WHA YU INDUSTRIAL CO., LTD.
No. 326 Sec 2. Kung Tao 5 Road,
Hsin Chu City, Taiwan
www.whayu.com

# Antenna Design For

# 鴻海 U10C093

**V1.06**

| | |
|---|---|
| **Document Number** | **NE3-14017** |
| **1st Released Date** | **02/07/2014** |
| **Last Released Date** | **07/08/2013** |
| **Author** | **David Feng** |
| **Review by** | **Sky** |

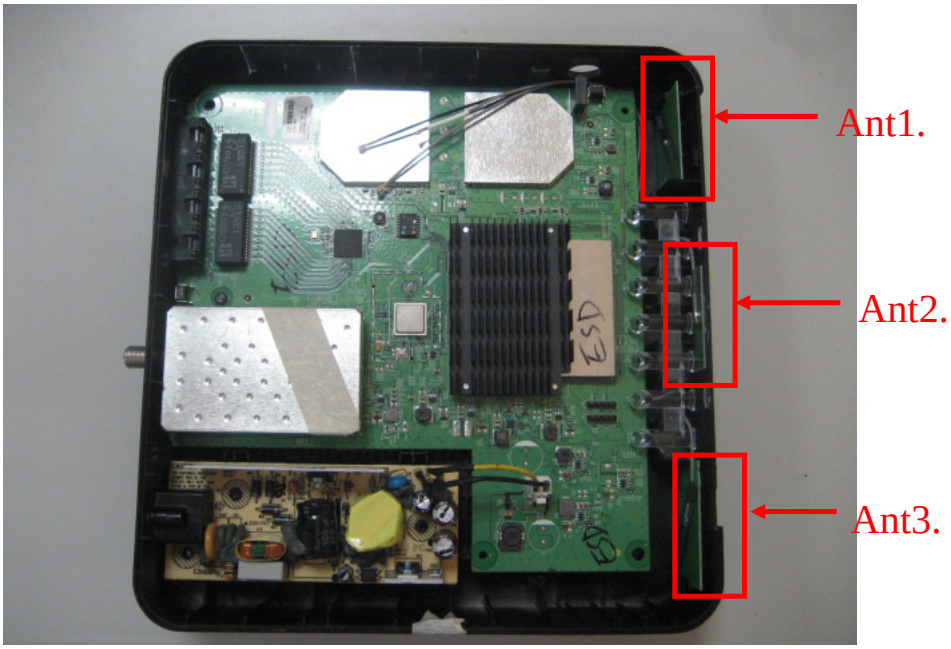
# Revised History

| Date | Version | Revised Record |
|---|---|---|
| 02/11/14 | 1.00 | ● 1st released |
| 03/06/14 | 1.01 | 天線設計於客戶 Mock-up 機台中. |
| 03/12/14 | 1.02 | Ant3 變更設計,線徑為 1.37mm. |
| 03/21/14 | 1.03 | Ant2 and Ant3 變更設計,線徑為 1.37mm. |
| 05/05/14 | 1.04 | Ant2 and Ant3 變更線材固定方式. |
| 06/27/14 | 1.05 | 變更天線設計與線材出線方式. |
| 07/08/14 | 1.06 | 變更天線設計. |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# Electrical Specification

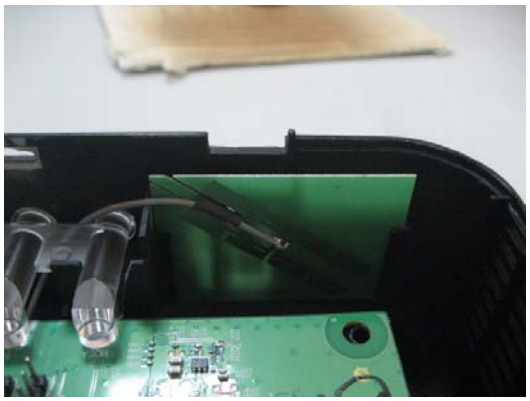
| **Rough description** | **Dual Band PCB antenna for U10C093** | |
|---|---|---|
| Item | Initial Specification | Final Specification |
| **Dimensions** | Ant1. (L)44*(W)35*(H)0.8mm<br>Ant2. (L) 41.65*(W)12.25*(H)0.8mm<br>Ant3. (L)50*(W)35*(H)0.8mm | |
| **Impedance** | 50Ω | |
| **Test environment** | With Housing | |
| **Spectrum** | 802.11 abcgn | |
| **Freq. Range** | 2.4~2.5GHz / 4.9~5.825GHz | |
| **Antenna type** | PCB ANT | |
| **Gain** | 6.0Max. @ 2GHz<br>5.0 Max. @ 5GHz | |
| **VSWR** | 1.92：1 | |
| **Radiation** | Omni | |
| **Polarization** | Linear | |
| **HPBW / H** | None | |
| **HPBW / E** | None | |
| **Rad. efficiency** | 60% | |
| **Connector type** | I-PEX | |
| **Cable type** | Φ1.37mm | |
| **Cable length** | None | |
| **Isolation** | -20 dB (MAX.) | |

