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Test report

314858-1TRFWL

Date of issue: October 3, 2016

Applicant:

StepsCount Inc.

Product:

PiezoRX™ Health System

Model:

Piezo

IC Registration number:

21864-PIEZO

FCC ID number:

2AK3D-PIEZO

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.247

  Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

- RSS-247, Issue 1, May 2015, Section 5

  Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test location

Company name	Nemko Canada Inc.
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City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: 176392; IC: 2040A-4 (3 m semi anechoic chamber)

Tested by	David Duchesne, Senior EMC/Wireless Specialist
Reviewed by	Kevin Rose, Wireless/EMC Specialist
Review date	October 3, 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

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	StepsCount Inc.
Address	PO Box 430, Deep River, ON, Canada, K0J 1P0

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725-5850 MHz.
RSS-247, Issue 1, May 2015, Section 5	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

558074 D01 DTS Meas Guidance v03 r05 (April 8, 2016)	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247
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 completed against all relevant requirements of the test standard. 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

None

1.6 Test report revision history

Table 1.6-1: *Test report revision history*

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

Notes: None

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Table 2.1-1: *FCC part 15 Subpart C test results*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable [1]
§15.31(e)	Variation of power source	Pass [2]
§15.203	Antenna requirement	Pass [3]

Notes: [1] The EUT is battery powered
[2] Equipment was tested with new battery.
[3] The antenna is located within the enclosure of EUT and not user accessible.

2.2 FCC Part 15 Subpart C, intentional radiators test results

Table 2.2-1: *FCC part 15 Subpart C, §15.247 test results*

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

Notes: None

2.3 IC RSS-GEN, Issue 4, test results

Table 2.3-1: *RSS GEN test results*

Part	Test description	Verdict
7.1.2	Receiver radiated emission limits	Not applicable [1]
7.1.3	Receiver conducted emission limits	Not applicable [1]
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not applicable [2]

Notes: [1] According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.
[2] The EUT is battery powered.

2.4 IC RSS-247, Issue 1, test results

Table 2.4-1: *RSS 247 test results*

Part	Test description	Verdict
5.1	Frequency Hopping Systems (FHSs)	
5.1 (1)	Bandwidth of a frequency hopping channel	Not applicable
5.1 (2)	Minimum channel spacing for frequency hopping systems	Not applicable
5.1 (3)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
5.1 (4)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.1 (5)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
5.2	Digital Transmission Systems (DTSs)	
5.2 (1)	Minimum 6 dB bandwidth	Pass
5.2 (2)	Maximum power spectral density	Pass
5.3	Hybrid Systems	
5.3 (1)	Digital modulation turned off	Not applicable
5.3 (2)	Frequency hopping turned off	Not applicable
5.4	Transmitter output power and e.i.r.p. requirements	
5.4 (1)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
5.4 (2)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.4 (3)	Frequency hopping systems operating in the 5725–5850 MHz	Not applicable
5.4 (4)	Systems employing digital modulation techniques	Pass
5.4 (5)	Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable
5.4 (6)	Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams	Not applicable
5.5	Out-of-band emissions	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	August 11, 2016
Nemko sample ID number	133002688

3.2 EUT information

Product name	PiezoRX™ Health System
Model	Piezo
Serial number	None (Pre-production)

3.3 Technical information

Applicant IC company number	21864
IC UPN number	21864-PIEZO
All used IC test site(s) Reg. number	2040A-4
RSS number and Issue number	RSS-247 Issue 1, May 2015
Frequency band	2400–2483.5 MHz
Frequency Min (MHz)	2402
Frequency Max (MHz)	2480
RF power (W), Conducted	N/A
Field strength, Units @ distance	90.2 dBµV/m Peak @ 3 m @ 2440 MHz
Measured BW (kHz) (6 dB for BLE)	654
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	GFSK
Emission classification (F1D, G1D, D1D)	F1D
Transmitter spurious, Units @ distance	55.5 dBµV/m Peak and 40.8 dBµV/m Average @ 3 m @ 2483.5 MHz
Power requirements	3 V_{DC} (Battery)
Antenna information	The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator. PCB antenna peak gain -2.4 dBi The antennas are a proprietary design by Audix and are integrated into the printed circuit board.

3.4 Product description and theory of operation

The EUT is Bluetooth-equipped pedometer. The EUT allows users to upload data collected by the pedometer to our logyoursteps.ca website, where the information is saved in a database. This upload process uses Bluetooth transmission to an intermediary app that runs on MacOSX, iOS, or Android devices that are Bluetooth-equipped. The intermediary app also has an admin mode that will allow the user to modify various pedometer settings that are unrelated to the Bluetooth capability.

3.5 EUT exercise details

The EUT was set for continuous transmission.

3.6 EUT 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

Two model variants of the EUT "PiezoRxD and PiezoKD" are available. The RxD (configured for use by adults) and the KD (configured for use by children) are identical in every respect except for color and in the use of slightly different calibration settings and thresholds in the step sensor/algorithms (adult vs. child step impact for example). Model PiezoRxD was tested as a representative sample to demonstrate compliance both models.

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

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	FA002047	1 year	Dec. 01/16
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	Jan. 07/17
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	Apr. 15/17
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Apr. 28/17
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Apr. 26/17
Horn antenna 18–40 GHz	EMCO	3116	FA001847	1 year	Apr.15/17
Pre-amplifier (1–18 GHz)	JCA	JCA118-503	FA002091	1 year	April 26/17
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Notch filter 2400–2483 MHz	Microwave Circuits	2400–2483 MHz	FA001940	—	VOU

Notes: VOU - verify on use

Table 7.1-2: *test software*

Test description	Manufacturer of Software	Details
Radiated emissions – Ottawa	Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 9.26.01

Notes: None

Section 8. Testing data

8.1 FCC 15.247(a)(2) and RSS-247 5.2(1): 6 dB bandwidth (DTS-BLE)

8.1.1 Definitions and limits

FCC §15.247 (a)(2):

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS-247, Clause 5.2 (1):

The minimum 6 dB bandwidth shall be 500 kHz.

