EMC TEST REPORT



Standard(s):

47 CFR FCC Part 15.247 RSS 247, Issue 3, 2023

FCC ID: DGFPSD201846 IC: 458A-PSD201846

Product: 3M™ Scott™ X3 Pak Alert SE7 Distress Alarm System Model(s): 201846-01

Company Name: 3M Company

Address:

Fire & SCBA Solutions 4320 Goldmine Road, Monroe, NC 28110

Report Number: HRE202406471-1 Report Issue Date: April 8, 2025

Report Prepared by:

Signature: Yuriy durinov Yuriy Litvinov Lead EMC Engineer

Tested by:

3M Company, Hardgoods Regulatory Engineering Laboratory 410 E. Fillmore Avenue, Building 76 St. Paul, Minnesota 55107-1208, USA



Report Number: HRE20240671-1 Date: April 8, 2025

Page 2 of 21

TABLE OF CONTENTS				
Iter	m	Description		
1.0		Test Summary	3	
	1.1	Measurement Uncertainty	3	
	1.2	Test Facility	3	
2.0		Equipment Description	4	
	2.1	Equipment Under Test	4	
3.0	† <u> </u>	EUT Configuration	5	
	3.1	System Configuration	5	
	3.2	Input/Output Ports of EUT	5	
	3.3	Cables	5	
	3.4	Measurement Arrangements of EUT	5	
	3.5	Exercising of EUT and Interfaces	5	
4.0	† <u> </u>	Test Conditions and Results	6	
	4.1	DTS Bandwidth	6	
	4.2	Maximum Peak Conducted Output Power	7	
	4.3	Maximum Power Spectral Density level	8	
	4.4	Radiated Emissions in restricted band	9	
	4.5	Radiated Emissions in non-restricted band	16	
	4.6	DTS Band-edge Emissions Measurements	18	
	4.7	Conducted Emissions	19	
	4.8	RF Exposure Evaluation	20	
5.0		Test Equipment	21	
6.0		Revision History	21	



Page 3 of 21

1.0 Test Summary

Based on the results of our investigation, we have concluded the product tested **comply** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

	Requirement – Test	Test Description	Result	Comments
4.1	FCC Part 15.247(a)(2)/ RSS-247(5.2(a))/RSS-Gen (6.7)	DTS Bandwidth	pass	
4.2	FCC Part 15.247(b)(3)/ RSS-247(5.4(d))	Maximum Peak Conducted Output Power	pass	
4.3	FCC Part 15.247(e)/ RSS-247(5.2(b))	Maximum Power Spectral Density level	pass	
4.4	FCC Part 15.209 RSS-Gen, 8.9	Radiated Emissions in restricted band	pass	See note
4.5	FCC Part 15.247(d)/ RSS-247(5.5)	Radiated Emissions in non-restricted band	pass	
4.6	FCC Part 15.247(d)(1)/ RSS-247(5.5)	DTS Band-edge Emissions Measurements	pass	
4.7	FCC Part 15.207/ RSS-Gen (8.8)	Conducted Emissions	N/A	
4.8	FCC Part 15.247(i)/ RSS 102 Issue 5	RF Exposure Compliance	pass	

Notes	Device contains certified BLE Module FCC ID: SQGBL5340 and IC:3147A-BL5340.
Note:	Limited Spurious Emissions test was performed to verify BLE module integration.

1.1 Measurement Uncertainty

The measured value related to the corresponding limit will be used to decide whether the equipment meets the requirements. The measurement uncertainty figures were calculated and correspond to a coverage factor of k=2, providing a confidence level of respectively 95.45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian).

