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	**:**	MSQWL120GV2A
Product name	**:**	Wireless Mini-PCI Module
Model	**:**	WL-120g V2A
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: $S = \frac{PG}{4pR^2} = \frac{126.77 \times 1.67}{4p\,(20)^2} = 0.021 mW / cm^2$

Estimated safe separation: $R = \sqrt{\frac{PG}{4p}} = \sqrt{\frac{126.77 \times 1.67}{4p}} = 4.10 cm$

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:

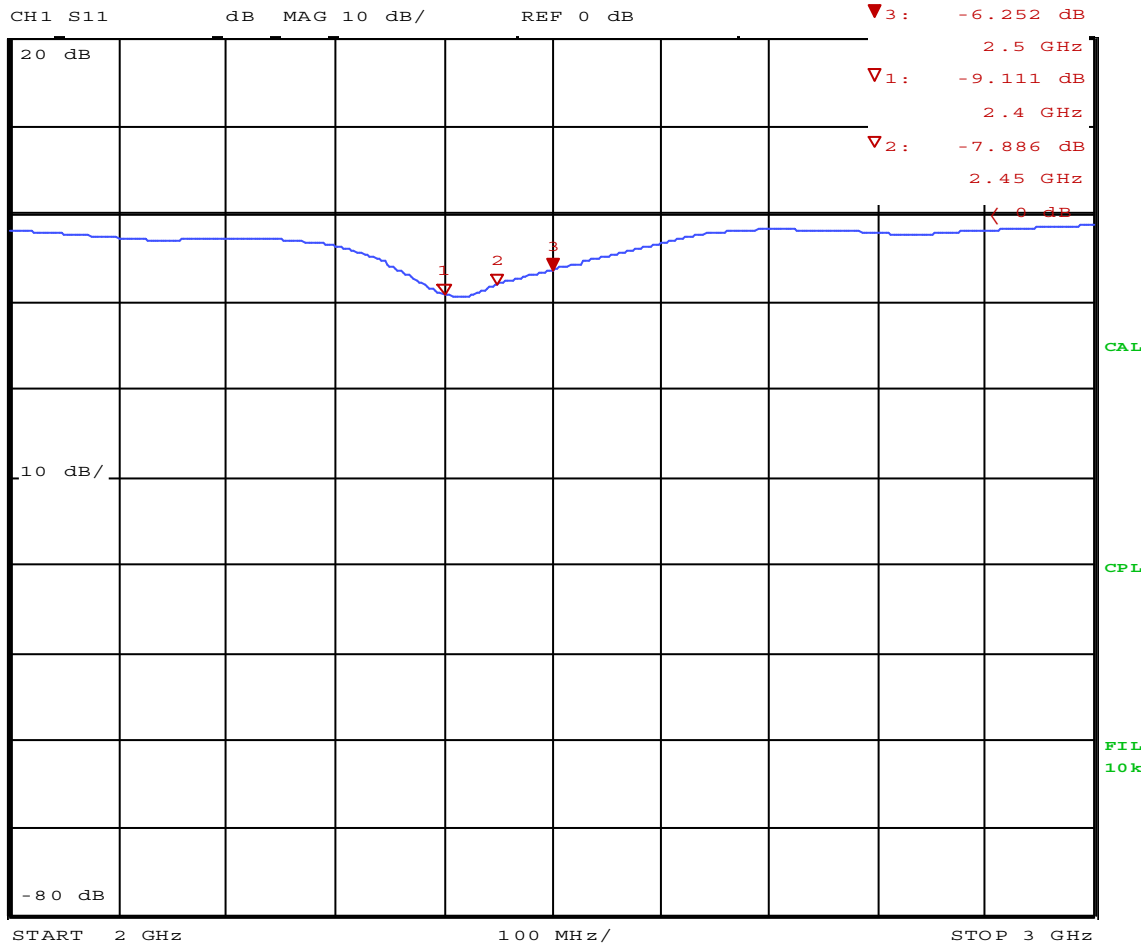
$G = \text{Log}^{-1}$ (***dB*** antenna gain / 10)

$G = \text{Log}^{-1}$ (2.24 / 10) = 1.67

Appendix

Antenna Specification

(Antenna#1 Printed Antenna)



