2021.12.21

RA-N2112-31

APPROVAL SHEET

MODEL : TuffTalk-New

Antenna layout

Review	Consent	Approval

Messrs. SENA Technology Co.,Ltd

RadiNa Co. ,Ltd

TEL:+82-2-463-0373

FAX:+82-2-463-0374

Table of contents

1. Revision History

NO.	Before	After	Reason	Date
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				

2. Product Information

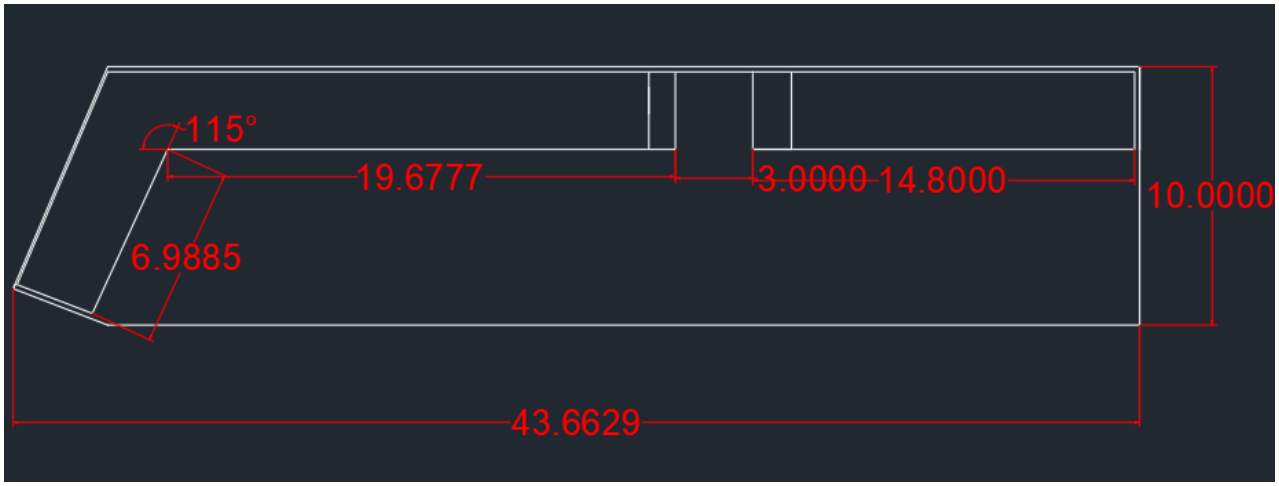
