HIGH-TEK HARNESS ENTERPRISE

Antenna Testing Report

MSI MS-6827

Prepared by *Approved by*

Rober Ku

General Information

- **Measurement Resume**

Date	Engineer	2.4~2.5 GHz	5.15~5.35 GHz	5.47~5.725 GHz	5.725~5.825 GHz
93/01/15	Rober Ku	✓	✓		

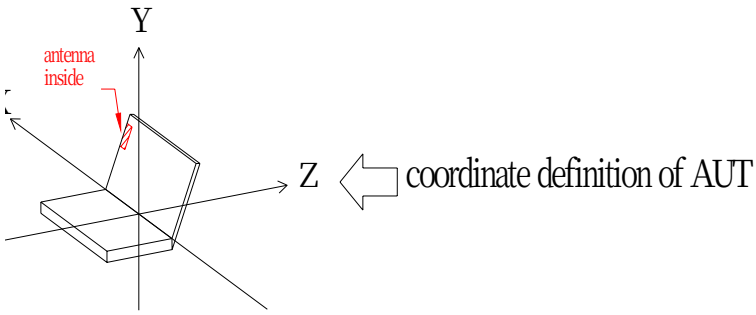
- **Antenna specifications:** *maximum size, unit: mm*

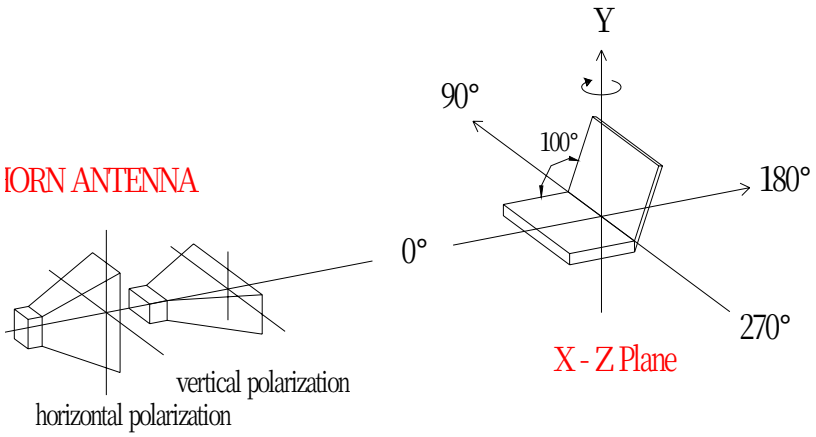
PIFA Type	Length	Width	Height	Cable length
Main Antenna	32	4.3	5	300
Aux Antenna	37	4.0	4	215

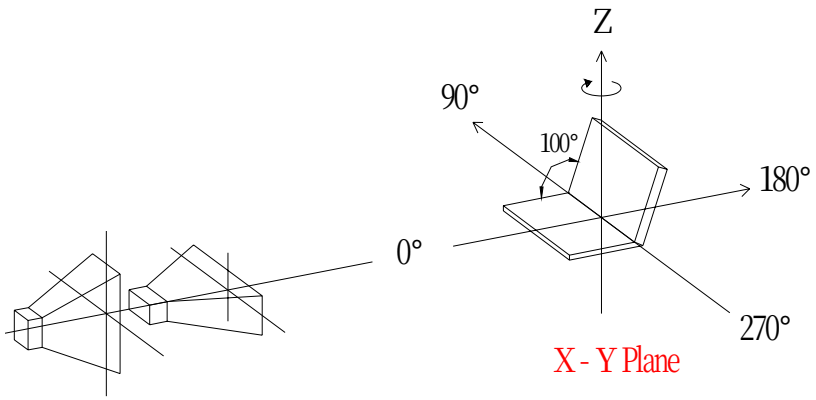
- **Measurement Setup & Environment**

Temp.	Humidity	Instrument	System	Entry
20 ℃	50%	VNA HP8753ES, 7x4x4 m anechoic chamber	NSI antenna measurement system	VSWR, Return Loss, Radiation pattern

