Application Note no.004

Ceramic Antenna Series

Bluetooth \ WLAN Ceramic Antenna

ACA-5036-A2-CC-S

Prepared	Checked	Approved
Leeting & YM	**D.F**	**Jimmy**

INPAQ Technology Co., LTD
http://www.inpaq.com.tw
TEL :+886-37-585-555
FAX : +886-37-585-511

INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

Application Note

Bluetooth \ WLAN Ceramic Antenna – ACA-5036-A2-CC-S

Revision History: 2010-05-25 Rev.A2

Previous Version :

Page	Subjects (major changes since last revision)	Version
All	Make up all document	A0
17~22	Adding recommended layout B and related electrical characteristic	A1
1	Adding dimension raw data	A2

INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

ACA-5036-A2-CC-S Application Note

Catalog

INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

Applications

This antenna is designed for Bluetooth\WLAN application and it's suitable for cellular phones, PDA, notebook, navigator, and all devices which have Bluetooth\WLAN function.

Features

- Omni-directional radiation
- High Efficiency
- Low profile and compact size(5.2 x 3.7 x 0.7mm)
- Low cost
- Lead free soldering compatible
- RoHS compliant
- Tape and reel packing

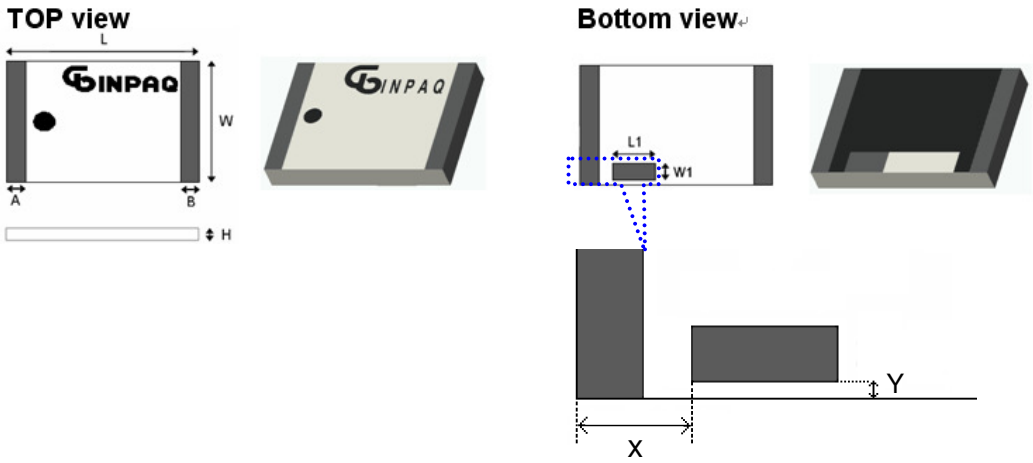
Electrical Characteristics

ITEM		SPECIFICATION
Frequency Band		2.40GHz～2.50GHz
VSWR		Less than 2.5
Polarization		Linear
*Peak Gain	Layout A	3 dBi Typ.
	Layout B	2.1 dBi Typ.
*Efficiency	Layout A	80% Typ.
	Layout B	74% Typ
Impedance		50Ω Typ.

* Test condition: Test board size 80*40 mm

Matching circuit: Pi matching circuit will be required

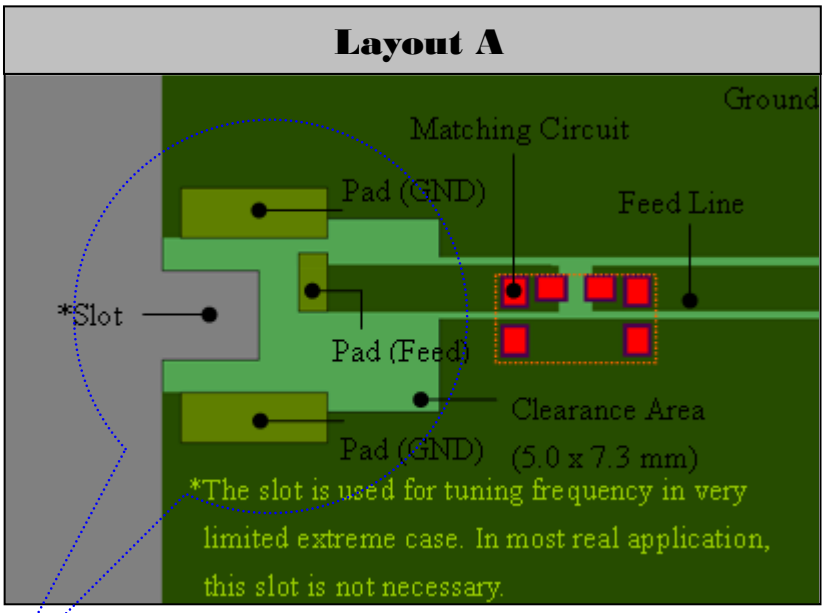
Antenna Dimension

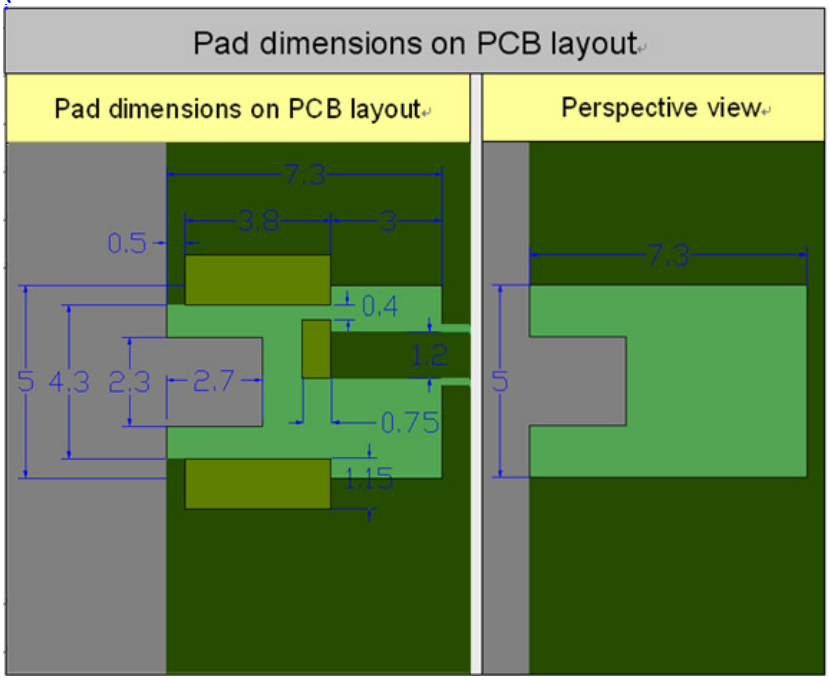


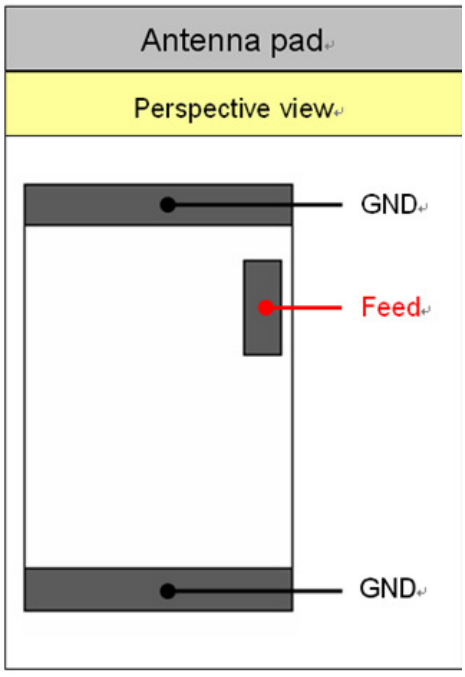
Chip Antenna	L	W	A	B	L1	W1	H	X	Y
ACA5036	5.2±0.3	3.7±0.3	0.45±0.25	0.45±0.25	1.1±0.20	0.55±0.20	0.70±0.15	0.85±0.25	0.12±0.06

INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

Recommended PCB layout (unit:mm)







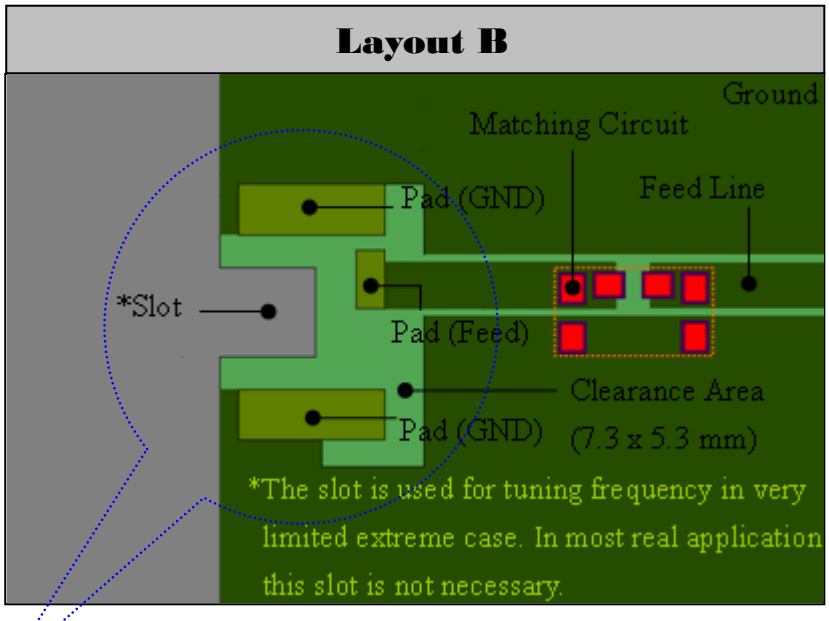
PCB pad dimensions

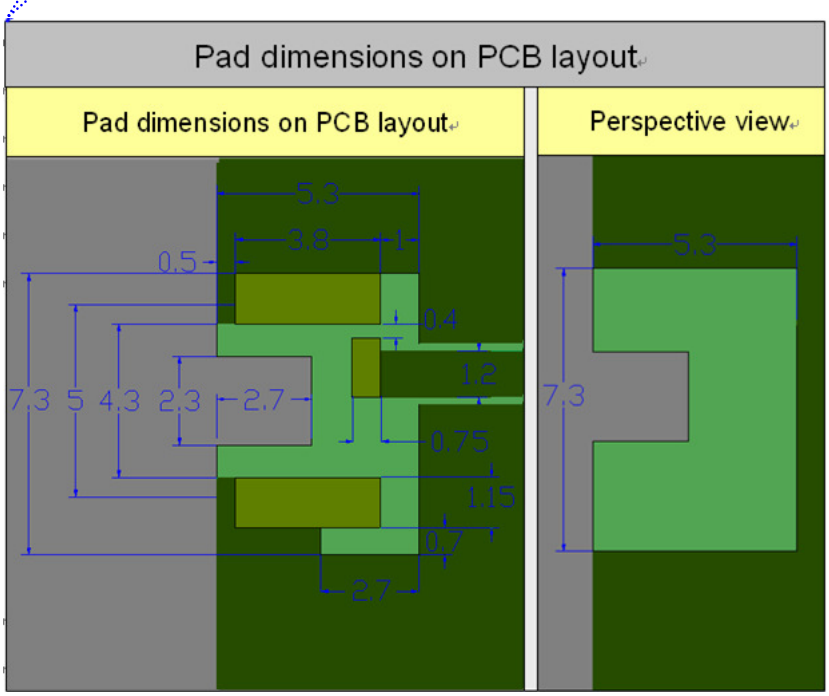
Terminal name	Terminal Dimensions
Pad (Feed)	1.2 X 0.75
Pad (GND)	3.8 X 1.15
Pad (GND)	3.8 X 1.15

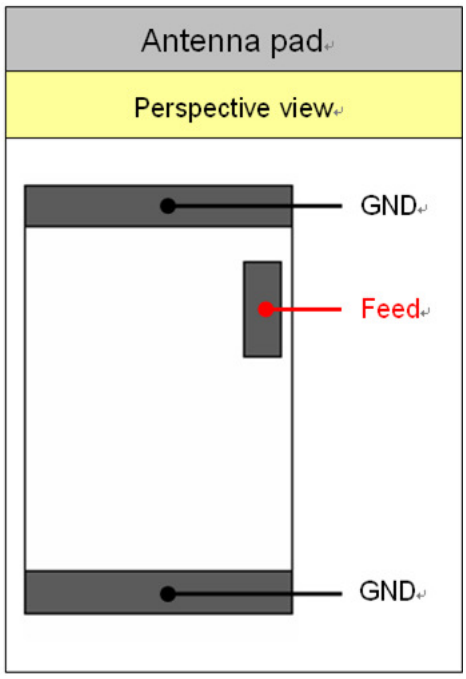
Antenna pad dimensions

Terminal name	Terminal Dimensions
Feed	1.1 X 0.55
GND	3.7 X 0.45
GND	3.7 X 0.45

INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511







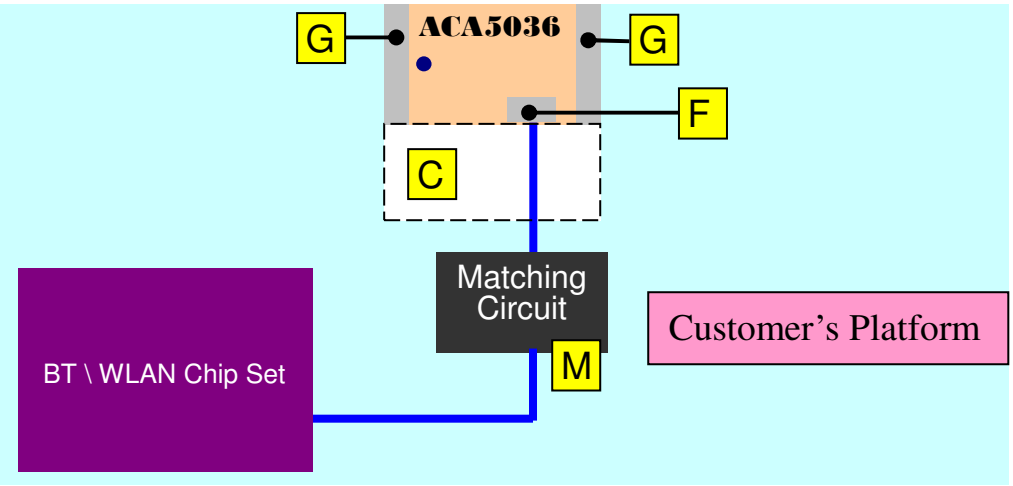
PCB pad

Terminal name	Terminal Dimensions
Pad (Feed)	1.2 X 0.75
Pad (GND)	3.8 X 1.15
Pad (GND)	3.8 X 1.15

Antenna pad dimensions

Terminal name	Terminal Dimensions
Feed	1.1 X 0.55
GND	3.7 X 0.45
GND	3.7 X 0.45

Layout Description



F. Feeding Pad

The signal from system must feed into the feeding pad.