2.1 General Features

PART NUMBER	GradiANT
ANTENNA TYPE	PCB Pattern Antenna
APPLICATIONS	Bluetooth

2.2 Electrical Specifications

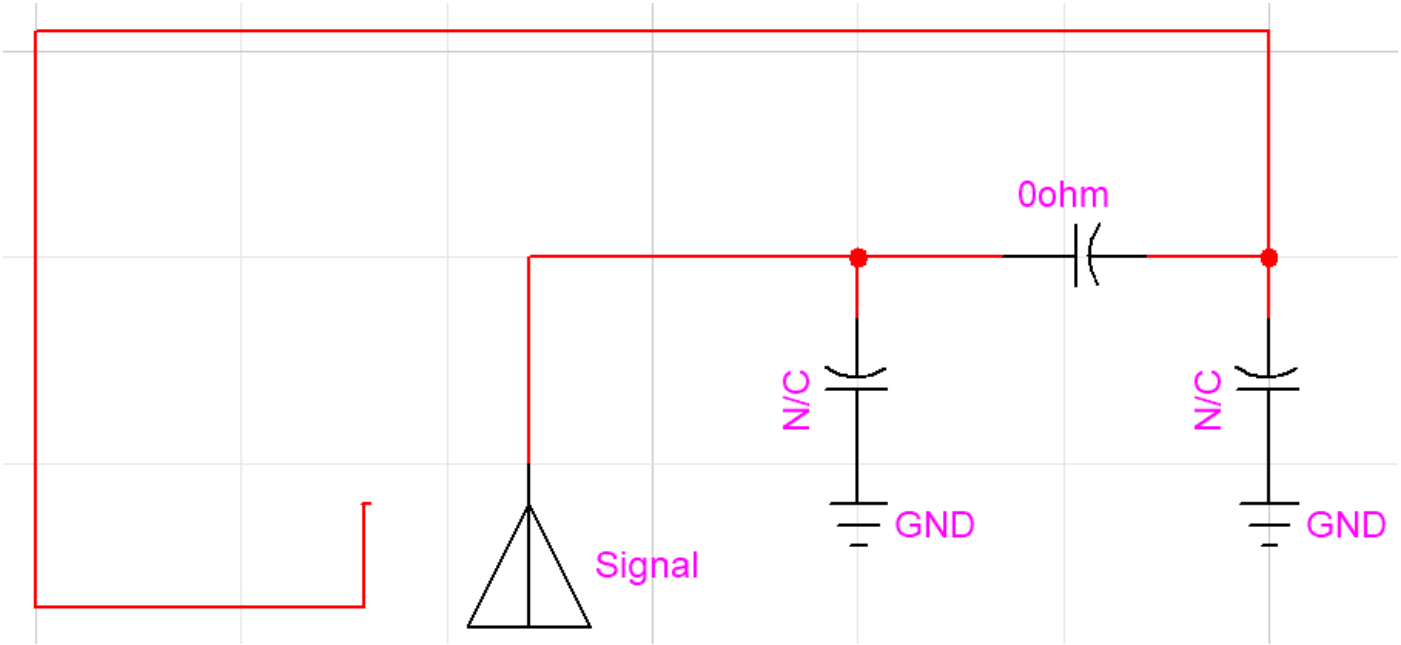
Frequency Range1 (TX)		2400MHz~2485MHz	
Frequency Range1 (RX)		2400MHz~2485MHz	
IMPEDANCE		50 Ω	
V.S.W.R	TX	2400MHz	2485MHz
		3↓	3↓
	RX	2400MHz	2485MHz
		3↓	3↓
RADIATION PATTERN		Omni-directional	
POLARIZATION		Linear	

