



Wireless test report – 379242-1R1TRFWL

Applicant:

Schneider Electric Systems Canada Inc. Company

Product type:

900 MHz FHSS RF Module Product type

Model:

16363

FCC ID:

OV716363

IC Registration number:

1614A-16363

Specifications:

◆ FCC 47 CFR Part 15 Subpart C, §15.247 (Limited)

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

◆ RSS-247, Issue 2, Feb 2017, Section 5 (Limited)

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

5) Standard specifications for frequency hopping systems and digital transmission systems operating in the bands 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz

Date of issue: December 16, 2019

David Duchesne, Senior EMC/Wireless Specialist

Tested by

Signature

Kevin Rose, Wireless/EMC Specialist

Reviewed by

Signature

Test location(s)

Company name	Nemko Canada Inc.
Site name	Ottawa
Address	303 River Road
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 (3 m SAC)	FCC: CA2040; IC: 2040A-4

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.

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Schneider Electric Systems Canada Inc.
Address	415 Legget Drive, Suite 101, Ottawa, ON, Canada, K2K 3R1

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 2, Feb 2017, 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 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.
DA 00-705, Released March 30, 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-Gen, Issue 5 Amendment 1, March 2019	General Requirements for Compliance of Radio Apparatus

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

The EUT was assessed for a C2PC. Spurious emissions, bandwidth and power were re-measured to support C2PC. Nemko original report 334091-1TRFWL.

1.6 Test report revision history

Table 1.6-1: Test report revision history

Revision #	Date of issue	Details of changes made to test report
TRF	November 6, 2019	Original report issued
R1	December 16, 2019	Updated report to include bandwidth measurements.

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, intentional radiators test results

Table 2.1-1: FCC 15.247 results

Part	Test description	Verdict
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Pass ¹
§15.247(b)(2)	Maximum peak output power in the 902–928 MHz band	Pass
§15.247(d)	Spurious emissions	Pass

Notes: ¹The bandwidth was the only test performed for this assessment.

2.2 ISSED RSS-247, Issue 2, test results

Table 2.2-1: RSS-247 results

Part	Test description	Verdict
5.1 (c)	Bandwidth of a frequency hopping channel	Pass ¹
5.4 (a)	Transmitter output power and e.i.r.p. requirements (Systems operating in the 902–928 MHz band)	Pass
5.5	Unwanted emissions	Pass

Notes: ¹The bandwidth was the only test performed for this assessment.

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	August 14, 2019
Nemko sample ID number	Item 1

3.2 EUT information

Product type	900 MHz FHSS RF Module
Model	16363
Serial number	None

3.3 Technical information

Applicant IC company number	1614A
IC UPN number	16363
All used IC test site(s) Reg. number	2040A-4
RSS number and Issue number	RSS-247 Issue 2, Feb 2017
Frequency band	902–928 MHz
Operating frequencies	904.6–925.4 MHz
RF power Max (W), Conducted	0.017, (12.30 dBm)
Field strength, dBμV/m @ 3 m	N/A
Measured BW (kHz), 20 dB and 99%	20 dB: 309.3 (19.2 kbaud) 99 %: 298.1 (19.2 kbaud), 342.9 (76.8 kbaud)
Type of modulation	FSK
Emission classification (F1D, G1D, D1D)	F1D
Transmitter spurious, dBμV/m @ 3 m	Peak: 58.5, Average: 53.4 [at 2776.2 MHz]
Power requirements	3.6 V _{DC} from 100–240 V _{AC} power adapter connected to a host board
Antenna information	Laird Technologies Collinear antenna, 6 dBd M/N: FG9026 Laird Technologies Yagi antenna, 6 dBd M/N: Y8963 Laird Technologies Collinear antenna, 3 dBd M/N: FG9023 Linx Technologies ½ wave whip antenna –0.4 dBi, M/N: ANT-916-PML Linx Technologies ¼ wave whip antenna 1.8 dBi, M/N: ANT-916-CW-QW The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The EUT is a wireless module that uses proprietary frequency hopping technique within 900 MHz ISM band.

3.5 EUT exercise details

EUT was set to transmit continuously on selected channels with hopping turned off as well as normal test mode with hopping turned on via engineering menu.

3.6 EUT setup diagram

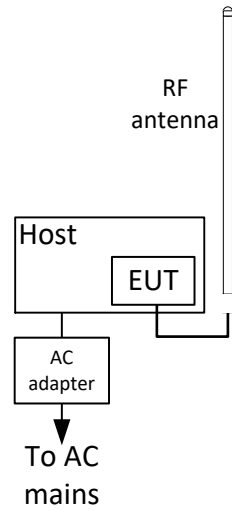


Figure 3.6-1: Setup diagram

3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	Serial number
AC adapter	Mean Well	MDR-100-24	RB062312
Host board	Schneider Electric	TBUABR20	S093288

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

None

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 $\pm 5\%$, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 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 6.1-1: Measurement uncertainty

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	Jan. 24, 2020
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	May 8, 2020
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002877	1 year	Nov. 4, 2019
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	Oct. 8, 2019
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	Jan. 3, 2020
50 Ω coax cable	Huber + Suhner	None	FA003099	1 year	May 10, 2020
High Pass filter	Microwave Circuits	H1G21G1	FA002342	VOU	VOU

Note: VOU - verify on use

Section 8. Testing data

8.1 FCC 15.247(b) and RSS-247 5.4(a) Transmitter output power and e.i.r.p. requirements for FHSS 900 MHz

8.1.1 Definitions and limits

FCC:

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

- (2) For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.
- (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.

ISED:

For FHSs operating in the band 902–928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

8.1.2 Test date

Start date August 14, 2019

8.1.3 Observations, settings and special notes

Conducted output power was tested per ANSI C63.10 subclause 7.8.5. The hopping shall be disabled for this test.

Spectrum analyser settings:

Resolution bandwidth	1 MHz
Video bandwidth	3 MHz
Frequency span	10 MHz
Detector mode	Peak
Trace mode	Max Hold
Sweep	Auto

8.1.4 Test data

Table 8.1-1: Output power and EIRP results

Baud Rate	Frequency, MHz	Peak output power, dBm	Limit, dBm	Margin, dB	Antenna gain, dBi	EIRP, dBm	Limit, dBm	Margin, dB
19.2 kbaud	904.6	12.29	30.00	17.71	8.15	20.44	36.00	15.56
	914.2	12.26	30.00	17.74	8.15	20.41	36.00	15.59
	925.4	12.26	30.00	17.74	8.15	20.41	36.00	15.59
76.8 kbaud	904.6	12.30	30.00	17.70	8.15	20.45	36.00	15.55
	914.2	12.25	30.00	17.75	8.15	20.40	36.00	15.60
	925.4	12.26	30.00	17.74	8.15	20.41	36.00	15.59

Notes: EIRP = Output power + Antenna gain

8.1.4 Test data, continued

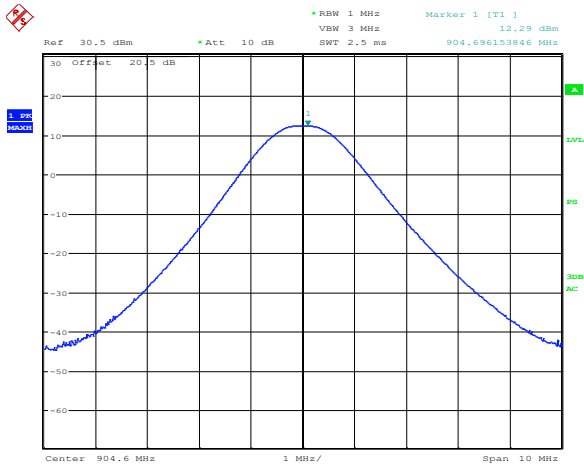


Figure 8.1-1: Output power on low channel – Sample plot

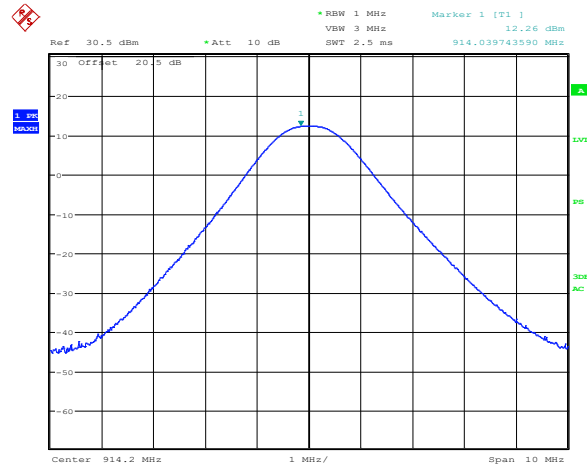


Figure 8.1-2: Output power on mid channel – Sample plot

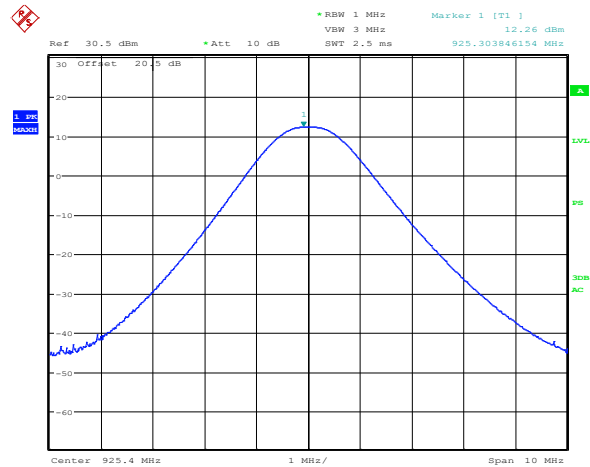


Figure 8.1-3: Output power on high channel – Sample plot

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

8.2.1 Definitions and limits

FCC:

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)).

ISED:

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 8.2-1: 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 8.2-2: 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	
12.29–12.293	240–285	4500–5150	Above 38.6
12.51975–12.52025	322–335.4	5350–5460	

8.2.1 Definitions and limits, continued

Table 8.2-3: 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			

8.2.2 Test date

Start date August 14, 2019

8.2.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10th harmonic.
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3 m,
- Since fundamental power was tested using the maximum peak conducted output power procedure to demonstrate compliance, the spurious emissions limit is –20 dBc/100 kHz.

Spectrum analyser settings for radiated measurements within restricted bands:

Resolution bandwidth:	Measurements below 1 GHz: 100 kHz, Measurements above 1 GHz: 1 MHz
Video bandwidth:	Measurements below 1 GHz: 300 kHz, Measurements above 1 GHz: 3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for conducted spurious emissions measurements:

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

8.2.4 Test data

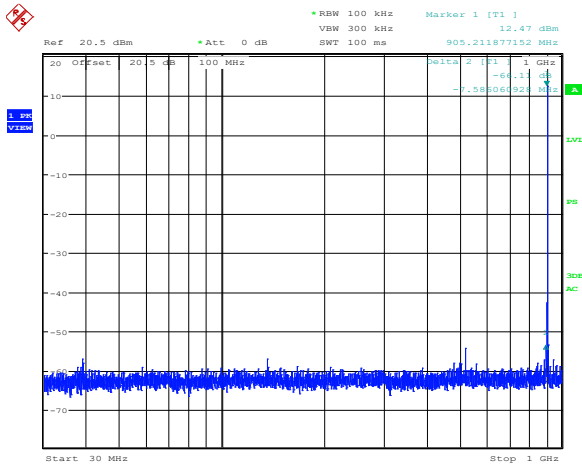


Figure 8.2-1: Conducted spurious emissions at low channel, below 1 GHz – 19.2 kbaud

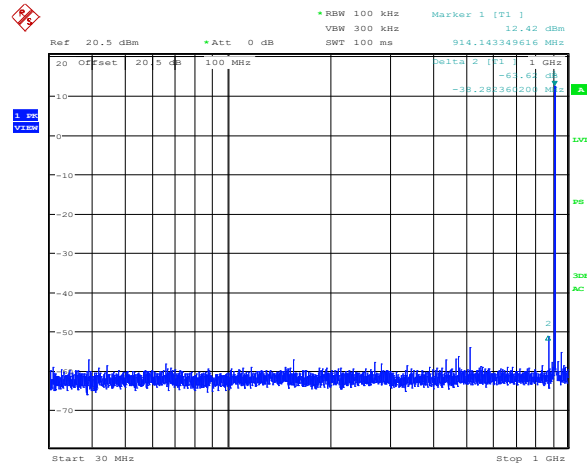


Figure 8.2-2: Conducted spurious emissions at mid channel, below 1 GHz – 19.2 kbaud

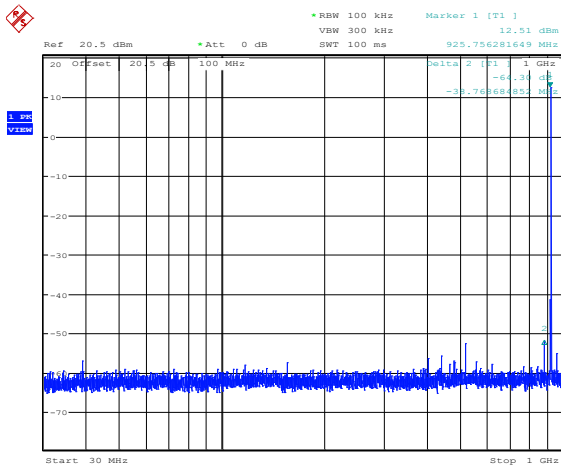


Figure 8.2-3: Conducted spurious emissions at high channel, below 1 GHz – 19.2 kbaud

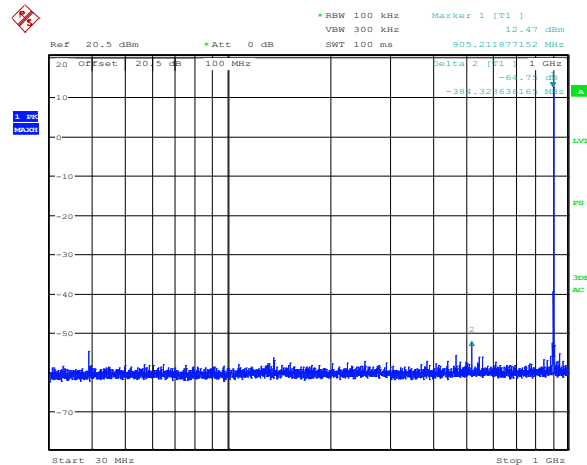


Figure 8.2-4: Conducted spurious emissions at low channel, below 1 GHz – 76.8 kbaud

8.2.4 Test data, continued

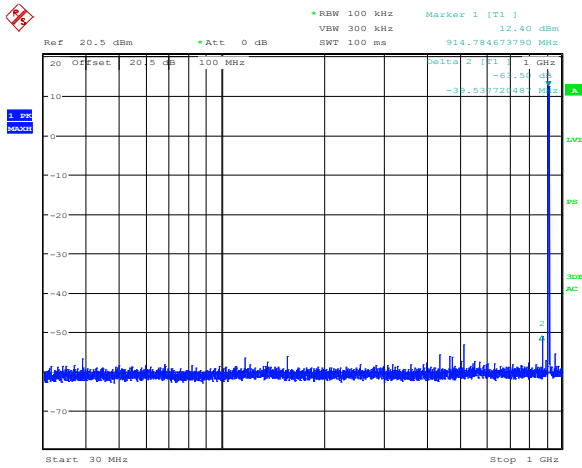


Figure 8.2-5: Conducted spurious emissions at mid channel, below 1 GHz – 76.8 kbaud

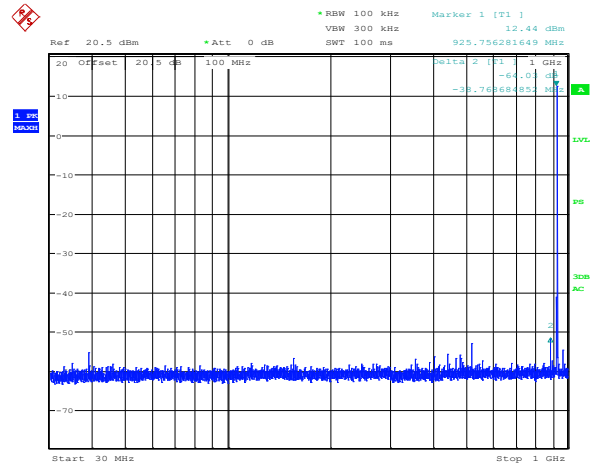


Figure 8.2-6: Conducted spurious emissions at high channel, below 1 GHz – 76.8 kbaud

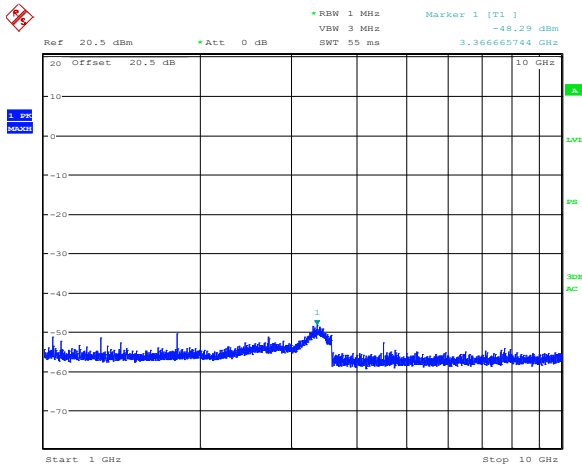


Figure 8.2-7: Conducted spurious emissions at low channel, above 1 GHz – 19.2 kbaud

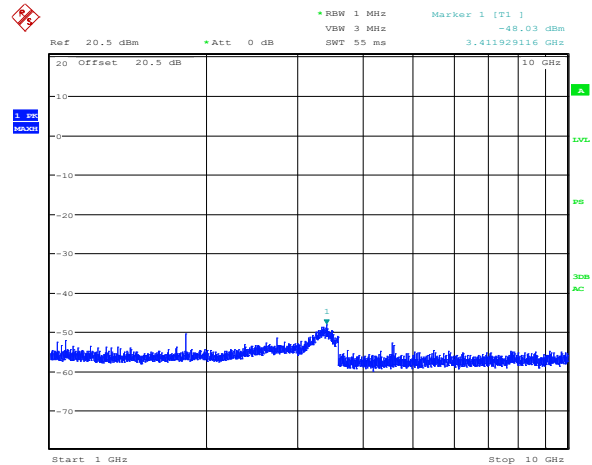


Figure 8.2-8: Conducted spurious emissions at mid channel, above 1 GHz – 19.2 kbaud

8.2.4 Test data, continued

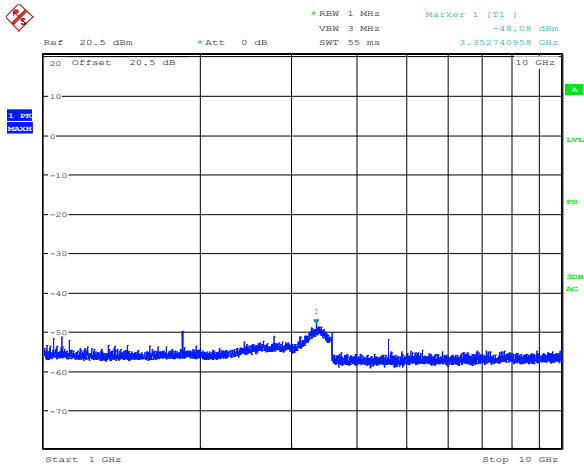


Figure 8.2-9: Conducted spurious emissions at high channel, above 1 GHz – 19.2 kbaud

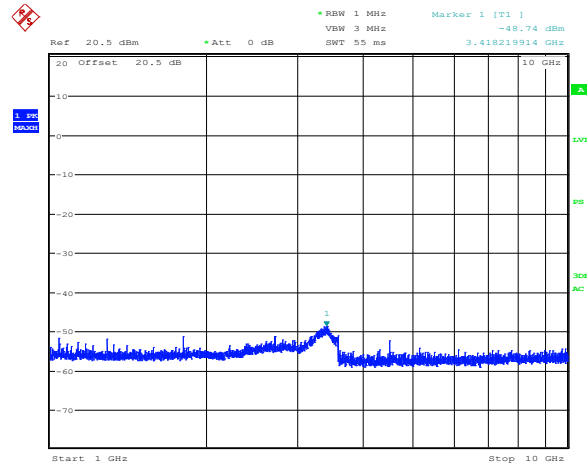


Figure 8.2-10: Conducted spurious emissions at low channel, above 1 GHz – 76.8 kbaud

