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Test report

284093-3TRFWL

Date of issue: May 26, 2016

Applicant:

Mobysens Technologies Inc

Product:

SenseDoc 2.0

Model:

SD2R1

FCC ID:

2ADVPSD2R1

IC Registration number:

12615A-SD2R1

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.249

  Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz and 24.0–24.25 GHz

- RSS-210, Issue 8, December 2010, Annex 2.9

  Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz frequency bands for any application

Test location

Company name	Nemko Canada Inc.
Address	292 Labrosse Avenue
City	Pointe-Claire
Province	QC
Postal code	H9R 5L8
Country	Canada
Telephone	+1 514 694 2684
Facsimile	+1 514 694 3528
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: 722545; IC: 2040G-5 (3 m semi anechoic chamber)

Tested by	Yong Huang, EMC/Wireless Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Review date	May 26, 2016
Reviewer signature	

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Mobysens Technologies Inc
Address	2177 rue Masson Suite 414
City	Montreal
Province/State	Quebec
Postal/Zip code	H2H 1B1
Country	Canada

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.249	Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz and 24.0–24.25 GHz
RSS-210, Issue 8 Annex 2.9	Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz frequency bands for any application

1.3 Test methods

662911 D01 Multiple Transmitter Output v02r01 (October 31, 2013)	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.5 below. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

1.5 Exclusions

As per customer’s request, this report is for purpose of verification for colocation. Only harmonics and spurious radiated tests were performed, other tests were excluded from the scope of this report.

1.6 Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not tested
§15.31(e)	Variation of power source	Not tested
§15.203	Antenna requirement	Not tested[2]
§15.215(c)	20 dB bandwidth	Not tested

Notes: [1] Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed

[2] The Antennas are professional installed as per client.

2.2 FCC Part 15 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.249(a)	Radiated emissions not in restricted bands	Pass
§15.249(b)	Fixed Point-to-Point operation in the 24.0–24.25 GHz band	Not applicable
§15.249(d)	Spurious emissions (except harmonics)	Pass

2.3 IC RSS-210, Issue 8, test results

Part	Test description	Verdict
§A2.9(a)	Radiated emissions not in restricted bands	Pass
§A2.9(b)	Spurious emissions (except harmonics)	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	June 29, 2015
Nemko sample ID number	133-000154

3.2 EUT information

Product name	SenseDoc 2.0
Model	SD2R1
Serial number	SD2R1-00xxx

3.3 Technical information

Frequency band	2400–2483.5 MHz
Frequency range	2457 MHz (ANT+) and 2410–2475 MHz (OB)
Field strength of fundamental (average), Units @ 3 m[1]	38.60 dBµV/m (ANT+) and 38.26 dBµV/m (OB)
Channel bandwidth	1 MHz (ANT+) and 2 MHz (OB)
Type of modulation	GFSK
Emission classification (F1D, G1D, D1D)	F1D
Transmitter spurious, Units @ 3 m	15.8 dBµV/m (average @ 1649 MHz)
Power requirements	Internal rechargeable battery or via Power adapter 120 V_{AC} 60 Hz
Antenna information	Johanson Tech. p/n: 2450AT43A100E 0.5 dBi gain The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

Note 1: fundamental field strength results are from previous report 284093-1TRFWL.

3.4 Product description and theory of operation

The EUT is Safety Extra Low Voltage (SELV) device with rechargeable lithium battery that operates in 2.4 GHz band and using ANT+ and OB technology for communication. In addition EUT has Cell/PCS capabilities (not covered in this report)

3.5 EUT exercise details

EUT was powered by battery. EUT was set to transmit on low, mid and high channel for OB protocol application and GSM 850/1900 application. Simultaneously, as per ANT+ application the only frequency was set to transmit continuously.

3.6 EUT setup diagram

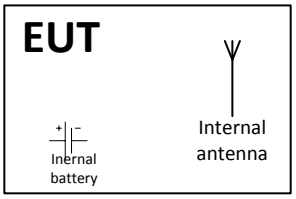


Figure 3.6-1: *Setup diagram*

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

As per customer's request, this report is for purpose of verification of collocation. Only radiated tests of harmonics and spurious were performed, other requirements were deemed to be covered by original approval of RF module.

