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 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: $S = \frac{PG}{4\pi R^2} = \frac{150.314 \times 1.633}{4\pi (20)^2} = 0.04883 mW/cm^2$

Estimated safe separation: $R = \sqrt{\frac{PG}{4\pi}} = \sqrt{\frac{150.314 \times 1.633}{4\pi}} = 4.41965 cm$

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:

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

$G = \text{Log}^{-1}$ (2.13 / 10) = 1.63305

Appendix

Antenna Specification

(Ant#1 A3E-L / A3E-R)

JOINSOON ELECTRONICS MFG.CO.,LTD.

建舜電子製造股份有限公司

承 認 書

APPROVAL SHEET

客戶名稱(CUSTOMER): ASUS A3E-R / A3E-L

品　　名(DESCRIPTION): NoteBook DualBand PIFA Antenna

品　　號(PART NO): IA-050042

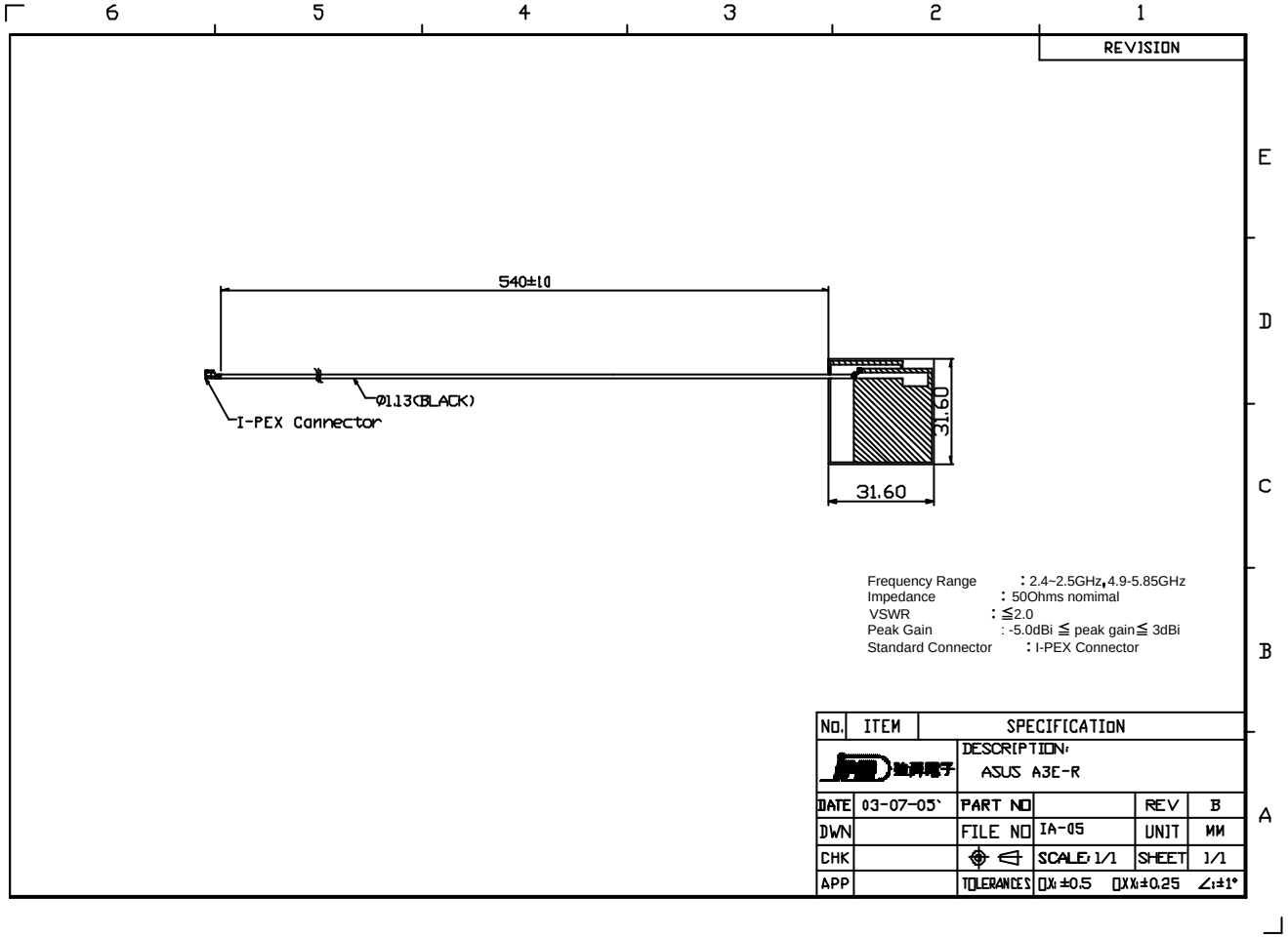
承認號碼(APPROVAL SHEET NO):

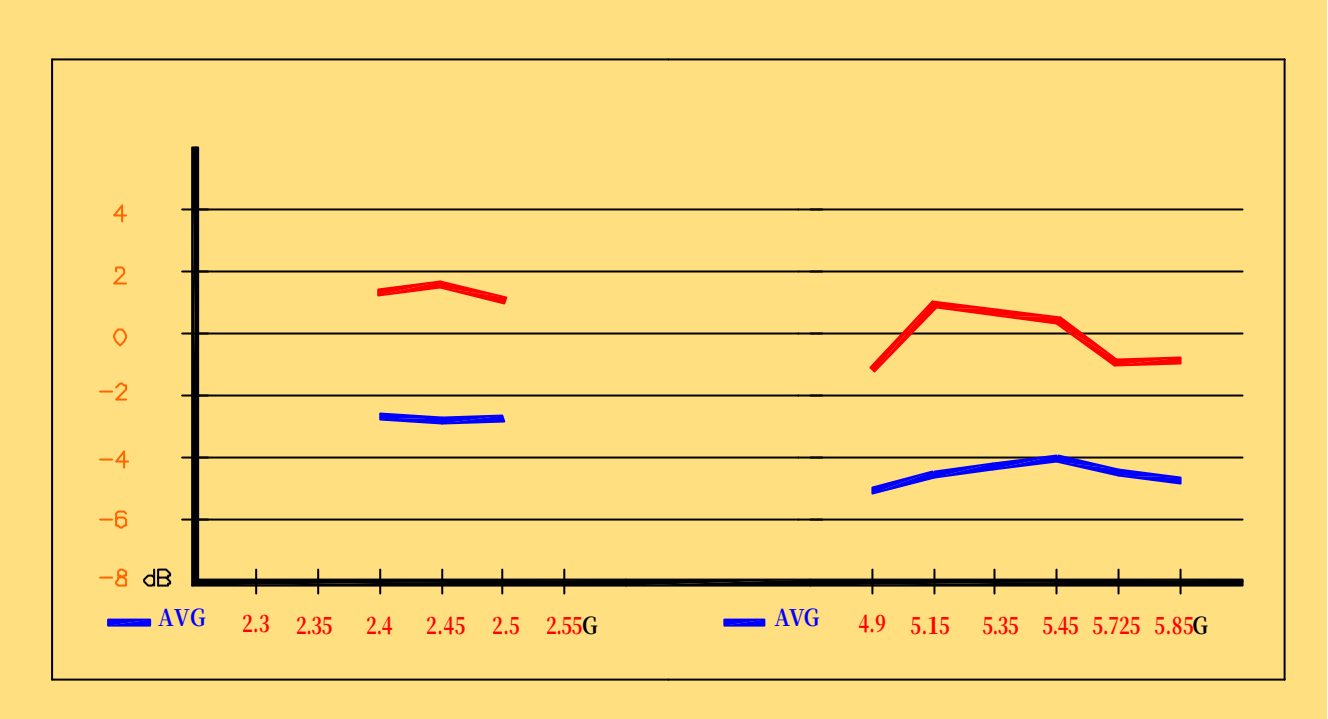
客戶承認 (CUSTOMER APPROVAL)

QUICK REFERENCE DATA for A3E-R

Antenna Patch Dimension	31.6*31.6 mm A3E-R Antenna
A3N –R Cable Length	540 mm, Color BLACK
Connector	I-PEX
Peak Gain	-5.0≦Peak Gain≦1.76 dBi
VSWR	≦2.0
Polarization	Linear
Impedance	50Ω
Operating Temperature	-40~90 ℃
Maximum Power	1W

一、成品圖


REVISION
540±10
Ø1.13(BLACK)
I-PEX Connector
31.60
31.60
Frequency Range : 2.4~2.5GHz, 4.9-5.85GHz
Impedance : 50Ohms nomimal
VSWR : ≦2.0
Peak Gain : -5.0dBi ≦ peak gain ≦ 3dBi
Standard Connector : I-PEX Connector
NO. ITEM SPECIFICATION
DESCRIPTION: ASUS A3E-R
DATE 03-07-05
PART NO
REV B
DWN
FILE NO IA-05
UNIT MM
CHK
SCALE: 1/1
SHEET 1/1
APP
TOLERANCES ±0.5 ±0.25 ∠±1°



Antenna	PEAK GAIN(H-H + H-V)		
	2.4GHz	2.45GHz	2.5GHz
R	**1.67**	**1.76**	**1.25**

Antenna	PEAK GAIN(H-H + H-V)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.875GH
R	**-1.12**	**1.03**	**0.75**	**0.31**	**-0.87**	**-0.85**

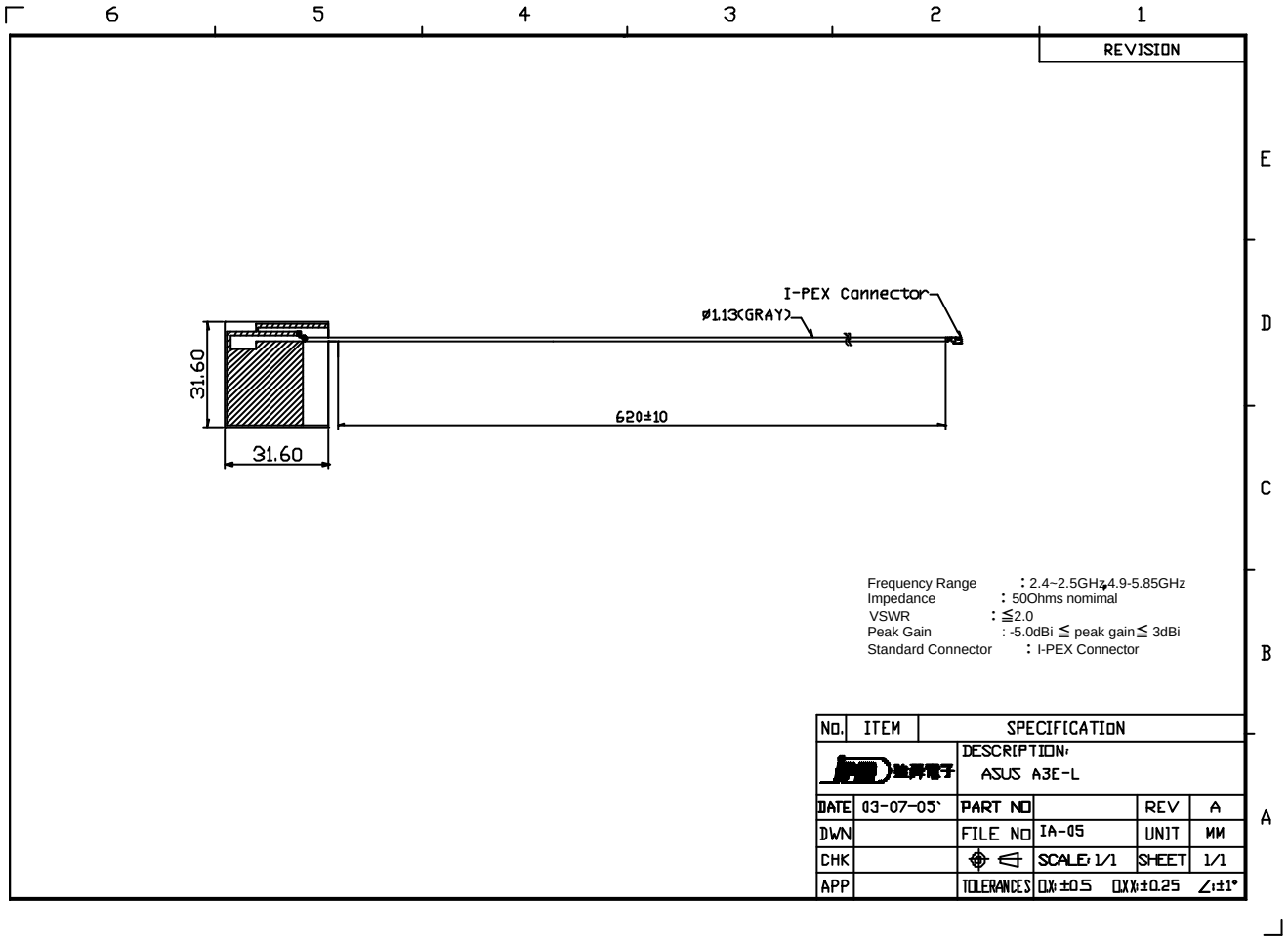
Antenna	PEAK GAIN(H-H + H-V)		
	2.4GHz	2.45GHz	2.5GHz
R	**-2.55**	**-2.61**	**-2.57**

