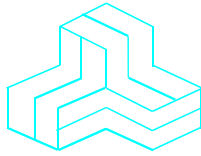


ENGINEERING TEST REPORT



myHABITAT Senses
Model(s): MHS271828
FCC ID: 2A4B5-MHS271828

Applicant:

LM Systems Corporation
206 Krieghoff Ave
Unionville, ON L3R 1W5
Canada

Tested in Accordance With

Federal Communications Commission (FCC)
47 CFR, Part 15, Subpart B, Class B Unintentional Radiators

UltraTech's File No.: 22LMS003_FCC15B

This Test report is Issued under the Authority of
Tri M. Luu
Vice President of Engineering
UltraTech Group of Labs

Date: February 17, 2022

Report Prepared by: Dan Huynh

Tested by: Nimisha Desai

Issued Date: February 17, 2022

Test Dates: January 5, 2022

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by any agency of the US Government.
- This test report shall not be reproduced, except in full, without a written approval from UltraTech

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: www.ultratech-labs.com, Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com



APEC TEL CA0001



1309



CA0001-2049



AT-1945



SL2-IN-E-1119R



CA0001

TABLE OF CONTENTS

EXHIBIT 1.	INTRODUCTION.....	1
1.1.	SCOPE	1
1.2.	RELATED SUBMITTAL(S)/GRANT(S)	1
1.3.	NORMATIVE REFERENCES	1
EXHIBIT 2.	PERFORMANCE ASSESSMENT	2
2.1.	CLIENT INFORMATION	2
2.2.	EQUIPMENT UNDER TEST (EUT) INFORMATION	2
2.3.	LIST OF EUT'S PORTS.....	2
2.4.	ANCILLARY EQUIPMENT	2
EXHIBIT 3.	EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS	3
3.1.	CLIMATE TEST CONDITIONS	3
3.2.	OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS.....	3
3.3.	TEST SETUP BLOCK DIAGRAMS.....	3
3.4.	TEST SETUP PHOTOGRAPHS	4
EXHIBIT 4.	SUMMARY OF TEST RESULTS.....	6
4.1.	LOCATION OF TESTS	6
4.2.	APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS	6
4.3.	MODIFICATIONS REQUIRED FOR COMPLIANCE.....	6
EXHIBIT 5.	MEASUREMENTS DATA.....	7
5.1.	RADIATED EMISSION FROM CLASS B UNINTENTIONAL RADIATORS (DIGITAL DEVICES) [47 CFR §15.109(a)]	7
EXHIBIT 6.	TEST INSTRUMENTS & MEASUREMENT UNCERTAINTY (k=2, 95% CONFIDENCE LEVEL)	9
6.1.	RADIATED EMISSION MEASUREMENT UNCERTAINTY	9

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart B, Sections 15.107 & 15.109
Title:	Code of Federal Regulations, Title 47 - Telecommunication, Part 15 Radio Frequency Devices.
Purpose of Test:	Equipment Certification for Part 15 Class B Digital Device
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	Commercial, industrial or business environment Residential environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
FCC 47 CFR 15	2021	Code of Federal Regulations , Title 47 - Telecommunication, Part 15 Radio Frequency Devices

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 22LMS003_FCC15B

February 17, 2022

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	LM Systems Corporation
Address:	206 Krieghoff Ave Unionville, ON L3R 1W5 Canada

Manufacturer	
Name:	LM Systems Corporation
Address:	206 Krieghoff Ave Unionville, ON L3R 1W5 Canada

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	LM Systems Corporation
Product Name:	myHABITAT Senses
Model(s):	MHS271828
Serial Number:	Test Sample
Type of Equipment:	Part 15 Class B Digital Device
Type of Power Source:	Battery
Power Input Source:	1.5 V
Primary User Functions of EUT:	Provide periodic room temperature and relative humidity readings to user via Bluetooth Low Energy connection with cellphone.