8.1.2 Test summary

Verdict	Pass				
Test date	August 11, 2016	Test engineer	David Duchesne		
Temperature	23.4 °C	Relative humidity	60.8 %	Air pressure	1004 mbar

8.1.3 Notes

Measurements were performed as per 558074 D01 DTS Meas Guidance v03r05 (The test was performed using method described in Section 8.1)

8.1.4 Setup details

Spectrum analyser settings: for 6 dB bandwidth test:

Resolution bandwidth	100 kHz
Video bandwidth	≥3 × RBW
Frequency span	2 MHz
Detector mode	Peak
Trace mode	Max Hold

8.1.5 Test data

Table 8.1-1: *6 dB bandwidth results*

Frequency, MHz	6 dB bandwidth, kHz	Minimum limit, kHz	Margin, kHz
2402	648.0	500.0	148.0
2440	654.4	500.0	154.4
2480	649.6	500.0	149.6

Notes: None

8.1.6 Test data, continued

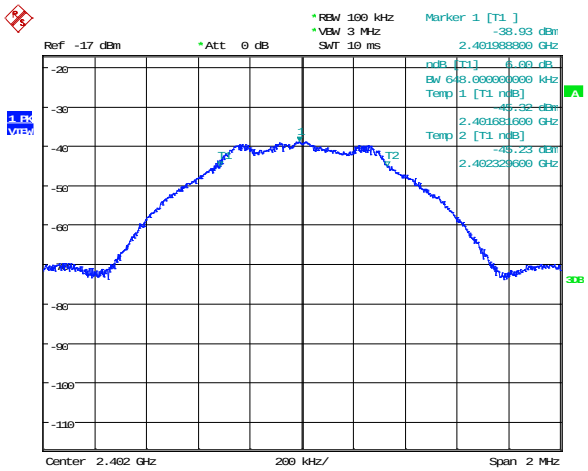


Figure 8.1-1: *6 dB bandwidth on low channel*

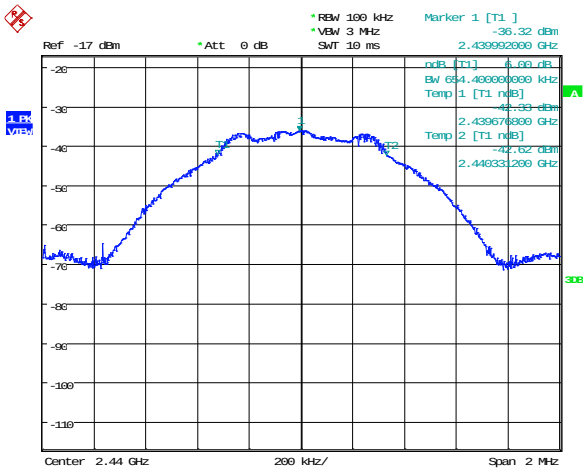


Figure 8.1-2: *6 dB bandwidth on mid channel*

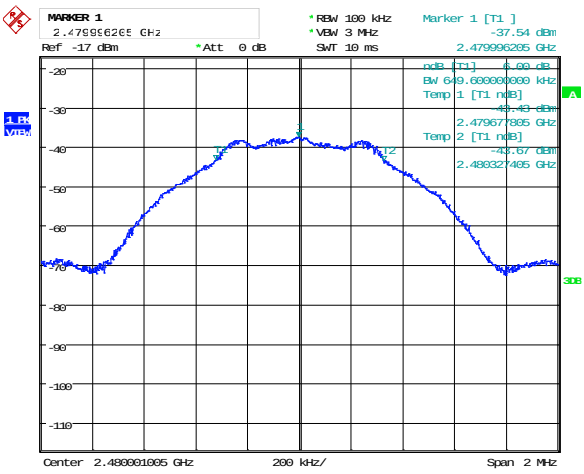


Figure 8.1-3: *6 dB bandwidth on high channel*

8.2 FCC 15.247(b) and RSS-247 5.4 (4) Transmitter output power and e.i.r.p. requirements

8.2.1 Definitions and limits

FCC §15.247 (b)(3,4):

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(3) For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 W (30 dBm). As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247, Clause 5.4 (4):

For DTSs employing digital modulation techniques operating in the bands 902–928 MHz and 2400–2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.
Fixed point-to-point systems in the bands 2400-2483.5 MHz and 5725-5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding an e.i.r.p. of 4 W.

8.2.2 Test summary

Verdict	Pass				
Test date	August 15, 2016	Test engineer	David Duchesne		
Temperature	22.9 °C	Relative humidity	65.7 %	Air pressure	1009 mbar

8.2.3 Notes

- The test was performed according to 558074 D01 DTS Meas Guidance v03r05 (The test was performed using method described in Section 9.1.1: Maximum peak conducted output power.)
- The radiated spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.
- The EUT was tested in three orthogonal positions to determine worst case emissions.

8.2.4 Setup details

Spectrum analyser settings:

Resolution bandwidth	1 MHz
Video bandwidth	≥3 × RBW
Frequency span	8 MHz
Detector mode	Peak
Trace mode	Max Hold

8.2.5 Test data

Table 8.2-1: *Output power measurements results*

Freq., MHz	Peak Field strength [1], dBµV/m	Conversion factor [2], dB	EIRP [3], dBm	EIRP limit, dBm	EIRP margin, dB	Antenna factor, dBi	Conducted output power [4], dBm	Conducted output power limit, dBm	Conducted output power margin, dB
2402	90.0	95.2	-5.2	36.0	41.2	-2.4	-2.8	30.0	32.8
2440	90.2	95.2	-5.0	36.0	41.0	-2.4	-2.6	30.0	32.6
2480	89.8	95.2	-5.4	36.0	41.4	-2.4	-3.0	30.0	33.0

Notes:
[1] Peak field strength (dBµV/m) = Spectrum analyzer value (dBµV) + transducer factors (dB)
Transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.
[2] Field strength to EIRP conversion factor.
[3] EIRP = Peak Field strength – Conversion factor
[4] Conducted output power = EIRP + Antenna factor

