# [APPROVAL SHEET]

Nice Korea Components
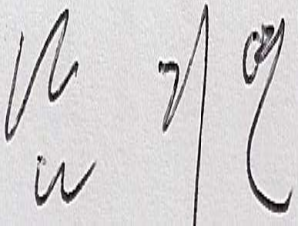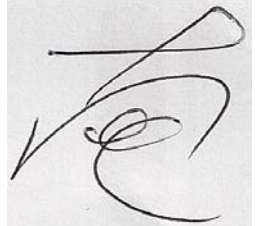
Antenna Solution company

Nice Korea Components Co., Ltd

TEL : 031-470-8989

FAX : 031-470-8949

# N.K.C

# [APPROVAL SHEET]

| Product | Chip M-type Antenna | |
|---|---|---|
| Model | NKC2450-M00 | |
| Designed by | Checked by | Approved by |
|  |  |  |
| 7/19 | 7/19 | 7/19 |

## 2010. 7. 19

## Nice Korea Components Co., Ltd

TEL : 031-470-8989

FAX : 031-470-8949

# N.K.C

# - Contents -

# N.K.C

## 1. Revision History

| product | Chip M-type Antenna | Model | NKC2450-M00 |
| --- | --- | --- | --- |

| Rev. No. | Rev. Issue | Page | Designed | Date |
| --- | --- | --- | --- | --- |
| 1.0 | Appro. Issue | – | KC. NAM | 2009.7.20 |
| 1.1 | revision | Total | KC. NAM | 2010.7.19 |
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# N.K.C

# 2. Features & Applications

## 2.1 Features

This ceramic chip antenna is applied to 2.4 GHz ISM band applications, i.e. Bluetooth. Zigbee, Wireless LAN, etc...

| 형태 | Bulk Ceramic | |
|---|---|---|
| 재질 | 유전체 | Al2O3(Alumina) |
| | 전극 | 은(Ag) |
| 크기 (mm) | L = 10+/− 0.1 | |
| | W = 2+/− 0.1 | |
| | T = 1.2+/− 0.1 | |
| Version | Revision 1.1 | |

# N.K.C

# 3. Electrical Specifications

3-1.

  * All item are measured in room temperature (24~25 'C).
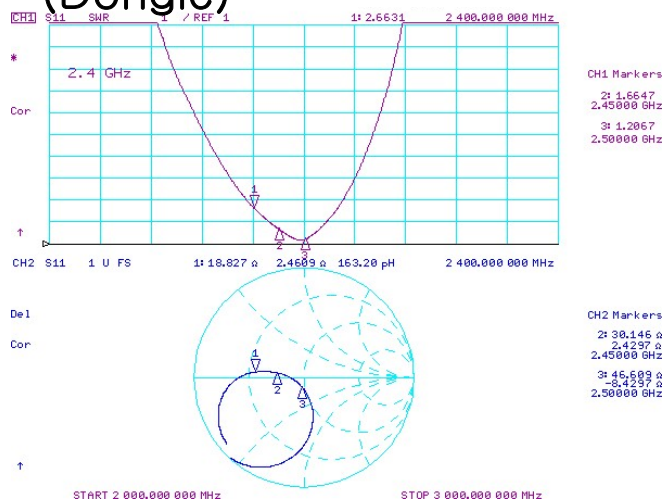
  * All item are measured at customer set condition.

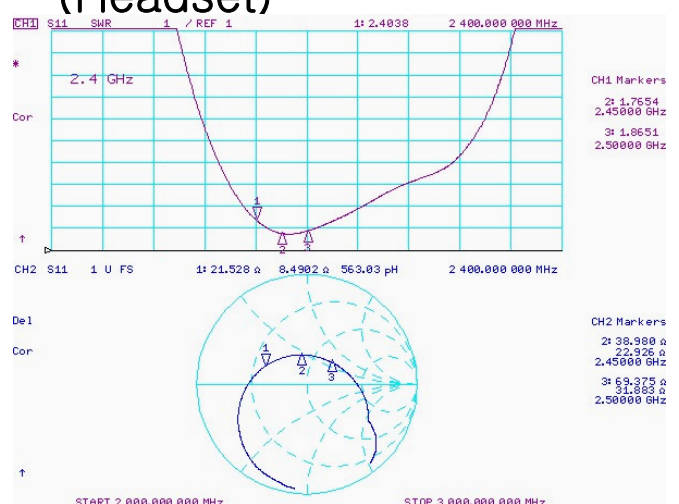| No. | Items | Typical Data |
|-----|-------|--------------|
| 1 | Frequency (MHz) | 2400 ~2485 |
| 2 | VSWR | 2 : 1 |
| 3 | Total Gain (Peak/AVG.) [dBi] | 0.19 / -1.82 |
| 4 | Impedance | 50 ohm |
| 5 | Polarization | Linear |

