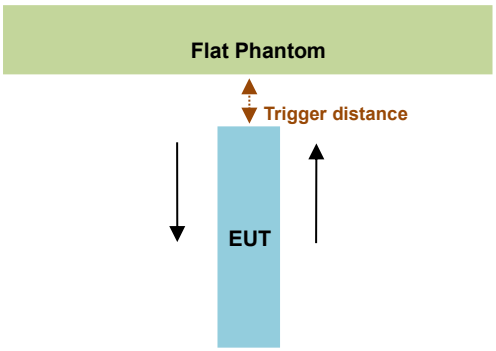
Appendix D. Proximity Sensor Verification

<Proximity Sensor Triggering Distance (KDB 616217 D04 section 6.2)>:

For the device is fully integrated, touch sensing capacitive sensor. It uses a charge transfer capacitive acquisition method that is capable of near range proximity detection. In this device offers a state of the art capacitive sensing engine with an embedded sampling capacitor and voltage regulator allowing the overall solution cost to be reduced and improving system immunity in noisy environments.
Proximity sensor triggering distance testing was performed according to the procedures outlined in KDB 616217 D04 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed. The details are illustrated as following, and the shortest triggering distances were reported and used for SAR assessment.
In the preliminary triggering distance testing, the tissue-equivalent medium for different frequency bands were used for verification; no other frequency bands tissue-equivalent medium was found to result in shortest triggering distance than that for 1900MHz, and the tissue-equivalent medium for 1900MHz was used for formal proximity sensor triggering testing.



Proximity Trigger Distance										
Position	Front		Back		Left Side		Top Side		Bottom Side	
Minimum (mm)	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away	Moving towards	Moving away
	40	39	30	34	31	31	35	37	17	18

Proximity sensor power reduction in open mode

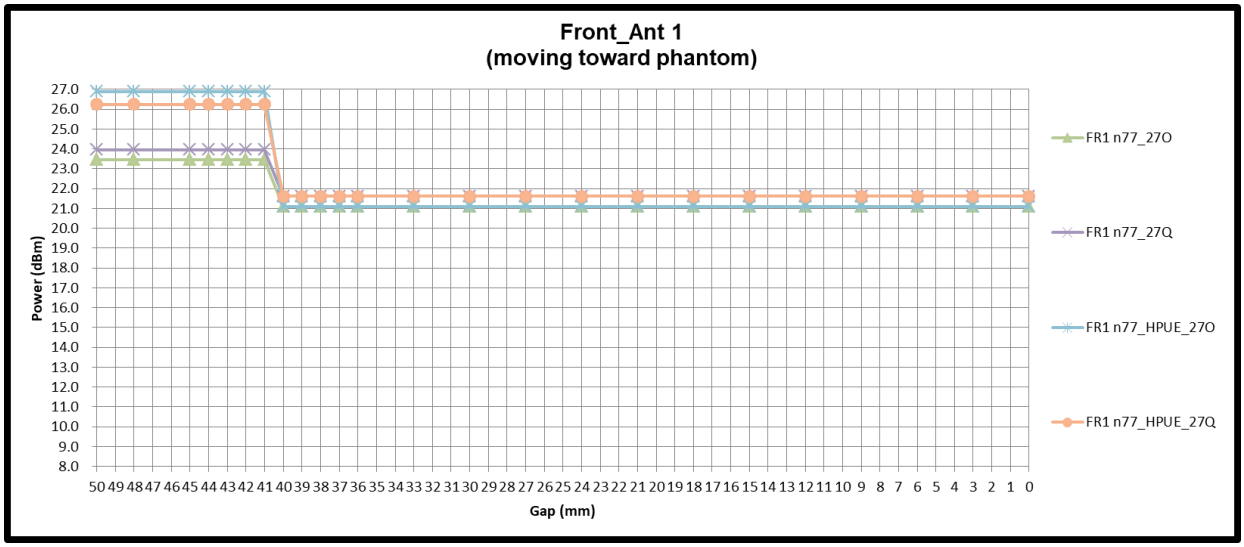
Transmit Ant 1		Transmit Ant 3		Transmit Ant 5		Transmit Ant 6		Transmit Ant 8	
Exposure Position / wireless Band	Front, Back, Left Side, Top Side, Bottom Side(1)	Exposure Position / wireless Band	Front, Back, Left Side, Top Side, Bottom Side(1)	Exposure Position / wireless Band	Front, Back, Left Side, Top Side, Bottom Side(1)	Exposure Position / wireless Band	Front, Back, Left Side, Top Side, Bottom Side(1)	Exposure Position / wireless Band	Front, Back, Left Side, Top Side, Bottom Side(1)
FR1 n77_PC3 27O	2.35 dB	LTE Band 2	0.78 dB	FR1 n77_PC3 27O	1.41 dB	FR1 n77_PC3 27O	2.77 dB	LTE Band 4	2.75 dB
FR1 n77_PC3 27Q	2.36 dB	LTE Band 4	2.45 dB	FR1 n77_PC3 27Q	1.36 dB	FR1 n77_PC3 27Q	2.20 dB	LTE Band 5	0.89 dB
FR1 n77_PC2 27O	5.78 dB	LTE Band 66	2.45 dB	FR1 n77_PC2 27O	4.53 dB	FR1 n77_PC2 27O	1.99 dB	LTE Band 66	2.44 dB
FR1 n77_PC2 27Q	4.63 dB	FR1 n2	1.97 dB	FR1 n77_PC2 27Q	3.83 dB	FR1 n77_PC2 27Q	1.60 dB	FR1 n2	0.84 dB
		FR1 n66	3.00 dB					FR1 n5	0.76 dB
		FR1 n77_PC3 27O	3.63 dB					FR1 n66	3.14 dB
		FR1 n77_PC3 27Q	3.45 dB						
		FR1 n77_PC2 27O	6.19 dB						
		FR1 n77_PC2 27Q	6.14 dB						

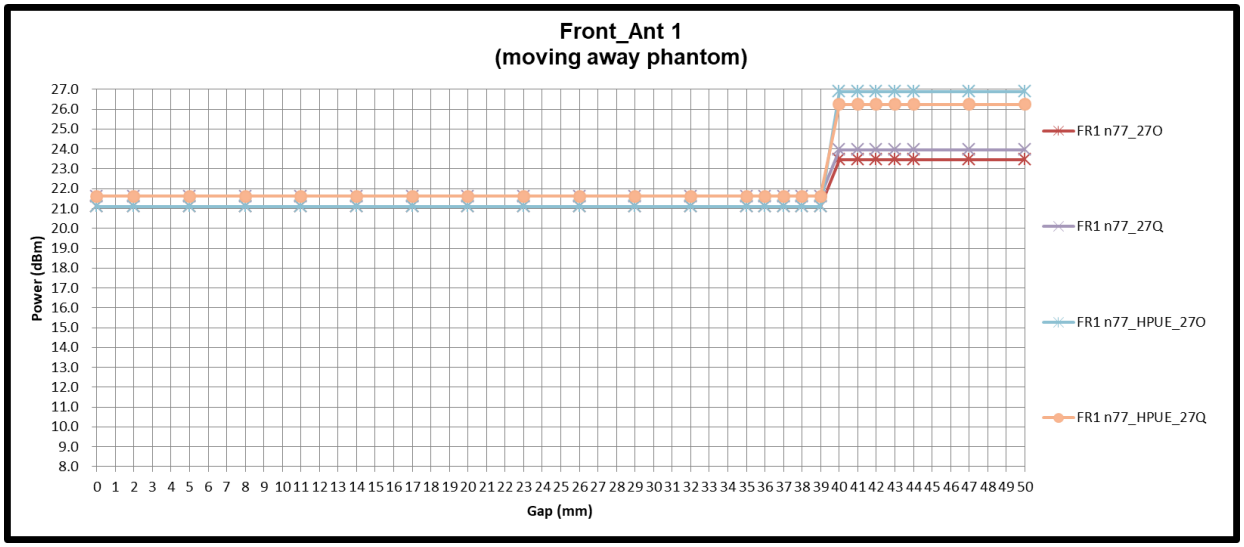
General Note:

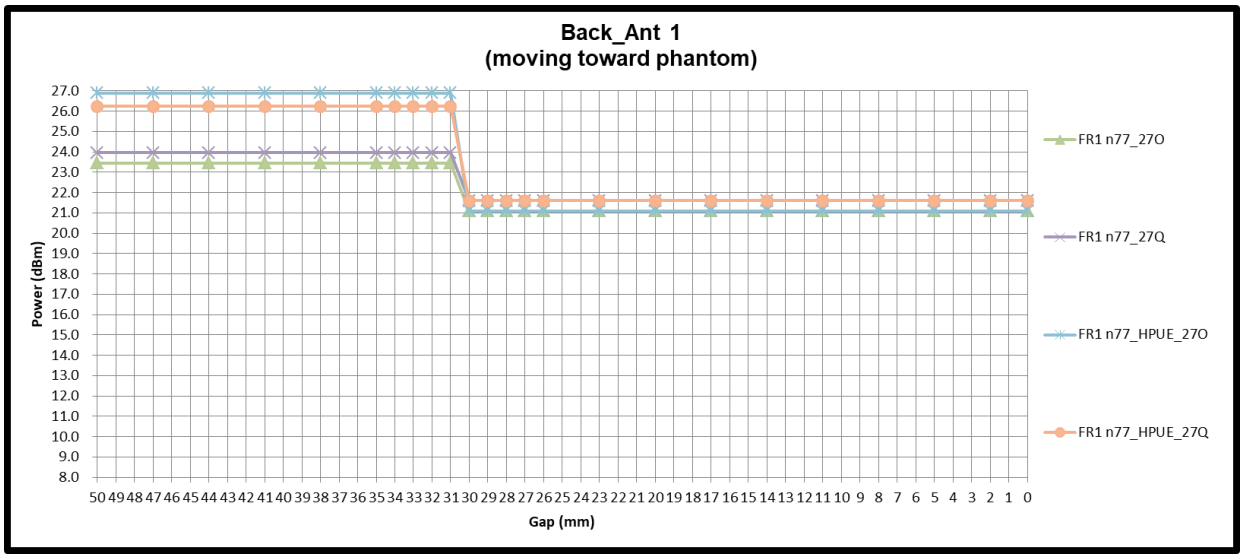
1. (1): Reduced maximum limit applied by activation of proximity sensor.
2. Tests were performed in accordance with KDB 616217 D04 section 6.1, 6.2, 6.3, 6.4 and 6.5 and compliant results are shown below
3. For the power verification was selected worst case power reduction level of band of each transmit antenna to verify.

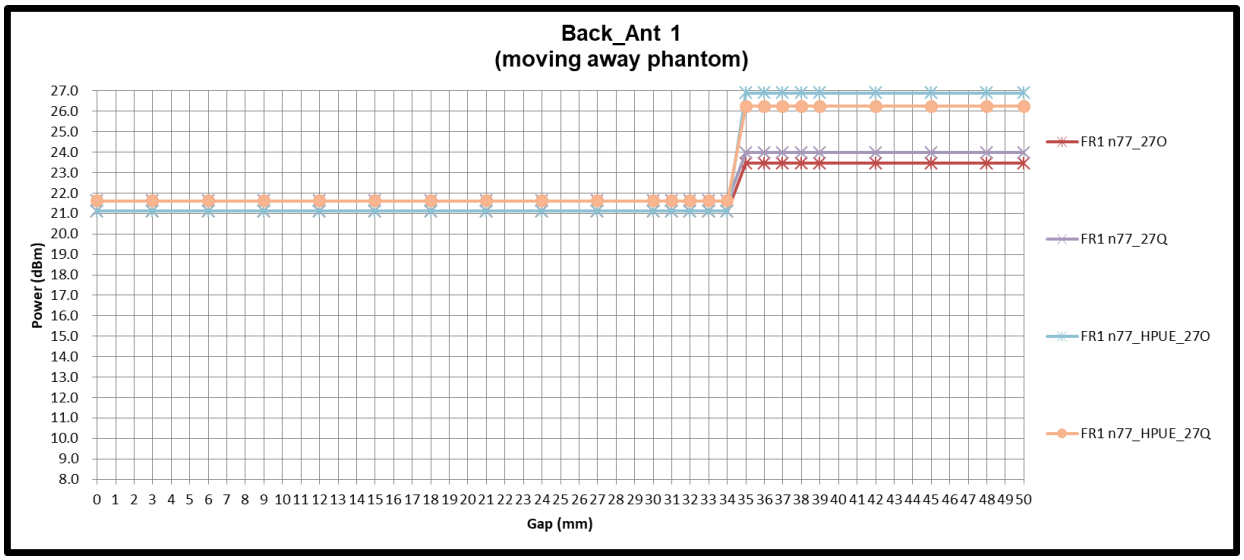
Power Measurement during Sensor Trigger distance testing

