



SONICWAVE 641

Antenna Test Report

Senao Networks, Inc.

Customer	SonicWall
Project	SONICWAVE 641
Project Description	2.4G antenna *4 5G antenna *4 BLE antenna *1 Scan antenna *1
Date	2020/12/21
Prepared by	Kenny
Checked	Tony
Report Version	A01

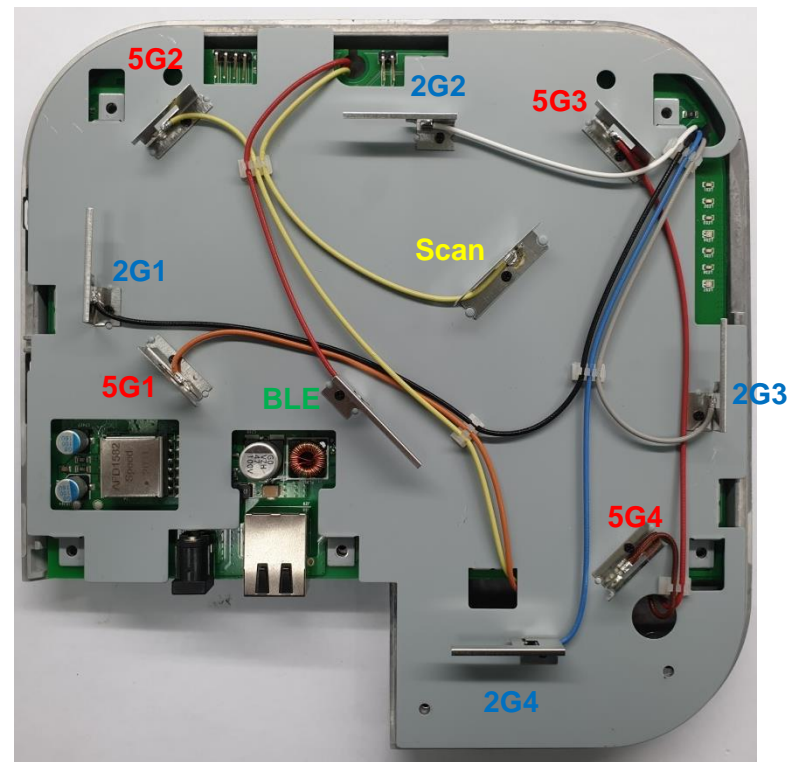
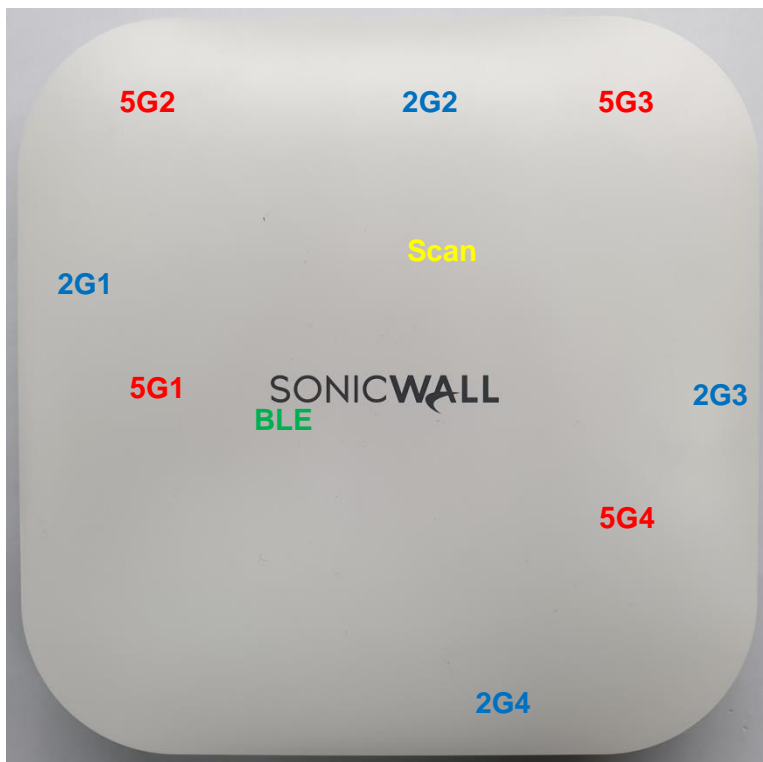
- **Purpose**

Antenna verification for SONICWAVE 641 device, result as following.

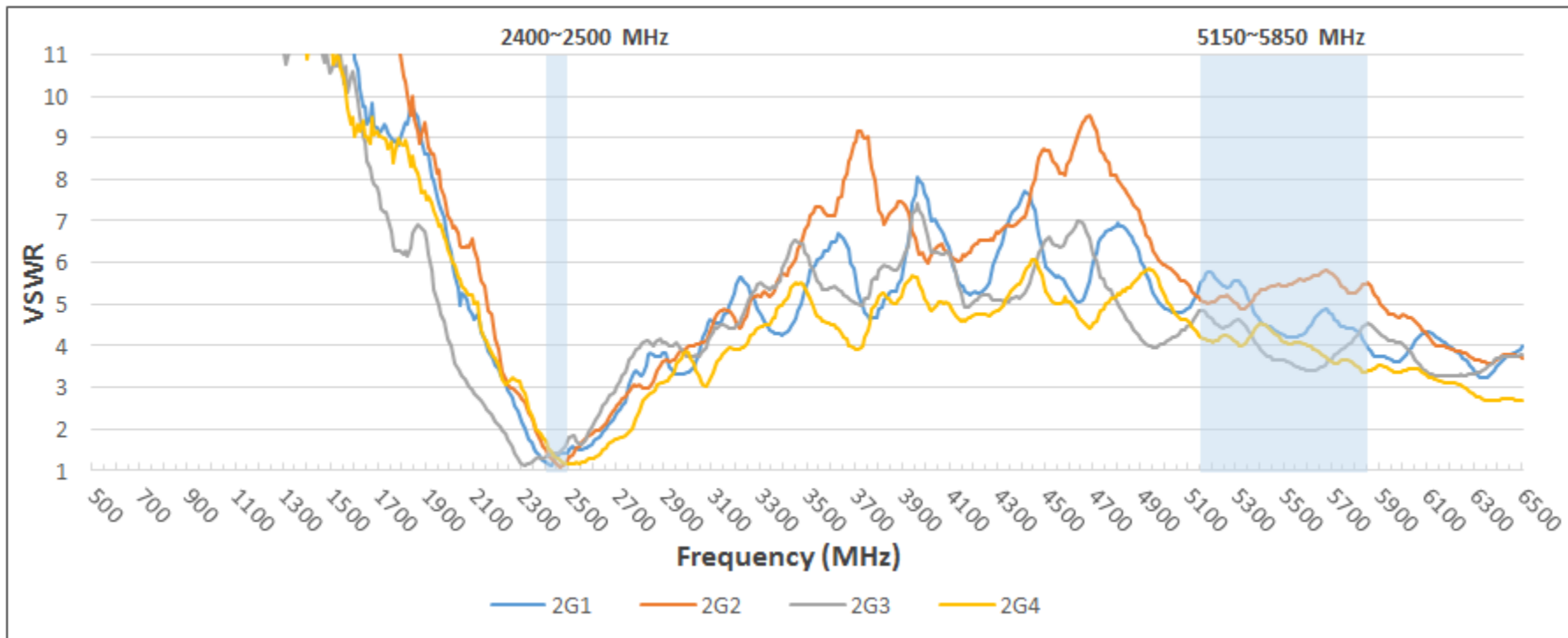
- **Agenda**

- Placement and Specification
- VSWR & Isolation
- Radiation Pattern
- Combine Pattern
- Efficiency and Gain

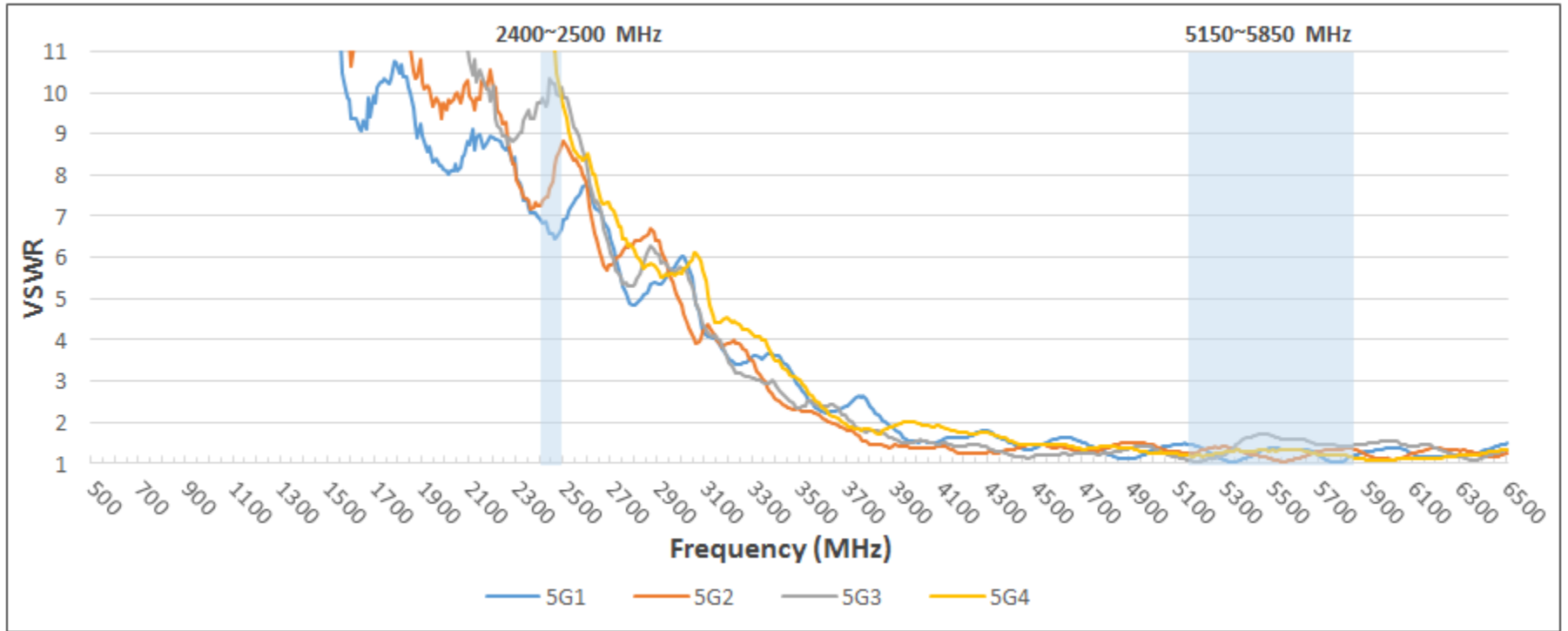
Antenna Placement & Definition			
Ant. No	Brand	Ant. P/N	Cable Color
Ant 1	Senao	5718A0570300	BLACK
Ant 2	Senao	5718A0571300	WHITE
Ant 3	Senao	5718A0572300	GRAY
Ant 4	Senao	5718A0573300	BLUE
Ant 5	Senao	5718A0574300	ORANGE
Ant 6	Senao	5718A0575300	YELLOW
Ant 7	Senao	5718A0576300	RED
Ant 8	Senao	5718A0577300	BROWN
Ant 9	Senao	5718A0578300	YELLOW
Ant 10	Senao	5718A0579300	RED



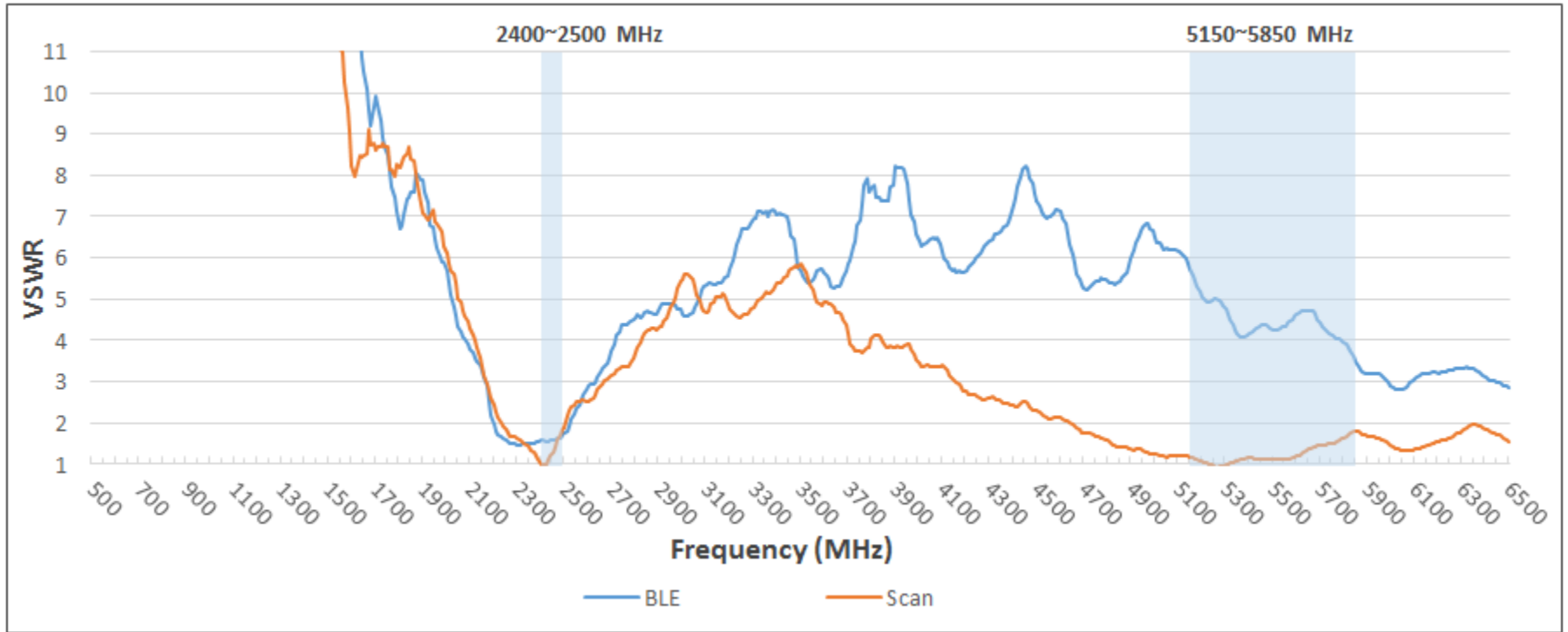
Ant No.	Operating Band	Gain (dBi)	Efficiency (%)	Ant type	Material	Feeding	Dimension
2G1~2G4	2400MHz ~ 2500 MHz	2.64~4.46	60.4~68.3	PIFA	Metal	Cable	29*10*7 mm ³
5G1~5G4	5150MHz ~ 5850 MHz	3.65~5.74	53.9~64.1	PIFA	Metal	Cable	21*10*5 mm ³
BLE	2400MHz ~ 2500 MHz	3.02~3.56	52.6~57.2	PIFA	Metal	Cable	29*10*7 mm ³
Scan	2400MHz ~ 2500 MHz	2.74~3.98	56.6~59.6	PIFA	Metal	Cable	30.2*6.3*10.3 mm ³
	5150MHz ~ 5850 MHz	3.32~4.95	51.5~58.4				



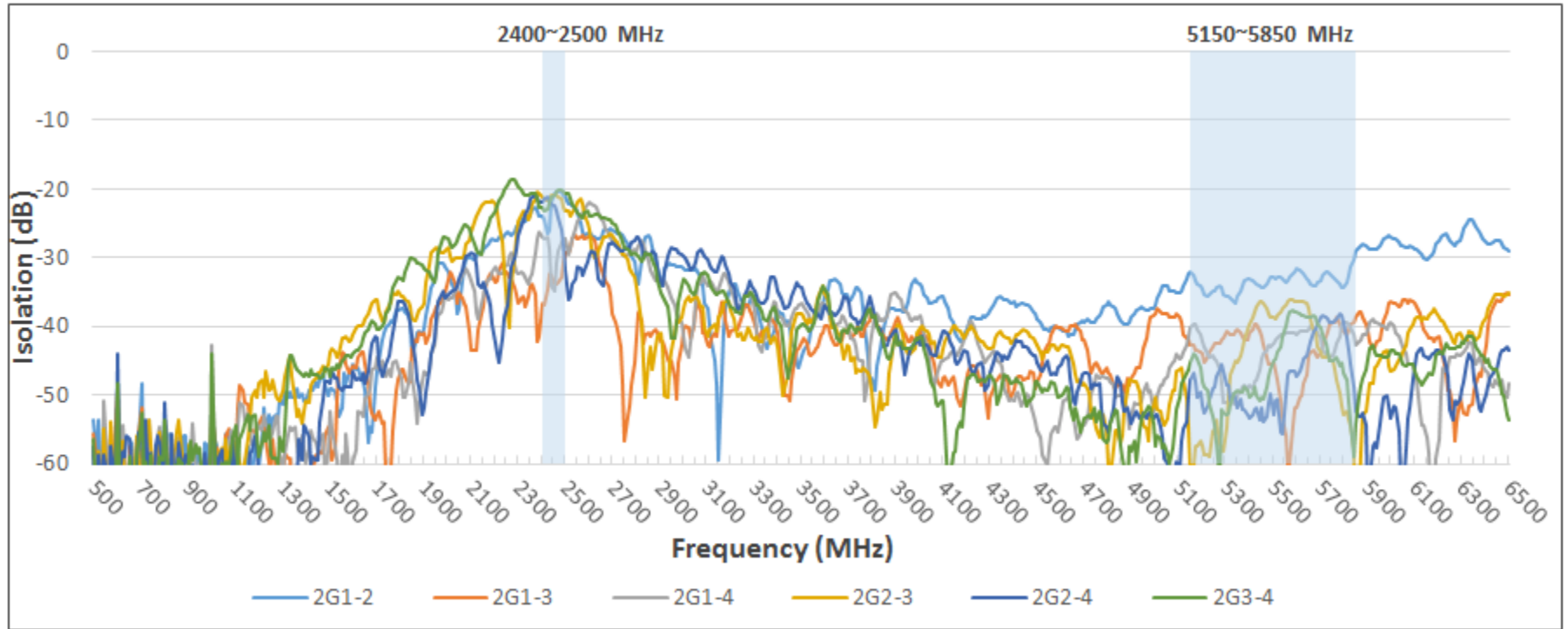
Freq. (MHz)	VSWR			
	2G1	2G2	2G3	2G4
2400	1.20	1.49	1.33	1.69
2450	1.37	1.14	1.42	1.27
2500	1.51	1.32	1.79	1.14



