

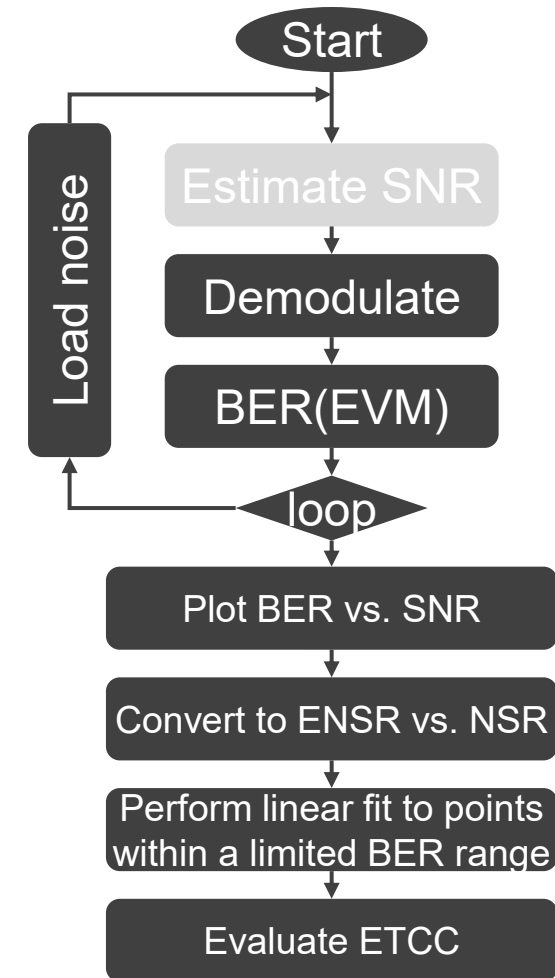
ETCC Analysis on OFC Plugfest Data

IEEE P802.3djTM - New Orleans, LA, USA - May 2025

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Joerg Pfeifle – Keysight Technologies

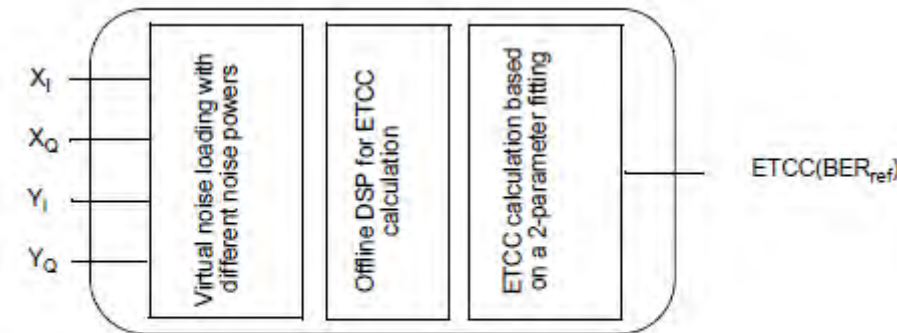
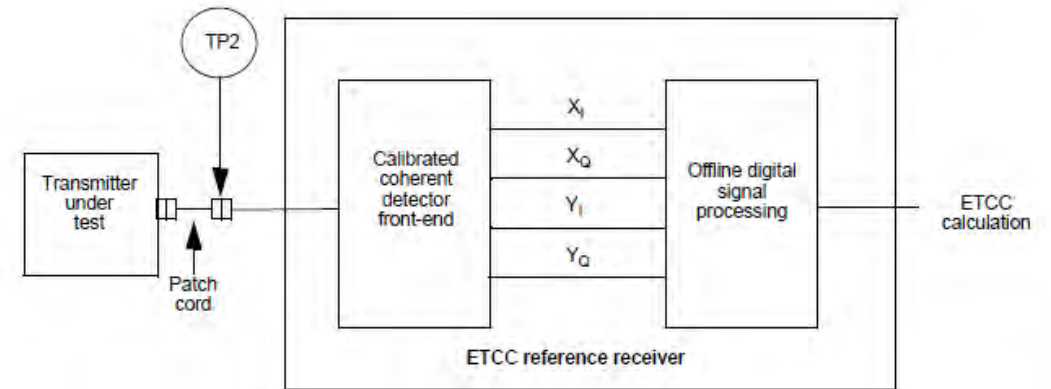
Agenda

- **ETCC Background**
- **ETCC Post-Processing Draft Implementation**
- **OFC2024 Plugfest Data (400ZR+)**
- **OFC2025 Plugfest Data (400ZR)**
- **OFC2025 Plugfest Data (800ZR)**
- **Summary and Remarks**
- **Areas for Further Study**



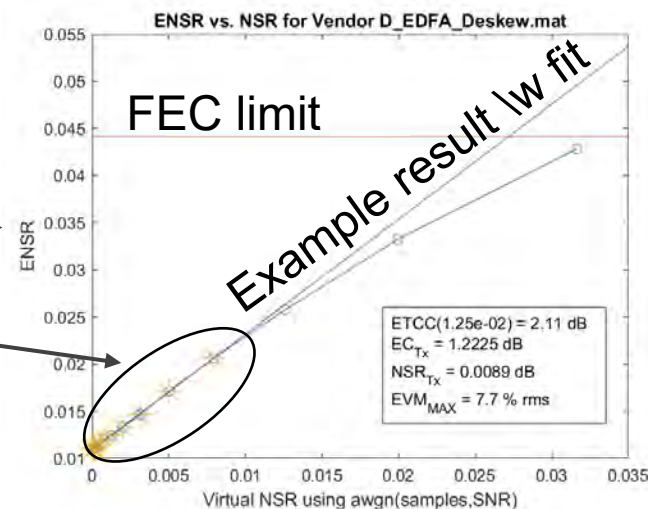
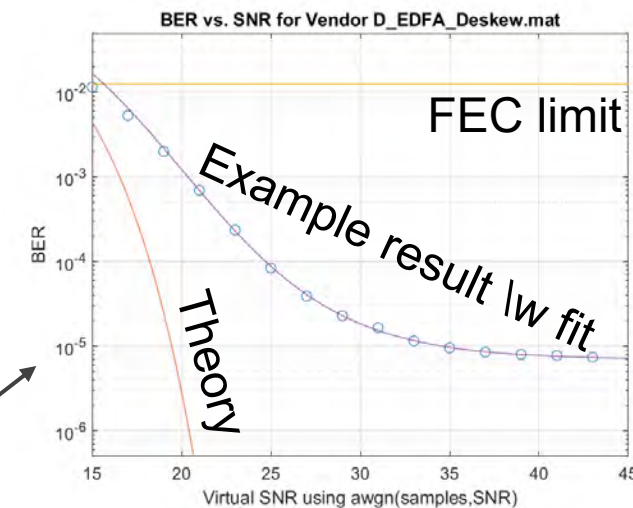
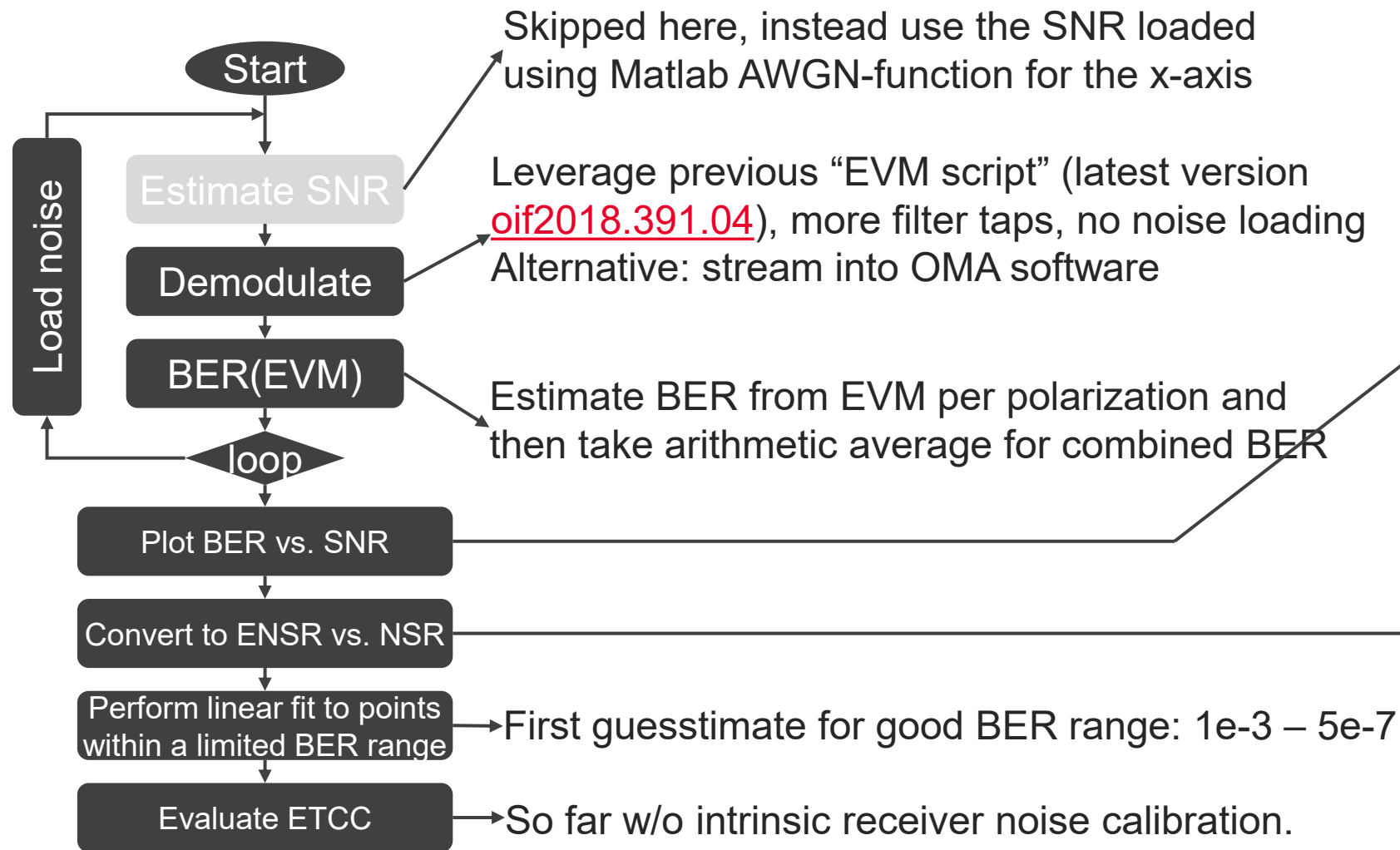
ETCC Background

