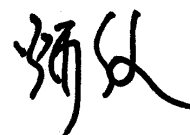



MSL Level 1
ROHS-Y

승 인 원

제 품 명	칩 안테나		
사 용 자	텔리안		
적 용 모 델	MGQ3180		
사용자 CODE			
공급자	주식회사 파트론		
공급자 CODE	ACS2450GBAMQ3		
텔리안	작성자	검토자	승인자
(주)파트론	작성자	품질 합의	승인자
			
	개발 2P	품질보증파트	연구소
	전찬익	이광규	임병준
	05/10	05/11	05/11

2007 . 05. 11


경기도 화성시 반월동 33번지 나동 455-300

Tel : 031-201-7870~6

Fax : 031-201-7800

www.partron.co.kr



MSL Level 1

ROHS-Y

SPECIFICATION

MODEL : ACS2450GBAMQ3

3D Structure



Top Pattern

Bottom Pattern

작성자	검토자	승인자
		
개발 2P	품질보증파트	연구소
전찬익	이광규	임병준
05/10	05/11	05/11

2007 . 05. 11



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3. 중점 관리 항목	5 p
4. 전기적 특성	6 p
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1. 이력관리

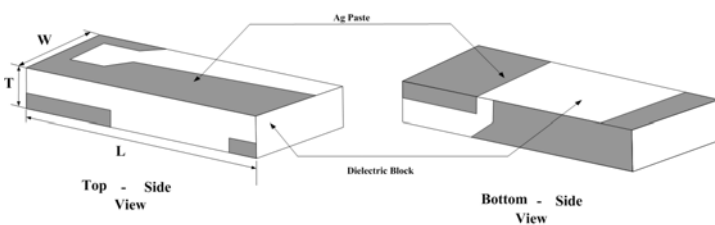
[illegible]

2. 부품의 개요 및 치수 규격

2.1 부품개요

본 제품은 유전체 무선 통신 기기 내장형 Chip Antenna로 직방의 형상을 갖는 유전체에 은(Ag) Paste로 패턴을 형성하여 특성을 구현한다.

2.2 부품 치수규격

Type	Only Bulk Ceramic	
재 질	Dielectric Block	Mg ₂ SiO ₄ (Magnesium Silicate)
	전극 Paste	Ag
크 기 [mm]	W = 2.0±0.1	
	L = 7.0±0.1	
	T = 1.2±0.1	
평탄도	0.04(소체기준)	
MSL LEVEL	MSL LEVEL 1	
ESD LEVEL	15 KV이상 (HBM CLASS 3B)	
Version	Revision 2.0	

3. 중점관리항목(CTF)

－ 아래 항목에 대하여 중점관리 항목으로 지정하여 관리한다.

제품의 CTQ 항목	지정 사유
성형무게,치수	성형무게 및 치수에 따라 소성후 소체 SIZE가 결정되며 소체 SIZE가 인쇄 정밀도에 영향을 미침
소성치수	소성후 치수가 인쇄 정밀도에 영향을줌
인쇄치수	인쇄치수 정밀도가 BT 안테나의 특성의 핵심적 항목임.

제품의 CTF 항목	지정 사유
단품측정 SWR	제품의 전기적 특성을 분별하는 주요 PARAMETER 임

－ 아래 항목에 대하여 주의를 요함

항 목	내 용
보 관	상온에 장시간 보관시 밀봉하여 보관
동 작	임의의 설계 변경시 특성이 변경될 수 있음

4. 전기적 특성

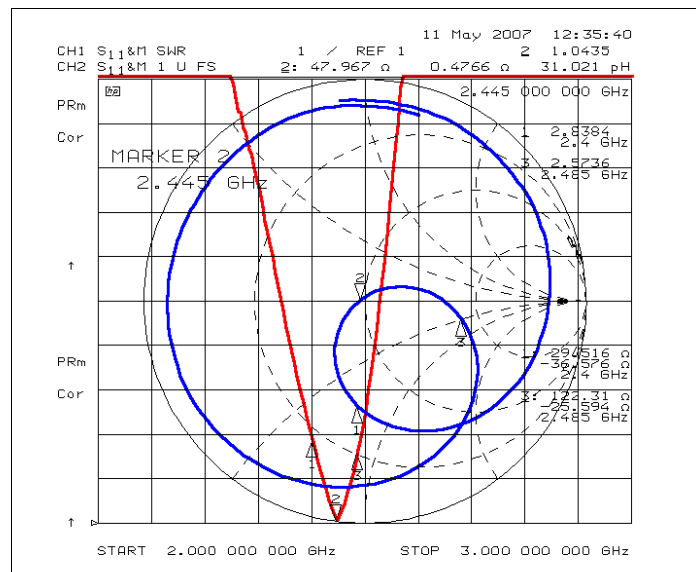
4.1 단품 Spec

ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2485
SWR [Max]	3 : 1 (Typ 2 : 1)
Input Impedance [Ω]	50
Polarization	Linear
Gain (Peak / Avg) [dBi]	2.5 / 0
Temperature [$^{\circ}\text{C}$]	-40 ~ +80
Humidity [%]	At the normal temperature, RH 100

4.2 Set 실장 측정

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]			-1.9./-7.2
	Azimuth	Theta	Peak	-7.00
			Average	-10.31
		Phi	Peak	-3.79
			Average	-9.24
	Elevation 1	Theta	Peak	-4.23
			Average	-7.38
		Phi	Peak	-7.46
			Average	-11.06
	Elevation 2	Theta	Peak	-10.24
			Average	-14.74
		Phi	Peak	0.18
			Average	-5.74

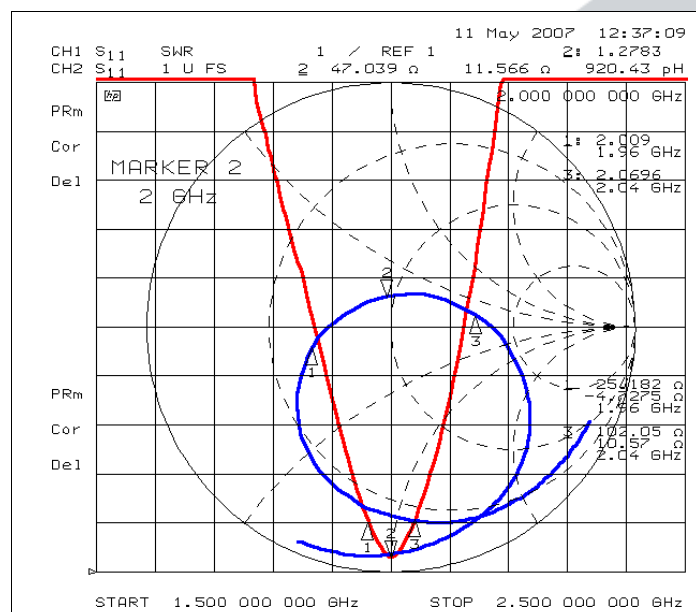
4.3 Set 실장 측정 Graph



4.4 Test Fixture 측정

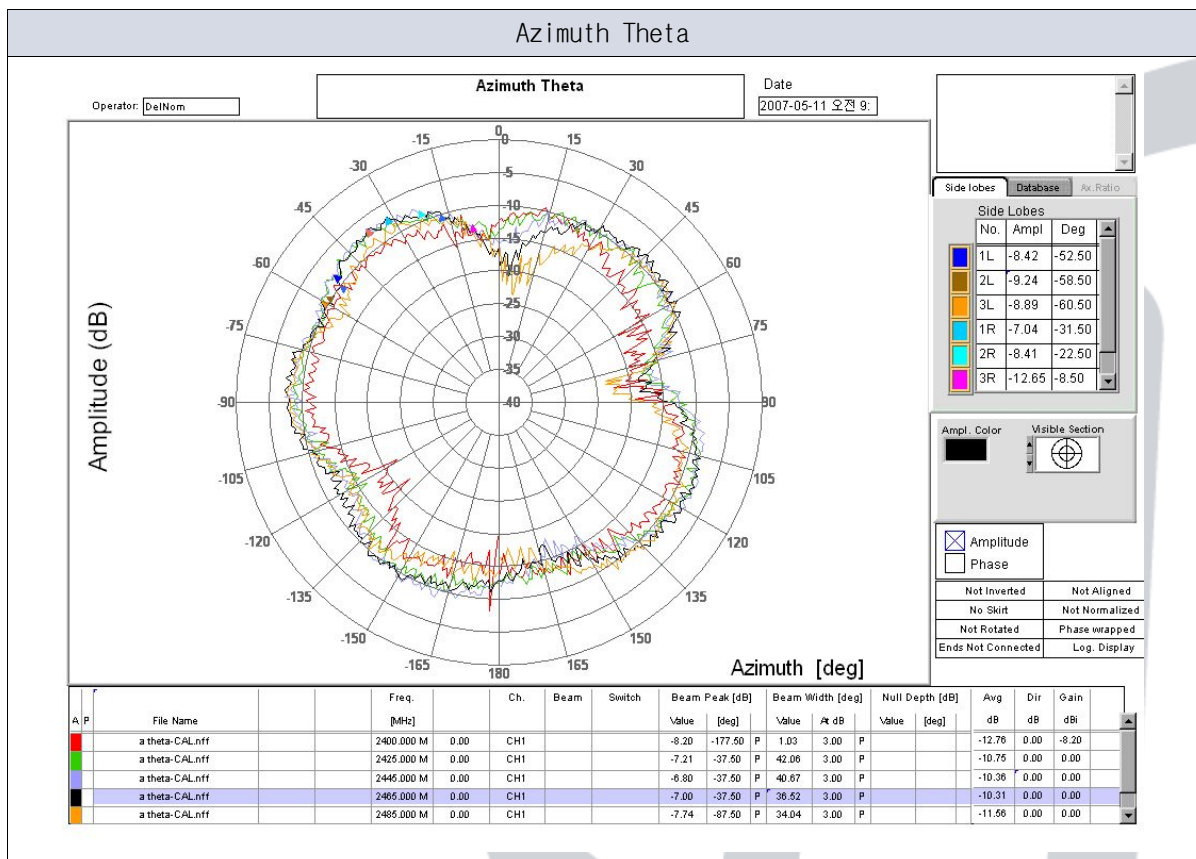
ITEM	SPEC
Frequency Range [MHz]	1960 ~ 2040
Lower frequency(1960MHz) SWR [Min~Max]	1.5 ~ 3.0 : 1 (Typ 2.0 : 1)
Upper frequency(2040MHz) SWR [Min~Max]	1.5 ~ 3.0 : 1 (Typ 2.0 : 1)