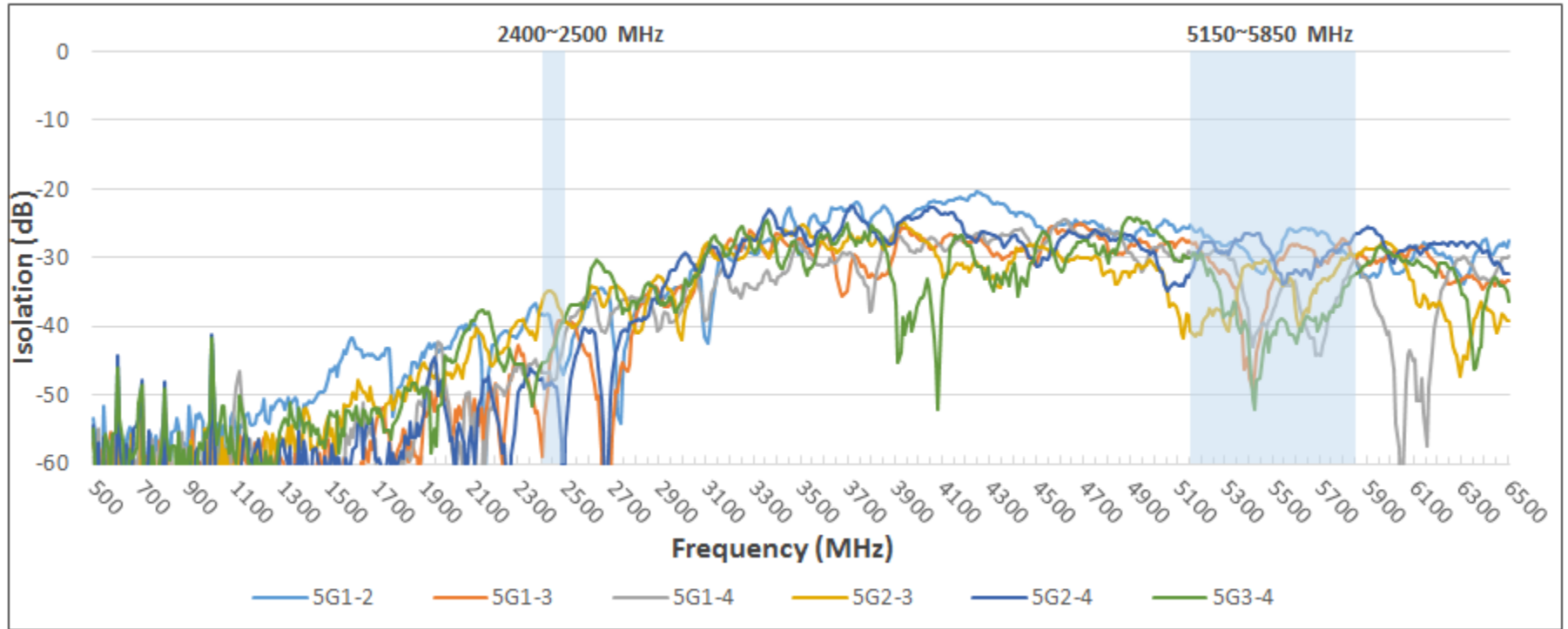
VSWR				
Freq. (MHz)	5G1	5G2	5G3	5G4
5150	1.47	1.23	1.08	1.19
5500	1.38	1.12	1.59	1.31
5850	1.21	1.35	1.44	1.14



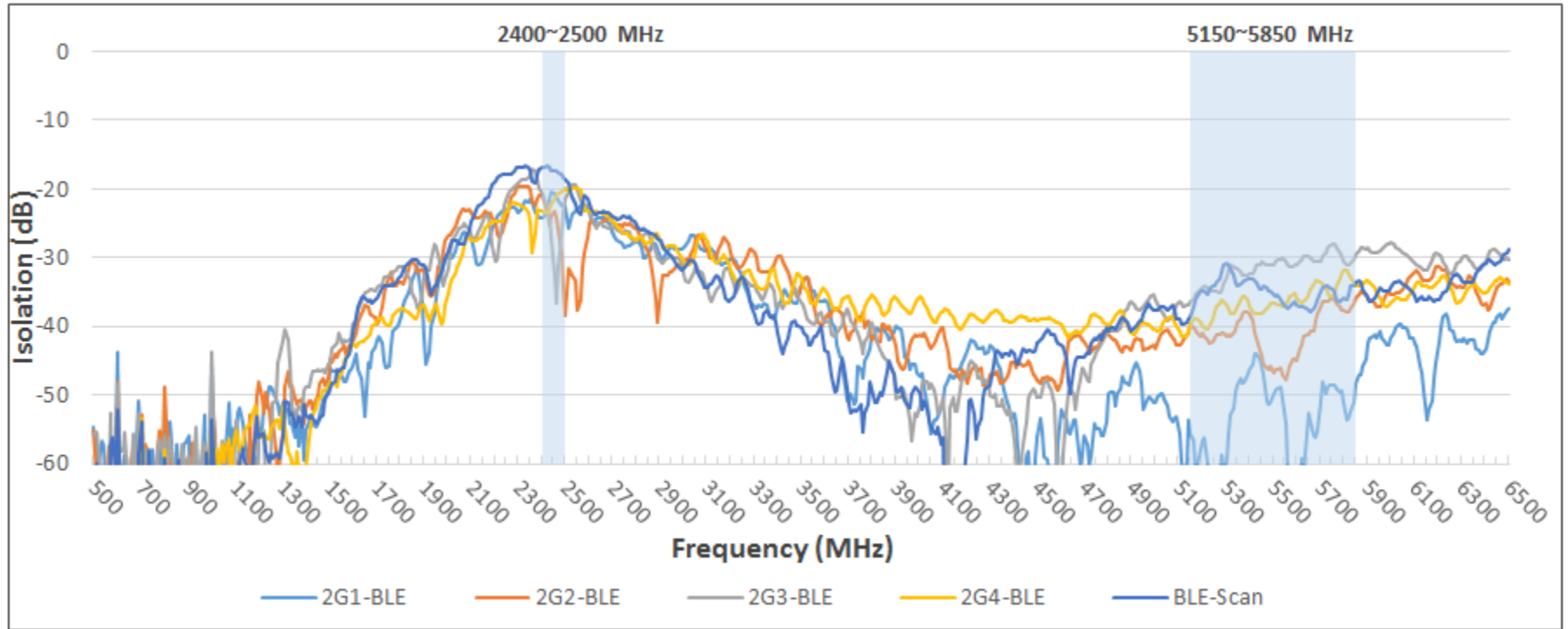
VSWR		
Freq. (MHz)	BLE	Scan
2400	1.57	1.01
2450	1.61	1.31
2500	1.77	1.89
5150	5.72	1.18
5500	4.27	1.14
5850	3.49	1.80



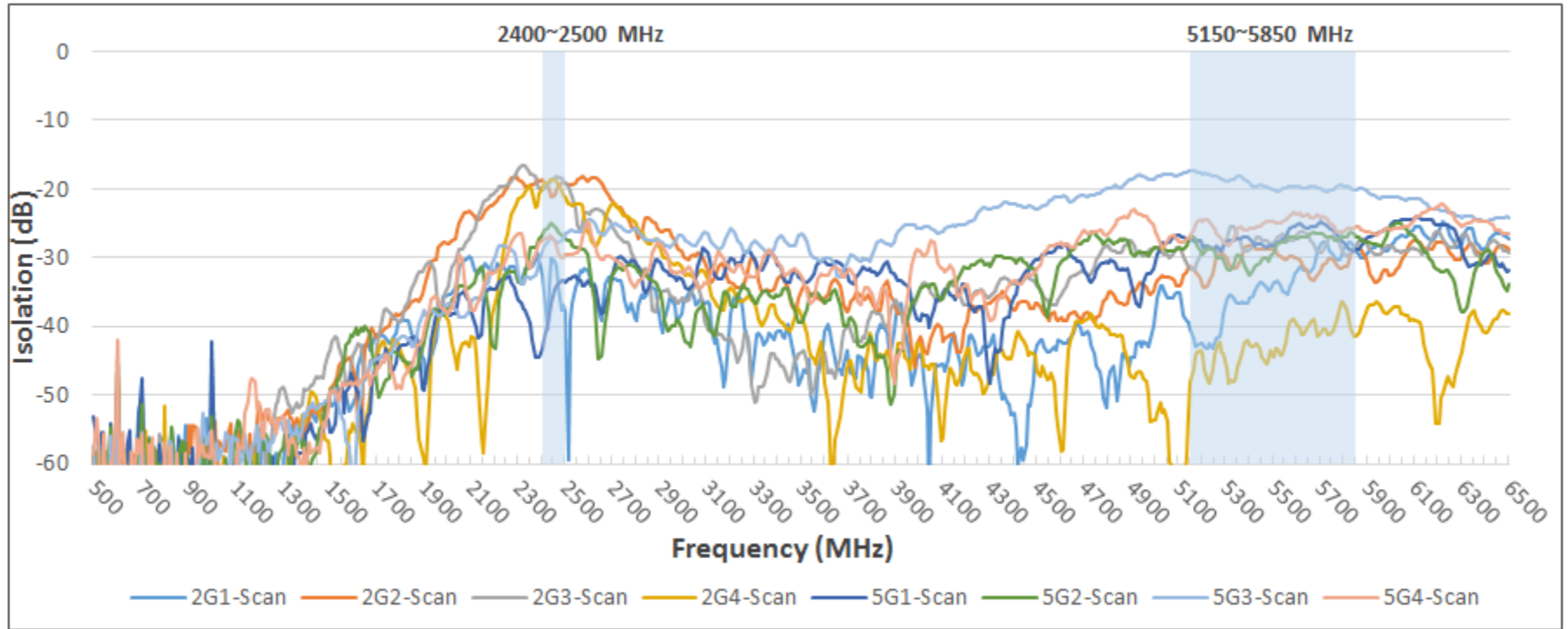
Isolation						
Freq. (MHz)	2G1-2	2G1-3	2G1-4	2G2-3	2G2-4	2G3-4
2400	-23.87	-36.78	-27.05	-21.23	-22.05	-22.77
2450	-20.82	-33.76	-34.96	-20.92	-22.48	-20.89
2500	-21.19	-29.21	-27.28	-23.25	-31.84	-20.63



