Channel Operating Margin Program Usage,

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Inclusion of comment resolutions from,

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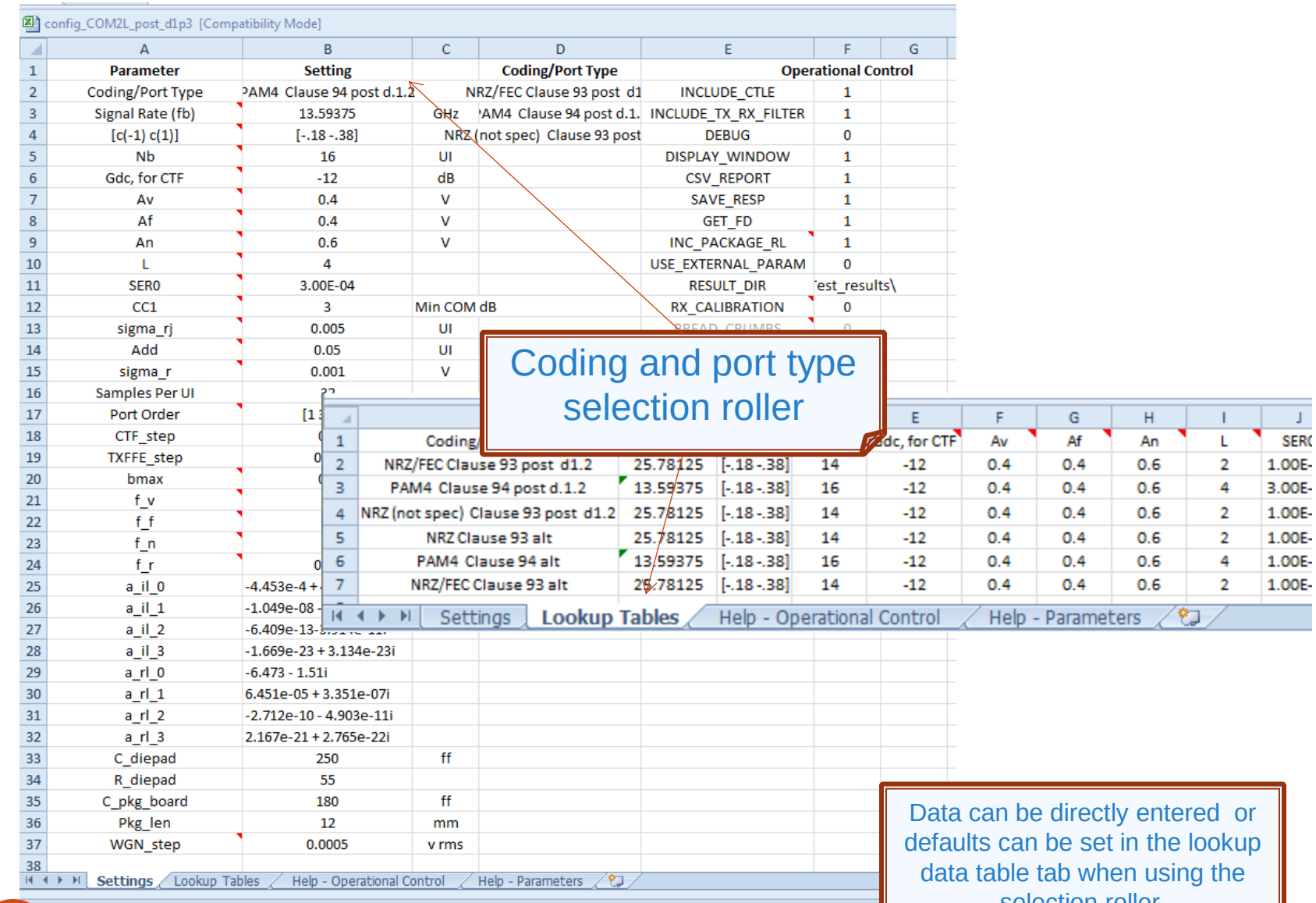
Overview and Operation

- There are two methods for running com2l_post_d1p3a
  - Using interactive file input (Q/A)
  - Using a single command line entry pointing to the files
    - This enables scripting
- com2l_post_d1p3a runs in MatLab® version 7 or higher
- Channels are specified as sets of s4p files
  - Thru, NEXT, FEXT
- Spreadsheet (XLS file) cells represent the COM parameters contain within the standard
- Output
  - Display to MatLab® window
  - Frequency plots to floating windows
  - Floating progress windows
  - Results reported in CSV file
    - Directory specified in configuration spreadsheet
- First step – select KP4 or KR4 in configuration spreadsheet (config_COM2L_post_d1p3.xls)
- Next step – run com2l_post_d1p3a in MatLab®
  - Post d1p3 means post draft d1.3 (after comment resolution)

Configuration Spreadsheet: Select Port Type



	A	B	C	D	E	F	G
1	**Parameter**	**Setting**		**Coding/Port Type**	**Operational Control**		
2	Coding/Port Type	PAM4 Clause 94 post d.1.2		NRZ/FEC Clause 93 post d1	INCLUDE_CTLE	1	
3	Signal Rate (fb)	13.59375	GHz	PAM4 Clause 94 post d.1.	INCLUDE_TX_RX_FILTER	1	
4	[c(-1) c(1)]	[-.18 -.38]		NRZ (not spec) Clause 93 post	DEBUG	0	
5	Nb	16	UI		DISPLAY_WINDOW	1	
6	Gdc, for CTF	-12	dB		CSV_REPORT	1	
7	Av	0.4	V		SAVE_RESP	1	
8	Af	0.4	V		GET_FD	1	
9	An	0.6	V		INC_PACKAGE_RL	1	
10	L	4			USE_EXTERNAL_PARAM	0	
11	SER0	3.00E-04			RESULT_DIR	Test_results\	
12	CC1	3	Min COM dB		RX_CALIBRATION	0	
13	sigma_rj	0.005	UI		BREAD_CRUMBS	0	
14	Add	0.05	UI				
15	sigma_r	0.001	V				
16	Samples Per UI	32					
17	Port Order	[1 3					
18	CTF_step	0					
19	TXFFE_step	0					
20	bmax	0					
21	f_v						
22	f_f						
23	f_n						
24	f_r	0					
25	a_il_0	-4.453e-4 +					
26	a_il_1	-1.049e-08 -					
27	a_il_2	-6.409e-13-					
28	a_il_3	-1.669e-23 + 3.134e-23i					
29	a_rl_0	-6.473 - 1.51i					
30	a_rl_1	6.451e-05 + 3.351e-07i					
31	a_rl_2	-2.712e-10 - 4.903e-11i					
32	a_rl_3	2.167e-21 + 2.765e-22i					
33	C_diepad	250	ff				
34	R_diepad	55					
35	C_pkg_board	180	ff				
36	Pkg_len	12	mm				
37	WGN_step	0.0005	v rms				
38							

Settings | Lookup Tables | Help - Operational Control | Help - Parameters

	Coding				E	F	G	H	I	J
1					Gdc, for CTF	Av	Af	An	L	SER0
2	NRZ/FEC Clause 93 post d1.2	25.78125	[-.18 -.38]	14	-12	0.4	0.4	0.6	2	1.00E-
3	PAM4 Clause 94 post d.1.2	13.59375	[-.18 -.38]	16	-12	0.4	0.4	0.6	4	3.00E-
4	NRZ (not spec) Clause 93 post d1.2	25.78125	[-.18 -.38]	14	-12	0.4	0.4	0.6	2	1.00E-
5	NRZ Clause 93 alt	25.78125	[-.18 -.38]	14	-12	0.4	0.4	0.6	2	1.00E-
6	PAM4 Clause 94 alt	13.59375	[-.18 -.38]	16	-12	0.4	0.4	0.6	4	1.00E-
7	NRZ/FEC Clause 93 alt	25.78125	[-.18 -.38]	14	-12	0.4	0.4	0.6	2	1.00E-

Settings | Lookup Tables | Help - Operational Control | Help - Parameters

Data can be directly entered or defaults can be set in the lookup data table tab when using the selection roller.

