Quasonix

ISO 9001:2015
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Technical Guide

RDMS™ Bit Error Rate Testing

Quasonix, Inc.
6025 Schumacher Park Dr.
West Chester, OH 45069
24 April 2022

****** Revision 1.0.1******

Specifications subject to change without notice.

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1 Bit Error Rate Testing

***Note:** The BER commands described in this document should be used with the Browser Interface for units that support it (Rack-Mount RDMS or Dual Channel Compact Receiver-Combiner).

There is a separate BERT for each data path in the receiver (0 main channel, 1 combiner channel). By default all commands are targeted to the current "tracking channel", 0 or 1.

The results of the test can be displayed using the BER command with no parameters or a continuous display can be produced using BER D 1. BER D 0 turns off the continuous display.

Table 1: Bit Error Rate Serial Commands

Mnemonic	Name	Description
BER ?	Bit Error Rate Help	Provides help for using the bit error rate commands
BER	Set BER Tracking Display	BER [<e> [-h][<f>][<r>]] - Sets bit error tracking display enable to <e> in format <f> at rate <r> where: <e> - Enable 0 - Disabled 1 - Enabled <f> - Format (last used, if not specified) N - Normal W - Wide C - CSV <r> - Display rate <r>, 100 to 60000 ms (500 ms if not specified) Options: -h - Do not display header Examples: BER 0 — Set bit error tracking display to Disabled BER 1 N — Set bit error tracking display to Enabled with format set to Normal BER 1 W — Set bit error tracking format to Wide BER 1 W 142 — Set bit error tracking format to Wide with a display rate of 142 ms BER 1 CSV — Set bit error tracking display to Comma Separated Values

Mnemonic	Name	Description
BER DQ	Set Average DQ	Sets average DQ for output (OUT) or datapath (DP) display enable to <e> BER [DQ {OUT|DP} <e>] where <e>: 0 - Disabled 1 – Enabled Examples: BER DQ OUT 0 Set average DQ for output to Disabled BER DQ DP 1 Set average DQ for datapath to Enabled
BER EST	Set Error Threshold	BER [EST <t>] where: <t> - Sets error seconds threshold to 0 to 46666666 Example: BER EST 420 Set error seconds threshold to 420
BER G n	Set Bit Error Measurement Gating	Sets bit error measurement gating The test can be configured to make a single measurement or, when a time limit, bit count, or error count is set, automatically repeat the test. BER [G <n>] Sets bit error measurement gating to <n> where <n> - Measurement gating S - Single R – Repeat C – Continuous (this is the default value) Examples: BER G S Set gating to Single BER G R Set gating to Repeat BER G C Set gating to Continuous
BER HEAD f	Show System Status Header	BER [HEAD <f>] - Shows system status header in format <f> where <f> - Format N - Normal W - Wide C – CSV Examples: BER Head N Show system status header format for Normal BER Head C Show system status header format for Comma Separated Values

Mnemonic	Name	Description
BER M	BERT Measurement Status	Display current BERT measurement status in a specific style BER [M [<s>] [-h]] where: <s> - Style N - Normal W - Wide C - CSV Options: -h - Do not display header Examples: BER M N N indicates Normal BER M W W indicates Wide BER M CSV CSV indicates Comma Separated Values
BER P n	Set Bit Error Test Pattern	Set bit error test pattern to PN sequence or a fixed pattern BER [P {<n>|<p>}] P indicates a preset or fixed pattern length where <n> is a PN sequence of PN6, PN9, PN11, PN15, PN17, PN20, PN23, or PN31 <p> is a fixed pattern length of 2 to 32 bits (fixed pattern lengths are automatically determined and leading zeros are significant) Examples: BER P PN9 Set test pattern to preset PN9 BER P 13 Set test pattern to a fixed pattern length of 13 bits
BER RR n	Set Restart Measurement	Set restart measurements on resync enable BER [RR <e>] where <e> : 0 = Disable 1 = Enable Examples: BER RR 0 Set restart measurements on resync to Disabled
BER R	Measurement Enable	Starts or Restarts bit error measurement If a time limit, bit count, or error count limit is set and the limit has been reached (enabled but not running) the BERT is restarted. Example: BER R Start bit error measurement on current tracking channel

Mnemonic	Name	Description
BER S	Measurement Disable	Stops bit error measurement Example: BER S Stop bit error measurement on current tracking channel
BER T n	Set Bit Error Measurement Type	Sets bit error measurement type The test type can be configured to run continuously or stop when either a time limit, bit count, or error count has been reached. The error count limit guarantees a minimum number of errors. BER [T <t>] T indicates type where <t> is one of the following: C = Sets to Continuous (clears limits) T <s> = Sets BERT time limit where <s> is between 0.000 and 4294967.500 seconds B <l> = Sets bit limit where <l> is between 1 and 2.81475e+14 bits E <l> = Sets error limit Where <l> is between 0 and 2.81475e+14 errors Bit count and error count limits are mutually exclusive--either option may be combined with time limit Examples: BER T C Set bit error measurement type to Continuous BER T 2.333 Set BERT time limit to 2.333 seconds BER T B 1 Set bit limit to 1 bit BER T E 0.5 Set error limit to 0.5 errors

The following examples illustrate how to display bit error registers in Normal, Wide, and CSV format. Note the details below.