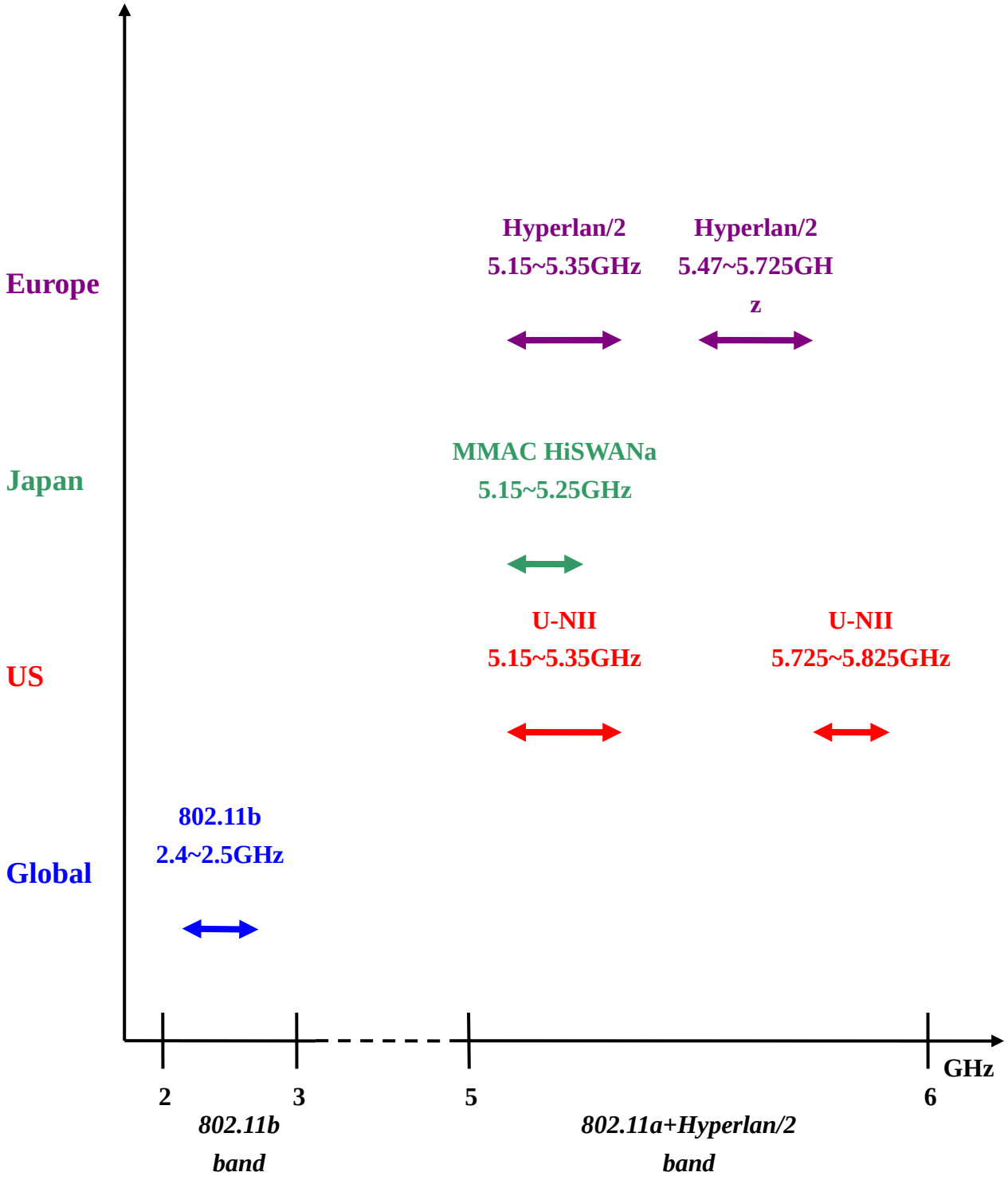
Coordinate Definition







Spectrum Allocation in worldwide WLAN



Typical Performance of Antenna

I. Typical Performance Table

	2.4~2.5GHz	5.15~5.35GHz	5.47~5.725GHz	5. 725~5.825GHz
VSWR	1.11	1.23		
Peak Gain	0.46 dBi	4.13 dBi		
Average Gain	-3.78 dBi	-1.71 dBi		

