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Otodata Wireless Network Inc. MPE REPORT

SCOPE OF WORK

MPE CALCULATION
ON THE TM5240 TANK MONITOR

REPORT NUMBER

105397891LEX-007.1

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MPE TEST REPORT

Report Number: 105397891LEX-007.1

Project Number: G105397891

Report Issue Date: 12/6/2023

Report Revised Date: 1/22/2024

Product Name: TM5240 Tank Monitor

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:

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Client:

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Table of Contents

1	<i>Introduction and Conclusion.....</i>	4
2	<i>Test Summary</i>	4
3	<i>Client Information</i>	5
4	<i>Description of Equipment under Test and Variant Models.....</i>	6
5	<i>Output Power.....</i>	7
6	<i>Antenna Gain</i>	8
7	<i>FCC Limits.....</i>	10
8	<i>RSS-102 Issue 5 Exposure Limits:</i>	11
9	<i>Test Procedure</i>	12
10	<i>Results:.....</i>	13
11	<i>Revision History.....</i>	15



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
10	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:	Otodata Wireless Network Inc.
Address:	1180 De Louvain Street West Montreal, QC H4N 1G5 Canada
Contact:	Julien Renaud
Telephone:	514-673-0244
Email:	jrenaud@otodata.com
Manufacturer Information	
Manufacturer Name:	Otodata Wireless Network Inc.
Manufacturer Address:	1180 De Louvain Street West Montreal, QC H4N 1G5 Canada



4 Description of Equipment under Test and Variant Models

Tank Monitor Gen III	
Product Name	TM5240 Tank Monitor
Model Number	MZ03AD
Hardware Version	C032
Software Version	2210
Supported Transmit Bands	ME310G1-WW: LTE Bands 2/4/5/12/13/25/26/66 STM32WB55CGU6: BLE 2402 – 2480 MHz
Embedded Module(s)	ME310G1-WW, STM32WB55CGU6
Receive Date	6/28/2023
Test Start Date	6/28/2023
Test End Date	7/21/2023
Device Received Condition	Good
Test Sample Type	Prototype
Input Ratings	Non-rechargeable 3.6VDC, 19Ah Battery
Description of Equipment Under Test (provided by client)	
The TM5240 Tank Monitor is a battery-operated wireless remote tank level monitor.	

4.1 Variant Models:

There were no variant models covered by this evaluation.



5 Output Power

The output power for the ME310G1-WW was taken from the Telit ME310G1-WW Product Brief found on the Telit website. The output power for the STM32WB55CGU6 was taken from the STM32WB55CGU6 datasheet found on the STMicroelectronics website. Deviations from these values may affect compliance. Intertek does not make any claims of compliance for values other than shown here.

ME310G1-W1		ME310G1-WW
Market	Worldwide	Worldwide
LTE-M/NB-IoT	Dual Mode LTE-M/NB-IoT	Dual Mode LTE-M/NB-IoT
4G Bands	B1, B2, B3, B4, B5, B8, B8_US**, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B71, B85, B103**	B1, B2, B3, B4, B5, B8, B8_US**, B12, B13, B18, B19, B20, B25, B26, B27, B28, B66, B71, B85, B103**
2G Bands	-	B2, B3, B5, B8
Output Power	LTE: 21 dBm (Power Class 5)	LTE: 23 dBm (Power Class 3) GSM/GPRS 33 dBm (Power Class 4)

Figure 1: ME310G1-WW

Table 26. RF transmitter Bluetooth Low Energy characteristics (1 Mbps)⁽¹⁾

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
P_{rf}	Maximum output power	SMPS Bypass ($V_{DD} > 1.71$ V) or ON ($V_{FBSMPS} = 1.7$ V and $V_{DD} > 1.95$ V) ⁽²⁾	-	6.0	-	dBm
		SMPS Bypass ($V_{DD} > 1.71$ V) or ON ($V_{FBSMPS} = 1.4$ V and $V_{DD} > 1.95$ V), Code 29 ⁽²⁾⁽³⁾	-	3.7	-	
	0 dBm output power	-	-	0	-	
	Minimum output power	-	-	-20	-	
P_{band}	Output power variation over the band	Tx = 0 dBm - Typical	-0.5	-	0.4	dB

