LYNwave Technology

Antenna & Thermal solution provider

2022

www.lynwave.com

Antenna Test Report

Project Name: **EW-7822UNX**

Model Name:

Feature: **Wifi Dual Band**

Application: **Dongle**

Date	Owner	Revision
01/17/2022	Alex	1. Antenna passive measurement with V1 mockup
02/07/2022	Zino	1. Antenna passive measurement with V1 mockup (new thermal sol.)
05/04/2022	Zino	1. Antenna passive measurement with V2 mockup (without heatsink)
06/23/2022	Zino	1. Antenna passive measurement with T2 mockup
07/06/2022	Zino	1. Add USB GND
07/18/2022	Zino	1. Antenna passive measurement with T3 mockup (Grounding USB)

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Table of Contents

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Antenna Placement

Antenna	Description	Frequency
Ant.1	2.4/5G	2400 MHz ~ 2500 MHz / 5150 MHz ~ 5825 MHz
Ant.2	2.4/5G	2400 MHz ~ 2500 MHz / 5150 MHz ~ 5825 MHz

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S-parameter Measurement Equipment

Equipment	Brand	Model	Calibration Date
Network analyzer	Keysight	M9010A	07/04/2022

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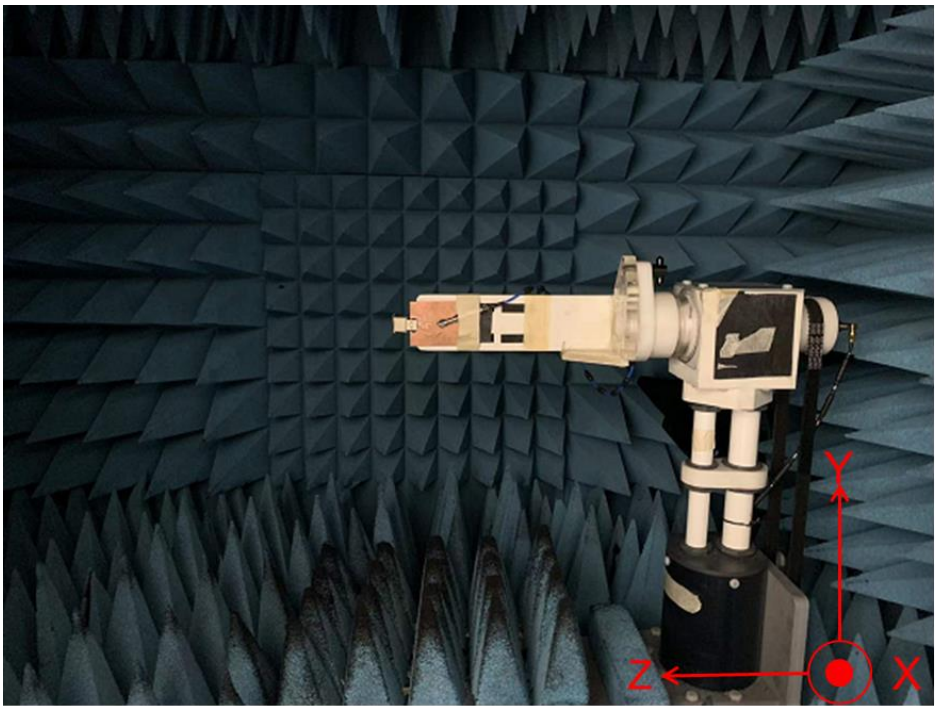
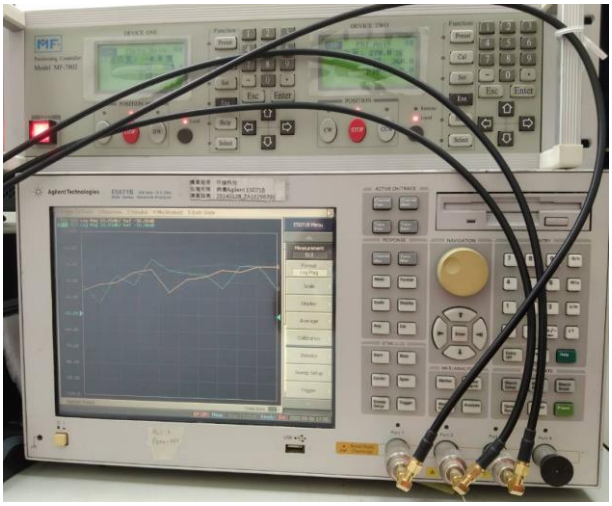
Passive Equipment List :

Antenna Chamber	MFC-2531(1.4x1.4x2.8m)
Test software	Passive 2D/3D川升
Network analyzer	Agilent E5071B
Controller	MF7802
Calibration time	07/04/2022

Antenna Chamber



Network analyzer and Controller :



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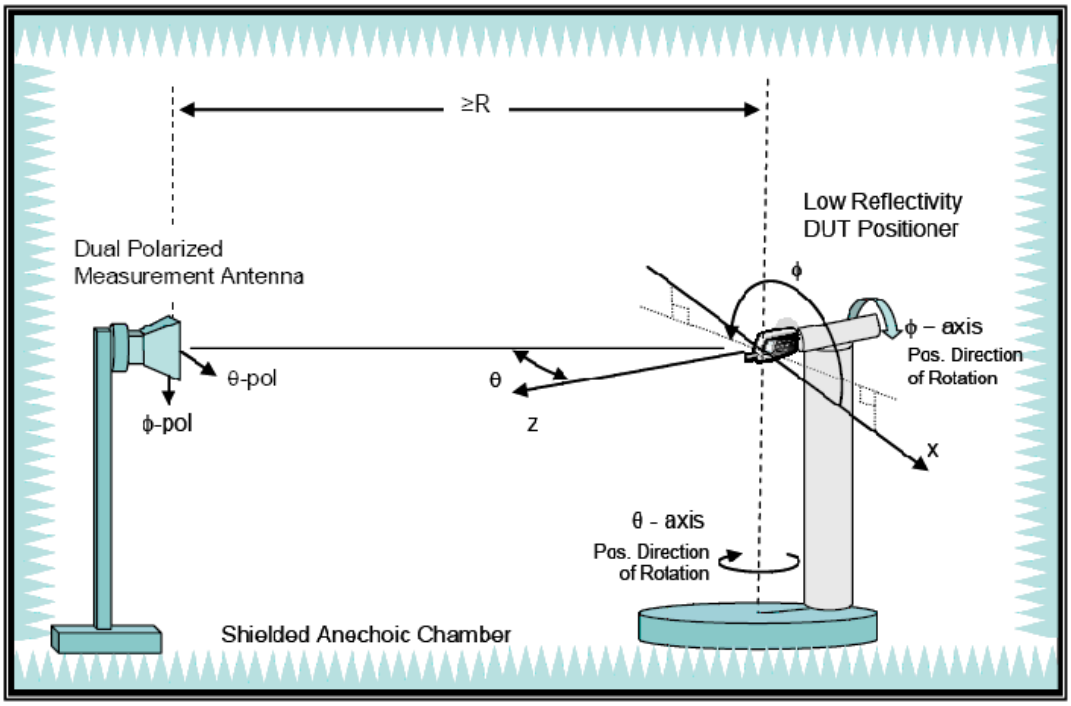
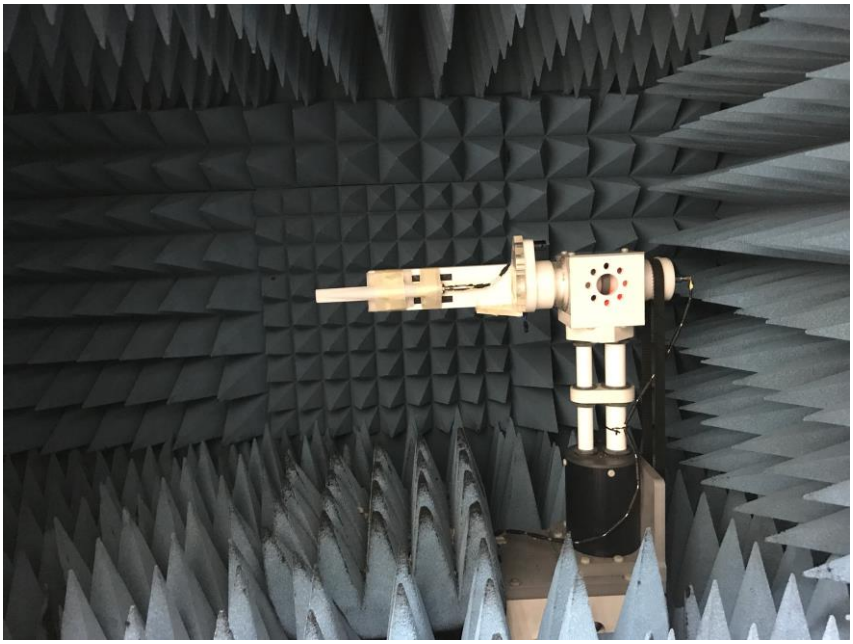
Test architecture :



Test System Calibration



We will use a standard antenna which have bean verified and whose accurate gain table is available to carry out the chamber calibration.
The standard antenna will be re-measured by the chamber. The difference between the measured gain values and its verified gain table will be compensated to the measurement system.