Parameter list

Example Setting		
Coding/Port Type	NRZ/FEC Clause 93 post d1.2	selector for port type name. the data is stored in the tab "Lookup Tables"
Signal Rate (fb)	25.78125	Unit Interval (Fb/2)
[c(-1) c(1)]	[-.18 -.38]	Transmitter equalizer, max pre and post cursor coefficient
Nb	14	Victim single bit response exception window (in UI). Decision feedback equalizer (DFE) length
Gdc, for CTF	-12	Continuous time filter, max DC gain
Av	0.4	Victim differential peak output voltage (not peak to peak)
Af	0.4	Transmitter differential peak output voltage for Far-end aggressor
An	0.6	Transmitter differential peak output voltage for Near-end aggressor
L	2	number of symbols levels (PAM-4 is 4, MRZ is 2)
SER0	1.00E-05	Target uncorrected symbol error ratio
CC1	3	Minimum channel operating margin
sigma_rj	0.01	Normalized RMS Gaussian noise, this is essentially jitter trj in UI
Add	0.07	Normalized peak dual-Dirac noise, this is half of the total deterministic jitter in UI
sigma_r	0.001	voltage sensitivey RMS Gaussian noise
Samples Per UI	32	
Port Order	[1 3 2 4]	for the 4 ports the first two listed are inputs and respective last two are outputs (RX)
CTF_step	1	Continuous time filter step size dB
TXFFE_step	0.02	Transmitter equalizer, pre/post cursor coefficient step size
bmax	1	max in W region
f_v	4	Transmitter 3 dB bandwith for victim. Set to > 2 to deactivate , the bandwidth is limited by the package in the present draft
f_f	4	Transmitter 3 dB bandwith for Far-end aggressor. Set to > 2 to deactivate , the bandwidth is limited by the package in the present draft
f_n	4	Transmitter 3 dB bandwith for Near-end aggressor. Set to > 2 to deactivate , the bandwidth is limited by the package in the present draft
f_r	0.75	Receiver 3dB bandwidth
a_il_0	-4.453e-4 + 4.467e-05i	package transmission line insertion loss parameters (mellitz_3bj_01b_0113)
a_il_1	-1.049e-08 - 4.568e-08i	package transmission line insertion loss parameters (mellitz_3bj_01b_0113)
a_il_2	-6.409e-13-3.914e-11i	package transmission line insertion loss parameters (mellitz_3bj_01b_0113)
a_il_3	-1.669e-23 + 3.134e-23i	package transmission line insertion loss parameters (mellitz_3bj_01b_0113)
a_rl_0	-6.473 - 1.51i	package transmission line return loss parameters (mellitz_3bj_01b_0113)
a_rl_1	6.451e-05 + 3.351e-07i	package transmission line return loss parameters (mellitz_3bj_01b_0113)
a_rl_2	-2.712e-10 - 4.903e-11i	package transmission line return loss parameters (mellitz_3bj_01b_0113)
a_rl_3	2.167e-21 + 2.765e-22i	package transmission line return loss parameters (mellitz_3bj_01b_0113)
C_diepad	240	package model die pad capacitance in ff (mellitz_3bj_01b_0113)
R_diepad	55	package model die pad termination resistance in ohms (mellitz_3bj_01b_0113)
C_pkg_board	130	package model capacitance associated with the boards to package interface in ff (mellitz_3bj_01b_0113)
Pkg_len	12	package transmissionline return loss length mm (mellitz_3bj_01b_0113)
WGN_step	0.00025	This is the WGN iteration step size to determine the rms value of WGN to calibrate the Rx Interference test (moore_3bj_02_0113)

Operational Control

INCLUDE_CTLE	0 = do not include CTLE
	1 = include CTLE. May eventually be removed
INCLUDE_TX_RX_FILTER	0 = do not include TX/RX filters
	1 = include TX/RX filters. May eventually be removed
DEBUG	0 = do not print internal data;
	1 = prints and graphs internal data. May eventually be removed
DISPLAY_WINDOW	0 - do not display FD graphs
	1 - display FD graphs (IL, ILD, ICR, RL, MDPST)
CSV_REPORT	0 - do not create CSV report file
	1- create CSV report file in .\results directory
SAVE_RESP	0 - do no save channel time domian data
	1 - save channel time domian data in mat file
GET_FD	0 - do not report freqency domain metrics
	1 - report some freqency domain metrics
USE_EXTERNAL_PARAM	set to 0 . May eventually be removed
RESULT_DIR	Directory for writing the csv results file. It is advisable to use the full path name here
INC_PACKAGE_IL	0 - Do not include package model in the channel response
	1 - Include package model in the channel response
RX_CALIBRATION	0 - normal operation
	1 - used to determine WGN for Rx calibration. see d1.4. Thru file is measured and 2nd file is special. It is the noise path s-parameter from the noise generator to tp5
BREAD_CRUMBS	print intermediate time and frequency domain to csv files. May not be fully operational

CSV and display outputs

Output Parameters	
Files set	Thru file name
channel_operating_margin_dB: (COM)	Figure of merit. Adjusted so that above zero passes and below fails
peak_interference_mV:	Peak interference on channel include chip and system noise. For a test type of channel, this would be the value for additive rx tolerance injected noise. Since this is peak value of interference, dividing by 7 may be the amount of rms noise from an AWGN generator. Peak interference is measure at the spec BER.
peak_channel_interference_mV:	The peak interference. contribution for residual ISI and crosstalk.
peak_ISI_mV:	The peak interference. contribution for residual ISI.
peak_MDXTK_interference_mV:	The peak interference. contribution for all crosstalk.
icn_mV:	If FD is selected this is the integrated crosstalk noise However this used filters in draft.
peak_MDNEXT_interference_mV:	The peak interference contribution for all NEXT crosstalk.
peak_MDFEXT_interference_mV:	The peak interference contribution for all FEXT crosstalk.
fit_loss_dB_at_Fnq:	If FD is selected this is the value of the fitted IL loss at Nyquist. Same as SCAT, IL_fit_atNq
IL_dB_at_Fnq:	If FD is selected this is the value of the IL loss at Nyquist.
ILD_RMS:	This may be useful for a quick evaluation of a channel. It is the RMS of the Insertion Loss Deviation in dB. However this used filters in draft.
available_signal_after_eq_mV:	Essentially the “zero-first-precursor” signal height after filtering and reference equalization
DFE_RSS4	mellitz_3bj_02_0113
coding	PAM4 or NRZ
Fnq (GHz)	Fb/2
file_names:	List of channel files

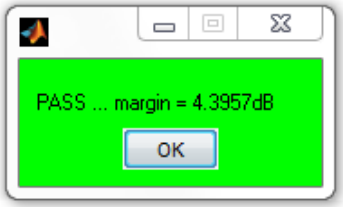
Syntax d1p2 example

```
function [ output_args ] =com2l(coding, num_fext, num_next, varargin)
```

