



Canada

# EMC & RF Test Report

As per

## RSS-247 Issue 2:2017 & FCC Part 15 Subpart 15.247

Unlicensed Intentional Radiators

on the

### MDF-1019 Zigbee Module

Issued by:

**TÜV SÜD Canada Inc.**  
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Reviewed by:

Min Xie,  
Sr. Project Engineer

Testing produced for



See Appendix A for full client &  
EUT details.



Registration #  
6844A-3



Testing Laboratory  
Certificate #2955.02



R-14023, G-20072  
C-14498, T-20060



Registration #  
CA6844

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Table of Contents

|                                                                  |    |
|------------------------------------------------------------------|----|
| Table of Contents .....                                          | 2  |
| Report Scope .....                                               | 3  |
| Summary .....                                                    | 4  |
| Test Results Summary .....                                       | 5  |
| Notes, Justifications, or Deviations .....                       | 6  |
| Sample Calculation(s) .....                                      | 6  |
| Applicable Standards, Specifications and Methods .....           | 7  |
| Document Revision Status .....                                   | 8  |
| Definitions and Acronyms .....                                   | 9  |
| Testing Facility .....                                           | 10 |
| Calibrations and Accreditations .....                            | 10 |
| Testing Environmental Conditions and Dates .....                 | 11 |
| Detailed Test Results Section .....                              | 12 |
| 6dB Bandwidth of Digitally Modulated Systems .....               | 13 |
| Maximum Peak Envelope Conducted Power .....                      | 17 |
| Antenna Spurious Conducted Emissions (-20 dBc Requirement) ..... | 22 |
| Transmitter Spurious Radiated Emissions .....                    | 32 |
| Power Spectral Density .....                                     | 53 |
| Appendix A – EUT Summary .....                                   | 58 |
| Appendix B – EUT and Test Setup Photos .....                     | 60 |

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Report Scope

This report addresses the EMC verification testing and test results of the **MDF-1019 Zigbee Module** and is herein referred to as EUT (Equipment Under Test). The EUT was tested for compliance against the following standards:

RSS-247 Issue 2:2017

FCC Part 15 Subpart C 15.247

Test procedures, results, justifications, and engineering considerations, if any, follow later in this report.

This report does not imply product endorsement by any government, accreditation agency, or TÜV SÜD Canada Inc.

Opinions or interpretations expressed in this report, if any, are outside the scope of TÜV SÜD Canada Inc. accreditations. Any opinions expressed do not necessarily reflect the opinions of TÜV SÜD Canada Inc., unless otherwise stated.

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
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| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Summary

The results contained in this report relate only to the item(s) tested.

|                                      |                           |
|--------------------------------------|---------------------------|
| EUT:                                 | MDF-1019<br>Zigbee Module |
| FCC Certification #, FCC ID:         | 2ABFD-MDF1019             |
| Industry Canada Certification #, IC: | 1156A-MDF1019             |
| EUT passed all tests performed       | Yes                       |
| Tests conducted by                   | Amir Emami                |
| Report reviewed by                   | Min Xie                   |

For testing dates, see "Testing Environmental Conditions and Dates".

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Test Results Summary

| Standard/Method                  | Description                                | Class/Limit           | Result                     |
|----------------------------------|--------------------------------------------|-----------------------|----------------------------|
| FCC 15.203                       | Antenna Requirement                        | Unique                | Pass<br>See Justification  |
| FCC 15.205<br>RSS-GEN (Table 6)  | Restricted Bands for Intentional Operation | QuasiPeak Average     | Pass                       |
| FCC 15.207<br>RSS-GEN (Table 3)  | Power Line Conducted Emissions             | QuasiPeak Average     | Pass                       |
| FCC 15.209<br>RSS-GEN (Table 4)  | Spurious Radiated Emissions                | QuasiPeak Average     | Pass                       |
| FCC 15.247(a)2<br>RSS-247 5.2(a) | 6 dB Bandwidth                             | > 500 kHz             | Pass                       |
| FCC 15.247(b)2<br>RSS-247 5.4(d) | Max Output Power                           | < 1 Watt              | Pass                       |
| FCC 15.247(b)4<br>RSS-247 5.4(d) | Antenna Gain                               | < 6 dBi               | Pass<br>See Justifications |
| FCC 15.247(d)<br>RSS-247 5.5     | Antenna Conducted Spurious                 | < 20 dBc              | Pass                       |
| FCC 15.247(e)<br>RSS-247 5.2(b)  | Spectral Density                           | < 8 dBm<br>(3 kHz BW) | Pass                       |
| <b>Overall Result</b>            |                                            |                       | <b>Pass</b>                |

If the product as tested or otherwise complies with the specification, the EUT is deemed to comply with the requirement and is deemed a 'PASS' grade. If not 'FAIL' grade will be issued. Note that 'PASS' / 'FAIL' grade is independent of any measurement uncertainties. A 'PASS' / 'FAIL' grade within measurement uncertainty is marked with a '\*'.

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
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| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

### ***Notes, Justifications, or Deviations***

The following notes, justifications for tests not performed or deviations from the above listed specifications apply:

For the Antenna requirement specified in FCC 15.203 (RSS-247 section 5.4(d)), the unit uses a reverse polarity antenna (5 dBi peak gain – Pulse W1038) with less than 6 dBi gain.

For the Restricted Bands of operation, the EUT is designed to only operate between 2400 – 2483.5 MHz.

The EUT is not a hybrid system and FCC 15.247 (f) does not apply to it. However the 15.247 (d) requirement of power density were met and are detailed later in this test report.

The EUT was mounted in three orthogonal axes. Worst case results were obtained with the EUT in the X-axis. Worst case results are presented. See Appendix B for setup details.

The EUT has a fixed (source based) duty cycle of 13% (13ms on time/100ms) which cannot be changed or modified by either the device or the end user. As per KDB 558074 section 12.2.5.2, for the average radiated emission measurements of the band edges and of the spurious emissions in the restricted bands, a duty cycle correction factor of 13% [ $20\log(13\%) = -17.72$ ] was applied to the peak measurement to obtain the average measurement.

Power line conducted emissions was not applicable since the EUT was a battery operated module. All tests were performed with new batteries.

### ***Sample Calculation(s)***

#### **Radiated Emission Test**

E-Field Level = Received Signal + Antenna Factor + Cable Loss – Pre-Amp Gain

E-Field Level = 50dB $\mu$ V + 10dB/m + 2dB – 20dB

E-Field Level = 42dB $\mu$ V/m

Margin = Limit – E-Field Level

Margin = 50dB $\mu$ V/m – 42dB $\mu$ V/m

Margin = 8.0 dB (pass)

|             |                                                    |                                                                                     |
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Applicable Standards, Specifications and Methods

|                         |                                                                                                                                      |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| ANSI C63.4:2014         | Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ANSI C63.10:2013        | American National Standard For Testing Unlicensed Wireless Devices                                                                   |
| CFR 47 FCC 15 Subpart C | Code of Federal Regulations – Radio Frequency Devices, Intentional Radiators                                                         |
| FCC KDB 558074: 2019    | FCC KDB 558074 Digital Transmission Systems, measurements and procedures                                                             |
| FCC KDB 447498: 2015    | RF exposure procedures and equipment authorization policies for mobile and portable devices                                          |
| ICES-003 Issue 6 2019   | Digital Apparatus - Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard                        |
| RSS-GEN Issue 5 2019    | General Requirements and Information for the Certification of Radio Apparatus                                                        |
| RSS-247 Issue 2:2017    | Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices         |
| ISO 17025:2017          | General Requirements for the Competence of Testing and Calibration Laboratories                                                      |

|             |                                                    |                                                                                               |
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Document Revision Status

| Revision | Date         | Description     | Initials |
|----------|--------------|-----------------|----------|
| 000      | May 26, 2021 | Initial Release | AE       |
| -        | -            | -               | -        |

|             |                                                    |                                                                                     |
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## Definitions and Acronyms

The following definitions and acronyms are applicable in this report.  
See also ANSI C63.14.

**DTS** – Digital Transmission System  
**LISN** – Line Impedance Stabilization Network  
**NCR** – No Calibration Required  
**NSA** – Normalized Site Attenuation  
**N/A** – Not Applicable  
**RF** – Radio Frequency

**AE** – Auxiliary Equipment. A digital accessory that feeds data into or receives data from another device (host) that in turn, controls its operation.

**Antenna Port** – Port, other than a broadcast receiver tuner port, for connection of an antenna used for intentional transmission and/or reception of radiated RF energy.

**BW** – Bandwidth. Unless otherwise stated, this refers to the 6 dB bandwidth.

**EMC** – Electro-Magnetic Compatibility. The ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

**EMI** – Electro-Magnetic Immunity. The ability to maintain a specified performance when the equipment is subjected to disturbance (unwanted) signals of specified levels.

**EUT** – Equipment Under Test. A device or system being evaluated for compliance that is representative of a product to be marketed.

**ITE** – Information Technology Equipment. Has a primary function of entry, storage, display, retrieval, transmission, processing, switching, or control of data and/or telecommunication messages and which may be equipped with one or more ports typically for information transfer.

|             |                                                    |                                                                                     |
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Testing Facility

Testing for EMC on the EUT was carried out at TÜV SÜD Canada testing lab near Toronto, Ontario. The testing lab has calibrated 3m semi-anechoic chambers which allow measurements on a EUT that has a maximum width or length of up to 2m and a height of up to 3m. The testing lab also has a calibrated 10m Open Area Test Site (OATS). The chambers are equipped with a turntable that is capable of testing devices up to 5000lb in weight and are equipped with a mast that controls the polarization and height of the antenna. Control of the mast occurs in the control room adjoining the shielded chamber. This facility is capable of testing products that are rated for single phase or 3-phase AC input and DC capability is also available. Radiated emission measurements are performed using a BiLog antenna and a Horn antenna where applicable. Conducted emissions, unless otherwise stated, are performed using a LISN and using the vertical ground plane if applicable.

### **Calibrations and Accreditations**

The 3m semi-anechoic chamber is registered with Federal Communications Commission (FCC, CA6844), Innovation, Science and Economic Development Canada (ISED, 6844A-3) and Voluntary Control Council for Interference (VCCI, R-14023, G-20072, C-14498, and T-20060). This chamber was calibrated for Normalized Site Attenuation (NSA) using test procedures outlined in ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The chamber is lined with ferrite tiles and absorption cones to minimize any undesired reflections. The NSA data is kept on file at TÜV SÜD Canada. For radiated susceptibility testing, a 16 point field calibration has been performed on the chamber. The field uniformity data is kept on file at TÜV SÜD Canada. TÜV SÜD Canada Inc. is accredited to ISO 17025 by A2LA with Testing Certificate #2955.02. The laboratory's current scope of accreditation listing can be found as listed on the A2LA website. All measuring equipment is calibrated on an annual or biennial basis as listed for each respective test.

|             |                                                    |                                                                                               |
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

### ***Testing Environmental Conditions and Dates***

Following environmental conditions were recorded in the facility during time of testing

| Date           | Test                        | Initials | Temperature (°C) | Humidity (%) | Pressure (kPa) |
|----------------|-----------------------------|----------|------------------|--------------|----------------|
| April 21, 2021 | Radiated Emissions          | AE       | 23.7             | 19.6         | 99.2           |
| April 21, 2021 | Antenna Conducted Emissions | AE       | 23.7             | 19.6         | 99.2           |

|             |                                                    |                                                                                               |
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| Product     | <b>MDF-1019</b>                                    |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Detailed Test Results Section

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## ***6dB Bandwidth of Digitally Modulated Systems***

### **Purpose**

The purpose of this test is to ensure that the bandwidth occupied exceeds a stated minimum. This helps ensure the utilization of the frequency allocation is sufficiently wide. This also helps prevent corruption of data by ensuring adequate data separation to distinguish the reception of the intended information.

### **Limits and Method**

The limit is as specified in FCC Part 15.247(a)2 and RSS-247 5.2(a).

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. This should be measured with a 100 kHz RBW and a 300 kHz VBW.

The method is given in FCC KDB 558074 Section 8.1 and ANSI C63.10.

### **Results**

The EUT passed.

The minimum 6 dB Bandwidth measured was 1571 kHz

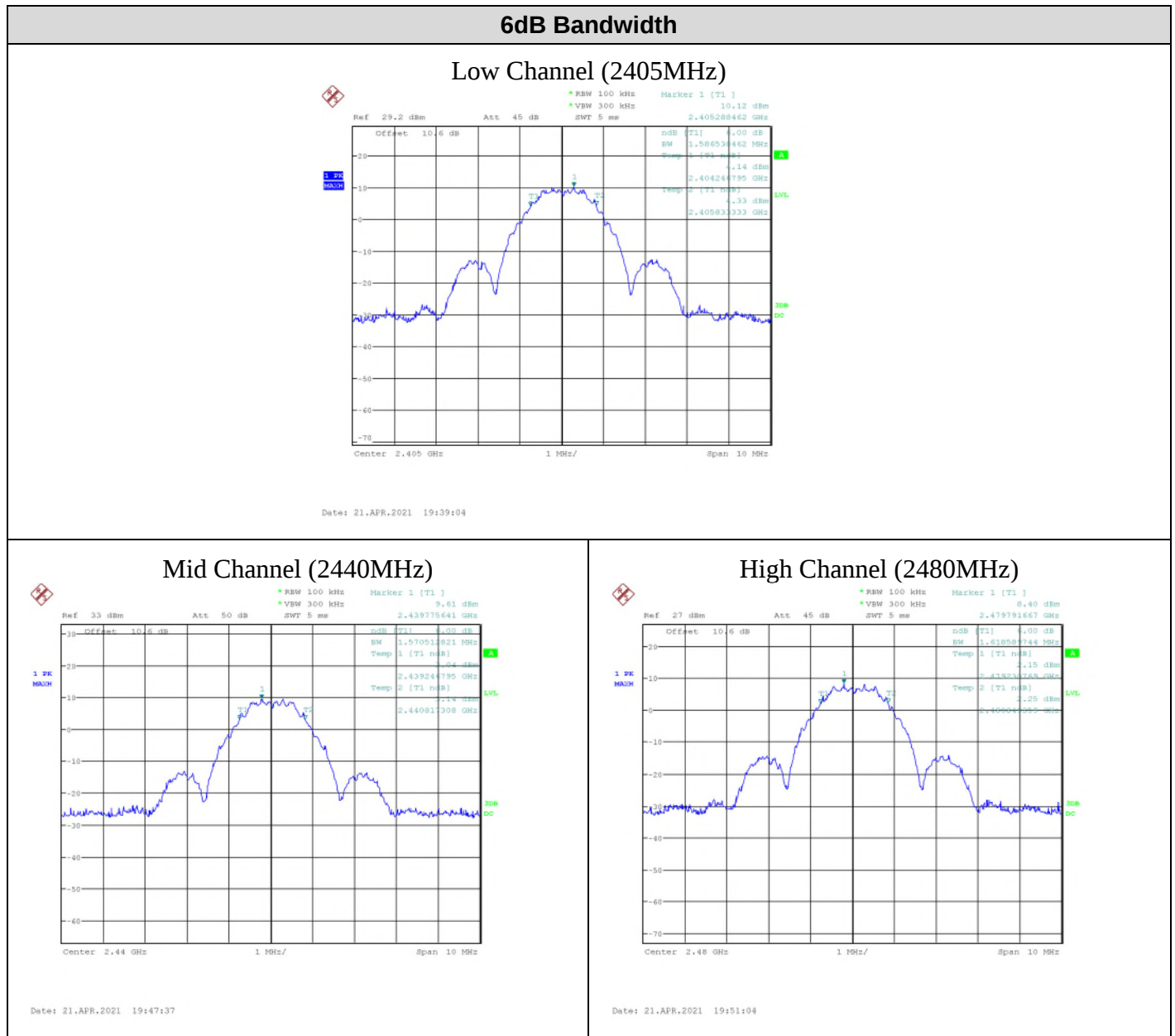
The maximum 99% Occupied Bandwidth was 2580 kHz.

| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|-----------------|----------------------|---------------------|
| Low     | 2405            | 1.587                | 2.55                |
| Mid     | 2440            | 1.571                | 2.52                |
| High    | 2480            | 1.619                | 2.58                |

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
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| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Graphs

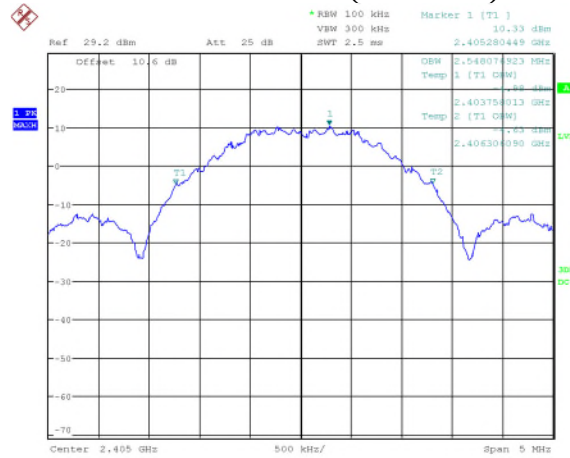
The graphs shown below show the OBW of the device during the conducted measurement operation of the EUT. This is measured by a max hold on the spectrum analyzer.



|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

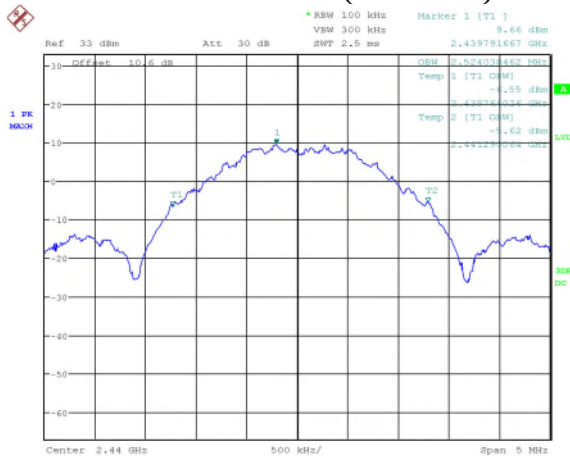
### 99% Bandwidth

#### Low Channel (2405MHz)



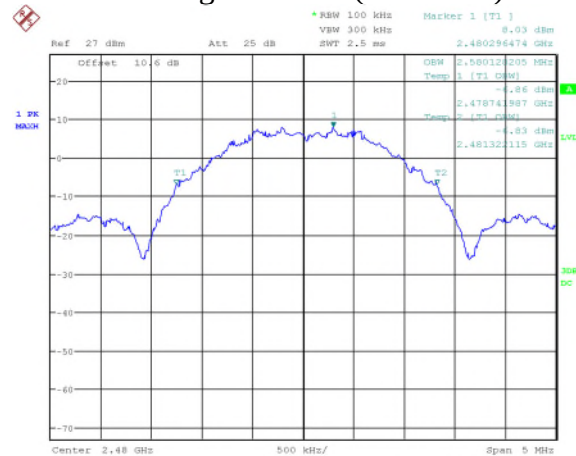
Date: 21.APR.2021 19:39:37

#### Mid Channel (2440MHz)



Date: 21.APR.2021 19:48:10

#### High Channel (2480MHz)



Date: 21.APR.2021 19:51:37

Note: See 'Appendix B – EUT & Test Setup Photos' for photos showing the test set-up.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
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| Product     | <b>MDF-1019</b>                                    |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Test Equipment List

| Equipment         | Model No. | Manufacturer    | Last Calibration Date | Next Calibration Date | Asset #  |
|-------------------|-----------|-----------------|-----------------------|-----------------------|----------|
| Spectrum Analyzer | ESU 40    | Rohde & Schwarz | Jan. 15, 2020         | Jan. 15, 2022         | GEMC 233 |
| Attenuator 10 dB  | 8493B     | Agilent         | NCR                   | NCR                   | GEMC 133 |

|             |                                                    |                                                                                     |
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| Client      | Mircom Technologies Ltd.                           |  |
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Maximum Peak Envelope Conducted Power

### Purpose

The purpose of this test is to ensure that the maximum power conducted to the radiating element does not exceed the limits specified. This ensures that if the end-user replaces the antenna, the maximum power does not exceed an amount which may create an excessive power level.

### Limits and Method

The limits are defined in FCC Part 15.247(b) and RSS-247 5.4(d).  
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands, the peak limit is 1 watt (30 dBm).

The method is given in FCC KDB 558074 Section 9.1.2 and ANSI C63.10.

### Results

The EUT passed.

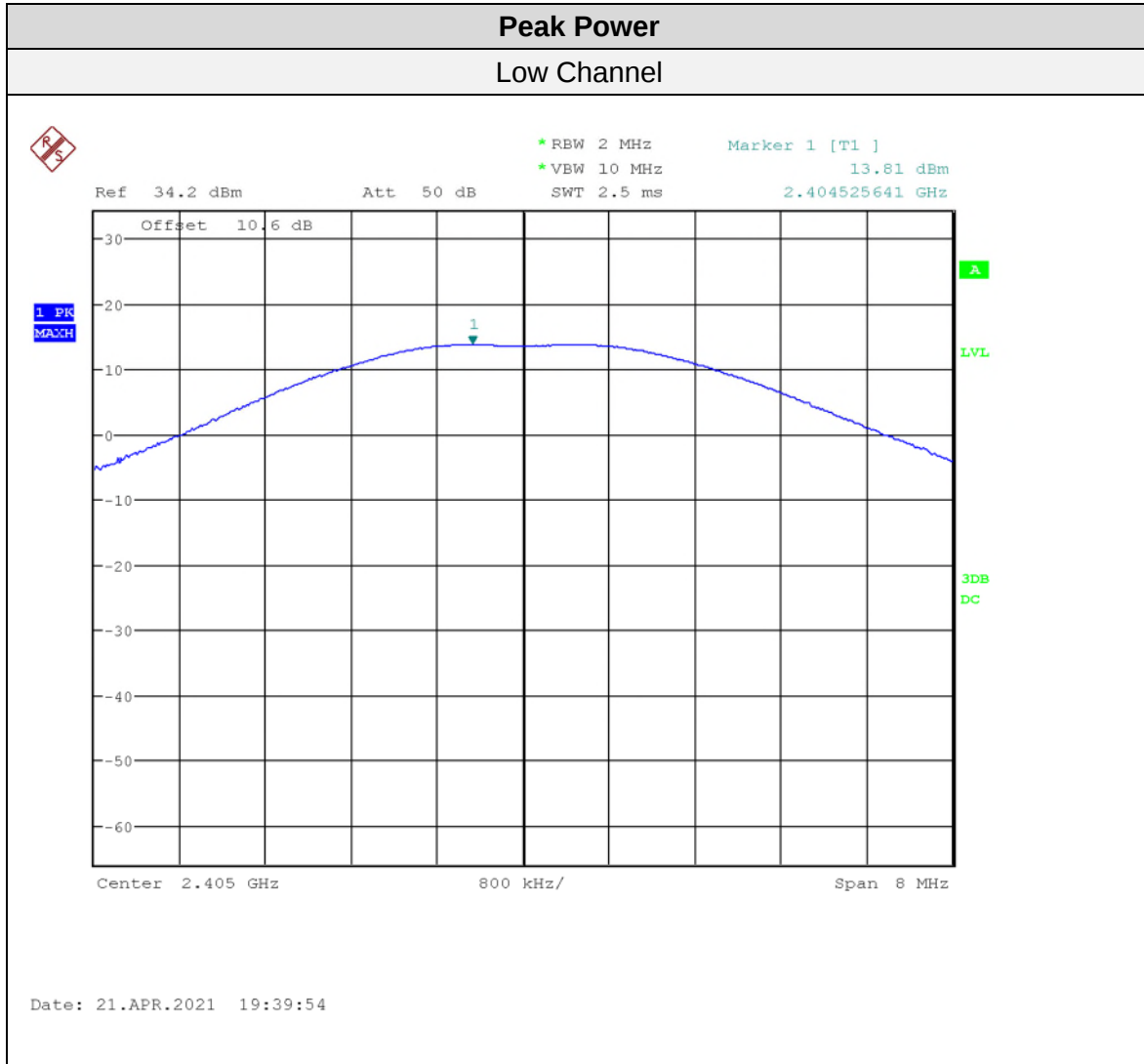
| Channel | Frequency (MHz) | Peak Power (dBm) | Peak Power (mW) |
|---------|-----------------|------------------|-----------------|
| Low     | 2405            | 13.81            | 24.04           |
| Mid     | 2440            | 13.04            | 20.14           |
| High    | 2480            | 11.95            | 15.67           |

Note: The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer

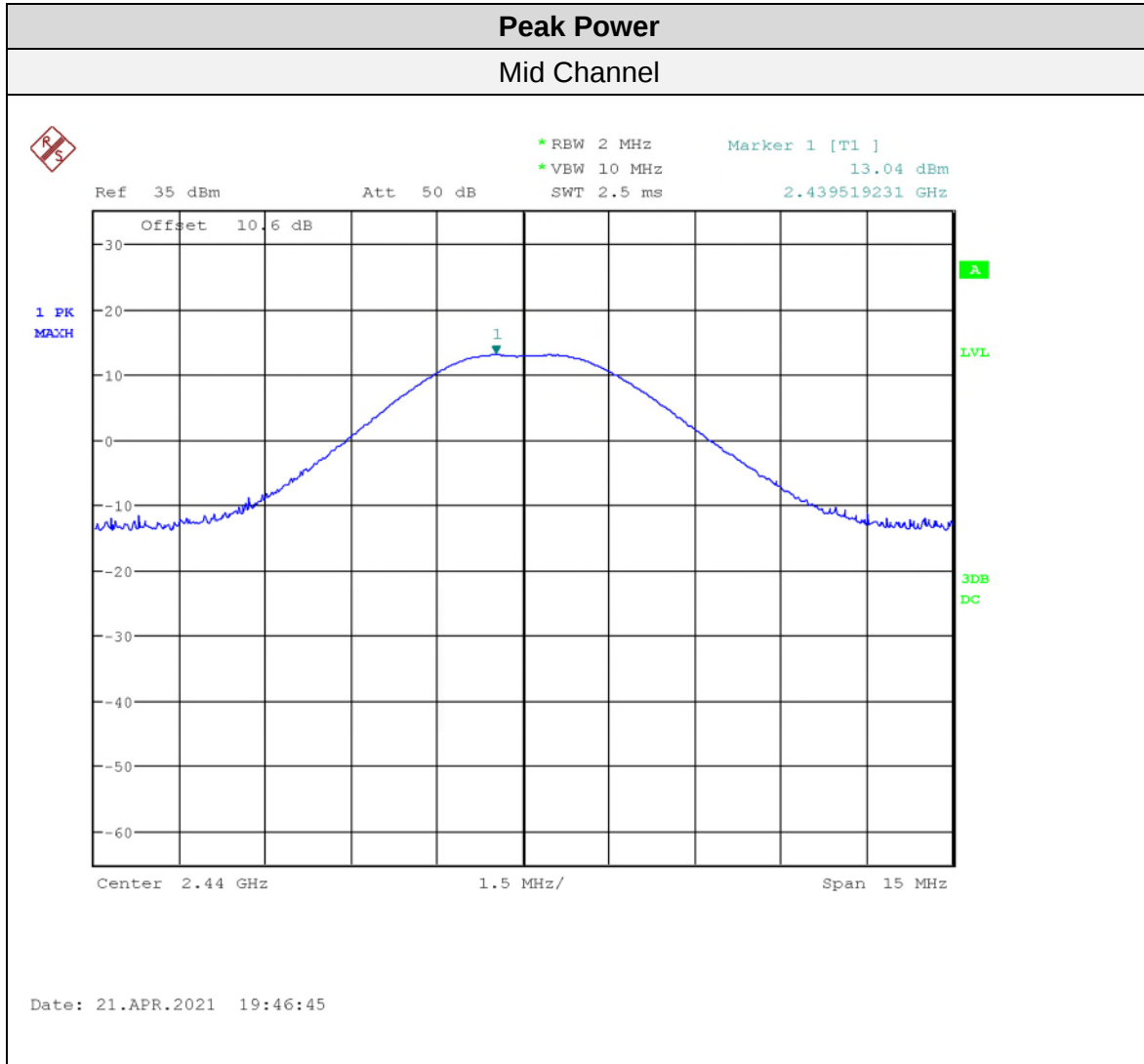
### Graphs

The graphs shown below show the peak power output of the device during the conducted measurement operation of the EUT. The measurement RBW is  $\geq$  than the DTS bandwidth.

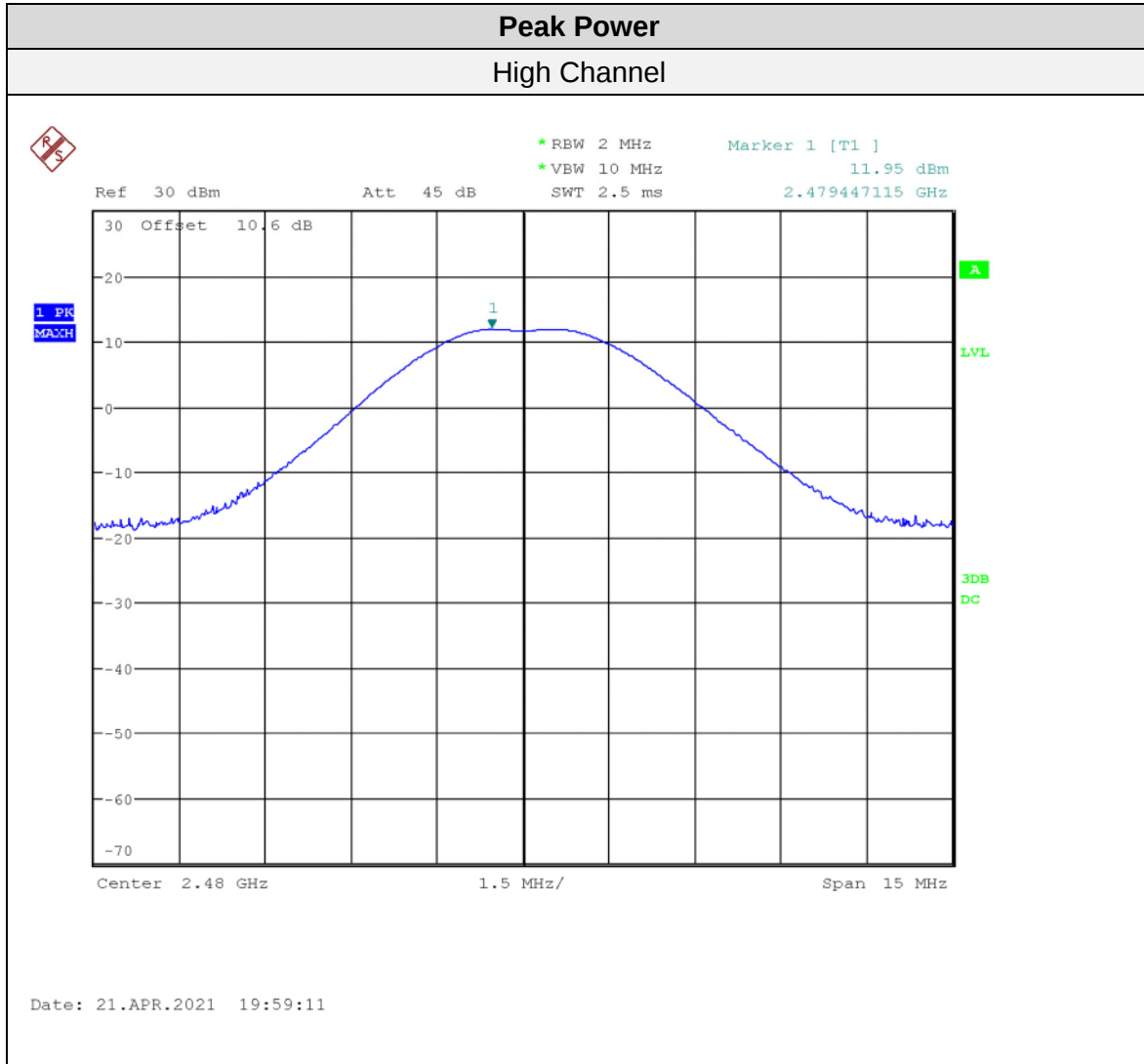
|             |                                                    |                                                                                               |
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| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



|             |                                                    |                                                                                               |
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|             |                                                    |                                                                                               |
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| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
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| Product     | <b>MDF-1019</b>                                    |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Test Equipment List

| Equipment         | Model No. | Manufacturer    | Last Calibration Date | Next Calibration Date | Asset #  |
|-------------------|-----------|-----------------|-----------------------|-----------------------|----------|
| Spectrum Analyzer | ESU 40    | Rohde & Schwarz | Jan. 15, 2020         | Jan. 15, 2022         | GEMC 233 |
| Attenuator 10 dB  | 8493B     | Agilent         | NCR                   | NCR                   | GEMC 133 |

|             |                                                    |                                                                                     |
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## ***Antenna Spurious Conducted Emissions (-20 dBc Requirement)***

### **Purpose**

The purpose of this test is to ensure that the maximum power conducted to the radiating element at frequencies outside of the authorized spectrum does not exceed the limits specified. This ensures that the only the intended signal is delivered to the radiating element.

### **Limits and Method**

The limits are defined in 15.247(d) and RSS-247 5.5. In any 100 kHz band, the peak spurious harmonics emissions must be at least 20 dB below the fundamental. Spurious Conducted emissions are to be evaluated up to the 10<sup>th</sup> harmonic. This -20 dBc requirement also applies at the 'band edge' or 2.4 GHz and 2.4835 GHz.

The method is given in FCC KDB 558074 Section 11 and ANSI C63.10

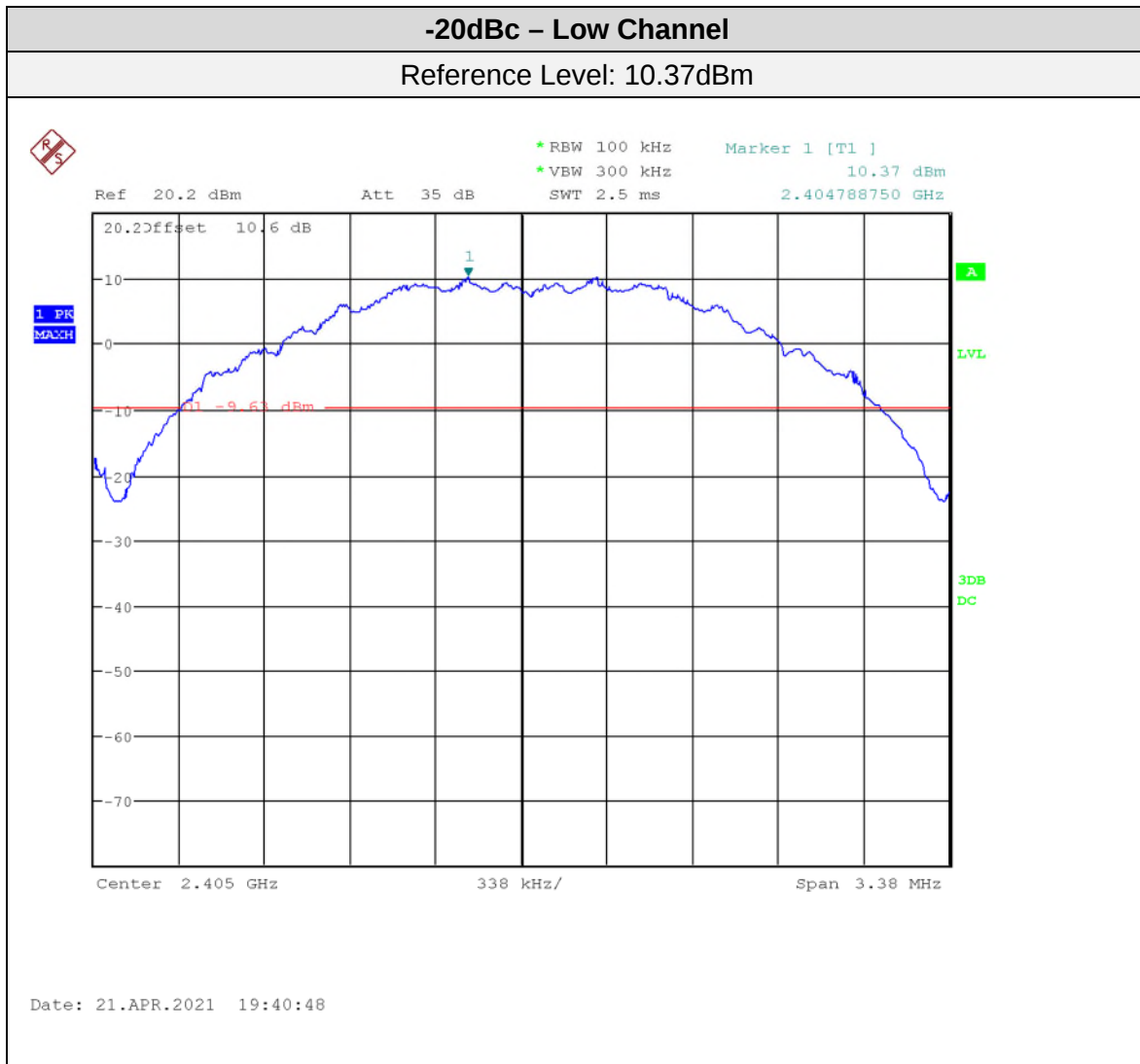
### **Results**

The EUT passed. Low, middle and high bands were measured. The -20 dBc requirement is shown for the lower band edge at 2.4 GHz in the low band and for the higher band edge at 2.4835 GHz in the high band.