2.3. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
None				

2.4. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

None.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 22LMS003_FCC15B
February 17, 2022

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C - 24°C
Humidity:	45% to 58%
Pressure:	102 kPa
Power input source:	1.5 V Battery

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TEST SIGNALS

The EUT was running an app, which was advertising Bluetooth Low Energy.

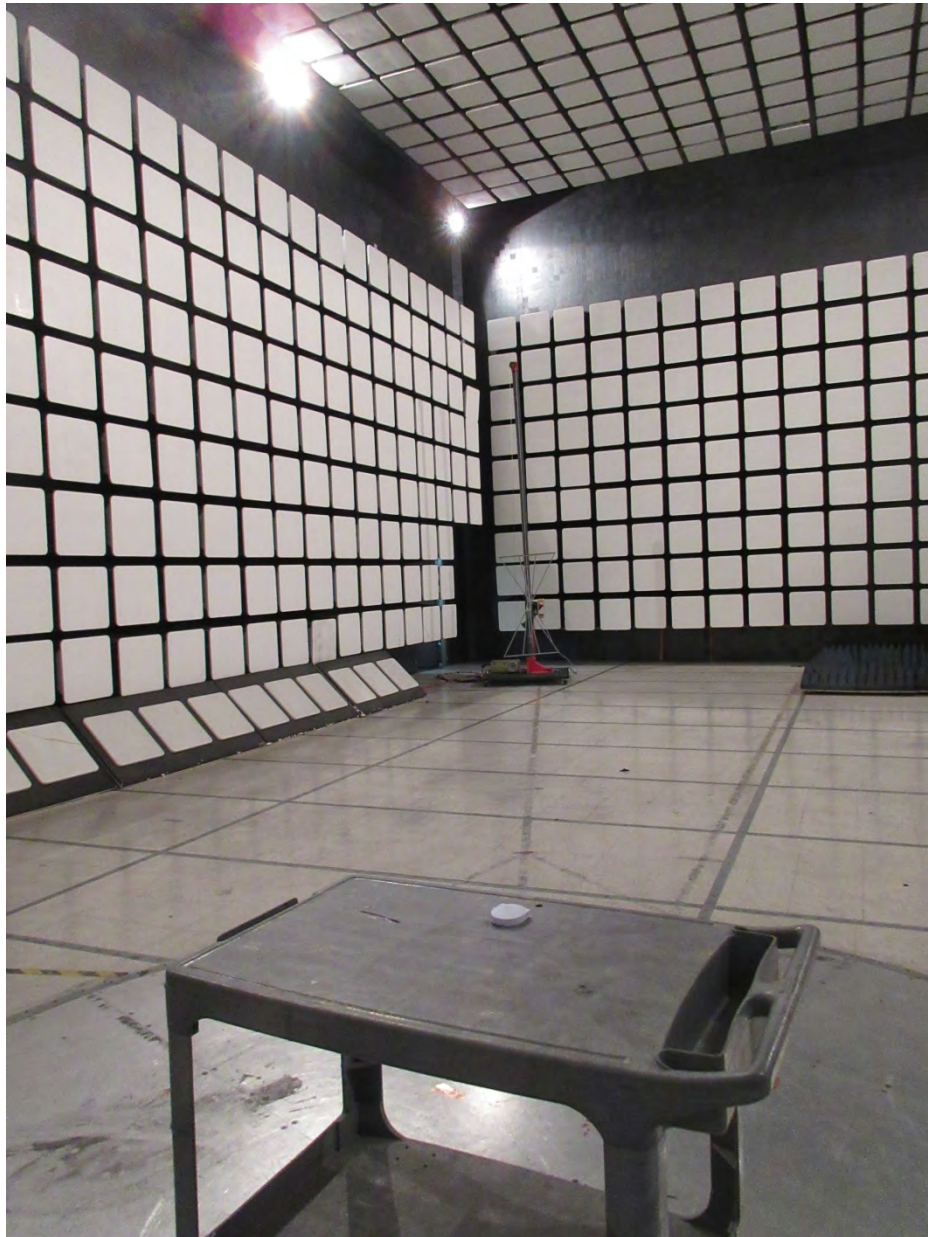
3.3. TEST SETUP BLOCK DIAGRAMS

RADIATED EMISSION



3.4. TEST SETUP PHOTOGRAPHS

Radiated Emissions at 10 m (30 - 1000 MHz)



