Nemko

Nemko

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RADIO TEST REPORT – APFWL

Type of assessment:

MPE Calculation report

Manufacturer:

Panduit

Hardware Version Identification Number (HVIN):

PAN100

Product Marketing Name (PMN):

WiFi/BT Radio Module

HVIN/Model variant(s):

NA

FCC ID:

2AVV3-PAN100

IC certification number:

11688B-PAN100

Specification:

- FCC 47 CFR Part 1 Subpart I, §§1.1307, 1.1310
- FCC 47 CFR Part 2 Subpart J, §2.1091
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- ISED Canada RSS-102 Issue 5 Amendment 1, (February 2021)

RSS-102 Annex B - Declaration of RF Exposure Compliance

ATTESTATION: I attest that the information provided in Annex A is correct; that the Technical Brief was prepared and the information contained therein is correct; that the device evaluation was performed or supervised by me; that applicable measurement methods and evaluation methodologies have been followed; and that the device meets the SAR and/or RF field strength limits of RSS-102.

Date of issue: Click here to enter a date.

Floyd Fleury

Prepared by

Signature

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Section 1 Evaluation summary

1.1 MPE calculation for standalone transmission

1.1.1 References, definitions and limits

FCC §2.1091(d)

(2) (2) For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part, except for portable devices as defined in §2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in §2.1093.

Table 1.1-1: *Table 1 to §1.1310(e)(1)—Limits for Maximum Permissible Exposure (MPE)*

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
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	1.0	<6
300–1500			f / 300	<6
1500–100000			5	<6
(ii) 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			f / 1500	<30
1500–100000			1.0	<30

Notes: f = frequency in MHz. * = Plane-wave equivalent power density.

RSS-102, Section 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where ƒ is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $0.0131\ f^{0.6834}$ W (adjusted for tune-up tolerance), where ƒ is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

1.2 MPE calculation for simultaneous transmission

1.2.1 References, definitions and limits

FCC §2.1091(d)

(2) (2) For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part, except for portable devices as defined in §2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in §2.1093.

Table 1.2-1: *Table 1 to §1.1310(e)(1)—Limits for Maximum Permissible Exposure (MPE)*

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
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	1.0	<6
300–1500			f / 300	<6
1500–100000			5	<6
(ii) 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			f / 1500	<30
1500–100000			1.0	<30

Notes: f = frequency in MHz. * = Plane-wave equivalent power density.

RSS-102, Section 2.5.2

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $0.0131\ f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

References, definitions and limits, continued

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = power density (mW/cm^2 or W/m^2)
P = power input to the antenna (mW or W)
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 (cm or m)

1.2.2 EUT technical information

	Transmitter 1 (BT)	Transmitter 2 (BLE)	Transmitter 3 (WiFi)
Prediction frequency	2.48 GHz	2.402 GHz	2.412GHz
Antenna type	3.6 Integral	3.6	
Antenna gain	3.6 dBi	3.6 dBi	3.6 dBi
Maximum transmitter conducted power	15.5 dBm (mW)	8.03 dBm (mW)	18.56 dBm (mW)
Prediction distance	20 cm	20 cm	20 cm