Radiated emissions 30MHz to 1000MHz	4.9 dB
Radiated emissions 1GHz to 18GHz	4.6 dB
Conducted emissions 150KHz to 30MHz (AMN)	2.7 dB
Conducted emissions 150KHz to 30MHz (AAN)	1.92 dB
RF frequency	±3 x 10 ⁻⁸
RF power, conducted	1.4 dB
RF Power Spectral Density	0.96 dB

1.2 Test Facility

	ISO/IEC 17025:2017, NVLAP LAB CODE: 200033-0
Test Facility Accreditations:	FCC US502
71001041141101101	ISED Canada CAB identifier: US0012



Page 4 of 21

2.0 Equipment Description

3M

2.1	Equipment Under Test				
Description:		Sensor Module Assembly is an electronics control module for battery power, audio (alarm tones), the Pak-Tracker radio transmitter, data logging, wireless communications. It is installed on the SCBA back frame. The Sensor Module consisting of a Pak-Tracker Transmitter, which is integrated into the PAK- ALERT SE + distress alarm and BLE radio transceiver is provided as a tunnel for accessing stored data concerning PAK operation.			
	Model(s):	201846-01			
	Serial number:	N/A			
	3M Division:	Personal Safety			
Modifi	cations and Special Measures:	none			
Frequency Range:		Pak-Tracker: 2425 BLE: 2402.0-2480			
Channel No.:		Pak-Tracker: 1/ Bl	LE:39		
Modulation Type:		GFSK			
	FCC Classification:	Digital Transmission System (DTS)			
	Pack-Tracker Output Power Conducted:	20.5dBm (112.2mW)			
Antenr	na Type and Antenna Assembly		☐ Integral PCB Antenna		☐ Dedicated
	Gain:		☐ Declared by the	he Manufacturer	
	Test Deviations or Exclusions	☐ Yes	⊠ No		
		Voltage:	☐ 120VAC	☐ 230VAC	⊠ 9VDC
	Rated Power:	Phase:	☐ 1ph	☐ 3ph	
	Nateu Power.	Frequency:	☐ 50Hz	☐ 60Hz	
		Current:	N/A		
	Test Dates:	03/10-03/13/2025			
	Received Date:	03/07/2025			
	Received Conditions:	Poor	⊠ Good		
	Received Conditions:		☐ Production		



Report Number: HRE20240671-1 Date: April 8, 2025

Page 5 of 21

3.0 EUT Configuration

3.1 System Configuration

No.	Product Type	Manufacturer	Model	Comments
1	EUT	3M	201846-01	
2	PC	Raspberry Pi		Support Equipment
3				

3.2 Input/Output Ports of EUT

No. Description		Type	Comments
1	Pressure Transducer	12 pin	Bulkhead Mount Circular Connector
2	Sensor Module, Console	11 pin	Bulkhead Mount Circular Connector

3.3 Cables

No.	Description	Туре	Length	Shielding	Comments
1	Control Cables	Twisted Pair	1m	Yes	
2					

3.4 Measurement Arrangements of EUT

Intended Operational Arrangement(s)	Comments
Table-top only	
Floor-standing only	
Floor-standing or table-top	
Other	Body-worn

3.5 Exercising of EUT and Interfaces

No.	Mode of Operation			
1	Continues transmission of modulated and CW signals at 2425.0MHz			
2	Bluetooth test set software was used to transmit at rated power and data rate.			
3	Device programming using "FCC_SENSOR_MOD_TEST" software provided by the manufacturer for continuous transmission of modulated carrier at maximum rated RF output power and Duty Cycle.			



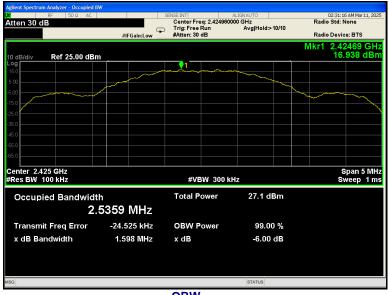
Page 6 of 21

4.0 **Test Conditions and Results**

3M

4.1	DTS Bandwidth	DTS Bandwidth			
		Laboratory Ambient Temperature:	23°C		
		Relative Humidity:	48%		
		Atmospheric Pressure:	1011 mbars		
Reference Standard(s):		☑ ANSI C63.10:2020, Section 11.8.2☑ FCC Part 15.247/RSS 247☑ KDB 558074	Measurement Point ☐ Conducted ☐ Radiated		
Fre	equency Range:	⊠ 2425.0MHz	RBW = 100KHz VBW ≥ 3 x RBW		
Nominal Voltage:		☐ 120VAC ☑ 9VDC			
Test Personnel:		Yuriy Litvinov ymy divinos	Date: 03/11/2025		

