FIELD TESTER CAPABILITY FOR BALANCE MEASUREMENT

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INTRODUCTION

- Definitions of Balance measurements.
- Measurement Procedures used for this contributions
- Overlay and accuracy Results for channel & PL measurements of TCL and ELTCTL
- Other possible measurement
- Conclusions

DEFINITIONS

C.2.8.1 Test configuration of channel TCL

Figure C.7 depicts the typical schematic diagram for testing TCL. The cabling or DUT pair under test shall be connected to the differential mode balun output terminals. All unused near-end pairs shall be terminated with DMCM resistor terminations (see clause B.6.2) or baluns as shown in figure C.7. All far-end pairs shall be terminated with DMCM resistor terminations (see clause B.6.2). The near-end terminating resistor networks shall be bonded and connected to the measurement ground plane. The far-end resistor networks shall be bonded together.

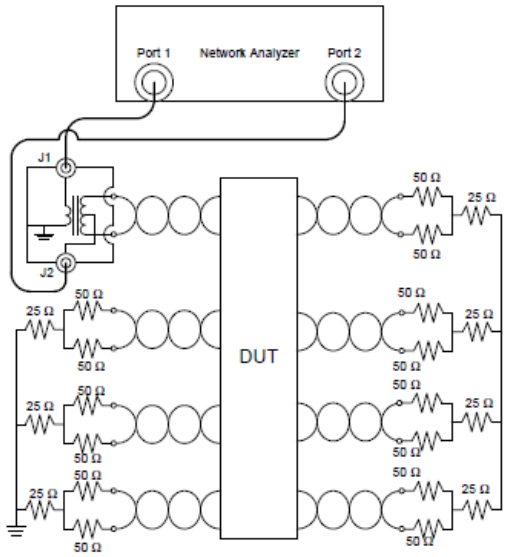


Figure C.7 - Laboratory test configuration for TCL

C.2.9.1 Test configuration of channel TCTL

Figure C.12 depicts the typical schematic diagram for testing TCTL. Two ends of the same cabling or DUT pair shall be connected to the differential outputs of the test baluns. For consistency, the output port of the network analyzer will be referred to as port 1 and the input port will be designated as port 2. Port 1 shall be connected to the differential input of the balun connected to the input end of the pair under test, while port 2 shall be connected to the common mode terminal of the balun connected to the output end of the pair under test. All unused pairs on both ends shall be terminated with DMCM resistor terminations as shown in figure C.12. There shall be a common ground at each end. The grounds of the two ends shall be connected securely to the same ground plane. Refer to Annex F for information on the impact of connecting the common ground at the local and remote ends of the link.

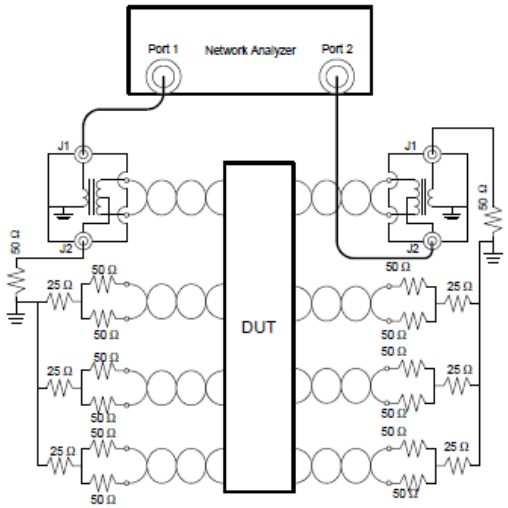


Figure C.12 - Laboratory test configuration for TCTL

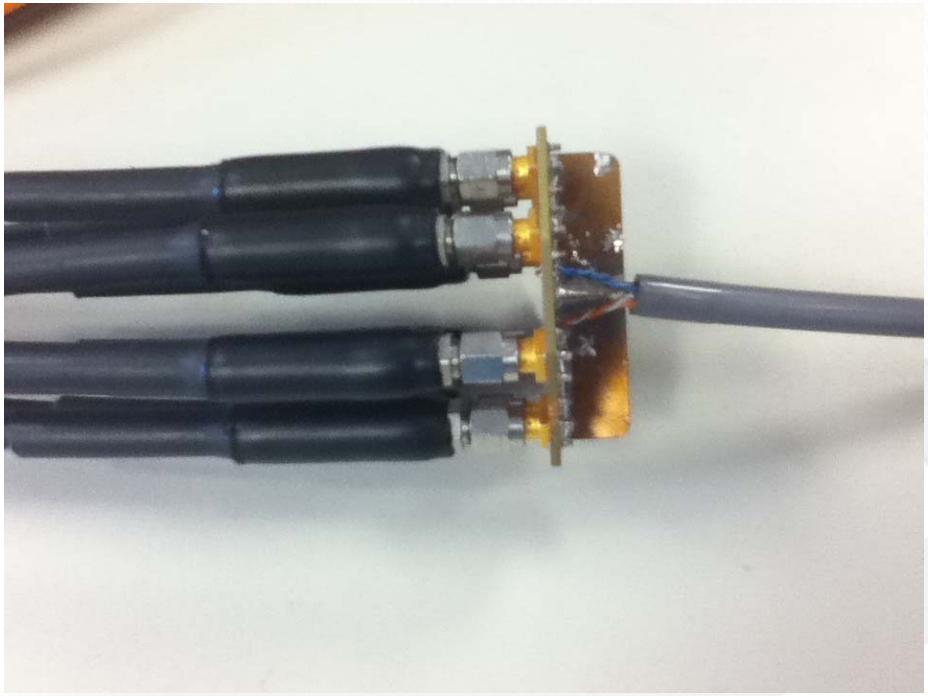
The above diagrams are copied from TIA568 C.2 and clarify the definition of the TCL and TCTL, as well as showing the main points of the test configuration

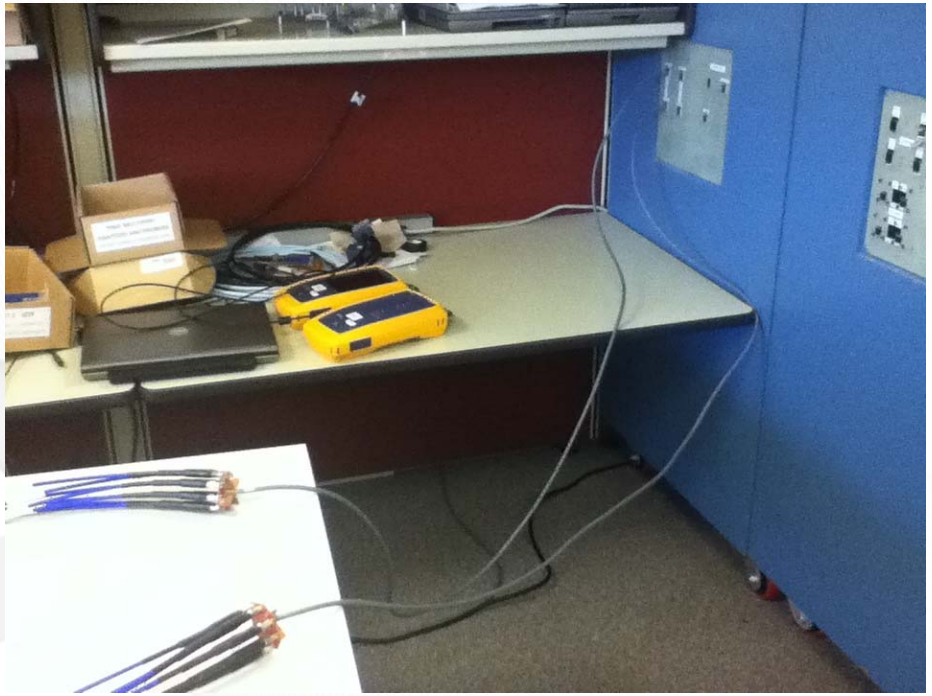
DESCRIPTION OF RESULTS

- Overlay plots are shown without processing for both VNA and field tester results.
- Accuracy plots were calculated by normalising the voltage difference between the field tester and VNA results against the limit line according to TIA 1152, section 4.8.3.2.2 ‘Comparison method using full frequency responses’.
- The limit lines used for these calculations were the Draft TIA Cat 8 channel limits for TCL and ELTCTL to 1000MHz.
- This trials were conducted as part of an evaluation of field testers to Level V requirements, so all results are displayed to 1000MHz.
- Results using 30m PL are shown in the presentation, additional results using 60m and 90m CH & PLs are included as an Appendix to this presentation.

CHANNEL MEASUREMENT SETUP 1

- All VNA measurements were taken using procedures for direst 16-port characterisation using the fixtures shown .
- All results were converted to 50-50-25 terminations.
- Cables were calibrated using Ecal, hence fixtures are included in VNA measurement.

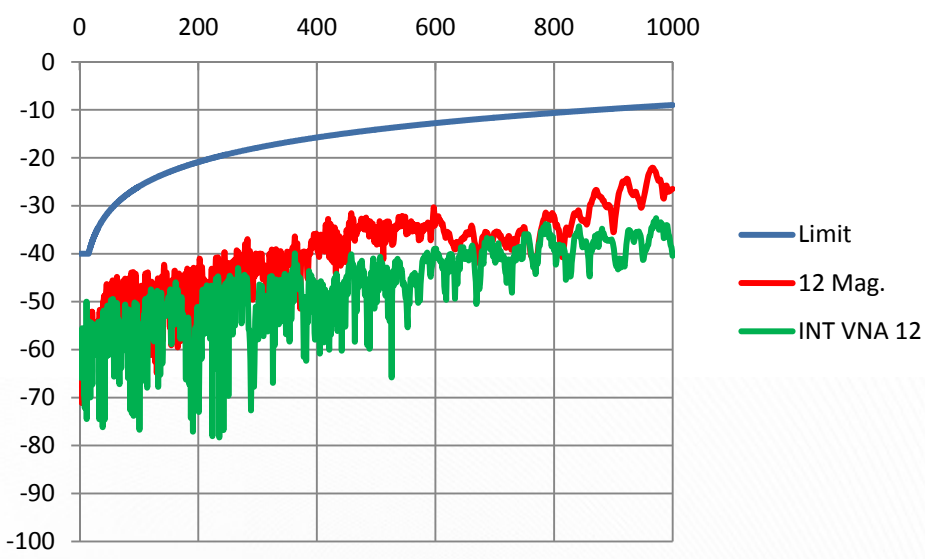


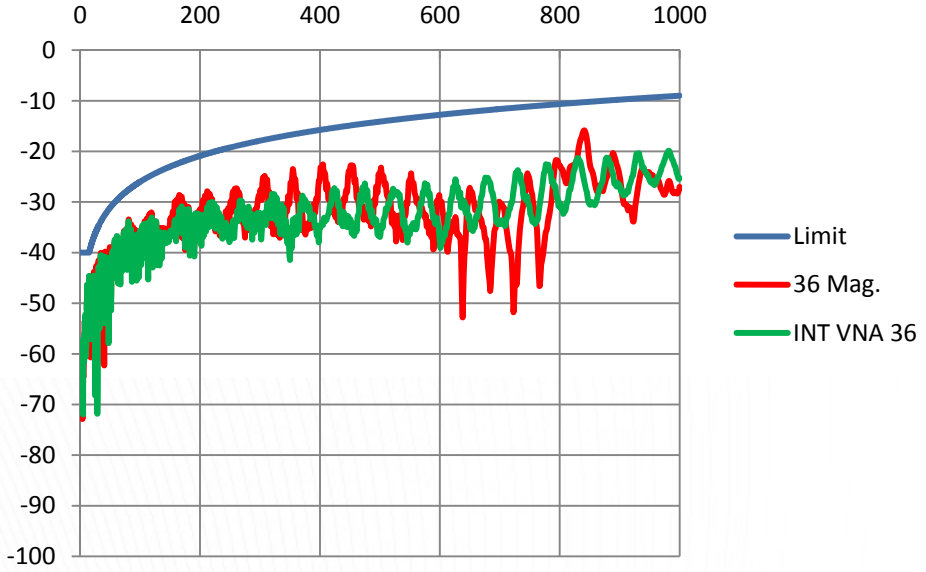


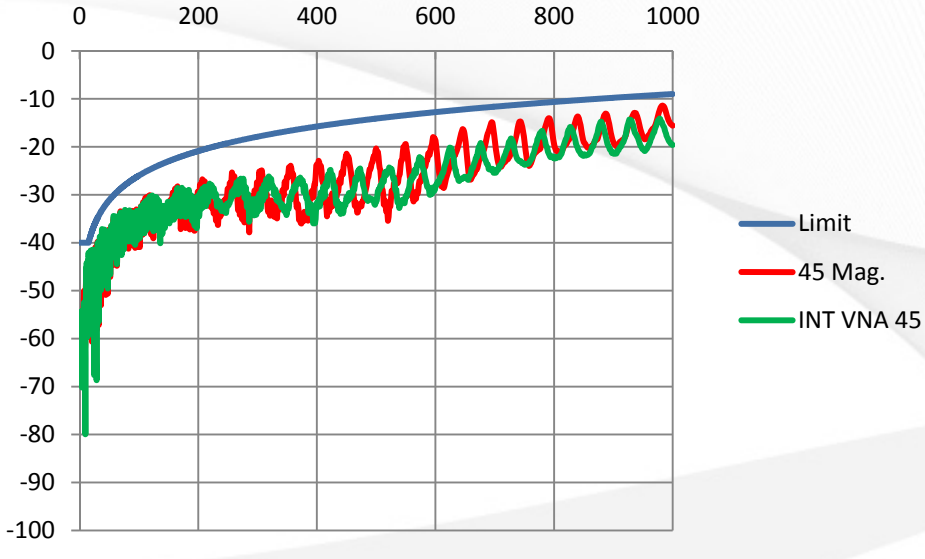
CHANNEL MEASUREMENT SETUP 2

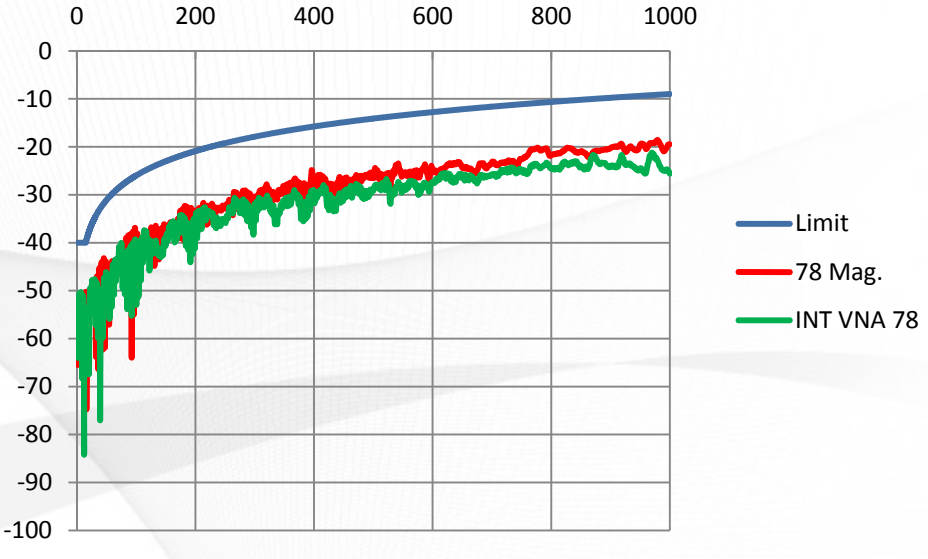
- The channel configurations with the following topology were used:
  - 3m-30m-3m
  - 3m-60m-3m
  - 3m-90m-3m
- All cable products were 500MHz Cat 6A RJ45.

