Maximum Public Exposure to RF (MPE) CFR 15.247 (i), CFR 1.1310 (e)

The maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, **S**, of 1 mW/cm^2 at a distance, d, of 20 cm from the EUT.

Therefore, for:

ZigBee

Peak Power (dBm) = 23.0 dBm
Peak Power (Watts) = 0.200 W
Gain of Transmit Antenna = 0 dB_i = 1, numeric
d = Distance = 20 cm = 0.2 m

S = $(PG/ 4\pi d^2)$ = EIRP/4A = 0.200(1.0)/4*π*0.2*0.2
=0.2000/0.5030 = 0.3976 w/m^2
= (0.3976 W/m^2) ($1m^2/W$) (0.1 mW/cm^2)
= 0.03976 mW/cm^2

which is << less than 1 mW/cm^2

RSS-102, 2.5.2 compliance for ZigBee:

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

$1.31 * 10^{-2} * 2440^{0.6834} = 2.7$ W
EUT max EIRP = 23 dBm + (0 dBi) = 23 dBm EIRP = 0.200 W
Which is << than 2.7 W

2.4 GHz WiFi

Peak Power (dBm) = 16.60 dBm
Peak Power (Watts) = 0.0457 W
Gain of Transmit Antenna = -2.5 dB_i = 0.5623, numeric
d = Distance = 20 cm = 0.2 m

S = $(PG/ 4\pi d^2)$ = EIRP/4A = 0.0457 (0.5623)/4*π*0.2*0.2
=0.0267/0.5030 = 0.05310 w/m^2
= (0.05310 W/m^2) (1m^2/W) (0.1 mW/cm^2)
= 0.00531 mW/cm^2

which is << less than 1 mW/cm^2

RSS-102, 2.5.2 compliance for 2.4 GHz WiFi:

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10^{-2} $f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

1.31 * 10^{-2}* $2440^{0.6834}$= 2.7 W
EUT max EIRP = 16.6 dBm + (-2.5 dBi) = 14.1 dBm EIRP = 0.026 W
Which is << than 2.7 W

Bluetooth

Peak Power (dBm) = +8.0 (rated)
Peak Power (Watts) = 0.0063 W
Gain of Transmit Antenna = -2.5 dB_i = 0.5623, numeric (from Table 4 of Test Report)
d = Distance = 20 cm = 0.2 m

S = $(PG/ 4\pi d^2)$ = EIRP/4A = 0.0063(0.5623)/4*π*0.2*0.2
=0.0035/0.5030 = 0.00704 w/m^2
= (0.00704W/m^2) (1m^2/W) (0.1 mW/cm^2)
= 0.00070 mW/cm^2

which is << less than 1 mW/cm^2

RSS-102, 2.5.2 compliance for 2.4 GHz WiFi:

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10^{-2} $f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

1.31 * 10^{-2}* $2440^{0.6834}$= 2.7 W
EUT max EIRP = 8.0 dBm + (-2.5 dBi) = 5.5 dBm EIRP = 0.004 W
Which is << than 2.7 W

NOTE: This information included here for simultaneous MPE calculation reasons only.

Simultaneous transmission MPE calculation for all radios in the EUT that operate in the 2400-2483.5 MHz band:

From above for operation at 20cm or greater:

Individual Power Spectral Density ratios:

Zigbee: 0.03976 mW/cm^2

WiFi: 0.00531 mW/cm^2

Bluetooth: 0.0070 mW/cm^2

Sum of the total of all three radios = 0.05207 mW/cm^2

which is << less than 1 mW/cm^2

Maximum Public Exposure to RF (MPE) CFR 1.1310 (e)

The maximum exposure level to the public from the RF power of the EUT shall not exceed a power density, **S**, of 1 mW/cm^2 at a distance, d, of 20 cm from the EUT.

Therefore, for:

5 GHz WiFi

Peak Power (dBm) = 15.93 dBm
Peak Power (Watts) = 0.040 W
Gain of Transmit Antenna = -2.5 dB_i = 0.5624, numeric
d = Distance = 20 cm = 0.2 m

S = (PG/ $4\pi d^2$) = EIRP/4A = 0.040(0.5624)/4*π*0.2*0.2
=0.0225/0.5030 = 0.0447 w/m^2
= (0.0447 W/m^2) (1m^2/W) (0.1 mW/cm^2)
= 0.00447 mW/cm^2

which is << less than 1 mW/cm^2

RSS-102, 2.5.2 compliance for 2.4 GHz WiFi:

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10^{-2} $f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

1.31 * 10^{-2}* $5180^{0.6834}$= 4.5 W
EUT max EIRP = 15.93 dBm + (-2.5 dBi) = 13.43 dBm EIRP = 0.022 W
Which is << than 2.7 W

All calculations performed by:
Date: 9/2/2016
Test Engineer: George Yang

Signature: