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RADIO TEST REPORT – 407508-1TRFWL

Type of assessment:

Modular transmitter integration

Applicant:

Giatec Scientific Inc.

Equipment description

Bluetooth Sensor

Product name:

SmartRock3 Sensor

Host model:

900144

Host model variant:

900143

Contains RF module with FCC ID:

2AYDI-SBGM13P

Contains RF module with FCC ID:

2AYDI-SBGM13P

RF module model:

SBGM13P2E

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.247
- RSS-247, Issue 2, Feb 2017, Section 5

Date of issue:

February 25, 2021

Andrey Adelberg, Senior EMC/RF Specialist

Tested by

Signature

David Duchesne, EMC/RF Lab Manager

Reviewed by

Signature

Lab locations

Company name	Nemko Canada Inc.			
Facilities	*Ottawa site:* 303 River Road Ottawa, Ontario Canada K1V 1H2 Tel: +1 613 737 9680 Fax: +1 613 737 9691	*Montréal site:* 292 Labrosse Avenue Pointe-Claire, Québec Canada H9R 5L8 Tel: +1 514 694 2684 Fax: +1 514 694 3528	*Cambridge site:* 1-130 Saltsman Drive Cambridge, Ontario Canada N3E 0B2 Tel: +1 519 650 4811	*Almonte site:* 1500 Peter Robinson Road West Carleton, Ontario Canada K0A 1L0 Tel: +1 613 256-9117
Test site identifier	**Organization**	**Ottawa/Almonte**	**Montreal**	**Cambridge**
	FCC:	CA2040	CA2041	CA0101
	ISED:	2040A-4	2040G-5	24676
Website	www.nemko.com			

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 contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

Copyright notification

Table of Contents

Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–585 MHz
RSS-247, Issue 2, Feb 2017, Section 5	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.2 Test methods

558074 D01 15.247 Meas Guidance v05r02 (April 2, 2019)	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-102, Issue 5, March 19, 2015	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

1.3 Exclusions

Partial testing was performed on the product with the transmitter operating to confirm that the host product meets the FCC requirements. This investigation of the final product was done by spot checking emissions from the device while operating the host as a composite system. This testing was performed with the host product configured in typical operational modes to check the spurious emissions for compliance with all the applicable rules.

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 1.3 above. 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 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	February 25, 2021	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

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

2.2 Technical judgment

There are two model variants:
900143 – SmartRock3 Sensor (30 cm measurement cable)
900144 – SmartRock3 Sensor LONG (3 m measurement cable)

RF module (FCC ID: 2AYDI-SBGM13P, IC: 26758-SBGM13P) model:
SBGM13P2E: RF module utilizes a U.FL connector for Antenna connection

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (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.

3.2 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 4 Measurement uncertainty

4.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

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

Table 4.1-1: *Measurement uncertainty calculations*

Test name	Measurement uncertainty, ±dB
Radiated spurious emissions	3.78

Section 5 Information provided by the applicant

5.1 Disclaimer

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacture

Name	Giatec Scientific Inc.
Address	245 Menten Pl. Suite 300, K2H9E8 Ottawa, Ontario, Canada

5.3 EUT information

Product	SmartRock3 Sensor
Host model	900143
Host model variant(s)	900144
RF module	Model: SBGM13P2E
Serial number	NA
Part number	900144(3)
Power supply requirements	Battery: 3 V(DC)
Product description and theory of operation	SmartRock is a wireless sensor for monitoring the curing and hardening of concrete. The sensor is fully embedded inside concrete during construction, making it completely maintenance and hassle-free. Temperature data is collected at two locations in the tip of the sensors' cable and the body. A smartphone can be used to connect to the sensor via Bluetooth and download the stored data from it. These results are accessible in real-time on the smartphone through the SmartRock mobile app and remotely on the Giatec 360™ cloud dashboard to help make informed decisions.

5.4 Radio technical information

Category of Wideband Data Transmission equipment	Other types of Wideband Data Transmission equipment (e.g., DSSS, OFDM, etc.).
Frequency band	2400–2483.5 MHz
Frequency Min (MHz)	2402
Frequency Max (MHz)	2480
Channel numbers	0–39
Type of modulation	BLE (GFSK)
Emission classification	F1D
Transmitter spurious, dBµV/m @ 3 m	49.72 (peak) at 2483.5 MHz
Antenna information	Embedded dipole antenna: Laird Connectivity, EBL2400A2S-4MHF1, +2.1 dBi

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions	During test EUT was set to continuous transmit mode with test software. 1 Use Silabs BGTool 2 Silabs RF Regulatory test module setting Modulation: GFSK Packet Length: 60 Byte Power level: 10 dBm Chanel: 0–39
Transmitter state	Transmitter was set to transmit continuous continuously with maximum power at low, mid and top channels.