30M CHANNEL TCL RESULTS

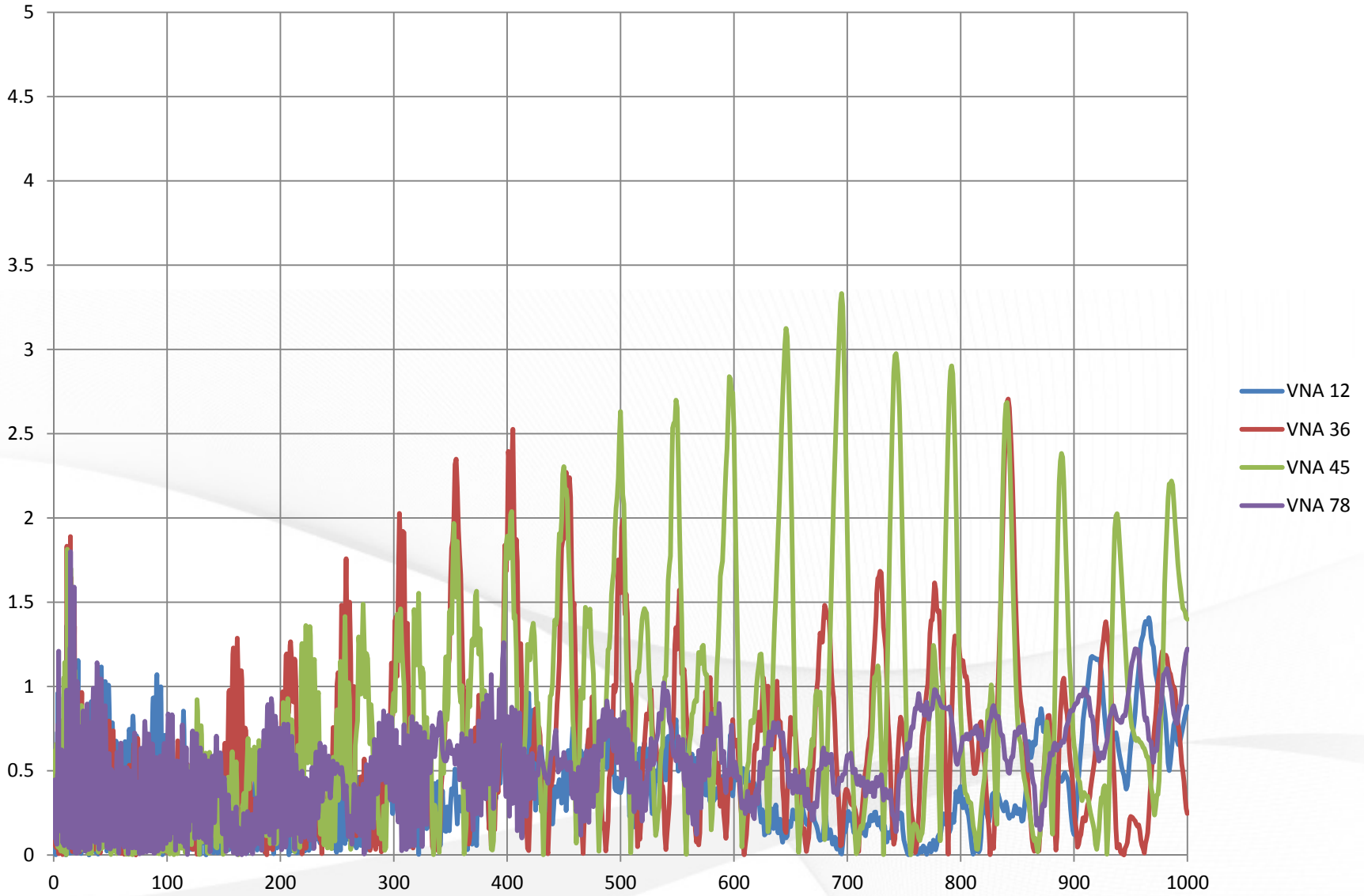




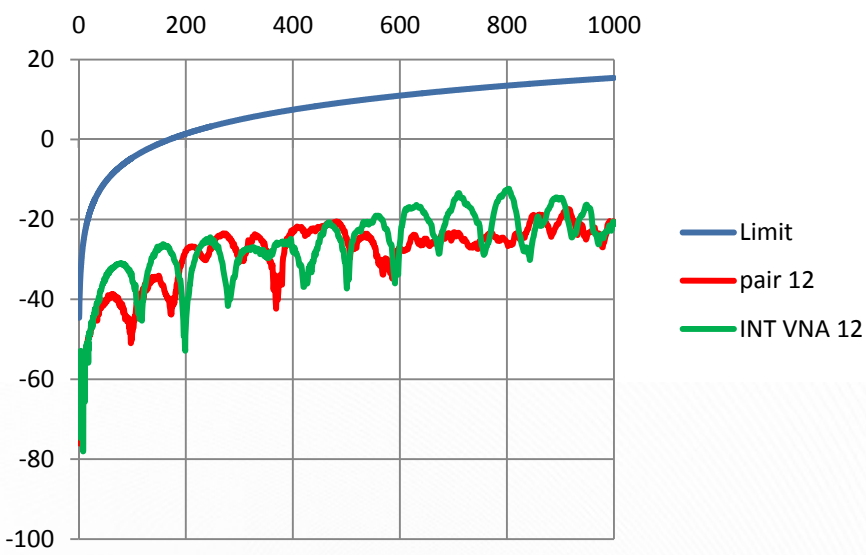


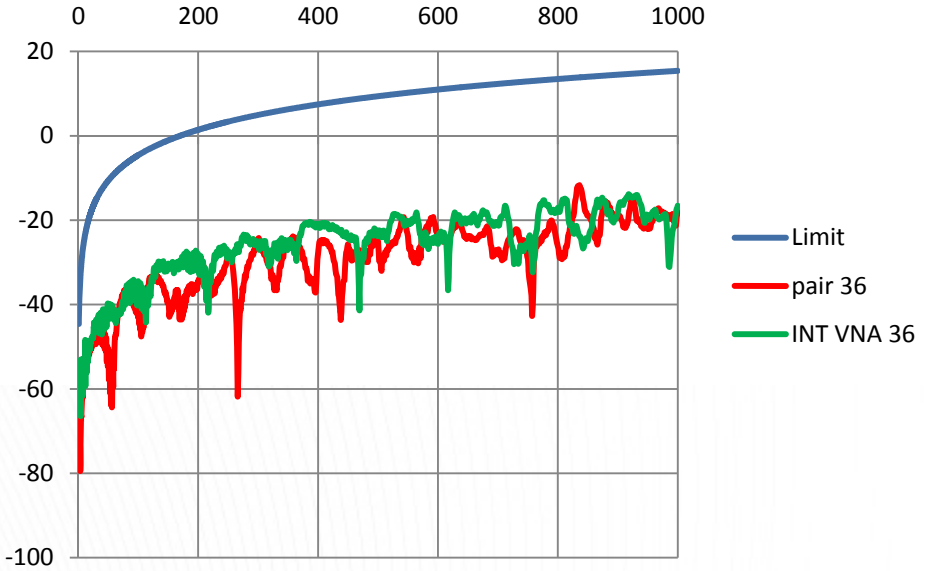


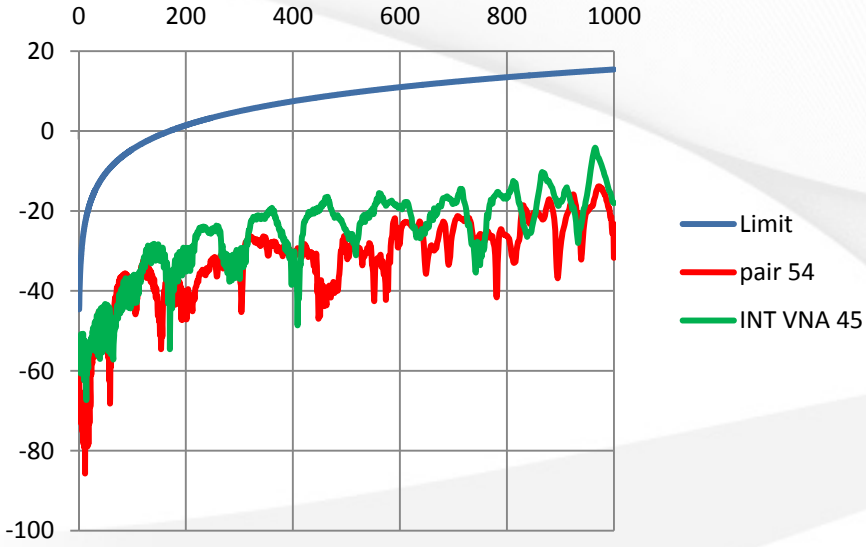
30M CHANNEL TCL ACCURACY

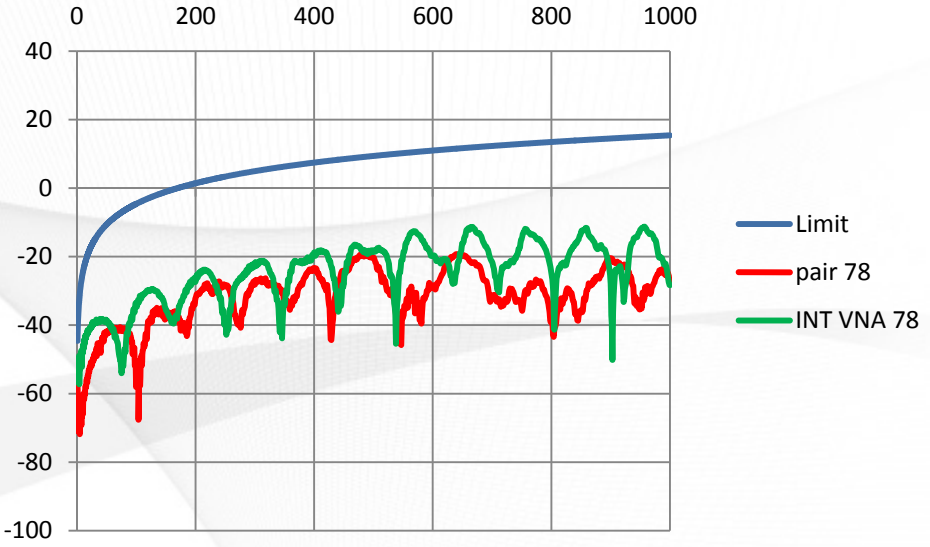


30M CHANNEL ELTCTL RESULTS

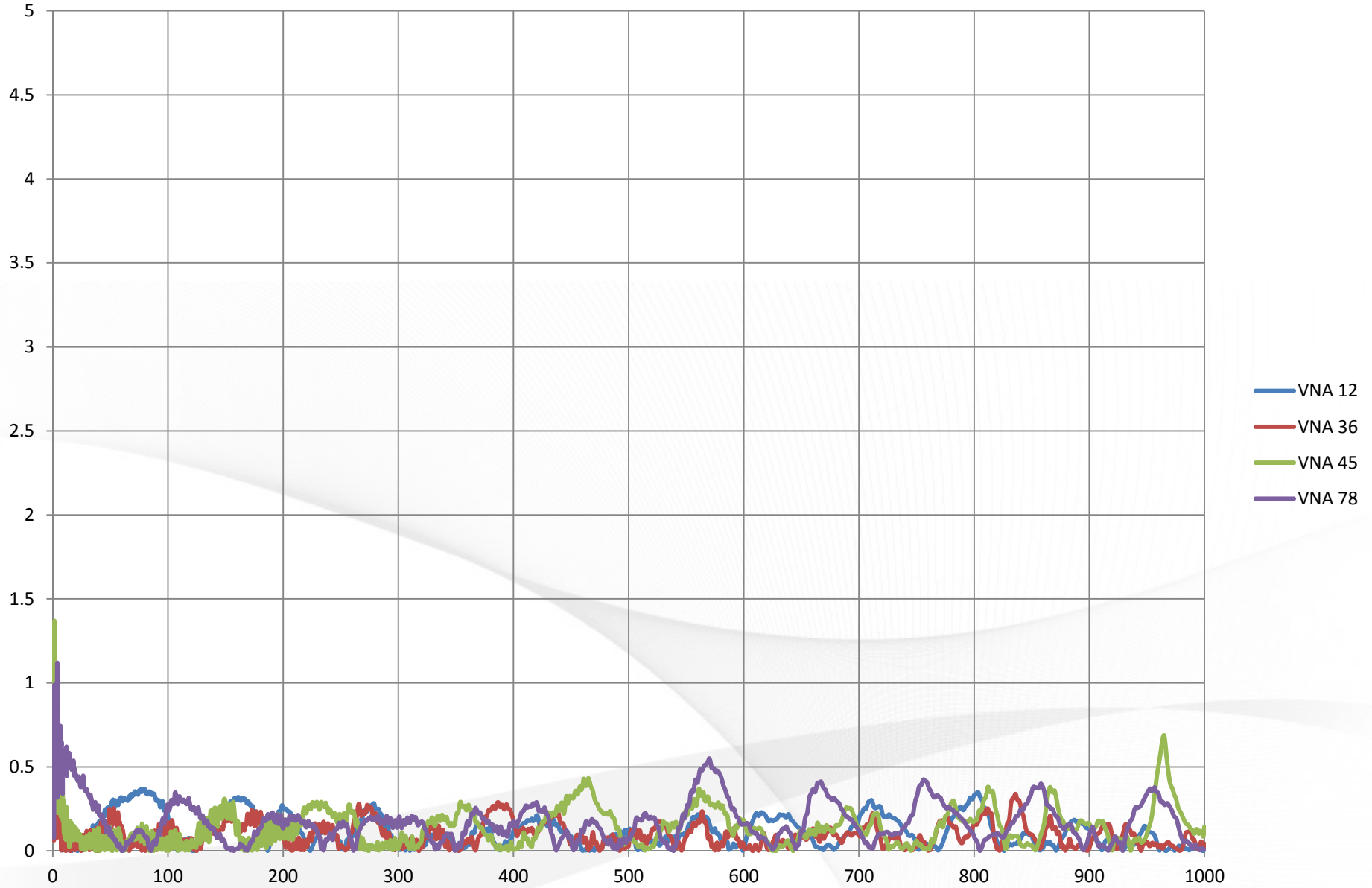






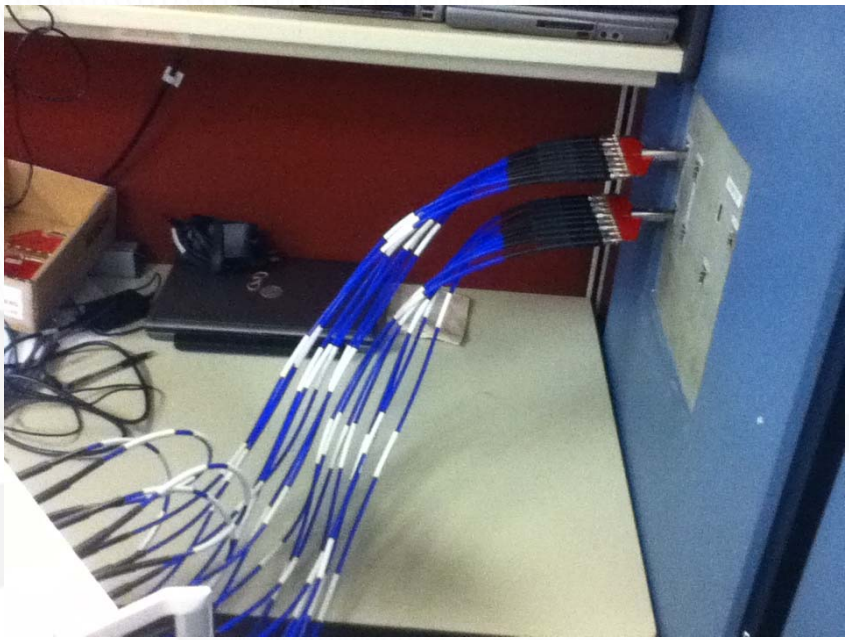


30M CHANNEL ELTCTL ACCURACY



PL MEASUREMENT SETUP 1

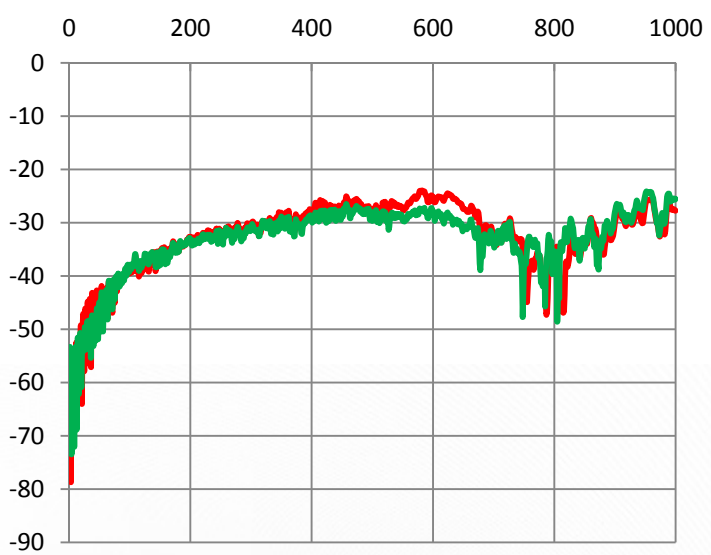
- All VNA measurements were taken using procedures based on 16 port characterisation.
- All results were converted to 50-50-25 terminations.
