# TEST REPORT

**Report Number: 102982605MIN-005D**
**Project Number: G102982605**

**Testing performed on the**
**R1**
**(Electronic Wall Mounted Access Control Reader, BLE Lens)**
**FCC ID: 2AK5B-R1**
**IC: 22134-R1**

**to**
**47 CFR, Part 15. 249:2017**
**RSS- 210, Issue 9, 2016**
**RSS-Gen, Issue 4, 2014**
**47 CFR, Part 15:2017, §15.107 and §15.109, Class B / ICES-003, Issue 6:2016**

**For**
**Latchable Inc.**

Test Performed by:
Intertek Testing Services NA, Inc.
7250 Hudson Blvd., Suite 100
Oakdale, MN 55128 USA

Test Authorized by:
Latchable Inc.
450 West 33rd Street-12th Floor
New York, NY 10001 USA

Prepared by: _____
Uri Spector

Reviewed by: _____ Date of issue: June 22, 2017
Norman Shpilsher

## TABLE OF CONTENTS


***1.0 GENERAL DESCRIPTION ..... 3***

1.1 Product Description; Test Facility ..... 4

1.3 Environmental conditions ..... 5

1.4 Measurement uncertainty ..... 6

1.5 Field Strength Calculation ..... 6

***2.0 TEST SUMMARY ..... 7***

***3.0 TEST CONDITIONS AND RESULTS ..... 8***

3.1 Field strength of fundamental ..... 8

3.2 Field strength of harmonics and spurious emissions ..... 10

*3.2.1 Average correction factor calculation ..... 28*

3.3 Bandwidth of Emissions ..... 32

3.4 Transmitter power line conducted emissions ..... 39

3.5 Receiver/digital device radiated emissions ..... 42

3.6 Digital device conducted emissions ..... 52

***4.0 TEST EQUIPMENT ..... 55***

***5.0 REVISION HISTORY ..... 56***

## 1.0 GENERAL DESCRIPTION

| | |
|---|---|
| **Model:** | R1 |
| **Type of EUT:** | Electronic Wall Mounted Access Control Reader, BLE Lens |
| **Serial Number:** | FCC 4 (Ch. 2402MHz)<br>FCC 7 (Ch. 2440MHz)<br>FCC 6 (Ch. 2480MHz)<br>FCC 1 (Rx mode) |
| **FCC ID:** | 2AK5B-R1 |
| **IC:** | 22134-R1 |
| **Related Submittal(s) Grants:** | This is composite device with the same ID under different section of FCC and ISED regulations. |
| **Company:** | Latchable Inc. |
| **Customer:** | Mr. Jim Griszbacher |
| **Address:** | 450 West 33rd Street-12th Floor<br>New York, NY 10001 USA |
| **Phone:** | (609) 922-3739 |
| **E-mail:** | jim@latchaccess.com |
| **Test Standards:** | ☒ 47 CFR, Part 15:2017, §15.249<br>☒ RSS–210, Issue 9, 2016<br>☒ RSS-Gen, Issue 4, 2014<br>☒ 47 CFR, Part 15:2017, §15.107 and §15.109, Class B, test method: ANSI C63.4-2014<br>☒ ICES-003, Issue 6:2016<br>☐ Other |
| **Type of radio:** | ☒ Stand -alone ☐ Module ☐ Hybrid |
| **Date Sample Submitted:** | May 31, 2017 |
| **Test Work Started:** | June 1, 2017 |
| **Test Work Completed:** | June 20, 2017 |
| **Test Sample Conditions:** | ☐ Damaged ☐Poor (Usable) ☒ Good |

## 1.1 Product Description; Test Facility

| | |
|---|---|
| **Product Description:** | 2.4 GHz Bluetooth BLE Transceiver |
| **Permitted Band of Operation:** | 2400MHz to 2483.5MHz |
| **Operating Frequency** | 2402MHz to 2480MHz |
| **Modulation:** | GFSK |
| **Emission Designator:** | 1M07F1D |
| **Antenna(s) Info:** | Antenna Type: Chip antenna Gain: 1.69dBi |
| **Antenna Installation:** | ☐ User ☐ Professional ☒ Factory |
| **Transmitter Power Configuration:** | ☐ Internal battery ☒ 120VAC via SL Power ME10A1203B01 AC Adapter<br>☐ 100-240VAC ☐ 230VAC ☐ 400VAC ☐ VDC ☐ Other: 0.2 Amp.<br>☐ 50Hz ☒ 60Hz |
| **Special Test Arrangement:** | None |
| **Test Facility Accreditation:** | A2LA (Certificate No. 1427.01) |
| **Test Methodology:** | Measurements performed according to the procedures in ANSI C63.10-2013 |

## 1.2 EUT Configuration

The equipment under test was operated during the measurement under the following conditions:

☒ - Standby
☒ - Continuous modulated
☒ - Continuous un-modulated
☐ - Test program (customer specific)
☒ - See below

**Operating modes of the EUT:**

| No. | Description |
|---|---|
| 1 | Samples (FCC 4, FCC 6 and FCC 7) were wired to provide continuous transmitting mode at low channel, middle channel and high channel or receiving/standby mode. |

**Cables:**

| No. | Type | Length | Designation | Note |
|---|---|---|---|---|
| 1 | Ethernet cable | 24cm | Unshielded CAT5 | |
| 2 | Multi-conductor I/O cable | 26cm | Unshielded, with DC power input, relay contacts, RS-485 communications interface, and additional inputs for peripheral devices | |

**Support equipment/Services**:

| No. | Item | Description |
|---|---|---|
| 1 | AC wall adapter | SL Power ME10A1203B01 AC/DC Adapter |
| 2 | R & S RF Generator SMR20 | RF Generator (to activate a receiver portion for FCC 15.109 testing) |

## 1.3 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

☒ **Normal**

**Temperature:** 15-35 ° C

**Humidity:** 30-60 %

**Atmospheric pressure:** 86-106 kPa

## 1.4 Measurement uncertainty

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be: ±4 dB at 10m and ±5.4 dB at 3m

The expanded uncertainty (k = 2) for radiated emissions above 1GHz has been determined to be: ±6.4 dB at 3m

The expanded uncertainty (k = 2) for conducted emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

## 1.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB($m^{-1}$)
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB($m^{-1}$) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB($m^{-1}$)
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

**General notes:**

## 2.0 TEST SUMMARY

Referring to the performance criteria and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards.

| TEST SPECIFICATION | TEST PARAMETERS | RESULT |
|---|---|---|
| 15.249(a) / RSS-210 A2.9(a) | Field strength of fundamental | Pass |
| 15.249(a) / RSS-210 A2.9(a) | Field strength of harmonics | Pass |
| 15.249(d) / RSS-210 A2.9(b) | Field strength of spurious emissions | Pass |
| 15.215(c) / RSS- Gen 4.6.1 | Bandwidth of the emission | Pass |
| 15.207/RSS-Gen 7.2.2 | Transmitter Power Line conducted emissions | Pass |
| 15.109/ICES-003 | Receiver/digital device radiated emissions | Pass |
| 15.107/ ICES-003 | Digital device conducted emissions | Pass |

## 3.0 TEST CONDITIONS AND RESULTS

### 3.1 Field strength of fundamental

**Test location:** ☐ OATS ☒ Anechoic Chamber ☐ Other

**Test distance:** ☐ 10 meters ☒ 3 meters

**Test result:** **Pass**

**Max. Emissions margin at fundamental:** 5.6dB below the limits

**Notes:** The EUT was tested for worst case emissions.

| | | |
|---|---|---|
| **Date:** | June 5, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector | |
| **Standard:** | FCC 15.249(a) / RSS-210 A2.9 | |
| **Test Point:** | Enclosure with antenna | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 23.8°C; 42%(RH); 98.1kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | None | |

**Table 3.1.1**

| Frequency | Antenna | | Ant. CF | Cable loss | Pre-amp | Peak Reading | Total @ 3m | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | dB1/m | dB | Gain (dB) | dBµV | dBµV/m | dBµV/m | dB |
| | | | | | | | | | |
| | | | | **Low Channel** | | | | | |
| 2402.11 | V | 100 | 28.2 | 2.9 | 0.0 | 56.8 | 87.9 | 94.0 | -6.1 |
| 2402.32 | H | 223 | 28.2 | 2.9 | 0.0 | 57.3 | 88.4 | 94.0 | -5.6 |
| | | | | | | | | | |
| | | | | **Middle Channel** | | | | | |
| 2440.41 | V | 216 | 28.3 | 2.9 | 0.0 | 49.8 | 81.0 | 94.0 | -13.0 |
| 2440.41 | H | 255 | 28.3 | 2.9 | 0.0 | 52.3 | 83.5 | 94.0 | -10.5 |
| | | | | | | | | | |
| | | | | **Upper Channel** | | | | | |
| 2479.64 | V | 239 | 28.4 | 2.9 | 0.0 | 53.6 | 84.9 | 94.0 | -9.1 |
| 2480.44 | H | 237 | 28.4 | 2.9 | 0.0 | 52.9 | 84.2 | 94.0 | -9.8 |
| | | | | | | | | | |

### 3.2 Field strength of harmonics and spurious emissions

**Test location:** ☐ OATS ☒ Anechoic Chamber ☐ Other

**Test distance:** ☐ 10 meters ☒ 3 meters

**Frequency range of measurements:** 30MHz-25GHz

**Test result:** **Pass**

**Max. margin of harmonics and spurious emissions:** 2.1dB below the limits

**Max. margin of bandedge compliance:** 2.3dB below the limits

**Notes:**

1. The EUT was tested for worst case emissions.
2. Fundamental transmitting frequency was excluded from the table.
3. No harmonics and spurious emissions were detected above the 5th harmonic.
4. Readings shown in Tables 3.2.1, 3.2.2 and 3.2.3 are not related with transmitter operation.

| | | |
|---|---|---|
| **Date:** | June 20, 2017 | **Result: Pass** |
| **Tested by:** | Simon Khazon | |
| **Standard:** | FCC 15.249(a) and (d) / RSS-210 A2.9 | |
| **Test Point:** | Enclosure with antenna | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 23.7°C; 40.4%(RH); 98.5kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | 30MHz-1GHz (2402MHz) | |

**Table 3.2.1**

| Frequency MHz | Antenna Polarity | Reading dBµV | Total C.F. dB1/m | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 274.76 MHz | V | 18.0 | 18.8 | 36.8 | 46.0 | -9.2 |
| 324.94 MHz | V | 11.9 | 20.1 | 32.0 | 46.0 | -14.0 |
| 374.81 MHz | V | 9.4 | 21.6 | 31.0 | 46.0 | -15.1 |
| 625.2 MHz | V | 4.7 | 25.6 | 30.3 | 46.0 | -15.7 |
| 675.02MHz(*) | V | 17.6 | 26.9 | 44.5 | 46.0 | -1.5 |
| 700.09 MHz | V | 12.1 | 25.9 | 38.0 | 46.0 | -8.0 |
| 724.85 MHz | V | 8.1 | 27.0 | 35.1 | 46.0 | -11.0 |
| 900.27 MHz | V | 5.1 | 28.6 | 33.7 | 46.0 | -12.3 |
| 927.14 MHz | V | 4.2 | 28.2 | 32.4 | 46.0 | -13.6 |
| | | | | | | |
| 324.94 MHz | H | 17.5 | 20.1 | 37.6 | 46.0 | -8.4 |
| 374.81 MHz | H | 16.3 | 21.6 | 37.9 | 46.0 | -8.1 |
| 674.98 MHz | H | 8.3 | 26.1 | 34.4 | 46.0 | -11.6 |
| 824.93 MHz | H | 8.5 | 27.5 | 35.9 | 46.0 | -10.1 |
| 850.04 MHz | H | 10.2 | 27.8 | 38.0 | 46.0 | -8.0 |
| 875.15 MHz | H | 13.6 | 28.2 | 41.7 | 46.0 | -4.3 |
| 900.27 MHz | H | 10.0 | 28.6 | 38.6 | 46.0 | -7.5 |
| 925.02 MHz | H | 8.7 | 28.1 | 36.8 | 46.0 | -9.2 |
| | | | | | | |

Measurements were taken using a Peak detector, and measurements marked (*) were taken using a Quasi-Peak detector.

| | | |
|---|---|---|
| **Date:** | June 20, 2017 | **Result: Pass** |
| **Tested by:** | Simon Khazon | |
| **Standard:** | FCC 15.249(a) and (d) / RSS-210 A2.9 | |
| **Test Point:** | Enclosure with antenna | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 23.7°C; 40.4%(RH); 98.5kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | 30MHz-1GHz (2440MHz) | |

**Table 3.2.2**

| Frequency MHz | Antenna Polarity | Reading dBµV | Total C.F. dB1/m | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 54.312 MHz | V | 13.5 | 12.4 | 25.8 | 40.0 | -14.2 |
| 274.76 MHz | V | 17.5 | 18.8 | 36.3 | 46.0 | -9.7 |
| 324.94 MHz | V | 11.1 | 20.1 | 31.2 | 46.0 | -14.8 |
| 674.98 MHz | V | 10.9 | 26.1 | 37.0 | 46.0 | -9.0 |
| 700.09 MHz | V | 8.7 | 25.9 | 34.6 | 46.0 | -11.4 |
| 724.85 MHz | V | 10.2 | 27.0 | 37.2 | 46.0 | -8.8 |
| 875.15 MHz | V | 3.4 | 28.2 | 31.5 | 46.0 | -14.5 |
| 925.02 MHz | V | 3.7 | 28.1 | 31.9 | 46.0 | -14.2 |
| | | | | | | |
| 275.08 MHz | H | 11.8 | 18.8 | 30.6 | 46.0 | -15.5 |
| 324.94 MHz | H | 17.0 | 20.1 | 37.2 | 46.0 | -8.9 |
| 374.81 MHz | H | 12.4 | 21.6 | 34.0 | 46.0 | -12.0 |
| 724.85 MHz | H | 4.1 | 27.0 | 31.0 | 46.0 | -15.0 |
| 824.93 MHz | H | 8.5 | 27.5 | 36.0 | 46.0 | -10.0 |
| 850.04 MHz | H | 4.6 | 27.8 | 32.4 | 46.0 | -13.6 |
| 875.15 MHz | H | 9.9 | 28.2 | 38.0 | 46.0 | -8.0 |
| 925.02 MHz | H | 5.4 | 28.1 | 33.6 | 46.0 | -12.5 |
| | | | | | | |

All measurements were taken using a Peak detector

| | | |
|---|---|---|
| **Date:** | June 20, 2017 | **Result: Pass** |
| **Tested by:** | Simon Khazon | |
| **Standard:** | FCC 15.249(a) and (d) / RSS-210 A2.9 | |
| **Test Point:** | Enclosure with antenna | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 23.7°C; 40.4%(RH); 98.5kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | 30MHz-1GHz (2480MHz) | |

**Table 3.2.3**

| Frequency MHz | Antenna Polarity | Reading dBµV | Total C.F. dB1/m | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 58.157 MHz | V | 14.5 | 11.5 | 26.1 | 40.0 | -13.9 |
| 61.447 MHz | V | 13.2 | 11.3 | 24.5 | 40.0 | -15.5 |
| 274.76 MHz | V | 16.9 | 18.8 | 35.7 | 46.0 | -10.3 |
| 700.09 MHz | V | 6.9 | 25.9 | 32.9 | 46.0 | -13.2 |
| 950.13 MHz | V | 3.4 | 28.7 | 32.1 | 46.0 | -13.9 |
| | | | | | | |
| 275.08 MHz | H | 11.0 | 18.8 | 29.8 | 46.0 | -16.2 |
| 324.94 MHz | H | 16.9 | 20.1 | 37.0 | 46.0 | -9.0 |
| 349.87 MHz | H | 11.1 | 20.7 | 31.8 | 46.0 | -14.3 |
| 374.81 MHz | H | 14.8 | 21.6 | 36.4 | 46.0 | -9.6 |
| 800.18 MHz | H | 5.9 | 27.0 | 32.9 | 46.0 | -13.1 |
| 850.04 MHz | H | 7.6 | 27.8 | 35.4 | 46.0 | -10.6 |
| 900.27 MHz | H | 8.5 | 28.6 | 37.1 | 46.0 | -8.9 |
| | | | | | | |

All measurements were taken using a Peak detector

| | | |
|---|---|---|
| **Date:** | June 5, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector | |
| **Standard:** | FCC 15.249(a) and (d) / RSS-210 A2.9 | |
| **Test Point:** | Enclosure with antenna | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 23.8°C; 42%(RH); 98.1kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | 1GHz-25GHz | |

**Table 3.2.4**

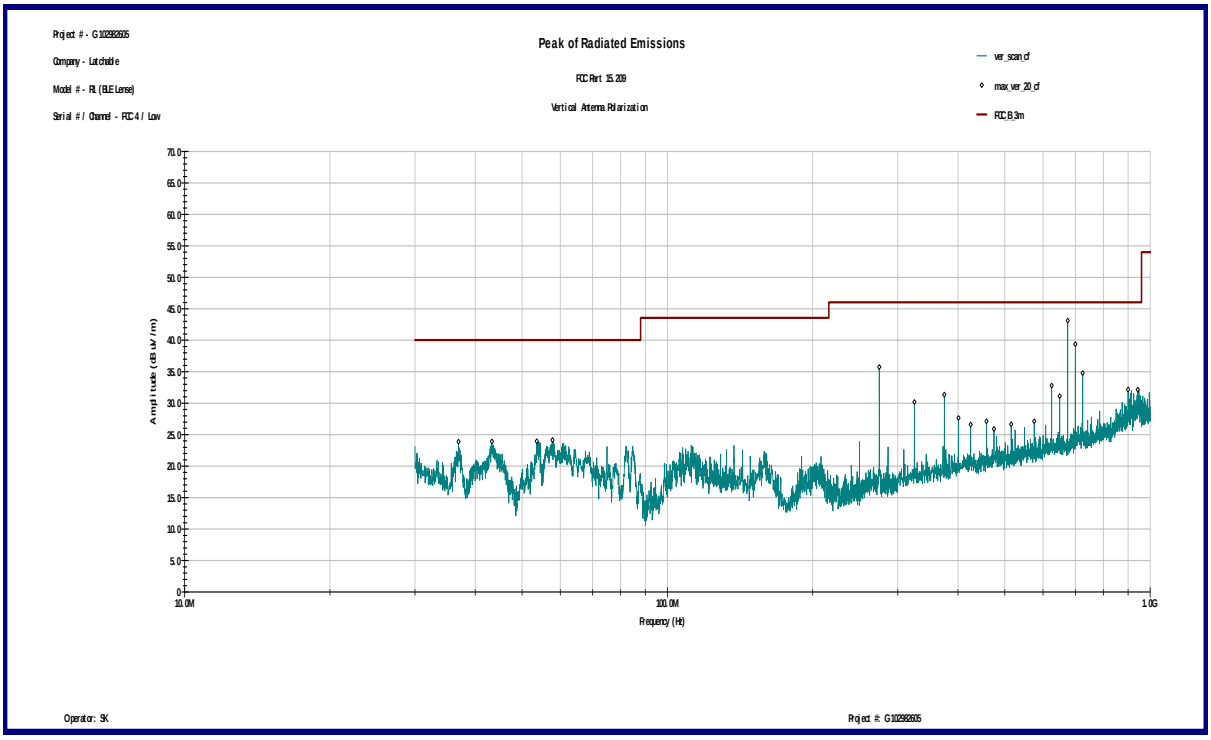
| Frequency MHz | Antenna Polarity | Reading dBµV | Total C.F. dB1/m | Pre-Amp. Gain (dB) | AVG Value C.F. (dB) | Total at 3m dBµV/m | Limit dBµV/m | Margin dB | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | **2402MHz** | | | | | | Peak |
| 4.8027 GHz | V | 45.6 | 37.0 | 39.2 | 0.0 | 43.4 | 54.0 | -10.6 | Peak |
| 4.8027 GHz | H | 53.0 | 37.0 | 39.2 | 0.0 | 43.4 | 54.0 | -3.2 | Peak |
| 12.013 GHz | H | 40.2 | 46.0 | 36.8 | 0.0 | 43.4 | 54.0 | -4.6 | Peak |
| | | | **2440MHz** | | | | | | |
| 4.882 GHz | V | 46.7 | 37.1 | 39.1 | 0.0 | 43.4 | 54.0 | -9.3 | Peak |
| 7.318 GHz | V | 42.5 | 41.6 | 38.1 | 0.0 | 43.4 | 54.0 | -8.0 | Peak |
| 4.882 GHz | H | 54.0 | 37.0 | 39.1 | 0.0 | 43.4 | 54.0 | -2.1 | Peak |
| 7.3227 GHz | H | 42.1 | 41.7 | 38.1 | 0.0 | 43.4 | 54.0 | -8.2 | Peak |
| 12.204 GHz | H | 42.8 | 45.8 | 37.0 | 0.0 | 43.4 | 54.0 | -2.4 | Peak |
| | | | **2480MHz** | | | | | | |
| 4.9613 GHz | V | 49.5 | 37.2 | 39.1 | 0.0 | 43.4 | 54.0 | -10.6 | Peak |
| 7.4393 GHz | V | 53.0 | 41.8 | 38.0 | 0.0 | 56.8 | 74.0 | -17.2 | Peak |
| 7.4393 GHz | V | 53.0 | 41.8 | 38.0 | 34.0 | 22.8 | 54.0 | -31.2 | AVG Value |
| 4.9613 GHz | H | 57.0 | 37.2 | 39.1 | 0.0 | 55.1 | 74.0 | -18.9 | Peak |
| 4.9613 GHz | H | 57.0 | 37.2 | 39.1 | 34.0 | 21.1 | 54.0 | -32.9 | AVG Value |
| 7.4393 GHz | H | 49.2 | 41.9 | 38.0 | 0.0 | 43.4 | 54.0 | -10.6 | Peak |
| 12.4 GHz | H | 40.2 | 45.7 | 37.3 | 0.0 | 43.4 | 54.0 | -10.6 | Peak |
| | | | | | | | | | |

| | | |
|---|---|---|
| **Date:** | June 5, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector | |
| **Standard:** | FCC 15.249(a) and (d) / RSS-210 A2.9 | |
| **Test Point:** | Enclosure with antenna | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 23.8°C; 42%(RH); 98.1kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | Bandedge compliance | |

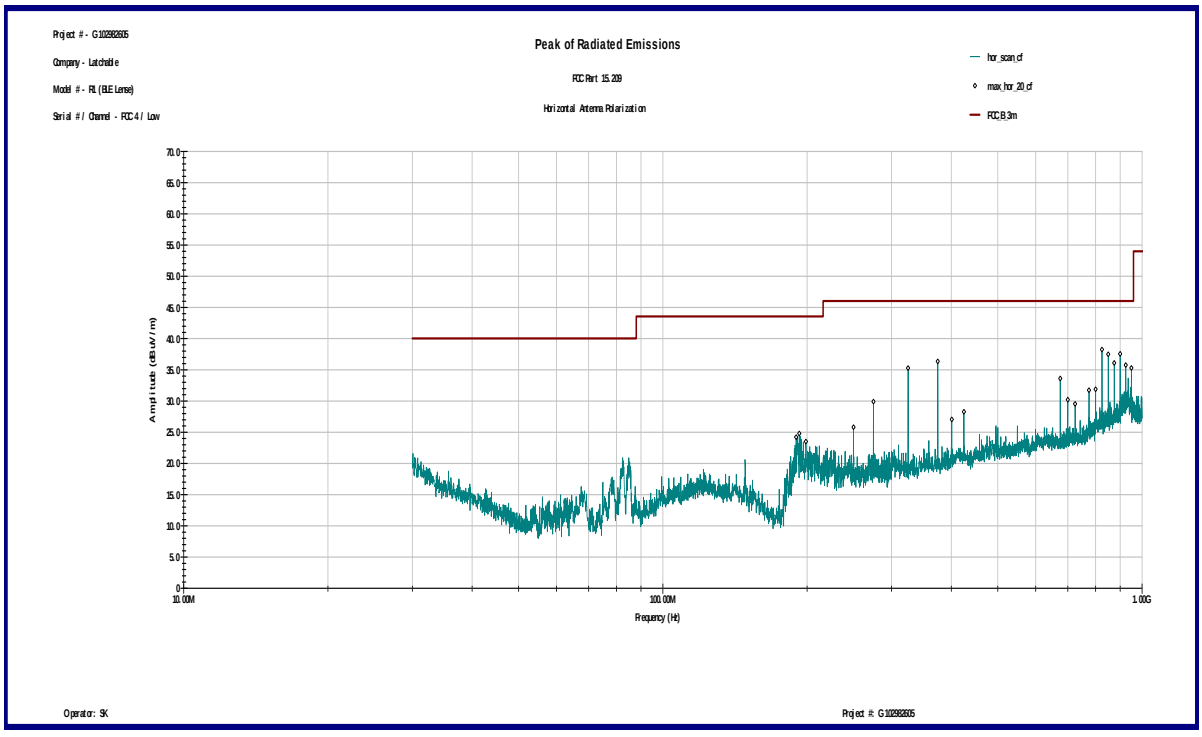
**Table 3.2.5**

| Frequency | Antenna | | Ant. CF | Cable loss | Pre-amp | Peak Reading | Total @ 3m | Limit | Margin |
|---|---|---|---|---|---|---|---|---|---|
| MHz | Polarity | Hts(cm) | dB1/m | dB | Gain (dB) | dBµV | dBµV/m | dBµV/m | dB |
| | | | | | | | | | |
| | | | | **Low Channel** | | | | | |
| 2390.00 | V | 230 | 28.1 | 2.9 | 0.0 | 20.1 | 51.1 | 54.0 | -2.9 |
| 2390.00 | H | 228 | 28.1 | 2.9 | 0.0 | 20.7 | 51.7 | 54.0 | -2.3 |
| | | | | | | | | | |
| | | | | **Upper Channel** | | | | | |
| 2483.50 | V | 239 | 28.4 | 2.9 | 0.0 | 10.7 | 42.0 | 54.0 | -12.0 |
| 2483.50 | H | 237 | 28.4 | 2.9 | 0.0 | 12.2 | 43.5 | 54.0 | -10.5 |
| | | | | | | | | | |

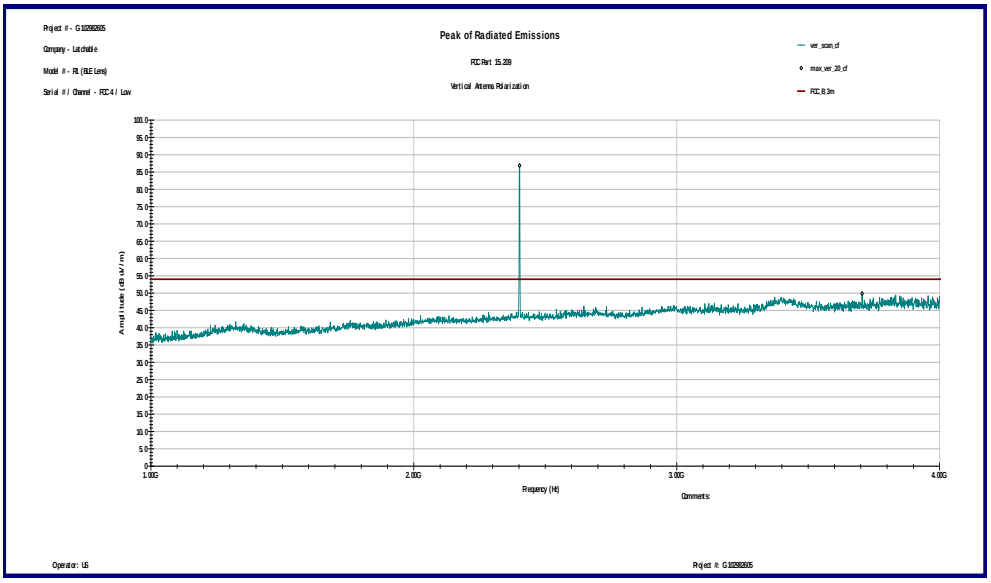
**Graph 3.2.1 (Peak)**



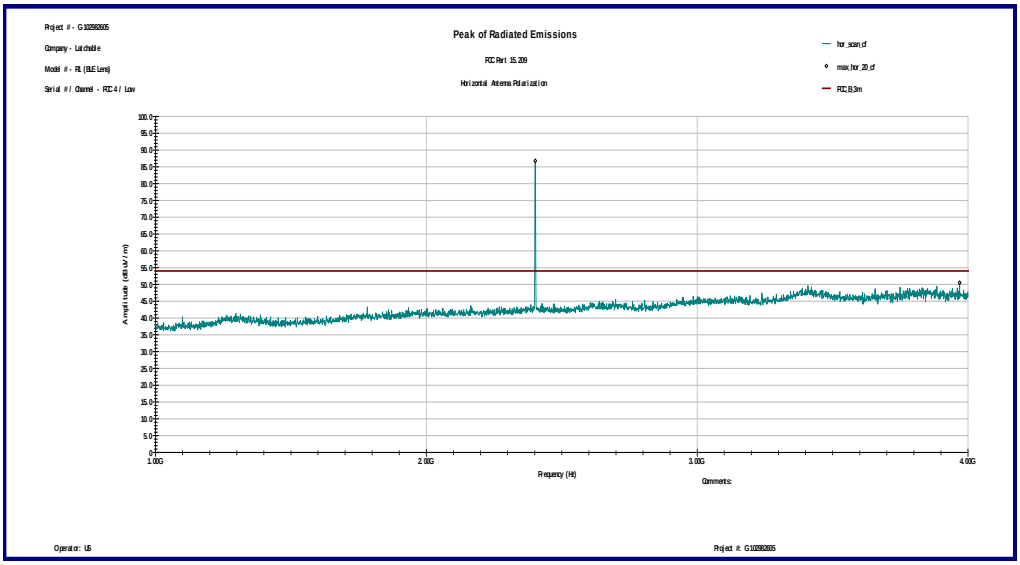

**Graph 3.2.2 (Peak)**



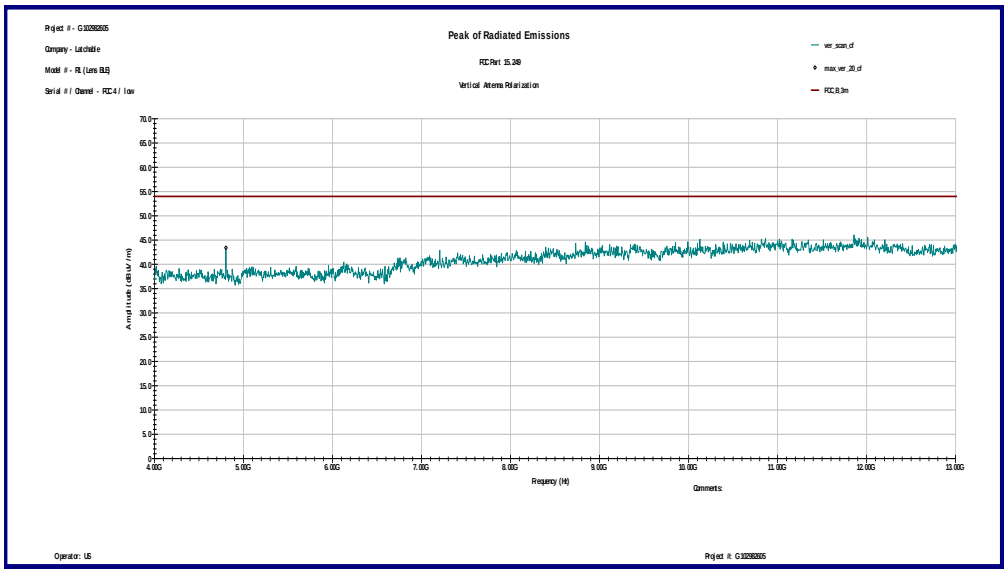
**Graph 3.2.3 (Peak)**



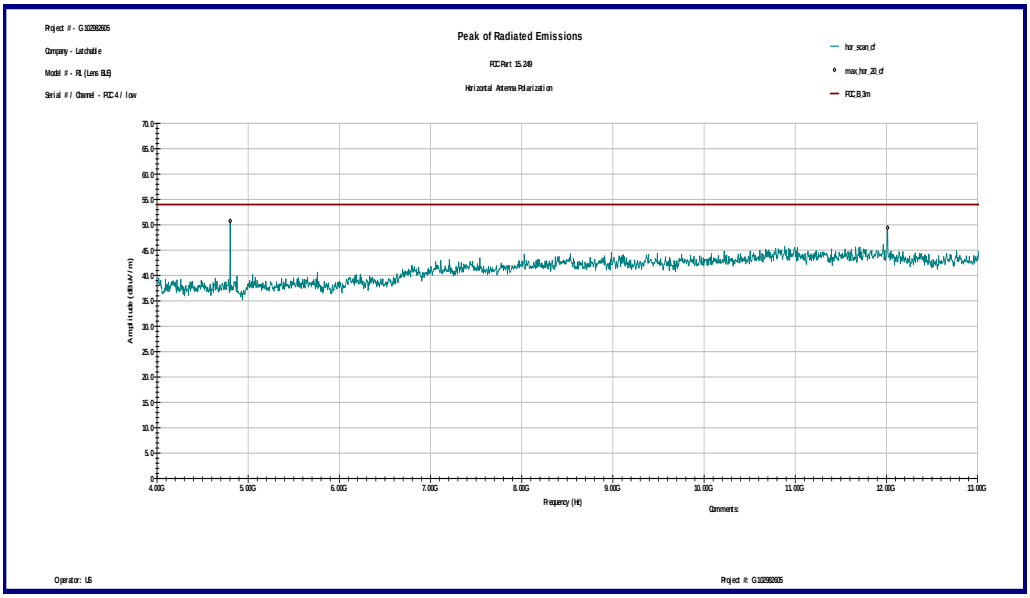

**Graph 3.2.4 (Peak)**



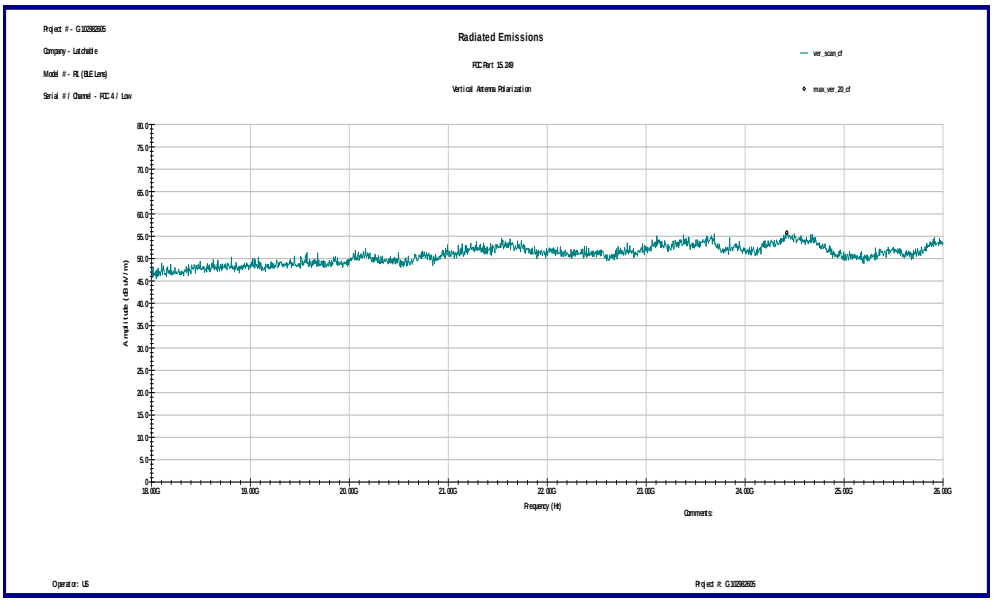
**Graph 3.2.5 (Peak)**



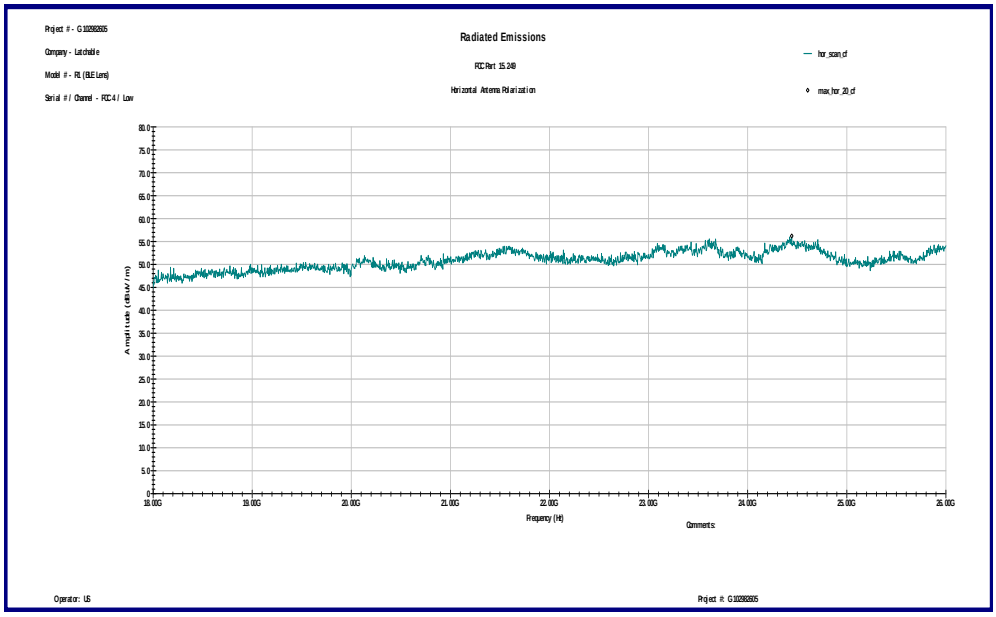

**Graph 3.2.6 (Peak)**



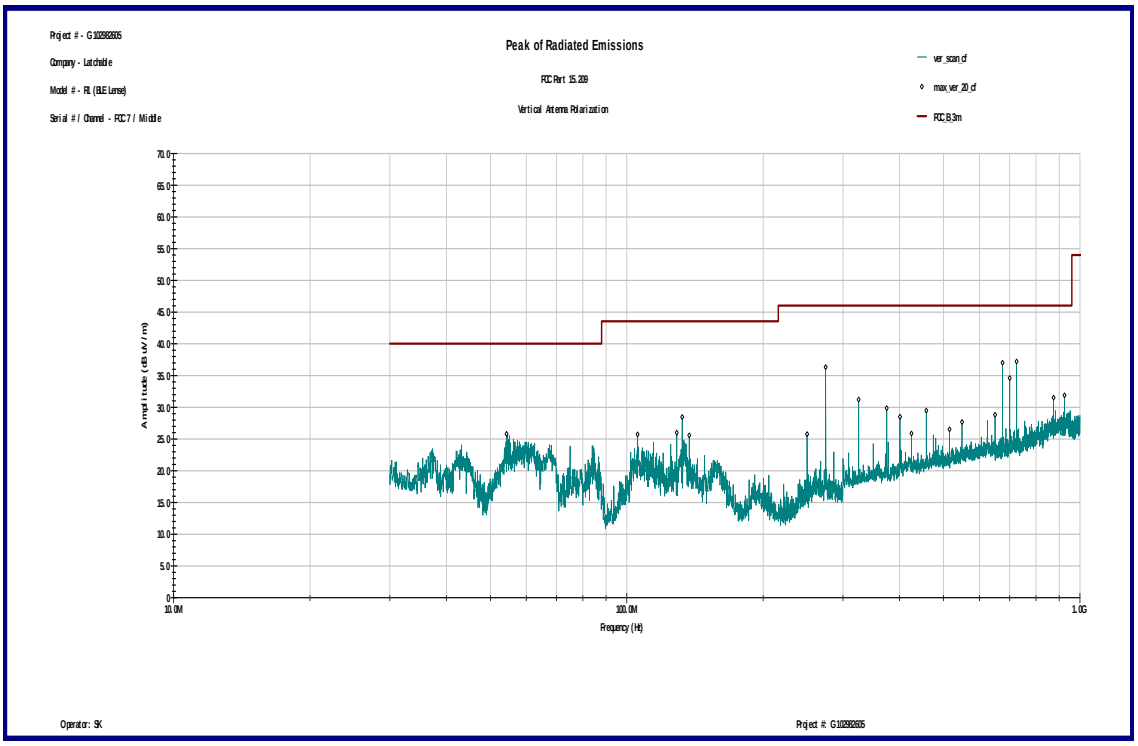
**Graph 3.2.7 (Peak)**



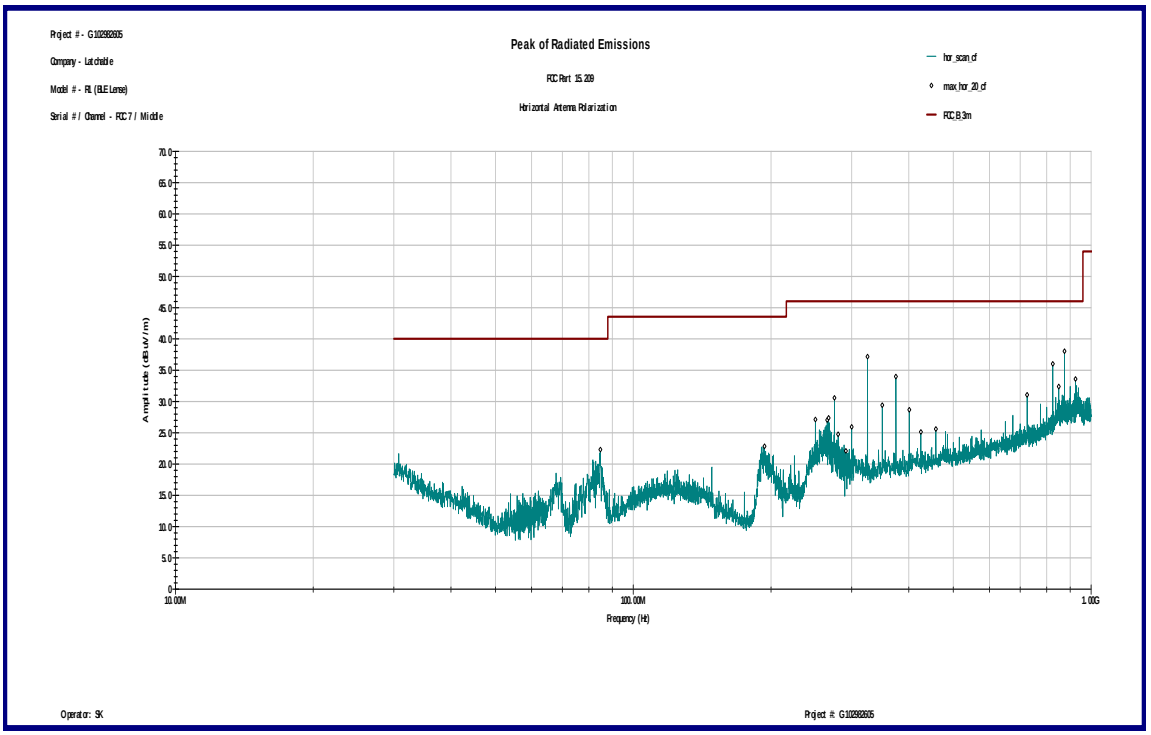

**Graph 3.2.8 (Peak)**



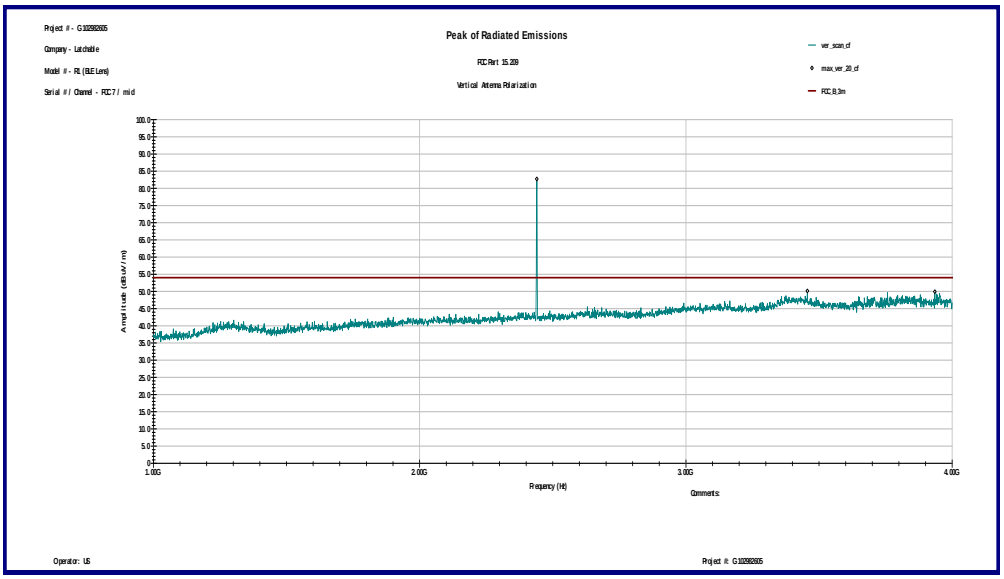
**Graph 3.2.9 (Peak)**



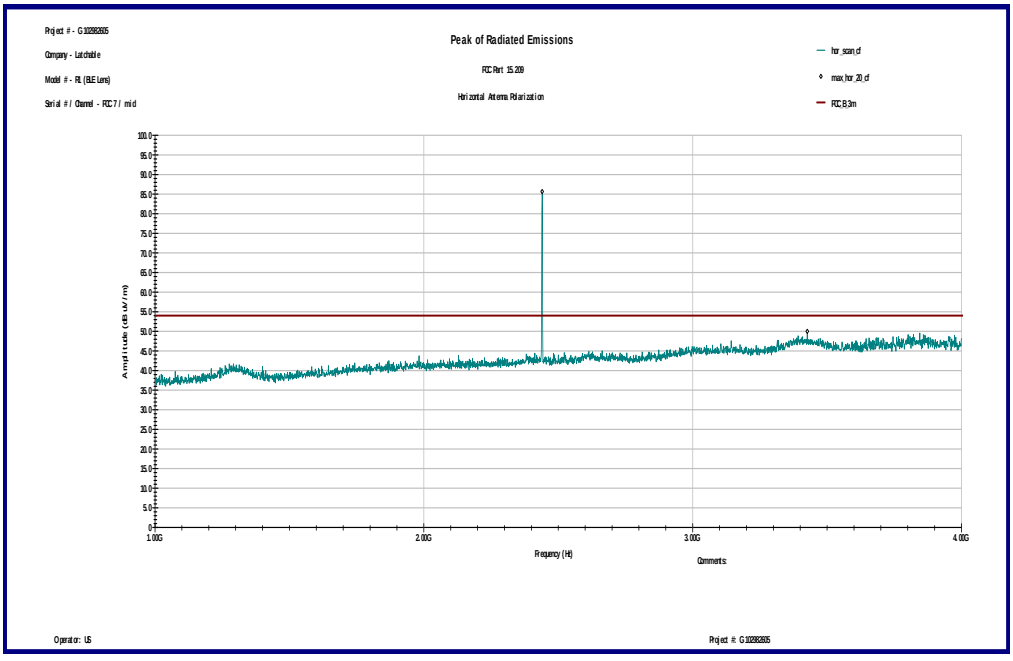

**Graph 3.2.10 (Peak)**



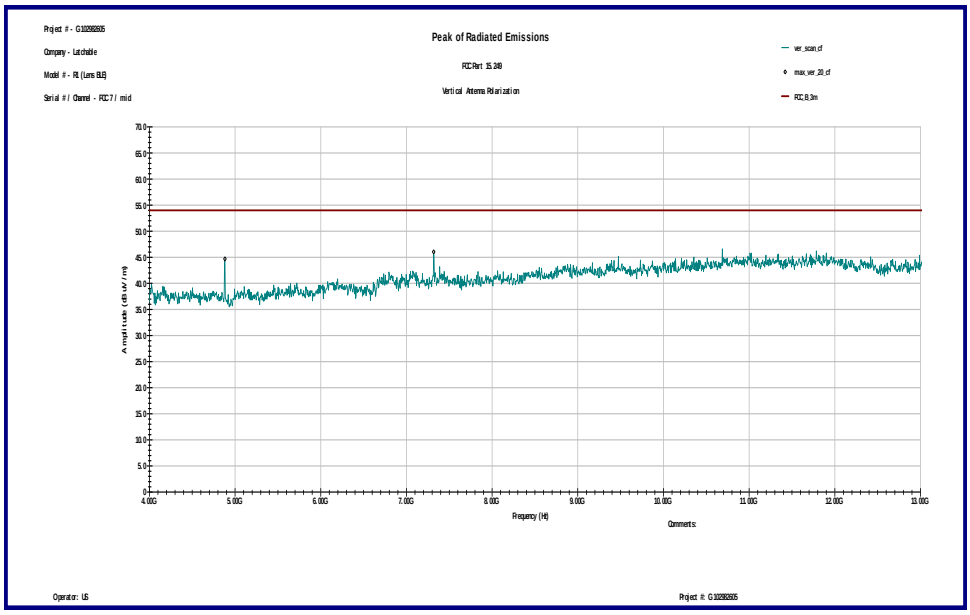
**Graph 3.2.11 (Peak)**



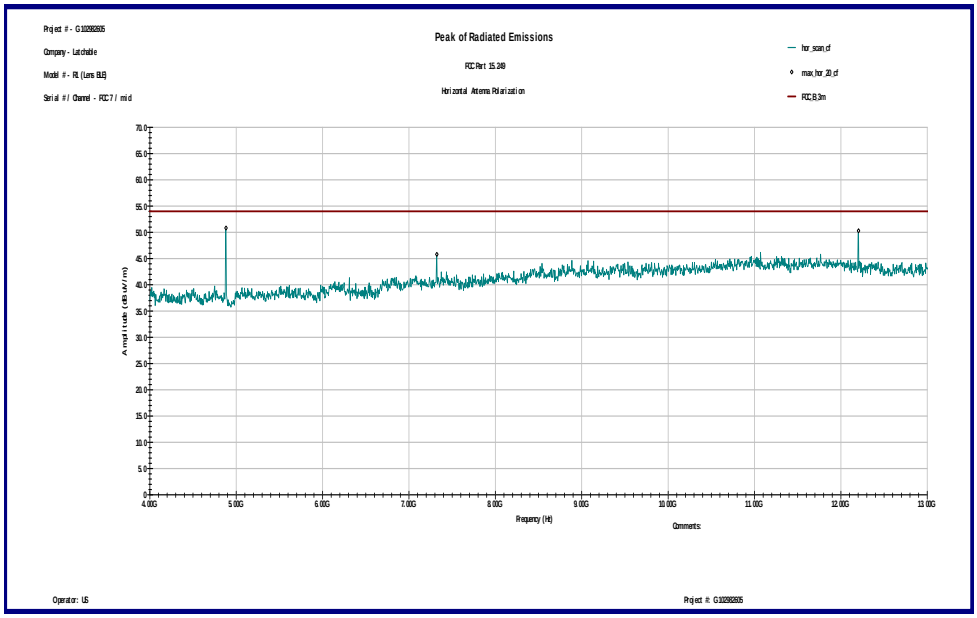

**Graph 3.2.12 (Peak)**



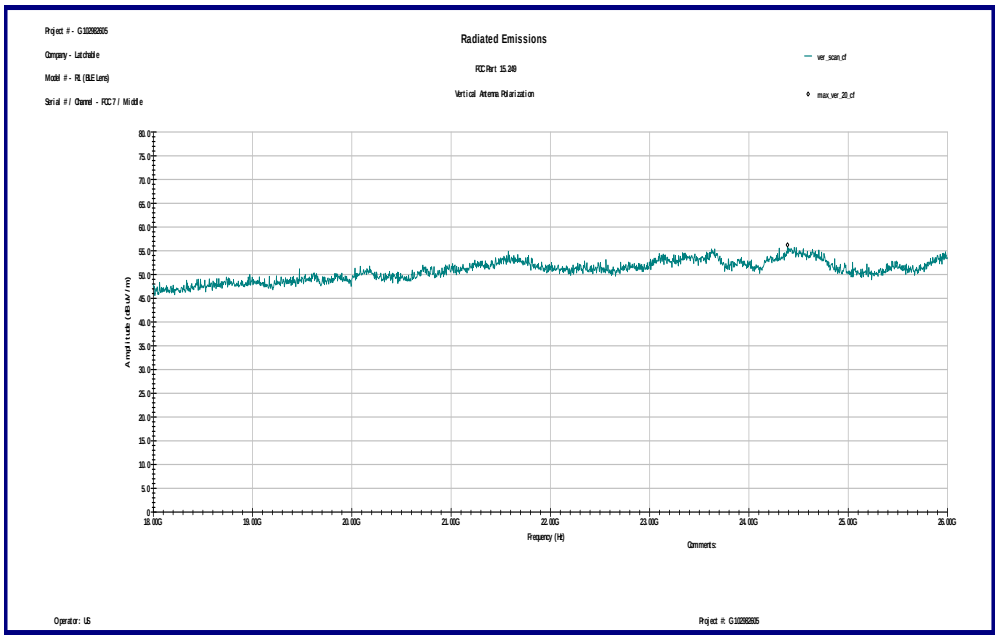
**Graph 3.2.13 (Peak)**



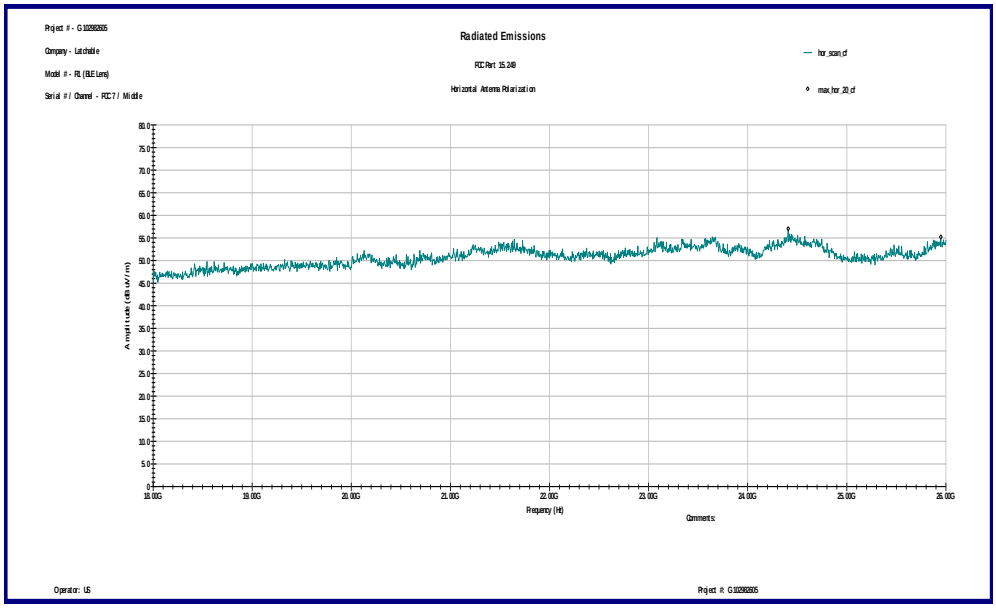

