TRC® Since1985
Training Research Co., Ltd.
255 Nanyang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C.
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Measurement of MPE

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

EUT	:	Bluetooth USB Dongle
Model No.	:	UD-23011
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
Granted FCC ID	:	IXMUD23011
Frequency Range	:	2401 MHz-2480 MHz
Support Channel	:	79 Channels
Antenna type	:	1 chip antenna
Channel Spacing	:	1 MHz
Modulation Skill	:	GFSK
Power Type	:	Powered by the USB port of the client device
Applicant	:	Universal Scientific Industrial Co., Ltd.
		135, Lane 351, Taiping Rd., Sect.1, Tsao Tuen, Nantou 542, Taiwan, R.O.C.

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, by the *Friis Transmission Formula*:**

Power density at the specific separation (portable): $S = \frac{PG}{4pR^2} = \frac{2.52 \times 1.778}{4p(20)^2} = 8.914 \times 10^{-4}\, mW/cm^2$

Estimated safe separation: $R = \sqrt{\frac{PG}{4p}} = \sqrt{\frac{2.52 \times 1.778}{4p}} = 0.597 cm$

Remarks: "The safe estimated separation that the user must maintain from the antenna is at least 0.597 cm."

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)

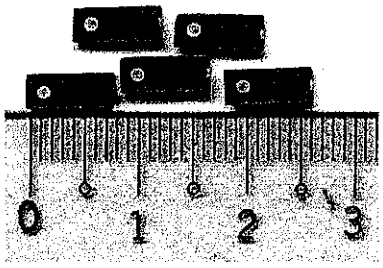
G = Log $^{-1}$ (2.5 / 10) = 1.778

MULTILAYER CERAMIC ANTENNA
FOR BLUETOOTH & WLAN IEEE 802.11b (2.45G Hz ISM Band)
(Long Shape)

Product Specification[1] (Preliminary)

QUICK REFERENCE DATA

Dimension	7.8* 3.6 * 0.9 mm
Central Frequency*	2.45 GHz
Bandwidth	>100 MHz
Gain	2.5 dBi max
VSWR	2.0 max
Polarization	Linear
Azimuth	Omni-directional
Impedance	50Ω
Operating Temperature	-55~125 ^{o}C
Termination	Ni/Sn (Environmentally-Friendly Leadless)
Resistance to soldering heat	260^{o}C, 10 sec.
Maximum Power	1W



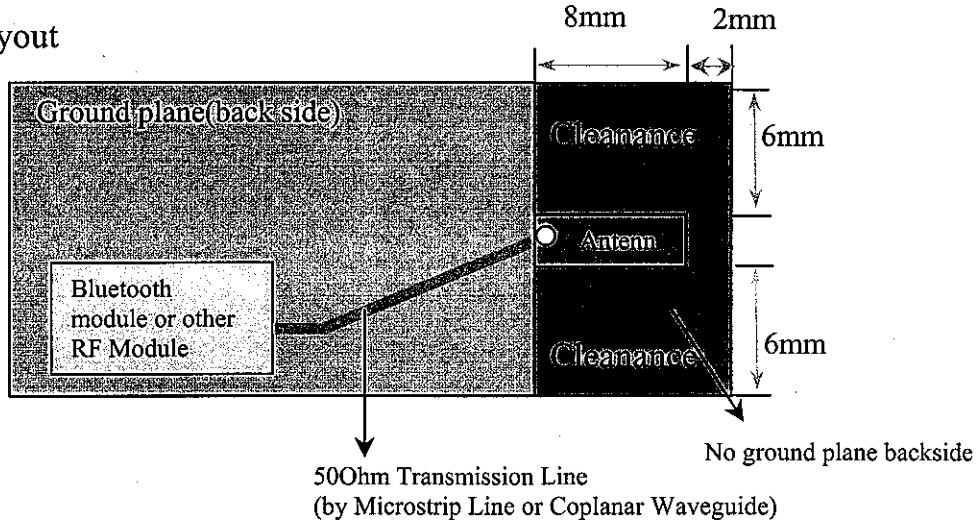
* Three types of antenna are available for central frequency adjustment (type 245, type 260, type 270)

Special Environmental Concerns- Green Products Design: The foil making process is using environmentally-friendly aqueous solvent technology. Termination is lead free (Pb free) and packing materials can be re-cycled