II. Antenna Type

Position	Main Antenna (Left-side Antenna)	Aux Antenna (Right-side Antenna)
Antenna Type	PIFA	PIFA
Material	Metal sheet	Metal sheet

III. VSWR

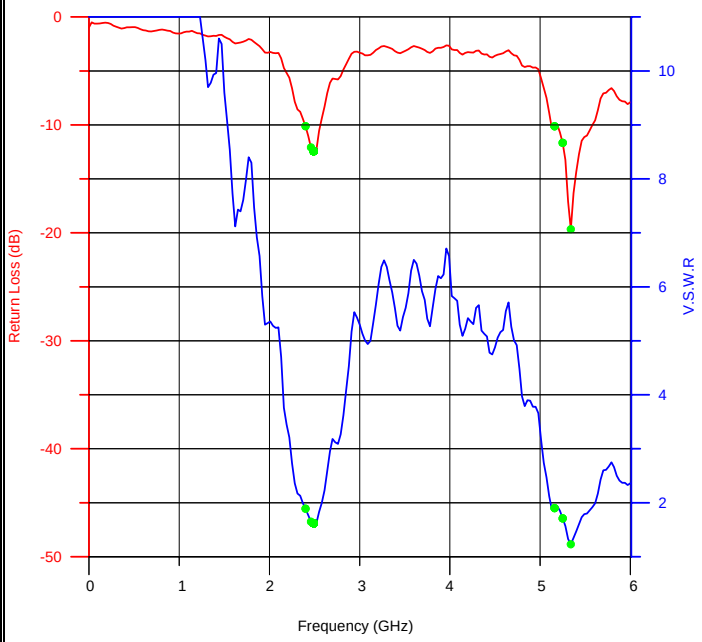
	2.4GHz ISM 2.4~2.5GHz			JAPAN,U-NII,Hyperlan/2 5.15~5.35GHz			Hyperlan/2+U-NII 5.47~5.825GHz				
Freq (GHz)	2.40	2.45	2.50	5.15	5.25	5.35	5.47	5.6	5.725	5.775	5.825
MAIN	1.89	1.65	1.62	1.90	1.71	1.23					
AUX	1.41	1.13	1.11	1.74	1.32	1.76					

IV. Peak Gain and Average Gain

Freq (GHz) / Gain (dBi)		2.4GHz ISM 2.4~2.5GHz			JAPAN,U-NII,Hyperlan/2 5.150~5.350GHz			Hyperlan/2+U-NII 5.47~5.825GHz				
		2.40	2.45	2.50	5.15	5.25	5.35	5.47	5.6	5.725	5.775	5.825
MAIN	Peak	-2.41	-1.69	-0.99	2.81	2.39	3.01					
	Avg	-6.41	-6.49	-6.47	-2.16	-1.99	-1.71					
AUX	Peak	-1.13	-0.77	0.46	2.82	4.04	4.13					
	Avg	-4.57	-4.14	-3.78	-3.49	-2.43	-2.67					

Return Loss & VSWR

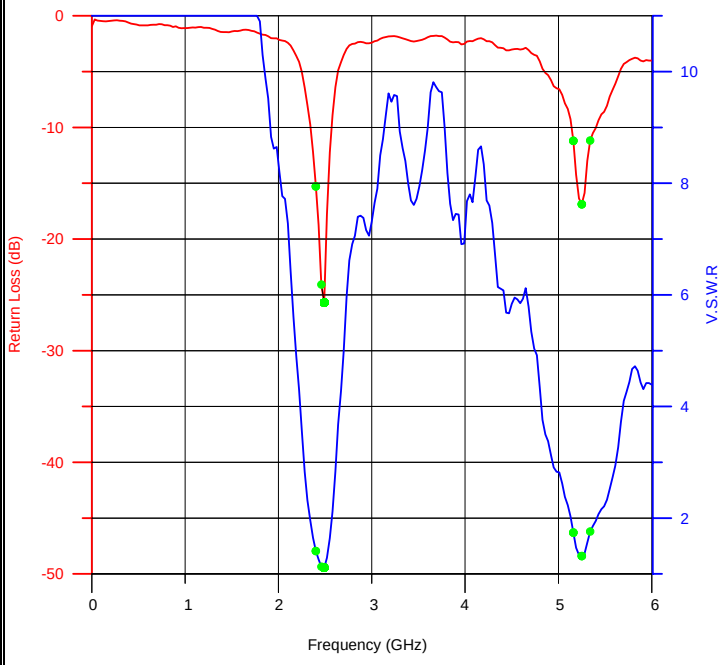
Main Antenna



2.4~2.5 GHz Center freq. @MHz		2450
Band Width @MHz		150
5.15~5.35 GHz Center freq. @MHz		5250
Band Width @MHz		400
freq.	Return Loss(dB)	VSWR
2.4 GHz	-10.12	1.89
2.45 GHz	-12.07	1.65
2.5 GHz	-12.43	1.62
5.15 GHz	-10.13	1.90
5.25 GHz	-11.65	1.71
5.35 GHz	-19.66	1.23

Note: the green points in the above and below diagram represent the main data we want(i.e. 2.4, 2.45, 2.5(WLAN 802.11b), 5.15, 5.25, 5.35(WLAN 802.11a) GHz)

Aux Antenna



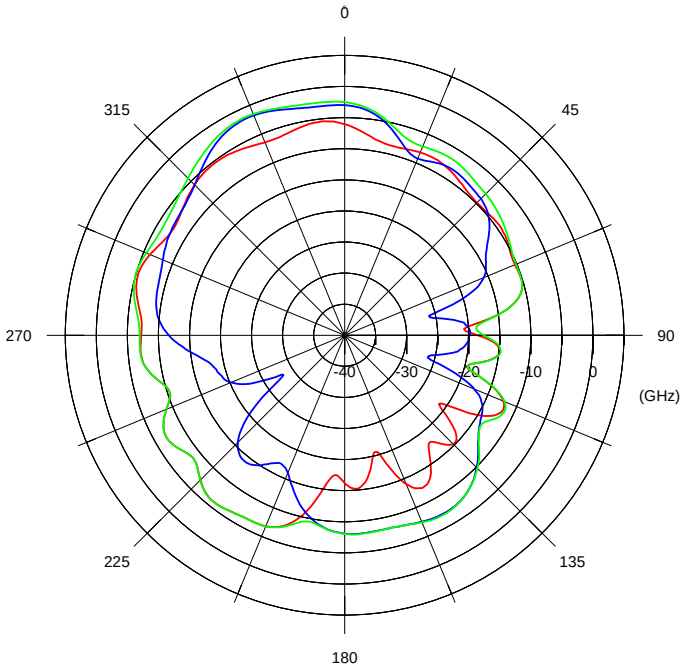
2.4~2.5 GHz Center freq. @MHz		2450
Band Width @MHz		260
5.15~5.35 GHz Center freq. @MHz		5250
Band Width @MHz		240
freq.	Return Loss(dB)	VSWR
2.4 GHz	-15.28	1.41
2.45 GHz	-24.07	1.13
2.5 GHz	-25.69	1.11
5.15 GHz	-11.20	1.74
5.25 GHz	-16.88	1.32
5.35 GHz	-11.17	1.76

Note: the green points in the above and below diagram represent the main data we want(i.e. 2.4, 2.45, 2.5(WLAN 802.11b), 5.15, 5.25, 5.35 (WLAN 802.11a)GHz)

Radiation Pattern I

Main Antenna(2.4~2.5 GHz)

Note: horizontal polarization plots in the red line and vertical polarization in the blue one



Average Gain And Peak Gain (On Azimuth Plane)

