAFFIC CARRIER and Dummy Carrier.

    CAUTION:

    Dummy bearer values may change.

- The FP to be tested must be able to generate a traffic bearer on the specified slot/carrier pair. Many FPs accept even slot values only.

- The set transmit power is sufficient for a call setup.

If an external reference frequency has been set in the SYNCHRONIZATION menu, a respective warning is displayed in the top righthand corner of this menu.

A connection is now established by pressing the SETUP CONNECT. softkey.

CAUTION:

The synchronization procedure is continuously repeated. A new synchronization procedure is also performed upon pressing the SETUP CONNECT.. This ensures that a connection is established only to the FP with the set PARK when several FPs are received.

Fig. 2.4-5   Menu SIGNALLING FP-TEST GAP-MODE

Most of the softkey functions of this menu correspond to those described in section 2.4.2.3. The differences encountered in the GAP mode are described below.

ACCEPT PARK	The currently displayed value for the detected PARK is stored as PARK setting.

SET PARK FOR PP	The currently displayed value for the detected PARK is stored in the SIGNALLING PP-TEST menu as PARK setting (see section 2.4.2.2).

MODE	Different connect modes are available:

- NORMAL

  The DUT converts the received data in its ADPCM. Picked up signals are also converted and sent to the CMD60. The corresponding audio signals are available at the 50-contact female connector of CMD60. In this mode, audio measurements (converter) can be performed (see note under ECHO).

- ECHO

  The signals present at the FP are sent to the CMD60, delayed for one second and then returned to the DUT. In this mode, a fast quality test of the DUT can be performed.

- The LOOPBACK setting from the normal SIGNALLING PP-TEST menu uses a message of the DECT test mode. This setting is therefore not available in the GAP mode and BER measurements cannot be performed.

IPUI	Entry of "International portable user identity". This number permits an unambiguous identification of the PP to be simulated.

A correctly entered IPUI is a precondition for a successful call setup.

PARK	Entry of "portable access rights key". It includes information on the access rights of the FP. A successful call setup is only possible if the set and the received PARK are identical.

TRAFFIC SLOT	Entry of slot number of Traffic Bearer for a call setup. Permissible values are 0 to 11. Make sure that the slot values for Dummy Bearer and Traffic Bearer are not identical. Adjacent slot values (eg 5 and 6 or 11 and 0) are only permissible when the channel numbers of the dummy bearer and the traffic bearer are identical.

The FP to be tested must be able to generate a traffic bearer on the specified slot value. Many FPs accept only odd slot values.

CAUTION:

Dummy slot values may change.

TRAFFIC CARRIER	Entry of channel number of Traffic Bearer for a call setup. Channel numbers from 0 to 9 are permissible. If the slot values of Dummy Bearer and Traffic Bearer are neighbouring, the channel numbers of Dummy Bearer and Traffic Bearer must be identical. The assignment of channel numbers and frequencies used can be looked up in section 2.4.2.1.

RF LEVEL	Setting the transmit power from -40 dBm to -100 dBm (referred to RF IN/OUT) in 0.1 dB steps.

SETUP CONNECT.	Call setup and branching to the CONNECTION ESTABLISHED menu. Please note that the requirements described at the beginning of the section must be met for a successful call setup.

2.4.3 DECT Measurements

In this section the measurement menus are described. They apply both to portable parts and fixed parts. If there are any differences, these will be explained.

CAUTION:
Working in the GAP mode involves some new aspects, because in this mode the bit pattern sent by the DUT cannot be influenced. In the GAP mode, the bit pattern sent by the DUT is always a random sequence.

2.4.3.1 Menu CONNECTION ESTABLISHED

In this menu, a combined power/modulation measurement is performed. For this purpose, the CMD60 sends the data "0000111100001111...", which are received and returned by the DUT (not in the GAP mode, see above). This type of signal is interpreted as "silence" by the converters.

The measured values are averaged over a number of bursts which can be set in the configuration menus POWER RAMP CONFIGURATION or 00RF - MODULATION.

The NTP (normal transmit power) is the power in dBm averaged over the DECT burst.

The frequency offset is obtained as the average of the demodulated signal over the B field for a selectable number of received bursts. Besides, the maximum and minimum modulation deviation is calculated that deviates from this average value.

The channel number and slot of the traffic bearer are displayed. Besides, the detected PMID of the PP under test appears in the PP-TEST. You may use this PMID in the FP test if the FP belonging to the PP does not accept any other PMID.

Fig. 2.4-6   CONNECTION ESTABLISHED menu

If the call is released (eg due to interference from other DECT units or excessive path attenuation), this is indicated by the message "Poor Signal Quality" in the upper menu area. In this case, it is necessary to return to the menu SIGNALLING PP/FP-TEST (keys BEARER RELEASE or MENU UP) and set up the call again.

By changing the values for TRAFFIC SLOT and TRAFFIC CARRIER, the traffic bearer can be changed during the call setup. This is done in different ways for portable parts and fixed parts.

NOTE: In the GAP mode, CMD60 cannot perform a bearer handover.

With portable parts, the CMD60 sends the message "FORCE TRANSMIT" with the "keep-previous" bit reset. This causes the PP to clear down the old bearer and set up a new one. To maintain synchronization of the PP, the switch DUMMY IF TRAFFIC in the signalling configuration menu (see section 2.5.2.1) should be set to ON. It must further be ensured that the settings for the dummy bearer

and traffic bearer do not contradict each other (it is not permissible to use the same slots, nor different channel numbers for adjacent slots).

With fixed parts, the message "BEARER HANDOVER" is sent. This causes a second bearer to be set up and the previous bearer to be cleared down subsequently. If it is not possible to set up a new bearer while the previous one still exists (identical slots, or different channel numbers with adjacent slots), a brief changeover is made to an intermediate slot. This intermediate bearer is in the same channel as the original bearer and is placed in a slot that is spaced from the original bearer by an even number and is not occupied by the dummy bearer.

NOTE:
The described method of bearer changeover is not supported by all DECT systems. If "Poor Signal Quality" is displayed after an attempted changeover, this indicates that changeover was not successful. In case of doubt, the bearer can be changed by clearing down the existing call, changing the bearer parameters and setting up a new call.

NOTE ON REMOTE CONTROL:
In the remote control mode, a slot and channel change can be effected during a call (DCE status) by means of configuration commands (eg CONFigure:PP:TRAFfic:SLOT for changing the slot and CONFigure:PP:TRAFfic:CARRier for changing the carrier).

ADDIT. MEAS.	The ADDITIONAL MEASUREMENTS menu is called (only with Option CMD-B41). In this menu, AF measurements can be performed (see sections 2.4.5 and 2.5.5).
POWER RAMP	By pressing this softkey, the power ramp measurement is started. The menu changes to the display for this measurement.
MODU-LATION	By pressing this softkey, the modulation measurement is started. The menu changes to the display for this measurement.
TIMING	By pressing this softkey, the timing measurement is started. the menu changes to the display for this measurement.
BER	By pressing this softkey, the bit error rate measurement is started. The menu changes to the display for this measurement.
ESCAPE SEQENCE	By pressing this softkey, the message displayed in hexadecimal format is sent as an MT message (MAC message). Messages can be set or modified with the hardkey CONFIG.

This feature of the CMD60 permits the use of device-specific escape messages starting with number "7".

Test messages start with "2", test escape messages with "24".

NOTE:
This softkey is not required for normal test operation. Incorrect MT messages may cause a call release.

TRAFFIC SLOT	Softkey for entry of slot number of traffic bearer for changing the slot during a call *(see NOTE above).*
TRAFFIC CARRIER	Softkey for entry of channel number of traffic bearer for changing the channel during a call *(see NOTE above).*

RF LEVEL	Setting of transmit power between -40 dBm and -100 dBm (referred to RF IN/OUT) in steps of 0.1 dB.

BEARER RELEASE	When this softkey is pressed, the CMD60 releases the call. It changes to the previous SIGNALLING PP/FP-TEST menu, from where a new call can be set up.

2.4.3.2   Menu POWER RAMP

In this menu, the power ramp of a burst of the DUT is displayed as a function of time. The first bit of the burst (P0) derived from the modulation signal (not displayed) is used as the time reference. Bit P0 is derived with an accuracy of approx. 1/12 bit, ie approx. 0.075 µs.

The CMD60 uses "0000111100001111..." as transmit data. These data are received and returned by the DUT (not in the GAP mode, see above). This type of signal is interpreted as "silence" by the converters.

The NTP is averaged over a number of bursts selectable in the configuration menu POWER RAMP CONFIGURATION.
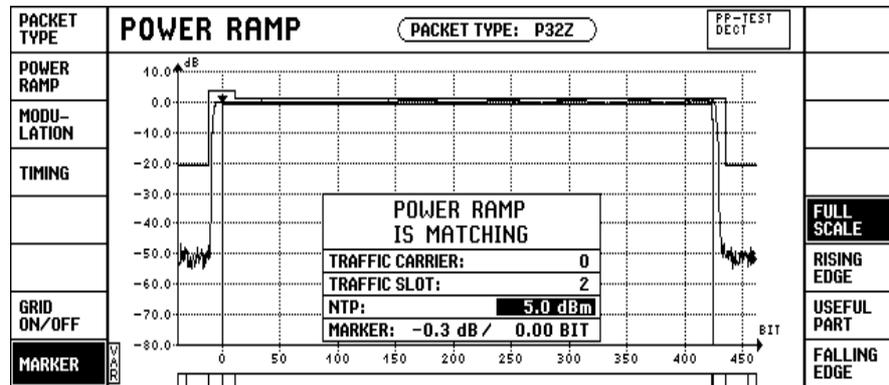
Fig. 2.4-7   Menu POWER RAMP

In this measurement menu, the display consists of the following items:

- Measurement curve showing the power ramp versus time.

- Tolerance mask. For the test to be successful, the measurement curve must not exceed the tolerance mask (power template) which is shown graphically. The tolerances can be entered in a configuration menu (see section 2.5.3.2). Depending on the type of measurement selectable in the configuration menu (HIGH DYNAMIC or LOW DYNAMIC), the limit values are used for the low power levels.

- Text. The traffic carrier, traffic slot and the power averaged over the burst (NTP) are indicated. Furthermore, an overall judgement indicates whether the power ramp measured always lies within the tolerance mask. Likewise, the marker coordinates are represented as bit number and relative power with respect to the NTP.

- Status bar. A bar in the bottom part of the menu indicates in which time segment the tolerance mask is exceeded.

PACKET TYPE	The following packet types may be selected

- P32

- P32Z

- PP32

- PP32Z

The (P)P32Z packet is identical to the (P)P32 packet, except that it has an extra four bits (the Z-field) appended which are a repeat of the last four bits of the P32 packet (the X-field). This test helps in the detection of collisions from multiple sources. In the PP32(Z) packet, 16 additional alternating bits (prolonged preamble) are sent before the first alternating 16 bits (preamble).

The default value after a system reset is P32Z.

The shape of the power ramp template shown on this menu changes according to the packet type selected.

POWER RAMP	Start of power ramp measurement in single-shot mode or after a stop caused by a tolerance being exceeded. Stop and start of measurement in continuous mode.

MODU-LATION	By pressing this softkey, the modulation measurement is started. The menu changes to the display for this measurement.

TIMING	By pressing this softkey the timing measurement is started. The menu changes to the display for this measurement.

GRID ON/OFF	This softkey is used to display a grid to facilitate reading of the measurement curve.

MARKER	After activation of this softkey, the marker position can be varied by turning the spinwheel or via a numerical entry in order to display the relative power with respect to the NTP.

FULL SCALE	Display of full power ramp (zoom function).

RISING EDGE	The rising edge of the burst is displayed (zoom function).

USEFUL PART	The part of the burst used for data transfer is displayed with higher resolution (zoom function).

FALLING EDGE	The falling edge of the burst is displayed (zoom function).

2.4.3.3   Menu RF MODULATION

In this menu, the demodulated signal of a burst of the DUT is displayed as a function of time. The first bit of the burst (P0) derived from the signal is used as the time reference.

The following patterns can be selected as transmit data:

- "FIG31". This data pattern is of interest for modulation measurement since it contains long sequences of successive "zeroes" and "ones" (measurement of maximum modulation deviation) and since there is a sequence of alternating "zeroes" and "ones" at the end. The latter is a prerequisite for performing drift measurements.

- "01010101".   Data sequence with the smallest deviation.

- "00110011".

- "00001111".   This data pattern is interpreted as "silence" by the converters (CODEC).

- "PSRBS".   Pseudo-random bit sequence: random numbers similar to the data sent in real operation.

- "SPRBS"   Static pseudo-random bit sequence: sequence of random numbers that is the same in all frames.
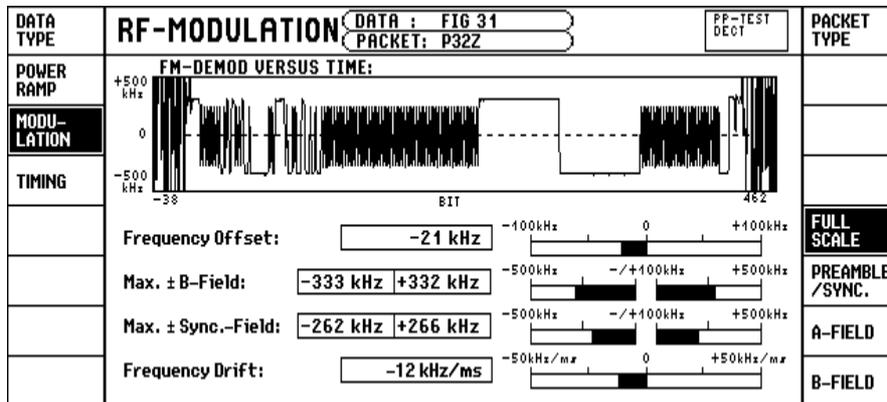
Fig. 2.4-8a   Menu RF - MODULATION
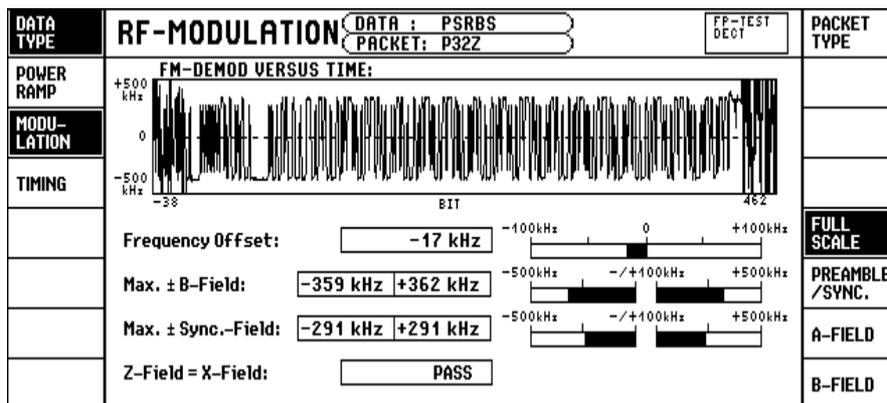
Fig. 2.4-8b   Menu RF - MODULATION

The display in this measurement menu shows the graphical curve of the FM-demodulated signal of a burst of the DUT versus time. Below the curve, the following measured values are displayed as numerical values and as analog bars. The modulation pattern corresponds to the data bits sent to DUT and returned by it:

- Frequency offset. It is obtained as the average of the demodulated signal over the B field for a selectable number of received bursts.

- Max. ± B field modulation. The peak values of the modulation deviation measured over the B field that maximally and minimally deviate from the frequency offset.

- Max. ± sync field modulation. The peak values of the modulation deviation measured over the S field (synchronization field) that deviate maximally and minimally from the frequency offset. The sync field consists of alternating "zeroes" and "ones" (8 zeros and 8 ones) at the beginning of the burst.

- Frequency drift. The latter is obtained from the frequency that varies within a burst. The frequency drift can only be measured by means of data patterns ending with "zero-one sequences". These are: "FIG31" and "01010101".

  Measurement of the frequency drift is performed as follows: The mean modulation deviation is formed each of the middle 14 bits of the 16 preamble bits and of the first 14 bits of the last 16 B field bits. The difference is multiplied by a constant, and the result is the frequency drift in kHz/ms.

  NOTE:
  This measurement is very sensitive to interference, therefore averaging should be performed over a large number of bursts. 200 bursts are recommended by the CTR06 specification.

- Z-field=X-field. This measurement compares the Z-field (the last four bits of a P32Z packet) with the previous four bits (the X-field) for each burst. If the X-field and Z-field are different for any burst within the number of bursts over which the other measurements are averaged, then the comparison fails. The Z-field=X-field comparison is only made for the "PSRBS" data type.

