



Maximum Permissible Exposure Evaluation

For the
EATON'S Cooper Power Systems
RFN SelectComm 1272 (3.3V) MODULE
FCC ID: P9X-SCOM1272V3
IC: 6766A-SCOM1272V3

WLL Report: 15295-02-MPE Rev 0
February 6, 2018

PREPARED FOR:
EATON'S COOPER POWER SYSTEMS
910 CLOPPER RD. SUITE 201S
GAITHERSBURG, MD 20878

Prepared by:

WASHINGTON LABORATORIES, LTD.
7560 LINDBERGH DRIVE
GAITHERSBURG, MARYLAND 20879

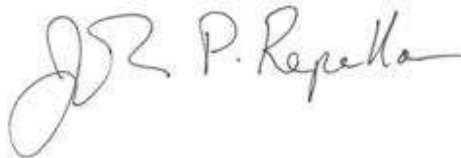


Maximum Permissible Exposure Evaluation

For the
EATON'S Cooper Power Systems
RFN SelectComm 1272 (3.3V) MODULE
FCC ID: P9X-SCOM1272V3
IC: 6766A-SCOM1272V3

WLL Report # 15298-02-MPE Rev 0
February 6, 2018

Prepared by:



John P. Repella
Compliance Engineer

Reviewed by:



Steven D. Koster
President

Abstract

This report has been prepared on behalf of EATON'S Cooper Power Systems to document the findings of the maximum permissible exposure evaluation on the RFN SelectComm SX-1272 (12V). The purpose of this evaluation is to establish a minimum safe distance as per the RF exposure requirements as defined in FCC §1.1307, §1.1310 & Industry Canada RSS-102 Issue 5.

This report documents the results of testing to the requirements of:

- CFR Title 47 Volume 1 Practice and Procedure; (1.1307) Environmental Assessments
- RSS-102 Issue 5 March 2015 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

The Evaluation was performed by Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Washington Laboratories, Ltd. has been accepted as an EMC Conformity Assessment Body (CAB) under the United States/European Union Memorandum of Agreement. Washington Laboratories, Ltd. is accredited by ANAB under Testing Certificate AT-1448.

Revision History	Reason	Date
Rev 0	Initial Release	February 6, 2018

Table of Contents

Abstract	iii
1 Introduction	1
2 Requirements	1
2.1 Transmitter Categories	1
2.2 Exposure Categories	1
3 Device Summary	4
4 Radio Frequency Radiation Exposure Evaluation	5
4.1 Exposure Calculations	5

List of Tables

Table 1: FCC MPE Limits	2
Table 2: ISED MPE Limits (General Population/Uncontrolled Exposure)	3
Table 3: Device Summary of the RFN SelectComm SX-1272 (12V)	4
Table 4: Duty Cycle Summary (All Data Rates)	5
Table 5: Transmitter FCC MPE Calculation Summary	6
Table 6: Transmitter ISED MPE Calculation Summary	6

1 Introduction

This report has been prepared on behalf of EATON'S Cooper Power Systems RFN SelectComm 1272 (3.3V) Transmitter to show compliance with the RF exposure requirements as defined in FCC §1.1307 and RSS-102 Issue 5.

Testing supporting this evaluation was performed at Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Washington Laboratories, Ltd. has been accepted as an EMC Conformity Assessment Body (CAB) under the United States/European Union Memorandum of Agreement. Washington Laboratories, Ltd. is accredited with ANAB under Testing Certificate AT-1448.

2 Requirements

Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile, and portable. Additionally, the FCC categorizes the use of the devices based on the user's awareness and the ability to exercise control over his or her exposure. The two categories are defined as Occupational/Controlled Exposure and General Population/Uncontrolled Exposure.

2.1 Transmitter Categories

2.1.1 Fixed Installations

A fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.

2.1.2 Mobile Devices

A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091.

2.1.3 Portable Devices

A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR §2.1093).

2.2 Exposure Categories

The limits for exposure are determined by the type of situation the individual is exposed to. Table 1 lists the limits for the particular environment.

2.2.1 Occupational/Controlled Exposure

In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.

2.2.2 General Population/Uncontrolled Exposure

The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category and the general population/uncontrolled exposure limits apply to these devices.

