Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

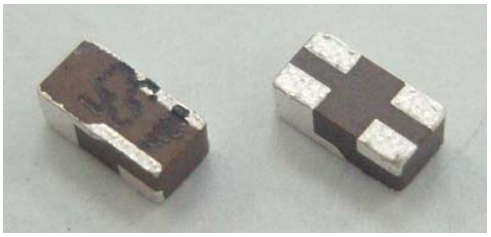
MSL Level 1

ROHS-Y

Approval Sheet

Customer : PANTECH
Model : Bluetooth Chip ANT
Model[Project]
: CDM-8999 [J-Touch]
Part No : 53C01000094
Maker code[Supplier CODE]
: SDBTPTR3015
Supplier : PARTRON

3D Structure



ANT. Size : 3.0 x 1.5 x 1.2T

By designed	By checked	By approved
Research 5 team	Quality Assurance	Laboratory
Chan-Ik.Jeon	Nam-Sik.Min	Byoung-Jun.Yim
04 / 28	04 / 28	04 / 28

2010. 04. 28

22-6, Seokwoo-dong, Hwaseong-si, Gyeonggi-do
Korea, 440-170
Tel : 82-31-201-7870~6
Fax : 82-31-201-7800
www.partron.co.kr

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1. Revision History

1.1 Approval sheet History LIST

No	REV	PANTECH REV	Before	After	Description of changes	ea	Requested by	Process step
1.	1.0	A	-	1.0_(20100428)	Issued	1	QA	TP1

2. Material

No	Part number	Raw material	Process	Post processing	ea	Company for raw material	Supplier	Remark
1	MWF-38U(Ceramic)	$Mgsi0_2$ (Magnesium silicate)	Molding/ Sintering	Polishing	1	Dongbang	Partron	1X4 cavity
2	PCC11836HV (paste)	Ag	Printing	Dry/ Baking Hole	1	METEC	Partron	200 ea/once PATTERN : Over10㎛ PAD : Min10㎛ (TYP 16~20㎛)
3	5135E(Black ink)	butanone	Marking	–	1	Image Korea	Partron	

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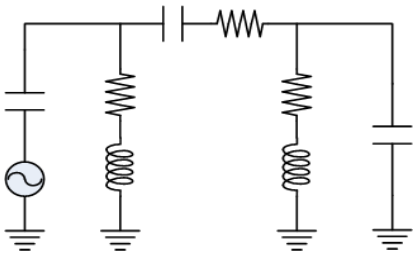
3. Application Note

– This product is the internal dielectric chip antenna of radio communication, forms the pattern with Ag paste on the brick of dielectric block and materializes the characteristics

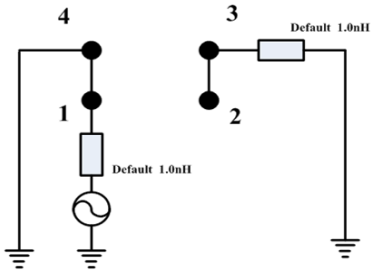
3.1 Electrical Characteristic

3.1.1 Internal Block Diagram

This product is made of the dielectric block and RF part materialized the characteristics by structural change of Ag pattern on the brick of dielectric block and conditioning value of the structural equivalent circuit.



<Chip Antenna Equivalent Circuit>



<Default Condition Equivalent Circuit>

3.1.2 Application Note

This product is an internal dielectric chip antenna that acts to convert guide waves on a transmission structure into free space waves.

This is able to position at anywhere of the PCB that you want. Even if the surround condition of chip antenna alter into the changed electrical characteristic, you can tune the electrical characteristic by designing the another PCB layout. And so far as circumstances permit, using only lumped element, you can adjust the electrical characteristic of antenna without the PCB layout alteration.

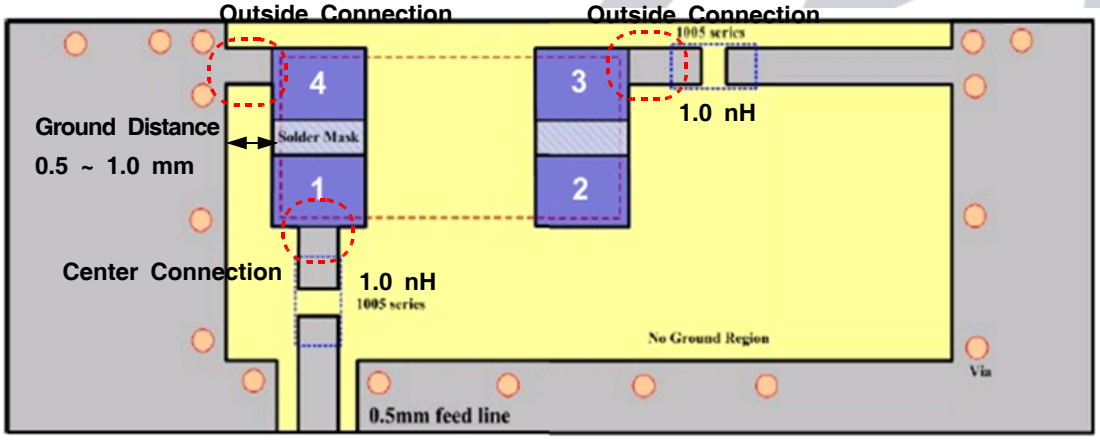
However, You must carefully choose the space for a chip antenna. Because this is only electromagnetic RF device, the electrical characteristic is changed by surrounding condition of antenna.

In case of this product, the four land pads exist and the fixed feeding structure is not, each the No 1, 2, 3 and 4 land pads can become the input pad or the ground short in each another situations. Sometimes, some land pads become just mount pad.

You can obtain the detail informations about the selection of each land pad from PARTRON

3.1.3 PCB Layout Design

3.1.3.1 Basic Design



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This Figure shows the normal PCB layout design for this product, there are the detail dimension informations at next page.

A : The No1 Pad is an input pad, the No4 and No3 pads are ground short pad. The No1 and No4 pads become electrical short, this region is not soldering region. Alike, the No2 and No3 pads are the same shape like a No1 and No4. Now this look like two land pads. The line width that the No3 and No4 are connecting with ground is over 0.5mm.

B : The area of No Ground Region is 4.0x7.0mm^2 at normal design condition. This product is not operated without the No Ground Region. At around the No Ground Region, insert the through Via like the figure.

C : The gap of between No1 land pad and ground is not exceeding 1.0 mm, over 0.5mm. Like a figure, at between the input pad and input line, the lumped element(1005 size) exists at No Ground Region. The default Value is 1.0 nH.

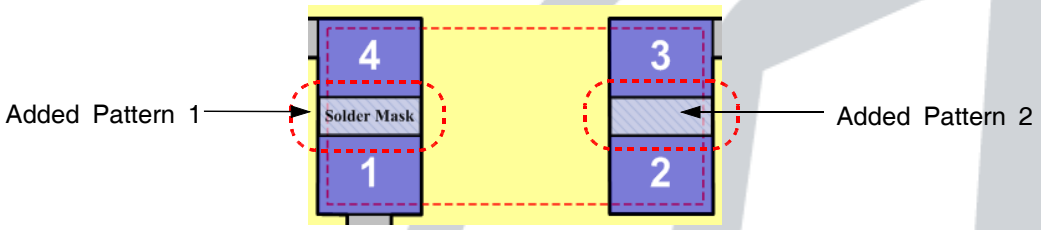
D : The No3 and No4 land pads are connected with the ground at outside of land pads and the No1 land pad is connected at center of land pad.

E : The No3 land pad is connected with the near ground, using the lumped element(1005 size). The value is 1.2 pF.

F : If the given condition do permit, insert many through Vias. Especially, have a careful at an edge.

3.1.3.2 Land Pad Design

Generally, the land pads of chip antenna are four and the soldering pads of PCB are same. But like a below figure, near land pads are connected each other, then it looks like two land pads on PCB.



If we have a need to change characteristics, the Added Pattern 1 or 2 is removed, the PCB land pads become three land pads or four land pads.

About this item, detail information is recommended at the process that cooperate with you.

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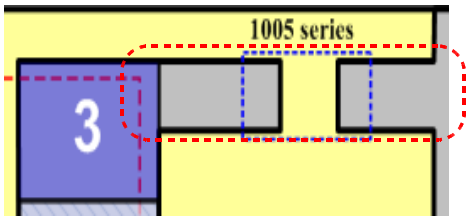
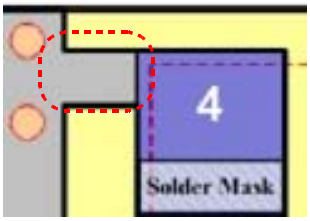
3.1.3.3 Line Design

The connect line width is over 0.5mm.

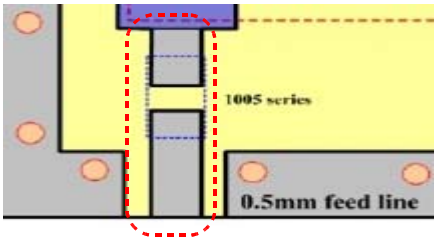
Line Width 0.5mm



Line Width 0.5mm

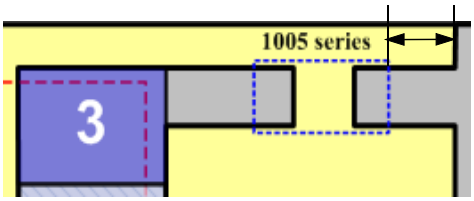


Line Width 0.5mm



3.1.3.4 Inserted Lumped Element

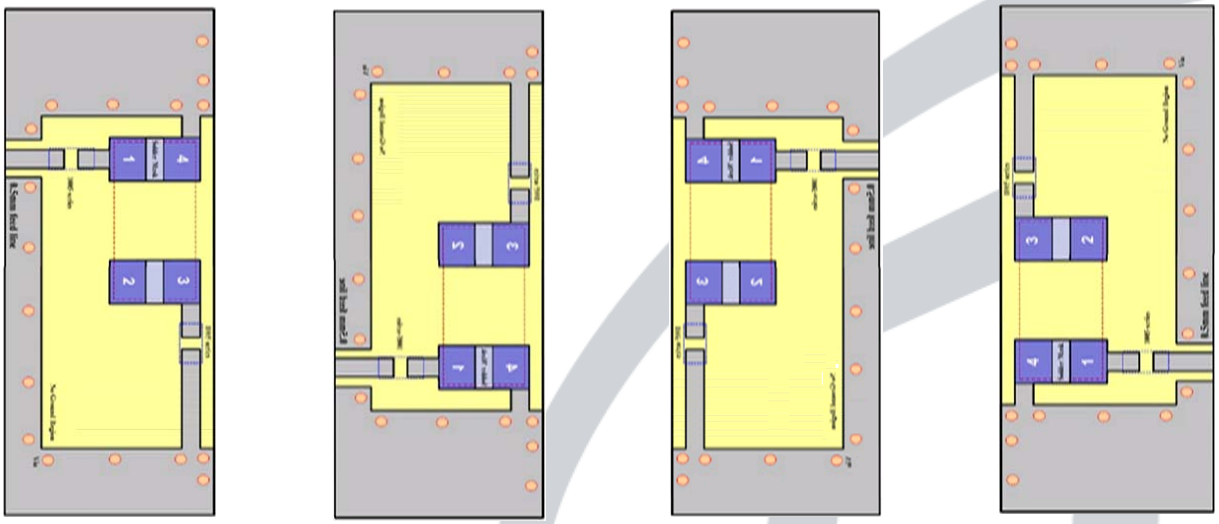
In reference with a position of lumped element, it is necessary to locate inner No Ground Region. The both default values are 1.0 nH. It is shown at below figure, the lumped element that existed between No3 land pad and Ground locate at interval of over 0.5mm from ground.



Distance, min 0.5mm

If you don't permit this design, it is possible to change position of lumped element and another design. Have a conference with PARTRON.

3.1.3.5 Change of Antenna Position



This product is able to position at various spaces of PCB, like above.

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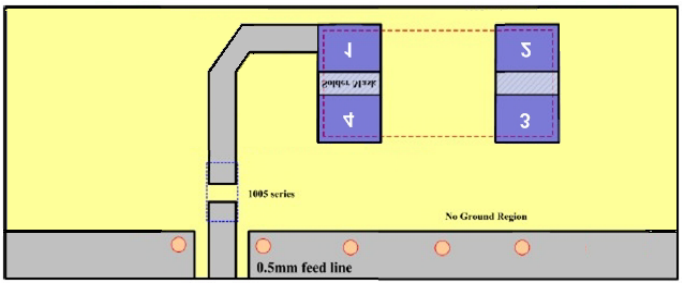
3.1.3.6 Example of Another Application

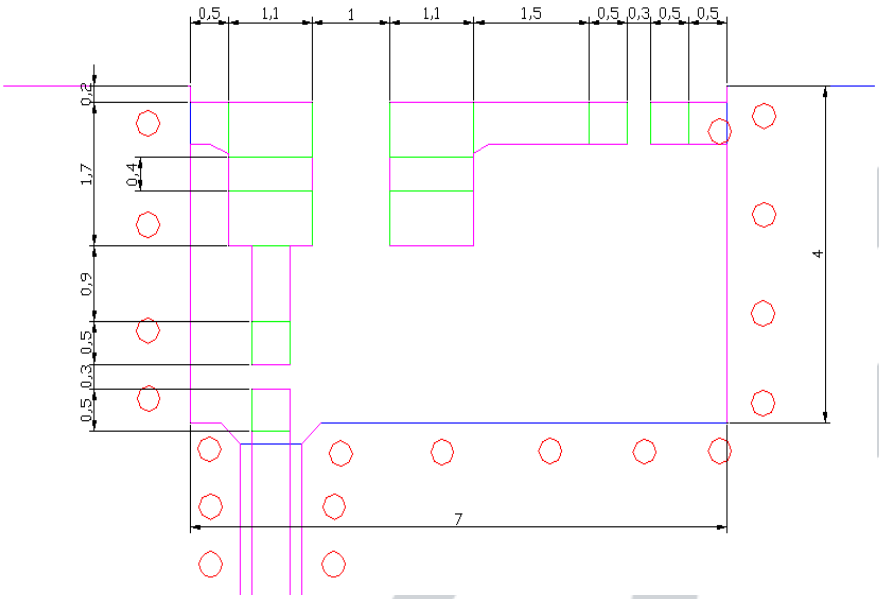
This product has a merit that the antenna is not changed. The electrical characteristic is adjusted by changing lumped element value and designing the another PCB drawing. The information about the another PCB drawing is many other cases, and so we don't explain this paper. If you need a technical report, ask for that in PARTRON.

