

F383 Antenna Report

DB2 and 5G+BT swap with increased cable length

Update date: 2026/03/26



Agenda

- Antenna Report
- Appendix

Requirement of Antenna Design and Measurement

Requirements of Antenna Design

RF Function	Number of ANT	Frequency Band	Remark
Wi-Fi _ Dual Band	2	2400~2500MHz & 5150~5850MHz	PCB
BT+Wi-Fi_5G	1	2400~2500MHz & 5150~5850MHz	PCB
Wi-Fi_5G	1	5150~5850MHz	PCB
Wi-Fi_6G	4	5925~7125MHz	PCB

Requirements of Measurement

Test Item	Specification	Result	
Efficiency	>75%	57%~78%.	Fail
Return Loss	< -12 dB	-10dB ~ -21dB	Fail
Isolation	2.4G < -20 dB ; 5G&6G < -25 dB	2.4G < -26 ~ -82 dB 5G & 6G < -26~-63 dB	Pass
Peak Gain	2.4G < 4.5 dBi ; 5G&6G < 5.5 dBi	2G < 4.36 dBi 5G < 5.47 dBi 6G < 5.45 dBi	Pass
ECC	0.2	MAX : 0.19	Pass
Uncorrelated combined gain	Between -7 dB and 1 dB Maximum +/-15° apart vertical directions -3 dB	MAX : 0.70 Min : -6.59	Pass
Correlated combined gain	< 6 dB	MAX : 5.90	Pass

Summary

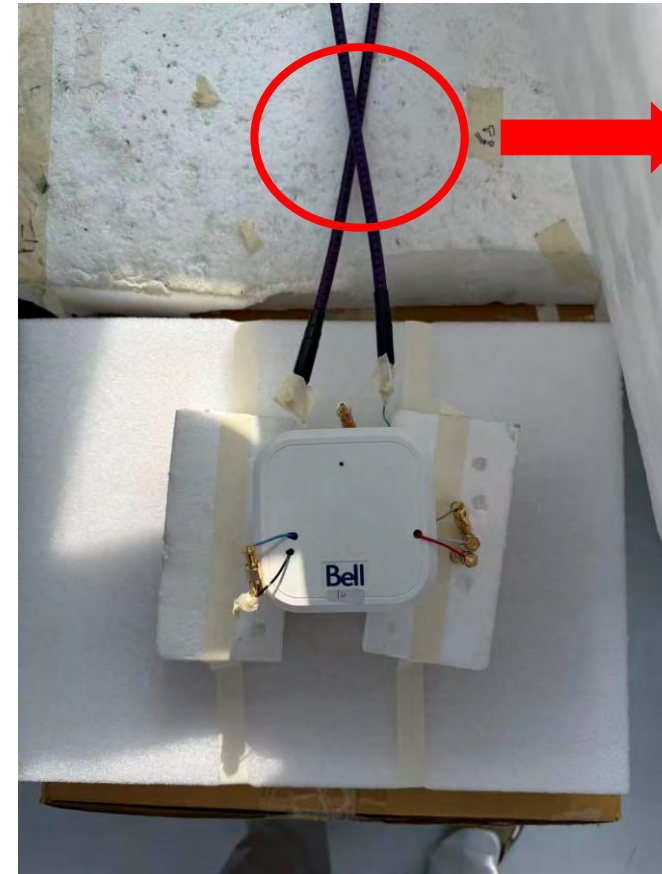
1. DB2 and 5G+BT have been swapped, and the cable length has been increased.
2. The Return Loss of all antennas can not meet spec.
3. The antenna isolation can meet spec.
4. All antenna efficiency can not meet spec , the measured efficiency range from 57% to 78%.
5. The Peak Gain of the DB1, DB2 and BT+5G antenna is about 2.91 to 5.47 dBi;
The Peak Gain of the 5G antenna is about 4.86 to 5.34 dBi;
The Peak Gain of the 6G1~6G4 antenna is about 4.72 to 5.45 dBi.
6. The ECC of all antennas is under 0.2.
7. The correlated gain is under 6 dBi
8. The uncorrelated gain is under 1 dBi

Measurement Environment



Measurement Environment

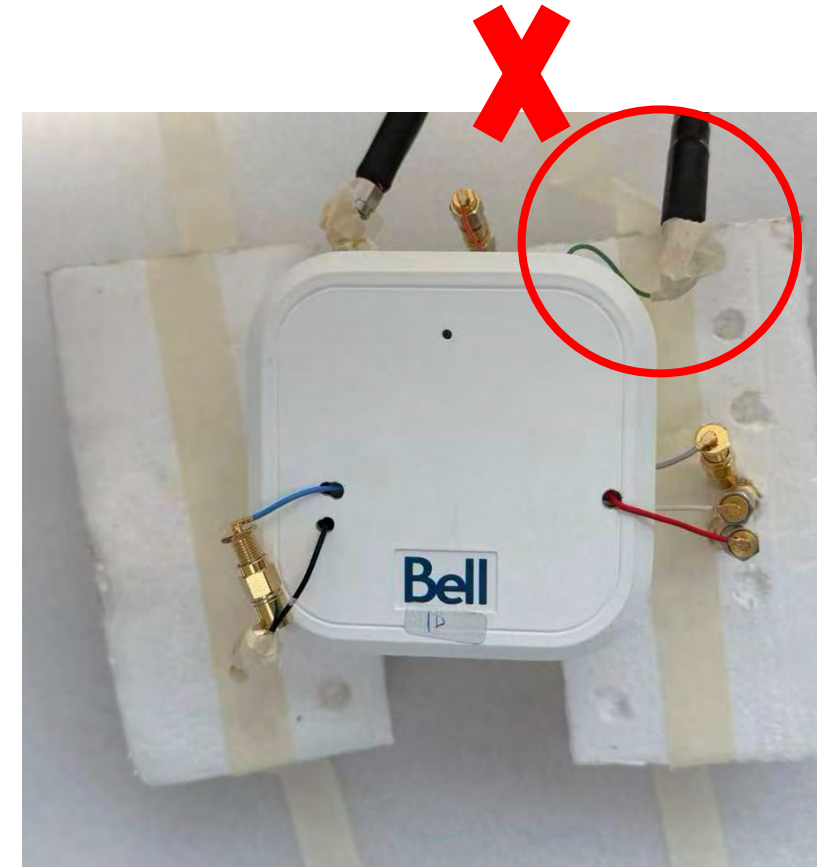
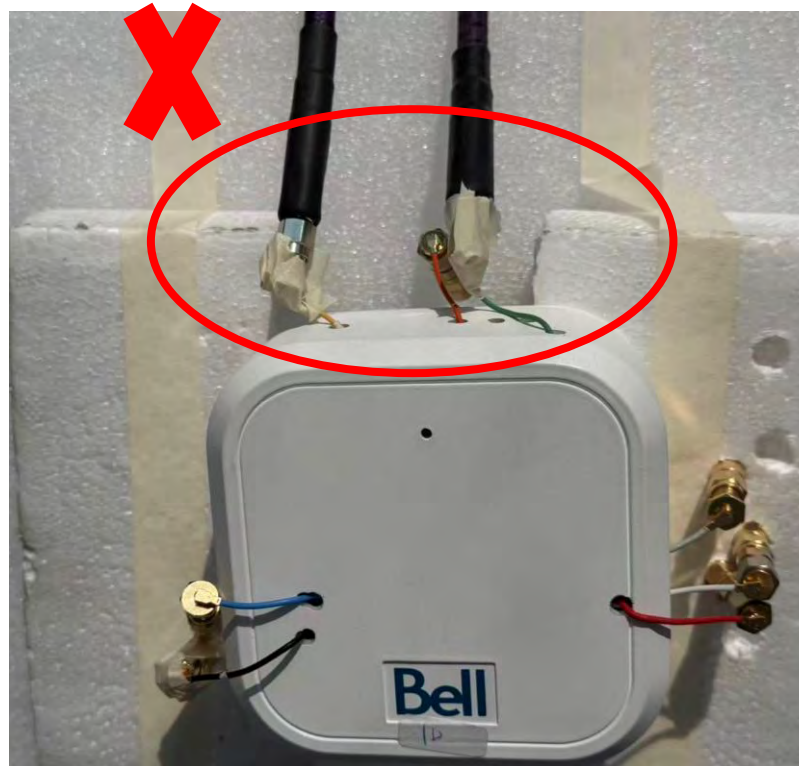
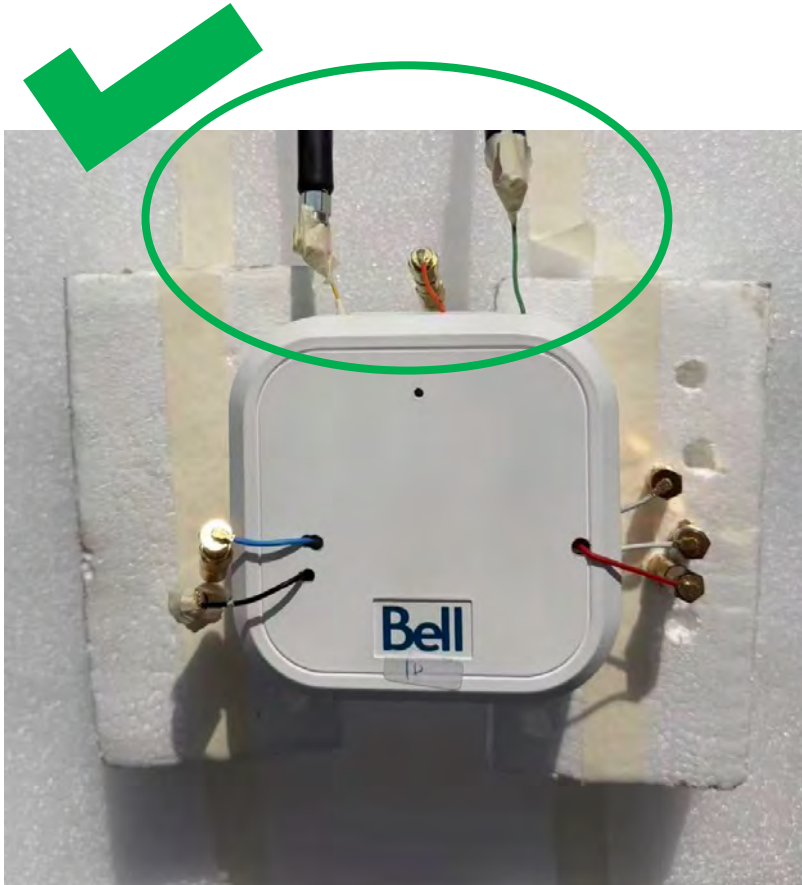
- Please straighten the SMA RF coaxial cable and avoid any crossing or overlapping, as this may degrade the isolation performance and cause it to fail to meet the specification.



the test cable
avoid crossing

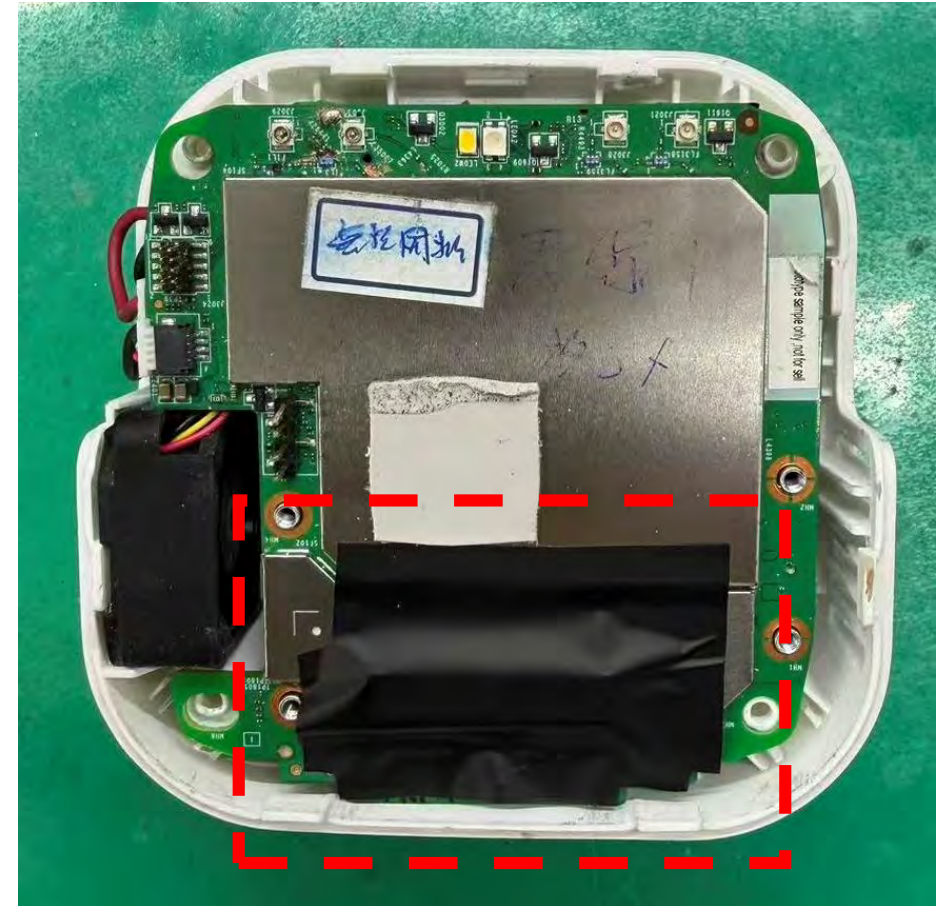
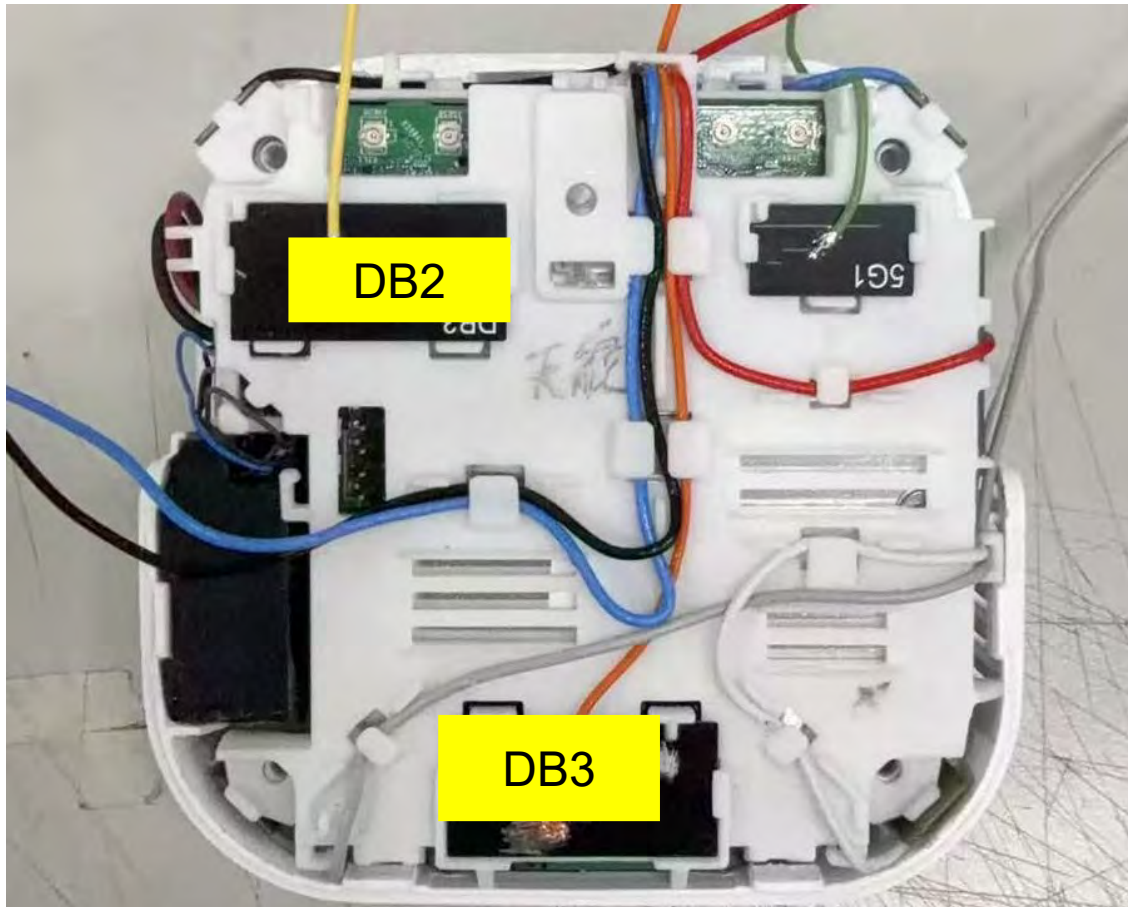
Measurement Environment

- Please straighten the test cable and do not leave it coiled.
- Please keep the SMA RF coaxial cable away from the antenna corner.



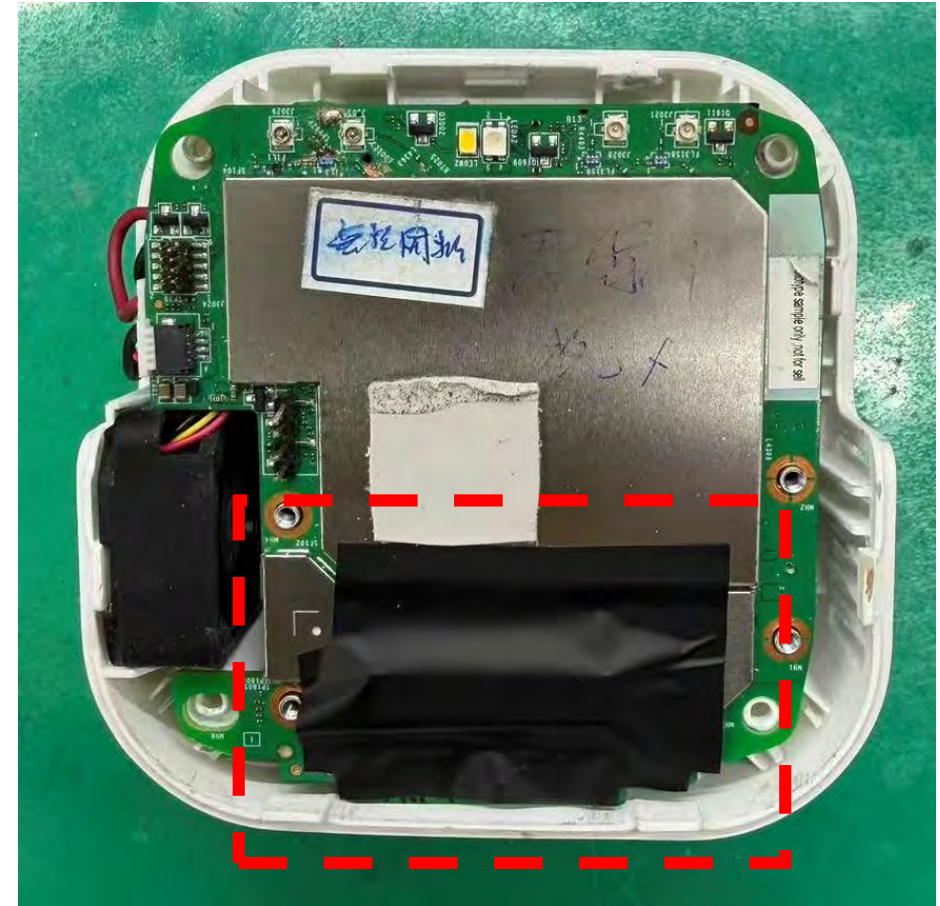
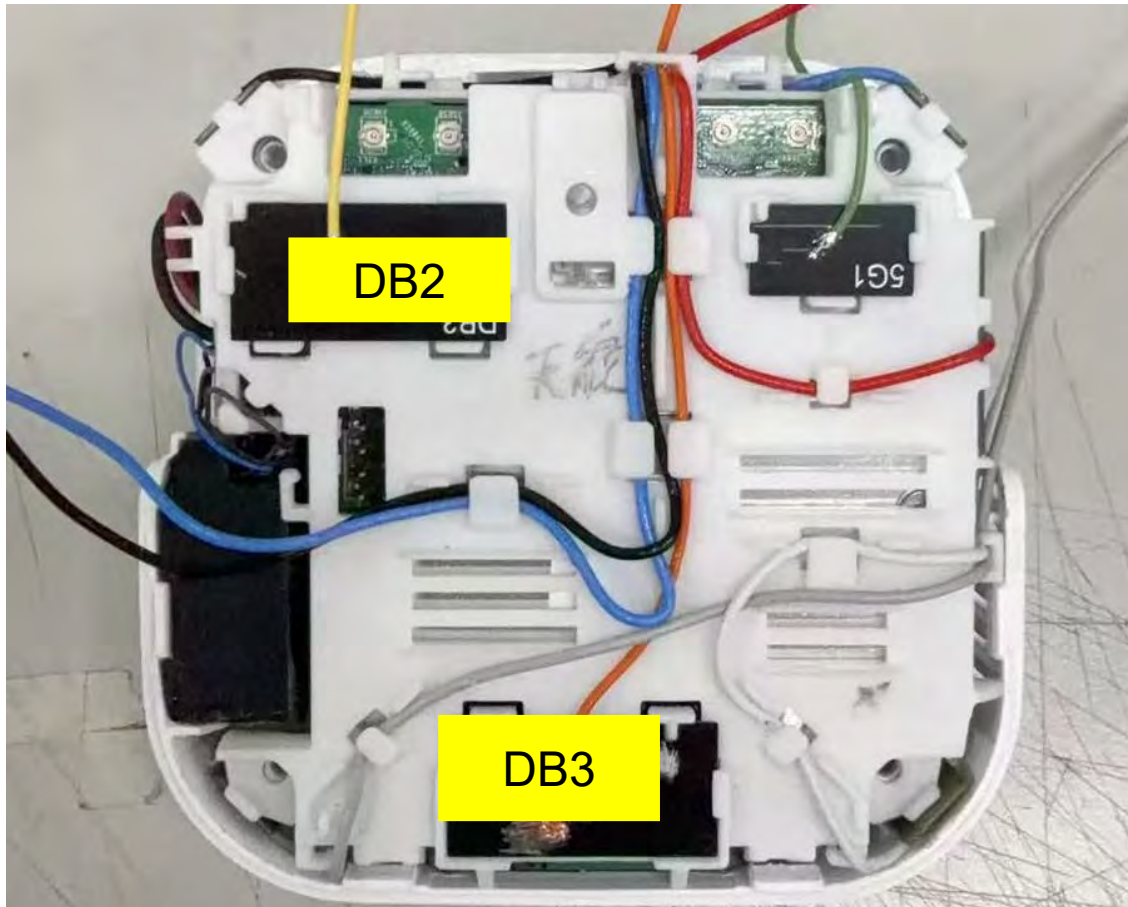
Measurement Environment

- Since the absorber is installed directly beneath the DB3 antenna, its impact is primarily concentrated on DB3 and the adjacent 6G3 and 6G4 antennas, resulting in more pronounced performance variation in these ports.



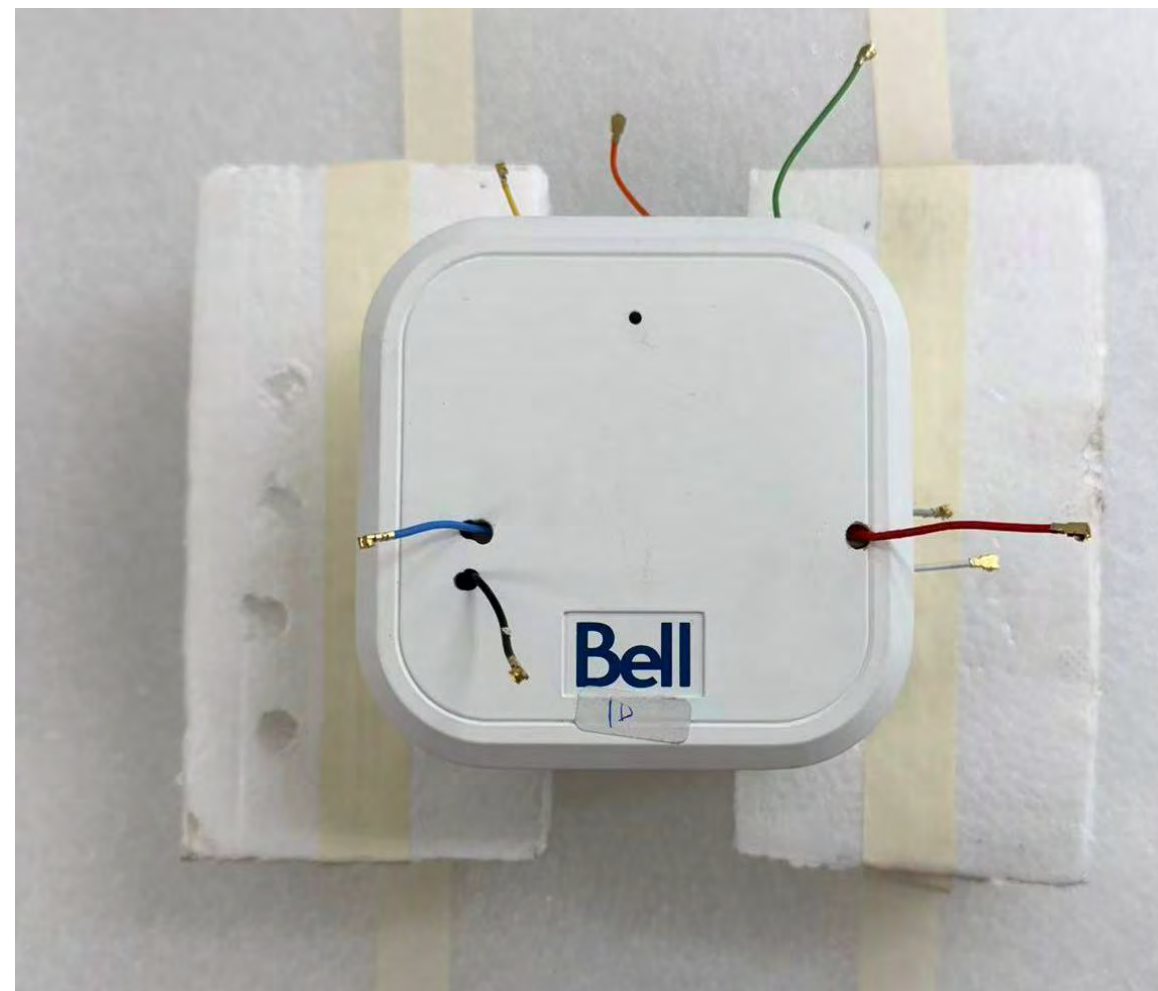
Measurement Environment

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Antenna Placement

Antenna	ANT Type	Cable color	Size (L * W * H)	Cable Type	Cable length
DB1	PCB	Red	25*18*0.6mm	1.37LLS	115 mm
DB3	PCB	Orange	30*15*0.6mm	1.13LLS	140 mm
DB2	PCB	Yellow	30*15*0.6mm	1.13LLS	95 mm
5G1	PCB	Green	18*10*0.6mm	1.13LLS	100 mm
6G1	PCB	Blue	20*10*0.6mm	1.37LLS	200 mm
6G2	PCB	Black	20*10*0.6mm	1.37LLS	225 mm
6G3	PCB	Grey	20*10*0.6mm	1.37LLS	240 mm
6G4	PCB	White	20*10*0.6mm	1.37LLS	205 mm



Antenna Return loss

Frequency (MHz)	DB1 (dB)	DB2 (dB)	BT+5G (dB)	5G (dB)	6G1 (dB)	6G2 (dB)	6G3 (dB)	6G4 (dB)	
2400	-17.87	-12.48	-10.63						
2500	-14.33	-14.75	-10.64						
5150	-14.62	-12.20	-15.79						-15.89
5850	-15.00	-14.29	-14.27						-16.92
5925					-13.01	-18.19	-12.65	-12.47	
7125					-18.78	-14.87	-19.03	-20.68	

Antenna Isolation(1)_2400MHz

	DB1	DB2	BT+5G	5G	6G1	6G2	6G3	6G4
DB1		-27.76	-26.42	-42.49	-52.64	-35.38	-42.94	-41.26
DB2	-27.76		-31.01	-30.99	-36.50	-31.89	-45.77	-52.86
BT+5G	-26.42	-31.01		-39.64	-48.84	-47.10	-50.23	-33.59
5G	-42.49	-30.99	-39.64		-44.99	-39.11	-62.54	-64.30
6G1	-52.64	-36.50	-48.84	-44.99		-59.71	-69.21	-63.41
6G2	-35.38	-31.89	-47.10	-39.11	-59.71		-63.60	-69.12
6G3	-42.94	-45.77	-50.23	-62.54	-69.21	-63.60		-52.45
6G4	-41.26	-52.86	-33.59	-64.30	-63.41	-69.12	-52.45	

Unit: dB

Antenna Isolation(2)_2500MHz

	DB1	DB2	BT+5G	5G	6G1	6G2	6G3	6G4
DB1		-30.31	-27.24	-37.90	-52.87	-38.25	-40.43	-41.63
DB2	-30.31		-33.90	-31.69	-36.66	-30.69	-42.18	-69.74
BT+5G	-27.24	-33.90		-41.53	-48.59	-45.28	-39.33	-32.25
5G	-37.90	-31.69	-41.53		-41.86	-41.86	-58.86	-70.89
6G1	-52.87	-36.66	-48.59	-41.86		-56.81	-62.45	-60.17
6G2	-38.25	-30.69	-45.28	-41.86	-56.81		-58.26	-81.47
6G3	-40.43	-42.18	-39.33	-58.86	-62.45	-58.26		-54.35
6G4	-41.63	-69.74	-32.25	-70.89	-60.17	-81.47	-54.35	

Unit: dB

Antenna Isolation(3)_5150MHz

	DB1	DB2	BT+5G	5G	6G1	6G2	6G3	6G4
DB1		-35.36	-41.70	-28.34	-30.58	-38.57	-30.07	-32.47
DB2	-35.36		-43.46	-38.99	-34.50	-26.36	-38.76	-41.02
BT+5G	-41.70	-43.46		-42.29	-47.68	-37.64	-32.86	-40.49
5G	-28.34	-38.99	-42.29		-27.35	-31.25	-38.60	38.87
6G1	-30.58	-34.50	-47.68	-27.35		-28.41	-37.95	-41.13
6G2	-38.57	-26.36	-37.64	-31.25	-28.41		-25.38	-62.04
6G3	-30.07	-38.76	-32.86	-38.60	-37.95	-25.38		-26.06
6G4	-32.47	-41.02	-40.49	38.87	-41.13	-62.04	-26.06	

Unit: dB

Antenna Isolation(4)_5850MHz

	DB1	DB2	BT+5G	5G	6G1	6G2	6G3	6G4
DB1		-35.25	-42.46	-30.43	-32.87	-47.17	-32.86	-58.44
DB2	-35.25		-37.70	-27.18	-35.81	-39.00	-45.46	-44.22
BT+5G	-42.46	-37.70		-38.39	-46.49	-38.05	-26.73	-31.65
5G	-30.43	-27.18	-38.39		-28.74	-40.16	-34.65	-40.48
6G1	-32.87	-35.81	-46.49	-28.74		-30.97	-35.40	-41.77
6G2	-47.17	-39.00	-38.05	-40.16	-30.97		-29.12	-42.65
6G3	-32.86	-45.46	-26.73	-34.65	-35.40	-29.12		-38.34
6G4	-58.44	-44.22	-31.65	-40.48	-41.77	-42.65	-38.34	

Unit: dB

Antenna Isolation(5)_5925MHz

	DB1	DB2	BT+5G	5G	6G1	6G2	6G3	6G4
DB1		-35.49	-40.39	-29.24	-31.77	-41.13	-33.30	-46.09
DB2	-35.49		-34.42	-28.17	-34.30	-40.45	-56.50	-49.75
BT+5G	-40.39	-34.42		-35.57	-50.30	-37.62	-28.18	-31.45
5G	-29.24	-28.17	-35.57		-29.83	-36.28	-32.84	-39.40
6G1	-31.77	-34.30	-50.30	-29.83		-31.05	-34.77	-40.11
6G2	-41.13	-40.45	-37.62	-36.28	-31.05		-30.23	-40.39
6G3	-33.30	-56.50	-28.18	-32.84	-34.77	-30.23		-33.29
6G4	-46.09	-49.75	-31.45	-39.40	-40.11	-40.39	-33.29	

