# *WIESON TECHNOLOGIES CO., LTD.*

# WIESON 3D CHAMBER TEST REPORT

| | |
|---|---|
| Customer: | **Testo** |
| Project Name: | **55X** |
| WIESON P/N: | **ARY196-0361-003-00** |
| Antenna Type: | **Internal** |
| Version No. : | **02** |


Contact Information:
Tel:02-2647-1896

PM: **Paul Lin**
paul_lin @wieson.com
Ext.6636

Engineer: **George Hung**
george_hung@wieson.com
Ext.6687


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## Revision History

| Revision | Date | Engineer | Description |
|---|---|---|---|
| 01 | 2020/07/15 | vicky | NEW RELEASE |
| 02 | 2022/09/15 | George Hung | Add Equipment List |


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# I. ELECTRONIC CHARACTERISTICS

| Item | Specification |
|---|---|
| **Operating Frequency(GHz)** | 2.4-2.5 |
| **Bandwidth** | 100 MHz (Min.) |
| **Return Loss** | -10 dB (Max) |
| **Polarization** | Linear |
| **Azimuth Bandwidth** | Omni-directional |
| **Peak Gain** | 2.5 dBi (Max) |
| **Impedance** | 50Ω |
| **Material** | FPC |
| **Maximum Power** | 1W |
| **V.S.W.R** | 2 : 1 |
| **Radiation** | Omni directional |
| **Efficiency** | > 40% |
| **Cable type** | OD:0.81 |
| **Operating Temperature** | -10~60℃ |
| **Storage temp** | -10~70℃ |

## Ⅱ. Summary：

This report to account for the measurement setup and result of the Antenna.
The measurement setup includes s-parameter, pattern, and gain measurement.
The measured data for Antenna are presented and analysis.

## Ⅲ. S-Parameter Measurement：

### A. Reflection coefficient :

(a) Instrument：Network Analyzer.

(b) Setup：

(1) Calibrate the Network Analyzer by one port calibration using O.S.L. calibration kits.
(2) Connect the antenna under test to the Network Analyzer.
(3) Measure the S11(reflection coefficient) shown in Fig. 1.
(4) Generally, the S11 is less than –10dB to ensure the 90% power into antenna and only less than 10% power back to system.

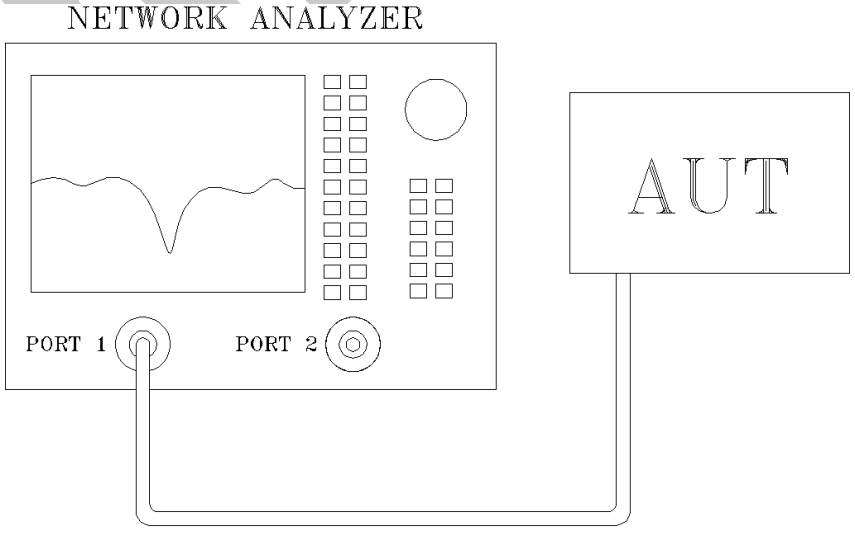


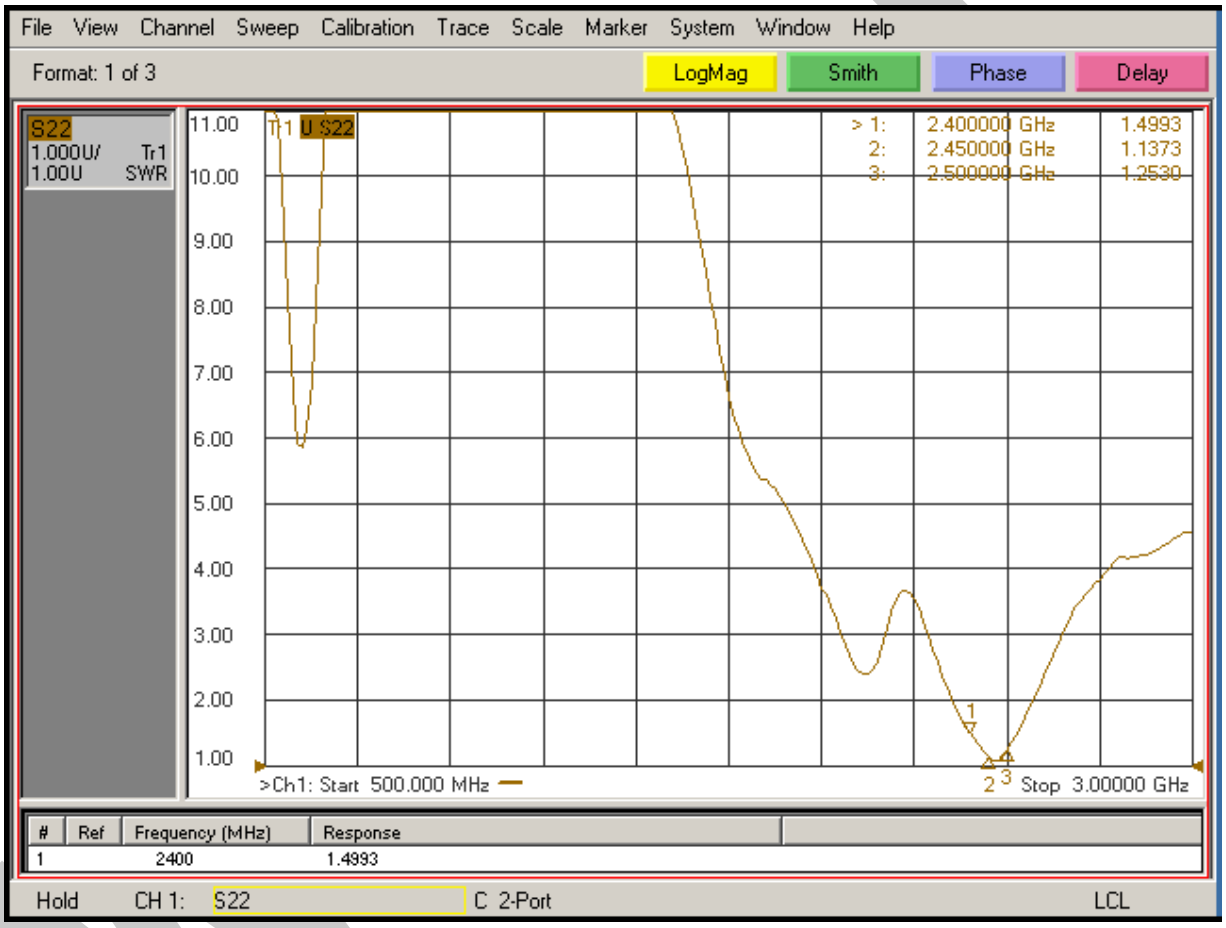

Fig.1 Antenna measured in Network Analyzer

## V. S-Parameter Measurement Result：

Return Loss

| Frequency (MHz) | 2400 | 2450 | 2500 |
|---|---|---|---|
| dB | -13.99 | -23.84 | -18.99 |

