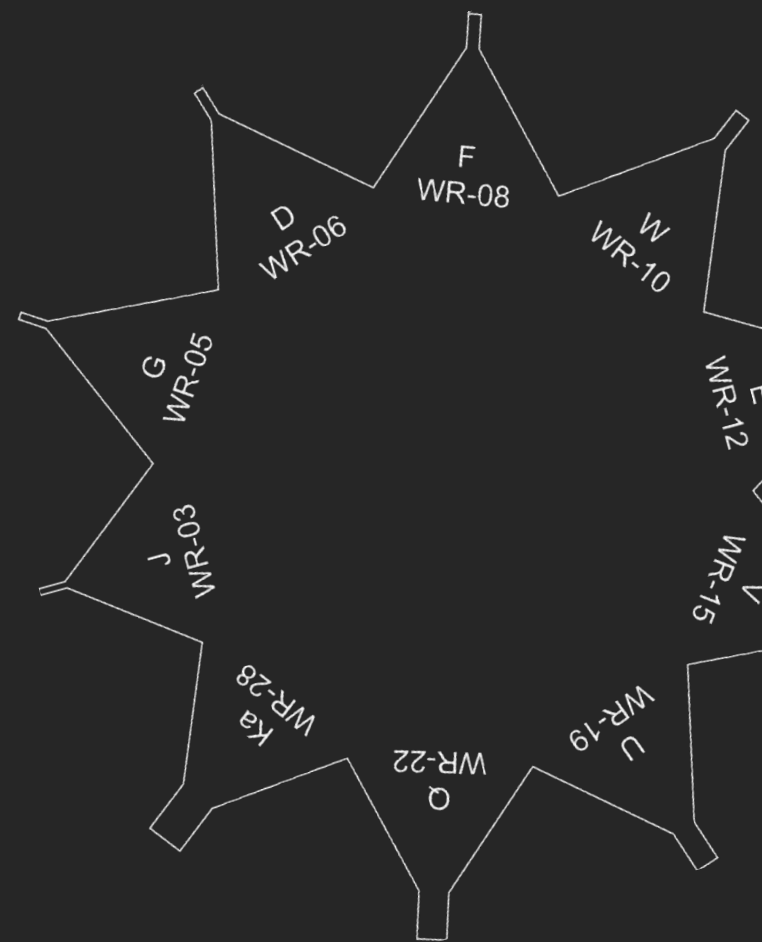


ERA^{ANT}

MAKING MILLIMETERWAVE ACCESSIBLE

G-BAND UPDATES

AUGUST 2022



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INTRODUCTION

ANTENNAS: RECTANGULAR HORNS, SCALAR HORNS, CHOKE FLANGE HORN, AND GAUSSIAN ANTENNA

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WAVEGUIDES: STRAIGHT, BEND, TWIST, TRANSITION

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PHASE SHIFTER: MECHANICAL ADJUSTABLE

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INTRODUCTION

ERAVANT designs and manufactures total solutions for microwave and millimeterwave applications covering 10 MHz to 220 GHz.

- **This presentation introduces Eravant's selective standard product offerings in the G-Band (140 to 220 GHz).**
- The product offering, including Limited Run models, are listed on the website at www.eravant.com.

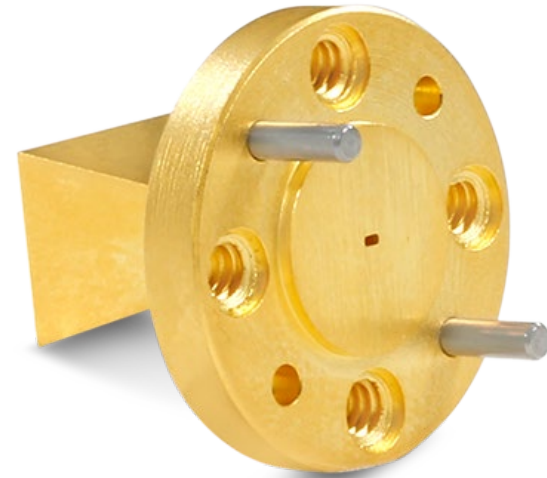
Additional products and presentations are available upon request.

- Custom models for components and subassemblies can be configured to customers' specifications.
- Presentations about Ka, Q, U, V, E, W, F, and D-Bands are available.
- Presentations for specific applications like 5G/IoT, Space, Test Instrumentation, Communications, and Radar are available online [here](#).

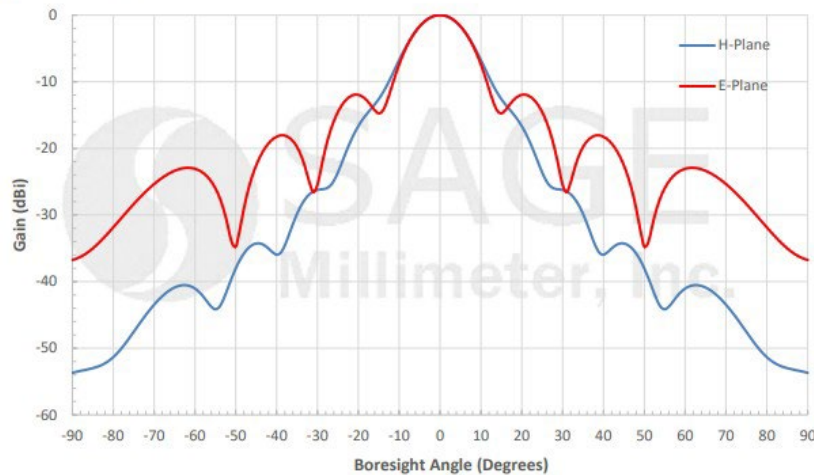
INTRODUCTION

- ERAVANT offers Total Product Solutions to configure any system applications in the Frequency Range of DC to 325 GHz.
- G Band products are mainly used in
 - 5G and 6G mmW systems
 - Security cameras
 - Radar systems
 - Scientific and industrial systems
 - Test equipment and lab set ups
- The intent of this presentation is to present the ERAVANT product offerings in G Band (140 to 220 GHz) to help the customers having a quick overview of available product families for their project and system planning. The model selected is for illustration purpose. Many models with various performance in the same product family are available on the website.

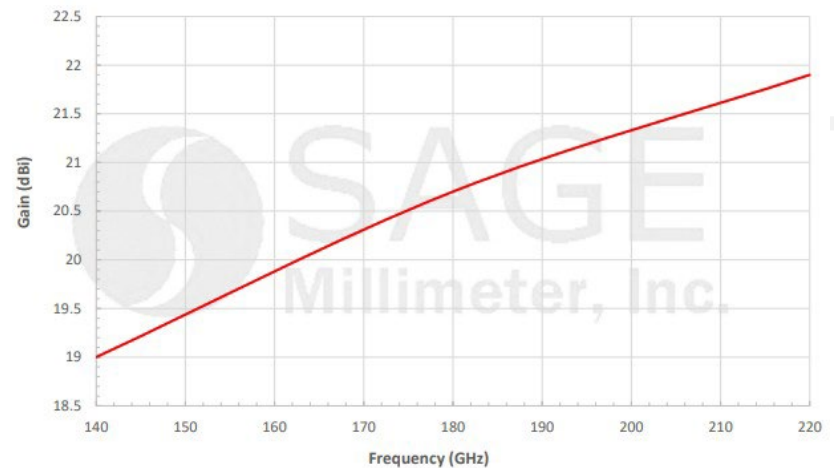
| Parameter | Minimum | Typical | Maximum |
|-------------------------|---------|---------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Gain | | 20 dBi | |
| Polarization | | Linear | |
| 3 dB Beamwidth, E-Plane | | 13° | |
| 3 dB Beamwidth, H-Plane | | 13° | |
| Side Lobes, E -Plane | | 12 dB | |
| Side Lobes, H Plane | | 25 dB | |
| VSWR | | 1.18:1 | |