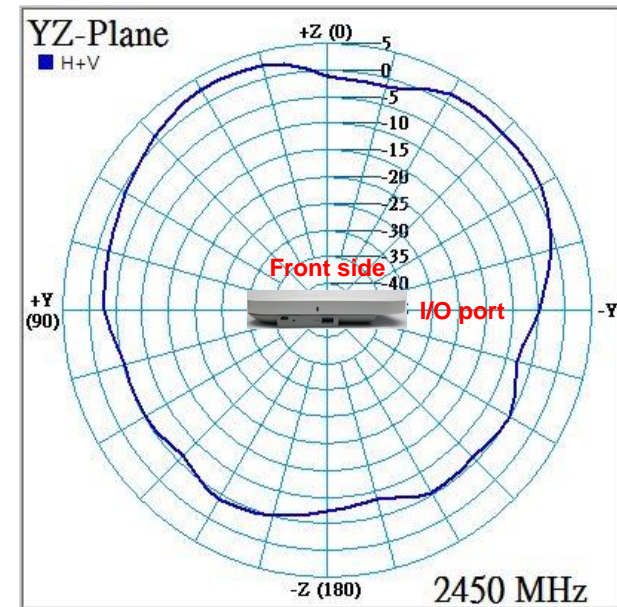
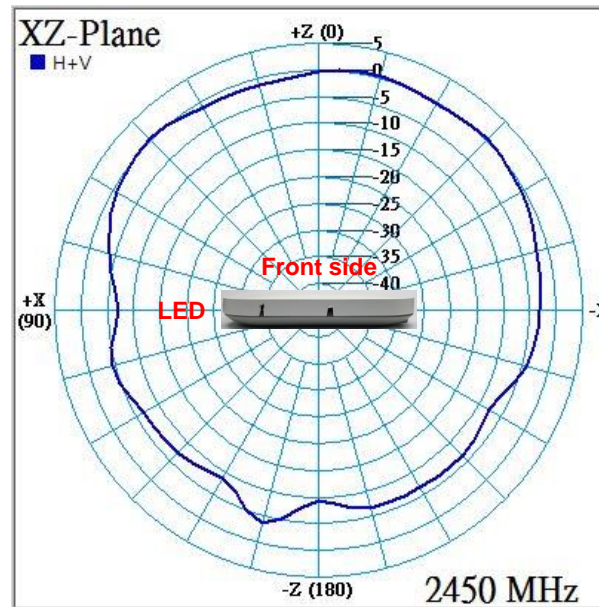
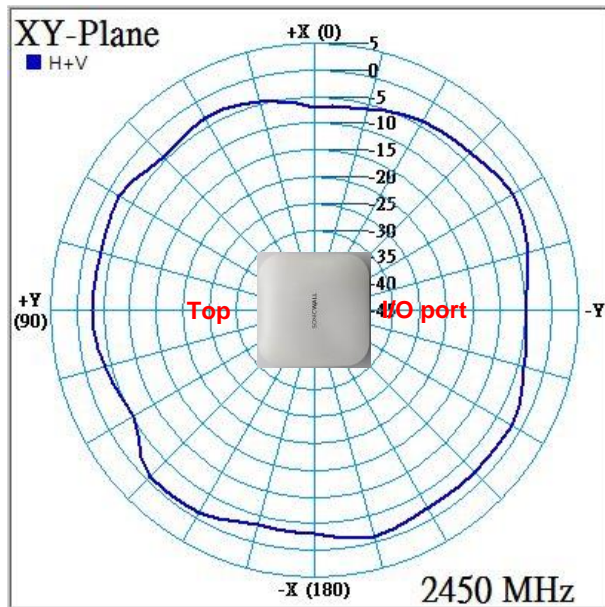
Isolation						
Freq. (MHz)	5G1-2	5G1-3	5G1-4	5G2-3	5G2-4	5G3-4
5150	-25.30	-27.85	-29.33	-40.70	-32.48	-30.11
5500	-30.26	-33.00	-37.46	-32.29	-30.39	-40.73
5850	-30.23	-30.30	-30.70	-29.73	-26.59	-32.46



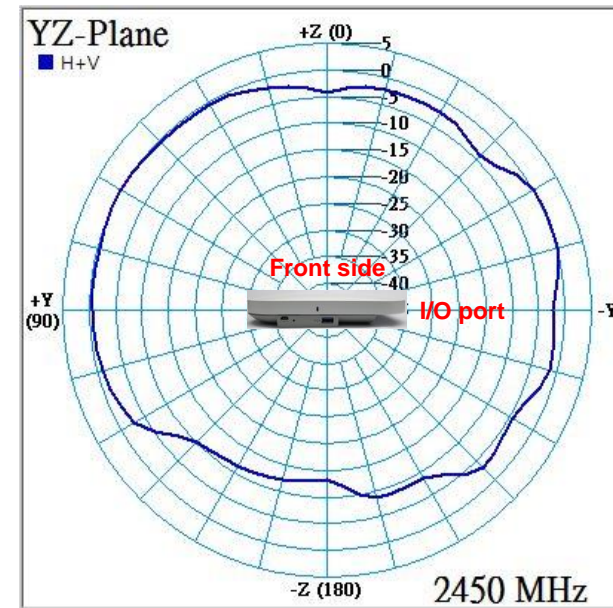
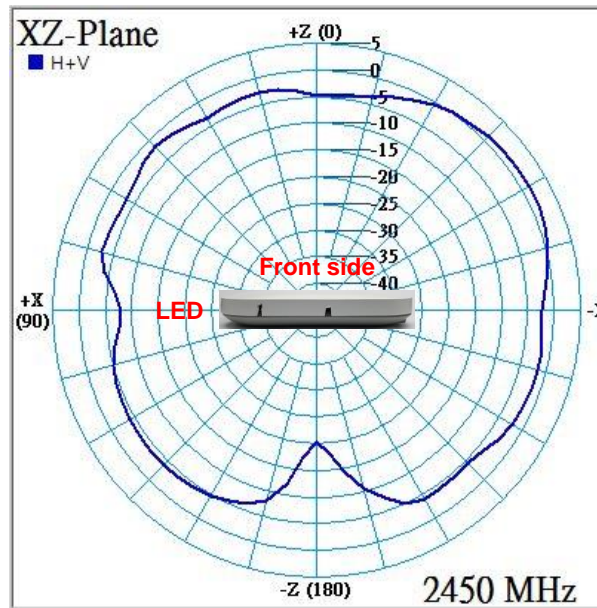
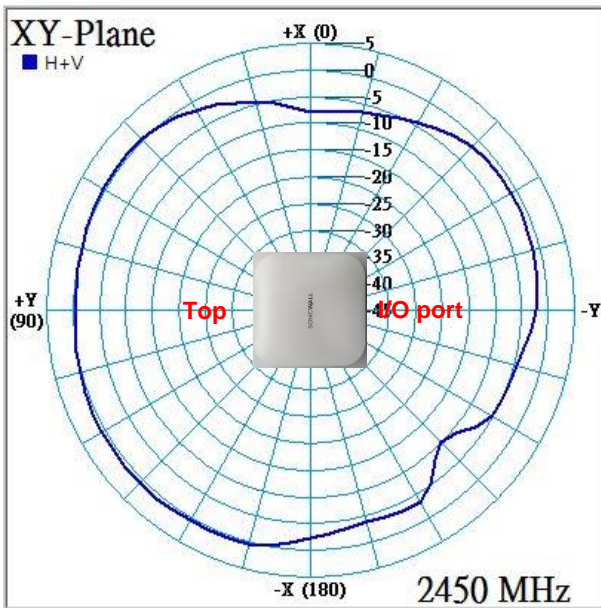
Isolation					
Freq. (MHz)	2G1-BLE	2G2-BLE	2G3-BLE	2G4-BLE	BLE-Scan
2400	-24.36	-20.87	-20.74	-23.23	-16.97
2450	-20.73	-23.29	-32.54	-21.50	-17.35
2500	-22.68	-38.55	-21.40	-20.05	-18.66
5150	-55.60	-39.80	-36.51	-39.67	-38.65
5500	-49.86	-46.83	-30.99	-36.56	-35.30
5850	-48.42	-35.94	-29.52	-34.08	-33.64



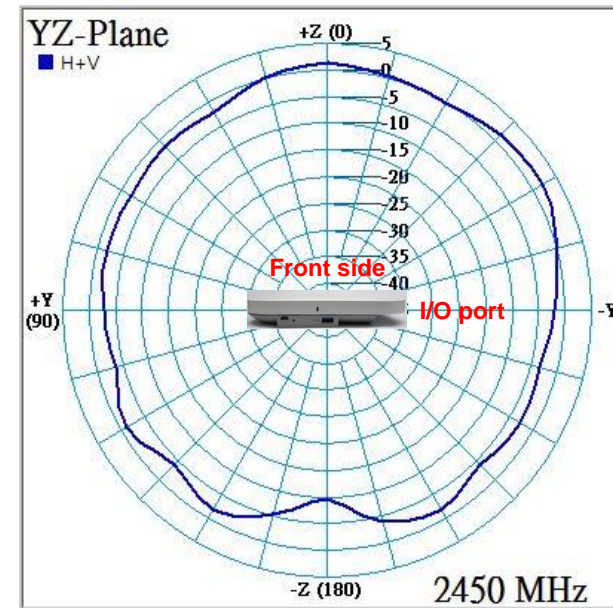
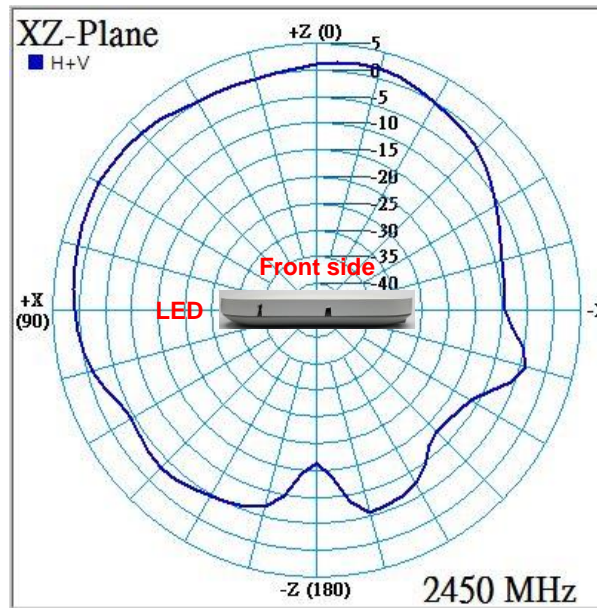
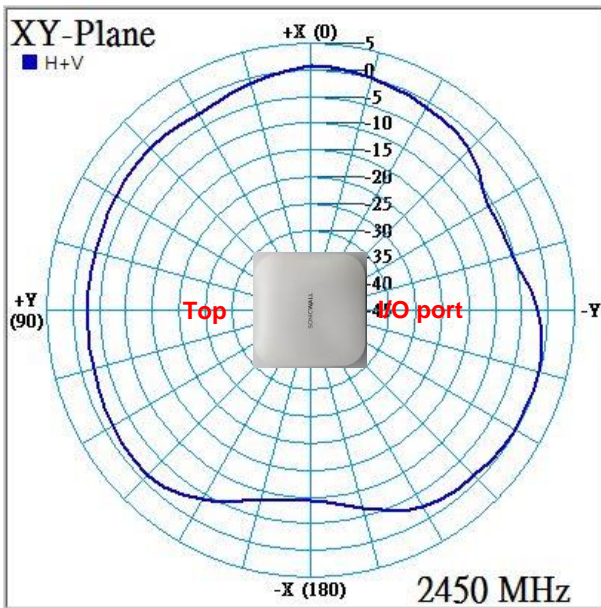
Isolation								
Freq. (MHz)	2G1-Scan	2G2-Scan	2G3-Scan	2G4-Scan	5G1-Scan	5G2-Scan	5G3-Scan	5G4-Scan
2400	-32.57	-18.63	-20.10	-19.86	-43.37	-26.69	-29.14	-27.43
2450	-30.69	-20.90	-18.51	-18.79	-34.74	-25.45	-27.57	-27.55
2500	-37.94	-19.24	-19.24	-21.32	-33.65	-27.39	-26.64	-29.51
5150	-40.41	-31.31	-31.59	-48.00	-27.35	-27.13	-17.34	-26.79
5500	-33.74	-28.79	-27.83	-44.55	-28.37	-29.22	-20.07	-24.82
5850	-29.16	-28.67	-28.27	-41.59	-28.69	-27.04	-20.13	-25.55