ULTRATECH GROUP OF LABS

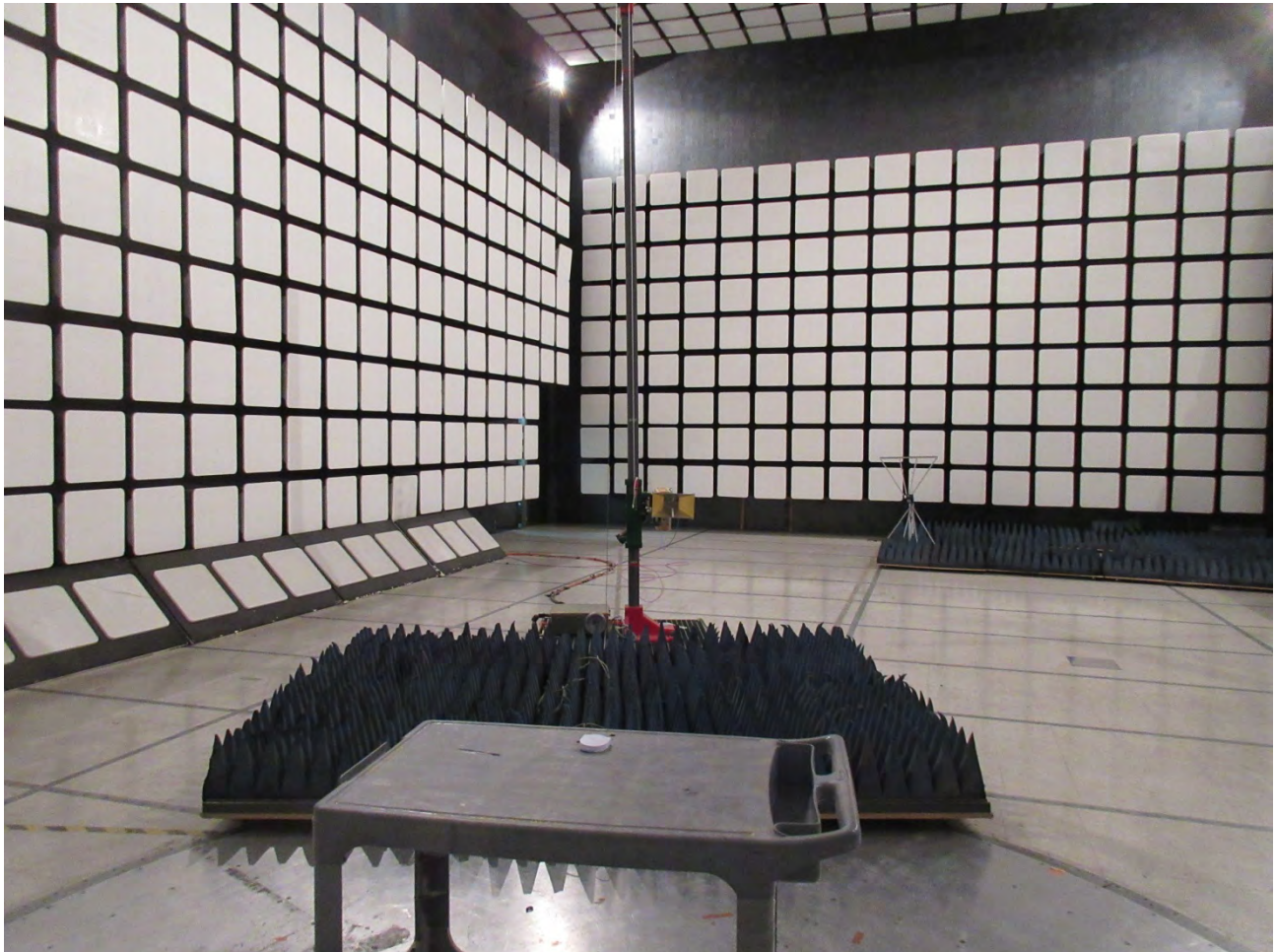
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 22LMS003_FCC15B

