Report from TP3 Conference Calls

November 8th 2004

TP3 Regular Participants:

Lew Aronson	Venu Balasubramonian	Sudeep Bhoja
Piers Dawe	John Ewen	Jesper Hanberg
John Jaeger	Ryan Latchman	Mike Lawton
Tom Lindsay	Rob Lingle	Jim McVey
Jan Peters Weem	Petre Popescu	Abhijit Shanbhag
Vivek Telang	Andre Van Schyndel	Nick Weiner
Kevin Witt		

Report from Conference Calls on TP3 Specification

- **Summary diagram for current test**

- **TP2 and the Link Budget**

- **Jitter testing**

- **OSNR calculations**

- **Conclusions and Further Work**

Latest Stressed Receiver Sensitivity Test Proposal
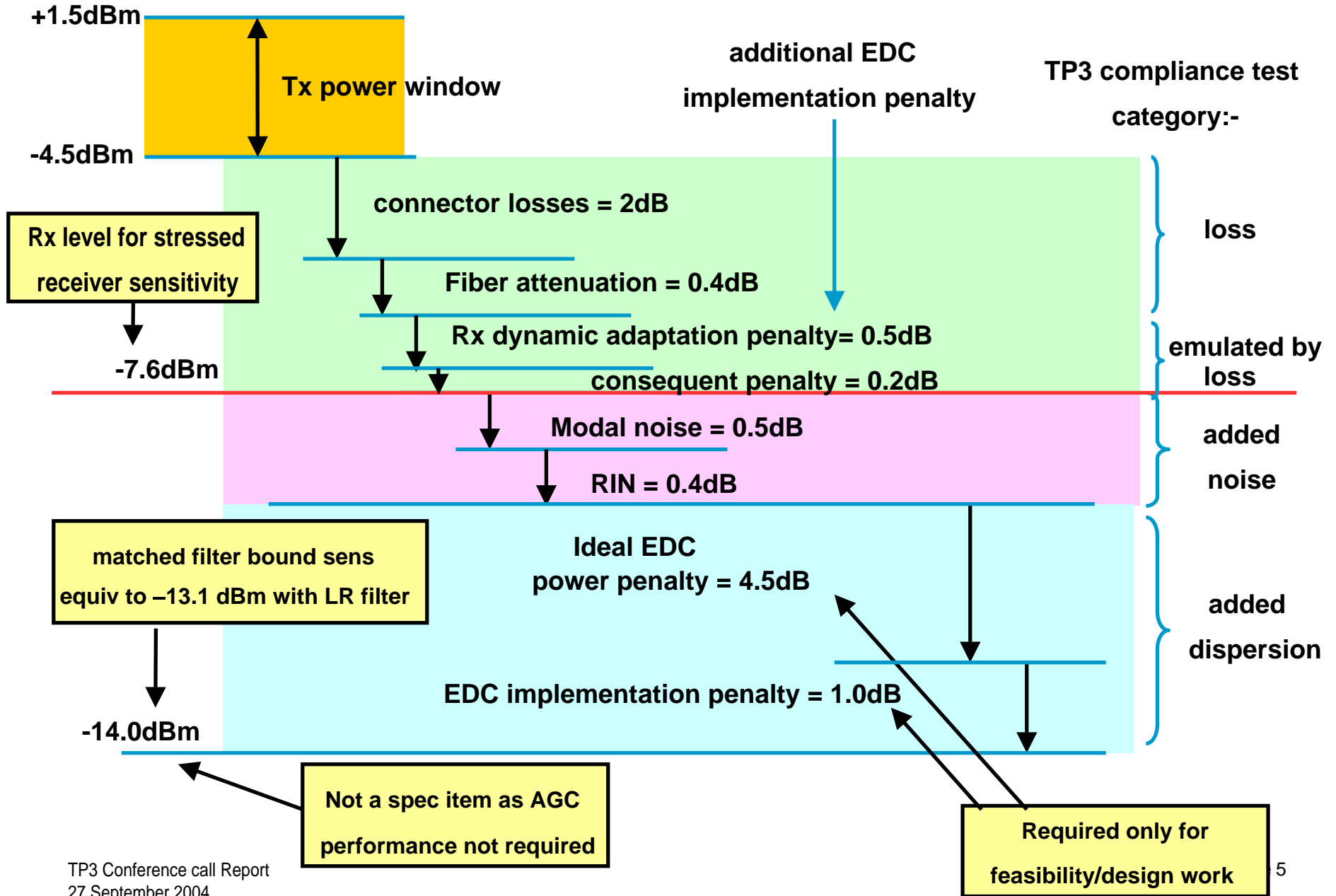
Equivalent to Figure 52-10 in 802.3ae

Freq Synthesizer

Clock Source — Jitter (40MHz, 0.05UI)

Patt. Generator

ISI

ISI Generator Block — t=?

