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Intertek
731 Enterprise Drive
Lexington, KY 40510

Tel 859 226 1000
Fax 859 226 1040

www.intertek.com

ROM Technologies Inc. MPE REPORT

SCOPE OF WORK

MPE CALCULATION
ON THE CARDIACCONNECT

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MPE TEST REPORT

Report Number: 105635605LEX-006

Project Number: G105635605

Report Issue Date: 1/29/2024

Product Name: CardiacConnect

Standards: FCC Part 1.1310 Limits for Maximum
Permissible Exposure (MPE)

RSS-102 Issue 5 RF Field Strength Limits for
Devices Used by the General Public

Tested by:
Intertek Testing Services NA, Inc.
731 Enterprise Drive
Lexington, KY 40510
USA

Client:
ROM Technologies Inc.
101 Silvermine Road
Brookfield, CT 06804
USA

Report prepared by



Brian Lackey, Staff Engineer

Report reviewed by



Michael Carlson, Team Leader

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1 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 4.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested **complies** with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

2 Test Summary

Section	Test full name	Result
8	FCC Part 1.1310 Limits for Maximum Permissible Exposure (MPE) (Limits for General Population / Uncontrolled Exposure)	Pass
	RSS-102 Issue 5 RF Field Strength Limits (For Devices Used by the General Public)	Pass



3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	ROM Technologies Inc.
Address:	101 Silvermine Road Brookfield, CT 06804 USA
Contact:	Francis Allotey
Telephone:	+1 (774) 242-0610
Email:	francis.allotey@romtech.com
Manufacturer Information	
Manufacturer Name:	ROM Technologies Inc.
Manufacturer Address:	101 Silvermine Road Brookfield, CT 06804 USA



4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	CardiacConnect
Model Numbers	10300
Input Rating	120 VAC, 2 A, 240 W
Software Used By EUT	CardiacConnect Intertek app – Intertek Testing v9 Electronic actuated pedal firmware – EAP-v1.2.9RADIOTEST_4NRF2 Pedal Unit Controller firmware – PUC-v2.6.7RADIOTEST_4NRF2 Motor Controller firmware – MC-v3.0.6
Description of Equipment Under Test (provided by client)	
The ROMTech CardiacConnect Rehab Device is a rehabilitative exercise therapy device that uses assisted movement to measure, evaluate, exercise, re-educate and strengthen muscles, and to increase joint range of motion. This device is also used in cardiac rehabilitation of patients that have undergone treatment of cardiac conditions, during sessions the CardiacConnect monitors the patients ECG (electrocardiogram), BP (Blood Pressure) and SpO2 (Oxygen Saturation) whilst session is overseen by a cardiac specialist.	
Equipment Under Test	
Product Name	Pedal Unit Controller
Model Numbers	10145-200 Rev 2
Frequency Band(s)	2402 – 2480 MHz
Modulation Type(s)	GFSK
Test Channel(s)	2402 MHz, 2440 MHz, 2480 MHz
Maximum Antenna Gain ¹	5.3 dBi
Equipment Under Test	
Product Name	Motor Controller
Model Numbers	15749-200 Rev 7
Frequency Band(s)	2402 – 2480 MHz
Modulation Type(s)	GFSK
Test Channel(s)	2402 MHz, 2440 MHz, 2480 MHz
Maximum Antenna Gain ¹	5.3 dBi

¹ This information was provided by the client and may affect compliance. Intertek does not make any claims of compliance for values other than those shown.



Embedded Transmitter Subassembly	
Product Name	Samsung
Model Numbers	Galaxy Tab Active4 PRO
Supported Transmit Bands	NFC: 13.56MHz BT/BLE: 2400 – 2483.5MHz Wi-Fi: 2400 – 2483.5MHz, U-NII-1, U-NII-2A, U-NII-2C, U-NII-3 2G GSM: GSM850, GSM900, DCS1800, PCS1900 3G UMTS: B1, B2, B4, B5, B8 4G FDD LTE: B1, B2, B3, B4, B5, B7, B8, B12, B13, B17, B20, B25, B26, B28, B32, B66 4G TDD LTE: B38, B40, B41 5G FDD Sub6: N1, N3, N5, N7, N8, N20, N28, N66 5G TDD Sub6: N38, N40, N41, N77, N78
Supported Transmit Modes	Bluetooth: BDR, 2-EDR, 3-EDR, Ble Wi-Fi: 802.11a/b/g/n/ac/ax 2.4G+5GHz, HE80, MIMO, 1024-QAM

4.1 Variant Models:

There were no variant models covered by this evaluation.



