



Technical Note

ASWipLL 2.4

Wireless IP-Based Local Loop System

Third-Party External Antennas for 2.4 GHz under FCC Regulations

Leading the World in Wireless DSL

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1. Introduction

This document provides a description of optional third-party external antennas recommended for use in the US for ASWipLL 2.4 operating in the 2.4 GHz band and under FCC regulations.

The recommended antennas include the following antenna types:

- **Omni-directional**
- **Panel**

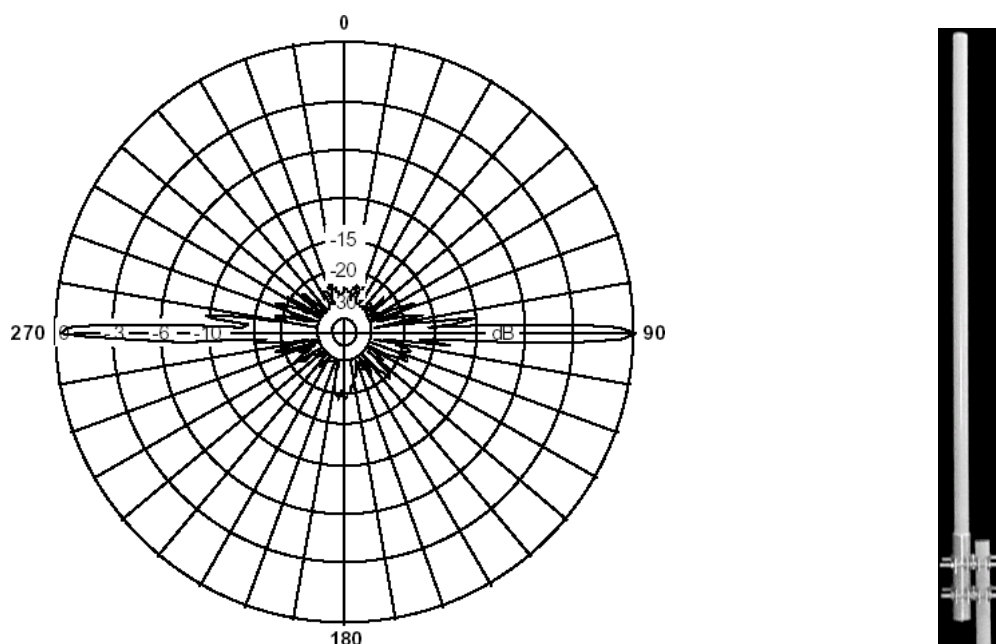
2. Omni-Directional Antennas

The following omni-directional antennas are recommended:

- Omni-Directional 360°/12 dBi
- Traditional Omni (XtremeWave™ MFB Series)
- Omni MUF24005

2.1. Omni-Directional 360°/12 dBi

The Omni-Directional 360°/12 dBi antenna's radiation pattern and physical design are shown in the figure below.



The table below lists the Omni-Directional 360°/12 dBi antenna specifications.

Electrical specifications	
Frequency range	2300 – 2500 MHz
Gain	12 dBi
VSWR	1.5:1 max
Polarization	Vertical
Power rating	50W
H-plane beamwidth	360°
E-plane beamwidth	4°
Cross pol. discrimination	20 dB min
Impedance	50Ω nominal
Termination	N female
Mechanical specifications	
Length	2,032 mm (80 in.)
Diameter	57 mm (2.25 in.)
Weight (incl. clamps)	8.1 kg (18 lbs)
Rated wind velocity	200 km/h (125 mph)
Hor. thrust at rated wind	23.6 kg (52 lb)
Mounting	44.5 – 102 mm (1.75 – 4 in.)

2.2. Traditional Omni (XtremeWave™ MFB Series)

The MaxRad XtremeWave™ wireless broadband omnidirectional antennas are designed to provide maximum performance and reliability under the toughest weather conditions. These antennas feature a U.V. stable, vented radome that provides ultimate protection against weather elements. The line includes MMDS, ISM, UNII and PCS models with gains ranging from 4 to 12 dBi. These antennas can be mast, wall or ceiling mounted.

