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**EMC testing of the Tektelic Communication Inc. Agriculture Sensor in accordance with FCC Part 15.247, ANSI C63.4: 2014 and ANSI C63.10: 2013 as referenced by KDB 558074 D01 15.247 Measurement Guidance v05r02.**

**FCC ID: 2ALEPT0005978**

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## REVISION RECORD

| ISSUE | DATE | AUTHOR | REVISIONS |
|---|---|---|---|
| DRAFT 1 | 2020-03-19 | I. Akram | Initial draft submitted for review. |
| Release 1 | 2020-03-23 | M. Rousseau | Sign off |

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# 1.0 INTRODUCTION

## 1.1 Scope

The purpose of this report is to present the results of compliance testing performed in accordance with FCC Part 15.247, ANSI C63.4-2014 and ANSI C63.10-2013 to gain FCC Certification Authorization for Low-Power License-Exempt transmitters. All test procedures, limits, criteria, and results described in this report apply only to the Tektelic Communication Inc. Agriculture Sensor test sample, referred to herein as the EUT (Equipment Under Test).

The samples have been provided by the customer.

This report does not imply product endorsement by the Electronics Test Centre, A2LA, nor any Canadian Government agency.

## 1.2 Applicant

This test report has been prepared for Tektelic Communication Inc., located in Calgary, Alberta, Canada.

## 1.3 Test Sample Description

As provided to ETC (Airdrie) by Tektelic Communication Inc.:

| | | |
|---|---|---|
| **Product Name:** | | Agriculture Sensor |
| **LoRa Radio** | **Frequency Band** | 902 – 928 MHz |
| | **Type of Modulation** | Chirp Spread Spectrum |
| | **BW/Frequency Range** | Hybrid 125kHz, 902.3 – 914.9 MHz |
| | **Associated Antenna** | Omnidirectional antenna 1.6 dBi gain |
| | **Detachable/Non Detachable** | Internal, Non Detachable |
| **Model# / Serial#** | | T0005982 / 1949A0019 |
| **Power supply:** | | Internal Battery |

**Note:** All three channels for T0005982 variant and all three channels / axis for T0005986/Sr#1949A0045 variant in hybrid mode were evaluated. Variant with worse emission profile and worse channel / axes were selected for detail analysis for radiated emission.

The EUT variant T0005982 is comprised of two PCBAs which provides all the functionality required by the product. The main PCBA provides the majority of the functionality including the internal LoRa radio antenna, while the second PCBA forms the basis for an external moisture sensing probe.

The EUT variant T0005986 is intended to allow external moisture probes to be connected, rather than the integrated probe of the first variant. The supported external probes are:
1) the watermark probe by Irrometer, and
2) a Tektelic remote moisture that uses the same PCBA as the first variant, but in this case it is separately housed and connected to the Agricultural sensor via a cable.

## 1.4 General Test Conditions and Assumptions

The EUT was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. All inputs and outputs to and from other equipment associated with the EUT were adequately simulated.

In this report, the EUT is only tested for the 125 kHz Hybrid transmission mode. Test results regarding DTS 500 kHz transmission mode is provided in the separate report.

**Modulation mode:** Hybrid 125 kHz, are meets part 15.247's requirements for hybrid system. The channels selected for the test are around **Low: 902.3MHz**, **Mid: 908.7MHz** and **High: 914.9MHz** in the frequency range.

The environmental conditions are recorded during each test and are reported in the relevant sections of this document.

## 1.5 Scope of Testing

Tests were performed in accordance with FCC Part 15.247, ANSI C63.4: 2014, ANSI C63.10: 2013 as referenced in KDB 558074 D01 15.247 Measurement Guidance v05r02.

The EUT was also tested as an unintentional radiator, as reported separately.

### 1.5.1 Test Methodology

Test methods are specified in the Basic Standard as referenced and/or modified by the Product Standard in the part of Section 2 of this report associated with each particular test case.

### 1.5.2 Variations in Test Methodology

Any variance in methodology or deviation from the reference Standard is documented in the part of Section 2 of this report associated with each particular Test Case.

### 1.5.3 Test Sample Verification, Configuration & Modifications

EUT setup, configuration, protocols for operation and monitoring of EUT functions, and any modifications performed in order to meet the requirements, are detailed in each Test Case of Section 2 of this report.

### 1.5.4 Uncertainty of Measurement:

The factors contributing to uncertainty of measurement are identified and calculated in accordance with UKAS (United Kingdom Accreditation Service) document "Lab 34, The Expression of Uncertainty in EMC Testing, Aug 2002." as based on the "ISO Guide to the Expression of Uncertainty in Measurement, 1995."

This uncertainty estimate represents an expended uncertainty expressed at approximately 95% confidence using a coverage factor of k = 2.

| Test Method | Uncertainty |
|---|---|
| Radiated Emissions Level (9 KHz – 1 GHz) | ±4.6 dB |
| Radiated Emissions Level (1 GHz – 26.5 GHz) | ±5.31 dB |
| Conducted Emissions Level (150 KHz – 30 MHz) | ±2.7 dB |
| Uncertainty Conducted Power level | ±0.5 dB |
| Uncertainty Conducted Spurious emission level | ±0.6 dB |
| Uncertainty for Bandwidth test | ±1.5 % |

## 2.0 TEST CONCLUSION

### STATEMENT OF COMPLIANCE

**The customer equipment referred to in this report was found to comply with the requirements, as summarized below.**

The EUT was subjected to the following tests. Compliance status is reported as **Compliant** or **Non-compliant**. **N/A** indicates the test was Not Applicable to the EUT.

**Note:** Maintenance of compliance is the responsibility of the Manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the EUT with respect to the standards detailed in this test report.

The following table summarizes the tests performed in terms of the specification, class or performance criterion applied, and the EUT modification state.

| Test Case | Test Type | Specification | Test Sample | Modifications | Config. | Result |
|---|---|---|---|---|---|---|
| **Frequency Range = 902.3 – 914.9 MHz<br>125 KHz Hybrid Mode Max. Conducted Tx Power=20.0dBm (0.1) Watt** | | | | | | |
| 2.1 | AC Conducted Emissions (Tx) | 15.207 | Agriculture Sensor | none | see § 2.1 | **n/a** |
| 2.2 | Occupied Bandwidth | 15.247(a)(1)<br>15.247(2)(2) | Agriculture Sensor | none | see § 2.2 | **Compliant** |
| 2.3 | Max Output average Power Conducted | 15.247(b) | Agriculture Sensor | none | see § 2.3 | **Compliant** |
| 2.4 | Power Spectral Density | 15.247(e)<br>15.247(f) | Agriculture Sensor | none | see § 2.4 | **Compliant** |
| 2.5 | Band Edge | 15.247(d) | Agriculture Sensor | none | see § 2.5 | **Compliant** |
| 2.6 | Conducted Spurious Emission (Non-Restricted Band Operation) | 15.247(d) | Agriculture Sensor | none | see § 2.6 | **Compliant** |
| 2.7 | Minimum channel separation | 15.247(a)(1) | Agriculture Sensor | none | see § 2.7 | **Compliant** |
| 2.8 | Average time of Occupancy for hybrid System | 15.247(f) | Agriculture Sensor | none | see § 2.8 | **Compliant** |
| 2.9 | EUT Position | ANSI C63.4 | Agriculture Sensor | none | see § 2.9 | **Assessed** |
| 2.10 | Radiated Spurious Emission (Restricted Band Operation) (Tx Mode) | 15.205, 15.209<br>15.247(d) | Agriculture Sensor | none | see § 2.10 | **Compliant** |
| 2.11 | RF Exposure | 15.247(i) | Agriculture Sensor | none | see § 2.11 | **Exempt** |

Refer to the test data for applicable test conditions.

## 2.1 AC Power Line Conducted Emissions – Not Applicable

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel:** | **Standard: FCC Part 15.207** |
| **Date:** | **Basic Standard: ANSI C63.10: 2013** |

**EUT status: n/a**

**Comments:** EUT powered up by Internal Battery. There is no connection to main during operation.

## 2.2 Channel Occupied Bandwidth (Hybrid Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Bushra Muharram/I.** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-06(21.1°C,13.2% RH)** | **Basic Standard: ANSI C63.10-2013** |

**EUT status: Compliant**

**Specification: FCC 15.215 (c)**

**Criteria:** For hybrid system there is no limit for the 20dB or 99% bandwidth.

### 2.2.1 Test Guidance: ANSI C63.10-2013, Clause 6.9.2, 6.9.3 &7.8.7 / KDB 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following spectrum analyzer settings: | |
|---|---|
| Span | between two times and five times the channel center frequency OBW |
| RBW | 1% to 5% of the OBW |
| VBW | approximately three times RBW |
| Sweep | auto |
| Detector function | peak |
| Trace | max hold |
| Allow the trace to stabilize. The automated 99% BW function of the spectrum analyzer is engaged, 20 dB OBW is measured with the x dB function. | |

### 2.2.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

### 2.2.3 Test Equipment

Testing was performed with the following equipment:

| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| MXE EMI Receiver | Keysight Technologies Inc | N9038A FW A 22.08 | 6906 | 2019-10-29 | 2020-10-29 |
| Temp/Humidity | Extech | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Attenuator | FairView Microwave | SA18N5WA-10 | 6886 | 2020-02-01 | 2021-02-01 |
| DC Blocker | MCL | BLK-89-S+ | - | 2020-02-01 | 2021-02-01 |
| CE Cable (50cm length) | Huber+Suhner | Enviroflex 400 | - | 2020-02-01 | 2021-02-01 |

### 2.2.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation.

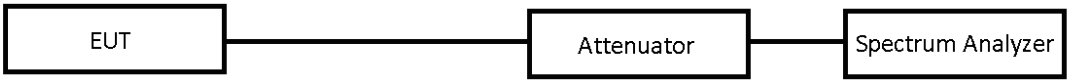
The EUT modified to provide the direct access to antenna port for conducted measurements.

For compliance purposes EUT met requirements without any modification

There is no Deviation and exclusions from test specifications.

**Test setup diagrams for Occupied Bandwidth testing:**

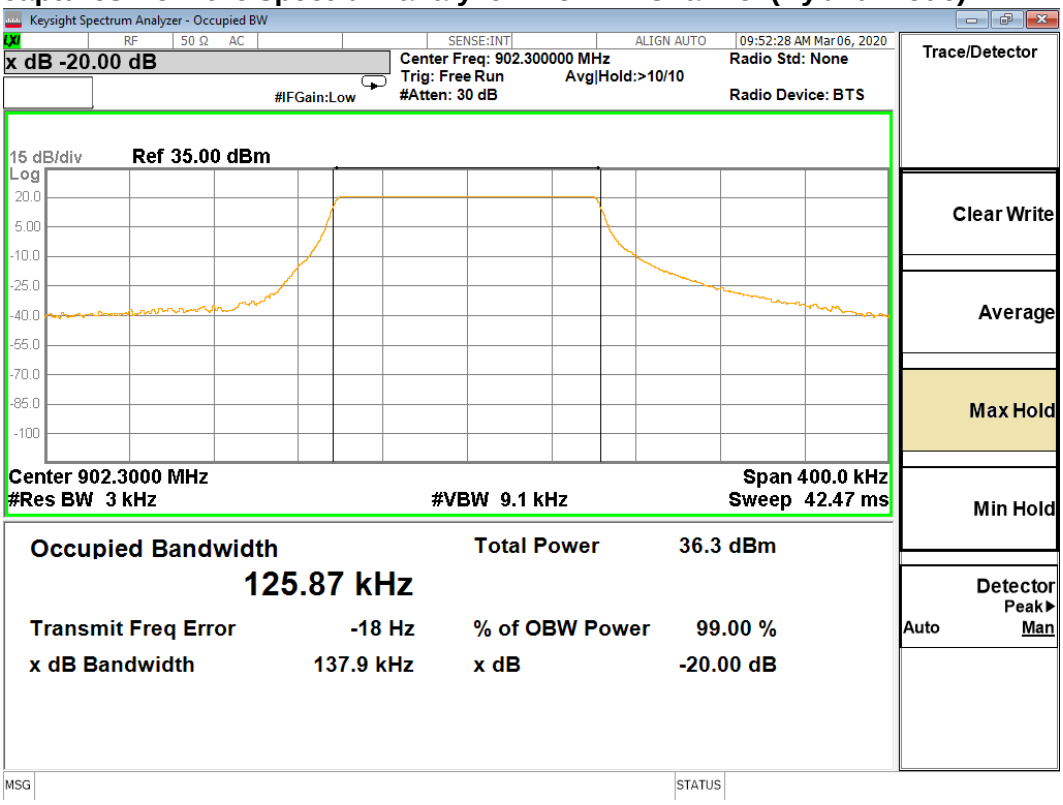
**Conducted:**



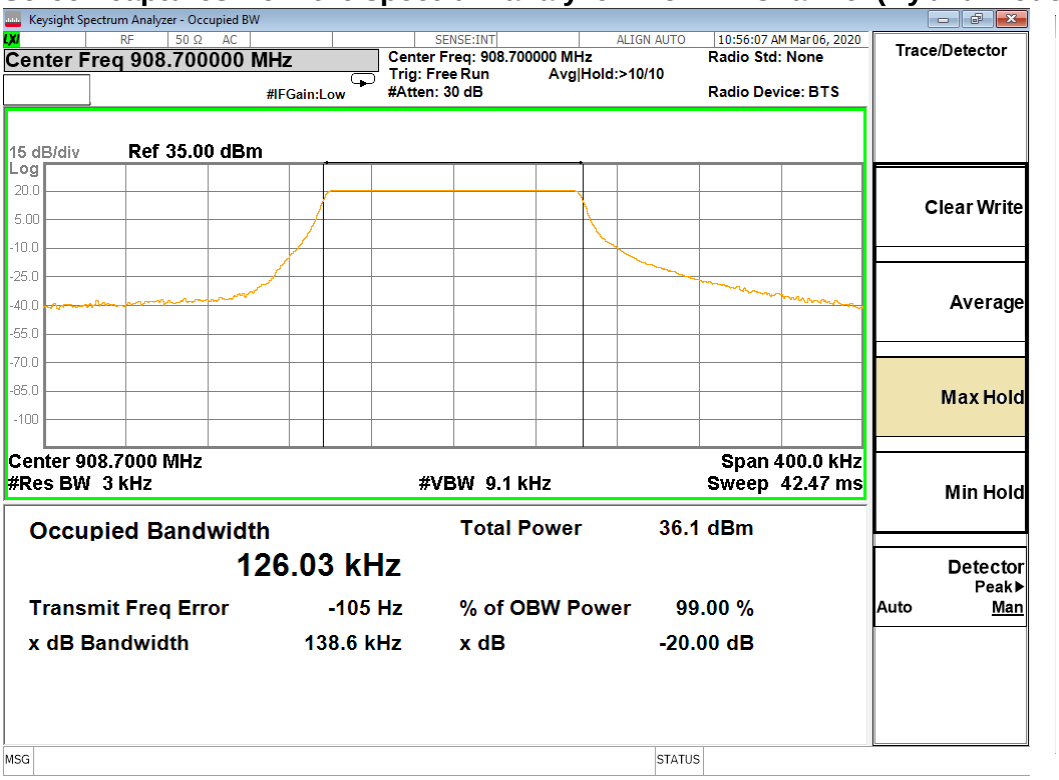

### 2.2.5 Channel Occupied Bandwidth Data: (Hybrid Mode)
### LoRa 125 KHz Channels

| Channel | Freq. [MHz] | 20 dB OBW [kHz] | 99% OBW [KHz] |
|---|---|---|---|
| Low | 902.3 | 137.9 | 125.87 |
| Mid | 908.7 | 138.6 | 126.03 |
| High | 914.9 | 138.0 | 125.85 |

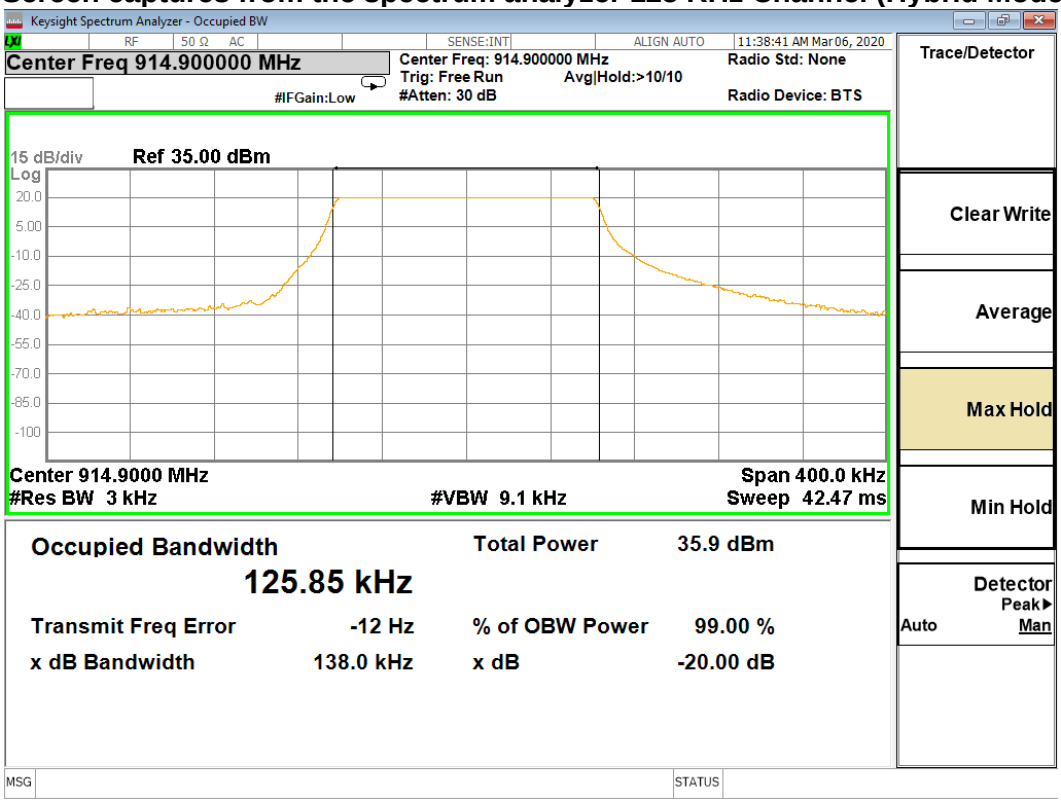
**Screen captures from the spectrum analyzer 125 KHz Channel (Hybrid Mode)**



## Screen captures from the spectrum analyzer 125 KHz Channel (Hybrid Mode)




## Screen captures from the spectrum analyzer 125 KHz Channel (Hybrid Mode)



## 2.3 Max Average Output Power (Hybrid Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Bushra Muharram** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-06(21.1°C,13.2% RH)** | **Basic Standard: ANSI C63.10: 2013** |

**EUT status: Compliant**

**Specification: FCC Part 15.247(b, 2)**

| | |
|---|---|
| **Criteria** | For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels |

### 2.3.1 Test Guidance: ANSI C63.10-2013, Clause 11.9.2.2.2, Clause 7.8.5 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed at low, mid and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| **Output Power Method AVGSA-1** | |
|---|---|
| Span | ≥ 1.5 times the OBW |
| RBW | 1 – 5 % of the OBW, ≤ 1 MHz |
| VBW | ≥ 3 x RBW |
| Number of Points in sweep | ≥ 2 x Span / RBW |
| Sweep time | Auto |
| Detector | RMS (Power Averaging) |
| Sweep trigger | Free Run (Duty Cycle ≥98%) |
| Trace Average | 100 traces in power Averaging (RMS) |
| Power measured | Integrated the spectrum across the OBW of the signal using the S/A band power measurement function, with band limit set equal to the OBW band edge. |

### 2.3.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

### 2.3.3 Test Equipment

Testing was performed with the following equipment:

| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| MXE EMI Receiver | Keysight Technologies Inc | N9038A FW A 22.08 | 6906 | 2019-10-29 | 2020-10-29 |
| Temp/Humidity | Extech | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Attenuator | FairView Microwave | SA18N5WA-10 | 6886 | 2020-02-01 | 2021-02-01 |
| DC Blocker | MCL | BLK-89-S+ | - | 2020-02-01 | 2021-02-01 |
| CE Cable (50cm length) | Huber+Suhner | Enviroflex 400 | - | 2020-02-01 | 2021-02-01 |

### 2.3.4 Test Sample Verification, Configuration & Modifications

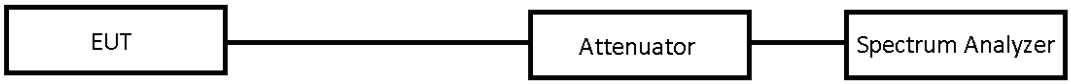
The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT modified to provide the direct access to antenna port for conducted measurements.

For compliance purposes EUT met requirements without any modification

**Test setup diagrams for Peak Power testing:**

**Conducted:**

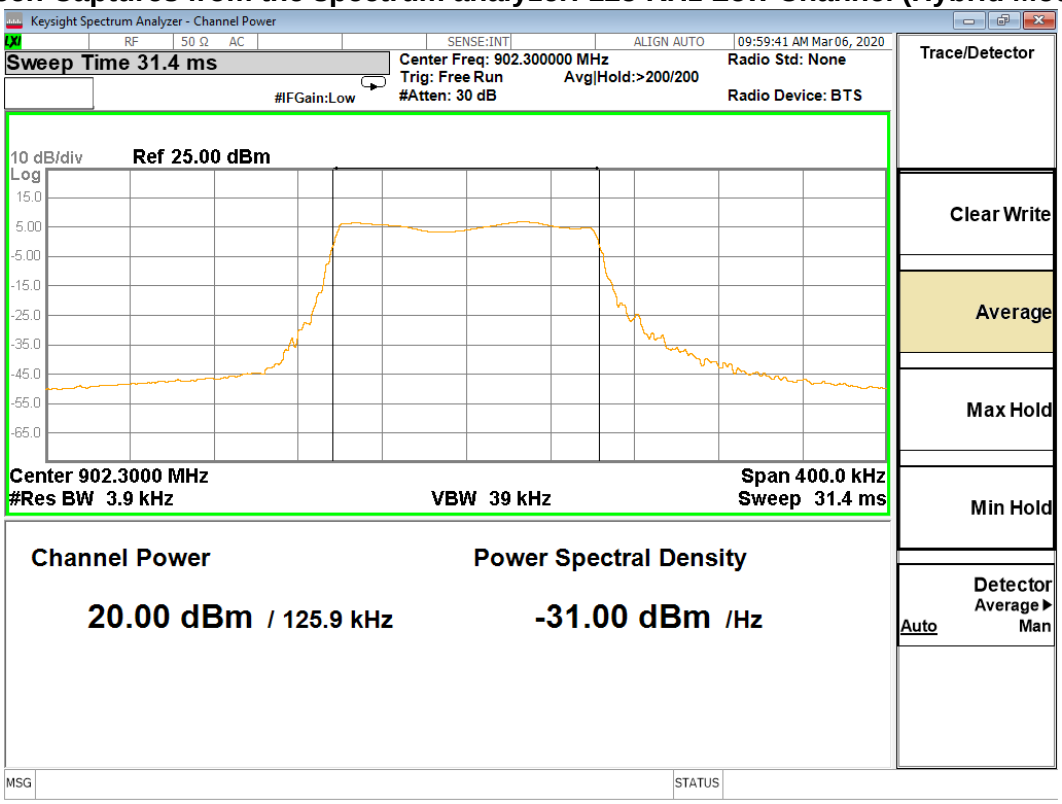



### 2.3.5 Peak Output Power Data (Hybrid Mode)

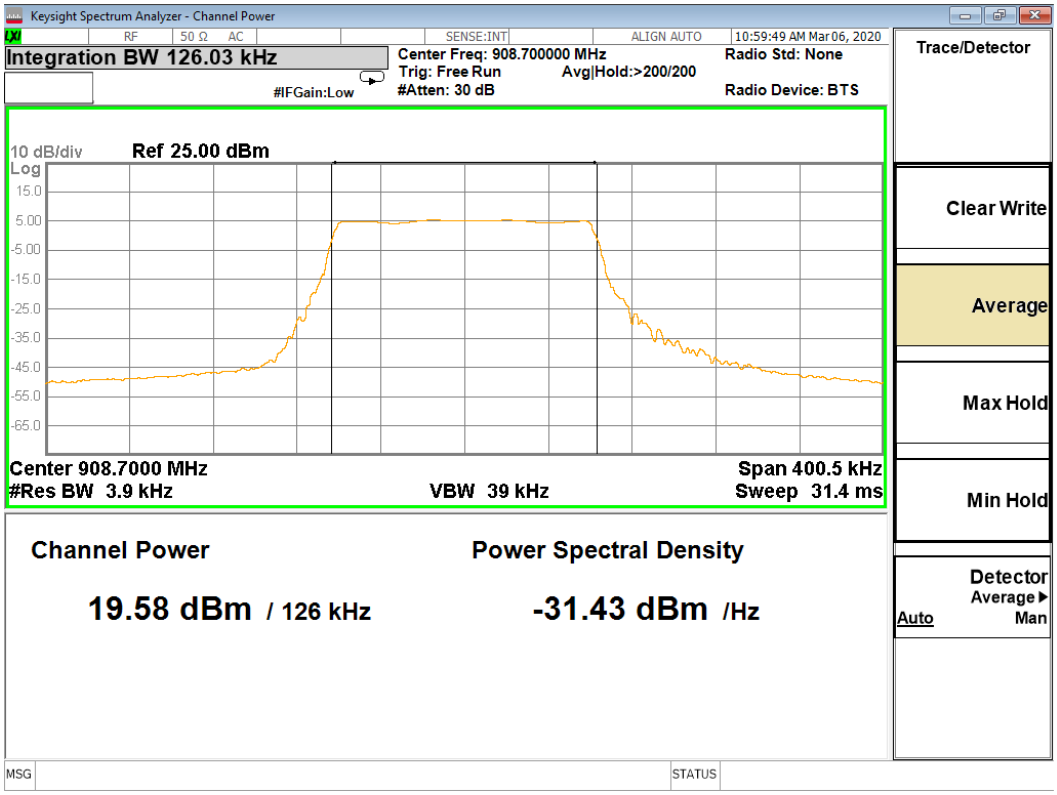
**Lora 125 KHz**

| Channel | Freq. [MHz] | Out Put Power (dBm) | Out Put Power Limit (dBm | Margin (dB) |
|---|---|---|---|---|
| Low | 902.3 | 20 | 30 | 10 |
| Mid | 908.7 | 19.58 | 30 | 10.42 |
| High | 914.9 | 19.76 | 30 | 10.24 |

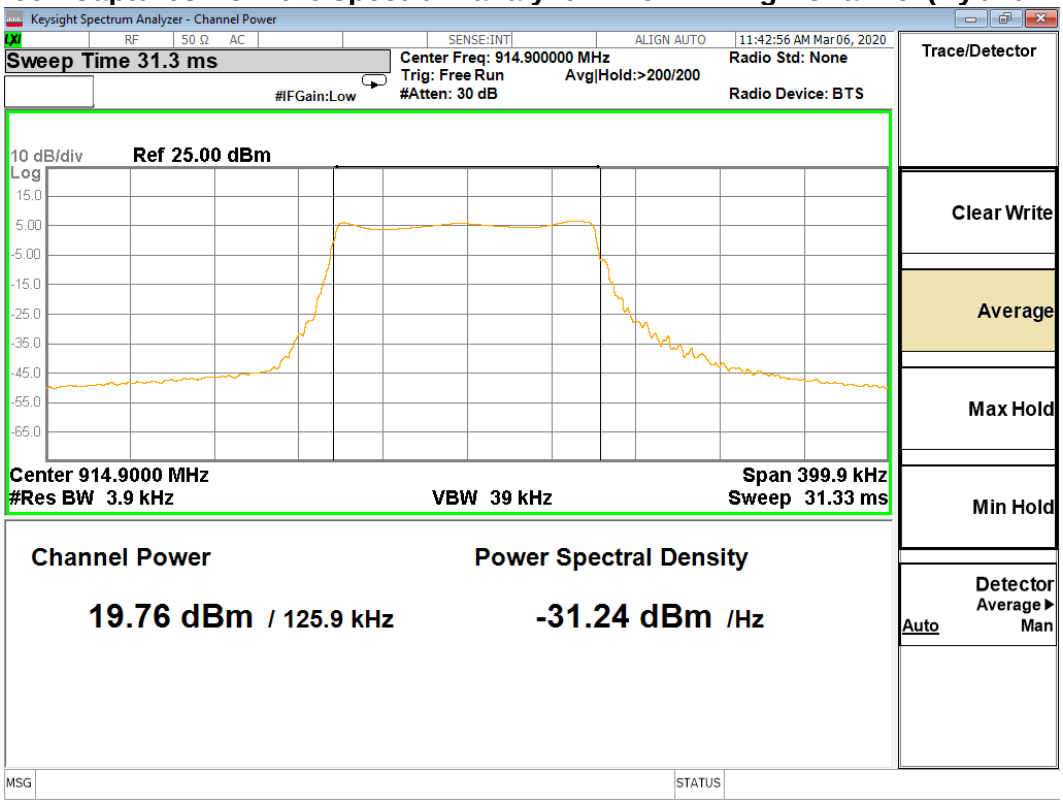
## Screen Captures from the spectrum analyzer: 125 KHz Low Channel (Hybrid Mode)




## Screen Captures from the spectrum analyzer: 125 KHz MID Channel (Hybrid Mode)



## Screen Captures from the spectrum analyzer: 125 KHz High Channel (Hybrid Mode)



## 2.4 Power Spectral Density (Hybrid Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Bushra Muharram** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-06(21.1°C,13.2% RH)** | **Basic Standard: ANSI C63.10: 2013** |

**EUT status: Compliant**

**Specification: FCC Part 15.247(f)**

**Criteria** For Hybrid system, 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.

### 2.4.1 Test Guidance: ANSI C63.10-2013, Clause 11.10.3 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed at low, mid and high frequencies, in continuous transmission, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following spectrum analyzer settings: | |
|---|---|
| Span | At least 1.5 times the OBW channel center frequency. |
| RBW | Set RBW to: 3 |
| VBW | Set VBW ≥ 3 × RBW]. |
| Sweep | auto |
| Detector function | Power averaging (RMS) or sample detector (when RMS not available). |
| Trace | Employ trace averaging (rms) mode over a minimum of 100 traces. |
| Ensure that the number of measurement points in the sweep ≥ [2 × span / RBW]. Allow the trace to stabilize. Use the peak marker function to determine the maximum amplitude level. | |

### 2.4.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

### 2.4.3 Test Equipment

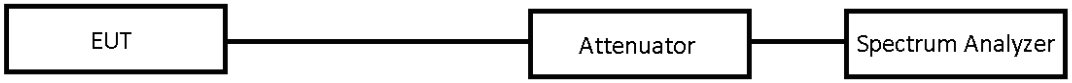
Testing was performed with this equipment:

| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| MXE EMI Receiver | Keysight Technologies Inc | N9038A FW A 22.08 | 6906 | 2019-10-29 | 2020-10-29 |
| Temp/Humidity | Extech | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Attenuator | FairView Microwave | SA18N5WA-10 | 6886 | 2020-02-01 | 2021-02-01 |
| DC Blocker | MCL | BLK-89-S+ | - | 2020-02-01 | 2021-02-01 |
| CE Cable (50cm length) | Huber+Suhner | Enviroflex 400 | - | 2020-02-01 | 2021-02-01 |

