Antenna Testing Report

Customer：Shenzhen sangge'er Polytron Technologies Inc

Project Name：MS2

Antenna Manufacturer: Sunnyway Technology(CHINA)

Address：The 6th floor, Building 5, Nantaiyun Innovation Valley Center, Guangming District, Shenzhen City

Report version： November 16, 2023 A0
Research staff: Huang Xiong

Record

Version	Report date	Remark
A0	2023.11.16	Antenna test report
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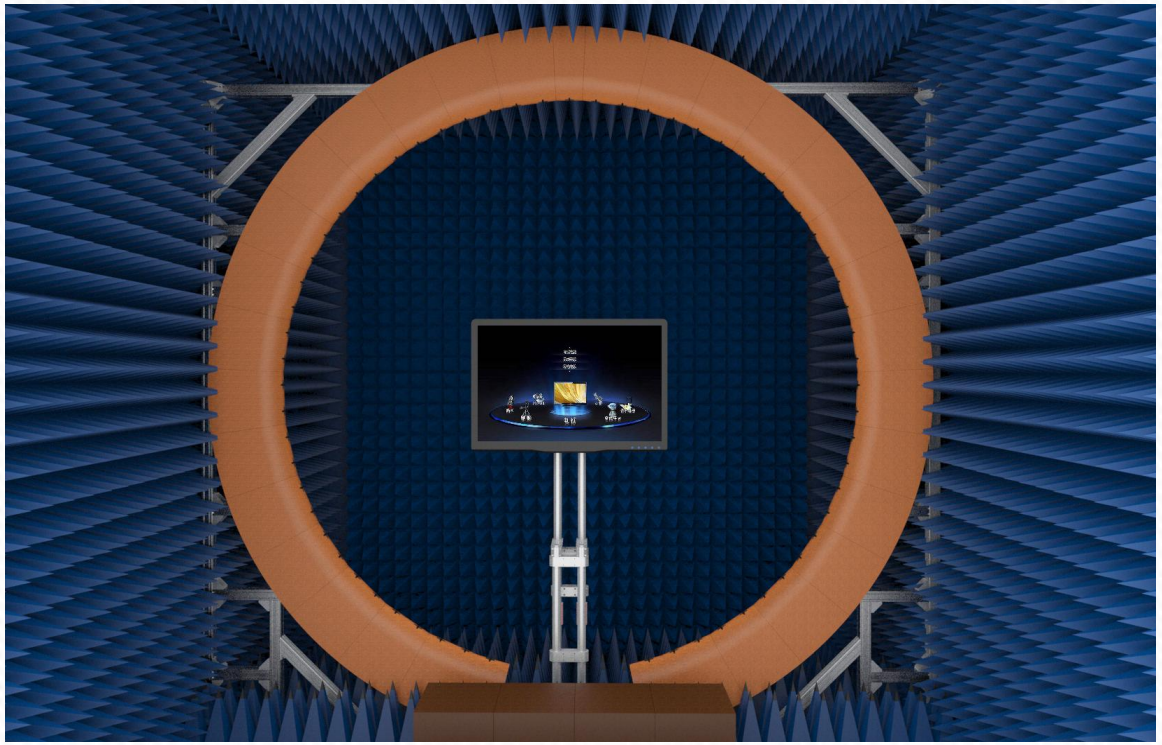
Equipment List



The industry's top 64 sensors OTA chamber

Frequency range: 400MHz-11GHz

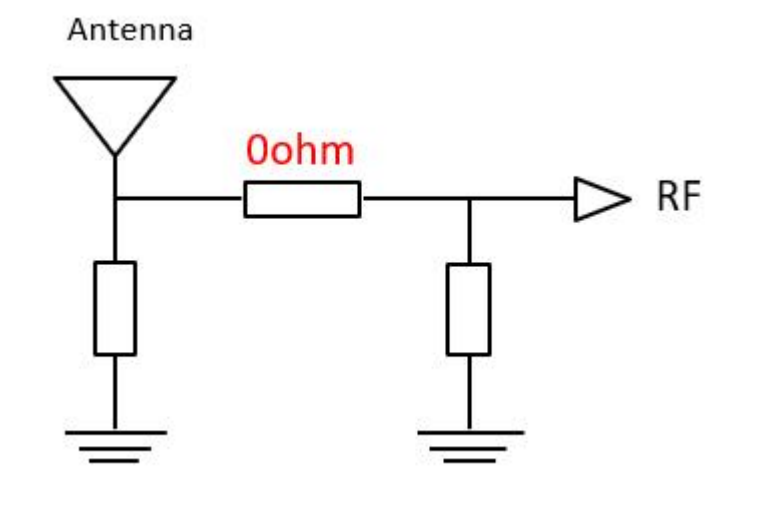
Device Llimitation: 2M

Load-bearing limitation:100KG

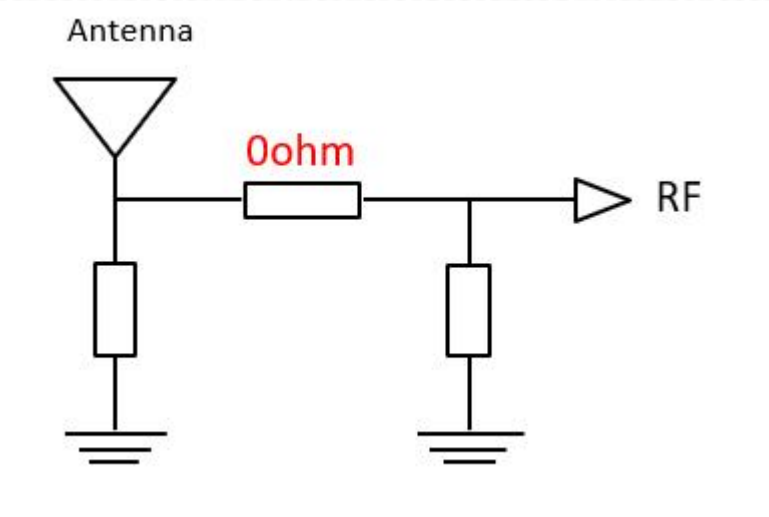
Equipments Items	Total Quantity	Quantity for Shanghai R&D	Quantity for Shenzhen R&D	Quantity for ChongQing R&D
OTA chamber	10	4	5	1
5G Tester（SP9500-CTS）	3	1	1	1
R&S Tester（high configuration CMW500）	6	3	2	1
Japan Anritsu Tester（Dual Channel 8820）	4	2	2	--
NB-IoT Tester (SP8315)	3	1	1	1
Agilent Tester（8960）	9	4	4	--
Agilent Network Analyzer（E5062A）	7	3	3	1
Agilent Network Analyzer（E5071C 8.5GHZ)	11	5	5	1
Agilent Network Analyzer（E5071B 8.5GHZ)	7	3	3	1
R&S Network Analyzer（ZND）	9	4	4	1
R&S Network Analyzer（ZVB）	3	1	1	1
OTA head hand / ear hand / arm hand	5	2	2	1
GPS/WIFI active test equipment	5	2	2	1