The XtremeWave™ MFB Series omni-directional antenna is shown below:



Features:

- U.V. stable, pultruded fiberglass radome. Allows outdoor installation even in harsh climates.
- Vented system design. Provides reliable performance by protecting the electrical design against extreme moisture and/or temperatures.
- Thread relief on connector.(all models, except MFB24012 and MFB58009PTNM which have pigtails). Improved accessibility for taping reduces installation time and improves overall effectiveness.
- Internal o-ring seal in the base of the antenna with integrated connector at the base. Assures a watertight seal to prevent water from migrating into the antenna connector (all models, except MFB24012 which has a pigtail.)
- Electrical downtilt options on select models. Provide system planners flexibility in challenging operating environments.
- All models available with DC grounding (add DC suffix after part number).
- Models MFB19008, MFB24006, MFB24008, MFB24010 and MFB58009 are also available with N male termination (add "NM" to the part number to order this option.)

The XtremeWave™ MFB Series omni-directional antenna specifications are listed in the tables below:

General specifications	
Radome Material	UV resistant pultruded fiberglass
Termination	• N female standard with all 2.4 GHz models, except MFB24012. N female, reverse polarity and reverse threaded connectors optional. • 16" RG-213 pigtail with N female connector for model MFB24012.
Polarization	Vertical
Impedance	50Ω
Lightning protection	All models are available with DC grounding (add "DC" to part number to order the DC grounded version of the antenna.)
Mounting Base Diameter	• 1.25 inches (all models except MFB24012) • 1.5 inches (model MFB24012)
Mounting Method (sold separately)	• MMK1924 – L-bracket mount for wall or pipe mount (all models, except MFB24010 and MFB24012) • MMK8 - Aluminum extruded bracket for mast mounting (all models, except model MFB24012) • MMK11 - Ceiling mount bracket (for MFB24004, MFB24006 and FB24008 only) • MMK12 - Heavy duty bracket for mast mounting the MFB24012 • MMK14 - Light duty mounting clamp for MFB24012

Electrical Specifications

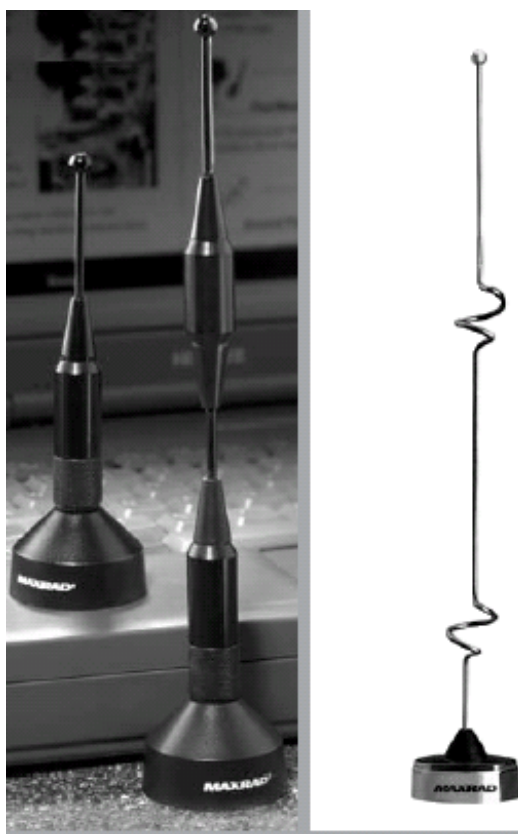
Model #	Frequency Range	Gain	Bandwidth @ 1.5:1 VSWR	Vertical Beamwidth @ 1/2 Power	VSWR	Maximum Power	Downtilt
MFB24004	2400-2483.5 MHz	4 dBi	100 MHz	30°	< 1.5:1	25 Watts	N/A
MFB24006	2400-2483.5 MHz	6 dBi	100 MHz	20°	< 1.5:1	25 Watts	N/A
MFB24008	2400-2483.5 MHz	8 dBi	100 MHz	13°	< 1.5:1	25 Watts	N/A
MFB24008DT3	2400-2483.5 MHz	8 dBi	100 MHz	13°	< 1.5:1	25 Watts	3°
MFB24008DT5	2400-2483.5 MHz	8 dBi	100 MHz	13°	< 1.5:1	25 Watts	5°
MFB24008DT7	2400-2483.5 MHz	8 dBi	100 MHz	13°	< 1.5:1	25 Watts	7°
MFB24008DT12	2400-2483.5 MHz	8 dBi	100 MHz	13°	< 1.5:1	25 Watts	12°
MFB24010	2400-2483.5 MHz	10 dBi	100 MHz	9°	< 1.5:1	25 Watts	N/A
MFB24012	2400-2500 MHz	12 dBi	100 MHz	7°	< 1.5:1	25 Watts	N/A

Mechanical Specifications

Model #	Wind Survival	Equivalent Flat Plate Area	Lateral Thrust @ Rated Wind	Bending Moment @ Rated Wind	Height	Weight
MFB24004	125 mph	.02 ft ²	2.1 lbs	0.7 ft-lbs	8.1" (205.7 mm)	0.34 lbs (0.154 kg)
MFB24006	125 mph	.04 ft ²	3.0 lbs	1.4 ft-lbs	11.6" (294.6 mm)	0.38 lbs (0.172 kg)
MFB24008	125 mph	.06 ft ²	5.2 lbs	4.4 ft-lbs	20.2" (513.1 mm)	0.50 lbs (0.226 kg)
MFB24008DT3	125 mph	.06 ft ²	5.2 lbs	4.4 ft-lbs	20.2" (513.1 mm)	0.50 lbs (0.226 kg)
MFB24008DT5	125 mph	.06 ft ²	5.2 lbs	4.4 ft-lbs	20.2" (513.1 mm)	0.50 lbs (0.226 kg)
MFB24008DT7	125 mph	.06 ft ²	5.2 lbs	4.4 ft-lbs	20.2" (513.1 mm)	0.50 lbs (0.226 kg)
MFB24008DT12	125 mph	.06 ft ²	5.2 lbs	4.4 ft-lbs	20.2" (513.1 mm)	0.50 lbs (0.226 kg)
MFB24010	125 mph	.11 ft ²	10.1 lbs	14.7 ft-lbs	36.0" (914.4 mm)	0.65 lbs (0.295 kg)
MFB24012	125 mph	.25 ft ²	22.4 lbs	41 ft-lbs	44.0" (1,118 mm)	3.00 lbs (1.400 kg)

2.3. Omni MUF24005

The (B)MAXC models provide wideband performance covering frequencies from 2.2 GHz to 2.9 GHz. They feature a molded polymer base, plated springloaded contact pin, and .100" diameter stainless steel whip for long lasting, trouble free service. The MUF24005 (not a wideband model) is a chrome nut antenna with a .062" stainless steel whip. Various mount and connector options provide low-loss mounting for a variety of metal surfaces.



BMAXC24503 and BMAX24505

- **General Specifications:** 2.4 GHz ISM mobile and WLAN antennas
- **Radiator Material:**
 - .100" OD stainless steel; bright (MAXC) or black finish (BMAXC)
 - .062" OD stainless steel; bright finish - MUF model
- **Base:**
 - Molded polymer with a plated brass insert ring and a spring-loaded, brass contact pin - (B)MAXC models
 - Brass mount nut with bright chrome finish - MUF model
- **Rod Ferrule:** 5/16"-24 thread; bright or black chrome plated brass - (B)MAXC models
- **Nominal Impedance:** 50 Ohms
- **Mount Method:** 3/4" hole mount

- **Mount Options:** Unless otherwise specified, the following mounts include 17' of ML195 high efficiency, low loss cable.
 - **SMML195:** 3/4" hole mount, 1-1/8"-18 thread stainless steel mount.
 - **BMML195:** 3/4" hole, 1-1/8"-18 thread brass mount.
 - **MAML195:** 3/8" or 3/4" hole, 1-1/8"-18 thread mount for 1/8" thick plates.
 - **BMATM338:** 3/8" hole, 1-1/8"-18 thread adjustable brass mount for metal surfaces of 1/32"-1/2" thickness. No cable or connector.
 - **MTPM800:** 5/8" hole, 1-1/8"-18 thread thick plate mount. Terminates in an N, female connector. No cable. Order cable assembly separately.
 - **MVP:** 5/8" hole, vandal proof mount. No cable or connector.
 - **MPM26-NC:** 3/4" hole, 1-1/8-18 thread, 26° pivot mount. Includes 17' RG58A/U cable. No connector.
 - **MPM26DSCP:** 3/4" hole, 1-1/8-18 thread, 26° pivot mount. Includes 17' double shielded cable with PL-259 connector.
 - **MMF:** 3/4" hole, 1-1/8"-18 mount for frequencies above 1 GHz. Terminates in an SMA, male connector. No cable. Order cable assembly (SMA, female ending) separately.

Features and Benefits:

- Molded polymer base ((B)MAXC models). Provides ruggedness and durability in harsh environments. Flexible rod design (MUF24005 model). Less prone to breakage in tough environments.
- Compact design. Measuring less than 9" tall.
- Wideband performance (BMAXC models only) provide coverage of 2.2 GHz to 2.9 GHz frequencies without any tuning required.

Electrical Specifications

Model #	Frequency Range	Factory Tuned Frequency	Coil Type	VSWR	Maximum Power	Gain
(B)MAXC24503	2.2-2.9 GHz	2.45 GHz	Closed	< 1.5:1	100 Watts	3 dBi
(B)MAXC24505	2.2-2.9 GHz	2.45 GHz	Closed	< 1.5:1	100 Watts	5 dBi
MUF24005	2.4-2.48 GHz	2.45 GHz	Open	< 1.5:1	100 Watts	5 dBi

* Prefix "B" indicates a black finish.

Mechanical Specifications

Model #	Antenna Height	Weight
(B)MAXC24503	5.25" (133.35 mm)	0.12 lbs (0.054 kg)
(B)MAXC24505	7.50" (190.50 mm)	0.16 lbs (0.073 kg)
MUF24005	8.75" (222.25 mm)	0.10 lbs (0.045 kg)

* Prefix "B" indicates a black finish.

3. Panel Antennas

The following panel antennas are recommended:

- SA12-180-24V/1046
- Mars 60° 2.4 - 2.7 Base Station Antenna (MA-WC24-5X)
- Suhner Planar Antenna (SPA 2400/75/9/0/V)
- ACPS-2400-8 Patch Antenna
- Panel 22°/ 17 dBi
- Adjustable Panel MSP24013

3.1. SA12-180-24V/1046

The SA12-180-24V/1046 (European Antennas Ltd.) antenna specifications are listed in the table below:

Electrical specifications	
Frequency range	2.3 - 2.5 GHz
Gain	11 dBi Nominal
VSWR	1.5:1
Front to back ratio	24 dB Minimum
Polarization	Linear (Vertical)
Power rating	50 W
Beamwidth	180° (Azimuth) x 7° (Elevation)
Cross pol.	20 dB Minimum
Mechanical specifications	
Temperature	-20° to +50°C
Weight	1.8 Kg Excluding Brackets
Wind loading	18.61 Kg / 40.94 lbs @ 100 mph
Finish	Gloss White Glass Fibre/Alocrom 1200

3.2. Mars 60° 2.4-2.7 Base Station Antenna (MA-WC24-5X)

The Mars 60° 2.4 - 2.7 GHz Base Station Antenna has a lightweight and durable construction. The antenna is shown below:

**Additional Features:**

- Quick and easy installation
- Easily adapted to any RF connector
- Adjustable Tilt

Applications:

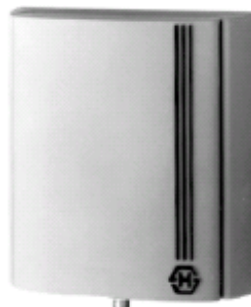
- Point to Multi Point
- Base Station Antenna for WLL applications.
- MMDS
- ISM applications

The Mars 60° 2.4 - 2.7 GHz Base Station Antenna specifications are listed in the table below:

Electrical specifications	
Frequency range	2.4 - 2.7 GHz
Gain	14 dBi
VSWR	1:1.5
Polarization	Linear Vertical
Power rating	50 Watts
3dB Beamwidth – Azimuth	60°
3dB Beamwidth – Elevation	12°
Input Impedance	50 Ohms
Mechanical specifications	
Dimensions (LxWxD)	600x140x30 mm
Radome	ABS - UV Protected
Connector	N-type/SMA/MCX (others available)
Back Plate	Anodized Aluminum
Operating Temperature	-40°C to +65°C
Humidity	100%
Lightning Protection	DC Grounded
Standards compliance	
ETSI EN 301 325 v1.1.1	

3.3. Suhner Planar Antenna (SPA 2400/75/9/0/V)

The Suhner Planar Antenna (SPA 2400/75/9/0/V) is shown below:

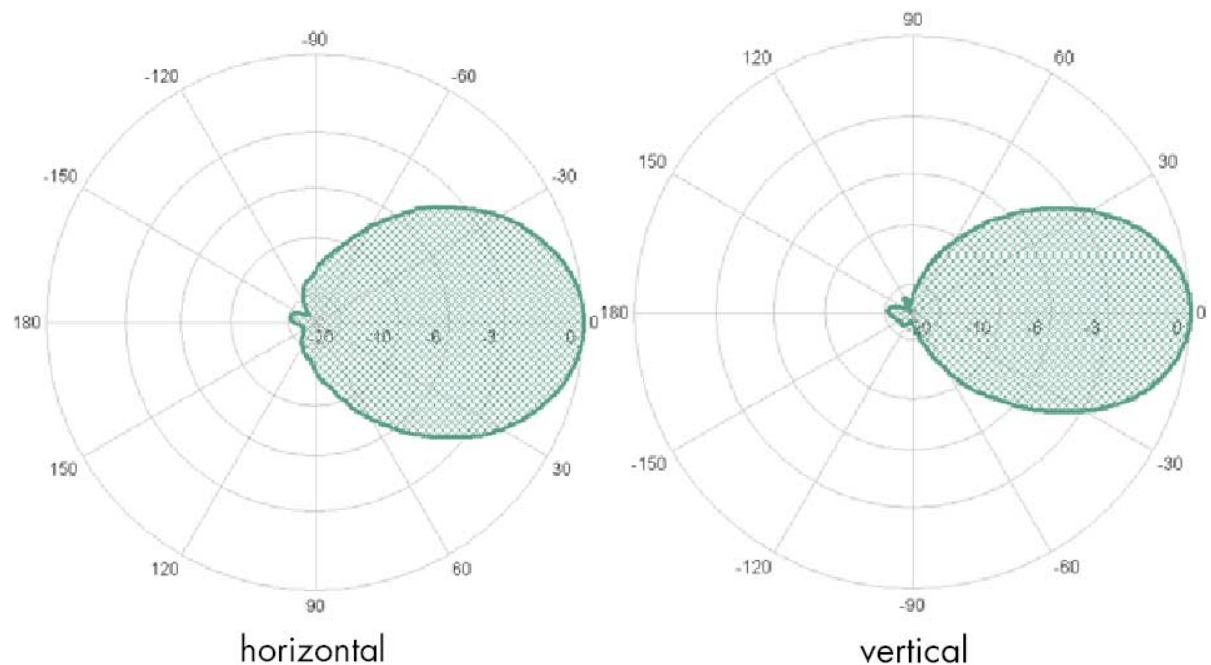


The Suhner Planar Antenna (SPA 2400/75/9/0/V) specifications are listed in the table below:

Electrical specifications	
Frequency range	2300 - 2500 MHz
Gain	8.5 dBi
VSWR	1.5
Polarization	linear, vertical
Max. Power	75 W (CW) at 25°C
3 dB Beamwidth horizontal	75°
3 dB Beamwidth vertical	60°

Impedance	50 Ohms
Downtilt	0°
Front to back ratio	20 dB
Mechanical specifications	
Dimensions	101 x 95 x 32 mm (3.98" x 3.74" x 1.26")
Weight	0.11 kg (0.24 lbs.)
Housing material	ASA and aluminum
Radome material	ASA
Radome color	RAL 7035 (light-grey)
Mounting bracket color	RAL 7042 (dark-grey)
Operating temperature range	- 40°C to + 80°C
Storage temperature range	- 40°C to + 80°C
Windload	15 N at 160km/h (100mph)

The Suhner Planar Antenna (SPA 2400/75/9/0/V) radiation patterns are shown below:



3.4. ACPS-2400-8 Patch Antenna

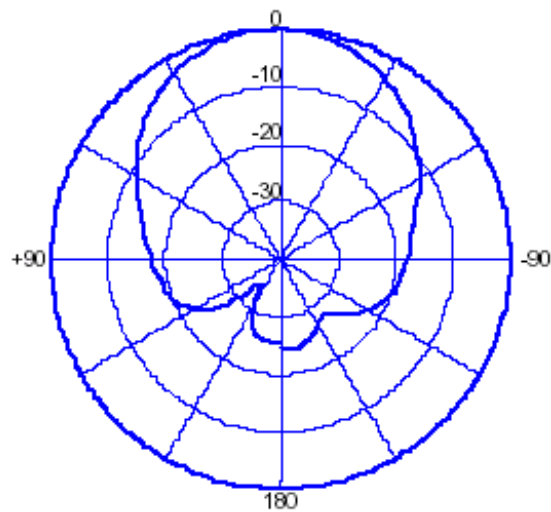
Gamma Nu, Inc. offers a wide range of patch antennas to be used for signal reception and transmission in the repeater or in-building solution. It is usually mounted on the indoor wall to be used as a subscriber friendly antenna. It is tilted with adjusting the bracket in vertical and horizontal axis. It can be used as an outdoor donor antenna mounted on the outdoor wall or pole to replace long Yagi antenna since it is fully protected from environmental effects.



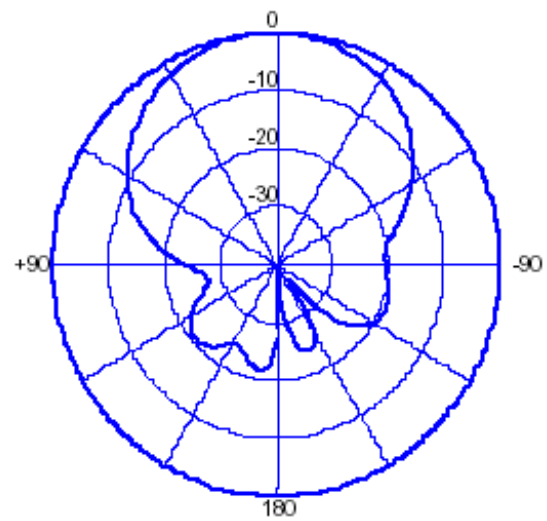
The ACPS-2400-8 Patch Antenna specifications are listed in the table below:

Electrical specifications	
Frequency range	2300-2500 MHz (WLL/W-LAN)
Gain	8 dBi
VSWR	< 1.5 : 1
Polarization	Vertical
Power	1 Watt
Beamwidth horizontal	65°
Beamwidth vertical	65°
Impedance	50 Ohms
Connector	N-F
Mechanical specifications	
Dimensions	128 x 103 x 39 mm
Weight	320 grams
Shipping Dimensions	140 x 110 x 50 mm
Mounting	Wall
Color	Gray / White / Ivory
Radome	ASA Plastic

The ACPS-2400-8 Patch Antenna radiation patterns are shown below:



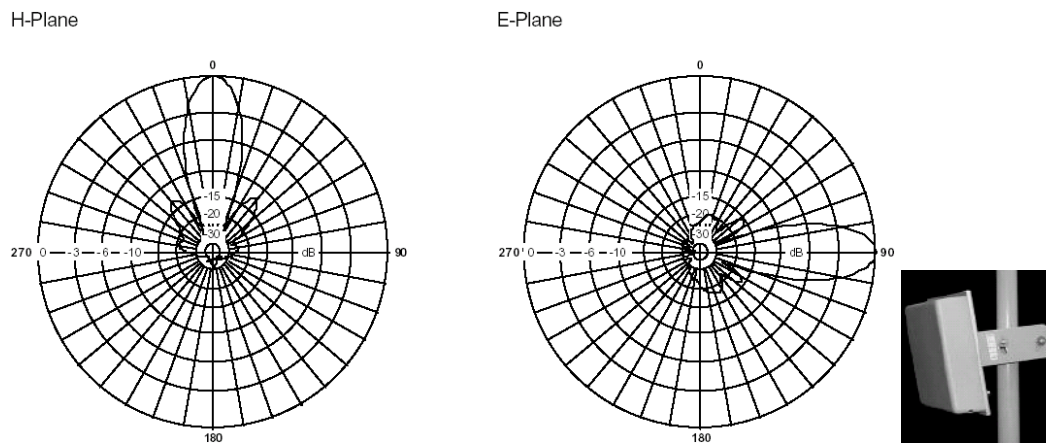
Horizontal Pattern



Vertical Pattern

3.5. Panel 22°/ 17 dBi

The panel 22°/ 17 dBi antenna's radiation pattern and physical design are shown in the figure below.



The table below lists the panel 22°/ 17 dBi antenna specifications.

Electrical specifications	
Frequency range	2300 – 2500 MHz
Gain	17 dBi
VSWR	1.5:1 max
Front to back ratio	30 dB
Polarization	Vertical or Horizontal
Power rating	25W
H-plane beamwidth	22°
E-plane beamwidth	22°
Cross pol. discrimination	20 dB min
Impedance	50Ω nominal
Termination	N female
Mechanical specifications	
Length	324 mm (12.75 in.)
Width	345 mm (13.6 in.)
Depth	76 mm (3 in.)
Weight (incl. clamps)	3.2 kg (7 lb)
Rated wind velocity	200 km/h (125 mph)
Hor. thrust at rated wind	34 kg (75 lb)
Mechanical tilt	0 +/- 11°
Mounting	19 – 76 mm (0.75 – 3 in.)

3.6. Adjustable Panel MSP24013

The MAXRAD XtremeWave™ sector panel covers the 2.4 GHz ISM band and provides field adjustable horizontal beamwidths of 45°, 60°, 90° or 120°. This unique design allows a system installer to stock a single antenna and field adjust it to the desired beamwidth, making it useful for wireless broadband applications where coverage of a geographical sector is desired. The panel can also be ordered with fixed beamwidths. This line also includes a compact 90° sector model for applications where space is very limited. This fixed beamwidth antenna measures less than 8 inches long.

In many applications, sector panels are used to provide omnidirectional coverage by using, for example, three radios and three 120° sector antennas to provide 360° coverage. This results in a stronger and more focused signal than that of a single omnidirectional antenna. It also provides a more robust design. The antenna features industry leading front-to-back ratios of more than 42 dB at 45°, 60° and 90° and over 32 dB at 120° with excellent cross pole discrimination.



- **General Specifications:** 2.4 GHz sector panel antennas
- **Radome Material:** Off white ASA plastic with UV resistance
- **Termination:** Type N, female. Other connector options available
- **Polarization:** Vertical
- **Lighting Protection:** DC grounded
- **Mounting Method:**
 - Adjustable stainless steel bracket, +/- 11 degrees of uptilt or downtilt
 - Pipe diameter: 0.75 thru 2.4" OD (19-60 mm)
- **Nominal Impedance:** 50 Ohms

Feature and Benefits:

- Adjustable multiple beamwidth sectors. A single antenna can be utilized to cover several geographical sectors.

- Three sectors with three data radios can be installed as an array for omnidirectional coverage. Provides a stronger, more focused signal than that of a standard omnidirectional antenna.
- Industry leading front-to-back ratios. Ensures that the radiated energy is focused towards its target, and not to the back or sides of the antenna.

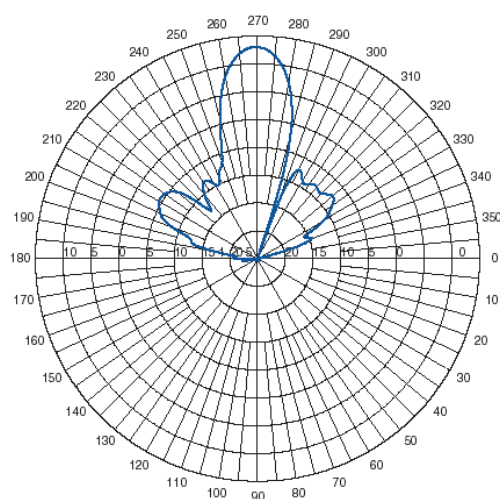
Electrical Specifications

Model #	Frequency Range	Nominal Gain	Front-to-Back Ratio	Horizontal Plane Beamwidth	E-Plane Beamwidth	Typical Cross Poll Discrimination	VSWR	Maximum Power Input
MSP24013MB	2400-2500 MHz	13 dBi at 120° 14 dBi at 90° 16 dBi at 60° 17 dBi at 45°	> 32 dB at 120° > 42 dB at 90° > 42 dB at 60° > 42 dB at 45°	120°, 90°, 60° and 45°	16°	270°-0°, 0°-90° = -20 dB 235°-270°, 90°-135° = -28 dB 180°-235°, 135°-180° = -32 dB	< 1.5:1	50 Watts
MSP24013-120	2400-2500 MHz	13 dBi	> 32 dB	120°	16°	(all models)	< 1.5:1	50 Watts
MSP24014-90	2400-2500 MHz	14 dBi	> 42 dB	90°	16°	270°-0°, 0°-90° = -20 dB	< 1.5:1	50 Watts
MSP24016-60	2400-2500 MHz	16 dBi	> 42 dB	60°	16°	235°-270°, 90°-135° = -28 dB	< 1.5:1	50 Watts
MSP24017-45	2400-2500 MHz	17 dBi	> 42 dB	45°	16°	180°-235°, 135°-180° = -32 dB	< 1.5:1	50 Watts
MSP2401090PT	2400-2500 MHz	10 dBi	> 32 dB	90°	35°	> 20 dB	< 1.5:1	50 Watts

Mechanical Specifications

Model #	Rated Wind Velocity	Horizontal Thrust at Rated Wind	Temperature Range	Dimensions	Weight
MSP24013MB	125 mph (200 km/h)	43 lbs (19.5 kg)	-30°C to +75°C	21.5" L x 6.5" W x 2.8" D (546 mm L 16.5 mm W x 7.2 mm D)	4 lbs (1.8 kg)
MSP24013-120	125 mph (200 km/h)	43 lbs (19.5 kg)	-30°C to +75°C	21.5" L x 6.5" W x 2.8" D (546 mm L 16.5 mm W x 7.2 mm D)	4 lbs (1.8 kg)
MSP24014-90	125 mph (200 km/h)	43 lbs (19.5 kg)	-30°C to +75°C	21.5" L x 6.5" W x 2.8" D (546 mm L 16.5 mm W x 7.2 mm D)	4 lbs (1.8 kg)
MSP24016-60	125 mph (200 km/h)	43 lbs (19.5 kg)	-30°C to +75°C	21.5" L x 6.5" W x 2.8" D (546 mm L 16.5 mm W x 7.2 mm D)	4 lbs (1.8 kg)
MSP24017-45	125 mph (200 km/h)	43 lbs (19.5 kg)	-30°C to +75°C	21.5" L x 6.5" W x 2.8" D (546 mm L 16.5 mm W x 7.2 mm D)	4 lbs (1.8 kg)
MSP2401090PT	125 mph (200 km/h)	43 lbs (19.5 kg)	-30°C to +75°C	8.0" L x 6.5" W x 2.8" D (203 mm L x 16.5 mm W x 7.2 mm D)	3 lbs (1.3 kg)

The MAXRAD XtremeWave™ sector panel radiation pattern is shown below:



Elevation Beamwidth
45°, 60°, 90° and 120° Sectors