



# WIRELESS TEST REPORT – 391110-1TRFWL

Applicant:

**Tyco Safety Products Canada Ltd.**

Product name:

**PowerG Hardwired to Wireless Converter for Alarm System**

Model:

**PG9WLSHW8**

FCC ID:

**F5320PG9WLSHW8**

IC Registration number:

**160A-PG9WLSHW8**

Specifications:

◆ **FCC 47 CFR Part 15 Subpart C, §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

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: **February 3, 2020**

**Avul Nzenza, EMC/Wireless Specialist**

Tested by

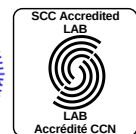
Signature

**Andrey Adelberg, Senior Wireless/EMC Specialist**

Reviewed by

Signature

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada.  
The tests included in this report are within the scope of this accreditation



## Lab locations

|                        |                                                                                                                            |                                                                                                                                         |                                                                                                                |
|------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Company name           | Nemko Canada Inc.                                                                                                          |                                                                                                                                         |                                                                                                                |
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| Test site registration | FCC: CA2040; IC: 2040A-4                                                                                                   | FCC: CA2041; IC: 2040G-5                                                                                                                | FCC/IC: CA0101                                                                                                 |
| Website                | <a href="http://www.nemko.com">www.nemko.com</a>                                                                           |                                                                                                                                         |                                                                                                                |

## 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.

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## Table of Contents

|                                                                                                                      |           |
|----------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Table of Contents .....</b>                                                                                       | <b>3</b>  |
| <b>Section 1      Report summary .....</b>                                                                           | <b>4</b>  |
| 1.1    Test specifications .....                                                                                     | 4         |
| 1.2    Test methods .....                                                                                            | 4         |
| 1.3    Exclusions .....                                                                                              | 4         |
| 1.4    Statement of compliance.....                                                                                  | 4         |
| 1.5    Test report revision history.....                                                                             | 4         |
| <b>Section 2      Engineering considerations .....</b>                                                               | <b>5</b>  |
| 2.1    Modifications incorporated in the EUT for compliance .....                                                    | 5         |
| 2.2    Technical judgment .....                                                                                      | 5         |
| 2.3    Deviations from laboratory tests procedures .....                                                             | 5         |
| <b>Section 3      Test conditions .....</b>                                                                          | <b>6</b>  |
| 3.1    Atmospheric conditions.....                                                                                   | 6         |
| 3.2    Power supply range .....                                                                                      | 6         |
| <b>Section 4      Measurement uncertainty .....</b>                                                                  | <b>7</b>  |
| 4.1    Uncertainty of measurement .....                                                                              | 7         |
| <b>Section 5      Summary of test results .....</b>                                                                  | <b>8</b>  |
| 5.1    Testing location .....                                                                                        | 8         |
| 5.2    Testing period.....                                                                                           | 8         |
| 5.3    Sample information .....                                                                                      | 8         |
| 5.4    FCC Part 15 Subpart C, general requirements test results .....                                                | 8         |
| 5.5    FCC Part 15 Subpart C, intentional radiators test results for frequency hopping spread spectrum systems ..... | 8         |
| 5.6    ISED RSS-Gen, Issue 5, test results .....                                                                     | 9         |
| 5.7    ISED RSS-247, Issue 2, test results for frequency hopping spread spectrum systems (FHSS) .....                | 9         |
| <b>Section 6      Information provided by the applicant.....</b>                                                     | <b>10</b> |
| 6.1    Disclaimer .....                                                                                              | 10        |
| 6.2    Applicant.....                                                                                                | 10        |
| 6.3    Manufacturer.....                                                                                             | 10        |
| 6.4    EUT information .....                                                                                         | 10        |
| 6.5    Technical information.....                                                                                    | 11        |
| 6.6    EUT exercise details .....                                                                                    | 11        |
| 6.7    EUT setup details .....                                                                                       | 11        |
| <b>Section 7      Test equipment.....</b>                                                                            | <b>12</b> |
| 7.1    Test Equipment list .....                                                                                     | 12        |
| <b>Section 8      Testing data .....</b>                                                                             | <b>13</b> |
| 8.1    FCC 15.31(e) Variation of power source .....                                                                  | 13        |
| 8.2    FCC 15.31(m) and RSS-Gen 6.9 Number of frequencies.....                                                       | 14        |
| 8.3    FCC 15.203 and RSS-Gen 6.8 Antenna requirement .....                                                          | 16        |
| 8.4    FCC 15.207(a) and RSS-Gen 8.8 AC power line conducted emissions limits.....                                   | 17        |
| 8.5    FCC 15.247(a)(1)(i) and RSS-247 5.1(a)b)(c) Frequency Hopping Systems requirements, 900 MHz operation .....   | 20        |
| 8.6    FCC 15.247(b)(2) and RSS-247 5.4(a) Transmitter output power and e.i.r.p. requirements for FHSS 900 MHz.....  | 27        |
| 8.7    FCC 15.247(d) and RSS-247 5.5 Spurious (out-of-band) unwanted emissions .....                                 | 29        |
| <b>Section 9      Block diagrams of test set-ups.....</b>                                                            | <b>36</b> |
| 9.1    Radiated emissions set-up for frequencies below 1 GHz .....                                                   | 36        |
| 9.2    Radiated emissions set-up for frequencies above 1 GHz .....                                                   | 36        |
| 9.3    Conducted emissions set-up.....                                                                               | 37        |
| 9.4    Antenna port set-up .....                                                                                     | 37        |

## 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. |
| 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                                                                                                                                    |

### 1.3 Exclusions

None

### 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. 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 3, 2020 | Original report issued                 |

## Section 2 Engineering considerations

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### 2.1 Modifications incorporated in the EUT for compliance

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The following modifications were performed by client: sample with 50  $\Omega$  connector instead of on-board antenna was provided for antenna port connector measurements.

### 2.2 Technical judgment

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None

### 2.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 3 Test conditions

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### 3.1 Atmospheric conditions

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|                   |                                         |
|-------------------|-----------------------------------------|
| 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

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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 4 Measurement uncertainty

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### 4.1 Uncertainty of measurement

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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**

| 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 5 Summary of test results

### 5.1 Testing location

Test location (s) Ottawa

### 5.2 Testing period

Test start date January 17, 2020 Test end date January 28, 2020

### 5.3 Sample information

Receipt date January 15, 2020 Nemko sample ID number 2 to 9

### 5.4 FCC Part 15 Subpart C, general requirements test results

**Table 5.4-1: FCC general requirements results**

| Part       | Test description                                                                                                                                                                                                                                                                                                               | Verdict           |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| §15.207(a) | Conducted limits                                                                                                                                                                                                                                                                                                               | Pass              |
| §15.31(e)  | Variation of power source                                                                                                                                                                                                                                                                                                      | Pass <sup>1</sup> |
| §15.31(m)  | Number of tested frequencies                                                                                                                                                                                                                                                                                                   | Pass              |
| §15.203    | Antenna requirement                                                                                                                                                                                                                                                                                                            | Pass              |
| Notes:     | <sup>1</sup> Measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, was performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. No noticeable output power variation was observed. |                   |

### 5.5 FCC Part 15 Subpart C, intentional radiators test results for frequency hopping spread spectrum systems

**Table 5.5-1: FCC 15.247 results for FHSS**

| Part               | Test description                                                                        | Verdict        |
|--------------------|-----------------------------------------------------------------------------------------|----------------|
| §15.247(a)(1)(i)   | Requirements for operation in the 902–928 MHz band                                      | Pass           |
| §15.247(a)(1)(ii)  | Requirements for operation in the 5725–5850 MHz band                                    | Not applicable |
| §15.247(a)(1)(iii) | Requirements for operation in the 2400–2483.5 MHz band                                  | Not applicable |
| §15.247(b)(1)      | Maximum peak output power in the 2400–2483.5 MHz band and 5725–5850 MHz band            | Not applicable |
| §15.247(b)(2)      | Maximum peak output power in the 902–928 MHz band                                       | 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(f)         | Time of occupancy for hybrid systems                                                    | Not applicable |
| Notes:             | None                                                                                    |                |



## 5.6 ISED RSS-Gen, Issue 5, test results

**Table 5.6-1: RSS-Gen results**

| Part | Test description                                  | Verdict                     |
|------|---------------------------------------------------|-----------------------------|
| 7.3  | Receiver radiated emission limits                 | Not applicable <sup>1</sup> |
| 7.4  | Receiver conducted emission limits                | Not applicable <sup>1</sup> |
| 6.9  | Operating bands and selection of test frequencies | Pass                        |
| 8.8  | AC power-line conducted emissions limits          | Pass                        |

Notes: <sup>1</sup> 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.

## 5.7 ISED RSS-247, Issue 2, test results for frequency hopping spread spectrum systems (FHSS)

**Table 5.7-1: RSS-247 results for FHSS**

| Part    | Test description                                                                       | Verdict        |
|---------|----------------------------------------------------------------------------------------|----------------|
| 5.1 (a) | Bandwidth of a frequency hopping channel                                               | Pass           |
| 5.1 (b) | Minimum channel spacing                                                                | Pass           |
| 5.1 (c) | Systems operating in the 902–928 MHz band                                              | Pass           |
| 5.1 (d) | Systems operating in the 2400–2483.5 MHz band                                          | Not applicable |
| 5.1 (e) | Systems operating in the 5725–5850 MHz band                                            | Not applicable |
| 5.3     | Hybrid Systems                                                                         |                |
| 5.3 (a) | Digital modulation turned off                                                          | Not applicable |
| 5.3 (b) | Frequency hopping turned off                                                           | Not applicable |
| 5.4     | Transmitter output power and e.i.r.p. requirements                                     |                |
| 5.4 (a) | Systems operating in the 902–928 MHz band                                              | Pass           |
| 5.4 (b) | Systems operating in the 2400–2483.5 MHz band                                          | Not applicable |
| 5.4 (c) | Systems operating in the 5725–5850 MHz                                                 | Not applicable |
| 5.4 (e) | Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band                       | Not applicable |
| 5.4 (f) | Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams | Not applicable |
| 5.5     | Unwanted emissions                                                                     | Pass           |

Notes: None

## Section 6 Information provided by the applicant

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### 6.1 Disclaimer

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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.

### 6.2 Applicant

---

|              |                                                   |
|--------------|---------------------------------------------------|
| Company name | Tyco Safety Products Canada Ltd                   |
| Address      | 3301 Langstaff Road, Vaughan, ON, Canada, L4K 4L2 |

### 6.3 Manufacturer

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|              |                                                   |
|--------------|---------------------------------------------------|
| Company name | Tyco Safety Products Canada Ltd                   |
| Address      | 3301 Langstaff Road, Vaughan, ON, Canada, L4K 4L2 |

### 6.4 EUT information

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|                                 |                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product name                    | PowerG Hardwired to Wireless Converter for Alarm System                                                                                                                                                                                                                                                                                             |
| Model                           | PG9WLSHW8                                                                                                                                                                                                                                                                                                                                           |
| Serial number                   | None                                                                                                                                                                                                                                                                                                                                                |
| Part number                     | PG9WLSHW8                                                                                                                                                                                                                                                                                                                                           |
| Power requirements              | 18 V <sub>DC</sub> /2.2 A, provided by external power supply model SOY-1800222-NA (120 Vac/1.2A/60 Hz)                                                                                                                                                                                                                                              |
| Description/theory of operation | The device allows the conversion of 8 hardwired inputs into a PowerG wireless transmission to the compatible alarm system receiver. When one of the zone inputs is triggered the device will transmit a wireless alarm to the compatible receiver/alarm panel that identifies the initiating device input zones that triggered the alarm condition. |
| Software details                | HW: Hardware/UA746Rev. 01/SW Ver. 1.0                                                                                                                                                                                                                                                                                                               |

## 6.5 Technical information

|                                         |                                                                                                        |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------|
| Applicant IC company number             | 160A                                                                                                   |
| IC UPN number                           | PG9WLSHW8                                                                                              |
| 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                                                                                           |
| Frequency Min (MHz)                     | 912.750                                                                                                |
| Frequency Max (MHz)                     | 919.106                                                                                                |
| Number of channels                      | 50                                                                                                     |
| RF power Max (W), Conducted             | 0.0447                                                                                                 |
| Field strength, dBμV/m @ 3 m            | N/A                                                                                                    |
| Measured BW (kHz), 99% OBW              | 88.1                                                                                                   |
| Type of modulation                      | FSK                                                                                                    |
| Emission classification (F1D, G1D, D1D) | W7D                                                                                                    |
| Transmitter spurious, dBμV/m @ 3 m      | 60.5 dBμV/m at 4595.5 MHz Peak@ 3 m; 44.0 dBμV/m at 4595.5 MHz Average@ 3 m                            |
| Power requirements                      | 18 V <sub>DC</sub> /2.2 A, provided by external power supply model SOY-1800222-NA (120 Vac/1.2A/60 Hz) |
| Antenna information                     | Internal, helical antenna, soldered to PCB assembly; Gain: –3.78 dB                                    |

## 6.6 EUT exercise details

During tests, the EUT was configured to continuously transmit at its maximum RF power.

## 6.7 EUT setup details

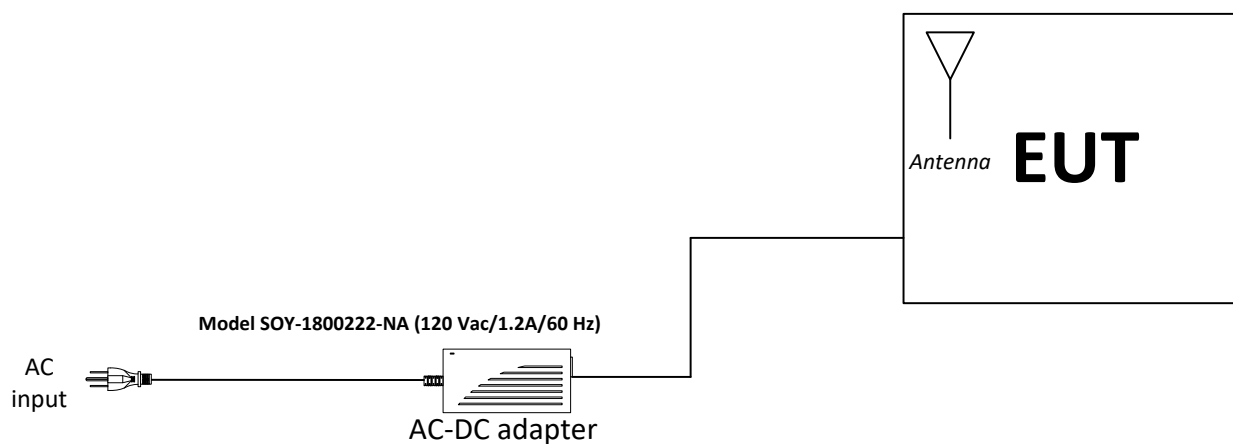


Figure 6.7-1: block diagram

## 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, 2020 |
| 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    | May 8, 2020      |
| Biconical antenna (30–300 MHz)      | Sunol           | BC2       | FA002078  | 1 year    | October 31, 2020 |
| Log periodic antenna (200–5000 MHz) | Sunol           | LP5       | FA002077  | 1 year    | October 31, 2020 |
| Horn antenna (1–18 GHz)             | EMCO            | 3115      | FA000825  | 1 year    | October 31, 2020 |
| Preamp (1–18 GHz)                   | ETS Lindgren    | 124334    | FA002877  | 1 year    | November 4, 2020 |
| 50 $\Omega$ coax cable              | Huber + Suhner  | None      | FA003099  | 1 year    | May 10, 2020     |
| 50 $\Omega$ coax cable              | C.C.A.          | None      | FA002556  | 1 year    | October 31, 2020 |
| Spectrum analyzer                   | Rohde & Schwarz | FSU       | FA001877  | 1 year    | October 31, 2020 |
| LISN                                | Rohde & Schwarz | ENV216    | FA002515  | 1 year    | July 18, 2020    |

Notes: NCR - no calibration required

## Section 8   Testing data

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### 8.1   FCC 15.31(e) Variation of power source

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#### 8.1.1   Definitions and limits

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**FCC §15.31:**

- (e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

#### 8.1.2   Test date

---

|            |                  |
|------------|------------------|
| Start date | January 16, 2020 |
|------------|------------------|

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#### 8.1.3   Observations, settings and special notes

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The testing was performed as per ANSI C63.10 Section 5.13.

- a) Where the device is intended to be powered from an external power adapter, the voltage variations shall be applied to the input of the adapter provided with the device at the time of sale. If the device is not marketed or sold with a specific adapter, then a typical power adapter shall be used.
- b) For devices where operating at a supply voltage deviating  $\pm 15\%$  from the nominal rated value may cause damages or loss of intended function, test to minimum and maximum allowable voltage per manufacturer's specification and document in the report.
- c) For devices with wide range of rated supply voltage, test at 15% below the lowest and 15% above the highest declared nominal rated supply voltage.
- d) For devices obtaining power from an input/output (I/O) port (USB, firewire, etc.), a test jig is necessary to apply voltage variation to the device from a support power supply, while maintaining the functionalities of the device.

For battery-operated equipment, the equipment tests shall be performed using a variable power supply.

#### 8.1.4   Test data

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The EUT is powered via host panel. The AC input of the host panel was varied.

## 8.2 FCC 15.31(m) and RSS-Gen 6.9 Number of frequencies

### 8.2.1 Definitions and limits

#### FCC §15.31:

(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

#### RSS-Gen Section 6.9:

Except where otherwise specified, measurements shall be performed for each frequency band of operation for which the radio apparatus is to be certified, with the device operating at the frequencies in each band of operation shown in table below. The frequencies selected for measurements shall be reported in the test report.

**Table 8.2-1: Frequency Range of Operation**

| Frequency range over which the device operates (in each band) | Number of test frequencies required | Location of measurement frequency inside the operating frequency range |
|---------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------|
| 1 MHz or less                                                 | 1                                   | Center (middle of the band)                                            |
| 1–10 MHz                                                      | 2                                   | 1 near high end, 1 near low end                                        |
| Greater than 10 MHz                                           | 3                                   | 1 near high end, 1 near center and 1 near low end                      |

Notes: “near” means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

### 8.2.2 Test date

Start date      January 16, 2020

### 8.2.3 Observations, settings and special notes

Per ANSI C63.10 Subclause 5.6.2.1:

The number of channels tested can be reduced by measuring the center channel bandwidth first and then applying the following relaxations as appropriate:

- For each operating mode, if the measured channel bandwidth on the middle channel is at least 150% of the minimum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.
- For multiple-input multiple-output (MIMO) systems, if the measured channel bandwidth on testing the middle channel exceeds the minimum permitted bandwidth by more than 50% on one transmit chain, then it is not necessary to repeat testing on the other chains.
- If the measured channel bandwidth on the middle channel is less than 50% of the maximum permitted bandwidth, then it is not necessary to measure the bandwidth on the high and low channels.

Per ANSI C63.10 Subclause 5.6.2.2:

For devices with multiple operating modes, measurements on the middle channel can be used to determine the worst-case mode(s). The worst-case modes are as follows:

- Band edge requirements—Measurements on the mode with the widest bandwidth can be used to cover the same channel (center frequency) on modes with narrower bandwidth that have the same or lower output power for each modulation family (e.g., OFDM and direct sequence spread spectrum).
- Spurious emissions—Measure the mode with the highest output power and the mode with the highest output power spectral density for each modulation family (e.g., OFDM and direct sequence spread spectrum).
- In-band PSD—Measurements on the mode with the narrowest bandwidth can be used to cover all modes within the same modulation family of an equal or lower output power provided the result is less than 50% of the limit.

#### 8.2.4      Test data

---

**Table 8.2-2:** *Test channels selection*

| Start of Frequency range, MHz | End of Frequency range, MHz | Frequency range bandwidth, MHz | Low channel, MHz | Mid channel, MHz | High channel, MHz |
|-------------------------------|-----------------------------|--------------------------------|------------------|------------------|-------------------|
| 902                           | 928                         | 26                             | 912.74           | 915.78           | 919.11            |

Notes:      Product min frequency utilized is 912.74 MHz  
             Product max frequency utilized is 919.11 MHz

## 8.3 FCC 15.203 and RSS-Gen 6.8 Antenna requirement

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### 8.3.1 Definitions and limits

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#### **FCC §15.203:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### **RSS-Gen Section 6.8:**

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report.

### 8.3.2 Test date

---

Start date      January 16, 2020

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### 8.3.3 Observations, settings and special notes

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None

### 8.3.4 Test data

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- The EUT has an internal integrated antenna, non-detachable.
- The EUT is not professionally installed.



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

### 8.4.1 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  $\mu$ H/50  $\Omega$  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 8.4-1: AC power line conducted emissions limit**

| Frequency of emission,<br>MHz | Conducted limit, dB $\mu$ V |           |
|-------------------------------|-----------------------------|-----------|
|                               | 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.

### 8.4.2 Test date

Start date January 20, 2020

### 8.4.3 Observations, settings and special notes

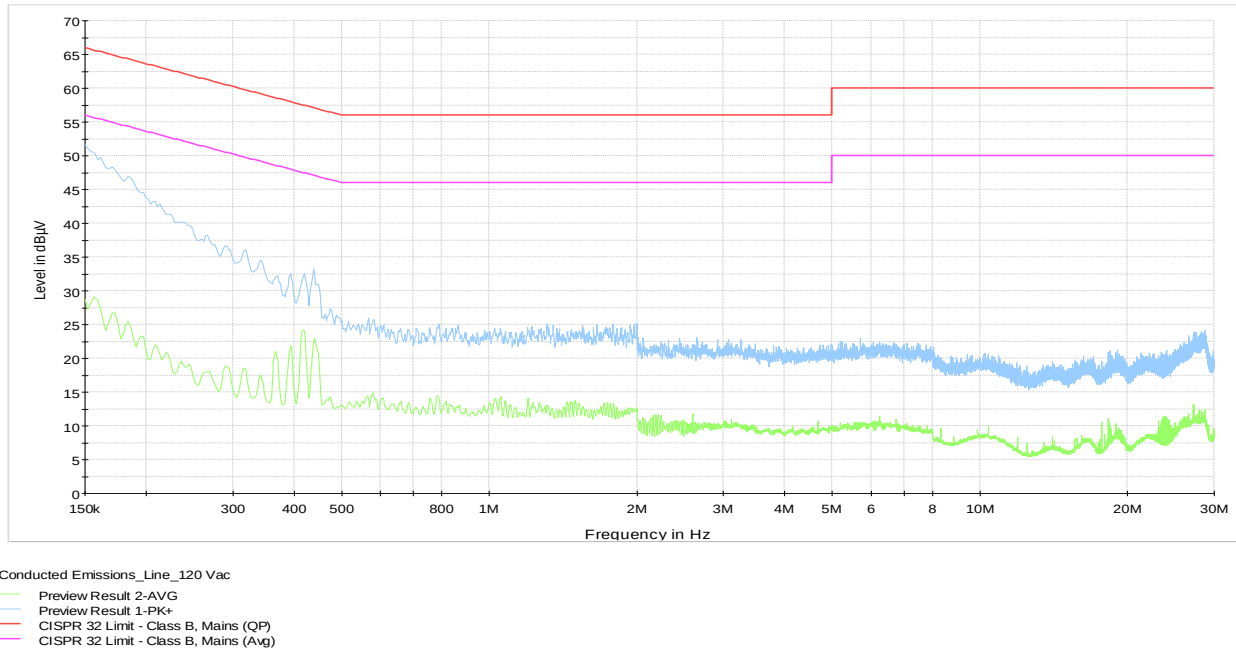
- The spectral plots within this section have been corrected with applicable transducer factors.
- Where tabular data has not been provided, no emissions were observed within 10 dB of the specified limit when measured with the appropriate detector. Additionally; where less than 6 measurements per detector has been provided, fewer than 6 emissions were observed within 10 dB of the specified limit when measured with the appropriate detector.

|                                   |                                                                                                                                                                                                                                                       |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port under test – Coupling device | AC input of Host Panel – Artificial Mains Network (AMN)                                                                                                                                                                                               |
| EUT power input during test       | 120 V <sub>AC</sub> , 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. |

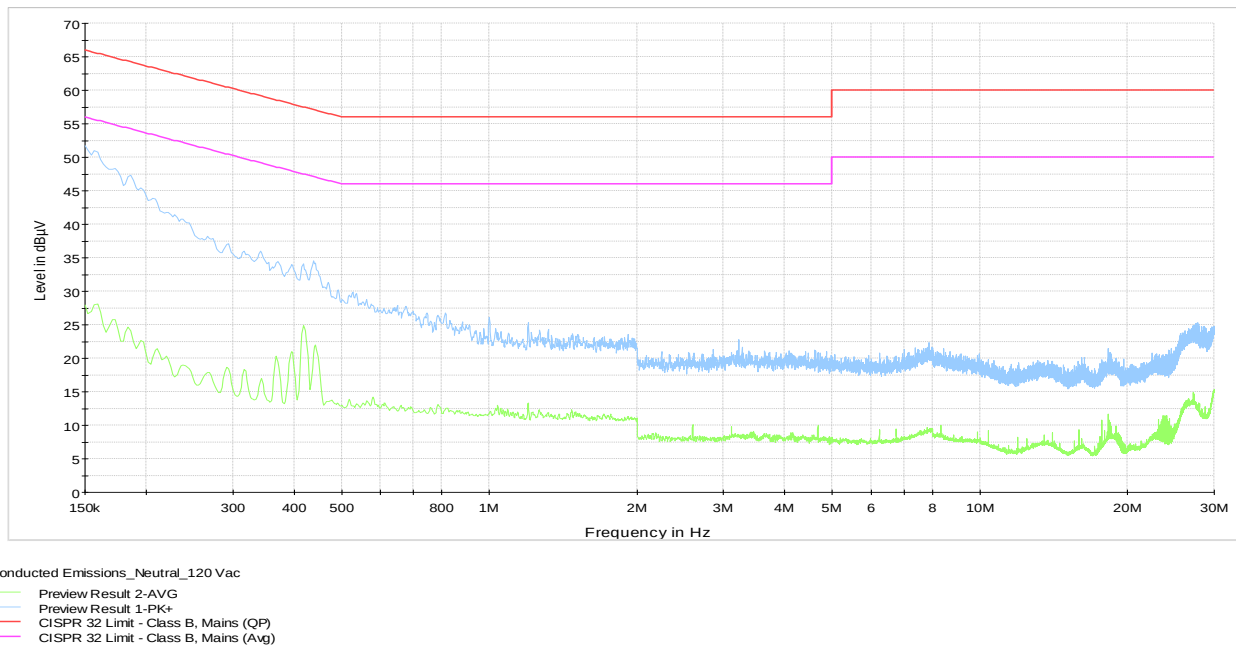
Receiver settings:

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

#### 8.4.4 Test data



**Figure 8.4-1:** AC power line conducted emissions – spectral plot on phase line



**Figure 8.4-2:** AC power line conducted emissions – spectral plot on neutral line

## 8.5 FCC 15.247(a)(1)(i) and RSS-247 5.1(a)(b)(c) Frequency Hopping Systems requirements, 900 MHz operation

### 8.5.1 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. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. 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 Section 5.1:

- a) The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system's radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. 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.
- b) FHSs 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. Alternatively, FHSs operating in the band 2400–2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.
- 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.

### 8.5.2 Test date

|            |                  |
|------------|------------------|
| Start date | January 21, 2020 |
|------------|------------------|

### 8.5.3 Observations, settings and special notes

**Carrier frequency separation was tested per ANSI C63.10 subclause 7.8.2. Spectrum analyser settings:**

|                      |                                                                                                                                                 |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Resolution bandwidth | Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel. |
| Video bandwidth      | ≥ RBW                                                                                                                                           |
| Frequency span       | Wide enough to capture the peaks of two adjacent channels                                                                                       |
| Detector mode        | Peak                                                                                                                                            |
| Trace mode           | Max Hold                                                                                                                                        |

**Number of hopping frequencies was tested per ANSI C63.10 subclause 7.8.3. Spectrum analyser settings:**

|                      |                                                                                                                                                                                                                                      |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resolution bandwidth | To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.                                                                                       |
| Video bandwidth      | ≥ RBW                                                                                                                                                                                                                                |
| Frequency span       | The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen. |
| Detector mode        | Peak                                                                                                                                                                                                                                 |
| Trace mode           | Max Hold                                                                                                                                                                                                                             |

**Time of occupancy (dwell time) was tested per ANSI C63.10 subclause 7.8.4. Spectrum analyser settings:**

|                      |                                                                                                                             |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Resolution bandwidth | shall be ≤ channel spacing and where possible RBW should be set $\gg 1/T$ , where T is the expected dwell time per channel. |
| Video bandwidth      | ≥ RBW                                                                                                                       |
| Frequency span       | Zero span, centered on a hopping channel.                                                                                   |
| Detector mode        | Peak                                                                                                                        |
| Trace mode           | Max Hold                                                                                                                    |

**20 dB bandwidth was tested per ANSI C63.10 subclause 6.9.2. Spectrum analyser settings:**

|                      |                                                                               |
|----------------------|-------------------------------------------------------------------------------|
| Resolution bandwidth | ≥ 1–5% of the 20 dB bandwidth                                                 |
| Video bandwidth      | ≥ RBW                                                                         |
| Frequency span       | approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel |
| Detector mode        | Peak                                                                          |
| Trace mode           | Max Hold                                                                      |

#### 8.5.4 Test data

**Table 8.5-1: 20 dB bandwidth results**

| Frequency, MHz | 20 dB bandwidth, kHz |
|----------------|----------------------|
| 912.74         | 101.7                |
| 915.78         | 96.1                 |
| 919.11         | 102.5                |

**Table 8.5-2: 99% occupied bandwidth results**

| Frequency, MHz | 99% occupied bandwidth, kHz |
|----------------|-----------------------------|
| 912.74         | 88.1                        |
| 915.78         | 87.3                        |
| 919.11         | 88.1                        |

Notes: There is no 99% occupied bandwidth limit in the standard's requirements, the measurement results provided for information purposes only.

**Table 8.5-3: Carrier frequency separation results**

| Carrier frequency separation, kHz | Minimum limit, kHz | Margin, kHz |
|-----------------------------------|--------------------|-------------|
| 141.5                             | 102.5              | 39          |

Notes: Limit = 25 kHz (or 20 dB BW whichever is greater), Maximum 20 dB bandwidth = 102.5 kHz

**Table 8.5-4: Number of hopping frequencies results**

| Number of hopping frequencies | Minimum limit |
|-------------------------------|---------------|
| 50                            | 50            |

**Table 8.5-5: Average time of occupancy results**

| Dwell time of each pulse, ms | Number of pulses within period | Total dwell time within period, ms | Limit, ms | Margin, ms |
|------------------------------|--------------------------------|------------------------------------|-----------|------------|
| 5                            | 3                              | 15.0                               | 400       | 385        |

Measurement Period is 20 s

#### 8.5.4 Test data, continued

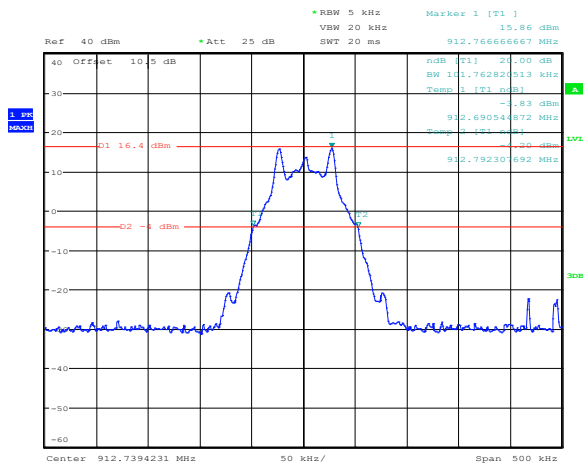


Figure 8.5-1: 20 dB bandwidth – Low channel

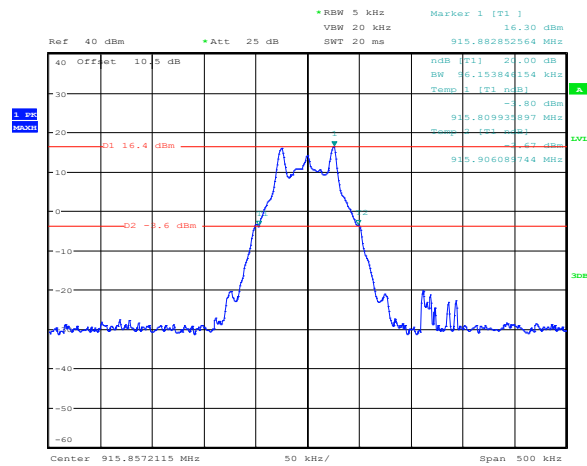


Figure 8.5-2: 20 dB bandwidth – Mid channel

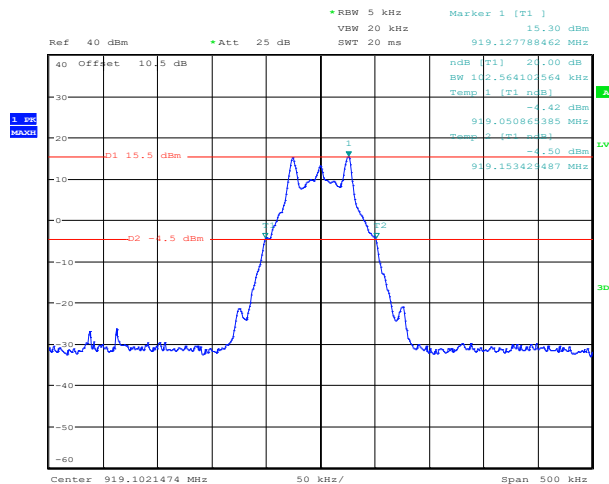
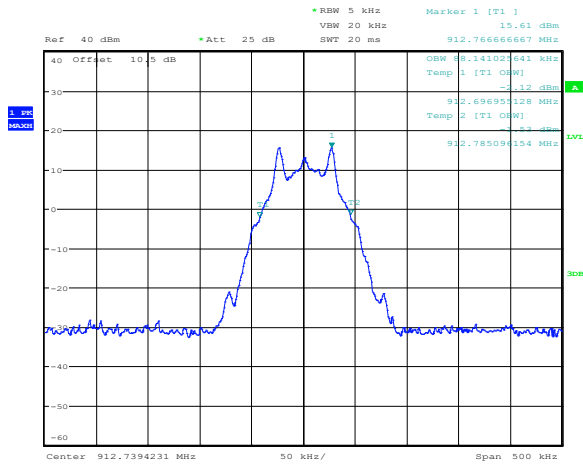
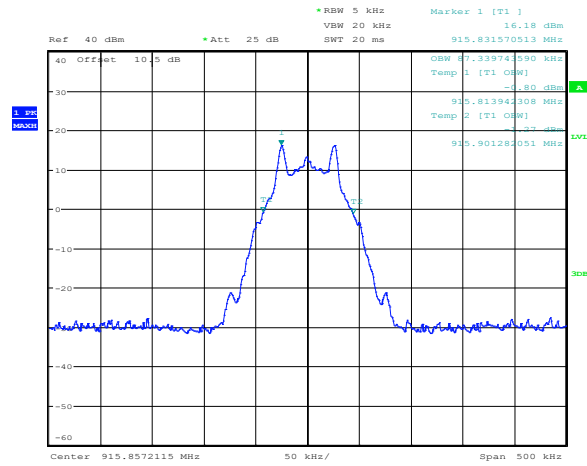


Figure 8.5-3: 20 dB bandwidth – High channel

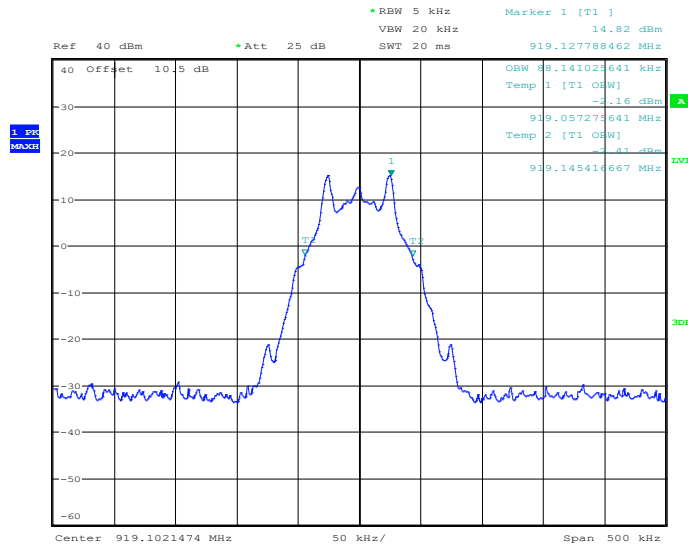
## 8.5.4 Test data, continued



**Figure 8.5-4: 99% bandwidth – Low channel**



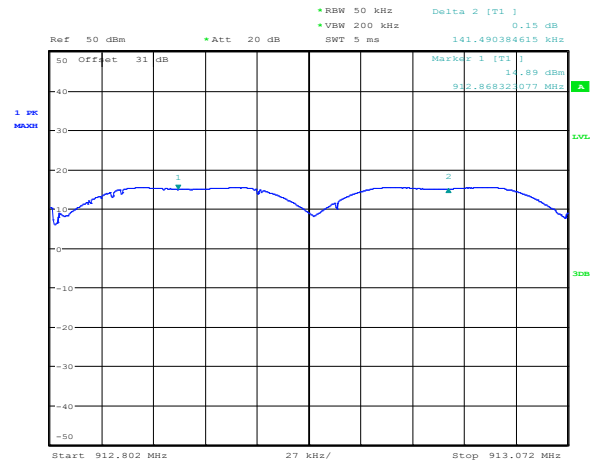
**Figure 8.5-5: 99% bandwidth – Mid channel**



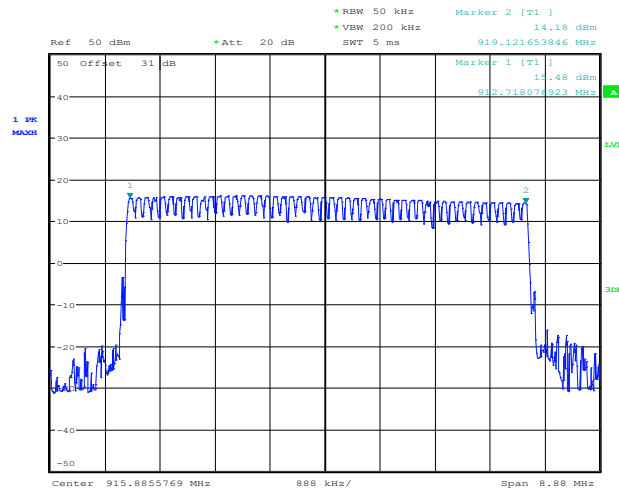
**Figure 8.5-6: 99% bandwidth – High channel**



#### 8.5.4 Test data, continued

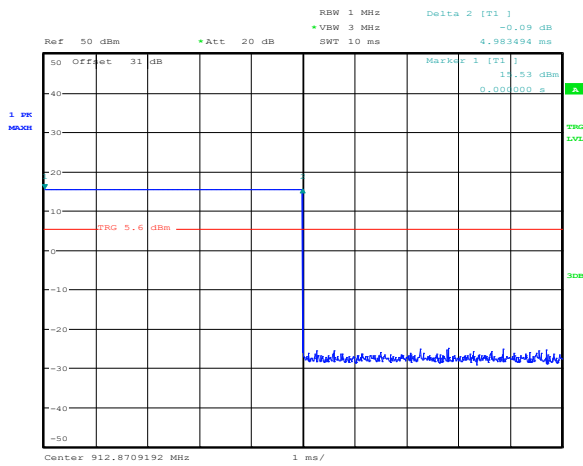


**Figure 8.5-7: Carrier frequency separation**

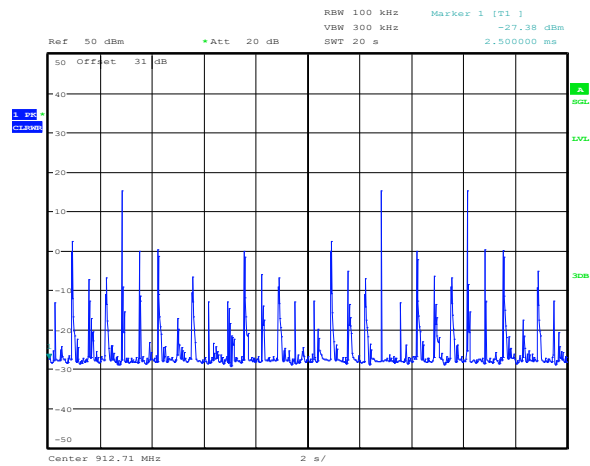


**Figure 8.5-8: Number of hopping channels = 50 Channels**

## 8.5.4 Test data, continued



**Figure 8.5-9:** Dwell time = 5 ms



**Figure 8.5-10:** Number of pulses per channel within 20 seconds. = 3

## 8.6 FCC 15.247(b)(2) and RSS-247 5.4(a) Transmitter output power and e.i.r.p. requirements for FHSS 900 MHz

### 8.6.1 Definitions and limits

#### FCC §15.247:

- (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.

#### RSS-247 Section 5.4:

- a. 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.

### 8.6.2 Test date

Start date January 21, 2020

### 8.6.3 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:**

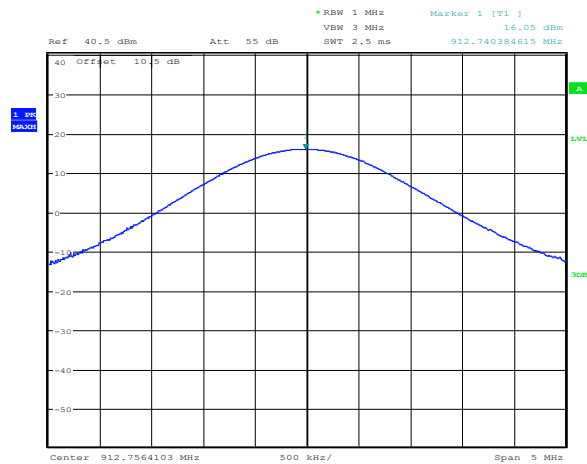
|                      |                                                                          |
|----------------------|--------------------------------------------------------------------------|
| Resolution bandwidth | > 20 dB bandwidth of the emission being measured                         |
| Video bandwidth      | ≥ RBW                                                                    |
| Frequency span       | approximately 5 times the 20 dB bandwidth, centered on a hopping channel |
| Detector mode        | Peak                                                                     |
| Trace mode           | Max Hold                                                                 |

#### 8.6.4 Test data

**Table 8.6-1: Output power measurements results**

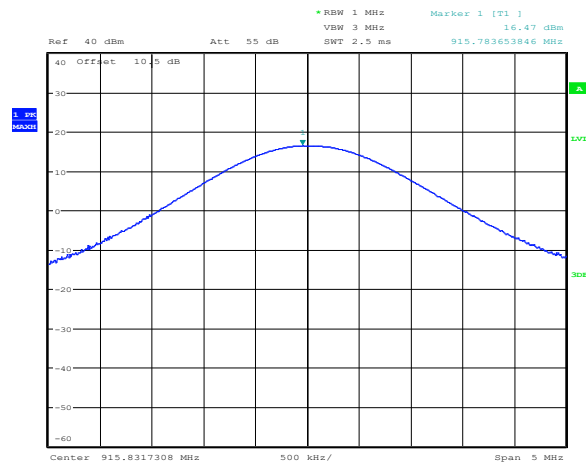
| Frequency,<br>MHz | Conducted output power, dBm |       | Margin, dB | Antenna gain,<br>dBi | EIRP,<br>dBm | EIRP limit,<br>dBm | EIRP margin, dB |
|-------------------|-----------------------------|-------|------------|----------------------|--------------|--------------------|-----------------|
|                   | Measured                    | Limit |            |                      |              |                    |                 |
| 912.74            | 16.1                        | 30.0  | 13.9       | -3.8                 | 12.3         | 36.0               | 23.7            |
| 915.78            | 16.5                        | 30.0  | 13.5       | -3.8                 | 12.7         | 36.0               | 23.3            |
| 919.11            | 15.4                        | 30.0  | 14.6       | -3.8                 | 11.6         | 36.0               | 24.4            |

Notes: EIRP = Output power + Antenna gain



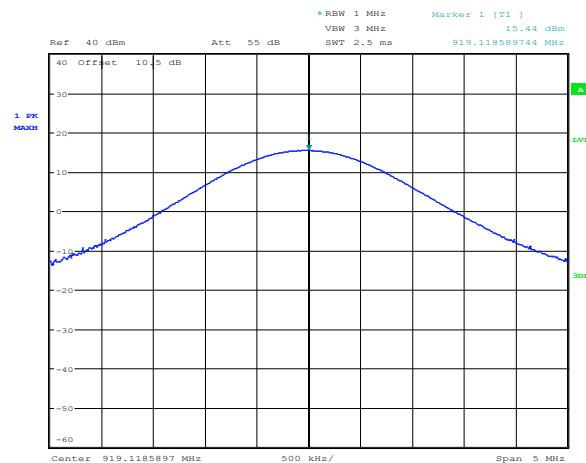
Date: 20.JAN.2020 13:56:31

**Figure 8.6-1: Output power on low channel**



Date: 21.JAN.2020 08:00:39

**Figure 8.6-2: Output power on mid channel**



Date: 21.JAN.2020 07:48:38

**Figure 8.6-3: Output power on high channel**

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

### 8.7.1 Definitions and limits

#### FCC §15.207 (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 Section 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 8.7-1: FCC §15.209 and RSS-Gen – Radiated emission limits**

| Frequency,<br>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

**Section 8****Test name****Specification****Testing data**

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

FCC Part 15 Subpart C and RSS-247, Issue 2

**8.7.1 Definitions and limits, continued****Table 8.7-2: 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     |             |

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 related devices are set out in the 200 and 300 series of RSSs

**Table 8.7-3: 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

**8.7.2 Test date**

Start date January 28, 2020

### 8.7.3 Observations, settings and special notes

- The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.
- Radiated measurements were performed at a distance of 3 m
- DTS emissions in non-restricted frequency bands test was performed as per KDB 558074, section 8.5 with reference to ANSI C63.10 subclause 11.11.
- 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.
- 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 conducted spurious emissions measurements:

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

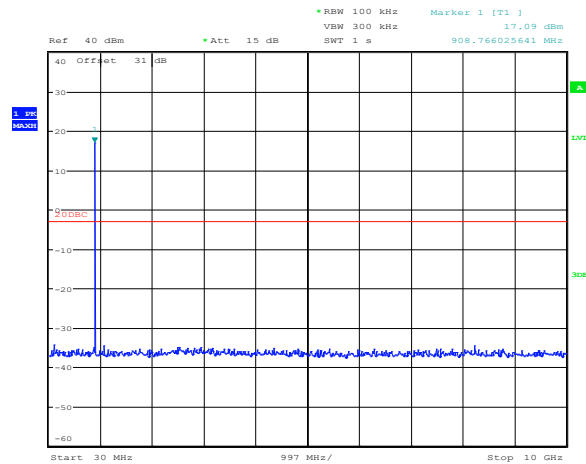
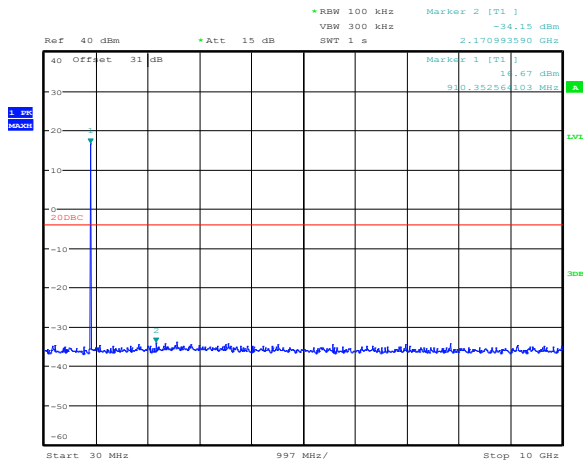
Spectrum analyser settings for radiated measurements within restricted bands:

|                       |                                                                  |
|-----------------------|------------------------------------------------------------------|
| Resolution bandwidth: | Frequencies below 1 GHz: 100 kHz, Frequencies above 1 GHz: 1 MHz |
| Video bandwidth:      | Frequencies below 1 GHz: 300 kHz, Frequencies above 1 GHz: 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 |

