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RF Exposure Exhibit

SCOPE OF WORK
EMC TESTING – LM DTS™, Model: Tray Reader

REPORT NUMBER
105031787MPK-002

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RF Exposure Exhibit
(Mobile Devices)

Report Number: 105031787MPK-002
Project Number: G105031787

Report Issue Date: April 20, 2022
Revision Date: June 30, 2022

Testing performed on the
LM DTS™
Model: Tray Reader

FCC ID: Y3D-RED4S

to

47CFR 2.1091
RSS-102 Issue 5

for

LM-Instruments Oy

Tested by:
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Report No. 105031787MPK-002	
Equipment Under Test:	LM DTS™
Model(s) Tested:	Tray Reader
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Applicable Regulation:	47CFR 2.1091 RSS-102 Issue 5

We attest to the accuracy of this report:

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1.0 RF Exposure Summary

Test	Reference FCC	Reference Industry Canada	Result
Radio frequency Radiation Exposure Evaluation	47 CFR§2.1091	RSS-102 Issue 5	Complies

2.0 RF Exposure Limits

In this document, we evaluate the RF Exposure to human body due the intentional transmission from the transmitter (EUT). The limits for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 and RSS-102 are followed.

2.1 FCC Limits

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A)Limits For Occupational / Control 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 density

2.2 Industry Canada Limits

According to RSS-102, Industry Canada has adopted the SAR and RF field strength limits established in Health Canada's RF exposure guideline, Safety Code 6.

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	83	90	-	Instantaneous*
0.1-10	-	0.73/ ƒ	-	6**
1.1-10	$87/ ƒ^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/ ƒ^{0.25}$	$0.1540/ ƒ^{0.25}$	8.944/ ƒ0.5	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 ƒ^{0.3417}$	$0.008335 ƒ^{0.3417}$	$0.02619 ƒ^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/ ƒ^{1.2}$
150000-300000	$0.158 ƒ^{0.5}$	$4.21 \times 10\text{-}4 ƒ^{0.5}$	$6.67 \times 10^{-5} ƒ$	$616000/ƒ^{1.2}$

Note: ƒ is frequency in MHz.
* Based on nerve stimulation (NS).
** Based on specific absorption rate (SAR).

3.0 Test Results (Mobile Configuration)

3.1 Classification

Radio is installed inside a mobile host device. The antenna of the product, under normal use condition, is at least 20 cm away from the body of the user and accessible to the end user. Warning statement to the user for keeping at least 20 cm or more separation distance with the antenna should be included in user's manual.

3.2 EIRP calculations

The LM DTS™, Model: Tray Reader consists of three radios: 13.56 MHz HF, 900 MHz UHF, and 2.4/5 GHz WiFi.

For RF exposure compliance refer to reports below:

Radio	FCC ID	Report Number
13.56 MHz – HF	Z64TRF7970AEVM	10211699RUS1
900 MHz – UHF	Y3D-RED4S	105031787MPK-001
2.4 GHz - WiFi	Z9W-MB	CCISE190310101
5 GHz - WiFi	Z9W-MB	CCISE190310102V01

3.3 Maximum RF Power

Frequency Range (MHz)	Peak FS @ 3m (dBµV/m)	Note
13.56	48.7	FS measurement was taken from Report #10211699RUS1.

Frequency Range (MHz)	RF Output (dBm)	Antenna Gain[1] (dBi)	Note
917.1 – 926.9	23.73	-10.0	Conducted power measurements were taken from Report #105031787MPK-001.
2412– 2462	18.95	4.0	Conducted power measurements were taken from Report #CCISE190310101.
5180- 5240, 5745- 5825	15.46	5.0	Conducted power measurements were taken from Report #CCISE190310102V01.

[1]As declared by the manufacturer.

3.4 RF Exposure Calculation

3.4.1 RF Exposure calculation for 13.56 MHz – HF

Frequency Range (MHz)	Peak FS @3m (dBµV/m)	Peak FS @20 cm* (dBµV/m)	Peak FS @20 cm (V/m)	RSS Limit (V/m)	FCC Limit (V/m)	Results
13.56	48.7	95.74	0.06	27.46	60.77	Complies

Note: Peak FS measurement was taken from FCC ID: Z64TRF7970AEVM
* Distance Correction Factor was used.

3.4.2 RF Exposure calculation for 900 MHz – UHF, 2.4 GHz – WiFi & 5 GHz - WiFi

Frequency Range (MHz)	EIRP[1] (dBm)	EIRP[1] (mW)	Power Density (mW/cm^2) @20 cm	FCC Limit (mW/cm^2)
917.1 - 926.9	23.73	236.0478	0.0470	0.6114
2412 - 2462	22.95	197.2423	0.0393	1.0000
5180- 5240, 5745- 5825	20.46	111.1732	0.0221	1.0000

Note: Antenna gains below 0 are considered as 0dBi.

Frequency Range (MHz)	EIRP[1] (dBm)	EIRP[1] (mW)	Power Density (W/m^2) @20 cm	RSS Limit (W/m^2)
917.1 - 926.9	23.73	236.0478	0.4698	2.7913
2412 - 2462	22.95	197.2423	0.3926	5.4418
5180- 5240, 5745- 5825	20.46	111.1732	0.2213	9.8025

Note: Antenna gains below 0 are considered as 0dBi.

3.5 Worst Case RF Exposure Ccalculation – 900MHz UHF + 2.4 GHz WiFi (Simultaneous Transmission)

Frequency Range (MHz)	EIRP[1] (dBm)	EIRP[1] (mW)	Power Density (mW/cm²) @20 cm	FCC Limit (mW/cm²)	MPE Ratio	Sum of MPE Ratios
917.1 - 926.9	23.73	236.0478	0.0470	0.6114	0.0768	0.1163
2412 - 2462	22.95	197.2423	0.0393	1.0000	0.0393	

Frequency Range (MHz)	EIRP[1] (dBm)	EIRP[1] (mW)	Power Density (W/m²) @20 cm	RSS Limit (W/m²)	MPE Ratio	Sum of MPE Ratios
917.1 - 926.9	23.73	236.0478	0.4698	2.7913	0.1683	0.2407
2412 - 2462	22.95	197.2423	0.3926	5.4418	0.0721	

Calculations for this report are based on highest power measured.

The summation of the MPE ratio is less than 1, therefore, the EUT complies for the MPE requirement of simultaneous transmission.

Appendix A: Power Density Calculation

The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in mW/cm^2
D is the distance from the antenna in cm.

4.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G105031787	KR	AS	April 20, 2022	Original Document
1.0 / G105031787	KR	AS	June 30, 2022	Updated units for RSS limits