Frequency (MHz)	Data Rate	99% dB Bandwidth (KHz)	6 dB Bandwidth (KHz)	6dB OBW Limit (KHz)	Results
2425	N/A	2536	1598	> 500	pass



OBW



Report Number: HRE20240671-1 Date: April 8, 2025

Page 7 of 21

4.2	Maximum Output	Maximum Output Power				
Method:	Measurements was performed with CW carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses.					
		Laboratory Ambient Temperature:	23°C			
		Relative Humidity:	48%			
		Atmospheric Pressure:	1011 mbars			
Refe	 ✓ ANSI C63.10:2020, Section 11.9 ✓ FCC Part 15.247/RSS 247 ✓ KDB 558074 		Measurement Point ☑ Conducted			
	Frequency Range:	☑ 2425.0MHz	Radiated			
	Antenna Gain:	2.7dBi	Maximum Power (EIRP):			
	Limit:	30 dBm	23.33dBm (215.3mW)			
	Nominal Voltage:	☐ 120VAC ☐ 9VDC				
	Test Personnel:	Yuriy Litvinov Yuriy divinor	Date: 03/11/2025			

Note: EIRP (dBm) = Conducted Power (dBm) +Antenna Gain (dBi)= 20.5+2.83=23.33dBm



Conducted RF Power



Report Number: HRE20240671-1 Date: April 8, 2025

Page 8 of 21

4.3	Maximum Power Spectral Density level					
Method:		Measurements was performed with modulated carrier at the highest power level at which the transmitter is intended to operate. The analyzer offset was adjusted to compensate for the attenuator and other losses.				
		Laboratory Ambient Temperature:	23°C			
		Relative Humidity:	48%			
		Atmospheric Pressure:	1011 mbars			
Refer	ence Standard(s):	☑ ANSI C63.10:2020, Section 11.10.2☑ FCC Part 15.247/RSS 247☑ KDB 558074	Measurement Point ☐ Conducted ☐ Radiated			
F	Frequency Range:	☑ 2425.0 MHz	PSD Results			
	PSD Limit:	8 dBm in any 3KHz band	4.6dBm			
	Nominal Voltage:	☐ 120VAC ☐ 9VDC				
Test Personnel:		Yuriy Litvinov Yuriy Lubihov	Date: 03/11/2025			



