

# Windrock, Inc.

# TEST REPORT

**SCOPE OF WORK**

MPE CALCULATION –Gateway, Model(s): A4000-00-00

**REPORT NUMBER**

104473889BOX-001E

**ISSUE DATE**

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**[REVISED DATE]**

Original Issue

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Non-Specific Radio Report Shell Rev. December 2017

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## MPE REPORT

**Report Number:** 104473889BOX-001E  
**Project Number:** G104473889

**Report Issue Date:** 07/23/2021

**Model(s) Tested:** A4000-00-00

**Model(s) Partially Tested:** None

**Model(s) Not Tested but declared equivalent by the client:** A4000-CC1-00 and A4000-CC2-00

**Standards:** **FCC Part 1 Subpart I, April 2021**

Procedures Implementing the National Environmental Policy Act of 1969  
*§1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.*

**ISED RSS-102 Issue 5, March 19, 2015**

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

Tested by:

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Boxborough, MA 01719  
USA

Client:

Windrock Inc  
1832 Midpark Rd Ste 102  
Knoxville, TN 37921-5941  
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## 1 Introduction and Conclusion

This evaluation report covers for a mobile device subject to routine environmental evaluation for RF exposure. A mobile device is defined as a transmitting device designed to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

The evaluation indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining sections are the verbatim text from the actual evaluation during the investigation. These sections include the evaluation name, the specified Method, and Results. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product evaluated **complies** with the requirements of the standard(s) indicated. The results obtained in this report pertain only to the item(s) evaluated. Intertek does not make any claims of compliance for samples or variants which were not evaluated.

## 2 Test Summary

Section	Test full name	Result
3	Client Information	--
4	Description of Equipment Under Test and Variant Models	--
5	System Setup and Method	--
6	Power Density Calculation (FCC §1.1310; ISED RSS-102 Issue 5)	Compliant
7	RF Exposure evaluation for multi-transmitter product procedures (FCC §1.1310; ISED RSS-102 Issue 5)	Compliant
8	Revision History	--

### 3 Client Information

This EUT was tested at the request of:

**Client:** Windrock Inc  
1832 Midpark Rd Ste 102  
Knoxville, TN 37921-5941  
USA

**Contact:** Abdul Razzaq  
**Telephone:** 908-238-7131  
**Email:** abdul.razzaq@apergy.com

### 4 Description of Equipment Under Test and Variant Models

**Manufacturer:** Windrock Inc  
1832 Midpark Rd Ste 102  
Knoxville, TN 37921-5941  
USA

Equipment Under Test			
Description	Manufacturer	Model Number	Serial Number
Gateway	Windrock Inc	A4000-00-00	BOX2101191351-001 (Intertek assigned)

Receive Date:	01/12/2021
Received Condition:	Good
Type:	Production

#### Description of Equipment Under Test (provided by client)

The Gateway is a 24Vdc powered device that collects data either wirelessly or wired (using IEEE 802.3 standard) from field devices. Some of the wireless protocols are on separate M.2 cards that need to be connected to the gateway in order to be used. Once data is collected, the gateway organizes and processes the data. It then transmits the information to a cloud computing service. The gateway may transmit in two ways, the first way is through commercial cellular networks. The second way is using wired IEEE 802.3.

Equipment Under Test Power Configuration			
Rated Voltage	Rated Current	Rated Frequency	Number of Phases
10-30VDC	Max 55W	N/A	N/A

#### Variant Models:

The following variant models were not tested as part of this evaluation, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

A4000-CC1-00 and A4000-CC2-00

## 5 Power Density Calculation

### 5.1 Requirement(s)

#### FCC §1.1310 Radiofrequency radiation exposure limits

Table 1 below sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic field.

**Table 1 – Limits for Maximum Permissible Exposure (MPE)**

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposure</b>				
0.3-3.0	614	1.63	*100	6
3.0-30	1842/f	4.89/f	*900/f <sup>2</sup>	6
30-300	61.4	0.163	1.0	6
300-1,500			f/300	6
1,500-100,000			5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*100	30
1.34-30	842/f	2.19/f	*180/f <sup>2</sup>	30
30-300	27.5	0.073	0.2	30
300-1,500			f/1500	30
1,500-100,000			1.0	30

F = frequency in MHz \* = Plane-wave equivalent power density

#### ISED RSS-102 Issue 5

Table 2 below sets forth limits for the RF field strength.

