

# Test report

**332152-2TRFWL**

Date of issue: July 7, 2017

Applicant:

**Fortin Systèmes Électroniques**

Product:

**Keyfob**

Model:

**FTX94**

FCC ID:

**2ACKU-R1W04FM**

IC Registration number:

**12084A-R1W04FM**

Specifications:

◆ **FCC 47 CFR Part 15 Subpart C, §15.231**

Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

◆ **RSS-210, Issue 9, August 2016, Annex A.1**

Momentarily operated devices

#### Test location

|              |                                                      |
|--------------|------------------------------------------------------|
| Company name | Nemko Canada Inc.                                    |
| Address      | 292 Labrosse Avenue                                  |
| City         | Pointe-Claire                                        |
| Province     | QC                                                   |
| Postal code  | H9R 5L8                                              |
| Country      | Canada                                               |
| Telephone    | +1 514 694 2684                                      |
| Facsimile    | +1 514 694 3528                                      |
| Toll free    | +1 800 563 6336                                      |
| Website      | www.nemko.com                                        |
| Site number  | FCC: CA2041; IC: 2040G-5 (3 m semi anechoic chamber) |

|                       |                                                                                     |
|-----------------------|-------------------------------------------------------------------------------------|
| Tested by             | Yong Huang, Wireless/EMC Specialist                                                 |
| Reviewed by           | Kevin Rose, Wireless/EMC Specialist                                                 |
| Date                  | July 7, 2017                                                                        |
| Signature of reviewer |  |

#### Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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## Section 1. Report summary

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### 1.1 Applicant and manufacturer

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|                 |                               |
|-----------------|-------------------------------|
| Company name    | Fortin Systèmes Électroniques |
| Address         | 9855, rue Colbert             |
| City            | Anjou                         |
| Province/State  | Québec                        |
| Postal/Zip code | H1J 1Z9                       |
| Country         | Canada                        |

### 1.2 Test specifications

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|                                              |                                                                 |
|----------------------------------------------|-----------------------------------------------------------------|
| FCC 47 CFR Part 15, Subpart C, Clause 15.231 | Periodic operation in the band 40.66–40.70 MHz and above 70 MHz |
| RSS-210, Issue 9, August 2016, Annex A.1     | Momentarily operated devices                                    |

### 1.3 Test methods

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|                    |                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------|
| ANSI C63.10 v 2013 | American National Standard for Procedures for Compliance Testing of Unsilenced Wireless Devices |
|--------------------|-------------------------------------------------------------------------------------------------|

### 1.4 Statement of compliance

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In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

### 1.5 Exclusions

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None

### 1.6 Test report revision history

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

## Section 2. Summary of test results

### 2.1 FCC Part 15 Subpart C test results

| Part        | Test description                                                       | Verdict                     |
|-------------|------------------------------------------------------------------------|-----------------------------|
| \$15.207(a) | Conducted limits                                                       | Not applicable              |
| \$15.31(e)  | Variation of power source                                              | See Notes <sup>1</sup>      |
| \$15.203    | Antenna requirement                                                    | See Notes <sup>2</sup>      |
| \$15.231(a) | Conditions for intentional radiators to comply with periodic operation | Pass                        |
| \$15.231(b) | Field strength of emissions                                            | Pass                        |
| \$15.231(c) | Emission bandwidth                                                     | Pass                        |
| \$15.231(d) | Requirements for devices operating within 40.66–40.70 MHz band         | Not applicable <sup>4</sup> |
| \$15.231(e) | Conditions for intentional radiators to comply with periodic operation | Not applicable <sup>5</sup> |

Notes:

- <sup>1</sup> Fundamental field strength was measured with a fresh battery.
- <sup>2</sup> The EUT is equipped with an integral antenna.
- <sup>3</sup> The EUT is battery powered.
- <sup>4</sup> The EUT does not operate in the frequency range of 40.66–40.70 MHz.
- <sup>5</sup> The EUT complies with requirement 15.231 (a).

### 2.2 IC RSS-GEN, Issue 4 test results

| Part  | Test description                                                         | Verdict                     |
|-------|--------------------------------------------------------------------------|-----------------------------|
| 7.1.2 | Receiver radiated emission limits                                        | Not applicable <sup>1</sup> |
| 7.1.3 | Receiver conducted emission limits                                       | Not applicable <sup>1</sup> |
| 8.8   | Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus | Not applicable <sup>2</sup> |

Notes:

- <sup>1</sup> The EUT does not contain a receiver.
- <sup>2</sup> The EUT is battery powered.

Notes: <sup>1</sup> According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

### 2.3 IC RSS-210, Issue 9 test results

| Part  | Test description               | Verdict                     |
|-------|--------------------------------|-----------------------------|
| A.1.1 | Types of momentary signals     | Pass                        |
| A.1.2 | Field strength of emissions    | Pass                        |
| A.1.3 | Bandwidth of momentary signals | Pass                        |
| A.1.4 | Reduced Field Strengths        | Not applicable <sup>1</sup> |

Notes: <sup>1</sup> The EUT complies with requirement RSS-210 A1.1.2.

## Section 3. Equipment under test (EUT) details

### 3.1 Sample information

|                        |              |
|------------------------|--------------|
| Receipt date           | May 25, 2017 |
| Nemko sample ID number | Item#5       |

### 3.2 EUT information

|               |        |
|---------------|--------|
| Product name  | Keyfob |
| Model         | FTX94  |
| Model variant | None   |
| Serial number | None   |

### 3.3 Technical information

|                                         |                                                                                   |
|-----------------------------------------|-----------------------------------------------------------------------------------|
| Applicant IC company number             | 12084A                                                                            |
| IC UPN number                           | R1W04FM                                                                           |
| All used IC test site(s) Reg. number    | 2040G-5                                                                           |
| RSS number and Issue number             | RSS-210 Annex A.1, Issue 9, August 2016                                           |
| Frequency Min (MHz)                     | 433.925                                                                           |
| Frequency Max (MHz)                     | 433.925                                                                           |
| RF power Min (W)                        | N/A                                                                               |
| RF power Max (W)                        | N/A                                                                               |
| Field strength, Units @ distance        | 90.8 dBμV/m, Peak field strength @ 3 m, 71.8 dBμV/m, Average field strength @ 3 m |
| Measured BW (kHz) (99 %)                | 81.7                                                                              |
| Calculated BW (kHz), as per TRC-43      | N/A                                                                               |
| Type of modulation                      | 2FSK                                                                              |
| Emission classification (F1D, G1D, D1D) | F1D                                                                               |
| Transmitter spurious, Units @ distance  | 36.0 dBμV/m (Avg) at 5641.0 MHz, @ 3 m                                            |
| Power requirements                      | Internally powered by two 3V button battery CR2016                                |
| Antenna information                     | The EUT uses a non-detachable antenna to the intentional radiator.                |

### 3.4 Product description and theory of operation

The product is an aftermarket remote starter keyfob. When the costumer press the remote button, the remote sends through radi o frequency a unique message that is received by the remote starter that will execute the command in the costumer vehicle.

### 3.5 EUT exercise details

EUT was configured and operated by client on site. During transmitter testing, the unit was set to transmit continuously.

3.6 EUT setup diagram

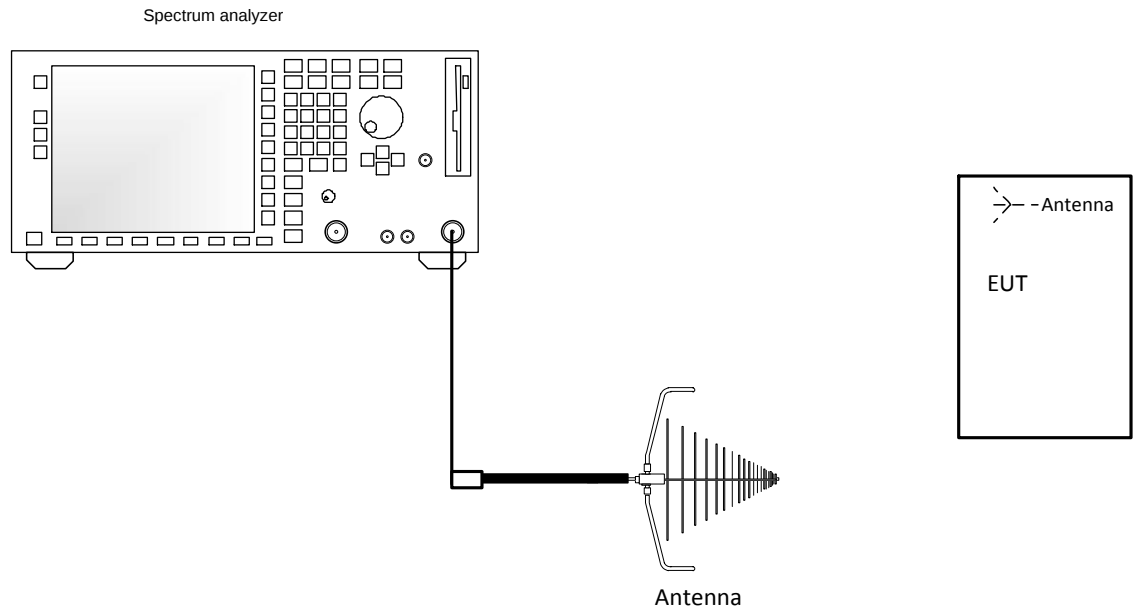


Figure 3.6-1: Setup diagram



**Section 4.**    Engineering considerations

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**4.1**    Modifications incorporated in the EUT

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

**4.2**    Technical judgment

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None

**4.3**    Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

# Section 5. Test conditions

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## 5.1 Atmospheric conditions

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|                   |               |
|-------------------|---------------|
| Temperature       | 15–30 °C      |
| Relative humidity | 20–75 %       |
| Air pressure      | 860–1060 mbar |

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

## 5.2 Power supply range

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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 6. Measurement uncertainty

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### 6.1 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.