  NOTE:
  The Z-field=X-field test is only displayed when the data type is "PSRBS". The frequency drift measurement is only displayed when the data type is "FIG31" or "01010101".

The limit values for the measurement and the number of bursts over which the modulation values are to be averaged are entered in a configuration menu (see section 2.5.3.3).

DATA TYPE	Selection of data type used for modulation measurements.
POWER RAMP	By pressing this softkey, the power ramp measurement is started. The menu changes to the display for this measurement.
MODU-LATION	Start of the modulation measurement in single-shot mode or after a stop caused by a tolerance being exceeded. Stop and start of measurement in continuous mode.
TIMING	By pressing this softkey, the timing measurement is started. The menu changes to the display for this measurement.
FULL SCALE	Display of complete modulation characteristic (zoom function). The zoom function only affects the display, not the measurement itself.
PREAMBLE/ SYNC.	Display of preamble and of synchronization word (zoom function). The zoom function only affects the display, not the measurement itself.

| A-FIELD | Display of A field (zoom function). The zoom function only affects the display, not the measurement itself. |

| B-FIELD | Display of B field (zoom function). The zoom function only affects the display, not the measurement itself. |

The bit pattern sent by the DUT in the GAP mode is always a random sequence. Because of this, the frequency drift cannot be evaluated and displayed when modulation measurements are made. Apart from that, the modulation measurements and the RF MODULATION menu are as described above.
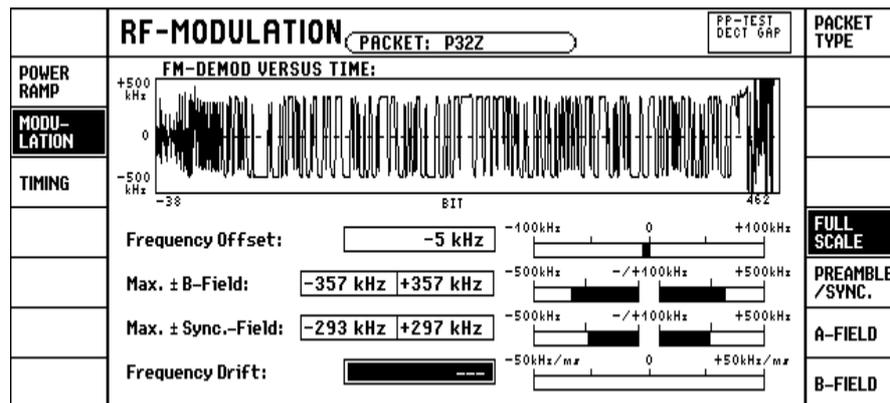
Fig. 2.4-8c   Menu RF-MODULATION GAP-MODE

2.4.3.4   Menu TIMING

With this menu, time parameters can be measured. To this end, the CMD60 transmits the sequence "0000111100001111...", which is received and returned by the DUT. This type of signal is interpreted by the converters as "silence". Of the received bursts, the time of the first bit (P0) is determined first, then the accuracy of successive bursts is calculated.

```
┌──────────┬──────────────────────────────────────────────┬────┐
│          │ TIMING                               ┌──────┐ │    │
│          │                                      │PP-TEST│ │    │
│          │                                      │DECT  │ │    │
│ POWER    │                                      └──────┘ │    │
│ RAMP     │                      -10 ppm    0    +10 ppm  │    │
│──────────│ Time Accuracy:  ┌─────────┐                   │    │
│ MODU-    │                 │ 0.00 ppm│   ├────┼────┤     │    │
│ LATION   │                 └─────────┘                   │    │
│──────────│                                               │    │
│ TIMING   │                                               │    │
│          │ Max. Pos. Jitter: ┌───────┐                   │    │
│          │                   │ 0.10 µs│                  │    │
│          │                   └───────┘                   │    │
│          │ Max. Neg. Jitter: ┌───────┐                   │    │
│          │                   │-0.12 µs│                  │    │
│          │ Max. Packet Delay:┌───────┐                   │    │
│          │                   │-2.10 µs│                  │    │
│          │ Min. Packet Delay:┌───────┐                   │    │
│          │                   │-2.25 µs│                  │    │
│          │                                               │    │
└──────────┴──────────────────────────────────────────────┴────┘
```
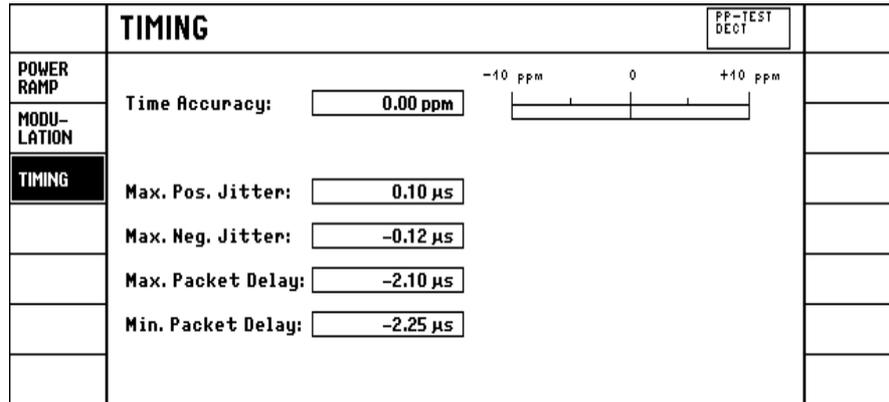
Fig. 2.4-9   Menu TIMING

The following measured values are displayed:

- Time Accuracy. This is the accuracy of the time period elapsing until a selectable number of bursts (see configuration menu in section 2.5.3.4) has been received, measured with respect to the time standard of the CMD60. This value is also indicated by an analog bar.

- Max. Pos. Jitter. The maximum time interval between two successive bursts minus the average time period.

- Min. Pos. Jitter. The minimum time interval between two successive bursts minus the average time period.

Additionally in PP-TEST:

- Max. Packet Delay
  Maximum time interval between bursts of the CMD60 as FP and bursts of the PP under test minus 5 ms.

- Min. Packet Delay
  Minimum time interval between bursts of the CMD60 as FP and bursts of the PP under test minus 5 ms.

| POWER RAMP | By pressing this softkey, the power ramp measurement is started. The menu changes to the display for this measurement. |

| MODU-LATION | By pressing this softkey, the modulation measurement is started. The menu changes to the display for this measurement. |

| TIMING | Start of the timing measurement in single-shot mode or after a stop caused by a tolerance being exceeded. Stop and start of the measurement in continuous mode. |

2.4.3.5   Menu BIT ERROR RATE

In contrast to the other tests, the bit-error-rate test is used for measuring the receiver of the DUT. The received bits are compared with the transmitted bits. The number of bits detected to be faulty compared to the number of all bits received yields the bit error rate (BER). However, if at least 25% of all bits of a frame are detected to be faulty, they are not considered in the BER, but in the frame error rate FER, which is the ratio of faulty frames to all frames.

NOTE:
Since the DUT does not return the received data, BER measurements are not possible in the GAP mode. A receiver measurement cannot therefore be performed.

The following data patterns can be selected:

- "FIG31"   128 bits with the pattern "01010101...", 64 bits "1", 64 bits "0", 64 bits with the pattern "010101..."

- "01010101"   320 bits with the pattern "01010101..."

- "00110011"   320 bits with the pattern "00110011..."

- "00001111"   320 bits with the pattern "00001111..."

- "PRBS"   CCITT O.153 pattern with the period $2^{11}-1$ in accordance with CTR06 (default)

- "SPRBS"   Static pseudo-random bit sequence with the period 320, ie same sequence of random numbers for all frames
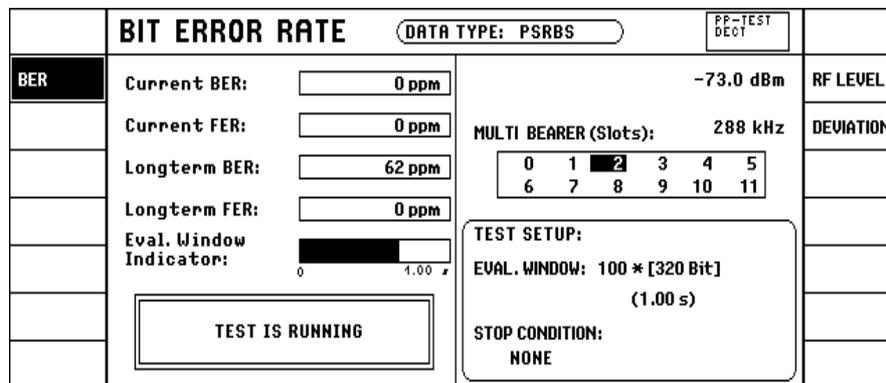
Fig. 2.4-10   Menu BIT ERROR RATE

The displays "Current BER" and "Current FER" indicate current values, the displays "Longterm BER" and "Longterm FER" indicate values averaged for a time window (Evaluation Window) to be set in the configuration menu (see section 2.5.3.5). The bargraph of the "Evaluation Window Indicator" shows the time elapsed compared to the measurement time.

A special feature of the CMD60 is its capability of determining bit errors simultaneously in several time slots. Since the bit error rate measurement is one of the most time-consuming measurements, this feature is particularly important if only short measurement times are available.

The slots involved in the measurement are displayed in inverse video in the right half of the menu. They can be selected in the configuration menu. After leaving the configuration menu, a call setup for the other bearers is attempted. If the call setup fails, this is indicated by the fact that the bearer in question is not displayed in inverse video. All further slots use the channel number (carrier) of the traffic bearer. All of the six slots can be used in the PP TEST, and two in the FP TEST.

NOTE:
Not all DECT systems can set up and maintain calls to the same partner in several slots simultaneously.

For example, if two traffic bearers are set up and an FER of 50% is displayed, this indicates that a second slot can be set up (eg for the purpose of handover) but that this slot is not intended for data transmission.

If the dummy slot of an FP is maintained after the call setup, this may prevent a further bearer from being set up in the dummy slot and its adjacent slot.

Another window indicates the size of the time window, the resulting net measurement time and the stop condition for the measurement. These parameters can be set in the configuration menu (see section 2.5.3.5).

| BER |

Start of bit error rate measurement in single-shot mode or after a stop caused by a tolerance being exceeded. Stop and start of the measurement in continuous mode.

| RF LEVEL |

Setting of transmit power (also during a measurement) between -40 dBm and -100 dBm (referred to RF IN/OUT) in steps of 0.1 dB. By varying the transmitted power, the limit of sensitivity of the DUT receiver can be determined.

| DEVIATION |

For setting the transmitter frequency deviation. The transmitter deviation can take values in the range 0...510 kHz in steps of 2 kHz. The default value of the transmitter deviation is 288 kHz.

2.4.4 Module Test

In this mode, measurements on modules or DECT systems can be performed without call setup and signalling.

2.4.4.1 Menu BURST ANALYSIS

In this menu, a combined power/modulation measurement can be performed for investigating transmitter units. The time range for the measurements is determined by the parameters MEAS. WINDOW (time window), TRIGGER DELAY (delay of the measurement after the trigger event) and TRIGGER (selected trigger mode).

ADDIT. MEAS.	BURST ANALYSIS			MOD-TEST DECT	
POWER VS. TIME	NTP:	−49.6 dBm		24 dBm	EXP. POWER
MODU-LATION	Freq. Offset:	−27 kHz		1897.344 MHz	FREQ./ RF CHAN.
	Max. ± Modulation:	523 kHz			
		−476 kHz		**MEASURED** NOMINAL ±PEAK/2	MOD. REF.
RF GEN.				350 µs	MEAS. WINDOW
CONNECT/ EXT. ATT.	USED RF INPUT: RF IN/OUT Ext. Attenuation: 0.0 dB			0 µs	TRIGGER DELAY
				FREE RUN	TRIGGER

Fig. 2.4-11   Menu BURST ANALYSIS

The following measured values are displayed:

- NTP
  Average power for selected measurement window in dBm. Since the average power does not correspond to the average of the dBm values (logarithm), the high power values are preferably considered in an intelligent averaging procedure.

- Frequency Offset
  This value is obtained as the average of the demodulated signal in the measurement window. If the number of modulated "zeroes" and "ones" is the same (eg with data pattern "010101"), the measured value corresponds to the frequency offset.

- Max. ± Modulation
  The positive and negative peak values of the demodulated signal compared with the frequency offset. The measurement of the maximum positive and negative modulation requires a signal with an even distribution of "zeroes" and "ones" in the measurement window.

Moreover, the values set for the external attenuation are displayed in the menu.

ADDIT. MEAS.	The ADDITIONAL MEASUREMENTS menu is called up (only with Option CMD-B41). This menu permits AF measurements to be performed (see sections 2.4.5 and 2.5.5).
POWER VS. TIME	By pressing this softkey, the power measurement is started as a function of time. The menu changes to the display for this measurement.
MODU-LATION	By pressing this softkey, the modulation measurement is started within the module test. The menu changes to the display for this measurement.

RF GEN.

Selection of RF SIGNAL GENERATOR menu for investigating receive units.

CONNECT/
EXT. ATT.

This softkey is used for going to a configuration menu (see section 2.5.4.1) in which the RF connectors and correction values for external path attenuations can be entered. The selected values are displayed in the BURST ANALYSIS menu.

EXP.
POWER

Setting of the maximum expected power between -10 dBm and 30 dBm in steps of 1 dB for fully utilizing the dynamic range of the test receiver of the CMD60.

NOTE:
If a value below the power of the measured signal is selected, the measured NTP value is not correct.

FREQ./
RF CHAN.

Input of the frequency or channel number of the signal to be received. The frequency input is terminated with the key "MHz A", the channel number input with "dB D". Channel numbers between -3 and 12 at half the DECT channel spacing (864 kHz) are possible.

MOD.
REF

The reference frequency against which the modulation is measured can be selected. The values are:

- MEASURED.
  The mean frequency of the measured signal. This mode is also used in manual test (CTR06).

- NOMINAL.
  The exact centre frequency of the carrier, as selected by the user.

- ±PEAK/2.
  The mid-point between the measured minimum and maximum measured peaks.

The default value is MEASURED.

MEAS.
WINDOW

Setting of discrete values between 25 µs and 1000 µs for the measurement window.

TRIGGER
DELAY

Setting of time values for the measurement delay after the trigger event from 0 to 10 ms in steps of 1 µs. In the trigger mode FREE RUN, the value set for TRIGGER DELAY is irrelevant.
TRIGGER DELAY also allows displaying the rising edge of a periodical signal triggered with the condition RISING SLOPE.

TRIGGER

Selection of one of the following trigger modes:

- FREE RUN
  The measurement is restarted again and again without any trigger condition being present.

- RISING SLOPE
  The measurement is started with rising power as the trigger event.

- EXTERNAL
  The measurement is started with the rising edge of the signal EXT_TRIGGER at the 50-contact socket on the rear.

2.4.4.2　Menu POWER VERSUS TIME

In this menu, the power ramp versus time can be displayed. This type of measurement, too, can be used for testing transmitter units without requiring a call to be set up. The time range for the measurements is determined by the parameters MEAS. WINDOW (time window), TRIGGER DELAY (delay of the measurement after the trigger event) and TRIGGER (selected trigger mode).
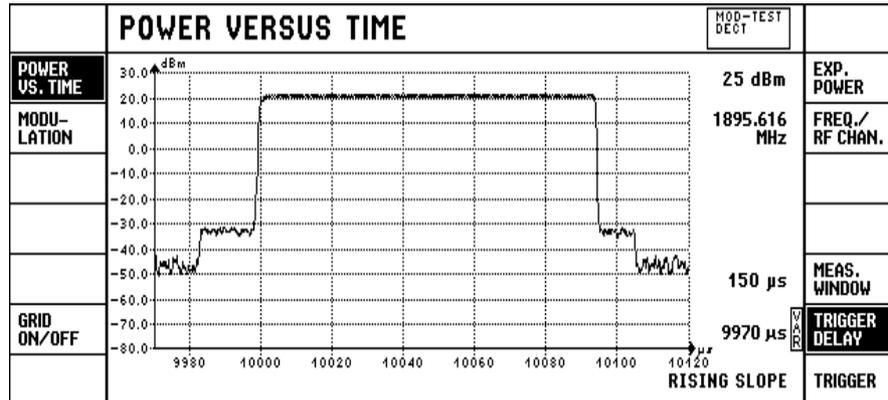
Fig. 2.4-12　Men POWER VERSUS TIME

| POWER VS. TIME | By pressing this softkey, the measurement is stopped and continued again. |

| MODU-LATION | By pressing this softkey, the modulation measurement in the module test is started. The menu changes to the display for this measurement. |

| GRID ON/OFF | This softkey is used for displaying a grid to facilitate reading of the measurement curve. |

| EXP. POWER | Setting of the maximum expected power between -10 dBm and 30 dBm in steps of 1 dB for fully utilizing the dynamic range of the test receiver of the CMD60.

