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DW009 Satellite Locator Project antenna report

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Report Edition: 20241009 V1.0





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Summary

Introduction to project development

Main antenna	Band		Antenna status	Antenna form	Design area	Match the changes	
	NTN	23/255/256		FPC	PIFA	Bottom of the mockup	not
Other antennas	GPS, Glonass, Galileo, Beidou	1575.42MHz~1602MHz		FPC	PIFA	Mockup top	not
	BT	2.4GHz~2.48GHz		FPC	PIFA	The upper right of the prototype	not
Mockup status	Prototype for trial production		Environmental treatment	There are multiple environmental treatments			

Report version feed

version	date	Content overview
V1.0	20241009	Passive verification of the antenna of the trial production prototype.

NTN antenna matching circuit

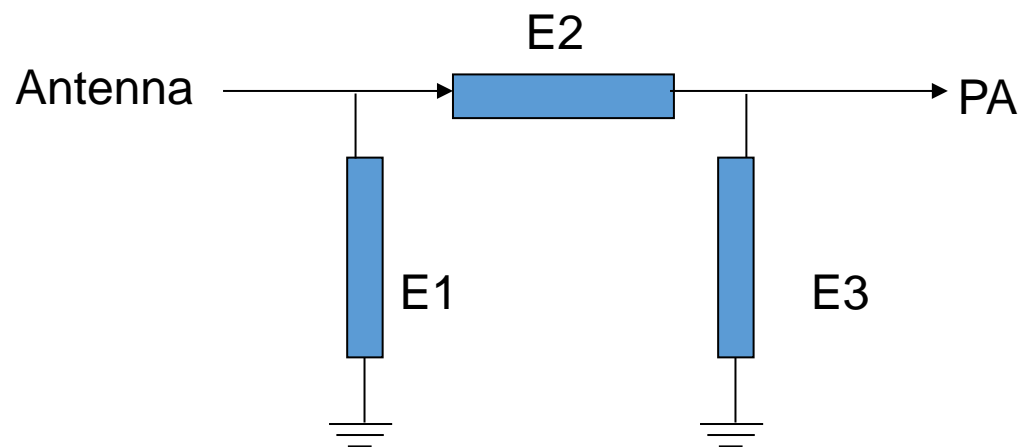
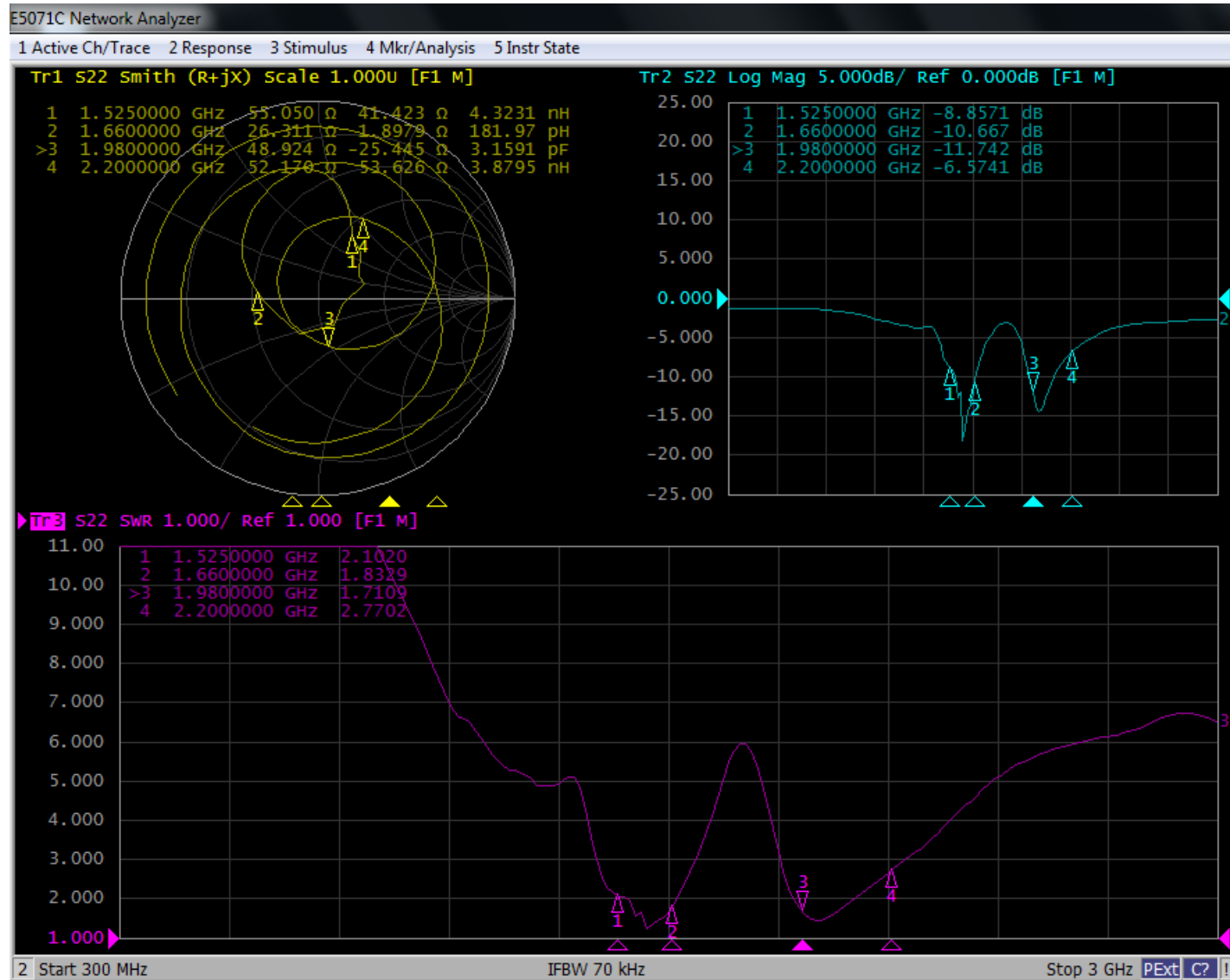
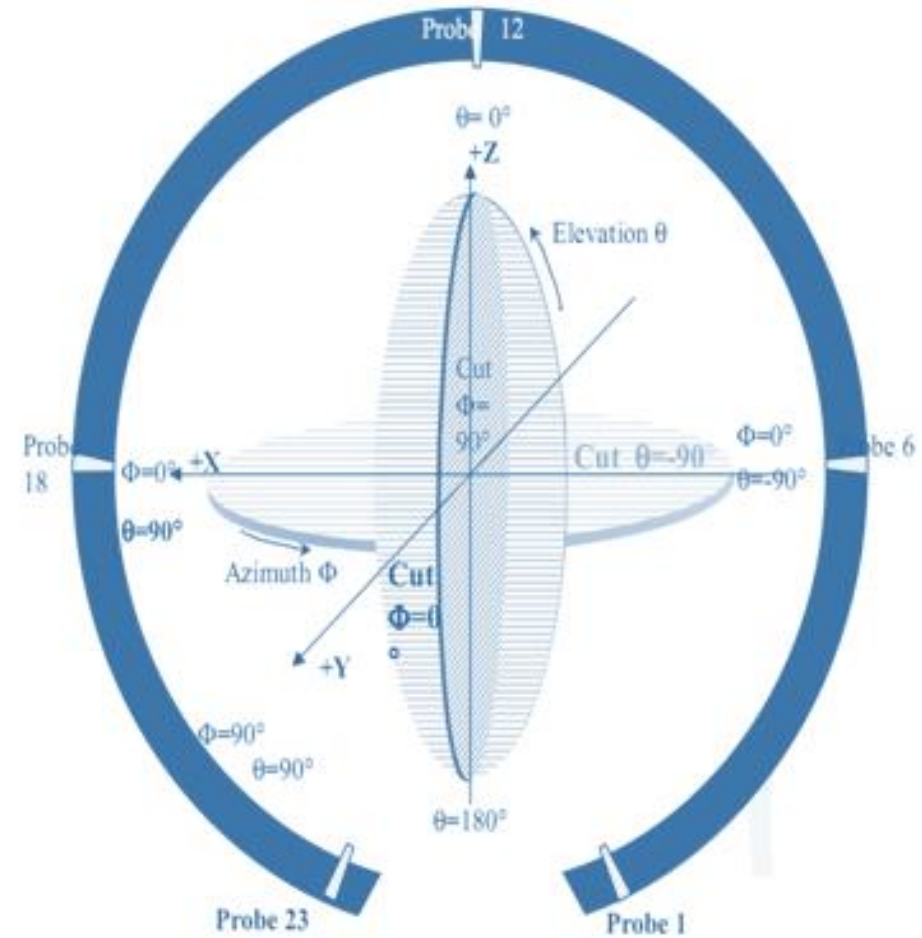
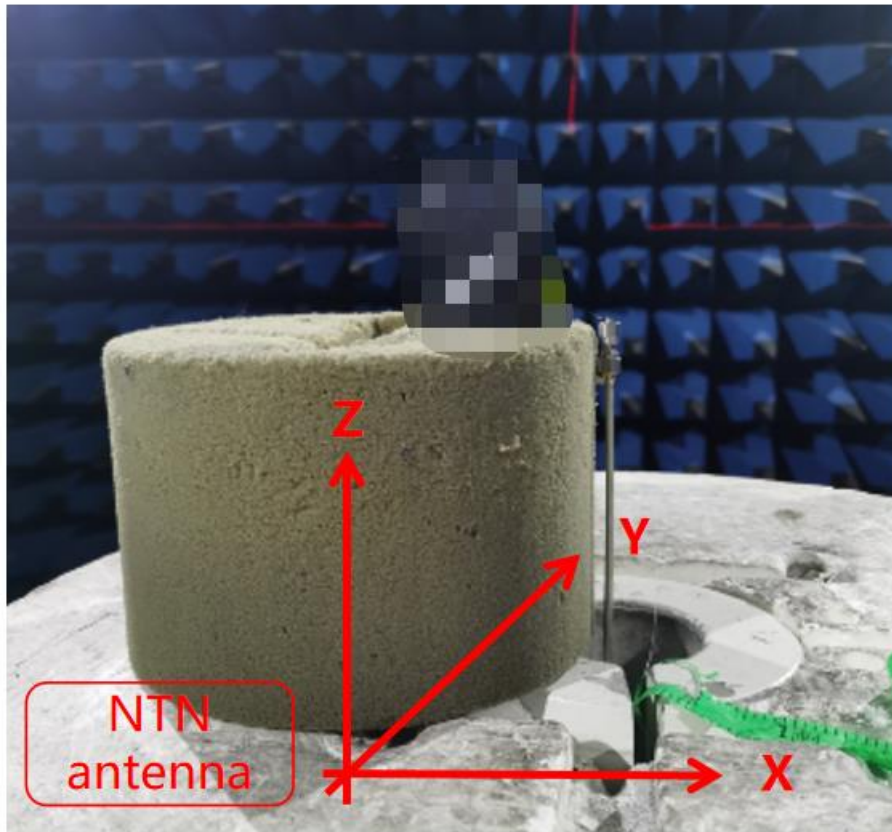


