Measurement of Maximum Permissible Exposure

1. Foreword

In adopt with the Human Exposure IEEE C95.1, and according to the FCC 1.1310. The *Maximum Permissible Exposure (MPE)* is obligated to measure in order to prove the safety of radiation harmfulness to the human body.

The *Gain* of the antenna used is measured in an *Anechoic chamber.* The *maximum total power to the antenna* is to be recorded. By adopting the ***Friis Transmission Formula*** and the *power gain of the antenna,* we can find the distance right away from the product, where the limit of the MPE is.

2. Description of EUT

FCC ID	:	VUIUPWL6025A
Product Name	:	WIFI MODULE
Model Name	:	UPWL6025
Frequency Range	**:**	IEEE 802.11b/g/n Draft 1.0 20M: 2.412GHz ~ 2.462GHz
		IEEE 802.11n Draft 1.0 40M: 2.422GHz ~ 2.452GHz
Channel Spacing	**:**	5MHz
Support Channel	**:**	IEEE 802.11b/g/n Draft 1.0 20M: 11 Channels
		IEEE 802.11n Draft 1.0 40M: 7 Channels
Modulation Skill	**:**	DBPSK, DQPSK, CCK, OFDM
Power Type	**:**	Powered by PCI Express interface of client's device

3. Limits for *Maximum Permissible Exposure (MPE)*

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Filed Strength (H) (A/m)	Power Density (S) (mW/cm2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	100	6
3.0-30	1842/f	4.89/f	$900/f^2$	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	100	30
1.34-30	824/f	2.19/f	$180/f^2$	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

[The EUT is tested in transmit and receive modes and in the first, middle and the last channel separately. The following shows only our observation have the greatest emissions.]

According to **OET BULLETIN 56 Fourth Edition/August 1999**, **Equation for Predicting RF Fields:**

Friis Transmission Formula: $S = \frac{PG}{4\pi R^2} = \frac{617.85 \times 2.49}{4\pi (20)^2} = 0.306 mW/cm^2$

Estimated safe separation: $R = \sqrt{\frac{PG}{4\pi}} = \sqrt{\frac{617.85 \times 2.49}{4\pi}} = 11.06 cm$

Note: "The safe estimated separation that the user must maintain from the antenna is at least 6.5cm"

Where: S = *power density* (in appropriate units, e.g. mW/cm2)

P = *power input* to the antenna (in appropriate units, e.g., mW)

G = *power gain* of the antenna in the direction of interest relative to an isotropic radiator

R = *distance* to the center of radiation of the antenna (appropriate units, e.g., cm)

The *Numeric gain G* of antenna with a gain specified in dB is determined by:

G = Log $^{-1}$ (***dB*** antenna gain / 10)

G = Log $^{-1}$ (3.97 / 10) = 2.49

Appendix

Antenna Specification
(Antenna#1 C1336S510053-A)

WHA YU INDUSTRIAL CO., LTD.(HEAD OFFICE)
DONGGUAN AEON TECH CO.,LTD.(CHINA)
SUZHOU AEON TECH CO.,LTD.(CHINA)
AEON TECH (SHANGHAI) CO.,LTD(CHINA)
DONGGUAN PARNER TECH CO.,LTD.(CHINA)

SPECIFICATION FOR APPROVAL

CUSTOMER: 永碩

PART NAME: *PCB Antenna*

PART NO: *REVISION:*

W. Y. P/NO: *C1336S510053-A(SSR-01027)* *REV: X1*

	MANUFACTURER SIGNATURE	CUSTOMER SIGNATURE
APPROVED BY :	張蓮	
DATE :	10.8.4	

WHA YU GROUP

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AEON TECH (SHANGHAI) CO.,LTD(CHINA)
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Tel:+86-21-64959151 Fax:+86-21-64959059
DONGGUAN PARNER TECH CO.,LTD.(CHINA)
東莞倍能電子有限公司
Address:Hupan Industrial District, Shida Road, Tai Ling Shan Town, Dong Guan City, Guangdong, China
Tel:+86-769-81662366 Fax:+86-769-81602681

PCB Antenna

Specification

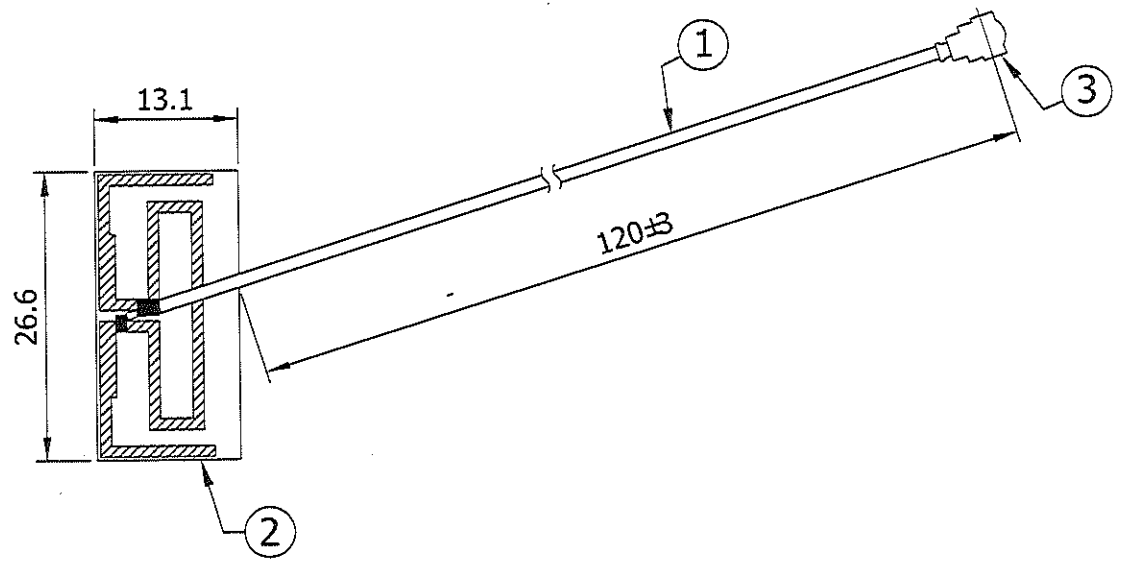
1. Electrical Properties :(Free Space)

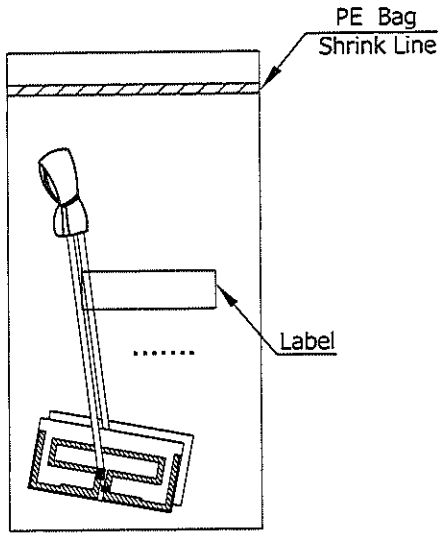
1.1 Frequency Range……2.52GHz ~ 2.62GHz
1.2 Impedance ……50Ω Nominal
1.3 VSWR ……1.92:1 Max.
1.4 Return Loss……-10 dB Max.
1.5 Radiation ……Omni-directional
1.6 Gain(peak)……2.0 dBi (excluding cable loss)
1.7 Cable Loss…… 0.4dB Max.
1.8 Polarization……Linear ; Vertical
1.9 Admitted Power…… 1W
1.10 Cable……Φ1.13 Cable;Color:Gray
1.11 Connector……MHF Plug

2. Physical Properties :

2.1 Operating Temp. ……-10℃ ~ +60℃
2.2 Storage Temp. ……-10℃ ~ +70℃

REV	DATE	DESCRIPTION
X1	8/13-2010	New Issue





Packing : 25 pcs/bag

NO	DESCRIPTION	Q'TY	REMARK
4	泡棉雙面膠	EVA+Sony G4000	1	
3	Connector	MHF Connector	1	
2	PCB	FR4 ;24mil	1	
1	Cable	Ø1.13mm Cable,Gray	1	

XX.	±5.0	APPROVED	
X.	±3.0		
.X	±1.0	CHECKED	
.XX	±0.5		
.XXX	±0.1	DRAWING	

CUSTOMER:	永 碩		
PART NO :			
PART NAME:	RF PCB Antenna Assembly		
W.Y P/NO :	C1336S510053-A		
REV	UNIT	FILE :	SSR-01027
X1	mm	SHEET :	1/1

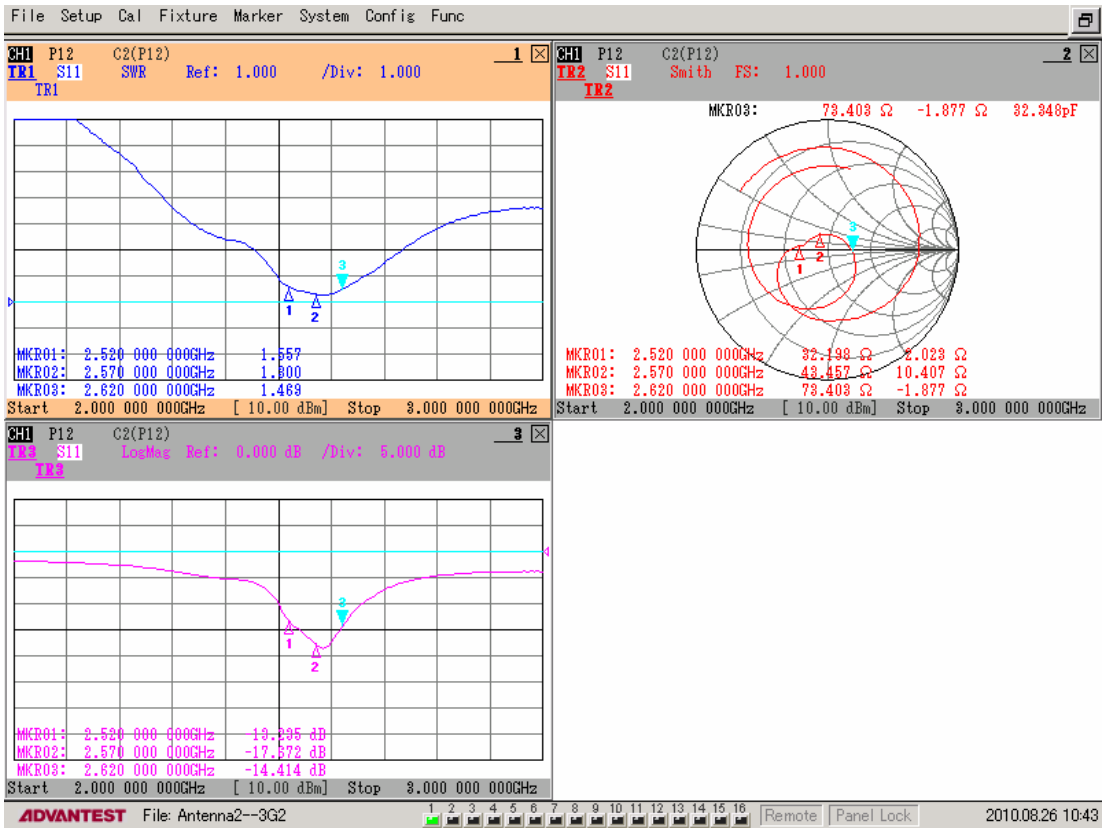
CUSTOMER'S SINGATURE

Wha Yu Group

8.13/10

PCB Antenna (Free Space)

P/NO :C1336S510053-A SPEC : 2.52~2.62GHz NO: SSR-01027

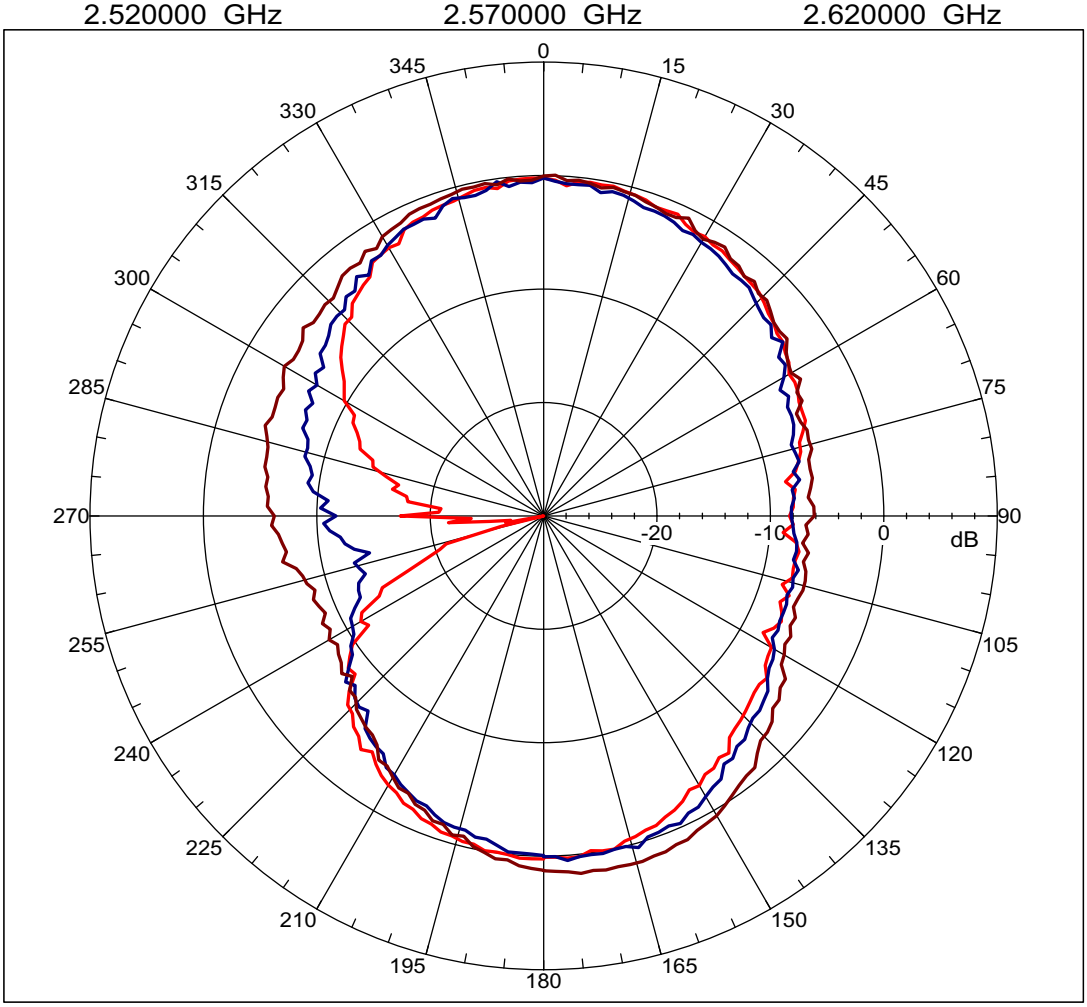


PCB Antenna (Free Space)

