



W66 N220 Commerce Court • Cedarburg, WI 53012
Phone: 262.375.4400 • Fax: 262.375.4248
www.lsr.com

RF Evaluation Exclusion Exhibit For:

8000-WiFi Module

Prepared by:

Peter Feilen, EMC Engineer

11-5-2015



W66 N220 Commerce Court • Cedarburg, WI 53012
Phone: 262.375.4400 • Fax: 262.375.4248
www.lsr.com

Contents

Product Description: 3

Associated Antenna(s): 3

Statement of compliance:..... 3

Limits: 3

Calculations: 5

Summary: 6

Summary: **Error! Bookmark not defined.**



W66 N220 Commerce Court • Cedarburg, WI 53012

Phone: 262.375.4400 • Fax: 262.375.4248

www.lsr.com

Product Description:

The 8000-WiFi is a module with support for WLAN (802.11 a/b/g/n)

Associated Antenna(s):

Corresponding antenna data associated with the EUT:

1. Peak gain of 2.5dBi – 2.4 GHz
2. Peak gain of 4.6 dBi – 5 GHz

Statement of compliance:

The 8000-WiFi module 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/m ²)	Reference Period (minutes)
0.003-10 ²¹	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 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$
<p>Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).</p>				

Per RSS 102 issue 5 section 2.5.2, RF exposure evaluation is required is 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).



W66 N220 Commerce Court • Cedarburg, WI 53012

Phone: 262.375.4400 • Fax: 262.375.4248

www.lsr.com

Calculations:

A. MPE Calculation

The following MPE calculations are based on a measured conducted RF power of +14.81 dBm as presented to the antenna. The peak gain of this antenna, based on the data sheet is 4.6 dBi.

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:	14.81 (dBm)
Maximum peak output power at antenna input terminal:	30.269 (mW)
Antenna gain(typical):	4.6 (dBi)
Maximum antenna gain:	2.884 (numeric)
Prediction distance:	20 (cm)
Prediction frequency:	5200 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm ²)
Power density at prediction frequency:	0.017367 (mW/cm ²)
Maximum allowable antenna gain:	22.2 (dBi)
Margin of Compliance at 20 cm =	17.6 dB

$$\text{Power Density} = \underline{\underline{0.0174\text{mW/cm}^2}} = \underline{\underline{0.174\text{ W/m}^2}}$$



W66 N220 Commerce Court • Cedarburg, WI 53012

Phone: 262.375.4400 • Fax: 262.375.4248

www.lsr.com

RF Exposure Evaluation:

Evaluated against exposure limits: General Public Use ☒ Controlled Use ☐

Duty cycle used in evaluation: 100 %

Standard(s)/Procedure(s) used for evaluation (e.g. IEEE C95.3): OET Buletin 65 and RSS 102

Measurement distance: 20 cm

RF field strength value: 0.174 V/m ☐ A/m ☐ W/m² ☒

Measured ☐ Computed ☐ Calculated ☒

Summary:

The calculated power density of the EUT was found to be below the OET Bulletin 65 MPE limit.

Per RSS 102 issue 5 section 2.5.2, since the EUT operates at less than

$$1.31 \times 10^{-2} * (5500)^{0.6834} W = 4.71 W$$

The EUT is excluded from Routine evaluation.

Based on the calculation above, the EUT complies with RF exposure requirement when used at a minimum separation distance of at least **20 cm**.