antenna matching circuitl

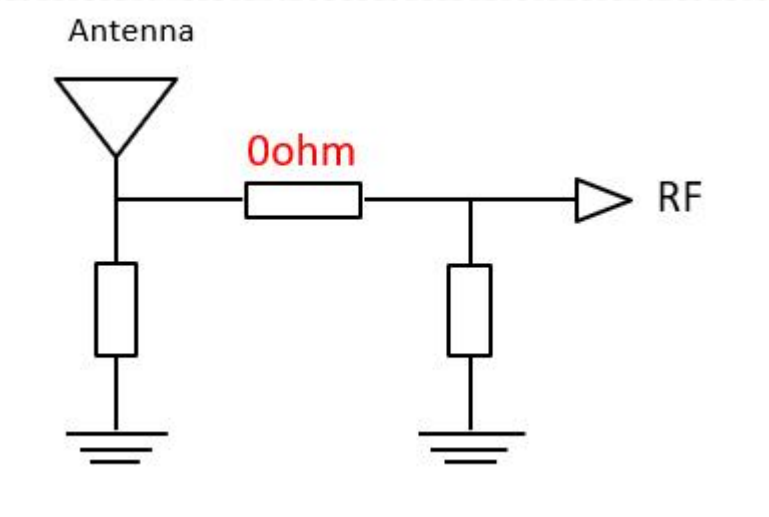
Main antenna ：



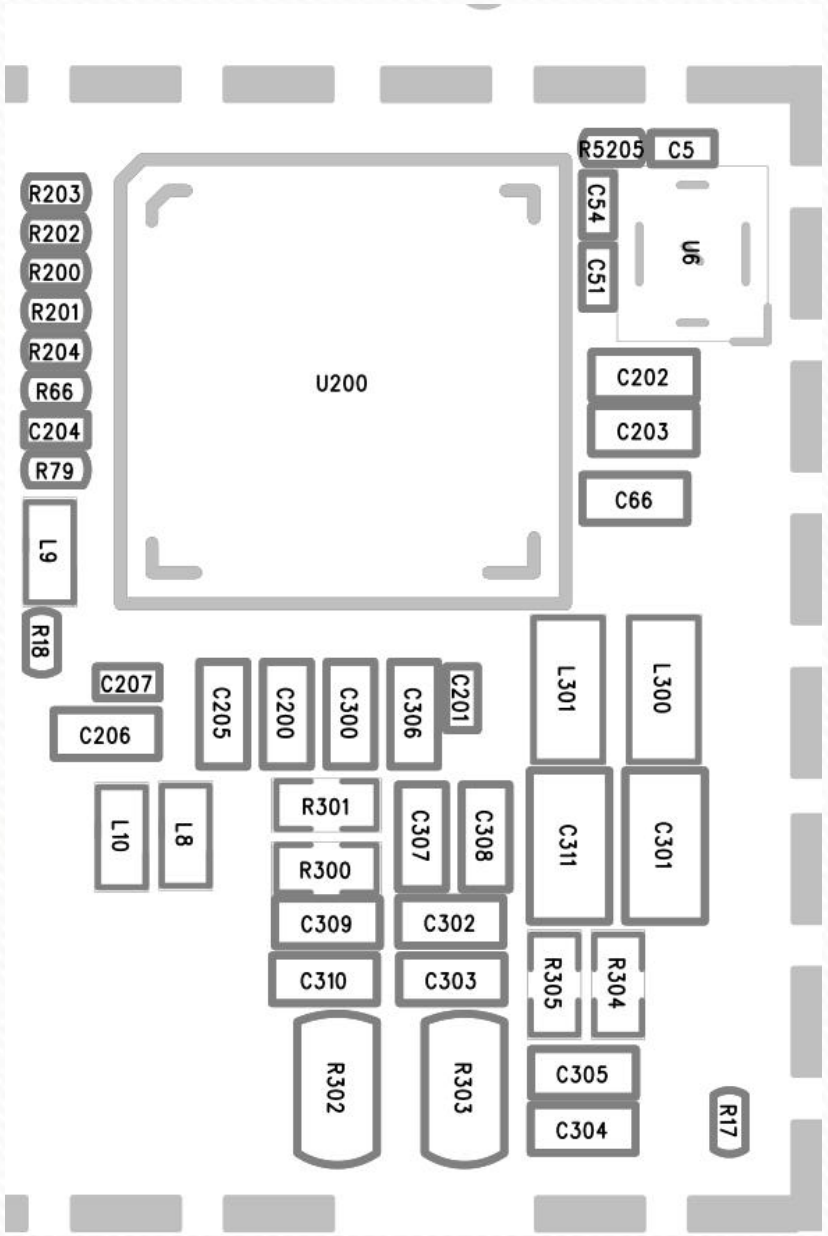
three-in-one antenna ：

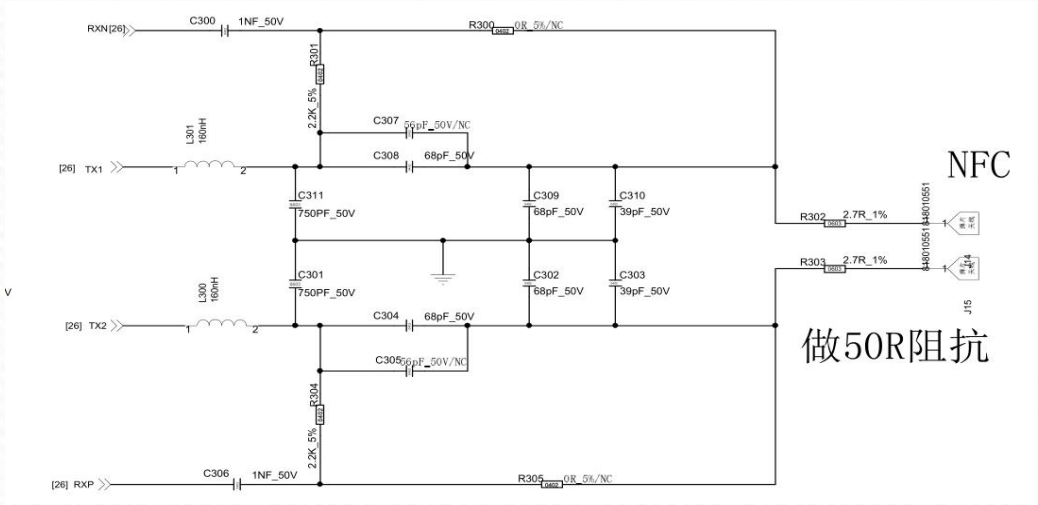


diversity antenna antenna ：



NFC matching circuitl

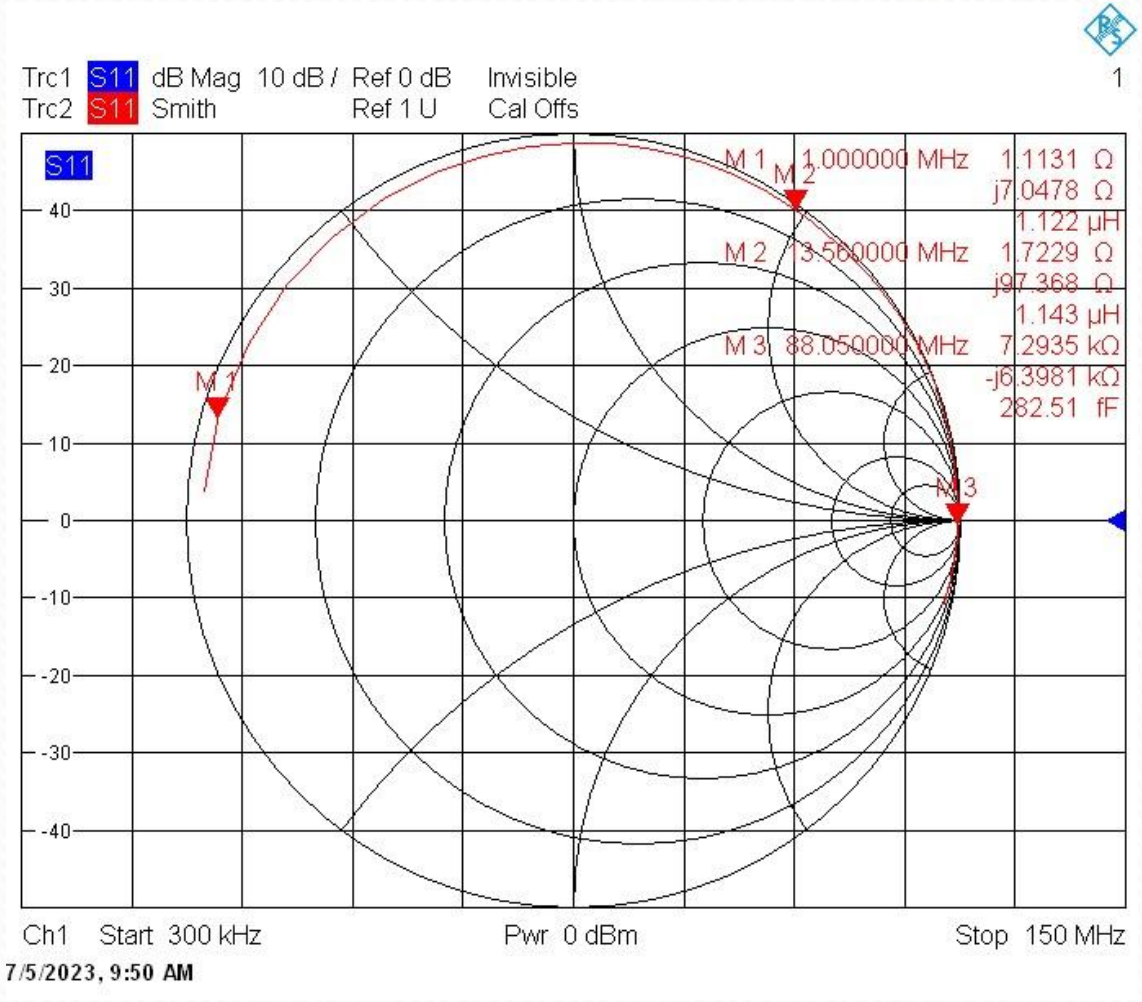




position	specifications and models	
C301/C311	750pF	0603 50V/±5%
C304/C308	68pF	0402 50V/±5%
C305/C307	NC	0402 50V/±5%
C309/C302	68pF	0402 50V/±5%
C310/C303	39pF	0402 50V/±5%
R301/R304	2.2KΩ	0402 ±1%
R302/R303	2.7Ω	0603 ±1%

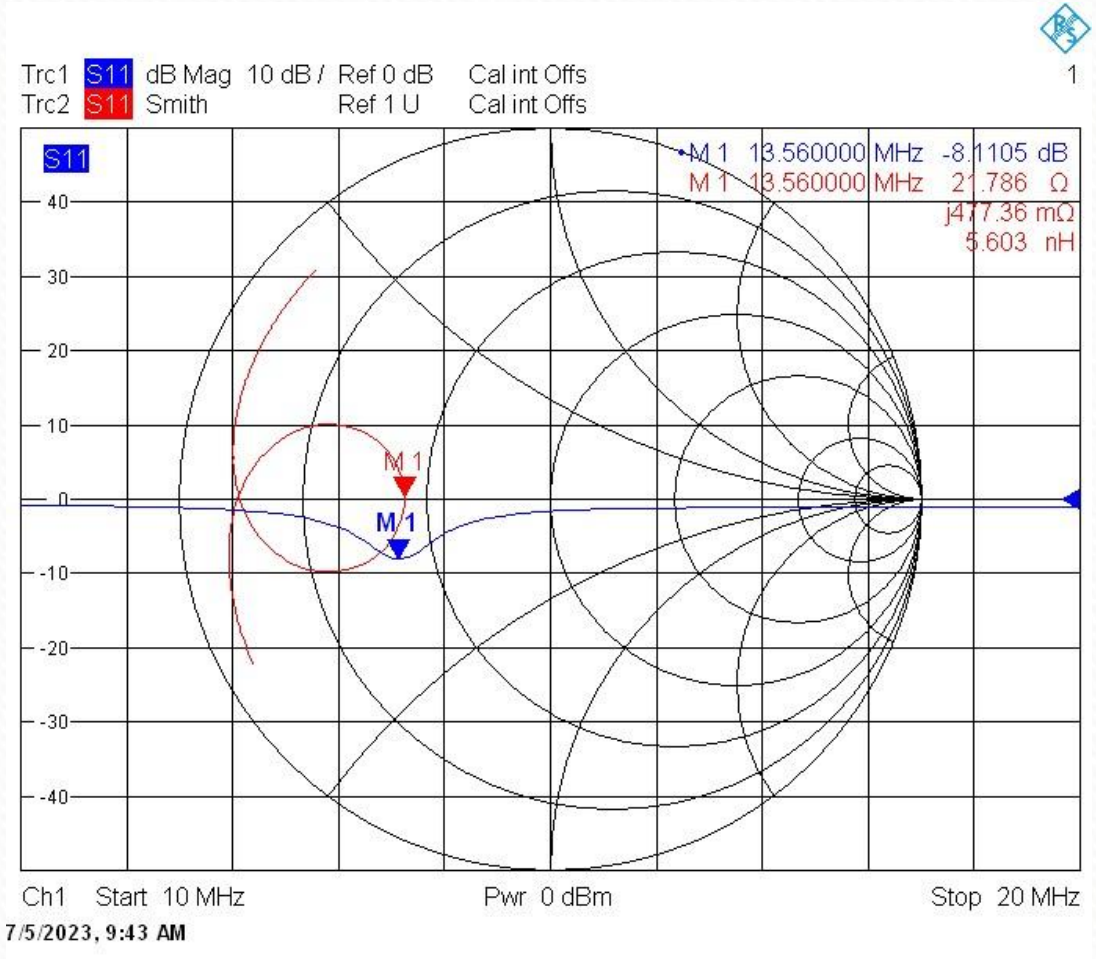
NFC antenna data

Antenna ontology data



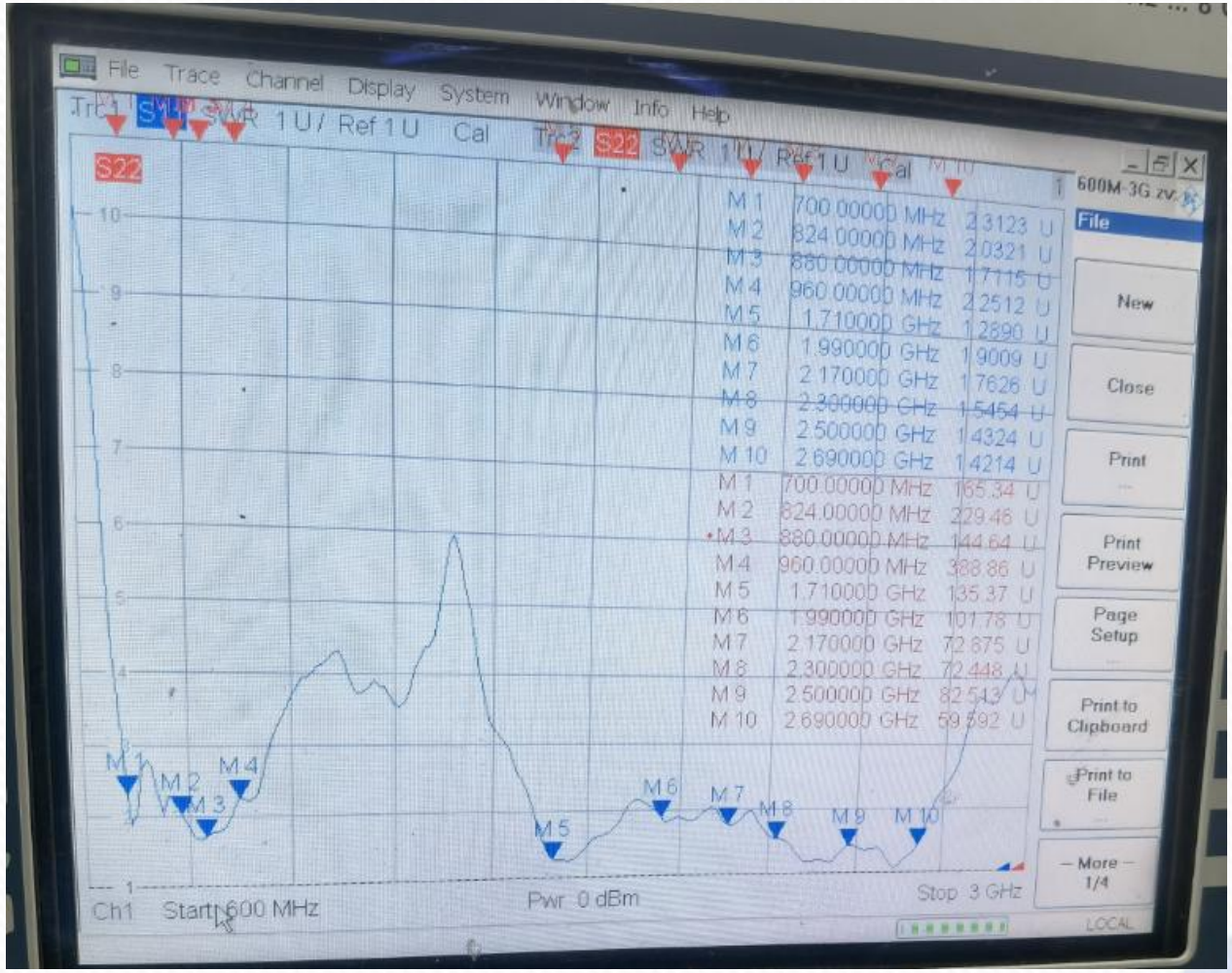
NFC antenna data

TX impedance： 21.7Ω+j0.47Ω



Main antenna data

S11-VSWR



Main antenna efficiency and gain

Frequency/Mhz	Efficiency / %	MaxGain/dBi	Frequency/Mhz	Efficiency / %	MaxGain/dBi	Frequency/Mhz	Efficiency / %	MaxGain/dBi
700	24.21	-1.24	1700	46.03	1.56	2240	48.75	0.52
710	27.93	-0.08	1720	49.2	2.04	2260	49.55	0.51
720	29.85	-0.34	1740	49.43	2.14	2280	48.98	0.5
730	34.36	-0.61	1760	50.82	1.97	2300	49.66	1.23
740	33.81	-1.65	1780	52.24	1.52	2320	49.09	0.88
750	33.65	-1.57	1800	52.97	1.43	2340	49.09	0.63
760	36.06	-0.76	1820	51.76	0.99	2360	50.58	0.94
770	40.83	-0.32	1840	49.66	0.83	2380	51.52	1.68
780	40.64	-0.46	1860	44.77	0.64	2400	53.83	2.12
790	40.18	-0.61	1880	42.17	0.6	2420	53.95	1.74
800	40.27	-0.02	1900	41.3	0.62	2440	51.52	1.3
810	41.02	0.18	1920	38.02	-0.07	2460	50.35	1.39
820	41.69	0.31	1940	38.02	0.37	2480	48.53	2.01
830	42.07	0.38	1960	37.33	1.14	2500	48.19	2.5
840	43.85	0.73	1980	39.17	1.38	2520	47.75	2.28
850	42.46	0.76	2000	48.75	1.59	2540	46.34	1.71
860	41.69	0.62	2020	46.45	-0.46	2560	44.26	1.08
870	38.73	0.53	2040	47.97	0.81	2580	45.6	1
880	36.06	0.03	2060	48.31	1.3	2600	41.98	1.22
890	34.91	-0.17	2080	47.75	0.28	2620	38.82	0.77
900	35.24	-0.64	2100	46.67	-0.48	2640	36.56	0.22
910	36.39	-0.3	2120	45.81	-0.09	2660	36.81	0.05
920	35.65	-0.38	2140	46.45	-0.01	2680	34.43	-0.89
930	37.84	-0.12	2160	46.77	0.4	2700	30.55	-1.38
940	36.31	-0.37	2180	47.64	0.85			
950	34.99	-0.63	2200	49.55	0.52			
960	33.11	-0.89	2220	48.31	0.61			

