BLE RF Evaluation Exclusion Exhibit For:

Carrier/ Bryant (BING)

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Contents

Product Description:

The EUT, BING, support for 2.4 GHz WLAN (802.11 b/g/n) and BLE 4.1.

Associated Antenna(s):

The associated antenna is a chip antenna, a WiLink 8 CC1835 with a part # of ANT162442DT-2001A2.

The peak antenna gain of this chip antenna is +2.1 dBi.

The EUT, BING, was evaluated against the requirements and limits of OET Bulletin 65, KDB 447498 as well as RSS-102 Issue 5 and was found to be compliant.

Limits:

A. Mobile (MPE)

OET Bulletin 65 limits for General population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $|E|^2$, $|H|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f^2)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz   *Plane-wave equivalent power density

RSS 102 limits for General population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m²)	Reference Period (minutes)
0.003-10²¹	83	90	-	Instantaneous*
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142\,f^{0.3417}$	$0.008335\,f^{0.3417}$	$0.02619\,f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158\,f^{0.5}$	$4.21 \times 10^{-4}\,f^{0.5}$	$6.67 \times 10^{-5}\,f$	$616000/f^{1.2}$

Note: f is frequency in MHz.
*Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

Per RSS 102 issue 5 section 2.5.2, RF exposure evaluation is required if separation distance between the user and/or bystander and the device's radiating element is greater than 20cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $22.48/f^{0.5}$W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- 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;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Data and calculations:

<u>Screen Capture of maximum output power</u>

Peak Power
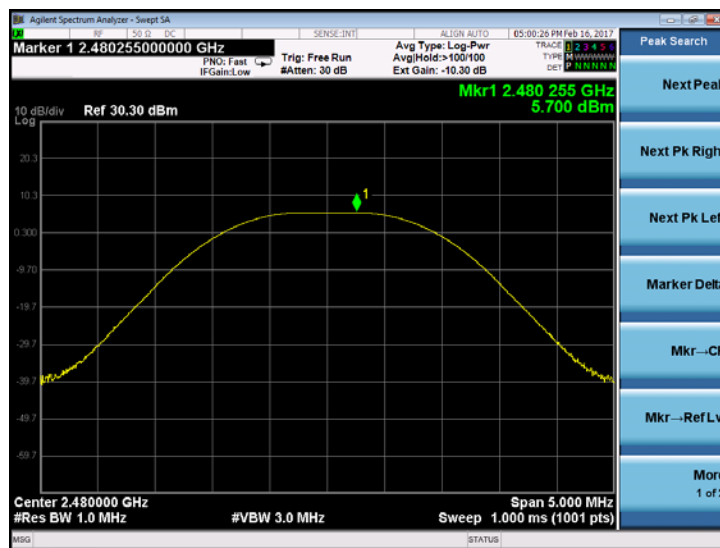
Frequency 2480 MHz; GFSK

A. <u>RF Exposure Exclusion Per MPE Calculation at a prediction Distance of 20 cm</u>

<u>Prediction of MPE limit at a given distance</u>

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:	5.70	(dBm)
Maximum peak output power at antenna input terminal:	3.715	(mW)
Antenna gain(typical):	2.1	(dBi)
Maximum antenna gain:	1.622	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2480	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm^2)
Power density at prediction frequency:	0.001199	(mW/cm^2)
Maximum allowable antenna gain:	31.3	(dBi)
Margin of Compliance at 20 cm =	29.2 dB	

Power Density = 0.0012 mW/cm^2 = 0.012 W/m^2

Therefore 0.0012 mW/cm^2 is << the limit of 1 mW/cm^2 from OET Bulletin 65 limits for General population/Uncontrolled Exposure.

B. RF Exposure Exclusion Per RSS 102 Issue 5 Section 2.5.2

- 1.31 x 10^{-2} $f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

In this situation f is 2480 MHz. The calculation yields 2.74 Watts the limit.

The max BLE power Raw is 5.7 dBm. Adding the Antenna Gain of 2.1 dBi and a tune-up tolerance of +1.5 = 9.3 dBm for the absolute worst case. This 9.3 dBm equates to 8.51mW.

8.51 mW << than the limit of 2.74 Watts at a minimum separation distance of 20 cm.

Summary:

Based on the calculations above, the EUT, when used in a mobile application complies with SAR test exclusion requirements.