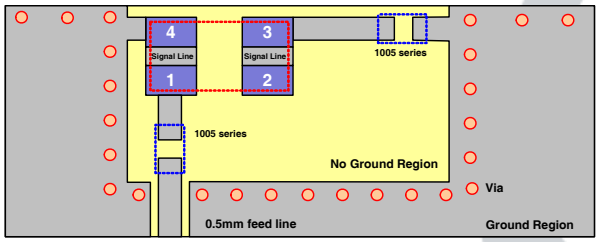
Now, there is an example drawing, this is working like monopole type for avoiding any situations. The Used antenna is sure the same antenna, however it is working differently.

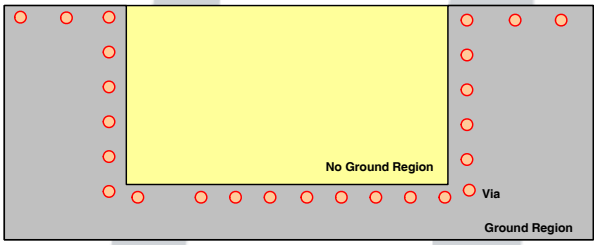
- Monopole Type Layout Example



3.1.3.7 PCB Drawing(Auto CAD Design)







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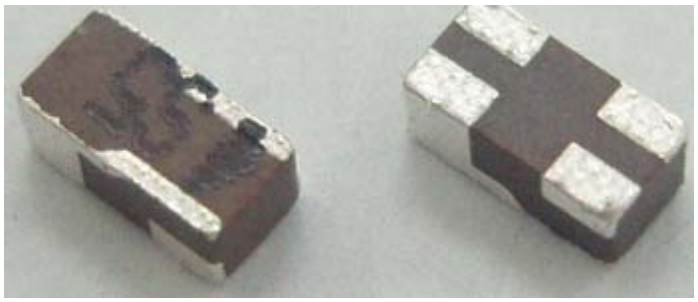
3.2 Mechanical Characteristics

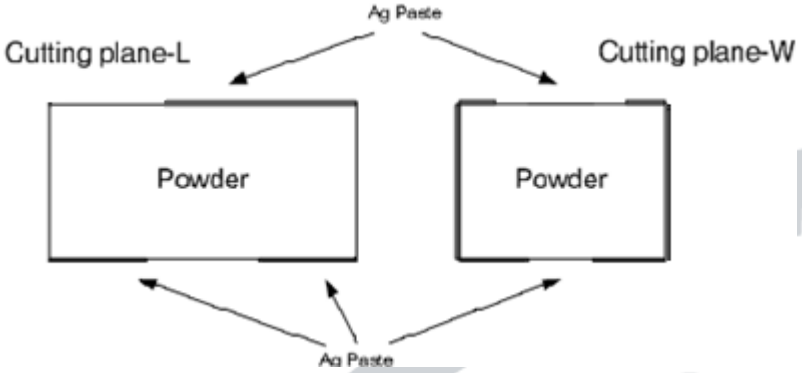
3.2.1 Fabrication

The structure is materialized printing Ag paste at the dielectric block

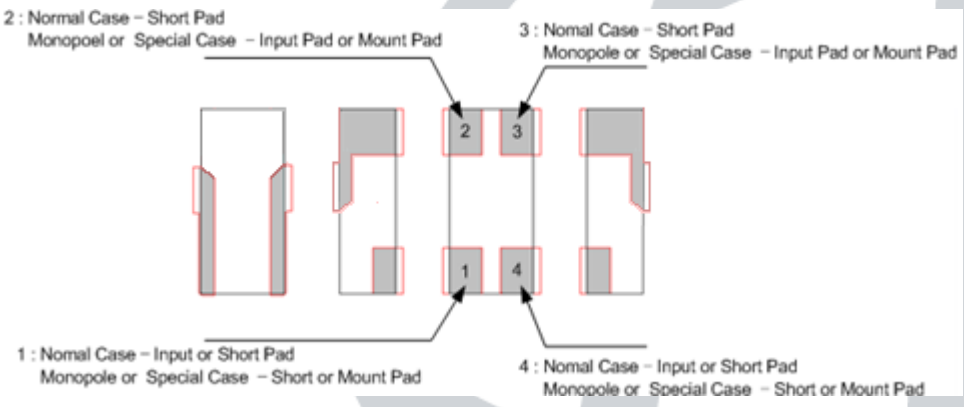
3.2.2 Structure



3.2.3 The Cross Section



3.2.4 Pin name



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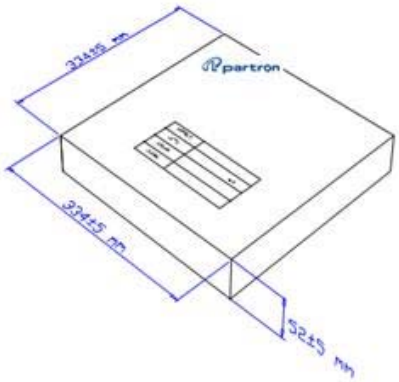
3.3 Packing

3.3.1 Carrier/Reel

Item	Material	Surface Resistance	Electricity	Method
Carrier	A-PET	Typical $10^8\Omega$	10V MAX	Heat Press
Cover tape	PET	Typical $10^8\Omega$	30V MAX	
Reel	PS	Typical $10^8\Omega$	30V MAX	-

Reel Picture

3.3.2 BOX Specification



Material : SK/S/K-E
골판지

Inner Box Picture

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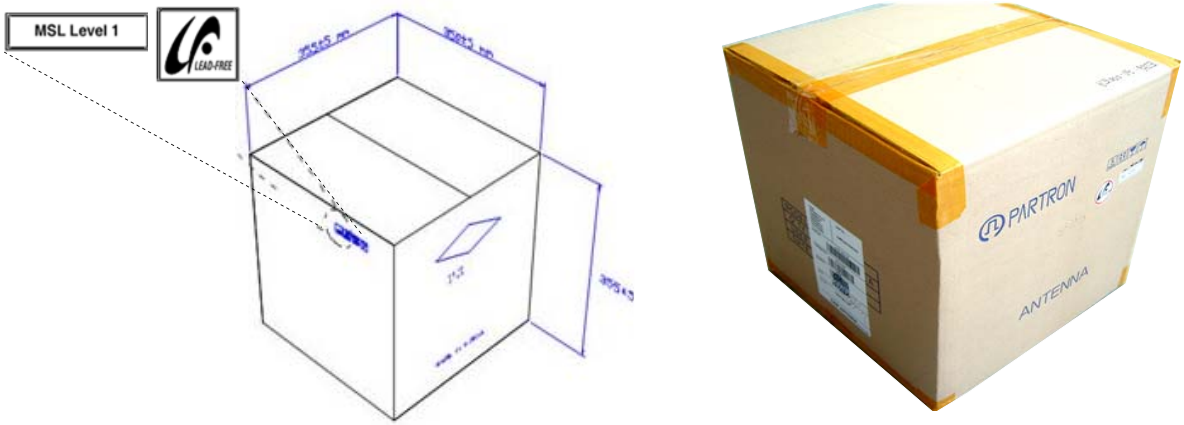

Outer Box Picture

Reel / Inner Box Label

Outer Box Label

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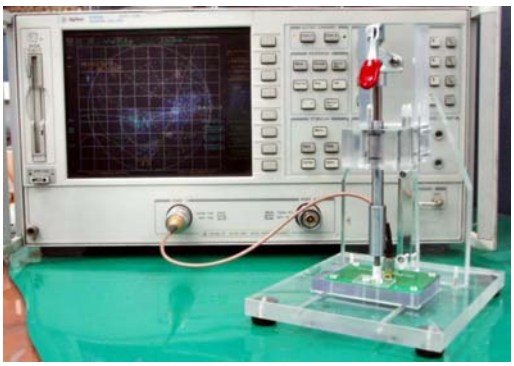
4. Measurement Process

4.1 Measurement Process

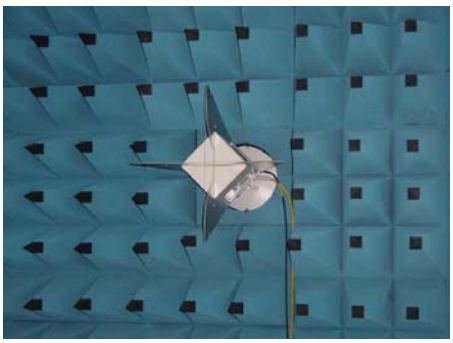
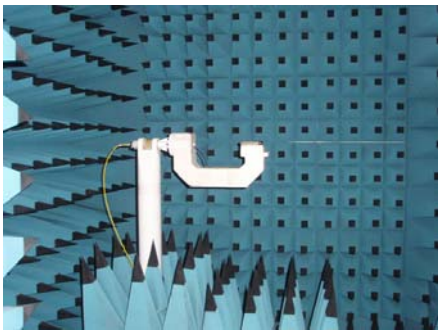
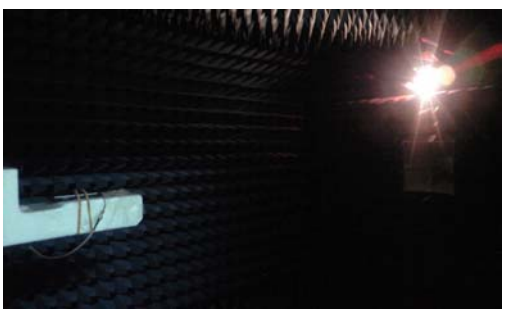
4.1.1 SWR/Return Loss

The SWR/Return loss is measured by Network Analyzer. Using the test fixture, the Selected reference sample is a standard product.

	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753E	Agilent HP8753E or Advantest R3765CH
Cable	RF cable(300mm)	RF cable(300mm)
Test condition		

4.1.2 Gain

The Antenna Gain is measured by using the Passive DUT at Anechoic Chamber

Anechoic Chamber for Antenna Gain Measurement	
	
	

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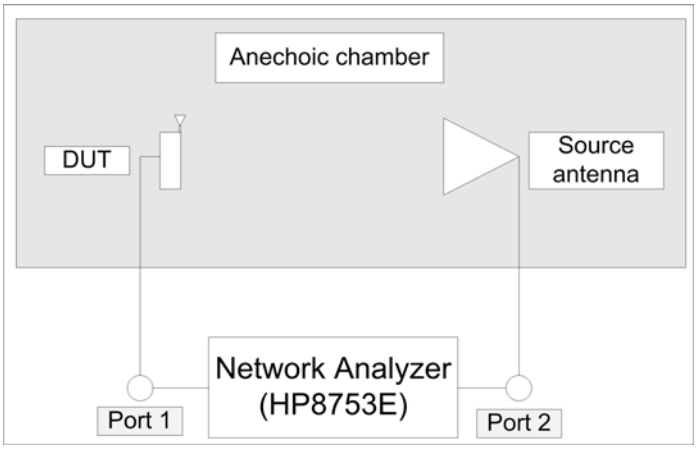
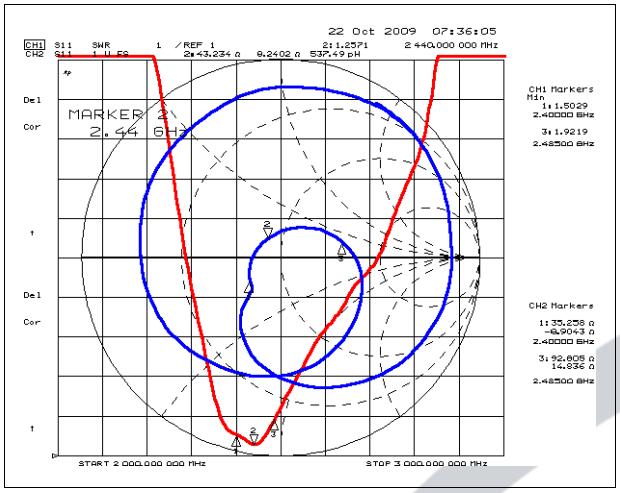
4.1.3 Gain Measurement block diagram



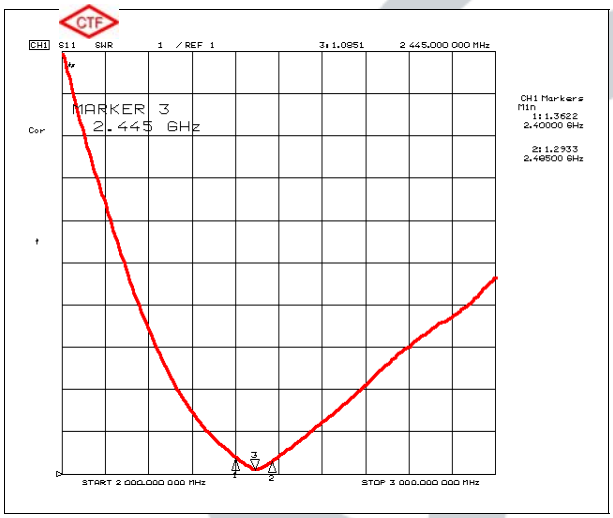
5. Electrical Characteristic

5.1 VSWR

5.1.1 Set Fixture Condition



5.1.2 S11 Graph of Test Fixtuere Condition



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5.1.3 Test Fixture Condition

ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2485
Lower frequency(2400 MHz) SWR [Min~Max]	1.0 ~ 3.0 : 1 (typ 2.5 : 1)
Upper frequency(2485 MHz) SWR [Min~Max]	1.0 ~ 3.0 : 1 (typ 2.5 : 1)

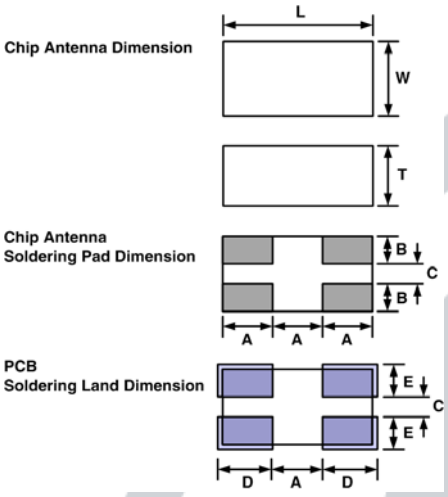
5.1.4 Test Fixture Specification

1)Test Fixture and Test PCB

Test Fixture Loss 0.2~0.3 dB

※Ev B'd and Test Fixture Jig is the same
(Contact way of Ev B'd is soldering, Test Fixture is copper contact way)

2) Soldering Pad Dimension and PCB layout Dimension



Top Layout **Bottom Pattern**

Parameter	L	W	T	A	B	C	D	E
Value[mm]	3.0 ± 0.1	1.5 ± 0.1	1.2 ± 0.1	1.0	0.55	0.4	1.1	0.65

Unit ; mm

Unless specified tolerances are ±0.05

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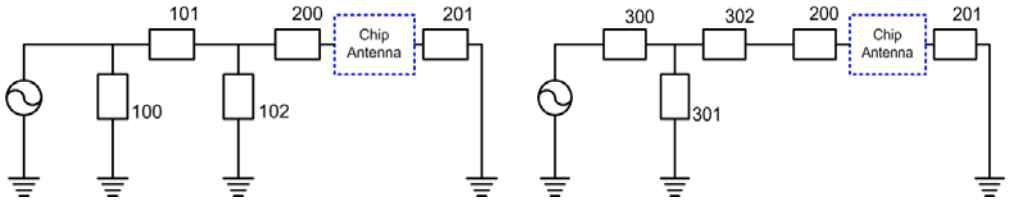
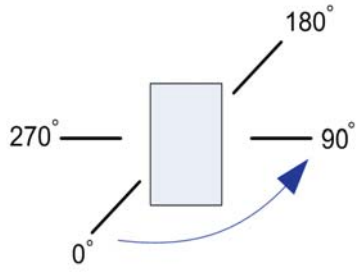
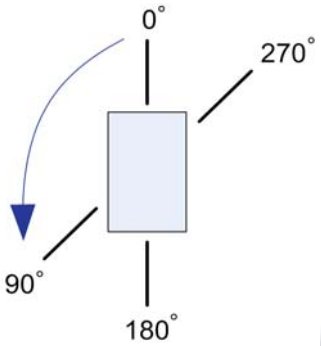
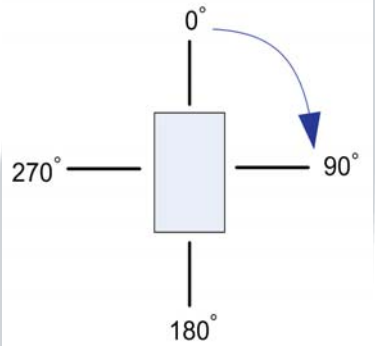
3) Matching Circuit and Default Value



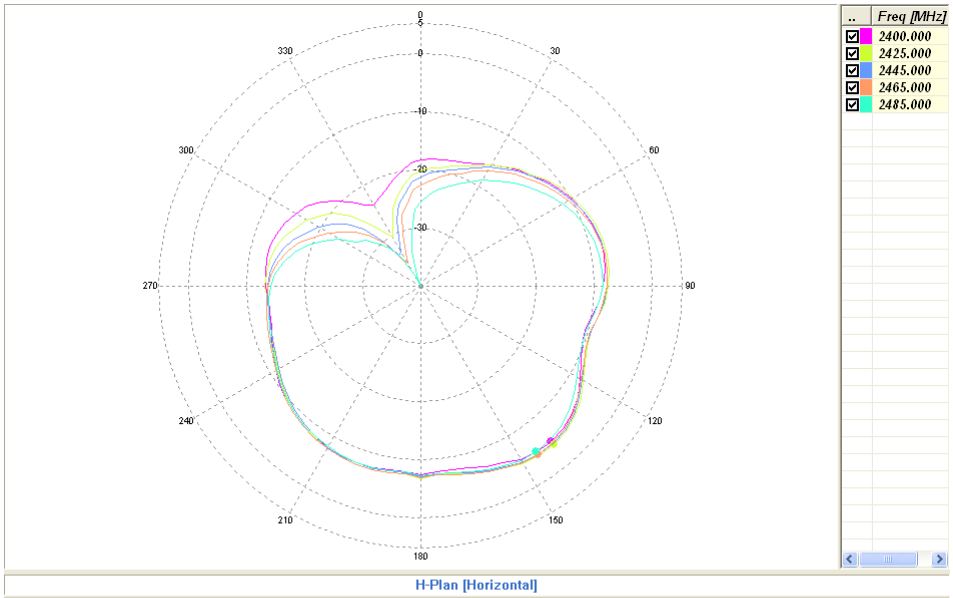
Number SPL	SDBTPTR3015		Number SPL	SDBTPTR3015		Number SPL	SDBTPTR3015	
spec→	SWR(Min:1.0~Max:3.0)		spec→	SWR(Min:1.0~Max:3.0)		spec→	SWR(Min:1.0~Max:3.0)	
Item↓	2400[MHz]	2485[MHz]	Item↓	2400[MHz]	2485[MHz]	Item↓	2400[MHz]	2485[MHz]
1	1.30	1.30	24	1.37	1.23	47	1.25	1.32
2	1.32	1.28	25	1.26	1.32	48	1.31	1.26
3	1.28	1.31	26	1.35	1.23	49	1.28	1.28
4	1.29	1.33	27	1.29	1.29	50	1.27	1.25
5	1.36	1.25	28	1.30	1.31	51	1.26	1.31
6	1.30	1.37	29	1.37	1.22	52	1.24	1.29
7	1.35	1.31	30	1.34	1.25	53	1.29	1.28
8	1.33	1.30	31	1.35	1.21	54	1.28	1.25
9	1.34	1.27	32	1.25	1.31	55	1.27	1.29
10	1.31	1.30	33	1.26	1.30	56	1.25	1.28
11	1.33	1.29	34	1.25	1.27	57	1.30	1.25
12	1.32	1.31	35	1.26	1.28	58	1.30	1.22
13	1.29	1.31	36	1.28	1.32	59	1.23	1.27
14	1.30	1.30	37	1.26	1.29	60	1.26	1.25
15	1.32	1.29	38	1.28	1.27	Min	1.23	1.21
16	1.29	1.33	39	1.30	1.28	Max	1.37	1.37
17	1.29	1.34	40	1.29	1.23	Ave	1.55	1.54
18	1.27	1.29	41	1.34	1.22			
19	1.30	1.34	42	1.27	1.30			
20	1.28	1.33	43	1.27	1.29			
21	1.29	1.28	44	1.31	1.25			
22	1.31	1.29	45	1.29	1.26			
23	1.26	1.33	46	1.32	1.24			

5.2 Radiation Pattern

Azimuth Plane	Elevation1 Plane	Elevation2 Plane
		
Theta	Vertical field of measured plane	
Phi	Horizontal field of measured plane	

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

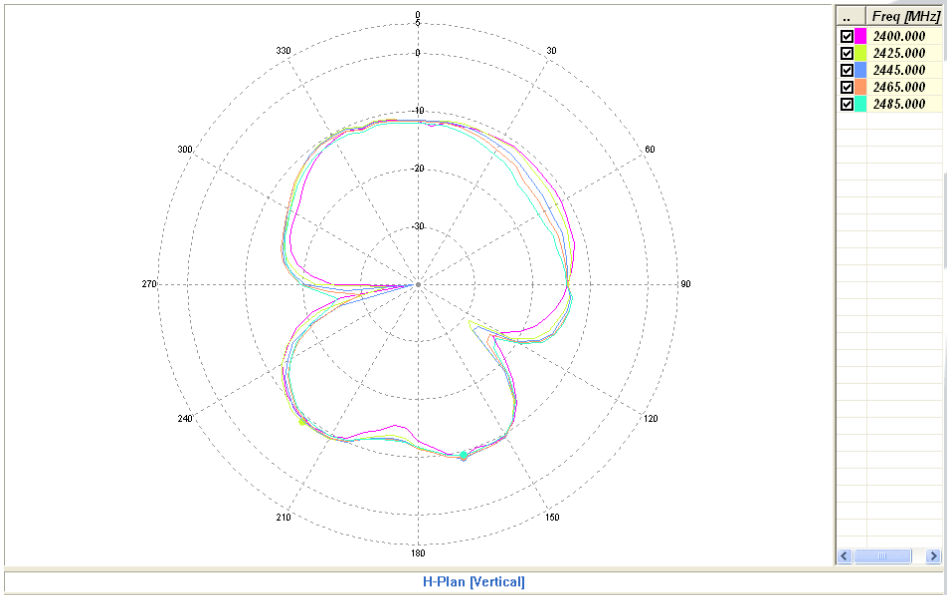
Azimuth Theta



H-Plan [Horizontal]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-5,16	90	140	-23,81	90	330		-10,08	9,93
2425,000	-4,44	90	140	-30,14	90	330		-9,70	10,82
2445,000	-4,69	90	145	-33,38	90	325		-9,96	10,20
2465,000	-4,73	90	145	-35,37	90	330		-9,94	10,26
2485,000	-5,32	90	145	-41,40	90	335		-10,53	8,96

Azimuth Phi

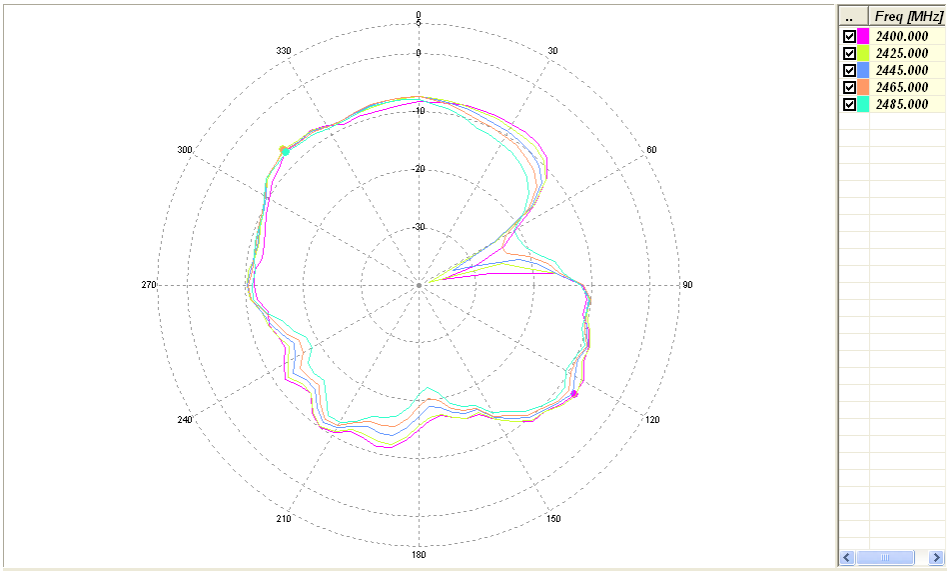


H-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-9,21	90	220	-37,76	90	265		-12,58	5,64
2425,000	-8,89	90	220	-34,75	90	265		-12,21	6,12
2445,000	-8,98	90	165	-39,11	90	260		-12,44	5,81
2465,000	-9,15	90	165	-29,77	90	260		-12,65	5,54
2485,000	-9,44	90	165	-25,76	90	260		-13,03	5,08