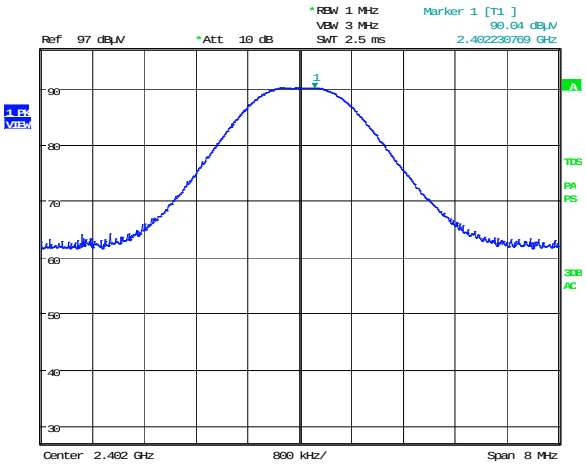


Figure 8.2-1: *Output power on low channel*

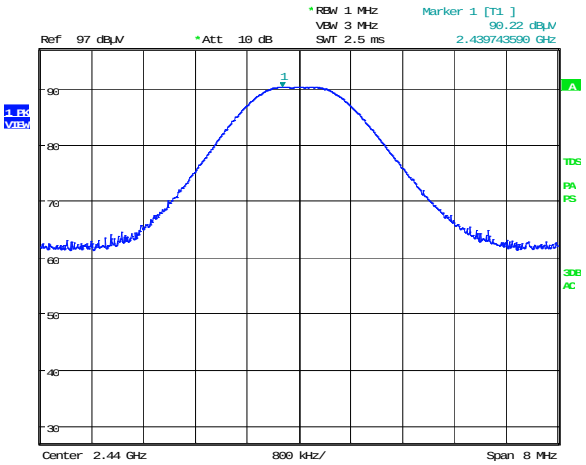


Figure 8.2-2: *Output power on mid channel*

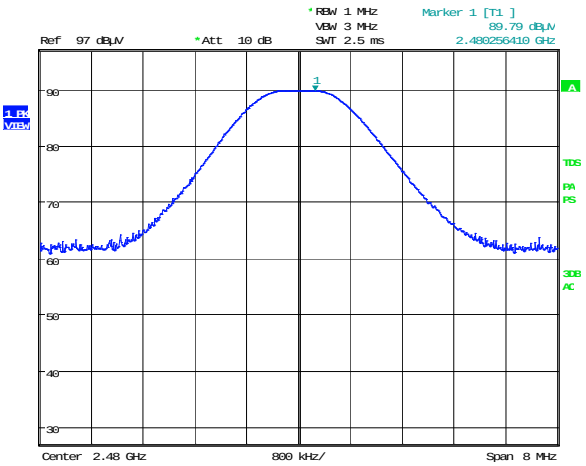


Figure 8.2-3: *Output power on high channel*

8.3 FCC 15.247(d) and RSS-247 5.5 Spurious (out-of-band) emissions

8.3.1 Definitions and limits

FCC §15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

RSS-247, Clause 5.5:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Table 8.3-1: *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 8.3-2: *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

Notes: 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 8.3-3: *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			

8.3.2 Test summary

Verdict	Pass				
Test date	August 15, 2016	Test engineer	David Duchesne		
Temperature	22.9 °C	Relative humidity	65.7 %	Air pressure	1009 mbar

8.3.3 Notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- Since fundamental power was tested using peak method, the spurious emissions limit is −20 dBc/100 kHz
- The radiated spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.
- The EUT was tested in three orthogonal positions to determine worst case emissions.

8.3.4 Setup details

Spectrum analyser settings for radiated measurements for spurious out of band emissions:

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

Spectrum analyser 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 analyser 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

8.3.5 Test data

Radiated spurious out of band emissions (−20 dBc/100 kHz)

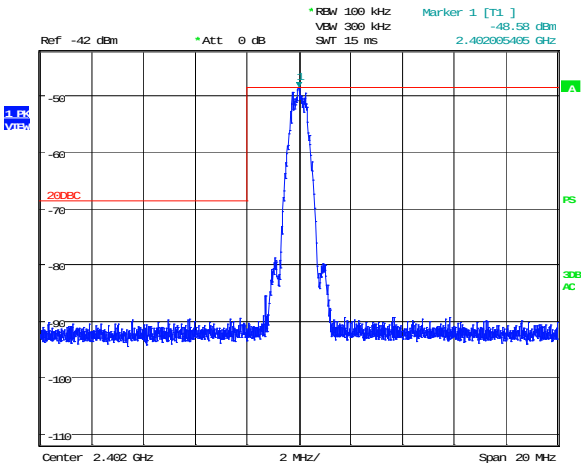


Figure 8.3-1: *Radiated spurious emissions Lower band edge emission, low channel*

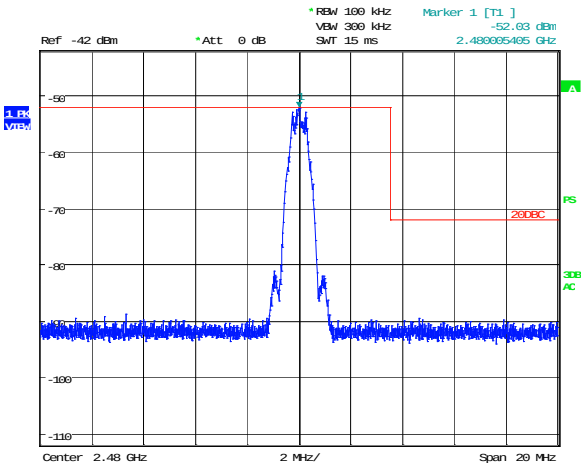


Figure 8.3-2: *Radiated spurious emissions Upper band edge emission, High channel*

8.3.5 Test data, continued

Radiated spurious out of band emissions (–20 dBc/100 kHz)

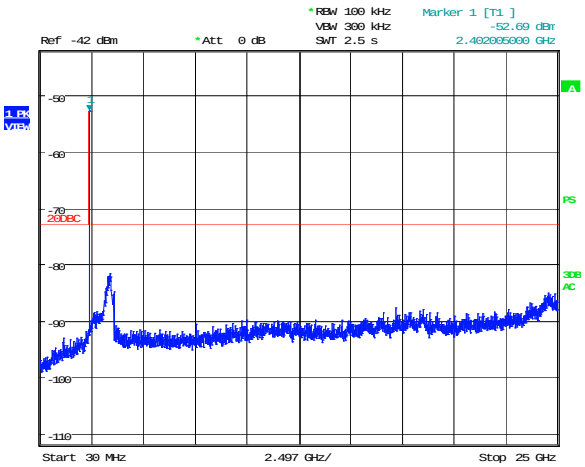


Figure 8.3-3: *Radiated spurious emissions, low channel, 30 MHz to 25 GHz*

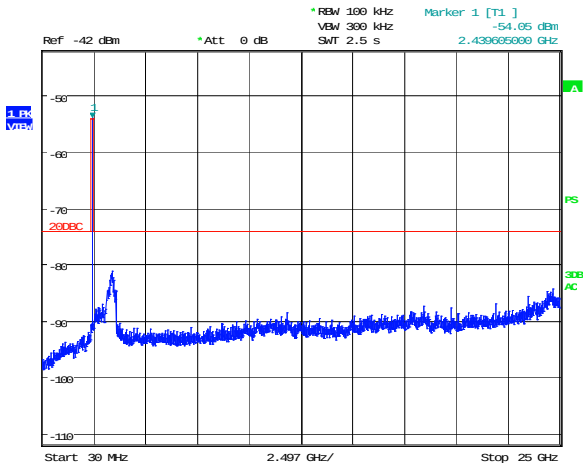


Figure 8.3-4: *Radiated spurious emissions, mid channel, 30 MHz to 25 GHz*

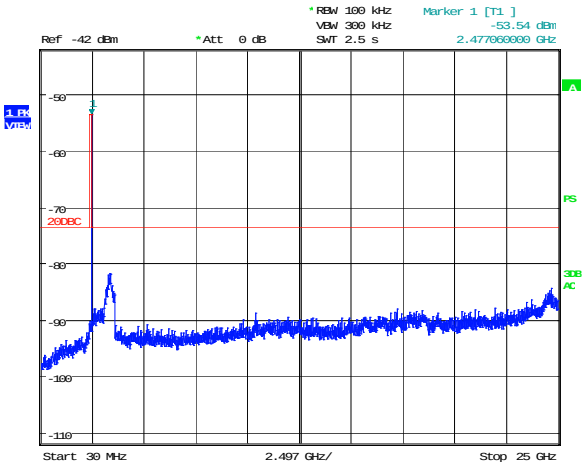


Figure 8.3-5: *Radiated spurious emissions, high channel, 30 MHz to 25 GHz*

8.3.6 Test data, continued

Duty Cycle

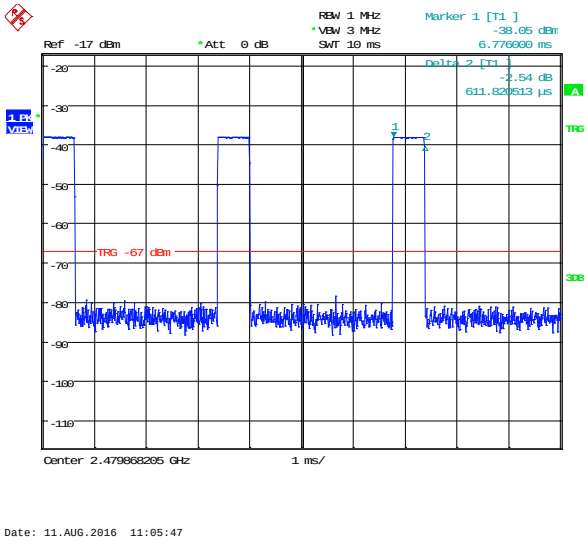


Figure 8.3-6: *Pulse width*

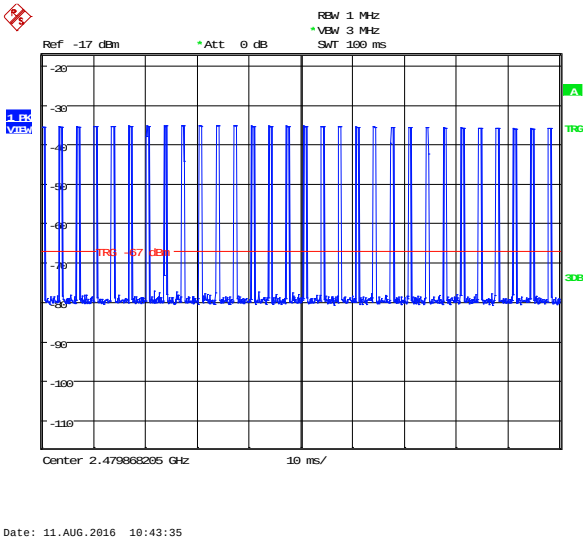


Figure 8.3-7: *Number of pulses within 100 ms time frame*

Duty Cycle Calculation:

Tx on Time: 0.612 ms × 30 (30 pulses within 100 ms time frame) = 18.36 ms

Duty cycle correction factor: $20 \times \text{Log}_{10}$ [(18.36) / 100] = −14.72 dB

8.3.5 Test data, continued

Table 8.3-4: *Radiated field strength measurement results*

Channel	Frequency, MHz	Peak Field strength, dBµV/m		Peak margin, dB	DCCF, dB	Average Field strength, dBµV/m		Margin, dB
		Measured	Limit			Calculated	Limit	
Low	2390	51.2	74.0	22.8	-14.7	36.5	54.0	17.5
Low	4804	44.4	74.0	29.6	-14.7	29.7	54.0	24.3
Mid	4880	46.2	74.0	27.8	-14.7	31.5	54.0	22.5
High	2483.5	55.5	74.0	18.5	-14.7	40.8	54.0	13.2
High	4960	47.1	74.0	26.9	-14.7	32.4	54.0	21.6

Notes: Field strength (dBµV/m) = Spectrum analyzer value (dBµV) + transducer factors (dB)
Transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.
Average field strength calculation was performed using the following formula: Average Field strength = Peak Field strength + Duty cycle correction factor

DCCF = −14.7 dB
All other emissions were greater than 20 dB form limit.

Radiated spurious out of band emissions within restricted bands

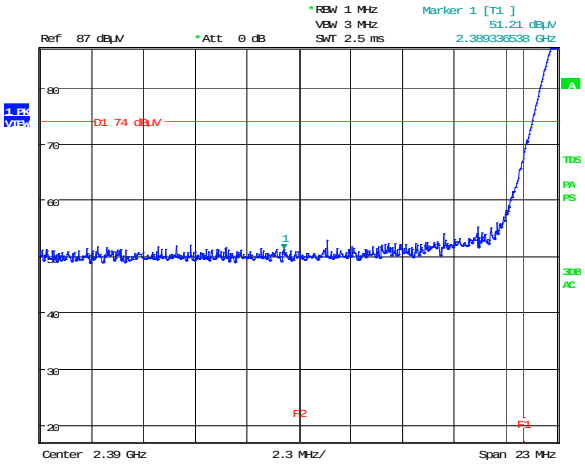


Figure 8.3-8: *Radiated spurious emissions Lower band edge emission, low channel. F2 = 2.39 GHz (end of restricted band), F1 = 2.4 GHz*

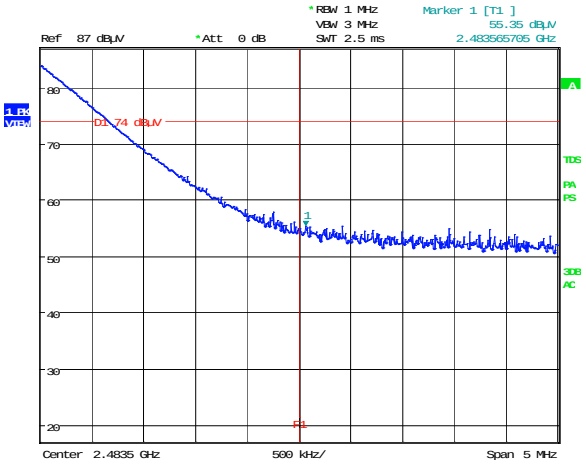


Figure 8.3-9: *Radiated spurious emissions Upper band edge emission, High channel. F1 = 2.4835 GHz (beginning of restricted band)*

8.3.5 Test data, continued

Radiated spurious out of band emissions within restricted bands

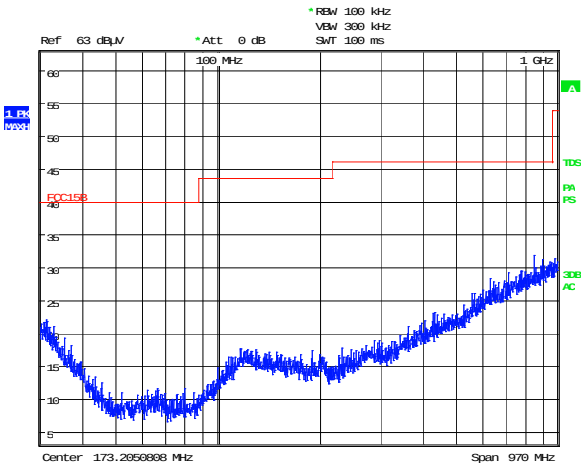


Figure 8.3-10: *Radiated spurious emissions, low channel, 30 to 1000 MHz*

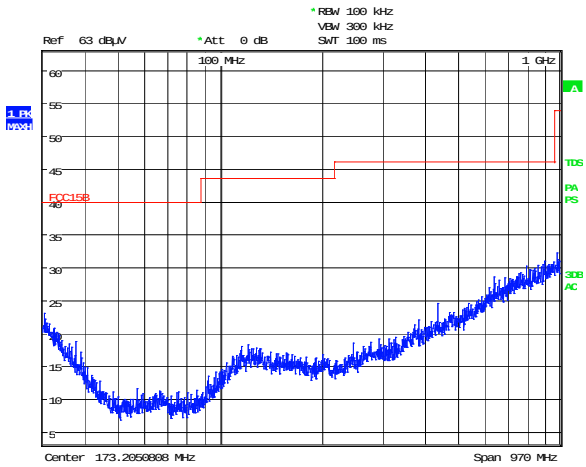


Figure 8.3-11: *Radiated spurious emissions, mid channel, 30 to 1000 MHz*

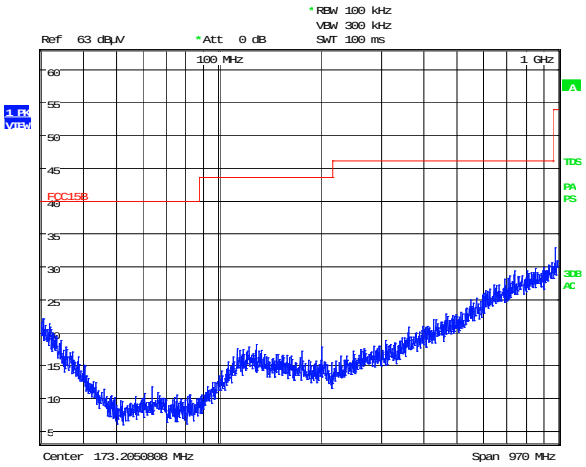


Figure 8.3-12: *Radiated spurious emissions, high channel, 30 to 1000 MHz*

8.3.5 Test data, continued

Radiated spurious out of band emissions within restricted bands

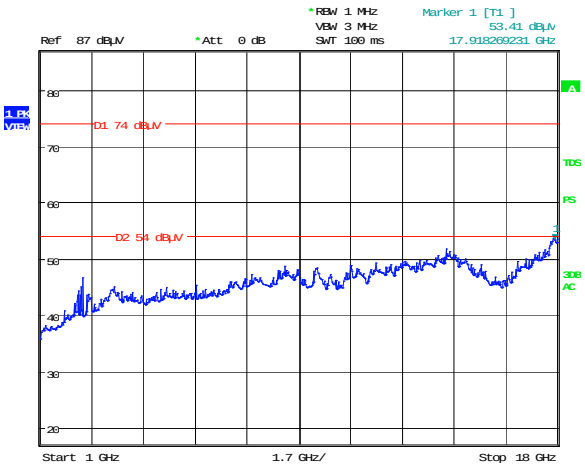


Figure 8.3-13: *Radiated spurious emissions, low channel, 1 to 18 GHz*

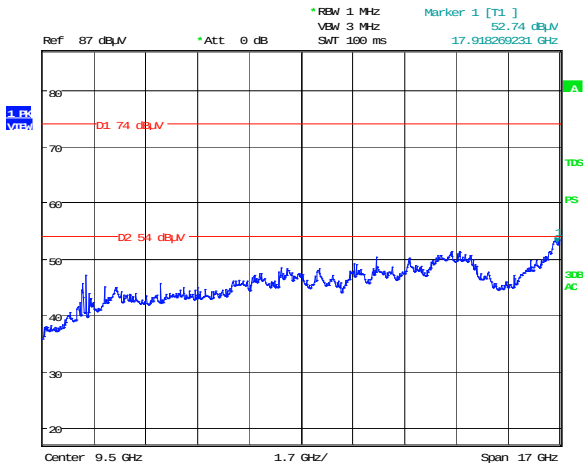


Figure 8.3-14: *Radiated spurious emissions, mid channel, 1 to 18 GHz*

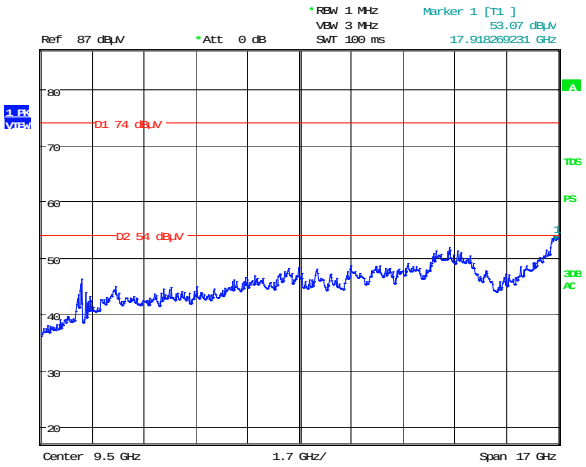


Figure 8.3-15: *Radiated spurious emissions, high channel, 1 to 18 GHz*