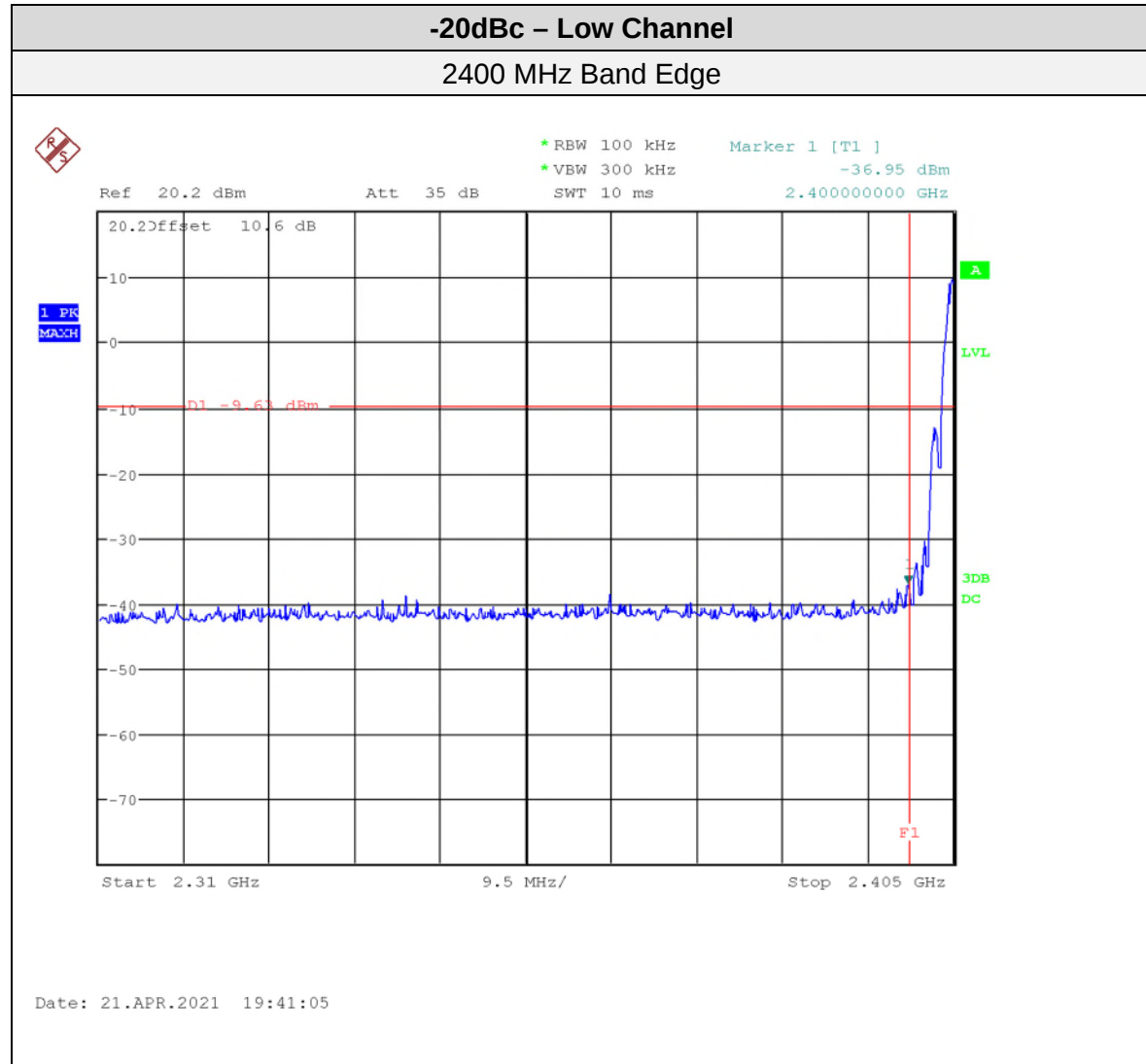
|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
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| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Graphs

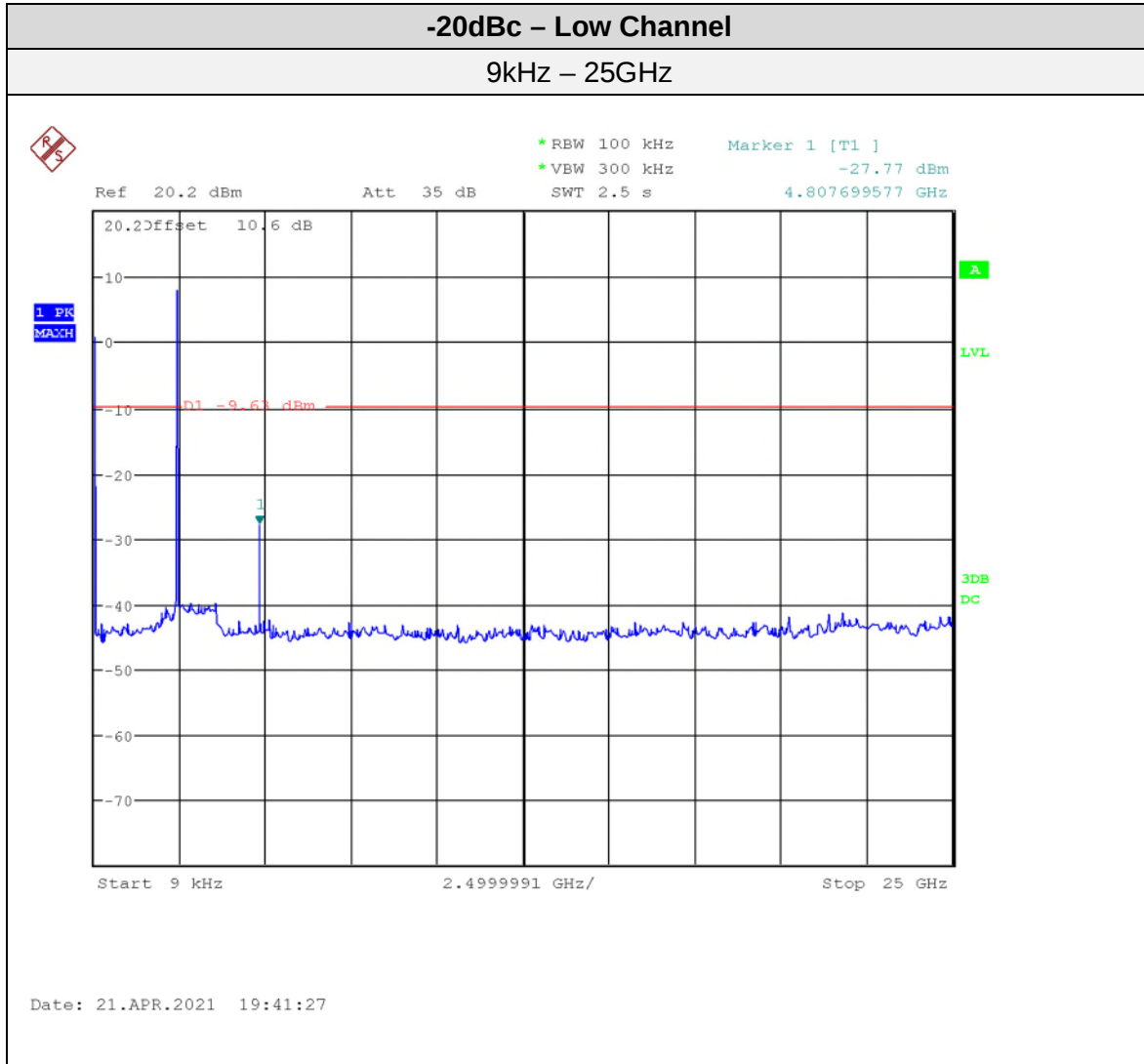
The graphs shown below show the power output of the device during the conducted measurement operation of the EUT.



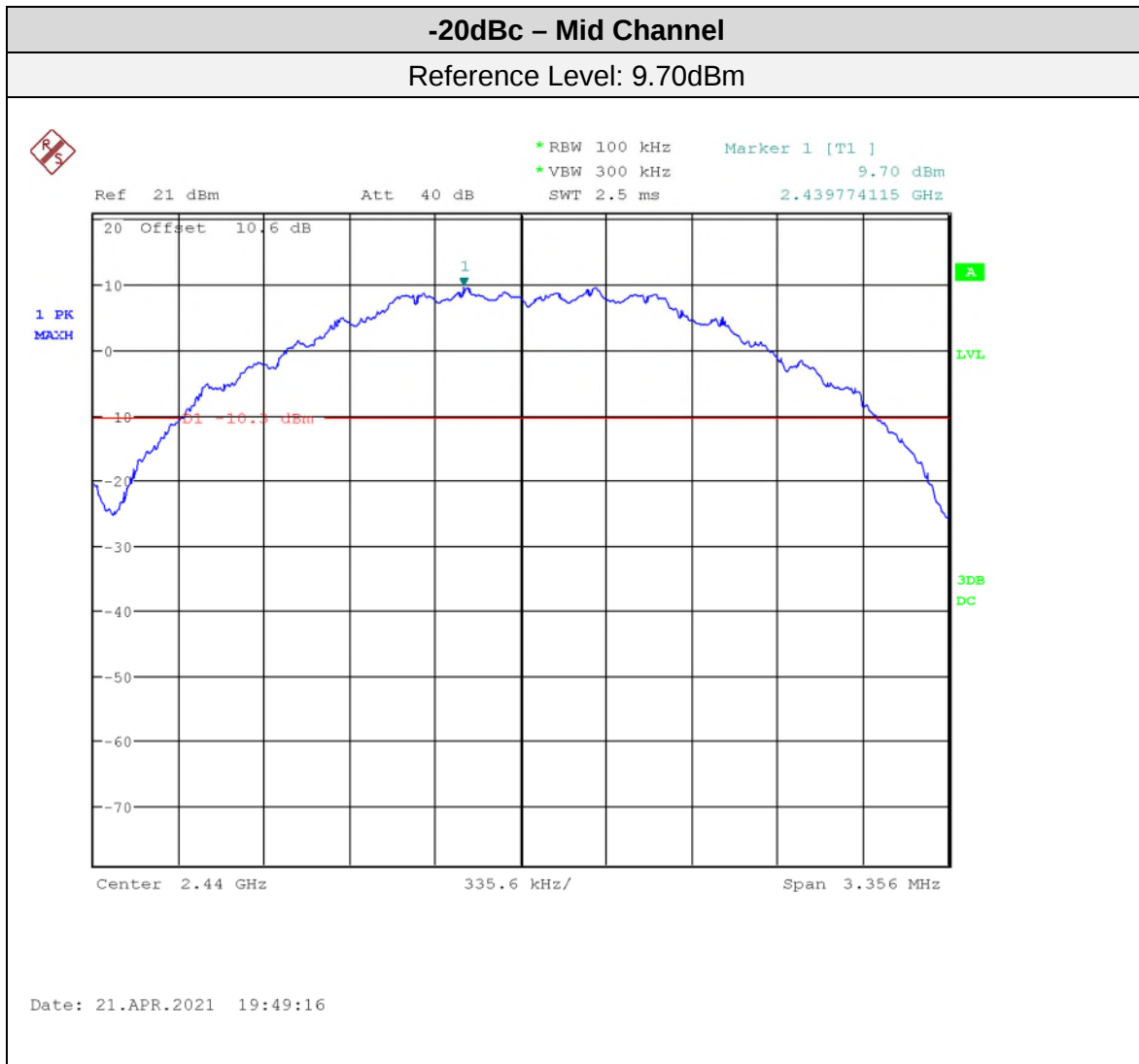
|             |                                                    |                                                                                               |
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| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



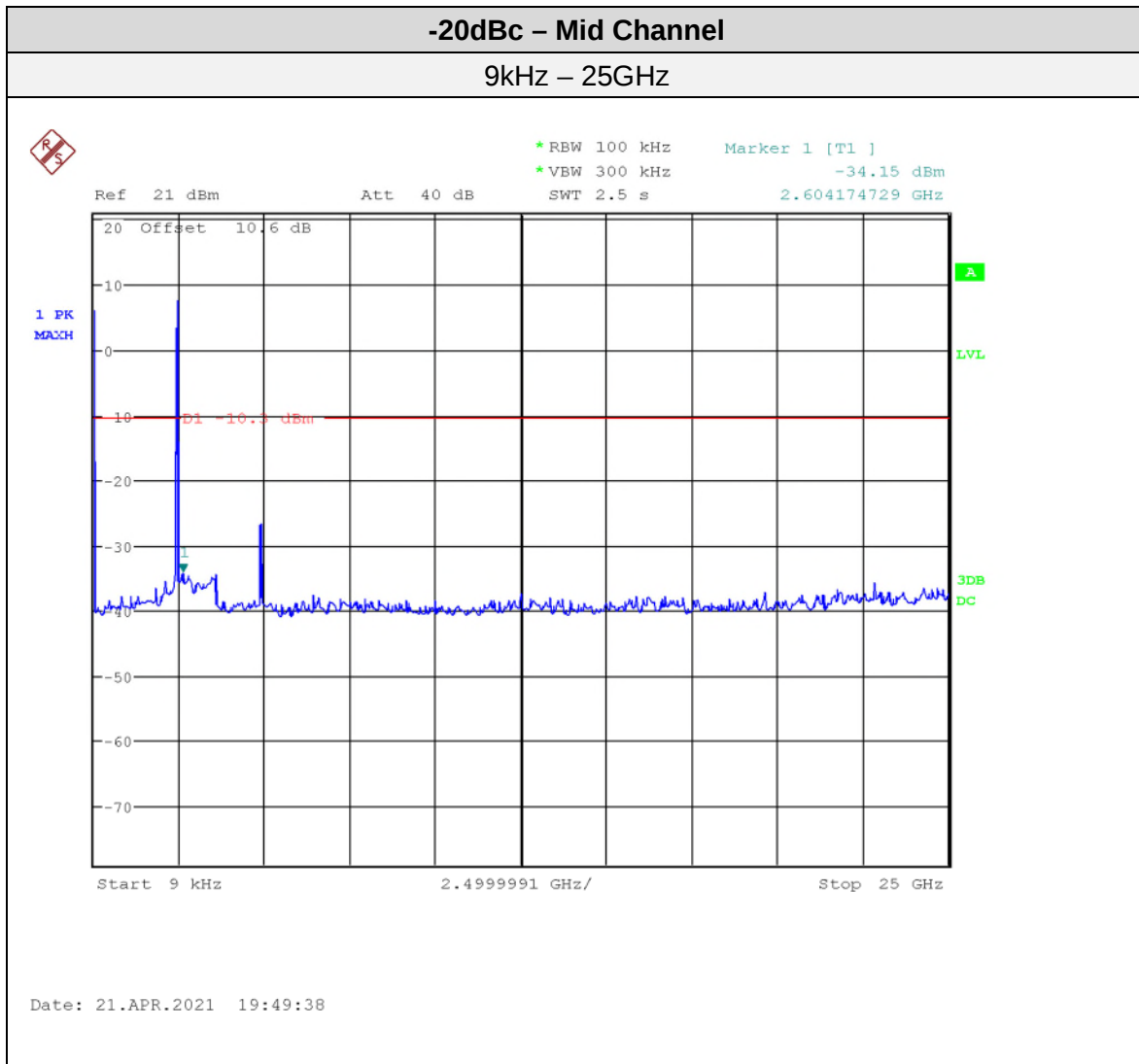
|             |                                                    |                                                                                               |
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| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



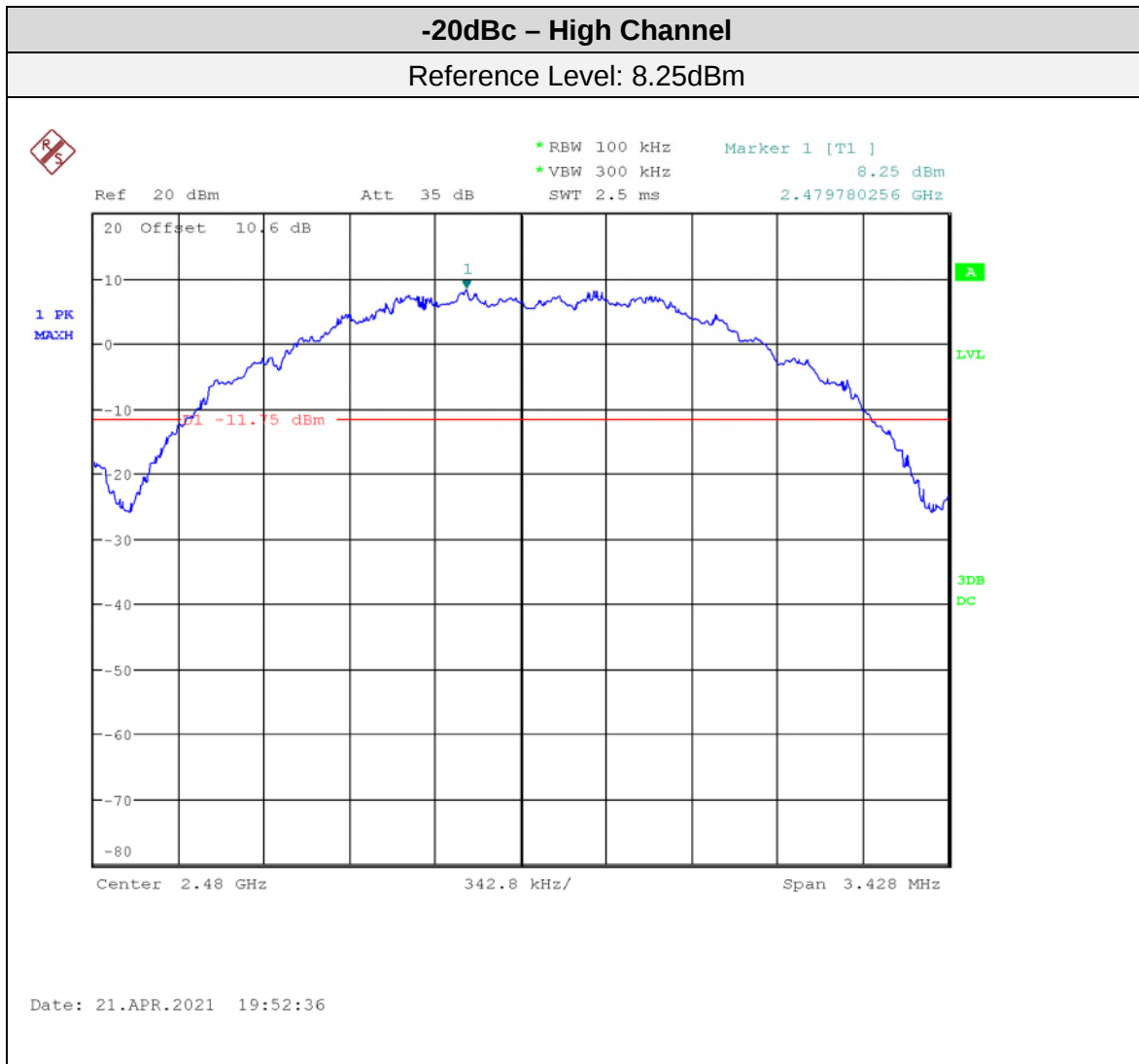
|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



