# PBA for the emission at elevation angle higher than 30 degrees from horizon

Sporton project number : 570330

Product name : *XH2120*

FCC ID : *SK6-XH2120*

Market name : Hardened Wireless Access Point

Product information :

The EUT is the indoor /outdoor AP, there are 2 RF modules inside. These 2 modules are the same 2x2 model, and support 3 kinds of omni - antenna

Now we pretest worst case (maximum Gain) to make this PBA.

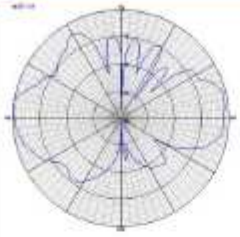
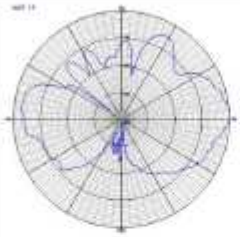
Outline :

1. Antenna information
2. Test requirement
3. Test method
4. EIRP of the EUT
5. Test result
6. Test setup Picture

1. Antenna information

Gain 5GHz : 5 dBi

2x2 Omni Antenna (ANT-OMNI-2x2-02)

| DESCRIPTION | 360° (OMNIDIRECTIONAL) ANTENNA | |
|---|---|---|
| Vertical Gain Pattern |  | |
| Horizontal Gain Pattern |  | |
| Frequency Range (GHz) | 2.4 – 2.5 | 5.15 – 5.825 |
| Impedance | 50 ohms | |
| VSWR (50 ohms) | 2.0: 1 max. typ. | |
| Peak Gain, dBi (2.4 and 5GHz) | 2.3 | 5 |
| Polarization | 4 x V (Linear, Vertical) | |
| 3dB Beamwidth Az (H) | 360° | |
| 3dB Beamwidth El (V) | 60° | |
| Maximum Power | 10 W. | |
| Connector | RP-TNC male | |
| Dimensions | 8.6 H x 6.3 OD inches | |
| Operating Temp | -30° C to + 70° C | |
| Storage Temp | -40° C to + 85° C | |
| Ingress Protection | IP-54 | |
| Mounting Options | 1.5" stud mount<br>Universal wall and mast mountable with included articulating mount. All tools and hardware included. Mounts to mast up to 1-1/2" in diameter.<br>Ceiling mountable to 1" thick ceiling tile with jam nut. Also includes rubber washer for mounting to smooth surfaces such as NEMA enclosures. | |
| Cable Specs | LMR-195, male RP-TNC to male N connectors and 10' length | |
| Connector | Four Reverse Polarity TNC (male)<br>ANSI 7/16-28 UNEF<br>28 threads | |
| What to order | For use with one XH2/XR-520H:<br>• 1 ANT-OMNI-2x2-02 | For use with one XR-2425H:<br>• 1 ANT-OMNI-2X2-02 |

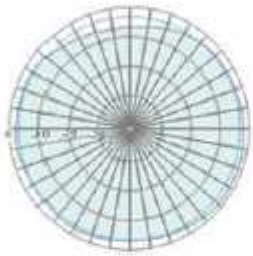
ANTENNA

MOUNTS

CONNECTOR CLOSEUP

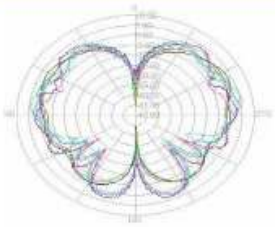
## 2x2 Omni Antenna (ANT-OMNI-2x2-03)

Single Band Antenna, operating in either the 2.4 GHz or 5 GHz band.

| DESCRIPTION | 360° (OMNIDIRECTIONAL) ANTENNA | | ANTENNA |
|---|---|---|---|
| Vertical Gain Pattern |  | |  |
| Horizontal Gain Pattern |  | | |
| Frequency Range (GHz) | 2.4 – 2.5 | 5.15 – 5.85 | |
| Impedance | 50 ohms | | |
| VSWR (50 ohms) | 1.7 max. typ. | 2.0 max. typ. | |
| Peak Gain, dBi (2.4 and 5GHz) | 2.3 | 3.5 | |
| Polarization | 4 x Vertical | | |
| 3dB Beamwidth Az (H) | 360° | 360° | |
| 3dB Beamwidth El (V) | 60° | 50° | |
| Maximum Input Power | 50 W | | |
| Connector | 4 x N female | | |
| Dimensions (mm) | 200 H x 110 OD (outer diameter) | | |
| Operating Temp | -40° C to + 55° C | | |
| Rated Wind Velocity | 36.9 (m/s) 82.5 mph | | |
| Mounting Options | Pole mount: 40-70mm OD, 1.6-2.75in OD | | |
| Cable Specs | LMR-195, male N connectors at both ends, 10' length | | |
| Connector | Four N Female | | |
| What to order | For use with one XH2-120/XR-520H:<br>1 ANT-OMNI-2x2-03 | | |

