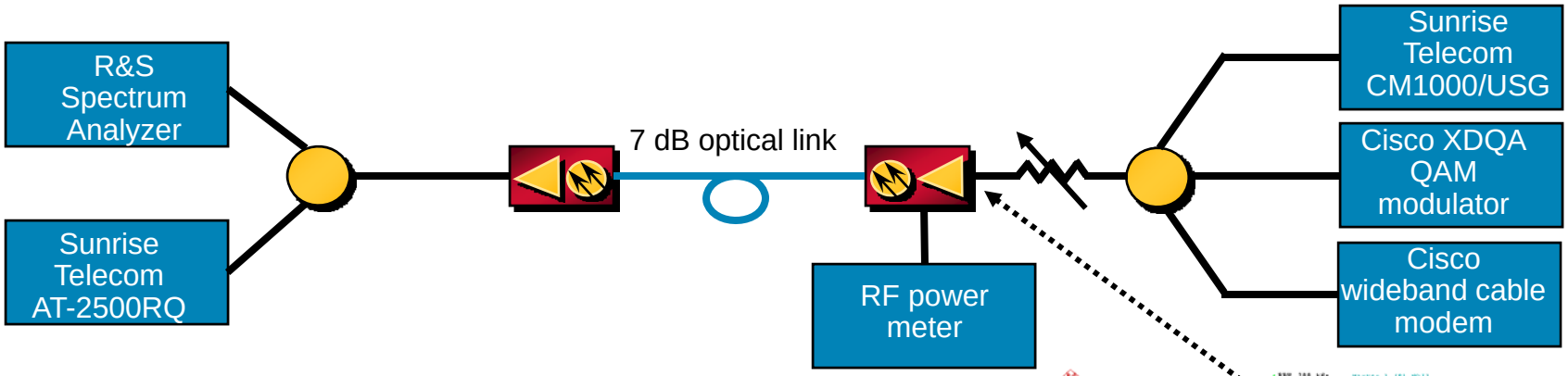
Characterizing Upstream Optical Links

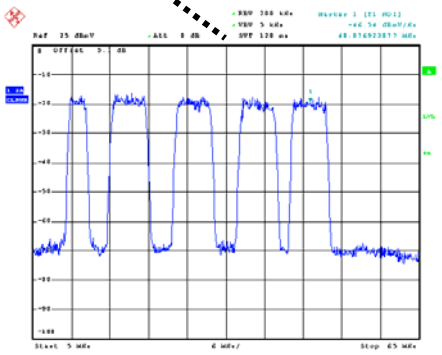
Ron Hranac

Testing Upstream Fiber Links

- Can FP and DFB upstream lasers support dense constellations such as 64-QAM?
- In particular, can upstream optical links support the additional channel loading of multiple bonded channels?
- To find out, we conducted a variety of lab tests on FP and DFB upstream optical links, using four 64-QAM channels (and one 16-QAM channel) to simulate a channel bonding environment.

Lab Equipment Configuration





- Signals used in test: one 3.2 MHz 16-QAM*, three 6.4 MHz 64-QAM, one 6.0 MHz 64-QAM (Annex C)*
- Upstream laser: FP or DFB
- RF power meter used to confirm upstream laser loading in power/Hz
- Evaluated received RF spectrum, pre-FEC BER, MER, constellation

* These two signals were used for upstream BER measurements

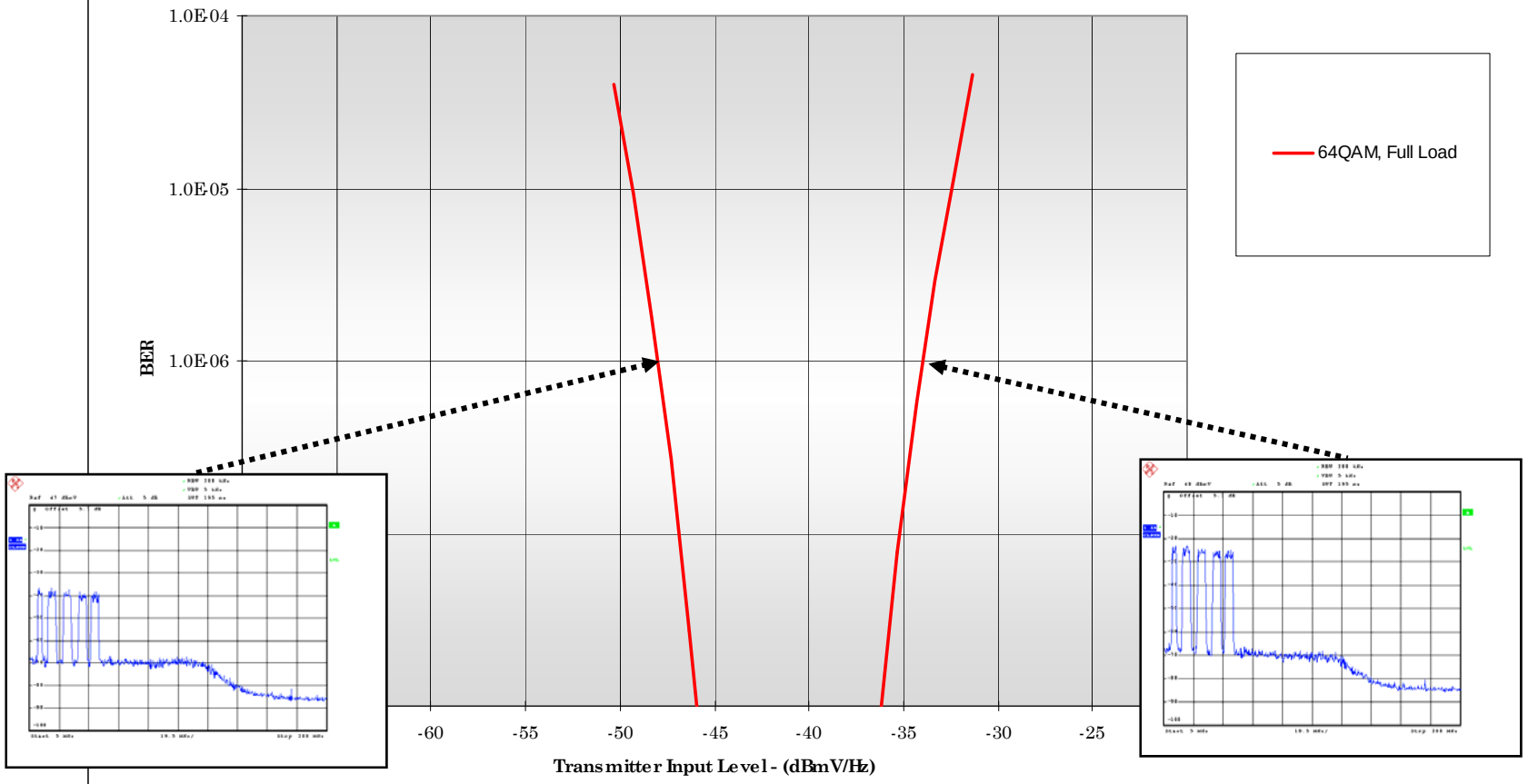
FP Laser Performance

FP Tx - 16QAM & 64QAM BER (Pre-FEC)

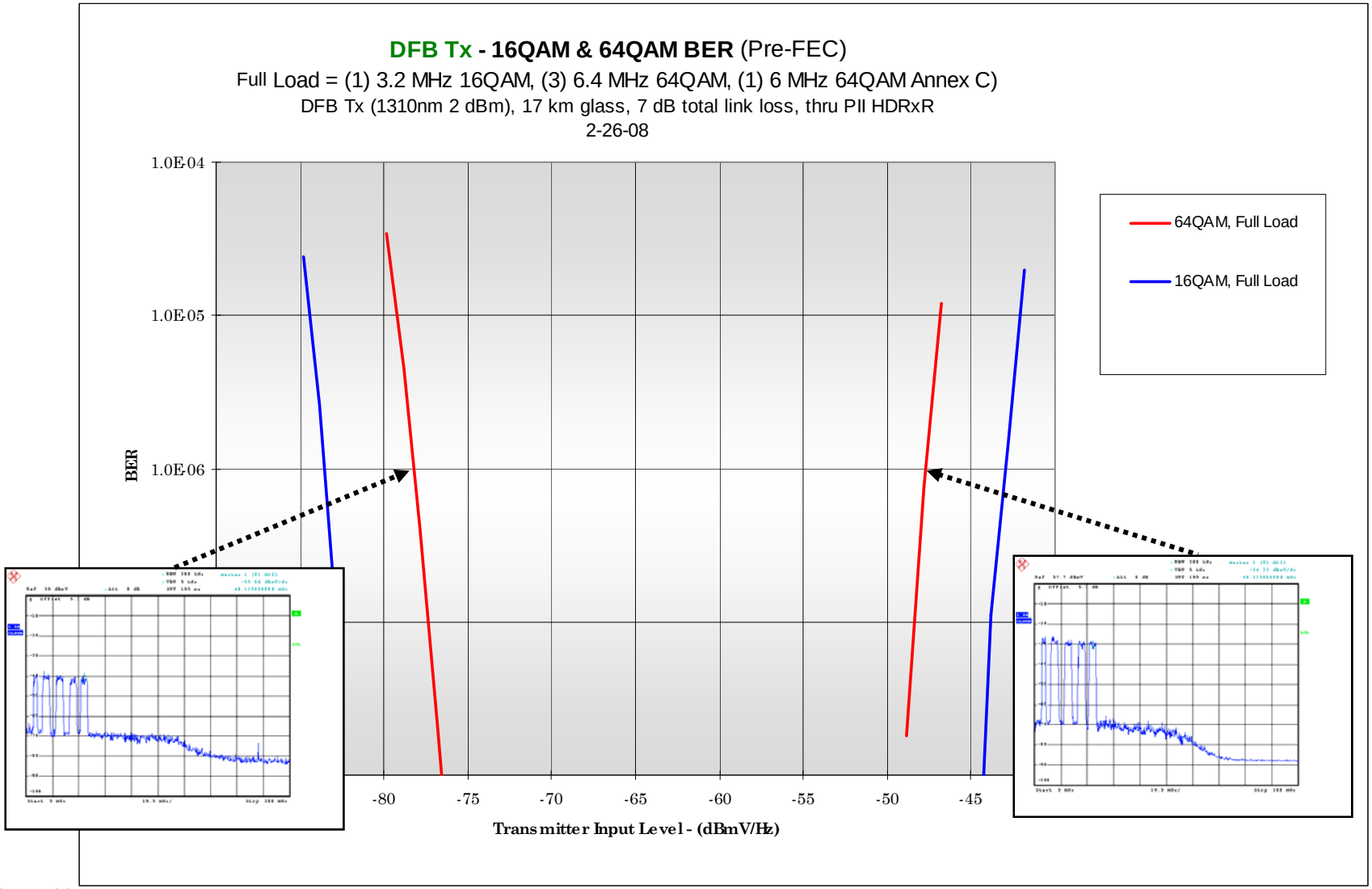
Full Load = (1) 3.2 MHz 16QAM, (3) 6.4 MHz 64QAM, (1) 6 MHz 64QAM Annex C)

FP Tx (1310nm, 2 dBm), 17 km glass, 7 dB total link loss, thru PII HDRxR

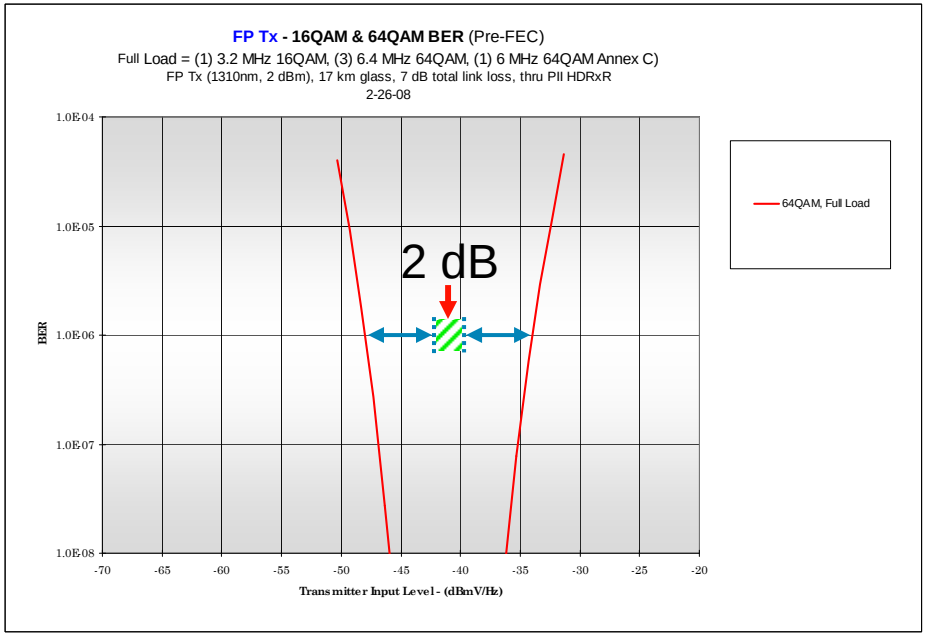
2-26-08

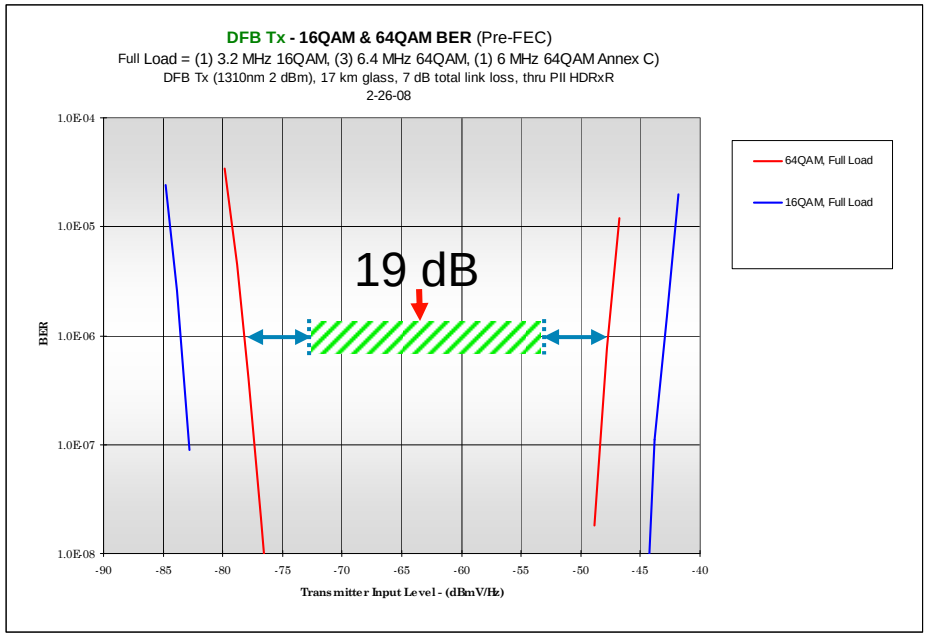


DFB Laser Performance



Operating Headroom





- 12 dB operational margin (noise and clipping) for temperature variations, alignment errors, and the usual upstream “gremlins” was recommended in a Cable-Tec Expo 2004 workshop*
- This leaves only 2 dB of usable dynamic range in the FP link, but 19 dB in the DFB laser!

* “Upstream System Characterization with 16-QAM and 64-QAM Signals,” Zhijian Sun, et. al., C-COR; *Cable-Tec Expo 2004 Proceedings Manual*