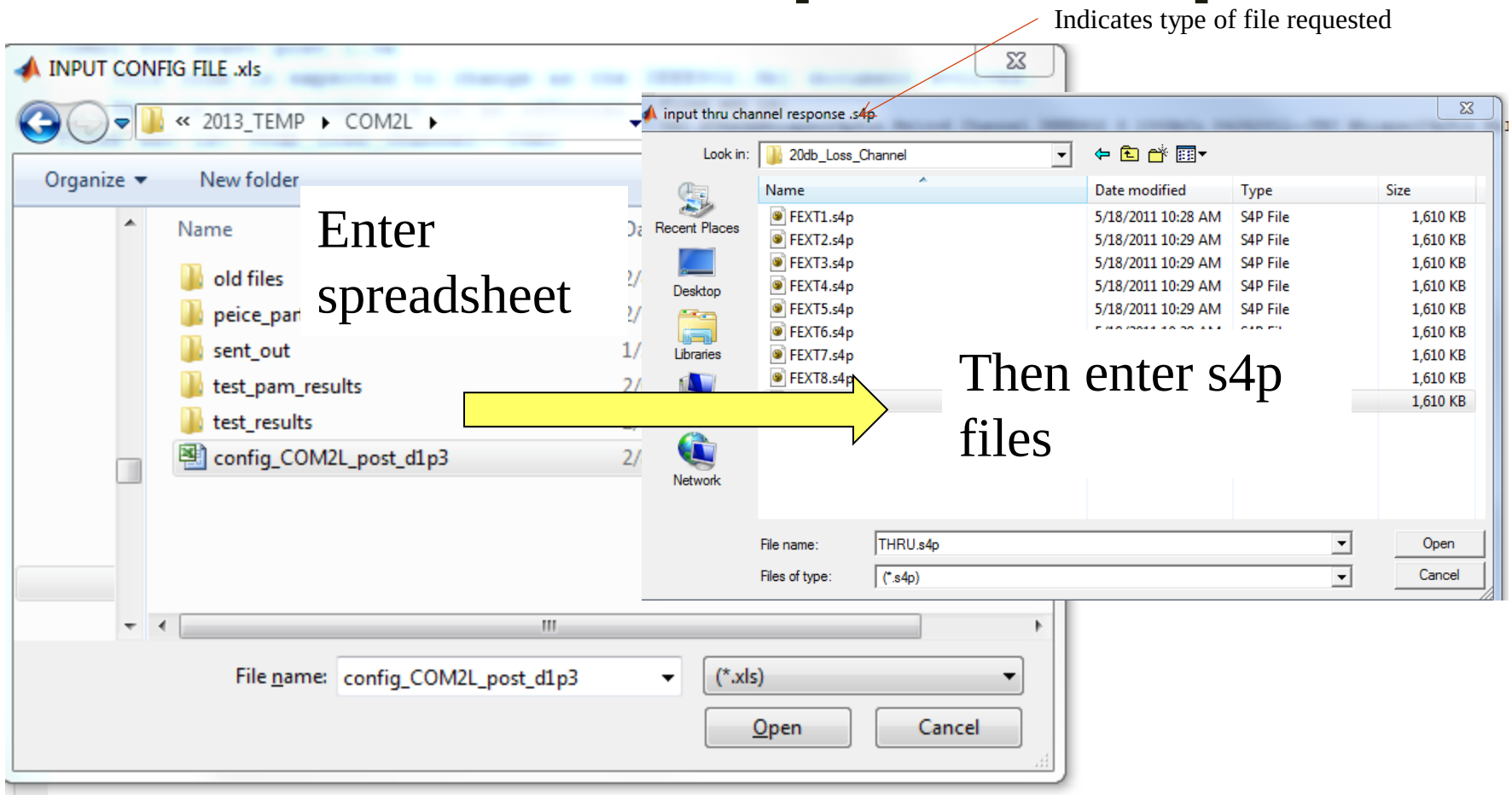
- output_args is a structure with results
- coding is string containing the full path name of the configuration spreadsheet
- num_fext is the number for fext s4p files
- num_next is the number for next s4p files
- All the res of the arguments are strings containing the file names of through, fext, and next files. The full path is required for the first channel file. The default directory will then be the last directory specified in the file list

```
>> com2l_post_d1p3a('config_COM2L_post_d1p3.xls',   8,
0,'C:\Users\rimellit\Documents\2013_TEMP\channels\ieee802p3bj\patel_01_0511\35db_Loss_channel\THRU.s4p',
'FEXT1.s4p',    'FEXT2.s4p',    'FEXT3.s4p',    'FEXT4.s4p',    'FEXT5.s4p',    'FEXT6.s4p',    'FEXT7.s4p',
'FEXT8.s4p')
COM2L for Draft post 1.3a
    This code is expected to change as the IEEE802.3bj document evolves.
    This is not a normative or an official IEEE document.
Files set is: 35db_Loss_channel--THRU

ans =

     channel_operating_margin_dB: 4.3957
            peak_interference_mV: 6.8000
    peak_channel_interference_mV: 3.9000
                   peak_ISI_mV: 3.8000
      peak_MDXTK_interference_mV: 0.3000
                          icn_mV: 1.2337
     peak_MDFEXT_interference_mV: 0.3000
    available_signal_after_eq_mV: 11.2797
              fit_loss_dB_at_Fnq: 34.7198
                    IL_dB_at_Fnq: 35.7122
                  baud_rate_GHz: 25.7813
                        ILD_RMS: 0.9402
                       dfe4_rss: 0.1631
                     file_names: [9x23 char]
```