# Omni-Directional Antennas:

"Rubber Duck" Antenna (ANT-OMNI-1x1-03)

| DESCRIPTION | 360° (OMNIDIRECTIONAL) ANTENNA | | ANTENNA |
|---|---|---|---|
| Gain Pattern (Omni-Directional) |  | |  |
| Frequency Range (GHz) | 2.4-2.5 | 5.15-5.35, 5.725-5.85 MHz |  |
| Impedance | 50 ohms | | |
| VSWR (50 ohms) | 2.0: 1 max. typ. | | |
| Peak Gain, dBi (2.4 and 5GHz) | 2.0 | 4.0 | |
| Polarization | Linear Vertical | | |
| 3dB Beamwidth Az (H) | 360° (Omnidirectional) | | |
| 3dB Beamwidth El (V) | 90° | 60° | |
| Maximum Power | 10 W max. | | |
| Connector | 1 x N Male | | |
| What to order | For use with one XH2-120: 4 ANT-OMNI-1x1-03 | For use with one XR-2425H: 8 ANT-OMNI-1X1-03 | |

## 2. Test requirement :

KDB 789033 D02 General UNII Test Procedures New Rules v01

**H. Measurement of emission at elevation angle higher than 30 degrees from horizon**

In addition to the emission limits specified in § 15.407(a)(1)(i), if the access point is an outdoor Point-to-Multipoint device operating in the band 5.15-5.25 GHz, the rules require that the maximum EIRP at any elevation angle above 30° not exceed 125 mW (21 dBm) as measured from the horizon. This restriction leads to a general requirement for the antenna pattern: if the EIRP within 3-dB elevation beamwidth of any radiation lobe is higher than 125 mW, this lobe must be controlled, either mechanically or electrically, so that the 3-dB elevation beamwidth of this lobe is below 30° elevation angle relative to horizon.

## 3. Test method

**For fixed infrastructure, not electrically or mechanically steerable beam antenna**

b) If elevation plane radiation pattern is not available, but the antenna type (such as dipole omnidirectional, Yagi, parabolic, or sector antenna) has symmetrical elevation plane pattern referenced at main beam and all lobes on the main beam elevation plane have highest gains, then the following measurement method is acceptable to determine compliance:

(i) Determine the device's intended mounting elevation angle referenced to the horizon. (ii) Rotate EUT antenna by 90° around the main beam axis in horizontal position to transform measurement in elevation angle into azimuth angle and define 0° reference angle based on device's intended mounting elevation angle.

(iii) Move test antenna along the horizontal arc, or rotate the turn table with EUT antenna placed at the center, between 30° and 90° relative to the 0° reference angle, and then continuing down from 90° to 30° on the other side of the pattern, while maintaining the test antenna pointing with constant distance to the EUT antenna and search for the spot which has the highest measured emission. Both horizontal and vertical polarization shall be investigated to find out the maximum radiated emission level.

Note: the moving of test antenna along the horizontal arc, or rotating the turn table, shall be performed in angular step size as small as possible but not larger than 3°

(iv) Calculate the EIRP based on the highest measured emission and compare to the limit of 125 mW to determine compliance.

(v) The antenna pattern measurements should be included in the filing.

