ONE WORLD ○ OUR APPROVAL

Wireless Test Report – 1R368533-7TRFWL

Applicant:

Ring LLC

Product name:

Ring

Model:

Base Station NA

FCC ID:

2AEUPBHABN002

ISED Registration number:

20271-BHABN002

Specifications:

FCC 47 CFR Part 15 Subpart C, §15.249

Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHZ, and 24.0-24.25 GHz.

RSS-210, Issue 9, December 2016, Annex F

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

Date of issue: April 2, 2019

Test engineer(s):	Mark Libbrecht , Wireless/EMC Specialist	Signature:
Reviewed by:	David Duchesne, Senior EMC/Wireless Specialist	Signature:

Lab and Test location(s)

Company name	Nemko Canada Inc. (Cambridge)	
Facility	130 Saltsman Drive, Unit #1 Cambridge, ON Canada, N3E 0B2 Tel: +1 519 680 4811 Test Firm Registration Number: 332406	
Test site registration	**Organization**	**Designation Number**
	FCC	CA0101
	ISED	CA0101
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 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	Ring LLC
Address	1523 26th Street, Santa Monica, CA, United States, 90404

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.249	Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz, and 24.0–24.25 GHz.
RSS-210 Issue 9, August 2016, Annex B.10	Devices operating in 902–928, 2400–2483.5 and 5725–5875 MHz

1.3 Test methods

ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
RSS-Gen, Issue 5, April 2018	General Requirements for Compliance of Radio Apparatus

1.4 Exclusions

None

1.5 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.

1.6 Test report revision history

Table 1.6-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	March 28, 2019	Original report issued
R1	April 2, 2019	Removed model variant

Section 2. Summary of test results

2.1 Testing period

Test start date	February 1, 2019
Test end date	March 12, 2019

2.2 FCC Part 15 Subpart C, general requirements test results

Table 2.2-1: *FCC general requirements results*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass
§15.31(m)	Number of tested frequencies	Pass
§15.203	Antenna requirement	Pass

Notes: None

2.3 FCC Part 15 Subpart C, intentional radiators test results

Table 2.3-1: *FCC subpart C 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
§15.215(c)	20 dB bandwidth	Pass

Notes: None

2.4 RSS-Gen, Issue 5, test results

Table 2.4-1: *RSS-Gen results*

Part	Test description	Verdict
7.3	Receiver radiated emission limits	Not applicable [1]
7.4	Receiver conducted emission limits	Not applicable [1]
6.9	Operating bands and selection of test frequencies	Pass
6.6	Occupied bandwidth	Pass
8.8	AC power-line conducted emissions limits	Pass

Notes: [1] According to sections 5.2 and 5.3 of RSS-Gen, Issue 5 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

2.5 ISED RSS-210, Issue 9, test results

Table 2.5-1: *ISED RSS-210 results*

Part	Test description	Verdict
4.1	Emissions Falling Within Restricted Frequency Bands	Pass
§B.10 (a)	Field strength of fundamental and harmonics emissions	Pass
§B.10 (b)	Spurious emissions (except harmonics)	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	February 1, 2019
Nemko sample ID number	Item # 3

3.2 EUT information

Product name	Ring
Model	Base Station NA
Serial number	BHBN21851PG000052

3.3 Technical information

Applicant IC company number	20271
IC UPN number	20271-BHABN002
All used IC test site(s) Reg. number	332406
RSS number and Issue number	RSS-210 Annex B.10 Issue 9, August 2016
Frequency band (MHz)	902–928
Frequency Min (MHz)	908.4
Frequency Max (MHz)	916.0
RF power Max (W), Conducted	N/A
Field strength, Units @ distance	93.7 dBµV/m @ 3 m
Measured BW (kHz) (99%)	108.8
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	2FSK
Emission classification	F1D
Transmitter spurious, Units @ distance	902 MHz, 42.5 dBµV/m @ 3 m
Power requirements	5 V_{DC} (via external 100–240 V_{AC}, 50/60 Hz power adapter)
Antenna information	Antenna gain is 0.8 dBi The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.
Hardware and software details	Labtool v1.0.0.164

3.4 Product description and theory of operation

Communications Hub for Home Security Products

3.5 EUT exercise details

The EUT was setup in continuous transmit state.

3.6 EUT setup diagram

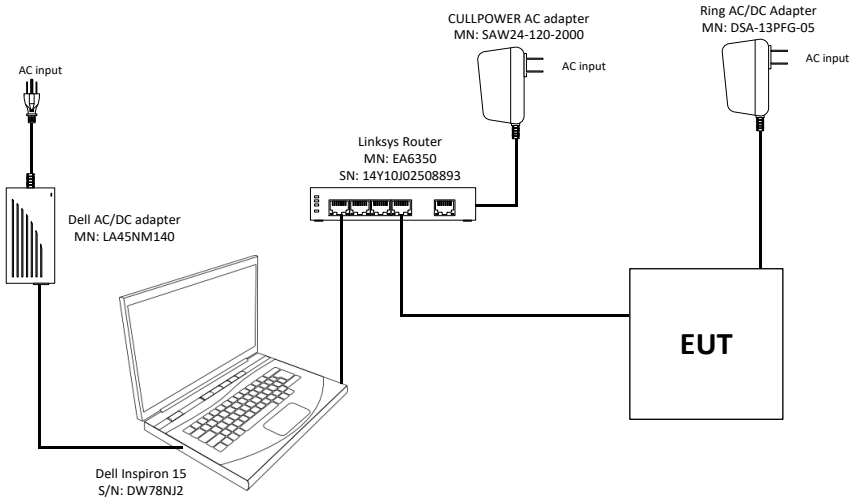


Figure 3.6-1: *Setup diagram*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
AC/DC Adapter	Ring	DSA-13PFG-05	BHAB11851DV000116
Laptop	Dell	Inspiron 15	DW78NJ2
Network switch	TP-Link	TL-SG1008D	2171682000263

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT for compliance

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	86–106 kPa

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

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
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.	Serial no.	Asset no.	Cal./Ver. cycle	Next cal./ver.
3 m EMI test chamber	TDK	SAC-3		FA003012	1 year	Aug. 22/19
Flush mount turntable	SUNAR	FM2022		FA003006	—	NCR
Controller	SUNAR	SC110V	050118-1	FA002976	—	NCR
Antenna mast	SUNAR	TLT2	042418-5	FA003007	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESR26	101367	FA002969	1 year	June 1/19
Horn antenna (1–18 GHz)	ETS-Lindgren	3117	00052793	FA002911	1 year	Aug. 16/19
Preamp (1–18 GHz)	ETS-Lindgren	124334	00224880	FA002956	1 year	Sept 18/19
Bilog antenna (30–2000 MHz)	SUNAR	JB1	A053018-2	FA003010	1 year	Sept. 6/19
50 Ω coax cable	Huber + Suhner	None	457630	FA003047	1 year	Nov 12/19
50 Ω coax cable	Huber + Suhner	None	457624	FA003044	1 year	Nov 12/19
Two-line v-network	Rohde & Schwarz	ENV216	101376	FA002964	1 year	Mar. 27/19
50 Ω coax cable	Rohde & Schwarz	None		FA003074	1 year	Dec. 21/19
AC Power source	Chroma	61605	616050002253	FA003034	—	VOU
Filter 902 – 928 MHz	Microwave Circuits	N03916M1	499787	FA003032	1 year	Oct. 1/19

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

Section 8. Testing data

8.1 FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits

8.1.1 Definitions and limits

FCC §15.207:

a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

ANSI: C63.10 subclause 6.2
If the EUT normally receives power from another device that in turn connects to the public utility ac power lines, measurements shall be made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is
operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.
For direct current (dc) powered devices where the ac power adapter is not supplied with the device, an "off-the-shelf" unmodified ac power adapter shall be used. If the device is supposed to be installed in a host (e.g., the device is a module or PC card), then it is tested in a typical compliant host.