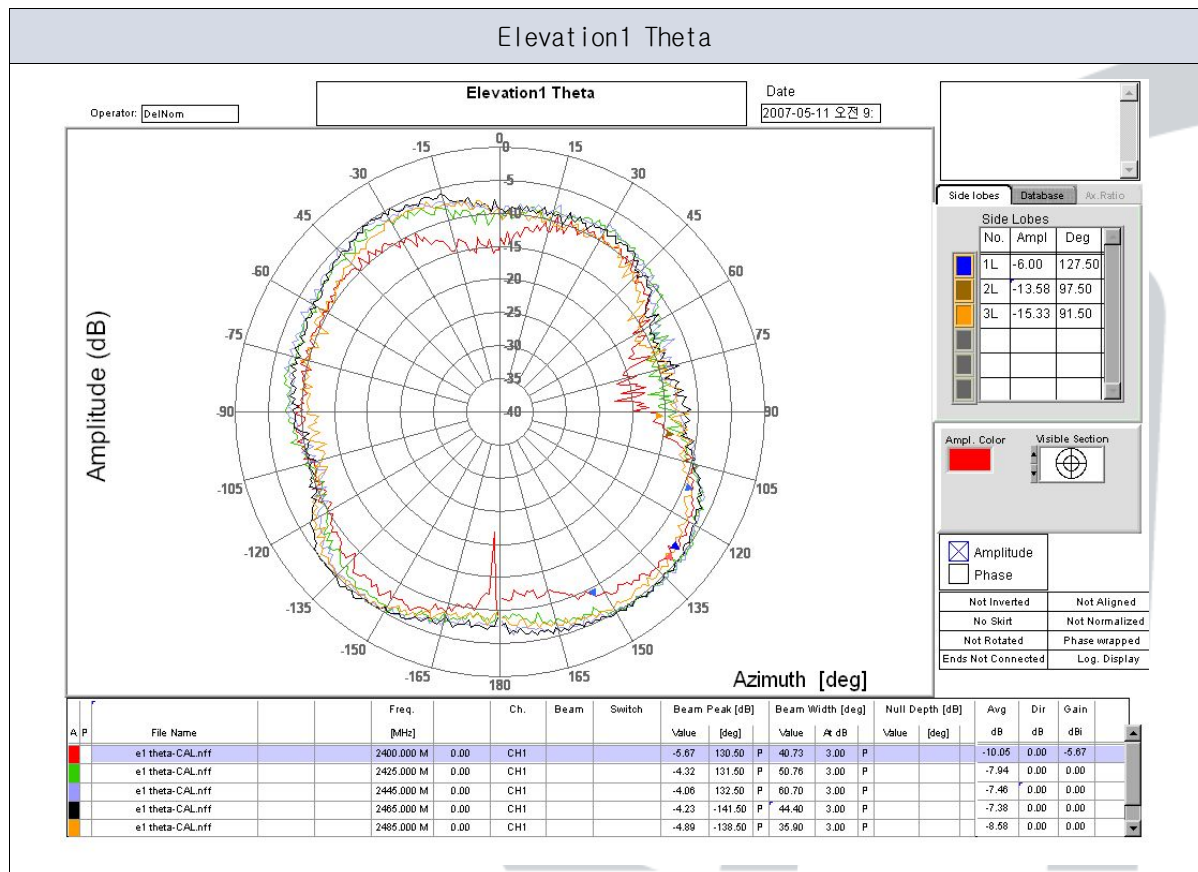
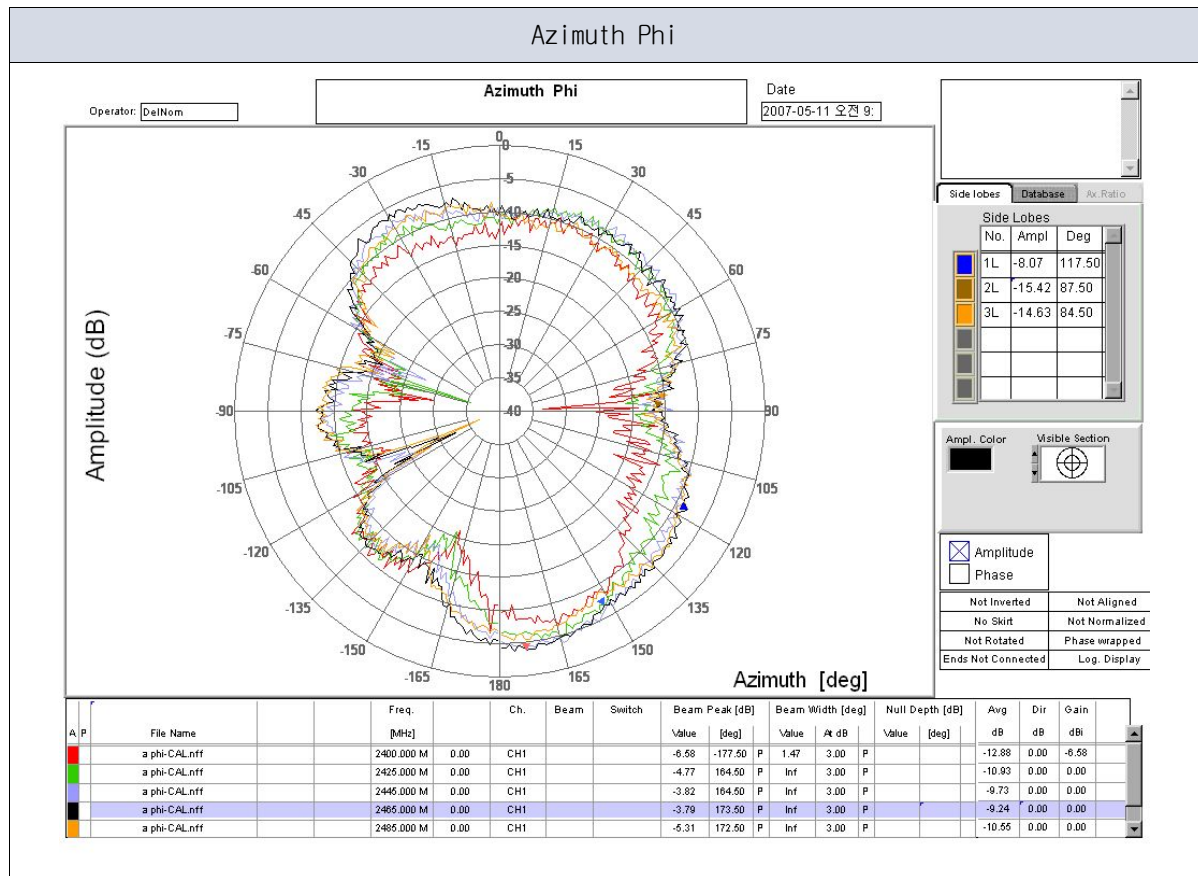
4.5 Test Fixture 측정 Graph

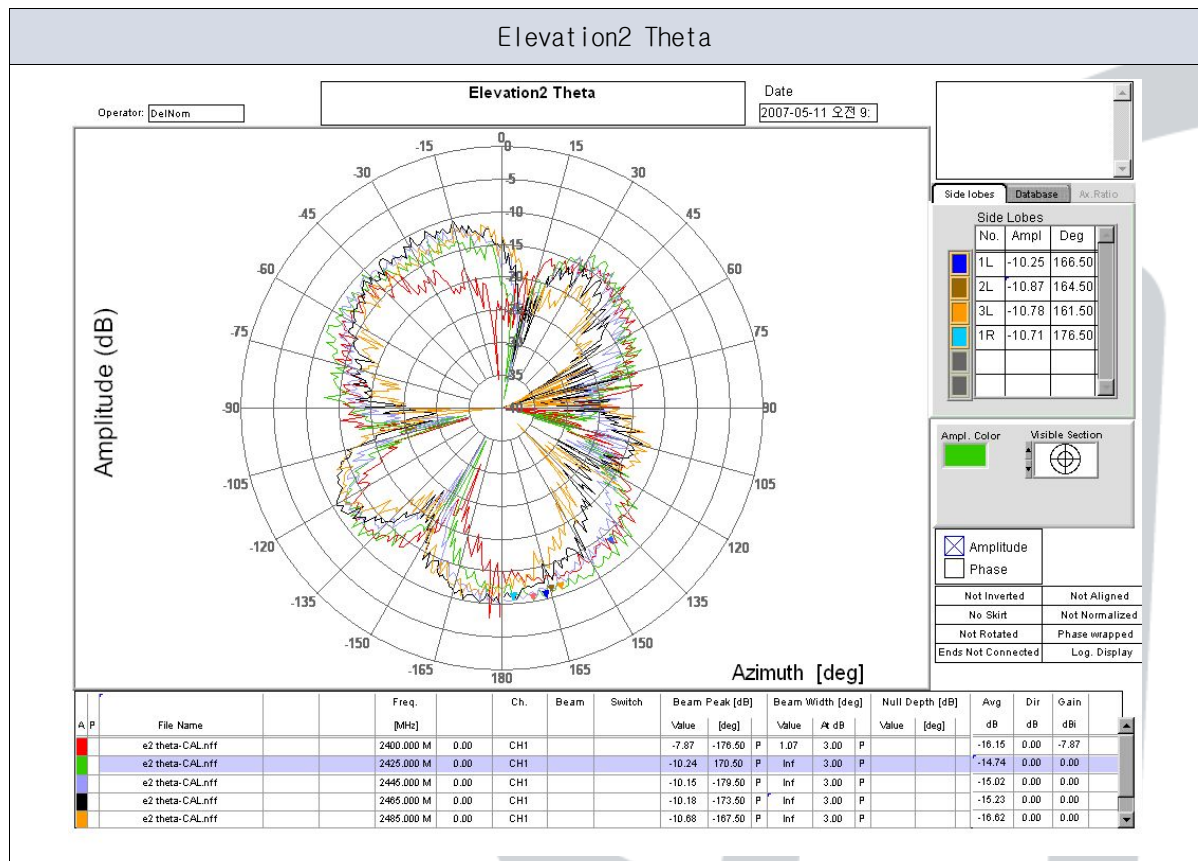
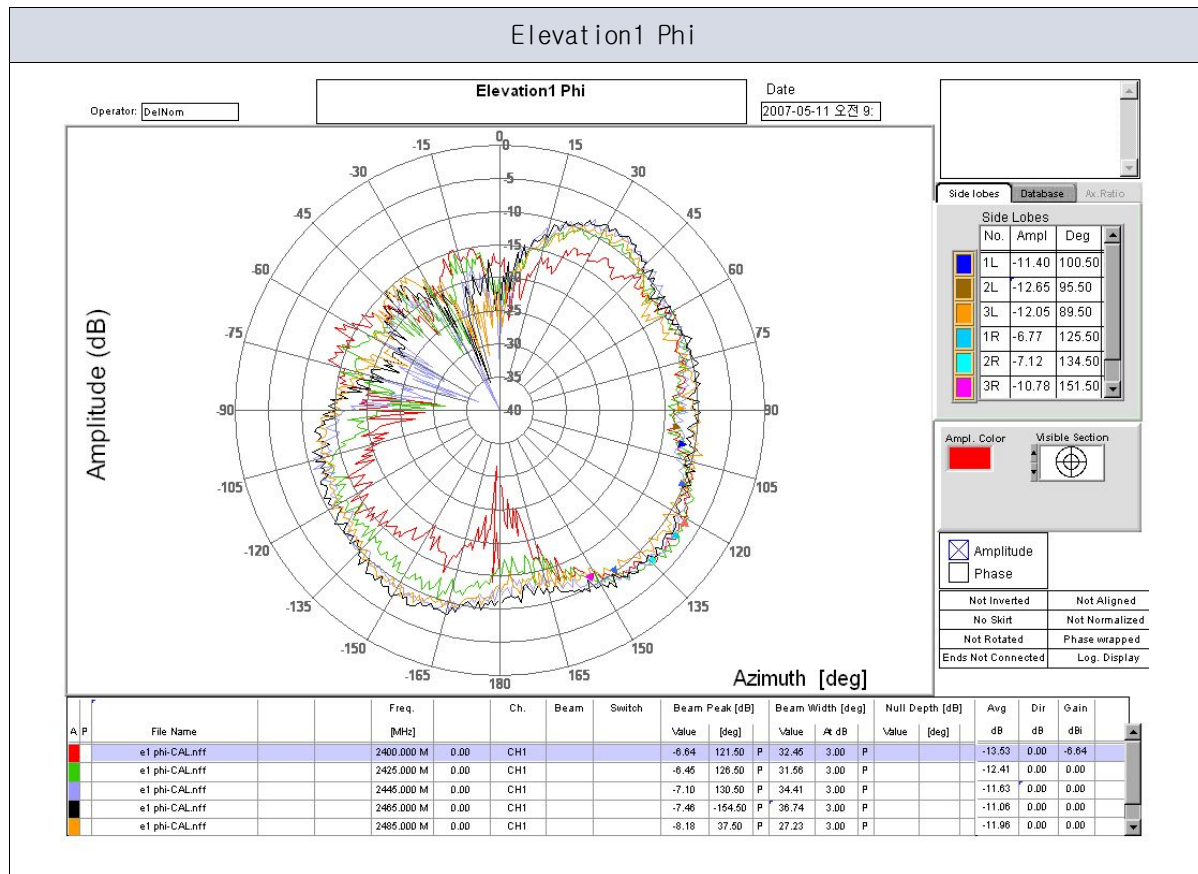


