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	**:**	VUIAWM6018P
Product name	**:**	WIFI module
Model	**:**	AWM6018-P
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 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: $S = \frac{PG}{4\pi R^2} = \frac{312.61 \times 3.55}{4\pi (20)^2} = 0.221 mW/cm^2$

Estimated safe separation: $R = \sqrt{\frac{PG}{4\pi}} = \sqrt{\frac{312.61 \times 3.55}{4\pi}} = 9.40 cm$

Remarks: *"The safe estimated separation that the user must maintain from the antenna is at least 5.8cm"*

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 $^{-1}$ (5.50 / 10) = 3.55

Appendix

Antenna Specification

承　　認　　書
SPECIFICATION FOR APPROVAL

客　　戶 CUSTOMER	永碩聯合國際股份有限公司
日　　期 DATE	2009/7/21
品　　名 DESCRIPTION	WSS025 2.4GHz 5dBi Antenna with RP-SMA(M)(Black)(SMA 套)
客 戶 料 號 CUSTOMER P/N	
成 品 編 號 Part NO.	UCW2420A1

萬旭電業股份有限公司
WANSHIH ELECTRONIC CO., LTD.
台北縣五股鄉五工六路 72 號 3 樓
3F 72 WU KONG 6TH RD., WU KU INDUSTRIAL DISTRICT
TAIPEI HSIEN, TAIWAN,R.O.C.
TEL：(02) 22988066 (5 LINE)　FAX：(02)22981102

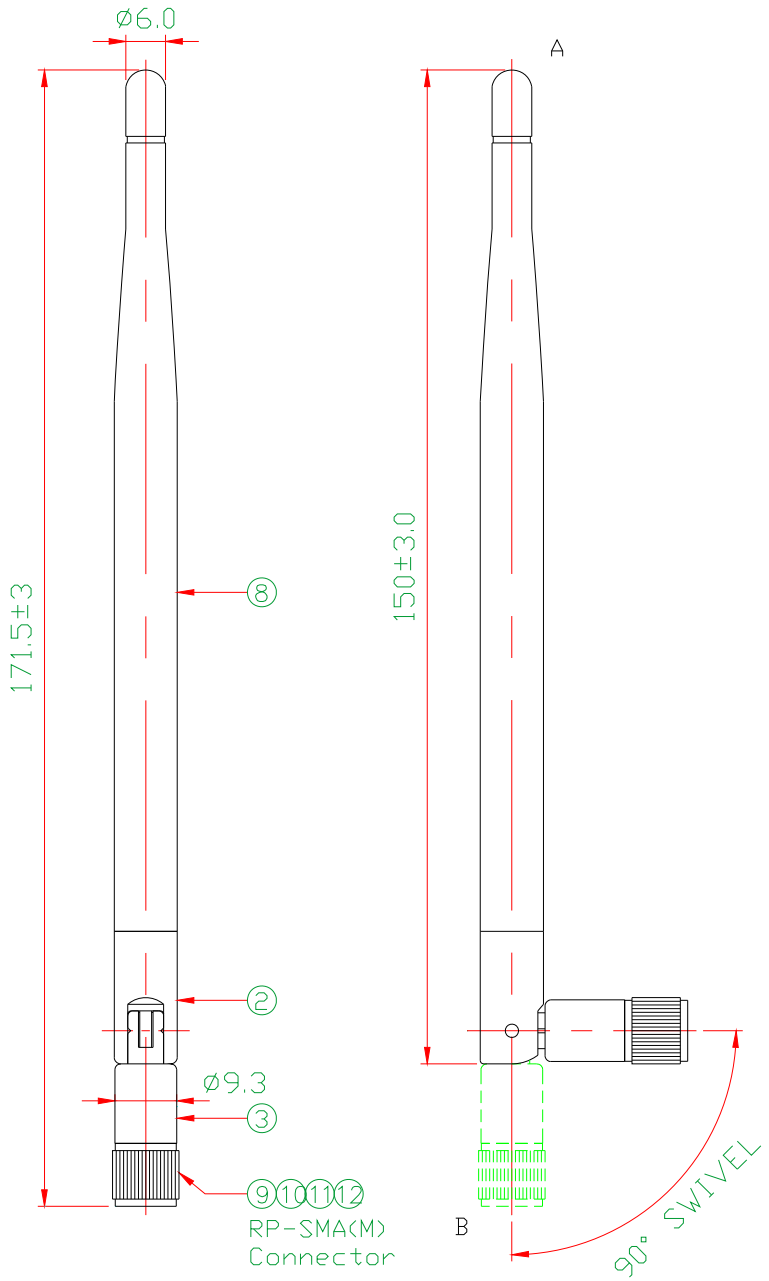
Table of Contents

SPECIFICATION

1.	Description	：2.4GHz 5dBi Antenna With RP-SMA(M)
2.	Customer	：永碩聯合國際股份有限公司
3.	Model No.	：WSS025
4.	Part No.	：UCW2420A1
5.	Standard	：IEEE 802.11b/g Wireless LAN
6.	Antenna Profile	：171.5 mm (see Drawing)
7.	Color	：Black
8.	Electrical Characteristics	
	Operating Frequency	：2.4~2.5GHz
	Antenna Type	：Monopole
	Polarization Type	：Linear
	Type of Radiation	：Toroidal
	Antenna Gain	：5.50 dBi Typical
	Impedance	：50 Ohm nominal
	V.S.W.R.	：2.0:1 Max.
9.	Mechanical Characteristics	
	Swivel	：90 degrees
	Connector	：RP-SMA(M)
	Core	：N/A
10.	Raw Material	
	Coaxial Cable	：RG-178
	Hinge	：PC+ALLOY
	SMA Cover	：POM

