

RE48 - Antenna Approval sheet

- PCB Overview & Matching Value
- VSWR & Smith Chart / 3D Gain data
- 2D Radiation Pattern & Gain
- 3D Radiation pattern

By designed	By checked	By approved
Kim.j.s	-	 Ji Kwon
2025.10.17		2025.10.17

Rev 1.0
OCT 17 , 2025

Specification

1. Features and Application :

This product is for BT band (2402 ~ 2480 MHz)

2. Features and Application :

This product is for

BT band (2402 ~ 2480 MHz)

Wi-Fi 2.4GHz band (2412 ~ 2472 MHz)

Wi-Fi 5GHz band (5150 ~ 5850 MHz)

Measurement Process

SWR / Return Loss

Use Network Analyzer when measuring SWR/Return loss and selecting standard SPL.

E5071B Agilent Network Analyzer

Additional Features:

300 kHz to 8.5 GHz

125 dB dynamic range at test port (typical)

9.6 us/point sweep speed

0.001 dB RMS trace noise

Integrated 2-, 3- and 4-ports with balanced measurements

Fixture embedding/de-embedding and port characteristic impedance conversion

Frequency-offset mode for frequency translated devices.

Built-in Visual Basic for Applications (VBA)

Measurement Wizard Assistant (MWA) software

Measurement Process

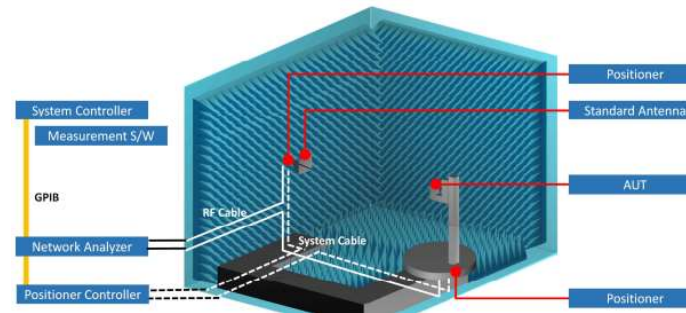
Gain

Antenna gain is measured in the Anechoic Chamber



o Size: 5.5(L) m × 5.5(W) m × 5.0(H) m

o Frequency range: 700 MHz to 8.0 GHz (Far Field)



Network Analyzer : R&C ZVA24 (10MHz ~ 24GHz)	GSM, CDMA, WCDMA : Agilent 5515C
4G, LTE Cat.M, NB-IoT : Anritsu MT8821C	
5G (Sub6G, mmWave) : Anritsu MT8000A	WLAN (802.11 a,b,g,n,ac) : Anritsu MT8862A

휴대폰 안테나 측정 시스템

Mobile Antenna Measurement System

측정내용
소형 안테나 성능 측정 및 모바일 단말기, 모듈의 수신감도 측정

측정대상
무선랜(IEEE 802.11 a, b, g, n, ac), 이동통신(4G, 5G) 기기 등

특성
규모 : 5.5(L) m × 5.5(W) m × 5.0(H) m 주파수 범위 : 700 MHz ~ 8 GHz
Quiet Zone : 0.8 m × 0.8 m @ 800 MHz 챔버 타입 : Rectangular
피복정 안테나 무게 : <12kg

구성도

Electrical Characteristics

This specification covers the dielectric pattern antenna **EE48** used in Bluetooth

Manufacturer : Remote Solution

Name : EE48 BLE

Peak[dBi] : -0.13dBi

ITEM		SPECIFICATION				
Frequency Range		2402 ~ 2480 MHz				
VSWR		Max 2.5				
Polarization		Linear				
Frequency [MHz]		2400	2425	2450	2480	
Gain [dBi]	Peak	-0.64	-0.35	-0.21	-0.13	
	Average	-6.58	-5.92	-5.18	-4.74	
Efficiency [%]		22.0	25.6	30.3	33.6	

Electrical Characteristics

This specification covers the dielectric pattern antenna **EE48** used in Bluetooth

