RTPGE Prototype Channel & Alien Test Results

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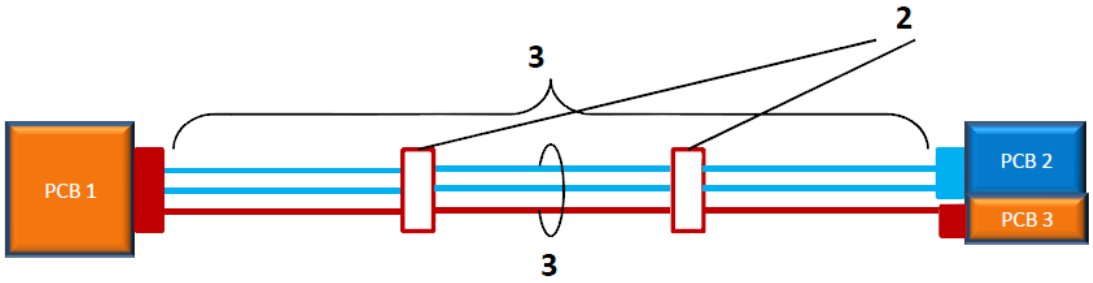
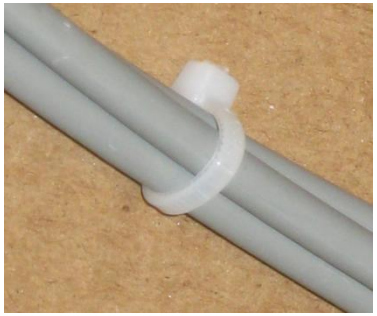
Recommended worst case - common scenario 1A

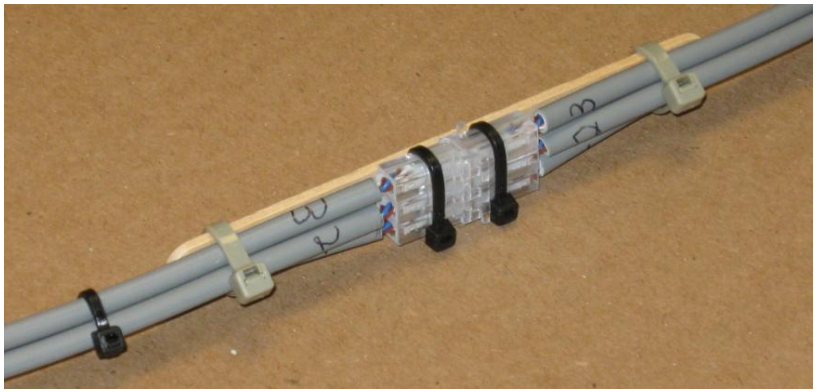
Three channels each with 2 inline connections

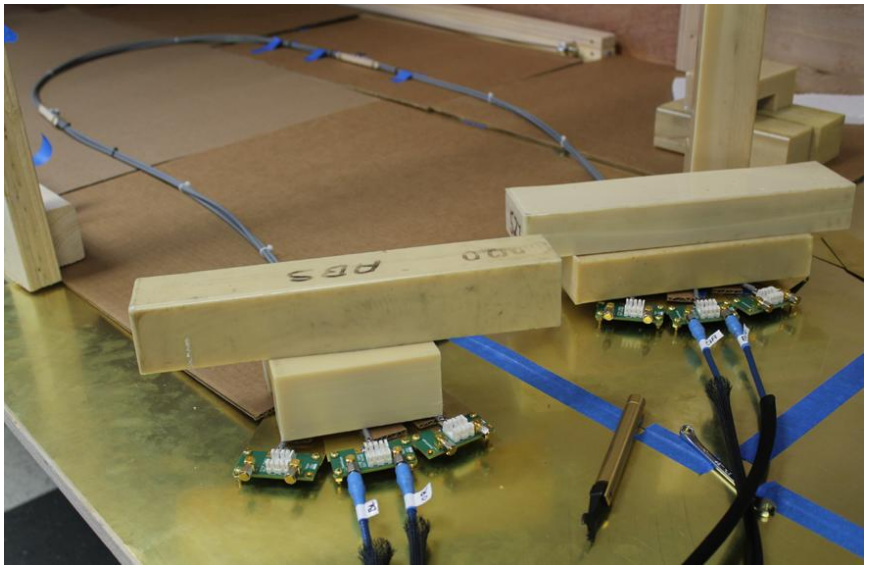


Prototype cable bundling

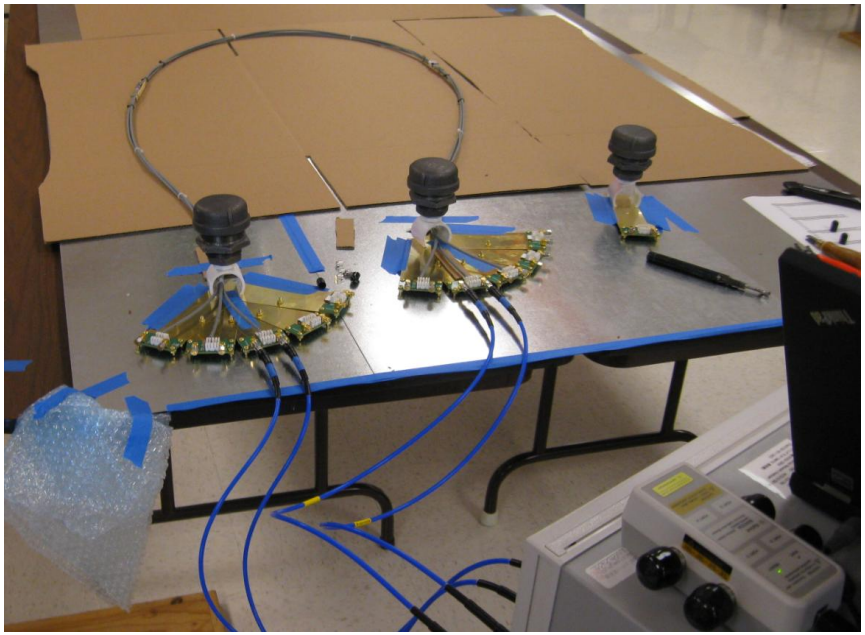


Prototype Connector Pack

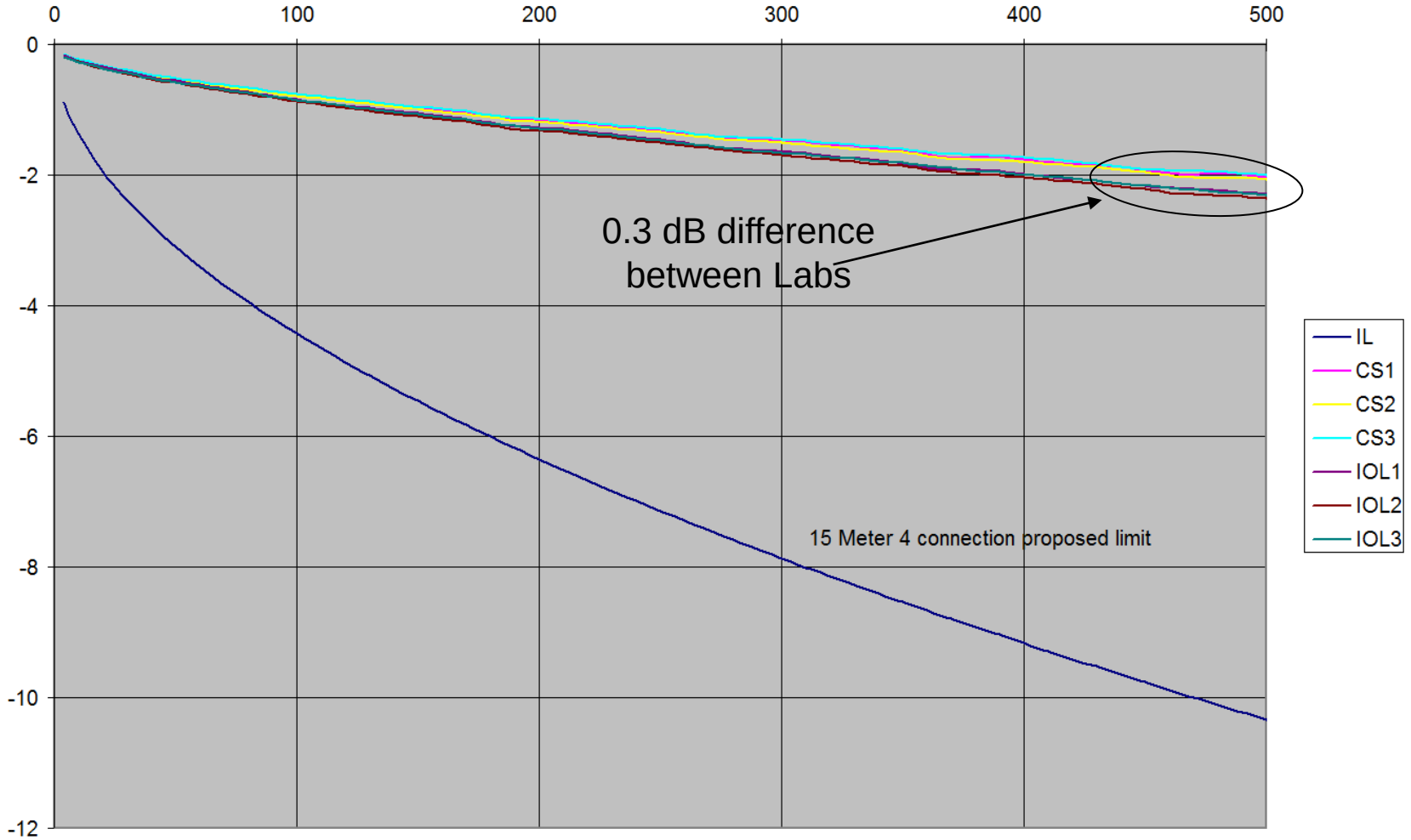


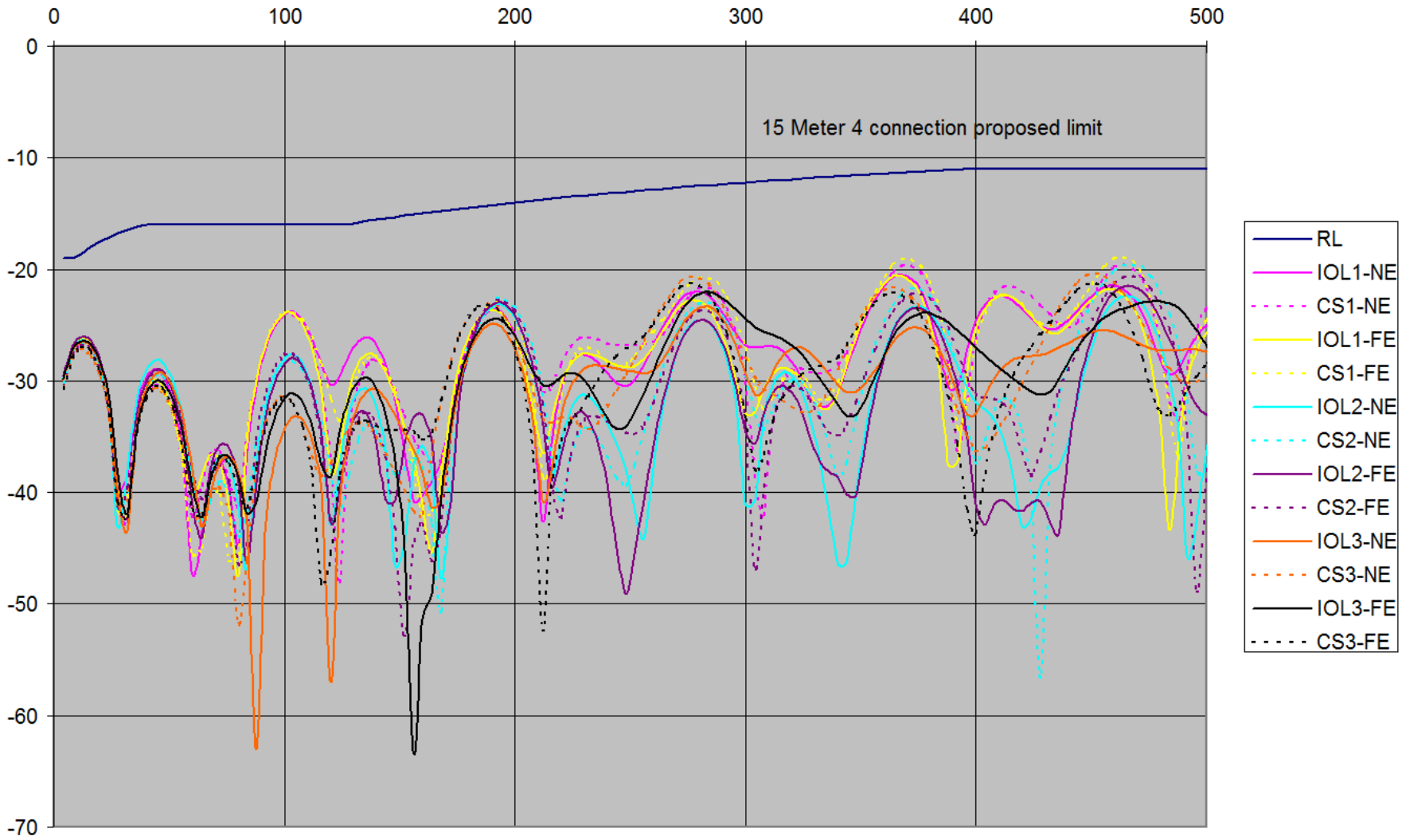


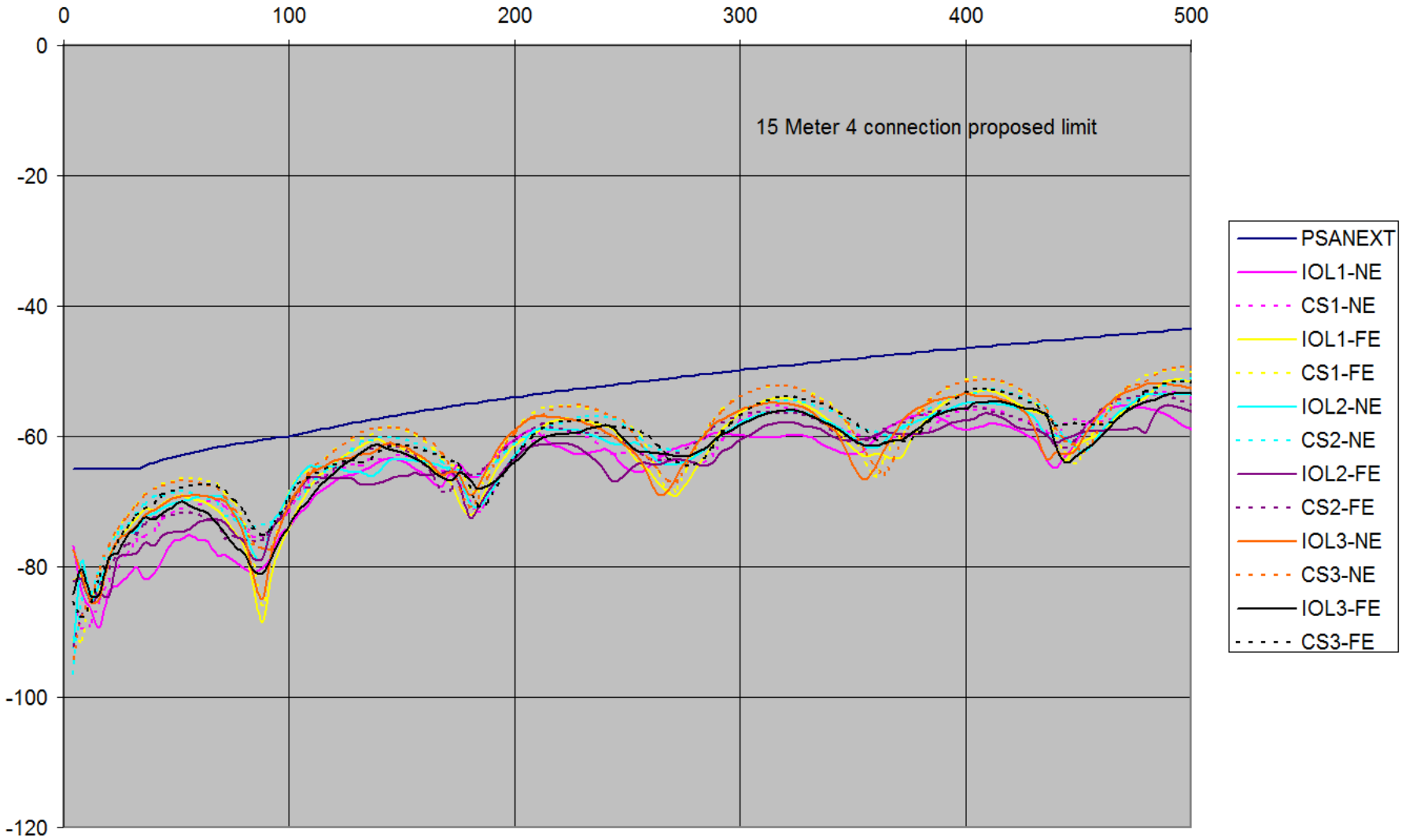
CommScope Test Setup

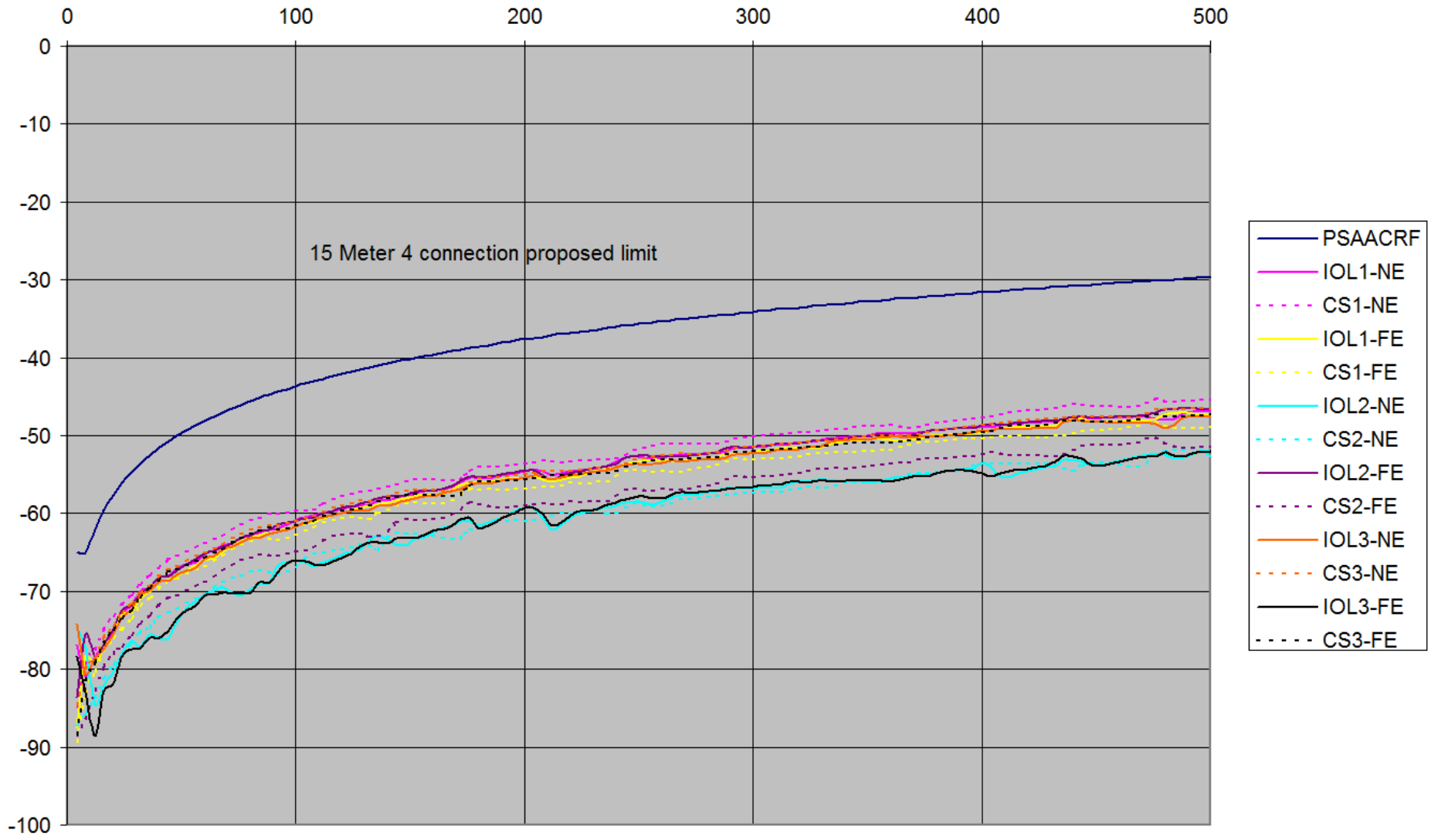


UNH-IOL Test Setup


0
100
200
300
400
500
0
-2
-4
-6
-8
-10
-12
0.3 dB difference between Labs
15 Meter 4 connection proposed limit
IL
CS1
CS2
CS3
IOL1
IOL2
IOL3

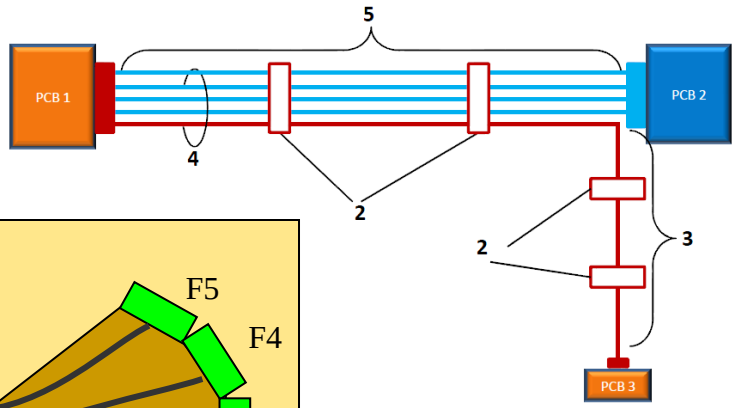

0
100
200
300
400
500
0
-10
-20
-30
-40
-50
-60
-70
15 Meter 4 connection proposed limit
RL
IOL1-NE
CS1-NE
IOL1-FE
CS1-FE
IOL2-NE
CS2-NE
IOL2-FE
CS2-FE
IOL3-NE
CS3-NE
IOL3-FE
CS3-FE

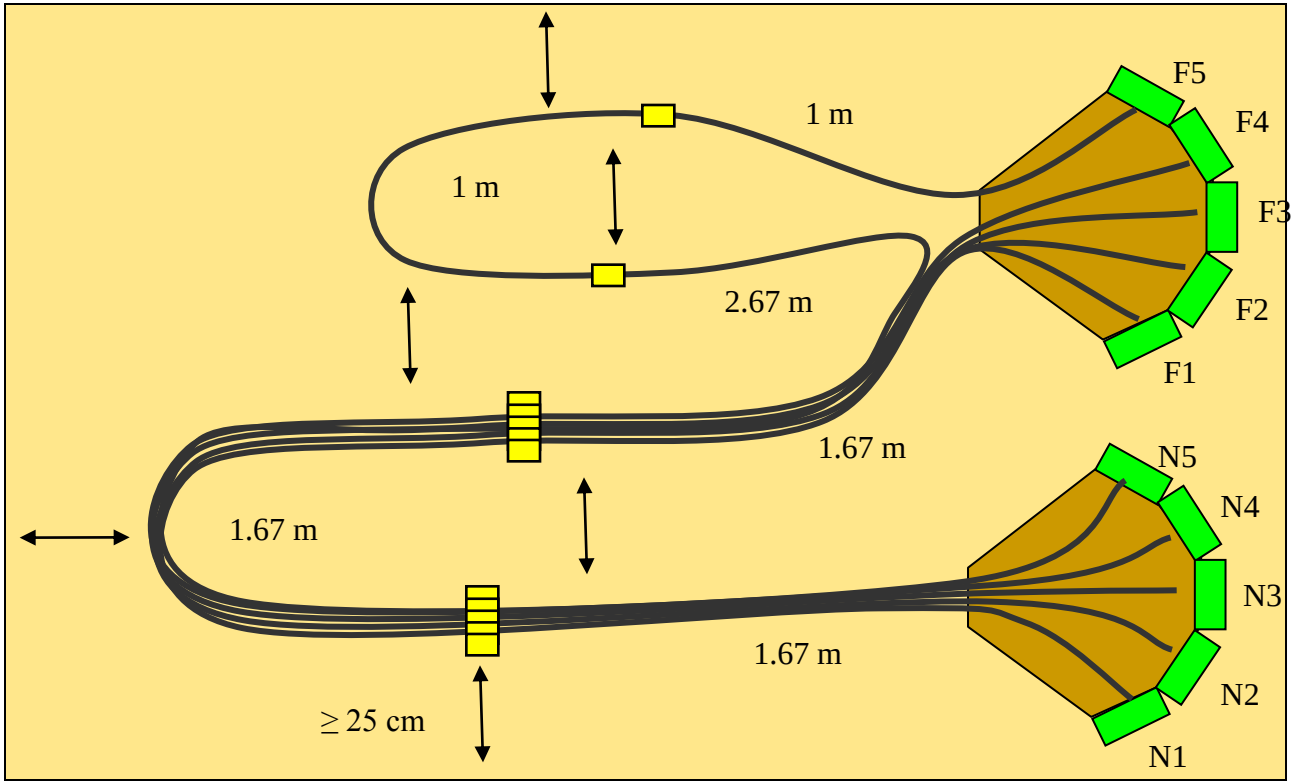

0
100
200
300
400
500
0
-20
-40
-60
-80
-100
-120
15 Meter 4 connection proposed limit
PSANEXT
IOL1-NE
CS1-NE
IOL1-FE
CS1-FE
IOL2-NE
CS2-NE
IOL2-FE
CS2-FE
IOL3-NE
CS3-NE
IOL3-FE
CS3-FE


0
100
200
300
400
500