NOTE:
If a value below the power of the measured signal is selected, the measured curve is not correct. |

| FREQ./ RF CHAN. | Input of the frequency or channel number of the signal to be received. The frequency input is terminated with the key "MHz A", the channel number input with "dB D". Channel numbers between -3 and 12 at half the DECT channel spacing (864 kHz) are possible. |

| MEAS. WINDOW | Setting of discrete values between 25 µs and 1000 µs for the measurement window. The selected value considerably influences the repetition rate of the measurement. |

TRIGGER DELAY	Setting of time values for the measurement delay after the trigger event from 0 to 10 ms in steps of 1 µs. In the trigger mode FREE RUN, the value set for TRIGGER DELAY is irrelevant.

TRIGGER DELAY also allows displaying the rising edge of a periodical signal triggered with the condition RISING SLOPE.

TRIGGER	Selection of one of the following trigger modes:

- FREE RUN
  The measurement is restarted again and again without any trigger condition being present.

- RISING SLOPE
  The measurement is started with rising power as the trigger event.

- EXTERNAL
  The measurement is started with the rising edge of the signal EXTTRG at the 50-contact socket (pin 19) on the rear.

2.4.4.3   Menu RF - MODULATION

In this menu, the demodulated signal versus time can be displayed. This type of measurement, too, can be used for testing transmitter units without requiring a call to be set up. The time range for the measurements is determined by the parameters MEAS. WINDOW (time window), TRIGGER DELAY (delay of the measurement after the trigger event) and TRIGGER (selected trigger mode).
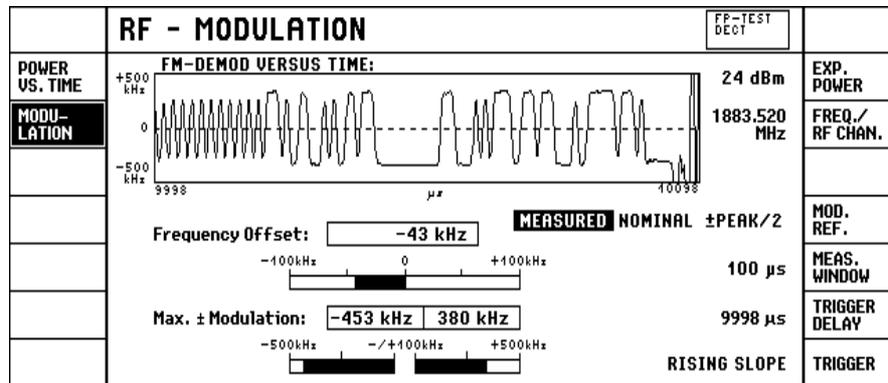
Fig. 2.4-13   Menu RF - MODULATION

The following measured values are displaced in addition to the measurement curve:

- Frequency Offset
  This value is obtained as the average of the demodulated signal in the measurement window. To measure the frequency offset, a signal with an equal number of "zeroes" and "ones" (eg "010101") is required.

- Max. ± Modulation
  The positive and negative peak values of the demodulated signal compared with the frequency offset. To measure the maximum positive and negative modulation, a signal with an even distribution of "zeroes" and "ones" in the measurement window is required.

| POWER
VS. TIME | By pressing this softkey, the power measurement is started as a function of time. The menu changes to the display for this measurement. |

| MODU-
LATION | By pressing this softkey, the measurement is stopped and continued again. |

| EXP.
POWER | Setting of the maximum expected power between -10 dBm and 30 dBm in steps of 1 dB for fully utilizing the dynamic range of the test receiver of the CMD60. |

| FREQ./
RF CHAN. | Input of the frequency or channel number of the signal to be received. The frequency input is terminated with the key "MHz A", the channel number input with "dB D". Channel numbers between -3 and 12 at half the DECT channel spacing (864 kHz) are possible. |

MOD.
REF

The reference frequency against which the positive and negative modulations are measured may be selected. The values are:

- MEASURED.
  The mean frequency of the measured signal.

- NOMINAL.
  The exact centre frequency of the carrier, as selected by the user. This mode is also used in manual test (TBR06).

- ±PEAK/2.
  The mid-point between the measured minimum and maximum measured peaks.

The default value is MEASURED. The graphical display is not influenced by this setting.

MEAS.
WINDOW

Setting of discrete values between 25 µs and 1000 µs for the measurement window. The selected value considerably influences the repetition rate of the measurement.

TRIGGER
DELAY

Setting of time values for the measurement delay after the trigger event from 0 to 10 ms in steps of 1 µs. In the trigger mode FREE RUN, the value set for TRIGGER DELAY is irrelevant.

TRIGGER DELAY also allows displaying the rising edge of a periodical signal triggered with the condition RISING SLOPE.

TRIGGER

Selection of one of the following trigger modes:

- FREE RUN
  The measurement is restarted again and again without any trigger condition being present.

- RISING SLOPE
  The measurement is started with rising power as the trigger event.

- EXTERNAL
  The measurement is started with the rising edge of the signal EXT_TRIGGER at the 50-contact socket on the rear.

2.4.4.4   Menu RF SIGNAL GENERATOR

Fig. 2.4-14   Menu RF SIGNAL GENERATOR

| ADDIT. MEAS. | The ADDITIONAL MEASUREMENTS menu is called (only with Option CMD-B41). With this menu, AF measurements can be performed (see sections 2.4.5 and 2.5.5). |

| FREQ./ RF CHAN. | Input of the frequency or channel number of the signal to be transmitted. The frequency input is terminated with the key "MHz A", the channel number input with "dB D". Channel numbers between -3 and 12 at half the DECT channel spacing (864 kHz) are possible. |

| DEVIATION | Input of the modulation deviation between 0 and 510 kHz in multiples of 2 kHz. For an unmodulated signal, 0 must be entered. |

SIGNAL

Selection of one of the following modulation data patterns:

- CONST.ENVELOP (01010101)
  Non-pulsed signal with a modulation frequency of 576 kHz corresponding to the data sequence "01010101".
- CONST.ENVELOP (00110011)
  Non-pulsed signal with a modulation frequency of 288 kHz corresponding to the data sequence "00110011".
- CONST.ENVELOP (00001111)
  Non-pulsed signal with a modulation frequency of 144 kHz corresponding to a data sequence of "00001111".
- CONST.ENVELOP EXTERN
  Non-pulsed signal that can be modulated with an external signal via the TTL-compatible digital input T_DATA_IN (pin 20 of 50-pin multifunction connector).
- BURST (01010101)
  Pulsed signal with a modulation frequency of 576 kHz corresponding to the data sequence "01010101". The burst lasts approx. 370 µs and is repeated every 10 ms.
- BURST (00110011)
  Pulsed signal with a modulation frequency of 288 kHz corresponding to the data sequence "00110011". The burst lasts approx. 370 µs and is repeated every 10 ms.
- BURST (00001111)
  Pulsed signal with a modulation frequency of 144 kHz corresponding to the data sequence "00001111". The burst lasts approx. 370 µs and is repeated every 10 ms.
- BURST EXTERN
  Pulsed signal that can be modulated with an external signal via the TTL-compatible digital input T_DATA_IN (pin 20 of 50-pin multifunction connector). The burst lasts approx. 370 µs and is repeated every 10 ms.
- DECT BURST (01010101)
  Burst DECT signal consisting of sync word, preamble, CRC and A and B field modulation with the data sequence "01010101" (packet P32).
- DECT BURST (00110011)
  Burst DECT signal consisting of sync word, preamble, CRC and A and B field modulation with the data sequence "00110011" (packet P32).
- DECT BURST (00001111)
  Burst DECT signal consisting of sync word, preamble, CRC and A and B field modulation with the data sequence "00001111" (packet P32).
- DECT BURST (FIG31)
  Burst DECT signal consisting of sync word, preamble, CRC, A and B field modulation with the data sequence "01010101" and 64 bits of successive "ones" and 64 bits of successive "zeroes" (packet P32).
- DECT BURST (PSRBS)
  Burst DECT signal consisting of sync word, preamble, CRC and A and B field modulation with random numbers (packet P32).
- DECT BURST (SPRBS)
  Pulsed DECT signal consisting of sync word, preamble, CRC and A and B field modulation with random numbers that are the same in each frame (packet P32).
- DECT BURST USER DATA
  Burst DECT signal consisting of sync word, CRC and user-definable contents of the preamble and the A and B fields (packet P32). If this type of signal is selected, softkey USER-DATA is displayed.

For an unmodulated signal, 0 must be entered for DEVIATION.

USER DATA

This softkey appears only if DECT BURST USER DATA is selected for SIGNAL. It allows user-defined values to be entered in hexadecimal format for the preamble and the A and B fields.

RF LEVEL

Setting of the transmit power between -40 dBm and -100 dBm (referred to RF IN/OUT) in steps of 0.1 dB.

CONNECT/ EXT. ATT.

This softkey is used for going to a configuration menu in which the RF connectors and correction values for external path attenuations can be selected. The set values are displayed in the RF GENERATOR menu.

SETTING 1

to

SETTING 7

Recalling of up to seven stored settings of the signal generator. The settings are stored in the configuration menu (key CONFIG).

2.4.5   Additional Measurements (Option CMD-B41)

2.4.5.1   Menu ADDITIONAL MEASUREMENTS

The CMD60 with Option CMD-B41 includes a 60-MHz frequency counter, an AF voltmeter and an AF signal generator for measurements in the audio range. In addition, current and voltage measurements can be performed.

For current measurements, an offset can be defined that is added to the results (see section 2.5.5.1). This can be used for accurate zero adjustment. Furthermore, it allows results to be related to a reference value.
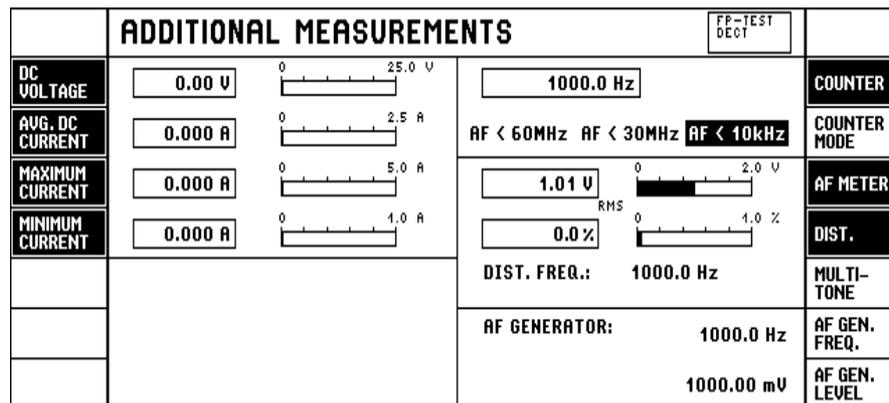
Fig. 2.4-15   Menu ADDITIONAL MEASUREMENTS

In the left half of the display, the results of current and voltage measurements are indicated. For these measurements, the DUT is connected to sockets I_{DC} and U_{DC} on the front of the unit. In current measurements, results are classified as maximum, minimum and average values. This is expedient since, with pulsed transmissions, current consumption varies at the rate of the pulse. This type of measurement is difficult to perform or not possible at all using conventional voltmeters.

| DC VOLTAGE | Measured DC value (together with AVG. DC CURRENT, this value allows the actual thermal power consumption to be measured). |

| AVG. DC CURRENT | Average DC current (together with DC VOLTAGE, this value allows the actual thermal power consumption to be measured). |

| MAXIMUM CURRENT | Maximum DC current (current consumption during active burst). |

| MINIMUM CURRENT | Minimum DC current (current consumption in the intervals between active bursts). |
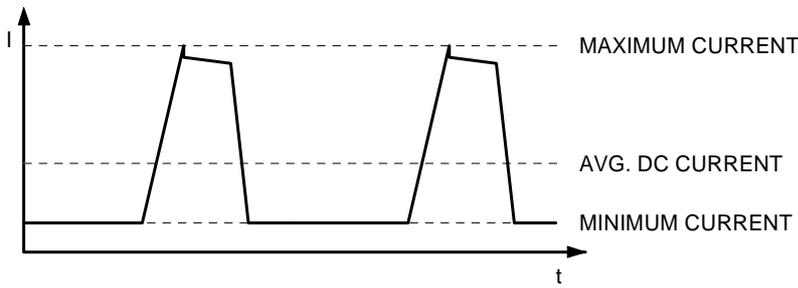
General information on current measurements:

The physical minimum and maximum values of the measured current is weighted. This results in a reversal of the displayed values if the polarity is reversed.

Example: AVG. DC CURRENT   0.5A   -0.5A
            MAXIMUM CURRENT   1.5A   0.3A
            MINIMUM CURRENT   0.3A   -1.5A

For the display of the average value, a time constant matched to the frame clock is used. Unsynchronized current bursts may therefore cause a lag of the average measurement relative to the other two measurements. This does however not cause any measurement errors, ie the current consumption of the DUT is measured correctly.

COUNTER	Display of measured frequency.
COUNTER MODE	Selection of frequency counter mode for measurements up to 10 kHz (measurement time < 1 s), up to 30 MHz (measurement time 1 s) and up to 60 MHz (measurement time 2 s).
AF METER	Level measurement of input signals applied to socket AF VOLTM.
DIST.	Distortion measurement of input signals applied to socket AF VOLTM.
MULTI-TONE	Change to menu MULTITONE AUDIO ANALYSIS.
AF GEN. FREQ.	Setting of frequency of AF output signal at socket AF GEN.
AF GEN. LEVEL	Setting of level of AF output signal at socket AF GEN. The AF generator can be deactivated by pressing hardkey CLEAR OFF and switched on by pressing ENTER ON.

2.4.5.2 Menu MULTITONE AUDIO ANALYSIS (only with Options CMD-B41 and CMD-B44)

The Option CMD-B44 enables the simultaneous generation and analysis of up to 14 audio frequencies. This allows fast measurements as required for frequency response and intermodulation.
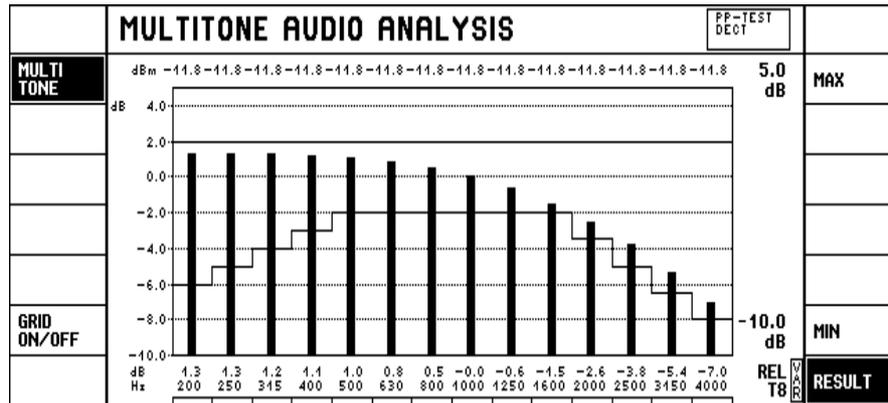
Fig. 2.4-16   Menu MULTITONE AUDIO ANALYSIS

The 14 tones can be varied in frequency and level largely independently of one another (for configuration see section 2.5.5.5). The total generator level must not exceed 5 V. For each level, upper and lower tolerance limits can be set. Measurements can be made in linear or logarithmic mode; logarithmic results can be indicated as absolute or relative values. Results are displayed as bars (see Fig. 2.4-16), tolerance limits as a staircase characteristic.

Above the bar diagram the generator levels are indicated in *mV* for linear and *dBm* for logarithmic representation. If a tone or tone generator is switched off for a measurement (see section 2.5.5.5), this is indicated by OFF.

NOTE:
Settings in dBm are referred to a resistance of 600 Ω in audio measurements.

Below the bar diagram, results and frequencies are displayed in *mV* for linear representation, in *dBm* for absolute logarithmic and in *dB* for relative logarithmic representation. If a tone is switched off for a measurement (see section 2.5.5.5), this is indicated by OFF in the frequency line. Out-of-tolerance condition is indicated by the associated oblong rectangle at the bottom of the screen.

NOTE:
The tone analyzers used for multitone measurement are coupled to the tone generators. Therefore, only the built-in tone generators may be used for this measurement. Phase shift and delay are taken into account in the measurement.