1.2.3 MPE calculation

	BT		BLE		WiFi	
Fundamental transmit (prediction) frequency:	2480 MHz		2402 MHz		2412 MHz	
Maximum measured conducted peak output power:	15.5 dBm		20 dBm		18.56 dBm	
Cable and/or jumper loss:	0 dB		0 dB		0 dB	
Maximum peak power at antenna input terminal:	15.5 dBm		8.03 dBm		18.56 dBm	
Tx On time:	0.650 ms		0.900 ms		0.650 ms	
Tx period time:	1.000 ms		1.000 ms		1.000 ms	
Average factor:	65 %		90 %		65 %	
Maximum calculated average power at antenna input terminal:	23.06287 mW		5.7179784 mW		46.656629 mW	
Single Antenna gain (typical):	3.6 dBi		3.6 dBi		3.6 dBi	
Number of antennae:	1		2		1	
Total system gain:	3.60 dBi		6.61 dBi		3.60 dBi	
	ISED limit	**FCC limit**	**ISED limit**	**FCC limit**	**ISED limit**	**FCC limit**
MPE limit for uncontrolled exposure at prediction frequency:	**0.546895 mW/cm^2**	**1.000000 mW/cm^2**	**0.535080 mW/cm^2**	**1.000000 mW/cm^2**	**0.536602 mW/cm^2**	**1.000000 mW/cm^2**
	5.468948 W/m^2	10.000000 W/m^2	5.350805 W/m^2	10.000000 W/m^2	5.366018 W/m^2	10.000000 W/m^2
Minimum calculated prediction distance for compliance:	20 cm	20 cm	20 cm	20 cm	20 cm	20 cm
Typical (declared) distance:	20 cm	20 cm	20 cm	20 cm	20 cm	20 cm
Average power density at prediction frequency:	**0.010511 mW/cm^2**	**0.010511 mW/cm^2**	**0.005212 mW/cm^2**	**0.005212 mW/cm^2**	**0.021264 mW/cm^2**	**0.021264 mW/cm^2**
	0.105110 W/m^2	0.105110 W/m^2	0.052120 W/m^2	0.052120 W/m^2	0.212639 W/m^2	0.212639 W/m^2
Combined MPE compliance:						
Margin of Compliance:	**17.16 dB**	**19.78 dB**	**20.11 dB**	**22.83 dB**	**14.02 dB**	**16.72 dB**
Maximum allowable antenna gain:	20.76 dBi	19.78 dBi	26.72 dBi	22.83 dBi	17.62 dBi	16.72 dBi
Average power density to MPE limit ratio:	0.019	0.011	0.010	0.005	0.040	0.021
Total sum of ratios for FCC:	0.037					
Total sum of ratios for ISED:	0.069					
Maximum allowed sum of ratios:	1					

1.2.4 Verdict

The calculation is below the limit; therefore, the product is passing the RF Exposure requirements for the declared distance.

1.2.5 RSS-102, Annex A - RF technical brief cover sheet

IC Certification Number	11688B-PAN100
Product marketing name (PMN)	WiFi/BT Radio Module
Hardware version identification number (HVIN)	PAN100
Firmware version identification number (FVIN)	N/A
Host marketing name (HMN)	N/A
Applicant company number	11688B
Applicant name	Panduit
SAR/RF exposure test laboratory	2040B-e (3 m semi anechoic chamber)
Type of evaluation	☐ SAR Evaluation: Device Used in the Vicinity of the Human Head ☐ SAR Evaluation: Body-Worn Device and Body-Supported Device ☐ SAR Evaluation: Limb-Worn Device ☒ RF Exposure Evaluation ☐ Nerve Stimulation Exposure Evaluation (SPR-002)
SAR evaluation	Multiple transmitters: ☒ Yes ☐ No
	Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use
	Duty cycle used in evaluation: N/A %
	Separation distance: N/A mm
	Standard used for evaluation: N/A
	SAR value: N/A W/kg
	☐ Measured ☐ Computed ☐ Calculated
Nerve Stimulation Evaluation (SPR-002)	Evaluated against exposure limits: ☐ General Public Use ☐ Controlled Use
	Measurement distance: N/A m
	Field Strength: N/A ☐ V/m (electric) ☐ A/m (magnetic) ☐ Measured ☐ Computed ☐ Calculated
	Exposure condition: ☐ Whole body/Torso/Head ☐ Leg ☐ Arm ☐ Hand/Foot
RF exposure evaluation	Evaluated against exposure limits: ☐ General Public Use ☐ Controlled Use
	Duty cycle used in evaluation: **100** %
	Operational frequency: MHz
	Standard used for evaluation: **Safety Code 6**
	Measurement distance: m
	RF value: ☒ W/m² ☐ V/m ☐ A/m ☐ Measured ☒ Computed ☐ Calculated

End of the test report