



Washington Laboratories, Ltd.

Maximum Permissible Exposure Evaluation

**For the
POWERCAST CORPORATION**

TX91503

FCC ID: YESTX91503

IC ID: 8985A-TX91503

January 27, 2020

WLL Report: 16324-02 Rev 1

Prepared for:
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February 20, 2020
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Abstract

This report has been prepared on behalf of Powercast to document the findings of the maximum permissible exposure evaluation on the Powercast TX91503. 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.

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 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

The Evaluation was performed by Washington Laboratories, Ltd, 4840 Winchester Blvd. Suite 5, Frederick, MD 21703. 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	January 27, 2020
Rev 1	Added the ISED limits and calculations to add clarity to the listing	February 20, 2020

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1 Introduction

This report has been prepared on behalf of Powercast to show compliance with the RF exposure requirements as defined in FCC §1.1307.

Testing supporting this evaluation was performed at Washington Laboratories, Ltd, 4840 Winchester Blvd., Frederick, MD 21703. 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 in which the individual is exposed. 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

Table 2: MPE Limits (ISED)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
Limits for General Population/Uncontrolled Exposure				
0.003-10	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).				

Frequency Range(MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
Limits for Occupational/Controlled Exposures				
0.003-1023	170	180	-	Instantaneous*
0.1-10	-	$1.6/f$	-	6**
1.29-10	$193/f^{0.5}$	-	-	6**
10-20	61.4	0.163	10	6
20-48	$129.8/f^{0.25}$	$0.3444/f^{0.25}$	$44.72/f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	$15.60 f^{0.25}$	$0.04138 f^{0.25}$	$0.6455 f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	$616000/f^{1.2}$
150000-300000	$0.354 f^{0.5}$	$9.40 \times 10^{-4} f^{0.5}$	$3.33 \times 10^{-4} f$	$616000/f^{1.2}$
f in MHz, * Based on nerve stimulation, ** Based on specific absorption rate(SAR)				

3 Device Summary

Table 3 below summarizes the criteria used to evaluate the Powercast TX91503

Table 3: Device Summary of the Powercast TX91503

Model Evaluated:	TX91503
Transmitter Category:	Mobile Device
Exposure Category:	General Population/Uncontrolled
Antenna Gain:	1.435dBi(2.4GHz), 6dBi(900MHz)
Power Output (dBm):	-7.51(2402MHz) & 28.71(915MHz)
Evaluation Distance:	20cm
Frequency Range:	2400-2483.5MHz & Single Channel @ 915MHz
FCC Limit:	1mW/cm ² , 0.61mW/cm ²
ISED Limit:	0.537mW/cm ² , 0.278mW/cm ²

It should be noted that this device contains a 915MHz (FCC ID: YESTX91503) radio which is part of the MPE evaluation for clarification. These two radios never operate at the same time as per the operational description. The MPE report for this device is listed with the certification for that radio.

The original certification under the FCC ID mentioned above, had the BLE device installed but only the receiver was enabled. Subsequently it was necessary to enable the transmitter portion of the BLE device.

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 1mW/cm².

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 4: Transmitter MPE Calculation Summary(FCC)

One Transmitter			
Frequency	915 MHz		
Limit	0.610 mW/cm ²		
Distance (cm), R =	20 cm		
Power (dBm), P =	28.71 dBm		
TX Ant Gain (dBi), G =	6 dB		
Power Density:	0.59 mW/cm ²	Separation<20 cm	
Minimum Distance:	19.6 cm		
Second Transmitter			
Frequency	2402 MHz		
Limit	1.000 mW/cm ²		
Distance (cm), R =	20 cm		
Power (dBm), P =	-7.51 dBm		
TX Ant Gain (dB), G =	1.435 dB		
Power Density:	0.00 mW/cm ²	Separation<20 cm	
Minimum Distance:	0.1 cm		
Multiple Transmitter Summary			
Power Density:	0.96 mW/cm ²	Separation<20 cm	
Minimum Distance:	19.8 cm	Sum of the Distances	

Table 5: Transmitter MPE Calculation Summary(ISED)

One Transmitter			
Frequency	915 MHz		
Limit	0.280 mW/cm ²		
Distance (cm), R =	20 cm		
Power (dBm), P =	28.71 dBm		
TX Ant Gain (dBi), G =	6 dB		
Power Density:	0.59 mW/cm ²	Separation>20 cm	
Minimum Distance:	29.0 cm		
Second Transmitter			
Frequency	2440 MHz		
Limit	0.537 mW/cm ²		
Distance (cm), R =	20 cm		
Power (dBm), P =	-7.51 dBm		
TX Ant Gain (dB), G =	1.435 dB		
Power Density:	0.00 mW/cm ²	Separation<20 cm	
Minimum Distance:	0.2 cm		
Multiple Transmitter Summary			
Power Density:	2.10 mW/cm ²	Separation>20 cm	
Minimum Distance:	29.2 cm	Sum of the Distances	