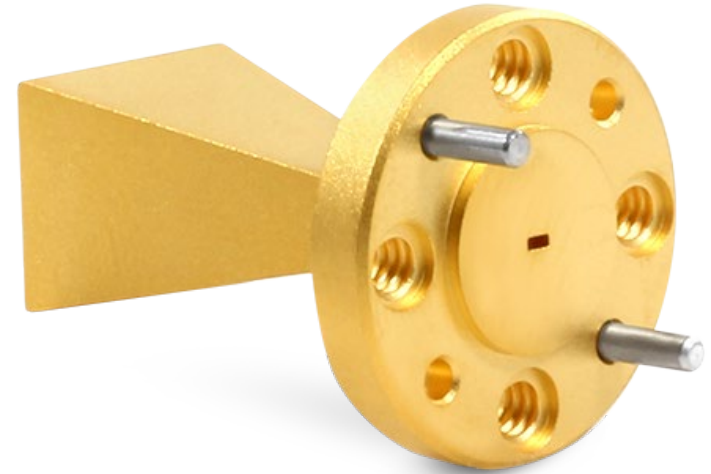
Typical Antenna Pattern @ 180 GHz



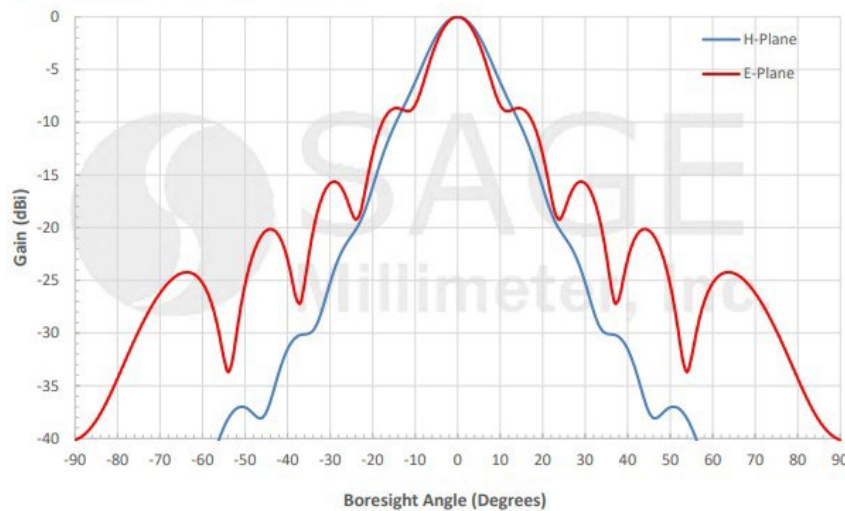
Typical Gain vs. Frequency



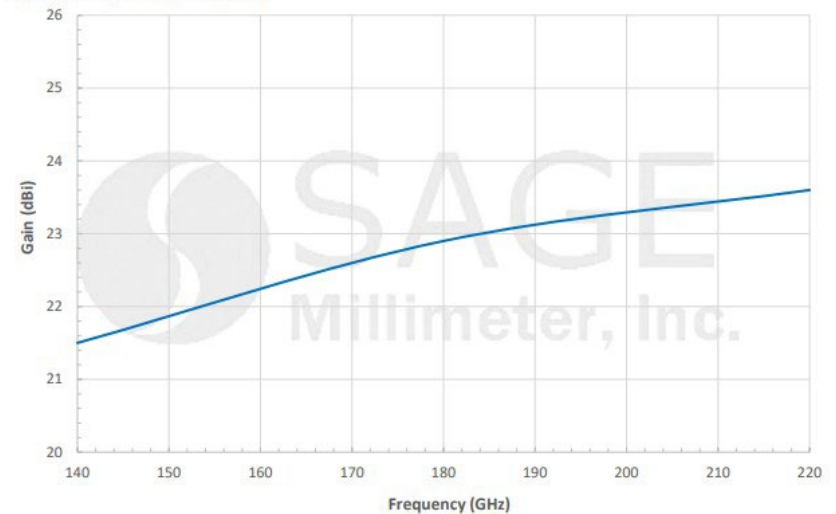
| Parameter | Minimum | Typical | Maximum |
|-------------------------|---------|---------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Gain | | 23 dBi | |
| Polarization | | Linear | |
| 3 dB Beamwidth, E-Plane | | 9° | |
| 3 dB Beamwidth, H-Plane | | 12° | |
| Side Lobes, E -Plane | | 9 dB | |
| Side Lobes, H Plane | | 26 dB | |
| VSWR | | 1.2:1 | |



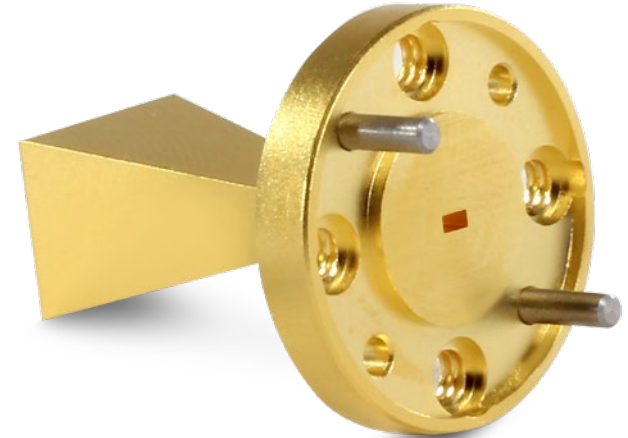
Typical Antenna Pattern @ 180 GHz



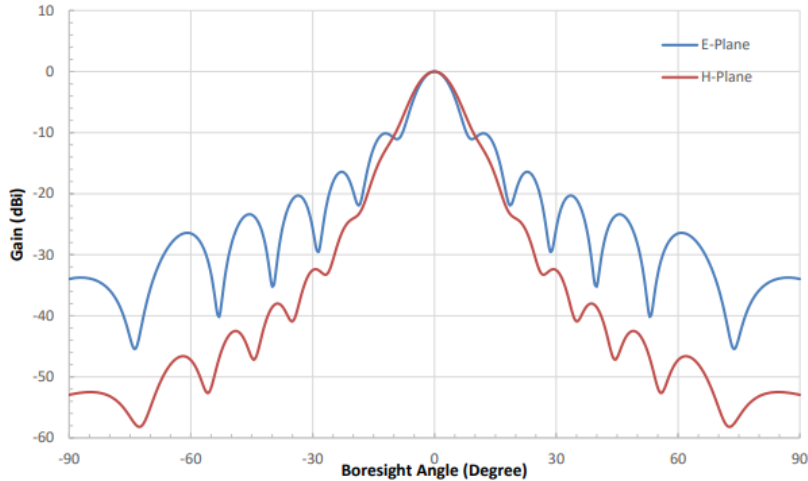
Typical Gain vs. Frequency



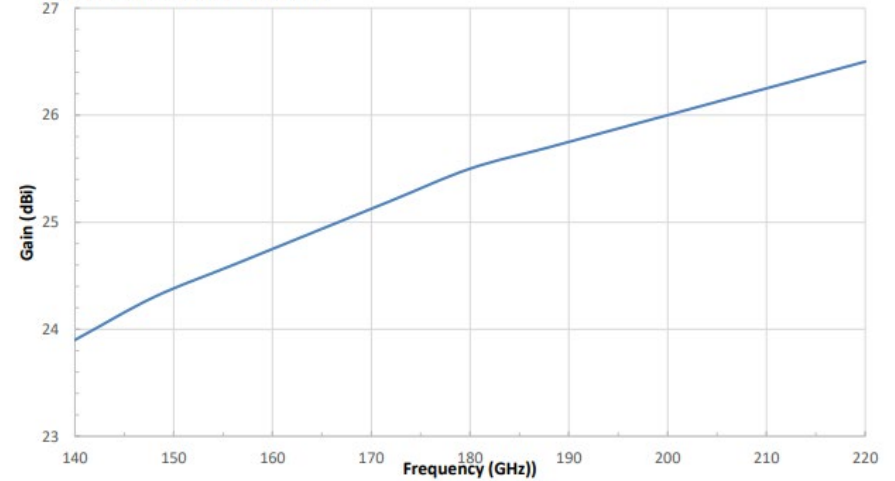
| Parameter | Minimum | Typical | Maximum |
|-------------------------|---------|---------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Gain | | 25 dBi | |
| Polarization | | Linear | |
| 3 dB Beamwidth, E-Plane | | 7° | |
| 3 dB Beamwidth, H-Plane | | 12° | |
| Side Lobes, E -Plane | | 9 dB | |
| Side Lobes, H Plane | | 26 dB | |
| VSWR | | 1.2:1 | |



Typical Antenna Patterns @ 180 GHz



Typical Gain Vs. Frequency



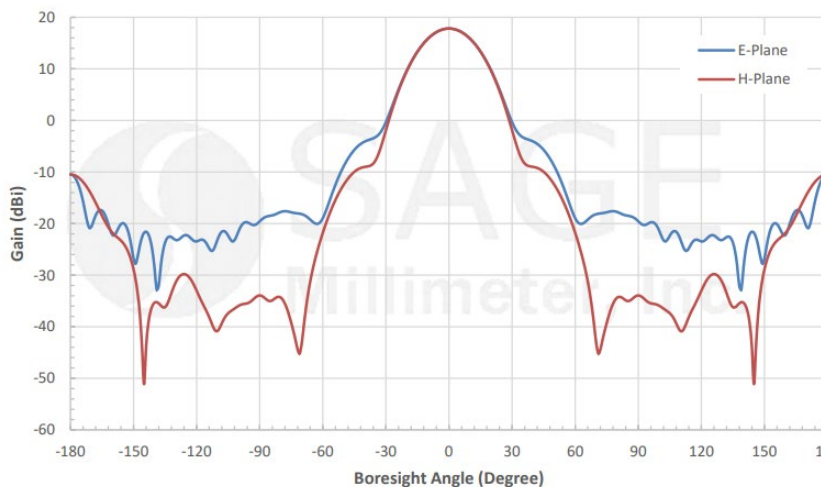
SAF-1442241725-067-S1

Scalar Feed Horn Antenna, 23 dBi

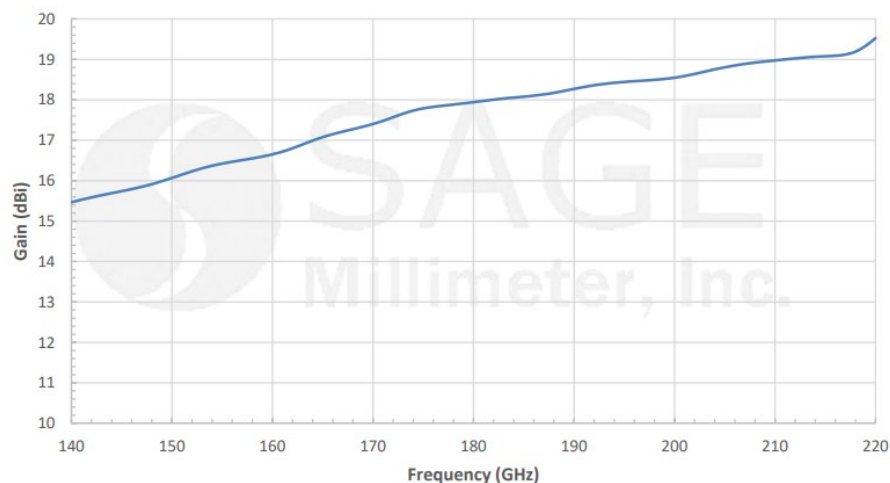
| Parameter | Minimum | Typical | Maximum |
|-------------------------|---------------------|---------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Gain | | 17 dBi | |
| Polarization | Linear and Circular | | |
| 3 dB Beamwidth, E-Plane | | 25° | |
| 3 dB Beamwidth, H-Plane | | 25° | |
| Side Lobes, E -Plane | | 25 dB | |
| Side Lobes, H Plane | | 25 dB | |
| VSWR | | 1.2:1 | |



