

Shenzhen Etheta Communication
Technology Co., Ltd.
(Shenzhen Etheta)

Customer: TCL Communication Ltd.

Project name: T614WS

Product name: T614WS - cellular & wifi antenna

Date: 2024.02.29

1. Antenna specification and test location

Antenna 0/1/2/3/4/5/6/7

Material: FPC

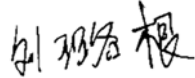
Manufacturer: Shenzhen Etheta

Manufacturer Address: Zone B, 3rd Floor, Building 1, Baisha Logistics Park, Xili Street, Nanshan District, Shenzhen.

Antenna gain and radiation pattern measured in SATIMO anechoic chamber.

Project date: 2023.12.15 - 2024.01.05

Test engineer: Lugen Liu



Test Equipment list

Description	Manufacturer	Model	Cal Date
Vector Network Analyzer	Agilent Technologies	E5071B	2023.12.14
Anechoic Chamber	SATIMO	SG16	2023.12.14

2. Test system introduction

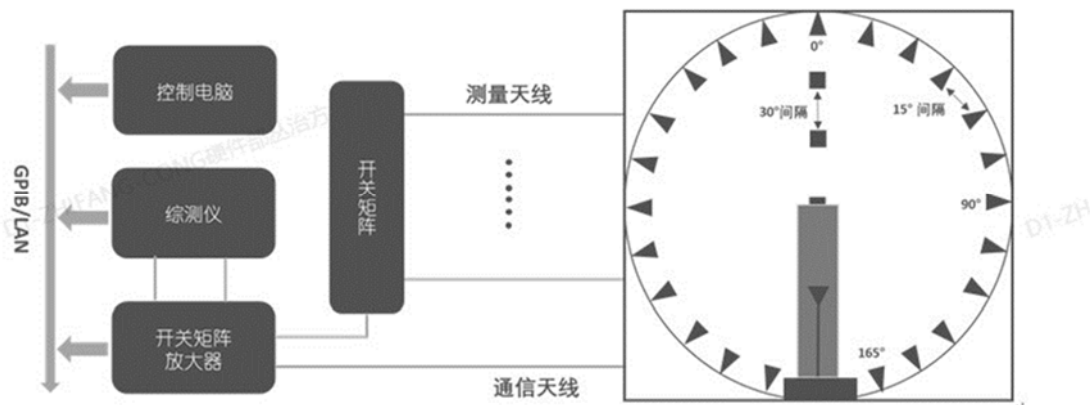
2.1 Anechoic chamber

Our company has a number of anechoic chamber for OTA test. It is ranging from 400 MHz to 8.5 GHz, which can provide passive test and active test, including OTA overall 2G, 3G, 4G, 5G FR test, WiFi multi-mode test, GPS active test, Bluetooth active test. The test system can provide antenna gain, efficiency, radiation pattern, upper and lower hemisphere efficiency values and mutual disturbance correlation coefficient analysis.



