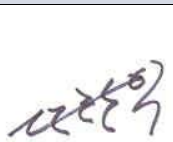
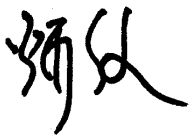
MSL Level 1

승 인 원

제 품 명	칩 안테나		
사 용 자	이랜텍		
적 용 모 델	LN 4500		
사용자 CODE			
공급자	주식회사 파트론		
공급자 CODE	ACS2450ICALN		
이랜텍	작성자	검토자	승인자
(주)파트론	작성자	품질합의	승인자
			
	개발 2P	품질보증파트	연구소
	전찬익	이광규	임병준
	02/13	02/13	02/13

2007 . 02. 13

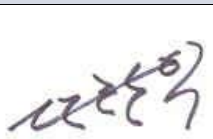
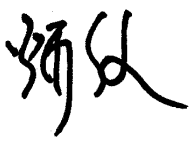
경기도 화성시 반월동 33번지 나동 455-300
Tel : 031-201-7870~6
Fax : 031-201-7800
www.partron.co.kr

MSL Level 1

SPECIFICATION

MODEL : ACS2450ICALN

DIELECTRIC CHIP ANTENNA

작성자	검토자	승인자
		
개발 2P	품질보증파트	연구소
전찬익	이광규	임병준
02/13	02/13	02/13

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- 목 차 -

1. 이력관리

Revision No	Originator	Description of changes	Date of changes
Ver 0.0	정찬익	승인원 제정	2007.02.13

2. 전기적 특성

2.1 단품 Spec

ITEM	SPEC
Frequency Range [MHz]	2400 ~ 2485
SWR [Max]	3:1
Bandwidth [MHz]	85
Gain (Peak / Avg) [dBi]	1.2 / -2.1

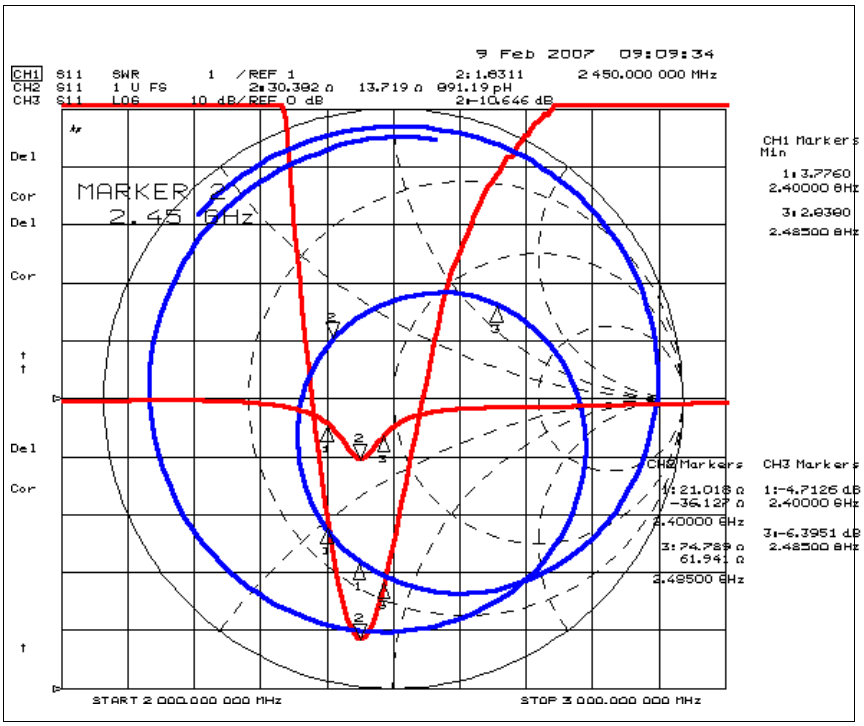
2.2 Set 실장 측정

ITEM				SPEC
Frequency Range [MHz]				2400 ~ 2485
VSWR [Max]				3:1
Bandwidth [MHz]				85
Polarization				Linear
Gain[dBi]	Total Gain (Peak / Avg) [dBi]			4.2 / -6.2
	Azimuth	Theta	Peak	-3.46
			Average	-6.89
		Phi	Peak	-1.50
			Average	-7.57
	Elevation 1	Theta	Peak	-2.04
			Average	-6.38
		Phi	Peak	-3.87
			Average	-10.30
	Elevation 2	Theta	Peak	-9.02
			Average	-16.94
		Phi	Peak	4.20
			Average	-1.40

2.3 Test Fixture 측정

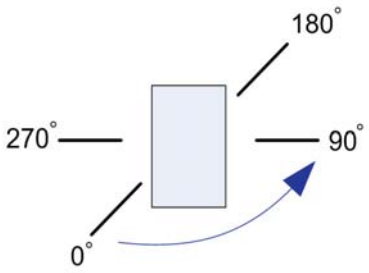
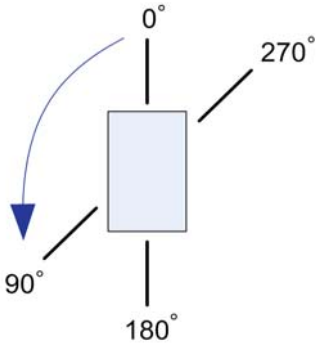
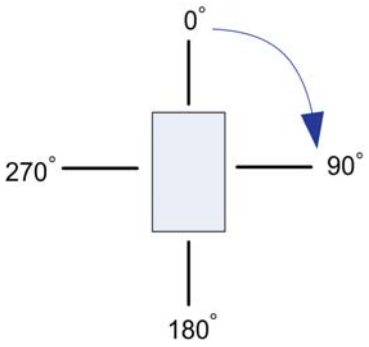
ITEM	SPEC CTQ
Frequency Range [MHz]	
SWR [Max]	3 : 1
Bandwidth [MHz]	80