Illustration number	Match the value
E1	NC
E2	1.5 nH
E3	NC

NTN antenna passive S-parameters



NTN antenna placement coordinates



SATIMO darkroom coordinates

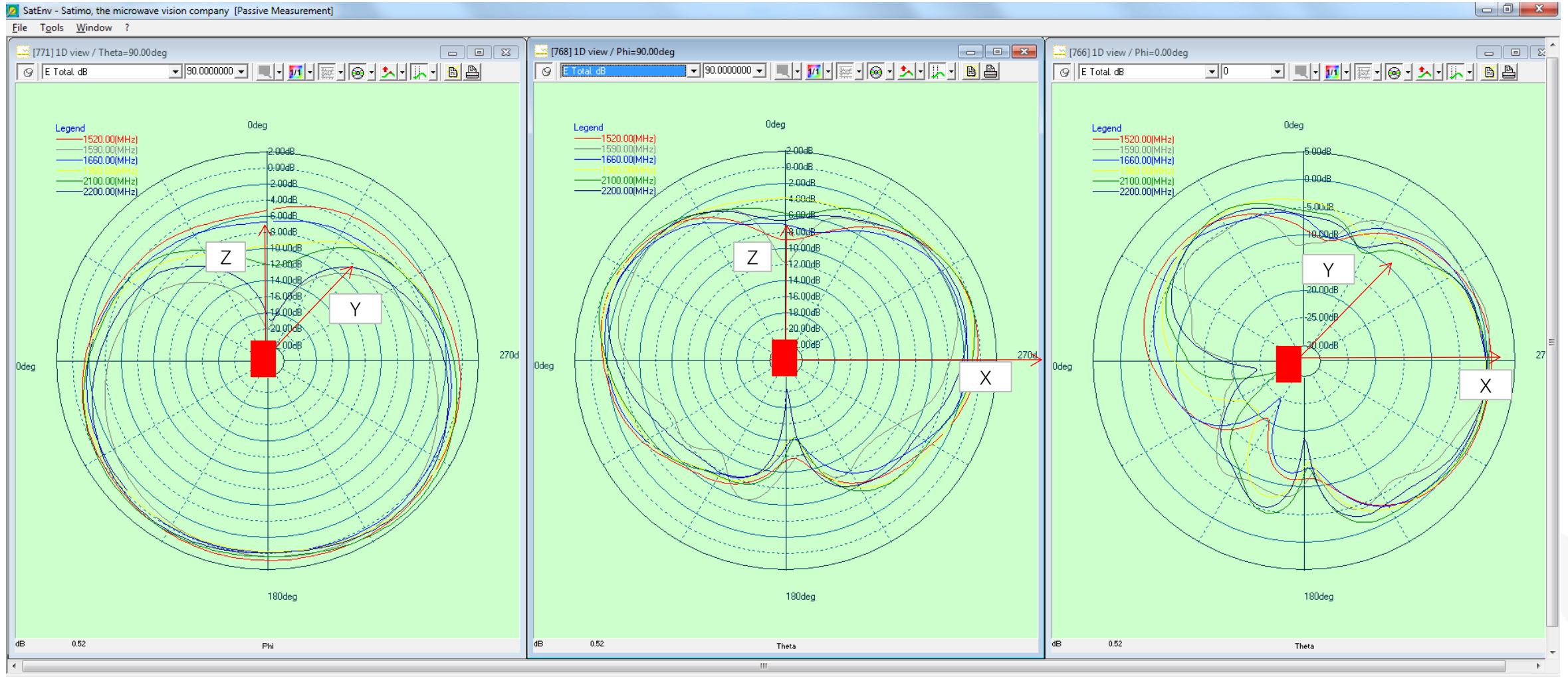
NTN antenna passive parameters



NTN antenna efficiency			
Frequency MHz	Efficiency(%)	Efficiency (dB)	Gain (dBi)
1520	55%	-2.62	1.01
1530	57%	-2.46	1.23
1540	56%	-2.49	1.58
1550	44%	-3.59	0.86
1560	47%	-3.24	0.96
1570	51%	-2.96	1.15
1580	48%	-3.17	1.41
1590	42%	-3.72	1.03
1600	45%	-3.51	1.56
1610	40%	-3.93	1.35
1620	38%	-4.16	1.15
1630	41%	-3.88	0.20
1640	44%	-3.53	0.11
1650	46%	-3.39	0.17
1660	46%	-3.36	0.46
1665	45%	-3.46	0.43
Avg	47%	-3.34	0.92