5.5.2 EUT setup configuration

Table 5.5-1: *EUT interface ports*

Description	Qty.
Temperature sensor	1

Table 5.5-2: *Support equipment*

Description	Brand name	Model, Part number, Serial number, Revision level
Developer kit		MN: WSTK, PN: PCB4001, SN: 192753840, Rev. A03
Laptop		MN: Lenovo, PN: T440s, SN: PC03Y9NA

Table 5.5-3: *Inter-connection cables*

Cable description	From	To	Length (m)
USB	Laptop	Developer kit	10
Proprietary flat cable	Developer kit	EUT	0.1

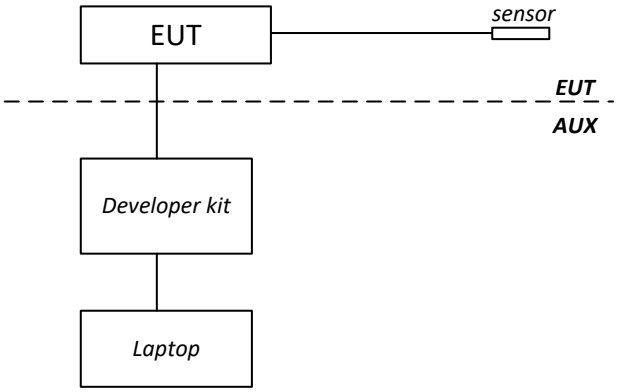

Figure 5.5-1: *Test setup block diagram*

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Ottawa

6.2 Testing period

Test start date	November 20, 2020	Test end date	November 20, 2020

6.3 Sample information

Receipt date	November 20, 2020	Nemko sample ID number(s)	1

6.4 FCC Part §15.247 test results

Table 6.4-1: *FCC DTS requirements results*

Part	Test description	Verdict
§15.247(d)	Spurious emissions	Pass

Notes: Only radiated spurious emissions was performed for model integration assessment.

6.5 ISED RSS-247, Issue 2, test results

Table 6.5-1: *ISED DTS requirements results*

Part	Test description	Verdict
5.5	Unwanted emissions	Pass

Notes: Only radiated spurious emissions was performed for model integration assessment.

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	January 24, 2021
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	November 6, 2021
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	April 31, 2021
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002877	1 year	October 13, 2021
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	January 14, 2021
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	April 30, 2021
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	May 7, 2021
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Notch Filter (2.4-2483.5 MHz)	Microwave Circuits	N0124413	FA002367	1 year	February 3, 2021

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

Section 8 Testing data

8.1 Spurious (out-of-band) unwanted emissions

8.1.1 References, 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(d), 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 8.1-1: *FCC §15.209 and RSS-Gen – Radiated emission limits*

	Field strength of emissions		
Frequency, MHz	**µV/m**	**dBµV/m**	**Measurement distance, 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.

References, definitions and limits, continued

Table 8.1-2: *ISED restricted frequency bands*

MHz	MHz	MHz	GHz
0.090–0.110	12.57675–12.57725	399.9–410	7.25–7.75
0.495–0.505	13.36–13.41	608–614	8.025–8.5
2.1735–2.1905	16.42–16.423	960–1427	9.0–9.2
3.020–3.026	16.69475–16.69525	1435–1626.5	9.3–9.5
4.125–4.128	16.80425–16.80475	1645.5–1646.5	10.6–12.7
4.17725–4.17775	25.5–25.67	1660–1710	13.25–13.4
4.20725–4.20775	37.5–38.25	1718.8–1722.2	14.47–14.5
5.677–5.683	73–74.6	2200–2300	15.35–16.2
6.215–6.218	74.8–75.2	2310–2390	17.7–21.4
6.26775–6.26825	108–138	2483.5–2500	22.01–23.12
6.31175–6.31225	149.9–150.05	2655–2900	23.6–24.0
8.291–8.294	156.52475–156.52525	3260–3267	31.2–31.8
8.362–8.366	156.7–156.9	3332–3339	36.43–36.5
8.37625–8.38675	162.0125–167.17	3345.8–3358	
8.41425–8.41475	167.72–173.2	3500–4400	Above 38.6
12.29–12.293	240–285	4500–5150	
12.51975–12.52025	322–335.4	5350–5460	

Note: Certain frequency bands listed in Table 8.1-2 and above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

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

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	November 20, 2020

8.1.3 Observations, settings and special notes

- As part of the current assessment, the test range of 9 kHz to 10th harmonic has been fully considered and compared to the actual frequencies utilized within the EUT. Since the EUT contains a transmitter in the GHz range, the EUT has been deemed compliant without formal testing in the 9 kHz to 30 MHz test range, therefore formal test results (tabular data and/or plots) are not provided within this test report.
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3 m.
- DTS emissions in restricted frequency bands test was performed as per KDB 558074, section 8.6 with reference to ANSI C63.10 subclause 11.12.
- DTS band-edge emission measurements test was performed as per KDB 558074, section 8.7 with reference to ANSI C63.10 subclause 11.13.

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

Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

8.1.4 Test data

Table 8.1-4: *Radiated field strength measurement results*

Channel	Frequency, MHz	Peak Field strength, dBµV/m	Average limit, dBµV/m	Margin, dB
Low	2390.0	48.70	54.00	5.30
Low	4804.3	47.10	54.00	6.90
Mid	4880.0	43.80	54.00	10.20
Mid	9760.0	47.67	54.00	6.33
High	2483.5	49.72	54.00	4.28
High	4980.7	46.14	54.00	7.86

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.
Peak field strength results were below Average limit line; therefore, no further average measurements were performed.

