Options for Adding Quantization Noise in COM
– Comments #243-261 Against D2.0

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Introduction

- Contribution shakiba_3dj_01b_2505.pdf reemphasized effects of adding quantization noise to the COM reference receiver for channel compliance verification and provided comprehensive data and analysis for three test sets of 112 CR/KR, 110 C2C, and 208 C2M channels
- The contribution explained process of incorporating direct modeling method of quantization noise to the COM reference receiver as well as its example Matlab code implementation
- The contribution also demonstrated reasonable overhead in math and code implementation
- Straw poll in the same meeting indicated support for moving in this direction
- This follow-up contribution details a proposal with few options as a basis for comments against D2.0 to add a quantization noise term to the COM reference receiver and COM calculation flow
- The goal is to build consensus around a more specific proposal

From Interim Meeting Minutes on May, 13, 2025

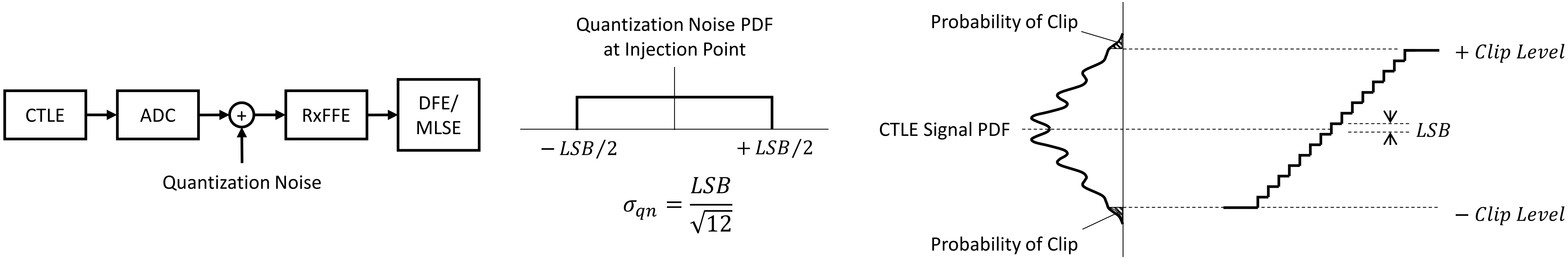
Straw Poll #1:
For the quantization noise modeling in COM Annex 178A, I prefer the direction of:

A. no change
B. direct method (e.g. shakiba_3dj_01a_2505, slide 5 & 15)
C. need more information/something else
D. abstain

(choose one)
Results: A: 14, B: 28, C: 8 , D: 10

Quantization Noise Model

- shakiba_3dj_01b_2505.pdf introduced a new quantization noise added between CTLE and RxFFE and modeled by a white random noise with uniform distribution over –LSB/2 to +LSB/2 at the injection point



- Quantization clip level is calculated from the desired probability of signal clip, P_qc
- LSB, quantization step size, is then calculated from the desired number of bits (noise-equivalent quantization bits), N_qb and P_qc (quantization clip probability)
- N_qb and P_qc, along with eta_0 are the parameters to be decided
- If determination of the current eta_0 value has included a proxy for quantization noise, with direct inclusion of this noise a new reduced eta_0 value is also needed

Few Proposal Options for Addition of Quantization Noise to the Draft

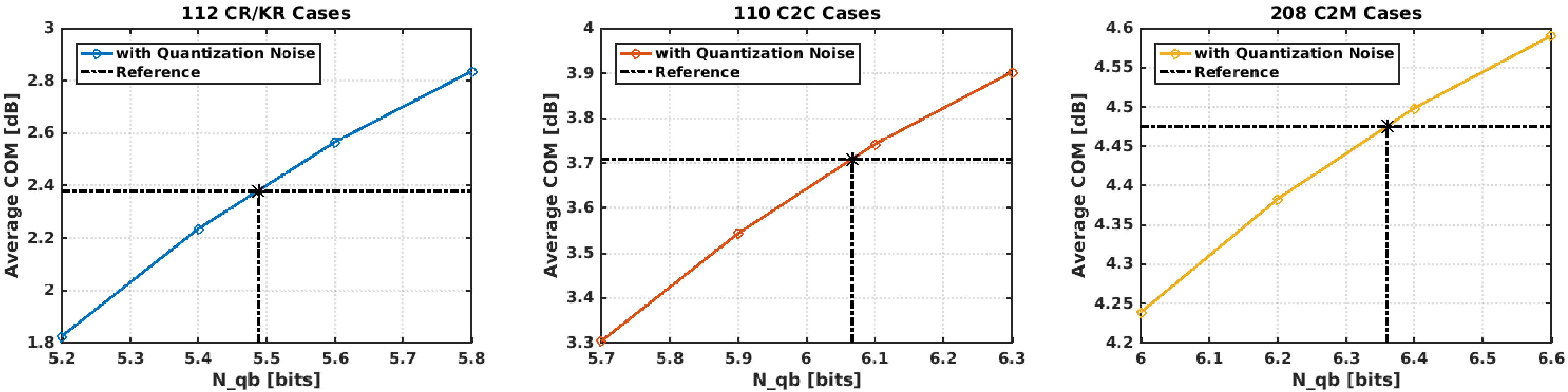
- Four (+ one) proposal options are presented here for consideration for a comment against Draft 2.0 to include quantization noise

- All options cover CR/KR, C2C, and C2M channels
  1) Reduce eta_0 from 1E-8 V^2/GHz to 5E-9 V^2/GHz and add enough quantization noise (N_qb) to make up the rest so that the average COM does not change
     - This option assumes 5E-9 V^2/GHz of eta_0 was consumed as a proxy to represent quantization noise
  2) Add 6 bits for quantization noise and reduce eta_0 so that the average COM does not change
     - This option assumes keeping current average COM results are more important than the actual eta_0 value
  3) Reduce eta_0 from 1E-8 V^2/GHz to (a) 5E-9 V^2/GHz or(b) 7.5E-9 V^2/GHz and add 6 bits for quantization noise and accept change in COM (including average)
     - This option assumes eta_0 represents actual receiver noise
  4) Keep eta_0 at 1E-8 V^2/GHz and add 6 bits for quantization noise and accept reduction in COM
     - This option assumes eta_0 was not used as a proxy and quantization noise was ignored

- In the following slides, the Reference case represents the existing state based on D2.0 with eta_0 = 1E-8 V^2/GHz and no quantization noise

Option 1

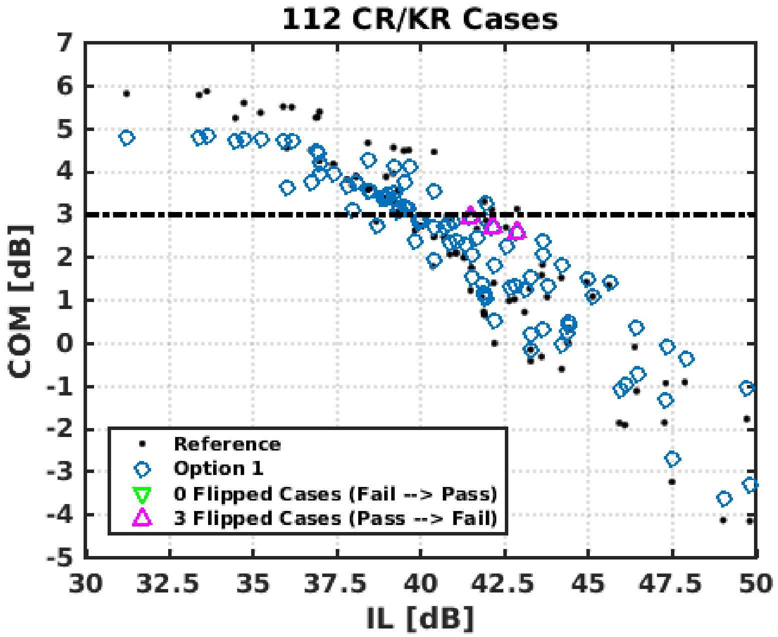
- Reduce eta_0 to 5e-9 V^2/GHz and determine N_qb for quantization noise to make up the rest
- Combination of eta_0 and quantization does not change COM ***average*** results