版次	修訂日期	ECR NO.	作 成	設 計 變 更 內 容 簡 述

TOLERANCES:
X ±0.5
X.X ±0.3
X.XX ±0.1
ANGULAR ±5.0°



修訂日期：		制訂日期：2009/07/21		承認圖號		
頁數：1/2	核 准	審 查	作 成	品 名	WSS025 2.4GHz 5dBi Antenna with RP-SMA(M)(Black)(SMA套)	
第三角法	Jason	Jason	郭雅珍			
單位：mm				成品編號	UCW2420	REV A / VERSION 1
比例：FREE						

萬旭電業股份有限公司

文件編號 ：FMT－0513－D7

環材

NO	材料名稱	環材	電腦編號	零件規格	顏色	切斷尺寸	用量	備註
12	小護套	ν	B0SMAPOM00001I	@SMA 小護套 POM<黑>	黑		1	或同級品
11	Reverse SMA φ10 本體	ν	B0SM3033A000A5	@SM3033-A 本體 SMA CONNECTOR φ10 W/P	銀		1	或同級品
10	Reverse SMA φ 10 PIN絕緣	ν	B02892200302A5	@028922003 SMA CONNECTOR 10φ母			1	或同級品
9	Reverse SMA φ10 連接軸	ν	B10874700000A5	@REVESE SMA φ10 連接軸 L=8.7 φ4.7銀	銀		1	或同級品
8	外套<黑>	ν	B2WSS025000001I	@WSS025 9.3φ*130L 外套<黑>	黑		1	或同級品
7	熱縮套管	ν	53A405003500BC	@F34 5.0 黑 L=35mm	黑		1	或同級品
6	彈簧<G>天線用	ν	B9ZZG00000001H	@彈簧<G>天線用OD5.6_ID3.2_6TURNS	金		1	或同級品
5	銅管 27L	ν	B252L2700000A5	@5.2φ*27L*0.2T 銅管<平頭>	銀		1	或同級品
4	固定鉚釘(黑鋅)	ν	B02892200140A5	@028922001-4 3.80*1.90φ固定鉚釘<小>(黑鋅)	黑		2	或同級品
3	下座<黑>	ν	B0936600000001I	@9.3φ下座 6.6φ扁孔凹槽<黑>	黑		1	或同級品
2	上座	ν	B6IY214BK1001I	@IY214BK100 9.5φ*20.0L 上座 <黑>	黑		1	或同級品
1	RG-178 Coaxial Cable	ν	19RG17800030AE	@RG-178 CABLE 105SV(萬泰)	橙	58	1	或同級品

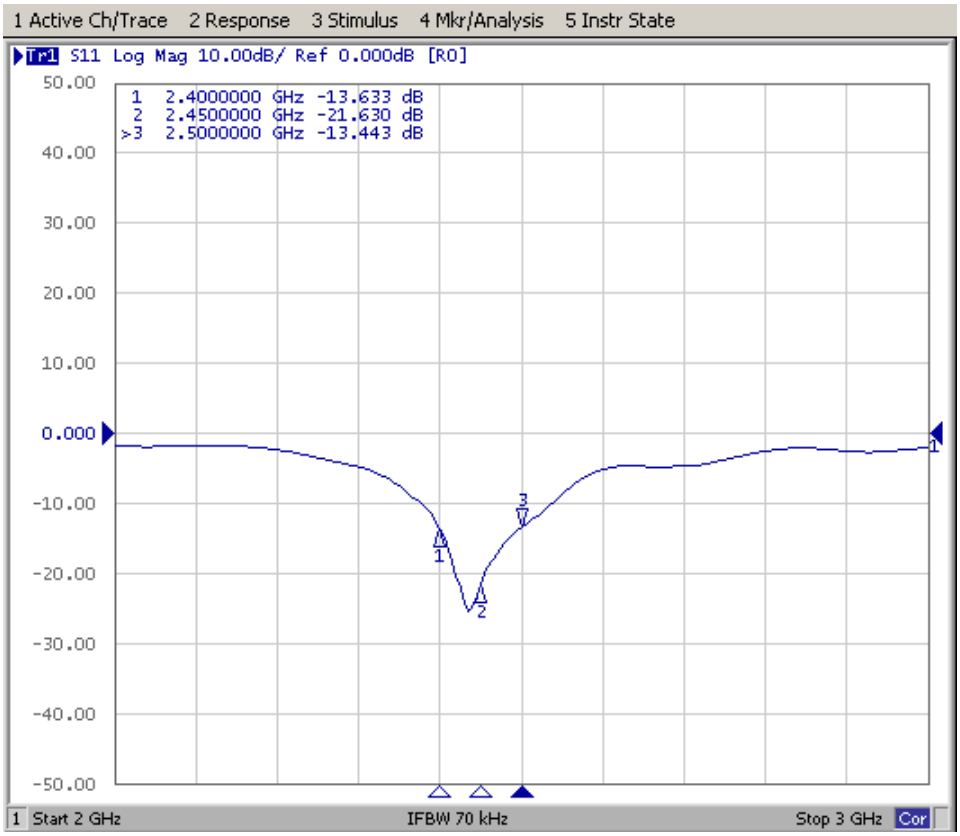
修訂日期：	制訂日期：2009/07/21			承認圖號		
頁數：2/2	核　准	審　查	作　成			
第三角法				品　　名	材料明細表	
單位：mm	Jason	Jason	郭雅珍			
比例：FREE				成品編號	UCW2420	REV A / VERSION 1