Figure 2: STM32WB55CGU6



6 Antenna Gain

The antenna gain values for the Bluetooth antenna were sourced from the Antenna Performance Test Report, Document Control Number: 208535. The antenna gain for the ME310G1-WW Cellular Module was sourced from the client in reference to the 105195808LEX-006 report. Deviations from these values may affect compliance. Intertek does not make any claims of compliance for values other than shown here.

6.1 Cellular Antenna

Quarter-wave Monopole Antenna for the Cellular Module	
Frequency (MHz)	Gain (dBi)
700	6.63
850	6.63
1700	6.00
1800	8.51



6.2 Bluetooth Antenna

Point Values	Peak EIRP (dBm)	Efficiency (dB)	Efficiency (%)	Gain (dBi)	Boresight Phi (°)	Boresight Th. (°)
Frequency (MHz)						
2400	1.76751	-3.23059	47.5271	1.76751	15	-150
2402	1.73321	-3.22041	47.6386	1.73321	15	-150
2404	1.50996	-3.43674	45.3237	1.50996	15	-150
2406	1.59776	-3.30288	46.7425	1.59776	15	-150
2408	1.8835	-3.13427	48.593	1.8835	15	-150
2410	1.63733	-3.23585	47.4695	1.63733	15	-150
2412	1.76891	-3.16723	48.2256	1.76891	15	-150
2414	1.65685	-3.28007	46.9887	1.65685	15	-150
2416	1.87144	-3.07862	49.2196	1.87144	15	-150
2418	1.63981	-3.26643	47.1365	1.63981	15	-150
2420	1.62004	-3.16382	48.2634	1.62004	15	-150
2422	1.88696	-3.0642	49.3832	1.88696	15	-150
2424	1.7176	-3.17019	48.1927	1.7176	15	-150
2426	1.73398	-3.14947	48.4232	1.73398	15	-150
2428	1.29202	-3.47318	44.9451	1.29202	15	-150
2430	1.55641	-3.19614	47.9055	1.55641	15	-150
2432	1.7532	-3.17262	48.1657	1.7532	15	-150
2434	1.52472	-3.26417	47.161	1.52472	15	-150
2436	1.39171	-3.41494	45.5518	1.39171	15	-150
2438	1.11649	-3.57656	43.8879	1.11649	15	-150
2440	1.54916	-3.25508	47.2598	1.54916	15	-150
2442	1.40976	-3.42669	45.4288	1.40976	15	-150
2444	1.2428	-3.48828	44.7891	1.2428	15	-150
2446	1.16558	-3.65866	43.0659	1.16558	15	-150
2448	1.2074	-3.58052	43.8478	1.2074	15	-150
2450	1.3415	-3.52362	44.4261	1.3415	15	-150
2452	1.062	-3.70498	42.6091	1.062	15	-150
2454	1.24864	-3.55691	44.0869	1.24864	15	-150
2456	1.28444	-3.62333	43.4177	1.28444	15	-150
2458	1.31904	-3.53627	44.2969	1.31904	15	-150
2460	1.11879	-3.71405	42.5202	1.11879	15	-150
2462	1.10853	-3.63449	43.3063	1.10853	15	-150
2464	1.47637	-3.43769	45.3139	1.47637	15	-150
2466	1.42994	-3.48502	44.8227	1.42994	15	-165
2468	1.31574	-3.52111	44.4518	1.31574	15	-150
2470	1.1971	-3.69614	42.6959	1.1971	15	-165
2472	1.54603	-3.35052	46.2325	1.54603	0	-165
2474	1.74828	-3.32725	46.481	1.74828	0	-165
2476	1.68999	-3.33768	46.3694	1.68999	15	-165
2478	1.56361	-3.37713	45.9501	1.56361	15	-165
2480	1.76979	-3.3824	45.8944	1.76979	15	-165
2482	1.98303	-3.13346	48.602	1.98303	15	-165



7 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.