**Table 2 – RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)**

Frequency range (MHz)	Electric field strength (V/m rms)	Magnetic field strength (A/m rms)	Power Density (W/m <sup>2</sup> )	Reference Period (minutes)
0.003-10	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ f <sup>0.5</sup>	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ f <sup>0.25</sup>	0.1540/ f <sup>0.25</sup>	8.944/ f <sup>0.5</sup>	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f <sup>0.3417</sup>	0.008335 f <sup>0.3417</sup>	0.02619 f <sup>0.6834</sup>	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ f <sup>1.2</sup>
150000-300000	0.158 f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616000/ f <sup>1.2</sup>

Note: f is frequency in MHz. \*Based on nerve stimulation (NS) \*\*Based on specific absorption rate (SAR)

## 5.2 Method

An MPE evaluation was performed in order to show that the device was compliant with FCC §2.1091 and ISED RSS-102. The maximum power density was calculated for each transmitter at a separation distance of 20 cm. The calculation was performed using the maximum gain from the internal and external antennas declared by the manufacturer.

The maximum permissible exposure (MPE) is predicted by using the following equation:

$$S = PG/4\pi R^2$$

where:  $S$  = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)

$P$  = power input to the antenna (in appropriate units, e.g., mW)

$G$  = 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 (appropriate units, e.g., cm)

## 5.3 Calculation:

### Worst-case output power of BLE:

Maximum Conducted Output Power = 6.06 dBm

EIRP = Power (conducted) + Antenna Factor = 6.06 dBm + 2 dBi = 8.06 dBm or 6.397 mW

Power Density = 6.397/5025.6

Power Density = 0.001273 mW/cm<sup>2</sup>

Limit at 2.402 GHz = 1mW/cm<sup>2</sup>

RSS-102 Issue 5 Exposure Limit at 2.402GHz = 5.35 W/m<sup>2</sup>

Power Density = 0.01273 W/m<sup>2</sup>

The calculated maximum power density at 20cm distance is less than the limit for general population.

### Worst-case output power of 802.15.4 Zigbee:

Maximum Conducted Output Power = 4.76 dBm

EIRP = Power (conducted) + Antenna Factor = 4.76 dBm + 2.0 dBi = 6.76 dBm or 4.742420 mW

Power Density = 4.742420/5025.6

Power Density = 0.000944 mW/cm<sup>2</sup>

Limit at 2.405 GHz = 1mW/cm<sup>2</sup>

The calculated maximum power density at 20cm distance is less than the limit for general population.

a): Data was taken from Intertek test report number: 104473889BOX-001

**5.4 Results:**

The sample tested was found to Comply. The calculated maximum power density at 20 cm distance is less than the limits for general population / uncontrolled exposure.

**6 ISED RSS-102 Issue 5 §2.5.2 Exemption****6.1 Requirement(s)**

Exemption Limits:  $1.31 \times 10^{-2} f^{0.6834}$  W (300 MHz  $\leq$  f  $<$  6 GHz), f is in MHz.

**6.2 Calculation****Worst-case output power of BLE:**

RSS-102 Issue 5 Exposure Limit at 2.402GHz = 5.35 W/m<sup>2</sup>

Power Density = 0.01273 W/m<sup>2</sup>

**Worst-case output power of 802.15.4 Zigbee:**

RSS-102 Issue 5 Exposure Limit at 2.405GHz = 5.355 W/m<sup>2</sup>

Power Density = 0.00944 W/m<sup>2</sup>

a): Data was taken from Intertek test report number: 104473889BOX-001

**6.3 Results:**

The sample tested was found to Comply. The power (e.i.r.p.) is much lower than the exemption limit, RF exposure evaluation is exempted.

## 7 RF Exposure evaluation for multi-transmitter product procedures

In mobile exposure conditions, simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated power density, is  $\leq 1.0$ , i.e.

$$\sum_{i=1}^n \frac{S_i}{(MPE)_i} \leq 1$$

Where  $S_i$  is the Power Density on the given distance for  $i=1, 2, 3, \dots, n$ ,

$n$  – number of antennas transmitting simultaneously,

$(MPE)_i$  is the Limit of MPE for the given transmitting frequency.

The  $\frac{S_i}{(MPE)_i}$  is the MPE ratio of each antenna, determined at the minimum *test separation distance*

required by the operating configurations and exposure conditions of the host device, according to the ratio of power density to MPE limit, at the frequency of interest.

Band	Frequency (MHz)	Power Spectral Density (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Power Density/Limit
2.4G*	2402	0.001273	1	0.001273
2.4G*	2405	0.000944	1	0.000944
Multi Bands**	Multi Freq. **	Multi PSD**	Multi Limits**	0.461000
			<b>Total</b>	<b>0.463217</b>

2.4G\* - Data was taken from Intertek test report number: 104473889BOX-001

Multi Bands\*\* - Data was taken from Sporton test report number: **FA741007**, FCC ID: **XMR201706SC20A**

**8 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	07/23/2021	104473889BOX-001E	VFV <i>VFV</i>	KPS <i>KPS</i>	Original Issue