## VSWR

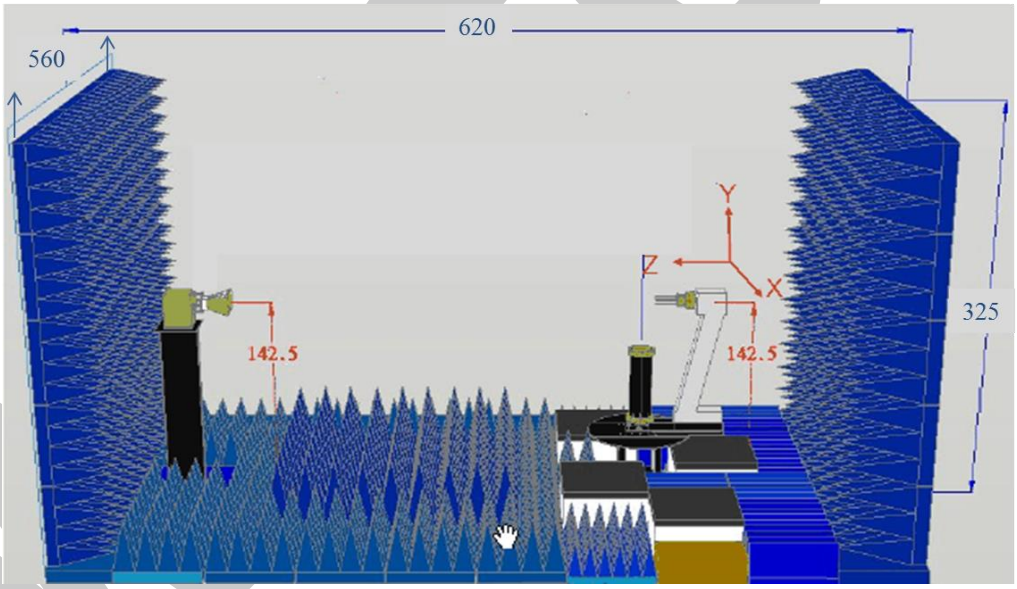



| Frequency (MHz) | 2400 | 2450 | 2500 |
|---|---|---|---|
| VSWR | 1.49 | 1.13 | 1.25 |

# VI. The Test Information Anechoic Chamber

## A. Scope

This statement of work defines the requirements of a far-field antenna measurement range, which includes
(1) One 560 cm (W) x 325 cm (H) x 620 cm (L) Antenna Measurement Anechoic Chamber, detailed requirements refer section B .
(2) One Far-field Antenna Measurement System with spinning linear CP measurement capabilities, detailed requirement refer section E & F .
(3) One broad-band transmitted antenna, detailed requirements refer section G .




## B. Antenna Measurement Anechoic Chamber

Fully anechoic chamber with dimension 560 cm in width, 325 cm in height and 620 cm in length. The quiet zone of this Chamber shall be greater than

60 cm @ 400MHz~900MHz, 43 cm @2.4 GHz, 31 cm @5.8 GHz,. Contractor should be aware of this anechoic chamber is going to be used for performing far-filed antenna measurement.

C. Electrical specifications

Frequency Range: 400 MHz to 6 GHz,
Quiet zone size: >60 cm @ 400MHz~900MHz, >43 cm @2.4 GHz,
>31 cm @5.8 GHz.
Quiet zone ripple: < +/- 1.5 dB @500(400)MHz~800MHz, < +/-0.75 dB @800MHz~1.5GHz, < +/- 0.5 dB @1.5GHz~6.0GHz

| **Field Probing Frequency** | **Peak-to-Peak Amplitude Taper (Within specified Quiet Zone Area)** | **Quiet Zone Size (cm)** | **Compliant** |
|---|---|---|---|
| 0.9 GHz | < 0.75 dB | 60 | Yes |
| 1.575 GHz | < 0.5 dB | 43 | Yes |
| 1.8 GHz | < 0.5 dB | 43 | Yes |
| 2.4 GHz | < 0.5 dB | 43 | Yes |
| 5.8 GHz | < 0.5 dB | 31 | Yes |

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## D. Absorbers

We shall design and install proper absorbers on the inner walls of the chamber to guarantee the electrical specifications. However, the absorbers height shall be no less than 24" which enables the space in the chamber to be around 438 cm (W) x 203 cm (H) x 513 cm (L). All the absorber used shall meet NRL-8093 fire retardant regulations

## E. Far-field Antenna Measurement System

We shall supply all the hardware and software which are capable of characterizing antenna radiation patterns from 30 KHz to 6 GHz using the existed Agilent 5230A PNA-L or Agilent 8753ES Vector Network Analyzer. The system shall be able to automatically measure and plot single axis amplitude and phase antenna patterns in either Cartesian or polar formats.

## F. Far-field measurement software

The software consists of the control or data acquisition software and the data plotting software.

(1) The data acquisition software shall at least be capable of the following functions:
*measuring single frequency per cut - single axis (azimuth); system can automatically switch frequency at the end of a scan.
*measuring data in Uni-direction or bi-direction
*measuring data at least with azimuth 360 degrees. (+/- 180 degrees or 0-360 degrees)
*real time plot in Cartesian or polar format
*screen shows real time angle position

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*system automatically calculates S/N ratio level based on measured signal fluctuation
*function to set positioner zero position
*operator can set data taking velocity and data sampling interval
*entry to allow positioner offset to any angle

(2) The data plotting software shall at least be capable of the following functions:
*Editing plot data
*plotting data in Cartesian, Polar or delimited ASCII output with header information
*plotting data in linear or dB scales
*normalizing data to peak (dB), standard gain reference (dBi), or no normalization
*overlaying data, (drag and drop capability is preferable)
*outputting data to any Windows supported printers

## G. Broadband Transmitted antenna

We shall provide a linear-polarized broadband antenna with the specifications better than those listed hereafter in this article,
Frequency: 0.5-6 GHz, Gain: >12 dBi @10 GHz, VSWR:<2,0:1, Front to Back Ration > 20 dB

## H. Equipment List

| Device | Ttype/Model | Serial# | Manufacturer | Cal. Date | Cal. Due Date |
|---|---|---|---|---|---|
| Anechoic Chamber | FFC-600L | FFC-600L-285 | wavepro | 30-Apr-22 | 30-Apr-23 |
| Network Anylyzer | N5230A | MY45000163 | Agilent Technologies | 11-May-21 | 11-May-23 |
| Turntable | NSI-SC-5606-3DZ | 011 | NSI-MI | N/A | N/A |
| Measurement SW | NSI 2000 | SOM-SM-2000-V4 | NSI-MI | N/A | N/A |
| Dual Polarization Vivaldi Antenna 0.6~8GHz | - | - | WavePro Inc. | 30-Oct-20 | 30-Oct-23 |
| Computer Monitor | HS-CM145 | 0410006420 | CCTVINDIA | 30-Aug-20 | 30-Aug-23 |
| Industrial PC | IPC-610BP | | Advantech Co., Ltd | 30-Aug-20 | 30-Aug-23 |
| Standard Beam Controller (SBC) | NSI-RF-5918 | 070 | NSI-MI | 30-Oct-20 | 30-Oct-23 |
| Antenna Range Controller (ARC | NSI-SC-5911-4 | 0335 | NSI-MI | 30-Oct-20 | 30-Oct-23 |
| RF Cable 240in 22GHz | UFA210C-1-2400-300300 | MFR 64639 207908-005 | Carlisle Interconnect Tech. | 30-Aug-20 | 30-Aug-23 |
| RF Cable 240in 22GHz | UFA210C-1-2400-300300 | MFR 64639 209026-013 | Carlisle Interconnect Tech. | 30-Aug-20 | 30-Aug-23 |
| RF Cable 60cm 26.5GHz | EC-A5-60-1678 | Z0066 | E-INSTUMENT TECH LTD. | 30-Aug-20 | 30-Aug-23 |

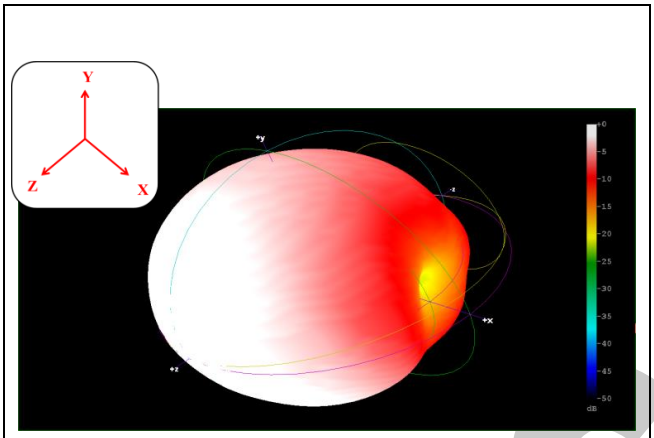
## Ⅶ. Antenna Measurement Photo-see Annex