**Graph 3.2.14 (Peak)**



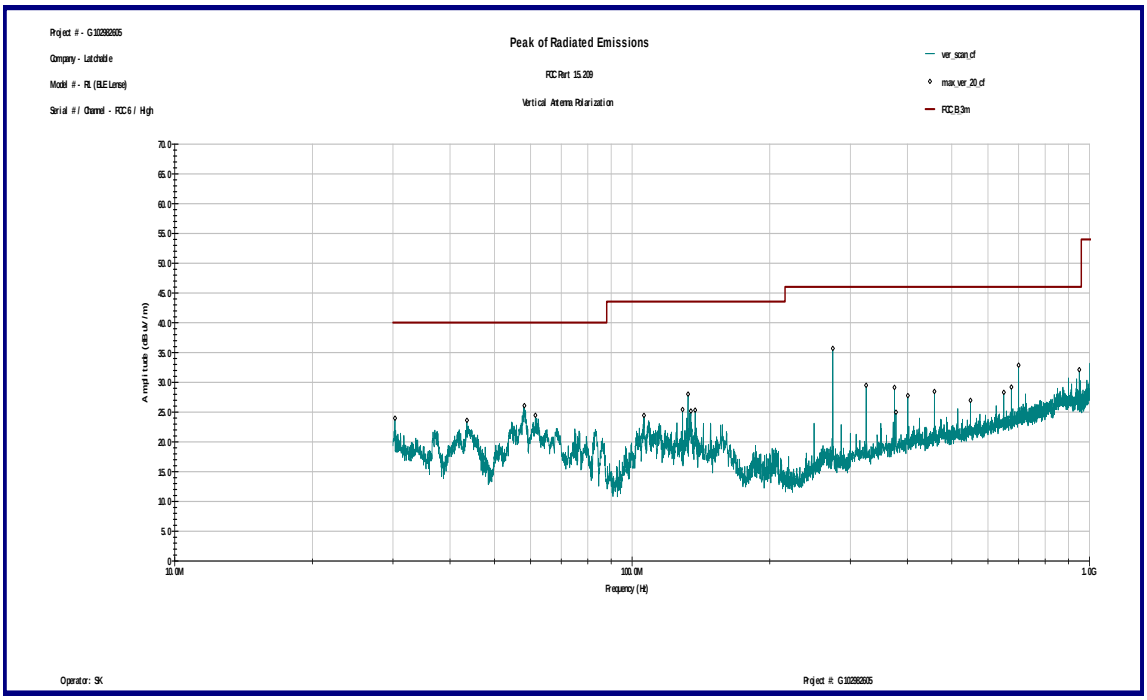
**Graph 3.2.15 (Peak)**



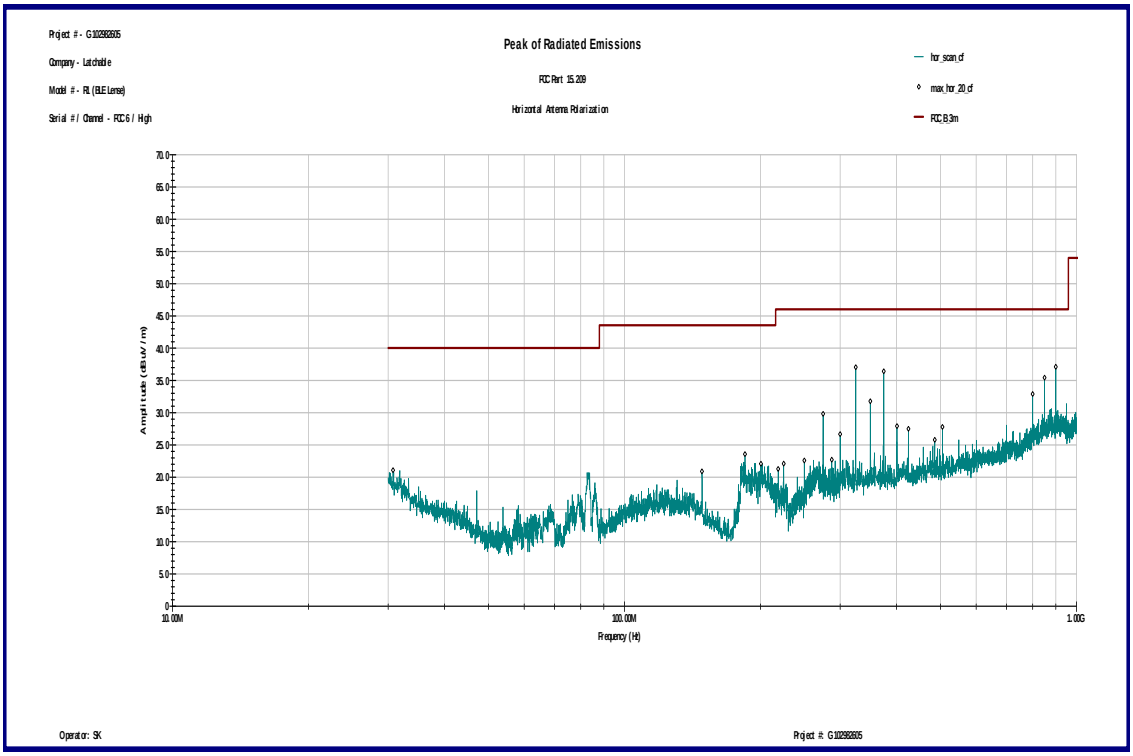

**Graph 3.2.16 (Peak)**



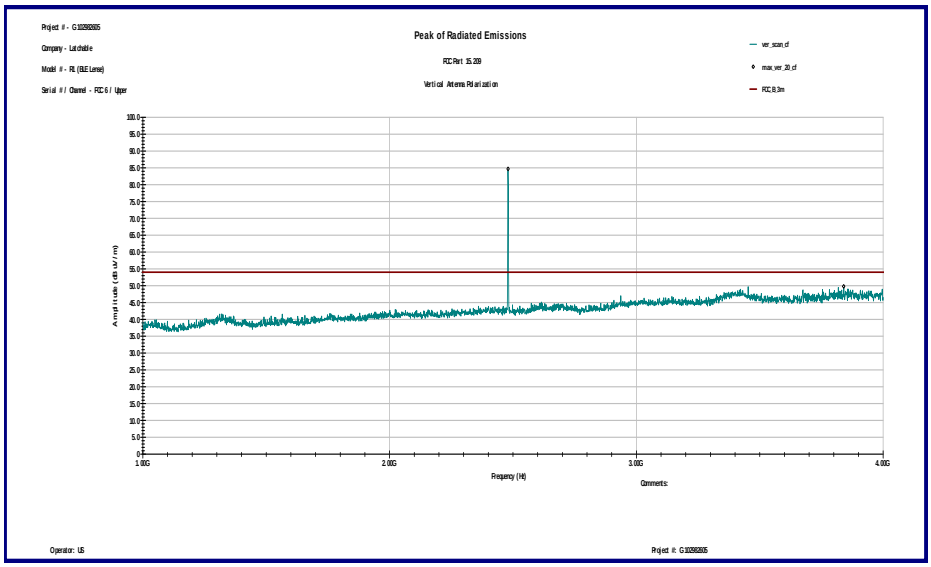
**Graph 3.2.17 (Peak)**



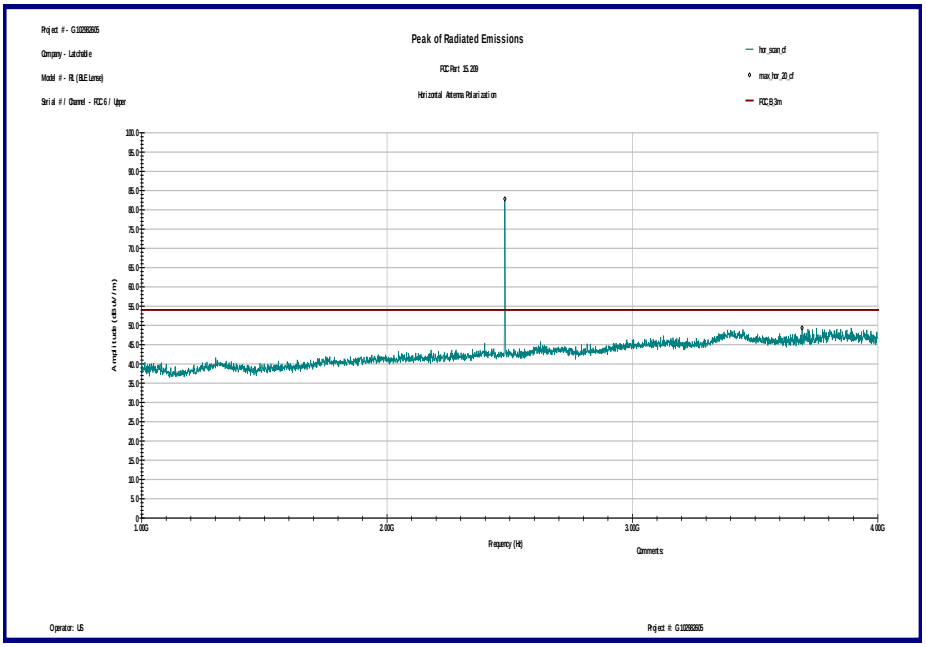

**Graph 3.2.18 (Peak)**



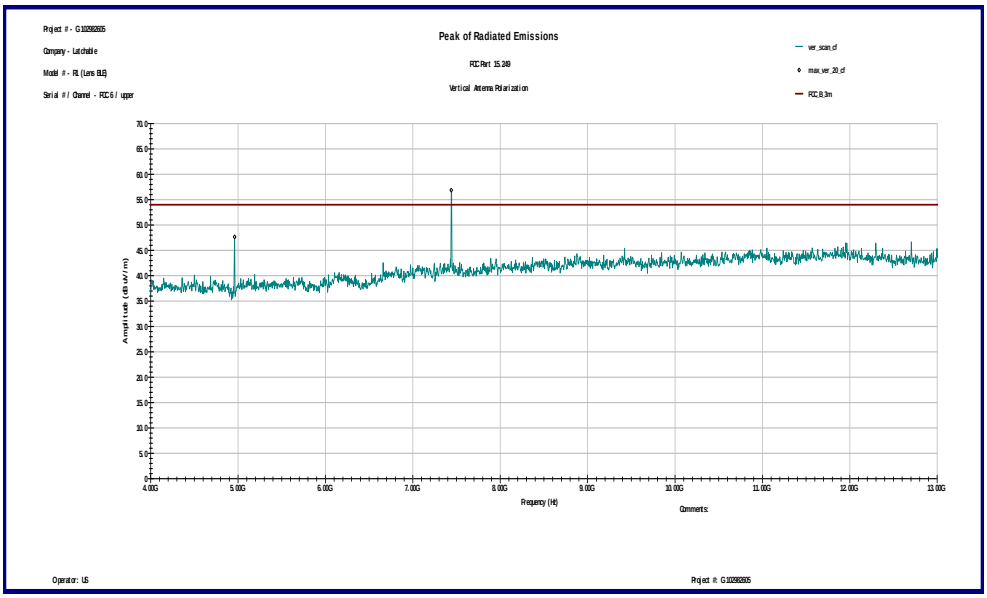
**Graph 3.2.19 (Peak)**



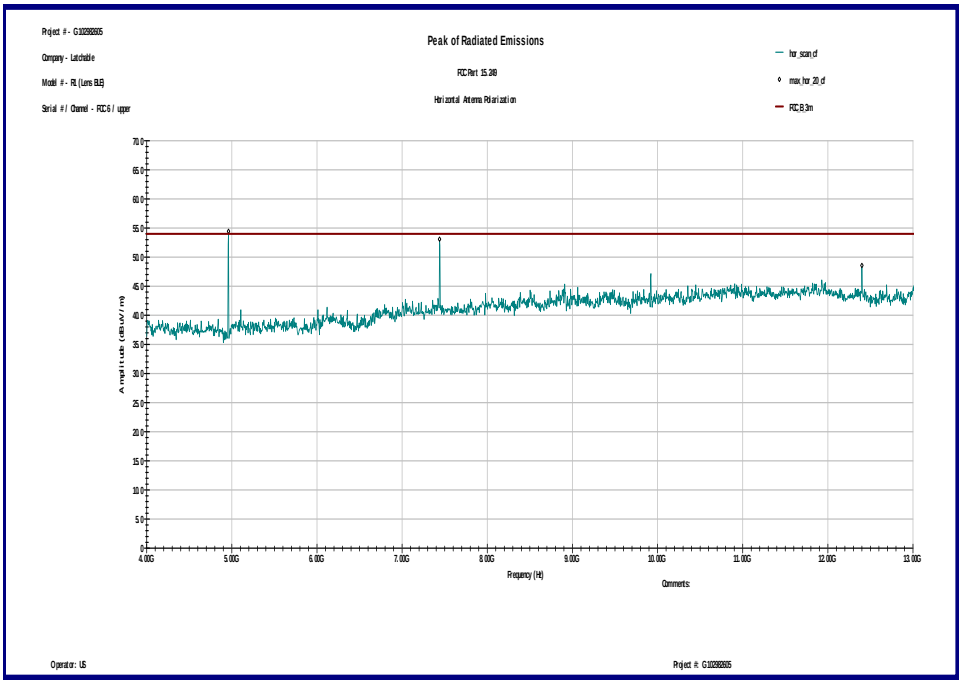

**Graph 3.2.20 (Peak)**



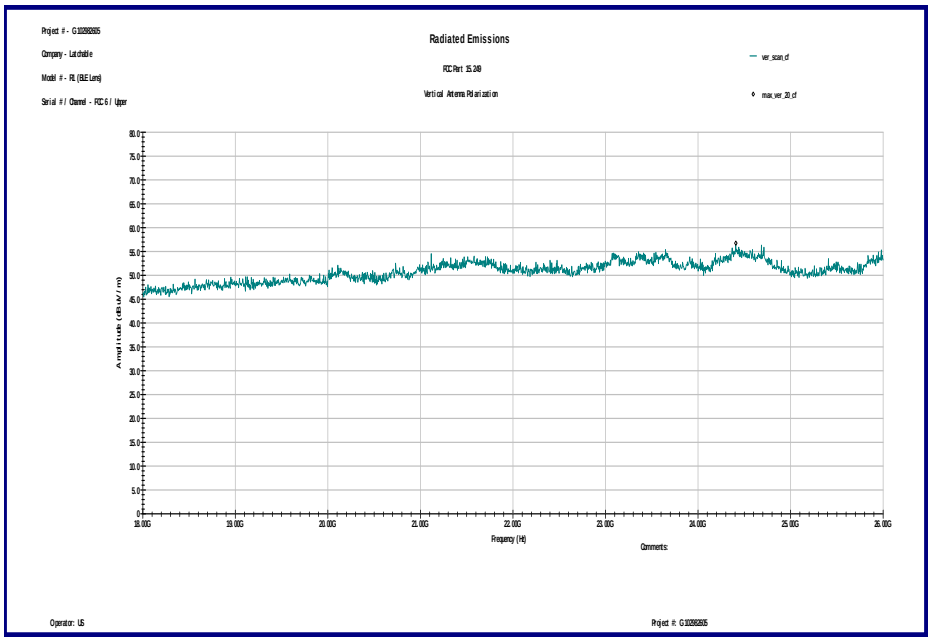
**Graph 3.2.21 (Peak)**



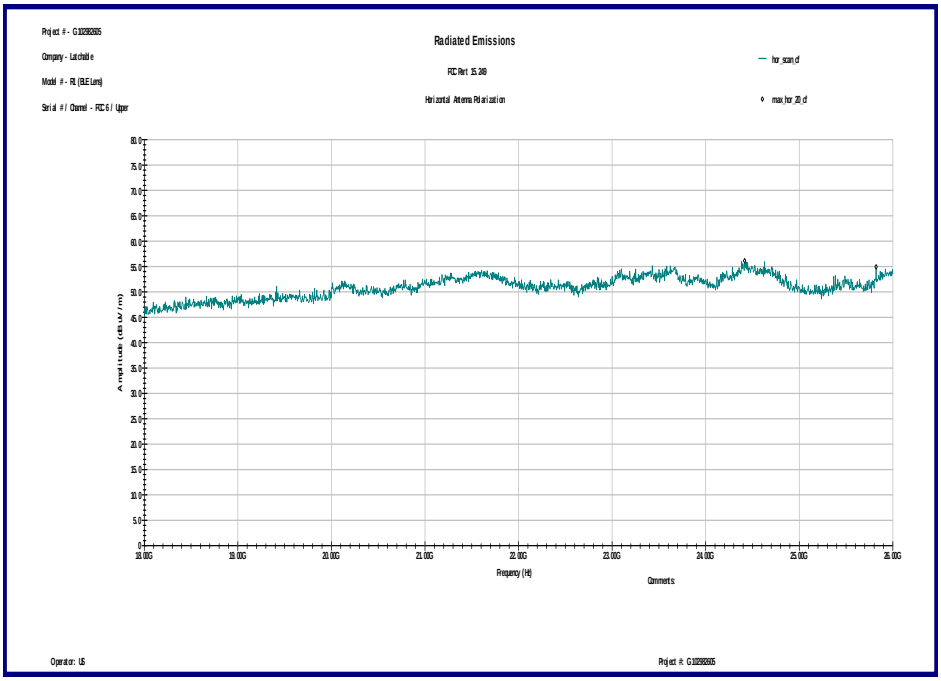

**Graph 3.2.22 (Peak)**



**Graph 3.2.23 (Peak)**




**Graph 3.2.24 (Peak)**



### 3.2.1 Average correction factor calculation

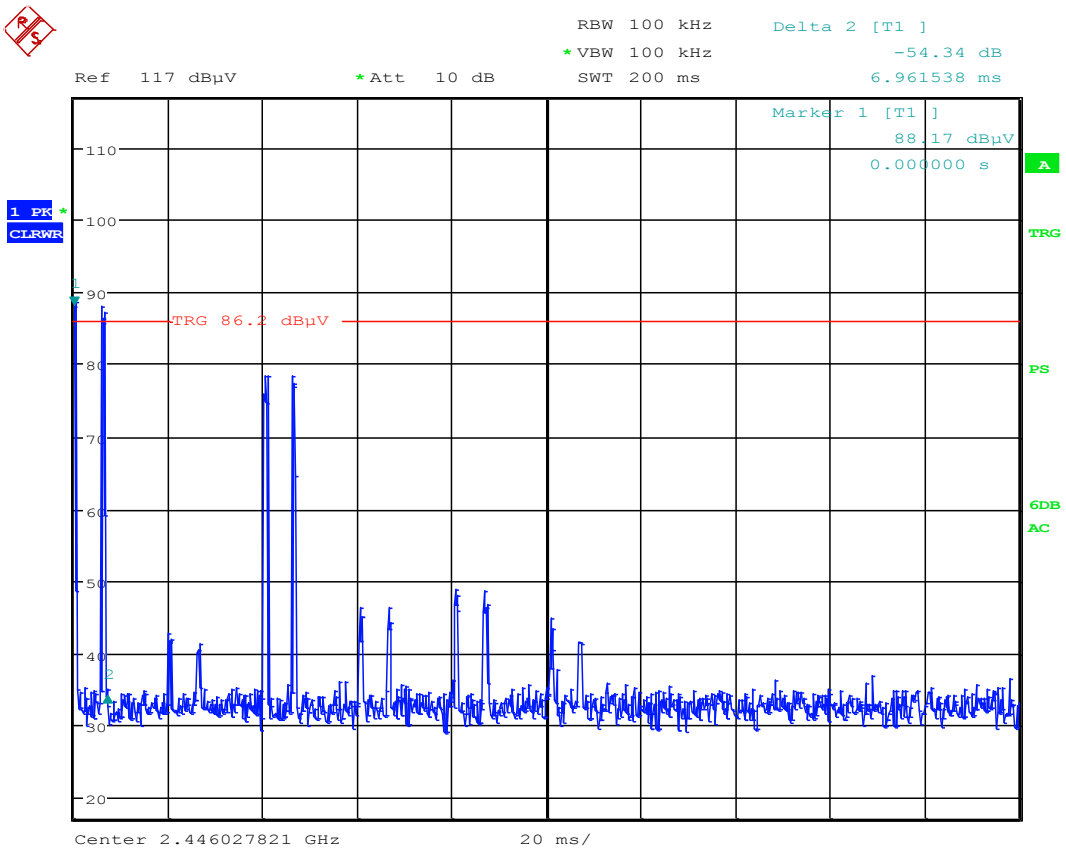
An Average correction factor is calculated by averaging one complete pulse train.

The pulse train exceeds 100ms for a single channel. Therefore the measured field strength was determined during a 100ms interval.

