

**Measured gain (in XOY plane) of Possio GSM/UMTS antenna**

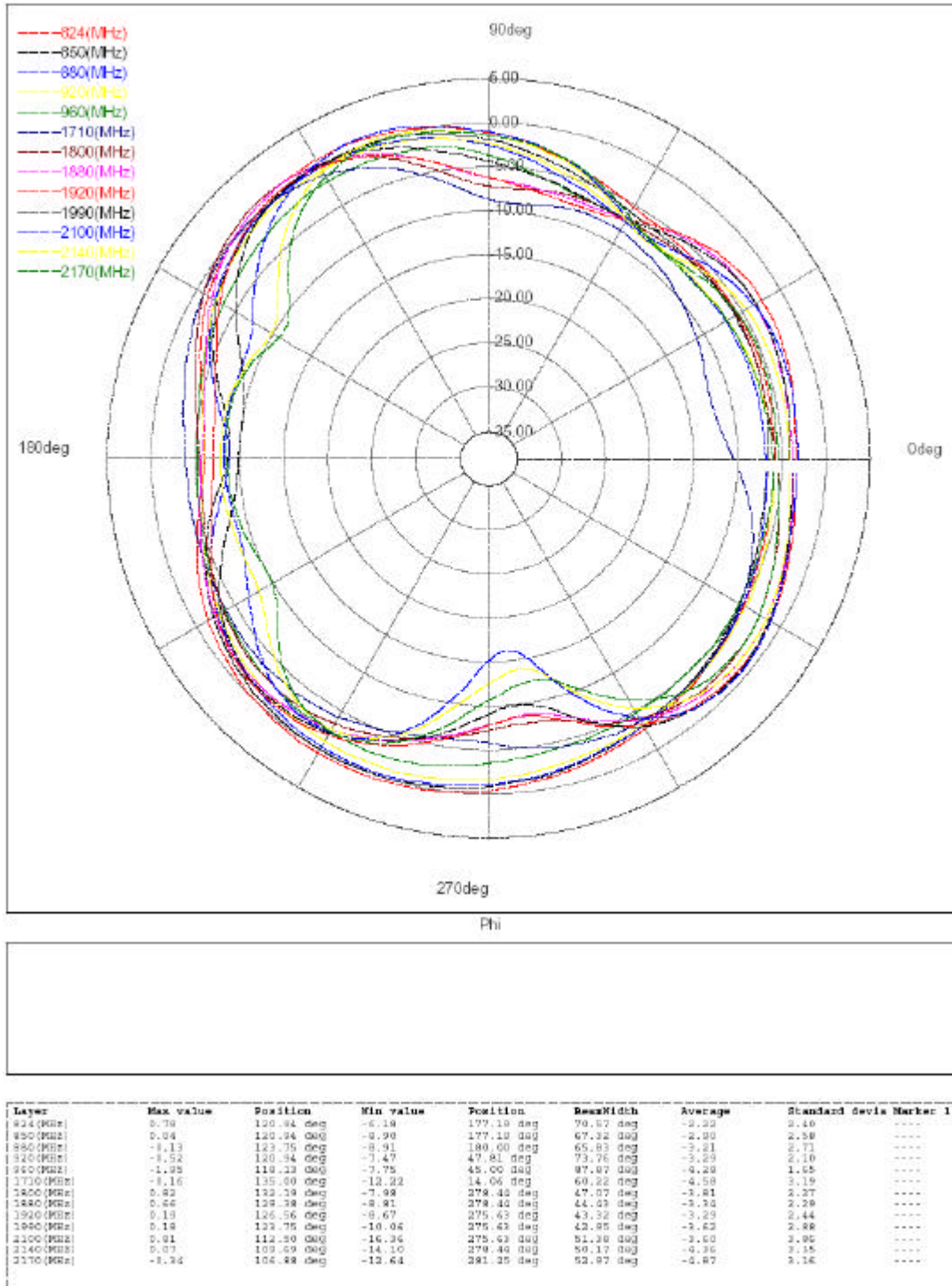
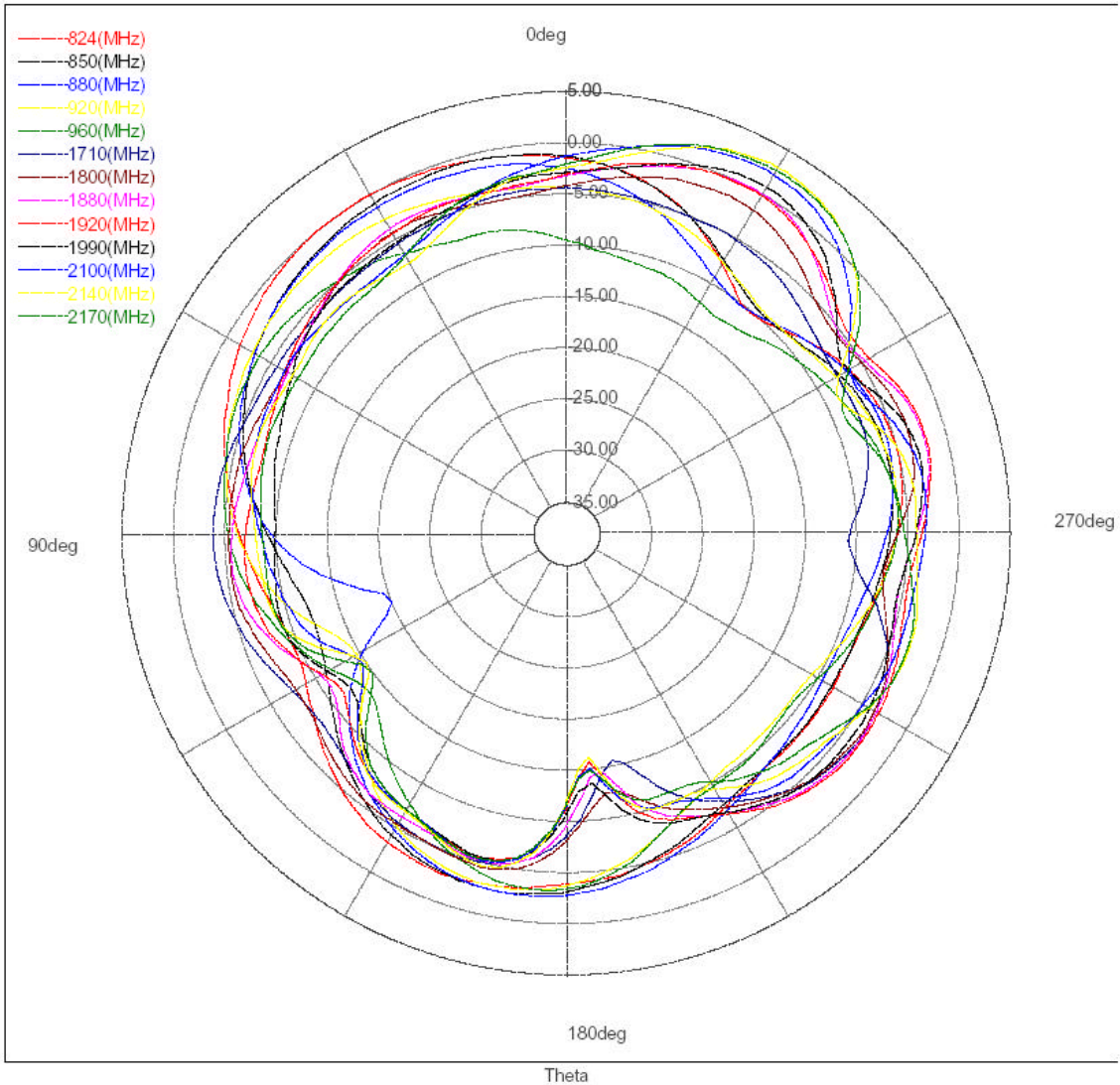