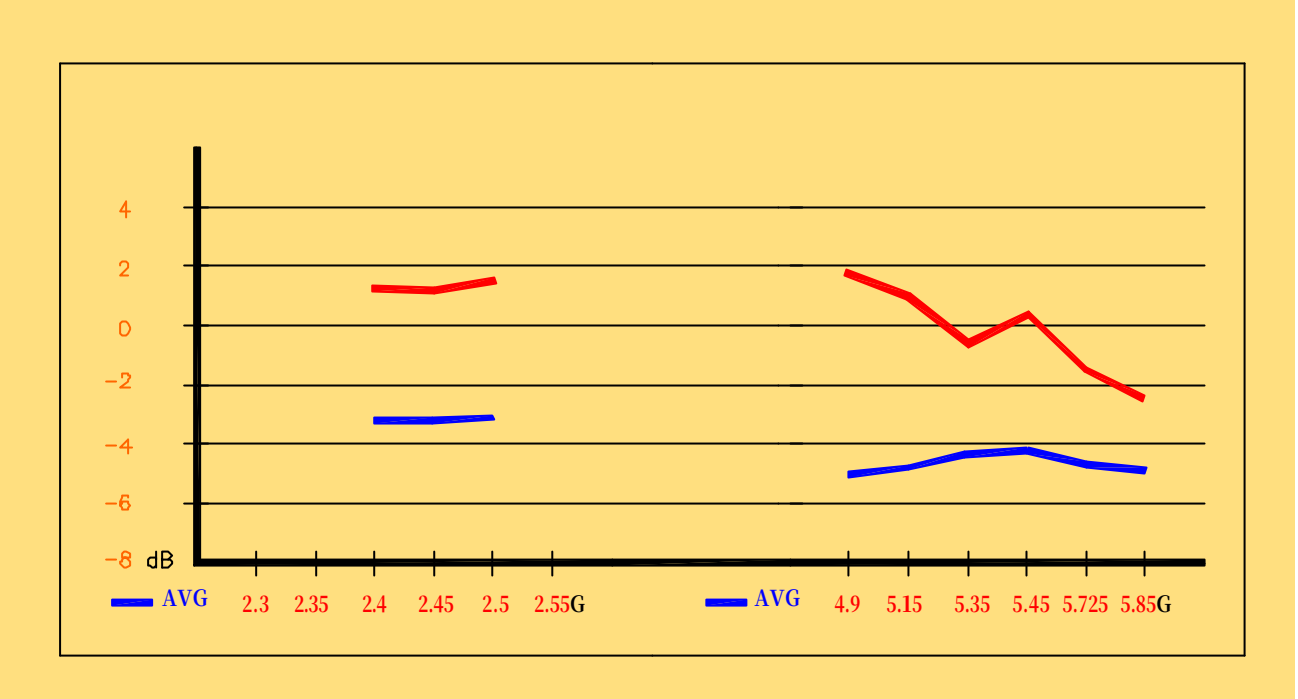
Antenna	PEAK GAIN(H-H + H-V)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.875GH
R	**-4.77**	**-4.54**	**-4.21**	**-4.06**	**-4.43**	**-4.63**

QUICK REFERENCE DATA for A3E-L

Antenna Patch Dimension	31.6*31.6 mm A3E-Left Antenna
A3N –Down Cable Length	620 mm, Color GRAY
Connector	I-PEX
Peak Gain	-5.0≦Peak Gain≦1.47 dBi
VSWR	≦2.0
Polarization	Linear
Impedance	50Ω
Operating Temperature	-40~90 ℃
Maximum Power	1W

一、成品圖


REVISION
I-PEX Connector
ø1.13(GRAY)
31.60
620±10
31.60
Frequency Range : 2.4~2.5GHz,4.9-5.85GHz
Impedance : 50Ohms nomimal
VSWR : ≦2.0
Peak Gain : -5.0dBi ≦ peak gain≦ 3dBi
Standard Connector : I-PEX Connector
NO. ITEM SPECIFICATION
DESCRIPTION: ASUS A3E-L
DATE 03-07-05 PART NO REV A
DWN FILE NO IA-05 UNIT MM
CHK SCALE: 1/1 SHEET 1/1
APP TOLERANCES



Antenna	PEAK GAIN(H-H + H-V)		
	2.4GHz	2.45GHz	2.5GHz
L	**1.32**	**1.21**	**1.47**

Antenna	PEAK GAIN(H-H + H-V)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.875GH
L	**-1.94**	**-1.12**	**-0.32**	**0.56**	**-1.34**	**-2.21**

Antenna	AVG GAIN(H-H + H-V)		
	2.4GHz	2.45GHz	2.5GHz
L	**-3.31**	**-3.32**	**-3.27**

Antenna	AVG GAIN(H-H + H-V)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.875GH
L	**-4.91**	**-4.82**	**-4.43**	**-4.21**	**-4.73**	**-4.85**

Appendix

Antenna Specification

(Ant#2 W3)

Data Sheet

Product type	WLAN antenna
Model number	ASUS / W3
Revision	R02
Part No. / Yageo / Main / Aux	CAN4313 379 012501B / 022501B
Part No. / Yageo / Bluetooth	CAN4313 379 012451B
Part No. / ASUS / Main / Aux	14-151019000 / 14-151019100
Part No. / ASUS / Bluetooth	14-152049000

Yageo (Taiwan) Ltd.
16, west 3rd Street, N.E.P.Z Kaohsiung, 811 Taiwan, R.O.C
Yegeo Electronics (China) Co, Ltd
No. 10, Zhu Yuan Road, Suzhou New District, Suzhou, PRC

2.45/5GHz Multi Band Antenna with Cable & Connector for IEEE802.11b, 11g, 11a, UNII		Yageo Part Number: Main / Aux: CAN4313 379 012501B/02250 CAN4313 379 012451B (BT)		R01	Nov. 20, 04
				R02	Nov. 26, 04
BY /	Howard.Chuang	DATE /	Nov. 26, 2004		

Specifications

1.1 Specifications for antennas

Frequency range (GHz)	2.40 ~ 2.50 for 802.11b/g 5.15 ~ 5.85 for 802.11a
VSWR	2.50 for 2.4GHz band For WL 2.50 for 5.0GHz band For WL 2.50 for 2.4GHz band For BT
Peak gain (dBi)	-1.26 dBi for 2.4GHz band 1.23 dBi for 5.0GHz band -6.30 dBi for 2.4GHz band (BT)
MiniPCI Connector	Ipex / Hirose or Compatible
Impedance	50Ω
Operating Temperature	-40~90℃
Maximum Power	1W
Polarization	Linear
Radiation pattern	Omni-directional

1.2 Antenna Dimension / Cable length

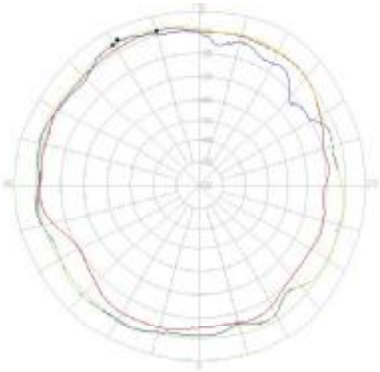
Product	ASUS / W3
Main antenna (LCD)	50.0*7.0*0.4 mm / 610.0 mm, Color Black
Aux antenna (LCD)	50.0*7.0*0.4 mm / 670.0 mm, Color White or Gray
Bluetooth (Base)	30.5*11.0*0.4 mm / 365.0 mm, Color White

1.3 Packing Spec.

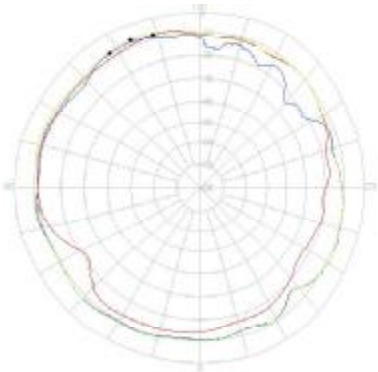
Product	For Example
Inner tray	60
Carton box	265*100

1.4 Antenna Pictures

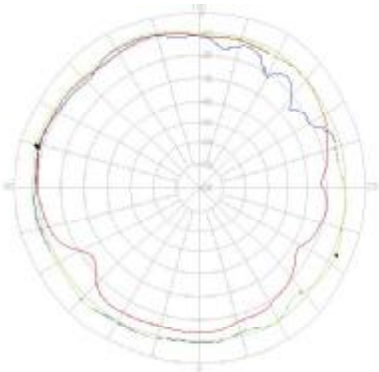
Low Frequency (2.40GHz~2.50GHz) / Bluetooth Antenna



2.40GHz



2.45GHz



2.50GHz

Average gain (dBi) summary

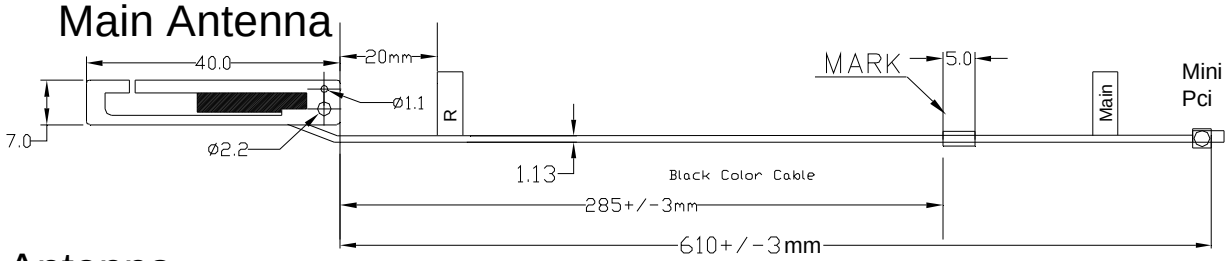
Main Antenna Gain						
Frequency	Max Value (dBi)		Average (dBi)			PASS/NG
	H-pol	V-pol	H-pol	V-pol	Total	
2400(MHz)	-1.96	-2.46	-6.94	-6.45	-4.74	PASS
2500(MHz)	-1.43	-1.43	-5.74	-5.76	-3.79	PASS
5150(MHz)	0.72	1.22	-4.69	-5.07	-2.85	PASS
5350(MHz)	1.23	-0.44	-4.52	-4.72	-2.64	PASS
5470(MHz)	-0.33	-1.33	-5.27	-5.81	-3.54	PASS
5725(MHz)	-1.48	-2.81	-5.87	-7.82	-4.77	PASS
5850(MHz)	-1.61	-4.03	-5.82	-8.23	-4.91	PASS

Aux Antenna Gain						
Frequency	Max Value (dBi)		Average (dBi)			PASS/NG
	H-pol	V-pol	H-pol	V-pol	Total	
2400(MHz)	-1.80	-1.84	-7.37	-6.31	-4.81	PASS
2500(MHz)	-1.26	-1.60	-5.90	-6.49	-4.17	PASS
5150(MHz)	-1.61	-0.61	-5.85	-7.62	-4.51	PASS
5350(MHz)	-0.44	0.23	-6.27	-5.62	-3.96	PASS
5470(MHz)	-2.50	-1.17	-6.12	-6.18	-4.18	PASS
5725(MHz)	-1.98	-2.48	-6.30	-7.13	-4.79	PASS
5850(MHz)	-1.03	-4.20	-5.55	-8.21	-4.71	PASS

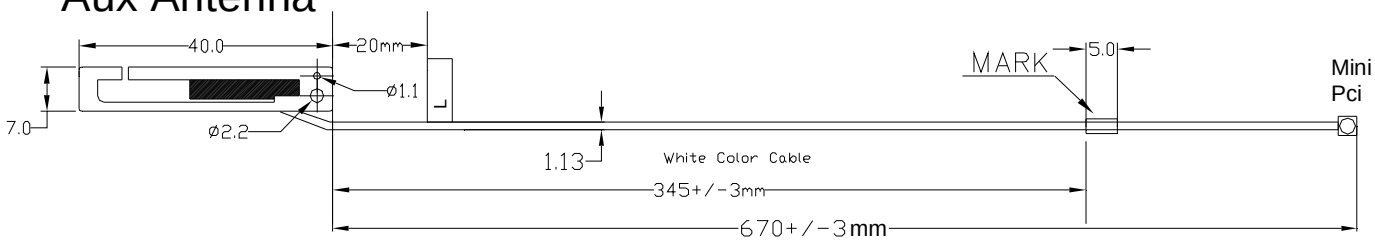
Bluetooth Antenna Gain					
Frequency	Max Value (dBi)		Average (dBi)		
	H-pol	V-pol	H-pol	V-pol	Total
2400(MHz)	-6.30	-7.46	-10.81	-12.27	-9.60
2450(MHz)	-7.85	-8.35	-10.79	-12.37	-9.60
2500(MHz)	-7.43	-8.26	-10.15	-12.44	-9.14

Antenna Drawing

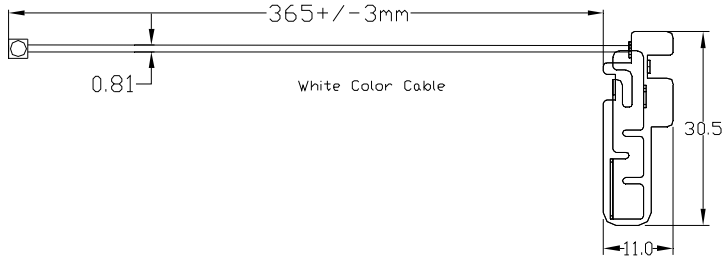
Main Antenna



Aux Antenna



Bluetooth



Appendix

Antenna Specification

(Ant#3 A6K-L / A6K-R)

JOINSOON ELECTRONICS MFG.CO.,LTD.