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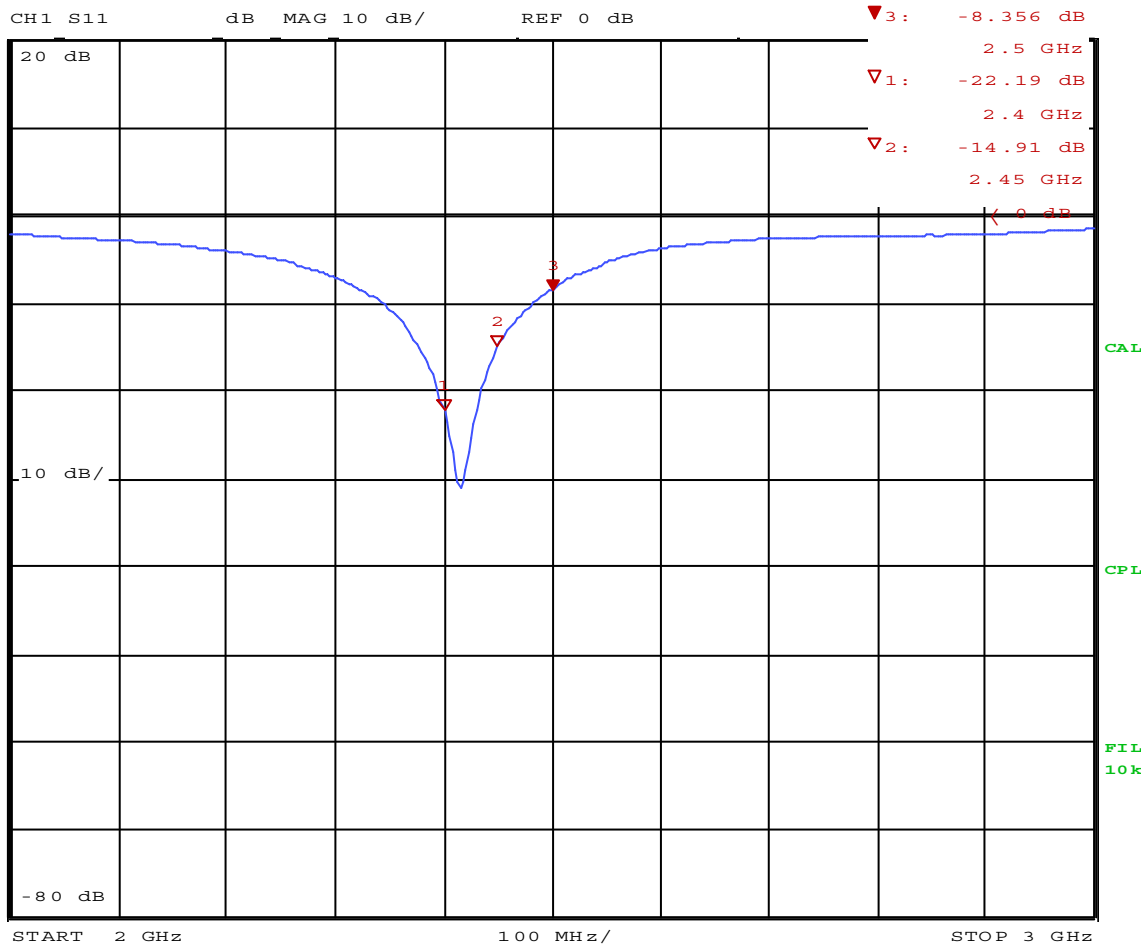
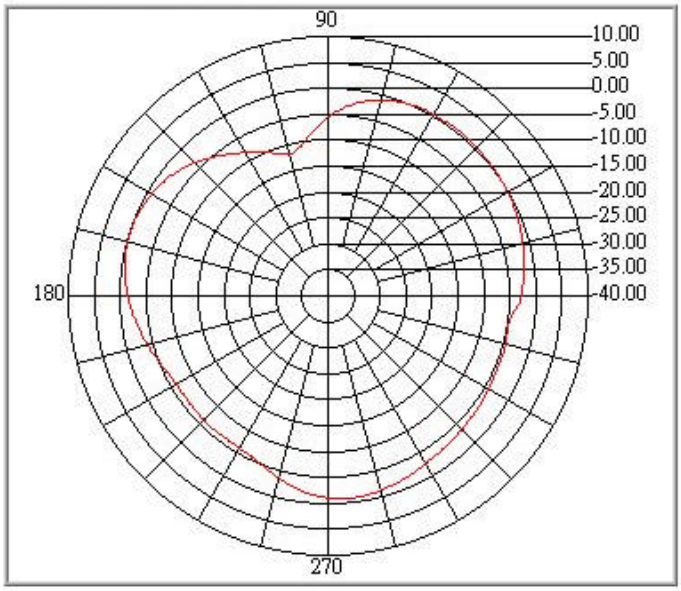


Date: 28.MAR.03 02:14:25

Model No: WL120G-X **Antenna Position**: Horizontal

Frequency 2450.00 **MHz**



Peak: 0.55 dBi **Peak Angle**: 49.59 Degree

Average: -3.28 dBi

Test engineer:_____

Test date: 2003/4/1 at AM 08:49

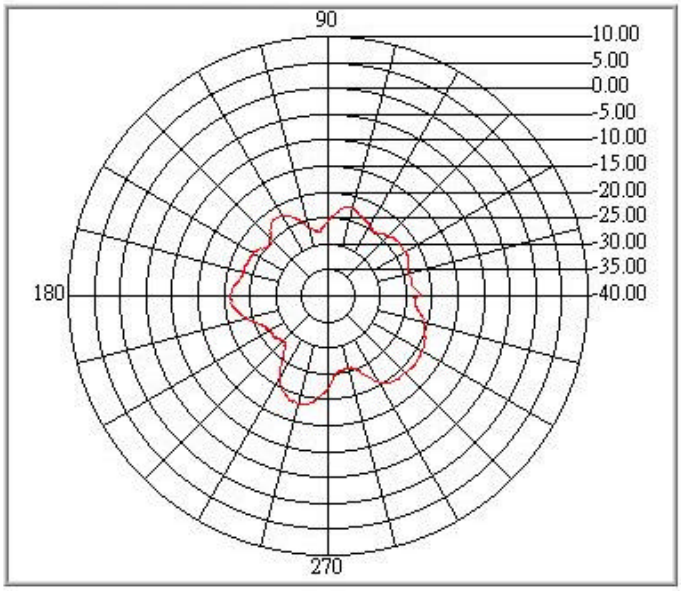
Traininig Research Co., Ltd.