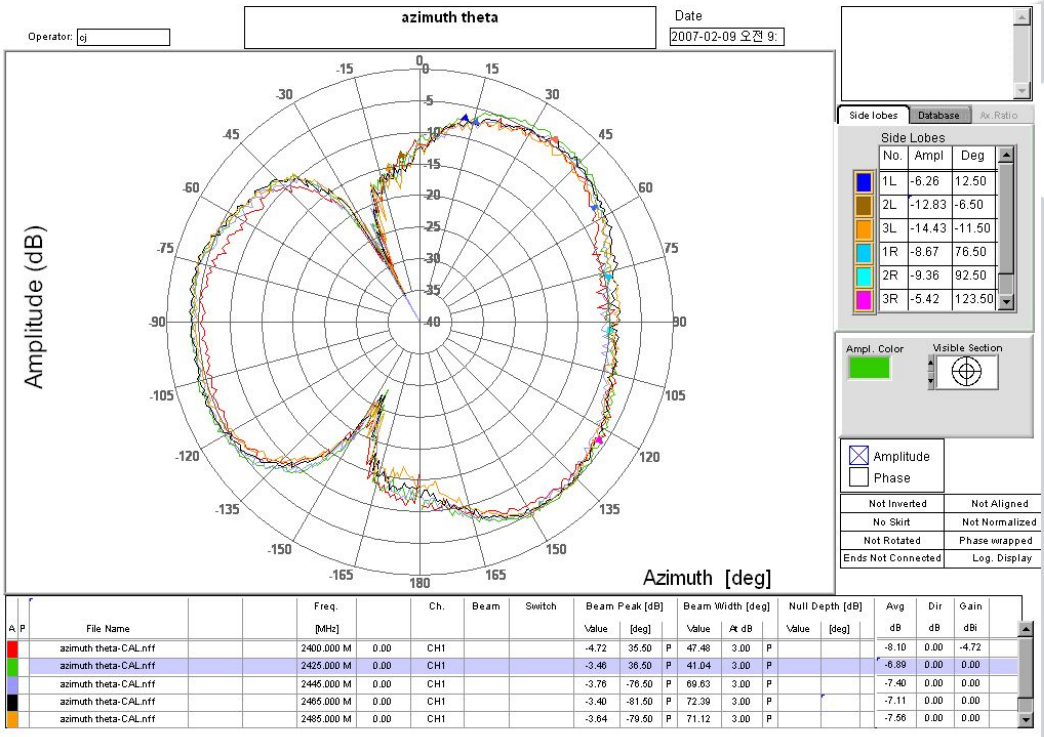
2.3 Set 실장 측정 Graph



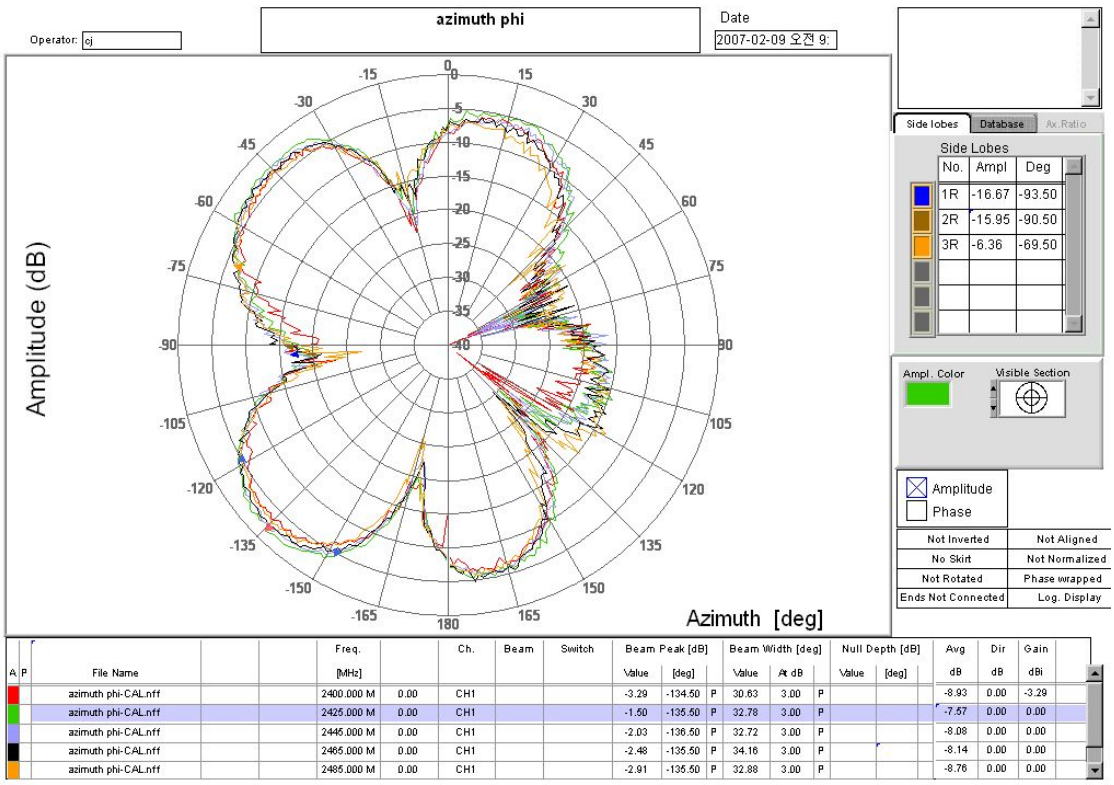
2.4 Test Fixture 측정 Graph CTQ

2.5 방사패턴

Azimuth Plane	Elevation 1 Plane	Elevation2 Plane
		
Theta	Vertical field of measured plane	
Phi	Horizontal field of measured plane	

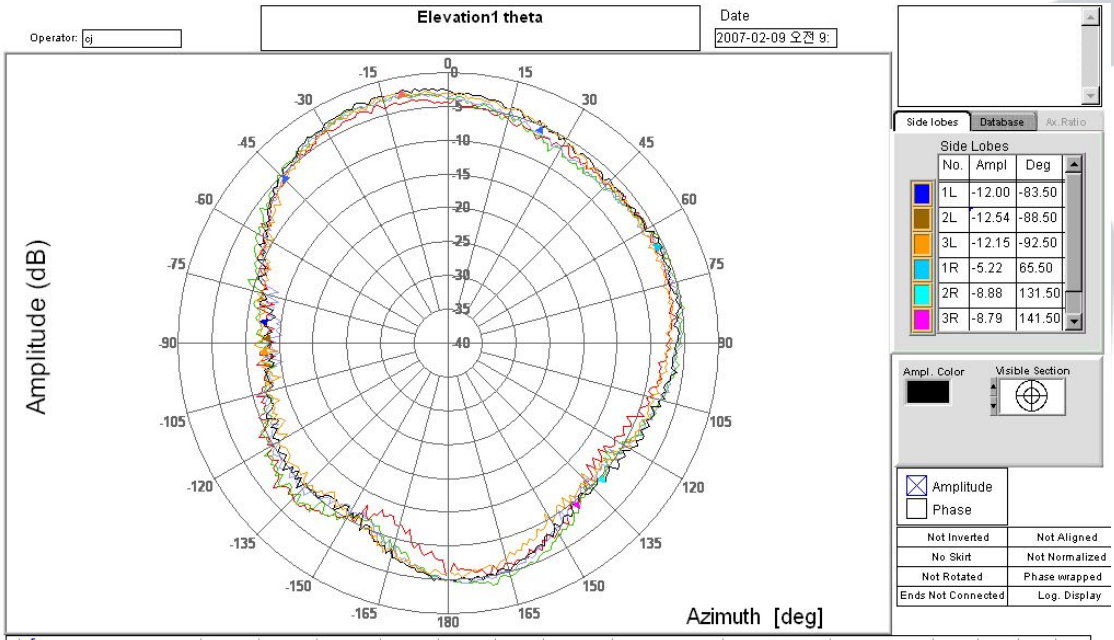
Azimuth Theta


Azimuth Phi



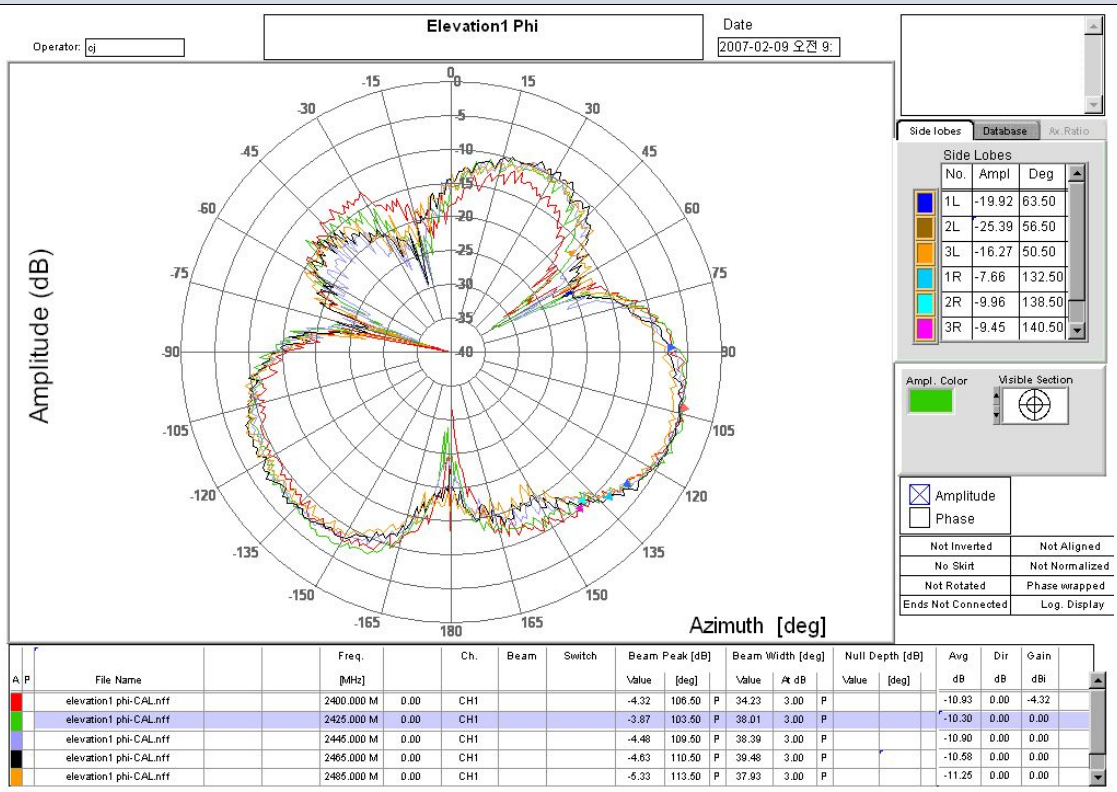
A	P	File Name	Freq. [MHz]		Ch.	Beam	Switch	Beam Peak [dB] Value	[deg]		Beam Width [deg] Value	At dB		Null Depth [dB] Value	[deg]	Avg dB	Dir dB	Gain dBi
		azimuth phi-CAL.nff	2400.000 M	0.00	CH1			-3.29	-134.50	P	30.63	3.00	P			-8.93	0.00	-3.29
		azimuth phi-CAL.nff	2425.000 M	0.00	CH1			-1.50	-135.50	P	32.78	3.00	P			-7.57	0.00	0.00
		azimuth phi-CAL.nff	2445.000 M	0.00	CH1			-2.03	-136.50	P	32.72	3.00	P			-8.08	0.00	0.00