Simulated Antenna Patterns @ 180 GHz



Simulated Gain vs. Frequency

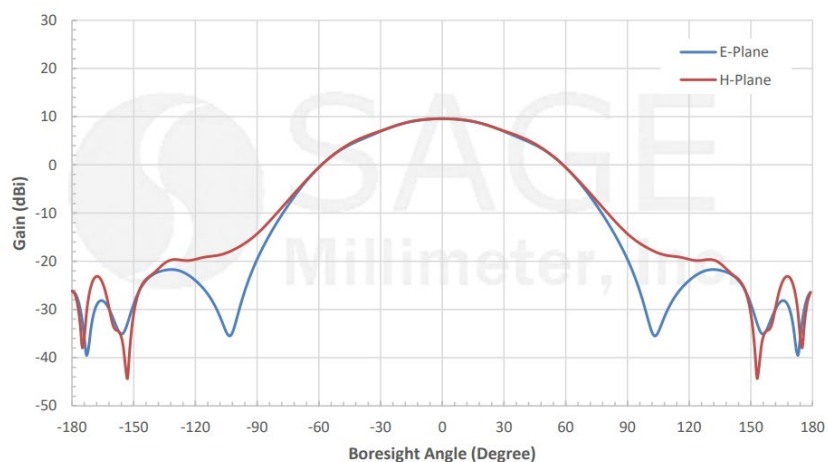


SAH-1442241060-059-S1 Choke Flange Feed Antenna, 10 dBi

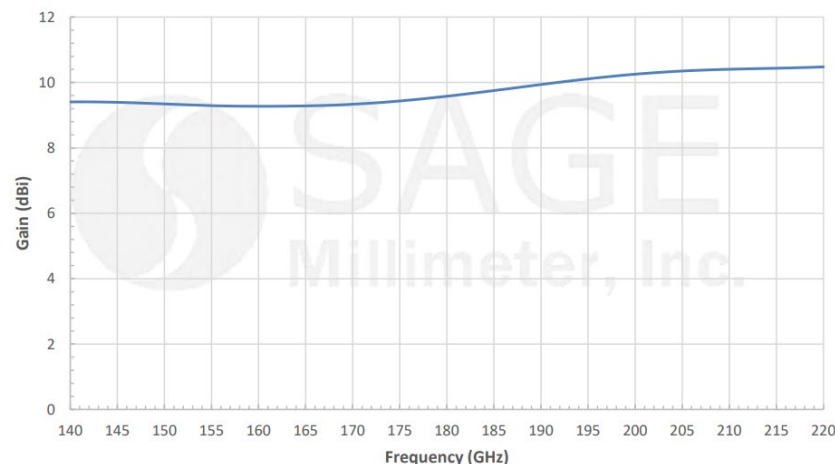
| Parameter | Minimum | Typical | Maximum |
|-------------------------|---------------------|---------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Gain | | 10 dBi | |
| Polarization | Linear and Circular | | |
| 3 dB Beamwidth, E-Plane | | 60° | |
| 3 dB Beamwidth, H-Plane | | 60° | |
| Side Lobes, E -Plane | | 30 dB | |
| Side Lobes, H Plane | | 30 dB | |
| VSWR | | 1.2:1 | |



Simulated Antenna Patterns @ 180 GHz



Simulated Gain vs. Frequency



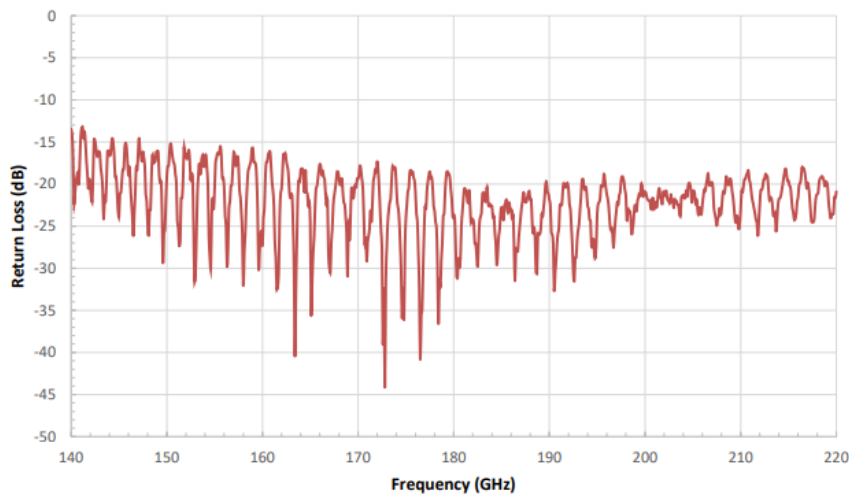
SAG-1442244501-059-S1

Gaussian Optics Antenna

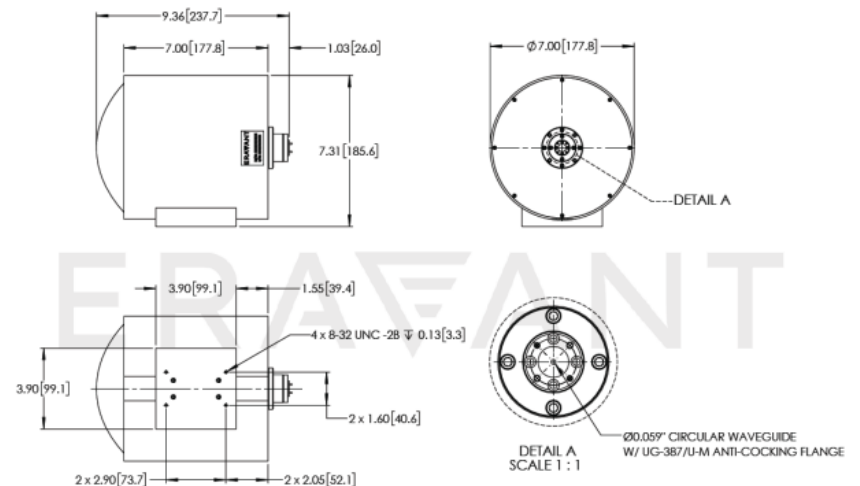
| Parameter | Minimum | Typical | Maximum |
|-------------------------|---------------------|---------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Gain | | 45 dBi | |
| Polarization | Linear and Circular | | |
| 3 dB Beamwidth, E-Plane | | 1.0° | |
| 3 dB Beamwidth, H-Plane | | 1.0° | |
| Side Lobes, E -Plane | | 15 dB | |
| Side Lobes, H Plane | | 15 dB | |
| Return Loss | | 15 dB | |



Typical Measured Return Loss vs Frequency



Mechanical Outline: (Unless otherwise specified, all dimensions are in inches [millimeters])

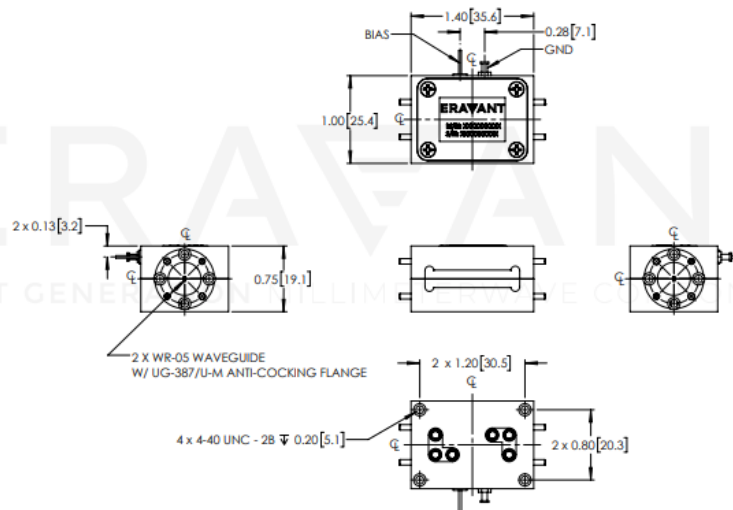


| Parameter | Minimum | Typical | Maximum |
|-----------------------|---------|--------------------|---------------------|
| Frequency | 140 GHz | | 200 GHz |
| Gain | | 15 dB | |
| P_{1dB} | | -5 dBm | |
| P_{in} | | | -3 dBm |
| Input Return Loss | | 6 dB | |
| Output Return Loss | | 10 dB | |
| DC Voltage | | +8 V _{DC} | +12 V _{DC} |
| DC Supply Current | | 40 mA | |
| Operation Temperature | 0 °C | | +50 °C |