Unit: dB

Antenna Isolation(6)_7125MHz

	DB1	DB2	BT+5G	5G	6G1	6G2	6G3	6G4
DB1		-38.44	-45.77	-39.72	-31.04	-33.12	-35.36	-34.03
DB2	-38.44		-35.37	-31.55	-36.34	-38.26	-32.81	-45.25
BT+5G	-45.77	-35.37		-45.52	-52.98	-43.30	-29.06	-35.95
5G	-39.72	-31.55	-45.52		-36.02	-44.42	-40.37	-37.45
6G1	-31.04	-36.34	-52.98	-36.02		-31.81	-48.72	-36.65
6G2	-33.12	-38.26	-43.30	-44.42	-31.81		-25.88	-40.96
6G3	-35.36	-32.81	-29.06	-40.37	-48.72	-25.88		-39.17
6G4	-34.03	-45.25	-35.95	-37.45	-36.65	-40.96	-39.17	

Unit: dB

Efficiency and Peak Gain(1)

Frequency (MHz)	DB1		DB2		BT+5G		5G	
	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)
2400	3.88	75.26	4.11	75.34	3.45	56.93		
2450	4.23	75.92	4.36	76.09	3.10	60.02		
2500	4.13	76.18	3.76	75.99	2.91	57.18		
5150	5.11	76.87	4.80	75.99	5.34	77.00	4.96	77.05
5470	5.47	75.89	5.40	75.10	5.27	75.65	5.34	75.77
5850	4.73	75.12	5.15	76.43	4.81	76.31	4.86	75.14

Efficiency and Peak Gain(2)

Frequency (MHz)	6G1		6G2		6G3		6G4	
	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)
5925	4.85	76.83	4.99	75.64	4.96	75.24	4.72	75.11
6525	5.37	75.12	5.16	76.36	5.45	75.02	5.23	76.26
7125	4.93	75.47	5.32	76.88	5.13	75.74	5.03	76.01

Correlated Gain and Uncorrelated Gain

Correlated signals

Any transmit beamforming mode, whether fixed or adaptive Examples: Phased arrays, Closed Loop MIMO, Transmitter Adaptive Antenna, Maximum Ratio Transmission (MRT), or Statistical Eigen Beamforming (EBF)

Cyclic Delay Diversity (CDD) modes Example: Legacy modes in 802.11n

Same digital data carried by each Tx antenna, but with different cyclic delays

Signals are highly correlated at any one frequency

Completely uncorrelated signals (if not combined with a correlated mode)

Space Time Block Codes (STBC) or Space Time Codes (STC) for which different digital data is carried by each Tx antenna during any symbol period Example: WiMAX Matrix A (Alamouti coding)

Spatial Multiplexing MIMO (SM-MIMO) Example: WiMAX Matrix B; Matrix C, which adds diversity, is also uncorrelated

Independent data streams sent to each Tx antenna

Unequal antenna gain, equal transmit powers

For antenna gains = $G_1, G_2, \dots, G_N$ dBi

If transmit signals are correlated, then Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N]$ dBi

If all transmit signals are completely uncorrelated, then Directional gain = $10 \log[(10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10})/N]$ dBi

Correlated Gain Table

Frequency (MHz)	3D Correlated Gain	
	Peak Gain (dBi)	Average Gain (dBi)
2450	3.65	-3.05
5470	6.53	0.82
6525	6.26	0.95

Uncorrelated Gain Table

Frequency (MHz)	3D Uncorrelated Gain	
	Peak Gain (dBi)	Average Gain (dBi)
2450	1.45	-5.39
5470	1.13	-4.33
6525	0.73	-4.32

ECC Table(1)

Correlation table (ECC) _2G

Frequency (MHz)	DB1&DB2	DB1&BT+5G	DB2&BT+5G
2400	0.18	0.18	0.16
2450	0.16	0.16	0.17
2500	0.16	0.18	0.18

ECC Table(2)

Correlation table (ECC) _5G

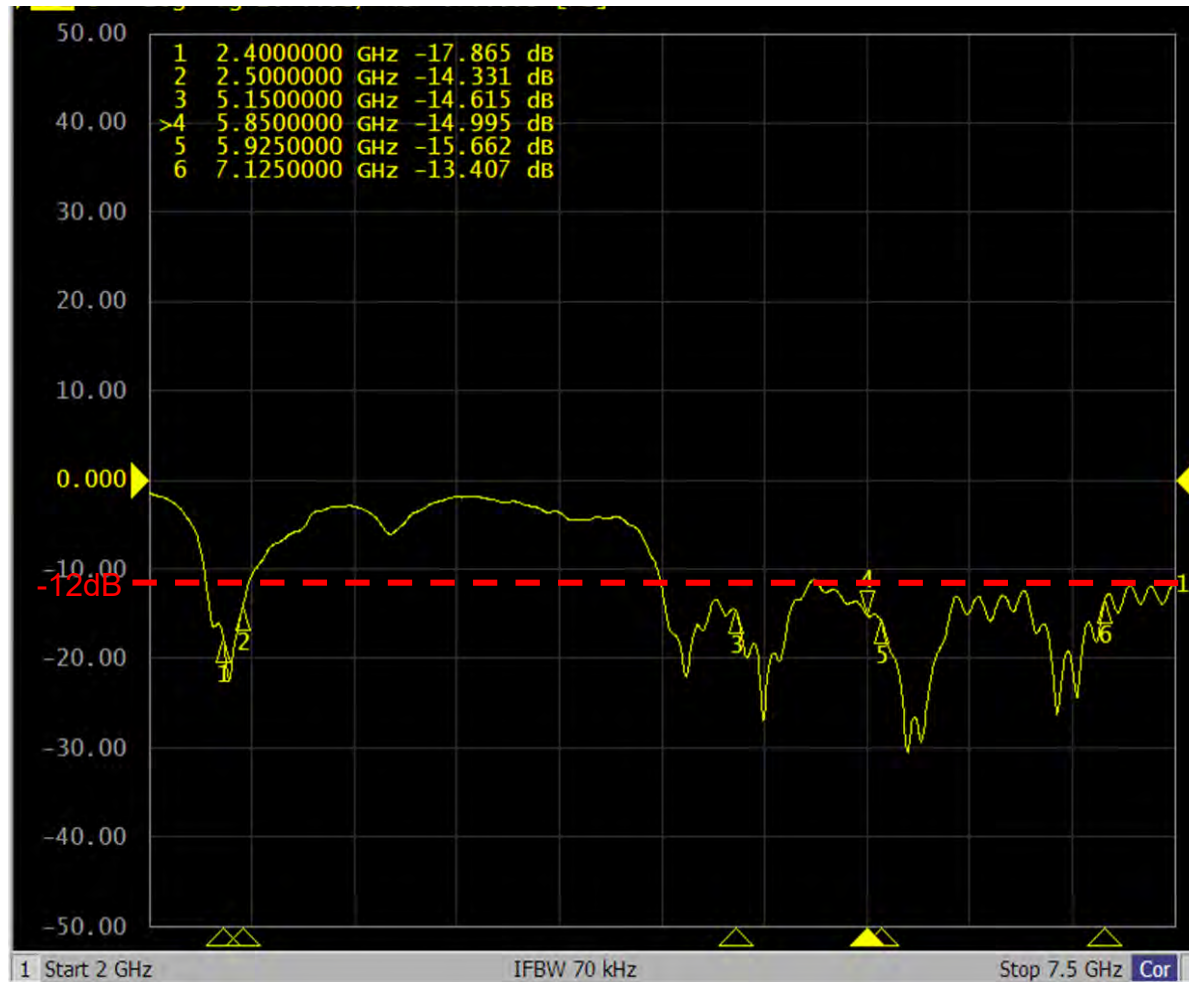
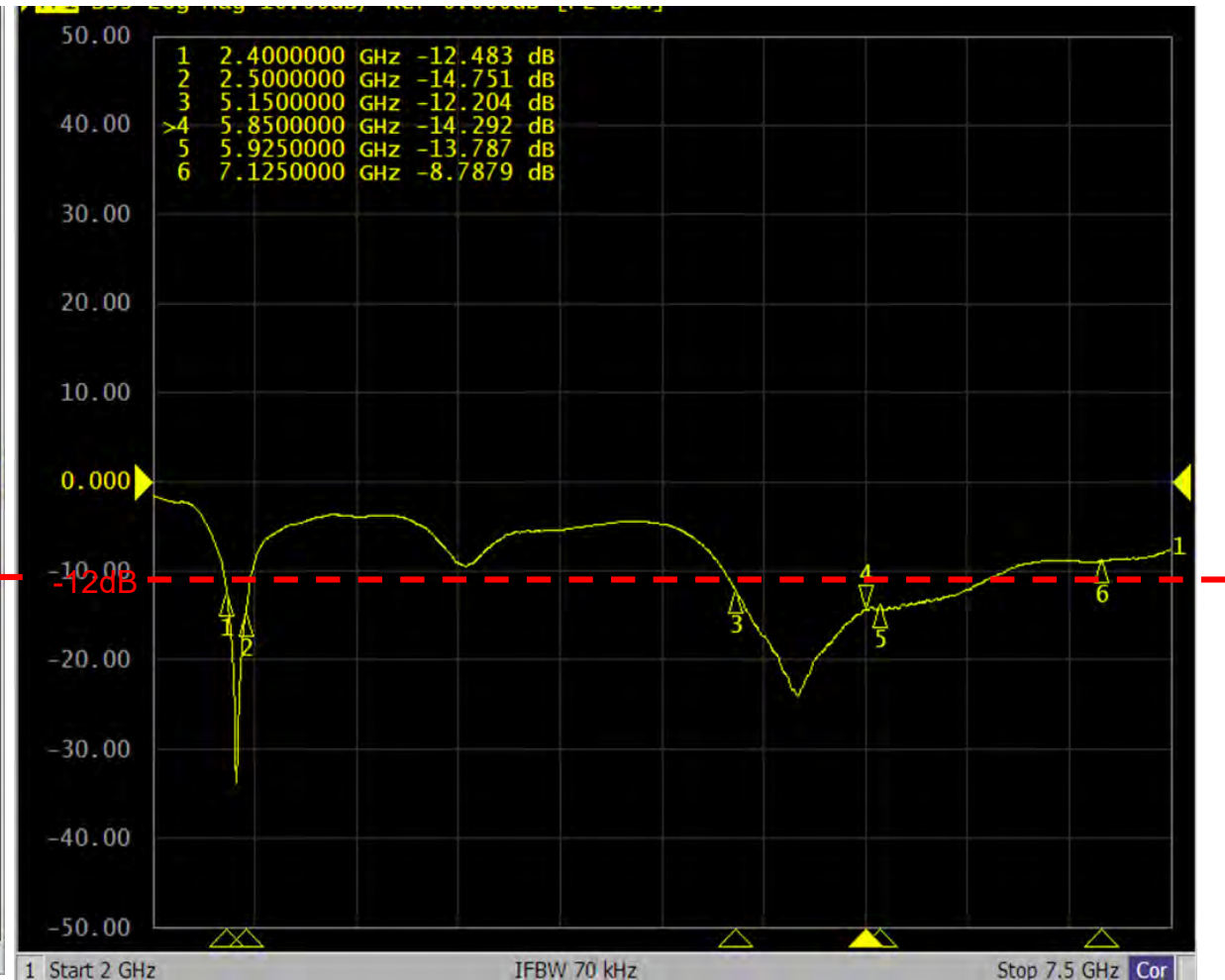
Frequency (MHz)	DB1&DB2	DB1&BT+5G	DB1&5G	DB2&BT+5G	DB2&5G	BT+5G&5G
5150	0.18	0.18	0.15	0.17	0.18	0.17
5470	0.17	0.17	0.17	0.15	0.16	0.17
5850	0.15	0.18	0.17	0.15	0.17	0.19

ECC Table(3)

Correlation table (ECC) _6G

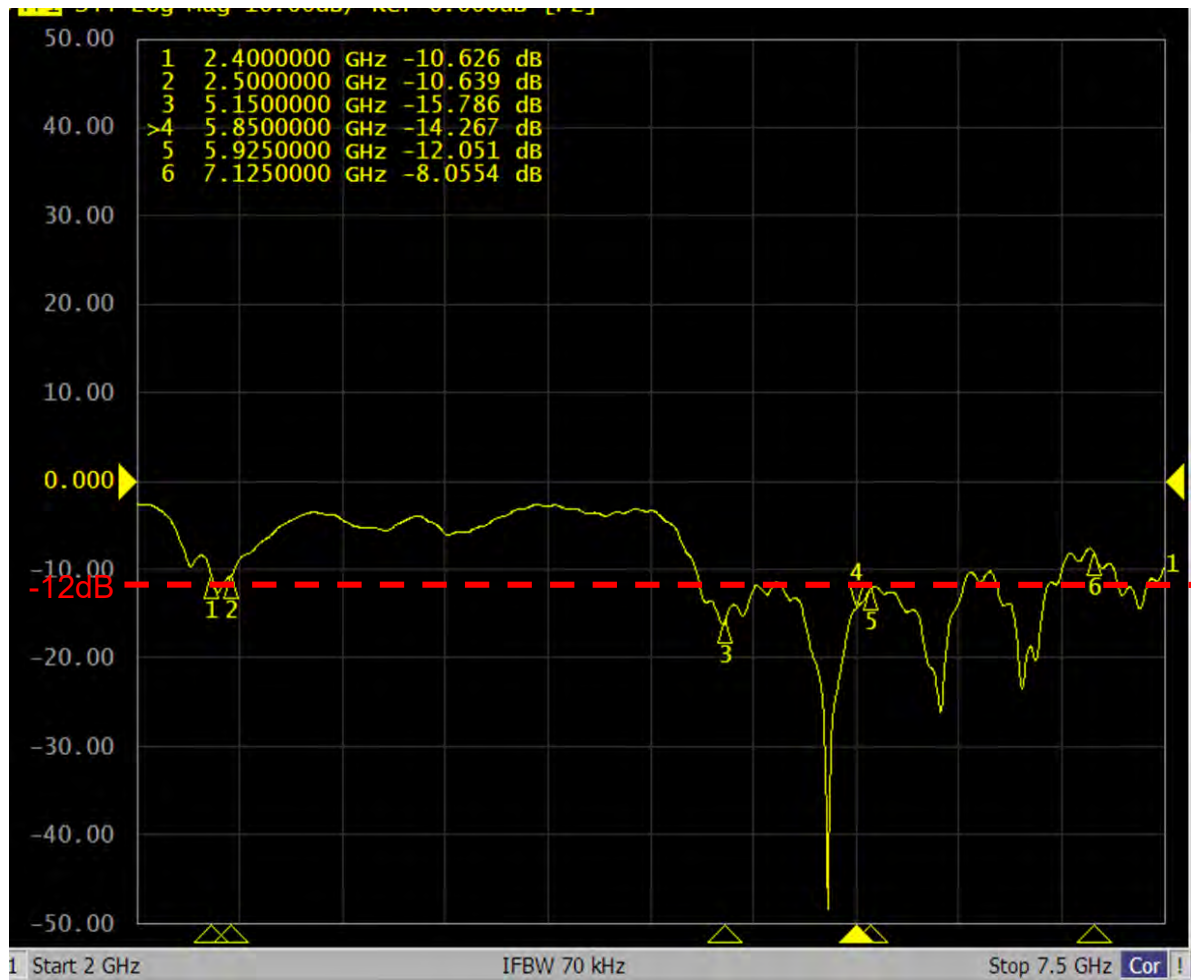
Frequency (MHz)	6G1&6G2	6G1&6G3	6G1&6G4	6G2&6G3	6G2&6G4	6G3&6G4
5925	0.16	0.15	0.17	0.16	0.19	0.17
6525	0.15	0.18	0.18	0.17	0.15	0.17
7125	0.18	0.16	0.18	0.17	0.16	0.17

Return Loss

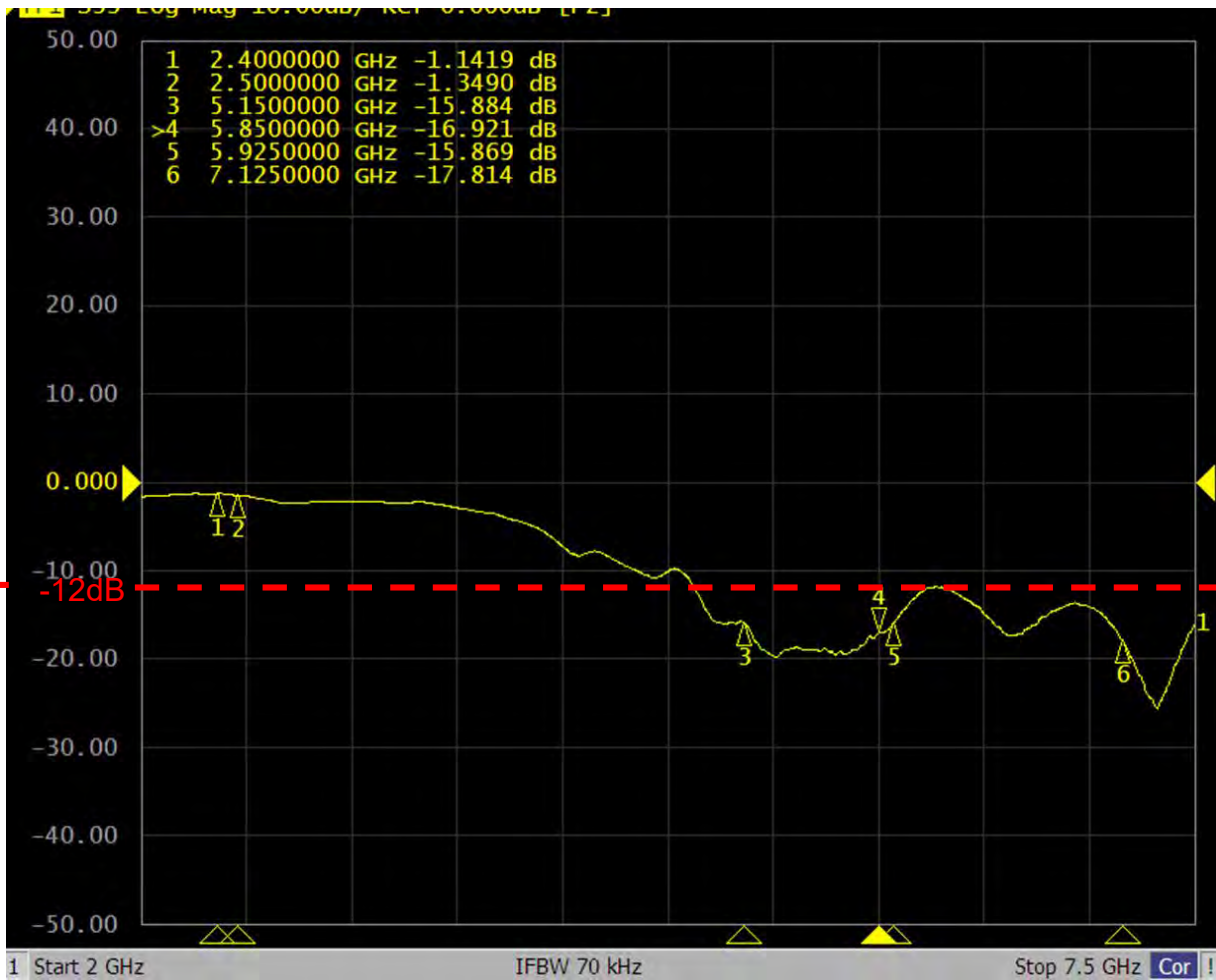
DB1**DB2**

Return Loss

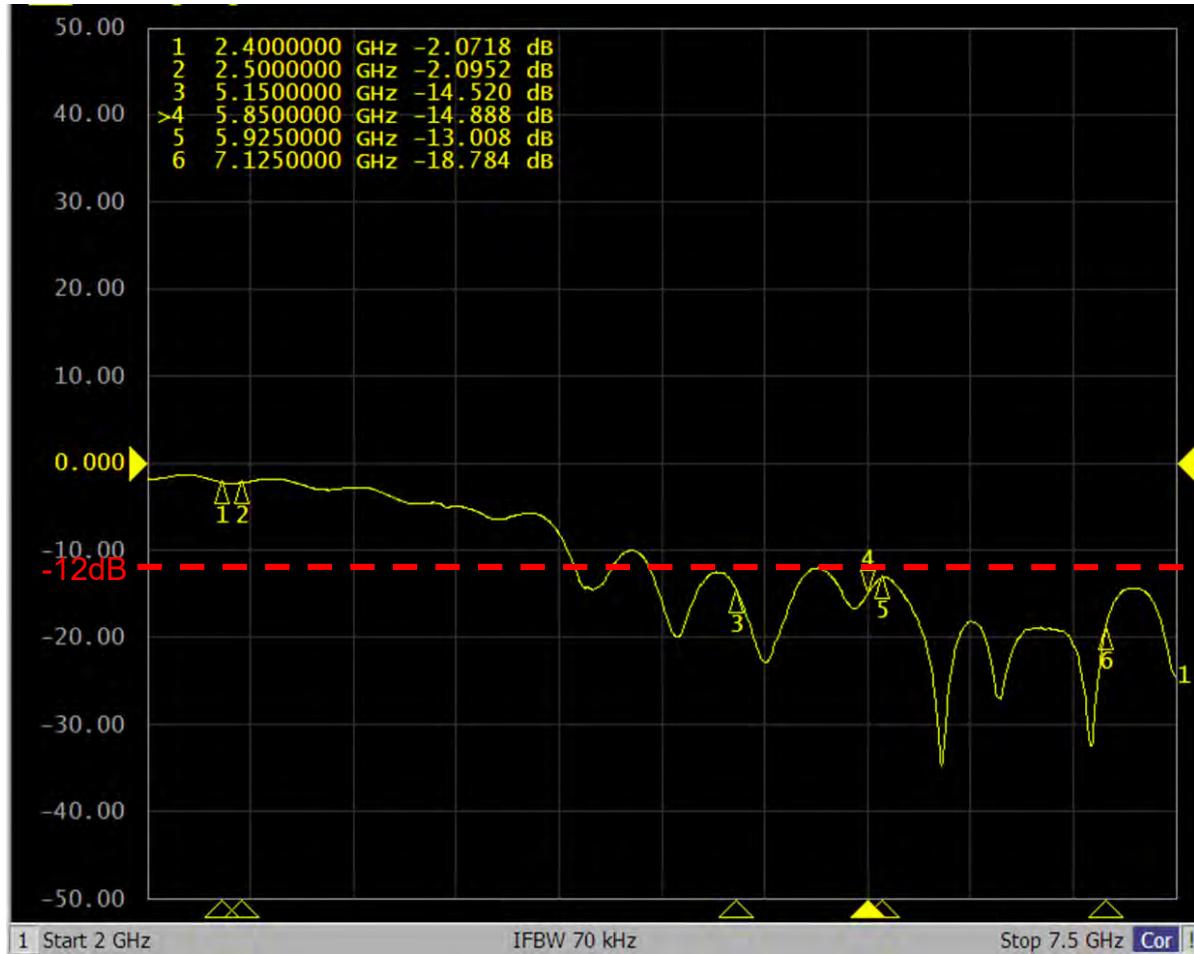
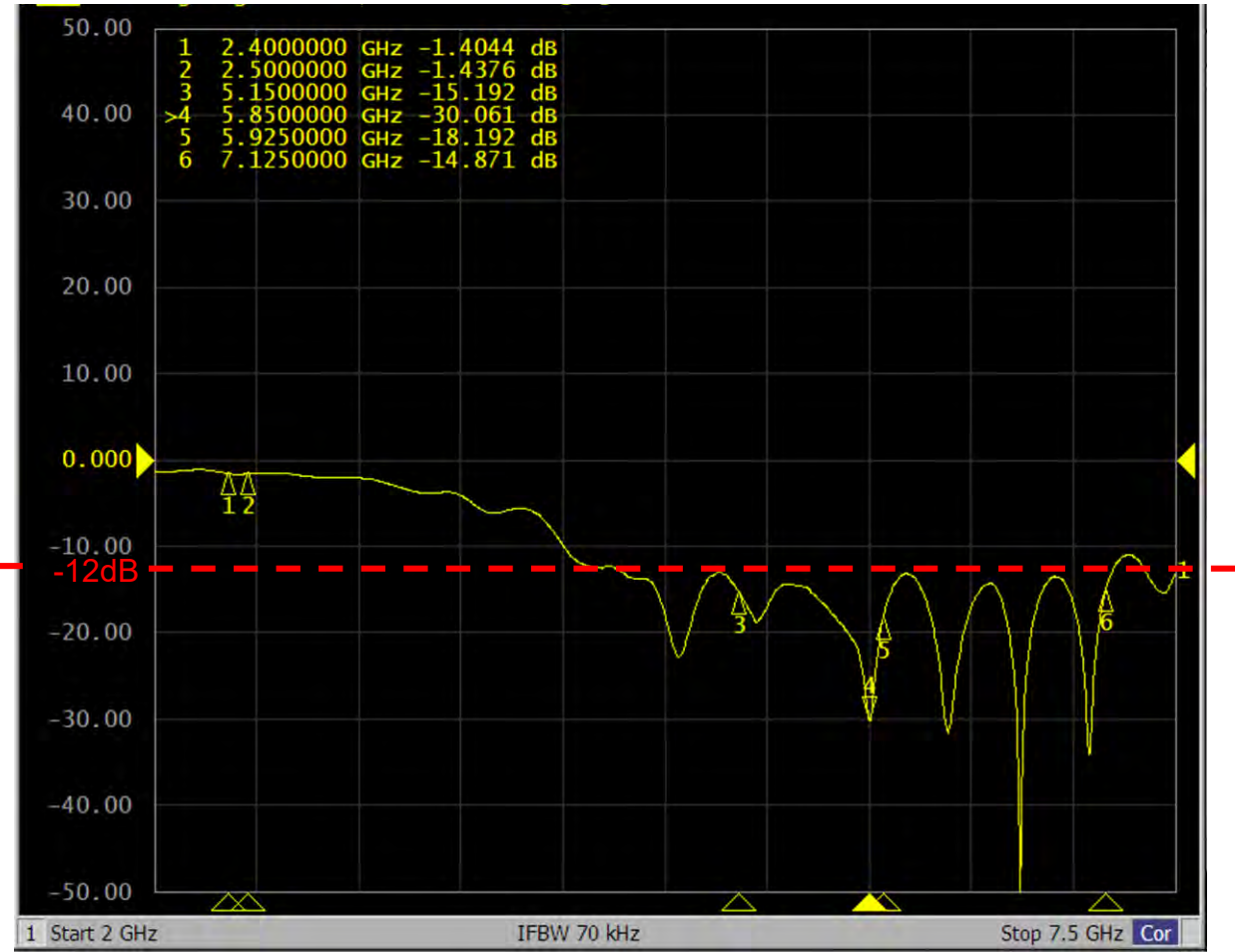
BT+5G



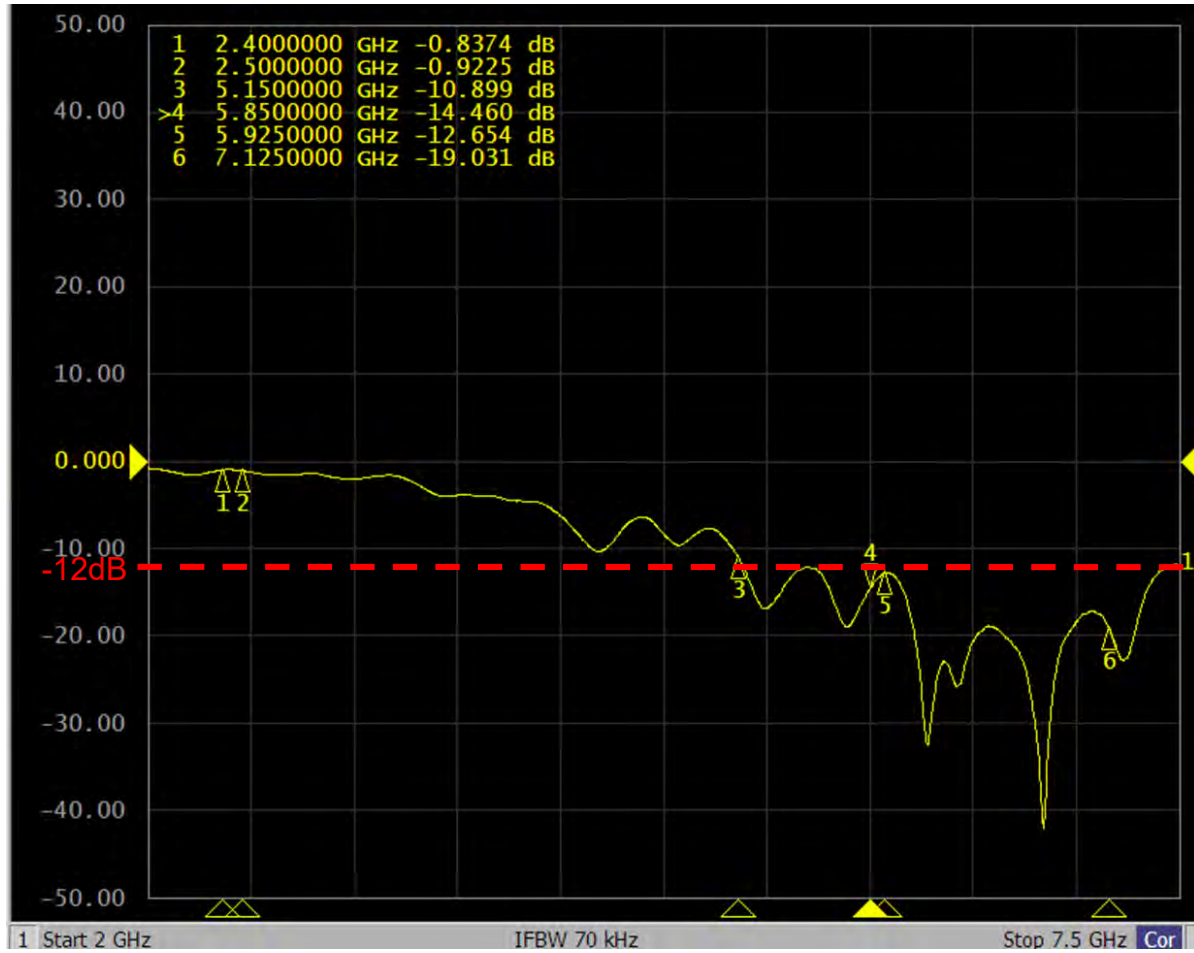
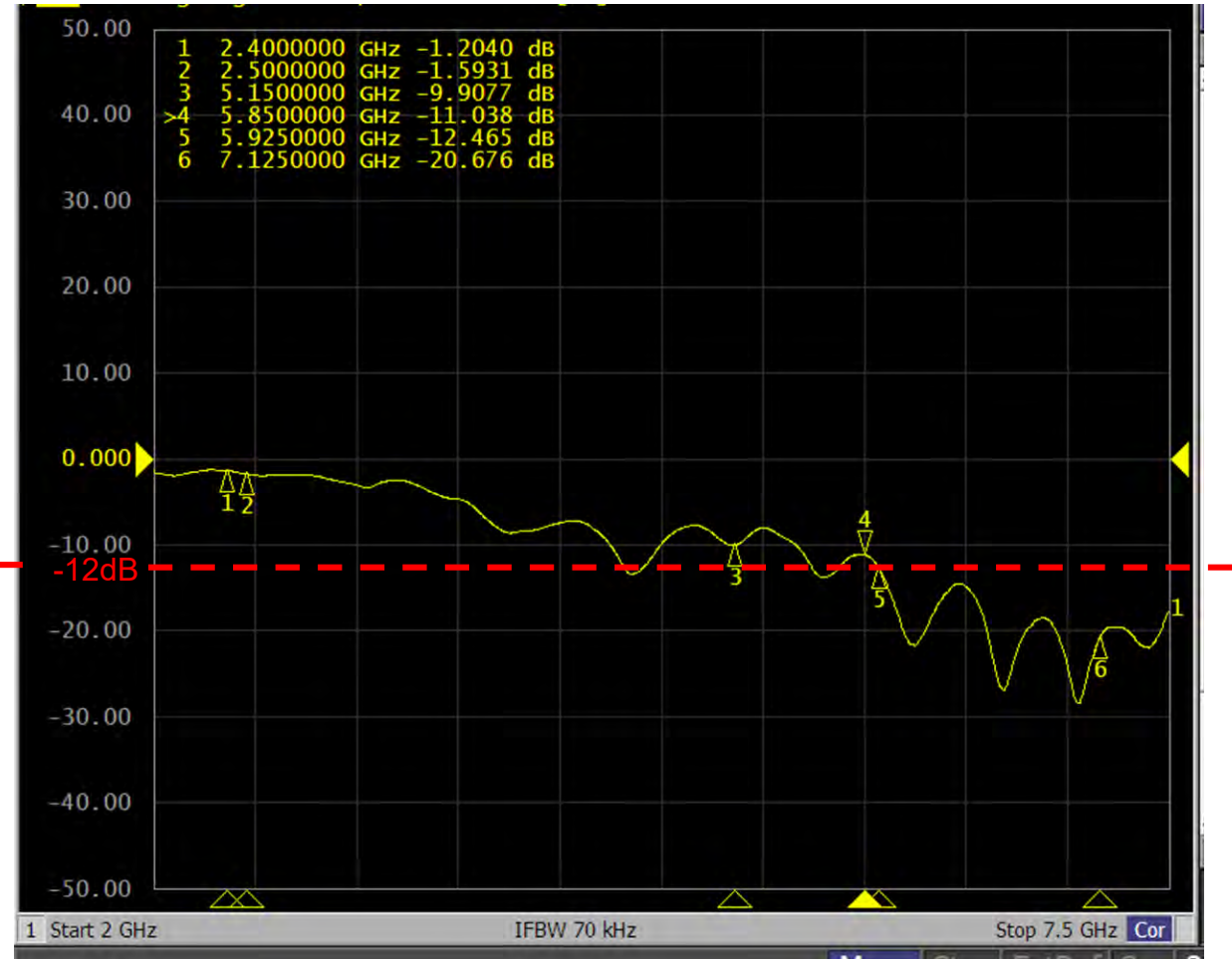
5G