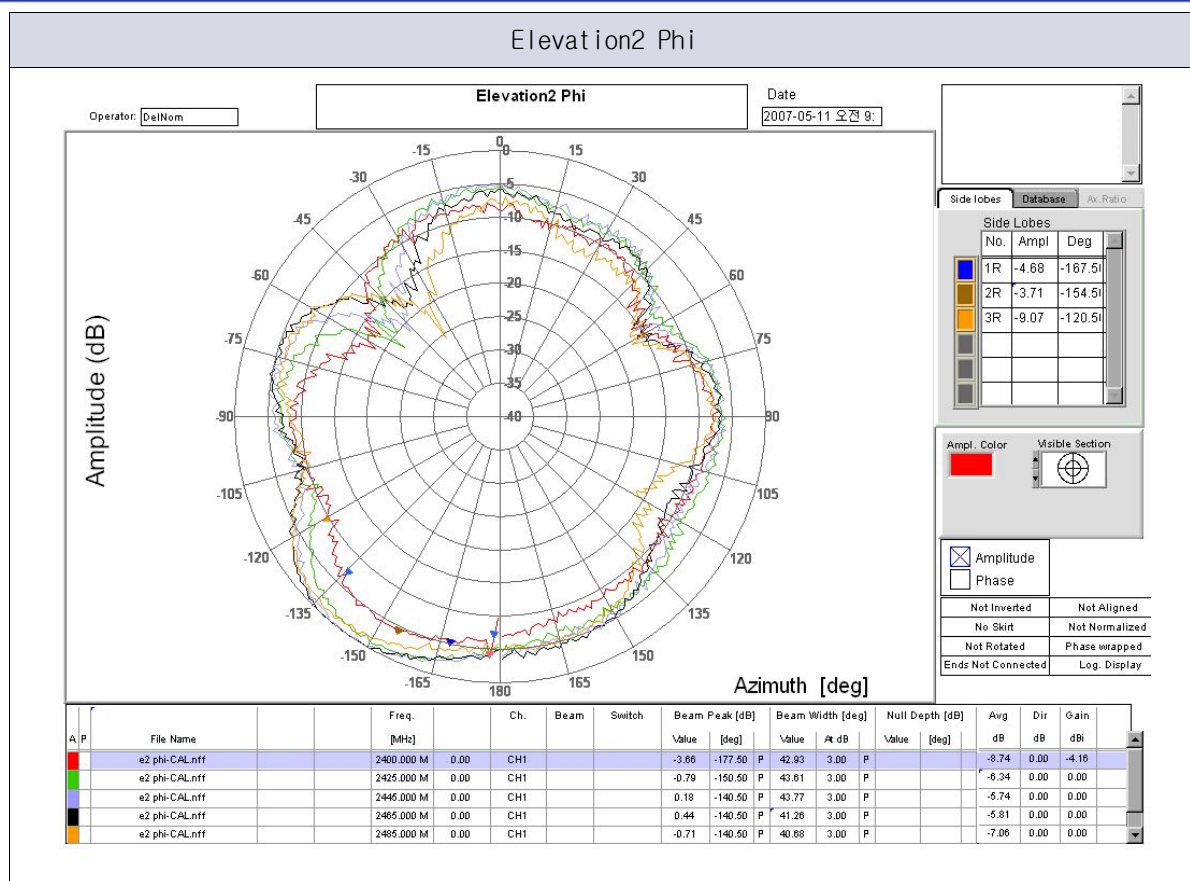
4.6 방사 패턴

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





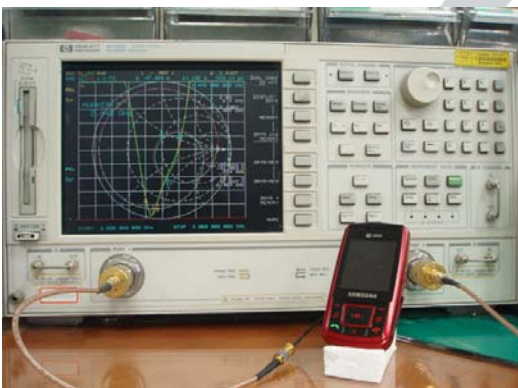
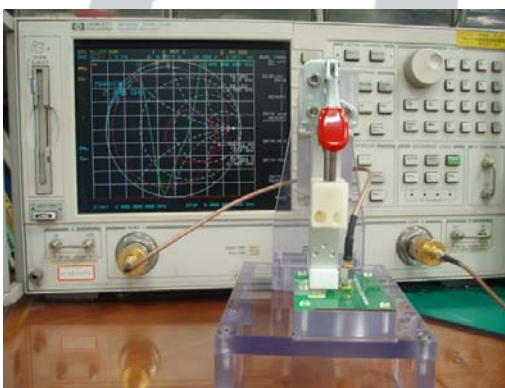




5. 시험 방법

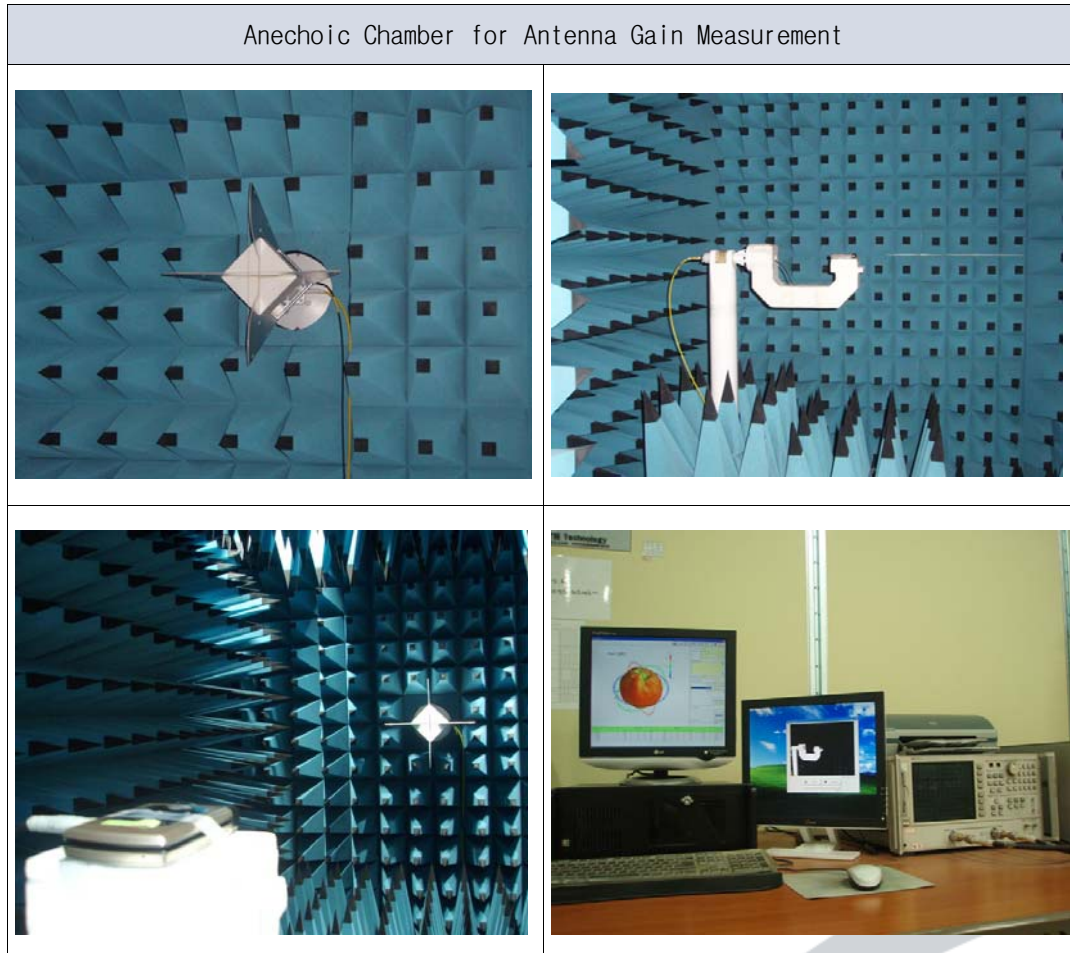
5.1 SWR/Return loss

Network Analyzer를 이용하여 SWR/Return loss 를 측정하며 표본 SPL을 선별 Test Fixture 또는 자동화 검사장비를 이용하여 양품과 불량품을 선별한다.

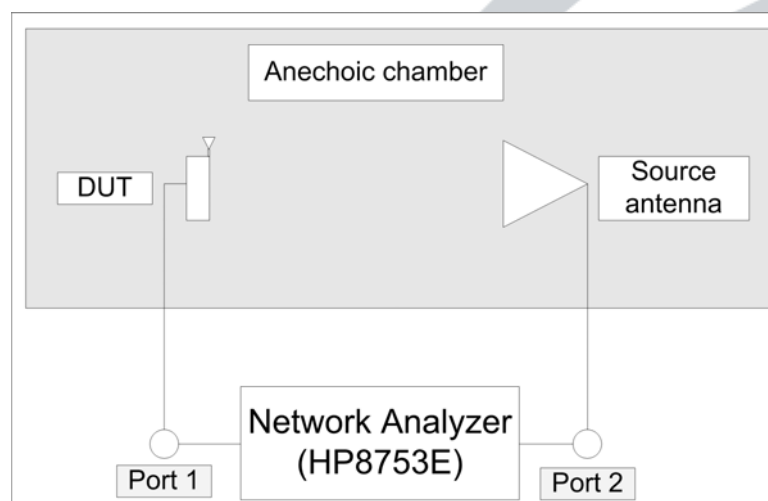
	Set Condition	Test Fixture Condition
Network Analyzer	Agilent HP8753D	Agilent HP8753D or Advantest R3765CH
Cable	RF cable(300mm)	RF cable(300mm)
Test condition		

5.2 Gain

당사가 보유한 전파 무반사실에서 상기4.1에서 측정된 Set를 이용하여 Antenna Gain을 측정한다.