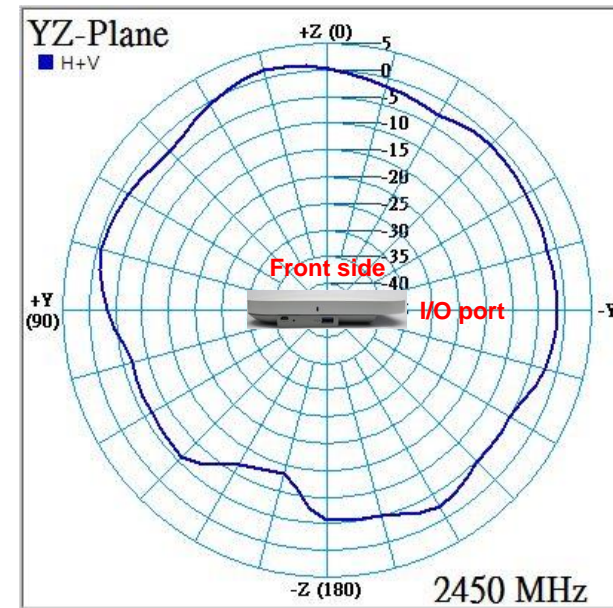
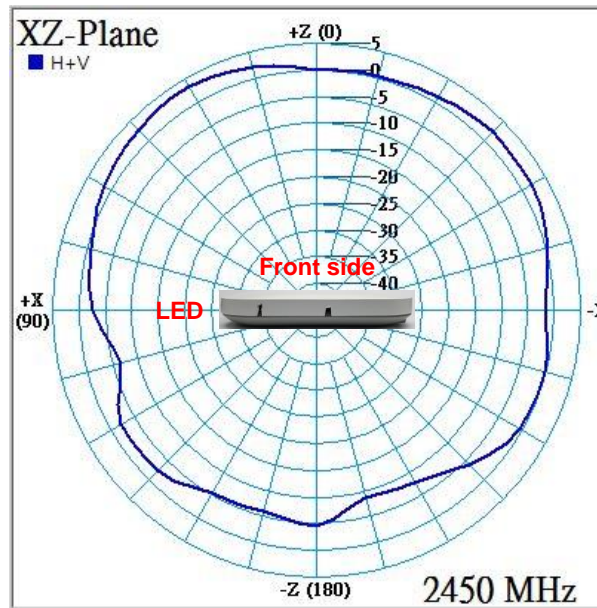
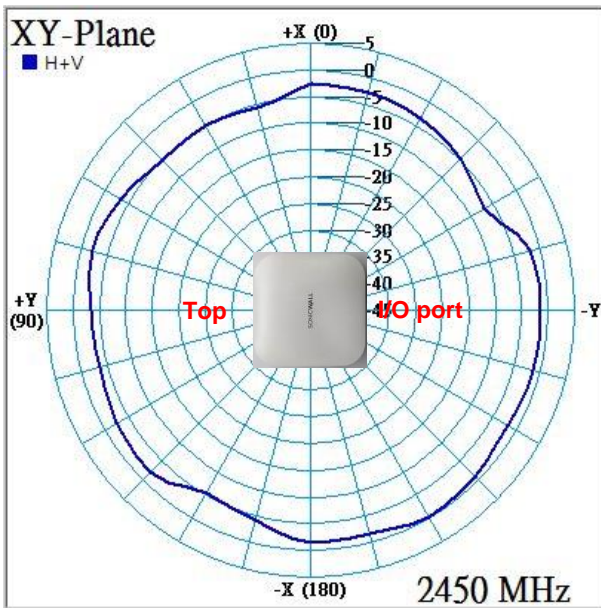


2D Radiation Pattern – 2G2 @ 2.45GHz

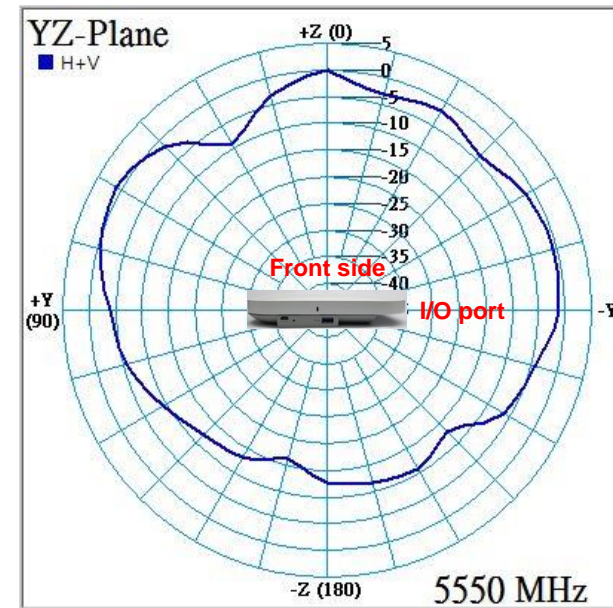
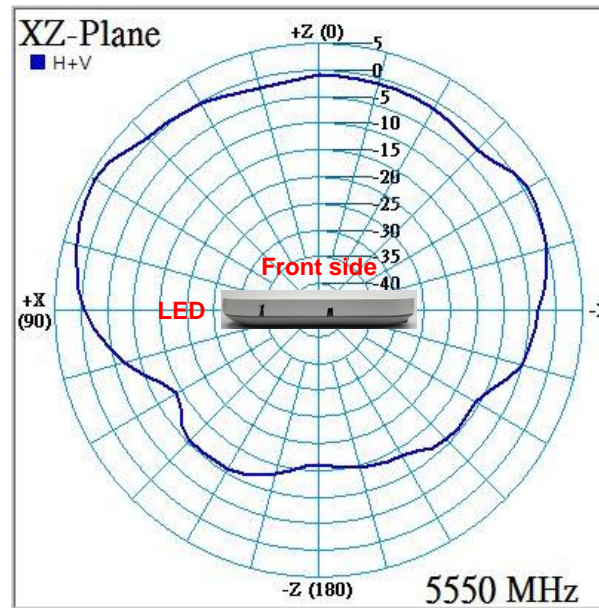
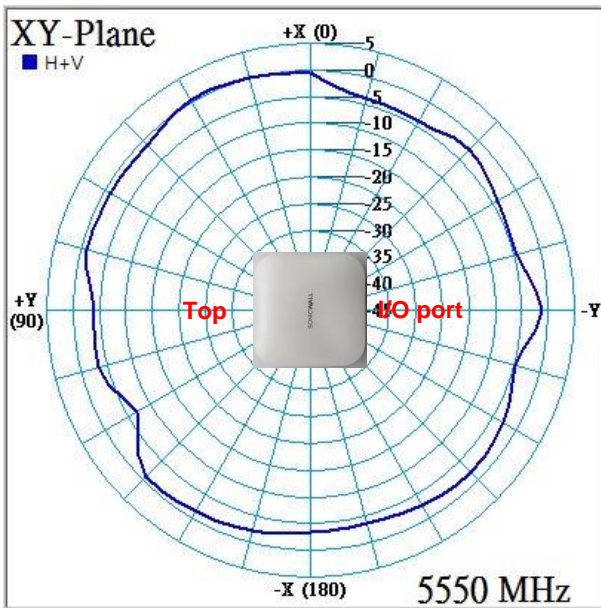