Test data, continued

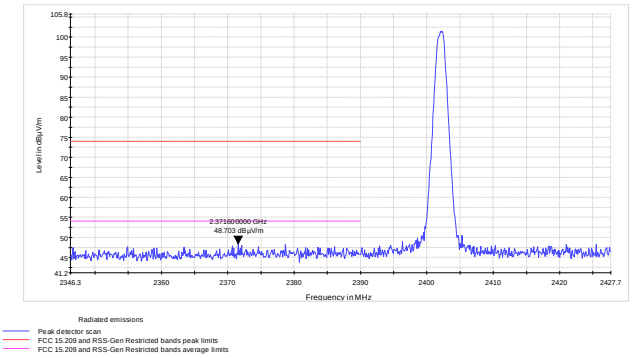

Figure 8.1-1: *Band edge spurious emissions at 2400 MHz*

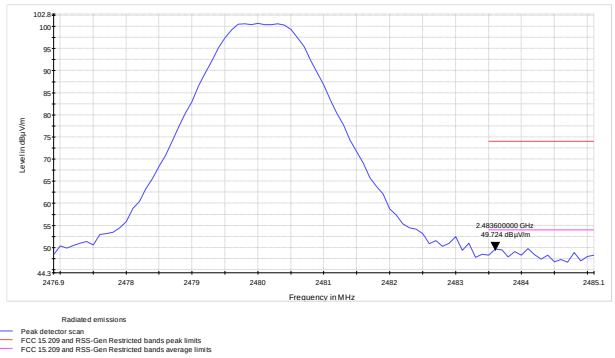

Figure 8.1-2: *Band edge spurious emissions at 2483.5 MHz*

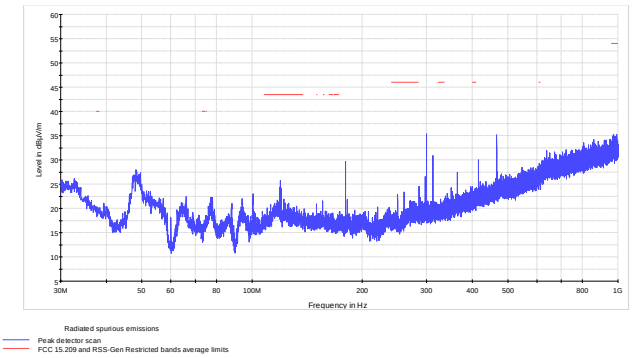

Figure 8.1-3: *Radiated spurious emissions below 1 GHz on low channel*

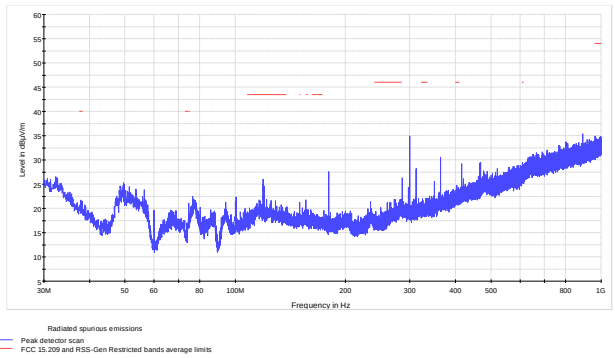

Figure 8.1-4: *Radiated spurious emissions below 1 GHz on mid channel*

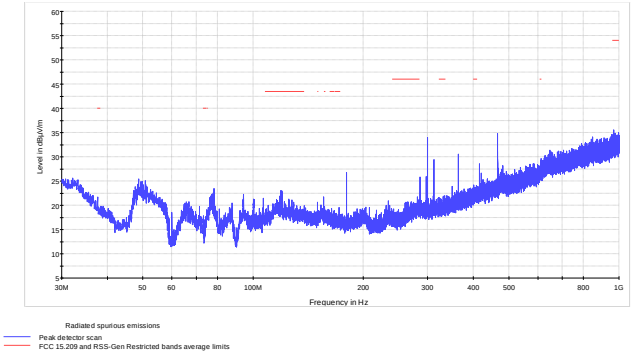

Figure 8.1-5: *Radiated spurious emissions below 1 GHz on top channel*

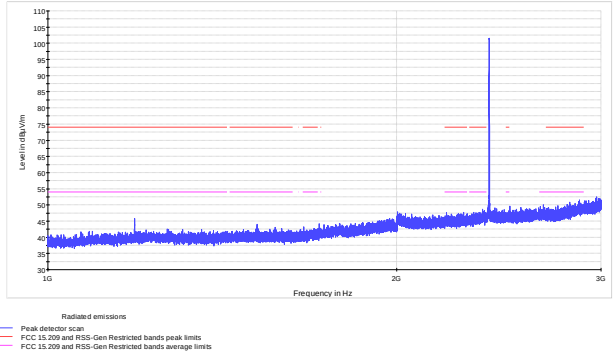

Figure 8.1-6: *Radiated spurious emissions within 1–3 GHz on low channel*

Test data, continued

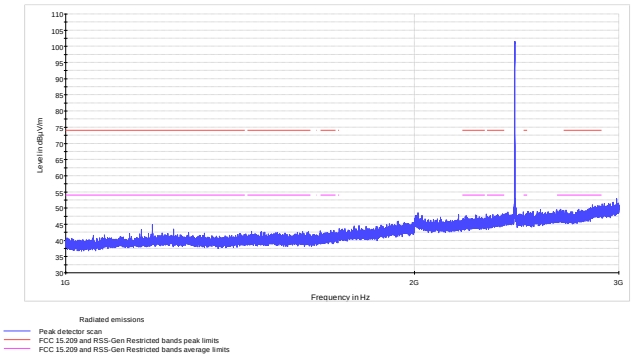

Figure 8.1-7: *Radiated spurious emissions within 1–3 GHz on mid channel*

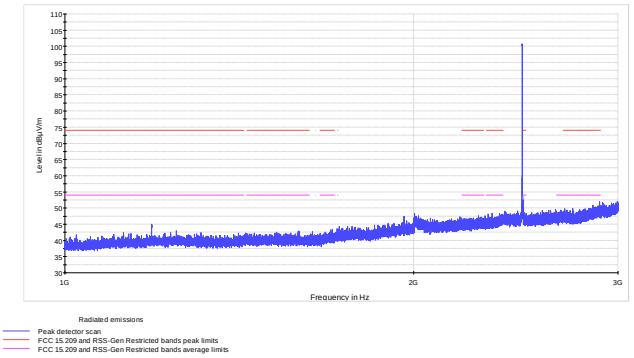

Figure 8.1-8: *Radiated spurious emissions within 1–3 GHz on top channel*

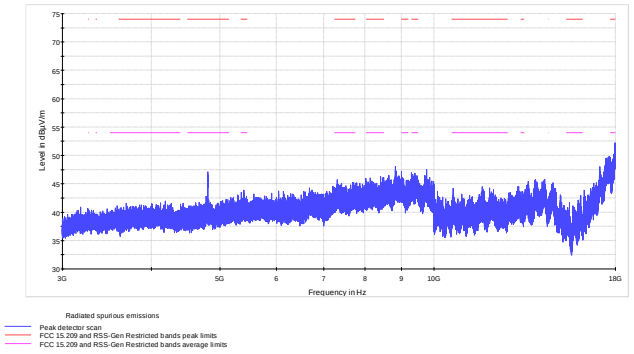

Figure 8.1-9: *Radiated spurious emissions within 3–18 GHz on low channel*

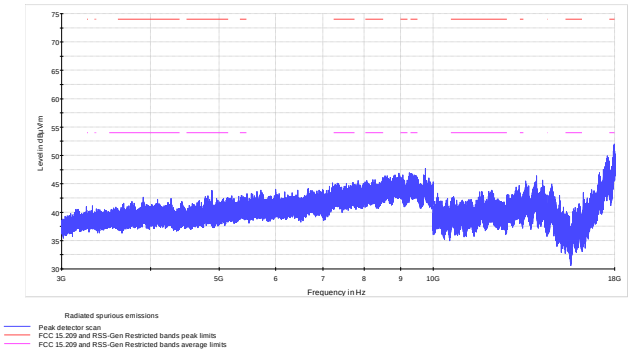

Figure 8.1-10: *Radiated spurious emissions within 3–18 GHz on mid channel*

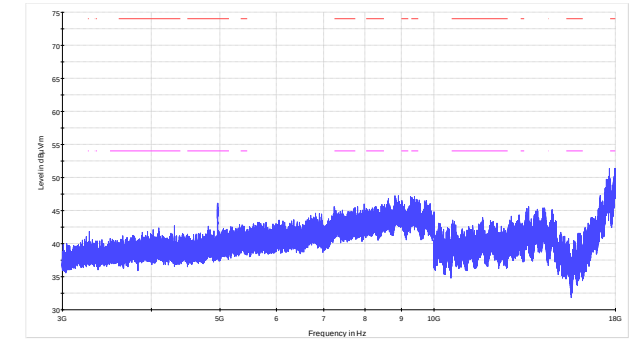

Figure 8.1-11: *Radiated spurious emissions within 3–18 GHz on top channel*

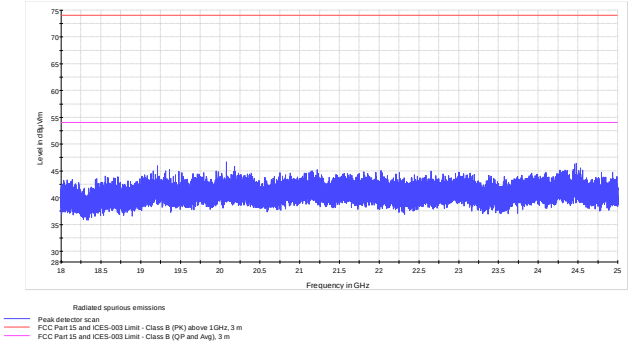

Figure 8.1-12: *Radiated spurious emissions above 18 GHz on low channel*

Test data, continued

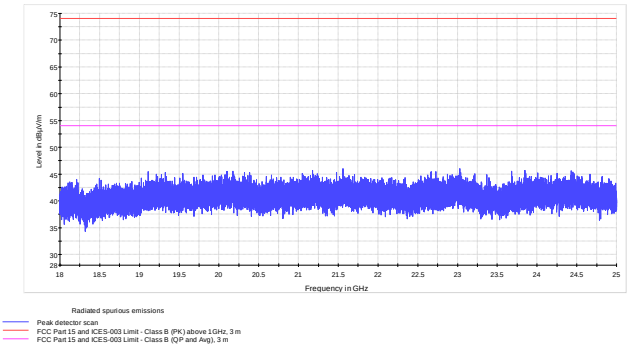

Figure 8.1-13: *Radiated spurious emissions above 18 GHz on mid channel*

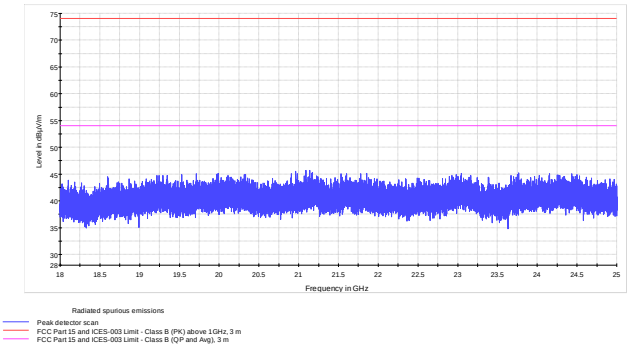

Figure 8.1-14: *Radiated spurious emissions above 18 GHz on top channel*

Section 9 EUT photos

9.1 External photos

Figure 9.1-1: *Top view photo*

Figure 9.1-2: *Bottom view photo*

Figure 9.1-3: *Side view photo*

End of the test report