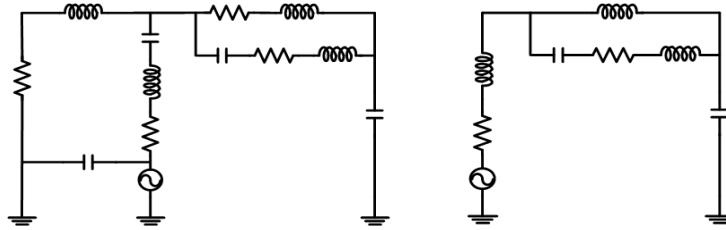


5.3 Gain test block diagram



6. 내부 Block Diagram

본 제품은 유전체를 재료로 한 직방형의 Block 표면에 Ag Pattern 의 구조적인 변경을 통하여 아래와 같은 구조적인 등가회로의 Value 를 조절하여 성능을 구현하는 RF 부품이다.



3 Land Type

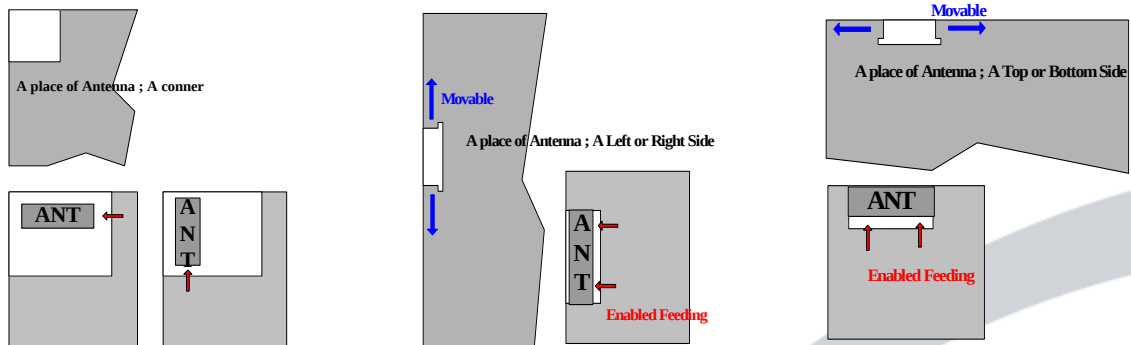
2 Land Type

7. 기본 동작 및 Application Note

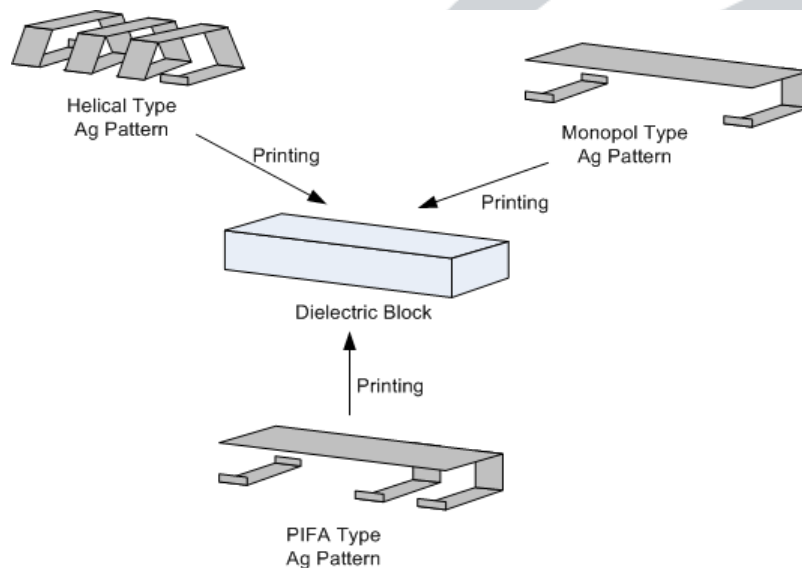
본 제품은 무선 통신 기기 내장형 유전체 Chip Antenna 로 전송선로를 따라 진행해온 전기적 신호를 자유공간파(FREE SPACE WAVE) 로 변환하는 장치이다.

본 제품은 원하는 어떠한 위치에도 실장이 가능하며 실장 조건에 따라 그 설계를 달리 한다.

다만 본 제품은 방사 부품으로 주변 Boundary Condition에 따라 그 특성을 달리 하므로 위치 선정에 각별한 주의를 기울여야 한다.

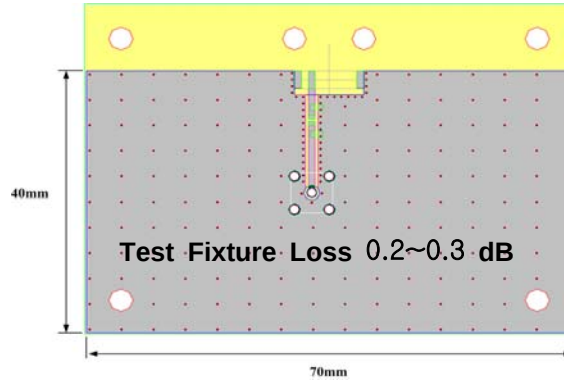


본 제품은 실장 주변 조건에 맞추어 아래와 같이 다양한 Antenna Type으로 설계 변경이 용이하다.



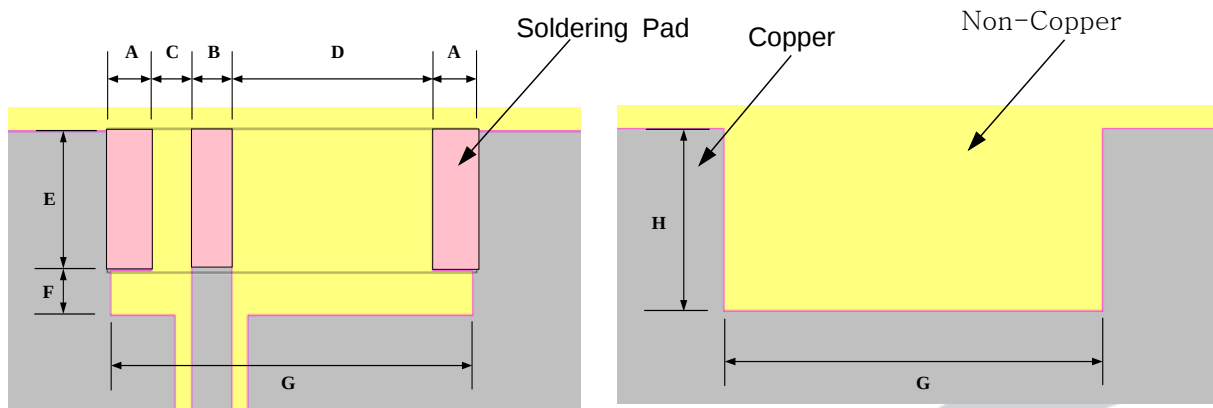
8. 측정 Jig 사양

8.1 Test Fixture And GROUND Condition



※ Ev B'd 와 Test fixture Jig 는 동일함(Ev B'd 는 접촉 방식이 납땜, Test Fixture 는 동편 Contact 방식)

8.2 PCB Layout & Soldering Pad Dimension



Top Layout

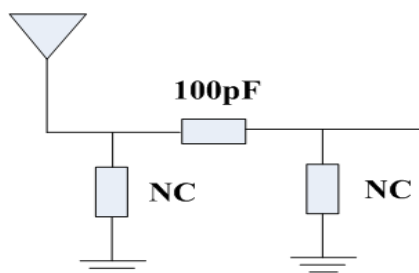
Bottom Pattern

Parameter	A	B	C	D	E	F	G	H
Value[mm]	1.1	1.0	0.5	3.5	2.2	1.0	7.2	3.2

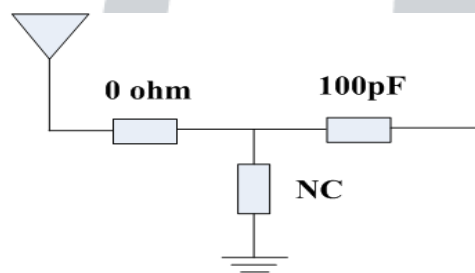
Unit ; mm

Unless specified tolerances are ± 0.1

8.3 Matching Circuit And Reference Value



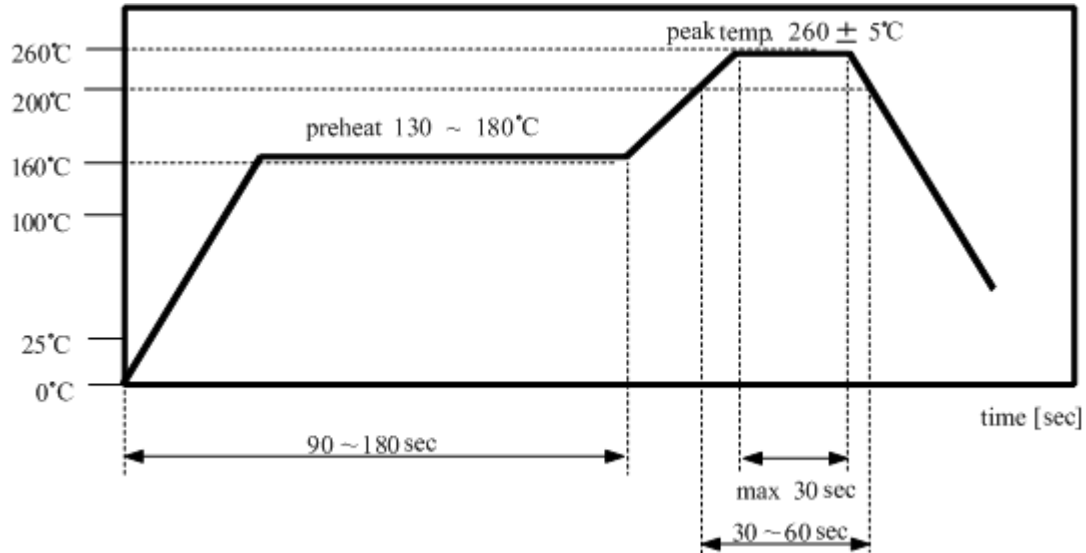
π Matching



T Matching

9. REFLOW PROFILE

9.1 표준 열경화(Reflow) 조건



9.2 수동 납땜 (납땜 인두기를 사용할 경우)

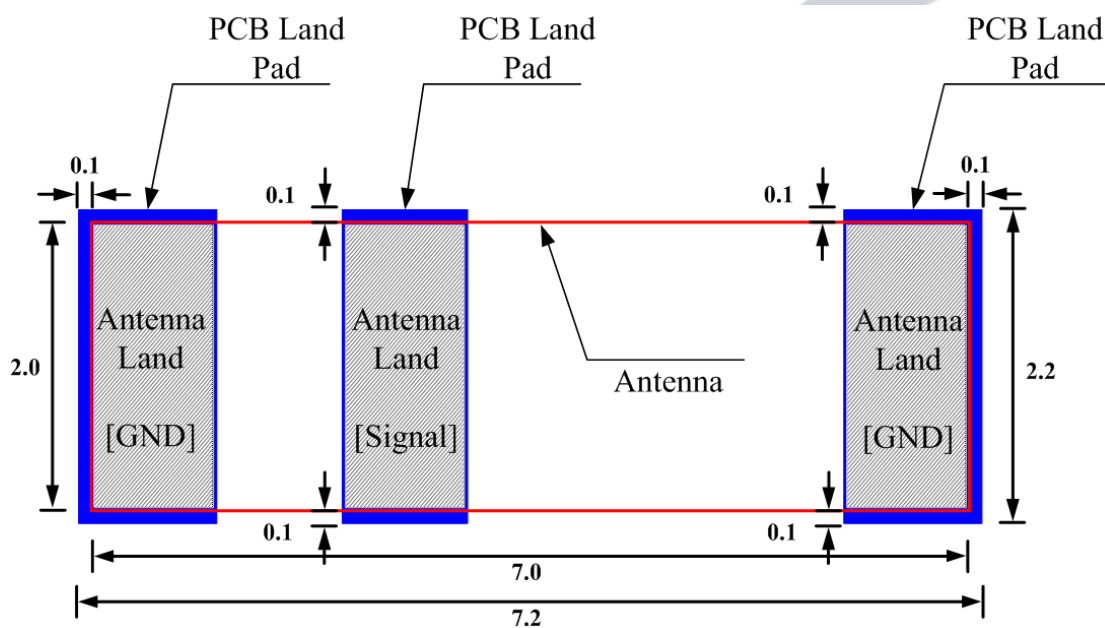
예 열 : 120°C / 시간 : 60 ~ 300 sec.