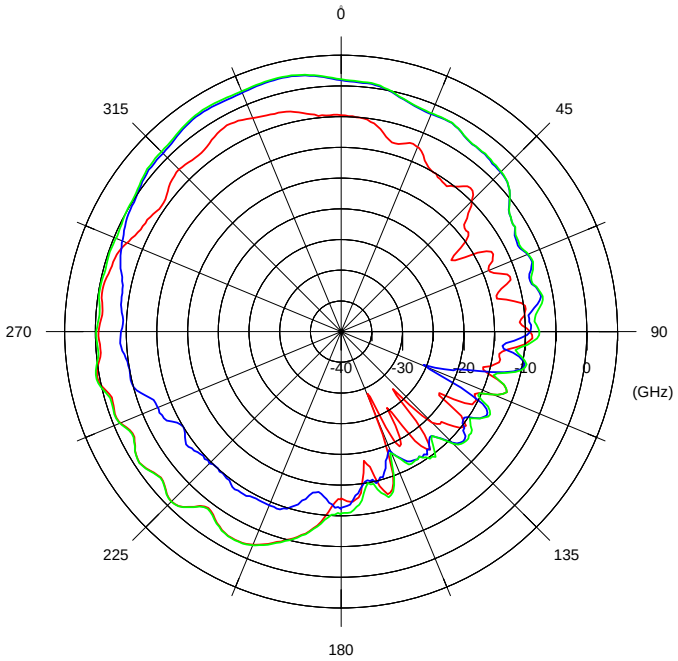
XZ- Plane

Peak Gain (dBi)	***-5.29***
Peak Gain (dBi)	***-1.69***
Avg. Gain (dBi)	***-6.49***

Note: The green line means the average gain of vertical and horizontal polarization.

Main Antenna(5.15~5.35 GHz)

Note: horizontal polarization plots in the red line and vertical polarization in the blue one



Average Gain And Peak Gain (On Azimuth Plane)

XZ- Plane

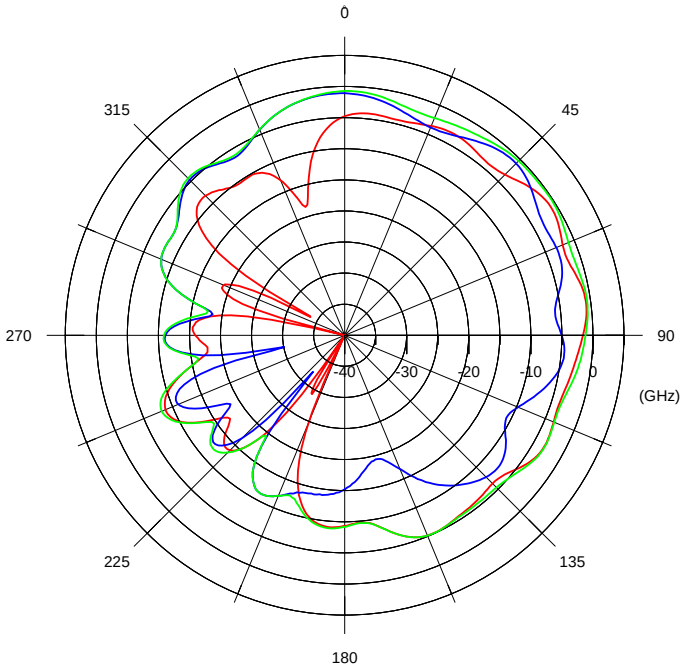
Peak Gain (dBi)	***0.36***
Peak Gain (dBi)	***2.39***
Avg. Gain (dBi)	***-1.99***

Note: The green line means the average gain of vertical and horizontal polarization.

