

Differential Return Loss for Clause 137 and Matched COM Package Parameters

For Comments #92 and #93

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Differential Return Loss and Package Options

- ▶ OPTION A: Go back to clause 93 and Annex 83d
- ▶ OPTION B: Do nothing keep what is in D1.2
- ▶ OPTION C: Keep packages in D1.2 and lower return loss by 3.5 dB to match packages
- ▶ OPTION D: Use lower return loss in OPTION C and specify a new 12 and 30 mm packages which matches RL even more closely
- ▶ OPTION E: Lower RL limit to and keep clause 93 and Annex 83d test fixture margin

Background: Return loss in Clause 93

Clause 137 Return Loss is Specified in Equation 93-3

93.8.1.4 Transmitter output return loss

The differential output return loss, in dB, of the transmitter shall meet Equation (93-3) where f is the frequency in GHz. This output impedance requirement applies to all valid output levels. The reference impedance for differential return loss measurements shall be 100 Ω .

$$RL_d(f) \geq \begin{cases} 12.05 - f & 0.05 \leq f \leq 6 \\ 6.5 - 0.075f & 6 < f \leq 19 \end{cases} \text{ dB} \quad (93-3)$$

137.9 Electrical characteristics

137.9.1 MDI

The MDI for the 50GBASE-KR, 100GBASE-KR2 and 200GBASE-KR4 is a dependent direct electrical connection between the PMD and the MDI. The MDI consists of two differential pairs, one pair for the transmit function and one pair for the receive function. The MDI is shown at TP0 and TP5 in Figure 137-2.

Transmitter and receiver characteristics are defined at TP0a and TP5a, which are connected to the MDI through the test fixtures described in 93.8.1.1 and 93.8.2.1.

137.9.3.1 Receiver input return loss

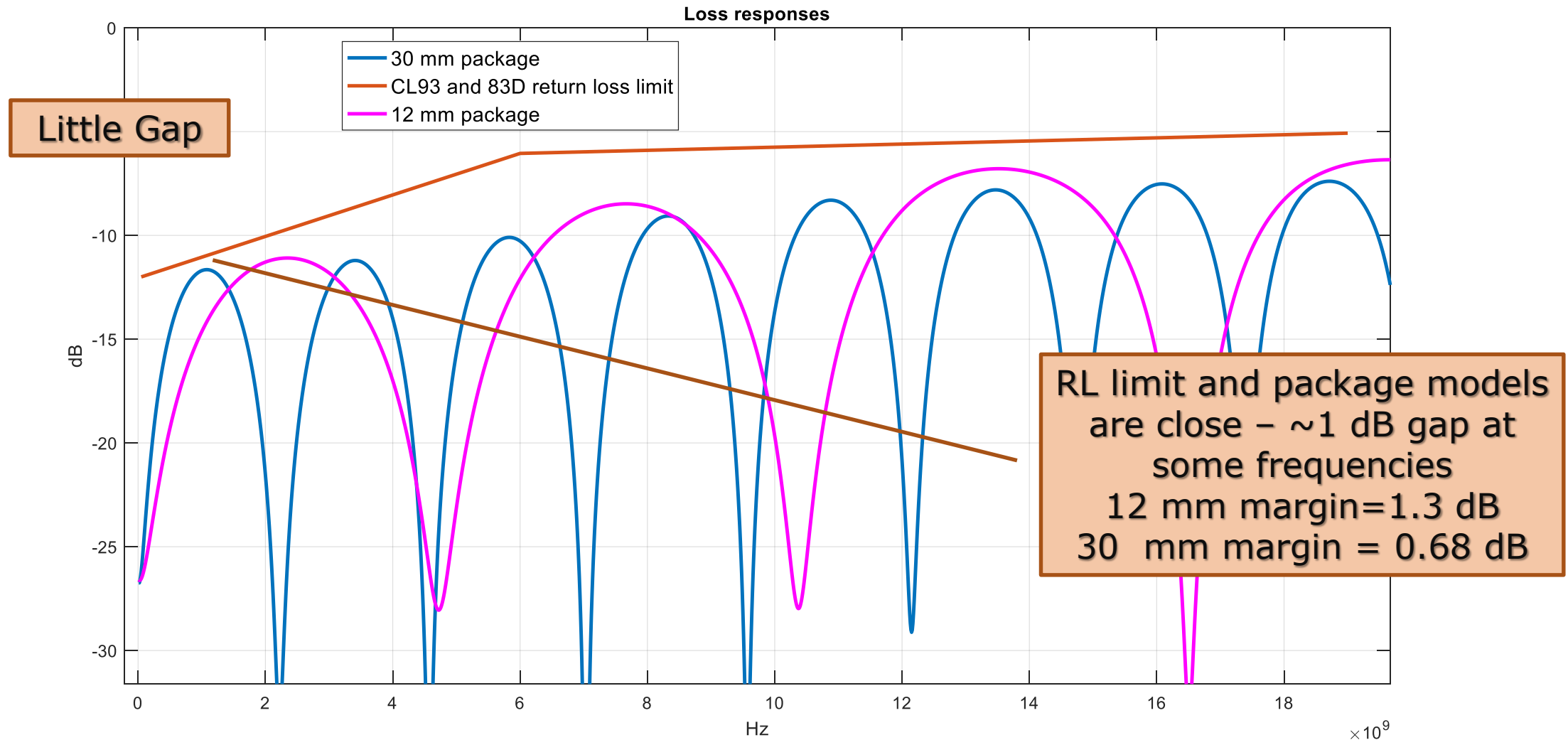
The differential return loss, in dB, of the receiver input shall meet Equation (137-1) where f is the frequency in GHz. The reference impedance for differential return loss measurements shall be 100 Ω .

$$RL_d(f) \geq \begin{cases} 12.05 - f & 0.05 \leq f \leq 6 \\ 6.5 - 0.075f & 6 < f \leq 19 \end{cases} \text{ dB} \quad (137-1)$$

The differential return loss limit is illustrated by Figure 137-2.

Option A: Go Back to Clause 93

COM package return loss compared to RL limit



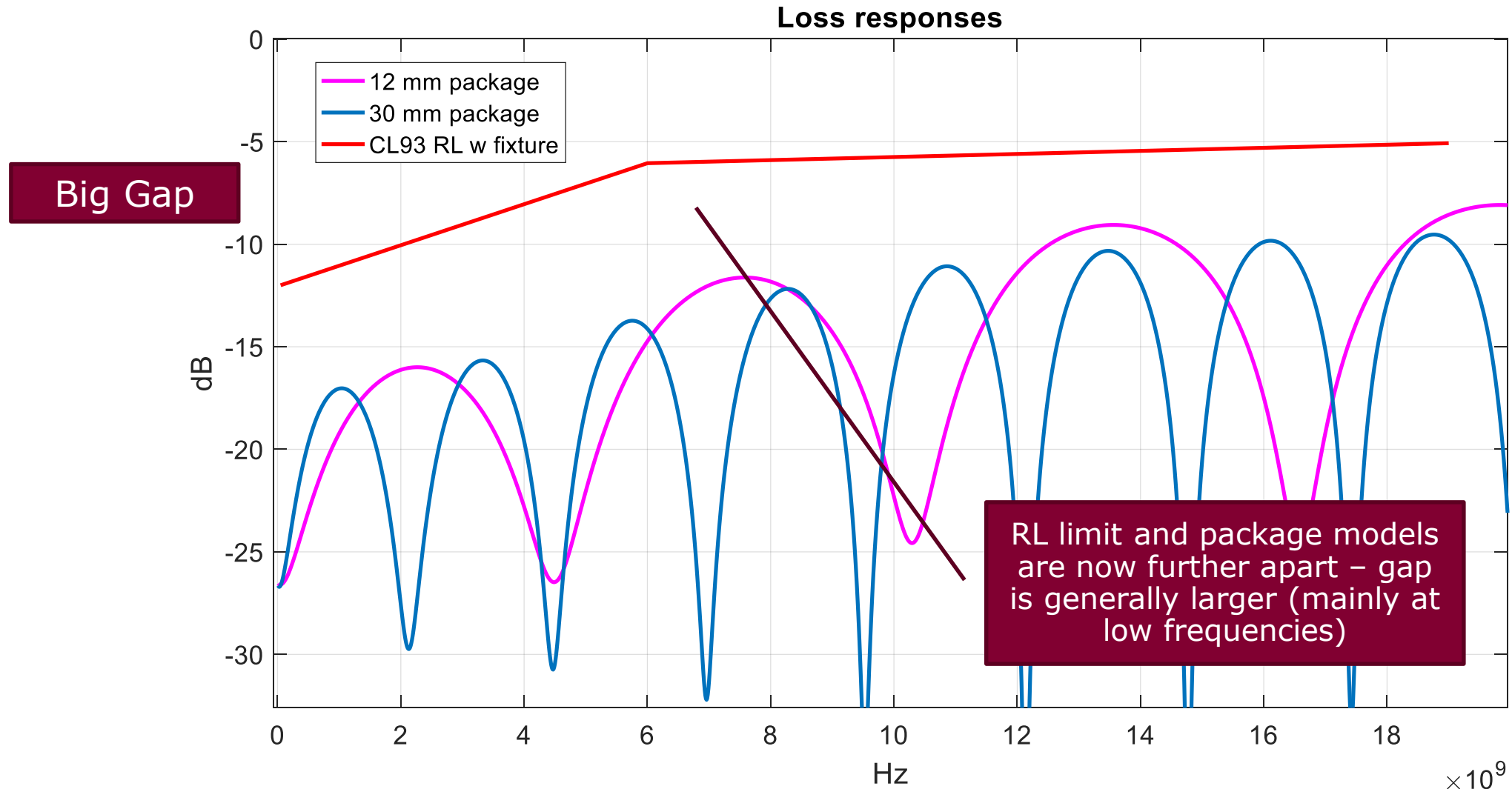
COM Package Parameters for Clause 137

Table 137–5—COM parameter values

Parameter	Symbol	Value	Units
Signaling rate	f_b	26.5625	GBd
Maximum start frequency	f_{\min}	0.05	GHz
Maximum frequency step	Δf	0.01	GHz