Return Loss

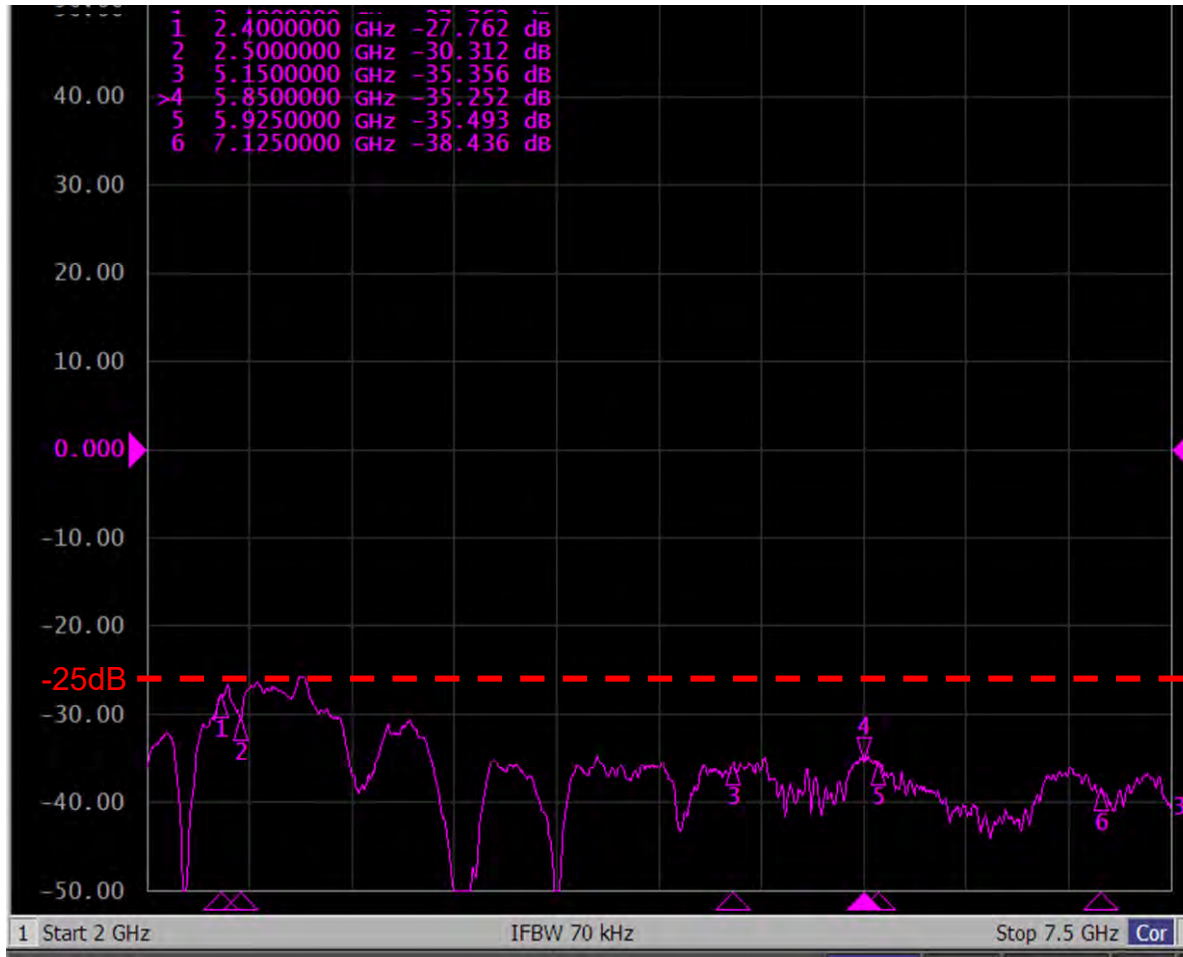
6G1**6G2**

Return Loss

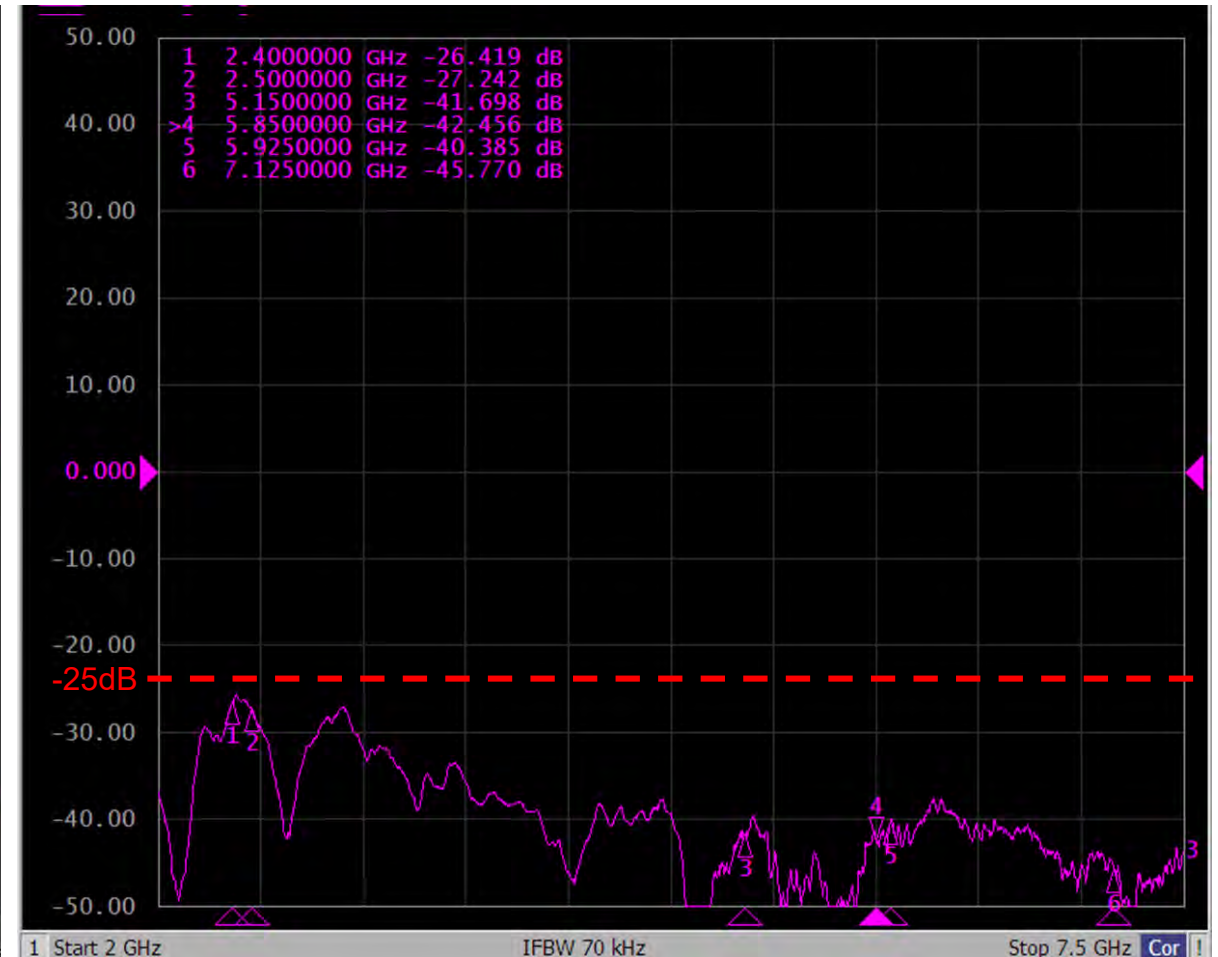
6G3**6G4**

Isolation

DB1&DB2

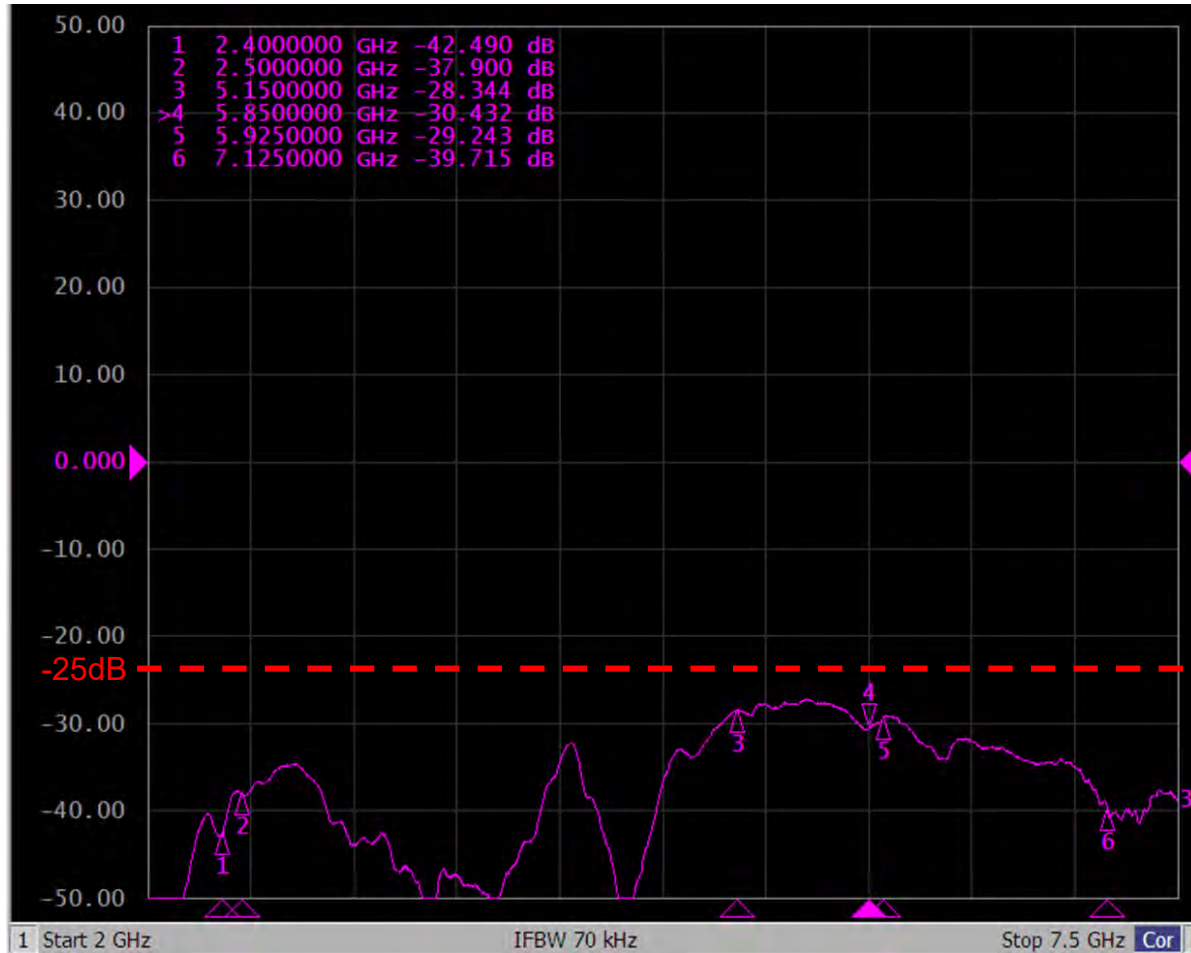


DB1&BT+5G

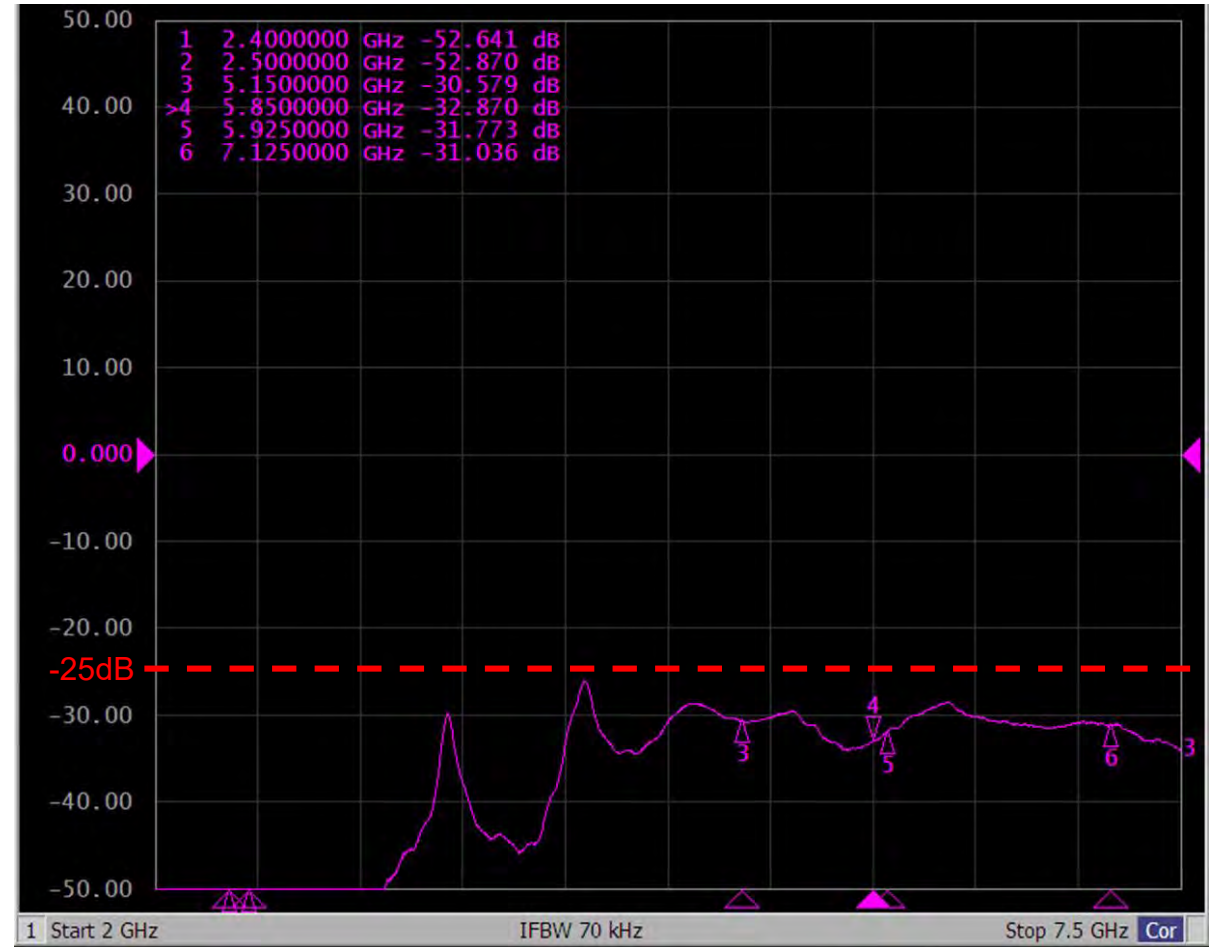


Isolation

DB1&5G

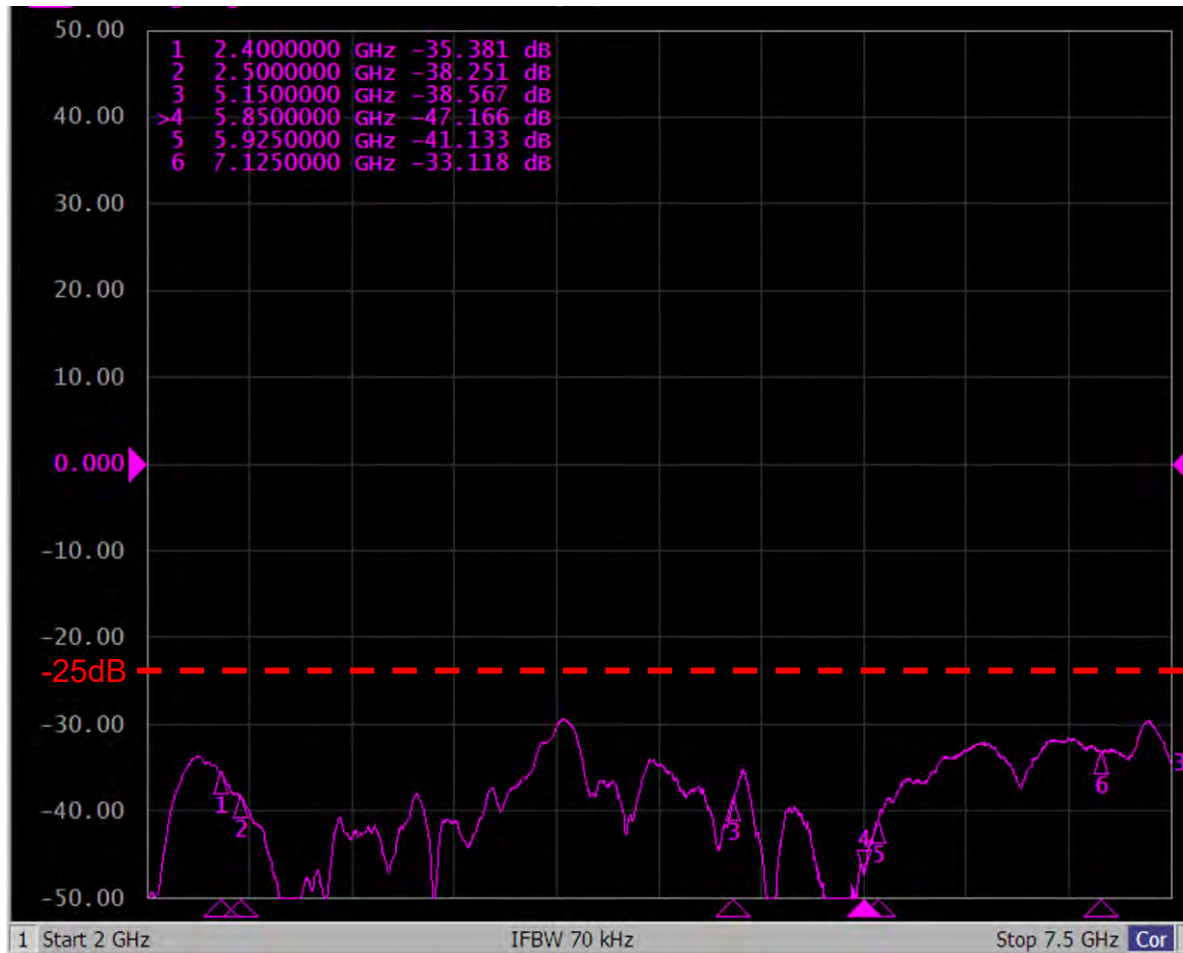


DB1&6G1

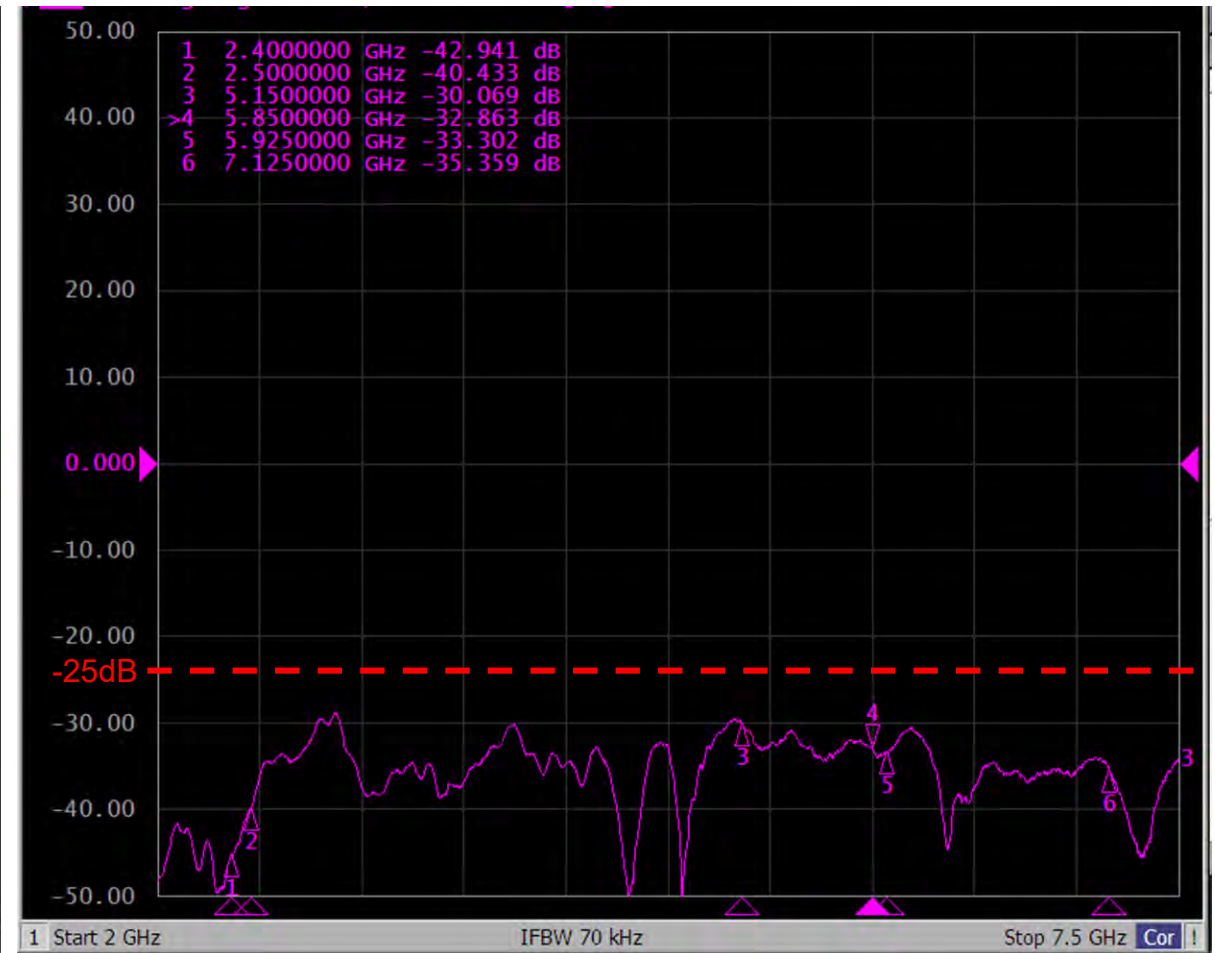


Isolation

DB1&6G2

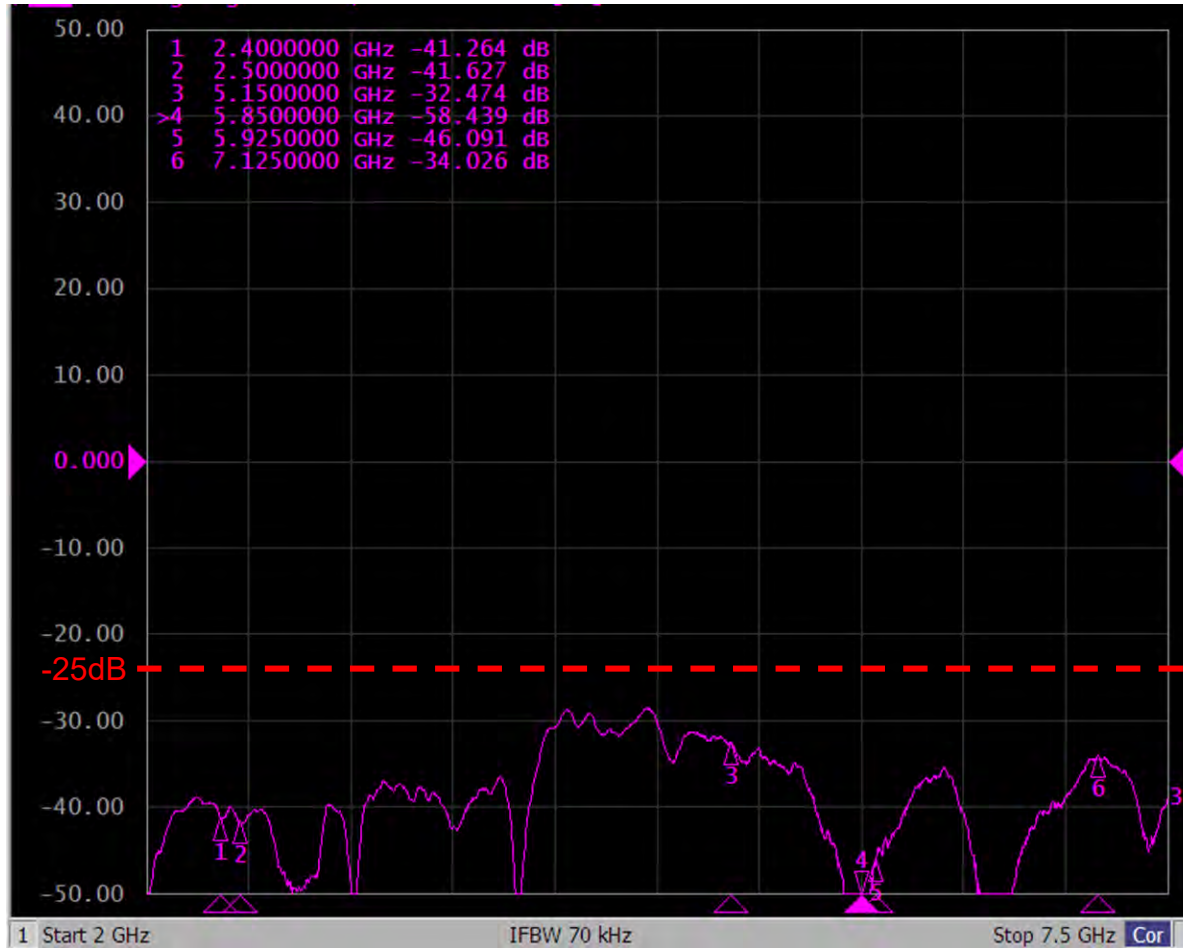


DB1&6G3

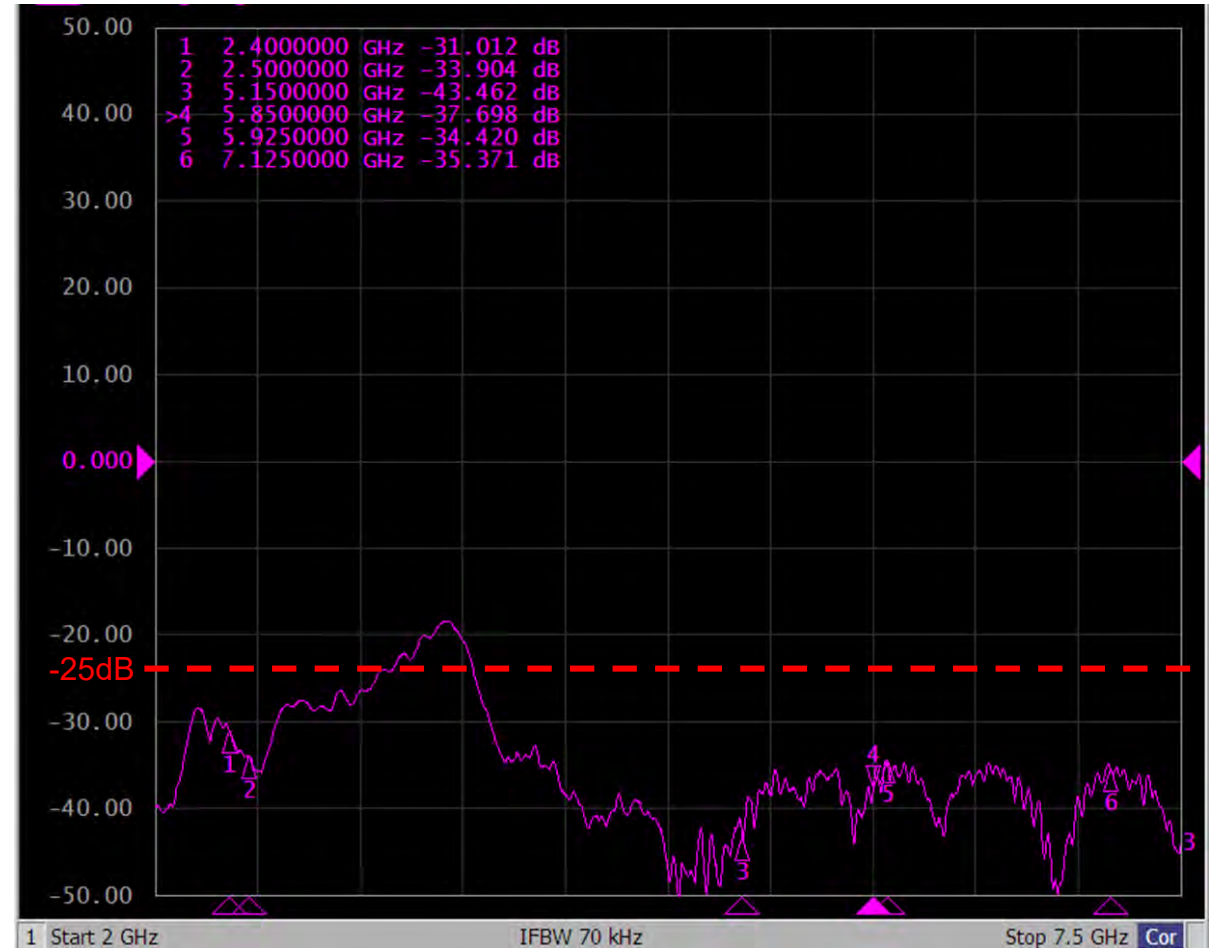


Isolation

DB1&6G4

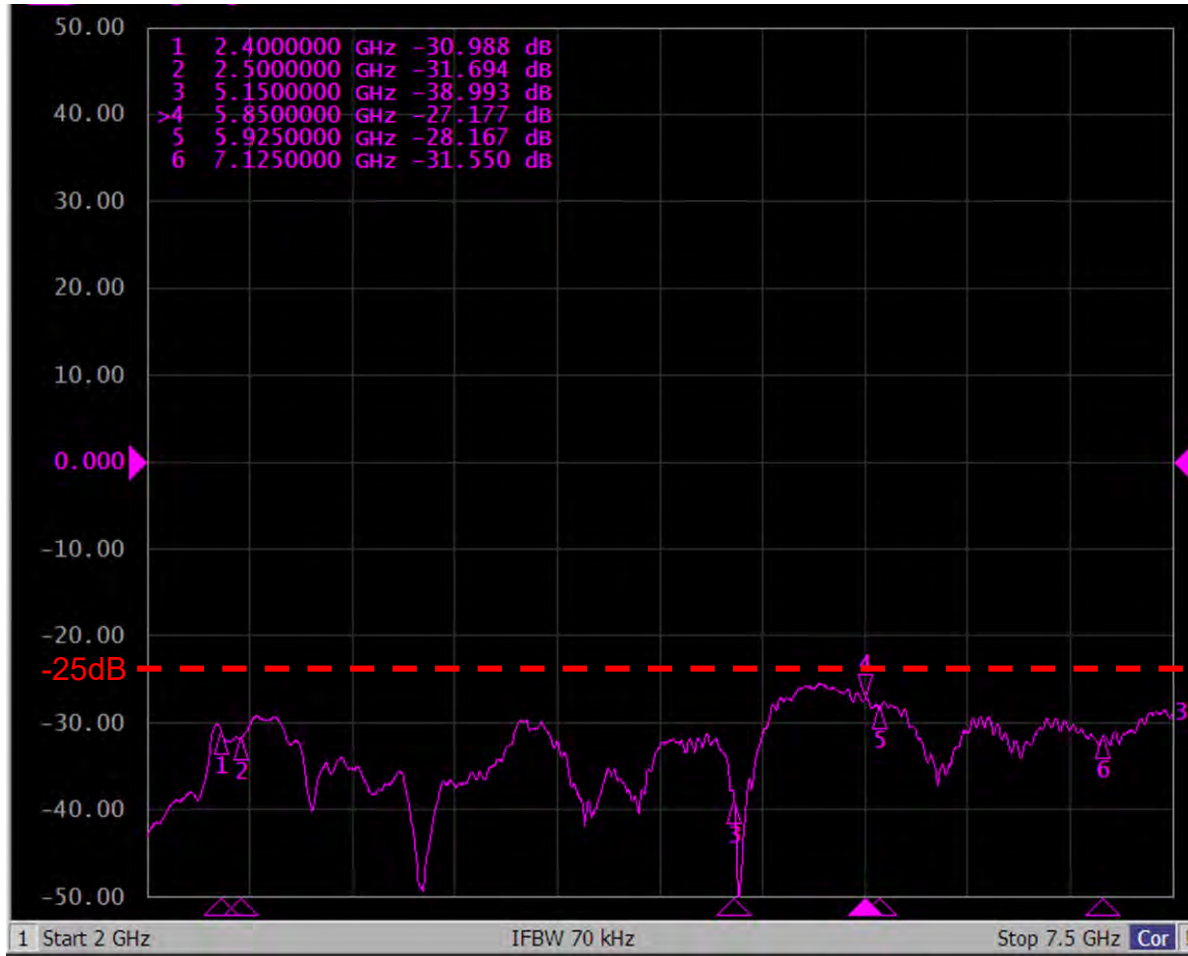


DB2&BT+5G

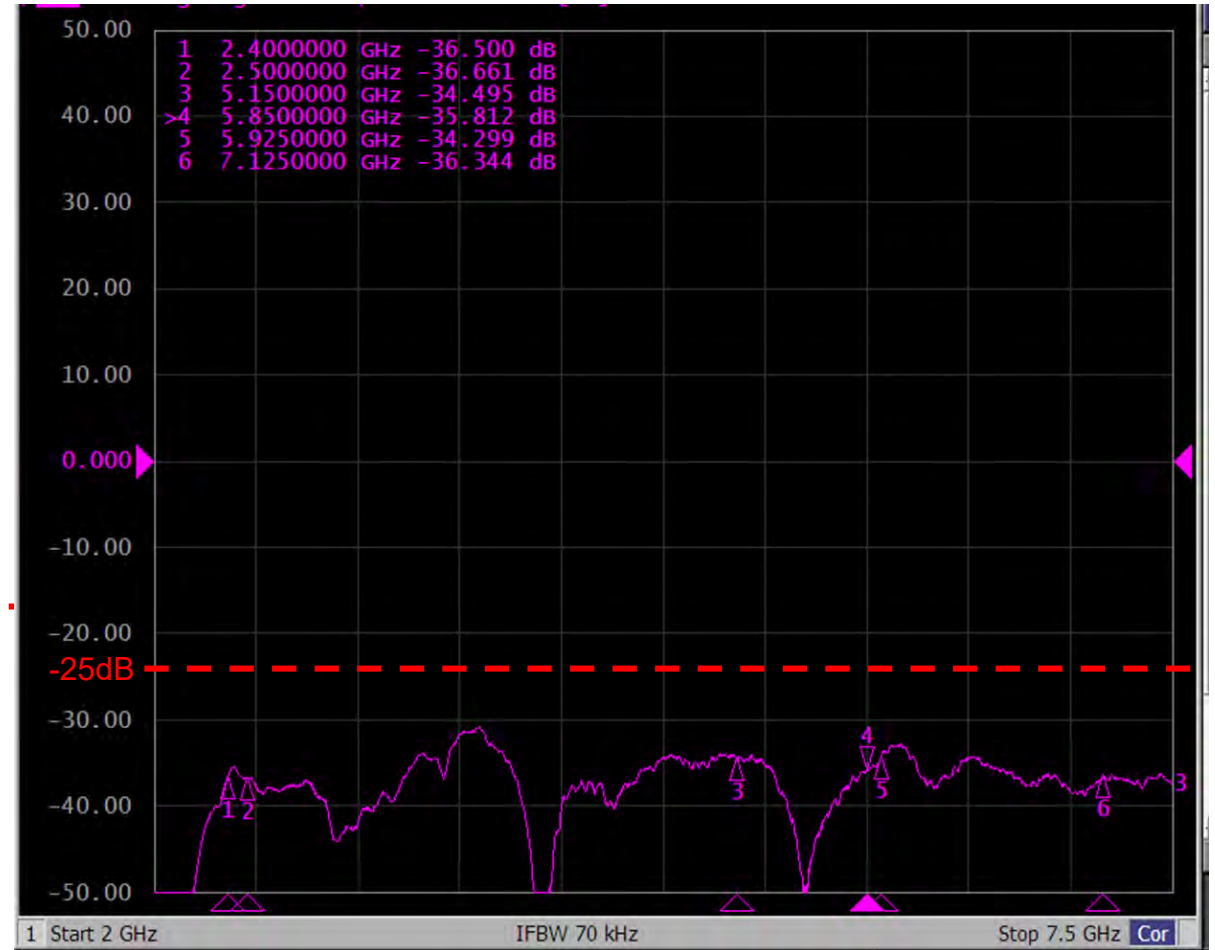


Isolation

DB2&5G