Manufacturer : Remote Solution

Name : EE48 WIFI

2.4G Peak[dBi] : -0.19 dBi

5.0G Peak[dBi] : +5.03 dBi

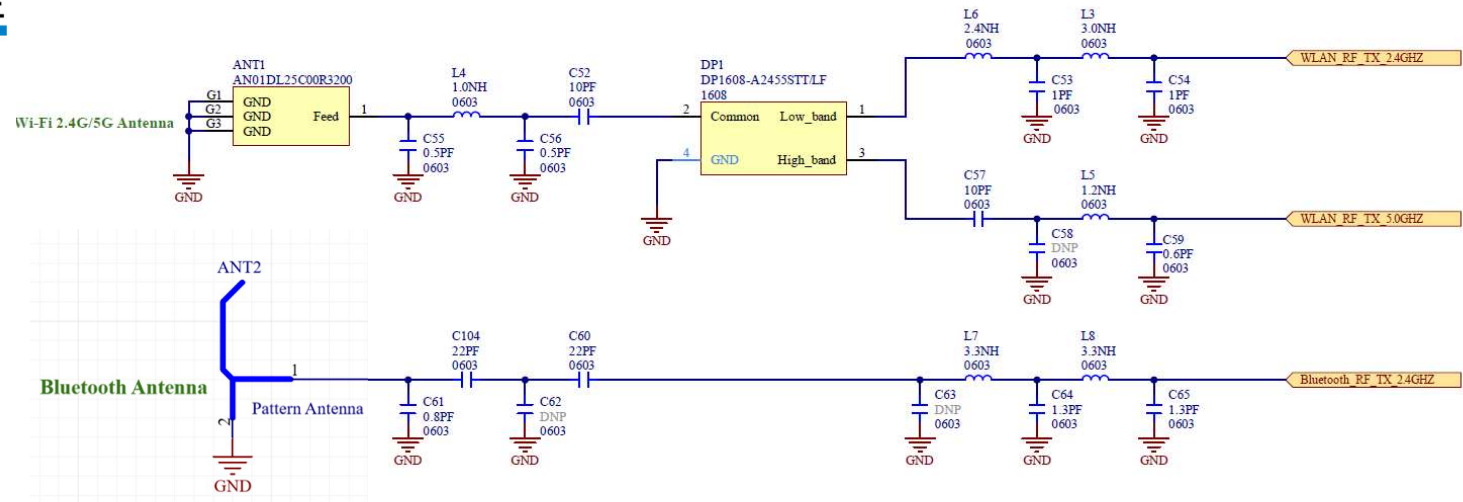
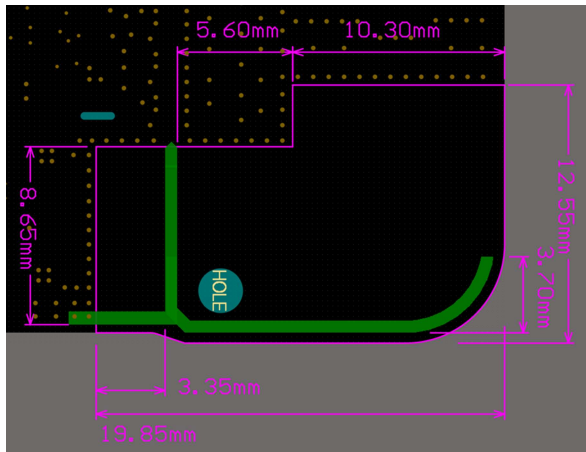
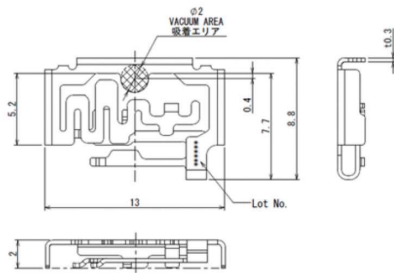
ITEM		SPECIFICATION					
Frequency Range		2402 ~ 2480 MHz					
VSWR		Max 2.5					
Polarization		Linear					
Frequency [MHz]		2400	2450	2485	5150	5650	5850
Gain [dBi]	Peak	-0.74	-0.19	-1.61	4.42	5.03	1.44
	Average	-4.89	-4.23	-5.50	-2026	-1.95	4.76
Efficiency [%]		32.4	37.8	28.2	59.4	63.8	33.4

PCB Overview & Matching Value



3.2 寸法 Dimensions

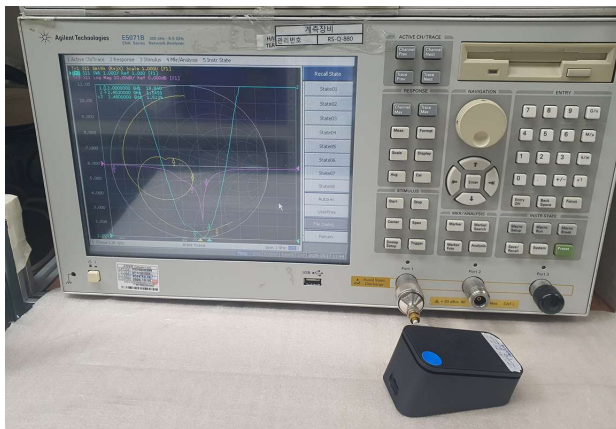
13 (width) × 8.8 (depth) × 2 (height) mm



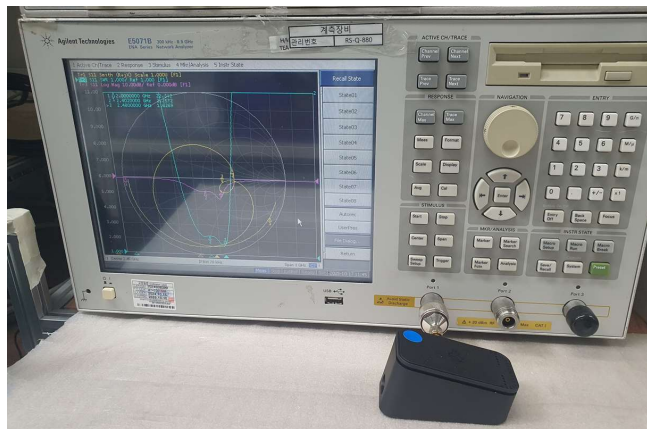
Manufacturer : Remote Solution

Name : EE48 ANT

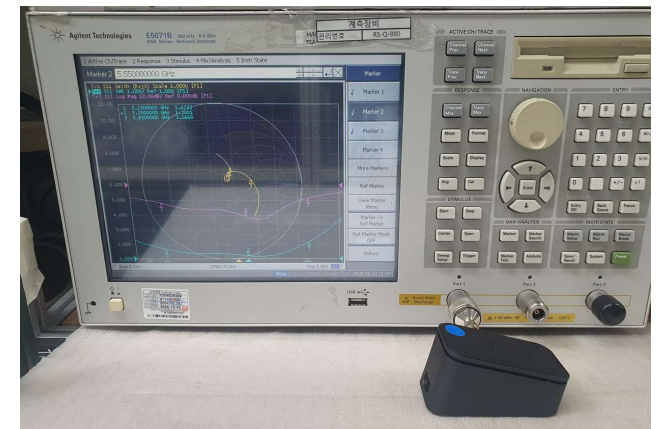
VSWR & Smith Chart / 3D Gain data



[EE48 BLE]



[EE48 WIFI 2.4G]

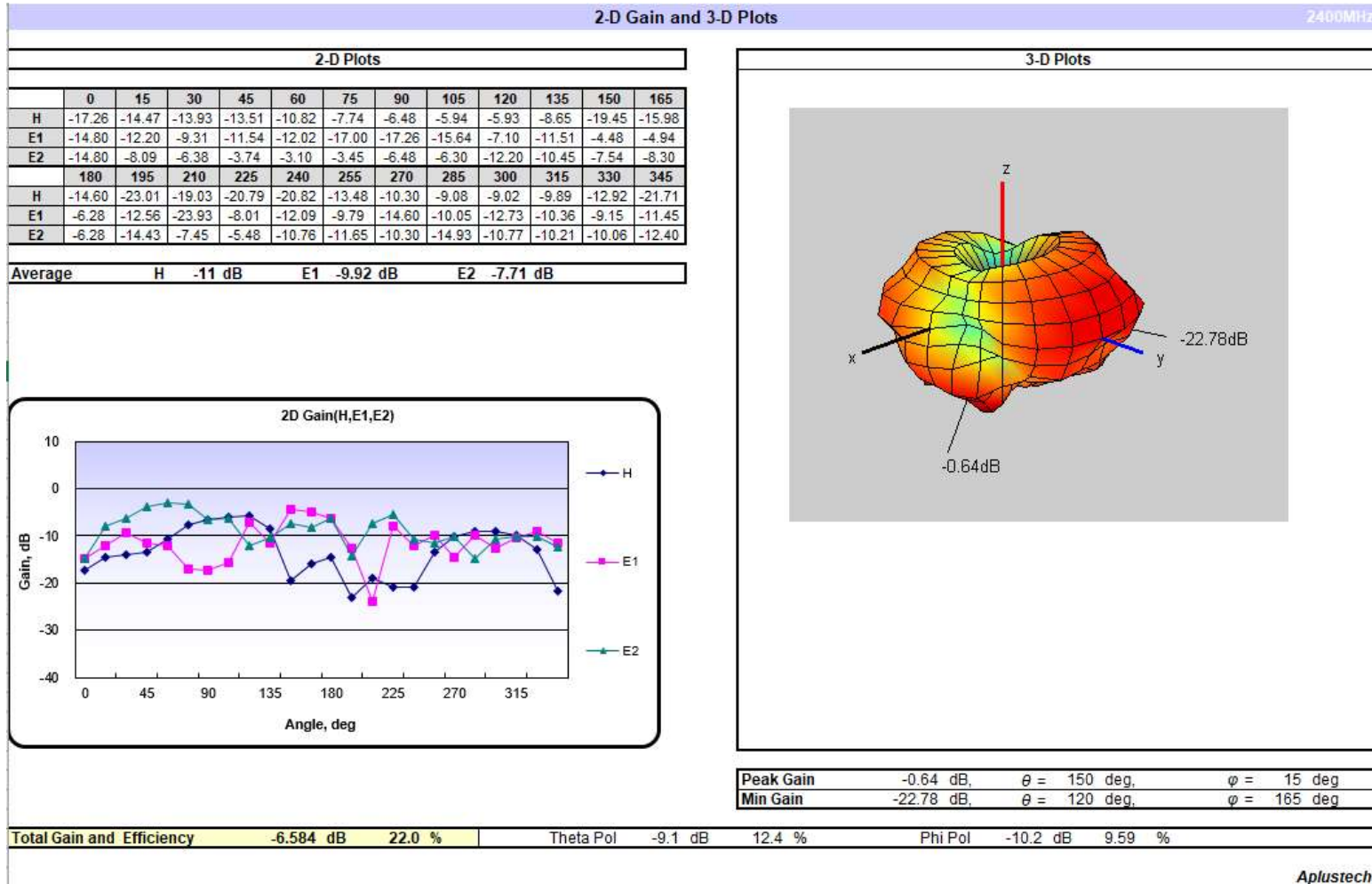


[EE48 WIFI 5.0G]

2D Radiation Pattern & Gain (EE48 BLE)

	1	2	3	4						
Frequency [MHz]	2400	2425	2450	2485						
Efficiency [dB]	-6.58	-5.92	-5.18	-4.74						
Efficiency [%]	22.0	25.6	30.3	33.6						
TRG _g [dB]	-9.08	-8.56	-8.09	-7.97						
Gain _{g Peak} [dBi]	-2.13	-1.85	-1.72	-1.90						
Gain _{g Min} [dBi]	-41.34	-40.43	-31.56	-29.35						
TRG _p [dB]	-10.18	-9.34	-8.30	-7.53						
Gain _{p Peak} [dBi]	-5.07	-3.84	-2.48	-1.22						
Gain _{p Min} [dBi]	-35.23	-44.80	-31.08	-25.79						
UHRG [dB]	-9.94	-9.31	-8.61	-8.18						
UHRG/TRG [%]	46.2	45.9	45.4	45.3						
H-Plane	-10.98	-10.71	-10.23	-9.88						
E1-Plane, AVG [dB]	-9.92	-9.33	-8.90	-8.89						
E2-Plane, AVG [dB]	-7.71	-7.22	-6.76	-6.64						
Peak Gain [dBi]	-0.64	-0.35	-0.21	-0.13						
Directivity [dB]	5.94	5.57	4.97	4.61						
Minimum Gain [dBi]	-22.78	-19.00	-15.98	-14.75						
Test Condition	FS									
Antenna Type										
Average Efficiency	-5.55 dB, 27.86 %									

3D Radiation pattern (EE48 BLE)



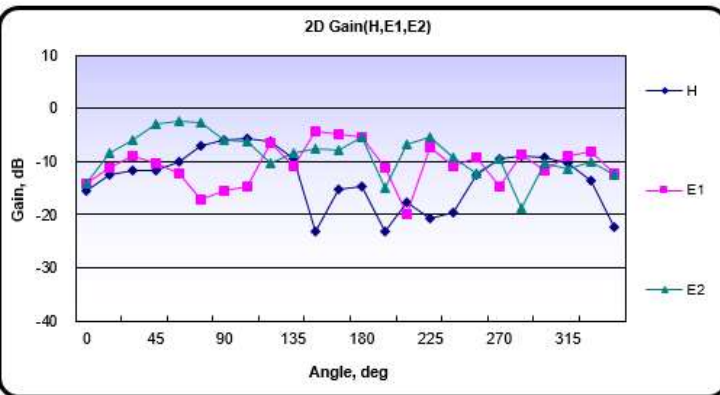
3D Radiation pattern (EE48 BLE)

