

# Wireless test report – 372813-6TRFWL

Applicant:

**ASSA ABLOY Global Solutions AS**

Product name:

**Assa Abloy locks with BLE Reader and RFID Reader**

Model:

**LCU5352SC1**

FCC ID:

**V7V-LCU5352SC1**

IC Registration number:

**9514A-LCU5352SC1**

Specifications:

**FCC 47 CFR Part 15.225**

Operation within the band 13.110–14.010 MHz

**RSS-210 Issue 9, August 2016, Annex B.6**

Devices operating in 13.110–14.010 MHz frequency band for any application

Date of issue: **August 23, 2019****Andrey Adelberg, Senior Wireless/EMC Specialist**

Test engineer(s)



Signature

**Kevin Rose, Wireless/EMC Specialist**

Reviewed by



Signature

#### Test location

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|              |                                                                                    |
|--------------|------------------------------------------------------------------------------------|
| Company name | Nemko Canada Inc.                                                                  |
| Address      | 303 River Road                                                                     |
| City         | Ottawa                                                                             |
| Province     | Ontario                                                                            |
| Postal code  | K1V 1H2                                                                            |
| Country      | Canada                                                                             |
| Telephone    | +1 613 737 9680                                                                    |
| Facsimile    | +1 613 737 9691                                                                    |
| Toll free    | +1 800 563 6336                                                                    |
| Website      | www.nemko.com                                                                      |
| Site number  | FCC test site registration number: CA2040, IC: 2040A-4 (3 m semi anechoic chamber) |

#### Limits of responsibility

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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 | ASSA ABLOY Global Solutions AS                      |
| Address      | Anolitveien 1-3<br>P.O. Box 340, 1402 Ski<br>Norway |

### 1.2 Test specifications

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|                                              |                                                                                                |
|----------------------------------------------|------------------------------------------------------------------------------------------------|
| FCC 47 CFR Part 15, Subpart C, Clause 15.225 | Operation in the 13.110–14.010 MHz                                                             |
| RSS-210 Issue 9, August 2016, Annex B.6      | Devices operating in 13.110–14.010 MHz frequency band for any application                      |
| ANSI C63.10 v2013                            | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |

### 1.3 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.

### 1.4 Exclusions

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None

### 1.5 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, general requirements test results

| Part       | Test description          | Verdict           |
|------------|---------------------------|-------------------|
| §15.207(a) | Conducted limits          | Not applicable    |
| §15.31(e)  | Variation of power source | Pass <sup>1</sup> |
| §15.203    | Antenna requirement       | Pass <sup>2</sup> |
| §15.215(c) | 20 dB bandwidth           | 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

<sup>2</sup> The Antennas are located within the enclosure of EUT and not user accessible.

### 2.2 FCC Part 15 Subpart C, intentional radiators test results

| Part       | Test description                                                    | Verdict |
|------------|---------------------------------------------------------------------|---------|
| §15.225(a) | Field strength within 13.553–13.567 MHz band                        | Pass    |
| §15.225(b) | Field strength within 13.410–13.553 MHz and 13.567–13.710 MHz bands | Pass    |
| §15.225(c) | Field strength within 13.110–13.410 MHz and 13.710–14.010 MHz bands | Pass    |
| §15.225(d) | Field strength outside 13.110–14.010 MHz band                       | Pass    |
| §15.225(e) | Frequency tolerance of carrier signal                               | Pass    |

Notes: None

### 2.3 IC RSS-GEN, Issue 5, test results

| Part | Test description                                  | Verdict        |
|------|---------------------------------------------------|----------------|
| 7.3  | Receiver radiated emission limits                 | Not applicable |
| 7.4  | Receiver conducted emission limits                | Not applicable |
| 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.

EUT is an AC powered device.