Mechanical Outline:

Unless otherwise specified, all dimensions are in inches [millimeters])



Features

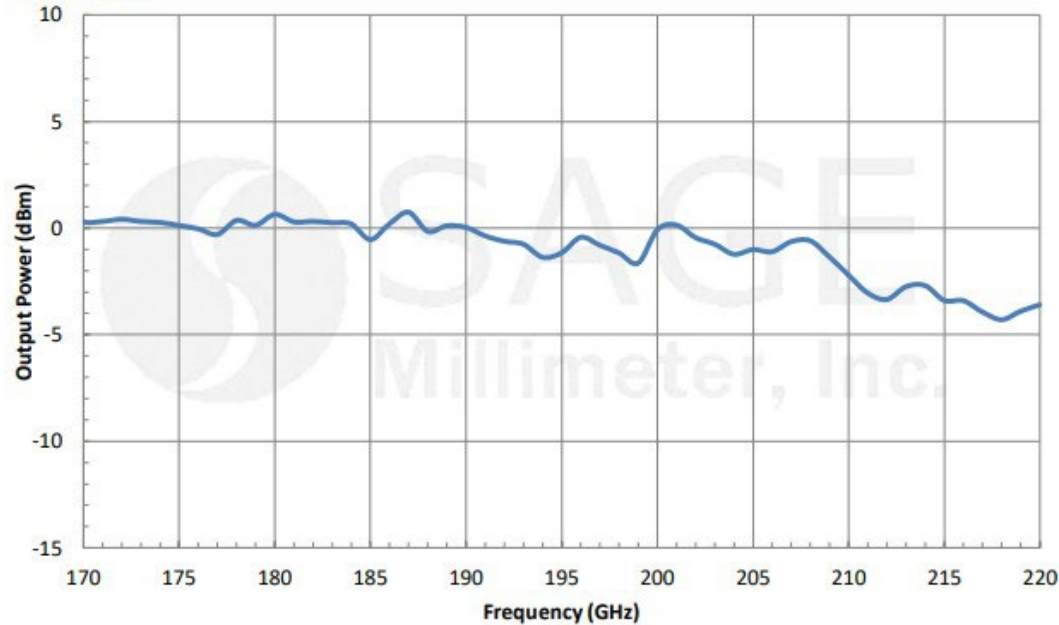
- Broad Band Operation
- Low Noise Figure
- Low Bias Current
- Compact Package

| Parameter | Minimum | Typical | Maximum |
|----------------------|---------|---------|---------|
| Input Frequency | 70 GHz | | 110 GHz |
| Output Frequency | 140 GHz | | 220 GHz |
| Input Power | | +16 dBm | +18 dBm |
| Output Power | | -3 dBm | |
| Harmonic Suppression | | 20 dB | |



Typical Output Power vs. Frequency

Pin: +16 dBm



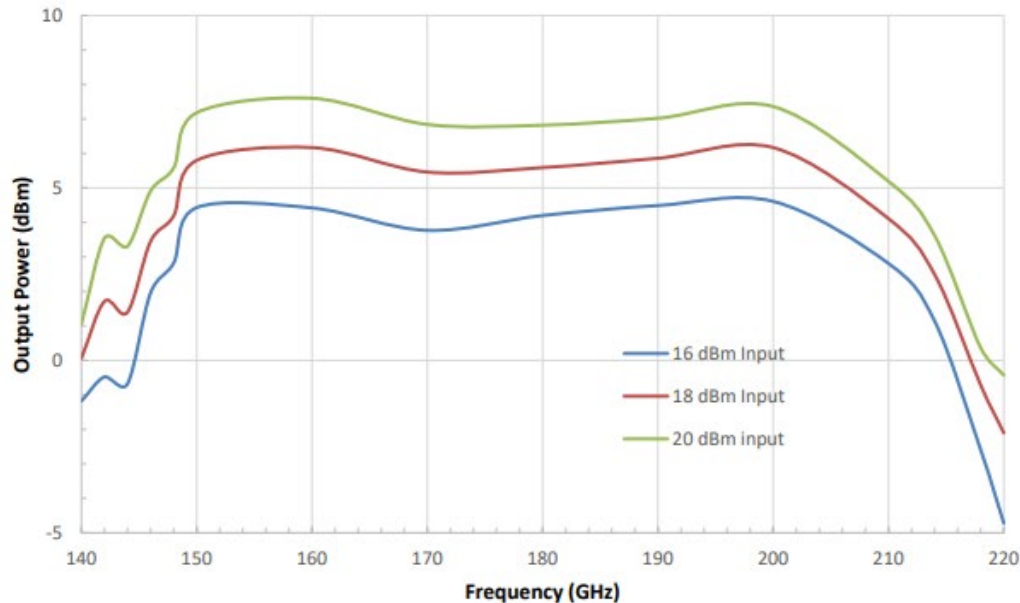
Features

- Full band Operation
- Low Conversion Loss
- No External Bias
- Compact Package

| Parameter | Minimum | Typical | Maximum |
|----------------------|---------|---------|---------|
| Input Frequency | 50 GHz | | 70 GHz |
| Output Frequency | 150 GHz | | 210 GHz |
| Input Power | | +16 dBm | +20 dBm |
| Output Power | | +3 dBm | |
| Harmonic Suppression | | 20 dB | |



Output Power vs. Frequency



Features

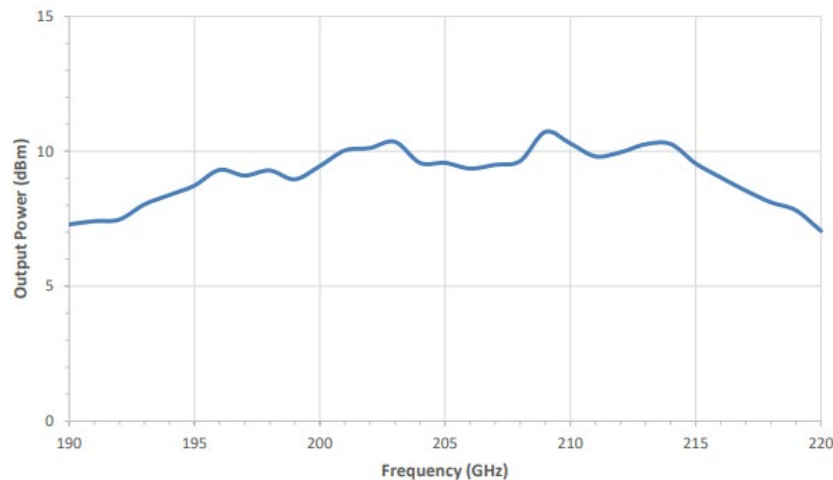
- Near Full Band Operation
- Low Conversion Loss
- No External Bias
- Compact Package

| Parameter | Minimum | Typical | Maximum |
|----------------------|---------|----------------|---------|
| Input Frequency | 95 GHz | | 110 GHz |
| Output Frequency | 190 GHz | | 220 GHz |
| Input Power | | +12 dBm | +14 dBm |
| Output Power | | +8 dBm | |
| Harmonic Suppression | | -15 dBc | |
| Spurious | | -60 dBc | |
| DC Bias | | +8 VDC /170 mA | |

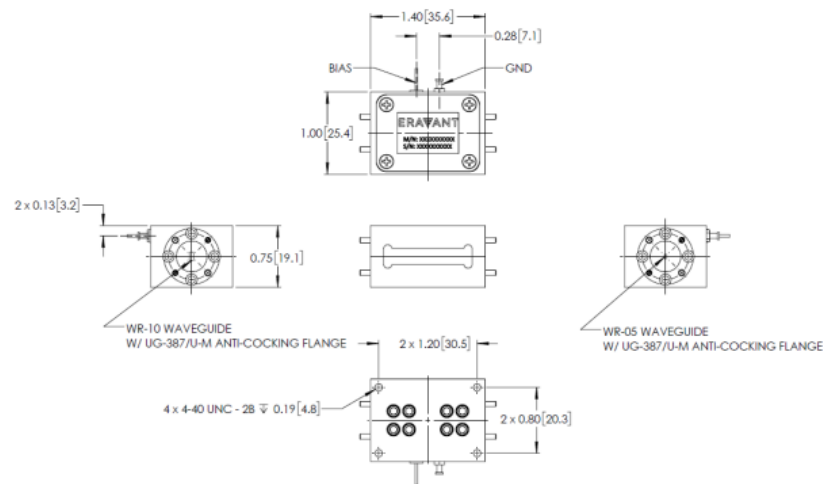


Output Power vs. Frequency

Bias: +8V_{DC}/153 mA; Input Power = +12 dBm
 RFsat: +8V_{DC}/170 mA



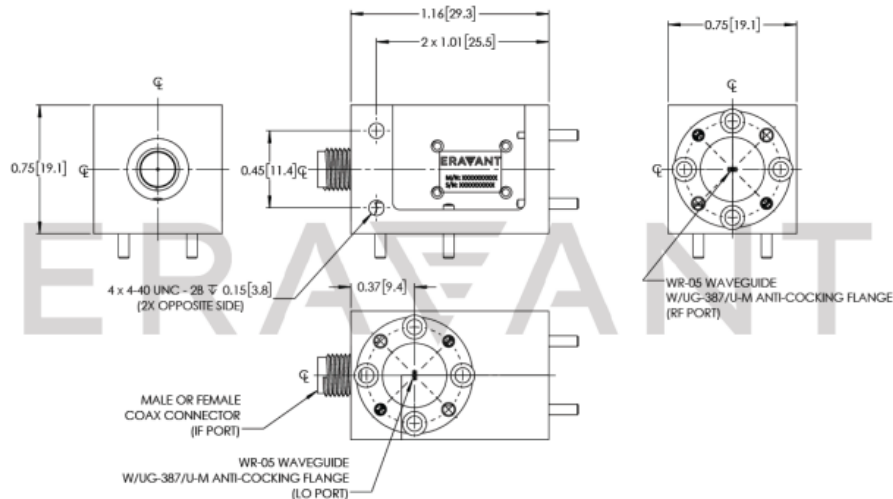
Mechanical Outline: (Unless otherwise specified, all dimensions are in inches [millimeters])



| Parameter | Minimum | Typical | Maximum |
|--------------------------|---------|---------|---------|
| RF Frequency | 140 GHz | | 220 GHz |
| LO Frequency | 140 GHz | | 220 GHz |
| IF Frequency | DC | | 40 GHz |
| LO Pumping Power | | +13 dBm | +15 dBm |
| Conversion Loss | | 13 dB | |
| Input P _{1dB} | | -3 dBm | |
| RF to LO Isolation | | 30 dB | |
| Combined RF and LO Power | | | +18 dBm |



Mechanical Outline:



Features

- Full band Operation
- Low Conversion Loss
- No External Bias
- Compact Package

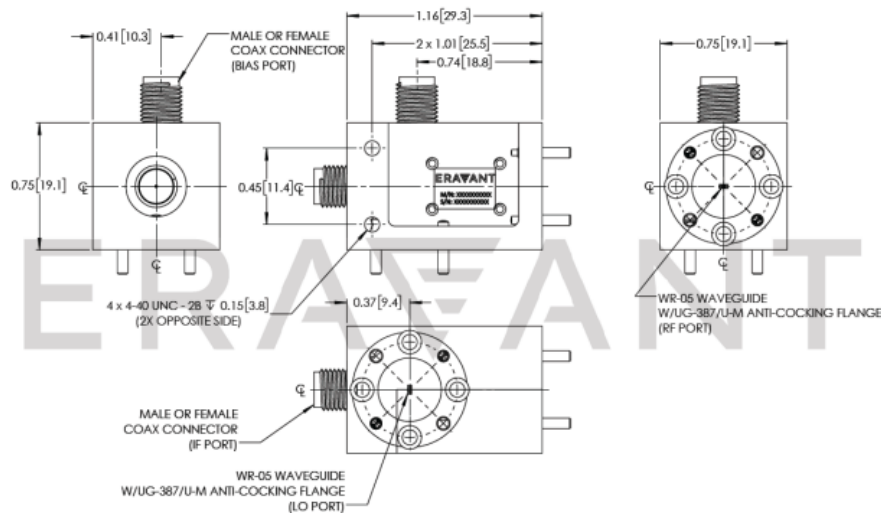
SFB-05-E2

Externally Biased Balanced Mixer

| Parameter | Minimum | Typical | Maximum |
|-------------------------------|---------|-------------|-------------|
| RF Frequency | 140 GHz | | 220 GHz |
| LO Frequency | 140 GHz | | 220 GHz |
| IF Frequency | DC | | 40 GHz |
| LO Pumping Power | 0 dBm | +3 dBm | +10 dBm |
| Conversion Loss | | 13 dB | |
| Input P _{1dB} | | -10 dBm | |
| RF to LO Isolation | | 30 dB | |
| Combined RF and LO Power | | | +13 dBm |
| External Bias Voltage/Current | | +5 VDC/2 mA | +5 VDC/5 mA |



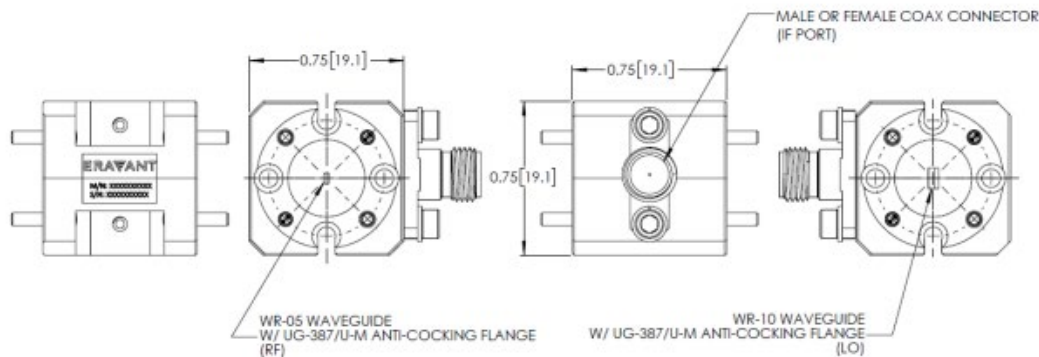
Mechanical Outline:



Features

- Full band Operation
- Low Conversion Loss
- Low LO Power
- Compact Package

| Parameter | Minimum | Typical | Maximum |
|--------------------------|---------|---------|---------|
| RF Frequency | 140 GHz | | 220 GHz |
| LO Frequency | 70 GHz | | 110 GHz |
| IF Frequency | DC | | 5.0 GHz |
| LO Pumping Power | +7 dBm | +10 dBm | +15 dBm |
| Conversion Loss | | 13 dB | |
| Input P _{1dB} | | -3 dBm | |
| LO to IF Isolation | | 30 dB | |
| LO to RF Isolation | | 15 dB | |
| Combined RF and LO Power | | | +18 dBm |



Features

- Full band Operation
- Low Conversion Loss
- Low LO Power
- ½ LO Frequency of RF
- Compact Package

| Parameter | Minimum | Typical | Maximum |
|----------------------------------|---------|------------|---------|
| Frequency Range | 140 GHz | | 220 GHz |
| Sensitivity (SFD-403603-19SF-N1) | | -200 mV/mV | |
| Sensitivity (SFD-403603-19SF-P1) | | +200 mV/mV | |
| Sensitivity Flatness | | ± 2.0 dB | |
| Linear Detection Range | -40 dBm | -20 dBm | -10 dBm |
| RF Input Power | | -20 dBm | +17 dBm |
| Video Bandwidth | | 10 MHz | |

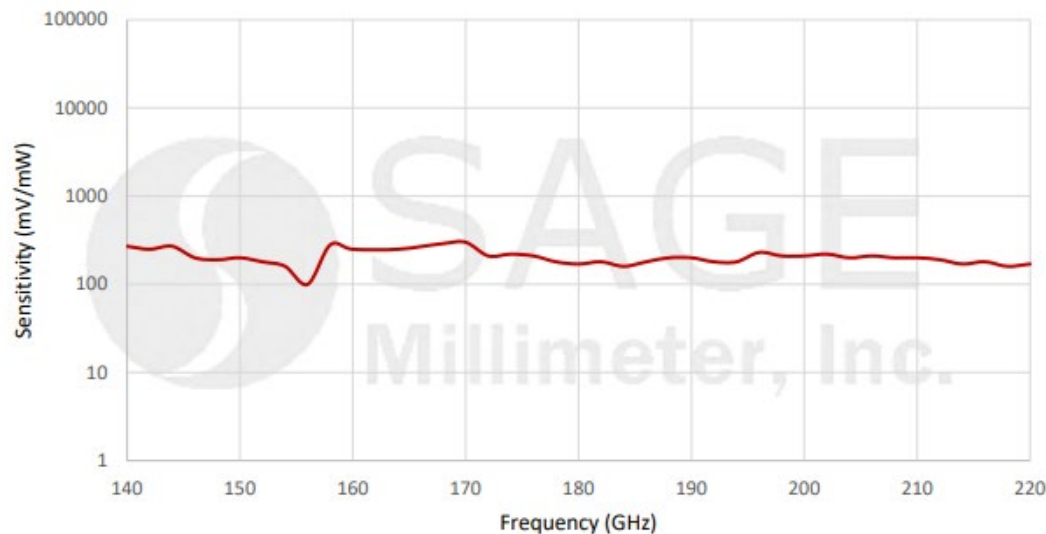


Features

- Full Waveguide Band Operation
- High Sensitivity Without Tuning
- High Sensitivity Stability Over Broad Temperature Range