2-D Gain and 3-D Plots

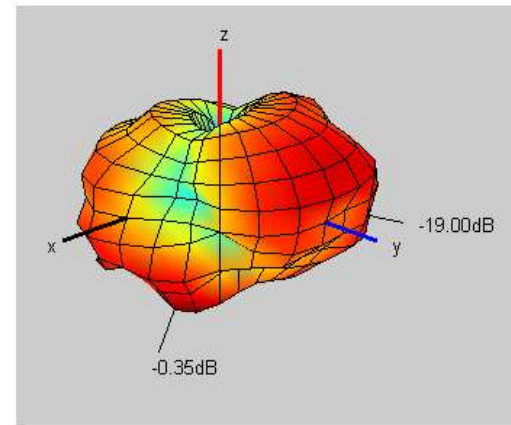
2425MHz

2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-15.66	-12.41	-11.85	-11.84	-10.22	-7.20	-5.90	-5.69	-6.26	-9.46	-23.28	-15.16
E1	-14.07	-11.23	-8.95	-10.35	-12.28	-17.11	-15.66	-14.62	-6.51	-10.79	-4.37	-4.75
E2	-14.07	-8.31	-5.94	-3.07	-2.33	-2.84	-5.90	-6.17	-10.33	-8.35	-7.63	-7.78
	180	195	210	225	240	255	270	285	300	315	330	345
H	-14.85	-23.32	-17.75	-20.80	-19.51	-12.54	-9.61	-8.92	-9.32	-10.41	-13.60	-22.37
E1	-5.48	-11.26	-19.87	-7.35	-10.99	-9.38	-14.85	-8.81	-11.73	-8.94	-8.18	-12.33
E2	-5.48	-15.07	-6.77	-5.33	-9.33	-12.29	-9.61	-18.96	-10.46	-11.55	-10.03	-12.43
Average	H -10.7 dB E1 -9.33 dB E2 -7.22 dB											



3-D Plots



Peak Gain	-0.35 dB,	$\theta = 150$ deg,	$\phi = 15$ deg
Min Gain	-19.00 dB,	$\theta = 120$ deg,	$\phi = 165$ deg

Total Gain and Efficiency	-5.921 dB	25.6 %	Theta Pol	-8.6 dB	13.9 %	Phi Pol	-9.3 dB	11.65 %
---------------------------	-----------	--------	-----------	---------	--------	---------	---------	---------

Aplustech

3D Radiation pattern (EE48 BLE)

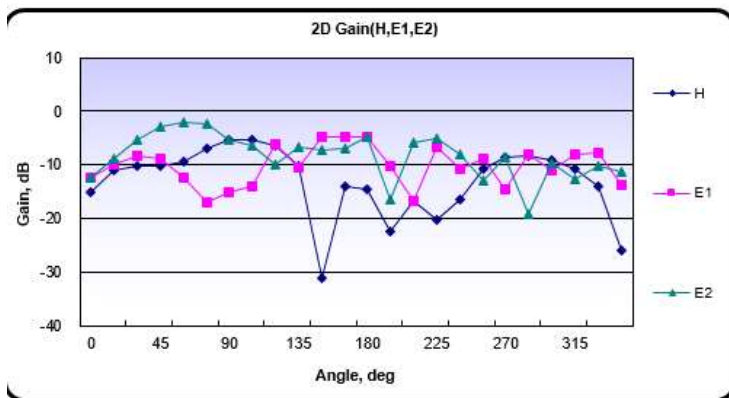
2-D Gain and 3-D Plots

2450MHz

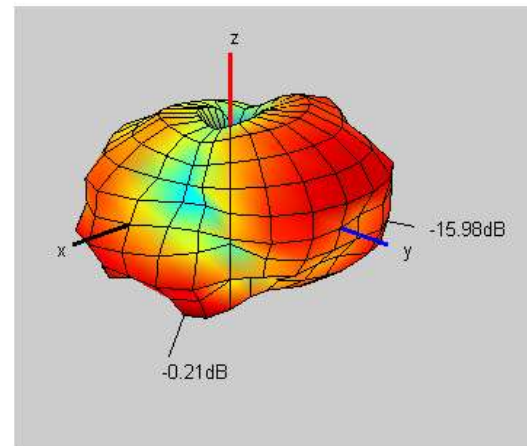
2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-15.08	-11.02	-10.21	-10.33	-9.41	-6.89	-5.35	-5.24	-6.44	-10.26	-31.24	-14.00
E1	-12.39	-9.96	-8.34	-8.87	-12.51	-17.06	-15.08	-13.97	-6.20	-10.60	-4.76	-4.77
E2	-12.39	-8.98	-5.35	-2.78	-1.98	-2.47	-5.35	-6.32	-9.86	-6.81	-7.26	-6.85
	180	195	210	225	240	255	270	285	300	315	330	345
H	-14.70	-22.60	-16.79	-20.30	-16.49	-10.69	-8.59	-8.27	-9.18	-10.91	-14.13	-26.05
E1	-4.71	-10.32	-16.67	-6.82	-10.78	-8.76	-14.70	-8.12	-11.09	-7.95	-7.79	-13.67
E2	-4.71	-16.50	-5.76	-5.06	-8.03	-12.93	-8.59	-19.15	-9.67	-12.60	-10.23	-11.24

Average H -10.2 dB E1 -8.9 dB E2 -6.76 dB



3-D Plots



Peak Gain	-0.21 dB,	$\theta = 150$ deg,	$\phi = 15$ deg
Min Gain	-15.98 dB,	$\theta = 120$ deg,	$\phi = 165$ deg

Total Gain and Efficiency	-5.184 dB	30.3 %	Theta Pol	-8.1 dB	15.5 %	Phi Pol	-8.3 dB	14.79 %
---------------------------	-----------	--------	-----------	---------	--------	---------	---------	---------

Aplustech

3D Radiation pattern (EE48 BLE)

