

规格承认书
SPECIFICATION FOR APPROVAL

日期
DATE: 2023.08.21
版本
REV.: V1.0

客 户
CUSTOMER: 德明通讯（上海）股份有限公司
客 户 料 号
CUSTOMER P/N: TX0667T001
品 名
PART NAME: PW550-NA2 Antenna
供 方 料 号
SUPPLIER P/N: N12-7407-R0A

送样日期 Date:		送样数量 Q'TY:	Pcs
客户确认 CUSTOMER APPROVED BY			
工程研发部	生产采购部	承认	
ENGINEER R&D DEPT	BUSSINESS DEPT	APPROVED BY	

供方确认 SUPPLIER SIGNATURE		
研发部	工程部	批准
ENGINEER R&D DEPT	ENGINEER R&D DEPT	APPROVAL

Revised History

[illegible]

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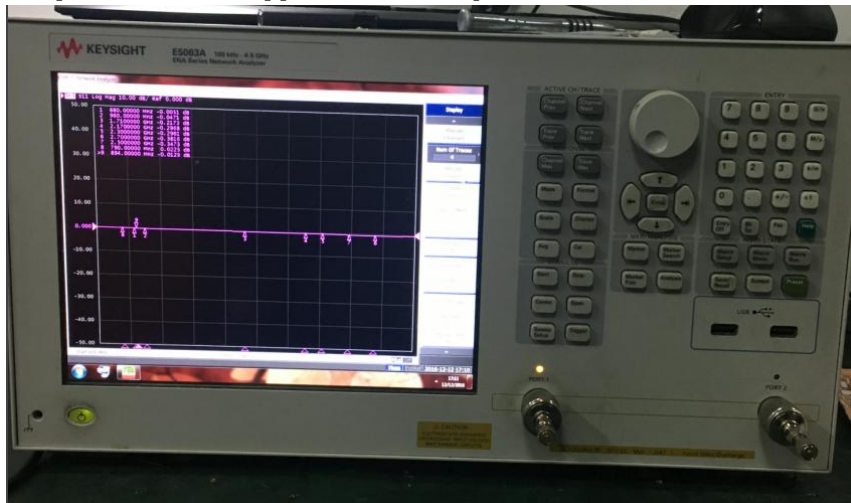
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1. RF Fixture Experiment

1.1 Test Setup

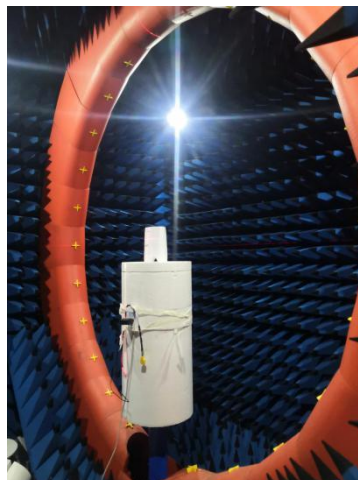
1.1.1 VNA Test Setup

VSWR and Return Loss measurements (S11) were performed using an Keysight E5071C Network Analyzer. The isolation between antennas is also tested. The testing was performed with apparatus in free space.



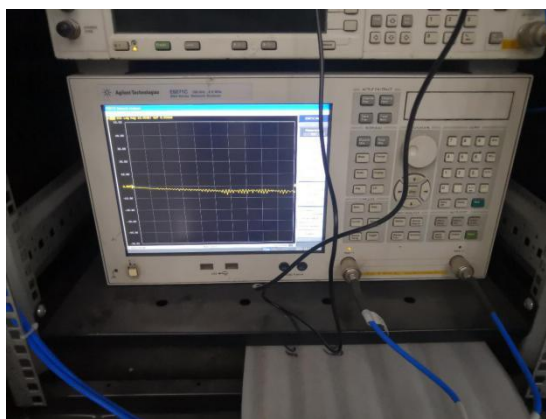
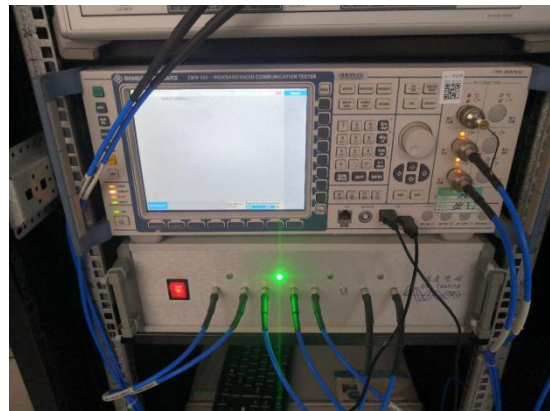
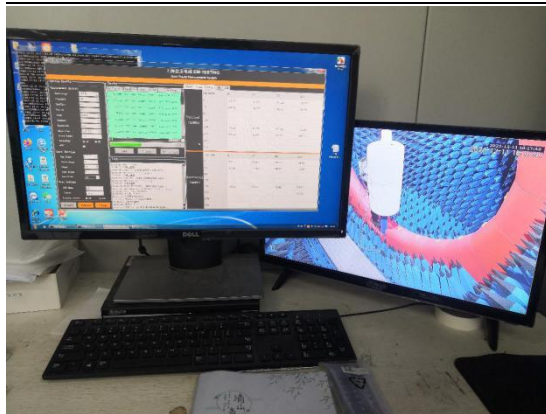
1.1.2 Anechoic Chamber Test Setup

When we test Gain and Efficiency of the antenna, we will use the ETS 3D chamber. The chamber provides test frequency from 400MHz to 6GHz. The real test environment is showing as following picture



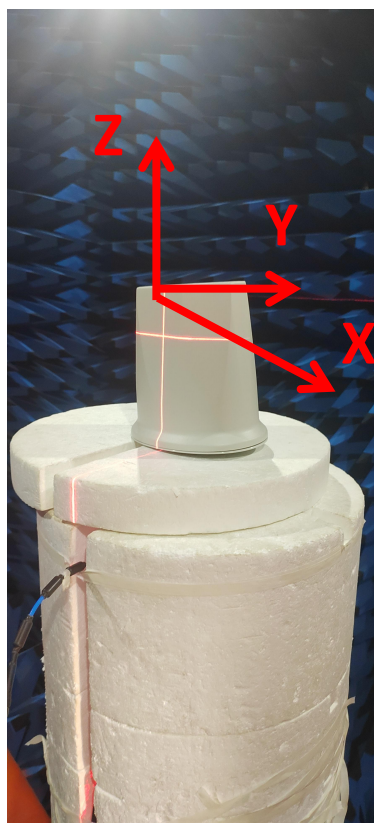


Shenzhen be-comfortable Technology Co. Ltd.

