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: $S = \frac{PG}{4\pi R^2} = \frac{312.61 \times 1.72}{4\pi (20)^2} = 0.107 mW/cm^2$

Estimated safe separation: $R = \sqrt{\frac{PG}{4\pi}} = \sqrt{\frac{312.61 \times 1.72}{4\pi}} = 6.54 cm$

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:

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

$G = \text{Log}^{-1}$ (2.35 / 10) = 1.72

Appendix

Antenna Specification

Antenna#1 (MAIN RF Output)

Antenna#2 (AUX RF Output)

納入仕様書

《新規．變更》

客戶 UNIHAN

制　　定	2010 年 03 月 17 日
部品番號	1415-01BS000
品　　名	SA2420_WPF117 Mini 1.13 Antenna with MHF L160mm(F5B)
公司番號	UCW2631

［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168號
PC:215155
TEL:86－512－66706259
FAX:86－512－65381104

作　成	檢　圖	確　認	核　準
曹 吉	沈天华	钱丽丽	林慕雄

SPECIFICATION

Description……..…: SA2420_WPF117 Mini 1.13 Antenna with MHF L160mm(F5B)

2.Customer……..: UNIHAN

3.Part No…….: 1415-01BS000

4.Coaxial Lenght…….:160mm(see Drawing)