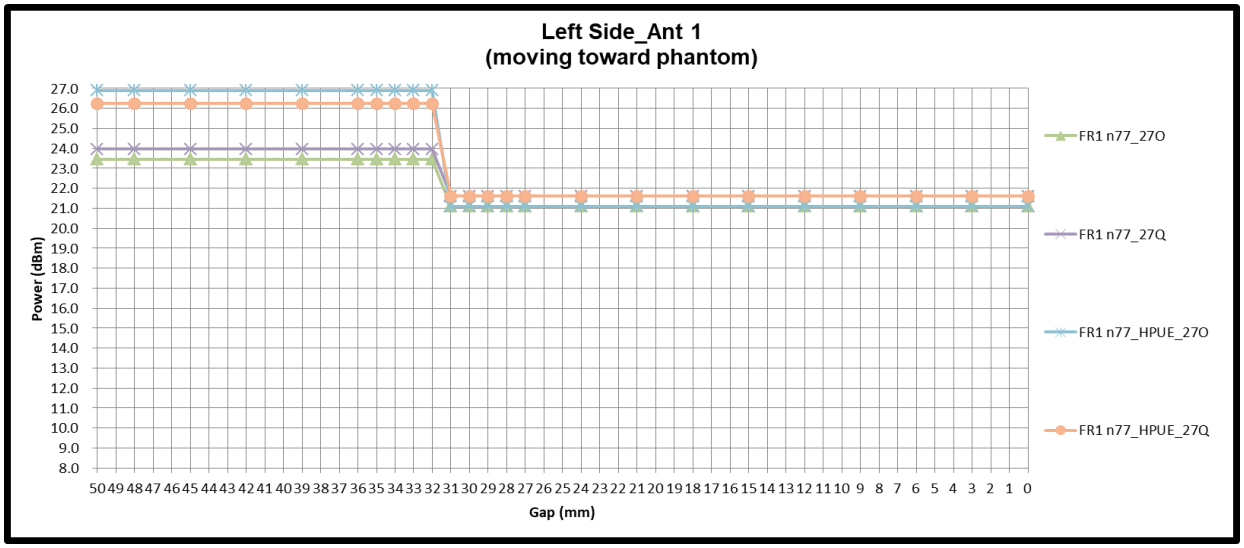
Ant 1






Back_Ant 1
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q


Back_Ant 1
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q


Left Side_Ant 1
(moving toward phantom)
Power (dBm)
Gap (mm)
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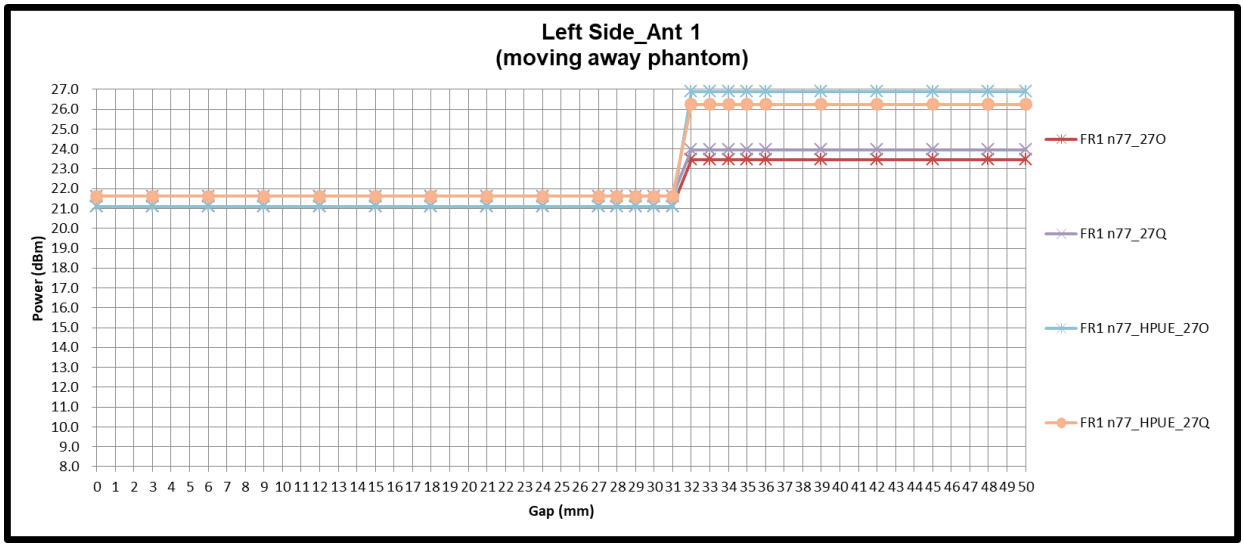
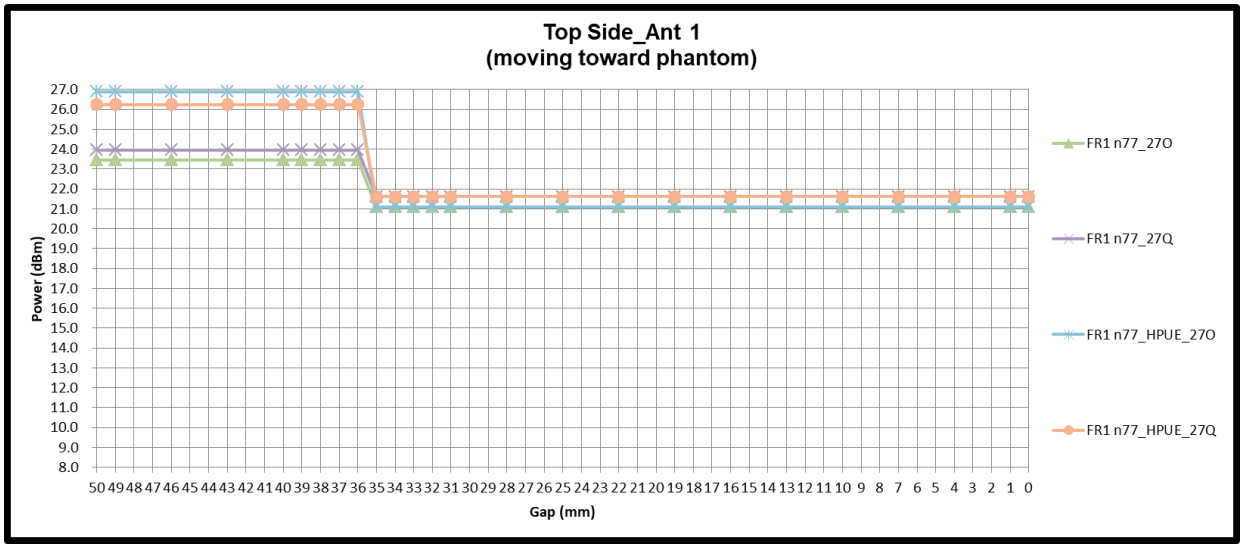
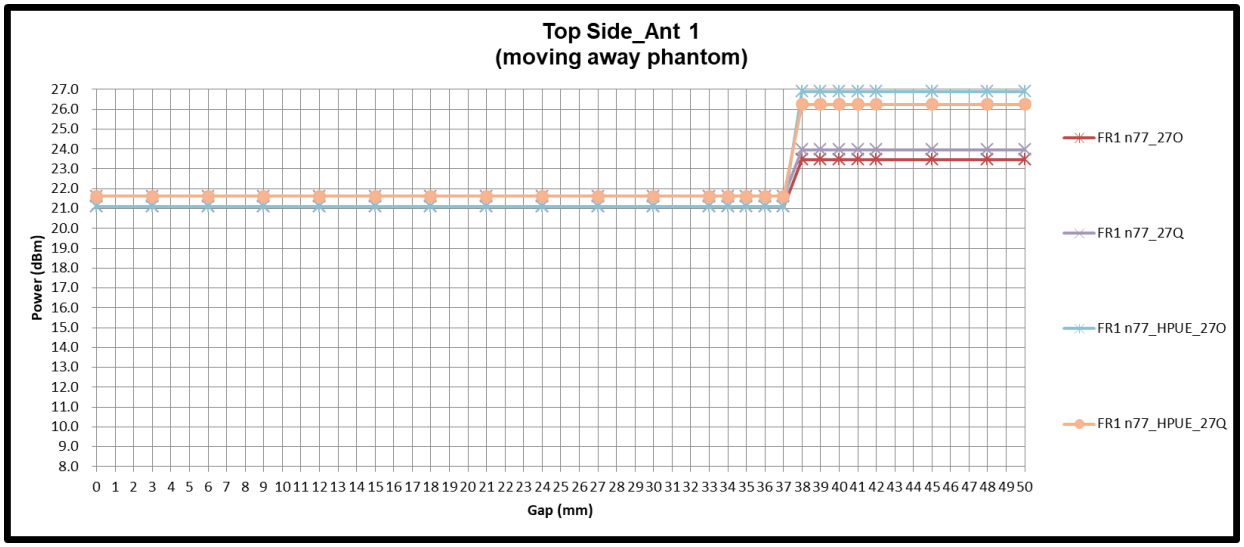
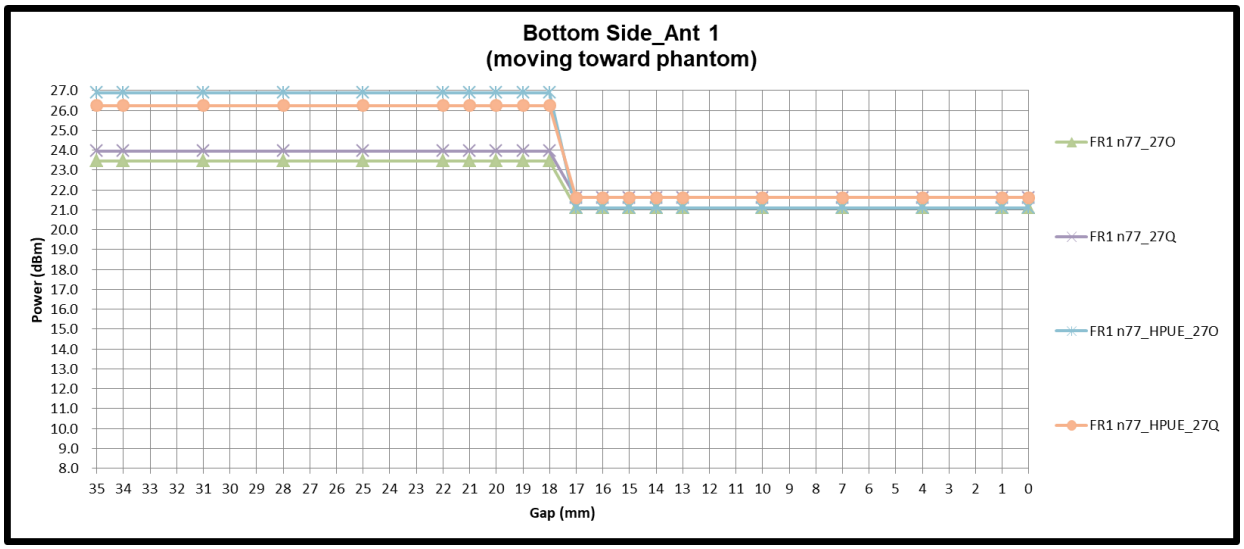
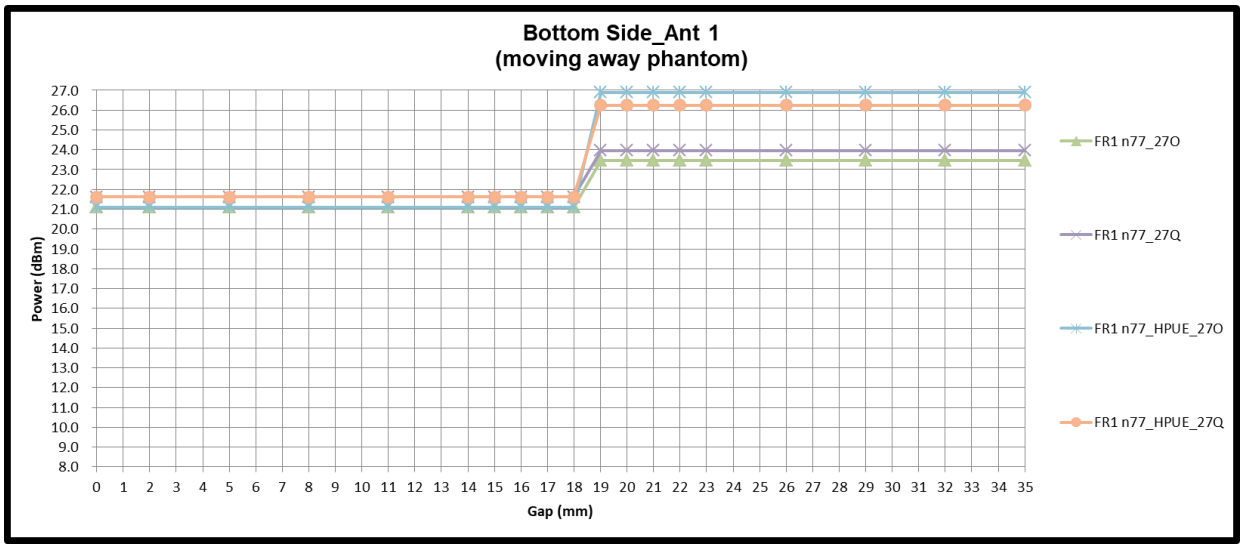
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q