## 3-2. VSWR (S₁₁)of TEST condition
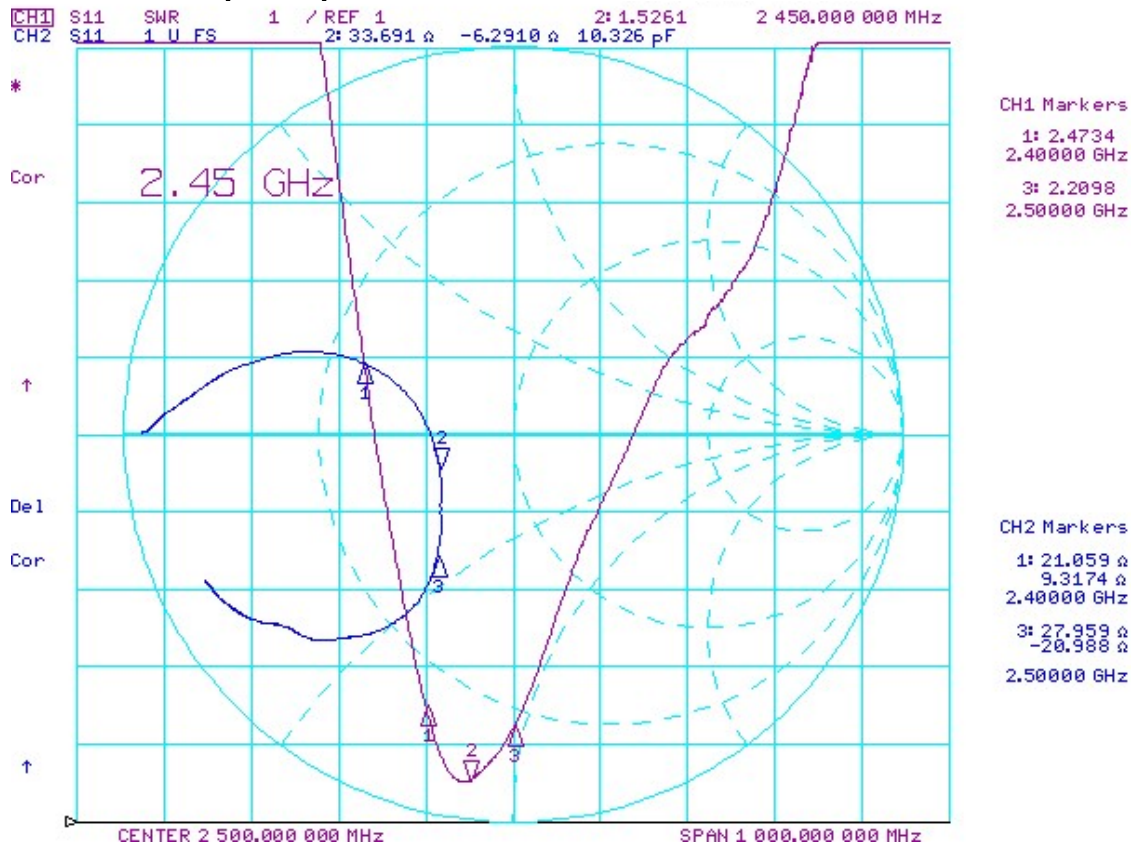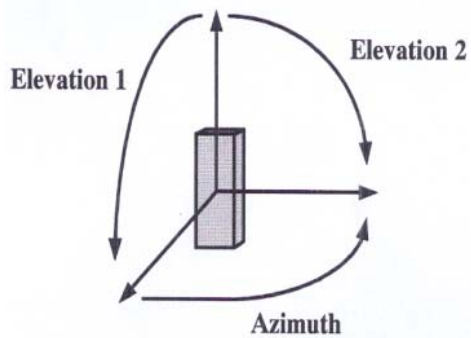


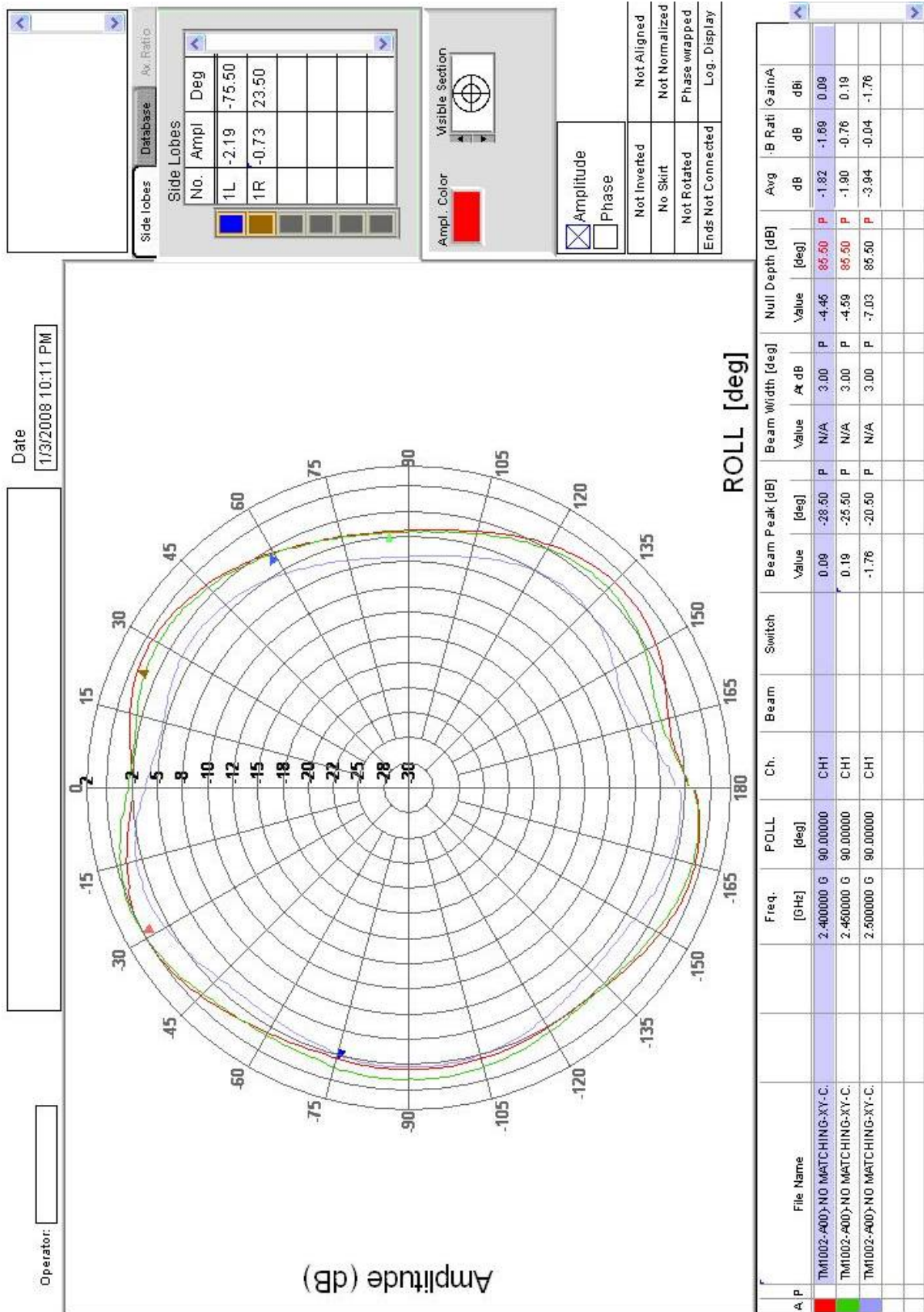## 3-3. VSWR (S₁₁)of SET condition

### (Dongle)



### (Headset)

# N.K.C

## 3-4. Radiation Patterns



| Theta | Vertical Field of measured plane |
|-------|----------------------------------|
| Phi   | Horizontal Field of measured plane |