建舜電子製造股份有限公司

承 認 書

APPROVAL SHEET

客戶名稱(CUSTOMER): ASUS-A6K

品　　名(DESCRIPTION): NoteBook DualBand PIFA Antenna

品　　號(PART NO): IA-050041

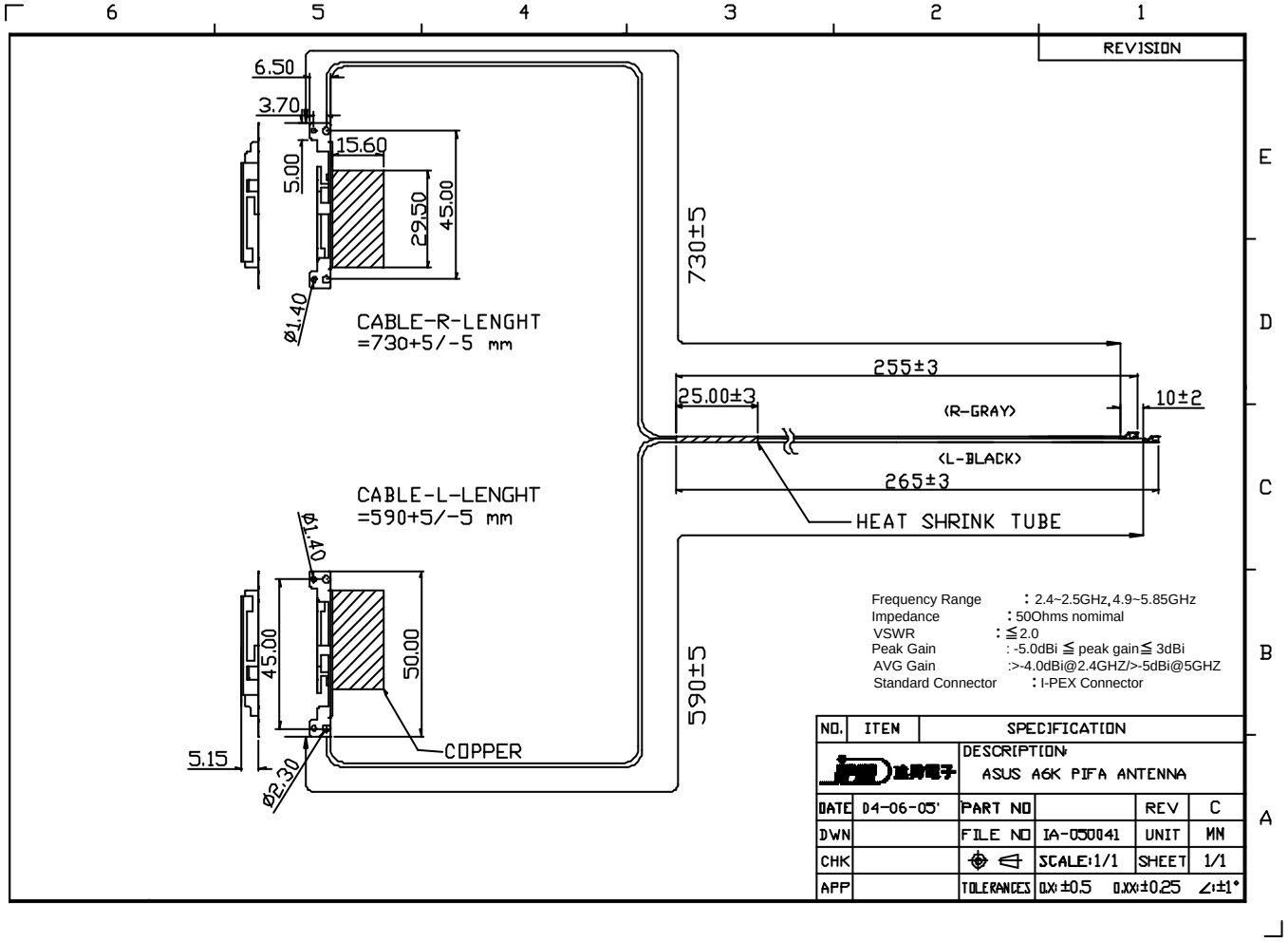
承認號碼(APPROVAL SHEET NO): 050063

客戶承認 (CUSTOMER APPROVAL)

QUICK REFERENCE DATA

Antenna Patch Dimension	50*4.4*6.5 mm A6K-L Antenna 50*4.4*6.5 mm A6K-R Antenna
A6K –R Cable Length	730 mm, Color GRAY
A6K –L Cable Length	590 mm, Color BLACK
Connector	I-PEX
Peak Gain	-5.0≦Peak Gain≦1.44 dBi
VSWR	≦2.0
Polarization	Linear
Impedance	50Ω
Operating Temperature	-40~90 ℃
Maximum Power	1W

一、成品圖


REVISION
6.50
3.70
15.60
5.00
29.50
45.00
Ø1.40
CABLE-R-LENGHT
=730+5/-5 mm
730±5
255±3
25.00±3
(R-GRAY)
10±2
(L-BLACK)
265±3
HEAT SHRINK TUBE
CABLE-L-LENGHT
=590+5/-5 mm
Ø1.40
45.00
50.00
5.15
Ø2.30
COPPER
590±5
Frequency Range : 2.4~2.5GHz,4.9~5.85GHz
Impedance : 50Ohms nomimal
VSWR : ≦2.0
Peak Gain : -5.0dBi ≦ peak gain≦ 3dBi
AVG Gain :>-4.0dBi@2.4GHZ/>-5dBi@5GHZ
Standard Connector : I-PEX Connector
NO. ITEM SPECIFICATION
DESCRIPTION
ASUS A6K PIFA ANTENNA
DATE 04-06-05'
PART NO
REV C
DWN
FILE NO IA-050041
UNIT MM
CHK
SCALE:1/1
SHEET 1/1
APP
TOLERANCES
0.X:±0.5 0.XX:±0.25 ∠:±1°

JOINSOON ELECTRONICS MFG. CO., LTD.

天 線 製 品 規 格

ANTENNA APPROVAL SHEET

1. 一般事項(Generation)

1.1 適用範圍 此樣式表適用於 JEM 開發之 E42 Series ISM Band 的無線通訊系統所使用之天線。

Application Field: This approval sheet only use for JEM development E42 Series Wireless LAN antenna of ISM Band.

1.2 使用溫度範圍 -20 ~ 65 ℃

Operation : -20 ~ 65 ℃

1.3 保存溫度範圍 -30 ~ 75 ℃

Storage : -30 ~ 75 ℃

1.4 測試狀態 溫度 5 ~ 35 ℃、相對濕度 45 ~ 85%、氣壓 860 ~ 1060 hpa 的標準狀態下進行測試。但是若對測試結果有質疑的話，可以於溫度 20 ± 2 ℃、相對濕度 65 ± 5%、氣壓 860 ~ 1060hpa 的基準狀態進行測試。

Test Condition: T=5 ~ 35 ℃ , Humidity=45 ~ 85%. If any doubt and you could test under the following standard T= 20 ±2℃ , Humidity = 65±5% , Atmosphere=860 ~ 1060hpa

2. 外觀、構造、尺寸 (Appearance , Construction , Dimension)

2.1 外觀 各部位的修飾加工良好，沒有對於機能有害的生銹、裂痕、瑕疵等等情形。

Appearance : Good manufacture of each parts and without rusting,cracking,defect…etc to damage product.

2.2 機能、尺寸 依據各個製品圖。

Construction, Dimension: According to each product drawing

3. 機械性能 Mechanical Performance

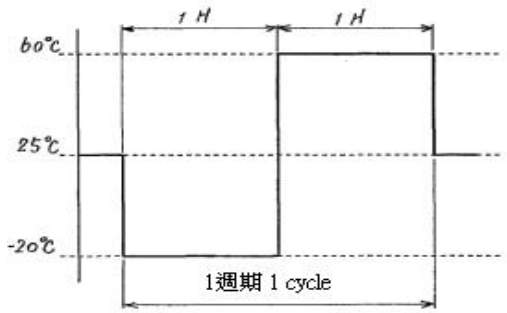
	項目 ITEM	測試條件 TEST CONDITION	規格 SPECIFICATION
3.1	抗振性 Vibration	振擺的比率 ： 10 ~ 55 ~ 10 Hz/分 總振幅 ： 1.5 mm X、Y、Z 方向各 2 小時（總計 6 小時） Ratio: 10-50-10 Hz/minute. Vibration amplitude:1.5 mm To vibrate 2 hrs on X,Y,Z direction(Totally 6 hrs)	外觀、構造無異常 機械性能無異常 符合電氣性能（4.1& 4.2 項） No abnormal of appearance, construction, mechanical. Meet electrical request(Item 4.1&4.2)
3.2	同軸電纜的抗拉強度 Tensile of Coaxial Cable	在同軸電纜的拉出方，施加 1 kgf 的靜止負荷重量一分鐘。 To load 1Kgf weight within 1 minute.	同軸電纜不會脫落 No fall of Coaxial cable. Remarks: This test only for pigtail type.

4. 電氣的性能 Electrical Properties

	項目 ITEM	測試條件 TEST CONDITION	規格 SPECIFICATION

4.1	駐波比 VSWR	放置在任何空間進行檢測。 (VSWR & Return Loss 的檢測方式參考次頁明細圖) To detect on any space. (VSWR & Return Loss testing to read next figure for ref.)	2.0 以下 2.0 Max. (2.4GHz ~ 2.5GHz / 4.9GHz ~ 5.875GHz)
4.2	反射損失 Return Loss		-10 dB 以下 -10 dB Max. (2.4GHz ~ 2.5GHz / 4.9GHz ~ 5.875GHz)
4.3	特徵阻抗 Impedance		50O
4.4	指向性 Certain direction		有指向性 directivity
4.5	最大增益 Max GAIN		-5~2 dBi 以上（絕對增益） -5~2 dBi Min.

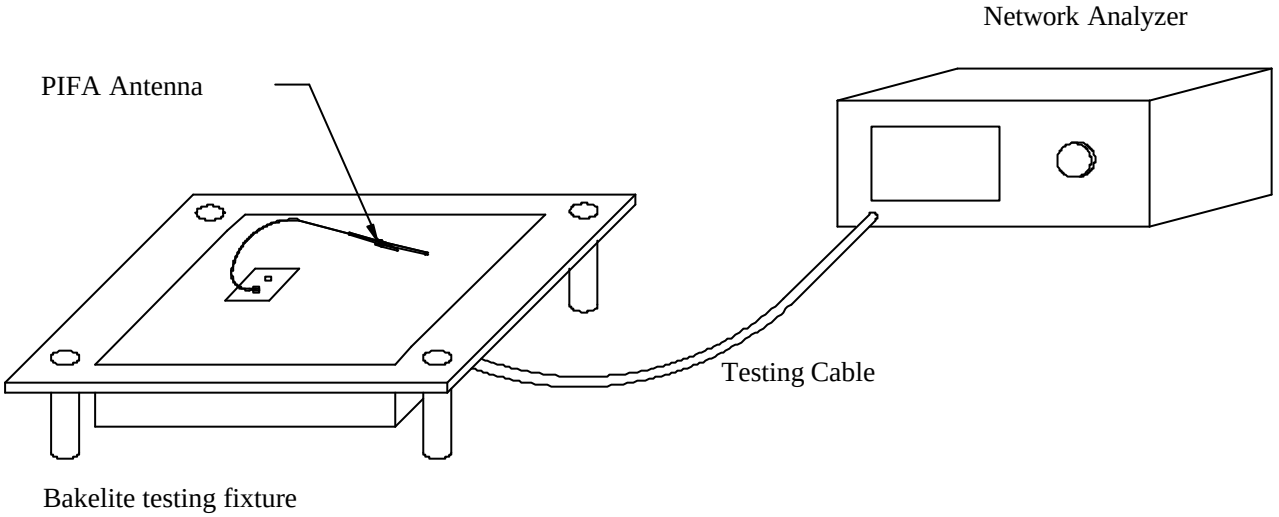
5. 耐氣候性 Environmental Performance

	項目 ITEM	測試條件 TEST CONDITION	規格 SPECIFICATION
5.1	耐熱性 Temperature Life	放置在溫度 60 ±2°C 中，96 小時後在正常溫濕度下放置 1 小時進行檢測。 To put antenna at 60±2°C within 96 hrs then take it out to put at normal environment within 1 hour later to detect.	外觀、構造無異常 機械性能無異常 符合電氣性能（4.1& 4.2 項） No abnormal of appearance, construction, mechanical. Meet electrical request(Item 4.1& 4.2)
5.2	耐寒性 Cold	放置在 -10 ±2°C 中，96 小時以後，再置於正常溫濕度 1 小時進行檢測。 To keep in -10±2°C within 96hrs and take out to put at normal environment within 1 hour later to detect.	
5.3	耐溫性 穩定狀態） Humidity (Stable)	放置在+40 ±2°C，相對濕度 90 ~ 95% 的狀態，96 小時以後，再置於正常溫濕度 1 小時進行檢測。 To keep in +40±2°C , damp=90~95% within 96 hrs and take it out to put at normal environment within 1 hour later to detect.	
5.4	熱沖擊測試 Thermal Shock	-20°C，+60°C 的狀態各放置 1 小時視為 1 週期，測試 10 週期後，再放置於正常溫濕度 1 小時後進行檢測。 To put antenna at -20°C & +60°C and each degree for 1 hour as a cycle , totally need to repeat 10 cycles then put at normal environment within 1 hour later to detect. 	

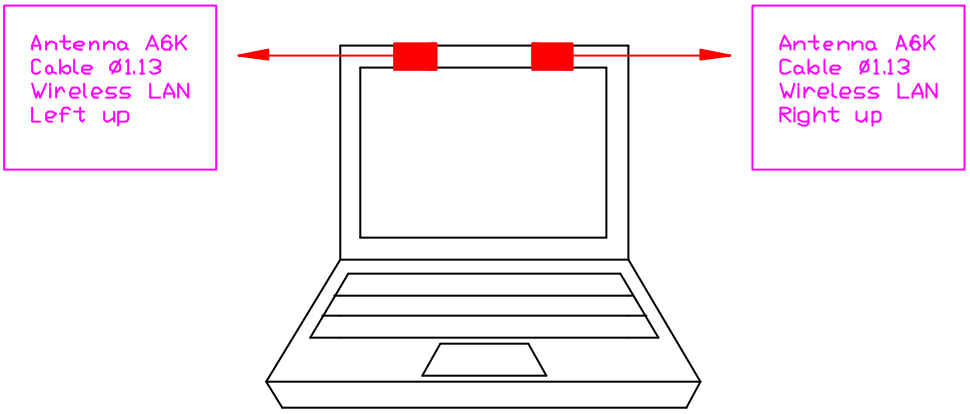
(註）電氣性能項目的檢測機器

(Remarks) Testing equipments

檢測器(equipment)：Agilent Network Analyzer E8358A



Mechanical dimensions



Gain:

Antenna	PEAK GAIN(H)		
	2.4GHz	2.45GHz	2.5GHz
A6K-L	1.44	1.03	-0.25

Antenna	PEAK GAIN(H)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.85GH
A6K -L	-1.64	-0.62	1.38	0.22	-1.51	-1.52

Antenna	PEAK GAIN(V)		
	2.4GHz	2.45GHz	2.5GHz
A6K-L	0.32	0.33	0.89

Antenna	PEAK GAIN(V)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.85GH
A6K -L	-1.77	0.12	1.17	-0.24	0.01	-0.42

Gain:

Antenna	PEAK GAIN(H)		
	2.4GHz	2.45GHz	2.5GHz
A6K-R	0.36	0.91	-0.56

Antenna	PEAK GAIN(H)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.85GH
A6K -R	-1.32	-1.20	-1.59	-1.76	-0.96	-0.74