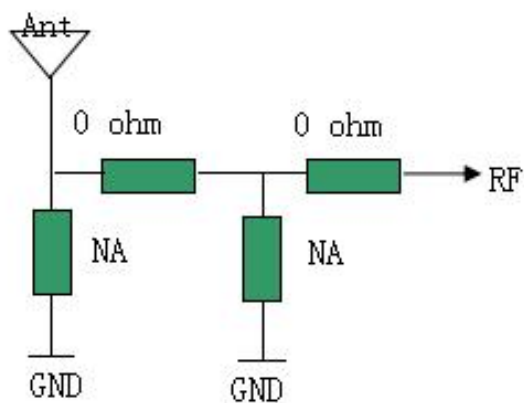


1.2 UE configuration

1.2.1 Antenna location pictures

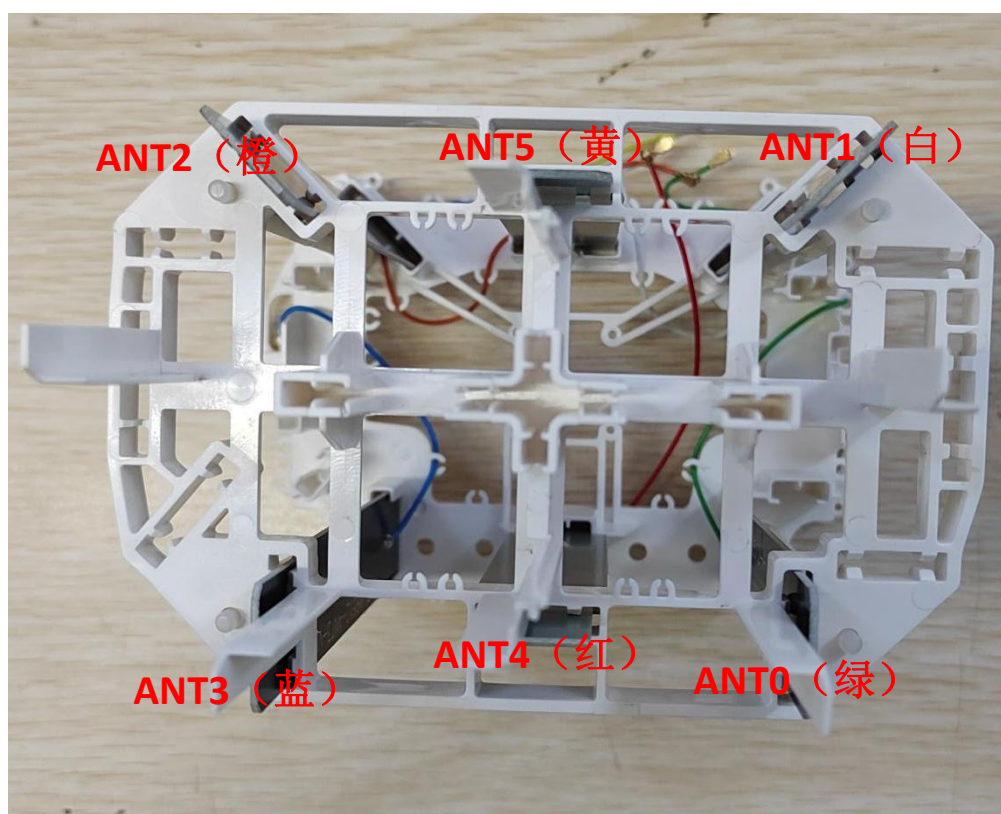


1.2.2 RF matching for different antennas



1.2.3

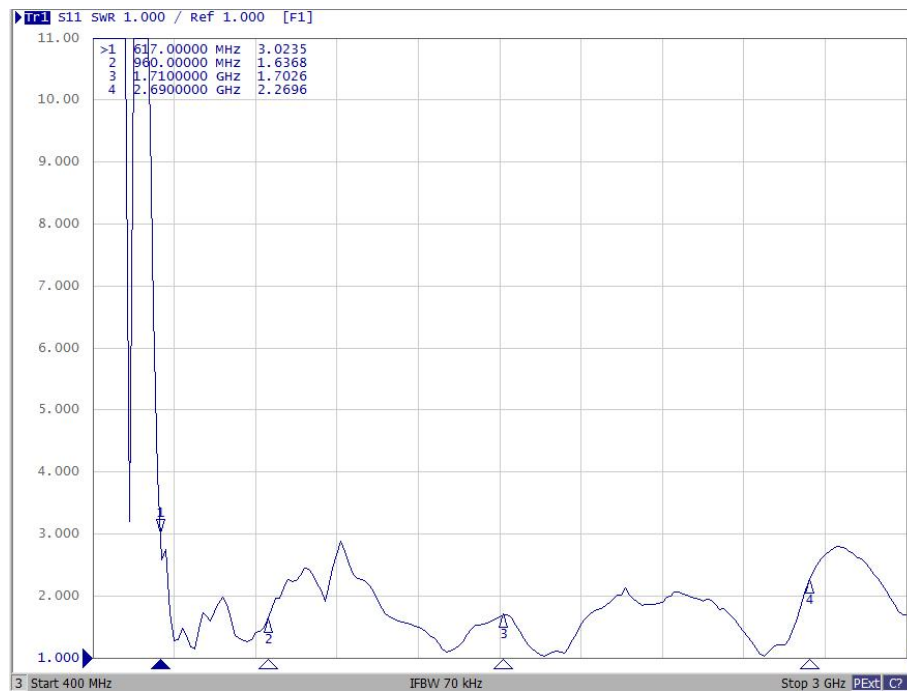
Physical figure



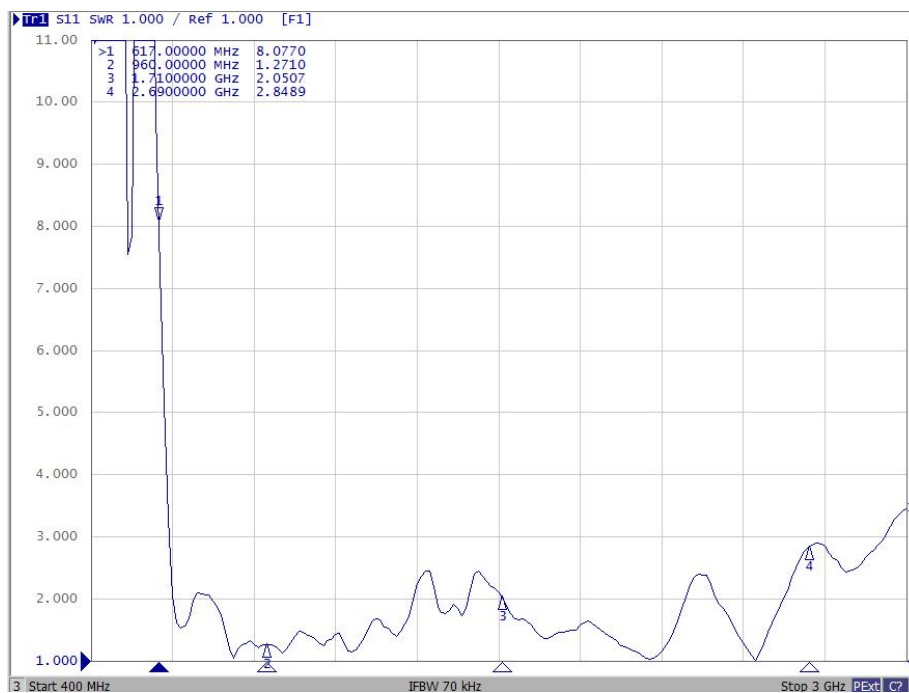
ANT0	617~960MHz	1710~2690MHz	/
ANT2	617~960MHz	1710~2690MHz	/
ANT4	3300~4200MHz	/	/
ANT1	1930~2690MHz	3300~4200MHz	5150~5925MHz
ANT3	1710~2690MHz	3300~4200MHz	5150~5925MHz
ANT5	3300~4200MHz	/	/

