



Certification Exhibit

Nordic radio FCC ID: ASU-ZP8J4MN1CRV
Murata radio Module FCC ID: VPYLB1ZM

FCC Rule Part: 47 CFR Part 2.1091

Project Number: 721007920

Manufacturer: Savant Systems Inc
Host Model Name/Number: PB-P2000-00

RF Exposure

General Information:

Applicant: Savant Systems Inc
Device Category: Mobile
Environment: General Population/Uncontrolled Exposure

Technical Information (Nordic BLE Radio 1):

Frequency Range (MHz): 2402 - 2480
*Antenna Type: Flexible Printed Circuit (FPC)
*Antenna Gains: 2 dBi
Maximum Transmitter Conducted Power: 2.1dBm, 1.62mW
Maximum System EIRP: 4.1dBm, 2.57mW
Exposure Conditions: 20 centimeters
*Declared by the customer

Technical Information (BLE) – (Nordic BLE Radio 2):

Frequency Range (MHz): 2402 - 2480
*Antenna Type: Flexible Printed Circuit (FPC)
*Antenna Gains: 2 dBi
Maximum Transmitter Conducted Power: 2.4dBm, 1.74mW
Maximum System EIRP: 4.4dBm, 2.75mW
Exposure Conditions: 20 centimeters
*Declared by the customer

Technical Information (Murata BLE radio):

Frequency Range (MHz): 2402 - 2480
Antenna Type: Monopole antenna (PCB)
Antenna Gains: 3.6 dBi
*Maximum Transmitter Conducted Power: 5.78dBm, 3.78mW
Maximum System EIRP: 9.38dBm, 8.67mW
Exposure Conditions: 20 centimeters
*Worst Case from original filing report

Technical Information – (Murata BT Classic radio):

Frequency Range (MHz): 2402 - 2480
Antenna Type: Monopole antenna (PCB)
Antenna Gains: 3.6 dBi
*Maximum Transmitter Conducted Power: 5.79dBm, 3.79mW
Maximum System EIRP: 9.39dBm, 8.69mW
Exposure Conditions: 20 centimeters
*Worst Case from original filing report

Technical Information – (Murata Wi-Fi 2.4 GHz radio):

Frequency Range (MHz): 2412 - 2462
Antenna Type: Monopole antenna (PCB)
Antenna Gains: 3.6 dBi
*Maximum Transmitter Conducted Power: 25.41dBm, 347.54mW
Maximum System EIRP: 29.01dBm, 796.16mW
Exposure Conditions: 20 centimeters
*Worst Case from original filing report

Technical Information – (Murata Wi-Fi 5 GHz radio):

Frequency Range (MHz): 5180 - 5825
Antenna Type: Dipole antenna
Antenna Gains: 4.75 dBi

*Maximum Transmitter Conducted Power: 16.96dBm, 49.66mW
Maximum System EIRP: 21.71dBm, 148.25mW
Exposure Conditions: 20 centimeters
*Worst Case from original filing report

Test Exemption Criteria

Test exemption is determined by 47 CFR 1.1307(b)(3)(i)(B) where single RF source is exempt if:

The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. Pth is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Test exemption is determined by 47 CFR 1.1307(b)(3)(i)(C) where at the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency according to the following table.

For the exemption in Table 1 of 47 CFR 1.1307(b)(3)(i)(C) (table 2 below) to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1: 47 CFR 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$.
1.34-30	$3,450 R^2/f^2$.
30-300	$3.83 R^2$.
300-1,500	$0.0128 R^2 f$.
1,500-100,000	$19.2 R^2$.

RF Exposure Calculation

Configuration 1: Nordic BLE Radio 1 + Nordic BLE Radio 2 + Murata BLE

Configuration 2: Nordic BLE Radio 1 + Nordic BLE Radio 2 + Murata BT Classic

Configuration 3: Nordic BLE Radio 1 + Nordic BLE Radio 2 + Murata Wi-Fi 2.4 GHz

Configuration 4: Nordic BLE Radio 1 + Nordic BLE Radio 2 + Murata Wi-Fi 5 GHz

Table 1: Configuration 1

Technical Parameters	Nordic BLE Radio 1	Nordic BLE Radio 2	Murata BLE Radio
Frequency (MHz)	2402	2402	2440
Separation Distance (cm)	20.00	20.0	20.0
Separation Distance (m)	0.2000	0.200	0.200
Antenna Gain (dBi)	2.00	2.00	3.60
ERP Easily Determined	YES	YES	YES
1-g body or 10-g extremity	Body	Body	Body
Conducted Power (dBm)	2.10	2.40	5.78
Conducted Power (mW)	1.62	1.74	3.78
Duty Factor (Source-Based) %	100.0	100.0	100.0
Maximum (Source-Based) Time-Averaged Conducted Power (mW)	1.62	1.74	3.78
Maximum (Source-Based) Time-Averaged ERP (mW)	1.57	1.68	5.29
Maximum (Source-Based) Time-Averaged EIRP (mW)	2.57	2.75	8.67
Maximum Output (mW)	1.62	1.74	5.29
47 CFR 1.1307(b)(3)(i)(c) MPE-Based Exemption ERP(W)			
$\lambda / 2\pi$ (m)	0.020	0.020	0.020
$R \geq \lambda / 2\pi$	YES	YES	YES
Maximum (Source-Based) Time-Averaged ERP (W)	0.0016	0.0017	0.0053
ERP Threshold (W)	0.7680	0.7680	0.7680
Exemption	YES	YES	YES
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.007
Summation of Contribution From MPE-Based Exemption			
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.007
Summation of Contribution Ratio (ERP / ERP _{th})	0.011		

Table 2: Configuration 2

Technical Parameters	Nordic BLE Radio 1	Nordic BLE Radio 2	Murata BT Classic Radio
Frequency (MHz)	2402	2402	2480
Separation Distance (cm)	20.00	20.0	20.0
Separation Distance (m)	0.2000	0.200	0.200
Antenna Gain (dBi)	2.00	2.00	3.60
ERP Easily Determined	YES	YES	YES
1-g body or 10-g extremity	Body	Body	Body
Conducted Power (dBm)	2.10	2.40	5.79
Conducted Power (mW)	1.62	1.74	3.79
Duty Factor (Source-Based) %	100.0	100.0	100.0
Maximum (Source-Based) Time-Averaged Conducted Power (mW)	1.62	1.74	3.79
Maximum (Source-Based) Time-Averaged ERP (mW)	1.57	1.68	5.30
Maximum (Source-Based) Time-Averaged EIRP (mW)	2.57	2.75	8.69
Maximum Output (mW)	1.62	1.74	5.30
47 CFR 1.1307(b)(3)(i)(c) MPE-Based Exemption ERP(W)			
$\lambda / 2\pi$ (m)	0.020	0.020	0.019
$R \geq \lambda / 2\pi$	YES	YES	YES
Maximum (Source-Based) Time-Averaged ERP (W)	0.0016	0.0017	0.0053
ERP Threshold (W)	0.7680	0.7680	0.7680
Exemption	YES	YES	YES
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.007
Summation of Contribution From MPE-Based Exemption			
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.007
Summation of Contribution Ratio (ERP / ERP _{th})	0.11		

Table 3: Configuration 3

Technical Parameters	Nordic BLE Radio 1	Nordic BLE Radio 2	Murata Wi-Fi 2.4 GHz Radio
Frequency (MHz)	2402	2402	2412
Separation Distance (cm)	20.00	20.0	20.0
Separation Distance (m)	0.2000	0.200	0.200
Antenna Gain (dBi)	2.00	2.00	3.60
ERP Easily Determined	YES	YES	YES
1-g body or 10-g extremity	Body	Body	Body
Conducted Power (dBm)	2.10	2.40	25.41
Conducted Power (mW)	1.62	1.74	347.54
Duty Factor (Source-Based) %	100.0	100.0	100.0
Maximum (Source-Based) Time-Averaged Conducted Power (mW)	1.62	1.74	347.54
Maximum (Source-Based) Time-Averaged ERP (mW)	1.57	1.68	485.46
Maximum (Source-Based) Time-Averaged EIRP (mW)	2.57	2.75	796.16
Maximum Output (mW)	1.62	1.74	485.46
47 CFR 1.1307(b)(3)(i)(c) MPE-Based Exemption ERP(W)			
$\lambda / 2\pi$ (m)	0.020	0.020	0.020
$R \geq \lambda / 2\pi$	YES	YES	YES
Maximum (Source-Based) Time-Averaged ERP (W)	0.0016	0.0017	0.4855
ERP Threshold (W)	0.7680	0.7680	0.7680
Exemption	YES	YES	YES
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.632
Summation of Contribution From MPE-Based Exemption			
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.632
Summation of Contribution Ratio (ERP / ERP _{th})	0.636		

Table 3: Configuration 4

Technical Parameters	Nordic BLE Radio 1	Nordic BLE Radio 2	Murata Wi-Fi 5 GHz Radio
Frequency (MHz)	2402	2402	5700
Separation Distance (cm)	20.00	20.0	20.0
Separation Distance (m)	0.2000	0.200	0.200
Antenna Gain (dBi)	2.00	2.00	4.75
ERP Easily Determined	YES	YES	YES
1-g body or 10-g extremity	Body	Body	Body
Conducted Power (dBm)	2.10	2.40	16.96
Conducted Power (mW)	1.62	1.74	49.66
Duty Factor (Source-Based) %	100.0	100.0	100.0
Maximum (Source-Based) Time-Averaged Conducted Power (mW)	1.62	1.74	49.66
Maximum (Source-Based) Time-Averaged ERP (mW)	1.57	1.68	90.40
Maximum (Source-Based) Time-Averaged EIRP (mW)	2.57	2.75	148.25
Maximum Output (mW)	1.62	1.74	90.40
47 CFR 1.1307(b)(3)(i)(c) MPE-Based Exemption ERP(W)			
$\lambda / 2\pi$ (m)	0.020	0.020	0.008
$R \geq \lambda / 2\pi$	YES	YES	YES
Maximum (Source-Based) Time-Averaged ERP (W)	0.0016	0.0017	0.0904
ERP Threshold (W)	0.7680	0.7680	0.7680
Exemption	YES	YES	YES
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.118
Summation of Contribution From MPE-Based Exemption			
Contribution Ratio (ERP / ERP _{th})	0.002	0.002	0.118
Summation of Contribution Ratio (ERP / ERP _{th})	0.122		