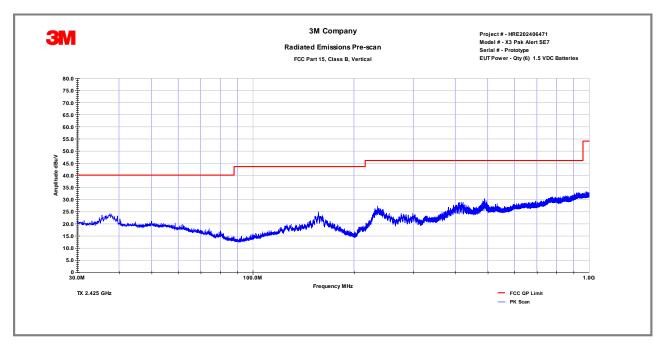
PSD

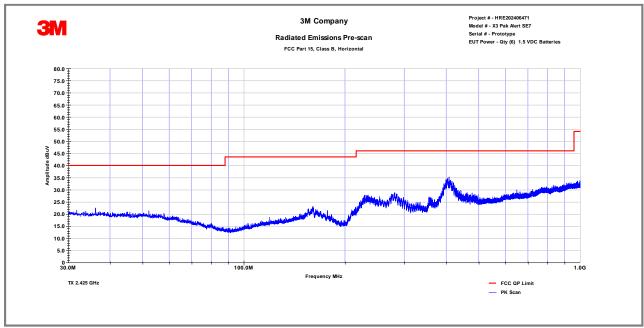


Page 9 of 21

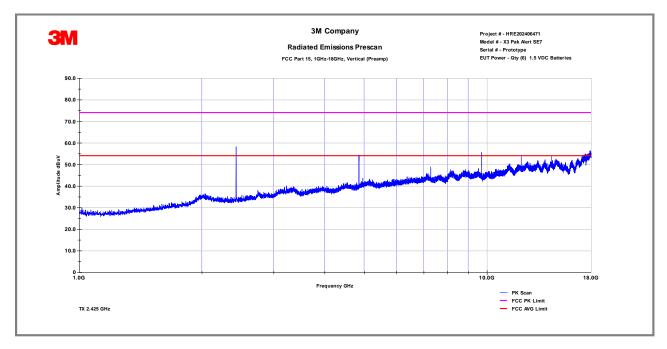
4.4	Radiated Emissions i						
Method:	EUT was rotated through highest emission relative the limit was used in mal performed with external p	in a 3-meter semi-anechoic chamber that complies to CISPR 16/ANSI C63.4 standards. hree orthogonal axes to determine which attitude (orientation) and arrangement produces the othe limit; the attitude and device arrangement that produces the highest emission relative to ng final radiated emission measurements. Spurious Radiated emissions measurements ware eamp and a high pass filter. Final measurements were then performed by rotating the EUT 360° antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical plicable.					
		Laborato	ry Ambient Tempe	rature:		23°C	
Test	Verification: ⊠		Relative Hu	midity:		55%	
			Atmospheric Pre	ssure:		1011 mb	oars
	oforonoo Stondord/s\-	⊠ ANSI C63.10:20				Measurement	Distance
R	eference Standard(s):		☐ FCC Part 15.205/15.209/RSS Gen (8.9) ☐ KDB 558074 ☐ ☐ 3 Meters ☐				
	Frequency Range:	⊠ 30 MHz to 1 GHz			RBW = 100KHz, VBW ≥ 3 x RBW		
	Frequency Kange.	☑ 1 GHz to 25 GHz			RBW = 1MHz, VBW ≥ 3 x RBW		
	Nominal Voltage:	☐ 120VAC ⊠ 9VDC					
	Test Personnel:	Keith Schwartz KS			Date: 03/12/2025		
		Limits –15	.209 and RSS Ger	า			
Fre	quency (MHz)	L	imit dB (μV/m)				
110	queriey (Wiriz)	Quasi-Peak	Average	Р	eak	Distance	Results
(0.009-0.490		2400/F(KHz)			300	N/A
(0.490-1.705	24000/F(KHz)				30	N/A
	1.705-30	30				30	N/A
	30 to 88	40				3	pass
	88 to 216	43.5				3	pass
	216 to 960	46				3	pass
	Above 960		54		74	3	pass

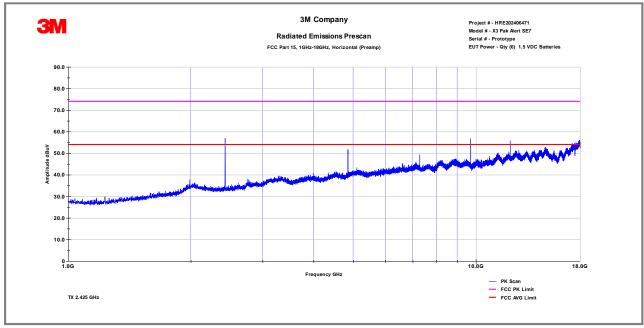
Modifications:	
	The lower limit applies at the transition frequency. An inverse proportionality factor of 20 dB per decade has been used to normalize the measured data to the specified distance for determining compliance
Note:	For emission in the restricted bands, the limit of 15.209 was used.
Note:	There are no emissions were detected in the 15.205 restricted band within 30dB below 15.209 limit adjacent or nearby to 2400-2483.5MHz frequency band during operation at the high channel.
	No radiated spurious emissions were detected above 18GHz



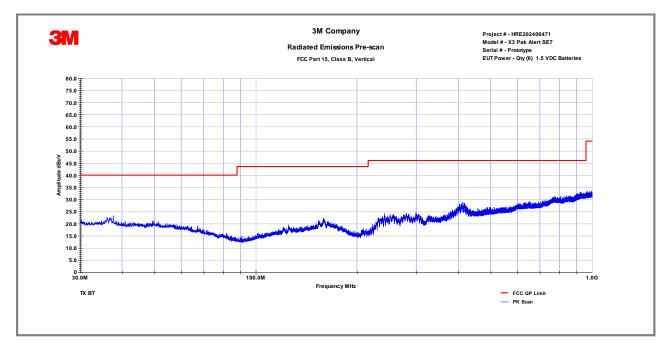


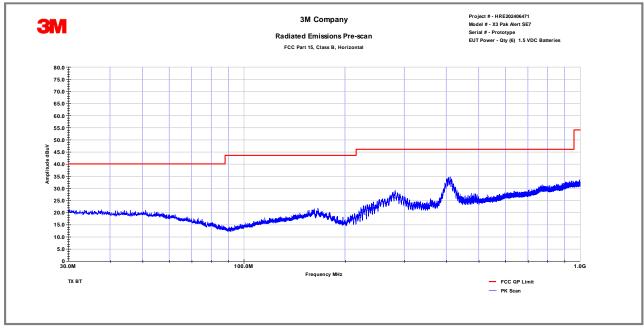
FCC Part 15.209 Radiated Emissions in restricted band - Pak-Tracker 2425.0MHz



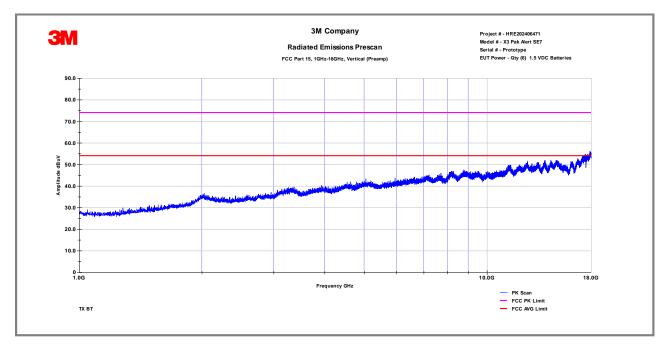


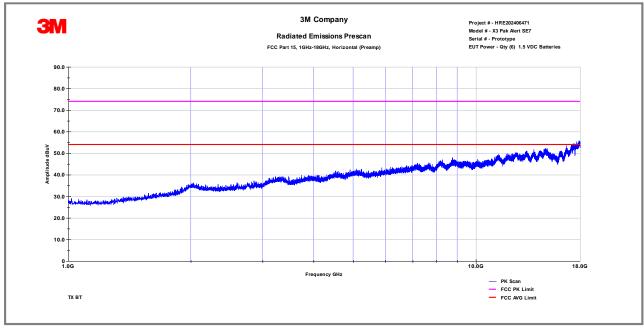
FCC Part 15.209 Radiated Emissions in restricted band - Pak-Tracker 2425.0MHz





FCC Part 15.209 Radiated Emissions in restricted band – BLE Verification





FCC Part 15.209 Radiated Emissions in restricted band – BLE Verification



Page 14 of 21

Tables - Radiated Emissions in restricted band

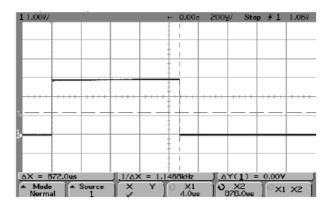
Frequency (MHz)	Pol.	QP Reading dBμV/m	Total CF dB	Net at 3 m dBµV/m	Limit (dBµV/m)	Margin dB	
38.09	Н	3.3	17.1	20.4	40	-19.6	
155.84	V	2.1	18.1	20.2	43.5	-23.3	
233.96	Н	7.1	15.8	22.9	46	-23.1	
280.31	Н	4.8	18	22.8	46	-23.2	
408.17	Н	6.6	21.1	27.6	46	-18.4	
487.46	Н	2.8	23.1	25.8	46	-20.2	
Notes:	Notes: Net Reading (dBuV) = Reading (dBµV) + Antenna CF(dB)+Cable CF(dB) – Amp Gain(dB) Pak Tracker 2425.0MHz						

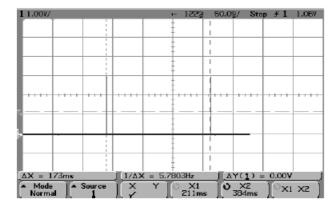
Pol	Frequency (MHz)	Peak dBµV/m	AVG dBµV/m	Total CF dB	Net Peak dBµV/m	Net AVG dBµV/m	PK Limit	AVGLimit dBµV/m	PK Margin dB	AVG Margin dB
V	2746.75	51.64	40.3	-12.72	38.92	18.92	74.00	54.00	-35.08	-35.08
Н	2746.75	51.58	40.2	-12.72	38.86	18.86	74.00	54.00	-35.14	-35.14
V	4850.50	61.13	56.3	-5.69	55.44	35.44	74.00	54.00	-18.56	-18.56
Н	4850.50	59.91	54.2	-5.69	54.22	34.22	74.00	54.00	-19.78	-19.78
V	7273.00	53.24	45.5	-3.11	51.70	30.13	74.00	54.00	-22.30	-23.87
Н	7273.00	54.81	47.6	-3.11	44.5	31.70	74.00	54.00	29.5	-22.30
V	12123.10	50.58	42.44	3.85	54.43	34.43	74.00	54.00	-19.57	-19.57
Н	12123.10	49.88	42.17	3.85	53.73	33.73	74.00	54.00	-20.27	-20.27
	Notes: Net AVG VBW>1/T=2KHz Reading (dBuV) = Reading (dBμV) + (Antenna with amp CF(dB)+Cable CF(dB) Max. Duty Cycle of 20dB used.						F(dB))			
		Pak Track	er 2425.0MH	lz						



Page 15 of 21

Duty Cycle Correction factor





Pak-Tracker

Per theory of operation the device operates in a packet mode only. Each packet is 872 µs long and is repeated at a rate of 4 times per second. The worst case one packet over 100ms period.

Duty Cycle = Time On/ 100ms 0.872ms/100ms = 0.00872

20log (0.0087) = -41.2dB, which was be applied to the Peak measurement for a corrected Average value

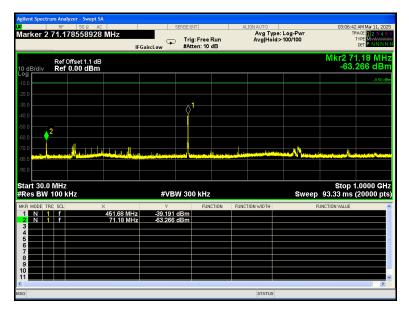


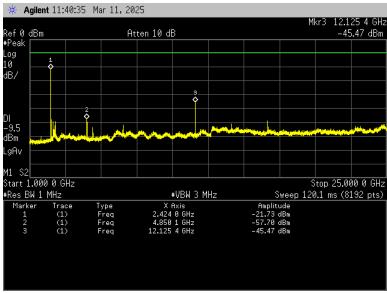
Report Number: HRE20240671-1 Date: April 8, 2025