### 2.4.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

**Test setup diagrams for Peak Power Spectral Density testing:**
**Conducted:**

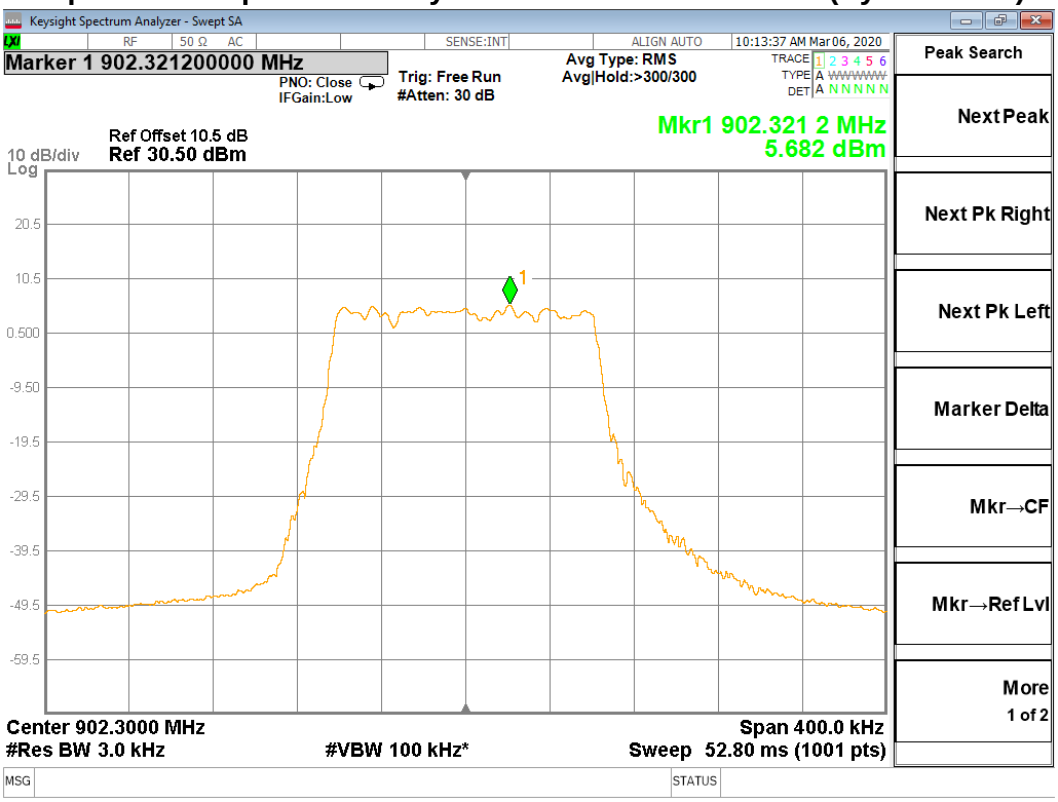



### 2.4.5 Peak PSD Data (Hybrid Mode)

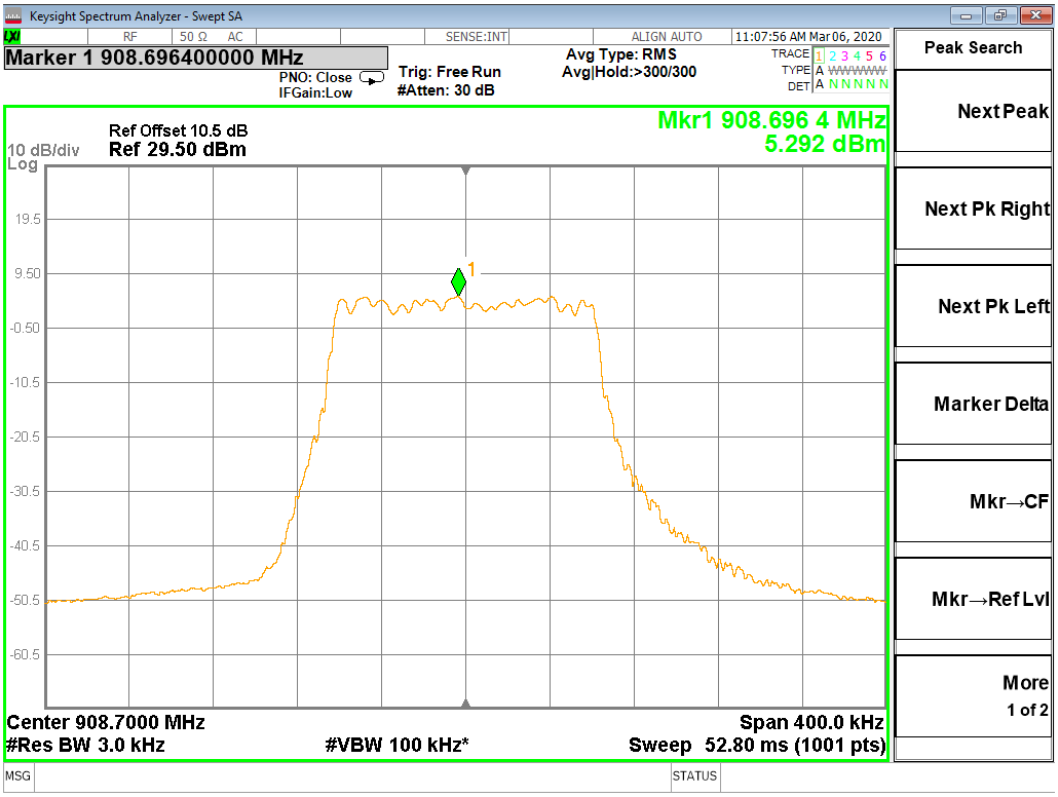
**125 KHz Channels**

| Channel | Freq. [MHz] | PSD (dBm/3kHz) | PSD Limit (dBm/3kHz) |
|---|---|---|---|
| Low | 902.3 | 5.682 | 8 |
| Mid | 908.7 | 5.292 | 8 |
| High | 914.9 | 5.346 | 8 |

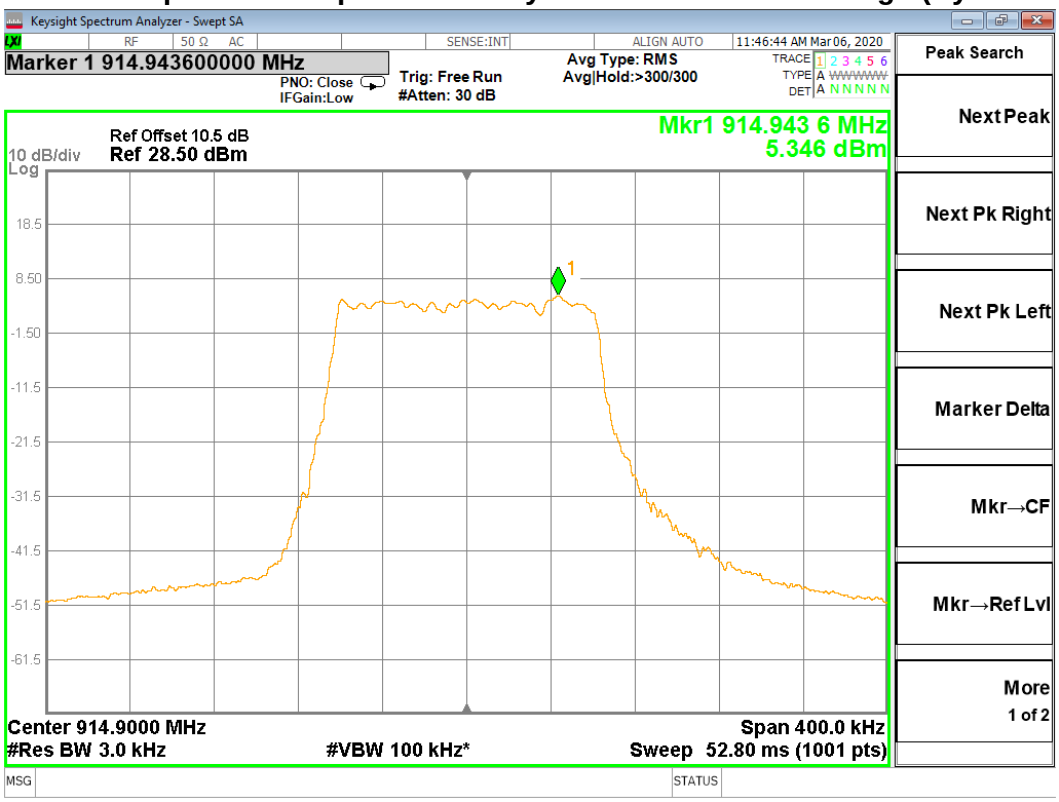
## Screen Capture from Spectrum Analyzer: 125 KHz Channel LOW (Hybrid Mode)




## Screen Capture from Spectrum Analyzer: 125 KHz Channel MID (Hybrid Mode)



## Screen Capture from Spectrum Analyzer: 125 KHz Channel High (Hybrid Mode)



## 2.5 Band Edge Attenuation (Hybrid Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Imran Akram/B. Muharram** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-06(21.1°C,13.2% RH)** | **Basic Standard: ANSI C63.10: 2013** |

**EUT status: Compliant**

**Specification: FCC Part 15.247(d)**

**Criteria:** In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### 2.5.1 Test Guidance: ANSI C63.10-2013 Clause 6.10.4, 6.10.6 & 7.8.6 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed at the low and high frequencies, with modulation.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following spectrum analyzer settings: | |
|---|---|
| Span | Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation. |
| Attenuation | Auto (at least 10 dB preferred). |
| RBW | 100 kHz |
| VBW | 300 kHz |
| Sweep | Coupled |
| Detector function | peak |
| Trace | max hold |
| Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission. | |

### 2.5.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

### 2.5.3 Test Equipment

Testing was performed with the following equipment:

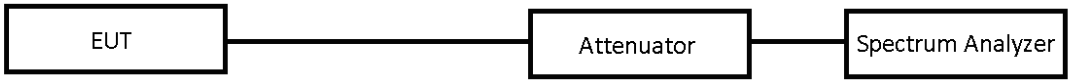
| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| MXE EMI Receiver | Keysight Technologies Inc | N9038A FW A 22.08 | 6906 | 2019-10-29 | 2020-10-29 |
| Temp/Humidity | Extech | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Attenuator | FairView Microwave | SA18N5WA-10 | 6886 | 2020-02-01 | 2021-02-01 |
| DC Blocker | MCL | BLK-89-S+ | - | 2020-02-01 | 2021-02-01 |
| CE Cable (50cm length) | Huber+Suhner | Enviroflex 400 | - | 2020-02-01 | 2021-02-01 |

### 2.5.4 Test Sample Verification, Configuration & Modifications

The EUT was set to transmit continuously on a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

**Test setup diagrams for Band Edge Attenuation testing:**

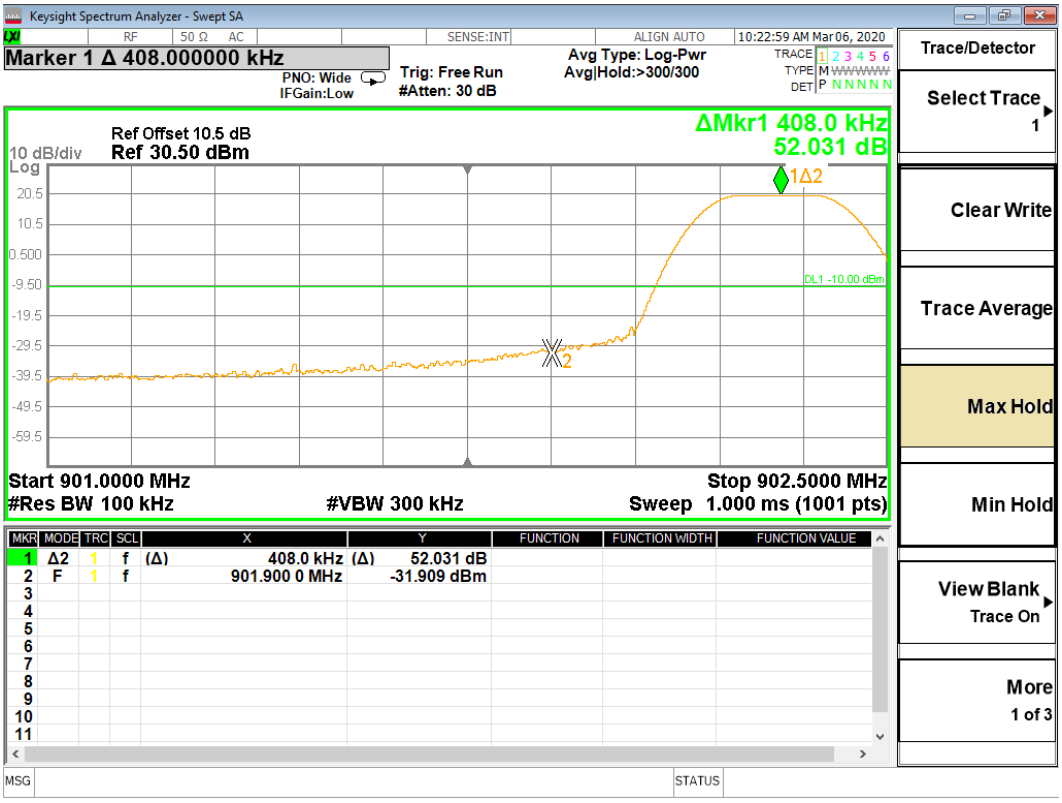
**Conducted:**



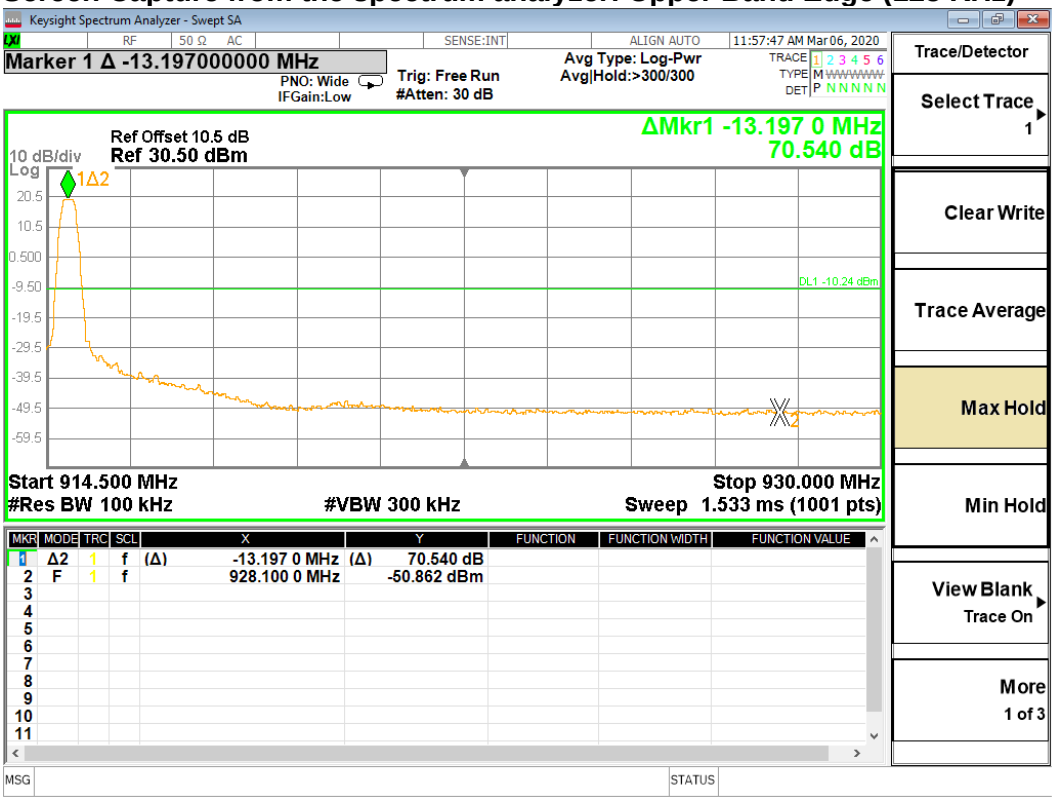

### 2.5.5 Band Edge Data (Hybrid Mode)

| Modulation | Channel | Attenuation at Band Edge | Attenuation Limit at Band Edge |
|---|---|---|---|
| Lora 125KHz Channels | 902.3 | 52.031 dBc | 30 dBc |
| | 914.9 | 70.540 dBc | 30 dBc |
| Lora 125KHz Channels (Hopping) | 902.3 | 54.430 dBc | 30 dBc |
| | 914.9 | 71.945 dBc | 30 dBc |