1. Antennas setup and environment



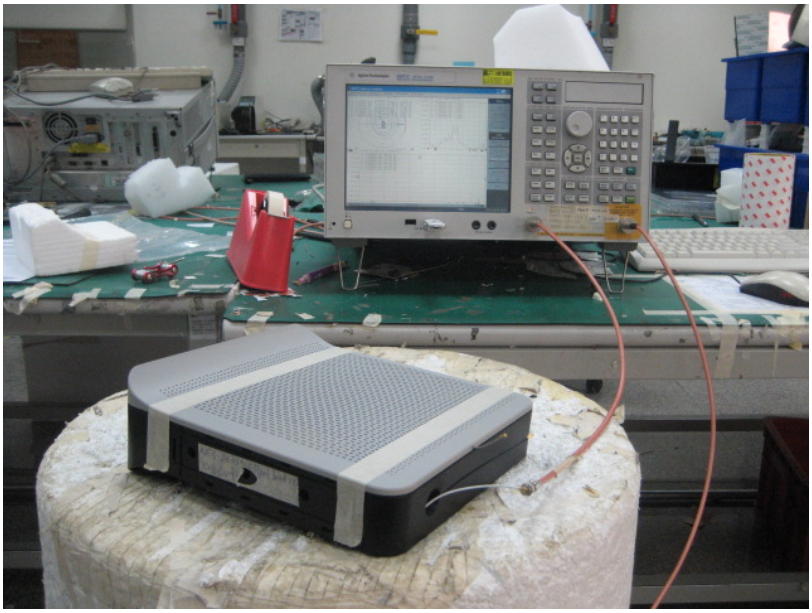
Ant1.
Dimension: (L)44mm*(W)35mm*(H)0.8mm
Φ1.37mm Cable Length: 142mm (Black)

Ant2.
Dimension: (L) 41.65*(W)12.25*(H)0.8mm
Φ1.37mm Cable Length: 243mm (Gray)



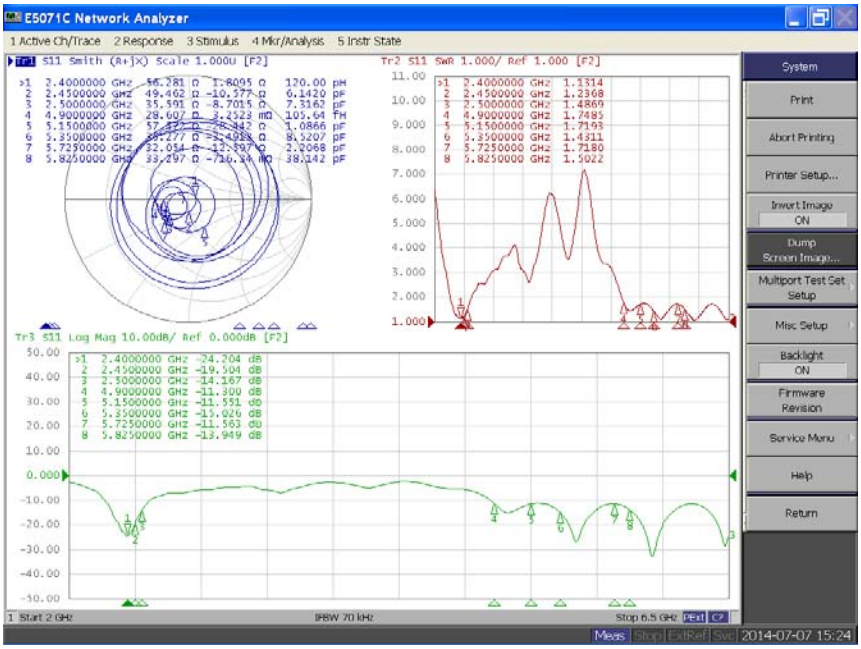
Ant3.
Dimension: (L)50mm*(W)35mm*(H)0.8mm
Φ1.37mm Cable Length: 288mm (White)