- VNA Cables were calibrated using Ecal. Fixtures removed using a 16 port deemebbed approach.
- Calibration plane is at Samtec jack, hence results include Salsa Plug.

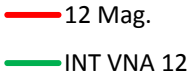


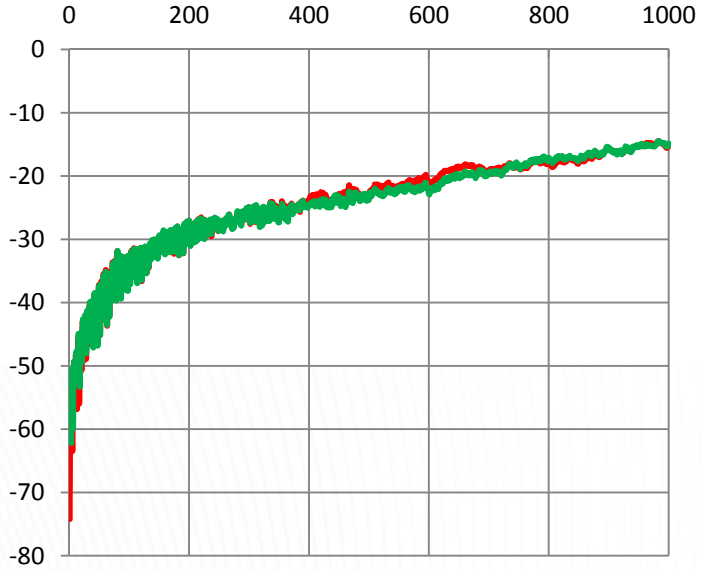
PL MEASUREMENT SETUP 2

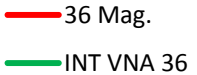
- Channel limit lines used to give reference to a limit.
  - No PL balance limits in Draft 0.7 568C.2-1
  - This limit is not a proposal for PL limit. It is only used for comparison to channel accuracy.
- Link lengths 30m, 60m and 90m RJ45 C6A construction.

