



# Antenna Test Report

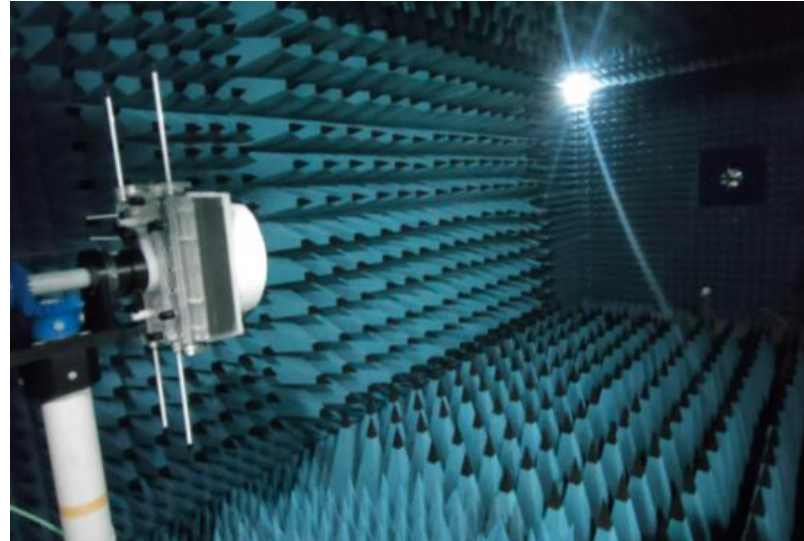
A faint, light blue world map is visible in the background of the lower left section of the slide.

**Senao Networks Inc.**

This report provides Wi-Fi antenna passive measurement results which include:

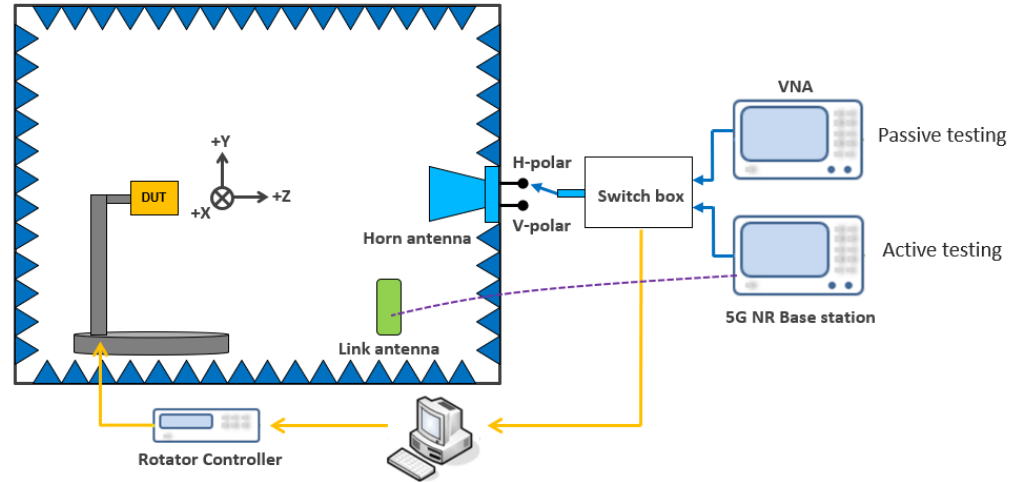
- General Information
- Antenna Measurement System Information
- Test Procedure
- DUT Information
- Single Antenna Test Result
- Directional Gain Result
- Set-up Photo

- Antenna Vendor : AWAN
- Test Date : 2026/01/26
- Test Engineer : Tony.Duan
- Measurement System : BWANT
- Software Name : BWANT 3D Passive
- Software Version : 2025061601



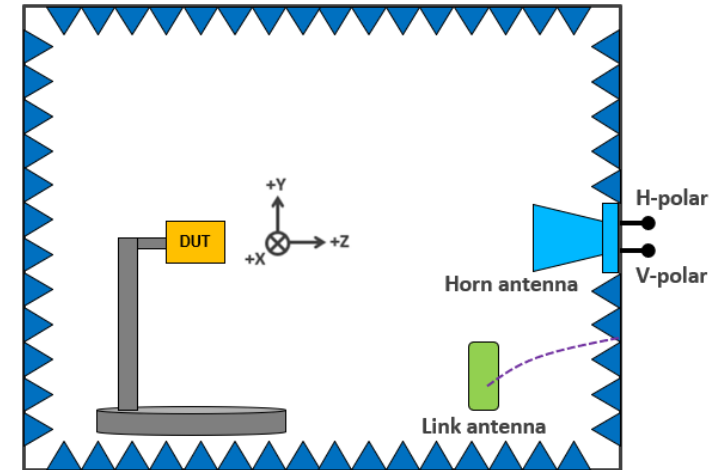
# Antenna Measurement System Information

- Measurement System: BWANT Chamber
- Measurement setup:
  - Pattern & Gain measurement
    1. BWANT chamber
    2. BWANT program (BWANT 3D Passive)
    3. System overview
  - Test item
    1. Antenna passive test 600MHz~8.5GHz
- Calibration Information

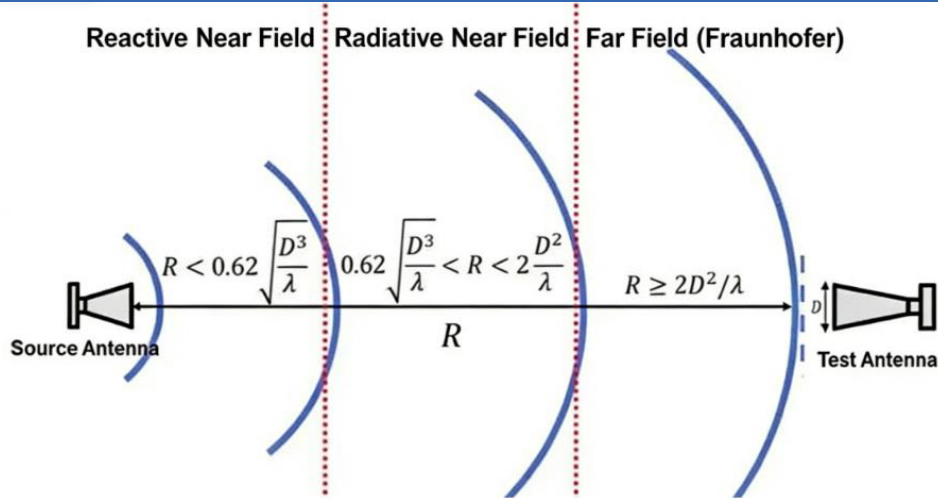


| Description      | Model No. | Serial #   | Calibration Date | Calibration Until |
|------------------|-----------|------------|------------------|-------------------|
| Chamber          | NA        | NA         | 2025/06/04       | 2026/06/03        |
| Network Analyzer | E5063A    | MY54101300 | 2025/10/09       | 2026/10/08        |

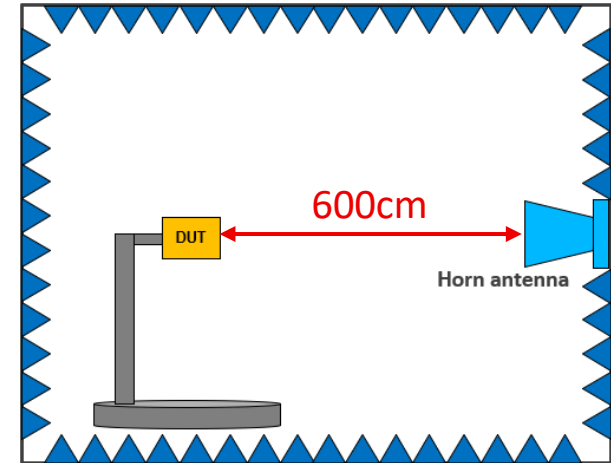
1. Place the device to be tested on the fixture and align it with the center of the chamber.
2. Connect the antenna cable to the RF connector of the chamber.
3. Use the SW to configure parameters (antenna name, frequency points, measurement angles, antenna dimension), and then run the test SW (BWANT 3D Passive).
4. By phi from  $0^{\circ}$  to  $360^{\circ}$  and theta from  $0^{\circ}$  to  $180^{\circ}$  with a step size of 2 degrees, get the 3D data, including efficiency, peak gain, 2D and 3D radiation patterns.
5. This is far field test for antenna verification.
6. This is passive measurement, which means the device is off and not in any operating mode.