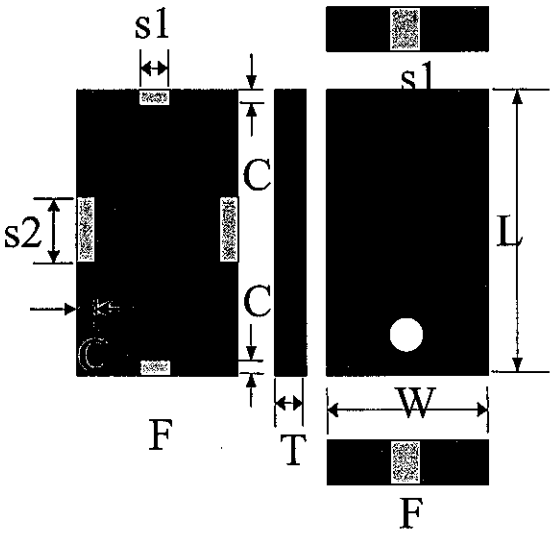
[1] All the technical data and information contained herein are subject to change without prior notice

APPLICATION

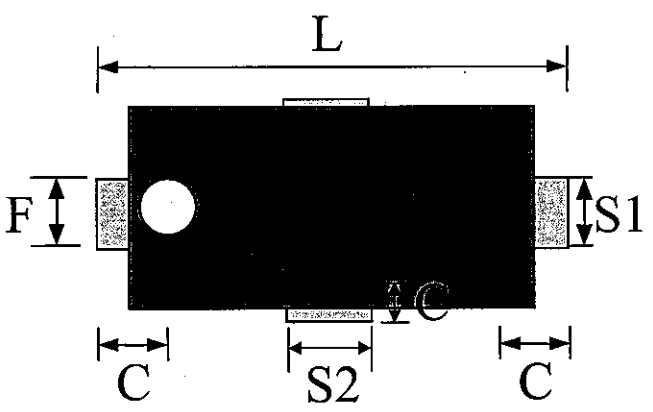
Suggested Layout



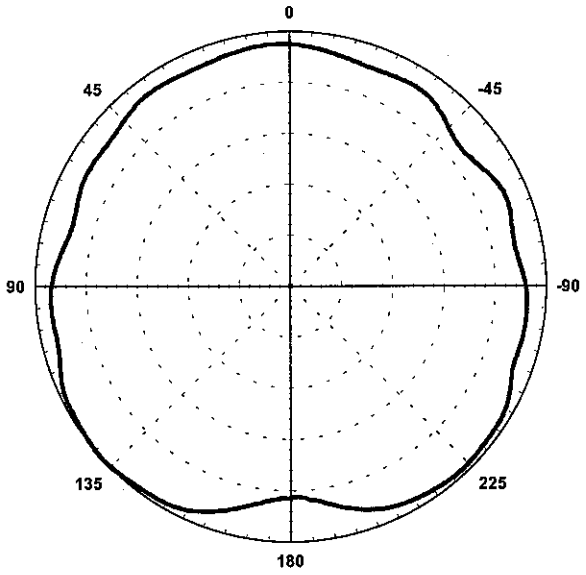
DIMENSIONAL DATA

Figure	Dimension		Port
	L	7.8± 0.25 mm	-
	W	3.6± 0.2 mm	-
	T	0.9± 0.2 mm	-
	F	1.25± 0.25 mm	Feed Termination
	C	0.4± 0.2 mm	-
	S1	1.25± 0.25 mm	NC Solder Termination Only
	S2	1.40 ± 0.25 mm	NC Solder Termination Only

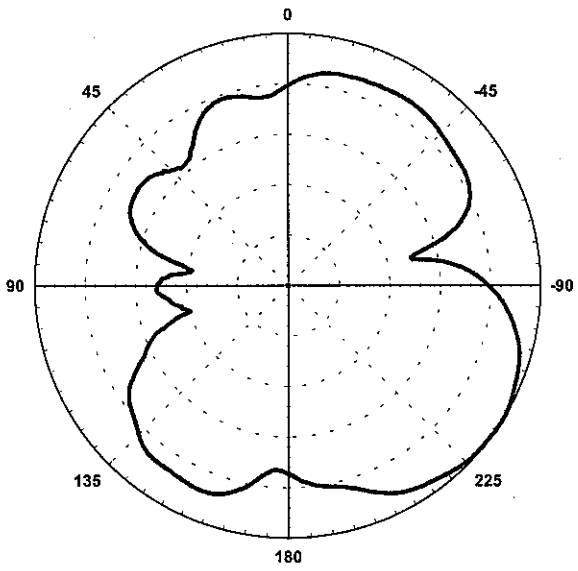
SOLDER LAND PATTERN

Figure	Dimensions		Remark
	L	9 ± 0.10 mm	
	F	1.40 ± 0.25 mm	Feed Pad
	C	0.80 ± 0.20 mm	
	S1	1.40 ± 0.25 mm	NC Mount Pad Only
	S2	1.60 ± 0.25 mm	NC Mount Pad Only

Radiation Pattern Polar Plot (Based on Suggested Layout)

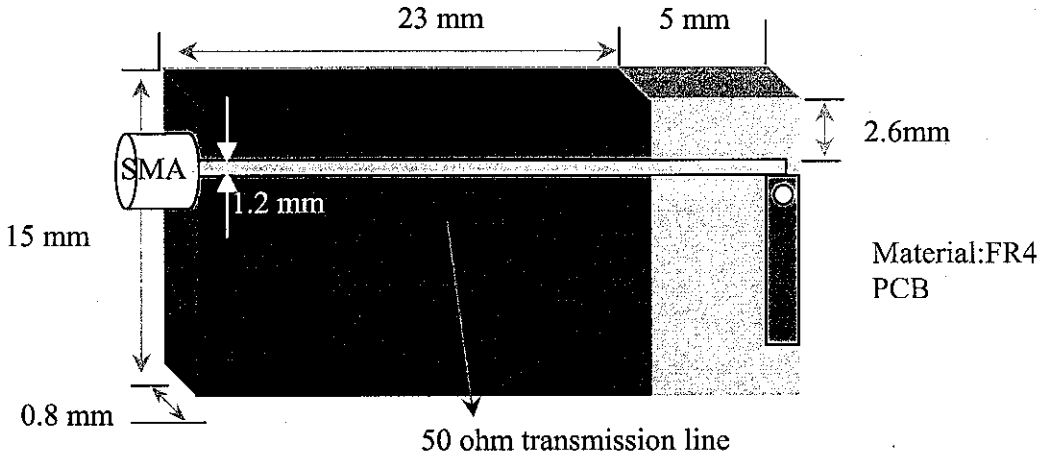


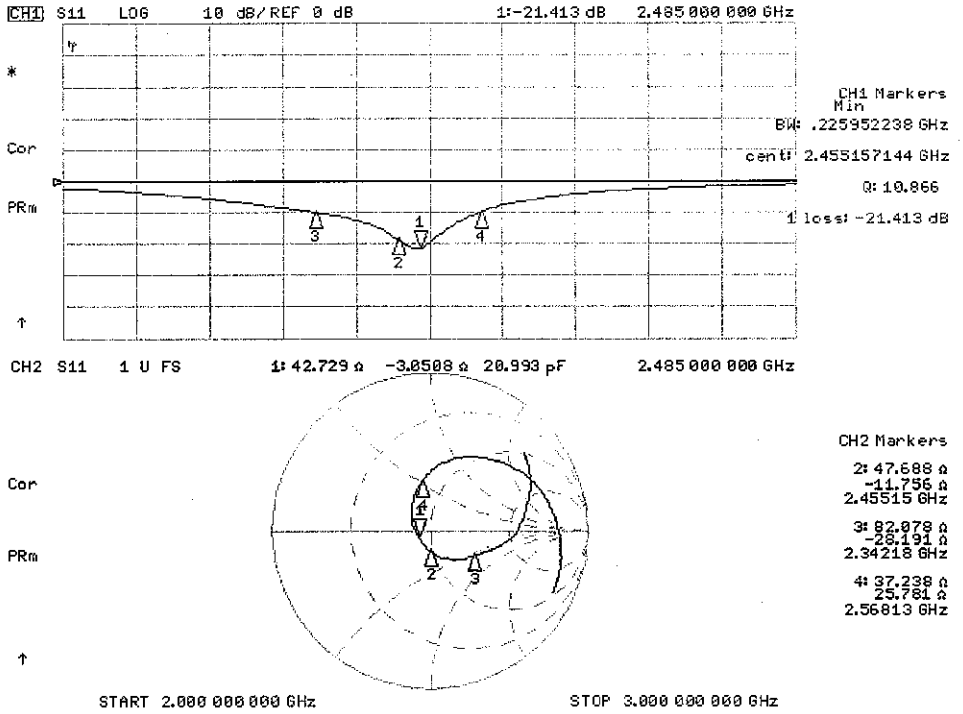
H-Plane



E-Plane

STANDARD TEST BOARD FOR SWR
(Note: Only for SWR Verification, not for suggested layout)





HF R&D	Print date 02/09/02			Preliminary internal use only				
	Long Shape **Multilayer Ceramic Antenna for Bluetooth (ISM Band 2.45GHz)**			**4311 115 00245/260/270**				Aug. 15. 01 Nov. 13, 01
Grant Lin/Cliff		2001-11-13		Page 4	sheet 190-4			A4
spec.doc	Phycomp Taiwan Ltd.							

RELIABILITY DATA (Reference to IEC Specification)

IEC 384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.4		Mounting	The antenna can be mounted on printed-circuit boards or ceramic substrates by applying wave soldering, reflow soldering (including vapour phase soldering) or conductive adhesive	No visible damage
4.5		Visual inspection and dimension check	Any applicable method using × 10 magnification	In accordance with specification (chip off 4mm)
4.6.1		Antenna	Central Frequency at 20 ^{o}C	Standard test board in page 4
4.8		Adhesion	A force of 3 N applied for 10 s to the line joining the terminations and in a plane parallel to the substrate	No visible damage
4.9		Bond strength of plating on end face	Mounted in accordance with CECC 32 100, paragraph 4.4	No visible damage
			Conditions: bending 0.5 mm at a rate of 1mm/s, radius jig. 340 mm, 2mm warp on FR4 board of 90 mm length	No visible damage

IEC 384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.10	20(Tb)	Resistance to soldering heat	260 ± 5 °C for 10 ± 0.5 s in a static solder bath	The terminations shall be well tinned after recovery and Central Freq. Change ± 6%
		Resistance to leaching	260 ± 5 °C for 30 ± 1 s in a static solder bath	Using visual enlargement of × 10, dissolution of the termination shall not exceed 10%
4.11	20(Ta)	Solderability	Zero hour test, and test after storage (20 to 24 months) in original atmosphere; un-mounted chips completely immersed for 2 ± 0.5 s in 235 ± 5°C.	The termination must be well tinned, at least 75% is well tinned at termination
4.12	4(Na)	Rapid change of temperature	-55 °C (30 minutes) to +125 °C (30 minutes); 100 cycles	No visible damage Central Freq. Change ± 6%
4.14	3(Ca)	Damp heat	500 ± 12 hours at 60 °C; 90 to 95 % RH	No visible damage 2 hours recovery Central Freq. Change ± 6%
4.15		Endurance	500 ± 12 hours at 125 °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:

4311 1 15 00 245
F C M S T A

F. Family Code
43 = Antenna

C. Packing Type Code
11 = 180 mm/ 7" blister (1000pcs) , **12** = 330 mm/13" blister (4000 pcs)
13 = Bulk (1000 pcs)

M. Materials Code
1 = High Frequency Material

S. Size Code
15 = 7.8 * 3.6 * 0.9 mm

T. Tolerance
00 = larger than 100 M Hz Band Width

A. Working Frequency (three types of antenna are available)

245 = 2.45 GHz	Type 245
260 = (2.45+0.15) GHz * Intention for shift up 150MHz	Type 260 (Marking 6)
270 = (2.45+0.25) GHz * Intention for shift up 250MHz	Type 270 (Marking 7)

Example: 12NC 4311 115 00245
Product description: Antenna (43) by 180 mm blister (11) of High Frequency Material (1), Size 7.8*3.6*0.9 mm (1);
Tolerance (00) of 100 MHz (VSWR<2)
Working Frequency (245) = 2.45G Hz

ORDERING INFORMATION: Method II- by Clear Text Code

The antennas may be ordered by using the 16-digit clear text ordering code. These code numbers can be determined by the following rules:

AN2450000708031K (Clear Text Code Example)						
AN	2450	00	07	0803	1	K
Product	Central Freq.	Bandwidth	Material	Size	Quantities	Packing
AN= Antenna	2450=2.45GHz 2600=2.60GHz 2700=2.70GHz	00= >100MHz	07=K7	0803=7.8*3.6* 0.9 mm	1 = 1K 4 = 4K	K=7" plastic F =13" plastic B = Bulk