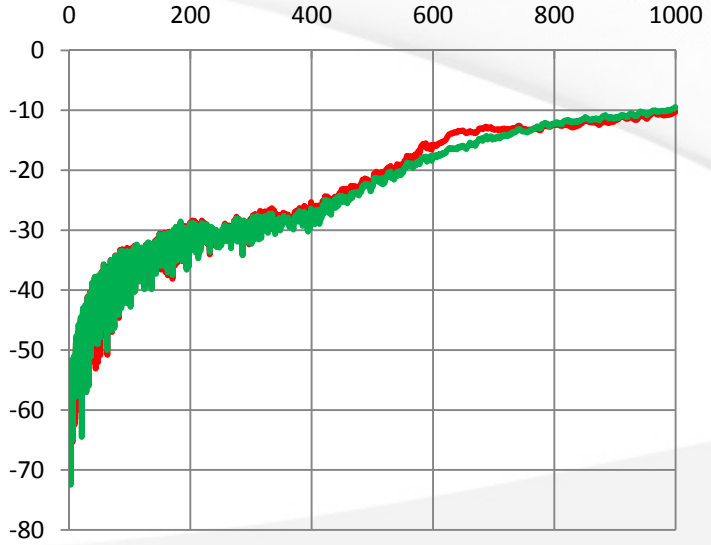
30M PL TCL RESULTS

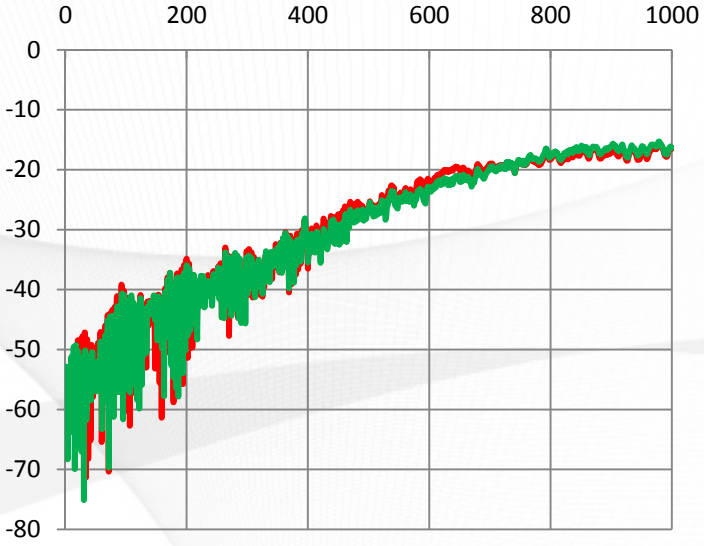




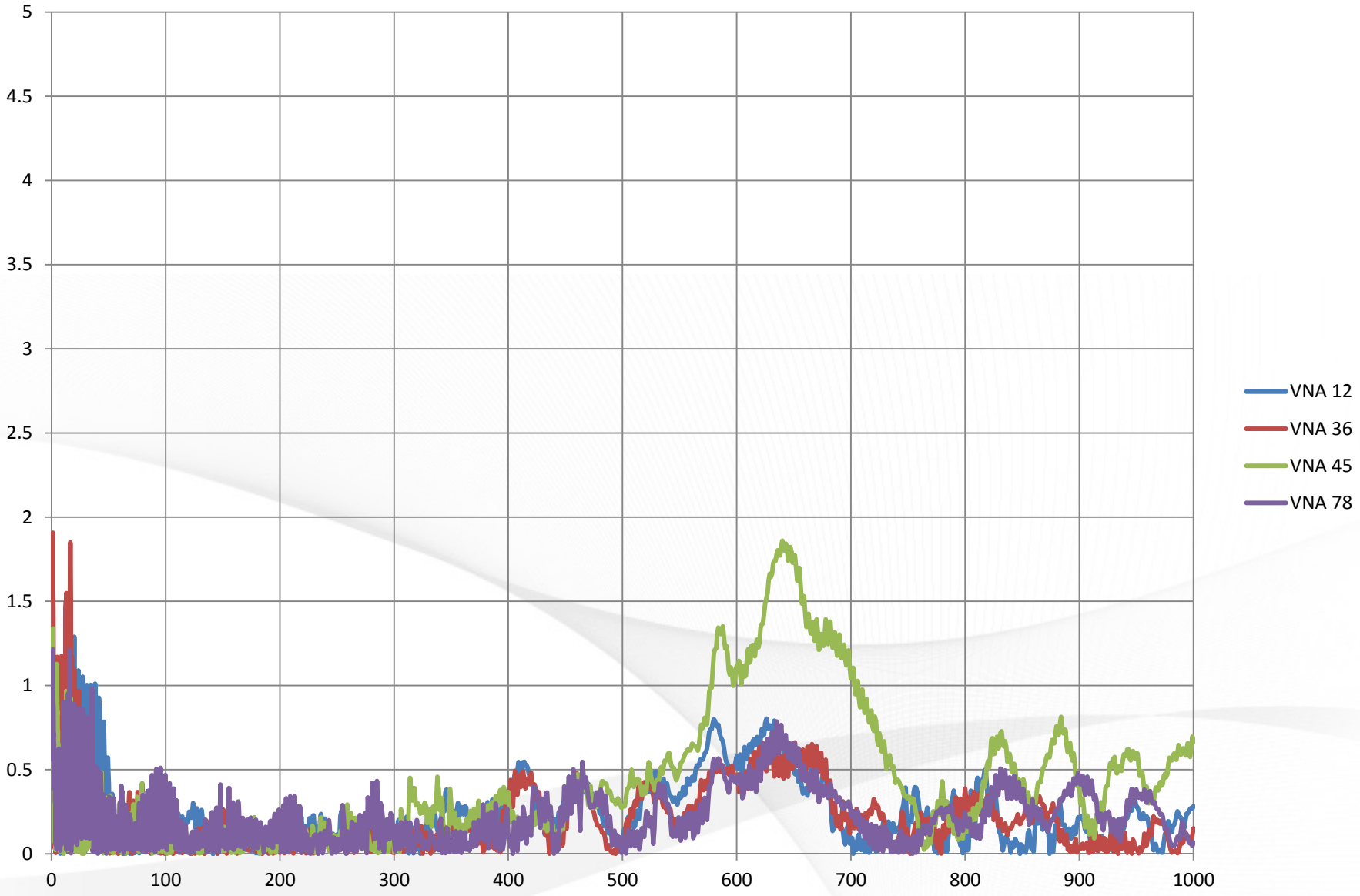




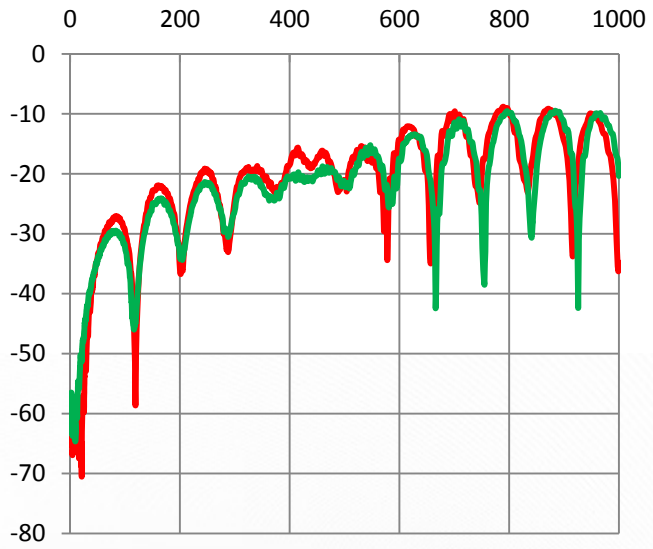


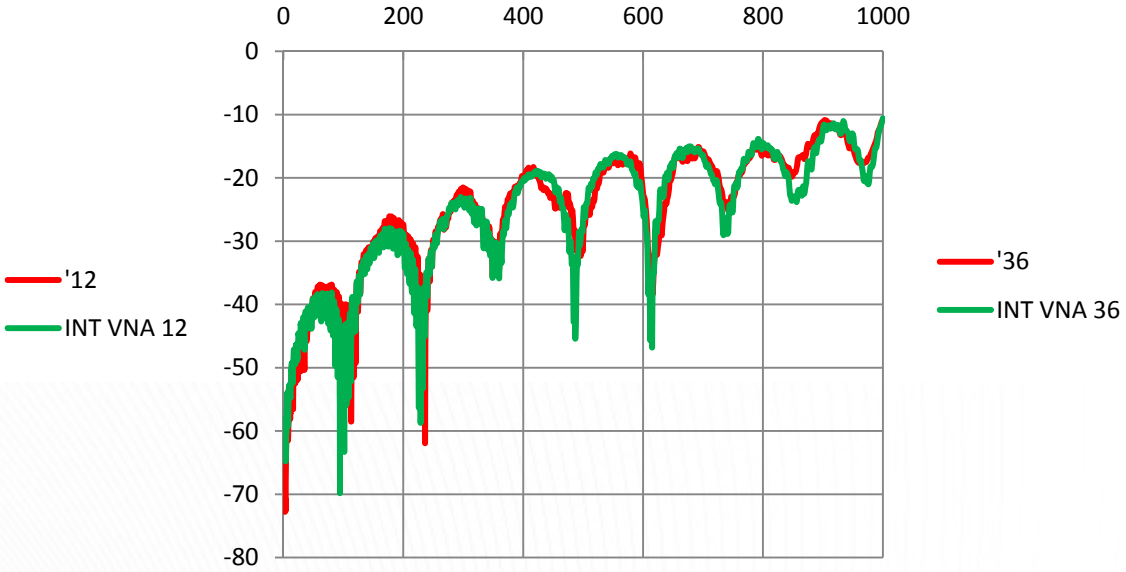