Left Side_Ant 1
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

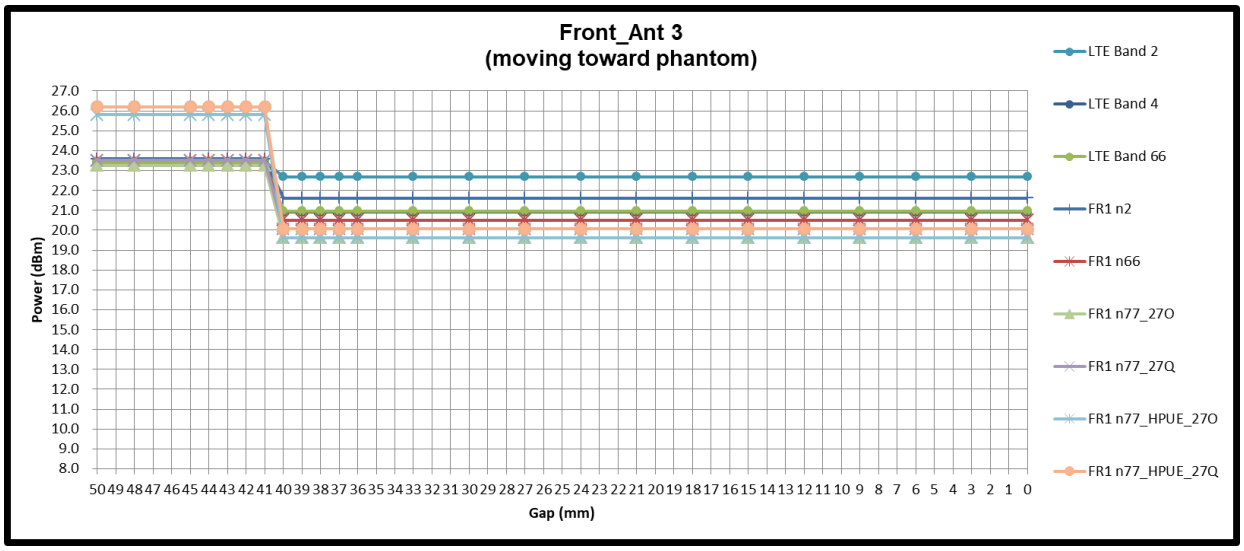

Top Side_Ant 1
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

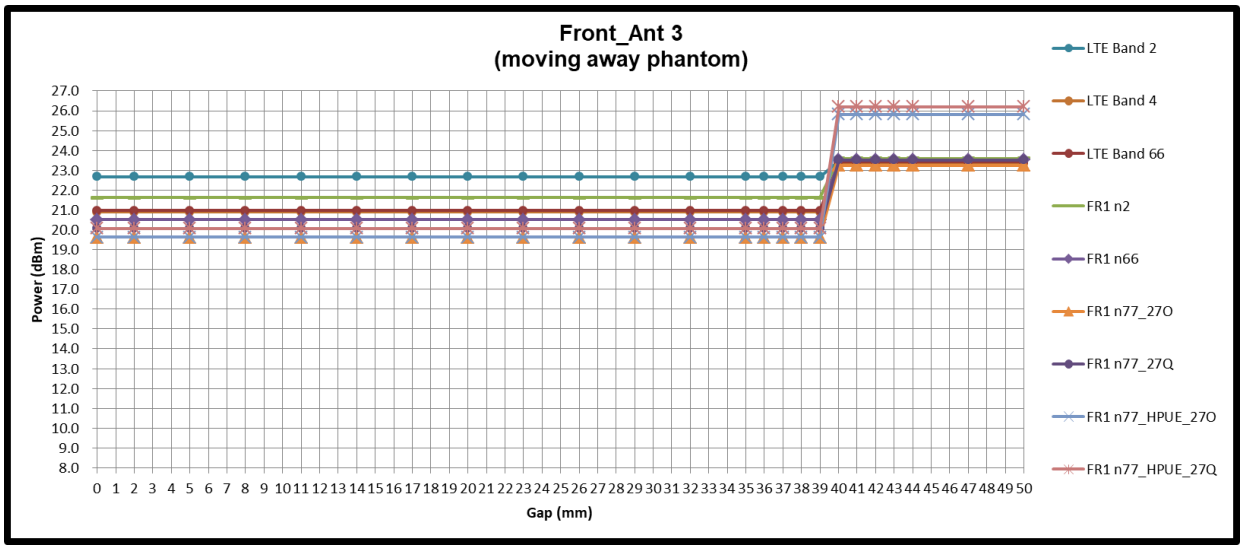

Top Side_Ant 1
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

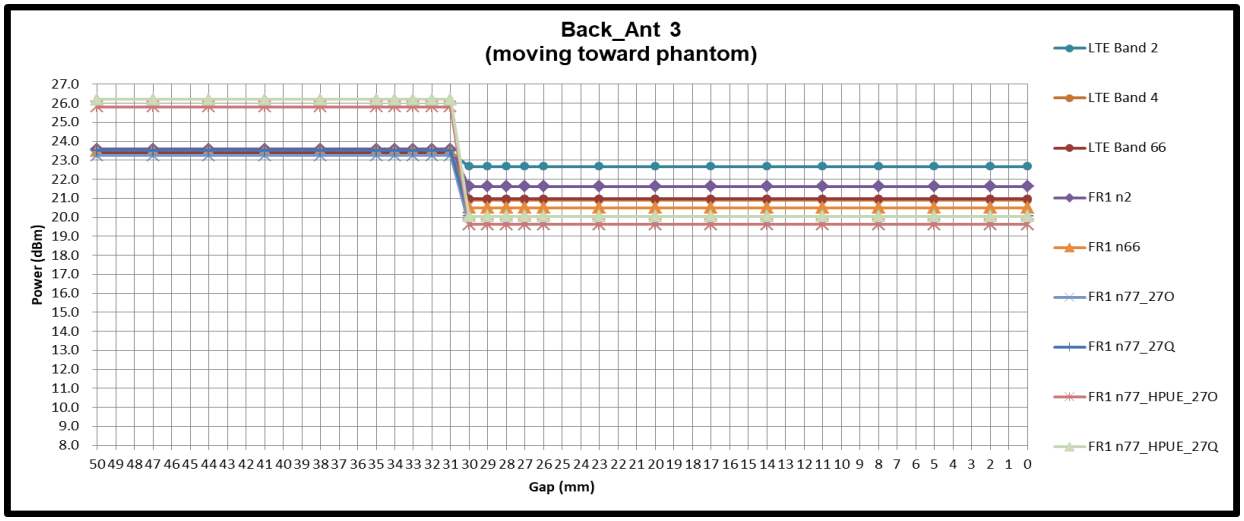

Bottom Side_Ant 1
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

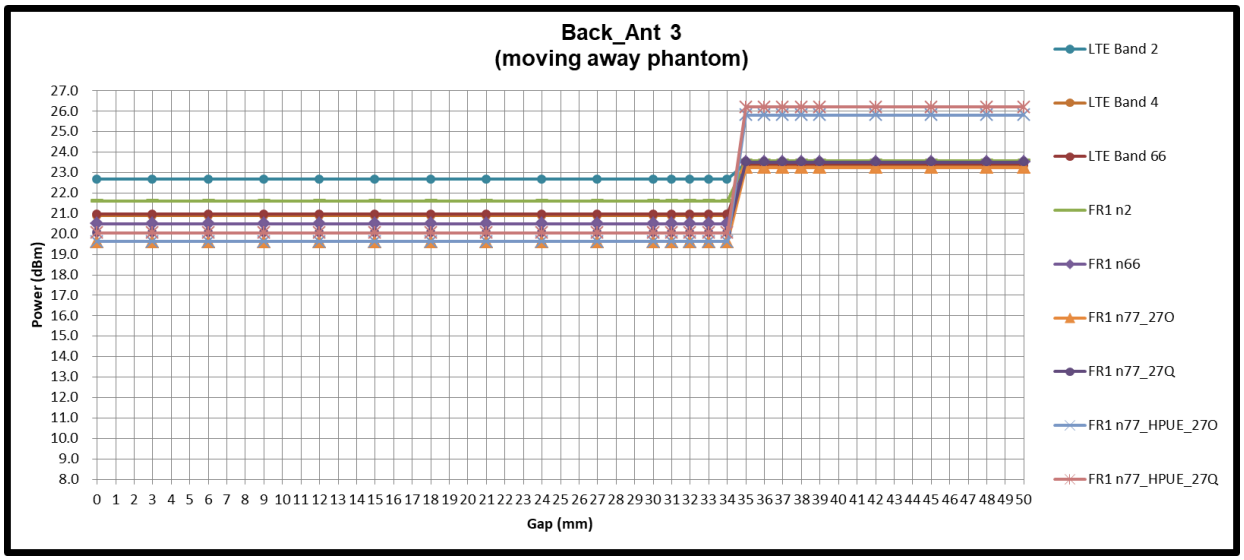

Bottom Side_Ant 1
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

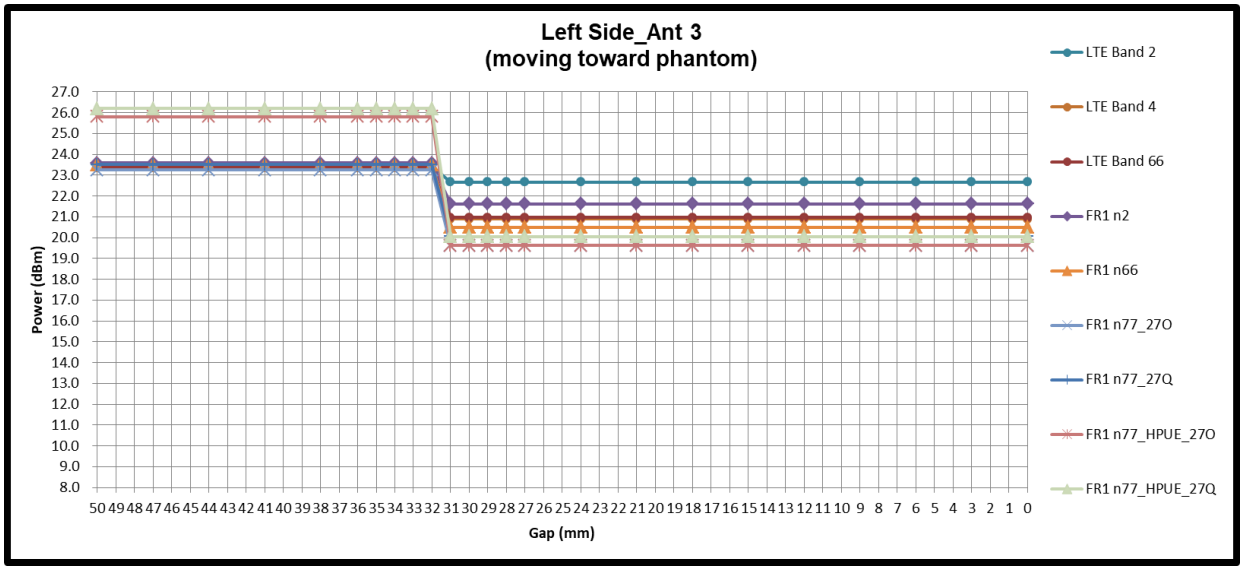
Ant 3

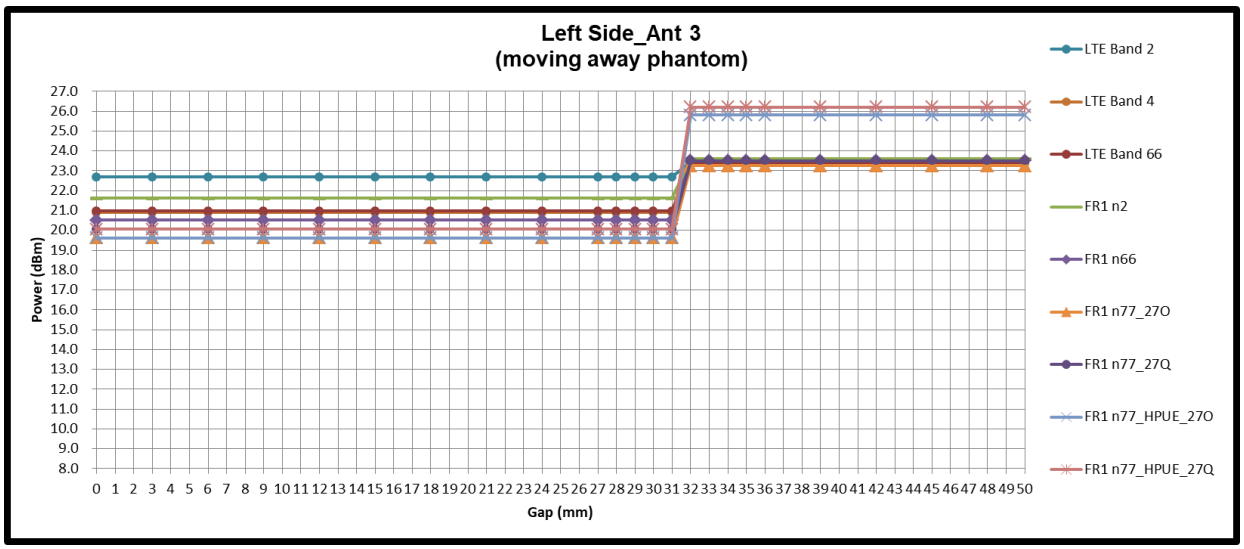

Front_Ant 3
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

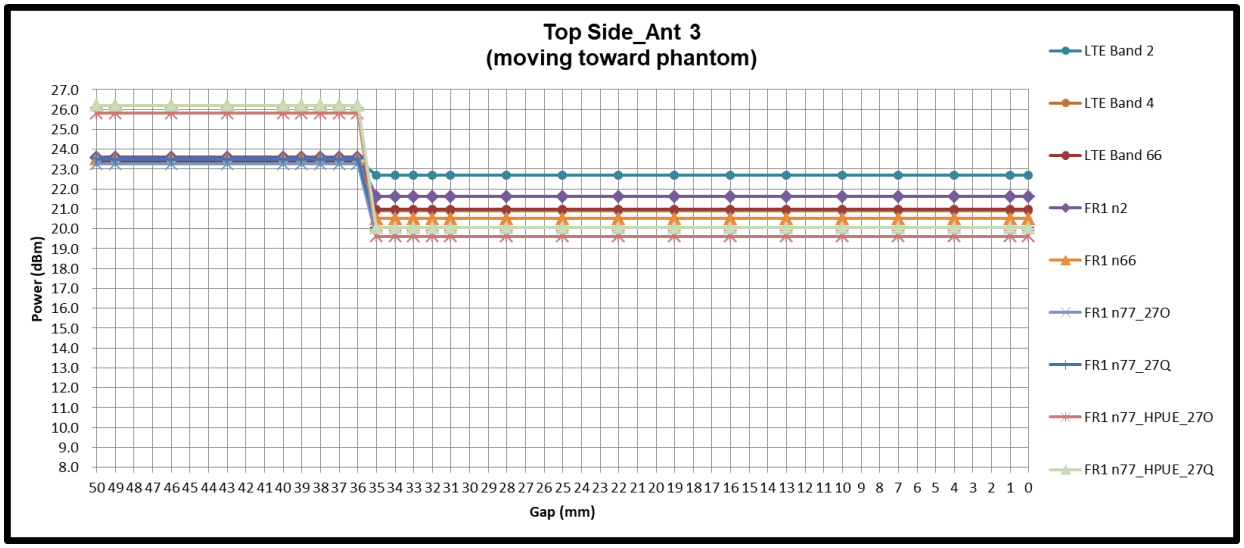

Front_Ant 3
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

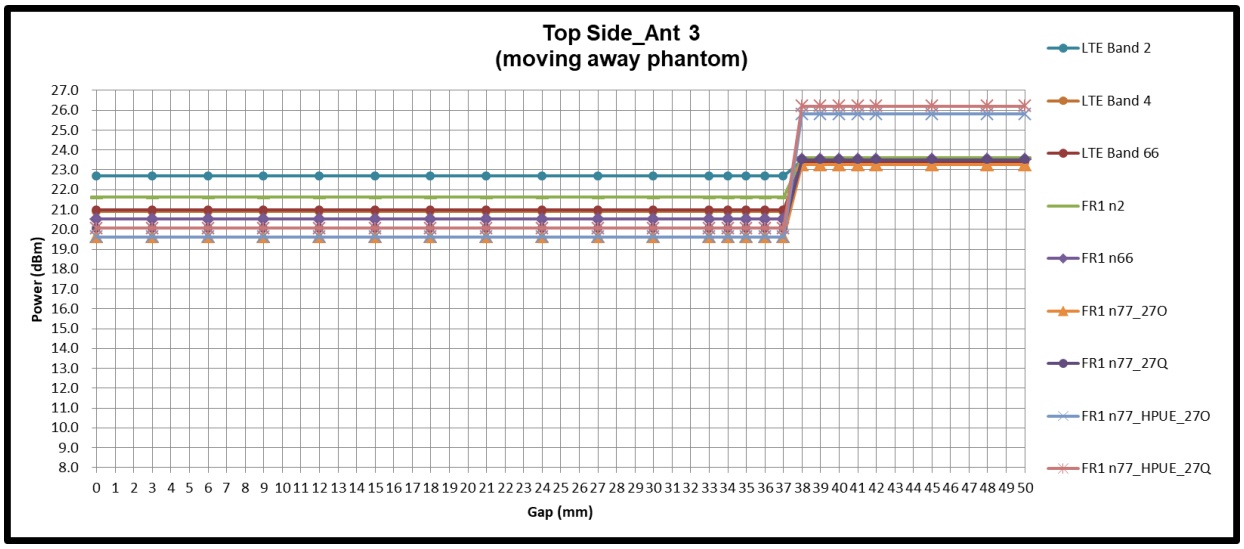

Back_Ant 3
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

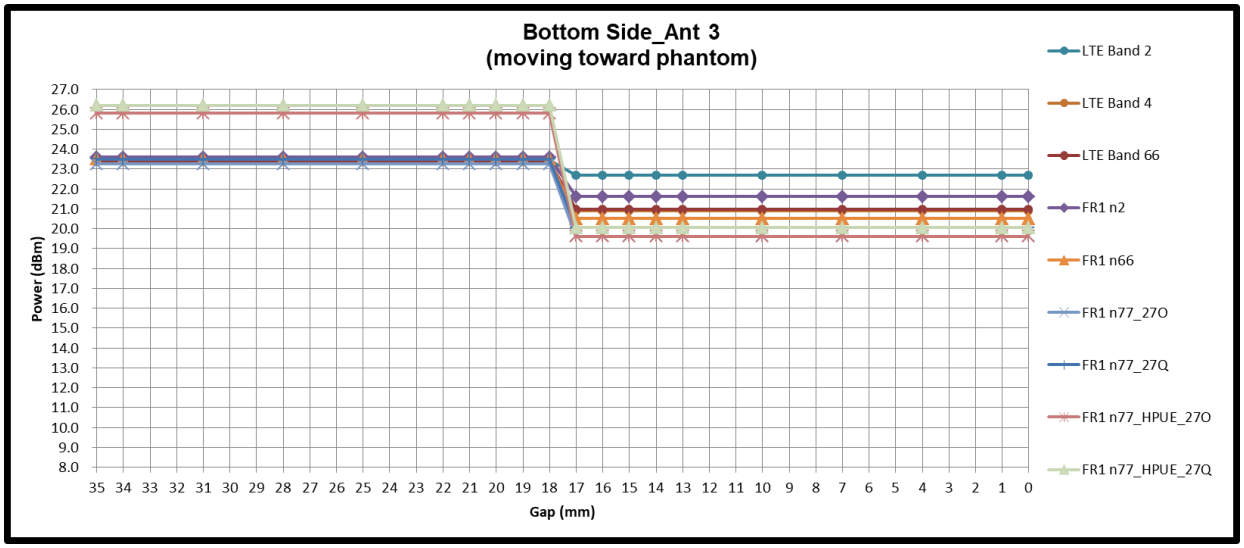

Back_Ant 3
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

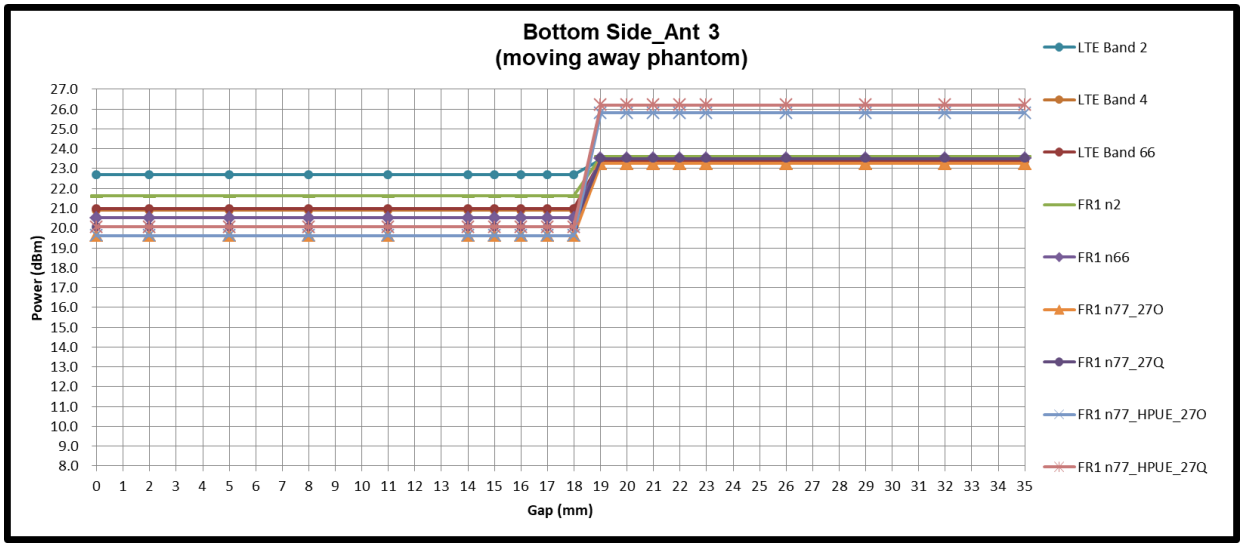

Left Side_Ant 3
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q


Left Side_Ant 3
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

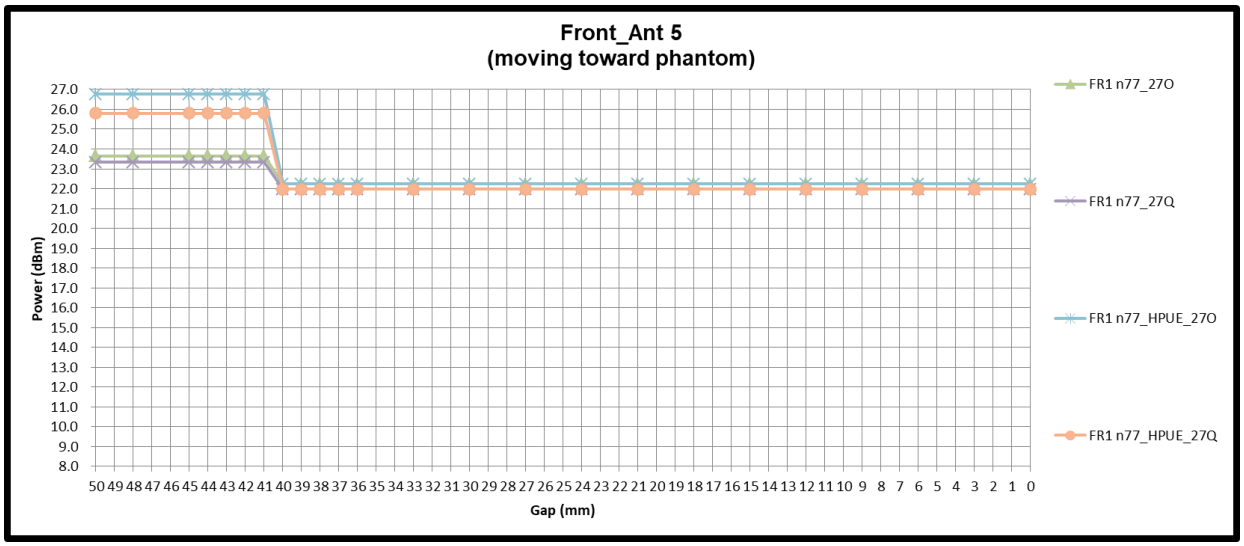

Top Side_Ant 3
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

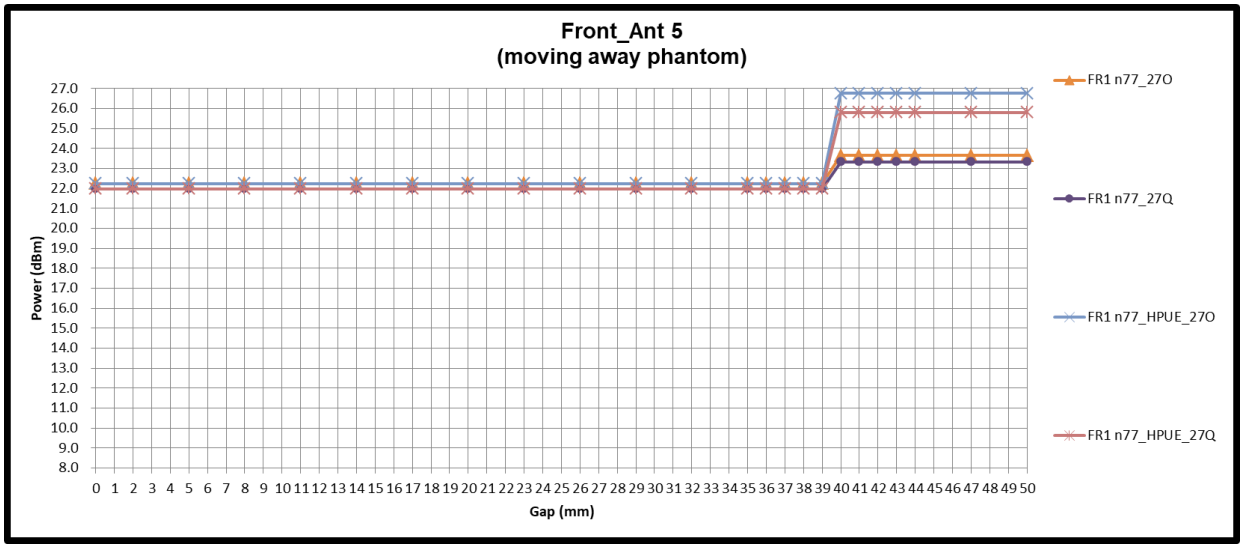

Top Side_Ant 3
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

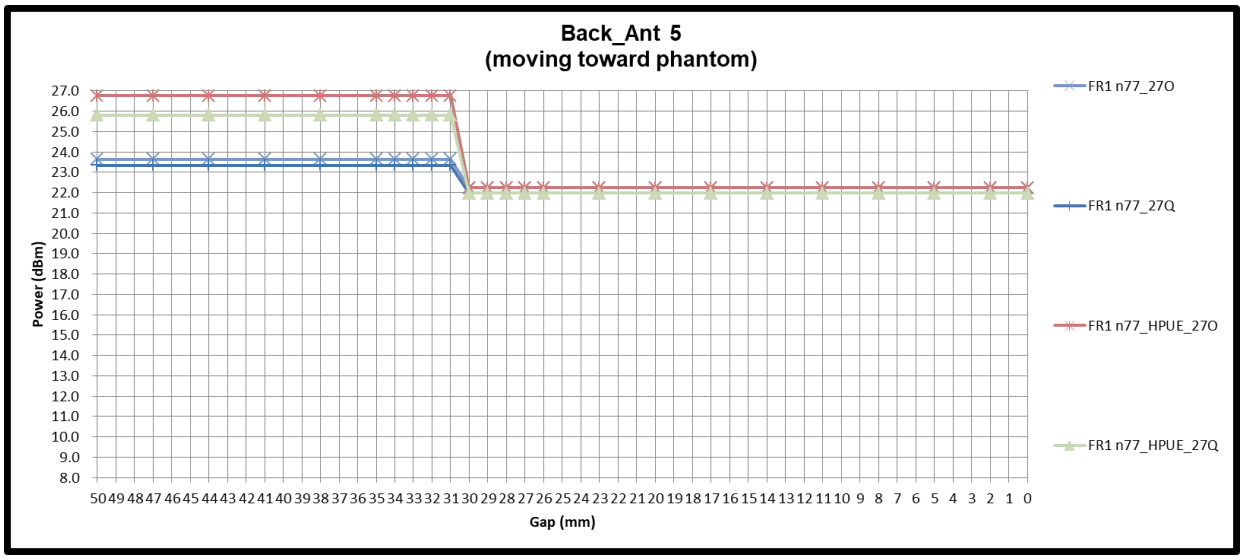

Bottom Side_Ant 3
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

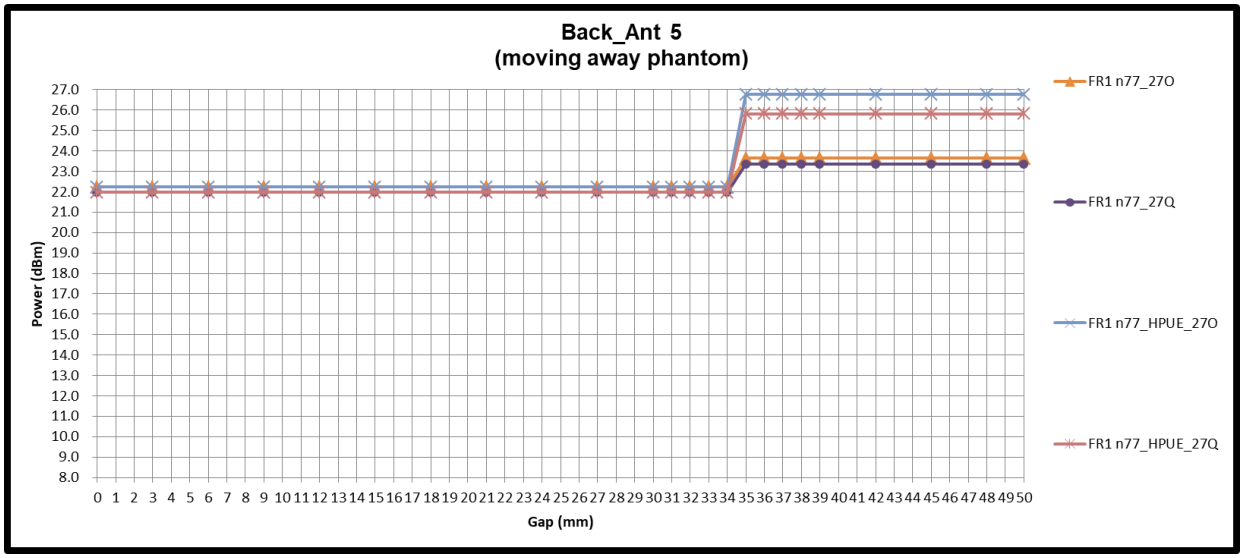

Bottom Side_Ant 3
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 2
LTE Band 4
LTE Band 66
FR1 n2
FR1 n66
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