## 2. Network Analyzer Measurement Test Environment

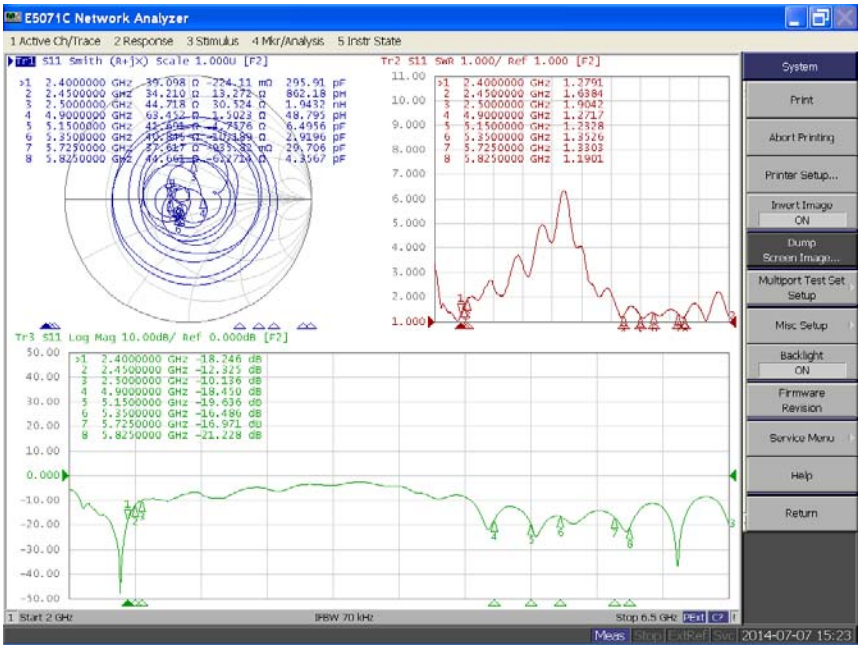


## 2.1 S-parameter Test Results

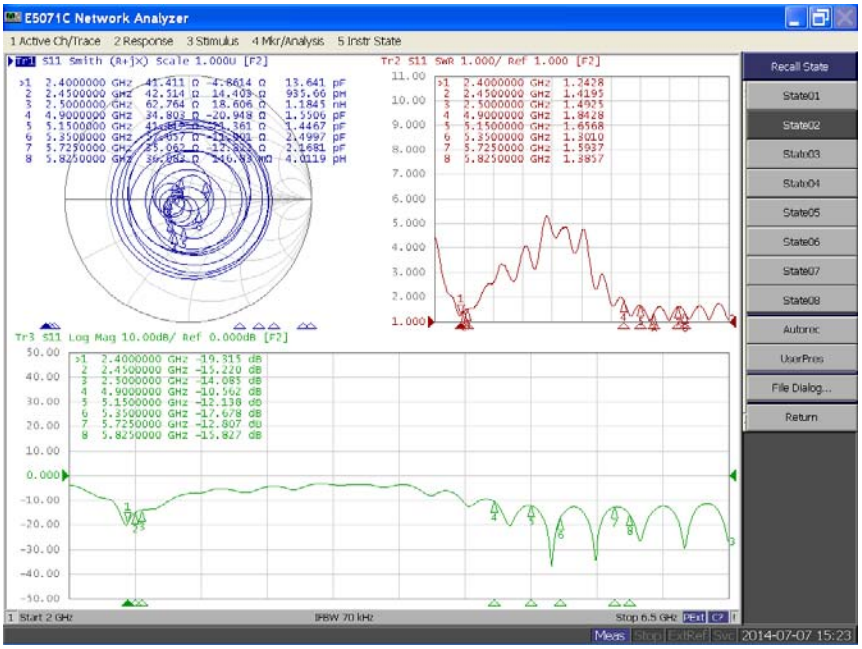
### 2.1.1 Ant1.