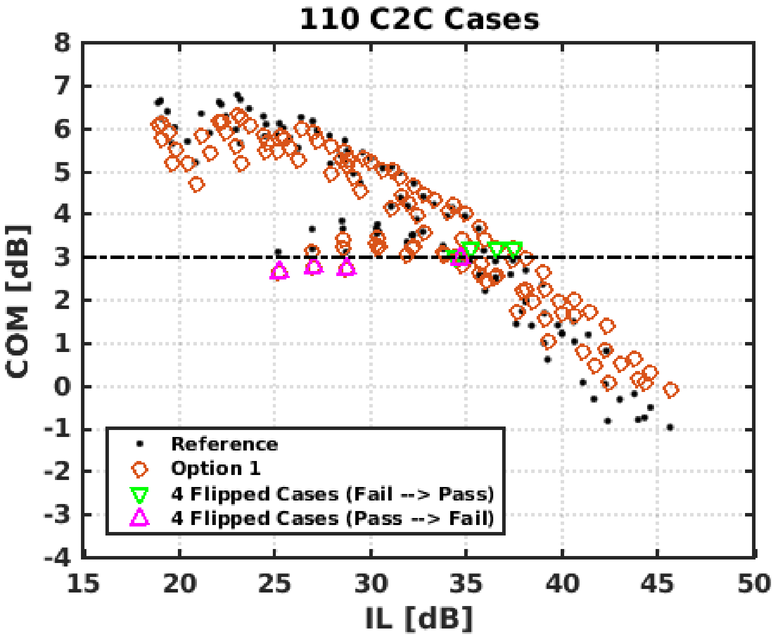


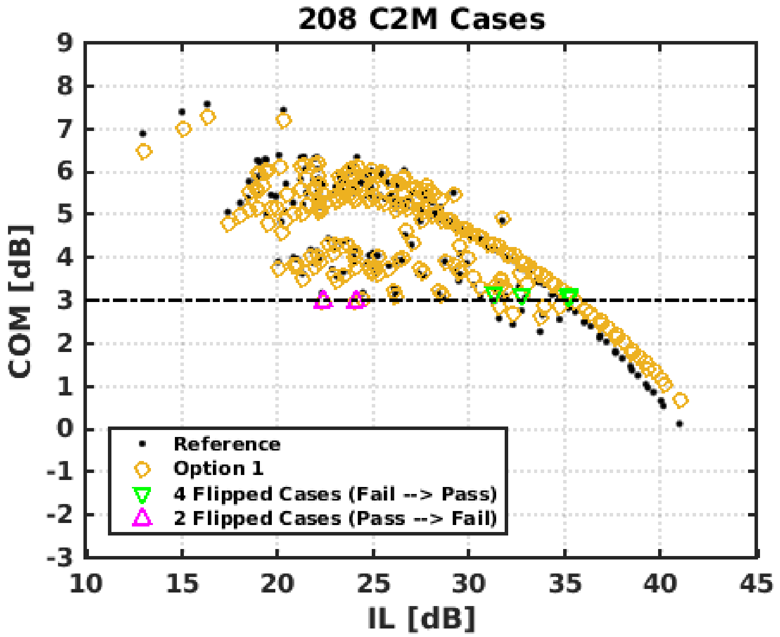
Option 1

- Case-dependent change in COM results
  - ❖ Similar average results as reference
  - ❖ Benefits high-loss channels, as quantization noise replaces some portion of eta_0 that was shown to be a pessimistic proxy for high-loss channels

[redacted]						
	CR/KR	**C2C**	**C2M**	**CR/KR**	**C2C**	**C2M**
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	5E-9	5E-9	5E-9
N_qb [bits]	NA (∞)	NA (∞)	NA (∞)	5.49	6.07	6.36
P_qc (= 2 x DER0)	NA	NA	NA	4E-4	1.34E-5	4E-5
Average COM [dB]	2.38	3.71	4.47	2.38	3.71	4.48

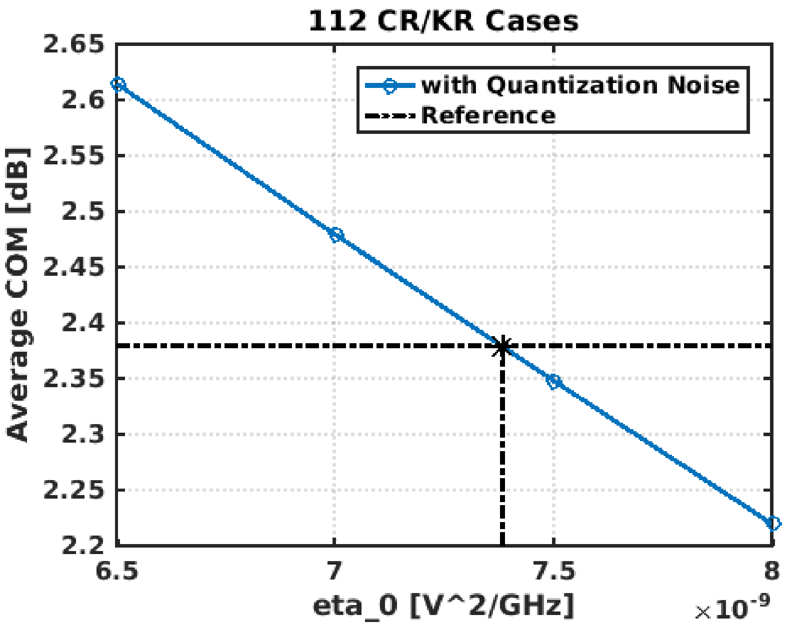


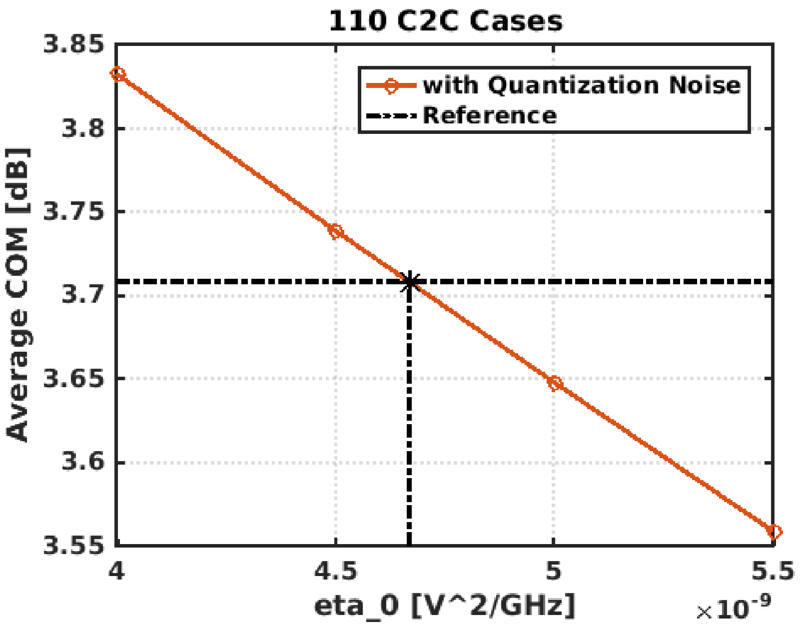


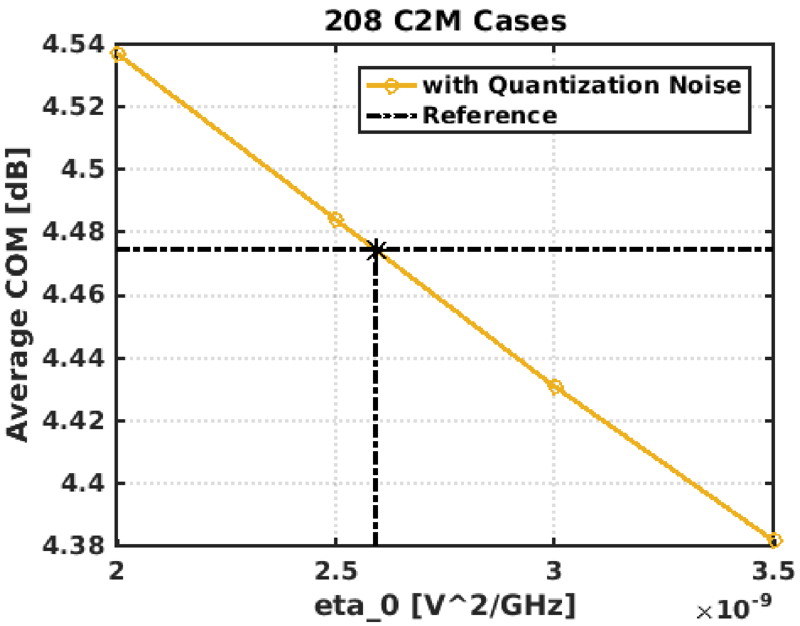


Option 2

- Set N_qb to 6 bits and determine eta_0 for receiver noise to make up the rest
- Combination of eta_0 and quantization does not change COM ***<u>average</u>*** results



