



Certification Exhibit

**Nordic radio FCC ID: ASU-B3X2L9TQ7WA
Murata radio Module FCC ID: VPYLB1ZM
Cellular radio Module FCC ID: 2AJYU-8PYA007**

FCC Rule Part: 47 CFR Part 2.1091

Project Number: 721004402

**Manufacturer: Savant Systems Inc
Model Name/Number: HST-DIRECTORC-01**

RF Exposure

General Information:

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

Purpose:

The purpose of this document is the RF exposure evaluation of the HST-DIRECTORC-01 model in accordance with FCC 47 CFR Part 2.1091.

Description:

The Savant HST-DIRECTORC-01 Power Director is a central energy management controller designed for integration within Savant smart home systems. It facilitates real-time monitoring and control of connected power modules, supporting up to 20 modules via Bluetooth Low Energy (BLE) communication in addition to external cellular communications.

HST-DIRECTORC-01 model contains Nordic BLE radio co-located with pre-approved Murata BLE/BT Classic/2.4 & 5 GHz Wi-Fi radio module (FCC ID: VPYLB1ZM / IC ID: 772C-LB1ZM) and pre-approved Cellular radio module (FCC ID: 2AJYU-8PYA007 / IC ID: 23761-8PYA008).

Technical Information (Nordic BLE Radio):

Frequency Range (MHz): 2402 - 2480
*Antenna Type: Flexible Printed Circuit (FPC)
*Antenna Gains: 2 dBi
Maximum Transmitter Conducted Power: 2.8dBm, 1.62mW
Maximum System EIRP: 4.8dBm, 3.02mW
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

Technical Information – (Cellular radio):

Frequency Range (MHz):

LTE FDD Band 2: 1850 – 1910 MHz

LTE FDD Band 4: 1710 – 1755 MHz

LTE FDD Band 5: 824 – 849 MHz

LTE FDD Band 12: 698 – 716 MHz

LTE FDD Band 13: 777 – 787 MHz

LTE FDD Band 25: 1850 – 1915 MHz

LTE FDD Band 26: 814 – 849 MHz

LTE TDD Band 41: 2496 – 2690 MHz

LTE FDD Band 66: 1710 – 1780 MHz

Antenna Type: Dipole antenna

Antenna Gains:

Band2:1.87dBi, Band4:3.12dBi, Band5:0.91dBi, Band12:0.95dBi, Band13:2.23dBi, Band25:1.87dBi,
Band26:0.91dBi, Band41:2.90dBi, Band66:3.12dBi

*Maximum Transmitter Conducted Power:

LTE Band	Maximum Conducted Power (dBm)	Maximum Conducted Power (mW)	EIRP (mW)	ERP (mW)
Band 2	23.20	208.93	321.37	195.95
Band 4	23.67	232.81	477.53	291.07
Band 5	25.30	338.84	417.83	254.68
Band 12	24.35	272.27	338.84	206.54
Band 13	22.06	160.69	268.53	163.68
Band 25	23.46	221.82	341.19	207.97
Band 26	24.16	260.62	321.37	195.88
Band 41	23.16	207.01	403.65	246.04
Band 66	23.08	203.24	416.87	254.10

*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 P_{th} (mW) described in the following formula. P_{th} 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	$19.2 R^2$.

Table 1: RF Exposure Calculation

Technical Parameters	Nordic BLE Radio	Murata BLE Radio	Murata BT Classic Radio	Murata Wi-Fi 2.4 GHz Radio	Murata Wi-Fi 5 GHz Radio
Frequency (MHz)	2402	2440	2480	2412	5700
Separation Distance (cm)	20.00	20.0	20.0	25.1	20.0
Separation Distance (m)	0.2000	0.200	0.200	0.200	0.200
Antenna Gain (dBi)	2.00	3.60	3.60	3.60	4.75
ERP Easily Determined	YES	YES	YES	YES	YES
1-g body or 10-g extremity	Body	Body	Body	Body	Body
Conducted Power (dBm)	2.80	5.78	5.79	25.41	16.96
Conducted Power (mW)	1.91	3.78	3.79	347.54	49.66
Duty Factor (Source-Based) %	100.0	100.0	100.0	100.0	100.0
Maximum (Source-Based) Time-Averaged Conducted Power (mW)	1.91	3.78	3.79	347.54	49.66
Maximum (Source-Based) Time-Averaged ERP (mW)	1.84	5.29	5.30	485.46	90.40
Maximum (Source-Based) Time-Averaged EIRP (mW)	3.02	8.67	8.69	796.16	148.25
Maximum Output (mW)	1.91	5.29	5.30	485.46	90.40
47 CFR 1.1307(b)(3)(i)(C) MPE-Based Exemption ERP (W)					
$\lambda / 2\pi$ (m)	0.020	0.020	0.019	0.020	0.008
$R \geq \lambda / 2\pi$	YES	YES	YES	YES	YES
Maximum (Source-Based) Time-Averaged ERP (W)	0.0018	0.0053	0.0053	0.4855	0.0904
ERP Threshold (W)	0.7680	0.7680	0.7680	1.2096	0.7680
Exemption	YES	YES	YES	YES	YES
Contribution Ratio (ERP / ERP _{th})	0.002	0.007	0.007	0.401	0.118

Table 2: RF Exposure Calculation – Cellular radio

Technical Parameters	LTE Band 2	LTE Band 4	LTE Band 5	LTE Band 12	LTE Band 13
Frequency (MHz)	1880	1750	836.5	711	782
Separation Distance (cm)	20.0	20.0	20.0	20.0	20.0
Separation Distance (m)	0.200	0.200	0.200	0.200	0.200
Antenna Gain (dBi)	1.87	3.12	0.91	0.95	2.23
ERP Easily Determined	YES	YES	YES	YES	YES
1-g body or 10-g extremity	Body	Body	Body	Body	Body
Conducted Power (dBm)	23.20	23.67	25.30	24.35	22.06
Conducted Power (mW)	208.93	232.81	338.84	272.27	160.69
Duty Factor (Source-Based) %	100.0	100.0	100.0	100.0	100.0
Maximum (Source-Based) Time-Averaged Conducted Power (mW)	208.93	232.81	338.84	272.27	160.69
Maximum (Source-Based) Time-Averaged ERP (mW)	195.95	291.18	254.77	206.61	163.74
Maximum (Source-Based) Time-Averaged EIRP (mW)	321.37	477.53	417.83	338.84	268.53
Maximum Output (mW)	208.93	291.18	338.84	272.27	163.74
47 CFR 1.1307(b)(3)(i)(C) MPE-Based Exemption ERP (W)					
$\lambda / 2\pi$ (m)	0.025	0.027	0.057	0.067	0.061
$R \geq \lambda / 2\pi$	YES	YES	YES	YES	YES
Maximum (Source-Based) Time-Averaged ERP (W)	0.1960	0.2912	0.2548	0.2066	0.1637
ERP Threshold (W)	0.7680	0.7680	0.4283	0.3640	0.4004
Exemption	YES	YES	YES	YES	YES
Contribution Ratio (ERP / ERP _{th})	0.255	0.379	0.595	0.568	0.409

Table 3: RF Exposure Calculation – Cellular radio

Technical Parameters	LTE Band 25	LTE Band 26	LTE Band 41	LTE Band 66
Frequency (MHz)	1910	831.5	2593	1745
Separation Distance (cm)	20.0	20.0	20.0	20.0
Separation Distance (m)	0.200	0.200	0.200	0.200
Antenna Gain (dBi)	1.87	0.91	2.90	3.12
ERP Easily Determined	YES	YES	YES	YES
1-g body or 10-g extremity	Body	Body	Body	Body
Conducted Power (dBm)	23.46	24.16	23.16	23.08
Conducted Power (mW)	221.82	260.62	207.01	203.24
Duty Factor (Source-Based) %	100.0	100.0	100.0	100.0
Maximum (Source-Based) Time-Averaged Conducted Power (mW)	221.82	260.62	207.01	203.24
Maximum (Source-Based) Time-Averaged ERP (mW)	208.04	195.95	246.13	254.19
Maximum (Source-Based) Time-Averaged EIRP (mW)	341.19	321.37	403.65	416.87
Maximum Output (mW)	221.82	260.62	246.13	254.19
47 CFR 1.1307(b)(3)(i)(C) MPE-Based Exemption ERP (W)				
$\lambda / 2\pi$ (m)	0.025	0.057	0.018	0.027
$R \geq \lambda / 2\pi$	YES	YES	YES	YES
Maximum (Source-Based) Time-Averaged ERP (W)	0.2080	0.1960	0.2461	0.2542
ERP Threshold (W)	0.7680	0.4257	0.7680	0.7680
Exemption	YES	YES	YES	YES
Contribution Ratio (ERP / ERP _{th})	0.271	0.460	0.320	0.331

Table 7: Summation of Contribution From MPE-Based Exemption – Worst Case Scenario 1

Summation of Contribution From MPE - Based Exemption			
	Nordic BLE Radio	Murata BLE Radio	LTE Band 5
Contribution Ratio (ERP / ERP _{th})	0.002	0.007	0.595
Summation of Contribution Ratios (ERP / ERP _{th})	0.604		

Table 8: Summation of Contribution From MPE-Based Exemption – Worst Case Scenario 2

Summation of Contribution From MPE - Based Exemption			
	Nordic BLE Radio	Murata BT Classic Radio	LTE Band 5
Contribution Ratio (ERP / ERP _{th})	0.002	0.007	0.595
Summation of Contribution Ratios (ERP / ERP _{th})	0.604		

Table 9: Summation of Contribution From MPE -Based Exemption – Worst Case Scenario 3

Summation of Contribution From MPE - Based Exemption			
	Nordic BLE Radio	Murata 2.4 GHz Radio	LTE Band 5
Contribution Ratio (ERP / ERP _{th})	0.002	0.401	0.595
Summation of Contribution Ratios (ERP / ERP _{th})	0.998		

Table 10: Summation of Contribution From MPE -Based Exemption – Worst Case Scenario 4

Summation of Contribution From MPE - Based Exemption			
	Nordic BLE Radio	Murata 5 GHz Radio	LTE Band 5
Contribution Ratio (ERP / ERP _{th})	0.002	0.118	0.595
Summation of Contribution Ratios (ERP / ERP _{th})	0.713		

Conclusion

Exemption from Routine Environmental Evaluation applies.