

	Title:	WSN 1.5 RF Exposure Evaluation			Doc #:	01043785
	Author:	J. Broeders / A. Hodge	Creation Date:	17/2/2020	Issue:	A

- Controlled and Confidential document -

WSN 1.5 RF Exposure Evaluation

Copyright and distribution statement:

This document is copyright and the property of Perpetuum Limited. The information contained in this document is strictly confidential and for the use of the recipient only. Notice is hereby given that any disclosure use or copying of this information by anyone other than the intended recipient is prohibited and may be illegal. Permission should be sought from Perpetuum for further distribution or disclosure of this document or its contents.

If you have received this document in error please notify Perpetuum immediately by email on support@perpetuum.com or by writing to the address provided below.

 perpetuum	Title:	WSN 1.5 RF Exposure Evaluation			Doc #:	01043785
	Author:	J. Broeders / A. Hodge	Creation Date:	17/2/2020	Issue:	A

- Controlled and Confidential document -

Issue Record

This document will be updated when necessary by issue of the complete document.

Each document issue is controlled by Perpetuum's automated Engineering Change Order (ECO) system.

Issue	ECO No.	Release Date	Pages Affected & Comments	Amended By:	Checked By:	Approved By:
A		17/02/20	First release			

 perpetuum	Title:	WSN 1.5 RF Exposure Evaluation			Doc #:	01043785
	Author:	J. Broeders / A. Hodge	Creation Date:	17/2/2020	Issue:	A

- Controlled and Confidential document -

1 Product information

FCC ID: 2AIZP-W15

IC ID: 25921-W15

Product name: WSN1.5 Processing Printed Circuit Board Assembly (PCBA)

This device contains a single transmitter with a duty cycle of 0.8% or less. It is incorporated into a unit that is mounted on the ends of the axles of railway rolling-stock and is therefore generally rather inaccessible. The housing of the unit prevents encroachment to the internal antenna closer than approximately 12mm. With the device time average emission of less than 0.25mW, routine evaluation exemption through section 2.5.1 of RSS-102 (Table 1) applies.

2 Evaluation method

A minimum separation of 20cm is normally maintained between the device and nearby persons. The device thus classifies as a mobile device under FCC 2.1091. The following maximum exposure limits, defined in FCC 1.1310, apply:

Frequency range (MHz)	Power Density (mW/cm ²)	Averaging time (minutes)
Limits for occupational/controlled exposure		
300-1500	f(MHz)/300	6
Limits for general population/uncontrolled exposure		
300-1500	f(MHz)/1500	30

For a device that transmits at a frequency of 905MHz then the power density limits are thus 3mW/cm² and 0.6mW/cm² for respectively controlled and uncontrolled exposure.

For RSS-102 the following limits are identified (RSS-102 Table 6)

Frequency range (MHz)	Power Density (mW/cm ²)	Averaging time (minutes)
Limits for controlled Use Devices (Controlled Environment)		
100-6000	0.6455f ^{0.5}	6

For a device that transmits at a frequency of 905MHz then the power density limits are thus 1.94mW/cm² for Controlled Environments.

The power density can be calculated using the following formula:

$$Pd = \frac{Pout \times G}{4 \times \pi \times r^2}$$

Where Pd = power density in mW/cm²

Pout = output power to antenna in mW

G = gain of antenna

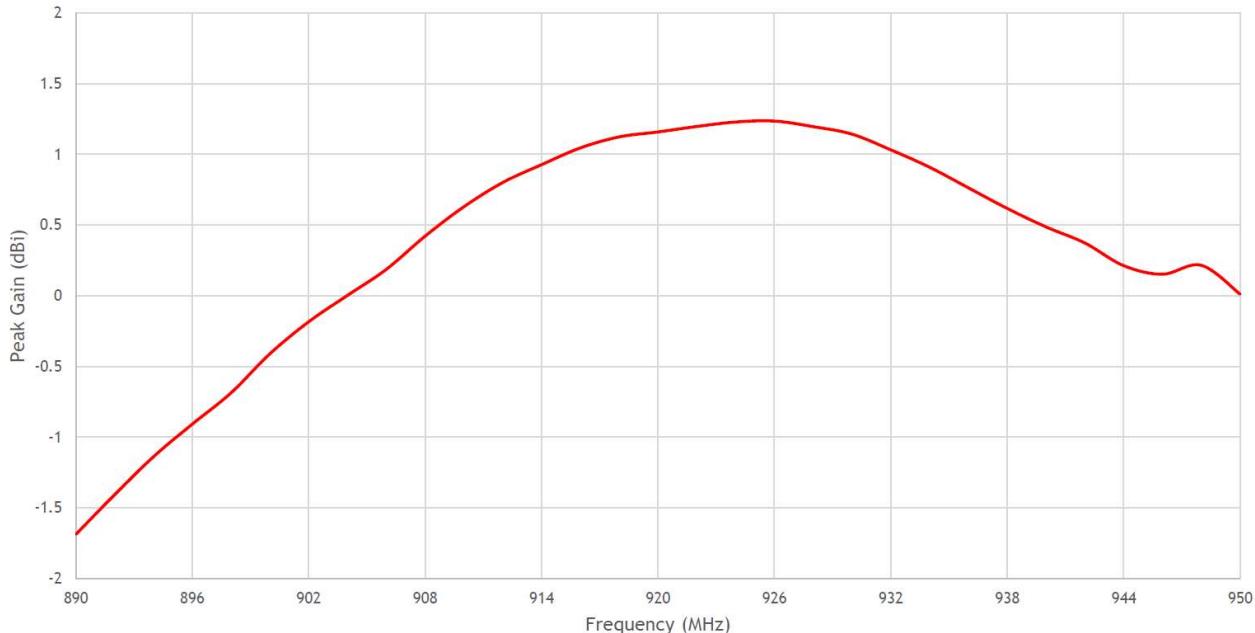
r = distance between observation point and centre of antenna

	Title:	WSN 1.5 RF Exposure Evaluation			Doc #:	01043785
	Author:	J. Broeders / A. Hodge	Creation Date:	17/2/2020	Issue:	A

- Controlled and Confidential document -

3 MPE calculation

The maximum output power, as documented in (EMC Test Report 1887FR) is 13.05dBm and the peak gain measured on the antenna, shown in below graph, is 1.3dBi.



The device is intended to be positioned on trains in a way that a minimum distance of 20cm is maintained to nearby persons. The power density at a distance of 20cm from the device equals:

$$Pd = \frac{13.05\text{dBm} \times 1.3\text{dBi}}{4 \times \pi \times 20^2} = \frac{20.2\text{mW} \times 1.35}{4 \times \pi \times 20^2} = 0.0054\text{mW/cm}^2$$

The above would be the Exposure if the transmitter were operational continuously. However, the maximum transmission is typically less than 120ms every 15 seconds reducing the above calculated exposure by a further 125 times.

4 Conclusion

The power density is significantly within the limits specified in FCC 1.1310 and RSS-102.

5 References

EMC Test Report 1887FR. Hursley, Eurofins.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices.