

Regulatory WWAN Antenna Information

| Platform information | | | | | | |
|----------------------|---------------------------------------------------------|----------------------------------|-----------------------------------------------------------|--------------------------------|----------------------------------|-----------------------------|
| Brand | ODM | Platform model name | Platform type (ex: regular NB, convertible PC, AIO...etc) | | | SAR minimum separation (mm) |
| HP Inc. | Inventec | HSN-I45C-6 | Notebook PC | | | 23.55 mm |
| Antenna information | | | | | | Maximum Peak gain |
| Vendor | Type | Antenna Part number (Ant5 TX/RX) | Antenna Part number (Ant6 RX) | Antenna Part number (Ant7 RX) | Antenna Part number (Ant8 TX/RX) | 2496MHz |
| WNC | PIFA | 6036B0307801 (81ELA215.G07) | 6036B0307501 (81ELA215.G08) | 6036B0307701 (81EABL15.G20) | 6036B0306801 (81EABL15.G21) | 3.52dBi |
| Module information | | | | | | |
| Model | Form factor and suffixes (NGW/ HMW AND AN/ NB/ BN....) | | | | | |
| Kavalan 4 | Fibocom FM350-GL WWAN 4x4 5G NR radio module | | | | | |
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| Antenna vendor connect person | |
|-------------------------------|-------------------------------------------------------------|
| Antenna Vendor | WNC |
| contact person | Annie Lo |
| E-mail | annie.lo@wnc.com.tw |
| Tel/Mobile | 886-3-666-7799 ext: 3415 |
| Web address | https://www.wnc.com.tw |
| Address | 20 Park Avenue II, Hsinchu Science Park Hsinchu 300, Taiwan |

Antenna Sample / Antenna Data Requirements for worldwide regulatory approval

| Section | Description of Required OEM / ODM Antenna Information | US / IC | EU | Japan | Taiwan | S.Korea |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|----------|--------------------------|--------------------------|
| 1A | Part Number for Antenna Assembly | Required | Required | Required | Required | Required |
| 1B | Antenna Manufacturer Name | Required | Required | Required | Required | Required |
| 1C | Description of Antenna Type | Required | N/A | N/A | N/A | N/A |
| 1D | Tx antenna Gain (Peak Gain W/ cable loss) * | Required | Required | Required | Required | Required |
| 2 | Dimensioned Photographs and Drawings of Tx and Rx antennas | Required | Required | Required | Required | Required |
| 3 | Radiation patterns of antennas loaded in the host platform. | N/A | Required | Required | Required | N/A |
| 4 | Platform model name / number - correlated to antenna manufacturer and antenna part number | Required | Required | Desired | Required | Desired |
| 5 | Photograph(s) or Drawings showing location of antennas in platform. (S. Korea requires photographs of antennas for approval submission). Taiwan requires pictures of each antenna type shown in the system. | Required | Required | Desired | <u>Required (Photos)</u> | <u>Required (Photos)</u> |
| 6 | Mech. drawings / photos with dimensions of antenna locations and distance from end-user (For evaluation of SAR testing requirement). | Required | N/A | N/A | N/A | N/A |
| 7 | Photograph(s) or Drawings showing the location of all antennas (WLAN, other) and distance between those transmitting antennas. Information will be used to evaluate whether co-location testing is required. | Required | N/A | N/A | N/A | N/A |
| 8 | Local representative contact information for LMA/ PARS process. | Required | N/A | N/A | N/A | N/A |

Test location: _____SGS_____

Testing date: _____2022/12/7_____

Equipment list

| Equipment Description | Manufacturer | Identification no. | Current calibration date | Next calibration date |
|---------------------------------------|---------------------|------------------------------|---------------------------------|------------------------------|
| Network analyzer | Agilent | E5071C | 2022/01/07 | 2023/01/06 |
| Measurement software | ETS-Lindgren | EMQuest | N/A | N/A |
| Multi axis positioning system(MAPSTM) | ETS-Lindgren | EMCO 2115 | N/A | N/A |
| Multi axis positioning system(MAPSTM) | ETS-Lindgren | EMCO 2110 | N/A | N/A |
| MAPSTM controller | ETS-Lindgren | EMCO 2090 | N/A | N/A |
| Horn antenna | ETS-Lindgren | 3164-10 | 2022/03/03 | 2023/03/03 |
| ETS OTA Chamber | ETS-Lindgren | AMS-8500 | 2022/03/03 | 2023/03/03 |
| Cable | ETS-Lindgren | RFC SMS-100-NMR Series | N/A | N/A |

Note: Chamber calibration included full set of implement

Antenna Information

Section 1. Antenna Assembly Specifications

| Communication System | Band | Frequency(MHz) from low to high spectrum | | 1A Part Number for Antenna Assembly | 1B Antenna Manufacturer Name | 1C Description of Antenna Type | 1D Tx Antenna Gain (dBi) Ant5 |
|----------------------------|------|------------------------------------------|------|-------------------------------------|------------------------------|--------------------------------|-------------------------------|
| WCDMA/ LTE/5G NR FR1 | 1 | 1920 | 1980 | Ant5 : 81ELA215.G07 | WNC | PIFA | 3.35 |
| WCDMA/ LTE/5G NR FR1 | 2 | 1850 | 1910 | | | | 3.05 |
| LTE/5G NR FR1 | 3 | 1710 | 1785 | | | | 2.11 |
| WCDMA/ LTE | 4 | 1710 | 1755 | | | | 2.11 |
| WCDMA/ LTE/5G NR FR1 | 5 | 824 | 849 | | | | -0.53 |
| LTE/5G NR FR1 | 7 | 2500 | 2570 | | | | 3.45 |
| WCDMA/ LTE/5G NR FR1 | 8 | 880 | 915 | | | | -0.45 |
| LTE | 12 | 699 | 716 | | | | -2.53 |
| LTE | 13 | 777 | 787 | | | | 0.26 |
| LTE | 14 | 788 | 798 | | | | 0.22 |
| LTE | 17 | 704 | 716 | | | | -2.53 |
| LTE | 18 | 815 | 830 | | | | -0.53 |
| LTE | 19 | 830 | 845 | | | | -0.80 |
| LTE/5G NR FR1 | 20 | 832 | 862 | | | | -0.80 |
| LTE/5G NR FR1 | 25 | 1850 | 1915 | | | | 3.05 |
| LTE | 26 | 814 | 849 | | | | -0.53 |
| LTE/5G NR FR1 | 28 | 703 | 748 | | | | -1.20 |
| LTE/5G NR FR1 | 30 | 2305 | 2315 | | | | 2.42 |
| LTE | 34 | 2010 | 2025 | | | | 3.08 |
| LTE/5G NR FR1 | 38 | 2570 | 2620 | | | | 2.28 |
| LTE | 39 | 1880 | 1920 | | | | 3.35 |
| LTE/5G NR FR1 | 40 | 2300 | 2400 | | | | 2.42 |
| LTE/5G NR FR1 | 41 | 2496 | 2690 | | | | 3.52 |
| LTE | 42 | 3400 | 3600 | | | | -0.06 |
| LTE | 43 | 3600 | 3800 | | | | 0.91 |
| LTE/5G NR FR1 | 66 | 1710 | 1780 | | | | 2.11 |
| LTE/5G NR FR1 | 71 | 663 | 698 | | | | -3.94 |
| 5G NR FR1 | 77 | 3300 | 4200 | | | | 0.91 |
| 5G NR FR1 | 78 | 3300 | 3800 | 0.91 | | | |
| 5G NR FR1 | 79 | 4400 | 5000 | 0.68 | | | |

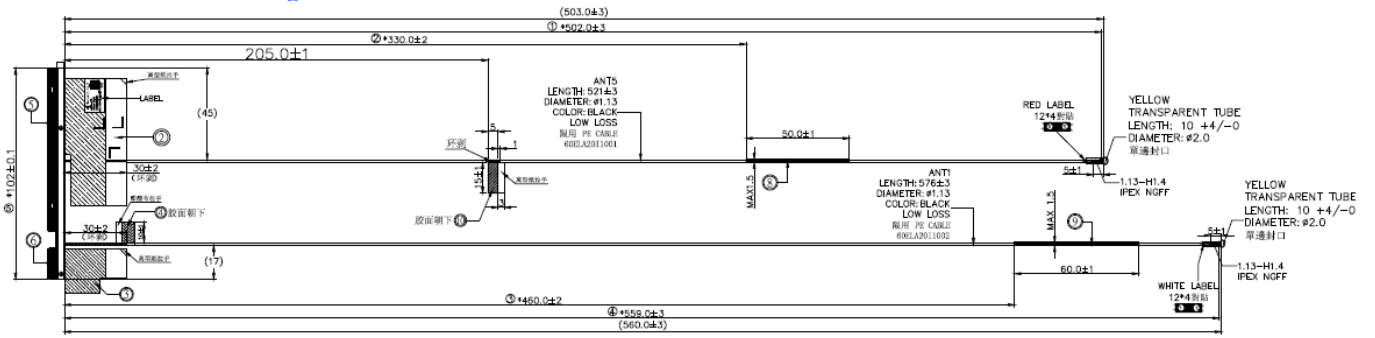
| Communication System | Band | Frequency(MHz) from low to high spectrum | | 1A Part Number for Antenna Assembly | 1B Antenna Manufacturer Name | 1C Description of Antenna Type | 1D Tx Antenna Gain (dBi) Ant8 |
|----------------------|------|------------------------------------------|------|-------------------------------------|------------------------------|--------------------------------|-------------------------------|
| 5G NR FR1 | 1 | 1920 | 1980 | Ant8 : 81EABL15.G21 | WNC | PIFA | 1.77 |
| LTE/5G NR FR1 | 2 | 1850 | 1910 | | | | 0.92 |
| 5G NR FR1 | 3 | 1710 | 1785 | | | | 2.14 |
| LTE | 4 | 1710 | 1755 | | | | 2.14 |
| 5G NR FR1 | 5 | 824 | 849 | | | | -15.27 |
| LTE/5G NR FR1 | 7 | 2500 | 2570 | | | | 1.87 |
| LTE/5G NR FR1 | 25 | 1850 | 1915 | | | | 0.92 |
| LTE/5G NR FR1 | 30 | 2305 | 2315 | | | | 2.05 |
| 5G NR FR1 | 38 | 2570 | 2620 | | | | -1.87 |
| 5G NR FR1 | 40 | 2300 | 2400 | | | | 4.93 |
| LTE/5G NR FR1 | 41 | 2496 | 2690 | | | | 1.79 |
| 5G NR FR1 | 48 | 3550 | 3700 | | | | 0.95 |
| LTE/5G NR FR1 | 66 | 1710 | 1780 | | | | 2.14 |
| 5G NR FR1 | 77 | 3300 | 4200 | | | | 0.95 |
| 5G NR FR1 | 78 | 3300 | 3800 | | | | 0.95 |
| 5G NR FR1 | 79 | 4400 | 5000 | | | | 2.25 |

Antenna Peak Gain required being test in system basis.

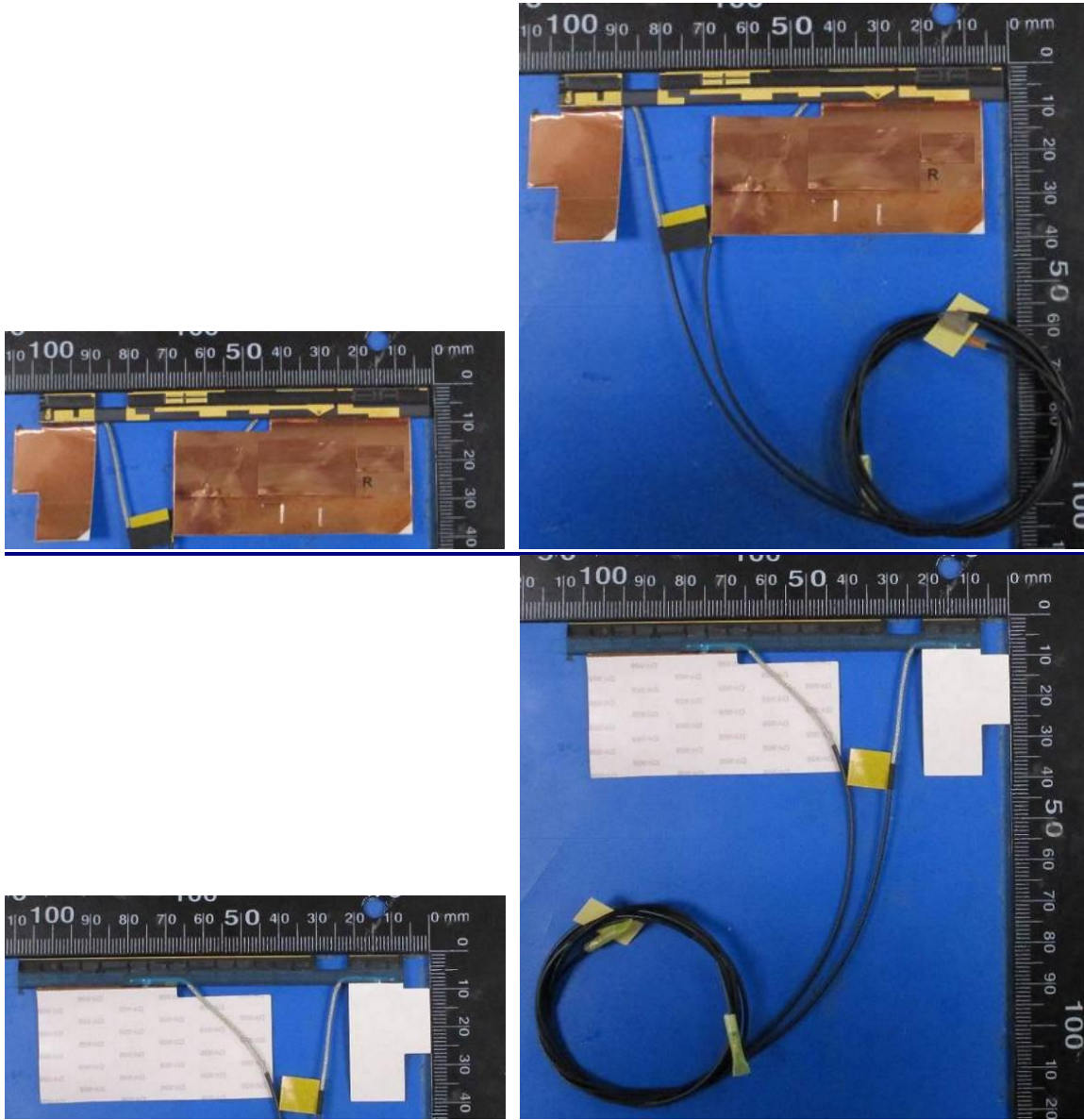
Section 2. Dimensioned Photos or Drawings of Antennas

| | Ant supplier | Part number | Drawing | Photo |
|------|--------------|--------------|---------|-------|
| Ant5 | WNC | 6036B0307801 | V | V |
| Ant6 | WNC | 6036B0307501 | V | V |
| Ant7 | WNC | 6036B0307701 | V | V |
| Ant8 | WNC | 6036B0306801 | V | V |

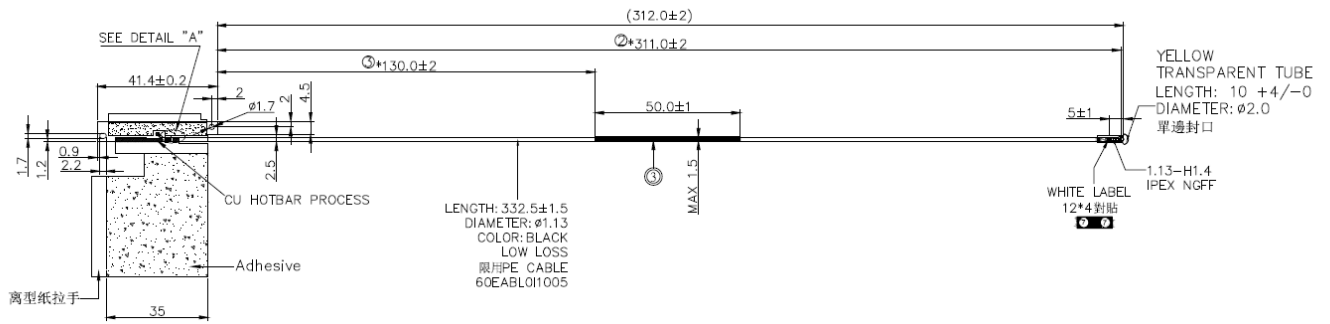
Ant5 Dimensioned Drawing:



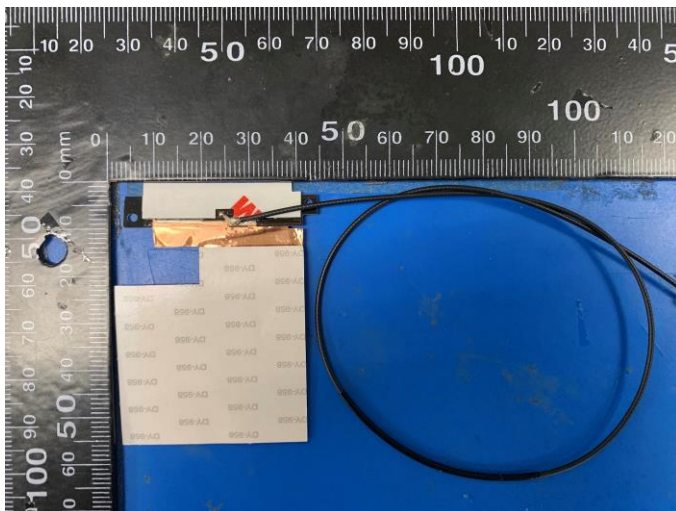
Ant5 Photo:



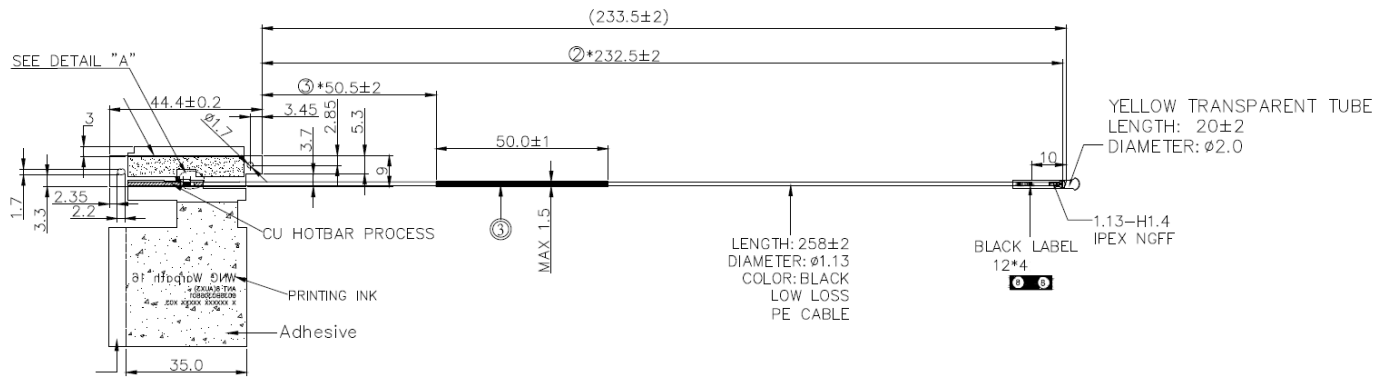
Ant7 Dimensioned Drawing:



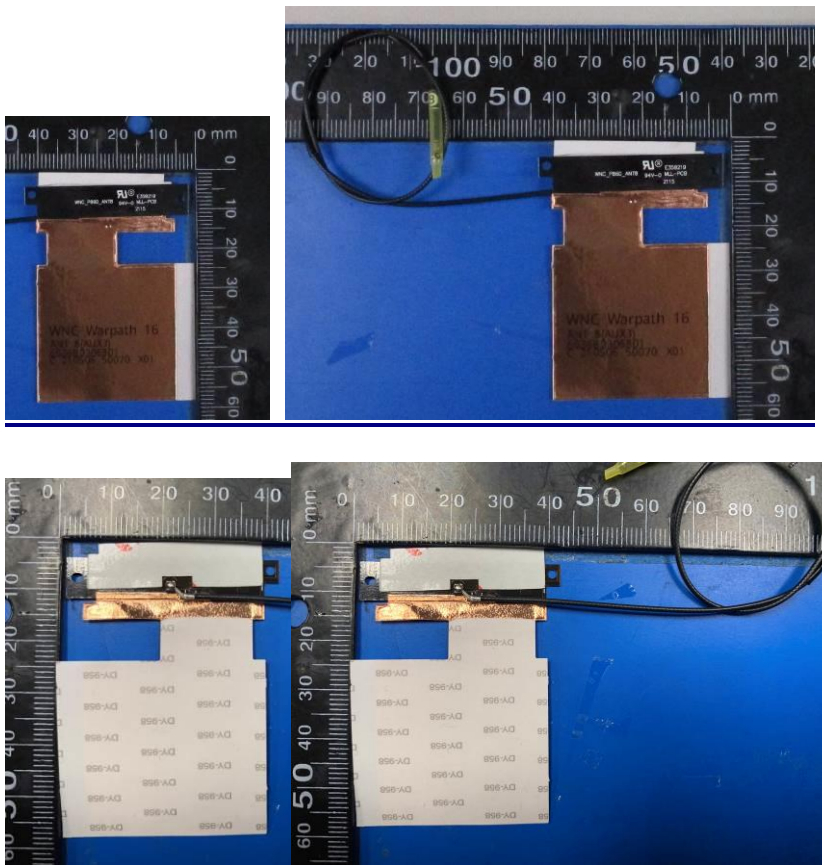
Ant7 Photo:



Ant8 Dimensioned Drawing:

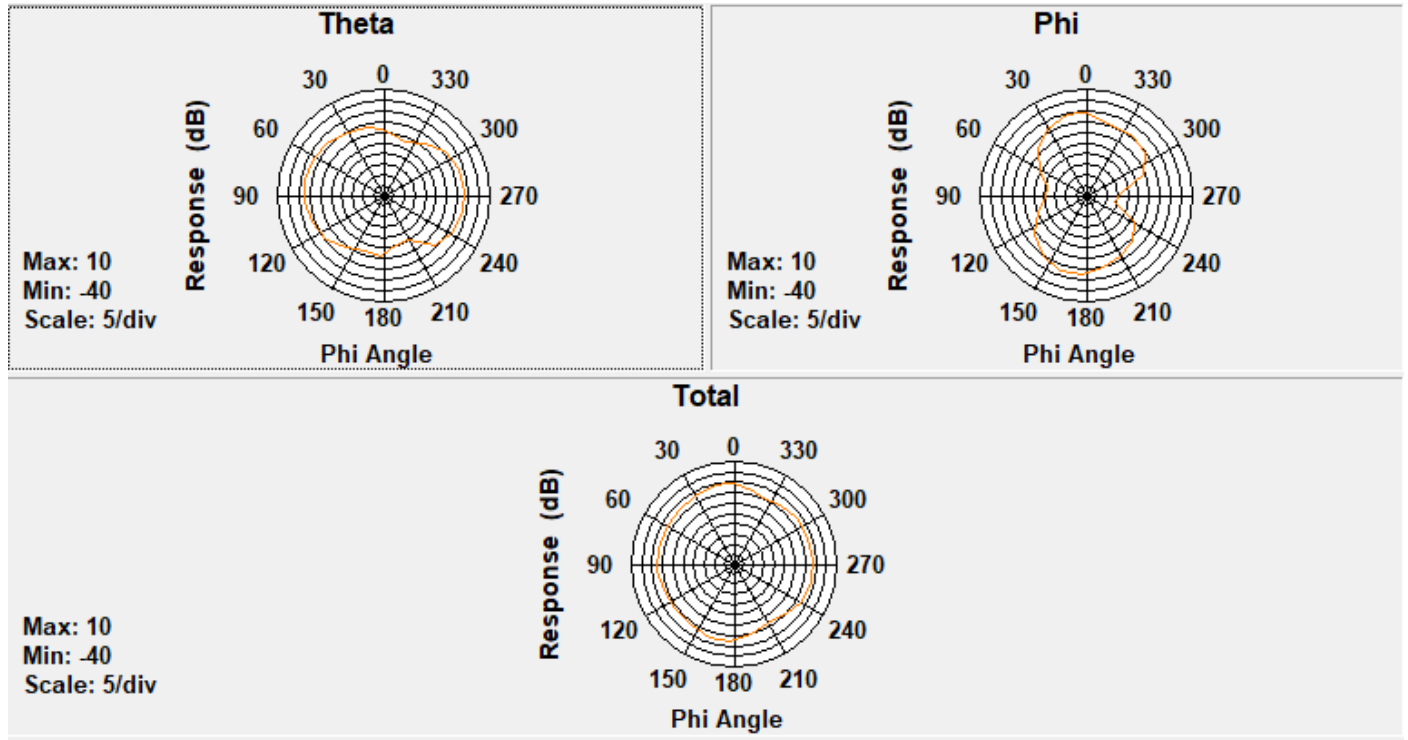


Ant8 Photo:



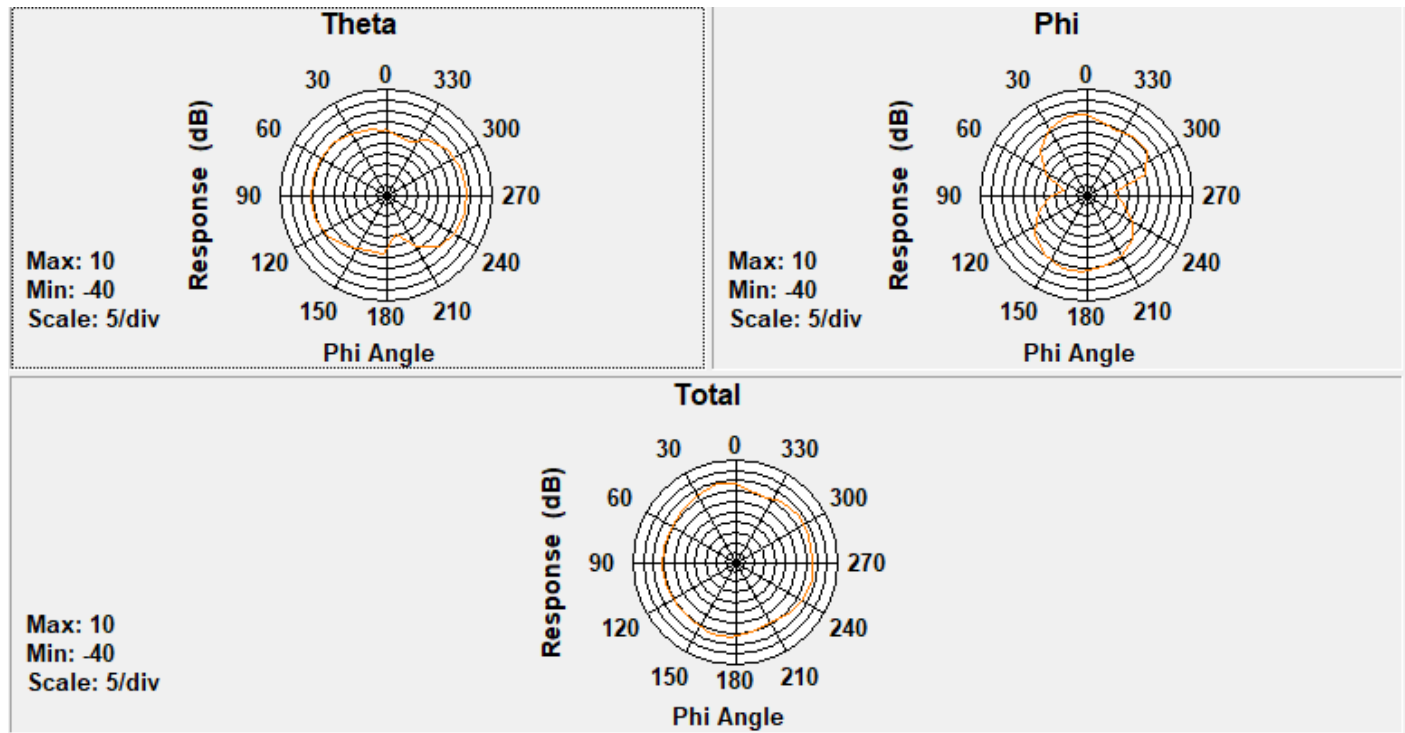
- The listed frequency 2D radiation pattern is required