Tel: 02-26935155 Fax: 02-26934440

URL: http://www.trclab.com.tw

Model No: WL120G-X **Antenna Position**: Vertical

Frequency 2450.00 **MHz**



Peak: -18.39 dBi **Peak Angle**: 254.08 Degree

Average: -23.06dBi

Test engineer:_____

Test date: 2003/4/1 at AM 08:46

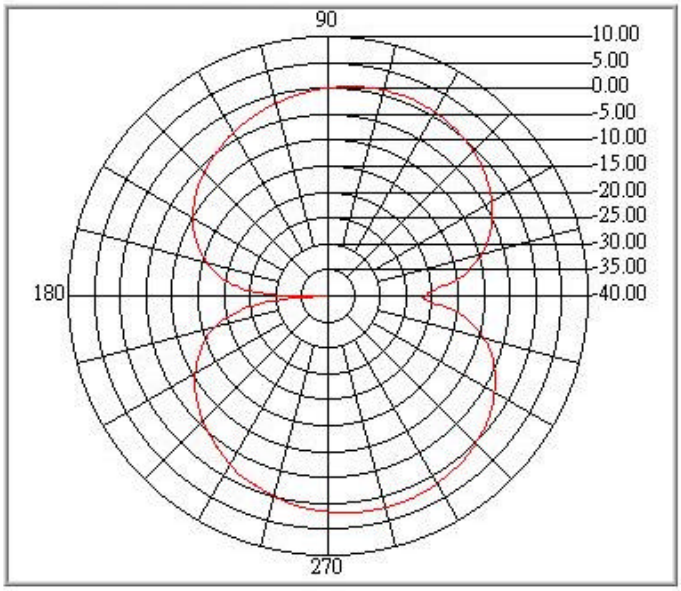
Traininig Research Co., Ltd.

Tel: 02-26935155 Fax: 02-26934440

URL: http://www.trclab.com.tw

Model No: WL120G-Y **Antenna Position**: Horizontal

Frequency 2450.00 **MHz**



Peak: 2.24 dBi **Peak Angle**: 284.69 Degree

Average: -5.91 dBi

Test engineer:_____

Test date: 2003/4/1 at AM 08:57

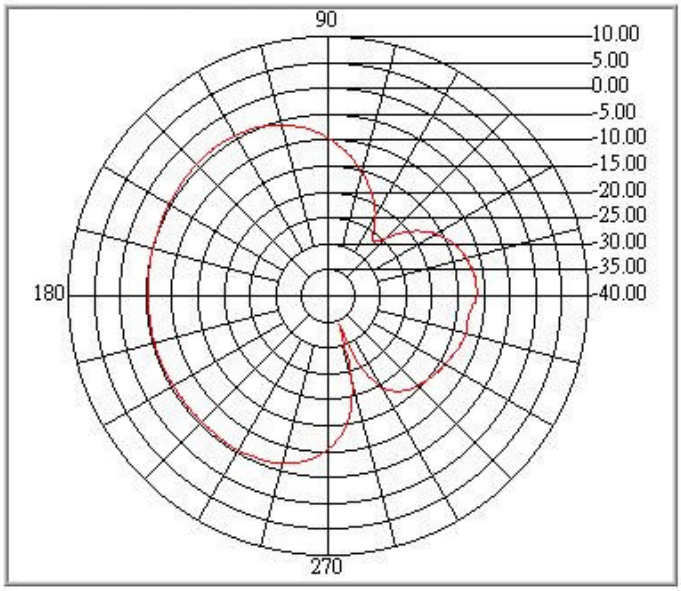
Traininig Research Co., Ltd.

Tel: 02-26935155 Fax: 02-26934440

URL: http://www.trclab.com.tw

Model No: WL120G-Y **Antenna Position**: Vertical

Frequency 2450.00 **MHz**



Peak: -4.04 dBi **Peak Angle**: 127.96 Degree

Average: -11.1dBi

Test engineer:_____

Test date: 2003/4/1 at AM 08:58

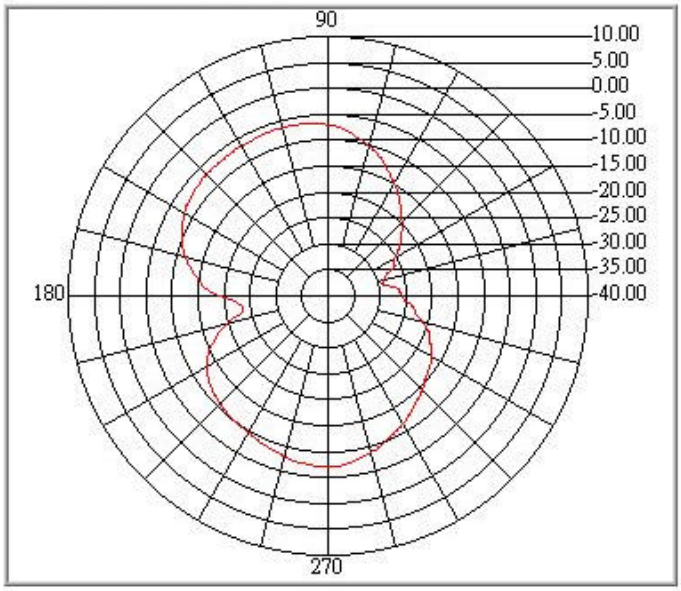
Traininig Research Co., Ltd.

