



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

RF Evaluation Exclusion Exhibit For:

IntelliCenter Virtual Cable

Prepared by:

Coty Hammerer, EMC Engineer

1/25/17

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Product Description:

The IntelliCenter Virtual Cable is a 2.4GHz wireless transceiver (IEEE 802.15.4 with DSSS modulation) that allows swimming pool owners to control their Pentair IntelliCenter Pool Automation system with a wireless remote. The IntelliCenter Virtual Cable is connected to the Pentair IntelliCenter Pool Automation system via an rs485 cable. The IntelliCenter Virtual Cable is powered by the rs485 cable and is mounted outside near the pool equipment pad. The benefit of the virtual cable is that a physical wired connection does not need to exist between the swimming pool equipment pad and the user's home.

Associated Antenna(s):

The antenna associated with the EUT:

1. Trace Monopole Antenna with a peak gain of 1.75 dBi.

Statement of compliance:

The Pentair IntelliCenter Virtual Cable wireless 2.4 GHz transceiver 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.

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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

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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>				

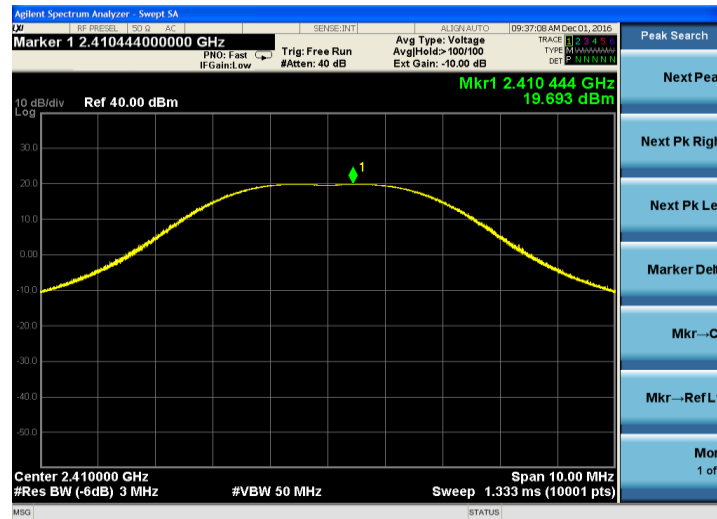
Per RSS 102 issue 5 section 2.5.2, RF exposure evaluation is required if separation distance between the user and/or bystander and the device's radiating element is greater than 20cm, except when the device operates as follows:

- 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).

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Data and calculations:

Screen Capture of maximum output power



Frequency 2410 MHz; GFSK

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A. MPE Calculation

The following MPE calculations are based on a measured conducted RF power of +19.693 dBm as presented to the antenna and a +2.8 dB tune-up tolerance. The peak gain of this antenna is +1.75 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:	22.49	(dBm)
Maximum peak output power at antenna input terminal:	177.542	(mW)
Antenna gain(typical):	1.75	(dBi)
Maximum antenna gain:	1.496	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2410	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1	(mW/cm ²)
Power density at prediction frequency:	0.052848	(mW/cm ²)
Maximum allowable antenna gain:	14.5	(dBi)
Margin of Compliance at 20 cm =	12.8	dB

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RSS 102 Issue 5 Power density limit at 2410 MHz:

$$0.02619 \cdot (2410)^{(0.6834)} = \underline{\underline{5.4 \text{ W/m}^2}}$$

$$\text{Power density for EUT} = 0.0528 \text{ mW/cm}^2 = \underline{\underline{0.528 \text{ W/m}^2}}$$

Conclusion:

Since $\underline{\underline{0.528 \text{ W/m}^2}} < \underline{\underline{5.4 \text{ W/m}^2}}$, the EUT complies with RSS 102 Issue 5.