- [Ant5:](#)
[815MHz](#)



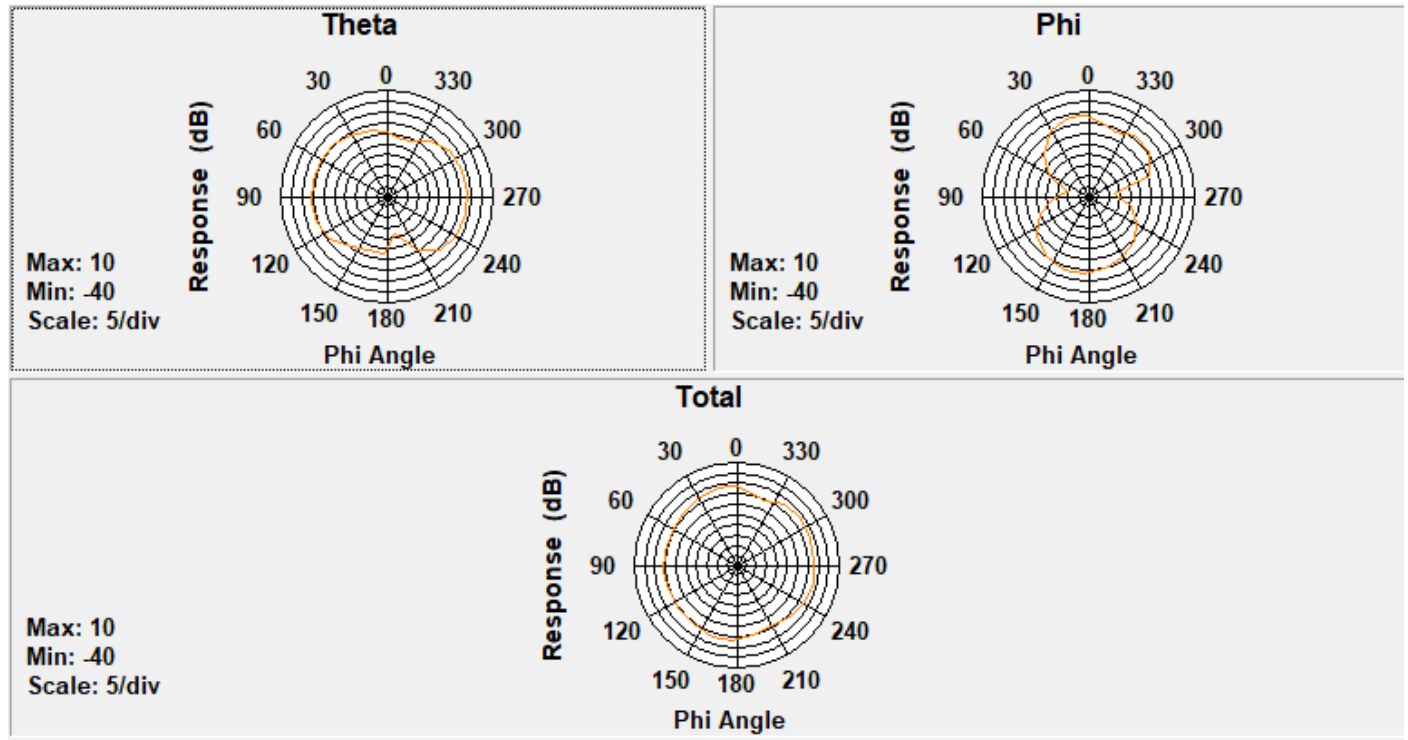
| | |
|-----------------------|---------------|
| Center Frequency | 815MHz |
| Horizontal (dBi) peak | -0.77 |
| Vertical (dBi) peak | -0.53 |

832MHz



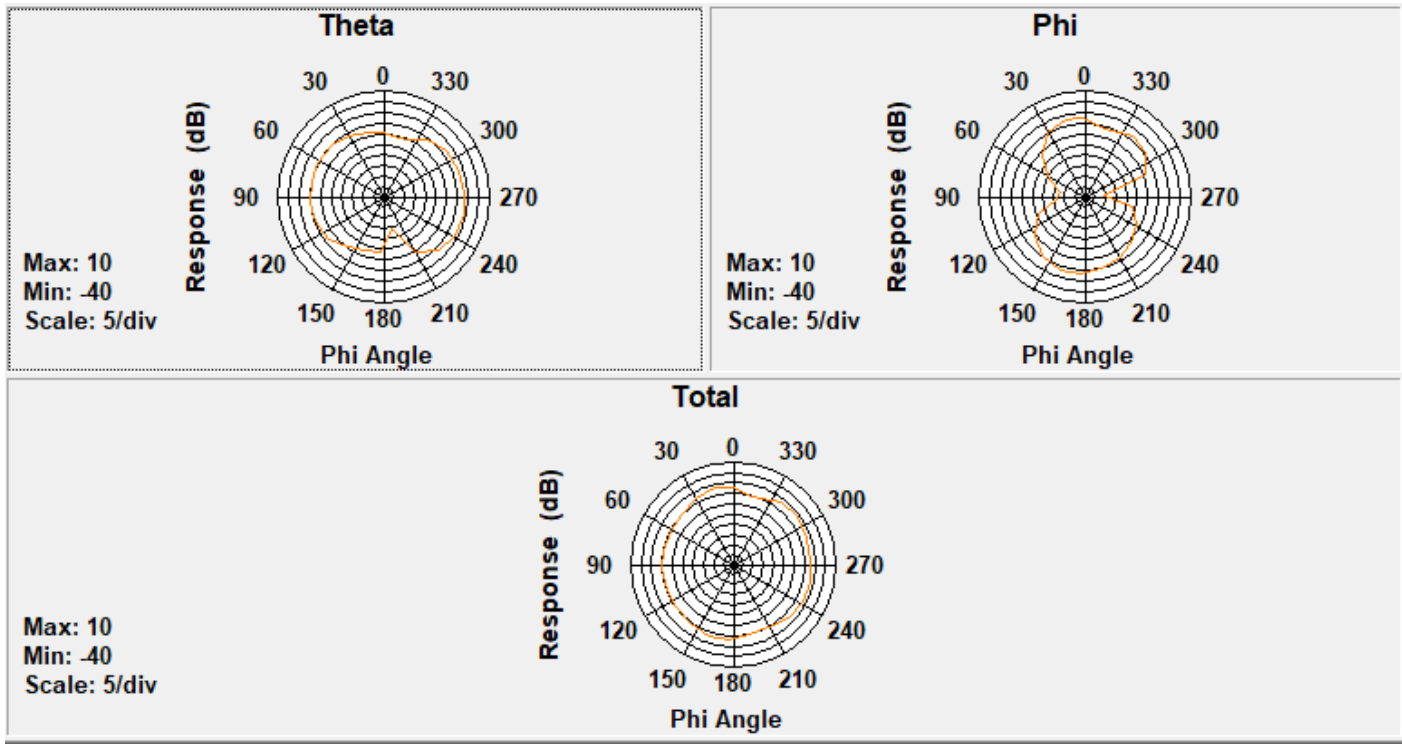
| | |
|-----------------------|---------------|
| Center Frequency | 832MHz |
| Horizontal (dBi) peak | -1.80 |
| Vertical (dBi) peak | -0.80 |

837MHz



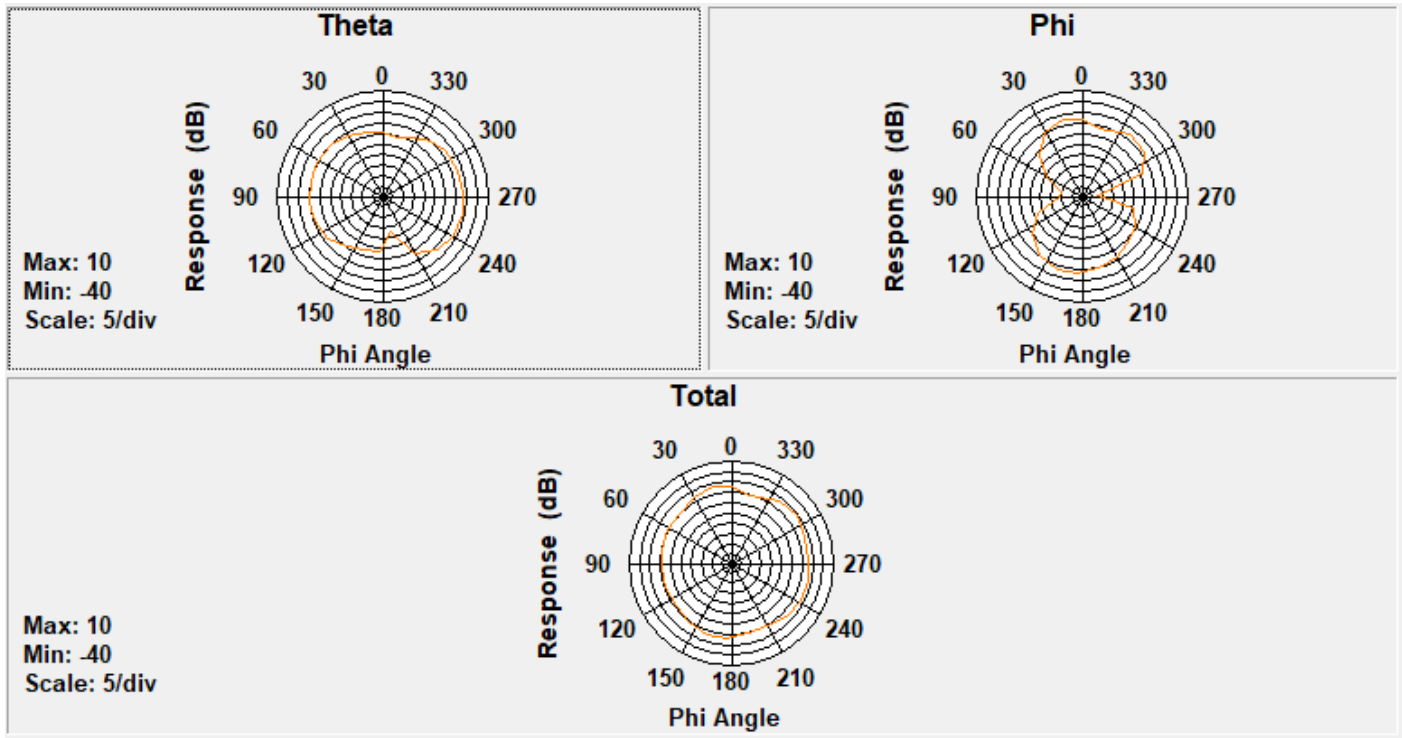
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|-----------------------|---------------|
| Center Frequency | 837MHz |
| Horizontal (dBi) peak | -1.97 |
| Vertical (dBi) peak | -0.94 |

845MHz



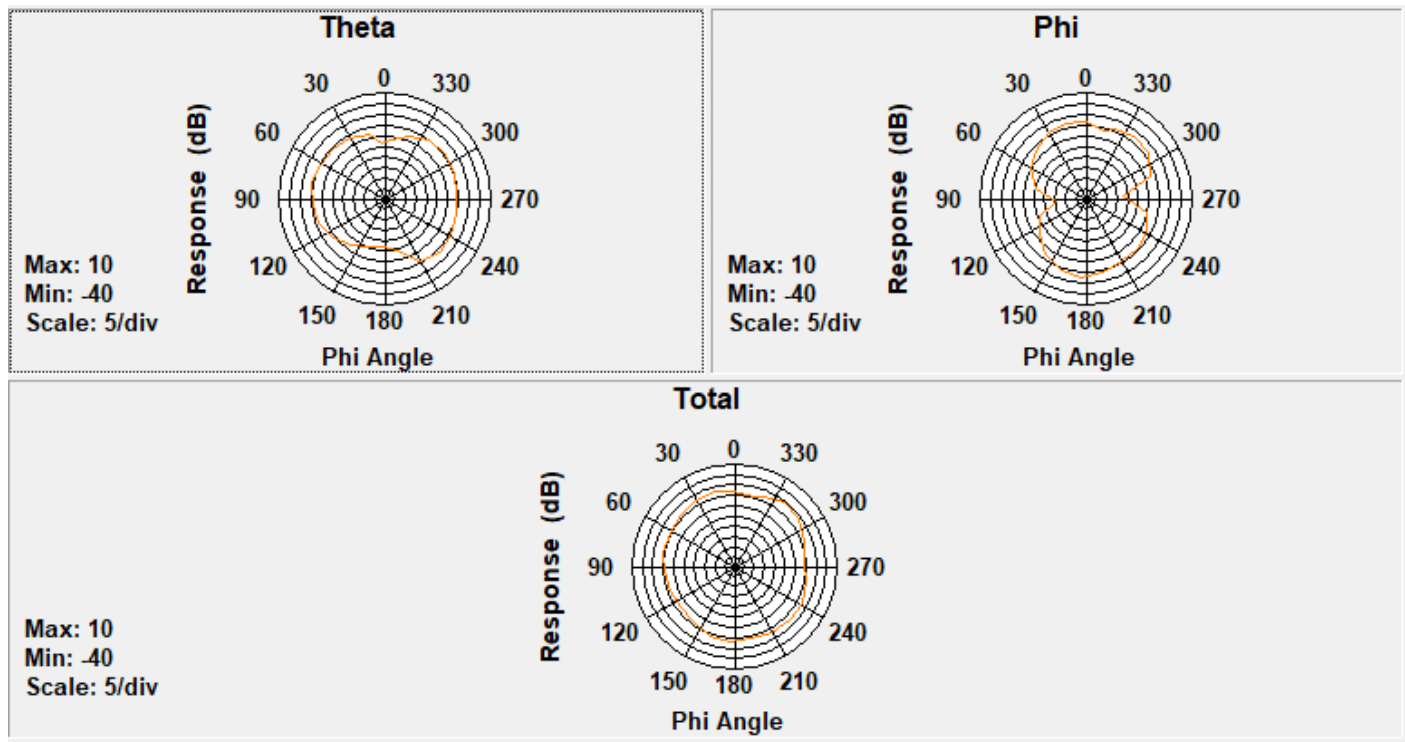
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|-----------------------|---------------|
| Center Frequency | 845MHz |
| Horizontal (dBi) peak | -1.95 |
| Vertical (dBi) peak | -1.23 |

849MHz



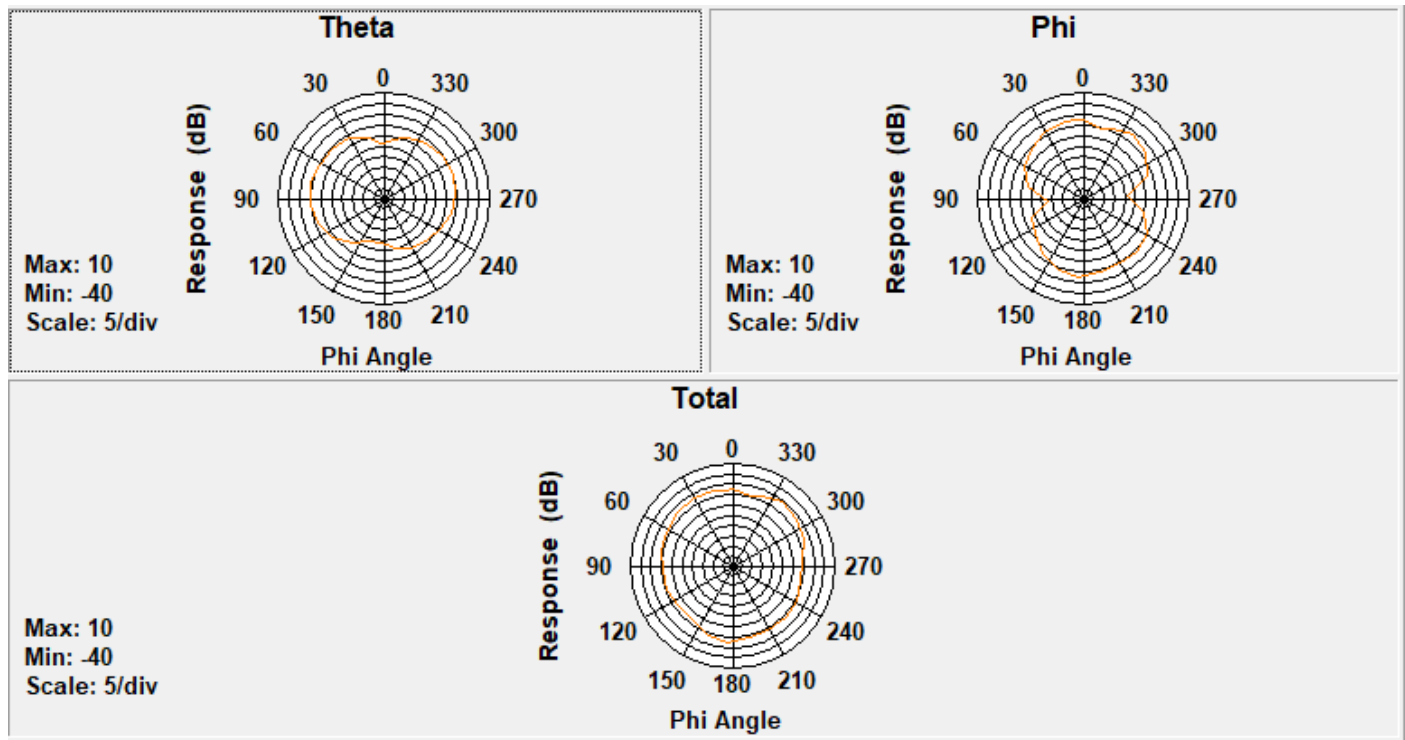
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|-----------------------|---------------|
| Center Frequency | 849MHz |
| Horizontal (dBi) peak | -1.99 |
| Vertical (dBi) peak | -1.28 |

880MHz



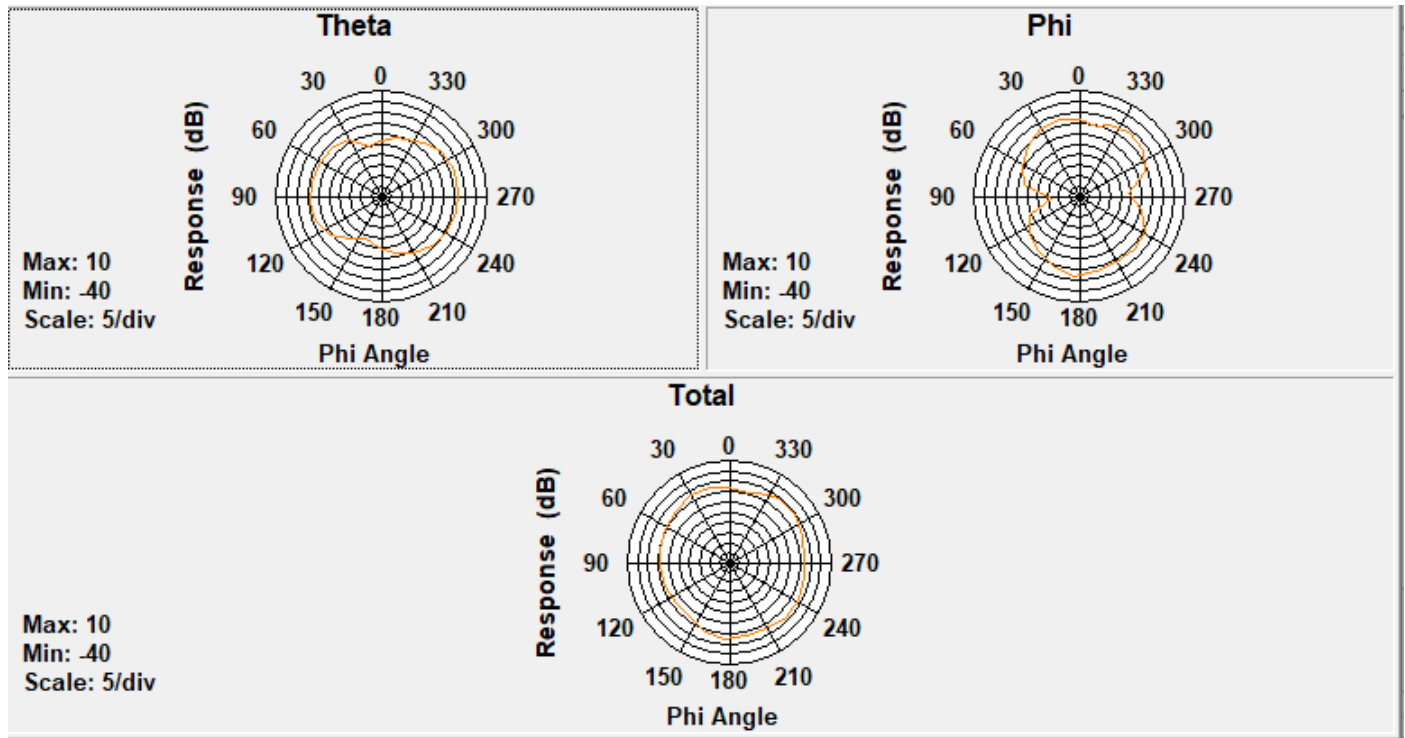
| | |
|-----------------------|---------------|
| Center Frequency | 880MHz |
| Horizontal (dBi) peak | -1.19 |
| Vertical (dBi) peak | -0.60 |

894MHz



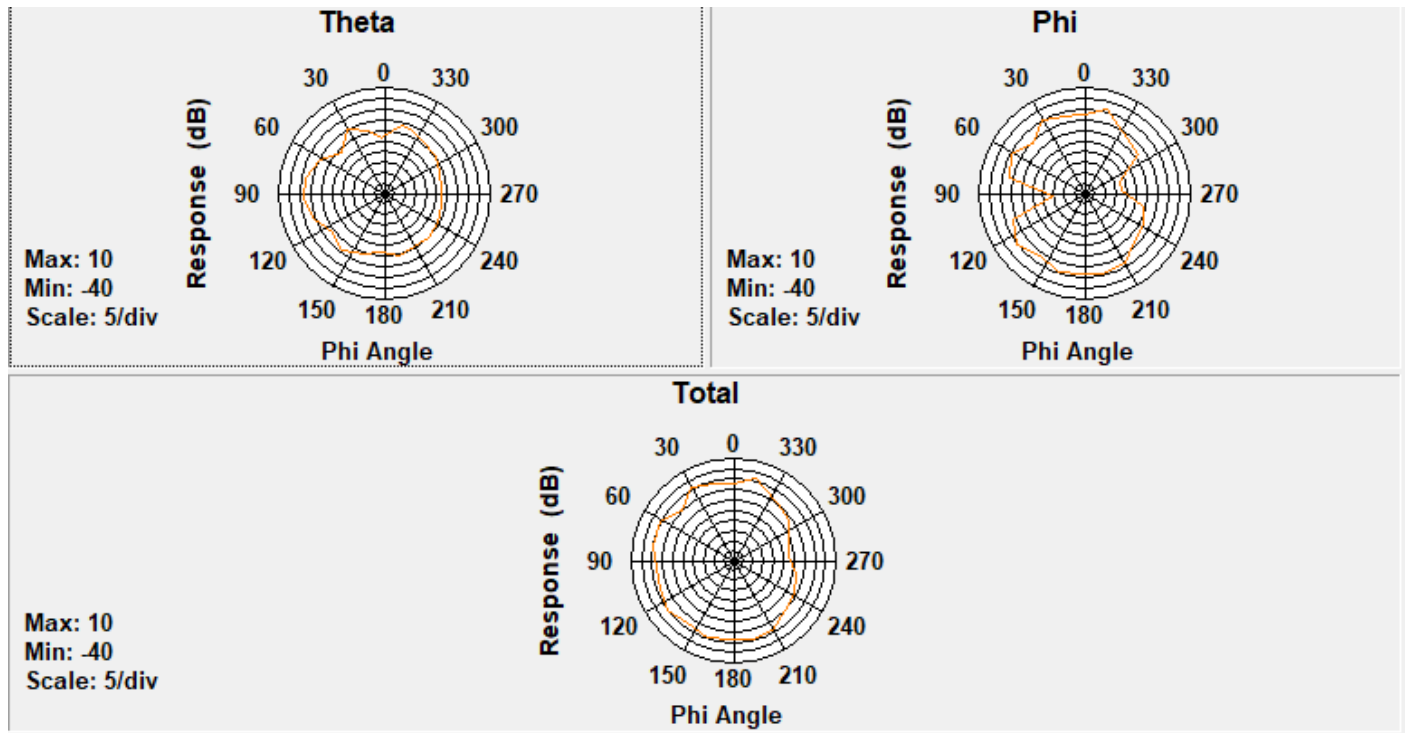
| | |
|-----------------------|---------------|
| Center Frequency | 894MHz |
| Horizontal (dBi) peak | -2.28 |
| Vertical (dBi) peak | -0.45 |

