C2M module R_{peak}

D3.1 comment #240

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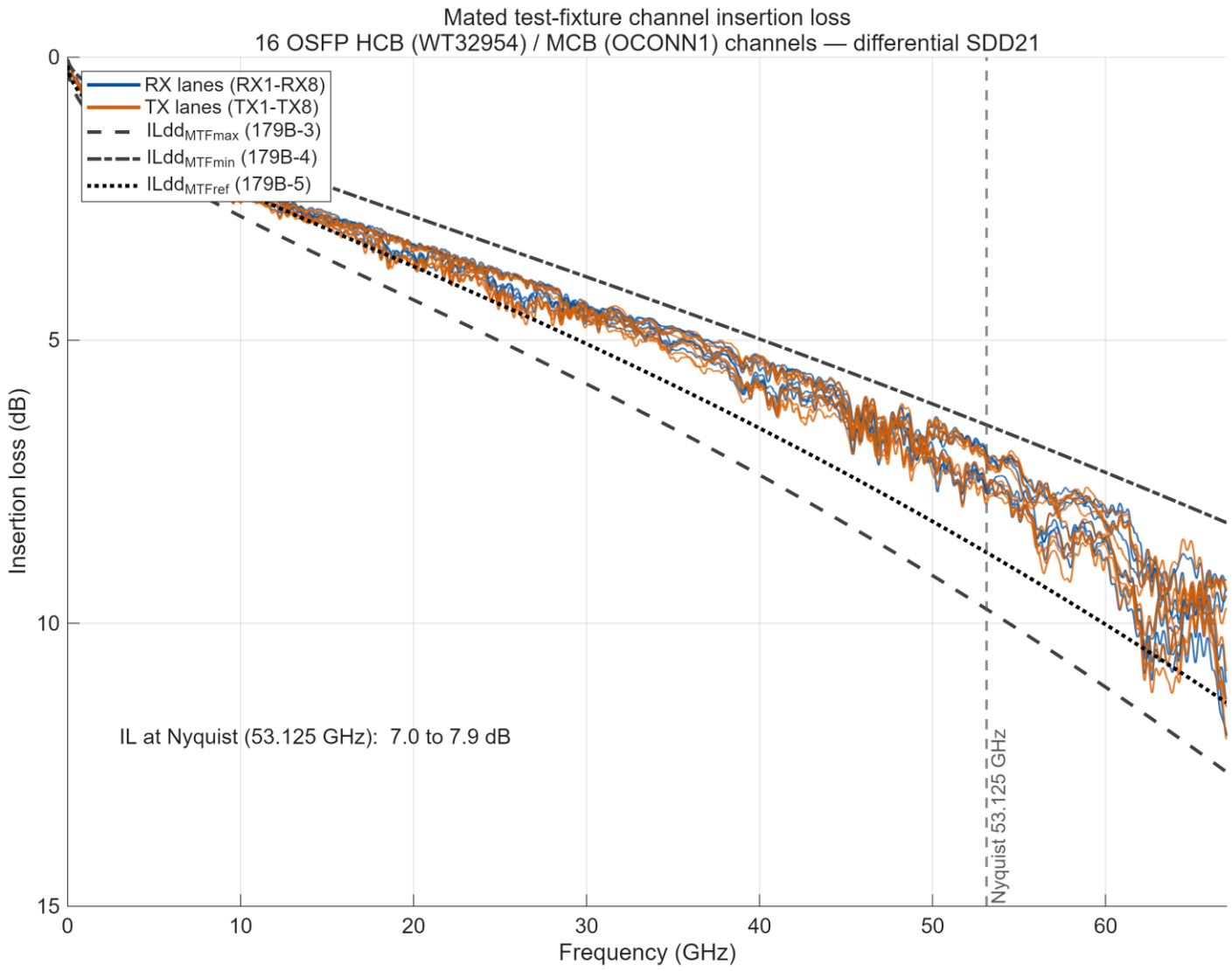
Introduction