G. Ground Pad

This pad must connect to ground plane of PCB.

C. Clearance Area

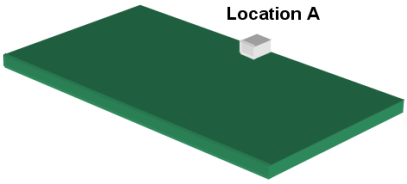
To achieve antenna performance, the clearance area is necessary and all metallization should be removed from all PCB layers.

M. Matching Circuit

Please keep the pads for PI-matching circuit to reduce return loss and shift the band to meet Bluetooth application.

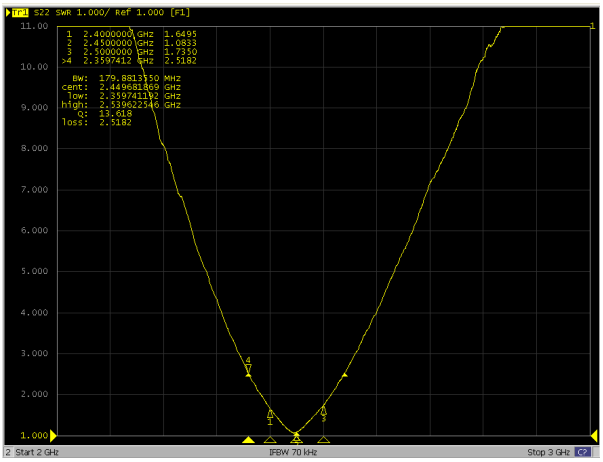
INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

Performance on Middle of Long Side

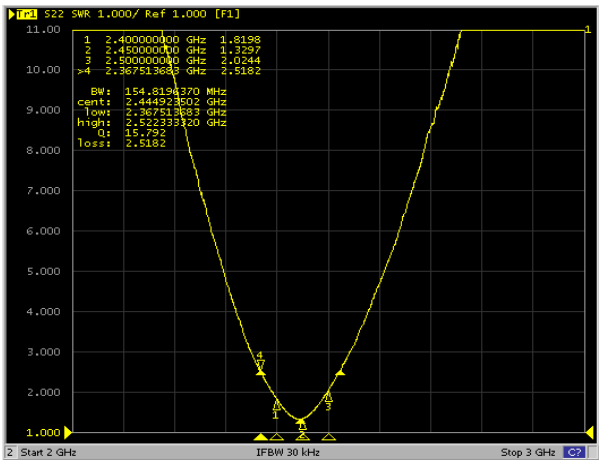


Typical VSWR

Layout A

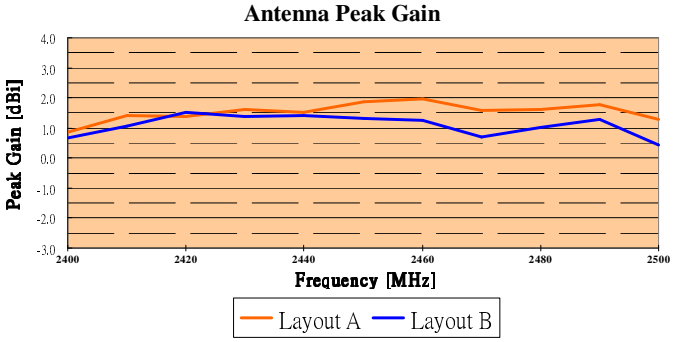


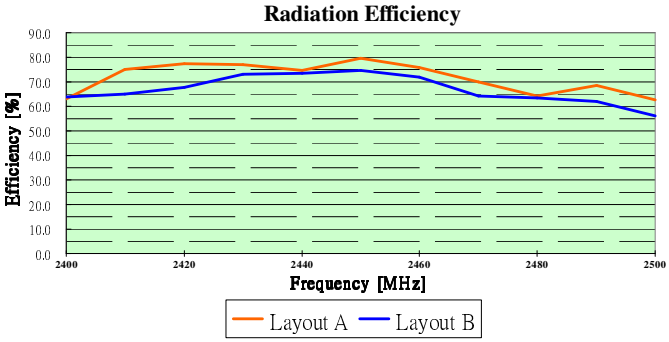
Layout B



Frequency	Layout A VSWR	Layout B VSWR
2400 MHz	1.65	1.82
2450 MHz	1.08	1.33
2500 MHz	1.74	2.02

Typical Free Space Peak Gain and Efficiency





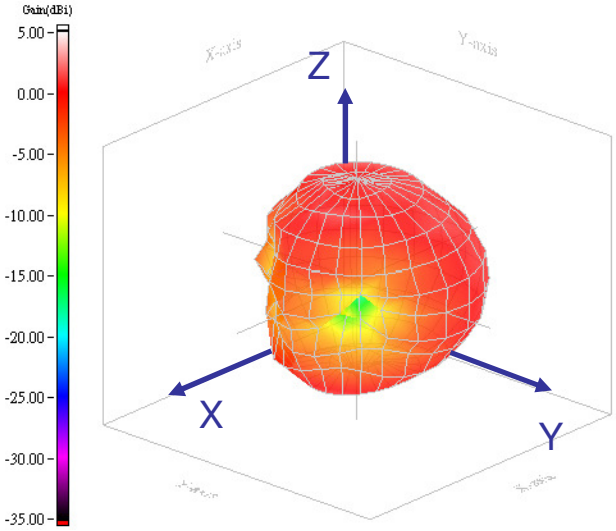
Frequency	Layout A Peak Gain	Layout B Peak Gain	Layout A Efficiency	Layout B Efficiency
2400 MHz	0.85 dBi	0.66 dBi	63.02%	63.80%
2450 MHz	1.86 dBi	1.33 dBi	79.60%	74.61%
2500 MHz	1.30 dBi	0.42 dBi	62.65%	56.31%

INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

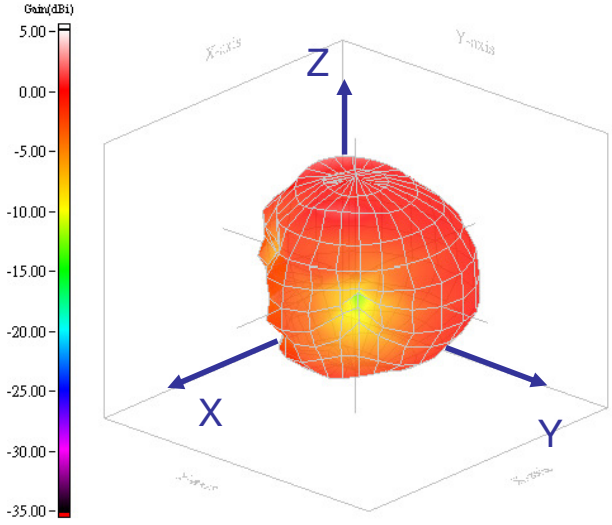
Typical Free Space Radiation Pattern

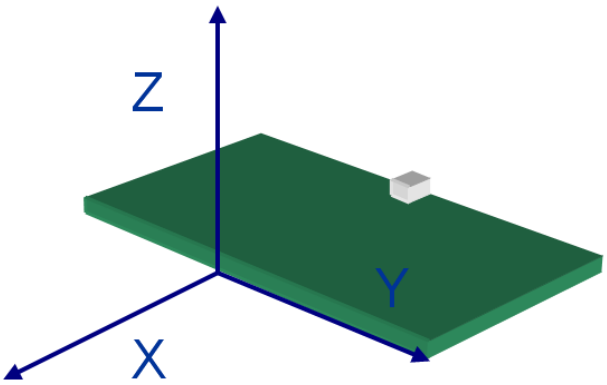
3D Radiation Pattern

Layout A 2450 MHz



Layout B 2450 MHz



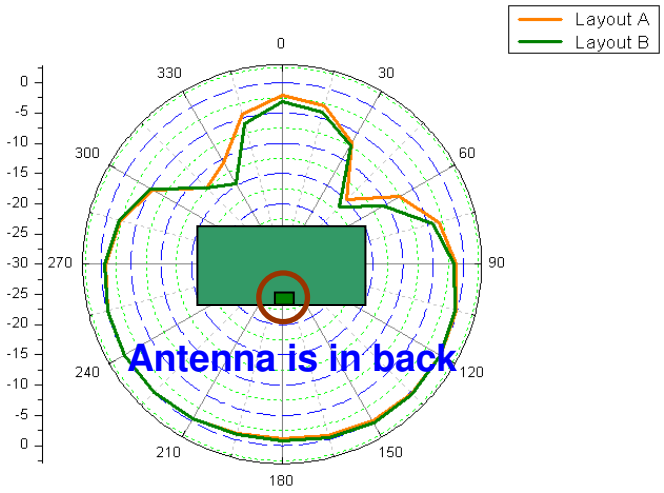


INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

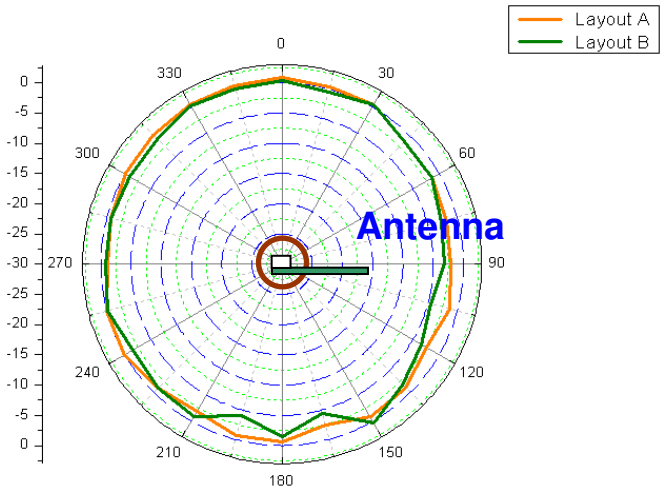
Typical Free Space Radiation Pattern

2D Radiation Pattern

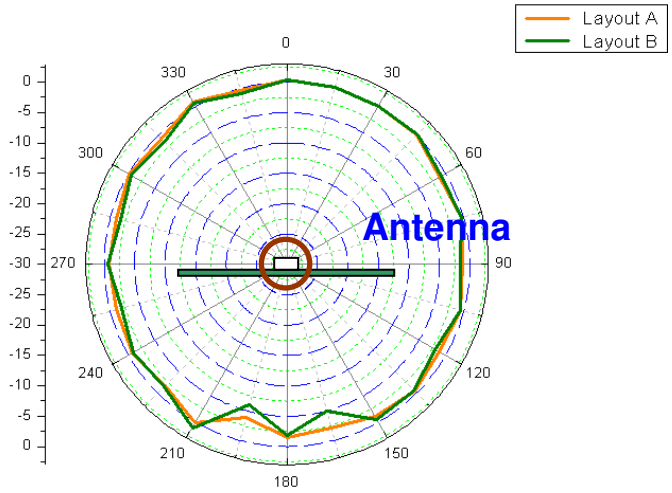
X-Y Plane 2450 MHz

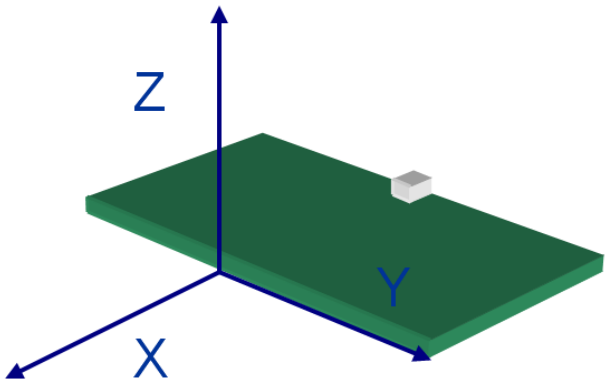


X-Z Plane 2450 MHz



Y-Z Plane 2450 MHz



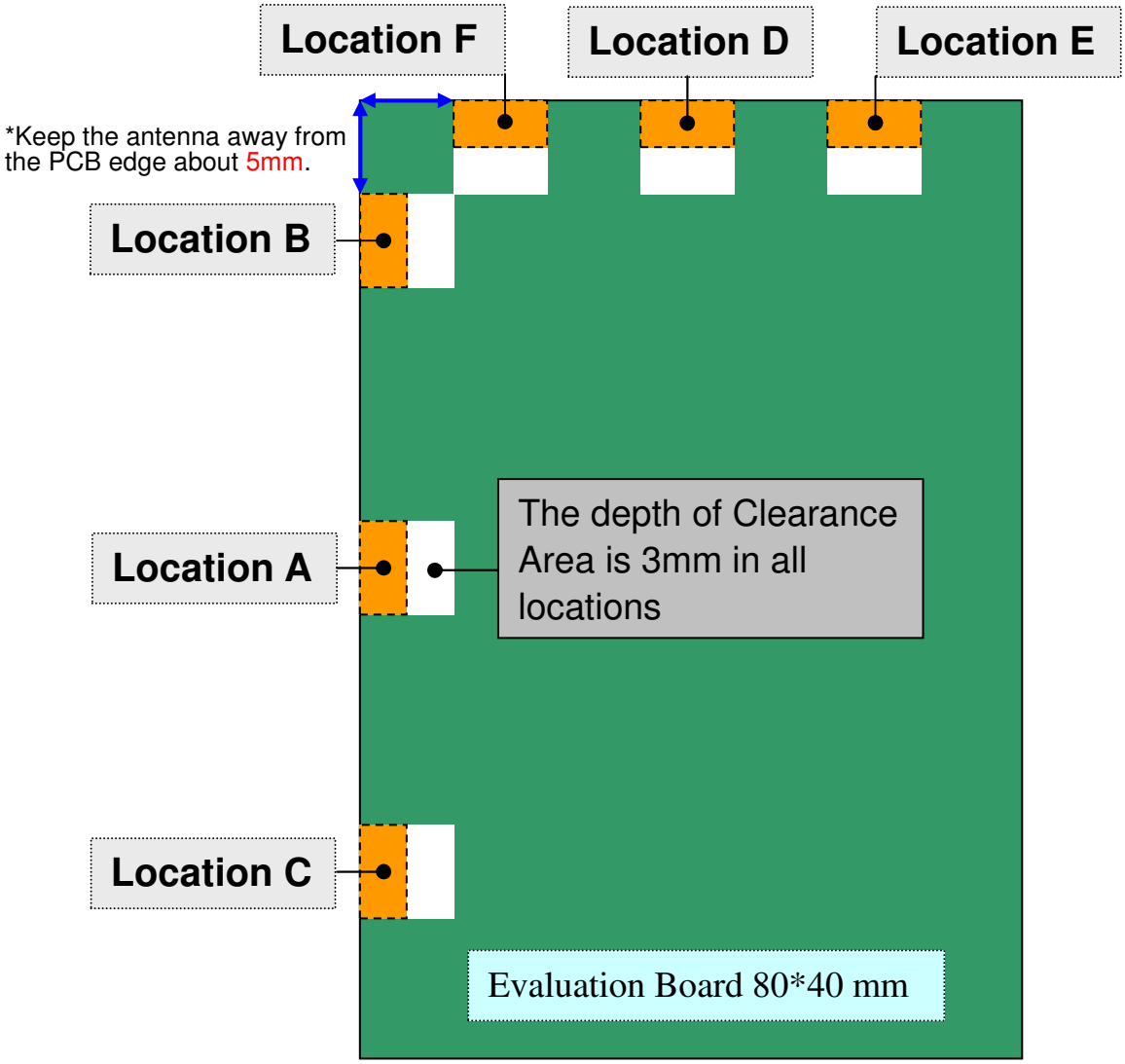


INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

The Efficiency and Bandwidth for Different Location

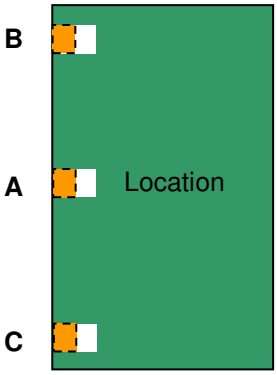
Layout A

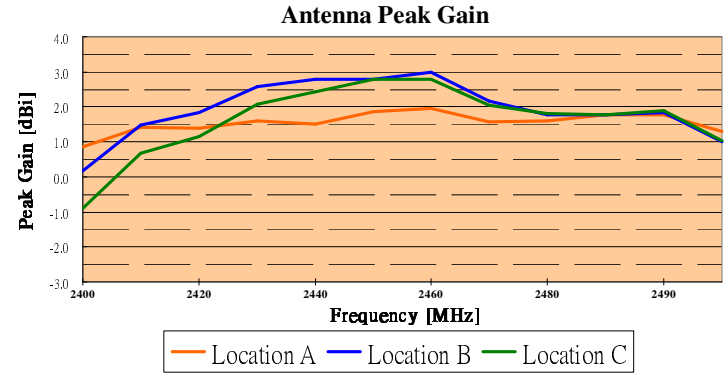
* All electrical characteristic depend on INPAQ 80 x 40mm evaluation board with matching circuit.

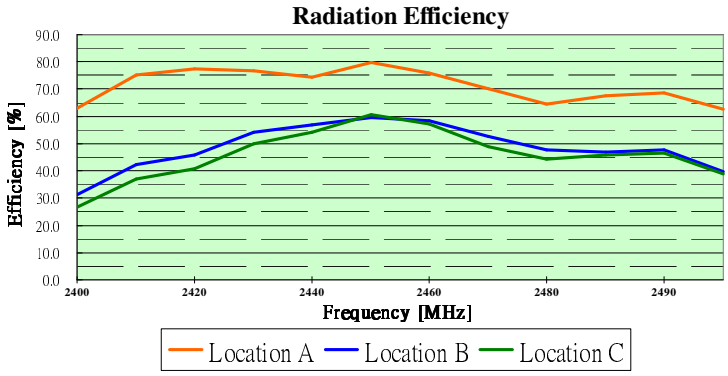


Locations / Test Item			Long side			Short side		
			A	B	C	D	E	F
Bandwidth [MHz] VSWR<2.5			180	73	67	151	96	85
Gain	Linear [dBi]	Peak	1.96	3.00	2.98	1.43	0.55	0.28
		Avg.	-1.10	-2.19	-2.22	-1.46	-1.86	-2.13
Efficiency	Linear [%]		79.55	60.44	59.94	71.39	65.23	61.29

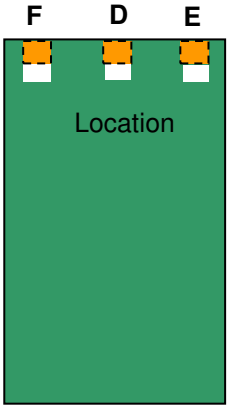
Peak Gain and Efficiency on Long Side

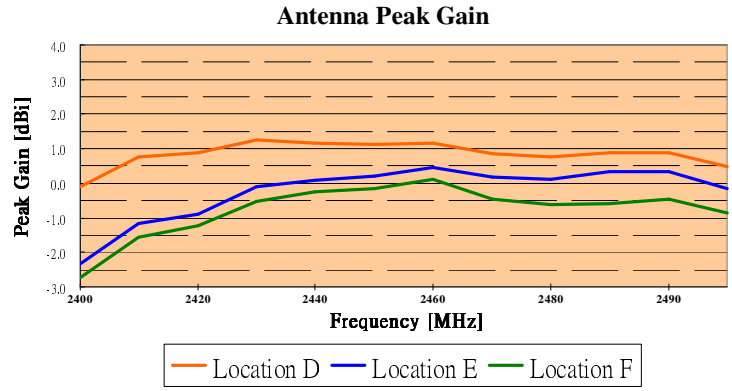


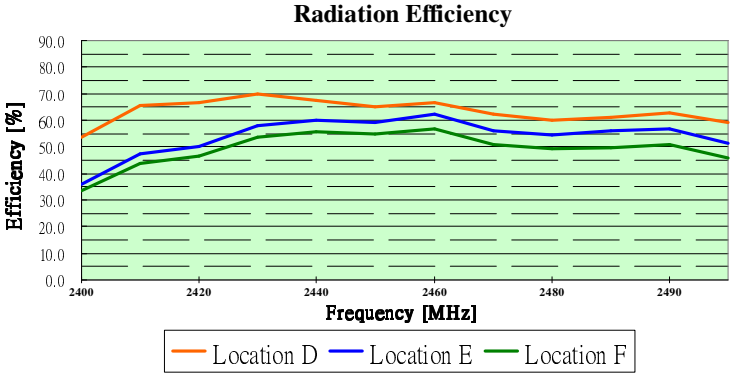




Peak Gain and Efficiency on Short Side



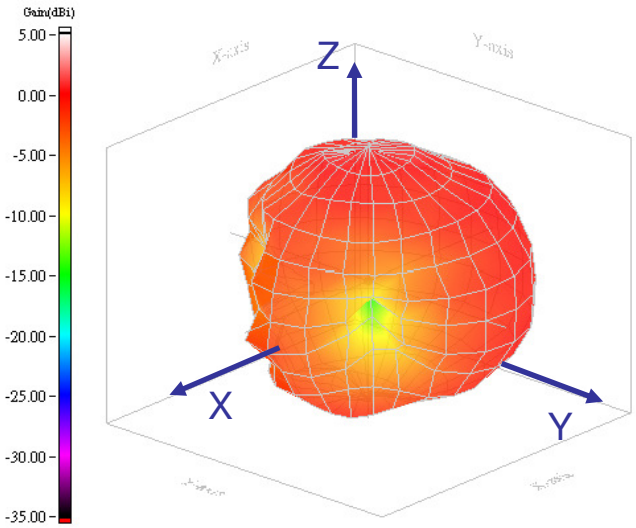




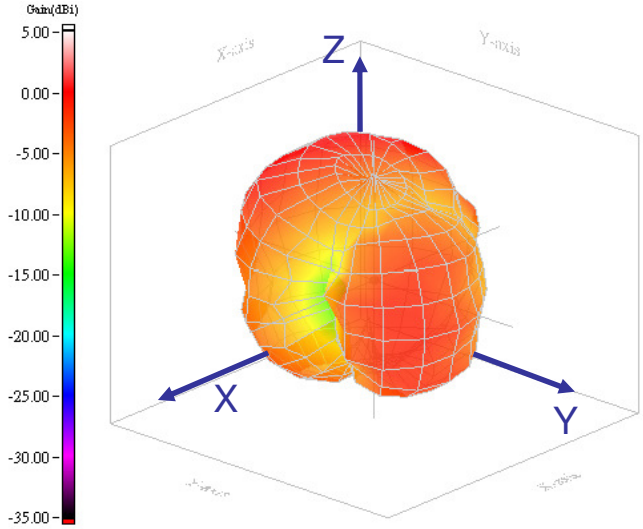
INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

