

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	:	MSQWL120GV2
Product name	:	Wireless Mini-PCI Modular
Model	:	WL-120g V2
Classification	:	Mobile Device (i) Under normal use condition, the antenna is at least 20cm away from the user; (ii) Warning statement for keeping 20cm separation distance and the prohibition of operating next to the person has been printed in the user's manual
Frequency Range	:	2.412 GHz ~ 2.462GHz
Supported Channel	:	11 Channels
Modulation Skill	:	DBPSK, DQPSK, CCK, OFDM
Power Type	:	Powered by mini-PCI interface

3. Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm ²)	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:
$$S = \frac{PG}{4\pi R^2} = \frac{150.314 \times 1.514}{4\pi(20)^2} = 0.04527 \text{ mW} / \text{cm}^2$$

Estimated safe separation:
$$R = \sqrt{\frac{PG}{4\pi}} = \sqrt{\frac{150.314 \times 1.514}{4\pi}} = 4.256 \text{ cm}$$

Remarks: "The safe estimated separation that the user must maintain from the antenna is at least 4.42cm"

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:

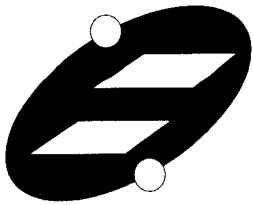
$$G = \text{Log}^{-1} (\text{dB antenna gain} / 10)$$

$$G = \text{Log}^{-1} (1.80 / 10) = 1.514$$

Appendix

Antenna Specification

(Ant#1 C660-510003-A)



WHA YU INDUSTRIAL CO., LTD. (HEAD OFFICE)
 TAI HWA ELECTRONIC CO., LTD.(CHINA)
 SHANGHAI HUA YU ELECTRONIC CO., LTD.(CHINA)
 AEON TECH CO., LTD. (CHINA)

SPECIFICATION FOR APPROVAL

CUSTOMER: 華碩科技股份有限公司

PART NAME: RF Antenna Assembly

PART NO.:

REVISION:

W. Y. P/NO.: C660-510003-A

REV.: X1

	MANUFACTURER SIGNATURE	CUSTOMER SIGNATURE
APPROVED BY :		
DATE :		

WHA YU GROUP

WHA YU INDUSTRIAL CO., LTD.(HEAD OFFICE)

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Tel: + 86-21-59741348 · + 86-21-59744101~4