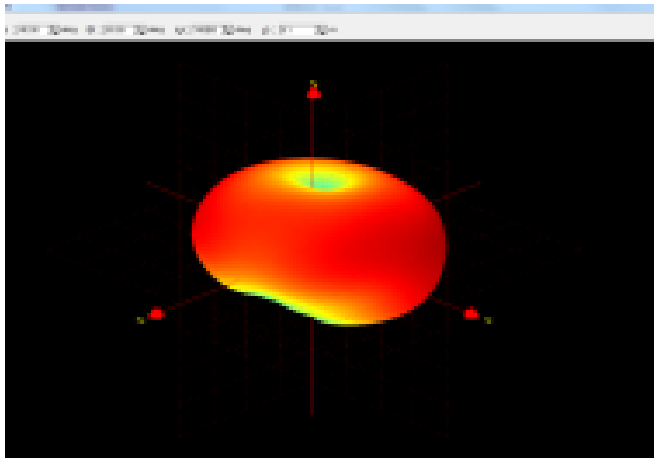
NTN antenna efficiency			
Frequency MHz	Efficiency(%)	Efficiency (dB)	Gain (dBi)
1980	41%	-3.83	0.53
1990	42%	-3.73	0.68
2000	45%	-3.51	0.80
2010	47%	-3.26	0.95
2020	48%	-3.19	1.06
2030	48%	-3.20	1.15
2040	48%	-3.17	1.18
2050	48%	-3.15	1.14
2060	48%	-3.15	1.12
2070	48%	-3.18	1.17
2080	49%	-3.10	1.30
2090	49%	-3.08	1.29
2100	49%	-3.07	1.27
2110	49%	-3.09	1.28
2120	48%	-3.15	1.21
2130	47%	-3.24	1.10
2140	47%	-3.27	1.11
2150	46%	-3.34	0.98
2160	46%	-3.33	0.99
2170	46%	-3.42	1.01
2180	45%	-3.43	0.94
2190	45%	-3.50	0.89
2200	44%	-3.57	0.75
Avg	47%	-3.25	1.04

NTN antenna efficiency distribution map

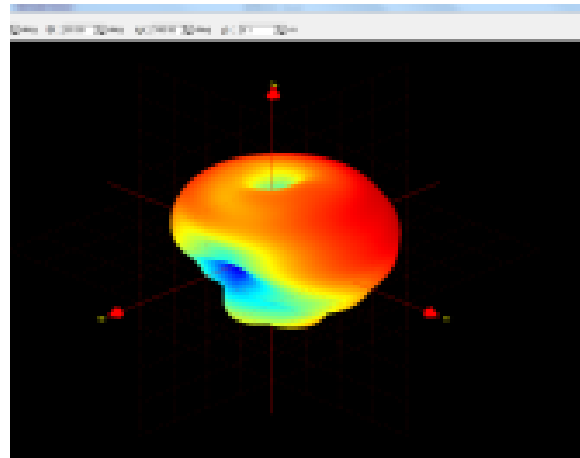


NTN antenna Apple 3D drawing

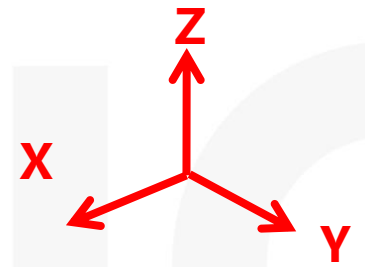
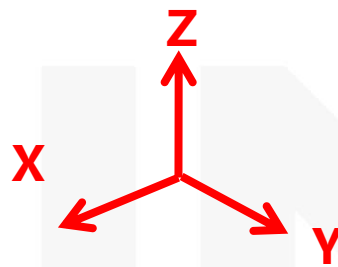
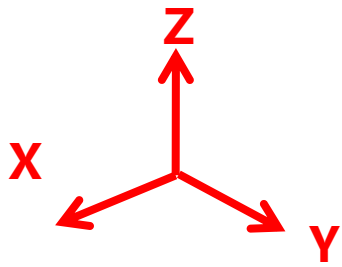
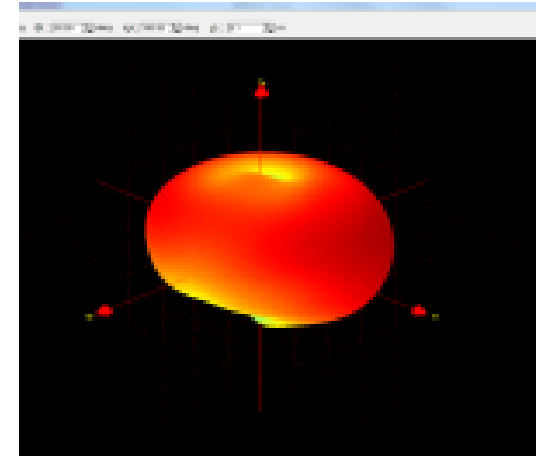
1.52GHz



1.59GHz

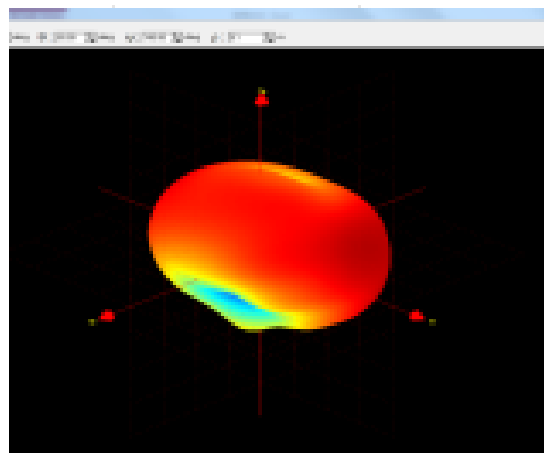


1.66GHz

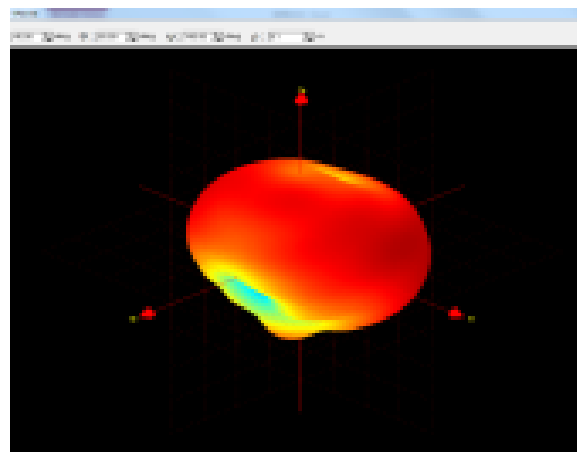


NTN antenna Apple 3D drawing

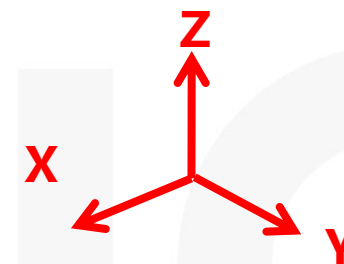
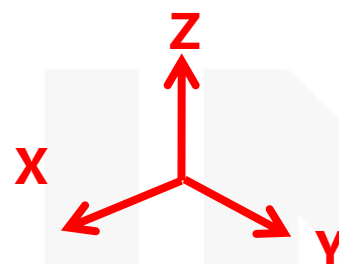
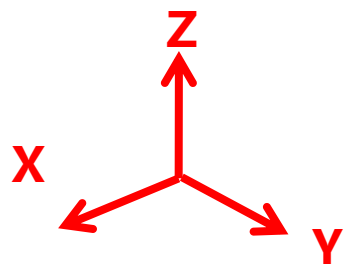
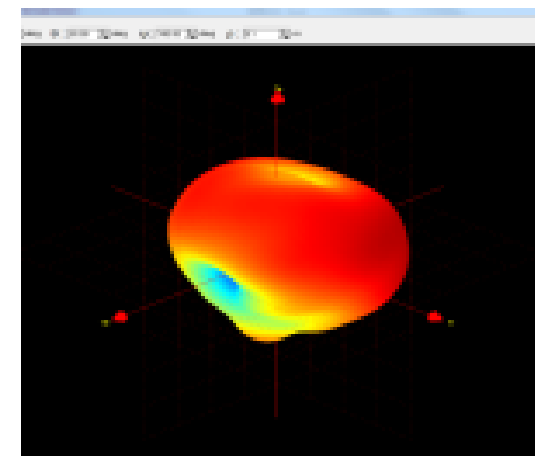
1.98GHz