## Ⅷ. Antenna Measurement Result

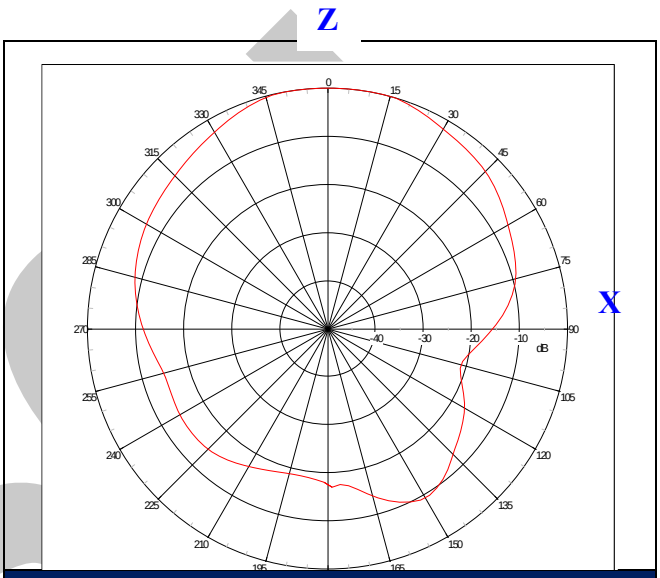
| Freq(MHz) | Gain(dBi) | 3D-avgGain(dBi) | Efficiency(%) |
|---|---|---|---|
| 2400 | 2.28 | -3.88 | 40.93 |
| 2410 | 2.21 | -3.85 | 41.21 |
| 2420 | 2.18 | -3.76 | 42.07 |
| 2430 | 2.28 | -3.61 | 43.55 |
| 2440 | 2.43 | -3.4 | 45.71 |
| 2450 | 2.5 | -3.24 | 47.42 |
| 2460 | 2.24 | -3.35 | 46.24 |
| 2470 | 2.24 | -3.3 | 46.77 |
| 2480 | 1.96 | -3.52 | 44.46 |
| 2490 | 1.71 | -3.76 | 42.07 |
| 2500 | 1.59 | -3.94 | 40.36 |

# IX. 3D Radiation Pattern

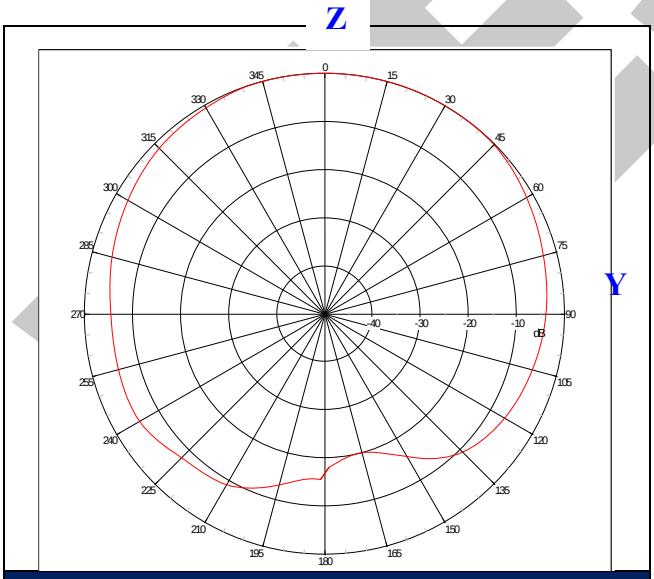
## 2.4GHz



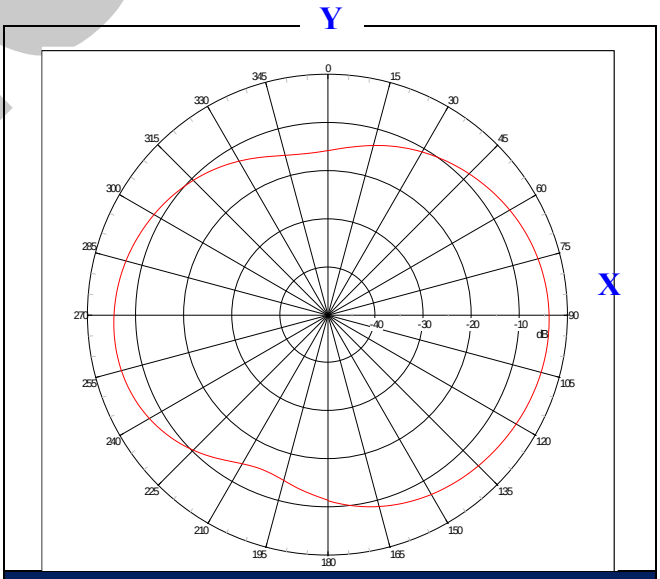

3D Pattern




Far-field Pattern @Phi=0 deg. (E-Theta Plane-Cut)

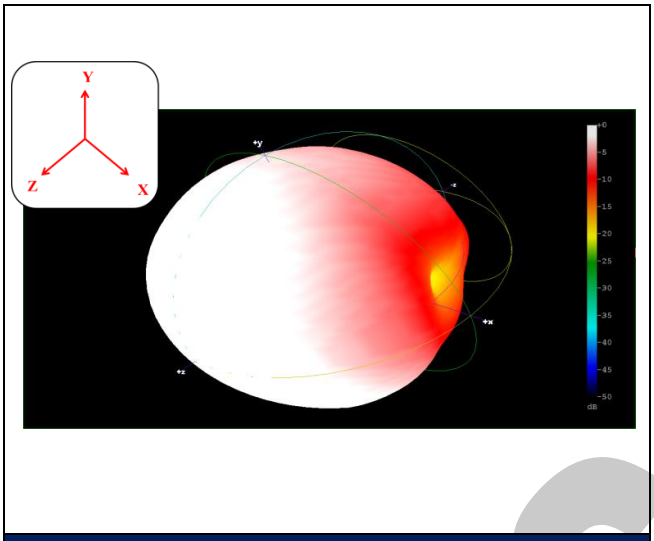



Far-field Pattern @Phi=90 deg. (E-Theta Plane-Cut)