萬旭電業股份有限公司

文件編號：FMT-0513-D7

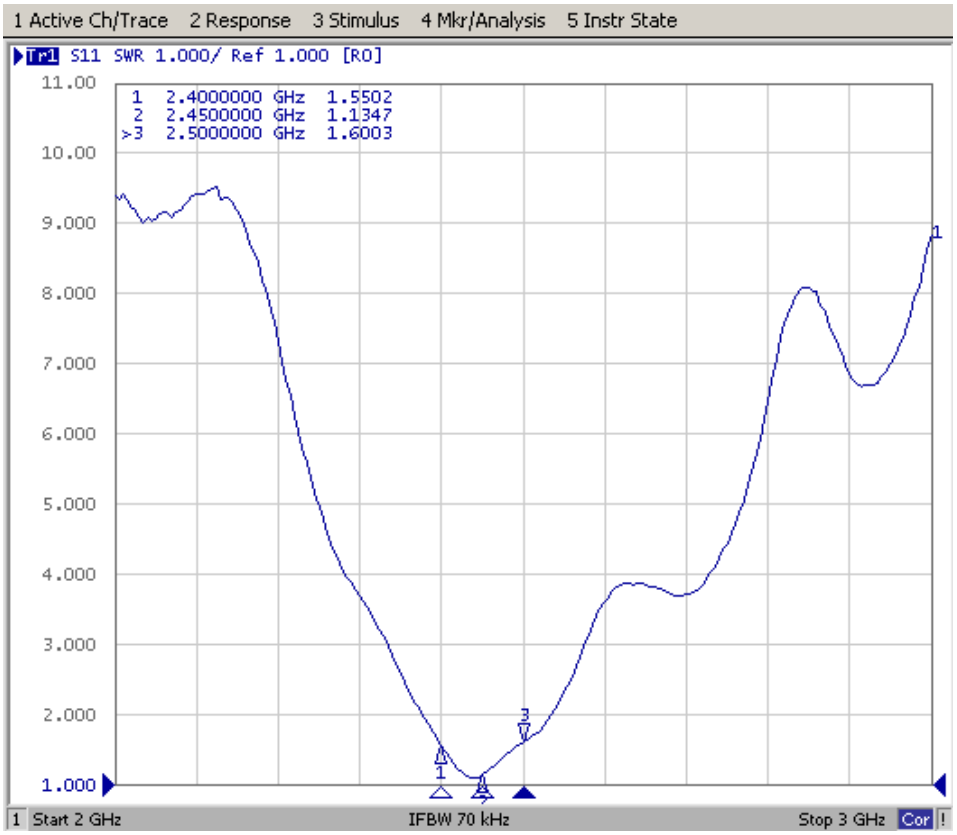
Electrical Properties

Return Loss



Electrical Properties

V.S.W.R

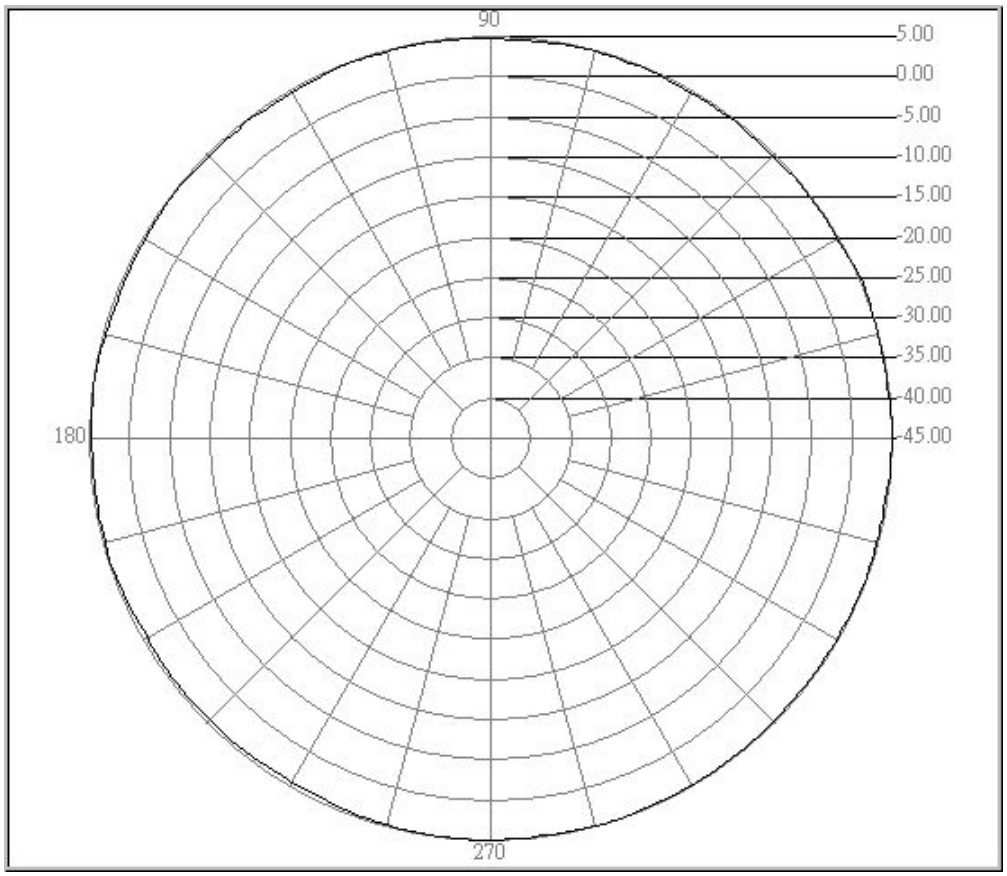


Electrical Properties

Radiation Pattern – H Plane

CCS WUGU Antenna Pattern

Job No.:970711-2400-H-2		
Date:2008/7/11	Time:下午 01:42	Temp.(℃)/Hum.(%):25℃/80%
Tested by:		