인두온도 : 340°C ± 5°C / 시간 : 각 단 최대 5 sec.

9.3 Recommend PCB Pattern Design

PCB Land Pattern은 제시한 Antenna의 land Dimension 보다 아래 그림에서 보여지는 것과 같이 0.1mm 이상 외각으로 확장된 형태로 설계된다.

* 8.2 PCB Layout & Soldering Pad Dimension 항목과 동일함



10. 초기 검사 성적서

검사항목	단품특성 [MHz] 		Ev B'd 특성 [MHz]		치수 [mm]		
규격	VSWR 3.0 Max		VSWR 3.0 Max		W=2.0±0.1	L=7.0±0.1	T=1.2±0.1
	1960	2040	1960	2040			
1	2.00	2.06	1.95	2.22	2.02	7.01	1.23
2	1.99	2.12	2.24	1.96	2.03	7.02	1.23
3	1.97	2.06	1.95	2.13	2.03	7.03	1.23
4	1.87	2.18	2.14	2.10	2.03	7.01	1.22
5	1.93	2.11	2.25	2.02	2.02	7.01	1.23
6	2.00	2.01	2.08	2.42	2.04	7.01	1.24
7	2.09	2.00	2.23	2.22	2.02	7.02	1.24
8	1.91	2.18	1.87	2.29	2.03	7.02	1.22
9	2.03	2.18	1.99	2.28	2.02	7.02	1.24
10	1.98	2.07	2.22	1.86	2.03	7.02	1.24
11	1.89	2.10	1.86	1.78	2.03	7.03	1.23
12	1.82	2.17	1.85	1.95	2.02	7.03	1.24
13	1.97	2.05	2.03	2.37	2.04	7.02	1.22
14	1.90	2.12	1.86	2.27	2.02	7.01	1.23
15	1.82	2.04	2.07	1.78	2.03	7.01	1.23
16	2.07	2.00	1.81	1.80	2.03	7.02	1.24
17	2.06	2.07	1.86	1.82	2.02	7.03	1.22
18	2.06	2.05	2.04	1.76	2.04	7.03	1.24
19	1.97	2.12	1.82	1.77	2.02	7.01	1.23
20	1.89	2.11	1.91	1.99	2.02	7.02	1.24
Min	1.82	2	1.81	1.76	2.02	7.01	1.22
Max	2.09	2.18	2.25	2.42	2.04	7.03	2.24
X	1.96	2.09	2.00	2.03	2.02	7.01	1.23
σ	0.08	0.05	0.09	0.09	0.01	0.01	0.01
Cpk	4.25	2.11	2.17	2.10	3.28	3.38	2.91
판정	OK	OK	OK	OK	OK	OK	OK

11. 신뢰성 보증조건

11.1 환경 시험

항목	시 험 조 건	판정기준
고온동작	85℃ ± 3℃에서 1시간 방치후 시험온도 상태에서 측정한다	시험후 4.3.항의 특성규격을 만족해야함.
고온방치	+85℃ ± 3℃, 120hr ± 2hr 방치한다	
저온동작	-40℃ ± 3℃에서 1시간 방치후 시험온도 상태에서 측정한다	
저온방치	- 40℃ ± 3℃, 120hr ± 2hr 방치한다	
내습동작	+85 ± 3℃, RH85%에서 1시간 방치후 시험온도 상태에서 측정한다	
내습방치	+85 ± 3℃, RH85% ,120hr ± 2hr 방치한다	

11.2 열충격 , REFLOW시험

항목	조 건	판정기준
열충격	조 건 :-40℃ ± 3℃/1min ↔ +85℃ ± 3℃/1min 시험 CYCLE : 32 cycle 온도변환시간 : 5min 미만일것	시험후 4.3.항의 특성규격을 만족해야함.
Reflow	Pre Heating : 200 ± 5℃ , 30 ~ 60 sec Peak Heating : 260℃ ± 5℃ , 30sec Max	

11.3 기계적 시험

항목	조 건	판정기준
진동시험	주파수 : 10~500Hz , 가속도 : 10 × 9.8m/s ² (G) Sweep time : 15min , X.Y.Z each 5 times	시험후 4.3.항의 특성규격을 만족해야함.
낙하시험	- 조건 : 152cm에서 낙하지그를 이용하여 18회 자유낙하(6면3회) - 지그 : 120g ± 20g 플라스틱 지그 사용 - 바닥 : 콘크리트 or 철판	

*진동 및 낙하시험은 Ev B'd 납땜하여 실시할 것

11.4 MSL LEVEL 시험

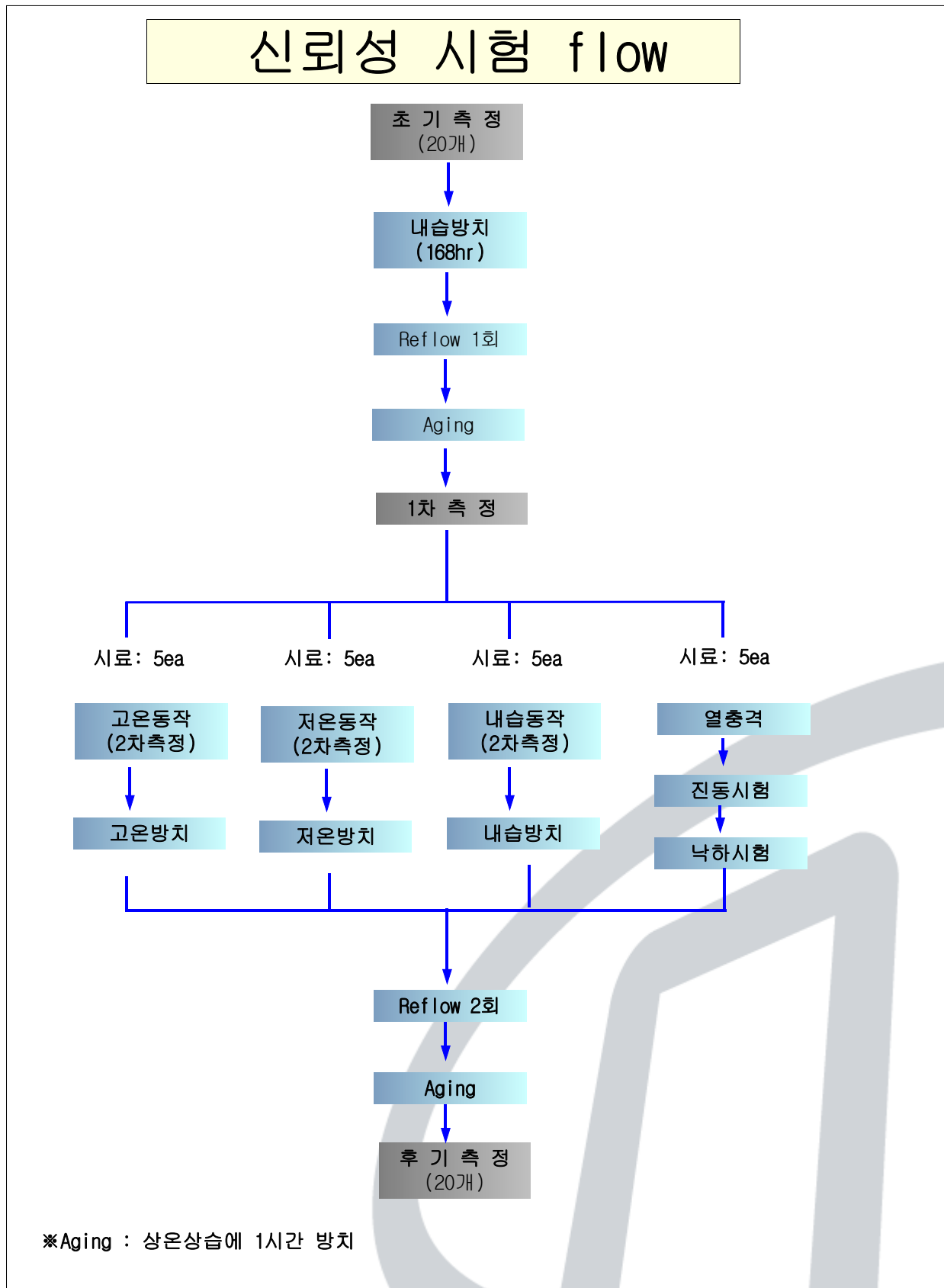
1)JEDEC J-STD-020C 조건

	Floor Life		Soak Requirements	
	Time	Conditions	Time	Conditions
1	Unlimited	= < 30℃/85%RH	168+5/-0	= < 85℃/85%RH