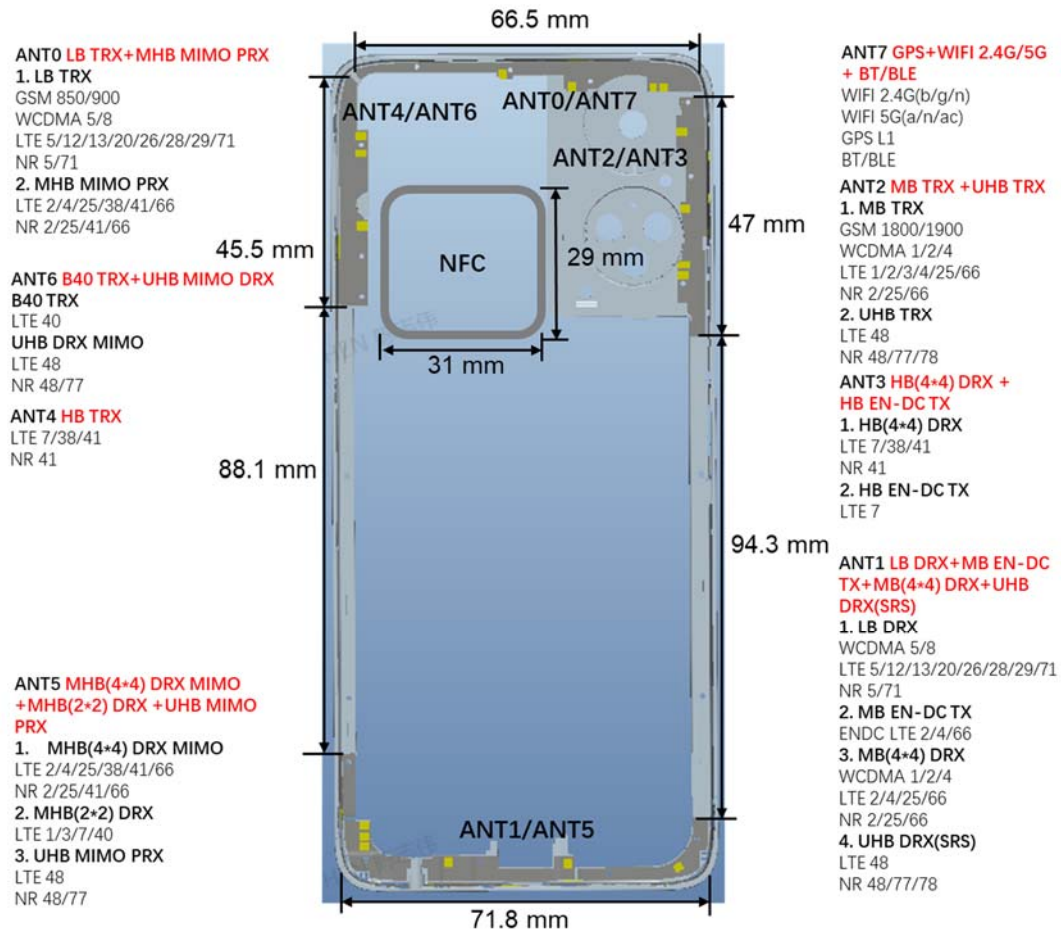
2.2 Test system Architecture

The figure above shows the connection and control process between the anechoic chamber of our company and the testing system and computer. The testing system has the characteristics of accurate, fast and simple testing. The operation interface is simple and humanized.



3. Test result

3.1 Antenna placement:



Antenna	Type	Description
0	FPC	LB TRX+MHB MIMO PRX antenna
1	FPC	LB DRX+MB EN-DC TX+MB(4*4) DRX+UHB DRX(SRS) antenna
2	FPC	MB TRX +UHB TRX antenna
3	FPC	HB(4*4) DRX + HB EN-DC TX antenna
4	FPC	HB TRX antenna
5	FPC	MHB(4*4) DRX MIMO +MHB(2*2) DRX +UHB MIMO PRX antenna
6	FPC	B40 TRX+UHB MIMO DRX antenna
7	FPC	GPS+WIFI 2.4G/5G+ BT antenna

3.2 Antenna Gain

Gain of Antenna 0

Band	Gain average(dBi)	Gain Peak (dBi)
GSM850	-3.03	-2.42
GSM900	-2.89	-2.22
WCDMA B5	-3.03	-2.32
WCDMA B8	-3.21	-2.45
LTE B5	-3.03	-2.32
LTE B12	-1.82	-1.72
LTE B13	-1.83	-1.32
LTE B20	-3.03	-2.32
LTE B26	-3.12	-2.44
LTE B28	-1.91	-1.73
LTE B71	-2.81	-2.58
NR n5	-3.03	-2.32
NR n71	-2.81	-2.48

Gain of Antenna 1

Band	Gain average(dBi)	Gain Peak (dBi)
(ENDC)LTE B2	-0.45	-0.15
(ENDC)LTE B4	-0.52	-0.13
(ENDC)LTE B66	-0.35	-0.17

Gain of Antenna 2

Band	Gain average(dBi)	Gain Peak (dBi)
GSM1800	-0.35	0.12
GSM1900	-0.52	0.07
WCDMA B1	-0.82	-0.17
WCDMA B2	-0.45	-0.15
WCDMA B4	-0.52	-0.13
LTE B1	-0.82	-0.17
LTE B2	-0.45	-0.15
LTE B3	-0.60	-0.11
LTE B4	-0.52	-0.13
LTE B25	-0.25	0.17
LTE B48	-3.36	-3.02
LTE B66	-0.35	-0.27
NR n2	-0.45	-0.15
NR n25	-0.25	0.17
NR n48	-3.36	-3.02
NR n66	-0.35	-0.27
NR n77	-3.52	-3.13

NR n78	-3.47	-3.09
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Gain of Antenna 4

Band	Gain average(dBi)	Gain Peak (dBi)
LTE B7	-0.62	-0.35
LTE B38	-1.46	-0.52
LTE B41	-1.63	-1.21
NR n41	-1.63	-1.21

Gain of Antenna 6

Band	Gain average(dBi)	Gain Peak (dBi)
LTE B40	-0.85	-0.54

Gain of Antenna 7

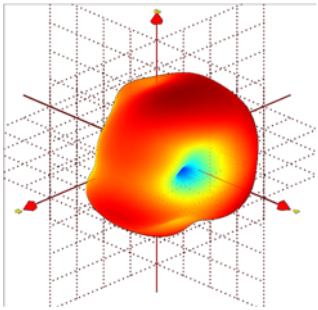
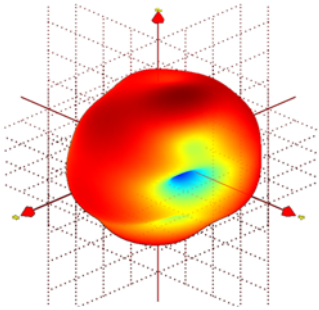
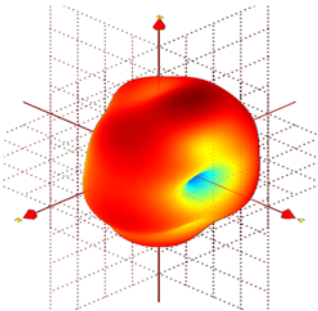
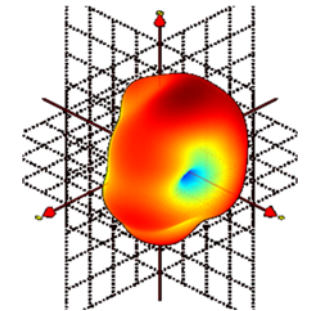
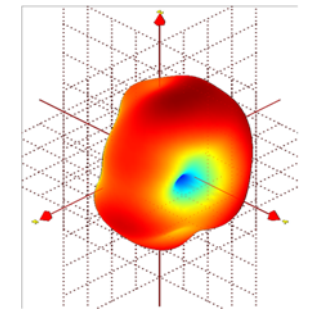
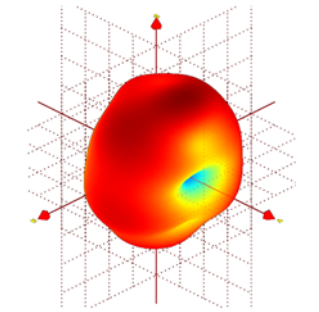
Band	Gain average(dBi)	Gain Peak (dBi)
GPS	-2.05	-1.78
Wi-Fi 2.4G/BT	-5.12	-4.75
Wi-Fi 5G	-5.12	-4.88

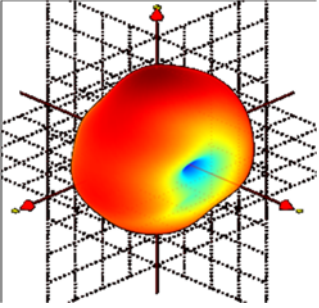
NFC antenna gain description:

The device does not support the test of NFC gain. In addition, all measurements were performed radiated and therefore additional antenna gain documentation is not required.

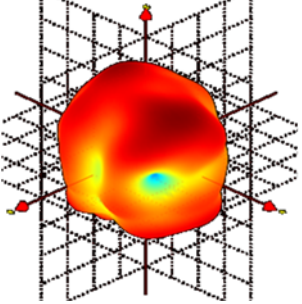
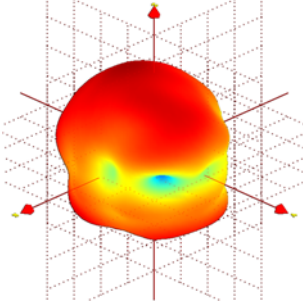
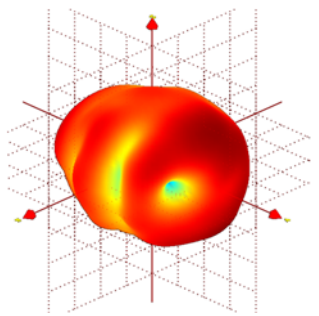
3.3 Radiation Pattern

