

Test Report

Product	Wireless Communication Device
Name and address of the applicant	Sonitor Technologies AS Drammensveien 288, N-0283 Oslo , Norway
Name and address of the manufacturer	Sonitor Technologies AS Drammensveien 288, N-0283 Oslo , Norway
Model	HHM-A001
Rating	6.0 VDC, (4x1.5 VDC secondary Batteries)
Trademark	Sonitor Technologies AS
Serial number	See page 3
Additional information	LF transmitter 125 kHz
Tested according to	FCC Part 15.209 Low Power Device Industry Canada RSS-210, Issue 10 Low Power Licence-Exempt Radio Apparatus, Category I Equipment
Order number	457218
Tested in period	2022-02-07 - 2022-02-15
Issue date	2022-03-01
Name and address of the testing laboratory	Nemko Scandinavia AS Instituttveien 6 2007 Kjeller Norway  
An accredited technical test executed under the Norwegian accreditation scheme	
	
Prepared by [G.Suhanthakumar]	Approved by [Frode Sveinsen]
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1 INFORMATION

1.1 Test Item

Name	SenseClean™ Hand Hygiene Module
FCC ID	2AD7T21122013101
ISED ID	20330-21122013101
Model/version	HHM-A001
Serial number	0004042
Hardware identity and/or version	V1.5
Software identity and/or version	nemkotest2022
Frequency Range	123 - 127 kHz
Operating frequency	125 kHz
Type of Modulation	OOK
Output Power	0.00045 mW (PK) 0.0000046 mW (AV) (EIRP, calculated using formula from KDB 412172)
User Frequency Adjustment	None
Type of Power Supply	6.0 VDC, (4x1.5 VDC secondary batteries)
Antenna Connector	No (integral loop antenna)
Antenna Diversity Supported	No

Description of Test Item

The EUT is an IEEE 802.15.4 based Zigbee radio and 125 kHz LF radio. The EUT does not transmit simultaneously. This report only covers for LF part.

This device will be installed in dispenser.

1.2 Normal test conditions

Temperature: 20 - 23 °C
Relative humidity: 40 - 50 %
Normal test voltage: 6.0 VDC

The values are the limit registered during the test period.

1.3 Test Engineer

G. Suhanthakumar

1.4 Test Equipment

See list of test equipment in clause 5.

1.5 Antenna Requirement

Is the antenna detachable? Yes No

If detachable, is the antenna connector non-standard? Yes No

Type of antenna connector: N/A

Ref. FCC §15.203

1.6 Worst-Case Configuration and Mode

Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

1.7 Comments

All measurements were done with the EUT powered by a fully charged battery.

All ports were populated during spurious emission measurements.



2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.209 and ISED Canada RSS-210 Issue 10 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3 m and 10 m.

A description of the test facility is on file with the FCC and Industry Canada.

<input checked="" type="checkbox"/> New Submission	<input checked="" type="checkbox"/> Production Unit
<input type="checkbox"/> Class II Permissive Change	<input type="checkbox"/> Pre-production Unit
DCD Equipment Code	<input type="checkbox"/> Family Listing



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 10 RSS-Gen Issue 5 ICES-003 Issue 7 reference	ANSI C63.10-2013 reference	Result
Power Line Conducted Emission	15.107(a) 15.207(a)	3.2 (ICES-003) 8.8 (RSS-GEN)	7.3 (C63.4-2014) 6.2	N/A ¹
Spurious Emissions (Radiated)	15.31 15.33 15.35 15.205 15.209(a)(d)	7.1, 7.2, 7.3 8.9, 8.10 (RSS-GEN)	6.3, 6.4	Complies

¹ The tested equipment only operates with battery

3 TEST RESULTS

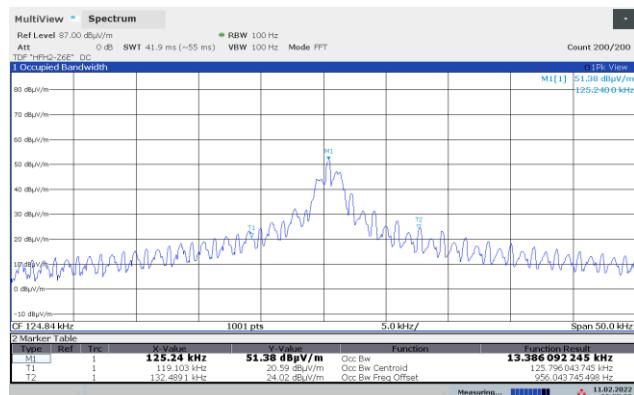
3.1 99 % Occupied Bandwidth

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement Data:

Measured 99 % Bandwidth (kHz)	
125 kHz	
13.39	

Requirements: No requirements.



99 % BW at 125 kHz

3.2 Radiated Emissions, 9 kHz – 30 MHz

FCC Parts 15.31, 15.33, 15.35, 15.209 (a) (d)

ISED Canada RSS-GEN 8.9, 8.10

Test Results: Complies

Measurement Data:

Radiated emissions 9kHz - 30 MHz.

Detector: Peak

Measuring distance 10 m

Measured Frequency kHz	Carrier Frequency kHz	Measured Field Strength @10m dB μ V/m	Detector	Duty cycle correction dB	Calculated AV Value dB μ V/m	Limit @10m dB μ V/m	Margin dB
125	125	51.35	PK	20	31.35	84.33	52.98

Duty Cycle Correction Factor Calculation:

Manufacturer stated duty cycle: 5.6 % (4x70ms each 5s)

Duty Cycle Correction factor = $-20 \times \log 0.056 = -45 \text{ dB}$

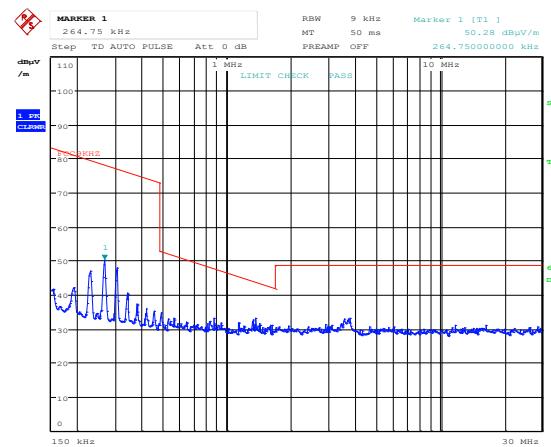
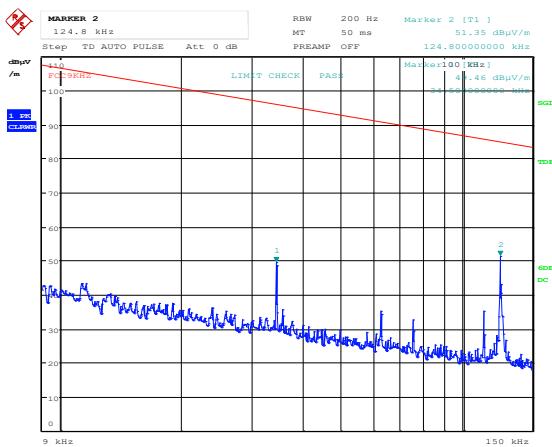
Maximum allowed Duty Cycle Correction: 20 dB

Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

The limit line in the graph is corrected for 10 m distance.

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer “Transducer factor”.

See attached graphs.