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
15 Meter 4 connection proposed limit
PSAACRF
IOL1-NE
CS1-NE
IOL1-FE
CS1-FE
IOL2-NE
CS2-NE
IOL2-FE
CS2-FE
IOL3-NE
CS3-NE
IOL3-FE
CS3-FE

Recommended Worst Case -Special scenario 6

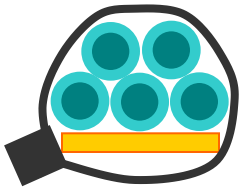
5 Channels



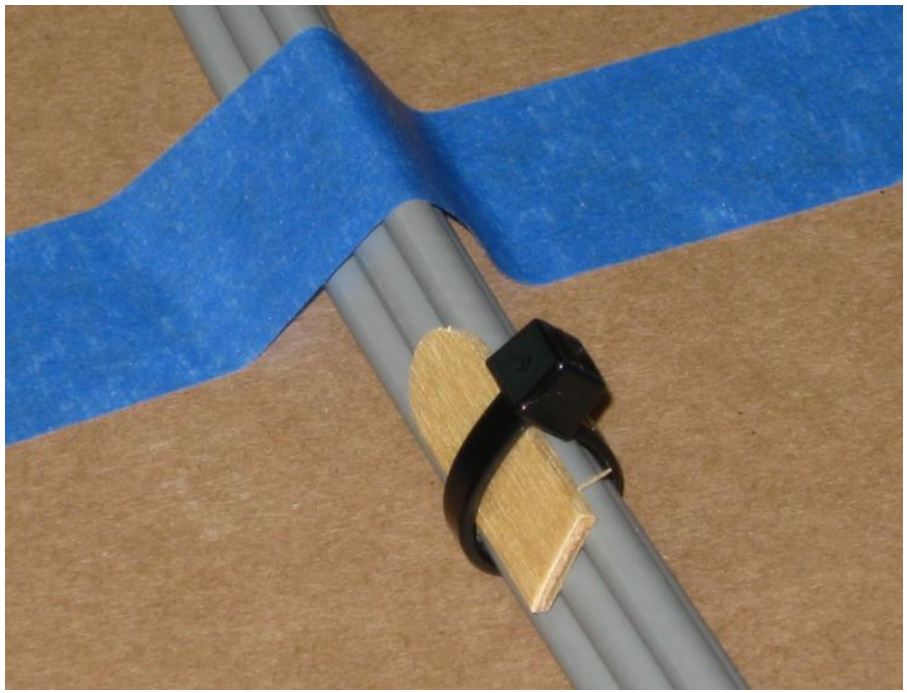


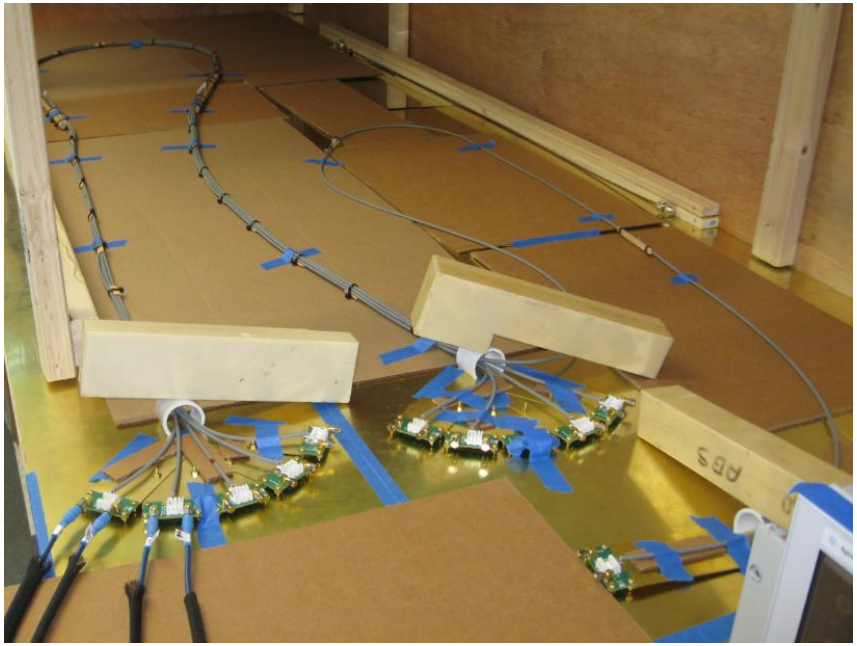
Proposed Layout

The original proposal for 5 channel bundling is a “4 around the long 1” using a foam tube, but this was not stable enough