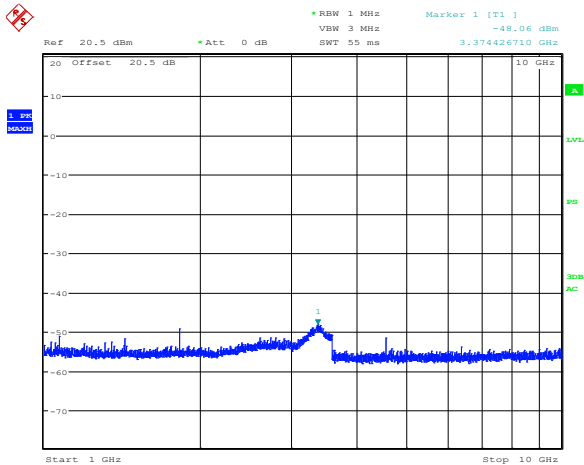


Figure 8.2-11: Conducted spurious emissions at mid channel, above 1 GHz – 76.8 kbaud

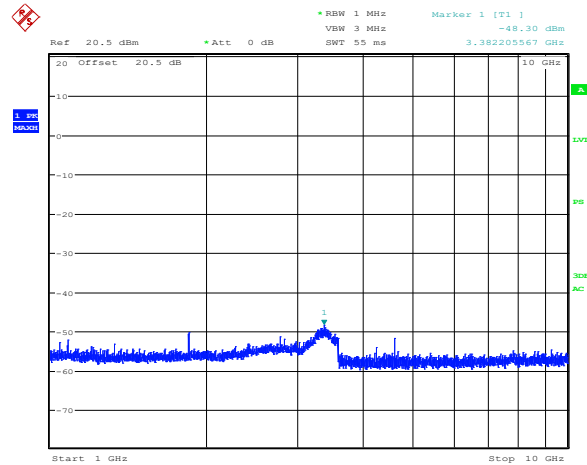
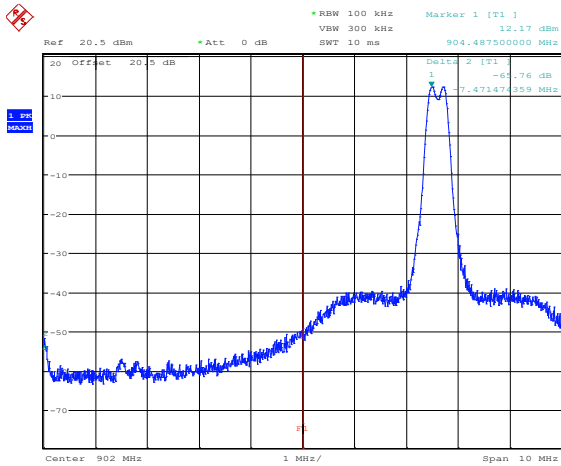


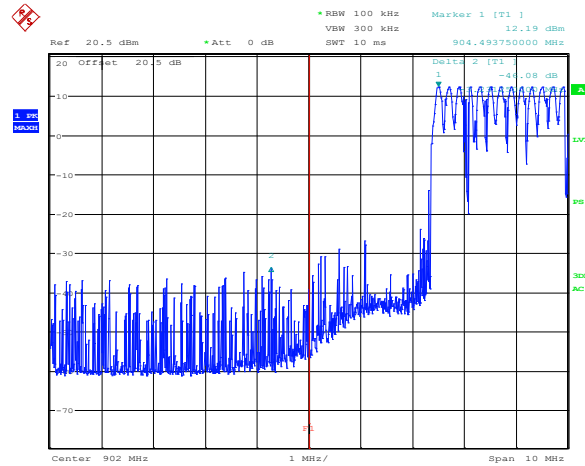
Figure 8.2-12: Conducted spurious emissions at high channel, above 1 GHz – 76.8 kbaud

8.2.4 Test data, continued



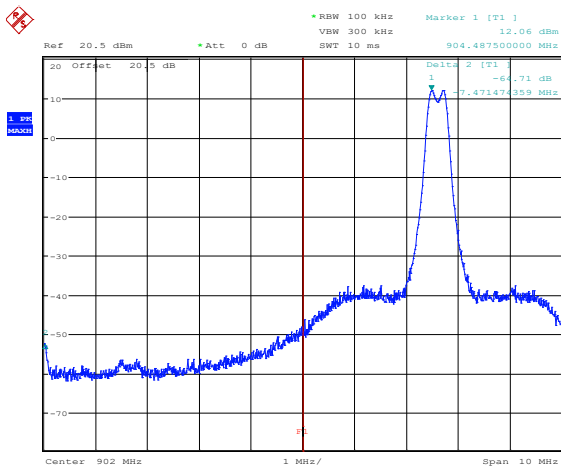
Date: 14.AUG.2019 14:06:22

Figure 8.2-13: Lower band edge, not hopping mode, 19.2 kbaud



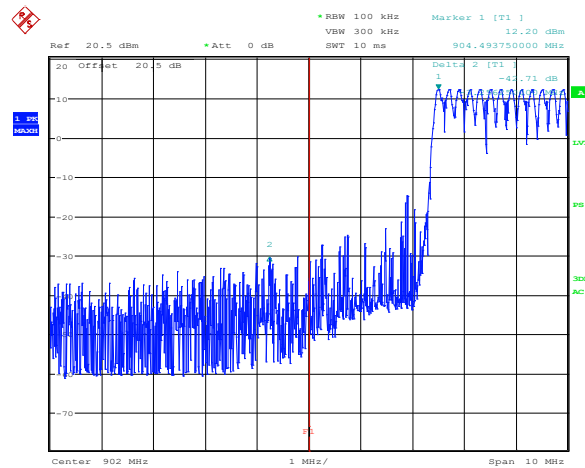
Date: 14.AUG.2019 14:09:24

Figure 8.2-14: Lower band edge, hopping mode, 19.2 kbaud



Date: 14.AUG.2019 14:05:24

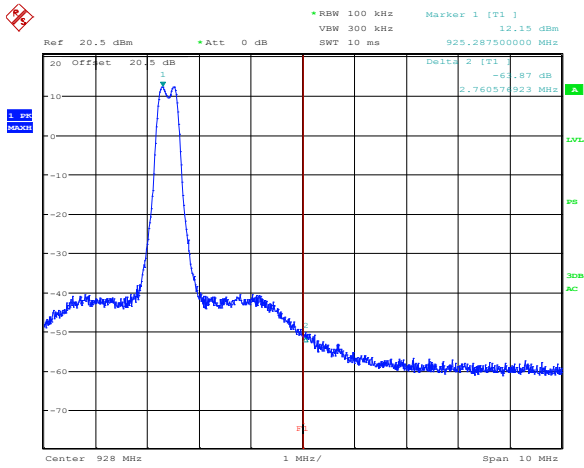
Figure 8.2-15: Lower band edge, not hopping mode, 76.8 kbaud