Each tone analyzer has zeroes spaced at 1-Hz intervals. This ensures that the tones do not interact with one another, which increases spectral purity.

MULTI
TONE

Start of multitone measurement in single-shot mode or after a stop caused by a tolerance being exceeded. Stop and start of measurement in continuous mode.

GRID
ON/OFF

This softkey is used to display a grid to facilitate reading of the measurement curve.

MAX

Selection of upper limit value of test diagram. The unit is *mV* for linear measurements, *dBm* for absolute logarithmic measurements and *dB* for relative logarithmic measurements.

REF

Selection of a reference value for the display type REL REF under RESULT. The softkey REF appears only if RESULT is selected. The reference value can also be entered in *dBm* or converted into *dBm* by means of the keys for entering units.

MIN

Selection of lower limit value of the diagram. The unit is *mV* for linear measurements, *dBm* for absolute logarithmic measurements and *dB* for relative logarithmic measurements.

RESULT

Selection of display type. Possible settings are:

- ABS LIN
  Results are displayed on a linear scale as absolute values in *mV*.

- ABS LOG
  Results are displayed on a logarithmic scale as absolute values in *dBm*.

- REL GEN
  Results are displayed on a logarithmic scale as relative values in *dB* referred to the set generator level. A typical application of this display mode is measurement of the transmission characteristics of single frequencies. The display is correct even if different generator levels are selected (eg artificial mouth). If a generator is switched off (see section 2.5.5.5), the result is invalid.

- REL REF
  Results are displayed on a logarithmic scale as relative values in *dB* referred to the value set under REF. The value set under REF may be the expected level, for example.

- REL T1 to REL T14
  Results are displayed on a logarithmic scale as relative values in *dB* referred to the measured value of a selected reference tone 1 out of 14. The result for the selected reference tone is 0 dB. The measured values of the other tones are referred to the measured value of the reference tone. If the measured value of the reference tone is below 1 mV, all measured values are invalid. Typical applications are frequency response, intermodulation and harmonics measurements.

Use of Option CMD-B41 for DECT audio measurements

Loudspeaker test   Microphone test
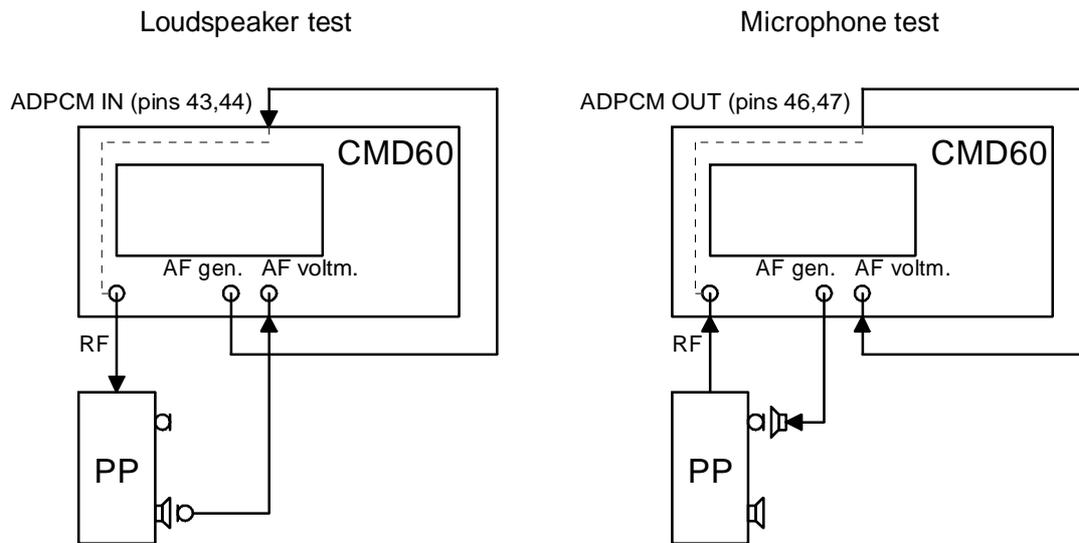
Fig. 2.4-17   DECT audio measurements

For performing these measurements, select the operating mode NORMAL in the menu SIGNALLING PP-TEST (see section 2.4.2.1).

CMD60 from serial No. 841 236 offers the possibility of internal cabling from and to ADPCM.

2.5   Description of Configuration Menus

The following configurations can be made with these menus:

•   Configuration of measuring instrument (eg selection of printer)

•   Configuration of test setup with DUT (eg taking into account external attenuator pads between measuring instrument and DUT, for example)

•   Configuration of measurement (eg setting of the data to be sent)

•   Configuration of tolerance parameters. The preset tolerances correspond to the test specifications CTR06 for DECT systems. These values can be restored using the softkey DEFAULT VALUES.

•   Information on configuration of CMD60 (menu OPTIONS)

•   Help menus

Configuration menus can be called in two ways:

•   Configuration main menu: from main menu with softkey CONFIG

•   Other configuration menus: context-sensitive with hardkey CONFIG. Further configuration menus, if available, can be selected via further softkeys.

2.5.1   Configuration Main Menu

Fig. 2.5-1   Configuration main menu

| ADDIT. MEAS. | The configuration menu for AF measurements is called up (only with Option CMD-B41). |

| TX TEST | Change to the configuration menus for transmitter tests, ie power ramp, modulation measurements and time measurements. |

| BER TEST | Change to the configuration menu for bit error rate measurements. |

SIGN.	Change to the configuration menus for setting the signalling parameters. Depending on the test mode selected in the main menu (PP-TEST or FP-TEST), one of menus "SIGNALLING PP-TEST CONFIGURATION" or "SIGNALLING FP-TEST CONFIGURATION" is entered.
CONNECT/ EXT. ATT.	With this softkey a configuration menu can be called up in which the RF connectors and the correction values for external path attenuations can be entered.
SYNC.	Change to a configuration menu for selecting synchronization of the CMD60 to an external reference frequency or to another CMD60 (only PP-TEST), and for selecting a DECT output reference frequency.
IEEE ADDRESS	Input of IEC/IEEE-bus remote-control address (with Options CMD-B6 and CMD-B61 fitted).
PRINTER	Change to printer configuration menu or selection of printer driver.
OPTIONS	Change to an information menu for display of the built-in options and the software and firmware versions.

2.5.2   Signalling Menus

2.5.2.1   Menu SIGNALLING PP-TEST CONFIGURATION

DEFAULT VALUES	SIGNALLING PP-TEST CONFIGURATION	PP-TEST DECT	HELP
Q0 PROTO	000003FF0000		
Q3 PROTO	003041108008		
Q6 PROTO	006F0F000000		
QE PROTO	000000000000		
QMUX TABLE	03060306	ON **OFF**	SCRAMBLE
		ON **OFF**	DUMMY IF TRAFFIC
		+0.0	CARRIER # OFFSET

Fig. 2.5-2   Menu SIGNALLING PP-TEST CONFIGURATION

DEFAULT
VALUES

When this softkey is pressed, the default values for this menu are used.

Q0
PROTO

Prototype of Q0 packet. In the Q0 packet, the FP (CMD60 in this measurement mode) transmits static system information, eg supported DECT channels. The value can be entered in hexadecimal format. However, not all bits are transferred for signalling. Decoding of the individual bits can be requested using the softkey HELP (not to be confused with the hardkey KEY HELP). The transmission sequence of the Q packets is defined in the QMUX-TABLE.

NOTE:
Changing the preset value may cause the call setup to fail. It is normally not necessary to change this value.

Q3
PROTO

Prototype of Q3 packet. In the Q3 packet, the FP (CMD60 in this measurement mode) sends the features it supports, eg slot types and message types. The value can be entered in hexadecimal format. However, not all bits are transferred for signalling. Decoding of the individual bits can be requested using the softkey HELP (not to be confused with the hardkey KEY HELP). The transmission sequence of the Q packets is defined in the QMUX-TABLE.

NOTE:
Changing the preset value may cause the call setup to fail. It is normally not necessary to change this value.

Q6 PROTO	Prototype of Q6 packet. In the Q6 packet, the FP (CMD60 in this measurement mode) sends the number of the current multiframe. For DECT signalling, this packet is optional, it is however required by some portable parts. Not all bits are transferred for signalling. Decoding of the individual bits can be requested using the softkey HELP (not to be confused with the hardkey KEY HELP). The transmission sequence of the Q packets is defined in the QMUX-TABLE.

NOTE:
Changing the preset value may cause the call setup to fail. It is normally not necessary to change this value.

QE PROTO	Prototype of another, user-selectable Q packet. Any desired packet can be formed by entering the associated number (eg Q5 packet). The transmission sequence of the Q packets is defined in the QMUX-TABLE.

NOTE:
Changing the preset value may cause the call setup to fail. It is normally not necessary to change this value. The user-selectable Q packet is intended only for products whose PPs require a further Q packet.

QMUX TABLE	Entry of transmission sequence of Q packets used. If "0306030E" is entered for example, this means a periodic sequence of Q packets, ie Q0 - Q3 - Q0 - Q6 - Q0 - Q3 - Q0 - QE. "QE" represents the user-selectable Q packet.

Since at least one Q0 packet and one Q3 packet are obligatory in DECT, the entry must contain at least one "0" and one "3".

NOTE:
Changing the preset value may cause the call setup to fail. It is normally not necessary to change this value.

HELP	Change to the help menus, which provide further information on entries for Q packets.

SCRAMBLE	Turn signal scrambling on or off. The default value when the DEFAULT key is pressed is off. Signal scrambling is only available in manual and remote test modes. Default is OFF.

DUMMY IF TRAFFIC	Setting of the switch determining whether the dummy bearer is to be maintained after call setup. Some DECT systems require the dummy carrier to be maintained. This leads however to restrictions in the selection of additional slots for fast bit error rate measurements.

CARRIER # OFFSET	Selection of value for CARRIER # OFFSET between -3 and +3 in steps of 0.5. To operate a larger number of test assemblies simultaneously and/or maintain telephone communication with DECT systems, the CMD60 offers the possibility of extended channels, ie channels going beyond the DECT frequency band. By varying the CARRIER # OFFSET value, the assignment of channel numbers to frequencies can be changed at half the DECT channel spacing (see assignment table 2.4-1 in section 2.4.2.1). Values for CARRIER # OFFSET unequal to zero are displayed in the menus SIGNALLING PP-TEST and SIGNALLING FP-TEST.

NOTE:
To make use of the facility of extended channels offered by the CMD60, the DUTs must be capable of performing the same channel/frequency assignment (exceeding the DECT frequency band). If the value for CARRIER # OFFSET is changed accidentally, this will cause the call setup to fail.

2.5.2.2 Menu SIGNALLING FP-TEST CONFIGURATION

DEFAULT VALUES	SIGNALLING FP-TEST CONFIGURATION	FP-TEST DECT	
	ON **OFF**	SCRAMBLE
	0	ANTENNA
	+0.0	CARRIER # OFFSET

Fig. 2.5-3   Menu SIGNALLING FP-TEST CONFIGURATION

DEFAULT VALUES

When this softkey is pressed, the default values laid down in DECT specification CTR06 are used as tolerances.

SCRAMBLE

Turn signal scrambling on or off. The default value when the DEFAULT key is pressed is off. Signal scrambling is only available in manual and remote test modes. Default is OFF.

ANTENNA

Setting of antenna number for FP under test between 0 and 7. On call setup, the FP is requested to use the antenna with the number set in this menu.

NOTE:
If an antenna not provided on the FP or an antenna with excessive path attenuation to the CMD60 is selected, this may cause disconnection of the call.

CARRIER # OFFSET

Selection of value for CARRIER # OFFSET between -3 and +3 in steps of 0.5. To operate a larger number of test assemblies simultaneously and/or maintain telephone communication with DECT systems, the CMD60 offers the possibility of extended channels, ie channels going beyond the DECT frequency band. By varying the CARRIER # OFFSET value, the assignment of channel numbers to frequencies can be changed at half the DECT channel spacing (see assignment table 2.4-1 in section 2.4.2.1). Values for CARRIER # OFFSET unequal to zero are displayed in the menus SIGNALLING PP-TEST and SIGNALLING FP-TEST.

NOTE:
To make use of the facility of extended channels offered by the CMD60, the DUTs must be capable of performing the same channel/frequency assignment (exceeding the DECT frequency band). If the value for CARRIER # OFFSET is changed inadvertently, this will cause the call setup to fail.

2.5.2.3   Menus SIGNALLING PP-TEST CONFIGURATION HELP

The following help menus support changing of the settings Q0 PROTO, Q3 PROTO, Q6 PROTO, QE PROTO and Q-MUX TABLE in the menu SIGNALLING PP-TEST CONFIGURATION.

```
SIGNALLING PP-TEST CONFIG. HELP
                                                          Page 1
The following pages contain a description of the four
editable Q-Packets and the Q-MUX table.

Caution: You should be very careful with modifications.
In case of wrong manipulations the signalling will not work!


Legend of the following tables:
X: not changeable
E: editable
C: constant, must set to the default value
-: no default value available

Note: Not each editable feature is supported by the test set.   | PAGE |
                                                                | UP   |
                                                                |------|
                                                                | PAGE |
                                                                | DOWN |
```

Fig. 2.5-4   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 1

```
SIGNALLING PP-TEST CONFIG. HELP
                                                          Page 2
Q0: STATIC SYSTEM INFO

Bits     X/E/C  Default-Value   Meaning
----------------------------------------------------------------
a0-a7     X     -               header
a8-a11    X     0000            Q0
a12-a15   X     -               slot-number
a16,a17   E     00              start-position
a18       E     0               escape bit
a19,a20   E     00              number of transceivers
a21       E     0               extended RF carrier info
a22-a31   E     1111111111      RF carriers available
a32,a33   X     00              spare bits
a34-a39   X     -               carrier number                | PAGE |
a40,a41   X     00              spare bits                    | UP   |
a42-a47   X     -               primary receiver scan carrier |------|
                                number                        | PAGE |
                                                              | DOWN |
```

Fig. 2.5-5   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 2

```
SIGNALLING PP-TEST CONFIG. HELP
                                                          Page 3
Q3: FIXED PART CAPABILITIES

Bits     X/E/C  Default-Value   Meaning
----------------------------------------------------------------
a0-a7     X     -               header
a8-a11    C     0011            Q3
a12       C     0               extended FP info (Q4)
a13       E     0               reserved
a14       E     0               reserved
a15       E     0               double slot
a16       E     0               half slot
a17       E     1               full slot
a18       E     0               frequency control
a19       E     0               page repetition              | PAGE |
a20       C     0               C/O setup on dummy allowed   | UP   |
a21       E     0               C/L uplink                   |------|
a22       E     0               C/L downlink                 | PAGE |
                                                             | DOWN |
```

Fig. 2.5-6   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 3

```
SIGNALLING PP-TEST CONFIG. HELP
                                               Page 4
Q3: FIXED PART CAPABILITIES (cont.)

Bits   X/E/C  Default-Value   Meaning
---------------------------------------------------------------
a23    E      1               basic A-field setup
a24    E      0               advanced A-field setup
a25    E      0               B-field setup
a26    E      0               CF messages
a27    E      1               IN minimum delay
a28    E      0               IN normal delay
a29    E      0               IP error detection
a30    E      0               IP error detection
a31    E      0               multibearer connections
a32    E      1               ADPCM/G.721 Voice service          PAGE
a33    E      0               Public Access Profile supported    UP
a34    E      0               Non-voice circuit switched service
a35    E      0               Non-voice circuit switched service PAGE
                                                                 DOWN
```

Fig. 2.5-7   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 4

```
SIGNALLING PP-TEST CONFIG. HELP
                                               Page 5
Q3: FIXED PART CAPABILITIES (cont.)

Bits   X/E/C  Default-Value   Meaning
---------------------------------------------------------------
a36    E      0               Standard authentication required
a37    E      0               Standard ciphering supported
a38    E      0               Location registration supported
a39    E      0               SIM service available
a40    E      0               Non-static Fixed Part
a41    E      0               CISS service available
a42    E      0               CLMS service available
a43    E      0               COMS service available
a44    E      1               Access Rights requests supported
a45    E      0               External handover supported        PAGE
a46    E      0               Connection handover supported      UP
a47    E      0               Reserved
                                                                 PAGE
                                                                 DOWN
```

Fig. 2.5-8   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 5

```
SIGNALLING PP-TEST CONFIG. HELP
                                               Page 6
Q6: MULTI-FRAME NUMBER

Bits     X/E/C  Default-Value   Meaning
---------------------------------------------------------------
a0-a7    X      –               header
a8-a11   C      0110            Q6
a12-a23  C      111100001111    spare bits
a24-a47  X      –               multiframe number




                                                                 PAGE
                                                                 UP

                                                                 PAGE
                                                                 DOWN
```

Fig. 2.5-9   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 6

```
SIGNALLING PP-TEST CONFIG. HELP
                                                    Page 7
QE: OPTIONAL Q-PACKET

Bits    X/E/C  Default-Value  Meaning
-----------------------------------------------------------
a0-a7     X       -           header
a8-a11    E       -           Q-packet number
a12-a47   E       -           packet specific number




                                              PAGE
                                              UP
                                              PAGE
                                              DOWN
```

Fig. 2.5-10   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 7

```
SIGNALLING PP-TEST CONFIG. HELP
                                                    Page 8
Q-MUX TABLE

At maximum 8 digit sequence of Q-Packets
e.g. 03060306 (E means QE packet)
Restriction: at minimum one Q0 and Q3 packet per sequence




                                              PAGE
                                              UP
                                              PAGE
                                              DOWN
```

Fig. 2.5-11   Menu SIGNALLING PP-TEST CONFIGURATION HELP, page 8

| PAGE UP | | Change to previous help menu. |

| PAGE DOWN | | Change to subsequent help menu. |

To exit a help menu, press hardkey MENU UP.