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

| Annex   | Test description                                                            | Verdict |
|---------|-----------------------------------------------------------------------------|---------|
| B.6 (a) | The field strength within the band 13.553–13.567 MHz                        | Pass    |
| B.6 (b) | The field strength within the bands 13.410–13.553 MHz and 13.567–13.710 MHz | Pass    |
| B.6 (c) | The field strength within the bands 13.110–13.410 MHz and 13.710–14.010 MHz | Pass    |
| B.6 (d) | The field strength outside the band 13.110–14.010 MHz                       | Pass    |
| B.6     | Carrier frequency stability                                                 | Pass    |

Notes: None

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

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### 3.1 Sample information

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|                        |               |
|------------------------|---------------|
| Receipt date           | June 27, 2019 |
| Nemko sample ID number | 1             |

### 3.2 EUT information

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|              |                                                  |
|--------------|--------------------------------------------------|
| Product type | Assa Abloy locks with BLE Reader and RFID Reader |
| Model        | <b>Error! Reference source not found.C1</b>      |
| Part number  | P001016399-001-001                               |

### 3.3 Technical information

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|                           |                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------|
| Operating band            | 13.553–13.567 MHz                                                                                                  |
| Operating frequency       | 13.56 MHz                                                                                                          |
| Modulation type           | CW                                                                                                                 |
| Occupied bandwidth (99 %) | 4.81 kHz                                                                                                           |
| Power requirements        | 4.5 V <sub>DC</sub> from 3 × 4.5 V batteries                                                                       |
| Emission designator       | NON                                                                                                                |
| Antenna information       | Loop printed antenna (The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.) |

### 3.4 Product description and theory of operation

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It is a Lock Controller Unit (LCU), with integrated RFID reader and BLE communication ability. If the MCU, by using the detection circuit, detects that a RFID keycard or Mobile phone is held in front of the lock, it will start up the RFID transceiver to try to read a RFID card. If the MCU (Main Microcontroller), by using the detection circuit, detects that a RFID keycard or Mobile phone is held in front of the lock, it will start up the RFID transceiver to try to read a RFID card. If no RFID card is found, it will turn off the RFID transceiver, and instead start up the BLE module.

### 3.5 EUT exercise details

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EUT was energized and transmission on 13.56 MHz commenced.

## 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

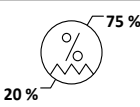
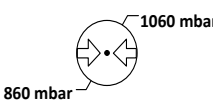
### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

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

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

5.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages  $\pm 5\%$ , for which the equipment was designed.



**Section 6.**    Measurement uncertainty

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6.1    Uncertainty of measurement

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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     | 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        |
| Active loop antenna (0.01–30 MHz) | Com-Power       | AL-130    | FA002674  | 1 year    | September 12, 2019 |
| Spectrum analyzer                 | Rohde & Schwarz | FSU       | FA001877  | 1 year    | October 26, 2019   |
| Bilog antenna (20–3000 MHz)       | Sunol           | JB3       | FA002108  | 1 year    | January 3, 2020    |

Note: NCR - no calibration required

## Section 8. Testing data

### 8.1 FCC 15.215(c) and RSS-Gen 6.7 Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth

#### 8.1.1 Definitions and limits

##### FCC

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

##### IC

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

#### 8.1.2 Test summary

Test date August 8, 2019

#### 8.1.3 Observations, settings and special notes

Spectrum analyzer settings:

|                      |              |
|----------------------|--------------|
| Detector mode        | Peak         |
| Resolution bandwidth | ≥1 % of span |
| Video bandwidth      | RBW × 3      |
| Trace mode           | Max Hold     |

#### 8.1.4 Test data

**Table 8.1-1: Lower 20 dBc frequency cross result**

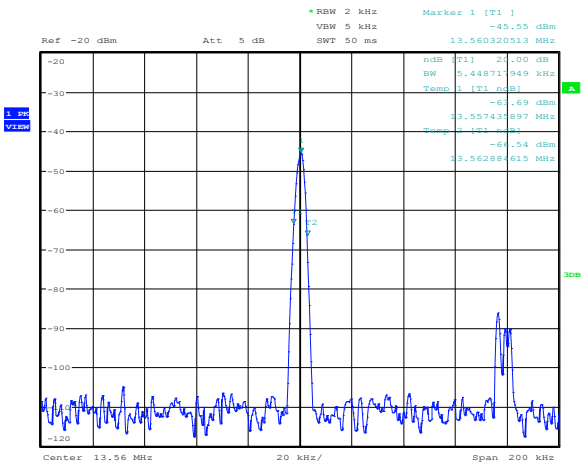
| Fundamental frequency, MHz | Lower 20 dBc frequency cross, MHz | Limit, MHz | Margin, MHz |
|----------------------------|-----------------------------------|------------|-------------|
| 13.560                     | 13.557                            | 13.553     | 0.04        |