915MHz



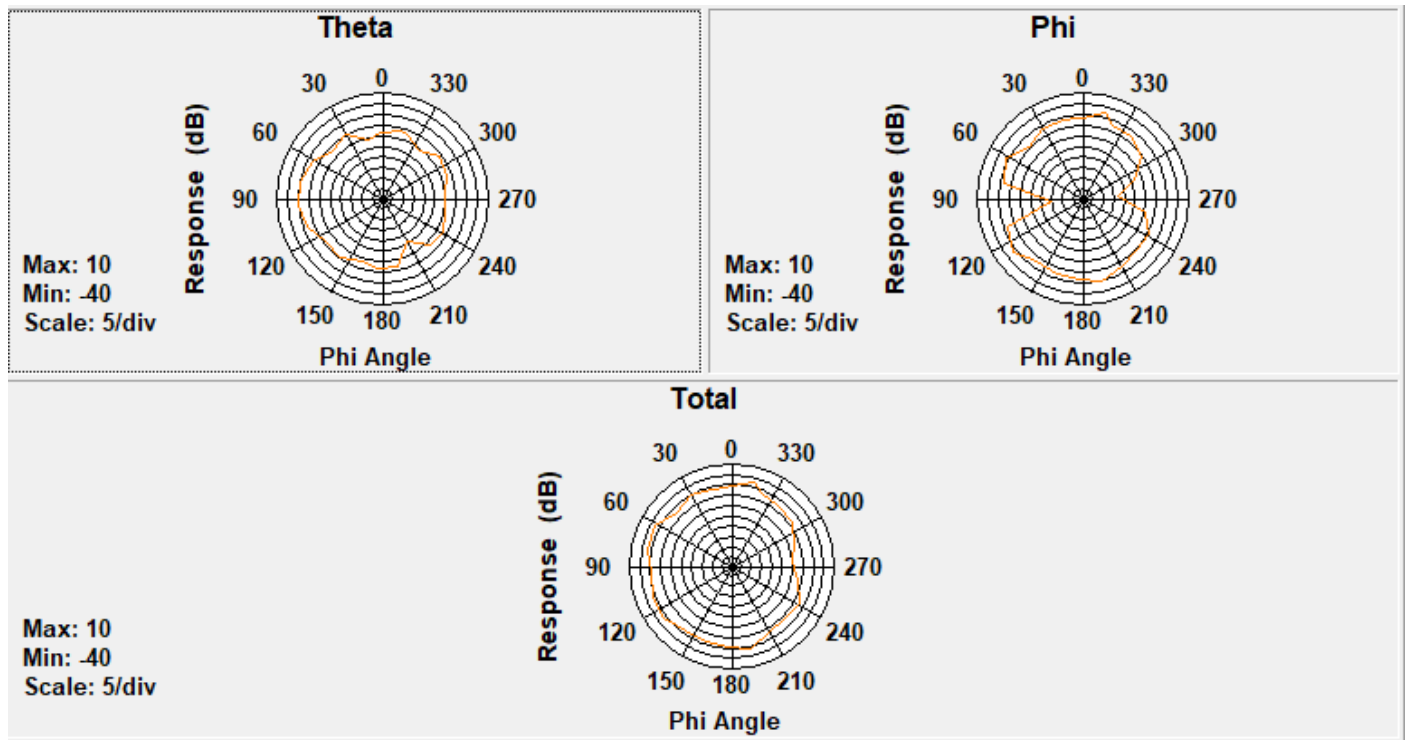
| | |
|-----------------------|---------------|
| Center Frequency | 915MHz |
| Horizontal (dBi) peak | -1.79 |
| Vertical (dBi) peak | -0.86 |

1710MHz



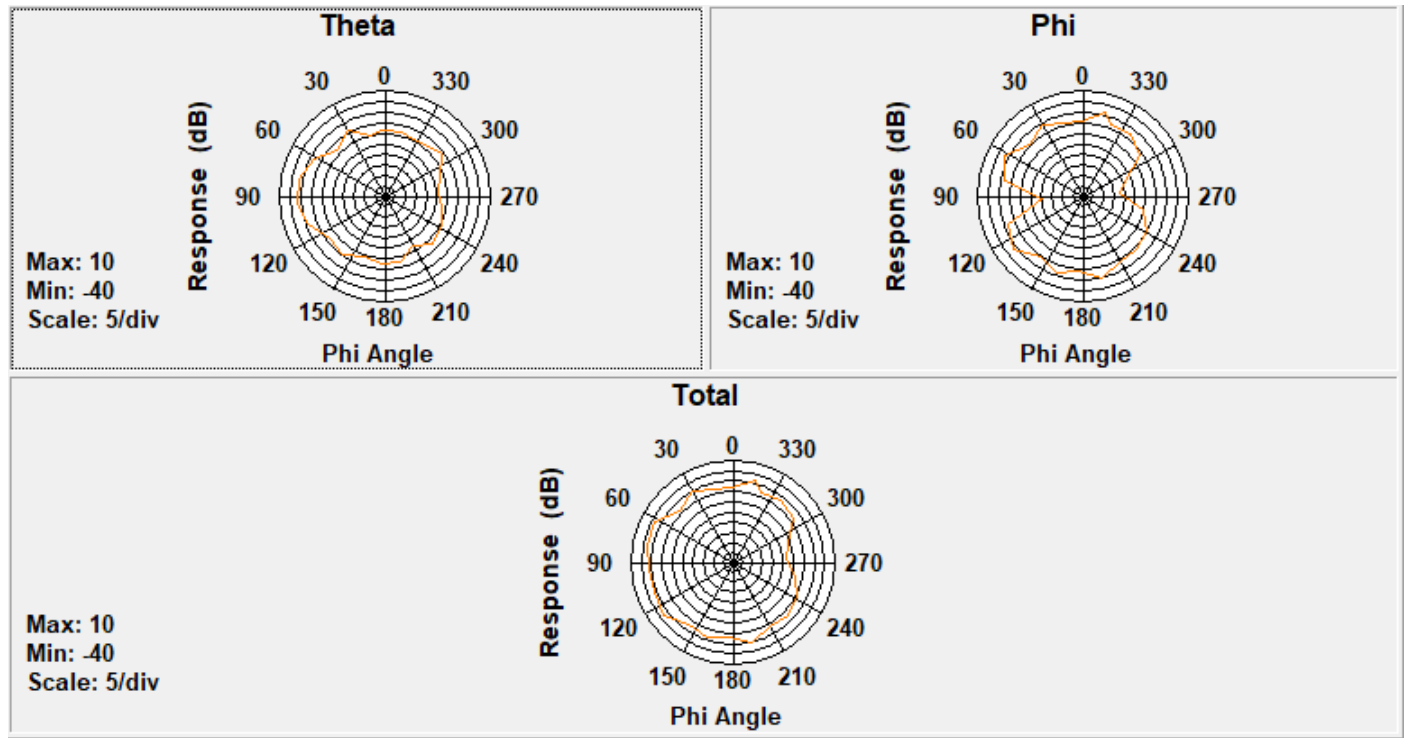
| | |
|-----------------------|----------------|
| Center Frequency | 1710MHz |
| Horizontal (dBi) peak | 2.04 |
| Vertical (dBi) peak | 1.47 |

1750MHz



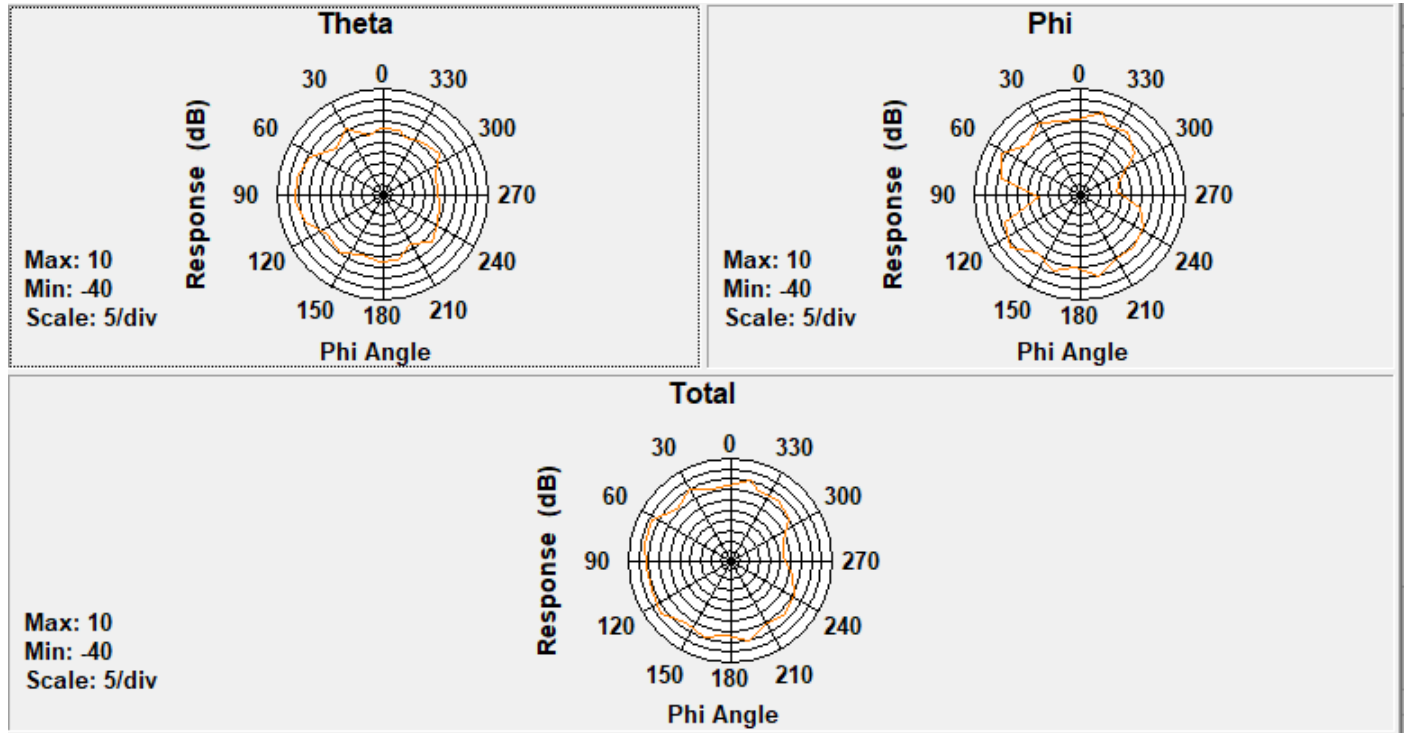
| | |
|-----------------------|----------------|
| Center Frequency | 1750MHz |
| Horizontal (dBi) peak | 2.11 |
| Vertical (dBi) peak | 1.88 |

1780MHz



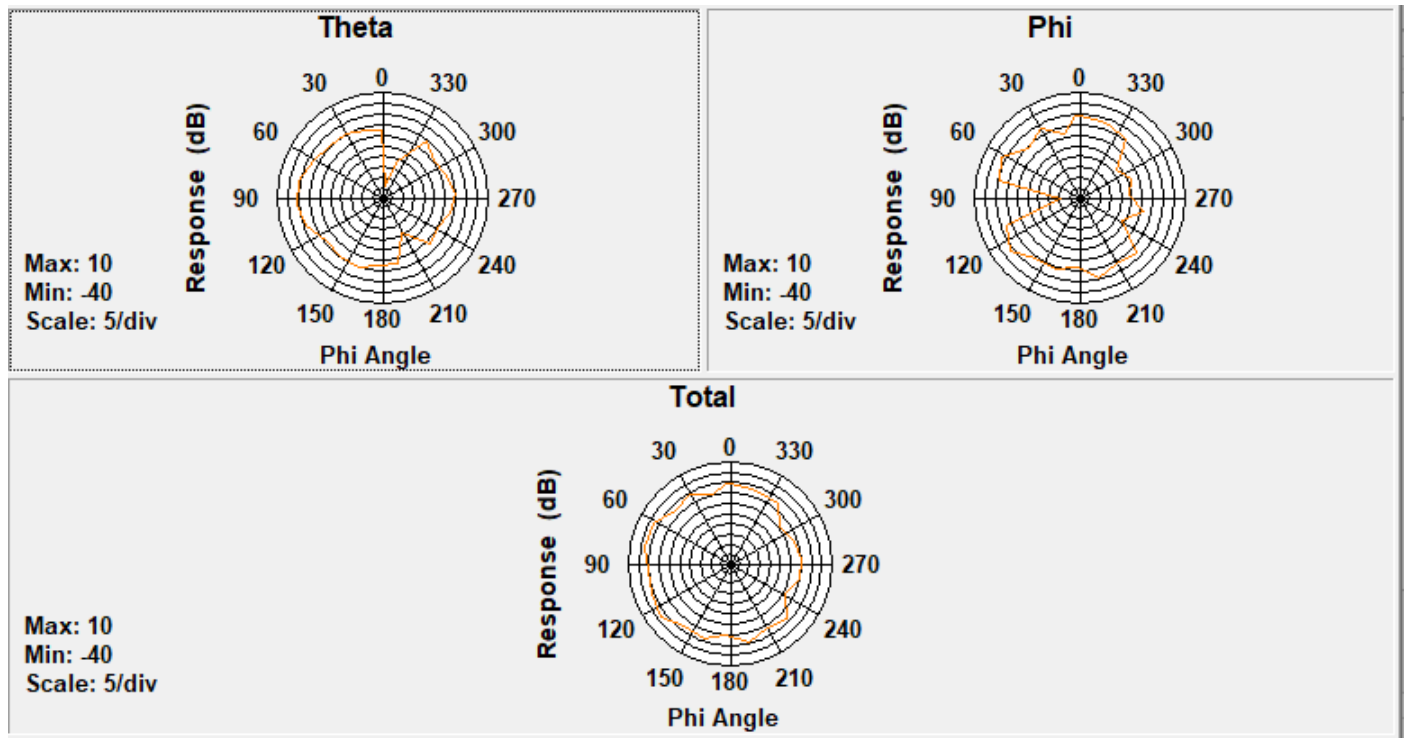
| | |
|-----------------------|----------------|
| Center Frequency | 1780MHz |
| Horizontal (dBi) peak | 1.34 |
| Vertical (dBi) peak | 2.10 |

1785MHz



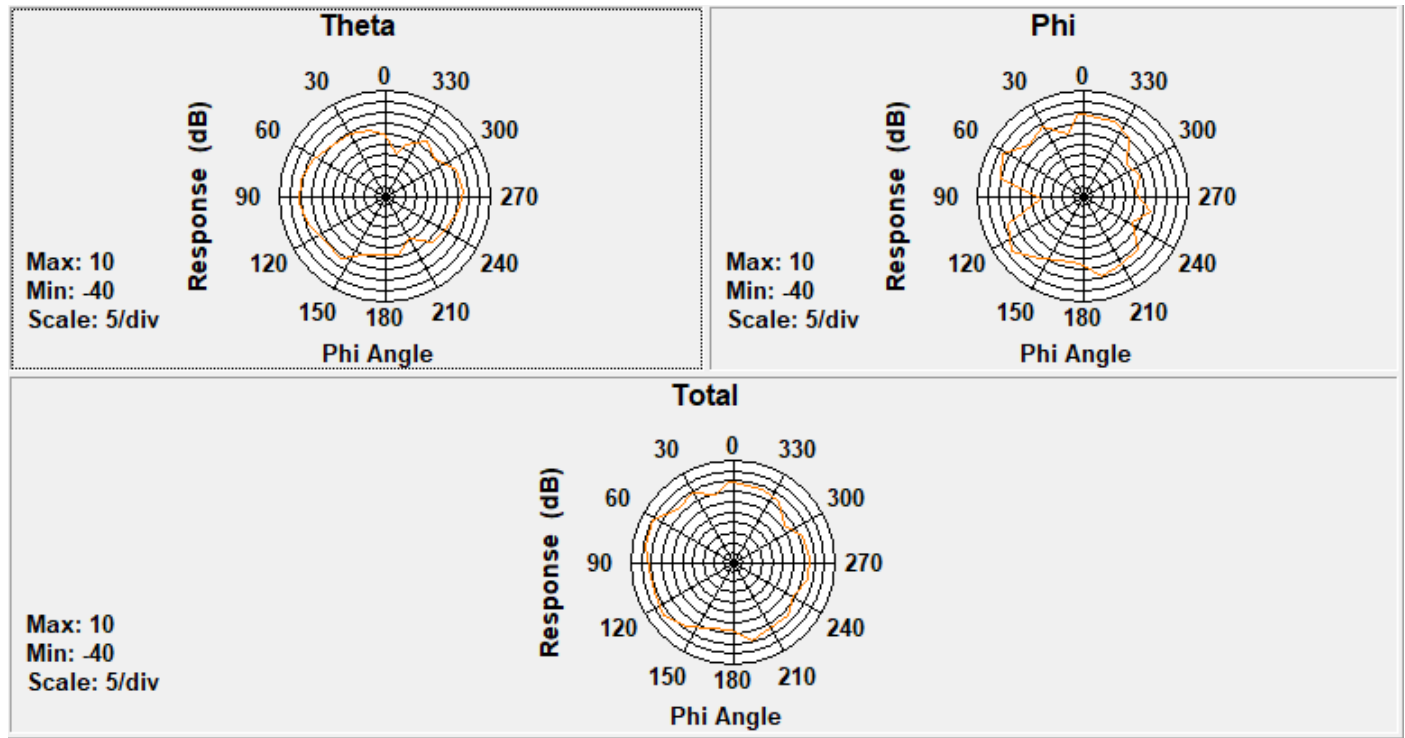
| | |
|-----------------------|----------------|
| Center Frequency | 1785MHz |
| Horizontal (dBi) peak | 1.39 |
| Vertical (dBi) peak | 2.09 |

1880MHz



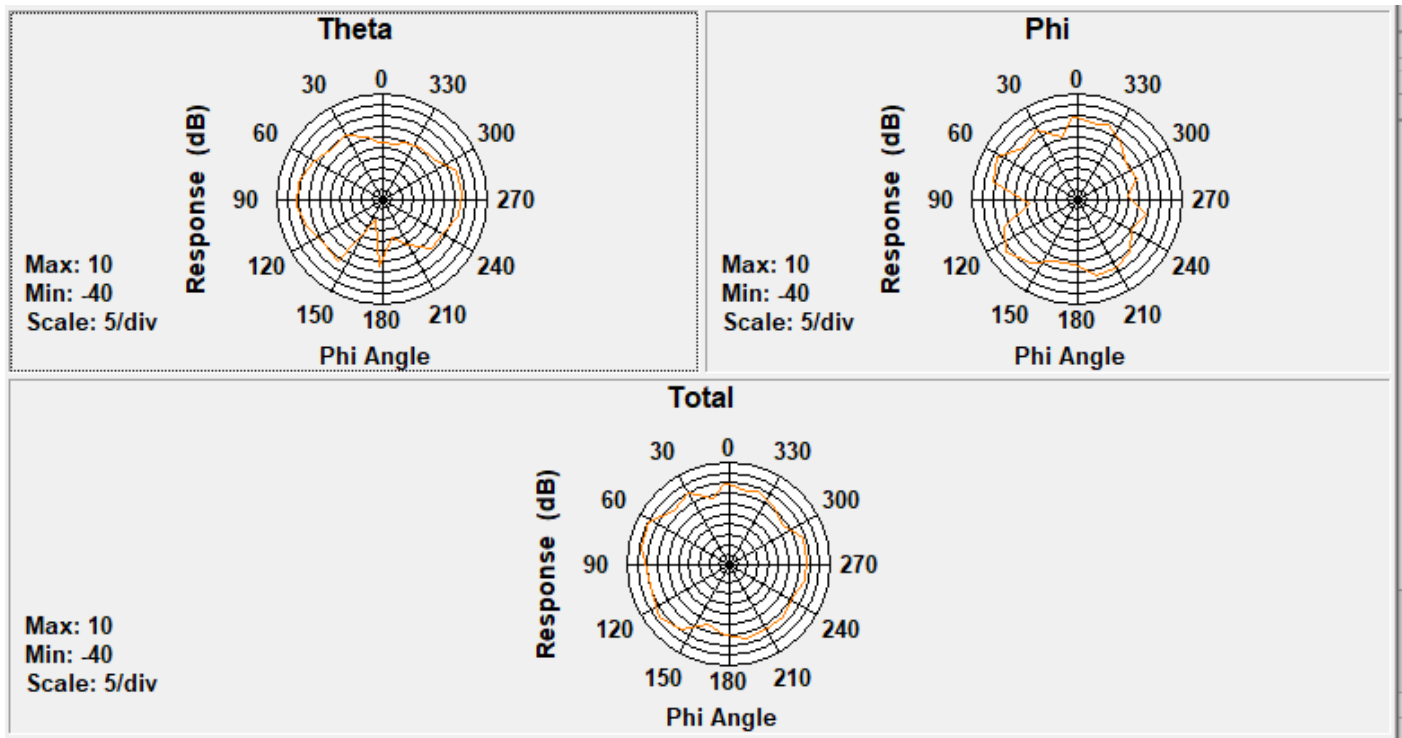
| | |
|-----------------------|----------------|
| Center Frequency | 1880MHz |
| Horizontal (dBi) peak | 1.53 |
| Vertical (dBi) peak | 2.44 |

1900MHz



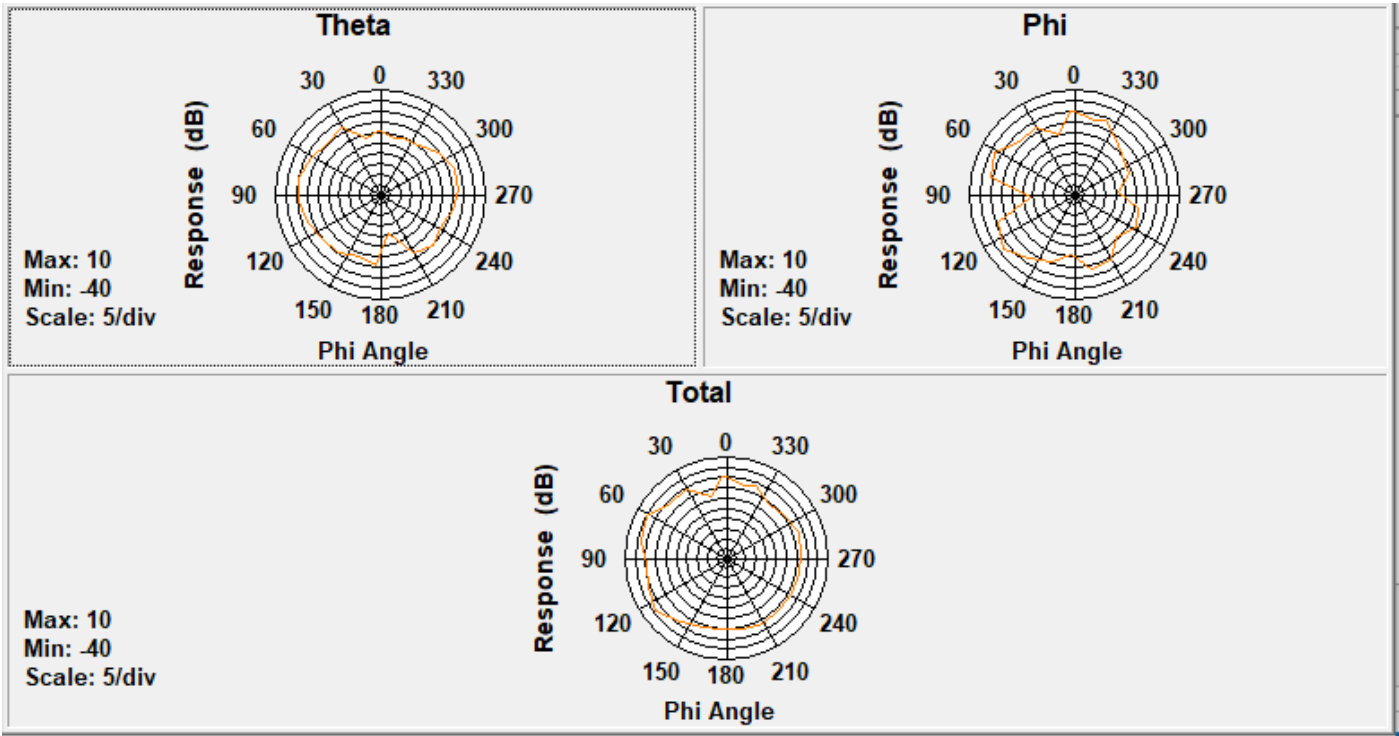
| | |
|-----------------------|----------------|
| Center Frequency | 1900MHz |
| Horizontal (dBi) peak | 1.56 |
| Vertical (dBi) peak | 3.05 |

1920MHz



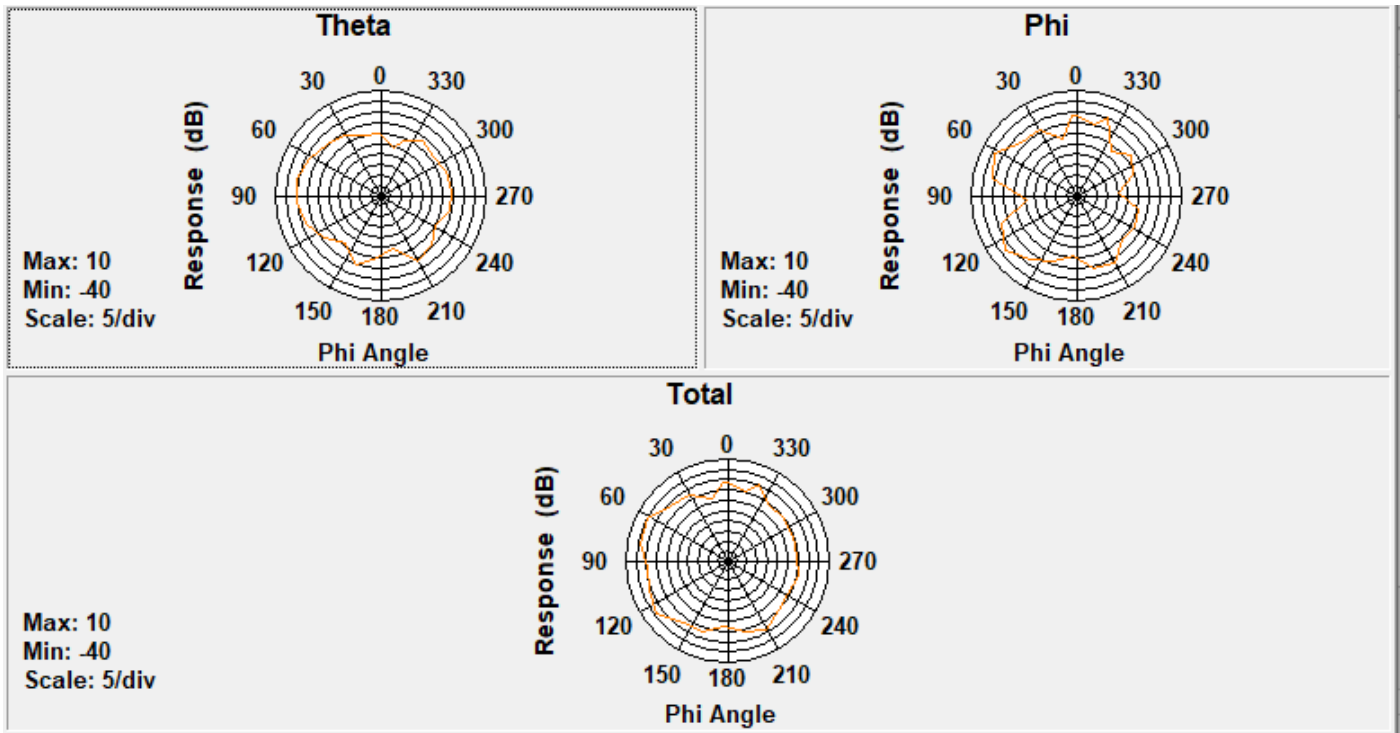
| | |
|-----------------------|----------------|
| Center Frequency | 1920MHz |
| Horizontal (dBi) peak | 2.07 |
| Vertical (dBi) peak | 3.35 |

