

ERO1BEM PRO Antenna Report V1.0



Deng Wen
2024.11.01

报告版本更新履历



版本号	修改描述	处理人	日期
V1.0	首次发行	Wen	2024.11.01

CONTENTS

- ◆ **Purpose & Environment**
- ◆ **DUT Antenna**
- ◆ **Return Loss and Isolation**
- ◆ **2D&3D Radiation Pattern**
- ◆ **Peak Gain and Efficiency**
- ◆ **Summary**

Purpose

- Meet the electrical performance index ;
- Confirm the antenna scheme to meet the design requirements;

Environment

Test Condition:

➤ Network analyzer(Keysight E5071C):

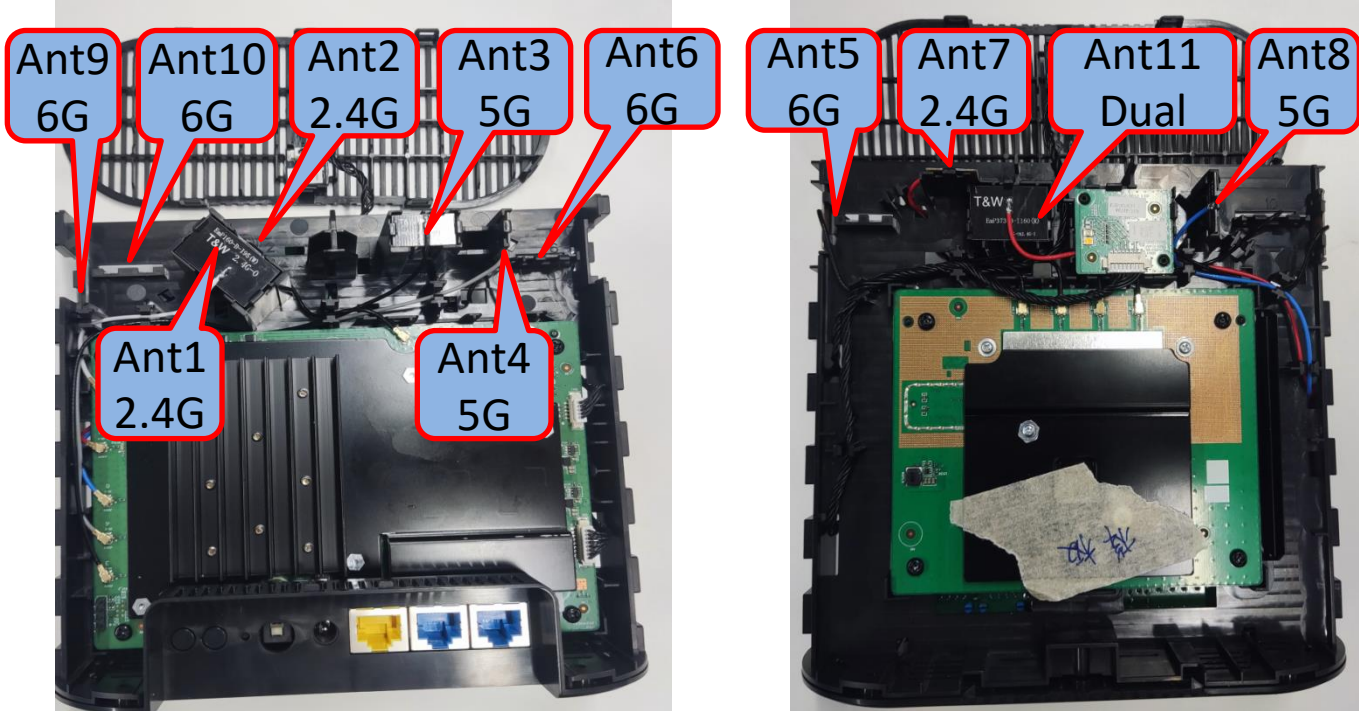
Device NO.: E000910100017, Cal.Date:20240506—20250506)

➤ SATIMO microwave anechoic chamber(MVG SG-24)

Device NO.: MY46523716, Cal.Date:20240926—20250925)

- Passive measurement results are presented mock up

Antenna Model



	NO.	Frequency
Wifi	ANT1-2.4G	2.4-2.5GHz
	ANT11-Dual	2.4-2.5GHz 5.15-5.85GHz
	ANT3-5G	5.15-5.85GHz
	ANT4-5G	5.15-5.85GHz
	ANT8-5G	5.15-5.85GHz
	ANT5-6G	5.9-7.125GHz
	ANT6-6G	5.9-7.125GHz
	ANT9-6G	5.9-7.125GHz
BT	ANT2-2.4G	2.4-2.5GHz
	ANT7-2.4G	2.4-2.5GHz

Antenna manufacturer :

ShangHai Signal Plus Technology Co.,Ltd.

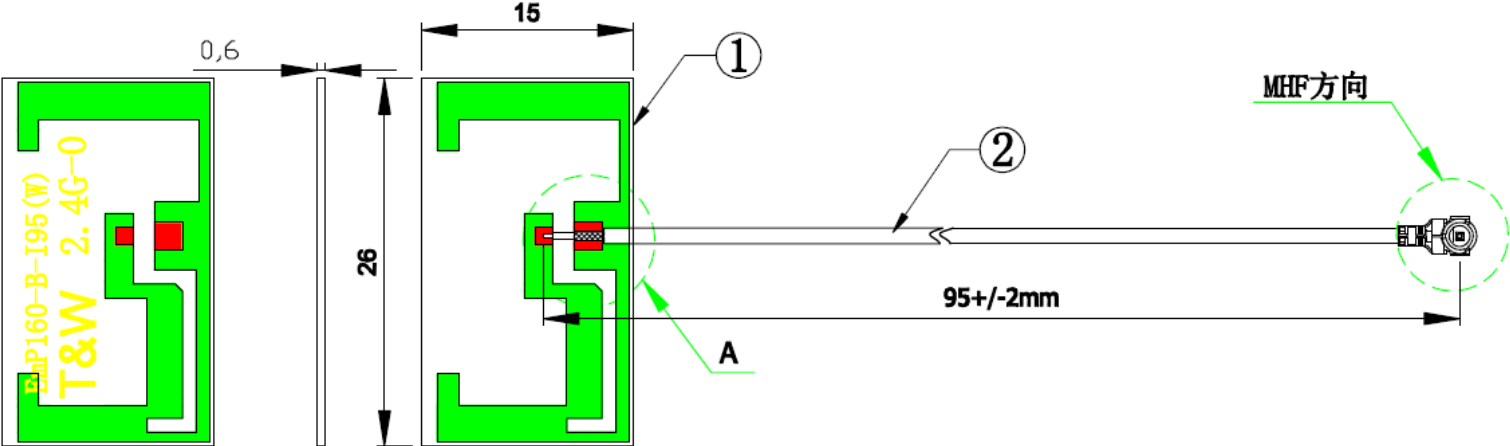
Antenna manufacturer's address:

Room 603, Building 30, No. 69, Guqing Road, Xuhui District,
Shanghai.

DUT Antenna

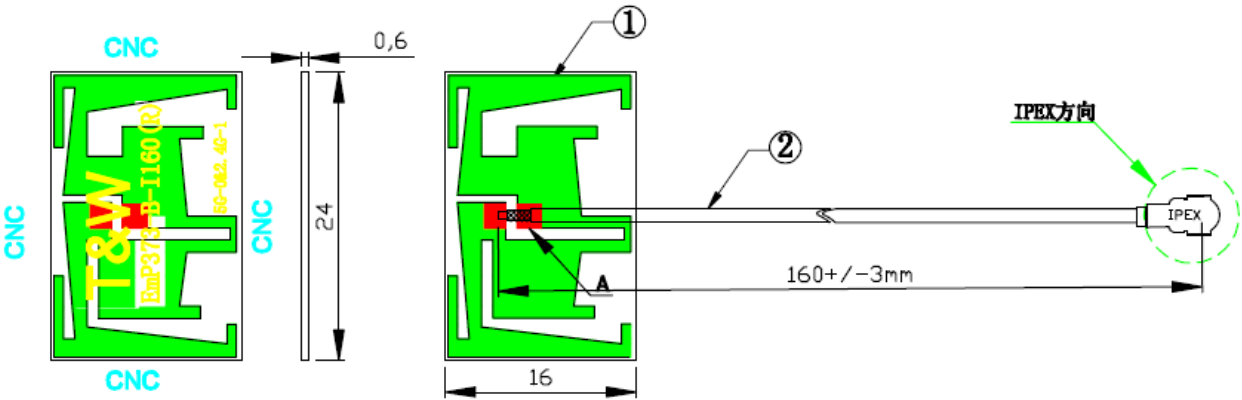


ANT1-2.4G



Antenna dimension:EmP160-B-I95(W)
(Remark: for White, the RF cable is 95mm)

ANT11-Dual

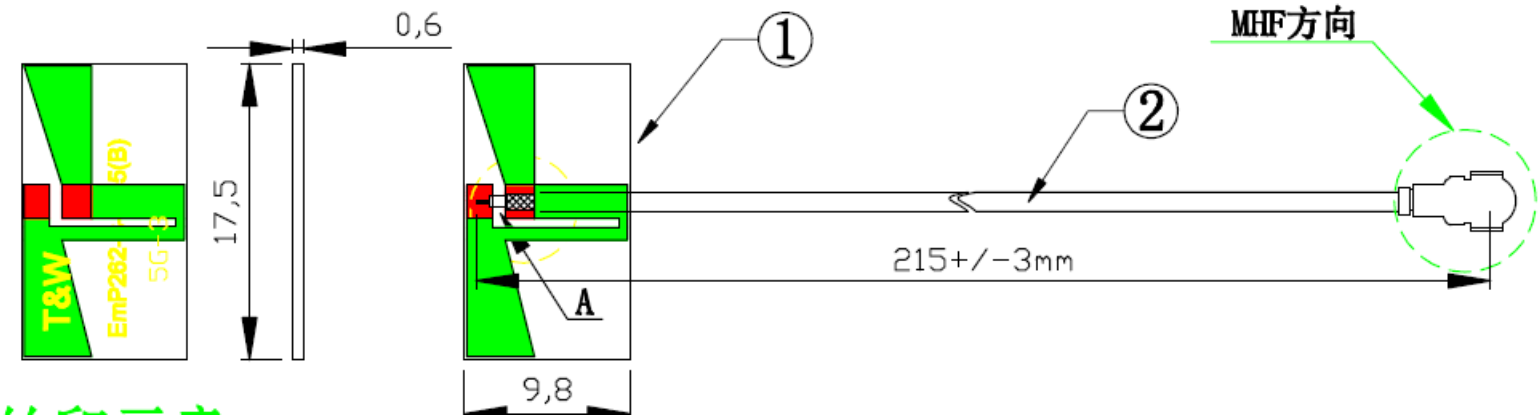


Antenna dimension:EmP373-B-I160(R)
(Remark: for Red, the RF cable is 160mm)

DUT Antenna

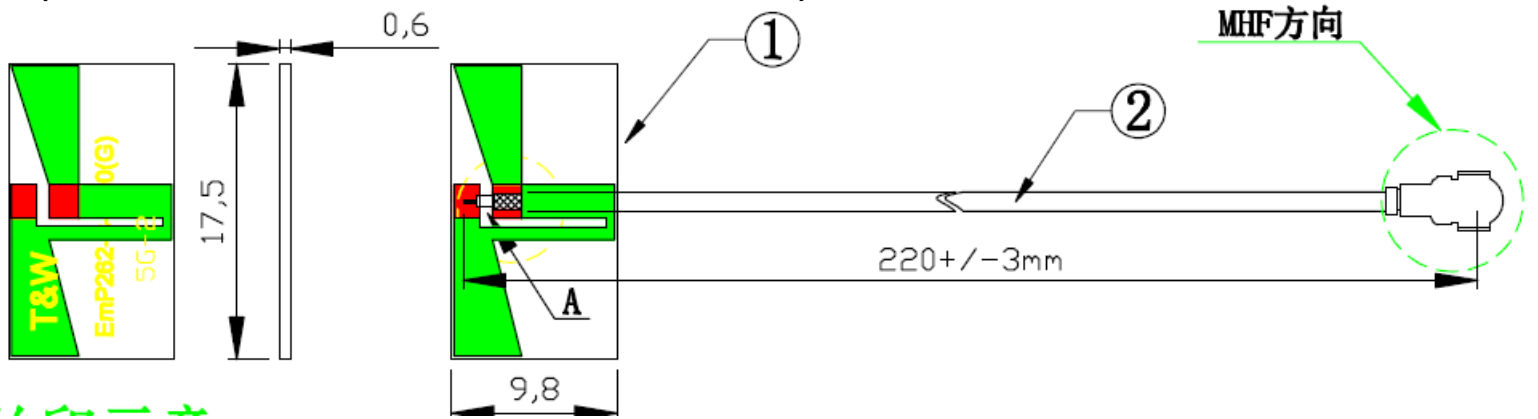


ANT3-5G



Antenna dimension:EmP262-B-I215(B)
(Remark: for Black, the RF cable is 215mm)

ANT4-5G

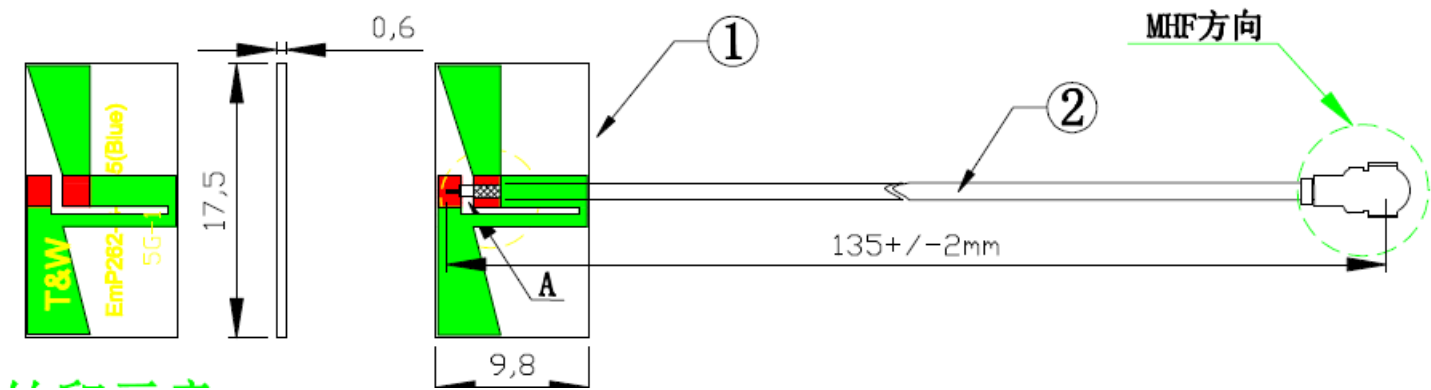


Antenna dimension:,EmP262-B-I220(G)
(Remark: for Gray, the RF cable is 220mm)

DUT Antenna

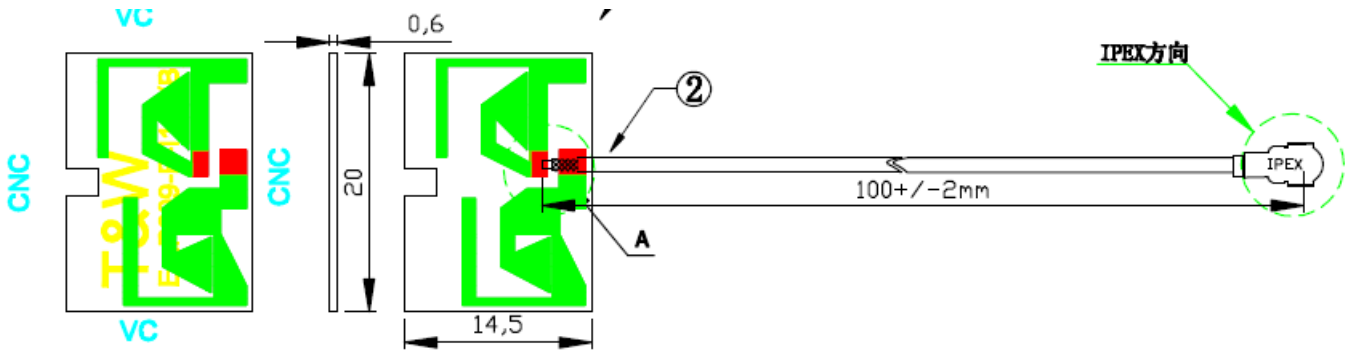


ANT8-5G



Antenna dimension:EmP262-B-I135(Blue)
(Remark: for Blue, the RF cable is 135mm)

- ANT5-6G
- ANT6-6G
- ANT9-6G
- ANT10-6G

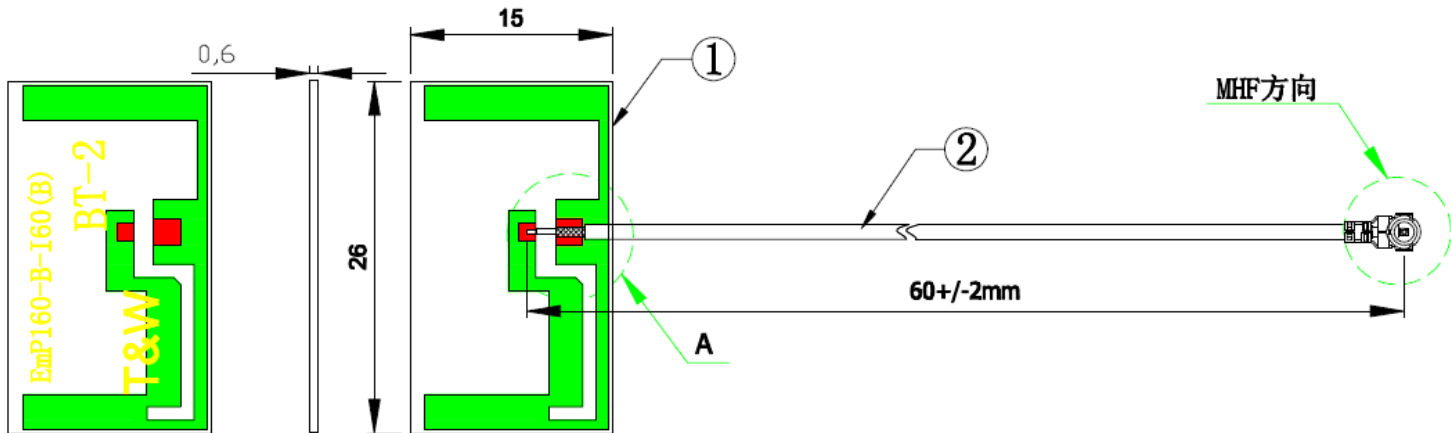


Antenna dimension:EmP609-B-I100(B)
(Remark: for Black, the RF cable is 100mm)