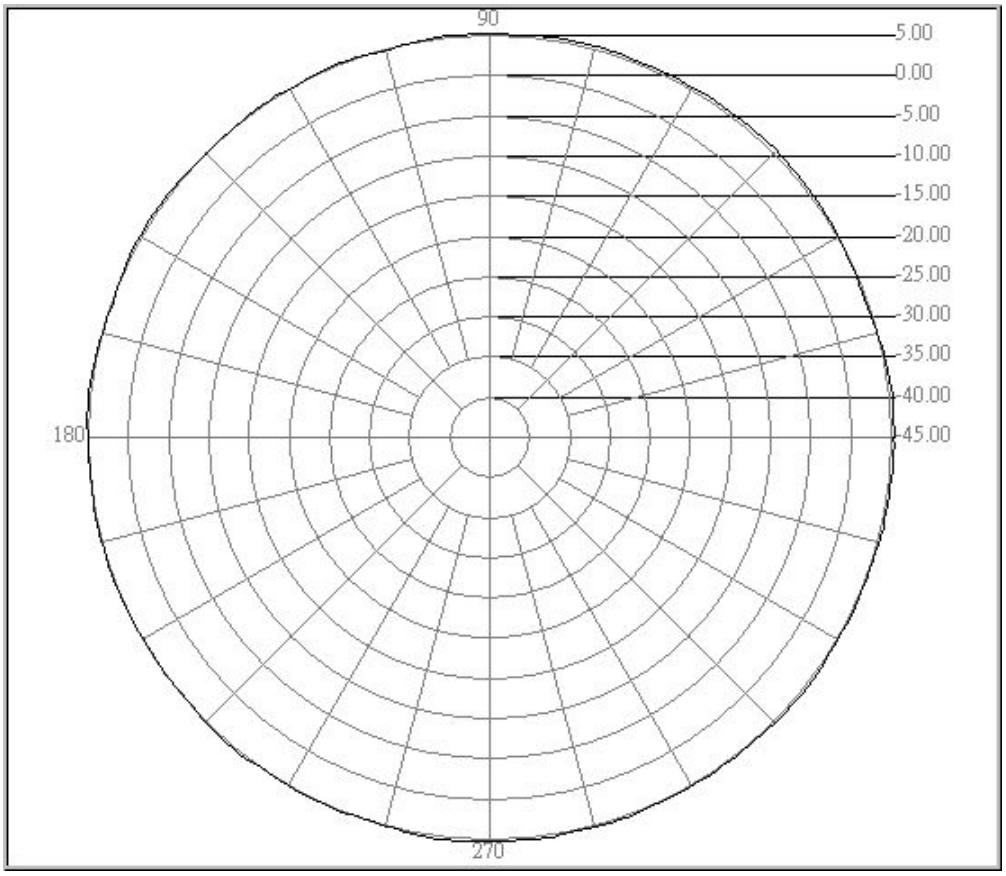


Center freq.(MHz): 2400 Polarization : H Plane

Max gain(dBi):5.25 Min gain(dBi):4.35 Avg gain(dBi):4.77

CCS WUGU Antenna Pattern

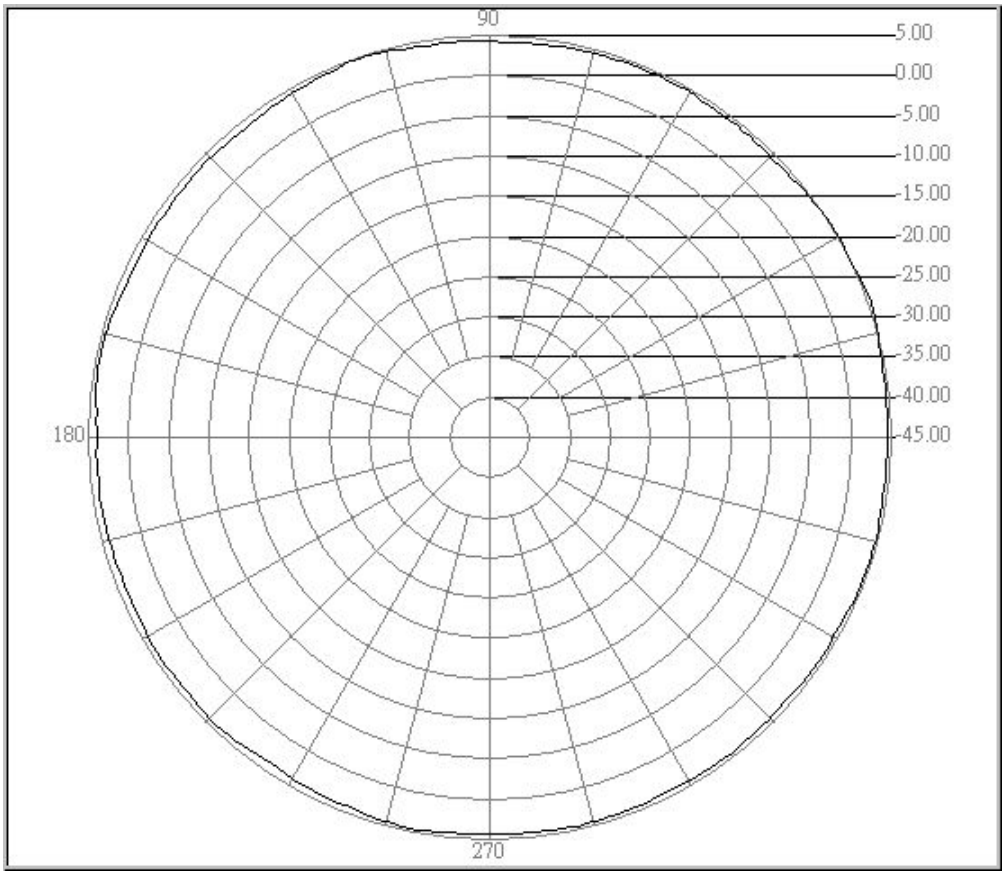
Job No.:970711-2450-H-2
Date:2008/7/11 Time:下午 01:43 Temp.(℃)/Hum.(%):25℃/80%
Tested by:



Center freq.(MHz): 2450 Polarization : H Plane