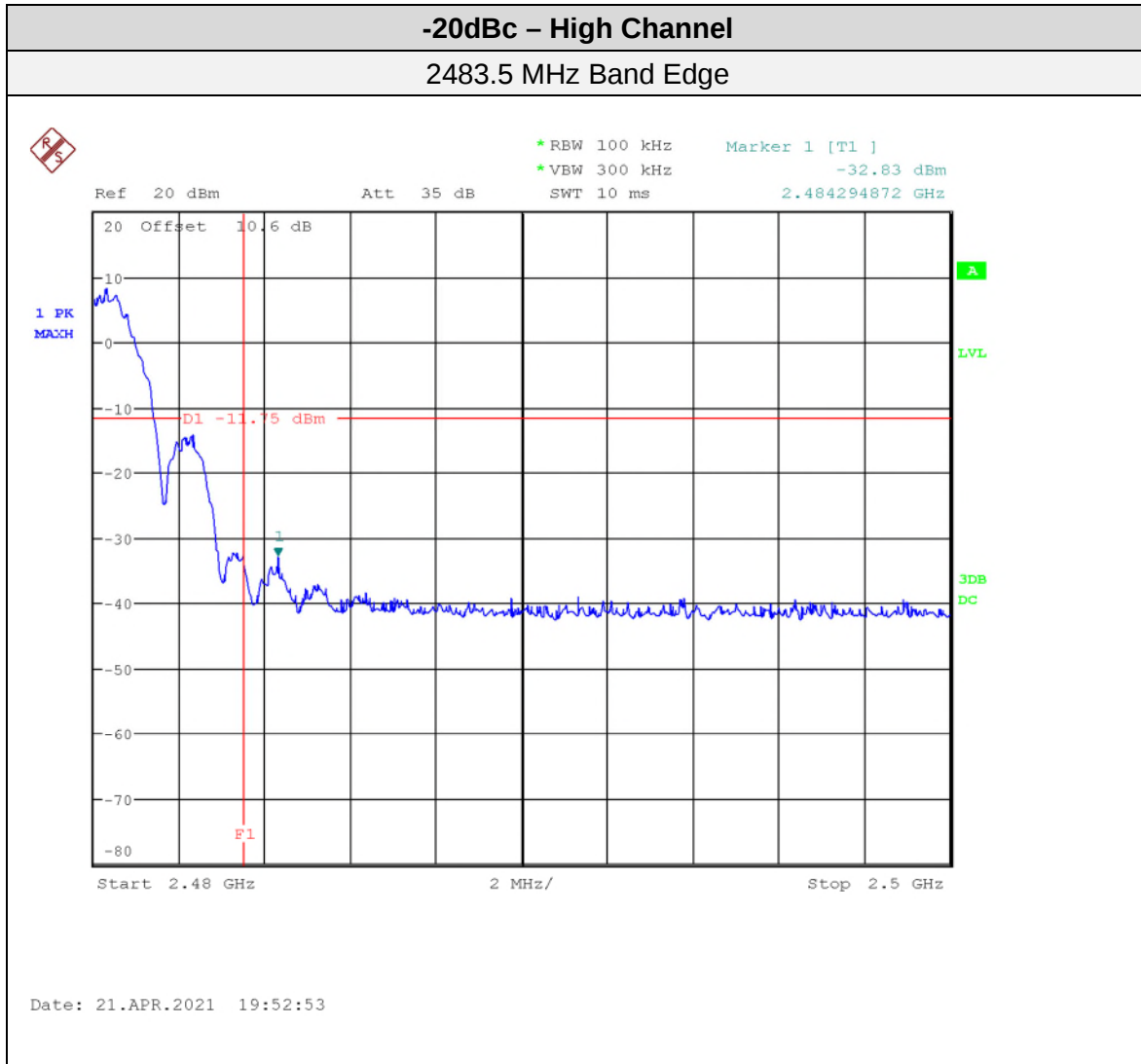
|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



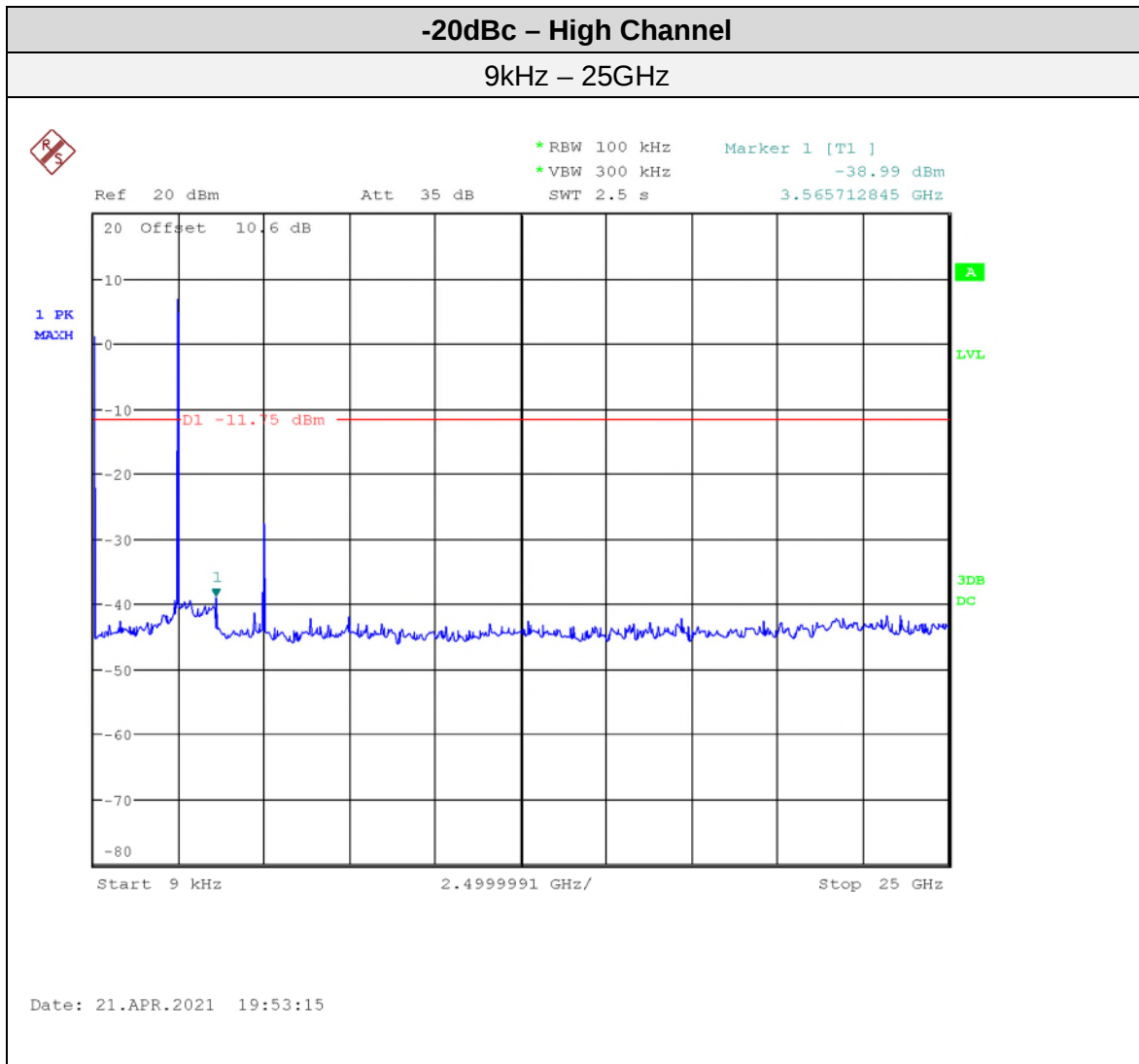
|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

## Test Equipment List

| Equipment           | Model No. | Manufacturer    | Last Calibration Date | Next Calibration Date | Asset #  |
|---------------------|-----------|-----------------|-----------------------|-----------------------|----------|
| Spectrum Analyzer   | ESU 40    | Rohde & Schwarz | Jan. 15, 2020         | Jan. 15, 2022         | GEMC 233 |
| Attenuator<br>10 dB | 8493B     | Agilent         | NCR                   | NCR                   | GEMC 133 |

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## ***Transmitter Spurious Radiated Emissions***

### **Purpose**

The purpose of this test is to ensure that the RF energy unintentionally emitted from the EUT does not exceed the limits listed below as defined in the applicable test standard, as measured from a receiving antenna. This helps protect broadcast radio services such as television, FM radio, pagers, cellular telephones, emergency services, and so on, from unwanted interference.

### **Limits and Method**

The method is as defined in FCC KDB 558074 Section 12.2 and ANSI C63.10.

The limits, as defined in 15.247(d) for unintentional radiated emissions, apply for those emissions that fall in the restricted bands, as defined in Section 15.205(a). These emissions must comply with the radiated emission limits specified in Section 15.209(a).

All unintentional emissions must also meet the ‘Spurious Conducted Emissions’ requirements of -20 dBc or greater. See also ‘Antenna Spurious Conducted Emissions (-20dBc)’ for further details.

| Frequency             | Field Strength Limit<br>( $\mu\text{V/m}$ ) | Field Strength at 3m<br>( $\text{dB}\mu\text{V/m}$ ) |
|-----------------------|---------------------------------------------|------------------------------------------------------|
| 0.009 MHz – 0.490 MHz | 2400/F(kHz) <sup>a</sup> (at 300m)          | 128.5 to 93.8 <sup>a</sup>                           |
| 0.490 MHz – 1.705 MHz | 24000/F(kHz) <sup>a</sup> (at 30m)          | 73.8 to 63.0 <sup>a</sup>                            |
| 1.705 MHz – 30 MHz    | 30 <sup>a</sup> (at 30m)                    | 69.5 <sup>a</sup>                                    |
| 30 MHz – 88 MHz       | 100 <sup>a</sup> (at 3m)                    | 40.0 <sup>a</sup>                                    |
| 88 MHz – 216 MHz      | 150 <sup>a</sup> (at 3m)                    | 43.5 <sup>a</sup>                                    |
| 216 MHz – 960 MHz     | 200 <sup>a</sup> (at 3m)                    | 46.0 <sup>a</sup>                                    |
| Above 960 MHz         | 500 <sup>a</sup> (at 3m)                    | 54.0 <sup>a</sup>                                    |
| Above 1000 MHz        | 500 <sup>b</sup> (at 3m)                    | 54.0 <sup>b</sup>                                    |
| Above 1000 MHz        | 5 mV/m <sup>c</sup> (at 3m)                 | 74.0 <sup>c</sup>                                    |

<sup>a</sup>Limit is with Quasi Peak detector with bandwidths as defined in CISPR-16-1-1

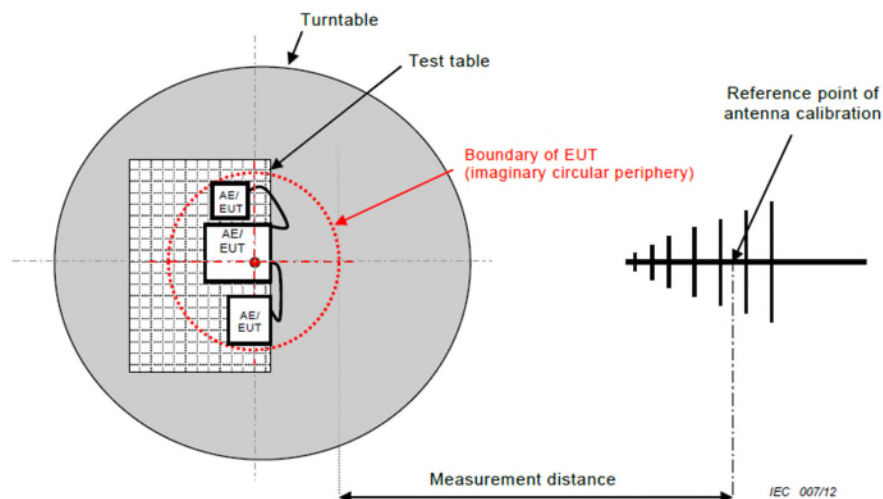
<sup>b</sup>Limit is with 1 MHz measurement bandwidth and using an Average detector

<sup>c</sup>Limit is with 1 MHz measurement bandwidth and using a Peak detector

Based on ANSI C63.4 Section 4.2, if the Peak detector measurements do not exceed the Quasi-Peak limits, where defined, then the EUT is deemed to have passed the requirements.

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

### Typical Radiated Emissions Setup



### Measurement Uncertainty

The expanded measurement uncertainty is calculated in accordance with CISPR 16-4-2 and is  $\pm 5.67\text{dB}$  for 30MHz – 1GHz and  $\pm 4.58\text{dB}$  for 1GHz – 18GHz with a 'k=2' coverage factor and a 95% confidence level.

### Preliminary Graphs

The graphs shown below are maximized peak measurement graphs measured with a resolution bandwidth greater than or equal to the final required detector over a full 0-360°. This peaking process is done as a worst case measurement and enables the detection of frequencies of concern for final measurement. For final measurements with the appropriate detector, where applicable, please refer to the tables under Final Measurements.

In accordance with FCC Part 15, Subpart A, Section 15.33, the device was scanned to the 10<sup>th</sup> harmonic (a minimum of 24.835 GHz).

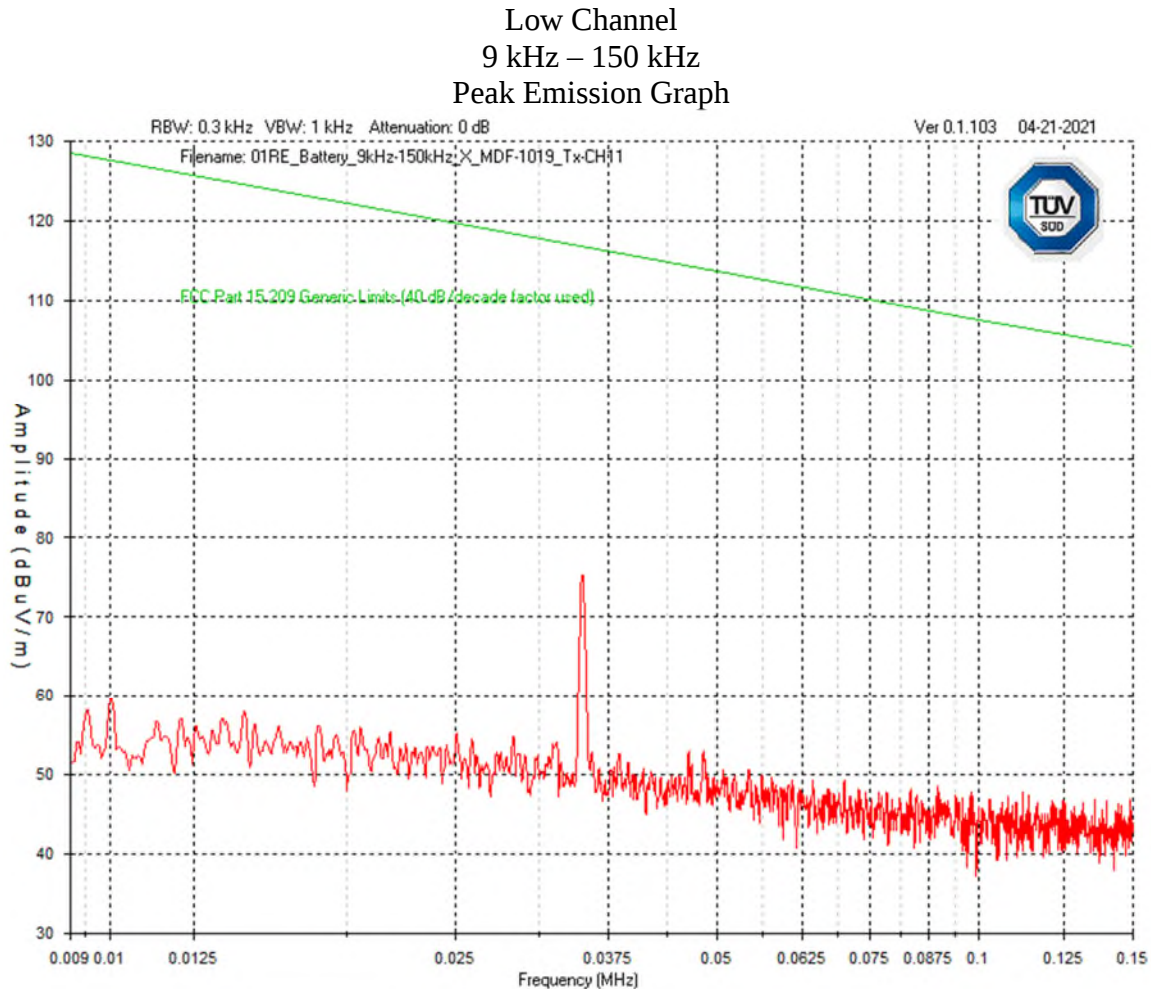
Devices scanned may be scanned at alternate test distances and in accordance with FCC Part 15, Subpart A, Section 15.31, an extrapolation factor of 20 dB/decade was used above 30 MHz and 40 dB/decade below 30 MHz. For example for 1 meter measurements, an extrapolation factor 9.5 dB from 20 Log (1m / 3m) is applied.

Peak output power for three orthogonal axes were checked. The worst case was used for the spurious emissions which was on the low channel and in the X-axis.