- A column header is displayed every ten rows.
- The 'E' column indicates the BERT is enabled by displaying a pound sign '#'. If the BERT is not enabled, this column is blank.
- The 'R' column indicates the BERT is actually running and making a measurement by displaying a '!'. If the BERT is not running, this column is blank.
- The BERT can be enabled, but not running, in the case of a time, bit, or error count limit.
- An asterisk '*' after the error rate column indicates that the data is inverted. If the display is continuous and a time, bit, or error limit is set with repeating gating, the display shows the end of the test by displaying '>>>' in the first three columns.

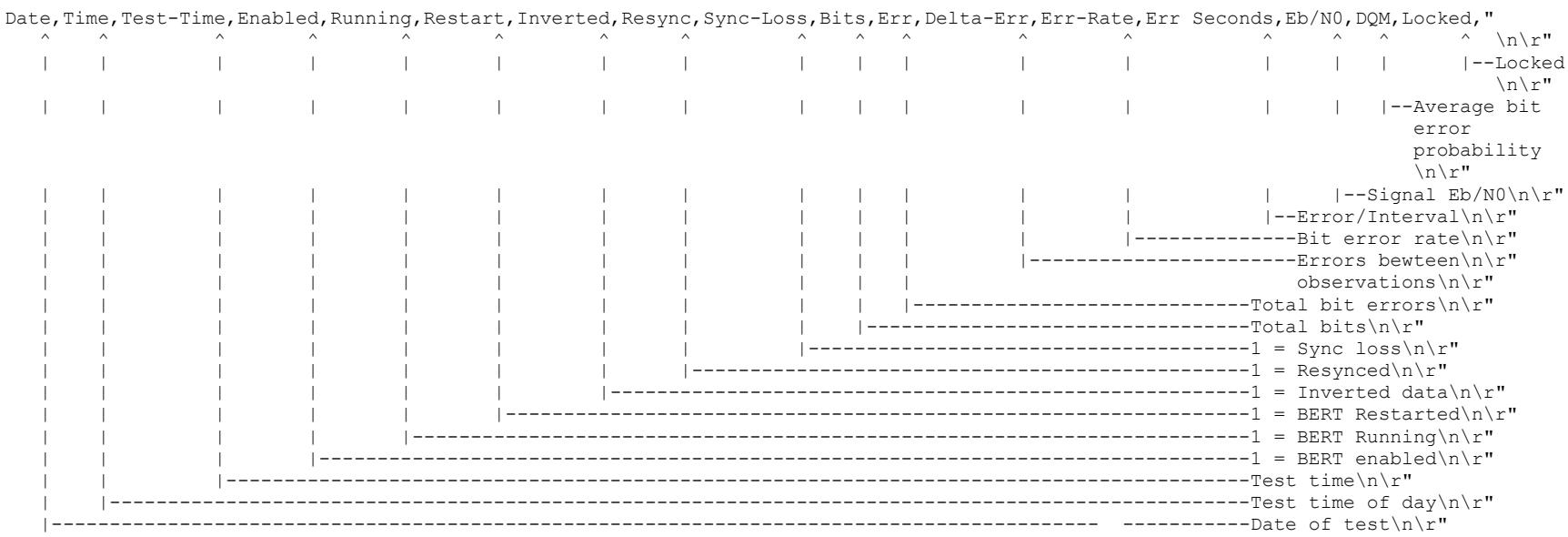
Normal

```
R S I            Time       Bits      Errors  Delta Err  Error Rate  Seconds   Eb/N0 L
! * *   99:59:59.999 9999999999 9999999999 9999999999   4.999e+01 99999999  999.99 !
^ ^ ^               ^          ^          ^          ^           ^        ^       ^ ^
| | |               |          |          |          |           |        |       | |---Locked\n\r"
| | |               |          |          |          |           |        |       |-----Signal Eb/N0\n\r"
| | |               |          |          |          |           |        |-------------Error/Interval\n\r"
| | |               |          |          |          |           |----------------------Bit error rate\n\r"
| | |               |          |          |          |-----------------------------------Errors between\n\r"
| | |               |          |          |                                                observations\n\r"
| | |               |          |          |-------------------------------------------------Total bit errors\n\r"
| | |               |          |-----------------------------------------------------------------Total bits\n\r"
| | |               |-------------------------------------------------------------------------------Test time\n\r"
| | |-------------------------------------------------------------------------------------------------Inverted data\n\r"
| |-----------------------------------------------------------------------------------------------------Sync loss\n\r"
|-------------------------------------------------------------------------------------------------------! = Running\n\r"
                                                                                                        * = Gating restart\n\r"
                                                                                                        # = Pattern resync\n\r"
```

Wide

```
R S I             Time       Bit Count     Error Count    Delta Errors Error Rate Error Seconds  Eb/N0    DQM BEP L"
! * * 999:23:59:59.999 999999999999999 999999999999999 999999999999999  4.999e+01    9999999999 999.99  4.999e+01 ! \n\r"
^ ^ ^                 ^               ^               ^               ^          ^             ^      ^          ^ ^ \n\r"
| | |                 |               |               |               |          |             |      |          | |-------Locked\n\r"
| | |                 |               |               |               |          |             |      |          |----Average bit error
                                                                                                                       probability \n\r"
| | |                 |               |               |               |          |             |      |--------------- Signal Eb/N0\n\r"
| | |                 |               |               |               |          |             |------------------- Error/Interval\n\r"
| | |                 |               |               |               |          |-----------------------------------Bit error rate\n\r"
| | |                 |               |               |               |----------------------------------------------Errors between\n\r"
| | |                 |               |               |                                                                observations\n\r"
| | |                 |               |               |-------------------------------------------------------------------Total bit errors\n\r"
| | |                 |               |-------------------------------------------------------------------------------------Total bits\n\r"
| | |                 |-------------------------------------------------------------------------------------------------------Test time\n\r"
| | |-------------------------------------------------------------------------------------------------------------------------Inverted data\n\r"
| |-------------------------------------------------------------------------------------------------------------------------Sync loss\n\r"
|-----------------------------------------------------------------------------------------------------------------------------! = Running\n\r"
                                                                                                                            * = Gating restart\n\r"
                                                                                                                            # = Pattern resync\n\r"
```

CSV


Date,Time,Test-Time,Enabled,Running,Restart,Inverted,Resync,Sync-Loss,Bits,Err,Delta-Err,Err-Rate,Err Seconds,Eb/N0,DQM,Locked,"
\n\r"
|--Locked
\n\r"
|--Average bit
error
probability
\n\r"
|--Signal Eb/N0\n\r"
|--Error/Interval\n\r"
|--------------Bit error rate\n\r"
|------------------------Errors bewteen\n\r"
observations\n\r"
|-----------------------------Total bit errors\n\r"
|----------------------------------Total bits\n\r"
|---------------------------------------1 = Sync loss\n\r"
|---1 = Resynced\n\r"
|---1 = Inverted data\n\r"
|---1 = BERT Restarted\n\r"
|---1 = BERT Running\n\r"
|---1 = BERT enabled\n\r"
|---Test time\n\r"
|---Test time of day\n\r"
|--- -----------Date of test\n\r"

1.1 Test Noise Commands

Digitally generated Additive White Gaussian Noise (AWGN) can be injected in the demodulator for test purposes. This noise can exhaust most or all of the demodulator's error-free signal processing margin so that small imperfections in the received signal will be visible as an increase in the bit error rate.

The noise level is calibrated relative to an extremely accurate measurement of the input signal level. This measurement will be most accurate when the received signal has a high signal-to-noise ratio. Therefore, input signal levels above -70 dBm are generally recommended. Due to the available dynamic range of the demodulator signal processing path and the faithful representation of the AWGN, noise samples may be clipped, especially at or below 0 dB Eb/N0.

Note that the noise is injected following downconversion to baseband but before demodulation. Therefore, the noise will affect demodulator output signals, including video outputs, but it will not change measurements of the input signal (signal strength and signal quality).

The AWGN command, described in Table 2, displays and controls Additive White Gaussian Noise settings.

Table 2: Test Noise Commands

Mnemonic	Name	Description
AWGN ?	Test Noise Help	Provides help for using the test noise commands
AWGN	Test Noise Status	Report test noise status of current tracking channel Example: AWGN AWGN disabled AWGN power 50.00 dB E_b/N_0
AWGN <e>	Enable/Disable Test Noise	Turns the test noise output Enabled or Disabled AWGN <e> <e> - Sets AWGN enable to <e> If 'e' is 0, test noise is Off/Disabled If 'e' is 1, test noise is On/Enabled Example: AWGN 1 AWGN enabled
AWGN [P <p>]	Set Test Noise Level	Sets the test noise power level in dB E_b/N_0 Range for p is -10.00 dB E_b/N_0 to +50.00 dB E_b/N_0 Example: AWGN P 42.00 AWGN power 42.00 dB E_b/N_0