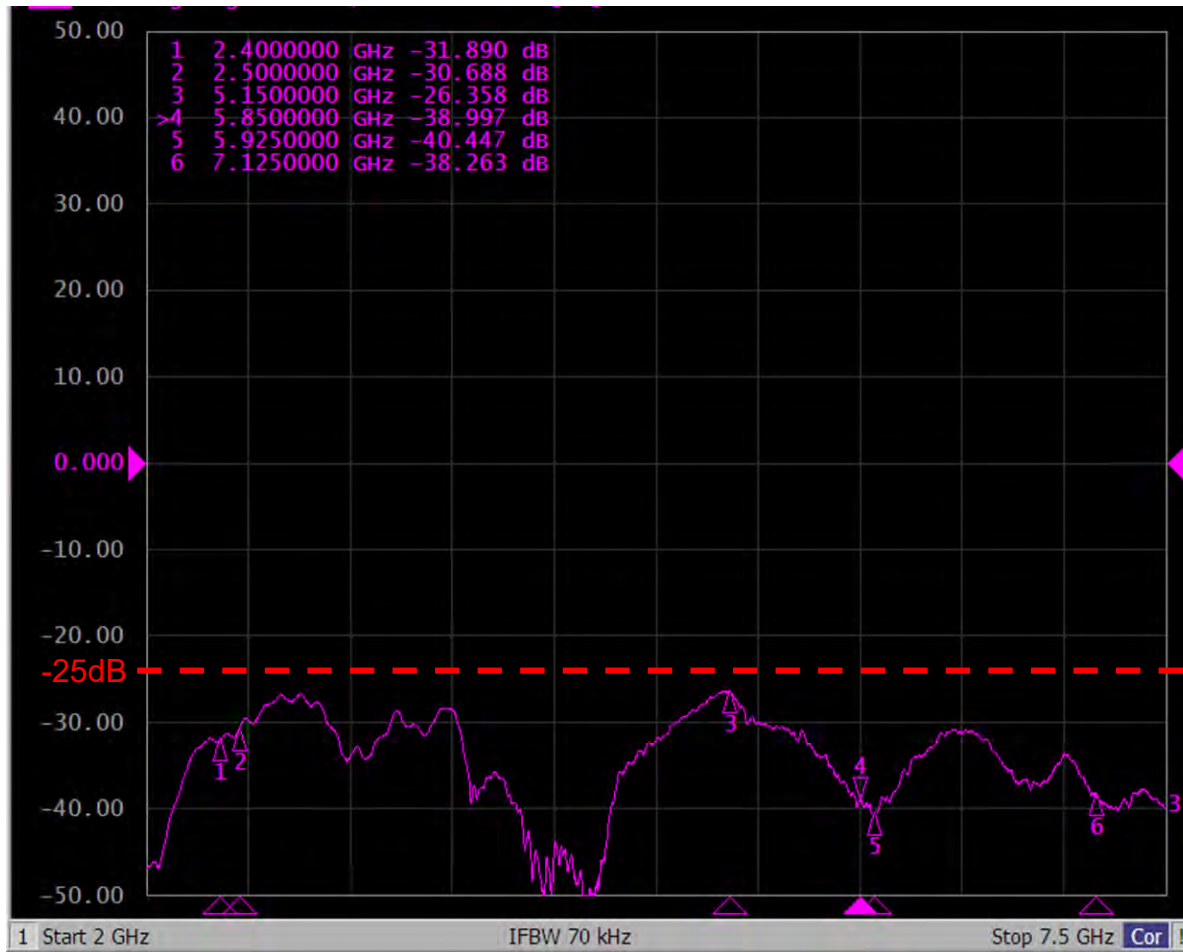


DB2&6G1

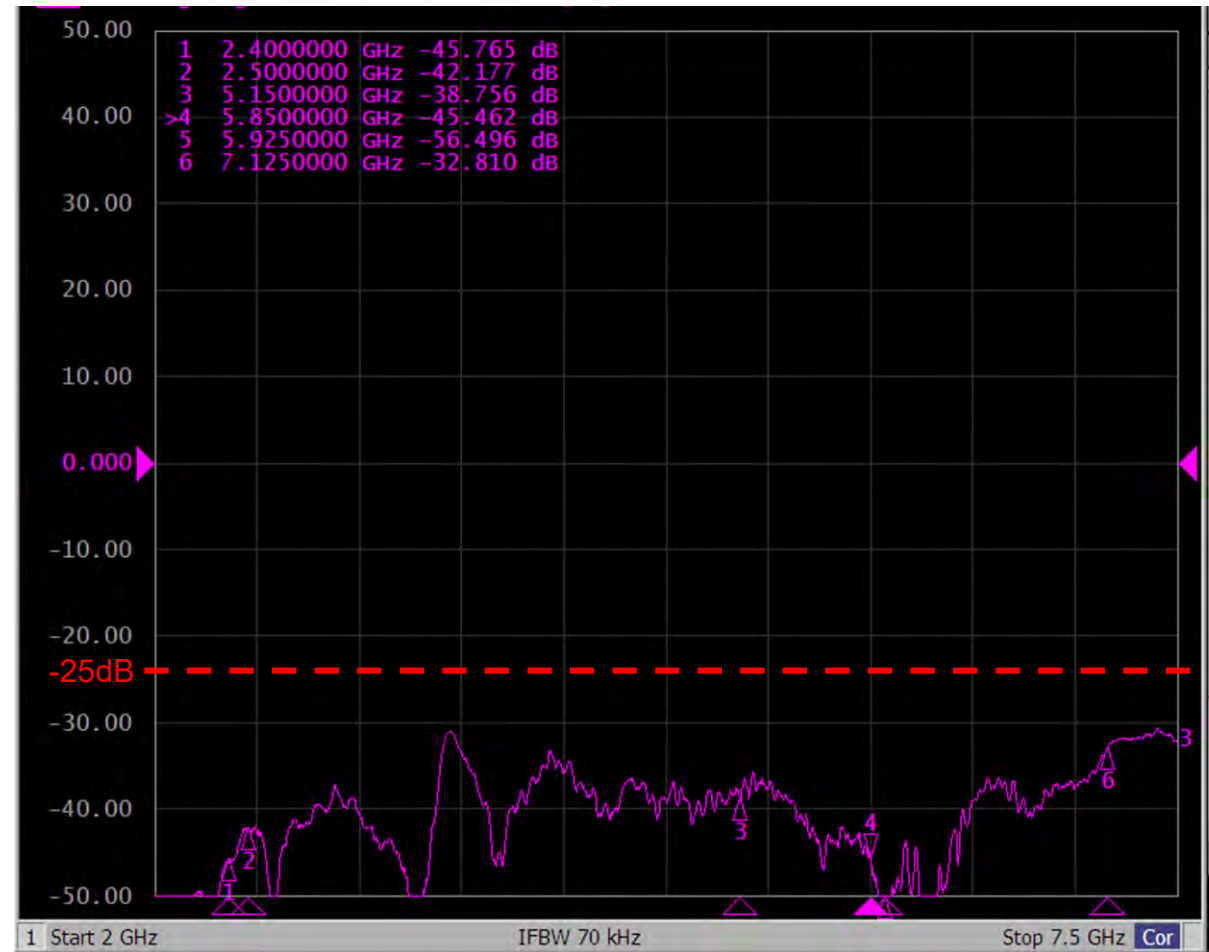


Isolation

DB2&6G2

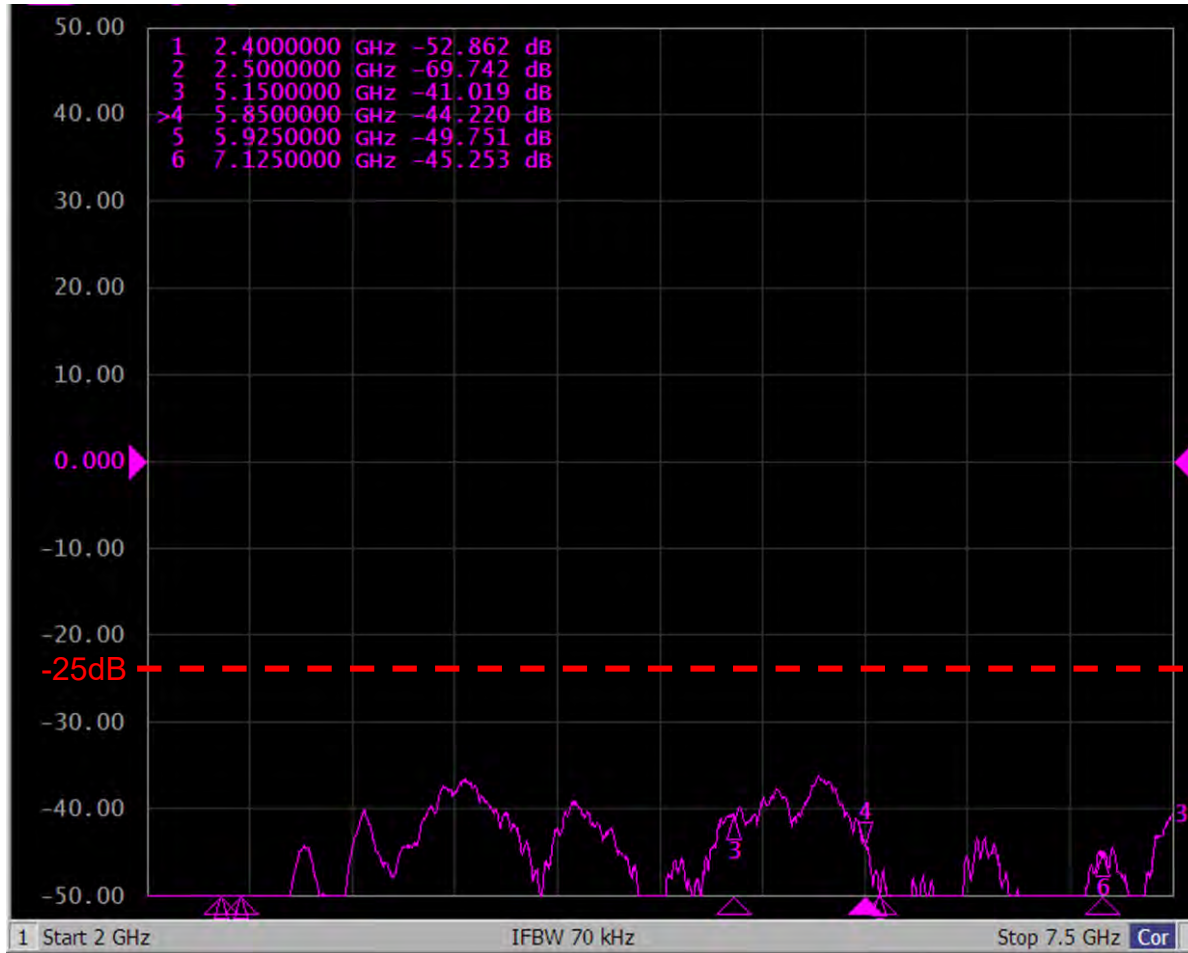


DB2&6G3

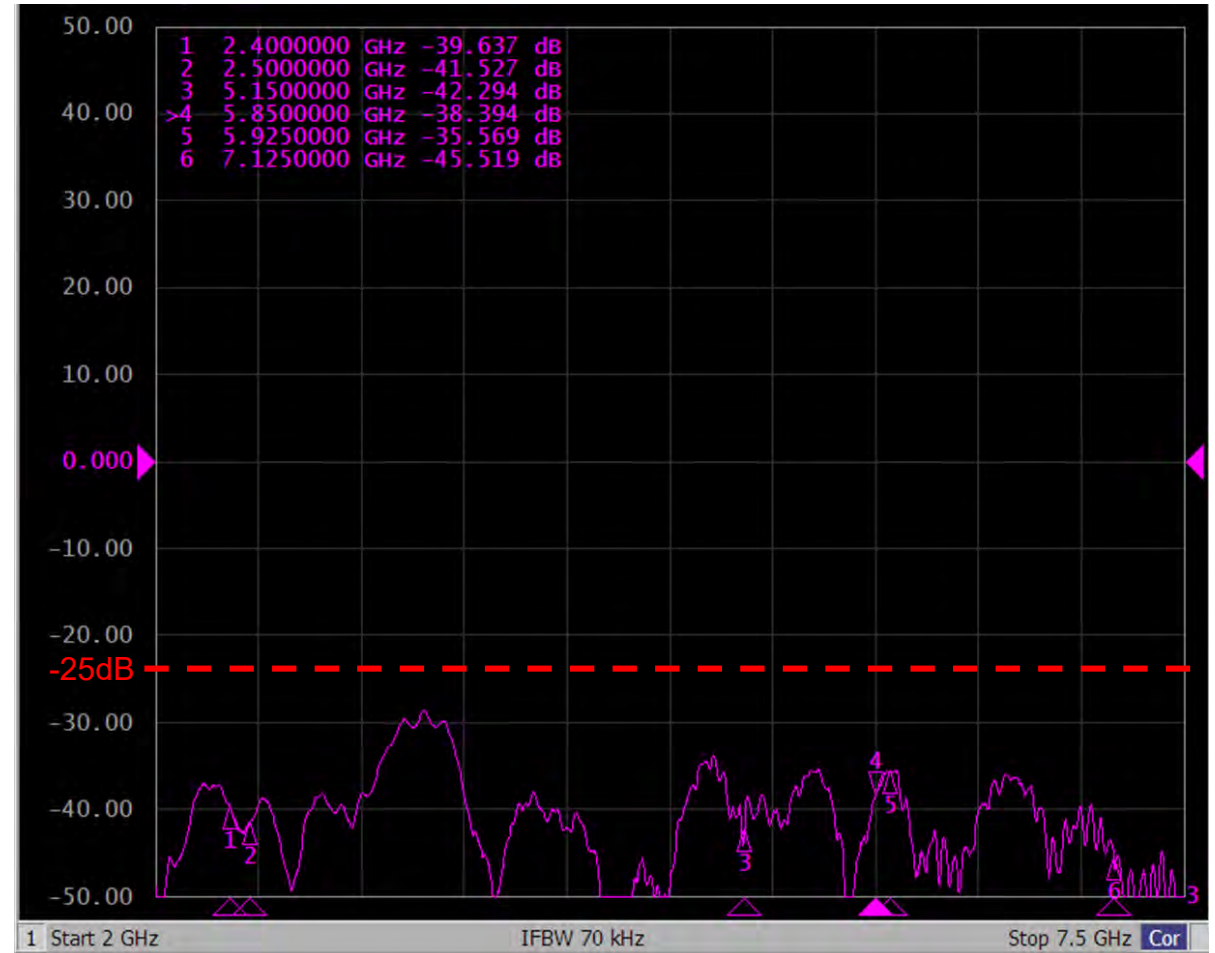


Isolation

DB2&6G4

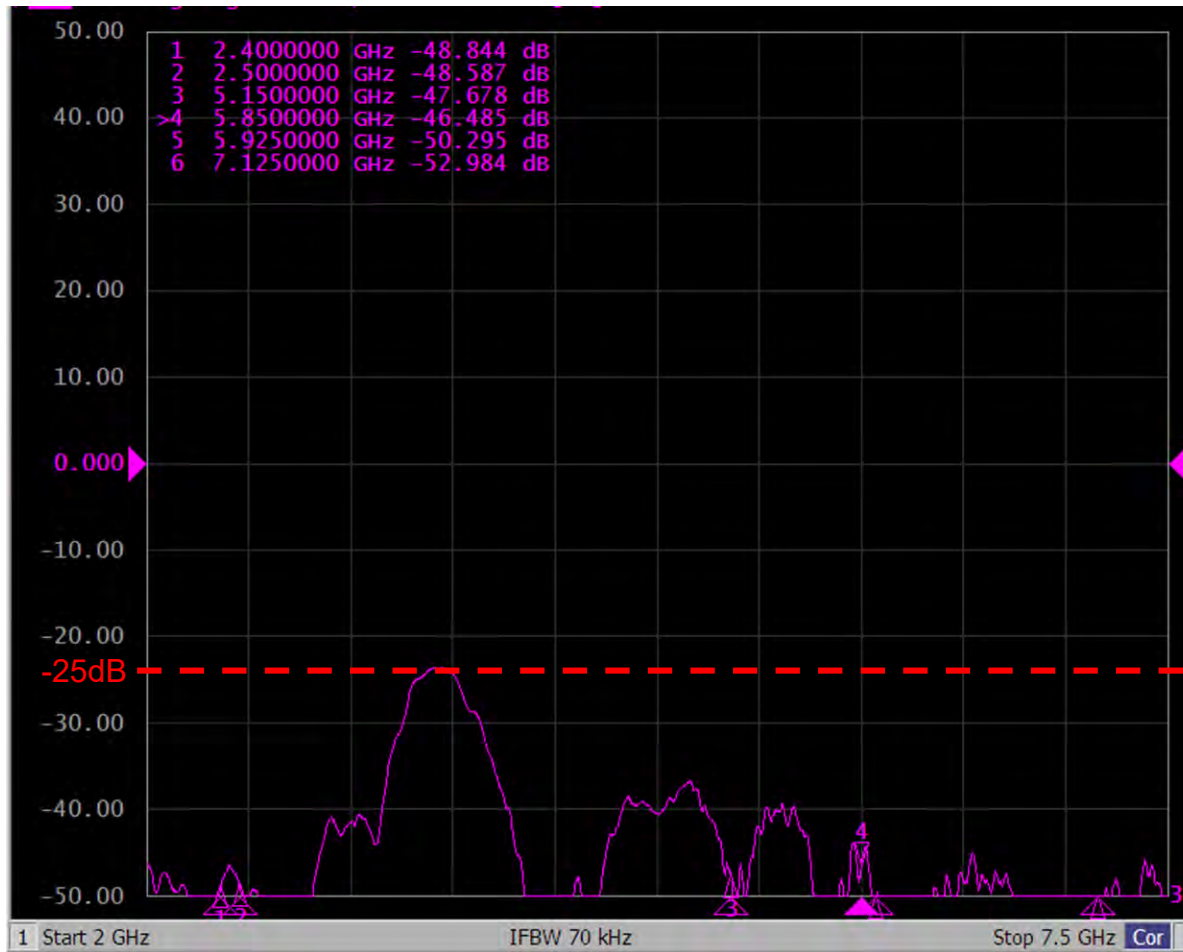


BT+5G&5G

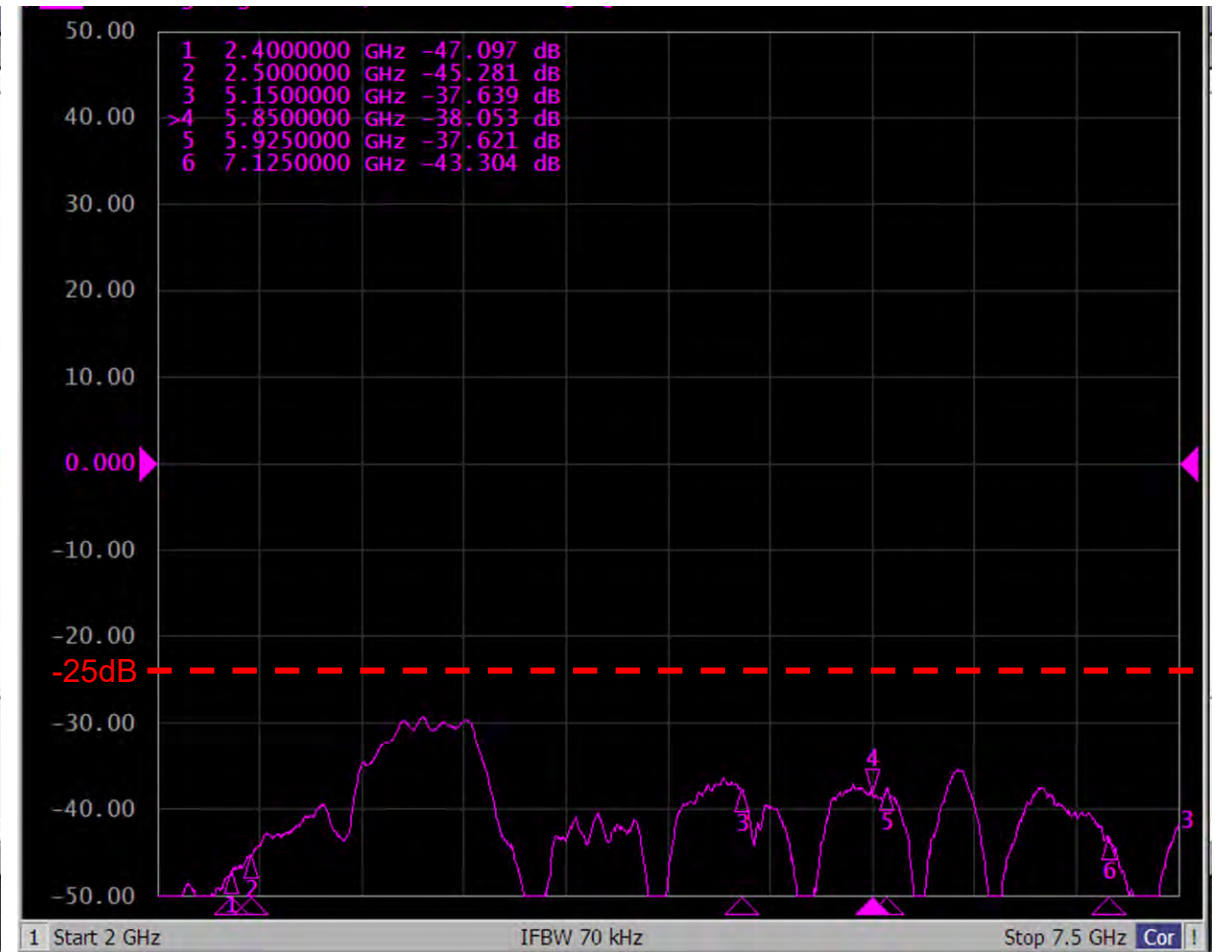


Isolation

BT+5G&6G1

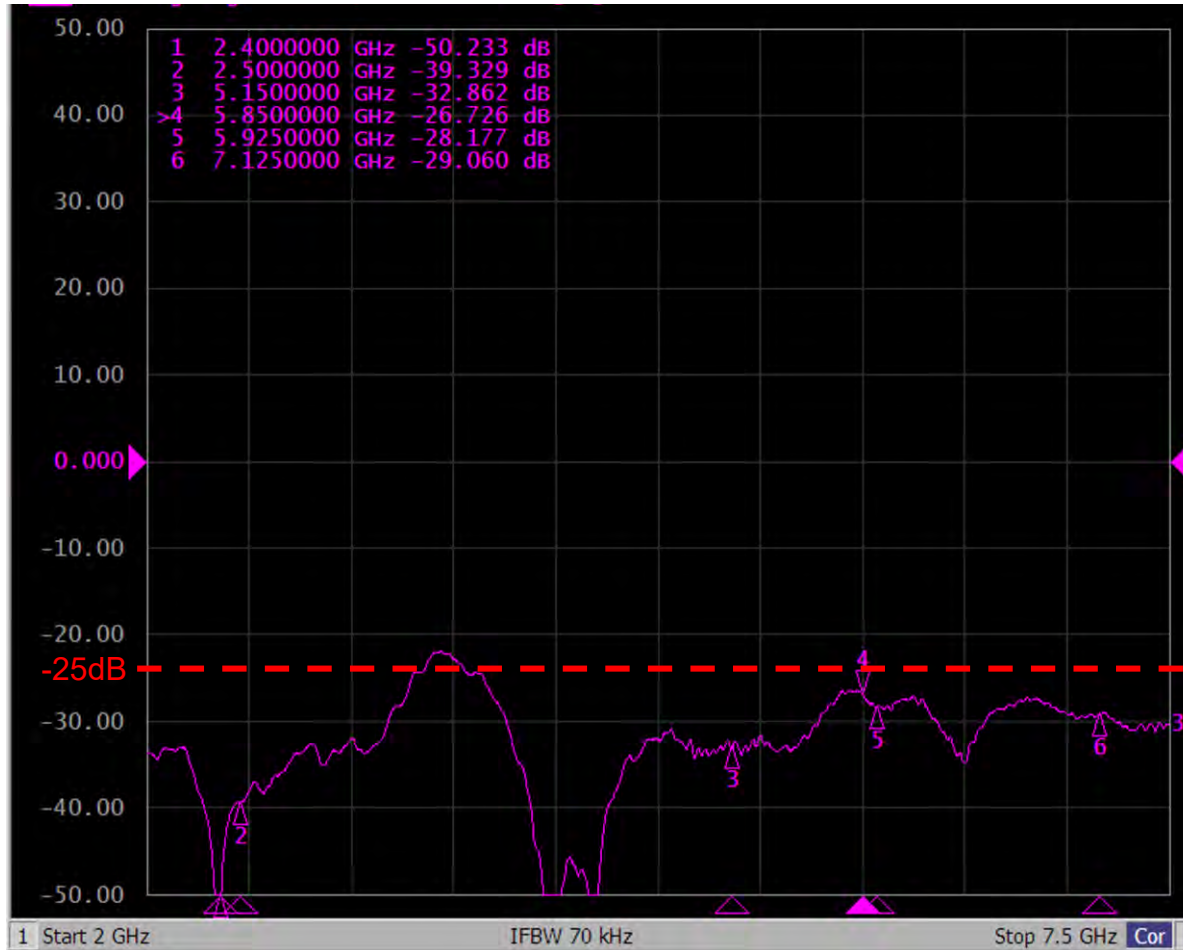


BT+5G&6G2

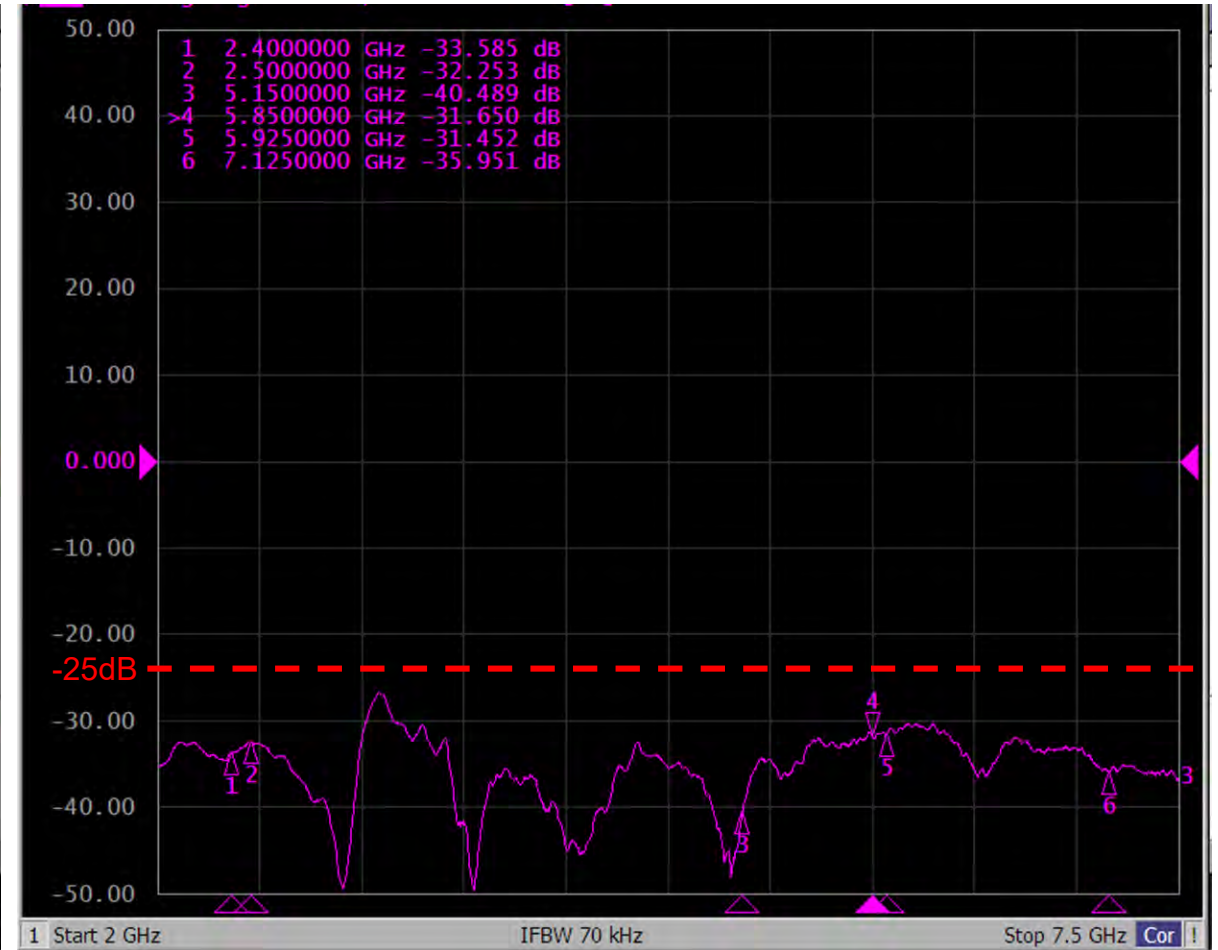


Isolation

BT+5G&6G3

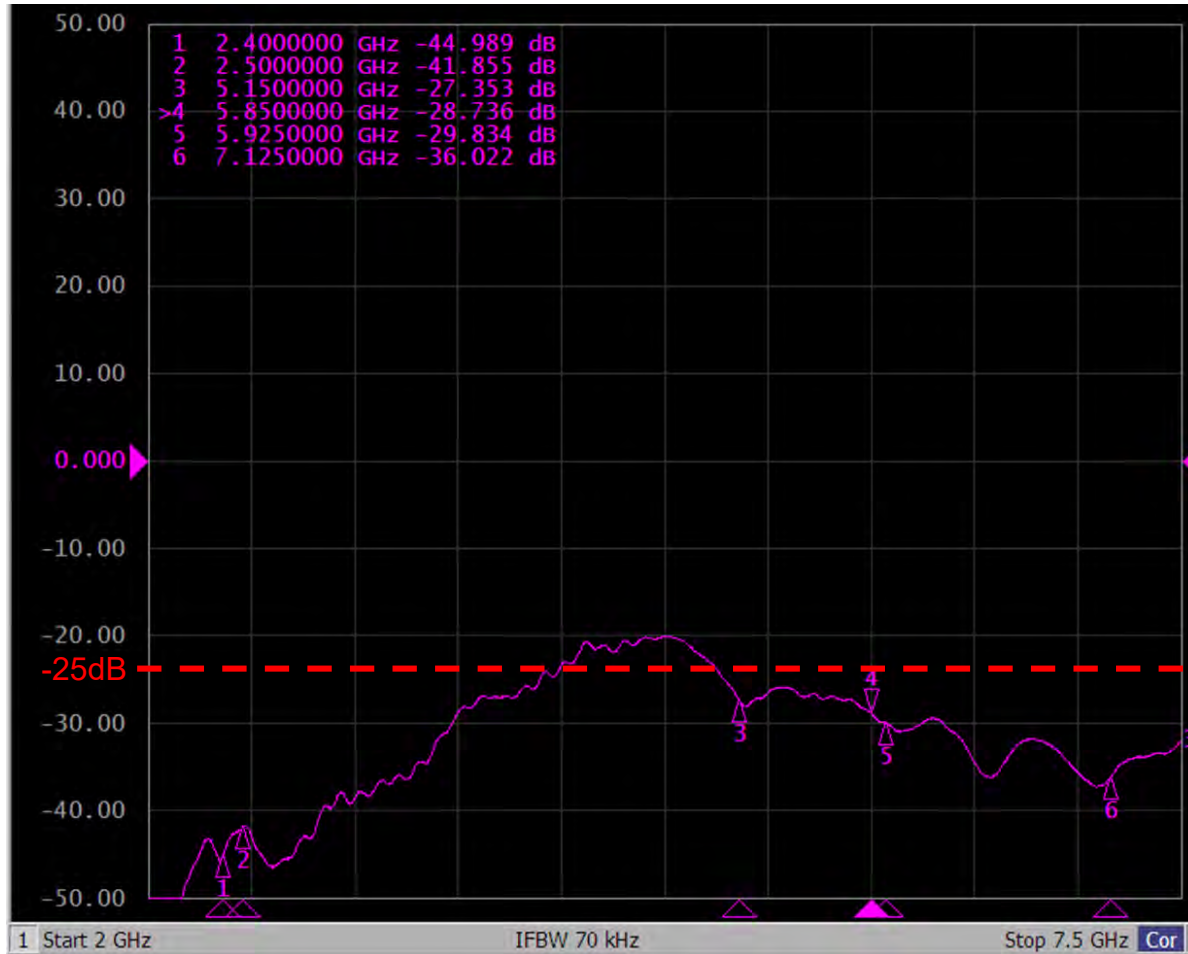


BT+5G&6G4

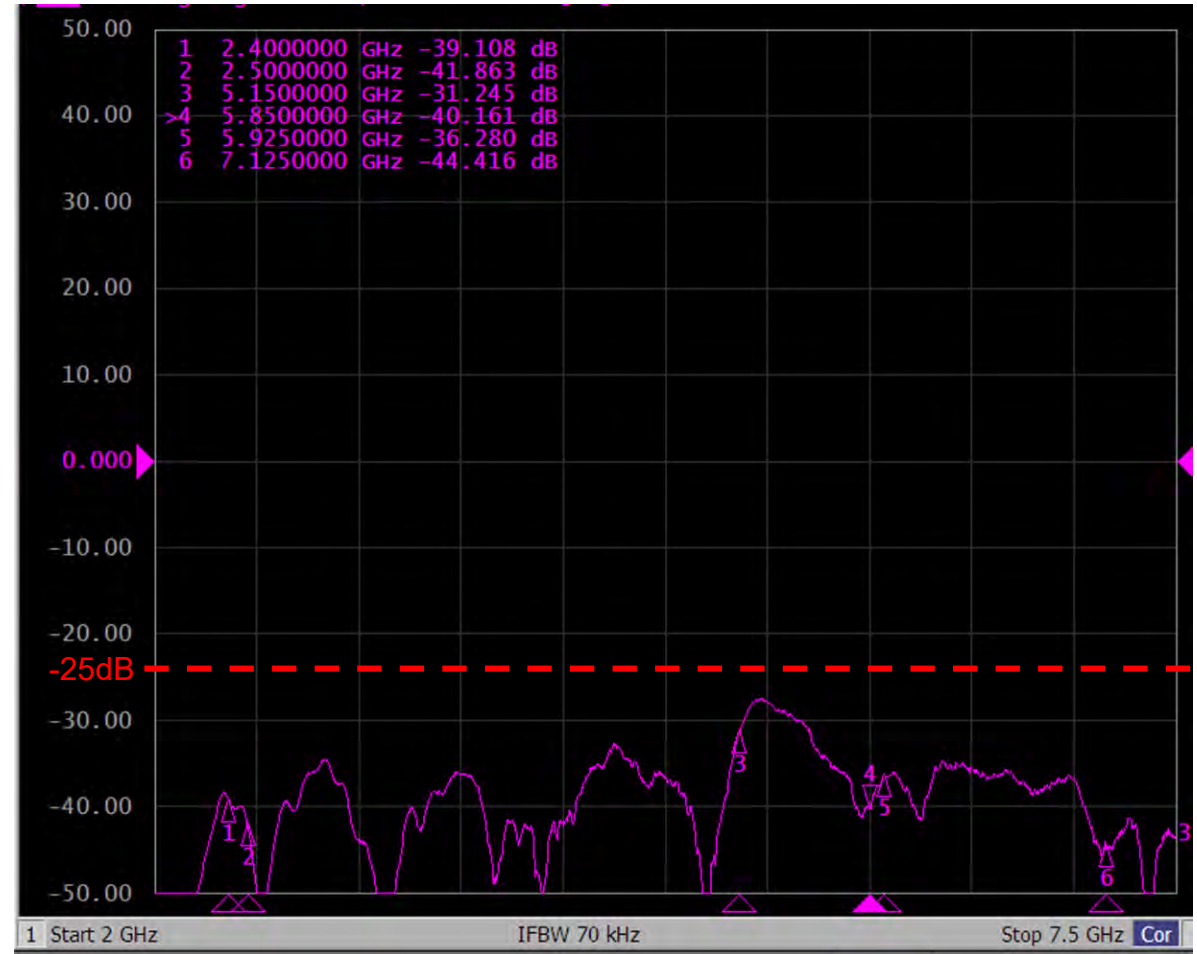


Isolation

5G&6G1

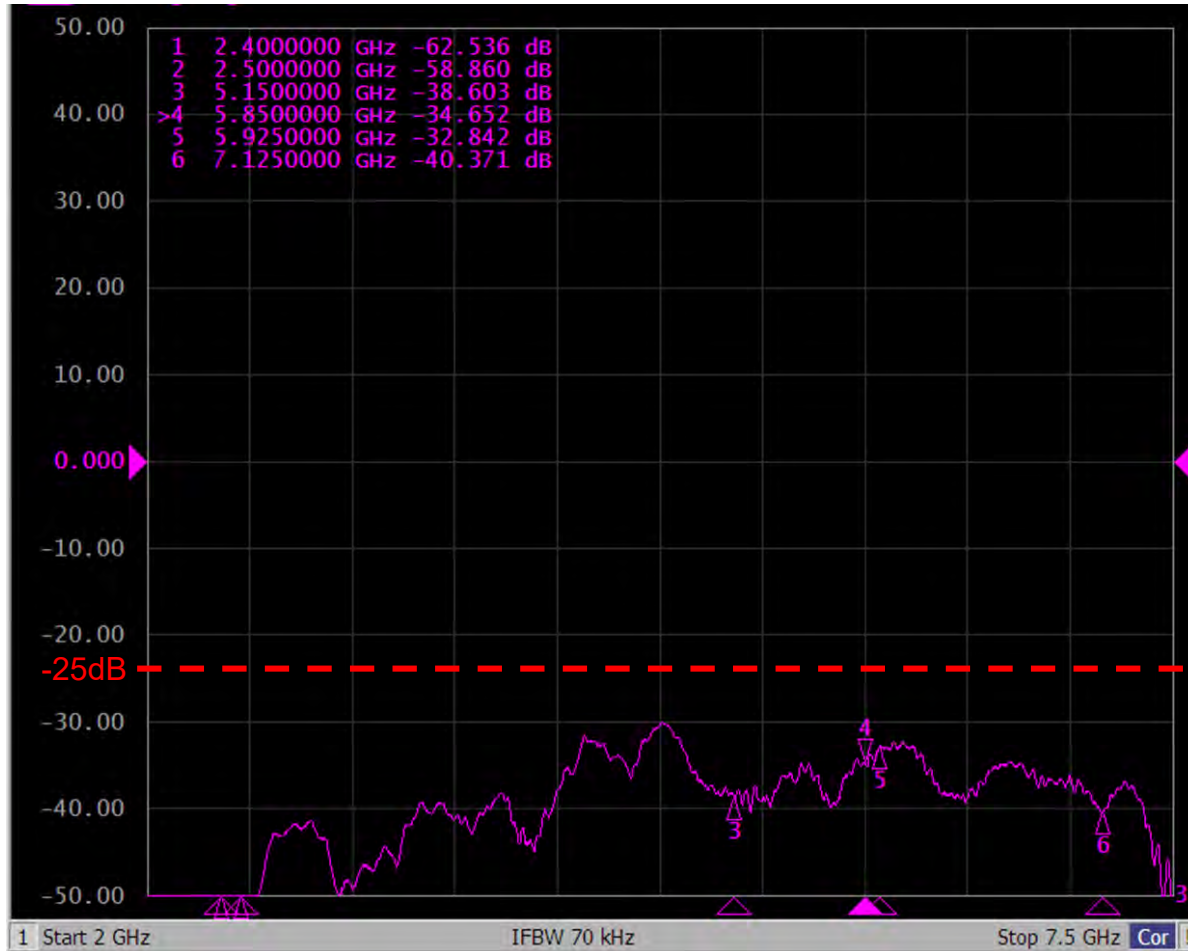


5G&6G2

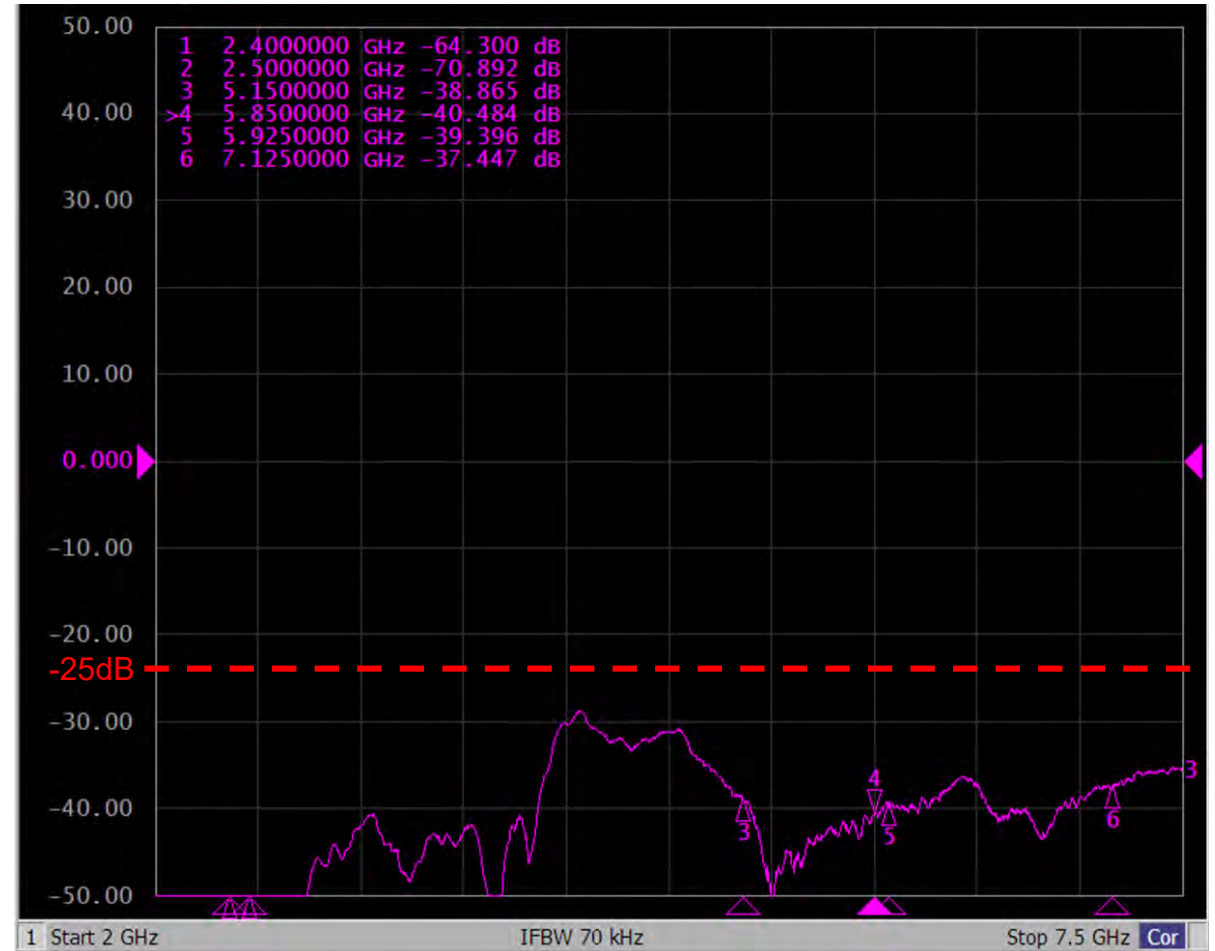