DUT Antenna

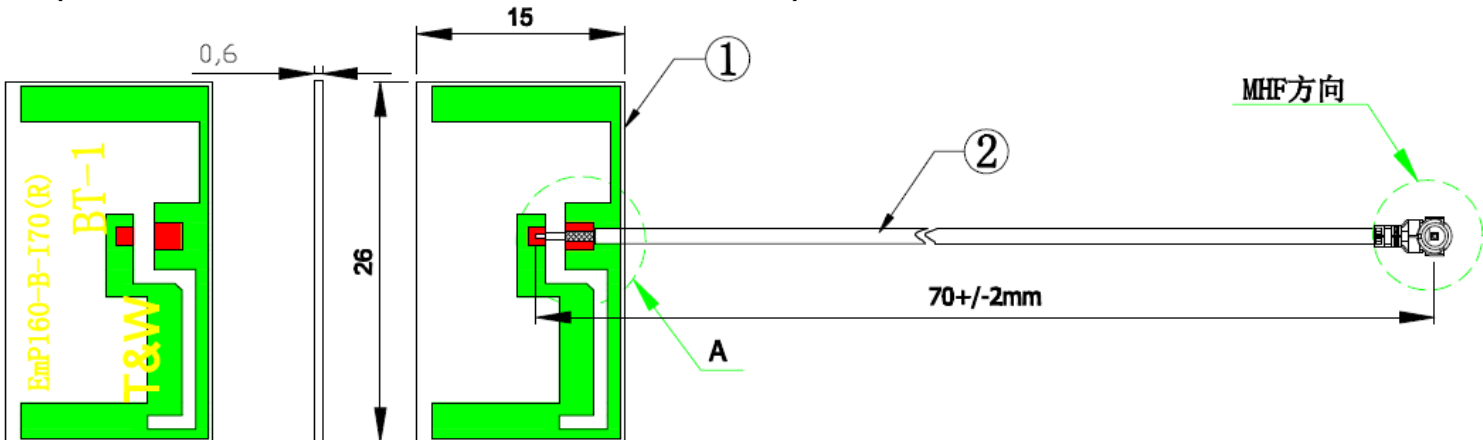


ANT2-2.4G



Antenna dimension:EmP160-B-I60(B)
(Remark: for Black, the RF cable is 60mm)

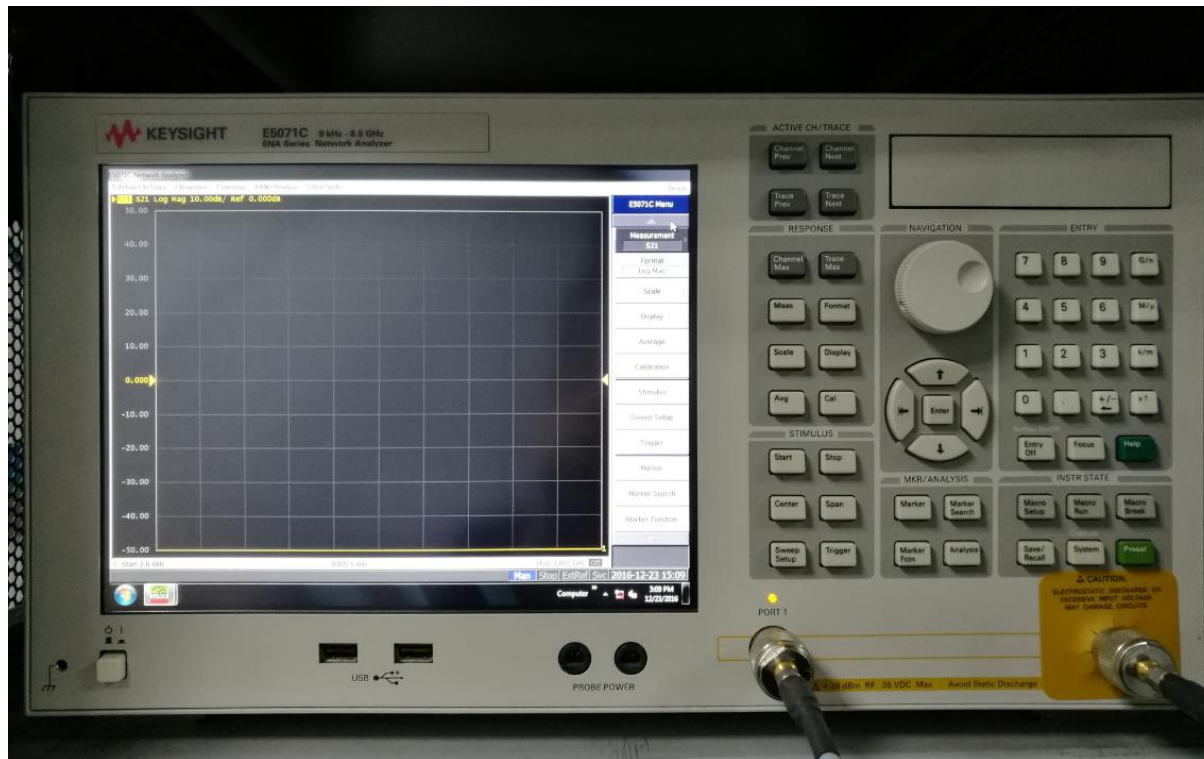
ANT7-2.4G



Antenna dimension:EmP160-B-I70(R)
(Remark: for Red, the RF cable is 70mm)