Antenna	PEAK GAIN(V)		
	2.4GHz	2.45GHz	2.5GHz
A6K -R	-0.52	-0.65	0.26

Antenna	PEAK GAIN(V)					
	4.9GHz	5.15GHz	5.35GHz	5.45GHz	5.725GHz	5.85GH
A6K -R	-0.88	-0.89	-1.43	-1.48	-0.49	-0.95

Appendix

Antenna Specification

(Ant#4 A7L / A7R)

Regulatory WLAN Antenna Information
2.45/5GHz A7 Multiple Band Antennas with Cable & Connector
For IEEE802.11b/g/a, UNII

(English Language Required for Intel Regulatory Review / Approval)

Brand Name	ASUS
Model Name	A7
Antenna Vendor	Yageo
Antenna Part Number	☐ Main Antenna: CAN4313 393 012501B
	☐ Aux Antenna: CAN4313 393 022501B
With WLAN Module	☐ WM3B2100
(Check Box)	☐ WM3B2200BG
	■ WM3B2915ABG
	☐ WM3945ABG

For ASUS A7 Antenna

Antenna Sample / Antenna Data
Requirements for worldwide regulatory approval

Section	Description of Required OEM / ODM Antenna Information	US / IC	EU	Japan	Taiwan	Korea
1A	Part Number for Antenna only	Required	Required	Required	Required	Required
1B	Antenna Manufacturer Name	Required	Required	Required	Required	Required
1C	Description of Antenna Type	Required	N/A	N/A	N/A	N/A
1D	Part number of Antenna Assembly / cable impedance, length & diameter.	Required	N/A	N/A	N/A	N/A
1E	Main & Aux antenna (Peak Gain W/ cable loss)	Required	Required	Required	Required	Required
	1E OR 1F, 1G, 1H					
1F	Main & Aux antenna (Peak Gain only)	Required	Required	Required	Required	Required
1G	VSWR of cable including connector	Required	Required	Required	Required	Required
1H	Main & Aux antenna (Cable loss W/ connector)	Required	Required	Required	Required	Required
2	Dimensioned Photographs or Drawings of main & auxiliary antennas	Required	Desired	Required	Required	Required
3	Radiation patterns of antennas loaded in the host platform.	Required	Desired	Required	Required	Required
4	Platform model name / number - correlated to antenna manufacturer and antenna part number	Required	Required	Required	Required	Required
5	Photograph(s) or Drawings showing location of antennas in platform.	Required	Required	Required	Required	Desired
6	Mech. drawings / photos with dimensions of antenna locations and distance from end-user (For evaluation of SAR testing requirement).	Required	N/A	N/A	N/A	N/A
7	Photograph(s) or Drawings showing the location of all antennas and distance those antennas. Information will be used to evaluate whether co-location testing is required.	Required	N/A	N/A	N/A	N/A

Antenna Information

Section 1. Antenna Assembly Specifications

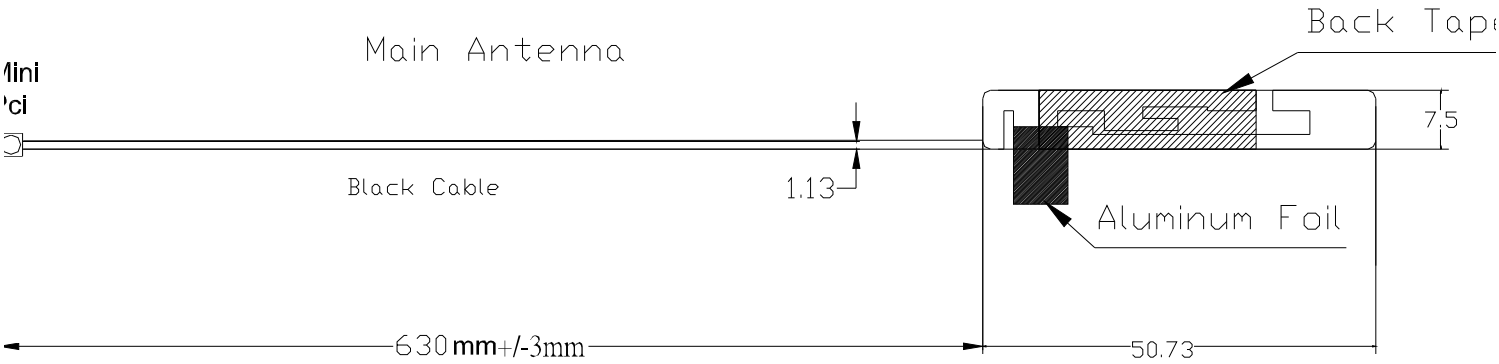
Antenna Assembly Summary:

1A Antenna Part Number	1B Manufacture	1C Antenna Type	1D Cable Assembly Part Number and Information	1E Peak Gain W/ Cable loss (dBi)	1F Peak Gain w/o Cable Loss (dBi)	1G VSWR	1H Cable Loss (dBi)
P/N: CAN4313393012501B Main Antenna	Phycomp/ Yageo Corporation	PIFA	Connector: (Hirose U.FL-LP) (Ipex MHF) 50 ohm Coaxial. Length: 630 mm diameter: 1.13mm	2400-2500MHz 2.13 dBi (peak)	2400-2500MHz 3.49 dBi (peak)	2400-2500MHz 2.5 max	2400-2500MHz 1.26 dBi (peak)
				5150-5350MHz -1.26 dBi (peak)	5150-5350MHz 0.05 dBi (peak)	5150-5350MHz 2.85 max	5150-5350MHz 1.31 dBi (peak)
				5470-5725MHz 0.03 dBi (peak)	5470-5725MHz 2.16 dBi (peak)	5470-5725MHz 2.85 max	5470-5725MHz 2.13 dBi (peak)
				5725-5850MHz 0.47 dBi (peak)	5725-5850MHz 2.58 dBi (peak)	5725-5850MHz 2.85 max	5725-5850MHz 2.10 dBi (peak)

Antenna Peak Gain Table:

Main Antenna Gain							
Frequency	Max Value (dBi)			Average (dBi)			PASS/NG
	H-pol	V-pol	Total	H-pol	V-pol	Total	
2400(MHz)	1.76	0.26	1.88	-3.75	-5.88	-2.56	PASS
2500(MHz)	1.96	2.13	2.17	-4.34	-5.29	-2.71	PASS
5150(MHz)	-1.37	-4.11	-1.37	-5.52	-9.61	-4.86	PASS
5350(MHz)	-1.26	-1.26	-0.98	-5.94	-7.62	-4.51	PASS
5470(MHz)	-1.00	-1.50	-0.76	-6.50	-7.34	-4.87	PASS
5725(MHz)	-0.81	0.03	0.14	-6.31	-5.18	-3.62	PASS
5850(MHz)	0.30	0.47	0.77	-5.96	-5.27	-3.52	PASS

Section 2. Dimensioned Photos or Drawings of Antennas



Section 2-1. Antenna Photos

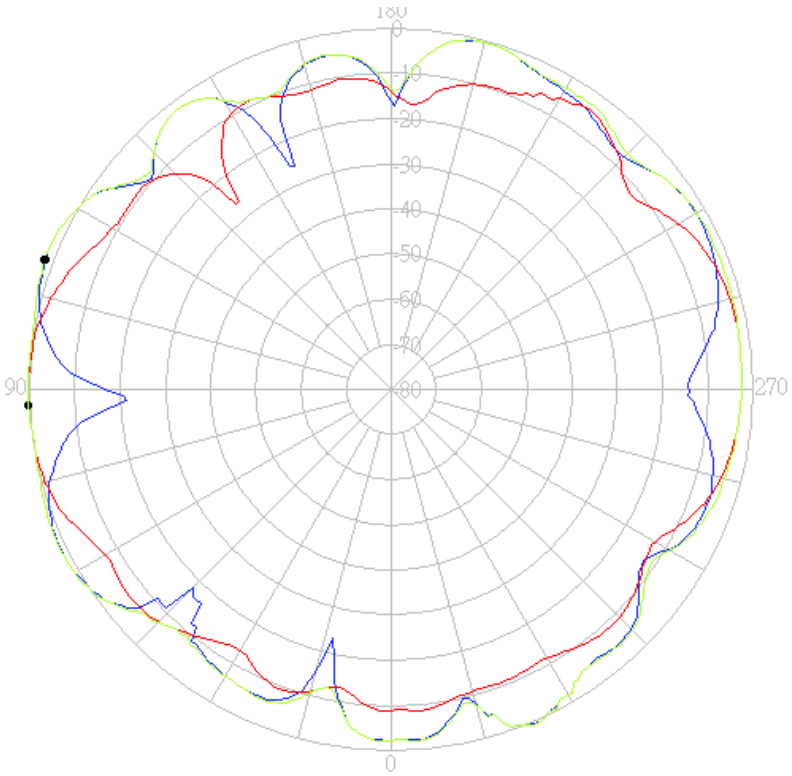
Main Antenna

Section 3. Radiation characteristics of antennae Loaded in Host Platform

Left Antenna: Red-Vertical Polarization; Blue-Horizontal Polarization)