Noise

Gaussian Noise Source

Modal noise + RIN

E/O Converter

Optical Attenuator

loss

62/125 Mode Cond. Patchcord — **TP3**

System Under Test

PCS (RX)

PMA (RX)

PMD (RX)

Signal Characterization Measurement — **For Future Study**
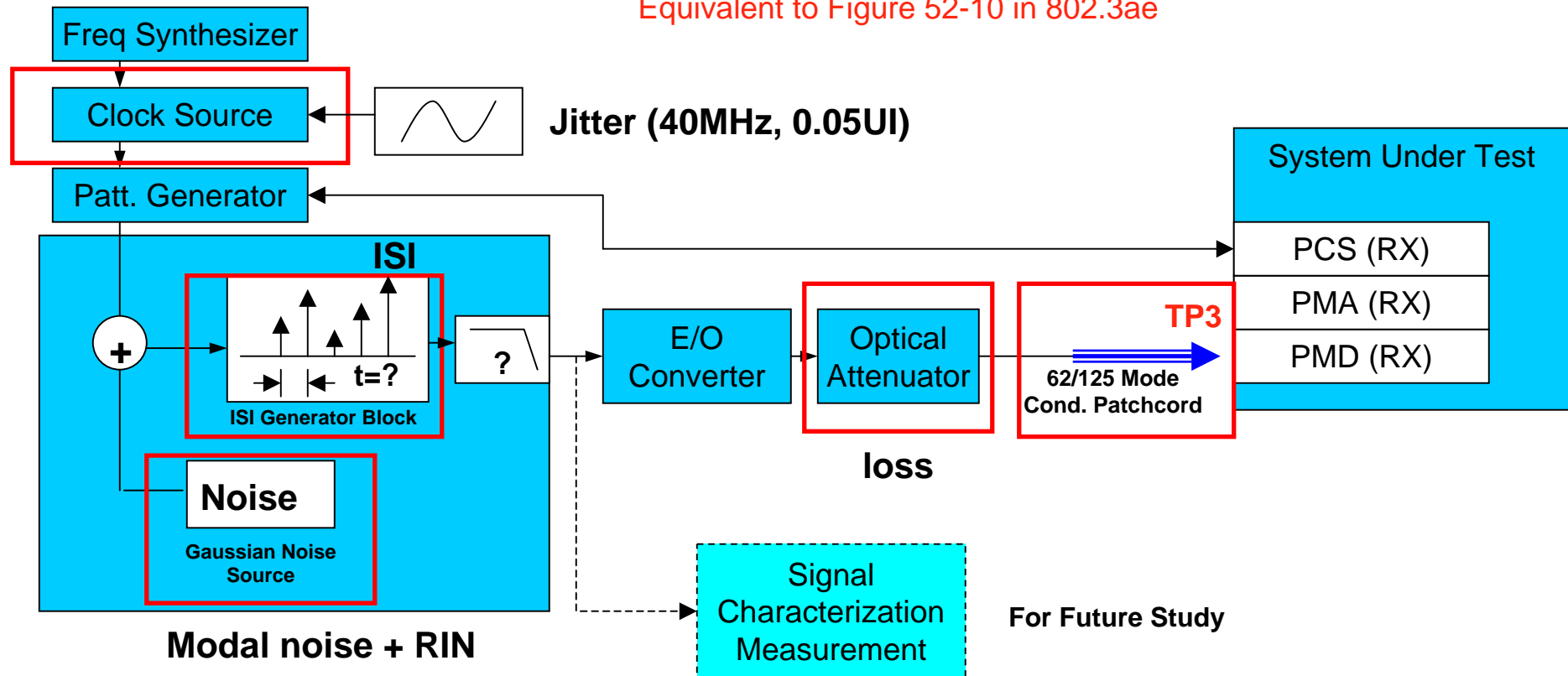
- **Leverages strongly off 10GBASE-LR**

- **Motivated to keep it simple whilst still represent all the key stressors**

- **Motivated to have practical test with reproducible results**

TP2 and the Link Budget
presentation from Tom Lindsay

- **The group agreed the following:-**
  - **TP2 and TP3 testing should both be test configurations which seek to represent the relevant aspects within the link budget**

- **We have a link budget from the Oregon meeting.**
  - **http://grouper.ieee.org/groups/802/3/aq/public/jul04/lawton_1_0704.pdf**

- **The group is working with the following assumptions:-**
  - **connector losses can be reduced from 2.0 to 1.5dB**

- **The following still needs to be done:-**
  - **Establish figures for Modal noise and RIN**
  - **Determine the need for an Adaptation penalty … and location above or below "waterline"**
  - **Agree on consequent penalty … and location above or below "waterline"**
  - **Determine appropriate representation of equaliser power penalty and associated implementation losses**

Interpreting the EDC Link Budget (OMA)

+1.5dBm

Tx power window

additional EDC implementation penalty

TP3 compliance test category:-

-4.5dBm

Rx level for stressed receiver sensitivity

connector losses = 2dB

loss

Fiber attenuation = 0.4dB

Rx dynamic adaptation penalty= 0.5dB

-7.6dBm

consequent penalty = 0.2dB

emulated by loss

Modal noise = 0.5dB

added noise

RIN = 0.4dB

matched filter bound sens equiv to –13.1 dBm with LR filter

Ideal EDC power penalty = 4.5dB

added dispersion

EDC implementation penalty = 1.0dB

-14.0dBm

Not a spec item as AGC performance not required

Required only for feasibility/design work

"Jitter Tolerance for Receiver Stressed Sensitivity Test" presentation from Petre Popescu

3. Jitter Sources and Impact on the Receiver Test

Jitter Source	Jitter Characteristics	Receiver impact	10GBASE-LRM Receiver
Transmitter clock, random jitter	High peak-to-peak amplitudes at low frequencies	The recovered clock will track the incoming jitter	Needed EDC will not correct
Laser random jitter	Small peak-to-peak amplitudes at low frequencies, uniform distribution at high-frequency	The recovered clock will not track the high-frequency incoming jitter	Needed EDC will not correct
Transmitter, pattern (data) dependent jitter (correlated)	Transmitter bandwidth limitation and phase non-linearities (ISI), high frequency components, (above 10 LB*)	The recovered clock will not track the high-frequency incoming jitter	Negligible compared with the channel contribution. Partially reduced by EDC.
Channel jitter contribution	Small for SMF, not generated in the "stress conditioning", for 10GBASE-L.	Equalizer required for MMF.	Not needed. Jitter generation is included in the "non-quasi-symmetrical stressed signal generator".

*LB - PLL loop bandwidth.

Jitter Testing choices …

1. Define mask and leave it to the implementer to determine appropriate testing

2. Define mask and advise a single frequency for stressed receiver testing.

3. Use of a PRBS to simultaneously modulate the Tx source with broadband jitter

- Group agreed to define a test in line with option 2:-

  - 40MHz, 0.05UI source for stressed receiver normative test

  - include a separate low frequency test, 40kHz 5UI

OSNR Calculations
(Contributions from Lew Aronson and Nick Weiner)

- **The purpose of the work is to establish the OSNR required at the Rx given that both Modal noise and RIN are represented by additional noise power penalties**

- **Calculation carried out with 2 techniques:-**

  - **Lew Aronson for non-equalising case without ISI**

  - **Nick Weiner for a channel with ISI and a perfect equaliser**

- **Both techniques were in close agreement and yielded a figure of 11dBo for Modal noise and RIN power penalties totaling 0.9dB**

- **Also agreed to measure S/N with the ISI OFF:-**

  - **consistent with TP2**

  - **avoids issues with different channels having different "gains"**

Conclusions and Further Work

- **Key Progress since last meeting:-**

  - **Agreed parameters for jitter testing**

  - **Determined approach for representing power penalties with reduced OSNR**

- **Further Work items:-**

  - **Select appropriate channels for compliance testing**

  - **Determine methodology for measuring OMA**

  - **Work with TP2 to refine link budget (primarily above the "waterline")**

    - **Determine what is above and below the line**

  - **Finalize simplified normative test**

  - **Build and validate test**