		azimuth phi-CAL.nff	2465.000 M	0.00	CH1			-2.48	-135.50	P	34.16	3.00	P			-8.14	0.00	0.00
		azimuth phi-CAL.nff	2485.000 M	0.00	CH1			-2.91	-135.50	P	32.88	3.00	P			-8.76	0.00	0.00

Elevation1 Theta



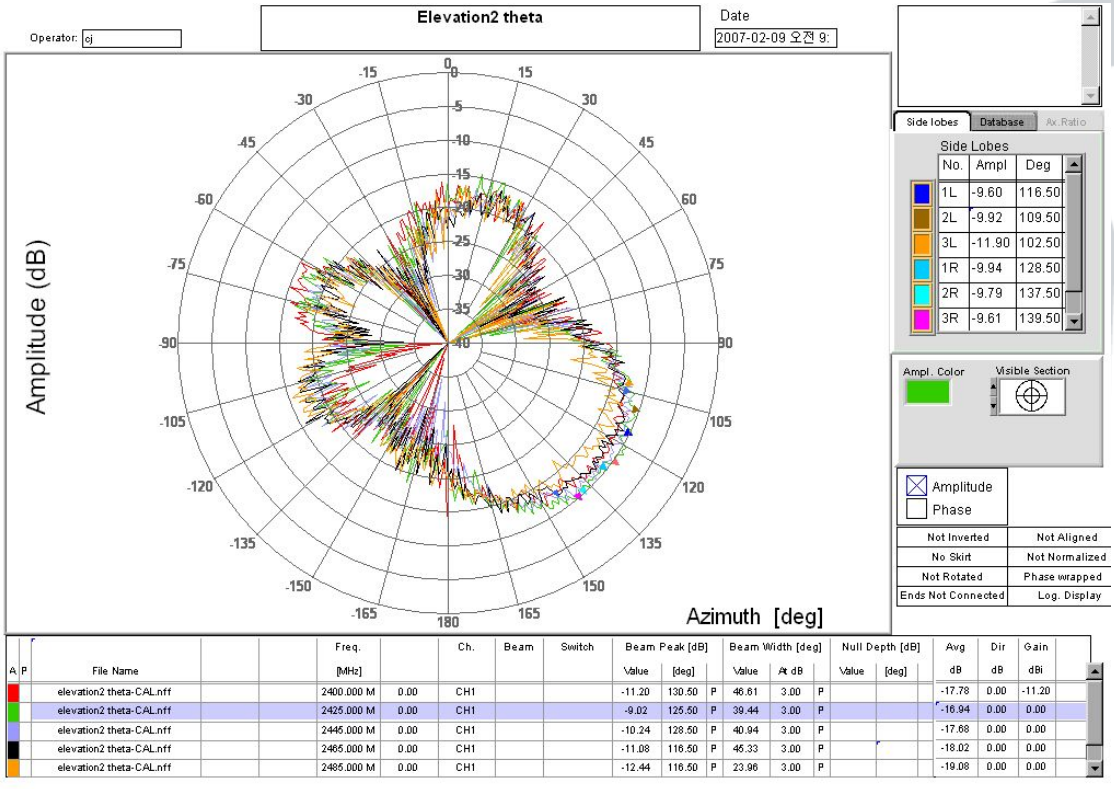
A	P	File Name	Freq. [MHz]		Ch.	Beam	Switch	Beam Peak [dB] Value	[deg]		Beam Width [deg] Value	At dB		Null Depth [dB] Value	[deg]	Avg dB	Dir dB	Gain dBi
		elevation1 theta-CAL.nff	2400.000 M	0.00	CH1			-3.38	-17.50	P	66.43	3.00	P			-7.28	0.00	-3.38
		elevation1 theta-CAL.nff	2425.000 M	0.00	CH1			-2.64	-12.50	P	59.91	3.00	P			-6.50	0.00	0.00
		elevation1 theta-CAL.nff	2445.000 M	0.00	CH1			-2.53	-10.50	P	60.65	3.00	P			-6.82	0.00	0.00
		elevation1 theta-CAL.nff	2465.000 M	0.00	CH1			-2.04	-10.50	P	68.17	3.00	P			-6.38	0.00	0.00
		elevation1 theta-CAL.nff	2485.000 M	0.00	CH1			-2.09	-16.50	P	63.98	3.00	P			-6.98	0.00	0.00

Elevation1 Phi



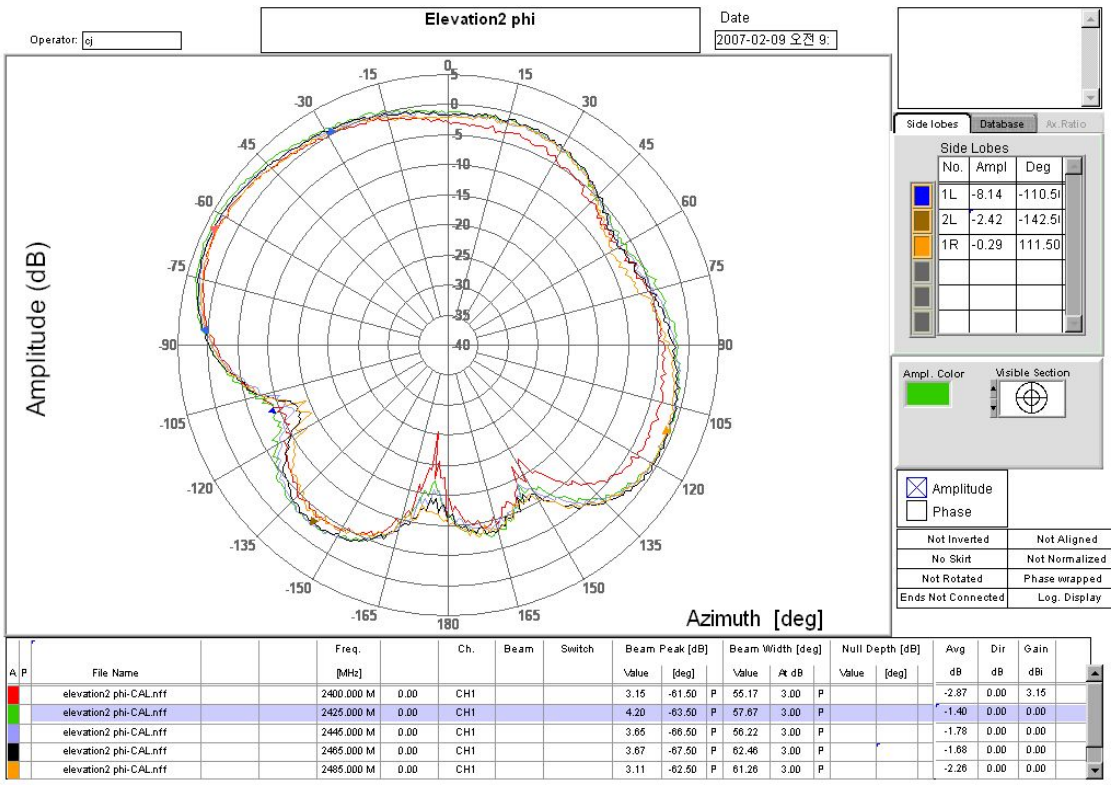
A	P	File Name	Freq. [MHz]		Ch.	Beam	Switch	Beam Peak [dB] Value	[deg]		Beam Width [deg] Value	At dB		Null Depth [dB] Value	[deg]	Avg dB	Dir dB	Gain dBi
		elevation1 phi-CAL.nff	2400.000 M	0.00	CH1			-4.32	106.50	P	34.23	3.00	P			-10.93	0.00	-4.32
		elevation1 phi-CAL.nff	2425.000 M	0.00	CH1			-3.87	103.50	P	38.01	3.00	P			-10.30	0.00	0.00
		elevation1 phi-CAL.nff	2445.000 M	0.00	CH1			-4.48	109.50	P	38.39	3.00	P			-10.90	0.00	0.00
		elevation1 phi-CAL.nff	2465.000 M	0.00	CH1			-4.63	110.50	P	39.48	3.00	P			-10.58	0.00	0.00
		elevation1 phi-CAL.nff	2485.000 M	0.00	CH1			-5.33	113.50	P	37.93	3.00	P			-11.25	0.00	0.00

Elevation2 Theta



A	P	File Name	Freq. [MHz]		Ch.	Beam	Switch	Beam Peak [dB] Value	[deg]		Beam Width [deg] Value	At dB		Null Depth [dB] Value	[deg]	Avg dB	Dir dB	Gain dBi
		elevation2 theta-CAL.nff	2400.000 M	0.00	CH1			-11.20	130.50	P	46.61	3.00	P			-17.78	0.00	-11.20
		elevation2 theta-CAL.nff	2425.000 M	0.00	CH1			-9.02	125.50	P	39.44	3.00	P			-16.94	0.00	0.00
		elevation2 theta-CAL.nff	2445.000 M	0.00	CH1			-10.24	128.50	P	40.94	3.00	P			-17.68	0.00	0.00
		elevation2 theta-CAL.nff	2465.000 M	0.00	CH1			-11.08	116.50	P	45.33	3.00	P			-18.02	0.00	0.00
		elevation2 theta-CAL.nff	2485.000 M	0.00	CH1			-12.44	116.50	P	23.96	3.00	P			-19.08	0.00	0.00