5.Electrical Characteristics

Operating Frequency…….:2~3 GHz

Impedance…….:50 Ohm nominal

6.Mechanical Chararteristics

Connector……...: MHF

7.Raw Material

Coaxial Cable……..: MINI1.13

Core……: F5B RH 6.35*15.8*3.3

一般未注公差(mm)	
X	±1.0
X.X	±0.5
X.XX	±0.3
ANGULAR	±5.0°
成品单重(g):	5.2g
制造厂别:	2F

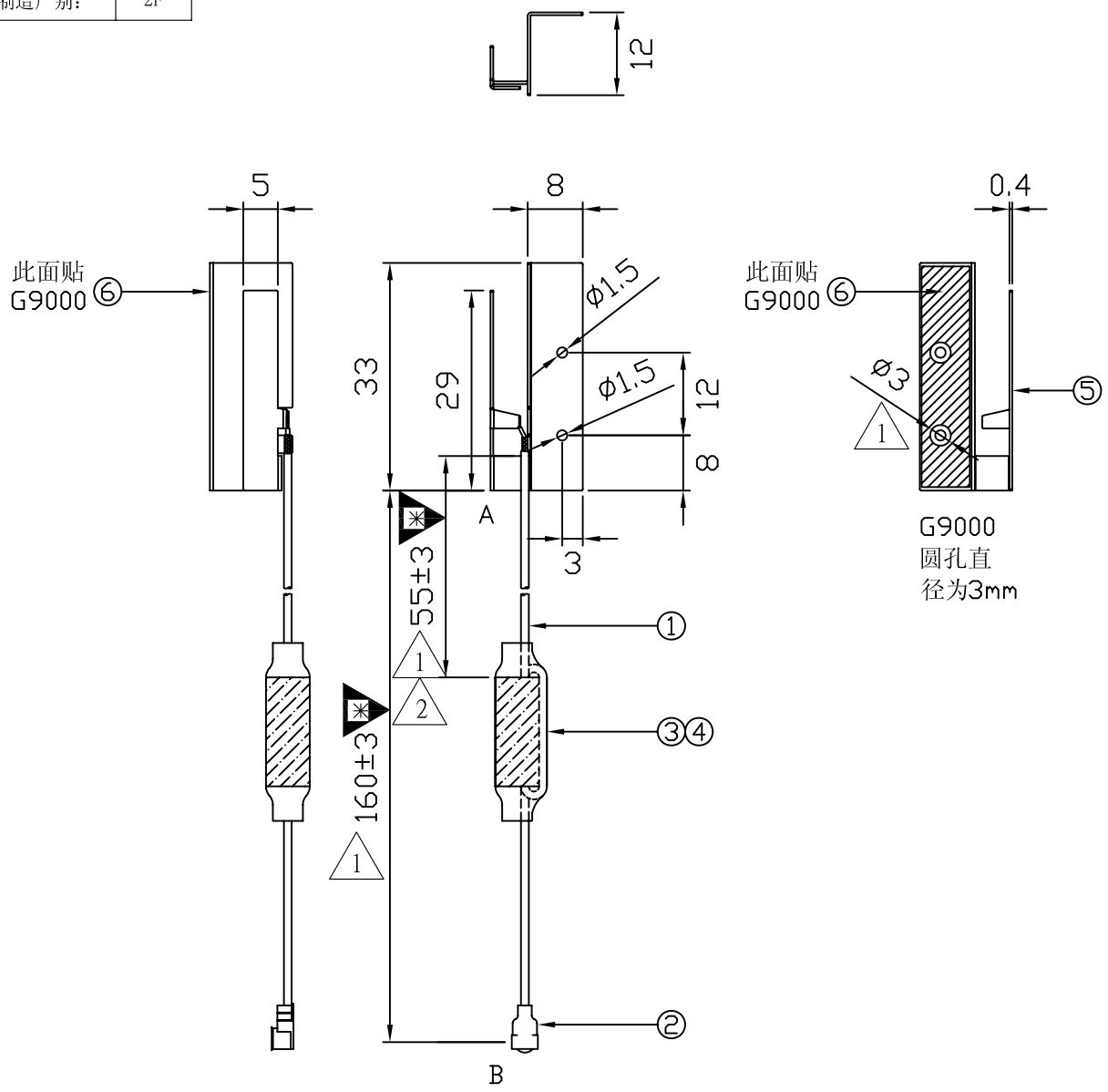
環材

1 变更点 指示符

重点尺寸 指示符

客户签名

客户承认图面



作業說明：

1. 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。

第3角法	圖面不用實測				部品番號	1415-01BS000
單位: mm	作成	檢圖	確認	核准	品名	SA2420_WPF117 Mini 1.13 Antenna with MHF L160mm(F5B)
比例: FREE	曹吉	沈天华	钱丽丽	林慕雄		
10年04月27日					公司番號	UCW2631

S.Z成品编号： HY1A18961C　T.W成品编号：UCW2631　文件编号：FMT40102-08　页次: 1/2

变更内容履历简述 REVISIONS DESCRIPTION	版次 REV.	年月日 DATE	變更切換方式	作成
△1 外露尺寸变更：原外露80mm;端子到core的距离是15mm ⟶ 外露160mm;core到PIFA距离为20mm G9000变更：原SONY G9000(7*32) 双面贴纸 ⟶ G9WS0160(7*32) 双面贴纸	B	10.04.22	立即变更	曹吉
△2 core到铁件的距离是20mm ⟶ core到铁件焊点内边缘距离为55mm	C	10.04.27	立即变更	曹吉
△3				

NO.	材料名稱	環材	廠商	零件規格	顏色	切斷尺寸& 備註	用量
6	G9000	√		G9WS0160(7*32) 双面贴纸 △1 HF			1
5	PIFA	√		WPF117 LF	银		1
4	热缩套管	√		CB 无卤套管 7.0 黑 HF	黑		1
3	Core	√		F5B RH 6.35*15.8*3.3 LF	黑		1
2	MHF Connector	√		20278-112R-13 HF	金		1
1	MINI1.13 Coaxial Cable	√		MINI RG OD:1.13 浅灰 (GY-193) LF HF	浅灰		1

第3角法	圖面不用實測				部品番號	1415-01BS000
單位: mm	作成	檢圖	確認	核准		
比例: FREE	曹吉	沈天华	钱丽丽	林慕雄	品名	SA2420_WPF117 Mini 1.13 Antenna with MHF L160mm(F5B)
10年04月27日					公司番號	UCW2631