2.5.3 Configuration Menus for Measurements

2.5.3.1 Menu TX TEST CONFIGURATION

Fig. 2.5-12   Menu TX TEST CONFIGURATION

| POWER | Change to configuration menu for power ramp measurements. |

| MODU-LATION | Change to configuration menu for modulation measurements. |

| TIMING | Change to configuration menu for timing measurements. |

2.5.3.2 Menu POWER RAMP CONFIGURATION

Fig. 2.5-13   Menu POWER RAMP CONFIGURATION

| DEFAULT VALUES | When this softkey is pressed, the default values laid down in DECT specification CTR06 are used as tolerances. |

| LOWER NTP | Tolerance for the minimum absolute power of the DUT, averaged over a burst. |

| UPPER
NTP | Tolerance for the maximum absolute power of the DUT, averaged over a burst. |

| AVERAGE
(BURSTS) | Number of bursts (1 to 12000) over which the NTP (normal transmit power) is averaged. The graphic display shows only one burst. The value set here is effective in the measurement menus CONNECTION ESTABLISHED, POWER RAMP and RF - MODULATION. |

DYNAMIC

Selection of dynamic range:

- LOW
  Display of one burst. Tolerance A (see Fig. 2.5-13) cannot be checked.

- HIGH
  Measurement and display of two bursts with different input sensitivity. Tolerance A (see Fig. 2.5-13) can be checked.

STOP
COND.

Selection of stop condition:

- NONE
  The measurement is performed continuously.

- OUT OF TOL
  The measurement is stopped when a tolerance is exceeded.

- SINGLE SHOT
  Only one measurement is made.

| A (ABS.) | Selection of tolerance for maximum absolute power up to 27 µs prior to bit P0 and from 27 µs after the end of the packet. |

| B (ABS.) | Selection of tolerance for maximum absolute power up to 10 µs prior to bit P0 and from 10 µs after the end of the packet. |

| C (REL.) | Selection of tolerance for maximum relative power referred to NTP between 10 µs prior to bit P0 and 10 µs after bit P0. |

| D (REL.) | Selection of tolerance for maximum relative power referred to NTP between 10 µs after bit P0 and 10 µs after the end of the packet. |

| E (REL.) | Selection of tolerance value for minimum relative power referred to NTP between bit P0 and the end of the packet. |

| F (REL.) | Selection of tolerance for minimum relative power referred to NTP between the end of the packet and 0.5 µs after the end of the packet. |

2.5.3.3 Menu RF-MODULATION CONFIGURATION

DEFAULT VALUES	RF - MODULATION CONFIGURATION		PP-TEST DECT	
DATA TYPE	FIG 31	LIMITS:	±50 kHz	FREQ. OFFSET
			±259 kHz	MIN.+/- B-FIELD
			±403 kHz	MAX.+/- B-FIELD
			±202 kHz	MIN.+/- SYNC-FLD.
AVERAGE (BURSTS)	4		±403 kHz	MAX.+/- SYNC-FLD.
			13 kHz/ms	FREQ. DRIFT
STOP COND.	**NONE** OUT OF TOL SINGLE SHOT		**kHz/ms** kHz/slot	F.DRIFT UNITS

Fig. 2.5-14   Menu RF-MODULATION CONFIGURATION

DEFAULT VALUES

When this softkey is pressed, the default values for this menu laid down in DECT specification CTR06 are used as tolerances.

DATA TYPE

The following data patterns can be selected:

- "FIG31"
  This data pattern is best suited for modulation measurements since it contains long sequences of successive "zeroes" and "ones" (measurement of maximum modulation deviation) and since there is a sequence of alternating "zeroes" and "ones" at the end. The latter is a prerequisite for performing drift measurements.

- "01010101"
  Data sequence with the smallest deviation.

- "00110011"
  Drift measurements not possible.

- "00001111"
  This data pattern is interpreted as "silence" by the converters (CODEC).
  Drift measurements are not possible.

- "PSRBS"
  Pseudo-random bit sequence: random numbers similar to the data sent in real operation. Drift measurements are not possible.

- "SPRBS"
  Static pseudo-random bit sequence: random numbers that are the same in all frames.

AVERAGE (BURSTS)

Number of bursts (1 to 12000) over which the modulation values are averaged. The graphic display shows only one burst. The value set here is effective in the measurement menus CONNECTION ESTABLISHED, POWER RAMP and RF - MODULATION.

| STOP COND. | Selection of stop condition: |

- NONE
  The measurement is performed continuously.

- OUT OF TOL
  The measurement is stopped when a tolerance is exceeded.

- SINGLE SHOT
  Only one measurement is made.

| FREQ. OFFSET | Selection of tolerance for minimum and maximum frequency offset. |

| MIN. +/- B-FIELD | Selection of tolerance for minimum frequency deviation, measured over the B field of received bursts. |

| MAX. +/- B-FIELD | Selection of tolerance for maximum frequency deviation, measured over the B field of received bursts. |

| MIN. +/- S-FIELD | Selection of tolerance for minimum frequency deviation, measured over sync field of received bursts. |

| MAX. +/- S-FIELD | Selection of tolerance for maximum frequency deviation, measured over sync field of received bursts. |

| FREQ. DRIFT | Selection of tolerance for maximum frequency drift within a received burst. |

| F. DRIFT UNITS | The units in which the frequency drift measurement and tolerance limits are displayed are selectable. The following units are available: |

- kHz/ms
- kHz/slot

When the unit kHz/slot is selected the displayed number is greater by the factor of 2.4.

The DEFAULT VALUES softkey does not change this setting, however the default units after a system reset are kHz/ms. The default values for the frequency drift tolerance limit (after pressing the DEFAULT VALUES softkey) are:

- 13 kHz/ms   (CTR06 first edition)
- 15 kHz/slot. (CTR06 second edition)

These values are *not* equivalent.

For each of these units, the maximum values for the frequency drift tolerance limits are:

- 100 kHz/ms
- 42 kHz/slot.

2.5.3.4   Menu TIMING CONFIGURATION

DEFAULT VALUES	TIMING CONFIGURATION			PP-TEST DECT	
		LIMITS:	5.0 ppm		TIME ACCURACY
			1.0 µs		MAX.POS. JITTER
			−1.0 µs		MAX.NEG. JITTER
			2.0 µs		MAX.PCKT. DELAY
AVERAGE (BURSTS)	32		−2.0 µs		MIN.PCKT. DELAY
STOP COND.	**NONE** OUT OF TOL				

Fig. 2.5-15   Menu TIMING CONFIGURATION

DEFAULT VALUES	When this softkey is pressed, the default values for this menu are used. These values contain tolerances laid down in DECT Test Specification CTR06.

AVERAGE (BURSTS)	Number of bursts (2 to 1000) over which the timing values are averaged.

STOP COND.	Selection of stop condition:

- NONE
  The measurement is performed continuously.

- OUT OF TOL
  The measurement is stopped when a tolerance is exceeded.

- SINGLE SHOT
  Only one measurement is made.

TIME ACCURACY	Selection of tolerance value for time accuracy. This is the accuracy of the time period in which the selected number of bursts is received referred to the time standard of the CMD60.

MAX.POS. JITTER	Selection of tolerance for maximum positive jitter. This is the maximum time interval between two successive bursts minus the average interval.

MAX. NEG. JITTER	Selection of tolerance for maximum negative jitter. This is the minimum time interval between two successive bursts minus the average interval.

MAX.PCKT. DELAY	Selection of tolerance for maximum time interval between bursts of the CMD60 as FP and bursts of the PP under test minus 5 ms. This softkey is not provided in the FP-TEST.

MIN.PCKT. DELAY	Selection of tolerance for minimum time interval between bursts of the CMD60 as FP and bursts of the PP under test minus 5 ms. This softkey is not provided in the FP-TEST.

2.5.3.5   Menu BIT ERROR RATE CONFIGURATION

Fig. 2.5-16   Menu BIT ERROR RATE CONFIGURATION

| DEFAULT VALUES | When this softkey is pressed, the default values for this menu are used. These values contain tolerances laid down in DECT Test Specification CTR06. |

| DATA TYPE | The following data patterns can be selected: |

- "FIG31"
  128 bits with the pattern "010101...", 64 bits "1", 64 bits "0", 64 bits with the pattern "010101..."

- "01010101"
  320 bits with the pattern "010101..."

- "00110011"
  320 bits with the pattern "00110011..."

- "00001111"
  320 bits with the pattern "00001111..."

- "PRBS"
  CCITT O.153 pattern with the period $2^{11}-1$ in accordance with CTR06 (default)

- "SPRBS"
  Static pseudo-random bit sequence with the period 320.

| EVAL. WINDOW | Input of measurement window in bursts between 1 and 30 000 000 (one burst with 320 net bits per slot. Frames are repeated with a period of 10 ms). |

| RESULT UNIT | Display of result in ppm or in exponential notation. |

STOP COND.	Selection of stop condition:

- NONE
  The measurement is performed continuously.

- EVAL. WINDOW ELAPSED
  The measurement is stopped when the time of the measurement window has elapsed.

- UPPERLIMIT BER
  The measurement is stopped when the tolerance for LONGTERM BER is exceeded.

- UPPERLIMIT FER
  The measurement is stopped when the tolerance for LONGTERM FER is exceeded.

CURRENT BER	Selection of tolerance for maximum current bit error rate.

CURRENT FER	Selection of tolerance for maximum current frame error rate.

LONGTERM BER	Selection of tolerance for maximum bit error rate averaged over the measurement window.

LONGTERM FER	Selection of tolerance for maximum frame error rate averaged over the measurement window.

MULTI BEARER	Selection of slots to be used for fast bit error rate measurement. After activating the softkey MULTI BEARER, the slot number is selected by means of the spinwheel and activated or deactivated with ENTER. The slot for the traffic bearer selected in menu SIGNALLING PP/FP-TEST cannot be deactivated. All selected slots use the channel number (carrier) of the traffic bearer. Adjacent slots cannot be used. Six slots can be used in the PP-TEST, two slots in the FP-TEST.

NOTE:
Not all DECT systems can set up and maintain calls to the same partner in several slots simultaneously.

For example, if two traffic bearers are set up and an FER of 50% is displayed, this indicates that a second slot can be set up (eg for the purpose of handover), but that this slot is not intended for data transmission.

If the dummy slot of an FP is maintained after the call setup, this may prevent a further bearer from being set up in the dummy slot and its adjacent slot. If the CMD60 operates as FP (PP-TEST), the dummy bearer can be switched off in menu SIGNALLING PP-TEST CONFIGURATION (see section 2.5.2.1).

2.5.4   General Configuration Menus

2.5.4.1   Menu RF CONNECTOR/EXTERNAL ATTENUATION

Fig. 2.5-17   Menu RF CONNECTOR/EXTERNAL ATTENUATION

The CMD60 has three RF connectors:

- a bidirectional input/output (RF IN/OUT)
- a sensitive input (RF IN 2)
- a high-level output (RF OUT2)

The three connectors cannot only be used alternatively but also combined. There are four possible combinations. An attenuation can be entered into the CMD60 for each connector. The attenuation is taken into account in level settings and level measurements. Negative attenuation values have the effect of amplification.

| RF IN/OUT |
| to |
| RF IN2 RF OUT2 |

With these four softkeys, one of the four possible input/output combinations is selected. The associated switch positions are shown in the figure below.

| EXT.ATT. RF IN/OUT |
| to |
| EXT.ATT. RF OUT2 |

Selection of correction value for path attenuation between the CMD60 and the DUT at I/O connector RF IN/OUT. Negative values are intended for series-connected amplifiers, if any. The correction values are used, for example, for optimally using the dynamic range of the CMD60. They are further taken into account in level outputs and level measurements.
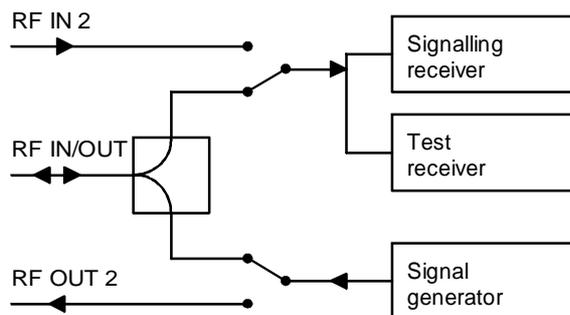

Fig. 2.5-18   Input and output circuitry

2.5.4.2 Menu SYNCHRONIZATION

Fig. 2.5-19 Menu SYNCHRONIZATION

| REF. FREQ. | *(only with Option CMD-B3)*
Selection of internal or external reference frequency of 10 MHz. All internal frequencies of the CMD60 are derived from this reference frequency.

NOTE:
If "10 MHz EXTERN" is selected and no external reference is connected, attempts to set up a call may fail and measurements may produce incorrect results. This condition is indicated by a message in the upper status line of the menus SIGNALLING PP-TEST and SIGNALLING FP-TEST .

| REF. OUT 3 | Selection of a DECT frequency to be output at socket REF OUT 3 (rear panel). Possible values are: 13.824 MHz, 6.912 MHz, 3.456 MHz, 1.152 MHz, 576 kHz, 288 kHz or 144 kHz. These frequencies are derived from the internal or external 10-MHz reference frequency.

NOTE:
The output frequency of REF OUT 3 is undefined in the main menu and in menu RF SIGNAL GENERATOR.

| SYNC PORT | If several CMD60 are operated in the PP-TEST (production line), they can be synchronized to one another. This allows simultaneous measurements on different slot/carrier pairs without the testers interfering with one another. To this end, the testers are interconnected via two differential lines connected to the 50-pin socket on the rear. One CMD60 operates as a MASTER, the others as SLAVES. The MASTER must change to the status SIGNALLING PP-TEST before the SLAVES change to this status.

NOTE:
If "SLAVE" is selected accidentally and no master is connected, attempts to set up a call may fail and measurements may produce incorrect results. This condition is indicated by a message in the upper status line.

Example of master/slave operation of CMD60 (synchronized to DECT timing)
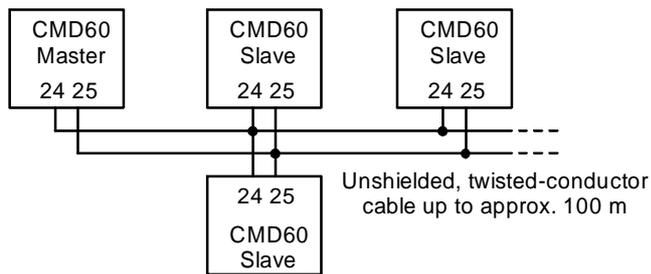
Fig. 2.5-20   Synchronization of several Testers CMD60

2.5.4.3 Menu PRINTER

Various setting for data printout can made in this menu:

- Selection of printer type

- Selection whether a hardcopy is made immediately or whether the drawing is first stored in a file.

- Selection whether the application report is printed immediately or whether it is first stored in a file.

- Selection of file name in which the hardcopy or application report can be stored. The name may include a number which is incremented each time a new file is created (auto increment).

- Files can be displayed before they are printed by the CMD.

Fig. 2.5-21a Menu PRINTER

PRINTER TYPE

Selection of printer type (relevant for hardcopy only).

Softkeys in the HARDCOPY field:

PRINT CHANNEL

Selection of print channel for hardcopy.

CENTRONICS   CMD prints via the Centronics interface.

INTERN   CMD prints into an internally generated file. The name of this file can be selected with the FILE NAME softkey.

MEMCARD   CMD prints into a file generated on its memory-card drive. The name of this file can be selected with the FILE NAME softkey.