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RF Antenna Cable Assembly

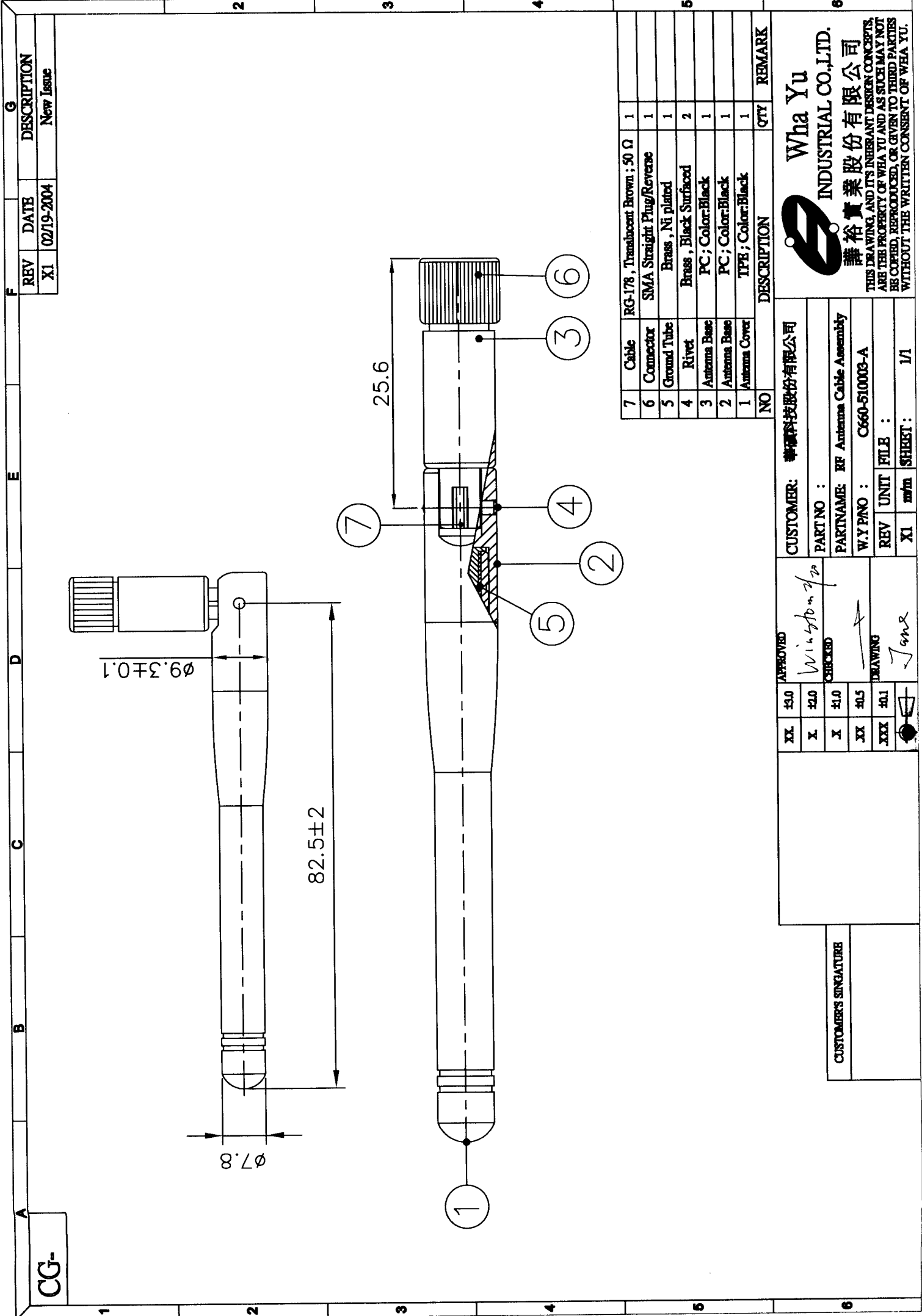
Specification

1. Electrical Properties :

- 1.1 Frequency Rang..... 2.4GHz ~ 2.5GHz
- 1.2 Impedance 50 Ω Nominal
- 1.3 VSWR 1.92 Max.
- 1.4 Return Loss..... -10dB Maximum
- 1.5 Electrical Wave..... 1/2 λ Diople
- 1.6 Gain..... 1.8 dBi
- 1.7 Admitted Power..... 1W

2. Physical Properties :

- 2.1 Cable..... RG-178 Cable
- 2.2 Antenna Cover..... TPE
- 2.3 Antenna Base..... PC
- 2.4 Operating Temp. -20 $^{\circ}$ C ~ +65 $^{\circ}$ C
- 2.5 Storage Temp. -30 $^{\circ}$ C ~ +75 $^{\circ}$ C
- 2.6 Color Black
- 2.7 Connector..... SMA Plug Reverse



REV	DATE	DESCRIPTION
X1	02/19-2004	New Issue

NO	DESCRIPTION	QTY	REMARK
7	Cable RG-178, Translucent Brown; 50 Ω	1	
6	Connector SMA Straight Plug/Reverse	1	
5	Ground Tube Brass, Ni plated	1	
4	Rivet Brass, Black Surfaced	2	
3	Antenna Base PC; Color:Black	1	
2	Antenna Base PC; Color:Black	1	
1	Antenna Cover TPE; Color:Black	1	

Wha Yu INDUSTRIAL CO.,LTD.
講裕實業股份有限公司

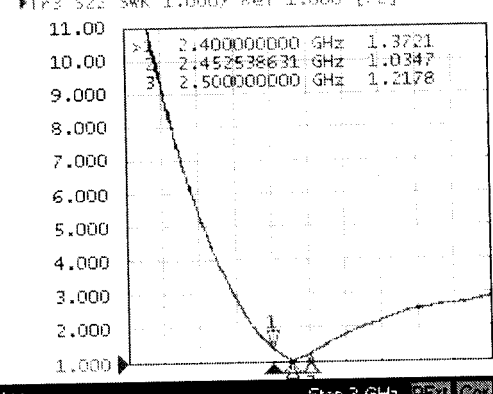
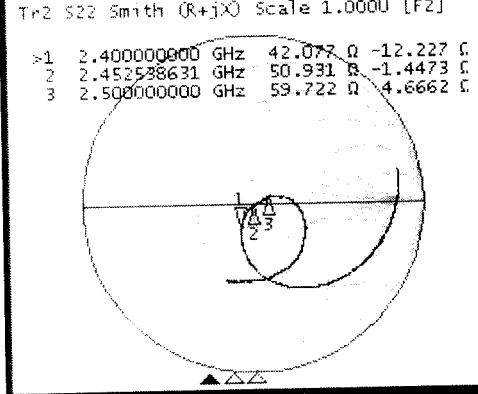
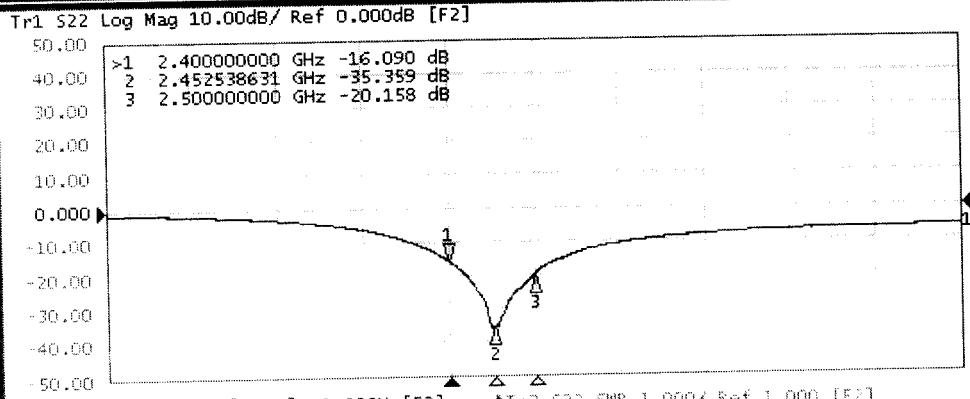
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CUSTOMER: 華研科技股份有限公司	
PART NO :	
PARTNAME: RF Antenna Cable Assembly	
W.Y.P/NO : C660-510009-A	
REV	UNIT FILE :
X1	mm SHEET: 1/1