Device package model			
Single-ended device capacitance	C_d	1.8×10^{-4}	nF
Transmission line length, Test 1	z_p	12	mm
Transmission line length, Test 2	z_p	30	mm
Single-ended package capacitance at package-to-board interface	C_p	1.1×10^{-4}	nF
Package transmission line characteristic impedance	Z_c	90	Ω
Single-ended reference resistance	R_0	50	Ω
Single-ended termination resistance	R_d	55	Ω

OPTION B: Do nothing and keep what is in D1.2

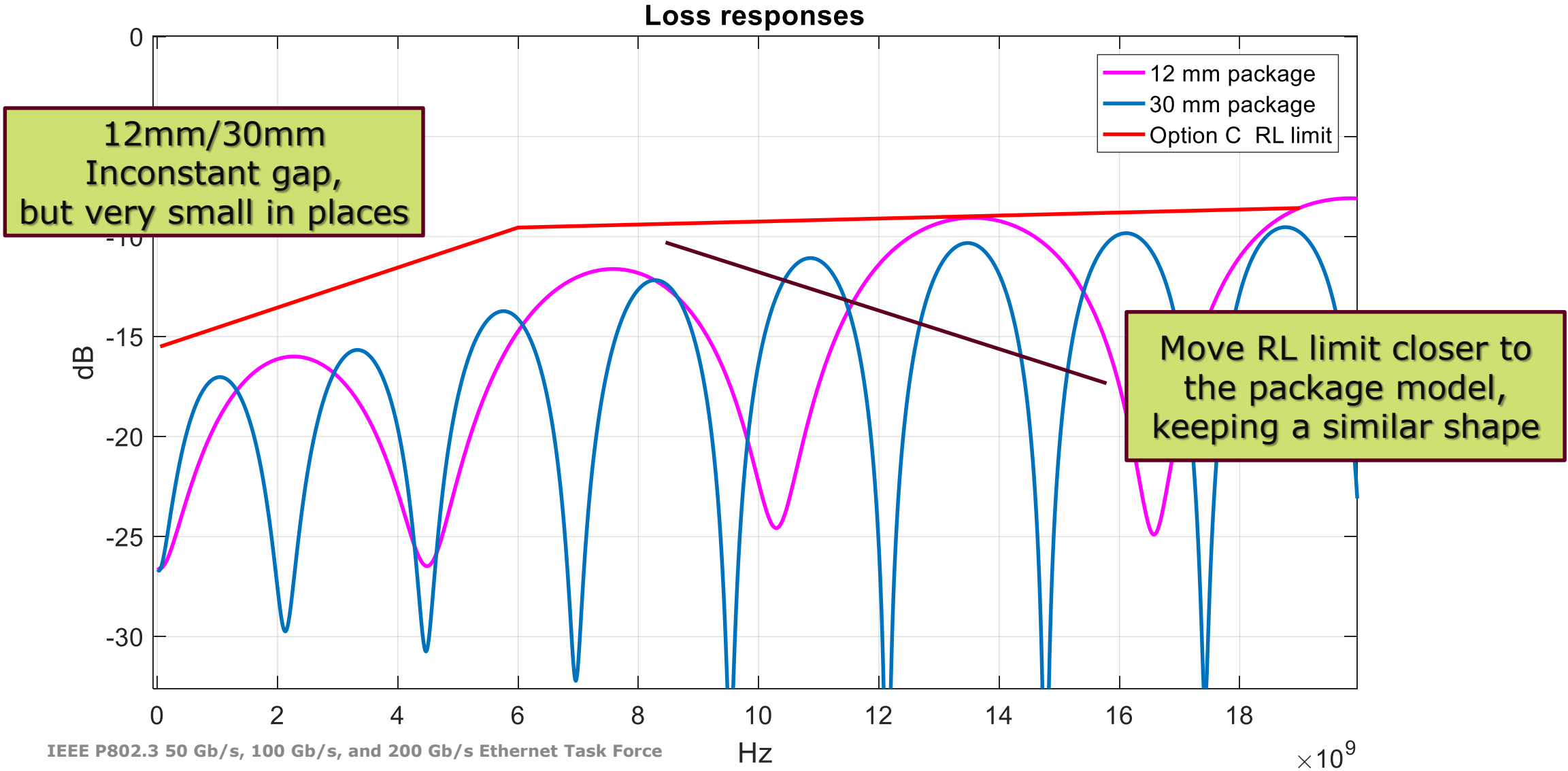
COM package return loss compared to RL limit



OPTION C: keep packages in D1.2 and lower return loss by 3.5 dB to match package

$$RL_d(f) \geq \left\{ \begin{array}{ll} \overset{15.55}{\cancel{12.05}} - f & 0.05 \leq f \leq 6 \\ \overset{10}{\cancel{6.5}} - 0.075f & 6 < f \leq 19 \end{array} \right\} \text{ dB}$$

OPTION C D1.2 packages and lower RL to match package COM package return loss compared to RL limit



Option D: Pedantic COM parameters for Option C Return Loss

Device package model			
Single-ended device capacitance	C_d	1.8×10^{-4}	nF
Transmission line length, Test 1	z_p	12	mm
Transmission line length, Test 2	z_p	30	mm
Single-ended package capacitance at package-to-board interface	C_p	1.1×10^{-4}	nF
Package transmission line characteristic impedance	Z_c	90	Ω
Single-ended reference resistance	R_0	50	Ω
Single-ended termination resistance	R_d	55	Ω

Device package model			
Single-ended device capacitance Test 1	C_d	1.78×10^{-4}	nF
Single-ended device capacitance Test 2	C_d	2.7×10^{-4}	nF
Transmission line length, Test 1	Z_p	12	mm
Transmission line length, Test 2	Z_p	30	mm
Single-ended package capacitance at package-to-board interface	C_p	1.1×10^{-4}	nF
Package transmission line characteristic impedance Test 1	Z_c	84.5	Ω
Package transmission line characteristic impedance Test 2	Z_c	82	Ω

Single-ended termination resistance Test 1	R_d	45	Ω
Single-ended termination resistance Test 2	R_d	50.5	Ω

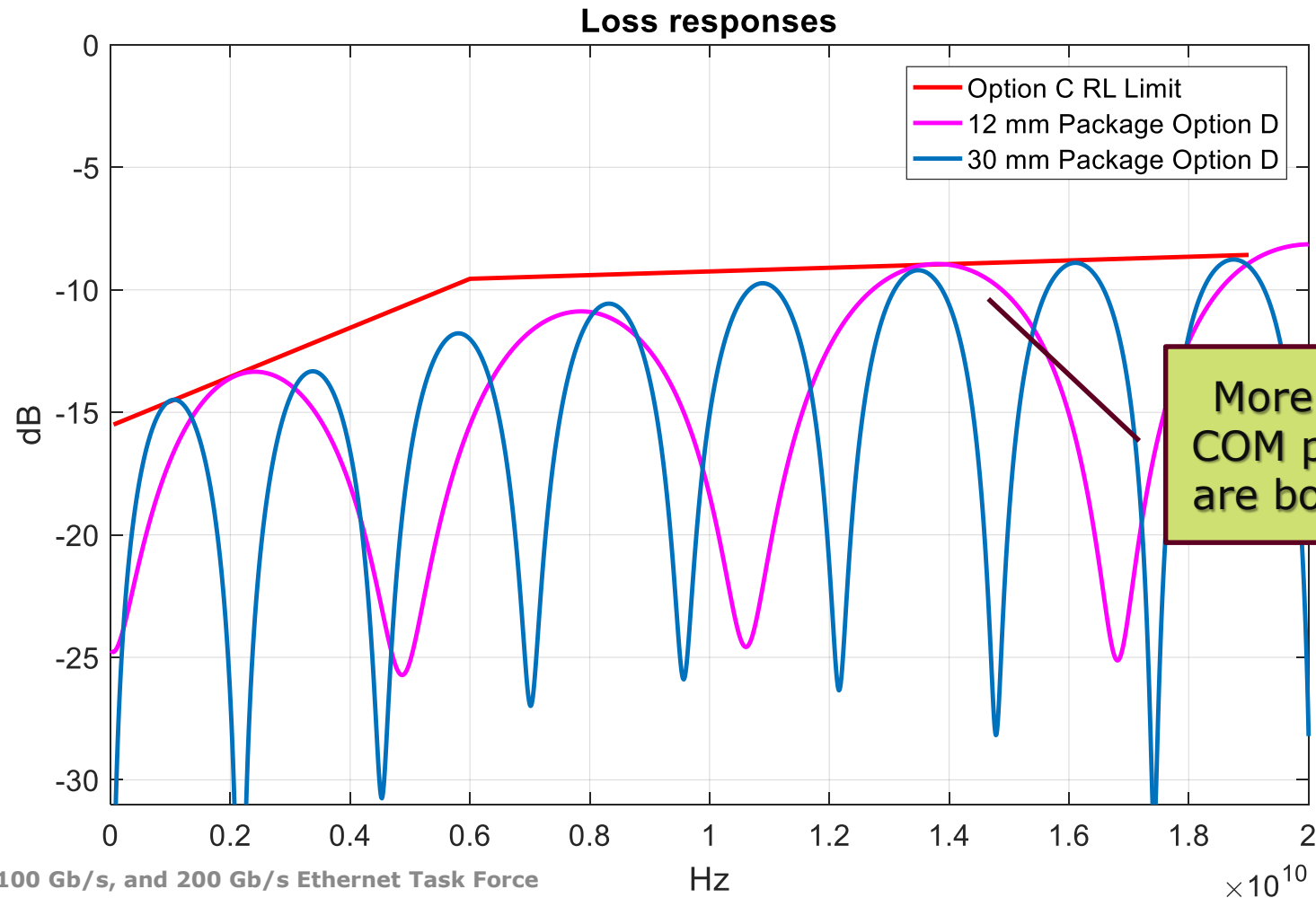
Option D: Pedantic COM associated voltage amplitude parameters for Option C Return Loss

	f_{p2}	$f_b / 40$	GHz
Transmitter differential peak output voltage			
Victim	A_v	0.45	V
Far-end aggressor	A_{fe}	0.45	V
Near-end aggressor	A_{ne}	0.63	V

Transmitter differential peak output voltage			
Victim Test 1	A_v	0.42	V
Far-end aggressor Test 1	A_{fe}	0.42	V
Near-end aggressor Test 1	A_{ne}	0.61	V
Victim Test 2	A_v	0.39	V
Far-end aggressor Test 2	A_{fe}	0.39	V
Near-end aggressor Test 2	A_{ne}	0.58	V

Option D: Pedantic COM package for Option C Return Loss

COM package return loss compared to RL limit

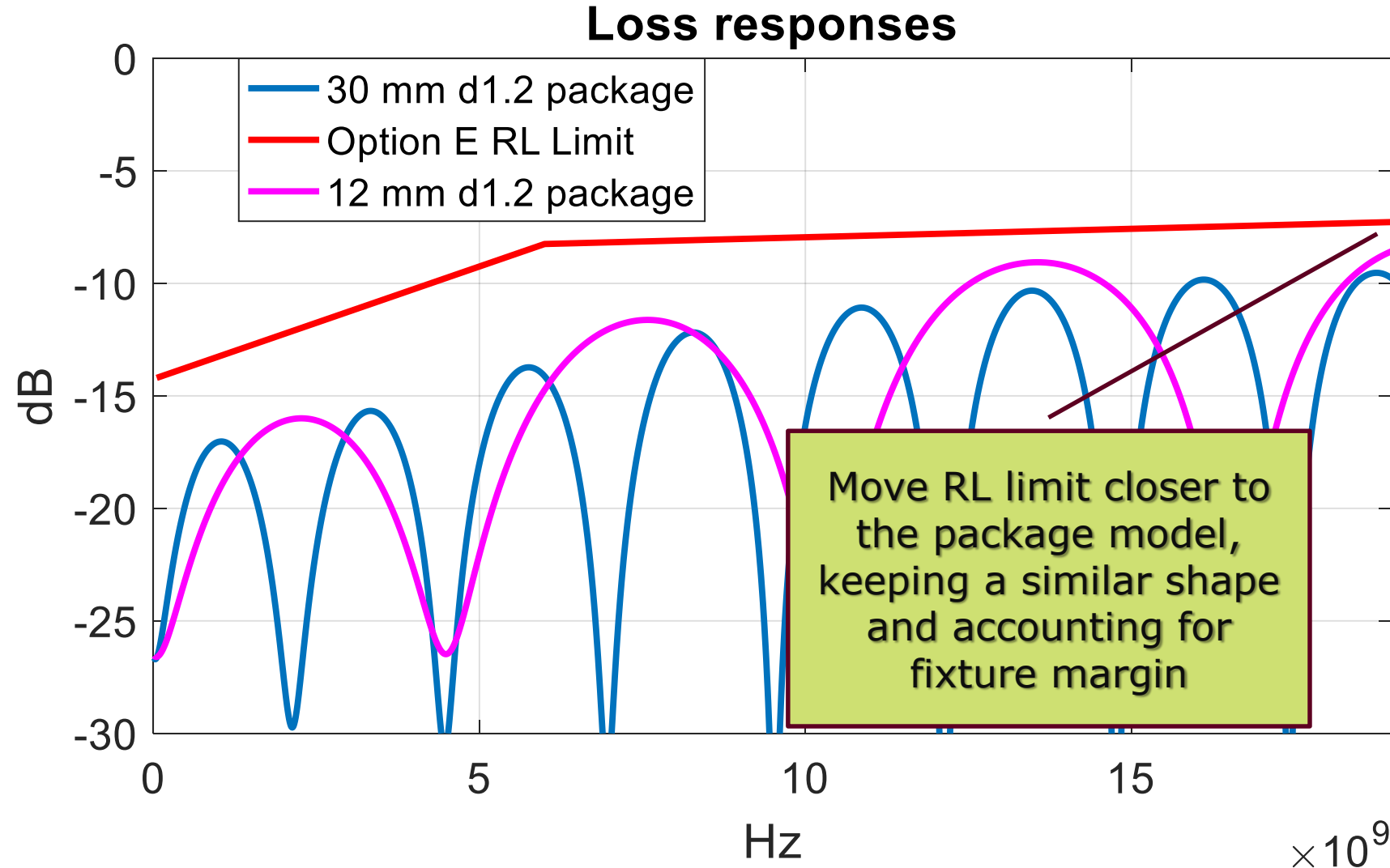


OPTION E: keep packages in D1.2 and lower return loss by 2.2 dB to match package

$$RL_d(f) \geq \left\{ \begin{array}{ll} \overset{14.25}{\cancel{12.05}} - f & 0.05 \leq f \leq 6 \\ \underset{8.7}{\cancel{6.5}} - 0.075f & 6 < f \leq 19 \end{array} \right\} \text{ dB}$$

OPTION E D1.2 packages and lower RL to match package test fixture margin

COM package return loss compared to RL limit



Summary of choices

- ▶ Choose OPTION A
 - Go back to clause 93
 - Wait for measurement product data
- ▶ Choose OPTION B
 - Do nothing. Keep what is in D1.2
 - Wait to align with Annex 120D
- ▶ Choose OPTION C
 - Keep COM packages in D1.2 and lower return loss by 3.5 dB to match package
 - Aligns with requirements from prior COM analyses
- ▶ Choose OPTION D
 - Use lower return loss in OPTION C and specify a new 12 and 30 mm package which matches RL more closely.
 - Lower impact of package proliferations on COM
 - Expected slightly lower COM than for Option B and option C
 - Reduces impact of manufacturing parameter variations on COM computations
- ▶ Choose OPTION E (recommended)
 - Move RL limit to keep to clause 93 and Annex 83d fixture margin