

**MTF ERL**

*Comments #122, #123*

**Amphenol Corporation**

**October 13, 2020**

**Amphenol**

# Supporters

- Bruce Champion, TE
- Alex Haser, Molex
- Chris Diminico, PHY-SI
- Rich Mellitz, Samtec
- Mike Dudek, Marvell
- John Calvin, Keysight

# Relevant Comments

#122, #123

CI 162B SC 162B.1.3.2 P256 L41 # 122  
Kocsis, Sam Amphenol  
Comment Type TR Comment Status X  
text says test fixture "shall meet" Eq 162B-6  
SuggestedRemedy  
Change to "is recommended to meet and shall meet an ERL of 8dB, see background/consensus presentation  
Proposed Response Response Status

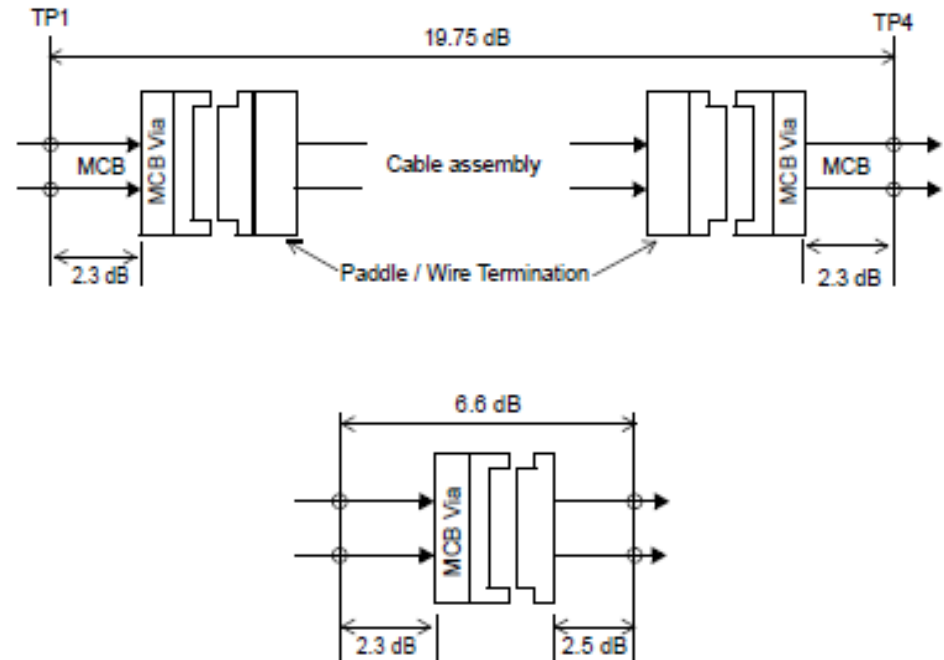
CI 162B SC 162B.1.3.2 P256 L41 # 123  
Kocsis, Sam Amphenol  
Comment Type TR Comment Status X  
Add definition of ERL for MTF  
SuggestedRemedy  
Copy Table120G-4, change Tfx to "0", use as reference for MTF ERL  
Proposed Response Response Status

- Presenting resolution of these comments together since they are related, though if necessary, comment #123 could be accepted while comment #122 rejected

# ERL for MTF

From D1p3

- ERL is a critical metric for determining compliance for copper cables, host TX/RX, and module TX/RX
- All of the cases above typically use either the module compliance board or the host compliance board (MCB, HCB)
- Currently there is no recommended or required ERL metric for the MTF



# Measured Data

From 3ck contributed TP1-TP4 channels

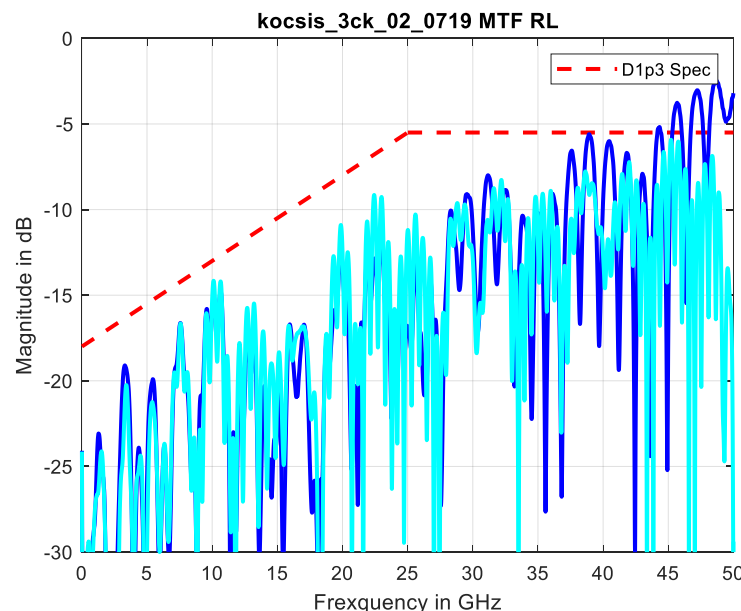
- There is currently only one posted MTF channel

[https://www.ieee802.org/3/ck/public/tools/cucable/kocsis\\_3ck\\_02\\_0719\\_MTFosfp.zip](https://www.ieee802.org/3/ck/public/tools/cucable/kocsis_3ck_02_0719_MTFosfp.zip)

- There have be several changes proposed to the RL mask, specifically at higher frequencies (>35GHz)

- New proposals continue to shape the RL mask around presented data

- There has not been much work to map the RL mask to ERL so to enable consistent expectations between MTF and C2M, CR, and KR



# ERL for MTF

## Proposal for ERL Methodology

Table ~~1206-1~~

**MTF**

ERL parameter values

Parameter	Symbol	Value	Units
Transition time associated with a pulse	$T_r$	0.01	ns
Incremental available signal loss factor	$\beta_x$	0	GHz
Permitted reflection from a transmission line external to the device under test	$\rho_x$	0.618	—
Length of the reflection signal	N	400	UI
Equalizer length associated with reflection signal	$N_{bx}$	0	UI
Twice the propagation delay associated with the test fixture	$T_{fx}$	0	ns
Tukey window flag	$rw$	1	—

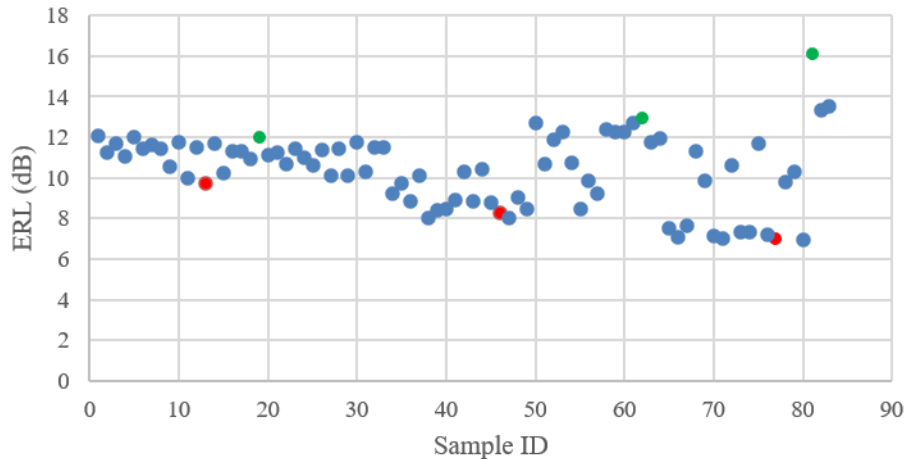
**\*The entire test fixture, between test points will be included in the ERL calculation.**

- The MTF test could leverage settings from a C2M setup with the exception that the entire fixture would be included in the ERL result, including the RF launch