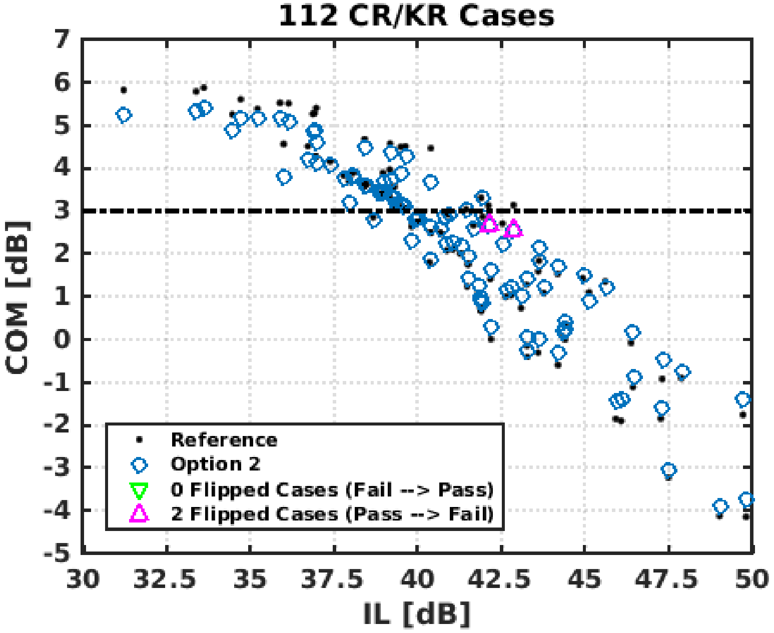


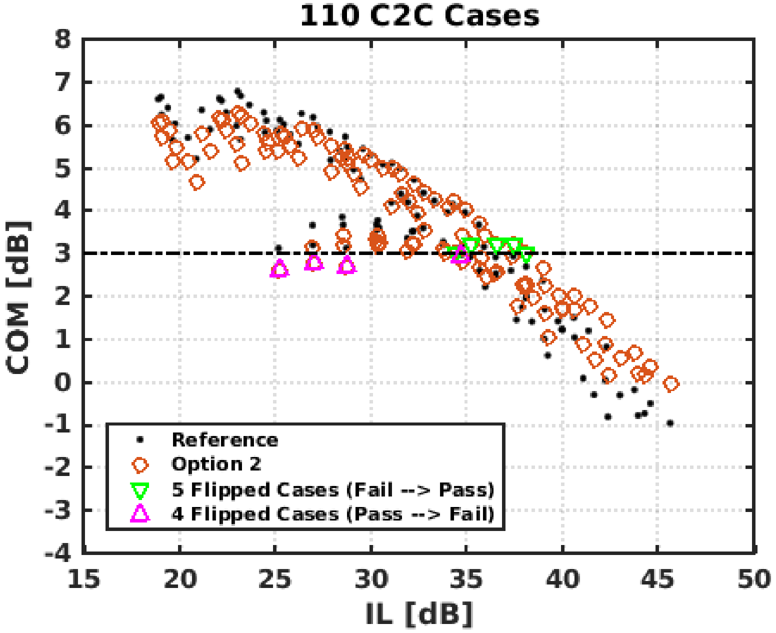


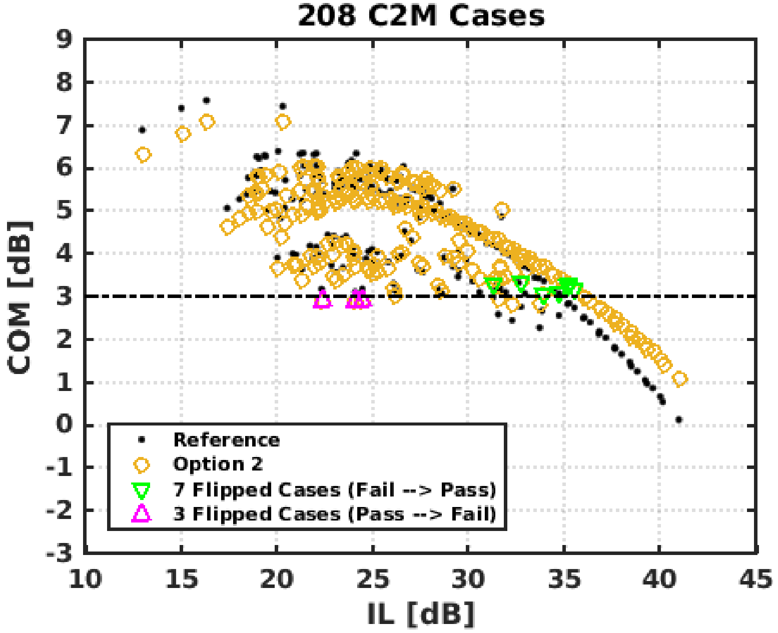
Option 2

- Case-dependent change in COM results
  - Similar average results as reference
  - Benefits high-loss channels, as quantization noise replaces some portion of eta_0 that was shown to be a pessimistic proxy for high-loss channels

	CR/KR	**C2C**	**C2M**	**CR/KR**	**C2C**	**C2M**
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	7.4E-9	4.7E-9	2.6E-9
N_qb [bits]	NA (∞)	NA (∞)	NA (∞)	6	6	6
P_qc (= 2 x DER0)	NA	NA	NA	4E-4	1.34E-5	4E-5
Average COM [dB]	2.38	3.71	4.47	2.37	3.70	4.47