8 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).				



9 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:

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

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



10 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.

10.1 FCC MPE Data

Radio	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)
Bluetooth	BLE	37	2402	6	100.0%	6.00	1.98	0.0012	1.0000	0.0012
		17	2440	6	100.0%	6.00	1.98	0.0011	1.0000	0.0012
		39	2480	6	100.0%	6.00	1.98	0.0012	1.0000	0.0012
Cellular	GSM/GPRS/EGPRS 850	128	824.2	33	12.5%	23.97	6.59	0.2263	0.5495	0.4118
		189	836.4	33	12.5%	23.97	6.59	0.2263	0.5576	0.4058
		251	848.8	33	12.5%	23.97	6.59	0.2263	0.5659	0.3999
	GSM/GPRS/EGPRS 1900	512	1850.2	33	12.5%	23.97	8.51	0.3521	1.0000	0.3521
		661	1880.0	33	12.5%	23.97	8.51	0.3521	1.0000	0.3521
		810	1909.8	33	12.5%	23.97	8.51	0.3521	1.0000	0.3521
	LTE B2 (FDD)	18000	1920.0	23	100.0%	23.00	8.51	0.2817	1.0000	0.2817
		18299	1949.9	23	100.0%	23.00	8.51	0.2817	1.0000	0.2817
		18599	1979.9	23	100.0%	23.00	8.51	0.2817	1.0000	0.2817
	LTE B4 (FDD)	19950	1710.0	23	100.0%	23.00	6	0.1580	1.0000	0.1580
		20174	1732.4	23	100.0%	23.00	6	0.1580	1.0000	0.1580
		20399	1754.9	23	100.0%	23.00	6	0.1580	1.0000	0.1580
	LTE B5 (FDD)	20400	824.0	23	100.0%	23.00	6.63	0.1827	0.5493	0.3326
		20524	836.4	23	100.0%	23.00	6.63	0.1827	0.5576	0.3276
		20649	848.9	23	100.0%	23.00	6.63	0.1827	0.5659	0.3228
	LTE B12 (FDD)	23010	699.0	23	100.0%	23.00	6.63	0.1827	0.4660	0.3921
		23094	707.4	23	100.0%	23.00	6.63	0.1827	0.4716	0.3874
		23179	715.9	23	100.0%	23.00	6.63	0.1827	0.4773	0.3828
	LTE B13 (FDD)	23180	777.0	23	100.0%	23.00	6.63	0.1827	0.5180	0.3527
		23229	781.9	23	100.0%	23.00	6.63	0.1827	0.5213	0.3505
		23279	786.9	23	100.0%	23.00	6.63	0.1827	0.5246	0.3483
	LTE B25 (FDD)	26040	1850.0	23	100.0%	23.00	8.51	0.2817	1.0000	0.2817
		26364	1882.4	23	100.0%	23.00	8.51	0.2817	1.0000	0.2817
		26689	1914.9	23	100.0%	23.00	8.51	0.2817	1.0000	0.2817
	LTE B26 (FDD)	26690	814.0	23	100.0%	23.00	6.63	0.1827	0.5427	0.3367
		26864	831.4	23	100.0%	23.00	6.63	0.1827	0.5543	0.3296
		27039	848.9	23	100.0%	23.00	6.63	0.1827	0.5659	0.3228
	LTE B66 (FDD)	131972	1710.0	23	100.0%	23.00	6	0.1580	1.0000	0.1580
		132321	1744.9	23	100.0%	23.00	6	0.1580	1.0000	0.1580
		132671	1779.9	23	100.0%	23.00	6	0.1580	1.0000	0.1580

Note: The BLE module and Cellular module will operate exclusively and therefore will not transmit simultaneously.

**10.2 RSS-102 Issue 5 MPE Data**

Band	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/m2)	MPE Limit (W/m2)	MPE / Limit Ratio (for Co-Location)
GSM/GPRS/EGPRS 850	128	824.2	33	12.5%	23.97	6.59	2.2628	2.5760	0.8784
	189	836.4	33	12.5%	23.97	6.59	2.2628	2.6020	0.8696
	251	848.8	33	12.5%	23.97	6.59	2.2628	2.6283	0.8609
GSM/GPRS/EGPRS 1900	512	1850.2	33	12.5%	23.97	8.51	3.5208	4.4766	0.7865
	661	1880.0	33	12.5%	23.97	8.51	3.5208	4.5258	0.7779
	810	1909.8	33	12.5%	23.97	8.51	3.5208	4.5747	0.7696
LTE B2 (FDD)	18000	1920.0	23	100.0%	23.00	8.51	2.8166	4.5914	0.6135
	18299	1949.9	23	100.0%	23.00	8.51	2.8166	4.6401	0.6070
	18599	1979.9	23	100.0%	23.00	8.51	2.8166	4.6888	0.6007
LTE B4 (FDD)	19950	1710.0	23	100.0%	23.00	6	1.5803	4.2419	0.3725
	20174	1732.4	23	100.0%	23.00	6	1.5803	4.2798	0.3692
	20399	1754.9	23	100.0%	23.00	6	1.5803	4.3178	0.3660
LTE B5 (FDD)	20400	824.0	23	100.0%	23.00	6.63	1.8270	2.5756	0.7093
	20524	836.4	23	100.0%	23.00	6.63	1.8270	2.6020	0.7021
	20649	848.9	23	100.0%	23.00	6.63	1.8270	2.6285	0.6950
LTE B12 (FDD)	23010	699.0	23	100.0%	23.00	6.63	1.8270	2.3017	0.7937
	23094	707.4	23	100.0%	23.00	6.63	1.8270	2.3206	0.7873
	23179	715.9	23	100.0%	23.00	6.63	1.8270	2.3396	0.7809
LTE B13 (FDD)	23180	777.0	23	100.0%	23.00	6.63	1.8270	2.4743	0.7384
	23229	781.9	23	100.0%	23.00	6.63	1.8270	2.4849	0.7352
	23279	786.9	23	100.0%	23.00	6.63	1.8270	2.4958	0.7320
LTE B25 (FDD)	26040	1850.0	23	100.0%	23.00	8.51	2.8166	4.4763	0.6292
	26364	1882.4	23	100.0%	23.00	8.51	2.8166	4.5297	0.6218
	26689	1914.9	23	100.0%	23.00	8.51	2.8166	4.5830	0.6146
LTE B26 (FDD)	26690	814.0	23	100.0%	23.00	6.63	1.8270	2.5542	0.7153
	26864	831.4	23	100.0%	23.00	6.63	1.8270	2.5914	0.7050
	27039	848.9	23	100.0%	23.00	6.63	1.8270	2.6285	0.6950
LTE B66 (FDD)	131972	1710.0	23	100.0%	23.00	6	1.5803	4.2419	0.3725
	132321	1744.9	23	100.0%	23.00	6	1.5803	4.3009	0.3674
	132671	1779.9	23	100.0%	23.00	6	1.5803	4.3597	0.3625
BLE	37	2402.0	6	100.0%	6.00	1.98	0.0118	5.3508	0.0023
	17	2440.0	6	100.0%	6.00	1.98	0.0113	5.4085	0.0023
	39	2480.0	6	100.0%	6.00	1.98	0.0119	5.4689	0.0023

Note: The BLE module and Cellular module will operate exclusively and therefore will not transmit simultaneously.

**11 Revision History**

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	12/6/2023	105397891LEX-007.1	<i>SP</i>	<i>MC</i>	Original Issue
1	1/22/2024	105397891LEX-007.1	<i>SP</i>	<i>MC</i>	Used the peak antenna gain across all frequencies for MPE calculation