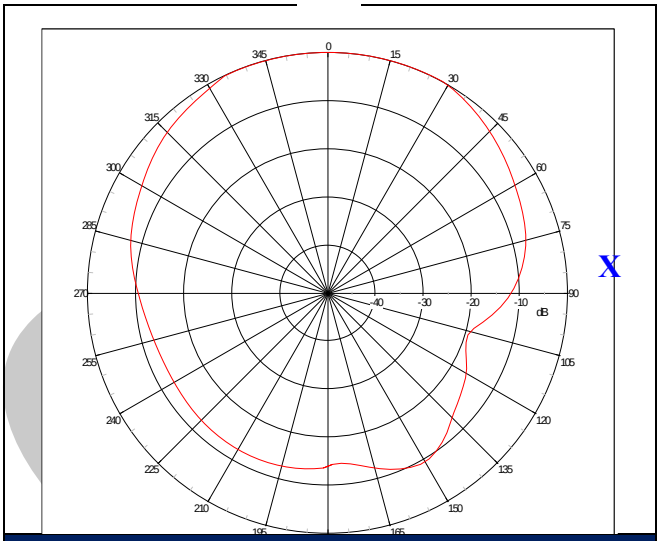



Far-field Pattern @Theta=90 deg. (E-Phi Plane-Cut)

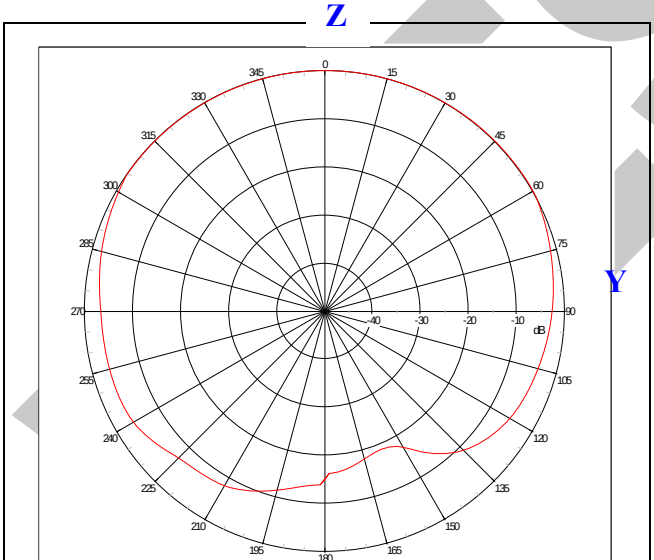
## 2.45GHz



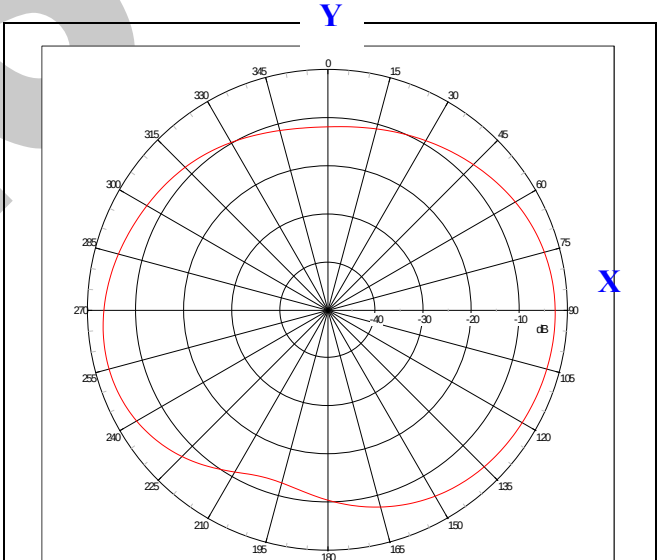

3D Pattern




Far-field Pattern @Phi=0 deg. (E-Theta Plane-Cut)