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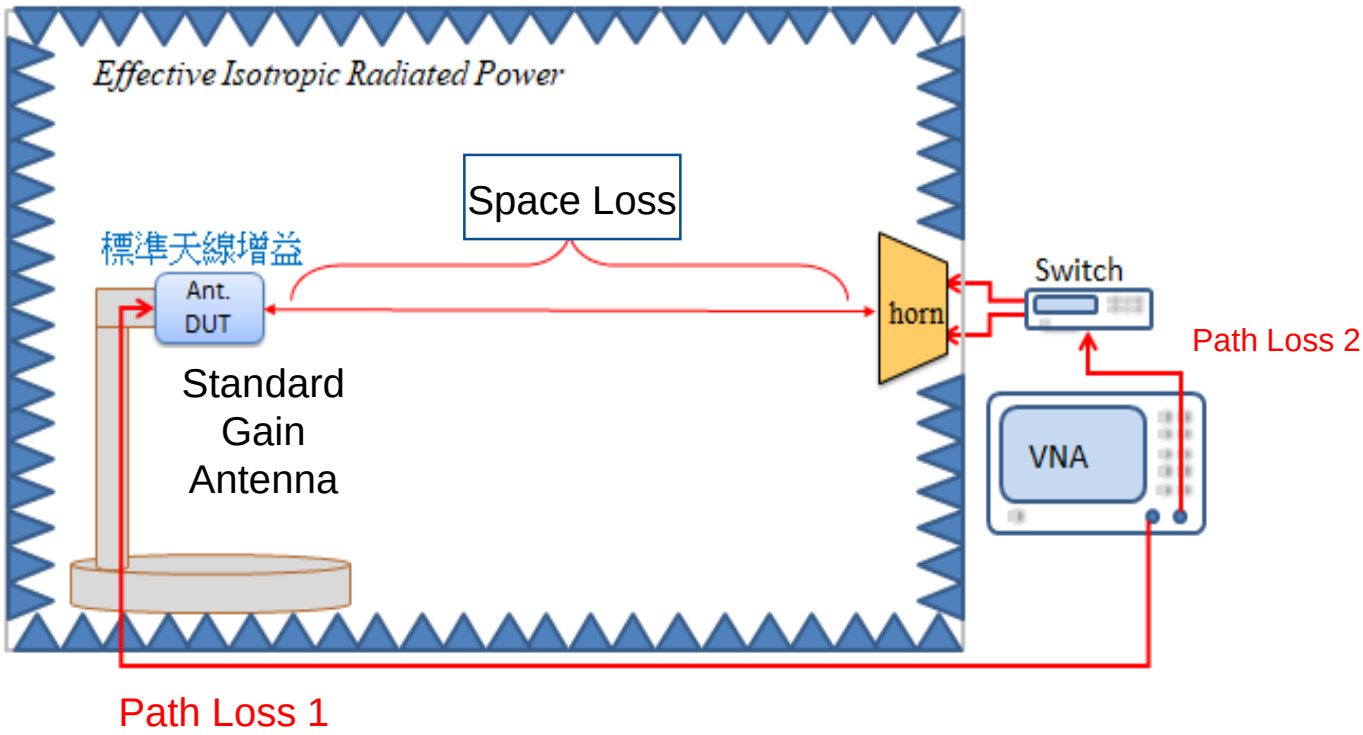
Conversion from S21 to antenna gain dBi performed step



Step :
1.Calculate Total Loss: Total Loss= Path Loss 1 + Path Loss 2 + Space Loss + Horn Gain
2.Measurement Value S21 By Chamber
3.Measurement Value S21- Standard Antenna Gain = Total Loss = Compensation (Path Loss)
4.Measurement Value S21 = Standard Antenna Gain + Total Loss

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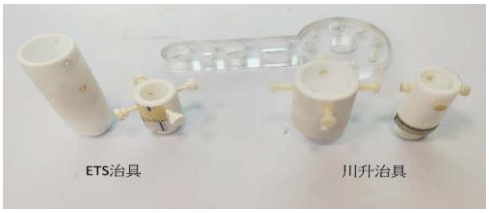
➢ Confirmation before calibration list and step

Check	List
	Remove the 3dB attenuator from the DUT's cable
	No other metal substances in the measurement environment
	No extension cable taped on Phi axis
	Align the DUT to the laser line center
	Prepare ETS or Bwant Dipole Fixture
	Crossline laser
	VNA, Turn Table, Switch on and confirm in NIMAX
	Passive Software

◆ The measured value of the same test object might be changed before and after calibration, so it is not recommended to calibrate frequently.



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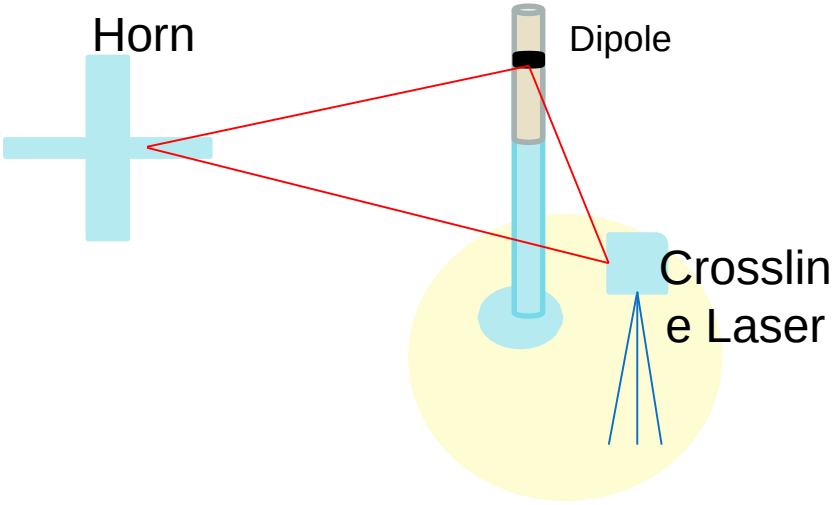
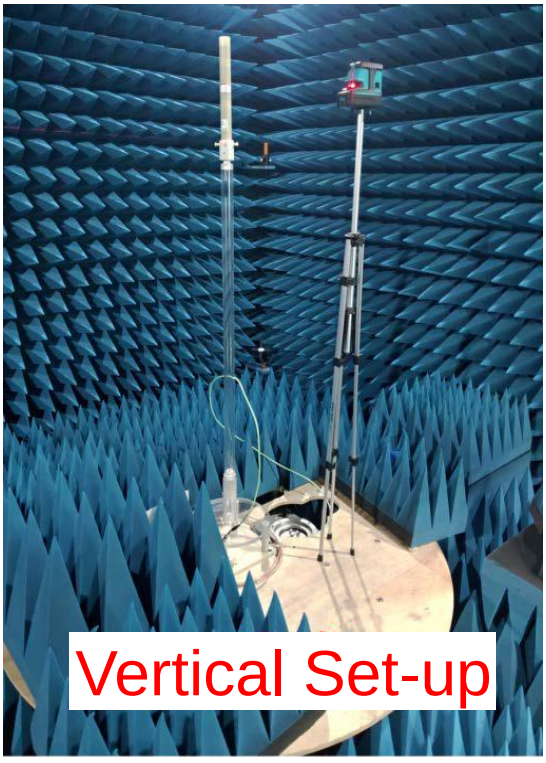
1. Align the horn horizontal blade by crossline laser.
2. Align the dipole feeding point to laser line.





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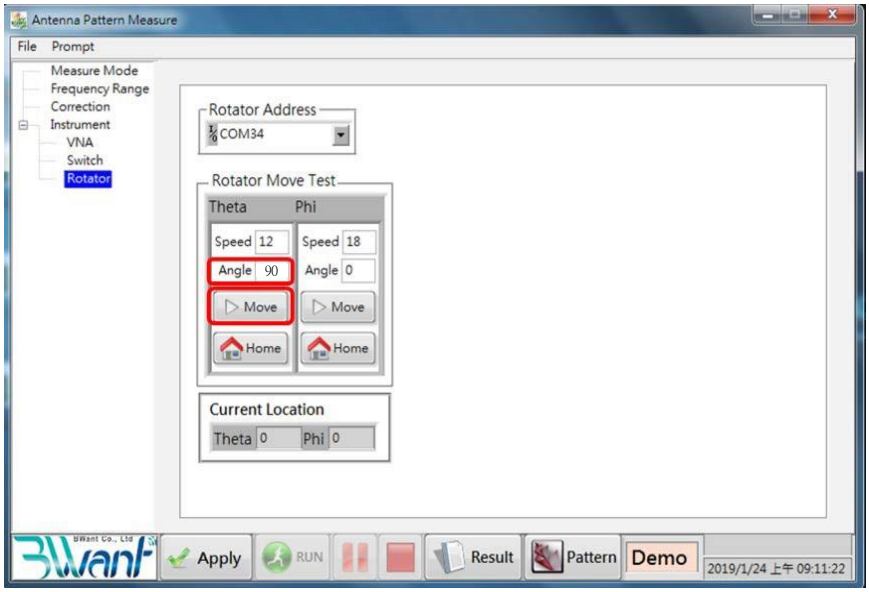
1. Set-up the dipole start from low frequency (SD650).
2. Rotate 90 degree on Theta axis.