3.1 Radiation pattern and gain

3.1.1 Low Frequency (2.40GHz~2.50GHz) / Main Antenna

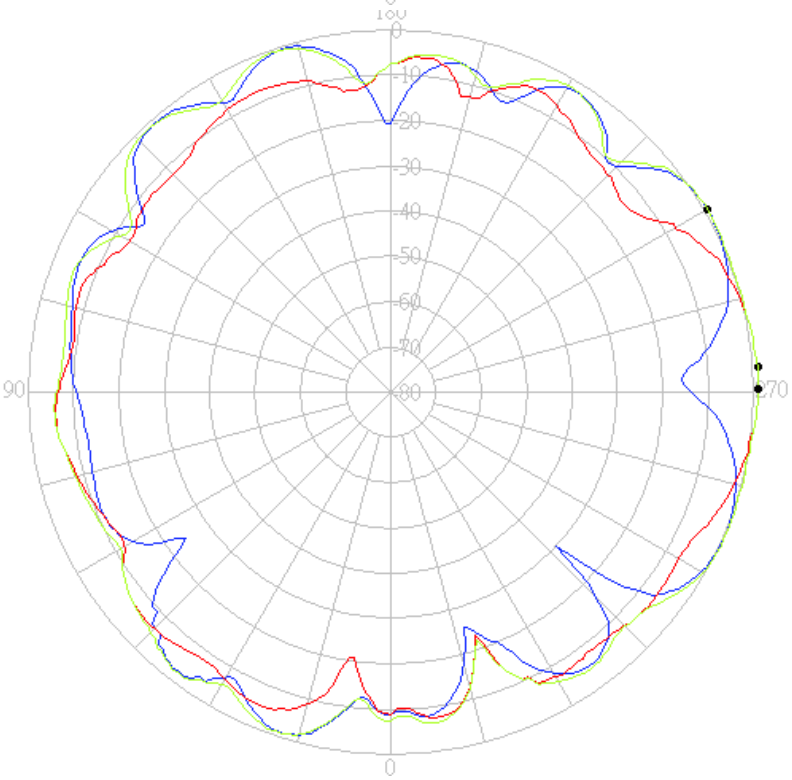


2.40GHz

Horizontal

Vertical

H+V



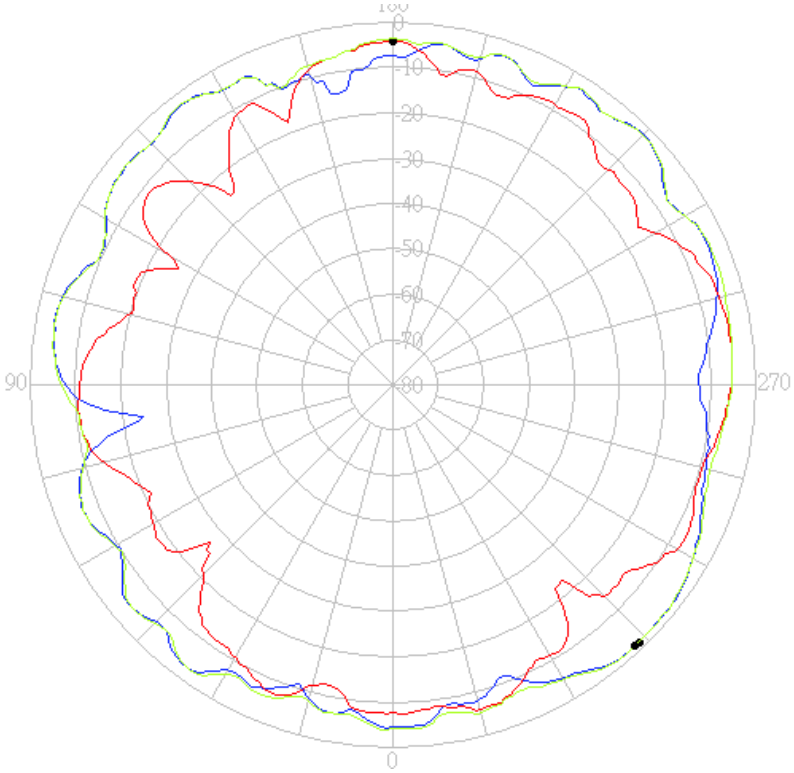
2.50GHz

Horizontal

Vertical

H+V

3.1.2 Middle Frequency (5.15GHz~5.35GHz) / Main Antenna

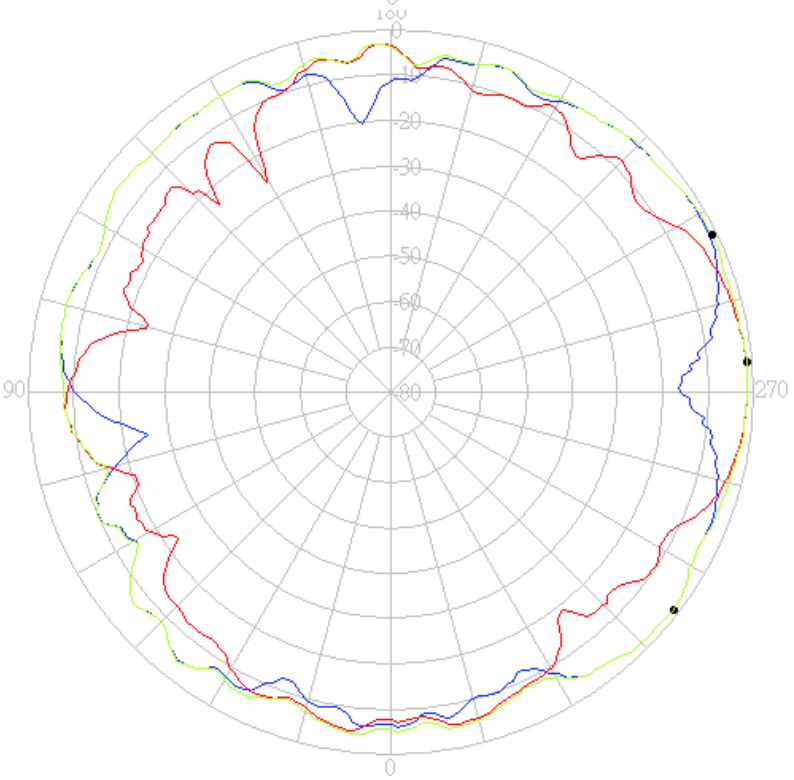


Horizontal

Vertical

H+V

5.15GHz



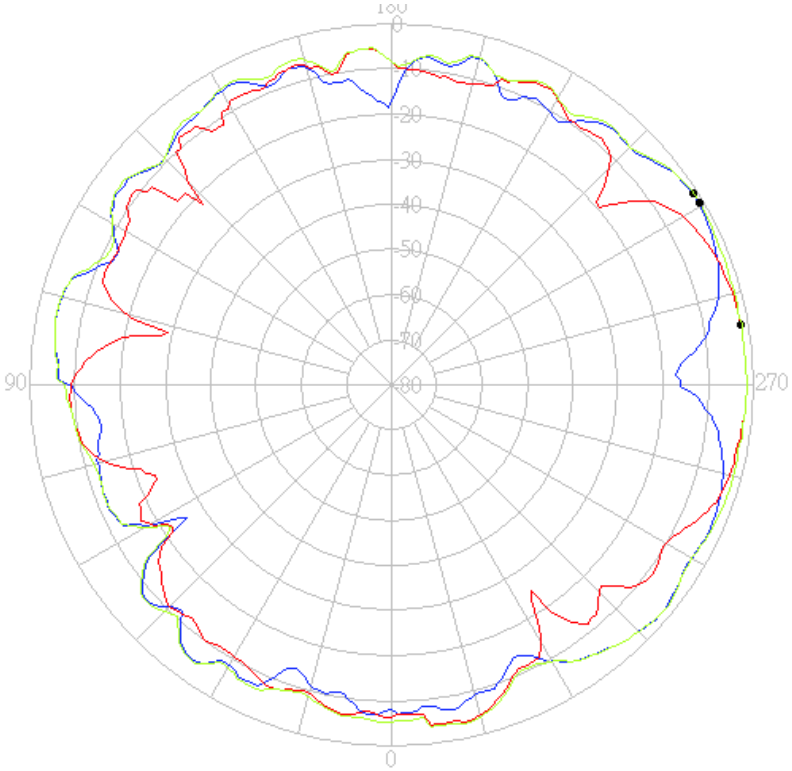
Horizontal

Vertical

H+V

5.35GHz

3.1.3 High Frequency (5.47GHz~5.85GHz) / Main Antenna

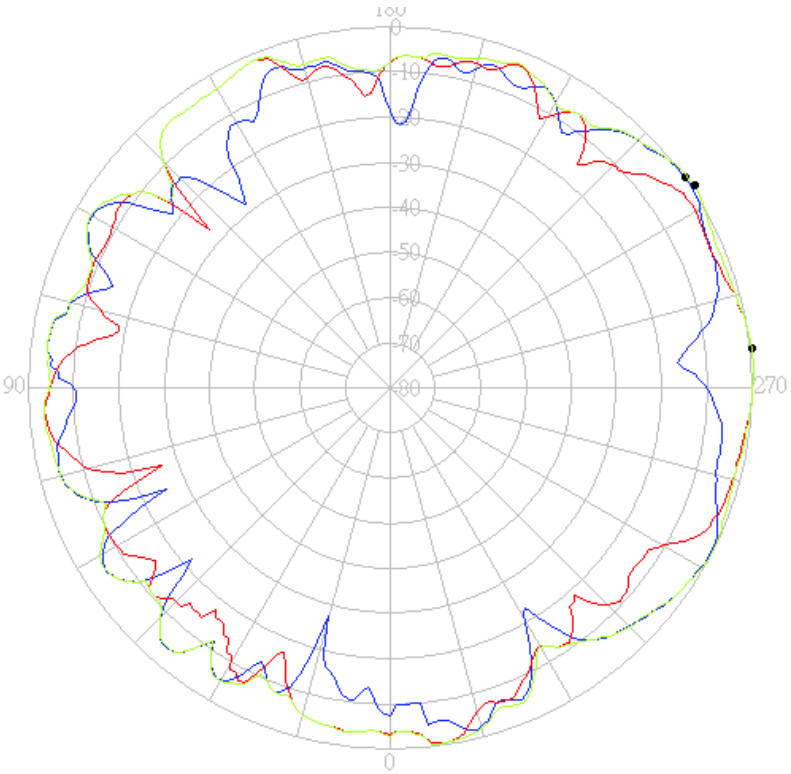


Horizontal

Vertical

H+V

5.47GHz



Horizontal

Vertical

H+V

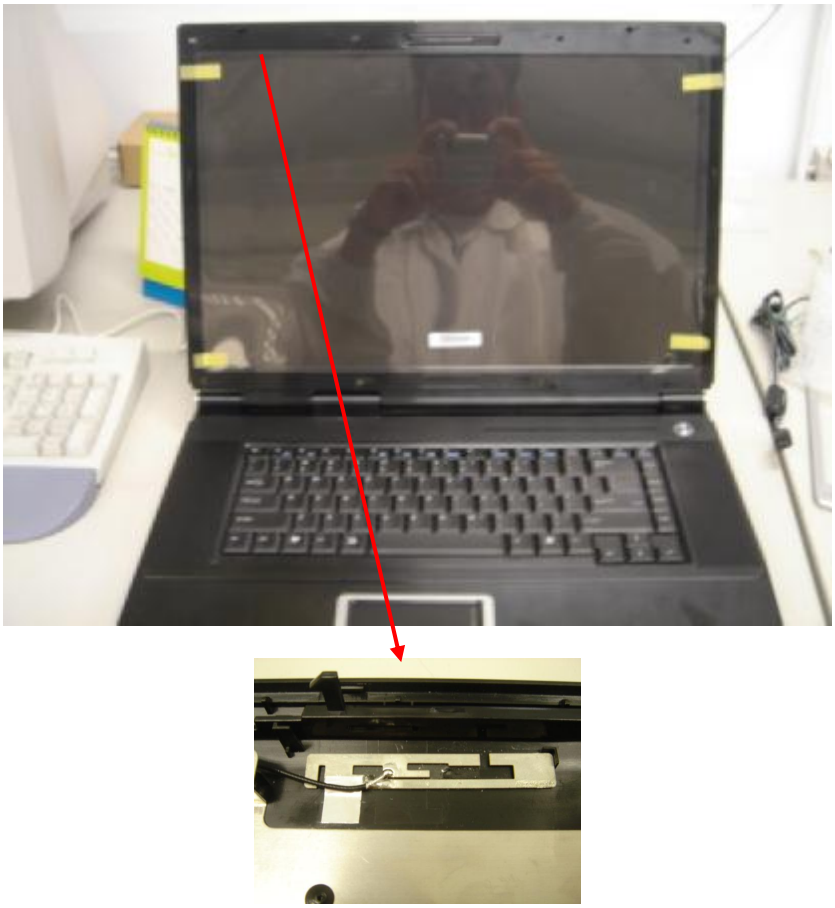
5.85GHz

Section 4. Host Platform Information

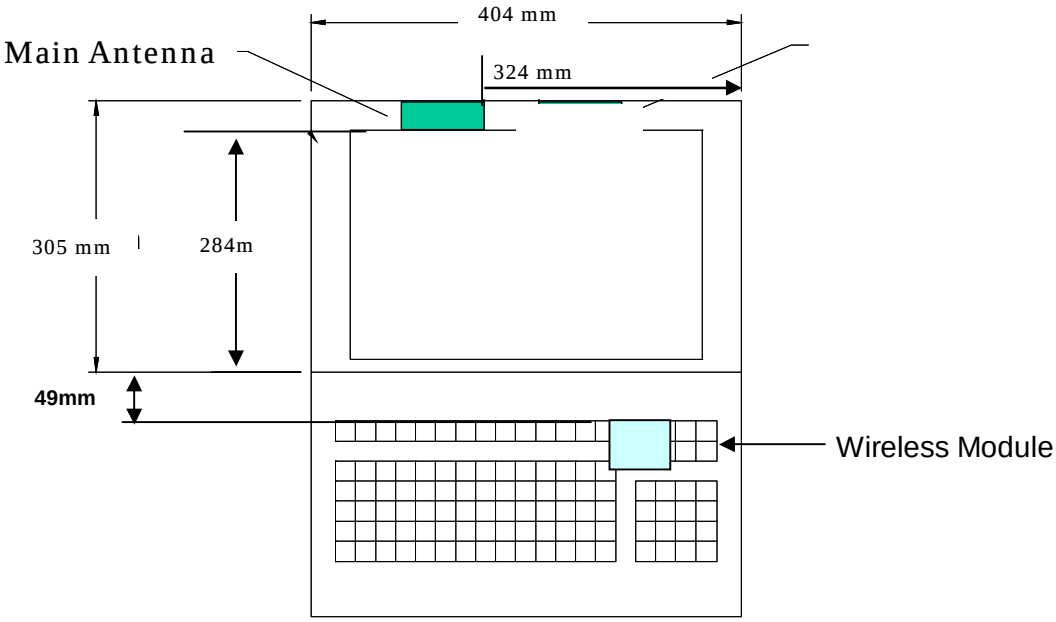
OEM / ODM Host platform: Asustek A7 Platform

Section 5. Antenna Host Platform Location Information

Include a dimensioned photos or dimensioned drawings of main and auxiliary antenna placements.

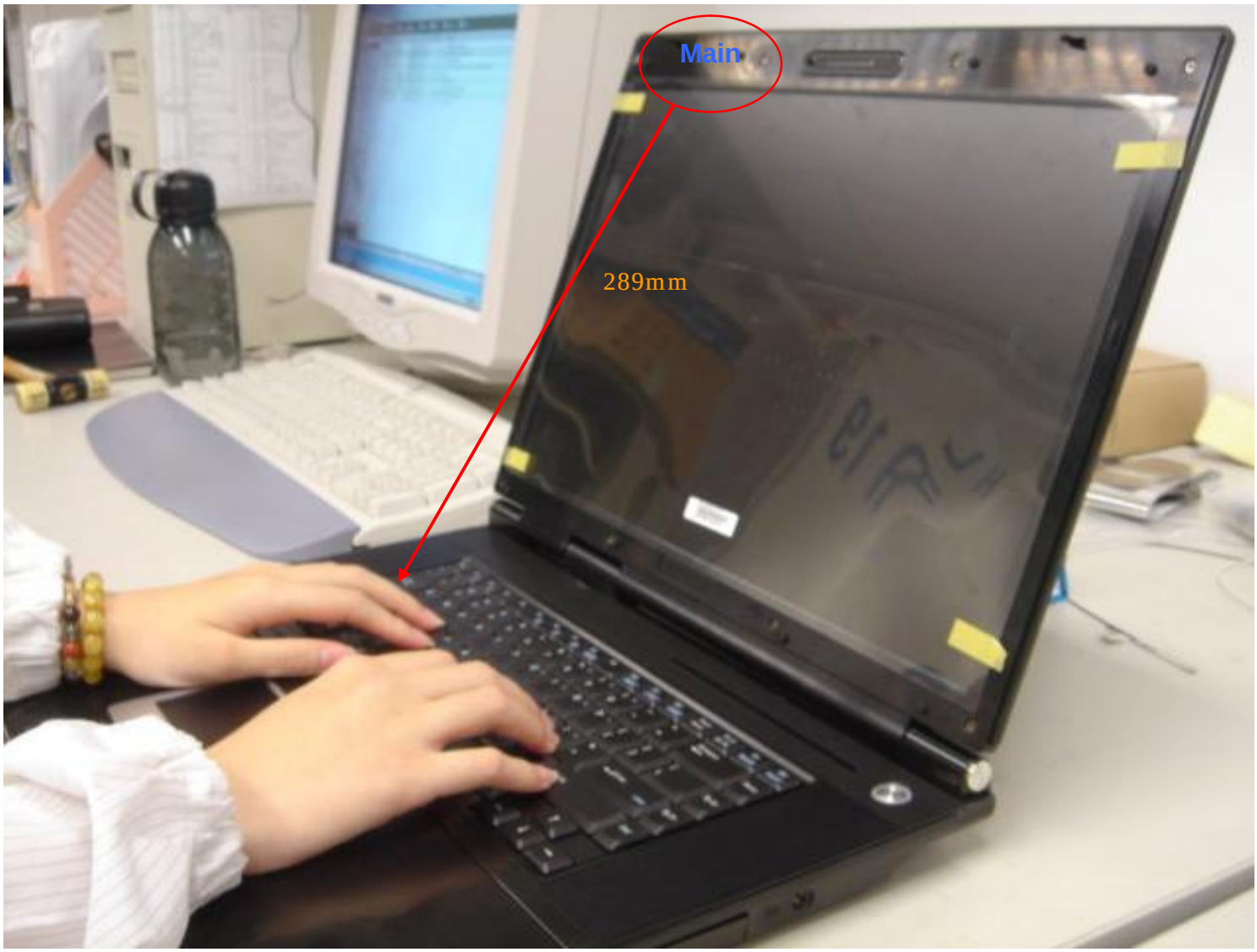


Left: Main Antenna



Section 6. Antenna dimensional information for SAR evaluation

Include a dimensioned photos or dimensioned drawings showing the distance (mm) between the transmit (main) antenna and the user (excluding hands, wrist, feet, and ankle)



Section 7. Diagram Example of Co-Location Antenna Separation

Indicate distance between WLAN module antennas and Bluetooth/other radio antenna element.