Date: 7.FEB.2022 15:58:11

Peak detector, 125 kHz, 9 kHz – 150 kHz @10 m
(34.5 KHz is not from the EUT, it is part of the test setup)

Date: 7.FEB.2022 15:53:17

Peak detector, 125 kHz, 150 kHz -30 MHz @10 m

3.3 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED Canada (MHz)	FCC (GHz)	ISED Canada (GHz)
0.090-0.110		0.96-1.24 1.3-1.427	0.96-1.427
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		2.69-2.9	2.655-2.9
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		3.6-4.4	3.5-4.4
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 123-138	108-138	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.4 Radiated Emissions, 30 – 1000 MHz

FCC Part 15.209

ISED Canada RSS-GEN Issue 5, Clause 8.9

Measurement Result: Complies with Class B Limits

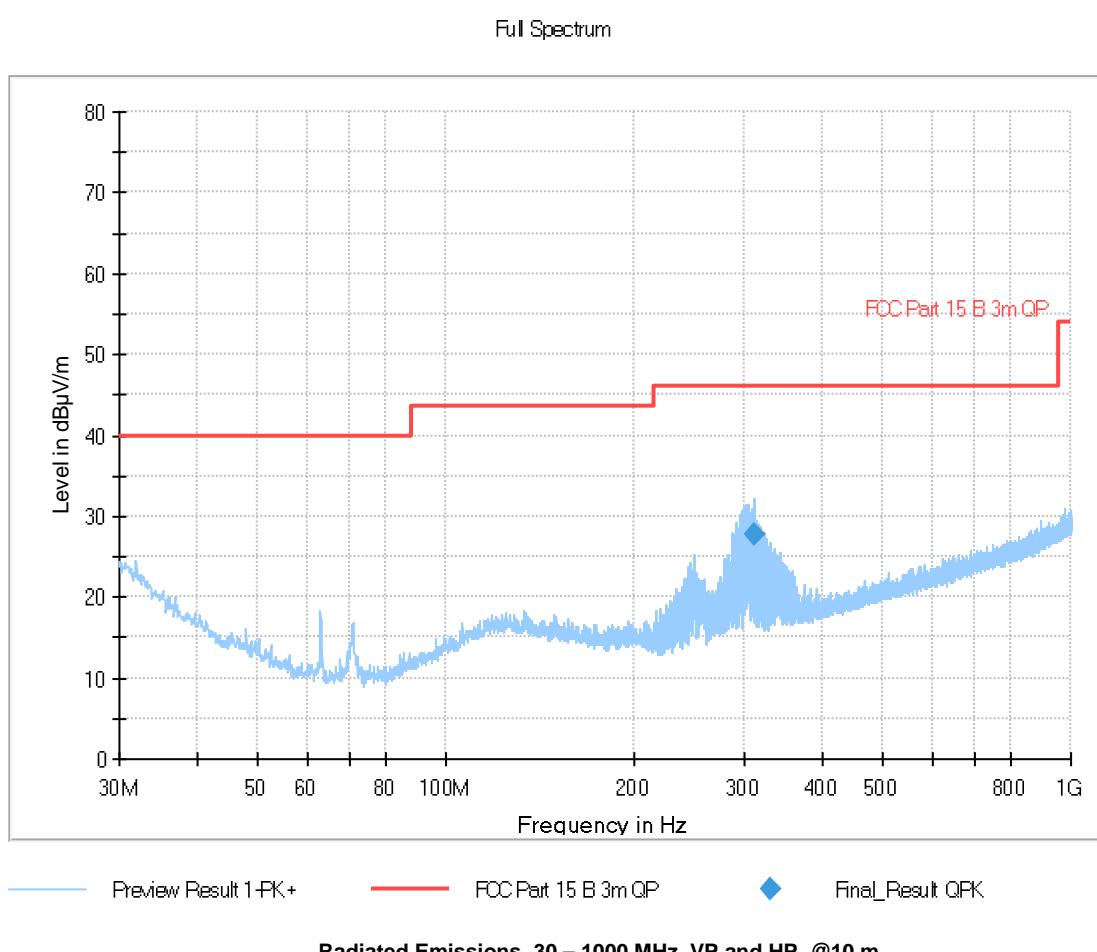
Detector: Peak

Measuring distance at 3 m.

All values are below the limit even when measured with Peak Detector.

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer “Transducer factor”.

See attached graphs.



Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
311.133350	27.82	46.00	18.18	1000.0	120.000	117.0	H	92.0

3.5 Radiated Emissions, 1-12 GHz

FCC Part 15.209

ISED Canada RSS-GEN Issue 5, Clause 8.9

1-12 GHz measured at 3 m

All values are below the average limit even when measured with Peak Detector

Peak detector

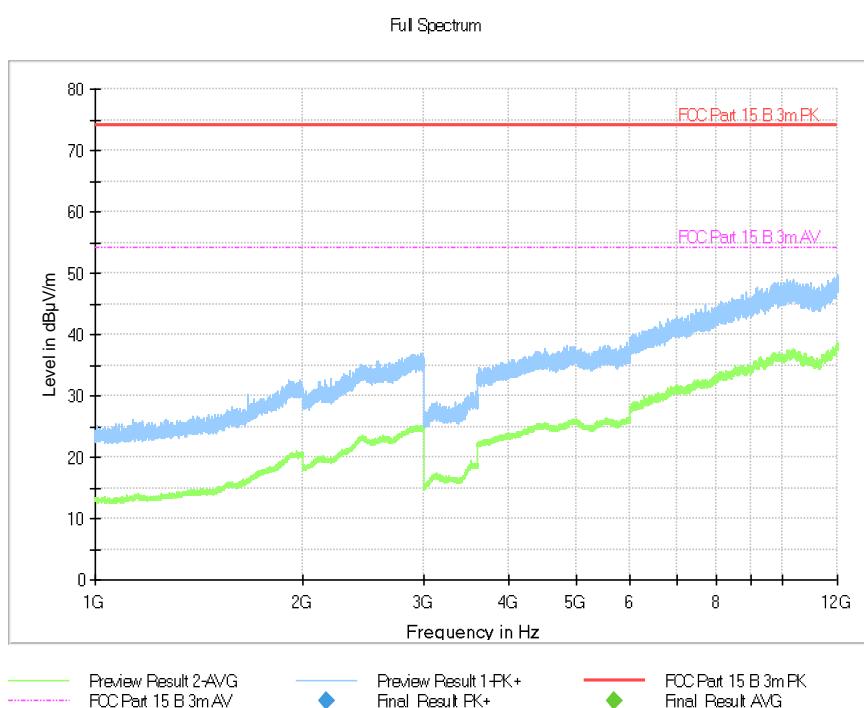
Frequency GHz	Field Strength @3m dB μ V/m	Detector	Limit dB μ V/m	Margin dB
/	/	Pk	74	/

Average detector

Frequency GHz	Field Strength @3m dB μ V/m	Detector	Limit dB μ V/m	Margin dB
/	/	Av	54	/

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer “Transducer factor”.

See attached plot.



Radiated Emissions, 1 – 12 GHz, VP/HP

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the test laboratory.

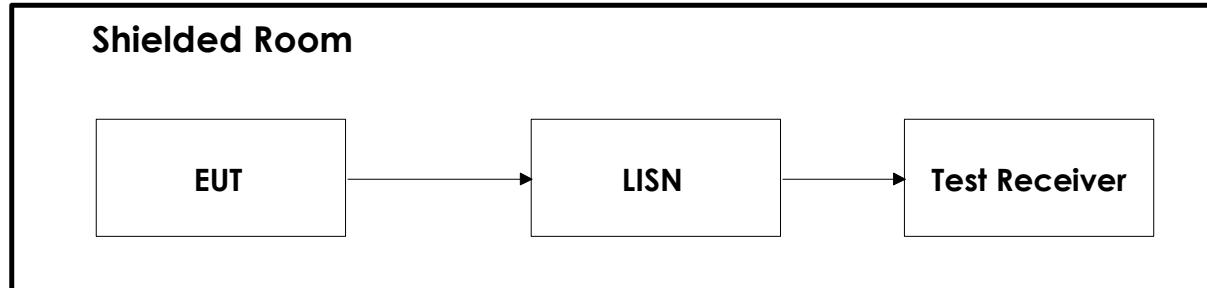
No.	Instrument/ ancillary	Type of instrument/ ancillary	Manufacturer	Ref. no.	Cal. Date	Cal. Due
1	ESU40	EMI Receiver	Rohde & Schwarz	LR1639	2022.01	2023.01
2	HFH2-Z2	Loop antenna	Rohde & Schwarz	LR1660	2022.02	2024.02
3	3117-PA	Antenna horn	ETS-Lindgren	LR 1717	2021.12	2022.12
4	JB3	Antenna Biog	Sunol Sciences Inc.	N-4525	2020.02	2024.02
5	310N	Pre-amplifier	Sonoma	LR 1686	2021.08	2022.08
6	Model 87 V	Multimeter	Fluke	LR 15999	2021.03	2023.03