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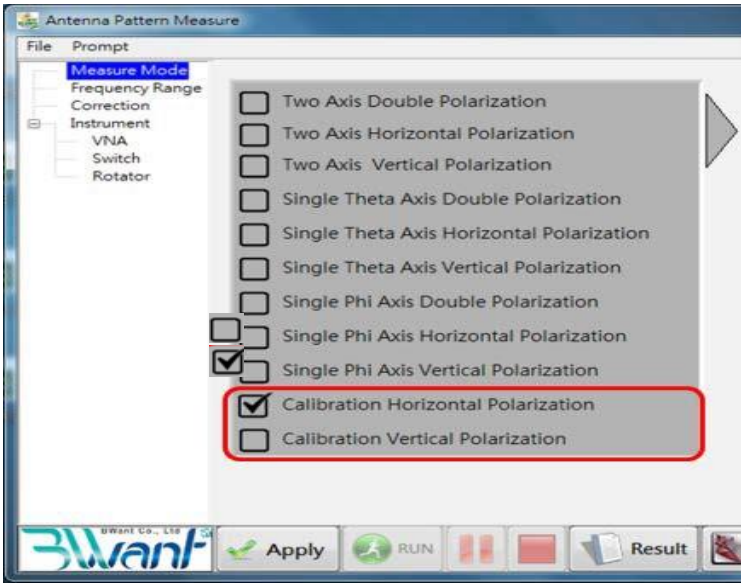
- Choose “Calibration Vertical Polarization“.
- Or choose “Calibration Horizontal Polarization” if you need a horizontal one.



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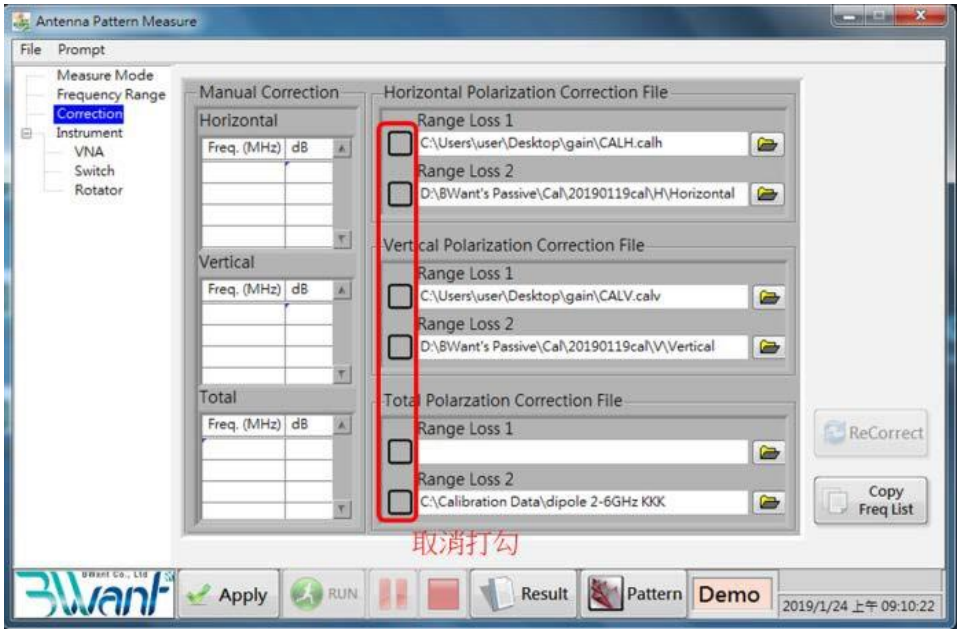
- Cancel all the selection as follow picture.



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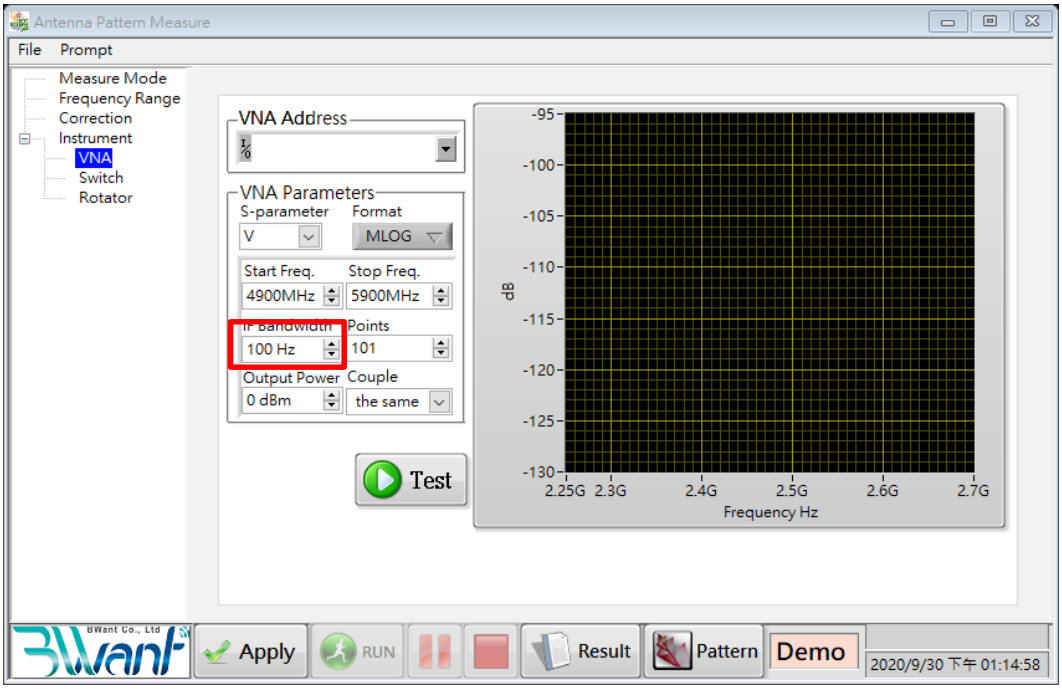
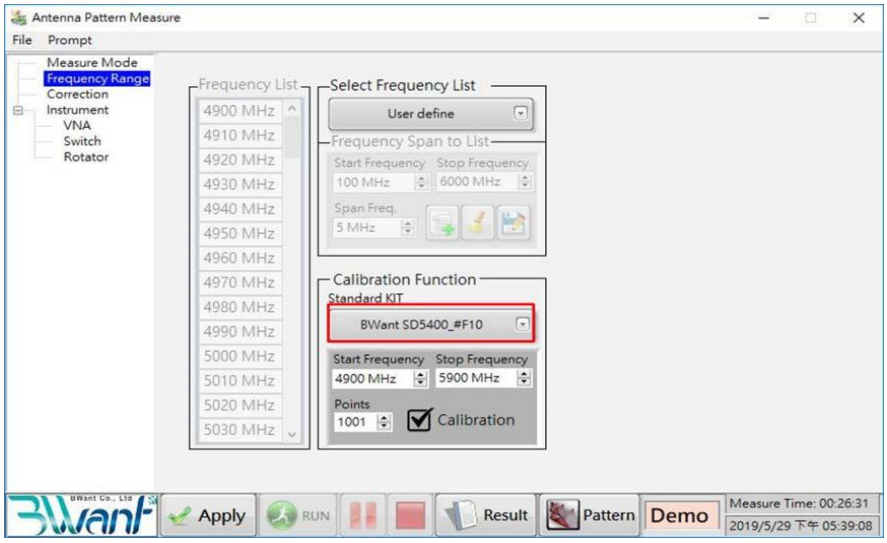
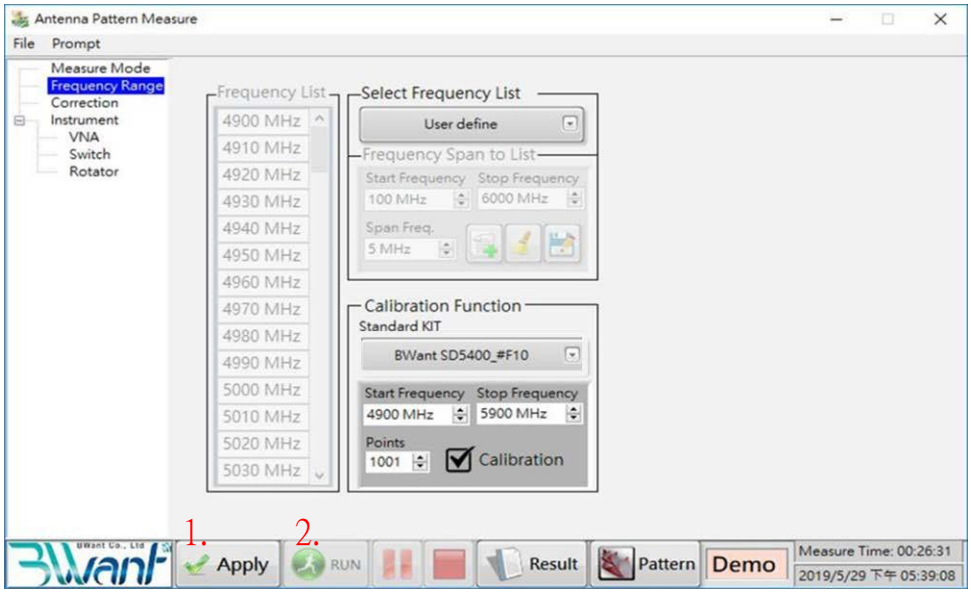
- Set the IF Bandwidth to 100Hz.



- Select the calibration dipole type from Standard KIT.
  - The frequency band is labeled on the dipole (the start & cutoff frequencies and the test points number would be set automatically after selection).