2.1 Passive Test Result(S parameters)

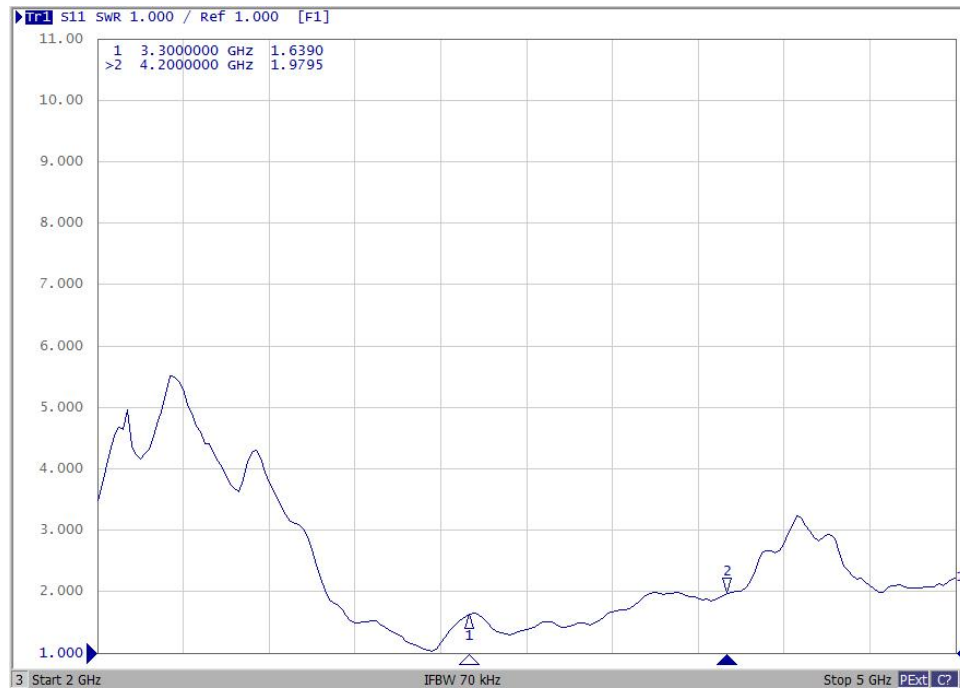
Antenna 0 617~960MHz 1710~2690MHz VSWR



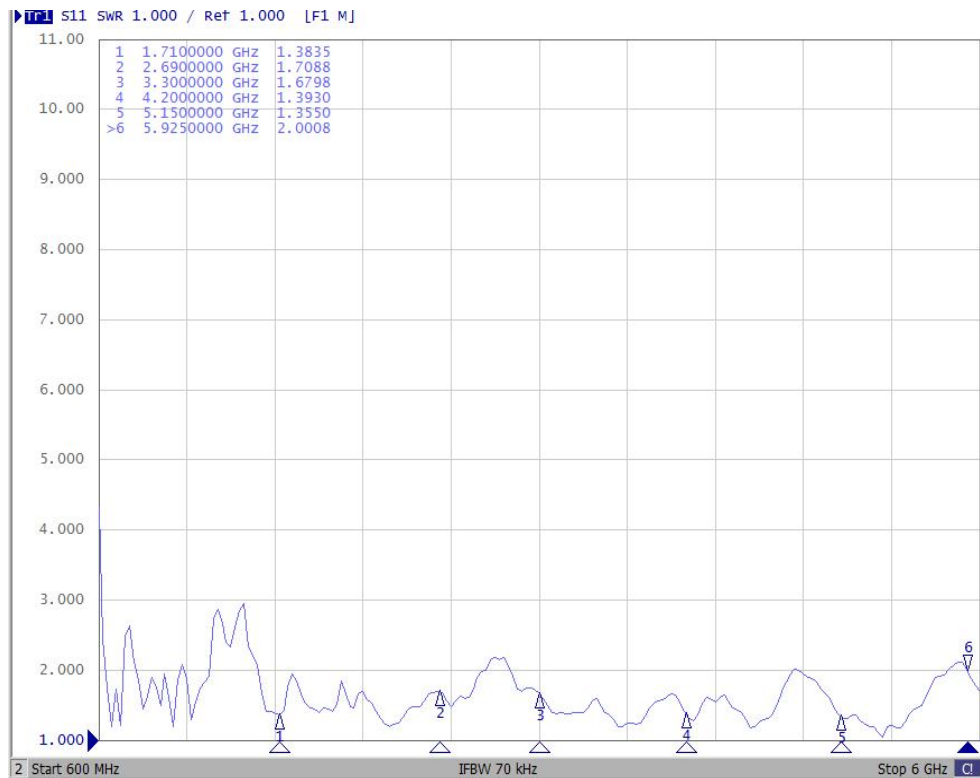
Antenna 2 617~960MHz 1710~2690MHz VSWR



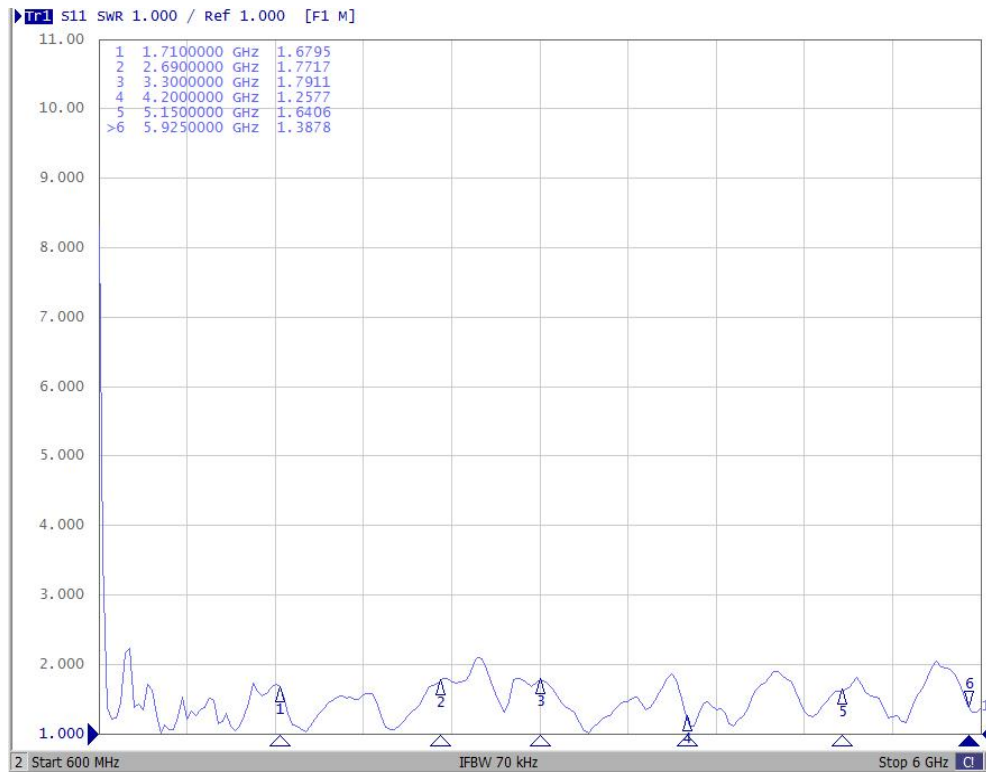
Antenna 4 3300~4200MHz VSWR



Antenna 1 1930~2690MHz 3300~4200MHz 5150~5925MHz VSWR



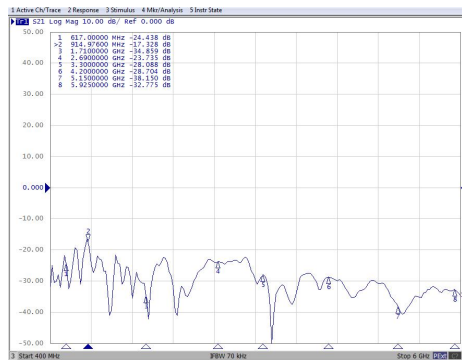
Antenna 3 1710~2690MHz 3300~4200MHz 5150~5925MHz VSWR



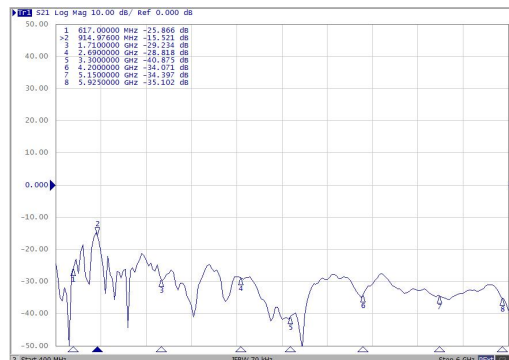
Antenna 5 3300~4200MHz VSWR