Max gain(dBi):5.50 Min gain(dBi):4.77 Avg gain(dBi):5.15

CCS WUGU Antenna Pattern

Job No.:970711-2500-H-2
Date:2008/7/11 Time:下午 01:45 Temp.(℃)/Hum.(%):25℃/80%
Tested by:



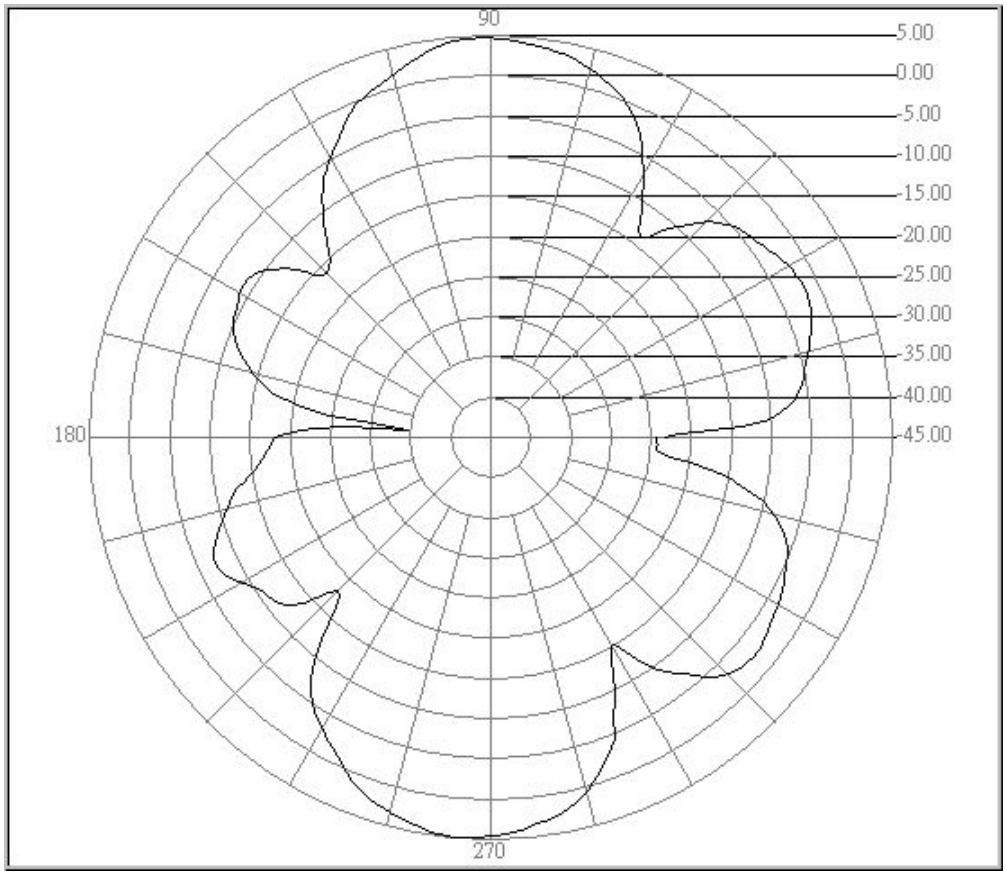
Center freq.(MHz): 2500 Polarization : H Plane
Max gain(dBi):5.39 Min gain(dBi):3.81 Avg gain(dBi):4.44