S.Z成品编号：HY1A18961C T.W成品编号：UCW2631 文件编号：FMT40102-08

蘇州萬旭電子元件有限公司

Wanshih Electronic Co., LTD

Research & Development Department

Antenna Measurement

CUSTOMER:UNIHAN – DPC2420

ANT BANDWIDTH :2.4-2.5GHz

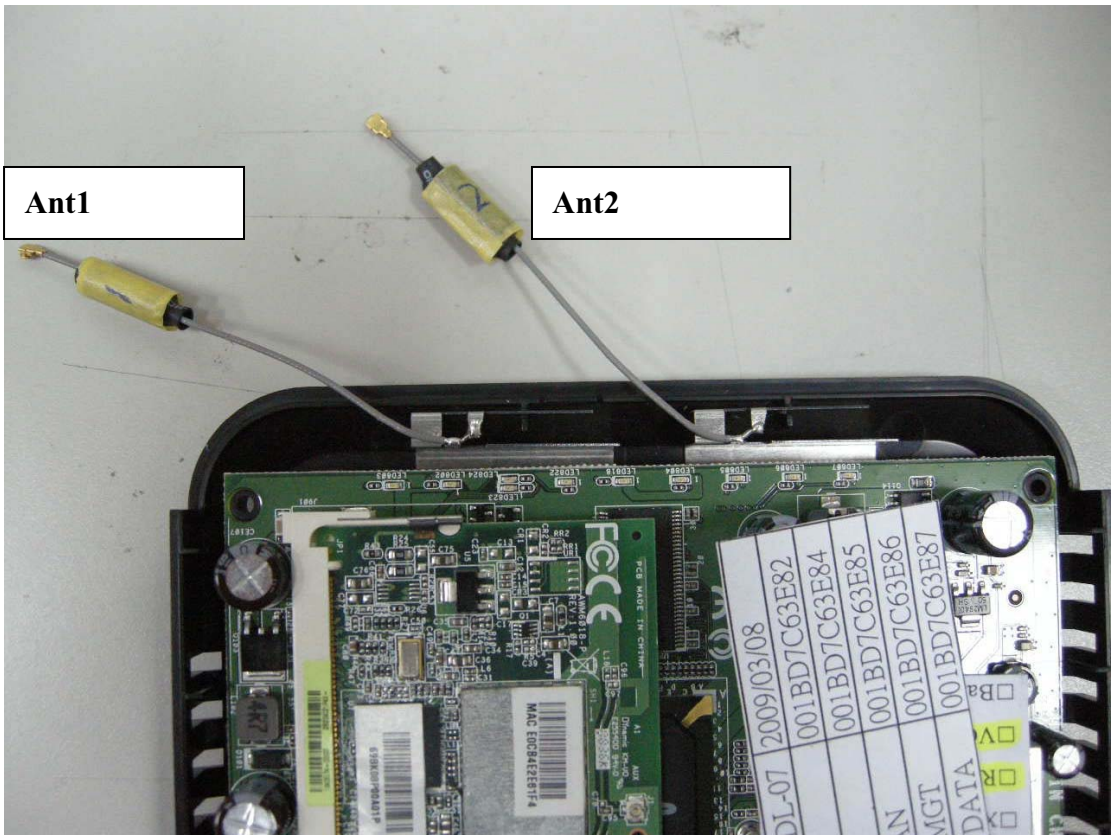
TEST INSTRUMENT：1. AGILENT E5071B NETWORK ANALYZER

2.Sporton ETS OTA Chamber

ENGINEER：Jason

