LS RESEARCH
Wireless Product Development

Exemption from Routine Evaluation Exhibit

Allegion
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IC: 8053B-NDE

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Output Power Evaluation.

Evaluation Frequency = 125 kHz, 13.56 MHz, and 2.462 GHz 2.480 GHz

Device Operation separation distance: ***>20cm***

Radiated Field Strength @ 125 kHz = 60.9 dBµV/m @ 3m
Maximum Effective Isotropic Radiated Power (mW) = Radiated field strength (dBµV/m @ 3m -95.2) * $\log^{-1}$(EIRP(dBm)/10) = 0.000369 mW

Radiated Field Strength @ 13.56 MHz = 54.1 dBµV/m @ 3m
Maximum Effective Isotropic Radiated Power (mW) = Radiated field strength (dBµV/m @ 3m -95.2) * $\log^{-1}$(EIRP(dBm)/10) = 0.000077 mW

15.209 Transmitter at 125 kHz:

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-34.33	(dBm)
Maximum peak output power at antenna input terminal:	0.000369	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	0.125	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	100	(mW/cm^2)*
Power density at prediction frequency:	0.0000000734	(mW/cm^2)

*Note: Since there are no limits expressed for < 300 kHz, the limit at 125 kHz was extrapolated based on Table 1 from Appendix A of OET 65.

15.225 Transmitter at 13.56 MHz:

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-41.13	(dBm)
Maximum peak output power at antenna input terminal:	0.000077	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	0.125	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.9789	(mW/cm^2)*
Power density at prediction frequency:	0.0000000153	(mW/cm^2)

FCC ID: QOQBLE112
IC: 5123A-BGTBLE112
2.4 GHz Transmitter Power Density at 20 cm:
0.0006133808 mW/cm^2

FCC ID: T9J-RN171
IC: 6514A-RN171
2.4 GHz Transmitter Power Density at 20 cm:
0.0221681854 mW/cm^2

Sum of MPE ratios for all simultaneous transmitting antennas:

$$\frac{7.34(10)^{-8}\ \frac{mW}{cm^2}}{100\,\frac{mW}{cm^2}} + \frac{1.53(10)^{-8}\ \frac{mW}{cm^2}}{9.79(10)^{-1}\,\frac{mW}{cm^2}} + \frac{6.13(10)^{-4}\ \frac{mW}{cm^2}}{1.00\,\frac{mW}{cm^2}} + \frac{2.22(10)^{-2}\ \frac{mW}{cm^2}}{1.00\,\frac{mW}{cm^2}}$$

$= 2.28(10)^{-2} \leq 1.0$

The following method is recommended to demonstrate compliance with the requirements of RSS-102:

1) At 20 cm, the measurements will be in the near field for the 125 kHz Tx. Therefore, E and H field measurements will need to be performed. The SC6 limits for uncontrolled environments at 125 kHz are set at 280 V/m and 2.19 A/m for E-field (RMS) and H-field (RMS), respectively. The SC6 limits for uncontrolled environments at 13.56 MHz are set at 28 V/m and 161.5(10^{-3}) A/m for E-Field (RMS) and H-Field (RMS), respectively. See SC6 limits in RSS-102 (http://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01904.html). The measurements would be based on IEEE C95.3 standard.

2) For the 2.4 GHz, the power density value would be determined for 20 cm. SC6 limit for uncontrolled environments at 2.4 GHz is set at 10 W/m2.

3) Once the E and H field values are obtained for the 127 kHz Tx and the power density value is obtained for the 2.4 GHz Tx, the following formulas are to be applied since the two TX are transmitting simultaneously.

(E-field value for 125 kHz/SC6 E-field limit)^2 + (E-field value for 13.56 MHz/SC6 E-field limit)^2 + (PD value for 2.4 GHz/SC6 PD limit) + (PD value for 2.4 GHz/SC6 PD limit) = or < 1

(H-field value for 127 kHz/SC6 H-field limit)^2 + (H-field value for 127 kHz/SC6 H-field limit)^2 + (PD value for 2.4 GHz/SC6 PD limit) + (PD value for 2.4 GHz/SC6 PD limit) = or < 1

If both values are less than unity, they are in compliance with RSS-102.

Response:

The 125 kHz and 13.56 MHz transmitters operating under RSS-GEN Section 7.2.5 limits with maximum field strength of 60.9 dBµV/m at 3 meters and 54.1 dBµV/m at 3 meters, respectively, as measured over a ground plane could be considered worst case conditions and near field conditions. For ease of calculation the duty cycles was assumed to be 100% for both transmitters. Given these considerations this is an extreme over-estimation of the actual RF Exposure.

The field strengths at 3 meters were extrapolated to 20 cm using the following equation for frequencies below 30 MHz. This value was then added to the 3 meter field strength to yield the field strength at a 20 cm separation. The field strength was then converted from dBµV/m to V/m.

$$40 * \log\left(\frac{3\ m}{0.2\ m}\right) = 47.04$$

125 kHz Transmitter:

E-Field Strength (dBµV/m) at 20 cm:

$$60.9\ dB\mu V/m + 47.04 = 107.94\ dB\mu V/m$$

Conversion from dBµV/m to V/m:

$$10^{\frac{107.94}{20}} \times 1(10)^{-6} = 0.25\ V/m$$

13.56 MHz Transmitter:

E-Field Strength (dBµV/m) at 20 cm:

$$54.1\ dB\mu V/m + 47.04 = 101.14\ dB\mu V/m$$

Conversion from dBµV/m to V/m:

$$10^{\frac{101.14}{20}} \times 1(10)^{-6} = 0.11\ V/m$$

Condition	E-Field (V/m)	H-Field (A/m)
Conversion of field strength of 125 kHz transmitter	0.25	$6.65(10)^{-4}$
SC6 Limit	280	2.19
$(\text{Value / Limit})^2$	$7.97(10)^{-7}$	$9.22(10)^{-8}$

Condition	E-Field (V/m)	H-Field (A/m)
Conversion of field strength of 13.56 MHz transmitter	0.11	$2.93(10)^{-4}$
SC6 Limit	20.65	$1.62(10)^{-1}$
$(\text{Value / Limit})^2$	$2.84(10)^{-5}$	$3.27(10)^{-6}$

Transmitter	Power Density (mW/cm^2)	Limit (mW/cm^2)
Bluetooth	$6.13(10)^{-4}$	1
WLAN	$2.22(10)^{-2}$	1

Sum of E-Field:

$$7.97(10)^{-7} + 2.84(10)^{-5} + 6.13(10)^{-4} + 2.22(10)^{-2} \;=\; 2.28(10)^{-2} < 1$$

Sum of H-Field:

$$9.22(10)^{-8} + 3.27(10)^{-6} + 6.13(10)^{-4} + 2.22(10)^{-2} = 2.28(10)^{-2} < 1$$