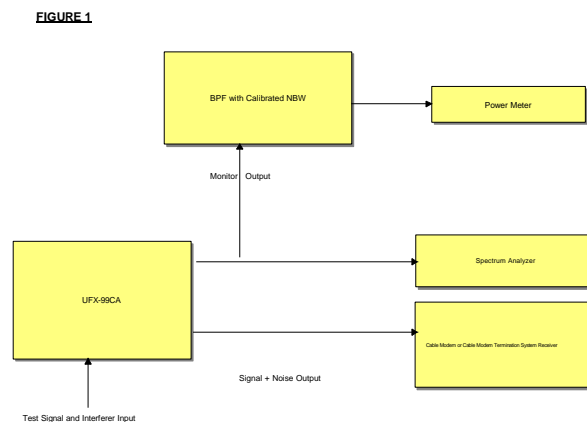


## Product Application Note

### Application Note # 122 ACCURATE $E_s/N_o$ SETTING FOR DOCSIS/CATV BER MEASUREMENTS

The Data-Over-Cable Service Radio Frequency Interface Specifications call out BER performance vs.  $E_s/N_o$  as required tests for both the Upstream CMTS (Cable Modem Termination System) and Downstream CM (Cable Modem) receivers.

Accurate setting of  $E_s/N_o$  for BER testing can be accomplished using the UFX99CA with the setup in **Figure 1** below.



$E_s/N_o$  (dB) is set with the adjacent channel or other interfering signals off. According to the following procedure:

1. Measure  $C_p$ , carrier power, at the monitor port with noise off.
2. Adjust carrier power to desired level using signal attenuators in the UFX99CA.
3. Measure  $N_p$ , noise power at the monitor port with carrier off.
4. Using the equation below, solve for  $E_s/N_o$ .
5. Adjust the noise attenuators until the desired ratio is achieved. An optional filter with calibrated Noise bandwidth can be ordered from Noise Com to achieve  $E_s/N_o$  accuracy for a specific frequency range.
6. After the correct ratio is achieved, the carrier and adjacent signals can be turned on to perform the BER test.

$$E_s/N_o = C_p - N_p + 10\log( NBW / SR )$$

Where:

$E_s$  = Energy per Symbol.

$N_o$  = Noise Power Spectral Density. Calculated from noise power measurement and calibrated NBW.

$C_p$  = Measured power of the carrier or signal (dBm or dBmV).

$N_p$  = Measured power of the noise (dBm or dBmV).

NBW = Noise Band-width of the noise source, or calibrated filter NBW (Hz). Used to determine  $N_o$ .

SR = Symbol Rate(symbols/second).

$E_s/N_o$  (dB) is set with the adjacent channel or other interfering signals off.

Similarly, for Carrier to Noise ratio.

$$C/N = C_p - N_p + 10\log( NBW/SBW )$$

Where SBW = DUT System bandwidth.

*Noise Com - 1999  
Data Subject to Change*

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