Note: Due to the evolving rules regarding co-location, each platform will need to be reviewed on a case by case basis)

No 2nd radiator available

Section 8. Local representative contact information

Local representative contact information is required for regulatory support for target countries below.

	Local company name	Contact name	Phone number	FAX Number	e-Mail Address	Notes
Argentina						
Brazil						
Indonesia						
Israel						
Malaysia						
Mexico						
Singapore						Telecommunication Equipment Dealer License Required
USA, Canada						

Appendix

Antenna Specification

(Ant#5 A5L / A5R)

Innovative Service Around the Globe YAGEO

Data Sheet

Product type	WLAN antenna
Model number	ASUS / A5
Revision	R02
Part No. / Yageo / Main / Aux	CAN4313 503 012501B / 022501B
Part No. / ASUS / Main / Aux	14-152060000

Yageo (Taiwan) Ltd.

16, west 3rd Street, N.E.P.Z Kaohsiung, 811 Taiwan, R.O.C

Yageo Electronics (China) Co, Ltd

No. 10, Zhu Yuan Road, Suzhou New District, Suzhou, PRC

2.45/5GHz Multi Band Antenna with Cable & Connector for IEEE802.11b, 11g, 11a, UNII		Yageo Part Number: Main / Aux: CAN4313 503 012501B CAN4313 503 022501B		R01	Apr. 18, 05
				R02	Apr. 27, 05
BY /	Howard.Chuang	DATE /	Apr. 27, 2005		

Specifications

1.1 Specifications for antennas

Frequency range (GHz)	2.40 ~ 2.50 for 802.11b/g 5.15 ~ 5.85 for 802.11a
VSWR	2.50 for 2.4GHz band For WL 2.85 for 5.0GHz band For WL
Peak gain (dBi)	2.10 dBi for 2.4GHz band 1.30 dBi for 5.0GHz band
MiniPCI Connector	Ipex / Hirose or Compatible
Impedance	50Ω
Operating Temperature	-40~90℃
Maximum Power	1W
Polarization	Linear
Radiation pattern	Omni-directional

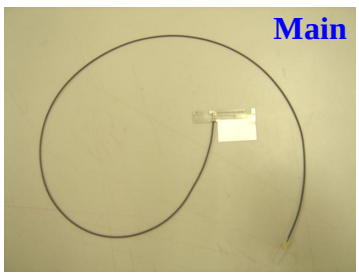
1.2 Antenna Dimension / Cable length

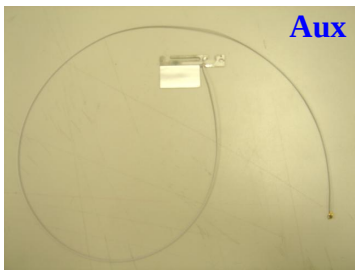
Product	ASUS / A5
Main antenna (LCD)	46.0*9.0*0.4 mm / 445.0 mm, Color Black
Aux antenna (LCD)	46.0*9.0*0.4 mm / 600.0 mm, Color White or Gray

1.3 Packing Spec.

Product	For Example
Inner tray	60
Carton box	265*100

1.4 Antenna Pictures



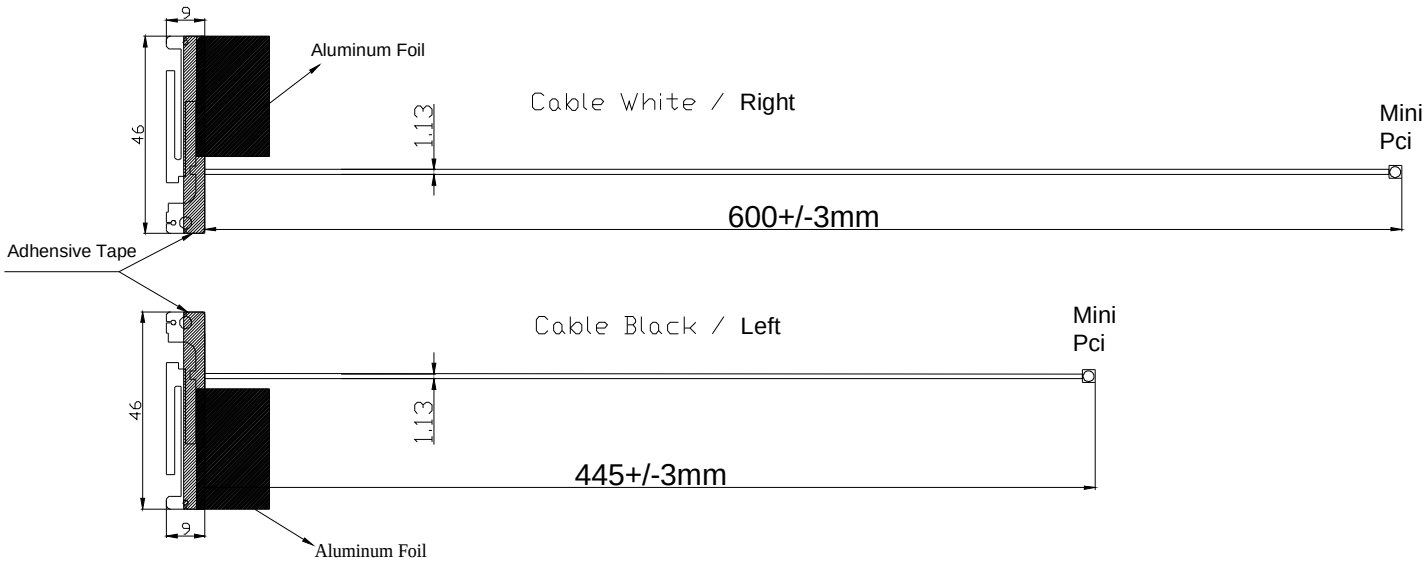


Average gain (dBi) summary

Main Antenna Gain							
Frequency	Max Value (dBi)			Average (dBi)			PASS/NG
	H-pol	V-pol	Total	H-pol	V-pol	Total	
2400(MHz)	1.10	-0.40	1.44	-6.94	-6.15	-4.63	PASS
2500(MHz)	1.63	1.13	2.06	-5.54	-5.61	-3.64	PASS
5150(MHz)	-2.28	-0.78	-0.57	-6.69	-5.63	-4.19	PASS
5350(MHz)	0.90	0.40	1.24	-5.98	-5.35	-3.76	PASS
5470(MHz)	-0.50	0.50	0.63	-6.85	-6.46	-4.72	PASS
5725(MHz)	-1.47	0.03	0.08	-8.25	-4.95	-4.18	PASS
5850(MHz)	-0.20	0.80	0.93	-7.57	-4.89	-3.96	PASS

Aux Antenna Gain							
Frequency	Max Value (dBi)			Average (dBi)			PASS/NG
	H-pol	V-pol	Total	H-pol	V-pol	Total	
2400(MHz)	2.10	0.43	2.28	-4.94	-5.82	-3.29	PASS
2500(MHz)	0.96	0.13	1.33	-5.88	-6.40	-4.17	PASS
5150(MHz)	-2.94	-0.28	-0.27	-7.75	-5.85	-4.67	PASS
5350(MHz)	-2.26	0.07	0.11	-8.31	-5.78	-4.80	PASS
5470(MHz)	-2.67	-0.36	-0.15	-8.21	-5.75	-4.84	PASS
5725(MHz)	-2.47	0.54	0.54	-9.14	-5.48	-4.80	PASS
5850(MHz)	-3.03	1.30	1.30	-9.35	-5.55	-4.83	PASS

Antenna Drawing



Regulatory WLAN Antenna Information
2.45/5GHz A5 Multiple Band Antennas with Cable & Connector
For IEEE802.11b/g/a, UNII

(English Language Required for Intel Regulatory Review / Approval)

Brand Name	ASUS
Model Name	A5
Antenna Vendor	Yageo
Antenna Part Number	☐ Main Antenna: CAN4313 503 012501B
	☐ Aux Antenna: CAN4313 503 022501B
With WLAN Module	☐ WM3B2100
(Check Box)	☐ WM3B2200BG
	■ WM3B2915ABG
	☐ WM3945ABG

For ASUS A5 Antenna

Antenna Information

Antenna Assembly Specifications

Antenna Assembly Summary

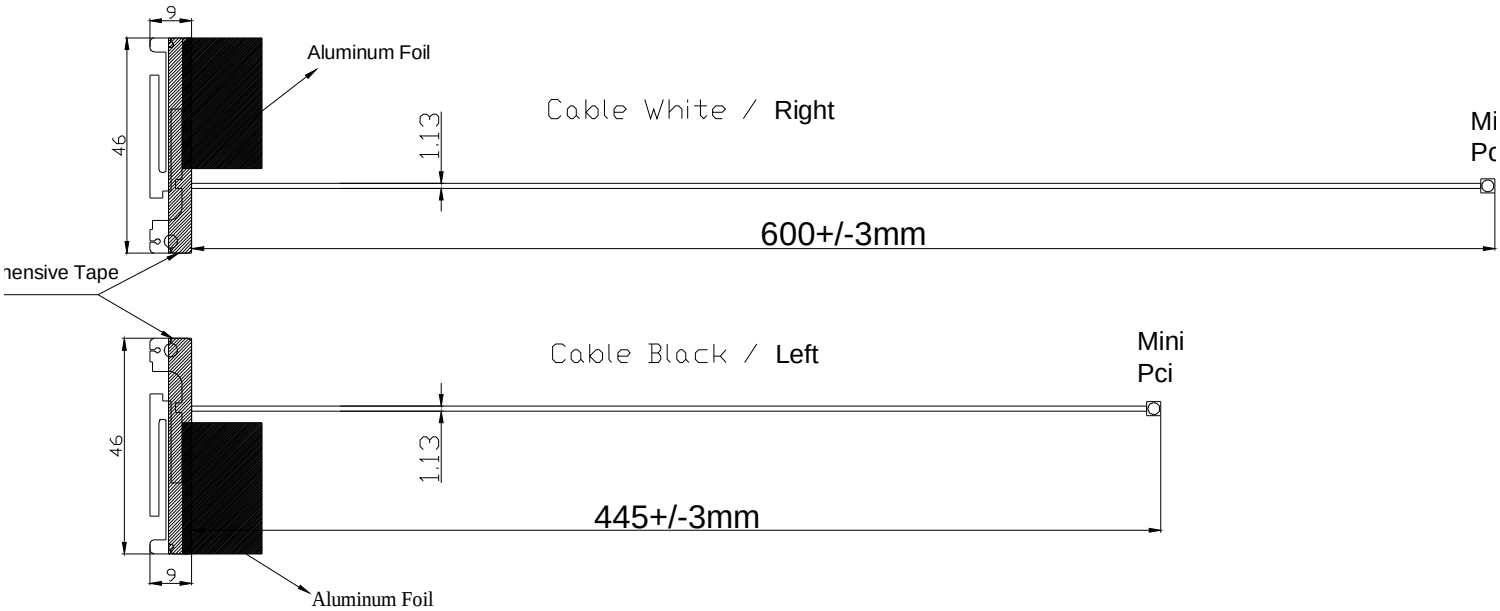
1A Antenna Part Number	1B Manufacture	1C Antenna Type	1D Cable Assembly Part Number and Information	1E Peak Gain W/ Cable loss (dBi)	1F Peak Gain w/o Cable Loss (dBi)	1G VSWR	1H Cable Loss (dBi)
P/N: CAN4313503012501B Main Antenna	Phycomp/ Yageo Corporation	PIFA	Connector: (Hirose U.FL-LP) (Ipex MHF) 50 ohm Coaxial. Length: 445mm diameter: 1.13mm	2400-2500MHz 1.63 dBi (peak)	2400-2500MHz 2.81 dBi (peak)	2400-2500MHz 2.5 max	2400-2500MHz 1.18 dBi (peak)
				5150-5350MHz 0.90 dBi (peak)	5150-5350MHz 2.16 dBi (peak)	5150-5350MHz 2.85 max	5150-5350MHz 1.26 dBi (peak)
				5470-5725MHz 0.50 dBi (peak)	5470-5725MHz 2.52 dBi (peak)	5470-5725MHz 2.85 max	5470-5725MHz 2.02 dBi (peak)
				5725-5850MHz 0.80 dBi (peak)	5725-5850MHz 2.76 dBi (peak)	5725-5850MHz 2.85 max	5725-5850MHz 1.96 dBi (peak)
P/N: CAN4313503022501B Auxiliary Antenna	Phycomp/ Yageo Corporation	PIFA	Connector: (Hirose U.FL-LP) (Ipex MHF) 50 ohm Coaxial. Length: 600mm diameter: 1.13mm	2400-2500MHz 2.10 dBi (peak)	2400-2500MHz 3.46 dBi (peak)	2400-2500MHz 2.5 max	2400-2500MHz 1.36 dBi (peak)
				5150-5350MHz 0.07 dBi (peak)	5150-5350MHz 2.42 dBi (peak)	5150-5350MHz 2.85 max	5150-5350MHz 2.35 dBi (peak)
				5470-5725MHz 0.54 dBi (peak)	5470-5725MHz 2.84 dBi (peak)	5470-5725MHz 2.85 max	5470-5725MHz 2.30 dBi (peak)
				5725-5850MHz 1.30 dBi (peak)	5725-5850MHz 3.74 dBi (peak)	5725-5850MHz 2.85 max	5725-5850MHz 2.44 dBi (peak)

Antenna Peak Gain Table:

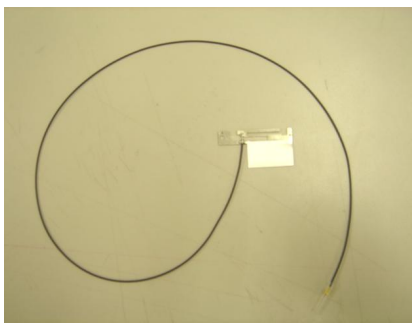
Main Antenna Gain							
Frequency	Max Value (dBi)			Average (dBi)			PASS/NG
	H-pol	V-pol	Total	H-pol	V-pol	Total	
2400(MHz)	1.10	-0.40	1.44	-6.94	-6.15	-4.63	PASS
2500(MHz)	1.63	1.13	2.06	-5.54	-5.61	-3.64	PASS
5150(MHz)	-2.28	-0.78	-0.57	-6.69	-5.63	-4.19	PASS
5350(MHz)	0.90	0.40	1.24	-5.98	-5.35	-3.76	PASS
5470(MHz)	-0.50	0.50	0.63	-6.85	-6.46	-4.72	PASS
5725(MHz)	-1.47	0.03	0.08	-8.25	-4.95	-4.18	PASS
5850(MHz)	-0.20	0.80	0.93	-7.57	-4.89	-3.96	PASS

Aux Antenna Gain							
Frequency	Max Value (dBi)			Average (dBi)			PASS/NG
	H-pol	V-pol	Total	H-pol	V-pol	Total	
2400(MHz)	2.10	0.43	2.28	-4.94	-5.82	-3.29	PASS
2500(MHz)	0.96	0.13	1.33	-5.88	-6.40	-4.17	PASS
5150(MHz)	-2.94	-0.28	-0.27	-7.75	-5.85	-4.67	PASS
5350(MHz)	-2.26	0.07	0.11	-8.31	-5.78	-4.80	PASS
5470(MHz)	-2.67	-0.36	-0.15	-8.21	-5.75	-4.84	PASS
5725(MHz)	-2.47	0.54	0.54	-9.14	-5.48	-4.80	PASS
5850(MHz)	-3.03	1.30	1.30	-9.35	-5.55	-4.83	PASS

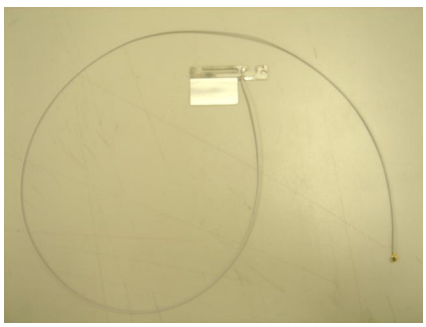
Dimensioned Photos or Drawings of Antennas



Antenna Photos



Main Antenna



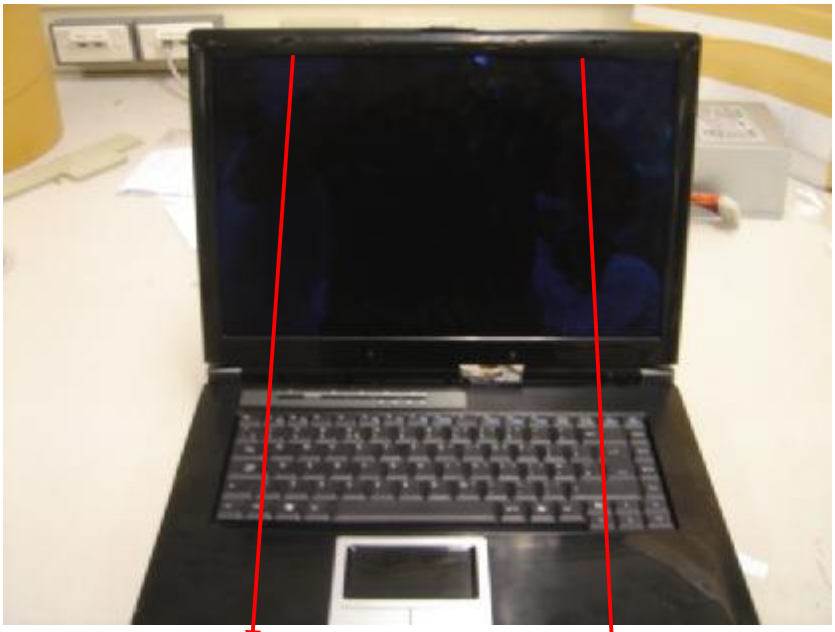
Aux Antenna

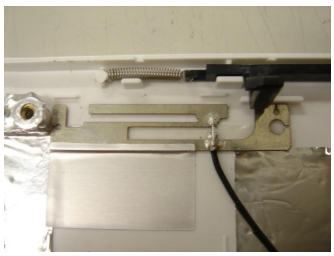
Host Platform Information

OEM / ODM Host platform: Asustek A5 Platform

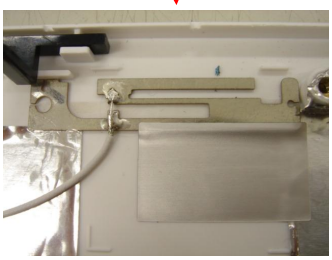
Antenna Host Platform Location Information

Include a dimensioned photos or dimensioned drawings of main and auxiliary antenna placements

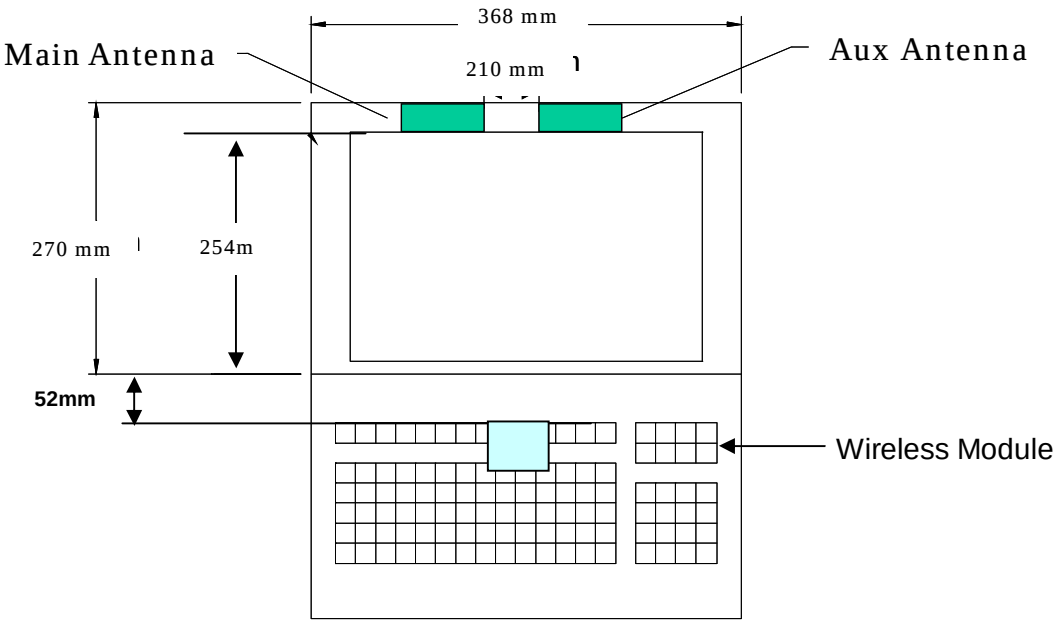




Left: Main Antenna

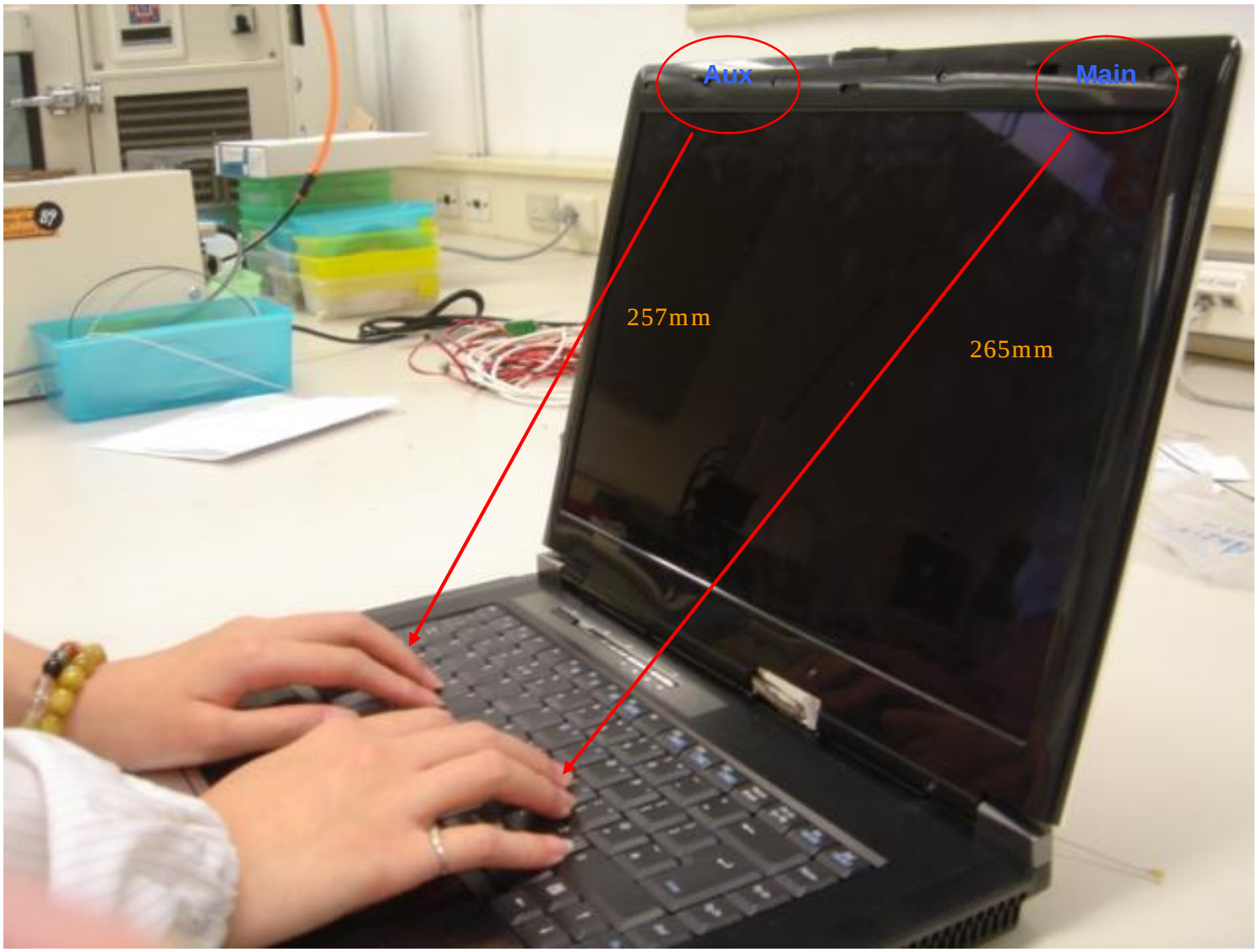


Right: Aux Antenna



Antenna dimensional information for SAR evaluation

Include a dimensioned photos or dimensioned drawings showing the distance (mm) between the transmit (main) antenna and the user (excluding hands, wrist, feet, and ankle



Appendix

Antenna Specification

(Ant#6 A3L / A3R)

DATA SHEET

2.45/5GHz A3 Dual Band Antenna with Cable & Connector for IEEE802.11b/g/a, UNII

Nov 25, 2004

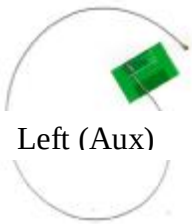
2.45/5GHz A3 Dual Band Antenna with Cable & Connector for IEEE802.11b, 11a, UNII				Yageo Main:CAN4313 374 012521B ASUS Main: 14-152035102 Yageo Main:CAN4313 374 022521B ASUS Aux: 14-152035001					— ▶	1	June 02, 04
									— ▶	2	July 07, 04
									— ▶	3	July 09, 04
BY / 製定者	YM Shen/ Cliff	SUPER / 原圖編號		TLL.SH / 共頁	9	PAGE/ 頁	1	SH nr.	— ▶	3	Nov. 25, 04
CHECK				DATE / 日期	Nov. 25, 2004				— ▶		

A3 Dual Band Antenna
FOR WLAN IEEE 802.11b/g/a, UNII
(With Cable & Mini PCI Connector)

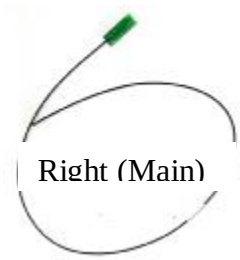
Product Specification

QUICK REFERENCE DATA

Antenna Patch Dimension	46*30*0.4 mm Left Antenna (Aux, White or Gray)
	28*10*0.4 mm Right Antenna (Main, Black)
Coaxial Cable Length Aux (Left)	470 mm, Color Gray or White
Coaxial Cable Length Main (Right)	560 mm, Color Black (**Black** is **Main!**)
MiniPCI Connector	Ipex/Hirose or Compatible
Max Gain	1.3 dBi/2.45GHz; 1.0 dBi/5GHz
VSWR	2.85 for 2.45GHz band
	2.85 for 5.15~5.35 GHz band
Polarization	Linear
Impedance	50Ω
Operating Temperature	-40~90 ^{o}C
Maximum Power	1W



Left (Aux)