Return Loss and Isolation

Measurement Condition

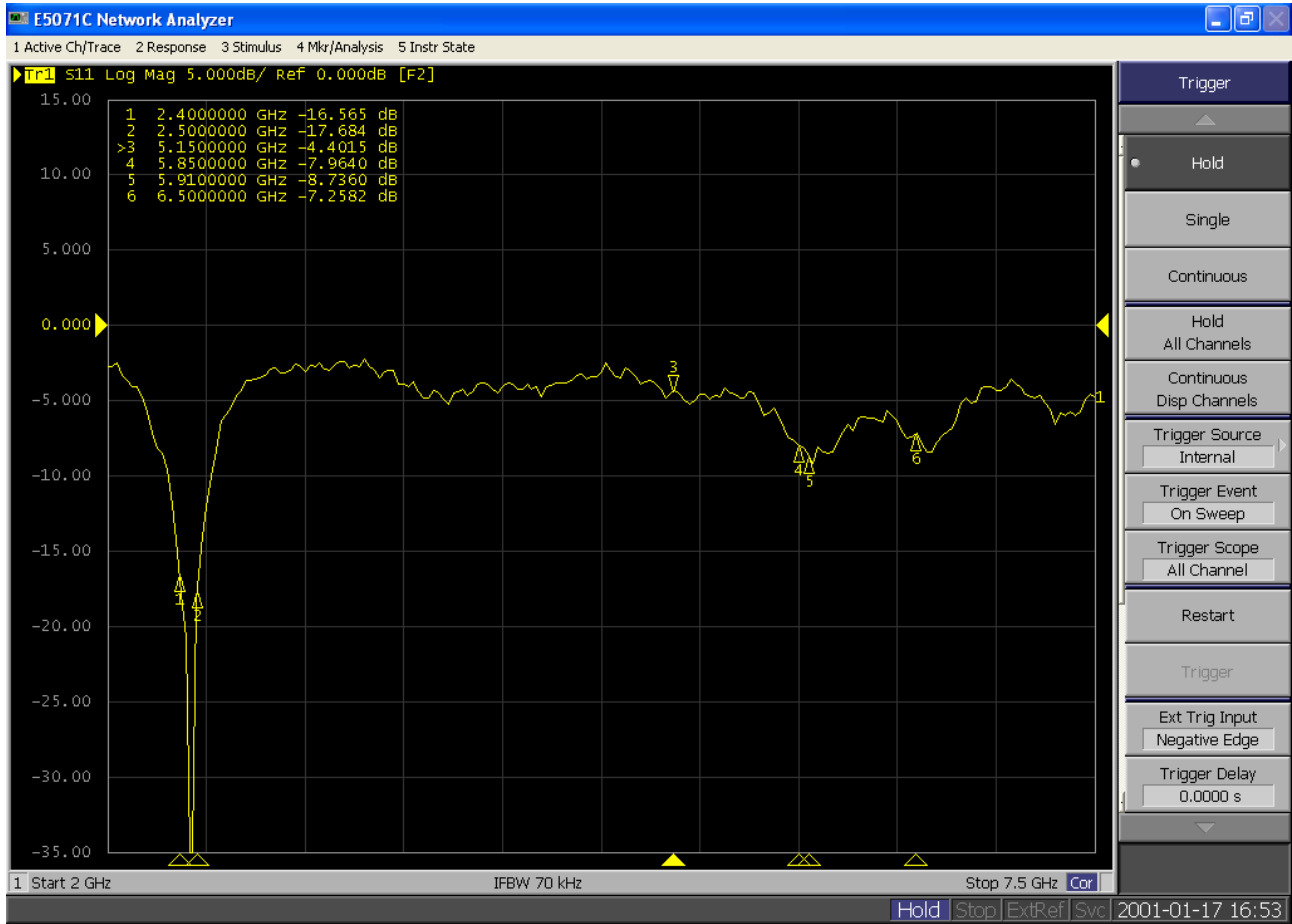


The network Analyzer

Return loss and Isolation



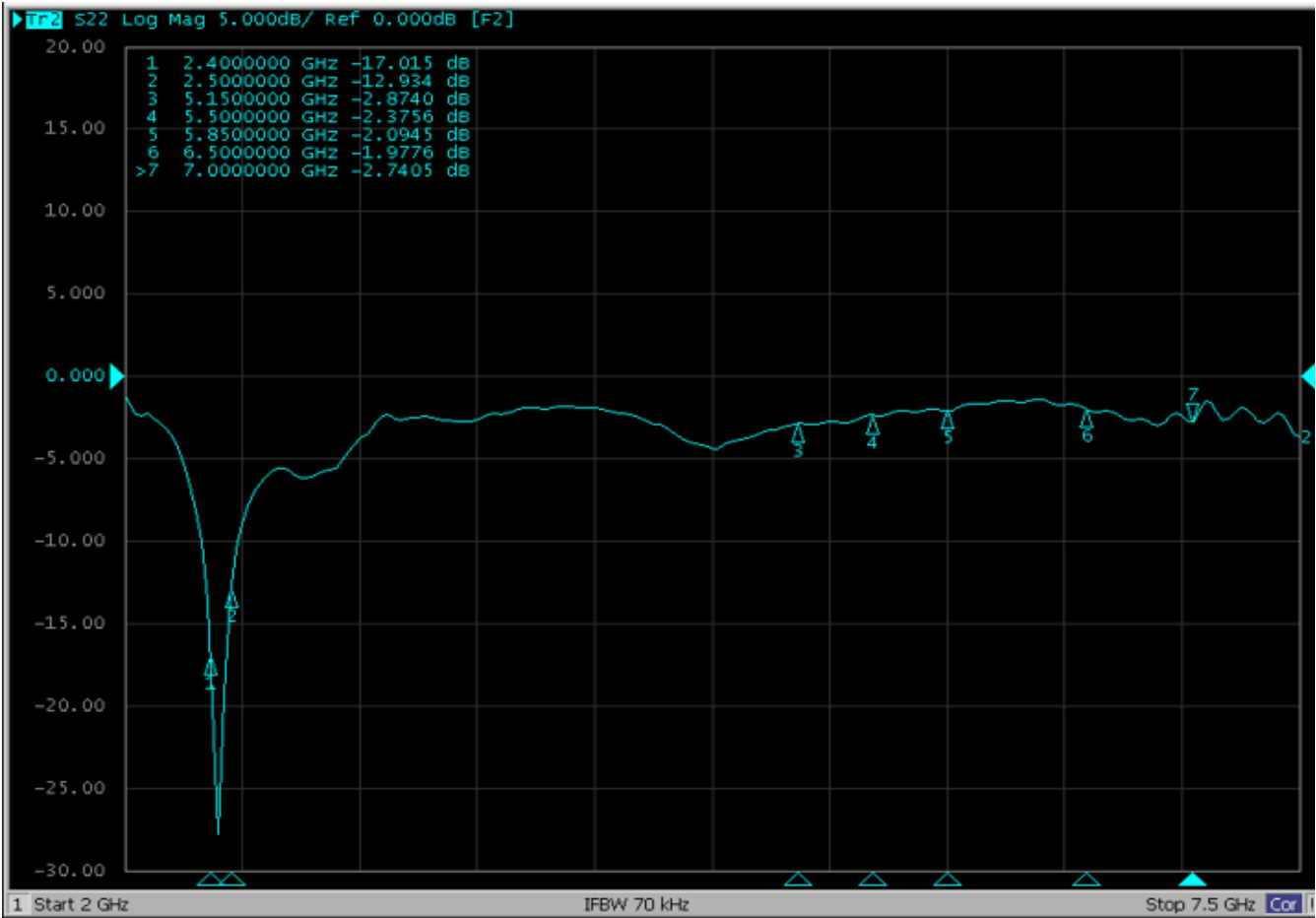
S11-2.4G



FRE.	2.4G	2.5G
RL.	-19.4	-18.9

Return loss and Isolation

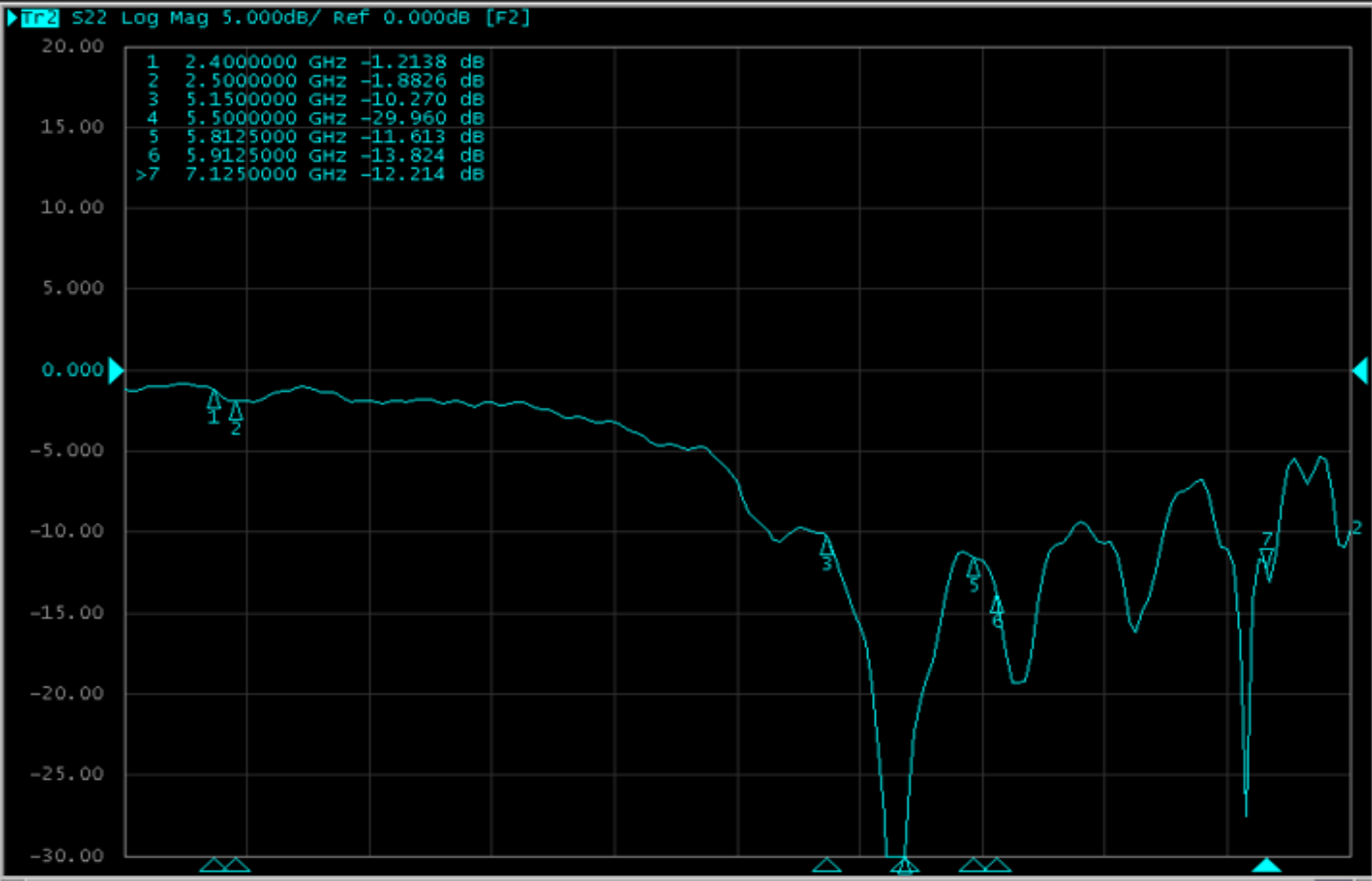
S22-2.4G



FRE.	2.4G	2.5G
RL.	-17.0	-12.9

Return loss and Isolation

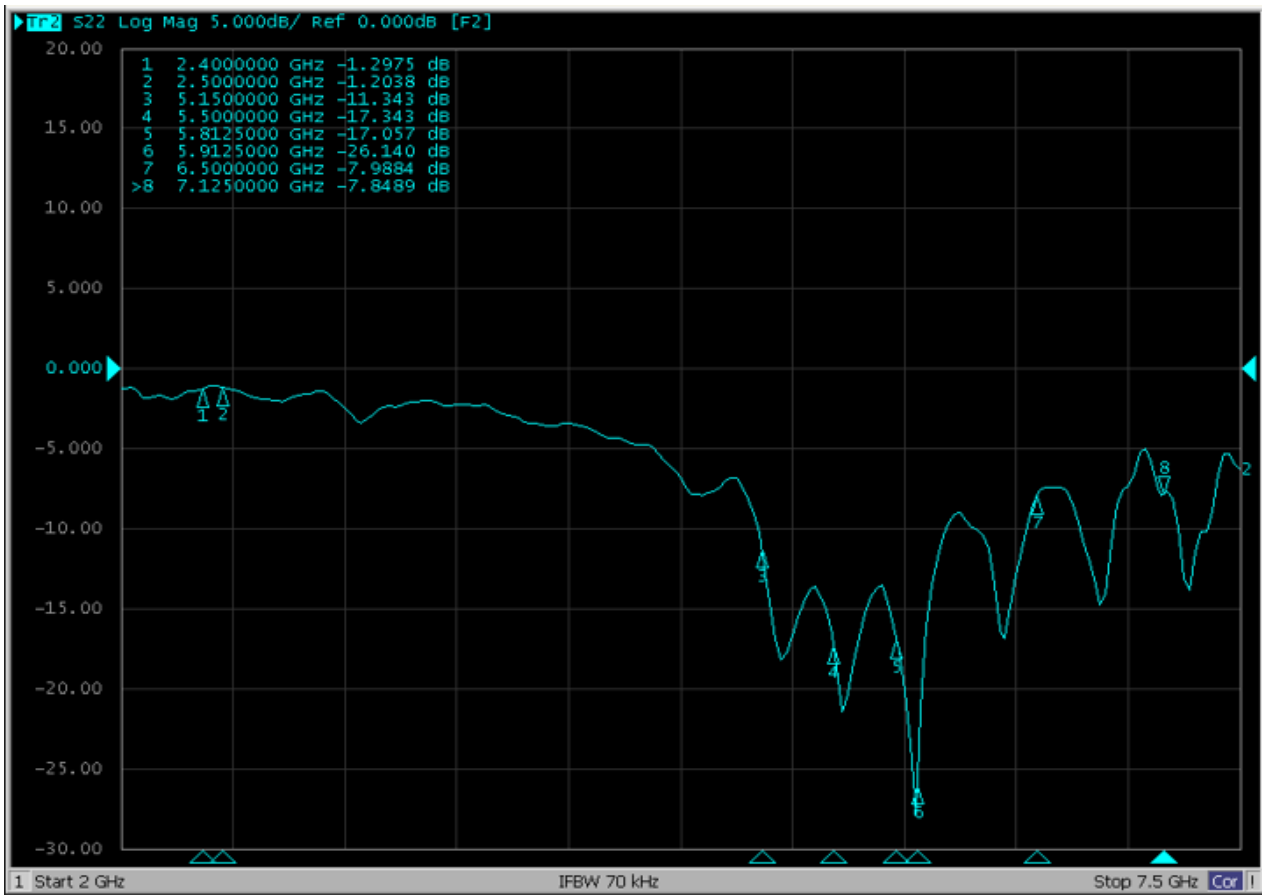
S33-5G



FRE.	5.15G	5.55G	5.825G
RL.	-11.6	-13.8	-12.2

Return loss and Isolation

S44-5G



FRE.	5.15G	5.55G	5.825G
RL.	-11.3	-17.3	-17.0

Return loss and Isolation



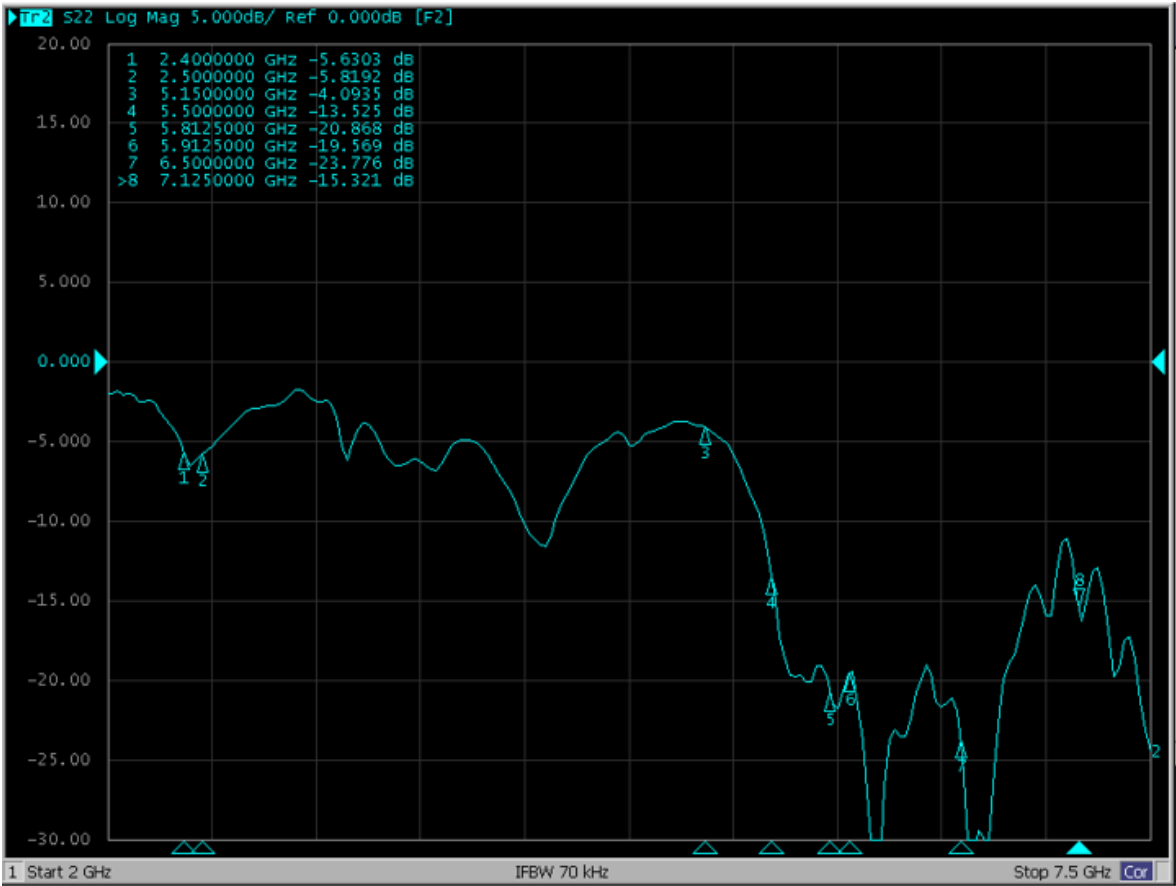
S55-6G



FRE.	5.9125G	6.5G	7.125G
RL.	-14.0	-17.4	-14.5

Return loss and Isolation

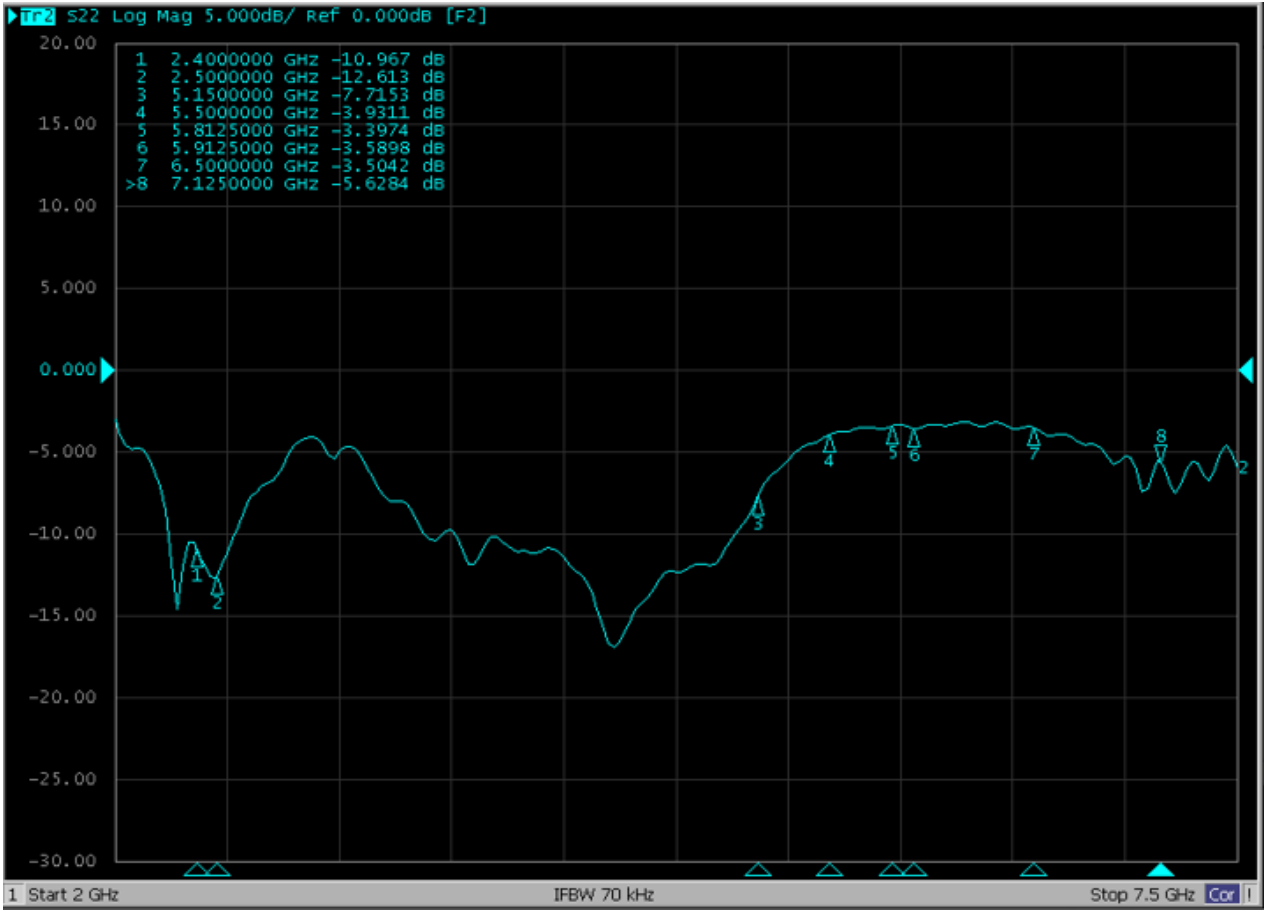
S66-6G



FRE.	5.9125G	6.5G	7.125G
RL.	-19.5	-23.7	-15.3

Return loss and Isolation

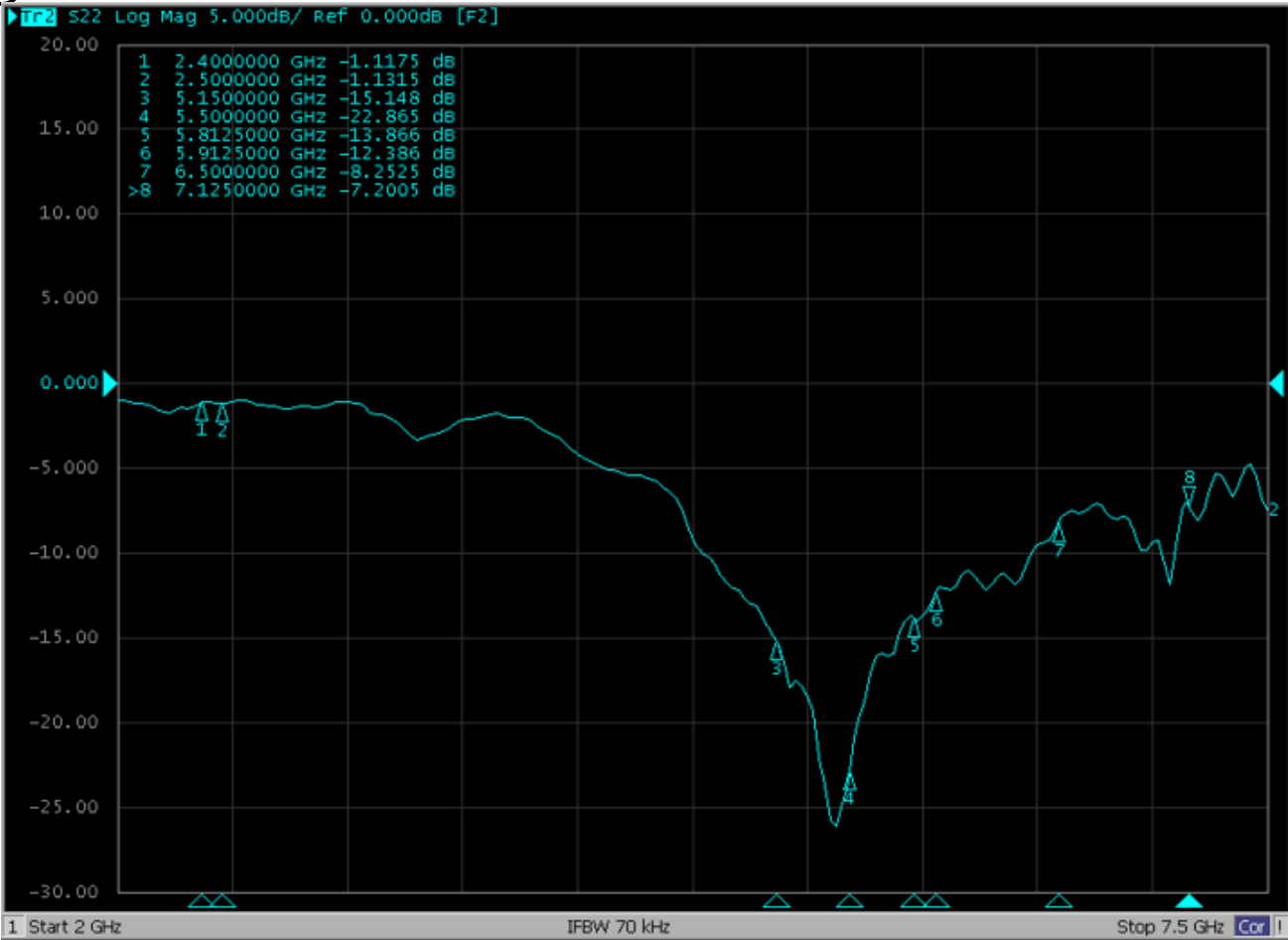
S77-2.4G



FRE.	2.4G	2.5G
RL.	-10.9	-12.6

Return loss and Isolation

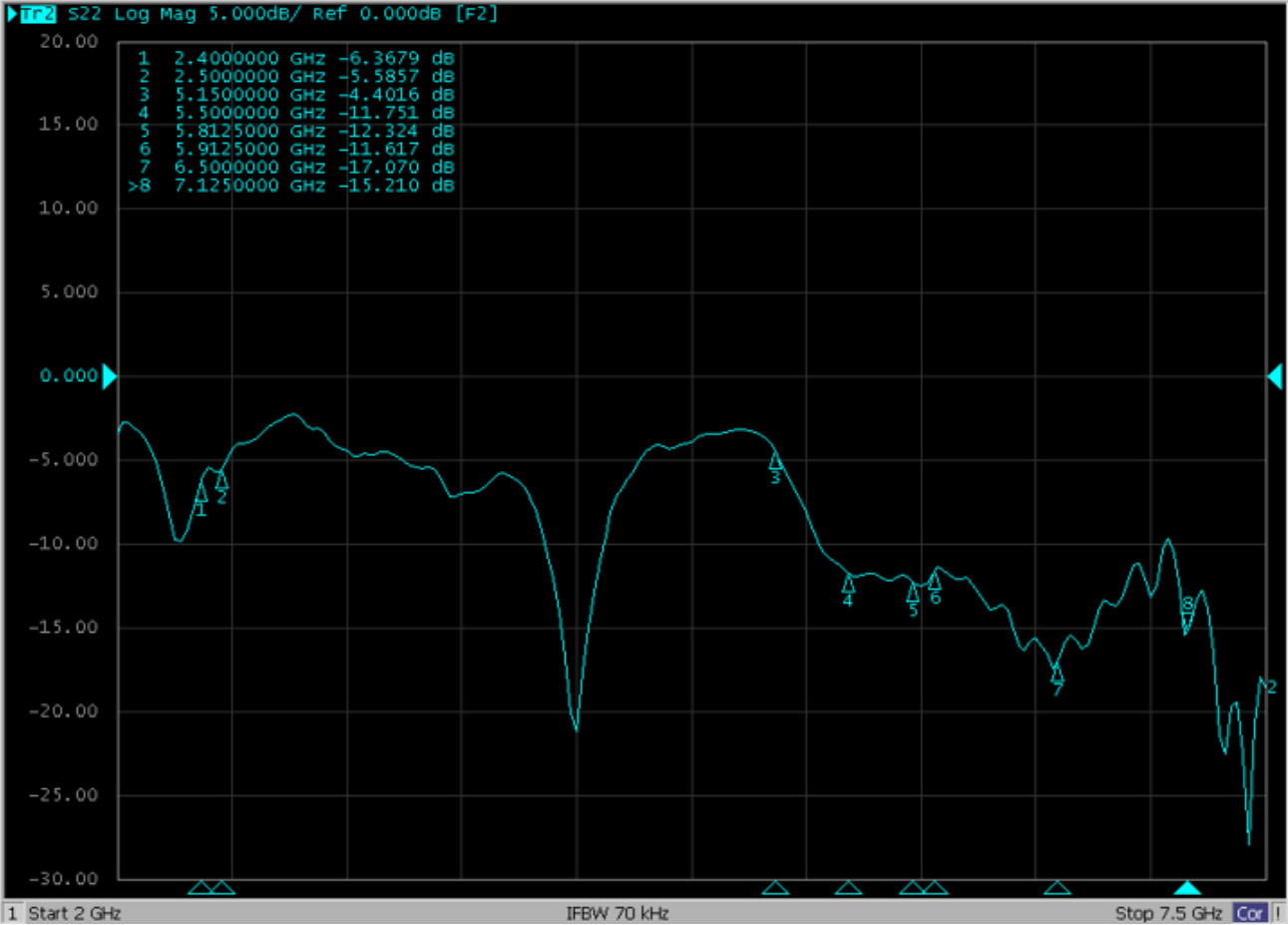
S88-5G



FRE.	5.15G	5.55G	5.825G
RL.	-15.1	-22.8	-13.8

Return loss and Isolation

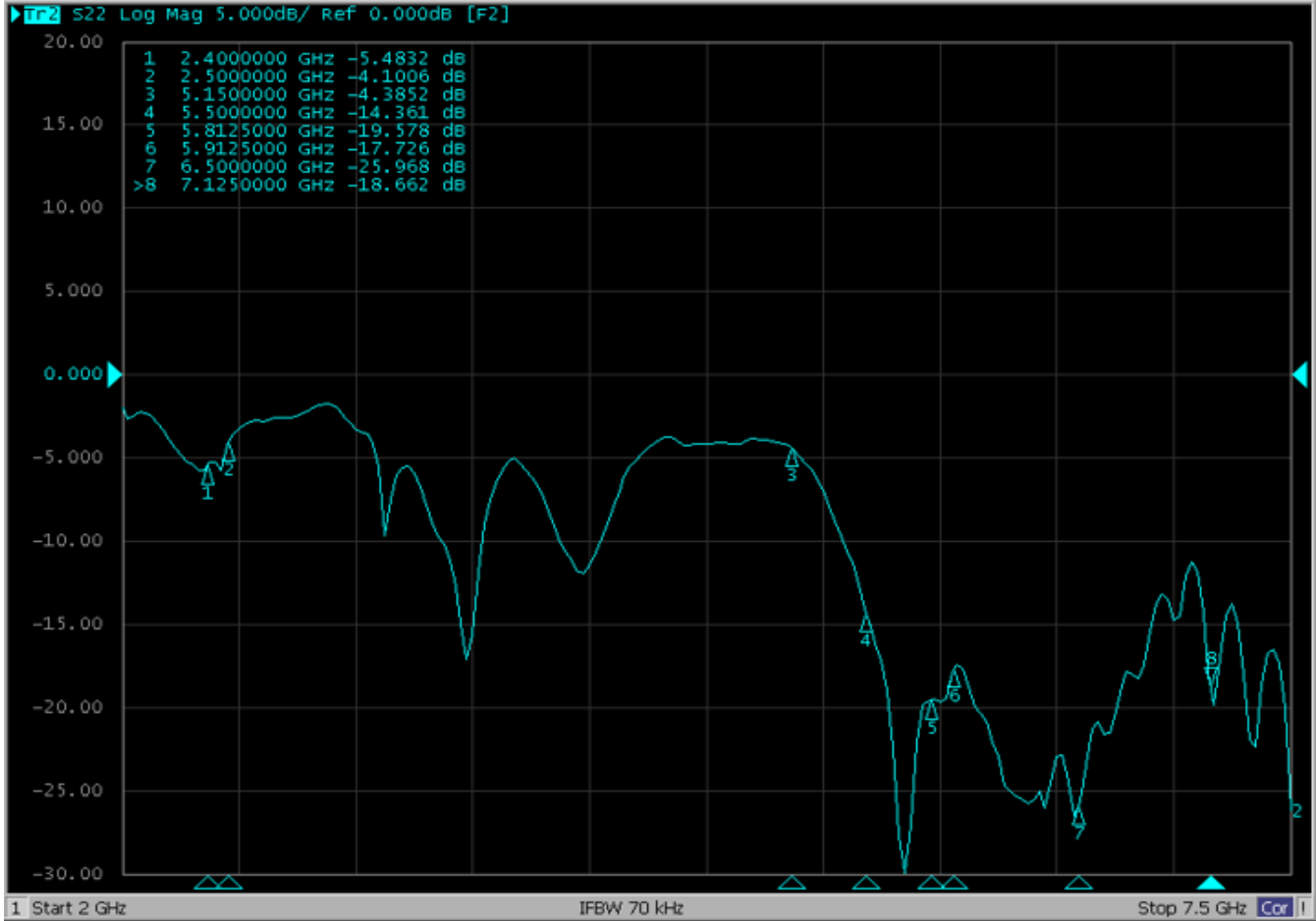
S99-6G



FE.	5.9125G	6.5G	7.125G
RL.	-11.6	-17.0	-15.2

Return loss and Isolation

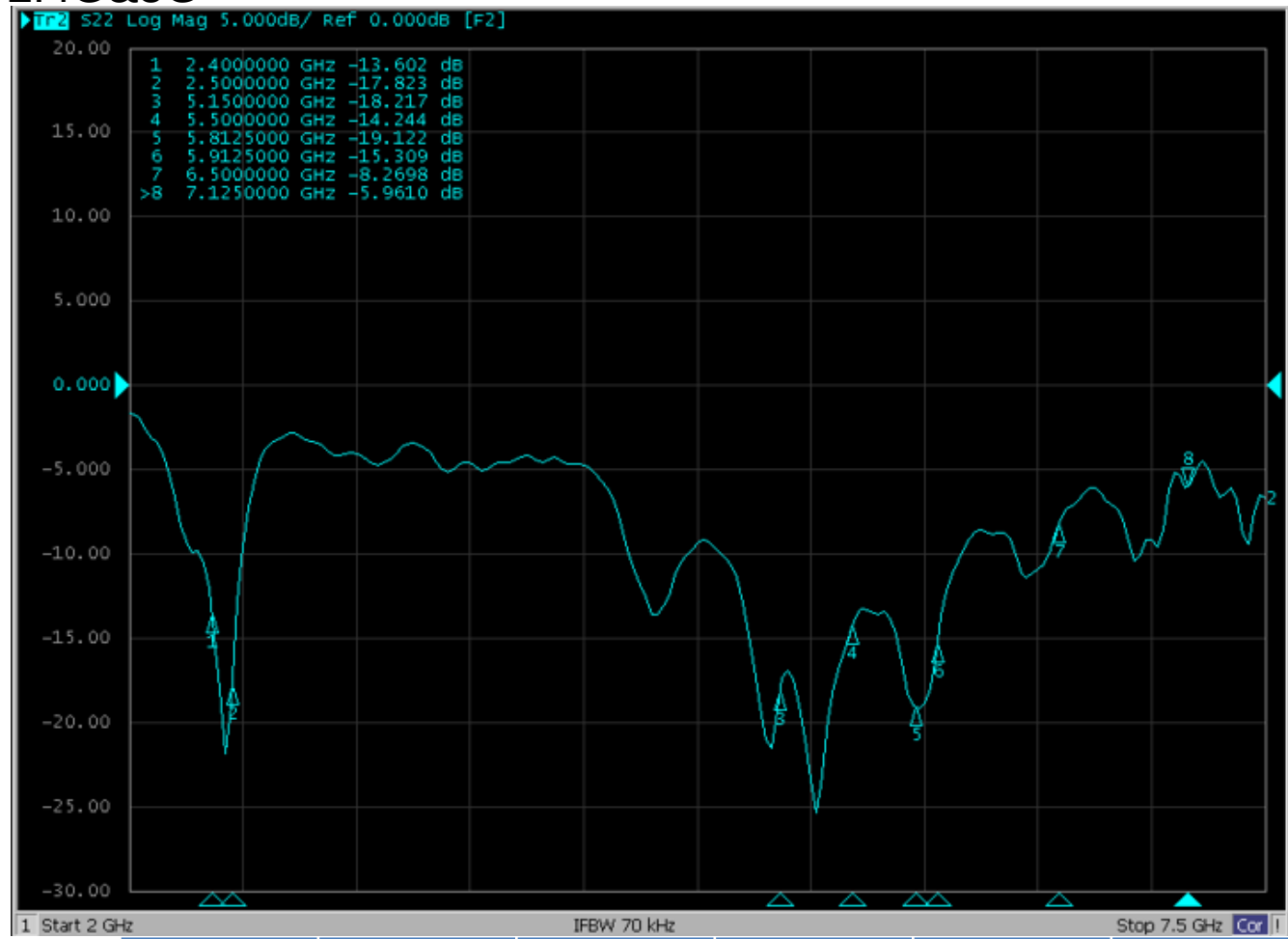
S1010-6G



FRE.	5.9125G	6.5G	7.125G
RL.	-17.7	-25.9	-18.6

Return loss and Isolation

S1111-2.4G&5G



FRE.	2.4G	2.5G	5.15G	5.5G	5.8125G
RL.	-13.6	-17.8	-18.2	-14.2	-19.1