Typical Performance vs. Frequency

Pin = -20 dBm

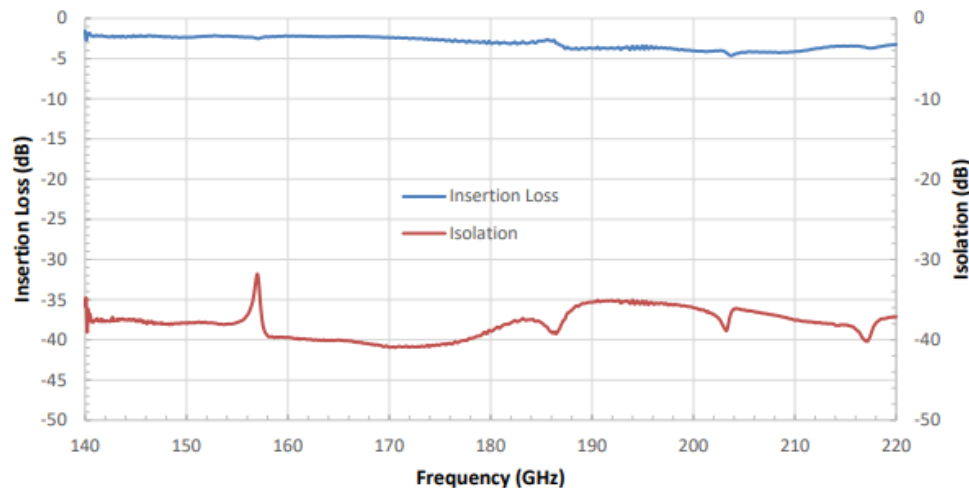


| Parameter | Minimum | Typical | Maximum |
|-----------------|---------|------------------|---------|
| RF Frequency | 140 GHz | | 220 GHz |
| Insertion Loss | | 2.5 dB | |
| Isolation | 25 dB | 30 dB | |
| Power Handling | | +20 dBm | +23 dBm |
| Bias Voltage | | $\pm 1.0 V_{DC}$ | |
| Bias Current | | +3 mA/0 mA | |
| Control Signal | | TTL | |
| Switching Speed | | 100 ns | |



Insertion Loss and Isolation vs. Frequency

Bias: $+1 V_{DC}/3 \text{ mA}$ and $-2 V_{DC}/<0 \text{ mA}$



Features

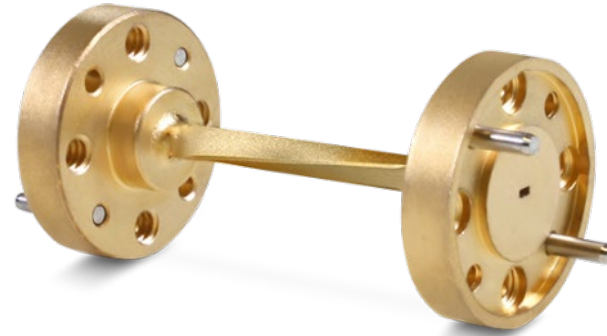
- Full Band Operation
- Low Insertion Loss
- High Isolation
- Fast Control Speed

Waveguides

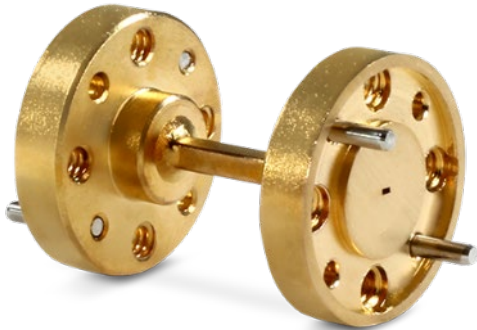
- Straights: 1", 2" etc. and Custom Length
- Bends, 45°, 90° and Custom Angle
- Twists, 45°, 90° and Custom Angle



Waveguide E-Bend: 90°



Waveguide Twist: 90°



Waveguide Straight: 1.25"



Waveguide H-Bend: 90°

Instrumentation Waveguide Sections



Metrology Grade
Model: STQ-WG-05025-F1-A-R



Contactless Flange
Model: STQ-WG-05025-FB-CF



Wave-Glide VNA Rail System
Model: STQ-TL-RW-S10-M1

Waveguide Transitions



WR-05 to WR-04
Model: SWT-0504-LB



WR-05 to WR-03
Model: SWT-0503-LB



WR-05 to 0.059" Dia
Model: SWT-05059-SB



WR-05 to 0.067" Dia
Model: SWT-05067-SB

SWM-14422420-05-SB

Waveguide Magic Tee

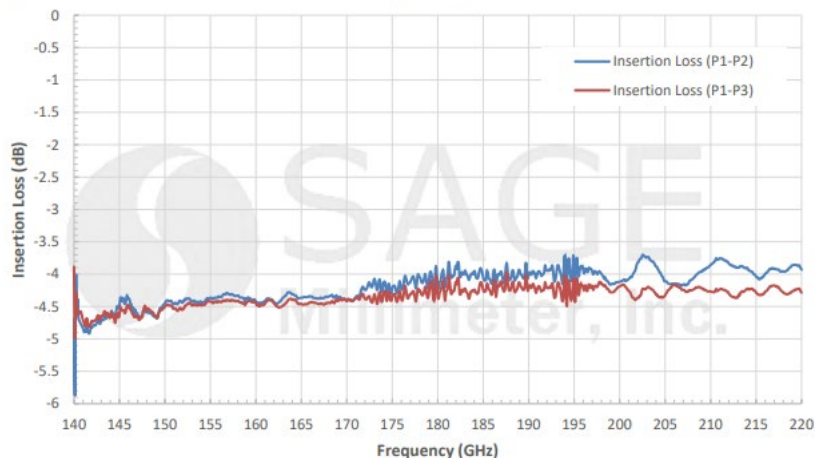
| Parameter | | Minimum | Typical | Maximum |
|-----------------|--------------------|---------|---------|---------|
| Frequency | | 140 GHz | | 220 GHz |
| Power Unbalance | | | ±0.3 dB | |
| Insertion Loss | | | 1.7 dB | |
| Isolation | Sum and Difference | | 30 dB | |
| | Colinear | | 20 dB | |
| Return Loss | | | 15 dB | |



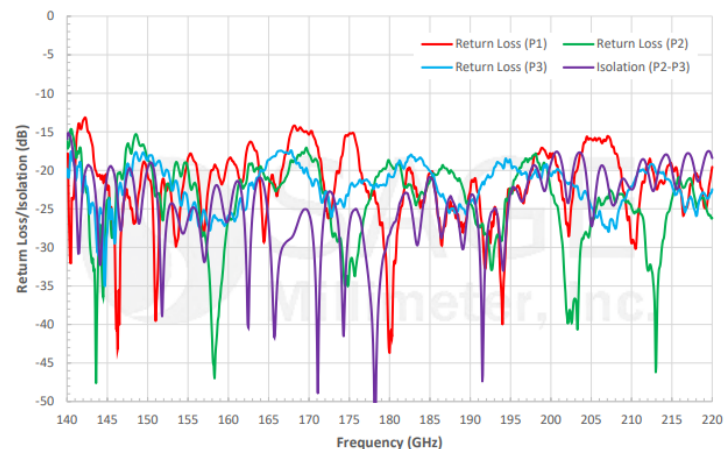
Features

- Full Band Operation
- Low Insertion Loss
- High Isolation
- Compact Design

Typical Measured Insertion Loss vs Frequency



Typical Measured Return Loss and Isolation vs Frequency



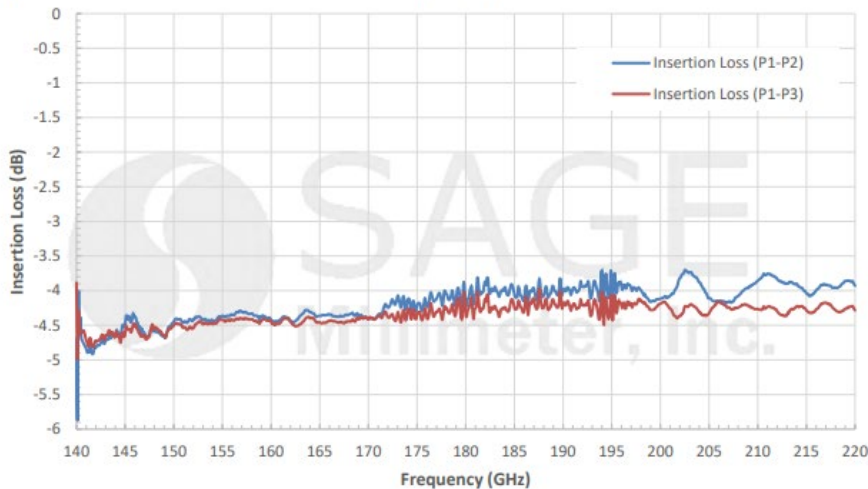
| Parameter | Minimum | Typical | Maximum |
|-----------------|---------|---------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Power Unbalance | | ±0.3 dB | |
| Insertion Loss | | 1.7 dB | |
| Isolation | | 20 dB | |
| Return Loss | | 15 dB | |