1. Click on “Apply“.
2. Click on ”Run“ and start the testing.



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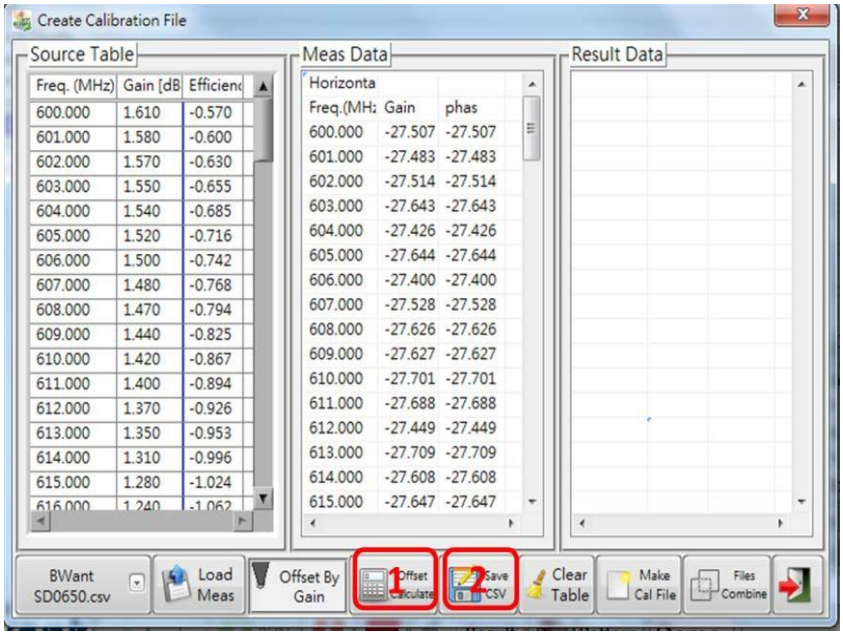
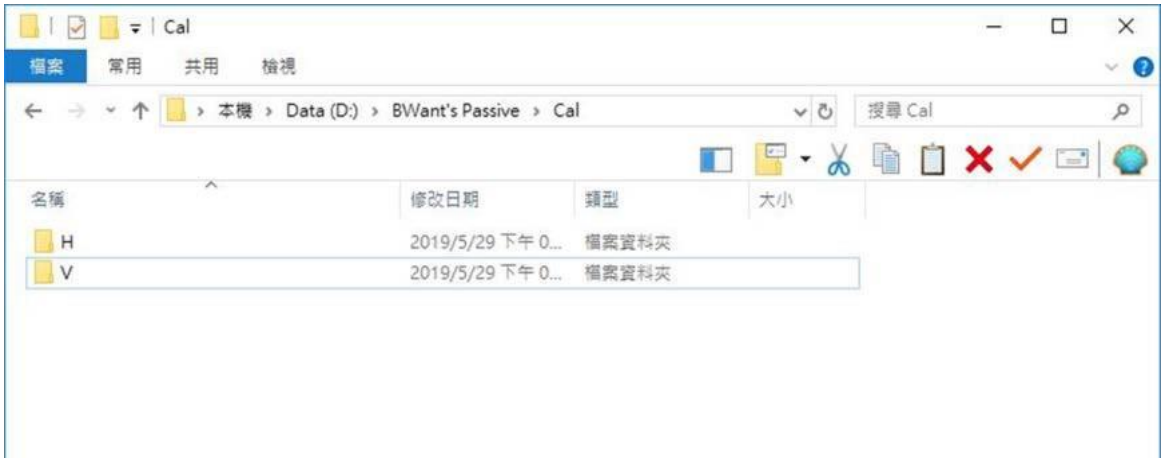
1. Confirm there is testing value in “Meas Data” field.
2. Click on “Offset Calculate“.
3. Click on “Save CSV“.



- Save the testing file according by each dipole test band and polarization.
  - Ex Vertical Polarization SD650
  - Place the Cal->V Folder and named it as “SD650_V"



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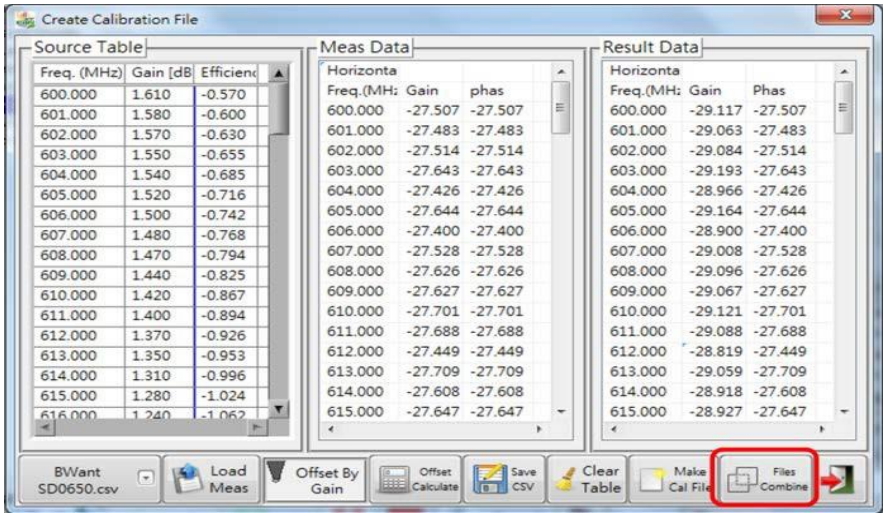
- Repeat all the 11pcs antenna as right table to complete the full band frequency according the steps from Page 5~12.
- Click on “Files Combine“ , select the “Folder V” and all frequency band file would be generated.
  - Ex. Vertical Polarization 600-5900 MHzPath Loss.csv



Vertical Confirmation	Dipole Name
	SD650
	SD740
	SD900
	SD1150
	SD1575
	SD1800
	SD2140
	SD2450
	SD3200
	SD3600
	SD5400

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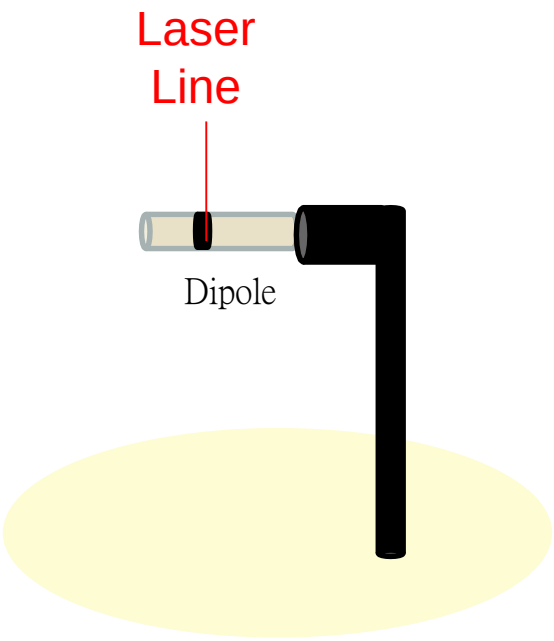
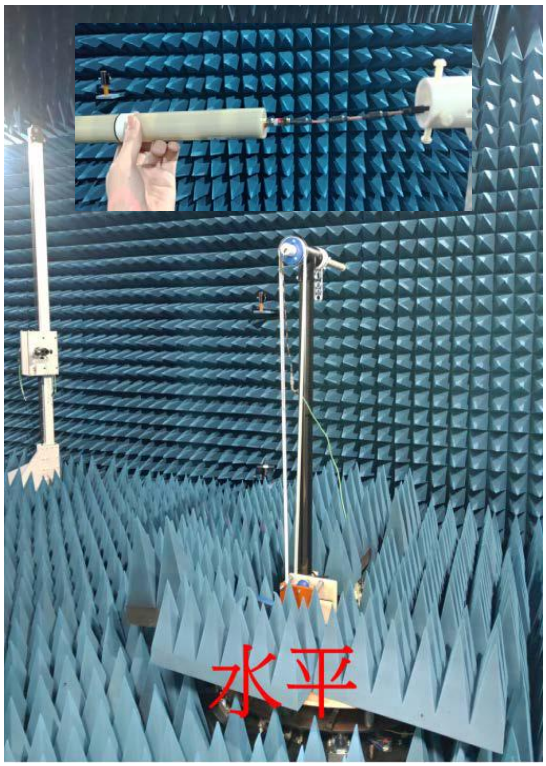
1. Align the dipole feeding point to laser line.





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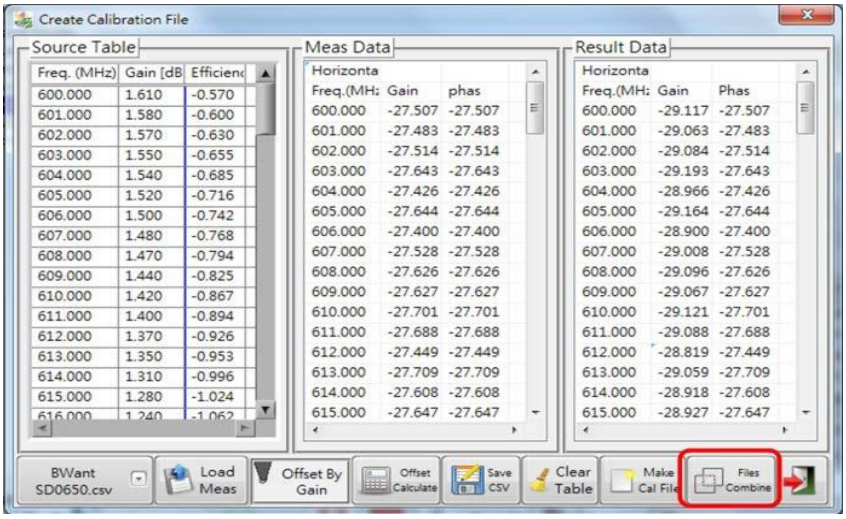
- Repeat all the 11pcs antenna as right table to complete the full band frequency according the steps from Page 5~12.
- Click on “Files Combine“ , select the “Folder H” and all frequency band file would be generated.
  - Ex. Horizontal Polarization 600-5900 MHzPath Loss.csv