2.10GHz



2.20GHz



GPS antenna matching circuit

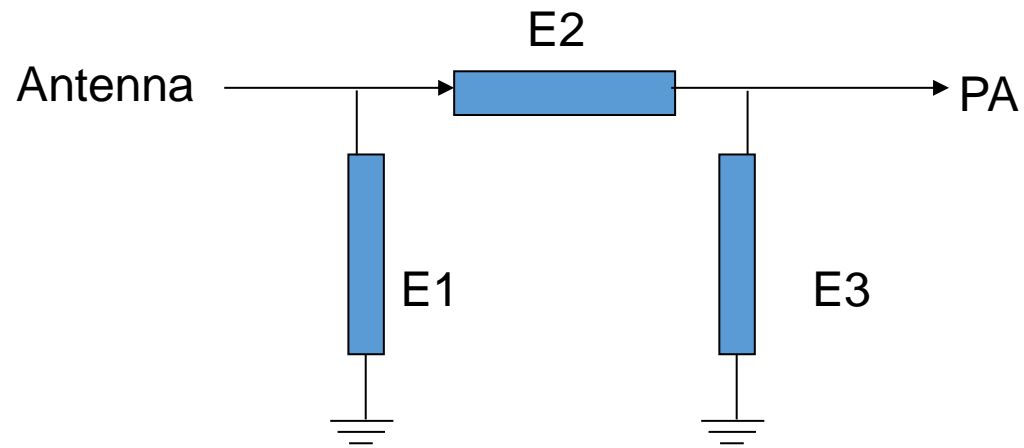
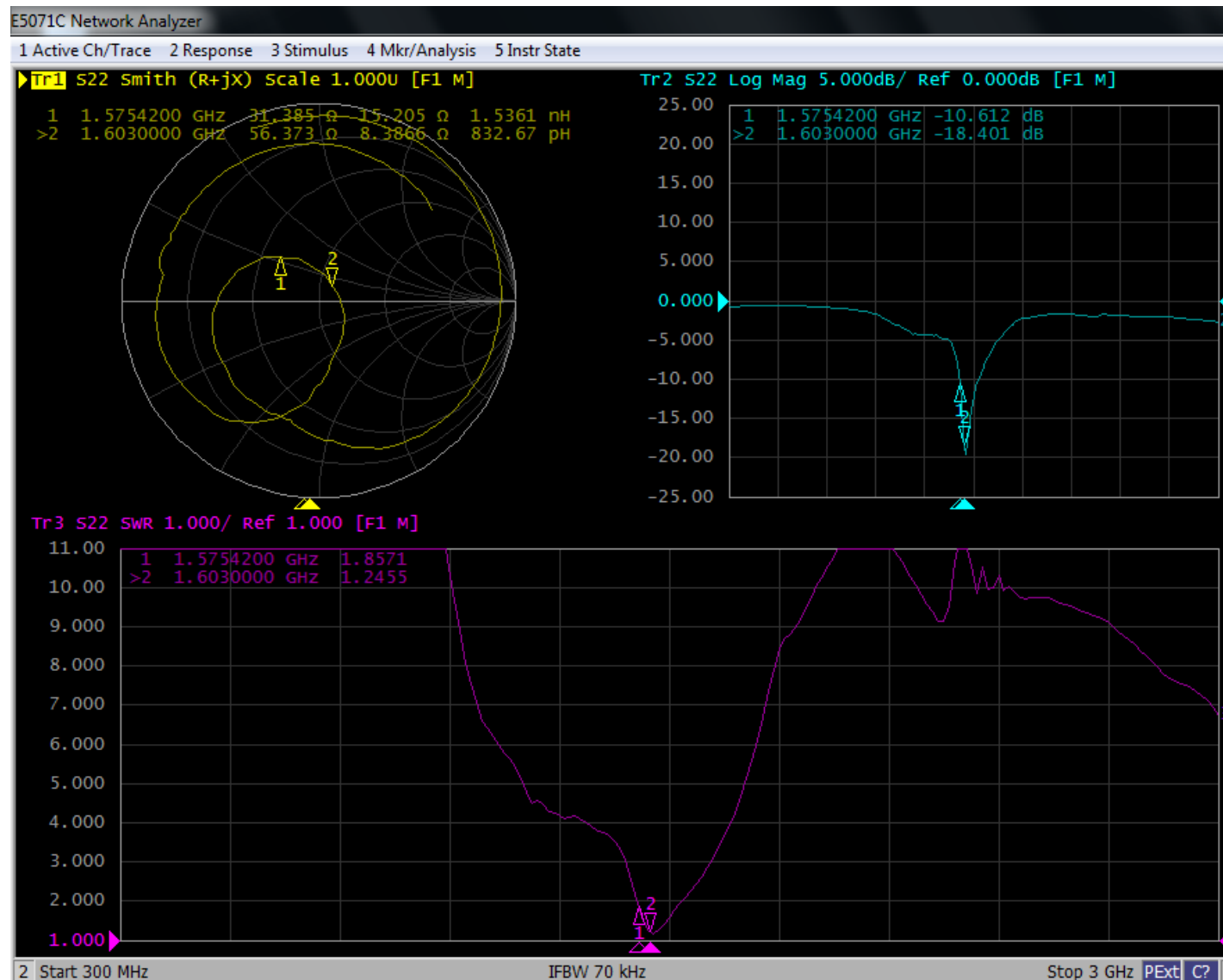
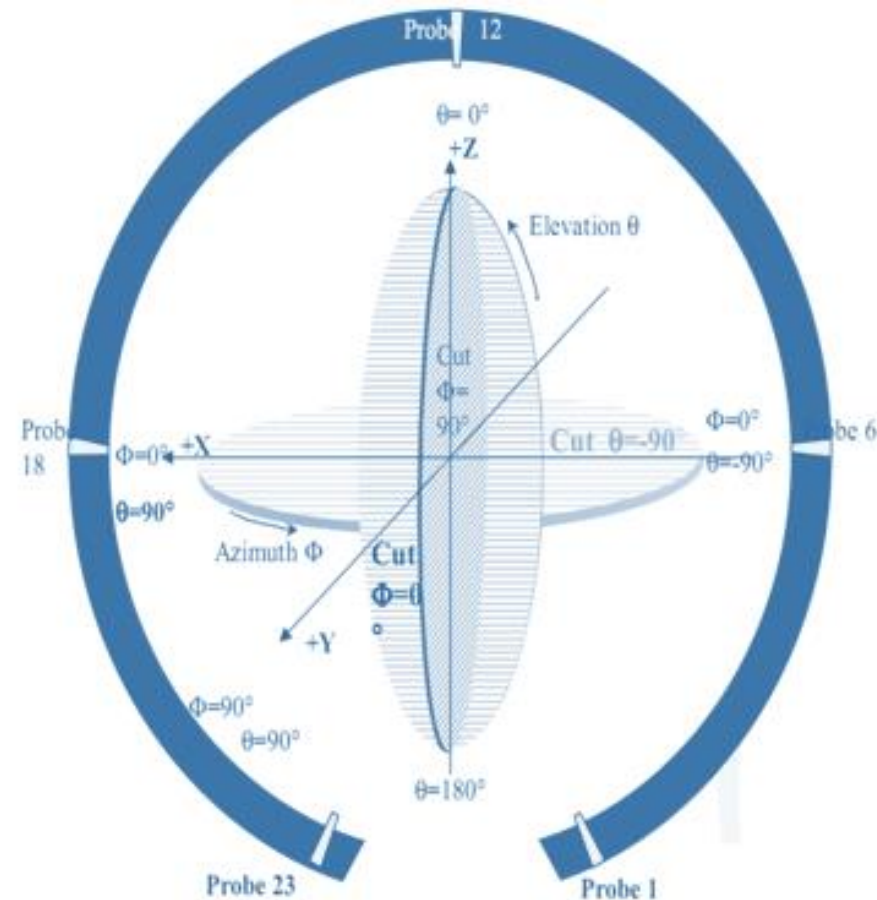
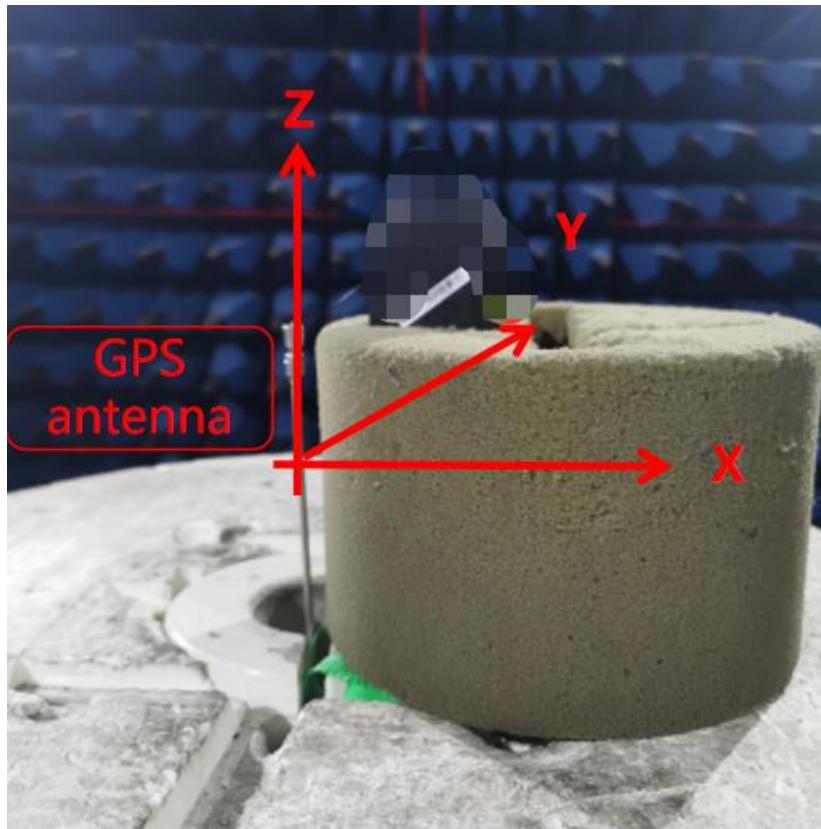