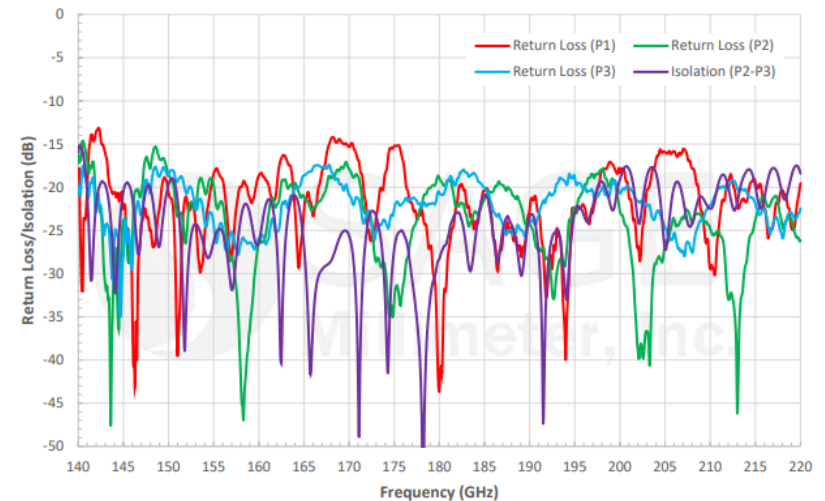
Features

- Full Band Operation
- Low Insertion Loss
- High Isolation
- Compact Design

Typical Measured Insertion Loss vs Frequency



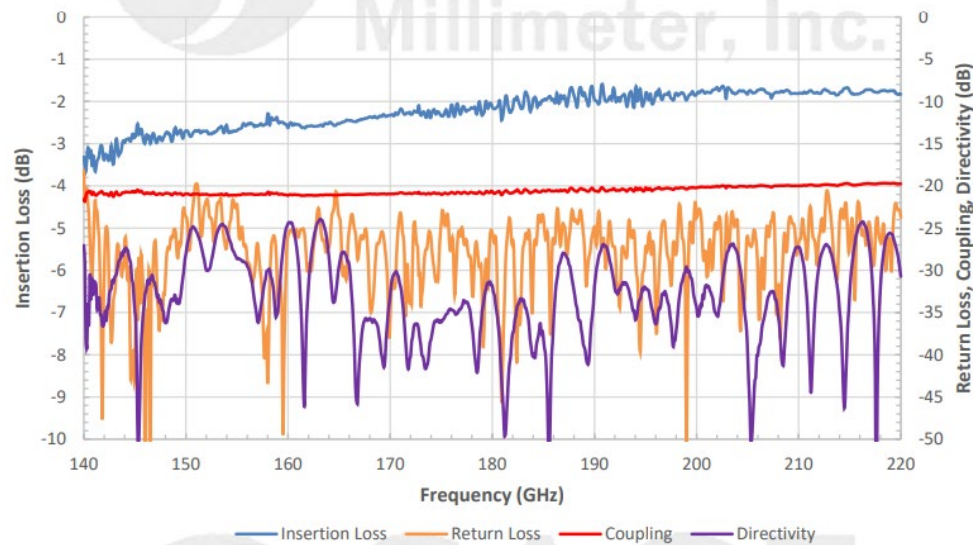
Typical Measured Return Loss and Isolation vs Frequency



| Parameter | Minimum | Typical | Maximum |
|----------------|---------|-----------|---------|
| Frequency | 140 GHz | | 220 GHz |
| Insertion Loss | | 3.0 dB | |
| Coupling | | 10, 20 dB | |
| Directivity | | 25 dB | |
| Return Loss | | 18 dB | |



Typical Performance vs Frequency



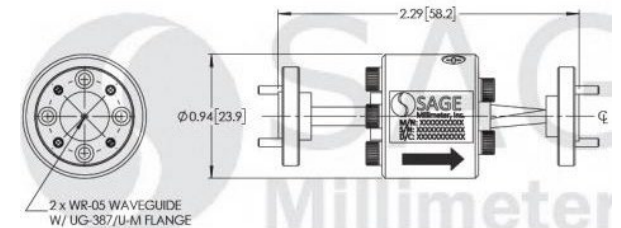
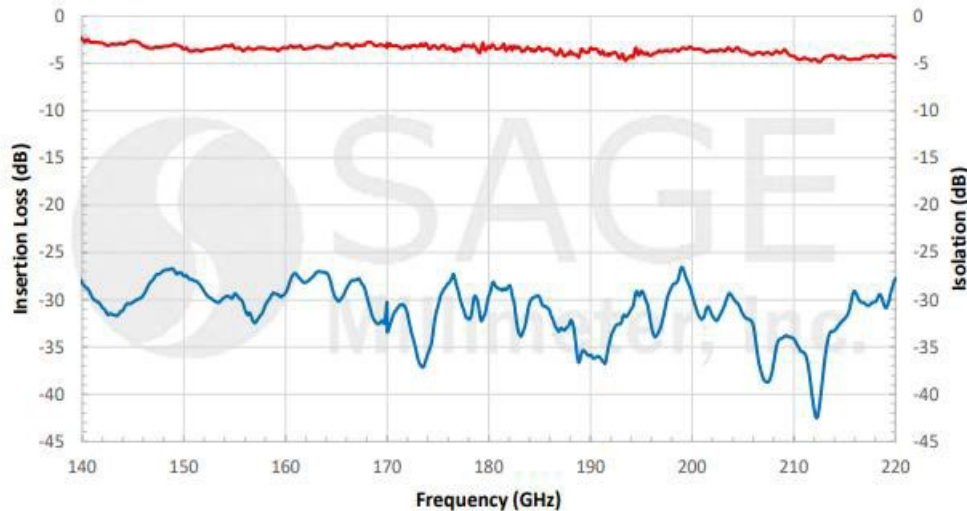
Features

- Full Band Operation
- Low Insertion Loss
- Good Directivity
- Compact Design

| Parameter | Minimum | Typical | Maximum |
|------------------------|---------|------------|------------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 4.0 dB | |
| Isolation | | 30 dB | |
| VSWR | | | 1.5:1 |
| Forward Power Handling | | 0.1 W (CW) | 0.2 W (CW) |
| Reverse Power Handling | | 0.1 W (CW) | 0.2 W (CW) |



Typical Performance vs. Frequency



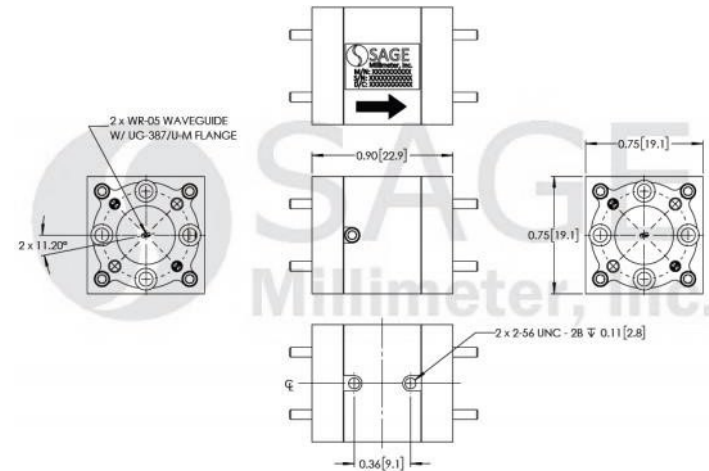
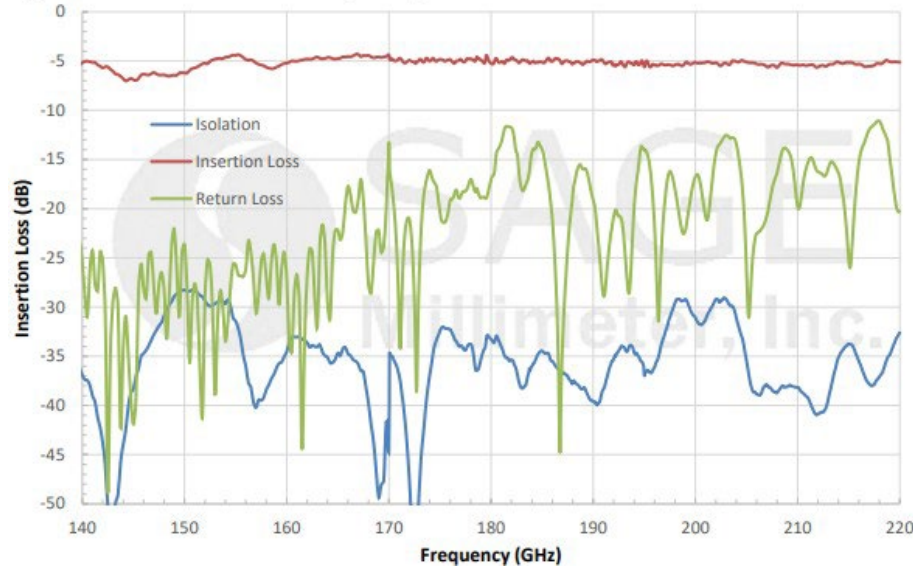
STF-05-S1-C

Faraday Isolator, Full Band, Compact

| Parameter | Minimum | Typical | Maximum |
|------------------------|---------|------------|------------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 5.0 dB | |
| Isolation | | 30 dB | |
| VSWR | | | 1.5:1 |
| Forward Power Handling | | 0.1 W (CW) | 0.2 W (CW) |
| Reverse Power Handling | | 0.1 W (CW) | 0.2 W (CW) |