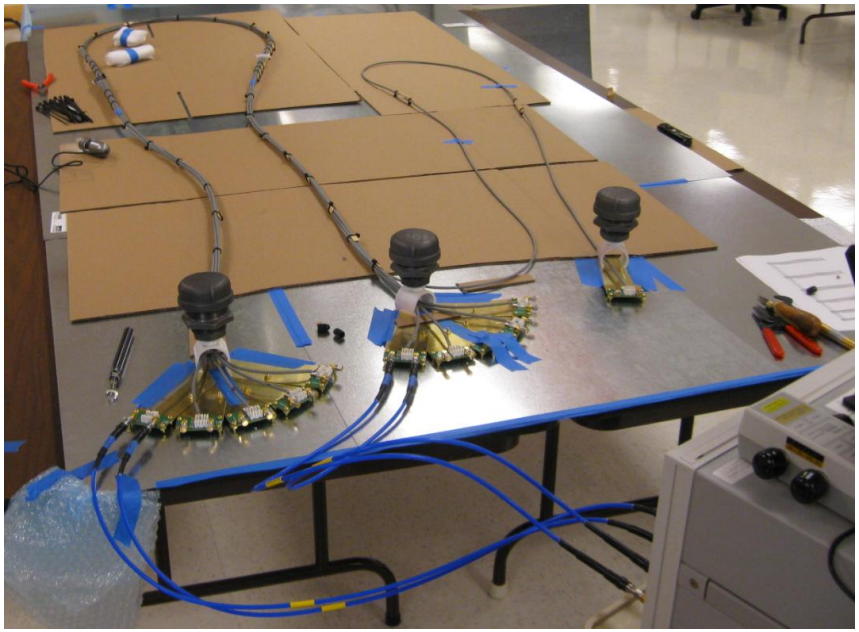


A flat stick does a better job of holding the 4 in place with a tie wrap





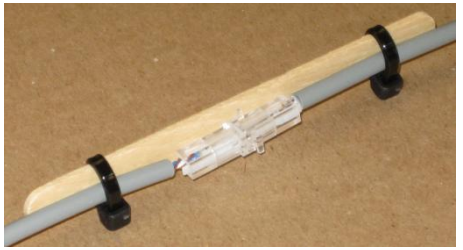
CommScope Test Setup

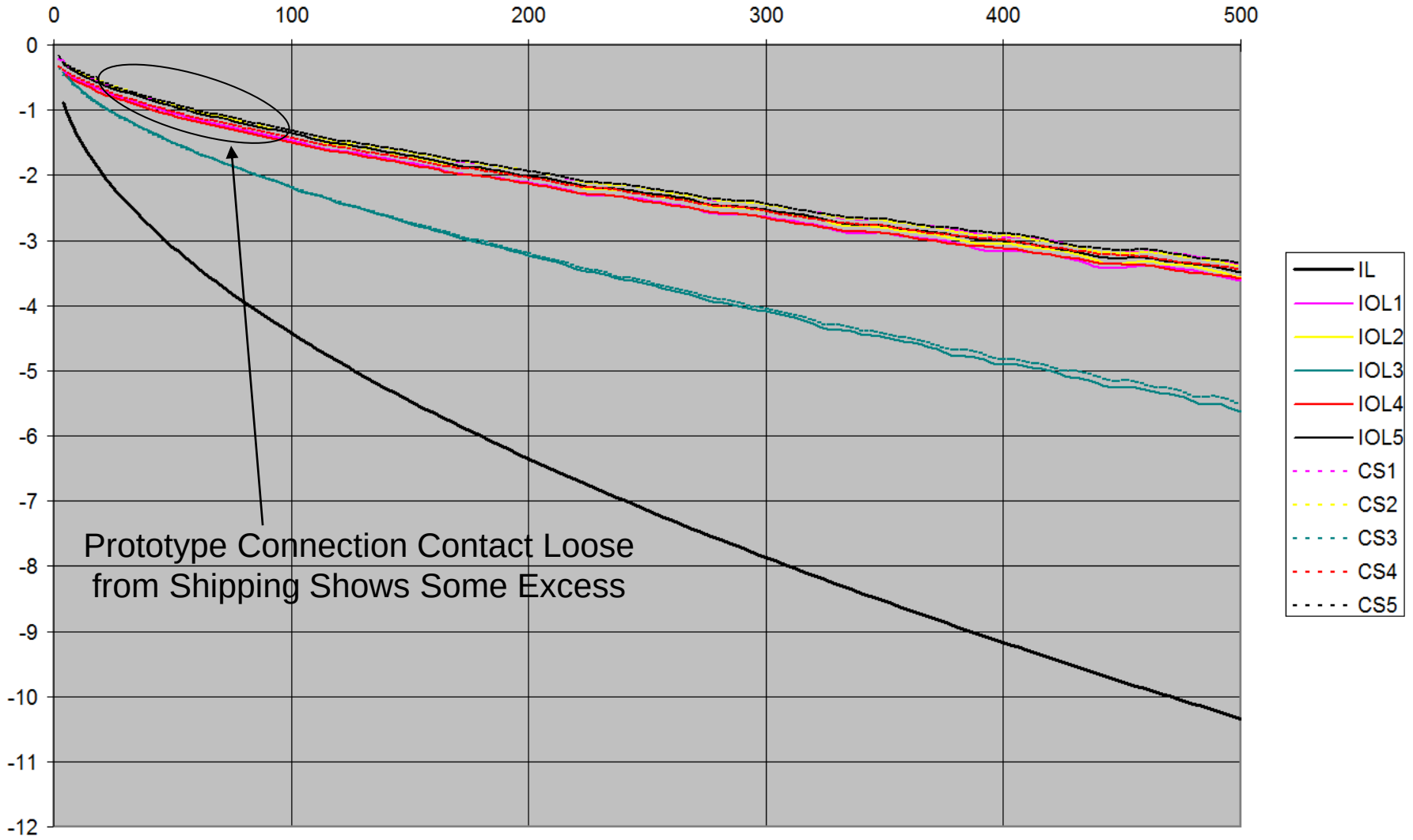


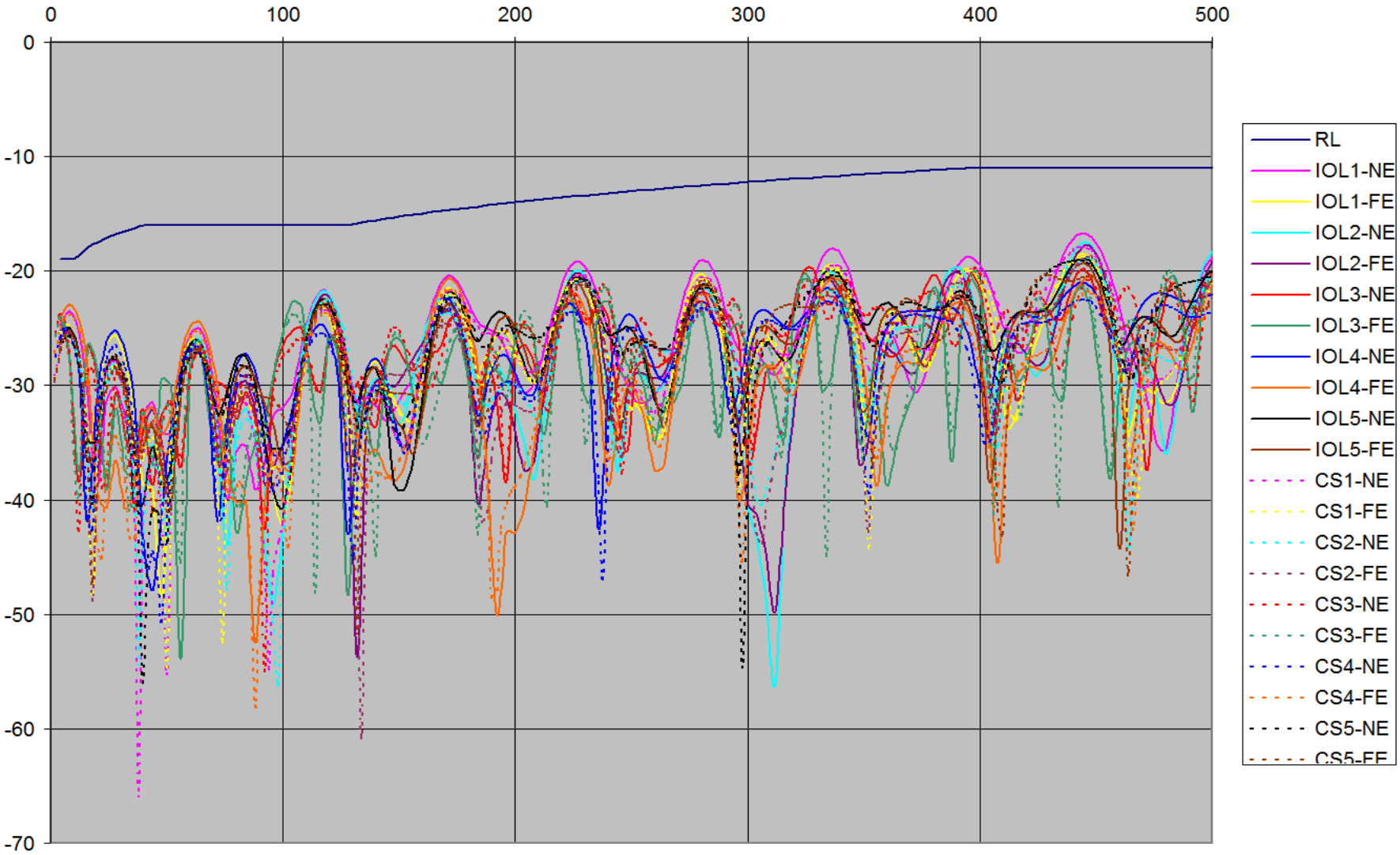
UNH-IOL Test Setup

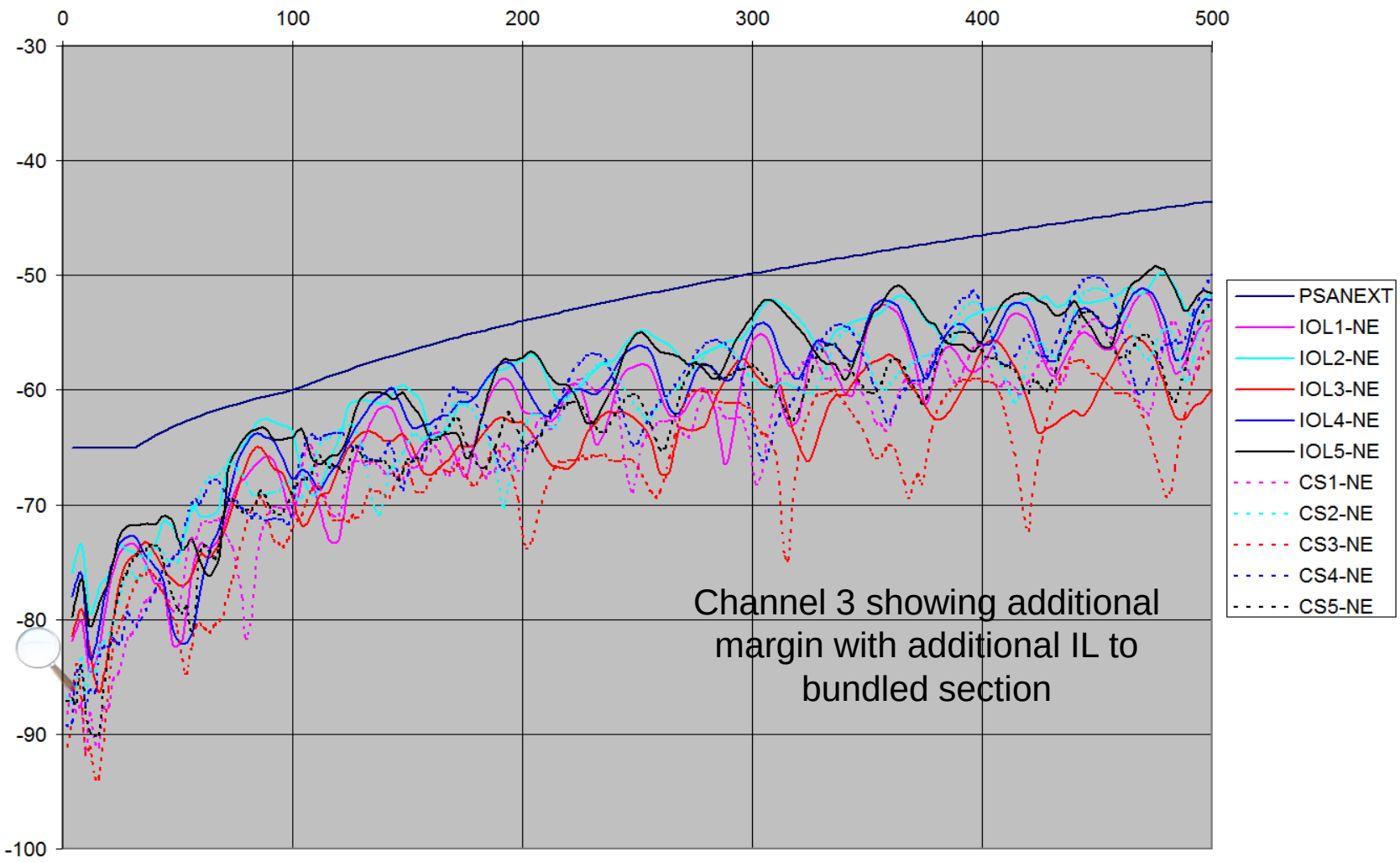
Prototype connector 5 Pack

Single

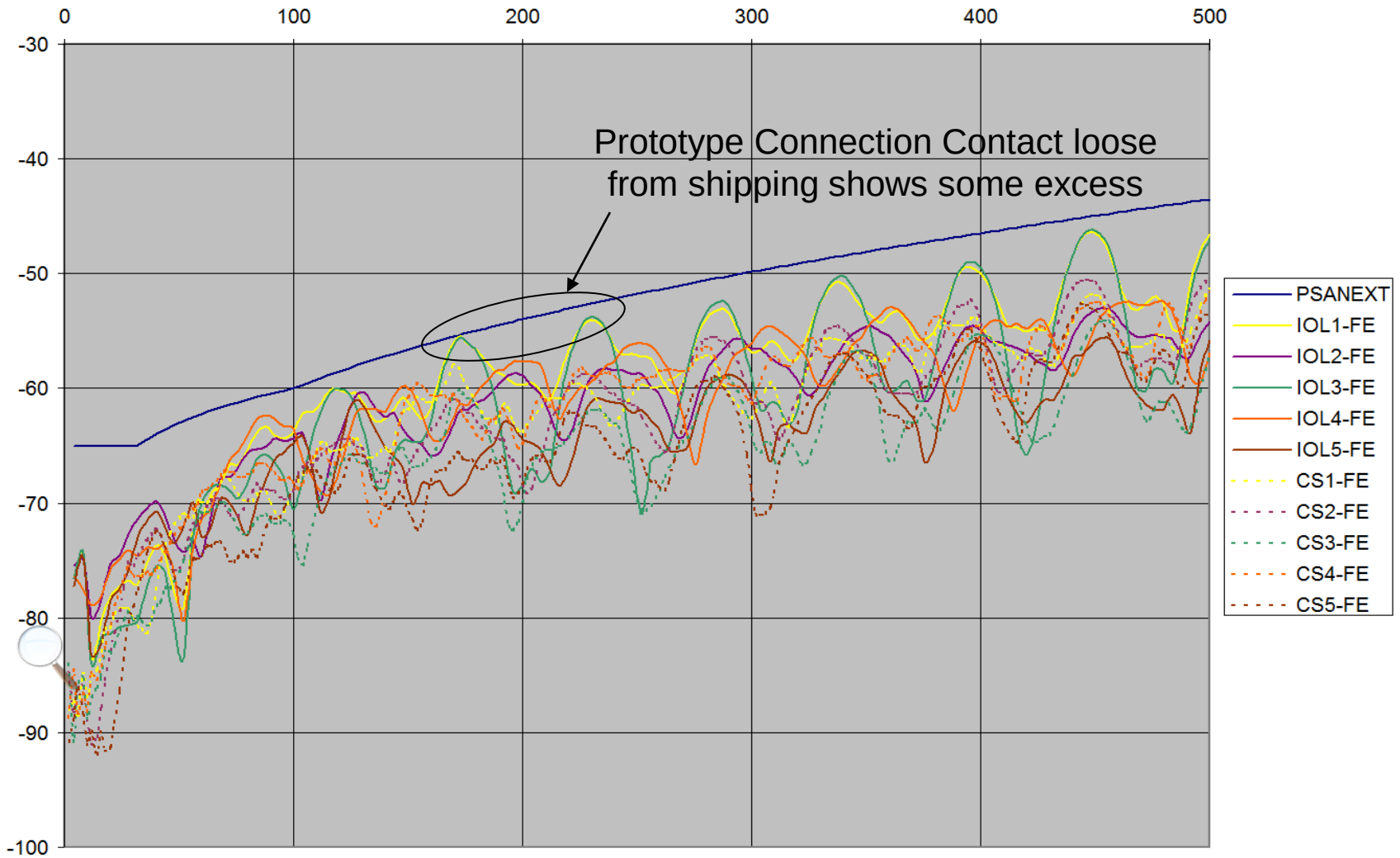



0
100
200
300
400
500
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
Prototype Connection Contact Loose from Shipping Shows Some Excess
IL
IOL1
IOL2
IOL3
IOL4
IOL5
CS1
CS2
CS3
CS4
CS5

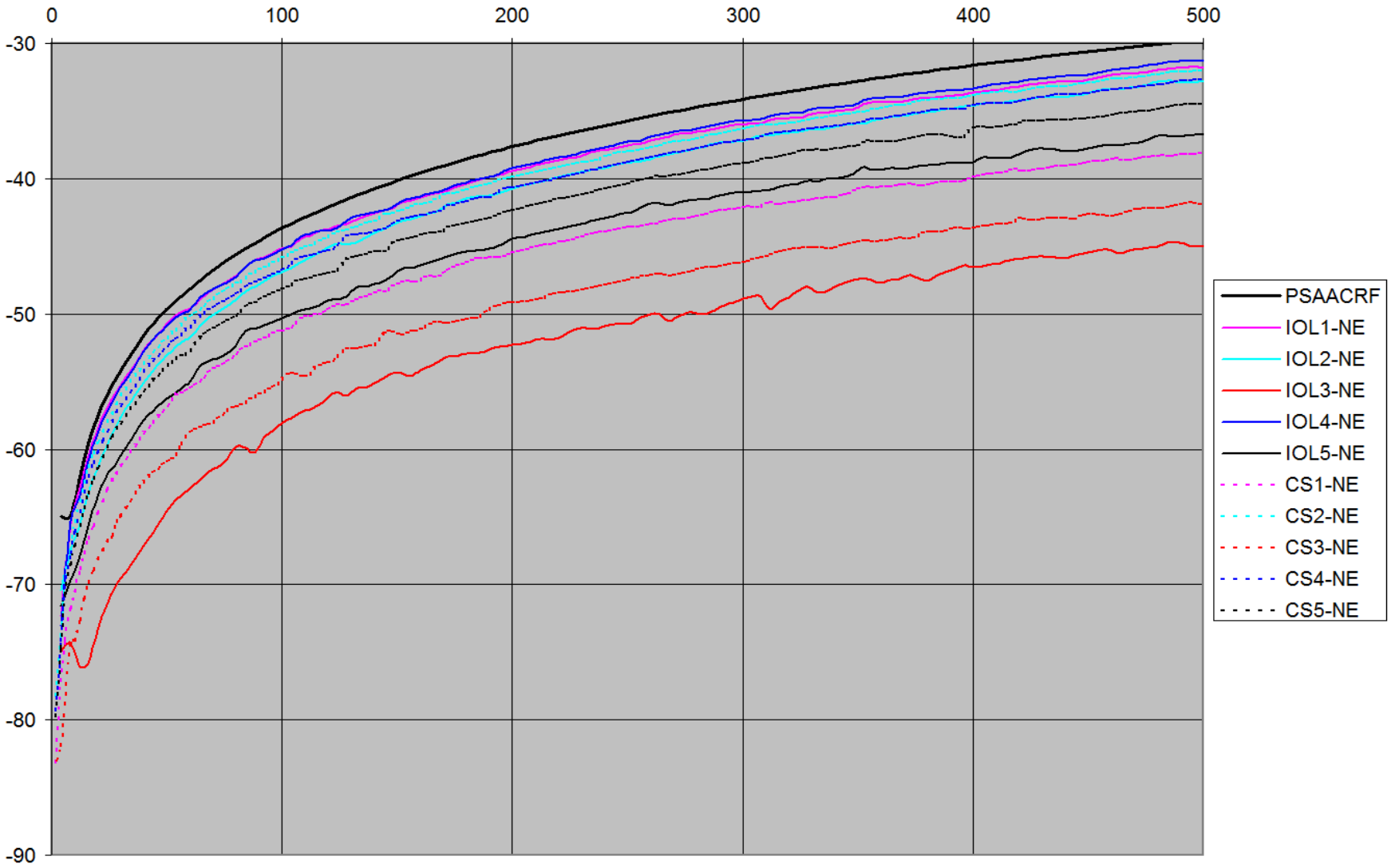

0
100
200
300
400
500
0
-10
-20
-30
-40
-50
-60
-70
RL
IOL1-NE
IOL1-FE
IOL2-NE
IOL2-FE
IOL3-NE
IOL3-FE
IOL4-NE
IOL4-FE
IOL5-NE
IOL5-FE
CS1-NE
CS1-FE
CS2-NE
CS2-FE
CS3-NE
CS3-FE
CS4-NE
CS4-FE
CS5-NE
CS5-FE

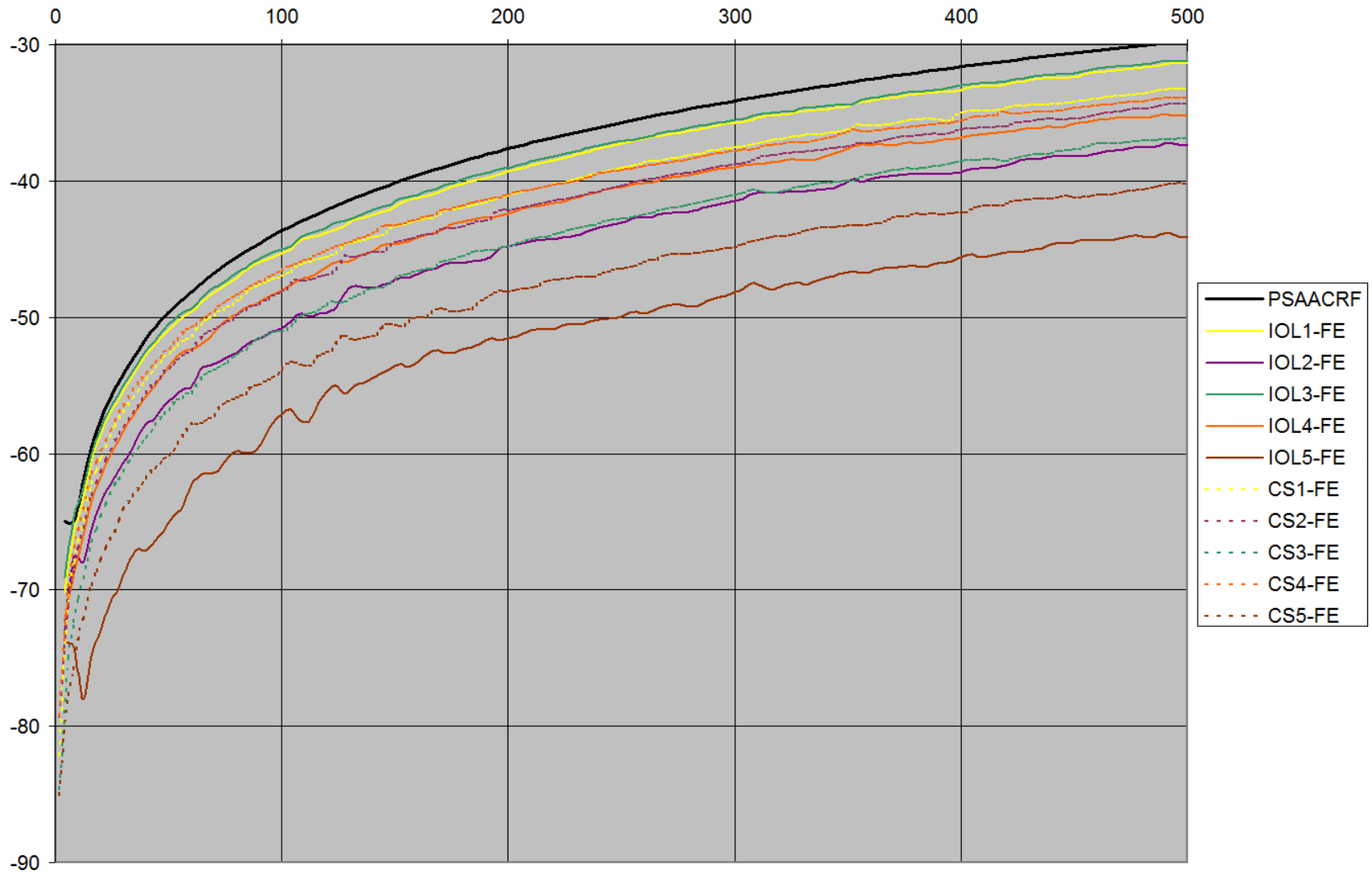


Near End 5 Channel Bundle Near End PSANEXT Comparison



Far End 5 Channel Bundle Far End PSANEXT Comparison


0
100
200
300
400
500
-30
-40
-50
-60
-70
-80
-90
PSAACRF
IOL1-NE
IOL2-NE
IOL3-NE
IOL4-NE
IOL5-NE
CS1-NE
CS2-NE
CS3-NE
CS4-NE
CS5-NE


0
100
200
300
400
500
-30
-40
-50
-60
-70
-80
-90
PSAACRF
IOL1-FE
IOL2-FE
IOL3-FE
IOL4-FE
IOL5-FE
CS1-FE
CS2-FE
CS3-FE
CS4-FE
CS5-FE

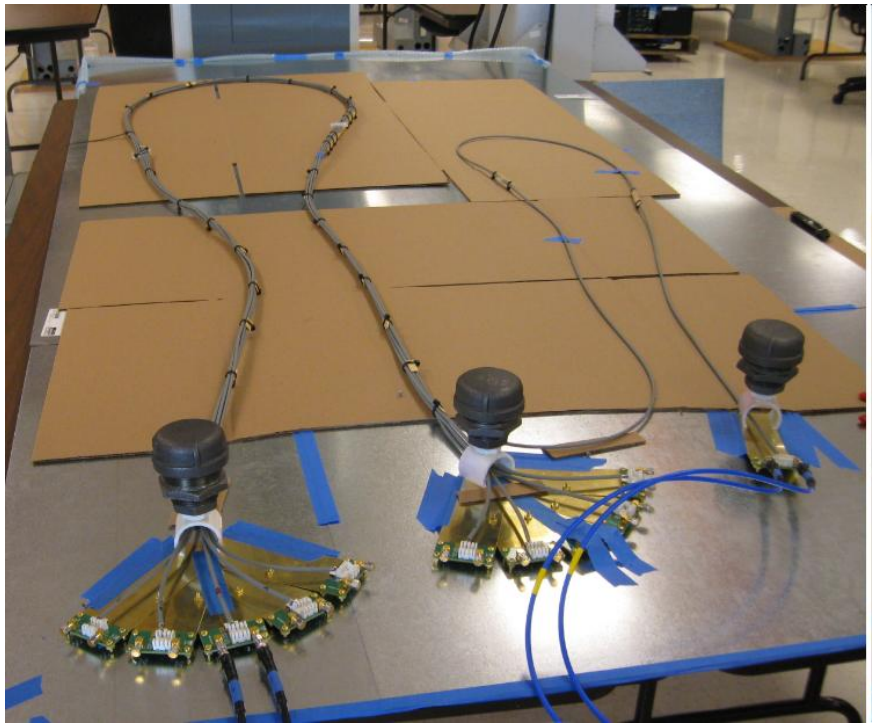
Key Points

- The 5 Channel bundling was modified from the previous proposal for improved stability in testing.