Isolation

5G&6G3

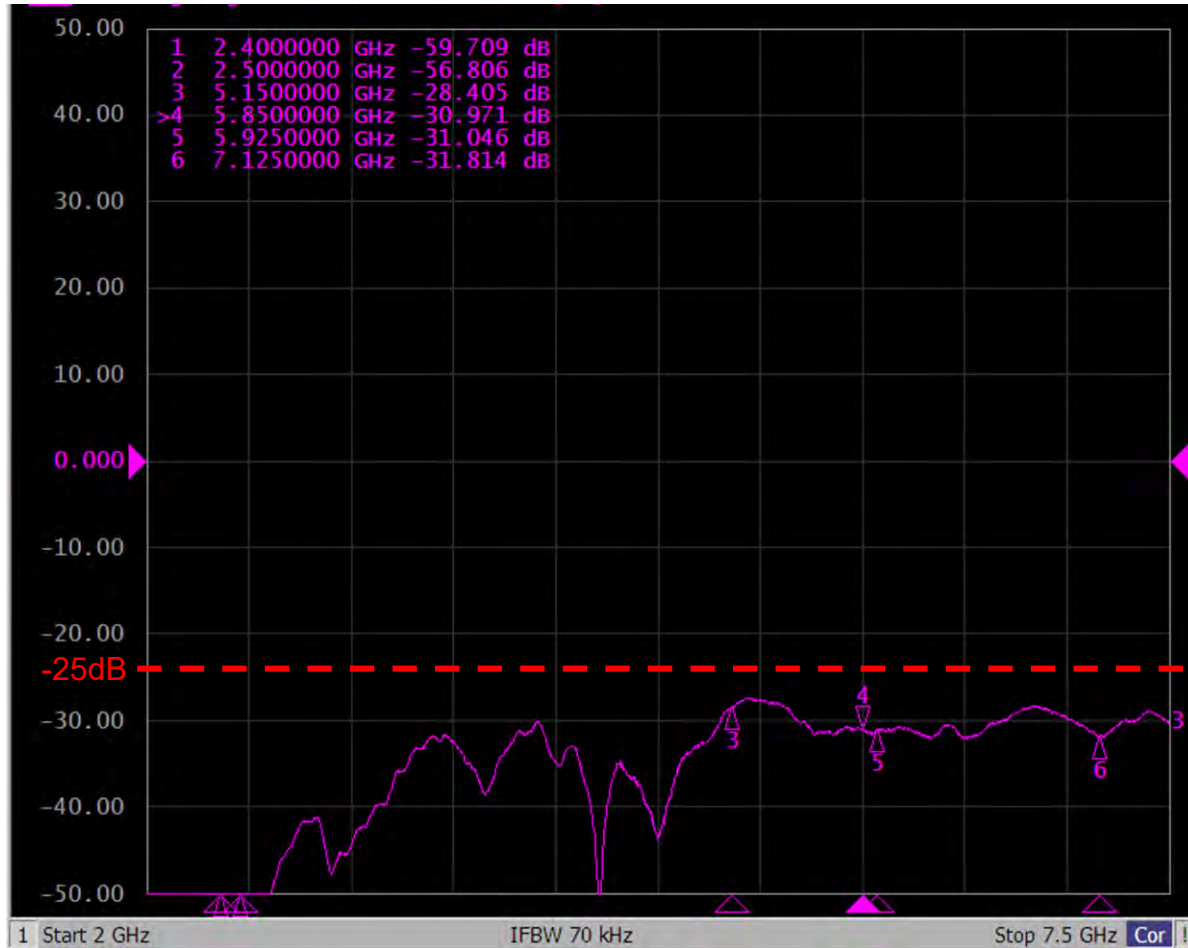


5G&6G4

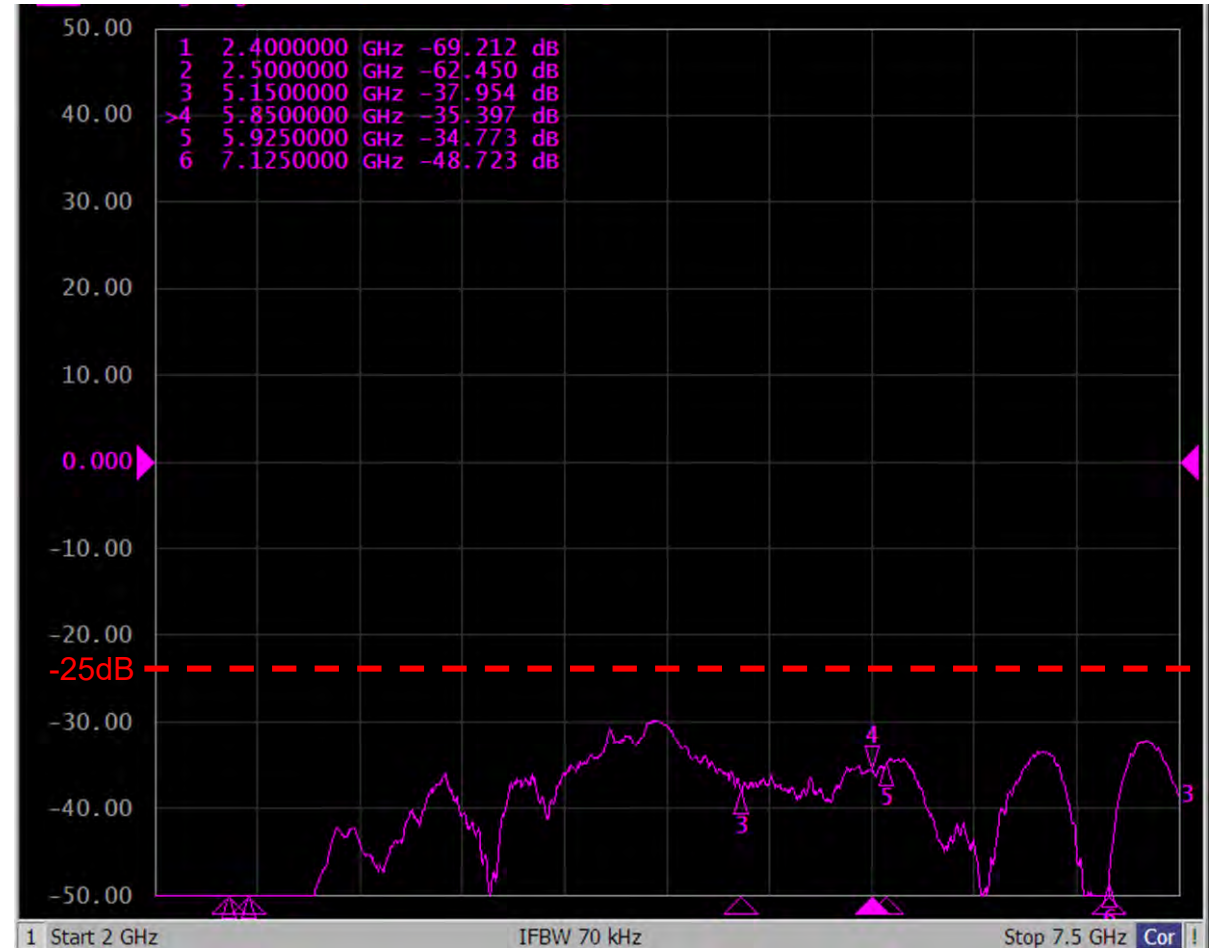


Isolation

6G1&6G2

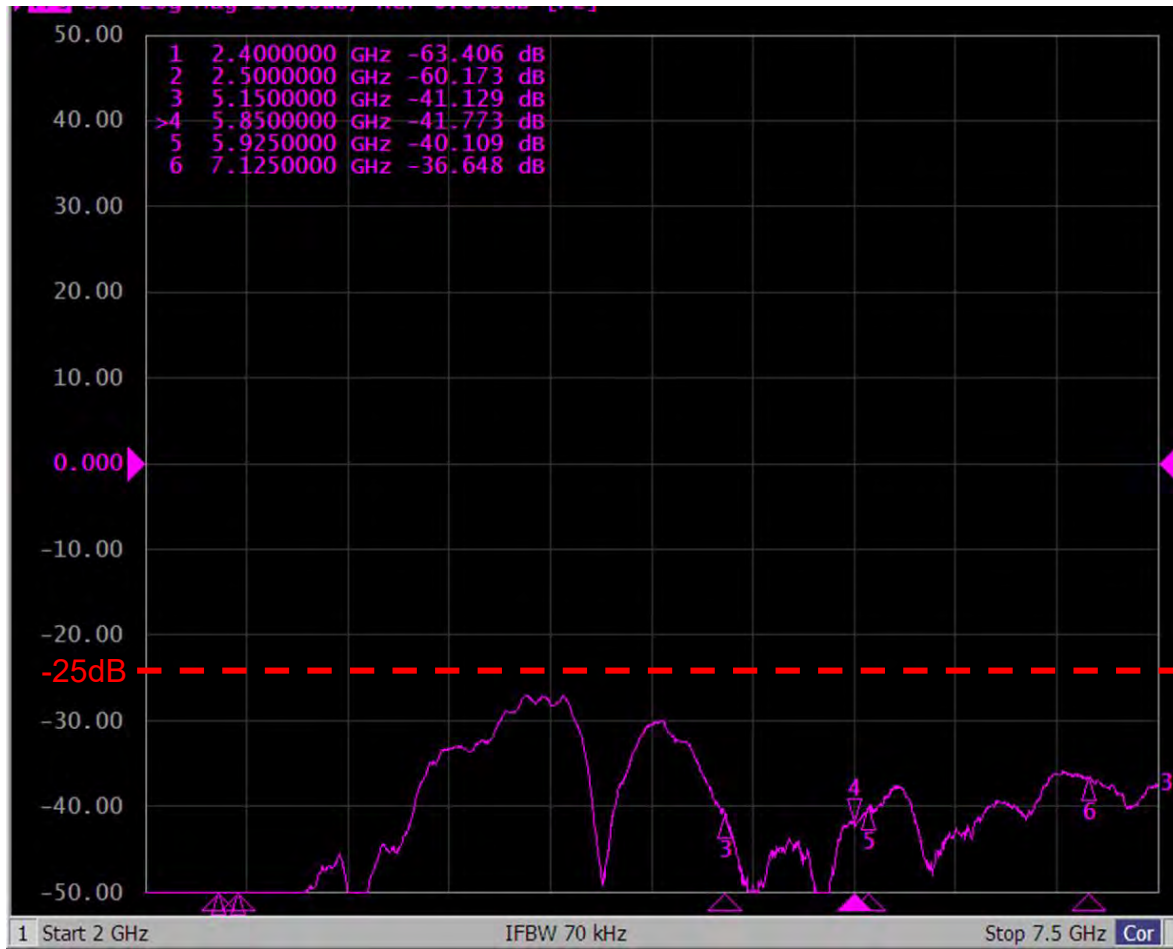


6G1&6G3

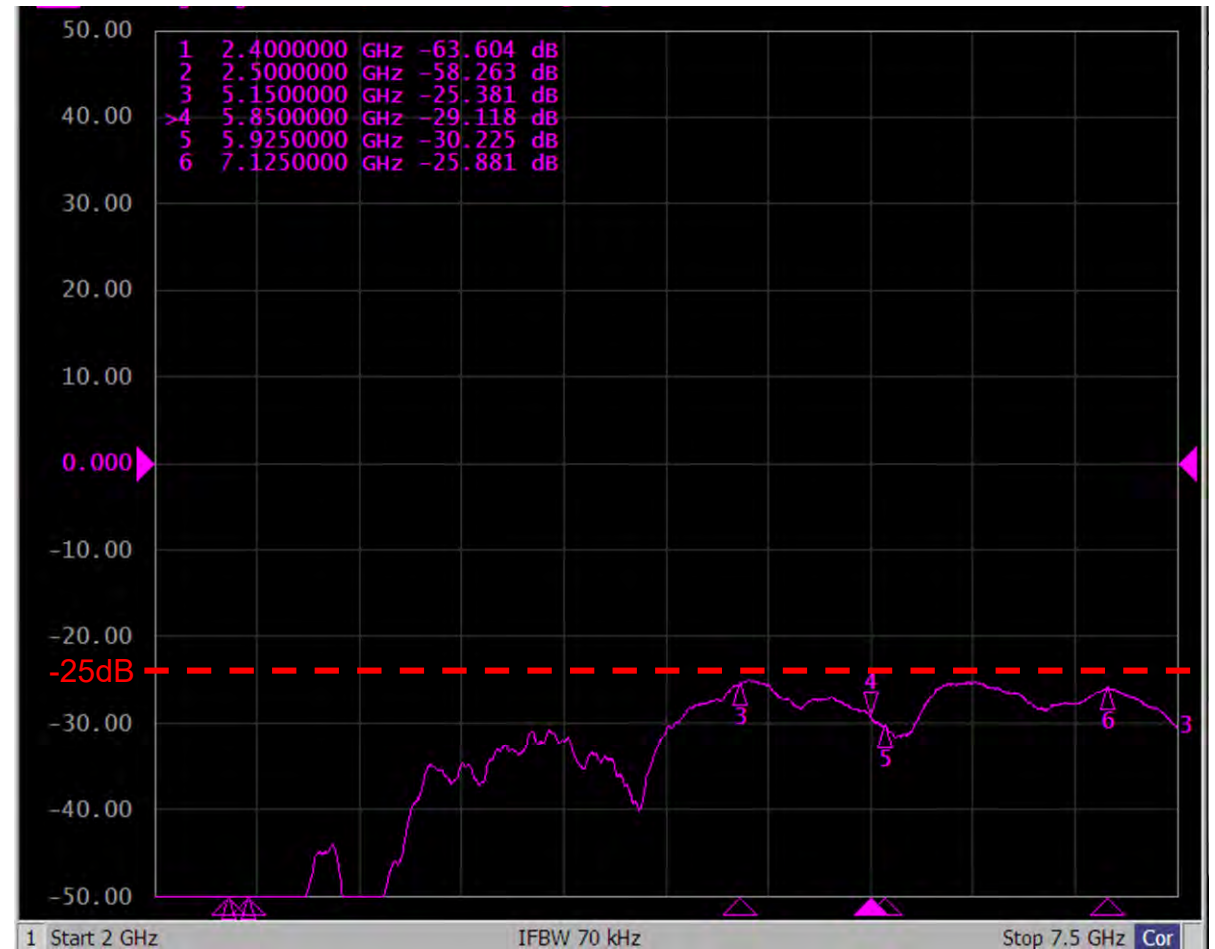


Isolation

6G1&6G4

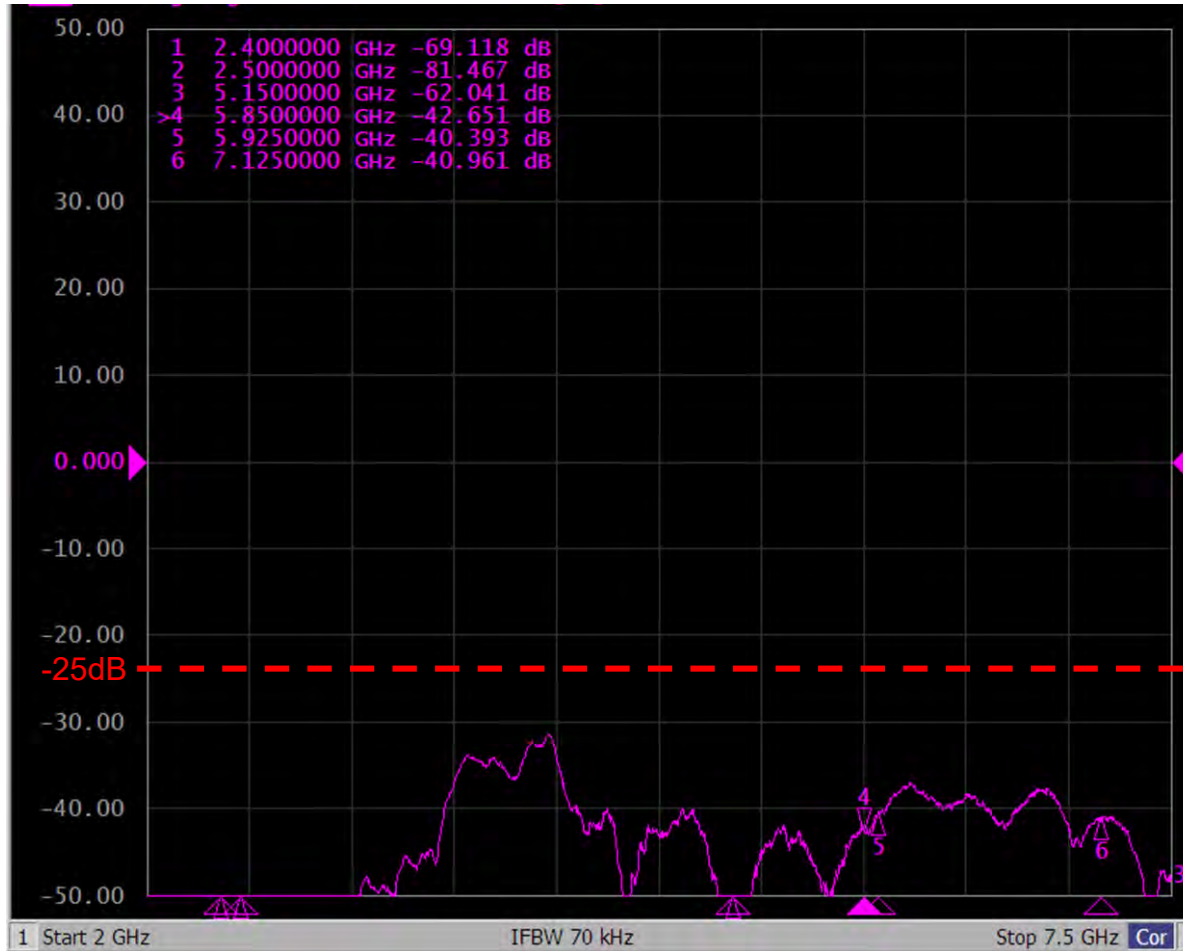


6G2&6G3

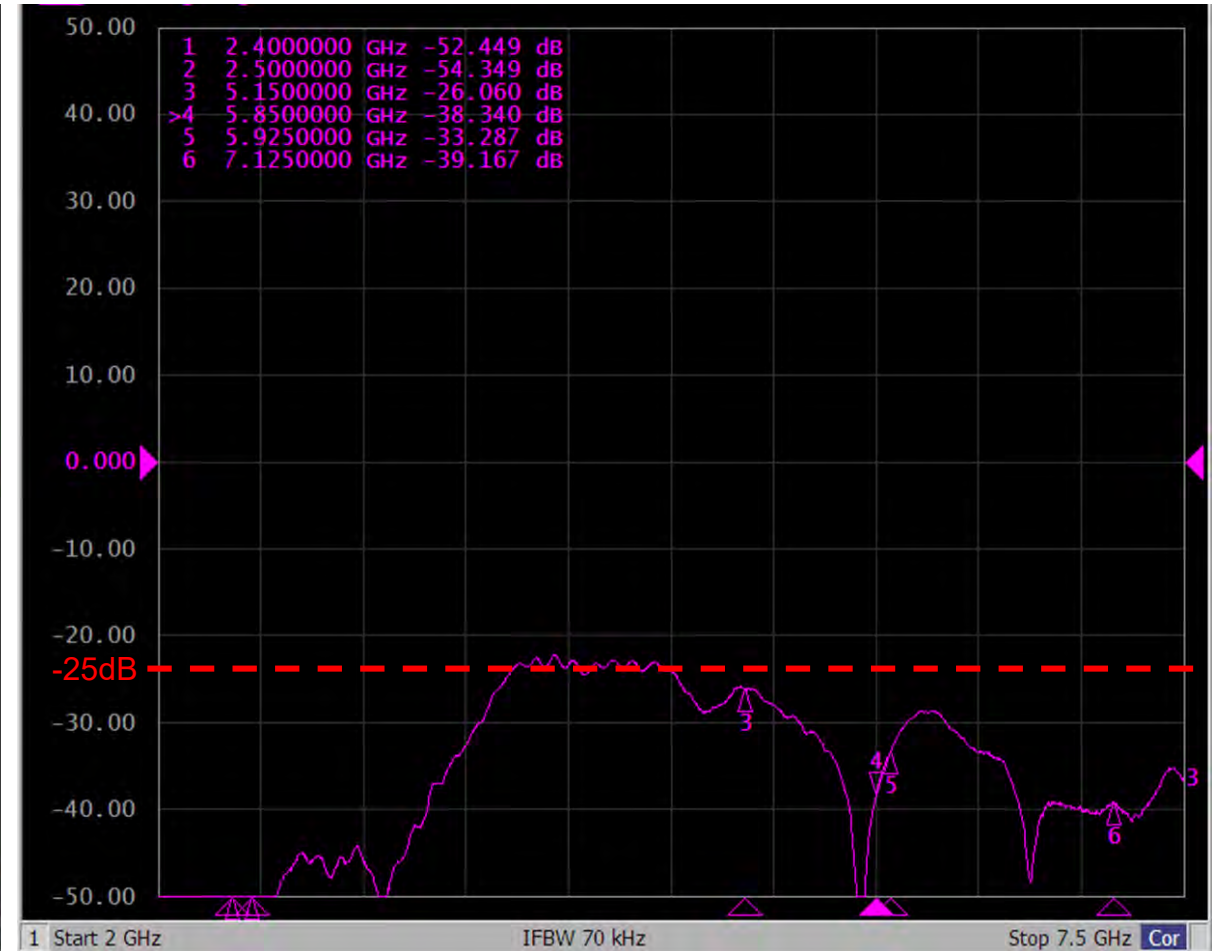


Isolation

6G2&6G4

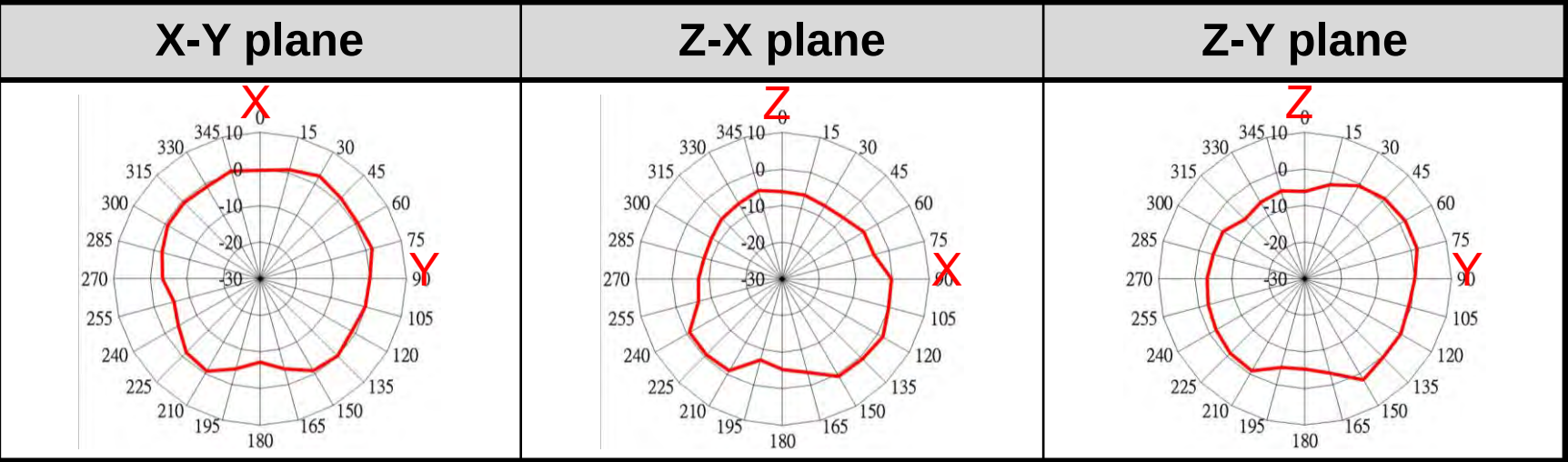


6G3&6G4

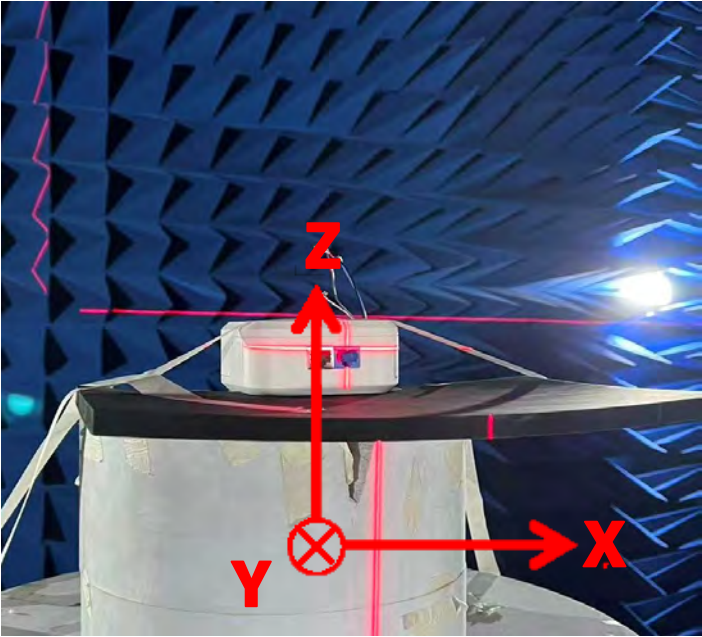
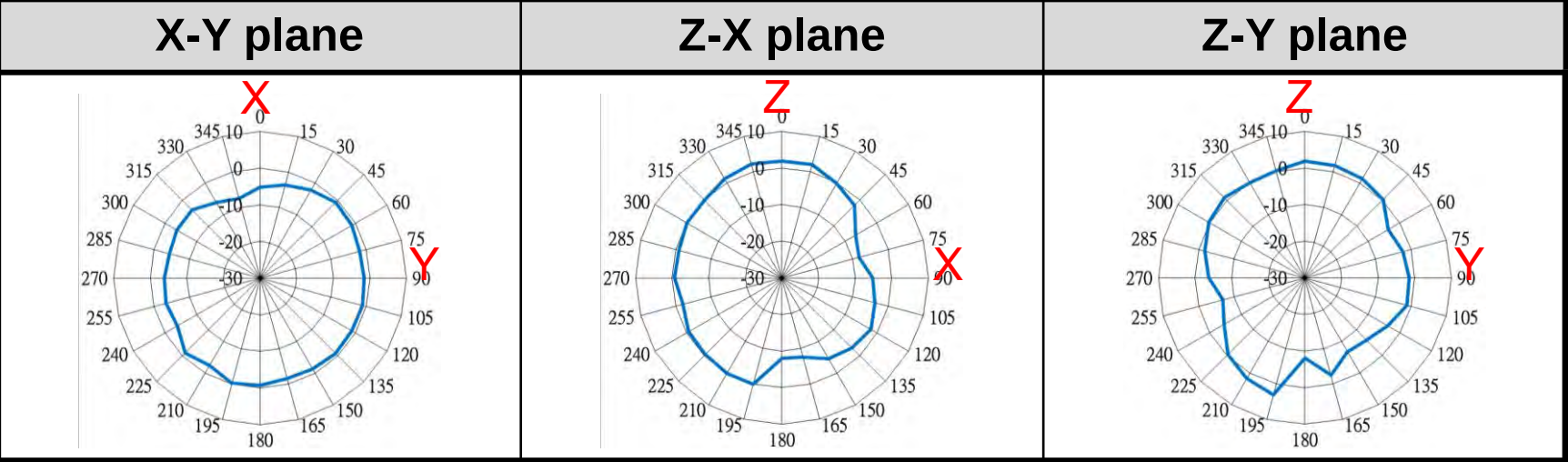


2D Radiation Pattern Results

DB1 - 2450MHz

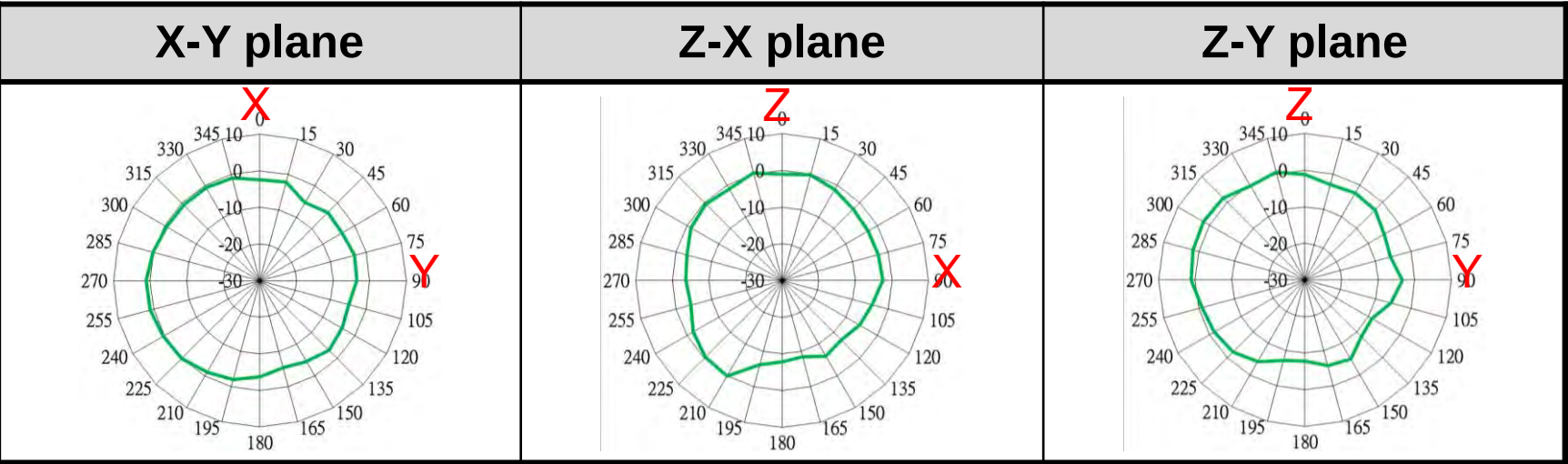


DB2 - 2450MHz