### 2.1.2 Ant2.



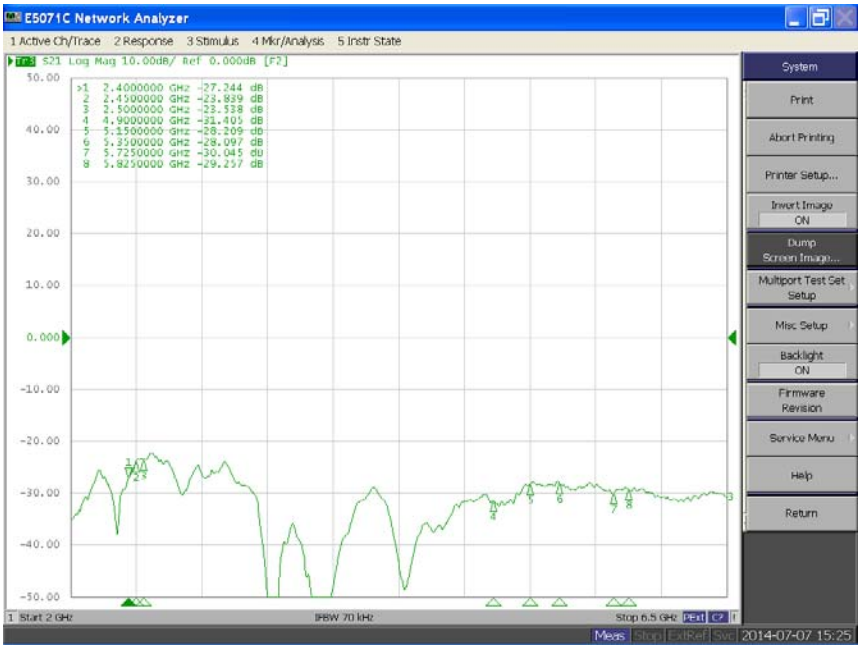
### 2.1.3 Ant3.




