



RF EXPOSURE EVALUATION REPORT

For: Siemens Aktiengesellschaft

Product: WLAN Module MPCIE-R1-ABGNAC-U4

FCC ID: LYHRAPACV1

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 Product: **WLAN Module MPCIE-R1-ABGNAC-U4**

RF Exposure Evaluation for the MPCIE-R1-ABGNAC-U4

The MPCIE-R1-ABGNAC-U4 is a wireless LAN access point mini PCIE module, which contains 2.4GHz and 5GHz WIFI transmitters. The module can operate as a client or master device.

The module does not support simultaneous transmission in 2.4GHz and 5GHz operating bands

WLAN supports SISO and 4x4 MIMO operation.

ANTENNAS SUPPORTED:

5GHz			2.4GHz		
Model Number	Antenna Type	Gain @5GHz (dBi)	Model Number	Antenna Type	Gain @2.4GHz (dBi)
ANT793-8DK	Patch	23/14,2*	ANT792-8DN	Patch	14
ANT793-8DJ	Patch	18/13.6**	ANT795-6DC	Patch	9
ANT793-8DP	Patch	13,5	ANT792-6MN	Dipole	6
ANT795-6DC	Patch	9	ANT795-6MN	Dipole	6
ANT793-6DG	Patch	9	ANT795-6MP	Dipole	5
ANT795-6MN	Dipole	8	ANT795-6MT	Dipole	4
ANT795-6MP	Dipole	7	ANT795-4MA	Dipole	3
ANT795-6MT	Dipole	6	ANT795-4MC	Dipole	3
ANT795-4MA	Dipole	5	ANT795-4MD	Dipole	3
ANT795-4MC	Dipole	5	ANT795-4MB	Dipole	2
ANT795-4MD	Dipole	5	ANT795-4MX	Dipole	2
ANT795-4MB	Dipole	3			
ANT795-4MX	Dipole	2.5			

** For ANT793-8DJ an antenna connection cable with a length of $\geq 5\text{m}$ is required (Geff = 13.6 dBm)

* For ANT793-8DK an antenna connection cable with a length of $\geq 10\text{m}$ is required (Geff = 14.2 dBm)

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MAXIMUM TRANSMITTER POWER

Transmitter power for MIMO operation is considered as 4 x SISO power (the sum of the conducted power levels at the four output ports - Ref. KDB 662911 D01)

WLAN 2.4GHz:

Applicable FCC Rule parts:

15.247(b)(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level

15.247(b)(4):

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

WLAN 5GHz:

Applicable FCC Rules:

15.407 (a)(1)(i) For an outdoor access point operating in the band [5.15-5.25](#) GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6dBi

(ii) For an indoor access point operating in the band [5.15-5.25](#) GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band [5.725-5.85](#) GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi

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Module 2.4GHz

15.247(b)(4) - Max EIRP is limited to 4W (36dBm) for all antennas/ combinations (1W + 6dBi max antenna gain)

Module UNII 1

15.407(i) - Max EIRP is limited to 4W (36dBm) for all antennas/ combinations (1W + 6dBi max antenna gain)

Module UNII 3

15.407(iv)(3) - Max EIRP is limited to 4W (36dBm) for all antennas/ combinations (1W + 6dBi max antenna gain)

Max. specified conducted power = 22dBm (SISO) = 28dBm (MIMO)

EIRP_{MIMO} = 34.0dBm = 2.5W

MPE CALCULATIONS

The MPE calculation used to calculate the safe operating distance for the user is.

$$S = \text{EIRP} / 4 \pi R^2$$

Where S = Power density
EIRP = Effective Isotropic Radiated Power (EIRP = P x G)
P = Conducted Transmitter Power
G = Antenna Gain (relative to an isotropic radiator)
R = distance to the centre of radiation of the antenna

Values:

Power Density Requirement

From table 1 (b) - Limits for General Population/ Uncontrolled Exposure of FCC Rule Part 1.1310 for >1.5GHz

$$S_{\text{req1}} = 1.0 \text{ mW/cm}^2$$

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For WLAN 2.4GHz

$$\text{EIRP}_{\text{max}} = 36\text{dBm (MIMO)} = 4000\text{mW}$$

$$S = \text{EIRP} / 4 \pi R^2$$
$$= 4000 / (4 \times 3.142 \times 400)$$

ie: S = 0.8 mW/cm² at 20cm

for S = 1.0 mW/cm² safe operating distance $R = \sqrt{(\text{EIRP} / 4\pi)}$

$$= \sqrt{(4000 / 4 \times 3.142)}$$

R = 17.84cm

For WLAN 5GHz UNII 1

$$\text{EIRP}_{\text{max}} = 36\text{dBm (MIMO)} = 4000 \text{ mW}$$

$$S = \text{EIRP} / 4 \pi R^2$$
$$= 4000 / (4 \times 3.142 \times 400)$$

ie: S = 0.8 mW/cm² at 20cm

for S = 1.0 mW/cm² safe operating distance $R = \sqrt{(\text{EIRP} / 4\pi)}$

$$= \sqrt{(4000 / 4 \times 3.142)}$$

R = 17.84cm

For WLAN 5GHz UNII 3

$$\text{EIRP}_{\text{max}} = 36\text{dBm (MIMO)} = 4000 \text{ mW}$$

$$S = \text{EIRP} / 4 \pi R^2$$
$$= 4000 / (4 \times 3.142 \times 400)$$

ie: S = 0.8 mW/cm² at 20cm

for S = 1.0 mW/cm² safe operating distance $R = \sqrt{(\text{EIRP} / 4\pi)}$

$$= \sqrt{(4000 / 4 \times 3.142)}$$

R = 17.84cm

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Conclusion

The required 20cm RF exposure limits for General Population/ Uncontrolled Exposure (FCC rule part §1.1310, table 1B) will not be exceeded for the MPCIE-R1-ABGNAC-U4 using the antennas as specified.

NOTE:

The safe operating distances are 17.84cm for 2.4GHz operation, UNII Band1 & UNII Band 3. These distances include the use of antennas with gains exceeding 6dBi where the transmitter power of the module is reduced in accordance with the applicable rule parts.