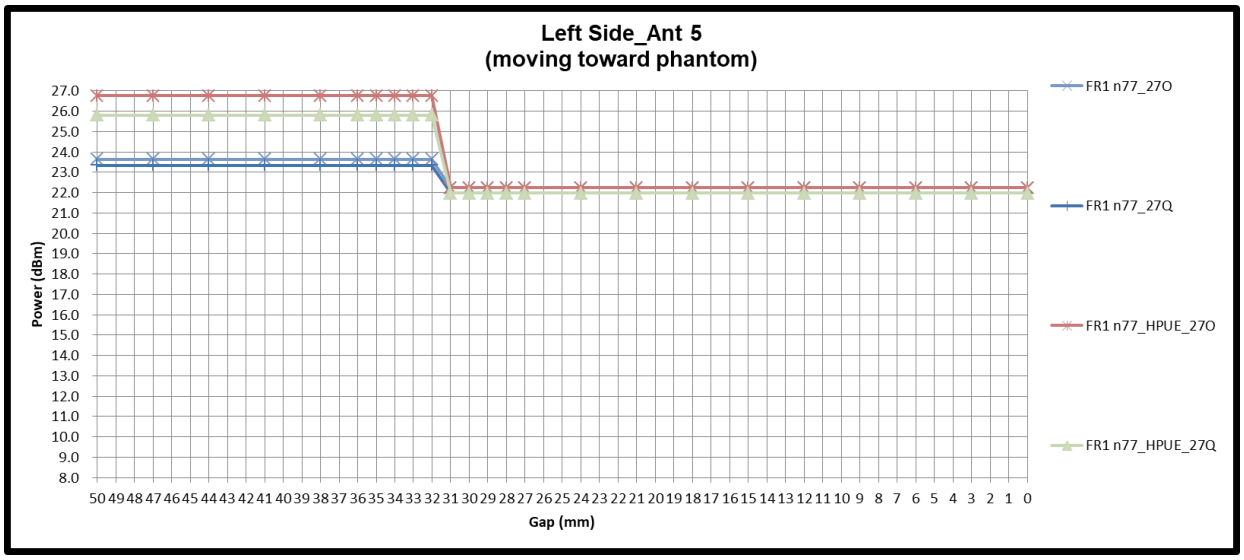
Ant 5

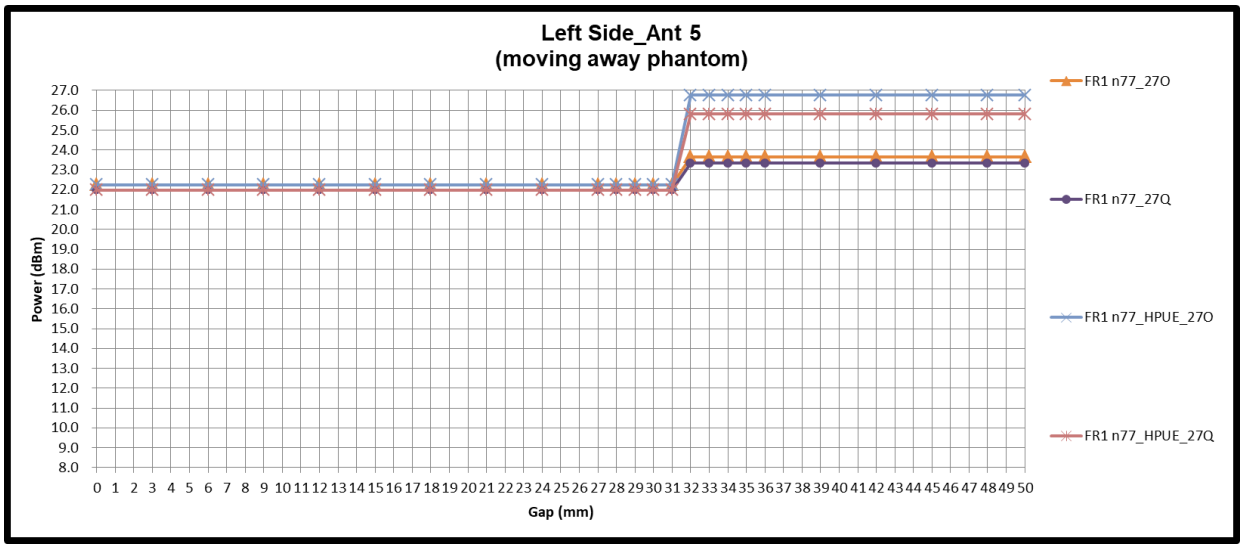

Front_Ant 5
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

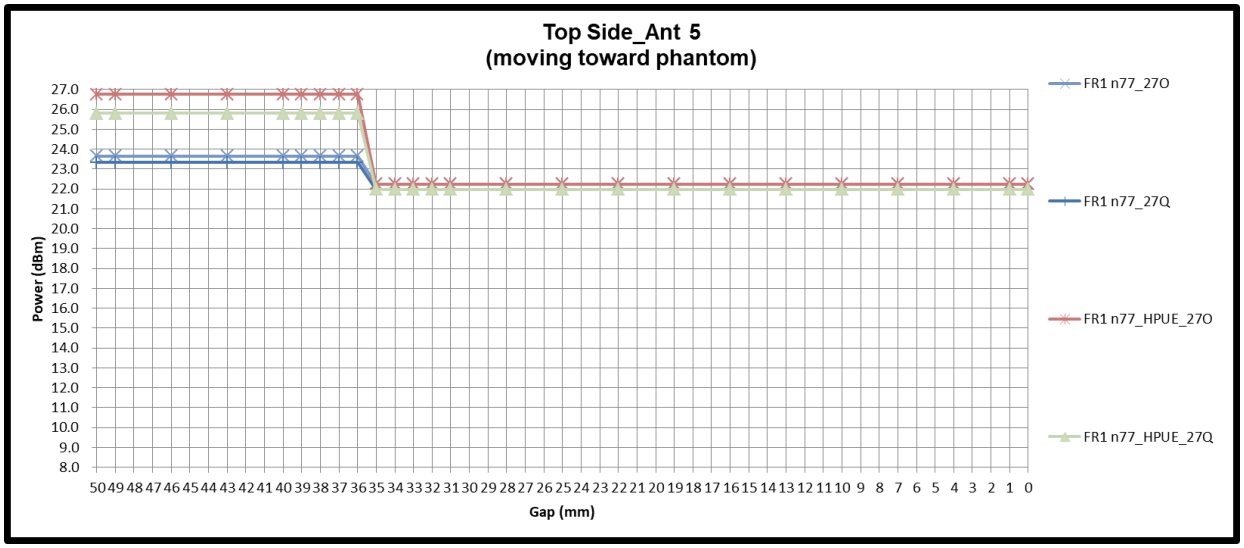

Front_Ant 5
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

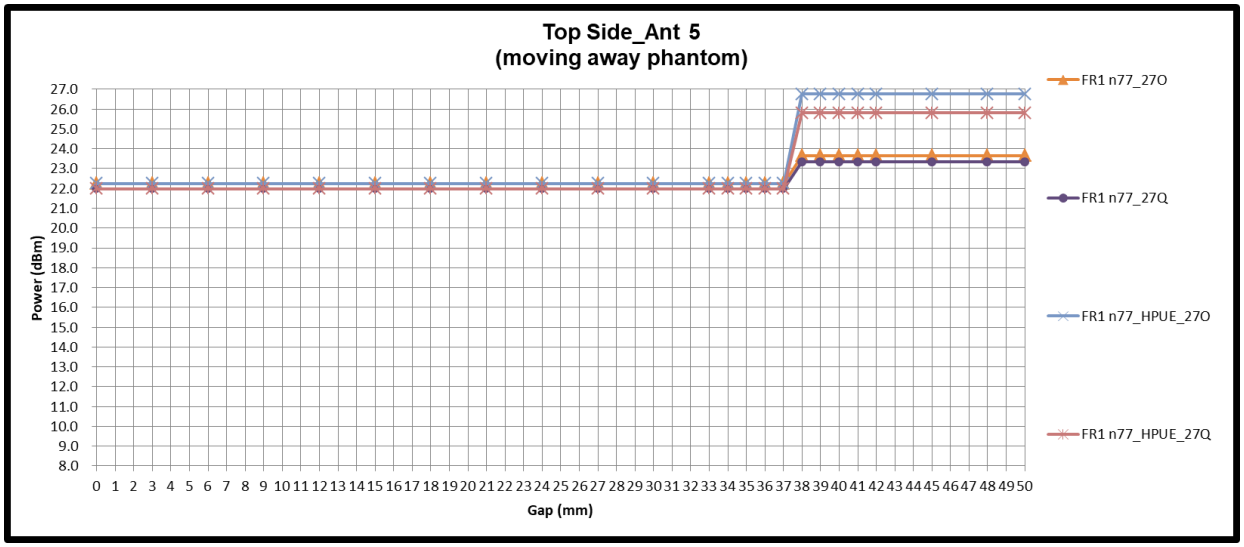

Back_Ant 5
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

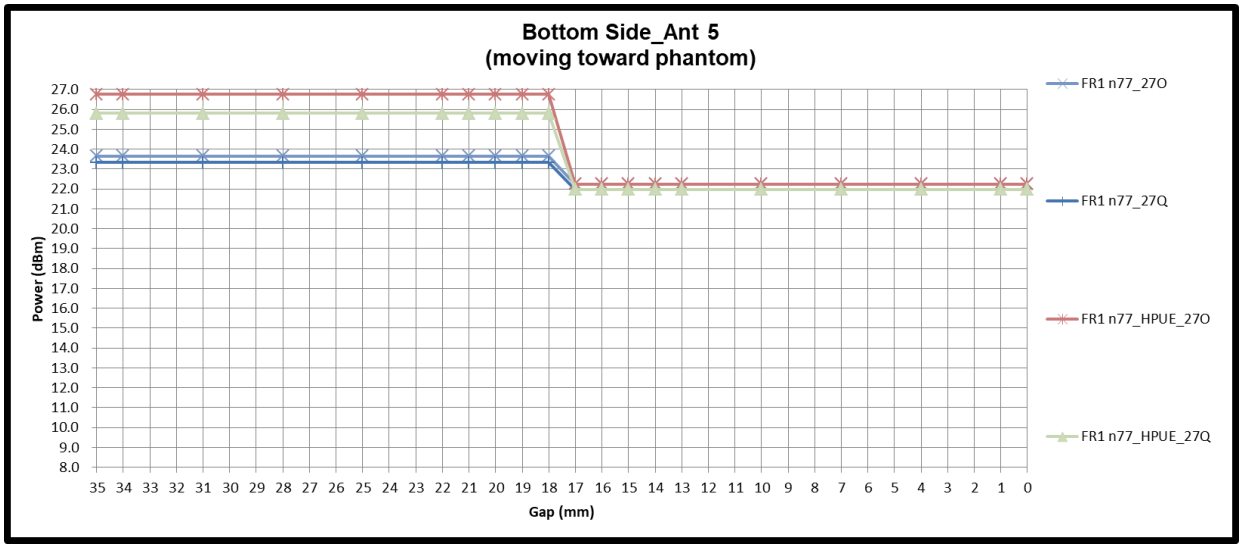

Back_Ant 5
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

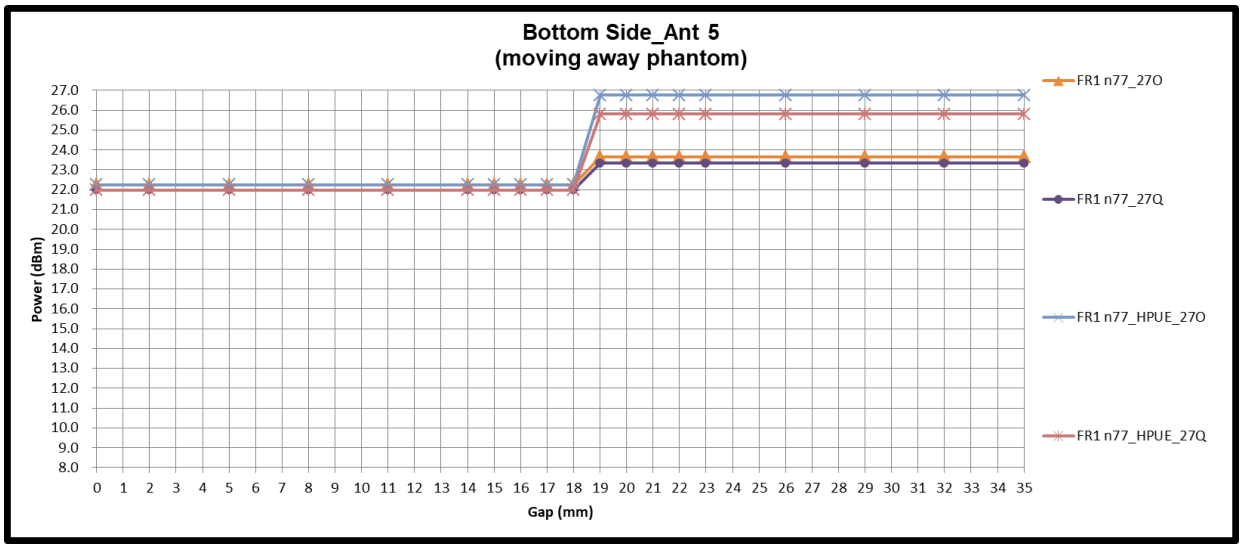

Left Side_Ant 5
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q


Left Side_Ant 5
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

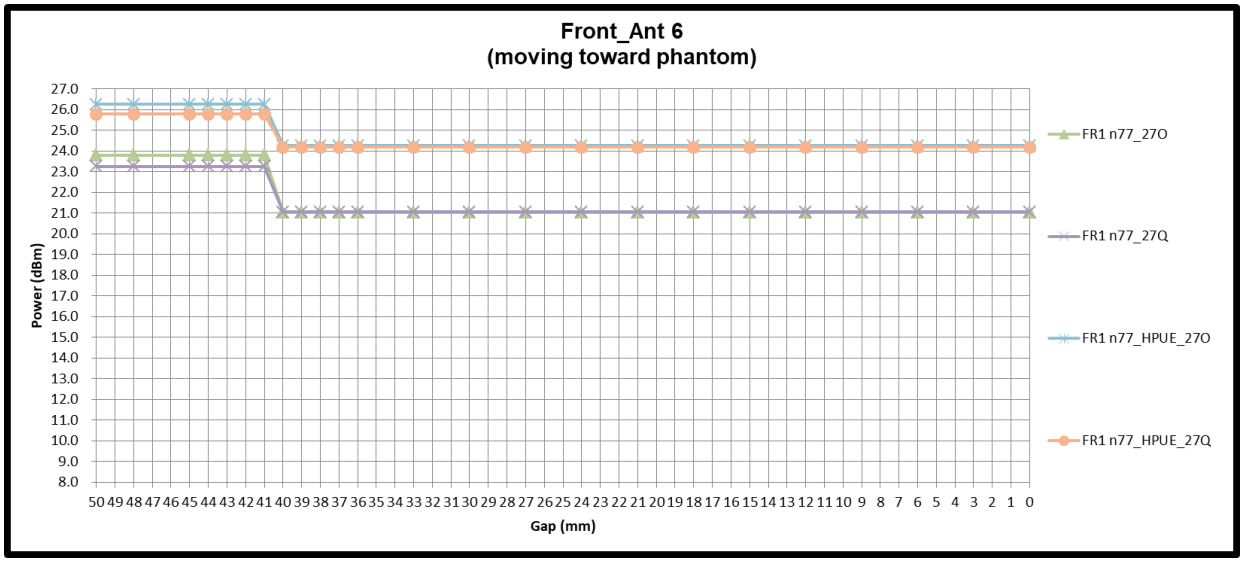

Top Side_Ant 5
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

