

WLAN RF Evaluation Exclusion Exhibit For:

Carrier/ Bryant (BING)

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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	Electric Field	Magnetic Field	Power Density	Averaging Time
Range	Strength (E)	Strength (H)	(S)	$ E ^2$, $ H ^2$ or S
(MHz)	(V/m)	(A/m)	(mW/cm^2)	(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)
$0.003 - 10^{21}$	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	12	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 x 10 ⁻⁵ f	616000/ f ^{1.2}

Note: *f* is frequency in MHz.

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 x $10^{-2} f^{0.6834}$ 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).

^{*}Based on nerve stimulation (NS).

^{**} Based on specific absorption rate (SAR).



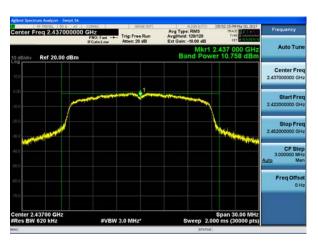
Data and calculations:

Screen Capture of maximum output power

Average Power

Frequency 2437 MHz; MCS11 (MIMO)





Ant. Port 1 Ant. Port 2



A. RF Exposure Exclusion Per MPE Calculation at a prediction Distance of 20 cm

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:

Maximum peak output power at antenna input terminal:

Antenna gain(typical):

Maximum antenna gain:

Prediction distance:

Prediction frequency:

MPE limit for uncontrolled exposure at prediction frequency:

16.95 (dBm)

49.545 (mW)

1.622 (numeric)

Prediction frequency:

20 (cm)

Prediction frequency:

1 (mW/cm^2)

Power density at prediction frequency: 0.015986 (mW/cm^2)

Maximum allowable antenna gain: 20.1 (dBi)

Margin of Compliance at 20 cm = 18.0 dB

Power Density = 0.0160 mW/cm² = 0.160 W/m²

Therefore 0.0160 mW/cm² is << the limit of 1 mW/cm² 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 2437 MHz. The calculation yields 2.70 Watts the limit.

The max Average WLAN power with D.C. correction is 16.95 dBm. Adding the Antenna Gain of 2.1 dBi and a tune-up tolerance of +1.5 = 20.6 dBm for the absolute worst case. This 20.6 dBm equates to 0.12 W

0.12 W << than the limit of 2.70 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.