3. Pattern Specifications



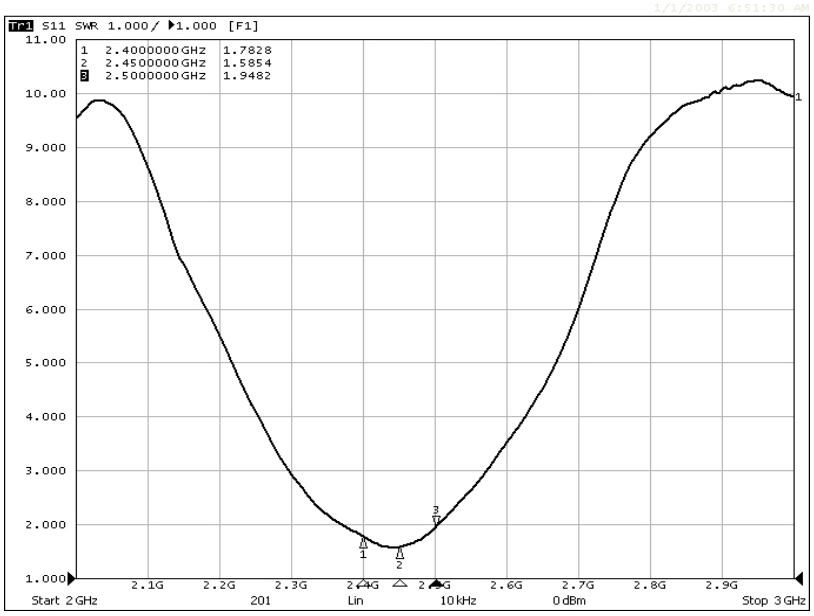
4. Matching Network

Capacitor value can be changed depending on different situation

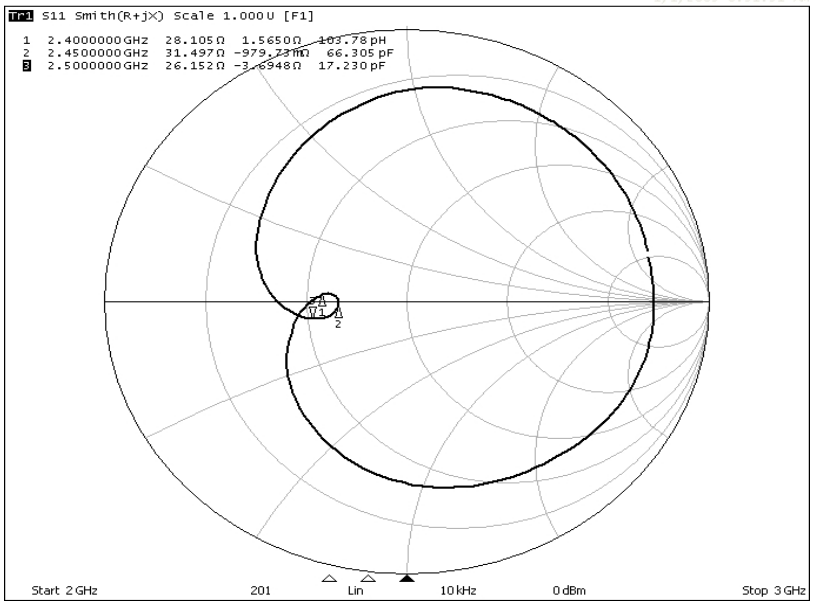


5. Electrical Characterristics

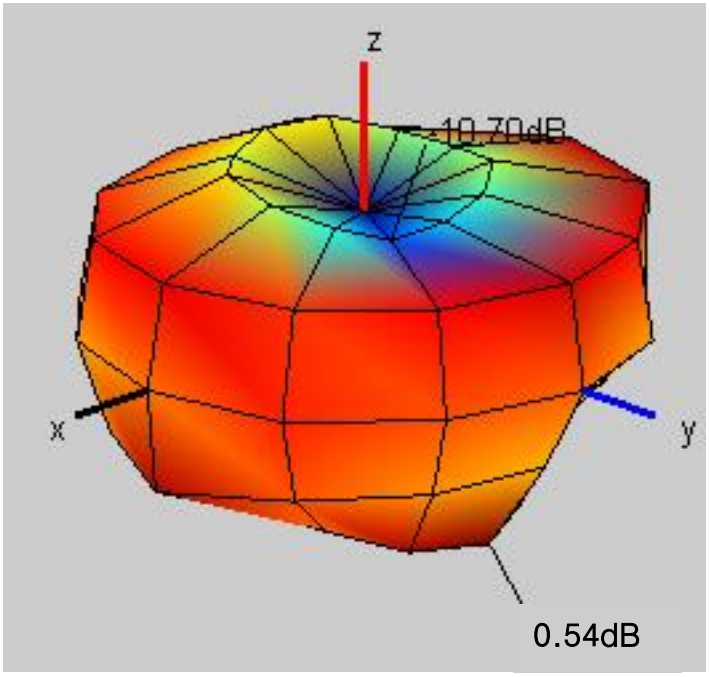
5.1 VSWR



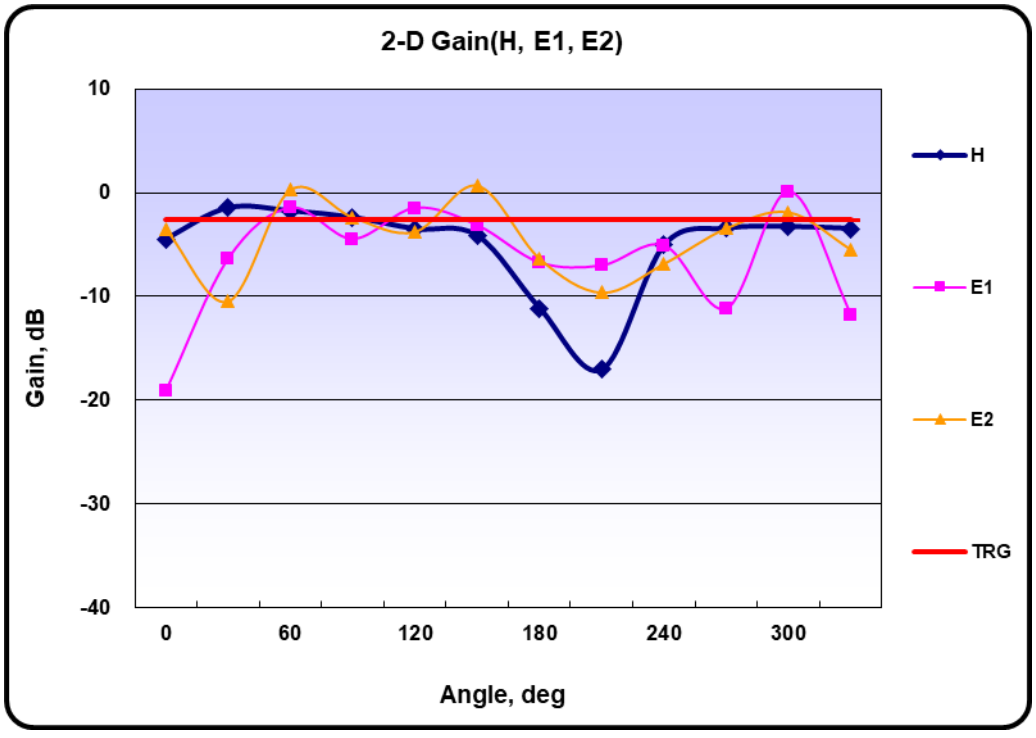
5.2 SMITH CHART



5.3 3D-PLOTs



5.4 2D-GAIN



6. Passive Measurement

	1	2	3	4	5	6	7	8	9	10
Frequency(MHz)	**2400**	**2405**	**2410**	**2415**	**2420**	**2425**	**2430**	**2435**	**2440**	**2445**
Efficiency(dB)	**-3.41**	**-3.39**	**-3.15**	**-2.92**	**-3.08**	**-3.04**	**-2.87**	**-2.67**	**-2.64**	**-2.64**
Efficiency(%)	**45.56**	**45.81**	**48.37**	**51.00**	**49.21**	**49.70**	**51.58**	**54.07**	**54.40**	**54.42**
