





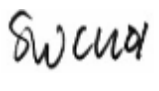

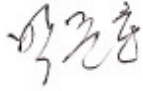
승 인 원

STM-8100 BT

REV. A

승 인 원

품 명	Bluetooth Chip Antenna
모델명 / 대역	STM-8100
품 번	M530301
고 객 명	Woongjin ST
공 급 처	에더트로닉스

회 로		기 구		품 질	
담 당	팀 장	담 당	팀 장	담 당	팀 장
CS YOON					
윤천수	김기수	설철훈	최승웅	왕명호	박준호



MSL Level 1

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1. 이력관리

REV NO.	개정일자	PAGE	개정사항		개정사유
			개정 전	개정 후	

2. 전기적 특성

2.1. SET 정재파비 (VSWR)

안테나는 전기적 사양에 명시되어 있는 정재파비 요구사항을 만족 해야 한다

주파수 대역 (Frequency Range)	2,400 MHz	2,450 MHz	2,480 MHz
단말기 정재파비 (V.S.W.R)	5.37:1 이하	1.58:1 이하	4.2:1 이하



그림 1: Testing with network analyzer

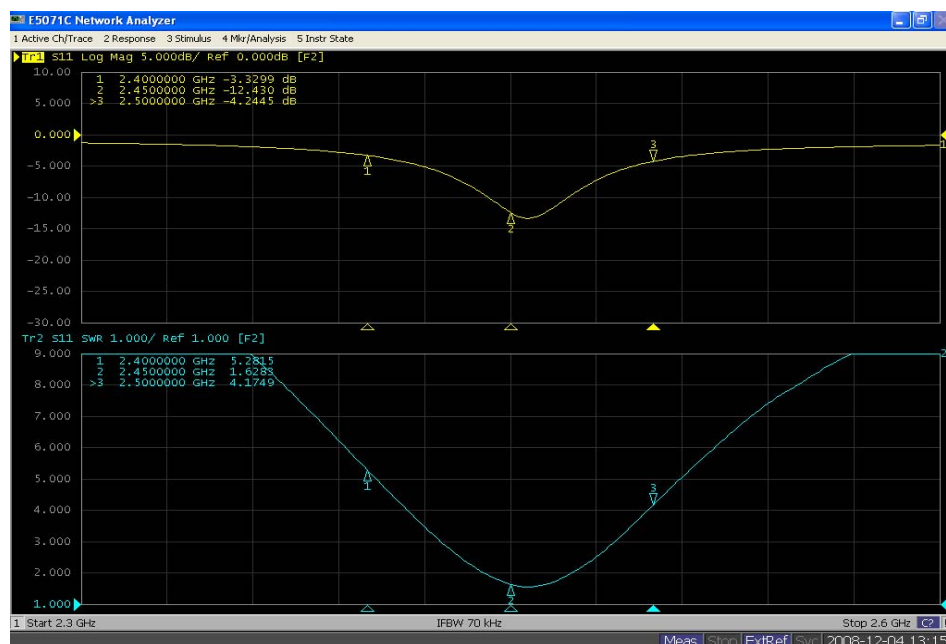


그림 2 :Return Loss and VSWR

2.2 SET 복사 패턴 (Radiation Pattern)

안테나의 복사 패턴은 수직면에서 무 지향성 패턴을 가져야 한다.

2.3 안테나 이득

안테나의 Gain 과 효율성을 실험하기 위해 셋트에 조립되어야 하며, 완전히 조립되고 작동하는 STM-8100 모뎀에서 테스트 되어져야 한다. 안테나는 무 반향실의 free space 에서 H,E1,E2 플랜에 의해 테스트가 실시되어야 한다. 안테나 지향성도는 전달/수용 밴드(transmit and receive bands) 중앙에서 측정되어야 한다.

주파수 대역 (Frequency Range)		2,400 MHz	2,450 MHz	2,500 MHz
단말기 정재파비 (V.S.W.R)		5.37:1 이하	1.58:1 이하	4.2:1 이하
검사 지그 정재파비 (V.S.W.R)		1,900 MHz	1,960 MHz	2,020 MHz
		5.1:1 이하	2.1:1 이하	4.3:1 이하
최대 이득 (Gain)	H-Plane	-9.40	-6.15	-8.33
	E1-Plane	-8.05	-5.09	-7.75
	E2-Plane	-12.24	-8.63	-10.63
공칭 임피던스		50Ω		
편파		수직		
복사패턴		무지향성		

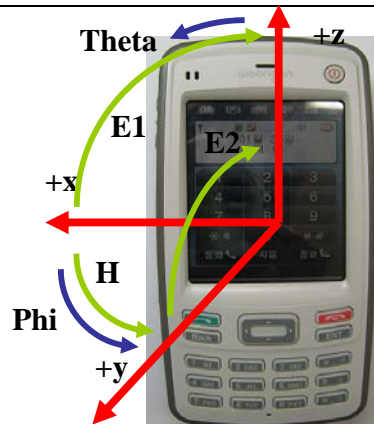
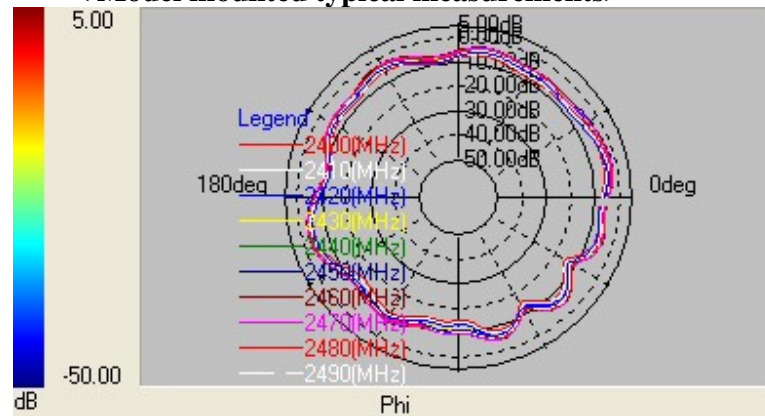


그림 3: Geometry for STM-8100 for radiation pattern

2.4 방사 패턴

2.4.1 Woongjin ST STM-8100 Model Bluetooth band (H-plane)

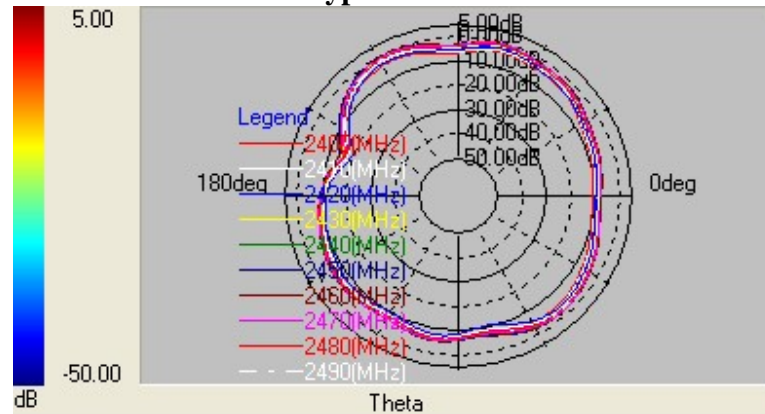
< Model mounted typical measurements >



Layer	Max value	Position	Min value	Position	BeamWidth	Average
2400(MHz)	-5.23 dB	14.07 deg	-16.20 dB	272.78 deg	----	-9.40 dB
2410(MHz)	-4.49 dB	14.07 deg	-15.21 dB	272.78 deg	----	-8.65 dB
2420(MHz)	-3.65 dB	14.07 deg	-14.24 dB	300.96 deg	----	-7.78 dB
2430(MHz)	-2.98 dB	14.07 deg	-13.53 dB	300.96 deg	----	-7.21 dB
2440(MHz)	-2.22 dB	14.05 deg	-12.91 dB	300.93 deg	----	-6.57 dB
2450(MHz)	-1.86 dB	14.05 deg	-12.79 dB	300.93 deg	----	-6.15 dB
2460(MHz)	-1.85 dB	11.25 deg	-12.53 dB	300.94 deg	----	-6.14 dB
2470(MHz)	-2.12 dB	11.25 deg	-12.56 dB	300.94 deg	----	-6.41 dB
2480(MHz)	-2.90 dB	11.25 deg	-13.29 dB	300.94 deg	----	-7.12 dB
2490(MHz)	-3.52 dB	11.25 deg	-13.63 dB	300.94 deg	----	-7.67 dB
2500(MHz)	-4.12 dB	11.25 deg	-14.04 dB	300.94 deg	----	-8.33 dB

2.4.2 Woongjin ST STM-8100 Model Bluetooth band (E1-plane)

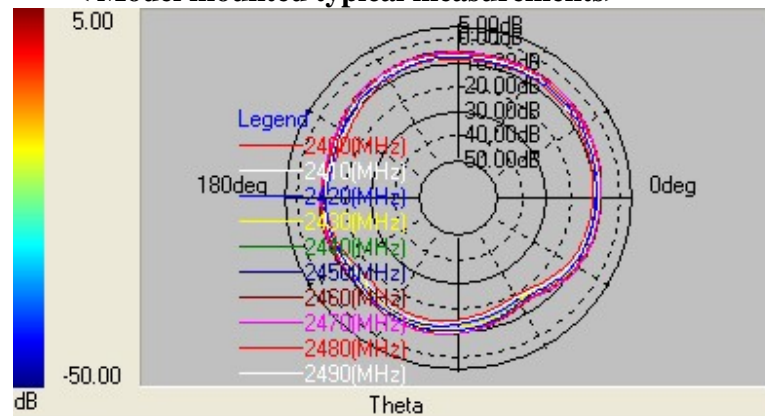
< Model mounted typical measurements >



Layer	Max value	Position	Min value	Position	BeamWidth	Average
2400(MHz)	-4.56 dB	117.14 deg	-17.73 dB	160.01 deg	43.25 deg	-8.05 dB
2410(MHz)	-3.58 dB	120.00 deg	-16.72 dB	160.01 deg	40.56 deg	-7.30 dB
2420(MHz)	-2.52 dB	120.00 deg	-16.00 dB	160.01 deg	40.01 deg	-6.41 dB
2430(MHz)	-1.78 dB	117.14 deg	-15.83 dB	160.01 deg	38.91 deg	-5.86 dB
2440(MHz)	-0.95 dB	117.14 deg	-14.45 dB	162.85 deg	38.71 deg	-5.35 dB
2450(MHz)	-0.77 dB	117.14 deg	-14.63 dB	160.01 deg	38.92 deg	-5.09 dB
2460(MHz)	-0.94 dB	117.14 deg	-14.91 dB	160.01 deg	39.78 deg	-5.07 dB
2470(MHz)	-1.40 dB	71.43 deg	-16.26 dB	160.01 deg	54.57 deg	-5.47 dB
2480(MHz)	-2.07 dB	71.43 deg	-17.00 dB	159.99 deg	54.56 deg	-6.22 dB
2490(MHz)	-2.68 dB	117.14 deg	-18.02 dB	159.99 deg	40.55 deg	-6.94 dB
2500(MHz)	-3.28 dB	71.43 deg	-19.65 dB	159.99 deg	55.68 deg	-7.75 dB

2.4.3 Woongjin ST STM-8100 Model Bluetooth band (E2-plane)

< Model mounted typical measurements >



Layer	Max value	Position	Min value	Position	BeamWidth	Average
2400(MHz)	-8.72 dB	57.14 deg	-19.68 dB	-60.00 deg	148.59 deg	-12.24 dB
2410(MHz)	-7.95 dB	60.00 deg	-19.01 dB	-60.00 deg	149.90 deg	-11.34 dB
2420(MHz)	-6.86 dB	54.29 deg	-17.49 dB	-57.16 deg	149.92 deg	-10.33 dB
2430(MHz)	-6.20 dB	54.29 deg	-17.49 dB	-57.14 deg	163.71 deg	-9.61 dB
2440(MHz)	-5.73 dB	48.57 deg	-16.39 dB	-57.16 deg	157.87 deg	-8.93 dB
2450(MHz)	-5.48 dB	45.71 deg	-15.52 dB	-57.16 deg	162.85 deg	-8.63 dB
2460(MHz)	-5.45 dB	42.86 deg	-15.15 dB	-57.14 deg	167.38 deg	-8.49 dB
2470(MHz)	-5.86 dB	42.86 deg	-15.47 dB	-57.14 deg	170.37 deg	-8.81 dB
2480(MHz)	-6.63 dB	45.71 deg	-15.77 dB	-57.14 deg	169.37 deg	-9.45 dB
2490(MHz)	-7.32 dB	57.14 deg	-16.40 dB	-57.14 deg	174.45 deg	-9.95 dB
2500(MHz)	-7.89 dB	45.71 deg	-16.56 dB	-54.30 deg	175.85 deg	-10.63 dB