Tel: 02-26935155 Fax: 02-26934440

URL: http://www.trclab.com.tw

Model No: WL120G-Z **Antenna Position**: Horizontal

Frequency 2450.00 **MHz**



Peak: -6.37 dBi **Peak Angle**: 105.88 Degree

Average: -13.80dBi

Test engineer:_____

Test date: 2003/4/1 at AM 09:03

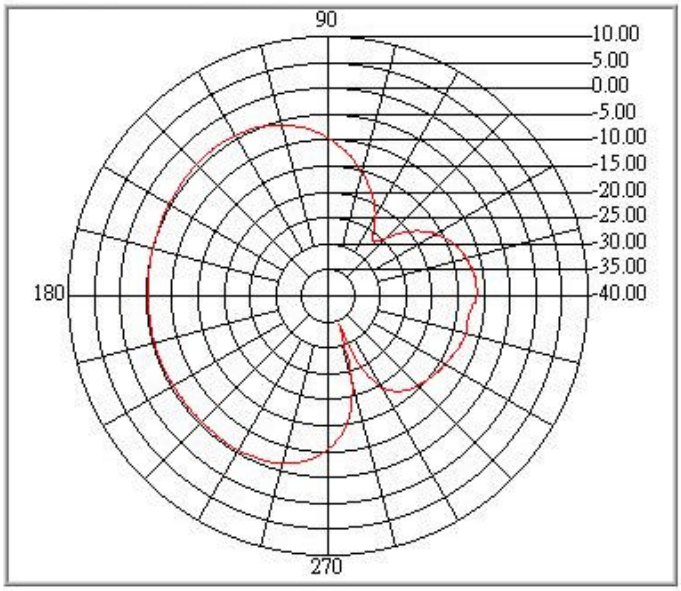
Traininig Research Co., Ltd.

Tel: 02-26935155 Fax: 02-26934440

URL: http://www.trclab.com.tw

Model No: WL120G-Y **Antenna Position**: Vertical

Frequency 2450.00 **MHz**



Peak: -4.04 dBi **Peak Angle**: 127.96 Degree

Average: -11.1dBi

Test engineer:_____

Test date: 2003/4/1 at AM 08:58

Traininig Research Co., Ltd.

Tel: 02-26935155 Fax: 02-26934440

URL: http://www.trclab.com.tw

Appendix

Antenna Specification

(Antenna#2 Dipole Antenna)

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.: ***C660-510017-A*** ***REV.:*** ***X1***

	MANUFACTURER SIGNATURE	CUSTOMER SIGNATURE
APPROVED BY :	Winston	
DATE :	2004/7/2	

WHA YU GROUP

WHA YU INDUSTRIAL CO., LTD.(HEAD OFFICE)
譁裕實業股份有限公司
Address: #70 Shui Li Road, Hsin Chu City, Taiwan, R.O.C.
Tel:+886-3-5714225(REP.)
Fax:+ 886-3-5713853 · + 886-3-5723600

TAI HWA ELECTRONC CO., LTD. (CHINA)
台樺電業制品廠
Address: Pak Ho District, Hiu Street Town, Dong Guan City, Guangdong, China
Tel: + 86-769-5599375 · + 86-769-5912375
Fax: + 86-769-5599376

HUA HONG INTERNATIONAL LTD.
華弘國際有限公司
Rm.1103A,President Commercial Centre,608 Nathan Road,Mong Kok,Kowloon,Hong Kong
Tel: + 86-852-27712210
Fax: + 86-852-23843747

SHANGHAI HUA YU ELECTRONIC CO., LTD. (CHINA)
上海譁裕電子有限公司
Address:3586,Wai Qing Song Road, Qing Pu County, Shanghai China
Tel: + 86-21-59741348 · + 86-21-59744101~4
Fax: + 86-21-59741347

SU ZHOU AEON TECH CO., LTD. (CHINA)
蘇州華廣電通有限公司
Address:Limin North Road, LiLi Town,LiLi Industrial Park,LinHu Economic Zone
Wujiang City,Jiangsu Province,China
Tel: + 86-512-63627980
Fax: + 86-512-63627981