TRG(dB)	**-3.41**	**-3.39**	**-3.15**	**-2.92**	**-3.08**	**-3.04**	**-2.87**	**-2.67**	**-2.64**	**-2.64**
TRG_{Theta}(dB)	-4.51	-4.50	-4.22	-4.01	-4.14	-4.09	-3.83	-3.59	-3.52	-3.50
TRG_{Phi}(dB)	-9.93	-9.86	-9.76	-9.48	-9.72	-9.71	-9.92	-9.88	-10.01	-10.10
UHRG(dB)	-6.30	-6.30	-6.06	-5.78	-5.95	-5.85	-5.62	-5.36	-5.34	-5.28
UHRG/TRG(%)	51.51	51.20	51.27	51.79	51.61	52.27	53.10	53.84	53.72	54.44
H-Plane	-5.40	-5.39	-4.95	-4.70	-4.75	-4.65	-4.33	-4.05	-3.92	-3.86
E1-Plane, AVG(dB)	-5.34	-5.29	-4.98	-4.79	-4.91	-4.89	-4.62	-4.41	-4.36	-4.37
E2-Plane, AVG(dB)	-4.21	-4.18	-3.99	-3.77	-3.90	-3.78	-3.56	-3.31	-3.24	-3.23
Peak Gain(dB)	-0.33	-0.17	0.05	0.32	0.10	0.23	0.41	0.60	0.53	0.54
Directivity(dB)	3.09	3.32	3.21	3.25	3.18	3.27	3.28	3.27	3.17	3.18
Minimum Gain(dB)	-11.37	-9.22	-11.19	-9.45	-9.19	-9.77	-10.48	-10.11	-10.12	-10.70