Return loss

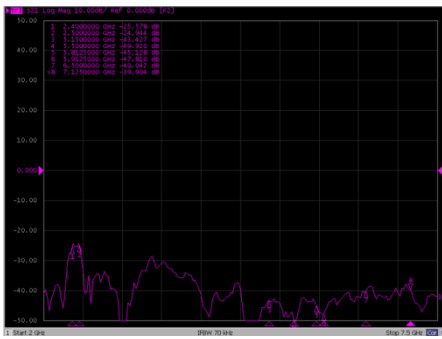
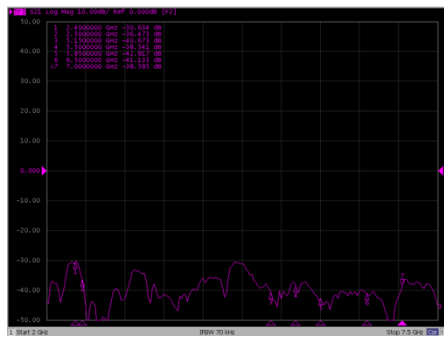
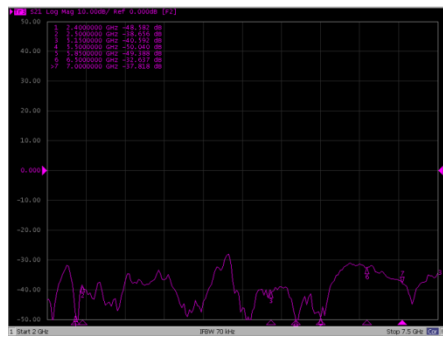
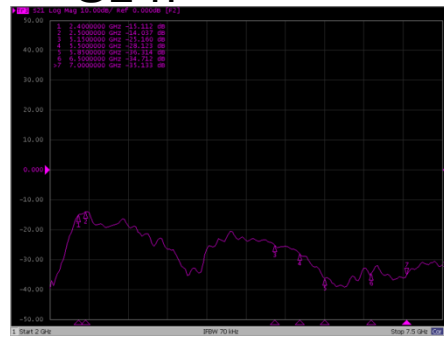


	Return loss		
Frequency (GHz)	2.4-2.5GHz	5.15-5.85GHz	5.9-7.125GHz
ANT1-2G	<-10dB	-	-
ANT2-2G		-	-
ANT3-5G	-	<-10dB	-
ANT4-5G	-		-
ANT5-6G	-	-	<-10dB
ANT6-6G	-		
ANT7-2G	<-10dB	-	
ANT8-5G	-	<-10dB	-
ANT9-6G	-	-	<-10dB
ANT10-6G	-	-	
ANT11-2G&5G	<-10dB		-

Return loss and Isolation



S1-n

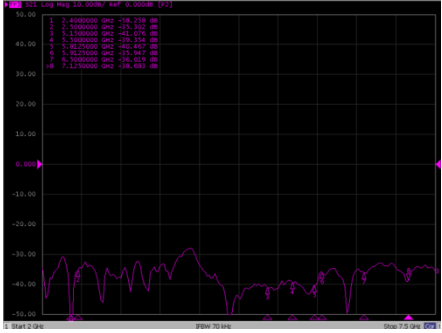
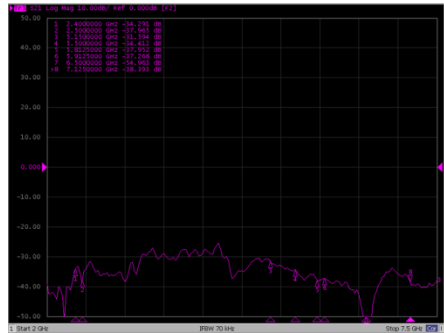
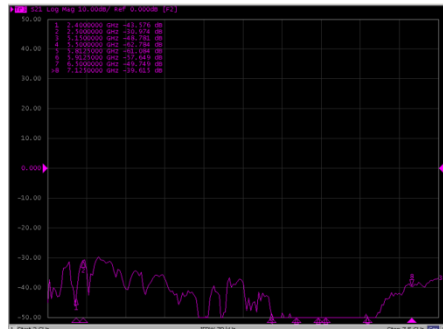
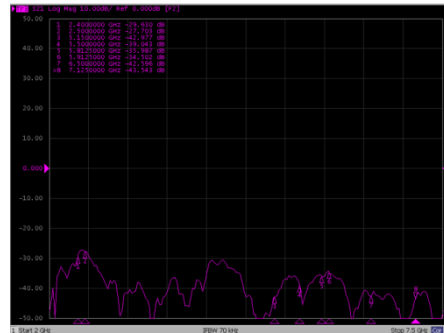


S12

S13

S14

S15

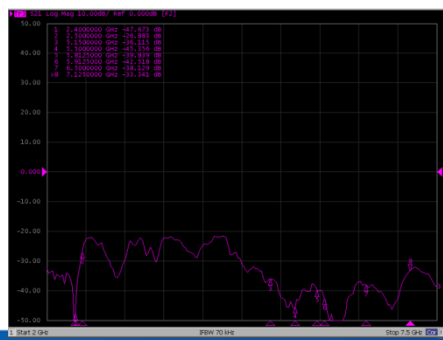
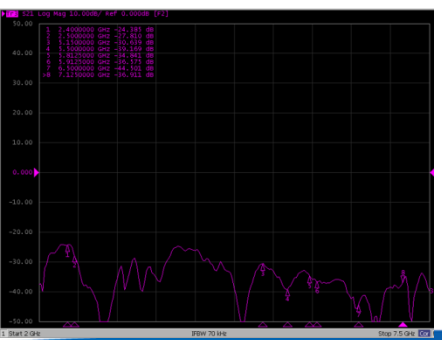


S16

S17

S18

S19



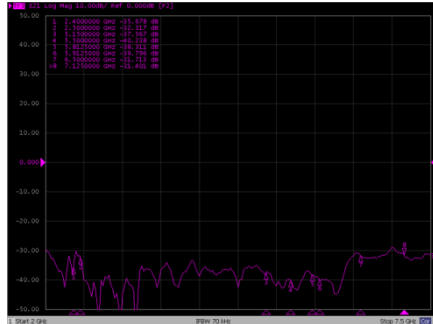
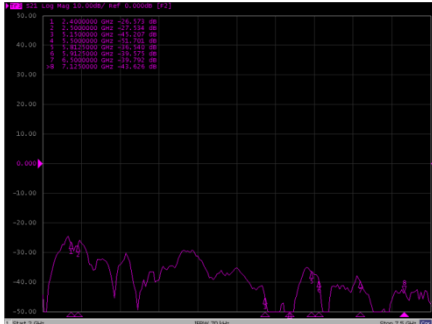
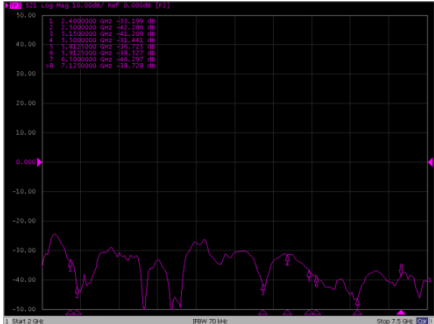
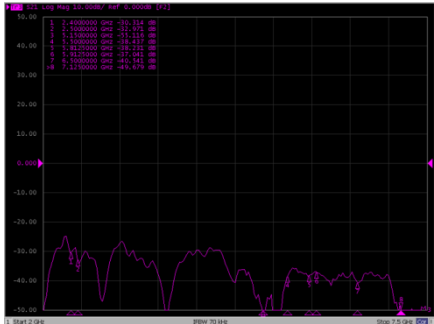
S1-10

S1-11

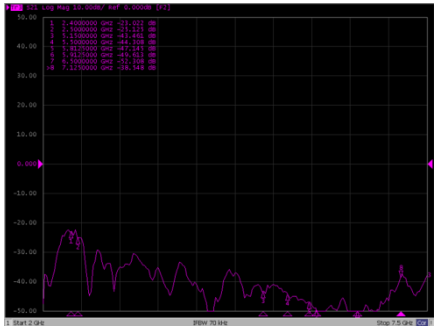
Return loss and Isolation



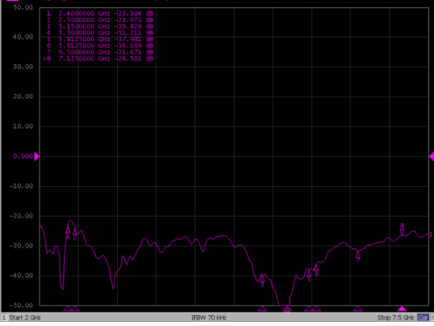
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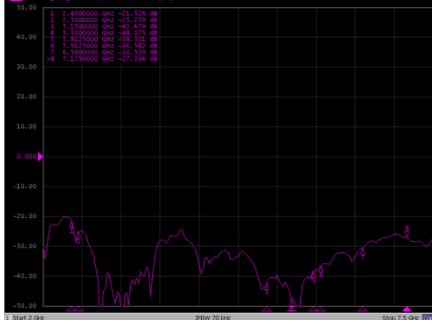
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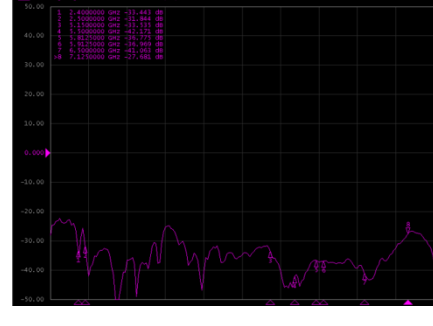
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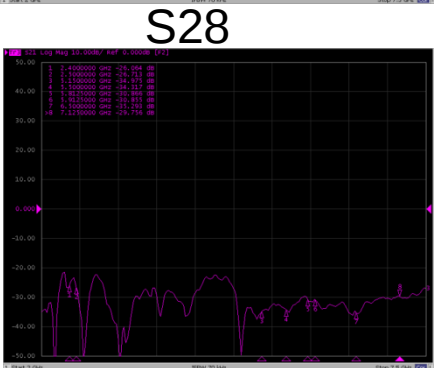
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S26