FILE NAME

Entry of file name into which a hardcopy should be written. The general DOS rules apply for the file name. Groups of successive question marks in the file name are replaced by a numeral when the file is created. Counting starts at 0, if 0 already exists it is replaced by 1, an existing 1 is replaced by 2, etc. When the group of numerals is full, no more files can be created by the CMD.

Example:
Files PRINT000 to PRINT999 are created with FILE NAME in the PRINTER menu. If file PRINT999 already exists no more files can be created. Therefore, with the next hardcopy the CMD will write into the PRINT999 file, however not before asking the operator whether the existing file may be overwritten. In the Printer menu shown, files PRINT000 to PRINT004 already exist. The next hardcopy command on the print channel INTERN would create the file PRINT005.

This softkey cannot be used if CENTRONICS has been selected under PRINT CHANNEL.

Softkeys in the REPORT field:

PRINT CHANNEL

Selection of print channel for the different application reports.

CENTRONICS	CMD directly prints onto the Centronics interface.
INTERN	CMD prints into an internally created file. You may chose a name for this file with the FILE NAME softkey.
MEMCARD	CMD prints into a file created on its memory-card drive. You may chose a name for this file with the FILE NAME softkey.
OFF	CMD ignores all print commands.

FILE NAME

Same as in the HARDCOPY field. This softkey cannot be used if CENTRONICS or OFF has been selected under PRINT CHANNEL.

Softkeys in the FILEPRINT field:

Here the services are available which are required for selecting, displaying and printing the files generated for printing into the INTERN or MEMCARD channel.

FILE TYPE

Selection of report type.

AUTOTEST REPORT	Files generated by the CMD during a DECT autotest.
HARDCOPY	Files generated by the CMD when the HARDCOPY key is pressed.

SELECT SOURCE

Selection of file display.

INTERN	CMD displays internally stored files.
MEMCARD	CMD displays the files stored on the memory card.

The files selected with FILE TYPE are displayed at the right-hand side in the FILEPRINT field. The lines around a file name mark the currently displayed file and will in the following be referred to as file cursor:

PREV LINE	Downward scroll in the displayed file list. The cursor remains in its original position.
NEXT LINE	Upward scroll in the displayed file list. The cursor remains in its original position.
DELETE	Clears the cursor-selected file.
SHOW HARDCOPY	Display of cursor-selected file. Since the hardcopy display takes up the whole screen, all softkeys are disabled while the file is displayed. For printing the displayed file press the HARDCOPY key. This softkey is only available if HARDCOPY has been selected with FILE TYPE.
SHOW REPORT	Display of cursor-selected file. To do so CMD changes to the REPORT menu. This softkey is only available if AUTOTEST REPORT has been selected under FILE TYPE. The key is at the same location as the SHOW HARDCOPY softkey.

With the print channel set to internal, the user is asked upon pressing the hardkey HARDCOPY to confirm the file name. When ENTER is pressed the proposed name is used (? being replaced by corresponding numerals), STOP aborts the procedure, CLEAR allows editing of the file name. In this case the following menu is displayed.

	PRINTER		
PRINTER TYPE	Epson RX Series		
FILE NAME	PRINT???		
START PRINT			

Fig. 2.5-21b Menu PRINTER (for editing a file name)

PRINTER TYPE	Selection of printer type (relevant for hardcopy only).

| FILE
NAME | Entry of file name as described above. |

| START
PRINT | Printing (into a file), which had been interrupted for editing, is now continued. Press MENU UP to abort the print procedure. |

2.5.4.4 Menu REPORT

In this menu the content of the file selected with the file cursor in the PRINTER menu is displayed. The file type is indicated in the menu line: AUTOTEST REPORT for the report of a DECT autotest.

```
REPORT      AUTOTEST REPORT

---------------------------------------------------   PAGE
TEST: Auto Test 01                                    UP
---------------------------------------------------   LINE
   Tested by      : <Name>                            UP
   Test Location  : <Location>                        LINE
   Type of Device : <Device>                          DOWN
   Serial Number  : <Serial No>
   Company        : <Company>                         PAGE
   RFPI           : 0000000000     PMID    : 00000    DOWN
---------------------------------------------------

(01) SETUP CONNECTION PP-TEST
   Mode      : LOOPBACK      Traffic Slot    : 2
   RF Level  : -73.0 dBm     Traffic Carrier : 0
   QO Proto  : 000003FF0000  Carrier Offset  : 0.0     PRINT
   Q3 Proto  : 003041108008  Dummy if Traffic : OFF    FILE
```

Fig. 2.5-22   Menu REPORT

| PAGE
UP | Upward scroll of displayed text by one page. |

| LINE
UP | Upward scroll of displayed text by one line. |

| LINE
DOWN | Downward scroll of displayed text by one line. |

| PAGE
DOWN | Downward scroll of displayed text by one page. |

| PRINT
FILE | Output of displayed text to a printer. |

2.5.4.5 Menu SOFTWARE OPTIONS

In the SOFTWARE OPTIONS, the options are indicated that can be enabled by means of a code.


```
SOFTWARE OPTIONS

        [ ] CMD-K30  MOC/MTC (CMD54/57)
        [✓] CMD-K43  NARROW BAND RF SPECTRUM ANALYZER
        [ ] CMD-K51  CIPHERING (CMD54/57)
        [ ] CMD-K80  UIC (CMD54/57)
        [ ] CMD-K??  VIRTUAL PC
        [ ] CMD-B20  U/I MEASUREMENTS (CMD 50/53)
        [ ] CMD-B30  RF IN2 / RF OUT2 (CMD 50/53)
        [✓] CMD-B44  MULTITONE AUDIO ANALYSIS

CODE                                                    HARDW.
NUMBER    0                                             OPTIONS
```

Fig. 2.5-23   Menu SOFTWARE OPTIONS

CODE NUMBER	Entry of code for enabling a software option.

HARDW. OPTIONS	Selection of menu HARDWARE OPTIONS (see section 2.5.4.6).

2.5.4.6 Menu HARDWARE OPTIONS

In the menu HARDWARE OPTIONS, the hardware configuration of the CMD60, the software and firmware versions and the serial number of the unit are indicated.


```
Digital Radiocommunication Tester CMD
        MODEL: 60 M      SERIAL NO: 840675/018
        SOFTWARE VERSION: X 3.00 02.05.96
           DECT FIRMWARE VERSION: D1.174 15.4.96

                   INSTALLED OPTIONS:
[✓] CMD-B1/2 OCXO REFERENCE OSCILLATOR           [ ] CMD-B7   Abis INTERFACE        (CMD 54/57)
[✓] CMD-B3   MULTI-REFERENCE FREQUENCY IN/OUT    [ ] CMD-B8   TEST MOBILE FUNCTIONALITY (CMD 54/57)
[✓] CMD-B4   FAST POWER RAMP, PHASE/FREQ. ERROR, BER  [✓] CMD-B9   2nd RF-SYNTHESIZER
[✓] CMD-B41  AUDIO MEASUREMENT UNIT              [✓] CMD-B19  DCS 1900 (CMD 55/57)
[✓] CMD-B42  HIGH DYNAMIC BURST ANALYSIS
[✓] CMD-B43  SPECTRUM MEASUREMENT UNIT
[✓] CMD-B5   SPEECH CODEC
[✓] CMD-B6   ADAPTER FOR CMD-B6.. OPTIONS
[✓] CMD-B61  IEEE 488 BUS INTERFACE
[✓] CMD-B62  MEMORY CARD INTERFACE

        50dB DYN. ATT.        H.MEAS              8 MB     CPU 3
```

Fig. 2.5-24   Menu HARDWARE OPTIONS

2.5.4.7   Menu OTHER CONFIGURATION PARAMETERS

OTHER CONFIGURATION PARAMETERS		
KEY BEEP	ON **OFF** 24.02.97	DATE
ACOUSTIC WARNINGS	**ON** OFF 11:58	TIME

Fig. 2.5-25   Menu OTHER CONFIGURATION PARAMETERS

KEY BEEP	Switches keyboard click on and off.
ACOUSTIC WARNINGS	Switches acoustic warning on and off.
DATE	The date can be entered.
TIME	The time can be entered.

2.5.5 Configuration Menus for Additional Measurements

2.5.5.1 Menu ADDITIONAL MEASUREMENTS CONFIGURATION

For current measurements, an offset can be defined that is added to the results. This can be used for accurate zero adjustment. Furthermore, it allows results to be related to a reference value.

Fig. 2.5-26   Menu ADDITIONAL MEASUREMENTS CONFIGURATION

ZERO OFFSET	The last measured value of the actual average current consumption (ie without any offset correction) is taken as the offset for current measurements.
CURRENT OFFSET	Entry of a user-selectable value as the offset for current measurements. If the hardkey CLEAR/OFF is pressed or if "0" is entered, no offset correction is performed.
AF METER	Change to configuration menu for AF voltage measurements.
DIST.	Change to configuration menu for distortion measurements.
MULTI TONE	Change to configuration menu for multitone measurements.
AF GEN.	Change to configuration menu for AF generator
AF GEN. FREQ.	
AF GEN. LEVEL	

2.5.5.2   Menu AF METER CONFIGURATION

AF METER CONFIGURATION		
RMS	3400.0 Hz	BAND PASS
SQRT(2) * RMS	300.0 Hz	BAND WIDTH
INPUT AF VOLTM. ADPCM (will also change the Distortion Meter setting) 100 Hz		LOWEST FREQ.

Fig. 2.5-27   Menu AF METER CONFIGURATION

| RMS |

The AF voltmeter measures rms values.

| SQRT(2) * RMS |

The AF voltmeter measures rms values. However, the displayed value is weighted with a factor of 1.41 (corresponding to the peak value of a sinewave signal).

| INPUT |

For Testers CMD60 with serial No. 841 236 and higher, this softkey allows the input of the AF voltmeter to be applied directly to the output of the ADPCM (see section 2.4.5).

NOTE:
The internal ADPCM is addressed in the NORMAL mode only (see section 2.4.2.1).

NOTE:
This setting also changes the input for the distortion and the multitone measurements.

| BAND PASS |

A bandpass filter can be connected in the signal path of the AF voltmeter to suppress ambient noise. After activating this softkey, the center frequency can be varied. The bandpass filter can be deactivated by pressing the hardkey CLEAR OFF and switched on again with ENTER ON.

| BAND WIDTH |

After activating this softkey, the bandwidth of the bandpass filter can be changed.

| LOWEST FREQ. |

Entry of the lowest AF frequency weighted without measuring error. High values reduce the measurement time.

NOTE:
This setting also changes the limit frequency for distortion measurements.

2.5.5.3 Menu DISTORTION METER CONFIGURATION

```
┌──────┬────────────────────────────────────────┬──────┐
│      │ DISTORTION METER CONFIGURATION         │      │
├──────┼────────────────────────────────────────┼──────┤
│DIST. │ 1000.0 Hz                              │      │
│FREQ. │                                        │      │
├──────┤                                        ├──────┤
│      │                                        │      │
├──────┤                                        ├──────┤
│      │                                        │      │
├──────┤                                        ├──────┤
│      │                                        │      │
├──────┤                                        ├──────┤
│      │                                        │      │
├──────┼─────────────────────┬──────────┬──────┼──────┤
│INPUT │ AF VOLTM. ADPCM     │will also change the│ LOWEST│
│      │                     │AF Meter setting  100 Hz│FREQ.│
└──────┴─────────────────────┴──────────┴──────┴──────┘
```

Fig. 2.5-28   Menu DISTORTION METER CONFIGURATION

| DIST. FREQ. | Entry of the operating frequency for distortion measurements (center frequency of notch filter). |

| INPUT | For Testers CMD60 with serial No. 841 236 and higher, this softkey allows the input of the AF voltmeter to be applied directly to the output of the ADPCM (see section 2.4.5). |

NOTE:
The internal ADPCM is addressed in the NORMAL mode only (see section).

NOTE:
This setting also changes the input of the voltmeter.

| LOWEST FREQ. | Entry of lowest AF frequency weighted without measuring error. High values reduce the measurement time. |

NOTE:
This setting also changes the limit frequency for distortion measurements.

2.5.5.4   Menu AF GENERATOR CONFIGURATION

```
┌──────┬─────────────────────────────────────┬──────┐
│      │ AF GENERATOR CONFIGURATION          │      │
│      ├─────────────────────────────────────┤      │
│      │                                     │      │
├──────┤                                     ├──────┤
│      │                                     │      │
├──────┤                                     ├──────┤
│      │                                     │      │
├──────┤                                     ├──────┤
│      │                                     │      │
├──────┤                                     ├──────┤
│      │                                     │ FREQ.│
│      │                          10.0 Hz    │ INC. │
├──────┤                                     ├──────┤
│AF GEN│ ON OFF                               │LEVEL │
│TO ADPCM│                        10.00 mV    │INC.  │
└──────┴─────────────────────────────────────┴──────┘
```

Fig. 2.5-29   Menu AF GENERATOR CONFIGURATION

AF GEN.
TO ADPCM

For Testers CMD60 with serial No. 841 236 and higher, this softkey allows the output of the AF signal generator to be connected to the input of the internal ADPCM (see section 2.4.5). Any connections made to pins 43 and 44 of the 50-pin multifunction connector on the rear will then be ineffective.

NOTE:
The internal ADPCM is addressed in the NORMAL mode only (see section 2.4.2.1).

NOTE:
This setting also changes the AF generator.

FREQ.
INC.

Entry of increment for varying the frequency of the AF generator by means of the spinwheel.

LEVEL
INC.

Entry of increment for varying the level of the AF generator by means of the spinwheel.

The signal generator can be deactivated by pressing the hardkey CLEAR OFF and switched on again with ENTER ON.

2.5.5.5 Menu MULTITONE AUDIO ANALYSIS CONFIGURATION (only with Options CMD-B41 and CMD-B44)

In this menu, the settings for multitone measurements (see section 2.4.5.2) are made.

DEFAULT	**MULTITONE AUDIO ANALYSIS CONFIGURATION**		
TONE INDEX	8	12 mV	UPPER LIM.(ABS)
FREQ	1000 Hz	8 mV	LOWER LIM.(ABS)
LEVEL	10 mV	3 dB	UPPER LIM.(REL)
		−3 dB	LOWER LIM.(REL)
		AF VOLTM. ADPCM	INPUT
AF GEN. LEAD	0 ms	will also change AF GEN. and AF METER settings	
STOP COND.	**NONE** OUT OF TOL. SINGLE SHOT	ON **OFF**	AF GEN. TO ADCPM

Fig. 2.5-30   Menu MULTITONE AUDIO ANALYSIS CONFIGURATION

DEFAULT	When this softkey is pressed, the default values for this menu are used.

TONE INDEX	With TONE INDEX, the index of the tone is selected for which the frequency, level and tolerance limits are to be set. Indexes between 1 and 14 can be selected.

FREQ	Setting of frequency for the tone selected under TONE INDEX. Integers between 50 and 8460 Hz can be selected. If the tone in question is not to be measured, ie if less than 14 tones are to be measured, the index can be switched off by pressing the hardkey OFF.

LEVEL	Setting of generator level for the tone selected under TONE INDEX. Values between 1 mV and 5 V can be selected. It should be noted however that the sum of the levels of all tones must not exceed 5 V. The genereator can be switched off by pressing hardkey OFF. In contrast to switch-off performed under FREQ, a measurement takes place in this case.

STOP COND.	Selection of stop condition:

- NONE
  The measurement is performed continuously.

- OUT OF TOL
  The measurement is stopped when a tolerance is exceeded.

- SINGLE SHOT
  Only one measurement is performed.

INPUT	For Testers CMD60 with serial No. 841 236 and higher, this softkey allows the input for the multitone measurement to be applied directly to the output of the ADPCM.

NOTE:
The internal ADPCM is addressed in the NORMAL mode only (see section 2.4.2.1).

NOTE:
This setting also changes the input for the other AF measurements.

UPPER LIM.(ABS)	Setting of upper tolerance limit for the tone selected under TONE INDEX for absolute measurements. Values between 1 mV and 9.999 V can be selected. The value must however be at least 1 mV above the lower tolerance limit. The value can also be entered in dBm or converted from or to dBm using the unit keys.

LOWER LIM.(ABS)	Setting of lower tolerance limit for the tone selected under TONE INDEX for absolute measurements. Values between 0 mV and 9.998 V can be selected. The value must however be at least 1 mV below the upper tolerance limit. The value can also be entered in dBm or converted from or to dBm using the unit keys.

UPPER LIM.(REL)	Setting of upper tolerance limit for the tone selected under TONE INDEX for relative measurements. Values between -79 dB and +80 dB can be selected. The value must however be at least 1 dB above the lower tolerance limit.