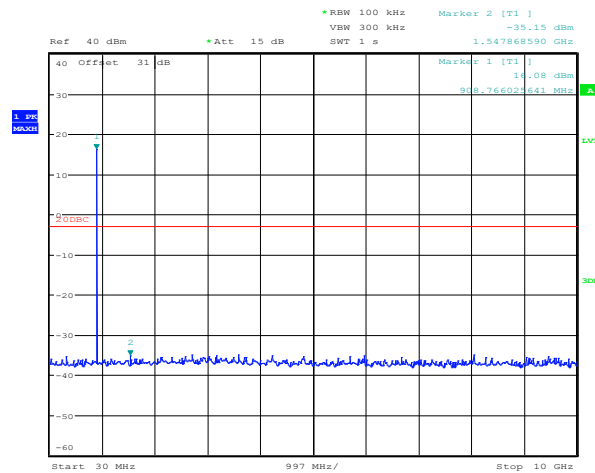
## 8.7.4 Test data



Date: 30.JAN.2020 07:07:23

**Figure 8.7-1: Conducted spurious (out-of-band) emissions, low channel**

**Figure 8.7-2: Conducted spurious (out-of-band) emissions, mid channel**

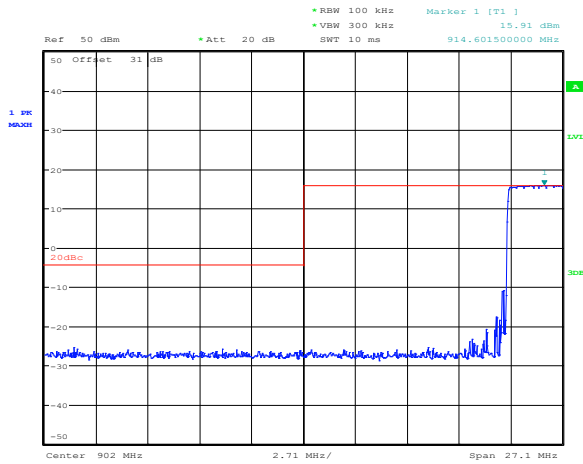


Date: 30.JAN.2020 07:10:33

**Figure 8.7-3: Conducted spurious (out-of-band) emissions, high channel**

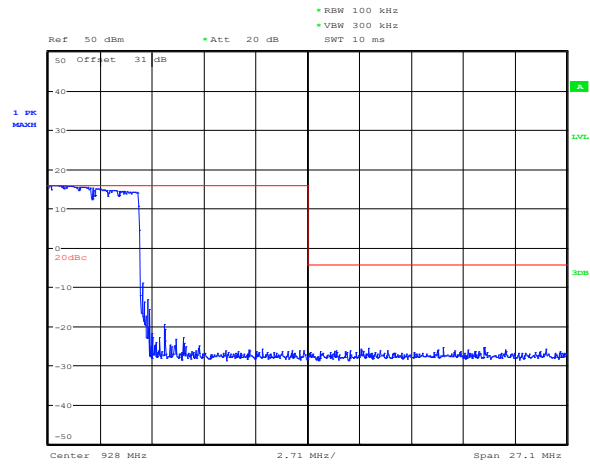


## 8.7.4 Test data, continued



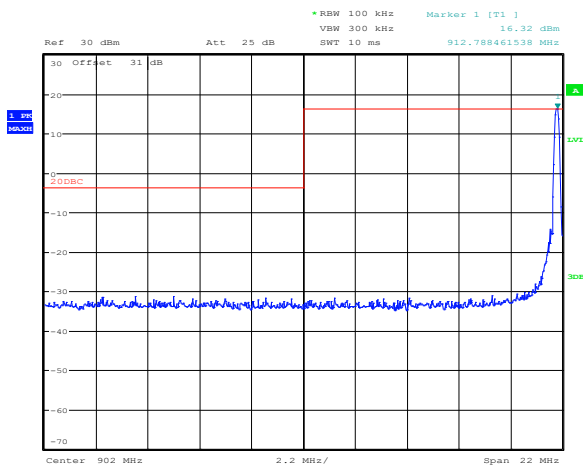
Date: 28.JAN.2020 13:12:37

**Figure 8.7-4:** Conducted spurious (out-of-band) emissions, Hopping – band edge low side



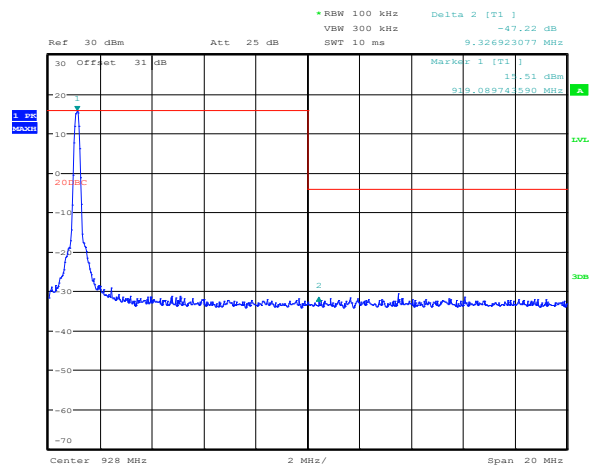
Date: 28.JAN.2020 13:20:40

**Figure 8.7-5:** Conducted spurious (out-of-band) emissions, Hopping – band edge high side



Date: 29.JAN.2020 11:43:10

**Figure 8.7-6:** Conducted spurious (out-of-band) emissions, Low channel – band edge low side



**Figure 8.7-7:** Conducted spurious (out-of-band) emissions, high channel – band edge high side

#### 8.7.4 Test data, continued

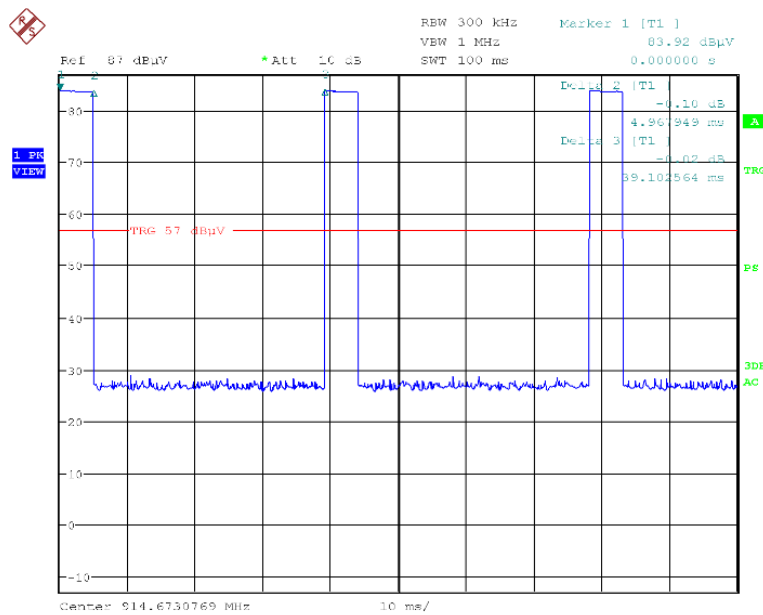
Duty cycle/average factor calculations

§15.35(c) When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed; the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

$$\text{Duty cycle or average factor} = 20 \times \log_{10} \left( \frac{T_{X_{on}}}{T_{X_{period}}} \right)$$

Tx on Time: 4.99 ms × 3 (3 pulses within 100 ms time frame) = 14.97 ms

DCCF = 20 × Log10 (TXON within 100 ms / 100 ms), therefore DCCF = 20 × Log10 (14.97 ms / 100 ms) = -16.5 dB