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Section 7. Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
3 m EMI test chamber	TDK	SAC-3	FA002532	1 year	May. 25/16
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	April 7/16
50 Ω coax cable	C.C.A.	None	FA002603	—	VOU
50 Ω coax cable	C.C.A.	None	FA002605	—	VOU
50 Ω coax cable	C.C.A.	None	FA002607	—	VOU
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	Sept. 29/16
Horn antenna (1–18 GHz)	EMCO	3115	FA001452	1 year	Sept. 29/16
Horn antenna (18–40 GHz)	EMCO	3116	FA002487	2 year	July 9/16
Pre-amplifier (0.5–18 GHz)	COM-POWER	PAM-118A	FA002561	1 year	May 6/16
Pre-amplifier (18–40 GHz)	COM-POWER	PAM-840	FA002508	1 year	May 6/16
Notch Filter (2.3–2.58GHz)	Microwave Circuits	N0324413	FA002693	—	VOU
High Pass Filter (> 1100 MHz)	Microwave Circuits	H1G212G1	FA002689	—	VOU

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 15.249(d) RSS 210 A2.9(b) Spurious emissions (except for harmonics)

8.1.1 Definitions and limits

FCC:
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

IC:
Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Table 8.1-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

Frequency, MHz	Field strength of emissions		Measurement distance, m
	µV/m	dBµV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

Table 8.1-2: *IC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677-5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

Note: Certain frequency bands listed in this table and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

Table 8.1-3: *FCC restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

8.1.2 Test summary

Test date	May 5, 2016	Temperature	24.6 °C
Test engineer	Yong Huang	Air pressure	1028.3 mbar
Verdict	Pass	Relative humidity	33.8 %

8.1.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
EUT was set to transmit continuously.
Radiated measurements were performed at a distance of 3 m. Configurations of high/mid/low channels on GSM850/1900 module were investigated, the worst case were presented.

Spectrum analyzer settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Average radiated measurements within restricted bands were calculated with duty cycle correction factor.

8.1.4 Test data

Table 8.1-4: *Radiated field strength measurement results for band-edge spurious in restricted bands, GSM850 @ ch128*

OB protocol Channel[1]	Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	Average Field strength, dBµV/m		Margin, dB
		Measured	Limit		Calculated[2]	Limit	
Low	2390	52.3	74	21.7	-2.0	54	56.0
Low	2483.5	58.3	74	15.7	4.0	54	50.0
High	2390	56.12	74	17.88	1.9	54	52.1
High	2483.5	55.06	74	18.94	0.8	54	53.2

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

Note 1: OB protocol channel setting: low channel at 2410 MHz; mid channel at 2440 MHz; high channel at 2475 MHz. While ANT+ protocol was transmitting continuously at 2457MHz.

Note 2: Calculated Average result was calculated as follows: Peak Field strength + $DCCF_{ANT+}$

As per report 284093-1 TRFWL, Duty cycle correction factor (DCCF) for OB protocol is −57.14 dB, Duty cycle correction factor (DCCF) for ANT+ protocol is -54.26dB, therefore worst case as -54.26 dB is used in calculation here

Table 8.1-5: *Radiated field strength measurement results for other spurious, GSM850 @ ch128*

Channel[1]	Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	Average Field strength, dBµV/m		Margin, dB
		Measured	Limit		Calculated[2]	Limit	
Low	1648	68.1	--	--	13.9	--	--
Low	3297	60.0	--	--	5.8	--	--
Low	4215	60.0	74.0	14.0	5.8	54.0	48.2
Low	5770	57.0	--	--	2.8	--	--
Mid	1648	68.0	--	--	13.8	--	--
Mid	3297	57.5	--	--	3.3	--	--
Mid	4122	60.0	74.0	14.0	5.8	54.0	48.2
Mid	5354	57.3	74.0	16.0	3.1	54.0	50.9
Mid	5770	58.0	--	--	3.8	--	--
High	1649	70.0	--	--	15.8	--	--
High	3297	61.2	--	--	7.0	--	--
High	4122	61.3	74.0	12.7	7.1	54.0	46.9
High	5770	58.3	--	--	4.1	--	--

Note: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

Note 1: OB protocol channel setting: low channel at 2410 MHz; mid channel at 2440 MHz; high channel at 2475 MHz. While ANT+ protocol was transmitting continuously at 2457MHz.