## 2.2 Isolation

### 2.2.1 Ant1. & Ant2.

## 2.2.2 Ant1. & Ant3.




## 2.2.3 Ant2. & Ant3.

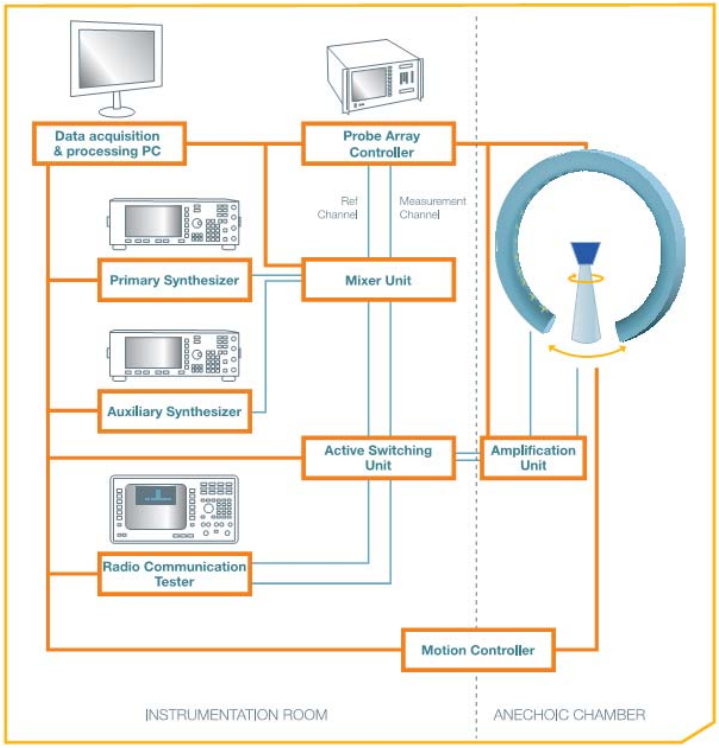
# 3. Gain & Patterns test results

## 3.1 Lab information

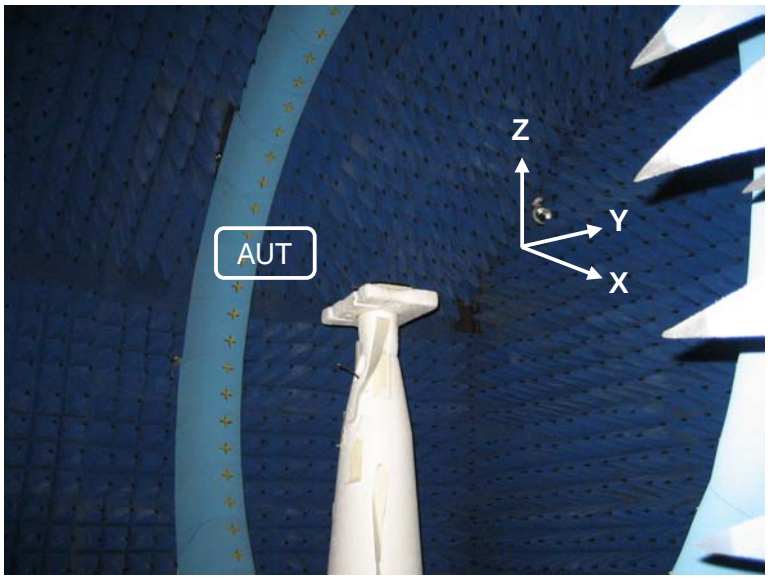
- Lab name：Satimo
- Address ：No.326 Sec.2, Kung Tao 5 Road, HsinChu City, Taiwan
- Certification：none (Satimo system certification: CTIA, 3GPP, Wi-Fi alliance and WiMAX Forum)
- Size (LxWxH)：5m x 5m x 5m
- Isolation level：>100dB
- Normal applications：antenna radiation pattern measurement, OTA performance testing.
- Frequency measurement range：0.4 to 6 GHz
- EUT scanning method：conical cut method
- Measurement distance：1.6m
- Measurement antenna specification (for $\theta$ and Φ polarization each)：dual polarization antenna for 0.4 to 6.0 GHz frequency range