	11	12	13	14	15	16	17	18	19	20
Frequency(MHz)	**2450**	**2455**	**2460**	**2465**	**2470**	**2475**	**2480**	**2485**	**2490**	**2497**
Efficiency(dB)	**-2.68**	**-2.64**	**-2.40**	**-2.49**	**-2.60**	**-2.63**	**-2.88**	**-3.13**	**-2.85**	**-2.76**
Efficiency(%)	**53.94**	**54.45**	**57.50**	**56.37**	**54.99**	**54.63**	**51.50**	**48.63**	**51.93**	**52.96**
TRG(dB)	**-2.68**	**-2.64**	**-2.40**	**-2.49**	**-2.60**	**-2.63**	**-2.88**	**-3.13**	**-2.85**	**-2.76**
TRG_{Theta}(dB)	-3.52	-3.42	-3.18	-3.27	-3.36	-3.39	-3.67	-3.93	-3.64	-3.56
TRG_{Phi}(dB)	-10.24	-10.51	-10.24	-10.33	-10.52	-10.53	-10.68	-10.86	-10.63	-10.52
UHRG(dB)	-5.29	-5.24	-4.98	-5.07	-5.19	-5.19	-5.47	-5.72	-5.40	-5.32
UHRG/TRG(%)	54.90	54.99	55.22	55.24	55.03	55.39	55.17	55.07	55.57	55.47
H-Plane	-3.88	-3.69	-3.45	-3.54	-3.63	-3.60	-3.93	-4.16	-3.80	-3.74
E1-Plane, AVG(dB)	-4.43	-4.40	-4.17	-4.29	-4.42	-4.46	-4.68	-5.03	-4.75	-4.61
E2-Plane, AVG(dB)	-3.29	-3.23	-2.98	-3.10	-3.24	-3.29	-3.57	-3.90	-3.58	-3.54
Peak Gain(dB)	0.44	0.47	**0.76**	0.58	0.57	0.55	0.30	0.08	0.27	0.39
Directivity(dB)	3.12	3.11	3.16	3.07	3.17	3.18	3.19	3.21	3.11	3.15
Minimum Gain(dB)	-10.53	-10.06	-10.30	-10.79	-10.58	-9.91	-10.24	-11.29	-9.79	-9.23

Average Efficiency	**-2.84dBi,**	**52.05%**
Peak Gain	**0.76dBi,**	

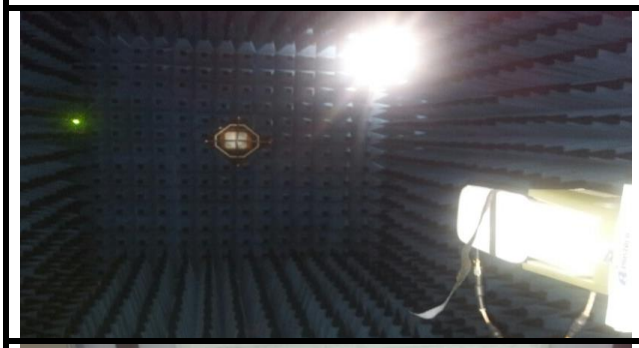
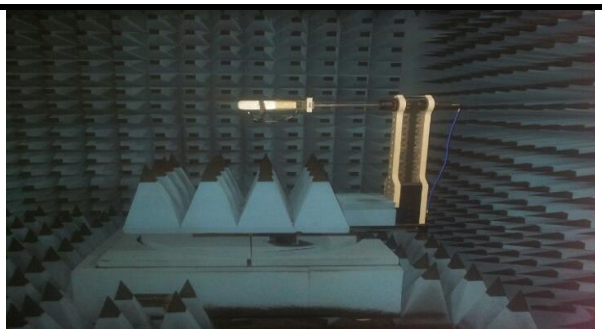
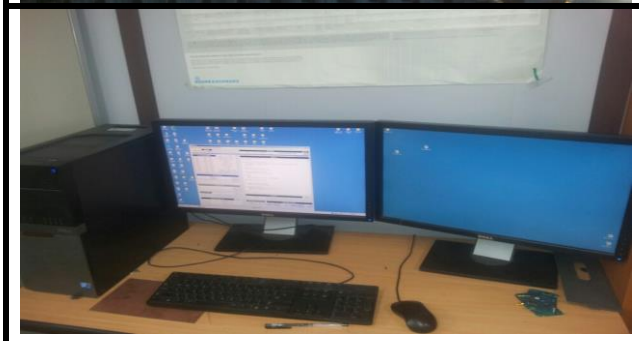
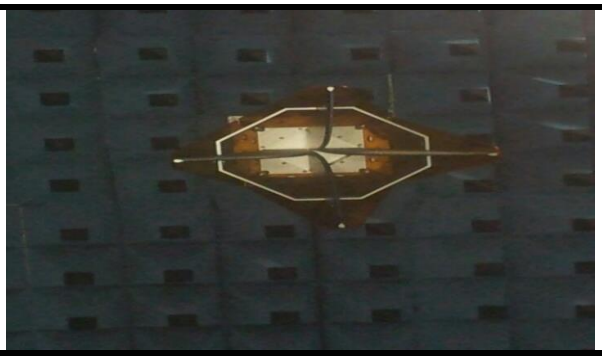
7. Measurement Process