P/NO : C1336S510053-A SPEC : 2.52~2.62GHz NO: SSR-01027

Far-field amplitude of C1336S510053-A H.nsi

2.520000 GHz 2.570000 GHz 2.620000 GHz

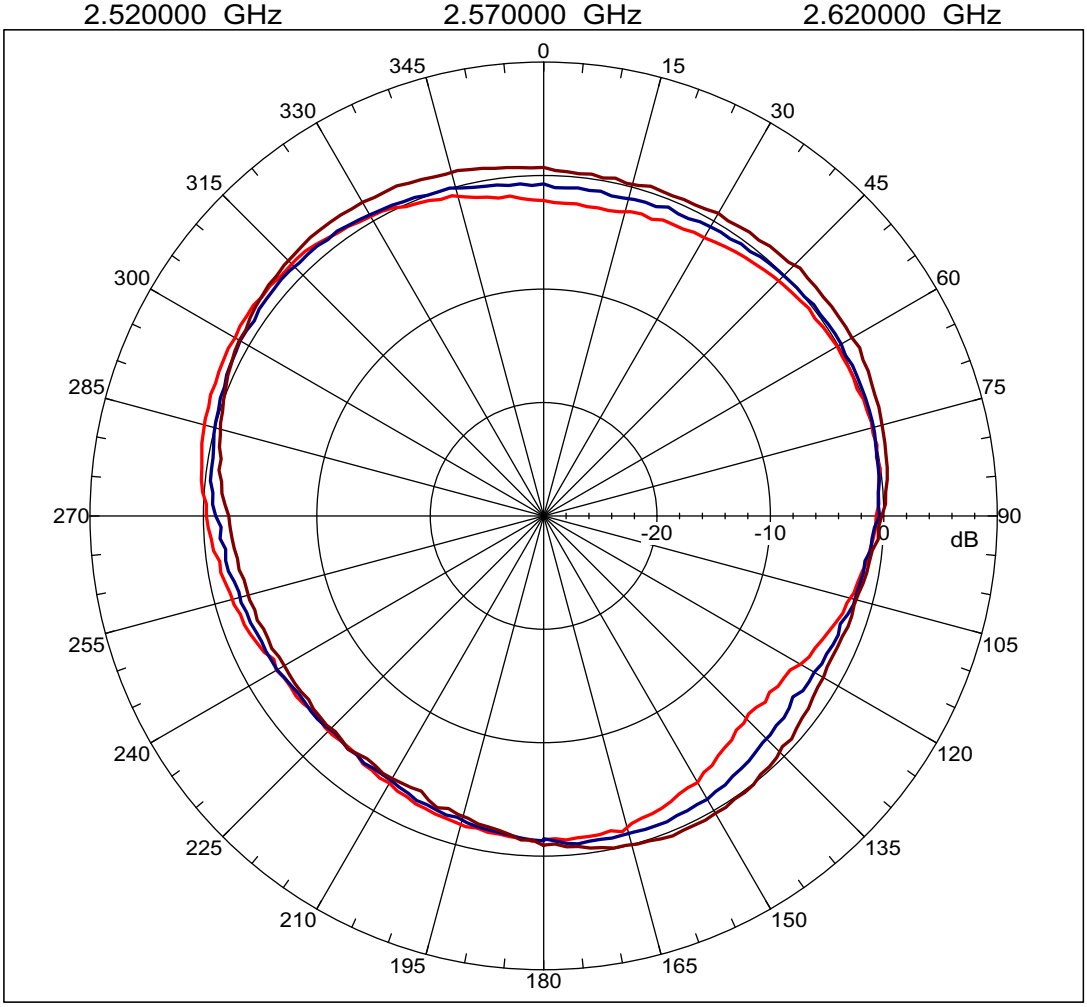


PCB Antenna (Free Space)

P/NO : C1336S510053-A SPEC : 2.52~2.62GHz NO: SSR-01027

Far-field amplitude of C1336S510053-A V.nsi

2.520000 GHz 2.570000 GHz 2.620000 GHz



Appendix

Antenna Specification
(Antenna#2 C1336S510032-A)

WHA YU INDUSTRIAL CO., LTD.(HEAD OFFICE)
DONGGUAN AEON TECH CO.,LTD.(CHINA)
SUZHOU AEON TECH CO.,LTD.(CHINA)
AEON TECH (SHANGHAI) CO.,LTD(CHINA)
DONGGUAN PARNER TECH CO.,LTD.(CHINA)

SPECIFICATION FOR APPROVAL

CUSTOMER: 永 碩

PART NAME: *RF PCB Antenna Assembly*

PART NO.: *REVISION:*

W. Y. P/NO.: *C1336S510032-A(SSR-210069)* *REV.: X1*

	MANUFACTURER SIGNATURE	CUSTOMER SIGNATURE
APPROVED BY :	Andrew	
DATE :	2010.01.13	

WHA YU GROUP

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AEON TECH (SHANGHAI) CO.,LTD(CHINA)
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DONGGUAN PARNER TECH CO.,LTD.(CHINA)
東莞倍能電子有限公司
Address:Hupan Industrial District, Shida Road, Tai Ling Shan Town,
Dong Guan City, Guangdong, China
Tel:+86-769-81662366 Fax:+86-769-81602681

RF Antenna Cable Assembly

Specification (With Housing)

1. Electrical Properties :

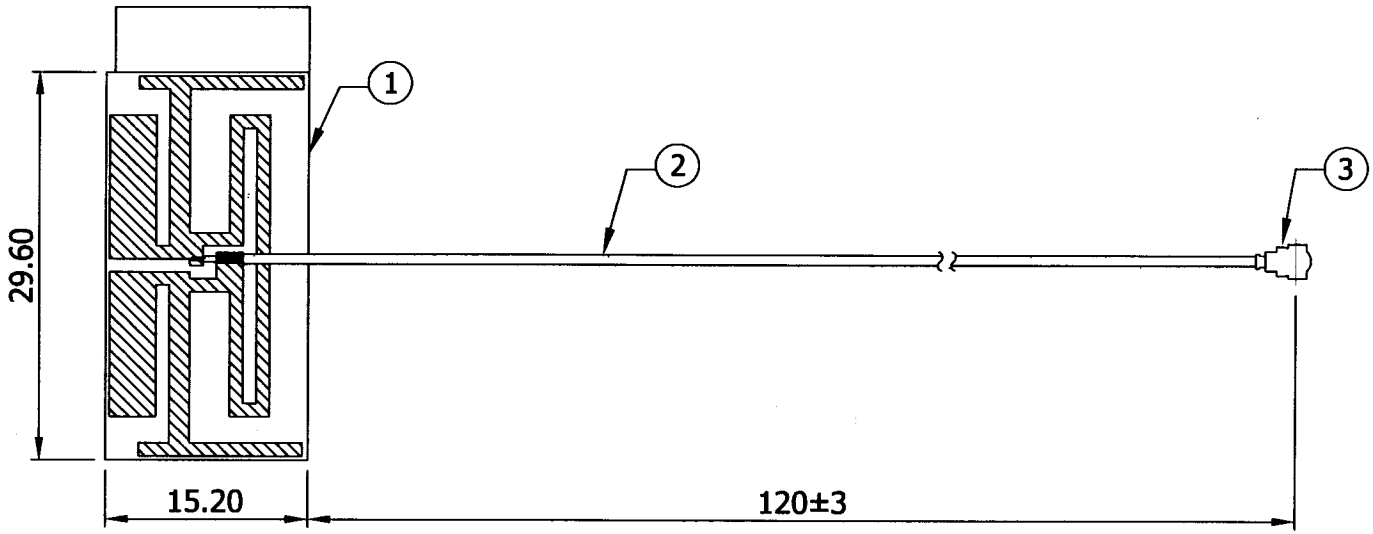
1.1	Frequency Range……	2.412 GHz ~ 2.472GHz
		4.9 GHz ~ 5.825GHz
1.2	Impedance ……	50 Ω Nominal
1.3	VSWR ……	1.92 : 1 Max.
1.4	Return Loss……	-10 dB Max.
1.5	Radiation ……	Omni-directional
1.6	Gain(peak)……	3.97dBi (excluding cable loss)
1.7	Cable Loss…… ……	0.36 dB Max. @ 2G
		0.65 dB Max. @ 5G
1.8	Polarization……	Linear ; Vertical
1.9	Admitted Power……	1W
1.10	Cable……	Φ1.13mm Coaxial Cable
1.11	Connector……	MHF