Illustration number	Match the value
E1	NC
E2	0 Ω
E3	NC

GPS antenna passively debugs the S-parameters

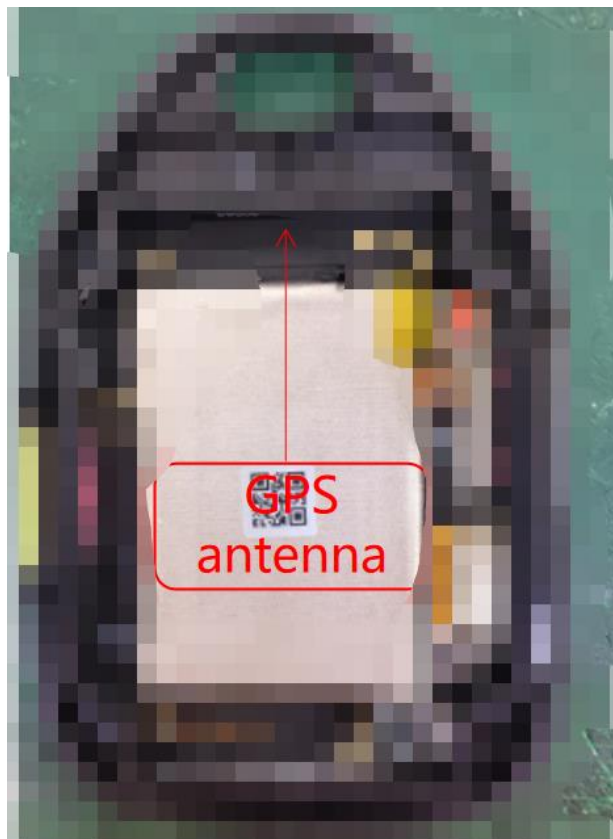


GPS antenna placement coordinates



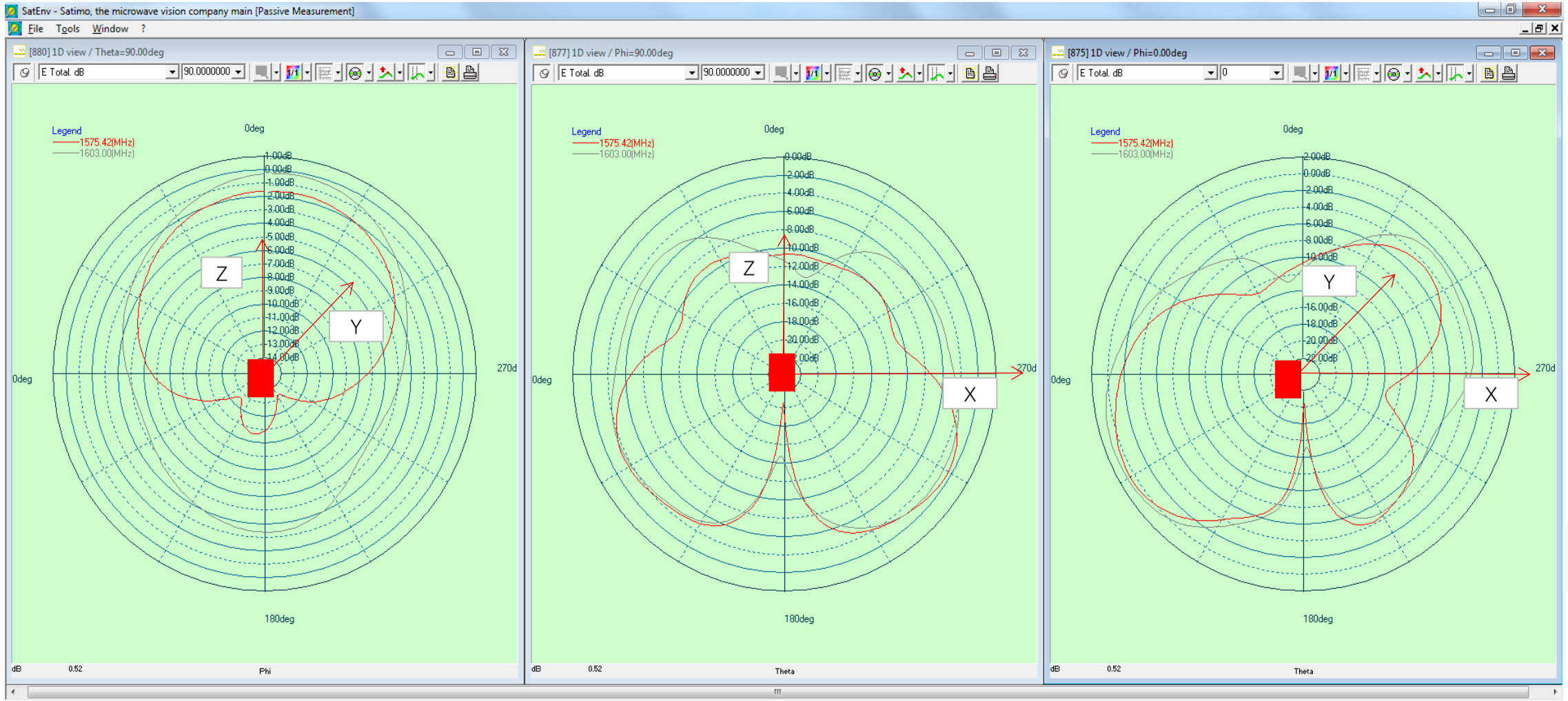
SATIMO darkroom
coordinates

GPS antenna passive parameters



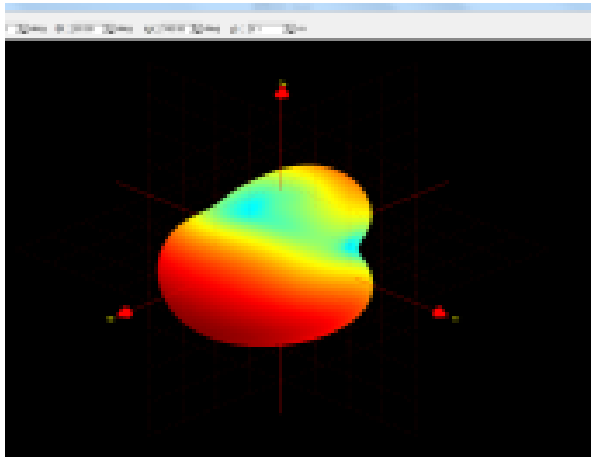
GPS antenna efficiency			
Frequency MHz	Efficiency(%)	Efficiency (dB)	Gain (dBi)
1550	41%	-3.92	0.90
1560	43%	-3.71	1.13