**Table 8.1-2: Upper 20 dBc frequency cross result**

| Fundamental frequency, MHz | Upper 20 dBc frequency cross, MHz | Limit, MHz | Margin, MHz |
|----------------------------|-----------------------------------|------------|-------------|
| 13.560                     | 13.562                            | 13.567     | 0.05        |

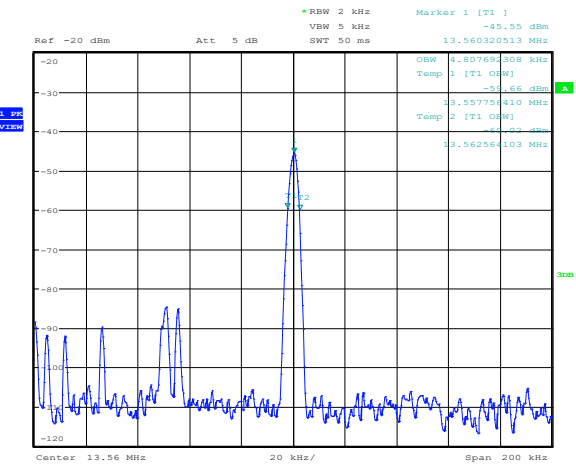
Section 8  
Test name  
Specification

Testing data  
FCC 15.215(c) and RSS-Gen 6.7 Occupied (Emission) bandwidth  
FCC 15 Subpart C and RSS-Gen



Date: 8.AUG.2019 11:22:56

Figure 8.1-1: 20 dB bandwidth



Date: 8.AUG.2019 11:22:14

Figure 8.1-2: 99% dB bandwidth

## 8.2 FCC 15.225(a-c) and RSS-210 B.6 (a-c) Field strength within the 13.110–14.010 MHz band

### 8.2.1 Definitions and limits

- a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15848  $\mu\text{V/m}$  (84 dB $\mu\text{V/m}$ ) at 30 m.
- b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334  $\mu\text{V/m}$  (50.5 dB $\mu\text{V/m}$ ) at 30 m.
- c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106  $\mu\text{V/m}$  (40.5 dB $\mu\text{V/m}$ ) at 30 m.

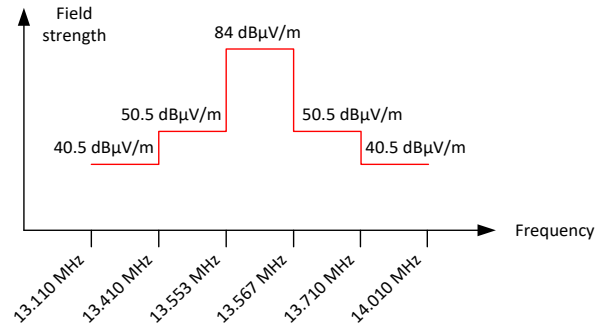


Figure 8.2-1: In-band spurious emissions limit

### 8.2.2 Test summary

Test date July 9, 2019

### 8.2.3 Observations/special notes

The measurements were performed at the distance of 3 m. 40 dB distance correction factor\* was applied to the measurement result in order to comply with 30 m limits.

\* 30 m to 3 m distance correction factor calculation (for 13 MHz band):

$$40 \times \log_{10} (3 \text{ m}/30 \text{ m}) = 40 \times \log_{10} (0.1) = -40 \text{ dB}$$

Spectrum analyzer settings:

|                      |          |
|----------------------|----------|
| Detector mode        | Peak     |
| Resolution bandwidth | 10 kHz   |
| Video bandwidth      | 30 kHz   |
| Trace mode           | Max Hold |