Horizontal Confirmation	Dipole Name
	SD650
	SD740
	SD900
	SD1150
	SD1575
	SD1800
	SD2140
	SD2450
	SD3200
	SD3600
	SD5400

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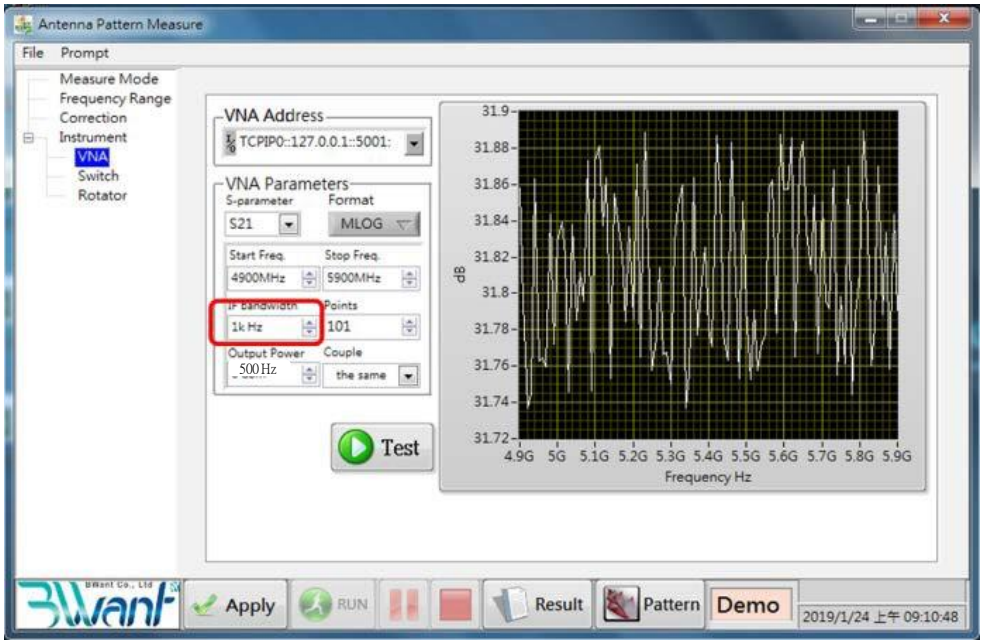
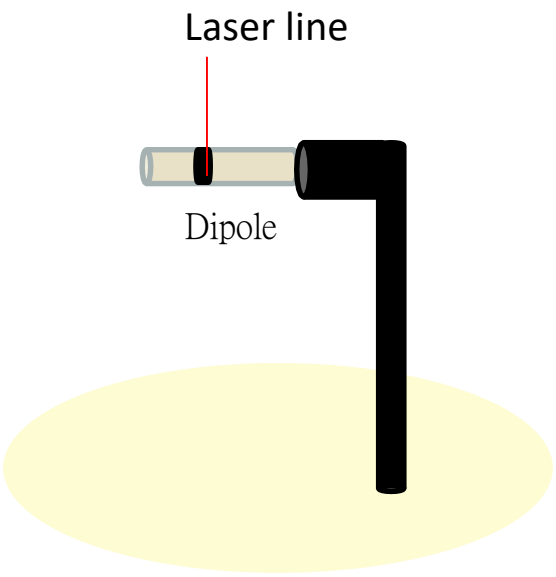
- Change the “IF Bandwidth" value back to 500Hz.



1. Set-up the dipole start from low frequency (SD650) as Page 14.



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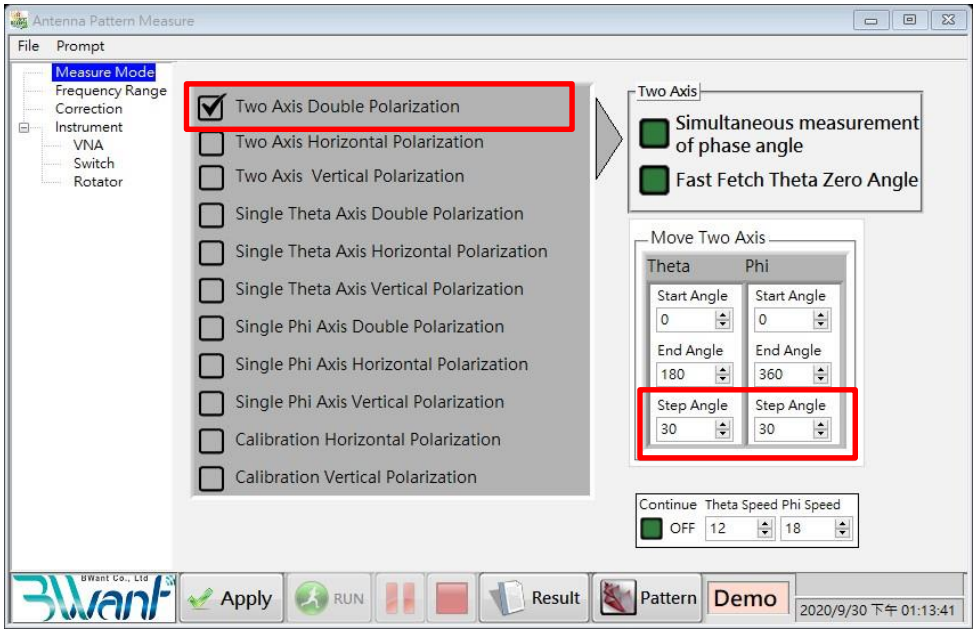
- Select “Two Axis Double Polarization “ on Measure Mode Page.
- Set the angle of Theta and Phi to 30 degree.



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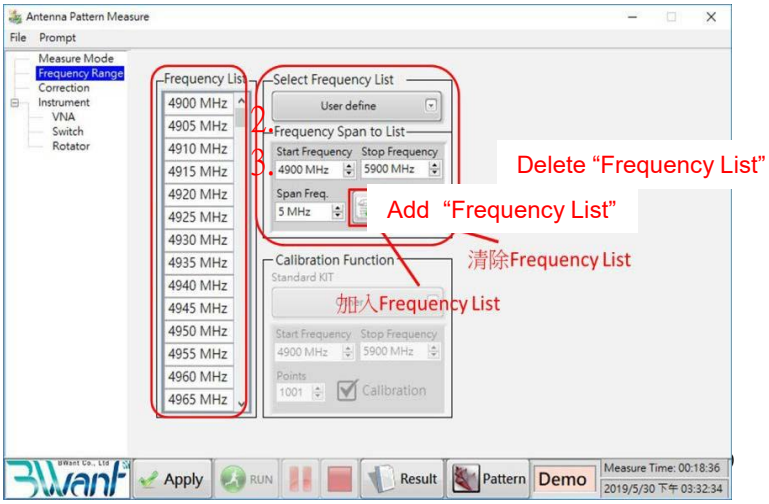
- Delete “Frequency List“.
- Insert the current dipole “start & cutoff frequencies”.
- Insert Span Freq.
  - SD650、SD740: 1MHz
  - – SD900、SD1575、SD5400: 5MHz
  - Other Dipole : 10MHz
- Add “Frequency List“.
- Apply.
- Run.



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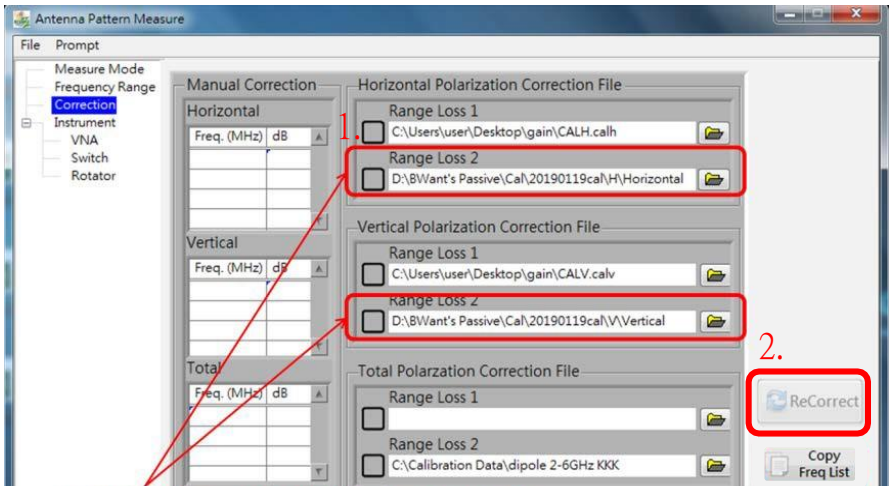
1. Select and check the calibration files that generated on Page 13 & Page 15.
2. Click on ”ReCorrect”.