5 FCC Limits

§ 1.1310: The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Part 1.1310 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)
(A) Limits for Occupational/Controlled Exposures				
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
1500–100,000 .....	.....	.....	5	6
(B) 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
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

**6 RSS-102 Issue 5 Exposure Limits:**

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	-2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$
Note: f is frequency in MHz. * Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				



7 Test Procedure

An MPE evaluation for was performed in order to show that the device was compliant with the general population exposure limits from FCC §2.1091 and RSS-102 Issue 5. The maximum power density was calculated for each transmitter band at a separation distance of 20cm using the maximum declared output power including tune up tolerance.

For each transmitter the maximum RF exposure at a 20 cm distance using the formula:

$$ConductedPower_{mW} = 10^{ConductedPower(dBm)/10}$$

$$PowerDensity = \frac{ConductedPower_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$

For transmitters that could operate simultaneously, the MPE to limit ratio for each was calculated and then summed. If the sum of the MPE to limit ratios was less than 1, that specific combination of transmitters was deemed to comply.



8 Results:

The calculated maximum power density at 20cm distance was equal to or less than the required limits for general population exposure for FCC Part 1.1310 and RSS-102 Issue 5.

Additionally, to demonstrate compliance for simultaneous transmission between the tablet, the motor controller, and the EAP, the worst-case limit to MPE ratios for each radio were summed. Since that sum was less than 1 that combination of radios is deemed to comply with the simultaneous transmission RF exposure criteria.

The measured SAR values for the tablet were taken from the SAR report 4790406775-S1V1 from the FCC filing, provided by the client. Any deviations from these values may affect compliance. Intertek does not make any claims of compliance for any values other than those shown below.

Equipment Class	Band	Antenna	The Highest Reported SAR (W/kg)
			1g of tissue
			Standalone exposure condition
DTS	2.4GHz WLAN	All	0.941
UNII	5GHz WLAN	All	1.143
DSS	Bluetooth	All	0.722
NFC	NFC	NFC Ant.	0.049



FCC MPE Data

Device	Band / Modulation	Channel	Frequency (MHz)	Declared Max Cond. Power (Inc. Tolerance) (dBm)	Duty Cycle (%)	Duty Cycle Adjusted Cond. Output Power (dBm)	Antenna Gain (dB)	MPE Value @ 20cm (mW/cm ²)	MPE Limit (mW/cm ²)	MPE / Limit Ratio (for Co-Location)
Motor Controller	BLE	37	2402	3.4	100.0%	3.40	5.3	0.0015	1.0000	0.0015
		17	2440	-1.08	100.0%	-1.08	5.3	0.0005	1.0000	0.0005
		39	2480	-1.74	100.0%	-1.74	5.3	0.0005	1.0000	0.0005
EAP	BLE	37	2402	-3.74	100.0%	-3.74	5.3	0.0003	1.0000	0.0003
		17	2440	-4.64	100.0%	-4.64	5.3	0.0002	1.0000	0.0002
		39	2480	-7.19	100.0%	-7.19	5.3	0.0001	1.0000	0.0001
Device	Band / Modulation	-						SAR Value (W/kg)	SAR Limit (W/kg)	SAR / Limit Ratio (for Co-Location)
Tablet	DTS	-						0.9410	1.6000	0.5881
	UNII	-						1.1430	1.6000	0.7144
	DSS	-						0.7220	1.6000	0.4513
	NFC	-						0.0490	1.6000	0.0306

$$0.0015 + 0.0003 + 0.7144 + 0.0306 = 0.7468 < 1$$

RSS-102 Issue 5 MPE Data

Device	Band / Modulation	Channel	Frequency (MHz)	Declared Max Cond. Power (Inc. Tolerance) (dBm)	Duty Cycle (%)	Duty Cycle Adjusted Cond. Output Power (dBm)	Antenna Gain (dB)	MPE Value @ 20cm (W/m ²)	MPE Limit (W/m ²)	MPE / Limit Ratio (for Co-Location)
Motor Controller	BLE	37	2402	3.4	100.0%	3.40	5.3	0.0147	5.3508	0.0028
		17	2440	-1.08	100.0%	-1.08	5.3	0.0053	5.4085	0.0010
		39	2480	-1.74	100.0%	-1.74	5.3	0.0045	5.4689	0.0008
EAP	BLE	37	2402	-3.74	100.0%	-3.74	5.3	0.0028	5.3508	0.0005
		17	2440	-4.64	100.0%	-4.64	5.3	0.0023	5.4085	0.0004
		39	2480	-7.19	100.0%	-7.19	5.3	0.0013	5.4689	0.0002
Device	Band / Modulation	-						SAR Value (W/kg)	SAR Limit (W/kg)	SAR / Limit Ratio (for Co-Location)
Tablet	DTS	-						0.9410	1.6000	0.5881
	UNII	-						1.1430	1.6000	0.7144
	DSS	-						0.7220	1.6000	0.4513
	NFC	-						0.0490	1.6000	0.0306

$$0.0028 + 0.0005 + 0.7144 + 0.0306 = 0.7483 < 1$$



9 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	1/29/2024	105635605LEX-006	BZ	MC	Original Issue