APPROVED	Wingston
CHECKED	Jane
DRAWING	

CUSTOMER'S SIGNATURE	
----------------------	--

CG-



Display

Data -> Mem

Edit Title Label

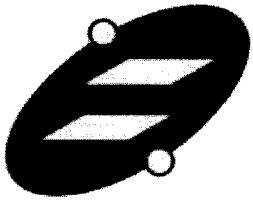
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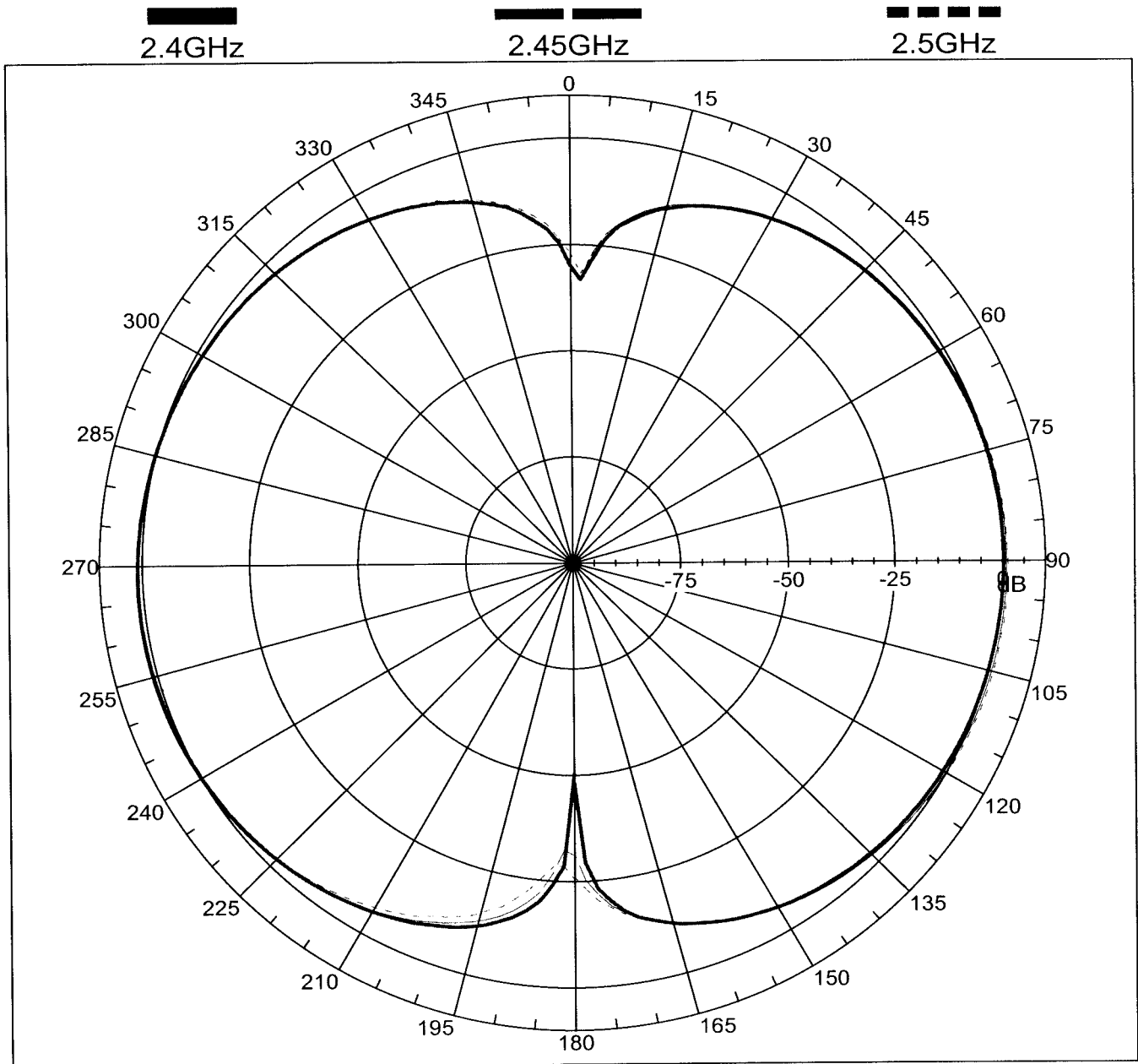
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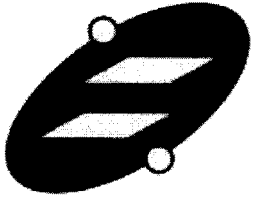