Main antenna OTA test data

1#

Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value	Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value
TRP	GSM850	128	26.65			TRP	WCDMA_B8	2712	17.23		
TRP	GSM850	190	27			TRP	WCDMA_B8	2787	17.8		
TRP	GSM850	251	27.54			TRP	WCDMA_B8	2863	17.86		
TIS(RSSI)	GSM850	251	-104.96	-104.16	0.8	TIS(RSSI)	WCDMA_B8	3088	-104.57	-104.62	-0.05
TRP	GSM900	1	25.99			TRP	FDD_B1(10MHz)	18050	19.9		
TRP	GSM900	62	25.52			TRP	FDD_B1(10MHz)	18300	18.25		
TRP	GSM900	124	25.35			TRP	FDD_B1(10MHz)	18550	18.41		
TIS(RSSI)	GSM900	124	-101.64	-101.48	0.16	TIS(RSSI)	FDD_B1(10MHz)	550	-93.45	-93.89	-0.44
TRP	PCS1900	512	26.68			TRP	FDD_B2(10MHz)	18650	19.34		
TRP	PCS1900	661	27.62			TRP	FDD_B2(10MHz)	18900	19.37		
TRP	PCS1900	810	27.25			TRP	FDD_B2(10MHz)	19150	20		
TIS(RSSI)	PCS1900	810	-104.79	-104.3	0.49	TIS(RSSI)	FDD_B2(10MHz)	1150	-93.88	-94.15	-0.27
TRP	WCDMA_B1	9612	20.02			TRP	FDD_B3(10MHz)	19250	18.44		
TRP	WCDMA_B1	9750	19.83			TRP	FDD_B3(10MHz)	19575	18.61		
TRP	WCDMA_B1	9888	19.91			TRP	FDD_B3(10MHz)	19900	19.71		
TIS(RSSI)	WCDMA_B1	10838	-103.58	-103.53	0.05	TIS(RSSI)	FDD_B3(10MHz)	1900	-96.89	-97.17	-0.28
TRP	WCDMA_B2	9262	19.77			TRP	FDD_B4(10MHz)	20000	18.7		
TRP	WCDMA_B2	9400	19.38			TRP	FDD_B4(10MHz)	20175	18.57		
TRP	WCDMA_B2	9538	19.71			TRP	FDD_B4(10MHz)	20350	18.12		
TIS(RSSI)	WCDMA_B2	9938	-103.14	-103.2	-0.06	TIS(RSSI)	FDD_B4(10MHz)	2350	-91.58	-91.56	0.02
TRP	WCDMA_B5	4132	15.58			TRP	FDD_B5(10MHz)	20450	15.66		
TRP	WCDMA_B5	4183	15.52			TRP	FDD_B5(10MHz)	20525	15.61		
TRP	WCDMA_B5	4233	15.62			TRP	FDD_B5(10MHz)	20600	15.41		
TIS(RSSI)	WCDMA_B5	4458	-104.16	-104.5	-0.34	TIS(RSSI)	FDD_B5(10MHz)	2600	-93.44	-93.2	0.24

Main antenna OTA test data

1#

Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value	Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value
TRP	FDD_B7(10MHz)	20800	19.72			TRP	FDD_B26(10MHz)	26740	15.8		
TRP	FDD_B7(10MHz)	21100	19.95			TRP	FDD_B26(10MHz)	26865	15.45		
TRP	FDD_B7(10MHz)	21400	20.19			TRP	FDD_B26(10MHz)	26990	15.33		
TIS(RSSI)	FDD_B7(10MHz)	3400	-93.19	-94.28	-1.09	TIS(RSSI)	FDD_B26(10MHz)	8990	-92.73	-92.91	-0.18
TRP	FDD_B8(10MHz)	21500	17.89			TRP	FDD_B66(10MHz)	132022	18.66		
TRP	FDD_B8(10MHz)	21625	17.25			TRP	FDD_B66(10MHz)	132322	18.75		
TRP	FDD_B8(10MHz)	21750	17.17			TRP	FDD_B66(10MHz)	132622	19.58		
TIS(RSSI)	FDD_B8(10MHz)	3750	-89.56	-88.03	1.53	TIS(RSSI)	FDD_B66(10MHz)	67036	-92.1	-92.02	0.09
TRP	FDD_B12(10MHz)	23060	19.22			TRP	TDD_B38(20MHz)	37850	16.86		
TRP	FDD_B12(10MHz)	23095	20.17			TRP	TDD_B38(20MHz)	38000	14.98		
TRP	FDD_B12(10MHz)	23130	19.55			TRP	TDD_B38(20MHz)	38150	14.04		
TIS(RSSI)	FDD_B12(10MHz)	5130	-91.69	-92	-0.31	TIS(RSSI)	TDD_B38(20MHz)	38150	-88.98	-89.15	-1.3
TRP	FDD_B14(10MHz)	23330	17.25			TRP	TDD_B40(20MHz)	38750	20.83		
TIS(RSSI)	FDD_B14(10MHz)	5330	-90.43	-91.56	-1.13	TRP	TDD_B40(20MHz)	39150	20.7		
TRP	FDD_B17(10MHz)	23780	18.49			TRP	TDD_B40(20MHz)	39550	20.77		
TRP	FDD_B17(10MHz)	23790	19			TIS(RSSI)	TDD_B40(20MHz)	39550	-94.12	-95.42	-0.17
TRP	FDD_B17(10MHz)	23800	18.64			TRP	TDD_B41(20MHz)	40340	19.11		
TIS(RSSI)	FDD_B17(10MHz)	5800	-91.59	-92.91	-1.32	TRP	TDD_B41(20MHz)	40620	15.26		
TRP	FDD_B25(10MHz)	26090	19.38			TRP	TDD_B41(20MHz)	41140	19.52		
TRP	FDD_B25(10MHz)	26365	18.85			TIS(RSSI)	TDD_B41(20MHz)	41140	-91.28	-91.19	0.08
TRP	FDD_B25(10MHz)	26640	20.8								
TIS(RSSI)	FDD_B25(10MHz)	8640	-92.14	-93.42	-1.28						

Main antenna OTA test data

2#

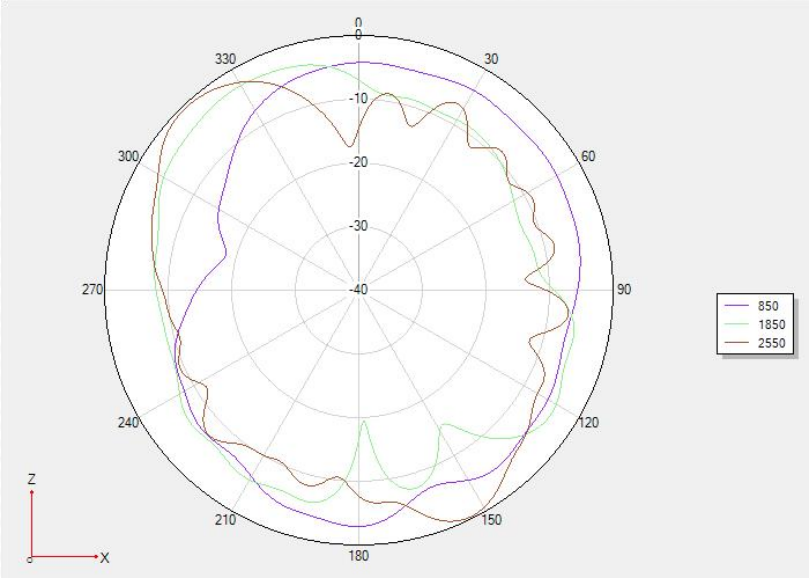
Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value	Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value
TRP	GSM850	128	26.81			TRP	WCDMA_B8	2712	17.29		
TRP	GSM850	190	27.03			TRP	WCDMA_B8	2787	17.73		
TRP	GSM850	251	27.48			TRP	WCDMA_B8	2863	17.76		
TIS(RSSI)	GSM850	251	-104.8	-105.08	-0.28	TIS(RSSI)	WCDMA_B8	3088	-104.02	-103.11	0.91
TRP	GSM900	1	25.81			TRP	FDD_B1(10MHz)	18050	19.47		
TRP	GSM900	62	25.25			TRP	FDD_B1(10MHz)	18300	18.45		
TRP	GSM900	124	24.97			TRP	FDD_B1(10MHz)	18550	18.33		
TIS(RSSI)	GSM900	124	-101.22	-100.42	0.8	TIS(RSSI)	FDD_B1(10MHz)	550	-94.14	-94.75	-0.61
TRP	PCS1900	512	26.03			TRP	FDD_B2(10MHz)	18650	20.23		
TRP	PCS1900	661	27.06			TRP	FDD_B2(10MHz)	18900	19.81		
TRP	PCS1900	810	27.8			TRP	FDD_B2(10MHz)	19150	20.85		
TIS(RSSI)	PCS1900	810	-106.89	-107.47	-0.58	TIS(RSSI)	FDD_B2(10MHz)	1150	-97.85	-95.76	2.09
TRP	WCDMA_B1	9612	20.74			TRP	FDD_B3(10MHz)	19250	18.78		
TRP	WCDMA_B1	9750	20.07			TRP	FDD_B3(10MHz)	19575	18.74		
TRP	WCDMA_B1	9888	19.86			TRP	FDD_B3(10MHz)	19900	19.6		
TIS(RSSI)	WCDMA_B1	10838	-107.57	-107.7	-0.13	TIS(RSSI)	FDD_B3(10MHz)	1900	-97.93	-98.91	-0.98
TRP	WCDMA_B2	9262	19.58			TRP	FDD_B4(10MHz)	20000	18.66		
TRP	WCDMA_B2	9400	18.86			TRP	FDD_B4(10MHz)	20175	18.29		
TRP	WCDMA_B2	9538	19.45			TRP	FDD_B4(10MHz)	20350	18.58		
TIS(RSSI)	WCDMA_B2	9938	-107.75	-107.83	-0.08	TIS(RSSI)	FDD_B4(10MHz)	2350	-93.19	-92.76	0.43
TRP	WCDMA_B5	4132	15.64			TRP	FDD_B5(10MHz)	20450	15.73		
TRP	WCDMA_B5	4183	15.58			TRP	FDD_B5(10MHz)	20525	15.54		
TRP	WCDMA_B5	4233	15.73			TRP	FDD_B5(10MHz)	20600	15.53		
TIS(RSSI)	WCDMA_B5	4458	-103.72	-104.31	-0.59	TIS(RSSI)	FDD_B5(10MHz)	2600	-93.36	-92.71	0.65