RF Antenna Cable Assembly

Specification

1. Electrical Properties :

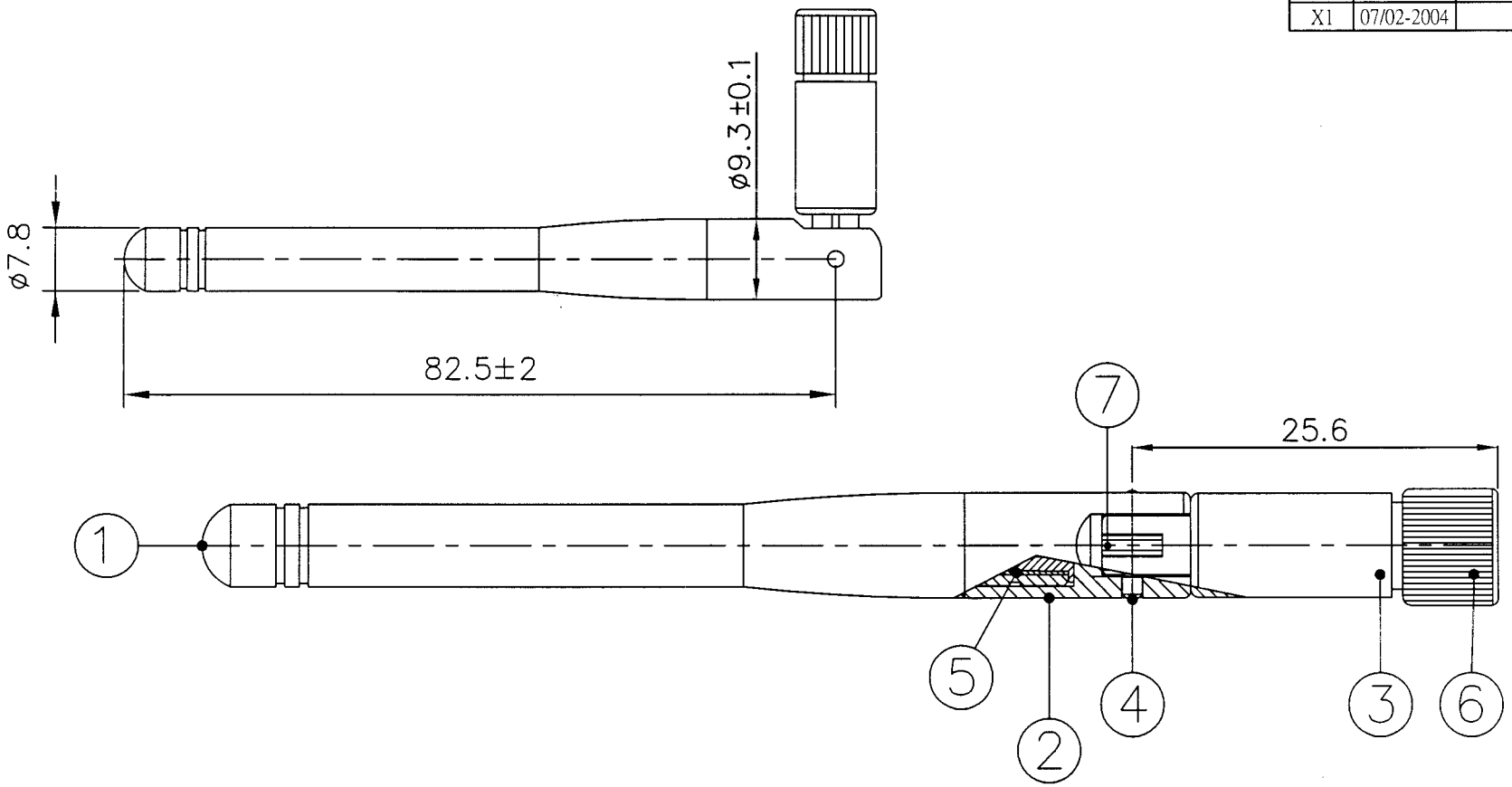
1.1 Frequency Rang..... 2.4GHz ~ 2.5GHz
1.2 Impedance ..... 50Ω Nominal
1.3 VSWR ..... 1.92 Max.
1.4 Return Loss..... -10dB Maximum
1.5 Electrical Wave..... 1/2 λ Diople
1.6 Gain..... 2.0 dBi
1.7 Admitted Power..... 1W

2. Physical Properties :

2.1 Cable ..... RG-178 Coaxial Cable
2.2 Antenna Cover ..... TPE
2.3 Antenna Base ..... PC
2.4 Antenna Base Holder ..... PC
2.5 Operating Temp ..... -20℃ ~ +65℃
2.6 Storage Temp ..... -30℃ ~ +75℃
2.7 Color ..... White,DuPont Spectramaster LS033
2.8 Color Tolerance △ E..... 2 maximum
2.9 Connector ..... SMA Plug Reverse (Plated Ni)

CG-

REV	DATE	DESCRIPTION
X1	07/02-2004	New Issue



NO	DESCRIPTION	QTY	REMARK
7	Cable	RG-178 , Translucent Brown ; 50 Ω	1	
6	Connector	SMA Straight Plug/Reverse (Ni Plated)	1	
5	Ground Tube	Brass , Ni plated	1	
4	Rivet	Brass , Plated Ni	2	
3	Antenna Base	PC ; Color:DuPont Spectramaster LS033	1	
2	Antenna Base	PC ; Color:DuPont Spectramaster LS033	1	
1	Antenna Cover	TPE ; Color:DuPont Spectramaster LS033	1	