There are 2 pulses within 100ms.Time with field strength in its maximum value (length of pulses) is 0.897ms (see Graph 3.2.1.2) and 0.913ms (see Graph 3.2.1.3)

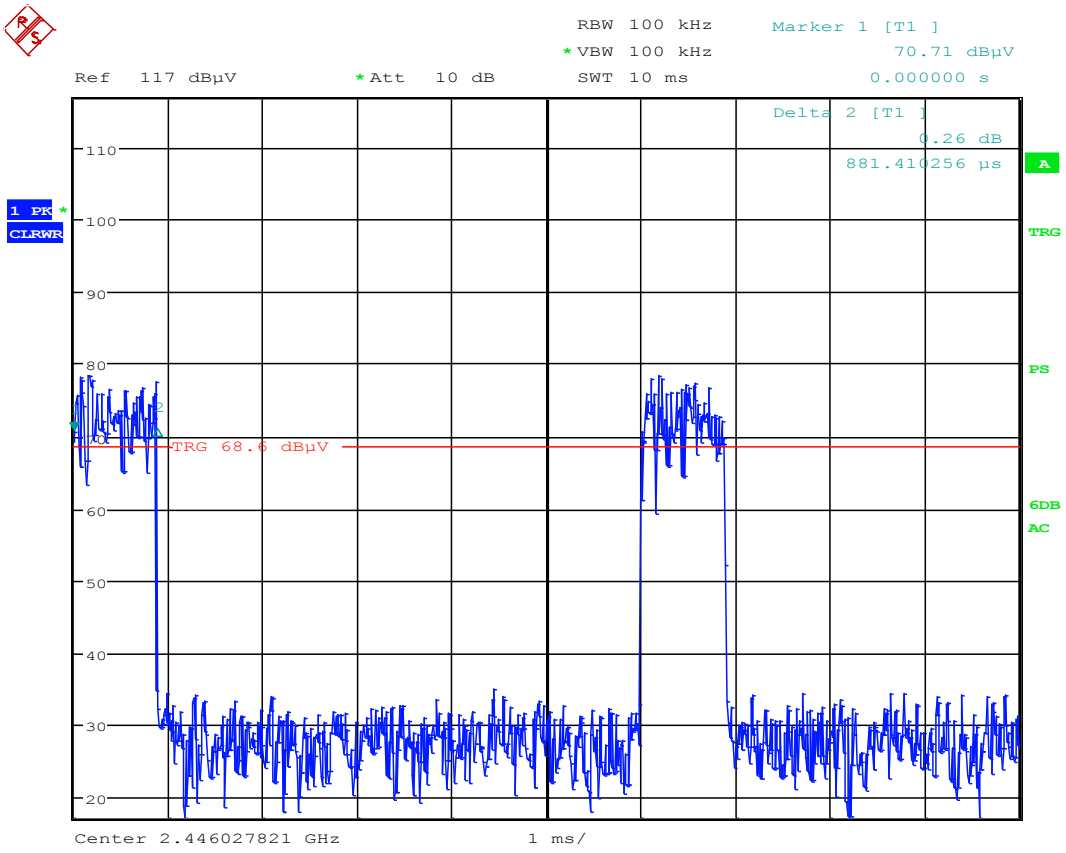
Average Correction Factor = 20Log(0.897ms+0.913ms/100ms) = -34dB

**Graph 3.2.1.1**



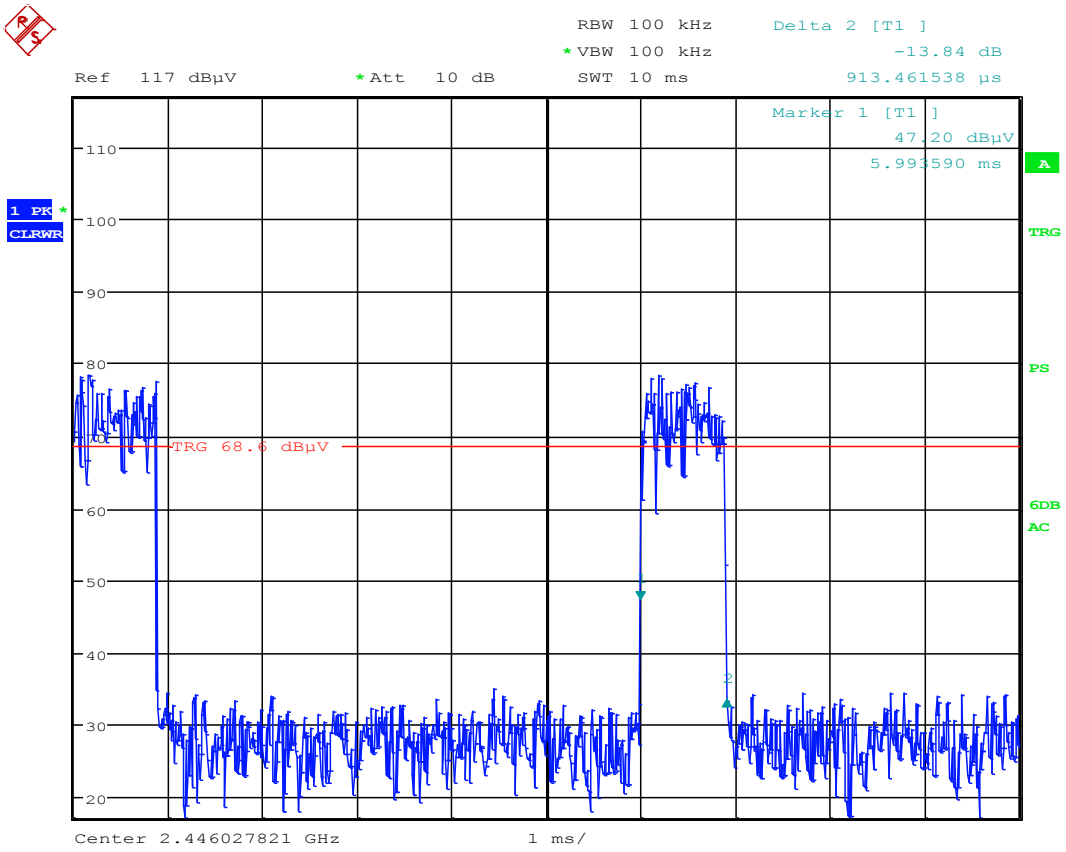

Date: 5.JUN.2017 14:04:02

**Graph 3.2.1.2**




Date: 5.JUN.2017 14:10:56

**Graph 3.2.1.3**




Date: 5.JUN.2017 14:12:04

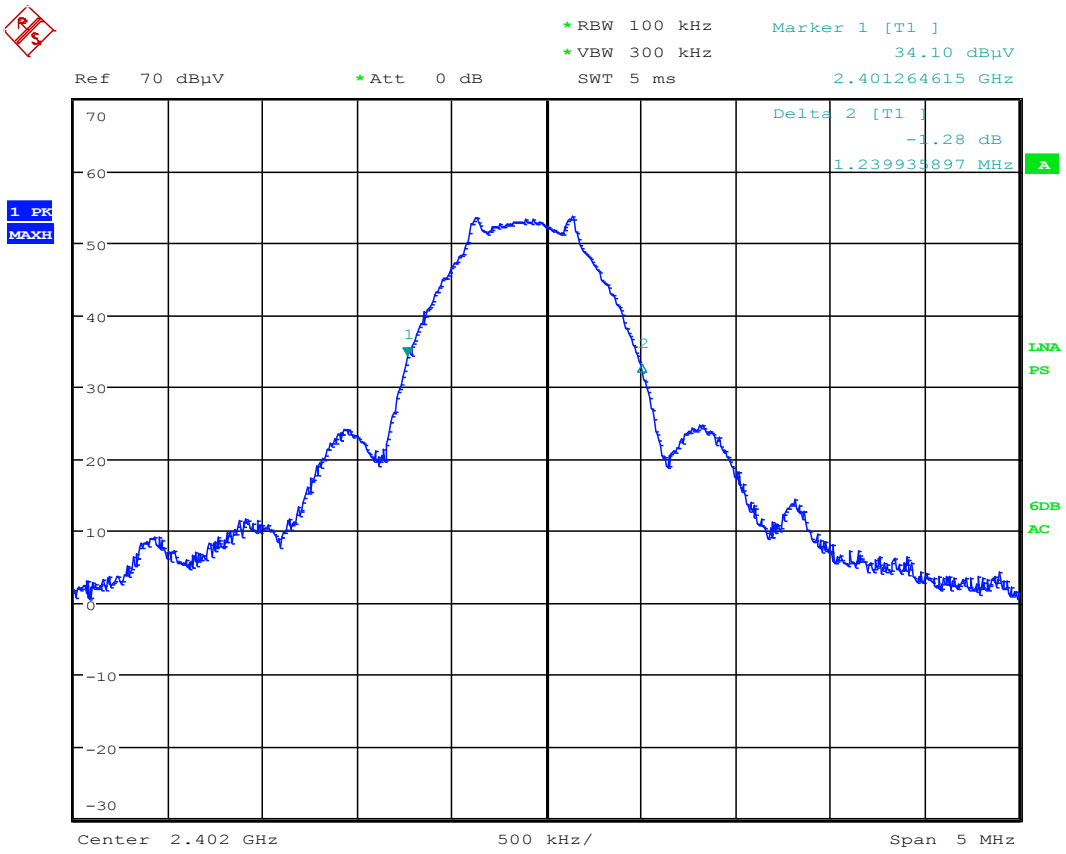
### 3.3 Bandwidth of Emissions

| Center Frequency of operation MHz | Measured 20dB bandwidth MHz | Measured 99% bandwidth MHz |
|---|---|---|
| 2402 | 1.24 | 1.05 |
| 2440 | 1.22 | 1.07 |
| 2480 | 1.24 | 1.07 |

Graphs 3-3-1 to 3-3-6 show bandwidth of emissions

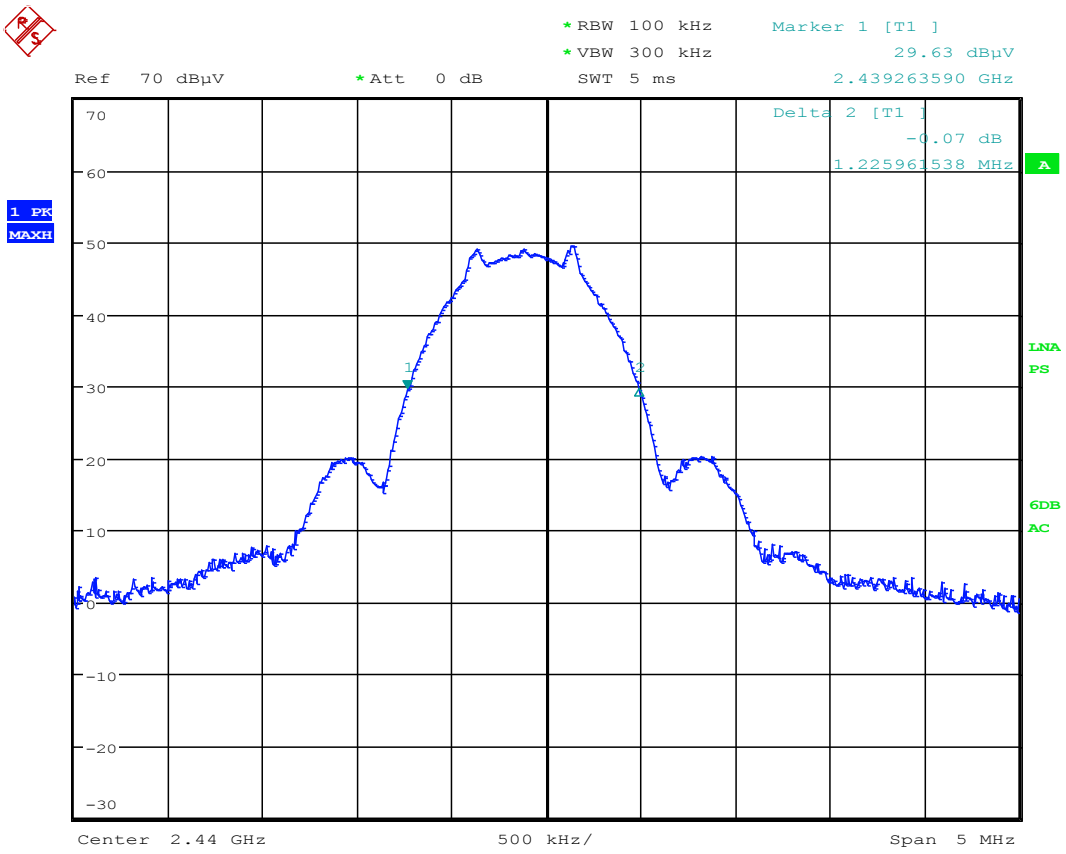
**Notes:** The bandwidth of emissions is contained within the frequency band of operation

**Graph 3.3.1**



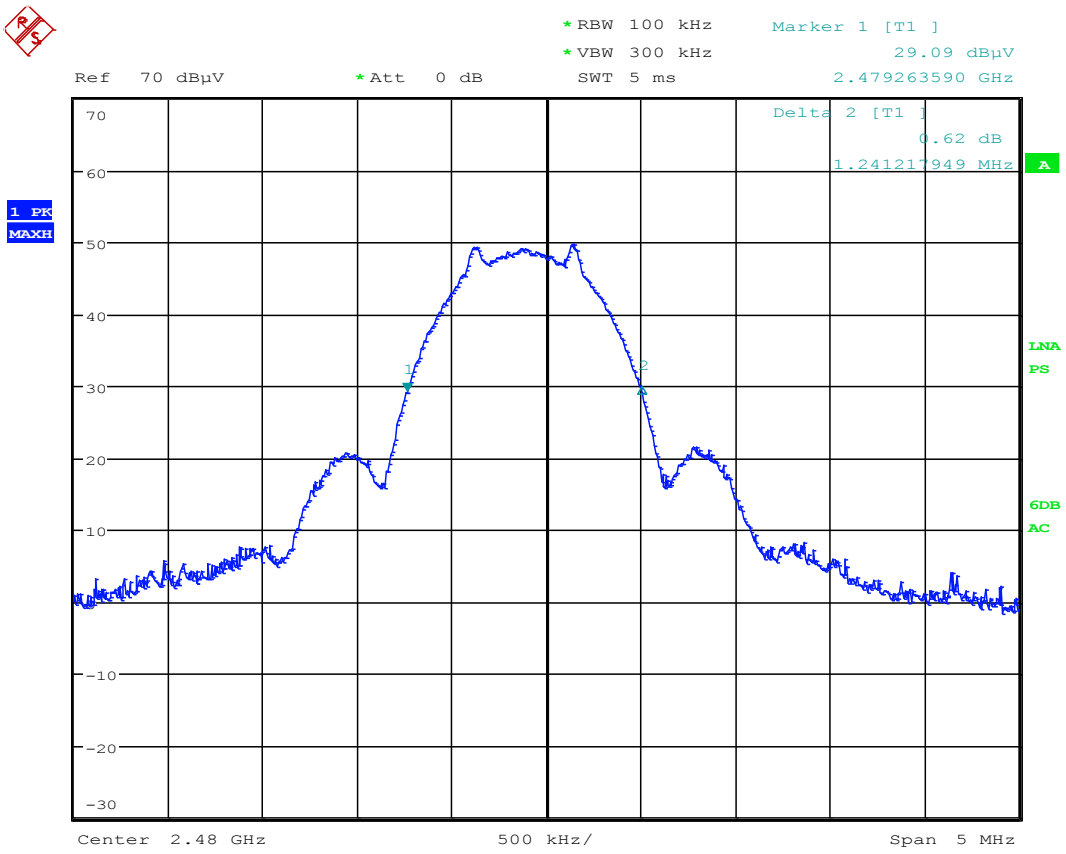

Date: 6.JUN.2017 12:10:36

**Graph 3.3.2**

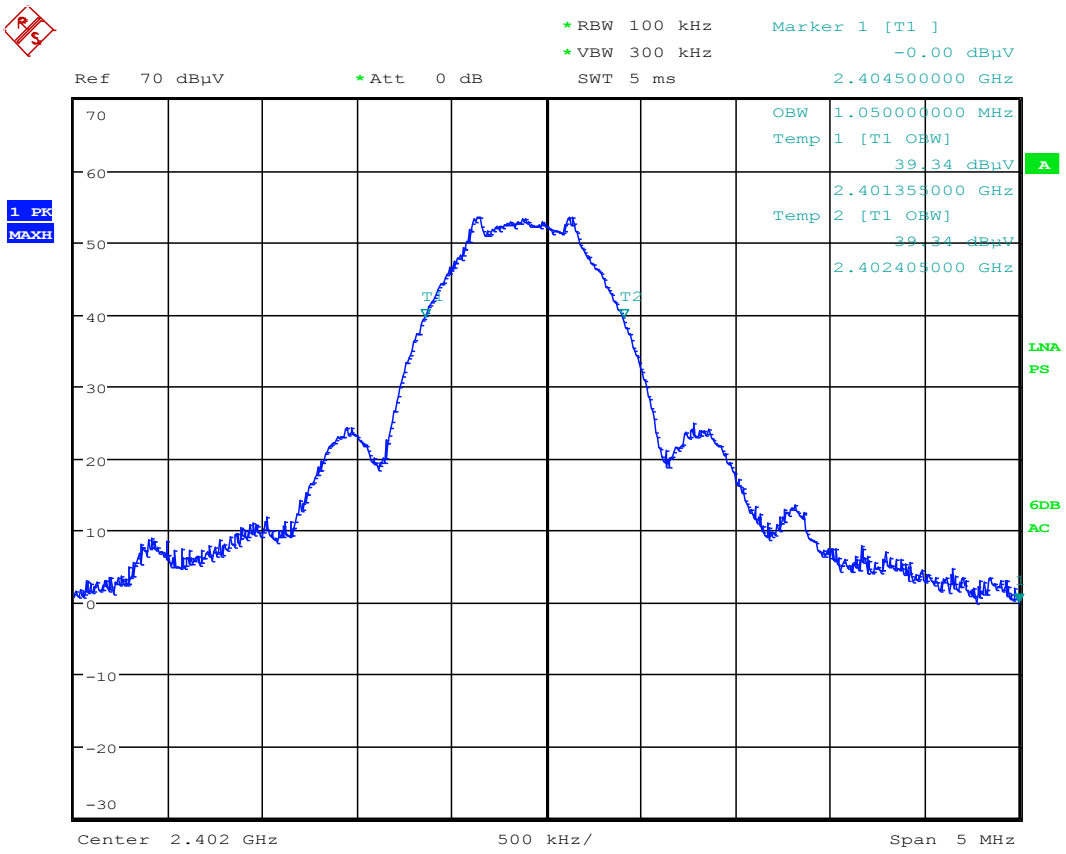



Date: 6.JUN.2017 12:05:00

**Graph 3.3.3**

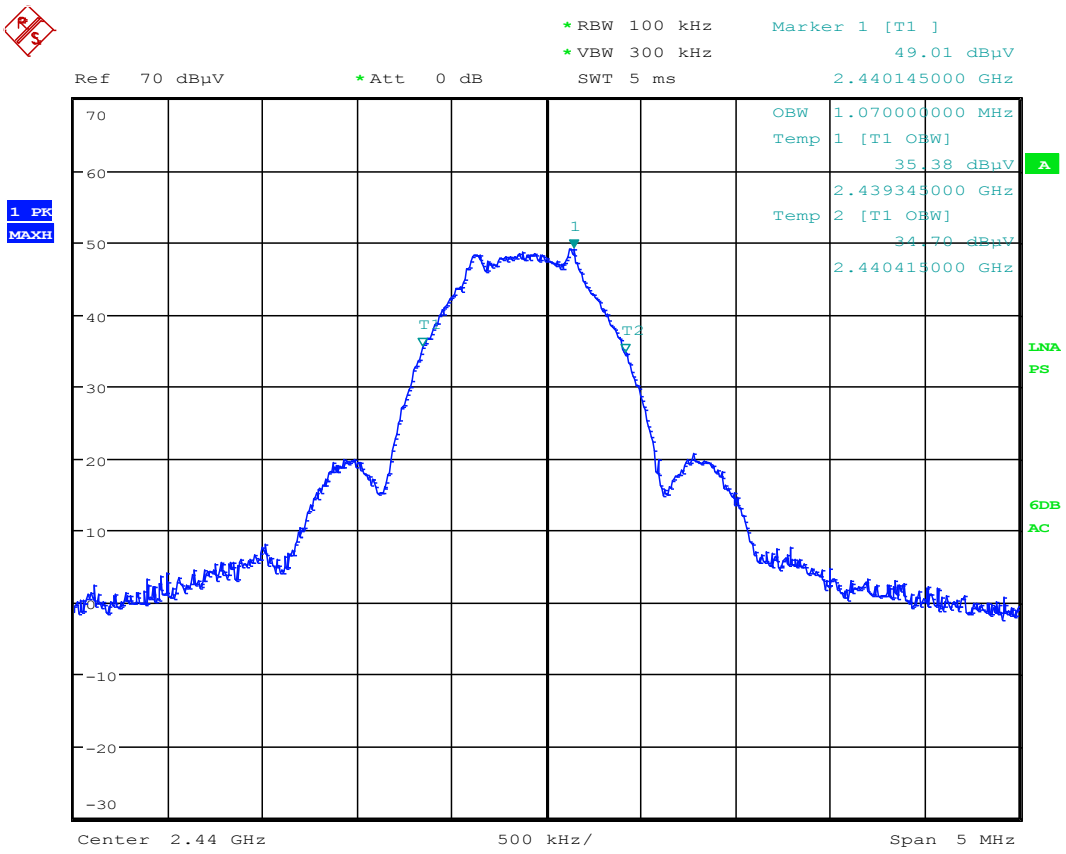

*RBW 100 kHz
*VBW 300 kHz
Ref 70 dBµV
*Att 0 dB
SWT 5 ms
Marker 1 [T1 ]
29.09 dBµV
2.479263590 GHz
Delta 2 [T1 ]
0.62 dB
1.241217949 MHz
1 PK
MAXH
A
LNA
PS
6DB
AC
70
60
50
40
30
20
10
-10
-20
-30
Center 2.48 GHz
500 kHz/
Span 5 MHz
Date: 6.JUN.2017 12:12:18