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

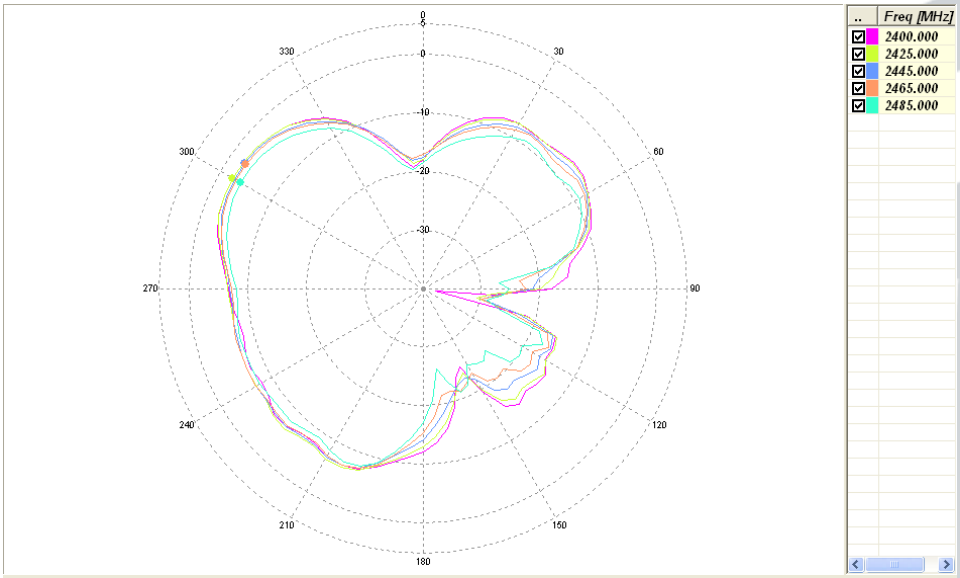
Elevation1 Theta



E1-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-7,10	125	0	-35,74	75	0		-10,51	9,00
2425,000	-6,85	315	0	-38,13	70	0		-10,35	9,33
2445,000	-7,14	315	0	-33,51	65	0		-10,75	8,53
2465,000	-7,21	315	0	-24,17	65	0		-11,05	7,96
2485,000	-7,60	315	0	-22,33	175	0		-11,59	7,05

Elevation1 Phi

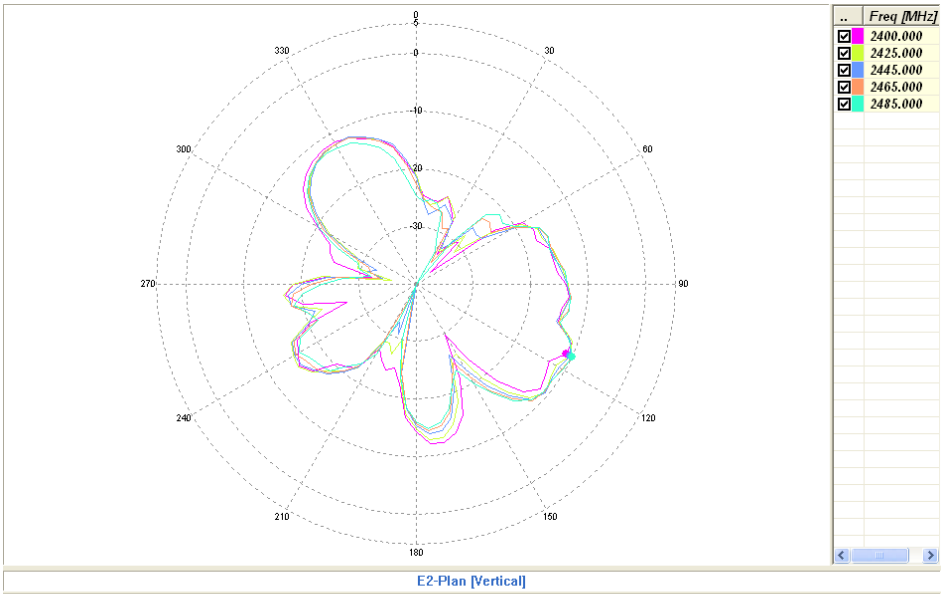


E1-Plan [Horizontal]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-2,48	300	0	-37,82	100	0		-8,11	15,55
2425,000	-2,46	300	0	-30,70	100	0		-8,06	15,76
2445,000	-2,81	305	0	-29,72	100	0		-8,47	14,33
2465,000	-2,92	305	0	-29,95	100	0		-8,72	13,54
2485,000	-3,92	300	0	-28,90	100	0		-9,70	10,82

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

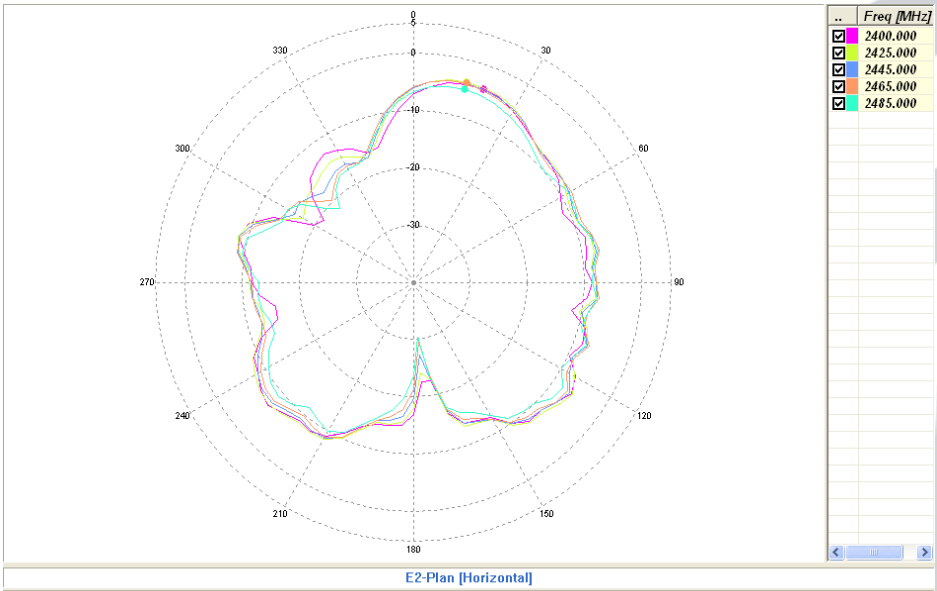
Elevation2 Theta



E2-Plan [Vertical]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-11,22	115	90	-36,66	50	90		-16,36	2,42
2425,000	-10,47	115	90	-35,59	280	90		-16,22	2,50
2445,000	-10,47	115	90	-40,73	195	90		-16,36	2,42
2465,000	-10,15	115	90	-38,12	200	90		-16,31	2,45
2485,000	-10,11	115	90	-42,05	35	90		-16,53	2,33

Elevation2 Phi



E2-Plan [Horizontal]

Frequency[MHz]	PeakValue	Theta[deg]	Phi[deg]	MinValue	Theta[deg]	Phi[deg]	3D Avg[dBi]	Gain[dBi]	Efficiency[%]
2400,000	-4,23	20	90	-22,71	175	90		-9,50	11,33
2425,000	-3,95	15	90	-24,28	175	90		-9,02	12,64
2445,000	-4,12	15	90	-27,36	175	90		-9,23	12,06
2465,000	-4,16	15	90	-29,57	175	90		-9,31	11,82
2485,000	-5,17	15	90	-30,35	175	90		-10,19	9,67

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

5.3 Set Condition

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
SWR [Max]				3 : 1 (Typ 2.5 : 1)
Input Impedance [Ω]				50 Ohm
Polarization				Linear
Gain [dBi]	Total Gain (Peak / Avg) [dBi]			-5.3 / -10.3
	Azimuth	Theta	Peak	-4.44
			Average	-9.70
		Phi	Peak	-8.89
			Average	-12.21
	Elevation 1	Theta	Peak	-6.85
			Average	-10.35
		Phi	Peak	-2.46
			Average	-8.06
	Elevation 2	Theta	Peak	-10.47
			Average	-16.22
		Phi	Peak	-3.95
			Average	-9.02

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

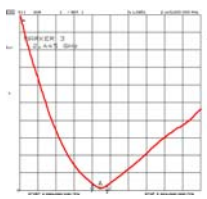
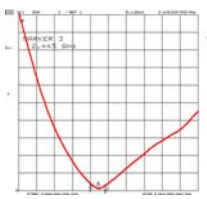
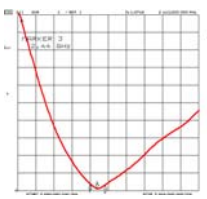
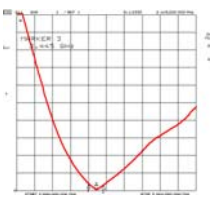
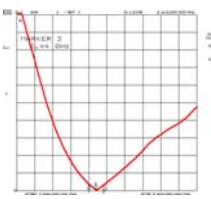
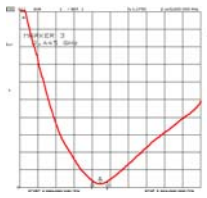
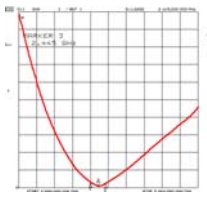
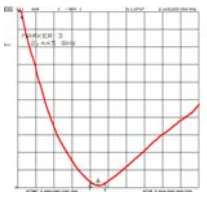
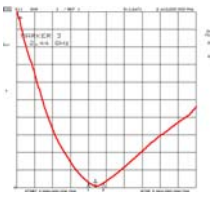
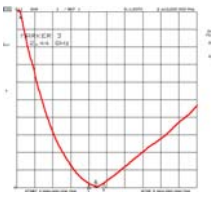
6. Mechanical Test

6.1. Random Vibration

1) Frequency 10~500 Hz, 10×9.8 ㎨(G) Sweep time : 15 min, X.Y.Z each 5 times

Model	SDBTPTR3015			
Test	Random Vibration			
	Before		After	
Spec	SWR (MIn:1.0 ~ Max:3.0)		SWR (MIn:1.0 ~ Max:3.0)	
ITEM	2400 MHz	2485 MHz	2400 MHz	2485 MHz
1	1.36	1.29	1.35	1.33
2	1.37	1.30	1.28	1.22
3	1.36	1.31	1.29	1.25
4	1.37	1.31	1.26	1.26
5	1.33	1.32	1.20	1.26
MIN	1.33	1.29	1.20	1.22
MAX	1.37	1.32	1.35	1.33
AVG	1.36	1.31	1.28	1.26
STD	0.02	0.01	0.05	0.04
CPK	6.83	8.41	1.60	2.05

■ Measurement Graph

	#1	#2	#3	#4	#5
Before					
After					

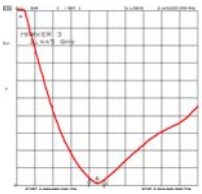
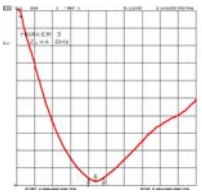
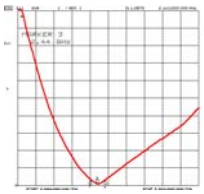
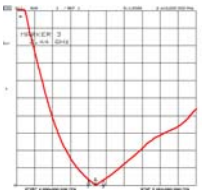
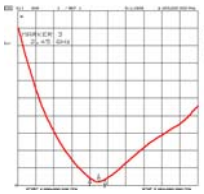
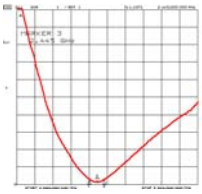
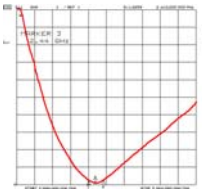
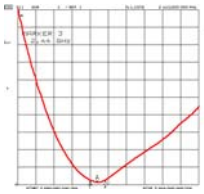
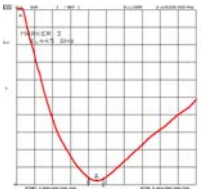
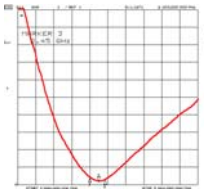
Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

6.2 Drop

1) Height : 150 cm, 12 times, Free Drop
2) Using the test fixture of 120g±20g
3) On Concrete or Iron Plate

Model	SDBTPTR3015			
Test	Drop			
	Before		After	
Spec	SWR (MIn:1.0 ~ Max:3.0)		SWR (MIn:1.0 ~ Max:3.0)	
ITEM	2400 MHz	2485 MHz	2400 MHz	2485 MHz
1	1.38	1.32	1.28	1.28
2	1.38	1.43	1.23	1.26
3	1.32	1.32	1.23	1.25
4	1.30	1.30	1.37	1.33
5	1.39	1.32	1.39	1.27
MIN	1.30	1.30	1.23	1.25
MAX	1.39	1.43	1.39	1.33
AVG	1.35	1.34	1.30	1.28
STD	0.04	0.05	0.08	0.03
CPK	2.71	2.03	1.23	2.80

■ Measurement Graph

	#1	#2	#3	#4	#5
Before					
After					

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

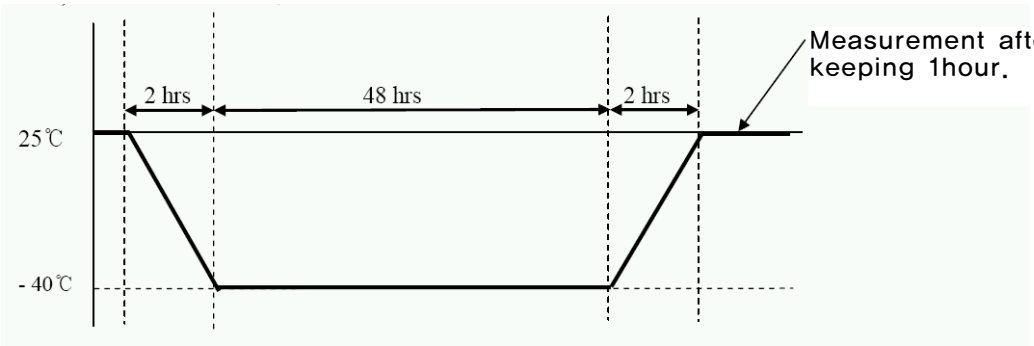
7. Environment Test

7.1 Low Temperature Action

7.1.1 TEST CONDITION

1) −40 ° C, 48 hrs

2) There should not be a kind of bending, twist, contraction and transformation phenomenon after finishing this test.