LOWER LIM.(REL)	Setting of lower tolerance limit for the tone selected under TONE INDEX for relative measurements. Values between -80 dB and +79 dB can be selected. The value must however be at least 1 dB below the upper tolerance limit.

AF GEN. LEAD	Setting of lead time of generator until the start of the measurement. This lead allows filter transient times and delays in transmission to be taken into account. Values between 0 and 65 s can be selected in steps of 1 ms.

AF GEN. TO ADPCM	For Testers CMD60 with Serial No. 841 236 and higher, the output of the multitone generator can be connected to the input of the internal ADPCM. The connections made to pins 43 and 44 of the 50-pin multifunction connector on the rear are in this case ineffective.

NOTE:
The internal ADPCM is addressed in the NORMAL mode only (see section 2.4.2.1).

NOTE:
This setting also changes the output of the AF generator.

2.6 Autotest

The autotest enables the automatic run of measurement steps without any remote control. There are 20 different autotests consisting of up to 50 freely configurable measurement steps referred to as actions. The actions are used for call setup and call clearing and for measurements. Log printouts may be generated either while the test is being performed or after completion of the test. After the autotest has been completed, it is indicated whether the actions have been carried out successfully or whether tolerances were exceeded. If Option CMD-B62 is fitted, transfer to other Testers CMD60 is possible via the memory card.

2.6.1 Menu AUTO TEST

The softkey AUTO TEST in the main menu is activated to branch into the AUTO TEST menu. In this menu, one of 20 autotests is selected, general report and test parameters are entered and the selected autotest is started. Besides, the menu is provided to branch into further menus for performance, configuration and copying of the tests.

SELECT	AUTO TEST	01: Auto Test 01	
DEVICE	‹Device›		PRINT IS OFF
TESTED BY	‹Name›	‹Serial No›	SERIAL NO
TEST LOCATION	‹Location›	‹Company›	COMPANY NAME
		0000000000	RFPI
		00000	PMID
			CONFIG.
COPY			START

Fig. 2.6-1   Menu AUTO TEST

SELECT — After activating this softkey, one of 20 autotests is selected using the spinwheel.

DEVICE / TESTED BY / TEST LOCATION / SERIAL NO / COMPANY NAME — Entry of report information either by means of a PC-AT keyboard connected to the rear panel or by means of the spinwheel in conjunction with the cursor keys START and LOCAL. This information is not specific for an autotest.

COPY — Branching to a menu for copying and deleting autotests.

PRINT IS ON	This indicates that a report is generated on the printer while the autotest is performed. The report can be switched off by pressing this softkey.
PRINT IS OFF	This indicates that there is no report generated while the autotest is performed. The report can be switched on by pressing this softkey.
RFPI	Entry of an RFPI for the DECT unit under test. In case of an FP, automatic RFPI identification and acceptance are possible (see section 2.6.4). The value set is displayed with the test report.
PMID	Entry of a PMID for the DECT unit under test. With PP-TEST, it is used for logging only.
CONFIG.	Branching to the configuration menu AUTO TEST EDIT, where the autotest is programmed. The CONFIG hardkey can be used alternatively.
START	Starting the currently selected autotest.

2.6.2   Menu AUTO TEST EDIT

The AUTO TEST menu allows for branching into this menu by actuating the CONFIG softkey or hardkey. In this menu, the current autotest is programmed by selection of the actions.

Fig. 2.6-2   Menu AUTO TEST EDIT

NAME	Entry of a name for the current autotest using either the PC-AT keyboard connected to the rear panel or the spinwheel in conjunction with the START and LOCAL keys used as cursor keys. Presetting of the name is "FREE" and, after programming, it is "Auto Test xx", xx indicating the autotest memory location.
INSERT	Inserting a free action step prior to the current (framed) action. **NOTE:** **If the previous action is occupied, it is removed.**

| REMOVE | Deleting of the current (framed) action. The subsequent actions move up by one position each. |

| PAGE UP | Paging up the autotest by 14 actions (in the direction of step 01). |

| PREV. ACTION | Selection of the previous step. |

| SELECT ACTION | Selection of an action for the current action step. The following actions may be selected: |

        FREE
        SETUP CONNECTION PP-TEST
        SETUP CONNECTION FP-TEST
        POWER RAMP
        RF MODULATION
        TIMING
        BIT ERROR RATE
        BEARER RELEASE
        CONDITIONAL GOTO
        PAUSE

Each of these actions except for FREE, BEARER RELEASE and PAUSE can be configured upon actuating hardkey CONFIG.

| NEXT ACTION | Selection of next action step. |

| PAGE DOWN | Paging down the autotest by 14 action steps (in the direction of step 50). |

The actions initiate the following operations:

Action	Operation	For measurement see section	For configuration see section
FREE	none- is skipped		
SETUP CONNECTION PP-TEST	Call setup to a PP An existing connection is cleared	2.4.2.1	2.6.3
SETUP CONNECTION FP-TEST	Call setup to an FP An existing connection is cleared	2.4.2.2	2.6.4
POWER RAMP	Measurement of power and power ramp versus time	2.4.3.2	2.6.5
RF MODULATION	Measurement of modulation parameters	2.4.3.3	2.6.6
TIMING	Measurement of timing parameters	2.4.3.4	2.6.7
BIT ERROR RATE	Measurement of BER and FER	2.4.3.5	2.6.8
BEARER RELEASE	Clearing of the connection		
CONDITIONAL GOTO	Jump that can be linked to a condition		2.6.9
PAUSE	Breakpoint at which the program can be interrupted and continued by pressing a key		

2.6.3   Menu SIGNALLING PP-TEST CONFIGURATION

DEFAULT VALUES	SIGNALLING PP-TEST CONFIGURATION	AUTOTEST DECT	HELP
Q0 PROTO	000003FF0000	ON **OFF**	DUMMY IF TRAFFIC
Q3 PROTO	003041108008	0	DUMMY SLOT
Q6 PROTO	006F0F000000	0	DUMMY CARRIER
QE PROTO	000000000000	2	TRAFFIC SLOT
QMUX TABLE	03060306	0	TRAFFIC CARRIER
SYNCH. TIME	AUTO 5s	−40.0 dBm	RF LEVEL
MODE	**LOOPBACK** NORMAL ECHO	+0.0	CARRIER # OFFSET

Fig. 2.6-3   Menu SIGNALLING PP-TEST CONFIGURATION

DEFAULT VALUES

This softkey selects the default values preset for this menu.

Q0 PROTO

Prototype of the Q0 packet. In the Q0-packet, the FP (in this measurement mode the CMD60) transmits static system information, eg supported DECT channels. This value can be entered in the hexadecimal format. However, not all of the bits are transferred to the signalling. Decoding of the individual bits can be requested using the "HELP" softkey (not to be confused with the hardkey KEY HELP). The transmission sequence of the Y-packets is determined by the QMUX-TABLE.

NOTE:
Modification of the preset value may cause a failure of the call setup. Normally, it is not necessary to change this value.

Q3 PROTO

Prototype of the Q3-packet. In the Q3-packet, the FP (in this measurement mode the CMD60) sends the supported features, eg, slot types and message types. This value can be entered in the hexadecimal format. However, not all of the bits are transferred to the signalling. Decoding of the individual bits can be requested using the HELP softkey (not to be confused with the hardkey KEY HELP). The transmission sequence of the Y-packets is determined by the QMUX-TABLE.

NOTE:
Modification of the preset value may cause a failure of the call setup. Normally, it is not necessary to change this value.

Q6 PROTO

Prototype of the Q6-packet. In the Q6-packet, the FP (in this measurement mode the CMD60) sends the number of the current multiframe. This packet is optional in the DECT signalling, however it is required by some portable parts. However, not all of the bits are transferred to the signalling. Decoding of the individual bits can be requested using the HELP softkey (not to be confused with the hardkey KEY HELP). The transmission sequence of the Y-packets is determined by the QMUX-TABLE.

NOTE:
Modification of the preset value may cause a failure of the call setup. Normally, it is not necessary to change this value.

QE PROTO

Prototype of any further Q-packet. This packet can be freely selected and any Q-packet can be formed by entering the corresponding value (eg a Q5-packet). The transmission sequence of the packets is determined by the QMUX-TABLE.

NOTE:
Modification of the preset value may cause a failure of the call setup. Normally, it is not necessary to change this value. This possibility is only provided for products whose PPs require a further Q-packet.

QMUX TABLE

Entry of the transmission sequence of the Q-packets used. The entry of "0306030E" eg implies a periodic sequence of Q-packets, ie: Q0 - Q3 - Q0 - Q6 - Q0 - Q3 - Q0 - QE. "E" represents the freely selectable Q-packet..

Since at least one Q0-packet and one Q3-packet are mandatory in DECT, the entry must contain at least one "0" and one "3" in each case.

NOTE:
Modification of the preset value may cause a failure of the call setup. Normally, it is not necessary to change this value.

SYNCH. TIME

Entry of a time period for synchronization of the PP to the synchronization signal of the CMD60. Time values from 0 to 10 seconds can be selected in steps of one second. Besides, in the MANUAL setting, the successful synchronization can be indicated using the CONTINUE softkey. This key may also be used to shorten set synchronization times to the delay.

```
┌──────────┐
│ MODE     │
└──────────┘
```

Different modes of connection are set:

- LOOPBACK:
  The DUT (Device Under Test) is set to the loopback mode in order to return the transmitted data without modification. This is the prerequisite for modulation and bit error rate measurements.

- NORMAL:
  The DUT converts the received data in the CODEC and passes them on to the loudspeaker. Signals recorded via the microphone are also converted and sent to the CMD60. This mode allows for performing audio measurements (microphone, loudspeaker, converter).

  NOTE:
  Not all portable parts permit audio connections in the test mode. Therefore, it may happen that NORMAL and ECHO modes do not have the desired result.

- ECHO:
  The signals applied to the microphone are sent to the CMD60, delayed by one second, returned to the DUT and output at its loudspeaker. This mode permits fast qualitative testing of the DUT.

  NOTE:
  Not all portable parts permit audio connections in the test mode. Therefore, it may happen that NORMAL and ECHO modes do not have the desired result.

```
┌──────────┐
│ HELP     │
└──────────┘
```

Change to the help menus providing further information on the possible inputs of the Q-packets.

```
┌──────────┐
│ DUMMY IF │
│ TRAFFIC  │
└──────────┘
```

Setting of the switch to determine whether the dummy bearer is to be maintained after the call setup. A few DECT systems require the dummy carriers to be maintained. However, this leads to restrictions in the selection of additional slots in the case of the fast bit error rate measurement.

| DUMMY SLOT | Entry of slot number of dummy bearer to be transmitted. Values between 0 and 11 can be entered. Please note that the slot values of the dummy bearer and the traffic bearer must not be identical. Moreover, adjacent slot values (eg 5 and 6, or 11 and 0) are permissible only if the channel numbers of the dummy bearer and the traffic bearer are identical. |

| DUMMY CARRIER | Entry of channel number of dummy bearer to be transmitted. Channel numbers between 0 and 9 can be entered. If the dummy bearer and the traffic bearer have adjacent slot numbers, the channel numbers of the dummy bearer and the traffic bearer must be identical. |

| TRAFFIC SLOT | Entry of slot number of traffic bearer for call setup. Values between 0 and 11 can be entered. Please note that the slot values of the dummy bearer and the traffic bearer must not be identical. Moreover, adjacent slot values (eg 5 and 6, or 11 and 0) are permissible only if the channel numbers of the dummy bearer and the traffic bearer are identical. |

| TRAFFIC CARRIER | Entry of channel number of traffic bearer for call setup. Channel numbers between 0 and 9 can be entered. If the slot numbers of the dummy bearer and the traffic bearer are adjacent, the channel numbers of the dummy bearer and the traffic bearer must be identical. |

| RF LEVEL | Selection of transmit power between -40 dBm and -100 dBm (referred to RF IN/OUT) in steps of 0.1 dB. |

| CARRIER # OFFSET | Selection of value for CARRIER # OFFSET between -3 and +3 in steps of 0.5. To operate a larger number of test assemblies simultaneously and/or maintain telephone communication with DECT systems, the CMD60 offers the possibility of extended channels, ie channels going beyond the DECT frequency band. By varying the CARRIER # OFFSET value, the assignment of channel numbers to frequencies can be changed at half the DECT channel spacing (see table in section 2.4.2.1). Values for CARRIER # OFFSET unequal to zero are displayed in the menus SIGNALLING PP-TEST and SIGNALLING FP-TEST. |

NOTE:
To make use of the facility of extended channels offered by the CMD60, the DUTs must be capable of performing the same channel/frequency assignment (exceeding the DECT frequency band). If the value for CARRIER # OFFSET is changed accidentally, this will cause the call setup to fail.

2.6.4   Menu SIGNALLING FP-TEST CONFIGURATION

DEFAULT VALUES	SIGNALLING FP-TEST CONFIGURATION	AUTOTEST DECT	
		0	ANTENNA
		0	TRAFFIC SLOT
ACCEPT RFPI	**ON** OFF	0	TRAFFIC CARRIER
		−40.0 dBm	RF LEVEL
MODE	**LOOPBACK** NORMAL ECHO	+0.0	CARRIER # OFFSET

Fig. 2.6-4   Menu SIGNALLING FP-TEST CONFIGURATION

DEFAULT
VALUES

This softkey permits using the default values preset for this menu.

ACCEPT
RFPI

Switch for switching on and off the automatic RFPI identification and acceptance.

MODE

Different modes of connection are set:

- LOOPBACK
  The DUT (device under test) is set to the loopback mode in order to return the transmitted data without modification. This is the prerequisite for modulation and bit error rate measurements.

- NORMAL
  The DUT converts the received data in the CODEC and passes them on to the loudspeaker. Signals recorded via the microphone are also converted and sent to the CMD60. This mode allows for performing audio measurements (converter).

  NOTE:
  Not all portable parts permit audio connections in the test mode. Therefore, it may happen that NORMAL and ECHO modes do not have the desired result. The NORMAL and ECHO modes are more useful with portable parts than with fixed parts.

- ECHO
  The signals applied to the FP are sent to the CMD60, delayed by one second, returned to the DUT and output at its loudspeaker. This mode permits fast qualitative testing of the DUT.

  NOTE:
  Not all portable parts permit audio connections in the test mode. Therefore, it may happen that NORMAL and ECHO modes do not have the desired result. The NORMAL and ECHO modes are more useful with portable parts than with fixed parts.

ANTENNA

Setting of the antenna number between 0 and 7 to be used by the FP under test. On call setup, the FP is requested to use the antenna with the number set in this menu.

NOTE:
Setting of an antenna not provided on the FP or of an antenna with an excessive path attenuation to the CMD 60 may cause a call release

TRAFFIC SLOT

Entry of the slot number of the traffic bearer to be transmitted. Permissible values are 0 to 11, however, note that the slot values of dummy bearer and traffic bearer are not identical. Besides, adjacent slot values (eg 5 and 6; 11 and 0 are adjacent, also) are only permissible if the channel numbers of dummy bearer and traffic bearer are identical.

The FP under test must be able to set up a traffic bearer at the indicated slot value. Many FPs accept even slot values, only.

NOTE:
The values of the dummy slot may vary.

TRAFFIC CARRIER

Entry of the channel number of the traffic carrier with call setup. Channel numbers from 0 to 9 are possible. If the slot values of ***dummy*** bearer and traffic bearer are adjacent, the channel numbers of ***dummy*** bearer and traffic bearer must coincide. The assignment of channel numbers to used frequencies is shown in Section 2.4.2.1.

RF LEVEL

Setting of the transmit power from -40 dBm to -100 dBm (referred to RF IN/OUT) in steps of 0.1 dB.

CARRIER # OFFSET

Selection of the value for "CARRIER # OFFSET" between -3 to +3 in steps of 0.5. To enable simultaneous operation of a larger number of test assemblies and/or to maintain the telephone operation with DECT systems the CMD 60 offers the possibility of using extended channels. By varying this value, it is possible to change the assignment of the channel numbers to the frequencies in half the DECT channel spacing (see assignment table in Section 2.4.2.1). This is an extension to DECT. Values for "CARRIER # OFFSET" unequal to zero are displayed in the SIGNALLING PP-TEST and SIGNALLING FP-TEST menus.

NOTE:
The extended channels of the CMD60 can be used only, if the devices under test are able to perform the same channel/frequency assignment (exceeding DECT). If a value for "CARRIER # OFFSET" is changed accidentally, this will cause a failure of the call setup.