**Graph 3.3.4**



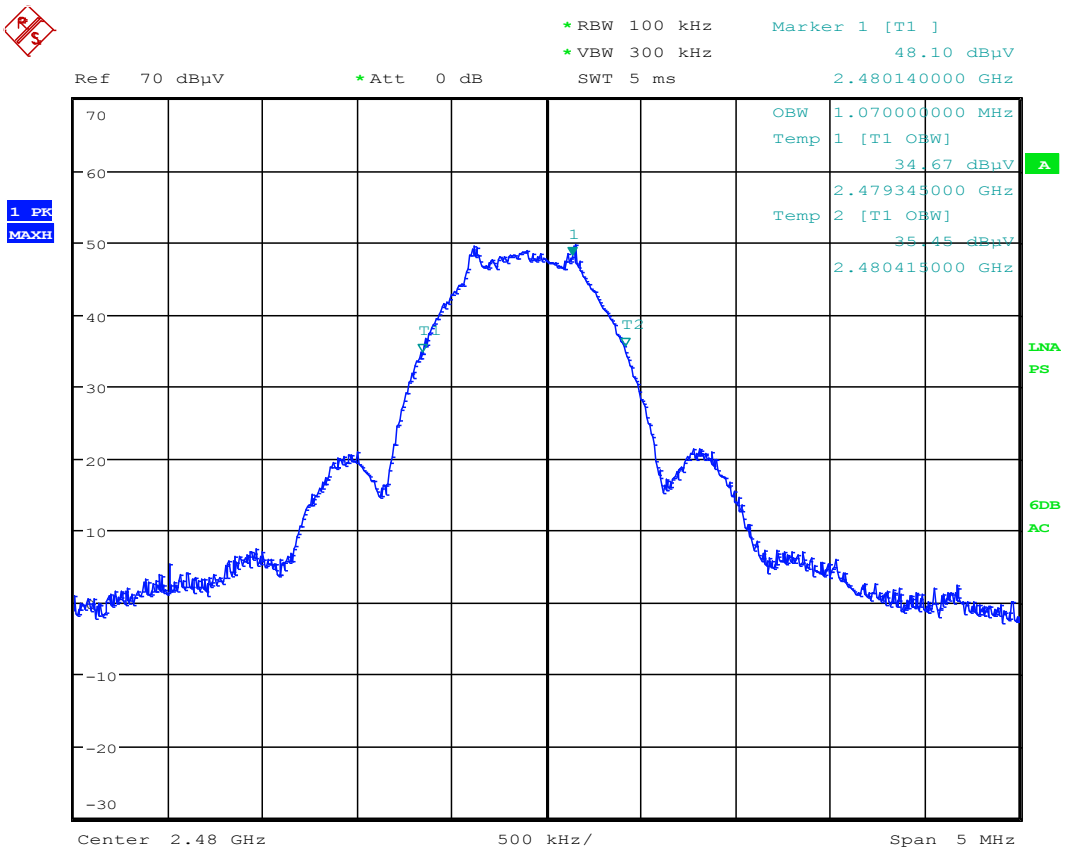

Date: 6.JUN.2017 12:09:28

**Graph 3.3.5**




Date: 6.JUN.2017 12:05:35

**Graph 3.3.6**




Date: 6.JUN.2017 12:12:44

### 3.4 Transmitter power line conducted emissions

**Test location:** ☐ OATS ☒ Anechoic Chamber ☐ Other

**Test result:** **Pass**

**Frequency range:** 0.15MHz-30MHz

**Max. Emissions margin:** 4.3dB below the limits

**Notes:** Test was performed at the AC adapter.

| | | |
|---|---|---|
| **Date:** | June 7, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector | |
| **Standard:** | FCC part 15.207 | |
| **Test Point:** | Power Line | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 24°C; 44%(RH); 98.7kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | None | |

**Table 3.4.1**

**Line 1**

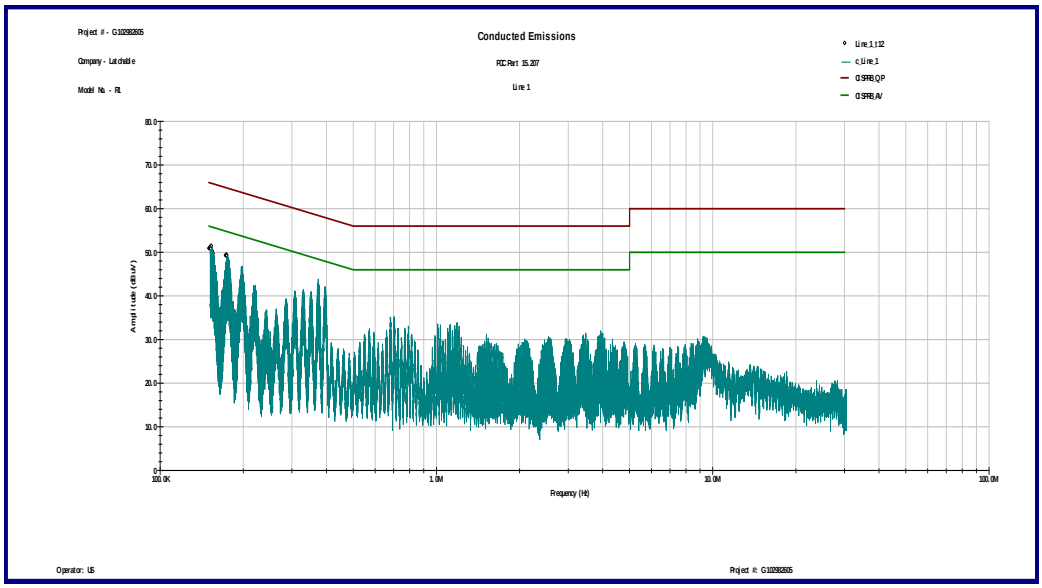
| Frequency | Peak dBµV | QP Limit dBµV | AVG Limit dBµV | QP Margin dB | AVG Margin dB |
|---|---|---|---|---|---|
| 151.75 KHz | 51.3 | 65.9 | 55.9 | -14.6 | -4.6 |
| 153.03 KHz | 51.5 | 65.8 | 55.8 | -14.3 | -4.3 |
| 172.41 KHz | 49.3 | 64.8 | 54.8 | -15.5 | -5.5 |
| 695.34 KHz | 35.3 | 56.0 | 46.0 | -20.7 | -10.7 |
| 1.172 MHz | 34.1 | 56.0 | 46.0 | -21.9 | -11.9 |
| 3.952 MHz | 31.9 | 56.0 | 46.0 | -24.1 | -14.1 |

**Line 2**

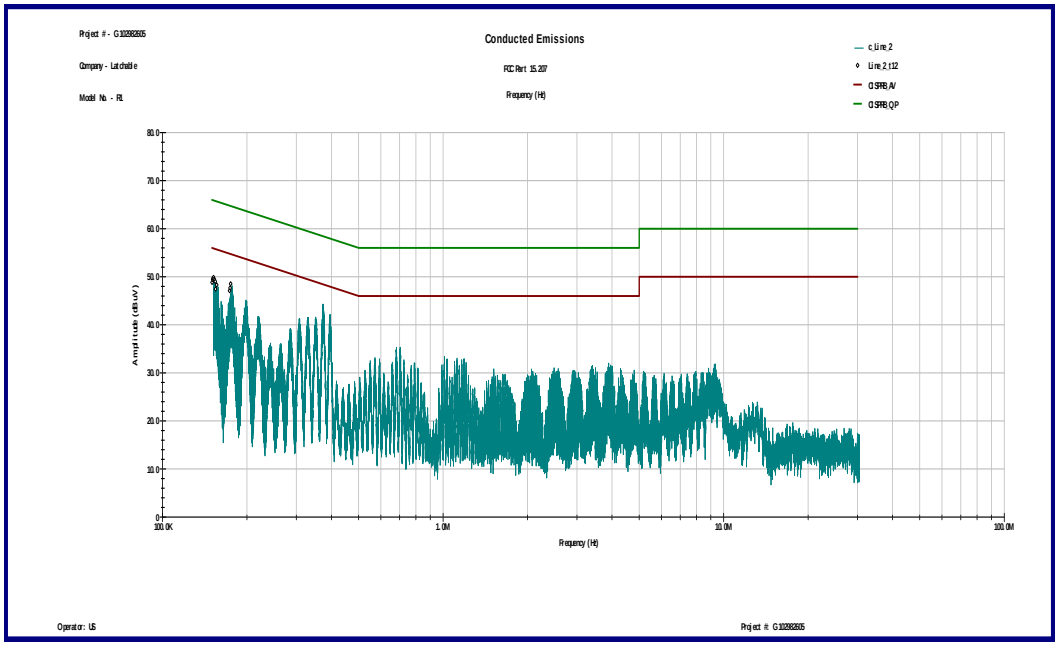
| Frequency | Peak dBµV | QP Limit dBmV | AVG Limit dBmV | QP Margin dB | AVG Margin dB |
|---|---|---|---|---|---|
| 152.02 KHz | 49.9 | 65.9 | 55.9 | -16.0 | -6.0 |
| 154.58 KHz | 47.4 | 65.8 | 55.8 | -18.3 | -8.3 |
| 174.9 KHz | 48.6 | 64.7 | 54.7 | -16.2 | -6.2 |
| 673.85 KHz | 35.1 | 56.0 | 46.0 | -20.9 | -10.9 |
| 1.151 MHz | 33.1 | 56.0 | 46.0 | -22.9 | -12.9 |
| 3.954 MHz | 31.7 | 56.0 | 46.0 | -24.3 | -14.3 |

**Graph 3.4.1**

**Line 1**




**Line 2**



### 3.5 Receiver/digital device radiated emissions

**Test location:** ☐ OATS ☒ Anechoic Chamber

**Test distance:** ☐ 10 meters ☒ 3 meters

**Test result:** **Pass**

**Frequency range:** 30MHz-13GHz

**Max. Emissions margin:** 9.7dB below the limits

**Notes:** The Radiated Emissions testing was performed in the Anechoic Chamber at 3m measurement distance (see Table 3.9.1, 3.9.2, 3.9.3 and Graphs 3.5.1 - 3.5.12)
Radiated Emissions from the RF Generator were excluded from the tables.

| | | |
|---|---|---|
| **Date:** | June 6, 2017 and June 19, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector / Simon Khazon | |
| **Standard:** | FCC Part 15.109, Class B | |
| **Test Point:** | Enclosure | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 24.4°C; 44%(RH); 98.4kPa<br>23.9°C; 42%(RH); 98.9kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | Channel 2402MHz | |

**Table 3.9.1**

| Frequency MHz | Antenna Polarity | Reading dBµV | Total C.F. dB1/m | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 148.5 MHz | V | 18.4 | 16.5 | 34.9 | 43.5 | -8.7 |
| 274.67 MHz | V | 18.5 | 18.8 | 37.3 | 46.0 | -8.8 |
| 649.91 MHz | V | 5.8 | 25.8 | 31.7 | 46.0 | -14.3 |
| 674.97 MHz | V | 5.4 | 26.1 | 31.5 | 46.0 | -14.5 |
| 700.04 MHz | V | 14.8 | 25.9 | 40.7 | 46.0 | -5.3 |
| 705.12 MHz | V | 8.4 | 26.1 | 34.4 | 46.0 | -11.6 |
| 732.26 MHz | V | 6.8 | 26.7 | 33.5 | 46.0 | -12.5 |
| | | | | | | |
| 257.61 MHz | H | 12.9 | 19.1 | 31.9 | 46.0 | -14.1 |
| 275.01 MHz | H | 13.8 | 18.8 | 32.6 | 46.0 | -13.5 |
| 300.0 MHz | H | 12.6 | 19.3 | 31.9 | 46.0 | -14.1 |
| 325.01 MHz | H | 14.3 | 20.1 | 34.4 | 46.0 | -11.6 |
| 350.03 MHz | H | 12.4 | 20.7 | 33.1 | 46.0 | -12.9 |
| 849.97 MHz | H | 9.6 | 27.8 | 37.4 | 46.0 | -8.7 |
| 900.03 MHz | H | 6.5 | 28.6 | 35.0 | 46.0 | -11.0 |
| 911.6 MHz | H | 4.5 | 28.9 | 33.4 | 46.0 | -12.6 |
| 942.17 MHz | H | 3.3 | 28.9 | 32.2 | 46.0 | -13.9 |
| 950.1 MHz | H | 5.9 | 28.7 | 34.6 | 46.0 | -11.5 |
| | | | | | | |

All measurements were taken using a Peak detector

| Frequency MHz | Antenna Polarity | Peak Reading dBµV | Total C.F. dB1/m | Pre-Amp. Gain (dB) | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 1.412 GHz | V | 52.3 | 27.4 | 41.7 | 38.0 | 54.0 | -16.0 |
| 1.048 GHz | H | 55.2 | 26.0 | 41.9 | 39.3 | 54.0 | -14.7 |
| 1.376 GHz | H | 52.5 | 27.4 | 41.8 | 38.1 | 54.0 | -15.9 |
| | | | | | | | |

| | | |
|---|---|---|
| **Date:** | June 6, 2017 and June 19, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector / Simon Khazon | |
| **Standard:** | FCC Part 15.109, Class B | |
| **Test Point:** | Enclosure | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 24.4°C; 44%(RH); 98.4kPa<br>23.9°C; 42%(RH); 98.9kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | Channel 2440MHz | |

**Table 3.9.2**

| Frequency MHz | Antenna Polarity | Reading dBµV | Total C.F. dB1/m | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 58.301 MHz | V | 15.4 | 11.4 | 26.8 | 40.0 | -13.2 |
| 148.46 MHz | V | 15.3 | 16.5 | 31.7 | 43.5 | -11.8 |
| 274.67 MHz | V | 16.7 | 18.8 | 35.5 | 46.0 | -10.5 |
| 700.04 MHz | V | 10.3 | 25.9 | 36.3 | 46.0 | -9.7 |
| 705.12 MHz | V | 5.5 | 26.1 | 31.6 | 46.0 | -14.4 |
| 732.26 MHz | V | 7.5 | 26.7 | 34.2 | 46.0 | -11.9 |
| | | | | | | |
| 325.01 MHz | H | 14.7 | 20.1 | 34.8 | 46.0 | -11.2 |
| 800.1 MHz | H | 4.2 | 27.0 | 31.2 | 46.0 | -14.8 |
| 849.97 MHz | H | 10.2 | 27.8 | 38.0 | 46.0 | -8.1 |
| 866.33 MHz | H | 7.8 | 28.1 | 35.9 | 46.0 | -10.1 |
| 900.03 MHz | H | 7.2 | 28.6 | 35.8 | 46.0 | -10.3 |
| 950.1 MHz | H | 7.5 | 28.7 | 36.2 | 46.0 | -9.9 |
| | | | | | | |

All measurements were taken using a Peak detector

| Frequency MHz | Antenna Polarity | Peak Reading dBµV | Total C.F. dB1/m | Pre-Amp. Gain (dB) | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 1.408 GHz | V | 53.5 | 27.4 | 41.7 | 39.2 | 54.0 | -14.8 |
| 1.86 GHz | V | 52.0 | 29.4 | 41.1 | 40.3 | 54.0 | -13.7 |
| 1.028 GHz | H | 55.3 | 26.0 | 42.0 | 39.3 | 54.0 | -14.7 |
| 1.392 GHz | H | 51.6 | 27.4 | 41.7 | 37.3 | 54.0 | -16.7 |
| | | | | | | | |

| | | |
|---|---|---|
| **Date:** | June 6, 2017 and June 19, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector / Simon Khazon | |
| **Standard:** | FCC Part 15.109, Class B | |
| **Test Point:** | Enclosure | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 24.4°C; 44%(RH); 98.4kPa<br>23.9°C; 42%(RH); 98.9kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | Channel 2480MHz | |