1950MHz



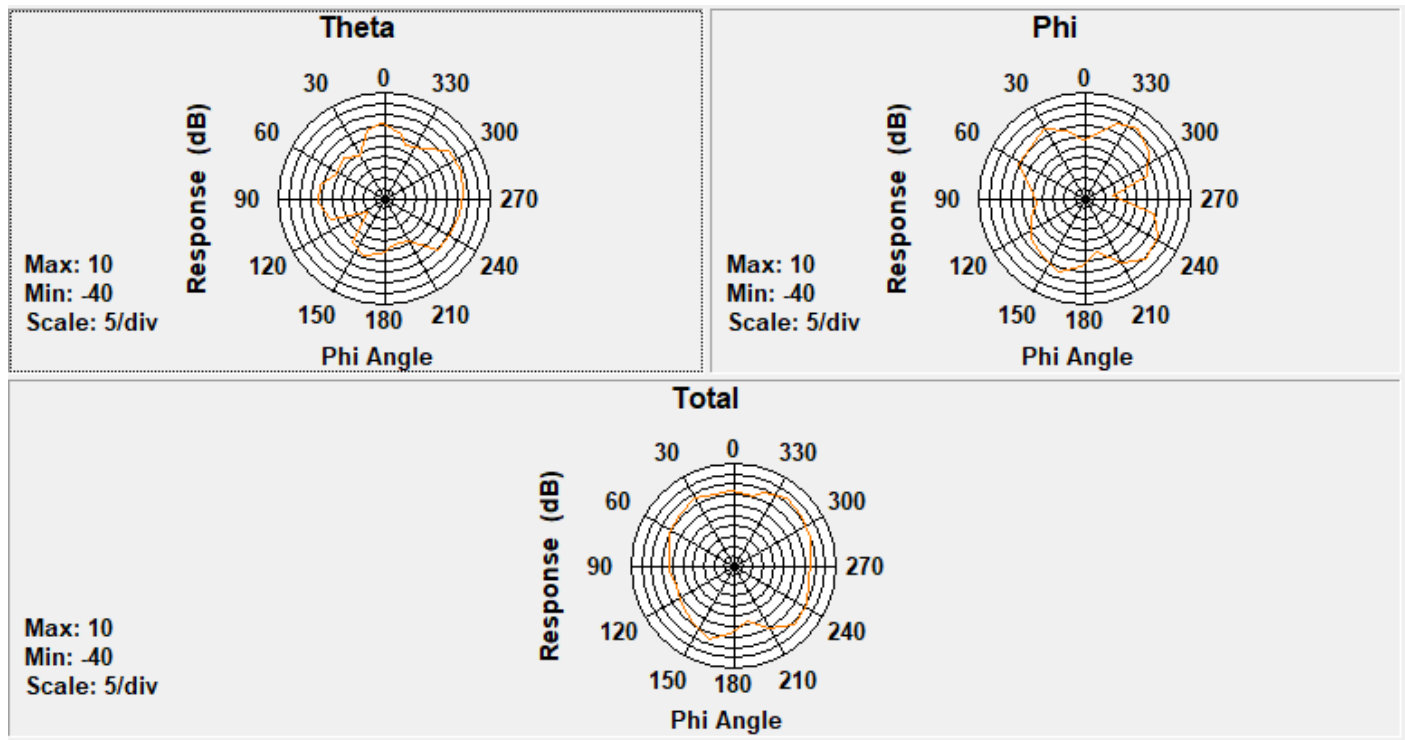
| | |
|-----------------------|----------------|
| Center Frequency | 1950MHz |
| Horizontal (dBi) peak | 1.80 |
| Vertical (dBi) peak | 3.09 |

1980MHz



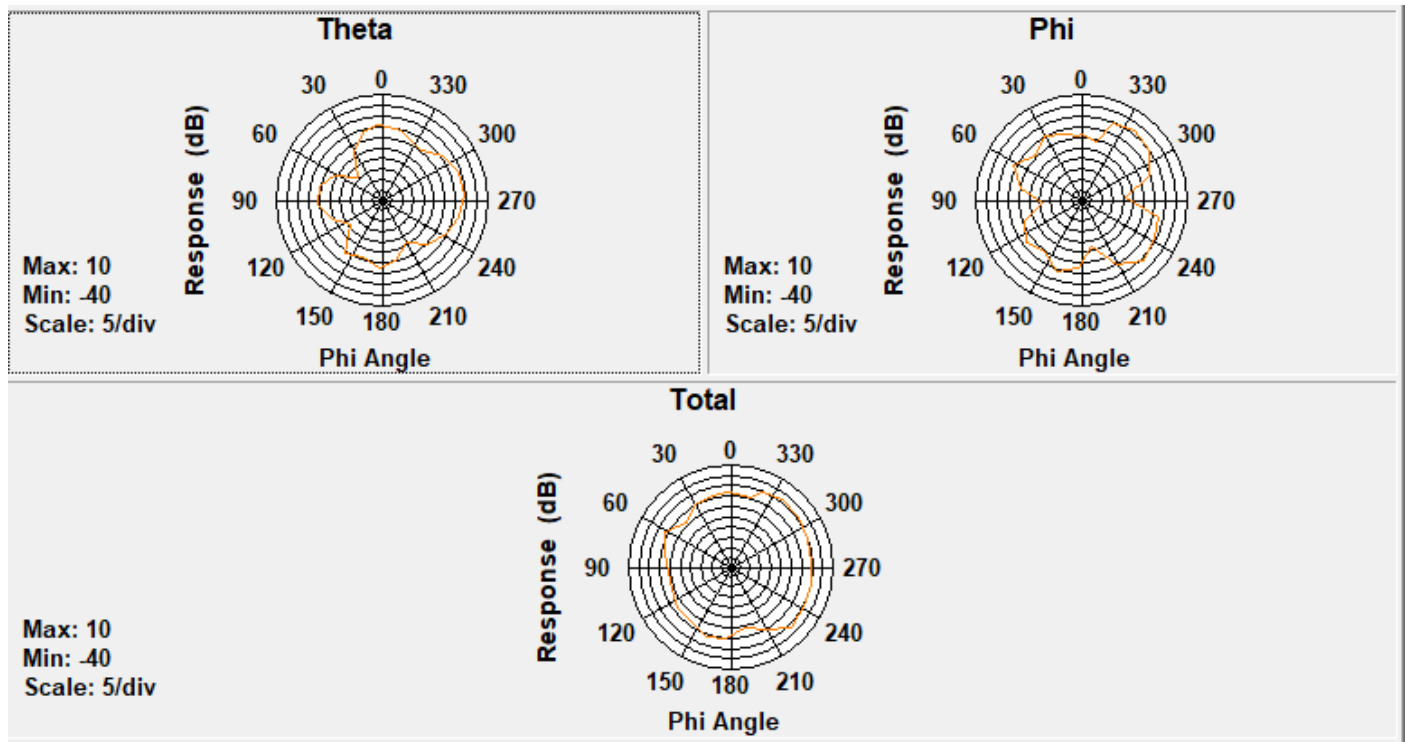
| | |
|-----------------------|----------------|
| Center Frequency | 1980MHz |
| Horizontal (dBi) peak | 2.40 |
| Vertical (dBi) peak | 3.28 |

2496MHz



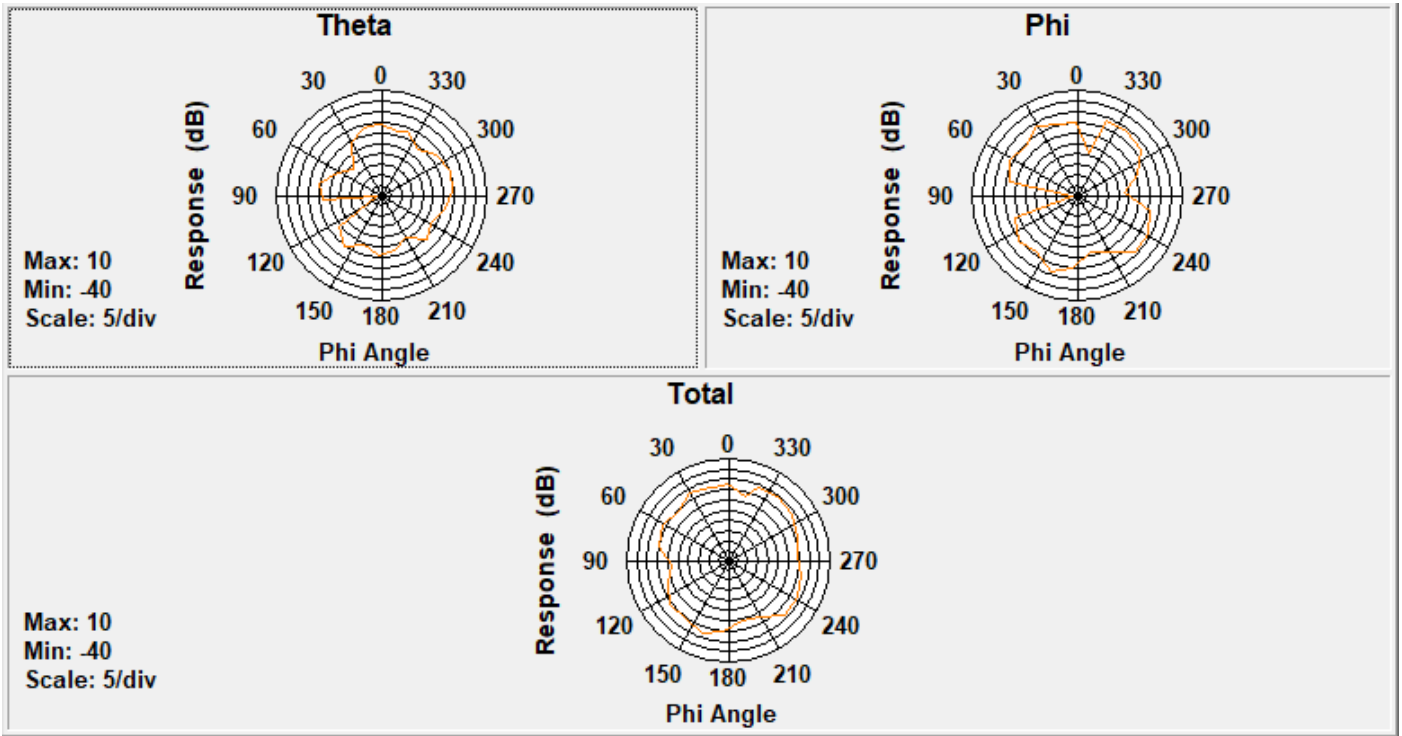
| | |
|-----------------------|---------|
| Center Frequency | 2496MHz |
| Horizontal (dBi) peak | 3.52 |
| Vertical (dBi) peak | 0.91 |

2595MHz



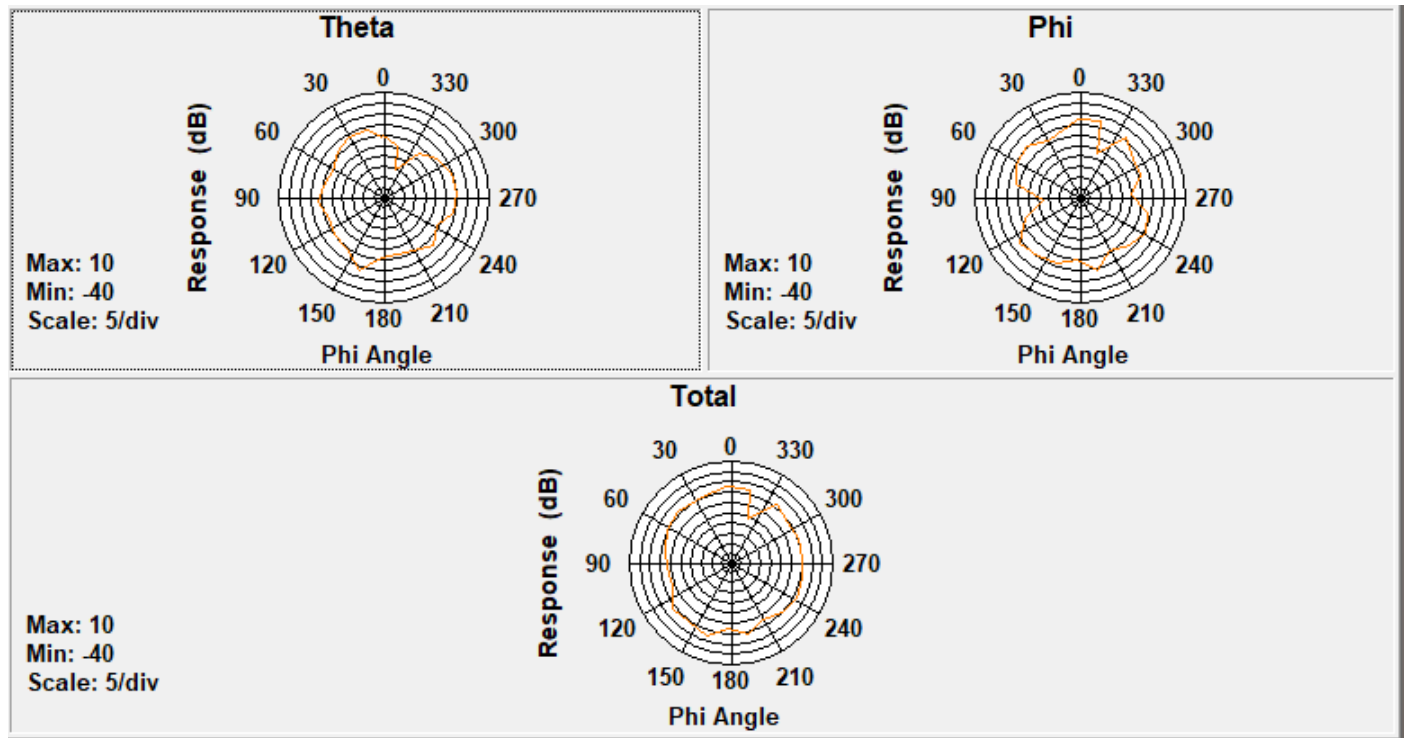
| | |
|-----------------------|----------------|
| Center Frequency | 2595MHz |
| Horizontal (dBi) peak | 2.28 |
| Vertical (dBi) peak | 0.83 |

2690MHz



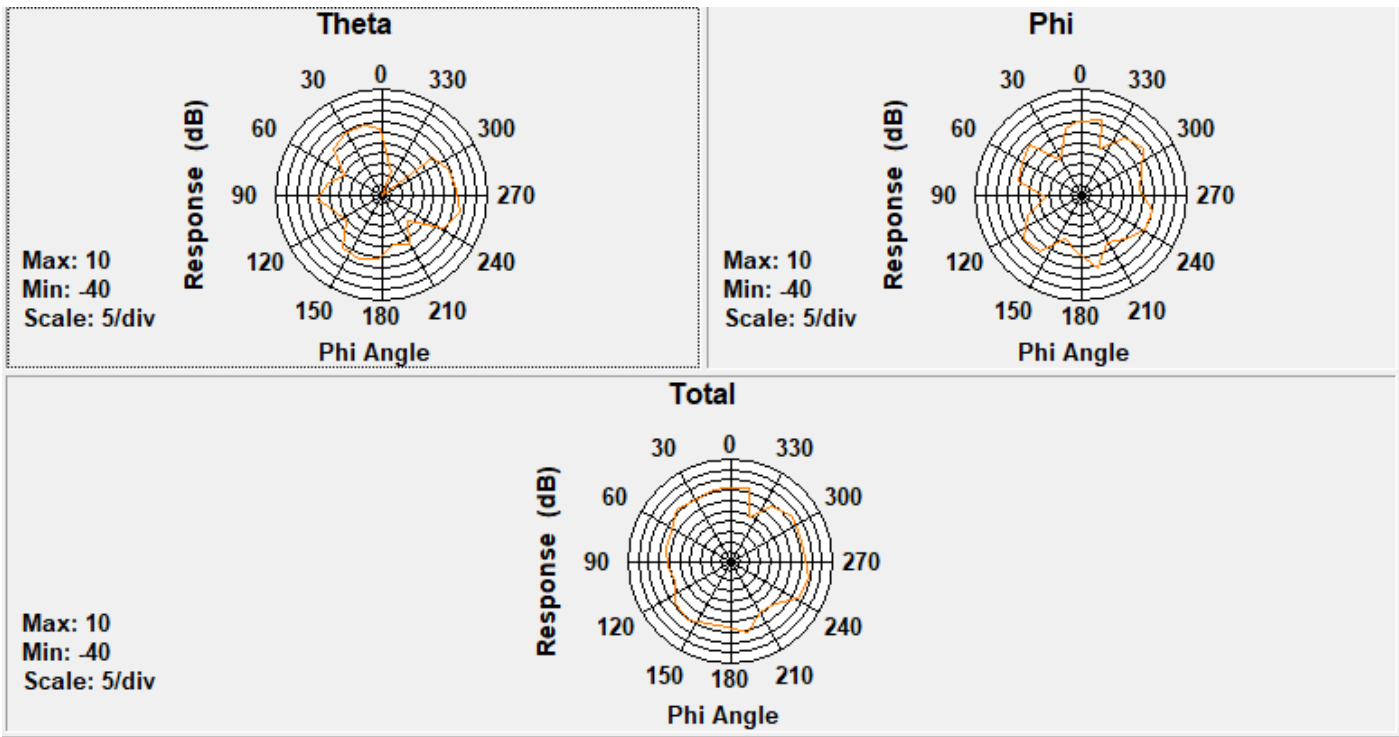
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|-----------------------|----------------|
| Center Frequency | 2690MHz |
| Horizontal (dBi) peak | -0.71 |
| Vertical (dBi) peak | -0.19 |

3300MHz



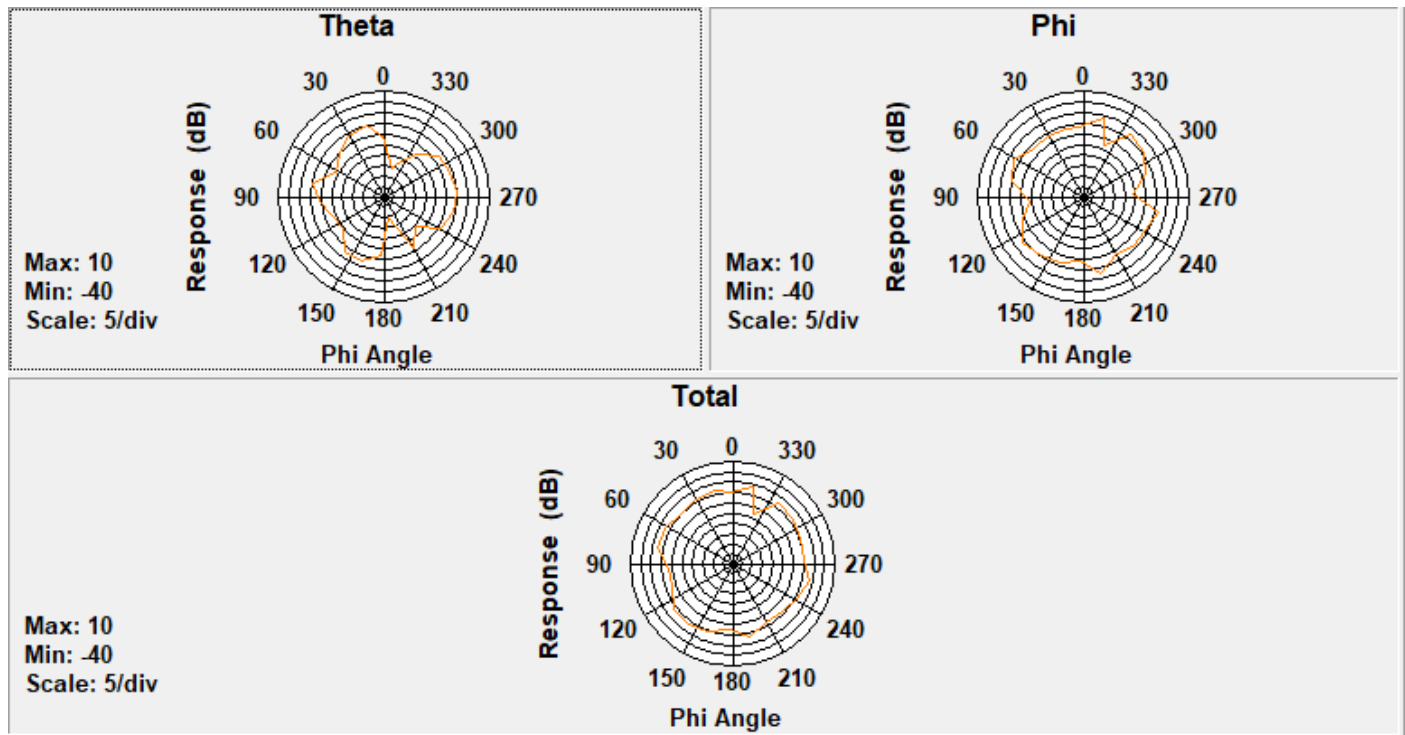
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|-----------------------|----------------|
| Center Frequency | 3300MHz |
| Horizontal (dBi) peak | -2.79 |
| Vertical (dBi) peak | -2.11 |

3400MHz



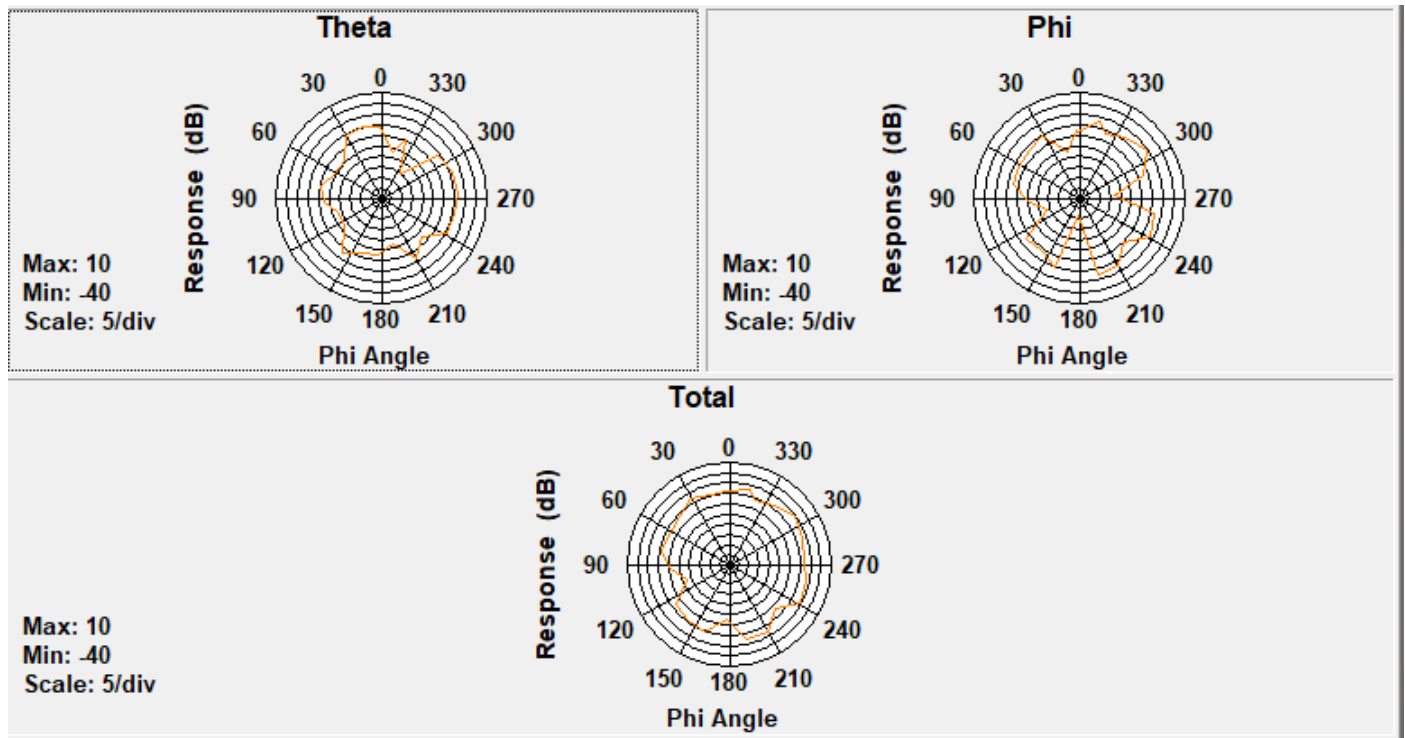
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|-----------------------|----------------|
| Center Frequency | 3400MHz |
| Horizontal (dBi) peak | -2.15 |
| Vertical (dBi) peak | -1.85 |

3500MHz



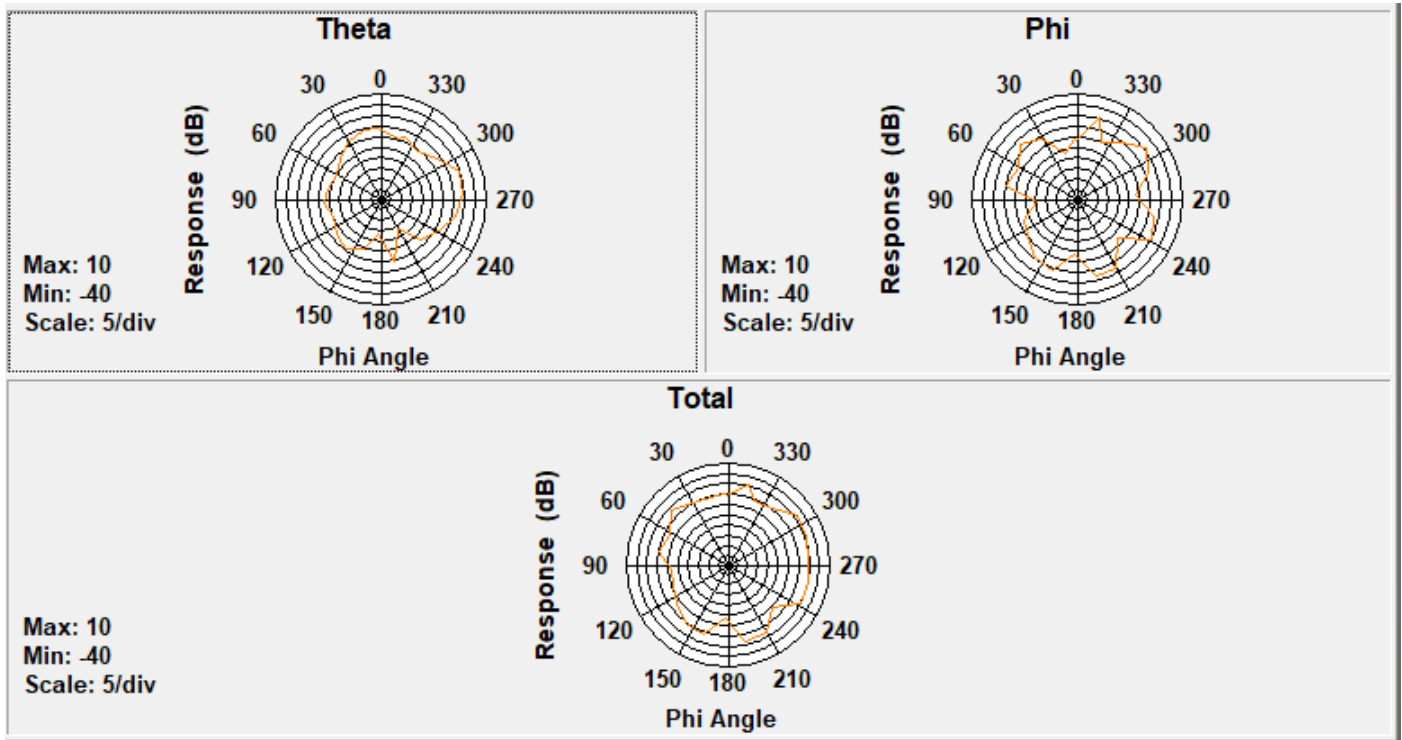
| | |
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| Center Frequency | 3500MHz |
| Horizontal (dBi) peak | -0.63 |
| Vertical (dBi) peak | -0.06 |

