



Maximum Permissible Exposure Evaluation

**For the
Cooper Power Systems
RFN-500LG
FCC ID: P9X-500LG
IC: 6766A-500LG**

**WLL Report: 14418-02-MPE Rev 4
February 29, 2016**

**Re-Issued
November 9, 2016**

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

Prepared by:

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



Testing Certificate AT-1448

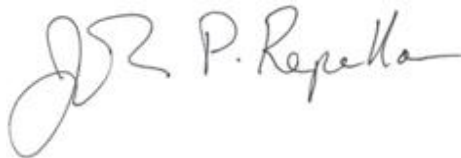
Maximum Permissible Exposure Evaluation

**For the
Cooper Power Systems
RFN-500LG**

**WLL Report # 14418-02-MPE Rev 4
February 29, 2016**

**Re-Issued
November 9, 2016**

Prepared by:



John P. Repella
Compliance Engineer

Reviewed by:



Steven D. Koster
President

Abstract

This report has been prepared on behalf of Cooper Power Systems RFN-500LG to document the findings of the maximum permissible exposure evaluation on the Cooper Power Systems RFN420CL. 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 4.

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

- CFR Title 47 Volume 1 Practice and Procedure; (1.1307) Environmental Assessments

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 29, 2016
Rev 1	Update to correct FCC/IC ID's	March 3, 2016
Rev 2	Update to Customer Address to correct Suite #	March 3, 2016
Rev 3	Updated to address the tune-up procedure and the duty cycle corrections	November 9, 2016
Rev 4	Typo corrected for duty cycle correction	November 9, 2016

Table of Contents

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

List of Tables

Table 1: MPE Limits	2
Table 2: Device Summary of the RFN-500LG	3
Table 3: Transmitter MPE Calculation Summary	4

1 Introduction

This report has been prepared on behalf of Cooper Power Systems RFN-500LG Transmitter to show compliance with the RF exposure requirements as defined in FCC §1.1307.

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: 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

3 Device Summary

Table 1 below summarizes the criteria used to evaluate the RFN-500LG.

Table 2: Device Summary of the RFN-500LG

Model Evaluated:	RFN-500LG
Transmitter Category:	Mobile
Exposure Category:	General Population/Uncontrolled Exposure
Antenna Gain:	5dBi
Maximum Power Output (dBm):	30.0dBm
Evaluation Distance:	20cm
Frequency Range:	902.75-927.25MHz
Minimum Required Separation Distance	15.26cm
Duty Cycle Correction:	2.43dB
Limit:	0.618mW/cm ²

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 0.618mW/cm². According to §1.1310 of the FCC rules, the power density limit for Occupational/Controlled Exposure is 3.090mW/cm².

As the 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 following power levels will be used in the calculations below:

RFN-500G: Max Power of 30dBm

The duty cycle correction factor is calculated by:

10 x LOG (dwell time/100 ms)

The dwell time per hop is 19.04ms. The maximum total dwell time per 100ms is 57.12ms. This corresponds to a duty cycle correction/reduction of 2.43dB for the power measurements.

The radio power used for the exposure calculation will be 30.dBm – 2.43dB or 27.57dBm.

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 3: Transmitter MPE Calculation Summary

One Transmitter		
Frequency	927.25	MHz
Limit	0.618	mW/cm ²
Distance (cm), R =	20	cm
Power (dBm), P =	27.57	dBm
TX Ant Gain (dBi), G =	5	dB
Power Density:	0.36	mW/cm ² Separation<20 cm
Minimum Distance:	15.26	cm