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STM-8100 BT

REV. A

3. 기구적 특성

3.1. 부품의 규격

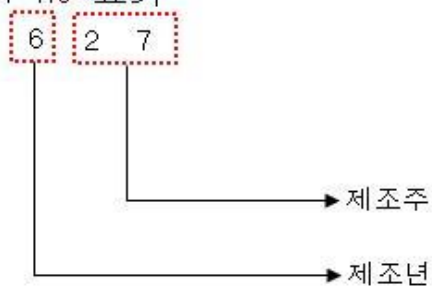
항 목	SPEC.	REMARK
내부전극	Ag	Pb-free
외부전극	Ag/Ni/Au	Pb-free
치 수	5.0(L)x3.0(W)x1.08 (H)	mm
무 게	0.05±0.01	g
동작온도	-35 ~ +85	°C

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	STM-8100 BT	REV. A

3.2. LOT 번호 마킹

LOT-NO 표기 방법

1. LOT-NO 표기



2. LOT NO 표기 설명

1) 제조연도 표기 예

제조연도	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
표 기	6	7	8	9	0	1	2	3	4	5

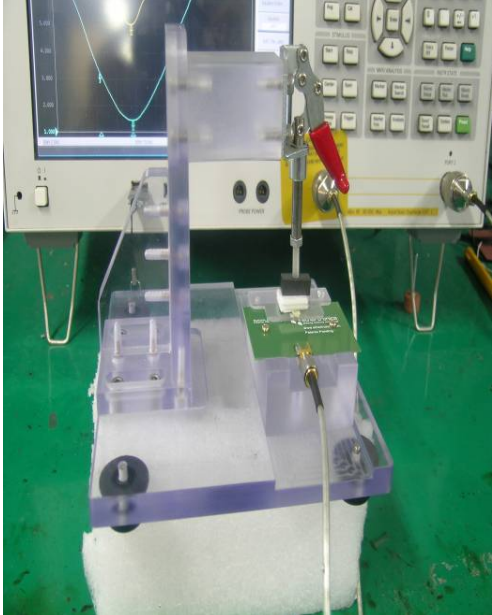
2) 제조주 표기 예

제조주	1	2	3	4	5	6	...	50	51	52	53	54
표 기	1	2	3	4	5	6	...	50	51	52	53	54

4. 시험 방법

4.1 SWR/Return Loss

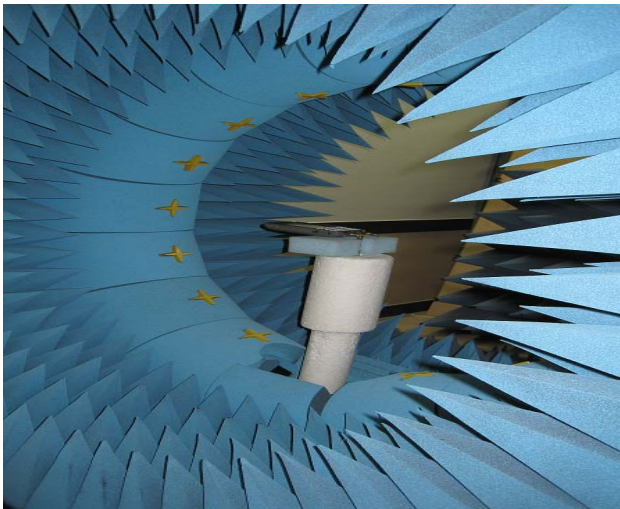
Network Analyzer 를 이용하여 SWR/Return Loss 를 측정하고 표본 Sample 을 선별 후 검사 지그를 사용하여 양품과 불량품을 선별한다.

	Set Condition	JIG Condition
Network Analyzer	Agilent E5071C (ENA)	Agilent E5071C (ENA)
Cable	RF Cable (400mm)	RF Cable (400mm)
Test Condition		

4.2 Gain

당사가 보유한 전자파 무반사실을 이용하여 Antenna Gain 을 측정한다.

Anechoic Chamber for antenna Gain Measurement



5. 특성검사(VSWR) 검사지그 측정 DATA



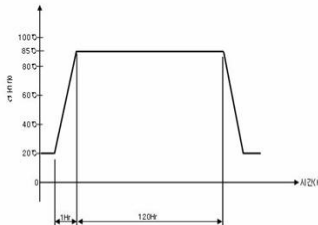
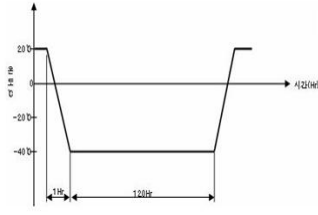
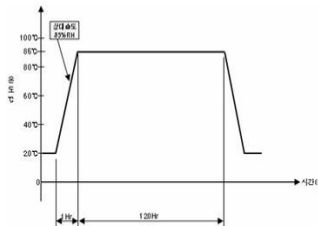
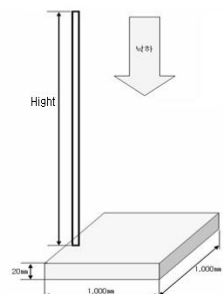
STM-8100 BT Antenna VSWR CPK

2009년 3월 26일




시료NO	검사 지그 V,S,W,R				Remark
	1,900MHz	1,960MHz	2,020MHz		
	5,1:1이하	2,1:1이하	4,3:1이하		
1	4.2	1.6	3.1		
2	4.0	1.5	3.2		
3	4.2	1.6	3.2		
4	4.0	1.5	3.5		
5	3.5	1.6	4.0		
6	4.3	1.6	3.0		
7	4.8	1.8	2.6		
8	4.4	1.6	3.0		
9	4.5	1.7	2.9		
10	4.4	1.6	3.0		
11	4.4	1.6	3.1		
12	4.8	1.7	2.7		
13	4.7	1.7	2.8		
14	4.1	1.5	3.4		
15	4.4	1.6	3.0		
16	4.3	1.6	3.1		
17	4.8	1.8	2.7		
18	3.9	1.5	3.6		
19	4.0	1.5	3.4		
20	4.2	1.6	3.1		
USL	5,1	2,1	4,3		
LSL					
Xbar	4,3	1,6	3,1		
Max	4,80	1,80	4,00		
Min	3,50	1,50	2,60		
R	1,30	0,30	1,40		