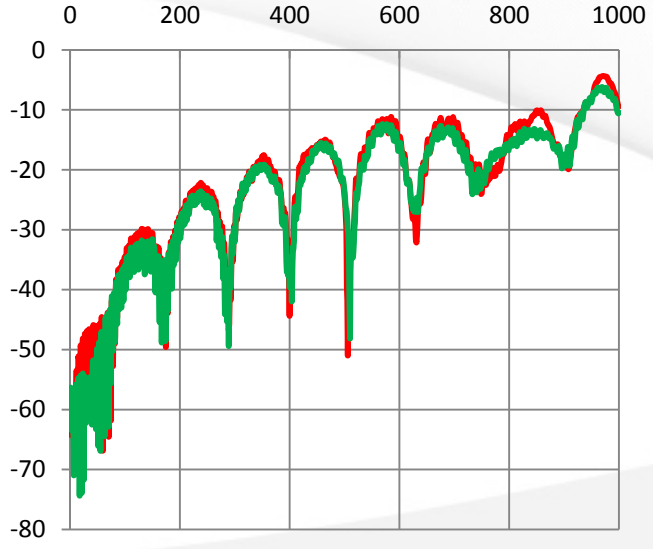
30M PL TCL ACCURACY

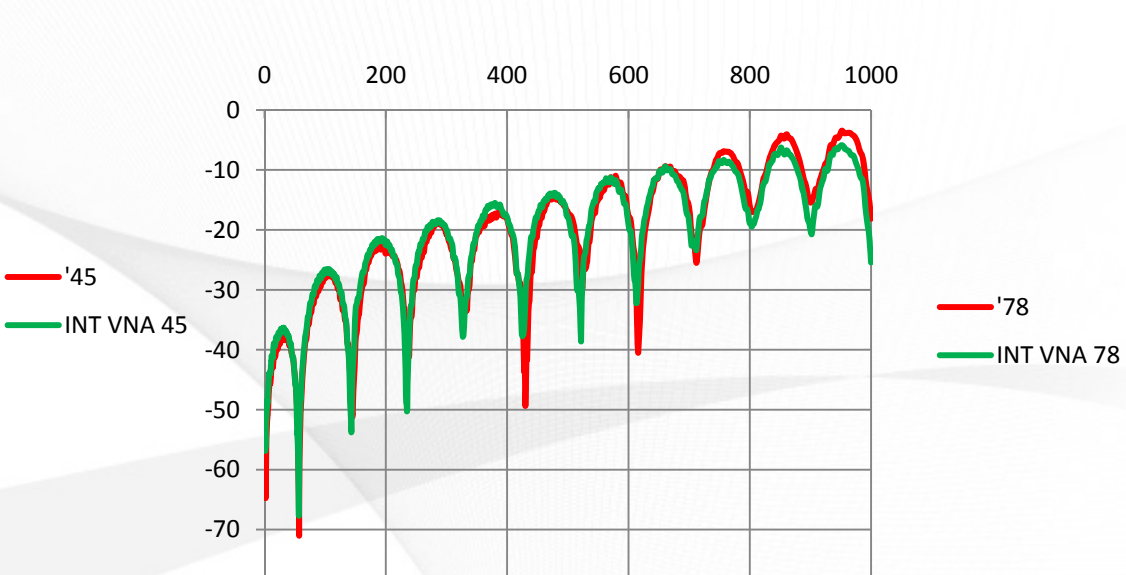


30M PL ELTCTL RESULTS

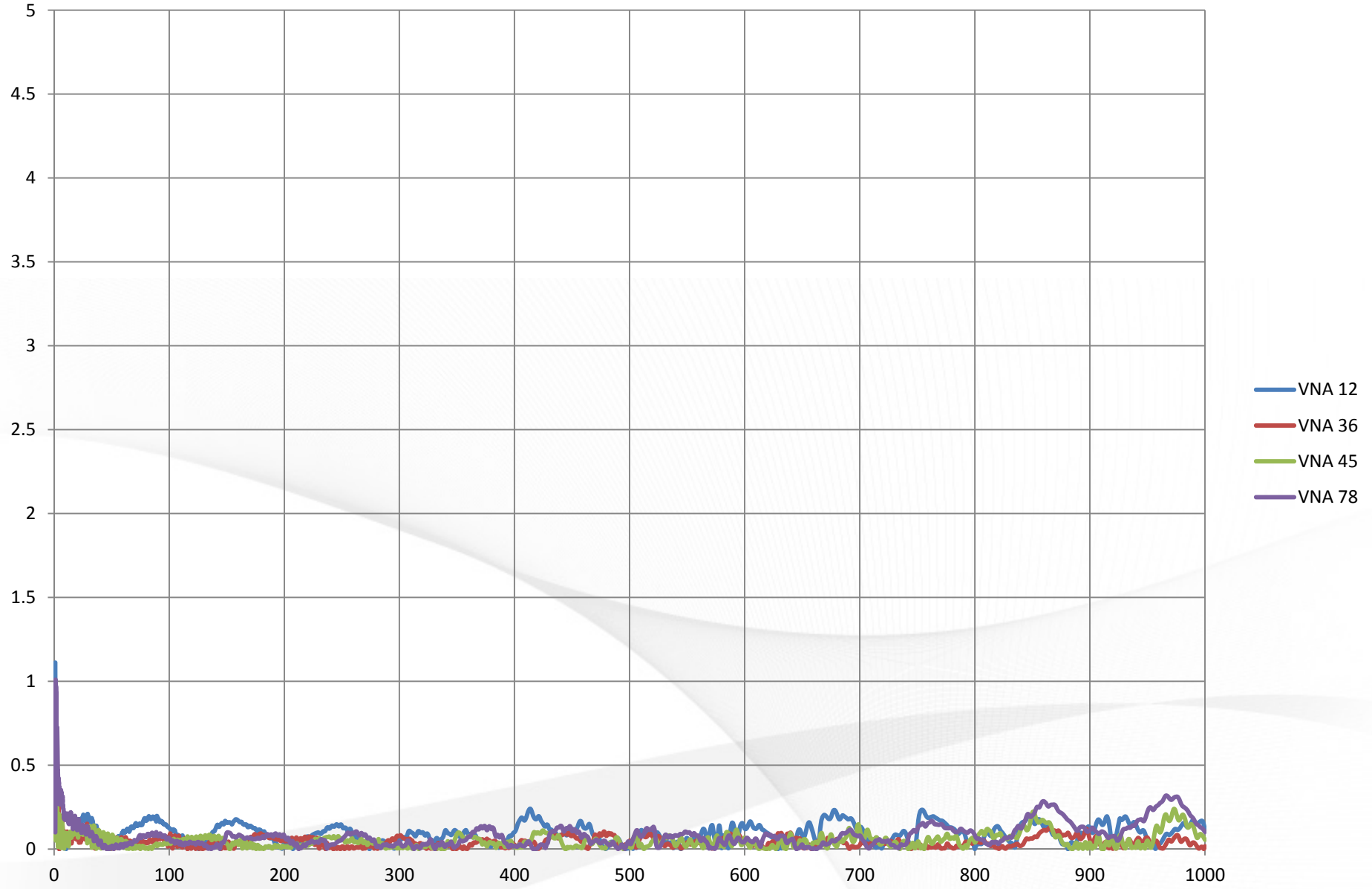






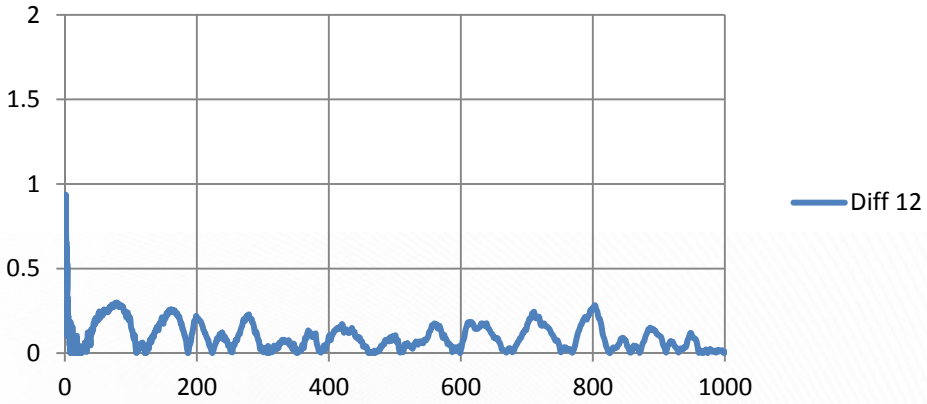


30M CHANNEL PL ACCURACY

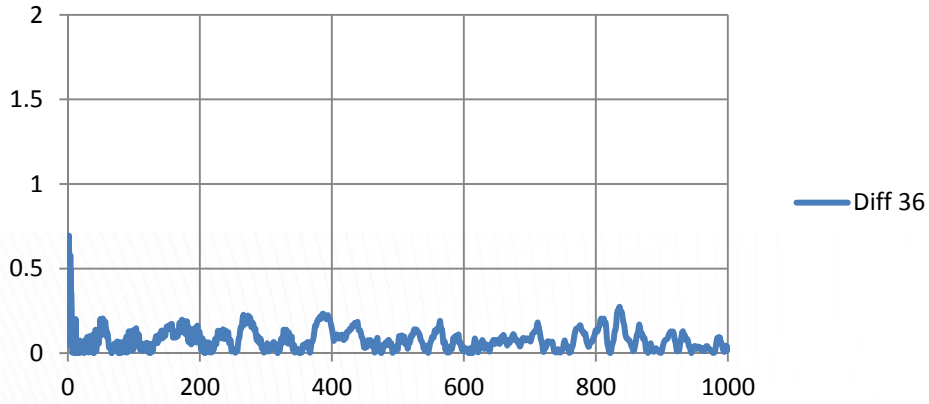


TCL IMPROVEMENT FOR C6A LIMITS

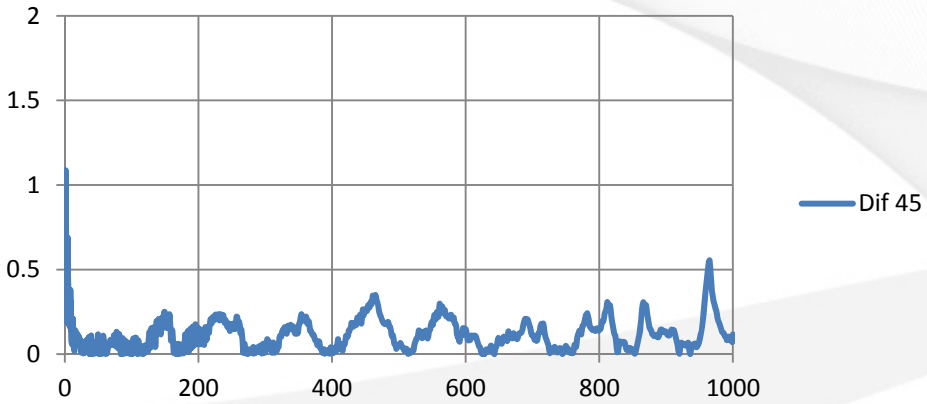
TCL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 12)