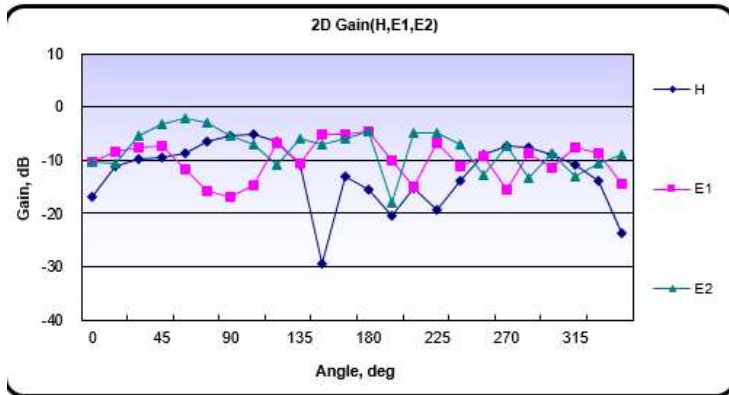
2-D Gain and 3-D Plots

2405MHz

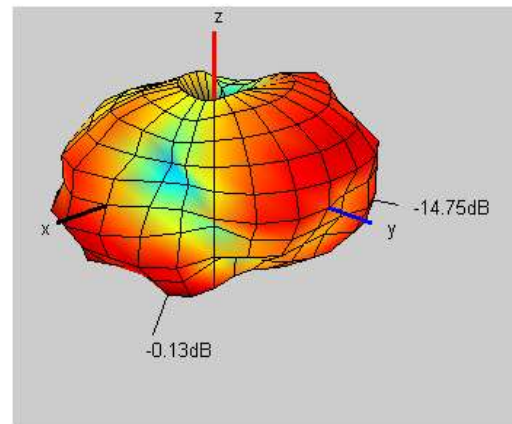
2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-16.82	-11.09	-9.86	-9.64	-8.84	-6.65	-5.32	-5.17	-6.41	-11.01	-29.35	-13.07
E1	-10.36	-8.45	-7.66	-7.44	-11.76	-15.90	-16.82	-14.76	-6.89	-10.57	-5.18	-5.14
E2	-10.36	-10.68	-5.47	-3.35	-2.03	-2.96	-5.32	-7.04	-10.89	-6.08	-7.01	-6.09
	180	195	210	225	240	255	270	285	300	315	330	345
H	-15.53	-20.59	-15.17	-19.31	-13.90	-9.10	-7.46	-7.52	-8.89	-11.01	-13.80	-23.64
E1	-4.56	-10.19	-15.10	-6.88	-11.27	-9.16	-15.53	-8.67	-11.40	-7.59	-8.63	-14.39
E2	-4.56	-18.07	-4.97	-4.78	-7.10	-12.70	-7.46	-13.26	-8.68	-13.21	-10.63	-9.07

Average H -9.88 dB E1 -8.89 dB E2 -6.64 dB



3-D Plots



Peak Gain	-0.13 dB,	$\theta = 150$ deg,	$\phi = 15$ deg
Min Gain	-14.75 dB,	$\theta = 120$ deg,	$\phi = 165$ deg

Total Gain and Efficiency	-4.737 dB	33.6 %	Theta Pol	-8.0 dB	16.0 %	Phi Pol	-7.5 dB	17.65 %
---------------------------	-----------	--------	-----------	---------	--------	---------	---------	---------

Aplustech

2D Radiation Pattern & Gain (EE48 WIFI)

	1	2	3	4	5	6	7	8	9	10	11	12
Frequency [MHz]	2400	2425	2450	2485	5150	5250	5350	5450	5550	5650	5750	5850
Efficiency [dB]	-4.89	-4.32	-4.23	-5.50	-2.26	-2.03	-2.06	-2.08	-2.35	-1.95	-2.42	-4.76
Efficiency [%]	32.4	37.0	37.8	28.2	59.4	62.7	62.2	61.9	58.2	63.8	57.3	33.4
TRG _s [dB]	-7.19	-6.77	-6.92	-8.60	-5.18	-5.49	-6.19	-6.83	-7.14	-5.89	-5.83	-8.05
Gain _{s Peak} [dBi]	-1.55	-1.06	-0.74	-1.99	2.63	1.86	0.43	-0.44	-0.29	0.48	0.20	-1.65
Gain _{s Min} [dBi]	-32.38	-40.53	-34.28	-33.55	-36.23	-35.02	-37.87	-41.93	-39.82	-31.37	-38.67	-39.64
TRG _p [dB]	-8.75	-7.98	-7.58	-8.43	-5.37	-4.63	-4.18	-3.85	-4.10	-4.20	-5.05	-7.51
Gain _{p Peak} [dBi]	-2.59	-1.59	-1.27	-2.54	1.93	2.62	3.31	3.85	4.14	4.36	3.15	-0.11
Gain _{p Min} [dBi]	-35.33	-46.84	-27.72	-28.81	-37.02	-29.93	-35.34	-32.47	-34.24	-43.73	-35.70	-47.16
UHRG [dB]	-8.24	-7.64	-7.56	-8.82	-5.02	-4.75	-4.54	-4.40	-4.51	-4.07	-4.66	-7.13
UHRG/TRG [%]	46.3	46.6	46.4	46.6	53.0	53.5	56.5	58.6	60.7	61.4	59.7	58.0
H-Plane	-7.74	-7.60	-8.00	-9.82	-5.38	-5.71	-6.55	-6.93	-7.13	-5.74	-5.57	-8.22
E1-Plane, AVG [dB]	-10.49	-9.61	-9.20	-9.97	-3.31	-3.96	-5.20	-6.43	-7.25	-6.12	-6.30	-8.85
E2-Plane, AVG [dB]	-5.25	-4.86	-5.13	-6.99	-6.66	-6.84	-7.09	-7.15	-7.06	-6.16	-6.23	-8.43
Peak Gain [dBi]	-0.74	-0.24	-0.19	-1.61	4.42	4.65	5.07	5.03	4.90	5.37	4.36	1.44
Directivity [dB]	4.15	4.08	4.03	3.89	6.68	6.68	7.13	7.11	7.25	7.32	6.77	6.20
Minimum Gain [dBi]	-16.88	-16.22	-14.77	-14.25	-28.26	-24.62	-26.22	-21.04	-24.16	-21.90	-22.47	-24.14
Test Condition	FS											
Antenna Type												
Average Efficiency	-3.05 dB, 49.53 %											