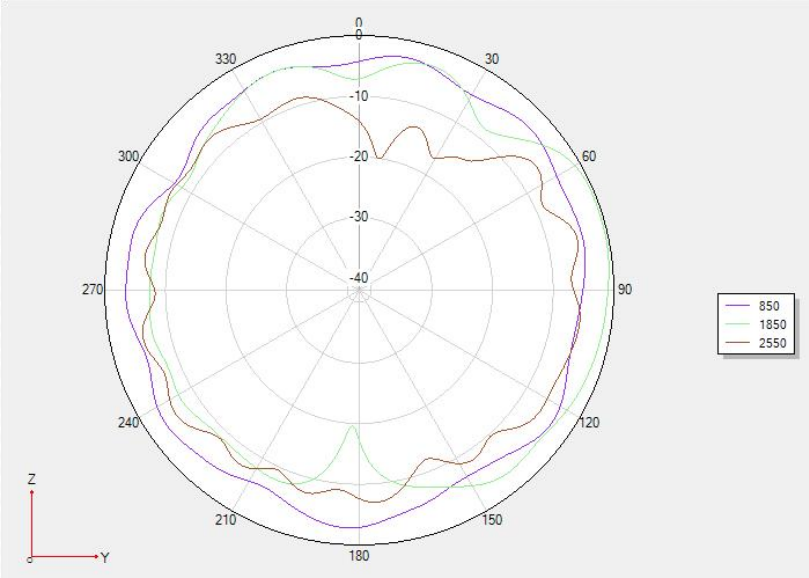
Main antenna OTA test data

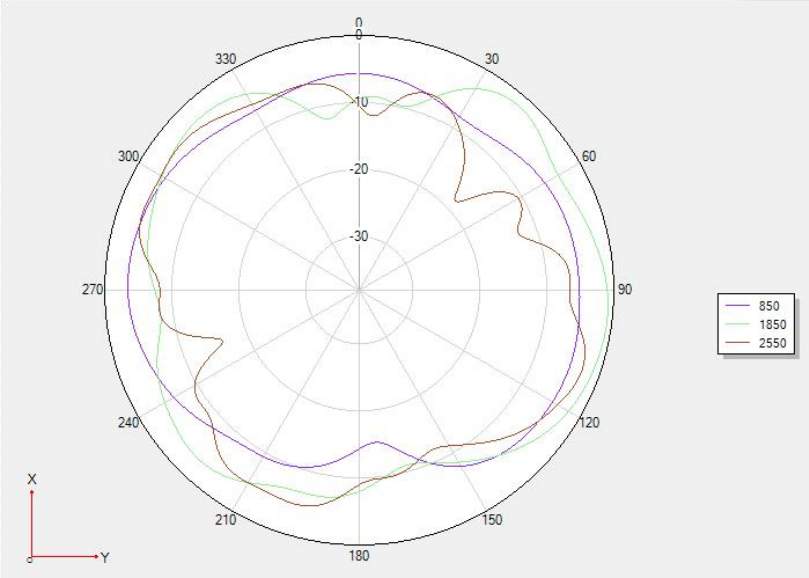
2#

Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value	Measurement	Band	Channel	Total-Bright screen	Total-Out of the screen	D-value
TRP	FDD_B7(10MHz)	20800	20.41			TRP	FDD_B26(10MHz)	26740	15.96		
TRP	FDD_B7(10MHz)	21100	20.51			TRP	FDD_B26(10MHz)	26865	15.57		
TRP	FDD_B7(10MHz)	21400	20.61			TRP	FDD_B26(10MHz)	26990	15.5		
TIS(RSSI)	FDD_B7(10MHz)	3400	-93.51	-93.85	-0.34	TIS(RSSI)	FDD_B26(10MHz)	8990	-92.44	-92.28	0.16
TRP	FDD_B8(10MHz)	21500	17.9			TRP	FDD_B66(10MHz)	132022	18.77		
TRP	FDD_B8(10MHz)	21625	17.14			TRP	FDD_B66(10MHz)	132322	18.48		
TRP	FDD_B8(10MHz)	21750	16.96			TRP	FDD_B66(10MHz)	132622	18.53		
TIS(RSSI)	FDD_B8(10MHz)	3750	-88.98	-89.73	-0.75	TIS(RSSI)	FDD_B66(10MHz)	67036	-93.03	-93.87	-0.84
TRP	FDD_B12(10MHz)	23060	20.15			TRP	TDD_B38(20MHz)	37850	16.82		
TRP	FDD_B12(10MHz)	23095	20.63			TRP	TDD_B38(20MHz)	38000	15.21		
TRP	FDD_B12(10MHz)	23130	20.38			TRP	TDD_B38(20MHz)	38150	15.18		
TIS(RSSI)	FDD_B12(10MHz)	5130	-93.69	-94.03	-0.34	TIS(RSSI)	TDD_B38(20MHz)	38150	-88.7	-88.95	-0.25
TRP	FDD_B14(10MHz)	23330	17.54			TRP	TDD_B40(20MHz)	38750	20.74		
TIS(RSSI)	FDD_B14(10MHz)	5330	-91.8	-92.19	-0.39	TRP	TDD_B40(20MHz)	39150	20.87		
TRP	FDD_B17(10MHz)	23780	18.93			TRP	TDD_B40(20MHz)	39550	20.35		
TRP	FDD_B17(10MHz)	23790	19.71			TIS(RSSI)	TDD_B40(20MHz)	39550	-94.24	-95.18	-0.94
TRP	FDD_B17(10MHz)	23800	19.47			TRP	TDD_B41(20MHz)	40340	19.17		
TIS(RSSI)	FDD_B17(10MHz)	5800	-92.15	-93.41	-1.26	TRP	TDD_B41(20MHz)	40620	15.31		
TRP	FDD_B25(10MHz)	26090	19.8			TRP	TDD_B41(20MHz)	41140	20.97		
TRP	FDD_B25(10MHz)	26365	19.74			TIS(RSSI)	TDD_B41(20MHz)	41140	-91.87	-90.42	1.45
TRP	FDD_B25(10MHz)	26640	20								
TIS(RSSI)	FDD_B25(10MHz)	8640	-92.48	-93.08	-0.6						