Elevation2 Phi



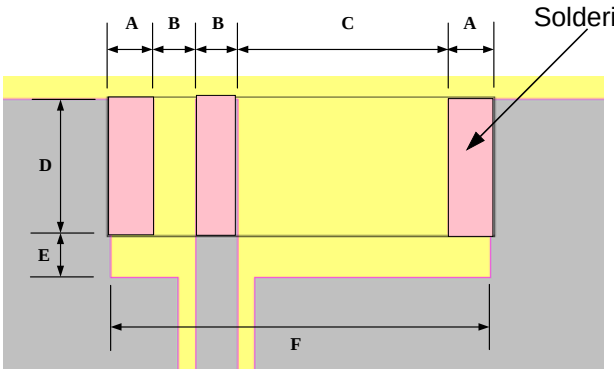
3. 기구적 특성

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

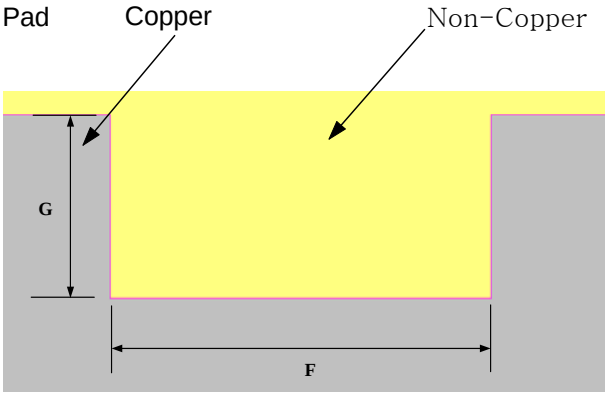
3.1 구조와 재질

Material	Dielectric Block (MMS-08)	3D Structure
	Ag Paste (Metech)	
Size [mm]	W = 3.0±0.1	
	L = 9.0±0.1	
	T = 1.2±0.1	
Temperature [℃]	- 40 ~ +80	
Humidity [%]	At the normal temperature, RH 100	

3.2 PCB Layout & Soldering Pad Dimension



Top Layout



Bottom Pattern

Parameter	A	B	C	D	E	F	G
Value[mm]	**1.1**	**1.0**	**5.0**	**3.2**	**1.0**	**9.2**	**4.2**

Unit ; mm

Unless specified tolerances are ±0.1

3.3 안테나 패턴 도면

Antenna Pattern View
Unit ; mm Unless specified tolerances are ±0.1

3.4 LOT 번호 표 기 법

7	2	2
①	②	③

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

3.5 Marking 사양

Marking View

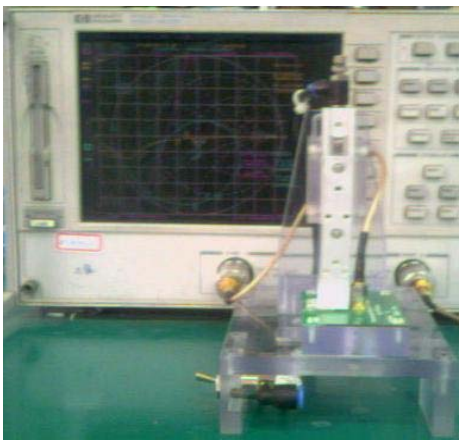
◀	L	N	7	2	1
①	②		③	④	⑤

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 ····

4. 시험 방법

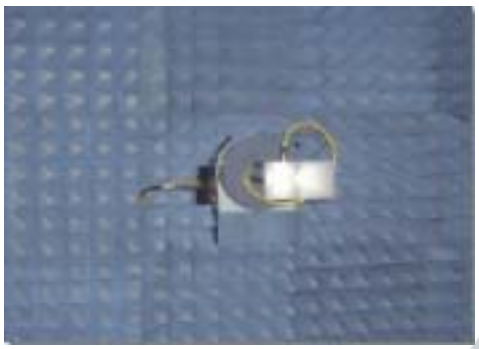
4.1 SWR/Returnloss

Network Analyzer를 이용하여 SWR/Returnloss 를 측정하며 표본 SPL을 선별 Test Fixture 를 이용 양품과 불량품을 선별한다.

Set Condition	Test Fixture Condition
	

4.2 Gain

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

Anechoic Chamber	
	
	

5. 초기 검사 성적서

검사항목	특성 [MHz] CTQ		치수 [mm]		
규격	VSWR 3.0 Max		W=3.0±0.1	L=9.0±0.1	T=1.2±0.1
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
X					
σ					
Cpk					
판정	Ok	Ok	Ok	Ok	Ok

6. 신뢰성 보증조건

6.1 환경 시험

항목	조 건	비고
고온방치	+85℃±3℃, 120hr±2hr	*시험 후 상온(25℃±5℃)에 서 1시간 방치 후 측정한다. *테이블1의 전기적 특성을 만족하여야한다
저온방치	-40℃±3℃ , 120hr±2hr	
내습시험	+60±3℃, RH90~95% ,120hr±2hr	

6.2 열충격 , REFLOW시험

항목	조 건	비고
열충격	-40℃±3℃/30min ↔ +85℃±3℃/30min cycle : 15 cycle 온도변환시간 : 5min 미만	6-1와 동일
Reflow	Pre Heating 200±5℃ , 30~60 sec Peak Heating 260℃±5℃ , 30sec Max	

6.3 기계적 시험

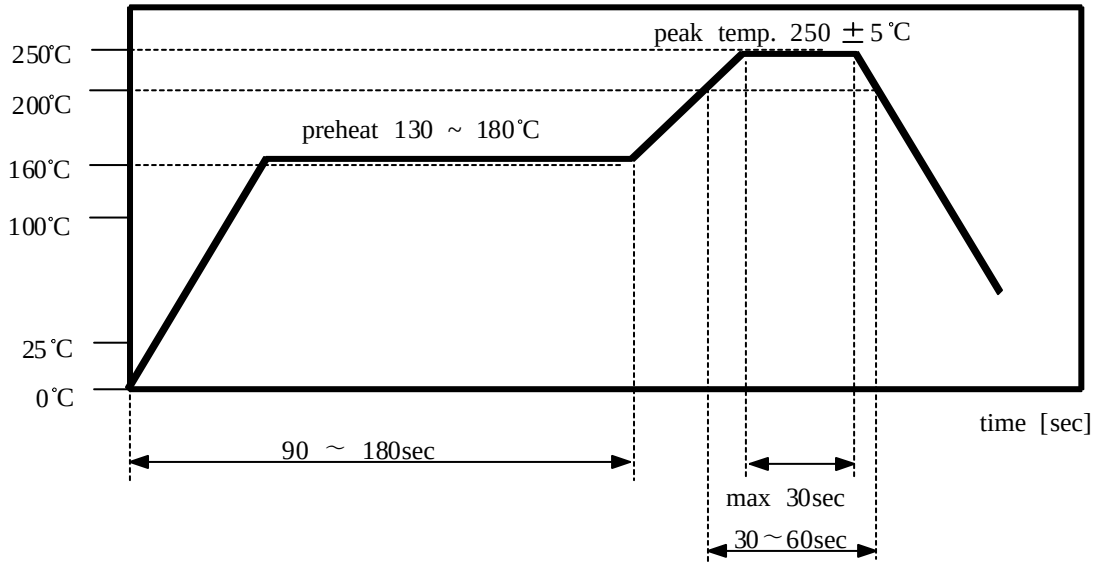
항목	조 건	비고
진동시험	주파수: 10~500Hz에서 10 ×9.8㎨(G) Sweep time 15min ,X.Y.Z each 5 times	*시험 후 테이블1의 전기적 특성을 만족하여야한다
낙하시험	높이 152㎝에서 각 면 5회 낙하(지그낙하)	

6.4 신뢰성 시험 성적서

※ 별첨

7. 납땜 조건

7.1 표준 열경화(Reflow) 조건



7.2 수동 납땜 (납땜 인두기를 사용할 경우)

예 열 : 120℃ / 시 간 : 60 ~ 300 sec.

인두온도 : 340℃±5℃ / 시 간 : 각 단 최대 5 sec.

8. 주의 사항

8.1 온도 조건

	Range of Temperature	unit
Application	-40 ~ +85	℃
Keeping	-40 ~ +85	℃

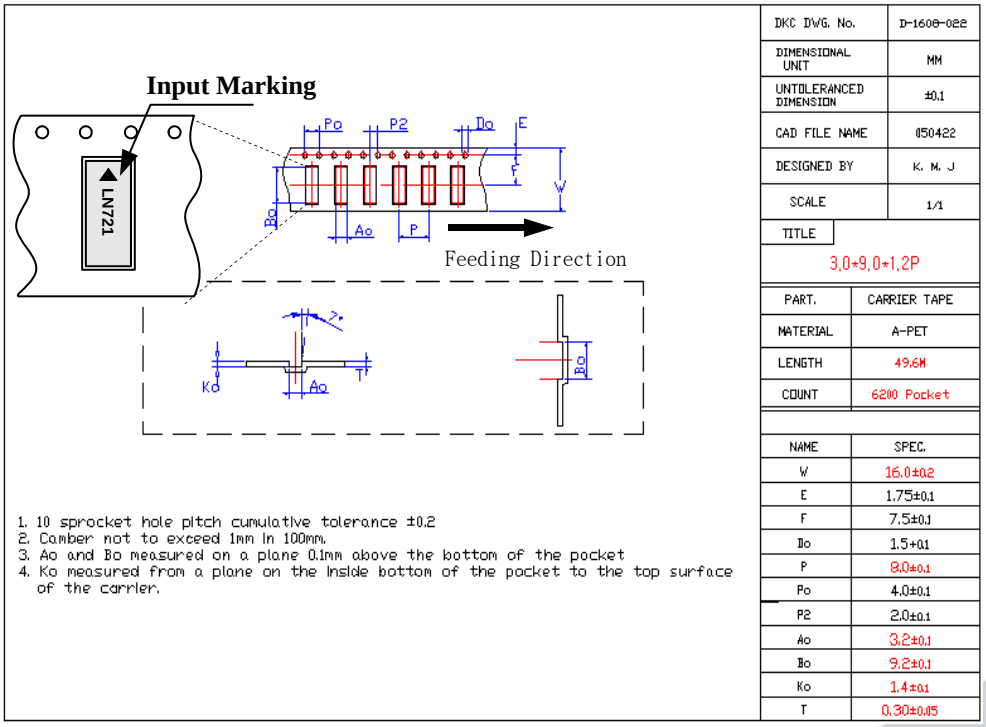
8.2 MSL LEVEL 1 (JEDEC J-STD-020C)

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

9. 포장 사양

9.1 Carrier/Reel 사양

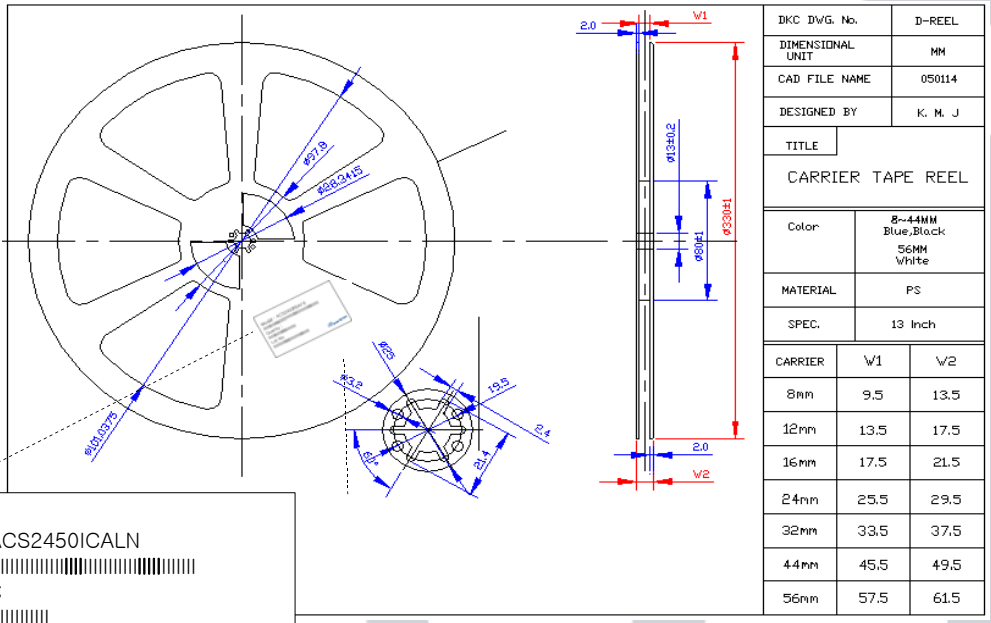
재질	표면저항	포장방식
대전 방지용 A-PET	Typical $10^8\Omega$	열 압착식



DKC DWG. No.	D-1608-022
DIMENSIONAL UNIT	MM
UNTOLERANCED DIMENSION	±0.1
CAD FILE NAME	050422
DESIGNED BY	K. M. J
SCALE	1/1
TITLE	3.0*9.0*1.2P

PART.	CARRIER TAPE
MATERIAL	A-PET
LENGTH	49.6M
COUNT	6200 Pocket

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	3.2±0.1
Bo	9.2±0.1
Ko	1.4±0.1
T	0.30±0.05



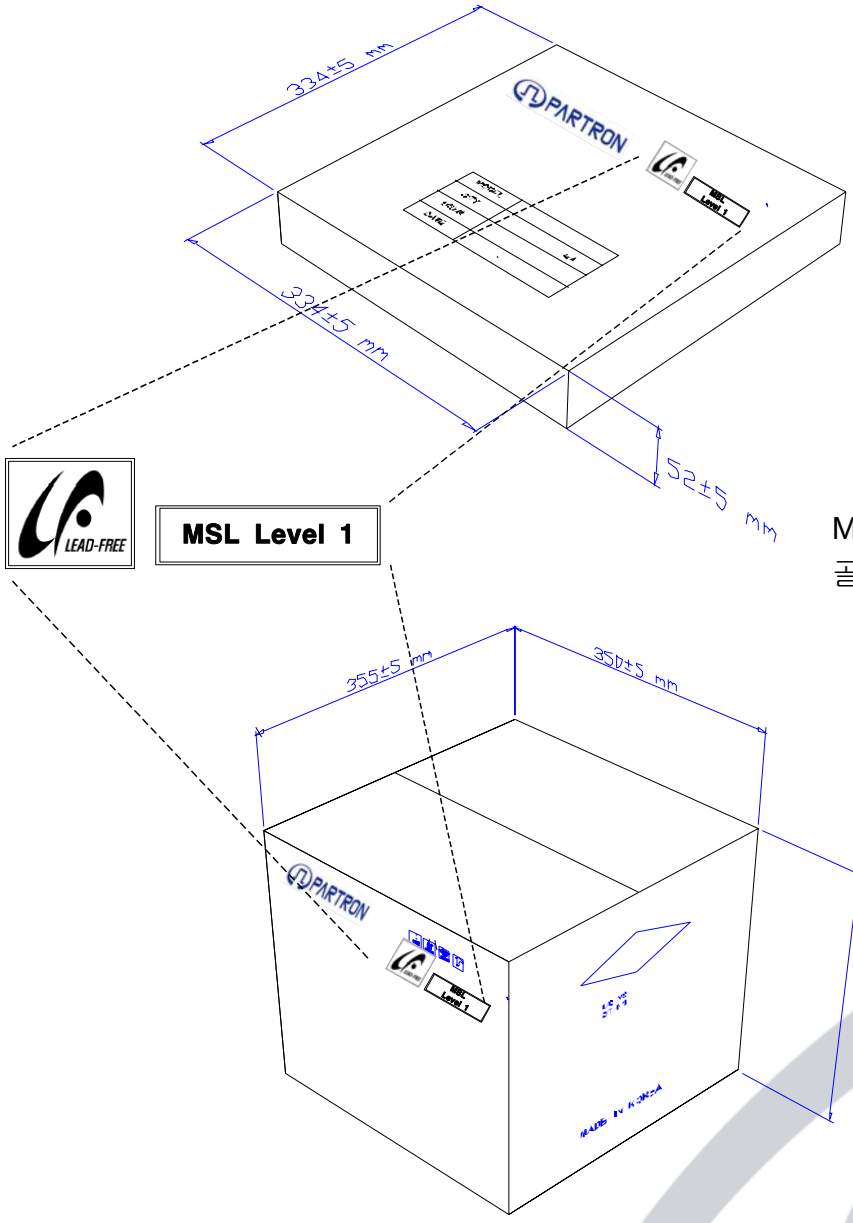
DKC DWG. No.	D-REEL
DIMENSIONAL UNIT	MM
CAD FILE NAME	050114
DESIGNED BY	K. M. J
TITLE	CARRIER TAPE REEL

Color	8~44MM Blue,Black 56MM White
MATERIAL	PS
SPEC.	13 Inch

CARRIER	W1	W2
8mm	9.5	13.5
12mm	13.5	17.5
16mm	17.5	21.5
24mm	25.5	29.5
32mm	33.5	37.5
44mm	45.5	49.5
56mm	57.5	61.5

Model : ACS2450ICALN
Quantity ;
Lot No
PARTRON

9.2 Box 사양



Material : SK/S/K-B
골판지

10. 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 윤활제	○		분말	Mixer					혼합	파우더:윤활제	저울	혼합시	-	폐기
		○	성형	프레스	양압 금형상태	작업지도서 참조	매LOT 1회/일	parameter C/SHEET	치수 무게 밀도 외관	작업지도서 참조	Micrometer 저울 Calculated Visual	5/100개검사 10개/LOT	LOT CARD	폐기
		○	소성	소성로	SETTER 외관 온도 PROFILE	작업지도서 참조	전수 2회/일 1회/월	C/sheet						
		◇	소체						폭 길이 모양	검사지도서 참조	Micrometer Calipers 목시	20개/LOT 20개/LOT 전수	C/sheet	폐기
AG PASTE		○	SIDE1 PAD 인쇄	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			
	Revised	05.04.03					

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	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	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 (초중종물 관리) CTQ공정	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	04.04.06.		PRCP-C001			
	Revised	05.04.03					

투입자재	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	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 역삽 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

11. 유해물질 성적서

1) Ceramic Powder

SGS

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 Yeh, M.R. / Operation Manager
Signed for and on behalf of
SGS TAIWAN LTD.

SGS

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 No.1
PBBs (Polybrominated biphenyls)	---	---	---	---
Monobromobiphenyl	%	With reference to USEPA3540C. Analysis was performed by HPLC/DAD, LC/MS or GC/MS. (prohibited by 2002/95/EC (RoHS), 83/264/EEC, and 76/769/EEC)	0.0005	N.D.
Dibromobiphenyl	%		0.0005	N.D.
Tribromobiphenyl	%		0.0005	N.D.
Tetrabromobiphenyl	%		0.0005	N.D.
Pentabromobiphenyl	%		0.0005	N.D.
Hexabromobiphenyl	%		0.0005	N.D.
Heptabromobiphenyl	%		0.0005	N.D.
Octabromobiphenyl	%		0.0005	N.D.
Nonabromobiphenyl	%		0.0005	N.D.
Decabromobiphenyl	%		0.0005	N.D.
Total PBBs (Polybrominated biphenyls)/Sum of above	%		-	N.D.
PBBEs(PBDEs) (Polybrominated biphenyl ethers)	---	---	---	---
Monobromobiphenyl ether	%	With reference to USEPA3540C. Analysis was performed by HPLC/DAD, LC/MS or GC/MS. (prohibited by 2002/95/EC (RoHS), 83/264/EEC, and 76/769/EEC)	0.0005	N.D.
Dibromobiphenyl ether	%		0.0005	N.D.
Tribromobiphenyl ether	%		0.0005	N.D.
Tetrabromobiphenyl ether	%		0.0005	N.D.
Pentabromobiphenyl ether	%		0.0005	N.D.
Hexabromobiphenyl ether	%		0.0005	N.D.
Heptabromobiphenyl ether	%		0.0005	N.D.
Octabromobiphenyl ether	%		0.0005	N.D.
Nonabromobiphenyl ether	%		0.0005	N.D.
Decabromobiphenyl ether	%		0.0005	N.D.
Total PBBEs(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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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 : 3 of 4