**4. EIRP of the EUT**

**5GHz power**

| Configuration | | | Maximum Conducted (Average) Output | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Modulation Mode | $N_{TX}$ | Freq. (MHz) | Chain Port 1 w/o Duty Factor | Chain Port 2 w/o Duty Factor | Duty Factor (dB) | Chain Port 1 | Chain Port 2 | Sum Chain | Power Limit | Power-DG (dBi) | EIRP Power |
| 11a | 2 | 5180 | 13.67 | 13.95 | 0.00 | 13.67 | 13.95 | 16.82 | 30.00 | 5.00 | 21.82 |
| 11a | 2 | 5200 | 13.76 | 14.00 | 0.00 | 13.76 | 14.00 | 16.89 | 30.00 | 5.00 | 21.89 |
| 11a | 2 | 5240 | 13.62 | 13.78 | 0.00 | 13.62 | 13.78 | 16.71 | 30.00 | 5.00 | 21.71 |
| HT20,M0-15 | 2 | 5180 | 13.61 | 13.94 | 0.00 | 13.61 | 13.94 | 16.79 | 30.00 | 5.00 | 21.79 |
| HT20,M0-15 | 2 | 5200 | 13.80 | 13.92 | 0.00 | 13.80 | 13.92 | 16.87 | 30.00 | 5.00 | 21.87 |
| HT20,M0-15 | 2 | 5240 | 13.52 | 13.73 | 0.00 | 13.52 | 13.73 | 16.64 | 30.00 | 5.00 | 21.64 |
| HT40,M0-15 | 2 | 5190 | 12.93 | 11.91 | 0.00 | 12.93 | 11.91 | 15.46 | 30.00 | 5.00 | 20.46 |
| HT40,M0-15 | 2 | 5230 | 14.11 | 13.45 | 0.00 | 14.11 | 13.45 | 16.80 | 30.00 | 5.00 | 21.80 |
| VHT20,M0-8 | 2 | 5180 | 13.75 | 13.58 | 0.00 | 13.75 | 13.58 | 16.68 | 30.00 | 5.00 | 21.68 |
| VHT20,M0-8 | 2 | 5200 | 13.78 | 13.88 | 0.00 | 13.78 | 13.88 | 16.84 | 30.00 | 5.00 | 21.84 |
| VHT20,M0-8 | 2 | 5240 | 13.58 | 13.74 | 0.00 | 13.58 | 13.74 | 16.67 | 30.00 | 5.00 | 21.67 |
| VHT40,M0-9 | 2 | 5190 | 12.98 | 11.91 | 0.00 | 12.98 | 11.91 | 15.49 | 30.00 | 5.00 | 20.49 |
| VHT40,M0-9 | 2 | 5230 | 14.15 | 13.46 | 0.00 | 14.15 | 13.46 | 16.83 | 30.00 | 5.00 | 21.83 |
| VHT80,M0-9 | 2 | 5210 | 12.27 | 11.18 | 0.00 | 12.27 | 11.18 | 14.77 | 30.00 | 5.00 | 19.77 |

Maximux

Antenna : 2x2-02, 5GHz gain : 5dBi
Max. EIRP = 21.89dBm @ 5200MHz

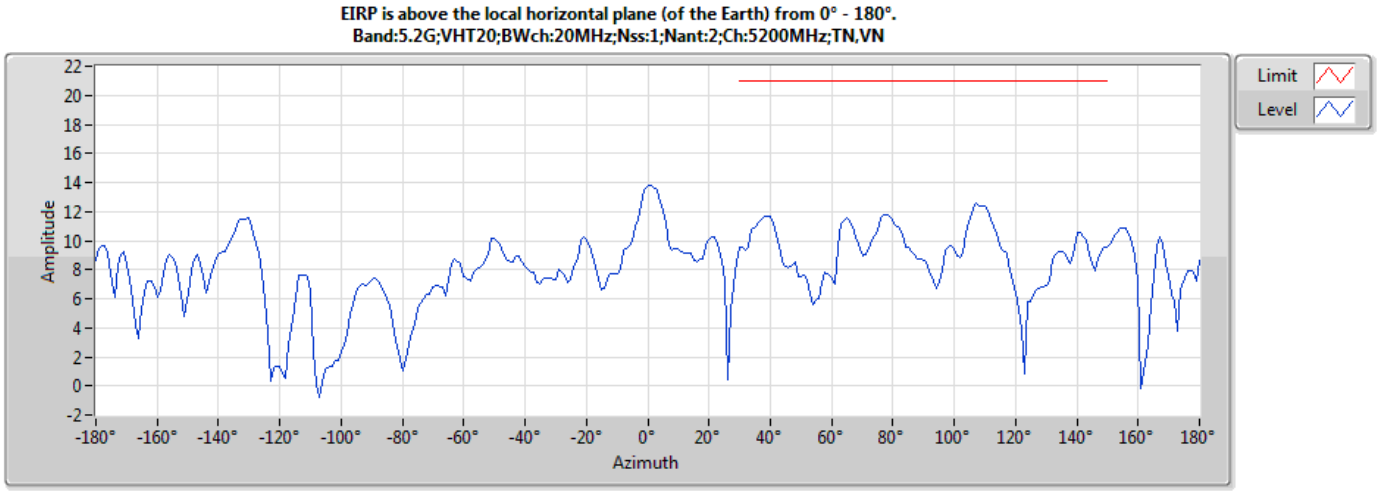
Antenna : 2x2-03, 5GHz gain : 3.5 dBi
Max. EIRP = 20.39 < 21 dBm
It is pass for this item

Antenna : 1x1-03, 5GHz gain : 4 dBi
Max. EIRP 20.89 dBm < 21 dBm
It is pass for this item