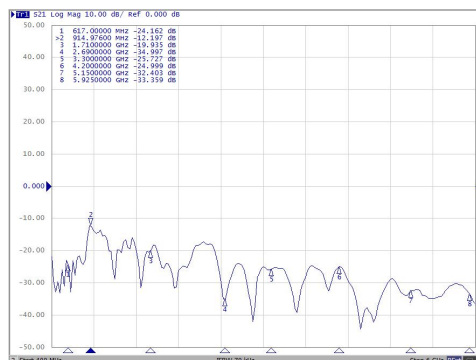
617~960MHz 1710~2690MHz Antenna 0 &
617~960MHz 1710~2690MHz Antenna 2
S21



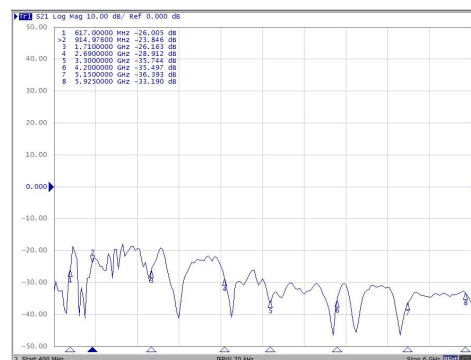
617~960MHz 1710~2690MHz Antenna 0 &
3300~4200MHz Antenna 4 S21



617~960MHz 1710~2690MHz Antenna 0 &
1930~2690MHz 3300~4200MHz
5150~5925MHz Antenna 1 S21

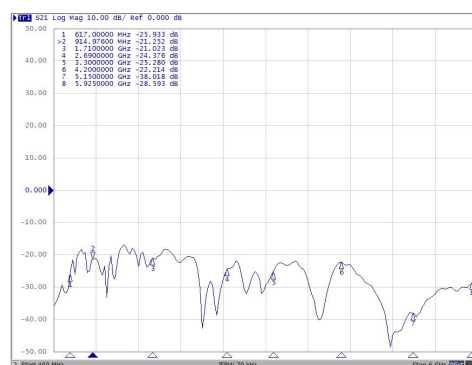
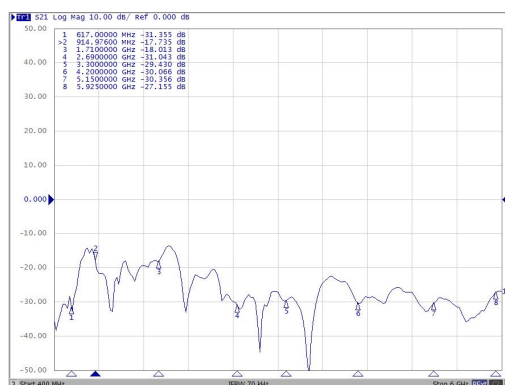


617~960MHz 1710~2690MHz Antenna 0 &
1710~2690MHz 3300~4200MHz
5150~5925MHz Antenna 3 S21