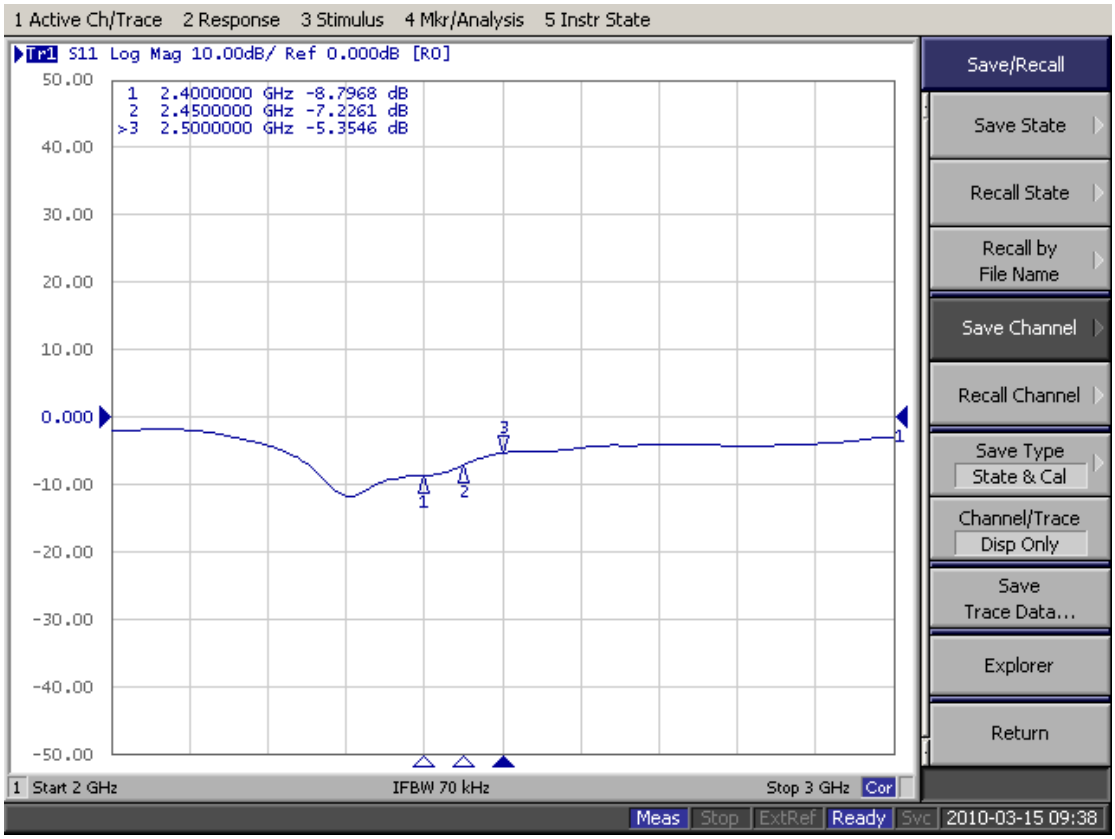
DATE：2010/03/12

LOCATION OF ANTS

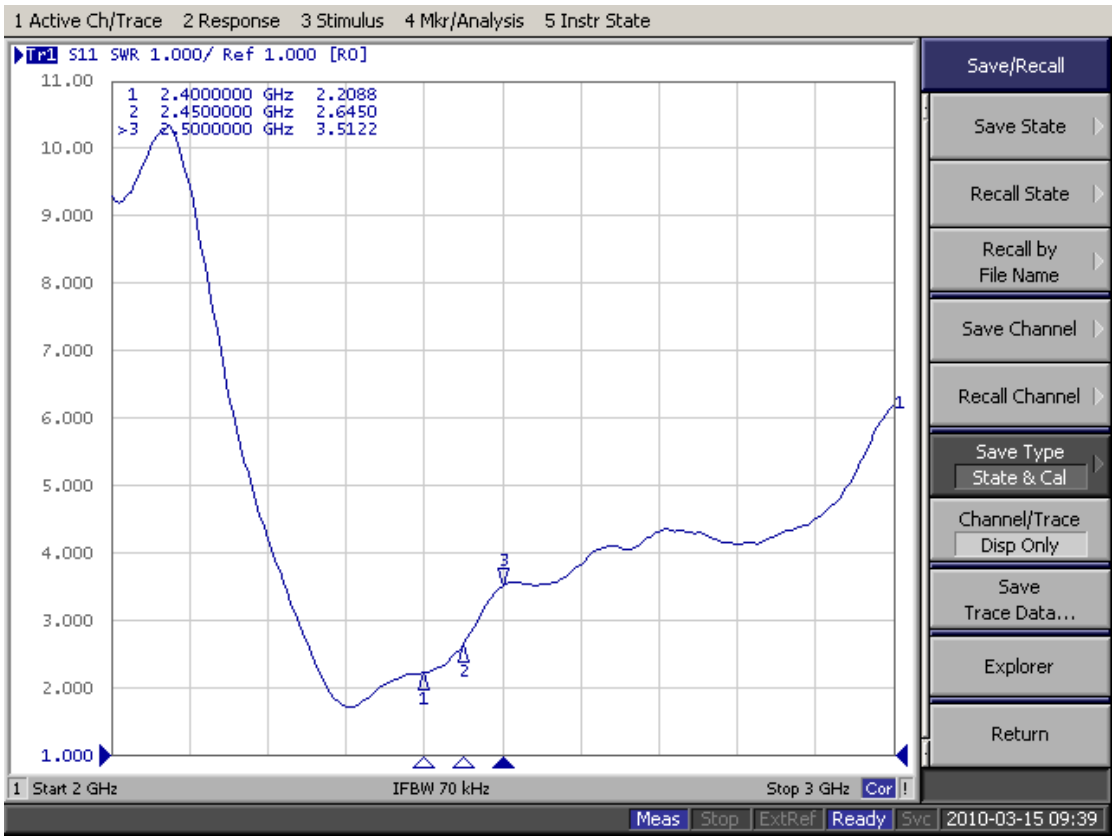


Ant1

RETURN LOSS:

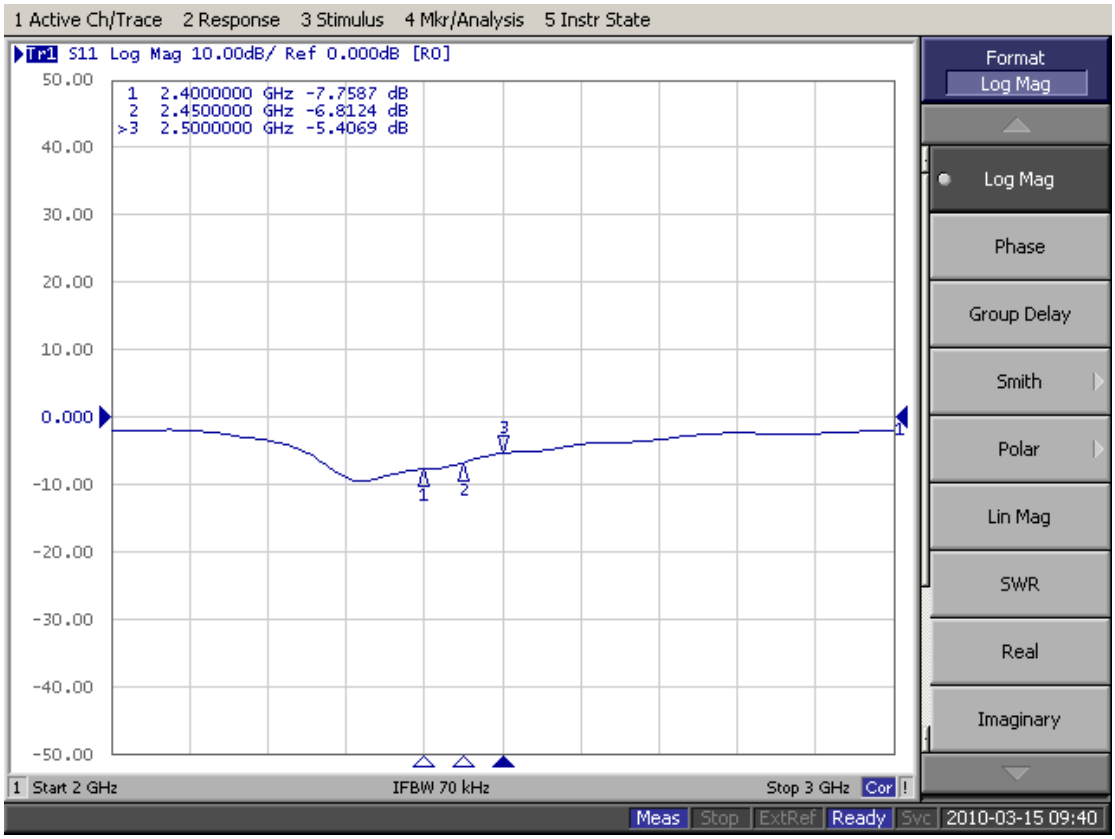


SWR:

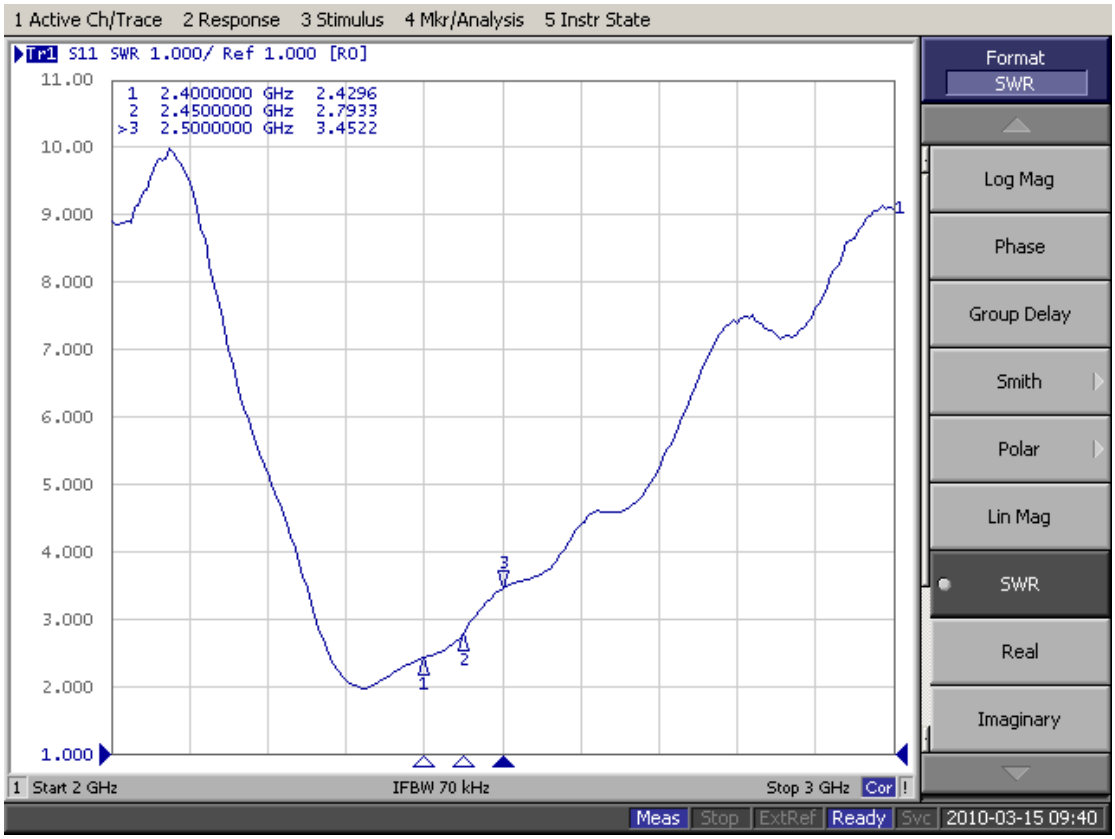


Ant2

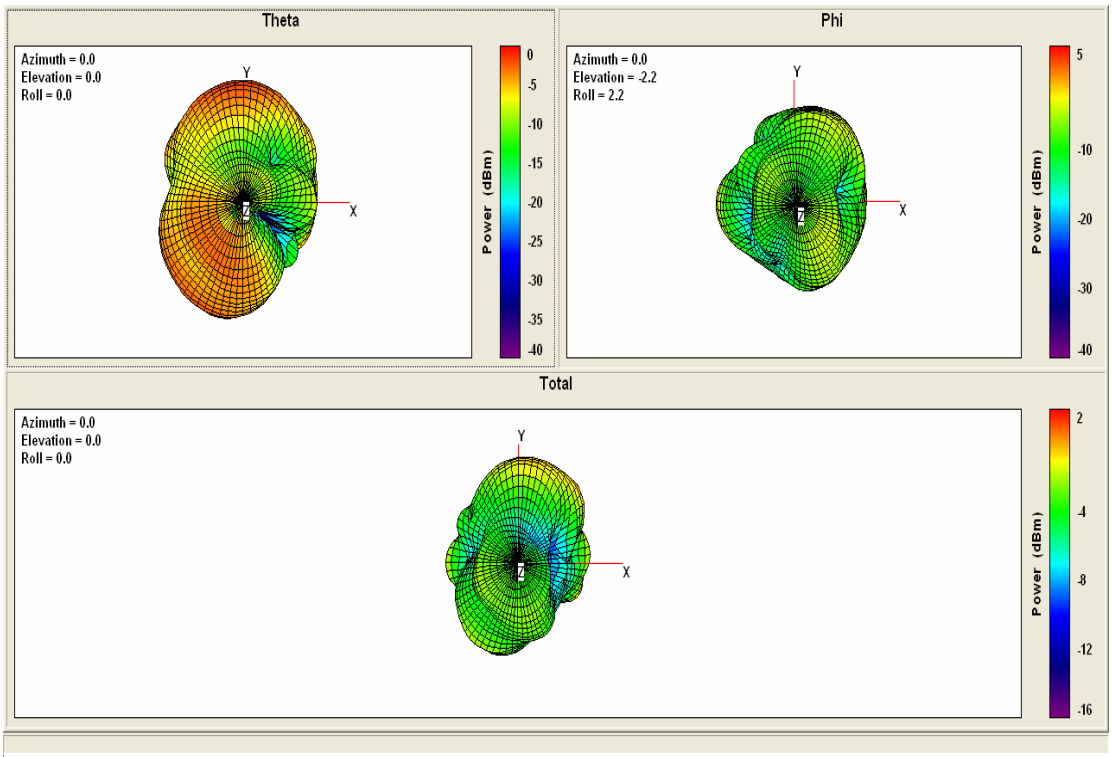
RETURN LOSS:



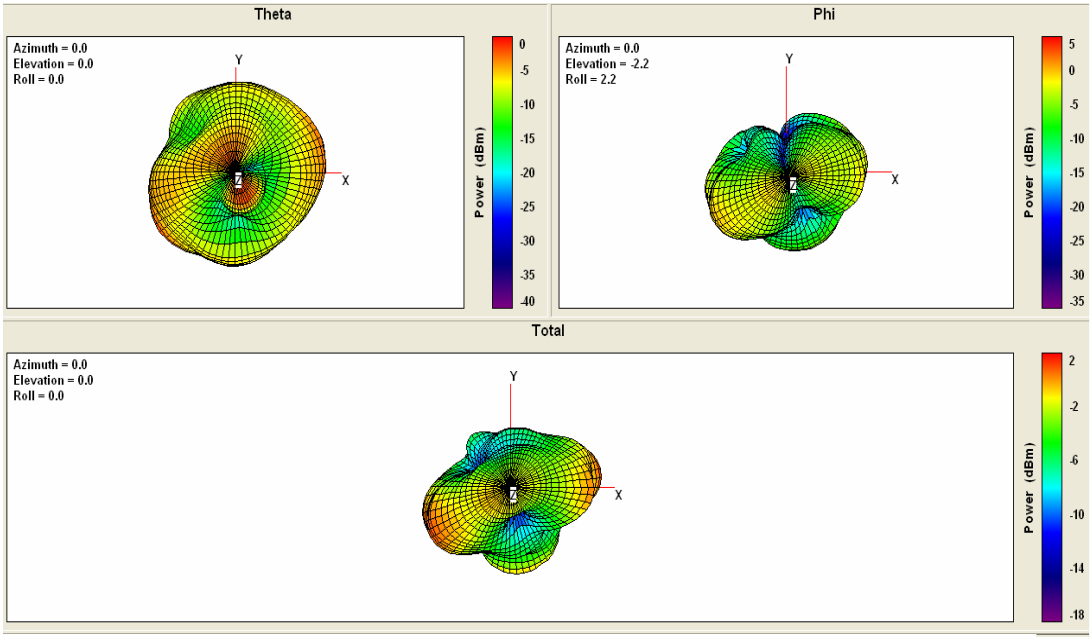
SWR:


1 Active Ch/Trace
2 Response
3 Stimulus
4 Mkr/Analysis
5 Instr State
Tr1 S11 SWR 1.000/ Ref 1.000 [RO]
1 2.4000000 GHz 2.4296
2 2.4500000 GHz 2.7933
>3 2.5000000 GHz 3.4522
11.00
10.00
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
Start 2 GHz
IFBW 70 kHz
Stop 3 GHz
Cor
Format
SWR
Log Mag
Phase
Group Delay
Smith
Polar
Lin Mag
SWR
Real
Imaginary
Meas
Stop
ExtRef
Ready
Svc
2010-03-15 09:40