8.3.5 Test data, continued

Radiated spurious out of band emissions within restricted bands

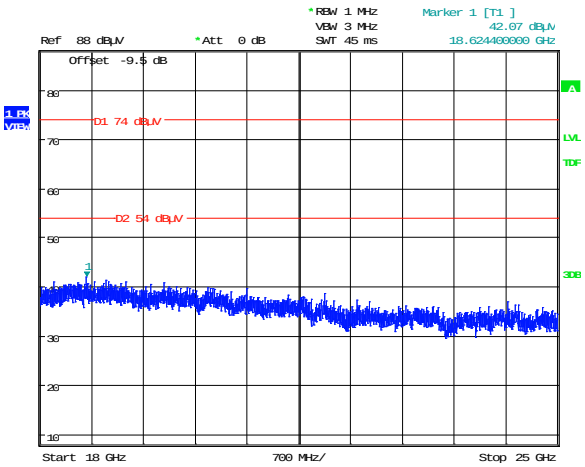


Figure 8.3-16: *Radiated spurious emissions for, low channel, 18 to 25 GHz*

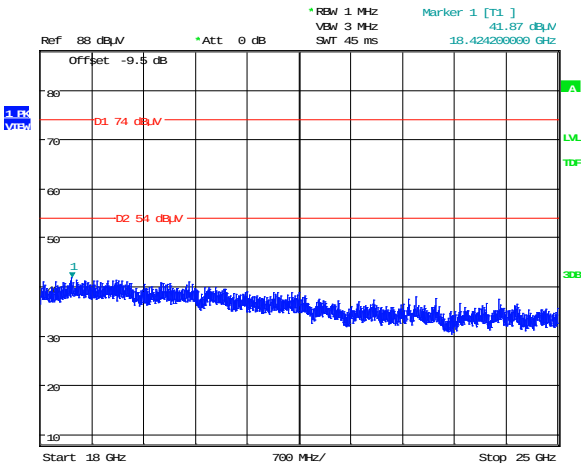


Figure 8.3-17: *Radiated spurious emissions for, mid channel, 18 to 25 GHz*

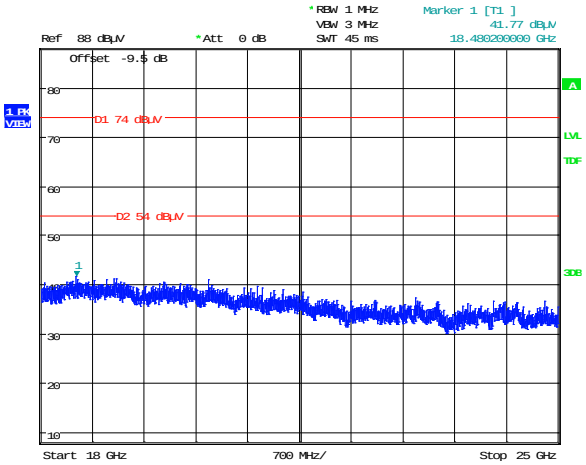


Figure 8.3-18: *Radiated spurious emissions, high channel, 18 to 25 GHz*

8.3.5 Test data, continued

Radiated spurious out of band emissions within restricted bands

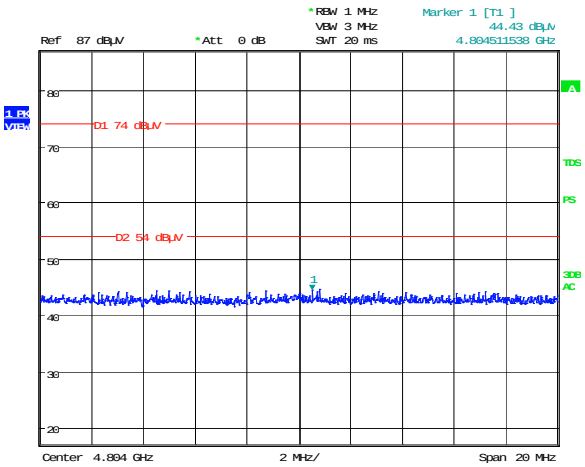


Figure 8.3-19: *2nd harmonic peak level, low channel*

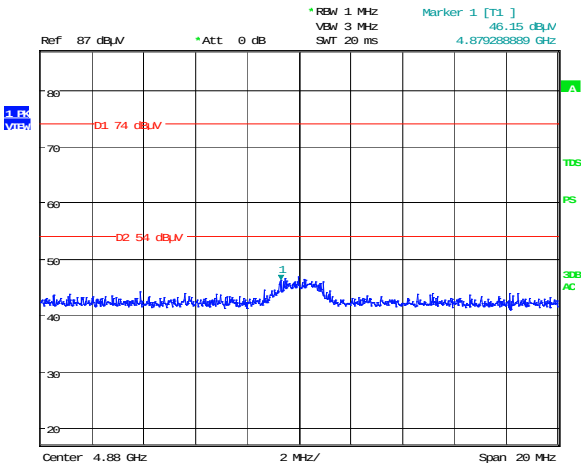


Figure 8.3-20: *2nd harmonic peak level, mid channel*

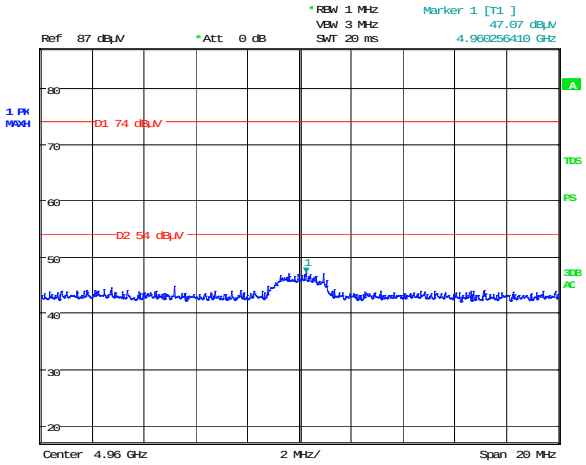


Figure 8.3-21: *2nd harmonic peak level, high channel*

8.3.6 Setup photos

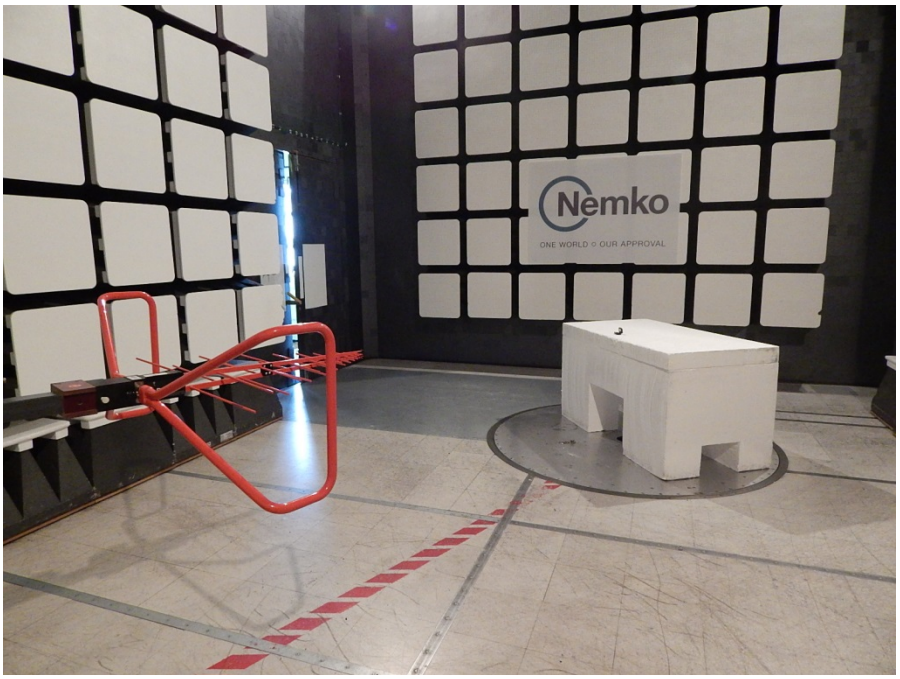


Figure 8.3-22: *Radiated spurious (out-of-band) emissions setup photo – 30 to 1000 MHz*

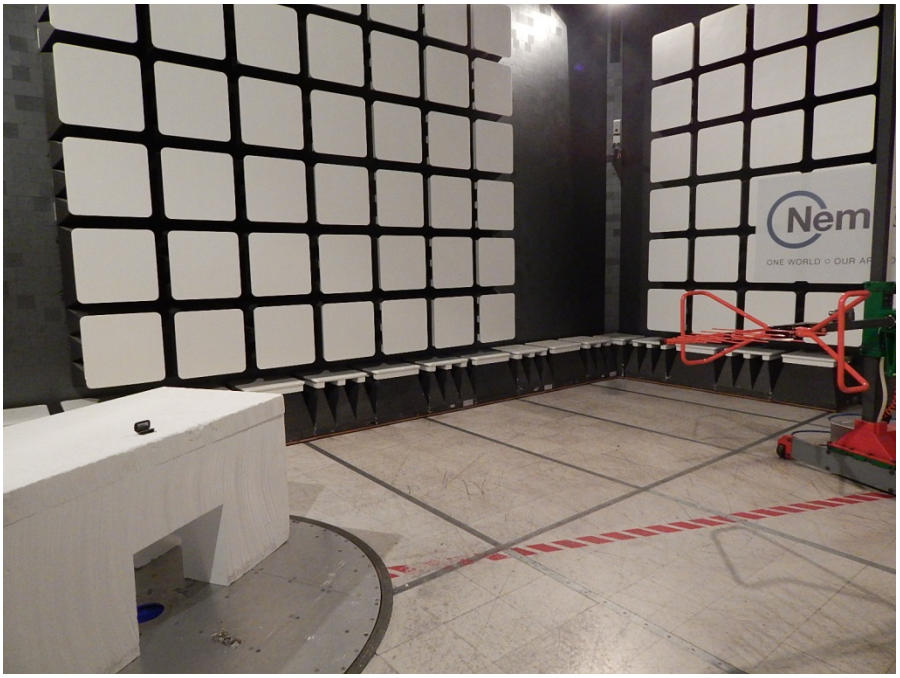


