RF Exposure report

The Equipment Under Test (EUT) is a Panel PC with WiFi function operating at 2412-2462MHz for 802.11b/g/n-HT20, 11 channels with 5MHz channel spacing and 2422-2452MHz for 802.11n-HT40, 9 channels with 5MHz channel spacing. The EUT also has a NFC function operating at 13.56MHz, and has a RFID function operating at 125kHz, they can't transmit Simultaneously. The EUT was powered by AC/DC adaptor through AC120V/50Hz or POE. For more detailed features description, please refer to the user's manual.

Modulation Type: BPSK, QPSK, 16QAM, 64QAM for OFDM. CCK, DQPSK, DBPSK for DSSS.
Antenna Type: Integral antenna
Antenna Gain: 2.2dBi
The nominal conducted output power specified: 20dBm (Tolerance: +/-3dB)

The maximum conducted output power for the EUT is 21.98 dBm in the frequency 2.462GHz 802.11n-HT20 mode which is within the production variation.

The minimum conducted output power for the EUT is 18.65dBm in the frequency 2.412GHz 802.11b mode which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting devices is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use,

For Maximum Permissible Exposure (MPE) evaluation of the product, the maximum power density at 20 cm from this transmitter shall be less than the General Population / Uncontrolled MPE limit in FCC Part 1.1310.

The maximum EIRP= 20+3+2.2=25.2dBm=331.1mW
The source-based time averaged maximum radiated power = 331.1 mW x Duty Cycle = 331.1mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna can be calculated according to OET 65 as follow:
$$= PG/4\pi R^2$$
$$= EIRP/4\pi R^2 = 331.1/ 4\pi R^2$$
$$= 0.07 \text{ mW/cm}^2$$

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The MPE limit is 1.0 mW/cm^2 for general population and uncontrolled exposure in the WiFi frequency range according to FCC Part 1.1310. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structure and body of the user or nearby persons.

Transmitter Duty Cycle Calculation
The EUT transmit continuously during the test, the duty cycle is 100%.

The following RF exposure statement or similar sentence is proposed to be included in the user manual:

"FCC RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons."

For NFC function operating at 13.56MHz.

Antenna Type: Integral antenna.
Antenna Gain: 0dBi
The nominal conducted output power specified: -15.00dBm (+/- 3dB)
The nominal radiated output power (e.r.p) specified: -17.15dBm (+/- 3dB)
Modulation Type: ASK

The worst-case peak radiated emission for the EUT is 79.2dBμV/m at
3m in the frequency 13.56MHz
The EIRP = [(FS*D) ^2 / 30] mW= -16.03dBm
The ERP = EIRP - 2.15 = -18.18 dBm
which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting devices is
categorically excluded from routine environmental evaluation for RF exposure
prior to equipment authorization or use,

For Maximum Permissible Exposure (MPE) evaluation of the product, the
maximum power density at 20 cm from this transmitter shall be less than the
General Population / Uncontrolled MPE limit in FCC Part 1.1310.

The maximum EIRP= -12dBm=0.063mW
The source-based time averaged maximum radiated power = 0.063mW x Duty
Cycle = 0.063mW

From above data, the exposed power density at a distance (R) of 20cm from
the center of radiation of the antenna can be calculated according to OET 65
as follow:
$= PG/4\pi R^2$
$= EIRP/4\pi R^2 = 0.063/ 4\pi R^2$

$= 1.25 \times 10^{-5}$ mW/cm^2

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The MPE limit is 0.98 mW/cm^2 for general population and uncontrolled exposure in the 1.34-30MHz frequency range according to FCC Part 1.1310. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structure and body of the user or nearby persons.

Transmitter Duty Cycle Calculation
The EUT transmit continuously during the test, the duty cycle is 100%.

The following RF exposure statement or similar sentence is proposed to be included in the user manual:

"FCC RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons."

For RFID function operating at 125 kHz.

Antenna Type: Integral antenna.
Antenna Gain: 0dBi
The nominal conducted output power specified: -25.00dBm (+/- 3dB)
The nominal radiated output power (e.r.p) specified: -27.15dBm (+/- 3dB)
Modulation Type: ASK

The worst-case peak radiated emission for the EUT is 70.1dBμV/m at
3m in the frequency 125 kHz
The EIRP = [(FS*D) ^2 / 30] mW= -25.13dBm
The ERP = EIRP – 2.15 = -27.28 dBm
which is within the production variation.

According to FCC Part 2.1091, this unlicensed transmitting devices is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use,

For Maximum Permissible Exposure (MPE) evaluation of the product, the maximum power density at 20 cm from this transmitter shall be less than the General Population / Uncontrolled MPE limit in FCC Part 1.1310.

The maximum EIRP= -22dBm=0.006mW
The source-based time averaged maximum radiated power = 0.006mW x Duty Cycle = 0.006mW

From above data, the exposed power density at a distance (R) of 20cm from the center of radiation of the antenna can be calculated according to OET 65 as follow:
= PG/4πR^2
= EIRP/4πR^2 =0.006/ 4πR^2

=1.2×10^{-6} mW/cm^2

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The MPE limit is 100 mW/cm^2 for general population and uncontrolled exposure in the 0.3-1.34MHz frequency range according to FCC Part 1.1310. As the measured power density at 20cm from the transmitter is lower than the MPE limit, the compliance to the MPE limit can be ensured by indicating the minimum 20cm separation between the transmitter's radiating structure and body of the user or nearby persons.

Transmitter Duty Cycle Calculation
The EUT transmit continuously during the test, the duty cycle is 100%.

The following RF exposure statement or similar sentence is proposed to be included in the user manual:

"FCC RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons."

Simultaneous transmissions for both WiFi function and NFC or RFID function

According to FCC Part 2.1091, this unlicensed transmitting devices is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use.

For Maximum Permissible Exposure (MPE) evaluation of the product, the maximum power density at 20 cm from this transmitter shall be less than the General Population / Uncontrolled MPE limit in FCC Part 1.1310.

According to the KDB 447498:
Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0, according to calculated/estimated, numerically modeled, or measured field strengths or power density.

When both WiFi and NFC transmitter are simultaneous transmissions:
MPE Ratio = $(1.25*10^{-5}$ mW/cm^2)/(0.98 mW/cm^2) + (0.07 mW/cm^2)/(1.0mW/cm^2) = 0.07≤ 1.0

When both WiFi and RFID transmitter are simultaneous transmissions:
MPE Ratio = $(1.2*10^{-6}$ mW/cm^2)/(100 mW/cm^2) + (0.07 mW/cm^2)/(1.0 mW/cm^2) = 0.07≤ 1.0

Since the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in the host device is ≤ 1.0, the EUT is considered to satisfy MPE compliance for simultaneous transmission operations.

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