6. 신뢰성 보증 조건

The standard of the reliability test

NO	division	Item	Test condition	test method	Judgment
1	Environment	High Temp.	85°C±3°C, 120hr±2hr	 <p>1step: Test VSWR by jig. 2step: Put it in the chamber. 3step: Test it like this picture which explains temp. circle. 4step: test VSWR after 1hr in normal Temp. & normal Humidity.</p>	-appearance is ok - vswr is ok
2		Low Temp.	-40°C±3°C, 120hr±2hr	 <p>1step: Test VSWR by jig. 2step: Put it in the chamber. 3step: Test it like this picture which explains temp. circle. 4step: test VSWR after 1hr in normal Temp. & normal Humidity.</p>	
3		High Temp. & High Hum.	85°C±3°C, RH=85%, 120hr±2hr	 <p>1step: Test VSWR by jig. 2step: Put it in the chamber. 3step: Test it like this picture which explains temp. circle. 4step: test VSWR after 1hr in normal Temp. & normal Humidity.</p>	
4		Salt spray	Nacl 5%, 35°C, 72hr	<p>1step: Test VSWR by jig. 2step: Put it in the chamber. 3step: Start test. 4step: wash the samples. 5step: test VSWR after 1hr in normal Temp. & normal Humidity.</p>	
5	Machinery Test	Drop	- From 100cm height, drop the sample to the bottom for 12 time per one test by drop jig. (each 2 time on 6 surfaces) - Jig: using the plastic jig(120±20g) - Material of Bottom: Concrete floor	 <p>1step: Solder antenna on EV board. 2step: assemble EV board(+antenna) on set. 3step: Test it like this picture which explains how to do it.</p> <p>※ If you want harder spec. than this, you need to apply glue on ceramic antenna.</p>	-Between PCB and Antenna are not seperated

7. 신뢰성시험 성적서

Reliability Test Report (A)										Framing		Investigation		Approval	
															
SUPPLIER			ethertronics		CUSTOMER		GANGUNG ELECTRO-MECHANICS			DATE		2009.3.15 ~ 2009.3.28			
MODEL NAME			STM-8100 BT		ETHER CODE		M530301			INSPECTOR		Wang, Myung Ho			
No	Division	Item	Inspection sort	SPEC	Result										Judgment
					Before					After					
					×1	×2	×3	×4	×5	×1	×2	×3	×4	×5	
1	E n v i r o n m e n t	High Temp.	appearance	no error	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
			V.S.W.R	1,900MHz less than 5.1:1	4.2	4.0	4.0	4.8	4.7	4.3	4.1	4.0	4.8	4.6	OK
				1,960MHz less than 2.1:1	1.6	1.5	1.5	1.6	1.5	1.6	1.7	1.5	1.6	1.7	OK
				2,020MHz less than 4.3:1	3.1	3.2	3.5	3.0	3.1	3.2	3.4	3.5	3.1	3.2	OK
2		Low Temp.	appearance	no error	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
			V.S.W.R	1,900MHz less than 5.1:1	4.1	4.0	4.1	4.6	4.7	4.3	4.3	4.1	4.7	4.6	OK
				1,960MHz less than 2.1:1	1.6	1.6	1.5	1.6	1.5	1.6	1.6	1.5	1.6	1.6	OK
				2,020MHz less than 4.3:1	3.2	3.2	3.6	3.3	3.2	3.2	3.4	3.5	3.4	3.1	OK
3		High Temp. & High Hum.	appearance	no error	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
			V.S.W.R	1,900MHz less than 5.1:1	4.2	4.1	4.1	4.5	4.5	4.1	4.2	4.2	4.5	4.8	OK
				1,960MHz less than 2.1:1	1.4	1.5	1.5	1.7	1.5	1.5	1.5	1.5	1.6	1.6	OK
				2,020MHz less than 4.3:1	3.2	3.2	3.1	3.2	3.4	3.1	3.1	3.2	3.4	3.4	OK

Reliability Test Report (B)

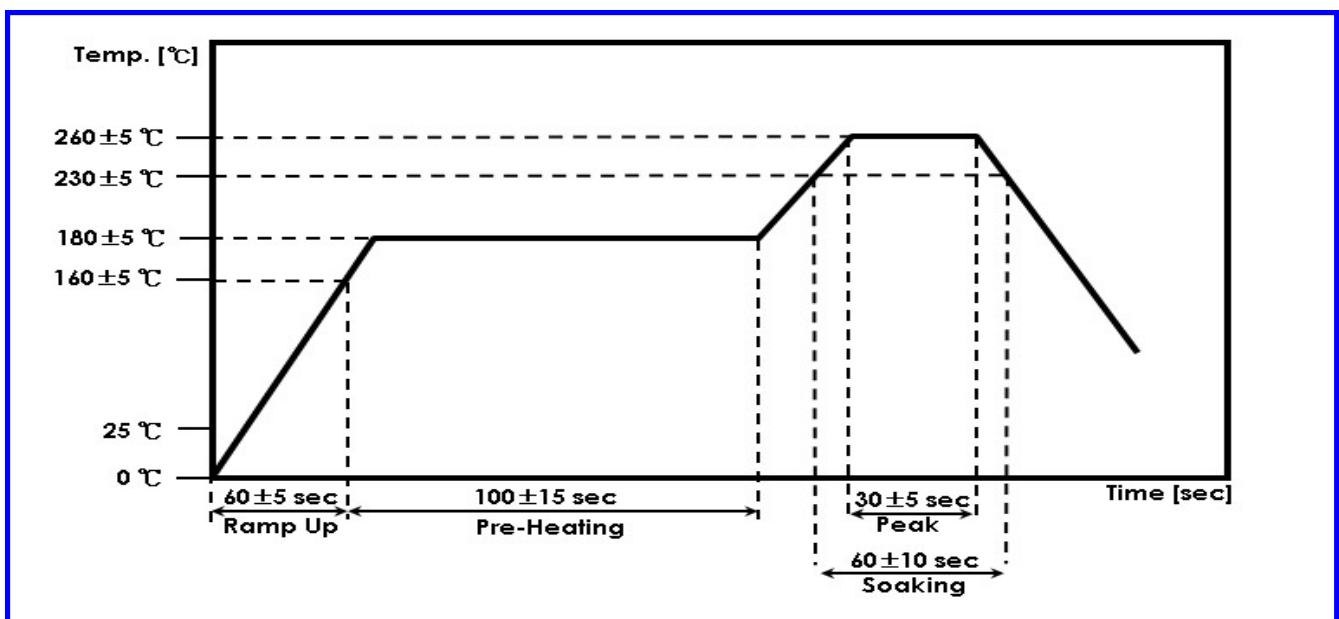
No	Division	Item	Inspection sort	SPEC	Result										Judgment
					Before					After					
					×1	×2	×3	×4	×5	×1	×2	×3	×4	×5	
4	E n v i r o n m e n t	Salt spray test	appearance	no error	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
			V.S.W.R	1,900MHz less than 5.1:1	4.3	4.0	4.0	4.8	4.7	4.3	4.1	4.0	4.8	4.6	OK
				1,960MHz less than 2.1:1	1.6	1.5	1.5	1.5	1.5	1.6	1.6	1.5	1.6	1.5	OK
				2,020MHz less than 4.3:1	3.3	3.2	3.1	3.4	3.1	3.5	3.1	3.2	3.1	3.3	OK
5	M a c h i n a r y T e s t	Drop test	appearance	not seperated						OK	OK	OK	OK	OK	

Remark

8. 납땜조건

8.1 REFLOW 조건

REFLOW 조건은 아래의 온도 및 시간을 따른다.