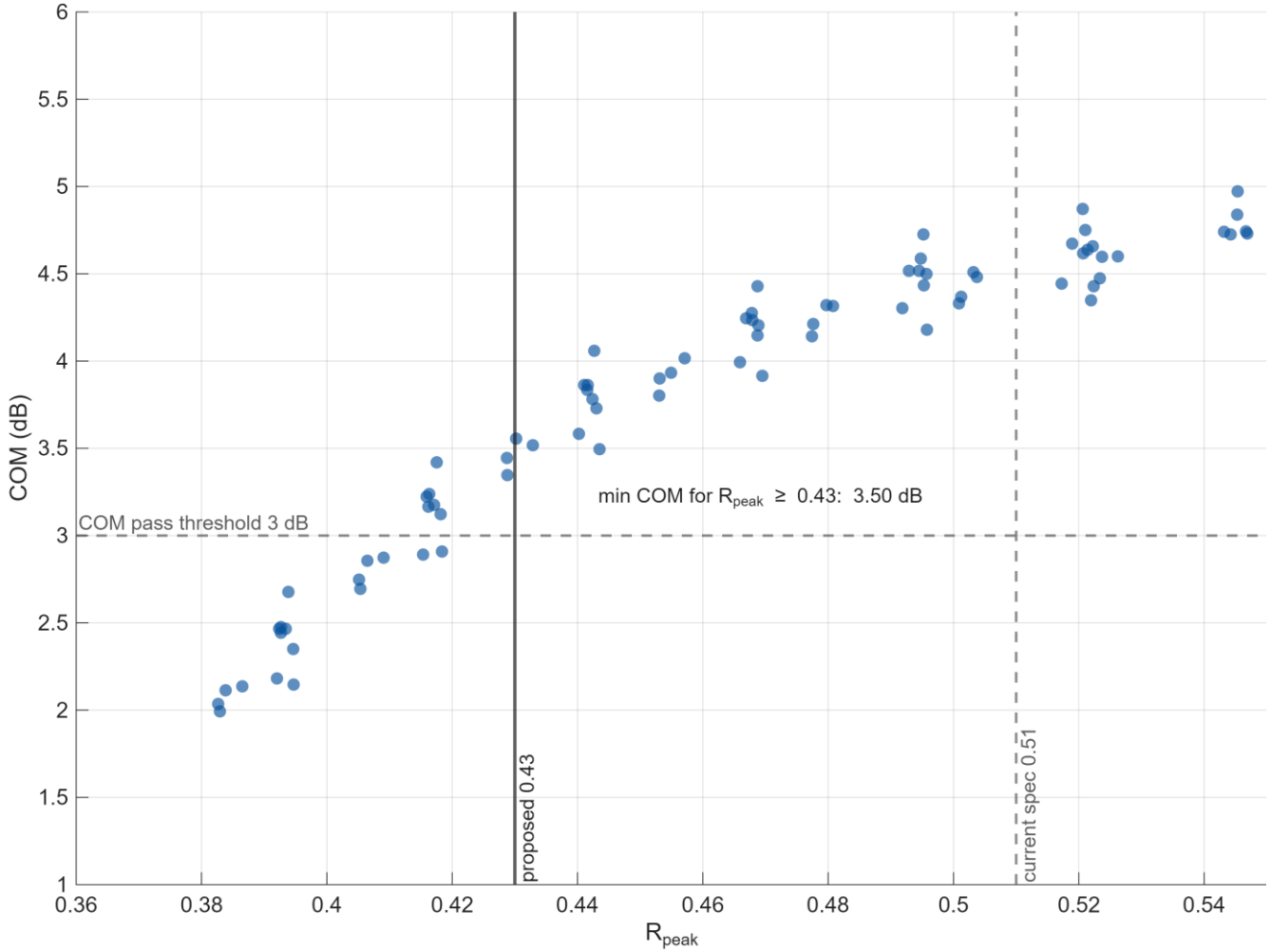
- R_{peak} = linear fit pulse peak ratio (176D.8.4, method of 179.9.4.2.2), specified for the module output at TP4.
  - Table 176D-3 today: R_{peak} (min) = 0.51, together with v_f (range) = 0.392 to 0.5 V.
- History: 0.567 (placeholder) -> 0.456 (mi_3dj_02a_2507) -> 0.46 (healey_3dj_01a_2511) -> 0.51 (healey_3dj_01_2601).
- The current limit is based on the COM reference model, but cannot be met even for slight deviation from this model.
- Data from recent interoperability events (e.g. calvin_3dj_01a_2601) show that most tested modules cannot meet the R_{peak} and v_f specifications together for the same TX preset. With that, these modules exhibited good interoperability with compliant hosts.
- Related to comment 240.

Simulation setup - tested channels (mammenga_3dj_01_2601)



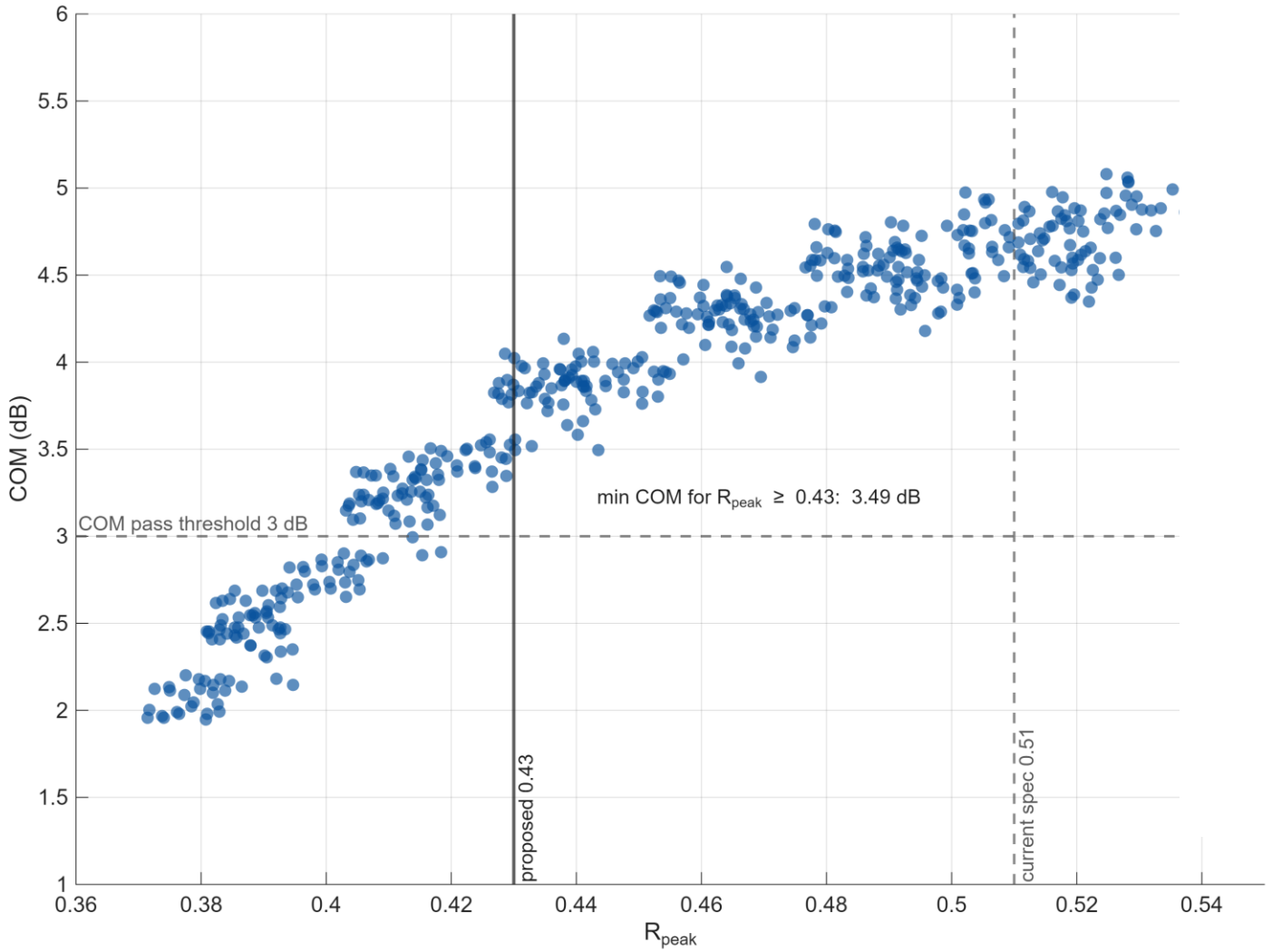
Simulation: COM vs R_{peak}, D3.1 reference model

- Numerous mated pair channels
- R_{peak} was altered by TX transition time sweep
- At the reference T_r = 4 ps, R_{peak} = 0.52 to 0.55
  - Marginal to the current limit
- Min COM at R_{peak} of 0.51 is 4.35 dB
- Min COM at R_{peak} of 0.43 is 3.5 dB
  - well above the 3.0 dB requirement