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

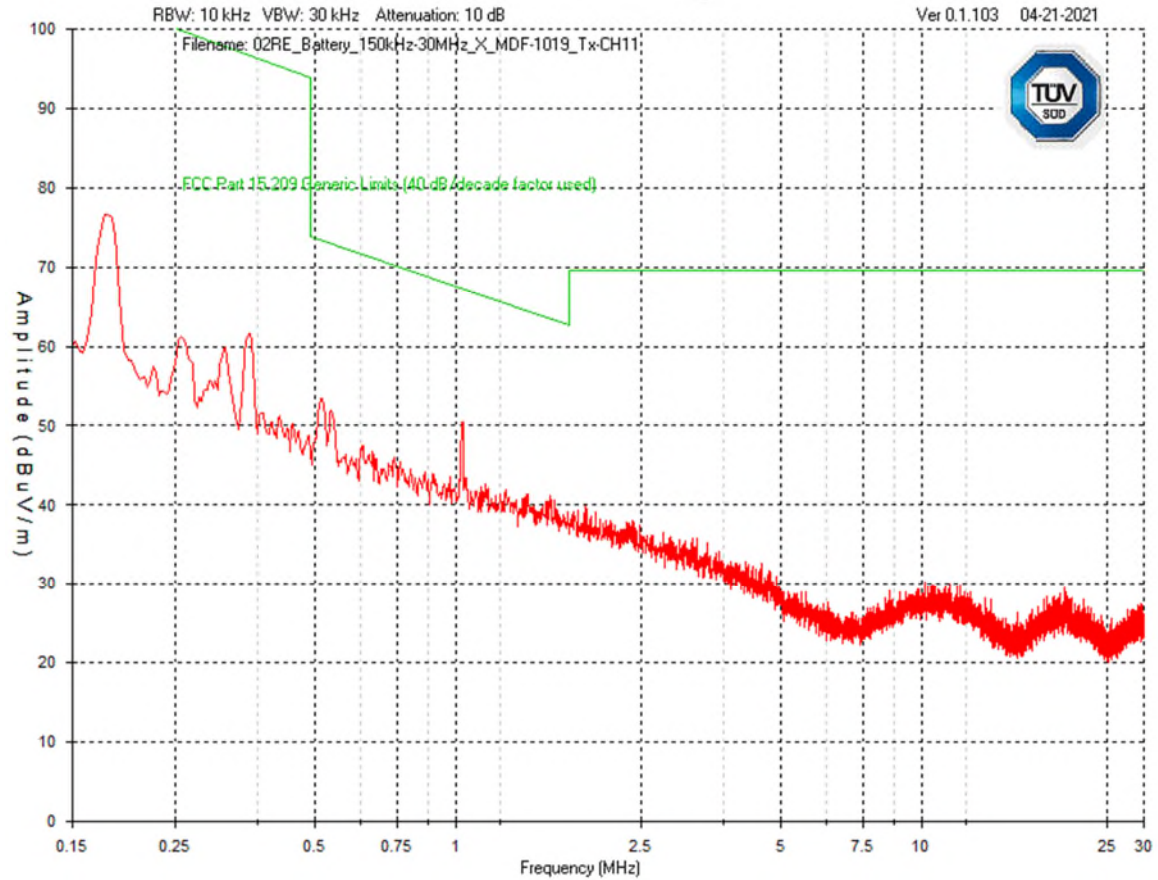
Band-edge measurement graphs are shown for illustration purposes. See final measurement section for all measurements. Graphs for the worst-case, X-axis, are presented.

## Spurious Emissions



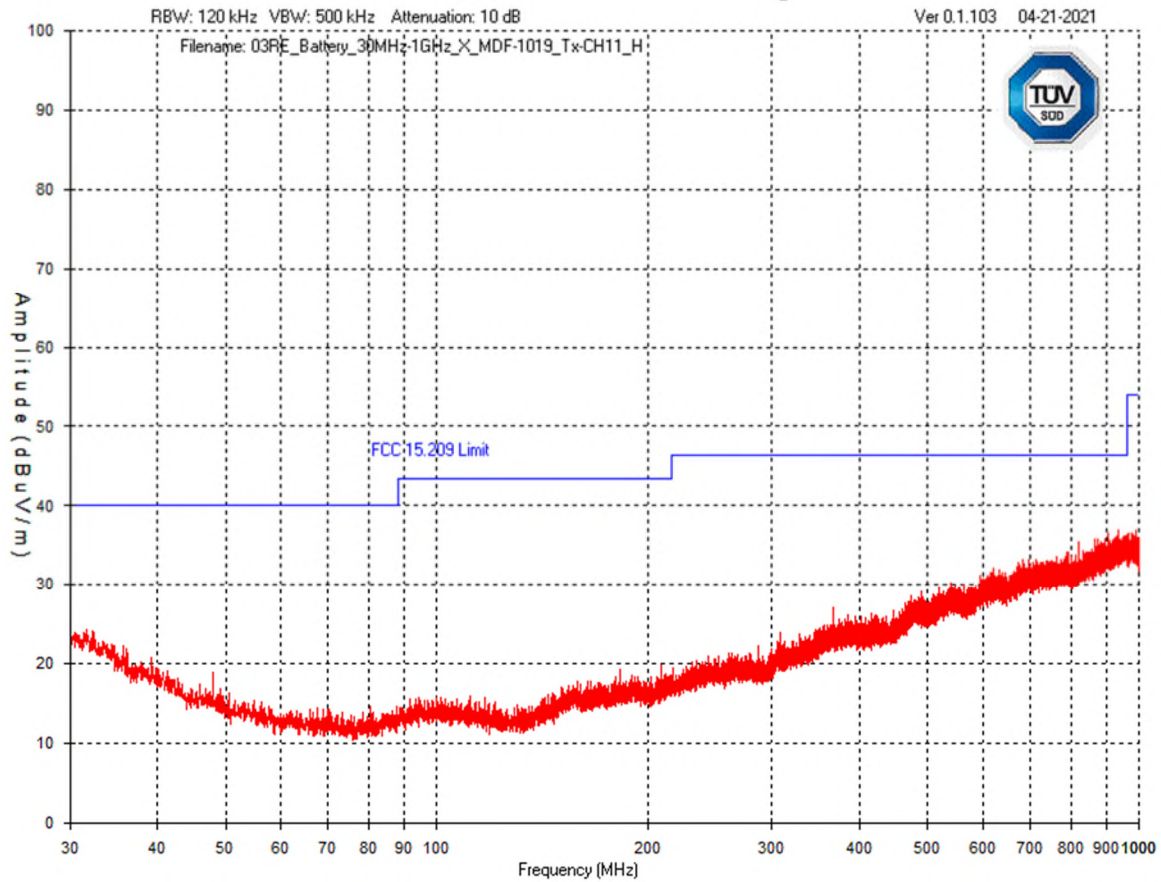
|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

Low Channel  
150 kHz – 30 MHz  
Peak Emission Graph



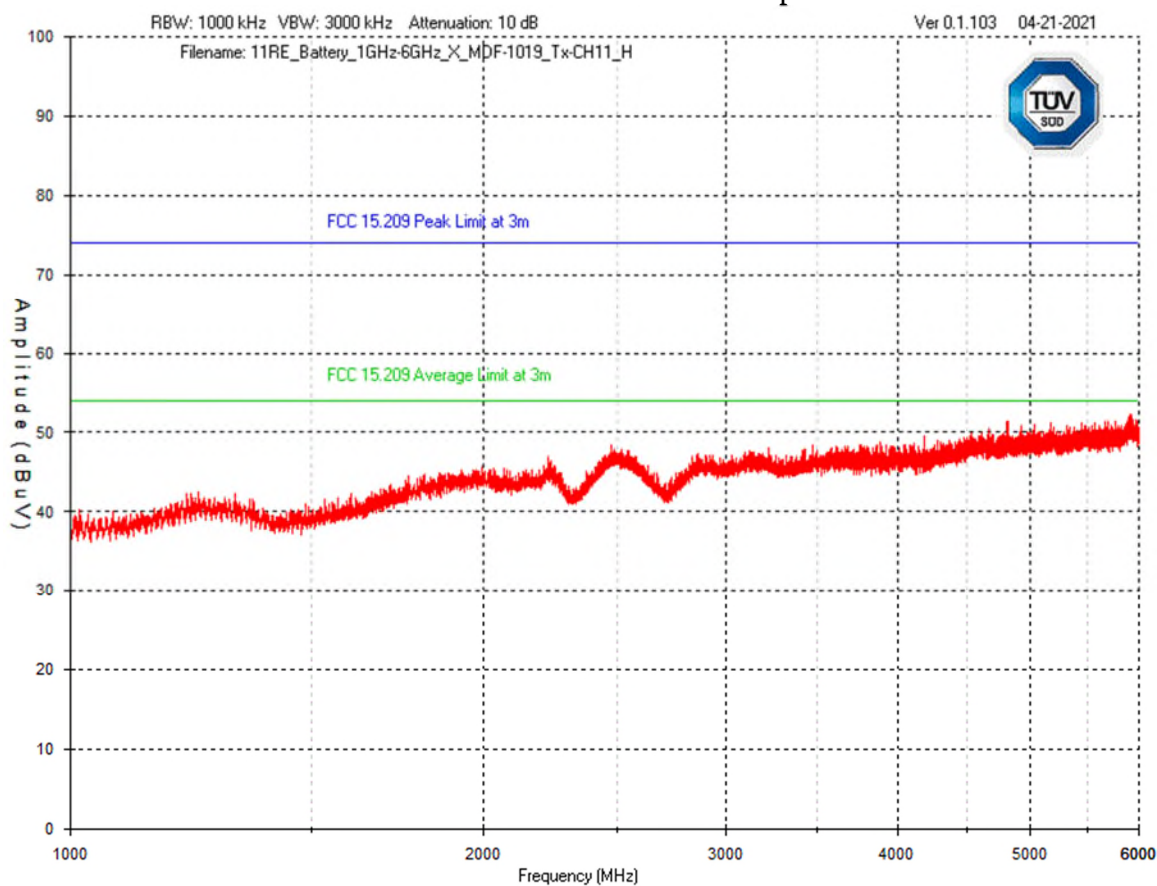
|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

Low Channel – 30 MHz – 1 GHz  
Horizontal - Peak Emission Graph



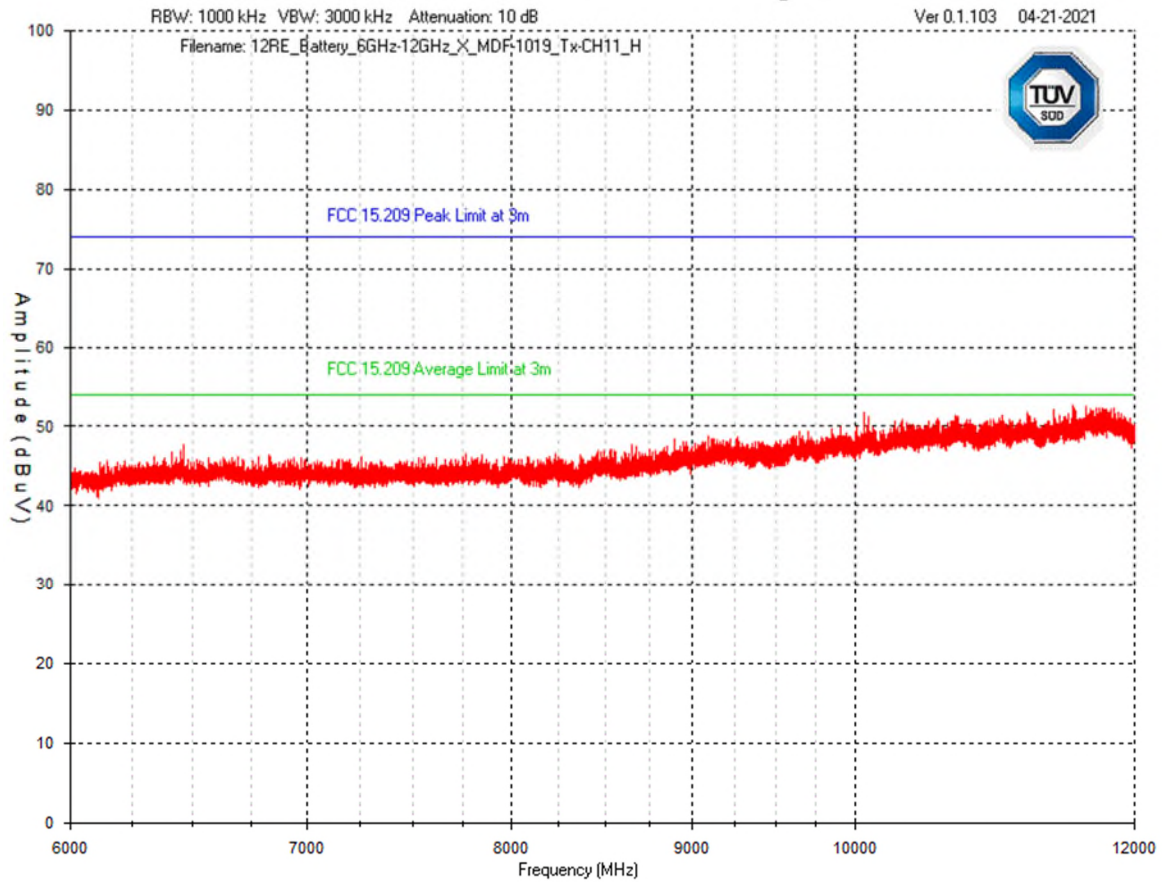
|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

Low Channel – 1 GHz – 6 GHz  
Horizontal - Peak Emission Graph



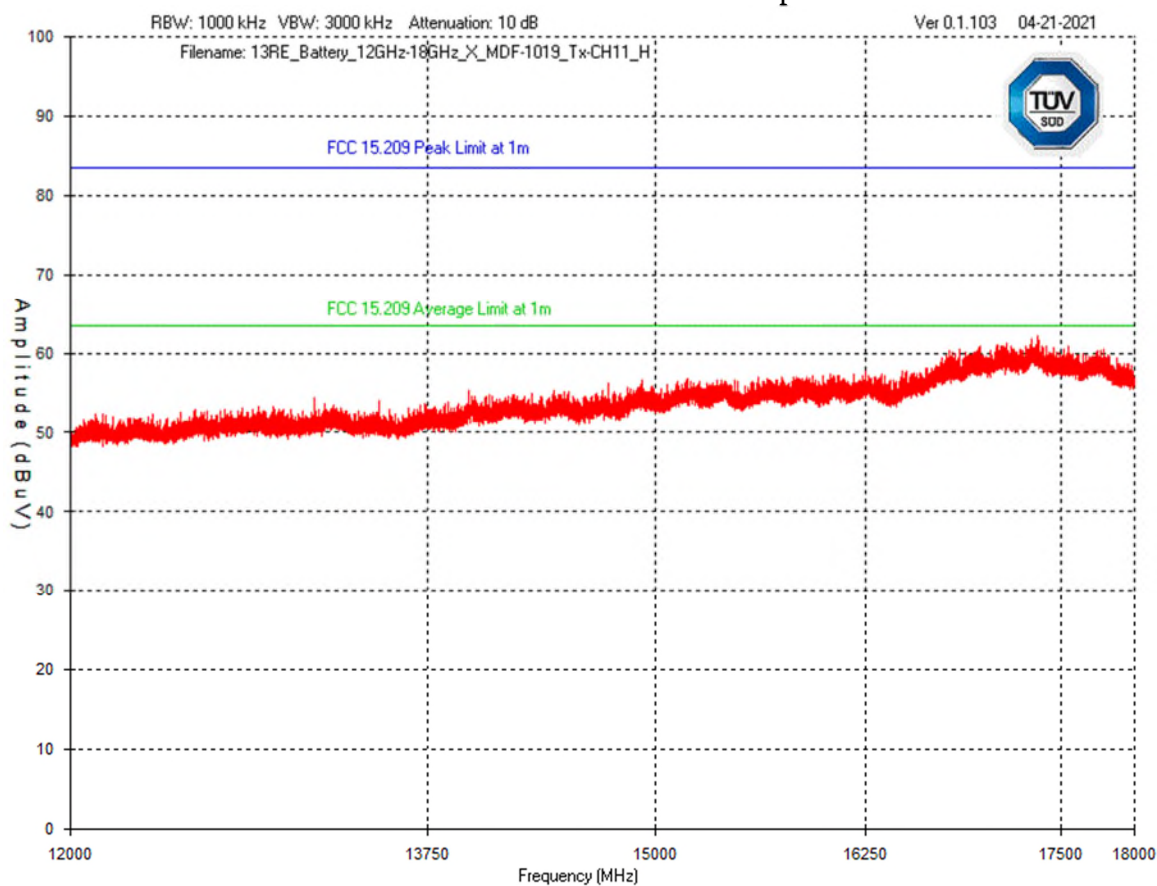
|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

Low Channel – 6 GHz – 12 GHz  
Horizontal - Peak Emission Graph



|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

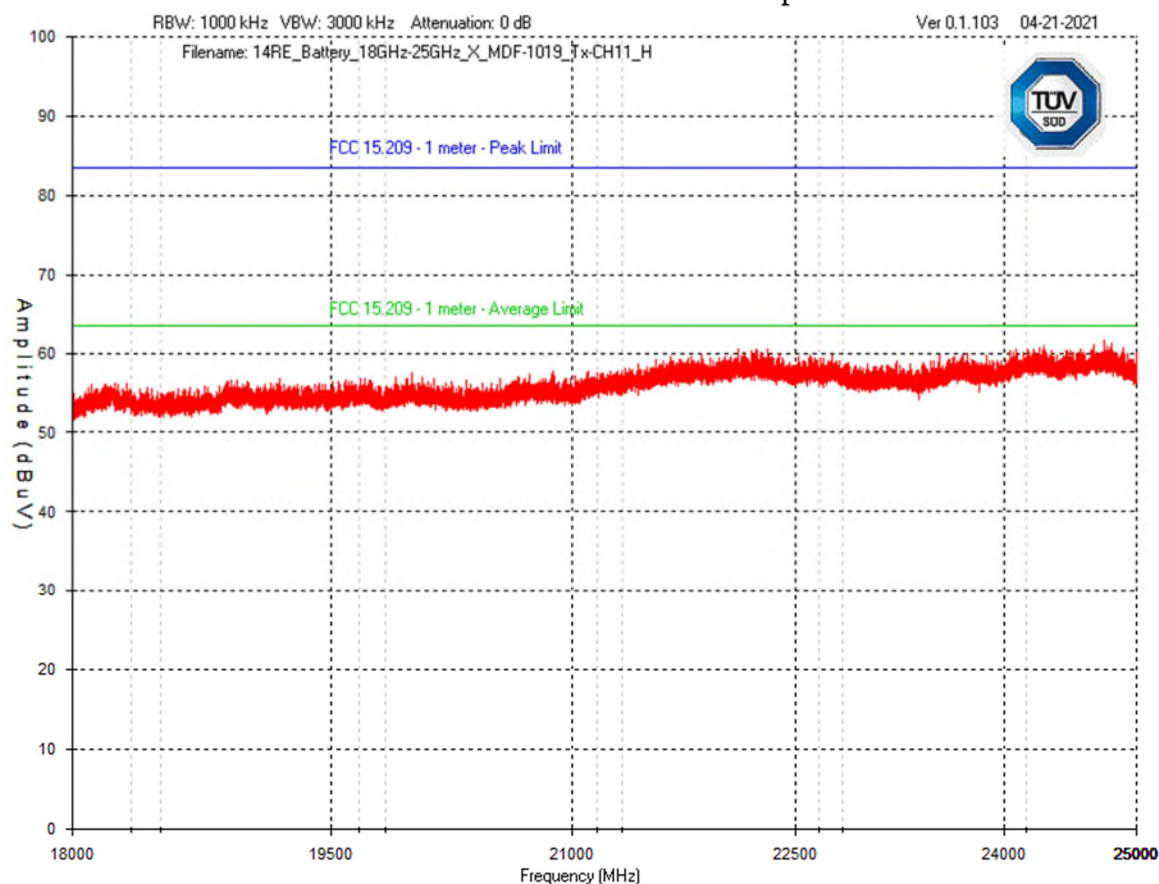
### Low Channel – 12 GHz – 18 GHz Horizontal - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