Antenna 0

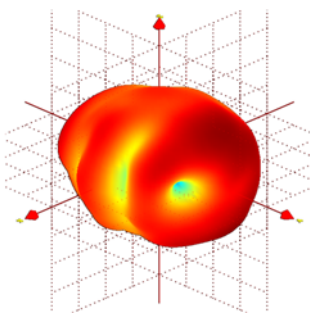
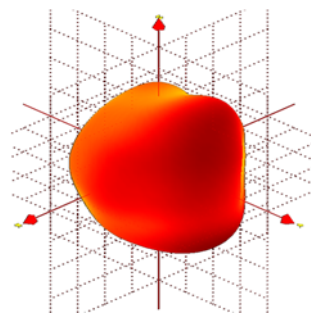
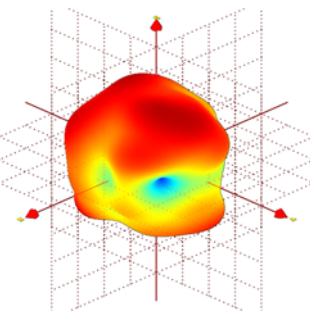
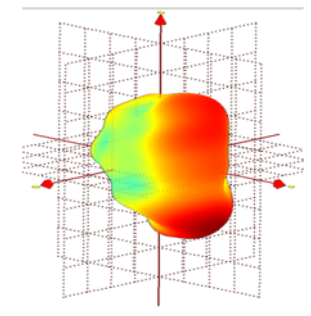
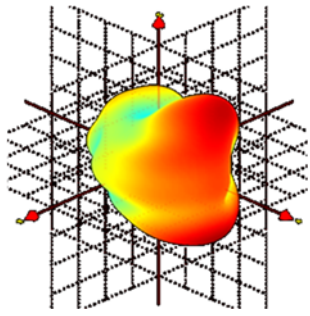
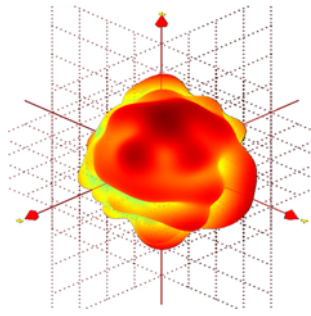
(Frequency Band)	B5	B12
3D Radiation Pattern		
Efficiency[%]	22	19
Avg Gain [dBi]	-3.03	-1.82
Peak Gain [dBi]	-2.32	-1.72
(Frequency Band)	B13	B20
3D Radiation Pattern		
Efficiency[%]	22	23
Avg Gain [dBi]	-1.83	-3.03
Peak Gain [dBi]	-1.32	-2.32
(Frequency Band)	B26	B28
3D Radiation Pattern		
Efficiency[%]	22	20
Avg Gain [dBi]	-3.12	-1.91
Peak Gain [dBi]	-2.44	-1.73
(Frequency Band)	B71	

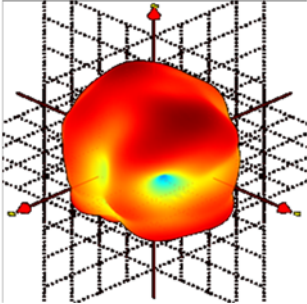
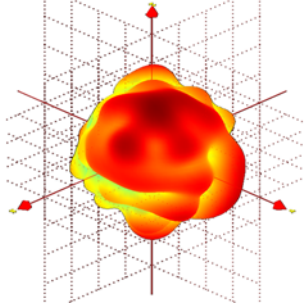
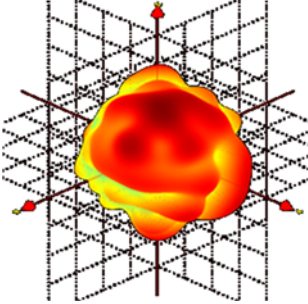
3D Radiation Pattern	
Efficiency[%]	20
Avg Gain [dBi]	-2.81
Peak Gain [dBi]	-2.58

Antenna 1

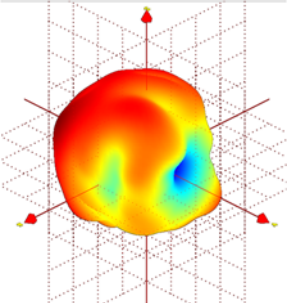
(Frequency Band)	B2	B4
3D Radiation Pattern		
Efficiency[%]	34	41
Avg Gain [dBi]	-0.45	-0.52
Peak Gain [dBi]	-0.15	-0.13
(Frequency Band)	B66	
3D Radiation Pattern		
Efficiency[%]	40	
Avg Gain [dBi]	-0.35	
Peak Gain [dBi]	-0.17	