3D Radiation pattern (EE48 WIFI)

2-D Gain and 3-D Plots

2400MHz

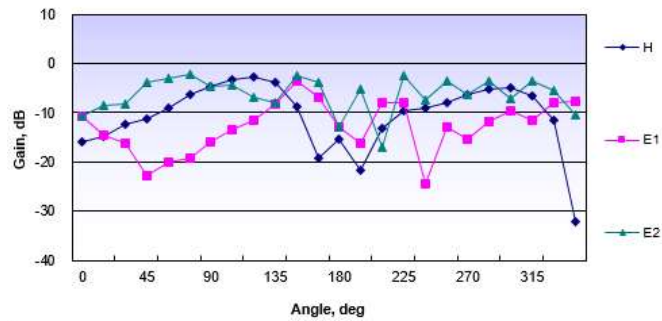
2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-15.91	-14.83	-12.34	-11.38	-9.14	-6.27	-4.63	-3.44	-2.74	-3.82	-8.73	-19.25
E1	-10.75	-14.50	-16.14	-22.73	-20.21	-19.34	-15.91	-13.61	-11.69	-8.39	-3.63	-6.94
E2	-10.75	-8.67	-8.26	-3.80	-3.14	-2.11	-4.63	-4.31	-6.79	-8.11	-2.57	-3.92

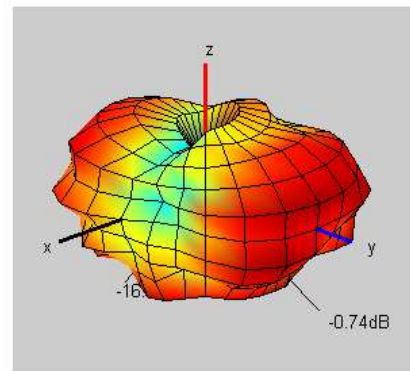
	180	195	210	225	240	255	270	285	300	315	330	345
H	-15.38	-21.84	-13.33	-9.70	-9.16	-8.12	-6.28	-5.18	-5.09	-6.58	-11.66	-32.14
E1	-13.05	-16.10	-7.87	-7.98	-24.61	-12.89	-15.38	-11.85	-9.68	-11.63	-7.91	-7.59
E2	-13.05	-5.35	-16.95	-2.55	-7.45	-3.48	-6.28	-3.49	-7.06	-3.63	-5.41	-10.47

Average H -7.74 dB E1 -10.5 dB E2 -5.25 dB

2D Gain(H,E1,E2)



3-D Plots



Peak Gain	-0.74 dB	$\theta = 150$ deg	$\phi = 135$ deg
Min Gain	-16.88 dB	$\theta = 150$ deg	$\phi = 270$ deg

Total Gain and Efficiency -4.889 dB 32.4 % Theta Pol -7.2 dB 19.1 % Phi Pol -8.7 dB 13.35 %

Aplustech

3D Radiation pattern (EE48 WIFI)

2-D Gain and 3-D Plots

2450MHz

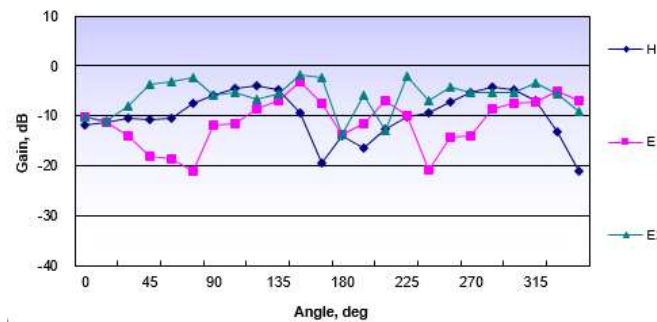
2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-11.98	-11.24	-10.45	-10.69	-10.63	-7.56	-5.81	-4.66	-4.02	-4.86	-9.31	-19.48
E1	-10.19	-11.22	-13.99	-18.15	-18.65	-21.05	-11.98	-11.54	-8.54	-6.95	-3.22	-7.60
E2	-10.19	-10.99	-8.03	-3.60	-3.13	-2.33	-5.81	-5.30	-6.65	-5.56	-1.82	-2.38

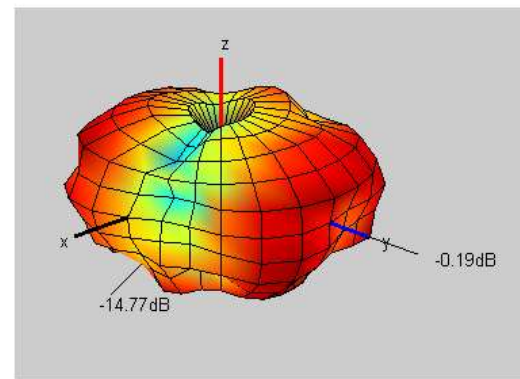
	180	195	210	225	240	255	270	285	300	315	330	345
H	-13.93	-16.62	-12.61	-10.30	-9.31	-7.28	-5.24	-4.35	-4.80	-6.95	-13.36	-20.99
E1	-13.71	-11.74	-6.94	-9.99	-20.81	-14.31	-13.93	-8.65	-7.63	-7.19	-5.02	-6.95
E2	-13.71	-6.00	-12.96	-2.19	-6.98	-4.32	-5.24	-5.24	-5.47	-3.54	-5.62	-9.29

Average H -8 dB E1 -9.2 dB E2 -5.13 dB

2D Gain(H,E1,E2)



3-D Plots



Peak Gain	-0.19 dB,	$\theta = 150$ deg,	$\phi = 135$ deg
Min Gain	-14.77 dB,	$\theta = 150$ deg,	$\phi = 300$ deg

Total Gain and Efficiency -4.227 dB 37.8 % Theta Pol -6.9 dB 20.3 % Phi Pol -7.6 dB 17.44 %

Aplustech

3D Radiation pattern (EE48 WIFI)