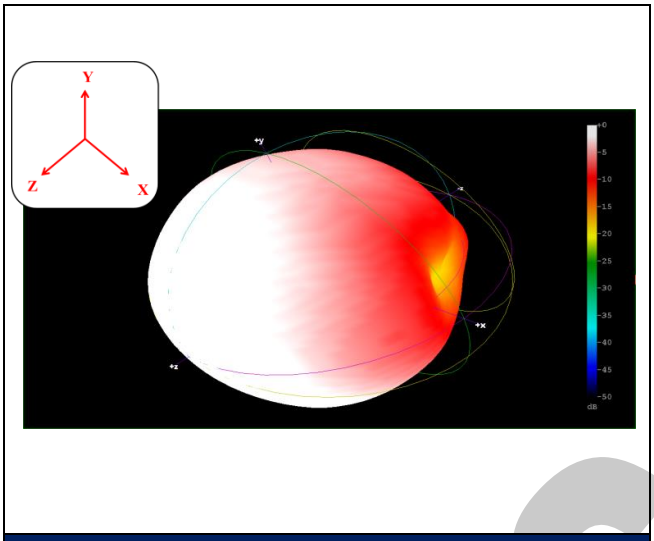



Far-field Pattern @Phi=90 deg. (E-Theta Plane-Cut)

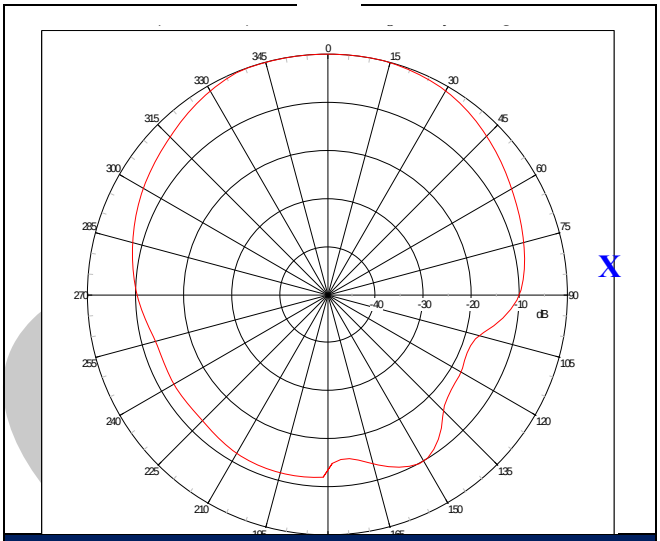



Far-field Pattern @Theta=90 deg. (E-Phi Plane-Cut)