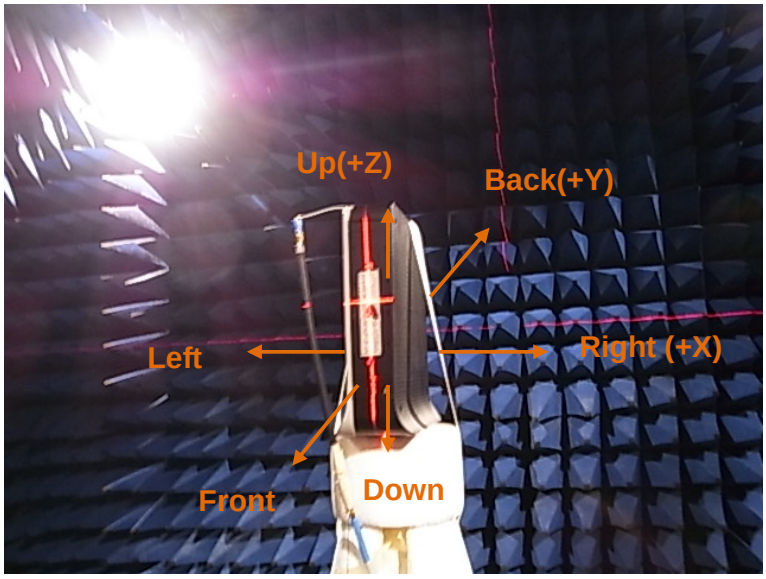
0.4 to 6.0 GHz probe

- Equipment list：

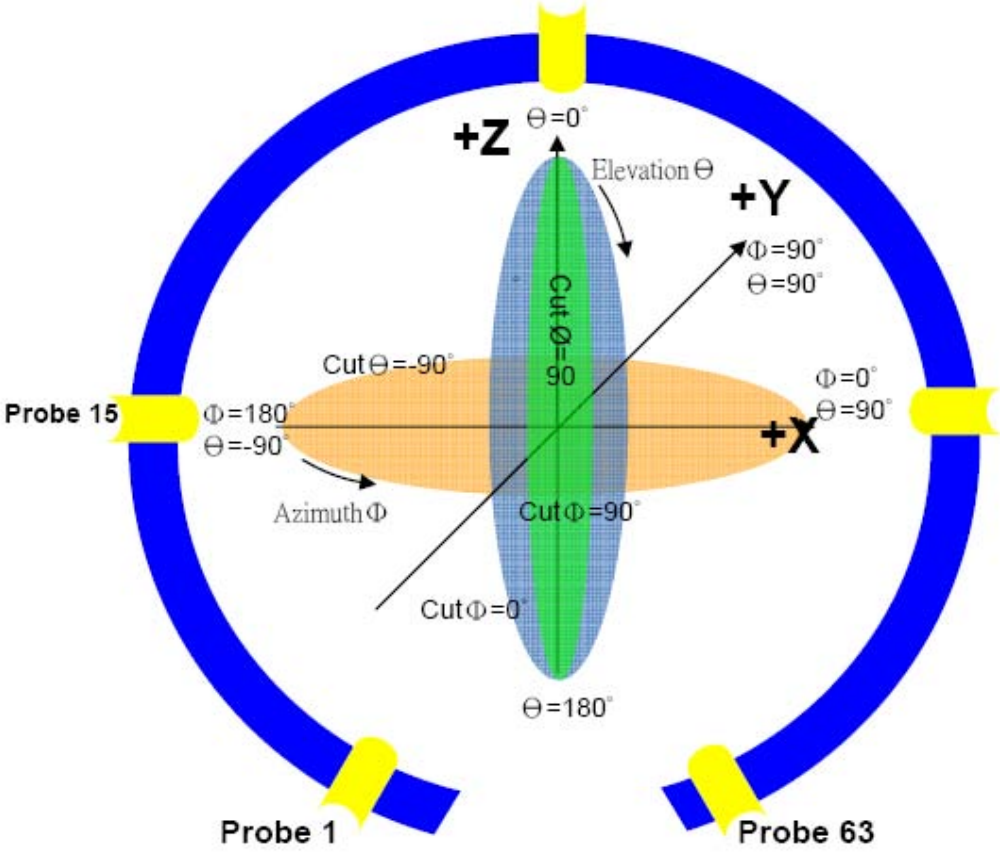


## 3.2 Measurement setting



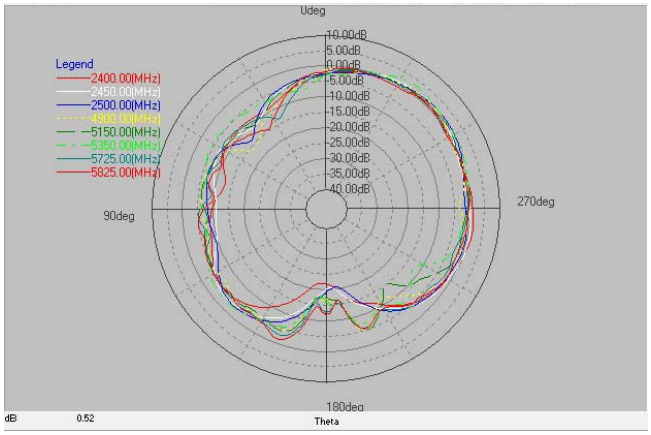

| | XY | YZ | XZ |
|---|---|---|---|
| 0° | Right | Up | Up |
| 90° | Back | Back | Right |
| 180° | Left | Down | Down |
| 270° | Front | Front | Left |



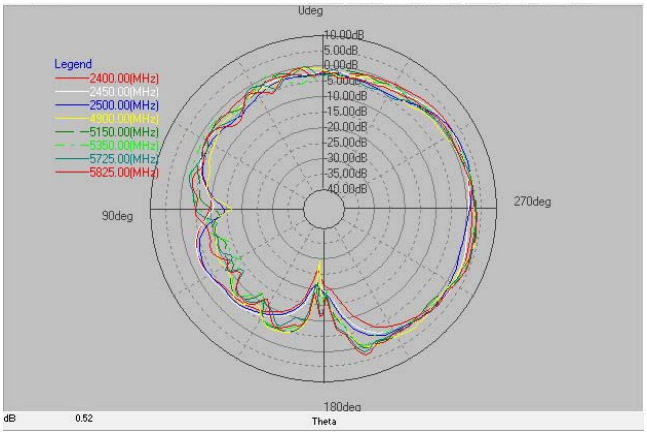

| | θ | φ |
|---|---|---|
| Total angle | 175˚ | 360˚ |
| How many angle scan one point | 5˚ | 5˚ |
| Total scan point | 36 | 73 |

## 3.3 2D patterns

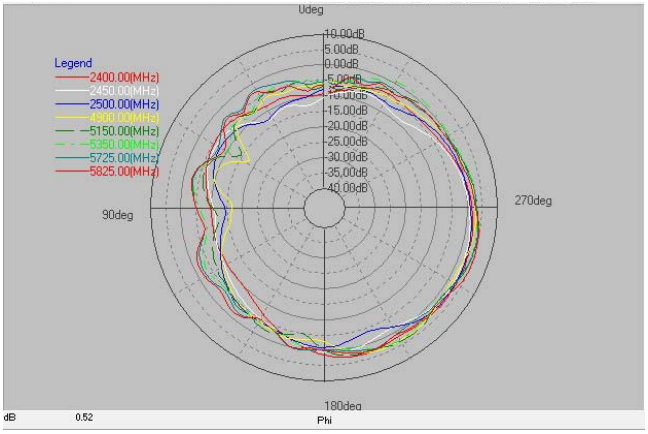
### 3.3.1 Ant1.