Main antenna Directional pattern

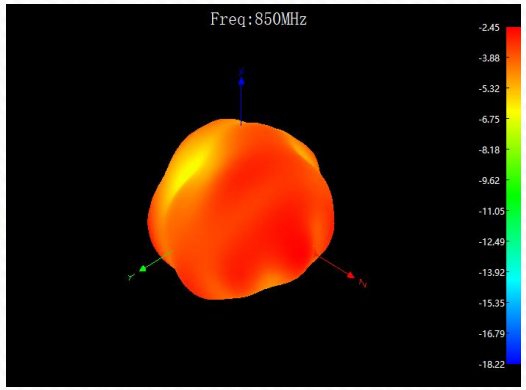


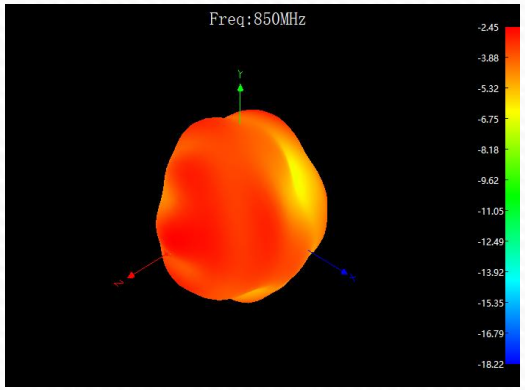


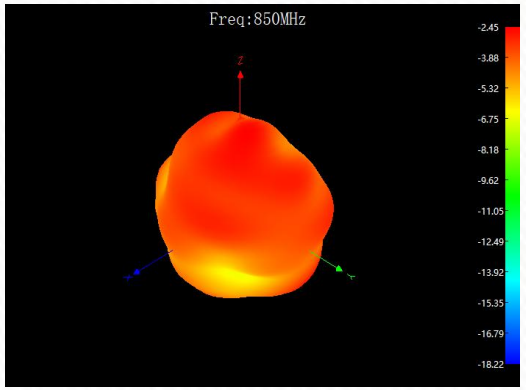


Main antenna Directional pattern

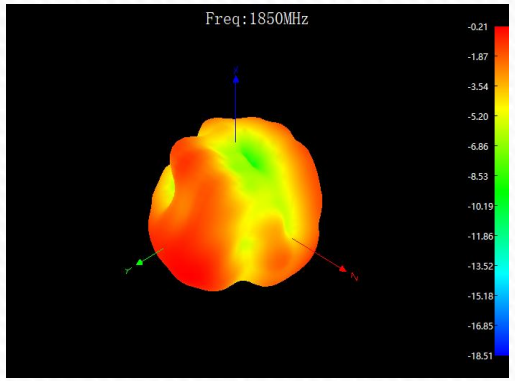
850Mhz

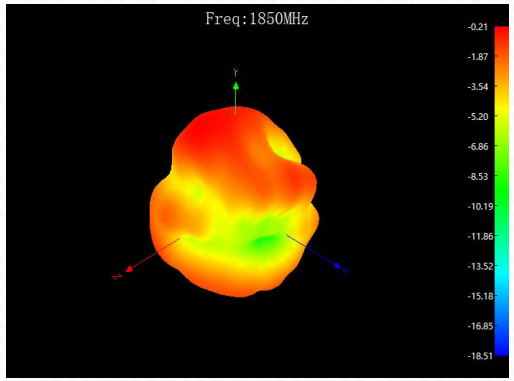


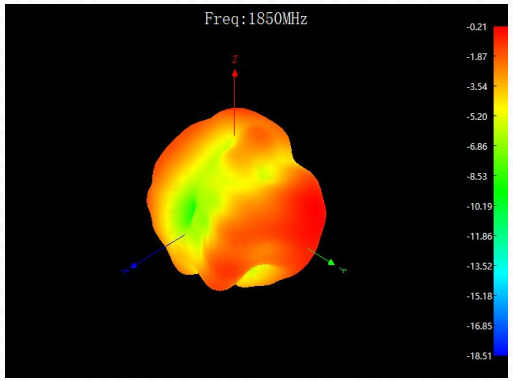




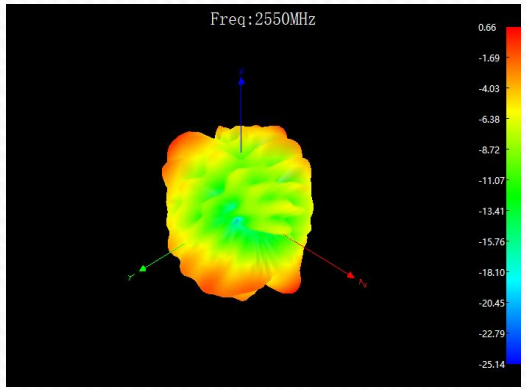
1850MHz

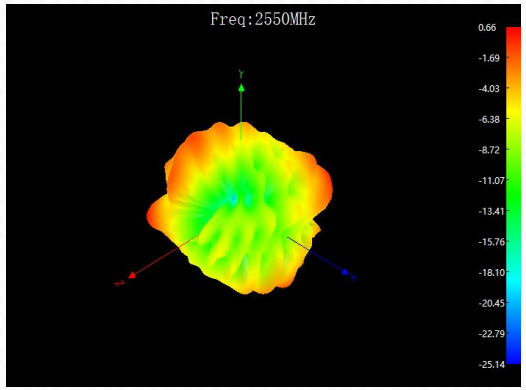


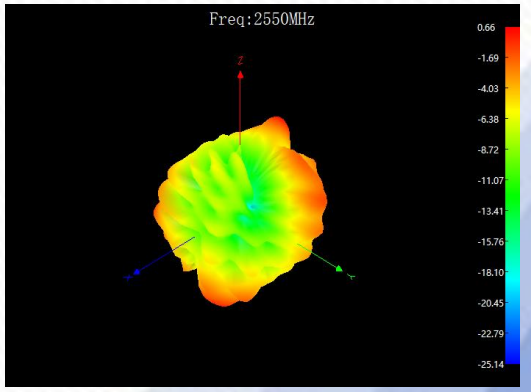




2550Mhz

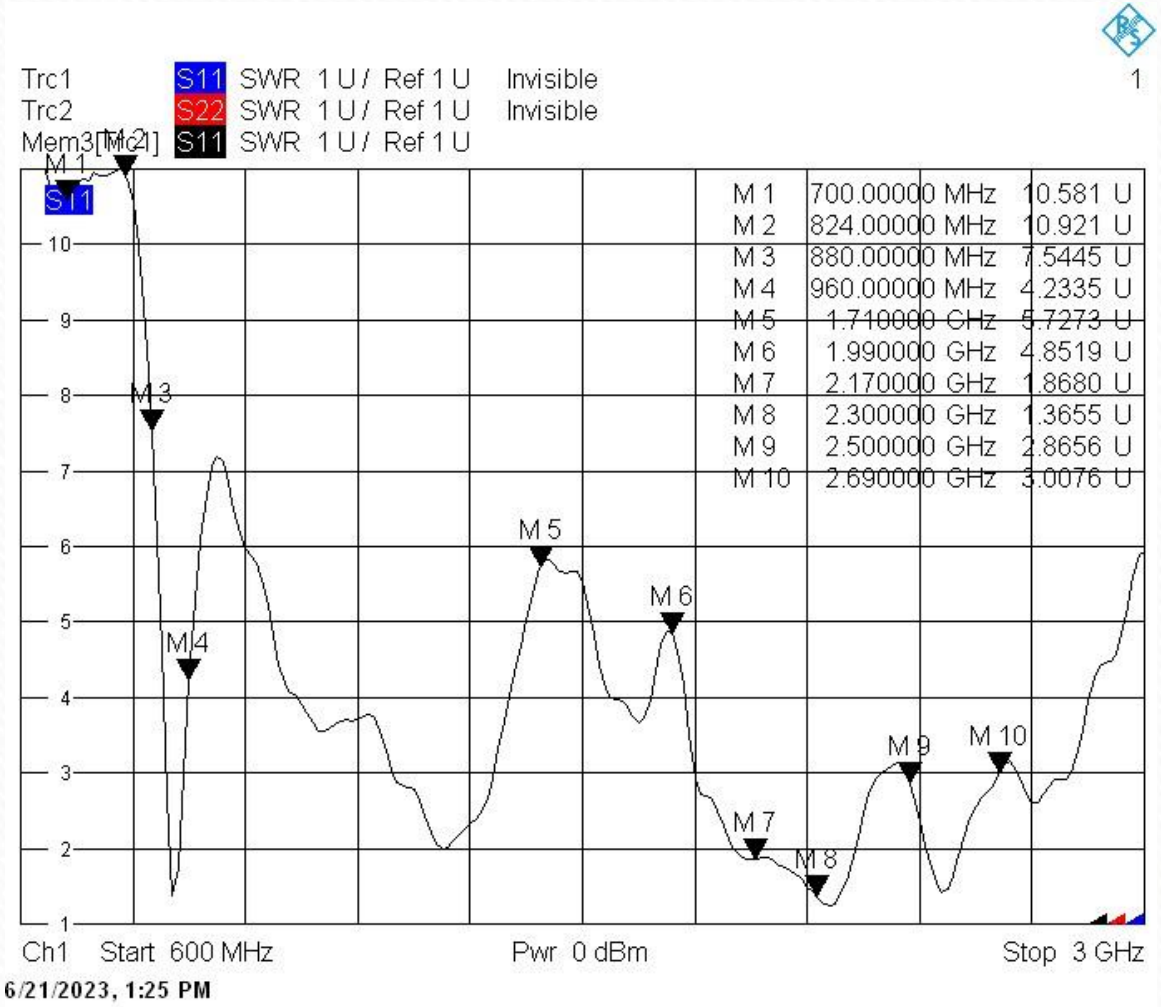






Diversity antenna data

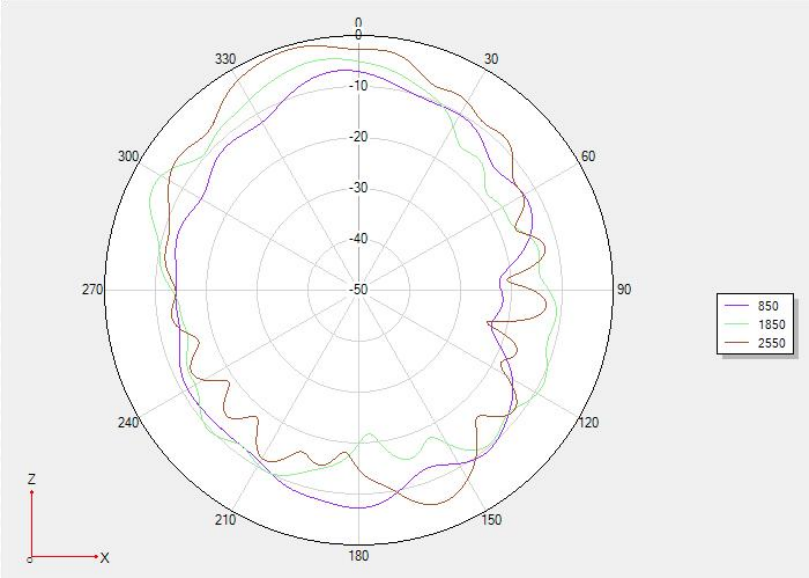
S11-VSWR

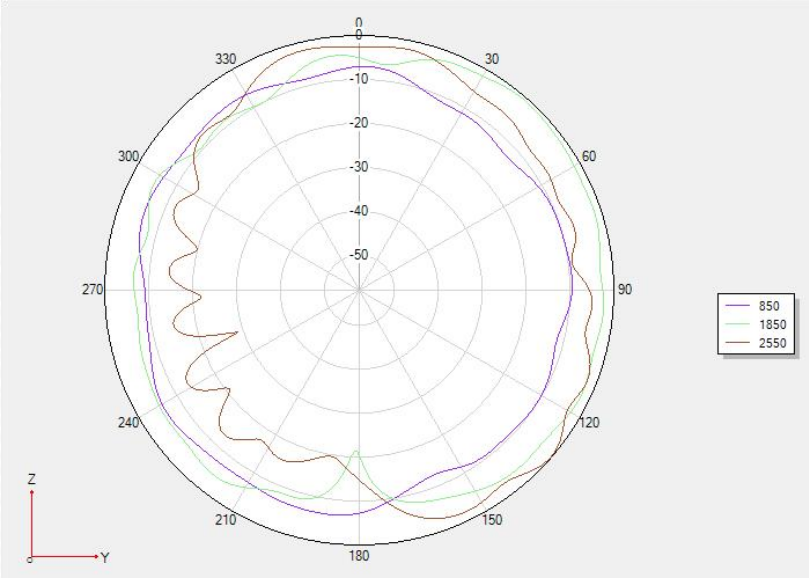


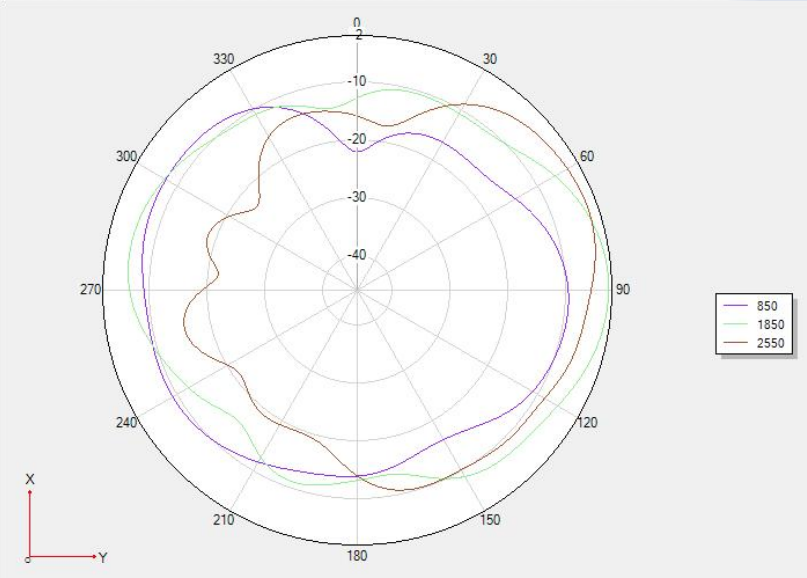
Diversity antenna efficiency and gain

Frequency/Mhz	Efficiency / %	MaxGain/dBi	Frequency/Mhz	Efficiency / %	MaxGain/dBi	Frequency/Mhz	Efficiency / %	MaxGain/dBi
700	0.06	-22.49	1710	10.52	-3.22	2220	22.86	0.18
720	0.06	-22.37	1740	8.2	-5.19	2250	25.94	0.36
740	0.07	-22.95	1770	7.01	-6.77	2280	28.31	0.83
760	0.13	-21.21	1800	5.62	-6.62	2310	28.12	0.94
780	0.23	-20.06	1830	5.45	-5.93	2340	28.05	1.23
800	0.35	-19.81	1860	6.08	-4.49	2370	24.55	0.63
820	0.56	-17.33	1890	6.81	-4.22	2400	19.82	-0.9
840	0.93	-15.13	1920	7.18	-5.04	2430	16.6	-1.53
860	1.75	-12.17	1950	6.76	-6.37	2460	15.49	-0.56
880	3.37	-9.31	1980	6.46	-7.04	2490	19.1	1.77
900	7.82	-5.65	2010	6.07	-6.55	2520	22.8	2.93
920	16.11	-1.92	2040	14.19	-2.81	2550	27.48	4.48
940	14.49	-1.42	2070	20.32	-1.03	2580	29.17	5.23
960	8.17	-4.2	2100	20.75	-0.28	2610	26.3	4.94
			2130	20.42	-0.35	2640	22.13	4.48
			2160	20	-0.68	2670	19.68	3.97
			2190	20.61	-0.41			