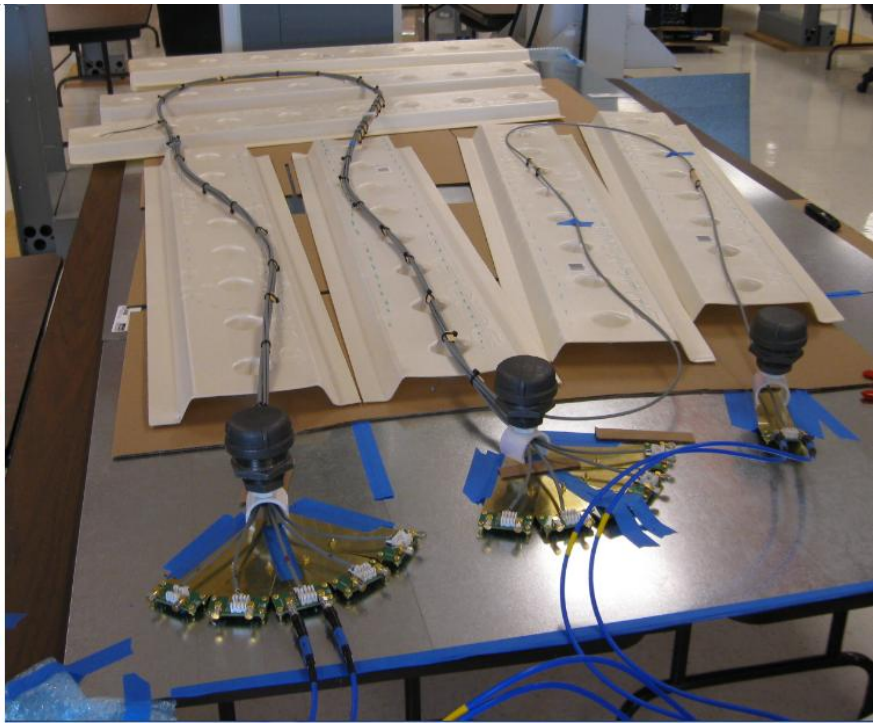
- Other than some minor shifts in IL and ANEXT due to a loose contact within one of the prototype connectors, comparison of results between Labs is excellent.

The 4 mm height recommendation (vs. 5 cm) was examined at UNH using the 5 channel bundle

4 mm height



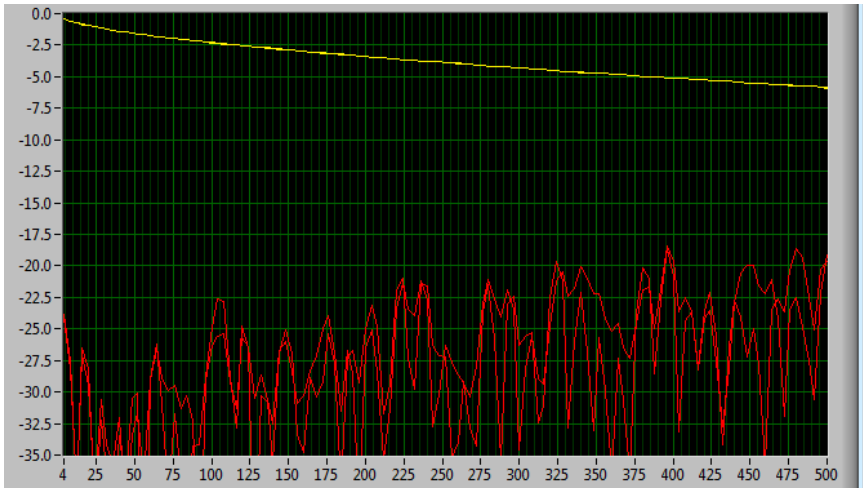
44 mm height



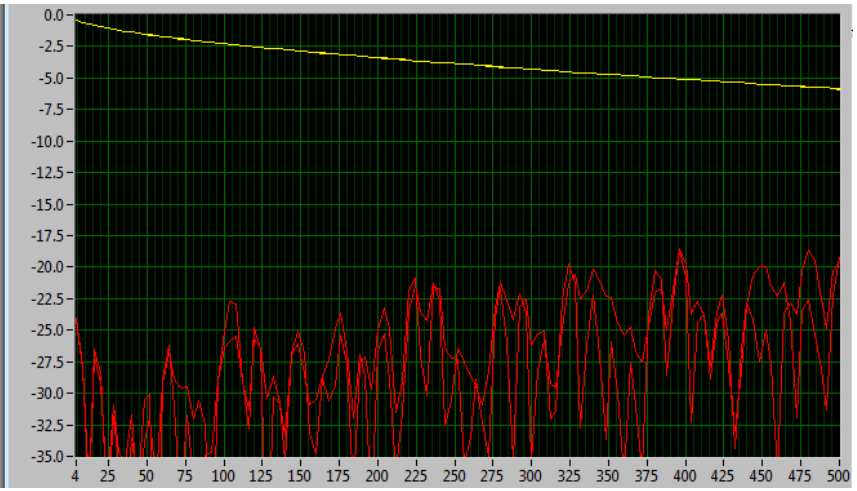
Compared:

- Channel 3 IL and RL
- Channel 3 - 4 Near End ANEXT

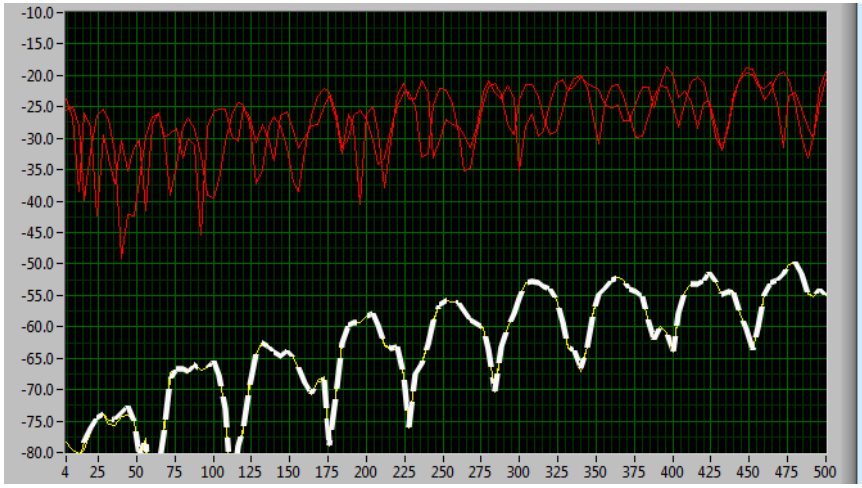
CH3 IL & RL @ 4 mm



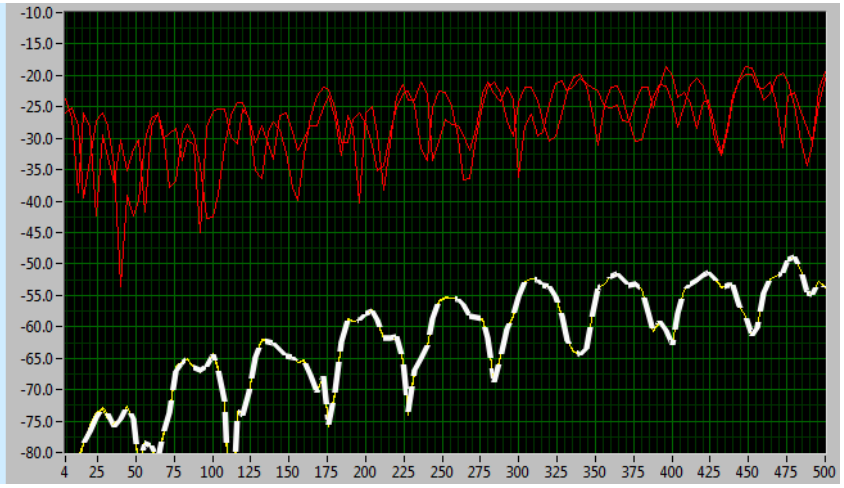
CH3 IL & RL @ 44 mm



CH3-4 ANEXT @ 4 mm

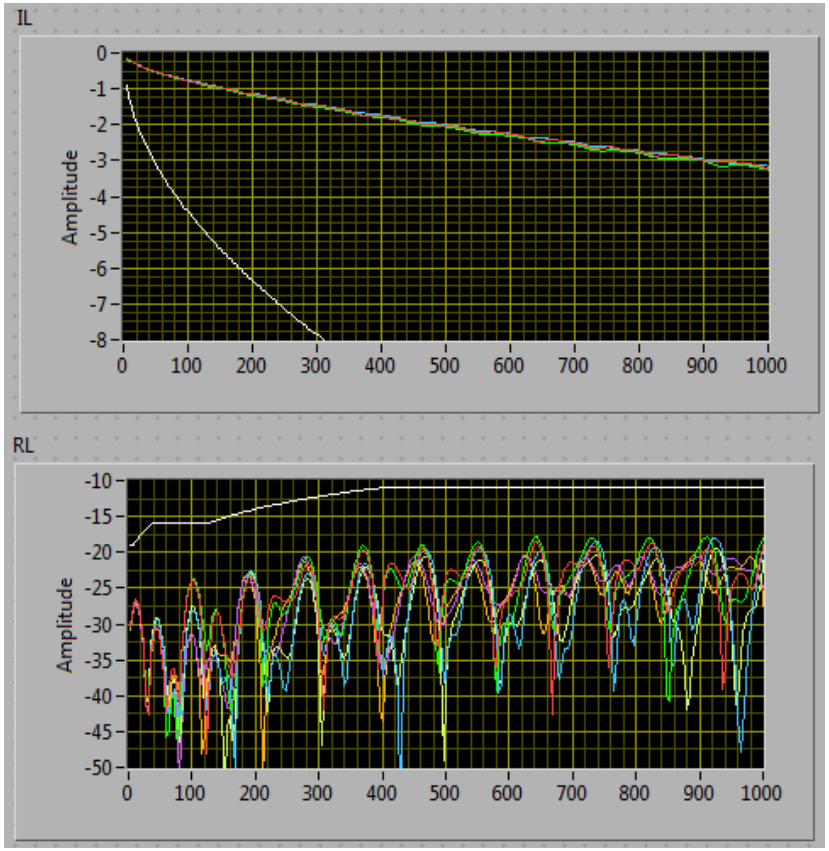


CH3-4 ANEXT @ 44 mm

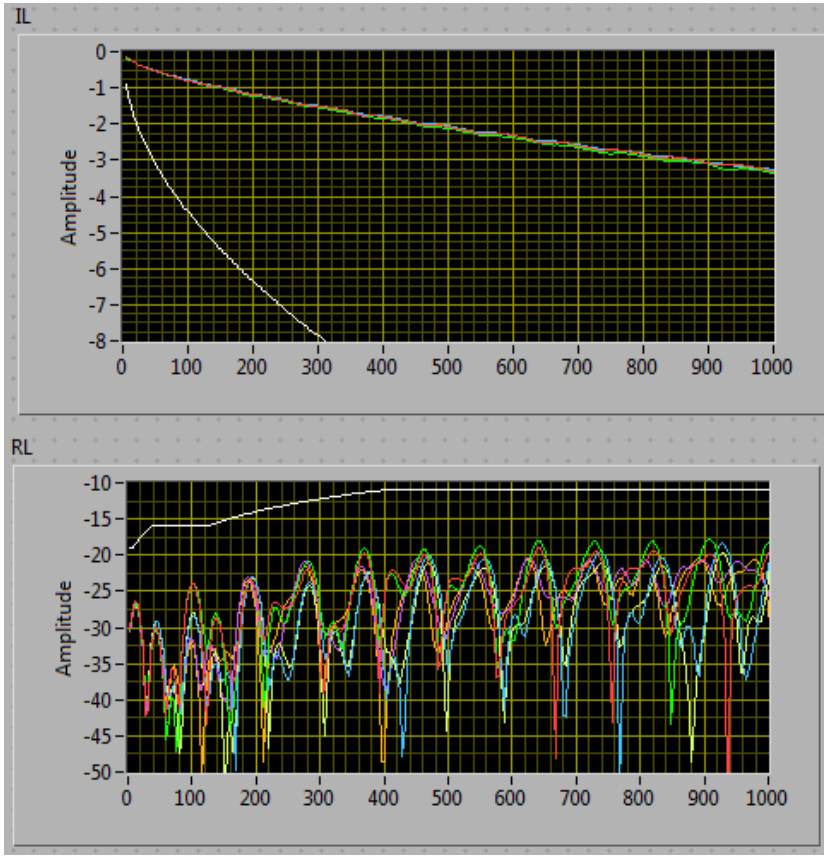


Similar height comparison was done at CommScope Labs on the complete measurement set of the 3 channel bundle

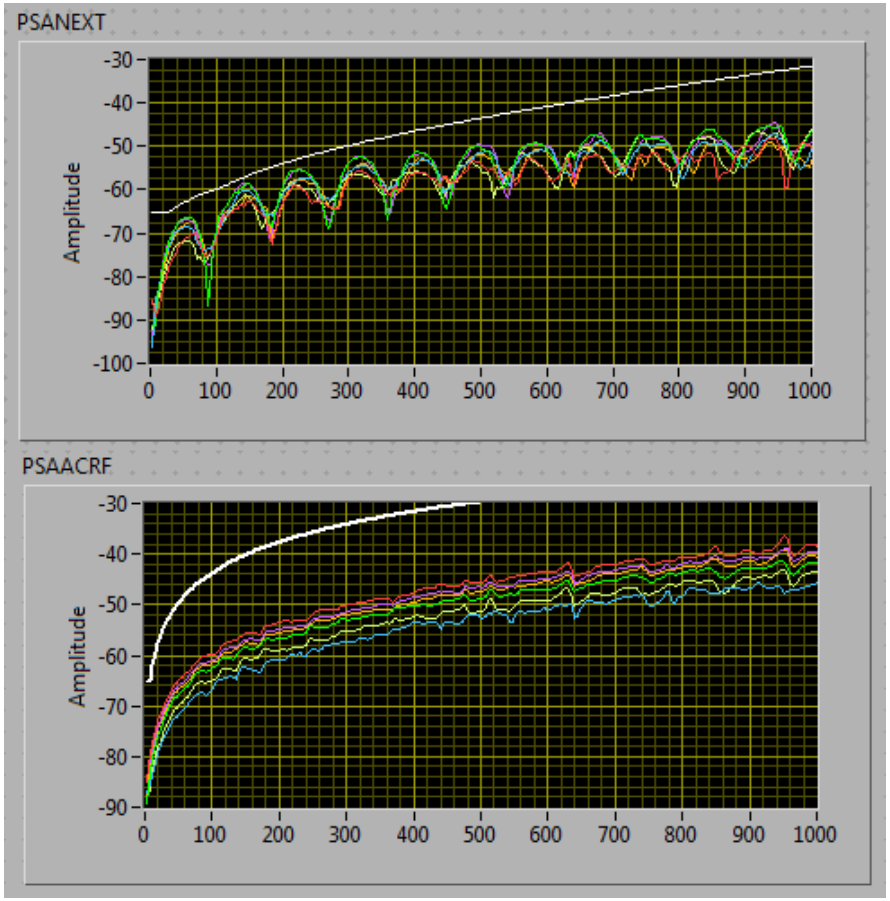
4 mm



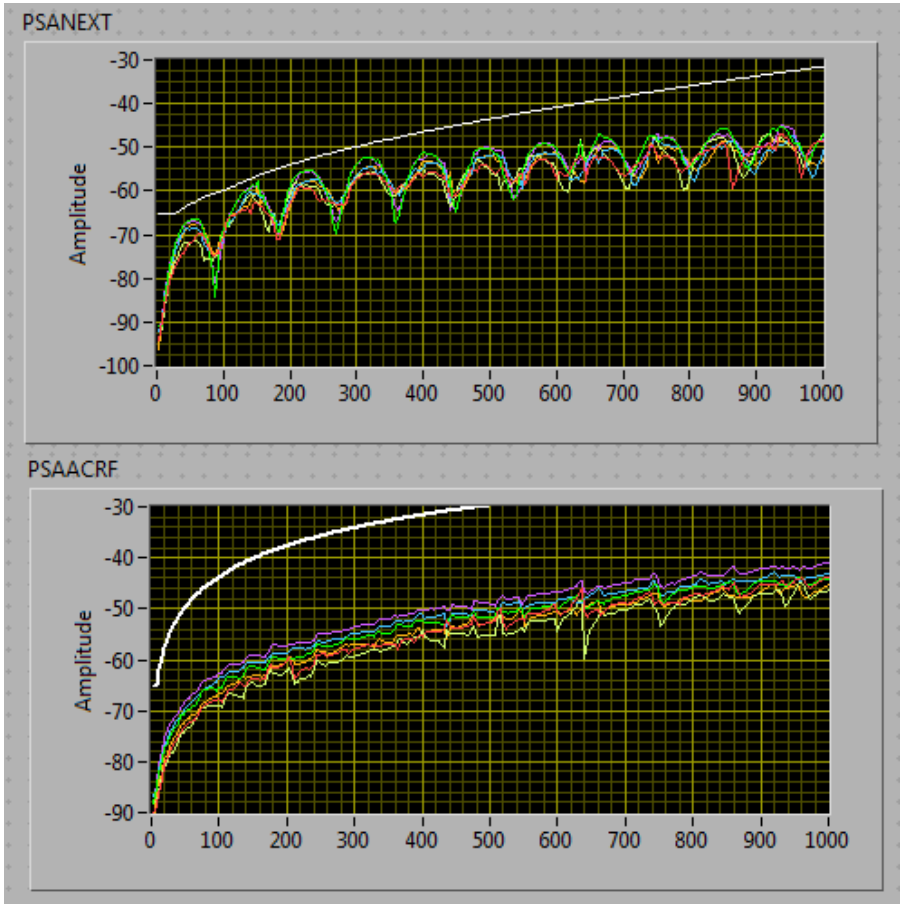
40 mm



4 mm


PSANEXT
Amplitude
-30
-40
-50
-60
-70
-80
-90
-100
0
100
200
300
400
500
600
700
800
900
1000
PSAACRF
Amplitude
-30
-40
-50
-60
-70
-80
-90
0
100
200
300
400
500
600
700
800
900
1000

40 mm


PSANEXT
Amplitude
-30
-40
-50
-60
-70
-80
-90
-100
0
100
200
300
400
500
600
700
800
900
1000
PSAACRF
Amplitude
-30
-40
-50
-60
-70
-80
-90
0
100
200
300
400
500
600
700
800
900
1000

Summary

- The stripline height of 5 cm over the ground plane is necessary for the stripline measurement because the stripline generates a strong EM field underneath where the victim device or DUT is placed for evaluation. If the DUT is moved down to the 4 mm height, the impressed field will be significantly lower and would provide much less coupling to the DUT. With this test the goal is to maximize it for a given amount of power injected onto the stripline.

- The network analyzer tests as we are promoting (including the 4mm height) are better suited for measuring cable and channel parameters, including alien crosstalk. These tests will not however replace EMC measurements such as stripline or BCI.

Summary

- The primary reason to get closer to the ground is in supporting the longer channel runs to be laid out on smaller ground planes and with better proximity to network analyzer ports. The 5 channel 8 meter test requires network analyzer attachment points not only at the bundle ends, but also at the longer channel's extension end. So these points along the bundle must get close to each other for testing, and a 5 cm height risks allowing cross-coupling that can alter results. The 4 mm height "captures" the fields around the cables better allowing lengths to be more reasonably placed as shown. While it is true that some cable parameters are influenced by shorter distance to ground, they turn out to be inconsequential and strongly overshadowed by other factors such as the natural common mode impedance mismatching and the bundling of other channels in close proximity.

- In concept, there may be an optimum height, although it is a soft optimum and data so far indicates that getting closer than 4 mm begins to become sensitive to placement accuracy, while going out to 4 cm raises coupling and also begins to open up unstable antennae-like effects. 4 mm height appears to be very stable, and data so far shows consistent results with 4 cm measurements.

Conclusions

- Recommended test configurations demonstrated
- Excellent agreement between labs
- 4 mm reference height confirmed as superior for channel and alien measurements