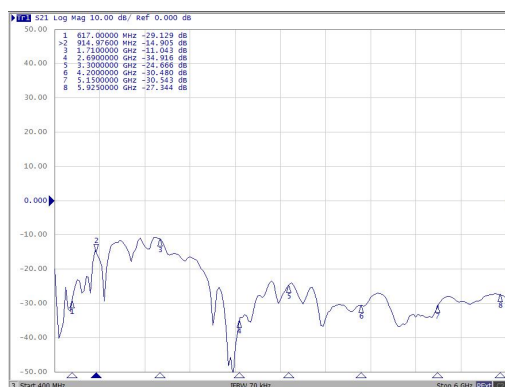
617~960MHz 1710~2690MHz Antenna 0 &
3300~4200MHz Antenna 5 S21

617~960MHz 1710~2690MHz Antenna 2 &
3300~4200MHz Antenna 4 S21



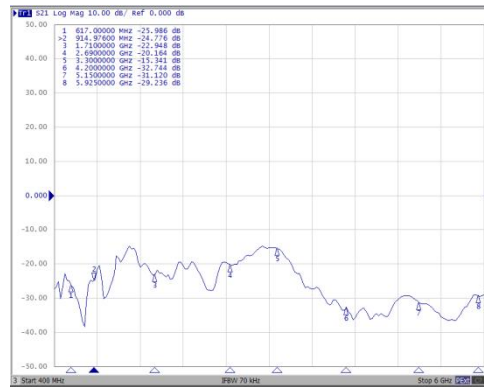
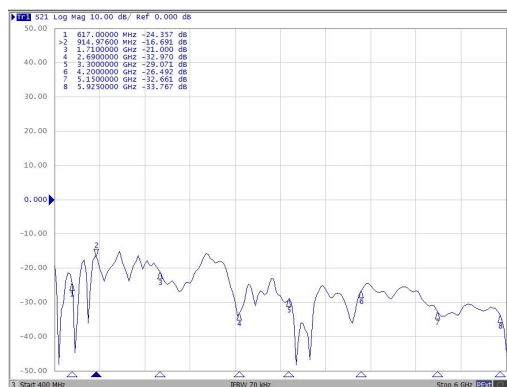
617~960MHz 1710~2690MHz Antenna 2 &
1930~2690MHz 3300~4200MHz
5150~5925MHz Antenna 1 S21

617~960MHz 1710~2690MHz Antenna 2 &
1710~2690MHz 3300~4200MHz
5150~5925MHz
Antenna 3 S21



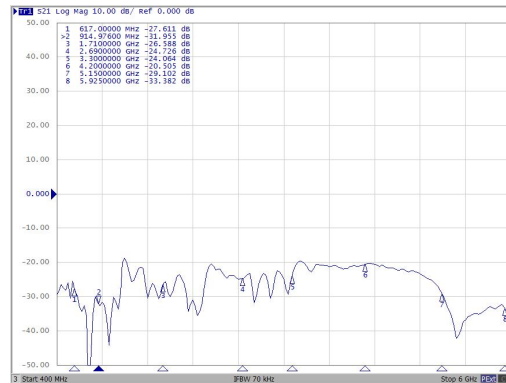
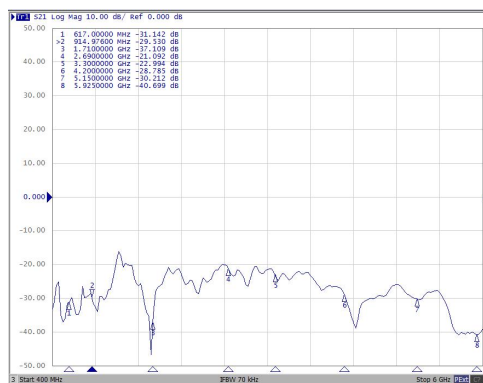
617~960MHz 1710~2690MHz Antenna 2 &
3300~4200MHz Antenna 5 S21

3300~4200MHz Antenna 4 &
1930~2690MHz 3300~4200MHz
5150~5925MHz
Antenna 1 S21



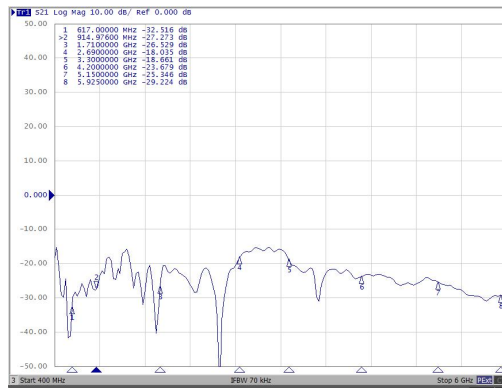
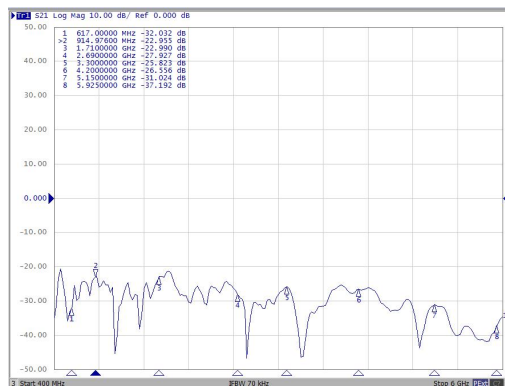
3300~4200MHz Antenna4 &
1710~2690MHz 3300~4200MHz
5150~5925MHz
Antenna 3 S21

3300~4200MHz Antenna 4 &
3300~4200MHz Antenna 5 S21

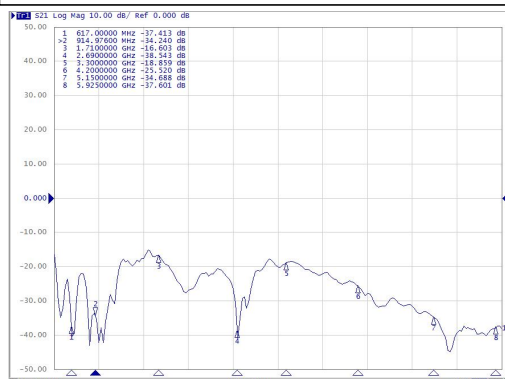


1930~2690MHz 3300~4200MHz
5150~5925MHz Antenna 1 &
1710~2690MHz 3300~4200MHz
5150~5925MHz
Antenna 3 S21