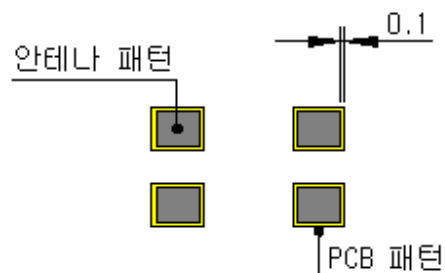
8.2 수동 납땜 조건


제품에 인두기를 직접 접촉하여 땀하지 않는다.

제품을 120 °C 에서 60 ~ 250 초 동안 예열 후 인두온도 250 °C ~ 280 °C 로 작업한다.

8.3 PCB PATTERN 의 설계

PCB PATTERN 은 칩 안테나 PATTERN 의 외곽 크기 보다 0.1MM 크게 설계한다.

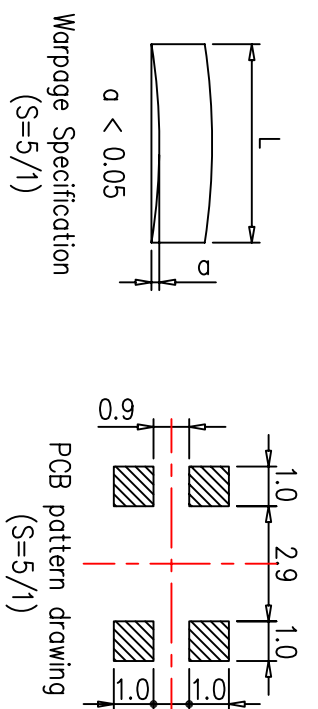
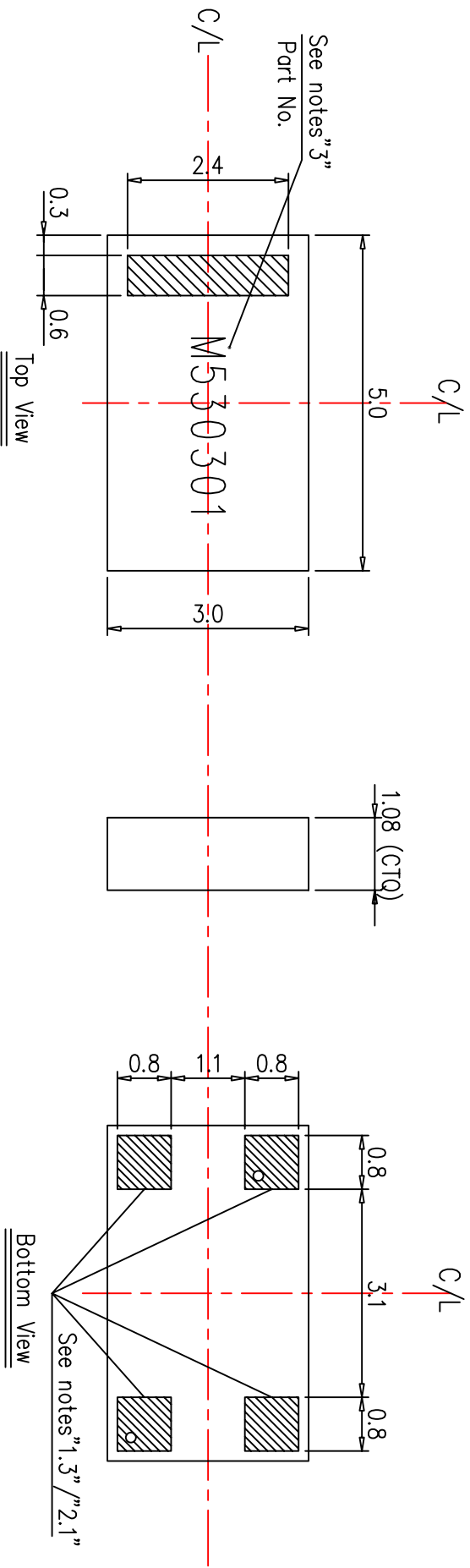


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	STM-8100 BT	REV. A

9. 구조 및 재질

9.1 도면

REV.	ZONE	ECO NO.	DESCRIPTION	DATE	CHECKED



- Notes:
- Material
 - Dielectric substance : Ceramic (Er=9.1)
 - Internal electrode : Ag paste
 - External electrode : Ag paste with Ni/Au plating
 - Plating specification
 - Under layer: Ni 2~5um, Top layer: Au more than 0.03um
 - PART No. & LOT Marking color : Black

		101-601 SK Ventium Bldg 522 Dangjeong-dong Guro-gu Seoul Gyeonggi-do Korea 435-776	
MATERIAL	SEE NOTES	MODEL NAME	STM-8100
UNIT	MM	DRAWN	WS LEE
DATE	24/03/09	CHECKED	CH SEOL
DATE	24/03/09	APPROVED	SW CHOI
DATE	24/03/09	SCALE	10 : 1
DATE	24/03/09	NUMBER OF SHEETS	1 OF 1
DATE	24/03/09	REV.	A
FINISH	SEE NOTES	PART NO.	M530301
GENERAL TOLERANCE	±0.1	ANGLE	±1.0°
THIRD ANGLE PROJECTION	LINEAR	SIZE	A4
DATE	24/03/09	SCALE	10 : 1
DATE	24/03/09	NUMBER OF SHEETS	1 OF 1
DATE	24/03/09	REV.	A

Warpage Specification
(S=5/1)

PCB pattern drawing
(S=5/1)

BT/W-LAN ANTENNA



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9.2 PART LIST

품명	재질	원료 업체	색상	가공 업체	가공 방법	후가공	후가공 업체	수량
CHIP ANTENNA	Er=9.1	-	GRAY	RN2	LTCC	도금 Ni: 2~5um Au: 0.03um 이상	-	1