S27



S28

S29

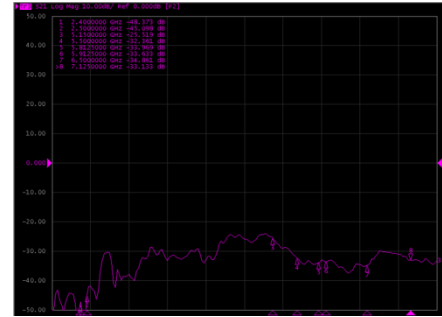
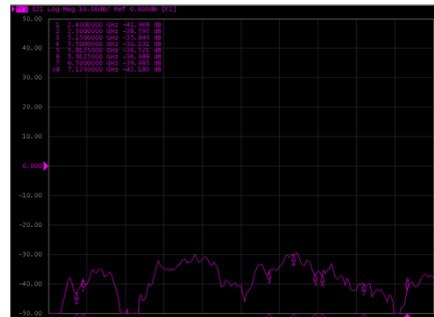
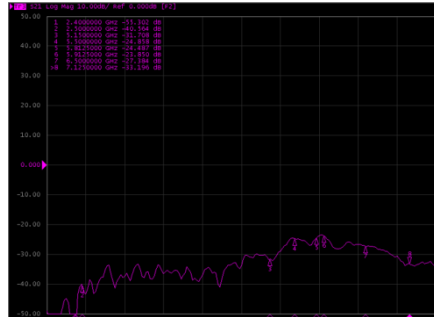
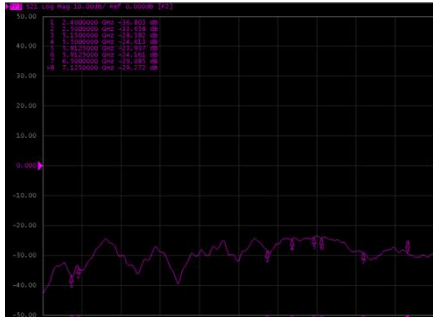
S2-10

S2-11

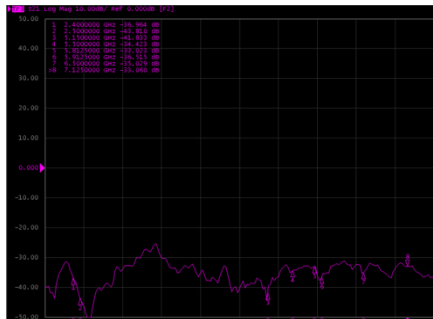
Return loss and Isolation



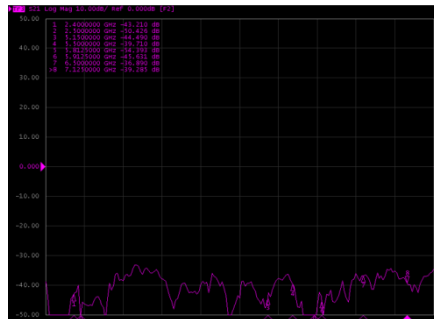
S3-n



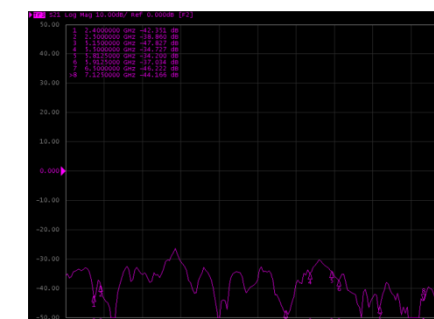
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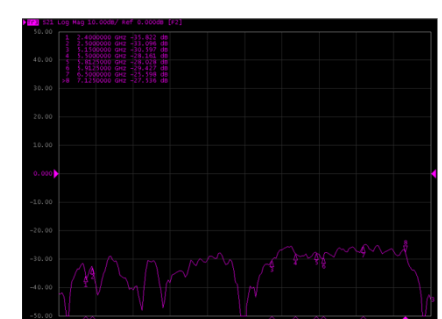
S35



S36



S37



S38



S39



S3-10



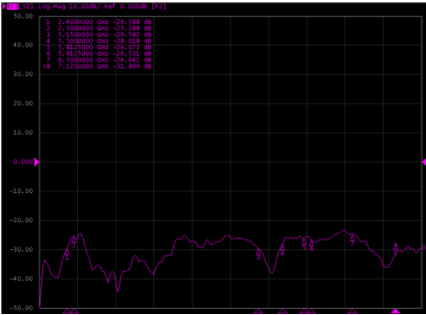
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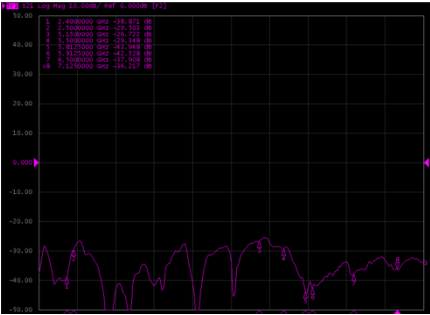
Return loss and Isolation



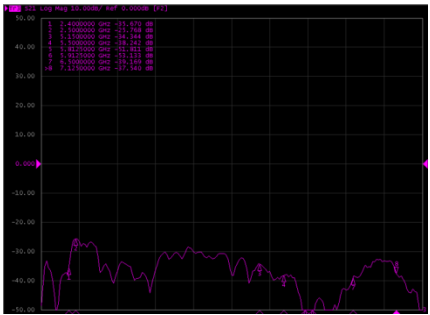
S4-n



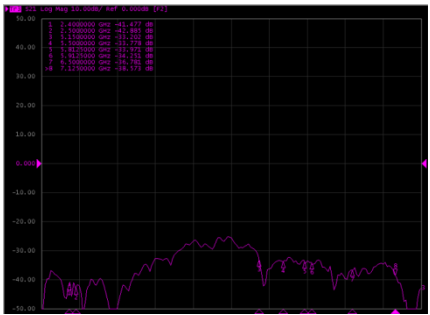
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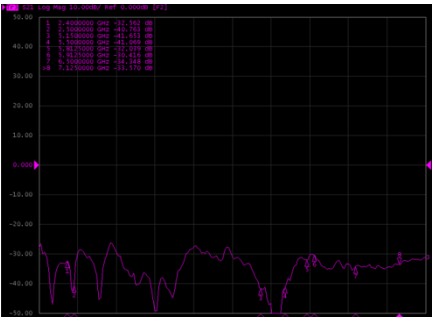
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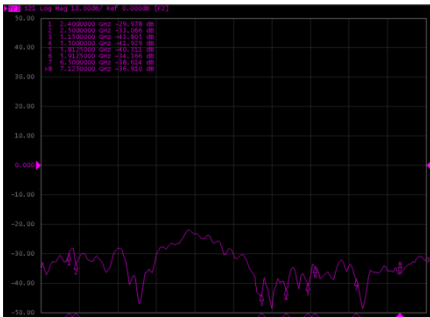
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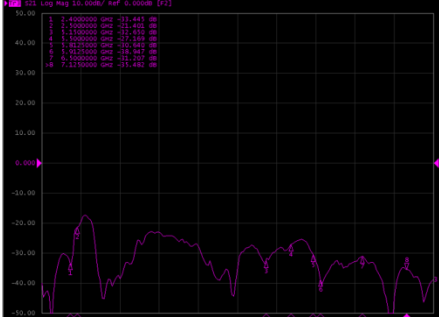
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S49



S4-10

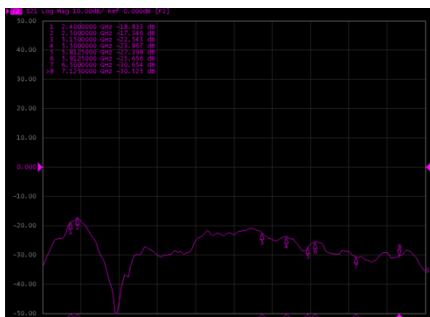


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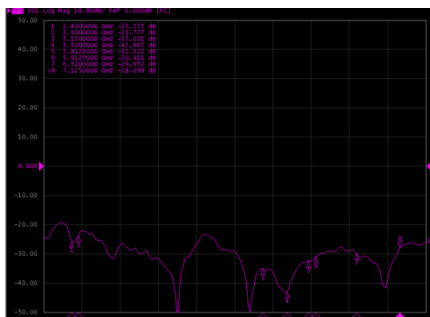
Return loss and Isolation



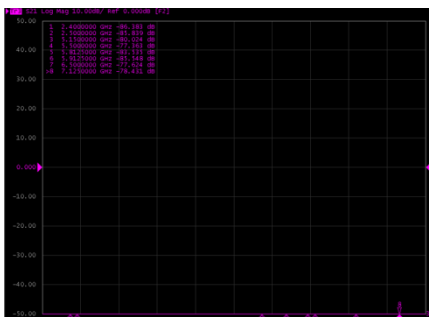
S5-n



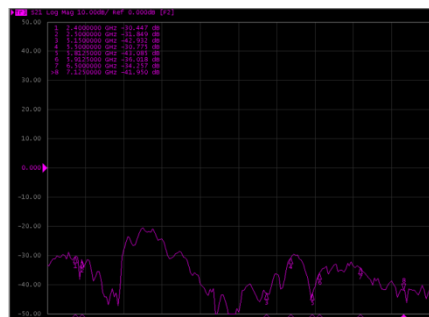
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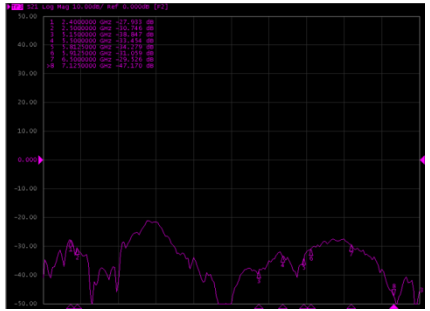
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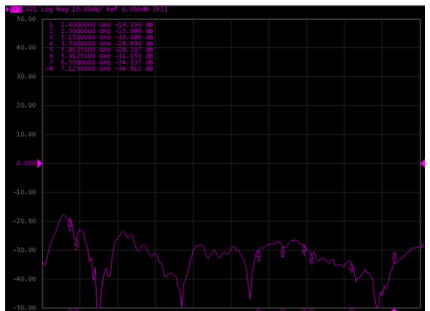
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S59



S5-10

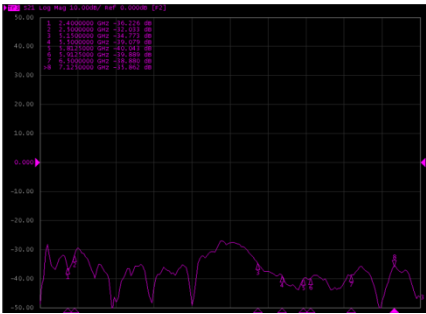


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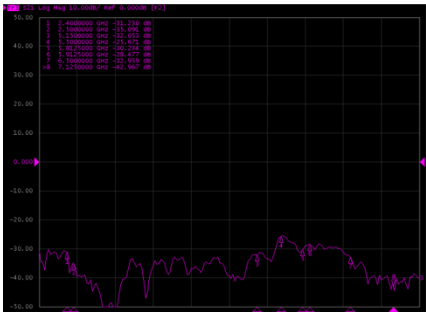
Return loss and Isolation



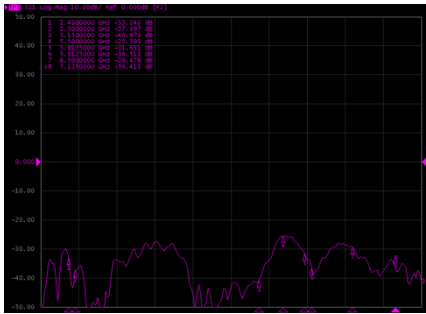
S6-n



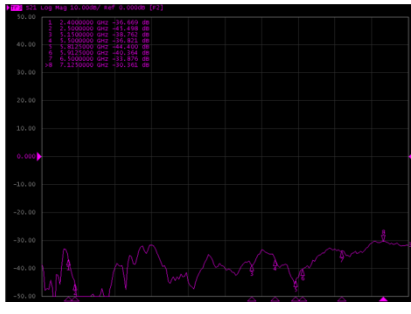
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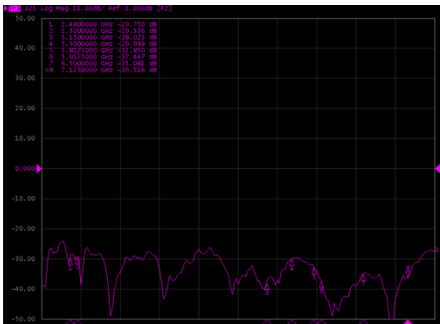
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S69



S6-10

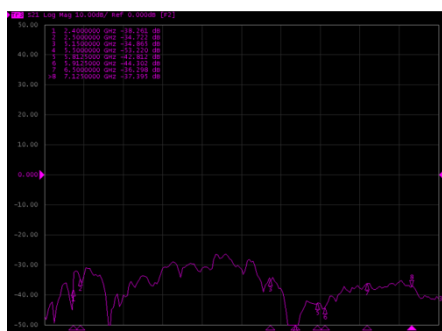


S6-11

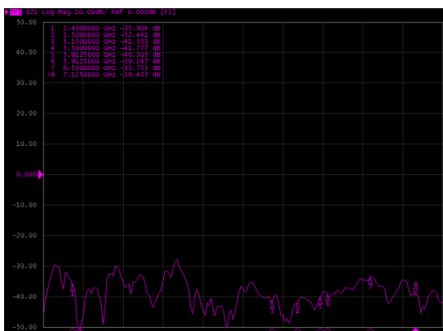
Return loss and Isolation



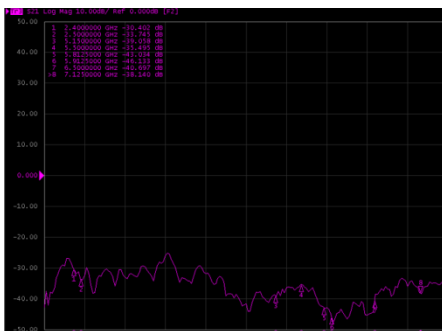
S7-n



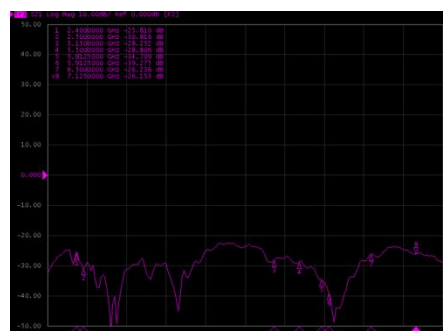
S78



S79



S7-10



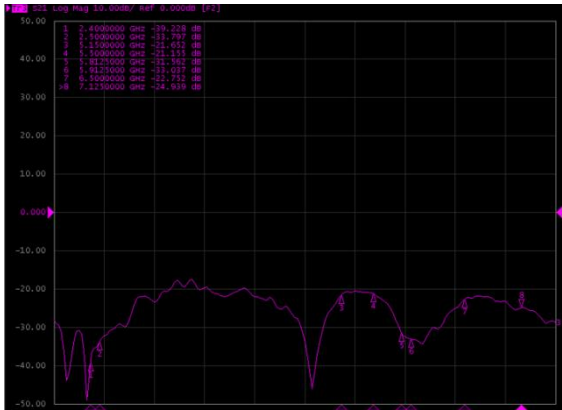
S7-11

T&W

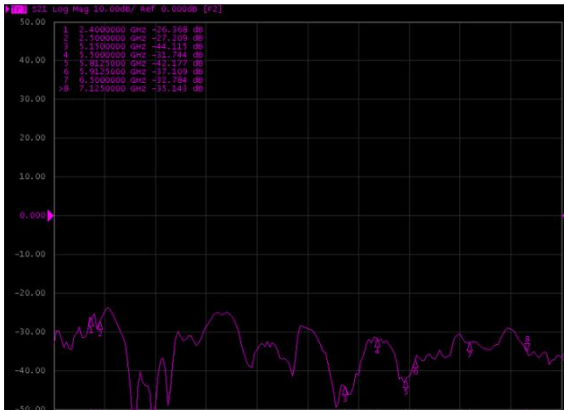
31 page

Return loss and Isolation

S9-n



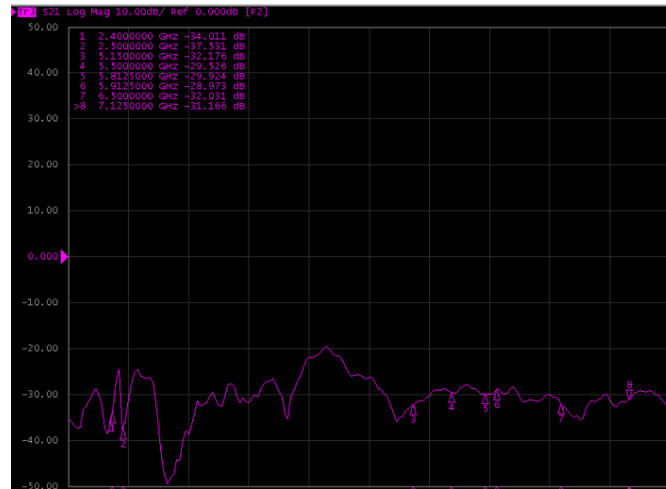
S9-10



S9-11

Return loss and Isolation

S10-n



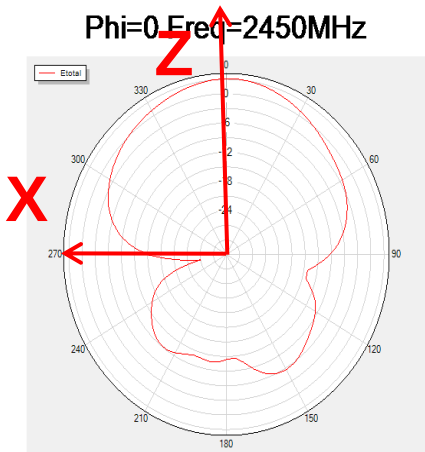
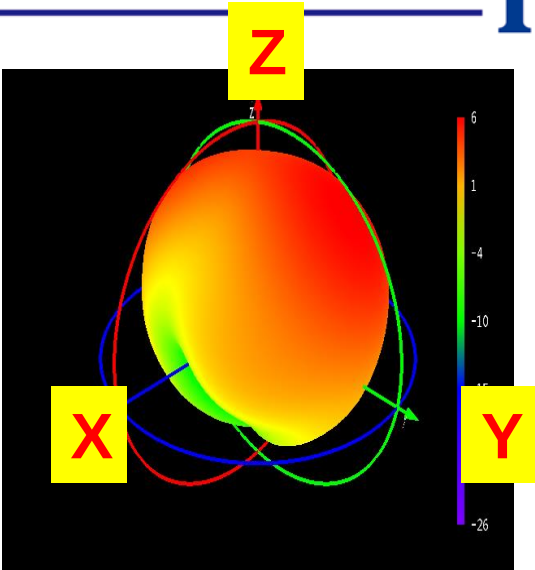
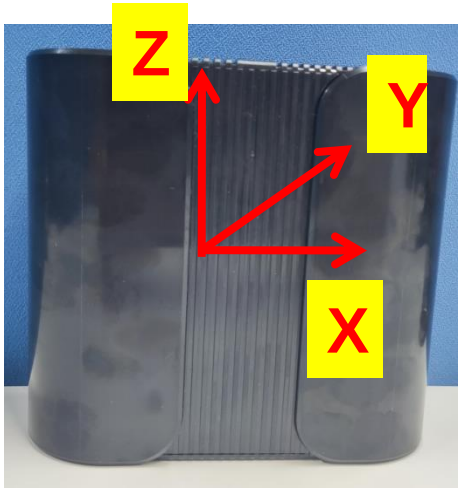
S10-11

Isolation

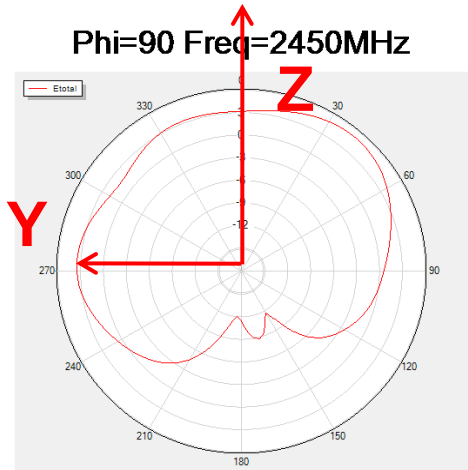
	Isolation		
Frequency (GHz)	2.4-2.5GHz	5.15-5.85GHz	5.9-7.125GHz
ANT1-2G	<-20dB	-	-
ANT2-2G		-	-
ANT3-5G	-	<-20dB	<-25dB
ANT4-5G	-		
ANT5-6G	-	<-25dB	<-20dB
ANT6-6G	-		
ANT7-2G	<-20dB	-	
ANT8-5G	-	<-20dB	<-25dB
ANT9-6G	-	<-25dB	<-20dB
ANT10-6G	-		
ANT11-2G&5G	<-20dB		-

Radiation Pattern

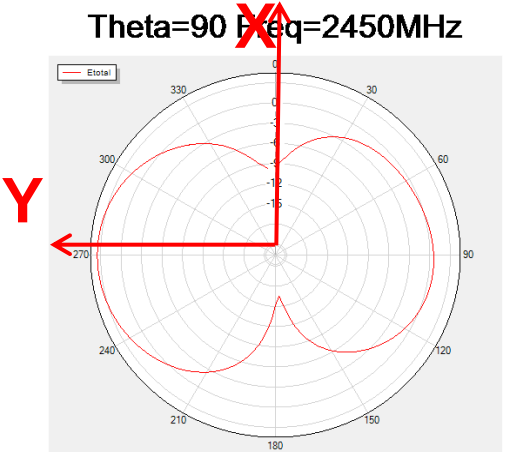
Ant1-2.4G



E1 (Phi=0)



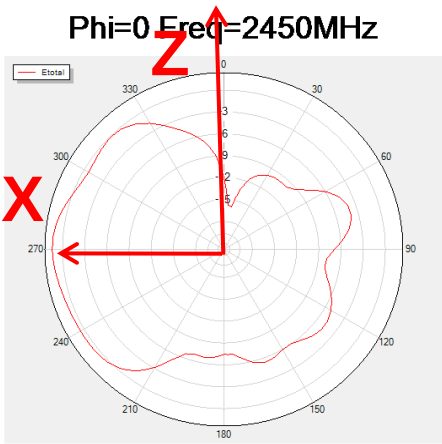
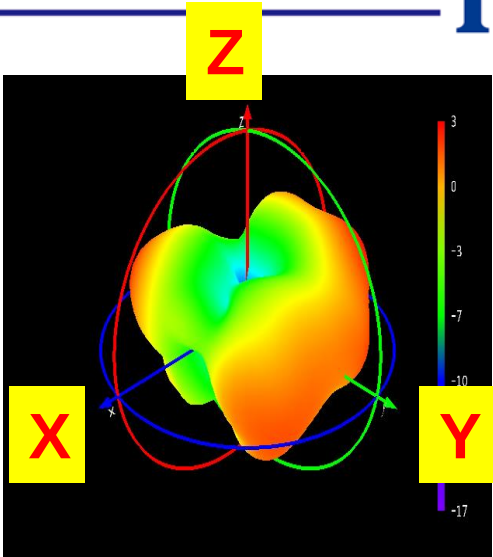
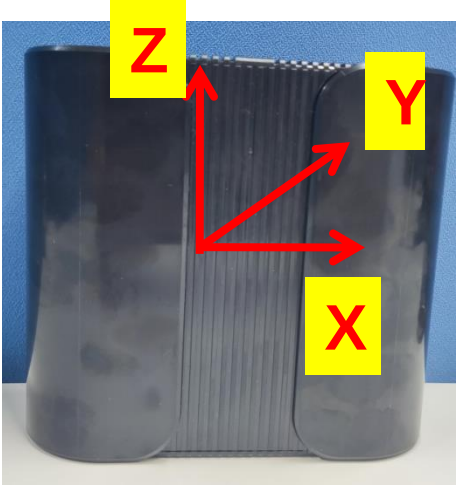
E2 (Phi=90)



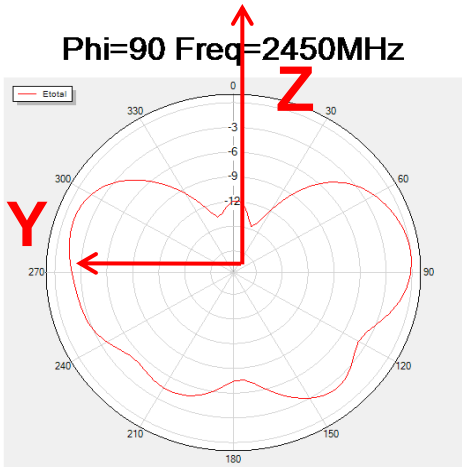
H (Theta=90)

Radiation Pattern

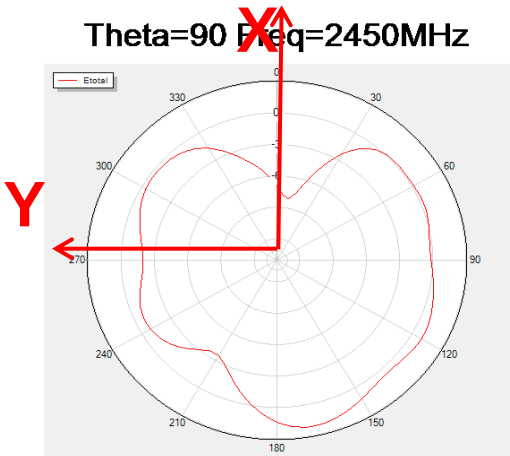
Ant11-2.4G



E1 (Phi=0)



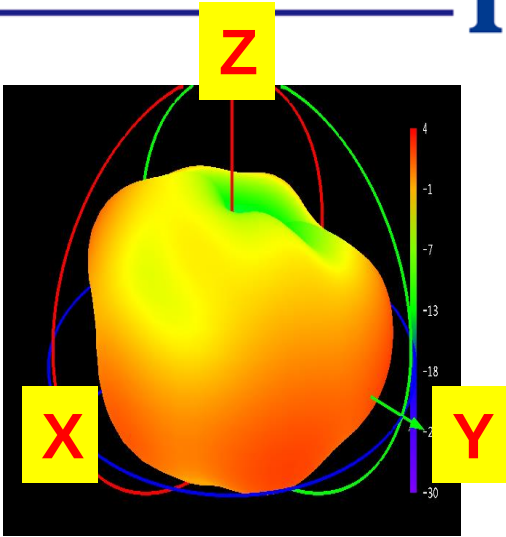
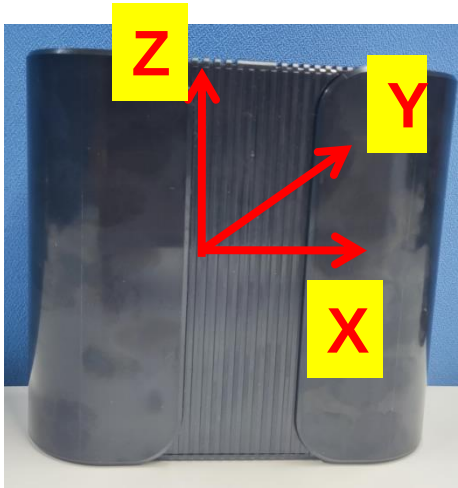
E2 (Phi=90)



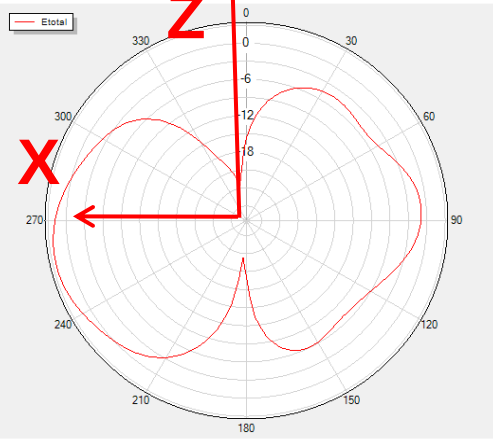
H (Theta=90)

Radiation Pattern

Ant11-5G

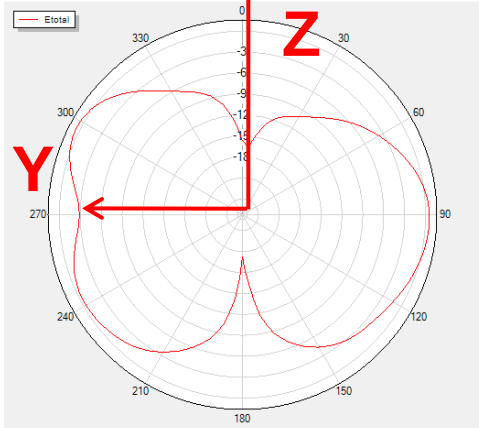


Phi=0 Freq=5500MHz



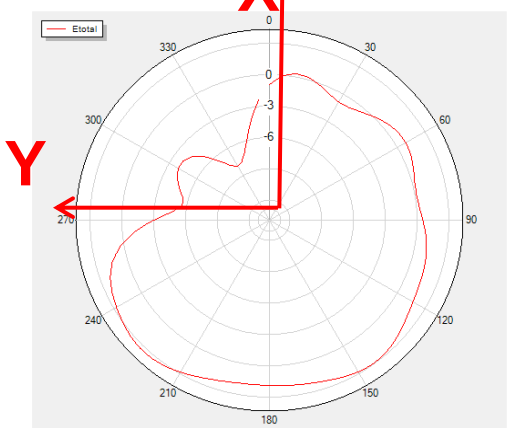
E1 (Phi=0)

Phi=90 Freq=5500MHz



E2 (Phi=90)

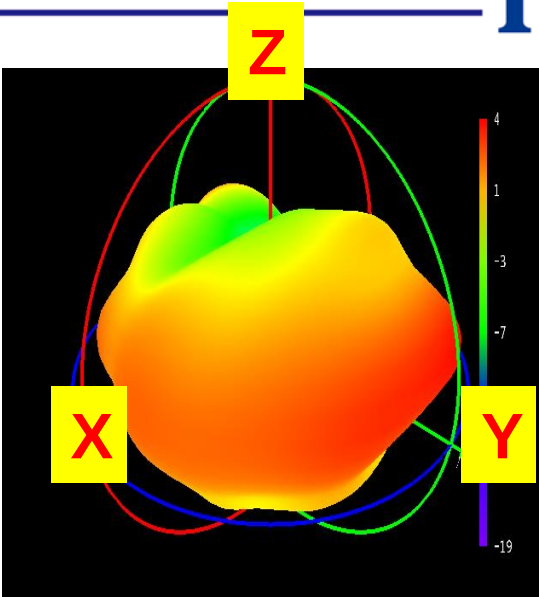
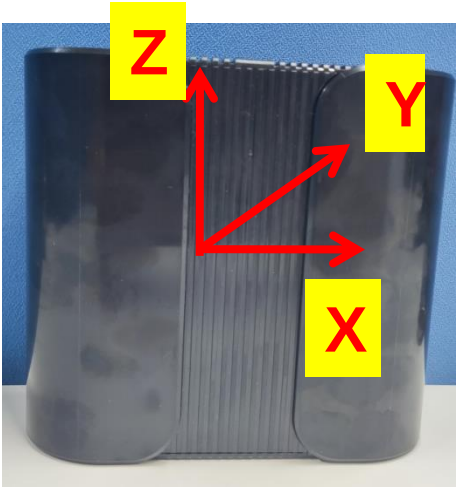
Theta=90 Freq=5500MHz



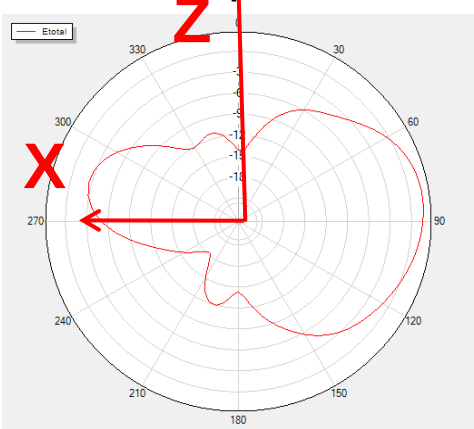
H (Theta=90)

Radiation Pattern

Ant3-5G

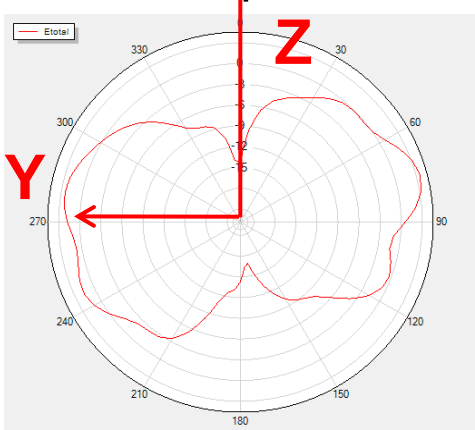


Phi=0 Freq=5500MHz



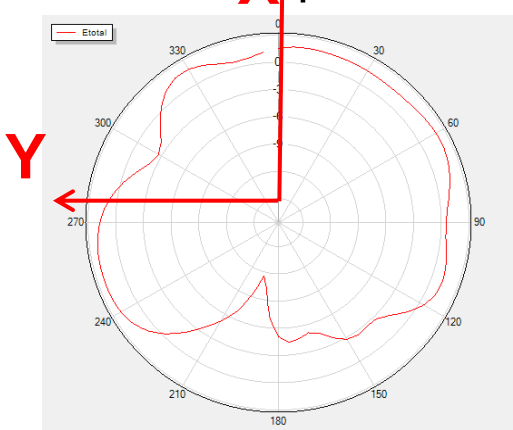
E1 (Phi=0)

Phi=90 Freq=5500MHz



E2 (Phi=90)

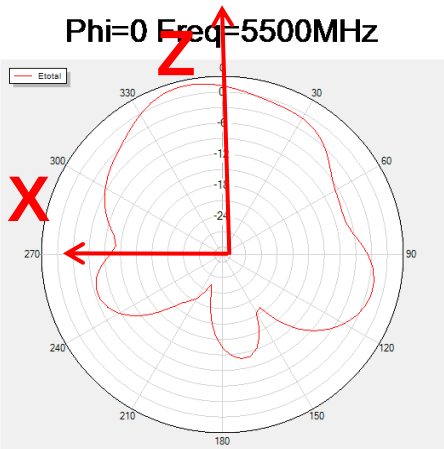
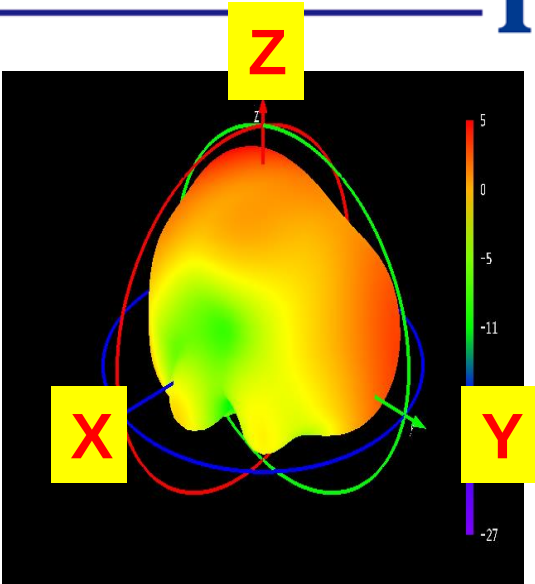
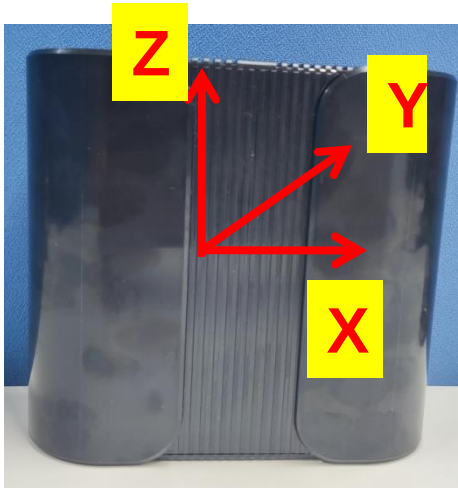
Theta=90 Freq=5500MHz



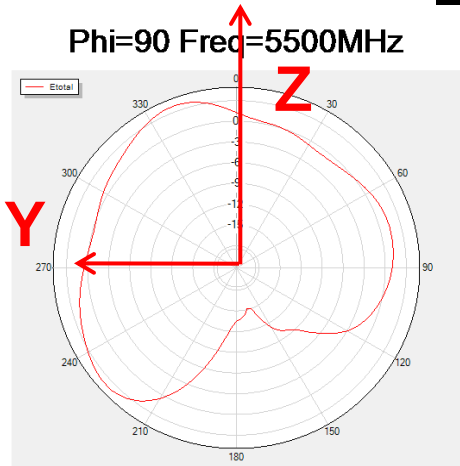
H (Theta=90)

Radiation Pattern

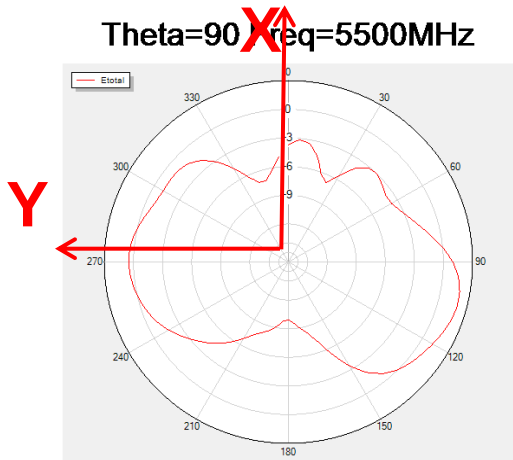
Ant4-5G



E1 (Phi=0)



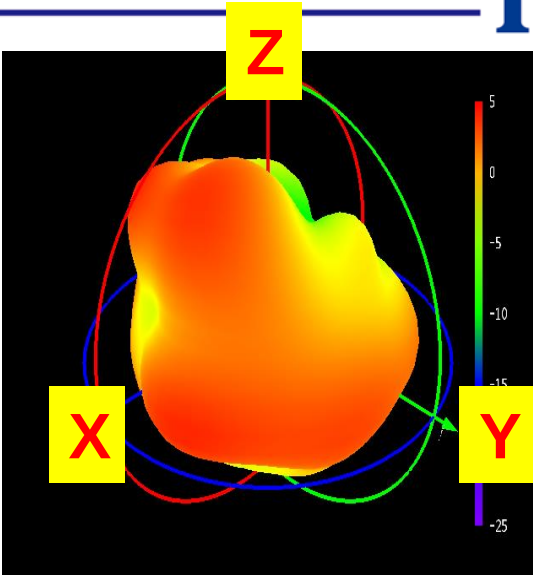
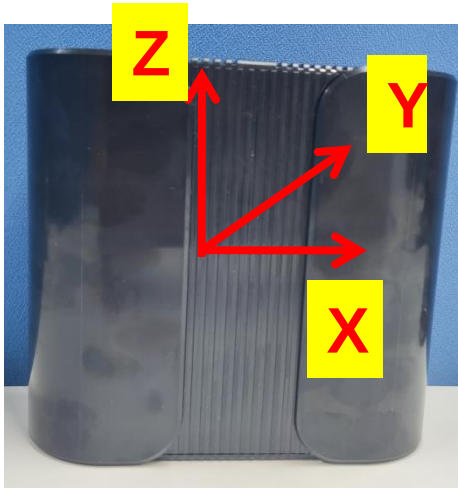
E2 (Phi=90)



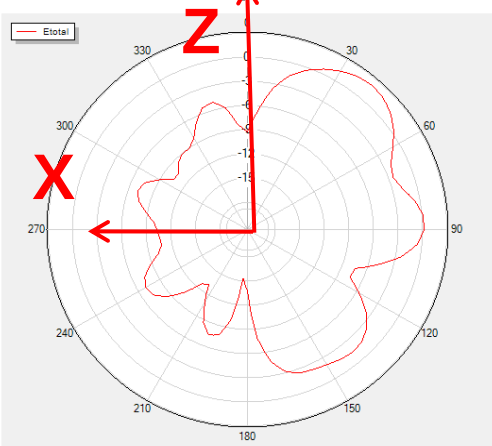
H (Theta=90)

Radiation Pattern

Ant8-5G

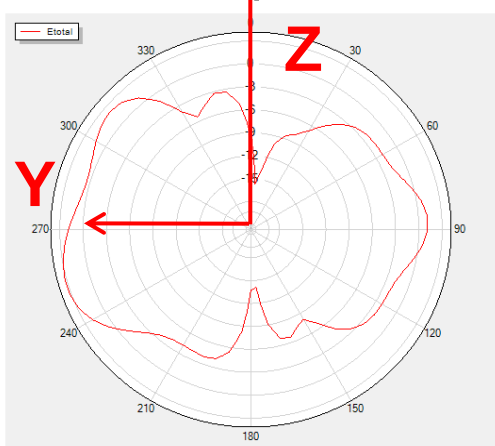


Phi=0 Freq=5500MHz



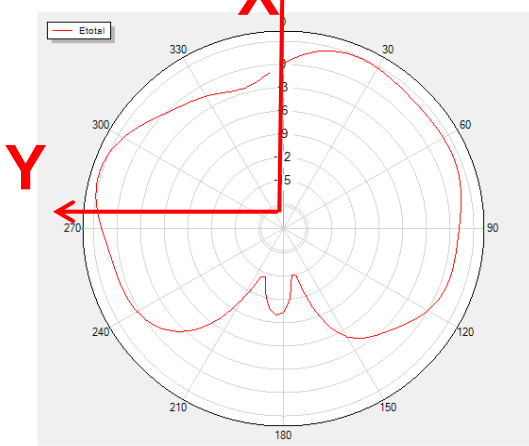
E1 (Phi=0)

Phi=90 Freq=5500MHz



E2 (Phi=90)

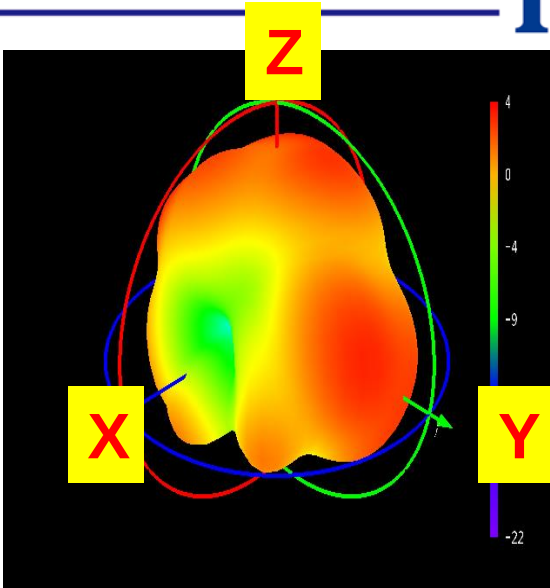
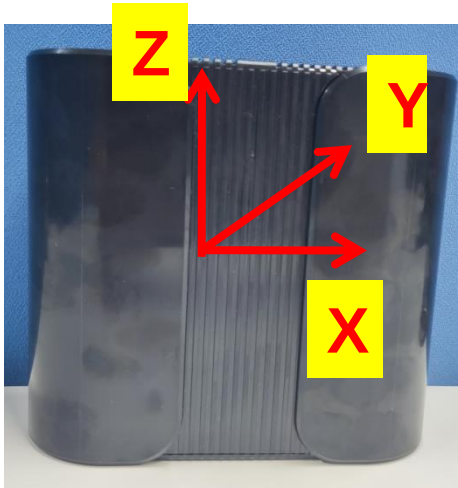
Theta=90 Freq=5500MHz



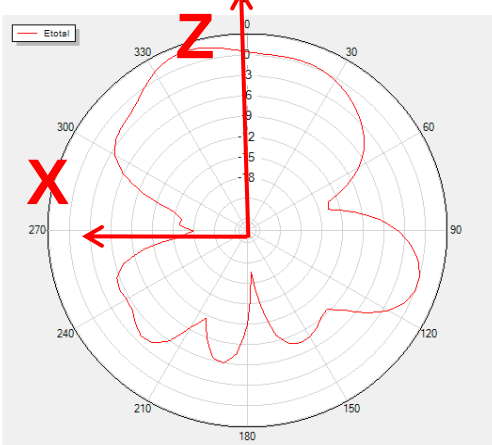
H (Theta=90)

Radiation Pattern

Ant5-6G

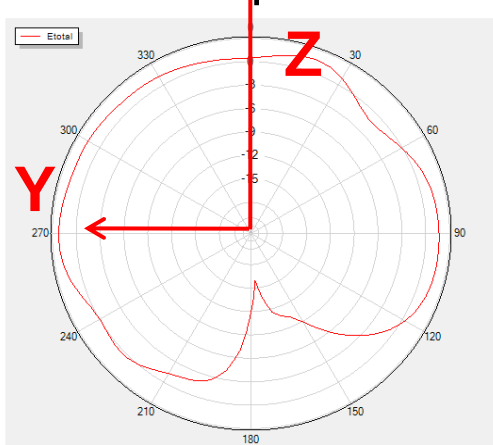


Phi=0 Freq=6525MHz



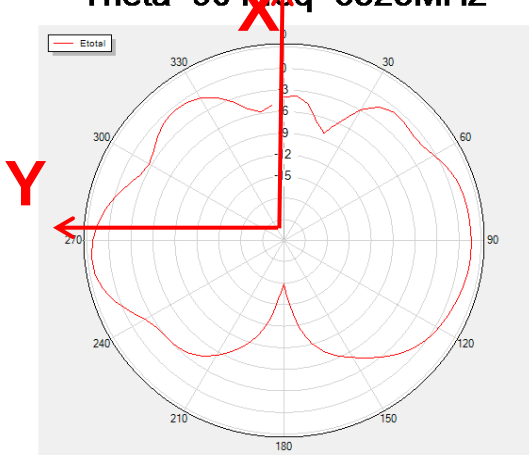
E1 (Phi=0)

Phi=90 Freq=6525MHz



E2 (Phi=90)

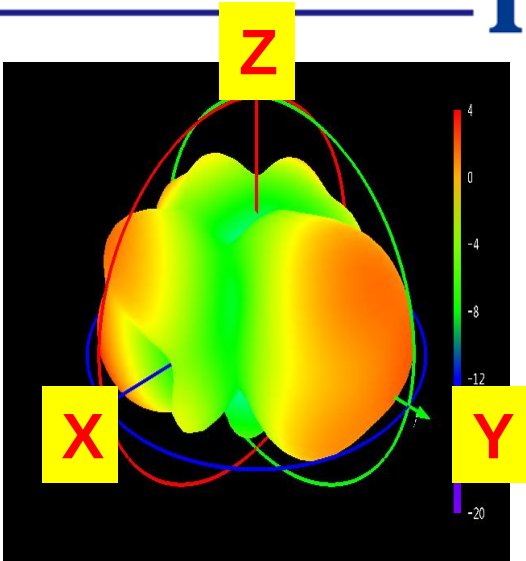
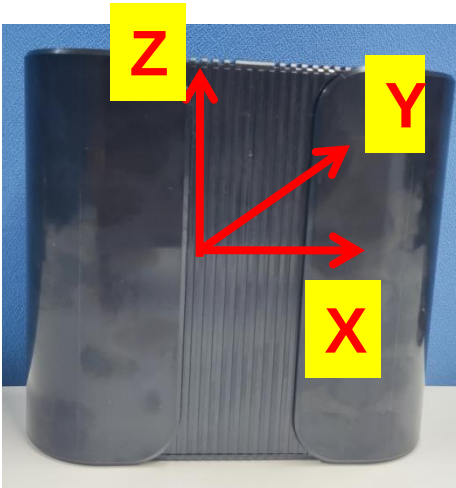
Theta=90 Freq=6525MHz



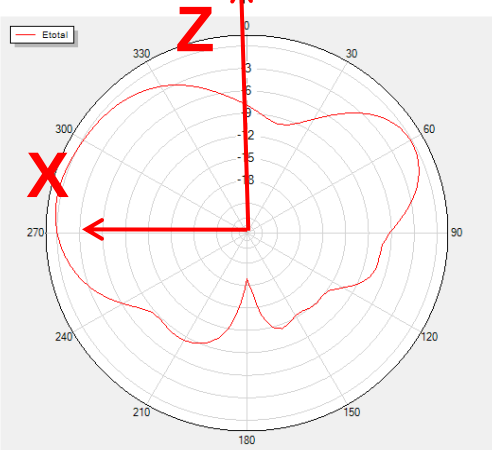
H (Theta=90)

Radiation Pattern

Ant6-6G

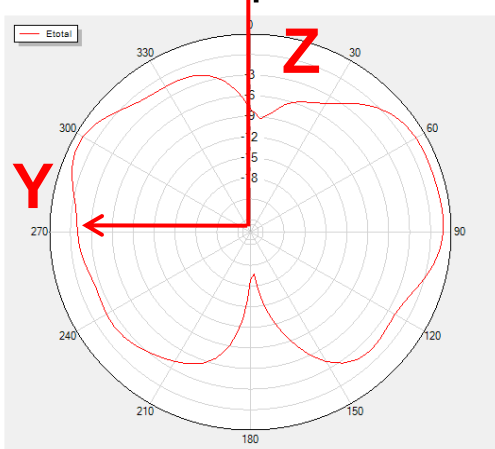


Phi=0 Freq=6525MHz



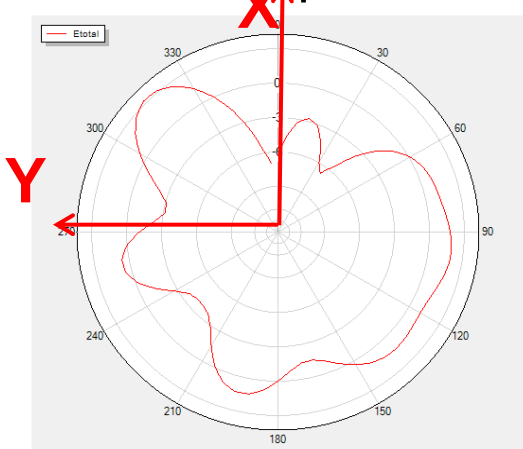
E1 (Phi=0)

Phi=90 Freq=6525MHz



E2 (Phi=90)

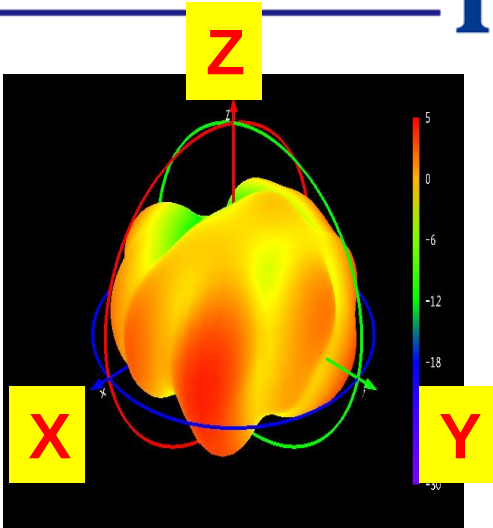
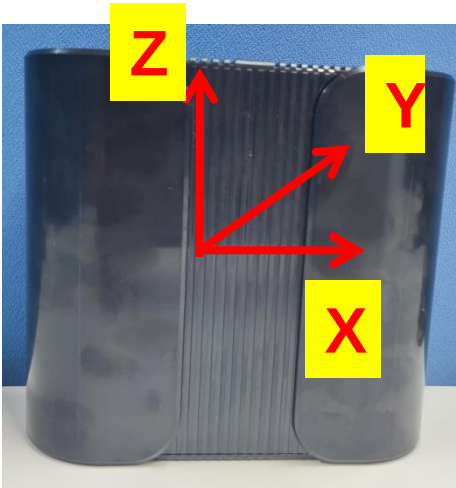
Theta=90 Freq=6525MHz



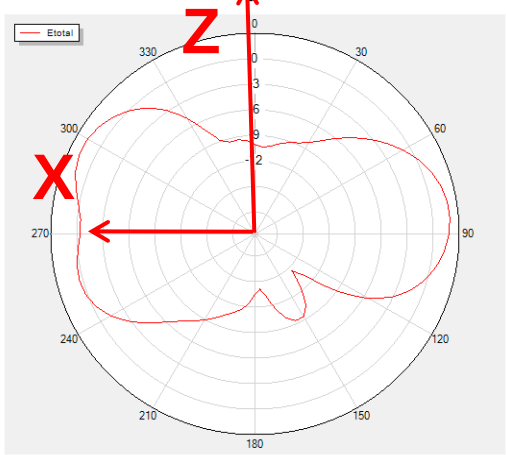
H (Theta=90)

Radiation Pattern

Ant9-6G

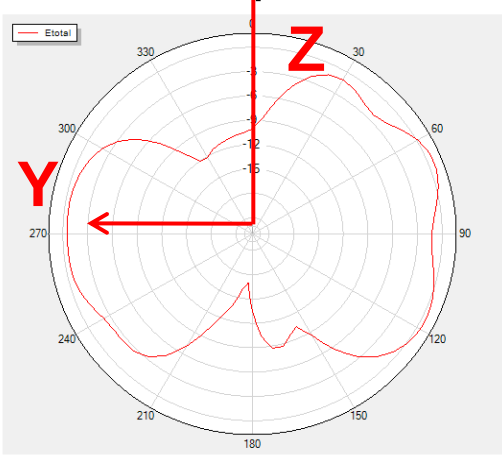


Phi=0 Freq=6525MHz



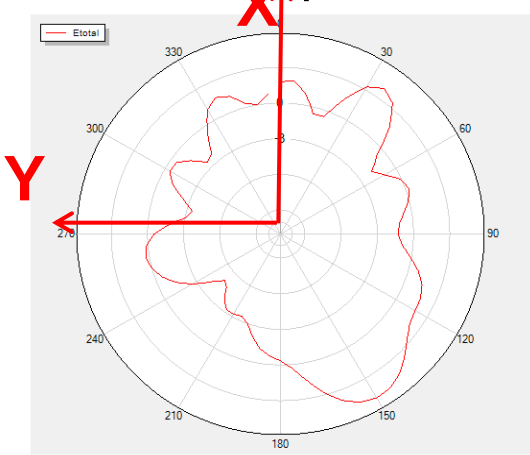
E1 (Phi=0)

Phi=90 Freq=6525MHz



E2 (Phi=90)

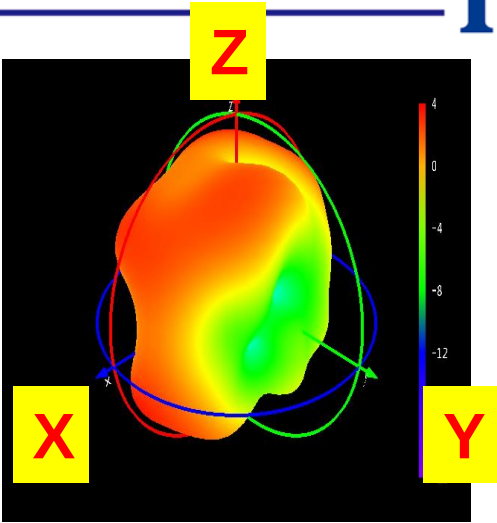
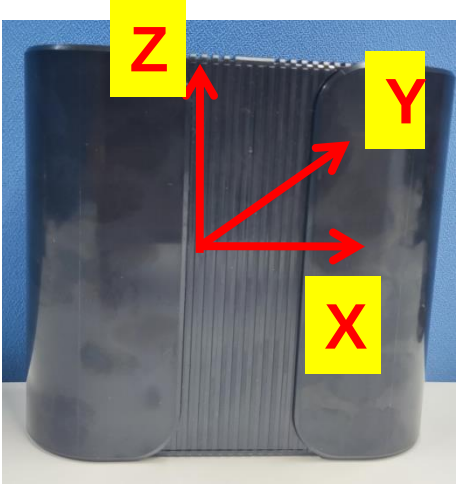
Theta=90 Freq=6525MHz



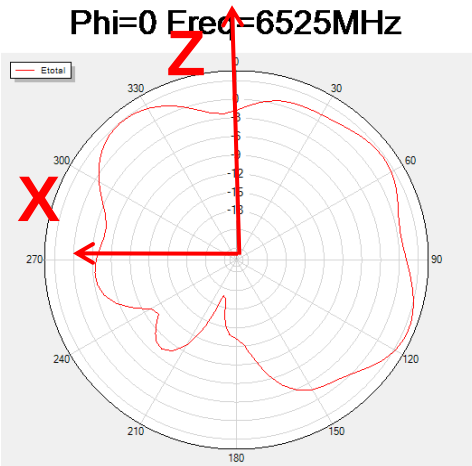
H (Theta=90)

Radiation Pattern

Ant10-6G

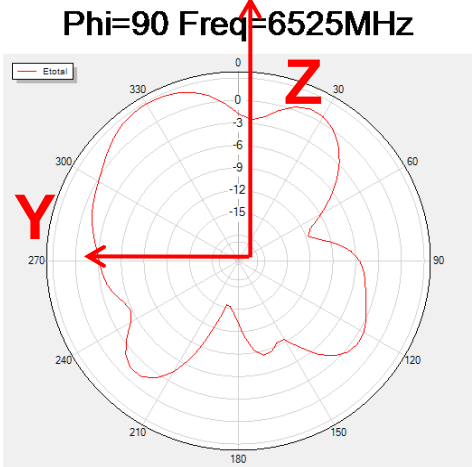


Phi=0 Freq=6525MHz



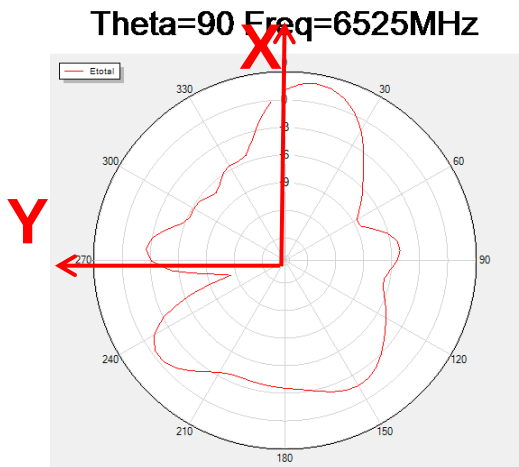
E1 (Phi=0)

Phi=90 Freq=6525MHz



E2 (Phi=90)

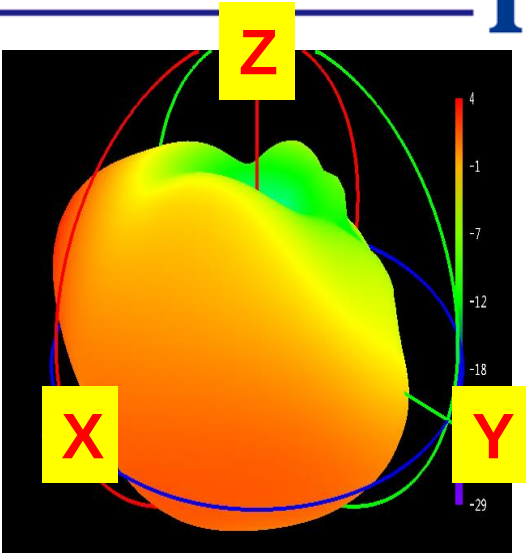
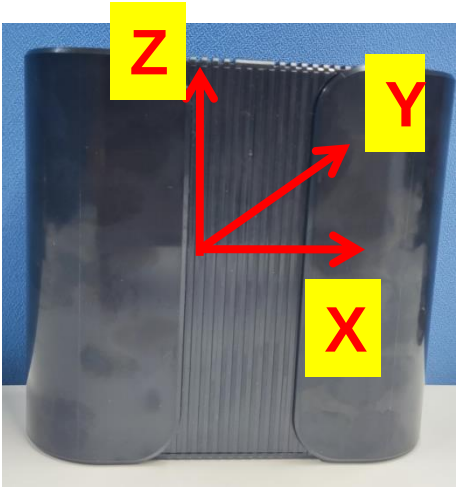
Theta=90 Freq=6525MHz



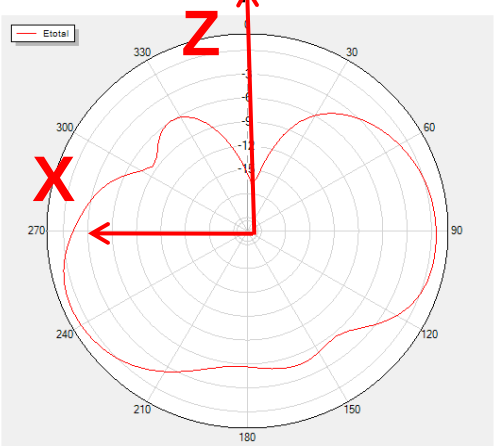
H (Theta=90)

Radiation Pattern

Ant2-2G

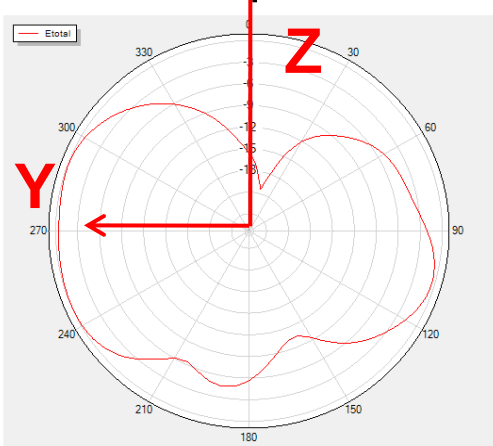


Phi=0 Freq=2450MHz



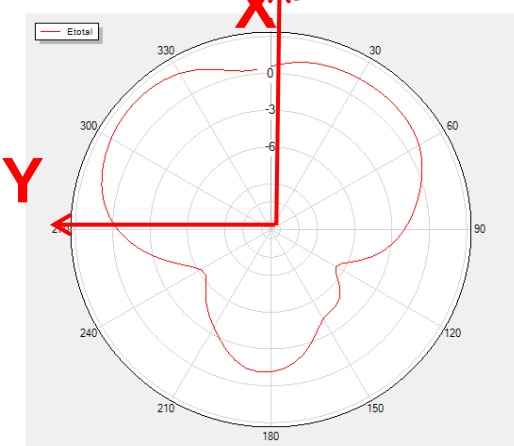
E1 (Phi=0)

Phi=90 Freq=2450MHz



E2 (Phi=90)

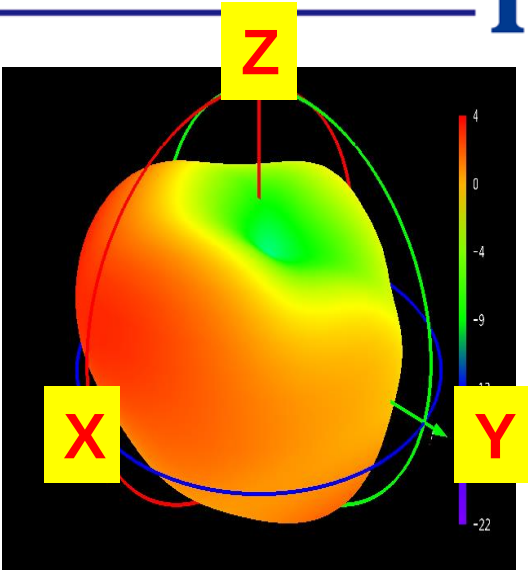
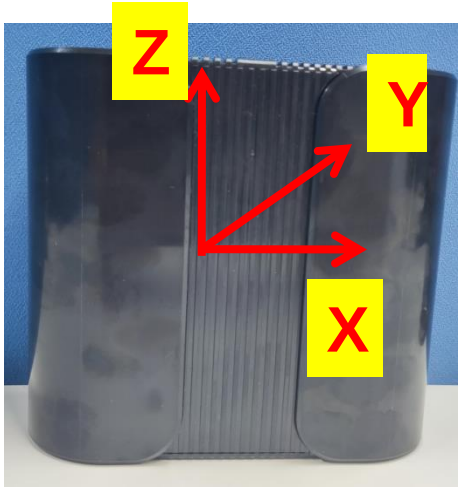
Theta=90 Freq=2450MHz



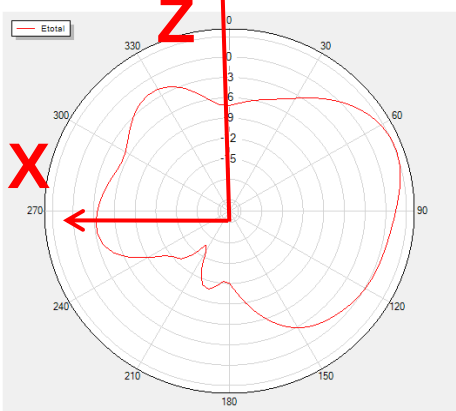
H (Theta=90)

Radiation Pattern

Ant7-2.4G

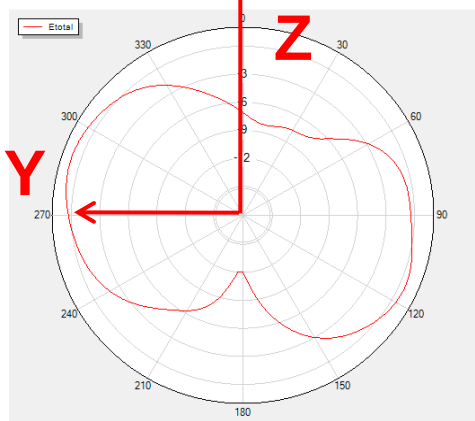


Phi=0 Freq=2450MHz



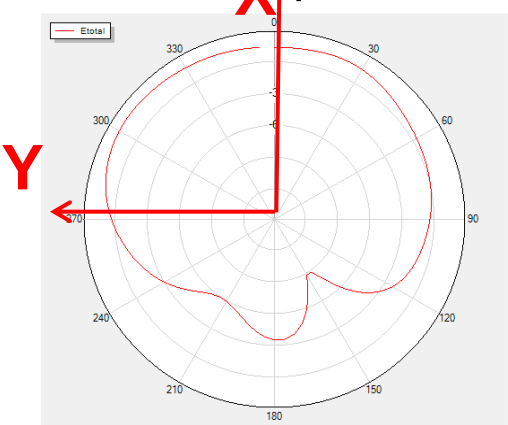
E1 (Phi=0)

Phi=90 Freq=2450MHz



E2 (Phi=90)

Theta=90 Freq=2450MHz



H (Theta=90)

Gain & Efficiency

ANT	NO.	Frequency(GHz)	Gain(dBi)	Efficiency
2G	ANT1-2G	2.45	3.47	>70%
	ANT11-2G&5G	2.45	3.32	
5G	ANT11-2G&5G	5.5	4.72	>65%
	ANT3-5G	5.5	4.68	
	ANT4-5G	5.5	4.73	
	ANT8-5G	5.5	4.19	
6G	ANT5-6G	6.5	4.24	>60%
	ANT6-6G	6.5	4.92	
	ANT9-6G	6.5	4.84	
	ANT10-6G	6.5	4.35	
BT	ANT2-2G	2.45	3.97	>65%
	ANT7-2G	2.45	3.83	

Directional Gain



Used for FCC and CE certification

ANT	NO.	Frequency(GHz)	Uncorrelated	Correlated
2G	ANT1-2G	2.45	1.78	4.78
	ANT11-2G&5G	2.45		
5G	ANT11-2G&5G	5.5	1.14	6.91
	ANT3-5G	5.5		
	ANT4-5G	5.5		
	ANT8-5G	5.5		
6G	ANT5-6G	6.5	1.16	6.57
	ANT6-6G	6.5		
	ANT9-6G	6.5		
	ANT10-6G	6.5		

1、Correlated Directional Gain

Directional gain = $10 \log[(10^{G1 \phi / 20} + 10^{G2 \phi / 20} + \dots + 10^{GN \phi / 20})^2 / N_{ANT} + (10^{G1 \theta / 20} + 10^{G2 \theta / 20} + \dots + 10^{GN \theta / 20})^2 / N_{ANT}]$ dBi

2、Uncorrelated Directional Gain

Directional gain = $10 \log[(10^{G1 \phi / 10} + 10^{G2 \phi / 10} + \dots + 10^{GN \phi / 10}) / N_{ANT} + (10^{G1 \theta / 10} + 10^{G2 \theta / 10} + \dots + 10^{GN \theta / 10}) / N_{ANT}]$ dBi

Summary

- **Return loss**

The data on page 17 shows:

- The WIFI 2.4G antenna's Return loss $< -10\text{dB}$;
- The WIFI 5G antenna's Return loss $< -10\text{dB}$;
- The WIFI 6G antenna's Return loss $< -10\text{dB}$;
- The WIFI BT antenna's Return loss $< -10\text{dB}$.

- **Isolation**

The data on page 28 shows:

- The Isolation between WIFI 2.4G antennas $< -20\text{dB}$;
- The Isolation between WIFI 5G antennas $< -20\text{dB}$;
- The Isolation between WIFI 6G antennas $< -20\text{dB}$;
- The Isolation between WIFI 5G & 6G antennas $< -20\text{dB}$;
- The Isolation between WIFI 2G & BT antennas $< -20\text{dB}$;

- **Gain & Efficiency**

The data on page 41 shows:

- The WIFI 2.4G antenna's Gain $< 3.5\text{dBi}$, Efficiency $> 70\%$;
- The WIFI 5G antenna's Gain $< 5.0\text{dBi}$, Efficiency $> 65\%$;
- The WIFI 6G antenna's Gain $< 5.0\text{dBi}$, Efficiency $> 65\%$;
- The WIFI BT antenna's Gain $< 4.0\text{dBi}$, Efficiency $> 65\%$



Through the above data analysis, the single antenna can meet the performance requirements.

Thanks!