Radiation Pattern II

Aux Antenna(2.4~2.5 GHz)

Note: horizontal polarization plots in the red line and vertical polarization in the blue one



Average Gain And Peak Gain (On Azimuth Plane)

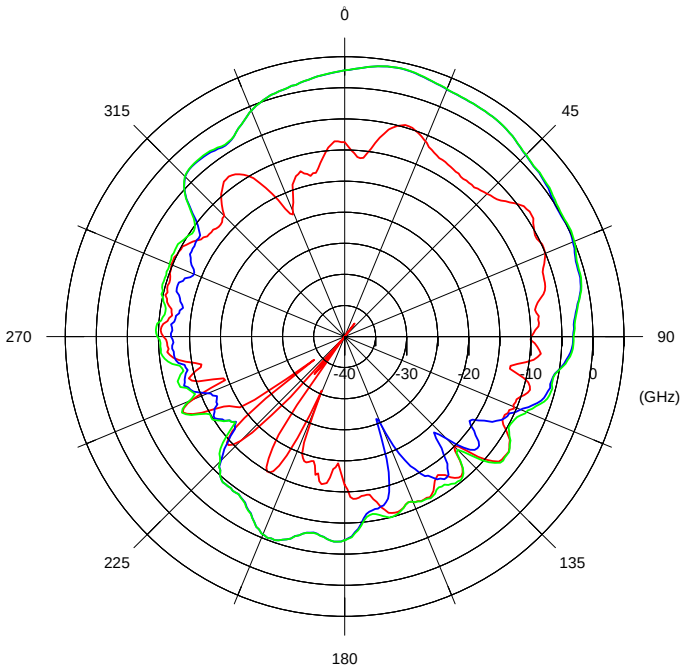
XZ- Plane

Peak Gain (dBi)	***-0.77***
Peak Gain (dBi)	***-0.95***
Avg. Gain (dBi)	***-4.14***

Note: The green line means the average gain of vertical and horizontal polarization.

Aux Antenna(5.15~5.35 GHz)

Note: horizontal polarization plots in the red line and vertical polarization in the blue one



Average Gain And Peak Gain (On Azimuth Plane)

XZ- Plane

Peak Gain (dBi)	***-4.07***
Peak Gain (dBi)	***4.04***
Avg. Gain (dBi)	***-2.43***

Note: The green line means the average gain of vertical and horizontal polarization.

Appendix

VSWR : *Voltage standing wave ratio on a transmission line in an antenna system. The ratio of the forward to reflected voltage on the line, and not a power ratio. A VSWR of 1:1 occurs when all parts of the antenna system are matched correctly.*

Return Loss : *When the load is mismatched, then, not all of the available power from the generator is delivered to the load. This 'loss 'is called return loss(RL).*

Radiation pattern : *The radiation characteristics of an antenna as a function of spatial coordinates. Normally, the pattern is measured in the far-field region and is represented graphically.*

Polarization : *The sense of the wave radiated by an antenna. This can be horizontal, vertical, elliptical, or circular (left or right hand circularity), depending on the design and application. The polarization of the antenna is based on the orientation of the electric or E field component. The polarization must be matched between two antennas to receive the maximum field intensity. Dependent on the antenna type, it is possible to radiate linear, elliptical and circular polarizations.*

Gain value : *The increase in effective radiated power in the desired direction of the major lobe.*

Peak gain : *The highest gain value in 360 degrees, which means the antenna efficiency at this angle is the best.*

Cable loss : *When RF signal transmitting in the coaxial cable, due to the material of the cable, the power may dissipate into to the air in the form of heat. So when we try to measure the gain of an antenna, we have to offset the cable loss. The power loss of coaxial cable (Φ=1.13 mm) at 2.4~2.5 GHz is 3dB per 1000 mm and 5dB per 1000 mm at 5.15~5.35 GHz. In this case, the cable length of the main antenna is about 300 mm, so the cable loss when RF signals transmitting at 2.4~2.5 GHz is about 0.9 dB; and the one at 5.15~5.35 GHz is about 1.5dB. For the same reason , the cable length of the left antenna is about 215 mm , so the cable loss when RF signal transmitting at 2.4~2.5 GHz is about 0.6dB ; and the loss at 5.15~5.35 GHz is about 1.1 dB. Which means we have to offset the cable loss to the gain value that we measure from the radiation pattern and that is the true antenna gain (G_a) we want.*