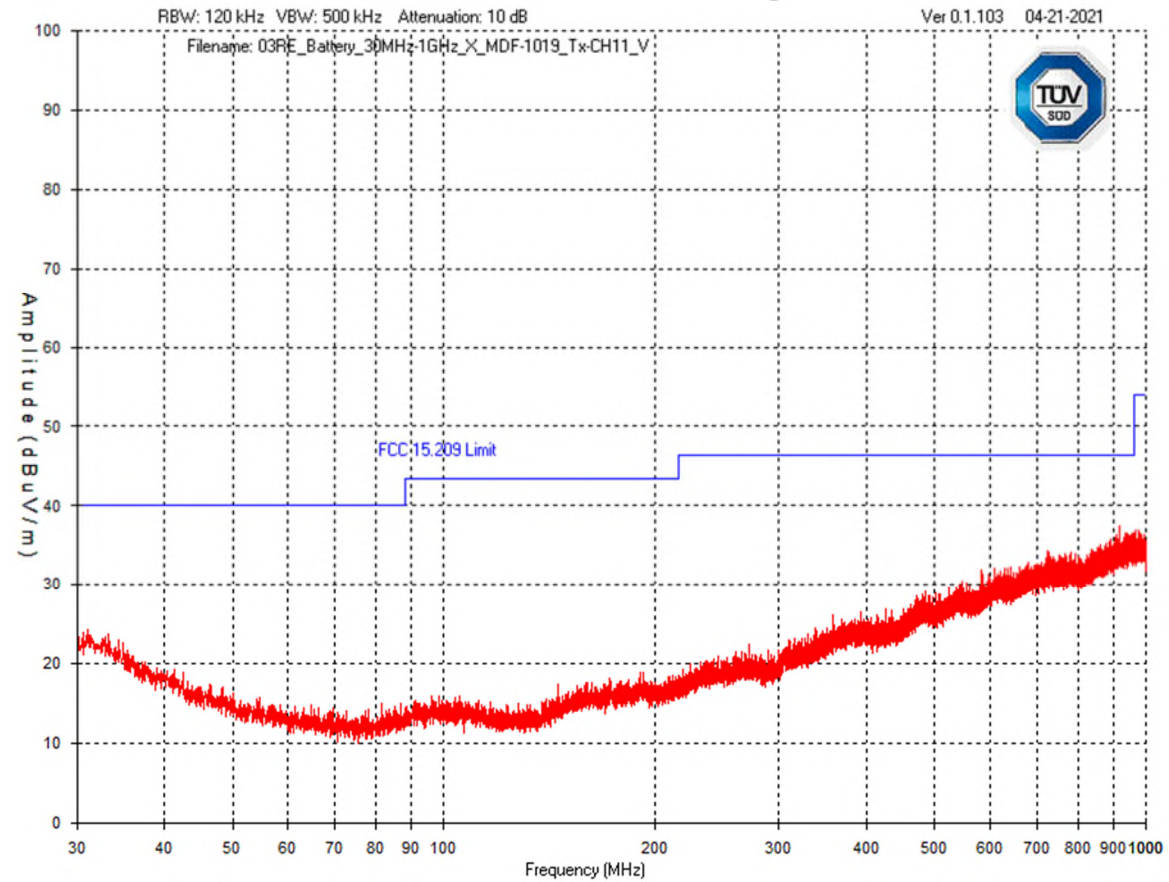
### Low Channel – 18 GHz – 25 GHz Horizontal - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

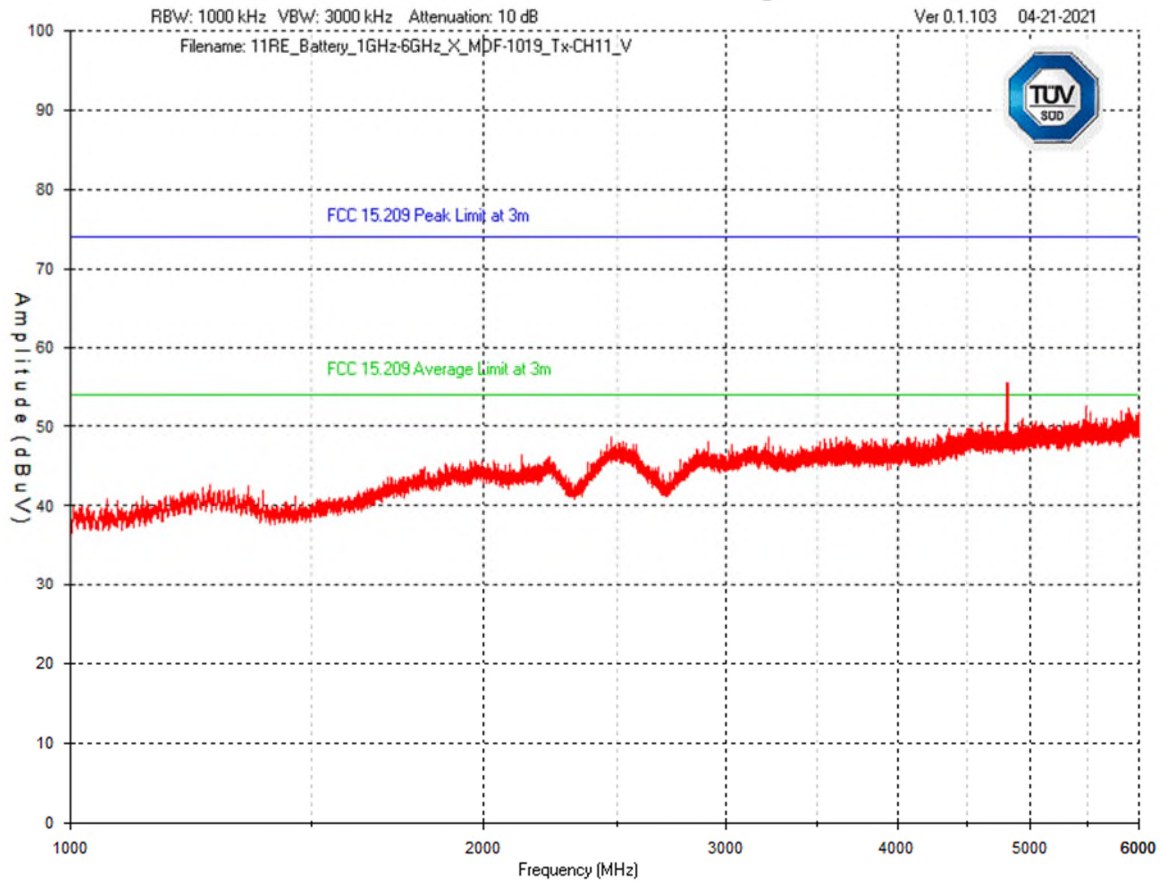
|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

Low Channel – 30 MHz – 1 GHz  
Vertical - Peak Emission Graph



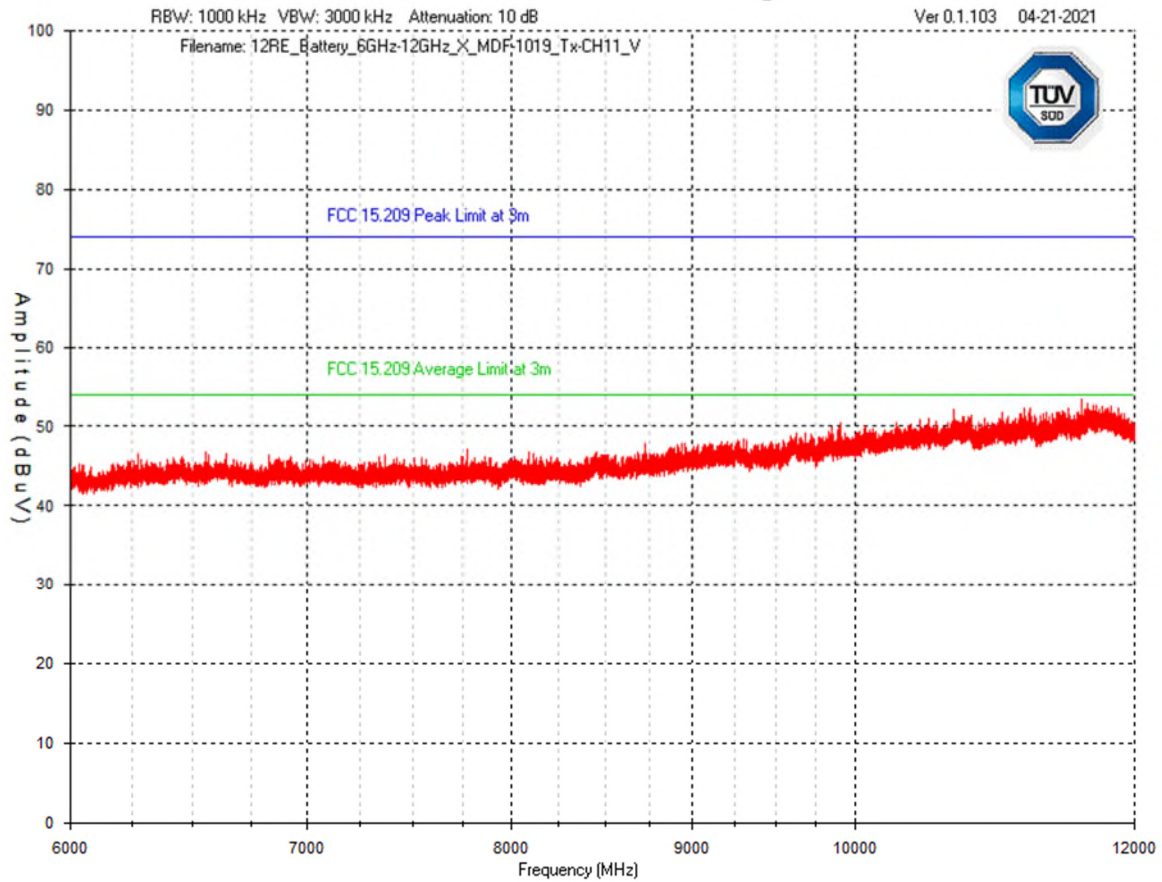
|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

Low Channel – 1 GHz – 6 GHz  
Vertical - Peak Emission Graph



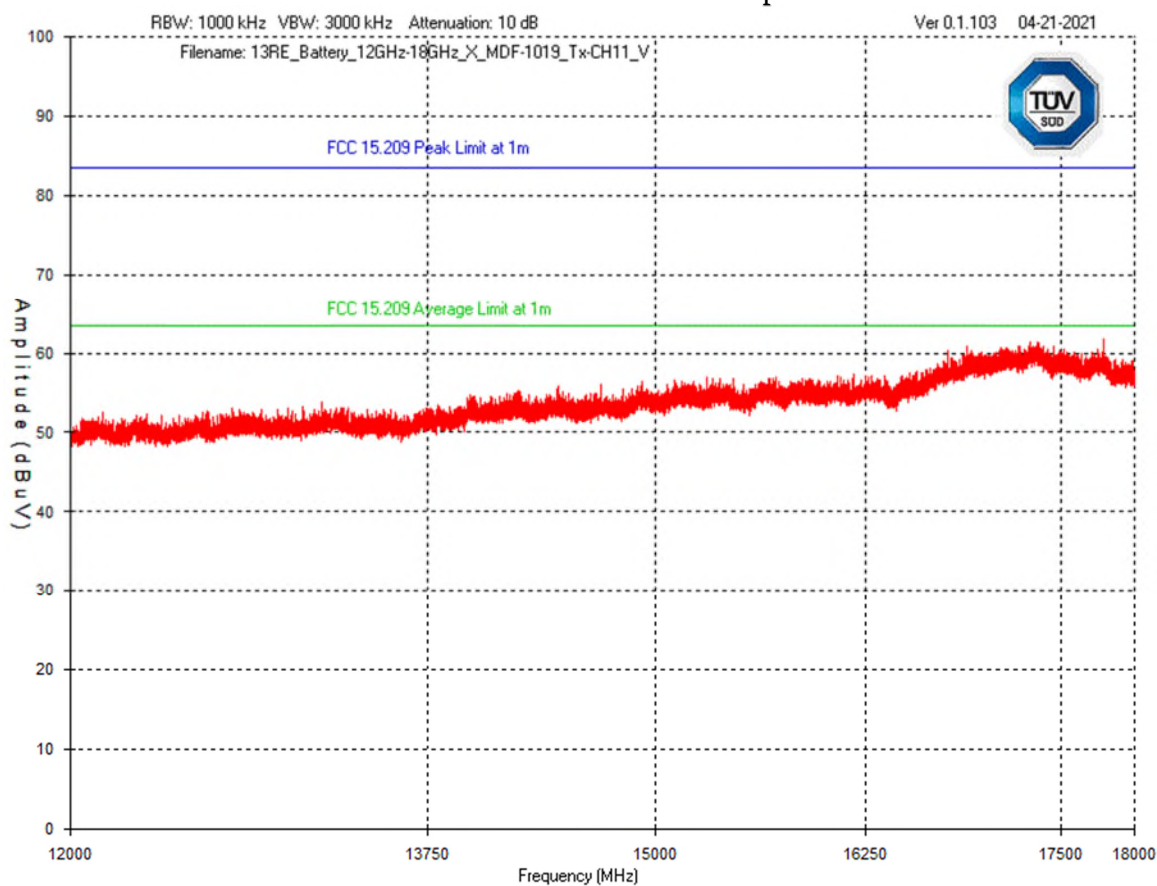
|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

Low Channel – 6 GHz – 12 GHz  
Vertical - Peak Emission Graph



|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

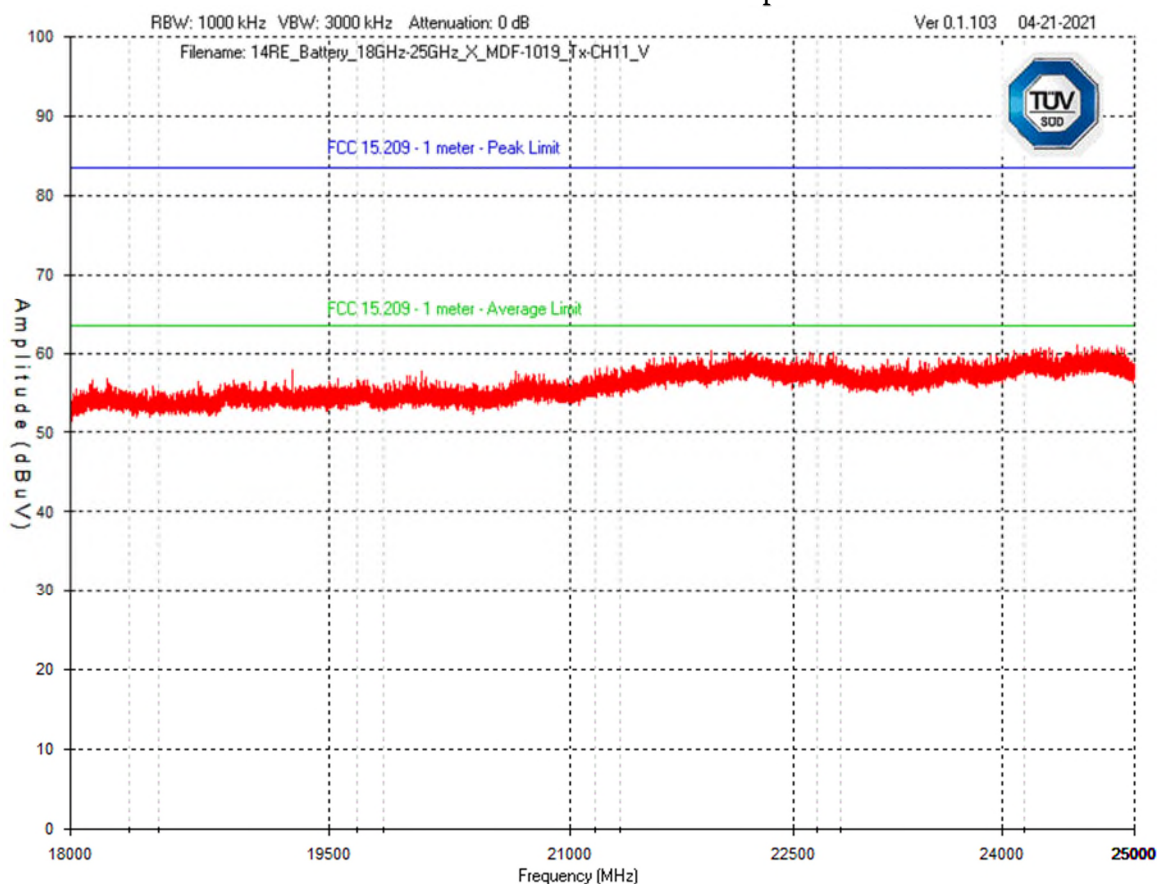
Low Channel – 12 GHz – 18 GHz  
Vertical - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