譚裕實業股份有限公司

WHA YU INDUSTRIAL CO., LTD

Far-field amplitude of 2.4GHz small dipole antenna-E-plane.nsi





譚裕實業股份有限公司

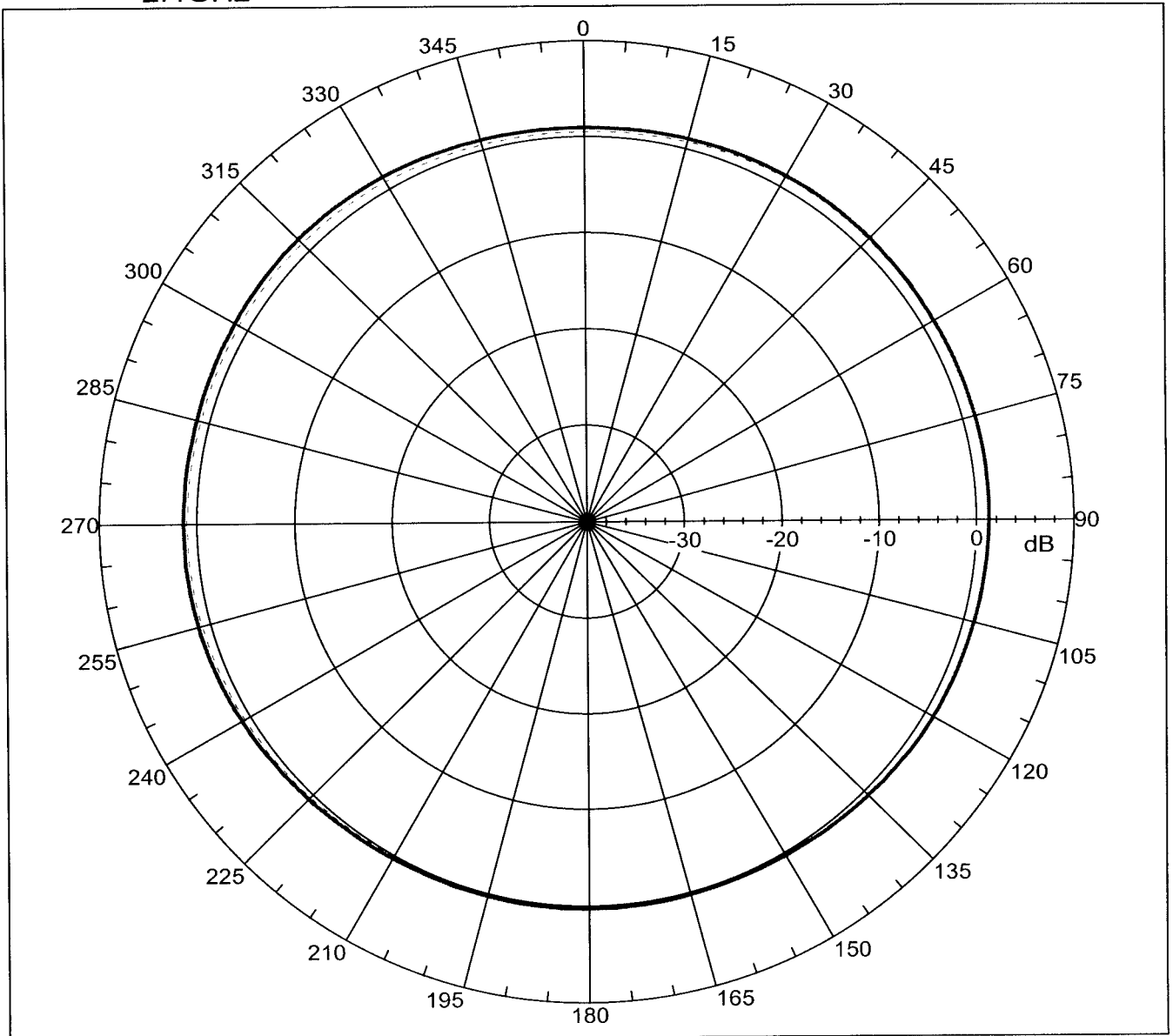
WHA YU INDUSTRIAL CO., LTD

Far-field amplitude of 2.4GHz small dipole antenna-H-plane.nsi

2.4GHz

2.45GHz

2.5GHz



Cable Specification

Cable : Mil-C-17 Coaxial Cable RG-178

1. Construction :

- 1 Conductor..... 30AWG 7/38 SCCS
- 2 Dielectric..... PTFE OD : 0.033"±0.002"
- 3 Shielded.....38AWG SPC OD : 0.051" Nominal
- 4 Jacket.....FEP OD : 0.071"±0.004"

2. Physical Properties :

- 1 Weight per 1000ft..... 6.3 lbs Maximum
- 2 Bend Radius.....0.35" Minimum
- 3 Operating Temperature Range -55°C ~ 200°C