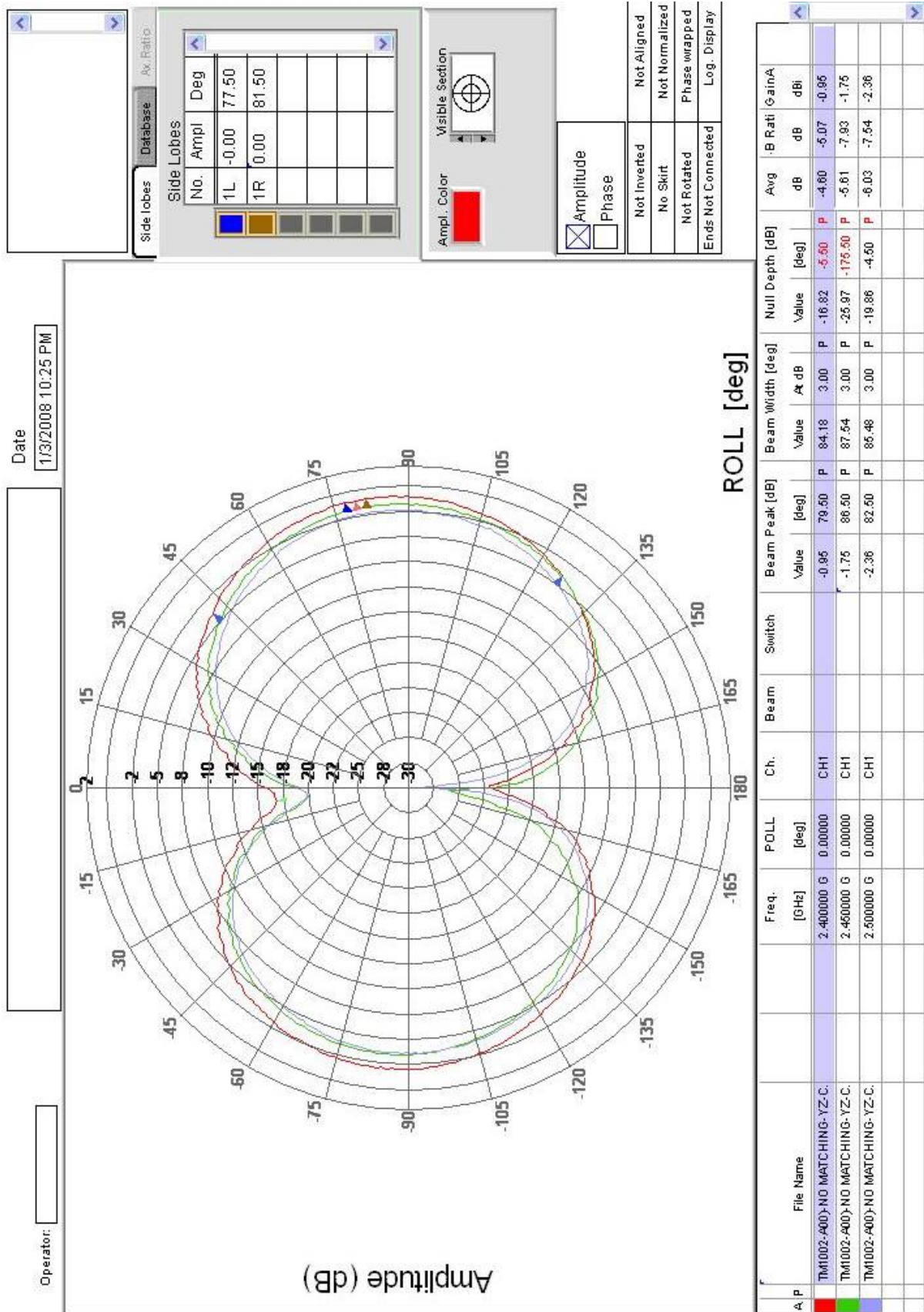| | Total Gain (Peak/Avg) [dBi] | | 0.19 / −1.82 | |
|---|---|---|---|---|
| 이득[dBi]<br>(Co-Pola) | Azimuth | Phi | Peak | 0.19 |
| | | | Avg | −1.82 |
| | Elevation 1 | Theta | Peak | −0.76 |
| | | | Avg | −4.22 |
| | Elevation 2 | Theta | Peak | −0.95 |
| | | | Avg | −4.60 |

## (Azimuth)



Side Lobes

| No. | Ampl | Deg |
|---|---|---|
| 1L | -2.19 | -75.50 |
| 1R | -0.73 | 23.50 |

Visible Section

Ampl. Color

Amplitude / Phase

| | |
|---|---|
| Not Aligned | |
| Not Normalized | Not Inverted |
| Phase wrapped | No Skirt |
| Log. Display | Not Rotated |
| | Ends Not Connected |

Date 1/3/2008 10:11 PM

ROLL [deg]

Amplitude (dB)

| File Name | Freq. [GHz] | POLL [deg] | Ch. | Beam | Switch | Beam Peak [dB] Value | [deg] | Beam Width [deg] Value | @ dB | Null Depth [dB] Value | [deg] | Avg dB | -B Rati dB | GainA dBi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TM1002-A00>-NO MATCHING-XY-C. | 2.400000 G | 90.00000 | CH1 | | | 0.09 | -28.50 P | N/A P | 3.00 P | -4.45 | 85.50 P | -1.82 | -1.69 | 0.09 |
| TM1002-A00>-NO MATCHING-XY-C. | 2.450000 G | 90.00000 | CH1 | | | 0.19 | -25.50 P | N/A P | 3.00 P | -4.59 | 85.50 P | -1.90 | -0.76 | 0.19 |
| TM1002-A00>-NO MATCHING-XY-C. | 2.500000 G | 90.00000 | CH1 | | | -1.76 | -20.50 P | N/A P | 3.00 P | -7.03 | 85.50 P | -3.94 | -0.04 | -1.76 |

Operator:

## (Elevation 1)



**Date:** 1/3/2008 10:17 PM

**Side Lobes**

| No. | Ampl | Deg |
|-----|-------|-------|
| 1L | -0.03 | 75.50 |
| 1R | -0.03 | 81.50 |