Revision history

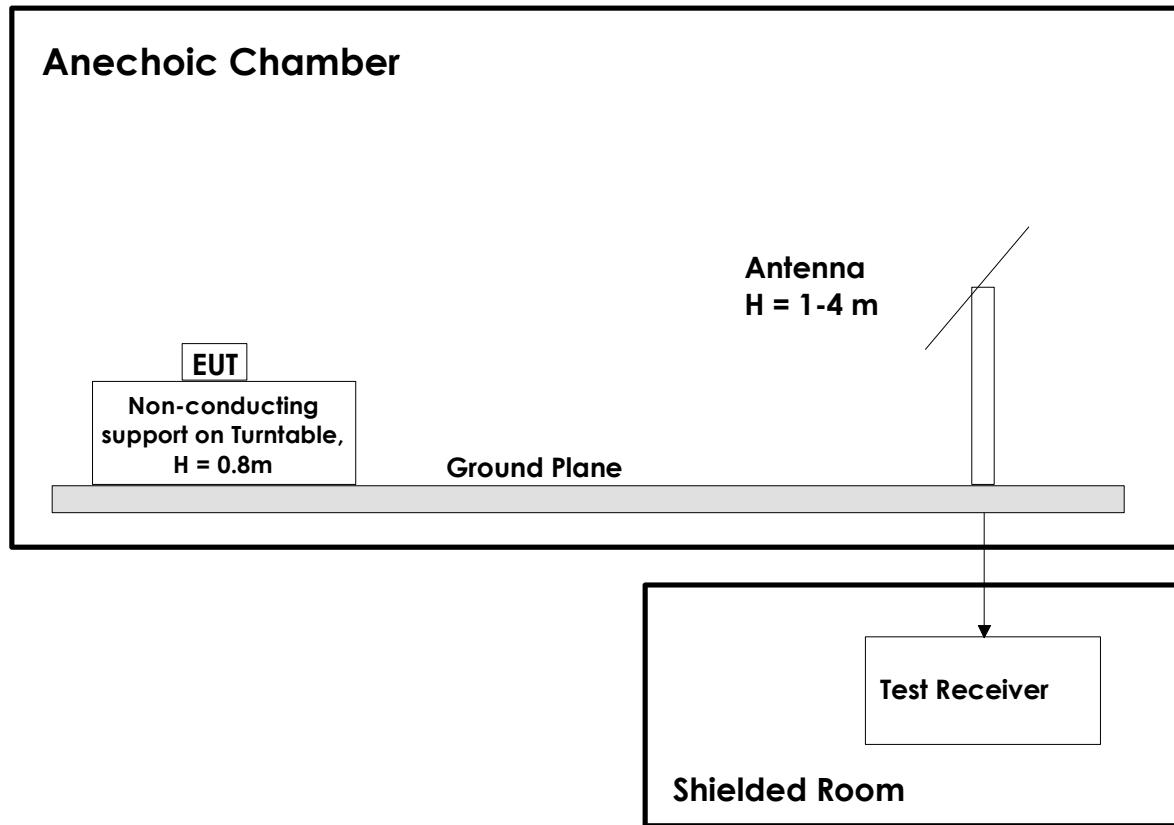
Revision	Date	Comment	Sign
00	2022-03-01	First version	gns

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests.

For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3 m or 1 m.

Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

A pre-amplifier is used for all measurements above 30 MHz.