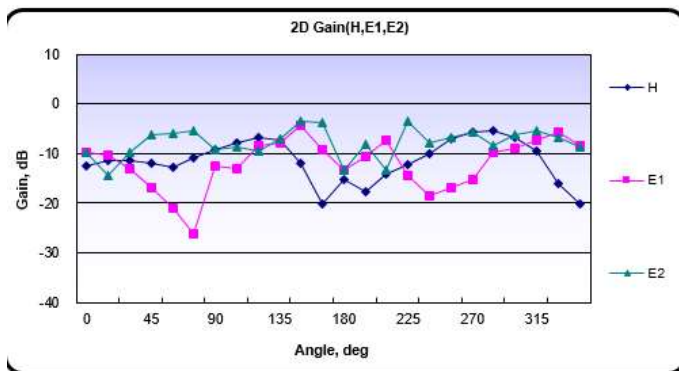
2-D Gain and 3-D Plots

2485MHz

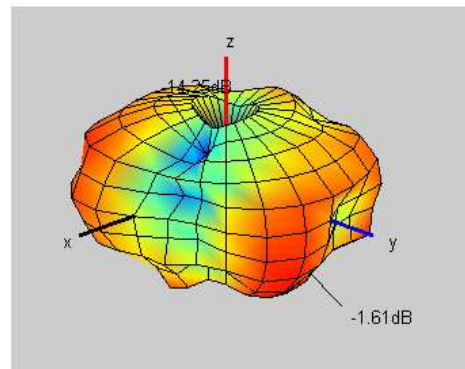
2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-12.67	-11.56	-11.36	-11.98	-12.70	-10.89	-9.21	-7.98	-6.75	-7.23	-11.95	-20.20
E1	-9.79	-10.31	-13.21	-16.88	-21.10	-26.10	-12.67	-13.18	-8.33	-7.76	-4.46	-9.18
E2	-9.79	-14.52	-9.83	-6.15	-5.91	-5.34	-9.21	-8.74	-9.57	-6.98	-3.59	-3.75
	180	195	210	225	240	255	270	285	300	315	330	345
H	-15.37	-17.72	-14.13	-12.24	-10.03	-7.15	-5.60	-5.50	-6.74	-9.51	-16.10	-20.24
E1	-13.48	-10.50	-7.36	-14.54	-18.44	-16.96	-15.37	-9.69	-8.89	-7.46	-5.70	-8.41
E2	-13.48	-8.08	-13.47	-3.59	-7.89	-6.76	-5.60	-8.50	-6.14	-5.35	-6.91	-8.75

Average	H	-9.82 dB	E1	-9.97 dB	E2	-6.99 dB
---------	---	----------	----	----------	----	----------



3-D Plots



Peak Gain	-1.61 dB,	$\theta = 150$ deg,	$\phi = 135$ deg
Min Gain	-14.25 dB,	$\theta = 30$ deg,	$\phi = 15$ deg

Total Gain and Efficiency	-5.501 dB	28.2 %	Theta Pol	-8.6 dB	13.8 %	Phi Pol	-8.4 dB	14.36 %
---------------------------	-----------	--------	-----------	---------	--------	---------	---------	---------

Aplustech

3D Radiation pattern (EE48 WIFI)

2-D Gain and 3-D Plots

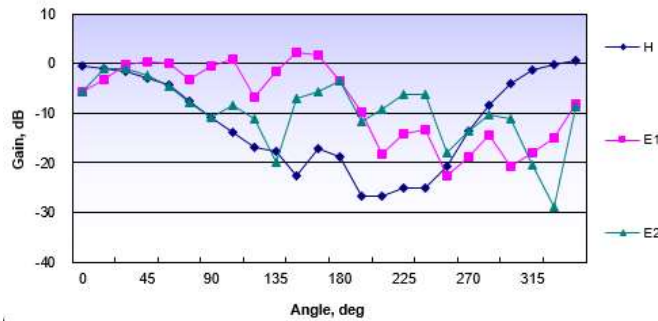
5150MHz

2-D Plots

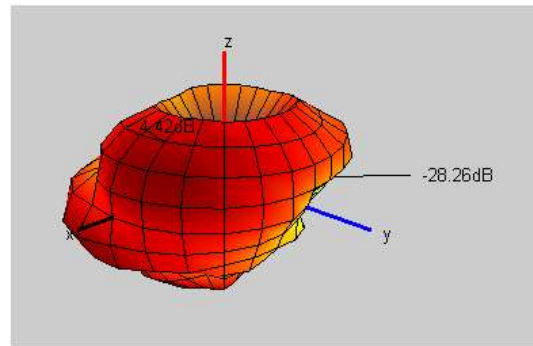
	0	15	30	45	60	75	90	105	120	135	150	165
H	-0.57	-1.09	-1.65	-3.04	-4.36	-7.67	-10.82	-13.91	-17.00	-17.69	-22.78	-17.19
E1	-5.62	-3.32	-0.29	0.17	-0.06	-3.20	-0.57	0.72	-6.70	-1.59	2.18	1.72
E2	-5.62	-1.19	-1.06	-2.30	-4.58	-7.77	-10.82	-8.37	-11.08	-19.80	-7.02	-5.70
	180	195	210	225	240	255	270	285	300	315	330	345
H	-18.91	-26.67	-26.83	-24.99	-25.18	-20.70	-13.61	-8.33	-4.14	-1.39	-0.28	0.50
E1	-3.46	-9.70	-18.24	-14.27	-13.31	-22.72	-18.91	-14.40	-20.68	-17.96	-14.90	-8.08
E2	-3.46	-11.69	-9.38	-6.26	-6.39	-17.96	-13.61	-10.40	-11.27	-20.57	-28.81	-8.69

Average H -5.38 dB E1 -3.31 dB E2 -6.66 dB

2D Gain(H,E1,E2)



3-D Plots



Peak Gain	4.42 dB,	$\theta = 45$ deg,	$\phi = 15$ deg
Min Gain	-28.26 dB,	$\theta = 105$ deg,	$\phi = 165$ deg

Total Gain and Efficiency -2.264 dB 59.4 % Theta Pol -5.2 dB 30.4 % Phi Pol -5.4 dB 29.01 %