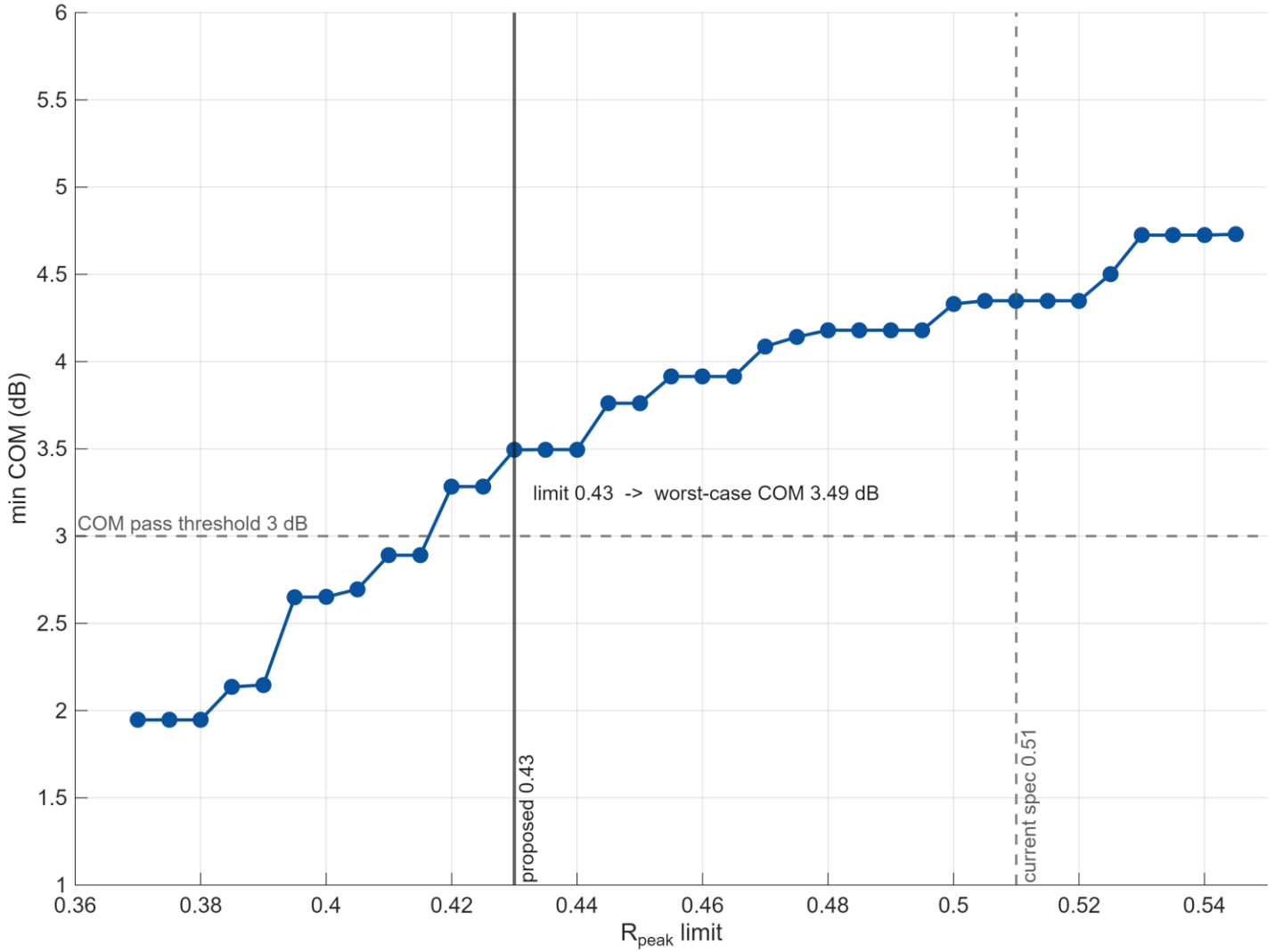


Same conclusion with a module package (informative)

- Same sweep, adding the module device package from the pre-D3.1 draft:
  - informative only: D3.1 removed the module package from the reference model
- COM-vs-R_{peak} relationship is unchanged.



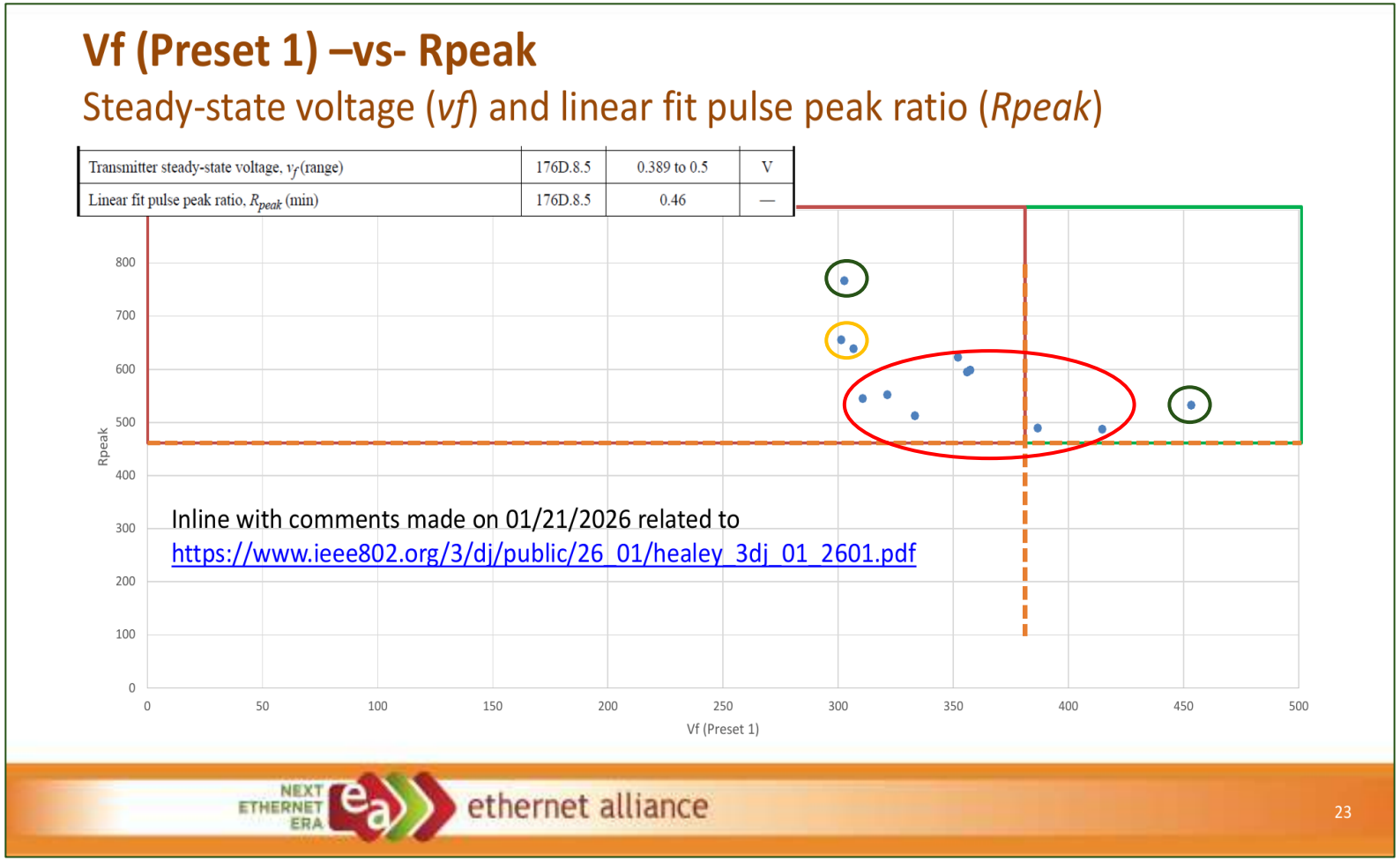
Minimum COM vs. R_{peak}



** min COM = worst COM among all simulated points with $R_{peak} \geq$ limit*

Field data: modules that fail the spec interoperate

- EA plugfest, Dec 2025: 22 modules measured at TP2/TP4
- v_f (preset 1) vs R_{peak} (figure):
  - most modules cannot meet v_f and R_{peak} at the same preset
  - note: tested against R_{peak} = 0.46
- Same modules against compliant systems:
  - 43/45 link-up (95%), zero FLR failures
- The current spec fails modules that demonstrably interoperate
- Similar results were observed in the recent IBTA Plugfest



Source: calvin_3dj_01a_2601 (Ethernet Alliance 224G plugfest, Dec 2025), slide 23

Modules that pass or likely to pass v_f and R_{peak}

Modules that may pass v_f and R_{peak}

Modules that are likely to fail v_f or R_{peak}

Why R_{peak} limit of 0.43 is safe?

- Host RX test is unchanged
  - the host RX interference tolerance test (176D.8.12) is calibrated via COM, independent of the module R_{peak} limit
- TX signal quality remains bounded
  - SNDR, output jitter, v_f, RLM
- System-level metric stays healthy
  - worst COM at R_{peak} = 0.43 is ≥ 3.49 dB, vs the 3.0 dB requirement

Conclusions

- The current R_{peak} limit cannot be met even for slight deviation from the COM reference model.
- Data from recent interoperability events (e.g. calvin_3dj_01a_2601) show that most tested modules cannot meet the R_{peak} and v_f specifications together for the same TX preset. With that, these modules exhibited good interoperability with compliant hosts.
- R_{peak} limit of 0.43 will ensure compliance of modules that proved proper interoperability without compromising the link quality.

- Suggested remedy – change the module output R_{peak} limit (Table 176D-3) to 0.43.

Thank you!