원료	품 명	구성물질	CAS #.
POWDER	X-200	GLASS FRIT	6599-17-3
금도금액	7875 내/외부전극	Silver	7440-22-4
		Diethylene glycol monobutyl ether	112-34-5
	7454B Via 전극	Silver powder	7440-22-4
		Ethyl cellulose	9004-57-3
		Diethylene glycol monobutyl ether	112-34-5
		Terpineol	98-55-5
니켈도금액	NIPEL PMF- 2000	차아인산나트륨 (NaH ₂ PO ₂ ·H ₂ O)	7681-53-0
		황산니켈(NiSO ₄ ·6H ₂ O)	7786-81-4
		수산화나트륨 (NaOH)	1310-73-2
PATTERN	Auruna	Au	-

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	STM-8100 BT	REV. A

10. 주의사항

10.1 보관조건

제품을 온도가 높거나 습도가 높은 장소에서 떨어진 곳에 보관할 것.
 40 ° C 이상의 고온방치 시 포장재에 변형이 발생할 수 있음.
 제품을 부식성의 가스(황화수소, 아황산, 염소, 암모니아 등)로부터 떨어진 곳에 보관할 것.
 보관장소의 온도는 5 ~ 35 ° C, 습도는 45 ~ 75% RH 일 것.
 보관기간은 포장일로부터 6 개월 이내일 것.

10.2 취급 및 운송

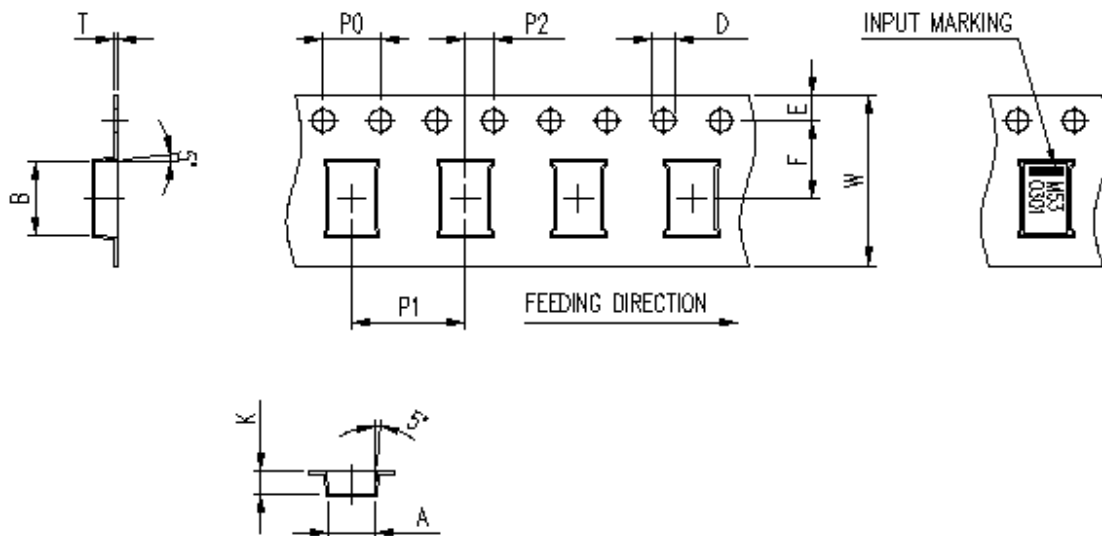
제품에 충격 또는 힘이 가해 지지 않도록 주의할 것.
 납땜 부위는 이물이 묻지 않도록 주의할 것.

11. 포장사양

11.1 Carrier Tape & Reel 사양

품 명	재 질	표면 저항	포장방식
Carrier Tape	Antistatic PET	10**8Ω	열 압착 방식
Cover Tape	PET	10**8Ω	
Reel	PS	10**8Ω	