1570	42%	-3.79	1.04
1575.42	40%	-3.93	0.94
1580	42%	-3.78	1.05
1590	43%	-3.66	1.11
1603	45%	-3.48	1.33
Avg	42%	-3.75	1.07

GPS antenna efficiency distribution map

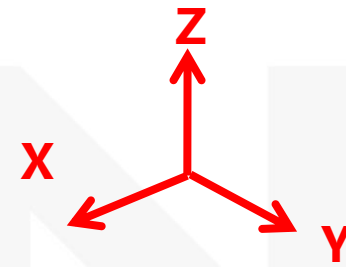
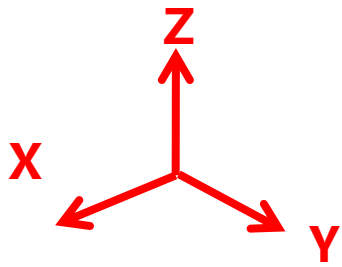
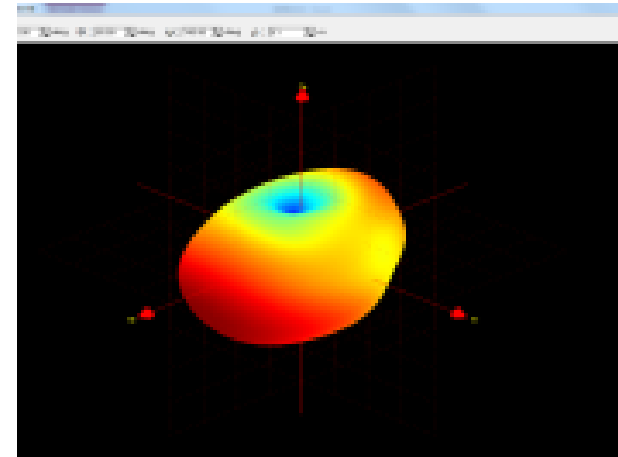


3D diagram of GPS antenna for Apple

1.57542GHz



1.603GHz



BT antenna matching circuit

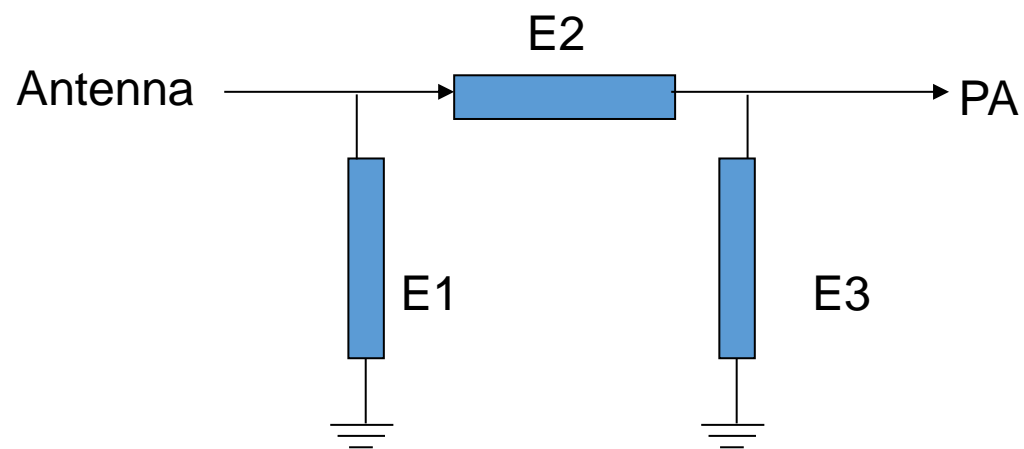
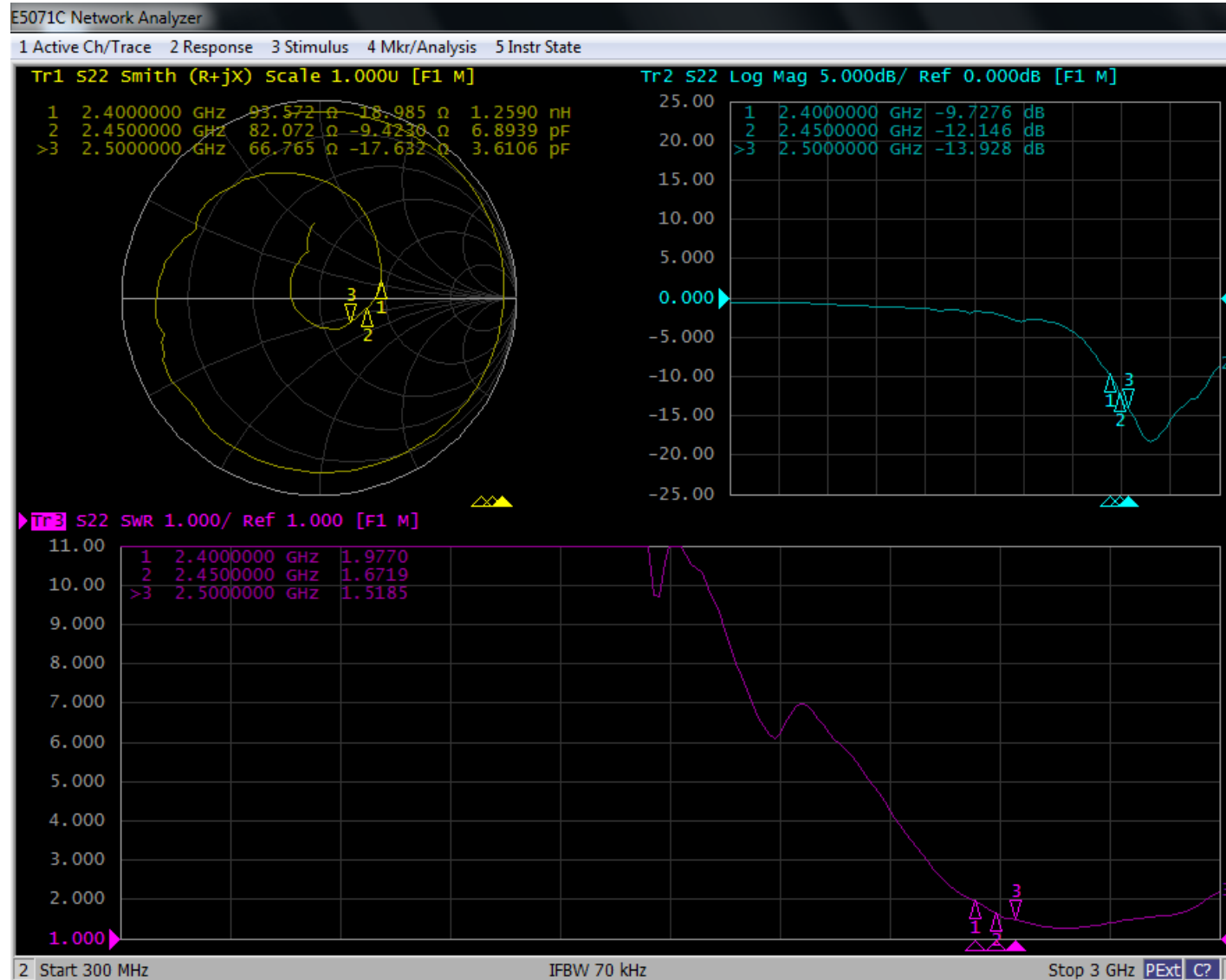