3D Gain Pattern on Long Side

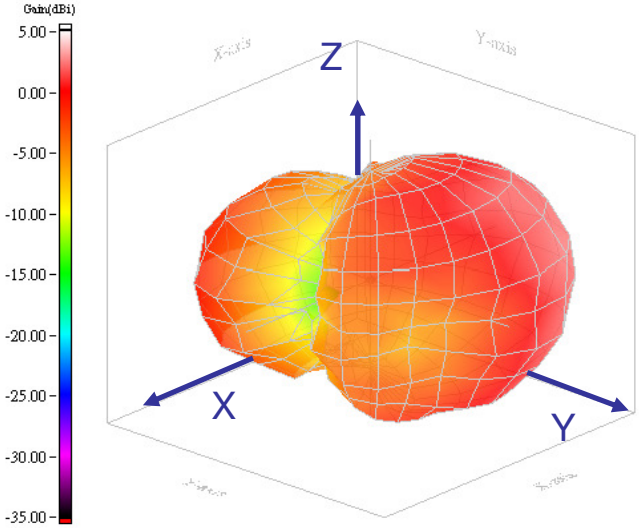
Location A 2450 MHz

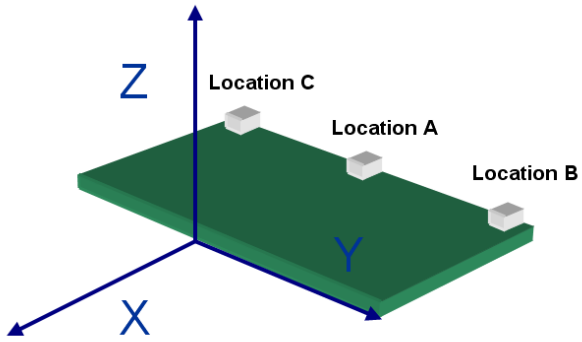


Location B 2450 MHz



Location C 2450 MHz

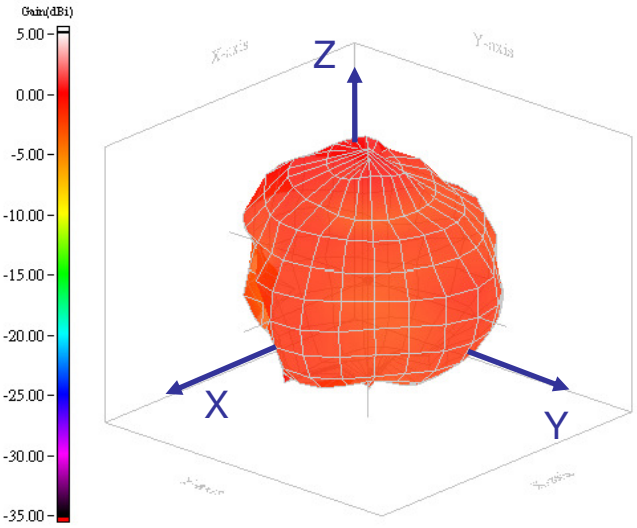




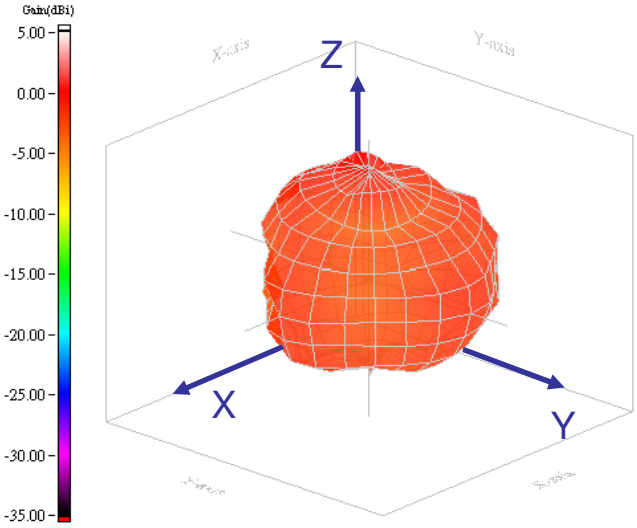
INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

3D Gain Pattern on Short Side

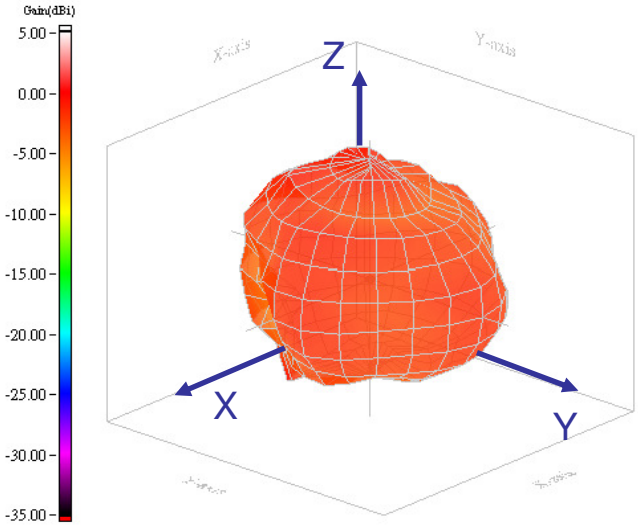
Location D 2450 MHz

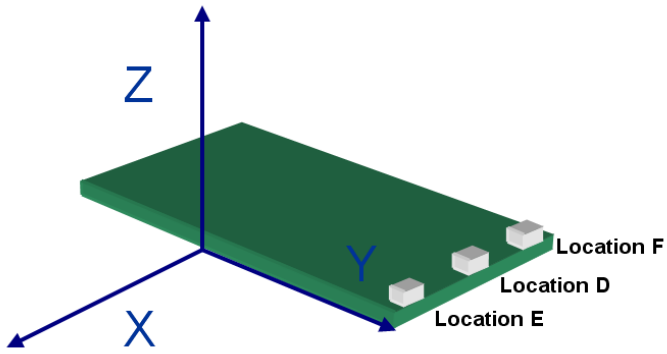


Location E 2450 MHz



Location F 2450 MHz

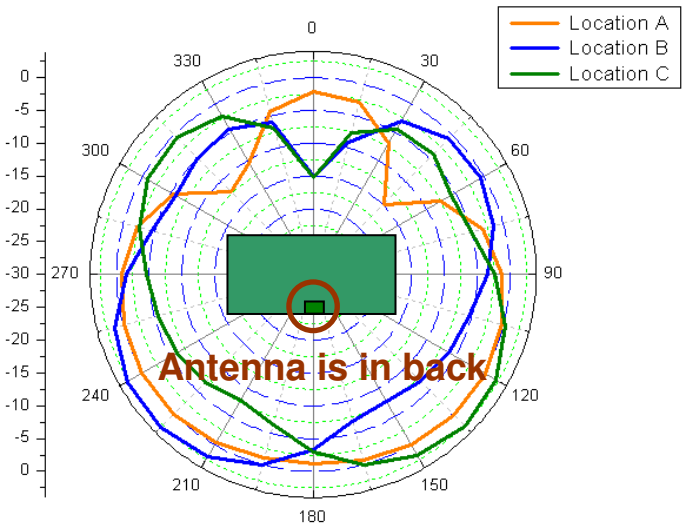




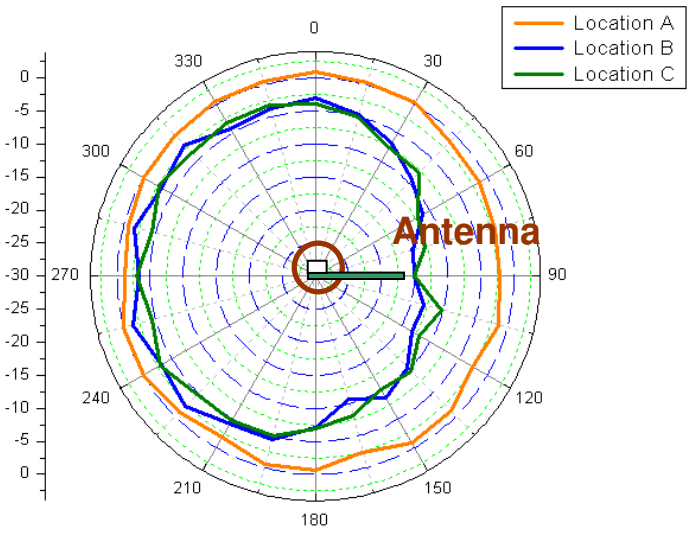
INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

2D Gain Pattern on Long Side

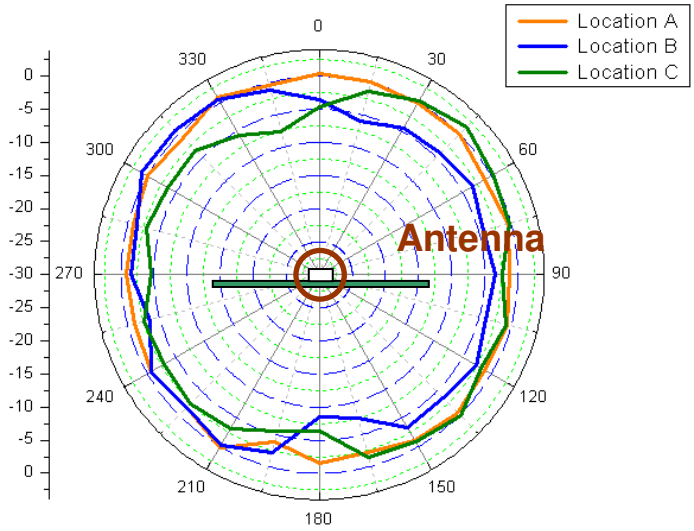
X-Y plane 2450 MHz

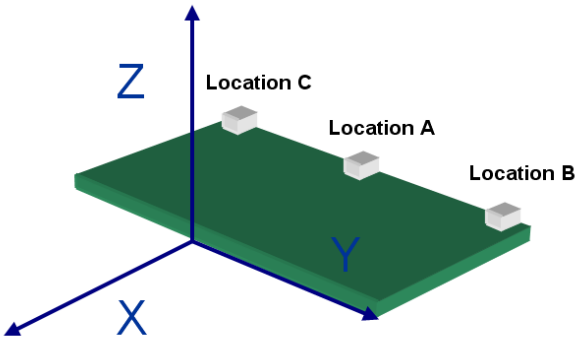


X-Z plane 2450 MHz



Y-Z plane 2450 MHz

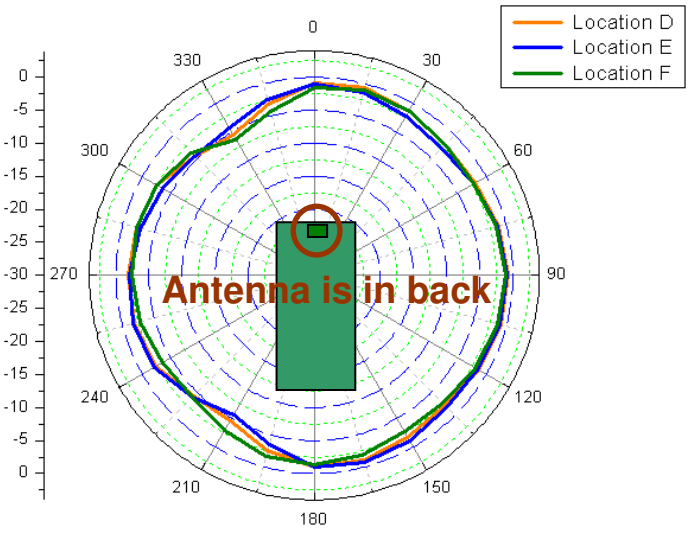




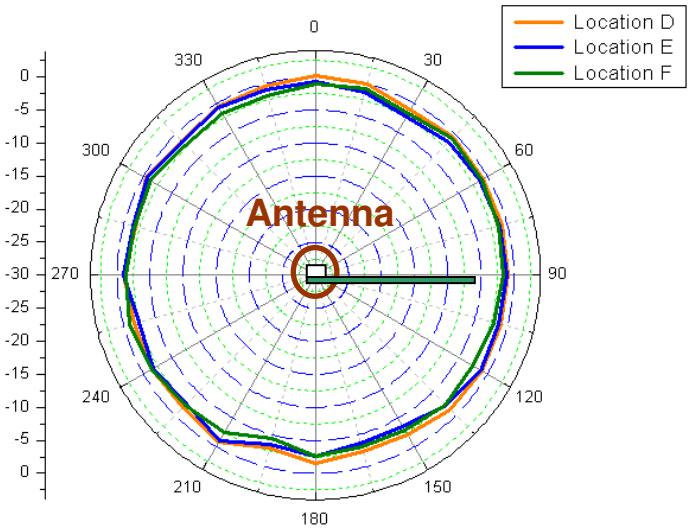
INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

2D Gain Pattern on Short Side

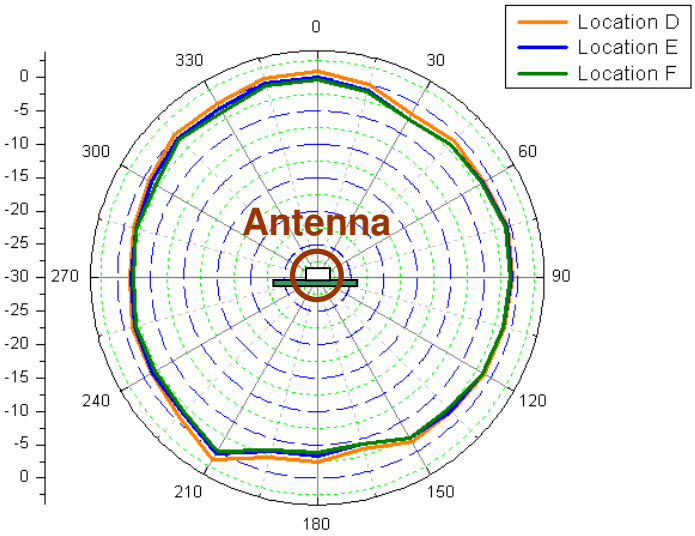
X-Y plane 2450 MHz

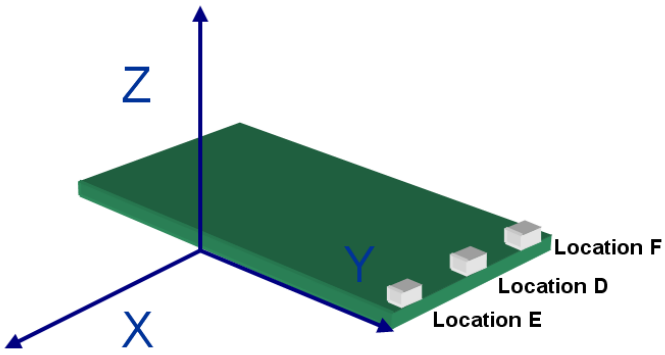


X-Z plane 2450 MHz

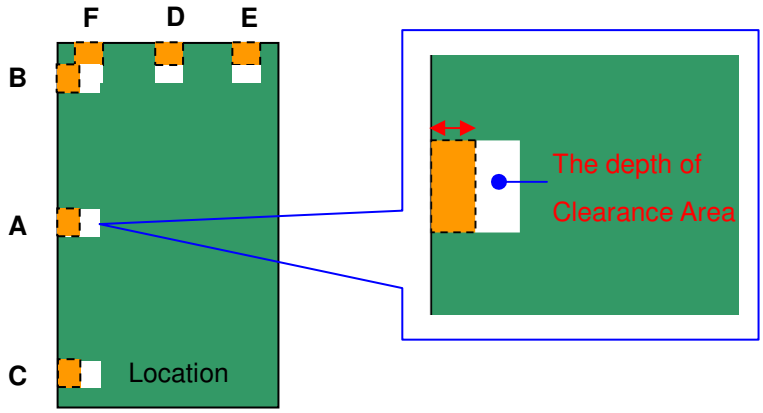


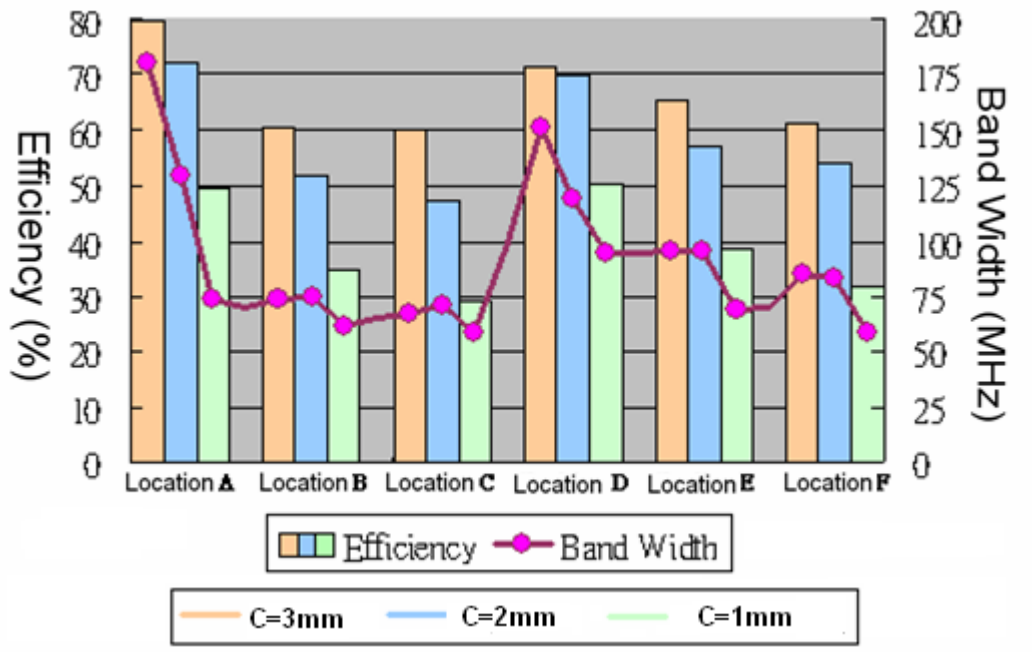
Y-Z plane 2450 MHz





Efficiency and Band Width V.S Different Depths of Clearance Area

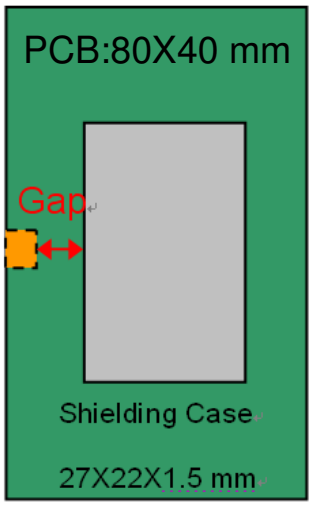


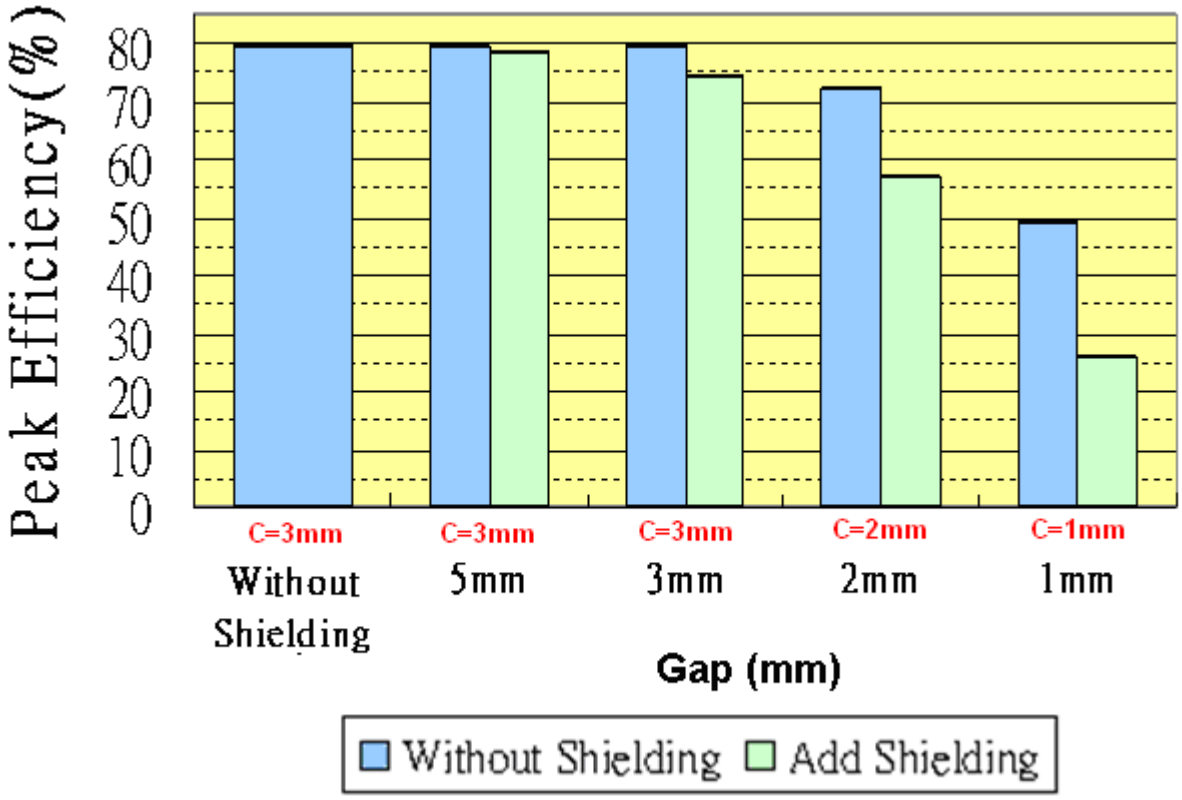


***C=Clearance Area**

***Clearance Area →All metallization should be removed from all PCB layers**

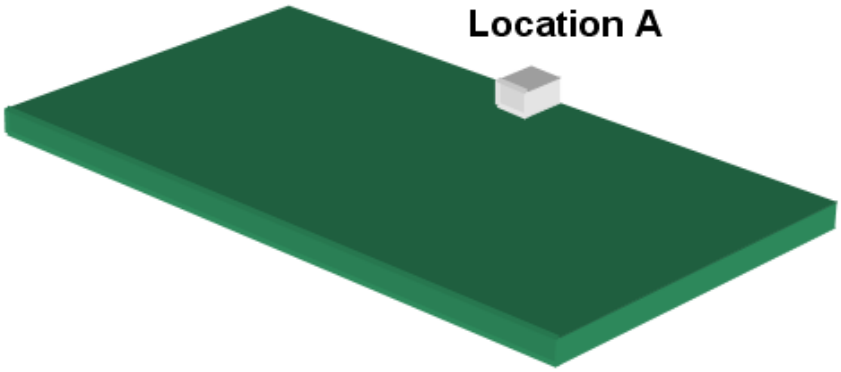
Near Metal Effect

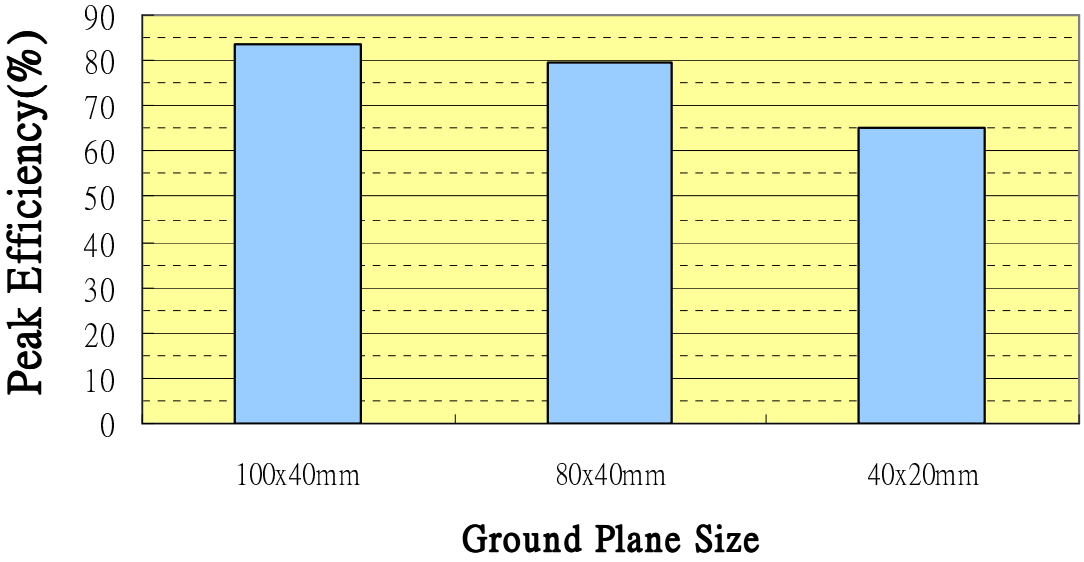




*C=Clearance Area

Ground Size V.S Efficiency



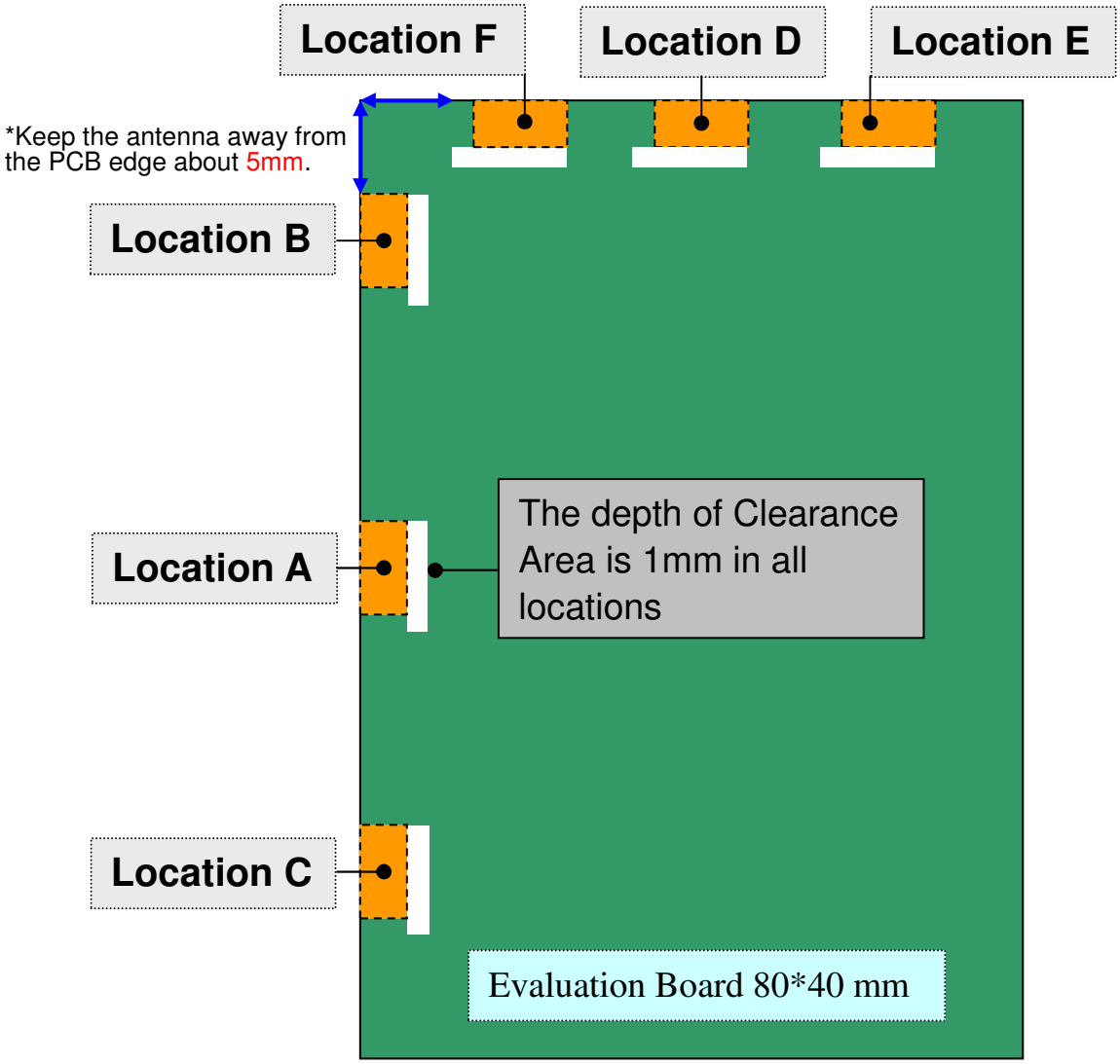


*The depth of Clearance Area is 3mm

The Efficiency and Bandwidth for Different Location

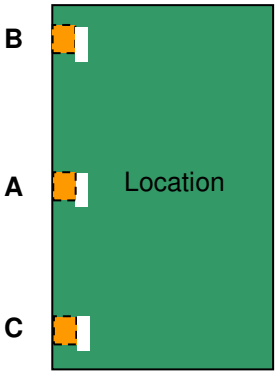
Layout B

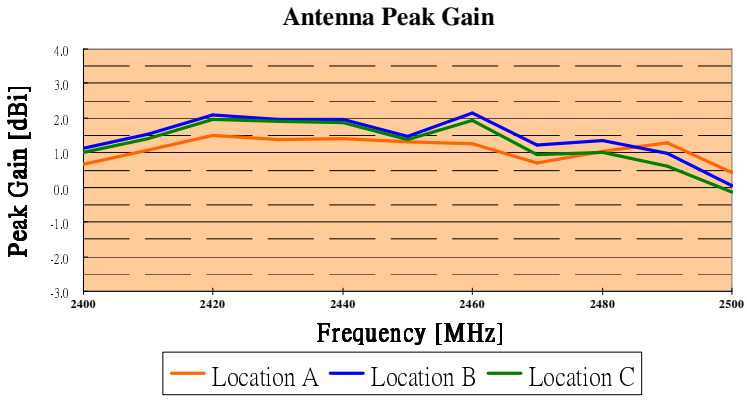
* All electrical characteristic depend on INPAQ 80 x 40mm evaluation board with matching circuit.

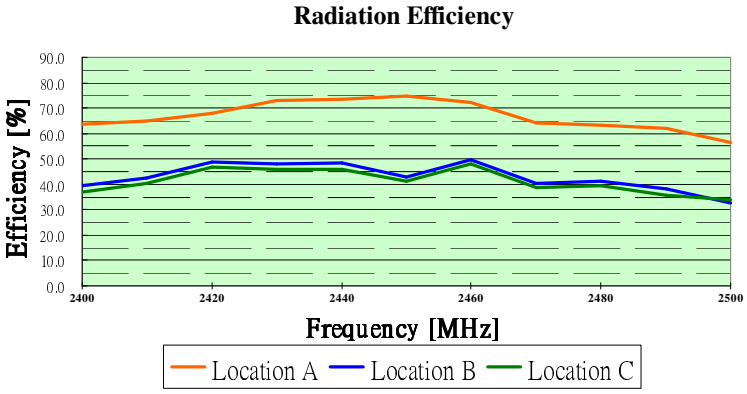


Locations / Test Item			Long side			Short side		
			A	B	C	D	E	F
Bandwidth [MHz] VSWR<2.5			154	90	88	152	107	100
Gain	Linear [dBi]	Peak	1.4	2.10	1.93	1.21	-0.35	0.08
		Avg.	-1.08	-3.60	-3.70	-1.63	-2.80	-2.84
Efficiency	Linear [%]		74.61	49.72	47.87	67.57	53.52	53.07

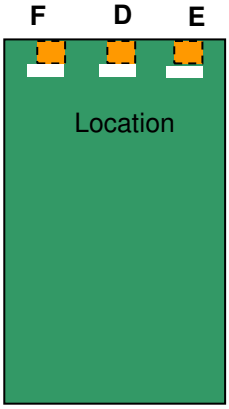
Peak Gain and Efficiency on Long Side

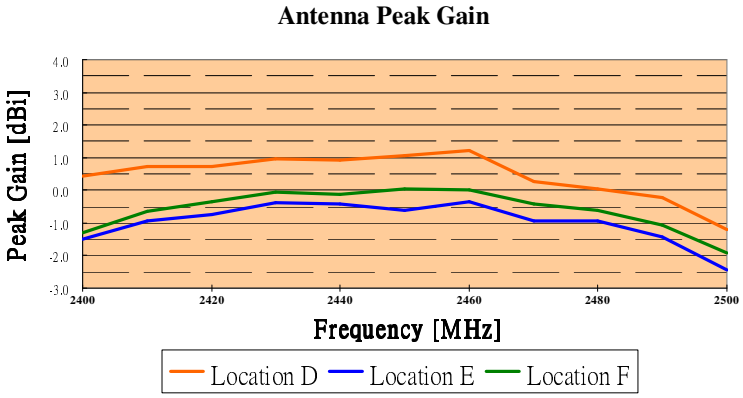


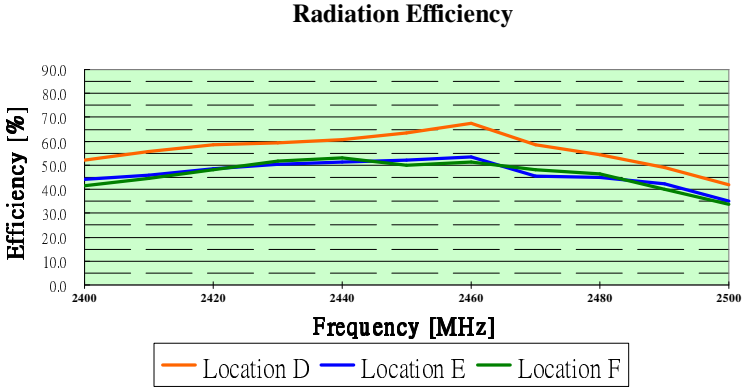




Peak Gain and Efficiency on Short Side

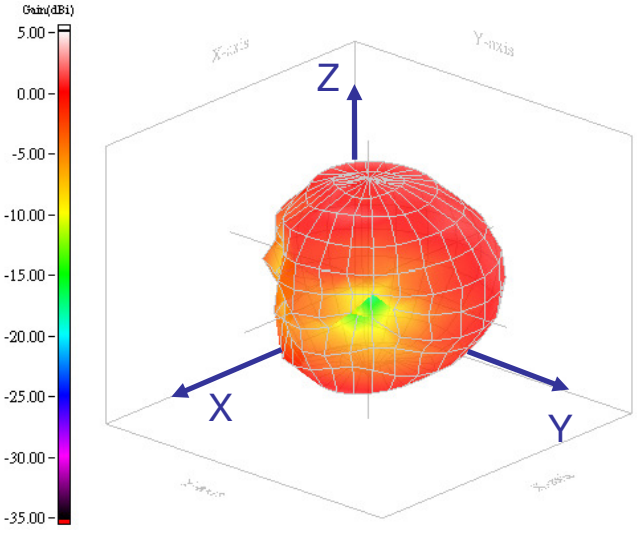




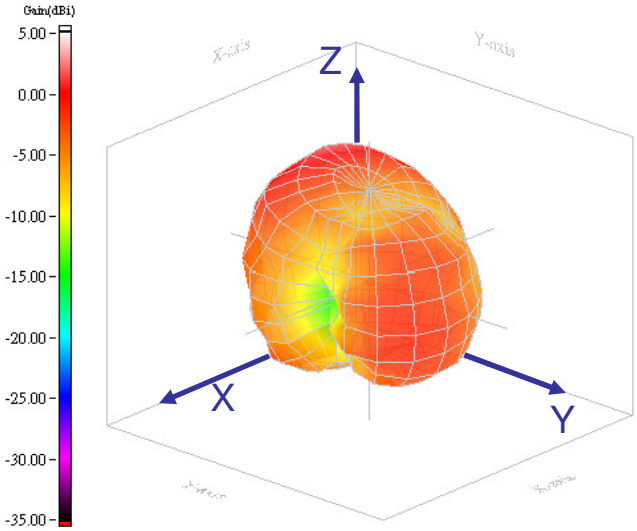


3D Gain Pattern on Long Side

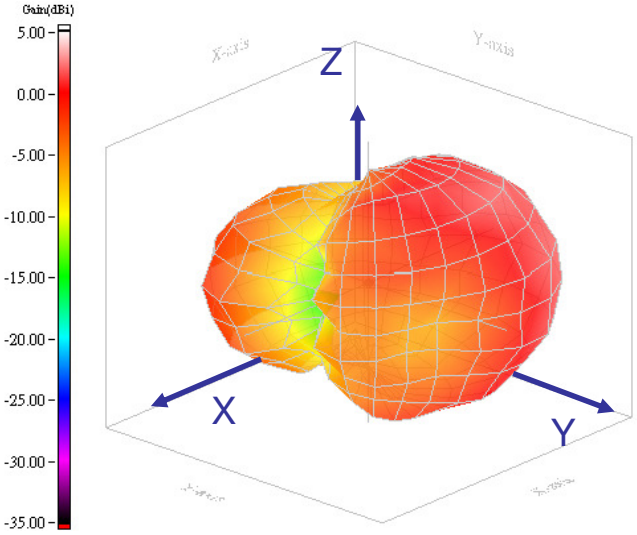
Location A 2450 MHz

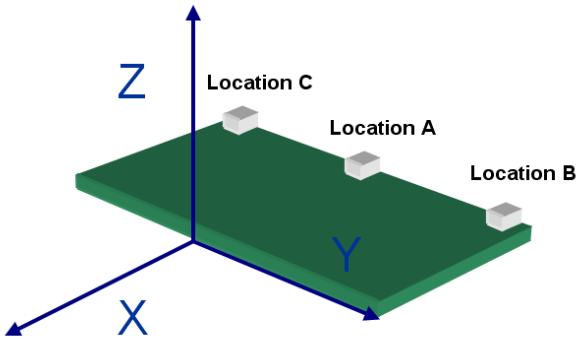


Location B 2450 MHz



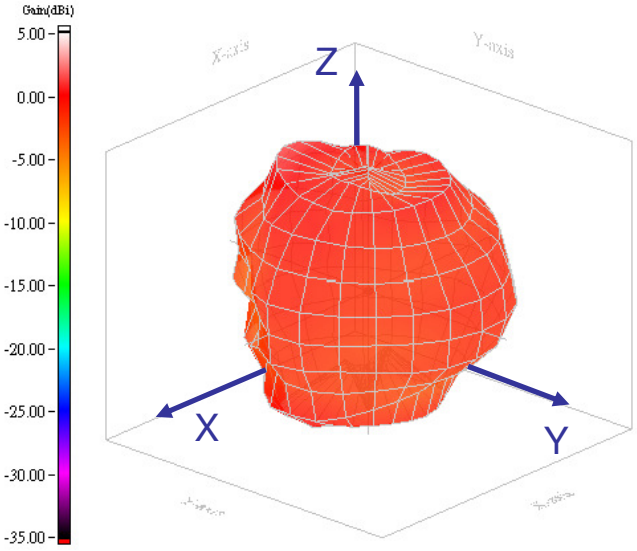
Location C 2450 MHz



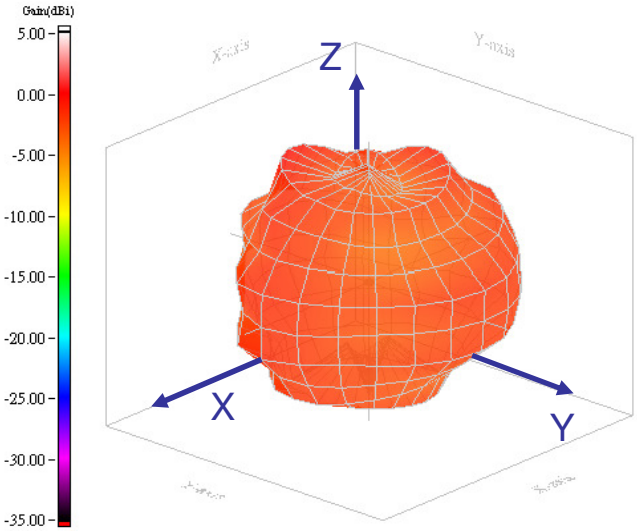


3D Gain Pattern on Short Side

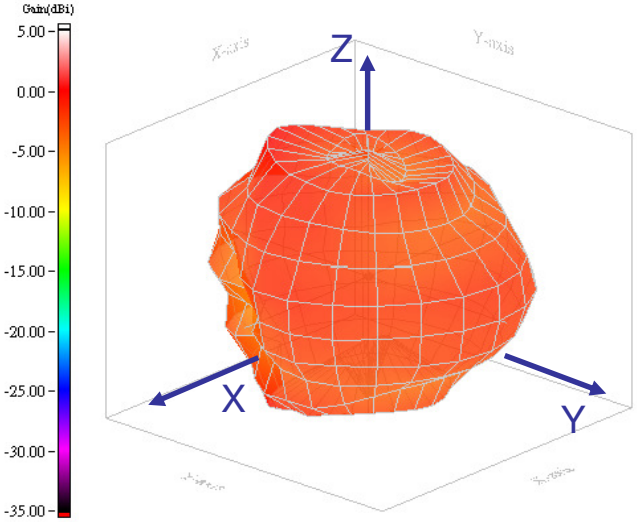
Location D 2450 MHz

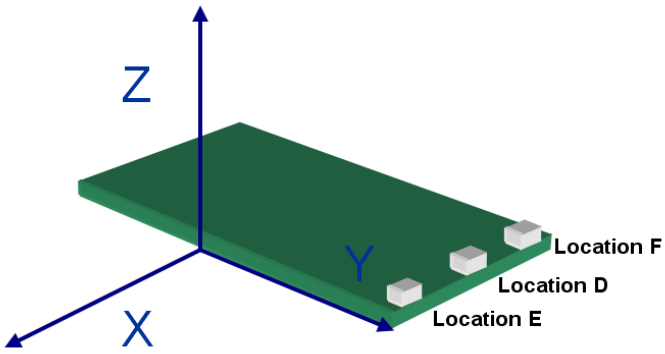


Location E 2450 MHz



Location F 2450 MHz

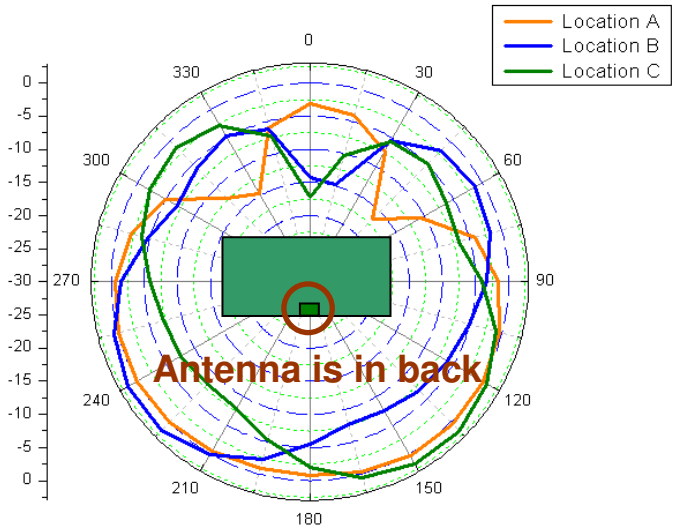




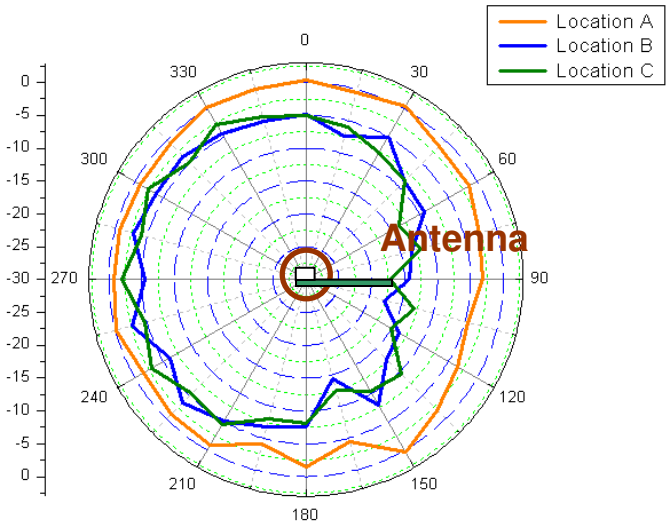
INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

2D Gain Pattern on Long Side

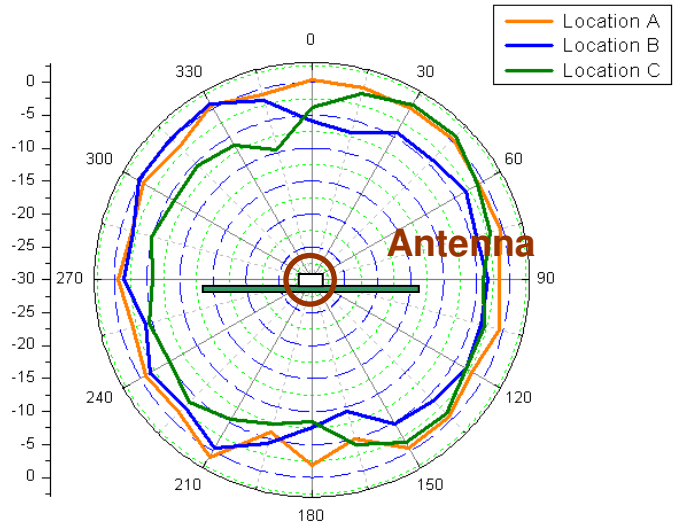
X-Y plane 2450 MHz

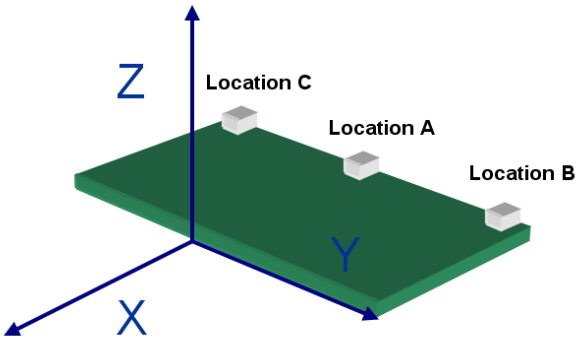


X-Z plane 2450 MHz



Y-Z plane 2450 MHz

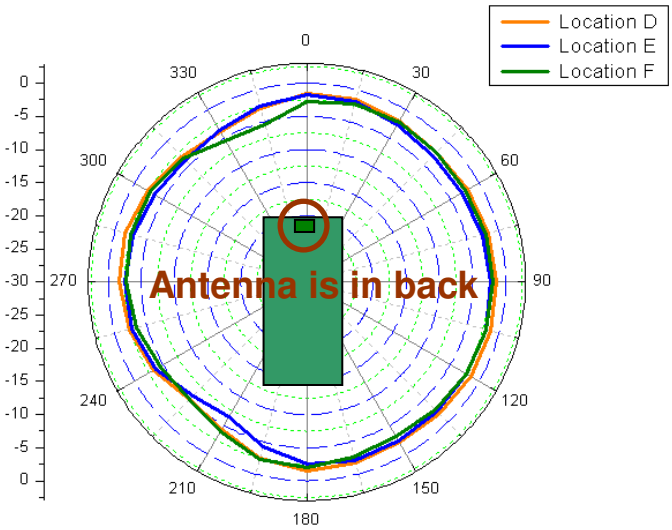




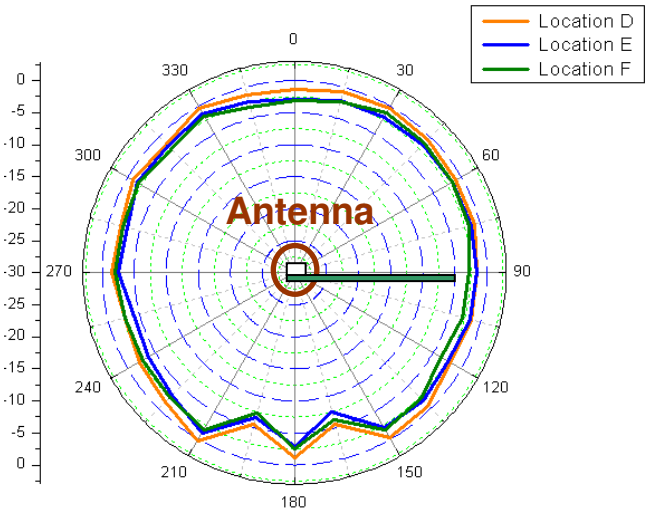
INPAQ Taiwan
TEL:+886-37-585-555
FAX: +886-37-585-511

2D Gain Pattern on Short Side

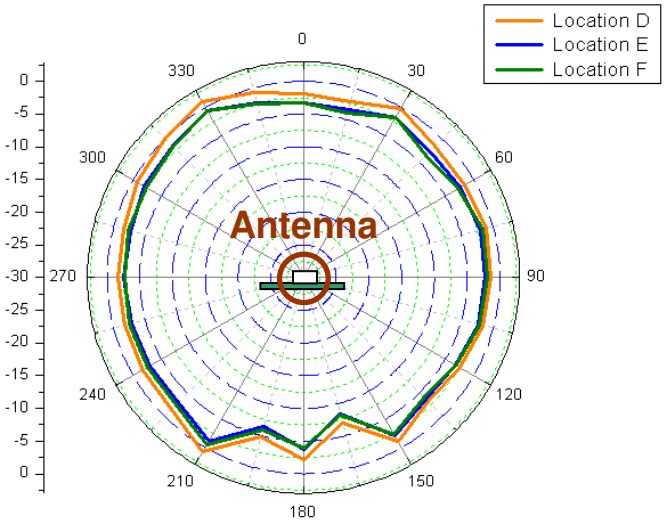
X-Y plane 2450 MHz

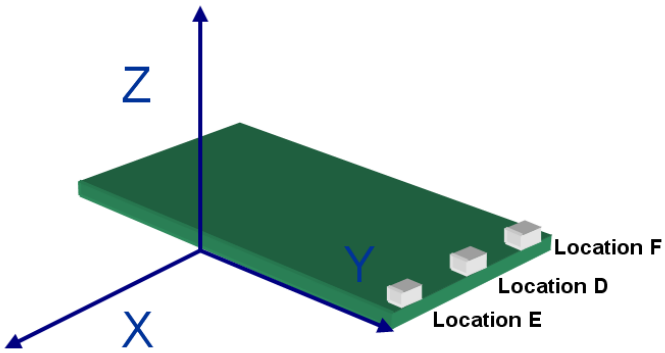


X-Z plane 2450 MHz



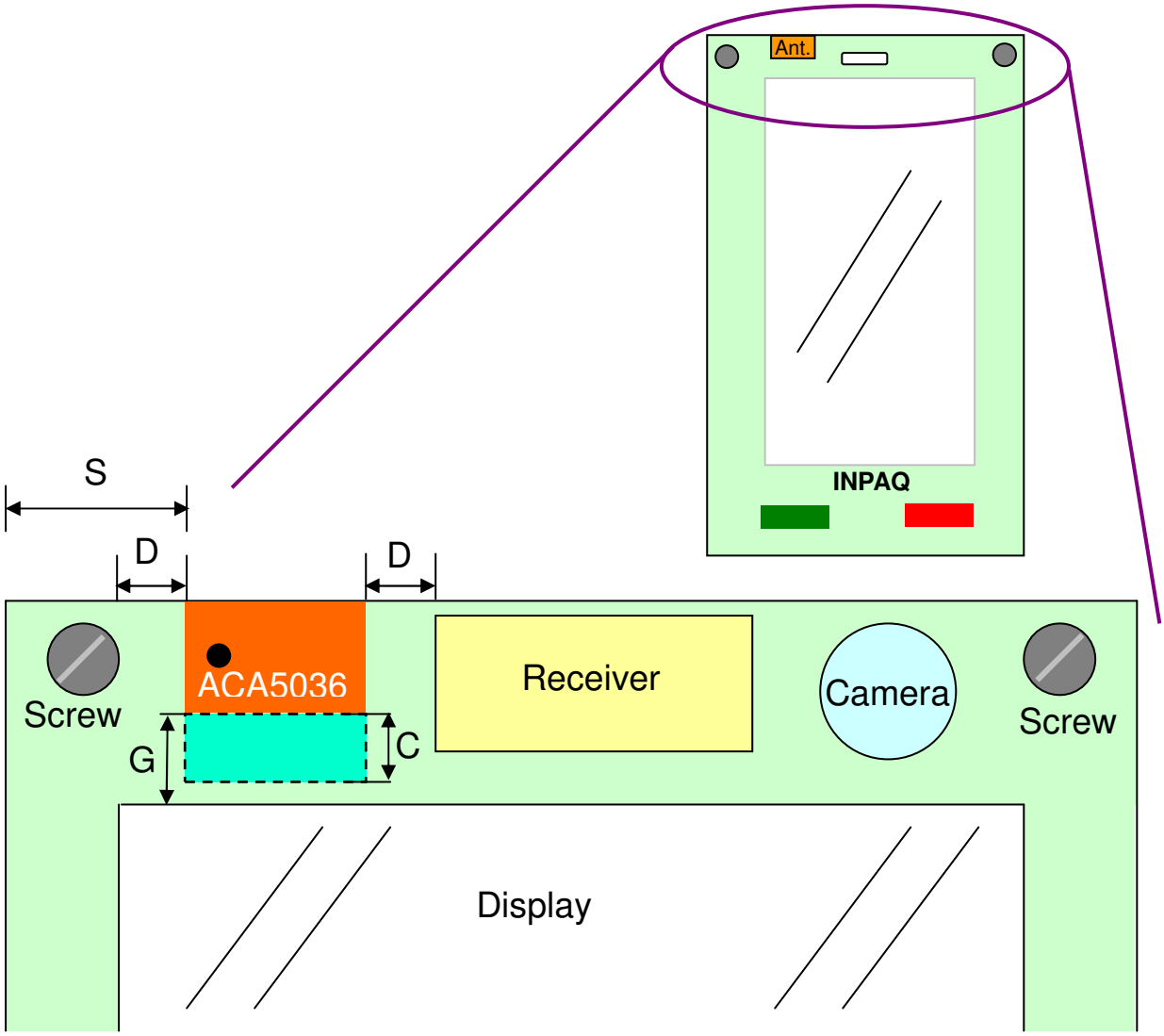
Y-Z plane 2450 MHz





Mobile Phone Applications

- For the mobile phone applications, because most of the key components are arranged along the long side of the PCB, there is no space to place our antenna. So we move the antenna to top edge of PCB as showed as follow picture. And the impedance of PCB in top edge is smaller than in long side edge, we get narrower bandwidth and lower performance than in long side of PCB. But we still get a workable performance by arranging antenna and components in a reasonable position.