Fig. 9. Measured gain of Possio GSM/UMTS antenna in XOY plane.

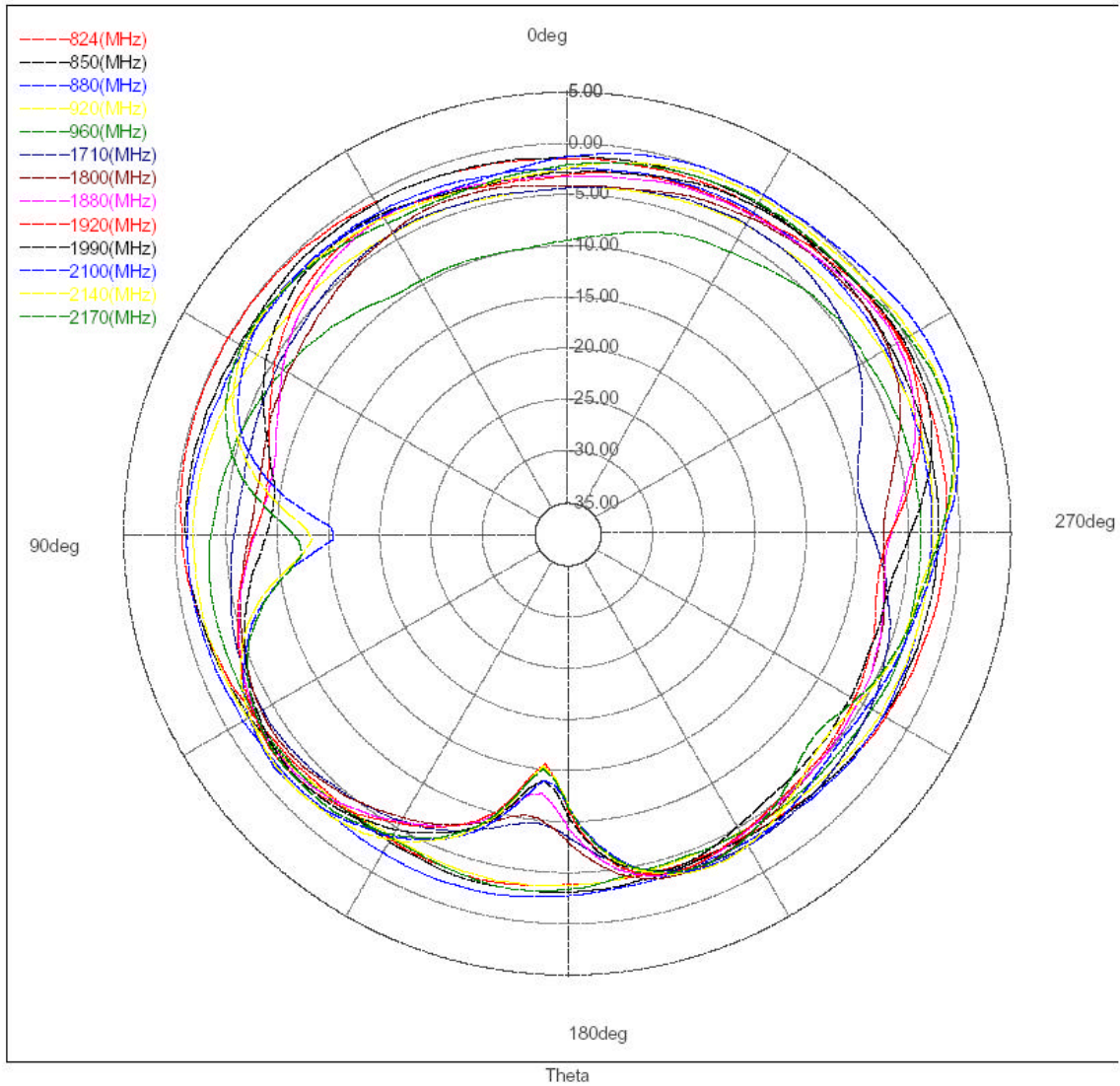
**Measured gain (in XOZ plane) of Possio GSM/UMTS antenna**