- Apply .calh file in “Range Loss1"
- Apply .csv file in “Range Loss2"



Select and check the combined CSV calibration file according to the H & V

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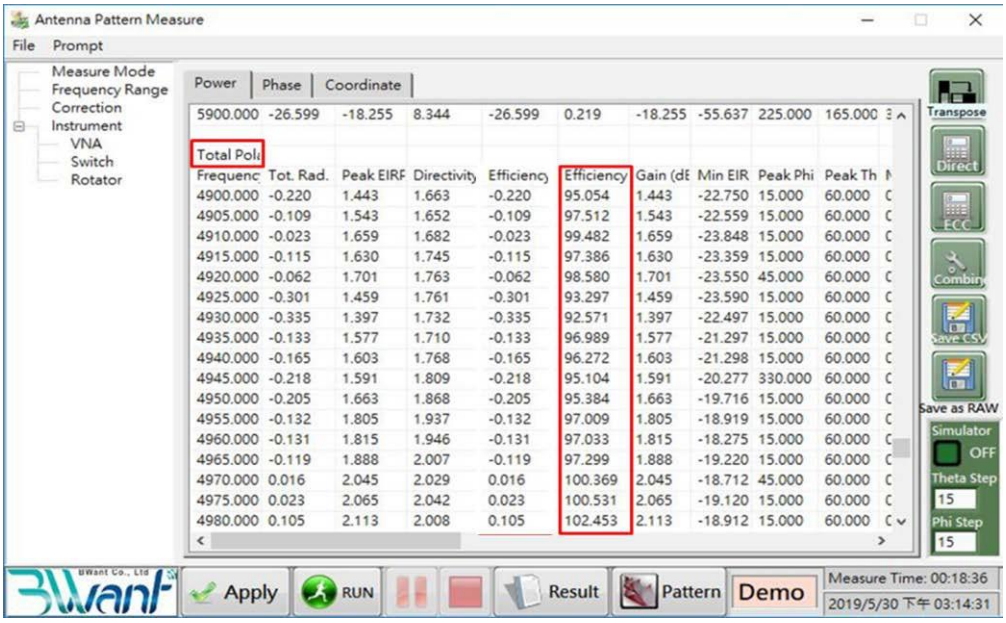
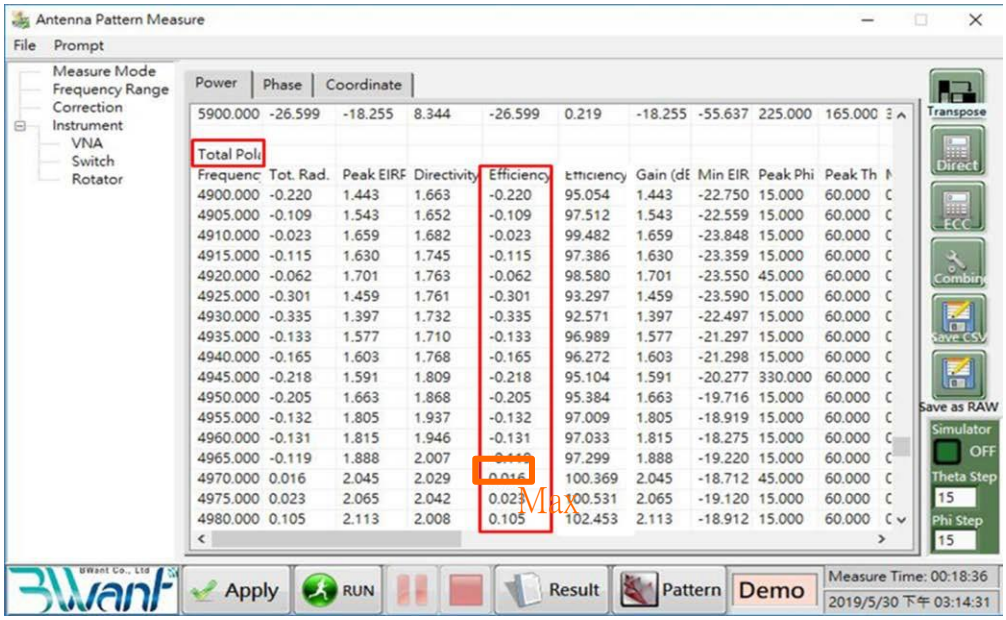
- If any efficiency value >100%, please refer to the next page to correct.
- Efficiency value <100%, then calibration is done.



Frequenc	Tot. Rad.	Peak EIRP	Directivity	Efficiency	Efficiency	Gain (dB	Min EIR	Peak Phi	Peak Th
5900.000	-26.599	-18.255	8.344	-26.599	0.219	-18.255	-55.637	225.000	165.000
4900.000	-0.220	1.443	1.663	-0.220	95.054	1.443	-22.750	15.000	60.000
4905.000	-0.109	1.543	1.652	-0.109	97.512	1.543	-22.559	15.000	60.000
4910.000	-0.023	1.659	1.682	-0.023	99.482	1.659	-23.848	15.000	60.000
4915.000	-0.115	1.630	1.745	-0.115	97.386	1.630	-23.359	15.000	60.000
4920.000	-0.062	1.701	1.763	-0.062	98.580	1.701	-23.550	45.000	60.000
4925.000	-0.301	1.459	1.761	-0.301	93.297	1.459	-23.590	15.000	60.000
4930.000	-0.335	1.397	1.732	-0.335	92.571	1.397	-22.497	15.000	60.000
4935.000	-0.133	1.577	1.710	-0.133	96.989	1.577	-21.297	15.000	60.000
4940.000	-0.165	1.603	1.768	-0.165	96.272	1.603	-21.298	15.000	60.000
4945.000	-0.218	1.591	1.809	-0.218	95.104	1.591	-20.277	330.000	60.000
4950.000	-0.205	1.663	1.868	-0.205	95.384	1.663	-19.716	15.000	60.000
4955.000	-0.132	1.805	1.937	-0.132	97.009	1.805	-18.919	15.000	60.000
4960.000	-0.131	1.815	1.946	-0.131	97.033	1.815	-18.275	15.000	60.000
4965.000	-0.119	1.888	2.007	-0.119	97.299	1.888	-19.220	15.000	60.000
4970.000	0.016	2.045	2.029	0.016	100.369	2.045	-18.712	45.000	60.000
4975.000	0.023	2.065	2.042	0.023	100.531	2.065	-19.120	15.000	60.000
4980.000	0.105	2.113	2.008	0.105	102.453	2.113	-18.912	15.000	60.000

- If any efficiency value >100%, please refer to the following steps to correct:
  1. Backup the Horizontal & Vertical combined files
  2. Find the maximum efficiency value, Ex. 0.105



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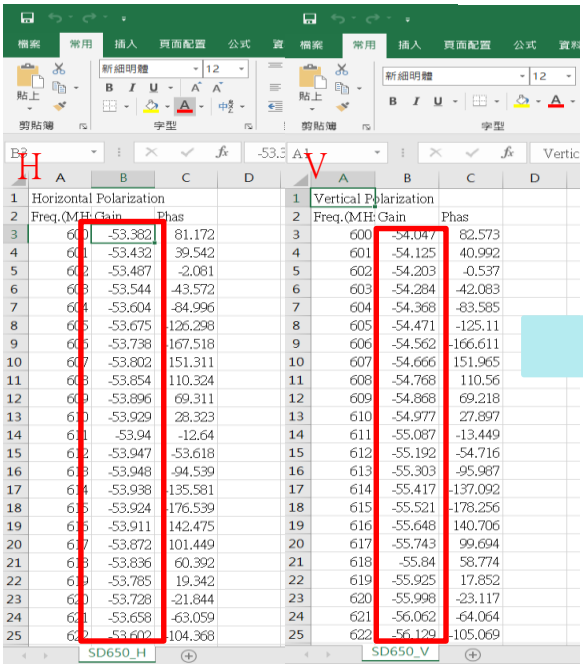
3. Correct the H & V calibration data.
   - Ex. Max: 0.105
   - New Gain=Red Frame + Max + 0.1



Ex. Original Freq 600 Gain= -53.382
New Gain=-53.382 +0.105 + 0.1= -53.177

	Freq.(MH	Gain	Phas
3	600	-53.177	81.172
4	601	-53.227	39.542
5	602	-53.282	-2.081
6	603	-53.339	-43.572
7	604	-53.399	-84.996
8	605	-53.47	-126.298
9	606	-53.533	-167.518
10	607	-53.597	151.311
	608	-53.649	110.324
	609	-53.691	69.311
	610	-53.724	28.323
	611	-53.735	-12.64
15	612	-53.742	-53.618
16	613	-53.743	-94.539
17	614	-53.733	-135.581
18	615	-53.719	-176.539
19	616	-53.706	142.475
20	617	-53.667	101.449
21	618	-53.631	60.392
22	619	-53.58	19.342
23	620	-53.523	-21.844
24	621	-53.453	-63.059
25	622	-53.397	-104.368

	Freq.(MH	Gain	Phas
3	600	-53.842	82.573
4	601	-53.92	40.992
5	602	-53.998	-0.537
6	603	-54.079	-42.083
7	604	-54.163	-83.585
8	605	-54.266	-125.11
9	606	-54.357	-166.611
10	607	-54.461	151.965
11	608	-54.563	110.56
12	609	-54.663	69.218
13	610	-54.772	27.897
14	611	-54.882	-13.449
15	612	-54.987	-54.716
16	613	-55.098	-95.987
17	614	-55.212	-137.092
18	615	-55.316	-178.256
19	616	-55.443	140.706
20	617	-55.538	99.694
21	618	-55.635	58.774
22	619	-55.72	17.852
23	620	-55.793	-23.117
24	621	-55.857	-64.064
25	622	-55.924	-105.069

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- According to the Page 17~24, keep confirm all the antennas' efficiency value.