Typical Performance vs. Frequency



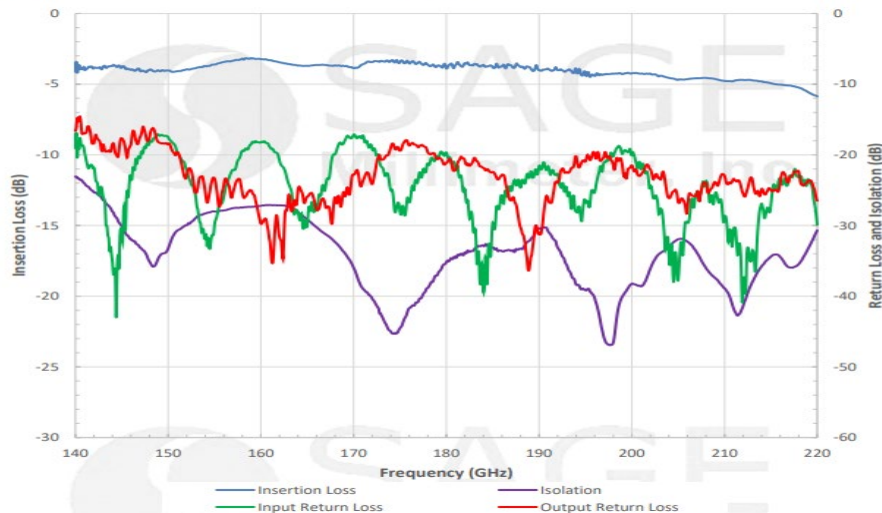
STF-05-S1-M

Faraday Isolator, Full Band, Miniature

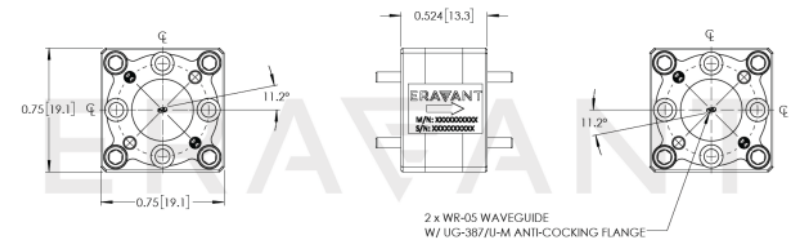
| Parameter | Minimum | Typical | Maximum |
|------------------------|---------|------------|------------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 4.5 dB | |
| Isolation | | 23 dB | |
| VSWR | | | 1.5:1 |
| Forward Power Handling | | 0.1 W (CW) | 0.2 W (CW) |
| Reverse Power Handling | | 0.1 W (CW) | 0.2 W (CW) |



Typical Measured Performance vs Frequency



Mechanical Outline: (Unless otherwise specified, all dimensions are in inches [millimeters])



Features

- Full Band Coverage
- Compact Size
- Low Insertion Loss
- Precision Machined Housing

Applications:

- Test Lab
- Instrumentations
- Manual Test Set



| Parameter | Minimum | Typical | Maximum |
|----------------------|------------------------------|---------|---------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 2.0 dB | |
| Phase Shifting Range | 0° | | 180° |
| Return Loss | | 20 dB | |
| Power Handling | | | 100 mW |
| Waveguide | WR-05 with UG-387/U-M Flange | | |

Features

- Full Band Coverage
- 3, 6, 10, 20, 30 dB etc. Attenuation Levels
- High Performance
- Rugged Mechanical Structure

Applications:

- Test Lab
- Instrumentations
- Subsystems



| Parameter | Minimum | Typical | Maximum |
|--------------------|------------------------------|---------|---------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Attenuation | | 10 dB | |
| Return Loss | | 16 dB | |
| Power Handling | | | 100 mW |
| Waveguide | WR-05 with UG-387/U-M Flange | | |

Features

- Full Band Coverage
- Compact Size
- Precision Machined Housing
- Convenient Level Setting

Applications:

- Test Lab
- Instrumentations
- Manual Test Set



| Parameter | Minimum | Typical | Maximum |
|--------------------|------------------------------|---------|---------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 2.0 dB | |
| Attenuation Range | 0 dB | | 30 dB |
| Return Loss | | 20 dB | |
| Power Handling | | | 100 mW |
| Waveguide | WR-05 with UG-387/U-M Flange | | |

Features

- Full Band Coverage
- High Attenuation Accuracy
- Large Scaled Dial

Applications:

- Test Lab
- Instrumentations
- Manual Test Set



| Parameter | Minimum | Typical | Maximum |
|----------------------|---|---------|---------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 3.0 dB | |
| Attenuation Range | 0 dB | | 60 dB |
| Attenuation Accuracy | 0.1 dB or 3% of reading, whichever is larger, up to 40 dB | | |
| Return Loss | | 17 dB | |
| Power Handling | | 50 mW | 100 mW |

Features

- Full Band Coverage
- High Attenuation Accuracy
- Digital Screen with Back Light

Applications:

- Test Lab
- Instrumentations
- Manual Test Set



| Parameter | Minimum | Typical | Maximum |
|----------------------|---|---------|---------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 4.0 dB | |
| Attenuation Range | 0 dB | | 60 dB |
| Attenuation Accuracy | 0.1 dB or 2% of reading, whichever is larger, up to 40 dB | | |
| VSWR | | 17 dB | |
| Power Handling | | 50 mW | 200 mW |

Features

- Full Band Coverage
- High Attenuation Accuracy
- IEEE-488 and USB Control Ports

Applications:

- Test Lab
- Instrumentations
- Auto Test Set



| Parameter | Minimum | Typical | Maximum |
|----------------------|---|---------|---------|
| RF Frequency Range | 140 GHz | | 220 GHz |
| Insertion Loss | | 6.0 dB | |
| Attenuation Range | 0 dB | | 60 dB |
| Attenuation Accuracy | 0.1 dB or 3% of reading, whichever is larger, up to 40 dB | | |
| VSWR | | 17 dB | |
| Power Handling | | 150 mW | 500 mW |

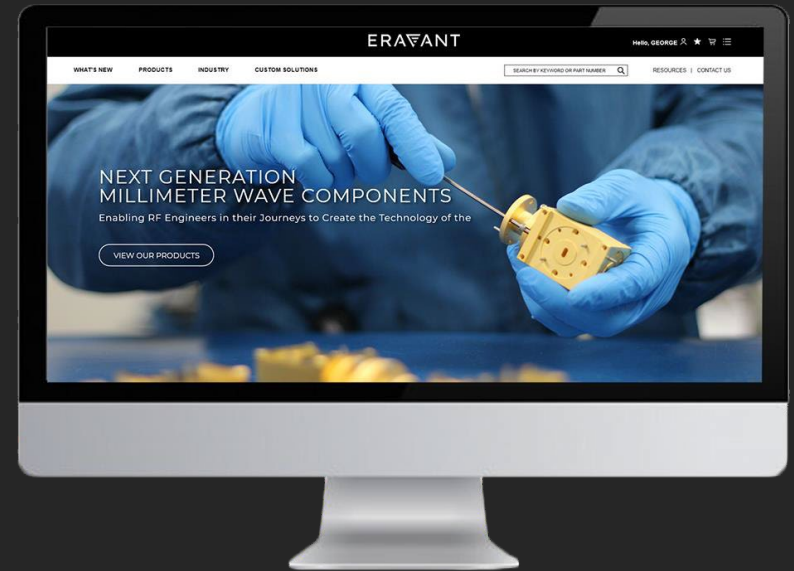
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PASSIVE FREQUENCY MULTIPLIERS

GRID TABLE 28 RESULTS

| MODEL | MINIMUM OUTPUT FREQUENCY | MAXIMUM OUTPUT FREQUENCY | OUTPUT POWER | MINIMUM INPUT FREQUENCY | MAXIMUM INPUT FREQUENCY | INPUT POWER | OUTPUT PORT | INPUT PORT | DOWNLOADS | VIEW |
|------------------------|--------------------------|--------------------------|--------------|-------------------------|-------------------------|-------------|-----------------|-----------------|------------------------|------|
| SFP-06212-S2 | 110 GHz | 170 GHz | 0 dBm | 55 GHz | 85 GHz | +16 dBm | WR-06 Waveguide | WR-12 Waveguide | Datasheet | View |
| SFP-06319-U0 | 110 GHz | 170 GHz | -3 dBm | 36.67 GHz | 56.67 GHz | +20 dBm | WR-06 Waveguide | WR-16 Waveguide | Datasheet | View |
| SFP-05210-S2 | 140 GHz | 220 GHz | -3 dBm | 70 GHz | 110 GHz | +17 dBm | WR-05 Waveguide | WR-10 Waveguide | Datasheet | View |
| SFP-223403205-28SF-S1 | 22 GHz | 40 GHz | +5 dBm | 11 GHz | 20 GHz | +18 dBm | WR-28 Waveguide | SMA (F) | Datasheet STEP File | View |
| SFP-448423303-28SF-S1 | 24 GHz | 42 GHz | +3 dBm | 8 GHz | 14 GHz | +20 dBm | WR-28 Waveguide | SMA (F) | Datasheet STEP File | View |
| SFP-2835F-U0 | 26.5 GHz | 40.0 GHz | +5 dBm | 8.37 GHz | 13.33 GHz | +20 dBm | WR-28 Waveguide | SMA (F) | Datasheet | View |
| SFP-2734033N05-28SF-S1 | 26.5 GHz | 40 GHz | -5 dBm | 8.37 GHz | 13.33 GHz | +10 dBm | WR-28 Waveguide | SMA (F) | Datasheet STEP File | View |
| SFP-2235F-S1 | 33 GHz | 50 GHz | +3 dBm | 11 GHz | 16.67 GHz | +20 dBm | WR-22 Waveguide | SMA (F) | Datasheet STEP File | View |
| SFP-222XF-S1 | 33 GHz | 50 GHz | +7 dBm | 10.5 GHz | 25 GHz | +20 dBm | WR-22 Waveguide | 2.92 mm (F) | Datasheet STEP File | View |
| SFP-3615T3303-10SF-F1 | 57 GHz | 36 GHz | +3 dBm | 12 GHz | 19 GHz | +20 dBm | WR-19 Waveguide | SMA (F) | Datasheet STEP File | View |
| SFP-192XF-S1 | 40 GHz | 80 GHz | +0 dBm | 20 GHz | 30 GHz | +20 dBm | WR-19 Waveguide | 2.92 mm (F) | Datasheet STEP File | View |