

Application Note

AEROFLEX
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FASTBIT FB2000A

CABLE MODEM

PHY PERFORMANCE EVALUATION



Fast and accurate performance testing of cable modems and other devices with noise and interferer impairments.

For the very latest specifications visit www.aeroflex.com

TECHNICAL HIGHLIGHTS

- Frequency Tunable Noise and Impairment Generator
- Automatic evaluation of cable modem BER performance per RFI v1.1, section 4.3.6
- Simultaneous Es/No, adjacent channel interference level setting
- Full upstream and down stream frequency coverage with 5 MHz to 2.4 GHz frequency tunable noise source, dual broadband interference inputs

RELATED APPLICATION NOTES

- BER ANALYSIS USING FRAMED DATA
- MEASURING BER OF DEVICES WITH UNIQUE SERIAL AND PARALLEL INTERFACES
- BER TEST TIME OPTIMIZATION

CABLE MODEM PERFORMANCE CHARACTERIZATION

Cable modem performance per DOCSIS Radio Frequency Interface (RFI) Specification v1.1 describes measuring a post-FEC BER of less than or equal to 10^{-8} at various signal levels and carrier to noise ratios:

64 QAM: -15 dBmV to +15 dBmV, Es/No 23.5 dB or lower

256QAM: +15 dBmV to -6 dBmV, Es/No 30 dB or lower

256QAM: -6 dBmV to -15 dBmV, Es/No 33 dB or lower

BER performance must be maintained with analog and/or digital signals at image frequencies, and in adjacent cable TV channels. Depending on the specific test, these interferers can be set at the level of the input signal, or at +10 dBc.

Es/No AT LOW INPUT POWER

The DOCSIS RFI requires setting Es/No at very low carrier power ranging from +15 dBmV (-33.8 dBm) to -15 dBmV (-63.8 dBm). For an Es/No of 33.0 dB, this requires the impairment test set to accurately set noise levels as low as -164 dBm/Hz.

To accommodate testing at the various operating frequencies of the cable modem, noise density (No) accuracy must be maintained across the 91 to 857 MHz band. Because of the difficulty in maintaining flatness across such a wide band, extreme care should be taken when using a broadband noise source and a wideband power meter to set No. Calculations of No for a given frequency will be incorrect if the flatness of the noise source is not taken into account. When using IF-based C/N test sets, accurate C/N ratios are limited to specific IF noise sources present in the

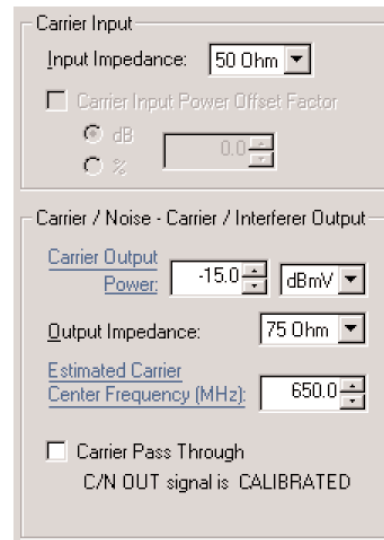
instrument, as well as a narrow range of IF carrier power levels. As a result, external attenuation, power measurement and calibration is necessary, along with careful consultation of the manufacturer's specification.

Provisions must also be made with additional hardware to insert and accurately ratio digital and analog adjacent signals in the 91 to 857 MHz band. For more information on the specifications, see <http://www.cablemodem.com>.

SETTING UP THE MEASUREMENT

STEP 1

Input a 64 or 256 QAM modulated signal with a carrier power of at least +15 dBmV at the carrier frequency of interest. Use the FB2000A user interface (UI) to set the carrier power to the first desired output level.



64-QAM Signal with Es/No = 23.7 dB
Adjacent Channel QAM Signals at +10 dBc

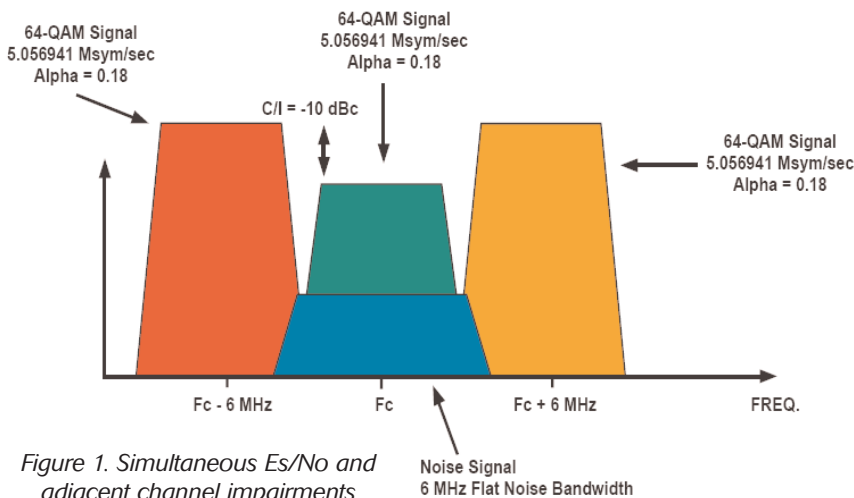
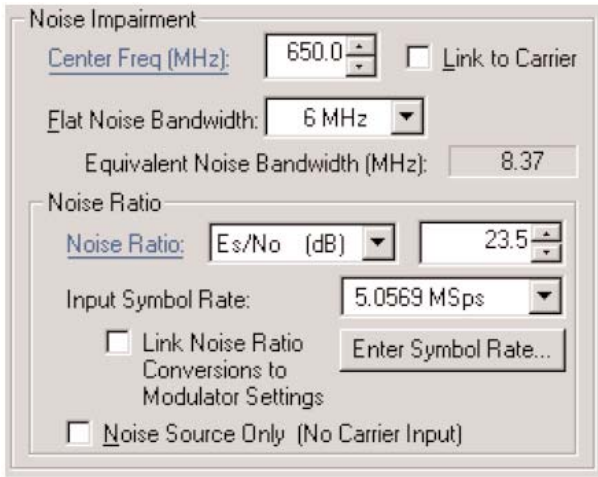


Figure 1. Simultaneous Es/No and adjacent channel impairments

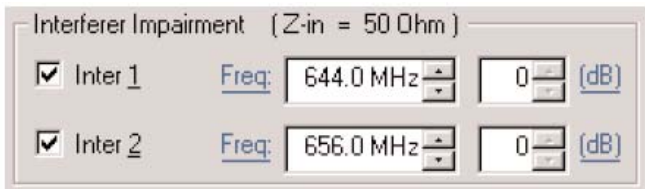
STEP 2

Select the flat noise bandwidth desired. Link the center frequency of the frequency tunable noise source to the carrier center frequency. Select the desired units for C/N (Es/No) and enter symbol rate. For additional interfering signals, connect to the BNC interferer inputs and set the C/I ratios with the FB2000A UI.



STEP 3

Set the external interferers to the desired frequencies and set the test set input levels to at least +10 dB relative to the carrier output power. Use the FB2000A user interface to set the interferer output levels according to the test section you are running.



Notes:

FB2000A

For applications where an additional noise source is required the FB2000A can be fitted with a second noise generator module including additional interferer inputs.

RUNNING THE TEST

STEP 4

Attach the FB100A parallel analyzer interface pod to the output of the demodulator using the header cable, or the micrograbbers. Run BER using the expected received pattern loaded into the analyzer reference pattern.



STEP 5

Change the interferer frequencies. Set the levels with the FB2000A UI, and re-run the tests.

FB100A

An integrated BER tester with noise and impairment generator module option offers a compact solution with the added option of automatic BER vs. C/N testing. This enables a dramatic reduction in test times.

See application note:

BER Test Time Optimization

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