- Methodology for extended transmitter constellation closure (ETCC) as a coherent transmitter quality metric (TQM) has been outlined in several contributions in OIF, IEEE and ITU
- It comprises a single waveform capture from a transmitter under test using a reference receiver
- The reference receiver post-processing comprises virtual noise loading, signal demodulation and analysis for each virtual noise level and a fitting procedure from which the ETCC value is determined



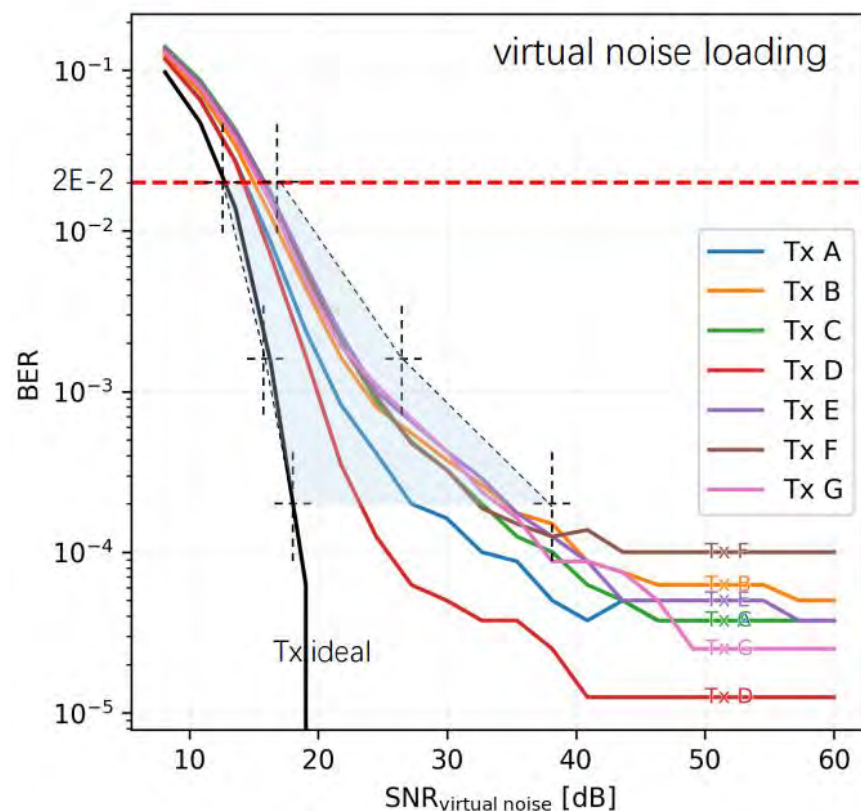
IEEE P802.3dj D1.5 – Annex 185A

ETCC Post-Processing Draft Implementation



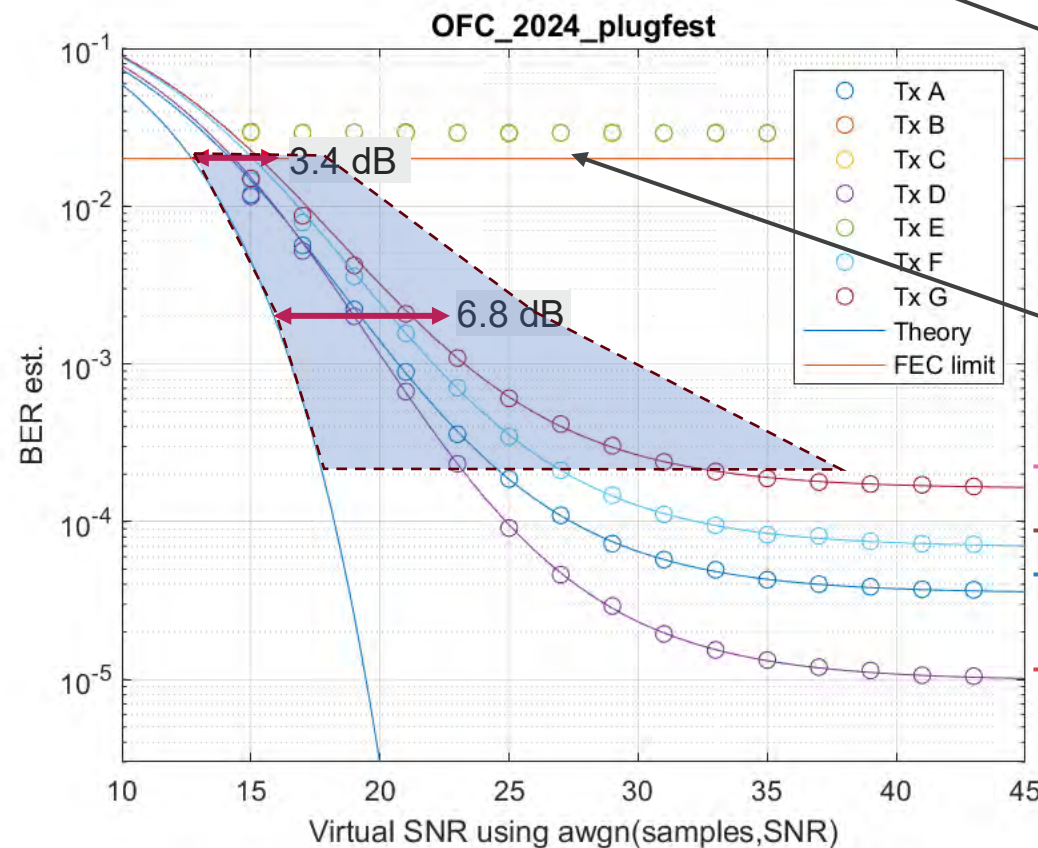
OFC2024 Plugfest Data (400ZR+) Compared to fan 3dj 02a 2407

From fan 3dj 02a 2407.pdf



4 Tx show similar behavior up to ~30 dB virtual SNR

Demod with EVM script (oif2018.391.04), settings see slide 11



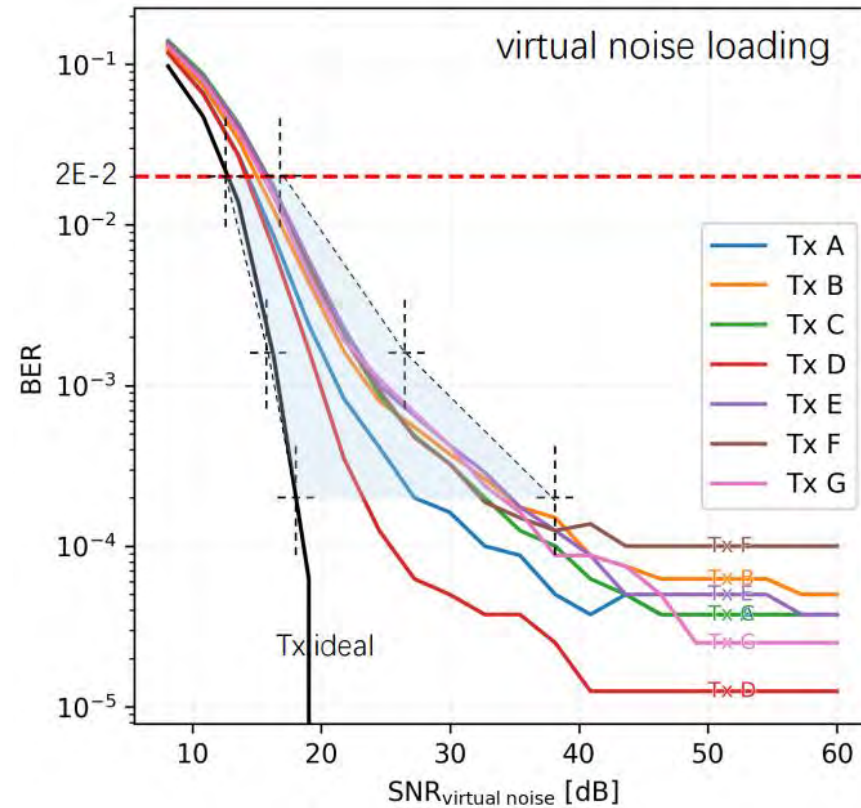
Available to OIF members or through Keysight

Demod fails for 3 Tx waveforms

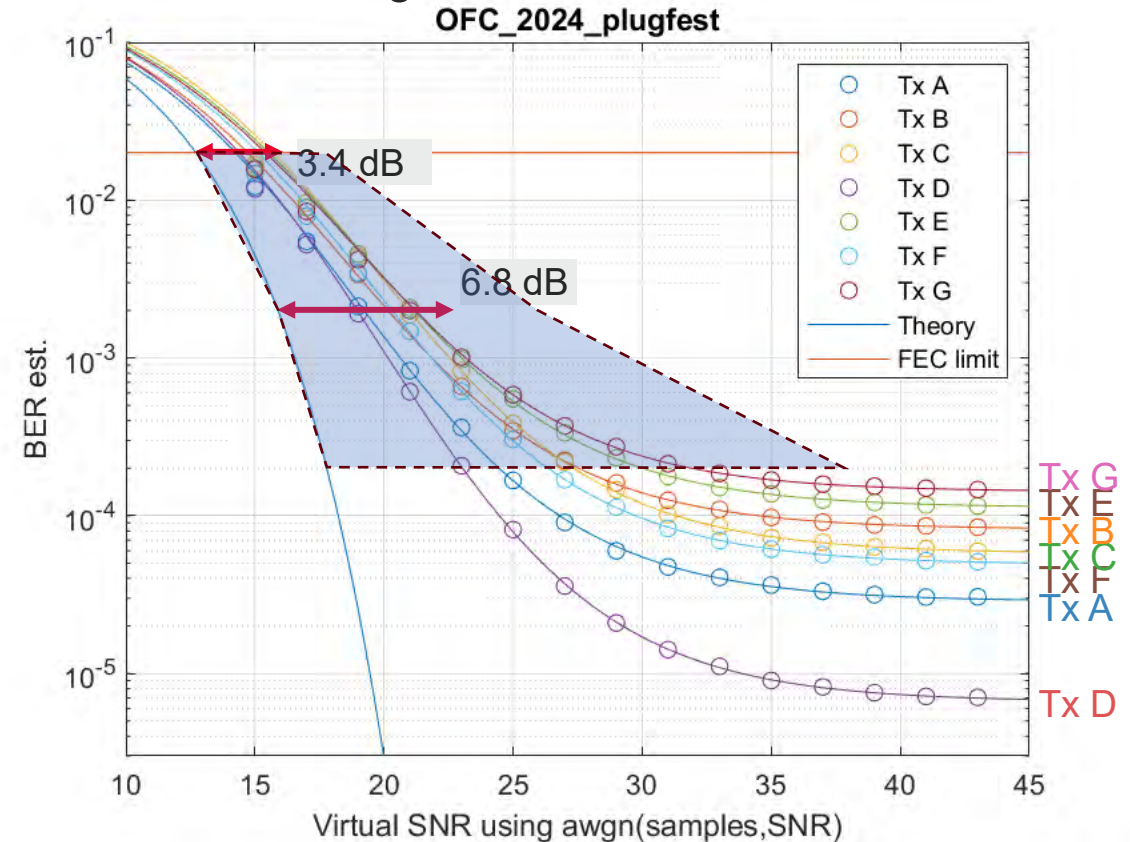
Font color to compare with fan_3dj_02a_2407

OFC2024 Plugfest Data (400ZR+) Compared to fan 3dj 02a 2407 – Continued

From fan 3dj 02a 2407.pdf



Demod with OMA software,
settings see slide 11



Font color to
compare with
fan_3dj_02a_2407

Very similar behavior up to ~30 dB virtual SNR

Preliminary OFC2024 Plugfest ETCC Results Compared to kota 3dj 02 2407

Vendor		A	B	C	D	E	F	G
<u>oif2024.430.01</u>	Rx1	1.5	2.7	3.4	1.3	2.6	3.0	2.6
	Rx2	1.1	2.2	3.2	0.9	2.2	2.5	2.2
	Rx3	1.3	2.9	3.4	1.3	2.5	2.9	3.2
	Rx4	1.1	2.4	2.9	1.0	2.1	2.6	2.7
This contribution:	EVM script demod	1.5	-	-	1.6	-	2.4	2.6
	OMA SW demod	1.5	2.0	3.0	1.7	2.8	2.4	2.7

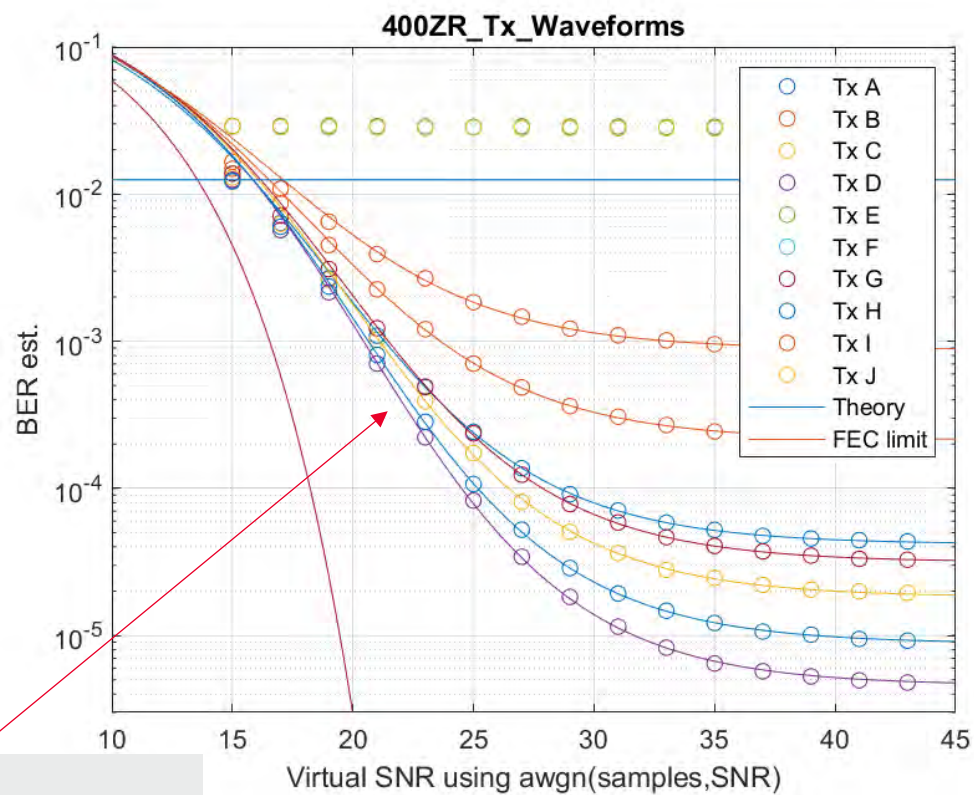
Similar trends!

Methodology seems to be useful in principle

Need consensus on detailed reference receiver post-processing

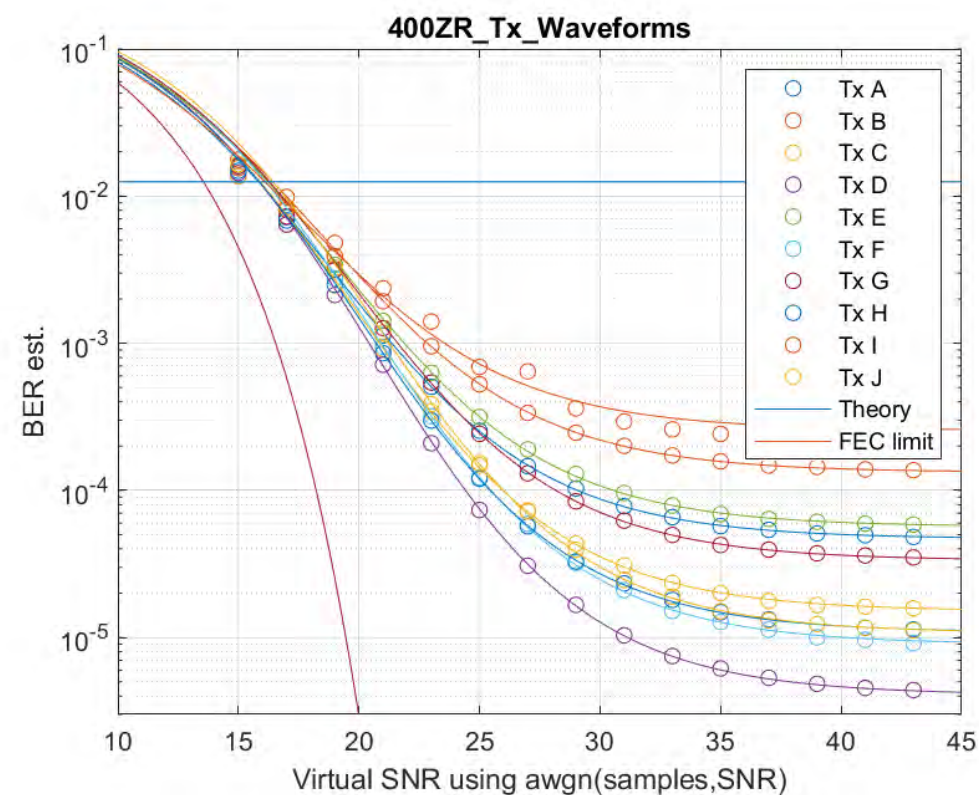
OFC2025 Plugfest Data (400ZR)

Demod with EVM script ([oif2018.391.04](#)),
settings see slide 11



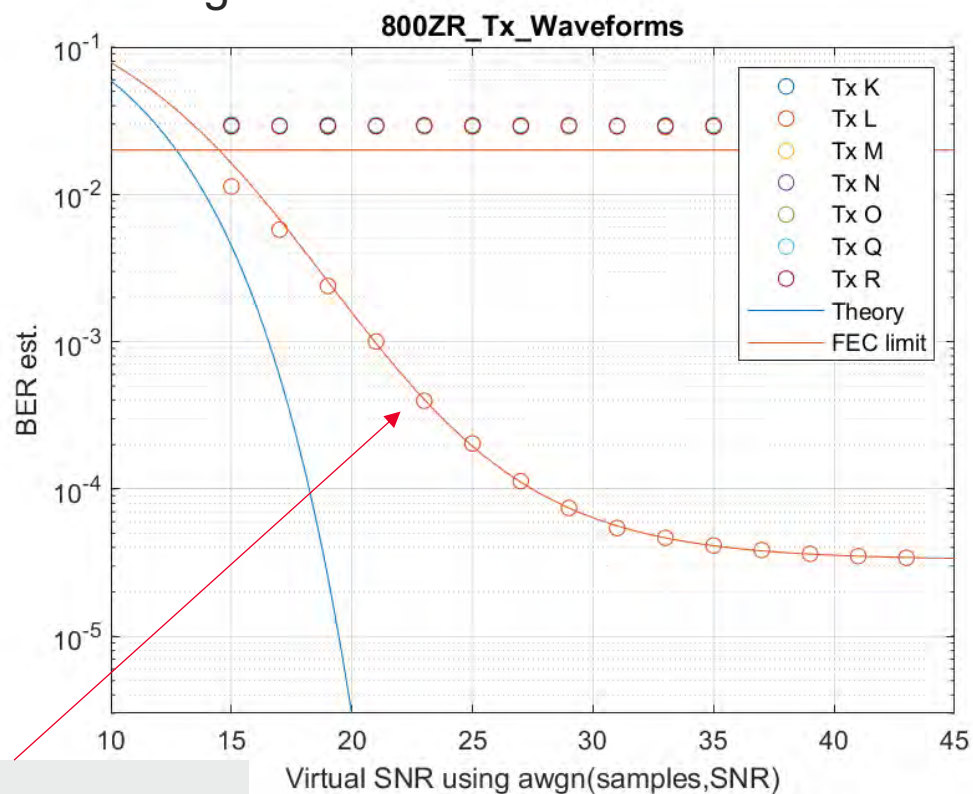
Demod converges
for 7 of 10 Tx

Demod with OMA software,
settings see slide 11



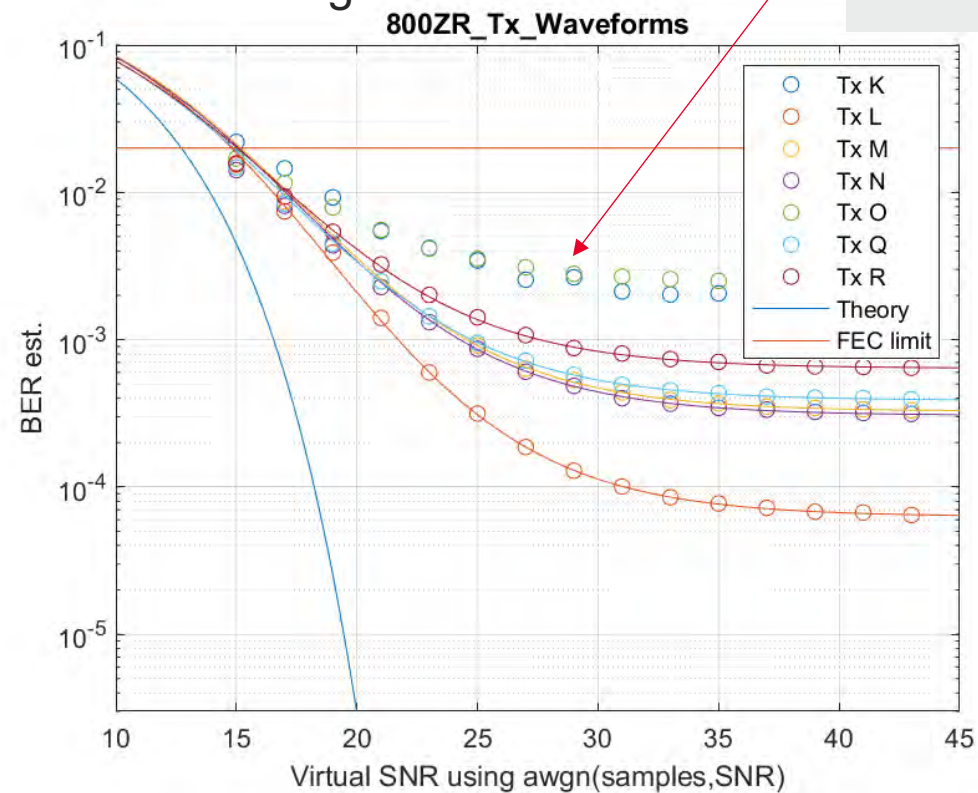
OFC2025 Plugfest Data (800ZR)

Demod with EVM script ([oif2018.391.04](#)),
settings see slide 11



Demod converges
only for one Tx

Demod with OMA software,
settings see slide 11



All data points
within BER range
that is excluded
from fitting

Preliminary OFC2025 Plugfest ETCC Results

400ZR	Vendor	A	B	C	D	E	F	G	H	I	J
	EVM script demod	2.3	3.0	2.5	2.3	-	-	2.6	2.3	2.6	-
	OMA SW demod	2.3	2.9	2.3	2.3	2.7	2.6	2.7	2.3	2.6	2.9

800ZR	Vendor	K	L	M	N	O	P	Q	R
	EVM script demod	-	1.8	-	-	-	-	-	-
	OMA SW demod	NaN	2.1	2.5	2.4	NaN	NA	2.2	2.3

Legend:

- Demodulation failed
- NaN Fitting procedure failed
- NA Module missed during measurement session

Demodulator Settings

- EVM script ([oif2018.391.04](https://www.oiforum.com/wp-content/uploads/OFC-2025-TQM-White-Paper-4_17.pdf))
- Changes compared to OIF-400ZR-03.0 Appendix C:
 - OSNR = Inf (no noise loading for EQ training)
 - numTaps = 45
 - receiveFilter = 'RootRaisedCosine'
 - receiveBT = 0.2
- EVM script ([oif2018.391.04](https://www.oiforum.com/wp-content/uploads/OFC-2025-TQM-White-Paper-4_17.pdf)) available to OIF members or through Keysight