3600MHz



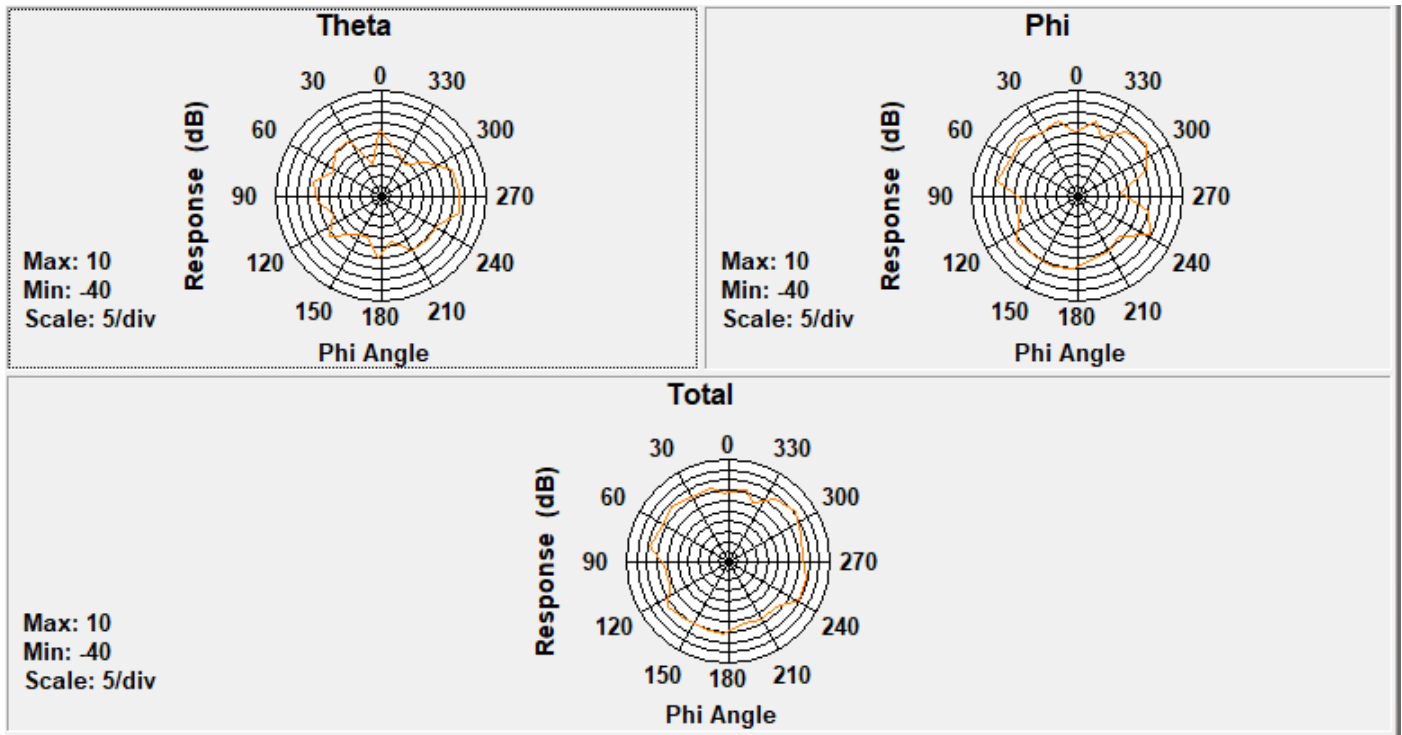
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|-----------------------|----------------|
| Center Frequency | 3600MHz |
| Horizontal (dBi) peak | -0.72 |
| Vertical (dBi) peak | -0.33 |

3750MHz



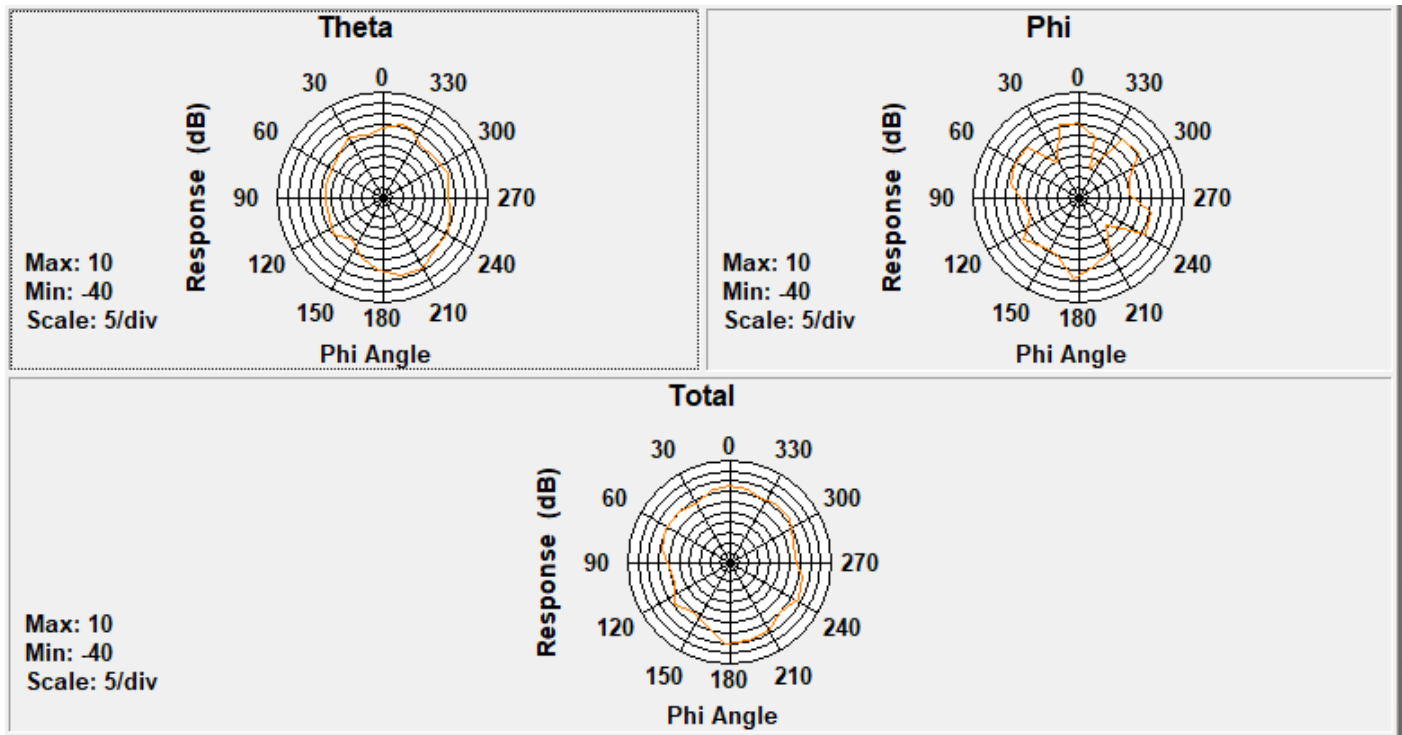
| | |
|-----------------------|----------------|
| Center Frequency | 3750MHz |
| Horizontal (dBi) peak | 0.91 |
| Vertical (dBi) peak | 0.64 |

4200MHz



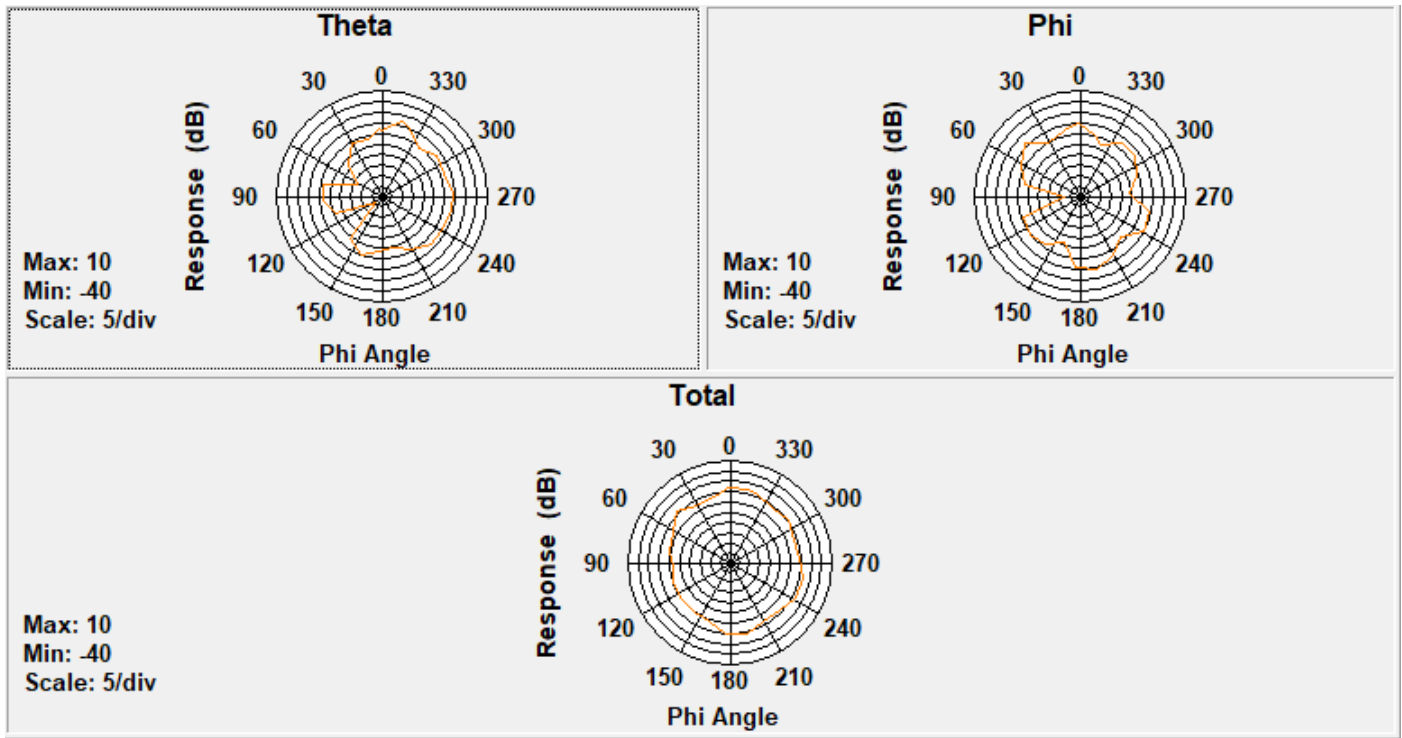
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|-----------------------|----------------|
| Center Frequency | 4200MHz |
| Horizontal (dBi) peak | -0.17 |
| Vertical (dBi) peak | 0.22 |

4400MHz



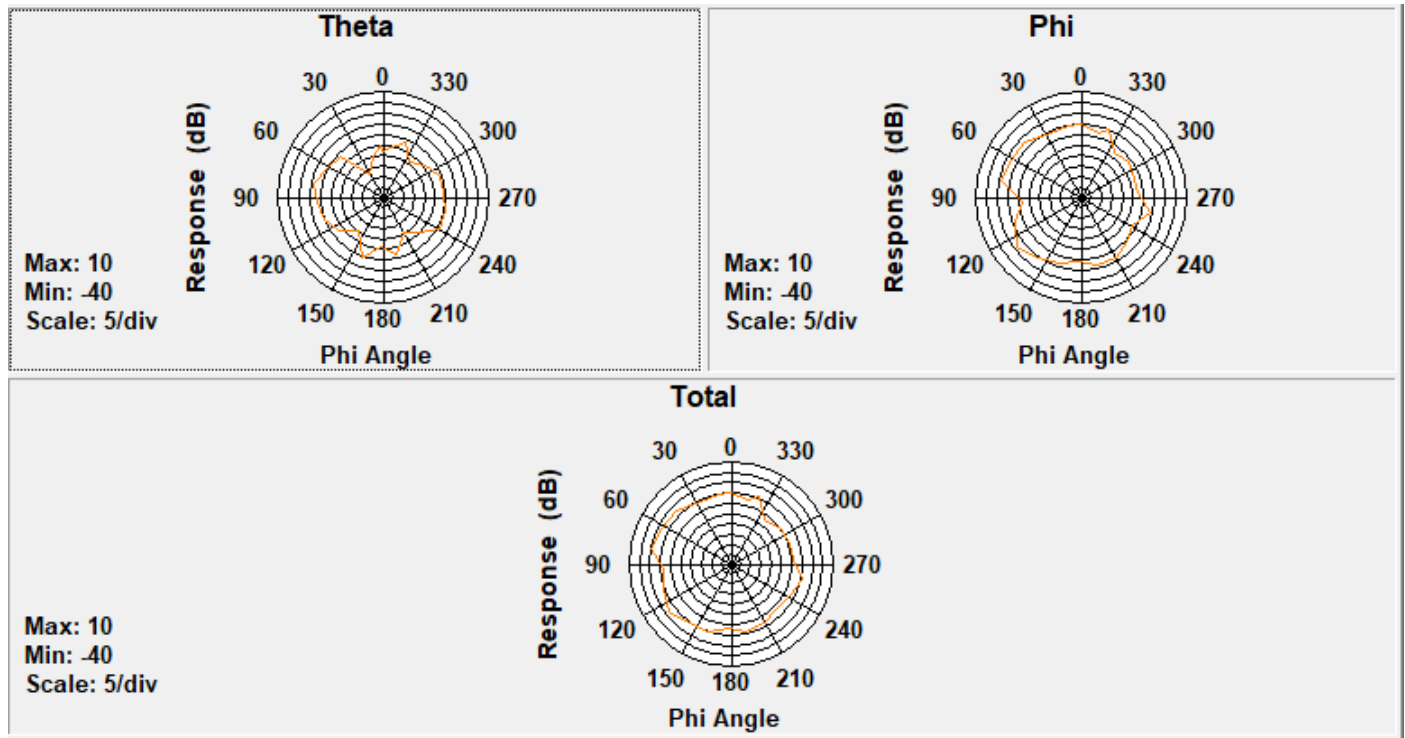
| | |
|-----------------------|----------------|
| Center Frequency | 4400MHz |
| Horizontal (dBi) peak | -2.09 |
| Vertical (dBi) peak | -1.00 |

4800MHz



| | |
|-----------------------|----------------|
| Center Frequency | 4800MHz |
| Horizontal (dBi) peak | -4.03 |
| Vertical (dBi) peak | -2.06 |

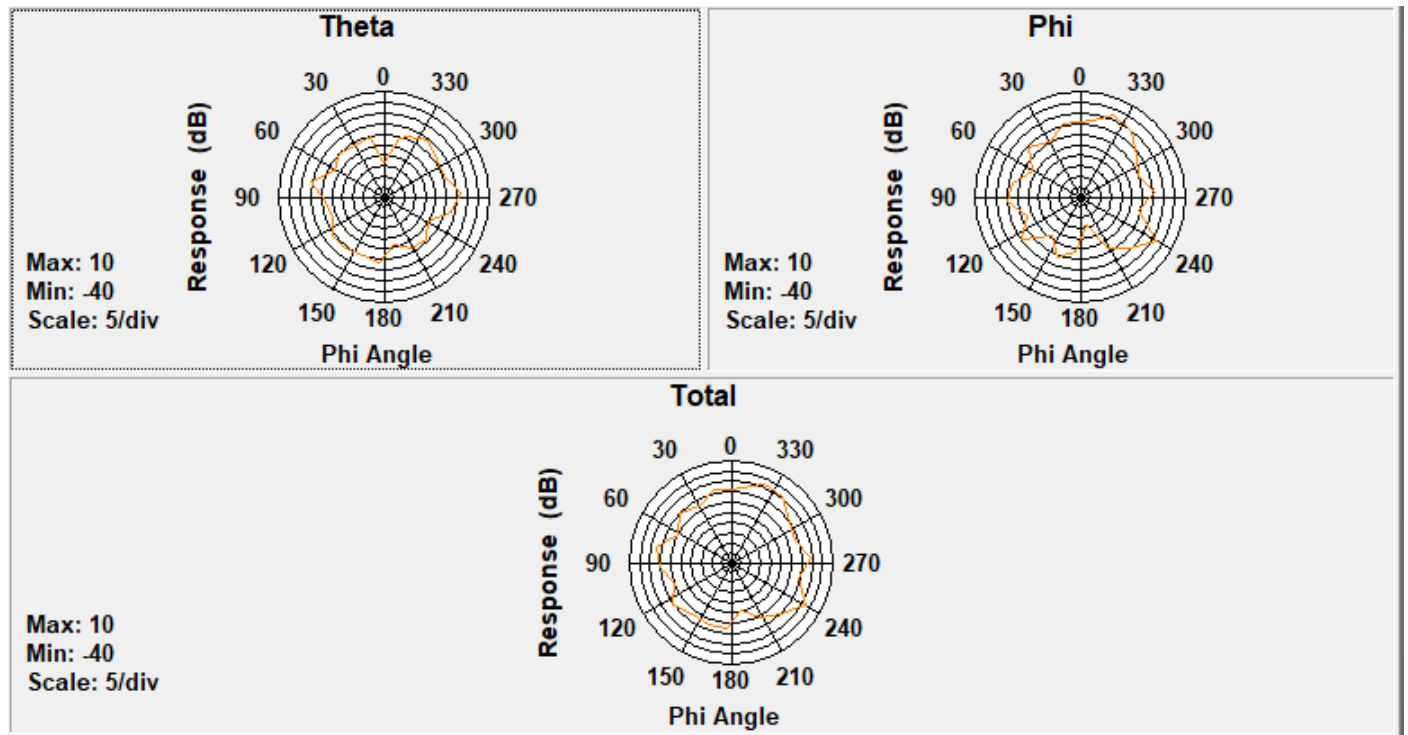
5000MHz



| | |
|-----------------------|----------------|
| Center Frequency | 5000MHz |
| Horizontal (dBi) peak | 0.68 |
| Vertical (dBi) peak | -0.58 |

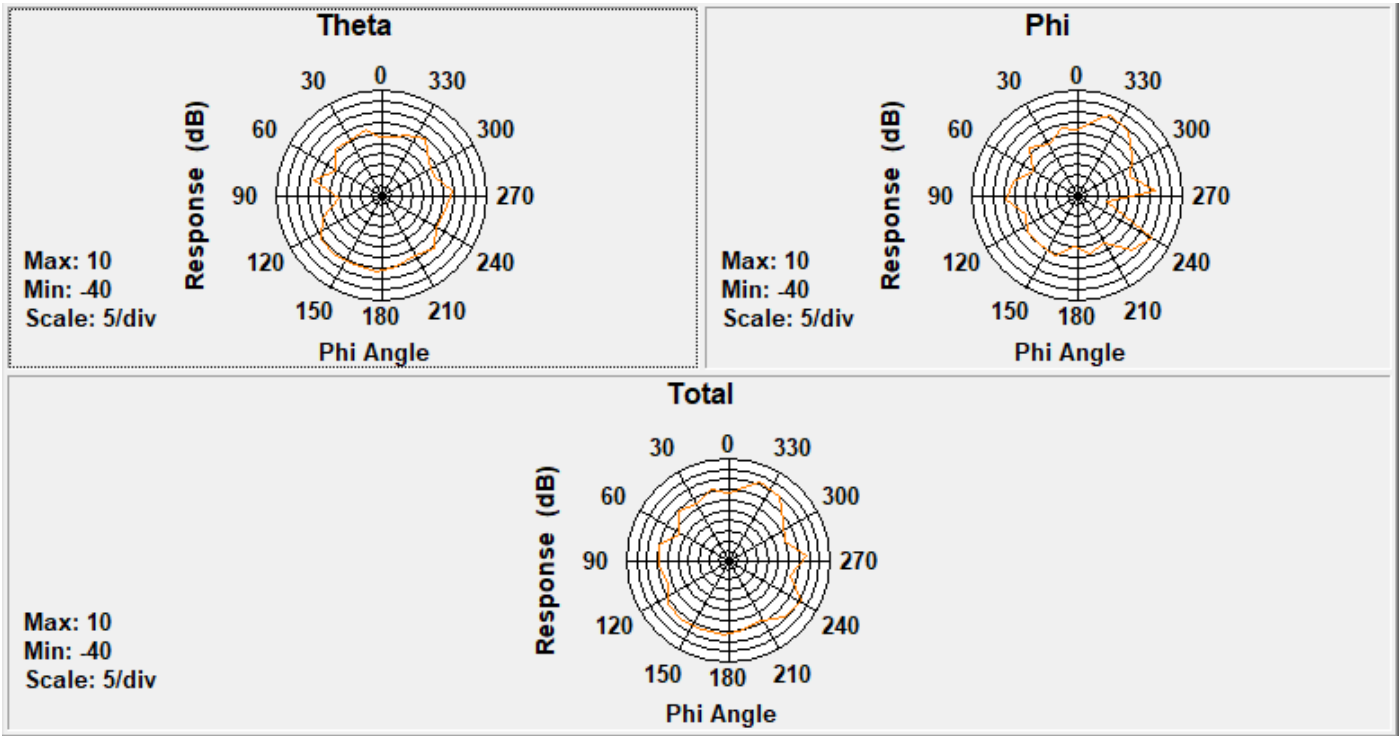
● [Ant8:](#)
Example

[1710 MHz](#)



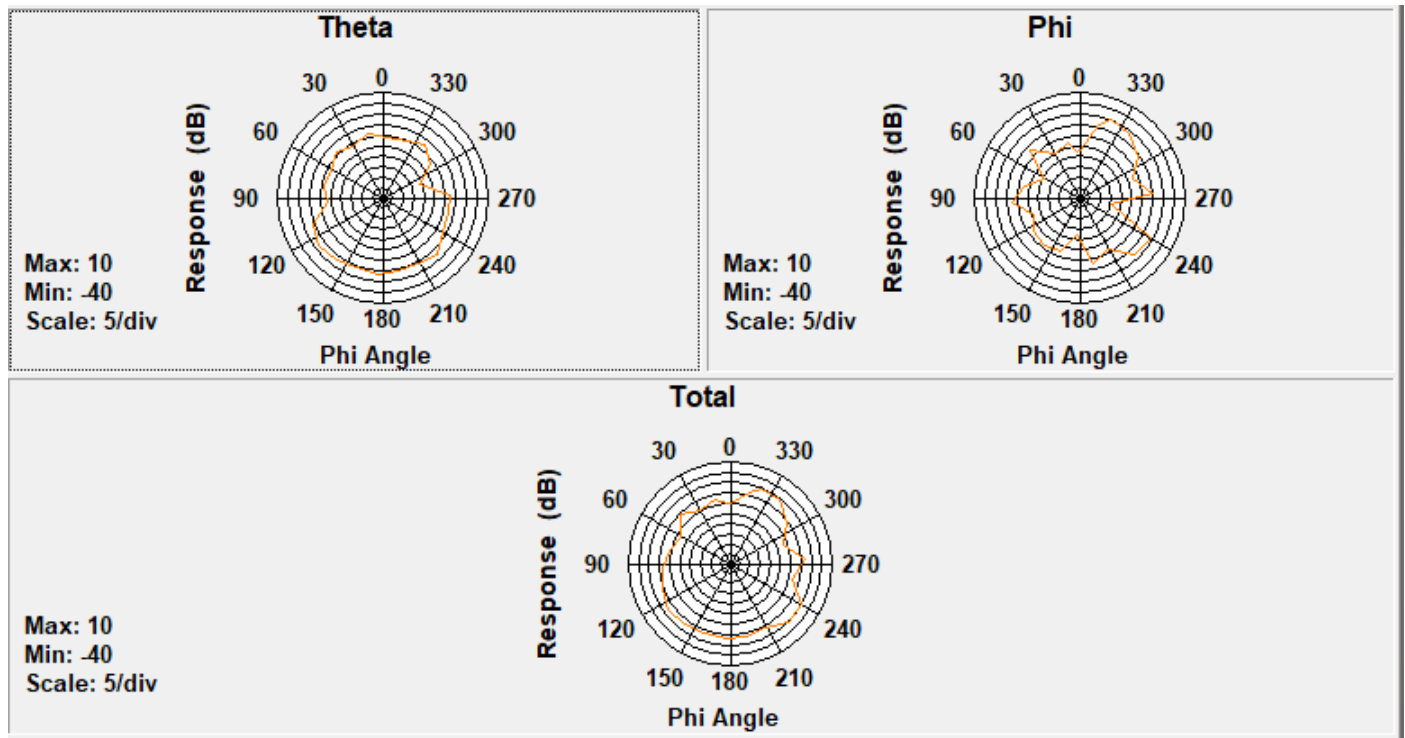
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|-----------------------|----------------|
| Center Frequency | 1710MHz |
| Horizontal (dBi) peak | 2.08 |
| Vertical (dBi) peak | 1.22 |