Note 2: Calculated Average result was calculated as follows: Peak Field strength + $DCCF_{ANT+}$

As per report 284093-1 TRFWL, Duty cycle correction factor (DCCF) for OB protocol is −57.14 dB, Duty cycle correction factor (DCCF) for ANT+ protocol is -54.26dB, therefore worst case as -54.26 dB is used in calculation here

8.1.1 Test data, continued

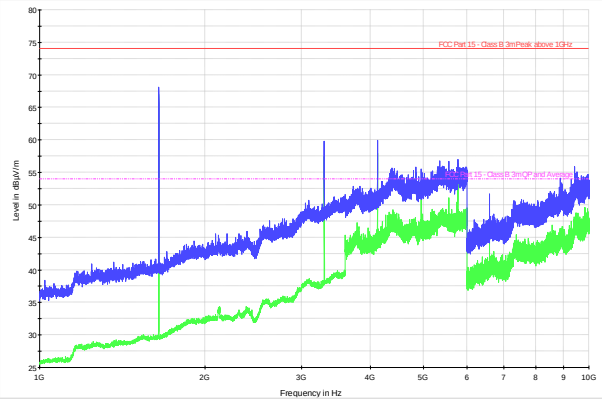


Figure 8.1-1: *Radiated spurious emissions,*

OB protocol @ low channel / GSM850@ ch128

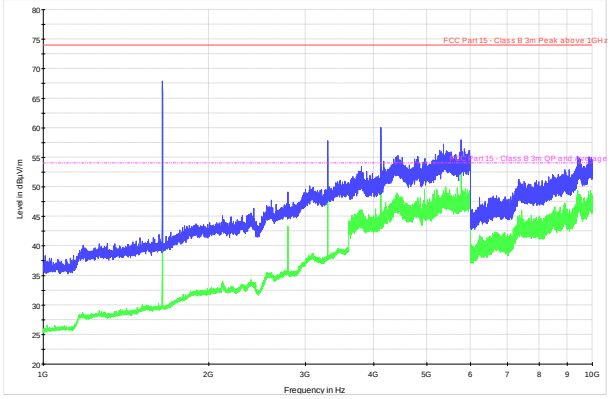


Figure 8.1-2: *Radiated spurious emissions,*