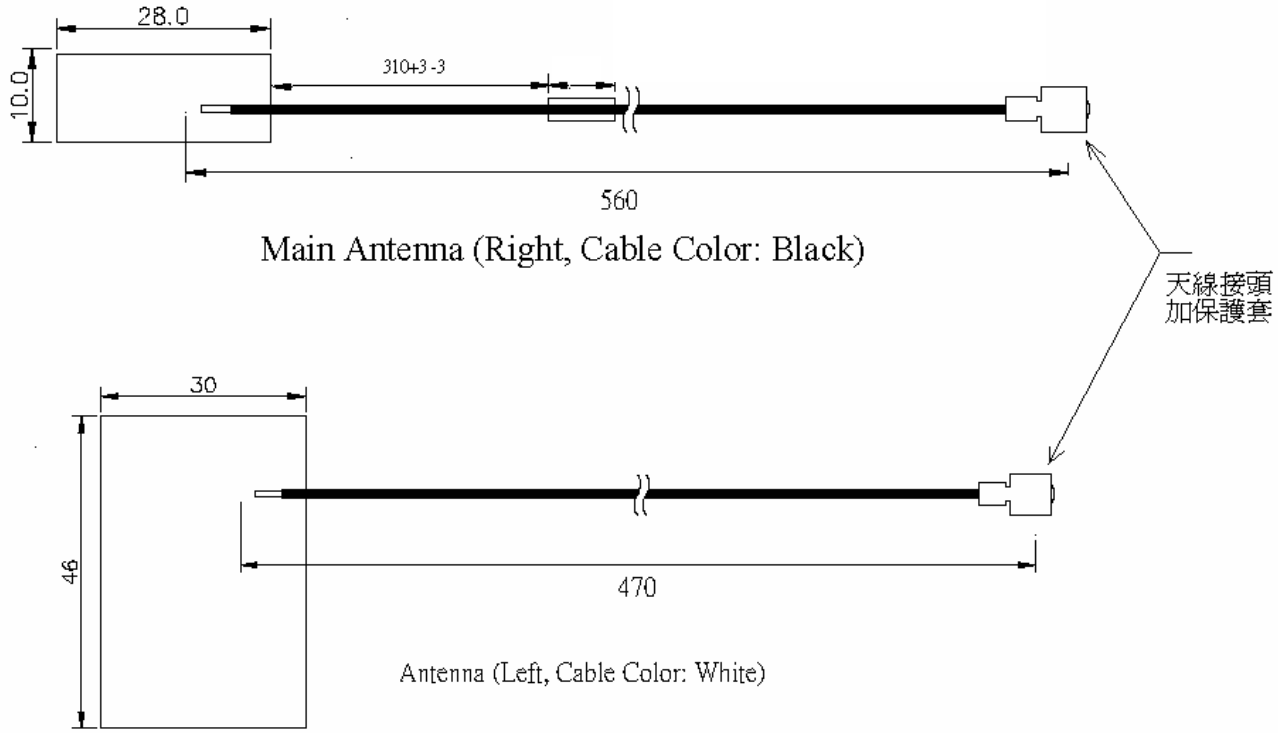


Right (Main)

DIMENSIONAL DATA and Connector/Cable Information

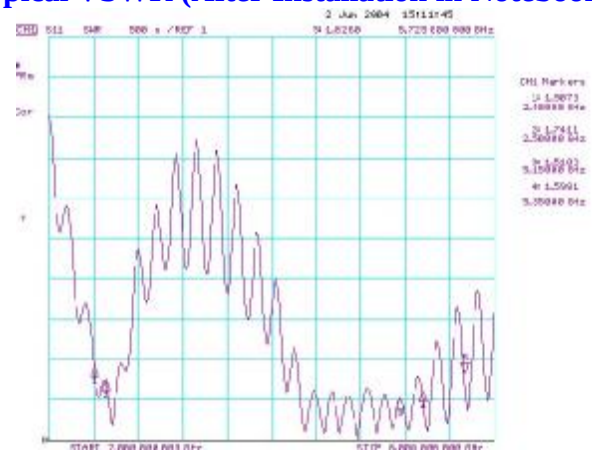
(Mark: 19.0±1)

Dimension **and Connector/Cable Information (PCB Tolerance +-0.25, cable +-5 mm)**

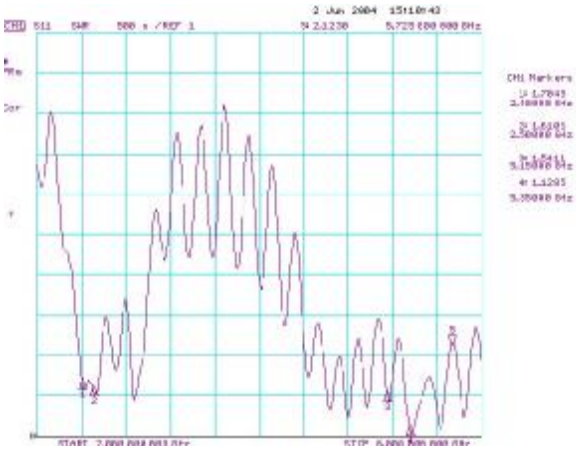


Note: The coax cable will be a 1.13mm diameter cable, single shielded, cable. It's inner conductor of the cable is silver-coated annealed copper wire or silver plated tin-copper alloy, the dielectric is a flouro-plastic (FEP) with a nominal diameter of 0.68mm and a nominal thickness of 0.22mm, the outer conductor is silver plated annealed copper wire with a nominal diameter of 0.93mm, and the jacket is a flouro-plastic (FEP) with an outer diameter of 1.13mm with a nominal thickness of 01.mm. The cable has a characteristic impedance of 50ohm, an insulation resistance of 1500meg-ohm/km maximum, and no breakdown for a dielectric withstanding voltage of 2000VAC for 1 minute. The insertion loss of a 250mm long cable assembled on both ends shall be no more than 0.85dB at 2.45GHz and no more than –1.5dB at 6.0GHz.

Typical VSWR (After Installation in Notebook)



Main Antenna VSWR (Right)

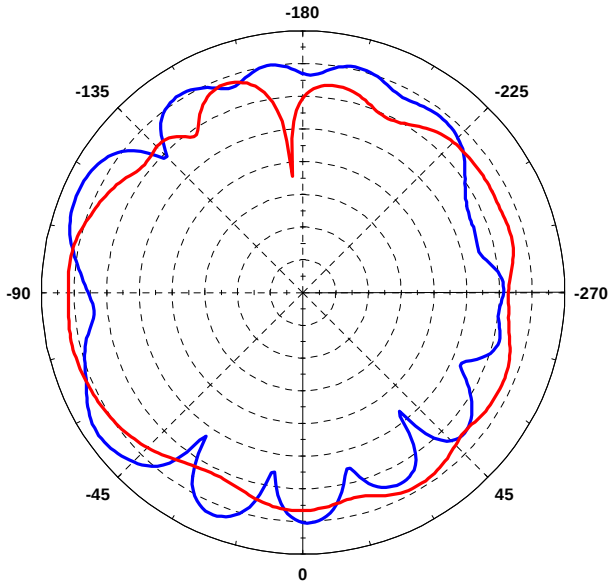


Aux Antenna VSWR (Left)

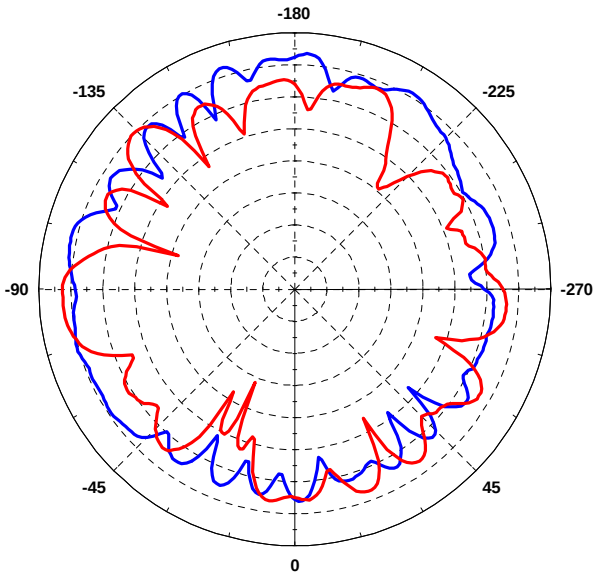
Note: May vary for different devices

Typical Radiation Pattern Polar Plot (Based on After Antenna Installation)

- Main Antenna (Right Antenna: Red-Vertical Polarization; Blue-Horizontal Polarization)

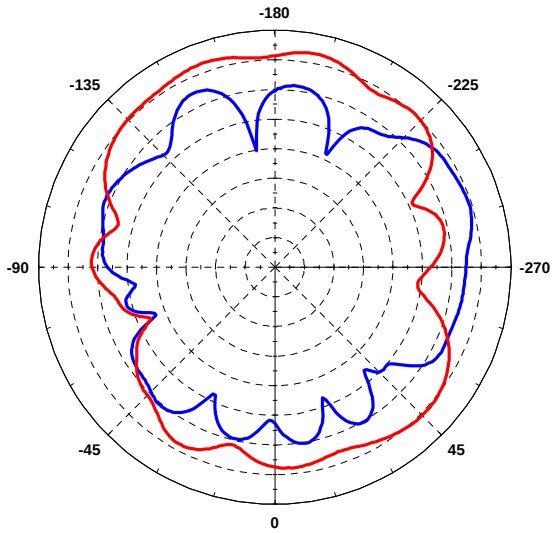


LCD Open 2450 MHz
(Total Max. Gain: 1.3dBi; Average Gain: -4.6 dBi)

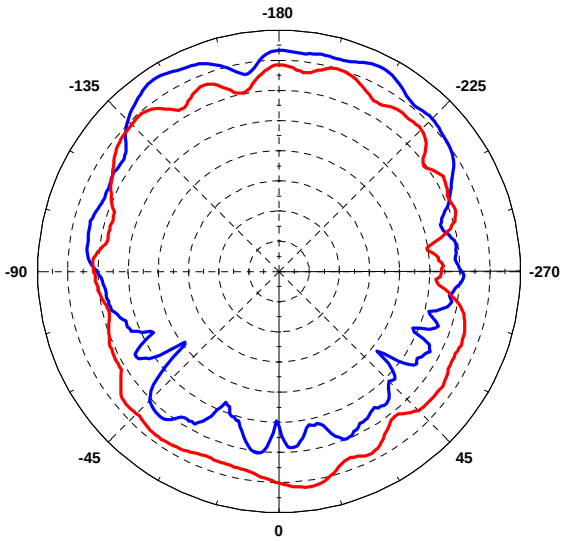


LCD Open 5250 MHz
(Total Max. Gain: -1.4dBi; Average Gain: -6.9 dBi)

- Aux Antenna (Left Antenna)



LCD Open 2450 MHz
(Total Max. Gain: -1.7dBi; Average Gain: -6.6 dBi)



LCD Open 5250 MHz
(Total Max. Gain: 1.0dBi; Average Gain: -5.5 dBi)

Note: May vary for different devices

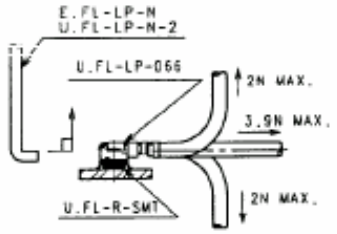
[PRECAUTIONS FOR HANDLING]

•Connector insertion and extraction

a.Connector shall be extracted vertically by specialised extraction JIG.
Part No.:E.FL-LP-N(CL Code:CL331-0441-9)
U.FL-LP-N-2(CL Code:CL331-0494-5)
Never hold the cable when extracting the cable because it damages the connector.

b.Insert the connector as perpendicularly to the mating surface as possible by aligning the mating axes of both connectors. Do not excessively slant the connectors when inserting.

•Allowable loads on the cable after the connectors are mated.
The figures below show the maximum allowable loads on the cable. Do not apply loads exceeding these values to the cable.



Use proper tooling to remove antenna cable such with proper force

Reliability Data for Connector

Item	Specification		Conditions
1. Contact resistance	Center: 20 mΩ max. Outside: 10 mΩ max.		Measured at 10 mA max.
2. Insulation resistance	500 MΩ min.		Measured at 100 V DC
3. Withstand voltage	No line or insulation breakdown		200 V AC for 1 minute
4. V.S.W.R.*	1.3 max.		DC to 3 GHz
	Dia.0.81Cable	1.35	3 to 6 GHz
	Dia.1.13Cable	1.4	
	Dia.1.32Cable	1.5	
5. Female contact holding force	0.15 N min.		Measured with a ϕ 0.475 pin gauge
6. Repetitive operation	Contact resistance 25 mΩ max. (Center) 15 mΩ max. (Outside)		30 cycles of insertion and disengagement
7. Vibration	No momentary disconnections of 1 μs min. No damage, cracks, or parts looseness min.		Frequency of 10 to 100 Hz, single amplitude of 1.5 mm, acceleration of 59 m/s², for 5 cyles in the direction of each of the 3 axes
8. Shock	No momentary disconnections of 1 μs min. No damage, cracks, or parts looseness		Acceleration of 735 m/s², 11 ms duration, sine half-wave waveform, for 6 cycles in the direction of each of the 3 axes
9. Humidity resistance (Steady state)	No damage, cracks, or parts looseness Insulation resistance 100 MΩ min.(High temperature) Insulation resistance 500 MΩ min.(Pry)		Temperature of 40˚C, humidity of 95%, let stand for 96 hours
10. Temperature cycle	No damage, cracks, or parts looseness Contact resistance 25 mΩ max. (Center) 15 mΩ max. (Outside)		Temperature: +40˚C → 5 to 35˚C → +90˚C → 5 to 35˚C Time: 30 min. → Within 5 min. → 30 min. → Within 5 min. Cycles: 5
11. Salt spray test	No excessive corrosion		48 hours continuous exposure to 5% salt water

RELIABILITY DATA for Antenna Patch (Reference to IEC Specification)

IEC 384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.12	4(Na)	Rapid change of temperature	-40 °C (30 minutes) to +90 °C (30 minutes); 100 cycles	No visible damage Central Freq. Change ± 6%
4.14	3(Ca)	Damp heat	500 ± 12 hours at 40 °C; 90 to 95 % RH	No visible damage 2 hours recovery Central Freq. Change ± 6%
4.15		Endurance	500 ± 12 hours at 90 °C;	No visible damage 2 hours recovery Central Freq. Change ± 6%

ORDERING INFORMATION: Method I- by 12NC Ordering Code

The antennas may be ordered by using the 12 NC ordering code. These code numbers can be determined by the following rules:

CAN4313 3 74 01 2521B CAN4313 3 74 02 252 1B
F C M S T A

F. Family Code
43 = Antenna
C. Packing Type Code
13 = Bulk (1000 pcs)
M. Materials Code
3 = High Frequency Material
S. Size Code
74 = 28*10*0.4 mm right main antenna; 46*30*0.4 mm left aux antenna
T. Tolerance/Cable
01 = Cable 1 right main antenna; **02** = Cable 2 left aux antenna
A. Working Frequency
252 = 2.45/5.2 GHz Dual Band
P. Packing
1B = **1000 pcs packing**

Revision Control:

Revision	Date	Content	Remark
1	June 02, 2004	Update A2 cable length	N/A
2	July 07, 2004	Update mark position (Mechanical Request)	N/A
3	July 09, 2004	Update mark position (Mechanical Request)	N/A
4	Nov. 25, 2004	Update ASUS P/N	N/A