1750 MHz



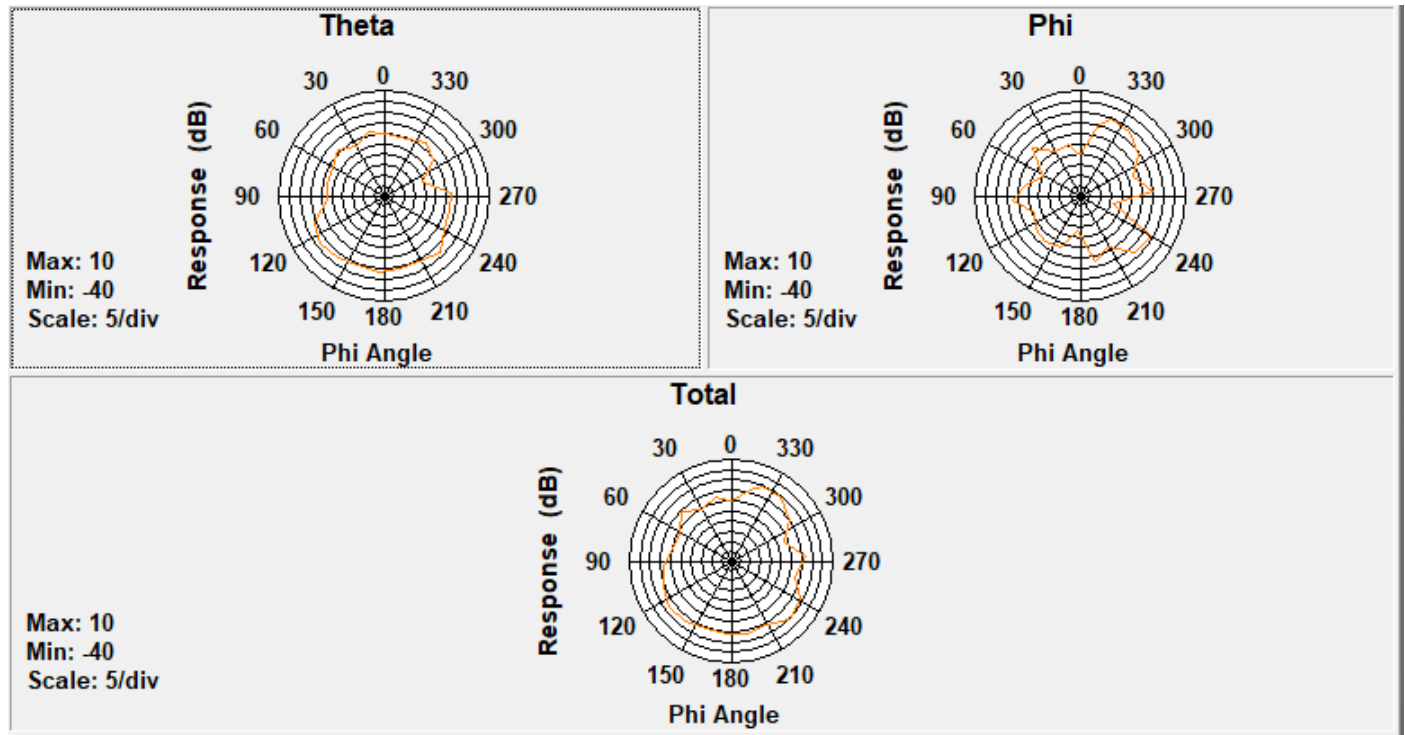
| | |
|-----------------------|----------------|
| Center Frequency | 1750MHz |
| Horizontal (dBi) peak | 2.14 |
| Vertical (dBi) peak | 0.13 |

1780 MHz



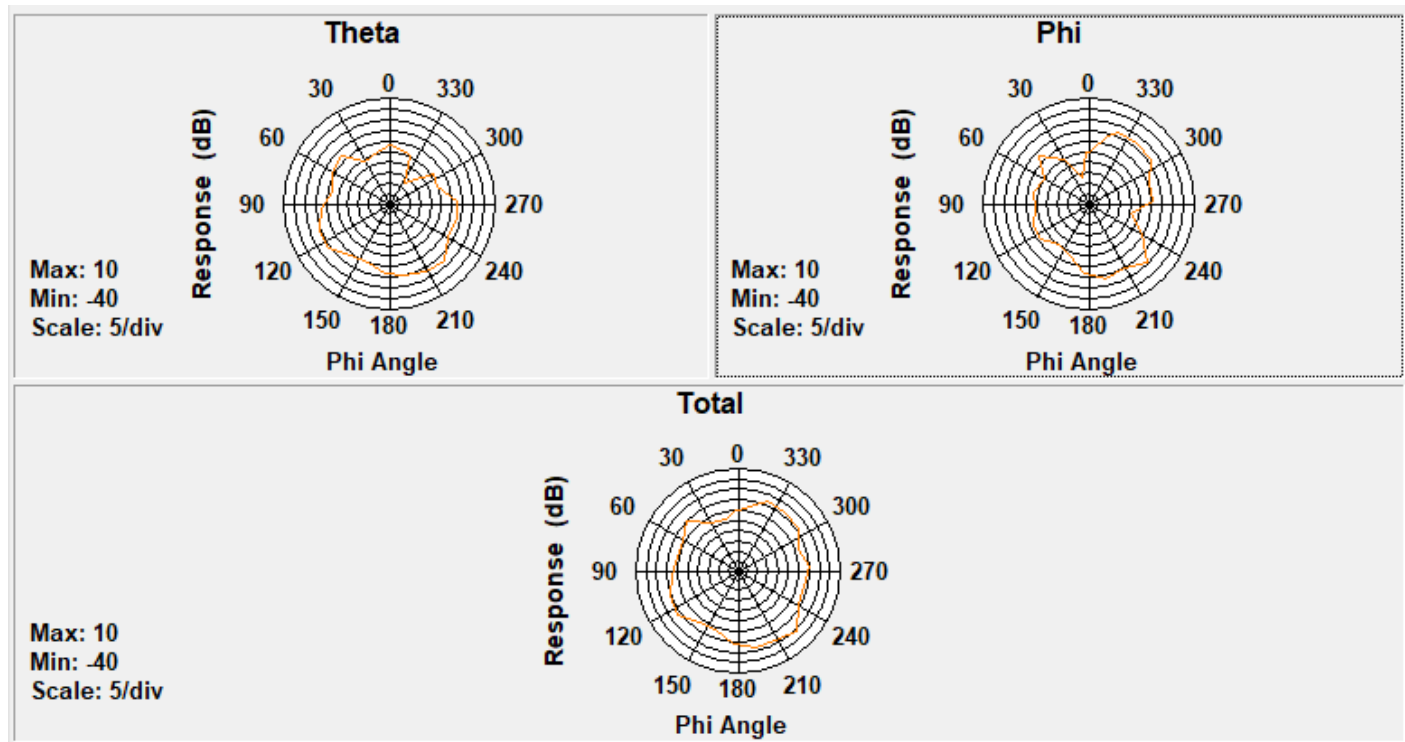
| | |
|-----------------------|----------------|
| Center Frequency | 1780MHz |
| Horizontal (dBi) peak | 2.00 |
| Vertical (dBi) peak | -0.63 |

1785 MHz



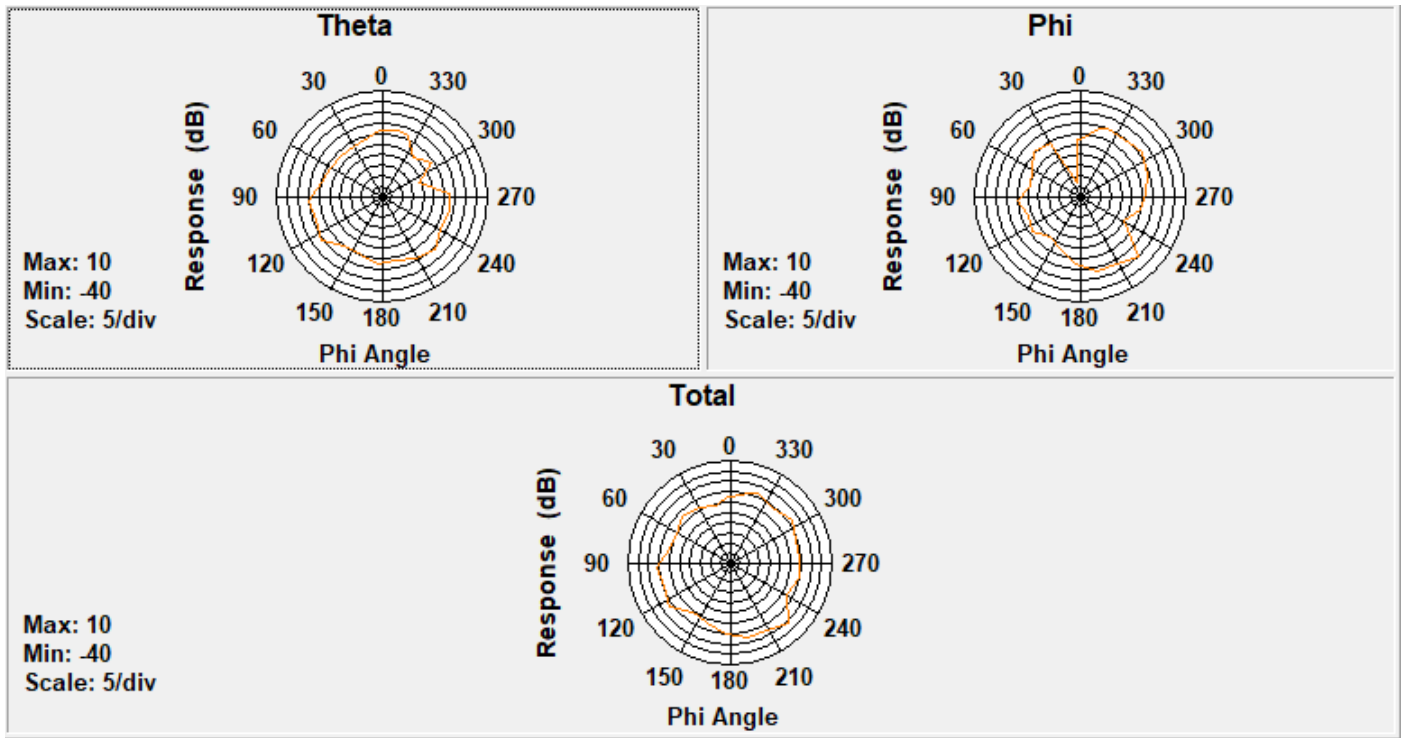
| | |
|-----------------------|----------------|
| Center Frequency | 1785MHz |
| Horizontal (dBi) peak | 2.05 |
| Vertical (dBi) peak | -0.80 |

1880 MHz



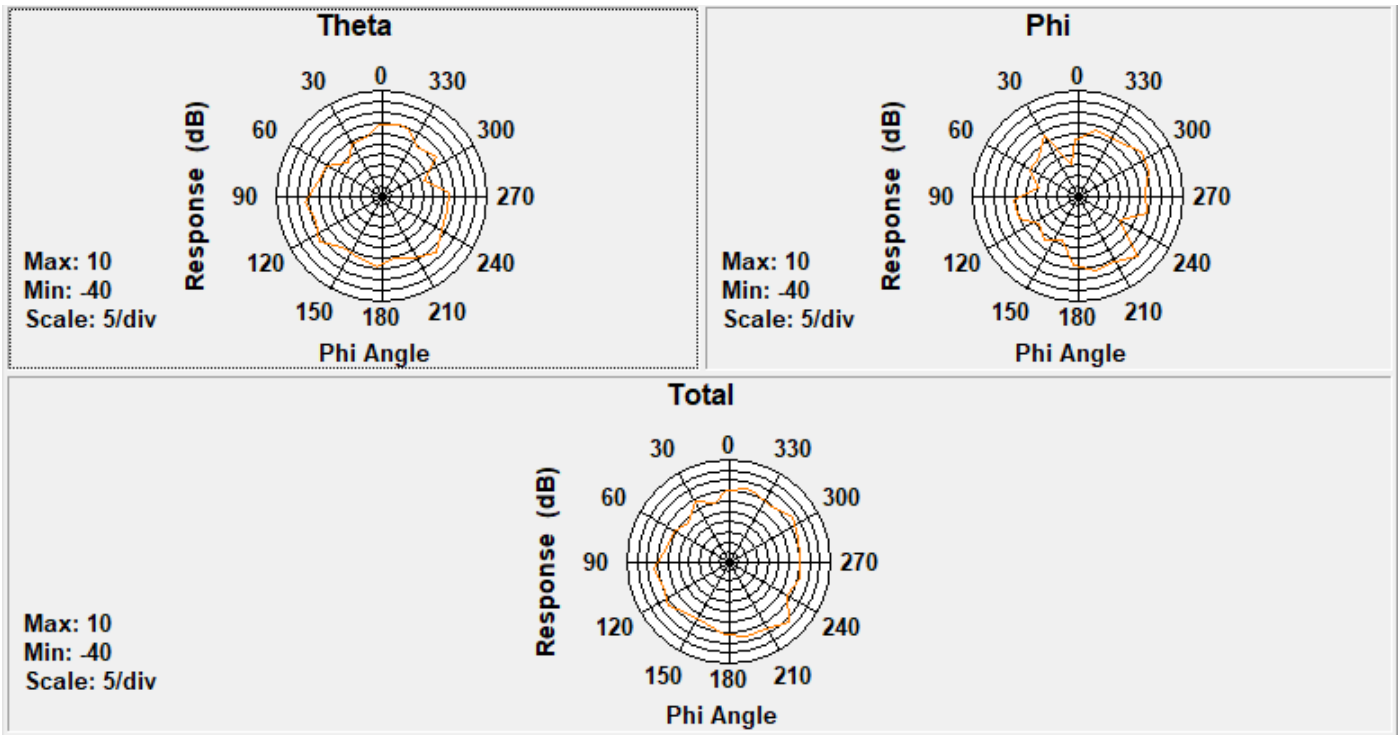
| | |
|-----------------------|----------------|
| Center Frequency | 1880MHz |
| Horizontal (dBi) peak | 0.42 |
| Vertical (dBi) peak | -0.65 |

1900 MHz



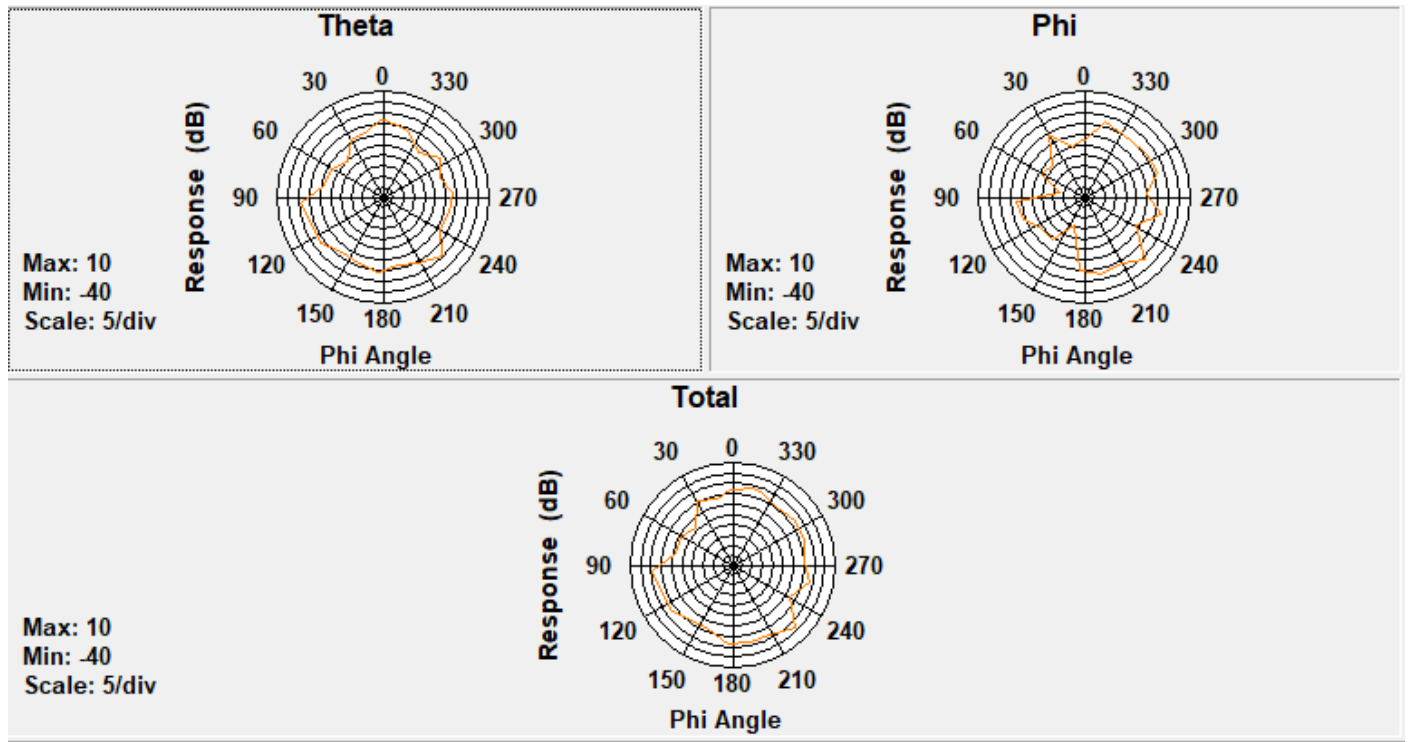
| | |
|-----------------------|----------------|
| Center Frequency | 1900MHz |
| Horizontal (dBi) peak | 0.92 |
| Vertical (dBi) peak | 0.15 |

1920 MHz



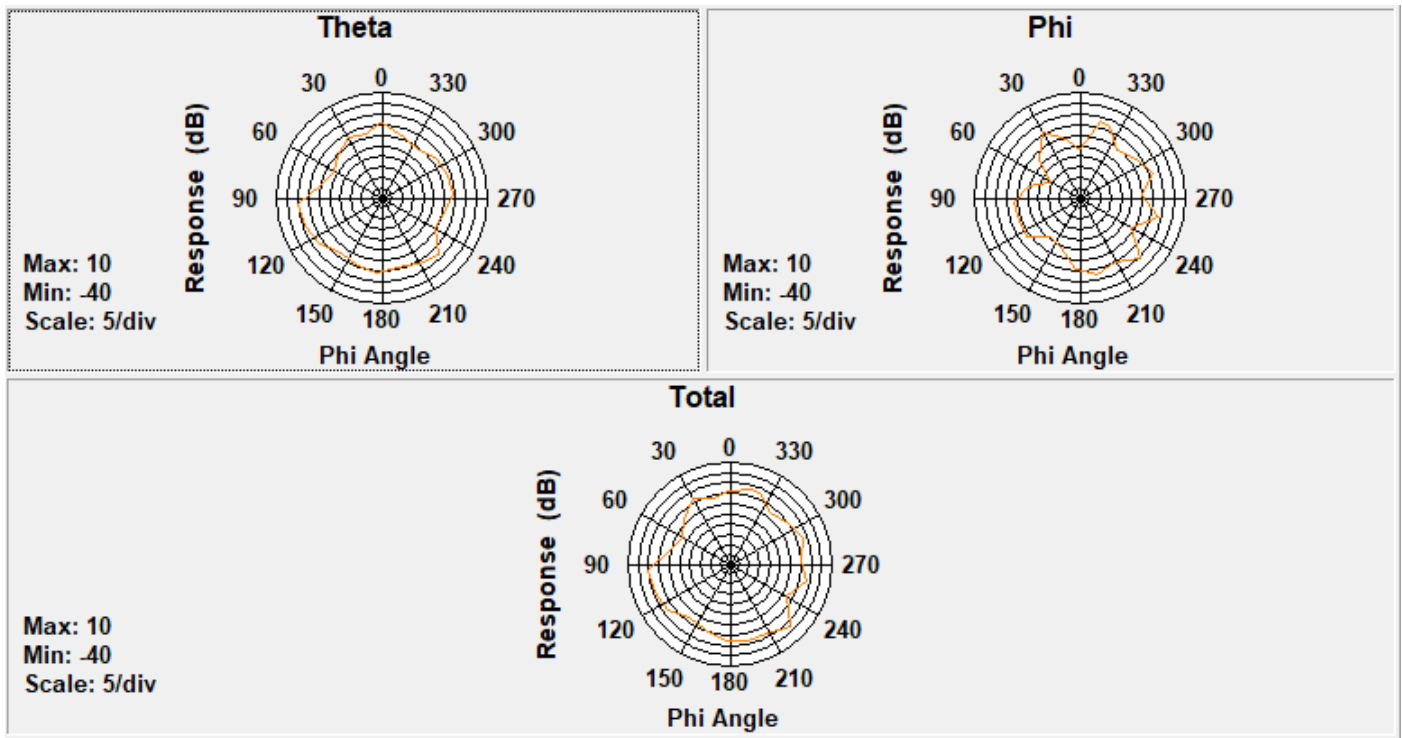
| | |
|-----------------------|----------------|
| Center Frequency | 1920MHz |
| Horizontal (dBi) peak | 0.82 |
| Vertical (dBi) peak | 1.25 |

1950 MHz



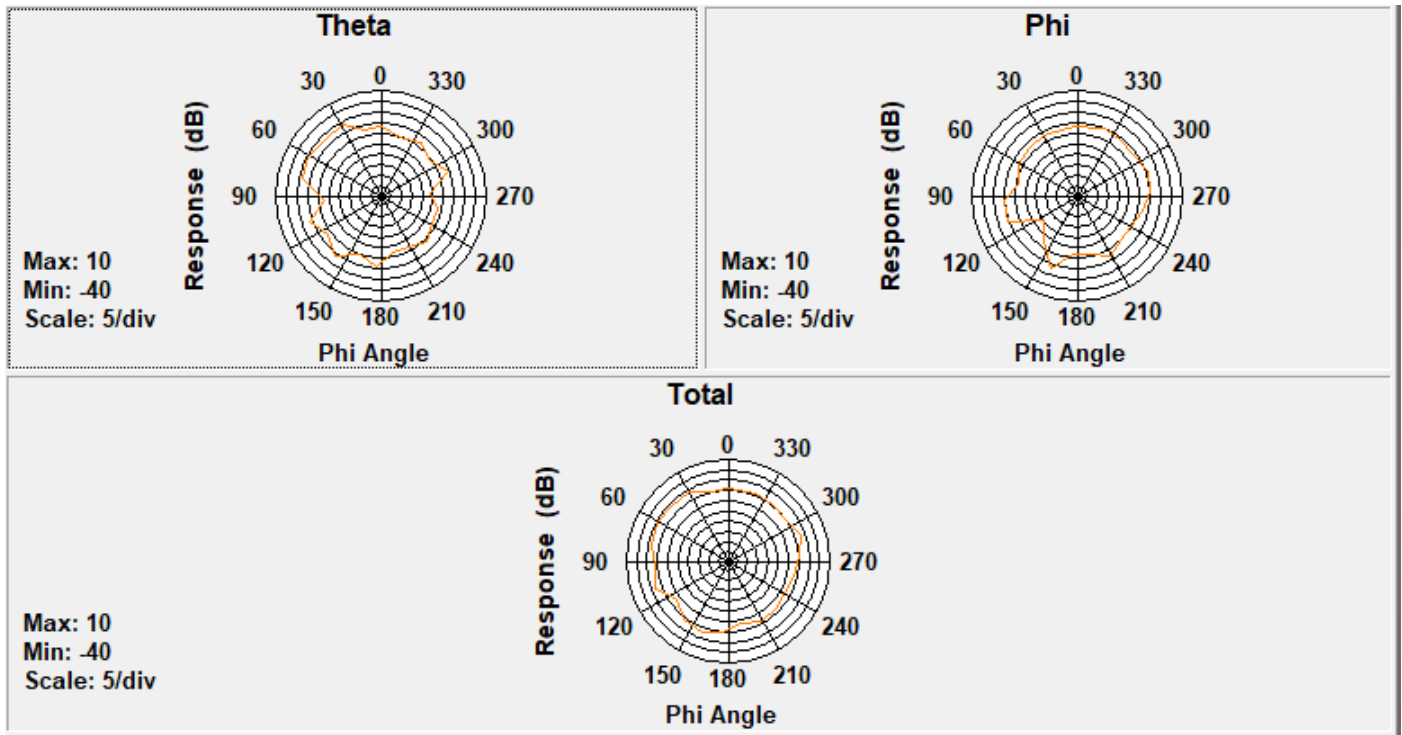
| | |
|-----------------------|----------------|
| Center Frequency | 1950MHz |
| Horizontal (dBi) peak | 1.68 |
| Vertical (dBi) peak | 0.80 |

1980 MHz



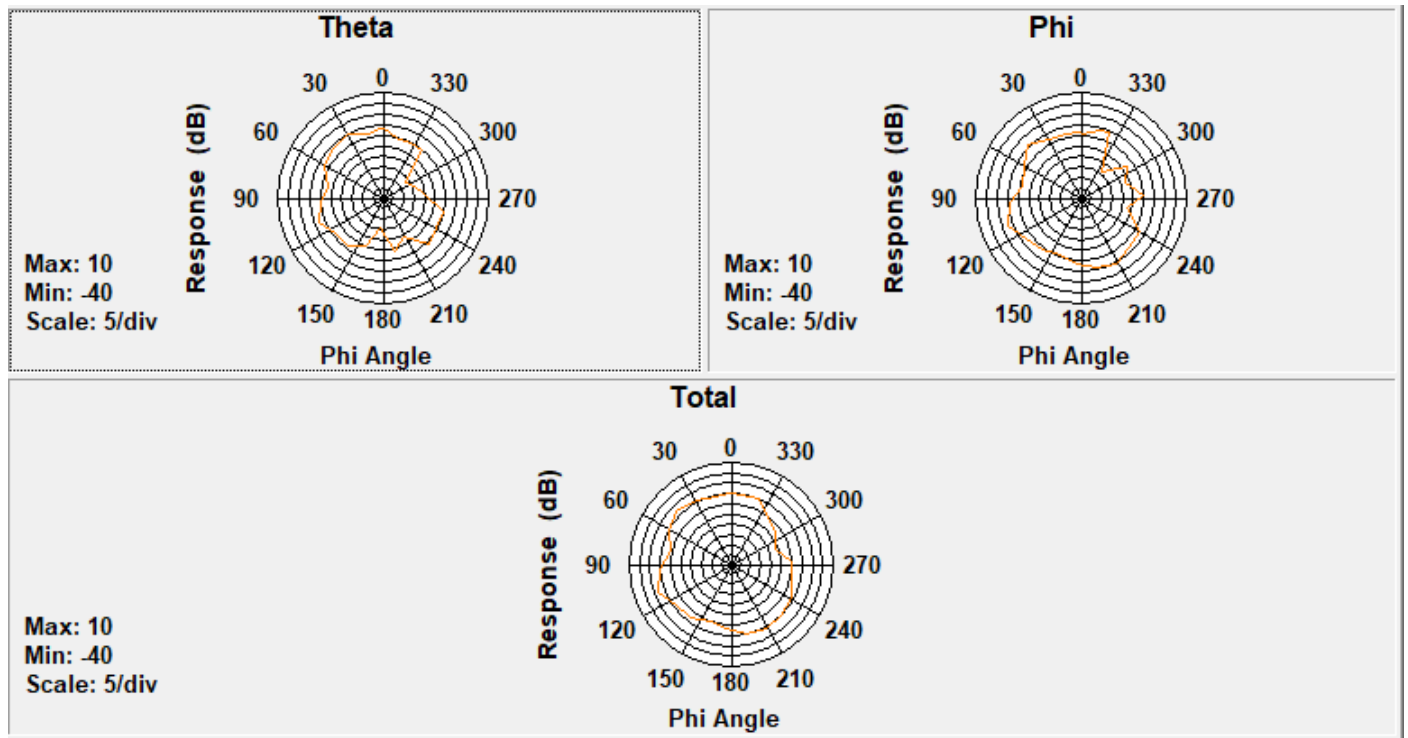
| | |
|-----------------------|----------------|
| Center Frequency | 1980MHz |
| Horizontal (dBi) peak | 1.77 |
| Vertical (dBi) peak | 0.84 |