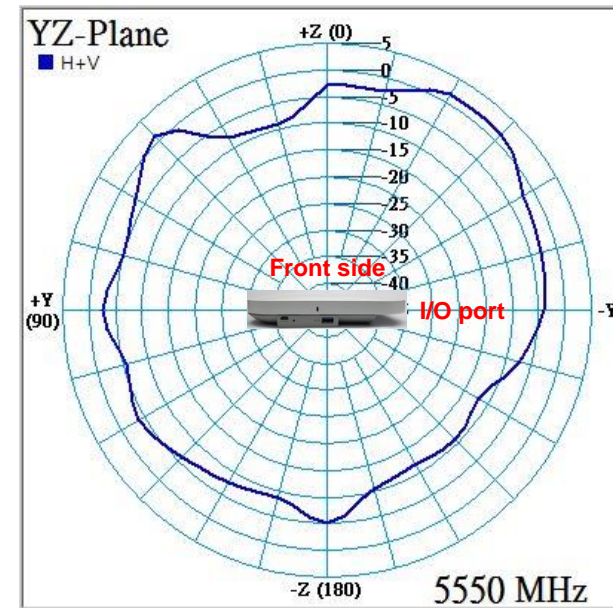
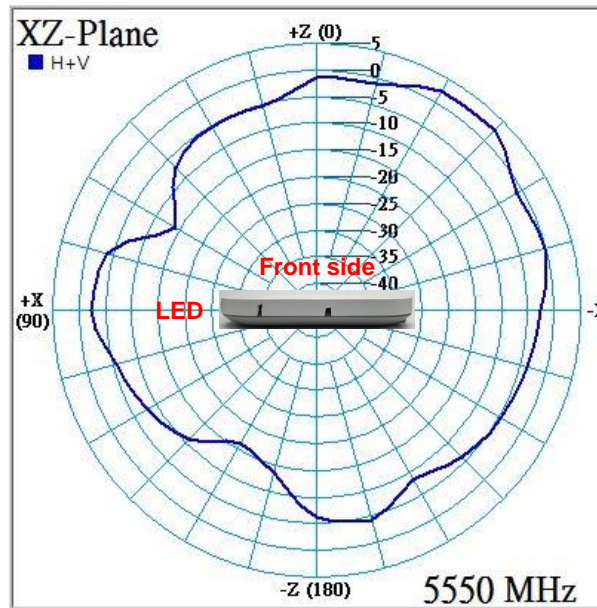
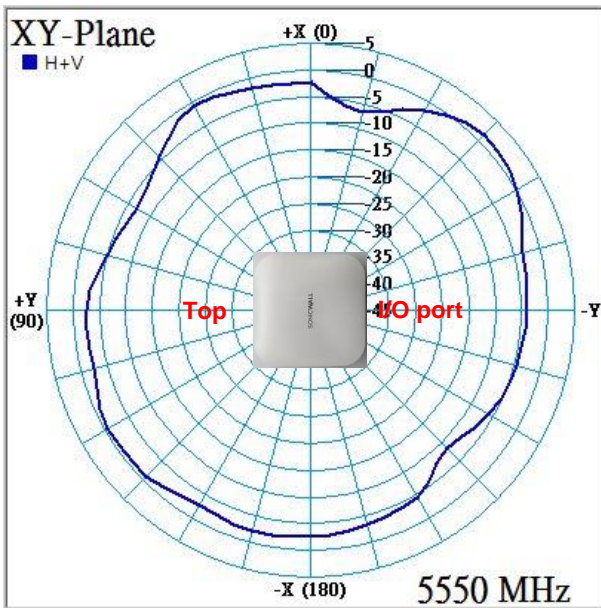
2D Radiation Pattern – 2G3 @ 2.45GHz

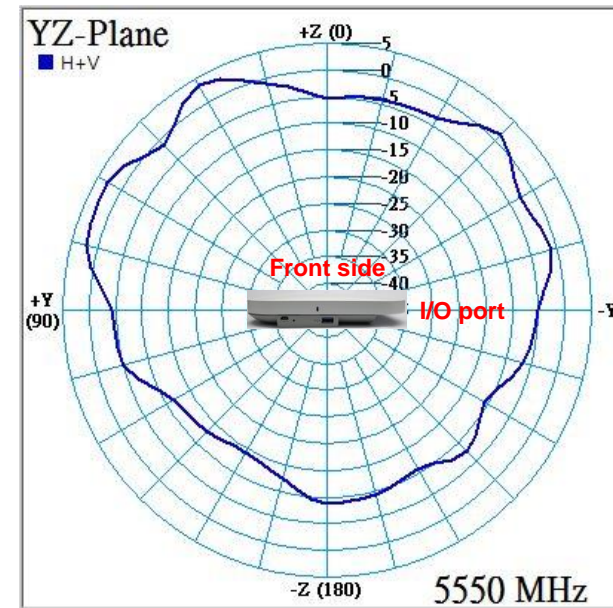
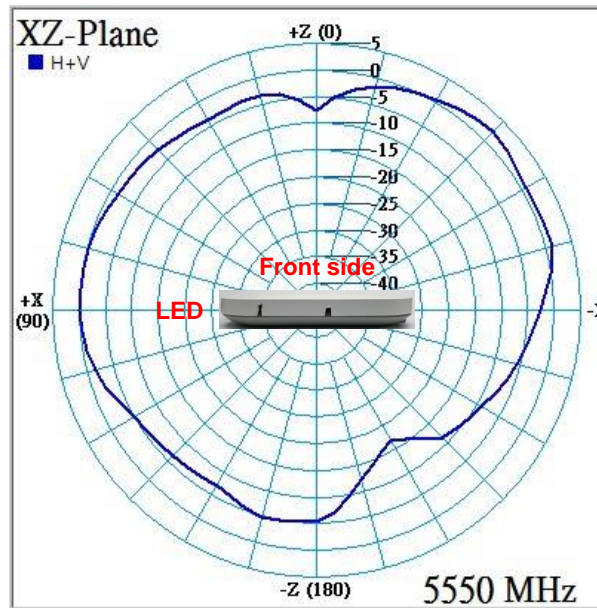
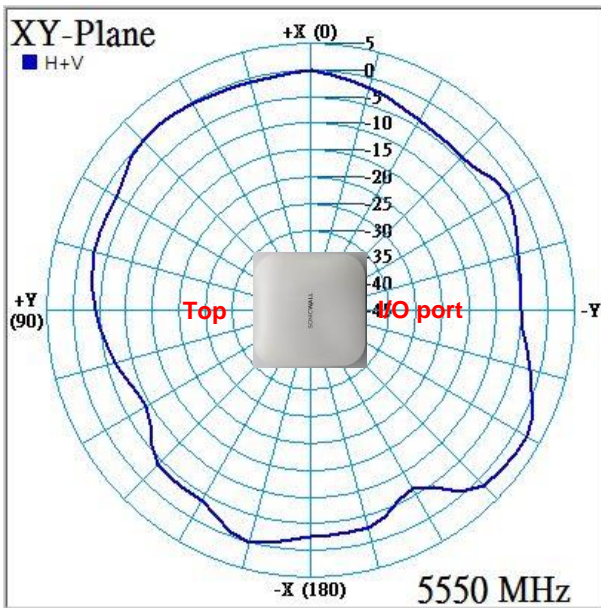




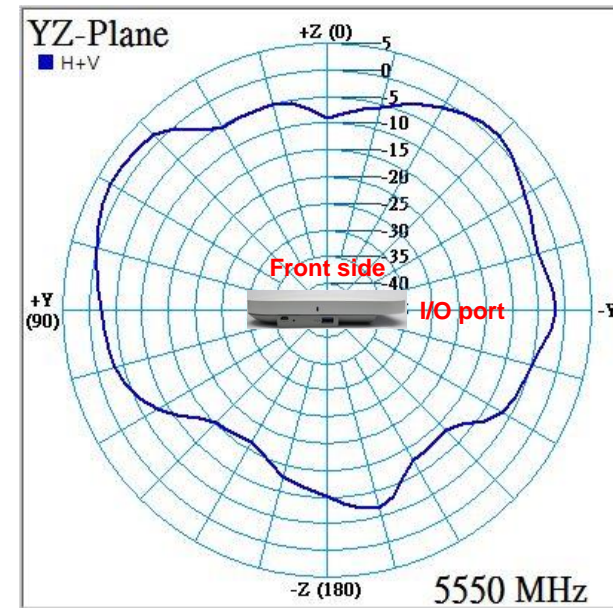
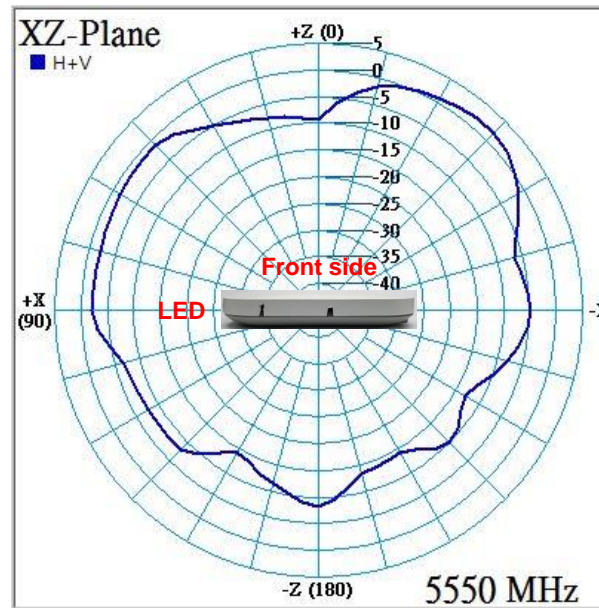
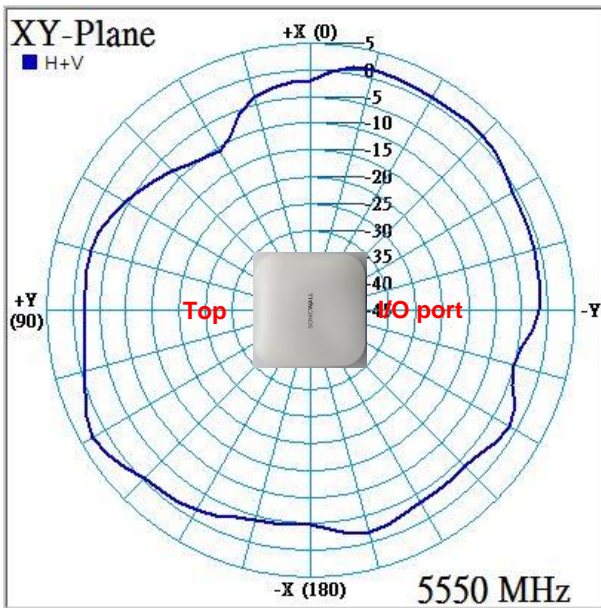
2D Radiation Pattern – 5G1 @ 5.55GHz