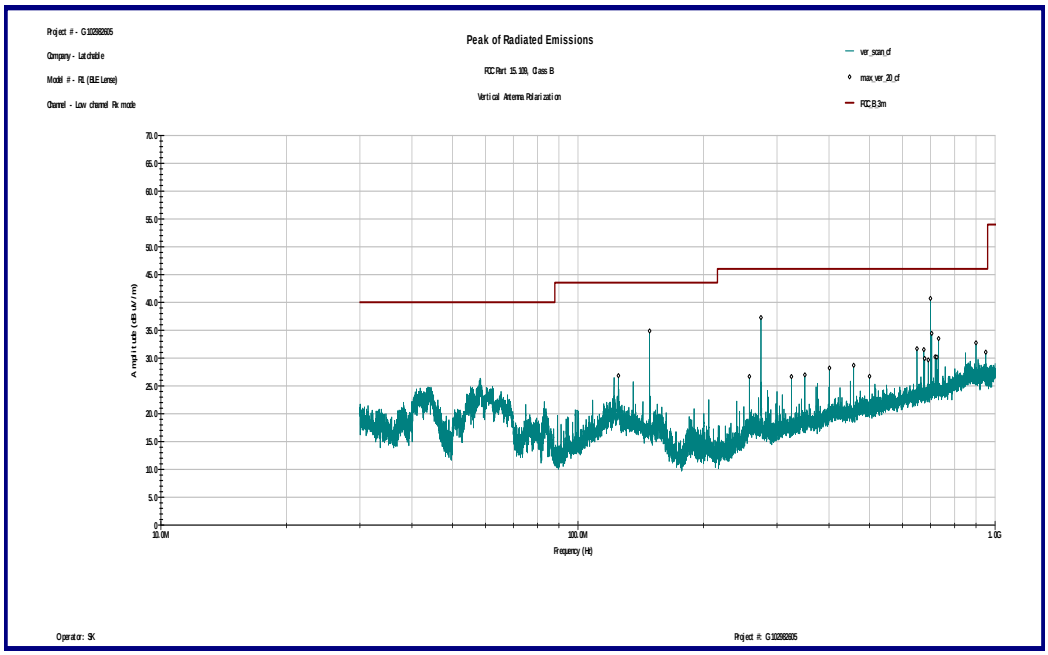
**Table 3.9.3**

| Frequency MHz | Antenna Polarity | Reading dBµV | Total C.F. dB1/m | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|
| 148.46 MHz | V | 17.3 | 16.5 | 33.8 | 43.5 | -9.7 |
| 274.67 MHz | V | 16.9 | 18.8 | 35.7 | 46.0 | -10.3 |
| 700.04 MHz | V | 9.3 | 25.9 | 35.2 | 46.0 | -10.8 |
| 705.12 MHz | V | 4.7 | 26.1 | 30.7 | 46.0 | -15.3 |
| 759.39 MHz | V | 3.5 | 26.6 | 30.0 | 46.0 | -16.0 |
| 900.03 MHz | V | 2.5 | 28.6 | 31.1 | 46.0 | -15.0 |
| | | | | | | |
| 275.01 MHz | H | 14.4 | 18.8 | 33.2 | 46.0 | -12.9 |
| 325.01 MHz | H | 14.0 | 20.1 | 34.2 | 46.0 | -11.9 |
| 350.03 MHz | H | 12.7 | 20.7 | 33.4 | 46.0 | -12.6 |
| 846.99 MHz | H | 6.6 | 27.8 | 34.4 | 46.0 | -11.6 |
| 849.97 MHz | H | 8.1 | 27.8 | 35.9 | 46.0 | -10.1 |
| 878.39 MHz | H | 5.0 | 28.2 | 33.2 | 46.0 | -12.8 |
| 900.03 MHz | H | 6.2 | 28.6 | 34.8 | 46.0 | -11.2 |
| 950.1 MHz | H | 6.2 | 28.7 | 34.9 | 46.0 | -11.2 |
| | | | | | | |

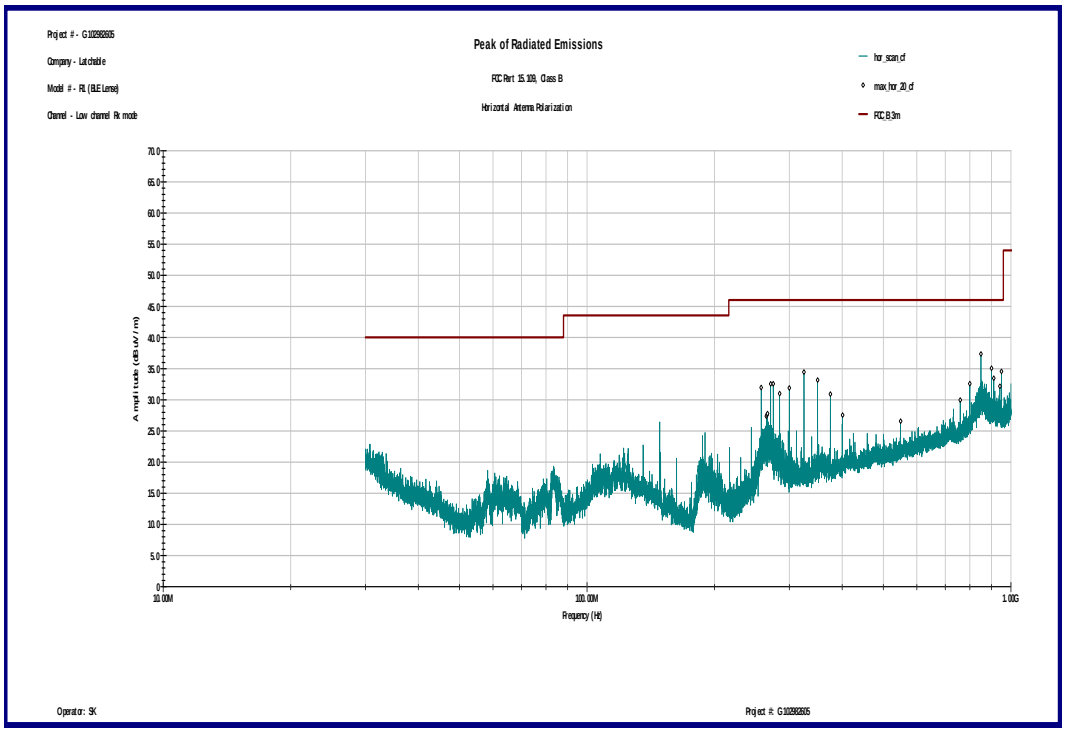
All measurements were taken using a Peak detector

| Frequency MHz | Antenna Polarity | Peak Reading dBµV | Total C.F. dB1/m | Pre-Amp. Gain (dB) | Total at 3m dBµV/m | Limit dBµV/m | Margin dB |
|---|---|---|---|---|---|---|---|
| 1.04 GHz | | 53.4 | 25.7 | 42.0 | 37.1 | 54.0 | -16.9 |
| 1.424 GHz | | 51.9 | 27.5 | 41.7 | 37.6 | 54.0 | -16.4 |
| 1.032 GHz | | 55.1 | 26.0 | 42.0 | 39.1 | 54.0 | -14.9 |
| 1.384 GHz | | 50.8 | 27.4 | 41.8 | 36.4 | 54.0 | -17.5 |
| | | | | | | | |