# Test Measurement System Far Field Information



R: Far-field starting distance  
 $\lambda$  : operating wavelength ( $\lambda=c/f$ )  
 D: Antenna Size



| Frequency (MHz) | Near Field        | Far Field             | EUT to Measurement antenna distance |
|-----------------|-------------------|-----------------------|-------------------------------------|
| 2500MHz         | $R < 16\text{cm}$ | $R \geq 65\text{cm}$  | $R = 600\text{cm}$                  |
| 5895MHz         | $R < 24\text{cm}$ | $R \geq 154\text{cm}$ | $R = 600\text{cm}$                  |

| Support band | TX/RX   | Operation mode         |
|--------------|---------|------------------------|
| 2.4G         | 2TX-2RX | 11b/11g/11n/11ax/11be  |
| 5G UNII-1    | 2TX-2RX | 11a/11n/11ac/11ax/11be |
| 5G UNII-2a   | 2TX-2RX | 11a/11n/11ac/11ax/11be |
| 5G UNII-2c   | 2TX-2RX | 11a/11n/11ac/11ax/11be |
| 5G UNII-3    | 2TX-2RX | 11a/11n/11ac/11ax/11be |

# DUT Information - DUT Operations Mode

| Band   | Modulation Mode   | CDD mode    | Beamforming mode |
|--------|-------------------|-------------|------------------|
| 2.4GHz | 802.11b           | Nss1        | Not Support      |
|        | 802.11g           | Nss1        | Not Support      |
|        | 802.11n (HT20)    | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11n (HT40)    | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11n (VHT20)   | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11n (VHT40)   | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ax (HE20)   | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ax (HE40)   | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11be (EHT20)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11be (EHT40)  | Nss1 / Nss2 | Nss1 / Nss2      |
| 5GHz   | 802.11a           | Nss1        | Not Support      |
|        | 802.11n (HT20)    | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11n (HT40)    | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ac (VHT20)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ac (VHT40)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ac (VHT80)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ac (VHT160) | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ax (HE20)   | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ax (HE40)   | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ax (HE80)   | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11ax (HE160)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11be (EHT20)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11be (EHT40)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11be (EHT80)  | Nss1 / Nss2 | Nss1 / Nss2      |
|        | 802.11be (EHT160) | Nss1 / Nss2 | Nss1 / Nss2      |

| Antenna No. | RF Chain No. | Brand | Model        | Support Function | Antenna Type | Connector Type |
|-------------|--------------|-------|--------------|------------------|--------------|----------------|
| Ant 1_2G    | 1            | AWAN  | 7102A1389000 | 2.4G             | Dipole       | RP-SMA         |
| Ant 2_2G    | 0            | AWAN  | 7102A1389000 | 2.4G             | Dipole       | RP-SMA         |
| Ant 3_5G    | 1            | AWAN  | 7102A1389000 | 5G               | Dipole       | RP-SMA         |
| Ant 4_5G    | 0            | AWAN  | 7102A1389000 | 5G               | Dipole       | RP-SMA         |

# Single Antenna Test Result - Antenna Peak Gain

| Individual Antenna Maximum Peak Gain |              |                      |                    |
|--------------------------------------|--------------|----------------------|--------------------|
| Antenna NO.                          | Model        | Test Frequency (MHz) | 3D Peak Gain (dBi) |
| Ant 1                                | 7102A1389000 | 2400                 | 3.11               |
|                                      |              | 2450                 | 3.04               |
|                                      |              | 2500                 | 3.77               |
| Ant 2                                | 7102A1389000 | 2400                 | 3.35               |
|                                      |              | 2450                 | 3.36               |
|                                      |              | 2500                 | 3.80               |
| Ant 3                                | 7102A1389000 | 5150                 | 3.40               |
|                                      |              | 5200                 | 2.88               |
|                                      |              | 5250                 | 4.16               |
|                                      |              | 5300                 | 3.50               |
|                                      |              | 5350                 | 3.36               |
|                                      |              | 5470                 | 3.08               |
|                                      |              | 5600                 | 3.43               |
|                                      |              | 5725                 | 4.53               |
|                                      |              | 5785                 | 4.69               |
|                                      |              | 5850                 | 4.90               |
|                                      |              | 5865                 | 4.74               |
| Ant 4                                | 7102A1389000 | 5895                 | 3.75               |
|                                      |              | 5150                 | 3.60               |
|                                      |              | 5200                 | 3.38               |
|                                      |              | 5250                 | 3.23               |
|                                      |              | 5300                 | 3.19               |
|                                      |              | 5350                 | 3.16               |
|                                      |              | 5470                 | 2.68               |
|                                      |              | 5600                 | 4.18               |
|                                      |              | 5725                 | 4.11               |
|                                      |              | 5785                 | 4.31               |
|                                      |              | 5850                 | 3.86               |
|                                      |              | 5865                 | 3.95               |
|                                      |              | 5895                 | 3.58               |