Illustration number	Match the value
E1	NC
E2	0 Ω
E3	NC



BT antenna passive S-parameters

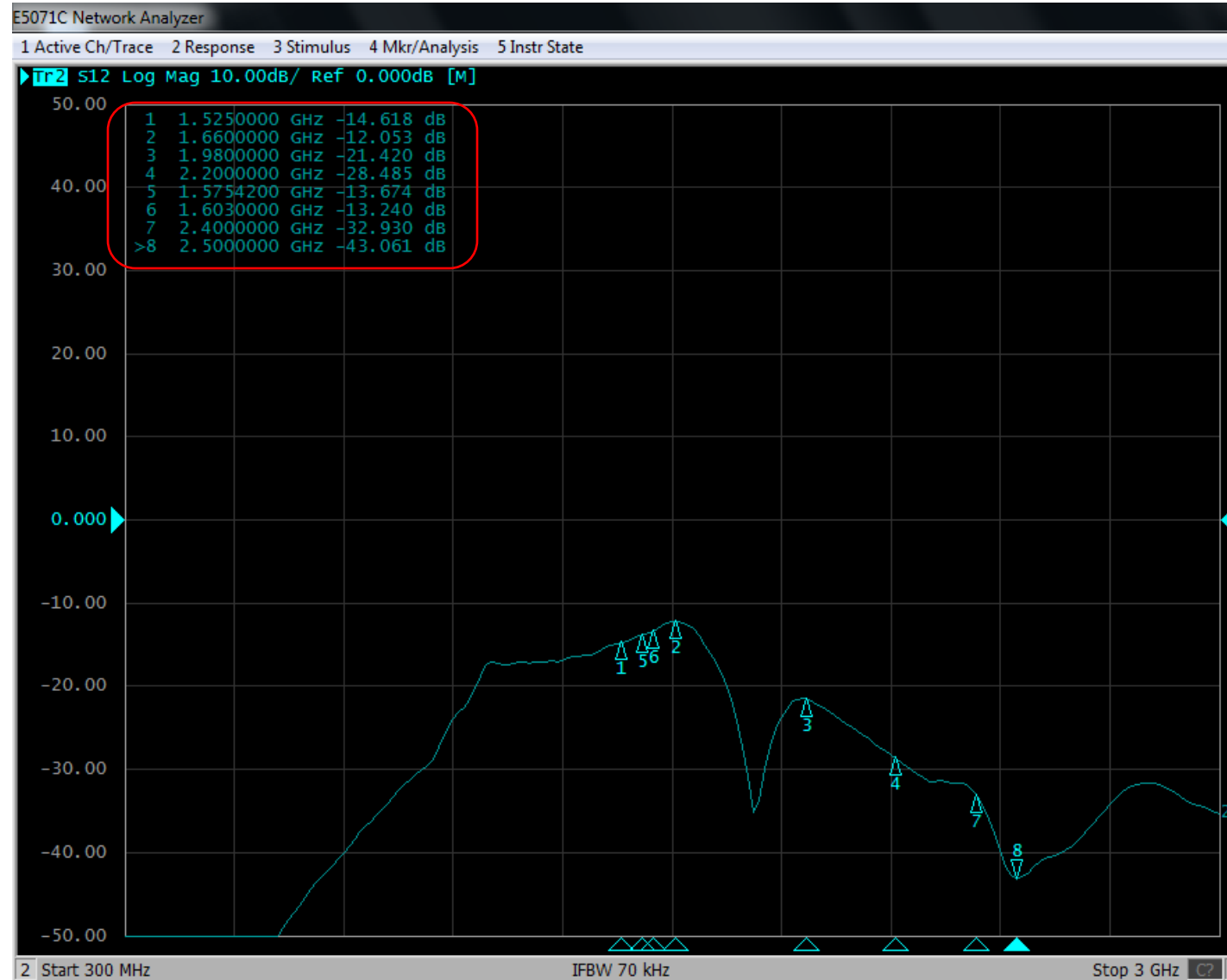


BT antenna passive parameters

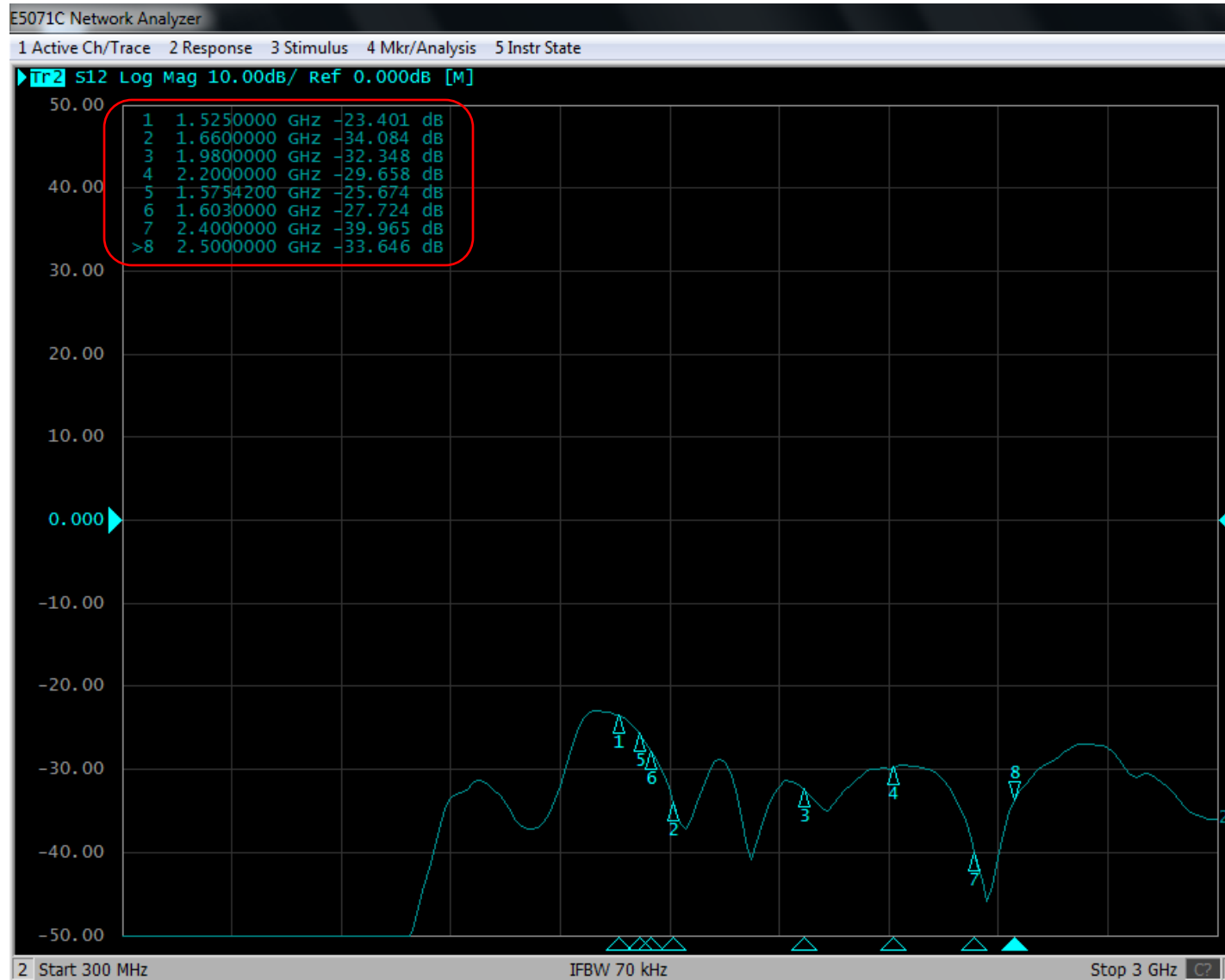


BT antenna efficiency			
Frequency MHz	Efficiency(%)	Efficiency (dB)	Gain (dBi)
2400	52%	-2.85	1.28
2410	53%	-2.72	1.32
2420	56%	-2.53	1.48
2430	57%	-2.45	1.51
2440	57%	-2.44	1.52
2450	57%	-2.41	1.53
2460	58%	-2.37	1.55
2470	58%	-2.37	1.54
2480	57%	-2.45	1.51
2490	58%	-2.37	1.54
2500	57%	-2.41	1.52
Avg	56%	-2.49	1.48

NTN and GPS antenna isolation S-parameters



NTN and BT antenna isolation S-parameters



GPS and BT antenna isolation S-parameters



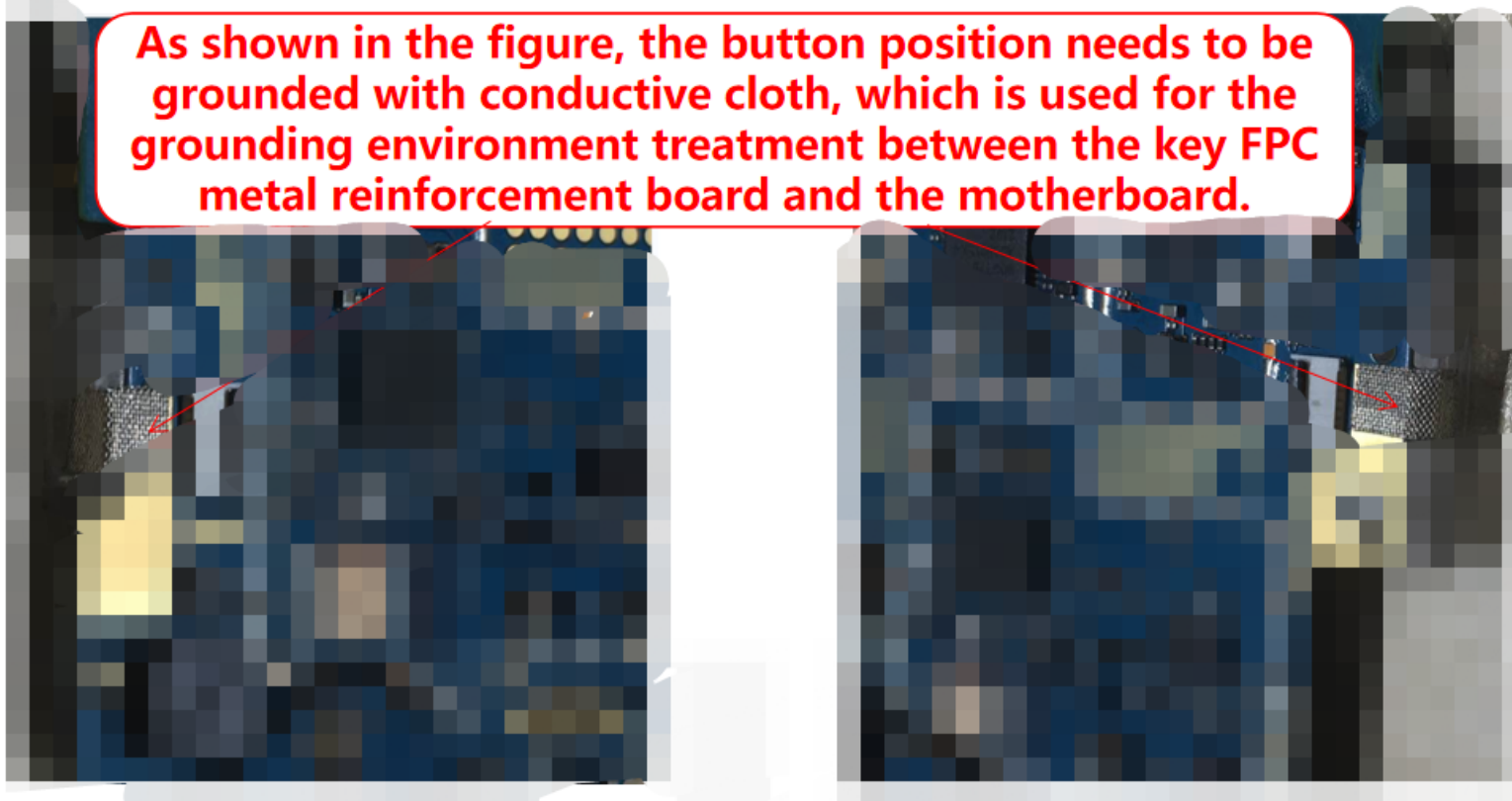
NTN antenna parameter prediction

The whole machine EMC processing OK without interference, the average OTA performance of each frequency band is expected to be compared as follows (antenna OTA performance reaches the test standard Class B):

Band	Channel	TX	Rx	Ant Efficiency		OTA Estimation		Loss	Gap	
				TX	RX	TRP	TIS		TRP	TIS
B23 (S band)	7501	22.6	-115	-3.51	-3.43	19.09	-111.57	1.5	1.59	2.07
	7600			-3.26	-3.50	19.34	-111.5	1.5	1.84	2
	7699			-3.19	-3.57	19.41	-111.43	1.5	1.91	1.93
B255 (L band)	228737	22.6	-115	-4.16	-2.62	18.44	-112.38	1.5	0.94	2.88
	228096			-3.39	-3.59	19.21	-111.41	1.5	1.71	1.91
	229075			-3.36	-3.04	19.24	-111.96	1.5	1.74	2.46