Directional pattern Directional pattern

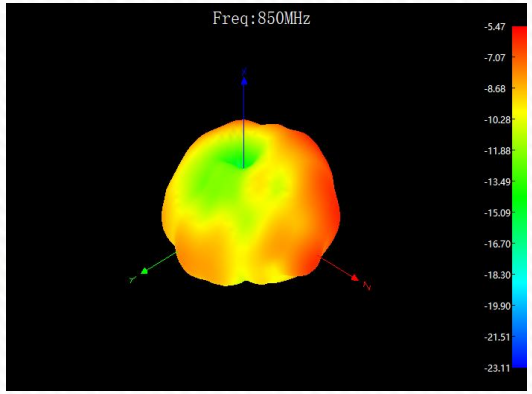


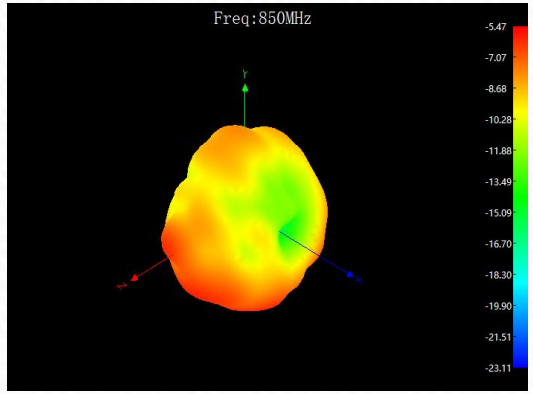


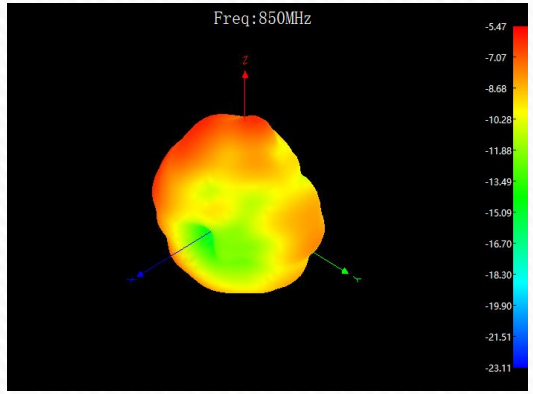


Directional pattern Directional pattern

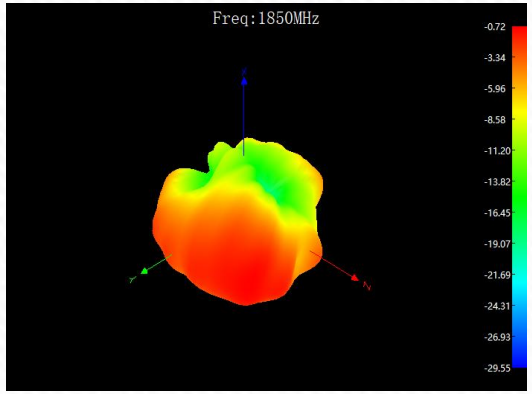
850Mhz

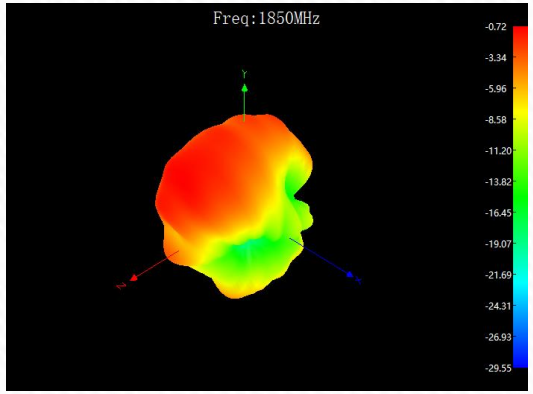


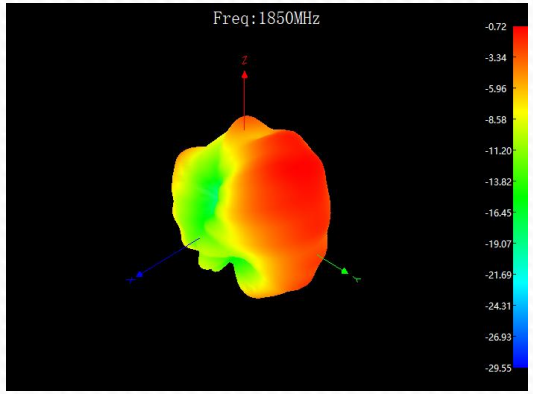




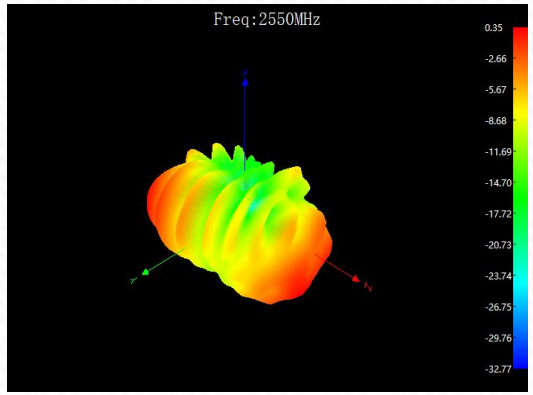
1850MHz

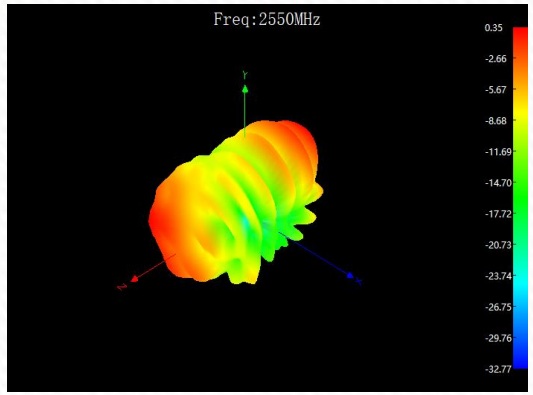


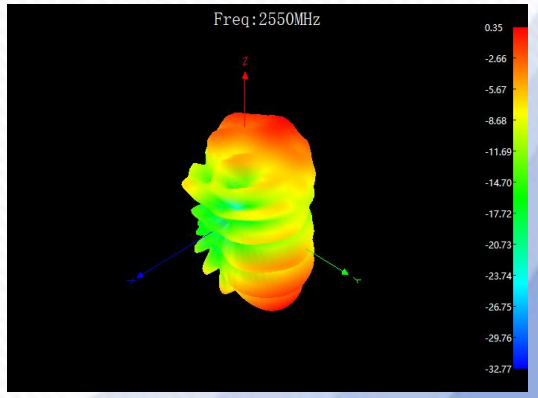




2550Mhz

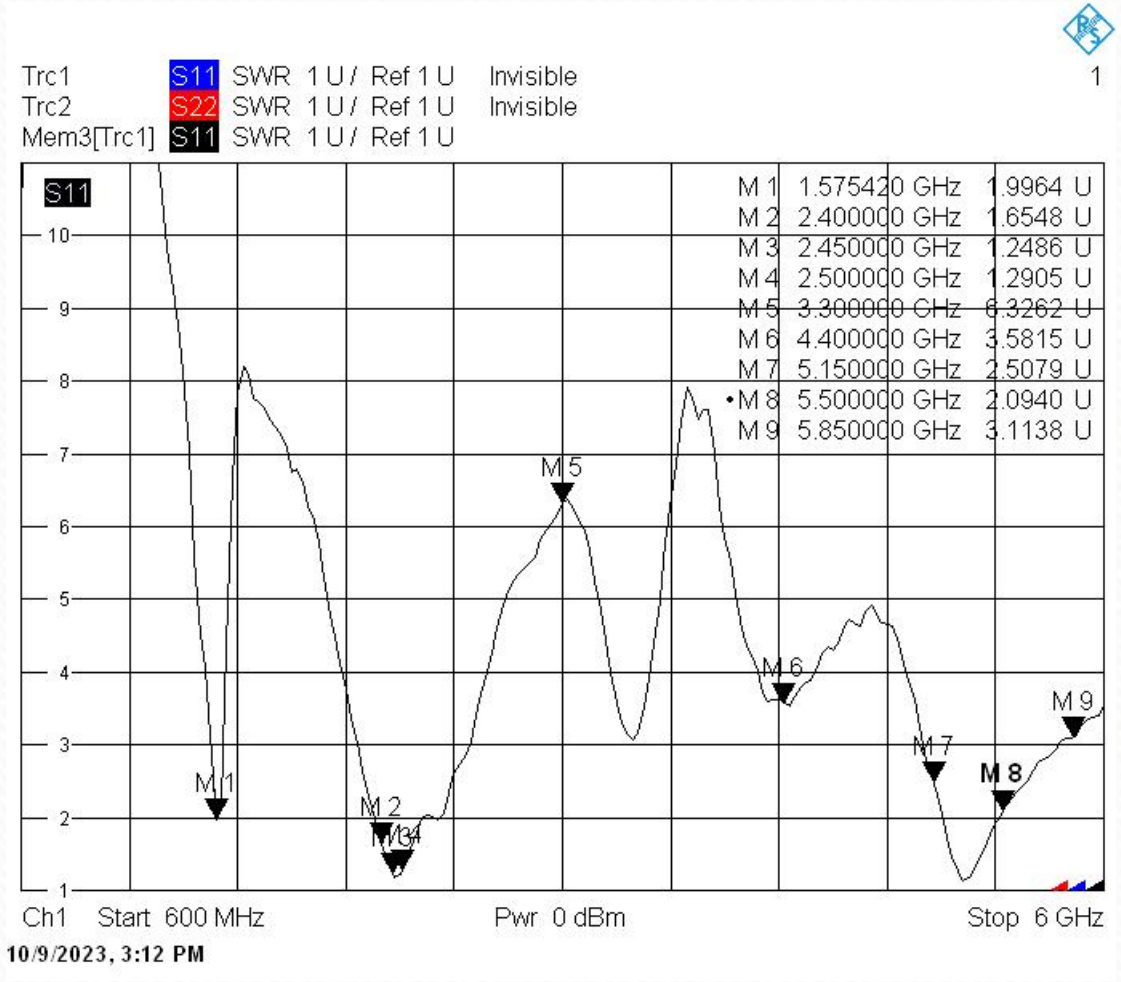






Three-in-one antenna

S11-VSWR



Three-in-one antenna efficiency and gain

Frequency/Mhz	Efficiency / %	MaxGain/dBi	Frequency/Mhz	Efficiency / %	MaxGain/dBi
1550	38.28	0.28	5150	36.9	2.14
1555	39.08	0.78	5200	40.46	3.14
1560	39.63	1.29	5250	44.87	4.3
1565	39.81	1.42	5300	47.53	4.47
1570	40.18	1.4	5350	48.42	4.35
1575	39.08	1.02	5400	48.08	3.8
1580	38.28	0.81	5450	45.39	3.18
1585	36.48	0.46	5500	43.25	2.75
1590	34.91	0.03	5550	38.55	2.22
2400	46.53	2.63	5600	34.36	2.02
2410	46.68	2.18	5650	31.26	2.73
2420	48.08	2.88	5700	28.97	2.22
2430	49.18	2.67	5750	26.85	2.23
2440	50.31	2.92	5800	24.1	1.93
2450	50.63	3.15	5850	20.75	1.19
2460	49.5	2.64			
2470	49.18	2.83			
2480	47.61	2.72			
2490	47.92	2.87			
2500	48.55	3.36			

WIFI antenna OTA data

1#

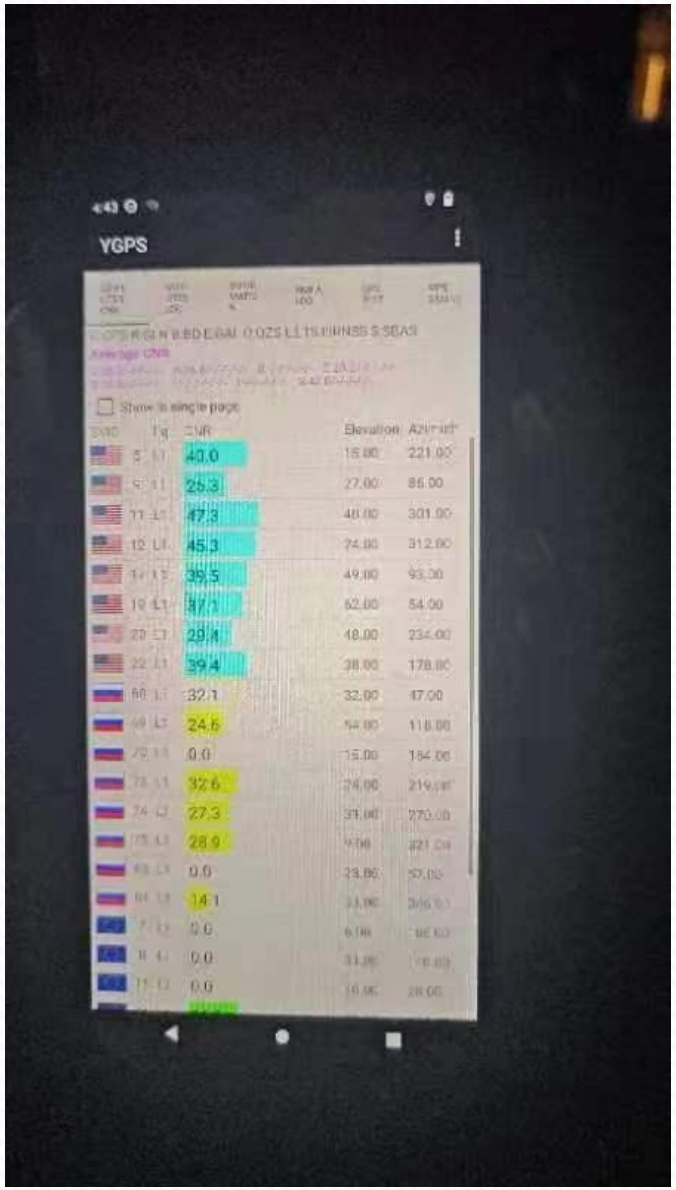
			Total-Bright screen	Total-Out of the screen	D-value				Total-Bright screen	Total-Out of the screen	D-value
Measurement	Band	Channel	Total	Total		Measurement	Band	Channel	Total	Total	
TRP	WIFI_B (1M)	1	14.46			TRP	WIFI_A (6M)	36	9.26		
TRP	WIFI_B (1M)	7	14.18			TRP	WIFI_A (6M)	149	11.45		
TRP	WIFI_B (1M)	13	14.47			TRP	WIFI_A (6M)	165	9.56		
TIS(EIRP)	WIFI_B (11M)	13	-86.38	-86.23	0.15	TIS(EIRP)	WIFI_A (54M)	165	-73.6	-73.12	0.48
TRP	WIFI_G (6M)	1	14.31			TRP	WIFI_N_UNII (6.5M)	36	7.4		
TRP	WIFI_G (6M)	7	13.96			TRP	WIFI_N_UNII (6.5M)	149	9.87		
TRP	WIFI_G (6M)	13	14.18			TRP	WIFI_N_UNII (6.5M)	165	8.55		
TIS(EIRP)	WIFI_G (54M)	13	-72.42	-72.86	-0.44	TIS(EIRP)	WIFI_N_UNII (65M)	165	-69.46	-69.75	-0.29
TRP	WIFI_N_ISM (6.5M)	1	13.27								
TRP	WIFI_N_ISM (6.5M)	7	11.58								
TRP	WIFI_N_ISM (6.5M)	13	12.33								
TIS(EIRP)	WIFI_N_ISM (65M)	13	-68.1	-68.53	-0.43						