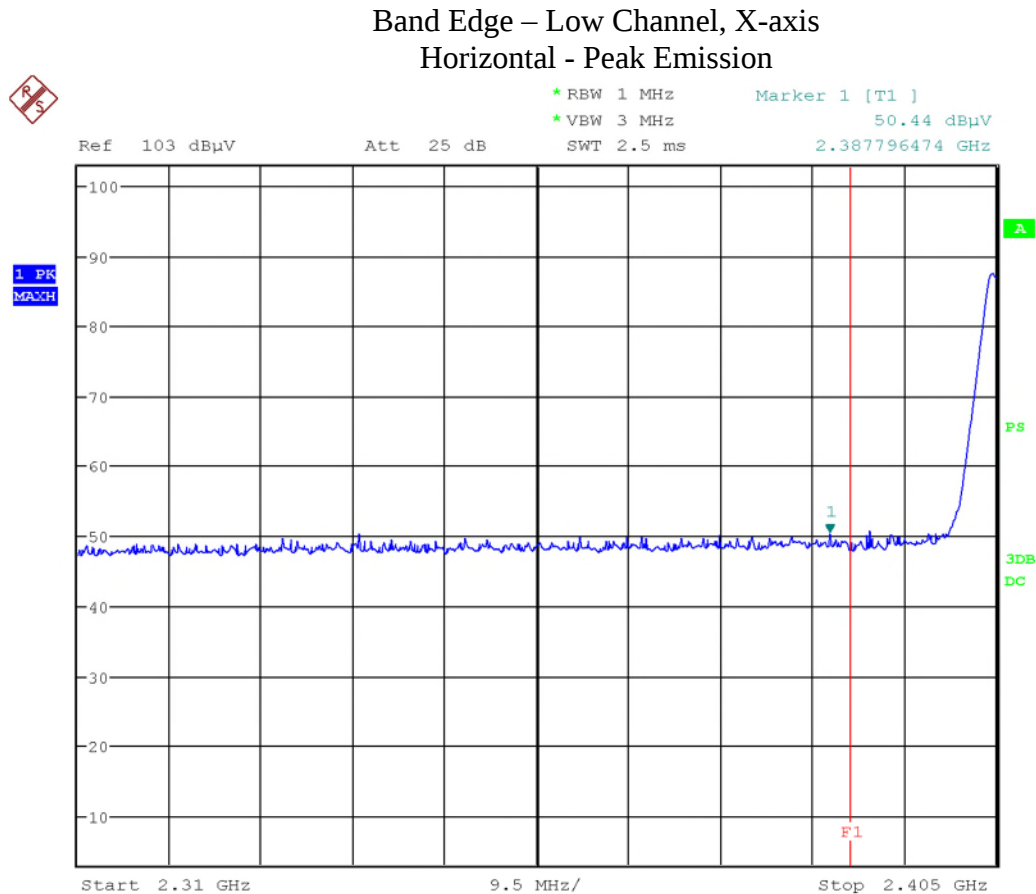
Low Channel – 18 GHz – 25 GHz  
Vertical - Peak Emission Graph



Plot was taken at a 1 meter distance. All emissions were noise floor of measurement instrument. No emissions were found in this frequency range.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Band Edges

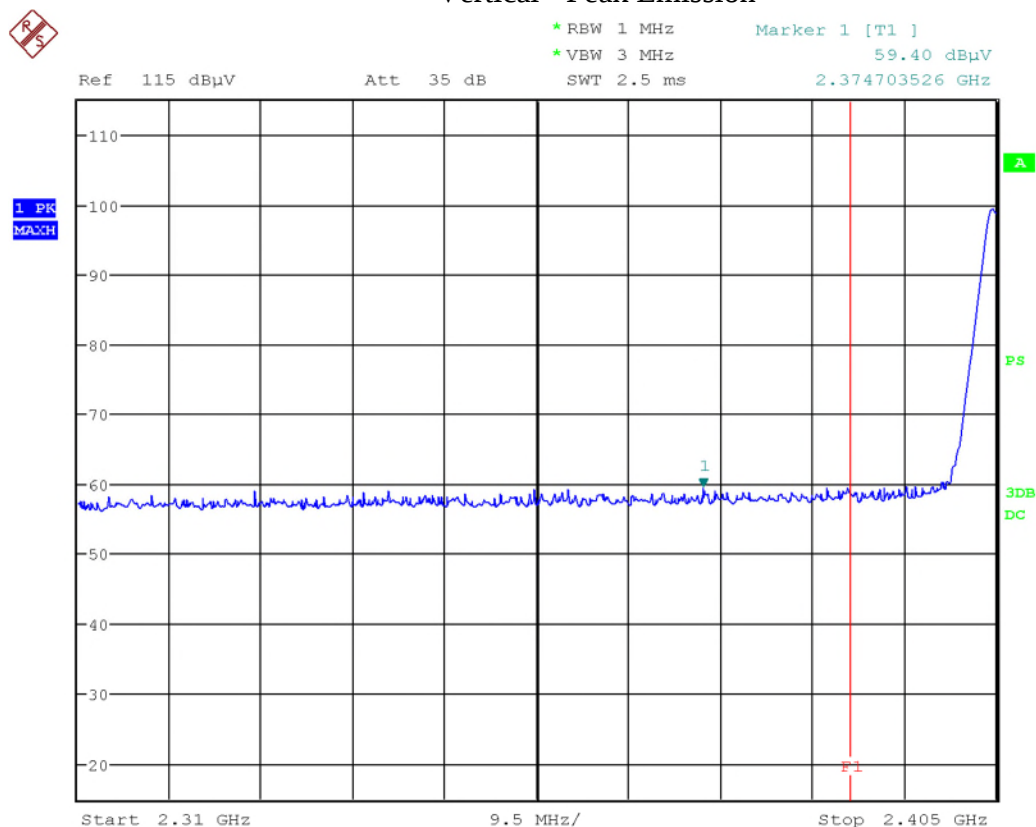


Date: 21.APR.2021 16:06:42

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           |  |
| Product     | MDF-1019                                           |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

### Band Edge – Low Channel, X-axis Vertical - Peak Emission

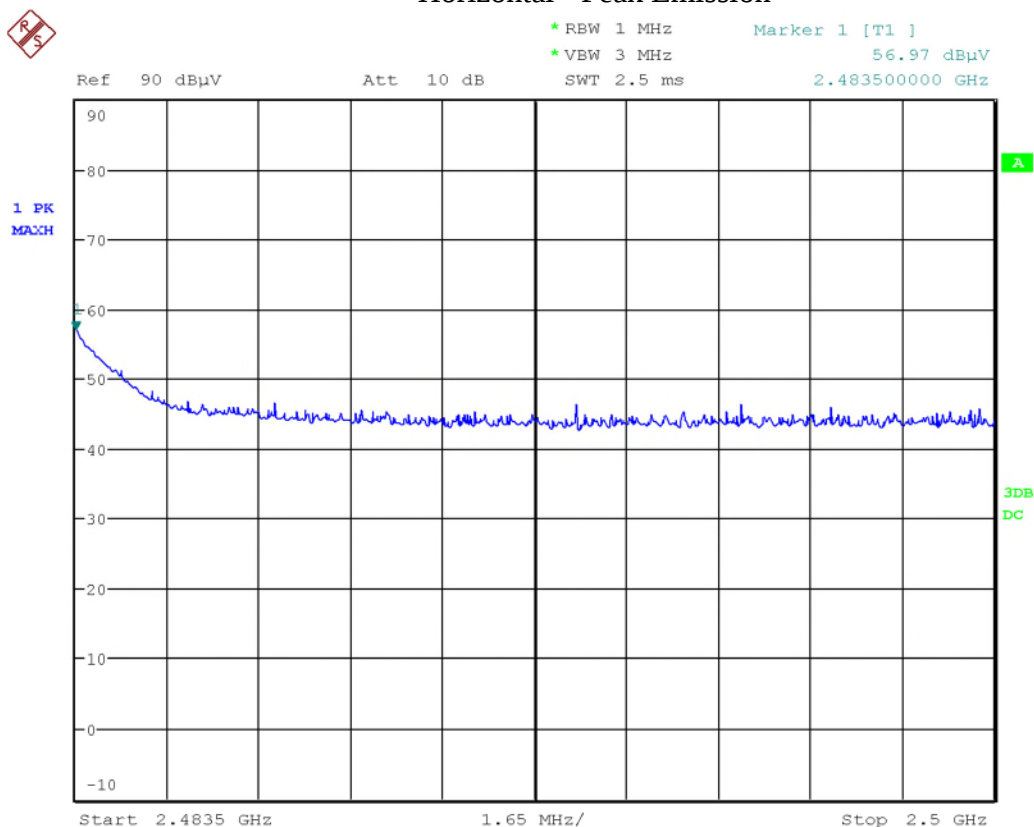


Date: 21.APR.2021 16:01:45

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

### Band Edge – High Channel, X-axis Horizontal - Peak Emission

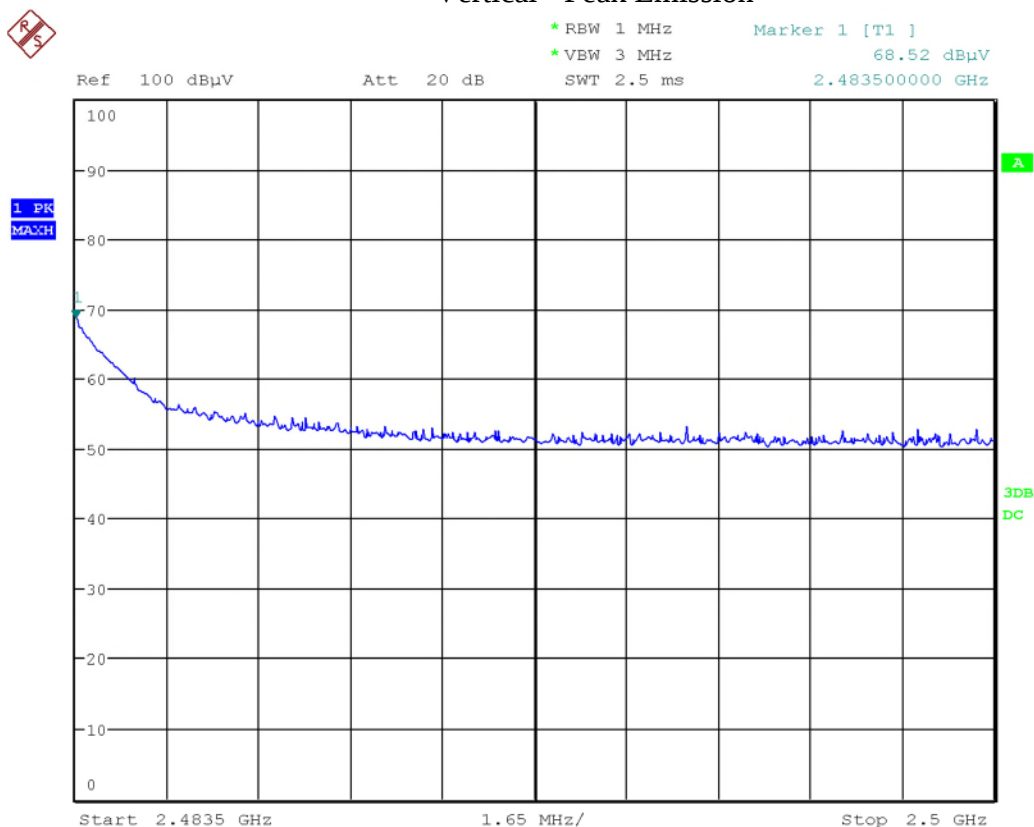


Date: 21.APR.2021 15:19:54

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

### Band Edge – High Channel, X-axis Vertical - Peak Emission



Date: 21.APR.2021 15:06:46

Note: Restricted band Band Edge plot was taken at a 3m measurement distance. The marker shows the raw value. See the Final Measurements and Results section below for correct values.

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Final Measurements and Results

The EUT passed. Low, middle, and high bands were measured.

In accordance with 15.247(d), only frequencies exceeding the 15.209 limit that occur within the bands listed in 15.205 need to be verified with a final detector.

The measurements were maximized by rotating the turn table over a full 0-360 rotation and the antenna height was varied from 1 m to 4 m.

The EUT has a fixed (source based) duty cycle of 13% (13ms on time/100ms) which cannot be changed or modified by either the device or the end user. As per KDB 558074 section 12.2.5.2, for the average radiated emission measurements of the band edges and of the spurious emissions in the restricted bands, a duty cycle correction factor of 13% [ $20\log(13\%) = -17.72$ ] was applied to the peak measurement to obtain the average measurement.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

| Test Frequency (MHz)                       | Detection Mode | Antenna Polarity (Horz/Vert) | Received Signal (dBμV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-Amp Gain (dB) | Level (dBμV/m) | Emission Limit (dBμV/m) | Margin (dB) | Result |
|--------------------------------------------|----------------|------------------------------|------------------------|-----------------------|-------------------|-------------------|----------------|-------------------------|-------------|--------|
| Low Channel                                |                |                              |                        |                       |                   |                   |                |                         |             |        |
| X axis (vertically positioned, antenna up) |                |                              |                        |                       |                   |                   |                |                         |             |        |
| 2405                                       | Peak           | Horz                         | 87.7                   | 32.0                  | 4.7               | -34.0             | 90.4           |                         |             | PASS   |
| 2405                                       | Avg            | Horz                         | 85.4                   | 32.0                  | 4.7               | -34.0             | 88.1           |                         |             | PASS   |
| 2405                                       | Peak           | Vert                         | 99.4                   | 32.0                  | 4.7               | -34.0             | 102.0          |                         |             | PASS   |
| 2405                                       | Avg            | Vert                         | 97.1                   | 32.0                  | 4.7               | -34.0             | 99.7           |                         |             | PASS   |
| 2387.8                                     | Peak           | Horz                         | 50.4                   | 32.0                  | 4.7               | -34.1             | 53.0           | 74.0                    | 21.0        | PASS   |
| 2387.8                                     | Avg            | Horz                         | 32.7                   | 32.0                  | 4.7               | -34.1             | 35.3           | 54.0                    | 18.7        | PASS   |
| 2374.7                                     | Peak           | Vert                         | 59.4                   | 32.0                  | 4.6               | -34.1             | 61.9           | 74.0                    | 12.1        | PASS   |
| 2374.7                                     | Avg            | Vert                         | 41.7                   | 32.0                  | 4.6               | -34.1             | 44.2           | 54.0                    | 9.8         | PASS   |
| 2496.7                                     | Peak           | Horz                         | 44.7                   | 32.2                  | 4.7               | -33.7             | 47.9           | 74.0                    | 26.1        | PASS   |
| 2496.7                                     | Avg            | Horz                         | 27.0                   | 32.2                  | 4.7               | -33.7             | 30.2           | 54.0                    | 23.8        | PASS   |
| 2495.4                                     | Peak           | Vert                         | 45.6                   | 32.2                  | 4.7               | -33.7             | 48.8           | 74.0                    | 25.2        | PASS   |
| 2495.4                                     | Avg            | Vert                         | 27.8                   | 32.2                  | 4.7               | -33.7             | 31.0           | 54.0                    | 23.0        | PASS   |
| 4810                                       | Peak           | Horz                         | 44.1                   | 34.2                  | 7.0               | -32.5             | 52.8           | 74.0                    | 21.2        | PASS   |
| 4810                                       | Avg            | Horz                         | 26.4                   | 34.2                  | 7.0               | -32.5             | 35.1           | 54.0                    | 18.9        | PASS   |
| 4810                                       | Peak           | Vert                         | 47.7                   | 34.2                  | 7.0               | -32.5             | 56.4           | 74.0                    | 17.6        | PASS   |
| 4810                                       | Avg            | Vert                         | 30.0                   | 34.2                  | 7.0               | -32.5             | 38.7           | 54.0                    | 15.3        | PASS   |
| 7215                                       | Peak           | Horz                         | 40.8                   | 35.7                  | 8.7               | -32.9             | 52.2           | 74.0                    | 21.8        | PASS   |
| 7215                                       | Avg            | Horz                         | 23.0                   | 35.7                  | 8.7               | -32.9             | 34.5           | 54.0                    | 19.5        | PASS   |
| 7215                                       | Peak           | Vert                         | 40.4                   | 35.7                  | 8.7               | -32.9             | 51.9           | 74.0                    | 22.1        | PASS   |
| 7215                                       | Avg            | Vert                         | 22.7                   | 35.7                  | 8.7               | -32.9             | 34.2           | 54.0                    | 19.8        | PASS   |
| Mid Channel                                |                |                              |                        |                       |                   |                   |                |                         |             |        |
| X axis (vertically positioned, antenna up) |                |                              |                        |                       |                   |                   |                |                         |             |        |
| 2440                                       | Peak           | Horz                         | 86.9                   | 32.2                  | 4.7               | -33.9             | 89.9           |                         |             | PASS   |
| 2440                                       | Avg            | Horz                         | 84.5                   | 32.2                  | 4.7               | -33.9             | 87.5           |                         |             | PASS   |
| 2440                                       | Peak           | Vert                         | 98.0                   | 32.2                  | 4.7               | -33.9             | 101.0          |                         |             | PASS   |
| 2440                                       | Avg            | Vert                         | 95.7                   | 32.2                  | 4.7               | -33.9             | 98.7           |                         |             | PASS   |
| High Channel                               |                |                              |                        |                       |                   |                   |                |                         |             |        |
| X axis (vertically positioned, antenna up) |                |                              |                        |                       |                   |                   |                |                         |             |        |
| 2480                                       | Peak           | Horz                         | 86.6                   | 32.2                  | 4.7               | -33.8             | 89.8           |                         |             | PASS   |
| 2480                                       | Avg            | Horz                         | 84.2                   | 32.2                  | 4.7               | -33.8             | 87.4           |                         |             | PASS   |
| 2480                                       | Peak           | Vert                         | 98.1                   | 32.2                  | 4.7               | -33.8             | 101.2          |                         |             | PASS   |
| 2480                                       | Avg            | Vert                         | 95.7                   | 32.2                  | 4.7               | -33.8             | 98.8           |                         |             | PASS   |
| 2388.6                                     | Peak           | Horz                         | 46.5                   | 32.0                  | 4.7               | -34.1             | 49.1           | 74.0                    | 24.9        | PASS   |
| 2388.6                                     | Avg            | Horz                         | 28.8                   | 32.0                  | 4.7               | -34.1             | 31.3           | 54.0                    | 22.7        | PASS   |
| 2386                                       | Peak           | Vert                         | 51.8                   | 32.0                  | 4.7               | -34.1             | 54.3           | 74.0                    | 19.7        | PASS   |
| 2386                                       | Avg            | Vert                         | 34.1                   | 32.0                  | 4.7               | -34.1             | 36.6           | 54.0                    | 17.4        | PASS   |
| 2483.5                                     | Peak           | Horz                         | 57.0                   | 32.2                  | 4.7               | -33.8             | 60.1           | 74.0                    | 13.9        | PASS   |
| 2483.5                                     | Avg            | Horz                         | 39.2                   | 32.2                  | 4.7               | -33.8             | 42.4           | 54.0                    | 11.6        | PASS   |
| 2483.5                                     | Peak           | Vert                         | 68.5                   | 32.2                  | 4.7               | -33.8             | 71.7           | 74.0                    | 2.3         | PASS   |
| 2483.5                                     | Avg            | Vert                         | 50.8                   | 32.2                  | 4.7               | -33.8             | 54.0           | 54.0                    | 0.0         | PASS   |