3. Electrical Properties:

- 1 Impedance..... 50±2 ohms
- 2 Capacitance..... 32 pF/ft Maximum
- 3 Cut off Frequency..... 116 GHz
- 4 Attenuation.....45.0 dB/100ft @ 1GHz
64.4 dB/100ft @ 2GHz
79.7 dB/100ft @ 3GHz
92.7 dB/100ft @ 4GHz
104.3 dB/100ft @ 5GHz
115.0 dB/100ft @ 6GHz

Appendix

Antenna Specification

(Ant#2 14G156012330)

納入仕様書

《新規・變更》

客戶 unihancorp

制 定	2008 年 09 月 12 日
部品番號	14G156012330
品 名	WPB090-R Mini 1.13(Black) with MHF L95mm
公司番號	HY1A-15392-A1

[驗收印欄]

蘇州萬旭電子元件有限公司
江蘇省蘇州市相城區望亭鎮問渡路68號

PC:215155

TEL:86-512-66701912

FAX:86-512-65381104

作 成	檢 圖	確 認	核 準
沈天華	張永明	白 娜	衛壽文

SPECIFICATION

1. Description.....:WPB090-R Mini 1.13(Black)

With MHF L95mm

2.Customer.....:unihancorp

3.Part No.....:14G156012330

4.Coaxial Lenght.....:95mm(see Drawing)

5.Electrical Characteristics

Operating Frequency.....:1~6GHz

Impedance.....:50 Ohm nominal

6.Mechanical Chararteristics

Connector.....: MHF

7.Raw Material

Coaxial Cable.....: Mini 1.13

Core.....: N/A

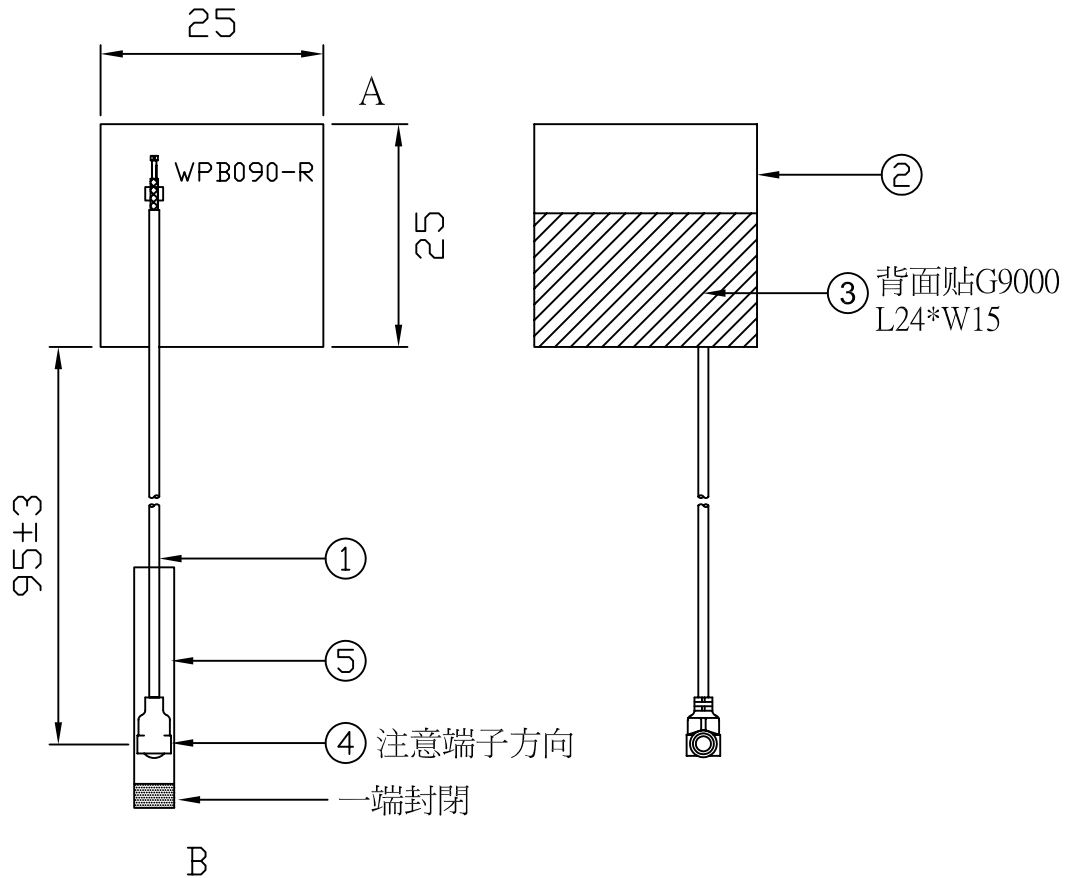
變更記錄 1.

2.

3.

4.