B256 (S band)	229077	22.6	-115	-3.83	-3.42	18.77	-111.58	1.5	1.27	2.08
	229226			-3.73	-3.50	18.87	-111.5	1.5	1.37	2
	229375			-3.26	-3.57	19.34	-111.43	1.5	1.84	1.93

Environmental treatment

As shown in the figure, the button position needs to be grounded with conductive cloth, which is used for the grounding environment treatment between the key FPC metal reinforcement board and the motherboard.



Environmental treatment

As shown in the figure, TYPE C needs to be pasted with conductive foam and LED lamp metal reinforcement board to do grounding environment treatment.

As shown in the figure, TYPE C needs to be treated with a grounding environment with a guide cloth and the motherboard.

As shown in the figure, the battery needs to be attached to conductive foam and grounded with the motherboard. Battery FPC reinforced metal needs to be pasted with a guide cloth and the motherboard for grounding environment treatment.

Summary

1. The passive efficiency of the NTN antenna of the trial production prototype $\geq 30\%$. The passive efficiency of the GPS antenna $\geq 30\%$. BT antenna passive efficiency $\geq 30\%$.
2. Passive verification of the antenna of the trial prototype, the isolation degree of NTN and GPS antennas is -12.05dB , the isolation degree of NTN and BT antennas is -23.4dB , and the isolation degree of GPS and BT antennas is -13.86dB .



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