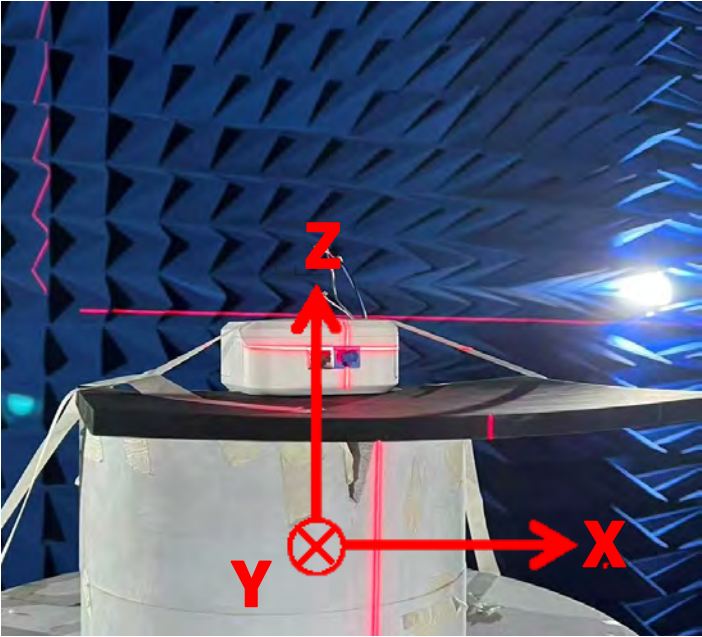
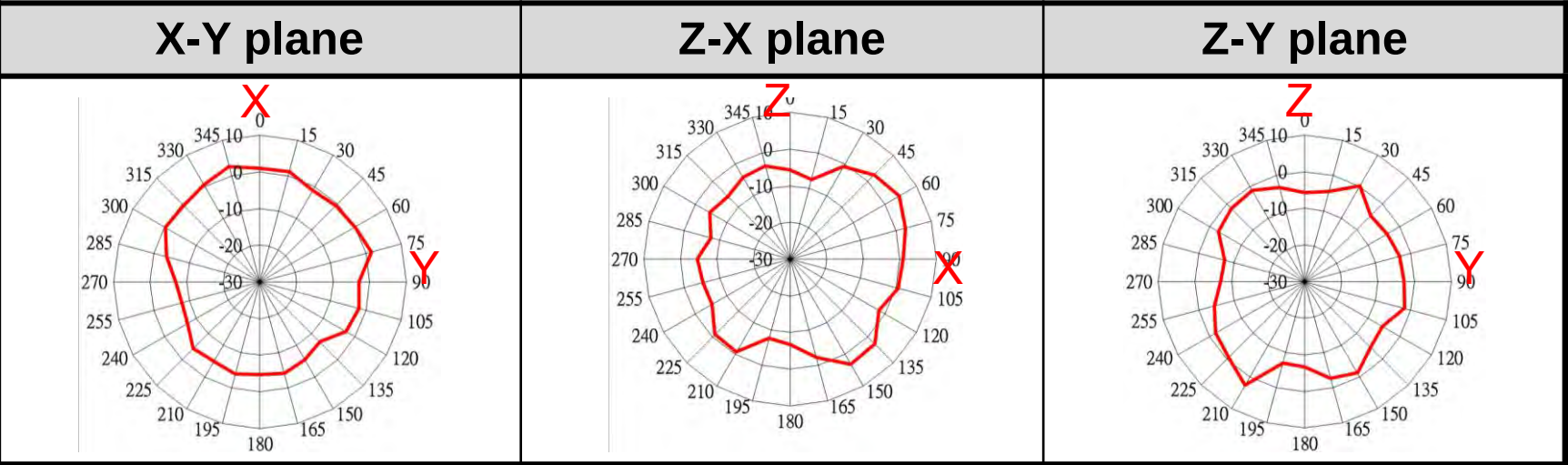


2D Radiation Pattern Results

BT+5G - 2450MHz

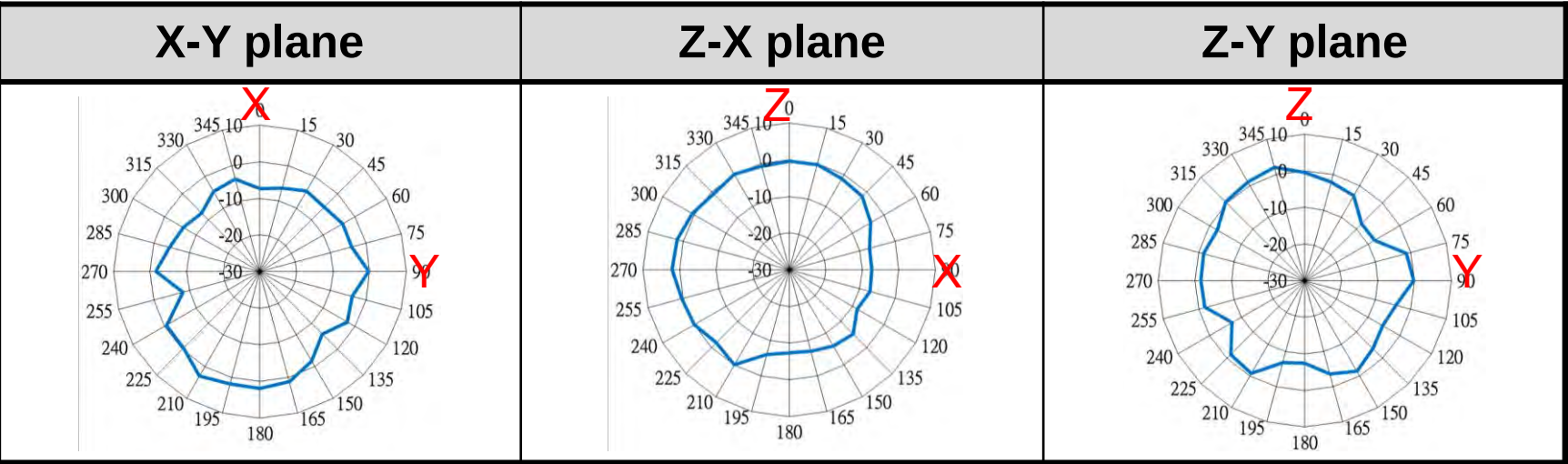


DB1 - 5470MHz

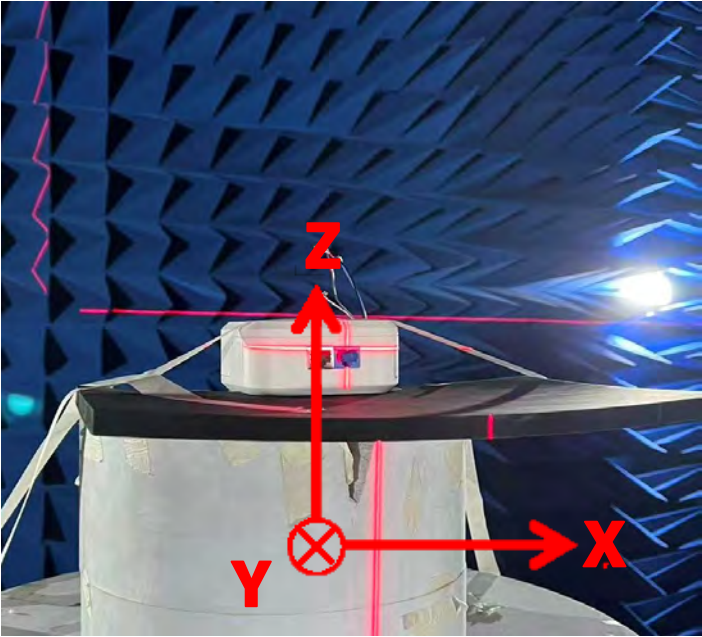
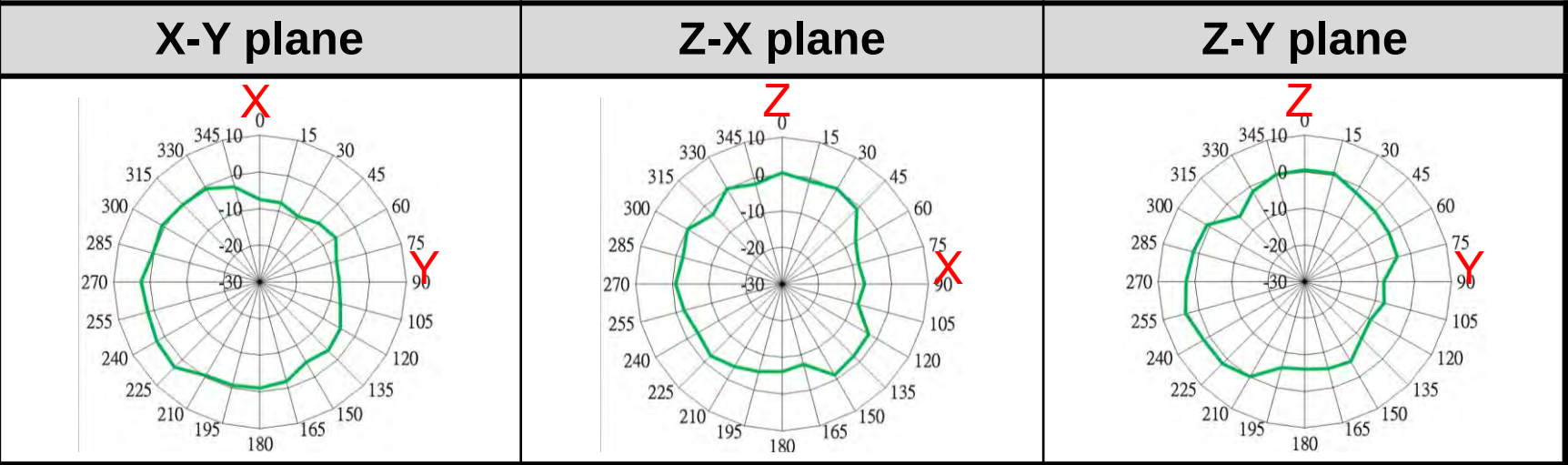


2D Radiation Pattern Results

DB2 - 5470MHz

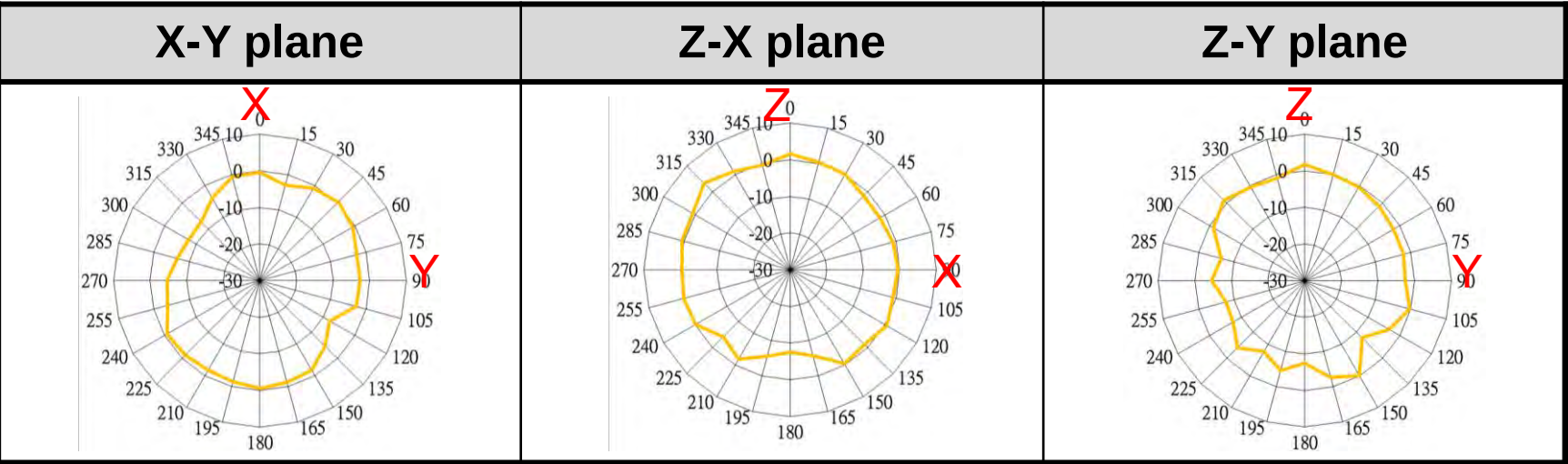


BT+5G - 5470MHz

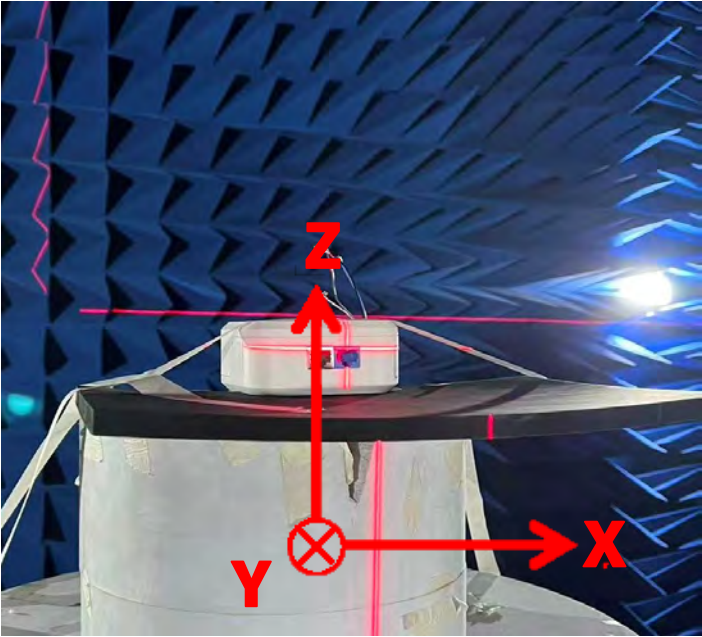
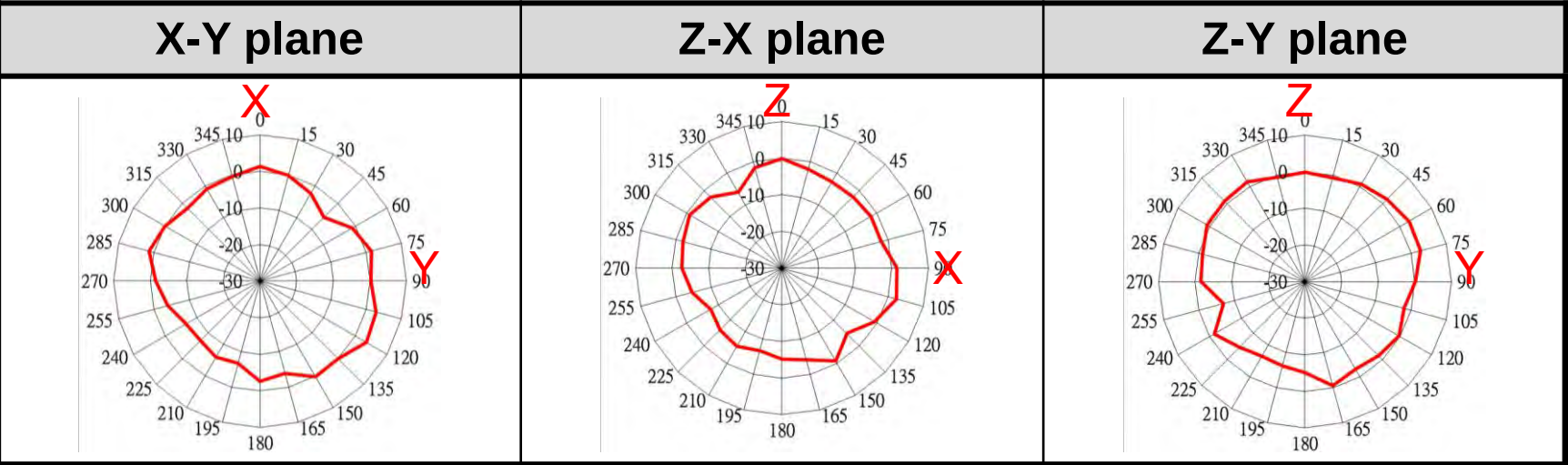


2D Radiation Pattern Results

5G - 5470MHz

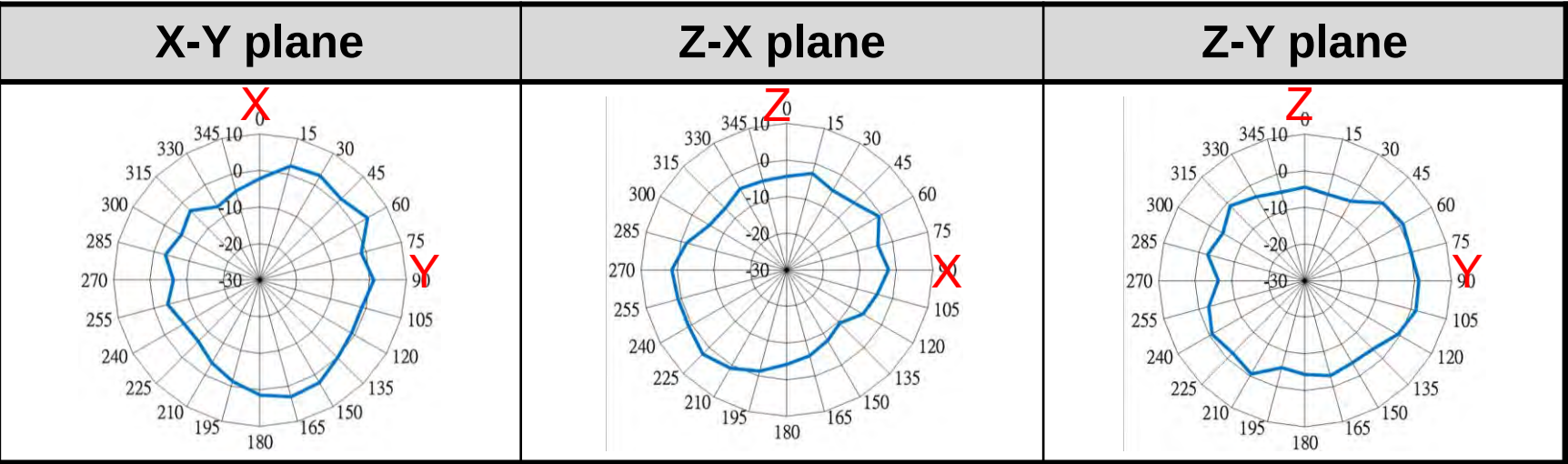


6G1 - 6525MHz

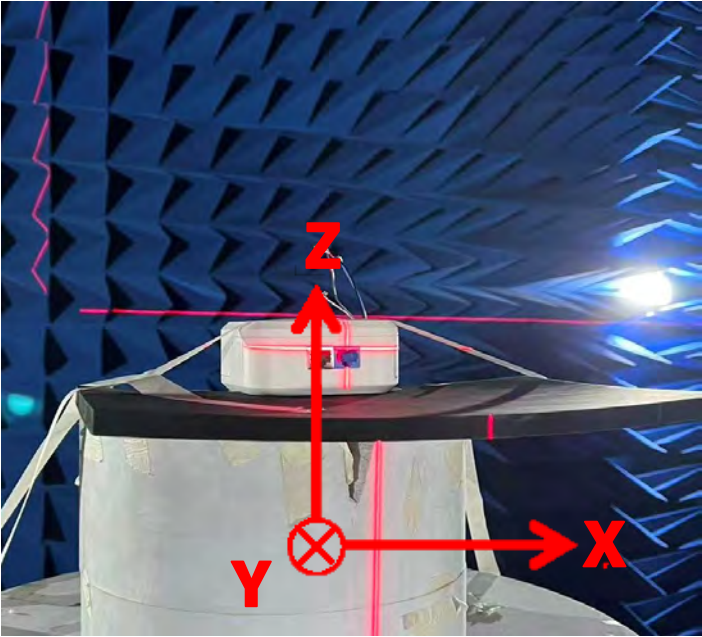
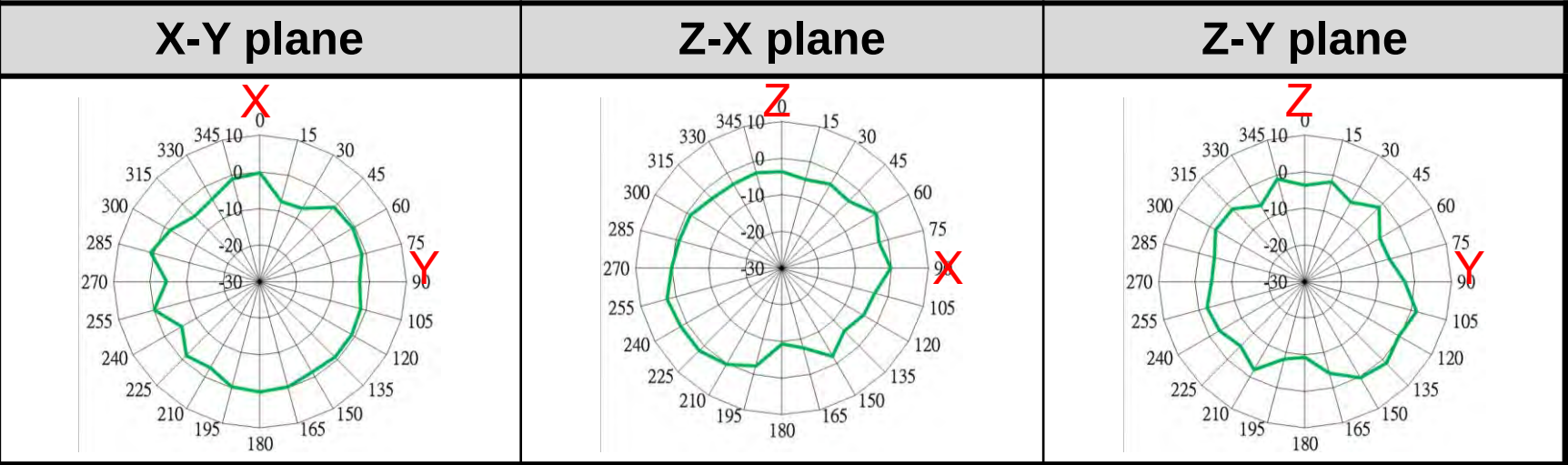


2D Radiation Pattern Results

6G2 - 6525MHz



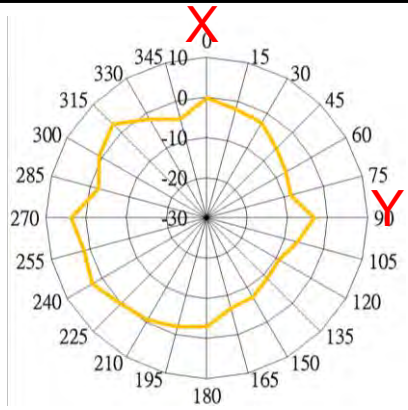
6G3 - 6525MHz



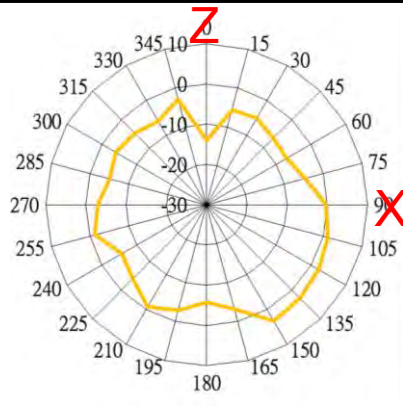
2D Radiation Pattern Results

6G4 - 6525MHz

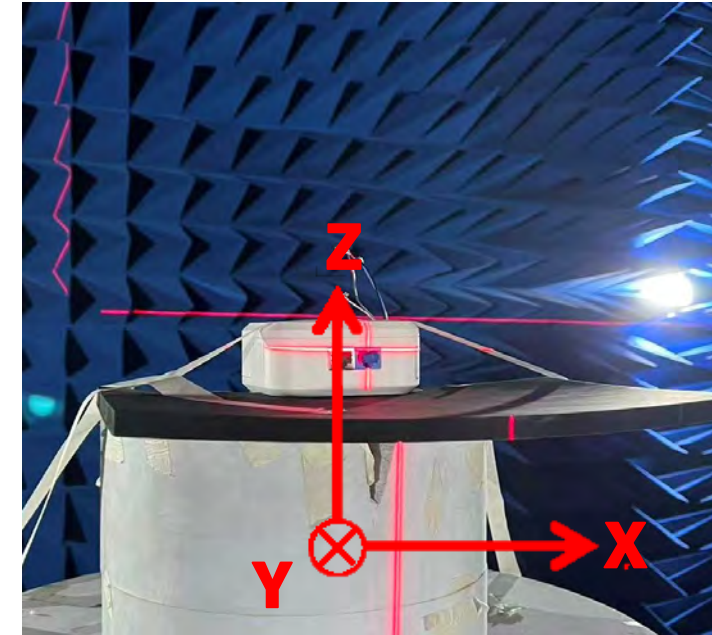
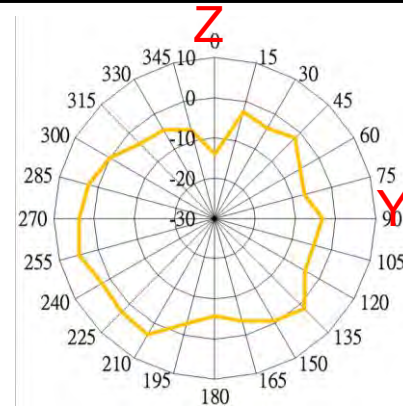
X-Y plane



Z-X plane



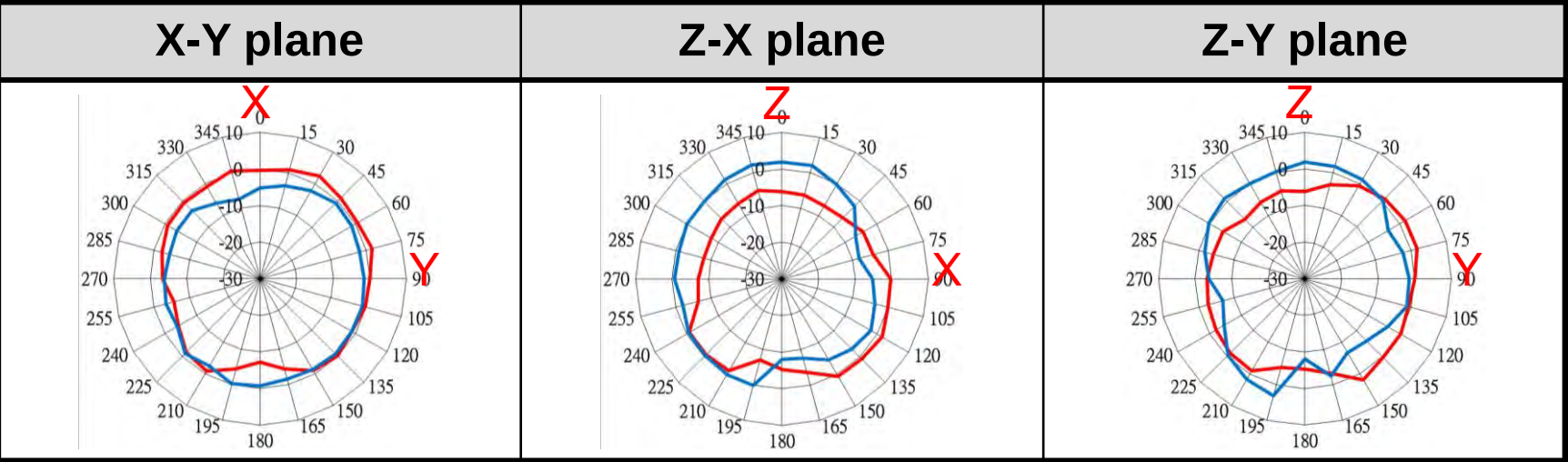
Z-Y plane



2D Radiation Pattern Results

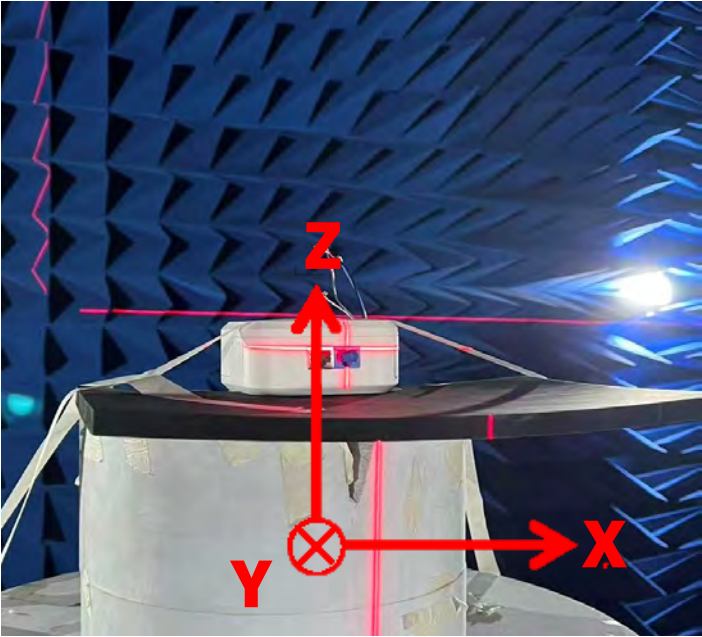
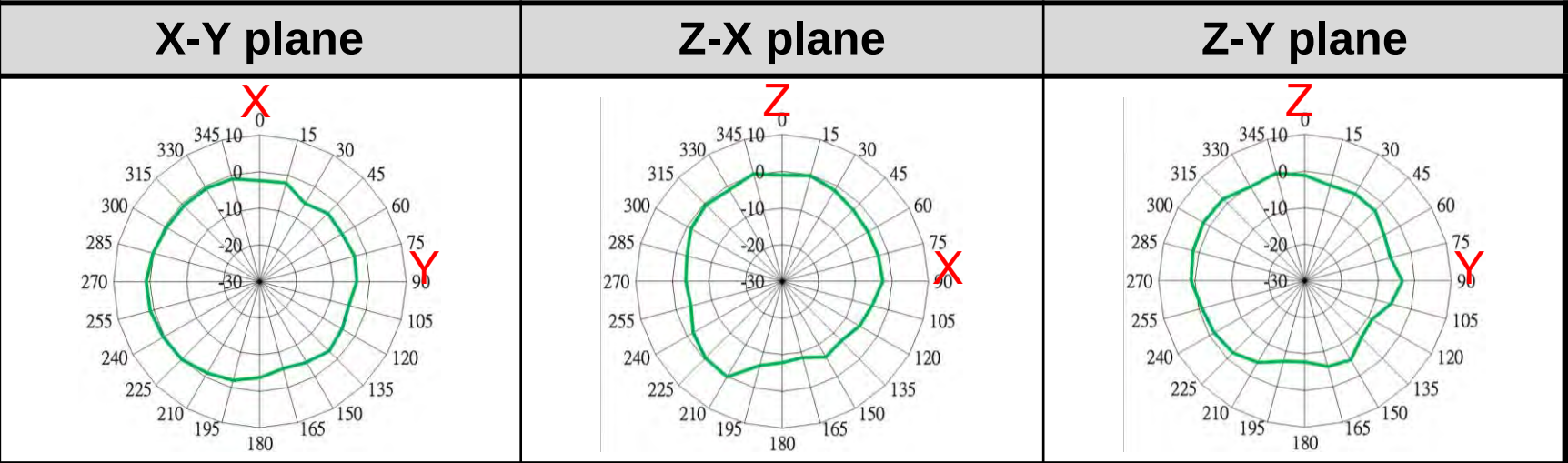
DB1&DB2 - 2450 MHz

DB1 DB2



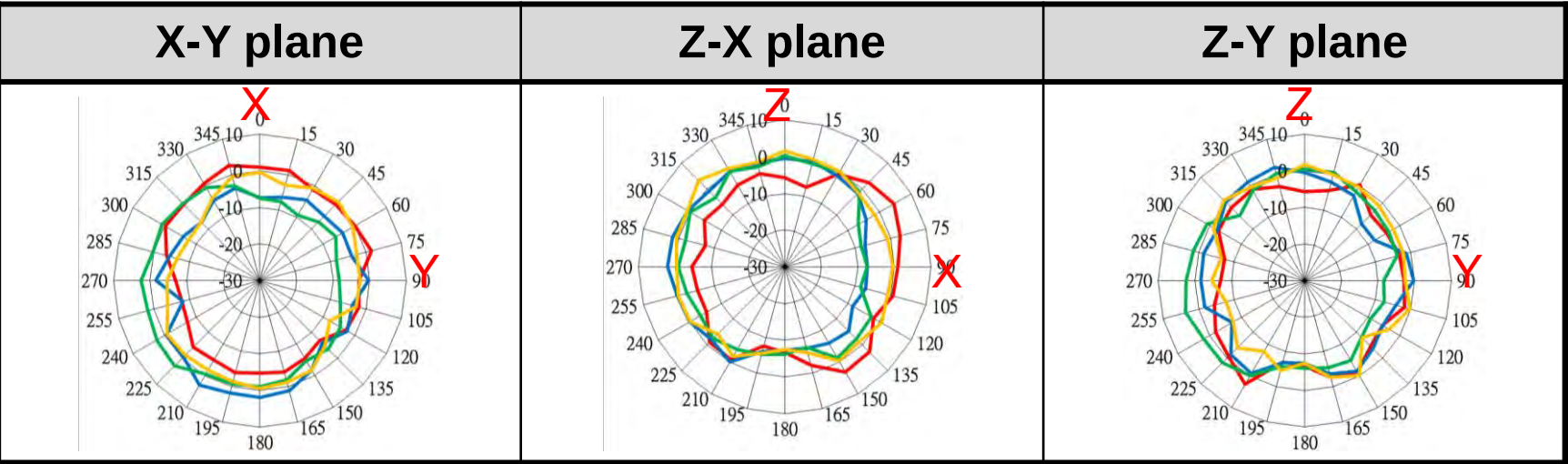
BT+5G - 2450 MHz

BT+5G

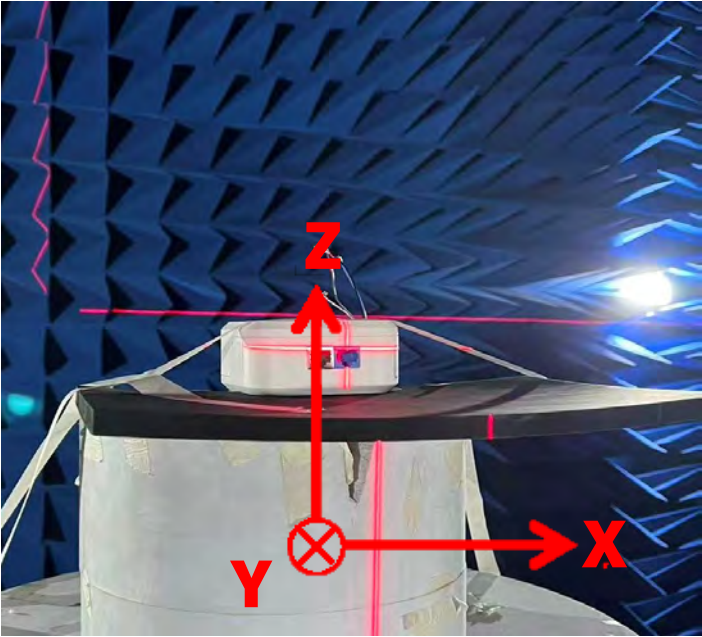
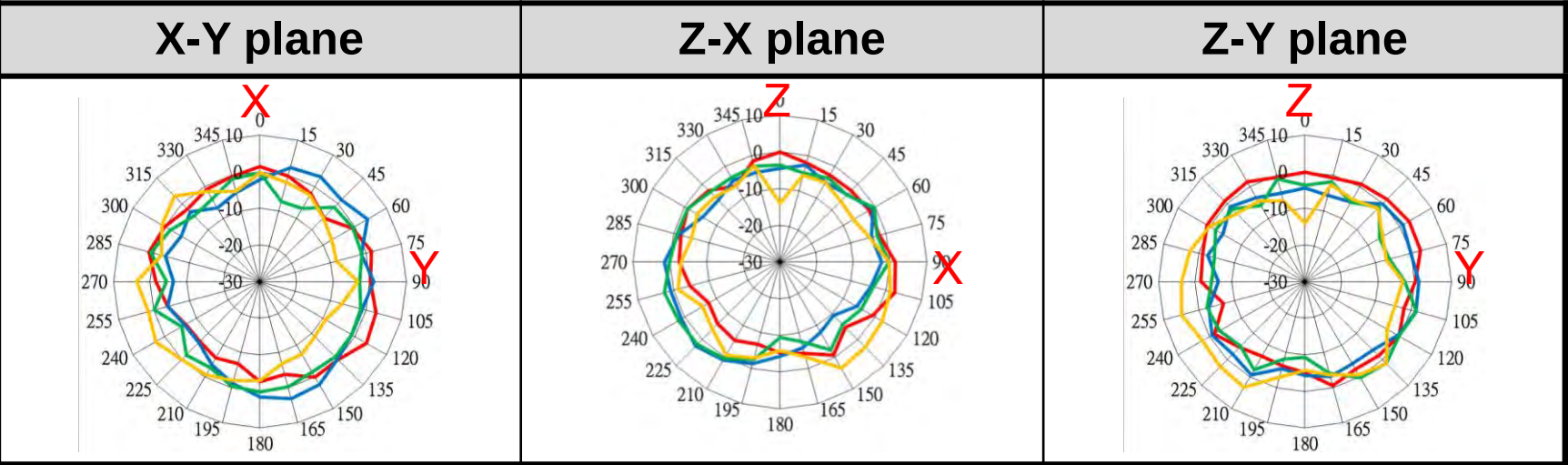


2D Radiation Pattern Results

DB1&DB2 & BT+5G & 5G - 5470 MHz ■ DB1 ■ DB2 ■ BT+5G ■ 5G1



6G1&6G2&6G3&6G4 - 6525 MHz ■ 6G1 ■ 6G2 ■ 6G3 ■ 6G4



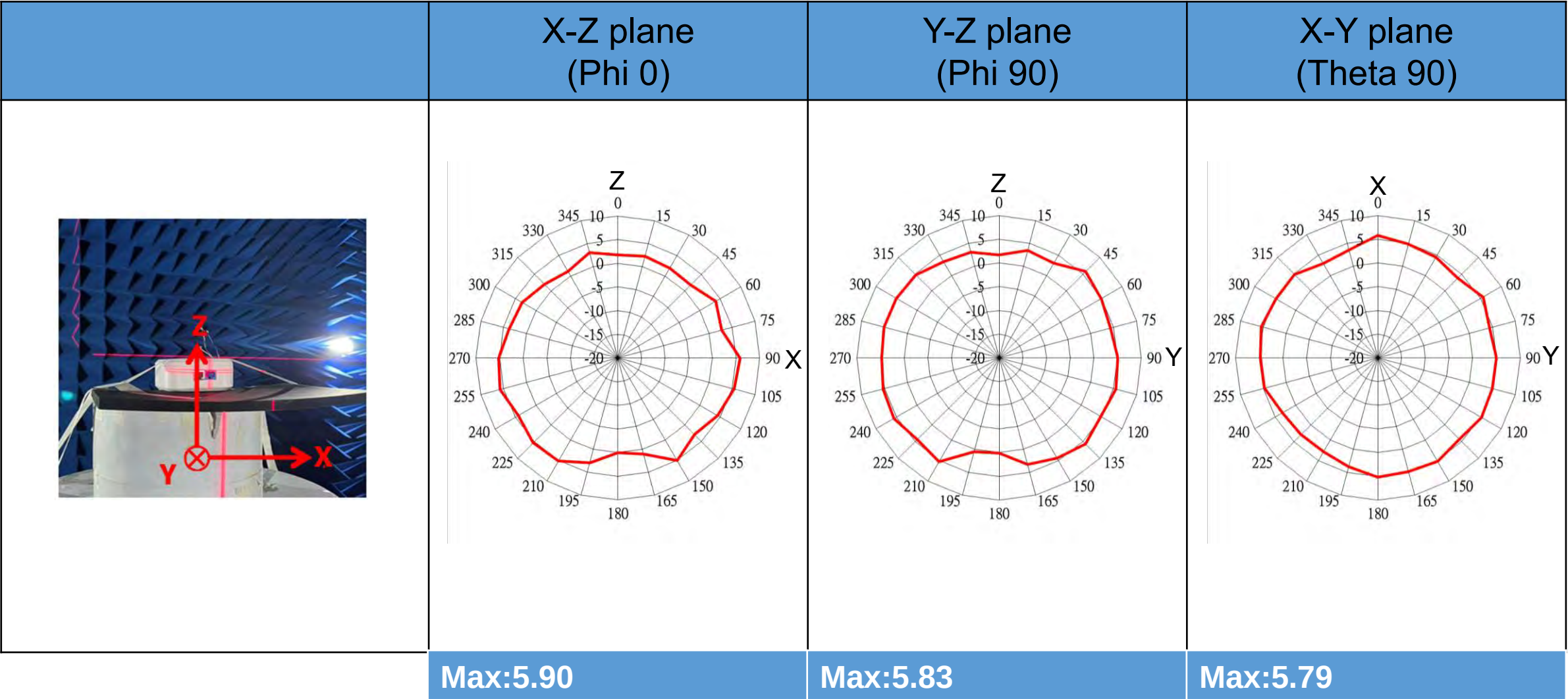
Correlated Radiation Pattern – 2.45GHz

	X-Z plane (Phi 0)	Y-Z plane (Phi 90)	X-Y plane (Theta 90)
	Max:3.24	Max:3.52	Max:3.43

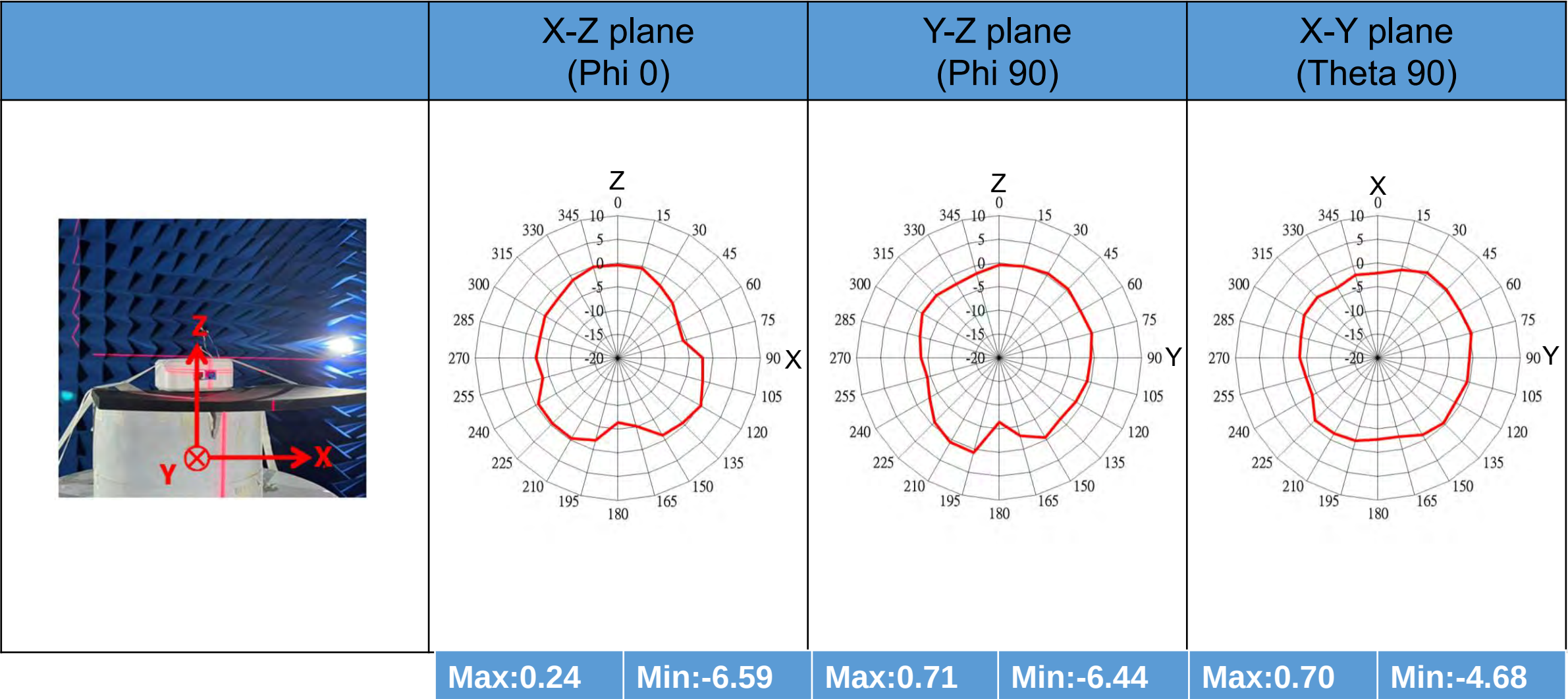
Correlated Radiation Pattern – 5.47GHz

	X-Z plane (Phi 0)	Y-Z plane (Phi 90)	X-Y plane (Theta 90)
	Max:5.77	Max:5.73	Max:5.69

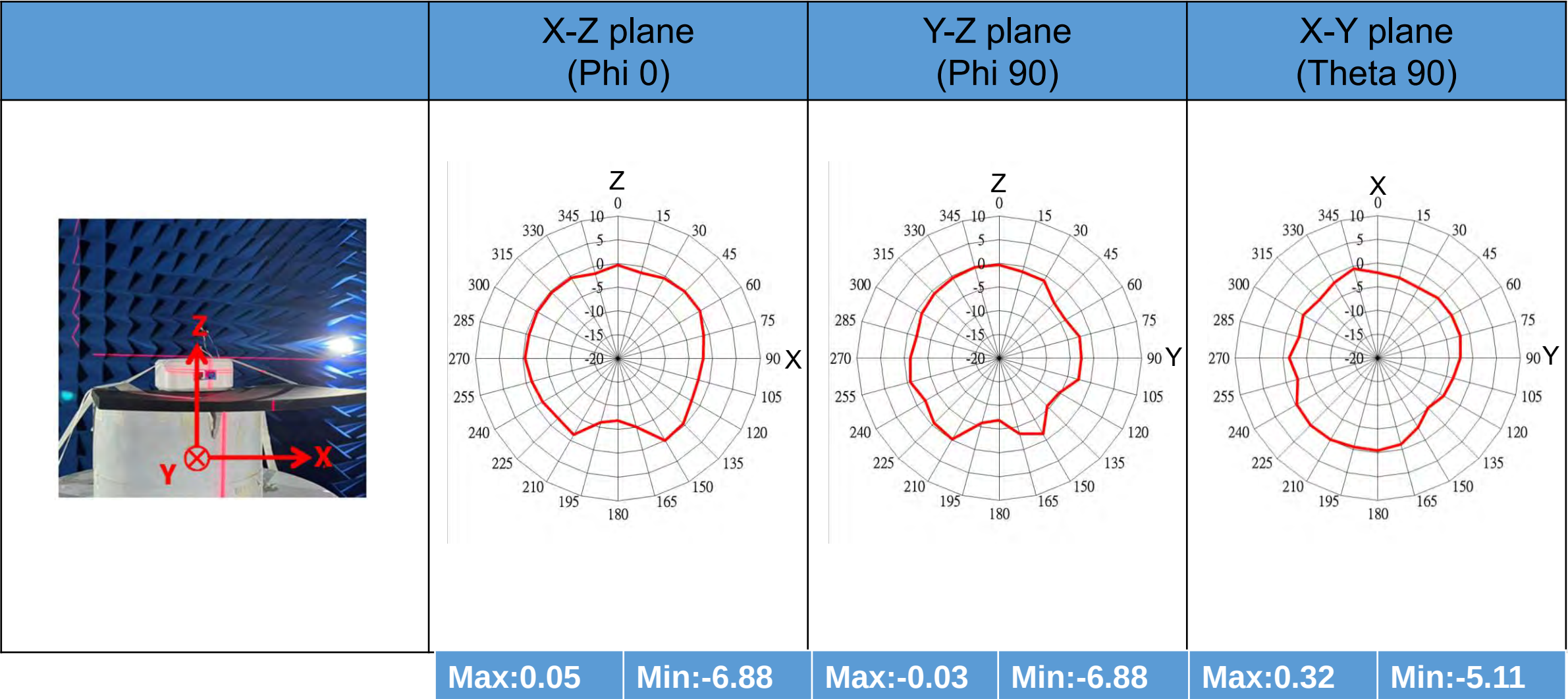
Correlated Radiation Pattern – 6.525GHz



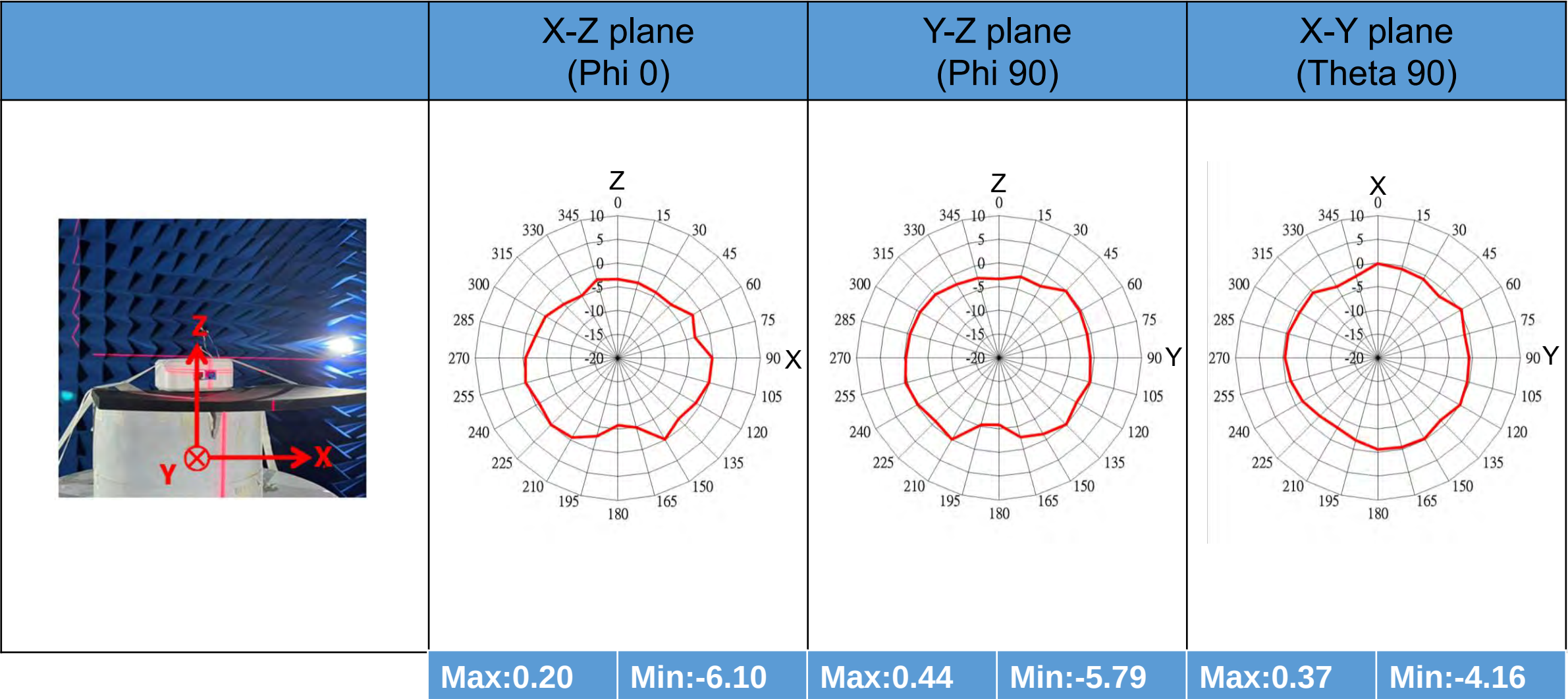
Uncorrelated Radiation Pattern – 2.45GHz