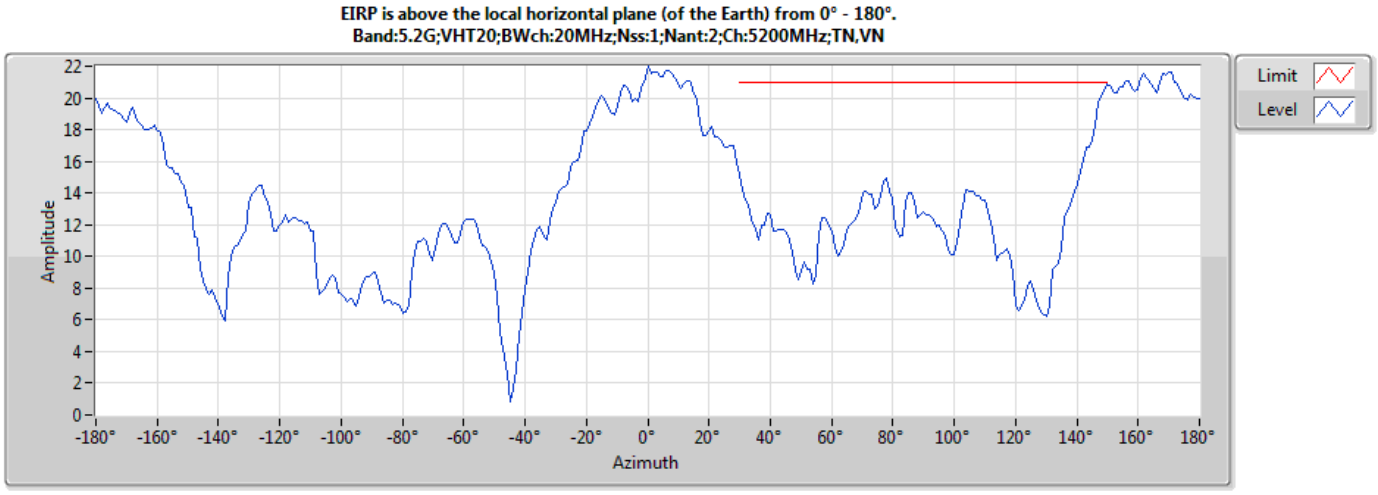
**5. Test result for 5200MHz for 2x2 -02 antenna**

Note : red line is EIRP limit (21dBm) for 30 ~ 150 dregee

1. Vertical axis of measure Antenna



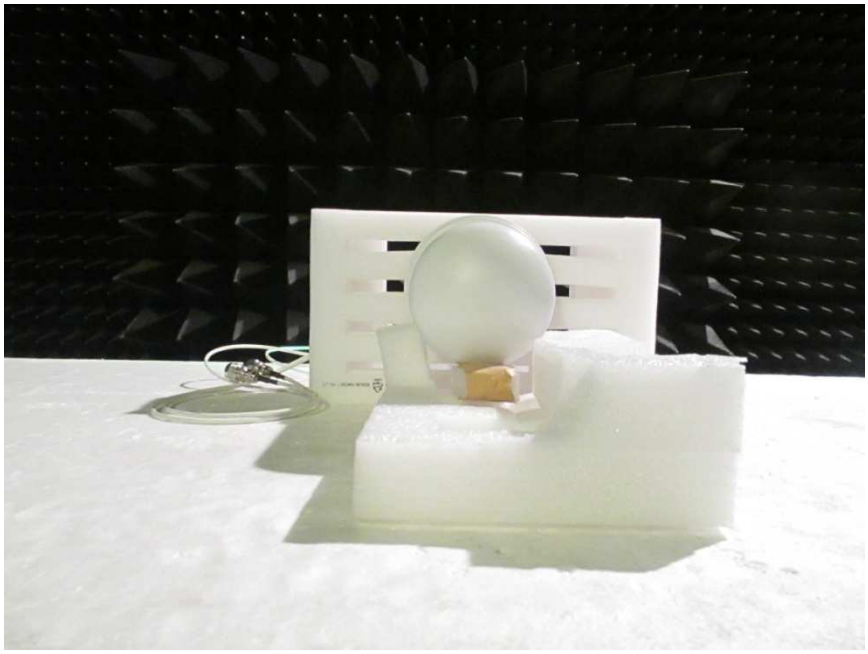

2. Horizontal axis of measure Antenna




Max. EIRP = 11a 5200MHz is 21.89dBm @ 0 degree.

**6. test setup picture**

Approaching pciture



Farther picture