RSS-GEN Section 8.8:

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz, shall not exceed the limits in table below.

Unless the requirements applicable to a given device state otherwise, for any radio apparatus equipped to operate from the public utility AC power supply either directly or indirectly (such as with a battery charger), the radio frequency voltage of emissions conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in table below. The more stringent limit applies at the frequency range boundaries.

Table 8.1-1: *AC power line conducted emissions limit*

Frequency of emission, MHz	Conducted limit, dBµV	
	Quasi-peak	Average**
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

Notes: * - The level decreases linearly with the logarithm of the frequency.
** - A linear average detector is required.

8.1.1 Test date

Start date	February 11, 2019

8.1.2 Observations, settings and special notes

Port under test – Coupling device	AC Input – Artificial Mains Network (AMN)
EUT power input during test	5 V_{DC} (Powered via external power adapter @ 120 V_{AC} 60 Hz)
EUT setup configuration	Table top
Measurement details	– A preview measurement was generated with the receiver in continuous scan mode. Emissions detected within 10 dB or above the limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement. – The spectral plots have been corrected with transducer factors. (i.e. cable loss, LISN factors, and attenuators) – No emissions were detected within 10 dB of the applicable limit.

Receiver settings:

Resolution bandwidth	9 kHz
Video bandwidth	30 kHz
Detector mode	Peak and Average (Preview measurement), Quasi-peak and CAverage (Final measurement)
Trace mode	Max Hold
Measurement time	– 100 ms (Peak and Average preview measurement) – 100 ms (Quasi-peak final measurement) – 160 ms (CAverage final measurement)

8.1.3 Test data

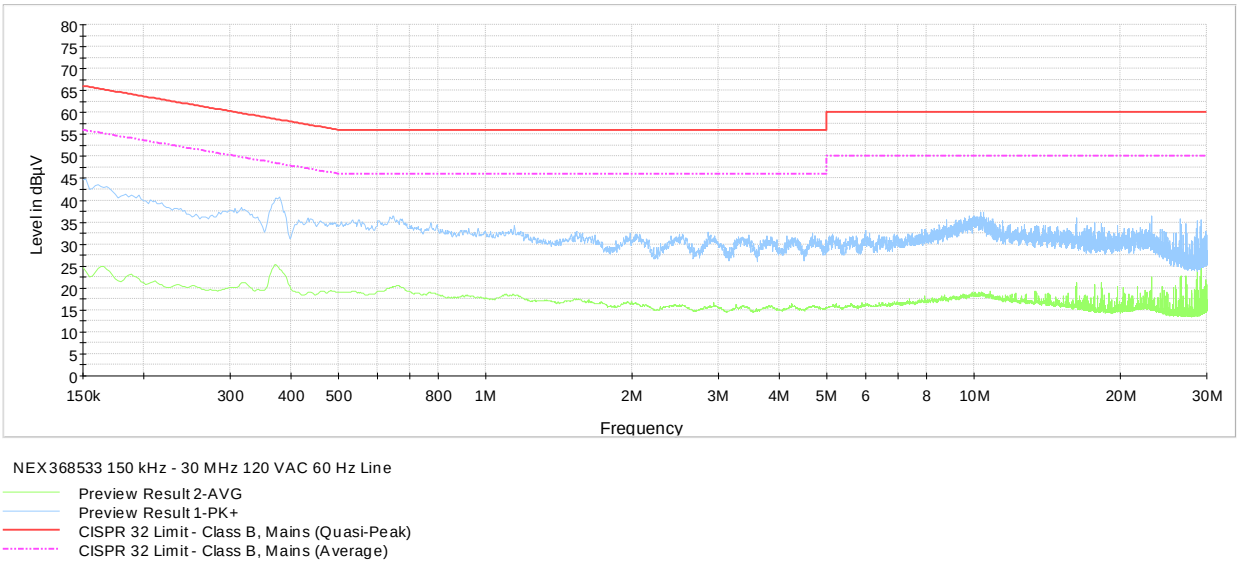


Figure 8.1-1: *AC power line conducted emissions – spectral plot on phase line*

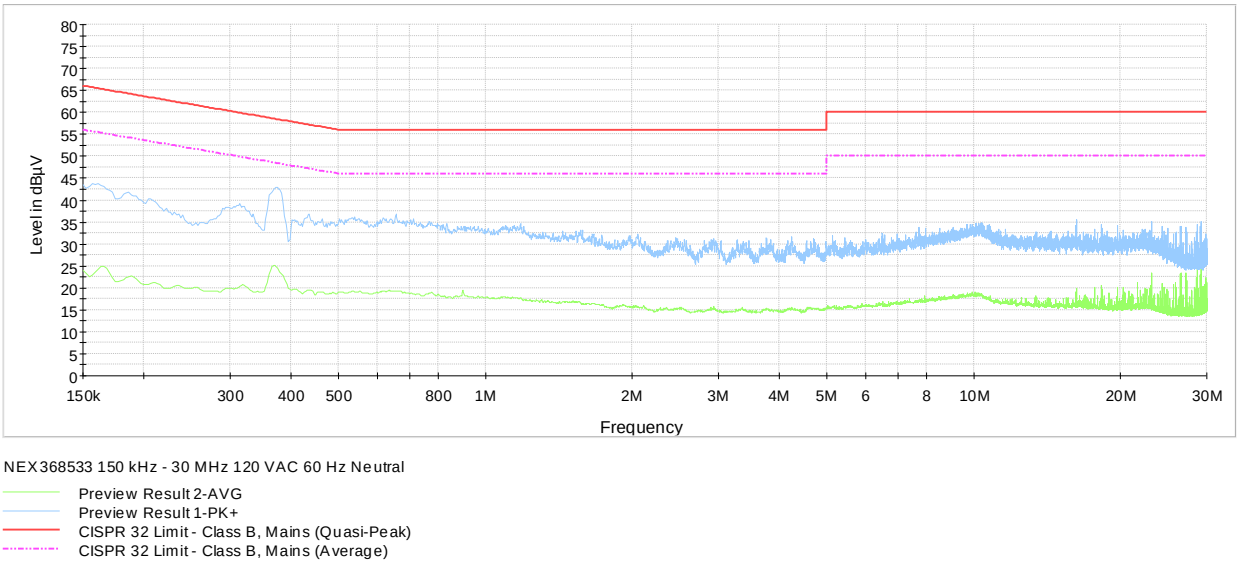


Figure 8.1-2: *AC power line conducted emissions – spectral plot on neutral line*

8.2 FCC 15.215(c) and RSS-Gen Section 6.6 Occupied (Emission) bandwidth

8.2.1 Definitions and limits

FCC §15.215 (c):

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

IC RSS-GEN Section 6.6:

When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

8.2.2 Test date

Start date	February 8, 2019

8.2.3 Observations, settings and special notes

None

Spectrum analyser settings:

Detector mode	Peak
Resolution bandwidth	1 % to 5 % of OBW
Video bandwidth	RBW × 3
Trace mode	Max Hold

8.2.4 Test data

Table 8.2-1: 20 dB bandwidth results

Frequency, MHz	Baud rate, k	20 dB bandwidth, kHz	99% bandwidth, kHz
908.40	9.6	79.88	83.94
908.40	40	88.57	87.99
908.42	9.6	86.25	81.04
916.00	100	115.20	108.83

Notes: None

8.2.4 Test data, continued

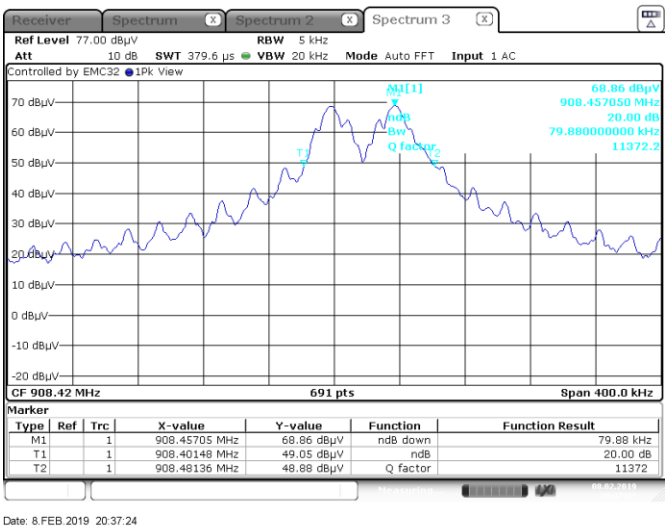


Figure 8.2-1: *20 dB bandwidth @ 908.42 MHz, 9.6k baud rate*

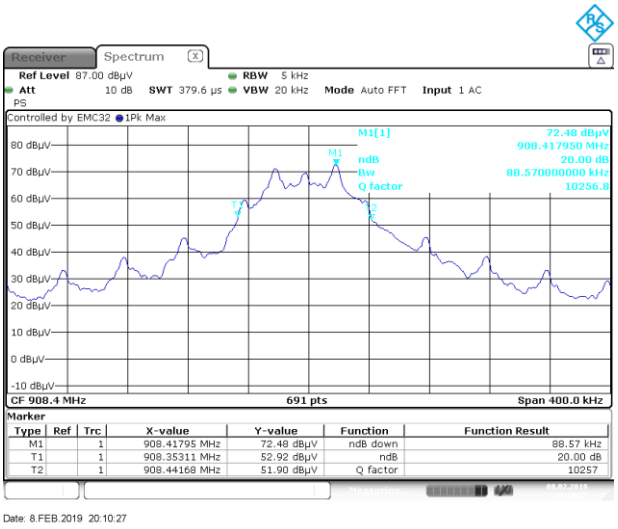


Figure 8.2-2: *20 dB bandwidth @ 908.4 MHz, 40k baud rate*

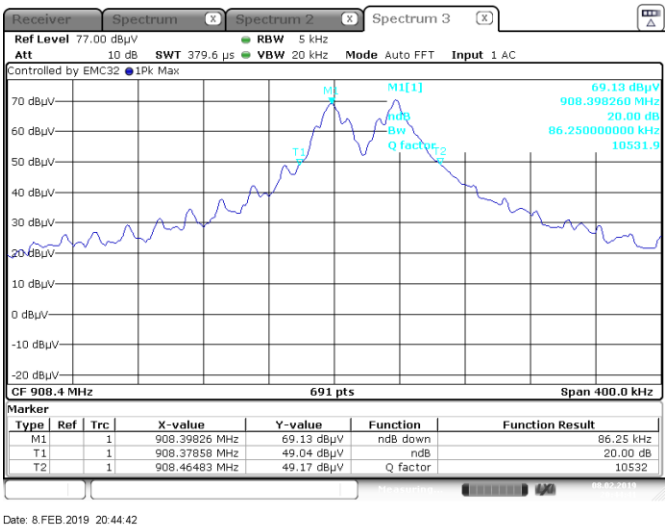


Figure 8.2-3: *20 dB bandwidth @ 908.4 MHz, 9.6k baud rate*

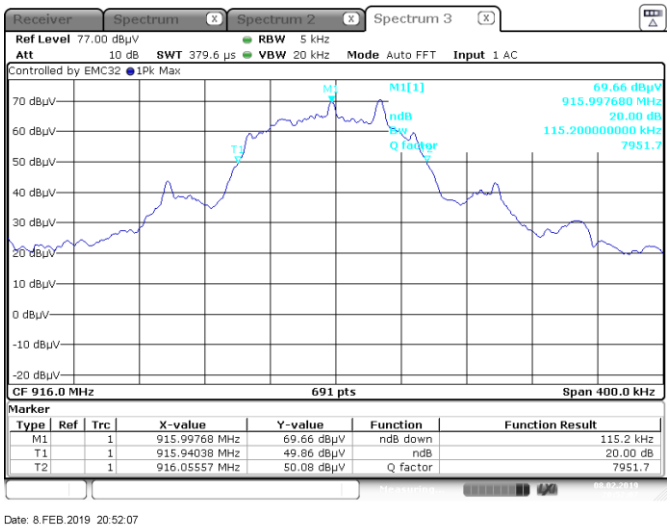


Figure 8.2-4: *20 dB bandwidth @ 916.0 MHz, 100k baud rate*

8.2.4 Test data, continued

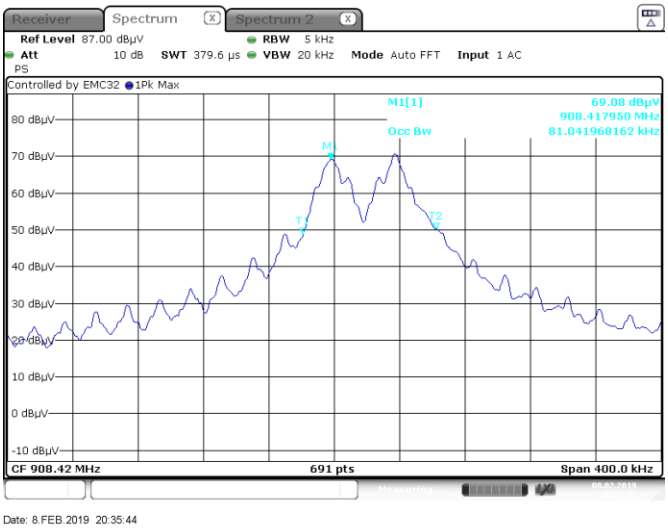


Figure 8.2-5: *99% bandwidth, @ 908.42 MHz, 9.6k baud rate*

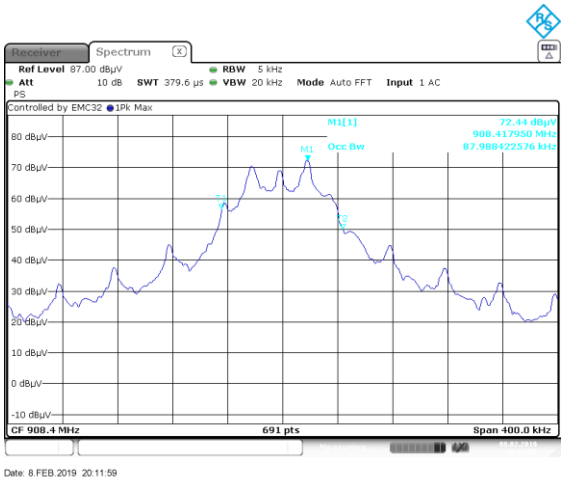


Figure 8.2-6: *99% bandwidth, @ 908.4 MHz, 40k baud rate*

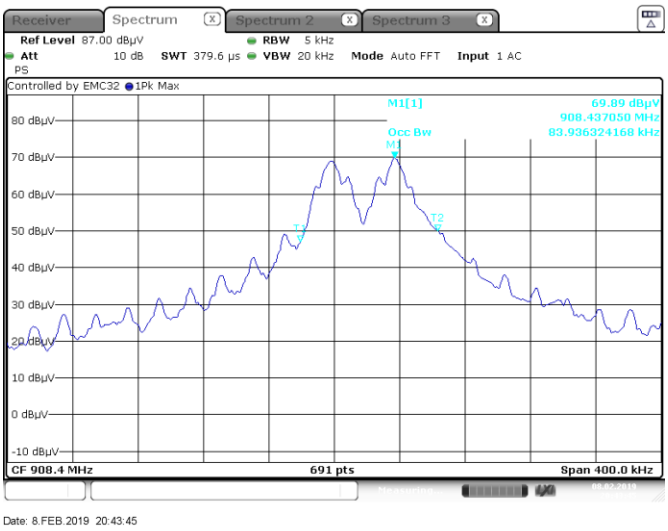


Figure 8.2-7: *99% bandwidth, @ 908.4 MHz, 9.6k baud rate*

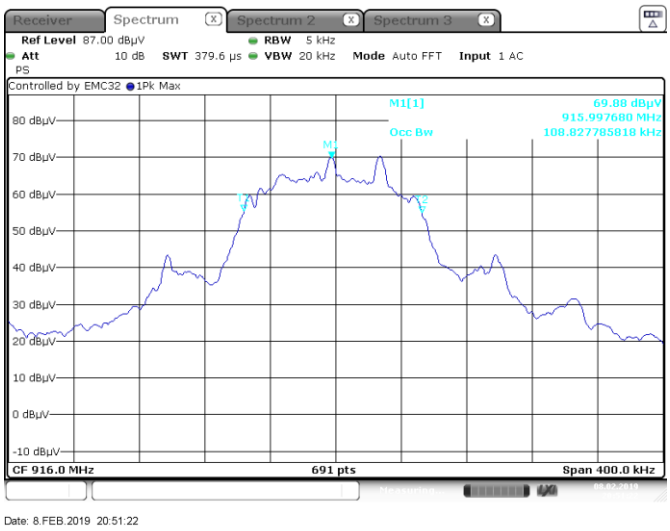


Figure 8.2-8: *99% bandwidth, @ 916 MHz, 100k baud rate*

8.3 FCC 15.249(a) RSS 210 and Section B.10(a) Field strength of fundamental and harmonics outside restricted bands

8.3.1 Definitions and limits

FCC §15.249 (a):

The field strength of emissions from intentional radiators shall comply with the following table. Field strength limits are specified at a distance of 3 meters.

IC RSS-210 Section B.10 (a):

The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively. See table below.

Table 8.3-1: *Field strength limits*

Fundamental frequencies,	Field strength of fundamental		Field strength of harmonics	
MHz	mV/m	dBµV/m	µV/m	dBµV/m
902–928	50	94	500	54
2400–2483.5	50	94	500	54
5725–5875	50	94	500	54
24000–24250	250	108	2500	68

Notes:
- The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902–928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.
- 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

8.3.2 Test date

Start date	February 13, 2019