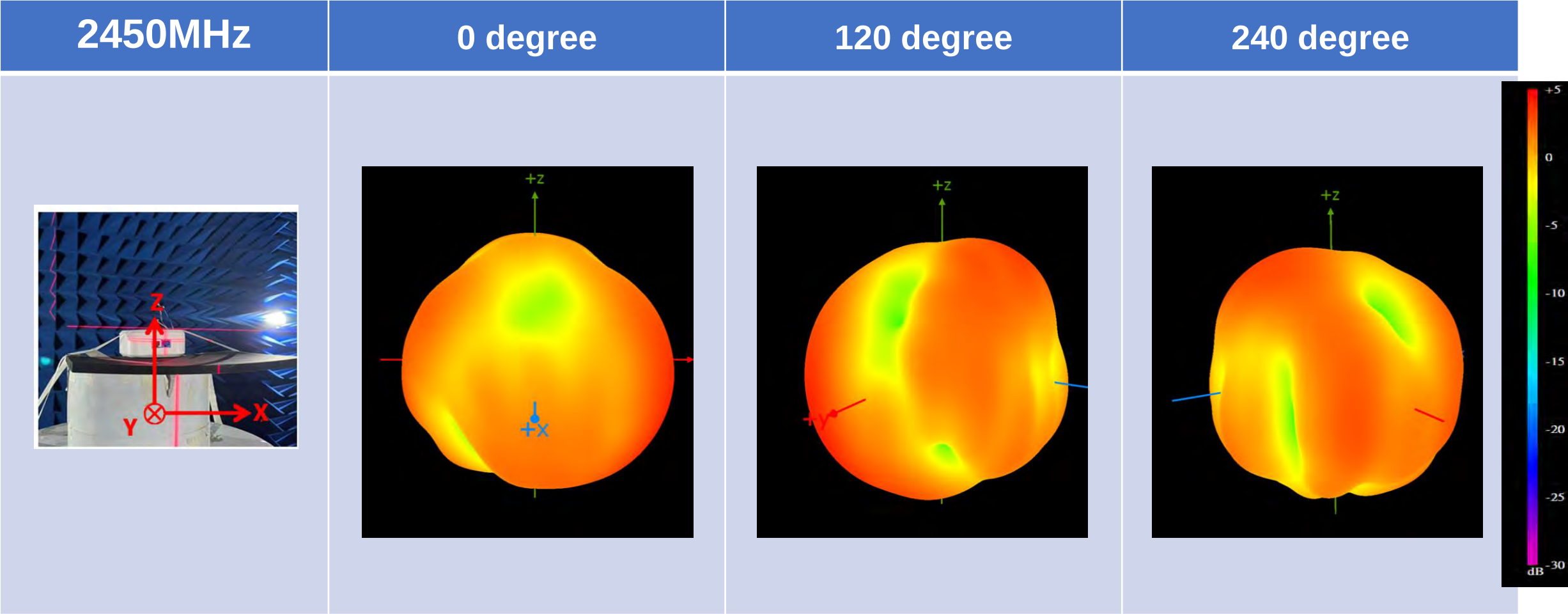
Uncorrelated Radiation Pattern – 5.47GHz



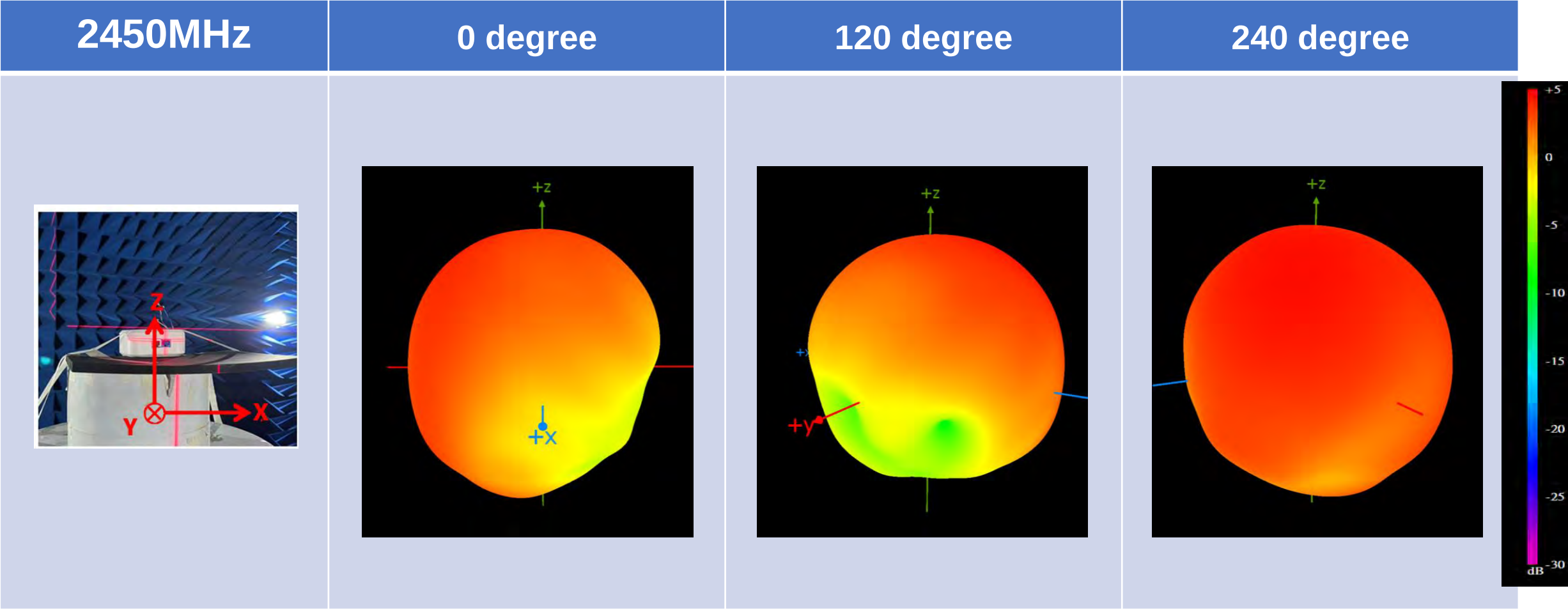
Uncorrelated Radiation Pattern – 6.525GHz



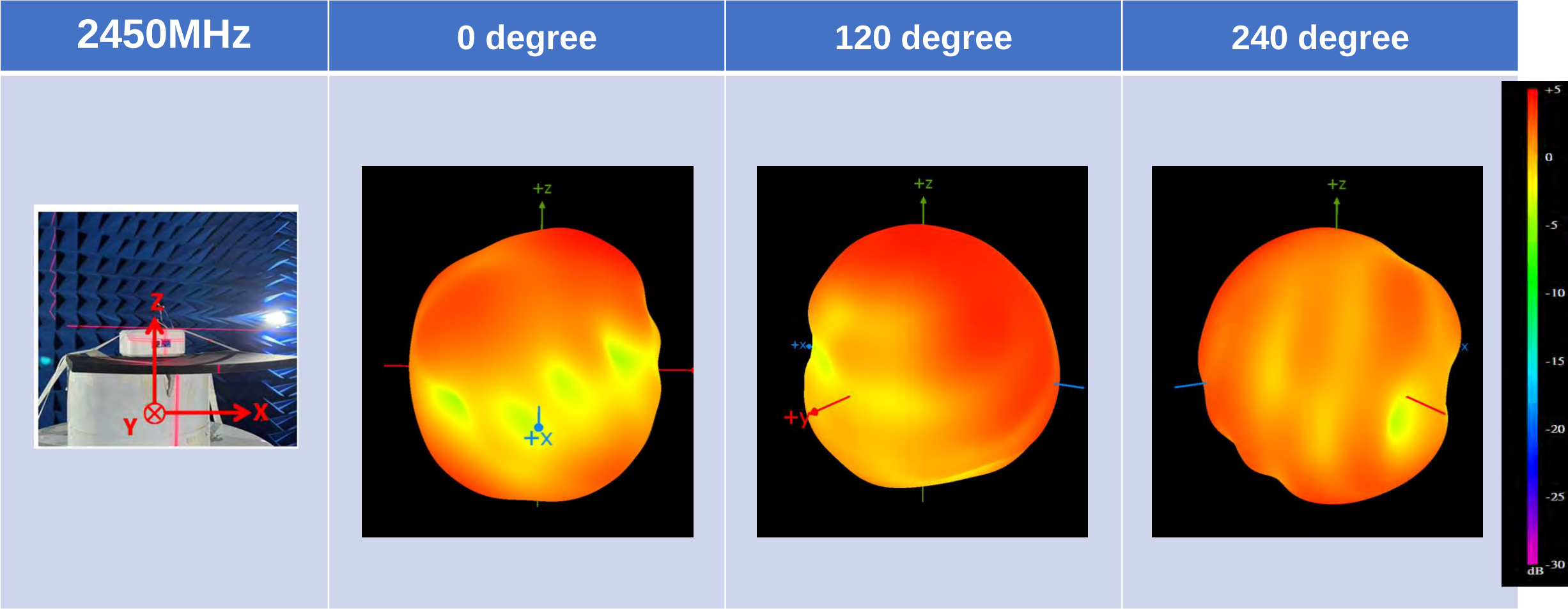
3D Radiation Pattern—DB1 2.45GHz



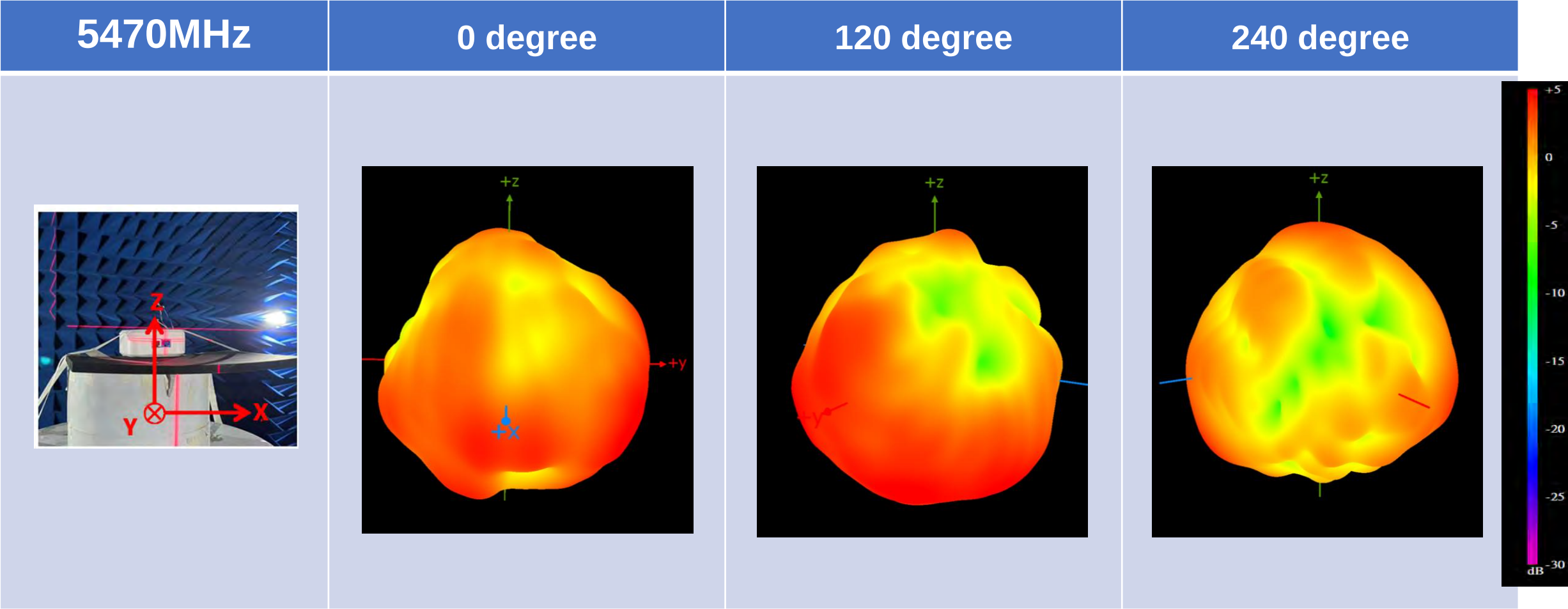
3D Radiation Pattern—DB2 2.45GHz



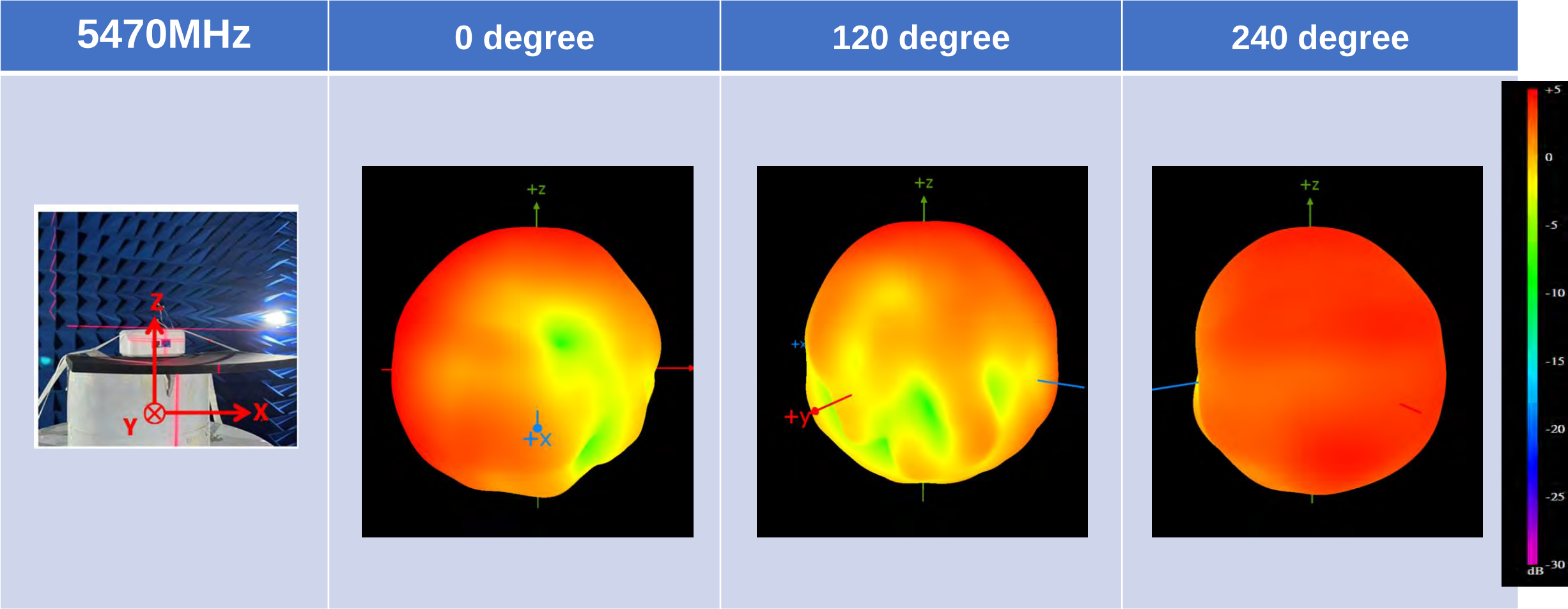
3D Radiation Pattern–BT+5G 2.45GHz



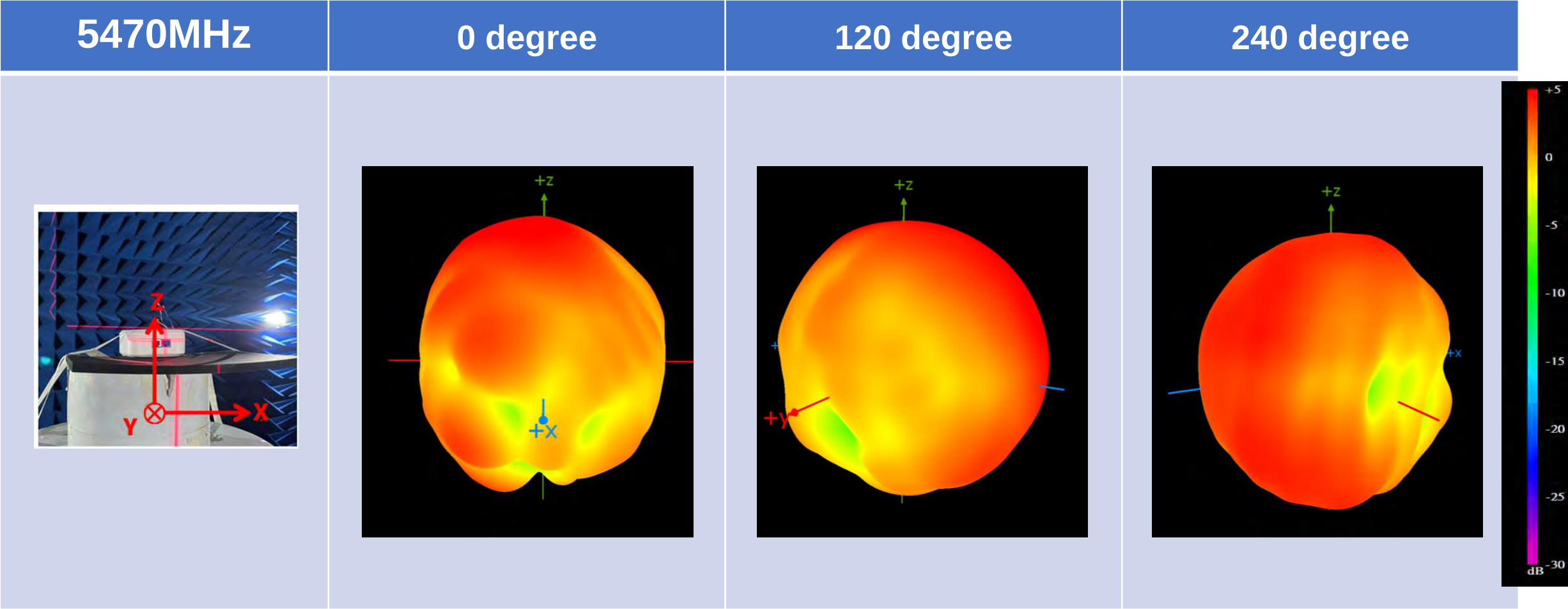
3D Radiation Pattern—DB1 5.47GHz



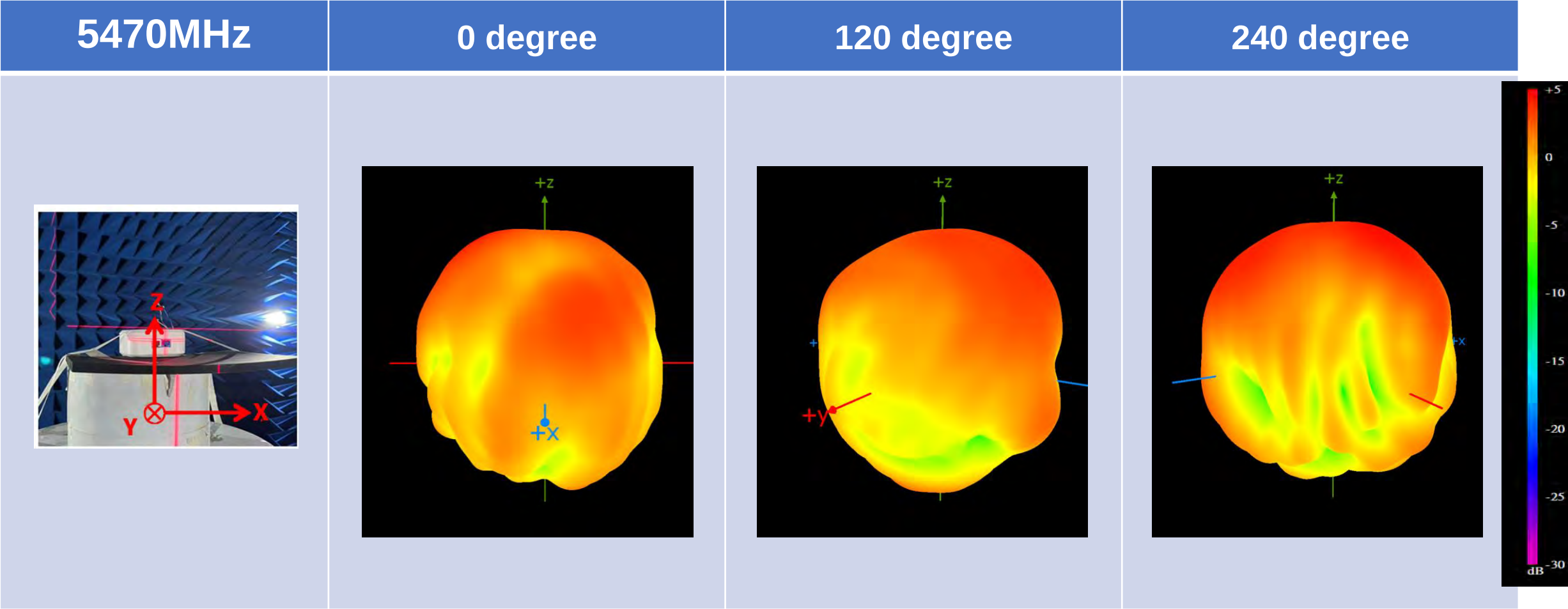
3D Radiation Pattern—DB2 5.47GHz



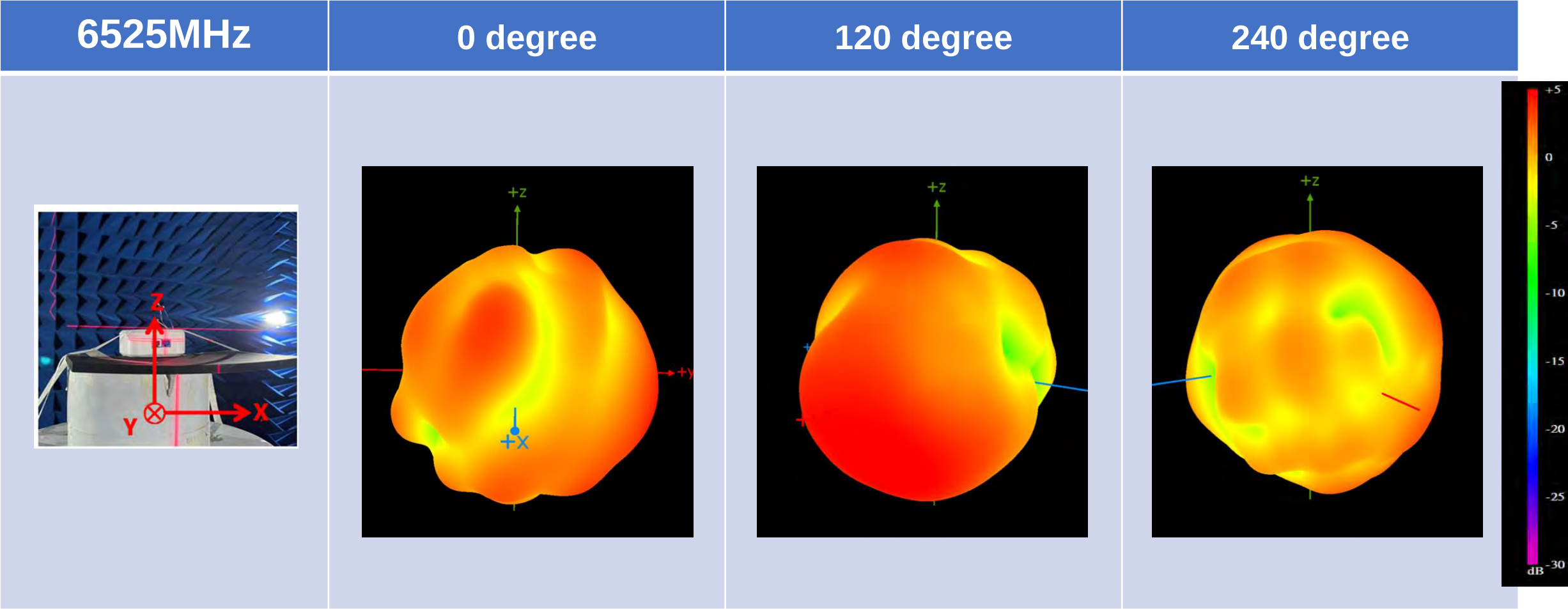
3D Radiation Pattern–BT+5G 5.47GHz



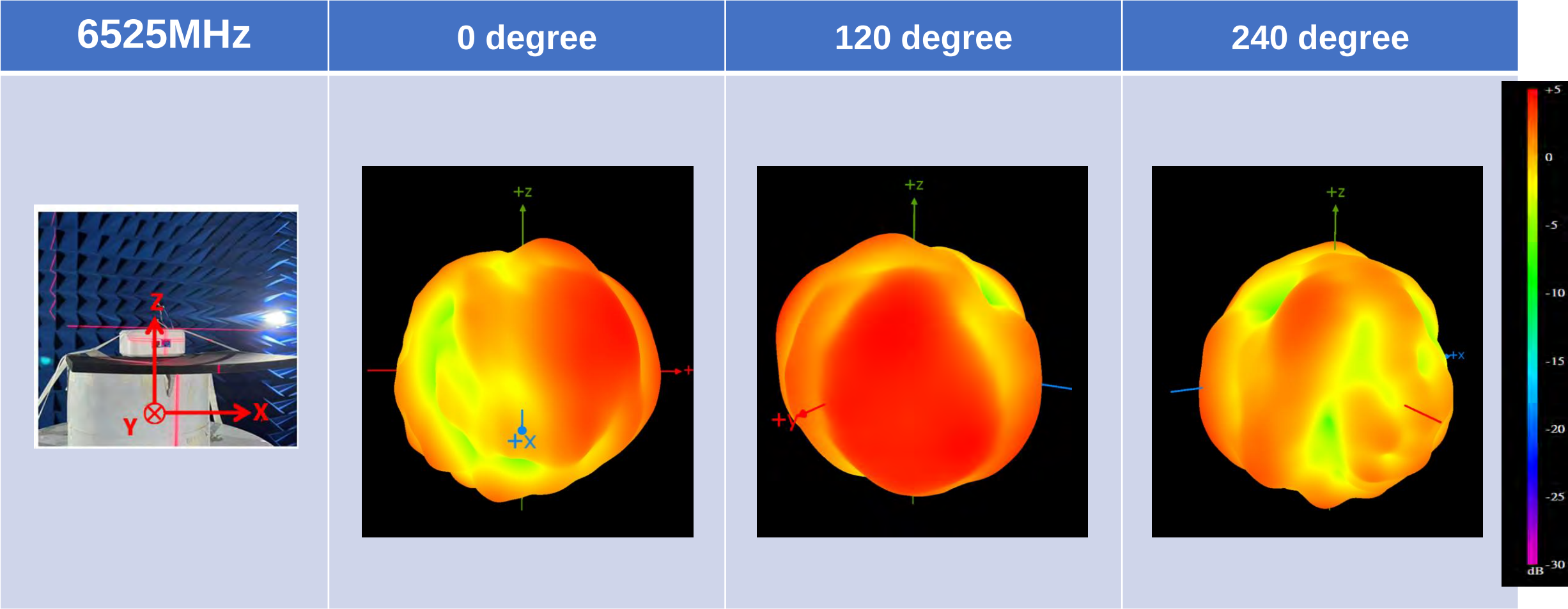
3D Radiation Pattern—5G 5.47GHz



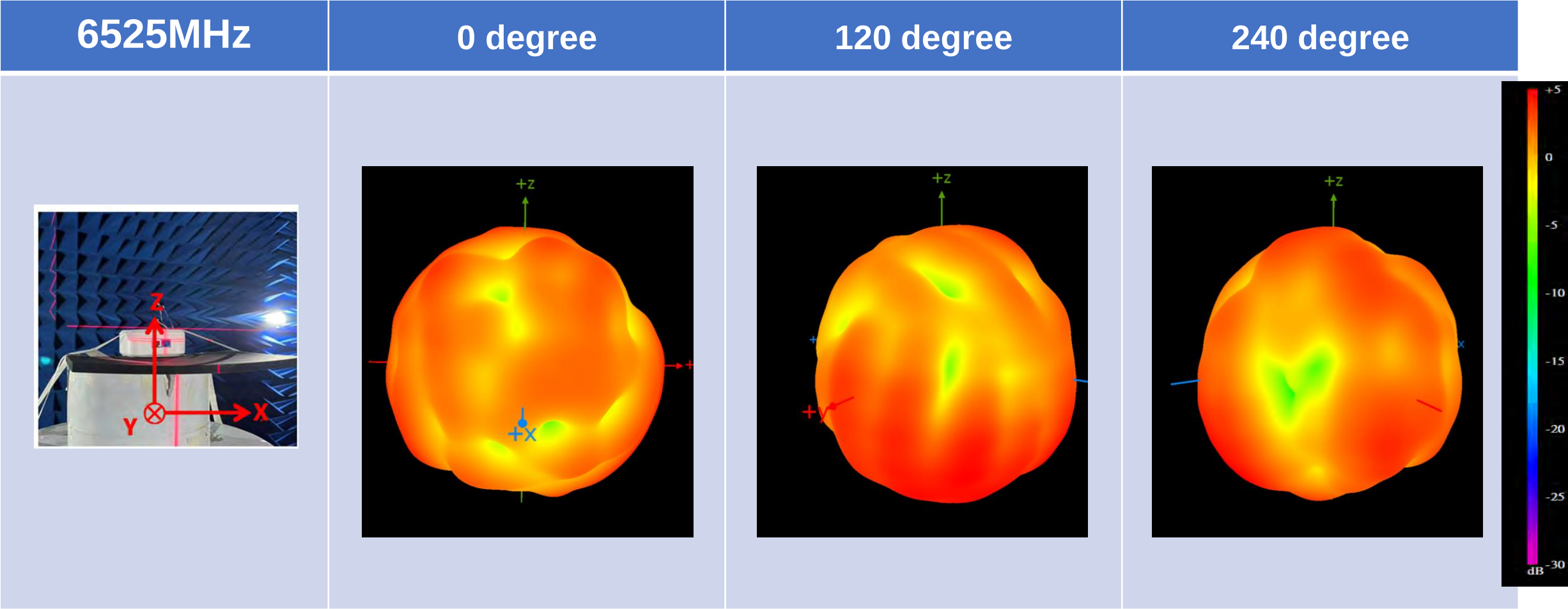
3D Radiation Pattern–6G1 6.525GHz



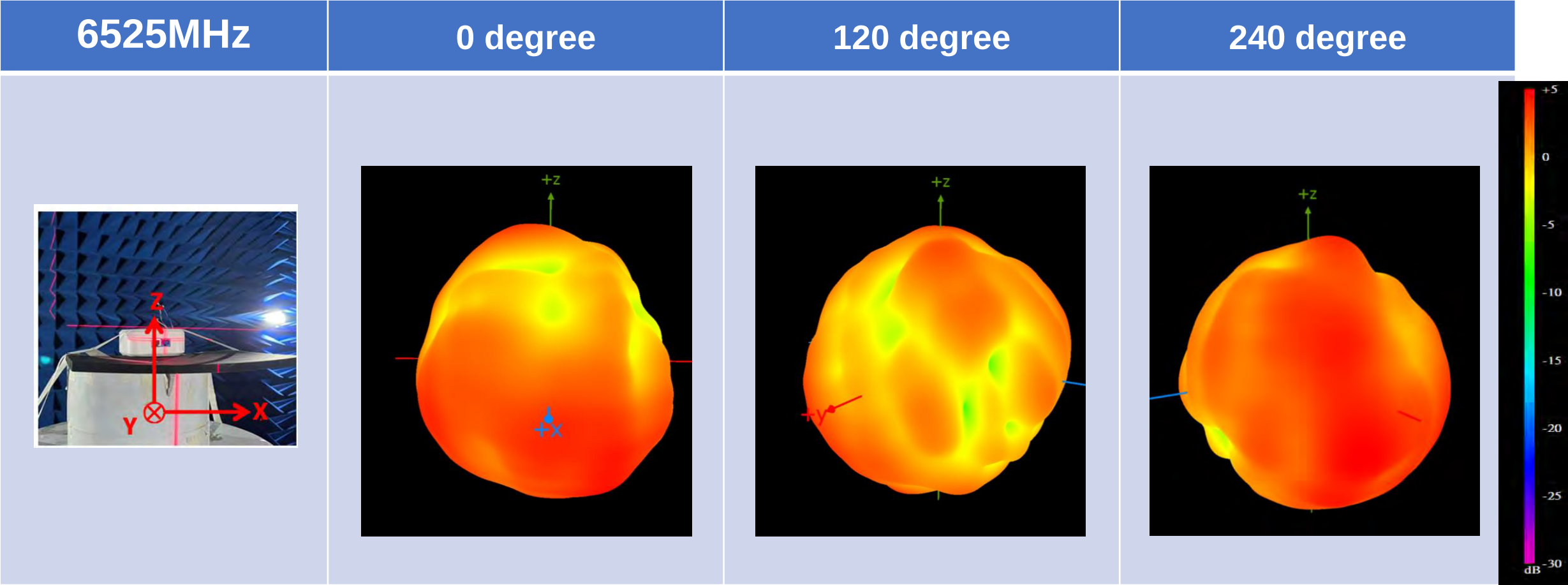
3D Radiation Pattern–6G2 6.525GHz



3D Radiation Pattern—6G3 6.525GHz



3D Radiation Pattern—6G4 6.525GHz



Thanks for your reading.