2)Test 조건

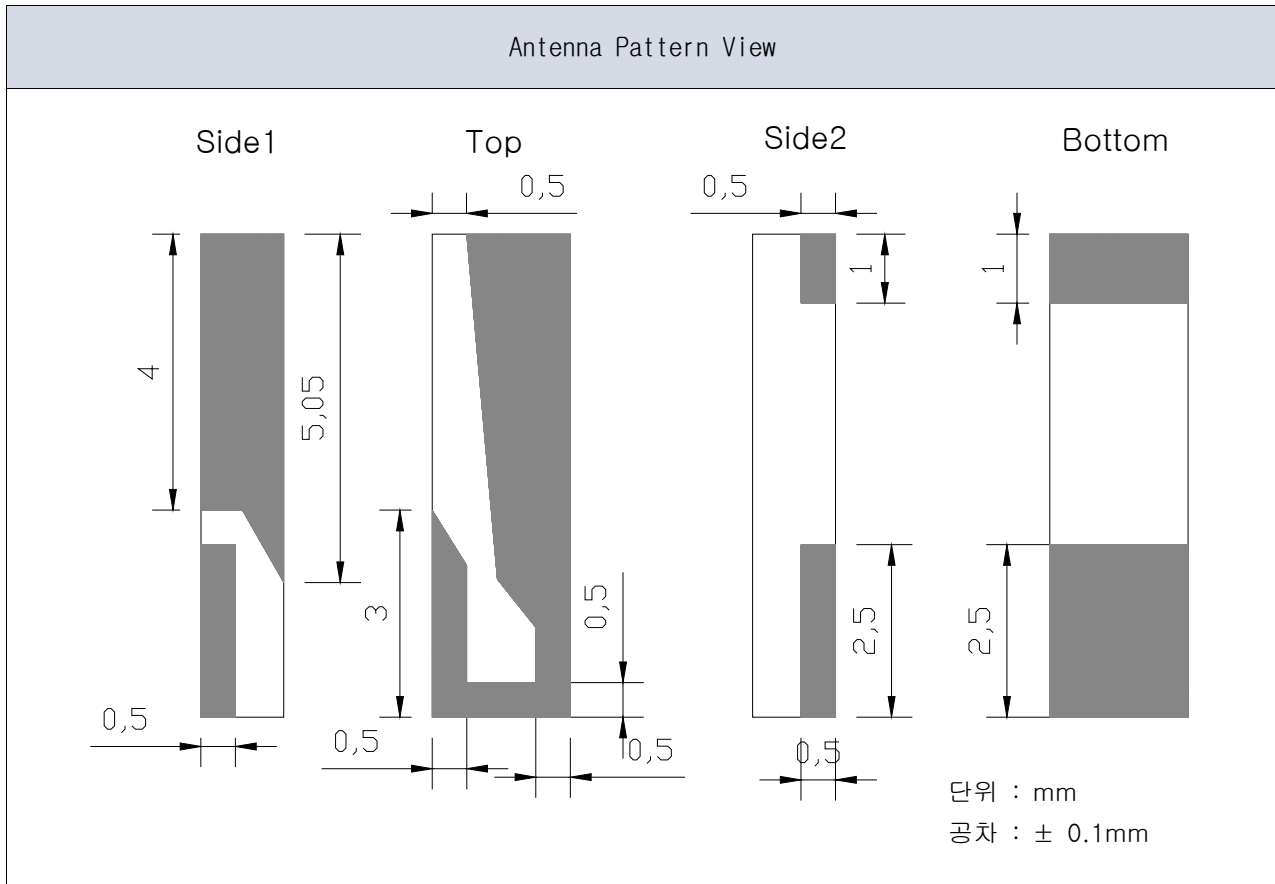
항목	조 건	비고
Soak Requirements	+85 ± 3℃, RH85% 168hr ± 2hr 방치후 Aging없이 Reflow 실시 2회 실시	시험후 4.3.항의 특성규격을 만족해야함.

11.5 신뢰성 시험 FLOW

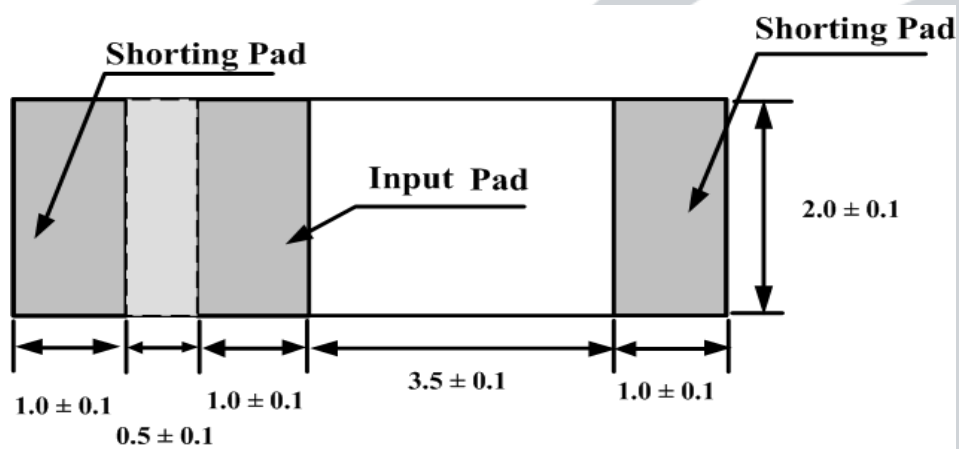


12. 기구적 특성

12.1 안테나 패턴 도면



12.2 Pin name

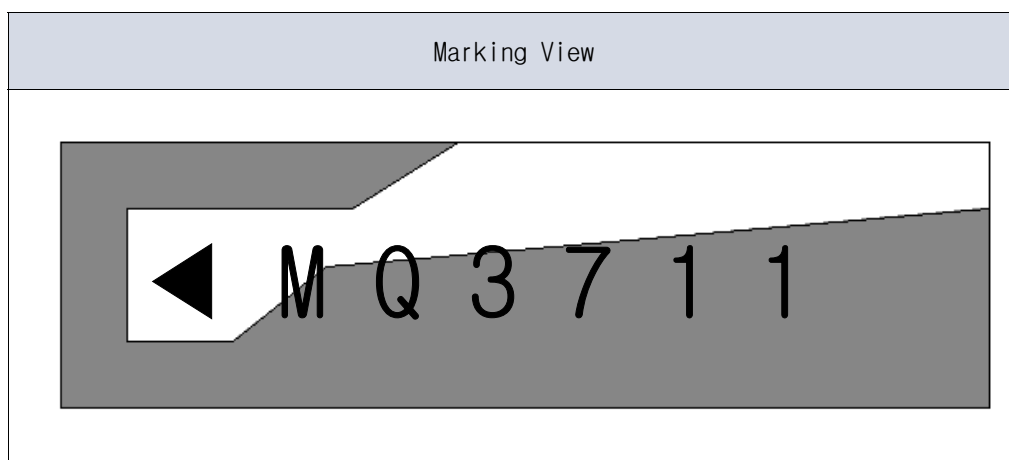


12.3 LOT 번호 표 기 법

<u>7</u>	<u>1</u>	<u>1</u>
①	②	③

- ① Year : 7 - 2007
- ② Month : 1 - January, 2 - February 9 - September, A - October, B - November ..
- ③ Date : 1 - 1st , 2 - 2nd A - 10th, B - 11th

12.4 Marking 사양



◀	<u>M</u>	<u>Q</u>	<u>3</u>	<u>7</u>	<u>1</u>	<u>1</u>
①	②	③	④	⑤		

- ① Input Signal
- ② Serial
- ③ Year; 1 - 2001, 2 - 2002, 7 - 2007
- ④ Month ; 1 - January, 2 - February 9 - September, A - October, B - November
- ⑤ Date : 1 - 1st , 2 - 2nd A - 10th, B - 11th

12.5 Marking 종류

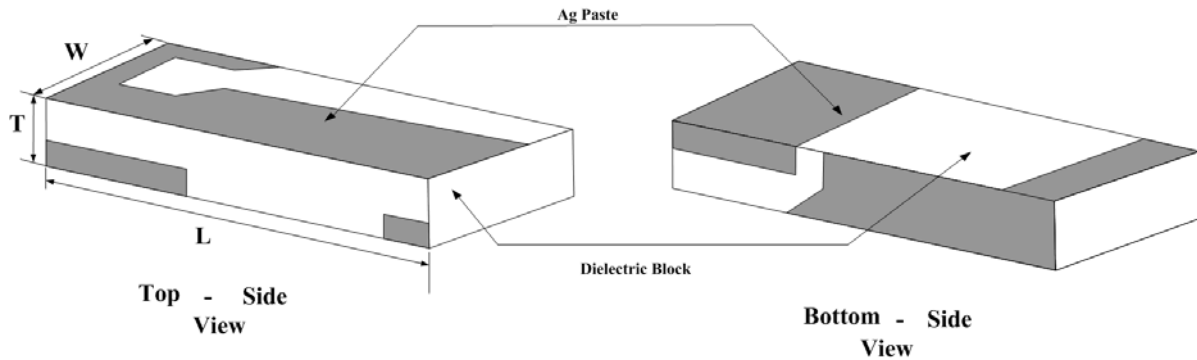
Ink marking - Black Ink 사용

13. 구조 및 재질

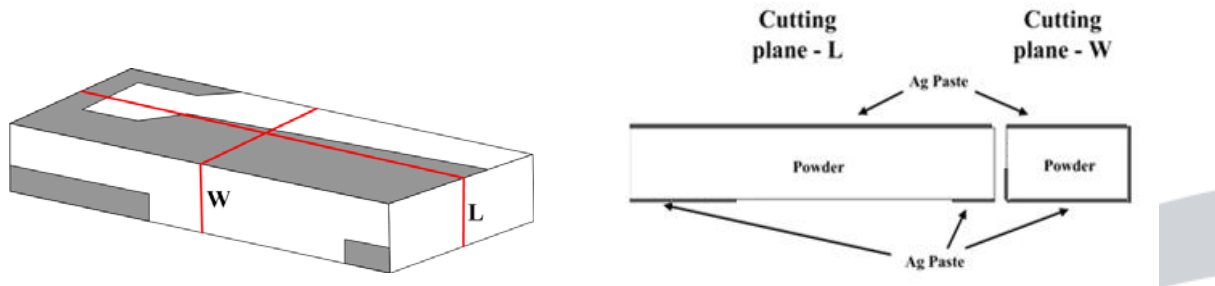
13.1 구현방법

직방체의 형상을 갖는 유전체 소체에 은(Ag) Paste로 패턴을 형성하여 특성을 구현함

13.2 구 조



13.3 내부 단면도



13.4 재 질

구 분	재질	제조사	인쇄패턴 사양
Dielectric Block	POWDER	후지	
PATTERN	Ag Paste	METECH	인쇄두께 : TYP 10 μ m
PAD	Ag paste	METECH	인쇄두께 : Min10 μ m(TYP 16~20 μ m)

14. 주의 사항

14.1 온도 조건

	온도범위	unit
사용온도	-40 ~ +100℃	℃
보관온도	-40 ~ + 70℃	℃

14.2 온도조건 TEST 조건

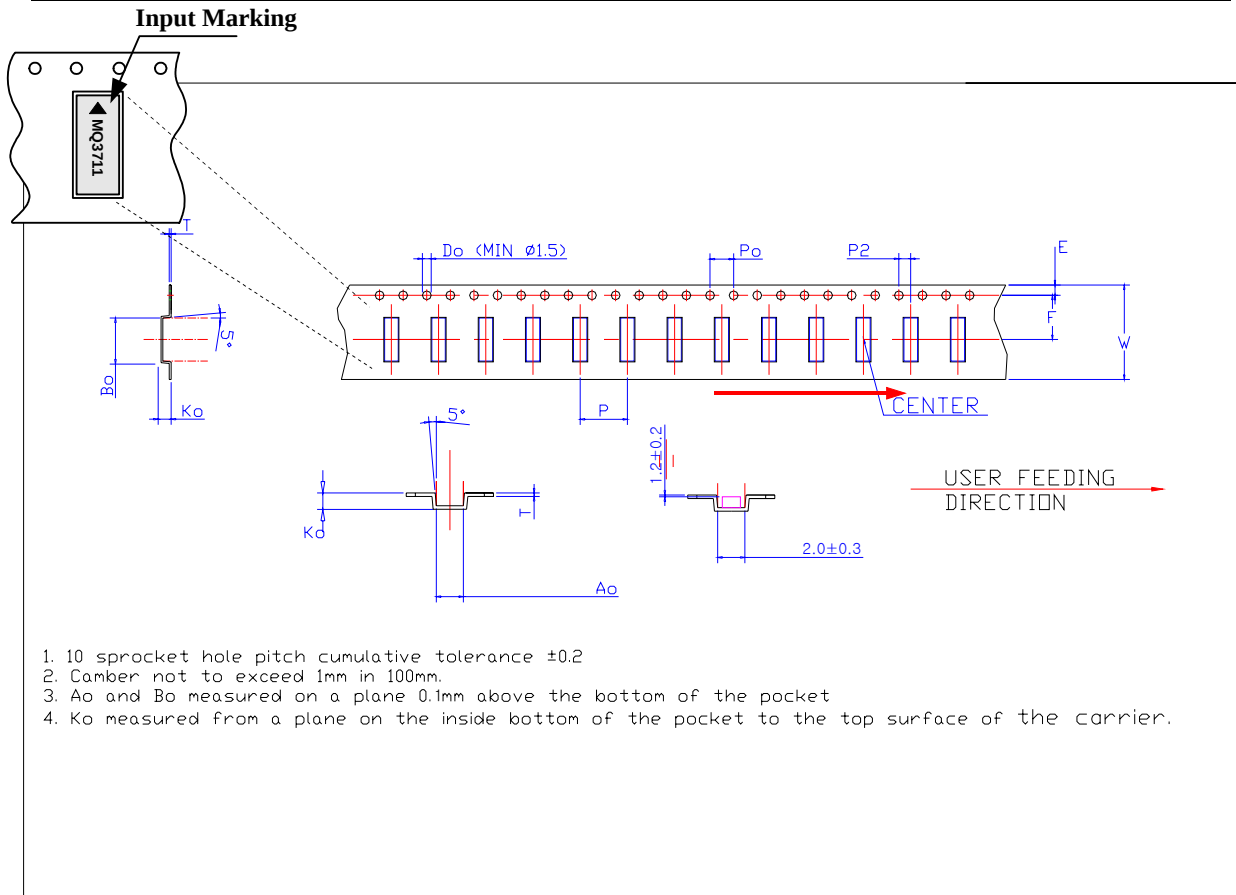
	항목	온도범위
사용온도	저온	-75℃에서 24시간 정상동작
	고온	+150℃에서 24시간 정상동작
보관온도	저온	-75℃에서 1000HR 방치시 정상동작
	고온	+85℃에서 1000HR 방치시 정상동작

* 고온방치시 포장재 보관온도 문제로 85℃이상 불가함

15. 포장 사양

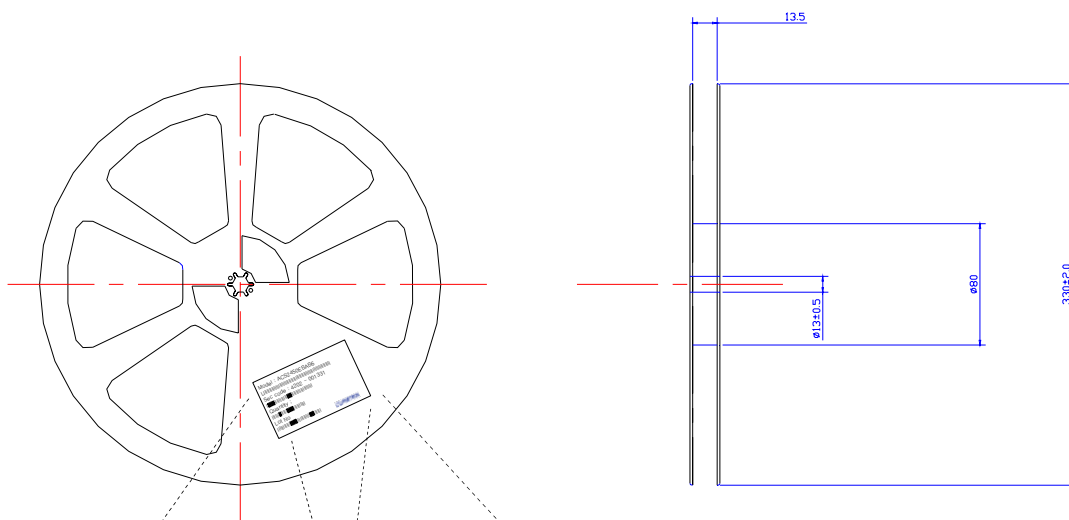
15.1 Carrier/Reel 사양

품목	재질	표면저항	정전기 발생량	포장방식
Carrier tape	A-PET	Typical $10^8 \Omega$	10V MAX	열 압착식
Cover tape	PET	Typical $10^8 \Omega$	30V MAX	
Reel	PS	Typical $10^8 \Omega$	30V MAX	-



DKC DWG. No.	D-1608-028	TITLE	
DIMENSIONAL UNIT	MM	CARRIER TAPE 2*7*1.2P	
UNTOLERANCED DIMENSION	± 0.1	PART.	CARRIER TAPE
CAD FILE NAME	050617	MATERIAL	A-PET
DESIGNED BY	K. M. J	LENGTH	48.4M
SCALE	1/1	COUNT	6050P

NAME	SPEC.
W	16.0 ± 0.2
E	1.75 ± 0.1
F	7.5 ± 0.1
Do	1.5 ± 0.1
P	8.0 ± 0.1
Po	4.0 ± 0.1
P2	2.0 ± 0.1
Ao	2.3 ± 0.1
Bo	7.3 ± 0.1
Ko	1.4 ± 0.1
T	0.3 ± 0.05



<http://www.dkcworld.com>

rm201. dkc Bldg.
366-340 shindang2-dong,
jung-gu, seoul. 100-452, korea

Tel. 822-2234-5890
Fax. 822-2238-8182

REEL DIMENSION	Type	Color	Size	Hub
	PS	Blue	ø330	ø80

Model : ACS2450GBAMQ3

[illegible]

Sec code :

Quantity ;

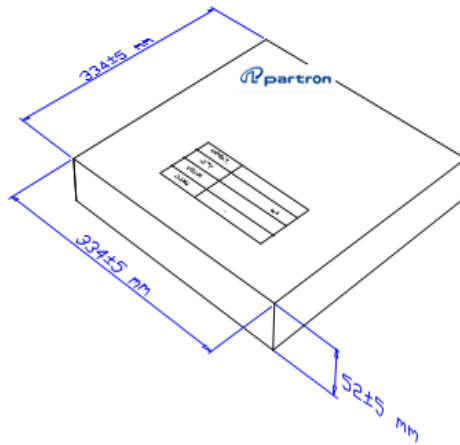
|||||||

Lot No

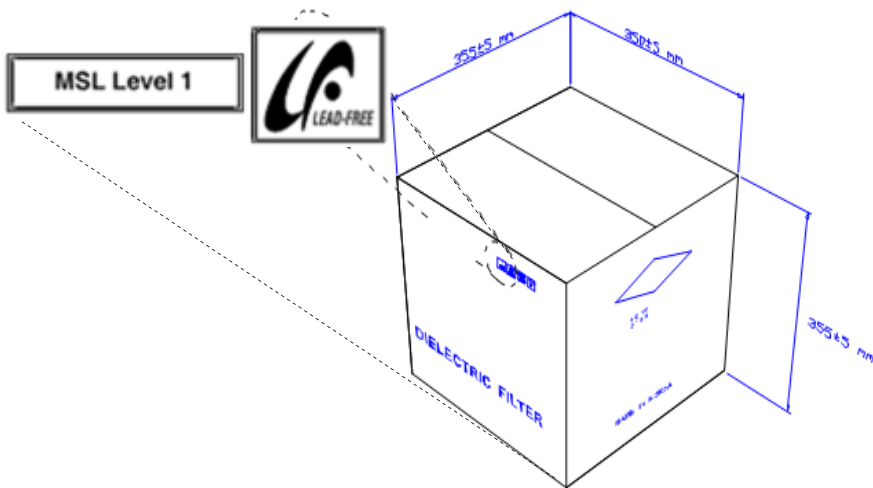
MSL Level 1



15.2 BOX 사양



Material : SK/S/K-B
골판지



15.2 포장 실물 사진



Reel 사진



내상 Box 사진

16. 관리공정도

제품		발행 /개정		품질관리공정도					관리번호	기안	심의	결정		
CHIP ANTENNA		Issued	04.04.06						PRCP-C001					
		Revised	05.04.03											
투입자재	FLOW CHART		공정명	요인관리					품질특성관리					
	준비	본공정		설비명	관리항목	조건	관리주기	기록관리	관리항목	관리한계	검사방법	관리주기	기록관리	조치사항
세라믹 파우더		◇	수입검사						수축율 유전율	작업지도서 참조	Micrometer Network	10개/LOT	C/sheet	반품
파우더 유회제	○		분말	Mixer					혼합	파우더:유회 제	저울	혼합시	-	폐기
		○	성형 CTQ공정 (무게, 치수)	프레스	양압 금형상태	작업지도서 참조	매LOT 1회/일	parameter C/SHEET	치수 무게 밀도 외관	작업지도서 참조	Micrometer 저울 Calculated Visual	5/100개검 사 10개/LOT	LOT CARD	폐기
		○	소성	소성로	SETTER 외관 온도 PROFILE	작업지도서 참조	전수 2회/일 1회/월	C/sheet						
		◇	소체 CTQ공정 (치수)						폭 길이 모양	검사지도서 참조	Micrometer Calipers 목시	20개/LOT 20개/LOT 전수	C/sheet	폐기
AG PASTE		○	SIDE1 PAD 인쇄 CTQ공정 (인쇄치수)	인쇄기 screen	스퀴즈 속도 /압력 SNAP	작업지도서 참조	1회/일	-	PATTERN치수 외관	작업지도서 참조	측정기 현미경	10개/3Jig	c/sheet	재작업
		○	건조	건조기 건조Jig	온도 Belt speed	작업지도서 참조	1회/주	Parameter	건조상태 인쇄상태 파손	작업지도서 참조	목시	전수검사	Lot card	재작업

제품		발행 /개정		품질관리공정도					관리번호	기안	심의	결정		
CHIP ANTENNA		Issued	04.04.06.						PRCP-C001					
투입자재	FLOW CHART		공정명	요인관리					품질특성관리					
	준비	본공정		설비명	관리항목	조건	관리주기	기록관리	관리항목	관리한계	검사방법	관리주기	기록관리	조치사항
AG PASTE		○	SIDE 2 PAD 인쇄 CTQ공정 (인쇄치수)	인쇄기 screen	스퀴즈 속도 /압력 SNAP	작업지도서 참조	1회/일	-	PATTERN치수 외관	작업지도서 참조	측정기 현미경	10개 /3Jig	c/sheet	재작업
		○	건조	건조기 건조Jig	온도 Belt speed	작업지도서 참조	1회/주	Parameter	건조상태 인쇄상태 파손	작업지도서 참조	목시	전수검사	Lot card	재작업
		○	소부	소부로 mesh망	온도 Belt speed	작업지도서 참조	1회/주	Parameter C/Sheet	소체파손 오염	작업지도서 참조	목시	전수	Lot card	폐기 재작업
AG PASTE		○	TOP 인쇄 CTQ공정 (인쇄치수)	인쇄기 screen	스퀴즈 속도 /압력 SNAP	작업지도서 참조	1회/일	-	PATTERN치수	작업지도서 참조	측정기	10개 /3Jig	c/sheet	재작업
		○	건조	건조기 건조Jig	온도 Belt speed	작업지도서 참조	1회/주	Parameter	건조상태 인쇄상태 파손	작업지도서 참조	목시	전수검사	Lot card	재작업
AG PASTE		○	BOTTOM PAD 인쇄 CTQ공정 (인쇄치수)	인쇄기 screen	스퀴즈 속도 /압력 SNAP	작업지도서 참조	1회/일	-	PATTERN치수 외관	작업지도서 참조	측정기 현미경	10개 /3Jig	c/sheet	재작업