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

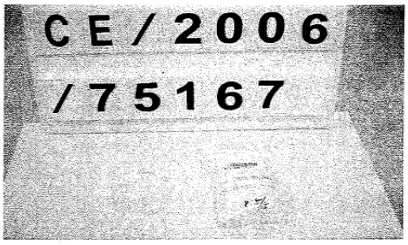
NOTE: (1) N.D. = Not Detected (<MDL)
(2) ppm = mg/kg
(3) MDL = Method Detection Limit
(4) Decabromobiphenyl ether (DecaBDE) in polymeric applications is exempted by Commission Decision of 13 Oct 2005 amending Directive 2002/95/EC notified under document 2005/717/EC.
(5) PBBEs=PBDEs=Polybrominated Diphenyl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

SGS

Test Report

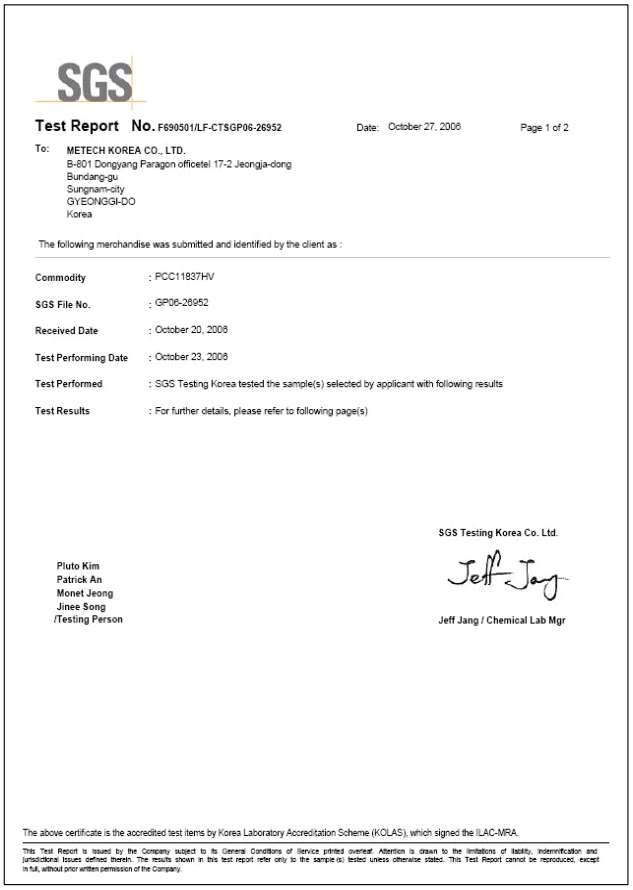
FUJI TITANIUM IND. CO., LTD.
12-8, SENGEN-CHO, HIRATSUKA-CITY, KANAKAWA-PREF. JAPAN. (T) 81-463-32-0210

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



** End of Report **

2) Ag paste



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 :

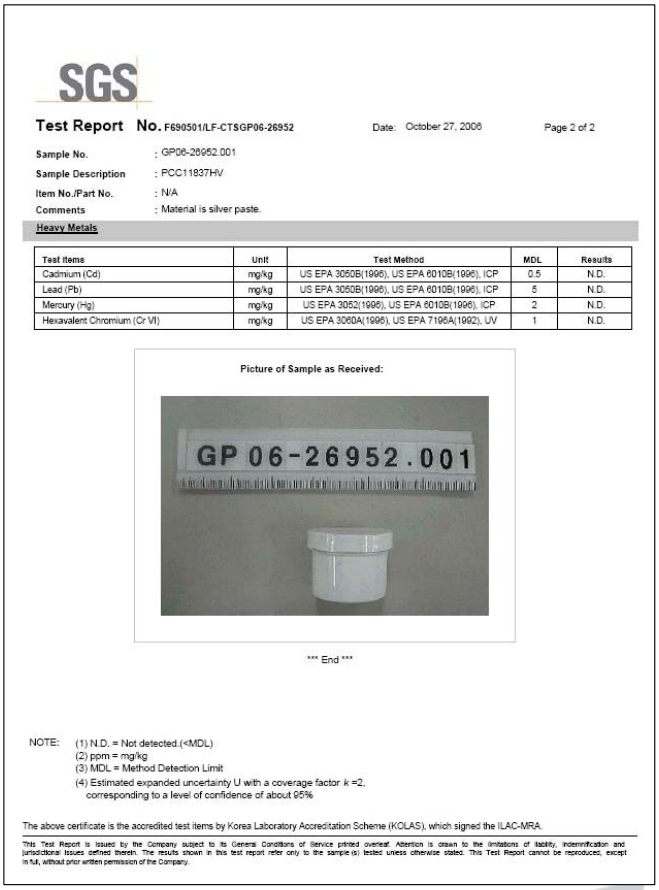
Commodity	: PCC11837HV
SGS File No.	: GP06-26952
Received Date	: October 20, 2006
Test Performing Date	: October 23, 2006
Test Performed	: SGS Testing Korea tested the sample(s) selected by applicant with following results
Test Results	: For further details, please refer to following page(s)

SGS Testing Korea Co. Ltd.

Pluto Kim
Patrick An
Monet Jeong
Jinee Song
/Testing Person

Jeff Jang / Chemical Lab Mgr

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



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 Items	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.

3) Marking ink

SGS

Test Report No. F690501/LF-CTSGP06-27074 Date: October 27, 2006 Page 1 of 3

To: IMAJE KOREA CO., LTD
1L1502, Daeryang Techno Town 7th
Kasan-dong
Keumcheon-ku
SEOUL
Korea

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

Commodity	: HV-E126E 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)

SGS Testing Korea Co. Ltd.

Pluto Kim
Monet Jeong
Judy Oh
Jenny Jung
/Testing Person

Jeff Jang / Chemical Lab Mgr

SGS

Test Report No. F690501/LF-CTSGP06-27074 Date: October 27, 2006 Page 2 of 3

Sample No.	: GP06-27074.001
Sample Description	: HV-E126E black ink.
Style/Item No.	: N/A

Heavy Metals

Test Items	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.

Flame Retardants-PBBs/PBDEs

Test Items	Unit	Test Method	MDL	Results
Monobromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Dibromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tribromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Tetrabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Pentabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Hexabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Heptabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Octabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Nonabromobiphenyl	mg/kg	US EPA 3540C, GC/MS	5	N.D.
Decabromobiphenyl	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

SGS

Test Report No. F690501/LF-CTSGP06-27074 Date: October 27, 2006 Page 3 of 3

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