WIFI antenna OTA data

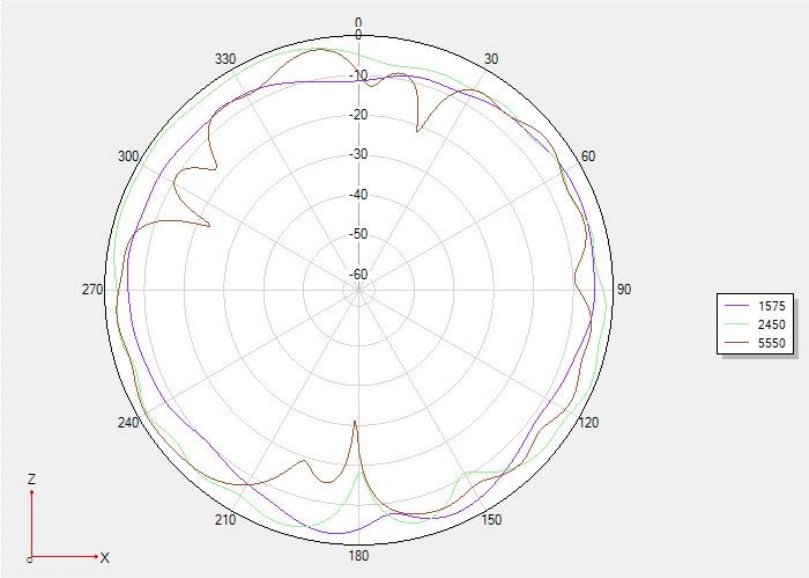
2#

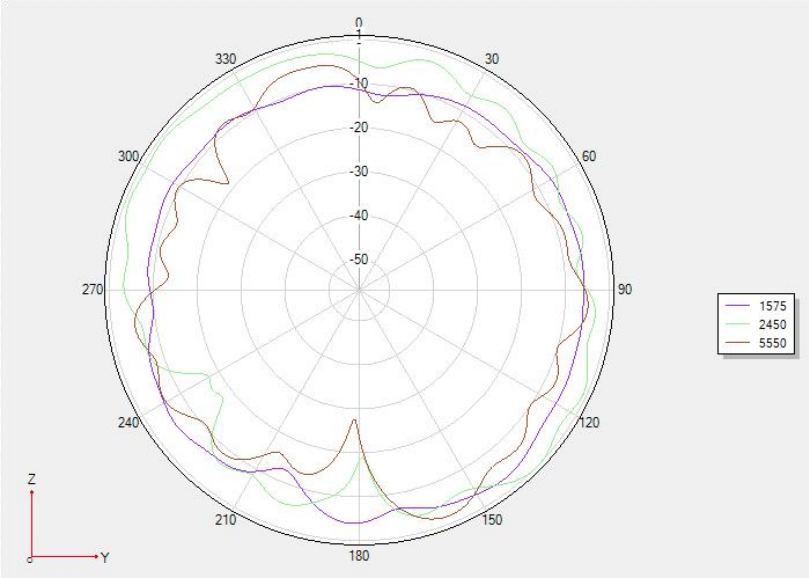
			Total-Bright screen	Total-Out of the screen	D-value				Total-Bright screen	Total-Out of the screen	D-value
Measurement	Band	Channel	Total	Total		Measurement	Band	Channel	Total	Total	
TRP	WIFI_B (1M)	1	14.28			TRP	WIFI_A (6M)	36	10.09		
TRP	WIFI_B (1M)	7	13.74			TRP	WIFI_A (6M)	149	11.59		
TRP	WIFI_B (1M)	13	14.51			TRP	WIFI_A (6M)	165	10.9		
TIS(EIRP)	WIFI_B (11M)	13	-86.57	-86.5	0.07	TIS(EIRP)	WIFI_A (54M)	165	-74.05	-74.35	-0.3
TRP	WIFI_G (6M)	1	14.52			TRP	WIFI_N_UNII (6.5M)	36	7.12		
TRP	WIFI_G (6M)	7	14.04			TRP	WIFI_N_UNII (6.5M)	149	10.08		
TRP	WIFI_G (6M)	13	14.69			TRP	WIFI_N_UNII (6.5M)	165	8.91		
TIS(EIRP)	WIFI_G (54M)	13	-72.57	-72.4	0.17	TIS(EIRP)	WIFI_N_UNII (65M)	165	-70.04	-69.06	0.98
TRP	WIFI_N_ISM (6.5M)	1	13.45								
TRP	WIFI_N_ISM (6.5M)	7	11.73								
TRP	WIFI_N_ISM (6.5M)	13	12.95								
TIS(EIRP)	WIFI_N_ISM (65M)	13	-68.35	-68.54	-0.19						