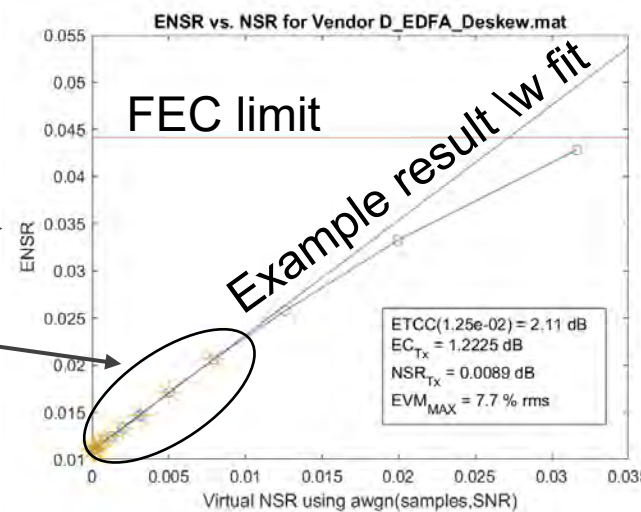
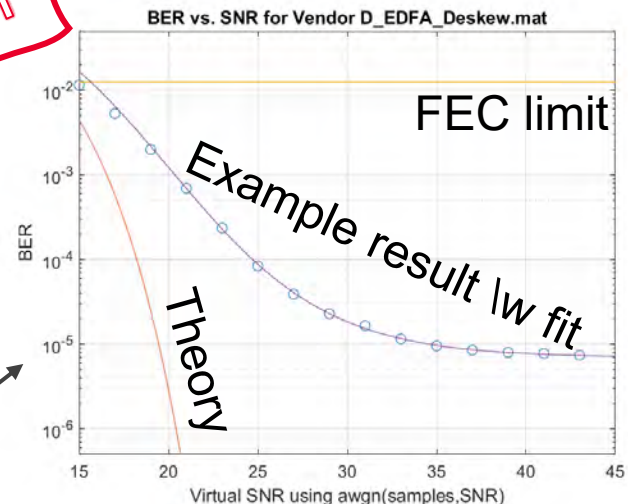
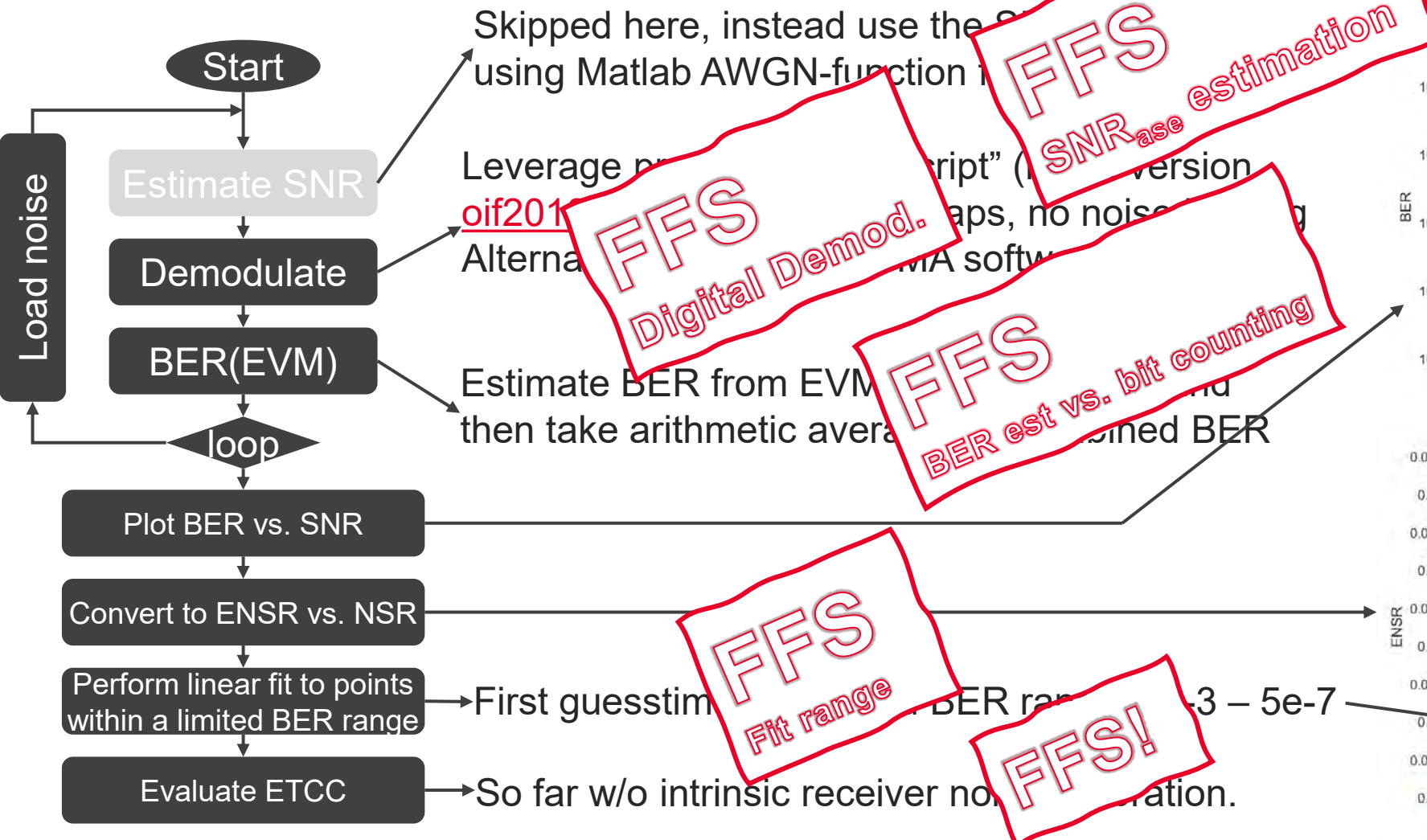
These settings are also described in OFC-2025-TQM-White-Paper-4_17.pdf available via:
https://www.oiforum.com/wp-content/uploads/OFC-2025-TQM-White-Paper-4_17.pdf

- OMA software demod:
- Pre-processing algorithms:
 - Transmitter Phase Response Equalizer (*used for 800ZR only*)
 - PolStokesAlign
 - Frequency Offset Compensation
- Custom IQ demodulator
 - Constellation: 16QAM
 - Result Length: 1000 Symbols
 - Measurement Filter: Root Raised Cosine
 - Reference Filter: Raised Cosine
 - Alpha/BT: 0.2
 - Filter Length: 45
 - Convergence: 5E-07
 - Frequency Estimation: Normal

Summary and Remarks

- Draft implementation of ETCC reference receiver post-processing flow with T&M toolsets delivers qualitatively comparable results to [fan 3dj 02a 2407](#) and [kota 3dj 02 2407](#)
- Reference receiver post-processing needs to be defined with high-level of detail to ensure consistent results across different implementations
- Need close collaboration between transceiver and test equipment vendors – suggested main areas “for further study” see next slide

ETCC Post-Processing Draft Implementation



Thank you