- Refer to the attached file: Single Antenna Test Result - 2D Radiation Pattern

- Refer to the attached file: Single Antenna Test Result – Raw Data

# Directional Gain Result - Procedure

- a) Sub-divide the whole sphere surface into many 2x2 degree subsection.
- b) Measure the gain contributed from each antenna within each subsection position.
- c) Apply the KDB 662911 D01 correlated directional gain formula to calculate directional gain for each subsection.
- d) After all subsections have been evaluated, the largest calculated value among all positions evaluated is picked as the worst-case directional gain for the system and used in RF/EMC test report.

## KDD 662911 D01 correlated directional gain formula

d) *Unequal antenna gains, with equal transmit powers.* For antenna gains given by  $G_1, G_2, \dots, G_N$  dBi

- (i) If transmit signals are *correlated*, then  
 Directional gain =  $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$  dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]
- (ii) If all transmit signals are *completely uncorrelated*, then  
 Directional gain =  $10 \log[(10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10}) / N_{ANT}]$  dBi

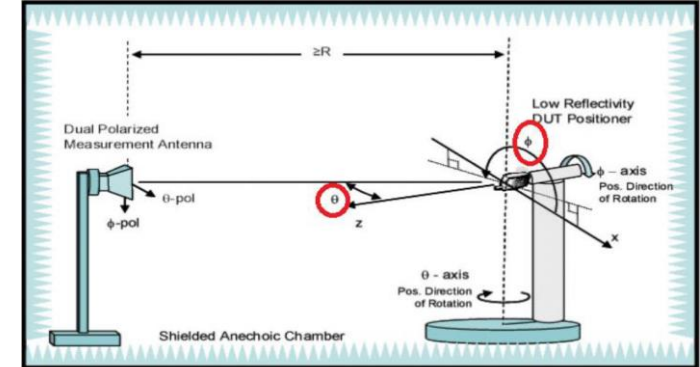
### Example:

Frequency: 2500MHz

Ant1 Max Gain: 2.63 at (135,345)

Ant2 Max Gain: 3.8 at (135,345)

Directional Gain =  $10 \log[(10^{(2.63/20)} + 10^{(3.8/20)})^2 / 2TX] = 6.25$  dBi



The definition of (θ, Φ) in antenna raw data.