Layer	Max value	Position	Min value	Position	BeamWidth	Average	Standard devia	Marker 1
824 (MHz)	-0.09	34.29 deg	-10.28	-40.00 deg	82.53 deg	-4.23	2.88	----
850 (MHz)	-0.86	17.14 deg	-12.17	108.57 deg	80.03 deg	-4.88	3.12	----
880 (MHz)	-1.48	22.86 deg	-20.04	111.43 deg	80.36 deg	-5.28	4.05	----
920 (MHz)	-2.58	42.86 deg	-14.68	120.00 deg	101.62 deg	-5.87	3.11	----
960 (MHz)	-3.35	174.29 deg	-13.65	128.57 deg	---	-7.08	2.81	----
1710 (MHz)	-3.33	-122.86 deg	-15.70	-168.57 deg	38.46 deg	-5.95	2.39	----
1800 (MHz)	-1.76	-25.71 deg	-12.60	-168.57 deg	49.47 deg	-5.14	2.03	----
1880 (MHz)	0.00	-28.57 deg	-14.64	-171.43 deg	41.82 deg	-4.60	2.93	----
1920 (MHz)	-0.23	-28.57 deg	-15.90	-174.29 deg	46.38 deg	-4.62	3.11	----
1990 (MHz)	0.75	-28.57 deg	-13.80	-174.29 deg	37.39 deg	-4.95	3.23	----
2100 (MHz)	2.15	-28.57 deg	-15.18	-174.29 deg	42.16 deg	-4.30	3.92	----
2140 (MHz)	2.90	-31.43 deg	-16.32	-174.29 deg	34.77 deg	-4.22	4.03	----
2170 (MHz)	2.59	-31.43 deg	-15.10	-174.29 deg	40.26 deg	-4.38	4.11	----

Fig. 10. Measured gain of Possio GSM/UMTS antenna in XOZ plane.

**Measured gain (in YOZ plane) of Possio GSM/UMTS antenna**



Layer	Max value	Position	Min value	Position	BeamWidth	Average	Standard devia	Marker 1
824 (MHz)	-0.12	62.86 deg	-4.14	-160.00 deg	255.81 deg	-1.81	1.33	----
850 (MHz)	-0.99	34.29 deg	-3.97	-154.29 deg	----	-2.07	0.97	----
880 (MHz)	-1.22	91.43 deg	-3.52	-157.14 deg	----	-2.33	0.57	----
920 (MHz)	-1.81	97.14 deg	-4.65	-154.29 deg	----	-3.33	0.85	----
960 (MHz)	-3.06	102.86 deg	-10.16	11.43 deg	----	-4.76	2.20	----
1710 (MHz)	-3.14	-148.57 deg	-9.87	174.29 deg	70.34 deg	-5.00	1.75	----
1800 (MHz)	-1.81	-51.43 deg	-10.44	171.43 deg	111.08 deg	-4.78	1.93	----
1880 (MHz)	-1.07	-57.14 deg	-12.76	174.29 deg	126.67 deg	-4.24	2.50	----
1920 (MHz)	-0.63	-57.14 deg	-15.65	174.29 deg	128.91 deg	-4.09	2.87	----
1990 (MHz)	-0.46	-62.86 deg	-14.11	174.29 deg	139.34 deg	-3.83	2.88	----
2100 (MHz)	1.60	-65.71 deg	-15.45	91.43 deg	88.14 deg	-2.45	3.81	----
2140 (MHz)	0.94	-68.57 deg	-15.53	174.29 deg	86.01 deg	-2.81	3.56	----
2170 (MHz)	0.72	-68.57 deg	-15.17	174.29 deg	91.86 deg	-3.06	3.38	----

Fig. 11. Measured gain of Possio GSM/UMTS antenna in YOZ plane.

## 4.2.2 Measured gain of WLAN antenna 1

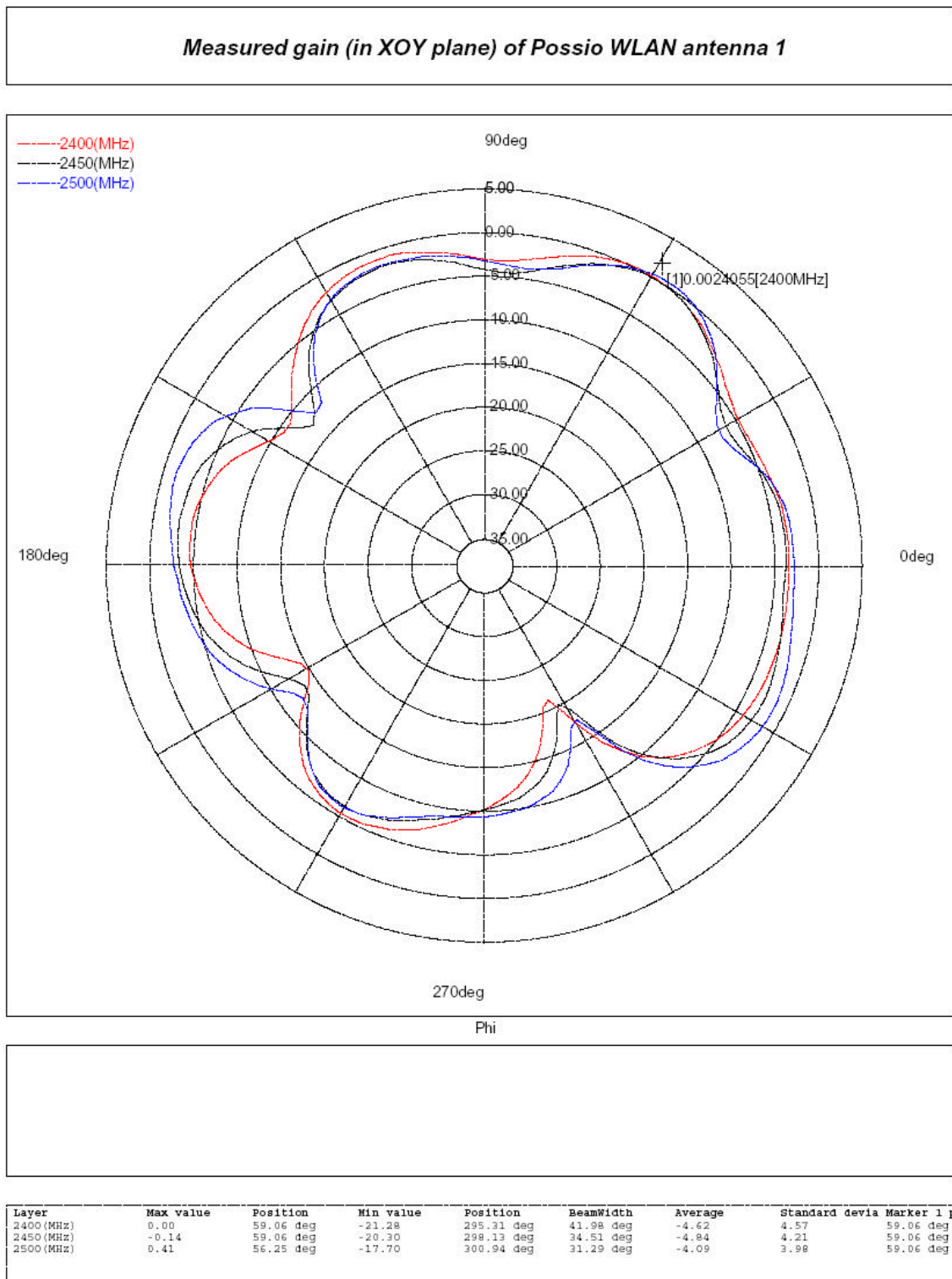
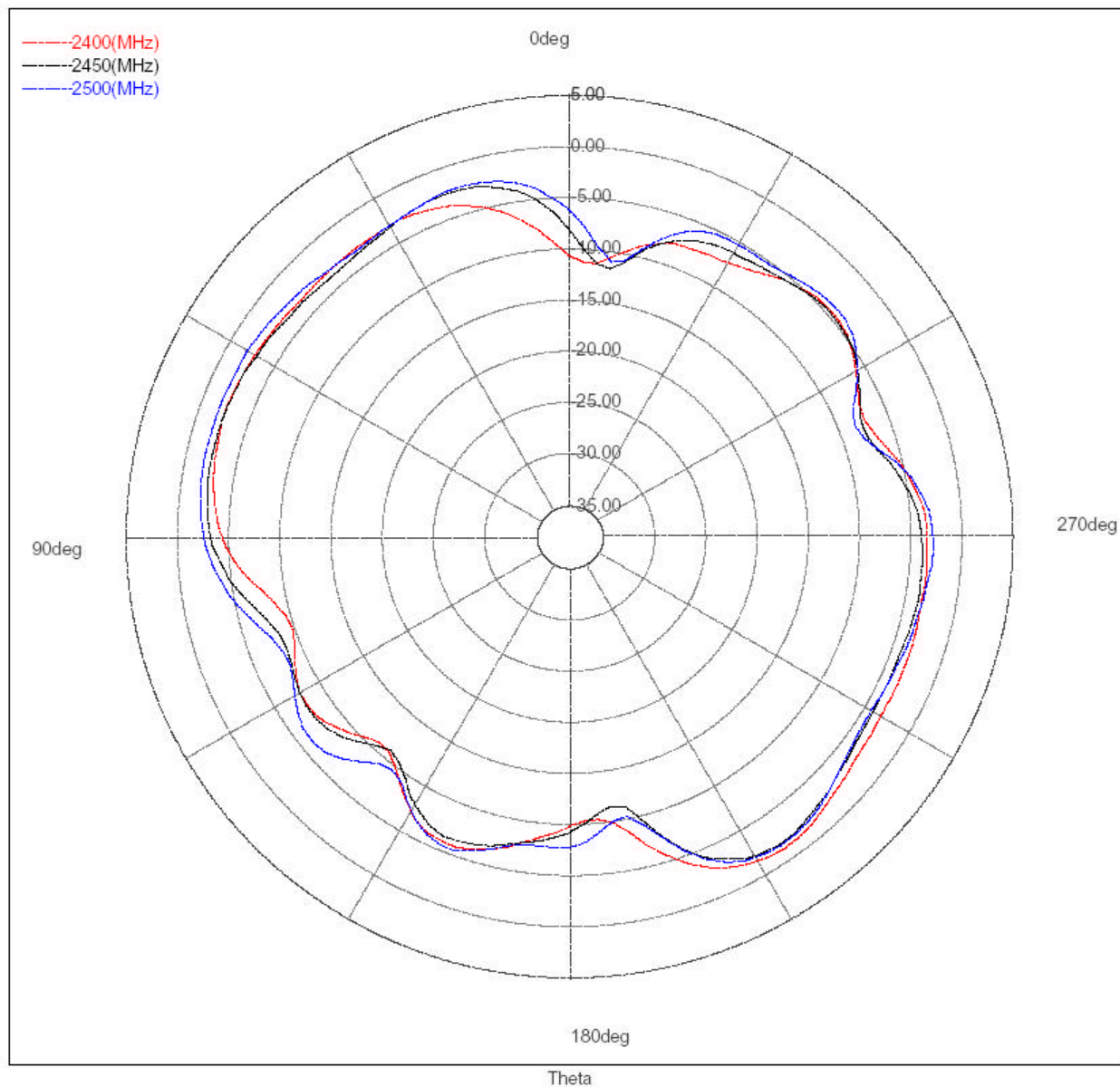