Symbol	Suggested Distance	Remark
S	≧5mm	The distance between PCB edge and antenna edge
D	≧3mm	The distance between antenna and receiver(or shielding case)edge
C	≧3mm	The width of clearance area needs 3mm from antenna edge.
G	≧3mm	The edge of display must keep away 3mm from antenna edge.

PND Applications

- For the PND applications, Bluetooth antenna usually place at the long side of PCB. To make the device thinner, it usually cut a part of PCB to put the battery in it and result in a shorter PCB than mobile phone application. In order to increase the performance of Bluetooth antenna, we suggest to keep some part of PCB to make it look as L-shape as figure E. However, the distance between panel and PCB will affect the antenna performance, we suggest keep the panel away from antenna edge at least 3mm in distance as Figure F.

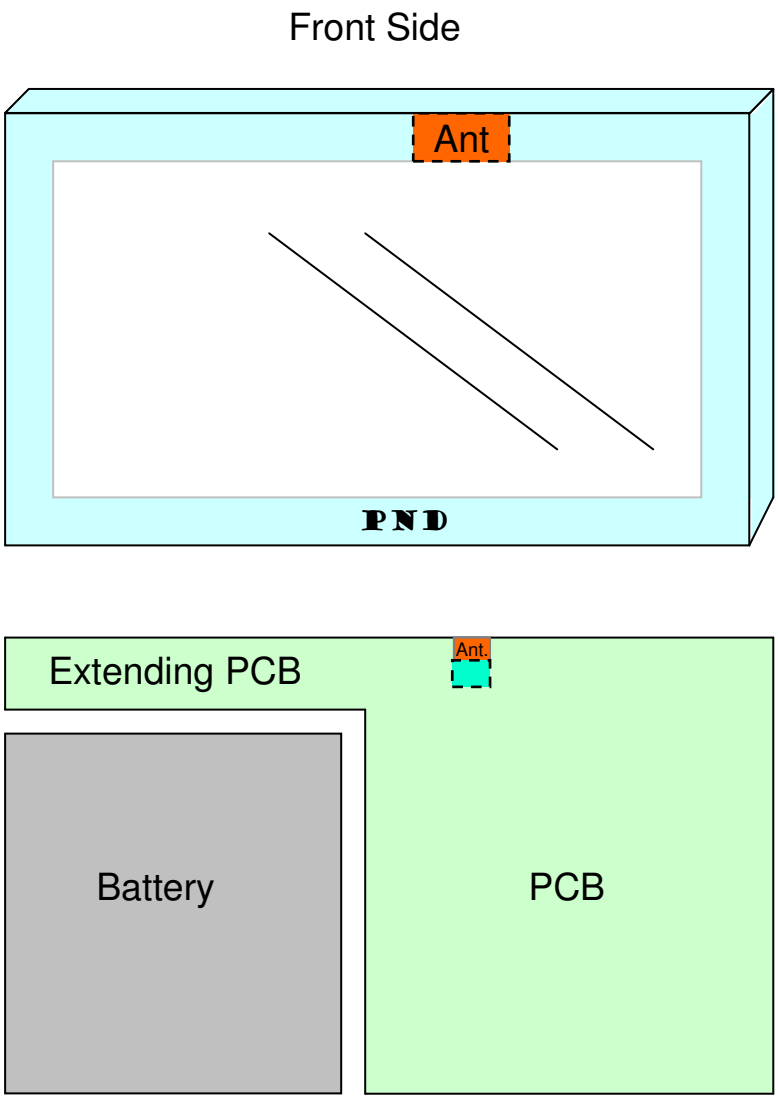


Figure E. Make the extending PCB to get the better performance

Back Side

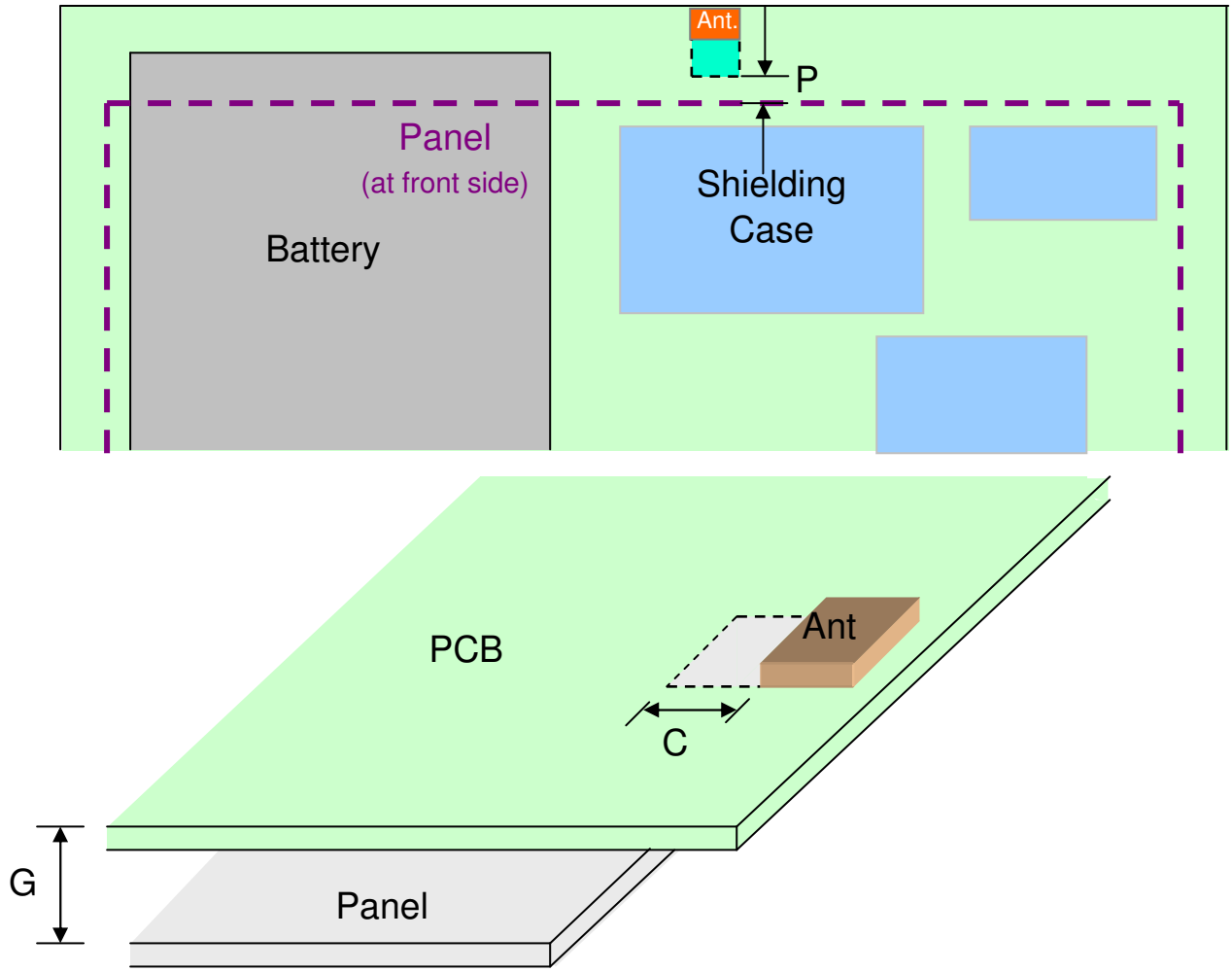
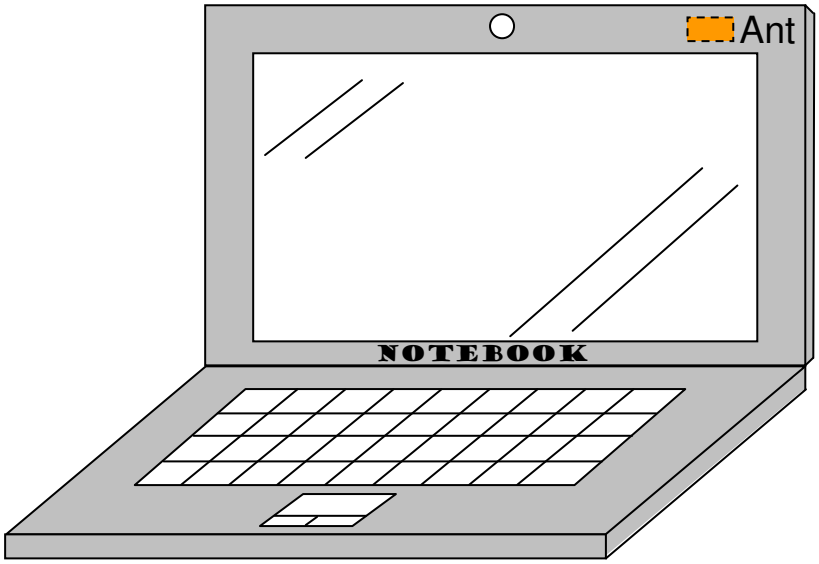


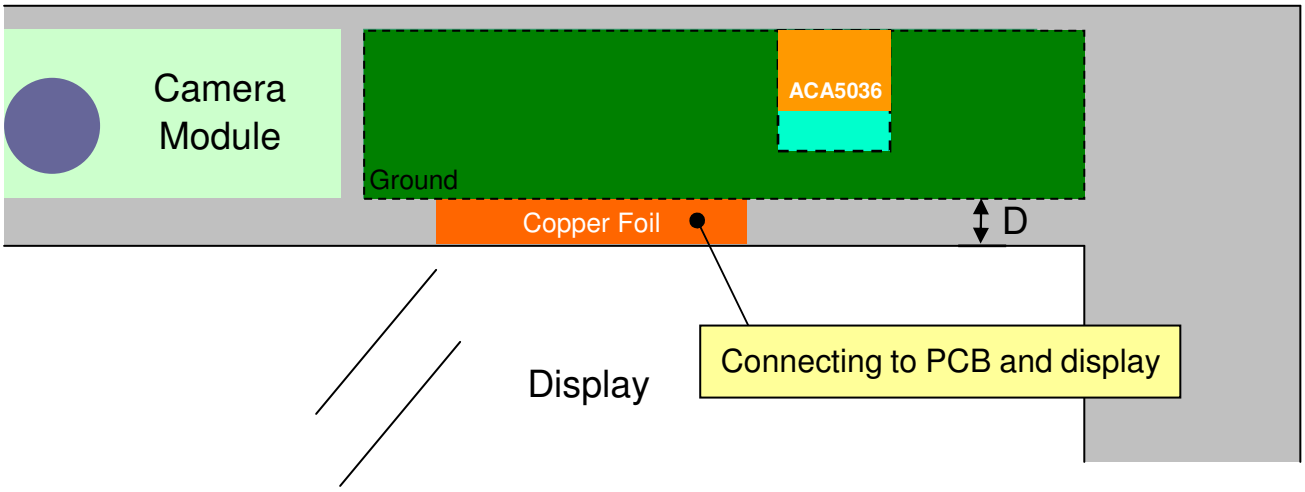
Figure F. Keep the panel away from the PCB more than 3mm.

Symbol	Suggested Distance	Remark
P	≧1mm	The edge of display must keep away 3mm from antenna edge.
C	≧3mm	The width of clearance area needs 3mm from antenna edge.
G	≧3mm	The distance between antenna and panel metal

Notebook Applications

- For the notebook applications, the space is too small to place a larger PCB. As we know, the smaller PCB we have, the worst antenna performance we get. But according to characteristic of this antenna, because the radiation efficiency depends on the size of the metal layer, so we can extend metal layer from PCB to panel by using copper foil. And if the radiation plane can be extended to metal of panel, the PCB size becomes a minor factor of antenna performance; it means we can use smaller PCB to get the similar performance. By the way, the cable which connects from PCB to main board must fix along the edge of display, and shorter cable will get the better performance due to its cable loss.





Symbol	Suggested Distance	Remark
D	≧3mm	The distance between antenna and the edge of panel.

Contact Information

INPAQ Technology Co, LTD

Taiwan Chunan

ADD: No.11, Ke-Yi St., Chunan, Miaoli 35059, Taiwan (R.O.C.)
TEL : +886-37-585-555
FAX : +886-37-585-511
E-Mail : info@inpaq.com.tw
Web site : http://www.inpaq.com.tw

USA Office

ADD: 21 Echo Brook Road, Rochester, NH 03839, U.S.A.
TEL:+1-603-332-6222
FAX:+1-603-509-2900

Korea Office

ADD: 221 Raemian Seocho Univill, 1445-4, Secho-Dong, Secho_gu, Seoul, Korea 130-070
TEL:+82-2-584-8959
FAX:+82-2-584-8951