2.6.5   Menu POWER RAMP CONFIGURATION

Fig. 2.6-5   Menu POWER RAMP CONFIGURATION

| DEFAULT VALUES | This softkey permits using the preset default values for the tolerance values according to the DECT test specification CTR06. |

| LOWER NTP | Tolerance value for the minimum absolute power of the DUT, averaged over one burst. |

| UPPER NTP | Tolerance value for the maximum absolute power of the DUT, averaged over one burst. |

| AVERAGE (BURSTS) | Number of bursts (1 to 200), over which the NTP value is averaged. The graphical display shows one burst only. |

DYNAMIC

Selection of dynamic range:

- LOW
  Display of a burst. The tolerance value A (see Fig. 2.5-13) cannot be checked.

- HIGH
  Measurement and combined display of two bursts with different input sensitivity. The tolerance value A (see Fig. 2.5-13) can also be checked.

PACKET TYPE

The following packet types may be selected

- P32.
- P32Z.

  The P32Z packet is identical to the P32 packet, except that it has an extra four bits (the Z-field) appended which are a repeat of the last four bits of the P32 packet (the X-field). This test helps in the detection of collisions from multiple sources.

The default value after a system reset is P32Z.
The shape of the power ramp template changes according to the packet type selected.

A (ABS.)

Selection of the tolerance value for the maximum absolute power up to 27μs before bit P0 and from 27μs after the end of the packet.

B (ABS.)	Selection of the tolerance value for the maximum absolute power up to 10µs before bit P0 and from 10µs after the end of the packet.

C (REL.)	Selection of the tolerance value for the maximum relative power referred to the NTP between 10µs before bit P0 and 10µs after bit P0.

D (REL.)	Selection of the tolerance value for the maximum relative power referred to the NTP between 10µs after bit P0 and 10µs after the end of the packet.

E (REL.)	Selection of the tolerance value for the minimum relative power referred to the NTP between bit P0 and the end of the packet.

F (REL.)	Selection of the tolerance value for the minimum relative power referred to the NTP between the end of the packet and 0.5µs after the end of the packet.

2.6.6   Menu RF MODULATION CONFIGURATION

Fig. 2.6-6   Menu RF MODULATION CONFIGURATION

DEFAULT
VALUES

This key permits using the preset default values for the tolerance values according to the DECT test specification CTR06.

DATA
TYPE

The following data types can be selected:

- "FIG31"
  This data pattern is best suited for the modulation measurement, since large areas of successive "zeroes" and "ones" occur (measurement of the maximum modulation deviation) and there is an alternating sequence of "zeroes" and "ones" at the end. This is the prerequisite for performing the drift measurement.

- "01010101"
  Data sequence with the smallest deviation.

- "00110011"
  Drift measurement not possible.

- "00001111"
  This data pattern is interpreted by the converters (CODEC) as "silence".
  Drift measurement not possible.

- "PSRBS"
  Pseudo-random bit sequence: random numbers similar to those sent during real operation. Drift measurement not possible.

- "SPRBS"
  Static pseudo-random bit sequence: random numbers repeated in each frame.

AVERAGE
(BURSTS)

Number of bursts (1 to 200), over which the modulation values are averaged. The graphical display shows one burst, only.

| STOP COND. | Selection of stop condition: |

- NONE
  The measurement is performed continuously.
- OUT OF TOL
  The measurement is stopped when a tolerance is exceeded.
- SINGLE SHOT
  Only one measurement is made.

| FREQ. OFFSET | Selection of the tolerance value for the minimum and maximum frequency offset. |

| MIN. +/- B-FIELD | Selection of the tolerance value for the minimum frequency deviation, measured over the B-field of received bursts. |

| MAX. +/- B-FIELD | Selection of the tolerance value for the maximum frequency deviation, measured over the B-field of received bursts. |

| MIN. +/- S-FIELD | Selection of the tolerance value for the minimum frequency deviation measured over the sync field of received bursts. |

| MAX. +/- S-FIELD | Selection of the tolerance value for the maximum frequency deviation measured over the sync field of received bursts. |

| FREQ. DRIFT | Selection of the tolerance value for the maximum frequency drift within a received burst. |

| F. DRIFT UNITS | The units in which the frequency drift measurement and tolerance limits are displayed are selectable. The following units are available: |

- kHz/ms
- kHz/slot

When the unit kHz/slot is selected the displayed number is greater by the factor of 2.4.

The DEFAULT VALUES softkey does not change this setting, however the default units after a system reset are kHz/ms. The default values for the frequency drift tolerance limit (after pressing the DEFAULT VALUES softkey) are:

- 13 kHz/ms   (CTR06 first edition)
- 15 kHz/slot. (CTR06 second edition)

These values are *not* equivalent.

For each of these units, the maximum values for the frequency drift tolerance limits are:

- 100 kHz/ms
- 42 kHz/slot.

2.6.7 Menu TIMING CONFIGURATION

Fig. 2.6-7   Menu TIMING CONFIGURATION

| DEFAULT VALUES | This softkey permits using the preset default values for the tolerance values according to the DECT test specification CTR06. |

| AVERAGE (BURSTS) | Number of bursts (2 to 1000), over which the time values are averaged. |

| TIME ACCURACY | Selection of the tolerance value for the time accuracy. This is the accuracy which the required number of bursts has been received in referred to the time standard of the CMD60. |

| MAX.POS. JITTER | Selection of the tolerance value for the maximum jitter. This is the maximum time interval of two successive bursts minus the average interval. |

| MAX. NEG. JITTER | Selection of the tolerance value for the minimum jitter. This is the minimum time interval of two successive bursts minus the average interval. |

| MAX.PCKT. DELAY | Selection of the tolerance value for the maximum time interval between bursts of the CMD60 as FP and bursts of the PP under test minus 5 ms. This softkey is not provided in the FP TEST. |

| MIN.PCKT. DELAY | Selection of the tolerance value for the minimum time interval between bursts of the CMD60 as FP and bursts of the PP under test minus 5 ms. This softkey is not provided in the FP TEST. |

2.6.8 Menu BIT ERROR RATE CONFIGURATION

Fig. 2.6-8   Menu BIT ERROR RATE CONFIGURATION

| DEFAULT VALUES | This softkey permits using the preset default values for the tolerance values according to the DECT test specification CTR06. |

| DATA TYPE | The following data patterns can be selected: |

- "FIG31"
  128 bits with the pattern "010101...", 64 bits "1", 64 bits "0", 64 bits with the pattern "010101..."

- "01010101"
  320 bits with the pattern "010101..."

- "00110011"
  320 bits with the pattern "00110011..."

- "00001111"
  320 bits with the pattern "00001111..."

- "PRBS"
  CCITT O.153 bit sequence with the period $2^{11}-1$ in accordance with CTR06 (default)

- "SPRBS"
  Pseudo-random bit sequence with the period 320

| DEVIATION | For setting the transmitter frequency deviation. The transmitter deviation can take values in the range 0...510 kHz in steps of 2 kHz. The default value of the transmitter deviation is 288 kHz. |

| EVAL. WINDOW | Entry of measurement window in bursts between 1 and 30 000 000 (one burst with 320 bits per slot. Frames are repeated with a period of 10 ms). |

| RESULT UNIT | Display of result in PPM or in exponential notation. |

| LONGTERM BER | Selection of tolerance for maximum bit error rate averaged over the measurement window. |

| LONGTERM FER | Selection of tolerance value for maximum frame erasure rate average over the measurement window. |

RF LEVEL

Setting of the transmit power from -40 dBm to -100 dBm (referred to RF IN/OUT) in steps of 0.1 dB even during the measurement. By varying the transmit power, the sensitivity limit of the receiver of the DUT can be determined.

MULTI BEARER

Selection of **additional** slots to be used for fast bit error rate measurement. After activating the softkeys MULTI BEARER, the slot number is selected by means of the spinwheel and activated or deactivated with ENTER. All selected slots use the channel number (carrier) of the traffic bearers. Five additional slots can be used in the PP-TEST, one slot in the FP-TEST. Adjacent slots cannot be used.

NOTE:
Not all DECT systems can set up and maintain calls to the same partner in several slots simultaneously.

For example, if two traffic bearers are set up and an FER of 50% is displayed, this indicates that a second slot can be set up (eg for the purpose of handover), but that this slot is not intended for data transmission.

If the dummy slot of an FP is maintained after the call setup, this may prevent a further bearer from being set up in the dummy slot and its adjacent slot. If the CMD60 operates as FP (PP-TEST), the dummy bearer can be switched off in menu SIGNALLING PP-TEST CONFIGURATION (see section 2.5.2.1.).

2.6.9 Menu CONDITIONAL GOTO CONFIGURATION

Fig. 2.6-9   Menu CONDITIONAL GOTO CONFIGURATION

The CONDITIONAL GOTO action is a powerful tool for the implementation of loops and jumps such as:

- Endless loops for long-term tests
- Jumps for the repetition of measurements with modified tolerance settings for the categorization of DUTs
- Repeated attempt of call setup if PP has not synchronized in order to avoid long waiting times
- Repeated attempt of call setup to an FP in another slot if call setup was not possible due to the dummy bearer of the FP
- Determination of receiver sensitivity through successive adaptation of power levels in BER test
- Reduction of measurement time for BER measurements if no bit errors have been found after a short test time so as to perform a random sample test

| LINE NUMBER | Entry of jump address. The jump address is retained through automatic adaptation if actions are inserted or deleted. |

| N | Loop counter for jump condition "N TIMES". |

| CONDITION | Jump condition. The following conditions can be selected: |

- ALWAYS
  Unconditional jump

- IF FAILED
  The jump is executed only if at least one result of the previous measurement is out of tolerance. Otherwise the program continues with the next action.

- IF PASSED
  The jump is executed only if all results of the previous measurement are within tolerances. Otherwise the program continues with the next action.

- N TIMES
  The jump is executed as many times as defined in field "N". Then the program continues with the next action.

2.6.10   Menu AUTO TEST Active

While the autotest is running, the display indicates how the measurement proceeds. The format corresponds to the log printout format.

```
AUTO TEST    05: Auto Test 05

    Pos B-Field          [+259,+403]    : +288 kHz       OK
    Neg B-Field          [-403,-259]    : -289 kHz       OK
    Pos Sync-Field       [+202,+403]    : +241 kHz       OK
    Neg Sync-Field       [-403,-202]    : -250 kHz       OK
    -------------------------------------------------------------
    (04) BEARER RELEASE
    -------------------------------------------------------------
    (05) SETUP CONNECTION PP-TEST
        Mode        : LOOPBACK        Traffic Slot     : 2
        RF Level    : -40.0 dBm       Traffic Carrier  : 0
        Q0 Proto    : 000003FF0000    Carrier Offset   : 0.0
        Q3 Proto    : 003041108008    Dummy if Traffic : OFF
        Q6 Proto    : 006F0F000000    Dummy Slot       : 0

ABORT       Press CONT key to setup connection!              CON
                                                             TINUE
```

Fig. 2.6-10   Menu AUTO TEST Active

ABORT

Abortion of the running autotest..

CON TINUE

This softkey is displayed only during the call setup with a PP. The autotest continues if the PP indicates successful synchronization to the dummy bearer.
If an automatic waiting time has been configured, the latter can be reduced.

2.6.11   Menu AUTO TEST End

```
AUTO TEST    01: Short PP Test
                                                          PRINT
                                                          IS OFF

                                                          STOP
        DEVICE:              Five Tons PP                 PRINTING
        SERIAL NO:           39500373097
        RFPI:                6162636465
        PMID:                     00000


              TEST  OK
         ALL MEASUREMENTS IN TOLERANCE
PRINT
RESULTS

DISPLAY
RESULTS                                                   RESTART
```

Fig. 2.6-11   Menu AUTO TEST End

PRINT RESULTS

This softkey is used to print out the test report. More copies can thus be generated.

DISPLAY RESULTS

This softkey is used to enter the DISPLAY RESULTS menu (see section 2.6.12) to enable paging in the test report.

PRINT IS ON	This indicates that a report is generated on the printer while the autotest is performed. The report can be switched off by pressing this softkey.
PRINT IS OFF	This indicates that there is no report generated while the autotest is performed. The report can be switched on by pressing this softkey.
STOP PRINTING	Abortion of output to printer
RESTART	Exit from this menu and change to the AUTO TEST menu (see Section 2.6.1) in order to restart or configure the autotest or to exit from the autotest.

2.6.12   Menu DISPLAY RESULTS


```
AUTO TEST   01: Short PP Test

(02) POWER RAMP
   Dynamic    : LOW        Average Burst   : 100
LIMITS
   A(abs.)    : 20 nW      D(rel.)     : +1.0 dB
   B(abs.)    : 25.0 uW    E(rel.)     : -1.0 dB
   C(rel.)    : +4.0 dB    F(rel.)     : -6.0 dB

RESULTS                                              PAGE
   NTP  [+0.0,+25.0]       : +0.0 dBm    OK          UP
   Template              :          IS MATCHING      LINE
----------------------------------------------------     UP
(03) RF - MODULATION                                 LINE
   Data Type          : FIG31    Average Burst   : 4  DOWN

RESULTS                                              PAGE
                                                     DOWN
```

Fig. 2.6-12   Menu DISPLAY RESULTS

PAGE UP	Paging the test report up by 14 lines (in the direction of action 01).
LINE UP	Paging the test report up by one line (in the direction of action 01).
LINE DOWN	Paging the test report down by one line (in the direction of the last action).
PAGE DOWN	Paging the test report down by 14 lines (in the direction of the last action)

Press hardkey MENU UP to exit the menu DISPLAY RESULTS and return to the menu AUTO TEST End (section 2.6.11).

2.6.13   Menu AUTO TEST COPY

This menu allows for copying autotests between internal memory locations and - if Option CMD-B62 is fitted - even to and from a memory card. The latter also allows for transferring autotests to other Testers CMD60.

The menu consists of two autotest directories. The source directory is displayed left of the menu and the target directory right of it.

Autotests in the target directory can be deleted, too. They can be copied to empty memory locations only, for reasons of operating security (the target memory location must be deleted prior to overwriting).

```
┌─────────┐ ┌──────────────────────────────────────────────────┐ ┌─────────┐
│         │ │ AUTO TEST COPY                                   │ │         │
│ SELECT  │ │ ┌──────────────────────┬───────────────────────┐ │ │ SELECT  │
│ SOURCE  │ │ │ INTERN     -- SOURCE --│ -- TARGET --   MEMCARD│ │ │ TARGET  │
│         │ │ │                      │                       │ │ │         │
│         │ │ │                      │ 01  Short PP Test     │ │ │         │
│ PAGE    │ │ │                      │ 02  Long PP Test      │ │ │ PAGE    │
│ UP      │ │ │ 01  Short PP Test    │ 03  Short FP Test     │ │ │ UP      │
│         │ │ │ 02  Long PP Test     │ 04  FREE              │ │ │         │
│ PREV.   │ │ │ 03  Short FP Test    │ 05  FREE              │ │ │ PREV.   │
│ TEST    │ │ │ 04  Long FP Test     │ 06  FREE              │ │ │ TEST    │
│         │ │ │ 05  Auto Test 05     │ 07  FREE              │ │ │         │
│ NEXT    │ │ │ 06  FREE             │ 08  FREE              │ │ │ NEXT    │
│ TEST    │ │ │ 07  FREE             │ 09  FREE              │ │ │ TEST    │
│         │ │ │ 08  FREE             │ 10  FREE              │ │ │         │
│ PAGE    │ │ │ 09  FREE             │ 11  FREE              │ │ │ PAGE    │
│ DOWN    │ │ │ 10  FREE             │                       │ │ │ DOWN    │
│         │ │ └──────────────────────┴───────────────────────┘ │ │         │
│ COPY    │ │                                                  │ │ DELETE  │
└─────────┘ └──────────────────────────────────────────────────┘ └─────────┘
```

Fig. 2.6-13   Menu AUTO TEST COPY

SELECT SOURCE	This softkey is provided only if Option CMD-B62 is fitted. It switches over the autotest source directory on the left between internal and memory card.
PAGE UP	Paging up by 14 memory locations in the source and target directories (in the direction of autotest 01).
PREV. TEST	Selection of the previous autotest in the source and the target directory each.
NEXT TEST	Selection of the next autotest in the source and the target directory each.
PAGE DOWN	Paging down by 14 memory locations in the source and target directories (in the direction of autotest 20).
COPY	This softkey initiates the copy procedure. The framed autotest in the source directory (left) is copied to the framed memory location in the target directory (right). Copying is possible only if the selected memory location in the target directory is FREE. If not, it must be deleted prior to copying.
SELECT TARGET	This softkey is provided only if Option CMD-B62 is fitted. It switches over the target autotest directory on the right between internal and memory card.
DELETE	Deletes the framed autotest in the target directory (right).