Fig. 12. Measured gain of Possio WLAN antenna 1 in XOY plane.



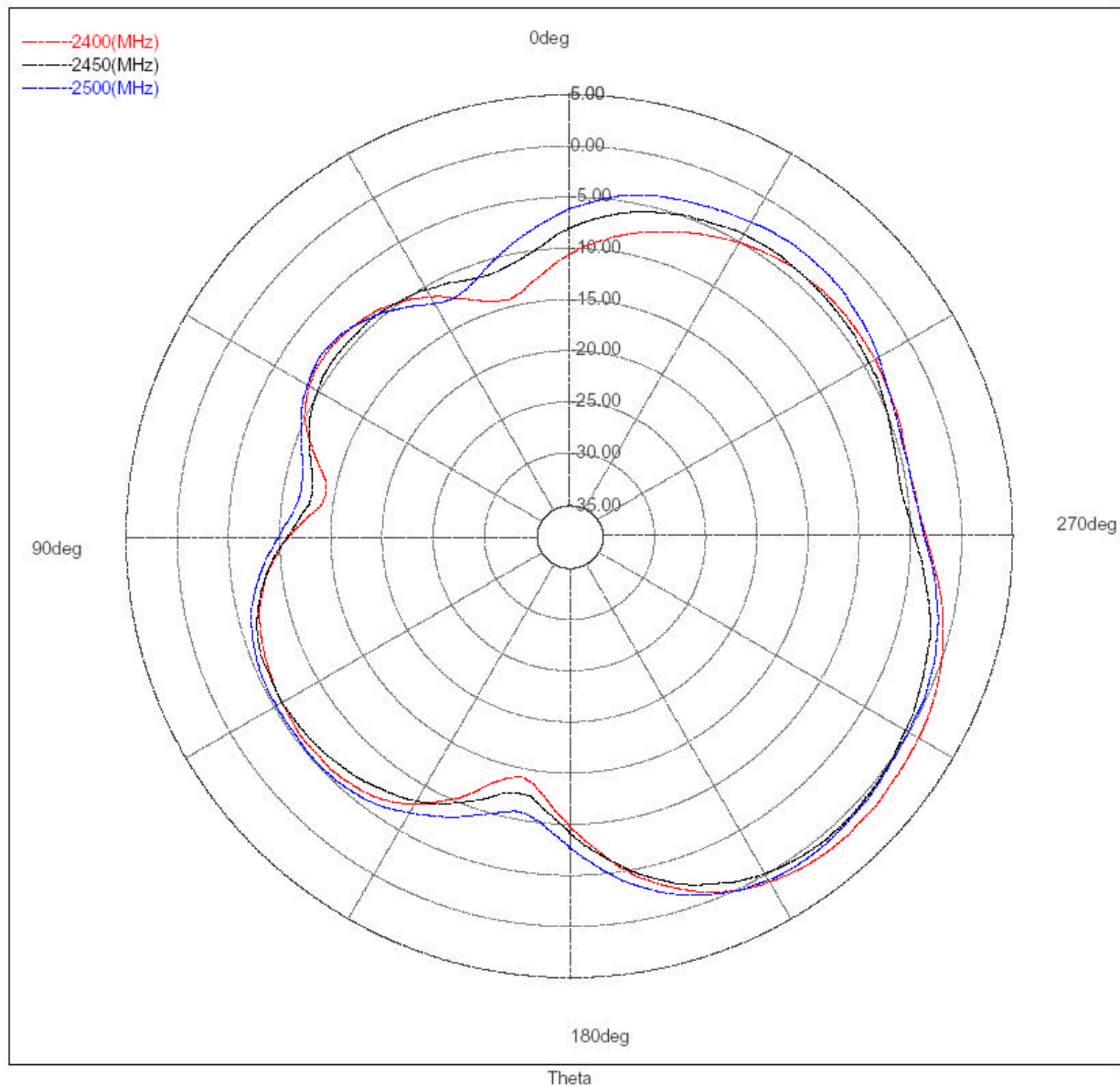
**Measured gain (in XOZ plane) of Possio WLAN antenna 1**



Layer	Max value	Position	Min value	Position	BeamWidth	Average	Standard devia	Marker 1
2400 (MHz)	-1.39	-145.71 deg	-11.48	-2.86 deg	79.01 deg	-4.96	2.78	----
2450 (MHz)	-1.93	-145.71 deg	-11.77	-8.57 deg	76.18 deg	-5.03	2.66	----
2500 (MHz)	-1.73	-145.71 deg	-11.12	-8.57 deg	78.75 deg	-4.45	2.47	----

Fig. 13. Measured gain of Possio WLAN antenna 1 in XOZ plane.

**Measured gain (in YOZ plane) of Possio WLAN antenna 1**



Layer	Max value	Position	Min value	Position	BeamWidth	Average	Standard devia	Marker 1
2400 (MHz)	1.52	-137.14 deg	-14.33	14.29 deg	60.85 deg	-4.28	4.56	----
2450 (MHz)	0.48	-137.14 deg	-12.86	60.00 deg	60.31 deg	-4.32	3.75	----
2500 (MHz)	0.82	-142.86 deg	-12.38	25.71 deg	66.78 deg	-4.04	3.75	----

Fig. 14. Measured gain of Possio WLAN antenna 1 in YOZ plane.

### 4.2.3 Measured gain of WLAN antenna 2

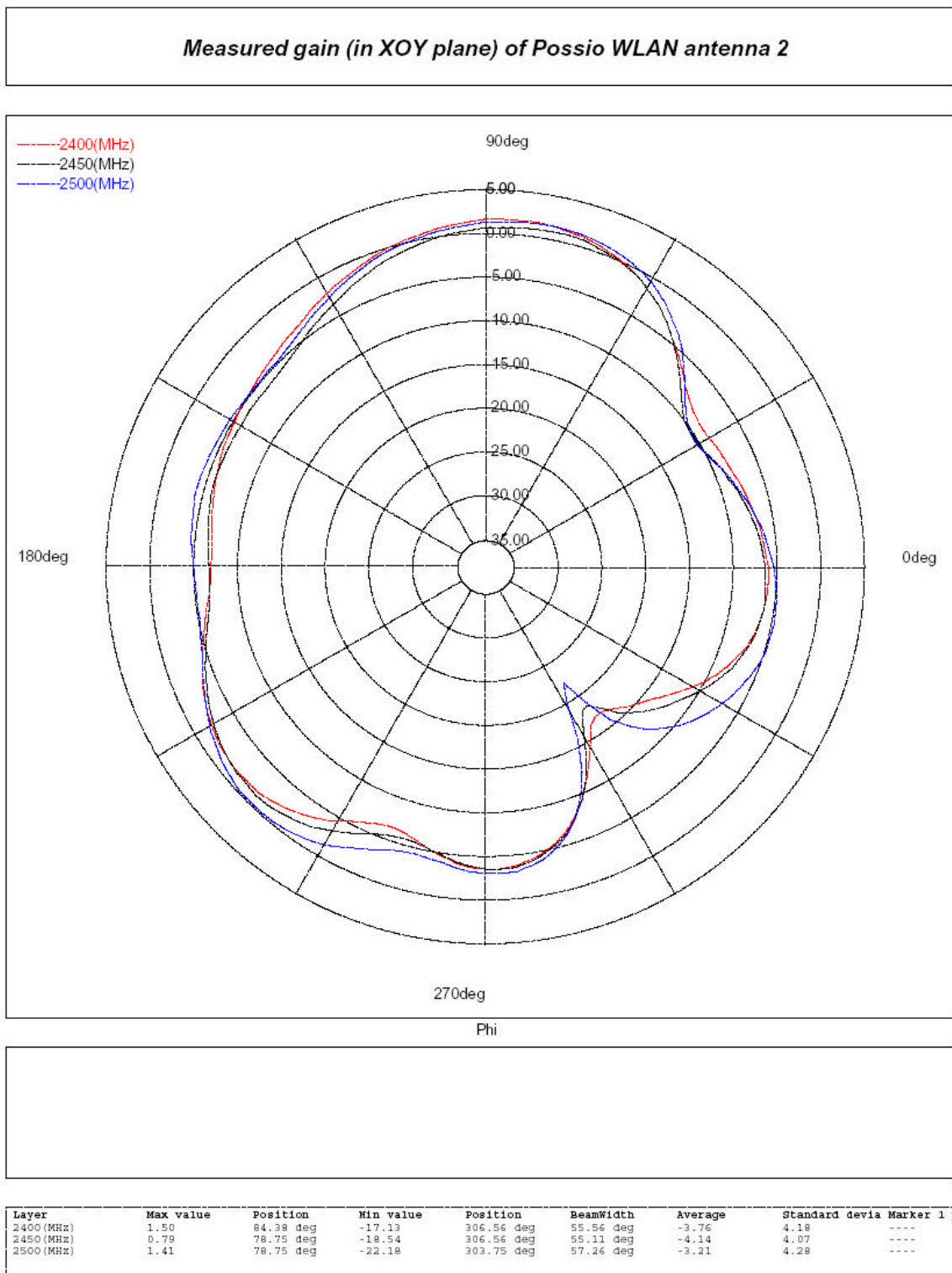
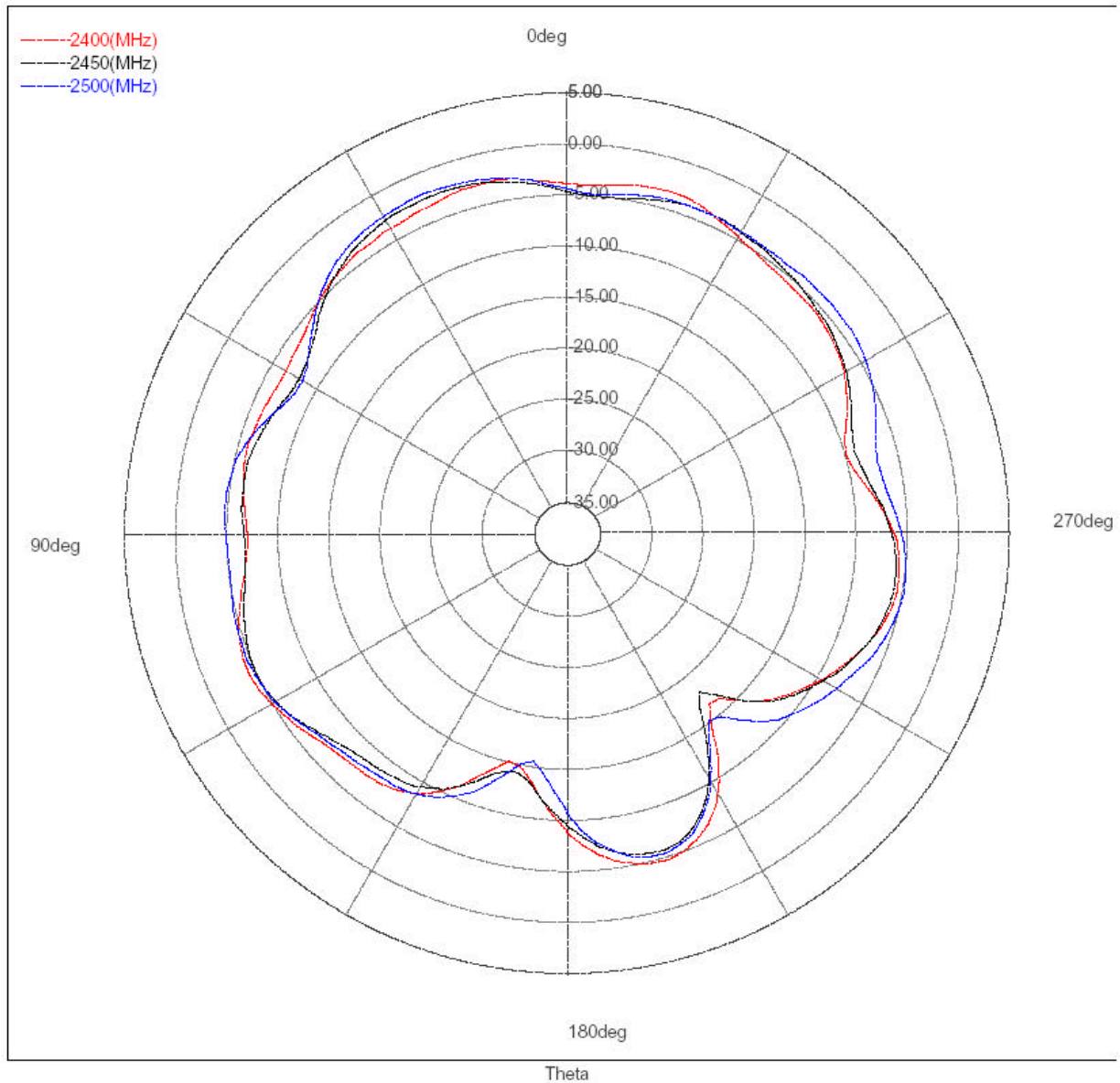