| 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. | Asset no. | Cal cycle | Next cal.  |
|-----------------------------|-----------------|-----------|-----------|-----------|------------|
| 3 m EMI test chamber        | TDK             | SAC-3     | FA002532  | 2 year    | Aug. 25/17 |
| Flush mount turntable       | Sunol           | FM2022    | FA002550  | —         | NCR        |
| Controller                  | Sunol           | SC104V    | FA002551  | —         | NCR        |
| Antenna mast                | Sunol           | TLT2      | FA002552  | —         | NCR        |
| Bilog antenna (20–2000 MHz) | Sunol           | JB1       | FA002517  | 1 year    | Oct. 5/17  |
| Horn antenna (1–18 GHz)     | EMCO            | 3115      | FA001451  | 1 year    | April 5/18 |
| Pre-amplifier (0.5–18 GHz)  | COM-POWER       | PAM-118A  | FA002561  | 1 year    | May 8/18   |
| 50 $\Omega$ coax cable      | C.C.A.          | None      | FA002603  | —         | VOU        |
| 50 $\Omega$ coax cable      | C.C.A.          | None      | FA002605  | —         | VOU        |
| 50 $\Omega$ coax cable      | C.C.A.          | None      | FA002607  | —         | VOU        |
| Receiver/spectrum analyzer  | Rohde & Schwarz | ESU 40    | FA002071  | 1 year    | May 3/18   |

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

## Section 8. Testing data

### 8.1 FCC 15.231(a) and RSS-210 A.1.1 Conditions for intentional radiators to comply with periodic operation

#### 8.1.1 Definitions and limits

##### FCC:

- (a) The provisions of this section are restricted to periodic operation within the band 40.66–40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:
  - (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
  - (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
  - (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.
  - (4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.
  - (5) Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

##### ISED:

Devices shall comply with the following for momentary operation:

- (a) A manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released.
- (b) A transmitter that has been activated automatically shall cease transmission within 5 seconds of activation.
- (c) Periodic transmissions at regular, predetermined intervals are not permitted, except as specified in Section A.1.4. However, polling or supervision transmissions that determine system integrity of transmitters used in security or safety applications are permitted, provided the total duration of transmission does not exceed 2 seconds per hour for each transmitter.
- (d) Intentional radiators used for radio control during emergencies involving fire, security of goods (e.g. burglar alarms), and safety-of-life, when activated to signal an alarm, may operate during the interval of the alarm condition.

#### 8.1.2 Test summary

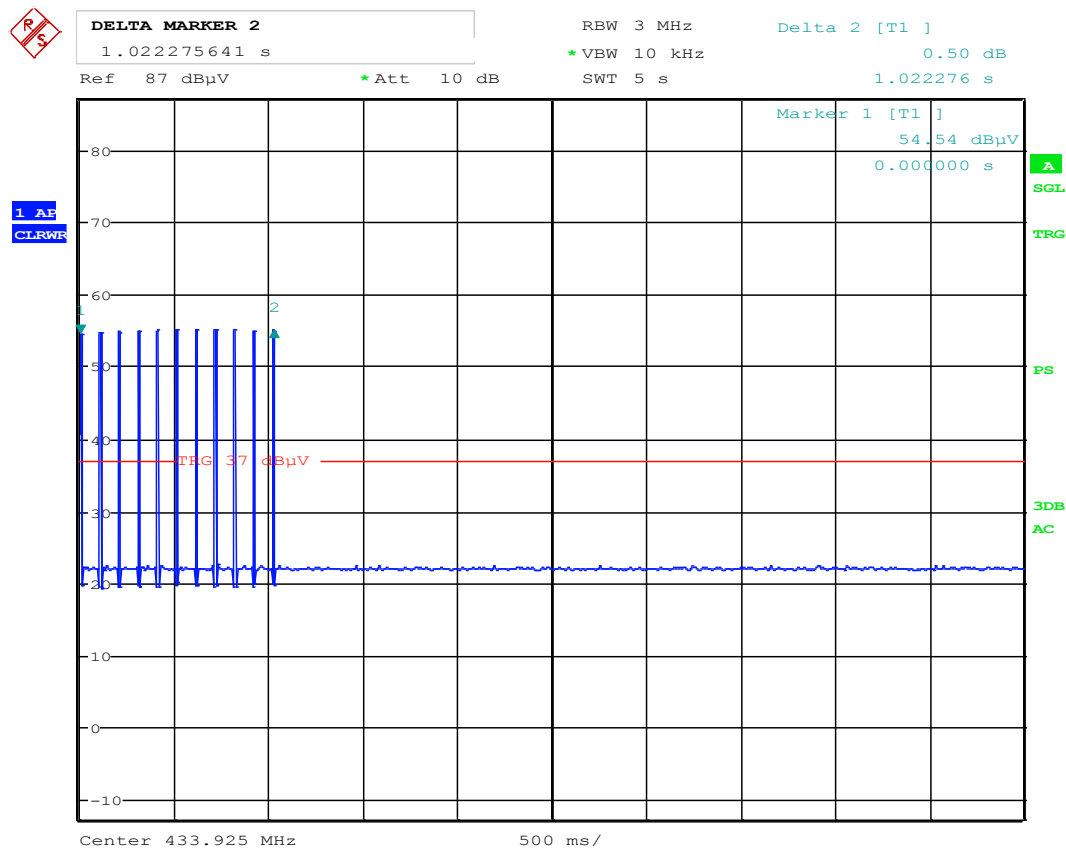
|               |              |                   |           |
|---------------|--------------|-------------------|-----------|
| Test date     | June 8, 2017 | Temperature       | 24 °C     |
| Test engineer | Yong Huang   | Air pressure      | 1010 mbar |
| Verdict       | Pass         | Relative humidity | 40 %      |