February 17, 2022

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Radiated Emissions at 3 m (Above 1 GHz)



ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 22LMS003_FCC15B

February 17, 2022

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with ANAB File No.: AT-1945.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Part 15, Subpart B	Test Requirements	Margin Below (-) / Above (+) the Limits	Compliance (Yes / No)
15.107(a), Class B	Power Line Conducted Emission	--	N/A
15.109(a), Class B	Radiated Emission from Unintentional Radiators (Digital Devices)	-1.4 dB @ 30 MHz	Yes

4.3. MODIFICATIONS REQUIRED FOR COMPLIANCE

None.

EXHIBIT 5. MEASUREMENTS DATA

5.1. RADIATED EMISSION FROM CLASS B UNINTENTIONAL RADIATORS (DIGITAL DEVICES) [47 CFR §15.109(a)]

5.1.1. Limit(s)

The equipment shall meet the limits of the following table:

47 CFR 15.109(a)

Frequency Range (MHz)	Class B Limits @ 3 m (dBµV/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
Above 960	54.0

5.1.2. Method of Measurements

ANSI C63.4 for method of measurements.

The spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 -1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

5.1.3. Test Equipment List

Refer to Exhibit 6 for test instruments & measurement uncertainty.

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 22LMS003_FCC15B
February 17, 2022

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

5.1.4. Test Data

Remarks:

- The measuring receiver shall be tuned over the frequency range 30 MHz to 18 GHz.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT shall be tested in three orthogonal positions.
- Measurements were conducted a 10 m distance from 30 – 1000 MHz and 3 m distance from 1 – 18 GHz.
- The results at 10 m distance are extrapolated to 3 m distance using an extrapolation factor of $20 \cdot \log(10/3)$ to compare with applicable limits at 3 m distance.

Frequency (MHz)	RF Level at 10m (dB μ V/m)	Extrapolated RF Level a 3m (dB μ V/m)	Detector Used (Peak/QP/Avg)	Antenna Plane (H/V)	Class B Limit at 3 m (dB μ V/m)	Margin (dB)
30.00	28.18	38.64	Peak	V	40.0	-1.4
30.00	22.51	32.97	Peak	H	40.0	-7.0
59.53	18.29	28.75	Peak	H	40.0	-11.3
75.09	14.32	24.78	Peak	V	40.0	-15.2
155.91	23.38	33.84	Peak	H	43.5	-9.7
183.89	20.21	30.67	Peak	H	43.5	-12.8
715.52	23.90	34.36	QP	V	46.0	-11.6

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 22LMS003_FCC15B

February 17, 2022

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 6. TEST INSTRUMENTS & MEASUREMENT UNCERTAINTY (k=2, 95% CONFIDENCE LEVEL)

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

6.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
EMI Receiver	Rohde & Schwarz	ESU40	100037	20Hz–40 GHz	01 Sep 2022
Preamplifier	Com-Power	PAM-118A	551052	500MHz-18GHz	11 Sep 2022
Biconilog Antenna	EMCO	3142C	00034792	26-2000MHz	16 May 2022
Horn Antenna	ETS	3115	5955	1-18GHz	12 Oct 2022

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.15	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.30	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.14	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.29	± 5.2

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured (dB)	Limit (dB)
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.52	Under consideration
U	Expanded uncertainty U: $U = 2u_c(y)$	± 3.04	Under consideration

ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: 22LMS003_FCC15B

February 17, 2022

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)