8.3.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to 10th harmonic of fundamental frequency.
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3 m.
- The spectral plots have been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators)
- Routing of ethernet and power cable critical. Power cable must be routed through back of EUT, and ethernet cable must be routed on right side of EUT.

Spectrum analyser settings for measurements below 1 GHz:

Resolution bandwidth:	100 or 120 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak or Quasi-Peak
Trace mode:	Max Hold

Spectrum analyzer settings for peak measurements at the frequencies above 1000 MHz:

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

Spectrum analyzer settings for Duty Cycle Correction Factor (DCCF):

Span	0 Hz
Detector mode	Peak
Resolution bandwidth	3 MHz
Video bandwidth	3 MHz
Trace mode	View

8.3.4 Test data

Table 8.3-2: *Field strength of fundamental results*

Frequency, MHz	Baud rate, k	Power setting	Q-Peak field strength at 3 m, dBµV	Q-Peak field strength limit at 3 m, dBµV/m	Margin, dB
916.0	100	29	93.7	94.0	0.3
908.4	9.6	31	93.4	94.0	0.6
908.42	9.6	31	93.5	94.0	0.5
908.4	40	31	93.4	94.0	0.6

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.
No harmonic emissions were detected within 10 dB of limit.

8.3.4 Test data, continued

Duty Cycle

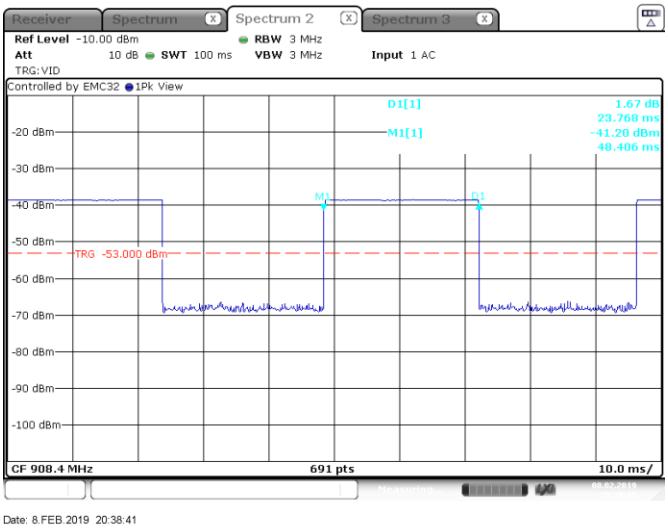


Figure 8.3-1: *908.42 MHz, 9.6k baud rate*

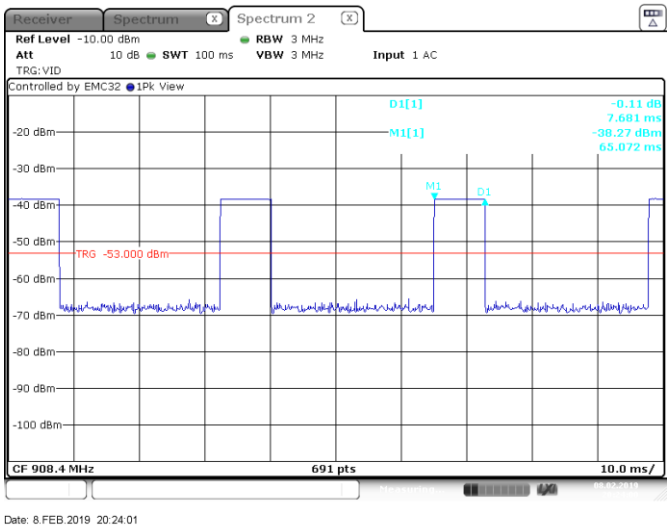


Figure 8.3-2: *908.4 MHz, 40k baud rate*

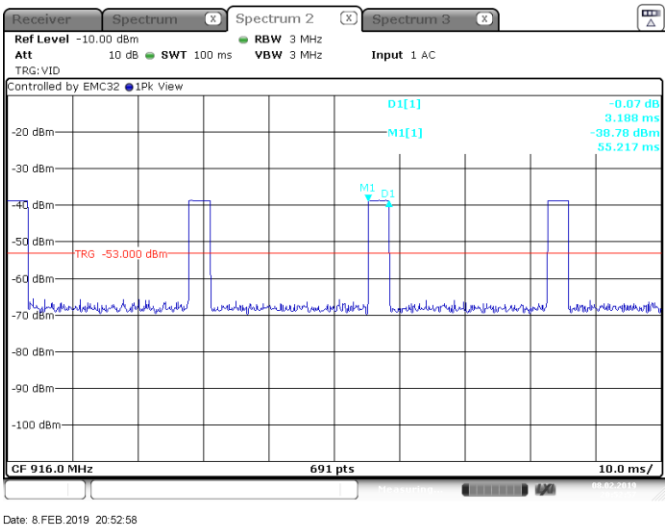


Figure 8.3-3: *916 MHz, 100k baud rate*

Duty cycle calculation:

908.42 MHz, 9.6k baud rate
Tx on Time = (2 pulses x 23.8 ms) + (1 pulse x 3.8 ms) = 51.4 ms
Duty cycle correction factor: $20 \times \text{Log}_{10}$ [(51.6) / 100] = −5.8 dB

908.40 MHz, 40k baud rate
Tx on Time = (3 pulses x 7.7 ms) + (1 pulse x 3 ms) = 26.1ms
Duty cycle correction factor: $20 \times \text{Log}_{10}$ [(26.9) / 100] = −11.4 dB

916 MHz, 100k baud rate
Tx on Time = 4 pulses x 3.2 ms = 12.8 ms
Duty cycle correction factor: $20 \times \text{Log}_{10}$ [(12.8) / 100] = −17.9 dB

8.3.4 Test data, continued

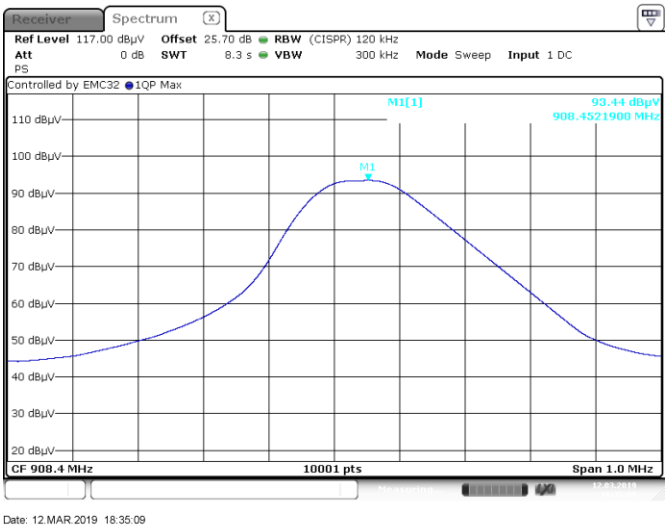


Figure 8.3-4: *Field strength of fundamental, 908.4 MHz, 9.6 k baud rate, Power setting 31*

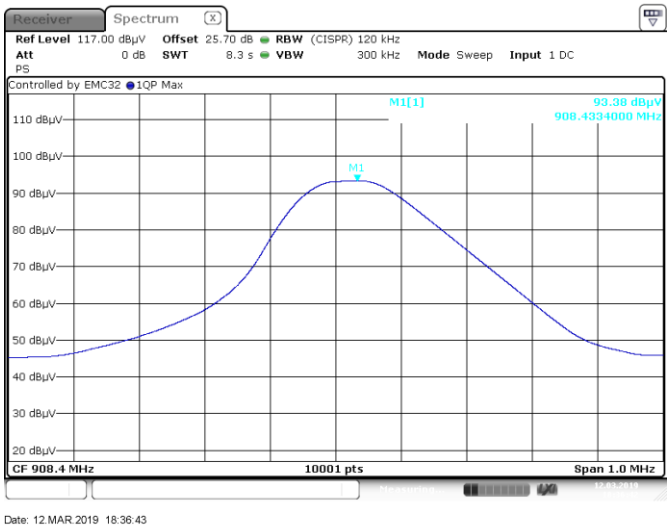


Figure 8.3-5: *Field strength of fundamental, 908.4 MHz, 40 k baud rate, Power setting 31*

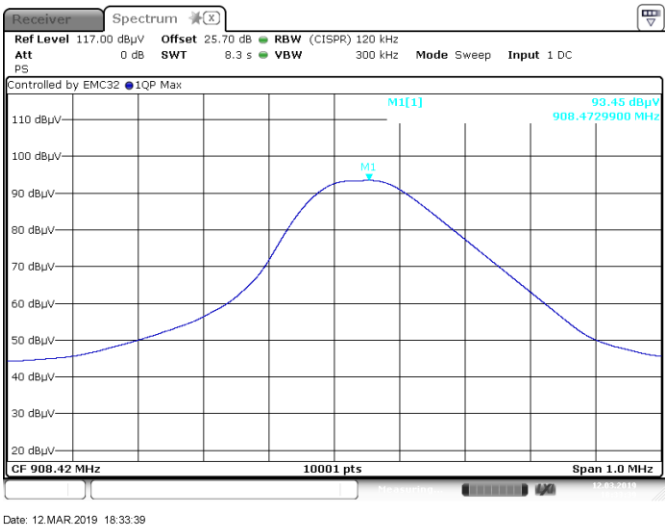


Figure 8.3-6: *Field strength of fundamental, 908.42 MHz, 9.6 k baud rate, Power setting 31*

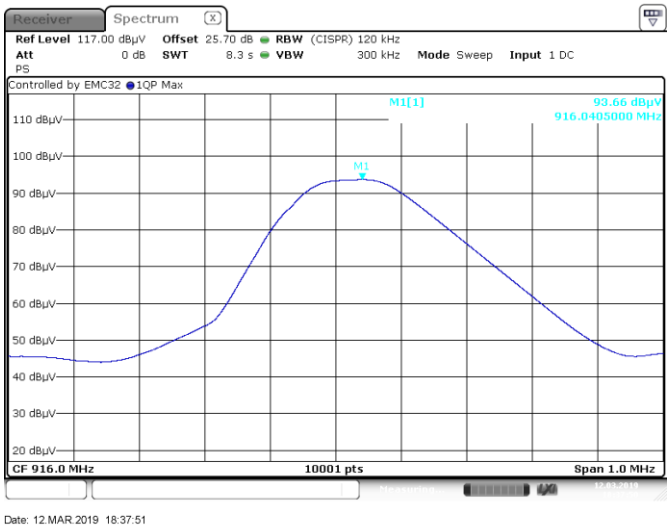


Figure 8.3-7: *Field strength of fundamental, 916 MHz, 100 k baud rate, power setting 29*

8.4 FCC 15.249(d) and RSS-210 Section B.10 (b) Spurious emissions (except for harmonics)

8.4.1 Definitions and limits

FCC §15.249 (d):

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 RSS-210 Section B.10 (b):

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

Table 8.4-1: *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 8.4-2: *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	Above 38.6
8.41425–8.41475	167.72–173.2	3500–4400	
12.29–12.293	240–285	4500–5150	
12.51975–12.52025	322–335.4	5350–5460	

Notes: Certain frequency bands listed in 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.

8.4.1 Definitions and limits, continued

Table 8.4-3: *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			

Notes: None

8.4.2 Test date

Start date	February 13, 2019

8.4.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to 10th harmonic of fundamental frequency.
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3 m.
- The spectral plots have been corrected with the associated transducer factors (i.e. antenna factors, cable loss, amplifier gains, and attenuators)
- No transmitter related radiated emissions were detected below 1 GHz. Emissions detected within restricted bands that were close to the limit were found to be digital emissions.

Spectrum analyser settings for measurements below 1 GHz:

Resolution bandwidth:	100 or 120 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak or Quasi-Peak
Trace mode:	Max Hold

Spectrum analyser settings for peak measurements above 1 GHz:

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

8.4.4 Test data

Table 8.4-4: *Radiated low band edge measurement results at 902 MHz*

Frequency, MHz	Baud rate, kHz	Peak Field strength, dBµV/m		Margin, dB
		Measured	Limit	
908.4	9.6	42.5	46.0	3.5
908.42	9.6	41.3	46.0	4.7
908.4	40.0	42.2	46.0	3.8
916.0	100.0	40.1	46.0	5.9

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

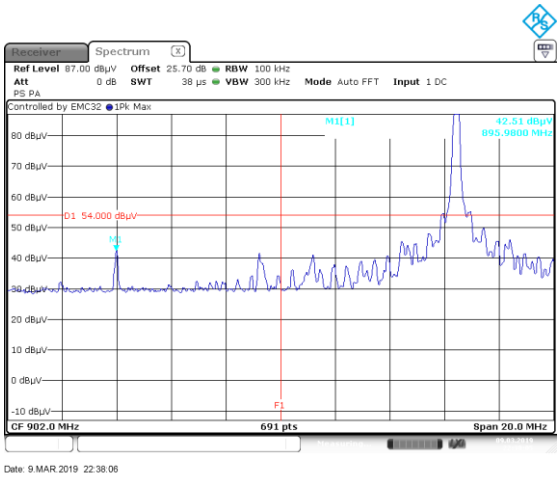


Figure 8.4-1: *Low Band edge emissions 908.4 MHz, 9.6 k baud rate*

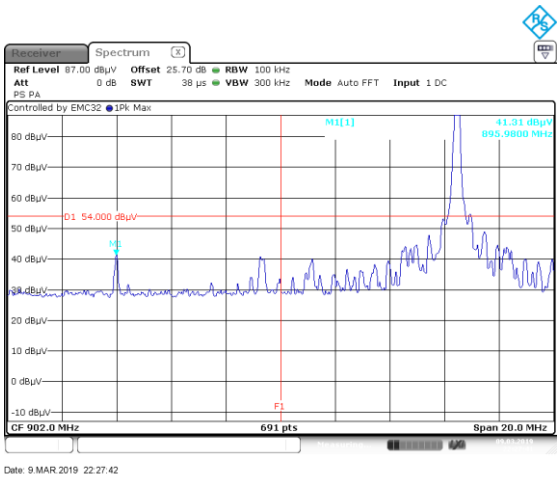


Figure 8.4-2: *Low Band edge emissions 908.42 MHz, 9.6 k baud rate*

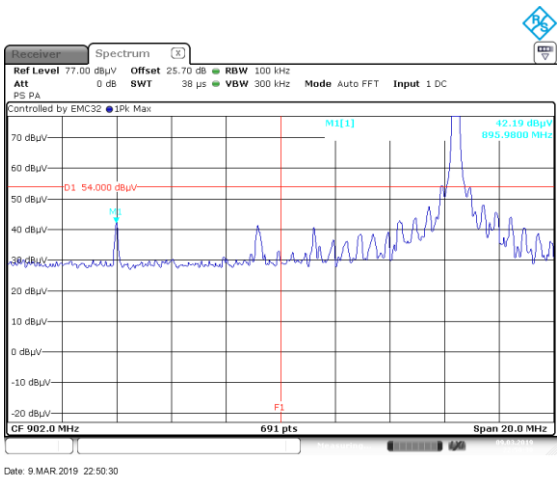


Figure 8.4-3: *Low Band edge emissions 908.4 MHz, 40 k baud rate*

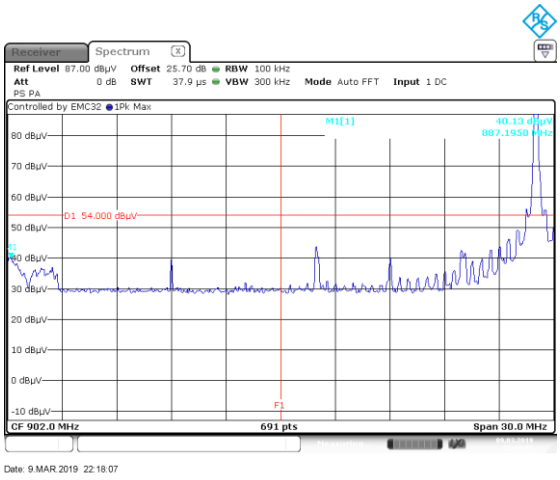


Figure 8.4-4*: Low Band edge emissions 916 MHz, 100 k baud rate*

8.4.4 Test data

Table 8.4-5: *Radiated high band edge measurement results at 928 MHz*

Frequency, MHz	Baud rate, kHz	Peak Field strength, dBµV/m		Margin, dB
		Measured	Limit	
908.4	9.6	33.5	46.0	12.5
908.42	9.6	33.6	46.0	12.4
908.4	40.0	32.7	46.0	13.3
916.0	100.0	42.0	46.0	4.0