1930~2690MHz 3300~4200MHz
5150~5925MHz Antenna 1 &
3300~4200MHz Antenna 5 S21



1710~2690MHz 3300~4200MHz
5150~5925MHz Antenna 3 &
3300~4200MHz Antenna 5 S21



Antenna 0 617~960MHz 1710~2690MHz Efficiency

Frequency (MHz)	Gain (dBi)	Efficiency (%)	Frequency (MHz)	Gain (dBi)	Efficiency (%)
600	-3.28	16.69	1700	1.24	55.53
620	0.56	31.26	1740	1.30	55.16
640	-0.48	28.03	1780	1.47	59.50
660	-1.33	20.84	1820	1.20	50.75
680	-1.12	22.30	1860	1.46	50.86
700	0.29	33.88	1900	1.53	55.98
720	1.86	32.84	1940	1.81	53.63
740	1.22	41.73	1980	1.82	54.61
760	1.31	43.54	2020	1.38	54.68
780	1.60	39.26	2060	1.02	52.21
800	0.87	38.70	2100	1.97	59.49
820	0.68	32.47	2140	1.03	51.94
840	0.90	35.30	2180	1.03	56.39
860	1.05	40.81	2220	1.39	52.31
880	1.63	46.45	2260	0.86	58.02
900	1.22	45.08	2300	0.22	58.11
920	1.31	47.38	2340	0.22	58.02
940	1.17	50.34	2380	0.79	55.70
960	1.60	49.19	2420	1.44	55.06
			2460	1.03	56.97
			2500	1.05	53.18
			2540	1.03	51.60
			2580	1.07	50.22
			2620	1.35	59.56
			2660	1.54	57.44
			2700	1.77	52.85

Antenna 2 617~960MHz 1710~2690MHz Efficiency

Frequency (MHz)	Gain(dBi)	Efficiency(%)	Frequency (MHz)	Gain(dBi)	Efficiency(%)
600	-8.08	8.73	1700	1.34	49.95
620	-5.51	13.44	1740	1.82	52.61
640	-4.19	17.83	1780	1.75	57.80
660	-1.18	21.36	1820	1.70	55.55
680	0.06	32.14	1860	1.70	56.89
700	0.92	39.01	1900	1.00	57.68
720	0.33	45.19	1940	1.13	58.19
740	1.43	50.27	1980	1.65	58.46
760	-0.06	47.13	2020	1.00	59.59
780	0.43	46.77	2060	1.37	58.73
800	-0.25	41.65	2100	1.35	56.43
820	0.85	37.72	2140	1.15	57.02
840	1.56	44.91	2180	1.50	59.18
860	1.43	48.84	2220	1.38	53.38
880	1.32	55.62	2260	0.86	52.07
900	1.56	58.41	2300	0.22	43.88
920	1.60	54.06	2340	0.22	39.69
940	1.27	53.54	2380	0.56	41.66
960	0.97	52.39	2420	0.92	51.20
			2460	1.12	50.42
			2500	1.07	59.83
			2540	1.04	50.67
			2580	1.04	56.27
			2620	1.58	57.59
			2660	1.77	51.41
			2700	1.04	45.91

Antenna 4 3300~4200MHz Efficiency

Frequency (MHz)	Gain(dBi)	Efficiency(%)	Frequency (MHz)	Gain(dBi)	Efficiency(%)
3300	1.34	50.52			
3350	0.55	52.13			
3400	0.86	53.08			
3450	1.18	53.56			
3500	0.84	54.00			
3550	1.84	55.58			
3600	1.09	54.66			
3650	1.41	56.90			
3700	1.43	58.27			
3750	0.95	58.21			
3800	0.58	57.89			
3850	0.30	55.20			
3900	0.02	54.44			
3950	1.45	52.76			
4000	0.70	50.25			
4050	0.67	59.52			
4100	1.45	50.59			
4150	1.38	53.05			
4200	1.10	52.49			

Antenna 1 1930~2690MHz 3300~4200MHz 5150~5925MHz
Efficiency

Frequency (MHz)	Gain(dBi)	Efficiency(%)	Frequency (MHz)	Gain(dBi)	Efficiency(%)
1900	1.91	51.59	5150	2.09	67.84
1950	1.19	52.12	5200	2.06	66.55
2000	1.84	56.05	5250	2.07	60.26
2050	1.10	59.26	5300	2.79	66.00
2100	1.22	58.78	5350	2.27	60.91
2150	1.75	57.60	5400	2.96	66.36

2200	1.17	51.27	5450	2.22	69.41
2250	0.37	56.65	5500	2.61	62.59
2300	0.22	54.74	5550	2.72	64.16
2350	0.22	50.79	5600	2.10	57.57
2400	0.39	50.20	5650	2.40	58.13
2450	1.15	51.48	5700	2.29	54.80
2500	1.07	59.28	5750	2.16	58.03
2550	1.02	52.47	5800	2.43	58.22
2600	1.01	53.60	5850	2.50	63.19
2650	1.24	59.50	5900	2.91	58.81
2700	1.71	59.95	5950	2.65	59.42
3300	4.12	50.74			
3350	4.23	51.89			
3400	3.95	51.14			
3450	4.24	52.07			
3500	4.69	52.77			
3550	4.53	53.42			
3600	4.58	52.54			
3650	4.39	52.21			
3700	4.58	54.67			
3750	4.72	55.71			
3800	4.66	56.54			
3850	4.62	56.29			
3900	4.53	55.27			
3950	4.41	53.98			
4000	4.28	52.29			
4050	4.33	52.51			
4100	4.38	53.09			
4150	4.23	53.91			
4200	4.33	53.74			

Antenna 3

1710~2690MHz

3300~4200MHz

5150~5925MHz Efficiency

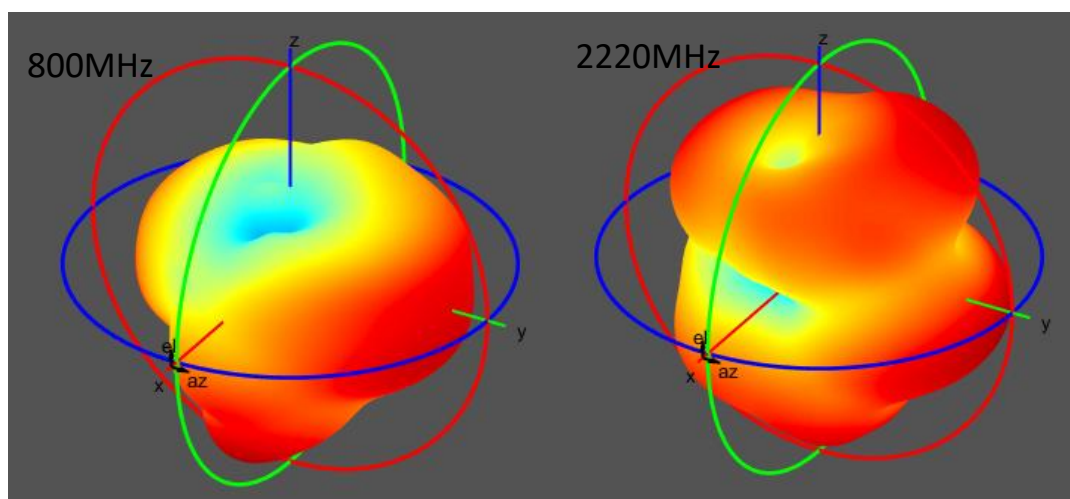
Frequency (MHz)	Gain(dBi)	Efficiency(%)	Frequency (MHz)	Gain(dBi)	Efficiency(%)
1700	1.87	58.16	5150	2.95	68.22
1750	1.77	51.56	5200	2.86	67.74