제품		발행 /개정		품질관리공정도					관리번호	기안	심의	결정		
CHIP ANTENNA		Issued Revised	04.04.06. 05.04.03						PRCP-C001					
투입 자재	FLOW CHART		공정명	요인관리					품질특성관리					
	준비	본공정		설비명	관리항목	조건	관리주기	기록관리	검사항목	관리한계	검사방법	관리주기	기록관리	조치사항
		○	건조	건조기 건조Jig	온도 Belt speed	작업지도서 참조	1회/주	Parameter	건조상태 인쇄상태 파손	작업지도서 참조	목시	전수검사	Lot card	재작업
		○	소부	소부로 mesh망	온도 Belt speed	작업지도서 참조	1회/주	Parameter C/Sheet	소체파손 오염	작업지도서 참조	목시	전수	Lot card	폐기 재작업
		◇	외관검사						제품외관	한도견본 작업지도서 참조	목시 현미경	전수	Lot card 생산일보	폐기 수리
		○	MARKING	마킹기					마킹외관	한도견본	목시	전수	Lot card 생산일보	재작업 폐기
		◇	특성검사 CTF공정	NETWORK 검사지그	교정상태	작업지도서 참조	1회/반	C/sheet	전기적 특성	작업지도서 참조	Network	전수	Lot card 생산일보	폐기 수리
		◇	외관검사						제품외관 제품치수	한도견본 작업지도서 참조	목시 현미경	전수	Lot card 생산일보	폐기 수리
Carrier cover reel		○	Taping						수량 역삼 외관	작업지도서 참조	수작업	전수	Lot card 생산일보	재작업
		◇	출하검사	NETWORK 검사지그	교정상태	작업지도서 참조	1회/반	C/sheet	전기적특성 제품외관 포장상태	검사지도서	Network 현미경 목시	작업 지도서	성적서	return 폐기
포장 box label		○	포장	bar code printer					포장상태 기종혼입 포장수량	포장작업 지도서	목시	전수	-	재작업
		◇	포장검사						포장상태 기종혼입 포장수량	포장작업 지도서	목시	전수	-	return

17. 유해물질 성적서

1) Ceramic Powder

Parts Name	White Powder(MMS-08)
Tester Organization	SGS Taiwan LTD.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table



Test Report

FUJI TITANIUM IND. CO., LTD.
12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-
PREF. JAPAN. (T) 81-463-32-0210

Report No. : CE/2006/75167
Date : 2006/07/25
Page : 1 of 4



The following sample(s) was/were submitted and identified by/on behalf of the client as :

Sample Description : MIXTURE OF (1) MAGNESIUM SILICATE
(2) STRONTIUM ZIRCONATE (3) BARIUM TITANATE
Style/Item No : MMS-08 (B)
Sample Received : 2006/07/18
Testing Period : 2006/07/18 TO 2006/07/25

Test Result(s) : - Please see the next page(s) -


Daniel Yen, M.R. Operation Manager
Signed for and on behalf of
SGS TAIWAN LTD.

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SGS TAIWAN LIMITED NO. 150-1, Wu-Kung Road, Shuang-Wei Industrial Zone, Taipei county, Taiwan
TEL: 886-2-22962221 FAX: 886-2-2296-2227 www.sgs.com.tw



Test Report

FUJI TITANIUM IND. CO., LTD.
12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-
PREF. JAPAN. (T) 81-463-32-0210

Report No. : CE/2006/75167
Date : 2006/07/25
Page : 2 of 4



Test Result(s)
PART NAME NO.1 : WHITE POWDER

Test Item (s):	Unit	Method	MDL	Result
PBBs (Polybrominated biphenyls)	---	---	---	---
Monobromobiphenyl	%		0.0005	N.D.
Dibromobiphenyl	%		0.0005	N.D.
Tri bromobiphenyl	%		0.0005	N.D.
Tetrabromobiphenyl	%		0.0005	N.D.
Pentabromobiphenyl	%	With reference to	0.0005	N.D.
Hexabromobiphenyl	%	USEPA3540C. Analysis was	0.0005	N.D.
Heptabromobiphenyl	%	performed by HPLC/DAD,	0.0005	N.D.
Octabromobiphenyl	%	LC/MS or GC/MS.	0.0005	N.D.
Nonabromobiphenyl	%	(prohibited by 2002/95/EC	0.0005	N.D.
Decabromobiphenyl	%	(RoHS), 83/264/EEC, and	0.0005	N.D.
		76/769/EEC)		
Total PBBs (Polybrominated biphenyls)/Sum of above	%			N.D.
PBDEs(PBDEs) (Polybrominated biphenyl ethers)	---	---	---	---
Monobromobiphenyl ether	%		0.0005	N.D.
Dibromobiphenyl ether	%		0.0005	N.D.
Tri bromobiphenyl ether	%		0.0005	N.D.
Tetrabromobiphenyl ether	%		0.0005	N.D.
Pentabromobiphenyl ether	%		0.0005	N.D.
Hexabromobiphenyl ether	%	With reference to	0.0005	N.D.
Heptabromobiphenyl ether	%	USEPA3540C. Analysis was	0.0005	N.D.
Octabromobiphenyl ether	%	performed by HPLC/DAD,	0.0005	N.D.
Nonabromobiphenyl ether	%	LC/MS or GC/MS.	0.0005	N.D.
Decabromobiphenyl ether	%	(prohibited by 2002/95/EC	0.0005	N.D.
		(RoHS), 83/264/EEC, and		
		76/769/EEC)		
Total PBDEs(PBDEs) (Polybrominated biphenyl ethers)/Sum of above	%			N.D.
Total of Mono to Nona-brominated biphenyl ether. (Note 4)	%			N.D.

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SGS TAIWAN LIMITED NO. 150-1, Wu-Kung Road, Shuang-Wei Industrial Zone, Taipei county, Taiwan
TEL: 886-2-22962221 FAX: 886-2-2296-2227 www.sgs.com.tw

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Test Report

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12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-
PREF. JAPAN, (T) 81-463-32-0210

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Test Item (s)	Unit	Method	MDL	Result No.1
Chromium VI (Cr+6)	ppm	UV-VIS(US EPA 7196A) after reference to US EPA 3060A.	2	N.D.
Cadmium (Cd)	ppm	ICP-AES after reference to EN 1122, method B/2001 or other acid digestion.	2	N.D.
Mercury (Hg)	ppm	ICP-AES after reference to US EPA 3052 or other acid digestion.	2	N.D.
Lead (Pb)	ppm	ICP-AES after reference to US EPA 3050B or other acid digestion.	2	19.3

NOTE: (1) N.D. = Not Detected (<MDL)
(2) ppm = mg/kg
(3) MDL = Method Detection Limit
(4) Decabromobiphenyl ether (DecaBDE) in polymeric applications is exempted by
Commission Decision of 13 Oct 2005 amending Directive 2002/95/EC notified
under document 2005/717/EC.
(5) PBBEs=PBDEs=Polybrominated Diphenyl Ethers=PBDOs=PBBOs.
(6) " - " = Not Regulation
(7) " --- " = Not Applicable

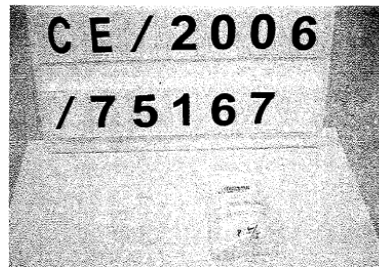
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offenders may be prosecuted to the fullest extent of the law.

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Test Report

FUJII TITANIUM IND. CO., LTD.
12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-
PREF. JAPAN, (T) 81-463-32-0210

Report No. : CE/2006/75167
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** End of Report **

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offenders may be prosecuted to the fullest extent of the law.

2) Ag Paste

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

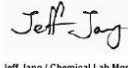
SGS

Test Report No. F690501/LF-CTSGP06-26952 **Date:** October 27, 2006 **Page 1 of 2**

To: METECH KOREA CO., LTD.
B-801 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:

Commodity : PCC11837HV
SGS File No. : GP06-26952
Received Date : October 20, 2006
Test Performing Date : October 23, 2006
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.

Jeff Jang / Chemical Lab Mgr

Pluto Kim
Patrick An
Monet Jeong
Jinhee Song
/Testing Person

The above certificate is the accredited test items by Korea Laboratory Accreditation Scheme (KOLAS), which signed the ILAC-MRA.

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SGS

Test Report No. F690501/LF-CTSGP06-26952 **Date:** October 27, 2006 **Page 2 of 2**

Sample No. : GP06-26952.001
Sample Description : PCC11837HV
Item No./Part No. : N/A
Comments : Material is silver paste.

Heavy Metals

Test Item	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3050B(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3050B(1996), US EPA 6010B(1996), ICP	5	N.D.
Mercury (Hg)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3060A(1996), US EPA 7196A(1992), UV	1	N.D.

Picture of Sample as Received:



*** End ***

NOTE: (1) N.D. = Not detected (<MDL)
(2) ppm = mg/kg
(3) MDL = Method Detection Limit
(4) Estimated expanded uncertainty U with a coverage factor k =2, corresponding to a level of confidence of about 95%

The above certificate is the accredited test items by Korea Laboratory Accreditation Scheme (KOLAS), which signed the ILAC-MRA.

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3) Marking Ink

Parts Name	Black Ink
Tester Organization	SGS Testing KOREA co. Ltd.
Measurement Tester	Please see the 'method' in the test report
Measurement Data	Please see the report under the table

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To: IMAJE KOREA CO., LTD
 %1302, Daeyung Techno Town 7th
 Kasan-dong
 Keumcheon-ku
 SEOUL
 Korea

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

Commodity : ink-8135E black ink

SGS File No. : GP06-27074

Received Date : October 20, 2006

Test Performing Date : October 23, 2006

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)

Pluto Kim
 Monet Jeong
 Juffy Oh
 Jerry Jung
 /Testing Person

SGS Testing Korea Co. Ltd.
Jeff Jang
 Jeff Jang / Chemical Lab Mgr

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Sample No. : GP06-27074.001

Sample Description : ink-8135E black ink

Style/Item No. : N/A

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3050a(1996), US EPA 8210B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3050a(1996), US EPA 8210B(1996), ICP	5	N.D.
Mercury (Hg)	mg/kg	US EPA 3052(1996), US EPA 8210B(1996), ICP	2	N.D.
Hexavalent Chromium (Cr VI)	mg/kg	US EPA 3060a(1996), US EPA 7196A(1992), UV	1	N.D.

Flame Retardants: PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromodiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Monobromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromodiphenyl ether	mg/kg	US EPA 3540C, GC/MS	5	N.D.

NOTE: (1) N.D. = Not detected (<MDL)
 (2) ppm = mg/kg
 (3) MDL = Method Detection Limit
 (4) - = No regulation
 (5) ** = Qualitative analysis (No Unit)
 (6) Negative = Undetectable / Positive = Detectable

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Picture of Sample as Received:



*** End ***

NOTE: (1) N.D. = Not detected (<MDL)
 (2) ppm = mg/kg
 (3) MDL = Method Detection Limit
 (4) - = No regulation
 (5) ** = Qualitative analysis (No Unit)
 (6) Negative = Undetectable / Positive = Detectable

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