Efficiency Value Confirmation	Dipole Name
	SD650
	SD740
	SD900
	SD1150
	SD1575
	SD1800
	SD2140
	SD2450
	SD3200
	SD3600
	SD5400

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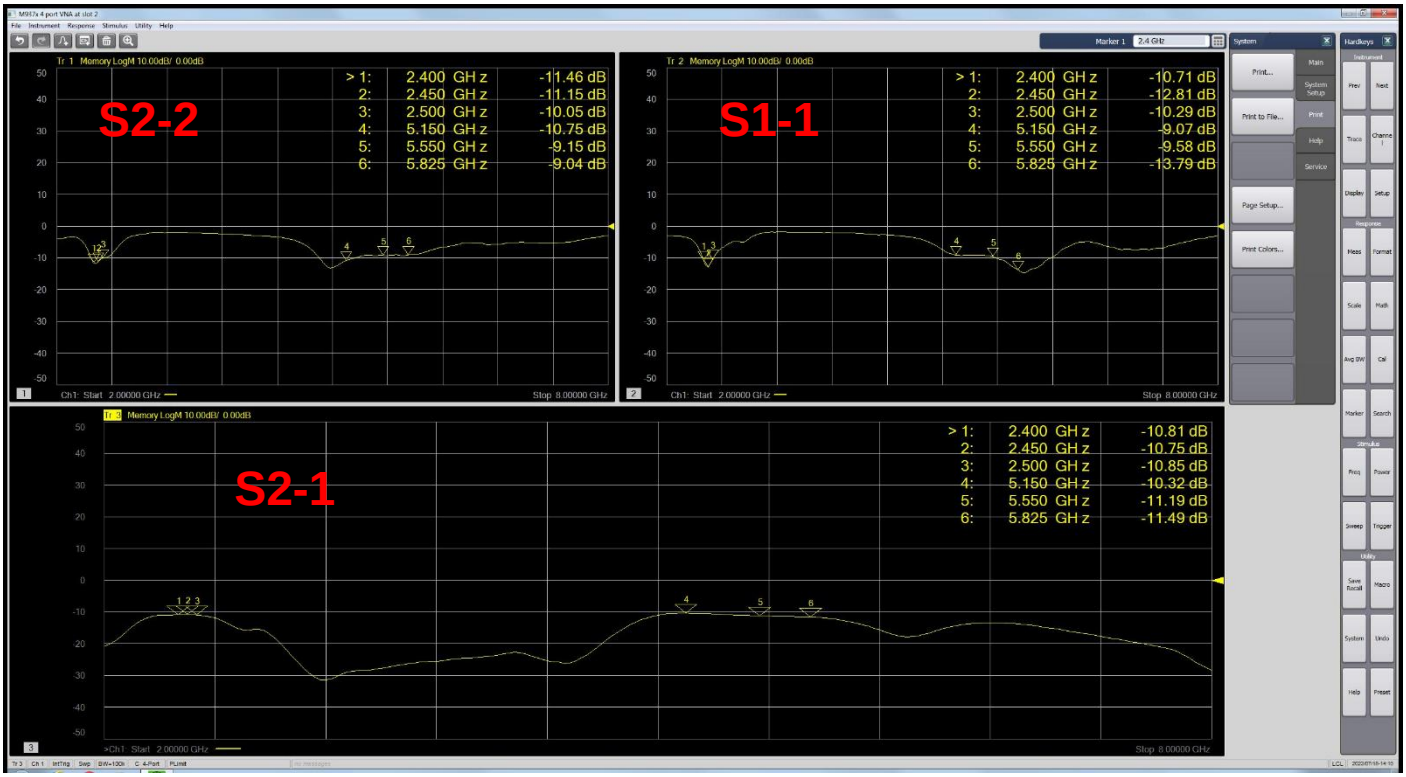
S-Parameters



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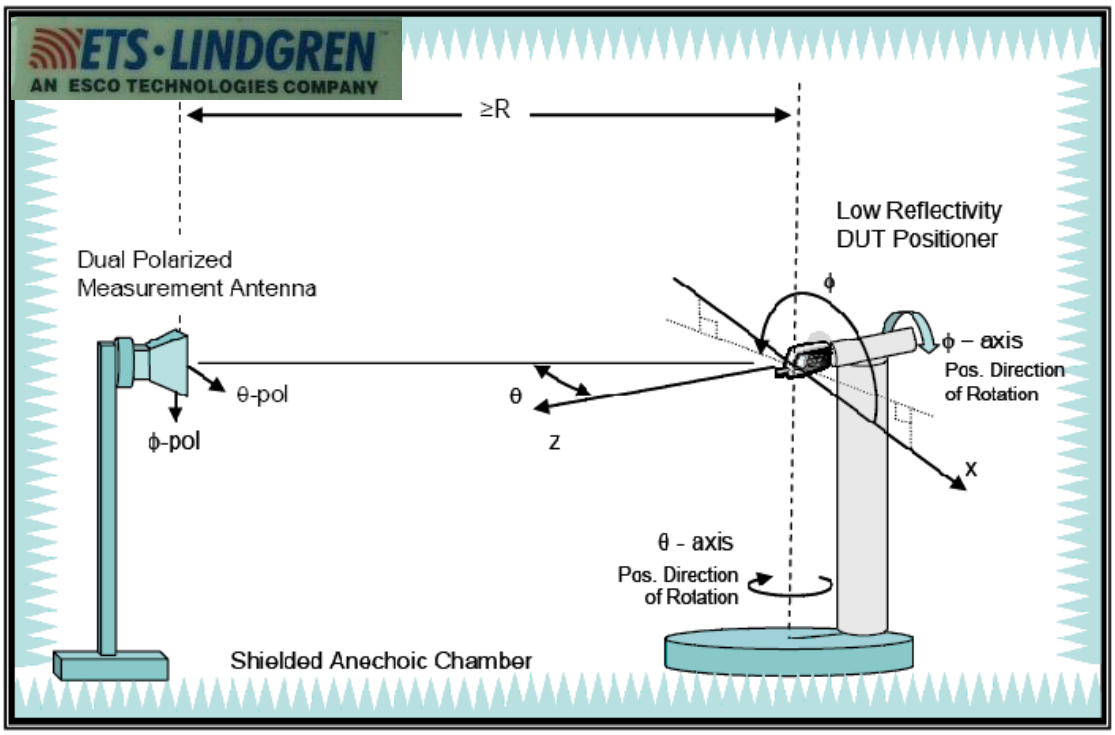
Equipment :
ETS Chamber



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Gain Table

Ant.1						
Frequency (MHz)	2400	2450	2500	5150	5550	5825
Efficiency(%)	31	32	33	42	43	42
Peak Gain(dBi)	-1.4	-0.9	-0.6	0.4	1.8	2.6
Ant.2						
Frequency (MHz)	2400	2450	2500	5150	5550	5825
Efficiency(%)	33	33	34	41	43	43
Peak Gain(dBi)	-1.7	-1.1	-0.9	0.5	2.8	3.0

The antenna characteristics

- Return loss < -8dB in operating band
- Isolation
  - All Band > 10 dB
- Efficiency
  - WIFI 2.4GHz Band ≥ 30%
  - WIFI 5GHz Band ≥ 40%
- Gain
  - WIFI 2.4GHz Band -1.7 ~ -0.6dBi
  - WIFI 5GHz Band 0.4 ~ 3.0dBi

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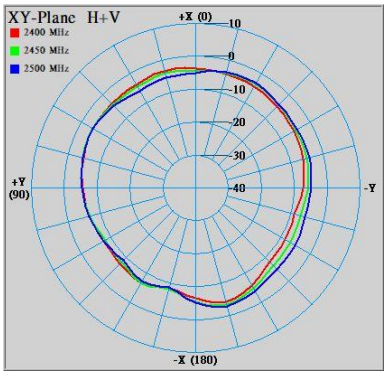
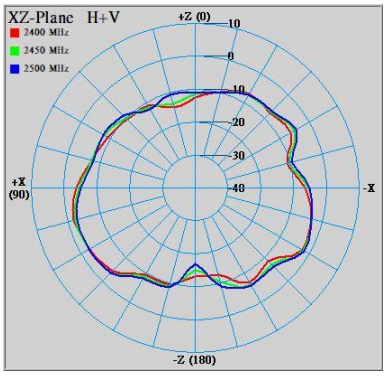
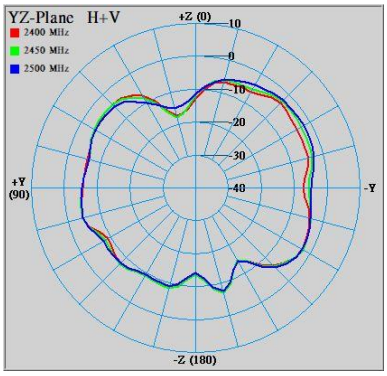
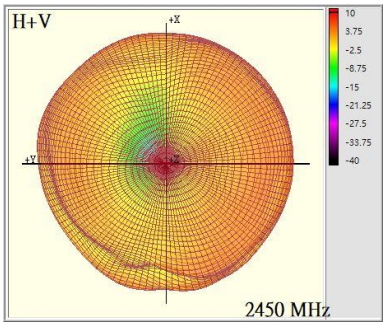
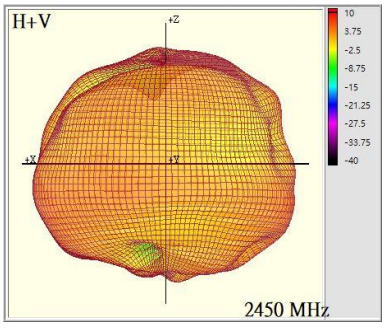
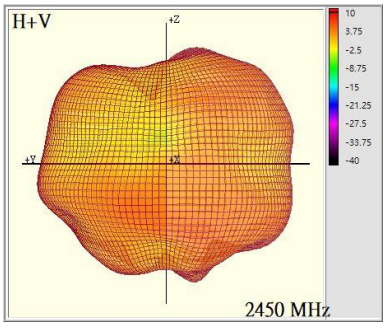
Ant.1_ 2D.3D Radiation Pattern
Frequency(MHz) : 2D. 2400~2500
3D. 2450

Radiation Pattern :

Azimuth Plane	Elevation Plane phi = 0	Elevation Plane phi = 90
		
		

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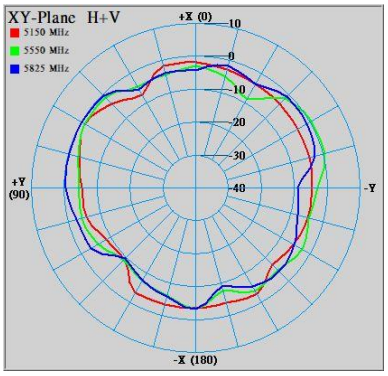
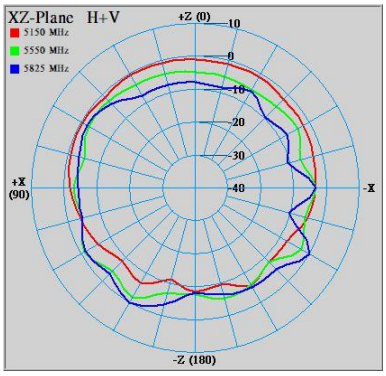
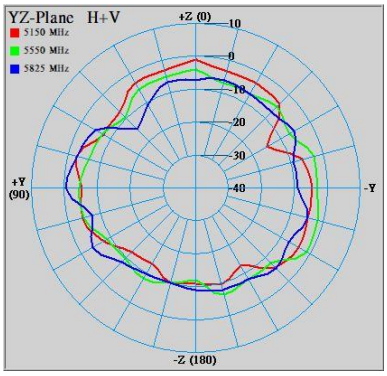
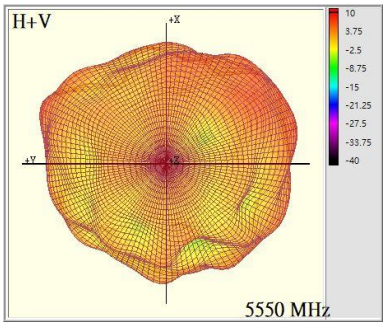
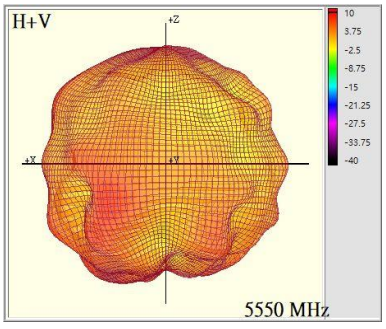
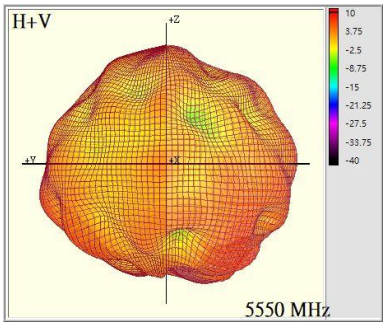
Ant.1_ 2D.3D Radiation Pattern
Frequency(MHz) : 2D. 5150~5825
3D. 5550

Radiation Pattern :

Azimuth Plane	Elevation Plane phi = 0	Elevation Plane phi = 90
		
		

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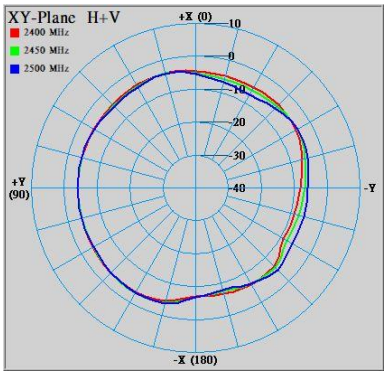
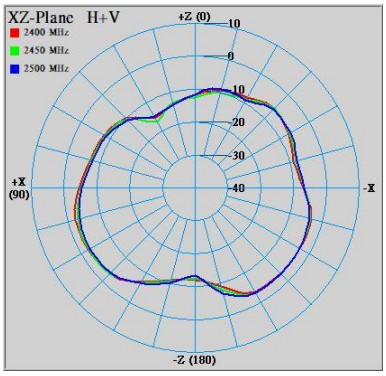
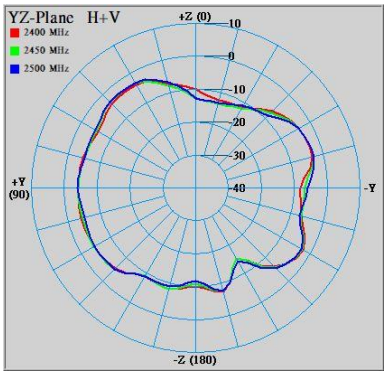
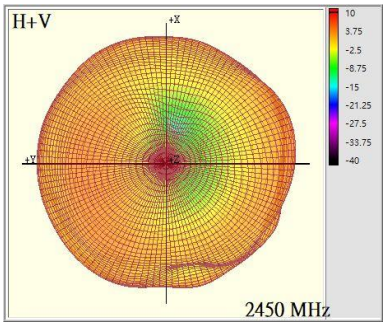
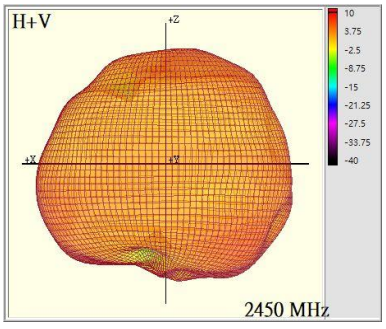
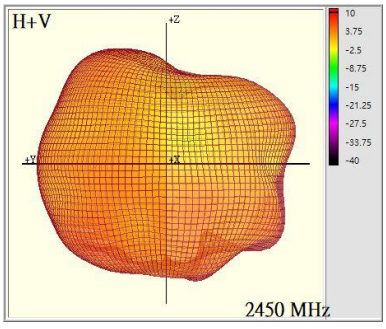
Ant.2_ 2D.3D Radiation Pattern
Frequency(MHz) : 2D. 2400~2500
3D. 2450

Radiation Pattern :

Azimuth Plane	Elevation Plane phi = 0	Elevation Plane phi = 90
		
		

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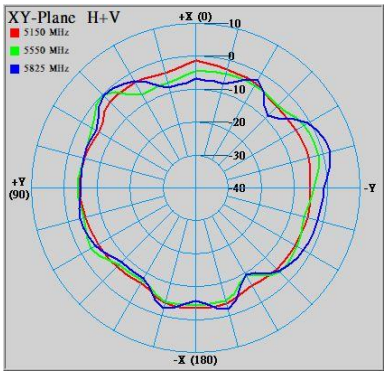
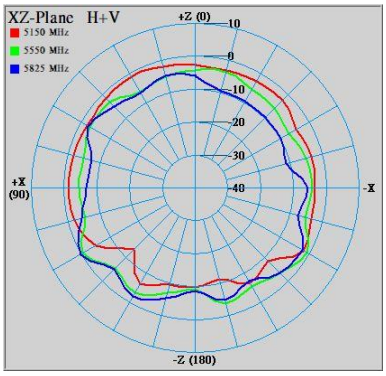
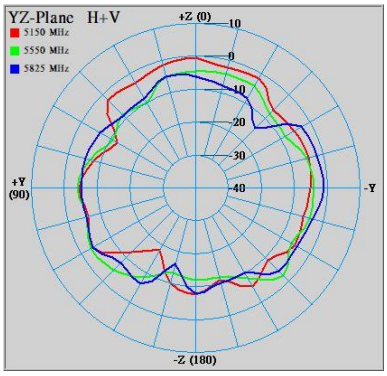
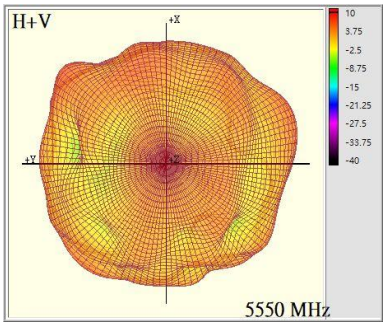
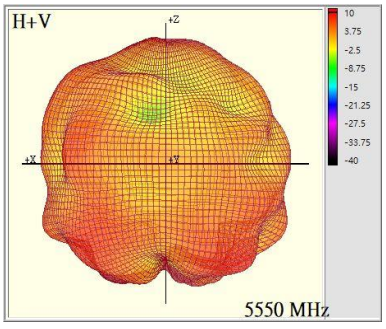
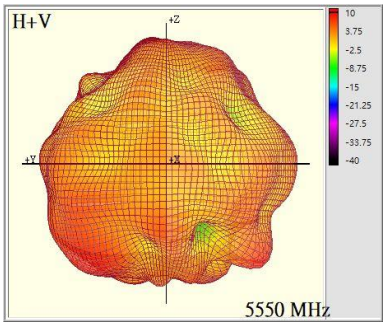
Ant.2_ 2D.3D Radiation Pattern
Frequency(MHz) : 2D. 5150~5825
3D. 5550

Radiation Pattern :

Azimuth Plane	Elevation Plane phi = 0	Elevation Plane phi = 90
		
		

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