Fig. 15. Measured gain of Possio WLAN antenna 2 in XOY plane.

**Measured gain (in XOZ plane) of Possio WLAN antenna 2**

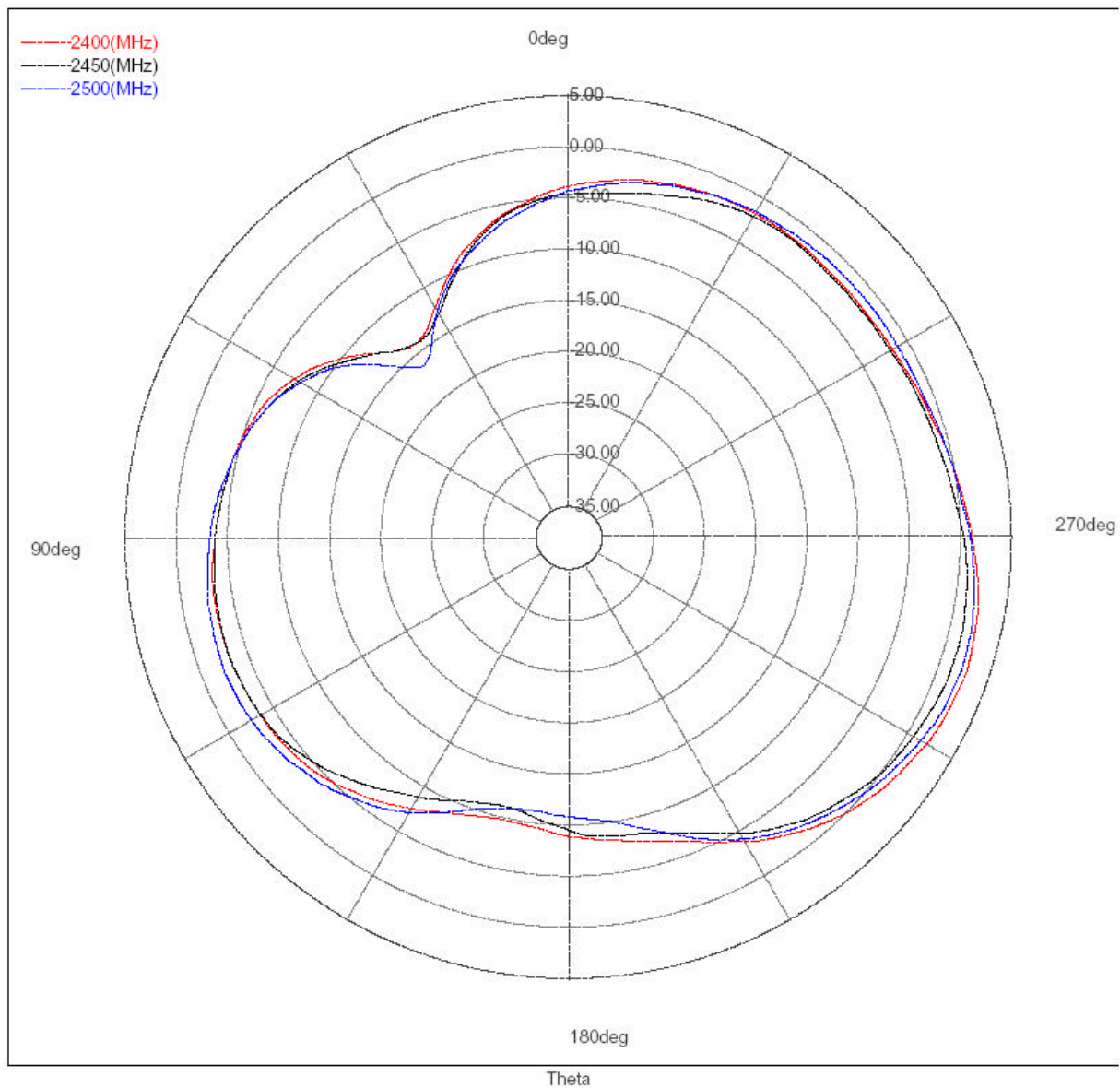


Layer	Max value	Position	Min value	Position	BeamWidth	Average	Standard devia	Marker 1
2400 (MHz)	-3.11	14.29 deg	-16.56	-140.00 deg	107.19 deg	-6.14	3.10	----
2450 (MHz)	-2.72	22.86 deg	-18.01	-140.00 deg	99.29 deg	-6.36	3.14	----
2500 (MHz)	-2.27	22.86 deg	-15.66	171.43 deg	113.32 deg	-5.68	3.09	----

Fig. 16. Measured gain of Possio WLAN antenna 2 in XOZ plane.



**Measured gain (in YOZ plane) of Possio WLAN antenna 2**



Layer	Max value	Position	Min value	Position	BeamWidth	Average	Standard devia	Marker 1
2400 (MHz)	2.68	-108.57 deg	-14.23	37.14 deg	58.16 deg	-2.70	4.12	----
2450 (MHz)	1.26	-105.71 deg	-14.28	37.14 deg	72.93 deg	-3.48	4.03	----
2500 (MHz)	2.21	-108.57 deg	-16.40	40.00 deg	63.31 deg	-2.81	4.54	----

Fig. 17. Measured gain of Possio WLAN antenna 2 in YOZ plane.

#### 4.2.4 Measured gain listed in tables

Table 3: Measured gain of Possio GSM/UMTS antenna

Frequency (MHz)	Measured average gain (dBi) of Possio GSM/UMTS antenna			
	In XOY plane	In XOZ plane	In YOZ plane	In 3D
824	-2.22	-4.23	-1.81	-2.63
850	-2.90	-4.88	-2.07	-3.13
880	-3.21	-5.28	-2.33	-3.44
920	-3.29	-5.87	-3.33	-4.01
960	-4.28	-7.08	-4.76	-5.21
1710	-4.58	-5.95	-5.00	-5.14
1800	-3.81	-5.14	-4.78	-4.54
1880	-3.34	-4.60	-4.24	-4.03
1920	-3.29	-4.62	-4.09	-3.97
1990	-3.62	-4.95	-3.83	-4.10
2100	-3.60	-4.30	-2.45	-3.38
2140	-4.36	-4.22	-2.81	-3.74
2170	-4.87	-4.38	-3.06	-4.03

Table 4 : Measured gain of Possio WLAN antenna 1

Frequency (MHz)	Measured average gain (dBi) of Possio WLAN antenna 1			
	In XOY plane	In XOZ plane	In YOZ plane	In 3D
2400	-4.62	-4.96	-4.28	-4.61
2450	-4.84	-5.03	-4.92	-4.93
2500	-4.09	-4.45	-4.04	-4.19

Table 5 : Measured gain of Possio WLAN antenna 2

Frequency (MHz)	Measured average gain (dBi) of Possio WLAN antenna 2			
	In XOY plane	In XOZ plane	In YOZ plane	In 3D
2400	-3.76	-6.14	-2.70	-3.98
2450	-4.14	-6.36	-3.48	-4.50
2500	-3.21	-5.68	-2.81	-3.73

## 5 Conclusion

- All the three antennas are well matched in their working frequency bands. The GSM/UMTS antenna can be used in GSM850, EGSM900, DCS1800, PCS1900 and UMTS2100 bands.
- The isolation among antennas is larger than 10dB.
- The average gain of WLAN antenna 1 is around  $-4.57\text{dBi}$ , and the averaged gain of WLAN antenna 2 is around  $-4.06\text{dBi}$
- The space averaged gain of GSM/UMTS antenna is between  $-2.63\text{dBi}$  and  $-5.21\text{dBi}$ . The lowest gain is found in the high frequency end of EGSM900 band and the beginning frequency end of DCS1800 band. In UMTS2100 band, the average gain is around  $-3.85\text{dBi}$ .