# Directional Gain Result - Summary of Single antenna

| Individual Antenna Maximum Peak Gain (3D) |                    |           |            |            |            |            |         |           |           |            |            |            |           |           |           |           |
|-------------------------------------------|--------------------|-----------|------------|------------|------------|------------|---------|-----------|-----------|------------|------------|------------|-----------|-----------|-----------|-----------|
| Frequency (MHz)                           |                    | 2400      | 2450       | 2500       | 5150       | 5200       | 5250    | 5300      | 5350      | 5470       | 5600       | 5725       | 5785      | 5850      | 5865      | 5895      |
| Ant 1                                     | Max. Gain (dBi)    | 3.11      | 3.04       | 3.77       | --         | --         | --      | --        | --        | --         | --         | --         | --        | --        | --        | --        |
|                                           | Polarization       | Phi       | Phi        | Phi        | --         | --         | --      | --        | --        | --         | --         | --         | --        | --        | --        | --        |
|                                           | Axis: (Theta, Phi) | (30, 180) | (150, 180) | (45, 195)  | --         | --         | --      | --        | --        | --         | --         | --         | --        | --        | --        | --        |
| Ant 2                                     | Max. Gain (dBi)    | 3.35      | 3.36       | 3.80       | --         | --         | --      | --        | --        | --         | --         | --         | --        | --        | --        | --        |
|                                           | Polarization       | Phi       | Phi        | Phi        | --         | --         | --      | --        | --        | --         | --         | --         | --        | --        | --        | --        |
|                                           | Axis: (Theta, Phi) | (150, 0)  | (150, 0)   | (135, 345) | --         | --         | --      | --        | --        | --         | --         | --         | --        | --        | --        | --        |
| Ant 3                                     | Max. Gain (dBi)    | --        | --         | --         | 3.40       | 2.88       | 4.16    | 3.50      | 3.36      | 3.08       | 3.43       | 4.53       | 4.69      | 4.90      | 4.74      | 3.75      |
|                                           | Polarization       | --        | --         | --         | Theta      | Theta      | Phi     | Phi       | Phi       | Phi        | Phi        | Phi        | Phi       | Phi       | Phi       | Phi       |
|                                           | Axis: (Theta, Phi) | --        | --         | --         | (165, 90)  | (150, 90)  | (45, 0) | (45, 0)   | (45, 0)   | (0, 0)     | (120, 180) | (120, 180) | (45, 345) | (45, 345) | (45, 345) | (45, 345) |
| Ant 4                                     | Max. Gain (dBi)    | --        | --         | --         | 3.60       | 3.38       | 3.23    | 3.19      | 3.16      | 2.68       | 4.18       | 4.11       | 4.31      | 3.86      | 3.95      | 3.58      |
|                                           | Polarization       | --        | --         | --         | Phi        | Phi        | Phi     | Phi       | Phi       | Phi        | Phi        | Phi        | Phi       | Phi       | Phi       | Phi       |
|                                           | Axis: (Theta, Phi) | --        | --         | --         | (135, 150) | (135, 150) | (15, 0) | (15, 345) | (45, 180) | (165, 345) | (165, 345) | (30, 195)  | (30, 195) | (45, 195) | (45, 195) | (45, 195) |

# Directional Gain Result - Summary

| Directional Gain (Peak)-Correlated (3D) |                    |            |            |            |            |            |          |           |           |           |            |           |            |            |          |          |
|-----------------------------------------|--------------------|------------|------------|------------|------------|------------|----------|-----------|-----------|-----------|------------|-----------|------------|------------|----------|----------|
| Frequency (MHz)                         |                    | 2400       | 2450       | 2500       | 5150       | 5200       | 5250     | 5300      | 5350      | 5470      | 5600       | 5725      | 5785       | 5850       | 5865     | 5895     |
| Theta Polarization                      | Max. Gain (dBi)    | 3.11       | 3.18       | 3.72       | 5.36       | 5.67       | 4.74     | 3.98      | 3.59      | 4.31      | 3.89       | 5.44      | 3.60       | 3.45       | 3.42     | 5.60     |
|                                         | Axis: (Theta, Phi) | (165, 285) | (165, 255) | (15, 255)  | (165, 90)  | (30, 90)   | (15, 75) | (165, 90) | (165, 75) | (165, 90) | (165, 285) | (15, 255) | (165, 285) | (165, 105) | (15, 90) | (0, 0)   |
| Phi Polarization                        | Axis: Theta(°)     | 5.43       | 5.86       | 6.25       | 5.37       | 5.70       | 5.91     | 5.77      | 5.68      | 5.16      | 5.66       | 5.86      | 5.83       | 5.56       | 5.64     | 5.33     |
|                                         | Axis: (Theta, Phi) | (150, 345) | (135, 345) | (135, 345) | (135, 150) | (135, 150) | (15, 0)  | (45, 180) | (45, 180) | (30, 180) | (30, 180)  | (30, 0)   | (120, 0)   | (45, 345)  | (0, 0)   | (135, 0) |

Note: If Directional Gain is less than individual antenna maximum peak gain, use individual antenna maximum peak gain as directional gain.

- Refer to the attached file: Directional Gain Result - 2D Radiation Pattern

- Refer to the attached file: Directional Gain Result – Raw Data



***Thank You***

**Senao Networks Inc.**