1800	1.20	48.26	5250	2.00	62.35
1850	1.57	56.24	5300	2.12	59.72
1900	1.26	51.47	5350	2.37	65.01
1950	1.52	52.18	5400	2.88	61.71
2000	1.67	54.92	5450	2.23	66.52
2050	1.22	59.45	5500	2.71	60.36
2100	1.84	50.40	5550	2.11	66.08
2150	1.56	52.63	5600	2.89	58.75
2200	1.37	55.17	5650	2.05	61.69
2250	0.74	53.45	5700	2.27	57.05
2300	0.22	54.41	5750	2.33	59.06
2350	0.17	53.75	5800	2.54	56.74
2400	0.22	52.23	5850	2.51	66.26
2450	1.08	59.57	5900	2.50	61.55
2500	1.05	55.11	5950	2.65	61.48
2550	1.07	51.14			
2600	1.05	54.75			
2650	1.92	50.12			
2700	1.23	50.10			
3300	4.26	52.32			
3350	4.30	52.26			
3400	4.25	52.51			
3450	4.27	53.33			
3500	4.33	54.59			
3550	4.32	54.54			
3600	4.39	55.28			
3650	4.49	57.67			
3700	4.64	58.42			
3750	4.57	57.01			
3800	4.46	55.45			
3850	4.35	53.50			
3900	4.26	52.50			
3950	4.06	52.62			
4000	4.11	52.42			
4050	4.26	52.72			
4100	4.32	52.42			
4150	4.31	53.13			
4200	4.29	53.46			

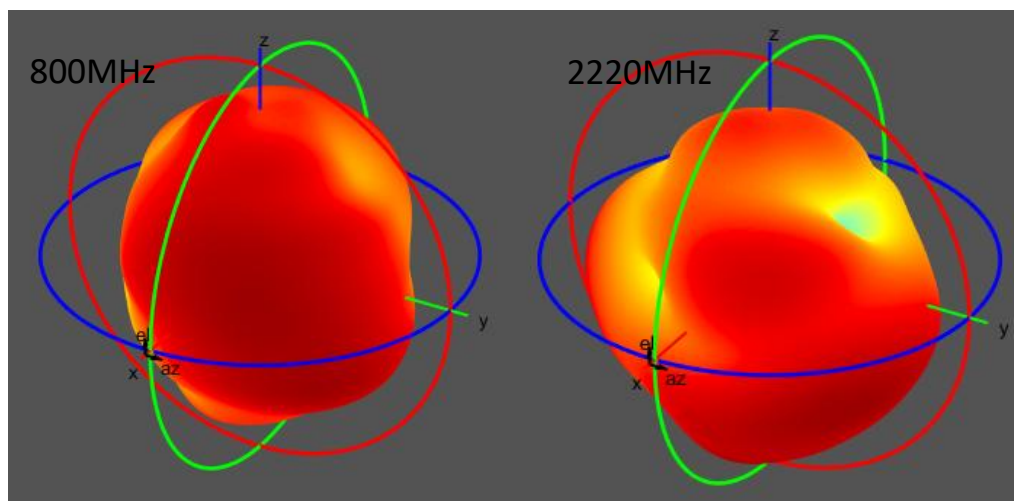
Antenna 5 3300~4200MHz Efficiency

Frequency (MHz)	Gain(dBi)	Efficiency(%)	Frequency (MHz)	Gain(dBi)	Efficiency(%)
3300	0.73	57.52			
3350	1.35	51.45			
3400	0.23	57.40			
3450	1.14	56.72			
3500	0.87	57.03			
3550	1.61	57.00			
3600	1.21	56.74			
3650	0.54	57.59			
3700	0.61	50.17			
3750	1.20	54.41			
3800	1.11	51.62			
3850	0.52	50.57			
3900	1.23	51.56			
3950	1.03	53.79			
4000	0.14	54.23			
4050	1.01	51.81			
4100	1.29	52.99			
4150	0.75	55.75			
4200	1.91	55.99			