Figure 8.3-23: *Radiated spurious (out-of-band) emissions setup photo – 30 to 1000 MHz*

8.3.6 Setup photos, continued

Figure 8.3-24: *Radiated spurious (out-of-band) emissions setup photo – above 1 GHz*

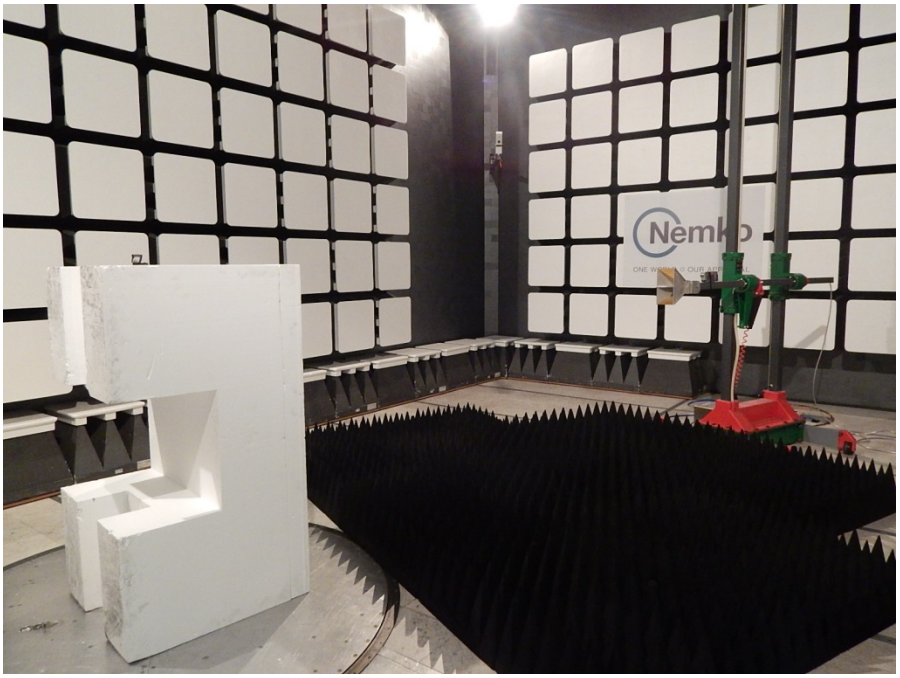


Figure 8.3-25: *Radiated spurious (out-of-band) emissions setup photo – above 1 GHz*

8.4 FCC 15.247(e) and RSS-247 5.2(2) Power spectral density for digitally modulated devices

8.4.1 Definitions and limits

FCC §15.247 (e):

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

RSS-247, Clause 5.2 (2):

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

8.4.2 Test summary

Verdict	Pass				
Test date	August 15, 2016	Test engineer	David Duchesne		
Temperature	22.9 °C	Relative humidity	65.7 %	Air pressure	1009 mbar

8.4.3 Notes

- Measurements were performed as per 558074 D01 DTS Meas Guidance v03r05. (The test was performed using method described in section 10.2 Method PKPSD (peak PSD).
- The radiated spectral plot is a summation of a vertical and horizontal scan. The spectral scan has been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.