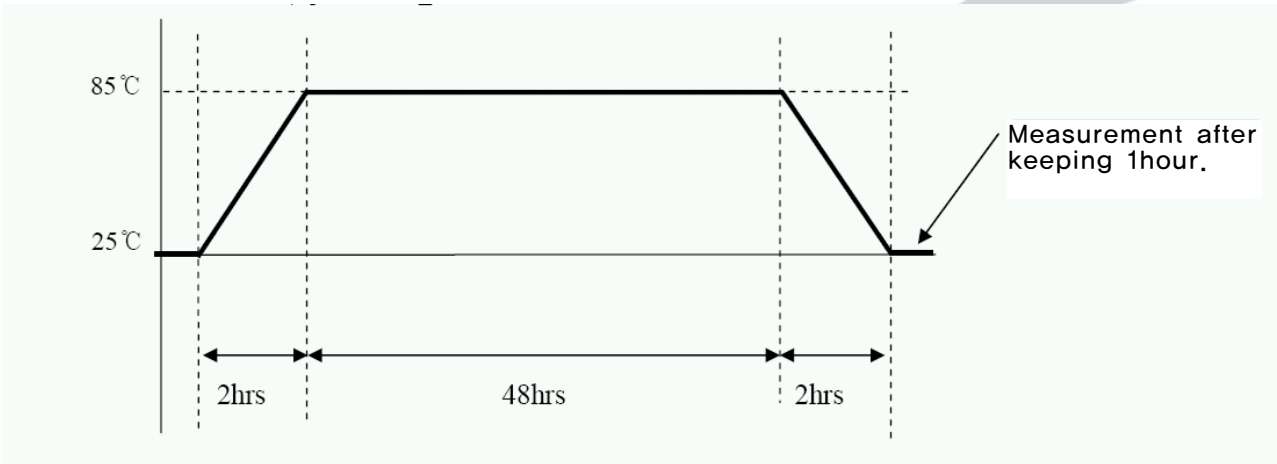


7.2 High Temperature Action

7.2.1 TEST CONDITION

1) +85 ° C, 48 hrs

2) There should not be a kind of bending, twist, contraction and transformation phenomenon after finishing this test.



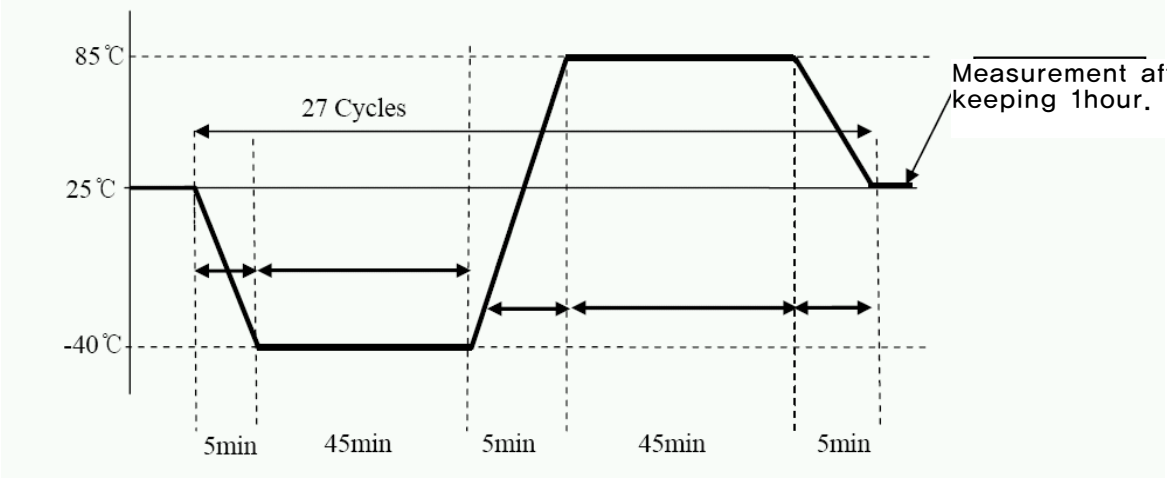
Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

7.3 Thermal Shock

7.3.1 TEST CONDITION

1) −40 ° C/85 ° C, 45min. recovery time 5 Min,27 Cycle

2) There should not be a kind of bending, twist, contraction and transformation phenomenon after finishing this test.

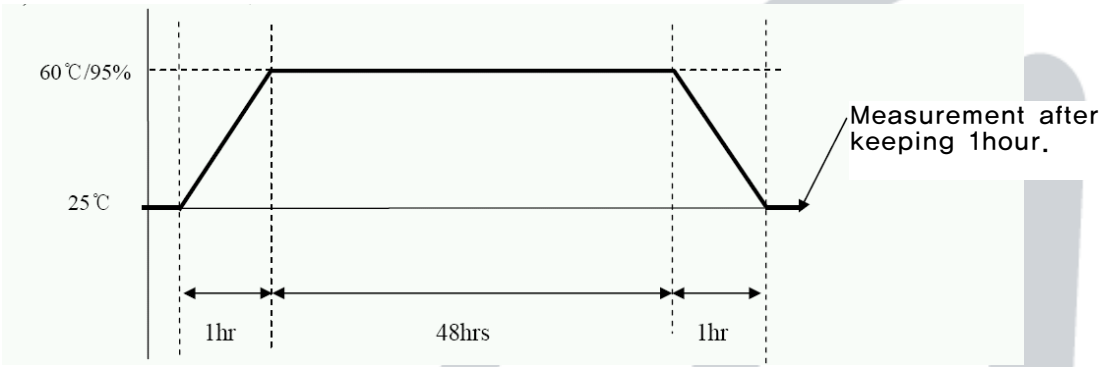


7.4 Humidity Action

7.4.1 TEST CONDITION

1) 60 ° C/95%

2) There should not be a kind of bending, twist, contraction and transformation phenomenon after finishing this test.



Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

7.5 Spray test with salt water

7.5.1 Test condition

1) Spray with salt water 35 ° C/5%,48hrs

2) Definition of spray test with salt water: To test corrosion resistance of metal or raw material.

- Salt water concentration : 5%
- Temp. of test suite : 35 ° C
- Test time : 24hrs~

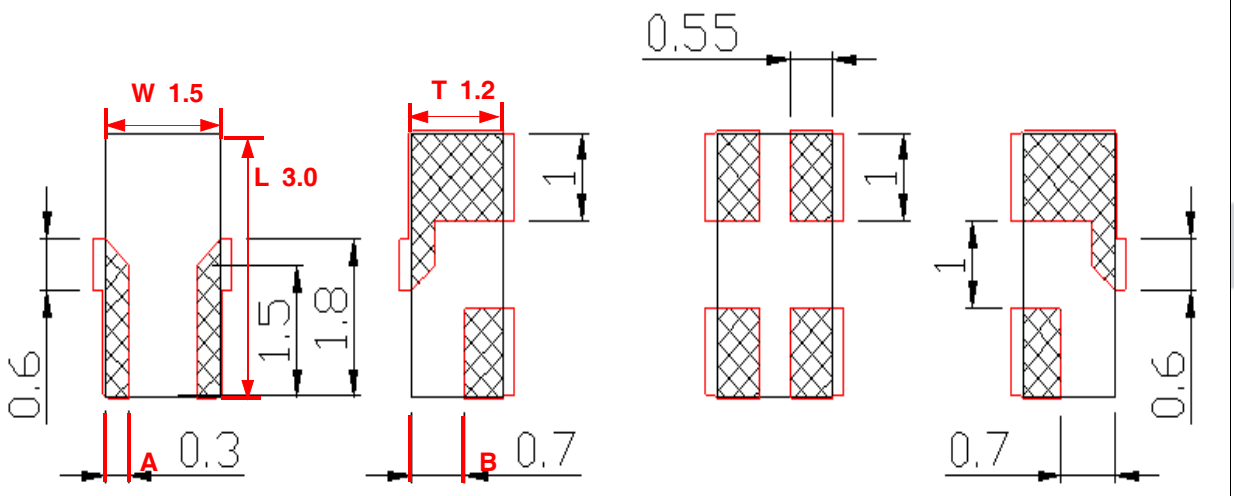
3)There should not be a kind of corrosion, rust, transformation, performance change and after finishing the test

8. An extra document·

8.1 Antenna Pattern Drawing

8.1.1 Antenna Pattern Drawing

Antenna pattern	Version 1.0



Unit : mm

Unless specified tolerances are ±0.05

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

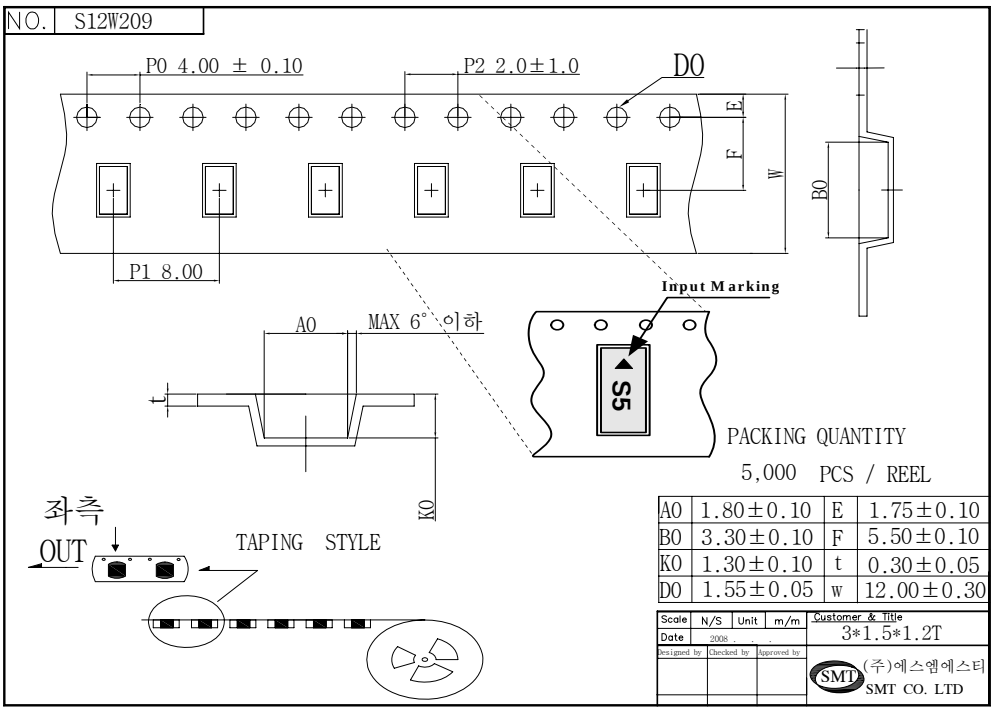
8.1.2 Dimension Measurement DATA

Contents	Dimension [mm] CTQ				
standard	W=1.5±0.1	L=3.0±0.1	T=1.2±0.1	A=0.3±0.05	B=0.7±0.05
1	1.51	3.00	1.22	0.31	0.71
2	1.52	2.99	1.20	0.32	0.73
3	1.52	2.98	1.21	0.31	0.71
4	1.51	2.98	1.22	0.30	0.72
5	1.51	3.00	1.21	0.31	0.71
6	1.52	2.99	1.20	0.31	0.70
7	1.50	2.99	1.20	0.32	0.71
8	1.51	2.98	1.23	0.32	0.70
9	1.52	2.99	1.20	0.32	0.72
10	1.52	2.99	1.23	0.32	0.71
11	1.50	3.00	1.21	0.33	0.70
12	1.51	2.99	1.23	0.31	0.72
13	1.52	3.00	1.22	0.31	0.71
14	1.52	2.99	1.22	0.32	0.71
15	1.51	2.98	1.23	0.32	0.70
16	1.52	3.01	1.21	0.32	0.71
17	1.51	2.98	1.22	0.33	0.70
18	1.51	2.99	1.23	0.32	0.72
19	1.52	2.99	1.21	0.31	0.71
20	1.50	2.99	1.22	0.30	0.72
Min.	1.50	2.98	1.20	0.30	0.70
Max.	1.52	3.01	1.23	0.33	0.73
X	1.51	2.99	1.21	0.31	0.71
σ	0.01	0.01	0.01	0.01	0.01
Cpk	3.91	3.61	2.52	1.37	1.51
Result	OK	OK	OK	OK	OK

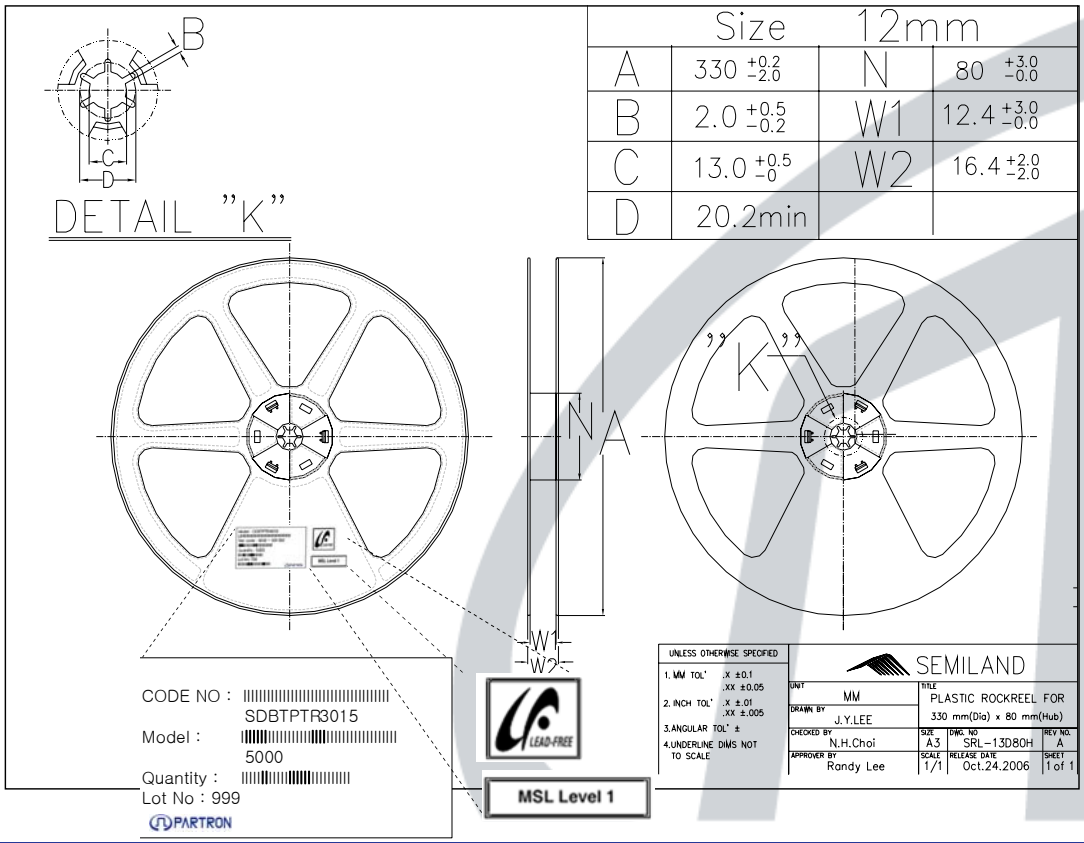
Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.2 Packing Drawing

8.2.1 Carrier Drawing



8.2.2 Real Drawing



Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.3 LOT Notation

8.3.1 Marking Specification

Marking View


◀ **S** **5**

① ② ③

① Antenna Position, Open Point

② Standard Initial

③ Month : 1 -January , 2 - February ···· 9 - September, A - October, B - November ··

8.3.2 Marking Method

Ink marking - Black Ink

8.3.3 Stamp Test

Picture
   

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.4 Process Control

Product	Issued/Revision		Rev.	QC MANAGEMENT FLOW CHART	Record	By designed	By checked	By approved
CHIP ANTENNA	Issued	04.04.06	1.0		PRCP-C001			
	Revised	05.04.03						

Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
Ceramic POWDER		◇	Import Inspection						shrinking rate permittivity	refer to Guide Sheet	Micrometer Network	10ea/LOT	C/sheet	Return
POWDER lubricant	○		powder	Mixer					mixing	POWDER lubricant	Scale	PER MIXING	-	Exhaust
		○	Shaping CTQ (weigh/ Dimension)	Press	pressure Mold Condition	refer to Guide Sheet	Per LOT 1/day	parameter C/SHEET	dimension weight density aspect	refer to Guide Sheet	Micrometer scale Calculated Visual	5/100EA 10ea/lot	LOT CARD	Exhaust
		○	Plasticity	Plasticity Hole	SETTER Outside Temperature PROFILE	refer to Guide Sheet	all 2/day 1/month	C/sheet						
		◇	Block CTQ (Dimension)						wide length shape	refer to Guide Sheet	Micrometer Calipers Visual Inspection	20ea/LOT 20ea/LOT all	C/sheet	Exhaust
AG PASTE		○	SIDE1 PAD Printing CTQ	Printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN Dimension aspect	refer to Guide Sheet	Microscope	10ea/3Jig	c/sheet	Rework
		○	Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	LOT CARD	Rework

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Product	Issued/Revision		Rev.	QC MANAGEMENT FLOW CHART	Record	By designed	By checked	By approved
CHIP ANTENNA	Issued	04.04.06	1.0		PRCP-C001			
	Revised	05.04.03						

Input Materials	FLOW CHART		Process name	Management of Factors					Management of quality					
	preparation	Main Process		Equipment Name	Checked	Condition	Cycle of management	Record	Checked Item	Margin	Method of Inspection	Cycle of management	Record	Action
AG PASTE		◯	SIDE 2 PAD Printing CTQ	Printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN Dimension aspect	refer to Guide Sheet	Microscope	10ea/3Jig	c/sheet	Rework
		◯	Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
		◯	Baking	Baking Hole mesh net	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter C/Sheet	Breakage Pollution	refer to Guide Sheet	Visual Inspection	all	Lot card	Exhaust Rework
AG PASTE		◯	TOP printing CTQ	Printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN dimension	refer to Guide Sheet	measure	10ea/3Jig	c/sheet	Rework
		◯	Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
AG PASTE		◯	BOTTOM PAD Printing CTQ	printer screen	Squeeze velocity/presure SNAP	refer to Guide Sheet	1/day	-	PATTERN dimension aspect	refer to Guide Sheet	measure Microscope	10ea/3Jig	c/sheet	Rework

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Product	Issued/Revision		Rev.	QC MANAGEMENT FLOW CHART	Record	By designed	By checked	By approved
CHIP ANTENNA	Issued	04.04.06	1.0		PRCP-C001			
	Revised	05.04.03						

투입자재	FLOW CHART		공정명	요인관리					품질특성관리					
	준비	본공정		설비명	관리항목	조건	관리주기	기록관리	검사항목	관리한계	검사방법	관리주기	기록 관리	조치 사항
		○	Dry	Dryer Dry Jig	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter	Dry Condition Printed condition breakage	refer to Guide Sheet	Visual Inspection	all	Lot card	Rework
		⬭	Baking	Baking Hole mesh net	Temperature Belt speed	refer to Guide Sheet	1/week	Parameter C/Sheet	Breakage Pollution	refer to Guide Sheet	Visual Inspection	all	Lot card	Exhaust Rework
		◇	Coating thickness in outgoing		Coating thickness in outgoing	Approval sheet	Lot		– Coating thickness in outgoing inspection sheet PATTERN :Over 10㎛ PAD : Min10㎛ (TYP 16-20㎛)	Approval sheet	Coating thickness Tester	Lot 50ea	Lot card	Exhaust Rework
		◇	aspect inspection						aspect	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
		○	MARKING	Marking Machine					marking	Reference SPL	Visual Inspection	all	Lot card production diary	Rework Exhaust
		◇	Electrical Characteristic	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/2hour	C/sheet	Electrical Characteristic	refer to Guide Sheet	Network	all	Lot card production diary	Exhaust repair
		◇	aspect inspectionCTF						aspect dimension	Reference SPL refer to Guide Sheet	Visual Inspection microscope	all	Lot card production diary	Exhaust repair
Carrier cover reel		○	Taping						Quantity Direction aspect	refer to Guide Sheet	Manual	all	Lot card production diary	Rework
		◇	shipper inspection	NETWORK Inspection Jig	proofreading Condition	refer to Guide Sheet	1/person	C/sheet	Electrical Characteristic aspect packing	refer to Guide Sheet	Network microscope Visual Inspection	refer to Guide Sheet	Result Paper	return Exhaust
포장 box label		○	packing	bar code printer					packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	-	Rework
		◇	packing inspection						packing P/N Quantity	refer to Guide Sheet	Visual Inspection	all	-	return

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

■ Pictures for QC management flow chart

Procdess		Description	Management item	Management condition / spec
Material inspection		– Screen, powder	– Dielectric constant – Contraction – Density – Screen Dimension	– Outgoing inspection made by supplier – Approval sheet(dimension)
Forming		– Forming with Powder	– Dimension – Appearance (Burr)	– Molding condition chart
Plasticity		– Plasticity with Formed ceramic block in high temp.	– Temp – Speed	– Temp : 1300±15 ° C – Speed : 8 ~ –14mm/Min
Barrel Grinding		– An each edge of ceramic block(Not tuned) grinded with Barrel to soften	– Mixing ratio	– Ceramic block(Not tuned):Ball:Water = 1:2:4

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Procdess		Description	Management item	Management condition / spec
Dimension inspection		– Dimension inspection of ceramic block sintered.	– Ceramic block size	– AQL standard – Tolerance : ±0.05mm
Printing		–Patterning process on ceramic block	– Printing speed	– Speed : 40~50mm(sec)
Reflow		– To dry the Ag of ceramic block	– Reflow Temp.	–Temp : 200~220 ° C (Over 30sec) / 4times
Visual inspection		– Measurement of coating thickness – Visual inspection of printed pattern – open/short inspection	– Coating thinkness – Pattern status – open/short inspection	– Coating thickness in outgoing inspection sheet PATTERN :Over 10㎛ PAD : Min10㎛ (TYP 16~20㎛)

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Procdess		Description	Management item	Management condition / spec
Marking		– Marking with ink on the product	– Marking status	– Marking instruction for each product
Automatic packing		– Performance inspection and packing	– Low/hing frequency	– Working instruction attached
Final inspection		–Product appearance and performance inspection	– Appearance, performance	– AQL standard
Packing		– Packing for each product	– Q'ty, packing status, mixing	– Working instruction for packing

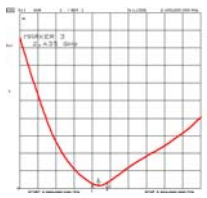
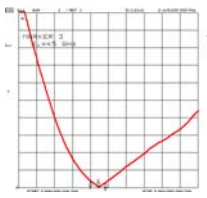
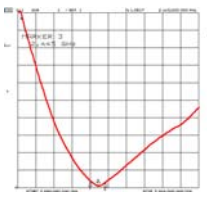
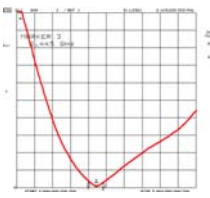
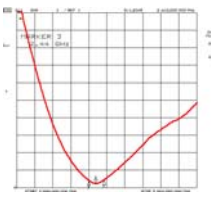
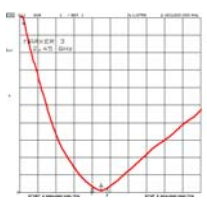
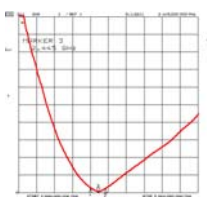
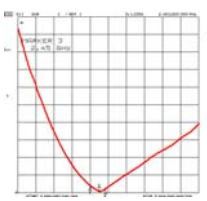
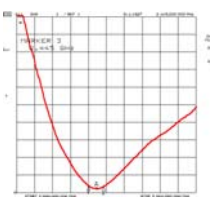
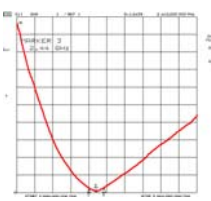
Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.5 Outgoing inspection sheet for reliability test

8.5.1 Low Temperature Action

Model	SDBTPTR3015			
Test	Low Temperature Action			
	Before		After	
Spec	SWR (MIn:1.0 ~ Max:3.0)		SWR (MIn:1.0 ~ Max:3.0)	
ITEM	2400 MHz	2485 MHz	2400 MHz	2485 MHz
1	1.24	1.32	1.30	1.24
2	1.35	1.28	1.25	1.23
3	1.35	1.29	1.36	1.21
4	1.34	1.29	1.36	1.33
5	1.37	1.43	1.23	1.27
MIN	1.24	1.28	1.23	1.21
MAX	1.37	1.43	1.36	1.33
AVG	1.33	1.32	1.30	1.26
STD	0.05	0.06	0.06	0.05
CPK	2.01	1.62	1.56	1.72

Measurement Graph

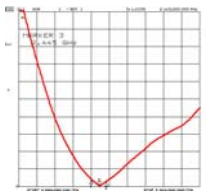
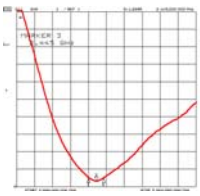
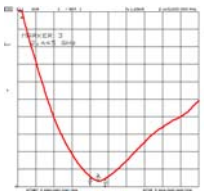
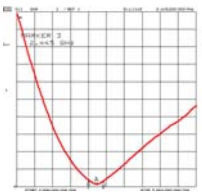
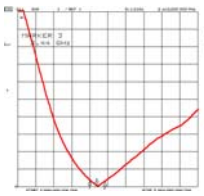
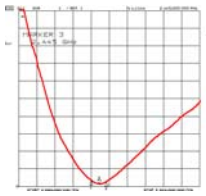
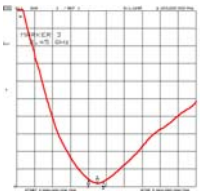
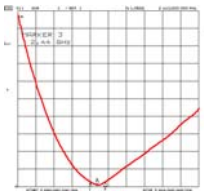
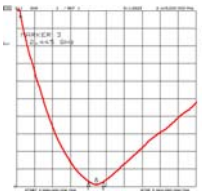
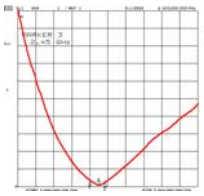
	#1	#2	#3	#4	#5
Before					
After					

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.5.2 High Temperature Action

Model	SDBTPTR3015			
Test	High Temperature Action			
	Before		After	
Spec	SWR (MIn:1.0 ~ Max:3.0)		SWR (MIn:1.0 ~ Max:3.0)	
ITEM	2400 MHz	2485 MHz	2400 MHz	2485 MHz
1	1.38	1.28	1.31	1.26
2	1.49	1.49	1.38	1.28
3	1.53	1.45	1.24	1.26
4	1.34	1.33	1.27	1.27
5	1.34	1.30	1.30	1.23
MIN	1.34	1.28	1.24	1.23
MAX	1.53	1.49	1.38	1.28
AVG	1.42	1.37	1.30	1.26
STD	0.09	0.09	0.05	0.02
CPK	1.47	1.23	1.79	4.35