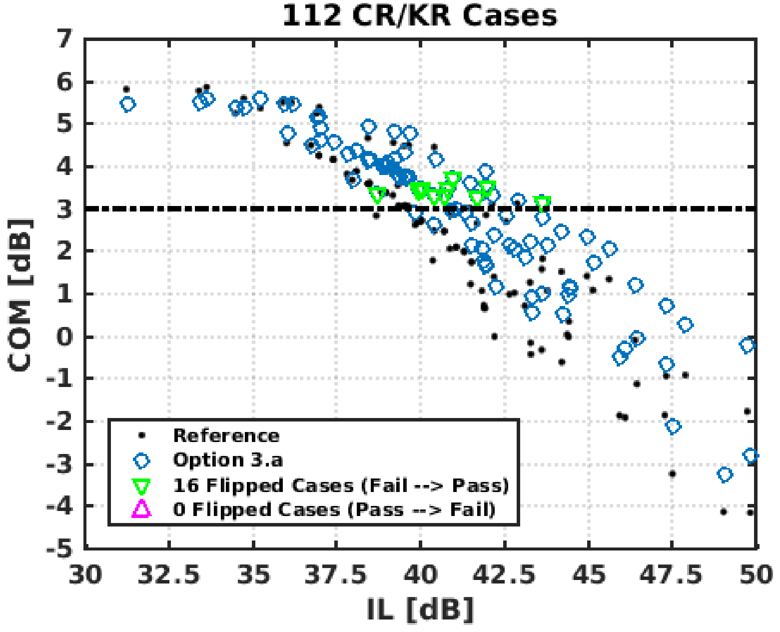


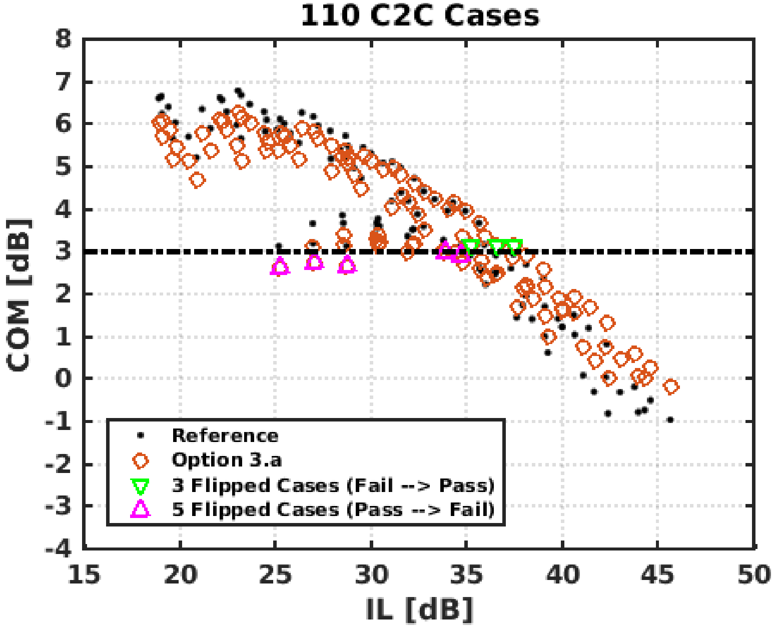
Option 3.a

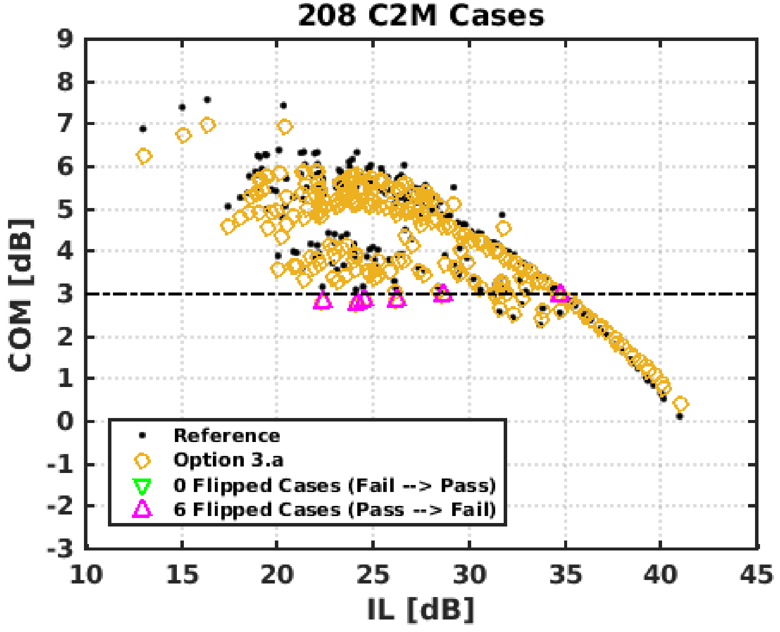
- Reduce eta_0 to 5e-9 V^2/GHz and set N_qb = 6 bits
- Accept change in COM results
  - Benefits high-loss channels, as quantization noise replaces some portion of eta_0 that was shown to be a pessimistic proxy for high-loss channels

	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	5E-9	5E-9	5E-9
N_qb [bits]	NA (∞)	NA (∞)	NA (∞)	6	6	6
P_qc (= 2 x DER0)	NA	NA	NA	4E-4	1.34E-5	4E-5
Average COM [dB]	2.38	3.71	4.47	3.05	3.65	4.24

  - Benefits CR/KR, as compared to the same eta_0 of option 1 quantization noise decreases (5.49 bits → 6 bits)
  - Hurts C2C and C2M, as compared the same eta_0 of option 1 quantization noise increases (C2C: 6.07 bits → 6 bits) (C2M: 6.36 bits → 6 bits)



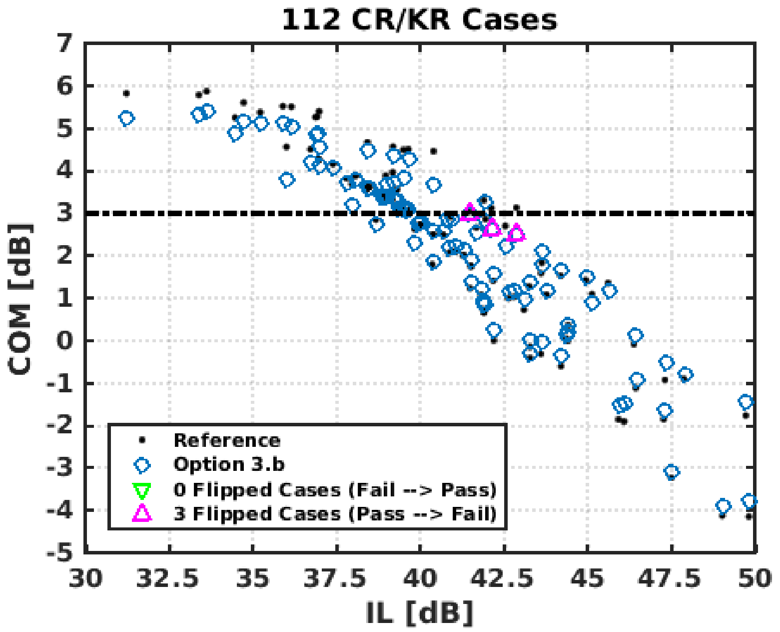


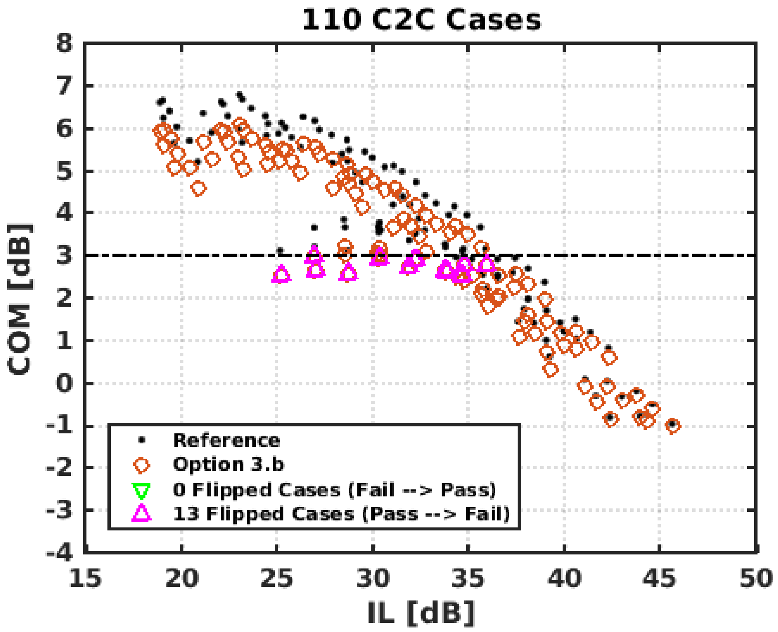


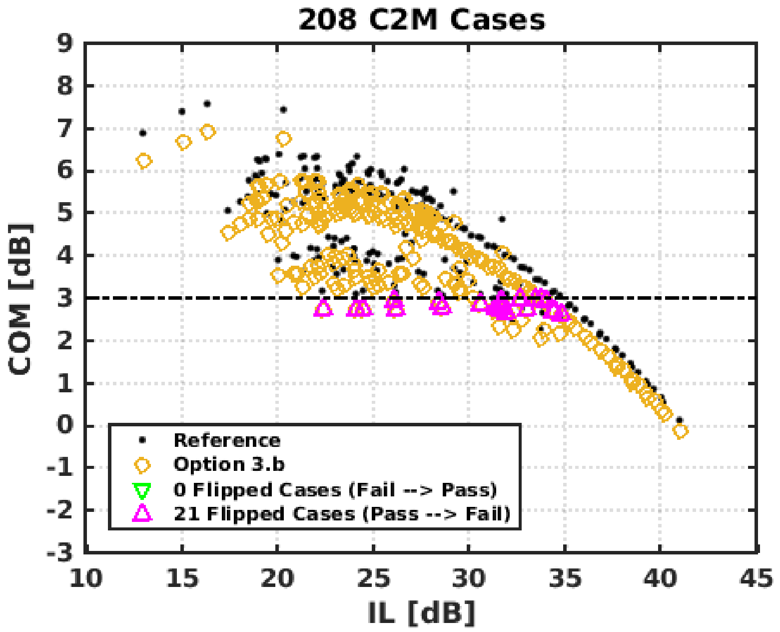
Option 3.b

- Reduce eta_0 to 7.5e-9 V^2/GHz and set N_qb = 6 bits
- Accept change in COM results:
  - More pessimistic than option 3.a, as for the same N_qb, eta_0 is larger
  - More optimistic than option 4, as for the same N_qb, eta_0 is smaller (next slide)

	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	7.5E-9	7.5E-9	7.5E-9
N_qb [bits]	NA (∞)	NA (∞)	NA (∞)	6	6	6
P_qc (= 2 x DER0)	NA	NA	NA	4E-4	1.34E-5	4E-5
Average COM [dB]	2.38	3.71	4.47	2.35	3.24	4.02



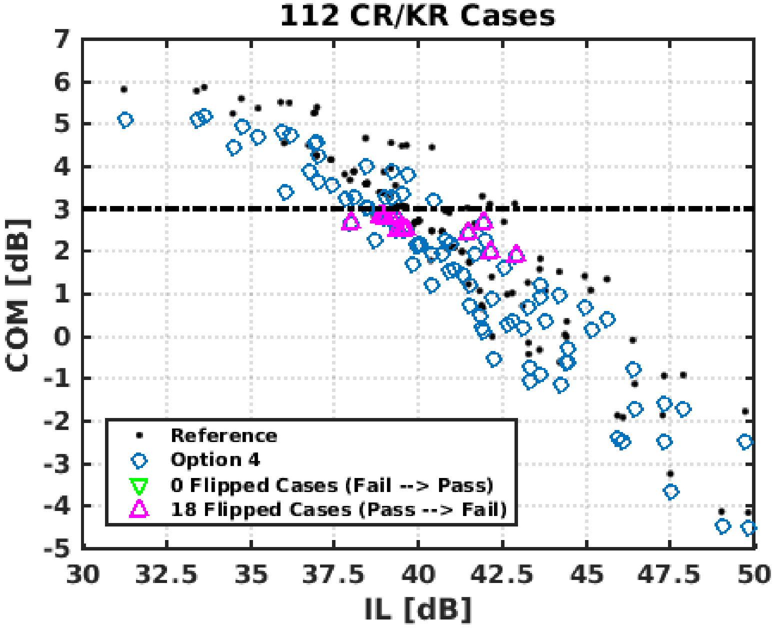


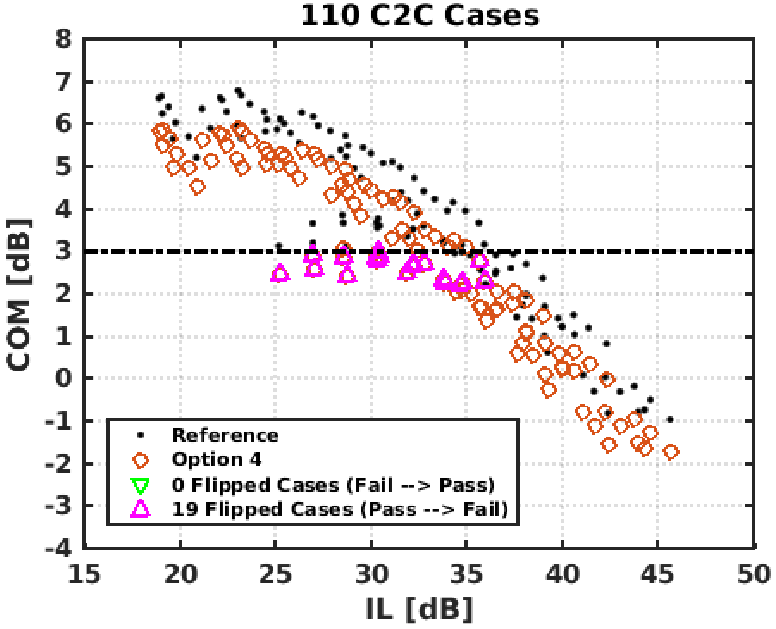


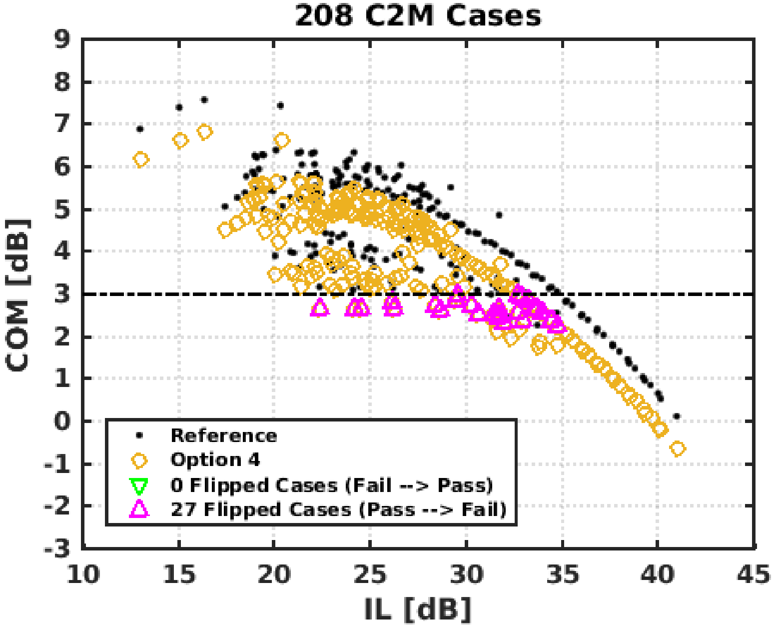
Option 4

- Keep eta_0 at its current value (1e-8 V^2/GHz) and set N_qb = 6 bits
- Accept more pessimistic results due to more overall noise
  - Hurts all cases, as compared to the same eta_0 of the reference, quantization noise is now added

	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	1E-8	1E-8	1E-8
N_qb [bits]	NA (∞)	NA (∞)	NA (∞)	6	6	6
P_qc (= 2 x DER0)	NA	NA	NA	4E-4	1.34E-5	4E-5
Average COM [dB]	2.38	3.71	4.47	1.74	2.88	3.81







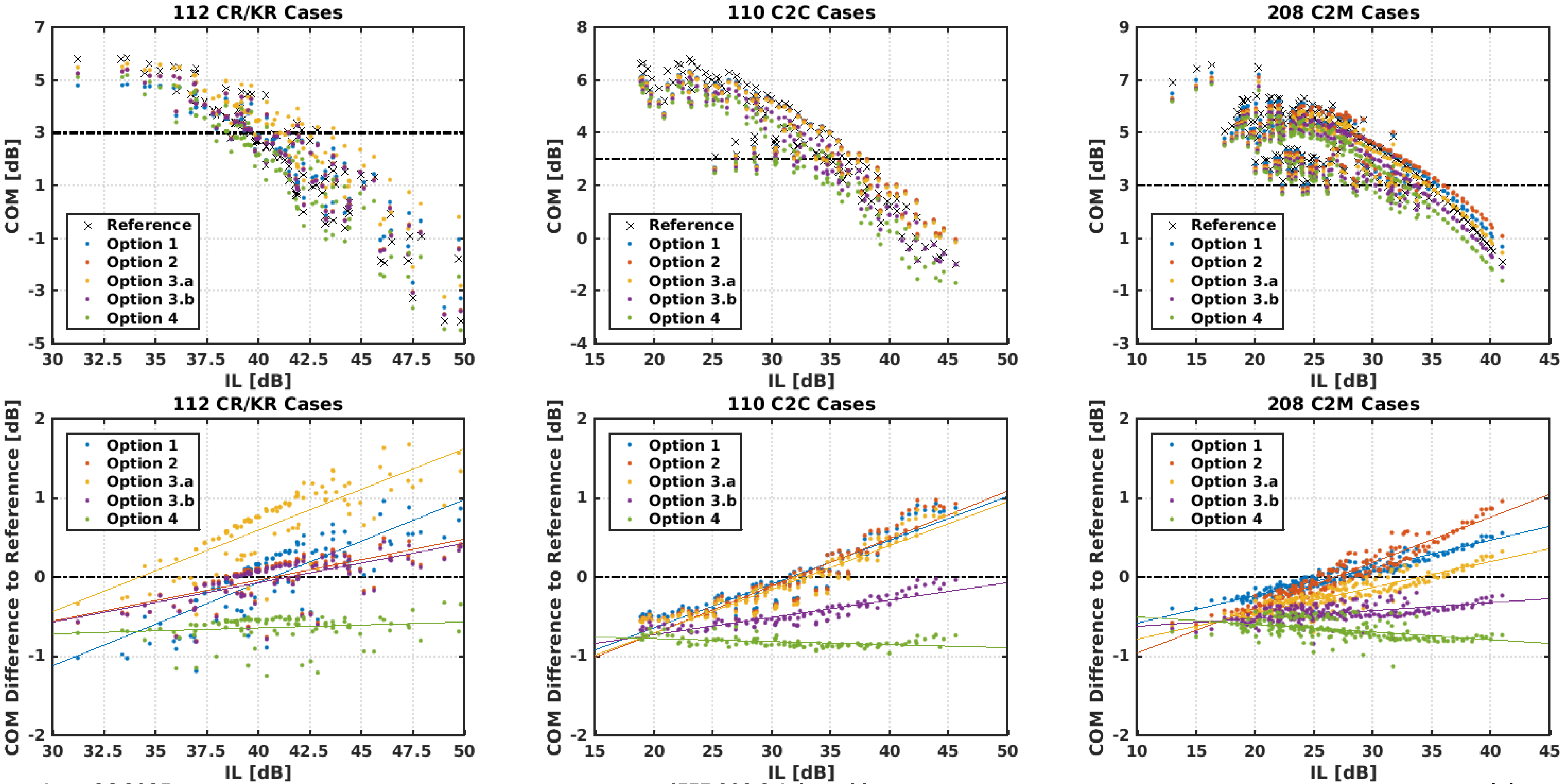
Summary of Results

CR/KR (112 Channels)	N_qb	P_qc (= 2 x DER0)	eta_0 [V²/GHz]	Average COM [dB]	# of Flips (Fail → Pass)	# of Flips (Pass → Fail)	Total # of Passes	Total # of Fails
Reference	–	–	1E-8	2.38	–	–	51	61
Option 1	5.49	4E-4	5E-9	2.38	0	3	48	64
Option 2	6	4E-4	7.4E-9	2.37	0	2	49	63
Option 3.a	6	4E-4	5E-9	3.05	16	0	67	45
Option 3.b	6	4E-4	7.5E-9	2.35	0	3	48	64
Option 4	6	4E-4	1E-8	1.74	0	18	33	79

C2C (110 Channels)	N_qb	P_qc (= 2 x DER0)	eta_0 [V²/GHz]	Average COM [dB]	# of Flips (Fail → Pass)	# of Flips (Pass → Fail)	Total # of Passes	Total # of Fails
Reference	–	–	1E-8	3.71	–	–	72	38
Option 1	6.07	1.34E-5	5E-9	3.71	4	4	72	38
Option 2	6	1.34E-5	4.7E-9	3.70	5	4	73	37
Option 3.a	6	1.34E-5	5E-9	3.65	3	5	70	40
Option 3.b	6	1.34E-5	7.5E-9	3.24	0	13	59	51
Option 4	6	1.34E-5	1E-8	2.88	0	19	53	57

C2M (208 Channels)	N_qb	P_qc (= 2 x DER0)	eta_0 [V²/GHz]	Average COM [dB]	# of Flips (Fail → Pass)	# of Flips (Pass → Fail)	Total # of Passes	Total # of Fails
Reference	–	–	1E-8	4.47	–	–	180	28
Option 1	6.36	4E-5	5E-9	4.48	4	2	182	26
Option 2	6	4E-5	2.6E-9	4.47	7	3	184	24
Option 3.a	6	4E-5	5E-9	4.24	0	6	174	34
Option 3.b	6	4E-5	7.5E-9	4.02	0	21	159	49
Option 4	6	4E-5	1E-8	3.81	0	27	153	55

Summary of Results



Few notes on Options

- Options 1 and 2 are attempts to keep the average COM unaffected by trading some eta_0 with quantization noise
- Concern with Option 1 is using different number of quantization bits for CR/KR, C2C, and C2M receivers
- Concern with Option 2 is using different values for input-referred noise for CR/KR, C2C, and C2M receivers
- Concern with Option 4 is its pessimistic results as quantization noise is added without any reduction in eta_0 (eta_0 was supposed to have been a proxy for quantization noise)
- Option 3 is more realistic as it assumes same and practical 6 bits for quantization as well same value for receiver input-referred noise eta_0
- Option 3.a is based on the assumption that half of the input-referred noise was allocated as a proxy for quantization noise and yields more optimistic/pessimistic results for higher/lower loss channels
- Option 3.b removes optimism of Option 3.a and yields increasingly more pessimistic results for lower loss channels

Summary and Conclusion

- Intuitively, setting P_qc to be equal to the error probability ensures that possible errors due to signal clipping are guaranteed to be less than the error target (not every clip induces an error), hence not practically affecting it

Option 1	Current Value			Proposed Value		
	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	5E-9	5E-9	5E-9
N_qb [bits]	NA	NA	NA	5.48	6.08	6.37

Option 2	Current Value			Proposed Value		
	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	7.4E-9	4.6E-9	2.4E-9
N_qb [bits]	NA	NA	NA	6	6	6

Option 3.a	Current Value			Proposed Value		
	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	5E-9	5E-9	5E-9
N_qb [bits]	NA	NA	NA	6	6	6

Option 3.b	Current Value			Proposed Value		
	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	7.5E-9	7.5E-9	7.5E-9
N_qb [bits]	NA	NA	NA	6	6	6

Option 4	Current Value			Proposed Value		
	CR/KR	C2C	C2M	CR/KR	C2C	C2M
eta_0 [V^2/GHz]	1E-8	1E-8	1E-8	1E-8	1E-8	1E-8
N_qb [bits]	NA	NA	NA	6	6	6

- My preference is Option 3.b, which is reasonably somewhere between options 3.a and 4
- Open to other options depending on the consensus

Thank You ☺

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Backup Slides

Channel and COM Info

CR/KR Test Channels

Channel #	Channel Source
1	https://www.ieee802.org/3/dj/public/tools/CR/lim_3dj_03_230629.zip
2	https://www.ieee802.org/3/dj/public/tools/CR/lim_3dj_04_230629.zip
3 – 7	https://www.ieee802.org/3/dj/public/tools/CR/kocsis_3dj_02_2305.zip
8 – 34	https://www.ieee802.org/3/dj/public/tools/KR/mellitz_3dj_02_elec_230504.zip
35 – 40	https://www.ieee802.org/3/dj/public/tools/CR/shanbhag_3dj_01_2305.zip
41 – 44	https://www.ieee802.org/3/dj/public/tools/KR/shanbhag_3dj_02_2305.zip
45 – 80	https://www.ieee802.org/3/dj/public/tools/KR/weaver_3dj_02_2305.zip
81 – 88	https://www.ieee802.org/3/dj/public/tools/KR/weaver_3dj_elec_01_230622.zip
89	https://www.ieee802.org/3/dj/public/tools/CR/lim_3dj_07_2309.zip
90 – 96	https://www.ieee802.org/3/dj/public/tools/KR/akinwale_3dj_01_2310.zip
97 – 100	https://www.ieee802.org/3/dj/public/tools/CR/akinwale_3dj_02_2311.zip
101 – 112	https://www.ieee802.org/3/dj/public/tools/CR/weaver_3dj_02_2311.zip

C2C Test Channels

Channel #	Channel Source
1 – 72	https://www.ieee802.org/3/dj/public/tools/c2c/heck_3dj_02_2405.zip
73 – 85	https://www.ieee802.org/3/dj/public/tools/c2c/heck_3dj_02_2403.zip
86 – 110	https://www.ieee802.org/3/dj/public/tools/c2c/mellitz_3dj_03_elec_230504.zip

C2M Test Channels

Channel #	Channel Source
1 – 4	https://www.ieee802.org/3/dj/public/tools/c2m/mellitz_3dj_02_2409.zip
5 – 64	https://www.ieee802.org/3/dj/public/tools/c2m/kareti_3dj_elec_02_240111.zip
65 – 82	https://www.ieee802.org/3/dj/public/tools/c2m/gore_3dj_elec_02_231026.zip
83 – 85	https://www.ieee802.org/3/dj/public/tools/c2m/lim_3dj_01_230629.zip https://www.ieee802.org/3/dj/public/tools/c2m/lim_3dj_02_230629.zip https://www.ieee802.org/3/dj/public/tools/c2m/lim_3dj_06_2309.zip
86 – 101 102 – 117	https://www.ieee802.org/3/dj/public/tools/c2m/weaver_3dj_elec_02_230831.zip
118 – 123	https://www.ieee802.org/3/dj/public/tools/c2m/shanbhag_3dj_03_2305.zip
124 – 206	https://www.ieee802.org/3/dj/public/tools/c2m/akinwale_3dj_02_2307.zip https://www.ieee802.org/3/dj/public/tools/c2m/akinwale_3dj_03_2307.zip https://www.ieee802.org/3/dj/public/tools/c2m/akinwale_3dj_04_2307.zip
207- 208	https://www.ieee802.org/3/dj/public/tools/c2m/rabinovich_3dj_02_230116.zip https://www.ieee802.org/3/dj/public/tools/c2m/rabinovich_3dj_03_230116.zip

COM Version and Config

- COM version “com_ieee8023_4p9p1_beta_Quantization_Pulse_Sampled”
  - “_beta_Quantization_Pulse” implements bug fix as per commit request 4p9_6
  - “_Sampled” implements bug fix as per commit request 4p9_7
  - Red color points to unavailability of this version on Gitlab at the time of this work

- Config (Package)

.START	PKG_LowR_CLASSA
Table 93A-3 parameters	
Parameter	**Setting**
package_tl_gamma0_a1_a2	[0.0005 0.00089 0.0002]
package_tl_tau	0.006141
package_Z_c	[87.5 87.5 ; 92.5 92.5 ; 100 100; 100 100]
R_d	[46.25 46.25]
z_p (TX)	[33 12 33 33 ; 1.8 1.8 1.8 1.8 ; 0 0 0 0 ; 0 0 0 0]
z_p (NEXT)	[33 12 33 33 ; 1.8 1.8 1.8 1.8 ; 0 0 0 0 ; 0 0 0 0]
z_p (FEXT)	[33 12 33 33 ; 1.8 1.8 1.8 1.8 ; 0 0 0 0 ; 0 0 0 0]
z_p (RX)	[33 12 33 33 ; 1.8 1.8 1.8 1.8 ; 0 0 0 0 ; 0 0 0 0]
C_p	[0.4e-4 0.4e-4]
A_v	[0.385 0.385 0.385 0.385]
A_fe	[0.385 0.385 0.385 0.385]
A_ne	[0.481 0.481 0.481 0.481]
.END	

.START	PKG_HiR_CLASSB
Table 93A-3 parameters	
Parameter	**Setting**
package_tl_gamma0_a1_a2	[0.0005 0.00065 0.000293]
package_tl_tau	0.006141
package_Z_c	[87.5 87.5 ; 95 95 ; 100 100; 78 78]
R_d	[46.25 46.25]
z_p (TX)	[45 30 8 24 ; 2 2 2 2 ; 1.3 1.3 1.3 1.3 ; 1.5 1.5 1.5 1.5]
z_p (NEXT)	[44 29 8 24 ; 2 2 2 2 ; 1.3 1.3 1.3 1.3 ; 1.5 1.5 1.5 1.5]
z_p (FEXT)	[45 30 8 24 ; 2 2 2 2 ; 1.3 1.3 1.3 1.3 ; 1.5 1.5 1.5 1.5]
z_p (RX)	[44 29 8 24 ; 2 2 2 2 ; 1.3 1.3 1.3 1.3 ; 1.5 1.5 1.5 1.5]
C_p	[0.4e-4 0.4e-4]
A_v	[0.385 0.385 0.385 0.385]
A_fe	[0.385 0.385 0.385 0.385]
A_ne	[0.481 0.481 0.481 0.481]
.END	

CR/KR COM Config

Table 93A-1 parameters		I/O control		3A-3 parameters (Table Not Used with ClassA and B Pac		SAVE_CONFIG2MAT	0
Parameter	**Setting**	DIAGNOSTICS	0	Parameter	**Setting**	Receiver testing	
f_b	106.25	DISPLAY_WINDOW	0	package_tl_gamma0_a1_a2	[5e-4 0.00065 0.0003]	RX_CALIBRATION	0
f_min	0.05	CSV_REPORT	0	package_tl_tau	0.006141	Sigma BBN step	5.00E-03
Delta_f	0.01	RESULT_DIR	.\results\C2M_{date}\	package_Z_c	92 ; 70 70; 80 80; 100 1	ICN parameters	
C_d	[0.4e-4 0.9e-4 1.1e-4 ;0.4e-4 0.9e-4 1.1e-4]	SAVE_FIGURES	0	z_p (TX)	1 1 1 1; 1 1 1 1 ; 0.5	f_v	0.278
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	Port Order	[1 3 2 4]	z_p (NEXT)	1 1 1 1; 1 1 1 1 ; 0.5	f_f	0.278
C_b	[0.3e-4 0.3e-4]	RUNTAG	C2M_	z_p (FEXT)	1 1 1 1; 1 1 1 1 ; 0.5	f_n	0.278
R_0	50	COM_CONTRIBUTION	1	z_p (RX)	1 1 1 1; 1 1 1 1 ; 0.5	f_2	58.438
R_d	[46.25 46.25]			C_p	[0.4e-4 0.4e-4]	A_ft	0.450
PKG_NAME	PKG_HiR_CLASSB PKG_LowR_CLASSA	TDR and ERL options		Operational		**A_nt**	0.450
A_v	0.387	TDR	1	ERL Pass threshold	10		
A_fe	0.387	ERL	1	COM Pass threshold	3	**Parameter**	**Setting**
A_ne	0.482	ERL_ONLY	0	DER_0	2.00E-04	board_tl_gamma0_a1_a2	[0 5.95e-4 2.6e-05]
z_p select	[1]	TR_TDR	0.005	T_r	0.00400	board_tl_tau	5.790E-03
L	4	N	7000	FORCE_TR	1	board_Z_c	92.5
M	32	TDR_Butterworth	1	PMD_type	C2C	z_bp (TX)	32
filter and Eq		beta_x	0	samples_for_C2M	100	z_bp (NEXT)	32
f_r	0.550	rho_x	0.618	T_O	50	z_bp (FEXT)	32
c(0)	0.54	TDR_W_TXPKG	1	EW	1	z_bp (RX)	32
c(-1)	0	N_bx	16	MLSE	1	C_0	[0.29e-4 0]
c(-2)	0	fixture delay time	[0 0]	ts_anchor	1	C_1	[0.1e-4 0]
c(-3)	0	Tukey_Window	1	sample_adjustment	[-16 16]	**Include PCB**	**0**
c(-4)	0	Noise, jitter		Local Search	2	Seletions (rectangle, gaussian,dual_rayleigh,triangle	
c(1)	0	sigma_RJ	0.01			Histogram_Window_Weight	gaussian
N_b	1	A_DD	0.02	Filter: Rx FFE		Qr	0.02
b_max(1)	0.85	eta_0	7.50E-09	ffe_pre_tap_len	6		
b_max(2..N_b)	0	SNR_TX	33.5	ffe_post_tap_len	8		
b_min(1)	0	R_LM	0.95	ffe_pre_tap1_max	0.7		
b_min(2..N_b)	-0.15			ffe_post_tap1_max	0.7		
g_DC	[-20:1:0]			ffe_tapn_max	0.7		
f_z	42.50	BREAD_CRUMBS	1	FFE_OPT_METHOD	MMSE		
f_p1	42.50	DER_CDR	1.00E-02	num_ui_RXFF_noise	2048		
f_p2	106.25	N_qb	6	Floating Tap Control			
g_DC_HP	[-6:1:0]	P_qc	4.00E-04	N_bg	2		
f_HP_PZ	1.328125	trunc	128	N_bf	4		
Butterworth	1	N_tc	128	N_f	80		
		add_rx_noise	3	bmaxg	0.2		
		Clip Method	Fast	B_float_RSS_MAX	1		
				N_tail_start	9		

C2C COM Config

Table 93A-1 parameters		I/O control		3A-3 parameters (Table Not Used with ClassA and B Pac		SAVE_CONFIG2MAT	0
Parameter	**Setting**	DIAGNOSTICS	0	Parameter	**Setting**	Receiver testing	
f_b	106.25	DISPLAY_WINDOW	0	package_tl_gamma0_a1_a2	[5e-4 0.00065 0.0003]	RX_CALIBRATION	0
f_min	0.05	CSV_REPORT	0	package_tl_tau	0.006141	Sigma BBN step	5.00E-03
Delta_f	0.01	RESULT_DIR	.\results\C2M_{date}\	package_Z_c	92 ; 70 70; 80 80; 100 1	ICN parameters	
C_d	[0.4e-4 0.9e-4 1.1e-4 ;0.4e-4 0.9e-4 1.1e-4]	SAVE_FIGURES	0	z_p (TX)	1 1 1 1; 1 1 1 1 ;0.5	f_v	0.278
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	Port Order	[1 3 2 4]	z_p (NEXT)	1 1 1 1; 1 1 1 1 ;0.5	f_f	0.278
C_b	[0.3e-4 0.3e-4]	RUNTAG	C2M_	z_p (FEXT)	1 1 1 1; 1 1 1 1 ;0.5	f_n	0.278
R_0	50	COM_CONTRIBUTION	1	z_p (RX)	1 1 1 1; 1 1 1 1 ;0.5	f_2	58.438
R_d	[46.25 46.25]			C_p	[0.4e-4 0.4e-4]	A_ft	0.450
PKG_NAME	PKG_HiR_CLASSB PKG_LowR_CLASSA	TDR and ERL options		Operational		**A_nt**	0.450
A_v	0.387	TDR	1	ERL Pass threshold	10		
A_fe	0.387	ERL	1	COM Pass threshold	3	**Parameter**	**Setting**
A_ne	0.482	ERL_ONLY	0	DER_0	6.70E-06	board_tl_gamma0_a1_a2	*[0 5.95e-4 2.6e-05]*
z_p select	[1]	TR_TDR	0.005	T_r	0.00400	board_tl_tau	5.790E-03
L	4	N	7000	FORCE_TR	1	board_Z_c	92.5
M	32	TDR_Butterworth	1	PMD_type	C2C	z_bp (TX)	*32*
filter and Eq		beta_x	0	samples_for_C2M	100	z_bp (NEXT)	*32*
f_r	0.550	rho_x	0.618	T_O	50	z_bp (FEXT)	*32*
c(0)	0.54	TDR_W_TXPKG	1	EW	1	z_bp (RX)	*32*
c(-1)	0	N_bx	16	MLSE	0	C_0	[0.29e-4 0]
c(-2)	0	fixture delay time	[0 0]	ts_anchor	1	C_1	[0.1e-4 0]
c(-3)	0	Tukey_Window	1	sample_adjustment	[-16 16]	**Include PCB**	**0**
c(-4)	0	Noise, jitter		Local Search	2	Seletions (rectangle, gaussian,dual_rayleigh,triangle	
c(1)	0	sigma_RJ	0.01			Histogram_Window_Weight	gaussian
N_b	1	A_DD	0.02	Filter: Rx FFE		Qr	0.02
b_max(1)	0.85	eta_0	7.50E-09	ffe_pre_tap_len	5		
b_max(2..N_b)	0	SNR_TX	33.5	ffe_post_tap_len	8		
b_min(1)	0	R_LM	0.95	ffe_pre_tap1_max	0.7		
b_min(2..N_b)	-0.15			ffe_post_tap1_max	0.7		
g_DC	[-20:1:0]			ffe_tapn_max	0.7		
f_z	42.50	BREAD_CRUMBS	1	FFE_OPT_METHOD	MMSE		
f_p1	42.50	DER_CDR	1.00E-02	num_ui_RXFF_noise	2048		
f_p2	106.25	N_qb	6	Floating Tap Control			
g_DC_HP	[-6:1:0]	P_qc	1.34E-05	N_bg	2		
f_HP_PZ	1.328125	trunc	128	N_bf	4		
Butterworth	1	N_tc	128	N_f	50		
		add_rx_noise	3	bmaxg	0.2		
		Clip Method	Fast	B_float_RSS_MAX	1		
				N_tail_start	9		

C2M COM Config

Table 93A-1 parameters		I/O control		3A-3 parameters (Table Not Used with ClassA and B Pac		SAVE_CONFIG2MAT	0
Parameter	**Setting**	DIAGNOSTICS	0	Parameter	**Setting**	Receiver testing	
f_b	106.25	DISPLAY_WINDOW	0	package_tl_gamma0_a1_a2	[5e-4 0.00065 0.0003]	RX_CALIBRATION	0
f_min	0.05	CSV_REPORT	0	package_tl_tau	0.006141	Sigma BBN step	5.00E-03
Delta_f	0.01	RESULT_DIR	.\results\C2M_{date}\	package_Z_c	92 ; 70 70; 80 80; 100 1	ICN parameters	
C_d	[0.4e-4 0.9e-4 1.1e-4 ;0.4e-4 0.9e-4 1.1e-4]	SAVE_FIGURES	0	z_p (TX)	1 1 1 1; 1 1 1 1 ;0.5	f_v	0.278
L_s	[0.13 0.15 0.14; 0.13 0.15 0.14]	Port Order	[1 3 2 4]	z_p (NEXT)	1 1 1 1; 1 1 1 1 ;0.5	f_f	0.278
C_b	[0.3e-4 0.3e-4]	RUNTAG	C2M_	z_p (FEXT)	1 1 1 1; 1 1 1 1 ;0.5	f_n	0.278
R_0	50	COM_CONTRIBUTION	1	z_p (RX)	1 1 1 1; 1 1 1 1 ;0.5	f_2	58.438
R_d	[46.25 46.25]			C_p	[0.4e-4 0.4e-4]	A_ft	0.450
PKG_NAME	PKG_HiR_CLASSB PKG_Module	TDR and ERL options		Operational		**A_nt**	0.450
A_v	0.387	TDR	1	ERL Pass threshold	10		
A_fe	0.387	ERL	1	COM Pass threshold	3	**Parameter**	**Setting**
A_ne	0.482	ERL_ONLY	0	DER_0	2.00E-05	board_tl_gamma0_a1_a2	*[0 5.95e-4 2.6e-05]*
z_p select	[2]	TR_TDR	0.005	T_r	0.00400	board_tl_tau	5.790E-03
L	4	N	7000	FORCE_TR	1	board_Z_c	92.5
M	32	TDR_Butterworth	1	PMD_type	C2C	z_bp (TX)	*32*
filter and Eq		beta_x	0	samples_for_C2M	100	z_bp (NEXT)	*32*
f_r	0.550	rho_x	0.618	T_O	50	z_bp (FEXT)	*32*
c(0)	0.54	TDR_W_TXPKG	1	EW	1	z_bp (RX)	*32*
c(-1)	0	N_bx	16	MLSE	0	C_0	[0.29e-4 0]
c(-2)	0	fixture delay time	[0 0]	ts_anchor	1	C_1	[0.1e-4 0]
c(-3)	0	Tukey_Window	1	sample_adjustment	[-16 16]	**Include PCB**	**0**
c(-4)	0	Noise, jitter		Local Search	2	Seletions (rectangle, gaussian,dual_rayleigh,triangle	
c(1)	0	sigma_RJ	0.01			Histogram_Window_Weight	gaussian
N_b	1	A_DD	0.02	Filter: Rx FFE		Qr	0.02
b_max(1)	0.85	eta_0	7.50E-09	ffe_pre_tap_len	5		
b_max(2..N_b)	0	SNR_TX	33.5	ffe_post_tap_len	8		
b_min(1)	0	R_LM	0.95	ffe_pre_tap1_max	0.7		
b_min(2..N_b)	-0.15			ffe_post_tap1_max	0.7		
g_DC	[-20:1:0]			ffe_tapn_max	0.7		
f_z	42.50	BREAD_CRUMBS	1	FFE_OPT_METHOD	MMSE		
f_p1	42.50	DER_CDR	1.00E-02	num_ui_RXFF_noise	2048		
f_p2	106.25	N_qb	6	Floating Tap Control			
g_DC_HP	[-6:1:0]	P_qc	4.00E-05	N_bg	2		
f_HP_PZ	1.328125	trunc	128	N_bf	4		
Butterworth	1	N_tc	128	N_f	50		
		add_rx_noise	3	bmaxg	0.2		
		Clip Method	Fast	B_float_RSS_MAX	1		
				N_tail_start	9		