

**Table 93A-1 parameters**

f_b	Baud (Signaling) rate
f_min	minimum required frequency start for s parameters
Delta_f	minimum required frequency step size s parameters
C_d	Device package model, Single-ended device capacitance (die pad)
z_p select	z_p test cases to run with correspond to respective z_p (TX),z_p (NEXT),z_p (FEXT),z_p (RX) values
z_p (TX)	List of victim transmitter package trace lengths in mm, one per case
z_p (NEXT)	List of NEXT aggressor transmitter package trace lengths in mm, one per case
z_p (FEXT)	List of FEXT aggressor transmitter package trace lengths in mm, one per case
z_p (RX)	List of victim receiver package trace lengths in mm, one per case
C_p	Single-ended package-to-board capacitance (BGA ball)
R_0	reference single-ended impedance
R_d	Device package model, Single-ended termination resistance
f_r	Receiver 3 dB bandwidth for the 4th order Bessel-Thomson filter
c(0)	TX equalizer cursor minimum value (actual value is calculated as 1-c(-1)-c(1), skipped if smaller than the minimum)
c(-1)	TX equalizer pre cursor individual settings or range
c(1)	TX equalizer post cursor individual settings or range
g_DC	Continuous time filter DC gain settings or range as specified in clause 93A
f_z	Continuous time filter zero frequency. Can be either a single value or a vector of the same length as g_DC.
f_p1	Continuous time filter first pole frequency. Can be either a single value or a vector of the same length as g_DC.
f_p2	Continuous time filter second pole frequency. Can be either a single value or a vector of the same length as g_DC.
A_v	Victim differential peak output voltage (half of peak to peak)
A_fe	Transmitter differential peak output voltage for Far-end aggressor
A_ne	Transmitter differential peak output voltage for Near-end aggressor
L	number of symbols levels (PAM-4 is 4, NRZ is 2)
M	samples per UI
N_b	Decision feedback equalizer (DFE) length
b_max(1)	DFE magnitude limit, first coefficient(ignored if Nb=0)
b_max(2..N_b)	DFE magnitude limit, second coefficient and on (ignored if Nb<2)
sigma_RJ	voltage sensitivity RMS Gaussian noise
A_DD	Normalized peak dual-Dirac noise, this is half of the total bound uncorrelated jitter (BUJ) in UI
eta_0	One-sided noise spectral density
SNR_TX	transmitter SNR noise (RMS)
R_LM	Ratio of level separation mismatch. Relevant for PAM-4 only.
DER_0	Target detector error ratio

**Below are parameters which represent model fit transmission line parameters****Table 93A-3 parameters**

package_tl_gamma0_a1_a2	The package trace lengths in mm are specified with z_p (TX), z_p (NEXT), z_p (FEXT), and z_p (RX). The package loads are specified with C_d, C_p, R_0, and R_d.
package_tl_tau	Fitting parameters for package model per unit length. First element is in 1/mm and affects DC loss of package model . Second element is in ns <sup>1/2</sup> /mm and affects loss proportional to sqrt(f). Third element is in ns/mm and affects loss proportional to f.
package_Z_c	Represents propagation delay per unit length, for reflection effects
	Package model characteristic impedance

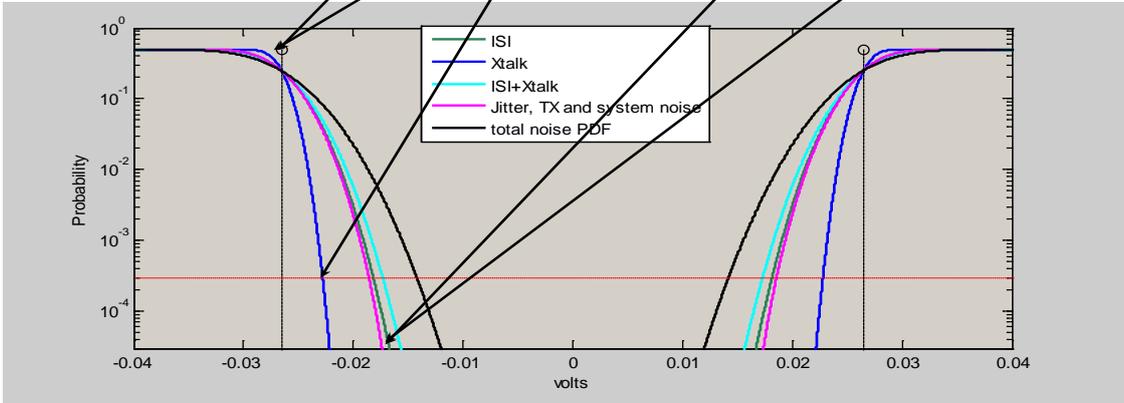
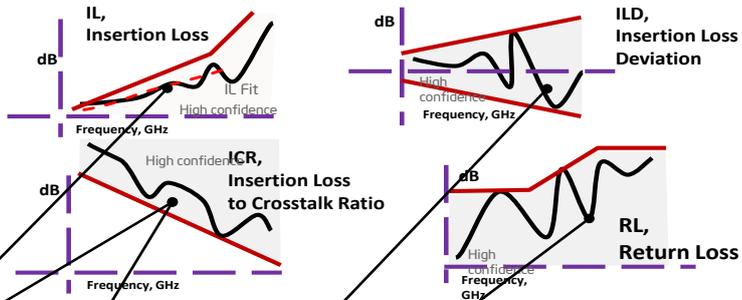
**Table 92-13 parameters**

board_tl_gamma0_a1_a2	The board trace lengths in mm are specified with z_bp (TX), z_bp (NEXT), z_bp (FEXT), and z_bp (RX).
board_tl_tau	Fitting parameters for board trace model per unit length. First element is in 1/mm and affects DC loss of package model . Second element is in ns <sup>1/2</sup> /mm and affects loss proportional to sqrt(f). Third element is in ns/mm and affects loss proportional to f.
board_Z_c	Represents propagation delay per unit length, for reflection effects
	Package model characteristic impedance

COM Pass threshold	the pass fail threshold for COM in dB
CSV_REPORT	When set to 1 a CSV report is created in the results directory. The name contains the name of the thru file and case number. 0 suppressed this .
DIAGNOSTICS	When set to 0 a limited set of results are reported. When set to 1 a fuller set of results are reported. This extra parameters can be useful for diagnosing contributions and other aspects of channel design. In addition a mat file is written to the result
Display frequency domain	When set to 1 a figure containing IL, RL, PST, ILD, and ICR is displayed. 0 suppresses this.
DISPLAY_WINDOW	When set to 0 the display window are suppressed. Set to 1 may be useful when running in a batch.
Enforce Causality	When set to 1 causality is enforced for the FD to TD conversion. If set to zero a IFFT using extrapolated low and high frequency data is used to convert to time domain. Look at the SBR in figure 100. If a small amount of precursor exists set to 1.
Enforce Causality DIFF_TOL	Tolerance parameter for causality, Hard enforcement, 1e-4, Soft enforcement, 1e-3
Enforce Causality pulse start tolerance	Tolerance parameter for causality, Hard enforcement, 0.05, Soft enforcement, .02
Enforce Causality REL_TOL	Tolerance parameter for causality, Hard enforcement, 1e-3, Soft enforcement, 1e-2
Error propagation COM margin	Unsupported. Set to 0
Force PDF bin size	Normally set to 0. This forces a PDF bin size when set to 1.
IDEAL_RX_TERM	Normally set to 0. When set to 1 an ideal termination replaces the Tx package.
IDEAL_TX_TERM	Normally set to 0. When set to 1 an ideal termination replaces the Rx package.
T_r	Rise time of transmitter, converted to a TX filter per Equation 93A-46 if IDEAL_TX_TERM is true.
INC_PACKAGE	When set to 1 the package is added to the channel model. If the channel model contains a package set this to 0. When set to 0 C_d, z_p select, z_p (TX), z_p (NEXT), z_p (FEXT), z_p (RX), C_p, R_0, and R_d are ignored.
Include PCB	This is normally set to 0. Set to 1 for CR4. When set to 1 a PCB board specified in cells in the Table 92–12 parameters section is concatenated on both sides of the tested channel.
INCLUDE_CTLE	Normally set to 1. When set to 0 the CTLE is omitted from analysis.
INCLUDE_TX_RX_FILTER	Normally set to 1. If set to 0 the Tx and Rx filter are omitted. However Tx FFE and CTLE are no affect by this parameter.
Max burst length calculated	Used for calculation of probabilities of error bursts due to DFE error propagation.
PDF bin size	the value in volts which is the size of PDF voltage bins. Essentially can be used a noise filter as any value lower than this voltage is considered as 0 V.
Port Order	order for s-parameter ports [ tx+, tx-, Rx+, Rx-]. Normally set to [1 3 2 4]
RESULT_DIR	The name of the results directory. May use relative references.
RX_CALIBRATION	Set to 0 for regular channel analysis. Set to 1 for calibrating the noise source in RX compliance test (Annex 93C.2).
Sigma BBN step	Initial step used for noise adjustment in Rx calibration.
SAVE_FIGURE_to_CSV	Set to one to save figure contents in .csv files in RESULTS_DIR.
SAVE_FIGURES	Set to one to save .fig files in RESULTS_DIR.
SAVE_RESP	A mat file containing some single bit responses is created when set to 1.