OB protocol @ mid channel / GSM850@ ch128

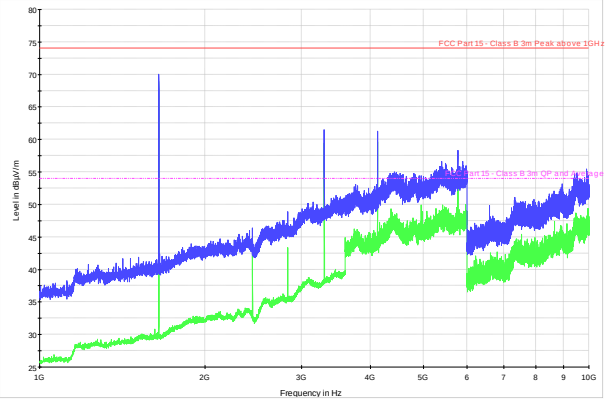


Figure 8.1-3: *Radiated spurious emissions, hi channel*

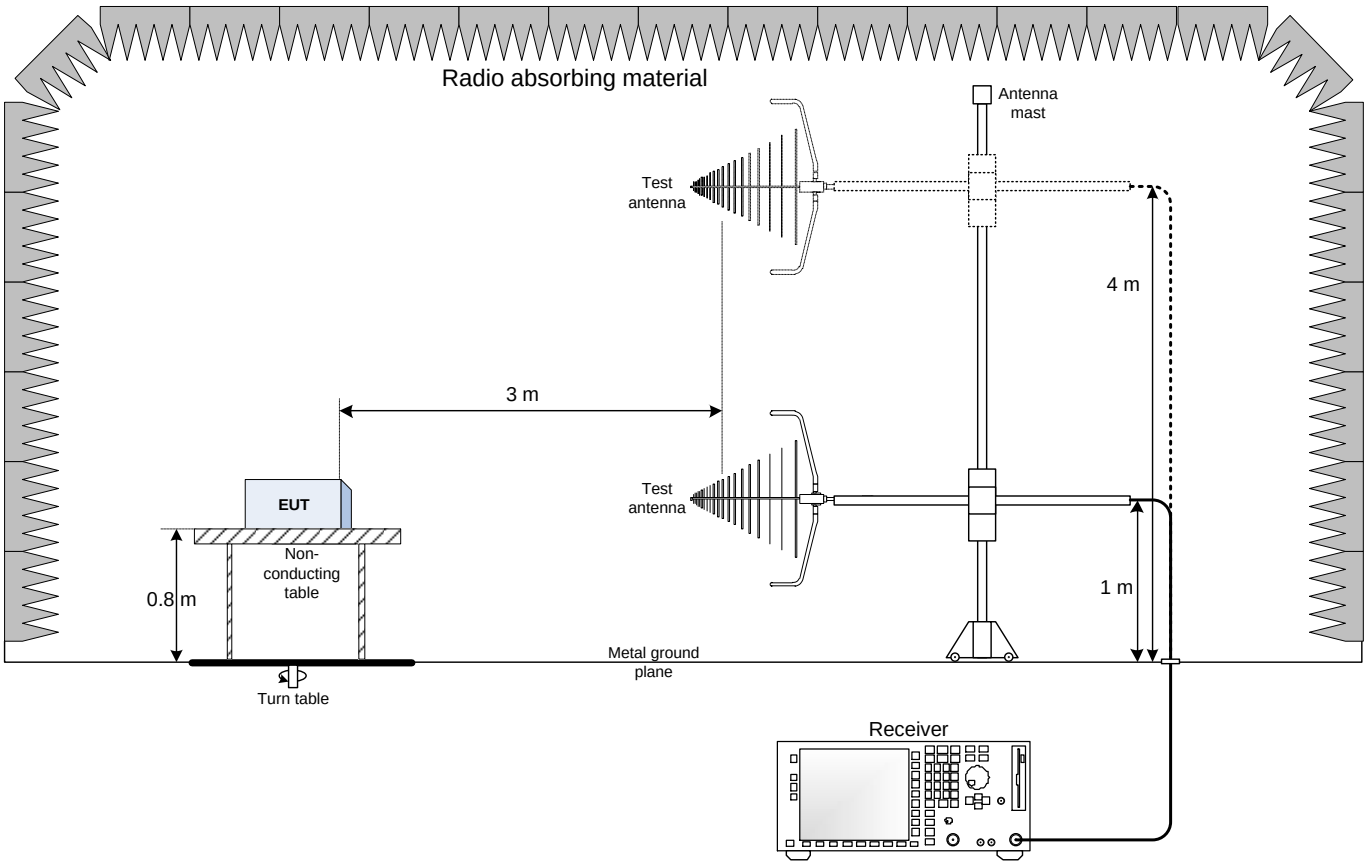
OB protocol @ high channel / GSM850@ ch128

Note: *Configurations of high/mid/low channels on GSM850 RF module were investigated, only the worst case was presented.*

Note: OB protocol channel setting: low channel at 2410 MHz; mid channel at 2440 MHz; high channel at 2475 MHz. While ANT+ protocol was transmitting continuously at 2457MHz.

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz