Proposed Updates to pittala_3ct_01a_0120

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Introduction

- nicholl_3cw_01a_210809 suggested general updates to pittala_3ct_01a_0120 (see next page)
- This presentation provides detailed changes to the adopted slides in pittala_3ct_01a_0120

- Recommendation:
  - Replace slides 5-9 of pittala_3ct_01a_0120 with slides 5-10 of nicholl_3cw_01a_210823 to enable correlation for the definition of a transmitter quality metric

nicholl_3cw_01a_210809: Proposed Updates to pittala_3ct_01a_0120

- Based on current “EVM for TQM” direction
  - For this exercise, it is assumed that the Test DP-16QAM Transmitter and the DP-16QAM Receiver are from the same implementer. We need testing from multiple implementations to confirm observed trends across implementations.
  - Update test steps that as measurements are being taken the optical attenuator is adjusted to maintain a constant optical input power to the receiver
  - Need to modify proposal to allow remote / local EVM calculation
  - Sampled optical data should be captured and stored for future investigation of alternative EVM algorithms
- If there is consensus to also evaluate Tx_BER as a TQM
  - Revisit updating pittala_3ct_01a_0120

Proposed Update to Pittala_3ct_01a_0120, Slides 5-9

Proposed Test Plan for 400GBASE-ZR Standardization Work

Measurements setups

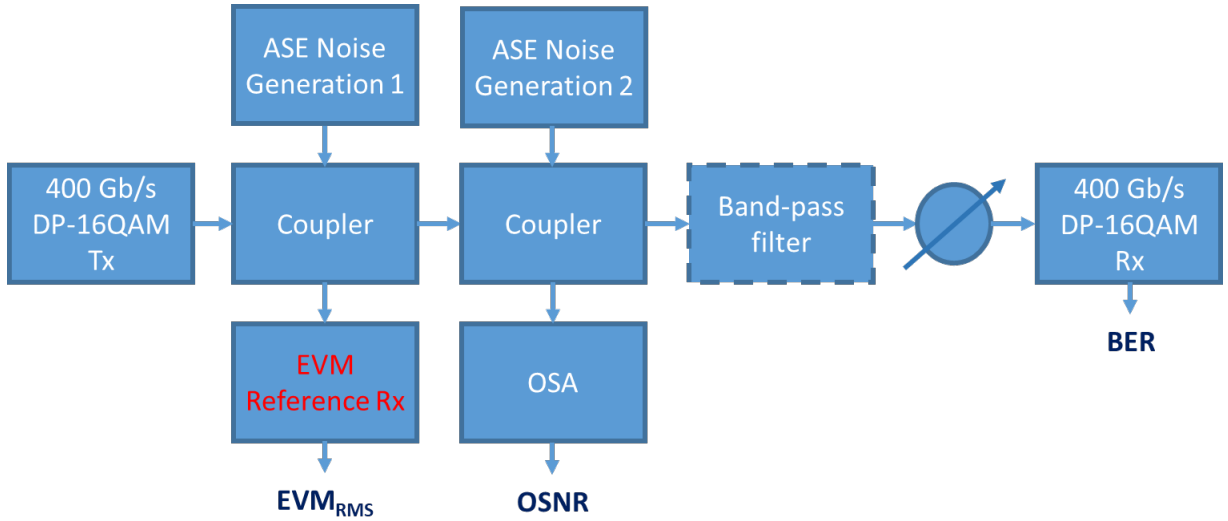

Fig. 1 Measurement setup for OSNR penalty vs EVM for non-equalizable noise like impairment.

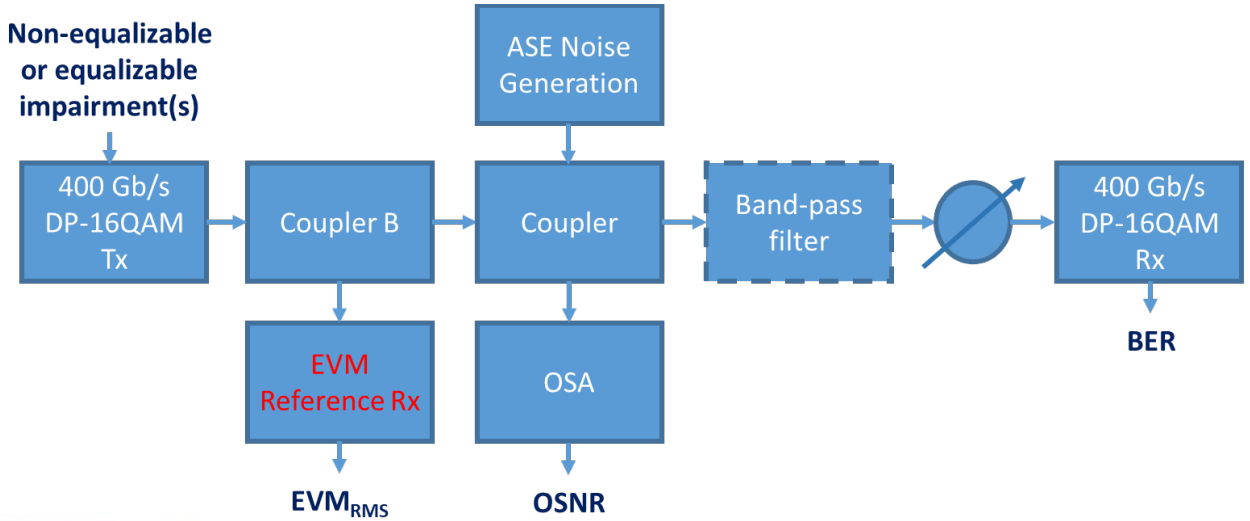

Fig. 2 Measurement setup for OSNR penalty vs EVM for non-equalizable (circle-like noise) or equalizable impairment(s).

The measurement setup in Fig. 1 (for noise like impairment) and the one in Fig. 2 (for non-equalizable or equalizable impairments) should be used to test if the following parameters can be covered by EVM:

- I-Q offset;
- Quadrature error;
- I-Q imbalance;
- I-Q skew;
- Non-linearities;
- non-equalizable impairment like circle-like noise (zero mean noise with fix magnitude and incremental phase) as shown in *anslow_3cn_01_181025*;
- non-equalizable noise like impairment;

Test setup conditions include:

- Relative Tx Polarization power imbalance. Maximum limit – 1.5 dB.

Measurements should be taken at a constant optical input power to the DP-16QAM receiver and EVM Reference Rx. Note - Needs further input & discussion. Suggest to add statement to detailed steps in slides 7-10.

For this exercise, it is assumed that the Test DP-16QAM Transmitter and the DP-16QAM Receiver are from the same implementer. Testing from multiple implementations to confirm observed trends across implementations would be preferred.

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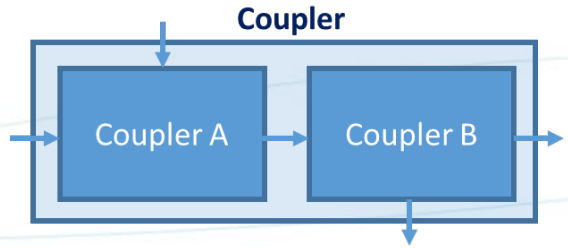
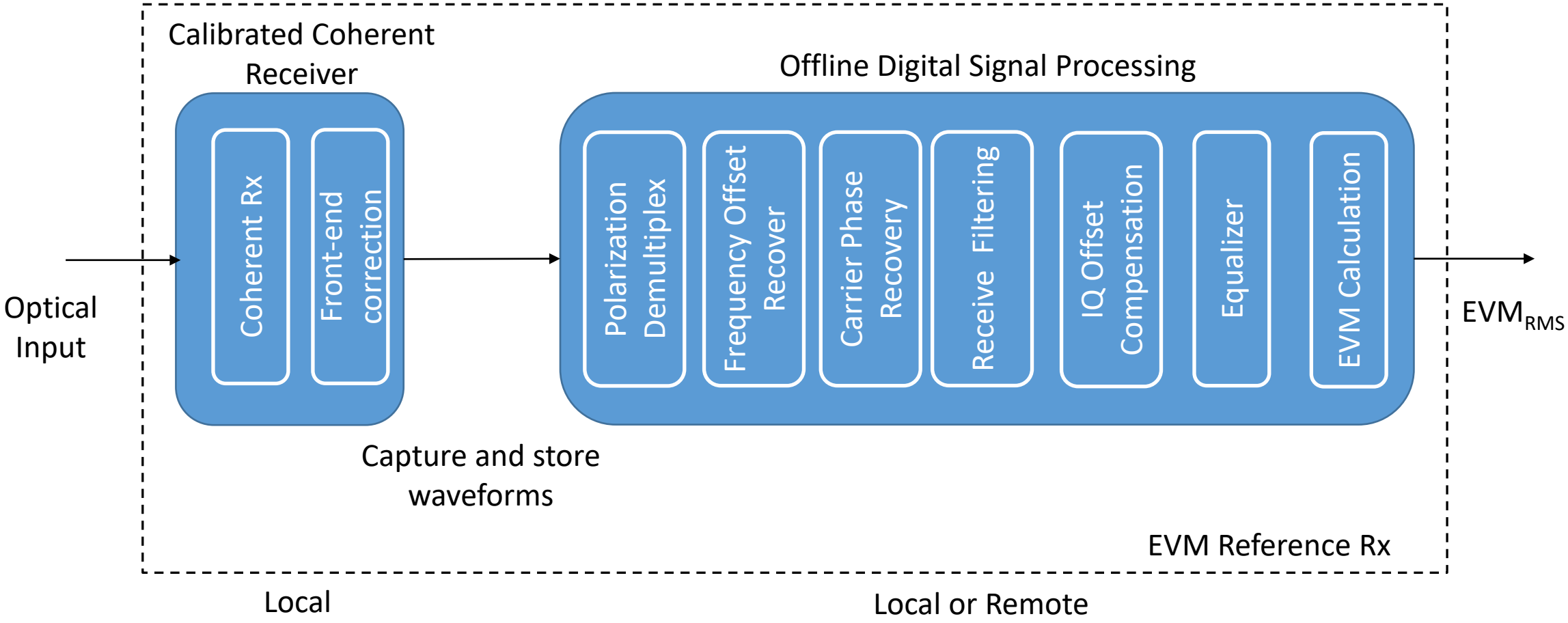
Applicable to both figures



EVM Reference Rx



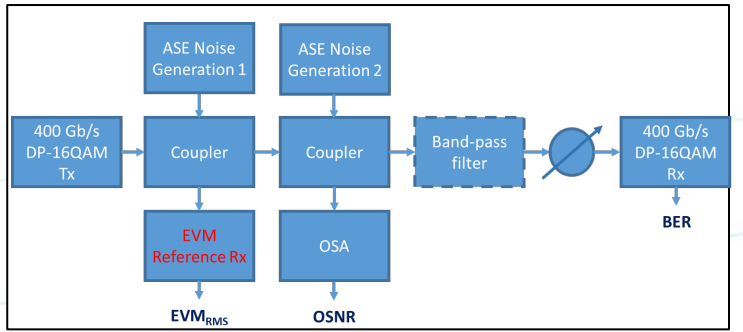
- Calibrated coherent receiver: always “local” to transmitter under test
- Offline digital signal processing: can be either “local” or “remote” to transmitter under test

Proposed Test Plan for 400GBASE-ZR Standardization Work

Measurements based on setup in Fig. 1

If measuring non-equalizable noise-like impairment using the setup in Fig. 1 the following steps are used:

1) Without ASE noise generation 1, adjust the ASE noise generation 2, to get the considered pre-FEC BER of 1.25e-2; then first EVM_{RMS} and OSNR values are measured (EVM_0, $OSNR_0$).
2) a) Introducing ASE noise generation 1 and measure EVM_{RMS} (EVM_1), the pre-FEC BER is changed (not 1.25e-2 anymore), b) then adjust the ASE noise generation 2, to set pre-FEC BER at 1.25e-2 again, then turn-off ASE noise generation 1 and then the second OSNR value is measured ($OSNR_1$), the OSNR penalty is ($OSNR_1$-$OSNR_0$).
3) Change the ASE noise generation 1, and repeat the step 2), more EVM_{RMS} and OSNR values are measured.
4) The curve of OSNR penalty versus EVM_{RMS} is obtained.



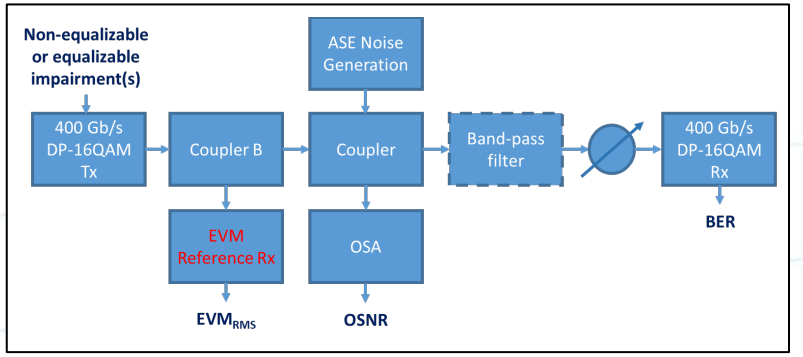
Proposed Test Plan for 400GBASE-ZR Standardization Work

Measurements based on setup in Fig. 2

It is preferred that measurements are obtained independently for each parameter, i.e as the effect of varying one parameter is being measured the other parameters remain unchanged.

Using IQ offset as an example the procedure is:

1) Adjust the ASE noise generation, to get the considered pre-FEC BER of 1.25e-2; then first EVM_{RMS} and OSNR values are measured (EVM_0, $OSNR_0$).
2) a) Modify the transmitter to give a certain value of IQ offset and b) measure EVM_{RMS} (EVM_1), the pre-FEC BER is changed (not 1.25e-2 anymore), then adjust the ASE noise generation, to set pre-FEC BER at 1.25e-2 again, then the second OSNR value is measured ($OSNR_1$), the OSNR penalty is ($OSNR_1$-$OSNR_0$).
3) Modify the transmitter to give a certain value of IQ offset and repeat the b) part of step 2), more EVM_{RMS} and OSNR values are measured.
4) The curve of OSNR penalty versus EVM_{RMS} is obtained.



Proposed Test Plan for 400GBASE-ZR Standardization Work

Evaluate Suitability of EVM_{RMS} metric for DP-16QAM

Step 1:

1) Generate OSNR penalty versus EVM_{RMS} plots containing noise like impairments and deterministic impairments (as example circular impairment) using the setups as shown in Fig. 1 and Fig. 2. The two plots should lie on top of each other.
2) Introduce a 3rd line for an individual impairment like IQ offset, quadrature error, IQ imbalance (just one impairment at the time) which shows OSNR penalty vs uncompensated EVM_{RMS}.
3) Then check if the 3rd line for the particular impairment is very close to the other two lines. If this is the case we do not need to treat it as separate impairment and we would not need to compensate for it in the EVM calculation.
4) In case the 3rd line is sufficiently different to the other two lines then we will need to compensate for it (as it has happened for IQ-offset for 100 Gb/s DP-DQPSK transmitters).

Proposed Test Plan for 400GBASE-ZR Standardization Work

Evaluate Suitability of EVM_{RMS} metric for DP-16QAM

Step 2 (to be addressed after step 1 is completed).

Check the OSNR penalty for combination of impairments that remain compensated by the compensated EVM metric after step 1:

1) Generate OSNR penalty versus “compensated impairment(s)” plot(s) and define a suitable limit for the individual impairment. P802.3cw would need to discuss how to define those limits based on what the performance impact and current transmitter capability is.
2) Apply the combination of individual impairments with the limit defined in 1) and measure the associated OSNR penalty.
3) Establish whether the measured OSNR penalty is acceptable. In case it is not acceptable we need to re-define the limit for the individual impairment (back to 1)).