Date: 14.AUG.2019 14:11:08

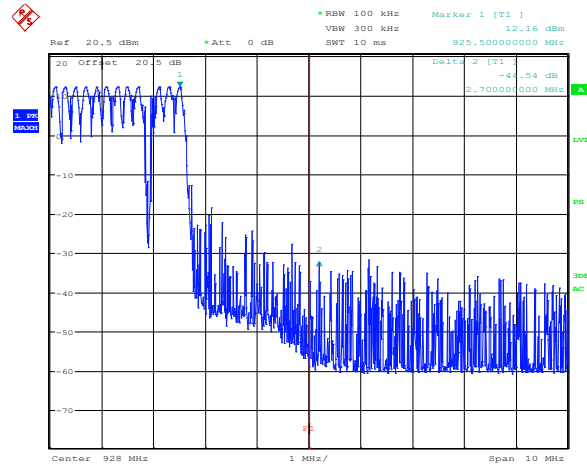
Figure 8.2-16: Lower band edge, hopping mode, 76.8 kbaud

8.2.4 Test data, continued



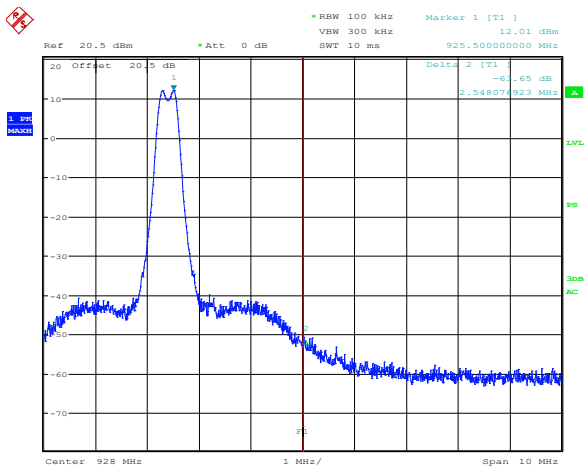
Date: 14.AUG.2019 14:02:36

Figure 8.2-17: Upper band edge, not hopping mode, 19.2 kbaud



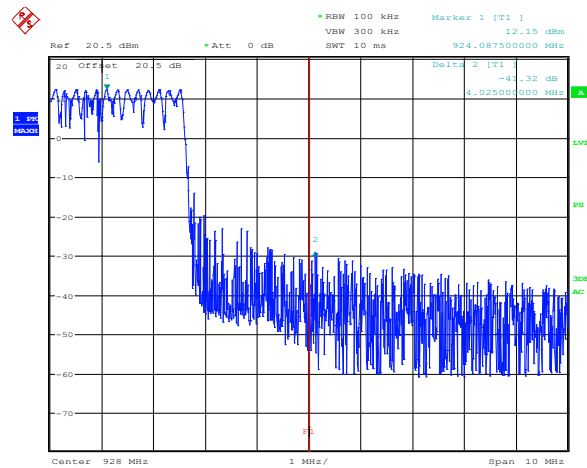
Date: 14.AUG.2019 14:18:05

Figure 8.2-18: Upper band edge, hopping mode, 19.2 kbaud



Date: 14.AUG.2019 14:03:25

Figure 8.2-19: Upper band edge, not hopping mode, 76.8 kbaud



Date: 14.AUG.2019 14:13:56

Figure 8.2-20: Upper band edge, hopping mode, 76.8 kbaud

8.2.4 Test data, continued

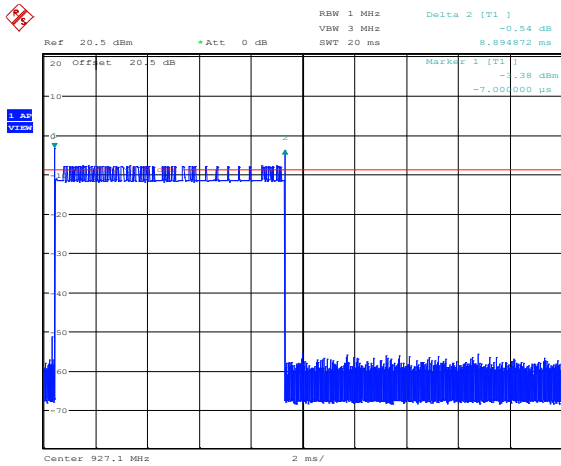


Figure 8.2-21: Single transmission length, 19.2 kbaud rate

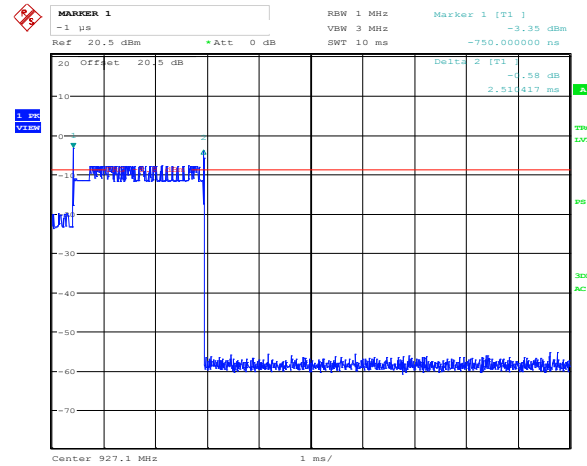


Figure 8.2-22: Single transmission length, 76.8 kbaud rate

Correction/average factor (CF) calculation:

Baud Rate: 19.2 kbaud

Transmission time within 100 ms: $8.9 \text{ ms} + 896 \text{ bits} / 19200 \text{ kbaud} = 8.9 + 46.67 = 55.56 \text{ ms}$

$20 \times \log_{10}(55.56 / 100) = -5.10 \text{ dB}$

Baud Rate: 76.8 kbaud

Transmission time within 100 ms: $2.51 \text{ ms} + 896 \text{ bits} / 76800 \text{ kbaud} = 2.51 + 11.67 = 14.18 \text{ ms}$

$20 \times \log_{10}(14.18 / 100) = -16.97 \text{ dB}$

8.2.4 Test data, continued

Table 8.2-4: Radiated field strength measurement results

Channel	Freq., (MHz)	Peak field strength ¹ and ² , dBμV/m	Peak limit, dBμV/m	Margin, dB	Duty cycle CF, dB	Average field strength ³ , dBμV/m	Average limit, dBμV/m	Margin, dB
Collinear antenna, MN: FG9026								
Low	2713.8	56.3	74.0	17.7	-5.1	51.2	54.0	2.8
	3618.4	52.2	74.0	21.8	-5.1	47.1	54.0	6.9
	4523	46.5	74.0	27.5	-5.1	41.4	54.0	12.6
Mid	2742.6	57.5	74.0	16.5	-5.1	52.4	54.0	1.6
	3656.8	50.8	74.0	23.2	-5.1	45.7	54.0	8.3
	4571	47.3	74.0	26.7	-5.1	42.2	54.0	11.8
High	2776.2	58.5	74.0	15.5	-5.1	53.4	54.0	0.6
	3701.6	51.7	74.0	22.3	-5.1	46.6	54.0	7.4
	4627	49.3	74.0	24.7	-5.1	44.2	54.0	9.8
Yagi antenna, MN: Y8963								
Low	2713.8	56.8	74.0	17.2	-5.1	51.7	54.0	2.3
	3618.4	51.6	74.0	22.4	-5.1	46.5	54.0	7.5
	4523	49.4	74.0	24.6	-5.1	44.3	54.0	9.7
Mid	2742.6	58	74.0	16.0	-5.1	52.9	54.0	1.1
	3656.8	51.8	74.0	22.2	-5.1	46.7	54.0	7.3
	4571	49.6	74.0	24.4	-5.1	44.5	54.0	9.5
High	2776.2	57.3	74.0	16.7	-5.1	52.2	54.0	1.8
	3701.6	50.9	74.0	23.1	-5.1	45.8	54.0	8.2
	4627	51	74.0	23.0	-5.1	45.9	54.0	8.1

Notes: ¹ Peak field strength (dBμV/m) = receiver/spectrum analyzer value (dBμV) + correction factor (dB)

² Correction factor = antenna factor ACF (dB) + cable loss (dB) – amplifier gain (dB)

³ Average field strength = Peak field strength + CF

- The EUT was tested at both 19.2kbaud and 76.8kbaud. The results from the 19.2kbaud rate were deemed to be the worst case and utilized to demonstrate compliance.
- Testing was limited to testing of Collinear antenna, MN: FG9026 and Yagi antenna, MN: Y8963

8.2.4 Test data, continued

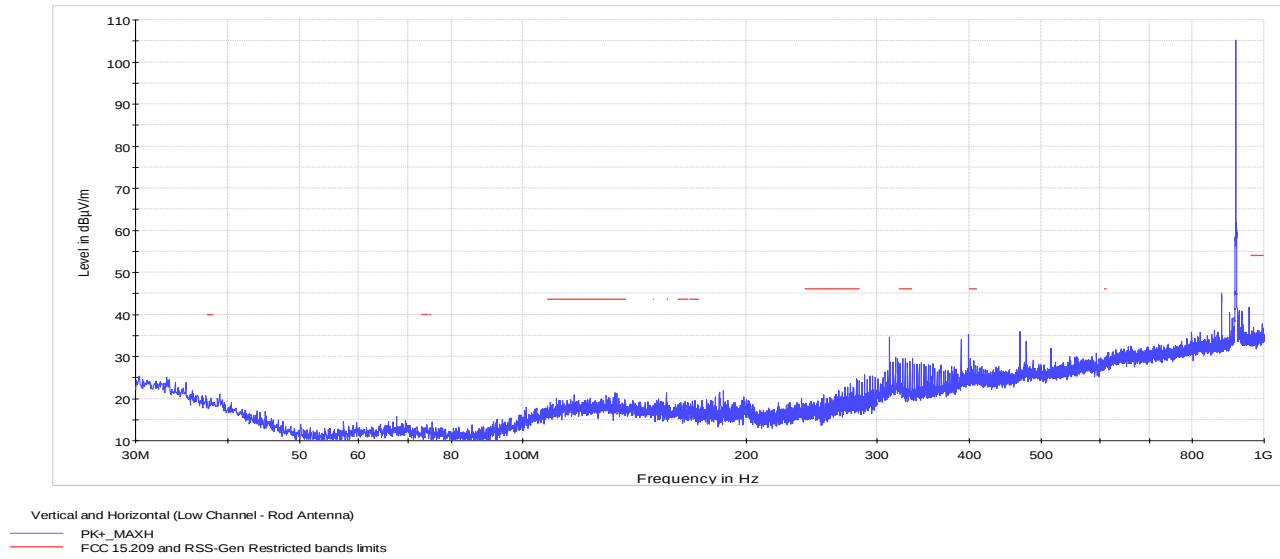


Figure 8.2-23: Radiated spurious emissions below 1 GHz, sample plot

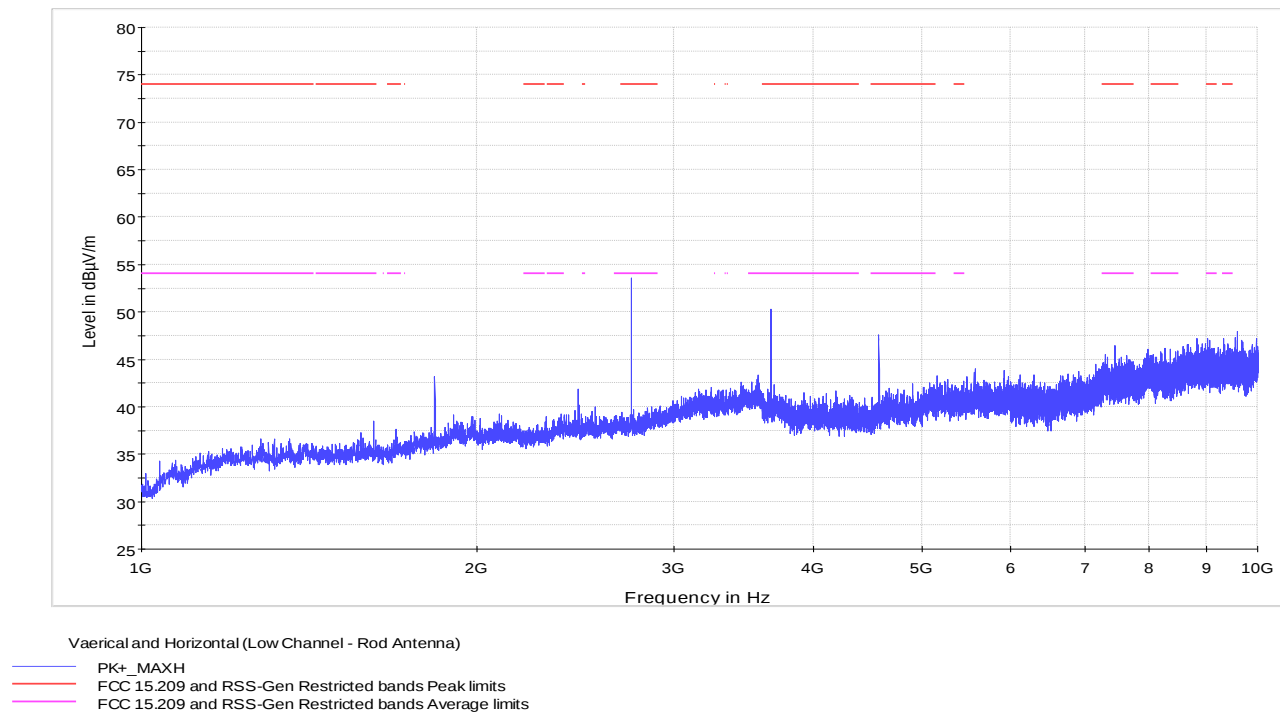


Figure 8.2-24: Radiated spurious emissions above 1 GHz, sample plot

8.3 FCC 15.247(a)(1) and RSS-247 5.1(c) Frequency Hopping Systems requirements

8.3.1 Definitions and limits

FCC 15.247 (a):

- (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
- (i) For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

RSS 247:

- c. For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

8.3.2 Test date

Start date December 16, 2019

8.3.3 Observations, settings and special notes

The bandwidth was the only test performed for this assessment.

Spectrum analyser settings bandwidth:

Resolution bandwidth	≥ 1% of the 20 dB bandwidth
Video bandwidth	≥ RBW
Frequency span	approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

8.3.4 Test data

Table 8.3-1: 20 dB bandwidth results

Baud Rate	Frequency, MHz	20 dB bandwidth, kHz
19.2 kbaud	904.6	309.3
19.2 kbaud	914.2	309.3
19.2 kbaud	925.4	306.1

Table 8.3-2: 99% occupied bandwidth results

Baud Rate	Frequency, MHz	99% bandwidth, kHz
19.2 kbaud	904.6	298.1
19.2 kbaud	914.2	294.9
19.2 kbaud	925.4	293.3
76.8 kbaud	904.6	342.9
76.8 kbaud	914.2	341.3
76.8 kbaud	925.4	342.9

8.3.4 Test data, continued

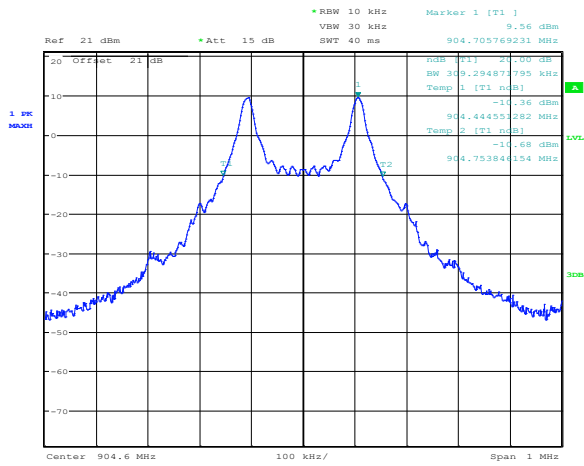


Figure 8.3-1: 20 dB bandwidth on low channel – 19.2 kbaud

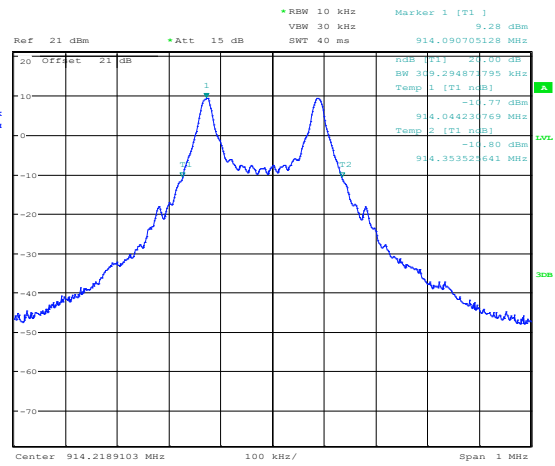


Figure 8.3-2: 20 dB bandwidth on mid channel – 19.2 kbaud

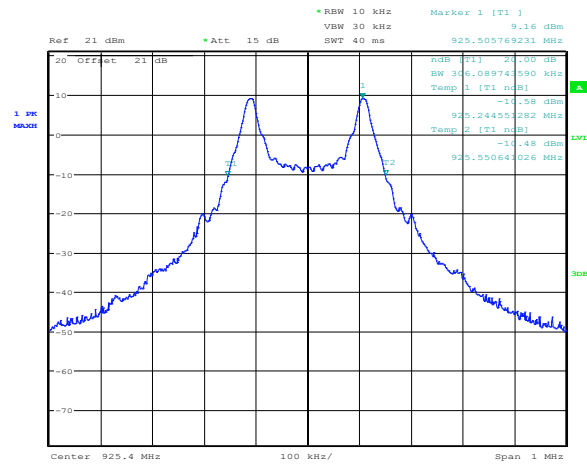


Figure 8.3-3: 20 dB bandwidth on high channel – 19.2 kbaud