8.4.4 Setup details

Spectrum analyser settings:

Resolution bandwidth:	3 kHz
Video bandwidth:	10 kHz
Frequency span:	2 MHz
Detector mode:	Peak
Trace mode:	Max Hold

8.4.5 Test data

Table 8.4-1: *PSD measurements results*

Freq., MHz	Peak Field strength [1], dBµV/m /3 kHz	Conversion factor [2], dB	EIRP, dBm /3 kHz	Antenna Factor, dBi	PSD [4], dBm/3 kHz	PSD limit, dBm/3 kHz	Margin, dB
2402	78.1	95.2	-17.1	-2.4	-14.7	8.0	22.7
2440	77.6	95.2	-17.6	-2.4	-15.2	8.0	23.2
2480	77.2	95.2	-18.0	-2.4	-15.6	8.0	23.6

Notes:
[1] Peak field strength (dBµV/m) = Spectrum analyzer value (dBµV) + transducer factors (dB)
Transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators.
[2] Field strength to EIRP conversion factor.
[3] EIRP = Peak Field strength – Conversion factor
[4] PSD = EIRP + Antenna factor

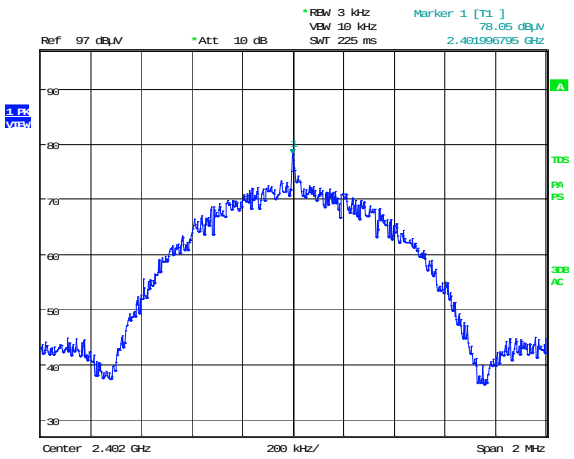


Figure 8.4-1: *PSD sample plot on low channel*

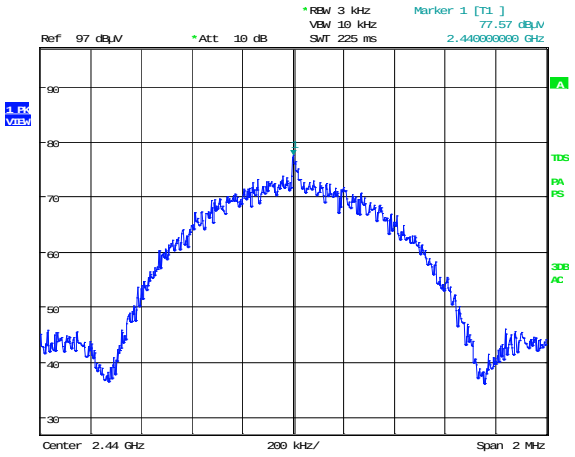


Figure 8.4-2: *PSD sample plot on mid channel*

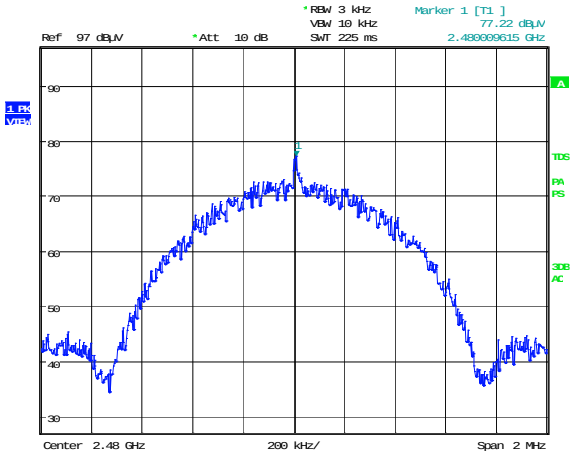
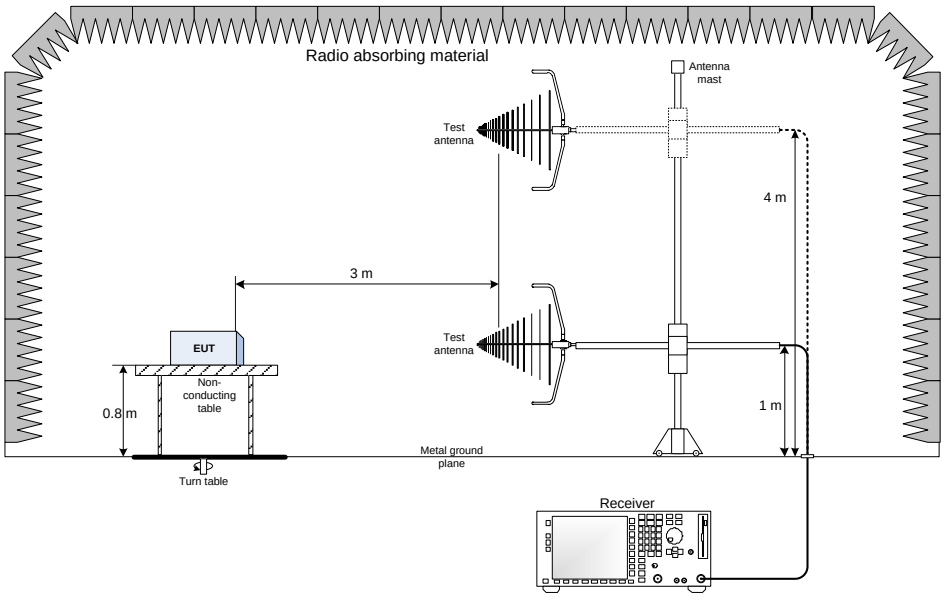


Figure 8.4-3: *PSD sample plot on high channel*

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