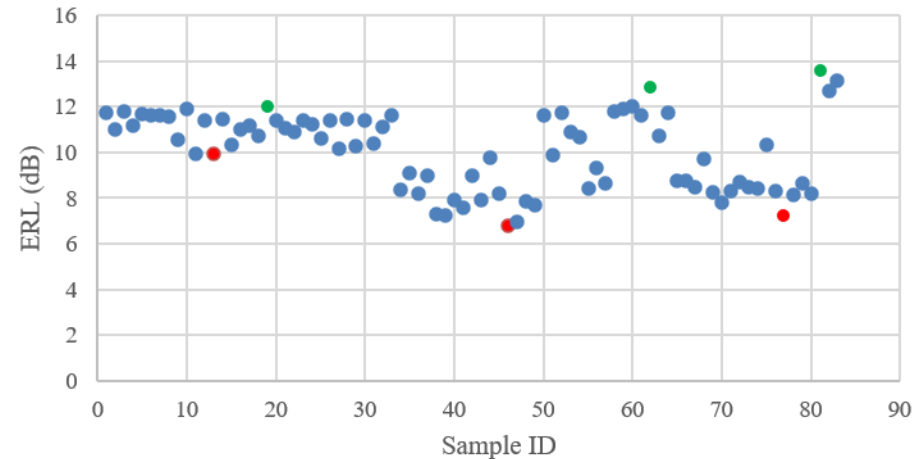
# ERL for MTF

## Larger Sample Study

MTF ERL11 (from MCB)



MTF ERL22 (from HCB)

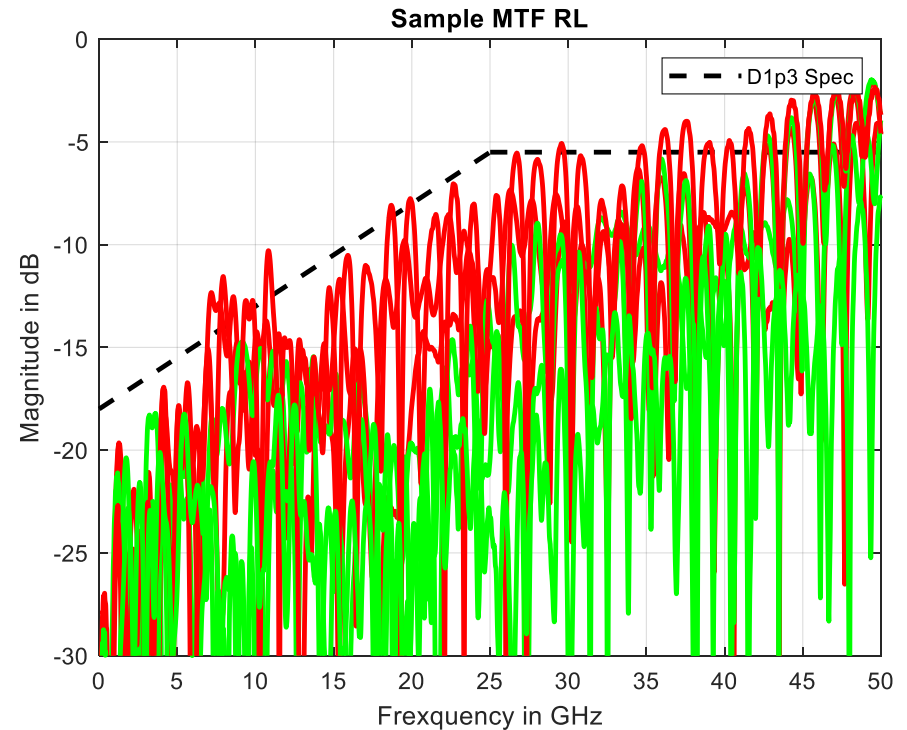


- 83 samples of MTF data were collected and compared using the methodology on the previous slide
- All samples are measured with compliant MCB and HCB
- Some samples are highly “engineered” for lab measurement
  - (3) of the **better** results were chosen for further investigation
  - (3) of the **poorer** results were chosen for further investigation

