LS RESEARCH
Wireless Product Development

Exemption from Routine Evaluation Exhibit

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Output Power Evaluation.

Evaluation Frequency = 127 kHz and 2.405 GHz

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

Radiated Field Strength @ 127 kHz = 88.78 dBµV/m @ 3m
Maximum Effective Isotropic Radiated Power (mW) = Radiated field strength (dBµV/m @ 3m - 95.2) * $\log^{-1}$(EIRP(dBm)/10) = 0.226 mW

15.209 Transmitter at 127 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

Radiated Field Strength:	88.78	(dBµV/m @ 3m)
Conversion to power:	0.228	(mW)
Prediction distance:	20	(cm)
Prediction frequency:	0.127	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	100	(mW/cm^2)
Power density at prediction frequency:	0.000045	(mW/cm^2)

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2.4 GHz Transmitter Power Density at 20 cm:
0.031530 mW/cm^2 / 1.0 mW/cm^2(limit) = 0.031530

127 kHz transmitter
.000045 mW/cm^2 / 100 mW/cm^2(limit) = 0.00000045

Simultaneous Transmission MPE Sum:
0.031530 + 0.00000045 = 0.031530 mW/cm^2 < 1.0

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

1) At 20 cm, the measurements will be in the near field for the 127 kHz Tx. Therefore, E and H field measurements will need to be performed. SC6 limits for uncontrolled environments at 127 kHz is set at 280 V/m and 2.19 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 127 kHz/SC6 E-field limit)^2 + (PD value for 2.4 GHz/SC6 PD limit) = or < 1
(H-field value for 127 kHz/SC6 H-field limit)^2 + (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 127 kHz transmitter operating under RSS-GEN Section 7.2.5 limits with maximum field strength of 88.78 dBµV/m at 3 meters as measured over a ground plane could be considered worst case conditions and near field conditions. For ease of calculation an assumed 100 % duty cycle for the 127 kHz transmitter is used. (Actual duty cycle of 20.2 %) Given these considerations this is an extreme over estimation of actual RF Exposure.

Converting the field strength of 88.78 dBµV/m at 3 meters to E and H fields to compare to RSS-102 limits yields an extremely large margin as shown below:

Condition	E-Field (V/m)	H-Field (A/m)
Conversion of field strength of 127 kHz transmitter	0.03	.00007311
SC6 Limit	280	2.19
(Value / Limit)^2	11.5×10^{-9}	1.11×10^{-9}

2.4 GHz Power Density:
0.3153 W/m^2 / 10 W/m^2 (limit) = 0.03153

Sum E-Field: 11.5×10^{-9} + 0.03153 = 0.0315300115 <<< 1
Sum H-Field: 1.11×10^{-9} + 0.03153 = 0.03153000111 <<< 1