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

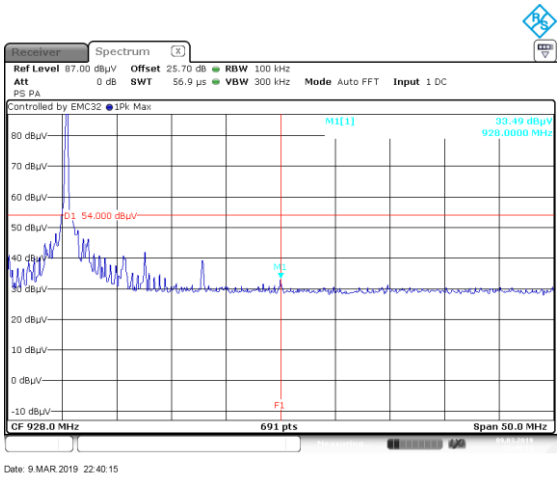


Figure 8.4-5: *High Band edge emissions 908.4 MHz, 9.6 k baud rate*

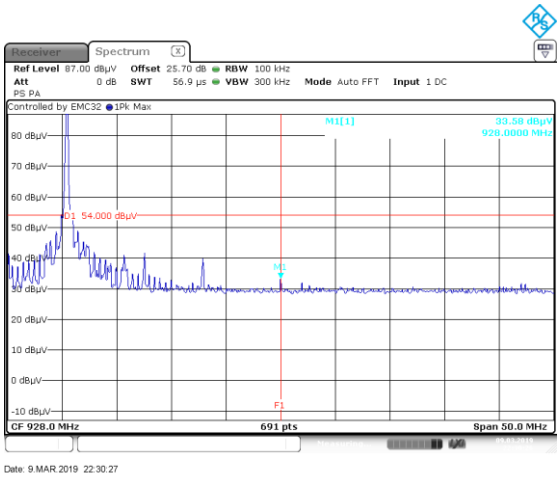


Figure 8.4-6: *High Band edge emissions 908.42 MHz, 9.6 k baud rate*

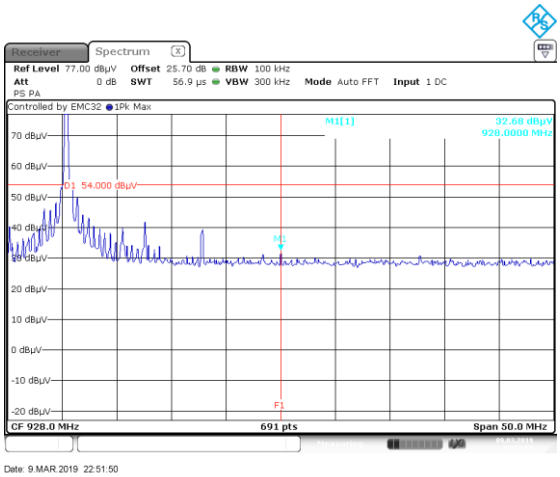


Figure 8.4-7: *High Band edge emissions 908.4 MHz, 40 k baud rate*

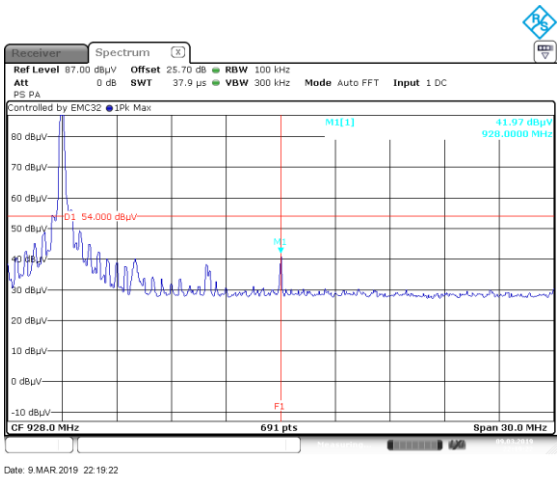


Figure 8.4-8: *High Band edge emissions 916 MHz, 100 k baud rate*

8.4.4 Test data

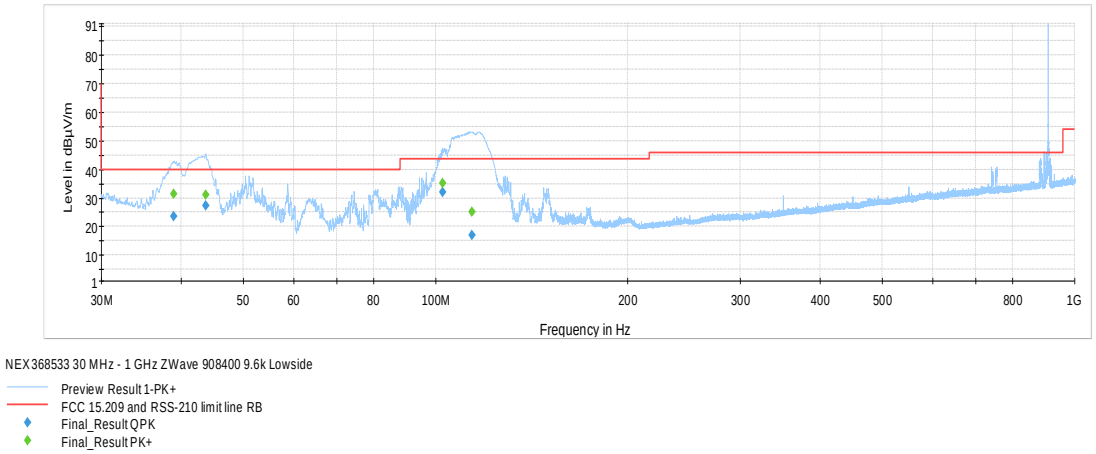


Figure 8.4-9: *Radiated emissions 30 MHz – 1 GHz, 908.4 MHz, 9.6 k baud rate*

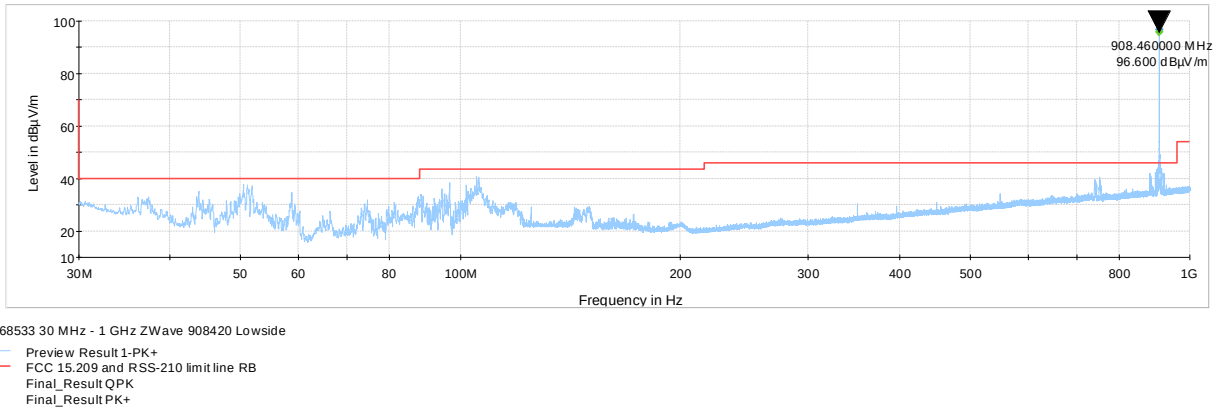


Figure 8.4-10: *Radiated emissions 30 MHz – 1 GHz, 908.42 MHz, 9.6 k baud rate*

8.4.4 Test data

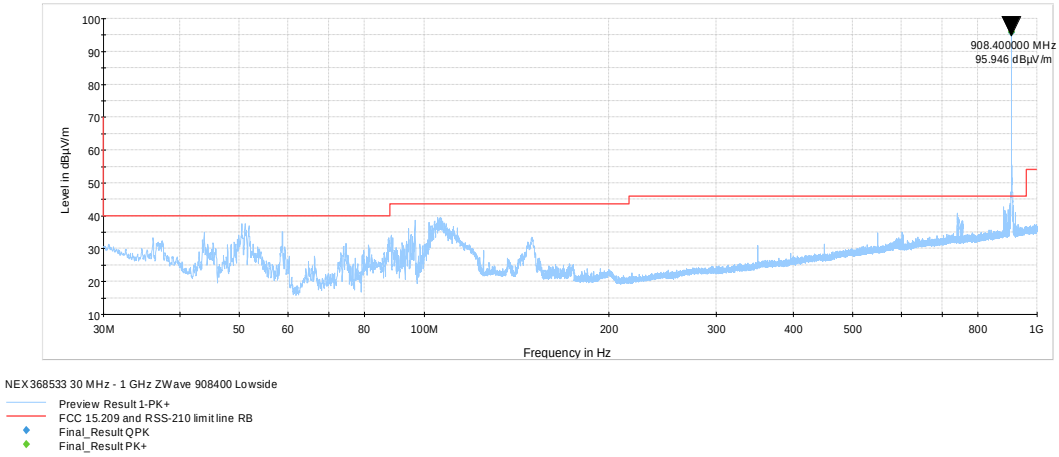


Figure 8.4-11: *Radiated emissions 30 MHz – 1 GHz, 908.4 MHz, 40 k baud rate*

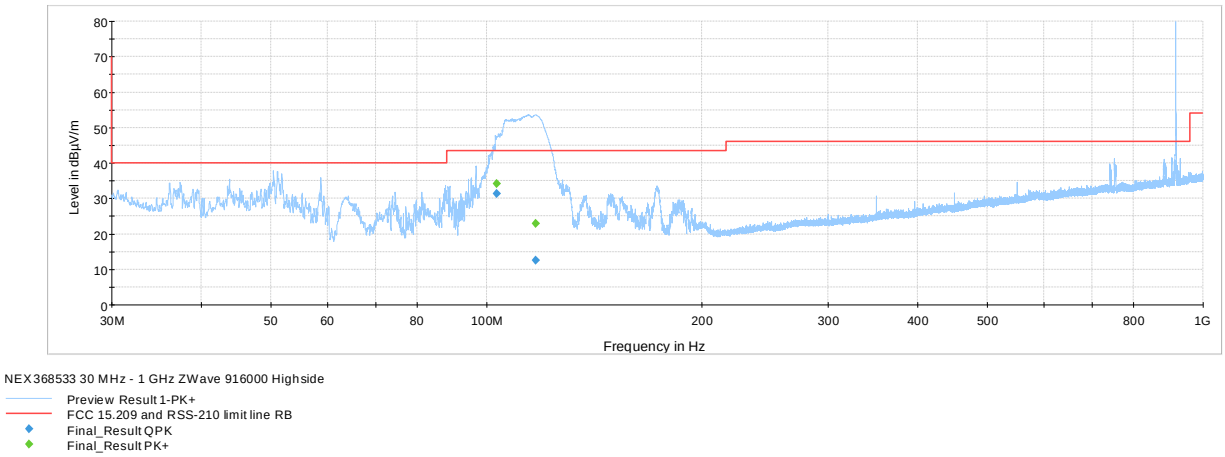


Figure 8.4-12: *Radiated emissions 30 MHz – 1 GHz, 916 MHz, 100 k baud rate*

8.4.4 Test data, continued

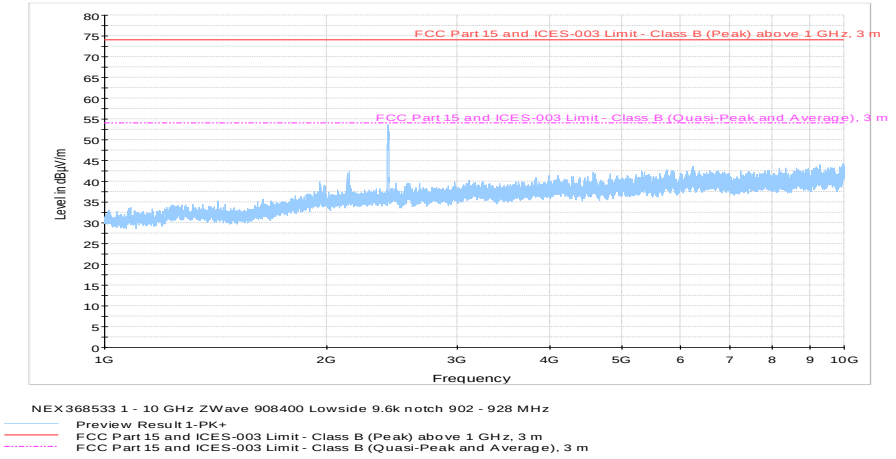


Figure 8.4-13: *Radiated emissions 1 - 10 GHz, 908.4 MHz, 9.6 k baud rate*

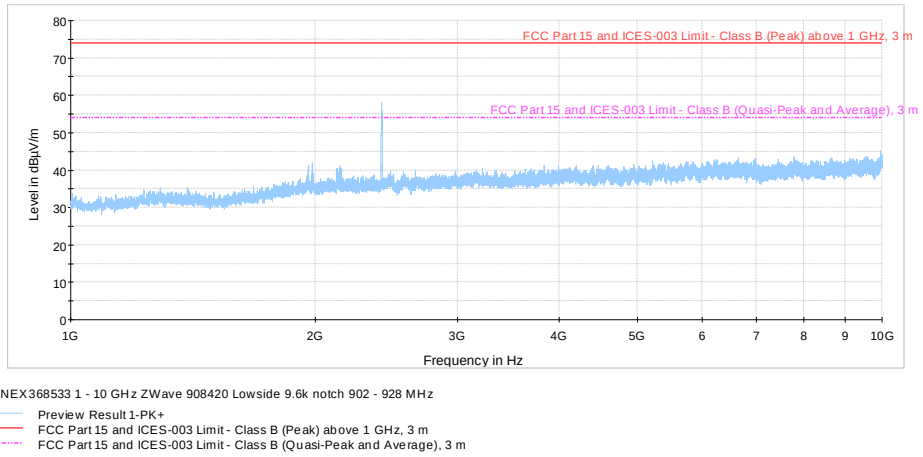


Figure 8.4-14: *Radiated emissions 1 - 10 GHz, 908.42 MHz, 9.6 k baud rate*

8.4.4 Test data

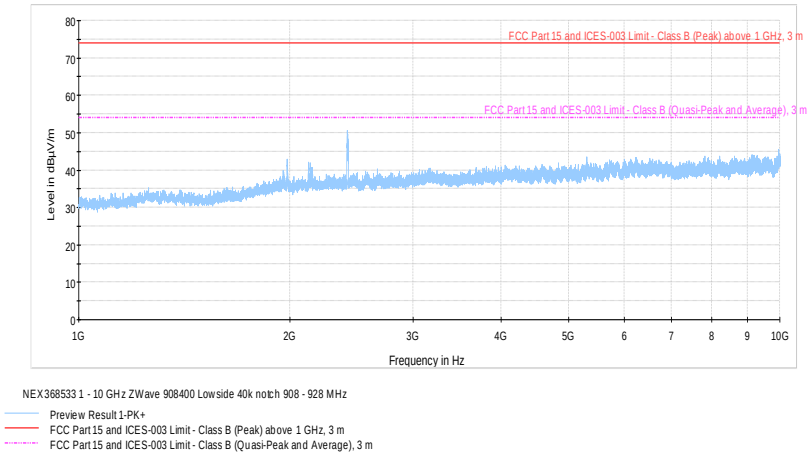


Figure 8.4-15: *Radiated emissions 1 - 10 GHz, 908.4 MHz, 40 k baud rate*

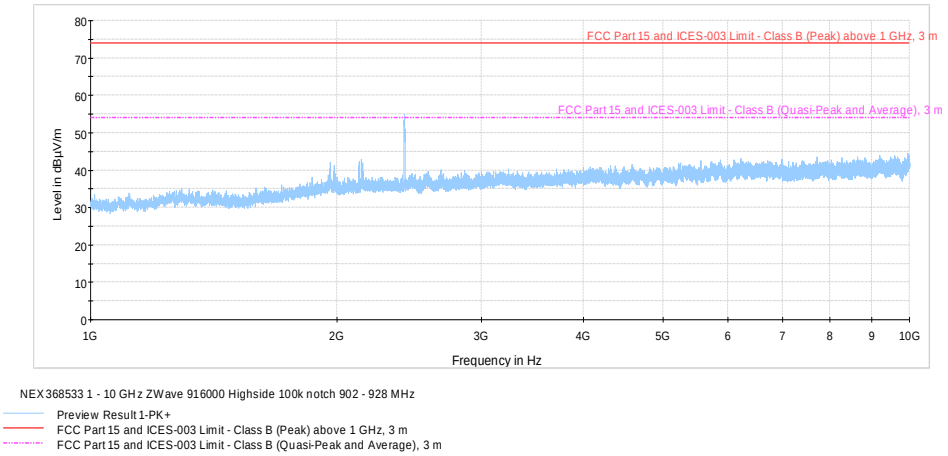
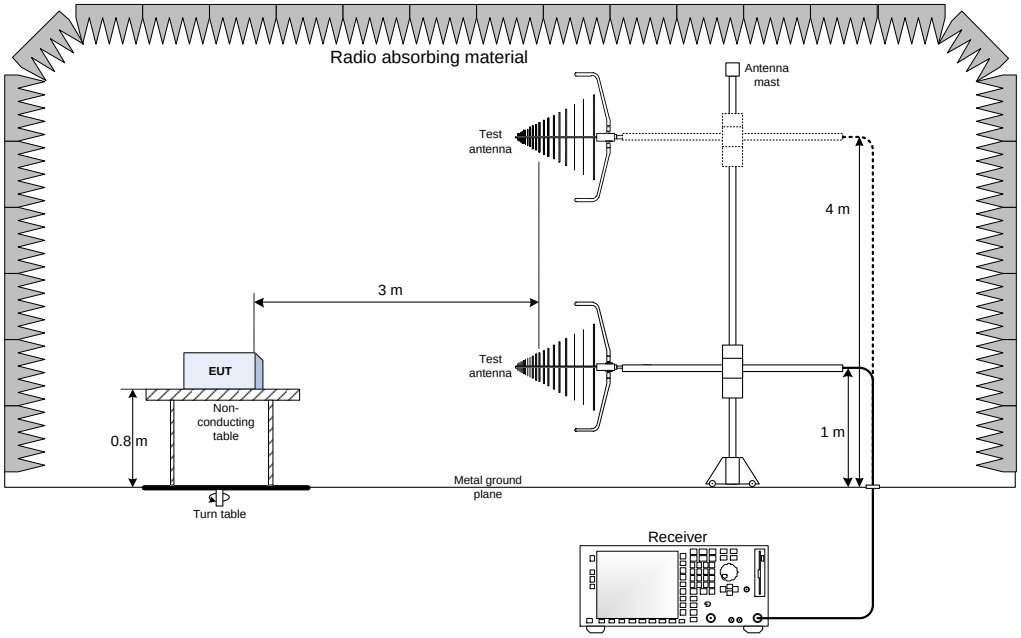


Figure 8.4-16: *Radiated emissions 1 – 10 GHz, 916 MHz, 100 k baud rate*

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