8.3.4 Test data, continued

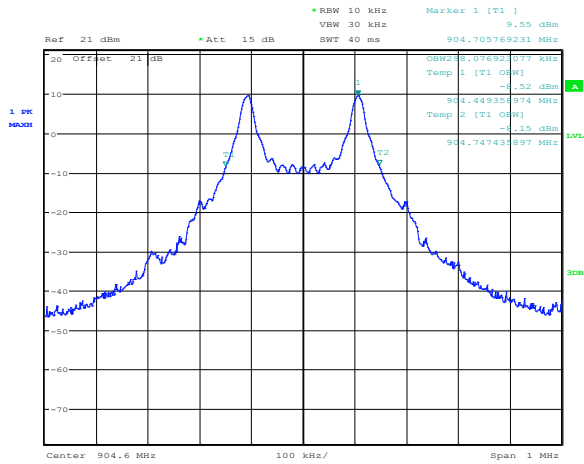


Figure 8.3-4: 99% occupied bandwidth on low channel – 19.2 kbaud

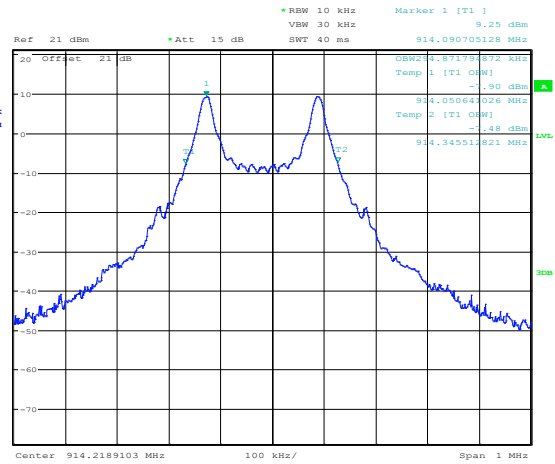


Figure 8.3-5: 99% occupied bandwidth on mid channel – 19.2 kbaud

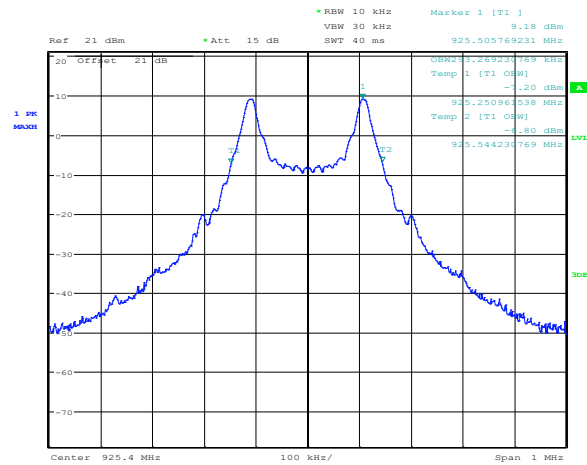


Figure 8.3-6: 99% occupied bandwidth on high channel – 19.2 kbaud

8.3.4 Test data, continued

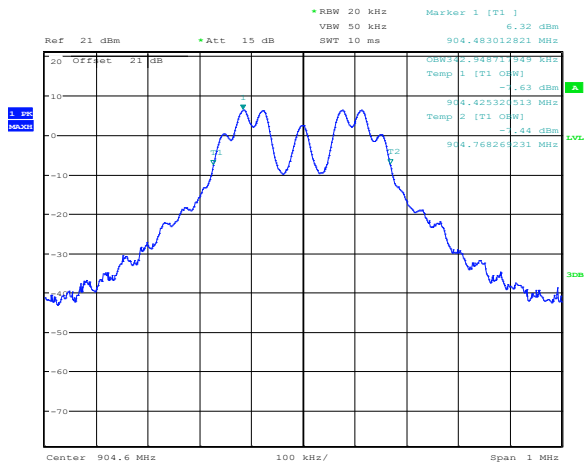


Figure 8.3-7: 99% occupied bandwidth on low channel – 76.8 kbaud

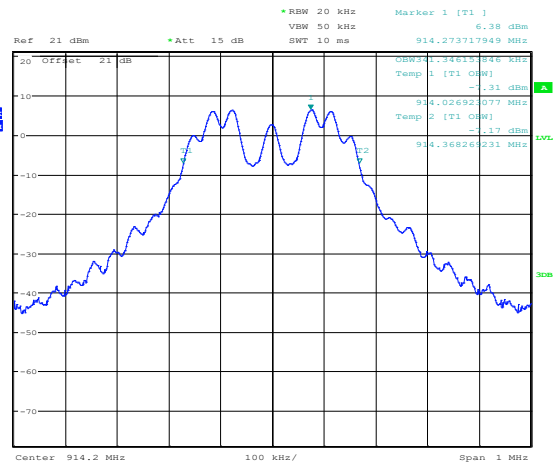


Figure 8.3-8: 99% occupied bandwidth on mid channel – 76.8 kbaud

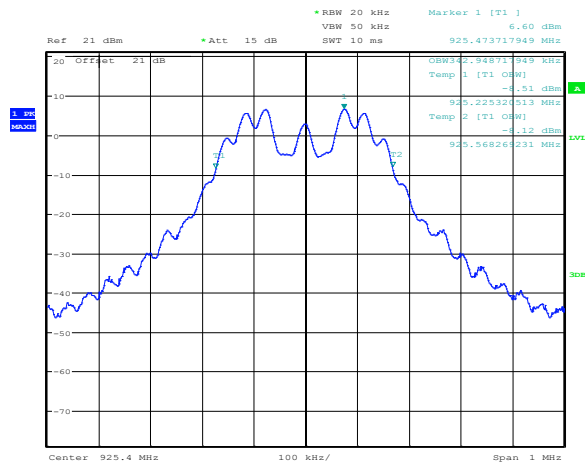
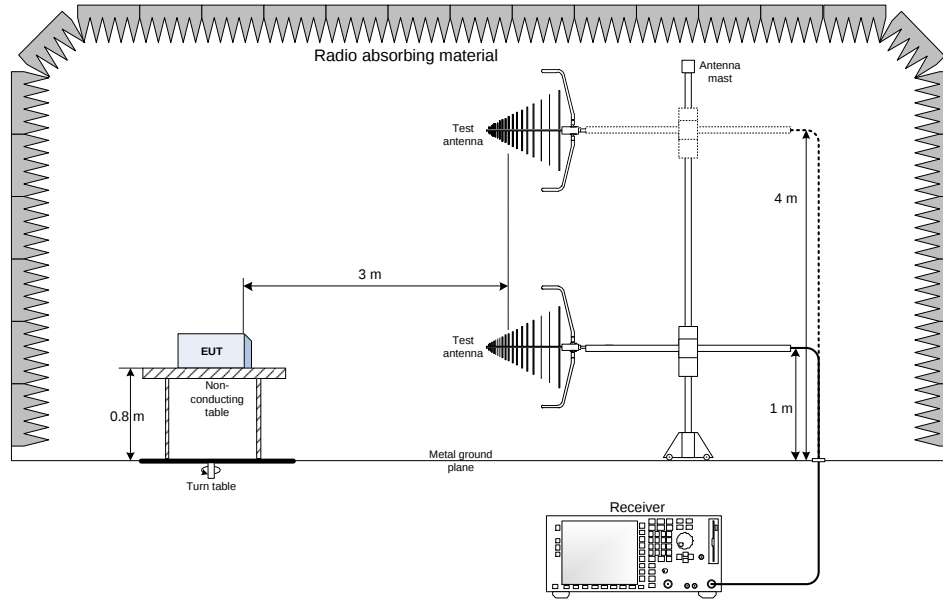


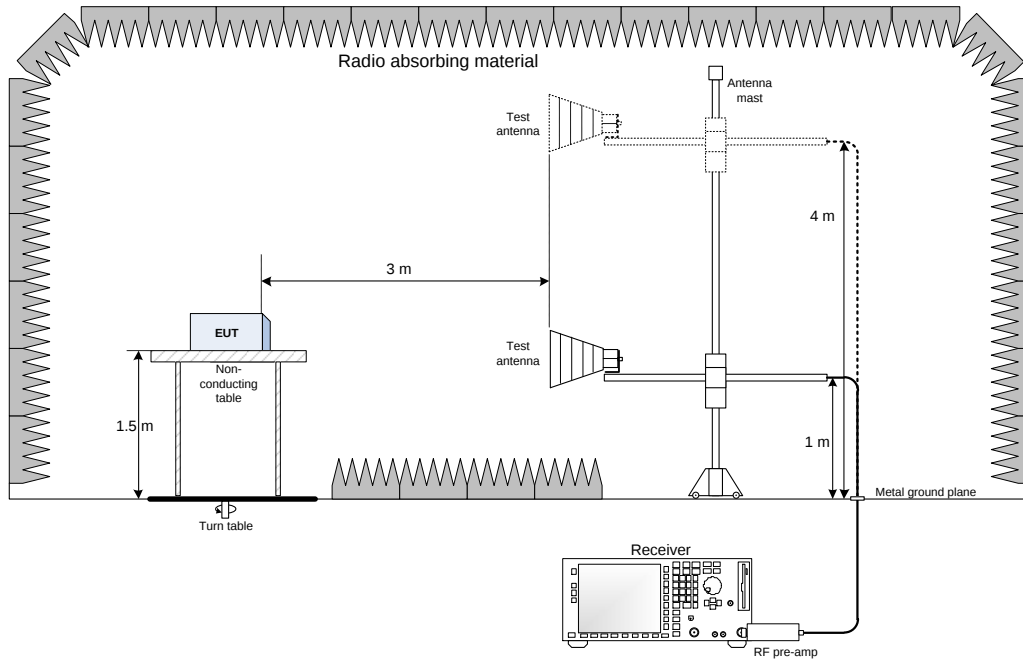
Figure 8.3-9: 99% occupied bandwidth on high channel – 76.8 kbaud

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



9.3 Antenna port set-up