Ampl. Color

Visible Section

☒ Amplitude  ☐ Phase

Not Inverted / Not Aligned
No Skirt / Not Normalized
Not Rotated / Phase wrapped
Ends Not Connected / Log. Display

**ROLL [deg]** — Amplitude (dB)

| A P | File Name | Freq. [GHz] | POLL [deg] | Ch. | Beam | Switch | Beam Peak [dB] Value | [deg] | | Beam Width [deg] Value | At dB | | Null Depth [dB] Value | [deg] | | Avg dB | -B Rati dB | GainA dBi |
|-----|-----------|-------------|------------|-----|------|--------|------|------|---|------|------|---|------|------|---|------|------|------|
| | TM1002-A00>-NO MATCHING-ZX-C, | 2.400000 G | 0.00000 | CH1 | | | -0.76 | 79.50 | P | 73.85 | 3.00 | P | -22.36 | 168.50 | P | -4.22 | -8.36 | -0.76 |
| | TM1002-A00>-NO MATCHING-ZX-C, | 2.450000 G | 0.00000 | CH1 | | | -1.56 | 74.50 | P | 75.19 | 3.00 | P | -22.56 | 171.50 | P | -4.98 | -6.30 | -1.56 |
| | TM1002-A00>-NO MATCHING-ZX-C, | 2.500000 G | 0.00000 | CH1 | | | -2.23 | 71.50 | P | 74.40 | 3.00 | P | -35.86 | 171.50 | P | -5.63 | -5.57 | -2.23 |

Operator:

# N.K.C

## (Elevation 2)

Date 1/3/2008 10:25 PM

Operator:

**Side Lobes**

| No. | Ampl | Deg |
|-----|------|------|
| 1L | -0.00 | 77.50 |
| 1R | 0.00 | 81.50 |

Side lobes / Database / Ax. Ratio

Ampl. Color

Visible Section

☒ Amplitude  ☐ Phase

| Not Aligned | Not Normalized | Phase wrapped | Log. Display |
|---|---|---|---|
| Not Inverted | No Skirt | Not Rotated | Ends Not Connected |



Amplitude (dB)

ROLL [deg]

| A P | File Name | Freq. [GHz] | POLL [deg] | Ch. | Beam | Switch | Beam Peak [dB] Value | Beam Peak [dB] [deg] | | Beam Width [deg] Value | Beam Width [deg] At dB | | Null Depth [dB] Value | Null Depth [dB] [deg] | | Avg dB | -B Rati dB | GainA dBi |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TM1002-A00)-NO MATCHING-YZ-C. | 2.400000 G | 0.00000 | CH1 | | | -0.95 | 79.50 | P | 84.18 | 3.00 | P | -16.82 | -5.50 | P | -4.60 | -5.07 | -0.95 |
| | TM1002-A00)-NO MATCHING-YZ-C. | 2.450000 G | 0.00000 | CH1 | | | -1.75 | 86.50 | P | 87.54 | 3.00 | P | -25.97 | -176.50 | P | -5.61 | -7.93 | -1.75 |
| | TM1002-A00)-NO MATCHING-YZ-C. | 2.500000 G | 0.00000 | CH1 | | | -2.36 | 82.50 | P | 85.48 | 3.00 | P | -19.86 | -4.50 | P | -6.03 | -7.54 | -2.36 |

# N.K.C

# 4. Measurements Method & Conditions

The measurement of antenna performance is   measurement of gain, radiation pattern using ORBIT/FR apparatus in Anechoic chamber and measurement of VSWR using Network analyzer.

## 4-1. The measurement of Frequency and VSWR
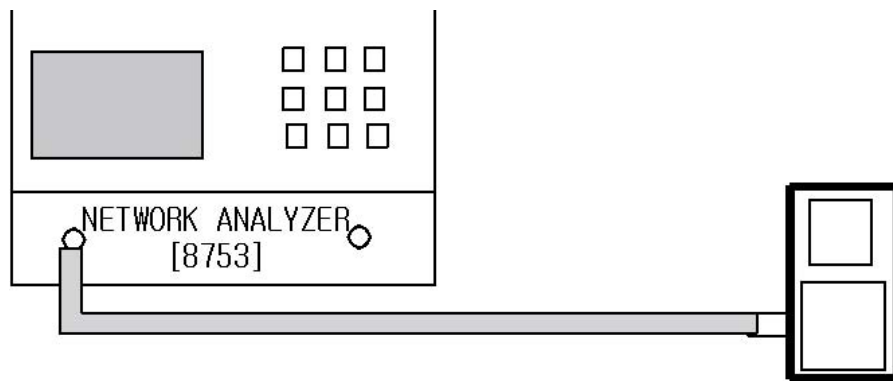


### [Measurement Method]

1. As seen the above, network analyzer is set up for S11 measurement.

2. The measurement frequency range is to set up from 2 GHz to 3 GHz.

3. Perform S11 one port full calibration.

4. Measure the VSWR of three points of Bluetooth frequency range such as 2.4 GHz, 2.45 GHz, and 2.5 GHz.

## 4-2. The measurement of Gain & Radiation Patterns
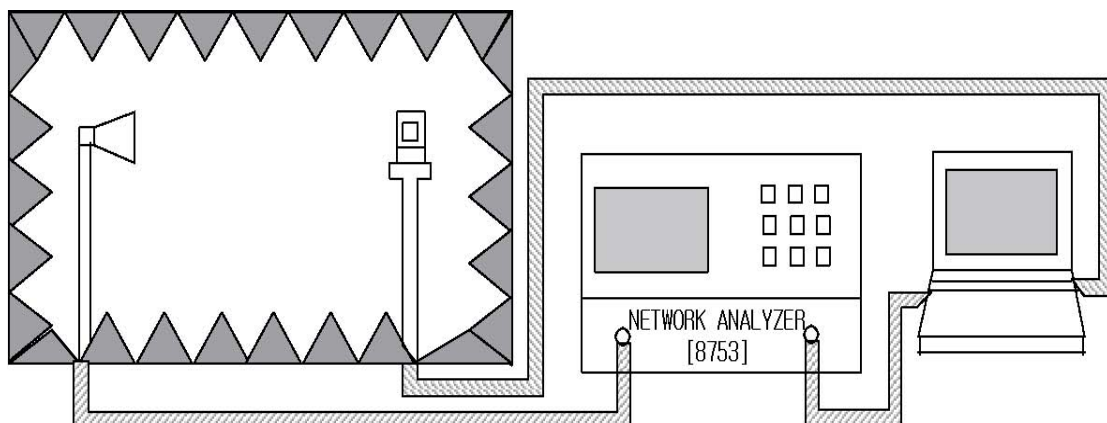
[Measurement Method]

1.  As seen the above, network analyzer is to set up in Anechoic chamber.

2.  As seen beneath, for the measurement planes as Azimuth, Elevation 1, and Elevation 2, measure Gain data of vertical polarization and horizontal polarization for each plane.

# 5. PCB Layout & Solder Pad size

## 5-1. Top Layout



Feeding line(50 ohm)

## 5-2. Top Layout



Feeding line(50 ohm)
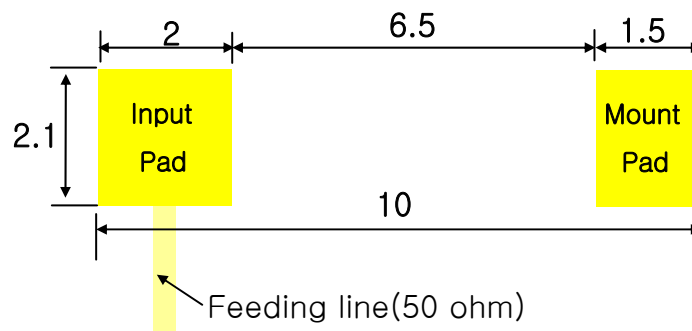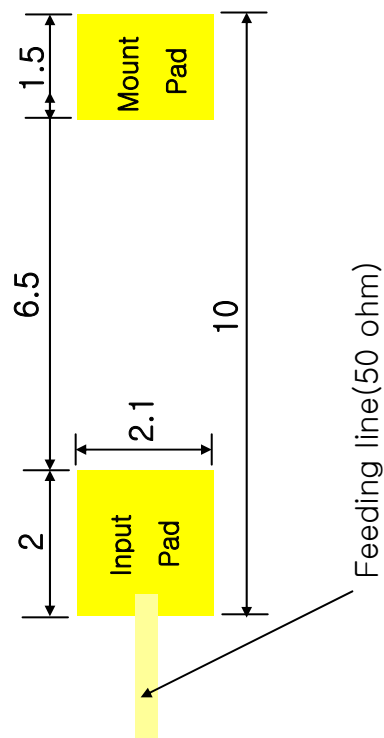
Unit : mm

tolerances : +/- 0.05

# N.K.C

5-3. Matching Circuits



L-type

ANT

T-type

ANT

π-type
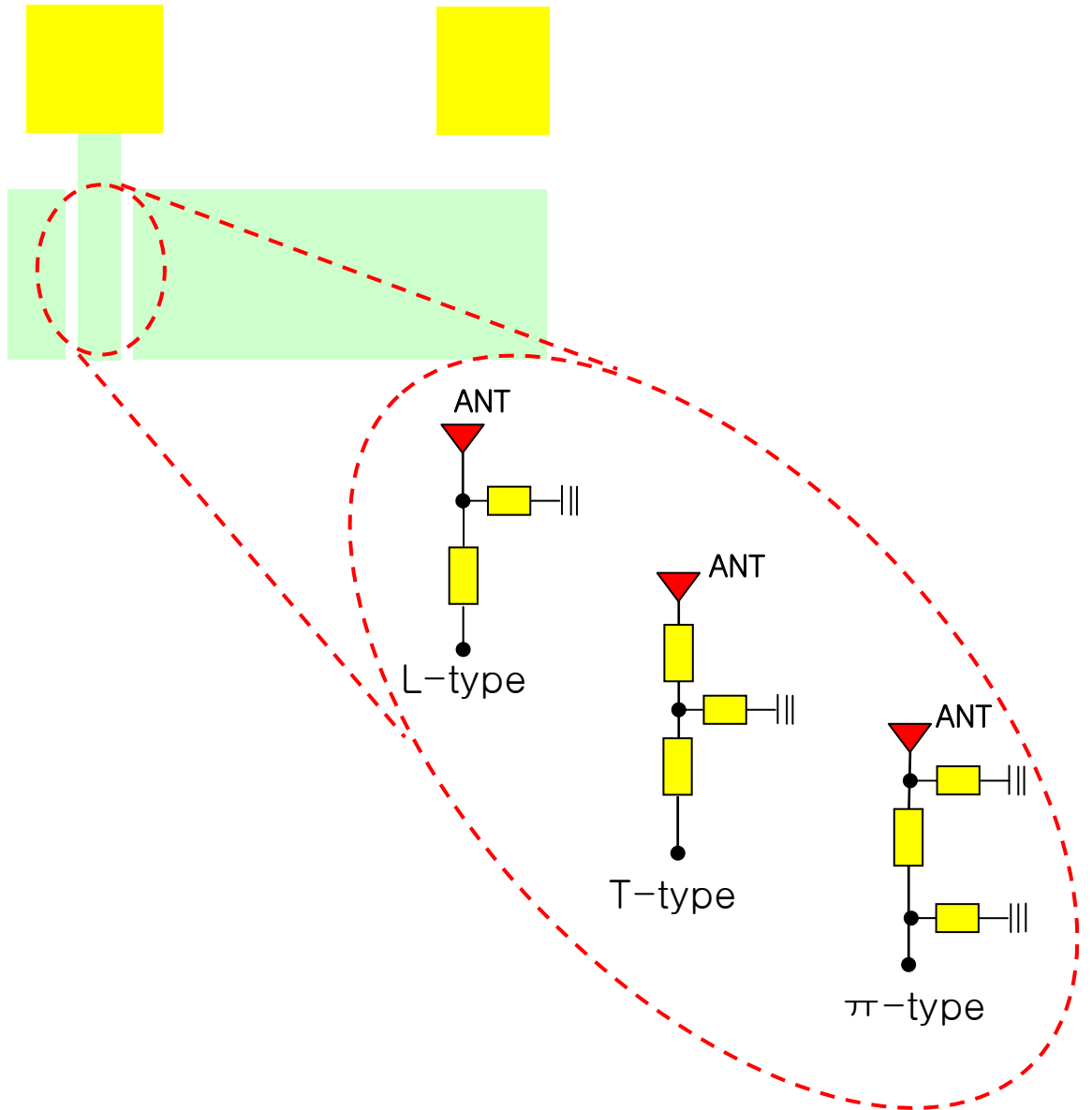
(1) 실제 적용되는 Board의 GND SIZE 및 형태에 따른 Impedance 조정,

(2) 설계된 전송선의 50 ohm miss-matching시 Impedance 조정,

(3) 안테나 자체의 부족한 Impedance 조정,

(4) 이 이외의 다른 변화에 따른 특성 조정에 Lumped elements 사용 시
   3가지 종류 중 한가지의 matching circuit을 적용함.

Matching circuit 적용 시 matching circuit이 차지하는 면적 및 가장 좋은 결과를 얻을 수 있는 matching type를 선택함.

# N.K.C

## 5-4. Antenna position & Soldering area

(A) 경우



INPUT(50 ohm)

(B) 경우



INPUT(50 ohm)
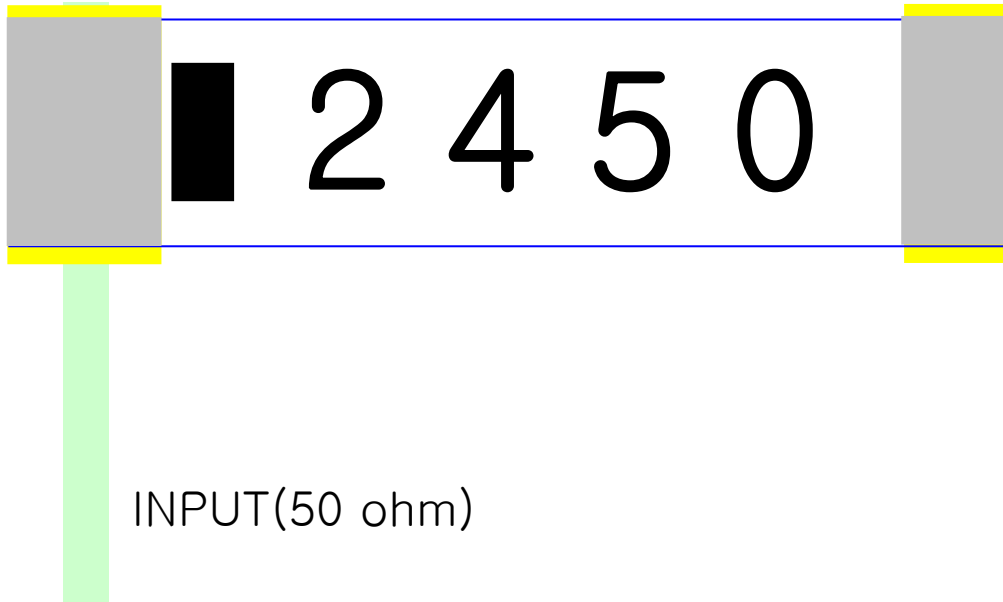
■(yellow) : Soldering cream 면적

■(black) □(white) : INPUT 방향

■(gray) : Soldering 되는 부분

# N.K.C

## 6. Antenna Dimensions

TOP

SID1

BOT

SID 2

1

2

1,5

## 7. Marking View

Input Mark

Company Name

NKC
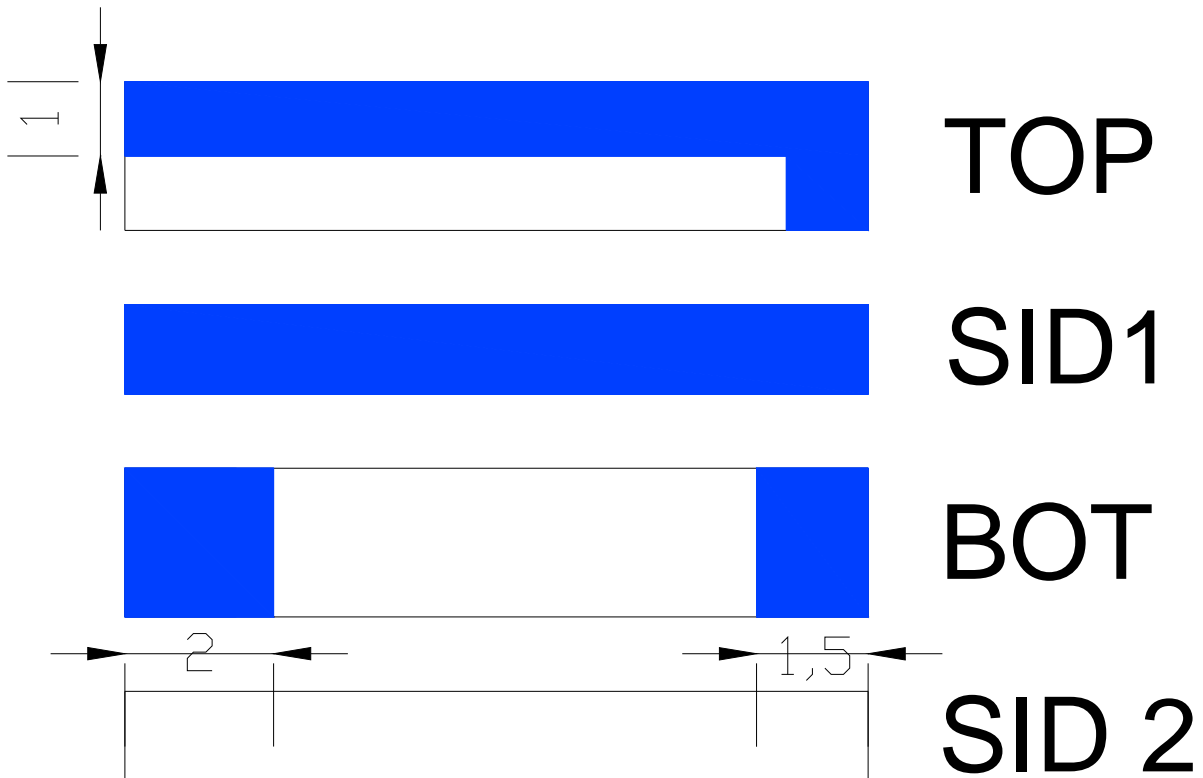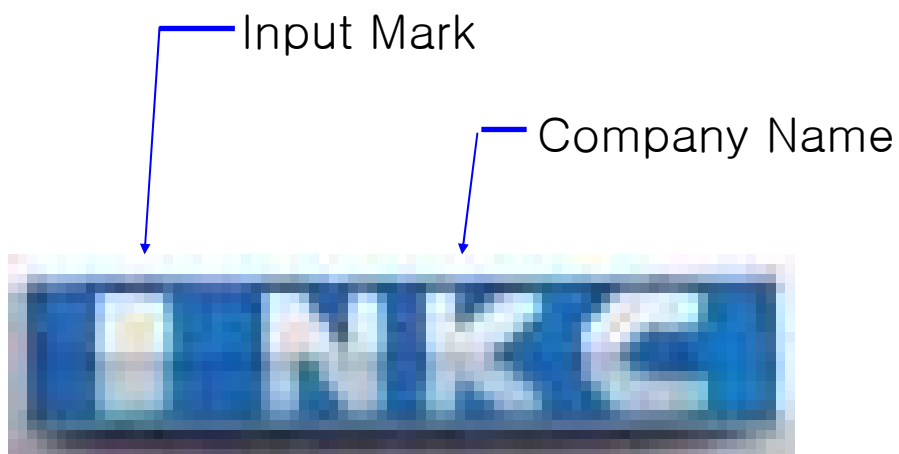
7-1. 마킹 종류