CUSTOMER'S SINGATURE

XX.	±5
X.	±1.0
.X	±0.1
.XX	±0.01
.XXX	±0.005

APPROVED: w.ss for 9/2

CHECKED:

DRAWING: 9/2

CUSTOMER: 華碩科技股份有限公司

PART NO :

PARTNAME: RF Antenna Cable Assembly

W.Y P/NO : C660-510017-A

REV	UNIT	FILE :
X1	m/m	SHEET : 1/1

Wha Yu
INDUSTRIAL CO.,LTD.
譁裕實業股份有限公司

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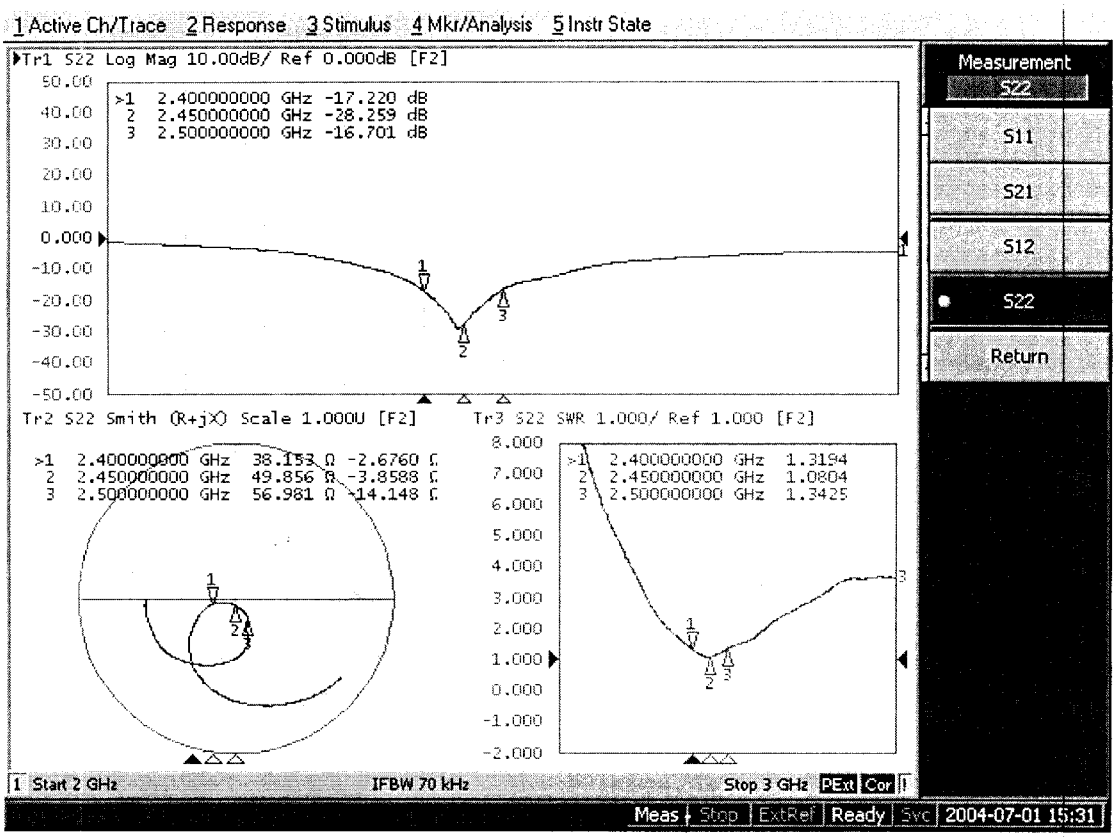
譁裕實業股份有限公司
WHA YU INDUSTRIAL CO., LTD