8.2.4 Test data

Table 8.2-1: Field strength measurements results

| Frequency range, MHz | Frequency, MHz | Field strength at 3 m, dBμV/m | Calculated field strength at 30 m, dBμV/m | Limit, dBμV/m | Margin, dB |
|----------------------|----------------|-------------------------------|-------------------------------------------|---------------|------------|
| 13.553–13.567        | 13.56          | 41.16                         | 1.16                                      | 84.00         | 82.84      |
| 13.410–13.553        | 13.410–13.553  | 22.00                         | -18.00                                    | 50.50         | 68.50      |
| 13.567–13.710        | 13.567–13.710  | 22.00                         | -18.00                                    | 50.50         | 68.50      |
| 13.110–13.410        | 13.110–13.410  | 22.00                         | -18.00                                    | 40.50         | 58.50      |
| 13.710–14.010        | 13.710–14.010  | 22.00                         | -18.00                                    | 40.50         | 58.50      |

Note: Calculated field strength at 30 m = Measured field strength at 3 m – 40 dB

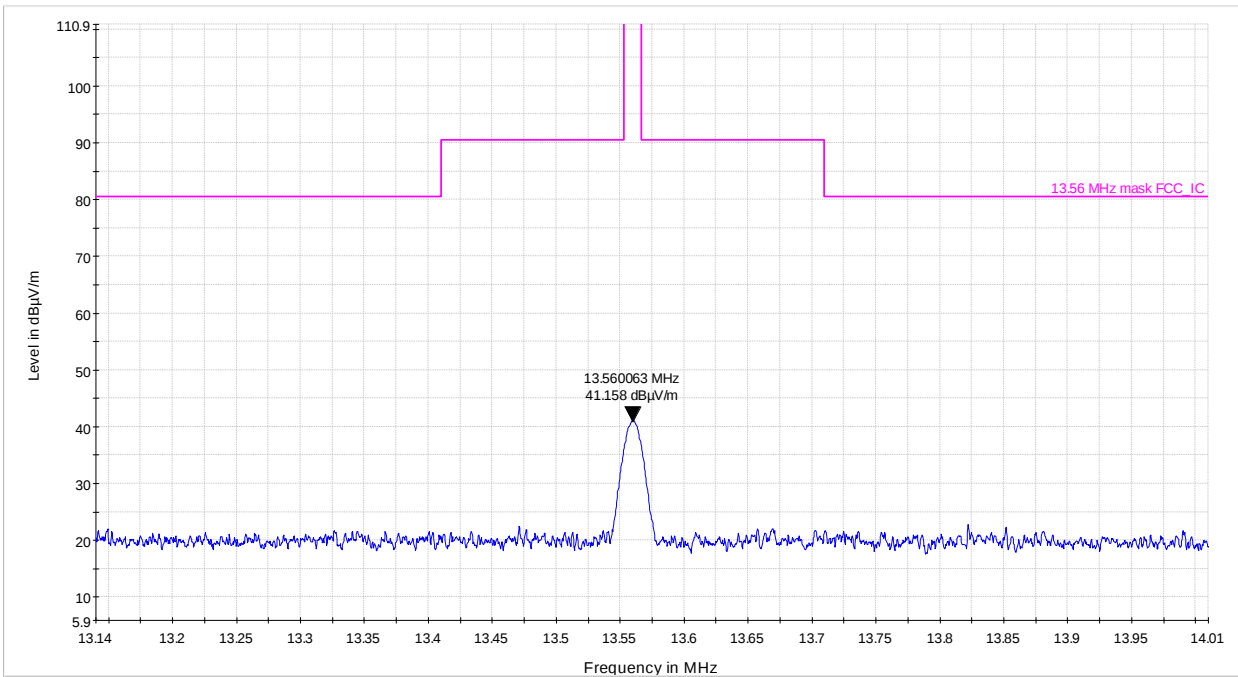


Figure 8.2-2: Field strength within 13.14–14.01 MHz band

## 8.3 FCC 15.225(d) and RSS-210 B.6(d) Field strength of emissions outside 13.110–14.010 MHz band

### 8.3.1 Definitions and limits

**FCC:**

The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209. The field strength of emissions appearing within restricted bands (as specified in §15.205) shall not exceed the limits from §15.209.

**ISED:**

RSS-Gen general field strength limits for frequencies outside the band 13.110–14.010 MHz.

**Table 8.3-1: 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

**Table 8.3-2: 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     |             |

Note: Certain frequency bands listed in the **Error! Reference source not found.** table and above 38.6 GHz are designated for licence-exempt applications. These frequency bands and the requirements that apply to related devices are set out in the 200 and 300 series of RSSs.