Electrical Properties

Radiation Pattern – E Plane

CCS WUGU Antenna Pattern

Job No.:970711-2400-E-2
Date:2008/7/11 Time:下午 01:50 Temp.(℃)/Hum.(%):25℃/80%
Tested by:

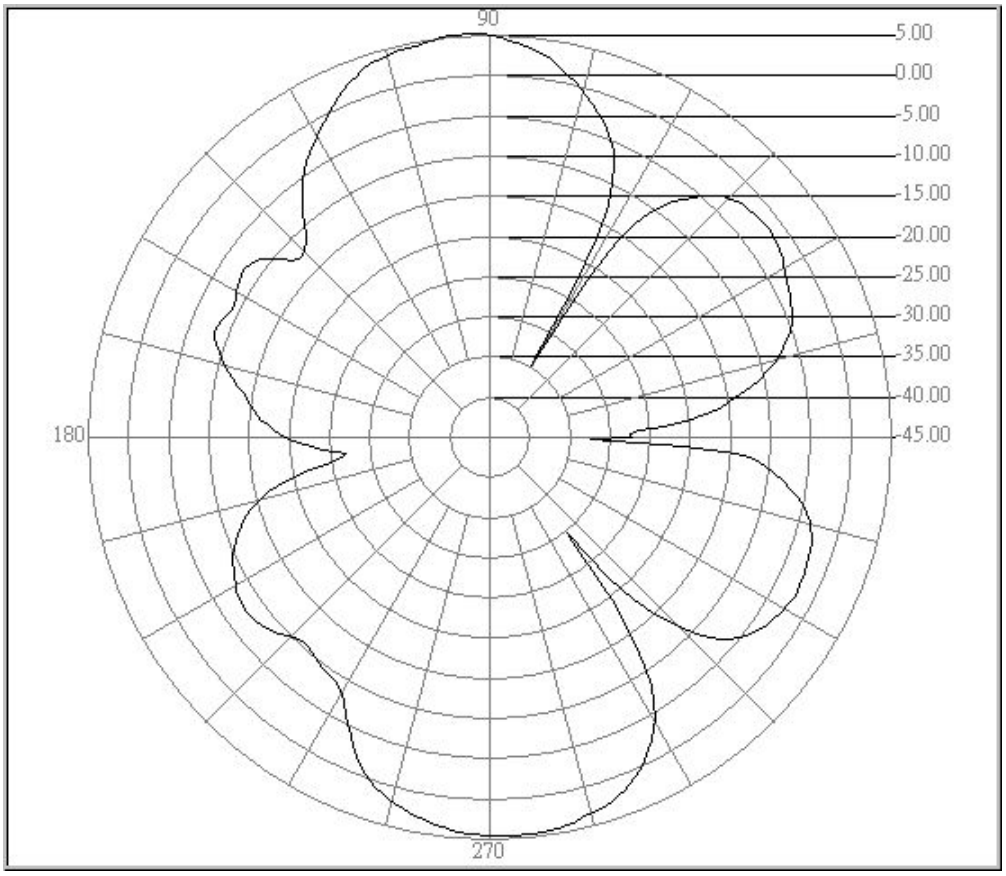


Center freq.(MHz): 2400 Polarization : E Plane

Max gain(dBi):4.99 Min gain(dBi):-34.67 Avg gain(dBi):-1.69

CCS WUGU Antenna Pattern

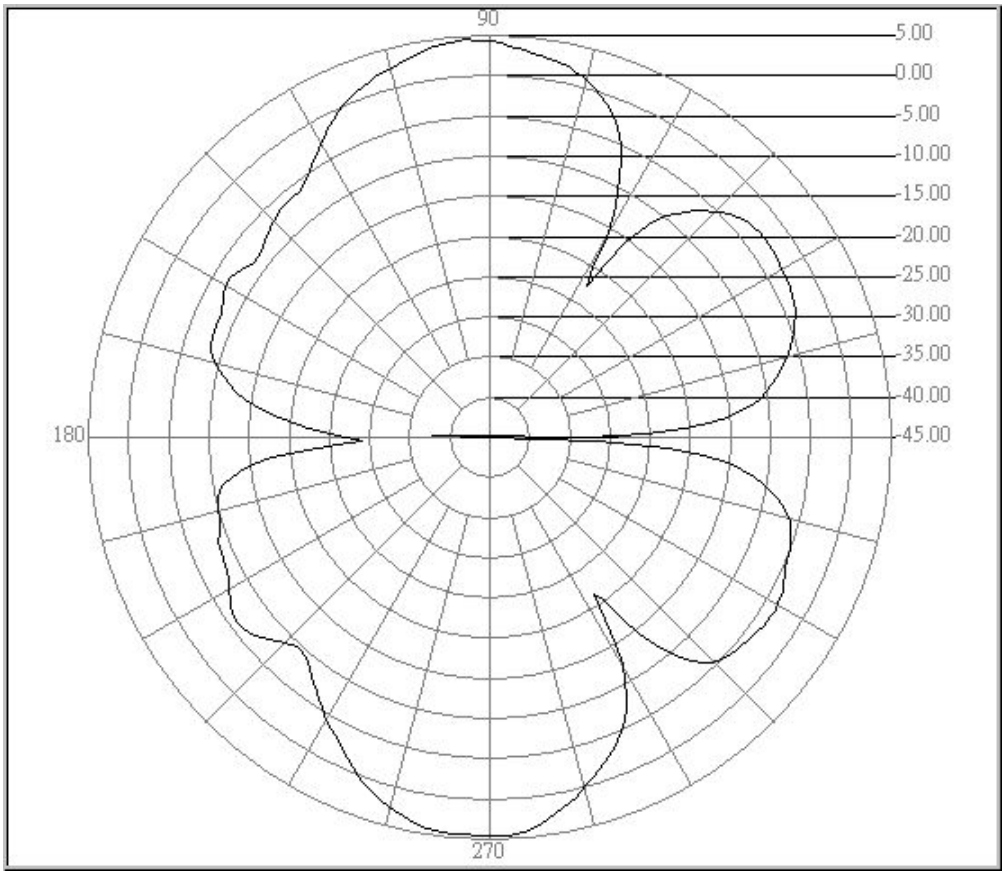
Job No.:970711-2450-E-2
Date:2008/7/11 Time:下午 01:49 Temp.(℃)/Hum.(%):25℃/80%
Tested by:



Center freq.(MHz): 2450 Polarization : E Plane
Max gain(dBi):5.24 Min gain(dBi):-34.67 Avg gain(dBi):-1.39

CCS WUGU Antenna Pattern

Job No.:970711-2500-E-2
Date:2008/7/11 Time:下午 01:47 Temp.(℃)/Hum.(%):25℃/80%
Tested by:



Center freq.(MHz): 2500 Polarization : E Plane
Max gain(dBi):4.55 Min gain(dBi):-52.14 Avg gain(dBi):-1.94

Coaxial Cable Data Sheet
RG-178

SPECIFICATION FOR APPROVAL

DOCUMENT: A30178B001

STYLE : 105℃ 30V
RG-178B/U

SIZE: 7/0.102 SCCS

RECOGNIZED: UL 1979

WONDERFUL HI-TECH CO.,LTD

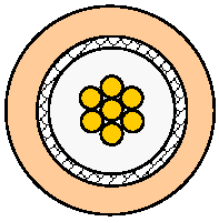
OFFICE：72WU KONG 6TH ROAD,
WU KU IND. DISTRICT
TAIPEI HSIEN,TAIWAN

TEL：(02)22988033
FAX：(02)22988031-2

FACTORY：17 PEI YUAN ROAD,
CHUNG-LI IND. PARK
TAIWAN, R.O.C.

TEL：(03)4527777
FAX：(03)4517214

WONDERFUL HI-TECH CO., LTD
SPECIFICATION

STYLE	105℃ 30V UL1979	DOCUMENT NO : A30178B001	
SIZE	RG-178B/U	ESTABLISHED DATE: 2004/03/22	
STANDARD : MIL-C-17			
Conductor	Size	AWG	30
	Material	----	Silver-Coated Copper Clad Steel
	Conductors No.	----	7
	Conductors Size	mm	0.102
	O.D.	mm	0.30
Insulation	Average Thickness	mm	0.28
	Diameter	mm	0.86 ±0.03
	Material	----	FEP
	Color	----	Clear
Braid	Material	----	Silver-Coated Copper
	Construction	mm	16 / 3 / 0.10
	Coverage	%	95
Jacket	Average Thickness	mm	0.25
	Diameter	mm	1.80 ±0.05
	Material	----	FEP
	Color	----	Brown
Marking			
Drawing			

WONDERFUL HI-TECH CO., LTD.
SPECIFICATION

Electrical & Physical Properties			
Item			RG-178B/U
Rating Temp Voltage			105℃ 30V
Conductor Resistance			838 OHM/KM/20℃ MAX.
Insulation Resistance			3000 MEGA OHM/KM MIN.
Dielectric Strength			AC 500V/Minute
Spark Test			2.5 KV
Insulation	Unaged	Tensile Strength	2500 PSI MIN.(1.76 Kg / ㎟)
		Elongation	200% MIN.
	Aged	Tensile Strength	**UNAGED MIN 75%(168HRS×232℃)**
		Elongation	**UNAGED MIN 75%(168HRS×232℃)**
Jacket	Unaged	Tensile Strength	2500 PSI MIN.(1.76 Kg / ㎟)
		Elongation	200% MIN.
	Aged	Tensile Strength	**UNAGED MIN.75%(168HRS×232℃)**
		Elongation	**UNAGED MIN.75%(168HRS×232℃)**
Nom. Impedance			50 Ohms
Nom. Capacitance			95.8 pF/m
Nom. Vel. of Prop.			69.5%
VSWR (0 – 6 GHZ)			UNDER 1.3

Attenuation (dB/100m)	100MHz	1GHz	1.8GHz	2.4GHz	5.2GHz	6GHz
	46	155	295	340	505	550