Aplustech

3D Radiation pattern (EE48 WIFI)

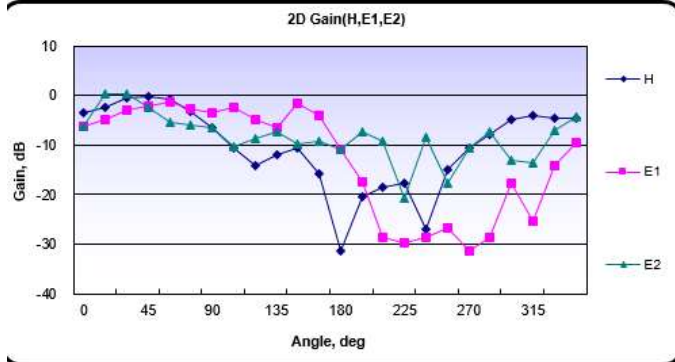
2-D Gain and 3-D Plots

5650MHz

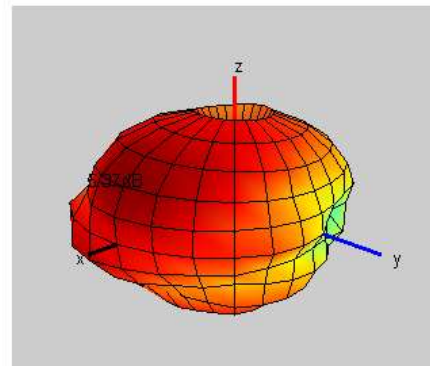
2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-3.58	-2.35	-0.43	-0.36	-0.86	-3.30	-6.49	-10.63	-14.22	-11.90	-10.49	-15.70
E1	-6.39	-4.78	-2.96	-2.03	-1.47	-2.76	-3.58	-2.50	-4.83	-6.58	-1.51	-3.97
E2	-6.39	0.27	0.22	-2.32	-5.38	-5.91	-6.49	-10.30	-8.68	-7.39	-9.94	-9.30
	180	195	210	225	240	255	270	285	300	315	330	345
H	-31.37	-20.39	-18.68	-17.69	-26.92	-15.05	-10.64	-7.76	-4.82	-4.11	-4.64	-4.64
E1	-10.87	-17.51	-28.65	-29.76	-28.57	-26.87	-31.37	-28.77	-17.84	-25.38	-14.21	-9.51
E2	-10.87	-7.23	-9.16	-20.82	-8.42	-17.80	-10.64	-7.46	-13.18	-13.75	-7.15	-4.31

Average H -5.74 dB E1 -6.12 dB E2 -6.16 dB



3-D Plots



Peak Gain	5.37 dB,	$\theta = 60$ deg,	$\phi = 0$ deg
Min Gain	-21.90 dB,	$\theta = 105$ deg,	$\phi = 225$ deg

Total Gain and Efficiency -1.951 dB 63.8 % Theta Pol -5.9 dB 25.7 % Phi Pol -4.2 dB 38.06 %

Aplustech

3D Radiation pattern (EE48 WIFI)

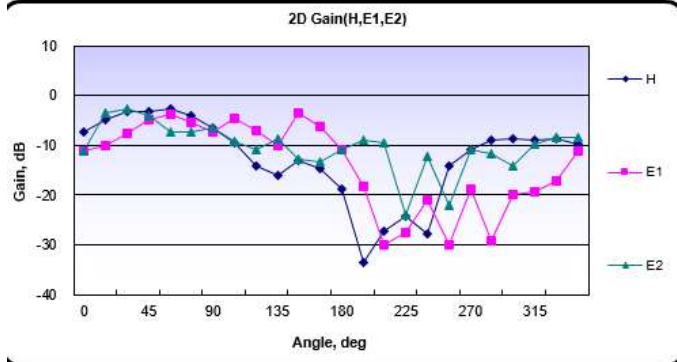
2-D Gain and 3-D Plots

5850MHz

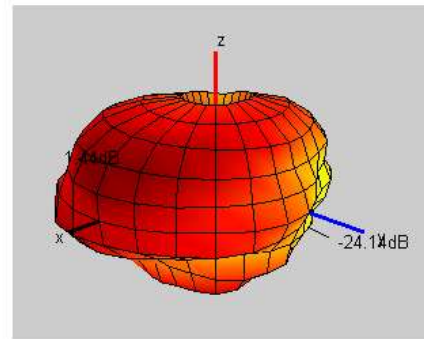
2-D Plots

	0	15	30	45	60	75	90	105	120	135	150	165
H	-7.35	-4.86	-3.35	-3.15	-2.82	-4.11	-6.42	-9.57	-14.18	-16.07	-13.21	-14.85
E1	-11.12	-10.14	-7.56	-4.97	-3.79	-5.30	-7.35	-4.63	-6.96	-10.08	-3.52	-6.30
E2	-11.12	-3.48	-2.76	-4.02	-7.29	-7.45	-6.42	-9.16	-10.96	-8.74	-12.93	-13.50
	180	195	210	225	240	255	270	285	300	315	330	345
H	-18.73	-33.65	-27.41	-24.39	-27.73	-14.18	-10.89	-9.02	-8.69	-8.86	-8.81	-9.83
E1	-10.92	-18.23	-29.90	-27.59	-20.94	-30.14	-18.73	-29.16	-19.89	-19.44	-17.18	-11.29
E2	-10.92	-9.06	-9.50	-23.92	-12.26	-22.22	-10.89	-11.63	-14.31	-9.94	-8.41	-8.38

Average H -8.22 dB E1 -8.85 dB E2 -8.43 dB



3-D Plots



Peak Gain	1.44 dB,	$\theta = 60$ deg,	$\phi = 0$ deg
Min Gain	-24.14 dB,	$\theta = 135$ deg,	$\phi = 180$ deg

Total Gain and Efficiency	-4.761 dB	33.4 %	Theta Pol	-8.0 dB	15.7 %	Phi Pol	-7.5 dB	17.74 %
---------------------------	-----------	--------	-----------	---------	--------	---------	---------	---------

Aplustech



Thank you