#### 8.1.3 Observations, settings and special notes

None

#### 8.1.4 Test data

- 1) The EUT is manual triggered. The EUT ceases transmission within 5 s after button is released. (See **Figure 8.1-1** below)
- 2) The EUT does not generate automatic transmission.
- 3) The EUT does not generate periodic transmission.
- 4) The EUT radio is not used for control purposes during emergencies involving fire, security, and safety of life.
- 5) The EUT does not transmit set-up information.



Date: 8.JUN.2017 18:30:59

**Figure 8.1-1: Timing measurement**

## 8.2 FCC 15.231(b) and RSS-210 A.1.2 Field strength of emissions

### 8.2.1 Definitions and limits

#### FCC:

- (b) In addition to the provisions of §15.205 the field strength of emissions from intentional radiators operated under this section shall not exceed the following table.
- 1) The field strength limits in the table are specified at a distance of 3 meters. The tighter limits apply at the band edges.
  - 2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.
  - 3) The limits on the field strength of the spurious emissions in the table below are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

#### ISED:

- a. The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits outlined in the table below, based on the average value of the measured emissions. The requirements of the Pulsed Operation section of RSS-Gen apply for averaging pulsed emissions and limiting peak emissions. Alternatively, compliance with the limits in the table below may be demonstrated using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.
- b. Unwanted emissions shall be 10 times below the fundamental emissions field strength limits in the table below or comply with the limits specified in RSS-Gen, whichever is less stringent.
- c. The field strength limits shown in Table A are based on the fundamental frequency of the intentional radiator. Unwanted emissions shall be attenuated to the limits listed in RSS-Gen or to the limits shown in table below, whichever are less stringent.

**Table 8.2-1: Field strength limits**

| Fundamental frequency<br>(MHz) | Field strength of fundamental |               | Field strength of spurious emissions |               |
|--------------------------------|-------------------------------|---------------|--------------------------------------|---------------|
|                                | (µV/m)                        | (dBµV/m)      | (µV/m)                               | (dBµV/m)      |
| 40.66–40.70 <sup>1</sup>       | 2,250                         | 67            | 225                                  | 47            |
| 70–130                         | 1,250                         | 61.9          | 125                                  | 41.9          |
| 130–174                        | 1,250 to 3,750*               | 61.9 to 71.5* | 125 to 375*                          | 41.9 to 51.5* |
| 174–260 <sup>2</sup>           | 3,750                         | 71.5          | 375                                  | 51.5          |
| 260–470 <sup>2</sup>           | 3,750 to 12,500*              | 71.5 to 81.9* | 375 to 1,250*                        | 51.5 to 61.9* |
| Above 470                      | 12,500                        | 81.9          | 1,250                                | 61.9          |

\* Linear interpolations

Note: <sup>1</sup>The levels applicable to FCC only.

\* Linear interpolation with frequency F in MHz:

For 130–174 MHz: Field Strength (µV/m) = (56.82 × F) – 6136

For 260–470 MHz: Field Strength (µV/m) = (41.67 × F) – 7083

Frequency bands 225–328.6 MHz and 335.4–399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

**Table 8.2-2: FCC §15.209 and RSS-Gen – Radiated emission limits**

| Frequency,<br>MHz | Field strength of emissions |                                        | Measurement distance, m |
|-------------------|-----------------------------|----------------------------------------|-------------------------|
|                   | $\mu\text{V/m}$             | $\text{dB}\mu\text{V/m}$               |                         |
| 0.009–0.490       | 2400/F                      | $67.6 - 20 \times \log_{10}(\text{F})$ | 300                     |
| 0.490–1.705       | 24000/F                     | $87.6 - 20 \times \log_{10}(\text{F})$ | 30                      |
| 1.705–30.0        | 30                          | 29.5                                   | 30                      |
| 30–88             | 100                         | 40.0                                   | 3                       |
| 88–216            | 150                         | 43.5                                   | 3                       |
| 216–960           | 200                         | 46.0                                   | 3                       |
| above 960         | 500                         | 54.0                                   | 3                       |