Ant 1


Theta
Azimuth = 0.0
Elevation = 0.0
Roll = 0.0
Power (dBm)
0
-5
-10
-15
-20
-25
-30
-35
-40
Phi
Azimuth = 0.0
Elevation = -2.2
Roll = 2.2
Power (dBm)
5
-10
-20
-30
-40
Total
Azimuth = 0.0
Elevation = 0.0
Roll = 0.0
Power (dBm)
2
-4
-8
-12
-16

Ant 2


Theta
Azimuth = 0.0
Elevation = 0.0
Roll = 0.0
Power (dBm)
0
-5
-10
-15
-20
-25
-30
-35
-40
Phi
Azimuth = 0.0
Elevation = -2.2
Roll = 2.2
Power (dBm)
5
0
-5
-10
-15
-20
-25
-30
-35
Total
Azimuth = 0.0
Elevation = 0.0
Roll = 0.0
Power (dBm)
2
-2
-6
-10
-14
-18

Test Summary

Ant 1

Model	WANSHIN_DPC2420-W_1_3D-1_FS_2400-2500 MHz		
Test / Position	Gain / Free Space		
Frequency	**2400**	**2450**	**2500**
Ant. Port Input Pwr. (dBm)	0	0	0
Tot. Rad. Pwr. (dBm)	**-3.52174**	**-3.62527**	**-4.13834**
Peak EIRP (dBm)	**1.35706**	**1.42695**	**1.0413**
Directivity (dBi)	4.8788	5.05222	5.17964
Efficiency (dB)	-3.52174	-3.62527	-4.13834
Efficiency (%)	44.4453	43.3983	38.5626
Gain (dBi)	1.35706	1.42695	1.0413
Phi BW (°)	35	33	20
Boresight Phi (°)	335.1	335.1	174.95
Boresight Th. (°)	150	150	150
Maximum Power (dBm)	1.35706	1.42695	1.0413
Minimum Power (dBm)	-14.8824	-17.3514	-17.8167
Average Power (dBm)	-3.60662	-3.80057	-4.39824
Max/Min Ratio (dB)	16.2395	18.7783	18.858
Max/Avg Ratio (dB)	4.96368	5.22752	5.43954
Min/Avg Ratio (dB)	-11.2758	-13.5508	-13.4185
Average Gain (dB)	-3.52174	-3.62527	-4.13834
Note	**1**		

Ant 2

Model	WANSHIN_DPC2420-W_2_3D-1_FS_2400-2500 MHz		
Test / Position	Gain / Free Space		
Frequency	**2400**	**2450**	**2500**
Ant. Port Input Pwr. (dBm)	0	0	0
Tot. Rad. Pwr. (dBm)	**-3.16946**	**-2.76743**	**-2.97968**
Peak EIRP (dBm)	**1.75412**	**2.35826**	**2.34009**
Directivity (dBi)	4.92358	5.12569	5.31977
Efficiency (dB)	-3.16946	-2.76743	-2.97968
Efficiency (%)	48.2008	52.8758	50.3538
Gain (dBi)	1.75412	2.35826	2.34009
Front/Back Ratio (dB)	10.0097	2.62398	3.74236
Phi BW (°)	47	40	41
Boresight Phi (°)	287.8	7.2	7.2
Boresight Th. (°)	135	90	90
Maximum Power (dBm)	1.75412	2.35826	2.34009
Minimum Power (dBm)	-17.6332	-18.4267	-17.3567
Average Power (dBm)	-2.85426	-2.46873	-2.7041
Max/Min Ratio (dB)	19.3874	20.785	19.6968
Max/Avg Ratio (dB)	4.60839	4.82698	5.04419
Min/Avg Ratio (dB)	-14.779	-15.958	-14.6526
Average Gain (dB)	-3.16946	-2.76743	-2.97968
Note	**2**		

3D Peak Gain & Efficiency

	Ant 1	
	Peak Gain(dBi)	**Efficiency%**
2.4GHz	**1.35**	**44.4**
2.45GHz	**1.42**	**43.9**
2.5GHz	**1.04**	**38.5**

	Ant 2	
	Peak Gain(dBi)	**Efficiency%**
2.4GHz	**1.75**	**48.2**
2.45GHz	**2.35**	**52.8**
2.5GHz	**2.34**	**50.3**