TOLERANCES:	
X	±1.0
X.X	±0.6
X.XX	±0.2
ANGULAR	±5.0°



作業說明：

- 天線組立依據天線組立作業指導書規定製作。
依據QC管理工程圖，執行品質管制。
- 測試要求: START: 2GHz; STOP: 6GHz
MARKER點為: 2.4GHz; 2.45GHz; 2.5GHz; 5.15GHz;
5.25GHz; 5.35GHz; 5.725GHz; 5.85GHz;
以上8點有波形即可。

5	透明管	V	3.6/3.0 (ø2.5)透明管 LF	透明	15	1
4	MHF Connector	V	20278-111R-13(I-PEX) LF	金		1
3	双面背膠	V	SONY G9000 (15*24) 貼紙 HF (卓文or恆得)	白		1
2	PCB	V	WPB090-R 25*25*0.8 HF (萬正)			1
1	MINI 1.13 Coaxial Cable	V	MINI RG OD:1.13 黑色 LF-Sn LF (萬泰)	黑	113	1

NO	部品名	環材	部	番	顏色	切斷尺寸	用量
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第3角法	圖面不用實測				部品番號	14G156012330	
比例 FREE	作成	檢圖	確認	核准	品名	WPB090-R Mini 1.13(Black) with MHF L95mm	
單位: mm	沈天華	張永明	白娜	衛壽文	公司番號	HY1A-15392-A1	
08年09月12日							

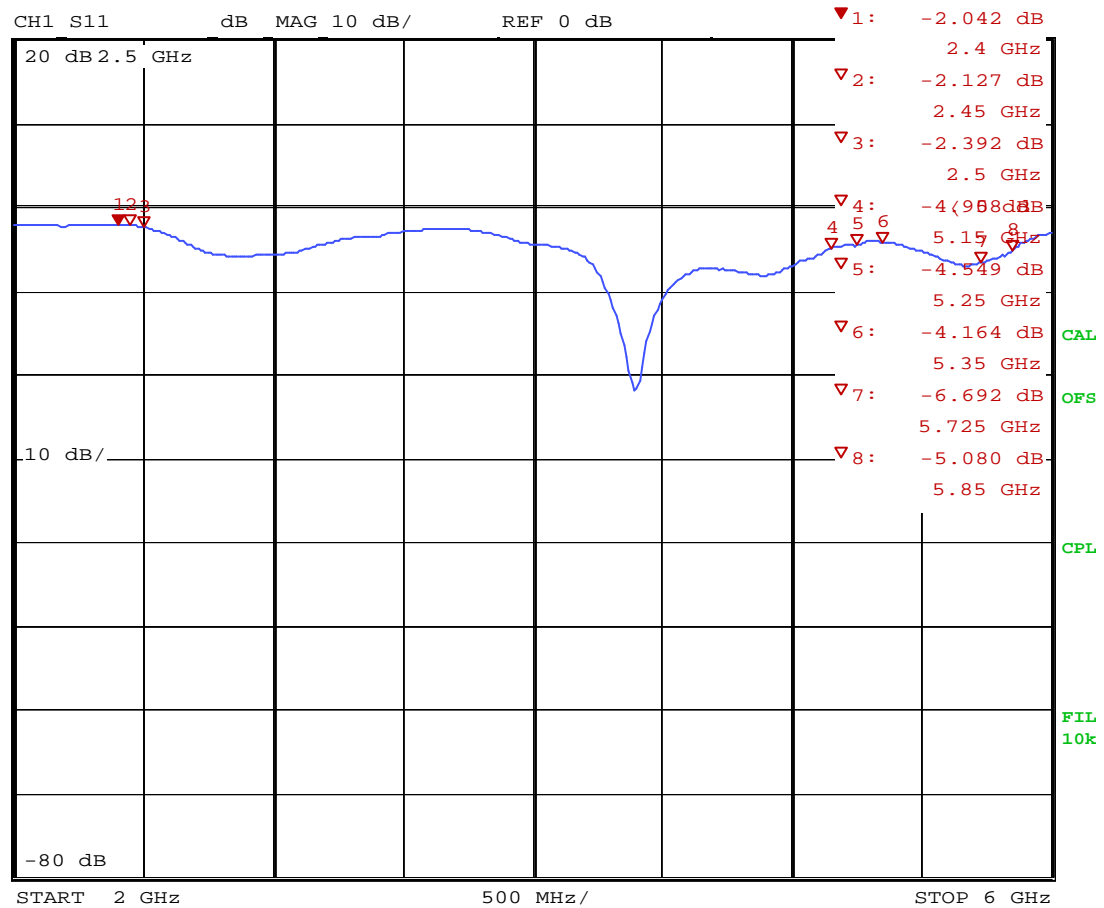


Electrical Properties

Return Loss



Suzhou Wanshih Electronic Element Co., Ltd.



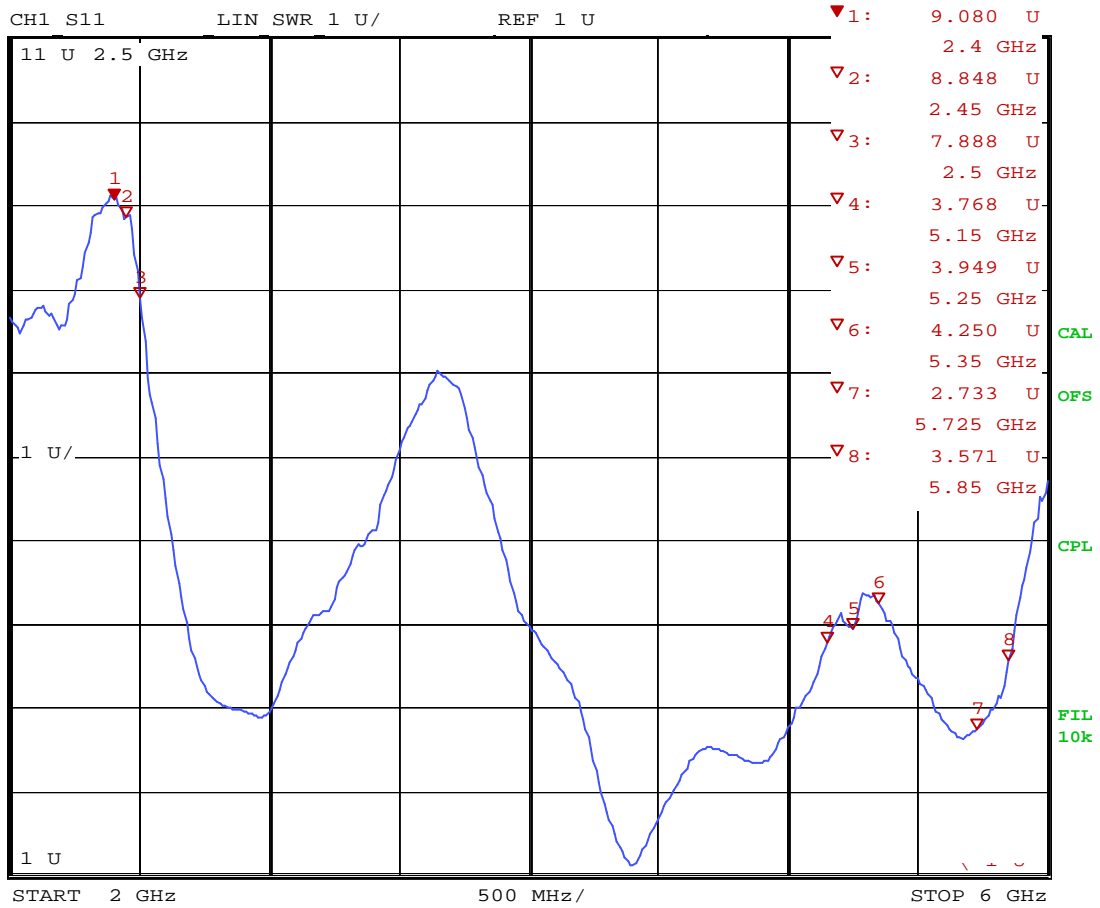
Date: 12.SEP.08 17:35:03

Electrical Properties

V.S.W.R



Suzhou Wanshih Electronic Element Co., Ltd.



Electrical Properties

2.4~2.5 H-Plane Test on board



Suzhou Wanshih Electronic Element Co., Ltd.

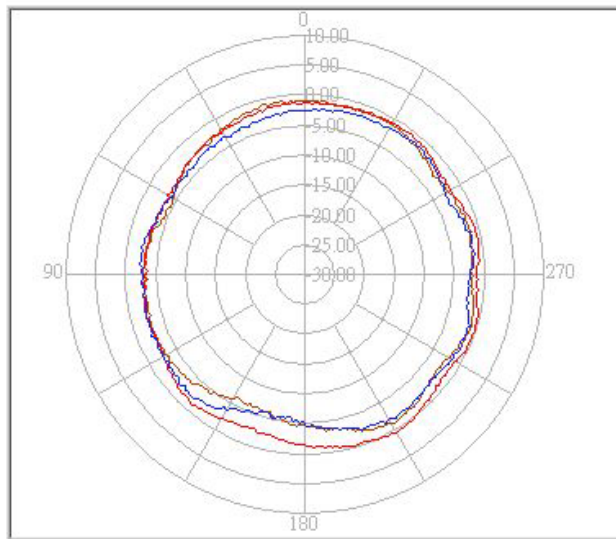


萬旭電業股份有限公司

Model No: 2.4-2.5

Antenna Position: Vertical

Test Mode: H-PLANE



Freq (MHz)	peak(dBi)	Angle(o)	Avg(dBi)
2400.00	-0.70	23.19	-2.46
2450.00	0.56	147.66	-1.50
2500.00	-1.03	107.39	-2.68

Test engineer: _____

Test date: 2008/8/22 at PM 04:07

Electrical Properties

2.4~2.5 E-Plane Test on board



Suzhou Wanshih Electronic Element Co., Ltd.

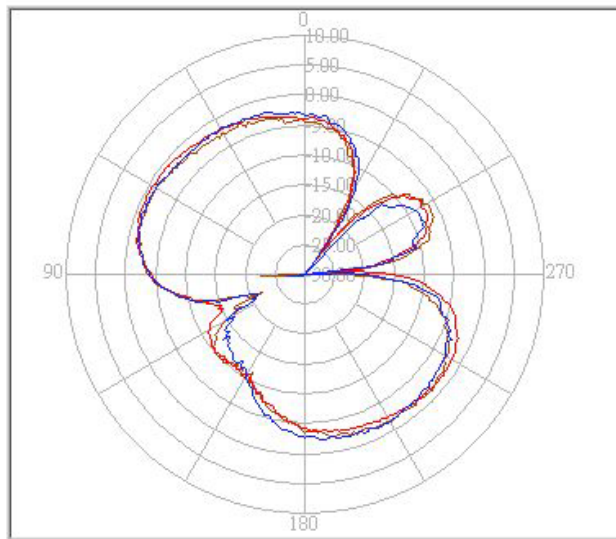


萬旭電業股份有限公司

Model No: 2.4-2.5

Antenna Position: Horizontal

Test Mode: E-PLANE



Freq (MHz)	peak(dBi)	Angle(o)	Avg(dBi)
2400.00	-1.12	295.10	-4.74
2450.00	-0.48	296.33	-4.38
2500.00	-0.91	288.98	-4.48

Test engineer: _____

Test date: 2008/8/22 at PM 04:12

Electrical Properties

5.15~5.85 H-Plane Test on board



Suzhou Wanshih Electronic Element Co., Ltd.

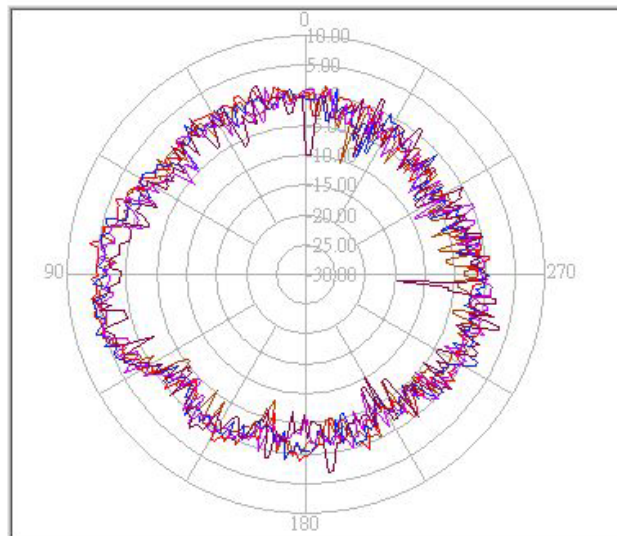


萬旭電業股份有限公司

Model No: 5.15-5.85

Antenna Position: Vertical

Test Mode: H-PLANE



Freq (MHz)	peak(dBi)	Angle(o)	Avg(dBi)
5150.00	5.58	252.61	-0.43
5250.00	6.53	278.24	0.46
5350.00	6.47	253.83	0.05
5725.00	5.20	253.83	-0.30
5850.00	5.97	262.37	-0.70

Test engineer: _____

Test date: 2008/8/22 at PM 03:34

Electrical Properties

5.15~5.85 E-Plane Test on board



Suzhou Wanshih Electronic Element Co., Ltd.

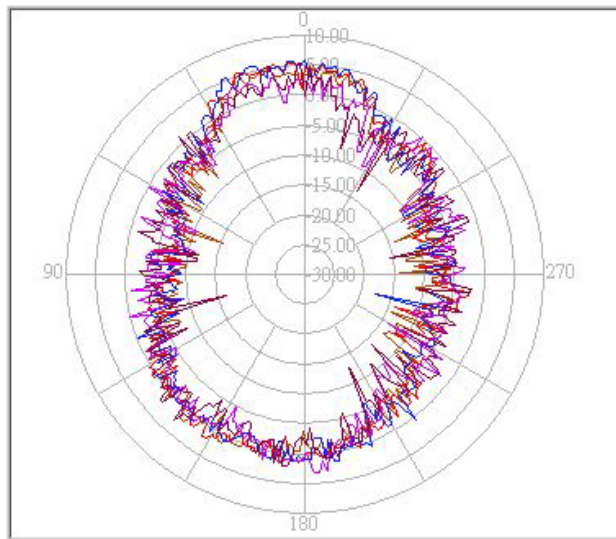


萬旭電業股份有限公司

Model No: 5.15-5.35

Antenna Position: Horizontal

Test Mode: E-PLANE



Freq (MHz)	peak(dBi)	Angle(o)	Avg(dBi)
5150.00	5.13	2.44	-1.63
5250.00	5.53	4.88	-0.80
5350.00	5.94	344.14	-0.78
5725.00	3.27	338.03	-1.80
5850.00	5.25	350.24	-1.87

Test engineer: _____

Test date: 2008/8/22 at PM 04:15