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

**Table 8.2-3: IC restricted frequency bands**

| MHz             | MHz                 | MHz           | GHz         |
|-----------------|---------------------|---------------|-------------|
| 0.090–0.110     | 12.51975–12.52025   | 399.9–410     | 5.35–5.46   |
| 2.1735–2.1905   | 12.57675–12.57725   | 608–614       | 7.25–7.75   |
| 3.020–3.026     | 13.36–13.41         | 960–1427      | 8.025–8.5   |
| 4.125–4.128     | 16.42–16.423        | 1435–1626.5   | 9.0–9.2     |
| 4.17725–4.17775 | 16.69475–16.69525   | 1645.5–1646.5 | 9.3–9.5     |
| 4.20725–4.20775 | 16.80425–16.80475   | 1660–1710     | 10.6–12.7   |
| 5.677–5.683     | 25.5–25.67          | 1718.8–1722.2 | 13.25–13.4  |
| 6.215–6.218     | 37.5–38.25          | 2200–2300     | 14.47–14.5  |
| 6.26775–6.26825 | 73–74.6             | 2310–2390     | 15.35–16.2  |
| 6.31175–6.31225 | 74.8–75.2           | 2655–2900     | 17.7–21.4   |
| 8.291–8.294     | 108–138             | 3260–3267     | 22.01–23.12 |
| 8.362–8.366     | 156.52475–156.52525 | 3332–3339     | 23.6–24.0   |
| 8.37625–8.38675 | 156.7–156.9         | 3345.8–3358   | 31.2–31.8   |
| 8.41425–8.41475 | 240–285             | 3500–4400     | 36.43–36.5  |
| 12.29–12.293    | 322–335.4           | 4500–5150     | Above 38.6  |

Note: Certain frequency bands listed in Table 8.2-3 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard

**Table 8.2-4: FCC restricted frequency bands**

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090–0.110       | 16.42–16.423        | 399.9–410     | 4.5–5.15    |
| 0.495–0.505       | 16.69475–16.69525   | 608–614       | 5.35–5.46   |
| 2.1735–2.1905     | 16.80425–16.80475   | 960–1240      | 7.25–7.75   |
| 4.125–4.128       | 25.5–25.67          | 1300–1427     | 8.025–8.5   |
| 4.17725–4.17775   | 37.5–38.25          | 1435–1626.5   | 9.0–9.2     |
| 4.20725–4.20775   | 73–74.6             | 1645.5–1646.5 | 9.3–9.5     |
| 6.215–6.218       | 74.8–75.2           | 1660–1710     | 10.6–12.7   |
| 6.26775–6.26825   | 108–121.94          | 1718.8–1722.2 | 13.25–13.4  |
| 6.31175–6.31225   | 123–138             | 2200–2300     | 14.47–14.5  |
| 8.291–8.294       | 149.9–150.05        | 2310–2390     | 15.35–16.2  |
| 8.362–8.366       | 156.52475–156.52525 | 2483.5–2500   | 17.7–21.4   |
| 8.37625–8.38675   | 156.7–156.9         | 2690–2900     | 22.01–23.12 |
| 8.41425–8.41475   | 162.0125–167.17     | 3260–3267     | 23.6–24.0   |
| 12.29–12.293      | 167.72–173.2        | 3332–3339     | 31.2–31.8   |
| 12.51975–12.52025 | 240–285             | 3345.8–3358   | 36.43–36.5  |
| 12.57675–12.57725 | 322–335.4           | 3600–4400     | Above 38.6  |
| 13.36–13.41       |                     |               |             |

### 8.2.2 Test summary

|               |                              |                   |           |
|---------------|------------------------------|-------------------|-----------|
| Test date     | June 5, 2017 to June 8, 2017 | Temperature       | 24 °C     |
| Test engineer | Yong Huang                   | Air pressure      | 1010 mbar |
| Verdict       | Pass                         | Relative humidity | 40 %      |

### 8.2.3 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.  
Average radiated emissions were obtained by subtracting duty cycle / correction factor from the peak measurement results.

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

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

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

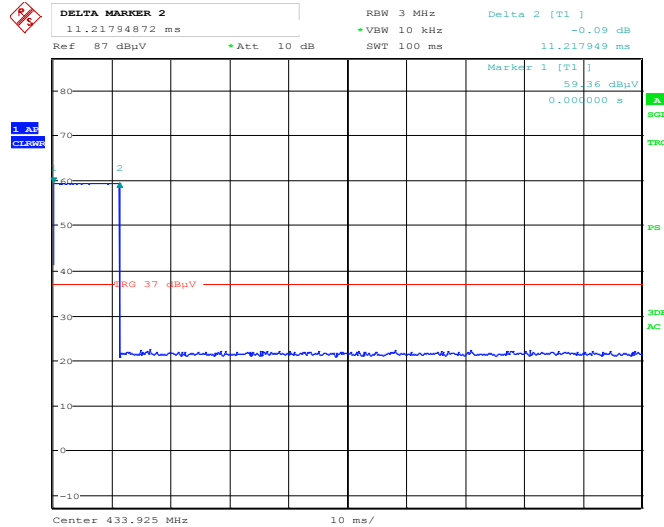
|                      |          |
|----------------------|----------|
| Resolution bandwidth | 1 MHz    |
| Video bandwidth      | 3 MHz    |
| Detector mode        | Peak     |
| Trace mode           | Max Hold |

## 8.2.4 Test data

### 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.

$$\text{Duty cycle or average factor} = 20 \times \log_{10} \left( \frac{Tx_{100ms}}{100ms} \right)$$



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Figure 8.2-1: Transmission within 100 ms

Measured Duty cycle:

Total ON time for data train: Tx on time<sub>100 ms</sub> = 11.54 ms

Therefor utilized the declared clients Duty cycle.