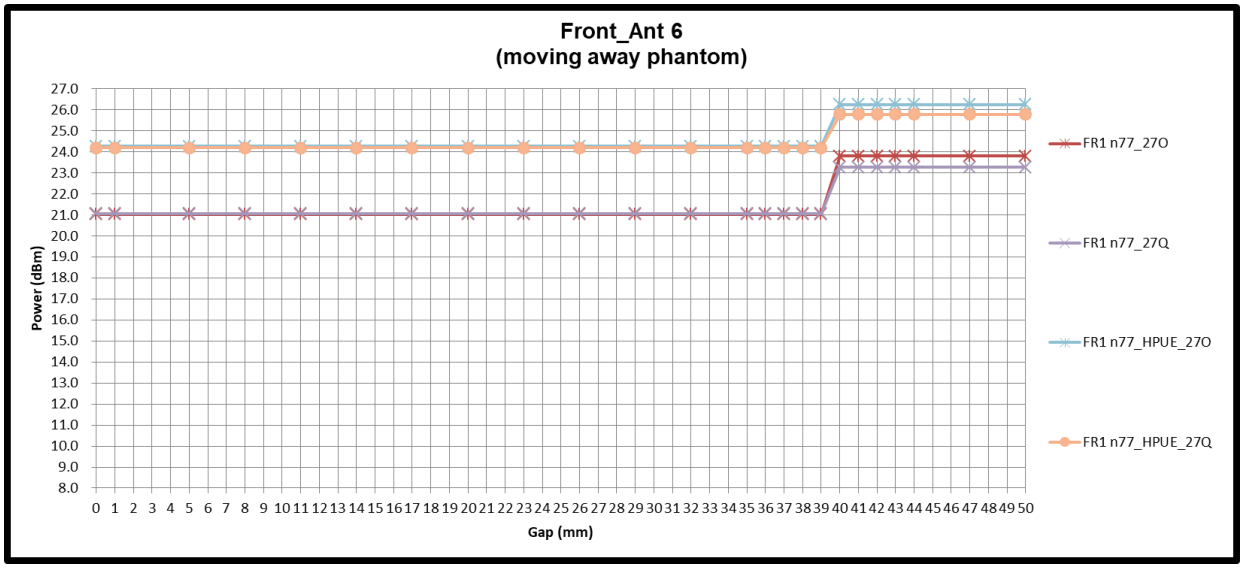

Top Side_Ant 5
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

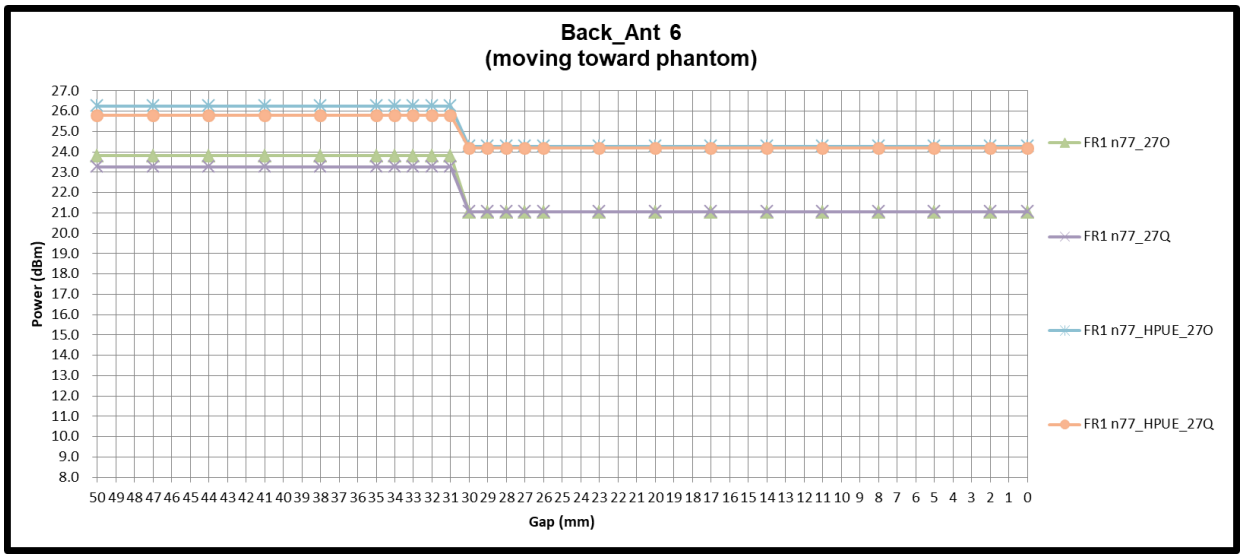

Bottom Side_Ant 5
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

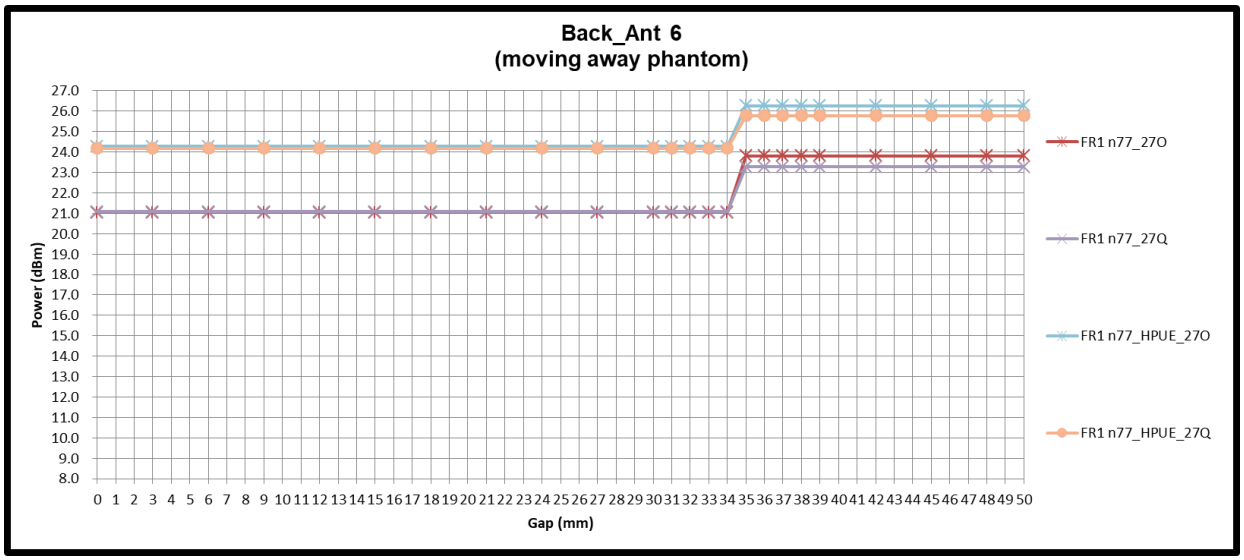

Bottom Side_Ant 5
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

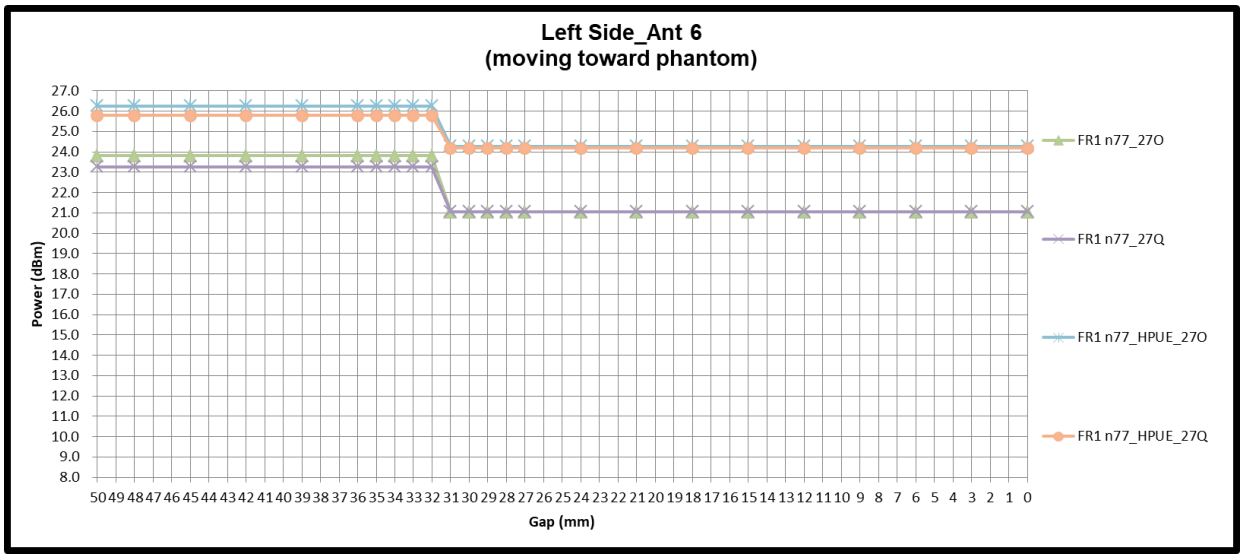
Ant 6

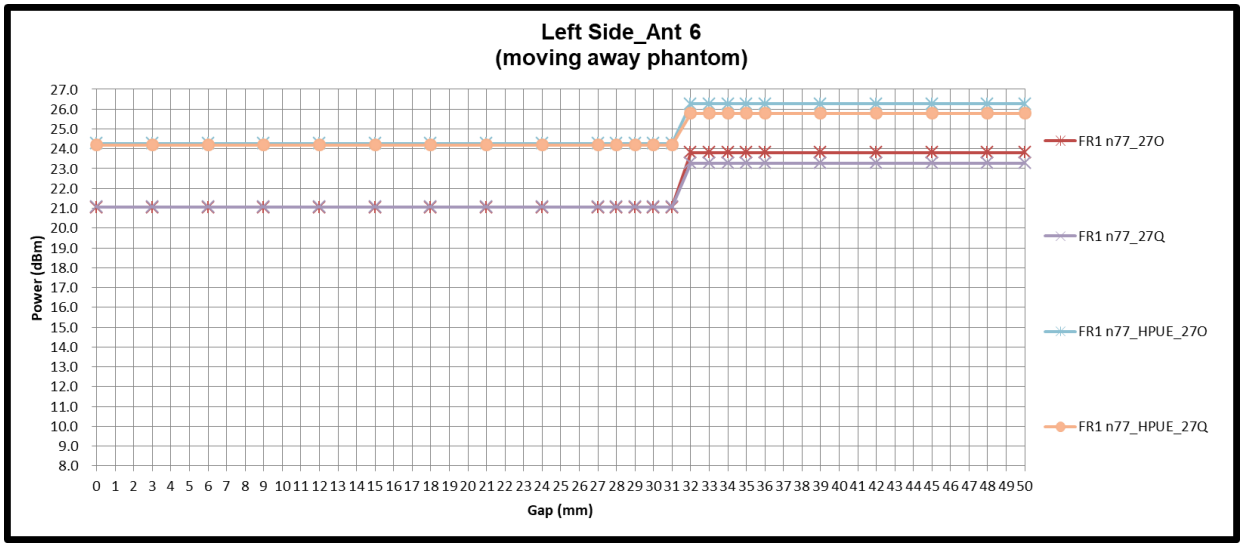

Front_Ant 6
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

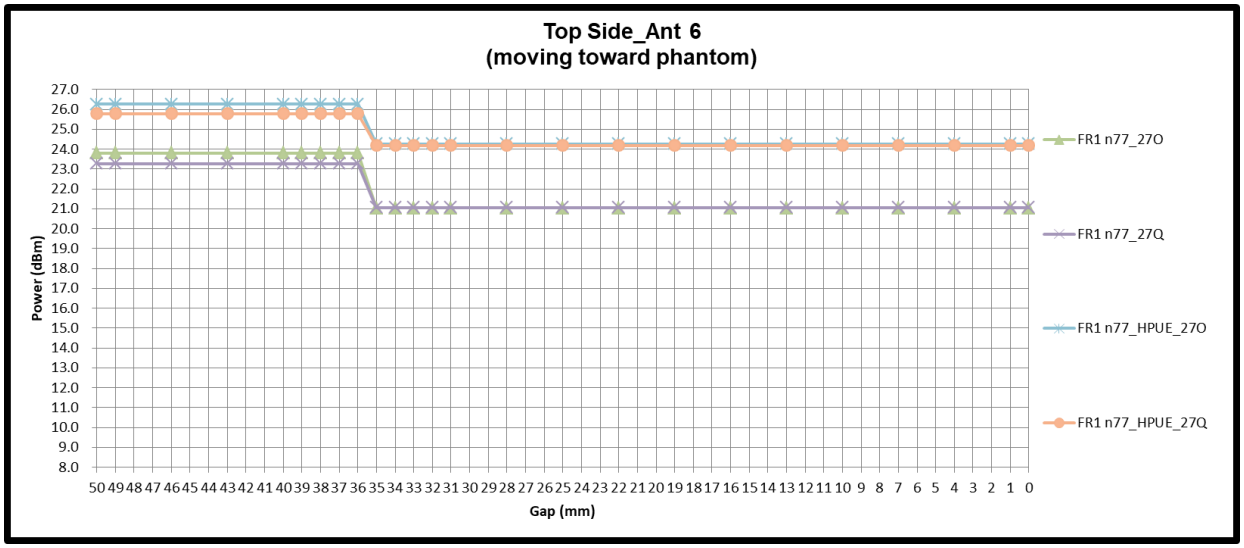

Front_Ant 6
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

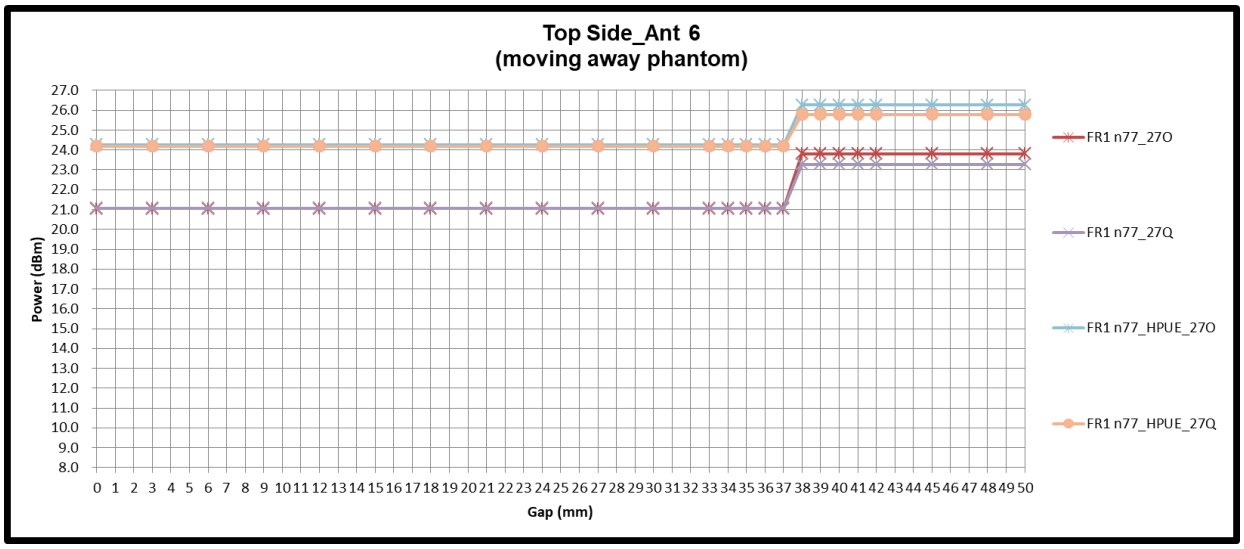

Back_Ant 6
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

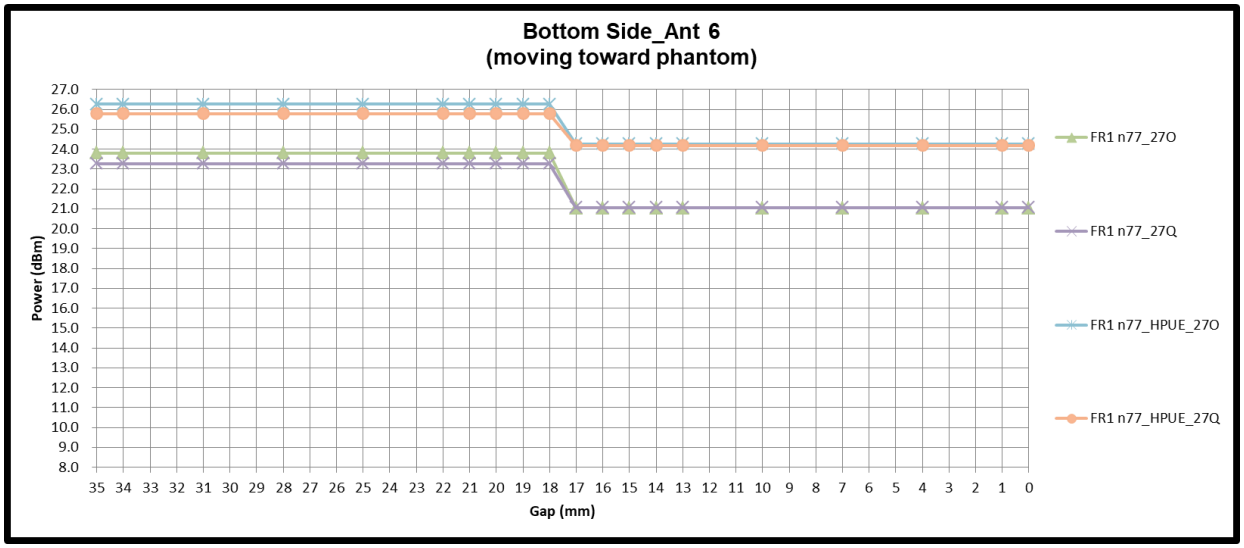