Housing Material Data Sheet

- Housing

HONSANE

Thoughfull Professional Unique

用心 專業 獨特

東莞宏德化學工業有限公司檢驗報告

DONG GUAN HONTEX CHEMICAL CO.,LTD. TEST REPORT

廣東省東莞市長安鎮霄邊工業區 Postcode:523850

Tel:(0769)85533620 Fax:(0769)85533635

http://www.dghontex.com.cn E-mail:hontex@pub.dgnet.gd.cn

品名 Product Name	TU56DG	制造批號 Lot No.	R80398005
送驗日期 Sample Received	2008/3/13	檢驗日期 Sample Tested	2008/3/14
檢驗項目 Test Items	標准值/測試條件 Spec./Test Method	檢驗結果 Test Results	
外觀 Appearance	/	霧狀	
拉伸強度(kg/cm^2) Tensile Strength	>300	496	
延伸率(%) Elongation	>380	603	
100%模量(kg/cm^2) 100% modulus	>90	131	
硬度(ShoreD) Hardness	56±2D	55D	
熔融指數(g/10min) Melt Index	10kg/210℃	16.2	
熔融粘度(Pa.s) Melt Viscosity	10kg/210℃	3195	
色差 Color Index	/	11.1	
耐磨耗(mm3) Abrasion:DIN	/	59	
耐寒耐曲折性 Flexibility@-10℃	-10℃/4萬次	完好	
透明性 Transparency	/	不透明	
INSPECTION RESULT		PASS	

主管: 2008.04.09 喜鳳
Supervisor:

檢驗員: 王文忠
(Inspector):

2008年4月9日

Hinge (Base/Holder) – PC+ALLOY/POM

SHINBLEND ®

ALLOY

ENGINEERING PLASTIC DIVISION

SHINKONG SYNTHETIC FIBERS CORPORATION
新 光 合 成 纖 維 股 份 有 限 公 司
8th Fl., 123, Sec.2, Nanking East Road, Taipei, Taiwan
Tel：886-2-2507-0131 886-2-2507-1251(30Lines) 886-3-4932131-1730
Fax：886-2-2506-8047 886-3-491-5763

Technical Data

工塑營業處
李文桂 分機 7548 行動：0935627706
台北市南京東路二段123號8樓
電話：02-25071251 FAX：02-25068047

SHINBLEND® A724NA

High Impact Grade / 超韌級：AD4011

		Unit	Test Method	Values
Mechanical properties	**機械性質**			
Izod Impact(Notched) 23°C	衝擊強度	Kg-cm/cm	ASTM D256	85
-20°C	衝擊強度	Kg-cm/cm	ASTM D256	70
-40°C	衝擊強度	Kg-cm/cm	ASTM D256	65
Tensile Strength	拉伸強度	Kg/cm^2	ASTM D638	540
Elongation	拉伸率	%	ASTM D638	100
Flexural Strength	彎曲強度	Kg/cm^2	ASTM D790	800
Flexural Modulus	彎曲模數	Kg/cm^2	ASTM D790	20000
Rockwell Hardness	洛式硬度	R	ASTM D785	115
Thermal properties	**熱 性 質**			
Heat Deflection Temperature	熱變形溫度		ASTM D648	
66psi		°C		-
264psi		°C		100
Flammability	防火性	-	UL94	-
Melting Point	熔點	°C	DSC	223
Electrical properties	**電氣性質**			
Dielectric Strength	介電強度	KV/MM	ASTM D149	-
Dielectric Constant	介電常數	…	ASTM D150	-
Volume Resistivity	體積電阻	Ω-CM	ASTM D257	-
Other properties	**其它性質**			
Specific Gravity	比重	-	ASTM D792	1.19
Water Absorption	吸水率	%	ASTM D570	0.14
Mold Shrinkage	成形收縮率		ASTM D955	
Flow	流動方向	%		0.4~0.6
Cross Flow	垂直方向	%		0.5~0.7

台灣鋼　共聚型聚縮醛樹脂品別、用途、物性一覽表 (POM)

品別				FM025-			FM090-			FM270-		
				08	10	13	08	10	13	08	10	13
特性				帶電防止	耐候性優異 耐熱水性	高黏度 低模垢 押出 厚斷面射出	帶電防止	耐候性優異 耐熱水性	標準流動性 低模垢	帶電防止	耐候性優異 耐熱水性	高流動性 低模垢 加工性優異
用途				・素材押出 ・其他押出品			・扣具扣扣 ・拉鍊 ・管件及五金 ・電子零件 ・汽車零件 ・家庭電氣 ・軸承 ・齒輪 ・其他射出零件			・扣扣 ・拉鍊 ・電子零件 ・汽車零件 ・家庭電氣 ・齒輪 ・其他小型機器零件		
試驗項目		單位	方法(ASTM)									
比重		----	D792	1.41			1.41			1.41		
硬度(Rockwell)	M刻度		D785	78			80			80		
	R刻度		D785	—			115			—		
抗折強度		kgf/cm²	D790	950			950			950		
抗折彈性係數		kgf/cm²	D790	26000			26000			26000		
拉伸強度	降伏點	kgf/cm²	D638	610			620			620		
	斷裂點	kgf/cm²	D638	510			510			510		
延伸率	降伏點	%	D638	10			10			10		
	斷裂點	%	D638	75			60			45		
壓縮強度	1%變形	kgf/cm²	D695	320			320			320		
	10%變形	kgf/cm²	D695	1100			1100			1100		
衝擊強度	凹側23℃ 50%RH	kgf/cm²	D256	7.6			6.5			5.4		
	反凹側23℃ 50%RH	kgf/cm²	D256	91			78			63		
吸水率	24小時浸漬	%	D570	0.22			0.22			0.22		
	平衡，50%RH	%	D570	0.16			0.16			0.16		
	平衡，浸漬	%	D570	0.80			0.80			0.80		

表中數值照上列試驗方法測得之參考值，僅供客戶選擇適當品類之用。