* RF용 파랑(검정) 잉크 사용

**N.K.C**

# 8. Reflow Profile

### 8-1. Standard reflow condition
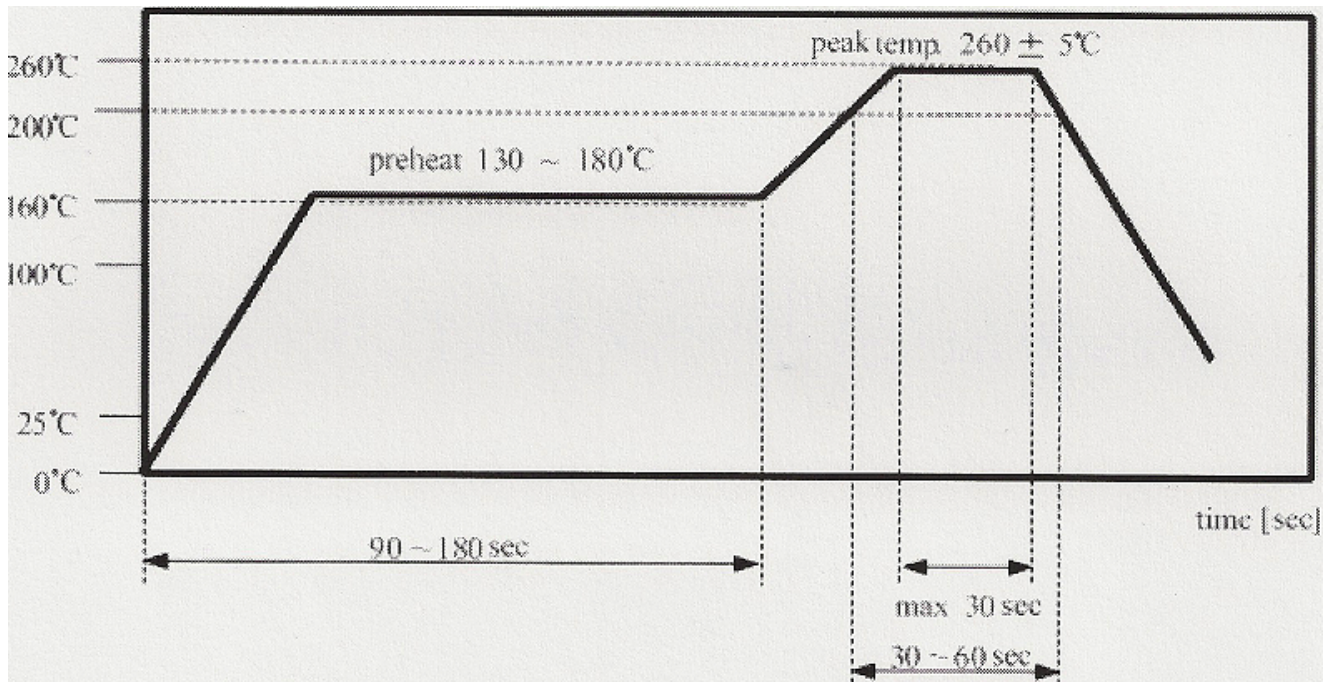


### 8-2. 수동 납땜 (인두기)을 할 경우

예열 : 120 ‘C  /  시간 : 60 ~ 300 sec

인두 온도 : 340 ‘C  /  시간 : 각 단 max 3 sec

# N.K.C

# 9. Environmental Tests

| No. | Item | Test Conditions |
|---|---|---|
| 1 | High Temperature Storage | Leave for 72+/−2 hours in a test bath retaining 85+/−2'C. After then, leave on the test condition for 1.5 hours. |
| 2 | Low Temperature Storage | Leave for 72+/−2 hours in a test bath retaining −30+/−2'C. After then, leave on the test condition for 1.5 hours. |
| 3 | Static Humidity | Leave for 24+/−2 hours in test bath retaining 90−90% RH/50+/−3'C. After then, leave in the test condition for 1.5 hours. |
| 4 | Thermal Shock | Cool from 25'C down to −30+/−2'C and leave for 30 minutes. After that, heat up to 85+/−2'C and leave for 30 minutes. After then, cool down to 25'C. Repeat the cycle 15 time and leave on the test conditions for 1.5 hours. |
| 5 | Drop Shock | Drop 150g weight onto steel floor from the height of 152cm, 19 times and 120cm, 12 times. |
| 6 | Vibration | With 5g of the whole acceleration at 20 to 2000 Hz, apply a vibration for 2 hours for each of 3 directions. |
| 7 | Solder Proof | No reaching after reflow for 5+/− sec at 260'C. |

# N.K.C

## 10. Packaging

### 10-1. Reel Taping Quantity

8,000 pcs / 1 reel

### 10-2. Carrier Tape & Reel Dimensions

(단위:mm)
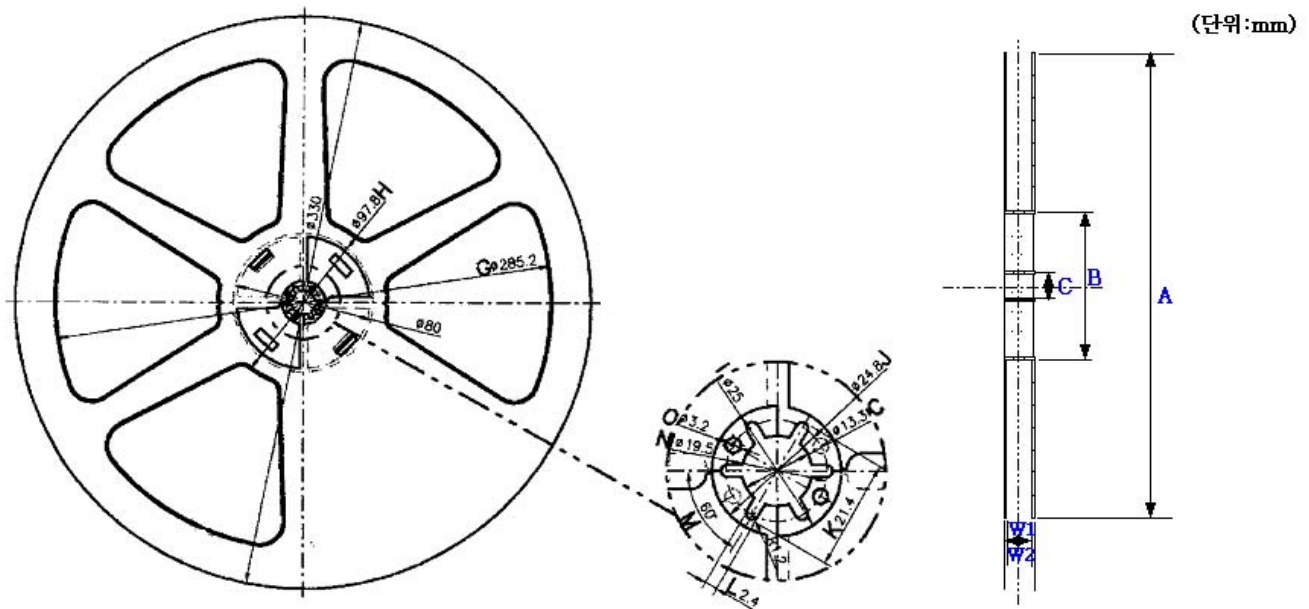
| 항 목 | A | B | C |
|-------|-----|-----|------|
| SPEC | 330±1 | 80±1 | 13±0.2 |

| EIAJ - RRM Ø330 | | | | | | |
|------|------|------|------|------|------|------|
| RRM08D -56D | | | | | | |
| 품명 | 08D | 12D | 16D | 24D | 32D | 44D | 56D |
| 규격 | 08 | 12 | 16 | 24 | 32 | 44 | 56 |
| W1 | 9.5 | 13.5 | 17.5 | 25.5 | 33.5 | 45.5 | 57.5 |
| W2 | 13.5 | 17.5 | 21.5 | 29.5 | 37.5 | 49.5 | 61.5 |

## 11. Usage and Cautions

Safe-keeping conditions : 1 months in 20+/-15'C & less than 60%

# 12. RoHS Data

## (1) Ceramic Power



시 험 성 적 서

| | |
|---|---|
| 한 국 세 라 믹 기 술 원 | 성적서번호 : 2010-0262 |
| 우153-801 서울시 금천구 가산동 233-5 (Tel: 02 3282 2416/7, Fax: 02 3282 2418) | 페이지 ( 1 )/(총 1 ) |

KICET

1. 의 뢰 자
   ○ 기관명/성명 : 해동세라믹 / 김원식
   ○ 주        소 : 경기도 화성시 장안면 석포리 681-13,14
   ○ 의 뢰 일 자 : 2010 년 02월 04일

2. 시험성적서의 용도 :  품질관리

3. 시험 시료명/물질 :  세라믹 Base

4. 시험기간 :  2010 년 02월 04일 ~ 2010 년 02월 09일

5. 시험방법 :  KS C IEC 62321, KS M 1810, KS M 3719, KS D 1662,
              KS M 1061 : 2007

6. 시험환경 :  온도 : ( 20~ 22 )℃ ,  상대습도 : ( 48 ~ 52) % R.H.

7. 시험결과

| 시료명 | 시험분석항목 | 시험분석결과 | 시험분석방법 | 비고 |
|---|---|---|---|---|
| 세라믹 Base | Pb (mg/Kg) | 불검출(<5) | KS C IEC 62321 KS M 1810, EPA 3052 | 유사 규격 준용 |
| | Cd (mg/Kg) | 불검출(<1) | KS C IEC 62321 KS M 1810, EPA 3052 | |
| | Hg (mg/Kg) | 불검출(<1) | KS C IEC 62321 KS M 3719 | |
| | $Cr^{6+}$ (mg/Kg) | 불검출(<0.1) | KS C IEC 62321 KS D 1662 | |
| | PBBs (mg/Kg) | 불검출 | KS M 1061 : 2007 | |
| | PBDs (mg/Kg) | 불검출 | | |

참고) 1. 상기 분석에 사용된 ICP-OES는 PERKIN-ELMER사의 OPTIMA 5300 DV임.
      2. 상기 분석에 사용된 AAS는 PERKIN-ELMER사의 AAnalyst 700임.
      3. 상기 분석에 사용된 GC-MS는 Perkin-Elmer Claus 500 mass.  끝.

| 확 인 | 시험자 : 김 선 택(2431), 최 기 인(7849) | 기술책임자 : 박 덕 원 |
|---|---|---|

2010 . 02 . 10

한 국 세 라 믹 기 술 원 장

비고) 이 성적서는 의뢰자가 제시한 시료 및 시료명으로 시험한 평가결과로서 전체 제품에 대한 품질 및 성능을 보증하지 않습니다.

양식-PB-03-05B(4)

# N.K.C

## (2) Ag Paste

# N.K.C

## (3) Marking Ink