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## Test Equipment List

| Equipment                     | Model No.                 | Manufacturer            | Last Calibration Date | Next Calibration Date | Asset #   |
|-------------------------------|---------------------------|-------------------------|-----------------------|-----------------------|-----------|
| Spectrum Analyzer             | ESU 40                    | Rohde & Schwarz         | Jan. 15, 2020         | Jan. 15, 2022         | GEMC 233  |
| Loop Antenna                  | EM 6871                   | Electro-Metrics         | Feb 26, 2021          | Feb 26, 2023          | GEMC 70   |
| Loop Antenna                  | EM 6872                   | Electro-Metrics         | Feb 26, 2021          | Feb 26, 2023          | GEMC 71   |
| BiLog Antenna                 | 3142-C                    | ETS-Lindgren            | Nov. 25, 2020         | Nov. 25, 2022         | GEMC 8    |
| Horn Antenna<br>1 – 6 GHz     | 3117                      | ETS-Lindgren            | Feb. 17, 2020         | Feb. 17, 2022         | GEMC 340  |
| Horn Antenna<br>6 – 18 GHz    | WBH218HN                  | Q-par                   | Apr. 1, 2020          | Apr. 1, 2022          | GEMC 6375 |
| Horn Antenna<br>18 - 26.5 GHz | SAS-572                   | A.H. Systems            | Oct. 23, 2018         | Oct. 23, 2020         | GEMC 6371 |
| Attenuator 6 dB               | 6N5W-06                   | Inmet                   | NCR                   | NCR                   | GEMC 345  |
| Pre-Amp<br>9 kHz – 1 GHz      | LNA 6901                  | Teseq                   | Feb. 12, 2021         | Feb. 12, 2023         | GEMC 168  |
| Pre-Amp<br>1 – 26.5 GHz       | HP 8449B                  | HP                      | Dec. 20, 2019         | Dec. 20, 2021         | GEMC 189  |
| 2.4GHz-2.5GHz<br>Notch Filter | BRM50702                  | Micro-Tronics           | NCR                   | NCR                   | GEMC 230  |
| RF Cable 10m                  | LMR-400-10M-<br>50Ω-MN-MN | LexTec                  | NCR                   | NCR                   | GEMC 274  |
| RF Cable 2m                   | Sucoflex 104A             | Huber+Suhner            | NCR                   | NCR                   | GEMC 271  |
| RF Cable                      | TM18                      | MegaPhase               | NCR                   | NCR                   | GEMC 366  |
| RF Cable                      | Micro-Coax                | Utiflex                 | NCR                   | NCR                   | GEMC 344  |
| Emissions<br>Software         | 0.1.103                   | TUV SUD<br>Canada, Inc. | NCR                   | NCR                   | GEMC 58   |

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

## ***Power Spectral Density***

### **Purpose**

The purpose of this test is to ensure that the maximum power spectral density to the radiating element does not exceed the limits specified. This ensures that the modulation is significantly wide enough, or low enough in power that it will allow for co-operation of other wireless devices operating within this frequency allocation.

### **Limits and Method**

The limits are defined in 15.247(e) and RSS-247 5.2(b).

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

The method is given in FCC KDB 558074 Section 10.2.

### **Results**

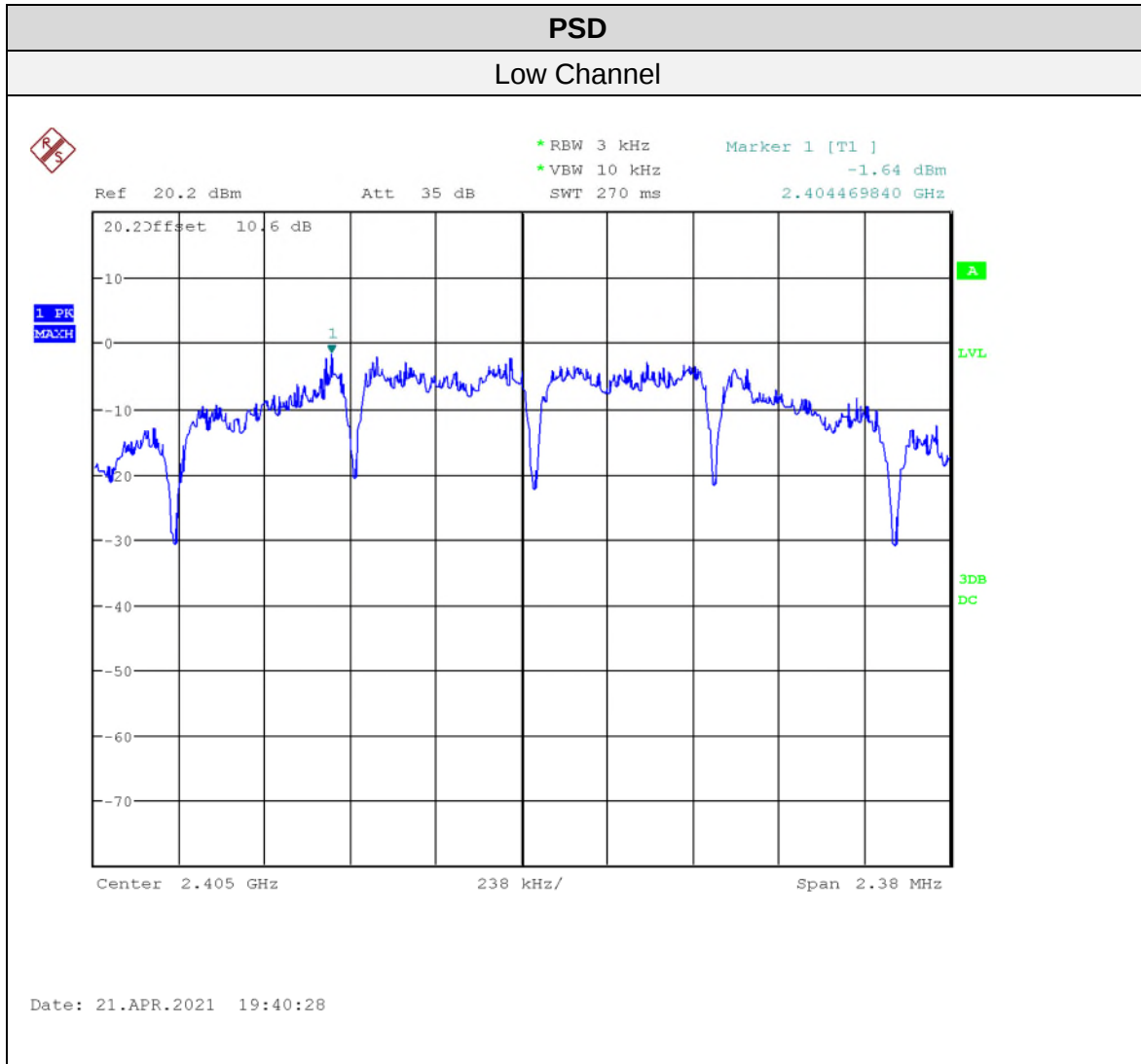
The EUT passed. Low, middle and high bands were measured.

| Channel | Frequency (MHz) | PSD (dBm) |
|---------|-----------------|-----------|
| Low     | 2405            | -1.64     |
| Mid     | 2440            | -1.74     |
| High    | 2480            | -3.99     |

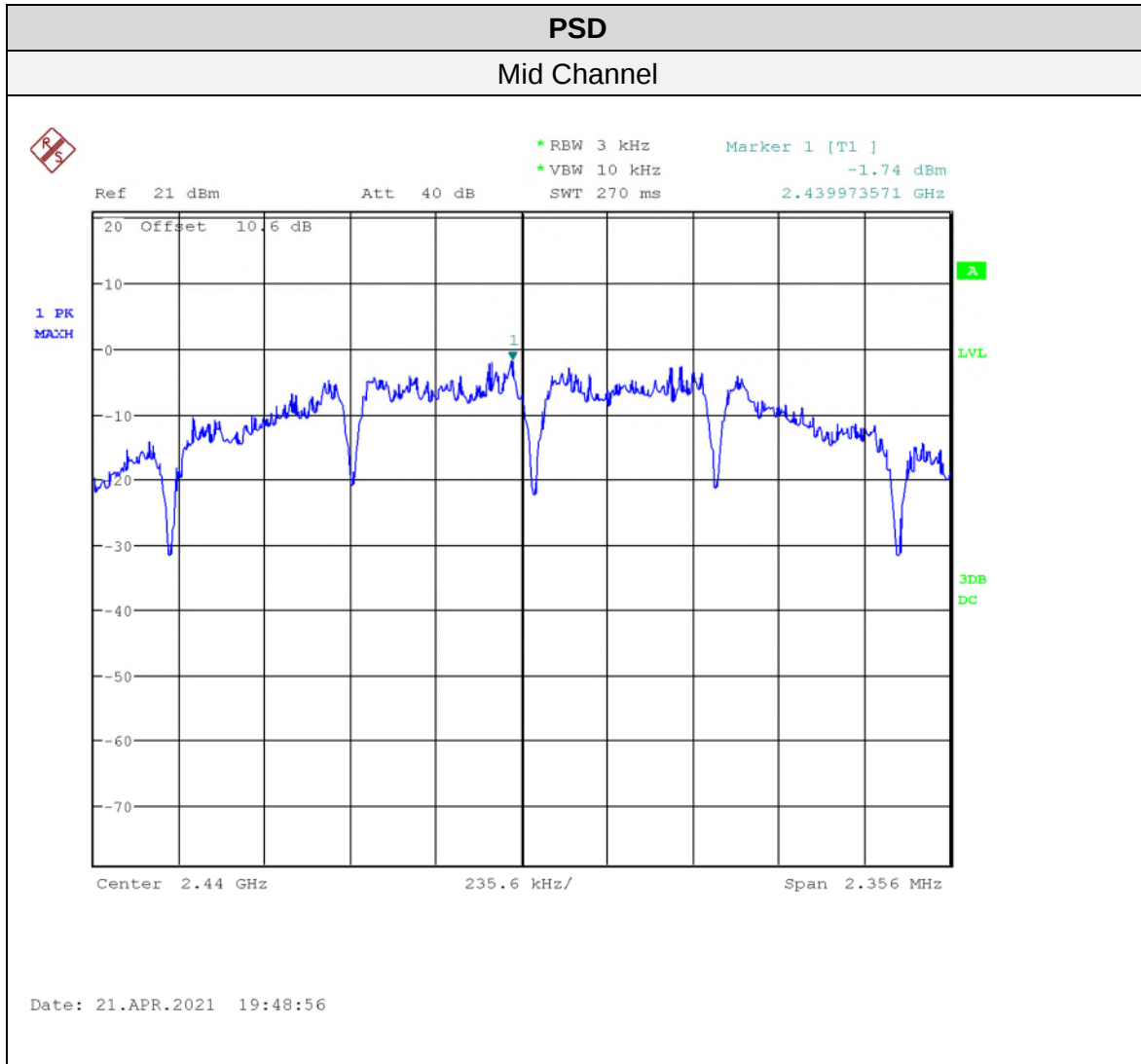
### **Graphs**

The graphs shown below show the power spectral density of the device during the conducted measurement operation of the EUT. The external attenuator and cable loss are accounted for as reference offset in the spectrum analyzer.

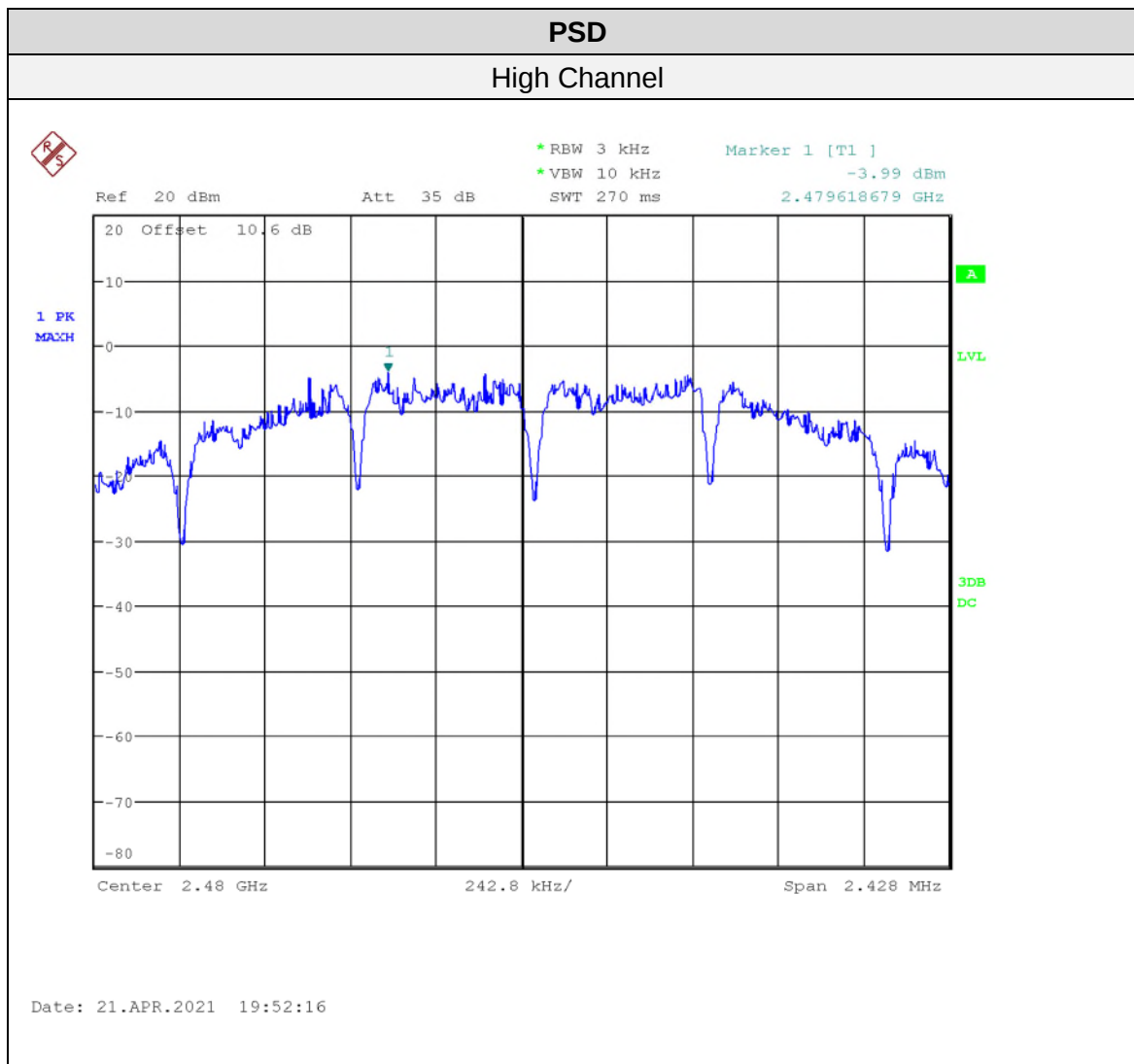
|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | Mircom Technologies Ltd.                           | <br>Canada |
| Product     | MDF-1019                                           |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |



See 'Appendix B – EUT and Test Setup Photos' for photos showing the test set-up.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    | <br>Canada |
| Product     | <b>MDF-1019</b>                                    |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Test Equipment List

| Equipment         | Model No. | Manufacturer    | Last Calibration Date | Next Calibration Date | Asset #  |
|-------------------|-----------|-----------------|-----------------------|-----------------------|----------|
| Spectrum Analyzer | ESU 40    | Rohde & Schwarz | Jan. 15, 2020         | Jan. 15, 2022         | GEMC 233 |
| Attenuator 10 dB  | 8493B     | Agilent         | NCR                   | NCR                   | GEMC 133 |

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    | <br>Canada |
| Product     | <b>MDF-1019</b>                                    |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Appendix A – EUT Summary

|             |                                                    |                                                                                     |
|-------------|----------------------------------------------------|-------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    |  |
| Product     | <b>MDF-1019</b>                                    |                                                                                     |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                     |

For further details for filing purposes, refer to filing package.

## General EUT Description

| Client                         |                                                                                                                                                                                                                              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Organization / Address         | Mircom Technologies Ltd.<br>25 Interchange Way<br>Vaughan, Ontario, L4K 5W3<br>Canada                                                                                                                                        |
| Contact                        | Haim Liberman                                                                                                                                                                                                                |
| Email                          | hliberman@mircomgroup.com                                                                                                                                                                                                    |
| EUT Details                    |                                                                                                                                                                                                                              |
| EUT Name                       | Zigbee Module                                                                                                                                                                                                                |
| Model                          | MDF-1019                                                                                                                                                                                                                     |
| FCC ID                         | 2ABFD-MDF1019                                                                                                                                                                                                                |
| IC ID                          | 1156A-MDF1019                                                                                                                                                                                                                |
| Equipment Category             | ITE                                                                                                                                                                                                                          |
| Basic EUT Functionality        | Zigbee Module used for communication between fire alarm panel and notification appliances                                                                                                                                    |
| Input Voltage                  | 3.3V DC                                                                                                                                                                                                                      |
| Rated Input Current            | 0.1A                                                                                                                                                                                                                         |
| Peripherals Required for Test  | Laptop to configure the test firmware on the EUT via UART                                                                                                                                                                    |
| Intentional Radiator Frequency | 2400 – 2483.5 MHz for Zigbee applications as described above.                                                                                                                                                                |
| EUT Configuration              | Wireless configured to transmit continuously with the following settings using TI's Smart RF Studio:<br>- IEEE 802.15.4 O-QPSK DSSS PHY ( 250 kbps )<br>- DC/DC enable<br>- Continues Tx<br>- Modulated<br>- Tx Power: 15dBm |

Note the EUT is considered to have been received the date of the commencement of the first test, unless otherwise stated. For a close-up picture of the EUT, see 'Appendix B – EUT and Test Setup Photos'.

|             |                                                    |                                                                                               |
|-------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Client      | <b>Mircom Technologies Ltd.</b>                    | <br>Canada |
| Product     | <b>MDF-1019</b>                                    |                                                                                               |
| Standard(s) | RSS 247 Issue 2:2017<br>FCC Part 15 Subpart 15.247 |                                                                                               |

## Appendix B – EUT and Test Setup Photos

Refer to the files separate from this test report