7.1 SWR / Return loss

	Set Condition
Network Analyzer	Agilent 8753ES
Cable	Semi-ridid (40mm, 60mm)
Test condition	

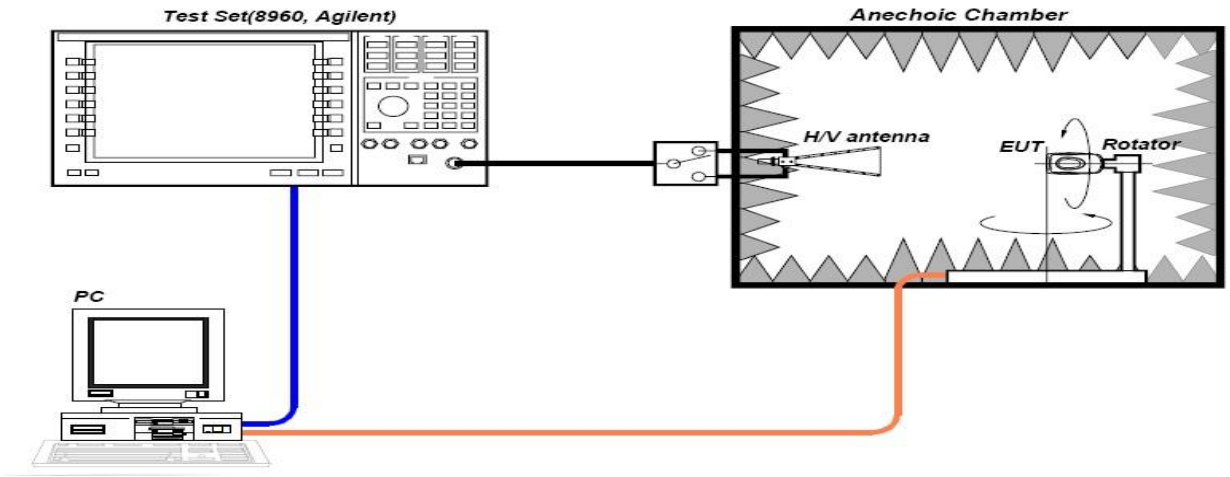
7.2 Gain

Antenna gain is measured in the anechoic chamber of this company.

Anechoic Chamber for Antenna Gain Measurement	
	
	

7.3 Gain test block diagram

Active test Sysetm
- TRP, NHPRP,UHRP
- TIS, NHPIS, UHIS
- Relative Sensitivity



Passiver test Sysetm
- Efficiency
- Peak Gain, Avg, Gain
- Min, Max PWR