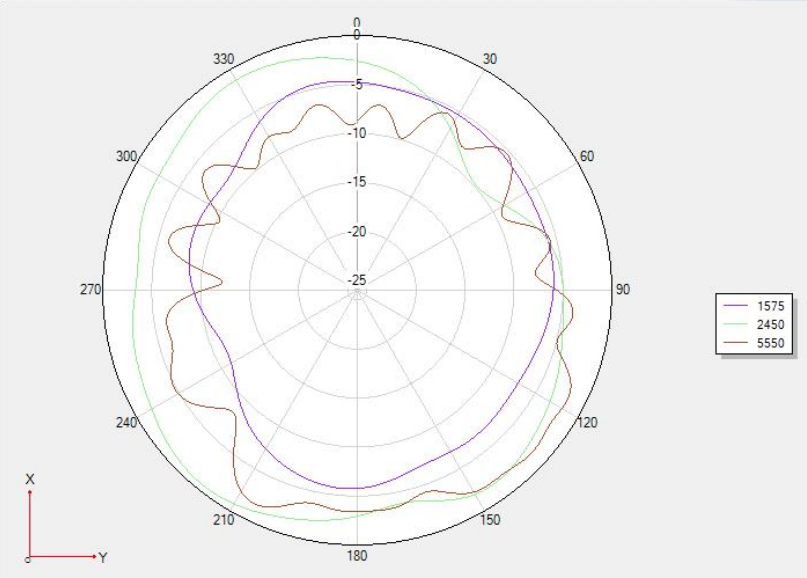
GPS actual measured data



Three-in-one antenna directional pattern

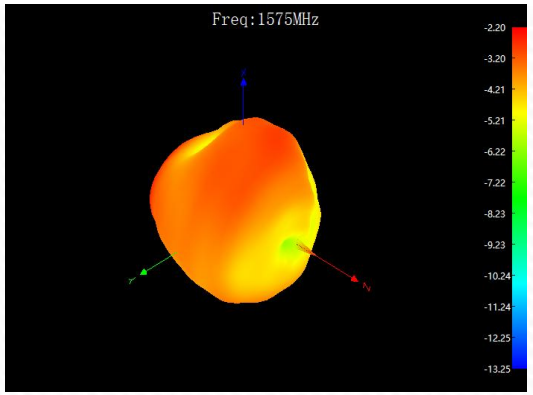


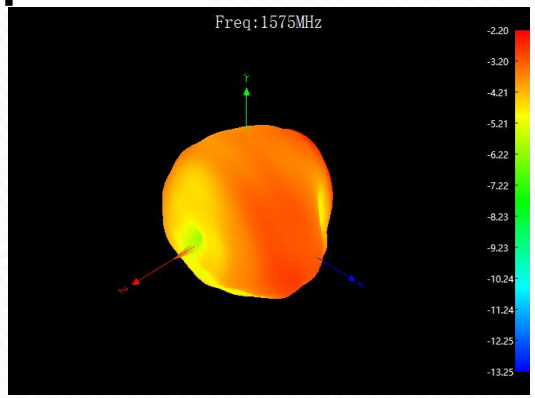


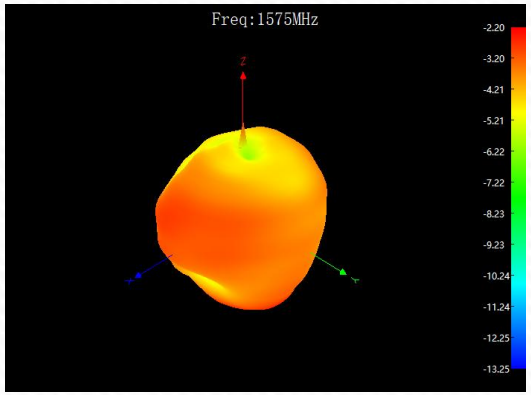


Three-in-one antenna directional pattern

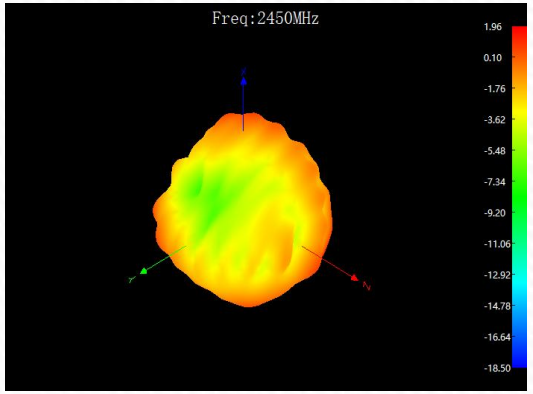
1575Mhz

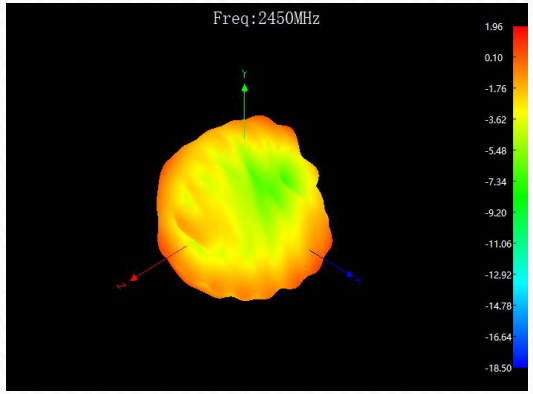


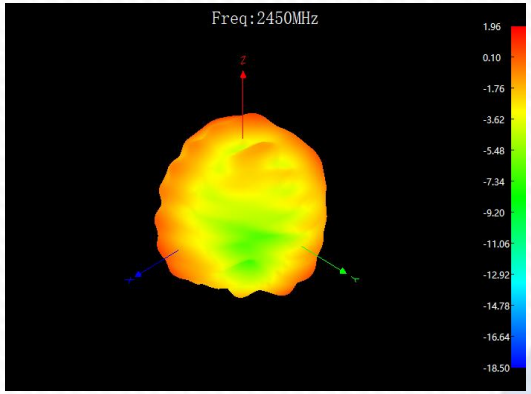




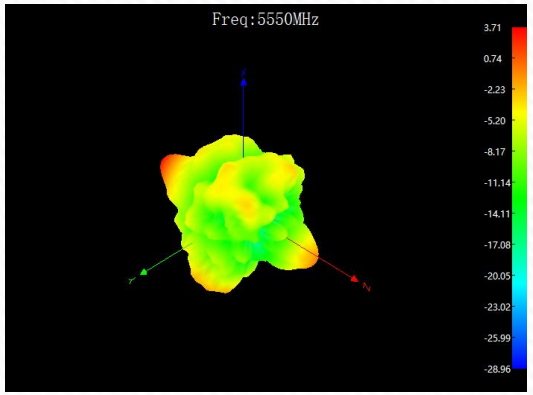
2450MHz

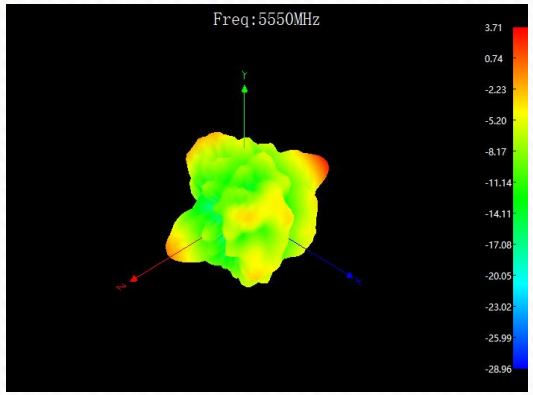


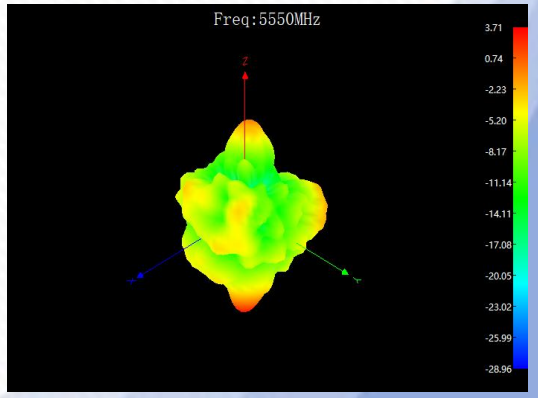




5550Mhz

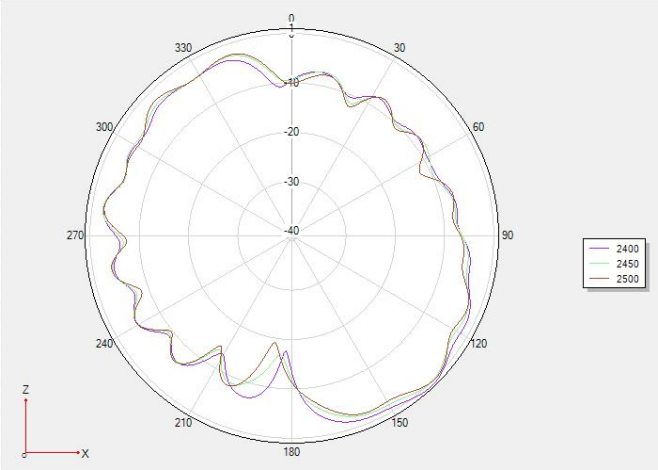




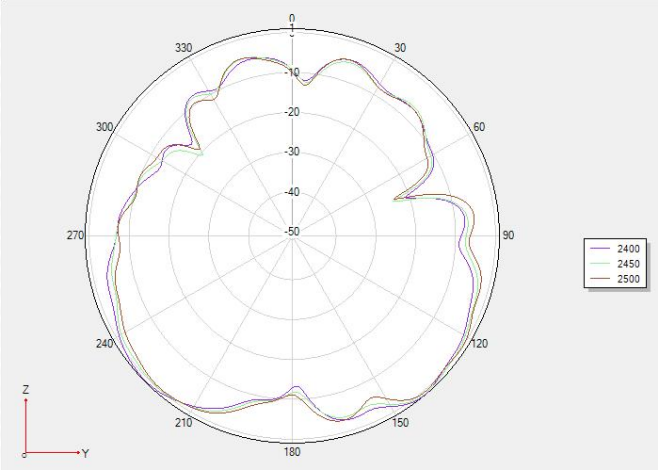


Three-in-one antenna directional pattern

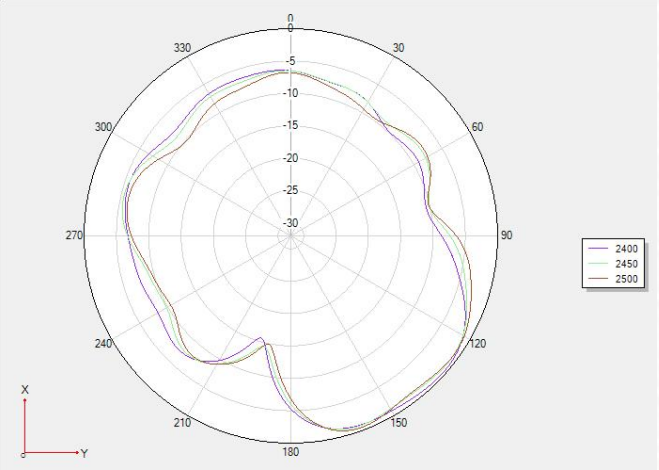
phi 0°

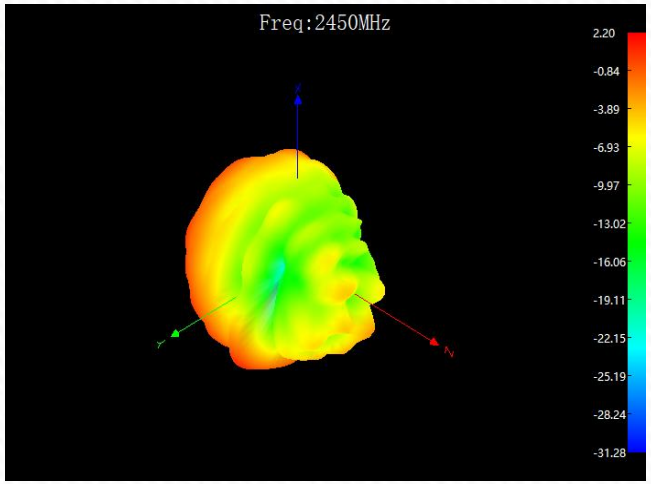


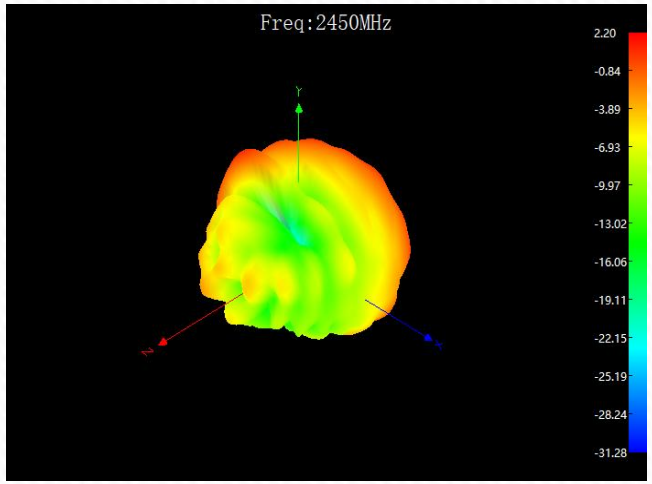
phi 90°

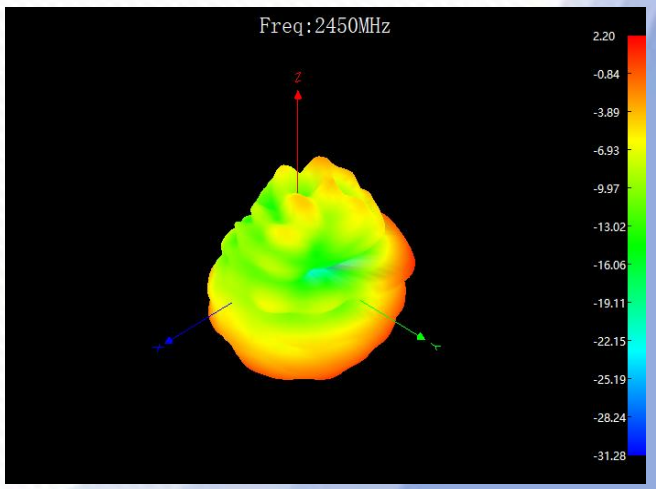


theta 90°



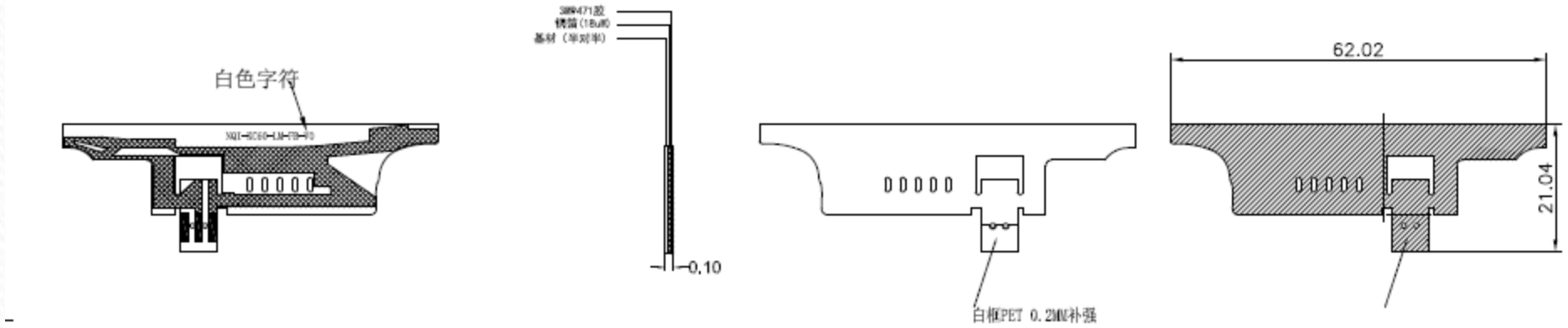






Antenna dimension figure (mm)

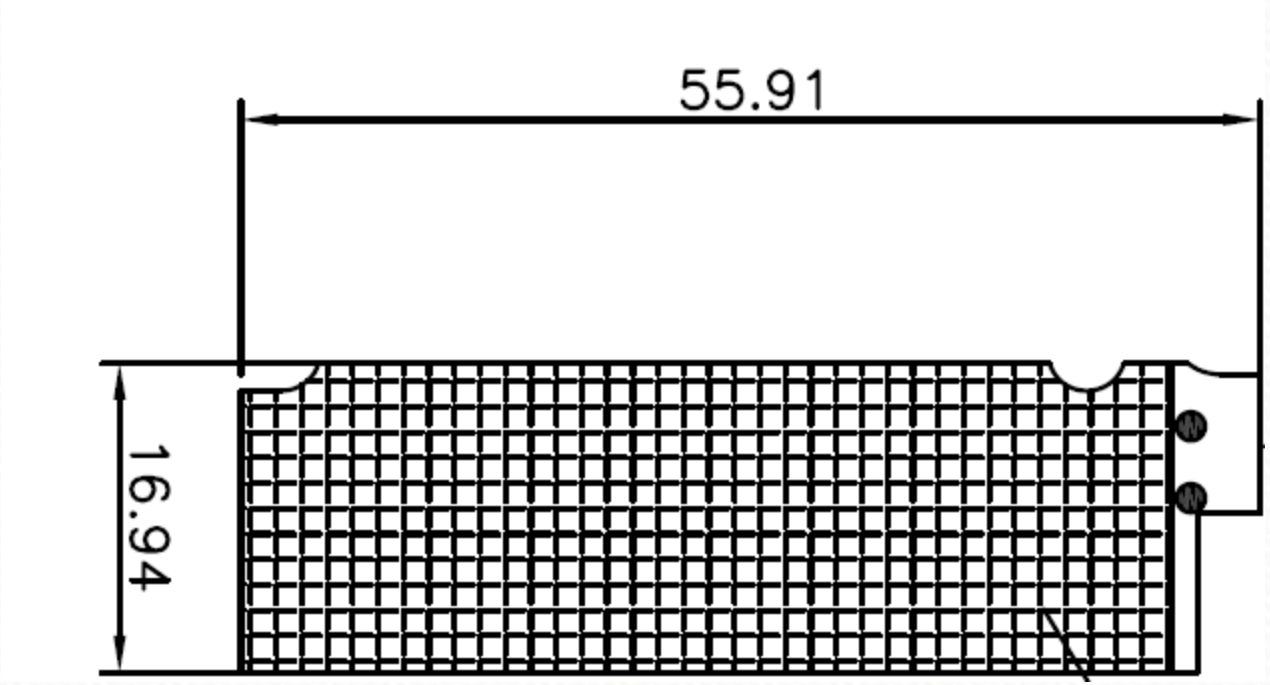
4G main ANT



Antenna dimension figure (mm)

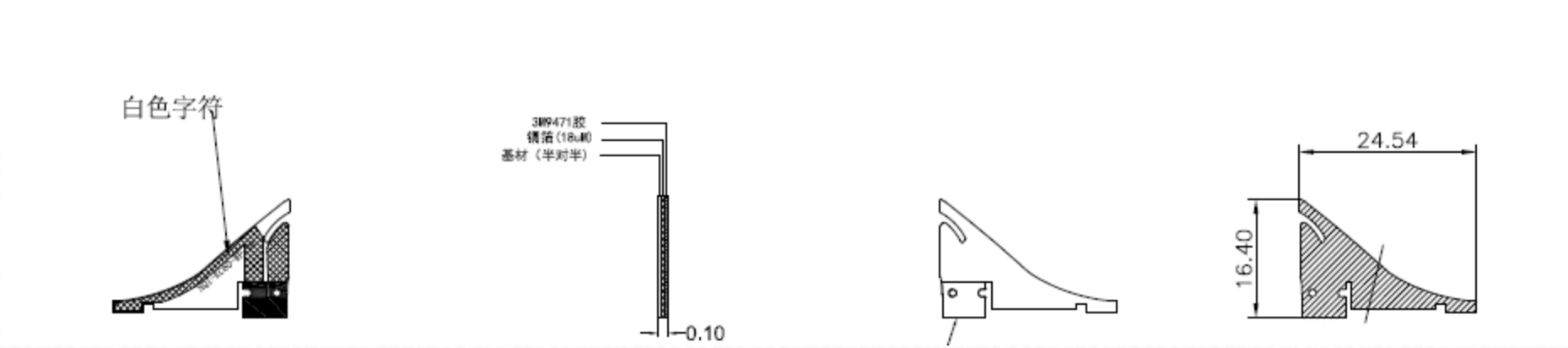
We statement that All measurements were performed radiated and therefore additional antenna gain documentation is not required.

NFC ANT



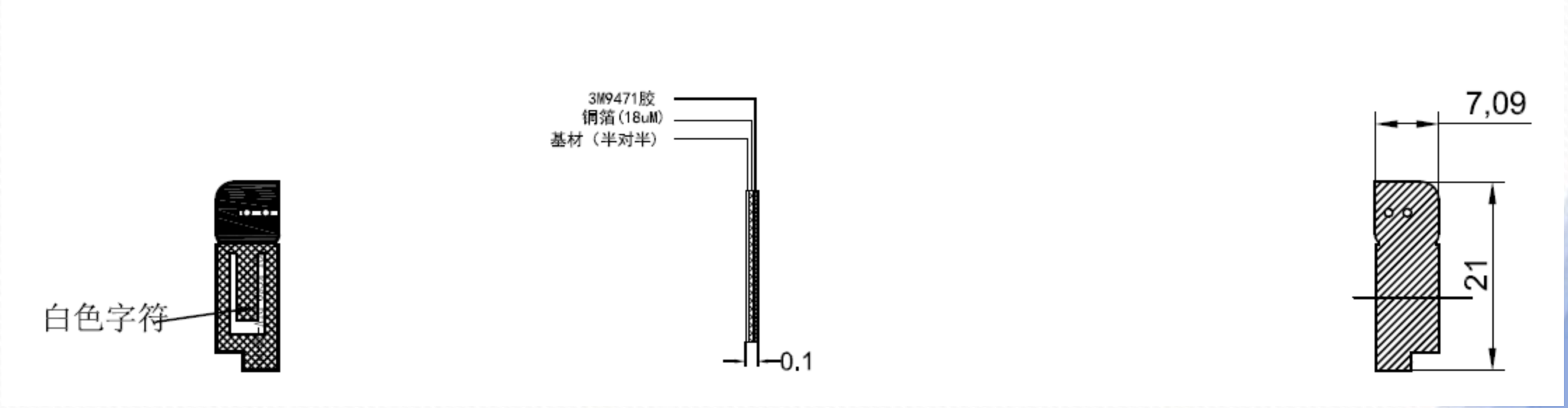
Antenna dimension figure (mm)

BT&WLAN&GPS ANT



Antenna dimension figure (mm)

4G DIV ANT



Summary

1. The antenna matching is not changed.

2. The antenna environment is not increased.

3. The antenna performance test is OK.

Thank You

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