Table 1: FCC MPE Limits

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1	6
300–1500	N/A	N/A	f/300	6
1500–100,000	N/A	N/A	5	6
(B) Limits for General Population/Uncontrolled Exposure				
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	N/A	N/A	f/1500	30
1500–100,000	N/A	N/A	1	30

Table 2: ISED MPE Limits (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	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

3 Device Summary

Table 1 below summarizes the criteria used to evaluate the RFN SelectComm 1272 (3.3V).

Table 3: Device Summary of the RFN SelectComm 1272 (3.3V)

Model Evaluated:	RFN SelectComm 1272 (3.3V)
Transmitter Category:	Mobile
Exposure Category:	General Population/Uncontrolled Exposure
Maximum Antenna Gain:	5dBi
Maximum Power Output (dBm):	30.0dBm (Duty Cycle Corrected 26.045dBm)
Evaluation Distance:	20cm
Frequency Range:	902.75-927.25MHz
Minimum Required Separation Distance (FCC)	12.97cm
Minimum Required Separation Distance (ISED)	19.22cm
Duty Cycle Correction:	3.954dB
FCC Limit:	0.6018mW/cm ²
ISED Limit:	2.741W/m ² (0.2741mW/cm ²)

Limits are based on max power measurements for the 3.3V device which were highest at the low frequency of 902.75MHz

4 Radio Frequency Radiation Exposure Evaluation

The highest RF output power of the unit was measured and recorded. According to §1.1310 of the FCC rules, the power density limit for General Population/Uncontrolled Exposure is Power Density (mW/cm²) = f/1500.

Where f = frequency in MHz of the maximum power measurement

Therefore:

$$\begin{aligned}\text{Power Density (mW/cm}^2\text{)} &= 902.75/1500 \\ &= 0.6018\text{mW/cm}^2\end{aligned}$$

According to ISSED RSS-102 Issue 5, the power density limit for General Population/Uncontrolled Exposure for the frequency range 300-6000MHz is $0.02619f^{0.6834}$.

Therefore:

$$\begin{aligned}\text{Power Density (W/m}^2\text{)} &= 0.02619f^{0.6834} \\ &= 0.02619*(902.75)^{0.6834} \\ &= 2.741 \text{ or } (0.2741\text{mW/cm}^2)\end{aligned}$$

4.1 Exposure Calculations

As stated in the manufacturer's tune-up procedure, the max power is set at 29dBm + 1dB for the radio. With consideration to the above tolerances the data in Table 4 will be used in the calculations below:

RFN SelectComm 1272 (3.3V): Max Power of 30.0dBm as per the Manufacturer's tune-up procedure

Table 4: Duty Cycle Summary (All Data Rates)

Data Rate (kbps)	Medium Utilization (%)	Duty Cycle (%)	Min. Gap Time (ms)	Max. Sequence Time (ms)	Max. Sequence Time (100ms)
9.6	0.683	46.094	22.686	19.400	38.800
19.2	0.642	47.796	21.952	20.1332	40.2306
38.4	0.692	46.767	16.288	19.682	39.396
76.8	0.579	46.077	18.547	19.391	38.785
153.6	0.582	41.768	11.005	9.209	36.831

The duty cycle correction factor is calculated by:

$$10 \times \log^*(\text{dwell time}/100\text{ms})$$

The on time per hop is 20.1332ms. The unit hops on 2 channels every 100ms and the maximum total on time per 100ms is 40.2306ms. This corresponds to a duty cycle correction/reduction of 3.954dB for the power measurements.

The radio power used for the exposure calculation will be 30dBm – (3.954) dB or 26.045dBm.

The MPE shall be calculated at 20cm to show compliance with the power density limit. The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at the Antenna Terminals

G = Gain of Transmit Antenna (linear gain-isotropic)

R = Distance from Transmitting Antenna

Table 5: Transmitter FCC MPE Calculation Summary

One Transmitter		
Frequency	902.75	MHz
Limit	0.602	mW/cm ²
Distance (cm), R =	20	cm
Power (dBm), P =	26.045	dBm
TX Ant Gain (dBi), G =	5	dB
Power Density:	0.25	mW/cm ² Separation<20 cm
Minimum Distance:	12.97	cm

Table 6: Transmitter ISED MPE Calculation Summary

One Transmitter		
Frequency	902.75	MHz
Limit	0.274	mW/cm ²
Distance (cm), R =	20	cm
Power (dBm), P =	26.045	dBm
TX Ant Gain (dBi), G =	5	dB
Power Density:	0.25	mW/cm ² Separation<20 cm
Minimum Distance:	19.22	cm