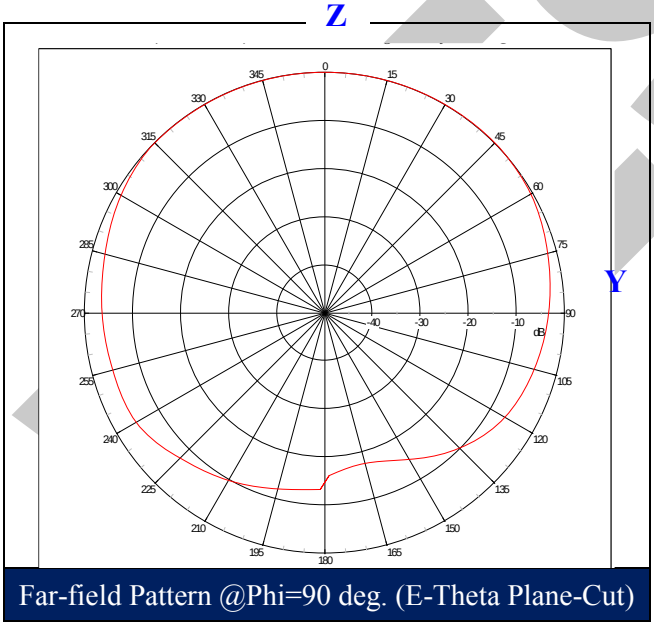
## 2.5GHz



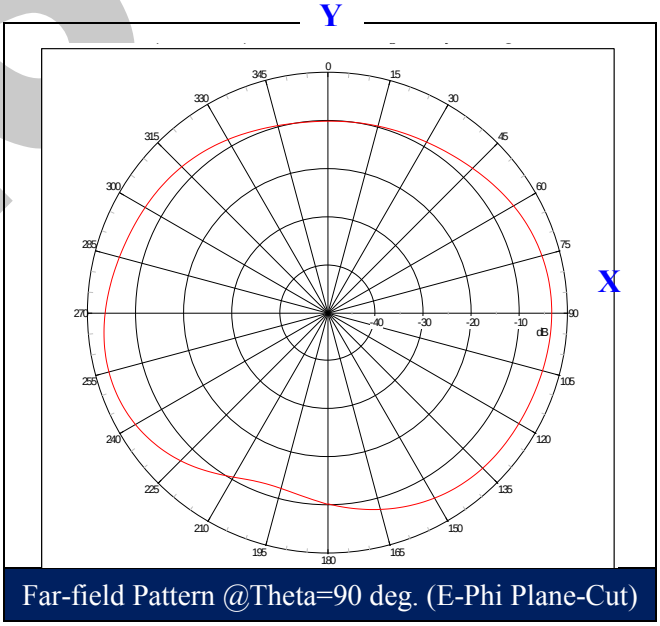

3D Pattern




Far-field Pattern @Phi=0 deg. (E-Theta Plane-Cut)




Far-field Pattern @Phi=90 deg. (E-Theta Plane-Cut)

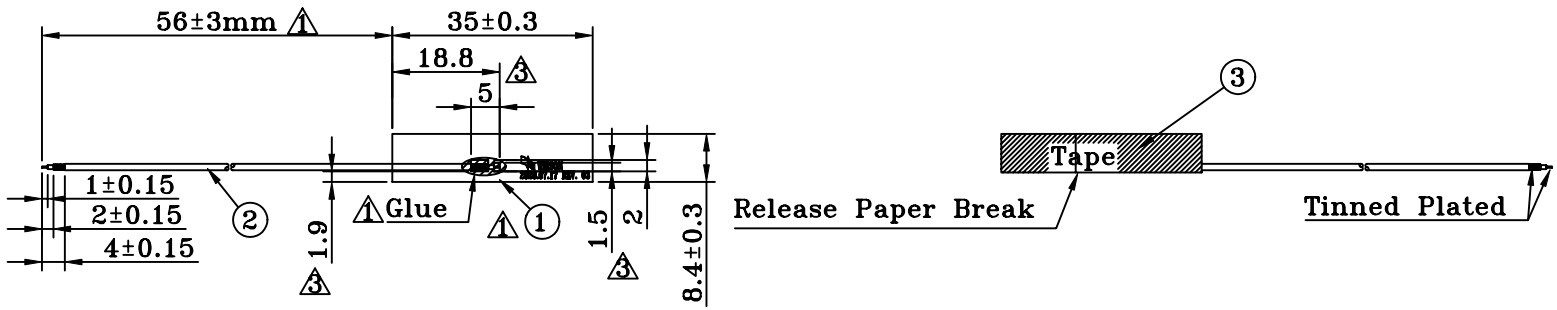



Far-field Pattern @Theta=90 deg. (E-Phi Plane-Cut)

Customer Drawing

RoHS Compliant

| REV | DATE | DESCRIPTION | ECN NO. | NAME |
|---|---|---|---|---|
| 01 | 20.07.03 | NEW RELEASE | | JAY |
| 02 | 20.07.15 | 1 Modify FPC & Cable Length & Add Glue | | JAY |
| 03 | 20.07.17 | 2 Modify FPC Size | | JAY |
| 04 | 20.09.02 | 3 Add Size | | JAY |




Note:
1.Frequency:2.4~2.5GHz
2.V.S.W.R.:≤2(With Case)
3.Efficiency:>40%
4.Impedance:50ohm

| NO. | ITEM | DESCRIPTION | QTY |
|---|---|---|---|
| ⑦ | | | |
| ⑥ | | | |
| ⑤ | | | |
| ④ | | | |
| ③ | Tape | 3M9448HK Tape , Size:35 x 8.4mm 1 2 | 1 |
| ② | Cable | 0.81mm Normal Coaxial Cable , FEP Black Jacket | 1 |
| ① | FPC | FPC , FPC Size: 35 x 8.4mm 1 2 | 1 |

WIESON TECHNOLOGIES CO., LTD

PART NO.: ARY196-0361-003-00

TITLE: ANTENNA

| | | | | | |
|---|---|---|---|---|---|
| DRAWN BY | JAY(WST) | DRAWING NO. | WSTSXXXXXX | | |
| CHECKED BY | | DRAWING SIZE | | A4 | |
| APPROVED BY | | UNIT | mm | | |
| SORTING NO. | WSC | PAGE | 1 OF 1 | | |

(SR-83-08)