2496 MHz



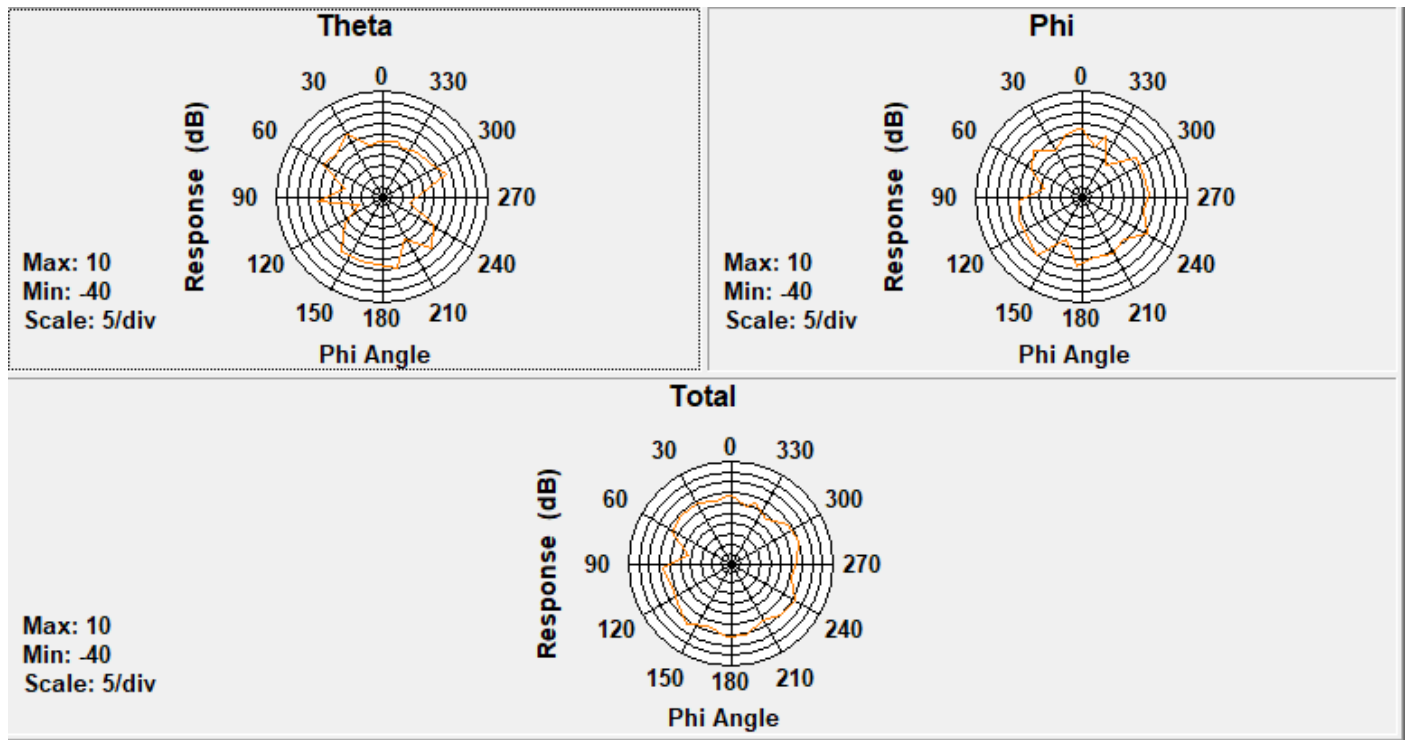
| | |
|-----------------------|---------|
| Center Frequency | 2496MHz |
| Horizontal (dBi) peak | 1.79 |
| Vertical (dBi) peak | -0.03 |

2595 MHz



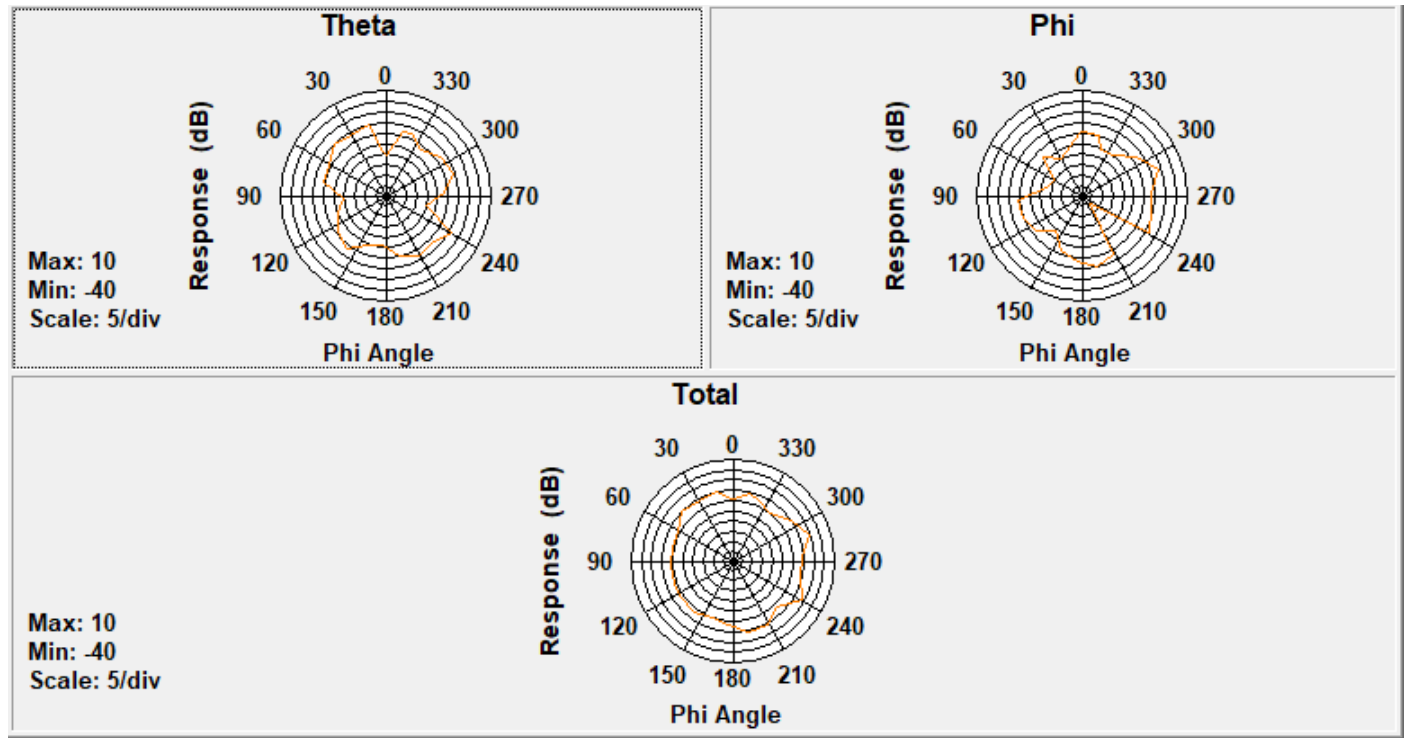
| | |
|-----------------------|----------------|
| Center Frequency | 2595MHz |
| Horizontal (dBi) peak | -1.98 |
| Vertical (dBi) peak | -1.87 |

2690 MHz



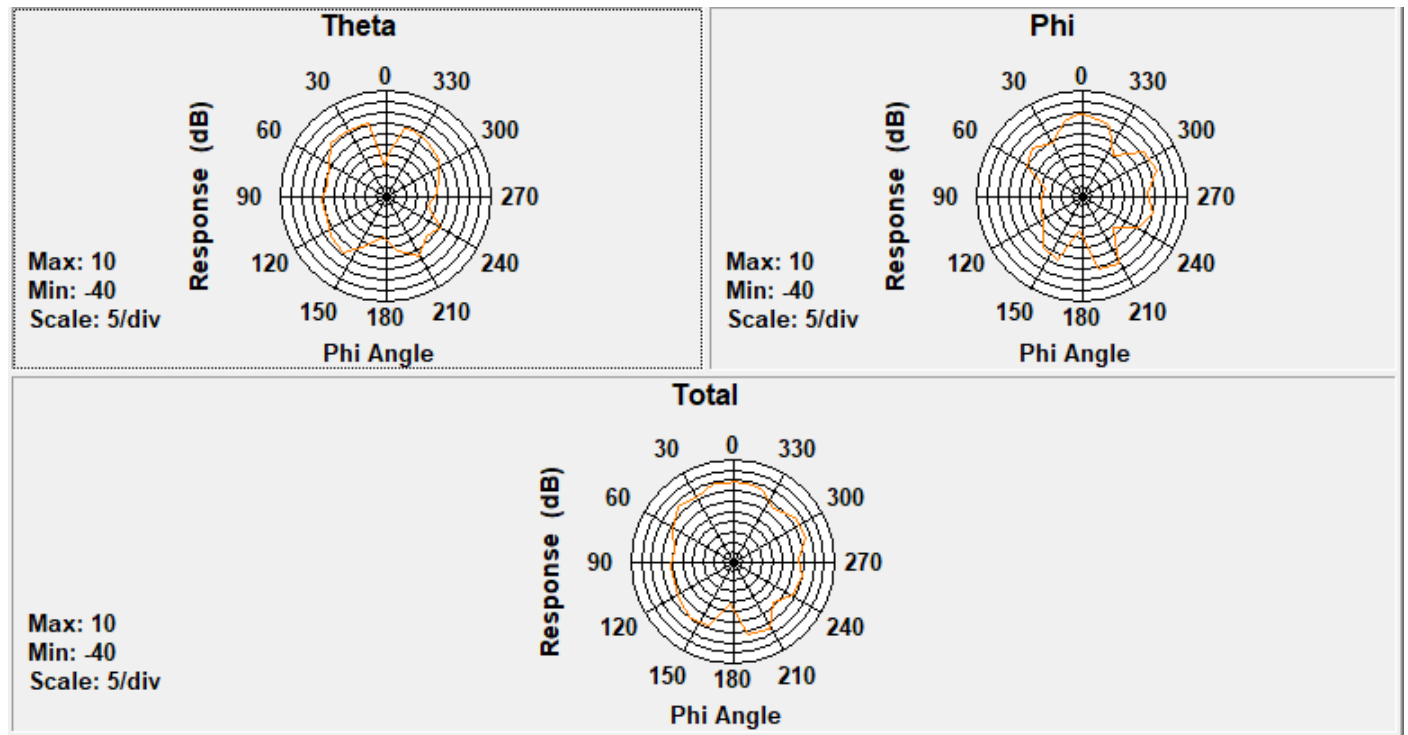
| | |
|-----------------------|----------------|
| Center Frequency | 2690MHz |
| Horizontal (dBi) peak | -1.56 |
| Vertical (dBi) peak | 1.27 |

3300 MHz



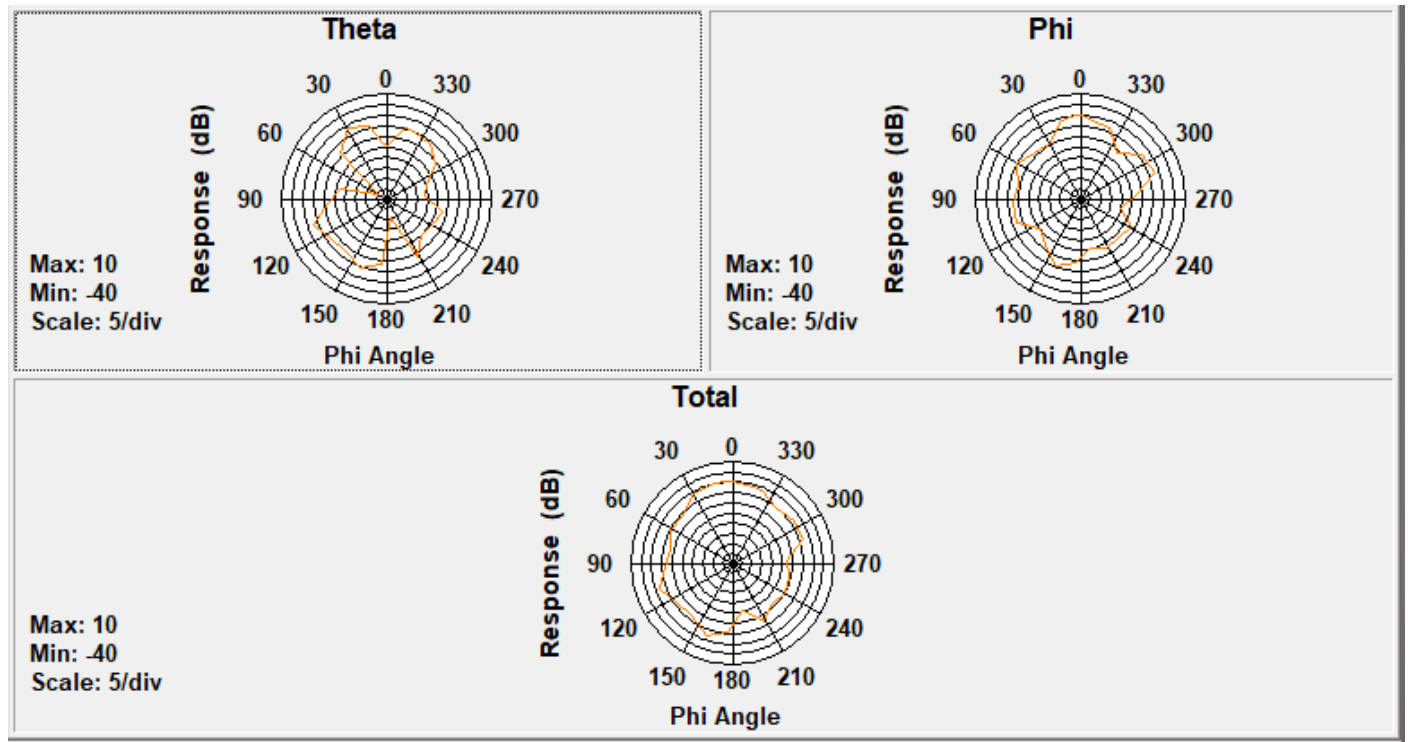
| | |
|-----------------------|----------------|
| Center Frequency | 3300MHz |
| Horizontal (dBi) peak | -0.26 |
| Vertical (dBi) peak | 0.28 |

3400 MHz



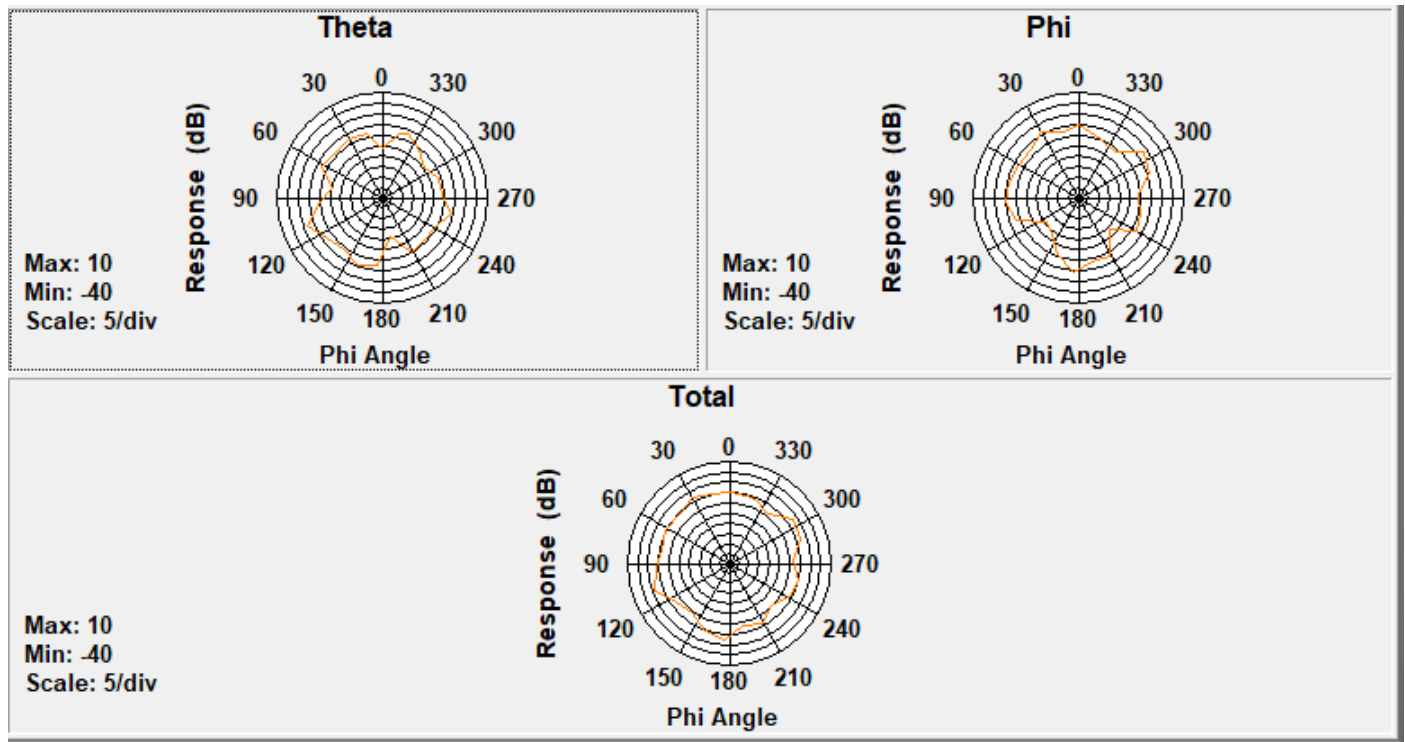
| | |
|-----------------------|----------------|
| Center Frequency | 3400MHz |
| Horizontal (dBi) peak | -0.53 |
| Vertical (dBi) peak | -0.50 |

3500 MHz



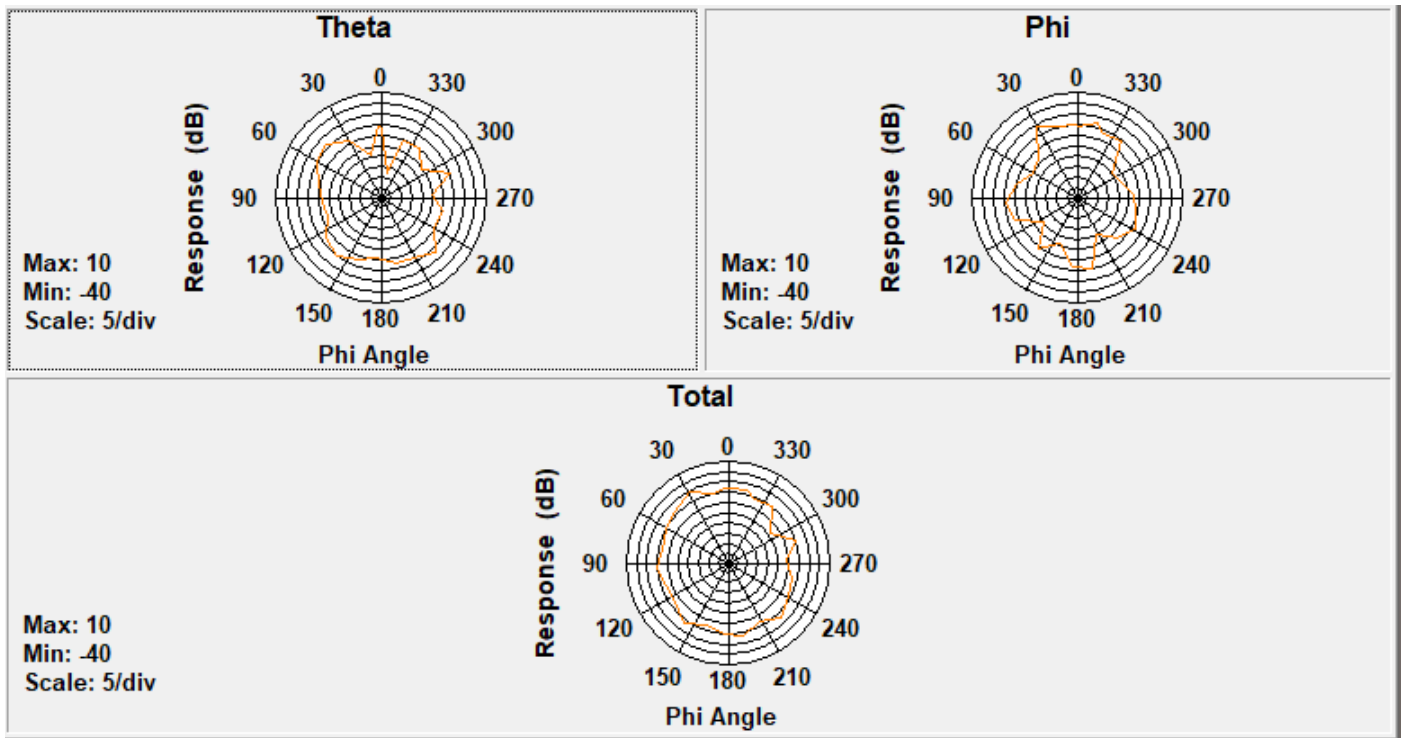
| | |
|-----------------------|----------------|
| Center Frequency | 3500MHz |
| Horizontal (dBi) peak | -1.21 |
| Vertical (dBi) peak | 0.95 |

3600 MHz



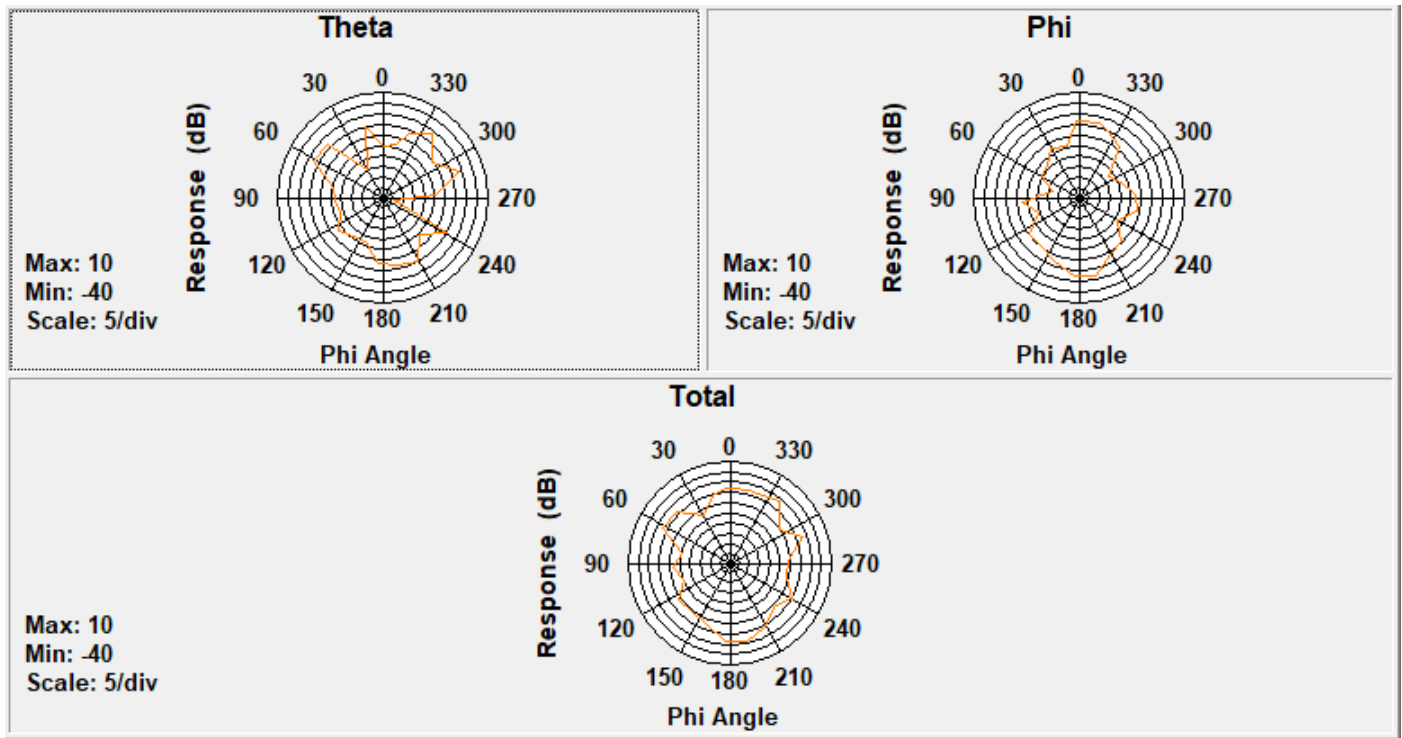
| | |
|-----------------------|----------------|
| Center Frequency | 3600MHz |
| Horizontal (dBi) peak | -0.93 |
| Vertical (dBi) peak | 0.56 |