11.2 Carrier Tape Drawing

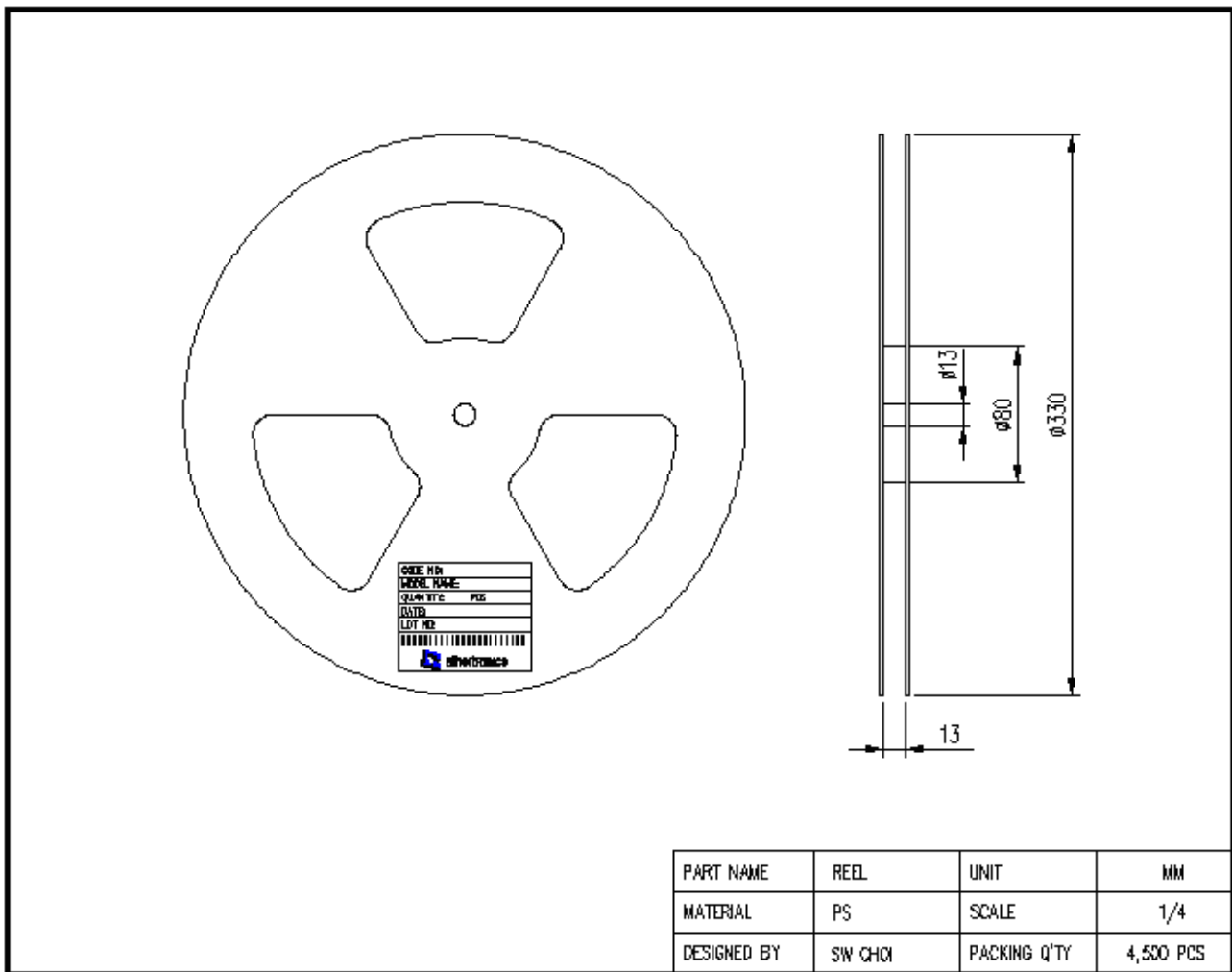


DIMENSION

A	3.25±0.1	E	1.75±0.1
B	5.25±0.1	F	5.5±0.1
D	1.55±0.1	K	1.6±0.1
P0	4.0±0.1	T	0.3±0.05
P1	8.0±0.1	W	12.0±0.2
P2	2.0±0.1		

PART NAME	CARRIER TAPE	UNIT	MM
MATERIAL	A-PET	SCALE	2/1
INNER CHIP SIZE	5x3x1.33t	GENERAL TOLERANCE	±0.1
PACKING Q'TY	5,000 PCS	DESIGNED BY	SW CHOI

11.3 Reel Drawing



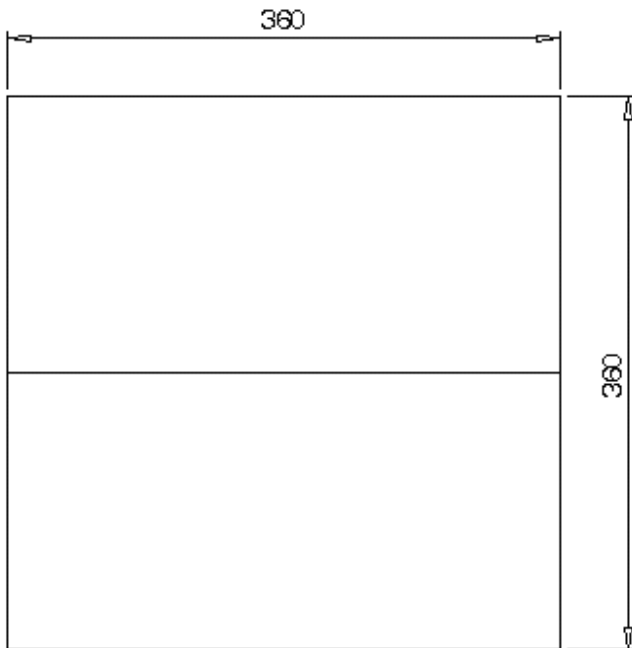


승 인 원

STM-8100 BT

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11.4 Box 사양



물품 명세서

거래처		
모 델		
포 인		
코드 NO		
수 량		
LOT NO		
납품일자		판 결
포 괄 자		
검 사 자		

제조 (Q.C)공정도

문서 번호	ETP-H-01-176	결	재	작성	검 토	승 인
PART - NO						
공정 명	부품시작부					
제 품 명	Antenna					

공정흐름도	사내	외주	공정명	검사항목	검사방법	검사장비	검사기준	관리			담당자	비고
								항목	주기	기록		
1	2	소재 입고	조립	물량	물량 및 Lot관리 확인.	육안	물량 Lot일치	수량	매 Lot	제품검사 성적서	담당자	소재 입고 전 이상 시 재검관리가 되고.
				정량배정	정량배로 오차범위내에서 숙정 후 투입.	정량계	오차 범위내	정량	매 작업	공정일지	담당자	*정량계 온도, 계 이상 시 해당 관리자에게 보고.
				물량인도	1차 조립 후 물량인도 확인	인도계	인도	인도	매 작업	공정일지	담당자	*정량계 온도, 계 이상 시 해당 관리자에게 보고.
				물량포장	물량인도 확인 후 물량인도 확인.	인도계	인도	인도	매 작업	공정일지	담당자	*정량계 온도, 계 이상 시 해당 관리자에게 보고.
				정도측정	정도측정 후 시료 인도 분포기로 측정	정도계	정도	정량	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
3	4	인도측정	인도측정	1차 조립 후 물량인도 인도 분포기로 측정	인도분포기	인도	정량	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.	
				Sheet 두께 측정 (CTQ)	Sheet 두께 검사	Height 게이지	두께	두께	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
				Sheet Cutting 상태	Sheet 절단 후 최초 작업 Sheet상태 확인 (Size/외관상태)	육안	가공	정량	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
				Sheet 정수	정수 확인 후 Sheet상태 확인 (Size/외관상태)	육안	정수	정수	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
				Sheet 정수	정수 확인 후 Sheet상태 확인 (Size/외관상태)	육안	정수	정수	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
4	5	정수	정수	정수 확인 후 Sheet상태 확인 (Size/외관상태)	육안	정수	정수	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.	
				정수	정수	정수	정수	정수	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
				정수	정수	정수	정수	정수	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
				정수	정수	정수	정수	정수	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.
				정수	정수	정수	정수	정수	매 작업	공정일지	담당자	*정도기 온도, 계 이상 시 해당 관리자에게 보고.

[illegible]

22	출하검사	포장상태검사	포장완료검사에 참여하여 포장상태 검사(누락/파손 등)	확인	포장완료검토서	불량	-	-	출하검사 서버 확인	검사자	요청 시 귀포장
23	출하	모형/LOT검사	출하지시서상의 모형, 수량 확인	확인	모형, 수량, LOT 기재	불량	-	-		검사자	불량 확인



승 인 원

STM-8100 BT

REV. A

13. 유해 물질 성적서

13.1 세라믹 파우더



Test Report No. F690501/LF-CTSAAYAA08-15067

Issued Date: May 23, 2008

Page 1 of 3

To: RN2 TECHNOLOGIES CO., LTD.
284-2, Gaigot-ri
Jinwe-myeon
Pyeongtaek-city
GYEONGGI-DO
Korea

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

Product Name : Ceramic Powder (LTCC)
SGS File No. : AYAA08-15067
Received Date : May 19, 2008
Test Performing Date : May 20, 2008
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)
Buyer(s) : ETHERTRONICS

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

SGS Testing Korea Co. Ltd.

Jeff Jang / Chemical Lab Mgr

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F0652 Version2


Test Report No. F690501/LF-CTSAAYAA08-15067

Issued Date: May 23, 2008

Page 2 of 3

Sample No. : AYAA08-15067.001
Sample Description : Ceramic Powder (LTCC)
Item No./Part No. : N/A
Comments : Material is Ceramic Powder (LTCC).

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(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) mg/kg = ppm
 (3) MDL = Method Detection Limit
 (4) - = No regulation
 (5) "" = Qualitative analysis (No Unit)
 (6) Negative = Undetectable / Positive = Detectable

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F062 Version2

SGS

Test Report No. F690501/LF-CTSA08-15067

Issued Date: May 23, 2008

Page 3 of 3

Sample No. : AYAA08-15067.001
Sample Description : Ceramic Powder (LTCC)
Item No./Part No. : N/A
Comments : Material is Ceramic Powder (LTCC).

Halogen Contents

Test Items	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	EN 14582:2007 , IC	30	N.D.
Chlorine(Cl)	mg/kg	EN 14582:2007 , IC	30	N.D.

Picture of Sample as Received:

Sample Color : White



*** 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) Negative = Undetectable / Positive = Detectable

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F052 Version2



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STM-8100 BT

REV. A

13.2 Au plating



Test Report No. F690501/LF-CTSA4A08-15065

Issued Date: May 23, 2008

Page 1 of 2

To: RN2 TECHNOLOGIES CO., LTD.
284-2, Gaigot-ri
Jinwe-myeon
Pyeongtaek-city
GYEONGGI-DO
Korea

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

Product Name : Au Plating Liquid
SGS File No. : AYAA08-15065
Received Date : May 19, 2008
Test Performing Date : May 20, 2008
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)
Buyer(s) : ETHERTRONICS

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

SGS Testing Korea Co. Ltd.


Jeff Jang / Chemical Lab Mgr

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F0652 Version2

SGS

Test Report No. F690501/LF-CT8AYAA08-15065

Issued Date: May 23, 2008

Page 2 of 2

Sample No. : AYAA08-15065.001
Sample Description : Au Plating Liquid
Item No./Part No. : N/A
Comments : Material is Au plating liquid.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(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:

Sample Color : Clear



*** 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) Negative = Undetectable / Positive = Detectable

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F052 Version2



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STM-8100 BT

REV. A

13.3 Ni plating



Test Report No. F690501/LF-CTSA06-15066

Issued Date: May 23, 2008

Page 1 of 2

To: RN2 TECHNOLOGIES CO., LTD.
284-2, Gaigot-ri
Jinwe-myeon
Pyeongtaek-city
GYEONGGI-DO
Korea

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

Product Name : Ni Plating Liquid
SGS File No. : AYAA06-15066
Received Date : May 19, 2008
Test Performing Date : May 20, 2008
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)
Buyer(s) : ETHERTRONICS

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

SGS Testing Korea Co. Ltd.


Jeff Jang / Chemical Lab Mgr

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FD052 Version2

SGS

Test Report No. F690501/LF-CT8AYAA08-15066

Issued Date: May 23, 2008

Page 2 of 2

Sample No. : AYAA08-15066.001
Sample Description : Ni Plating Liquid
Item No./Part No. : N/A
Comments : Material is Ni plating liquid.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(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:

Sample Color : Green



*** 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) Negative = Undetectable / Positive = Detectable

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F052 Version2



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STM-8100 BT

REV. A

13.4 Ag Paste



Test Report No. F690501/LF-CTSA YAA06-15064

Issued Date: May 23, 2008

Page 1 of 2

To: RN2 TECHNOLOGIES CO., LTD.
284-2, Gaigot-ri
Jinwe-myeon
Pyeongtaek-city
GYEONGGI-DO
Korea

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

Product Name : Ag Paste
SGS File No. : AYAA06-15064
Received Date : May 19, 2008
Test Performing Date : May 20, 2008
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)
Buyer(s) : ETHERTRONICS

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

SGS Testing Korea Co. Ltd.

Jeff Jang / Chemical Lab Mgr

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F0652 Version2



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STM-8100 BT

REV. A

SGS

Test Report No. F690501/LF-CTSA08-15064

Issued Date: May 23, 2008

Page 2 of 2

Sample No. : AYAA08-15064.001

Sample Description : Ag Paste

Item No./Part No. : N/A

Comments : Material Is Ag.

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(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:

Sample Color :

Gray



*** End ***

- NOTE:
- (1) N.D. = Not detected.(<MDL)
 - (2) mg/kg = ppm
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 - (4) - = No regulation
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 - (6) Negative = Undetectable / Positive = Detectable

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F052 Version2



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STM-8100 BT

REV. A

13.5 Marking Paste



Test Report No. F690501/LF-CTSAAYAA08-15068

Issued Date: May 23, 2008

Page 1 of 3

To: RN2 TECHNOLOGIES CO., LTD.
284-2, Galgot-ri
Jinwi-myeon
Pyeongtaek-city
GYEONGGI-DO
Korea

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

Product Name : Marking Paste
SGS File No. : AYAA08-15068
Received Date : May 19, 2008
Test Performing Date : May 20, 2008
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)
Buyer(s) : ETHERTRONICS

Pluto Kim
Monet Jeong
Billy Oh / Testing Person

SGS Testing Korea Co. Ltd.

Jeff Jang / Chemical Lab Mgr

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F062 Version2

SGS

Test Report No. F690501/LF-CT8AYAA08-15068

Issued Date: May 23, 2008

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Sample No. : AYAA08-15068.001

Sample Description : Marking Paste

Item No./Part No. : G-3920RN

Heavy Metals

Test Items	Unit	Test Method	MDL	Results
Cadmium (Cd)	mg/kg	US EPA 3052(1996), US EPA 6010B(1996), ICP	0.5	N.D.
Lead (Pb)	mg/kg	US EPA 3052(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) mg/kg = ppm
 (3) MDL = Method Detection Limit
 (4) - = No regulation
 (5) ** = Qualitative analysis (No Unit)
 (6) Negative = Undetectable / Positive = Detectable

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F062 Version2

SGS

Test Report No. F690501/LF-CT9AYAA08-15068

Issued Date: May 23, 2008

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Sample No. : AYAA08-15068.001

Sample Description : Marking Paste

Item No./Part No. : G-3920RN

Halogen Contents

Test Item	Unit	Test Method	MDL	Results
Bromine(Br)	mg/kg	EN 14582:2007, IC	30	N.D.
Chlorine(Cl)	mg/kg	EN 14582:2007, IC	30	N.D.

Picture of Sample as Received:

Sample Color : Black



*** 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) Negative = Undetectable / Positive = Detectable

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