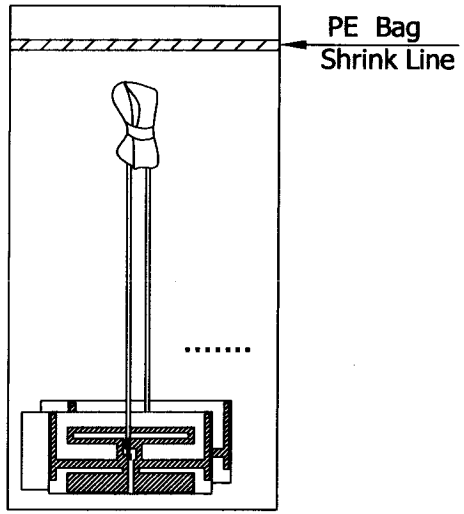
2. Physical Properties :

2.1	Operating Temp. ……	-10℃ ~ +60℃
2.2	Storage Temp. ……	-10℃ ~ +70℃

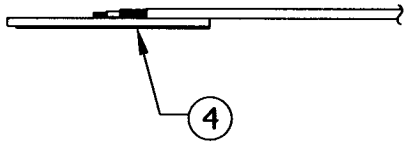
CG-

REV	DATE	DESCRIPTION
X1	1/12-2010	New Issue





Packing : 25 pcs/bag



NO	DESCRIPTION		Q'TY	REMARK
4	雙面背膠	Sony G4000	1	
3	Connector	MHF Connector	1	
2	Cable	Φ1.13mm Cable,Gray,50Ω	1	
1	PCB	FR4;24mil;1/2Oz	1	

XX.	±5.0	APPROVED Andrew 1/12/10	CUSTOMER:	永碩	
X.	±3.0		PART NO :		
.X	±1.0	CHECKED	PART NAME:	PCB Antenna Assembly	
.XX	±0.5		W.Y P/NO :	C1336S510032-A	
.XXX	±0.1	DRAWING Sarah 1/12/10	REV / UNIT / FILE :	X1 / mm / SSR-210069	
			SHEET :	1/1	