$$\text{Duty}_{\text{cycle}}^{\text{average}} \text{ factor} = 20 \times \log_{10} \left( \frac{Tx_{100ms}}{100ms} \right) = 20 \times \log_{10} \left( \frac{11.22ms}{100ms} \right) = -19.0 \text{ dB}$$

## 8.2.4 Test data, continued

**Table 8.2-5: Field Strength of Fundamental results**

| Freq. (MHz) | Meas. peak field strength <sup>1</sup> (dBμV/m) | Peak field strength limit (dBμV/m) | Peak field strength margin <sup>3</sup> (dB) | Duty cycle correction factor (dB) | Calculated average field strength <sup>2</sup> (dBμV/m) | Average field strength limit (dBμV/m) | Average field strength margin <sup>3</sup> (dB) |
|-------------|-------------------------------------------------|------------------------------------|----------------------------------------------|-----------------------------------|---------------------------------------------------------|---------------------------------------|-------------------------------------------------|
| 433.925     | 90.8                                            | 100.8                              | 10.0                                         | -19.0                             | 71.8                                                    | 80.8                                  | 9.0                                             |

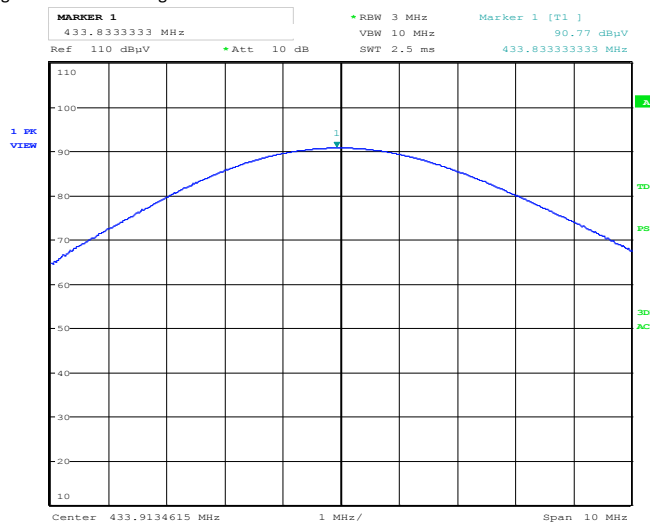
Notes: <sup>1</sup> Field strength (dBμV/m) = spectrum analyzer value (dBμV) + correction factor (dB)

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

Sample calculation: 96.1 dBμV/m (field strength) = 76.2 dBμV (receiver reading) + 19.9 dB (Correction factor)

<sup>2</sup> Calculated average field strength (dBμV/m) = measured Peak field strength (dBμV/m) + Duty cycle correction factor (dB). Duty cycle correction factor as calculated from §15.35 (c)

<sup>3</sup> Margin (dB) = field strength limit – field strength measurement



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**Figure 8.2-2: Field Strength of Fundamental plot**

**Table 8.2-6: Field Strength of Spurious emissions (Harmonic) results**

| Freq. (MHz) | Meas. peak field strength <sup>1</sup> (dBμV/m) | Peak field strength limit (dBμV/m) | Peak field strength margin <sup>3</sup> (dB) | Duty cycle correction factor (dB) | Calculated average field strength <sup>2</sup> (dBμV/m) | Average field strength limit (dBμV/m) | Average field strength margin <sup>3</sup> (dB) |
|-------------|-------------------------------------------------|------------------------------------|----------------------------------------------|-----------------------------------|---------------------------------------------------------|---------------------------------------|-------------------------------------------------|
| 3905        | 52.2                                            | 80.8                               | 28.6                                         | -19.0                             | 33.2                                                    | 60.8                                  | 27.6                                            |
| 4339        | 50.2                                            | 80.8                               | 30.6                                         | -19.0                             | 31.2                                                    | 60.8                                  | 29.6                                            |
| 5207        | 52.2                                            | 80.8                               | 28.6                                         | -19.0                             | 33.2                                                    | 60.8                                  | 27.6                                            |
| 5641        | 55.0                                            | 80.8                               | 25.8                                         | -19.0                             | 36.0                                                    | 60.8                                  | 24.8                                            |

Notes: <sup>1</sup> Field strength (dBμV/m) = spectrum analyzer value (dBμV) + correction factor (dB)

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

Sample calculation: 59.4 dBμV/m (field strength) = 70.3 dBμV (receiver reading) + (-10.9 dB) (Correction factor)

<sup>2</sup> Calculated average field strength (dBμV/m) = measured Peak field strength (dBμV/m) + Duty cycle correction factor (dB). Duty cycle correction factor as calculated from §15.35 (c)

<sup>3</sup> Margin (dB) = field strength limit – field strength measurement

All other spurious emissions (Harmonics) were greater than 20 dB from limit.