Measurement Graph

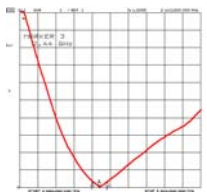
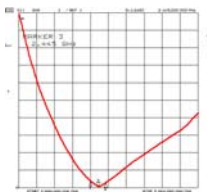
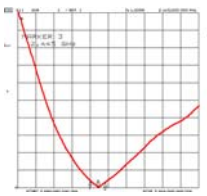
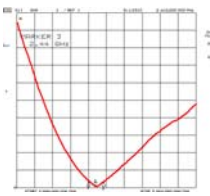
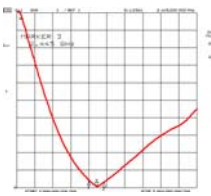
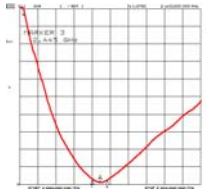
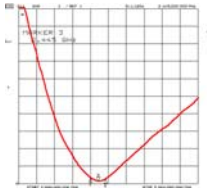
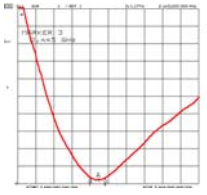
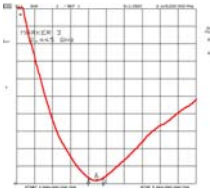
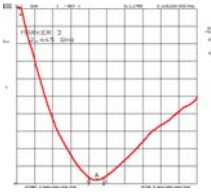
	#1	#2	#3	#4	#5
Before					
After					

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.5.3 Thermal Shock

Model	SDBTPTR3015			
Test	Thermal Shock			
	Before		After	
Spec	SWR (MIn:1.0 ~ Max:3.0)		SWR (MIn:1.0 ~ Max:3.0)	
ITEM	2400 MHz	2485 MHz	2400 MHz	2485 MHz
1	1.32	1.33	1.28	1.24
2	1.35	1.27	1.31	1.26
3	1.36	1.30	1.33	1.33
4	1.36	1.33	1.30	1.32
5	1.38	1.30	1.33	1.34
MIN	1.32	1.27	1.28	1.24
MAX	1.38	1.33	1.33	1.34
AVG	1.35	1.31	1.31	1.30
STD	0.02	0.03	0.02	0.04
CPK	5.06	3.82	4.58	2.08

Measurement Graph

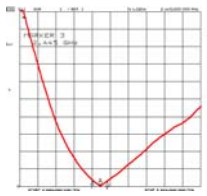
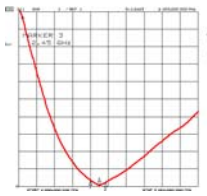
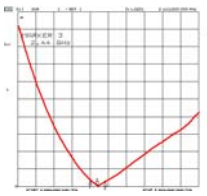
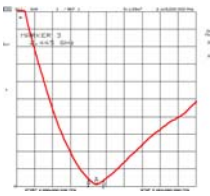
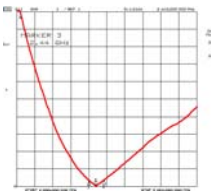
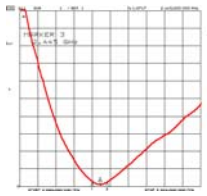
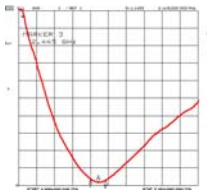
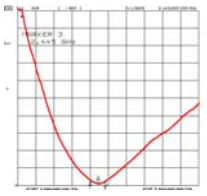
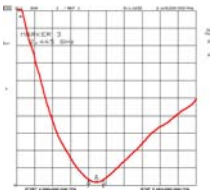
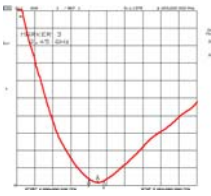
	#1	#2	#3	#4	#5
Before					
After					

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.5.4 Humidity Action

Model	SDBTPTR3015			
Test	Humidity Action			
	Before		After	
Spec	SWR (MIn:1.0 ~ Max:3.0)		SWR (MIn:1.0 ~ Max:3.0)	
ITEM	2400 MHz	2485 MHz	2400 MHz	2485 MHz
1	1.34	1.30	1.25	1.24
2	1.32	1.22	1.33	1.28
3	1.34	1.27	1.28	1.23
4	1.38	1.34	1.32	1.33
5	1.31	1.36	1.34	1.25
MIN	1.31	1.22	1.25	1.23
MAX	1.38	1.36	1.34	1.33
AVG	1.34	1.30	1.30	1.27
STD	0.03	0.06	0.04	0.04
CPK	3.95	1.67	2.52	2.06

Measurement Graph

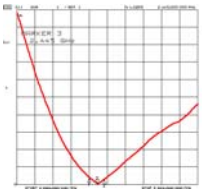
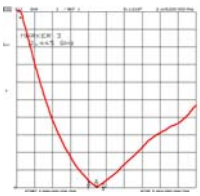
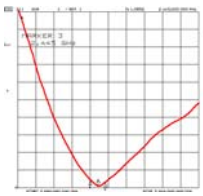
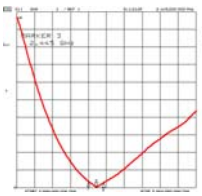
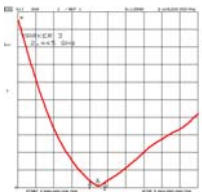
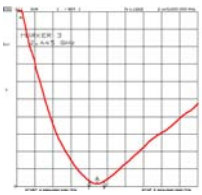
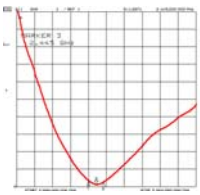
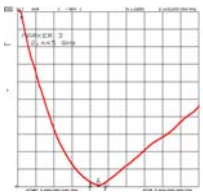
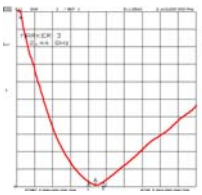
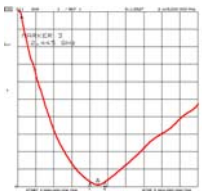
	#1	#2	#3	#4	#5
Before					
After					

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.5.5 Spray test with salt water

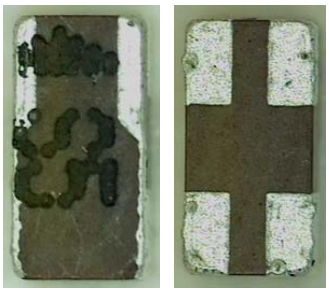
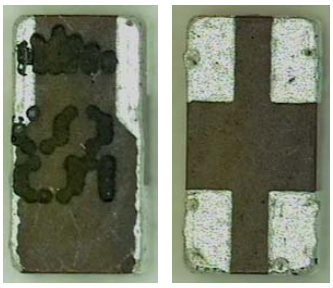
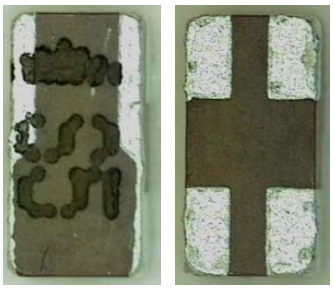
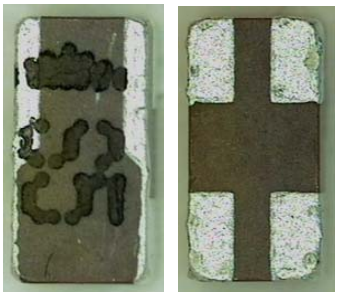
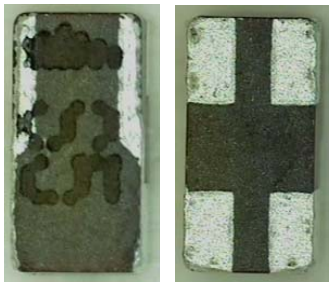
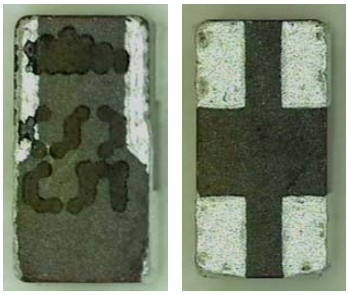
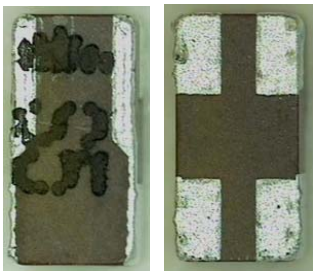
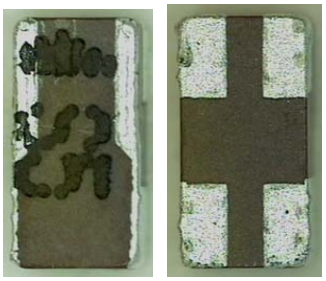
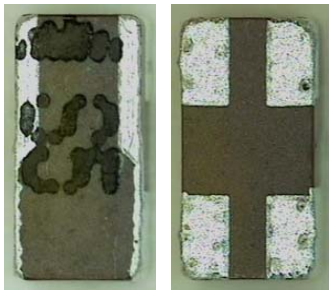
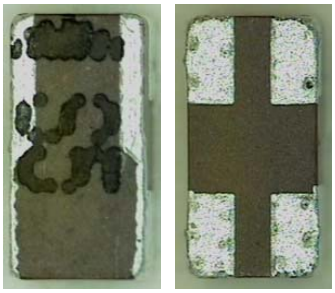
Model	SDBTPTR3015			
Test	Spray test with salt water			
	Before		After	
Spec	SWR (MIn:1.0 ~ Max:3.0)		SWR (MIn:1.0 ~ Max:3.0)	
ITEM	2400 MHz	2485 MHz	2400 MHz	2485 MHz
1	1.38	1.29	1.29	1.30
2	1.37	1.28	1.31	1.26
3	1.41	1.31	1.23	1.23
4	1.32	1.26	1.24	1.27
5	1.36	1.29	1.25	1.26
MIN	1.32	1.26	1.23	1.23
MAX	1.41	1.31	1.31	1.30
AVG	1.37	1.29	1.26	1.26
STD	0.03	0.02	0.03	0.03
CPK	3.52	4.93	2.41	3.30

Measurement Graph

	#1	#2	#3	#4	#5
Before					
After					

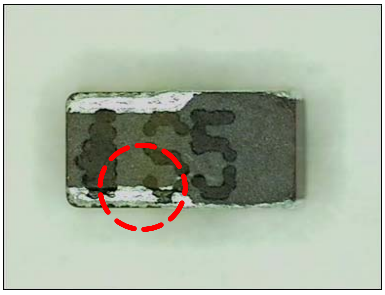
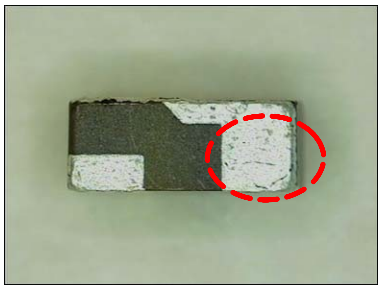
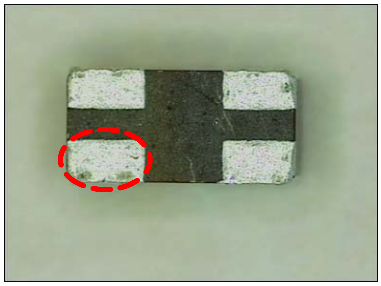
Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

■ Before and After pictures of Spray test with salt water

	Before	After
#1		
#2		
#3		
#4		
#5		

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

8.6 Inspection sheet of coating thickness

A	B	C
		

Inspection sheet of coating thickness							
Spec [㎛]		PATTERN : Over 10㎛				PAD : Min10㎛ (TYP 16~20㎛)	
Inspection item		A		B		C	
1	16	11.28	11.04	11.28	12.19	18.26	18.42
2	17	10.23	11.12	10.90	12.31	19.30	19.26
3	18	10.90	12.01	10.29	11.58	19.43	20.03
4	19	10.92	11.98	11.34	10.63	20.03	19.01
5	20	11.25	10.84	11.36	11.77	19.88	18.85
6	21	11.42	10.95	12.05	10.58	17.69	17.66
7	22	10.35	11.26	11.98	10.59	17.83	17.54
8	23	10.62	12.20	10.57	11.02	18.82	19.06
9	24	10.58	11.38	10.58	11.00	19.20	19.37
10	25	11.02	12.30	10.90	10.92	19.26	19.27
11	26	11.29	11.35	11.96	11.94	19.60	18.70
12	27	10.84	10.62	12.18	12.15	19.31	18.77
13	28	10.98	10.67	10.52	10.52	18.52	19.24
14	29	10.88	11.24	10.49	10.90	17.55	19.05
15	30	11.02	10.51	11.26	10.83	18.36	18.26
Min.		10.23		10.29		17.54	
Max.		12.30		12.31		20.03	
X		11.10		11.22		18.85	
σ		0.51		0.64		0.71	
Cpk		0.71		0.63		4.10	

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

9. RoHS Data

9.1 Ceramic Powder

Parts Name	MWF-38U
Tester Organization	DJK Coperation
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

Intertek

TEST REPORT

Applicant : DONG BANG ENTERPRISE
Address : 105-1102, 109, Sadang 5-dong, Dongjak-ku, Seoul, Korea

Page: 1 of 3

Report No. RT09R-S3787-E Date: Aug. 27, 2009

Sample Description : The following submitted sample(s) said to be:-

Name/Type of Product : HIZIRCO MWF-38U
Sample ID No. : RT09R-S3787
Manufacturer/Vender : DONG BANG ENTERPRISE

Sample received : Aug. 24, 2009
Testing Date : Aug. 24, 2009 ~ Aug. 27, 2009
Testing Laboratory : Intertek Testing Center
Testing Environment : Temperature : (24 ± 2) ℃, Humidity : (60 ± 5) % R.H.