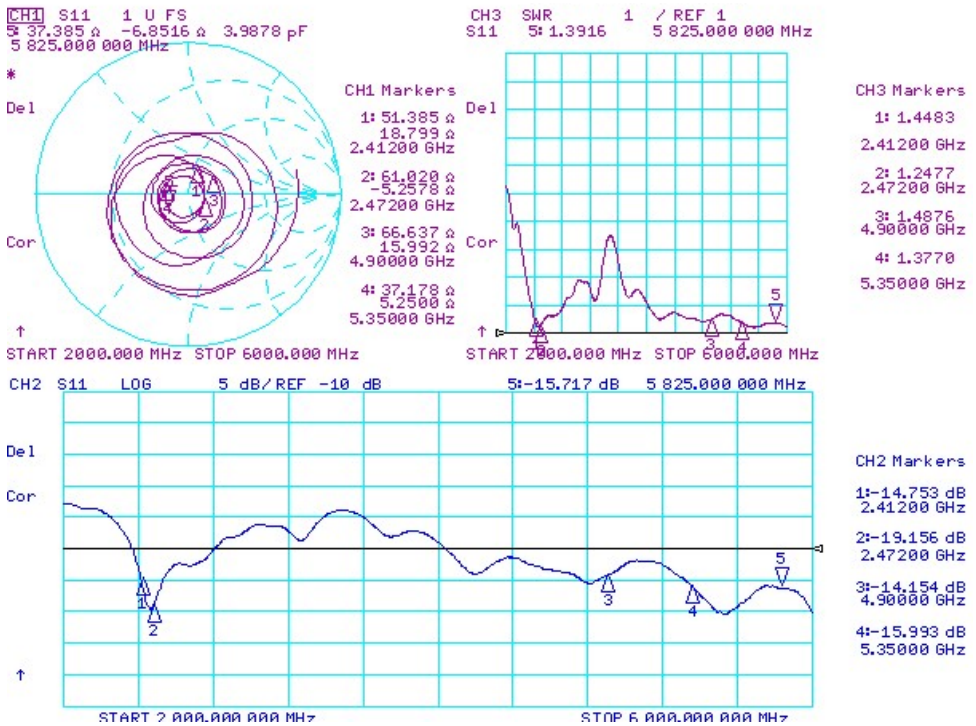
CUSTOMER'S SINGATURE

M.gear Wha Yu Group

C1336S510032-A Test Report

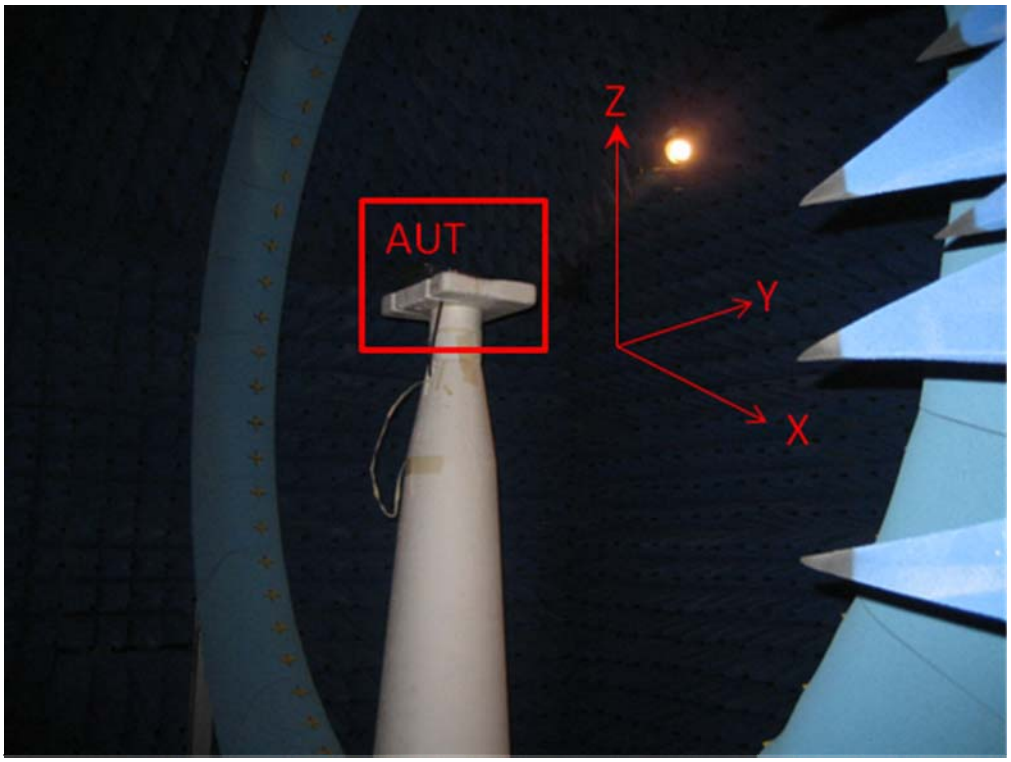
1 S-parameter test results

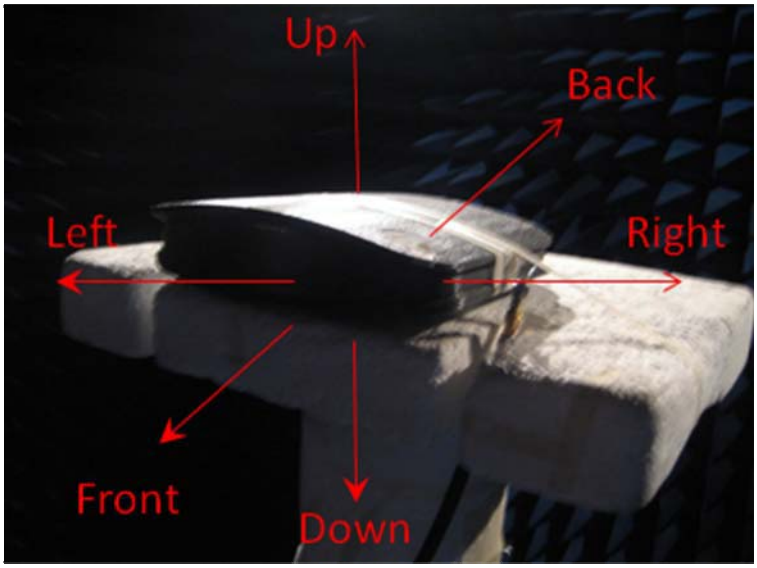
1.1 S11 test results



