1 Cover Page

RF Exposure Evaluation Report

Application No.:	KSCR2410002068HS
FCC ID:	OU5MULW01
IC:	4048B-MULW01
Applicant:	GE Medical Systems Information Technologies, Inc.
Address of Applicant:	8200 West Tower Avenue, Milwaukee, Wisconsin, 53223, United States
Manufacturer:	GE Medical Systems Information Technologies, Inc.
Address of Manufacturer:	8200 West Tower Avenue, Milwaukee, Wisconsin, 53223, United States
Equipment Under Test (EUT):	
EUT Name:	WLAN Module
Model No.:	WLANCSMOD
Trade Mark:	GE HealthCare
Standard(s) :	FCC Rules 47 CFR §2.1091 KDB 447498 D04 interim General RF Exposure Guidance v01 RSS-102 Issue 6 (December 15, 2023)
Date of Receipt:	2024-06-06
Date of Test:	2024-06-07 to 2024-07-10
Date of Issue:	2024-07-12
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Revision Record			
Version	**Description**	**Date**	**Remark**
00	Original	2024-07-12	/

Authorized for issue by:				
Tested By		 **Damon_Zhou/Project Engineer**		
Approved By		 **Terry Hou /Reviewer**		

2 Contents

3 General Information

3.1 General Description of E.U.T.

Power supply:	DC 3.3V
S/N:	9180169-003
Firmware Version:	(FRev) Rev 8.9.0.0.90

3.2 Technical Specifications

BT

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.1 Dual mode
Modulation Type:	GFSK, pi/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Spectrum Spread Technology:	Frequency Hopping Spread Spectrum(FHSS)
Antenna Type:	FPC Antenna
Antenna Gain:	2.71 dBi (Provided by manufacturer)
Antenna Number:	1

BLE

Operation Frequency:	2402MHz to 2480MHz
Bluetooth Version:	V4.1 Dual mode
Modulation Type:	GFSK
Number of Channels:	40
Channel Spacing:	2MHz
Antenna Type:	FPC Antenna
Antenna Gain:	2.71 dBi (Provided by manufacturer)
Antenna Number:	1

2.4GHz WiFi

Operation Frequency:	802.11b/g/n(HT20): 2412MHz to 2462MHz;802.11n(HT40): 2422MHz to 2452MHz
Modulation Type:	802.11b: DSSS (CCK, DQPSK, DBPSK);802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Number of Channels:	802.11b/g/n(HT20):11;802.11n(HT40):7
Channel Spacing:	5MHz
Antenna Type:	Antenna 1: FPC Antenna Antenna 2: FPC Antenna
Antenna Gain:	Antenna 1: 2.71dBi; Antenna 2: 1.49dBi (Provided by manufacturer) Directional gain: 5.13dBi
Remark:	n20: MIMO; Other: SISO
Antenna Number:	2
Date Rate:	802.11b:1/2/5.5./11Mbps 802.11g:6/9/12/18/24/36/48/54Mbps 802.11n:MCS0-MCS7

5GHz WiFi

Operation Frequency:	Band	Mode	Frequency Range(MHz)	Number of channels
	UNII Band I	802.11a/n(HT20)	5180-5240	4
		802.11n(HT40)	5190-5230	2
	UNII Band II-A	802.11a/n(HT20)	5260-5320	4
		802.11n(HT40)	5270-5310	2
	UNII Band II-C	802.11a/n(HT20)	5500-5700	11
		802.11n(HT40)	5510-5670	5
	UNII Band III	802.11a/n(HT20)	5745-5825	5
		802.11n(HT40)	5755-5795	2
Modulation Type:	802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM)			
Date Rate:	802.11a:6/9/12/18/24/36/48/54Mbps 802.11n:MCS0-MCS7			
Channel Spacing:	802.11a/n(HT20): 20MHz 802.11n(HT40): 40MHz			
Antenna Gain:	Antenna 1: 5.71dBi Antenna 2: 2.97dBi (Provided by manufacturer)			
Antenna Type:	Antenna 1: FPC Antenna Antenna 2: FPC Antenna			
TPC Function:	Not support			
DFS Function:	Slaver without radar detection			
Date Rate:	802.11a:6/9/12/18/24/36/48/54Mbps 802.11n:MCS0-MCS7 802.11ac:VHT MCS0-MCS7			

Note: 5600MHz to 5650MHz band can not be operated in Canada

3.3 Separation Distance

Separation distance between the antenna to person (R):	＞20cm
Remark: This minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander. R has been stated in user manual.	

3.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc.

No.10 Weiye Rd, Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.

Tel: +86 512 5735 5888 Fax: +86 512 5737 0818

No tests were sub-contracted.

Note:

1. SGS is not responsible for wrong test results due to incorrect information (e.g. max. clock frequency, highest internal frequency, antenna gain, cable loss, etc) is provided by the applicant. (if applicable).
2. SGS is not responsible for the authenticity, integrity and the validity of the conclusion based on results of the data provided by applicant. (if applicable).
3. Sample source: sent by customer.

3.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **A2LA**

Compliance Certification Services (Kunshan) Inc. is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 2541.01.

- **FCC**

Compliance Certification Services (Kunshan) Inc. has been recognized as an accredited testing laboratory. Designation Number: CN1172.

- **ISED**

Compliance Certification Services (Kunshan) Inc. has been recognized by Innovation, Science and Economic Development Canada (ISED) as an accredited testing laboratory. Company Number: 2324E

- **VCCI**

The 3m and 10m Semi-anechoic chamber and Shielded Room of Compliance Certification Services (Kunshan) Inc. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-20134, R-11600, C-11707, T-11499, G-10216 respectively.

4 RF Exposure Test Exemptions

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.

4.1 RF Exposure Test Exemptions for single RF sources

4.1.1 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of §1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

The 1-mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph §1.1307(b)(3)(ii)(A).

The 1-mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

4.1.2 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of §1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz. 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. For the exemption in Table 1 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 B.1—Thresholds For Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R^2
1.34	–	30	35.6 m	–	1.6 m	3,450 R^2/f^2
30	–	300	1.6 m	–	159 mm	3.83 R^2
300	–	1,500	159 mm	–	31.8 mm	0.0128 R^2f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R^2
Subscripts L and H are low and high; λ is wavelength. R:Separation distance between the antenna to person						

The table applies to any RF source (i.e. single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least λ/2π. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

Limit calculation				
Frequency range	Frequency(MHz)	λ/2π(m)	R(m)	Threshold ERP(W)
1500~100000MHz	**2462**	0.0194	0.2000	0.768
1500~100000MHz	**2480**	0.0193	0.2000	0.768
1500~100000MHz	**5825**	0.0082	0.2000	0.768

4.1.3 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.

As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of §1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from **0.5cm to 40cm** and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{\text{th}}\ (\text{mW}) = \begin{cases} ERP_{20\ \text{cm}}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ \text{cm}} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases} \qquad \text{(B.2)}$$

where

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

and *f* is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1).

4.2 RF Exposure Test Exemptions for Simultaneous Transmission

The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluatedk term) shall be used to determine exemption for simultaneous transmission. In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a}\frac{P_i}{P_{\text{th},i}} + \sum_{j=1}^{b}\frac{ERP_j}{ERP_{\text{th},j}} + \sum_{k=1}^{c}\frac{Evaluated_k}{Exposure\ Limit_k} \le 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(B) of this section for Pth, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

Pi = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive).

Pth,i = the exemption threshold power (Pth) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i.

ERPj = the ERP of fixed, mobile, or portable RF source j.

ERPth,j = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least λ /2π according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

Evaluatedk = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limitk = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from § 1.1310 of this chapter.

4.3 IC Field reference level exposure exemption limits:

According to RSS-102 issue 6 section 6.6, 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 $1.31 \times 10^{-2}\ f^{0.6834}$ 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).

For 2.4G device, the limit of worse case is 2.68 W

For 5G device, the limit of worse case is 4.53 W

5 Measurement and Calculation

5.1 Maximum transmit power

BT

The Power Data is based on the RF Test Report SHCR240600107601

Test Mode	Antenna	Channel	Result[dBm]	Result[mW]
DH5	Ant1	2402	6.62	4.59
		2441	6.79	4.78
		2480	6.83	**4.82**
2DH5	Ant1	2402	3.37	2.17
		2441	3.57	2.28
		2480	3.74	2.37
3DH5	Ant1	2402	4.01	2.52
		2441	4.19	2.62
		2480	4.33	2.71

BLE

The Power Data is based on the RF Test Report SHCR240600107602

Test Mode	Antenna	Channel	Result[dBm]	Result[mW]
BLE_1M	Ant1	2402	-1.25	0.75
		2440	-1.08	0.78
		2480	-0.95	**0.80**

2.4GHz WiFi

The Power Data is based on the RF Test Report SHCR240600107603

Test Mode	Antenna	Channel	Result[dBm]	Result[mW]
11B	Ant1	2412	13.88	24.43
		2437	14.27	**26.73**
		2462	14.12	25.82
11G	Ant1	2412	10.32	10.76
		2437	13.79	23.93
		2462	10.58	11.43
11N40SISO	Ant1	2422	8.30	6.76
		2437	13.37	21.73
		2452	8.80	7.59
11N20MIMO	Ant1	2412	8.24	6.67
	Ant2	2412	10.51	**11.25**
	total	2412	12.53	17.91
	Ant1	2437	10.33	10.79
	Ant2	2437	9.80	9.55
	total	2437	13.08	**20.32**
	Ant1	2462	9.63	9.18
	Ant2	2462	5.75	3.76
	total	2462	11.12	12.94

5GHz WiFi:

The Power Data is based on the RF Test Report SHCR240600107604

Test Mode	Antenna	Channel	Power [dBm]	Limit [dBm]
11A	Ant1	5180	12.48	17.70
		5220	11.58	14.39
		5240	11.59	14.42
		5260	8.48	7.05
		5300	7.94	6.22
		5320	8.34	6.82
		5500	7.01	5.02
		5580	8.53	7.13
		5700	7.03	5.05
		5745	7.65	5.82
		5785	9.77	9.48
		5825	9.91	9.79
11N20SISO	Ant1	5180	12.86	**19.32**
	Ant2	5180	13.30	**21.38**
	Ant1	5220	12.08	16.14
	Ant2	5220	12.79	19.01
	Ant1	5240	11.89	15.45
	Ant2	5240	13.10	20.42
	Ant1	5260	9.73	9.40
	Ant2	5260	10.19	10.45
	Ant1	5300	8.77	7.53
	Ant2	5300	10.95	12.45
	Ant1	5320	9.12	8.17
	Ant2	5320	11.21	13.21
	Ant1	5500	8.39	6.90
	Ant2	5500	9.69	9.31
	Ant1	5580	9.50	8.91
	Ant2	5580	6.78	4.76
	Ant1	5700	7.43	5.53
	Ant2	5700	4.27	2.67
	Ant1	5745	7.88	6.14
	Ant2	5745	6.06	4.04
	Ant1	5785	9.71	9.35
	Ant2	5785	8.46	7.01
	Ant1	5825	9.85	9.66
	Ant2	5825	8.87	7.71
11N40SISO	Ant1	5190	9.10	8.13
	Ant2	5190	8.39	6.90
	Ant1	5230	12.51	17.82
	Ant2	5230	11.64	14.59
	Ant1	5270	11.65	14.62
	Ant2	5270	11.30	13.49
	Ant1	5310	7.77	5.98
	Ant2	5310	8.77	7.53
	Ant1	5510	6.82	4.81
	Ant2	5510	6.84	4.83
	Ant1	5550	8.70	7.41
	Ant2	5550	7.49	5.61
	Ant1	5670	8.10	6.46
	Ant2	5670	5.83	3.83
	Ant1	5755	6.19	4.16

	Ant2	5755	4.15	2.60
	Ant1	5795	9.60	9.12
	Ant2	5795	8.16	6.55

5.2 RF Exposure Calculation

For FCC:

For single RF source:

	Evaluation method	Separation distance between the antenna to person (R)
☐	Blanket 1 mW Blanket Exemption	Regardless of separation distance
☒	MPE-based Exemption(ERP)	R≥(λ /2 π)
☐	SAR-based Exemption(P_{th})	0.5cm<R<40cm

BT

The Max Conducted Output Power is 4.82mW. The best case gain of the antenna is 2.71dBi.

2.71dBi logarithmic terms convert to numeric result is nearly 1.87

According to the formula. calculate the EIRP test result:

EIRP= P x G = 4.82 mW x 1.87 = 9.01mW＜768mW

BLE

The Max Conducted Output Power is 0.80mW. The best case gain of the antenna is 2.71dBi.

2.71dBi logarithmic terms convert to numeric result is nearly 1.87

According to the formula. calculate the EIRP test result:

EIRP= P x G = 0.80 mW x 1.87 = 1.50mW＜768mW

2.4GHz WiFi

The Max Conducted Output Power is 26.73 mW for antenna1, 11.25 mW for antenna2,

20.32 mW for MIMO.

The best case gain of the antenna is 2.71dBi for antenna1 and 1.49dBi for antenna2.

Directional gain: 5.13dBi.

2.71dBi logarithmic terms convert to numeric result is nearly 1.87.

1.49dBi logarithmic terms convert to numeric result is nearly 1.41.

5.13dBi logarithmic terms convert to numeric result is nearly 3.26.

According to the formula. calculate the EIRP test result:

Antenna1: E.I.R.P.= P x G = 26.73 mW x 1.87= 49.99mW＜768mW

Antenna2: E.I.R.P.= P x G = 11.25 mW x 1.41 = 15.86mW＜768mW

In MIMO mode: EIRP= P x G = 20.32 mW x 3.26= 66.24mW＜768mW

5GHz WiFi

The Max Conducted Output Power is 19.32 mW for antenna1, 21.38 mW for antenna2.

The best case gain of the antenna is 5.71dBi for antenna1 and 2.97dBi for antenna2.

5.71dBi logarithmic terms convert to numeric result is nearly 3.72.

2.97dBi logarithmic terms convert to numeric result is nearly 1.98.

According to the formula. calculate the EIRP test result:

Antenna1: EIRP= P x G = 19.32 mW x 3.72 = 71.87mW＜768mW

Antenna2: E.I.R.P.= P x G = 21.38 mW x 1.98 = 42.33mW＜768mW

Remark: we used the maximum power between the conducted power and ERP/EIRP to perform RF exposure exemption evaluation.

For multiple RF sources:

The BT & 2.4GHz WiFi and 5GHz WiFi modules can simultaneous transmitting, so the maximum rate of MPE is 9.01/768+66.24/768+71.87/768=0.19≤1. So the device is exclusion from SAR test

For IC:

BT
E.I.R.P.= P x G= 0.00482W x 1.87=0.009W<2.68W
BLE
E.I.R.P.= P x G= 0.0008W x 1.87=0.002W<2.68W
2.4GHz WiFi
Antenna1: E.I.R.P.= P x G = 0.02673W x 1.87= 0.050W<2.68W
Antenna2: E.I.R.P.= P x G = 0.01125W x 1.41= 0.016W<2.68W
In MIMO mode: E.I.R.P.= P x G = 0.02032W x 3.26= 0.066W<2.68W
5GHz WiFi
Antenna1: E.I.R.P.= P*G = 0.01932W x 1.995=0.072W<4.53W
Antenna2: E.I.R.P.= P x G = 0.02138 mW x 1.98 = 0.042mW<4.53W
The BT & 2.4GHz WiFi and 5GHz WiFi modules can simultaneous transmitting, so the maximum rate of MPE is 0.009/2.68+0.066/2.68+0.072/4.53=0.044≤1. So the device is exclusion from SAR test

--End of the Report--