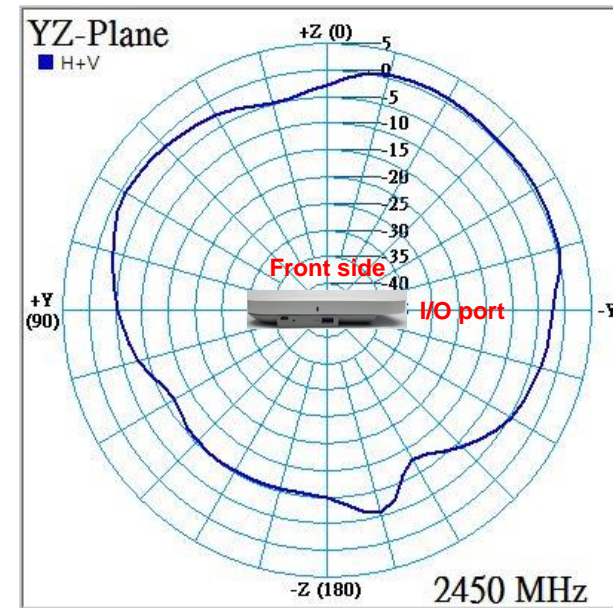
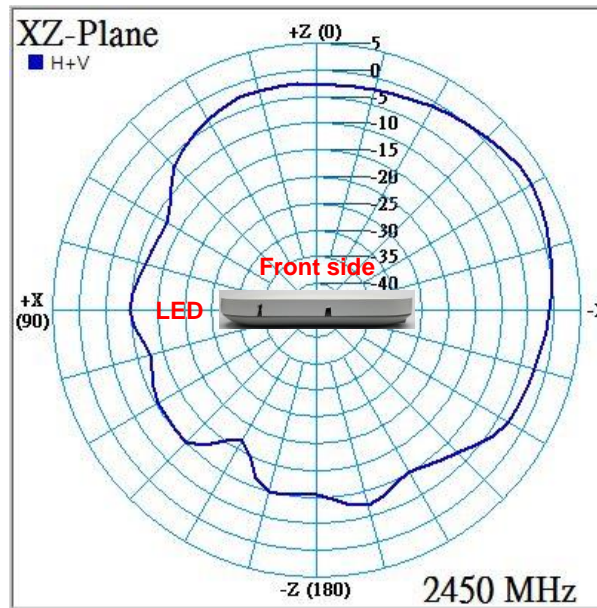
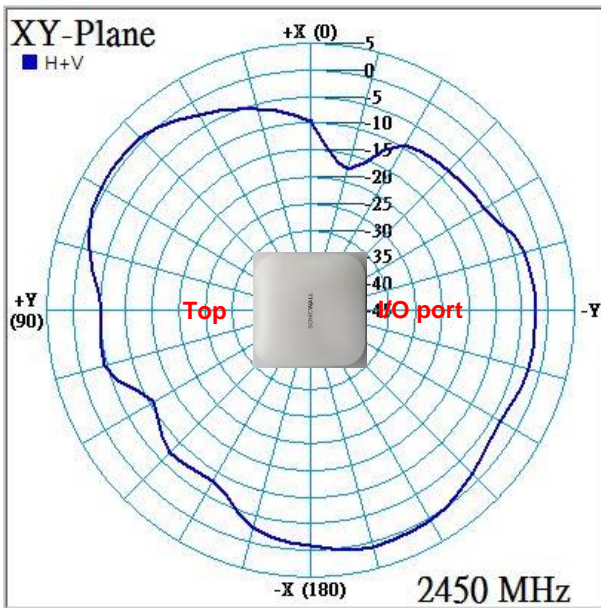




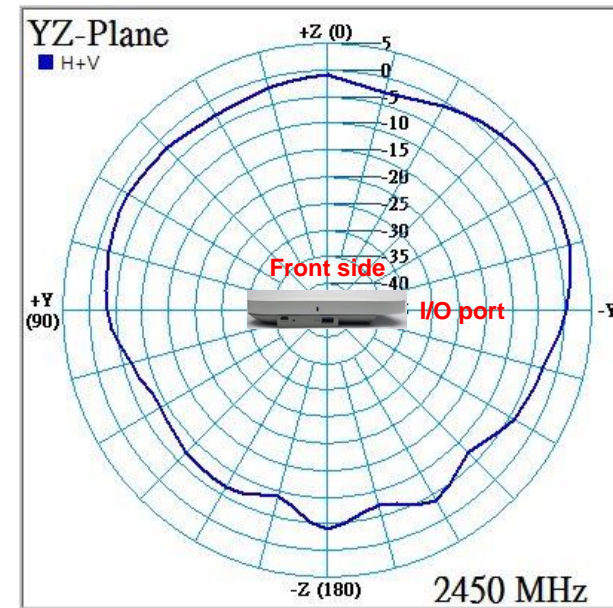
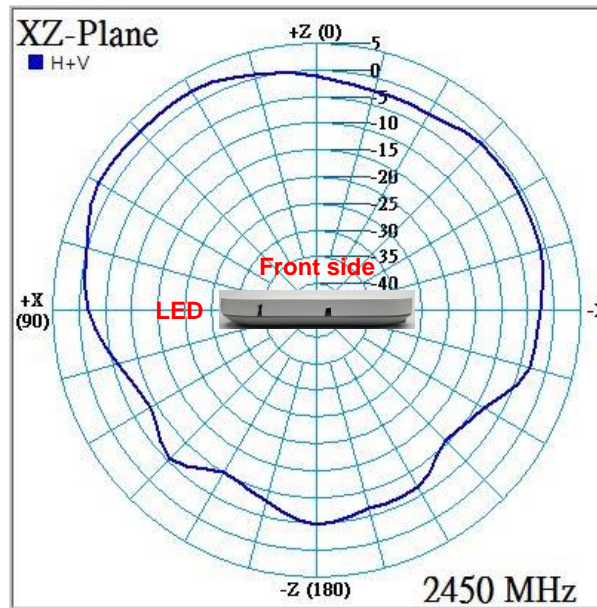
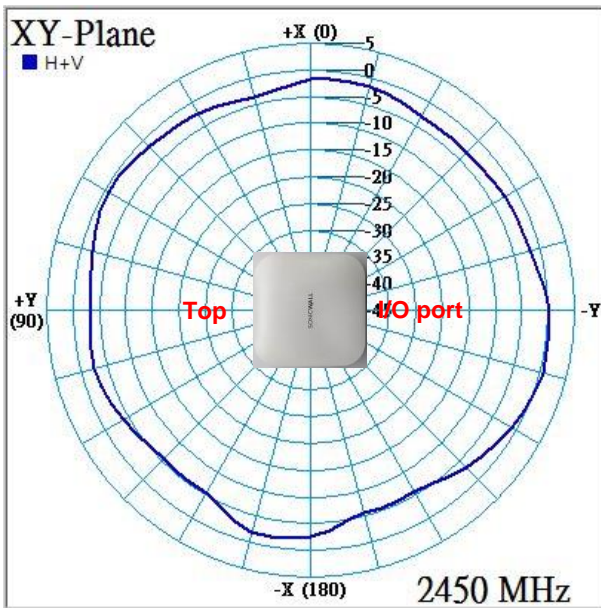
2D Radiation Pattern – 5G4 @ 5.55GHz



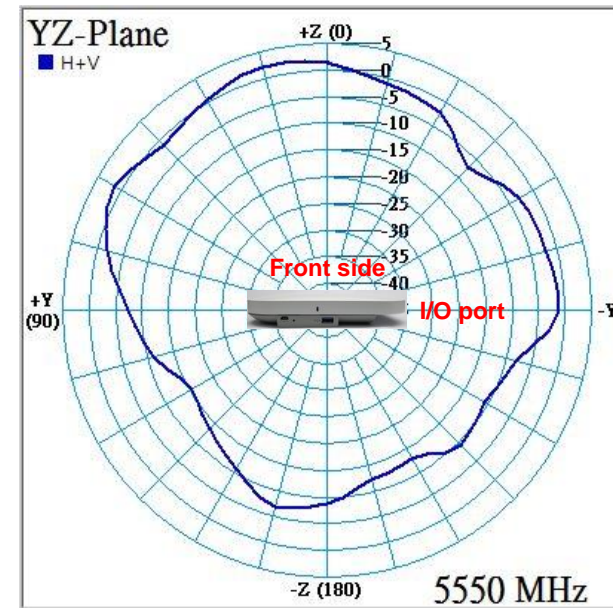
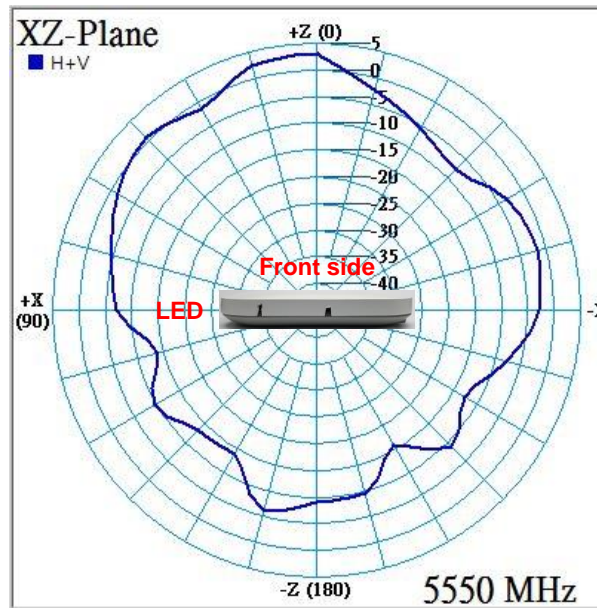
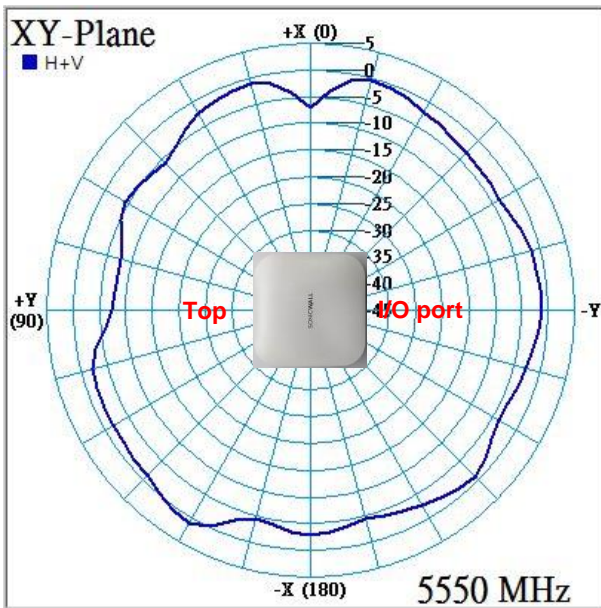
2D Radiation Pattern – BLE @ 2450MHz