**X-Z Plane (E-total)**

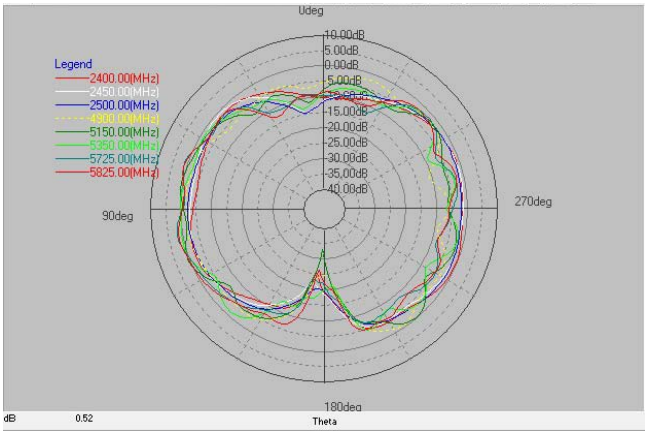



**Y-Z Plane (E-total)**

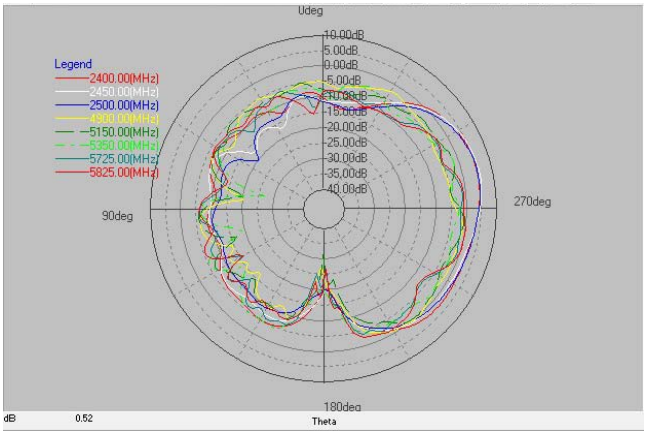



**X-Y Plane (E-total)**

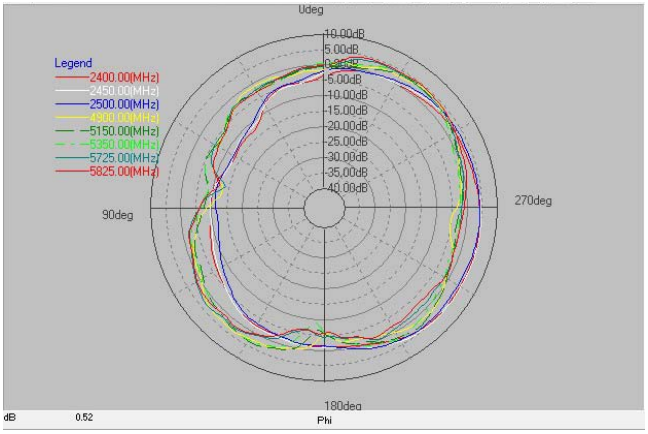
### 3.3.2 Ant2.