Result screen

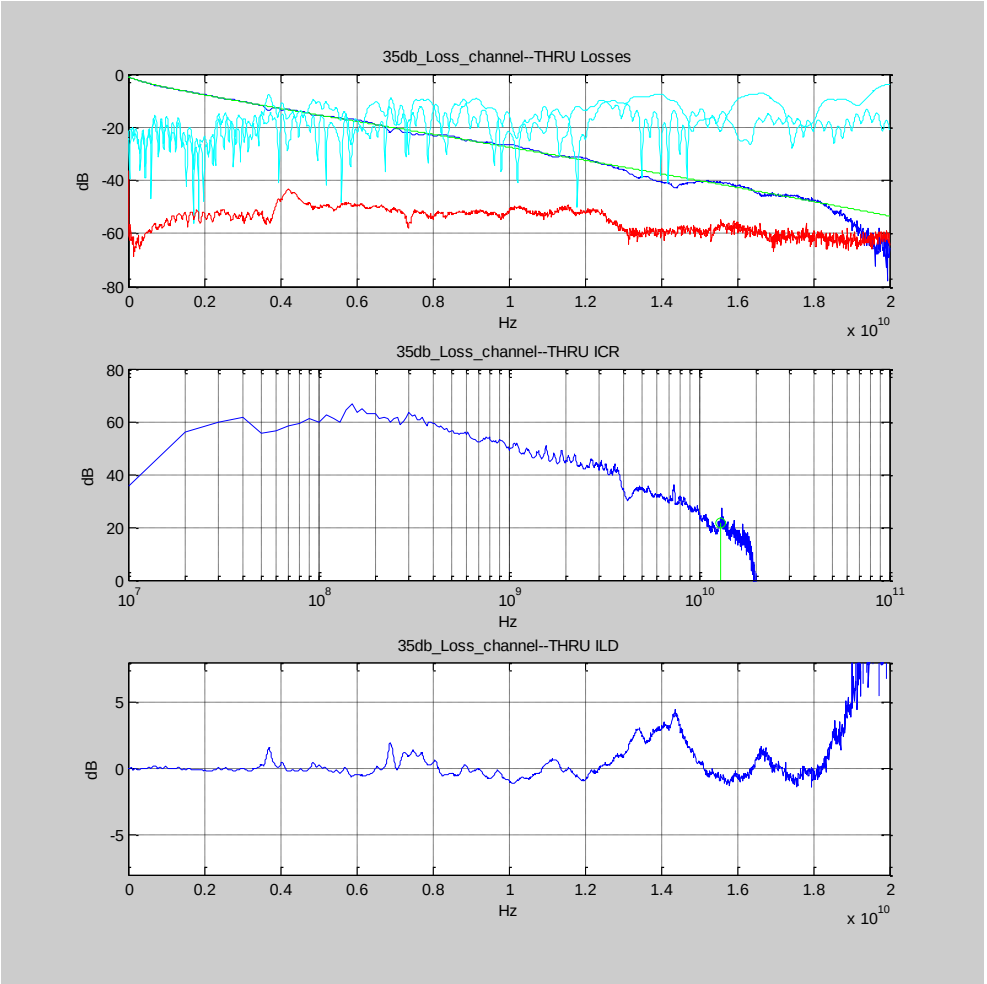


Interactive file input example




```
>> com2l_post_d1p3a
COM2L for Draft post 1.3a
    This code is expected to change as the IEEE802.3bj document evolves.
    This is not a normative or an official IEEE document.
Enter config XLS file or return will just pop a window to ask for the XLS file]:
```

Additional Informational Frequency domain display



Results are written to CSV file

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	File set	COM dB	peak interference mV	peak channel interference mV	peak ISI mV	peak MDXTK interference mV	ICN	peak MDNEXT interference mV	peak MDFEXT interference mV	fit loss dB at Fnq	IL loss dB at Fnq	ILD RMS	available signal after eq mV	dfe4 rss	coding	Fnq (GHz)								
2	35db_Loss_channel--THRU	4.39574	6.8	3.9	3.8	0.3	1.233716	0	0.3	34.71978	35.71225	0.9402	11.27965	0.16314	NRZ	12.89063	FEXT1	FEXT2	FEXT3	FEXT4	FEXT5	FEXT6	FEXT7	FEXT8

35db Loss channel--THRU results