Antenna 2

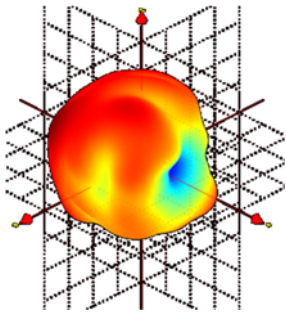
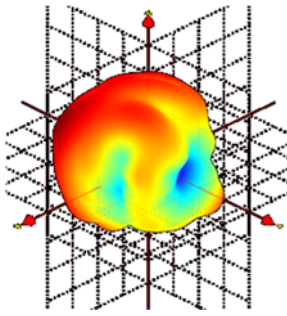
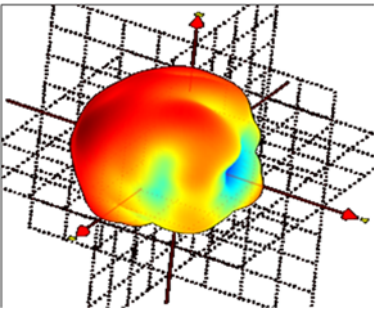
(Frequency Band)	B1	B2
3D Radiation Pattern		
Efficiency[%]	30	33
Avg Gain [dBi]	-0.82	-0.45
Peak Gain [dBi]	-0.17	-0.15
(Frequency Band)	B3	B4
3D Radiation Pattern		
Efficiency[%]	35	36
Avg Gain [dBi]	-0.60	-0.52
Peak Gain [dBi]	-0.11	-0.13
(Frequency Band)	B25	B48
3D Radiation Pattern		
Efficiency[%]	32	32
Avg Gain [dBi]	-0.25	-3.36
Peak Gain [dBi]	0.17	-3.02
(Frequency Band)	B66	n77

3D Radiation Pattern		
Efficiency[%]	36	28
Avg Gain [dBi]	-0.35	-3.52
Peak Gain [dBi]	-0.27	-3.13
(Frequency Band)	n78	
3D Radiation Pattern		
Efficiency[%]	30	
Avg Gain [dBi]	-3.47	
Peak Gain [dBi]	-3.09	

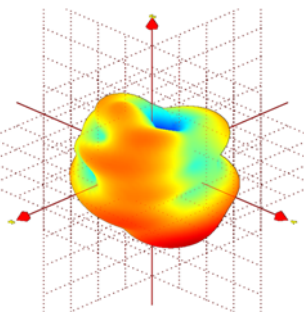
Antenna 3

(Frequency Band)	B7	
3D Radiation Pattern		
Efficiency[%]	6	
Avg Gain [dBi]	-10.12	
Peak Gain [dBi]	-8.06	

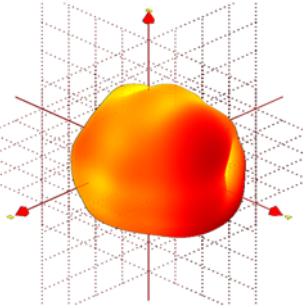
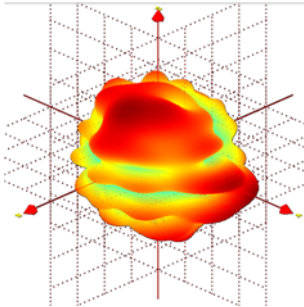
Antenna 4

(Frequency Band)	B7	B38
3D Radiation Pattern		
Efficiency[%]	23	25
Avg Gain [dBi]	-0.62	-1.46
Peak Gain [dBi]	-0.35	-0.52
(Frequency Band)	B41/n41	
3D Radiation Pattern		
Efficiency[%]	24	
Avg Gain [dBi]	-1.63	
Peak Gain [dBi]	-1.21	

Antenna 6

(Frequency Band)	B40
3D Radiation Pattern	
Efficiency[%]	17
Avg Gain [dBi]	-0.85
Peak Gain [dBi]	-0.54

Antenna 7

(Frequency Band)	WiFi 2.4G/BT	WiFi 5G
3D Radiation Pattern		
Efficiency[%]	31	32
Avg Gain [dBi]	-5.12	-5.12
Peak Gain [dBi]	-4.75	-4.88