Test Method(s) : Please see the following page(s).
Test Result(s) : Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.
* Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.

Approved by, Authorized by,

Jade Jang / Lab. Technical Manager Bo Park / Lab. General Manager

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Intertek Testing Center

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Seoul Lab. : #709, 7Fl, Ace Techno Tower V, 197-22, Guro-3Dong, Guro-Gu, Seoul 152-766 Korea Tel : 02-2109-1260 Fax : 02-2109-1258
Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Parts Name	MWF-38U
Tester Organization	DJK Coperation
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

Intertek

TEST REPORT

Page: 2 of 3
Report No. RT09R-S3787-E Date: Aug. 27, 2009

Sample ID No. : RT09R-S3787
Sample Description : HIZIRCO MWF-38U

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	5	N.D.
Mercury (Hg)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.
Hexavalent Chromium (Cr^{6+})	mg/kg	With reference to US EPA 3060A and determined by UV-VIS Spectrophotometer	1	N.D.

Tested by : Nikkie Lee, Peter Kim

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

* View of sample as received:-

Intertek Testing Center

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Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

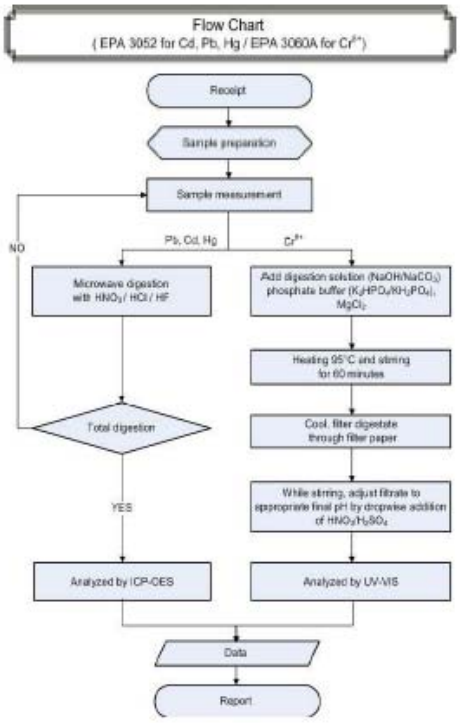
Parts Name	MWF-38U
Tester Organization	DJK Coperation
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

Intertek

TEST REPORT

Page: 3 of 3
Report No. RT09R-S3787-E Date: Aug. 27, 2009

Sample ID No. : RT09R-S3787
Sample Description : HIZIRCO MWF-38U



** Remarks : The samples were dissolved totally by pre-conditioning method according to above flow chart.

***** End of Report *****

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Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

9.2 Ag Paste

Parts Name	Silver Paste
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'Test Method' in the table
Measurement Data	Please see the table in the test report

SGS

Test Report No. FG90501/LF-CTSAYAA09-27959 Issued Date: October 13, 2009 Page 1 of 3

To: METECH KOREA CO., LTD.
B-601 Dongyang Paragon officetel 17-2 Jeongja-dong
Bundang-gu
Sungnam-city
GYEONGGI-DO
Korea

The following merchandise was submitted and identified by the client as :

Product Name	: Silver Paste
SGS File No.	: AYAA09-27959
Received Date	: October 08, 2009
Test Performing Date	: October 09, 2009
Test Performed	: SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results	: For further details, please refer to following page(s)

SGS Testing Korea Co. Ltd.

Pluto Kim
Cindy Park
Jinee Song/ Testing Person

Jeff Jang / Chemical Lab Mgr

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Parts Name	Silver Paste
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'Test Method' in the table
Measurement Data	Please see the table in the test report

SGS

Test Report No. F690501/LF-CTSAYAA09-27959 Issued Date: October 13, 2009 Page 2 of 3

Sample No. : AYAA09-27959.001
Sample Description : Silver Paste
Item No./Part No. : PCC11836HV
Comments : Material is silver.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to IEC 62321:2008, ICP	0.5	N.D.
Lead (Pb)	mg/kg	With reference to IEC 62321:2008, ICP	5	N.D.
Mercury (Hg)	mg/kg	With reference to IEC 62321:2008, ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	With reference to IEC 62321:2008, UV-VIS	1	N.D.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromobiphenyl	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Monobromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Dibromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tribromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Octabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.
Decabromodiphenyl ether	mg/kg	With reference to IEC 62321:2008, GC-MS	5	N.D.

NOTE:
(1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) "" = Qualitative analysis (No Unit)
(6) " = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

F052 Version3

SGS Testing Korea Co.,Ltd.

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Parts Name	Silver Paste
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'Test Method' in the table
Measurement Data	Please see the table in the test report

SGS

Test Report No. FG90501/LF-CTSAYAA09-27959 Issued Date: October 13, 2009 Page 3 of 3

Sample No. : AYAA09-27959.001
Sample Description : Silver Paste
Item No./Part No. : PCC11836HV
Comments : Material is silver.

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	With reference to ASTM D 7359-08 , IC	30	N.D.
Chlorine(Cl)	mg/kg	With reference to ASTM D 7359-08 , IC	30	N.D.

Picture of Sample as Received:

*** End ***

NOTE: (1) N.D. = Not detected.(<MDL)
(2) mg/kg = ppm
(3) MDL = Method Detection Limit
(4) - = No regulation
(5) " = Qualitative analysis (No Unit)
(6) ' = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

F052 Version3

SGS Testing Korea Co. Ltd.

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

9.3 Marking Ink

Parts Name	ink-5135E Black ink
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'Test Method' in the table
Measurement Data	Please see the table in the report

Intertek

TEST REPORT

Applicant : Imaje Korea Co., Ltd.
Address : R# 1301, Deeryung Technotown 7th, 489-11, Gasan-dong, Gumcheon-gu, Seoul, Korea

Page: 1 of 3

Report No. RT08R-10381-003 Date: Oct. 07, 2008

Sample Description : The following submitted sample(s) said to be:-

Name/Type of Product : 5135E black ink
Sample ID No. : RT08R-10381-003
Manufacturer/Vender : Imaje Korea Co., Ltd.

Sample received : Sep. 30, 2008
Testing Date : Sep. 30, 2008 ~ Oct. 07, 2008
Testing Laboratory : Intertek Testing Center
Testing Environment : Temperature : (22 ~ 26) °C Relative Humidity: (55 ~ 65) %

Test Method(s) : Please see the following page(s).
Test Result(s) : Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.
* Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.

Approved by, Authorized by,

Jade Jang / Lab. Technical Manager Bo Park / Lab. General Manager

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Intertek Testing Center

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Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Parts Name	ink-5135E Black ink
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'Test Method' in the table
Measurement Data	Please see the table in the report

Intertek

TEST REPORT

Page: 2 of 3
Report No. RT08R-10381-003 Date: Oct. 07, 2008

Sample ID No. : RT08R-10381-003
Sample Description : 5135E black ink

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	0.5	N.D.
Lead (Pb)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	5	N.D.
Mercury (Hg)	mg/kg	With reference to US EPA 3052, by acid digestion and determined by ICP-OES	2	N.D.
Hexavalent Chromium (Cr^{6+})	mg/kg	With reference to US EPA 3060A and determined by UV-VIS Spectrophotometer	1	N.D.
Polybrominated Biphenyl (PBBs)				
Monobromobiphenyl	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS	5	N.D.
Dibromobiphenyl	mg/kg		5	N.D.
Tribromobiphenyl	mg/kg		5	N.D.
Tetrabromobiphenyl	mg/kg		5	N.D.
Pentabromobiphenyl	mg/kg		5	N.D.
Hexabromobiphenyl	mg/kg		5	N.D.
Heptabromobiphenyl	mg/kg		5	N.D.
Octabromobiphenyl	mg/kg		5	N.D.
Nonabromobiphenyl	mg/kg		5	N.D.
Decabromobiphenyl	mg/kg		5	N.D.
Polybrominated Diphenyl Ether (PBDEs)				
Monobromodiphenyl ether	mg/kg	With reference to US EPA 3540C, by solvent extraction and determined by GC/MS	5	N.D.
Dibromodiphenyl ether	mg/kg		5	N.D.
Tribromodiphenyl ether	mg/kg		5	N.D.
Tetrabromodiphenyl ether	mg/kg		5	N.D.
Pentabromodiphenyl ether	mg/kg		5	N.D.
Hexabromodiphenyl ether	mg/kg		5	N.D.
Heptabromodiphenyl ether	mg/kg		5	N.D.
Octabromodiphenyl ether	mg/kg		5	N.D.
Nonabromodiphenyl ether	mg/kg		5	N.D.
Decabromodiphenyl ether	mg/kg		5	N.D.

Tested by : Nikkie Lee, HR Kim, Ellen Jung

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

Intertek Testing Center

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Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

Parts Name	ink-5135E Black ink
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'Test Method' in the table
Measurement Data	Please see the table in the report

Intertek

TEST REPORT

Page: 3 of 3
Report No. RT08R-10381-003 Date: Oct. 07, 2008

Sample ID No. : RT08R-10381-003
Sample Description : 5135E black ink

Test Items	Unit	Test Method	MDL	Results
Bromine (Br)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.
Chlorine (Cl)	mg/kg	With reference to EN 14582, by oxygen combustion with bomb and determined by IC	30	N.D.

Tested by : Nikkie Lee

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

* View of sample as received:-

***** End of Report *****

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Ulsan Lab. : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea Tel : 052-257-6754 Fax : 052-276-6792

Prepared	Model	Type	Date	Document No	PANTECH Rev	Rev
WOO S.H	Blue tooth (J-Touch)	internal dielectric chip antenna	2010.04.28		A	1.0

10. Primary Inspection List

- Pantech

Number SPL	SDBTPTR3015		Number SPL	SDBTPTR3015		Number SPL	SDBTPTR3015	
spec→	SWR(Min:1.0~Max:3.0)		spec→	SWR(Min:1.0~Max:3.0)		spec→	SWR(Min:1.0~Max:3.0)	
Item↓	2400[MHz]	2485[MHz]	Item↓	2400[MHz]	2485[MHz]	Item↓	2400[MHz]	2485[MHz]
1	1.30	1.30	24	1.37	1.23	47	1.25	1.32
2	1.32	1.28	25	1.26	1.32	48	1.31	1.26
3	1.28	1.31	26	1.35	1.23	49	1.28	1.28
4	1.29	1.33	27	1.29	1.29	50	1.27	1.25
5	1.36	1.25	28	1.30	1.31	51	1.26	1.31
6	1.30	1.37	29	1.37	1.22	52	1.24	1.29
7	1.35	1.31	30	1.34	1.25	53	1.29	1.28
8	1.33	1.30	31	1.35	1.21	54	1.28	1.25
9	1.34	1.27	32	1.25	1.31	55	1.27	1.29
10	1.31	1.30	33	1.26	1.30	56	1.25	1.28
11	1.33	1.29	34	1.25	1.27	57	1.30	1.25
12	1.32	1.31	35	1.26	1.28	58	1.30	1.22
13	1.29	1.31	36	1.28	1.32	59	1.23	1.27
14	1.30	1.30	37	1.26	1.29	60	1.26	1.25
15	1.32	1.29	38	1.28	1.27	Min	1.23	1.21
16	1.29	1.33	39	1.30	1.28	Max	1.37	1.37
17	1.29	1.34	40	1.29	1.23	Ave	1.55	1.54
18	1.27	1.29	41	1.34	1.22			
19	1.30	1.34	42	1.27	1.30			
20	1.28	1.33	43	1.27	1.29			
21	1.29	1.28	44	1.31	1.25			
22	1.31	1.29	45	1.29	1.26			
23	1.26	1.33	46	1.32	1.24			

- Partron

Number SPL	SDBTPTR3015		Number SPL	SDBTPTR3015		Number SPL	SDBTPTR3015	
spec→	SWR(Min:1.0~Max:3.0)		spec→	SWR(Min:1.0~Max:3.0)		spec→	SWR(Min:1.0~Max:3.0)	
Item↓	2400[MHz]	2485[MHz]	Item↓	2400[MHz]	2485[MHz]	Item↓	2400[MHz]	2485[MHz]
1	1.29	1.32	24	1.35	1.26	47	1.24	1.29
2	1.30	1.28	25	1.28	1.32	48	1.29	1.28
3	1.26	1.32	26	1.34	1.29	49	1.28	1.28
4	1.30	1.31	27	1.30	1.31	50	1.32	1.31
5	1.34	1.27	28	1.30	1.31	51	1.29	1.31
6	1.31	1.34	29	1.25	1.27	52	1.24	1.29
7	1.35	1.29	30	1.26	1.28	53	1.29	1.28
8	1.30	1.31	31	1.28	1.32	54	1.28	1.25
9	1.33	1.28	32	1.25	1.31	55	1.27	1.31
10	1.30	1.30	33	1.32	1.29	56	1.29	1.28
11	1.32	1.29	34	1.32	1.31	57	1.30	1.30
12	1.32	1.31	35	1.29	1.31	58	1.34	1.27
13	1.29	1.31	36	1.28	1.32	59	1.31	1.34
14	1.31	1.28	37	1.30	1.30	60	1.35	1.29
15	1.30	1.30	38	1.28	1.29	Min	1.24	1.25
16	1.28	1.31	39	1.28	1.30	Max	1.35	1.35
17	1.31	1.31	40	1.25	1.31	Ave	1.55	1.56
18	1.25	1.29	41	1.30	1.26			
19	1.28	1.35	42	1.29	1.31			
20	1.27	1.31	43	1.31	1.28			
21	1.29	1.28	44	1.31	1.25			
22	1.30	1.30	45	1.25	1.27			
23	1.27	1.34	46	1.26	1.28			