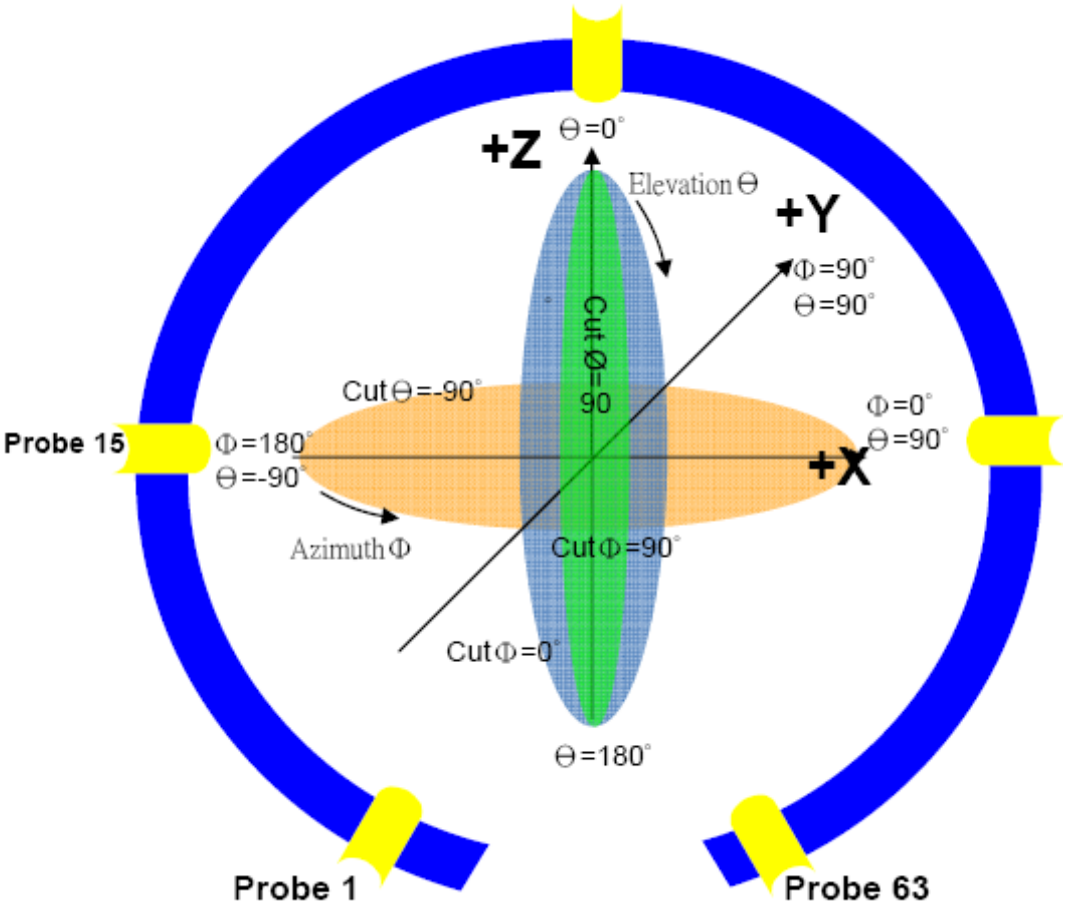
2 Gain & Patterns test results

2.1 Measurement setting





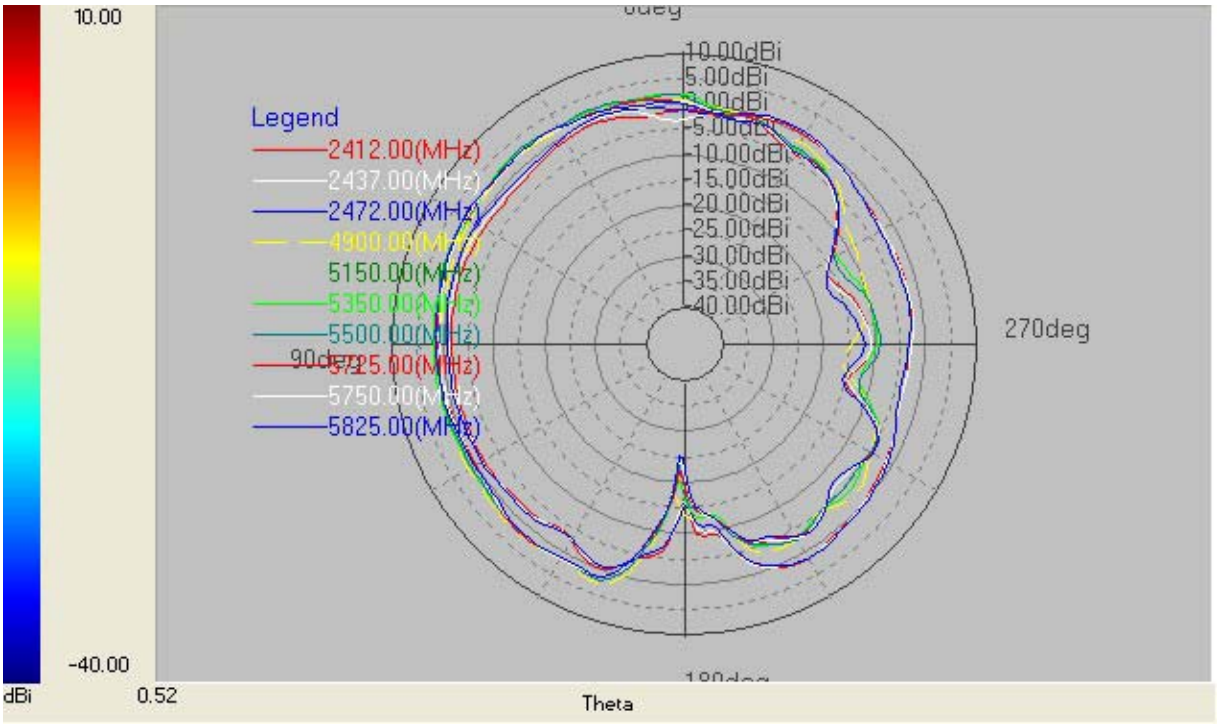
	XY	YZ	XZ
0°	Right	Up	Up
90°	Back	Back	Right
180°	Left	Down	Down
270°	Front	Front	Left



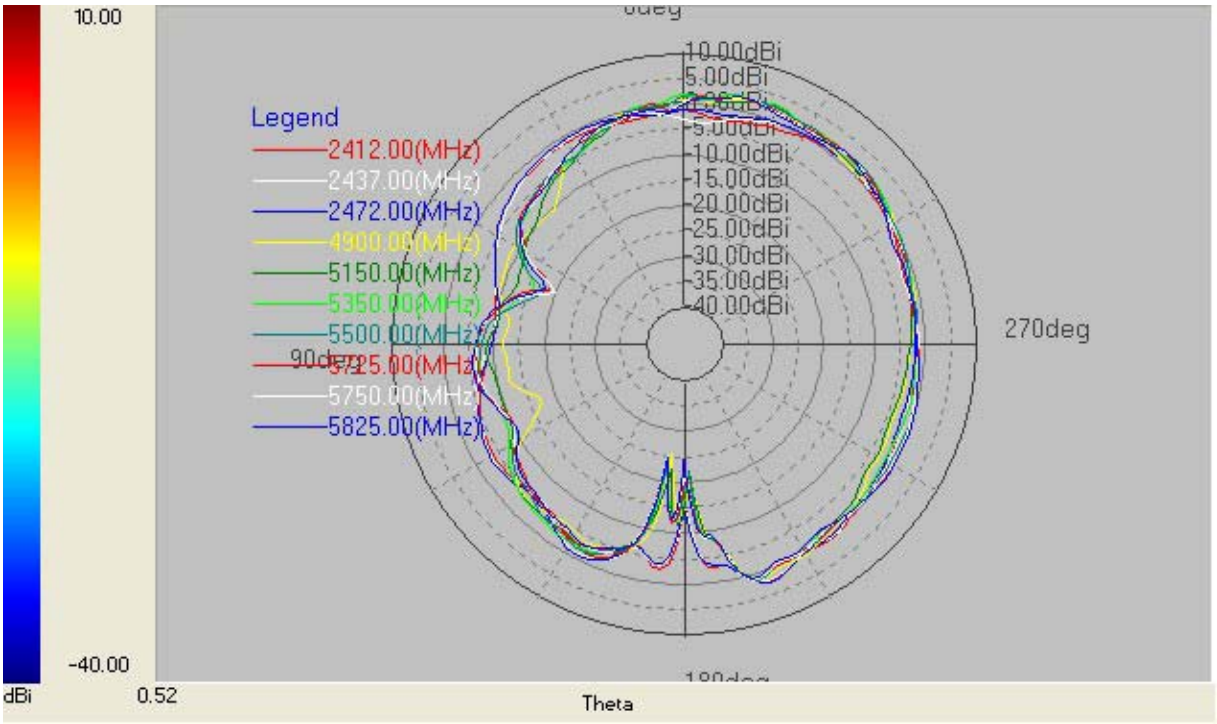
	θ	ϕ
Total angle	175˚	360˚
How many angle scan one point	5˚	5˚
Total scan point	36	73

2.2 2D patterns

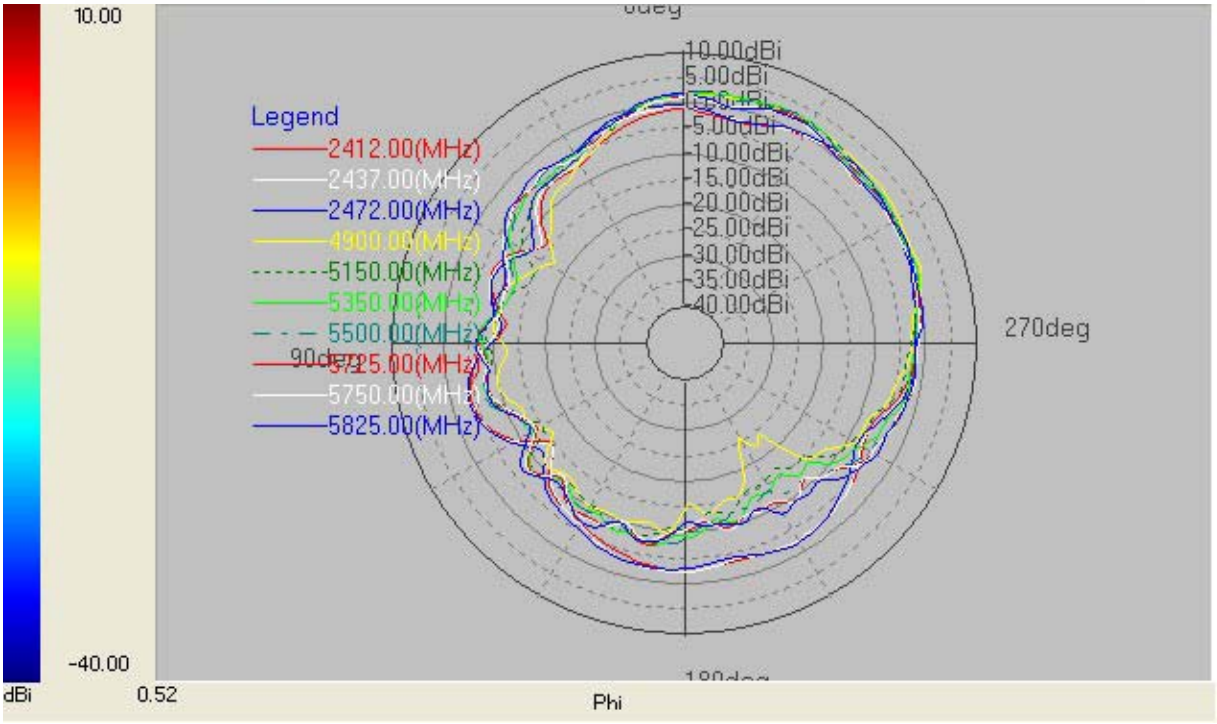
2.412 ~ 2.472 GHz ; 4.9 ~ 5.825 GHz



X-Z Plane (E-total)



Y-Z Plane (E-total)



X-Y Plane (E-total)

3 Summary

3.1 Return Loss

Frequency	Ant (dB)
2.412 GHz	-14.753
2.472 GHz	-19.156
4.90 GHz	-14.154
5.35 GHz	-15.993
5.825 GHz	-15.717

3.2 3D total Peak Gain & Efficiency

Frequency	Peak Gain (dBi)	Efficiency (%)
2.412 GHz	3.19	63.58
2.437 GHz	3.65	67.12
2.472 GHz	3.97	68.80
4.90 GHz	3.52	64.69
5.15 GHz	3.44	62.29
5.35 GHz	3.93	67.30
5.50 GHz	3.68	67.98
5.725 GHz	3.28	62.23
5.750 GHz	3.31	60.70
5.825 GHz	3.33	62.12

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