Back_Ant 6
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

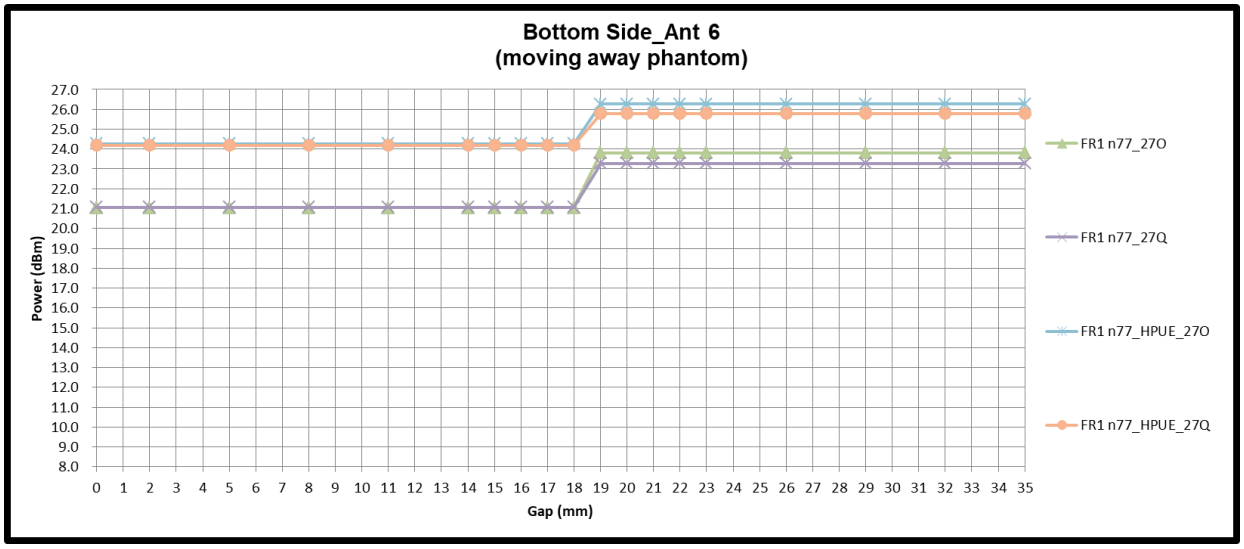

Left Side_Ant 6
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q


Left Side_Ant 6
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

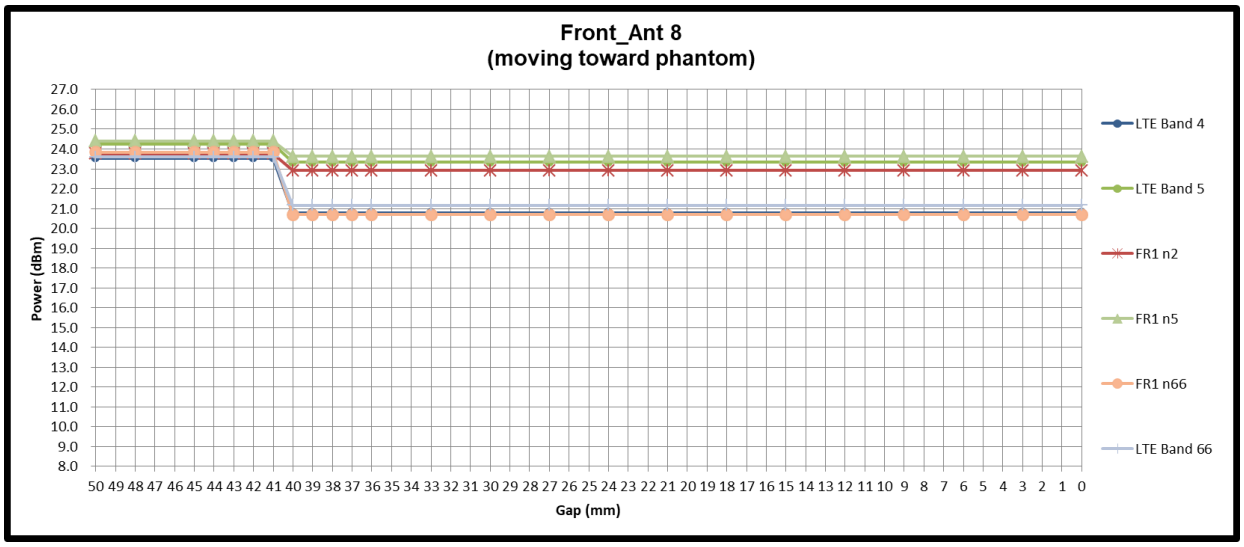

Top Side_Ant 6
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

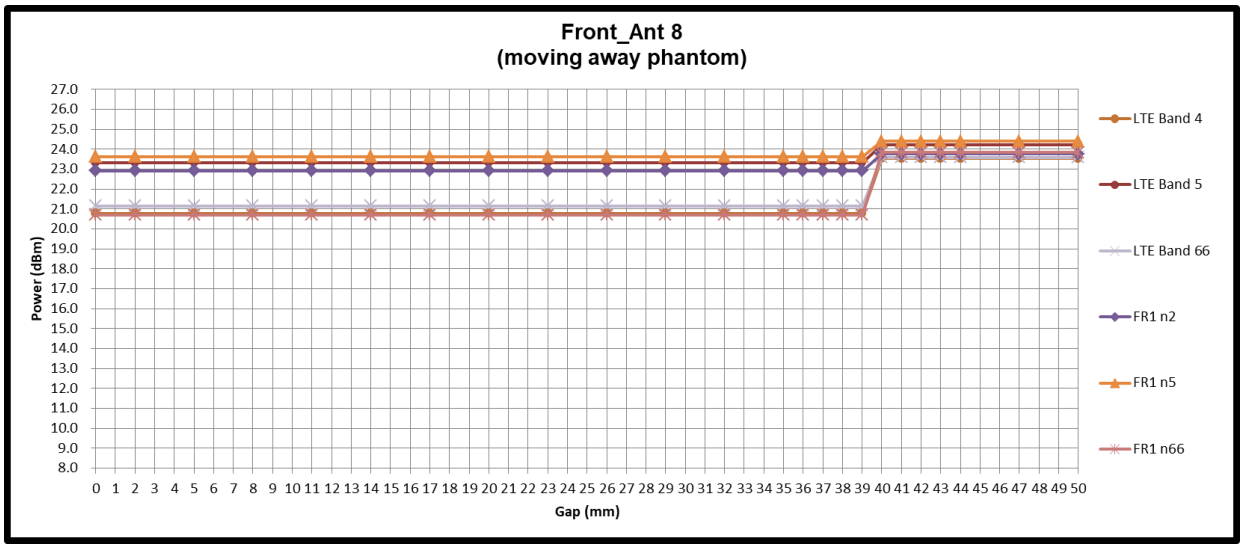

Top Side_Ant 6
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

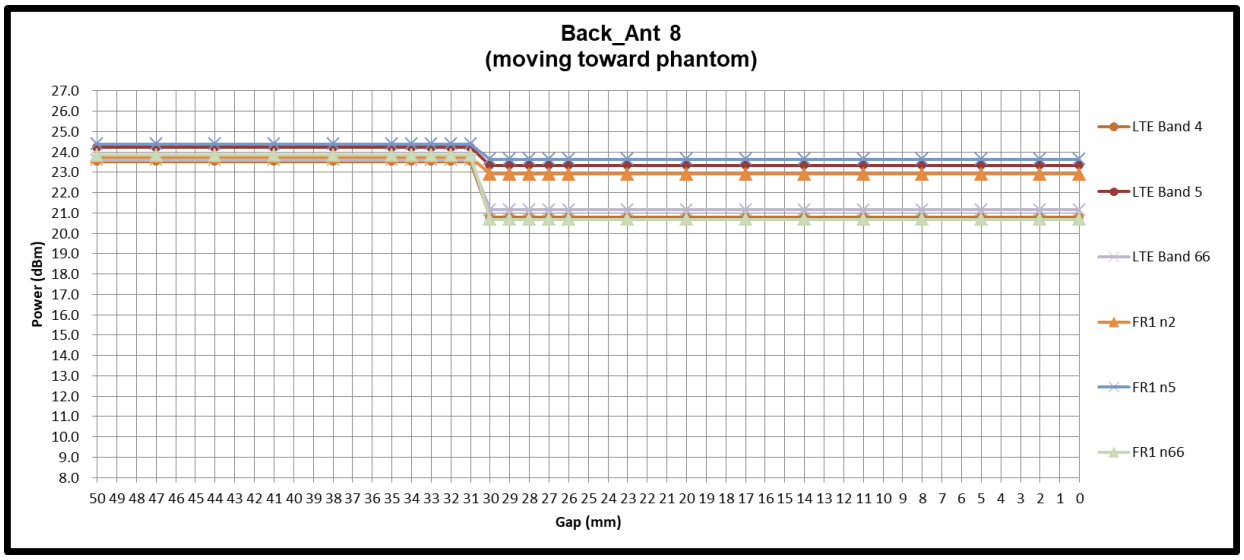

Bottom Side_Ant 6
(moving toward phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

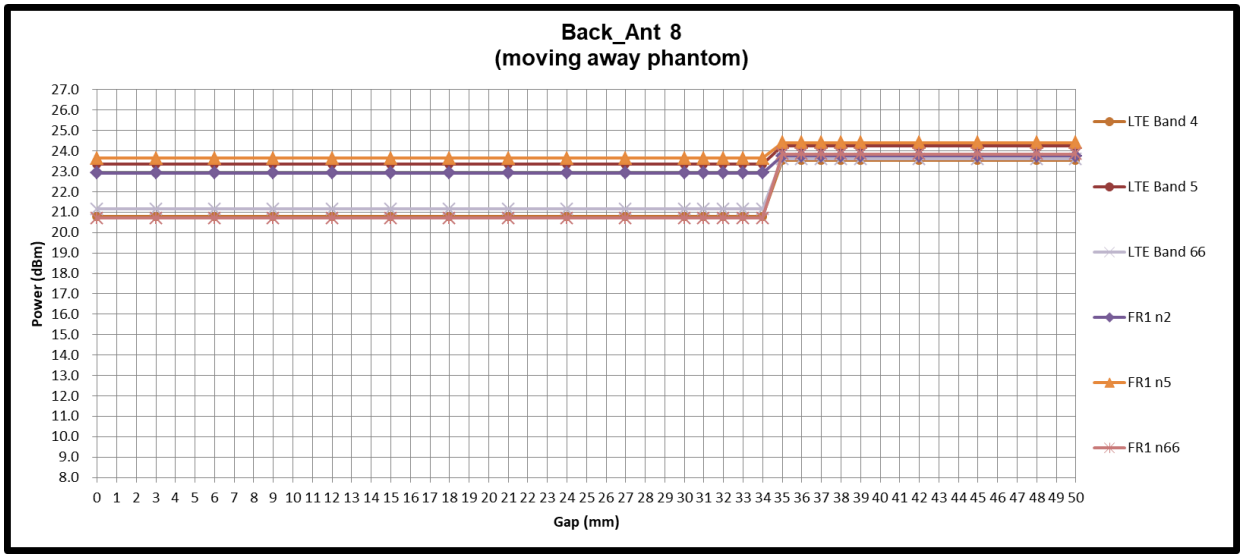

Bottom Side_Ant 6
(moving away phantom)
Power (dBm)
Gap (mm)
FR1 n77_27O
FR1 n77_27Q
FR1 n77_HPUE_27O
FR1 n77_HPUE_27Q