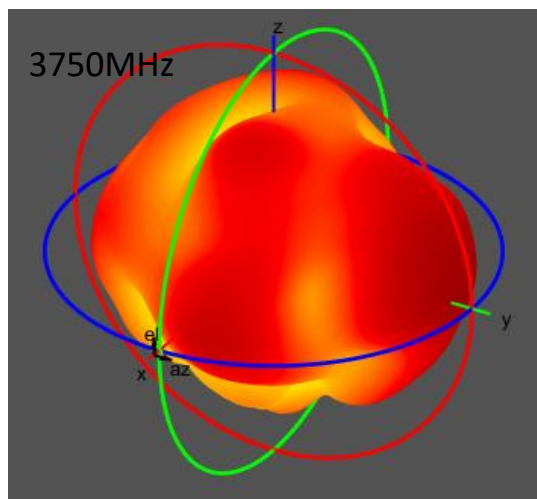
Antenna 0 617~960MHz 1710~2690MHz 3D



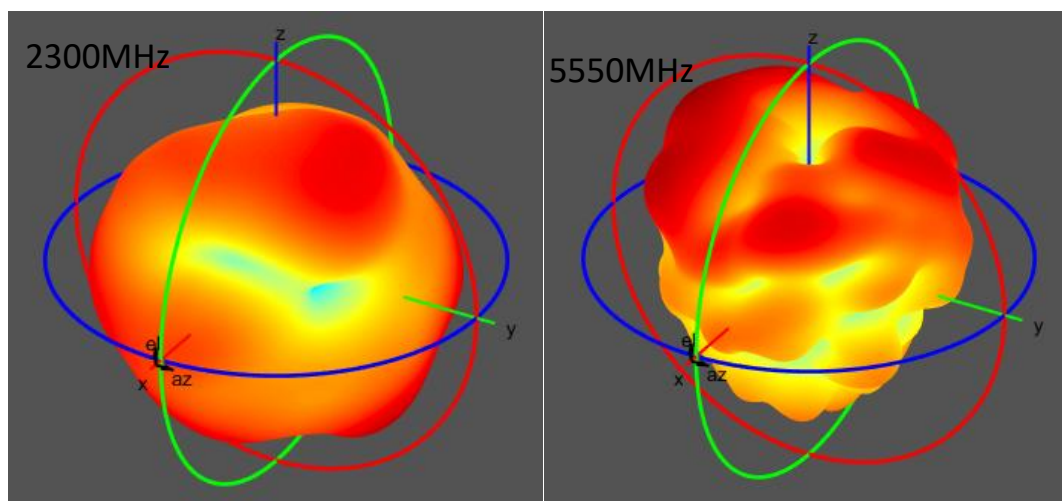
Antenna2 617~960MHz 1710~2690MHz 3D



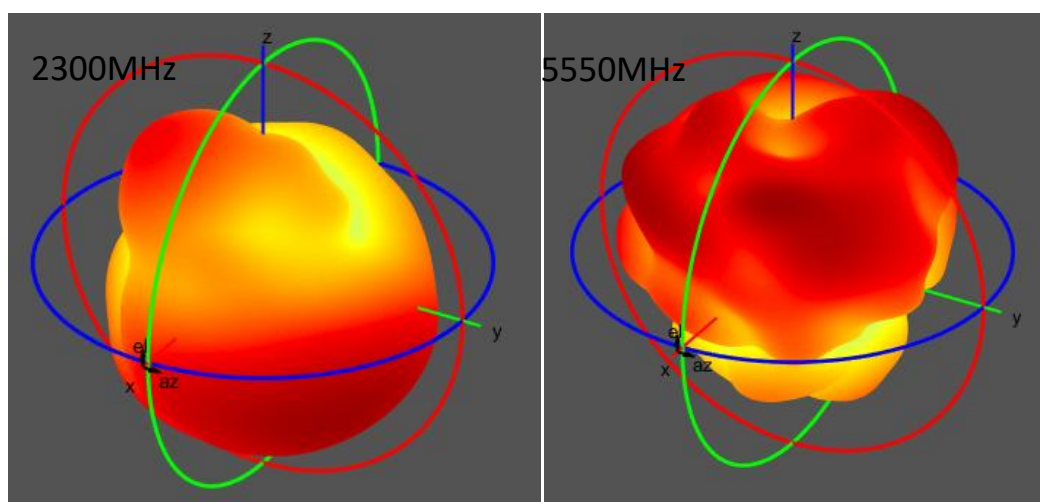
Antenna 4 3300~4200MHz 3D



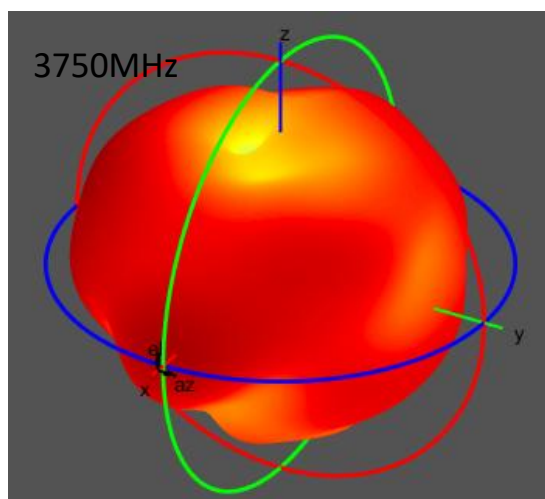
Antenna 1 1930~2690MHz 3300~4200MHz 5150~5925MHz 3D



Antenna 3 2400~2500MHz 3300~4200MHz 5150~5850MHz 3D



Antenna 5 3300~4200MHz 3D



2.2 Active Test Result(TRP TIS)

LTE	Channel	TRP(dBm)	TIS(dBm)	LTE	Channel	TRP(dBm)	TIS(dBm)
Band 2(10M)	L	20.12	-99.97	Band 25(10M)	L	20.07	-103.47
	M	20.12	-99.34		M	20.74	-103.44
	H	20.57	-99.18		H	20.54	-103.36
Band 66(4) (10M)	L	20.17	-99.4	Band 26(10M)	L	19.20	-100.02
	M	20.56	-99.3		M	19.79	-100.53
	H	20.11	-100.23		H	19.33	-100.07
Band 5(10M)	L	20.43	-99.12	Band 30(10M)	M	18.47	-97.57
	M	20.19	-99.86	Band 41(20M) (TIS WIFI CH1)	L	22.55	-96.33
	H	20.36	-99.38		M	22.62	-96.46
Band 7(10M) (TIS WIFI CH1)	L	19.31	-99.73	Band 48(20M)	H	22.60	-96.43
	M	19.89	-98.66		L	19.46	-99.85
	H	19.44	-98.54		M	19.58	-99.1
Band 12(10M)	L	18.12	-98.07	Band 71(10M)	H	20.02	-99.86
	M	18.74	-98.35		L	17.54	-95.89
	H	18.86	-97.92		M	17.63	-95.26
Band 13(10M)	L	18.11	-97.65		H	17.61	-96.27
	M	18.07	-97.49				
	H	18.15	-97.12				
Band 14(10M)	L	18.11	-95.60				
	M	18.35	-95.31				
	H	18.76	-95.53				

Band 17(10M)	L	19.44	-97.06	
	M	19.72	-97.19	
	H	19.91	-97.59	

5G SA	Channels	SCS(KHz)	TRP(dBm)	TIS(dBm)
N2 (10MHz)	L	15	20.04	-97.99
	M	15	20.18	-97.41
	H	15	20.05	-97.14
N5 (10MHz)	L	15	20.59	-97.56
	M	15	20.48	-97.34
	H	15	20.28	-98.01
n7 (10MHz) (TIS WIFI CH1)	L	15	20.31	-96.03
	M	15	20.38	-96.61
	H	15	20.88	-96.98
N12 (10MHz)	L	15	19.01	-93.65
	M	15	19.61	-93.23
	H	15	18.96	-93.04
N14 (10MHz)	L	15	18.38	-93.61
	M	15	19.41	-93.77
	H	15	19.88	-93.59

N25 (10MHz)	L	15	20.34	-98.82
	M	15	20.84	-98.79
	H	15	20.16	-99.45
n30 (10MHz) n41 (100MHz) (TIS WIFI CH1)	L	15	18.31	-97.45
	L	30	22.78	-87.18
	M	30	22.50	-87.57
	H	30	22.56	-87.93
n48 (100MHz)	L	30	19.4	-91.06
	M	30	19.54	-91.33
	H	30	19.75	-91.4
N66 (10MHz)	L	30	20.7	-97.7
	M	30	20.38	-97.88
	H	30	20.98	-98.87
N71 (10MHz)	L	30	17.04	-91.3
	M	30	17.86	-91.16
	H	30	18.29	-90.86
n77 (100MHz)	L	30	22.72	-91.34
	M	30	22.90	-91.66
	H	30	23.20	-92.77
n78 (100MHz)	L	30	22.78	-91.19
	M	30	22.86	-91.46
	H	30	23.02	-91.58