8.2.1 Test data, continued

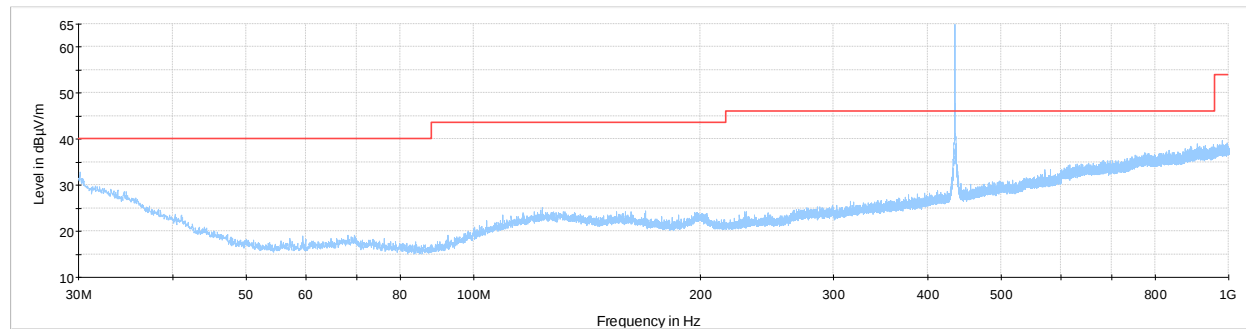


Figure 8.2-3: Spurious emissions below 1 GHz

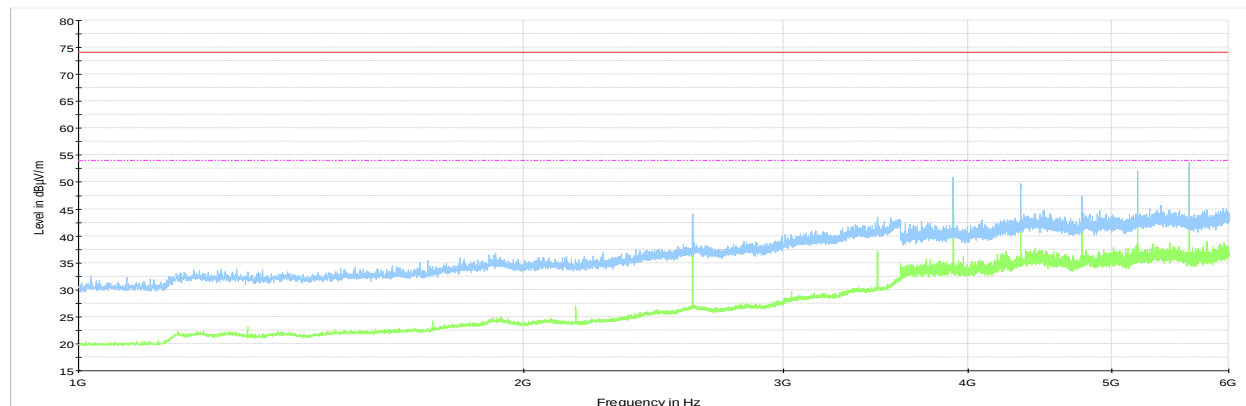


Figure 8.2-4: Spurious emissions above 1 GHz

## 8.3 FCC 15.231(c) and RSS-210 A.1.3 Emission bandwidth of momentary signals

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### 8.3.1 Definitions and limits

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**FCC:**

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

**ISED:**

The 99% bandwidth of momentarily operated devices shall be less or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99% bandwidth shall be less or equal to 0.5% of the centre frequency.

### 8.3.2 Test summary

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|               |              |                   |           |
|---------------|--------------|-------------------|-----------|
| Test date     | June 8, 2017 | Temperature       | 24 °C     |
| Test engineer | Yong Huang   | Air pressure      | 1010 mbar |
| Verdict       | Pass         | Relative humidity | 40 %      |

### 8.3.3 Observations, settings and special notes

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Limit: 0.25 % of 433.925 MHz is 1084.8 kHz

Spectrum analyser settings:

|                      |                                  |
|----------------------|----------------------------------|
| Resolution bandwidth | $\geq 1$ % of emission bandwidth |
| Video bandwidth      | $\geq 3 \times \text{RBW}$       |
| Frequency span       | Wider than emission bandwidth    |
| Detector mode        | Peak                             |

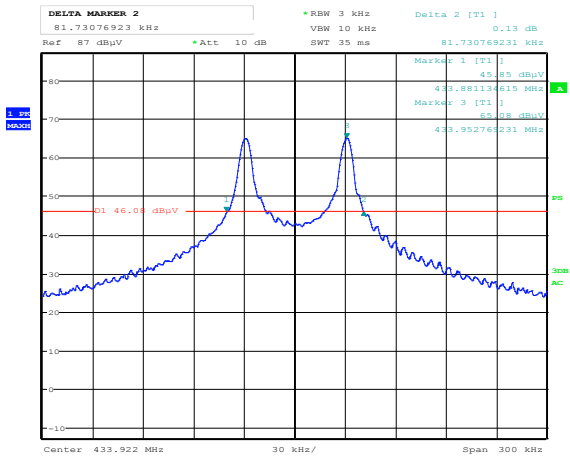
8.3.4 Test data

Table 8.3-1: 20 dB bandwidth measurement result

| 20 dB bandwidth, kHz | Limit, kHz | Margin, kHz |
|----------------------|------------|-------------|
| 81.7                 | 1084.8     | 1003.1      |

