STABILOCK 4031 4032

CDMA 800/1900 MHz BS Test

Software Option 897 804

Operating Instructions

(61_CDMA) Doc. Version: 9811-210-A

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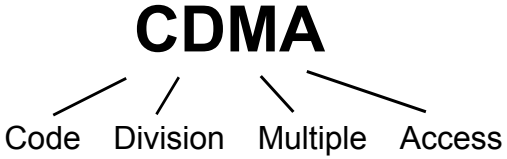
☞ **Differences from older software versions:** see Lifeline at end of these instructions.

Introduction

The CDMA BS Test option enables the user to test the performance of CDMA base stations to the IS-95 and related specifications standard defined by the United States Telecommunications Industry Association. In addition to tests defined in the standard, other measurements can be performed that are useful when troubleshooting a base station. All tests can be fully automated under IEEE control.

For easy-to-use measurement, pre-defined settings for `IS-95` and `PCS 1900` are available by pressing only one softkey.



☞ If you are not familiar with the usage of the STABILOCK, see the operating manual or, for a brief introduction read section "Short Notation Rules" in this manual.

Equipment supplied

The CDMA BS Test is delivered as a dual-band version with 800 MHz and 1900 MHz (Software option CDMA.SYS 897 804).

Each CDMA option is delivered with the following standard accessories:

1 × CDMA hardware, implemented in the STABILOCK (slot 5 and slot 6), (including software 897 805).
1 × RF cable K113
1 × SYSTEM CARD with the CDMA system program (Software option 897 804)
1 × 10 MHz filter

Equipment recommended

Software option 2.1 GHz Analyzer Tracking (897 928)

Short notation rules

Screen messages in running text

`Offset` Notation for texts when they are to be read off the screen.

Following the text `IEEE-488 ADR.:` there is a number ... on the screen shown in inverted form.	`IEEE-488 ADR.:` is a screen message that you will look at later when calling up the so-called status mask.

Prompt to operate key

[AUX] Notation for keys.

(DATA) Notations for softkeys (these are the six function keys along the bottom edge of the screen).

[AUX] + (DATA) Notation for entry prompts. In plain text this example means: first press the [AUX] key and then the (DATA) softkey.

If there is just lowercase text between pointed brackets (<text>), there is **no** key with this name. In such cases entries are meant, examples of which will be given below.

If a number appears between pointed brackets (<text>), this refers to the entry of this number on the keypad.

[FREQU]	Operate the [FREQU] key.

[FREQU] + <value> + [ENTER]	This string means that first the user presses the [FREQU] key and then, using the keys of the numeric cluster, enters the required (frequency) value. Finally the user transfers the value to the 4032 with [ENTER]. <value> can also mean that the user only has to alter a previously entered value manually.

1. [FREQU] 2. <value> 3. [ENTER]	This is the numeric sequence of the preceeding example.

☞ Please read chapter 3, "Operating" of the Communication Test Set manual for further information. Read chapter 11, "TRAINING" of the operation manual for proper use of the STABILOCK.

Hardware requirements

In order to test CDMA BTS equipment, the following hardware components are required:

- CDMA option fitted in the STABILOCK 4032 (253 003)
- FEX frequency-range extension (248 295)
- Necessary for Analyzer Tracking:
  Analyzer hardware option fitted in the STABILOCK 4032 (236 062).

To verify the configuration status of the Communication Test Set, execute the following procedure:

- Call up STATUS mask with AUX + DEF.PAR + STATUS.
- Check status of firmware version:

  HOST MCU ≥ 6.20

  CRT MCU ≥ 3.20

  RF/AF MCU ≥ 6.20
- Entries `Duplex + FEX` and Data Module must be identified as `installed` in the OPTIONS mask.
- HW REVISIONS mask must show the following entries:

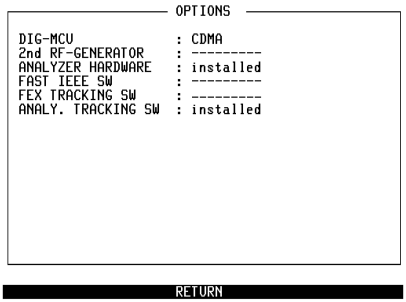


Fig. 10.1:
OPTIONS mask, field `DIG-MCU` shows that the CDMA hardware is installed and the field `ANALY. TRACKING SW` shows that the software option Analyzer Tracking is installed.

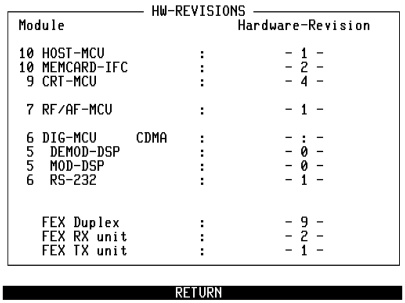


Fig. 10.2:
HW-REVISIONS mask.

Fig. 10.3:
Second HW-REVISIONS mask.

Loading and Starting CDMA System Program

The CDMA BS Test system program is contained on a 64 kByte SYSTEM CARD. You have to load the CDMA system program into the RAM of the Communication Test Set if it is the first time that you use the CDMA program or after a total reset of the STABILOCK, or if you use another system program before CDMA.

If the CDMA system program is already in the RAM of the STABILOCK (the program is not lost, if you switch off or disconnect the STABILOCK from the power line) you can call up CDMA with the steps described in "Start CDMA system program" below.

Load CDMA system program

1.) Insert the memory card with the CDMA system program in the memory card slot of STABILOCK.

2.) Call up the MEMORY mask by (MEMORY). The display shows the contents of the SYSTEM CARD.

3.) Select the CDMA.SYS entry with the cursor and then load the system program by (RECALL). The message `INFO: Loading Program` is displayed about 5 seconds.

4.) The CDMA BS Test system program is now in the RAM of the Communication Test Set.

Start CDMA system program

1.) Insert the memory card with the CDMA system program in the memory card slot of STABILOCK.

2.) Start the system program by (AUX) + (DATA) .

3.) The Summary mask of the CDMA BS Test option is displayed. The measurements starts automatically.

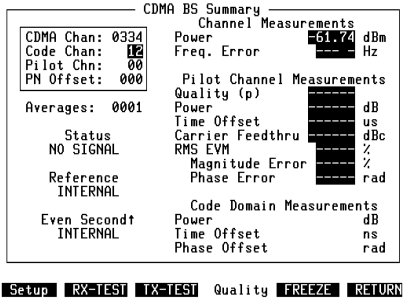
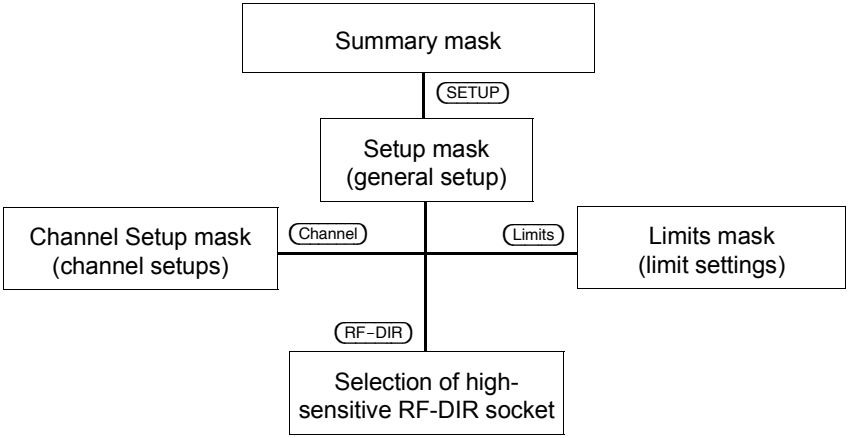


Fig. 10.4:
Summary mask after starting system program (no BS connected).

General Test Parameters

Overview



Available Setup masks

Fig. 10.5:
Setup mask: for making basic settings for other CDMA BS Test masks.
Mask called up by (SETUP) from the Summary mask.

Fig. 10.6:
Channel Setup mask, for setting channel/frequency allocations.
Mask called up by (SETUP) + (Channel) from the Summary mask.

Fig. 10.7:
Limits mask: here the user enters the limits for pass/fail assessment of the measured results.
Mask called up by (SETUP) + (Limits) from the Summary mask.