RF Antenna Assembly

P/NO : C660-510017-A SPEC : 2.4 GHz

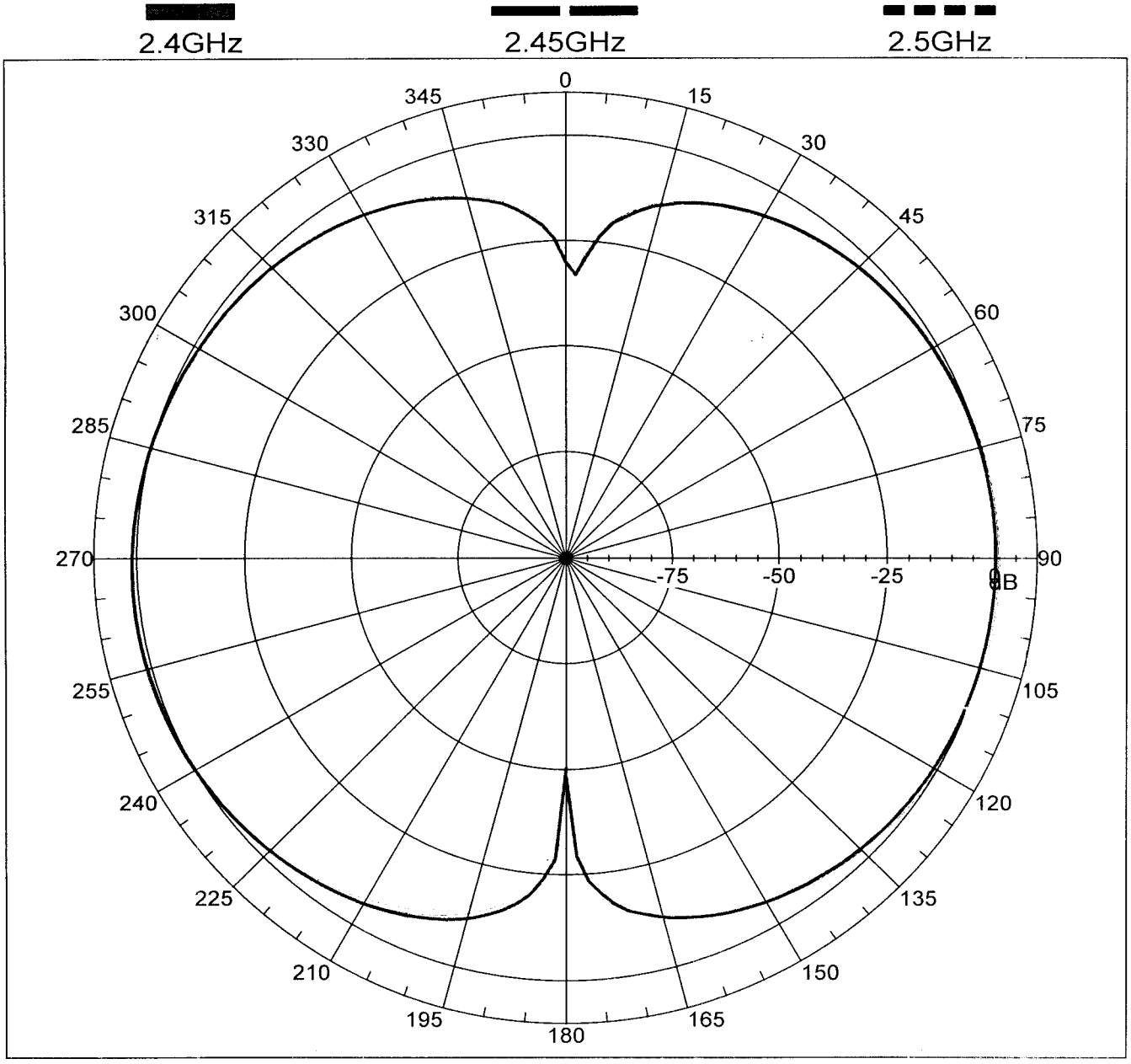


7/1/2004

譁裕實業股份有限公司
WHA YU INDUSTRIAL CO., LTD

C660-510017-A

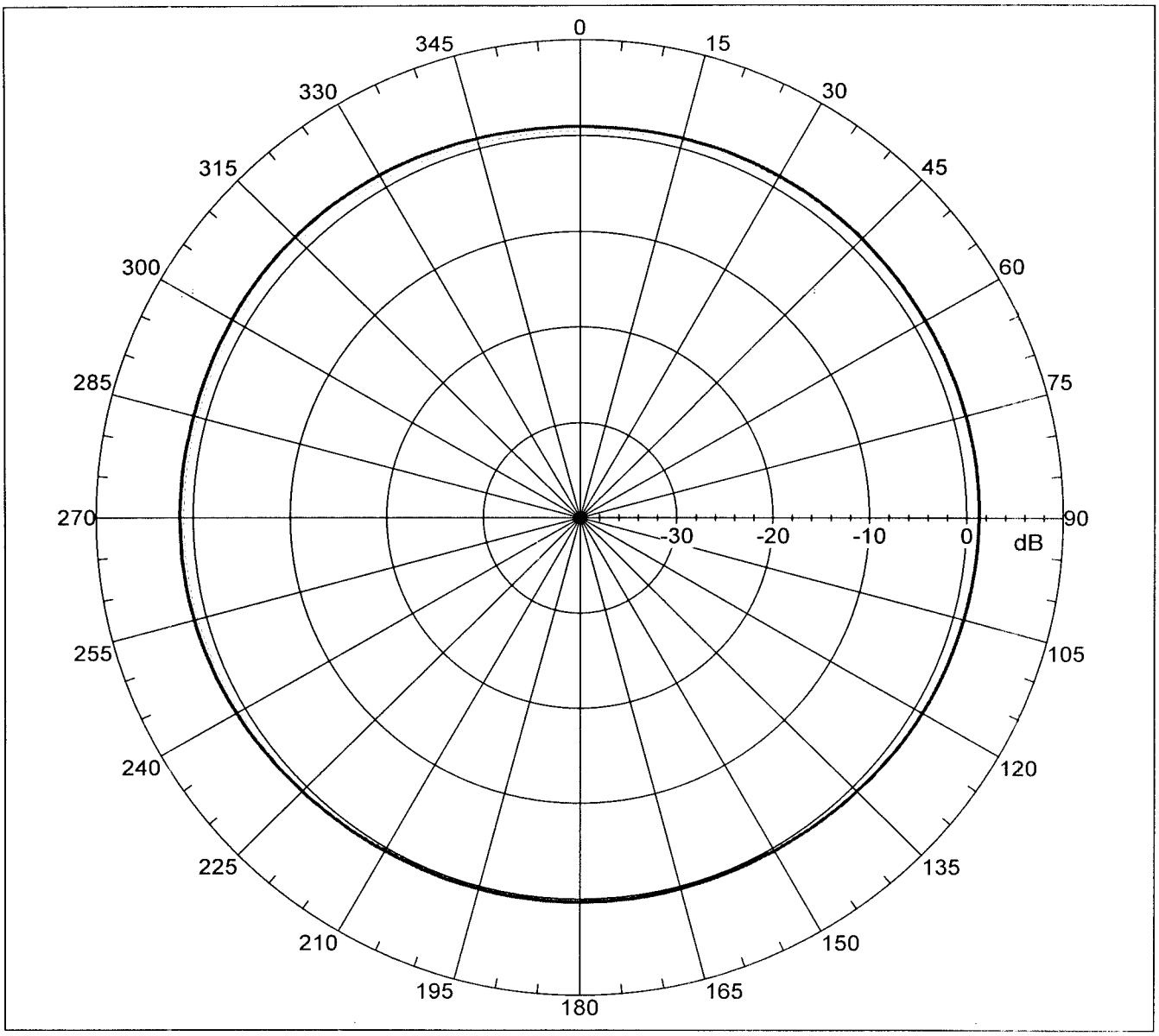
Far-field amplitude of 2.4GHz small dipole antenna-E-plane.nsi



譁裕實業股份有限公司
WHA YU INDUSTRIAL CO., LTD

C660-510017-A

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



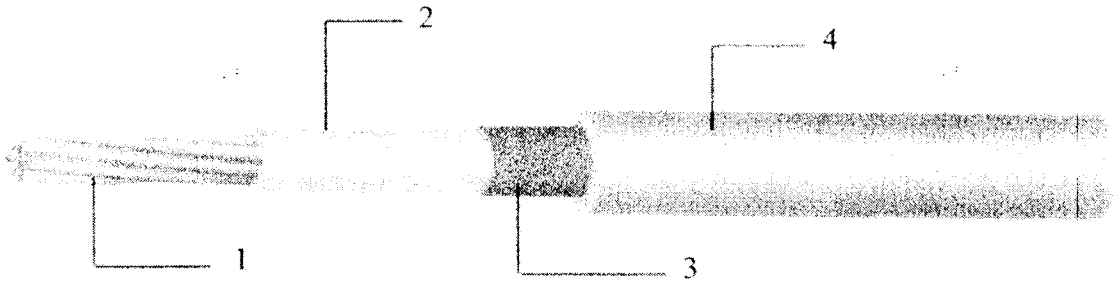
Nizing Electric Co., Ltd.
11-15 Santai Rd., Hsinchuang, Taipei Hsien, 242, Taiwan, R.O.C
Tel: 02-29016164 Fax: 29050644 E-mail: shenbinnizing@yahoo.com.tw

RG 178 B/U	FEP INSULATED HIGH-FREQUENCY COAXIAL CABLE	PAGE	1 / 2
PRODUCT STANDARD		ISSUED	21. Oct. 2003
		REVISED	

I - Scope

This specification presents a FEP insulated high-frequency coaxial cable AWG 30, 1.8 mm O.D. for internal wiring of electronic equipment, such as Computer / Notebook with wireless communication systems.

II - Construction



Item		Unit	Details
1. Inner Conductor	Material	—	CP-AG
	Composition	No./mm	AWG 30 or 7 × 0.1
	Dia. (approx.)	mm	0.305
2. Dielectric	Material	—	Extruded FEP
	Nom. O.D.	mm	0.84 ± 0.05
	Color	—	Natural
3. Outer Conductor	Material	—	Silver coated copper
	Composition	—	Braided (16 / 3 / 0.1)
	Dia. (approx)	mm	1.29 ± 0.07
4. Jacket	Material	—	Extruded FEP
	Dia.	mm	1.80 ± 0.08
	Color	—	Standard color is Light Orange

Note:

MADE BY
APPROVALS

Nizing Electric Co., Ltd.
11-15 Santai Rd., Hsinchuang, Taipei Hsien, 242, Taiwan, R.O.C
Tel: 02-29016164 Fax: 29050644 E-mail: shenbinnizing@yahoo.com.tw

III – Characteristics

Item	Unit	Specified Value	Note
Temperature Rating	℃	-55 ~ +200	
Voltage Lasting	V	1000	
Dielectric strength	—	Dielectric core: No breakdown at AC 3 kv for 0.2 sec.	Spark test
		Jacket: No breakdown at AC 3 kv for 0.2 sec.	Spark test
Characteristic Impedance	Ω	50 ± 2	TDR method
Capacitance	pF / ft	29.4	
Attenuation. (Max.)	dB/100ft	16.0	100.0 MHz
		33.0	400.0 MHz
		52.0	1.0 GHz
		94.0	3.0 GHz
Approx. Weight	g / m	7.68	

Note

MADE BY
APPROVALS

Shen Bin-hao

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 Properities :
   - 1 Weight per 1000ft..... 6.3 lbs Maximum
   - 2 Bend Radius.....0.35" Mininum
   - 3 Operating Temperature Range -55℃~ 200℃

3. Electrical Properities:
   - 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