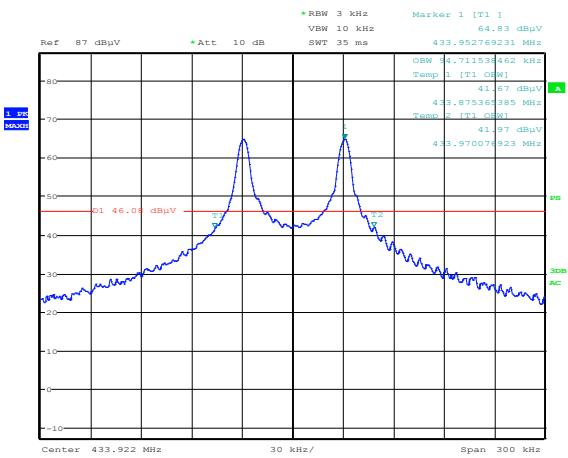
Table 8.3-2: 99 % occupied bandwidth measurement result

| 99 % occupied bandwidth, kHz | Limit, kHz | Margin, kHz |
|------------------------------|------------|-------------|
| 94.7                         | 1084.8     | 990.1       |



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Figure 8.3-1: 20 dB occupied bandwidth

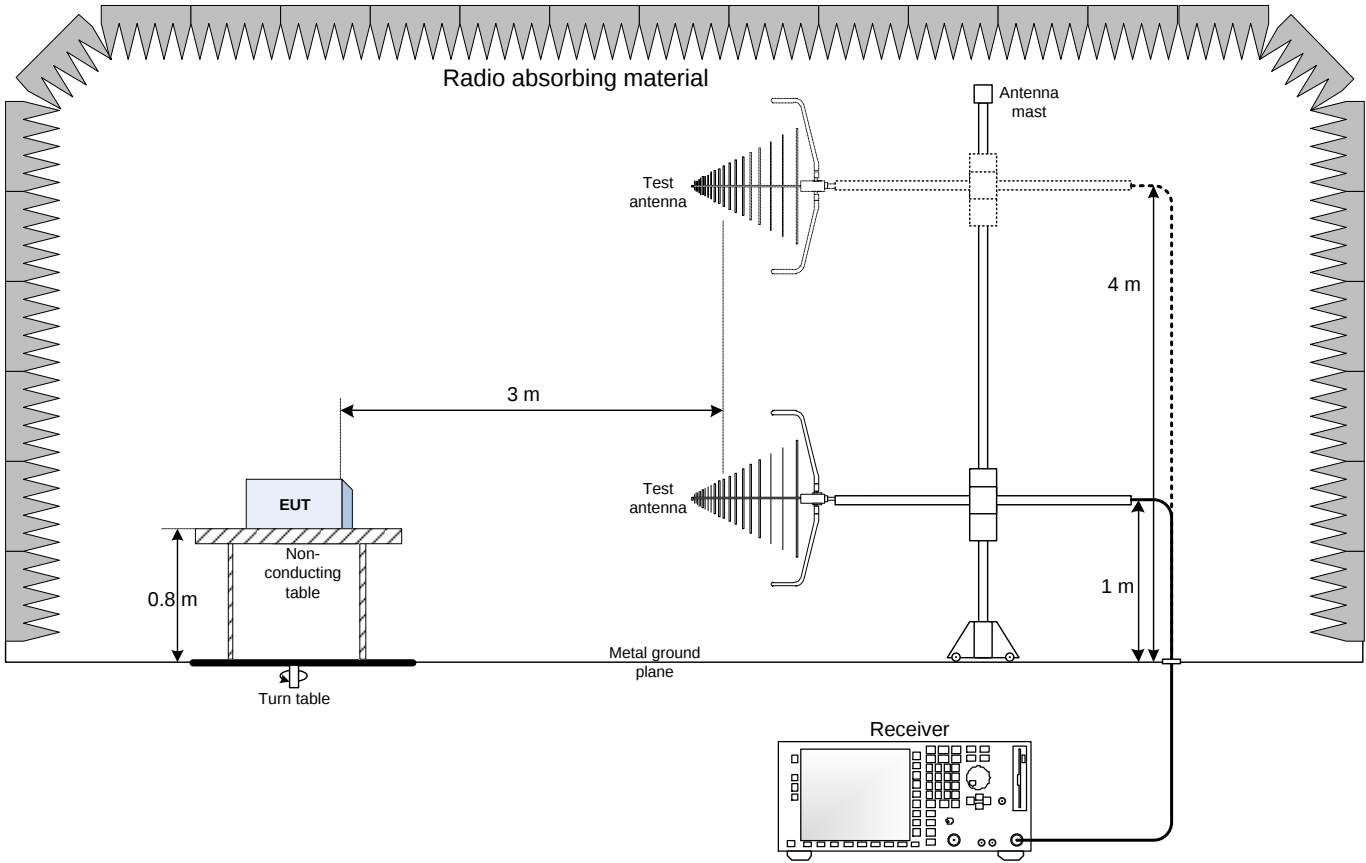


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Figure 8.3-2: 99 % occupied bandwidth

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