All displayed values reflect the default parameter settings.

Display parameters and test parameters

All settings of display parameters and test parameters are made either in the Setup mask (called up from Summary mask by (Setup)) or in additional masks accessed from the mask.

The standard settings of all entry fields of the mask can be retrieved by (Default).

Averages

Setting in Setup mask

`Averages, Summary`
`Averages, Min-Max`
`Averages, Code Domain`

In these fields the user enters the number of measurements on which the particular average is formed. Numbers between 1 and 1000 are permissible.

`Measurement Interval`

The values selected on this line determine the size of the measurement window, defined in increments of Walsh Function Periods (WFP).

The following window sizes (WFP values) can be selected:

WFP	Corresponds to
4	0.2083 ms
8	0.4167 ms
12	0.6250 ms
16	0.8333 ms
20	1.0417 ms
24	1.2500 ms

Longer measurement windows (higher WFP) yield more accurate measurements.

Changing units of test results

Setting in Setup mask

`Channel Power Units` — Unit of transmitted power on channel, can be set as dBm or W (including mW).

`Pilot Power Units` — Unit of power of pilot signal. Power of pilot signal is indicated in relation to total power. Possible settings are ρ, dB (= 10 × log ρ) and % (= 100 × ρ).

`Code Domain Power Units` — Unit of power in Code Domain masks. Power is indicated in relation to total power. Possible settings are ρ, dB (= 10 × log ρ) and % (= 100 × ρ).

`Pilot RMS Phase Units` — Unit of phase of pilot signal, can be set as rad or deg.

`Code Domain Phase Units` — Unit of phase in Code Domain masks, can be set as rad or deg.

Setting pre-attenuation

Pre-attenuation can be set either in the CDMA mask or in the GENERAL PARAMETERS mask (call up by [AUX], [DEF.PAR.]).

`Pre-Attenuation` — Enter pre-attenuation value in dB (eg. for cable loss), which is then used in all channel power measurements.

Setting time domain interval

`Time Domain Interval` — Setting of time interval for measurements in the Channel Power vs Time mask. Results between 1 and 999 ms are permissible. 200 ms are preset.

High-sensitive RF DIR socket

In the Setup mask, [RF-DIR] activates the high-sensitive RF DIR socket for TX tests and lits the DIR LED. The softkey labelling changes to [RF-DIR]. Pressing it again, reselects the RF socket and the DIR LED is turned off.

The RF DIR socket is by 27 dB more sensitive than the RF socket and can therefore be used e.g. for TX measurements with an antenna instead of a cable.

The socket selected here is automatically used for spectrum and power measurements. By default it is set to RF.

☞ In RX test, only the RF socket is used.

Channel/frequency assignment

Channel/frequency assignment can be set up in the Channel Setup mask. Default channel and frequency assignments for IS-95 and J-STD-008 (labeled PDC 1900) are available, but user-defined channel settings are also possible.

CDMA BS Channel Setup mask

Pre-defined channel settings

1.) From the CDMA Summary mask, call up the Channel Setup mask by (Setup) and then (Channel) (mask).

2.) Select the appropriate system in the `System` field by using the (+) or (–) hardkeys to toggle the selections. Possible settings are `IS-95`, `PCS 1900` and `Custom`. Select `IS-95` or `PCS 1900` (J-STD-008), the related parameters are entered in the Channel Setup mask automatically.

User-defined channel settings

1.) Select the `Custom` entry in the `System` field.

2.) Enter the duplex spacing in the `Duplex Spacing` field.

3.) Enter whether the mobile transmits on a channel above or below the base station in the `Duplex Direction` field.

4.) Enter the channel spacing in the `Channel Spacing` field.

5.) Enter whether the frequency becomes higher with ascending channel number (Freq ↑) or lower (Frequ ↓) in the `Direction` field.

6.) Enter the frequency of channel 1 and channel 991 in the `Start Frequency` field.

Setting pass/fail limits

When results are displayed in the measurement masks, those that fall outside pass/fail limits defined in the Limits mask are shown in reverse video. Test limits can be specified such that reported results are either checked against maximum only, minimum only, maximum and minimum, or no check is performed.

Fig. 10.8:
(Limits) calls up the Limits mask from the mask.

`Measurement` Measured value that is tested (eg power or frequency error).

`Nominal` The parameter value that the base station, ideally, should meet.

`Min`
`Max` The lower and upper parameter limits.

`Test` In this column, the user specifies the type of limit testing to be performed.

Set entry	Meaning
`Min/Max`	Measurements are tested against both upper and lower limit.
`Min`	Measurements are only tested against lower limit.
`Max`	Measurements are only tested against upper limit.
`Blank`	No limit testing enabled.

(Default) Standard limits are reset, see Fig.10.8.

(RETURN) Returns to mask.

Perform CDMA Tests

Pre-settings

1. After entering the general test parameters, call the CDMA Summary mask.
2. Enter the frequency channel number to be measured in the `CDMA Chan` field.
3. Enter the code channel to be measured in the `Code Chan` field. All code domain measurements are performed on this channel. The following channel assignments are defined in CDMA specifications:

Channel number	Assignment
0	Pilot channel
1	Paging channel
2-7	Paging or traffic channel
8-31	Traffic channel
32	Synchronization channel
33-63	Traffic channel

4. Enter the pilot PN offset index of the BTS sector to be tested in the `PN Offset` field.

☞ If the PN offset index of the BS is unknown, then perform the PN offset search function (see page 10-15).

PN offset search function

The PN offset search function allows to quickly find the PN offset of the sector connected to. The STABILOCK automatically searches for the correct timing offset of the short PN code. This code is used by the CDMA network to distinguish sectors from one another.

Since there are 512 unique offsets (the short sequence is 32768 bits long and each offset is 64 bits), this function greatly reduces the amount of setup time needed to accurately test a CDMA base station.

The only input needed on the STABILOCK to begin measuring is the CDMA channel, which is constant across the network, if there are no multiple carrier implementations. While searching (for maximum 8 seconds) the status field shows SEARCHING.

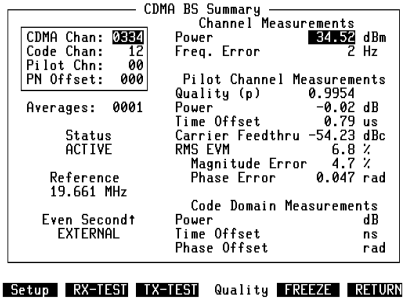


Fig. 10.9: The Summary mask with connected BS.

☞ If you are not aware of the right PN offset index, you can start a PN offset search by entering the dummy index 512.

☞ Before starting the search function, please ensure that ext. Even Second Clock and RF power > –50 dBm is connected to the STABILOCK test set.

☞ The PN offset search function works in the **Summary mask only**.
Softkey (Quality) must be displayed in inverse video.

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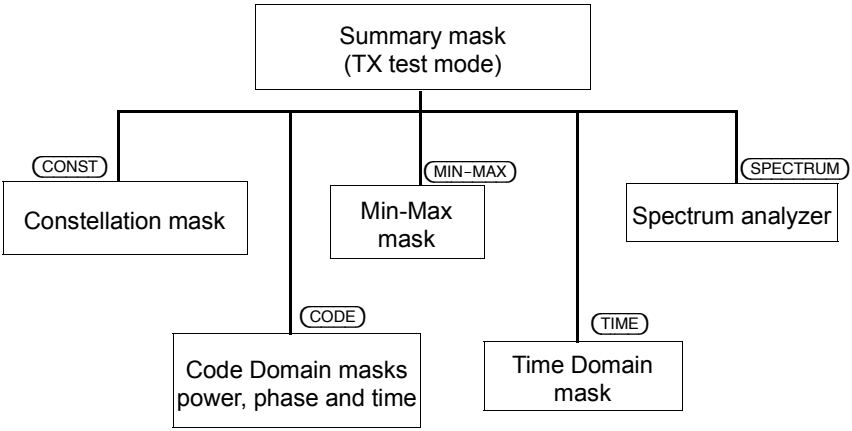
TX test

Overview



☞ For TX tests, both the RF and the RF-DIR socket are available. You select the desired one in the Setup mask.

Available TX test masks

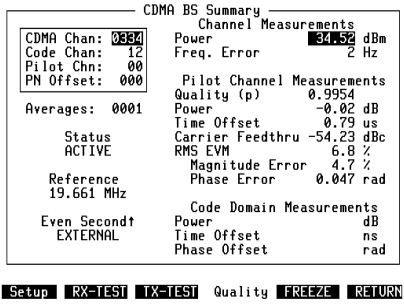


Fig. 10.10:
Summary mask before a TX test is started.

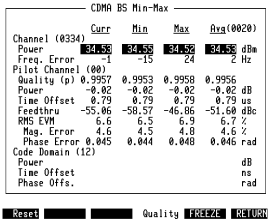


Fig. 10.11:
Min-Max mask: this shows the current measured figure, the minimum, maximum and average of the last measured results from all measurements.
Mask called up by (TX-TEST) + (MIN-MAX) from the Summary mask.

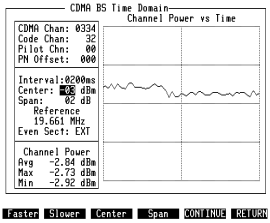


Fig. 10.12:
Time Domain mask: the power in the CDMA channel is displayed on the time axis.
Mask called up by (TX-TEST) + (TIME) from the Summary mask.

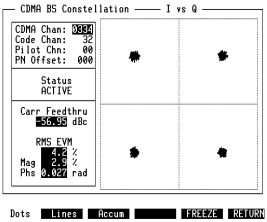


Fig. 10.13:
Constellation mask:
called up by (TX-TEST) + (CONST) from the Summary mask.

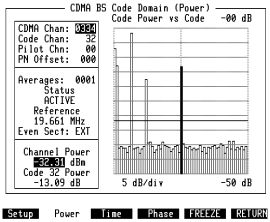


Fig. 10.14:
Code Domain Power mask: display of the power in the individual CDMA channels.
Mask called up by (TX-TEST) + (CODE) + (Power) from the Summary mask.

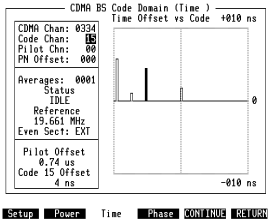


Fig. 10.15:
Code Domain Time mask: display of the time offset of the CDMA channels.
Mask called up by (TX-TEST) + (CODE) + (Time) from the Summary mask.

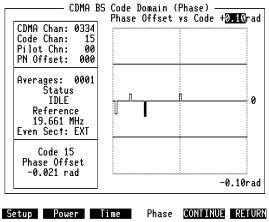


Fig. 10.16:
Code Domain Phase mask: display of the phase offset of all 64 CDMA channels.
Mask called up by (TX-TEST) + (CODE) + (Phase) from the Summary mask.

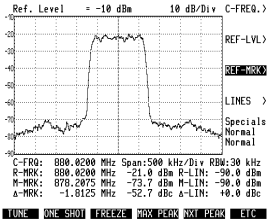


Fig. 10.17:
Basic analyzer mask: the functions of the spectrum analyzer are described in the operating manual, chapter 6.
Mask called up by (TX-TEST) + (SPECTRUM) from the Summary mask.

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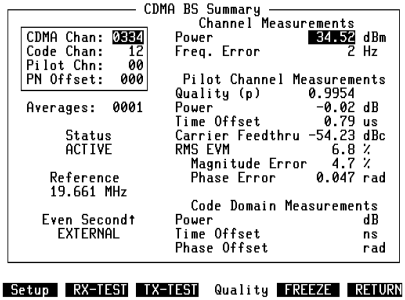
TX test results

After (TX-TEST) only the softkeys alter, the STABILOCK switches to the TX test mode. The Summary mask shows all measured values of the TX test.

Fig. 10.18:
An active channel has been found and is used for measurements.



Summary mask

Status information

`Status` field

The following status information can be displayed:

Status information	Meaning
IDLE	The measurements have been suspended by pressing (FREEZE), no measurement is performed.
SEARCHING	The Communication Test Set is performing a correlation search on the pilot channel. This search mode is activated when the CDMA module detects that there is no external even clock connected to the test set. In this mode, the test set is using its internal even second clock. The result of the search is the PN sequence state that provides the maximum correlation with the current signal sample. Once this has been found, the test set will remain synchronized to the BTS signal unless the pilot power changes by more than ±1.25 dB. The latter condition will cause the test set to reinitiate a search for the optimum PN sequence state.
NO SIGNAL	Transmitted power is too low.
NO PILOT	The Communication Test Set has found a signal on the channel but the pilot power is too low (less than –13 dB).
NO CODE CH	The Communication Test Set has correlated to the pilot channel signal but could not detect the selected code channel. All measurements except for code domain are valid.
ACTIVE	The Communication Test Set has detected the signal on both the pilot channel and the code channel. All measurements can be performed.

Reference field — Indicates the reference frequency for all measurements.

Indication	Meaning
INTERNAL	The Communication Test set is using either its internal 10 MHz reference, or a 10 MHz reference injected at the standard reference port.
19.661 MHz	An external frequency was injected at the EXT REF input of the CDMA module. This external reference must be 19.6608 MHz.
UNSTABLE	An external reference was found but it is unstable. The Communication Test Set automatically switches to its internal reference.

Even Second field — Indicates whether the even second clock is generated internally or externally.

Indication	Meaning
INTERNAL	No even second clock detected. An internal even second reference clock is generated by the Communication Test Set.
EXTERNAL ↑	An even second clock was detected and is used for measurements. The STABILOCK 4032 is synchronized to the rising edge of the even second clock pulse.

Measurement in CDMA channel

`Power`	Average of power in the CDMA channel.
`Freq. Error`	Frequency error. The difference between the measured and the specified carrier frequency.

Measurement in pilot channel

`Quality (ρ)`	Modulation quality as specified in IS-97 (10.3.2). The quality is the normalized correlated difference between the measured and the ideal signal. The measurement is only valid if transmission is solely on the pilot channel.
`Power`	The power (correlated) of the signal on the pilot channel, relative to total power.
`Time Offset`	The measured time offset of the pilot channel, relative to the PN offset, as specified in IS-97, 10.3.1. Time offset of the pilot channel is not measured when the test set is using its internal even second clock.
`Carrier Feedthru`	Origin offset.
`RMS EVM`	The RMS average of all vector errors. The measurement is only valid if transmission is solely on the pilot channel.
`Magnitude Error`	The RMS average of the magnitude difference between the measured signal and the ideal signal at the point of maximum effect (POME). The measurement is only valid if transmission is solely on the pilot channel.
`Phase Error`	The RMS average of the phase difference between the measured signal and the ideal signal at the point of maximum effect (POME). The measurement is only valid if transmission is solely on the pilot channel.

Code domain measurements

☞ Code domain measurements are only performed when (Quality) is not activated.

`Power`	The power (correlated) of the selected code channel, relative to the power on all channels.
`Time Offset`	Time offset between the selected code channel and the pilot channel.
`Phase Offset`	Phase offset between the selected code channel and the pilot channel.

The following softkeys can be used to activate specific transmitter test modes:

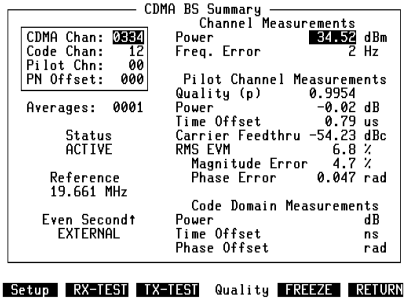


Fig. 10.19:
Summary mask after selecting (TX-TEST).

(CONST) Calls up Constellation mask.

(CODE) Calls up Code Domain mask.

(TIME) Calls up Time Domain mask.

(MIN-MAX) Calls up Min-Max mask.

(SPECTRUM) Calls up spectrum analyzer of Communication Test Set.

(RETURN) Recalls Summary mask with first softkey level.

Constellation mask

Call up with (CONST).

The Constellation mask shows the I/Q diagram for the demodulated BTS signal. This diagram can be used to qualitatively assess impairments in the BTS transmitter, such as excessive phase noise, frequency offset, or amplitude distortion.

(FREEZE) (FREEZE) stops the ongoing measurement and freezes the display.
(CONTINUE) Press (CONTINUE) to continue the measurement.

(RETURN) Calls up the Summary mask.

Entry fields

The CDMA channel, the code channel and the PN offset can be altered in the Constellation mask.

Display fields

– Status information (`Status` field) as in the Summary mask (see description of Summary mask).

– Origin offset (`Carr Feedthru` field) as in the Summary mask (`Carrier Feedthru` field).

– Average of the difference of all vector errors, magnitude errors and phase errors as in the Summary mask.

☞ These measurements are only valid if transmission is solely on the pilot channel.

– Constellation diagram.

Available displays of diagram:

(Dots) The points of maximum effect (POME) of a measurement are indicated. A well aligned base station shows four tight accumulations of dots in the centers of the diagram squares.

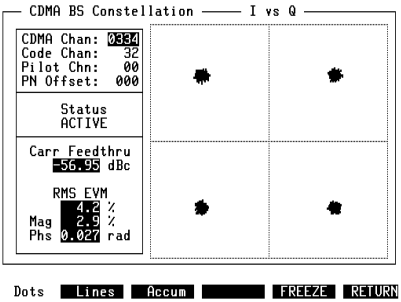


Fig. 10.20: Constellation mask with well aligned base station.

(Lines) The points of maximum effect (POME) are joined together. Phase errors are easy to recognize in this kind of display.

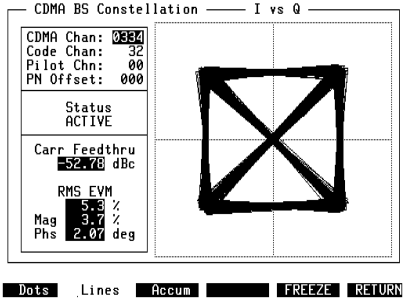


Fig. 10.21: Constellation mask with an I/Q diagram indicating a phase error.

(Accum) As in (Dots), however the points are not erased after a measurement but continue to be displayed. Long-term trends in the BTS transmitter quality can be observed.

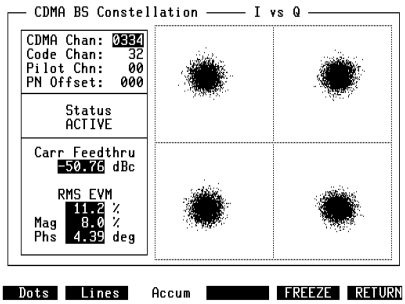


Fig. 10.22: Here a base station that is not particularly well aligned has been measured over an extended period.

Code Domain masks

The Code Domain masks show the measured result (phase or time or power) in the 64 code channels of the current CDMA channel.

The Code Domain Power mask shows the correlated power for **all** code channels.
The Code Domain Phase mask shows the phase error for **active** code channels.
The Code Domain Time mask shows the time offset for **active** code channels.

Code domain time and phase offset measurements are relative to the pilot channel, as specified in IS-97 (10.3.1).

Code Domain Power mask

Shows the correlated power in each of the 64 code channels.

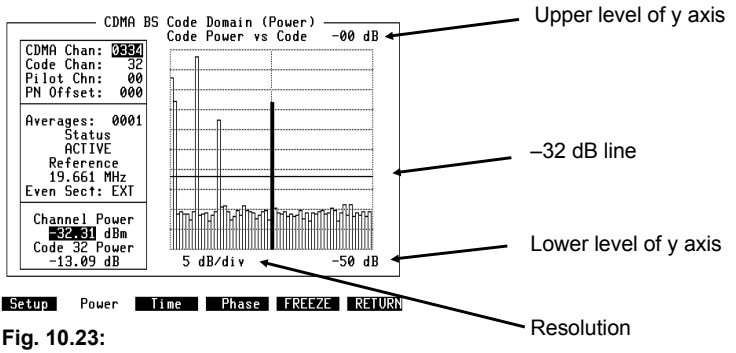


Fig. 10.23:
Indication of power in all 64 code channels.

(Phase)	Changes to the Code Domain Phase mask.
(Time)	Changes to the Code Domain Time mask.
(FREEZE)	Stops the ongoing measurement and freezes its display.
(CONTINUE)	Restarts a measurement after (FREEZE).
(RETURN)	Calls up the Summary mask.

Entry fields

In the Code Domain Power mask it is possible to change the CDMA channel, the code channel and the PN offset (see Summary mask for details of fields). The selected code is highlighted in the graphical display.

☞ The entry field `Code Chan` can be changed via handwheel if the field is displayed in inverse video, even if (FREEZE) was pressed.

In field upper level of y axis, you can enter the power level reflected by the upper line of the grid. With the scroll field resolution, you can alter the displayed resolution (available values: 0.1, 0.5, 1, 2, 5).

The field lower level of y axis is a rusult of the field upper level of y axis and the resolution:
upper level of y axis = 99 dB – 10 × resolution

The 99 dB results from the maximum displayed area:
upper level of y axis + 10 × resolution ≤ 99 dB

Display fields

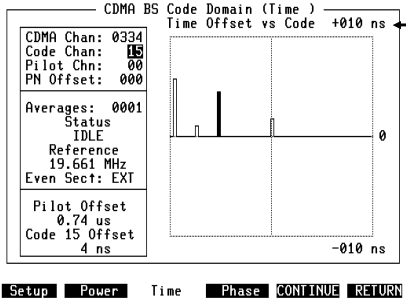
– Status information (`Status` field) as in the Summary mask (see description of Summary mask).
– Reference frequency and even second clock status.
– The displayed –32 dB line reflects the threshold for active code channels (according IS-97, chapter 10.4.4.3).

The total power in the CDMA channel is indicated in the `Channel Power` field.

The power of the selected code channel relative to the channel power can be read numerically in the `Code Power` field.

Code Domain Time mask

Shows the relative time offset of each active code channel.



permitted values are from 1 to 999 ns

Fig. 10.24:
Indication of time offset in active code channels.

(Power) Changes to the Code Domain Power mask.

(Phase) Changes to the Code Domain Phase mask.

(FREEZE) Stops the ongoing measurement and freezes its display.

(CONTINUE) Restarts a measurement after (FREEZE).

(RETURN) Calls up the Summary mask.

Entry fields

In the Code Domain Time mask it is possible to alter the CDMA channel, the code channel and the PN offset (see Summary mask for details of fields).
The selected code channel is highlited in the graphical display.

☞ The code channel can be changed via handwheel, if the according numerical value is highlighted (even if (FREEZE) was pressed).

Display fields

– Status information (`Status` field) as in the Summary mask (see description of Summary mask).

– Reference frequency and even second clock status.

The pilot time offset relative to the specified time is indicated in the `Pilot Offset` field.

The time offset of the selected code channel relative to the pilot channel can be read numerically in the `Code xx Offset` field.

Code Domain Phase mask

Shows the relative phase error of each active code channel.

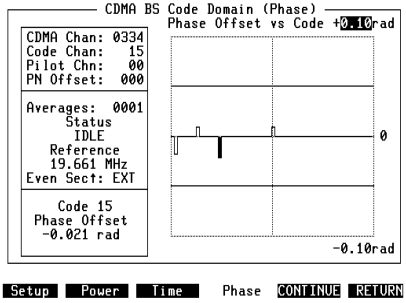


Fig. 10.25:
Indication of phase error in active code channels.

(Power) Changes to the Code Domain Power mask.

(Time) Changes to the Code Domain Time mask.

(FREEZE) Stops the ongoing measurement and freezes its display.

(CONTINUE) Restarts a measurement after (FREEZE).

(RETURN) Calls up the Summary mask.

Entry fields

In the Code Domain Phase mask it is possible to alter the CDMA channel, the code channel and the PN offset (see Summary mask for details of fields).
The selected code channel is also highlighted in the graphical display using inverse video.

☞ The code channel can be changed via handwheel, if the according numerical value is highlighted (even if (FREEZE) was pressed).

Display fields

– Status information (`Status` field) as in the Summary mask (see description of Summary mask).

– Reference frequency and even second clock status.

The phase error of the selected code channel can be read numerically in the `Phase Offset` field.

Time Domain mask

The Time Domain mask shows the total channel power versus time template of the CDMA channel.

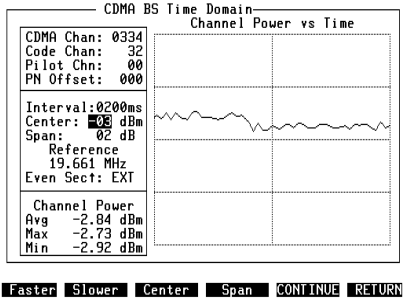


Fig. 10.26:
Time Domain mask with horizontal time axis and vertical power axis.

(Faster) Decreases the update interval of the display. It does not effect the measurement accuracy.

(Slower) Increases the update interval of the display. It does not effect the measurement accuracy.

(Center) Centers the display on the average last measured (rounded up/down to the nearest integer value). If the measurement is indicated in W, dBm should be selected for the average before (Center).

(Span) Sets the display range of the diagram to 4/3 of the difference between the minimum and maximum of the measured average. If the measurement is indicated in W, dBm should be selected for the average before (Span).

(FREEZE) Stops the ongoing measurement and freezes its display.

(CONTINUE) Restarts a measurement after (FREEZE).

(RETURN) Calls up the Summary mask.

Entry fields

In the Time Domain mask it is possible to alter the CDMA channel, the code channel and the PN offset (see Summary mask for details of fields).

Display fields

– The `Interval` field shows the measurement period interval.

– Reference status and even second clock status.

– Current (average) power measurement.

– Maximum power measured in the ongoing interval.

– Minimum power measured in the ongoing interval.

Min-Max mask

The Min-Max mask shows the current measurements, the minimum measured figure, the maximum measured figure and the average of all measurements performed in the ongoing interval.

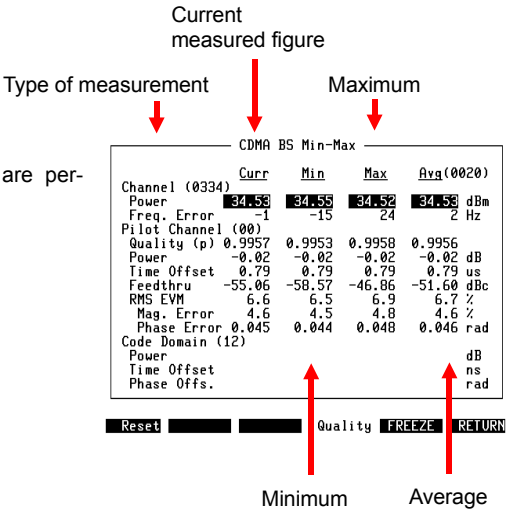


Fig. 10.27:
No code domain measurements are performed when (Quality) is active.

(Reset) Resets the calculation of averages and the current minimum and maximum results to 0.

(Quality) Toggling the (Quality) softkey switches between Pilot mode measurement and code domain measurements.

(FREEZE) Stops the ongoing measurement and freezes its display.

(CONTINUE) Restarts a measurement after (FREEZE).

(RETURN) Calls up the Summary mask.

Spectrum analyzer mask

The displayed SPECTRUM ANALYZER mask is based on the spectrum analyzer hardware option (ordering code: 248 291). For details of this mask, refer to the operating instructions for the spectrum analyzer.

When activated from the Summary mask (in TX test mode), the Spectrum analyzer mask will take over the center frequency of the CDMA channel, selected in the Summary mask. The default span is 500 kHz/div., or a total span of 5 MHz. The resolution bandwidth is 30 kHz.

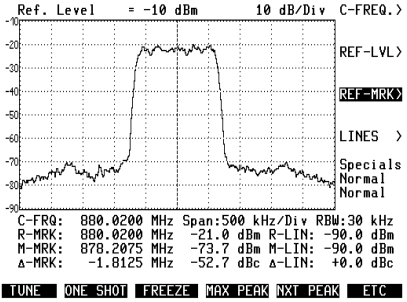


Fig. 10.28:
Spectrum analyzer mask.

(ETC) Changes the softkeys to:

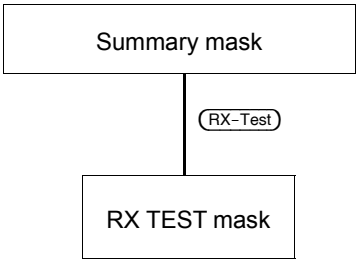
Fig. 10.29:
Spectrum analyzer mask with (ETC).

☞ Spectrum measurements automatically use the socket specified in the Setup mask (RF socket or high-sensitive RF-DIR socket).

☞ (TRACKING) is only available, if the software option "2.1 GHz Analyzer Tracking" 897 928 is installed, otherwise the softkey is left blank. For details concerning the software option, please refer to the respective manual.

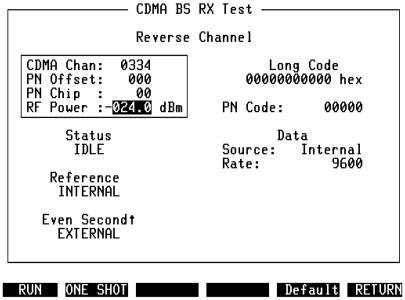
RX test

Overview



RX masks

Fig. 10.30:
RX TEST mask.



Start RX test

The RX TEST mask allows the user to generate a reverse channel signal with the Communication Test Set. The signal is modulated with random data and can be used for sensitivity or FER measurements on the base station receiver.

(RX-Test)	Calls up the RX Test mask (from Summary mask).
(RUN)	Starts a continuous RX test.
(ONE SHOT)	Starts a single RX test.

`CDMA Chan`	Set the CDMA channel.
`PN Chip`	The user may enter a value between 0 and 63. Can be used to introduce time offset (delay) into reverse signal. Each unit (chip) will introduce a 813 ns delay in the transmitted signal.
`PN Code`	This field displays the total offset in the reverse channel signal, calculated using the PN offset and the PN chip. Displayed in units of chips. PN code = PN chip + (64 × PN offset)
`PN Offset`	Enter the pilot PN offset (0 to 511) of the base station under test.
`RF Power`	Total output power for the reverse channel signal (signal + noise if AWGN is ON).
`Long Code`	A PN sequence with the period 2^{42}–1. This sequence identifies a mobile on the traffic channel. Fixed to all zeros.
`Data Source`	The source from which data are transmitted on the reverse channel: Internal: the Communication Test Set generates internal random data. Custom: data is loaded from an external unit on the IEEE interface.
`Data Rate`	The baud rate at which the data is transmitted.

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Querying Results with IEEE Controller

The Communication Test Set can be controlled by an external IEEE controller. Precise details of how IEEE commands are used can be found in Chapter 8 of the STABILOCK manual, section "IEEE Commands".

IEEE programming conventions

Only the first five characters are relevant for identifying an IEEE command (written in upper case in the name of the command). To make a program easier to understand, any number of characters may be added to the name of a command (eg `SETDUPLEX` instead of `SETDU`). No distinction is made between upper case and lower case.

Many IEEE commands require the entry of parameters. These are numeric results with and without units for example, softkey designations or states (on/off). The parameters necessary for a command are stated in the details of the command.

Masks called up by IEEE commands differ on one point from masks called up manually: the instrument shows measured results on the display until the next measurement request (command) produces a new result.

☞ An IEEE command line may be maximally 100 characters long.

CDMA BS Test-specific IEEE Commands

SPECIal01,a,bbbb		
The command starts CDMA TX measurements and controls the averaging of measured results.		
a = Averaging of measured results.	0	The calculated averages are only reset if the number of measured results over which the averages are formed is altered.
	1	The averages are reset.
bbbb = Number of measurements over which average is to be formed.	0001 to 9999	

SPECIal02

Status query, the Communication Test Set reports the status of the CDMA BS Test option to the controller.

Output format: aaaa, bb, cc, dd

aaaa = CDMA BS Test status (16 bits)

Value	Bit number							
	15	14	13	12	11	10	9	8
0	Synchronization ok	Not used						
1	External synchronization lost							

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

bb = Number of mask currently displayed

90	Summary mask	93	Power diagram	96	Power/time template
91	Min-Max mask	94	Phase diagram	97	Spectrum analyzer
92	Constellation diagram	95	Time diagram		

cc = current softkey level of Summary mask

00	Standard softkey level of active mask

dd = test mode

01 = BS test

SPECIal03,aaaa,bbbb,cccc,ddd	
Sets the values of fields `Result, averaging` and `Timing measurements` of the `CDMA SETTINGS` mask. Measurement has to be restarted for changes to take effect.	
aaaa	Averaging in the Summary mask is performed over the number of frames set in aaaa (`Result averaging` field).
bbbb	Averaging in the Min-Max mask is performed over the number of frames set in bbbb (`Timing measurements` field).
cccc	Averaging in the diagram masks is performed over the number of frames set in cccc (`Timing measurements` field).
ddd	Time interval in power/time template.

SPECIal04,aaaa,bbb...b	
Transfer of user-defined data. A maximum of 3000 frames can be transferred, so the SPECIal04 command has to be transmitted 3000 times to define all reverse channel data.	
aaaa	Number of frames (1 to 3000).
bbb...b	Data, up to 36 bytes (72 hexadecimal results).

Query with RESULt command

Command	String 12345678901234567890	Meaning
Summary mask		
RESULt1	aaaaaabbbccccddddddd	a = Channel power b = Channel power unit of measure c = Frequency error (Hz) d = Pilot time offset (µs)
RESULt2	aaaaaabbbbbbccddddddd	a = Waveform quality b = Code domain power c = Code domain power dimension d = Carrier feedthru
RESULt3	aaaabbbbbbccdddddeee	a = Code domain time offset b = Pilot power c = Pilot power unit of measure d = RMS phase error e = RMS error dimension
RESULt4	aaaaabbbbbccccccddd*	a = RMS EVM b = RMS magnitude error c = Code domain phase offset d = Code domain offset dimension * = not used
RESULt5	aaaaaaaaaa**********	a = Measurement status * = not used
RESULt6	aaaaaaaaaabbbbbbbb**	a = Reference status b = Even second clock * = not used

Command	String 12345678901234567890	Meaning
Min-Max mask		
RESULt1	aaaaabbbbbccccddddd	Frequency error (Hz): a = current b = minimum c = maximum d = average
RESULt2	aaaaaabbbbbbccccccdd	Pilot time offset (µs): a = current b = minimum c = maximum d = average (first two digits)
RESULt3	aaaabbbbccccddddeeee	Pilot time offset: a = average (last four digits) Code time offset (ns): b = current c = minimum d = maximum e = average (first two digits)
RESULt4	aaaaabbbbbccccddddd	RMS magnitude error (%): a = current b = minimum c = maximum d = average
RESULt5	aaaaabbbbbccccddddd	RMS phase error (deg or rad): a = current b = minimum c = maximum d = average
RESULt6	aaaaabbbbbccccddddd	RMS EVM (%): a = current b = minimum c = maximum d = average
RESULt7	aaaaaabbbbbbcccccc**	Channel power (dBm or W): a = current b = minimum c = maximum * = not used
RESULt8	aaaaaabbbbbbcccccc**	Channel power: a = average Waveform quality: b = current c = minimum

Command	String 12345678901234567890	Meaning
RESULt9	aaaaaabbbbbbccccccc**	Waveform quality: a = maximum b = average Pilot power (dB, % or linear): c = current * = not used
RESULtA	aaaaaabbbbbbcccccc**	Pilot power: a = minimum b = maximum c = average * = not used
RESULtB	aaaaaabbbbbbcccccc**	Carrier feedthru (dBc): a = current b = minimum c = maximum * = not used
RESULtC	aaaaaabbbbbbcccccc**	Carrier feedthru: a = average Code domain power (dB or %): b = current c = minimum * = not used
RESULtD	aaaaaabbbbbbcccccc**	Code domain power: a = maximum b = average Code domain phase (deg or rad): c = current * = not used
RESULtE	aaaaaabbbbbbcccccc**	Code domain phase: a = minimum b = maximum c = average * = not used
RESULtF	aaabbccdddeee*******	Dimension: a = Channel Power b = Pilot power c = Code domain power d = RMS phase e = Code domain phase * = not used

Command	String 12345678901234567890	Meaning
Time Domain mask		
RESULt1	aaaaaabbbccccccddd**	a = Average channel power b = Average channel power unit of measure c = Maximum channel power d = Maximum channel power unit of measure * = not used
RESULt2	aaaaaabbbcccdd******	a = Minimum channel power b = Minimum channel power unit of measure c = Center d = Span * = not used
RESULt3	aaaaaaaaaa**********	a = Measurement status * = not used
RESULt4	aaaaaaaaaabbbbbbbb**	a = Reference status b = Even second clock * = not used
Code Domain mask		
RESULt1	aaaaaabbbcccccdd***	a = Channel power b = Channel power unit of measure c = Code power d = Code power unit of measure * = not used
RESULt2	aaaaaabbbb**********	a = Pilot time offset (µs) b = Code time offset (ns) * = not used
RESULt3	aaaaaabbb***********	a = Code phase offset b = Code phase offset unit of measure * = not used
RESULt4	aaaaaaaaaa**********	a = Measurement status * = not used
RESULt5	aaaaaaaaaabbbbbbbb**	a = Reference status b = Even second clock * = not used

Command	String 12345678901234567890	Meaning
Constellation mask		
RESULt1	aaaaaa**************	a = Carrier feedthru * = not used
RESULt2	aaaaabbbbbccccccddd**	a = RMS EVM b = RMS magnitude error c = RMS phase error d = RMS phase error unit of measure * = not used
RESULt3	aaaaaaaaaa**********	a = Measurement status * = not used
RESULt4	aaaaaaaaaabbbbbbbb**	a = Reference status b = Even second clock * = not used
RX Test mask		
RESULt1	aaaaaaaaaa**********	a = Measurement status * = not used
RESULt2	aaaaaaaaaabbbbbbbb**	a = Reference status b = Even second clock * = not used
Self Test mask		
RESULt1	aaaa****************	a = Host version * = not used
RESULt2	aaaa****************	a = D-MCU version * = not used
RESULt3	aa******************	a = DSP module version * = not used
RESULt4	aa******************	a = OM module version * = not used
RESULt5	aa******************	a = TM module version * = not used
RESULt6	aaaaaaaaaaa*********	a = DSP module test * = not used
RESULt7	aaaaaaaaaaa*********	a = OM module test * = not used
RESULt8	aaaaaaaaaaa*********	a = TM module test * = not used
RESULt9	aa******************	a = TM module status * = not used

Appendix

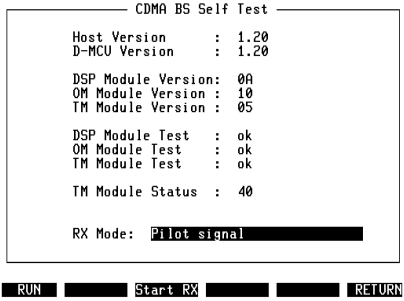
Performing selftest

The CDMA system program has its own selftest. All modules on the CDMA option are checked for proper functioning. The software and hardware versions of the individual modules are also read and displayed.

While in the CDMA summary mask, call up the SELFTEST mask by pressing (Setup) and (Self Test).

(RUN) Starts selftest.

(RETURN) Returns to mask.



Software version number

Hardware version number

Functional test

Status of timing module

RX Mode, only for internal use

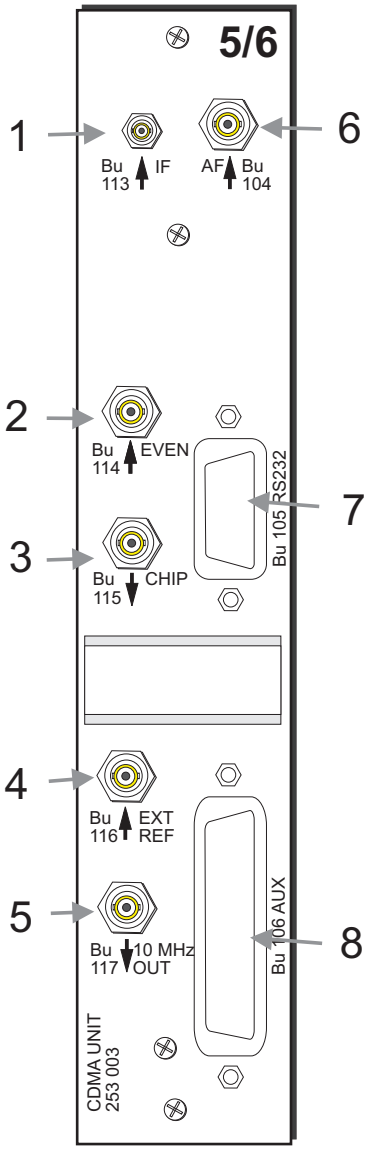
Fig. 10.31:
CDMA BS Test with fully functional modules.

If the test is passed, the software version number of the module or `ok` is displayed. If the module is defective, `failure` is indicated by a two-digit failure code (note this failure code and then contact an authorized Wavetek service organisation).

Field `TM Module Status`: Displayed value can differ dependant to the connected external synchronization lines to the BS (external reference, even second clock).

☞ Field `RX Mode`: This field is for internal use only. No mismatch to the functionality if other modes are selected.

CDMA module I/O connectors



1 IF (Intermediate Frequency) signal input. This input connector is connected to the IF output of the HF slave by an external coaxial cable (K113, 382 171, supplied with CDMA option).

2 Input for an even second reference clock pulse from the CDMA base station.

3 Output connector for even second clock.

4 External 19.6608 MHz reference input (50 Ω). The input signal is automatically detected and converted to a 10 MHz reference (output on Bu 117).

5 When an acceptable external reference is injected into Bu 116, a 10 MHz clock is present on this connector. This output signal should be connected via the 10 MHz filter (Hardware option 248 312) to Bu 12 on the 10 MHz reference board.

6 No connection (not available for the user).

7 9 pin connector. Factory use only.

8 25 pin connector. Factory use only.

Fig. 10.32: CDMA I/O Connectors.

Cabling

Connect the CDMA BTS under test to the Communication Test Set as follows:

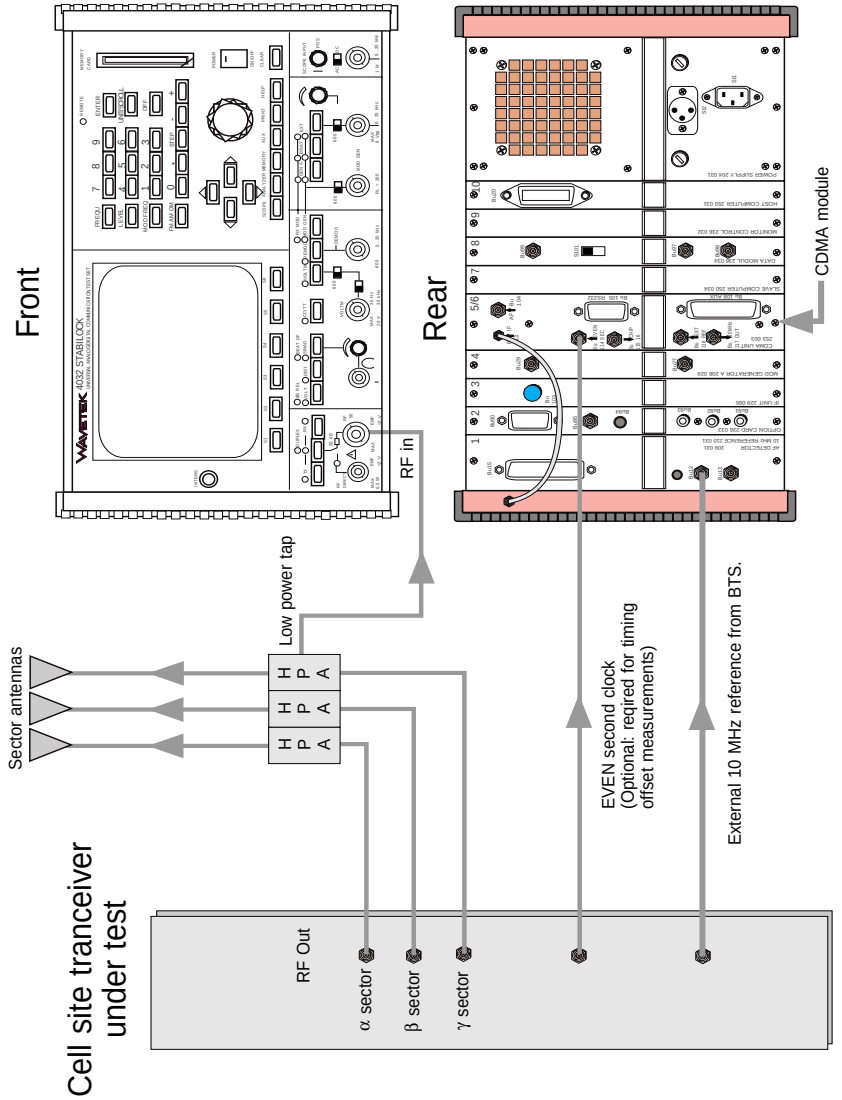


Fig. 10-33: In-service testing. An external 10 MHz signal is provided by the BS and directly injected into the 10 MHz reference input on the Communication Test Set.

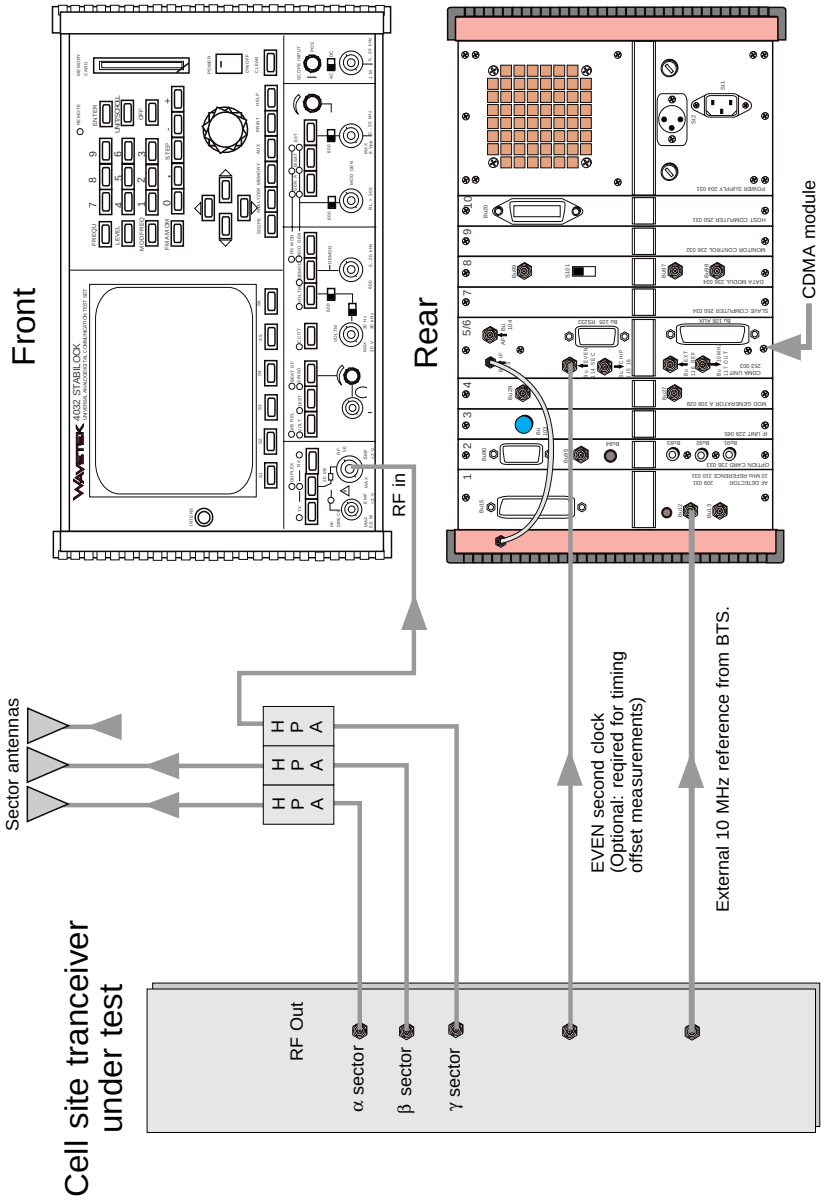


Fig. 10.34: Out-of-service testing using HPA antenna output. An external 10 MHz signal is provided by the BS and directly injected into the 10 MHz reference input on the Communication Test Set.