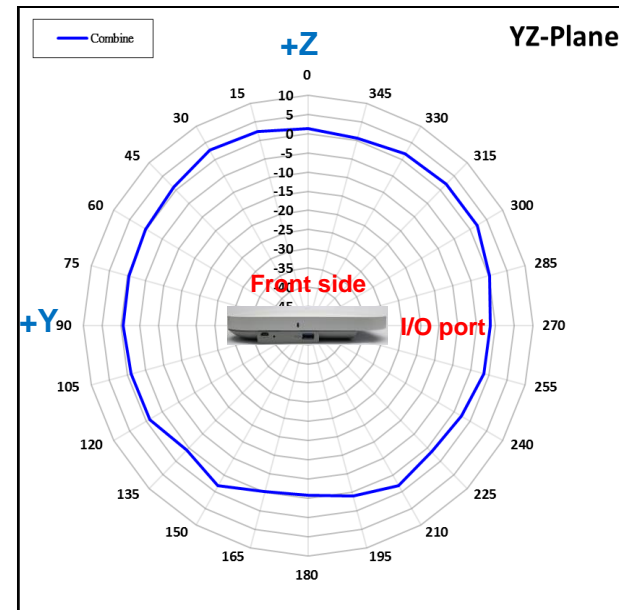
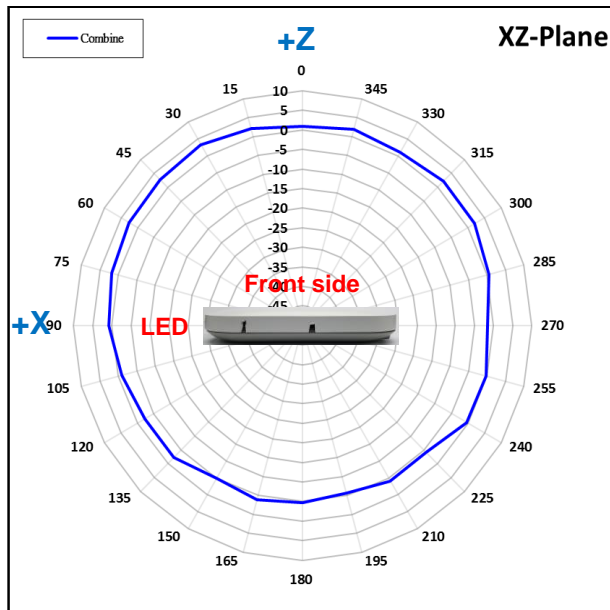
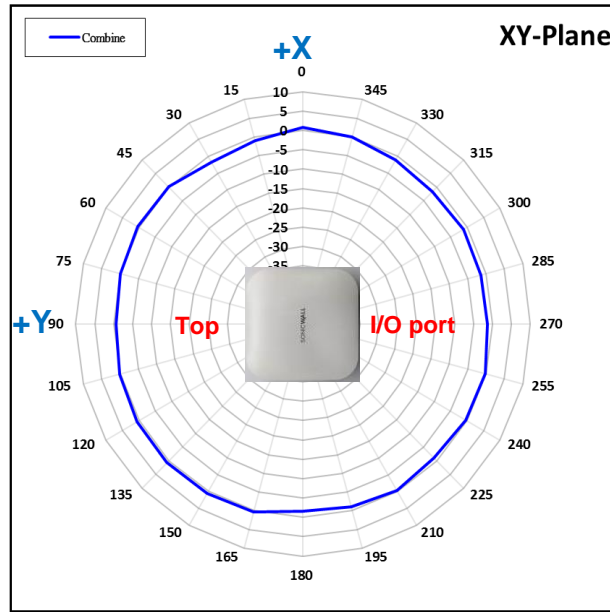


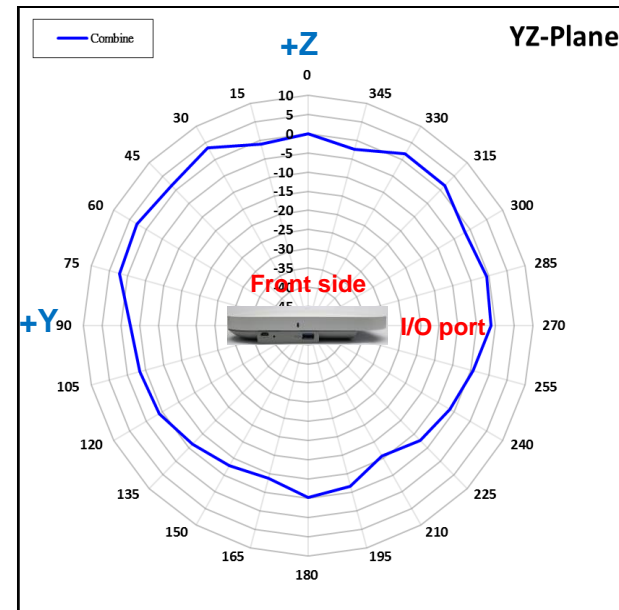
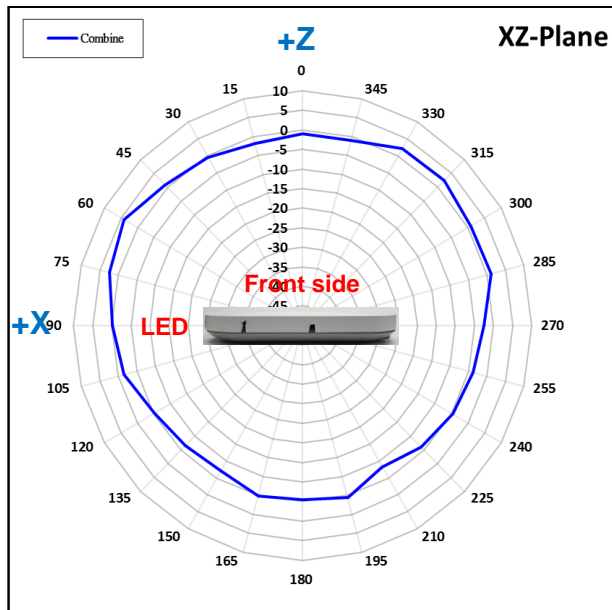
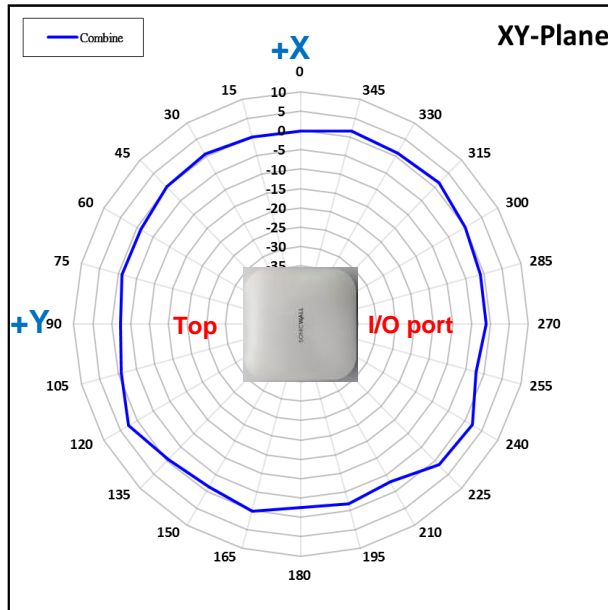
2D Radiation Pattern – Scan @ 2.45GHz



2D Radiation Pattern – Scan @ 5.55GHz







Antenna Efficiency and Gain

Antenna Performance

Freq. (MHz)	2G1		2G2	
	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)
2400	61.2	3.34	66.9	3.51
2450	62.4	3.54	68.3	4.29
2500	62.4	3.44	66.5	4.46

Antenna Performance

Freq. (MHz)	5G1		5G2	
	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)
5150	53.9	4.94	56.0	4.24
5500	54.4	4.03	56.9	3.68
5850	58.3	4.33	57.6	3.66

Antenna Performance

Freq. (MHz)	2G3		2G4	
	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)
2400	63.8	2.71	61.7	2.64
2450	65.2	2.94	61.4	3.69
2500	60.4	2.96	67.0	3.86

Antenna Performance

Freq. (MHz)	5G3		5G4	
	Efficiency (%)	Peak Gain (dBi)	Efficiency (%)	Peak Gain (dBi)
5150	60.7	3.65	64.1	4.44
5500	53.9	4.82	60.2	5.01
5850	57.6	4.28	60.5	5.74

Antenna Performance

Freq. (MHz)	BLE	
	Efficiency (%)	Peak Gain (dBi)
2400	57.2	3.56
2450	54.0	3.13
2500	52.6	3.02

Antenna Performance

Freq. (MHz)	Scan	
	Efficiency (%)	Peak Gain (dBi)
2400	59.6	3.98
2450	59.4	2.98
2500	56.6	2.74
5150	58.4	4.95
5500	53.1	3.32
5850	51.5	3.79