# ERL for MTF

## Larger Sample Study

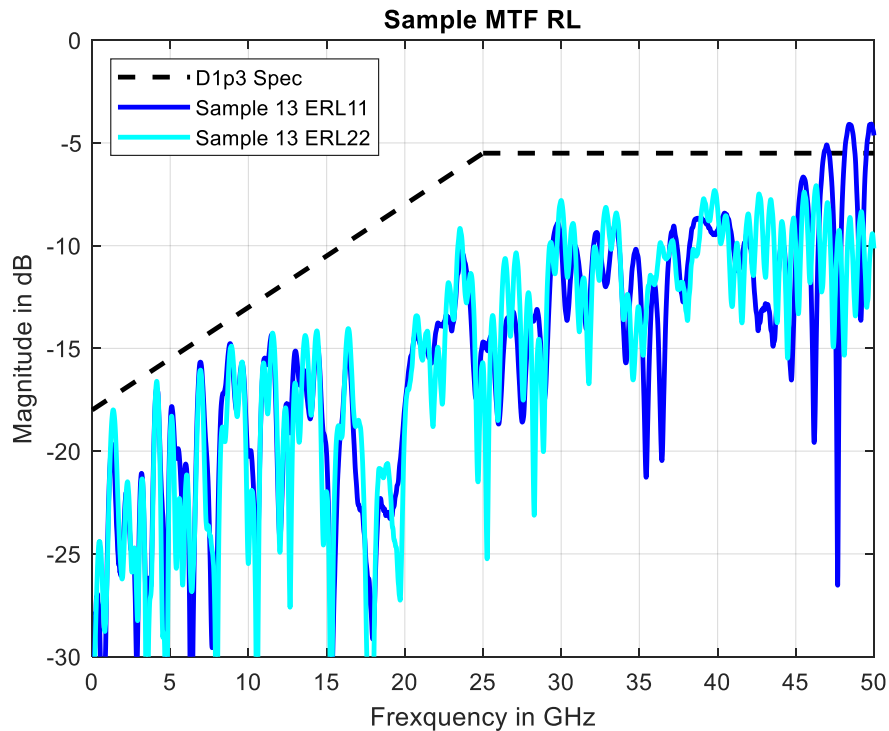
Sample ID	ERL11	ERL22
13	9.7410	9.9324
19	11.9892	12.0204
46	8.2998	6.7789
62	12.9602	12.8642
77	6.9841	7.2162
81	16.082	13.568



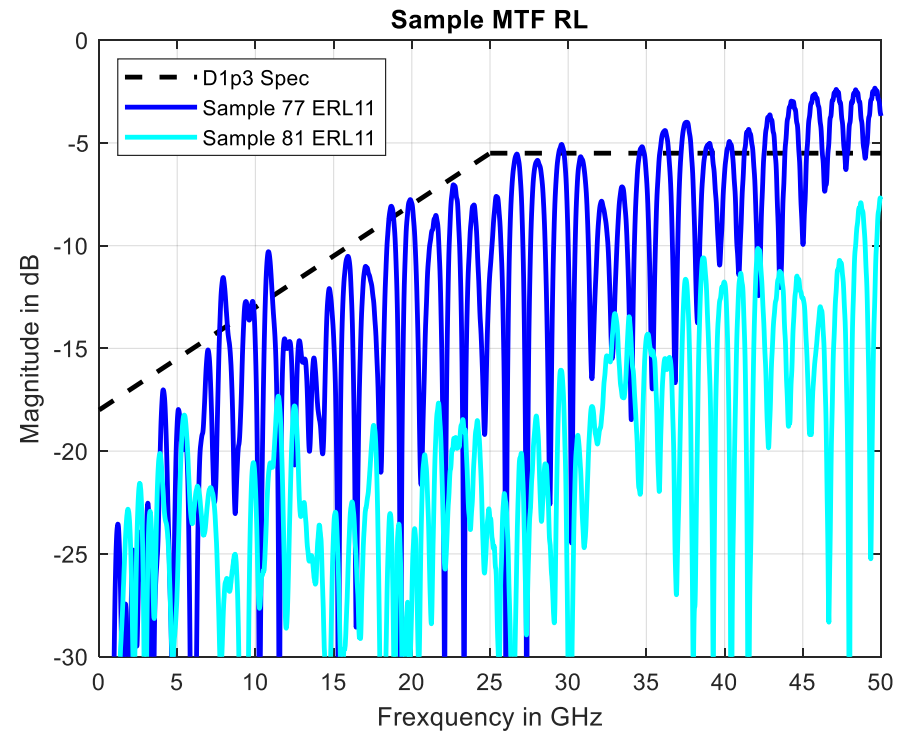


# ERL for MTF

## Sample Comparison



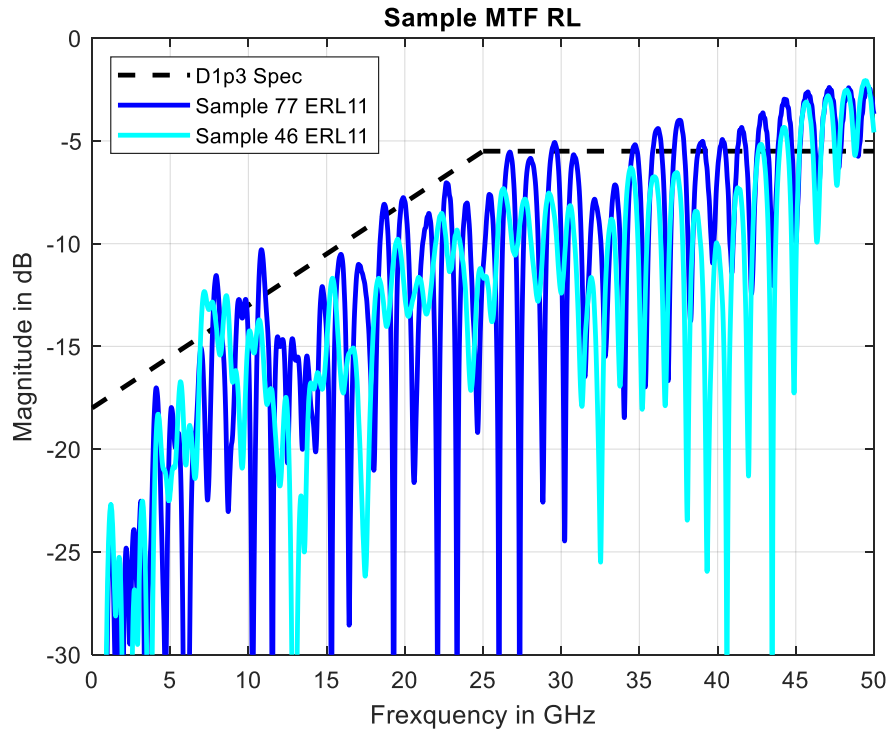
The difference caused by the limit line violation >45GHz is ~0.2dB ERL



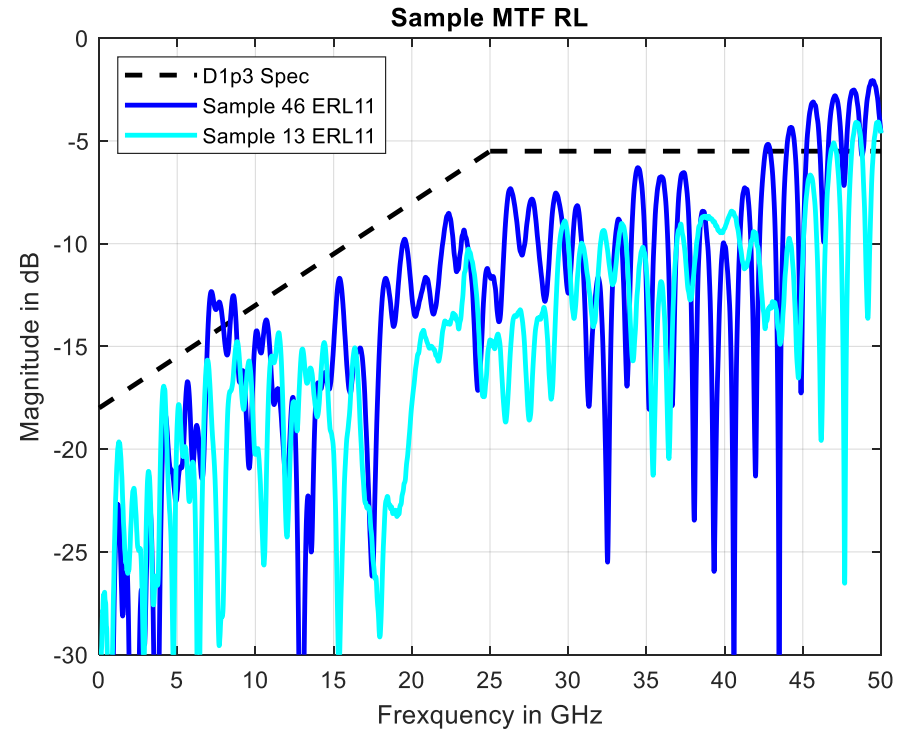
The difference between ERL ~7dB  
ERL ~16dB is very significant

# ERL for MTF

## Sample Comparison



Shown difference between ERL ~7dB and ERL ~8dB



Shown difference between ERL ~8dB and ERL ~10dB

# ERL for MTF

## Proposed Resolution

- Keep the limit line defined in Eq. 162B-6 as an informative requirement
- Add MTF ERL to Annex 162B as defined on Slide 6
- Make the normative limit for MTF ERL = 8dB