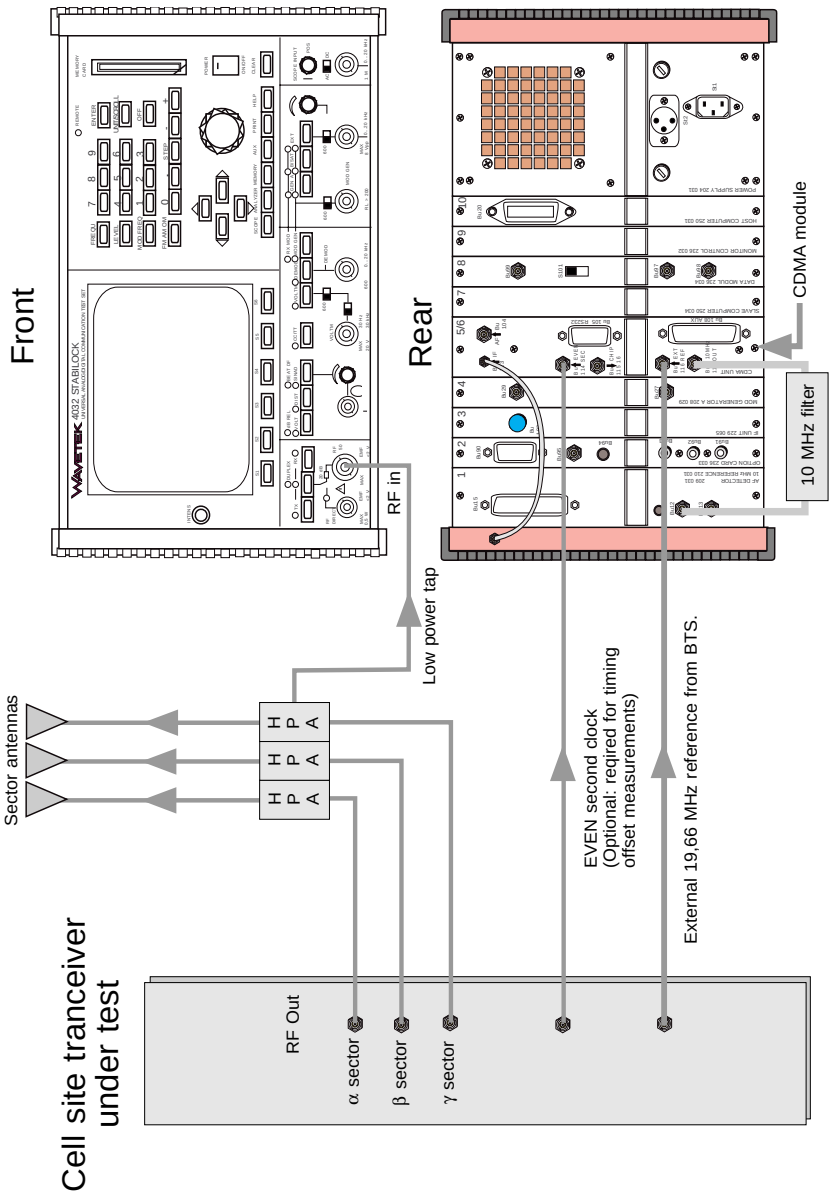


Fig. 10-35: In-service testing. An external 19.6608 MHz signal is provided by the BS and directly injected into the Communication Test Set. The CDMA module regenerates a 10 MHz reference used as the system reference for the Communication Test Set.

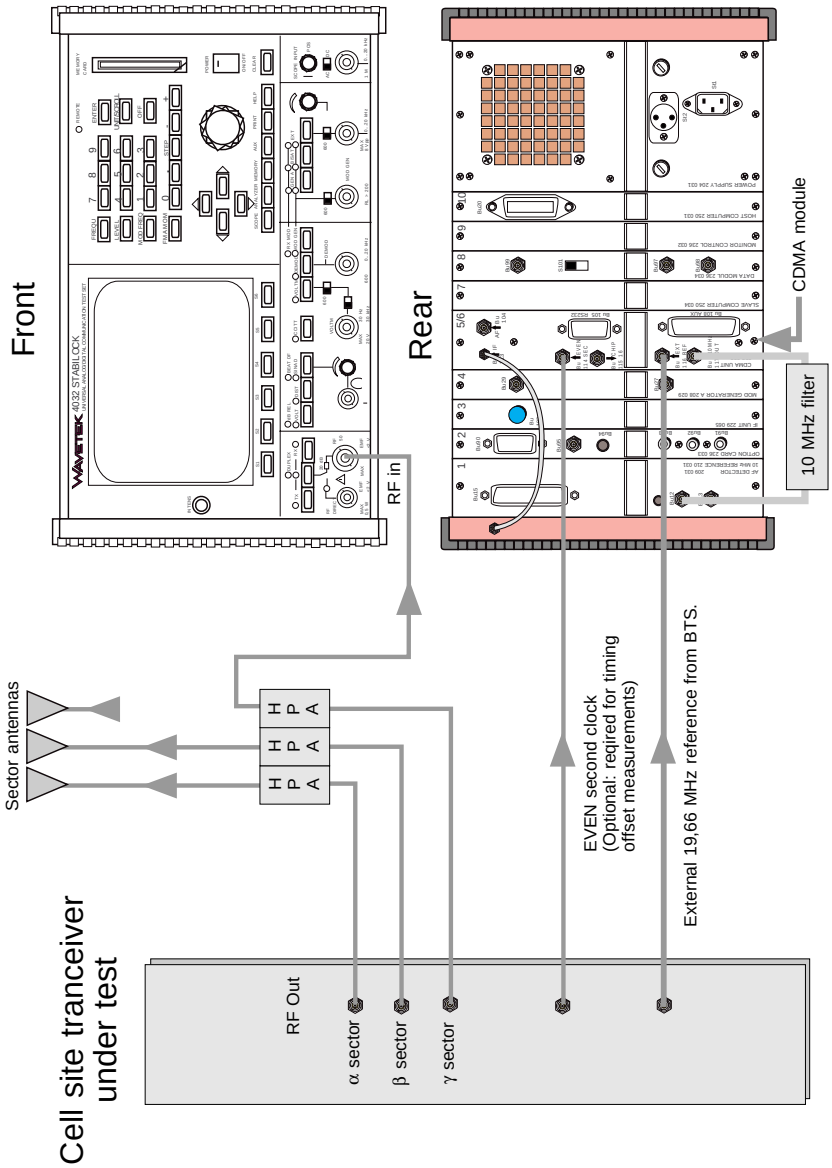


Fig. 10-36: Out-of-service testing using HPA antenna output. An external 19.6608 MHz signal is provided by the BS and directly injected into the Communication Test Set. The CDMA module regenerates a 10 MHz reference used as the system reference for the Communication Test Set.

Glossary

These are some of the acronyms used in CDMA.

BS	Base station
CDMA	Code division multiple access
Chip	Time interval defined as 1/1.2288 MHz = 0.814 µs
EVM	Error vector magnitude
FER	Frame error rate
MS	Mobile station
PN	Pseudo random
POME	Point of maximum effect
RMS	Root mean square
TIA/EIA	Telecommunications Industry Association in association with the Electronic Industries Association
WFP	Walsh function period (1 WFP = 64 chips = 52.083 µs)

Lifeline

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

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

SW	Doc. Version	Δ pages	Code	Changes
1.00	9706-100-A	no		First edition.
1.00	9707-100-B	some	C	Corrections in the manual.
1.00	9710-100-C	some	C	Corrections in the manual.
1.10	9801-110-A	10-5	C	CDMA now always a dual band version.
		10-11 10-12	C	10 MHz filter added in the picture.
		10-41	C	AWGN and Eb/No Ratio field no longer available.
		some	C	Corrections in the manual
		–	C	Power measurement corrected.
1.20	9806-120-A	–	NF	Handwheel can be used in all Code Domain masks.
		10-39	C	AWGN Source section is deleted (RX Test mask).
2.00	9807-200-A	all	NF	PN offset search function added.
2.10	9811-210-A	10-9 10-11 10-16 10-30	NF	High-sensitive RF DIR socket available for TX tests.