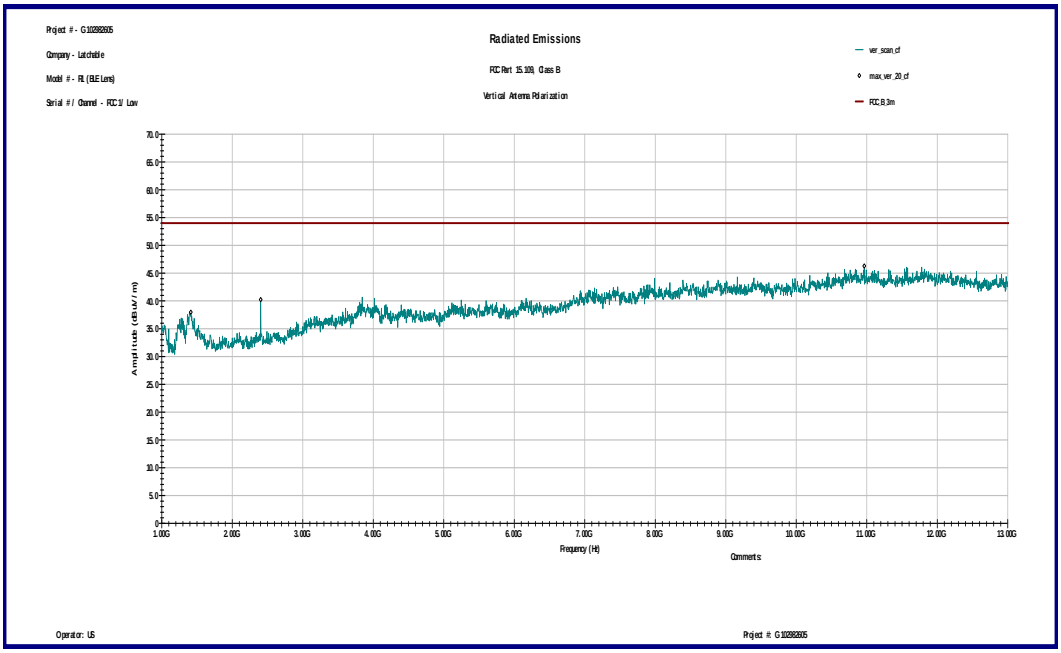
**Graph 3.5.1**



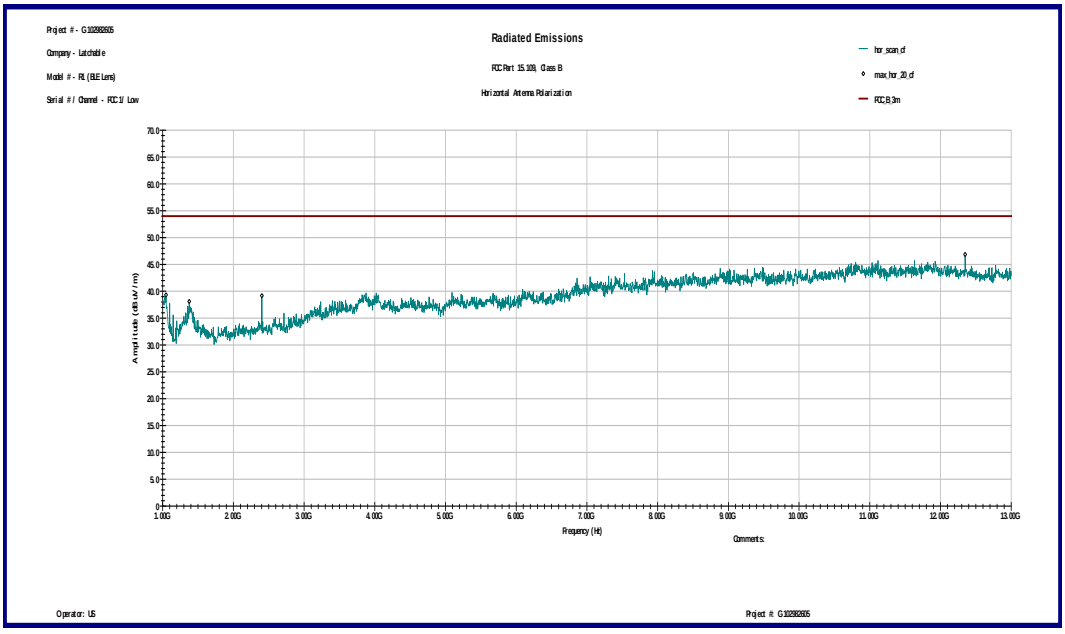

**Graph 3.5.2**



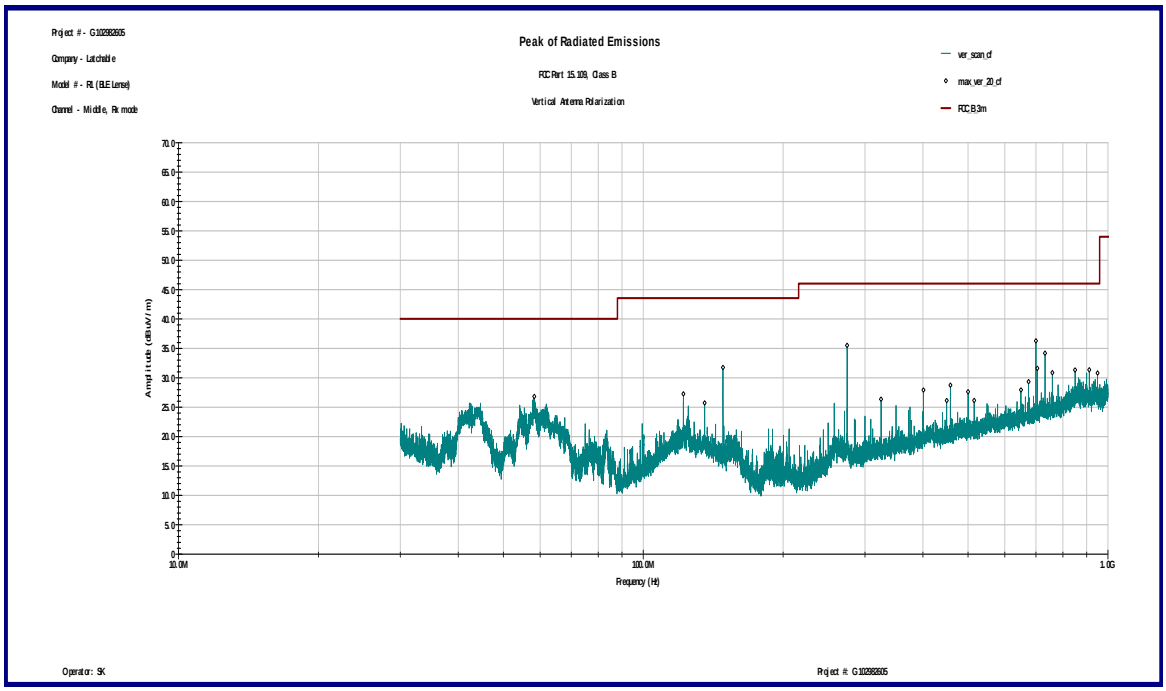
## Graph 3.5.3



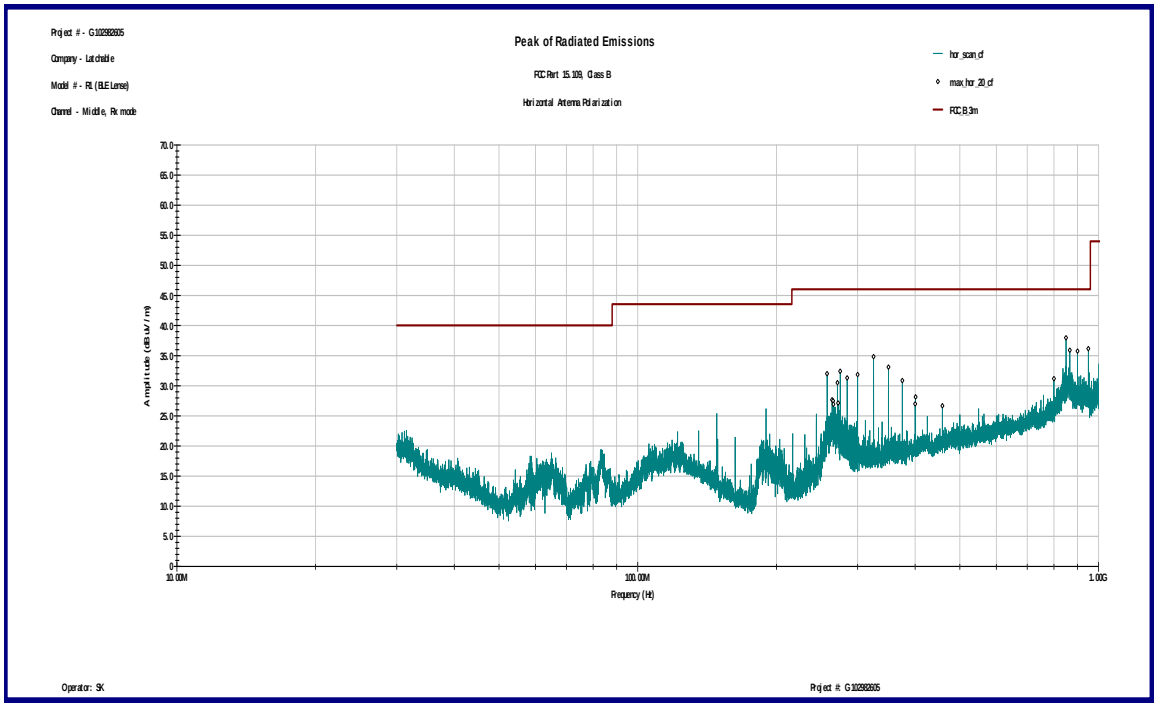

## Graph 3.5.4



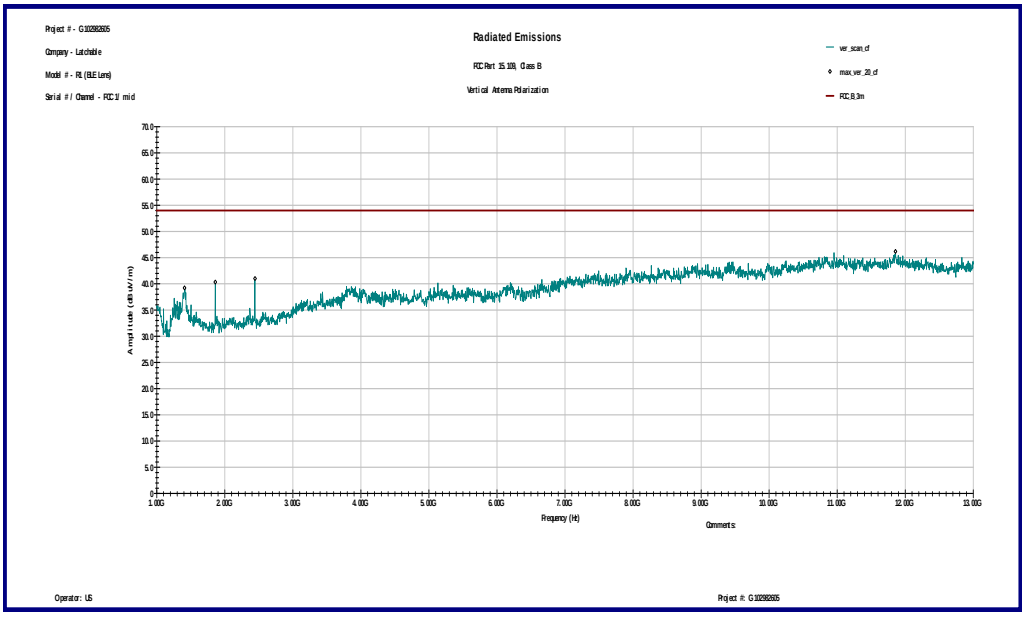
## Graph 3.5.5



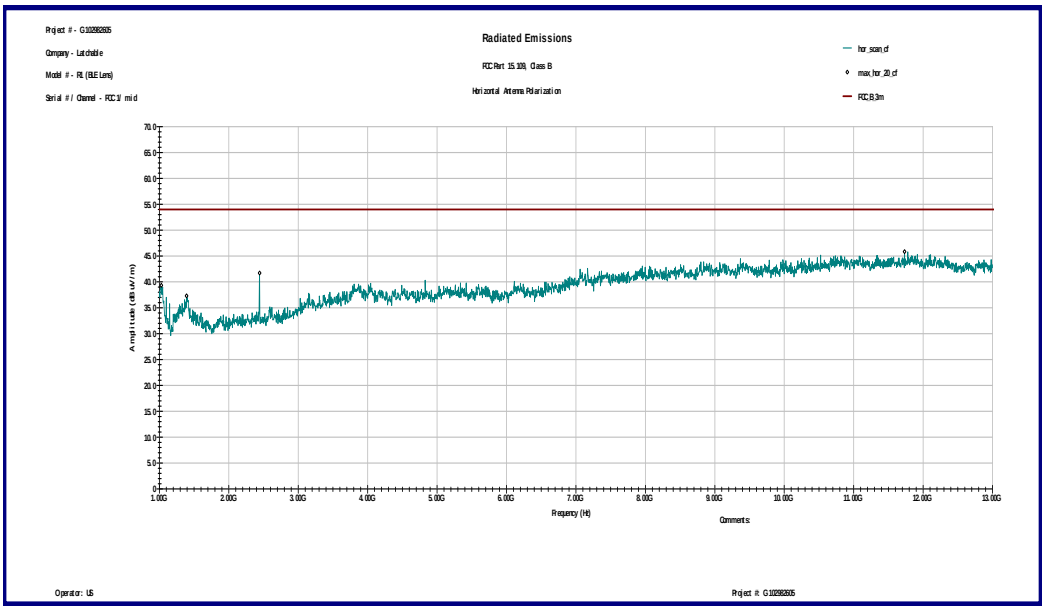

## Graph 3.5.6



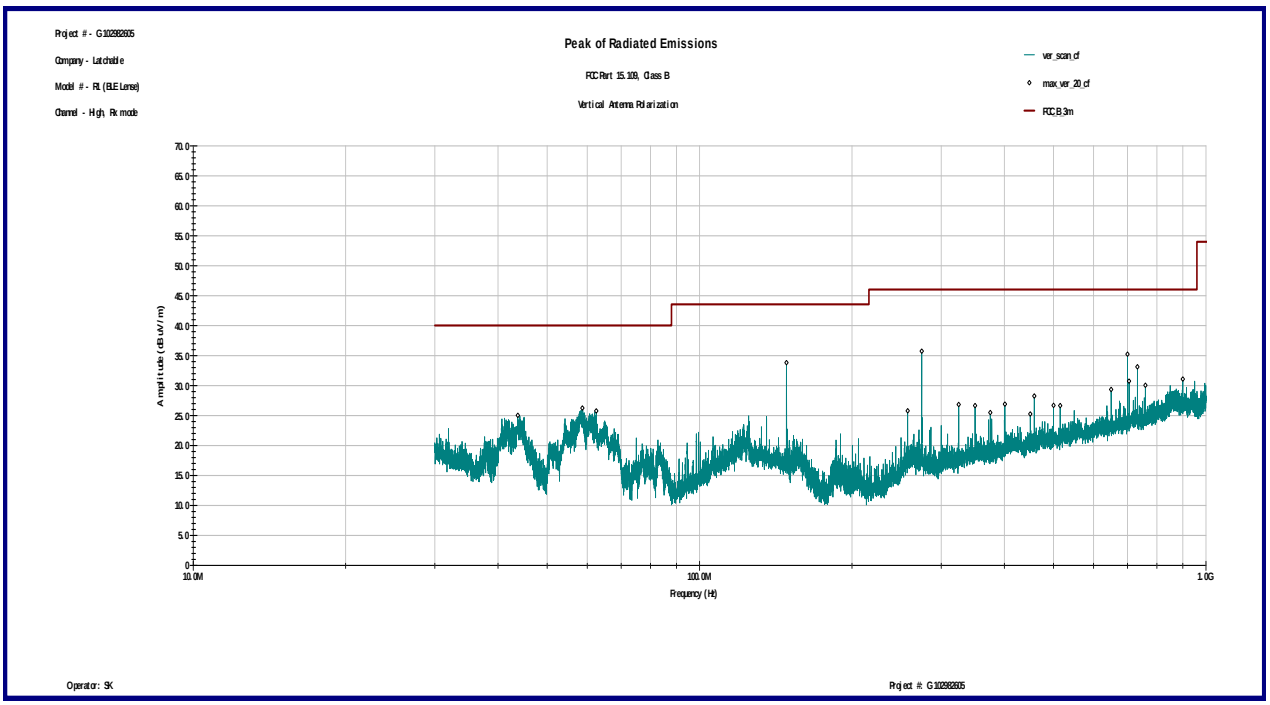
**Graph 3.5.7**



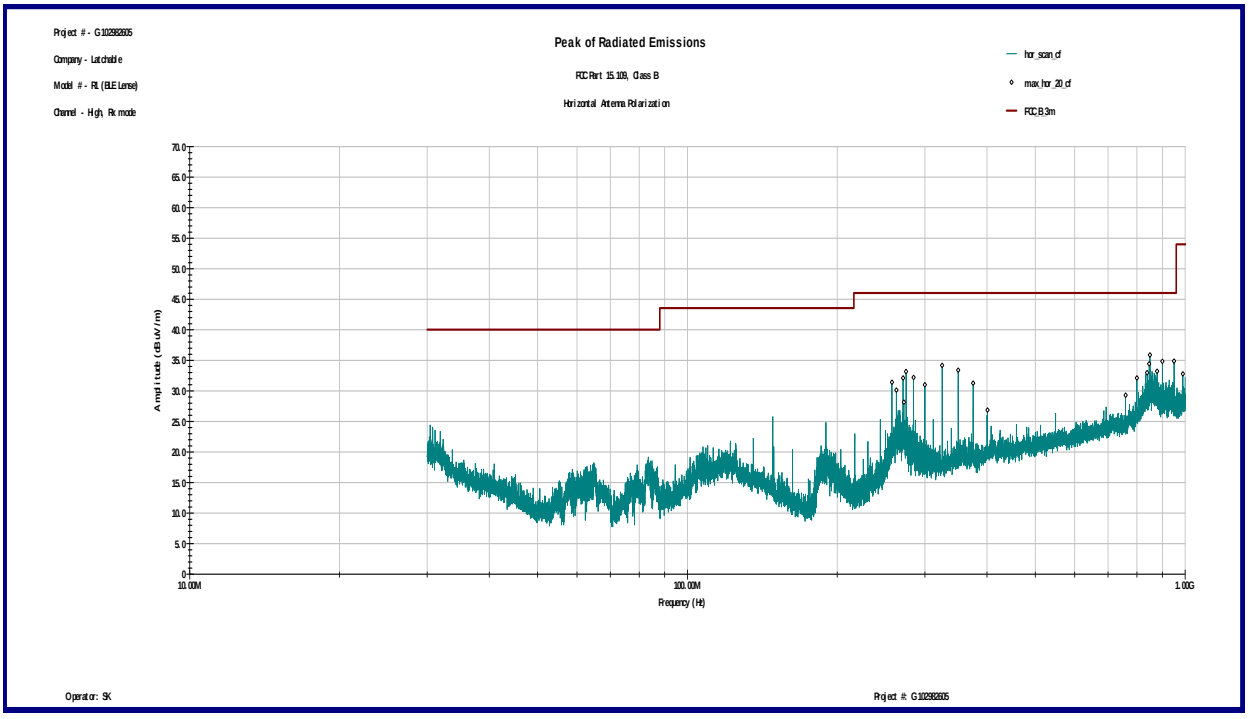

**Graph 3.5.8**



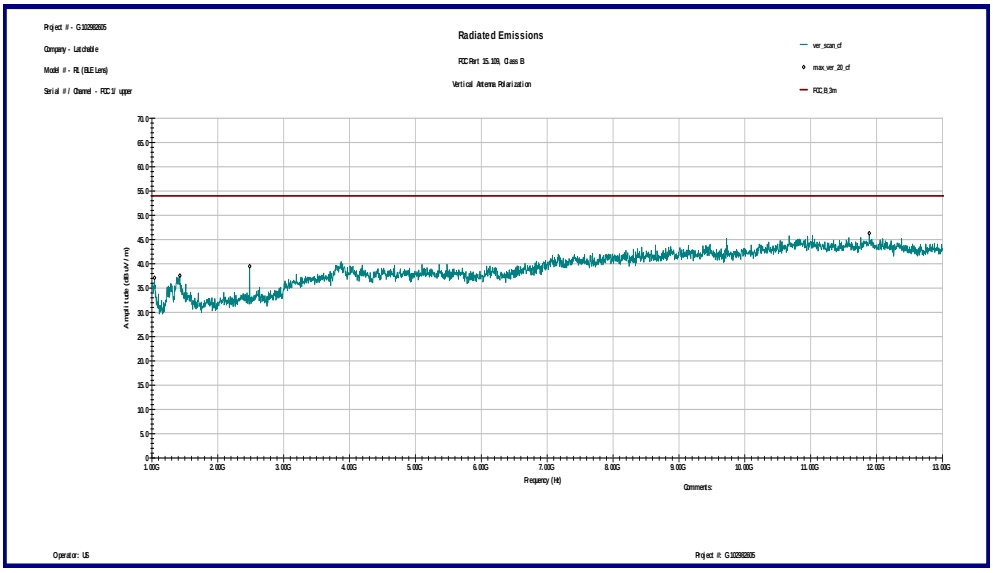
## Graph 3.5.9



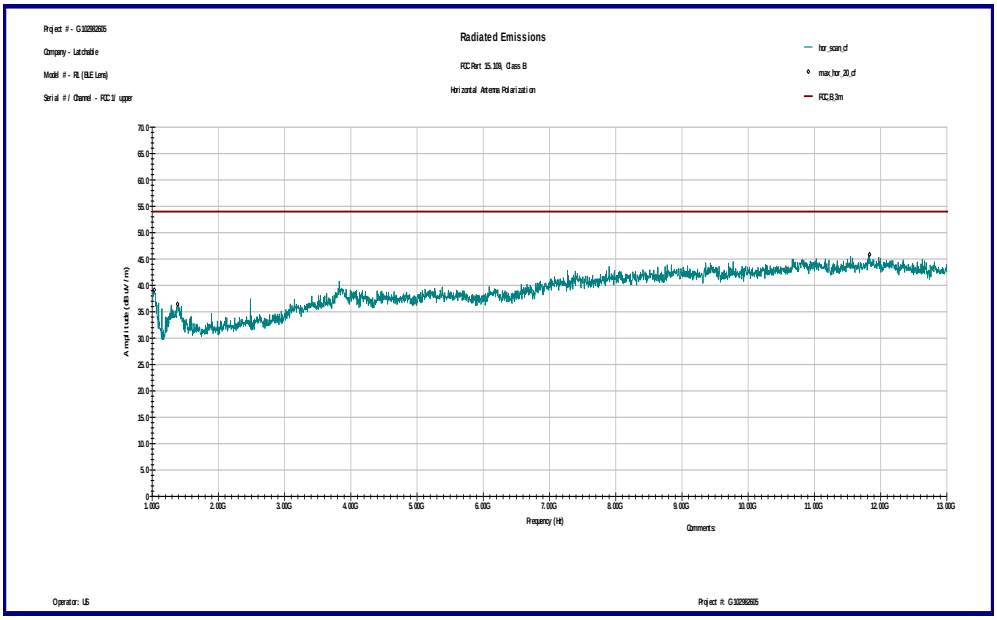

## Graph 3.5.10



**Graph 3.5.11**




**Graph 3.5.12**



### 3.6 Digital device conducted emissions

**Test result:** **Pass**

**Frequency range:** 0.15MHz-30MHz

**Max. Emissions margin:** 6.0dB below the limits

Notes: Test was performed at the AC adapter.

| | | |
|---|---|---|
| **Date:** | June 7, 2017 | **Result: Pass** |
| **Tested by:** | Uri Spector | |
| **Standard:** | FCC Part 15.107, Class B | |
| **Test Point:** | Line 1 and Line 2 | |
| **Operation mode:** | See page 5 | |
| **Environmental Conditions:** | 24°C; 44%(RH); 98.7kPa | |
| **Equipment Verification:** | ☒ | |
| **Note:** | None | |

**Table 3.10.1**

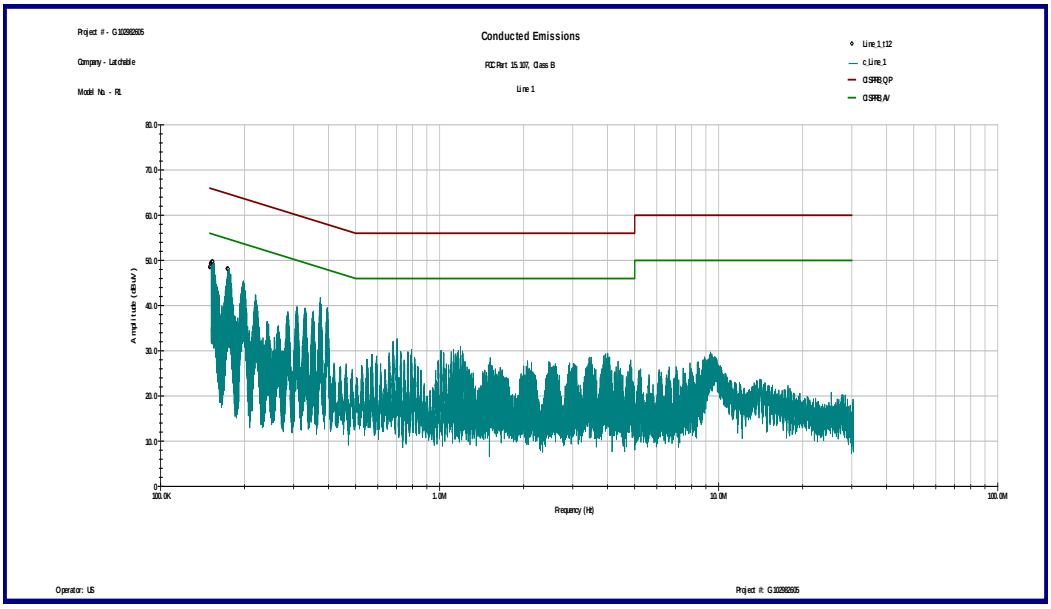
**Line 1**

| Frequency | Peak dBµV | QP Limit dBµV | AVG Limit dBµV | QP Margin dB | AVG Margin dB |
|---|---|---|---|---|---|
| 153.73 KHz | 49.8 | 65.8 | 55.8 | -16.0 | -6.0 |
| 154.39 KHz | 48.4 | 65.8 | 55.8 | -17.4 | -7.4 |
| 173.85 KHz | 48.2 | 64.8 | 54.8 | -16.6 | -6.6 |
| 696.27 KHz | 32.9 | 56.0 | 46.0 | -23.1 | -13.1 |
| 1.173 MHz | 31.2 | 56.0 | 46.0 | -24.8 | -14.8 |
| 3.956 MHz | 29.9 | 56.0 | 46.0 | -26.1 | -16.1 |

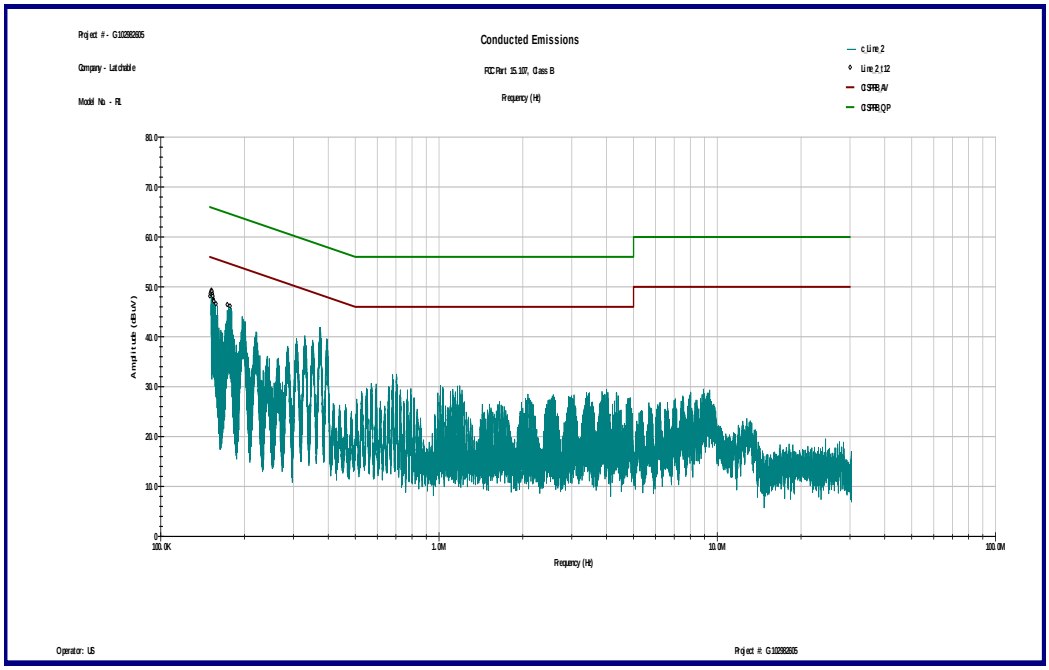
**Line 2**

| Frequency | Peak dBµV | QP Limit dBmV | AVG Limit dBmV | QP Margin dB | AVG Margin dB |
|---|---|---|---|---|---|
| 151.98 KHz | 49.3 | 65.9 | 55.9 | -16.6 | -6.6 |
| 153.3 KHz | 48.6 | 65.8 | 55.8 | -17.3 | -7.3 |
| 177.3 KHz | 46.2 | 64.6 | 54.6 | -18.4 | -8.4 |
| 696.73 KHz | 32.4 | 56.0 | 46.0 | -23.6 | -13.6 |
| 1.173 MHz | 30.0 | 56.0 | 46.0 | -26.0 | -16.0 |
| 3.955 MHz | 29.9 | 56.0 | 46.0 | -26.1 | -16.1 |

**Graph 3.10.1**




**Graph 3.10.2**



## 4.0 TEST EQUIPMENT

| DESCRIPTION | MANUFACTURER | MODEL | SERIAL NO. | INTERTEK ID | LAST CAL DATE | CAL DUE | USED |
|---|---|---|---|---|---|---|---|
| Spectrum Analyzer | R & S | FSP 40 | 100024 | 12559 | 01/26/2017 | 01/26/2018 | ☒ |
| Spectrum Analyzer | R & S | ESU | 100398 | 25283 | 03/21/2017 | 03/21/2018 | ☒ |
| Bicono-Log Antenna | Teseq | CBL6112D | 32859 | 25289 | 10/03/2016 | 10/03/2017 | ☒ |
| Horn Antenna | EMCO | 3115 | 9507-4513 | 9936 | 07/12/2016 | 07/12/2017 | ☒ |
| Waveguide Horn Antenna | EMCO | 3116 | 9904-2423 | 9705 | 12/09/2016 | 12/09/2017 | ☒ |
| High Pass Filter | Reactel | 7HS-4G-S12 | 0223 | 015274 | VBU | VBU | ☒ |
| LISN | COM-Power | Li-215A | 191970 | 172315 | 06/13/2016 | 06/13/2017 | ☒ |
| Pre-Amplifier | MITEQ | AMF-5D-00501800-28-13P | 1122951 | 13475 | 12/01/2016 | 12/01/2017 | ☒ |
| Pre-Amplifier | MITEQ | AMF-6F-16002600-25-10P | 1222383 | MIN-0065 | 12/01/2016 | 12/01/2017 | ☒ |
| System | Quantum Change | TILE! Instrument Control | Ver. 3.4.K.29 | 15259 | VBU | VBU | ☒ |

## 5.0 Revision History

| REVISION LEVEL | DATE | REPORT NUMBER | PREPARED | REVIEWED | NOTES |
|---|---|---|---|---|---|
| 0 | 06-22-2017 | 102982605MIN-005D | US | NS | Original Issue |
| | | | | | |
| | | | | | |