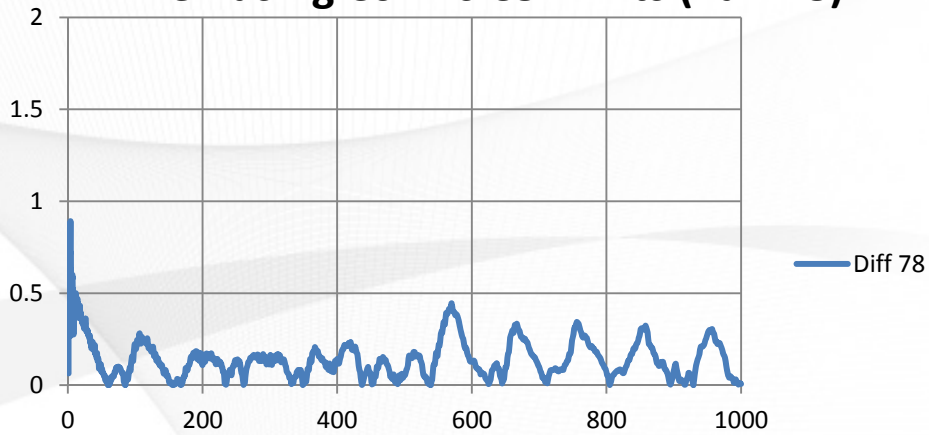
TCL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 36)



TCL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 45)



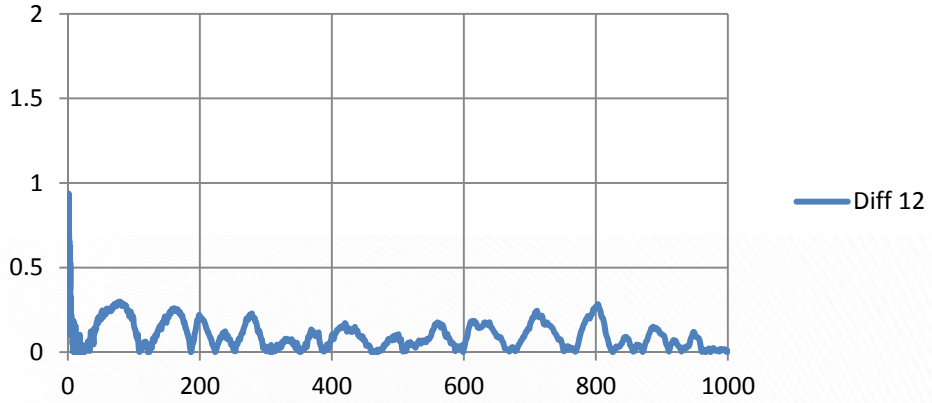
TCL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 78)



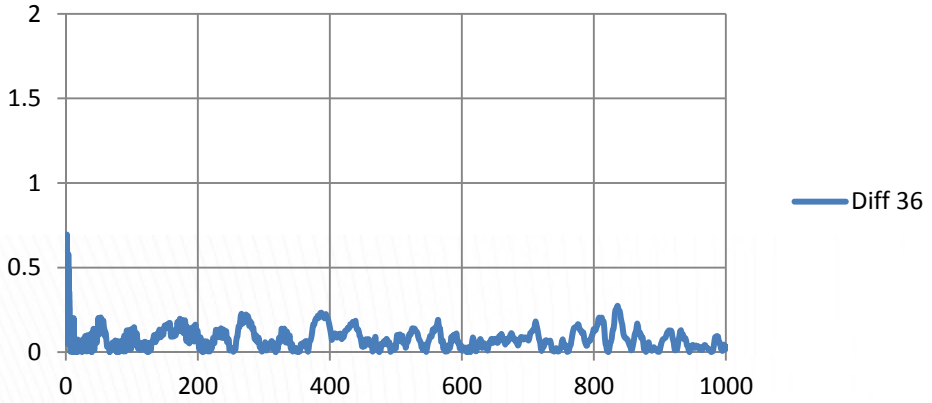
Data shown was produced using 30m Channel Results.

ELTCTL IMPROVEMENT FOR C6A LIMITS

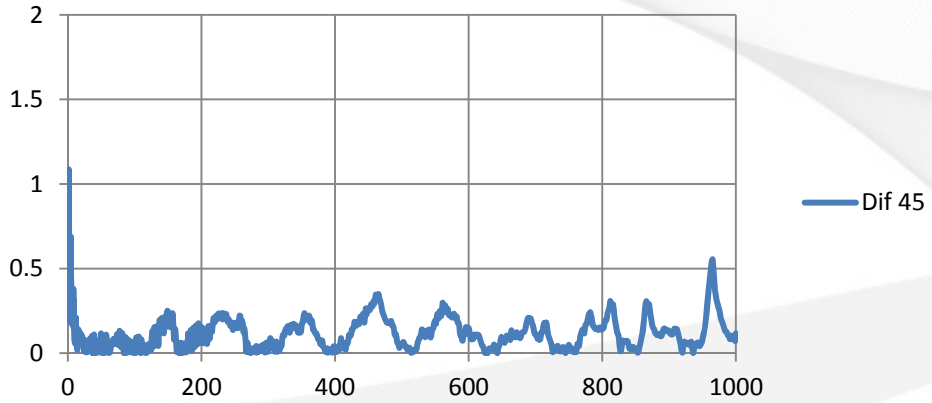
ELTCTL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 12)



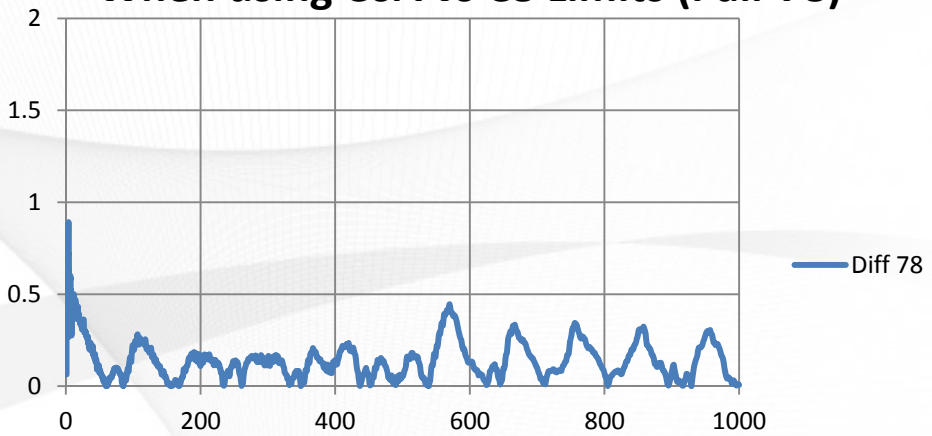
ELTCTL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 36)



ELTCTL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 45)



ELTCTL Accuracy@Limit Improvement When using C6A vs C8 Limits (Pair 78)



OTHER BALANCE TESTS

- Although the TIA568 series of documents only specifies TCL and ELTCTL, other mixed mode measurements are possible using field testers. These include:-
  - RLcc (Common Mode Return Loss)
  - NEXTcd (Intermodal NEXT)
  - ELFEXTcd (Intermodal ELFEXT)

CONCLUSIONS

- Currently specified channel balance requirements can be measured in the field.
- Balance measurements can be performed on Permanent links and channels. *(PL measurements produce better accuracies.)*
- Accuracy improves significantly, when calculated at the limit for the cable under test (C6A) vs C8 limits.
- Additional balance properties not currently specified by the TIA 568 Series could also be tested in the field.

THANK YOU

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ADDITIONAL RESULTS FOR 60M AND 90M CONFIGURATIONS

Available from the authors upon request.

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