3750 MHz



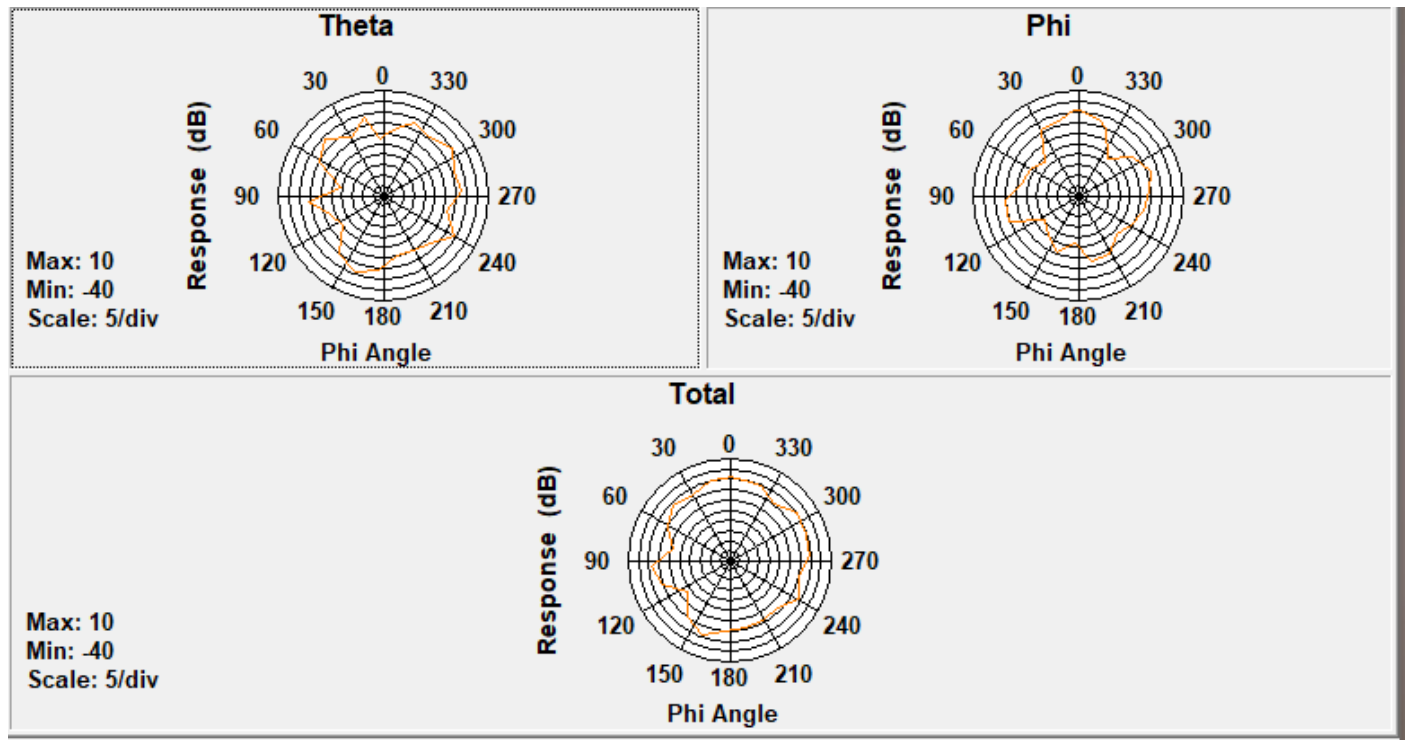
| | |
|-----------------------|----------------|
| Center Frequency | 3750MHz |
| Horizontal (dBi) peak | 0.18 |
| Vertical (dBi) peak | 0.28 |

4200 MHz



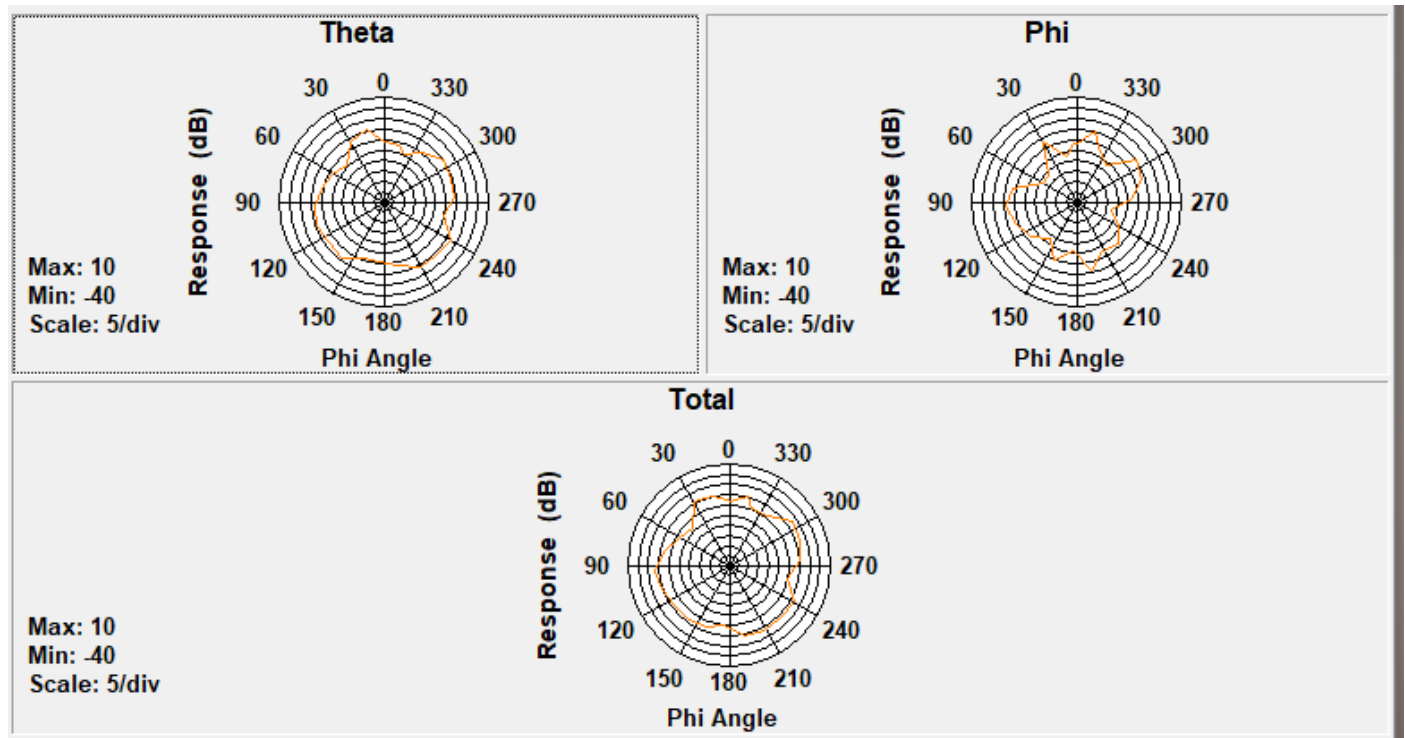
| | |
|-----------------------|----------------|
| Center Frequency | 4200MHz |
| Horizontal (dBi) peak | -0.50 |
| Vertical (dBi) peak | 0.78 |

4400 MHz



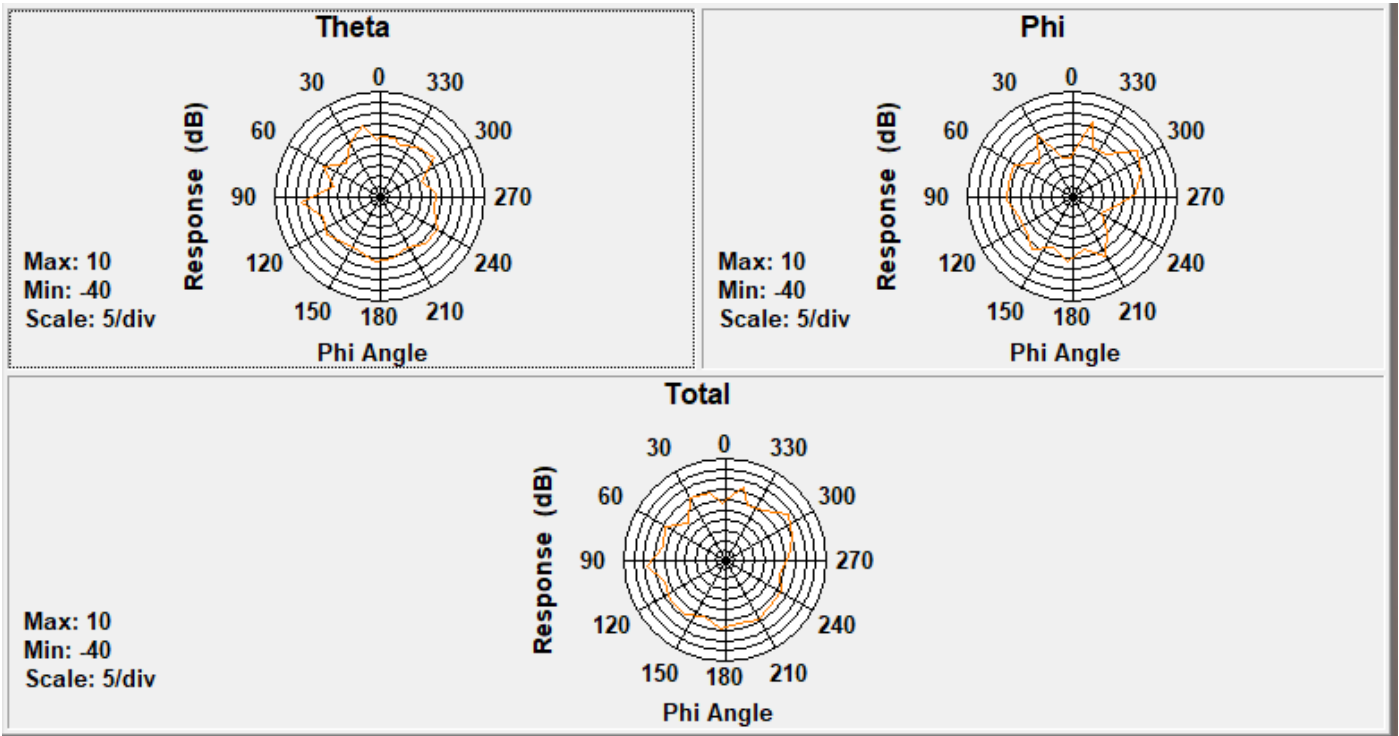
| | |
|-----------------------|----------------|
| Center Frequency | 4400MHz |
| Horizontal (dBi) peak | 2.25 |
| Vertical (dBi) peak | 0.00 |

4800 MHz



| | |
|-----------------------|----------------|
| Center Frequency | 4800MHz |
| Horizontal (dBi) peak | -1.22 |
| Vertical (dBi) peak | -3.14 |

5000 MHz

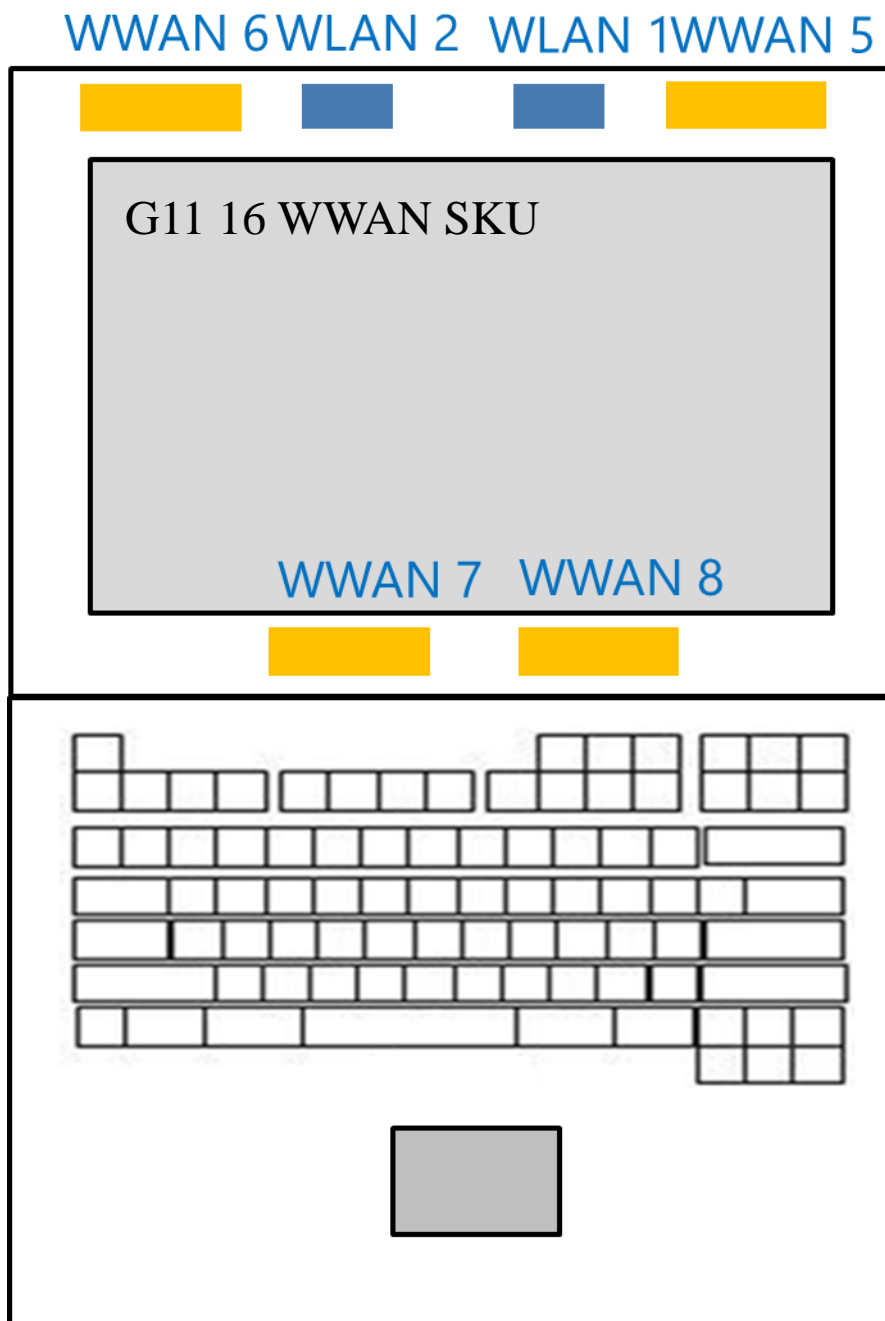


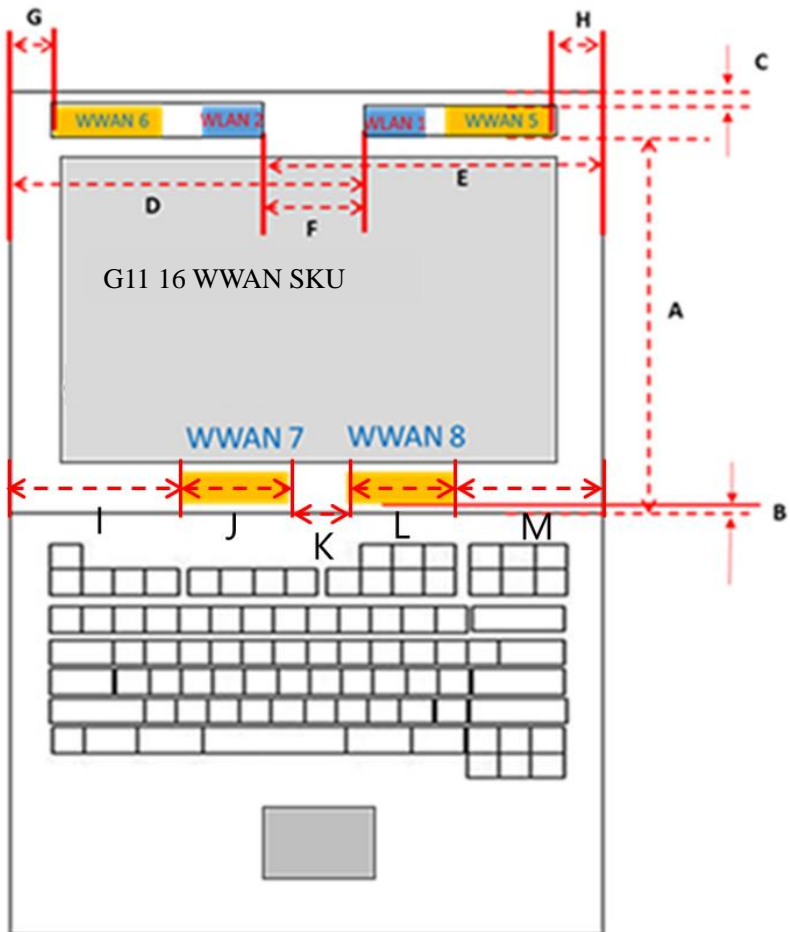
| | |
|-----------------------|----------------|
| Center Frequency | 5000MHz |
| Horizontal (dBi) peak | -1.21 |
| Vertical (dBi) peak | -3.17 |

Section 4. Host Platform Information

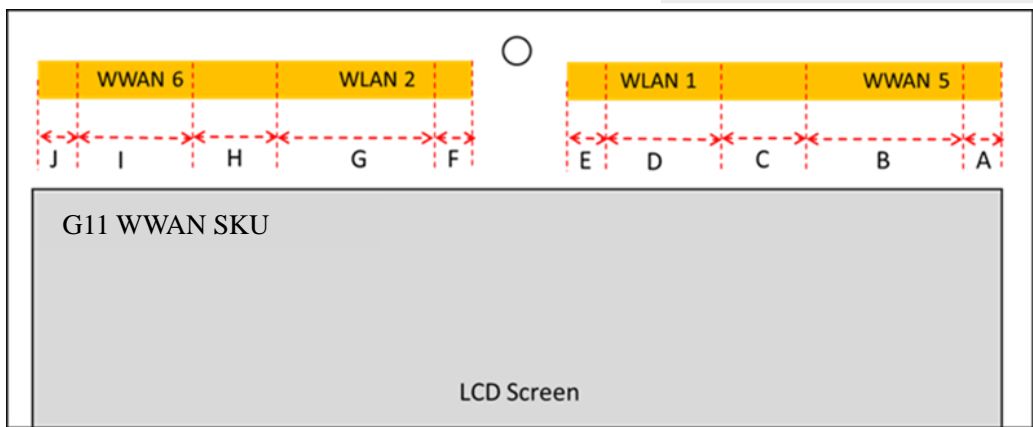
Include a **dimensioned photo(s) or dimensioned drawing(s)** of Main and Aux antenna placements (measurements are not required for receive-only antenna).

Any antenna that transmits must show dimensions to bottom of laptop. Provide a description of the materials that are used for supporting or surrounding transmit antennas; for example, non-conductive plastics vs. conductive coated plastic or metallic materials.





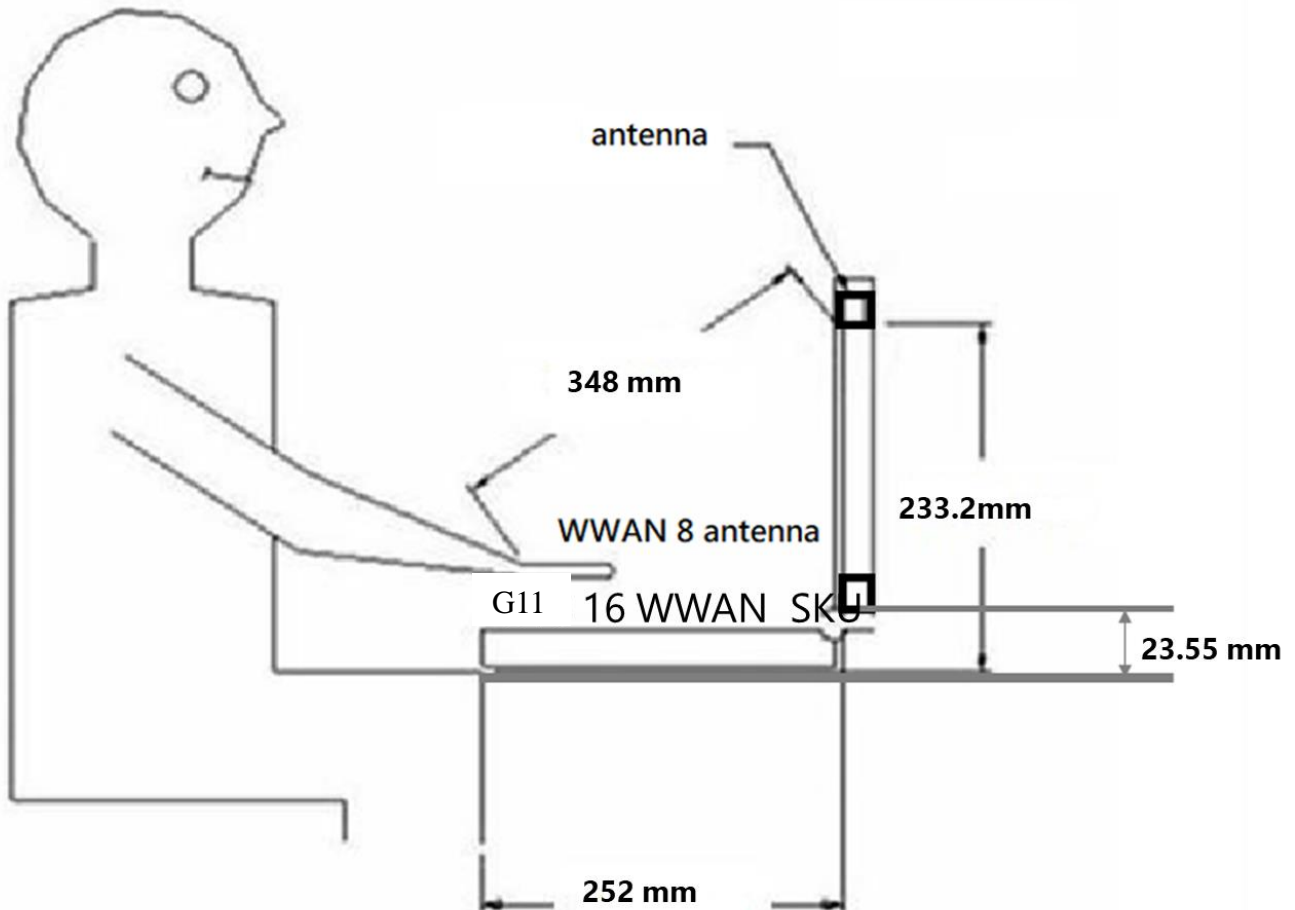
| | |
|----------|----------|
| A | 233.2mm |
| B | 23.55mm |
| C | 1.5mm |
| D | 215.85mm |
| E | 226.45mm |
| F | 79.6mm |
| G | 39.25mm |
| H | 40.85mm |
| I | 138.16mm |
| J | 35mm |
| K | 47.125mm |
| L | 35mm |
| M | 103.02mm |



| | | | |
|---|--------|---|------|
| A | 0mm | F | 0mm |
| B | 78.8mm | G | 15mm |
| C | 8mm | H | 8mm |
| D | 15.2mm | I | 74mm |
| E | 0mm | J | 0mm |

Section 5. Antenna dimensional information for SAR evaluation

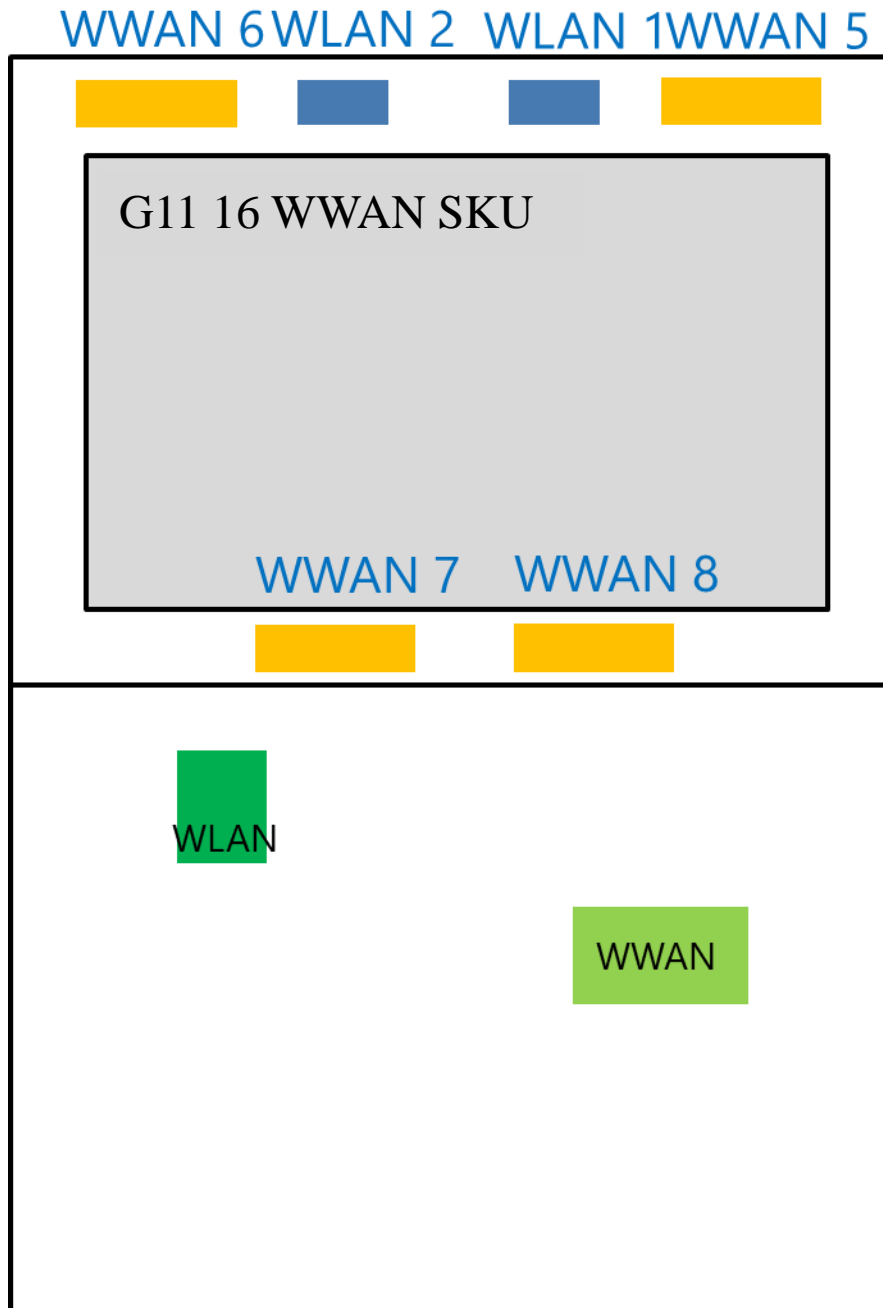
Include a **dimensioned photo(s) or dimensioned drawing(s)** showing the distance (mm) between the transmit antennas and the user. For notebook/laptop hosts show lapheld position (example below). For tablet hosts show all orientations including lapheld, primary & secondary portrait, primary & secondary landscape positions. Include a description of any proximity sensors or power throttling implementations that limit or exclude use of any host orientation.



Section 6. Diagram Example of Co-Location Antenna Separation

Include a **dimensioned photo or dimensioned drawing** showing the distance (mm) between all WLAN transmit antennas and other co-located radiator transmit antenna such as Bluetooth, WWAN,..

(Note: Due to the evolving rules regarding co-location, each platform will need to be reviewed on a case by case basis)



Section 8. Local representative contact information

Local representative contact information is required for regulatory support for target countries below.

| | Local company name | Contact name | Phone number | FAX Number | e-Mail Address | Notes |
|--------------|--------------------|--------------|--------------|------------|----------------|-----------------------------------------------------------|
| Argentina | | | | | | |
| Azerbaijan | | | | | | |
| Cambodia | | | | | | |
| Indonesia | | | | | | |
| Israel | | | | | | |
| Malaysia | | | | | | |
| Philippines | | | | | | |
| Singapore | | | | | | Telecommunication Equipment Dealer License Required |
| South Africa | | | | | | |
| USA, Canada | | | | | | |
| Vietnam | | | | | | |