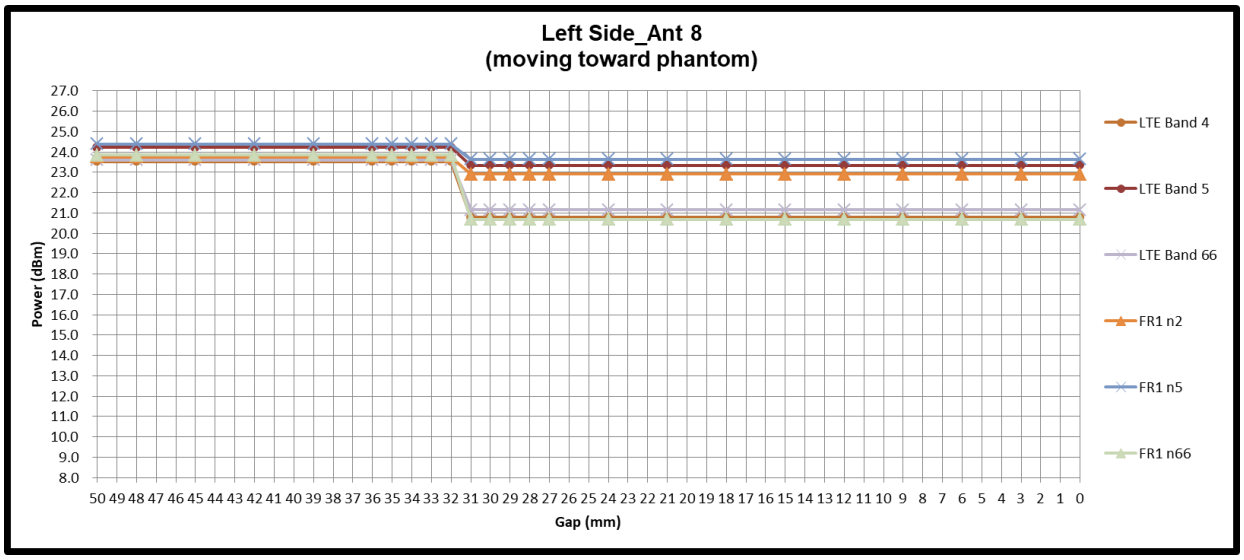
Ant 8

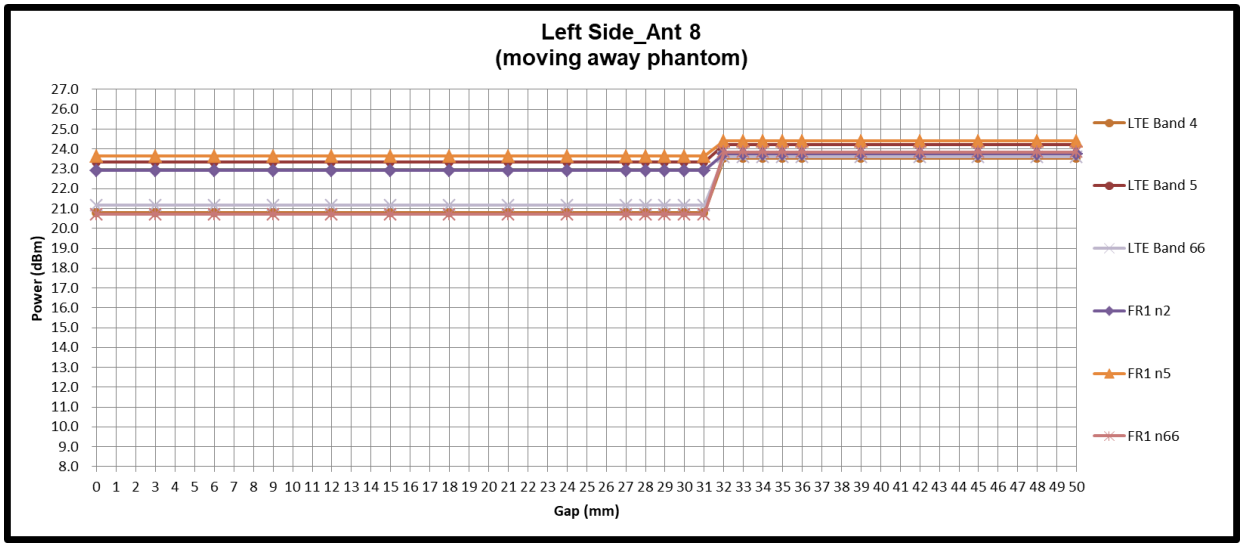

Front_Ant 8
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
FR1 n2
FR1 n5
FR1 n66
LTE Band 66

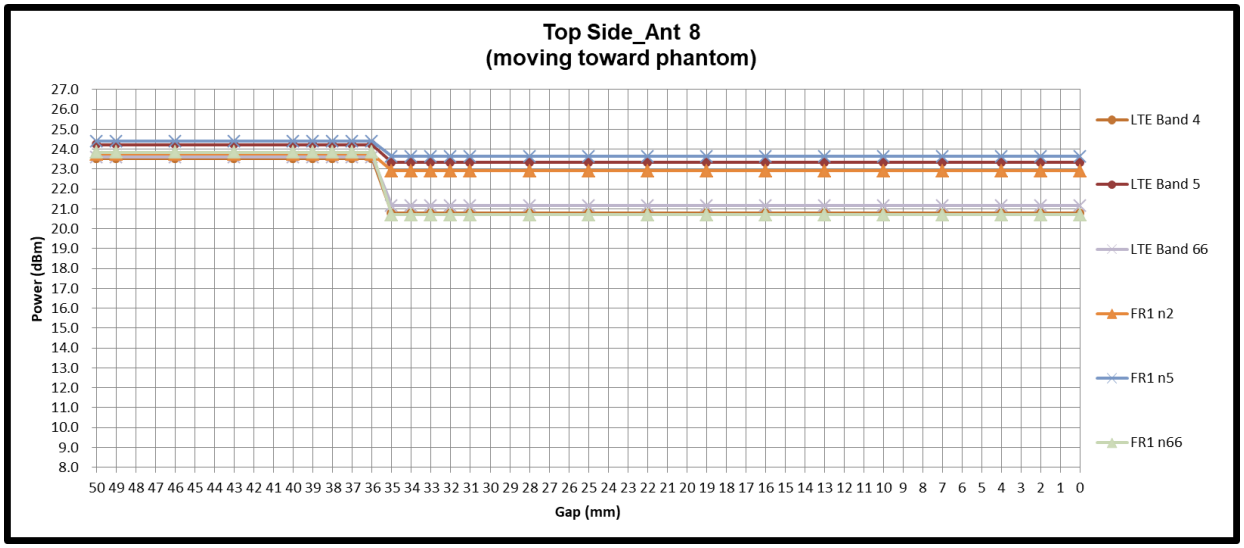

Front_Ant 8
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
LTE Band 66
FR1 n2
FR1 n5
FR1 n66

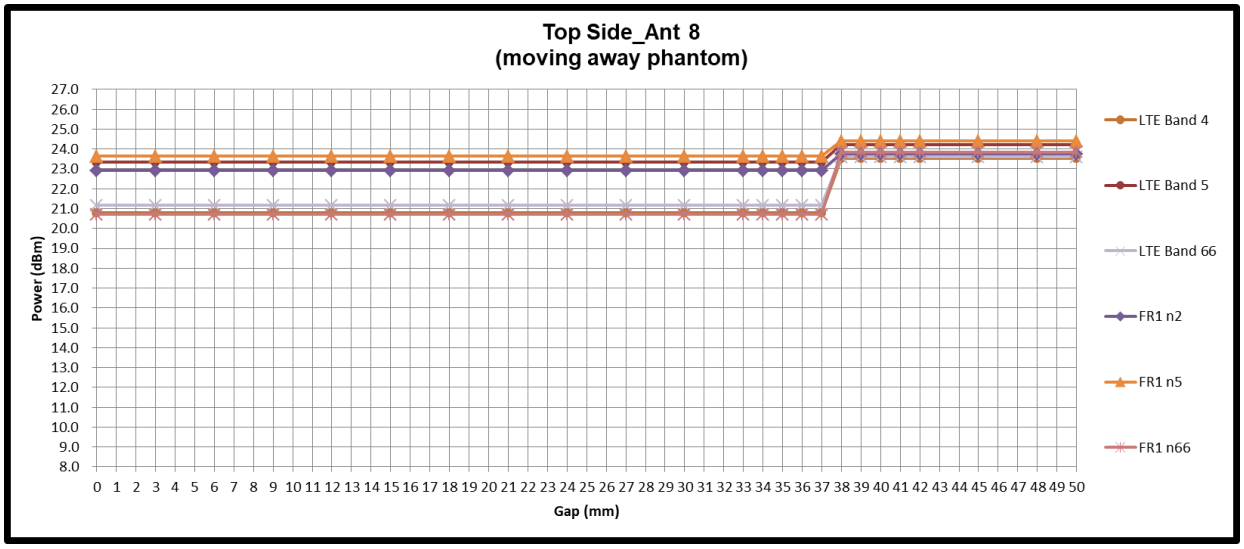

Back_Ant 8
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
LTE Band 66
FR1 n2
FR1 n5
FR1 n66

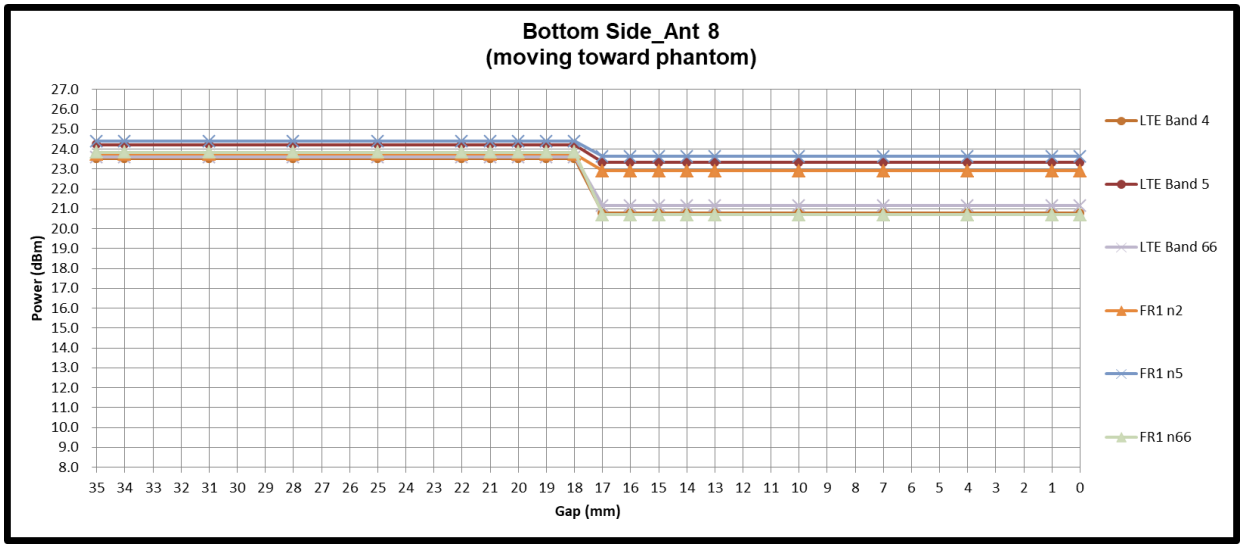

Back_Ant 8
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
LTE Band 66
FR1 n2
FR1 n5
FR1 n66

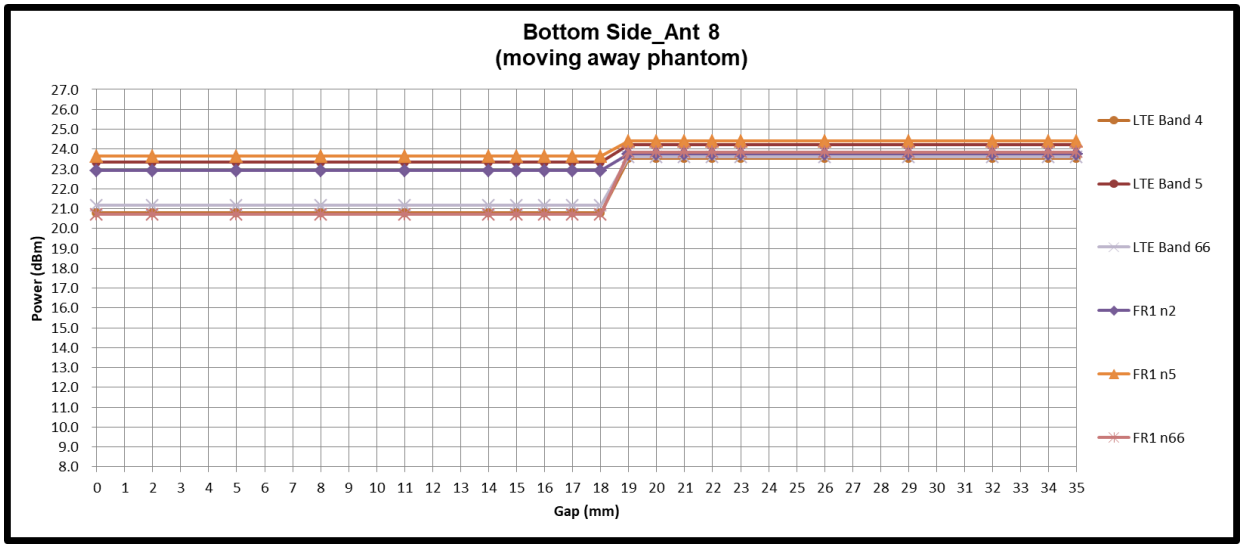

Left Side_Ant 8
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
LTE Band 66
FR1 n2
FR1 n5
FR1 n66


Left Side_Ant 8
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
LTE Band 66
FR1 n2
FR1 n5
FR1 n66


Top Side_Ant 8
(moving toward phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
LTE Band 66
FR1 n2
FR1 n5
FR1 n66


Top Side_Ant 8
(moving away phantom)
Power (dBm)
Gap (mm)
LTE Band 4
LTE Band 5
LTE Band 66
FR1 n2
FR1 n5
FR1 n66



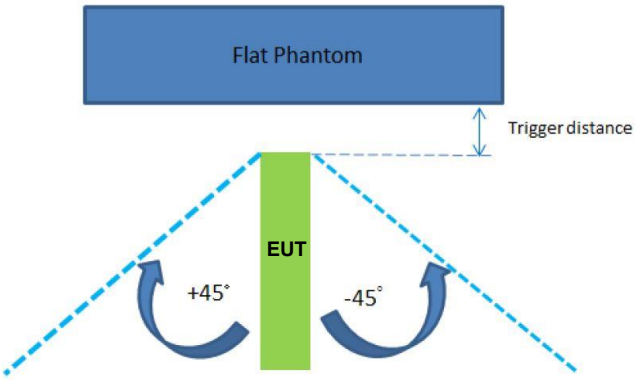


<Proximity Sensor Triggering Coverage (KDB 616217 D04 section 6.3)>:

Since the antenna and sensor are collocated and all of the peak SAR location is overlapping with the sensor pad for this device, therefore, According to KDB 616217 section6.3, these procedures do not apply and are not required for this device. Due to the antenna and sensor are collocated and the peak SAR location is overlapping with the sensor on this device.

<Tablet Tilt angle influences to proximity sensor triggering (KDB 616217 D04 section 6.4)>:

The influence of table tilt angles to proximity sensor triggering was determined by positioning each tablet edge that contains a transmitting antenna, perpendicular to the flat phantom, at above separation distance.
Rotating the tablet around the edge next to the phantom in ≤ 10° increments until the tablet is ± 45° from the vertical position at 0°, and the maximum output power remains in the reduced mode.



Proximity Trigger Distance						
Position	Top Side		Left Side		Bottom Side	
Minimum (mm)	45	-45	45	-45	45	-45
Ant 1	16	17	31	31	17	18
Ant 3	16	17	31	31	17	18
Ant 5	16	17	31	31	17	18
Ant 6	16	17	31	31	17	18
Ant 8	16	17	31	31	17	18

<SAR measurement procedure involving proximity sensors>

1. Additional conservative evaluation of all positions to ensure that users can use it in hand exposure at a low power state.
2. For verification of compliance of power reduction scheme, additional SAR testing with EUT transmitting at full RF power at a conservative trigger distance was performed:

   Ant 1/3/5/6/8:

   Front: 35 mm
   Back: 20 mm
   Left Side: 30 mm
   Top Side: 15 mm
   Bottom Side: 15 mm