Page 16 of 21

4.5	Radiated Emissions in non-restricted band					
Method:	The measurements	The measurements were made with transmitter set to transmit continuously.				
		Laboratory Ambient Temperature:	23°C			
		Relative Humidity:	48%			
		Atmospheric Pressure:	1011 mbars			
Reference Standard(s): Frequency Range:		⊠ KDB 558074	Measurement Point ☑ Conducted ☐ Radiated			
In-ban	d power in 100KHz:	☑ 20.5dBm	Results:			
	Limit:	☑ -9.5dBm (30dBc below in-band power)	>39dBc			
	Nominal Voltage:	☐ 120VAC ☐ 9VDC				
Test Personnel:		Yuriy Litvinov Yuriy divinos	Date: 03/11/2025			
	Note:					

Note:	





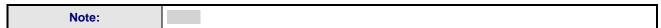
Conducted Spurious - Pack Tracker 2425.0 MHz

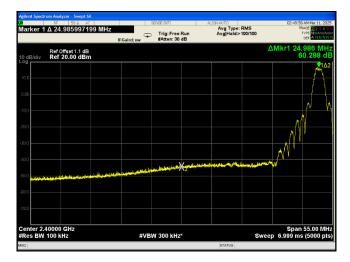


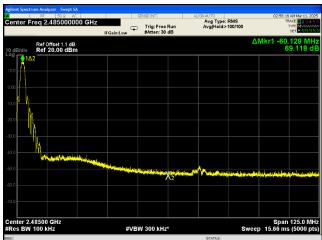
Report Number: HRE20240671-1 Date: April 8, 2025

Page 18 of 21

4.6	Band-Edge Co	I-Edge Compliance				
Method:	The measureme channels.	he measurements were made with transmitter set to transmit continuously with modulated signal at low and high hannels.				
		Laboratory Ambient Temperature:	23°C			
		Relative Humidity:	48%			
		Atmospheric Pressure:	1011 mbars			
Referenc	e Standard(s):	☒ ANSI C63.10:2020, Section 11.13.2☒ FCC Part 15.247/RSS 247☒ KDB 558074	Measurement Point ☐ Conducted ☐ Radiated			
Freq	uency Range:	☑ 2425.0MHz	Results			
Limit:		⊠ >30dBc	Low, 2402 MHz > 60dBc High, 2480 MHz > 69dBc			
No	minal Voltage:	☐ 120VAC ☐ 9VDC				
Test Personnel:		Yuriy Litvinov yung diarina	Date: 03/16/2025			







Band Edge - Low Center Freq. 2.400GHz

Band Edge - High Center Freq. 2.4835GHz



Report Number: HRE20240671-1 Date: April 8, 2025

Page 19 of 21

4.7	Conducte	ed Emissions Data						
	was betwee 0.8 m from	was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance en the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage ents on mains lines were made at the output of the AMN.						
Method:	connected were made	wer was connected to the system through Artificial Mains Network (AMN). All tested telecommunications lines were ected to an Asymmetric Artificial Network (AAN) and conducted voltage measurements on telecommunications lines made at the output of the ISN. Where an AAN was not appropriate or available measurements were made using a citive Voltage Probe.						
	Laboratory Ambient Temperature:							
	Test Verif	ication:	Rela	tive Humidity:				
			Atmosph	eric Pressure:				
	Re	eference Standard(s):	☐ RSS Gen/FCC 15.207 ☐ ANSI C63.4:2014 ☐ ANSI C63.10:2020		Measurement Point ☑ Mains ☐ Telecommunication ports ☐			
		Nominal Voltage:	☐ 120VAC ☐ 230VAC ☐ VDC					
		Test Personnel:		Date:				
		Limits	- Part 15.207/RSS Gen -	AC Mains				
Fragues	cy (MHz)		Limit dB (μV)					
Frequen	Cy (IVII IZ)	Quasi-Peak	Average	Result	Comments			
0.15 t	o 0.50	66 to 56	56 to 46	N/A				
0.50	0.50 to 5 56		46	N/A				
5 to	30	60	50	N/A				
Modific	ations:							
No	te:							



Report Number: HRE20240671-1 Date: April 8, 2025

Page 20 of 21

-					
4.8	RF Exposure Evaluation				
	Reference Standard(s):	 KDB 447498 RF Exposure Guidance v06 KDB 447498 Interim RF Exposure Guidance v01 RSS 102, Issue 5 SAR Evaluation SAR Test Exc 			
	Frequency Range(s):				
	Antenna Separation Distance:	>10mm			
	RF Exposure Conditions:	Portable (Body-worn)			
	Pak Tracker Antenna Gain:	2.83dBi			
Pak Tracke	r the source-based conducted output power:	112mW(20.5dBm)* 0.00872 (worst case duty cycle)= 0.98mW(-0.1dBm)			
Pak Tra	acker EIRP/ERP output power:	EIRP =-0.1dBm + 2.83dBi=2.73dBm, ERP =2.73dBm - 2.15dB=0.58dBm(1.14mW)			
The estin	nated 1-g SAR Value of the BT EDR transmitter:				
	BLE Antenna Gain:	2.0dBi			
BLE the so	urce-based conducted output power:	1.2.24m\///3.5dBm\^().85/\/\orgt case duty cycle\=1.9m\///2.8dBm\			
	BLE EIRP/ERP output power:	EIRP =2.8dBm + 2.0dBi=4.8dBm, ERP =4.8dBm - 2.15dB= 2	.65dBm(1.84mW)		
The estima	ated 1-g SAR Value of the BLE transmitter:	1			
	of ratios for all simultaneously smitting BLE and Pak Tracker	1.14/10+1.84/10=0.32 (sum of ratio is < 1.0)			
The sum of ratios (1-g SAR value) for all simultaneously transmitting Pack Tracker and BLE antennas incorporated in a radio: (SAR value of Pak Tracker Transmitter/SAR limit) + (SAR value of Pak Tracker Transmitter/SAR limit) + (SAR value of Pak Tracker Transmitter/SAR limit) + (SAR value) = (0.023/1.6) + (0.04/1.6) = 0.014+0.025= 0.04 < 1			alue of BLE		
The SAR Exclusion Threshold Level					
	FCC Part 2.1093	<u>19</u> mW<10mm @2.45GHz			

Note:	The device has two simultaneously transmitting antennas for Pack Tracker and BLE.
Note:	The device has two simultaneously transmitting antennas for Pack Tracker and BLE.



Report Number: HRE20240671-1 Date: April 8, 2025

Page 21 of 21

5.0	Test Equipment							
Test Equipment Used								
Description	Manufacturer	Model	Identifier	Last Cal. Date	Check			
Biconilog Antenna	Schwarzbeck	VULB 9168	9168-1070	10/20/2024	\boxtimes			
Horn Antenna	A.H. Systems	SAS 571	1010	10/20/2024				
Loop Antenna	A.H. Systems	EHA-51B	1213E	10/20/2024				
EMI Receiver	Rohde & Schwarz	ESW26	101412	10/20/2024				
Signal Analyzer	Agilent	N9000A	MY53031040	10/20/2024	\boxtimes			
EMI Receiver	Agilent	E4448A	1530975	10/20/2024				
LISN	TESEQ	NNB51	1130	10/20/2024				
Coaxial Cable	Insulated Wire	2803	CBL2039	10/20/2024				
EMC Software	ETS-Lindgren	TILE 7		N/A				
Equipment Calibration Interval:				24 months				

6.0	Report revision history					
Revisio	n Level	Date	Report Number	Notes		
	0	04/08/2025	HRE202406471-1	Original Issue		