**X-Z Plane (E-total)**

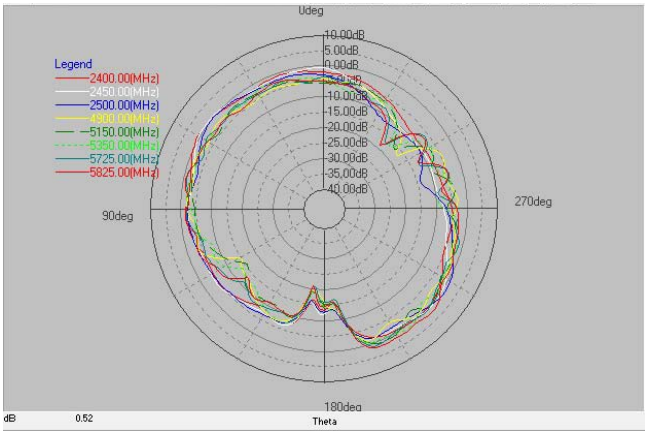



**Y-Z Plane (E-total)**

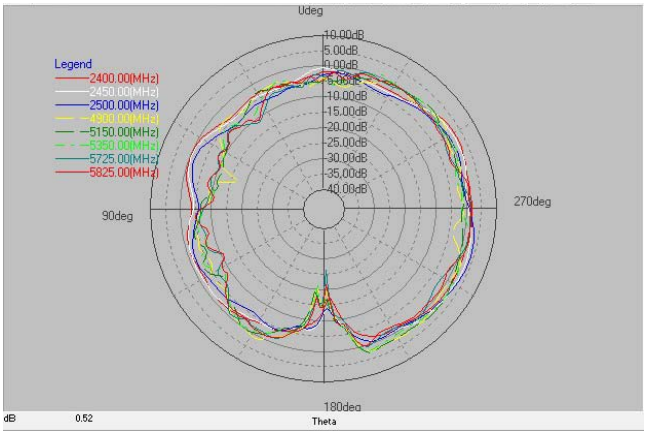



**X-Y Plane (E-total)**

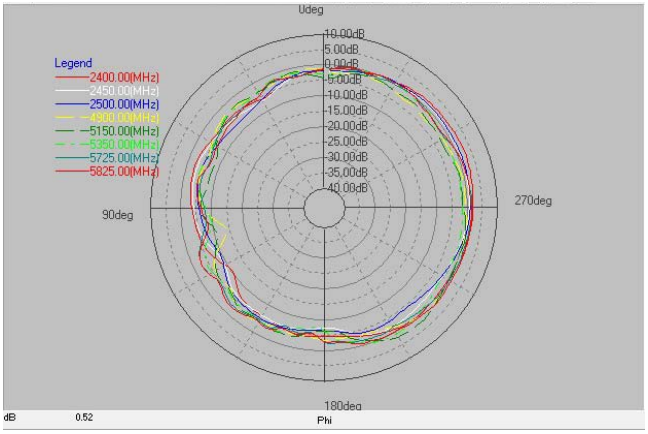
### 3.3.3 Ant3.




**X-Z Plane (E-total)**




**Y-Z Plane (E-total)**




**X-Y Plane (E-total)**

# 4. Summary

## 4.1 Return Loss

| Frequency | Ant 1 (dB) | Ant 2 (dB) | Ant 3 (dB) |
|---|---|---|---|
| 2400MHz | -24.2 | -18.2 | -19.3 |
| 2450MHz | -19.5 | -12.3 | -15.2 |
| 2500MHz | -14.1 | -10.1 | -14.0 |
| 4900MHz | -11.3 | -18.4 | -10.5 |
| 5150MHz | -11.5 | -19.6 | -12.1 |
| 5350MHz | -15.0 | -16.4 | -17.6 |
| 5725MHz | -11.5 | -16.9 | -12.8 |
| 5825MHz | -13.9 | -21.2 | -15.8 |

## 4.2 Isolation

| Frequency | Isolation Ant 1&Ant2 (dB) | Isolation Ant 1&Ant3 (dB) | Isolation Ant 2&Ant3 (dB) |
|---|---|---|---|
| 2400MHz | -22.6 | -27.2 | -24.3 |
| 2450MHz | -24.2 | -23.8 | -23.8 |
| 2500MHz | -27.9 | -23.5 | -23.8 |
| 4900MHz | -29.8 | -31.4 | -33.3 |
| 5150MHz | -31.2 | -28.2 | -35.9 |
| 5350MHz | -32.6 | -28.0 | -33.2 |
| 5725MHz | -29.1 | -30.0 | -30.2 |
| 5825MHz | -28.6 | -29.2 | -31.3 |

## 4.3 3D total Peak Gain & Efficiency

| Frequency | Ant 1 | | Ant2 | | Ant3 | |
|---|---|---|---|---|---|---|
| | Peak Gain (dBi) | Efficiency (%) | Peak Gain (dBi) | Efficiency (%) | Peak Gain (dBi) | Efficiency (%) |
| 2400MHz | 4.5 | 70.6 | 5.5 | 73.7 | 3.2 | 70.7 |
| 2450MHz | 4.8 | 67.1 | 6.0 | 73.9 | 3.2 | 67.6 |
| 2500MHz | 5.6 | 63.4 | 5.3 | 69.1 | 4.0 | 61.9 |
| 4900MHz | 4.2 | 65.9 | 4.1 | 62.6 | 2.8 | 60.7 |
| 5150MHz | 4.6 | 68.7 | 4.8 | 69.2 | 4.4 | 64.2 |
| 5350MHz | 4.3 | 73.5 | 4.3 | 64.6 | 4.4 | 64.1 |
| 5725MHz | 4.4 | 65.5 | 4.5 | 62.0 | 4.0 | 60.4 |
| 5825MHz | 5.0 | 69.2 | 4.8 | 66.2 | 4.3 | 65.3 |