Date: 20.JAN.2020 15:01:21

**Figure 8.7-8: Transmission duration plot**



#### 8.7.4 Test data, continued

**Table 8.7-4:** *Radiated Spurious (out-of-band) unwanted emissions within restricted bands results*

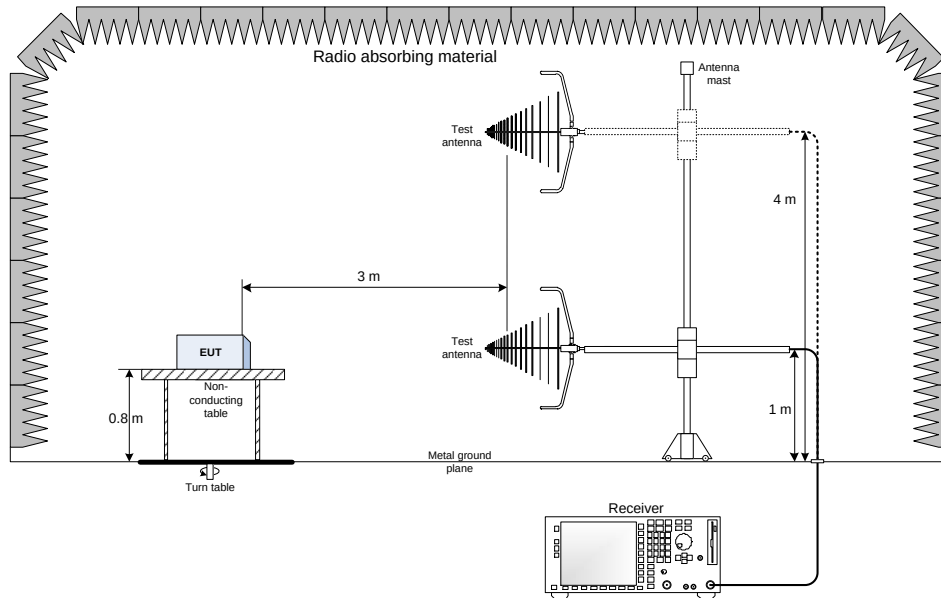
| Channel | Frequency,<br>MHz | Peak Field strength, dBµV/m |       | Peak margin,<br>dB | Average Field strength, dBµV/m |            |       | Average<br>margin, dB |
|---------|-------------------|-----------------------------|-------|--------------------|--------------------------------|------------|-------|-----------------------|
|         |                   | Measured                    | Limit |                    | DCCF                           | Calculated | Limit |                       |
| Low     | 2738.3            | 55.5                        | 74.0  | 18.5               | -16.5                          | 39.0       | 54.0  | 15.0                  |
| Low     | 3651.0            | 56.1                        | 74.0  | 17.9               | -16.5                          | 39.6       | 54.0  | 14.4                  |
| Low     | 4563.8            | 59.8                        | 74.0  | 14.3               | -16.5                          | 43.3       | 54.0  | 10.8                  |
| Mid     | 2747.5            | 52.5                        | 74.0  | 21.5               | -16.5                          | 36.0       | 54.0  | 18.0                  |
| Mid     | 3663.3            | 57.8                        | 74.0  | 16.2               | -16.5                          | 41.3       | 54.0  | 12.7                  |
| Mid     | 4579.2            | 60.0                        | 74.0  | 14.0               | -16.5                          | 43.5       | 54.0  | 10.5                  |
| High    | 2757.3            | 52.7                        | 74.0  | 21.3               | -16.5                          | 36.2       | 54.0  | 17.8                  |
| High    | 3676.4            | 57.3                        | 74.0  | 16.7               | -16.5                          | 40.8       | 54.0  | 13.2                  |
| High    | 4595.5            | 60.5                        | 74.0  | 13.6               | -16.5                          | 44.0       | 54.0  | 10.1                  |

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) for BT  
  
                 DCCF = -16.5 dB  
                 All other emissions were greater than 20 dB below the limit.

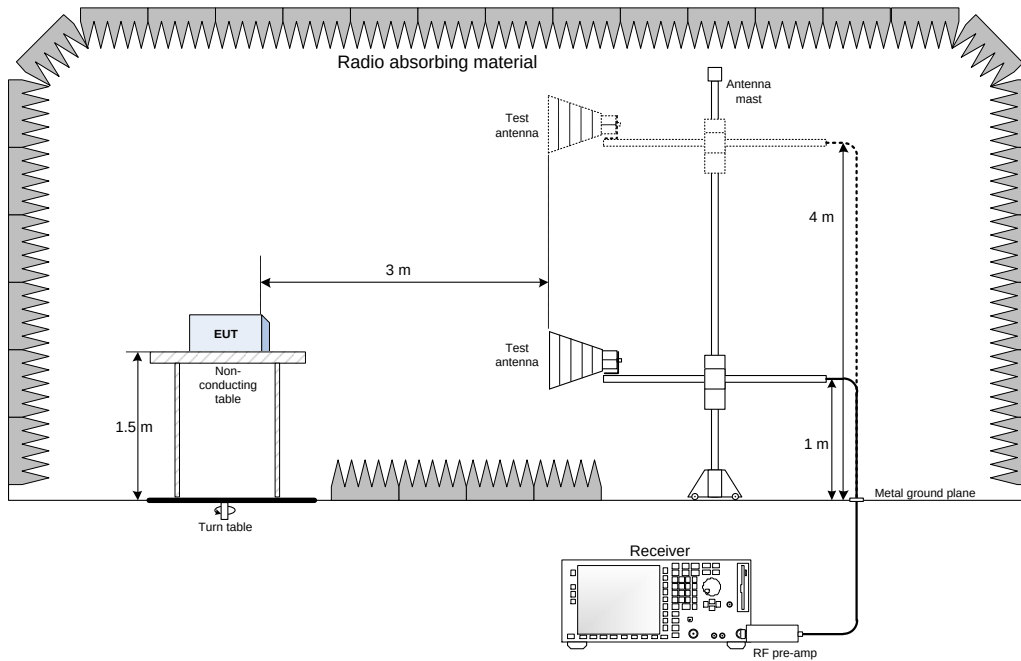
All other emissions were 20 dB below the limit

## Section 9 Block diagrams of test set-ups

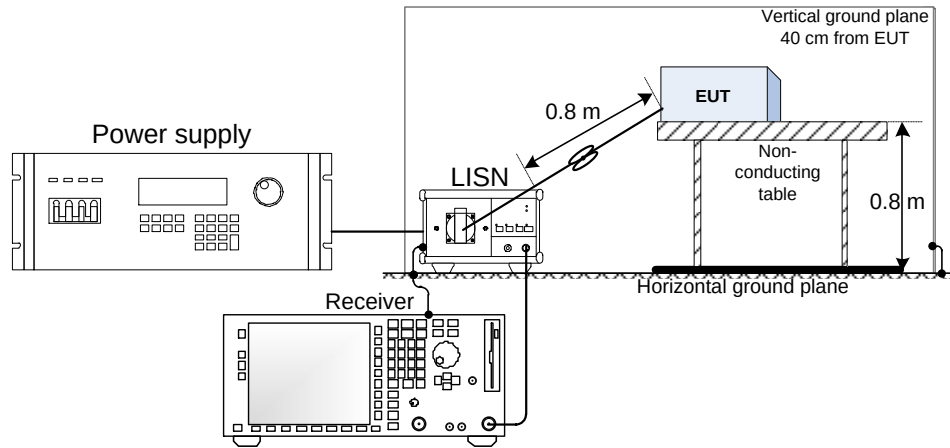
### 9.1 Radiated emissions set-up for frequencies below 1 GHz



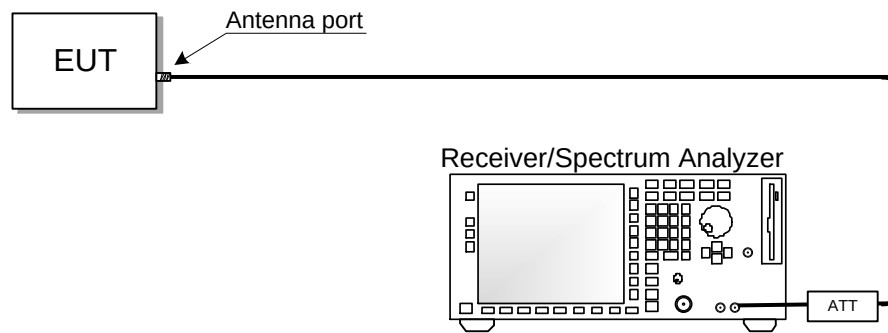
### 9.2 Radiated emissions set-up for frequencies above 1 GHz



### 9.3 Conducted emissions set-up



### 9.4 Antenna port set-up



End of the test report