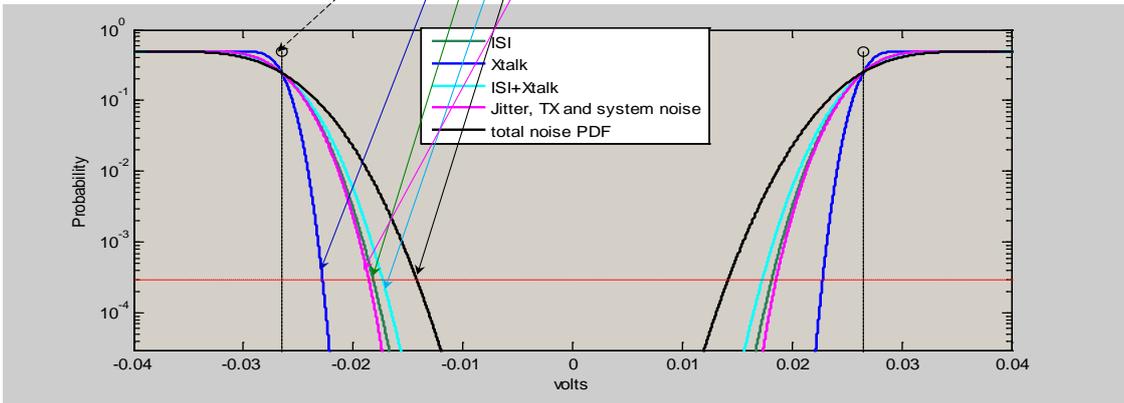
--- Testcase xx results ---	This report is produced for each package case. These parameters are reported in the report mat and cvs files.
file_names:	This is the tag used for the channel run set - it contains the thru file name
config_file:	The configuration xls files used for the report
levels:	number of symbols levels (PAM-4 is 4, NRZ is 2)
Pkg_len_TX:	Victim transmitter package trace length in mm (integer only) cases
Pkg_len_NEXT:	NEXT aggressor transmitter package trace length in mm (integer only) for this cases
Pkg_len_FEXT:	FEXT aggressor transmitter package trace length in mm (integer only) for this cases
Pkg_len_RX:	victim receiver package trace length in mm (integer only) for this cases
baud_rate_GHz:	Baud (Signaling) rate (GHz) i.e. f_b
f_Nyquist_GHz:	f_b/2
channel_operating_margin_dB:	COM value in dB for this case
peak_interference_mV:	The total noise at probability DER_0 . This is used in COM calculation
peak_channel_interference_mV:	The noise at probability DER_0 for the combined uncompensated ISI and crosstalk. This is used in the diagnosis of a channel design.
peak_ISI_mV:	The noise at probability DER_0 for only uncompensated ISI. This is used in the diagnosis of a channel design.
peak_MDXTK_interference_mV:	The noise at probability DER_0 for only all the crosstalk. This is used in the diagnosis of a channel design.
peak_MDNEXT_interference_mV:	The noise at probability DER_0 for only all NEXT crosstalk. This is used in the diagnosis of a channel design.
peak_MDFEXT_interference_mV:	The noise at probability DER_0 for only all FEXT crosstalk. This is used in the diagnosis of a channel design.
available_signal_after_eq_mV:	The amplitude of the available signal (A_s). This is used in COM calculation and VEO calculations. It is essentially defined at the sample point.
steady_state_voltage_mV:	steady state voltage
VEO_mV:	vertical eye opening at the sample point.
VEO_normalized:	normalized vertical eye opening at the sample point.
VEC_dB:	dB of normalized vertical eye opening at the sample point.
fit_loss_dB_at_Fnq:	fitted insertion loss at f_b/2. Not intended to couple with any particular standard or method.
IL_dB_at_Fnq:	insertion loss at f_b/2
ILD_RMS:	RMS over f_b/2 span of insertion loss deviation. This may used in the diagnosis of a channel design. Not intended to couple with any particular standard or method.
ICN_mV:	RMS over f_b/2 span of power sum of the crosstalk. This may used in the diagnosis of a channel design. Not intended to couple with any particular standard or method.
equivalent_ISI_ICN:	RMS over f_b/2 span of power sum of the crosstalk and ISI. This may used in the diagnosis of a channel design. Not intended to couple with any particular standard or method.
sci_noise_FD_RMS:	obsolete
CTLE_zero_poles:	List of zero pole1 and pole2 in Hz used for the CTLE in the COM calculations
CTLE_DC_gain_dB:	DC gain in DB used for the CTLE in the COM calculations
TXLE_taps:	List of transmitter FFE taps used for the CTLE in the COM calculations
DFE_taps:	List of transmitter DFE taps used for the CTLE in the COM calculations
cci_noise_TD_BER:	obsolete
peak_interference_at_BER:	same as peak_channel_interference_mV but in volts
FOM:	Best figure of merit result from the CTLE and Tx FFE optimization.
DFE4_RSS:	Root sum squared of DFE taps 4 to last DFE tap
error_propagation_probability:	sequential list of error propagation probabilities for each DFE tap
burst_probabilities:	sequential list of burst error probabilities for each burst length.

# COM Diagnoses Bathtub Key



# COM Diagnoses Bathtub vs Report Key

- peak\_MDXTK\_interference\_mV
- peak\_ISI\_mV
- available\_signal\_after\_eq\_mV
- peak\_channel\_interference\_mV
- peak\_interference\_mV:
- Device jitter and noise



# Contributors

	IL	ILDrms	ICN
peak_MDXTK_interference_mV			X
peak_ISI_mV		X	
steady_state_voltage_mV	X		
available_signal_after_eq_mV	X		
peak_channel_interference_mV		X	X