**Table 8.3-3: FCC restricted frequency bands**

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

### 8.3.2 Test summary

Test date July 9, 2019

### 8.3.3 Observations, settings and special notes

The spectrum was searched from 9 kHz to 1 GHz.  
Radiated measurements were performed at a distance of 3 m.

Spectrum analyzer settings for frequencies below 150 kHz:

|                      |            |
|----------------------|------------|
| Detector mode        | Quasi-Peak |
| Resolution bandwidth | 300 Hz     |
| Video bandwidth      | 9 kHz      |
| Trace mode           | Max Hold   |
| Measurement time     | 100 ms     |

|                      |            |
|----------------------|------------|
| Detector mode        | Quasi-Peak |
| Resolution bandwidth | 9 kHz      |
| Video bandwidth      | 30 kHz     |
| Trace mode           | Max Hold   |
| Measurement time     | 100 ms     |

Spectrum analyzer settings for frequencies above 30 MHz:

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

8.3.4 Test data

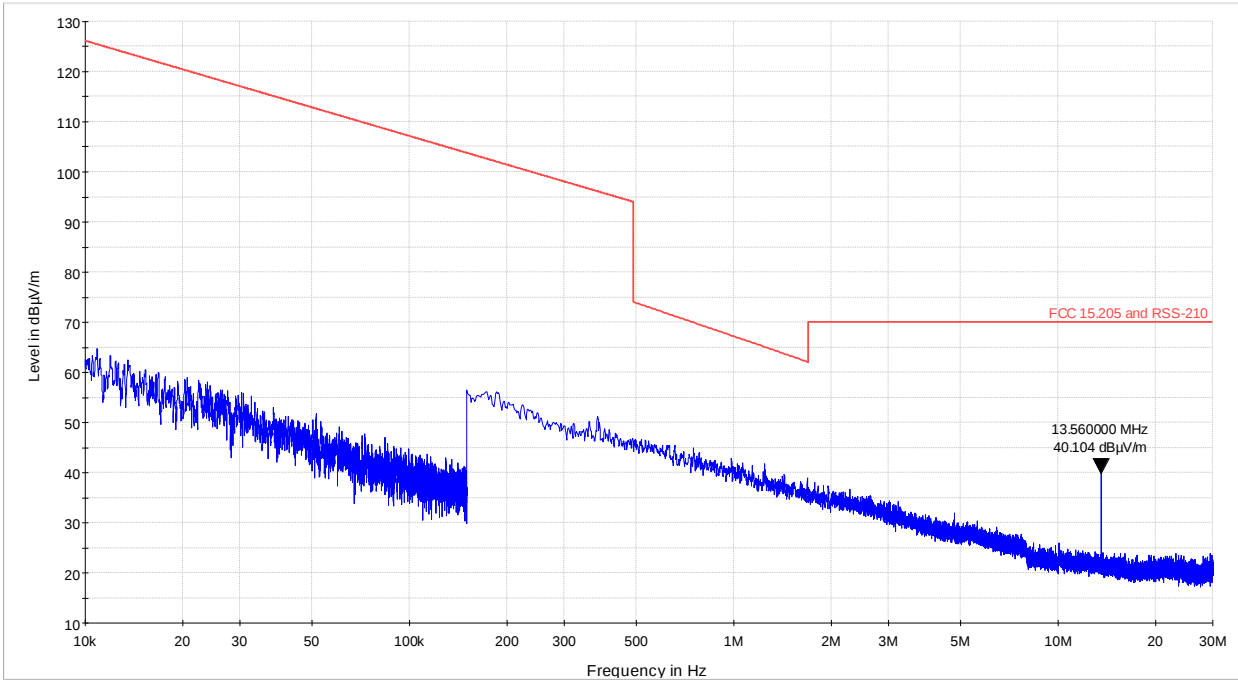


Figure 8.3-1: Field strength of spurious emissions below 30 MHz

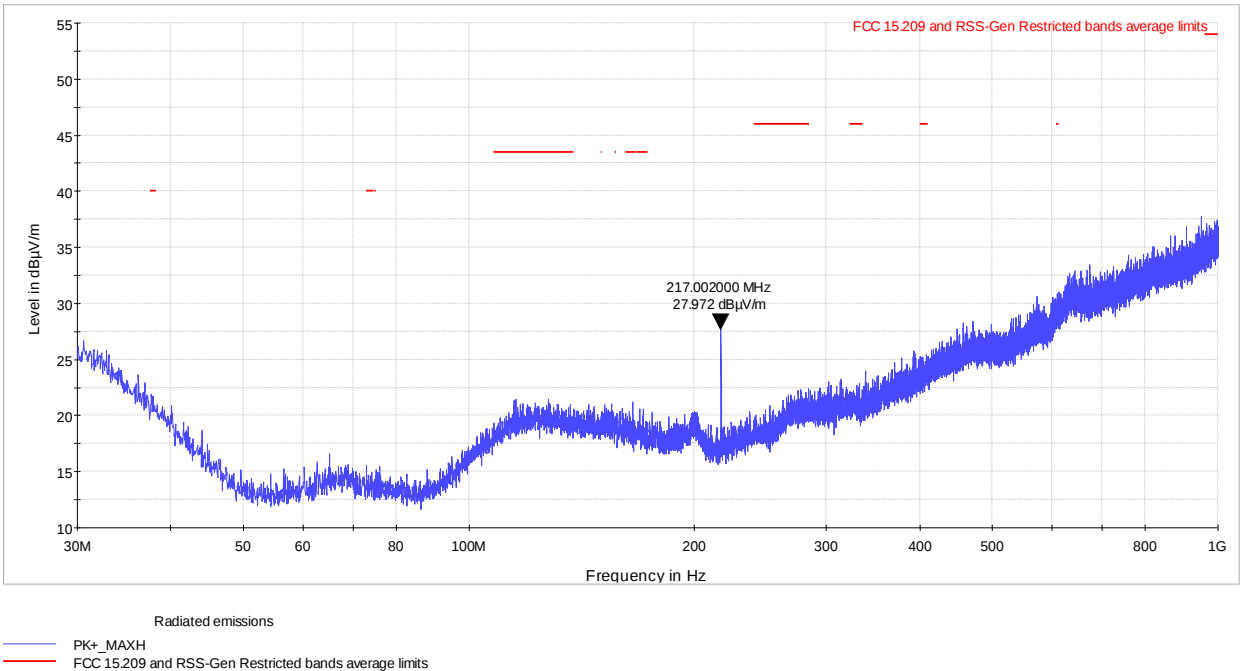


Figure 8.3-2: Field strength of spurious emissions above 30 MHz

Note: all measurement results indicated in the plot were taken with a peak detector, which is more stringent measurement, and still comply with quasi-peak limit.

## 8.4 FCC 15.225(e) and RSS-210 B.6 Frequency tolerance of the carrier signal

### 8.4.1 Definitions and limits

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  ( $\pm 100$  ppm) of the operating frequency over a temperature variation of  $-20\text{ }^{\circ}\text{C}$  to  $+50\text{ }^{\circ}\text{C}$  at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of  $20\text{ }^{\circ}\text{C}$ . For battery operated equipment, the equipment tests shall be performed using a new battery.

### 8.4.2 Test summary

Test date August 7, 2019

### 8.4.3 Observations, settings and special notes

Spectrum analyzer settings:

|                      |                                  |
|----------------------|----------------------------------|
| Detector mode        | Peak                             |
| Resolution bandwidth | $\geq 1\%$ of emission bandwidth |
| Video bandwidth      | RBW $\times 3$                   |
| Trace mode           | Max Hold                         |

### 8.4.4 Test data

**Table 8.4-1:** Frequency drift measurements results

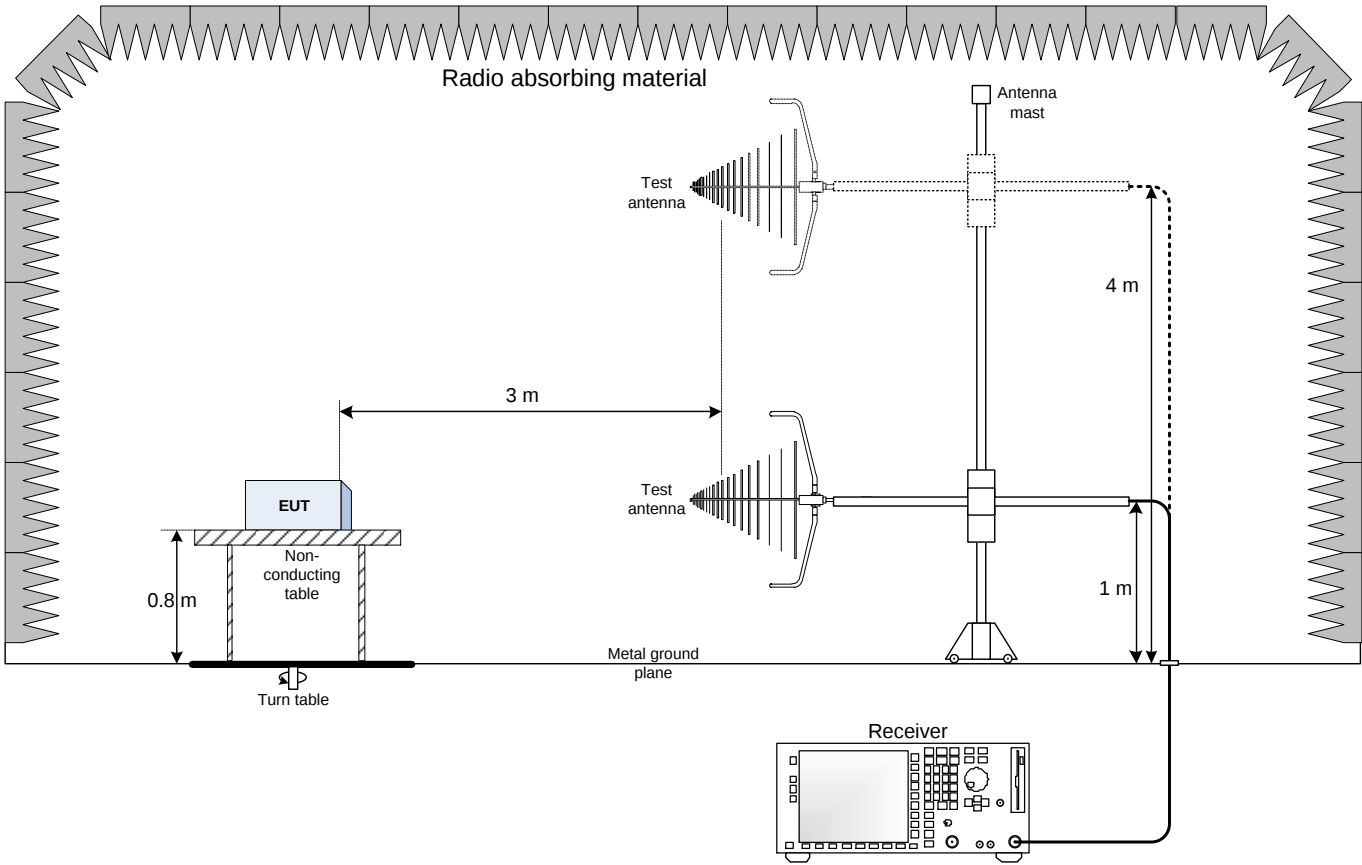
| Test conditions                  | Frequency, MHz | Frequency drift, $\pm$ ppm | Limit, $\pm$ ppm | Margin, ppm |
|----------------------------------|----------------|----------------------------|------------------|-------------|
| +50 $^{\circ}\text{C}$ , Nominal | 13560.206      | 0                          | 100              | 0           |
| +20 $^{\circ}\text{C}$ , +15 %   | 13560.206      | 0                          | 100              | 0           |
| +20 $^{\circ}\text{C}$ , Nominal | 13560.206      | Reference                  | Reference        | Reference   |
| +20 $^{\circ}\text{C}$ , -15 %   | 13560.206      | 0                          | 100              | 0           |
| -20 $^{\circ}\text{C}$ , Nominal | 13560.206      | 0                          | 100              | 0           |

Note: frequency drift was calculated as follows:

$$\text{Frequency drift (ppm)} = ((F_{\text{measured}} - F_{\text{reference}}) \div F_{\text{reference}}) \times 1 \times 10^6$$

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up



9.2 Conducted emissions set-up