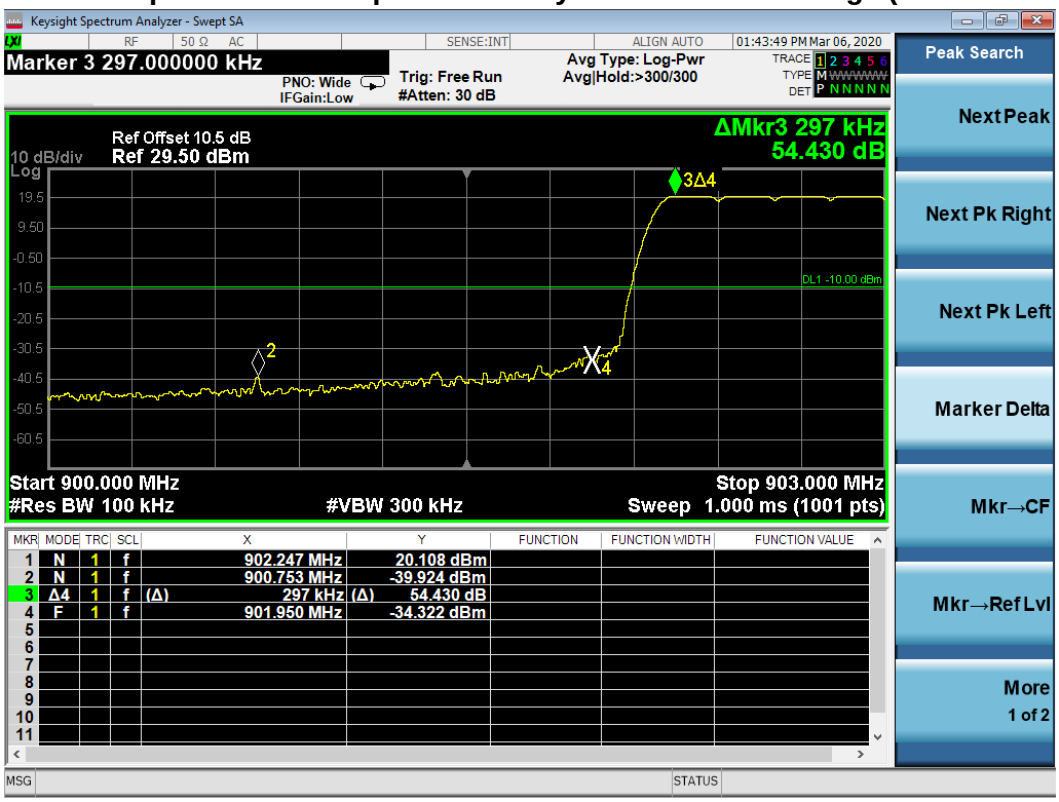
## Screen Capture from the spectrum analyzer: Lower Band Edge (125 KHz)



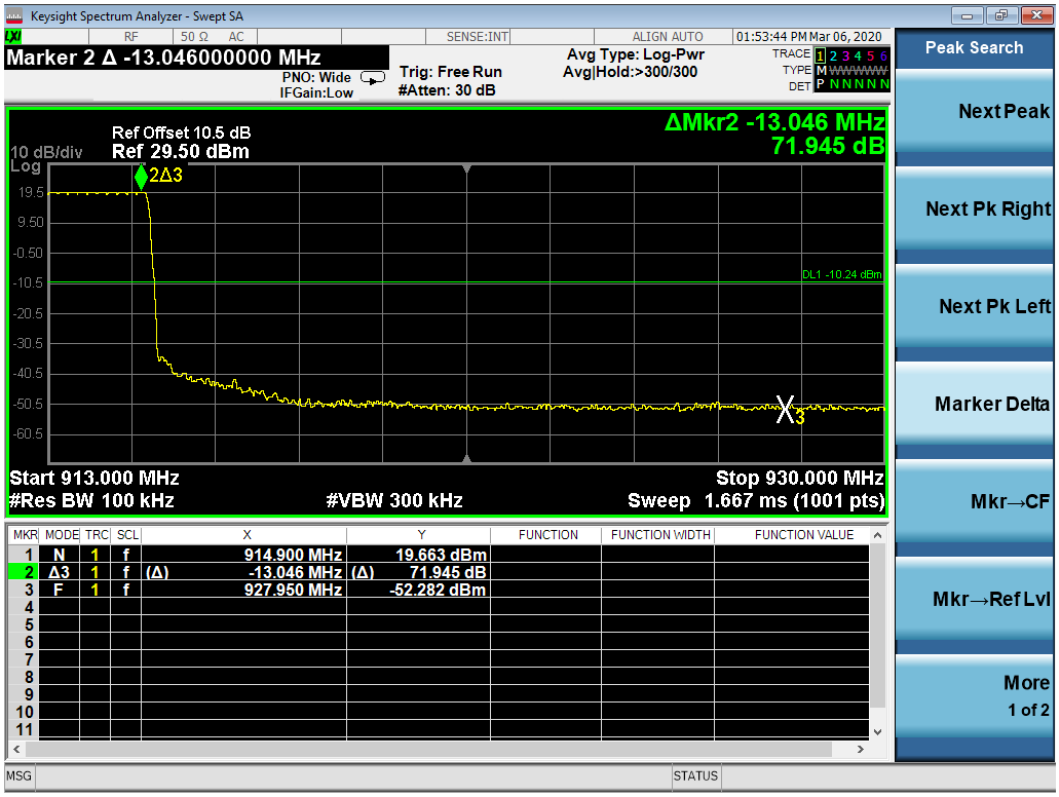

## Screen Capture from the spectrum analyzer: Upper Band Edge (125 KHz)



## Screen Capture from the spectrum analyzer: Lower Band Edge (125 KHz Hopping)




## Screen Capture from the spectrum analyzer: Upper Band Edge (125 KHz Hopping)



## 2.6 Conducted Spurious Emissions in non-restricted frequency bands (Hybrid Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Bushra Muharram** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-06(21.1°C,13.2% RH)** | **Basic Standard: ANSI C63.10-2013** |

**EUT status: Compliant**

**Specification: FCC Part 15.247(d)**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### 2.6.1 Test Guidance: ANSI C63.10-2013, Clause 6.7, 7.8.8 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed at the low, mid and high frequencies, with modulation.
The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

| Use the following spectrum analyzer settings: | |
|---|---|
| Span | Set the center frequency and span to encompass frequency range to be measured. |
| RBW | 100 kHz |
| VBW | 300 kHz |
| Sweep | Auto Coupled |
| Detector function | peak |
| Trace | max hold |
| Allow the trace to stabilize. Use the peak marker function to determine the maximum amplitude level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified in | |

### 2.6.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

### 2.6.3 Test Equipment

Testing was performed with the following equipment:

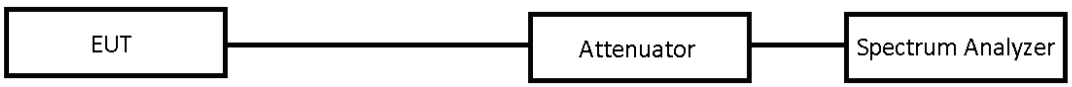
| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| MXE EMI Receiver | Keysight Technologies Inc | N9038A FW A 22.08 | 6906 | 2019-10-29 | 2020-10-29 |
| Temp/Humidity | Extech | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Attenuator | FairView Microwave | SA18N5WA-10 | 6886 | 2020-02-01 | 2021-02-01 |
| DC Blocker | MCL | BLK-89-S+ | - | 2020-02-01 | 2021-02-01 |
| CE Cable (50cm length) | Huber+Suhner | Enviroflex 400 | - | 2020-02-01 | 2021-02-01 |

### 2.6.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation. The EUT met the requirements without modification.

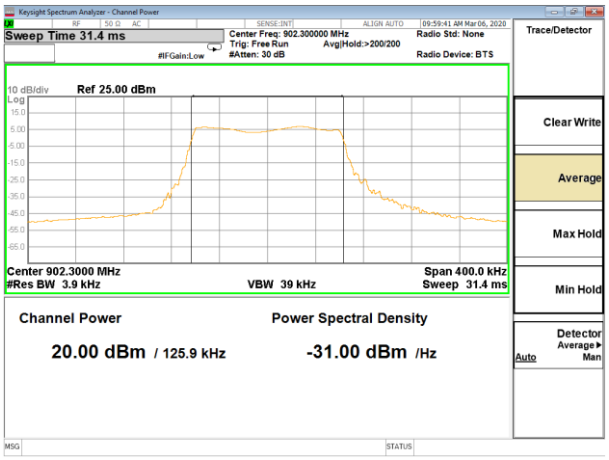
The EUT modified to provide the direct access to antenna trace for conducted measurements.

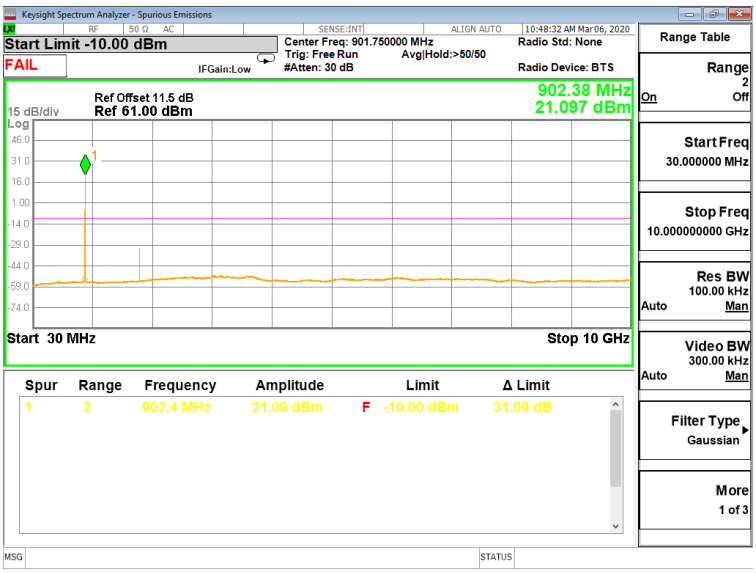
**Test setup diagram for Conducted Spurious Emissions testing:**

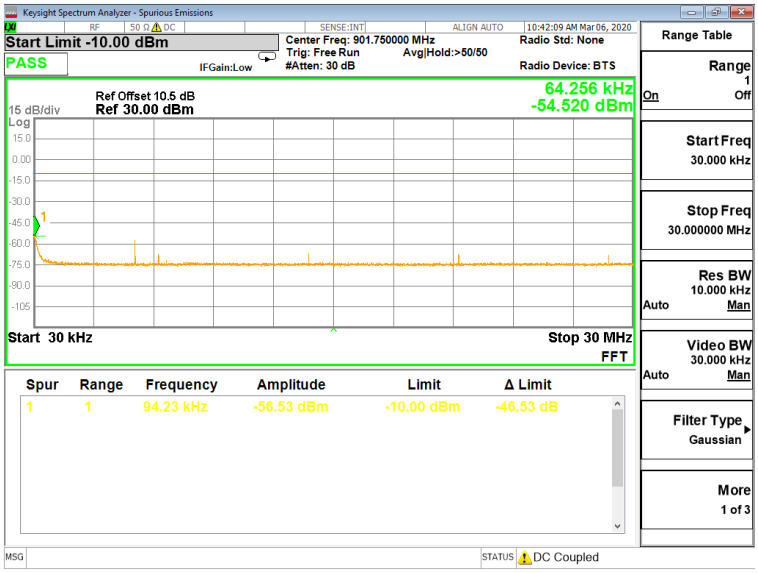


## 2.6.5 Conducted Emissions Data: (Hybrid Mode)

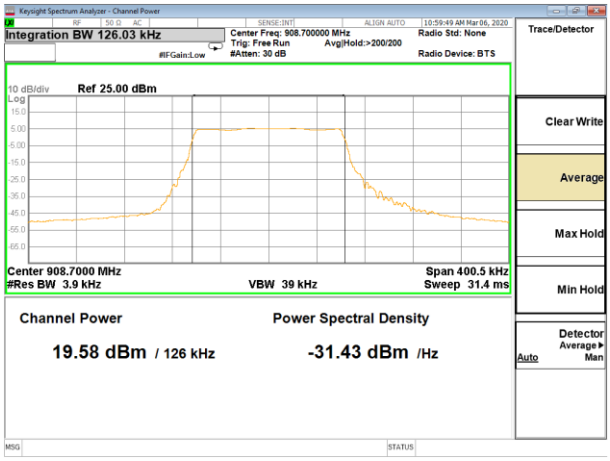
### 125 KHz Low Channel

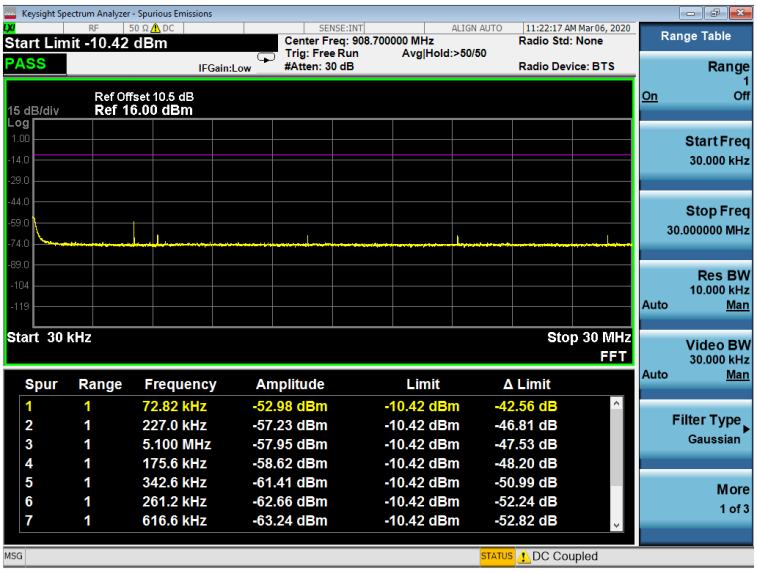


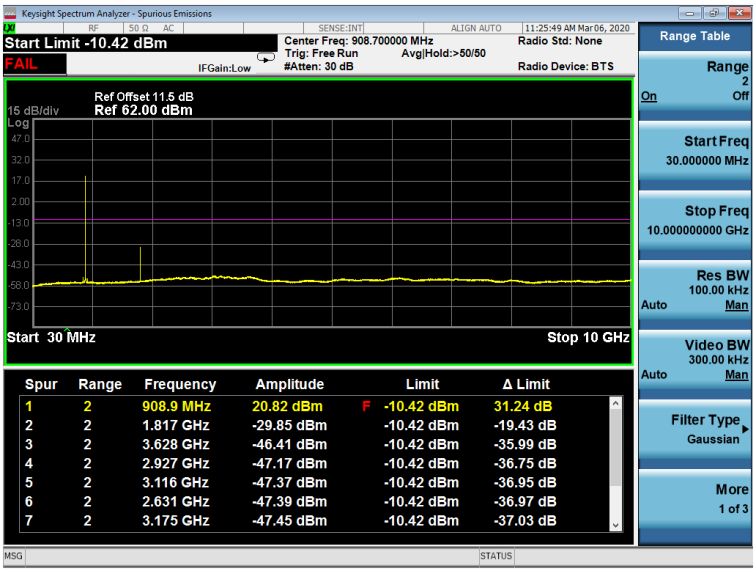



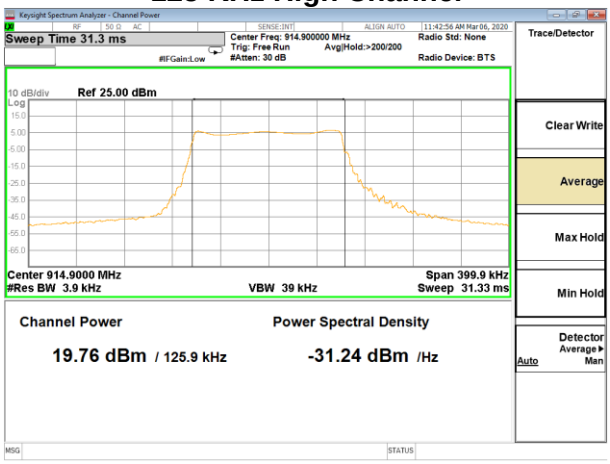
# 125 KHz MID Channel

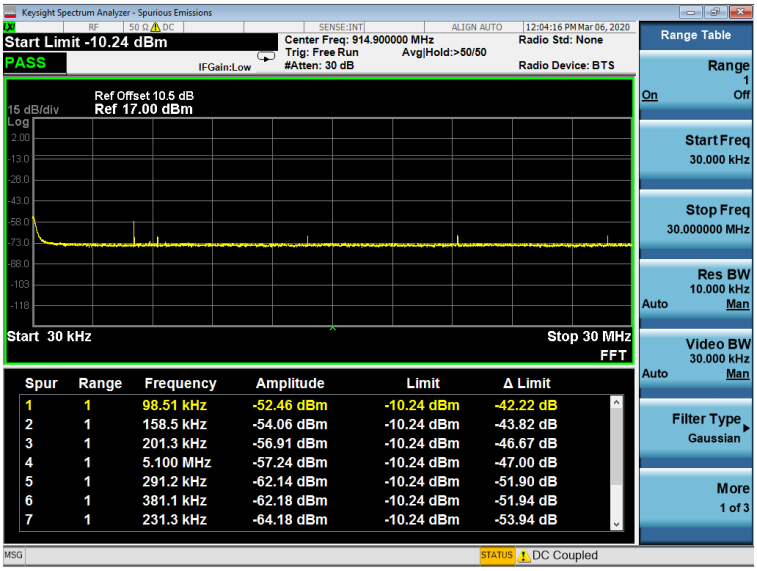


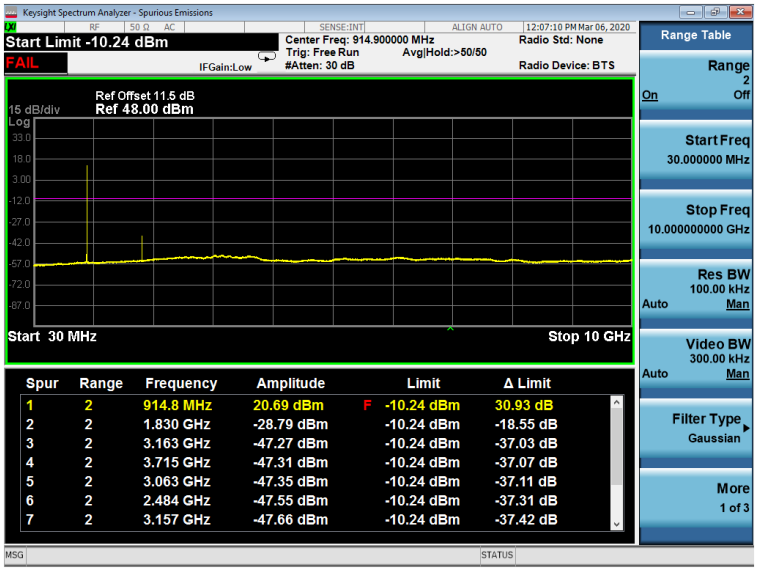



## 125 KHz High Channel



## 2.7 Channel Separation (Hybrid Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Imran Akram** | **Standard: FCC Part 15.247** |
| **Date: 2020-03-06(21.1°C,13.2% RH)** | **Basic Standard: ANSI C63.10: 2013** |

**EUT status: Compliant**

**Specification: FCC Part 15.247(a, 1)**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

### 2.7.1 Test Guidance: ANSI 63.10 Clause 7.8.2 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed with the EUT transmitter frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The spectrum analyzer is set for a frequency span wide enough to capture at least two adjacent channels. The RBW is set to at least 1% of the span. The Peak detector is used, with the trace set to Max Hold. Channel Separation is displayed with the Marker Delta function.

### 2.7.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

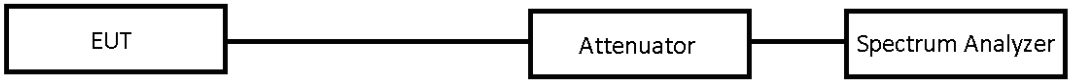
### 2.7.3 Test Equipment

Testing was performed with the following equipment:

| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| MXE EMI Receiver | Keysight Technologies Inc | N9038A FW A 22.08 | 6906 | 2019-10-29 | 2020-10-29 |
| Temp/Humidity | Extech | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Attenuator | FairView Microwave | SA18N5WA-10 | 6886 | 2020-02-01 | 2021-02-01 |
| DC Blocker | MCL | BLK-89-S+ | - | 2020-02-01 | 2021-02-01 |
| CE Cable (50cm length) | Huber+Suhner | Enviroflex 400 | - | 2020-02-01 | 2021-02-01 |

### 2.7.4 Test Sample Verification, Configuration & Modifications

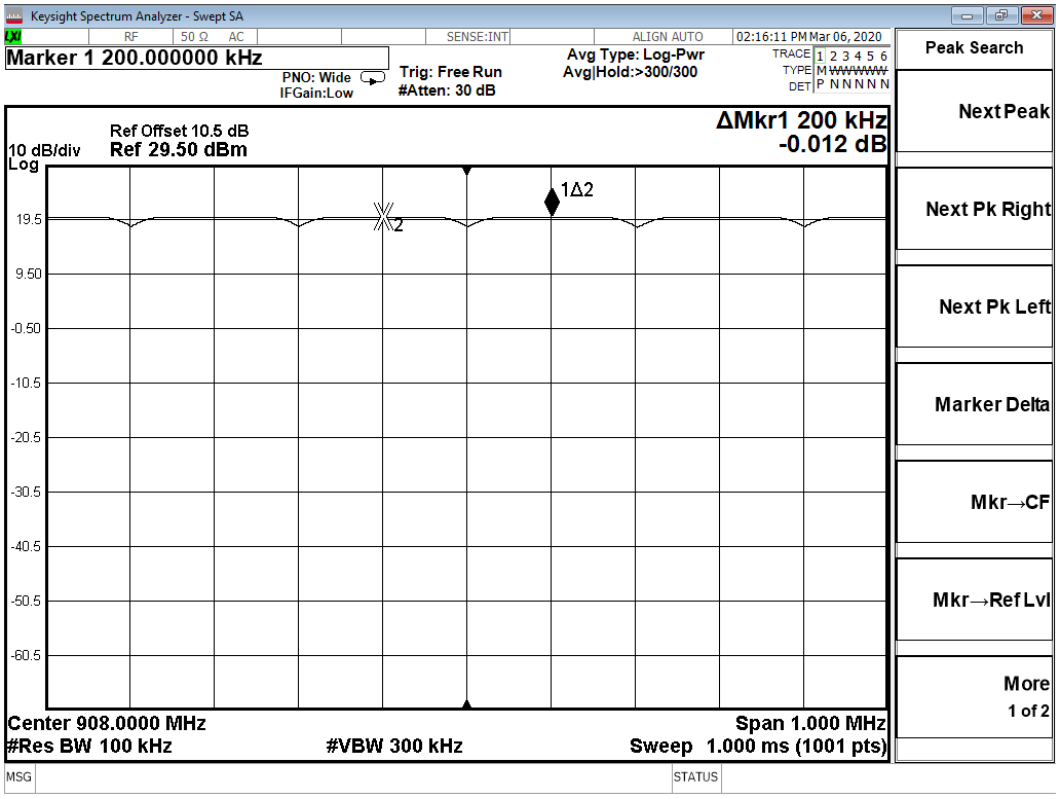
**EUT configuration for Channel Separation testing:**



### 2.7.5 Channel Separation Data:

**Compliant:** The channel separation measured for this device is 200 kHz.

**Screen Captures from the spectrum analyzer: Hybrid 125 KHz**



## 2.8 Time of Occupancy (Hybrid Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Imran Akram** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-06(21.1°C,13.2% RH)** | **Basic Standard: ANSI C63.10: 20013** |

**EUT status: Compliant**

**Specification: FCC Part 15.247 (f)**

The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4

### 2.8.1 Test Guidance: ANSI 63.10 Clause 7.8.4 / 558074 D01 15.247 Measurement Guidance v05r02

This measurement is performed with the EUT frequency hopping function active.

The RF output of EUT with an antenna connector is fed to the input of the spectrum analyzer through appropriate attenuation. The loss from the cable and the attenuator were added on the analyzer as gain offset setting there by allowing direct measurements, without the need for any further corrections.

The spectrum analyzer is set for Peak detection over a 0 Hz frequency span (time domain) centered on a hopping channel. The RBW shall be ≤ Channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel. VBW ≥ RBW. The sweep time is adjusted to clearly capture one transmission. The Dwell time is measured with the Marker Delta function.

Another sweep is set to capture enough transmission events to calculate the number of events within the specified period of time. The Peak detector is used, with the trace set to Max Hold.

### 2.8.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

### 2.8.3 Test Equipment

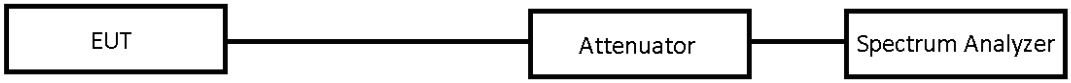
Testing was performed with the following equipment:

| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| MXE EMI Receiver | Keysight Technologies Inc | N9038A FW A 22.08 | 6906 | 2019-10-29 | 2020-10-29 |
| Temp/Humidity | Extech | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Attenuator | FairView Microwave | SA18N5WA-10 | 6886 | 2020-02-01 | 2021-02-01 |
| DC Blocker | MCL | BLK-89-S+ | - | 2020-02-01 | 2021-02-01 |
| CE Cable (50cm length) | Huber+Suhner | Enviroflex 400 | - | 2020-02-01 | 2021-02-01 |

### 2.8.4 Test Sample Verification, Configuration & Modifications

The EUT was operating in normal mode. The EUT met the requirements without modification.

**EUT configuration for Dwell Time testing:**




### 2.8.5 Dwell Time Data:

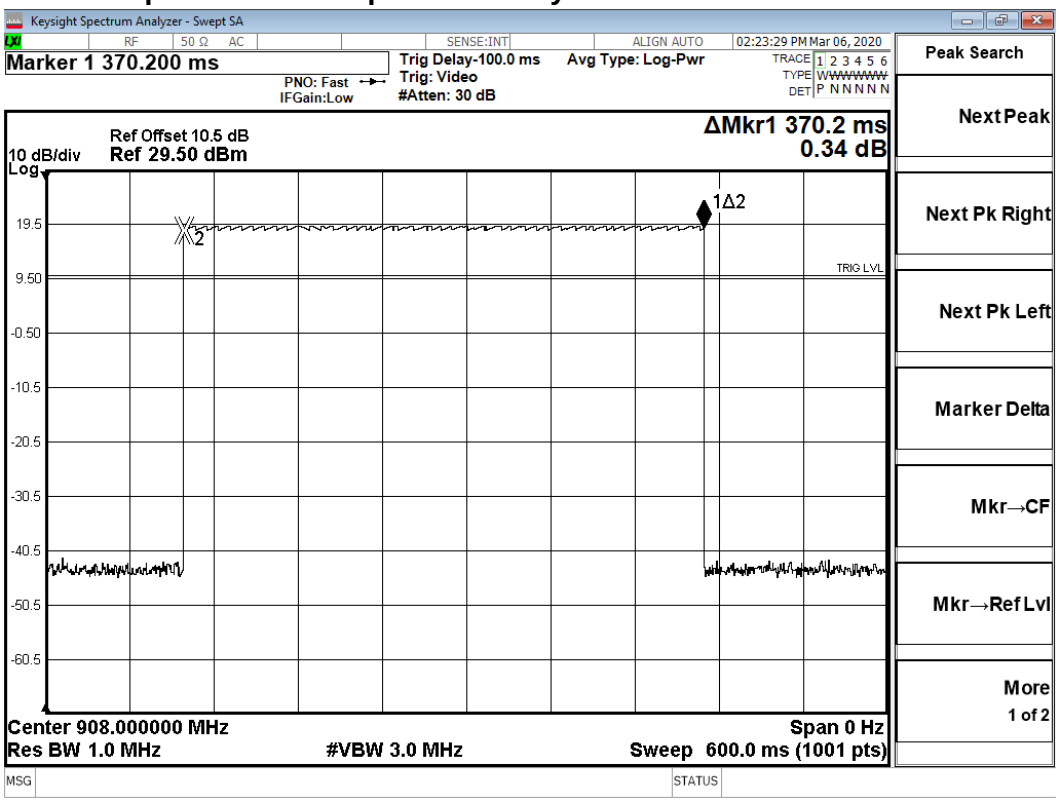
Measured Dwell time = 370.2 ms

Window of measurement is equal to number of hopping channels multiple by 400ms = **0.4 x 64** = 25.6Sec

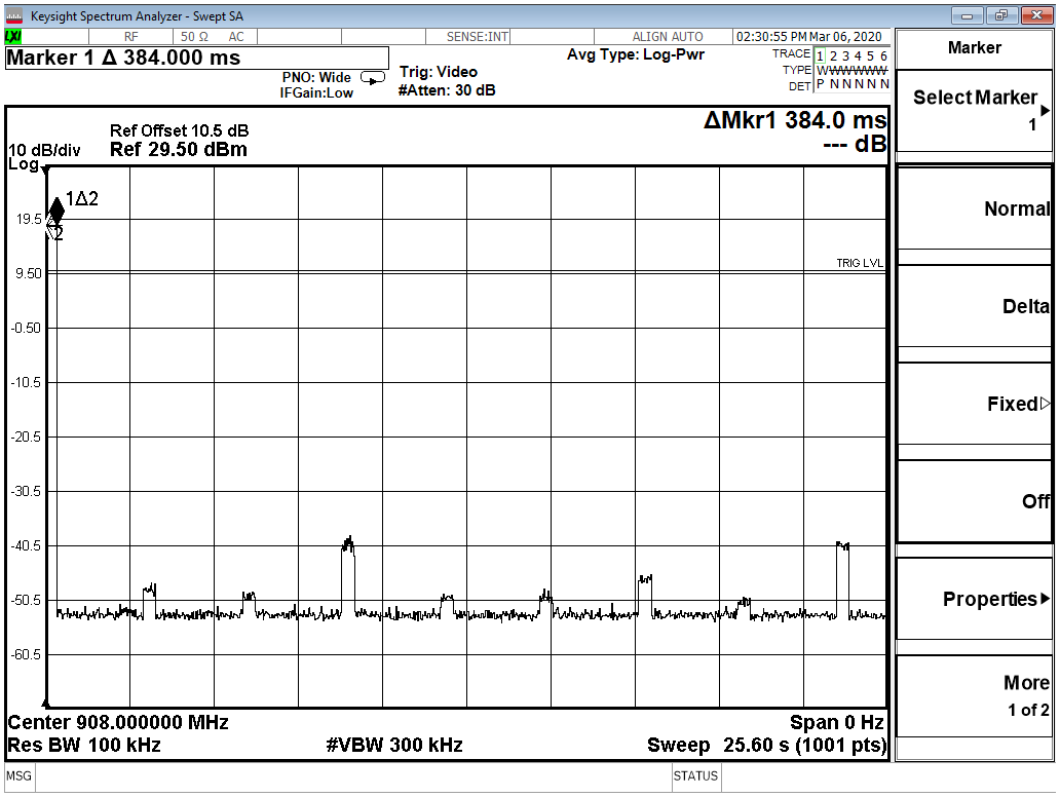
Number of events in 25.6Sec = 1

Margin = 400 – 370.2 = **29.8ms**

**Screen Capture from the spectrum analyzer: Dwell time in 600ms**



## Screen Capture from the spectrum analyzer: Dwell Time in 25.6 Sec




Note: The time reported for the duration of the transmit occurrence has a sampling period of 25.6ms, which makes its accuracy +/-25.6ms.

## 2.9 EUT Positioning Assessment

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: I. Akram** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-02 (19.5°C,13.5 % RH)** | **Basic Standard: ANSI C63.4-2014** |

**X-Axis Found worse**

**Comments:** T0005986 variant oriented in three axis's and X- axis found to be worse emission axis.

T0005982 variant has only one possible application orientation 'X' and was found with emission similar to T0005986 X-axis but showed more spurious emission. The radiated spurious testing was performed with this unit.

**Specification: ANSI C63.4-2014, Clause 6.3.2.1**

Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m, but it may be larger or smaller to accommodate various sized EUTs (see Figure 6, Figure 7, and Figure 9). For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

Refer to Test Setup photo exhibit.

## 2.10 Radiated Spurious Emissions in restricted frequency bands (TX Mode)

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel: Bushra Muharram** | **Standard: FCC PART 15.247** |
| **Date: 2020-03-(03/04) (20.7°C,15.6 % RH)** | **Basic Standard: ANSI C63.10-2013** |

**EUT status: Compliant**

**Specification: FCC PART 15.247(d)**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### 2.10.1 Test Guidance: ANSI C63.10-2013, Clause 13.4.2

From 9 kHz to 150 kHz (resolution bandwidth of 200 Hz) and from 150 kHz to 30 MHz (resolution bandwidth 9 kHz) measurements are performed with a loop antenna (as per KDB 460108).

From 30 MHz to 1000 MHz, measurements are performed with a broadband biconilog antenna and a resolution bandwidth of 120 kHz.

Above 1000 MHz, measurements are performed with a DRG Horn antenna or a Standard Gain horn, and a resolution bandwidth of 1 MHz The EUT is raised to 150 cm above the ground plane, and the area between the EUT and the antenna mast is covered with RF absorbent material.

The scan is performed at discrete increments of turntable azimuth and antenna height, which are selected in accordance with the applicable standard in order to assure capture of frequencies of interest. Optimization is performed based on the scan data.

Frequencies having peak emissions within 10dB of the limits are optimized. The EUT is rotated in azimuth over 360 degrees and the direction of maximum emission is noted.

Antenna height is varied from 1 – 4 meters at this azimuth to obtain the maximum emission. Then the maximum level is measured with the appropriate detector and recorded. Up to 1 GHz, measurements are performed with a Quasi-Peak detector. Above 1 GHz, measurements are recorded with Peak and/or Average detectors, as applicable.

### 2.10.2 Deviations From The Standard:

There were no deviations from the EUT setup or methodology specified in the standard.

### 2.10.3 Test Equipment

Testing was performed with the following equipment:

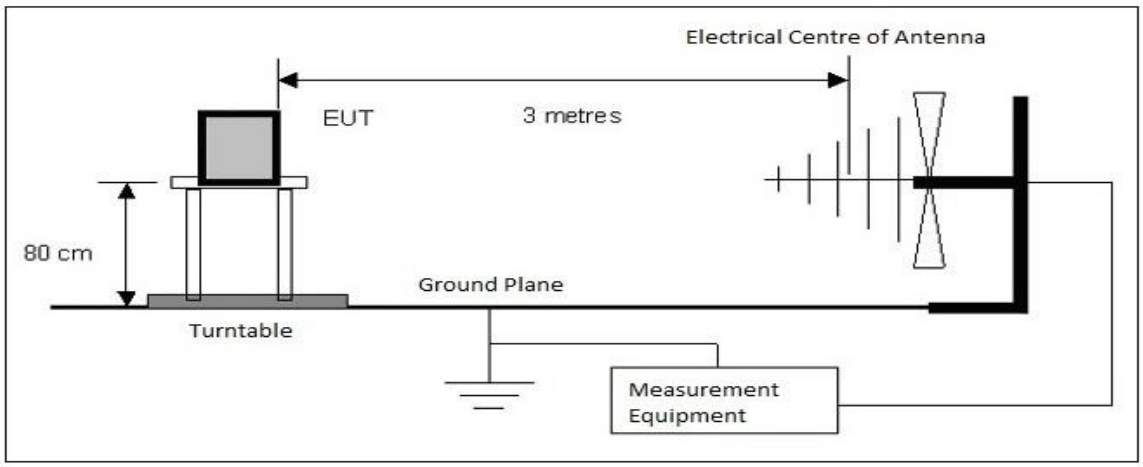
| Equipment | Manufacturer | Model # | Asset # | Cal. Date (yyyy-mm-dd) | Cal. Due (yyyy-mm-dd) |
|---|---|---|---|---|---|
| EMC Software | UL | Ver. 9.5 | ETC-SW-EMC 2.1 | N/A | |
| EMI receiver | Agilent | N9038A (FW A.25.05) | 6130 | 2019-05-10 | 2020-05-10 |
| Loop Antenna | EMCO | 6502 | 10868 | 2019-04-11 | 2021-04-11 |
| Biconilog Antenna | ARA | LPB-2520/A | 4318 | 2018-09-19 | 2020-09-19 |
| DRG Horn | EMCO | 3115 | 19357 | 2018-09-12 | 2020-09-12 |
| Humidity/Temp Logger | Extech Ins. Corp. | 42270 | 5892 | 2019-04-05 | 2020-04-05 |
| Low Noise Amplifier (1 – 18 GHz) | MITEQ | JS43-01001800-21-5P | 4354 | 2020-01-03 | 2021-01-03 |
| Pre-Amplifier (30 – 1300 MHz) | HP | 8447D | 9291 | 2020-01-03 | 2021-01-03 |
| RE Cable below 1GHz | Insulated Wire Inc. | KPS-1501A-3600-KPA-01102006 | 4419 | 2020-01-03 | 2021-01-03 |
| Re Cable Above 1 GHz | A.H. System Inc. | SAC-26G-8.23 | 6187 | 2020-01-03 | 2021-01-03 |
| High Pass Filter | K&L | 4DH21 | - | 2020-01-03 | 2021-01-03 |

### 2.10.4 Test Sample Verification, Configuration & Modifications

The EUT was set to a selected channel with test-specific software. The output was modulated as in normal operation.

The EUT met the requirements without modification.

**Test setup diagram for Radiated Spurious Emissions testing (below 1GHz):**




Above 1GHz, the EUT is raised using a low permittivity material (polystyrene) to a height of 1.5m.

## FCC Part 15.205 Restricted Bands of Operation:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| [1]0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2690 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 - 335.4 | 3600 - 4400 | ([2]) |
| 13.36 - 13.41 | | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz, [2] Above 38.6

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in 15.209 shall be demonstrated based on the average value of the measured emissions.

### Specification: FCC15.209 Radiated emission limits.

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (µV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009 – 0.490 | 2400 / F(KHz) | 300 |
| 0.490 – 1.705 | 24000 / F(KHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 – 960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 2.10.5 Radiated Emissions Data:

The emissions data are presented in tabular form, showing turntable azimuth, antenna height and polarization, the uncorrected spectrum analyzer reading, the correction factors applied, the net result, the value of the limit at the frequency investigated, and the Delta between the result and the limit.

**Meter Reading in dBμV + Antenna Factor in dB/m + Gain/Loss Factor in dB = Corrected Field Strength in dbμV/m.**

**Delta = Field Strength - Limit**

**Notes:**

- When a preamp is used, the resulting gain is compensated, producing a negative value for the Cable Loss.
- Measurements reported are the result of adjusting the turntable azimuth and antenna height to obtain the maximum EUT emission. This may produce a different reading than the plot trace. The plot is a Peak Hold function obtained at discrete increments of height and azimuth, while the reported measurement is obtained with the appropriate Quasi Peak or Average detector after the height and azimuth have been adjusted for maximum emission.
- Preliminary scans were performed for all channels in Transmit modes. The Low band channel 902.3 MHz was selected as the worst-case condition for detailed examination.
- In Transmit mode, the EUT was assessed up to 10.0 GHz.

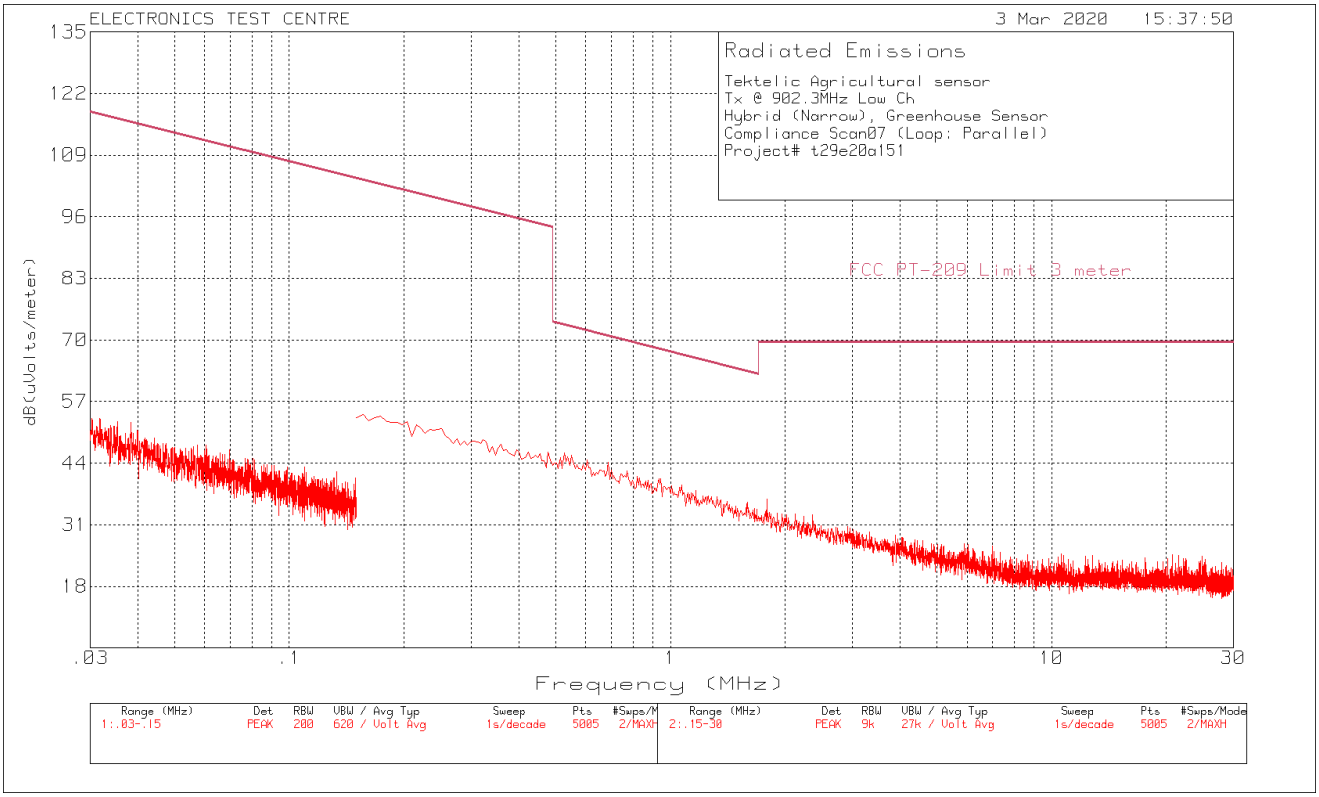
**Negative values for Delta indicate compliance.**

| Band | Freq. Marker | Freq. [MHz] | Raw reading [dBμv] | Det | Antenna Factor [dB/m] | Pre amp Gain /Cable Loss [dB] | Corrected Reading [dBμv/m] | FCC 15.209 Limit [dBμv/m] | Delta [dB] | Azimuth [Deg] | Height [cm] | Polarization |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency Range 30 – 1000 MHz | | | | | | | | | | | |
| RB | 7 | 111.424 | 13.65 | QP | 14.5 | 2.8 | 30.95 | 43.5 | -12.55 | 79 | 108 | Vertical |
| NRB | 10 | 519.2311 | 13.2 | QP | 21.8 | 5.8 | 40.8 | 46.02 | -5.22 | 93 | 103 | Verical |
| | Frequency Range 1000 – 1400 MHz | | | | | | | | | | | |
| RB | 1 | 1070.0 | 27.04 | AV | 24.5 | -18.7 | 32.84 | 54 | -21.16 | 89 | 215 | Horizontal |
| RB | 1 | 1070.0 | 39.31 | PK | 24.5 | -18.7 | 45.11 | 74 | -28.89 | 89 | 215 | Horizontal |
| RB | 2 | 1123.7 | 19.07 | AV | 24.6 | -18.9 | 24.77 | 54 | -29.23 | 276 | 379 | Horizontal |
| RB | 2 | 1123.7 | 32.6 | PK | 24.6 | -18.9 | 38.36 | 74 | -35.64 | 276 | 379 | Horizontal |
| RB | 3 | 1337.0 | 18.47 | AV | 25.2 | -18.8 | 24.87 | 54 | -29.13 | 335 | 202 | Vertical |
| RB | 3 | 1337.0 | 52.29 | PK | 25.2 | -18.8 | 58.69 | 74 | -15.31 | 335 | 202 | Vertical |
| RB | 4 | 1348.0 | 30.69 | AV | 25.2 | -18.8 | 37.09 | 54 | -16.91 | 302 | 154 | Vertical |
| RB | 4 | 1348.0 | 57.53 | PK | 25.2 | -18.8 | 63.93 | 74 | -10.07 | 302 | 154 | Vertical |
| | Frequency Range 1400 – 3600 MHz | | | | | | | | | | | |
| RB | 1 | 1448.8 | 26.55 | AV | 25.3 | -29 | 22.85 | 54 | -31.15 | 300 | 345 | Horizontal |
| RB | 1 | 1448.8 | 41.03 | PK | 25.3 | -29 | 37.33 | 74 | -36.67 | 300 | 345 | Horizontal |
| RB | 2 | 1682.3 | 40.67 | AV | 26 | -34.5 | 32.17 | 54 | -21.83 | 343 | 145 | Horizontal |
| RB | 2 | 1682.3 | 41.15 | PK | 26 | -34.5 | 32.65 | 74 | -41.35 | 343 | 145 | Horizontal |
| RB | 3 | 2239.3 | 27.09 | AV | 28 | -34.4 | 20.69 | 54 | -33.31 | 284 | 152 | Horizontal |
| RB | 3 | 2239.3 | 40.46 | PK | 28 | -34.4 | 34.06 | 74 | -39.94 | 284 | 152 | Horizontal |
| RB | 4 | 1448.8 | 26.54 | AV | 25.3 | -29 | 22.84 | 54 | -31.16 | 263 | 178 | Vertical |
| RB | 4 | 1448.8 | 58.71 | PK | 25.3 | -29 | 55.01 | 74 | -18.99 | 263 | 178 | Vertical |
| RB | 5 | 1571 | 27.88 | AV | 25.5 | -33.4 | 19.98 | 54 | -34.02 | 92 | 133 | Vertical |
| RB | 5 | 1571 | 40.24 | PK | 25.5 | -33.4 | 32.34 | 74 | -41.66 | 92 | 133 | Vertical |
| RB | 6 | 1682.3 | 27.7 | AV | 26 | -34.5 | 19.2 | 54 | -34.8 | 123 | 102 | Vertical |
| RB | 6 | 1682.3 | 40.55 | PK | 26 | -34.5 | 32.05 | 74 | -41.95 | 123 | 102 | Vertical |
| RB | 7 | 2239.3 | 27.09 | AV | 28 | -34.4 | 20.69 | 54 | -33.31 | 146 | 382 | Vertical |
| RB | 7 | 2239.3 | 38.9 | PK | 28 | -34.4 | 32.5 | 74 | -41.5 | 146 | 382 | Vertical |
| RB | 8 | 3354.2 | 27.85 | AV | 31.1 | -32.9 | 26.05 | 54 | -27.95 | 147 | 158 | Vertical |
| RB | 8 | 3354.2 | 45.07 | PK | 31.1 | -32.9 | 43.27 | 74 | -30.73 | 147 | 158 | Vertical |

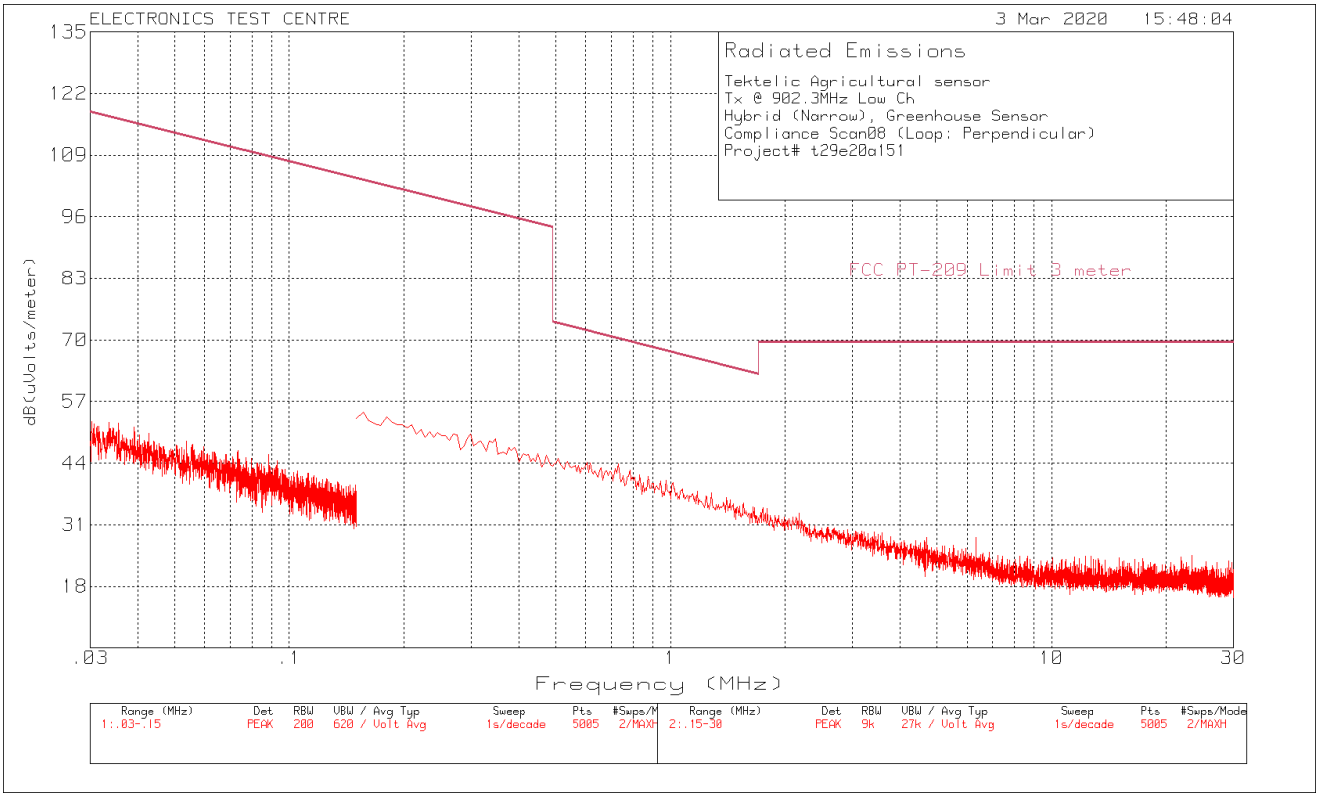
| Band | Freq. Marker | Freq. [MHz] | Raw reading [dBµv] | Det | Antenna Factor [dB/m] | Pre amp Gain [dB] | Corrected Reading [dBµv/m] | FCC 15.209 Limit [dBµv/m] | Delta [dB] | Azimuth [Deg] | Height [cm] | Polarization |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Frequency Range 3600 – 10000 MHz | | | | | | | | | | | |
| RB | 1 | 3609.3 | 45.19 | AV | 31.5 | -32.8 | 43.89 | 54 | -10.11 | 203 | 103 | Horizontal |
| RB | 1 | 3609.3 | 48.34 | PK | 31.5 | -32.8 | 47.04 | 74 | -26.96 | 203 | 103 | Horizontal |
| RB | 2 | 4511.4 | 39.75 | AV | 32.4 | -32.4 | 39.75 | 54 | -14.25 | 306 | 287 | Horizontal |
| RB | 2 | 4511.4 | 44.61 | PK | 32.4 | -32.4 | 44.61 | 74 | -29.39 | 306 | 287 | Horizontal |
| RB | 3 | 5413.5 | 40.91 | AV | 34 | -30.6 | 44.31 | 54 | -9.69 | 211 | 290 | Horizontal |
| RB | 3 | 5413.5 | 46.92 | PK | 34 | -30.6 | 50.32 | 74 | -23.68 | 211 | 290 | Horizontal |
| RB | 4 | 8121.1 | 31.12 | AV | 36.7 | -26.1 | 41.72 | 54 | -12.28 | 105 | 343 | Horizontal |
| RB | 4 | 8121.1 | 39.3 | PK | 36.7 | -26.1 | 49.9 | 74 | -24.1 | 105 | 343 | Horizontal |
| RB | 5 | 3609.3 | 48.26 | AV | 31.5 | -32.8 | 46.96 | 54 | -7.04 | 247 | 286 | Vertical |
| RB | 5 | 3609.3 | 50.96 | PK | 31.5 | -32.8 | 49.66 | 74 | -24.34 | 247 | 286 | Vertical |
| RB | 6 | 4510.9 | 35.62 | AV | 32.4 | -32.4 | 35.62 | 54 | -18.38 | 274 | 270 | Vertical |
| RB | 6 | 4510.9 | 45.08 | PK | 32.4 | -32.4 | 45.08 | 74 | -28.92 | 274 | 270 | Vertical |
| RB | 7 | 5413.5 | 41.26 | AV | 34 | -30.6 | 44.66 | 54 | -9.34 | 299 | 261 | Vertical |
| RB | 7 | 5413.5 | 46.76 | PK | 34 | -30.6 | 50.16 | 74 | -23.84 | 299 | 261 | Vertical |
| RB | 8 | 8120.6 | 39.77 | AV | 36.7 | -26.1 | 50.37 | 54 | -3.63 | 247 | 197 | Vertical |
| RB | 8 | 8120.6 | 44.28 | PK | 36.7 | -26.1 | 54.88 | 74 | -19.12 | 247 | 197 | Vertical |
| RB | 9 | 9022.7 | 29.23 | AV | 37.5 | -26.5 | 40.23 | 54 | -13.77 | 254 | 235 | Vertical |
| RB | 9 | 9022.7 | 37.86 | PK | 37.5 | -26.5 | 48.86 | 74 | -25.14 | 254 | 235 | Vertical |

**Restricted Band (RB)**
**Non Restricted Band (NRB)**

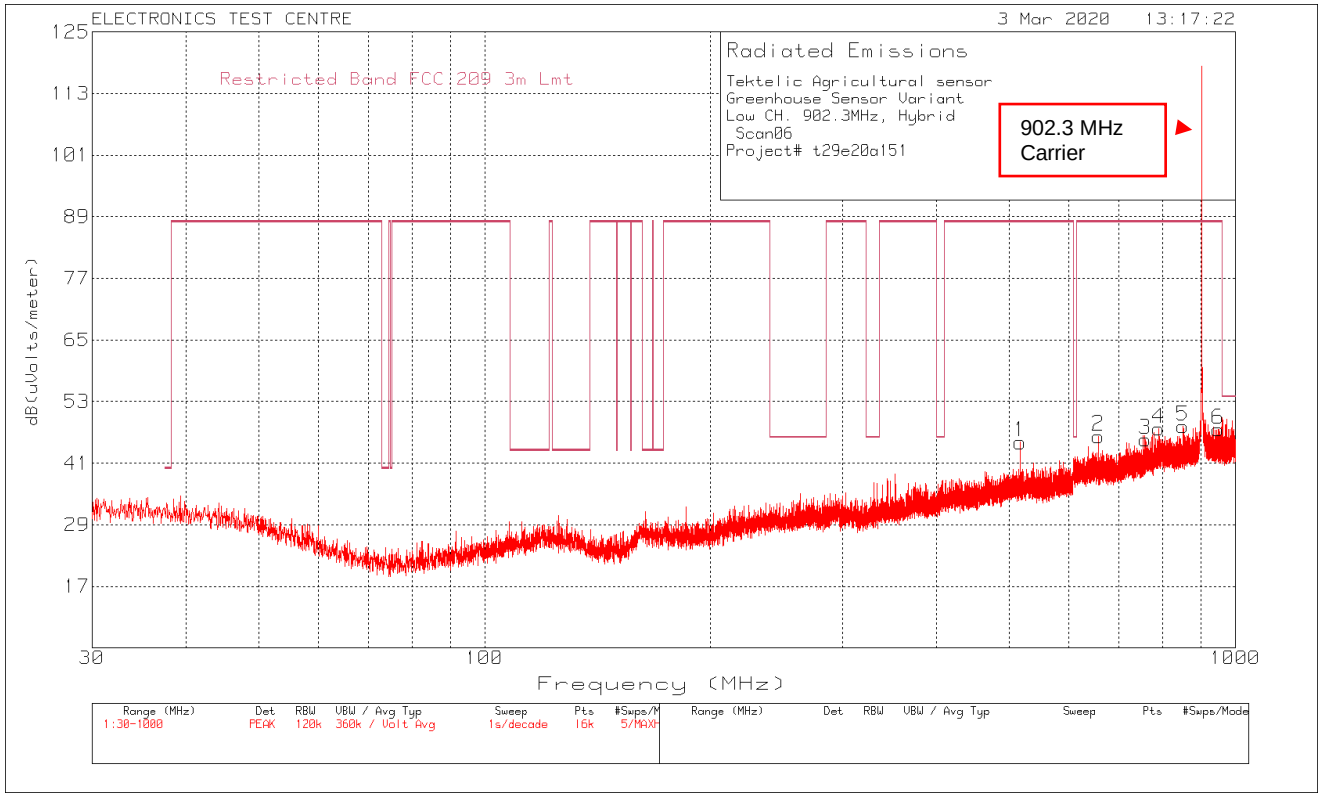
## Plot of Radiated Emissions: Measuring Antenna Parallel



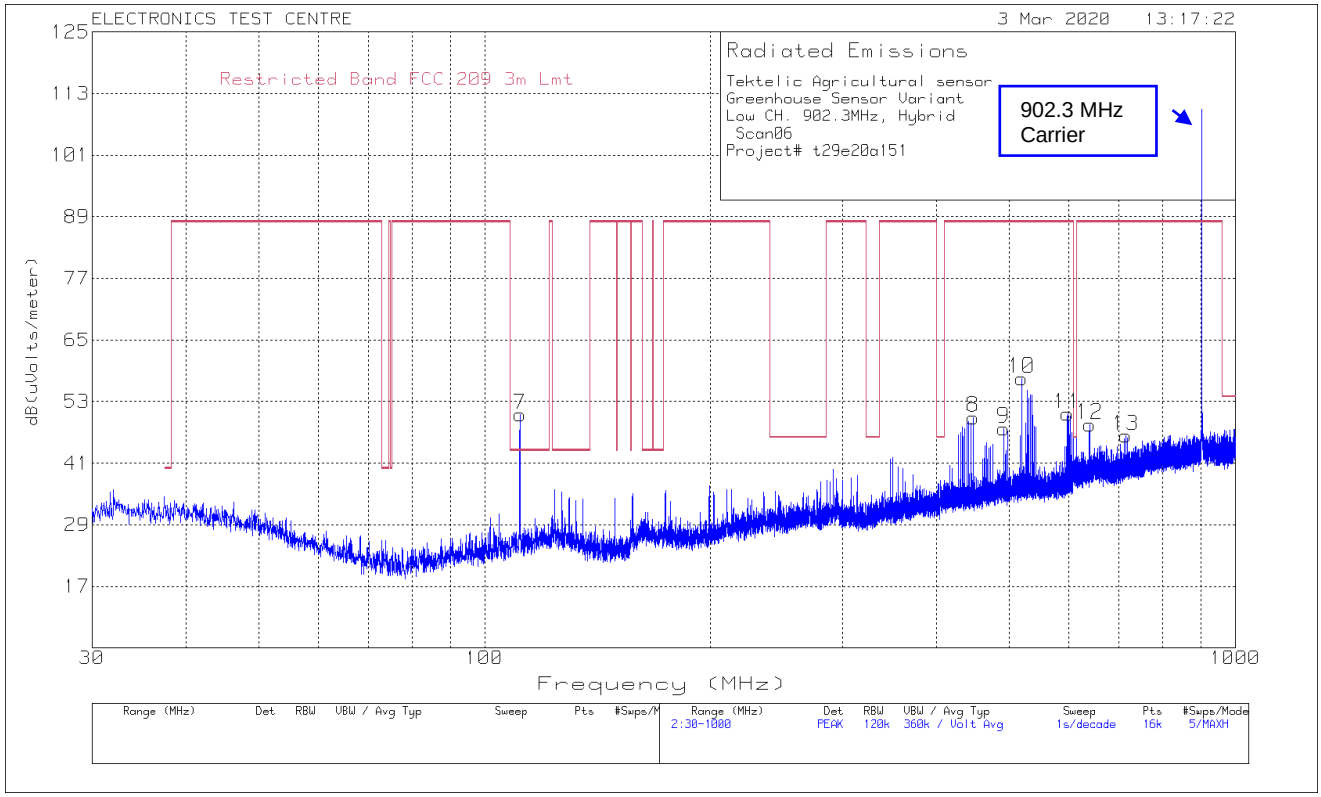

## Plot of Radiated Emissions: Measuring Antenna Perpendicular



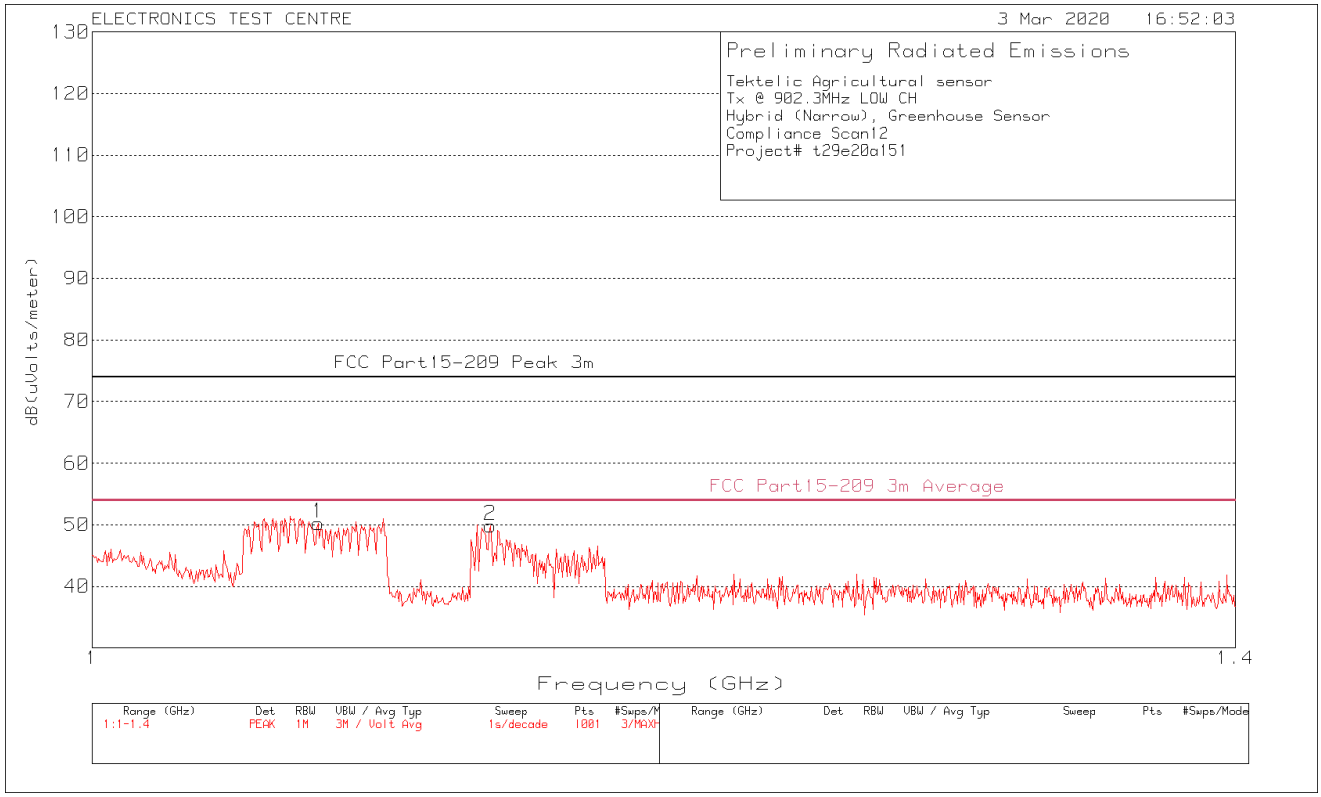
## Plot of Radiated Emissions: Horizontal polarization



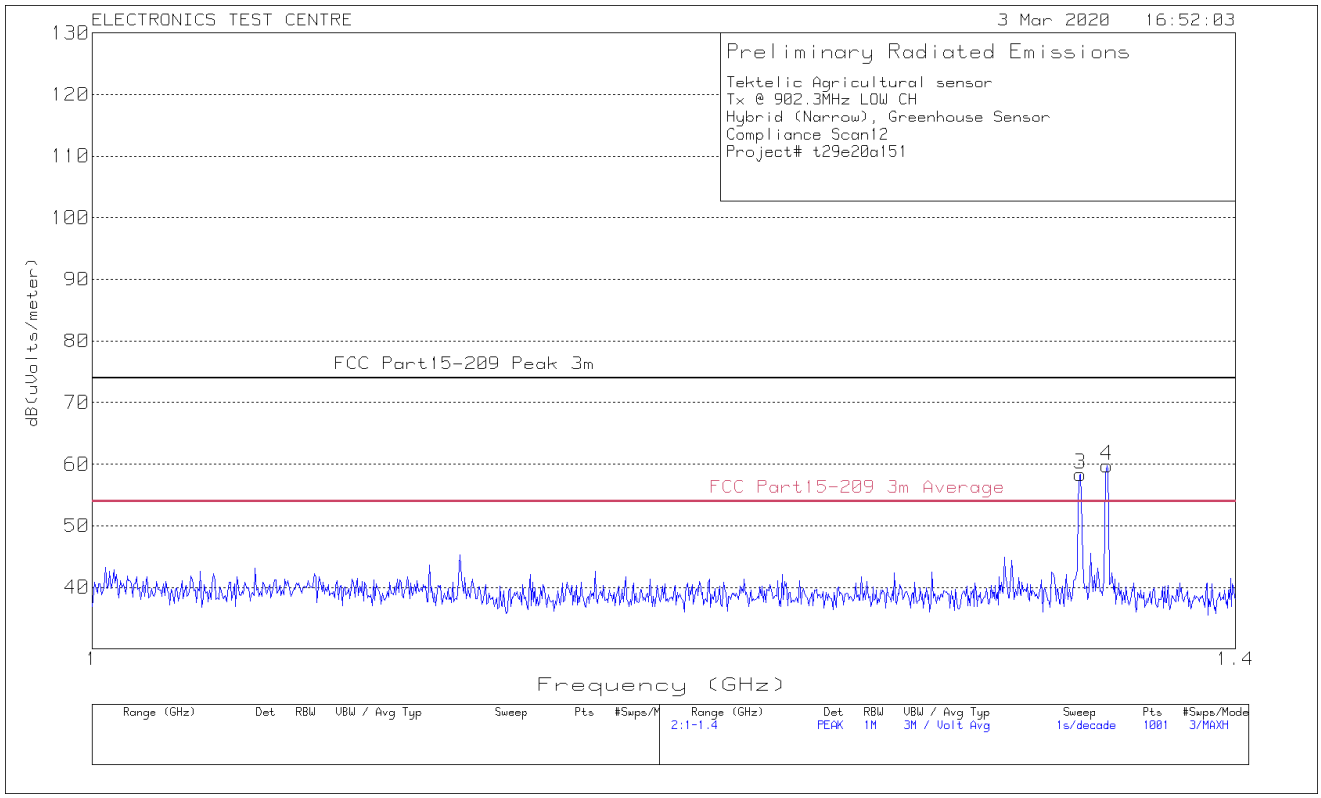

## Plot of Radiated Emissions: Vertical polarization



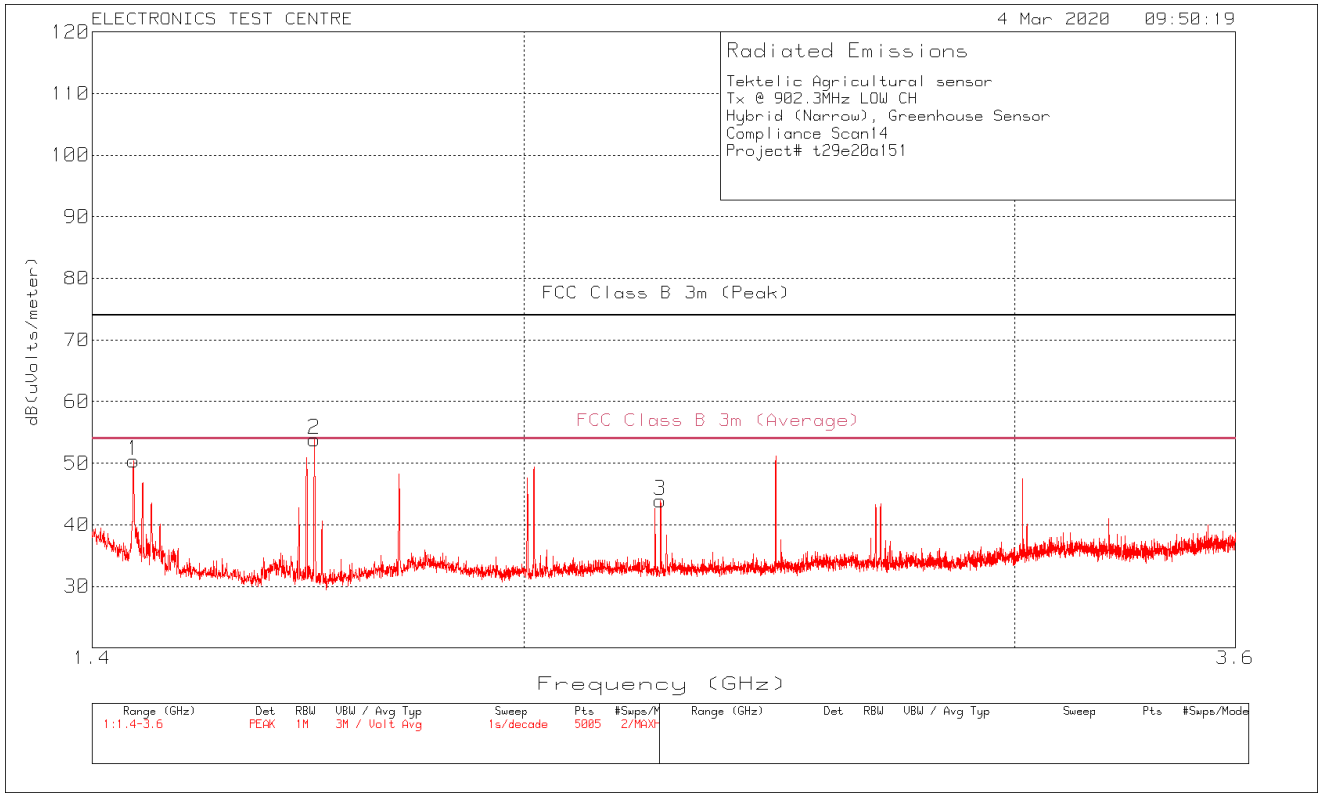
## Plot of Radiated Emissions: Horizontal polarization



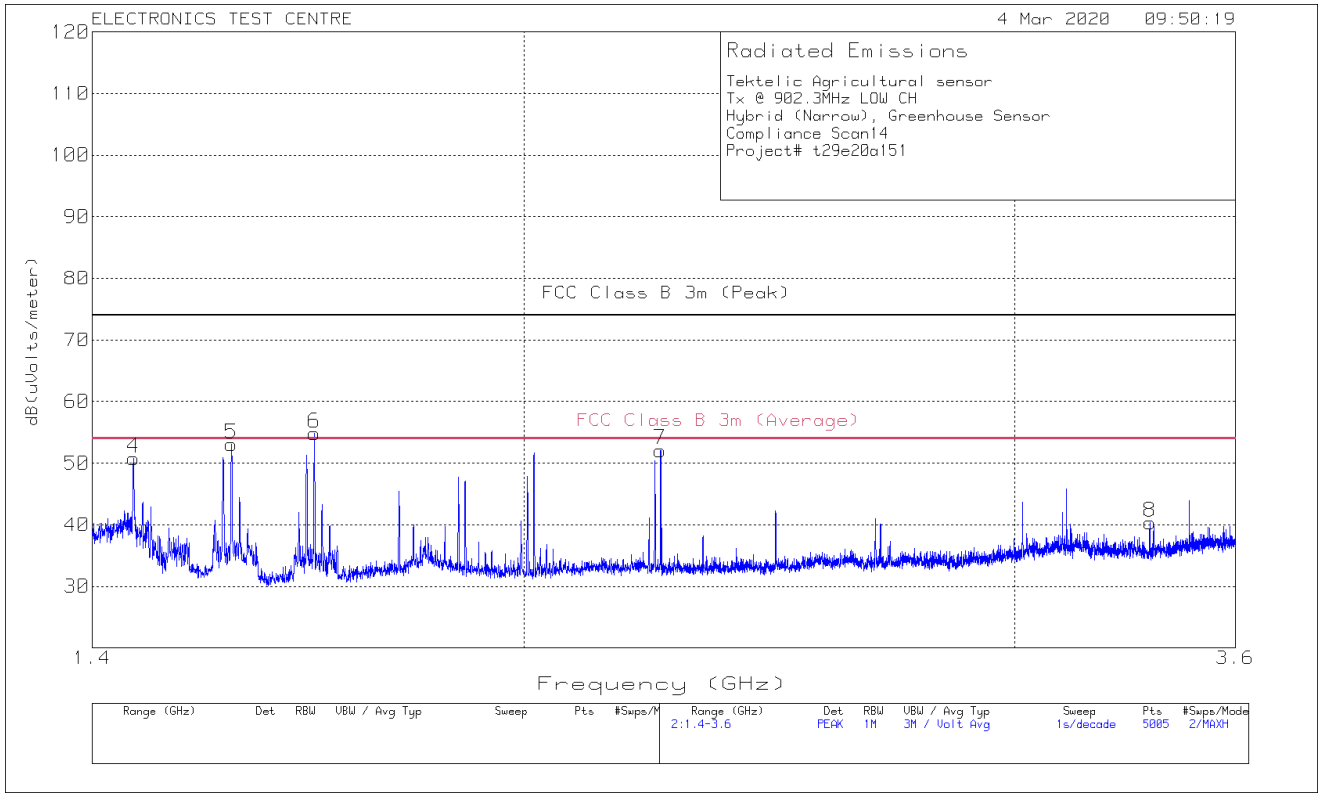

## Plot of Radiated Emissions: Vertical polarization



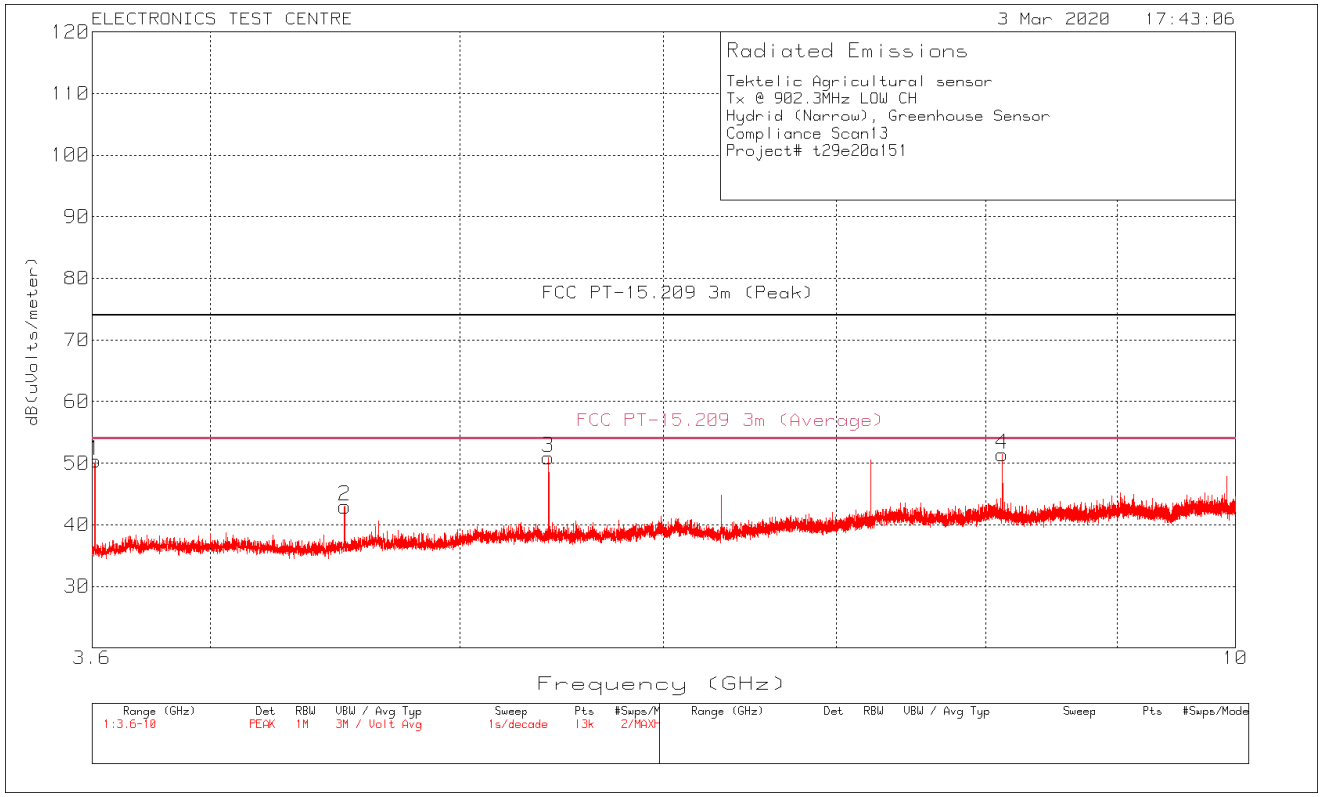
## Plot of Radiated Emissions: Horizontal polarization



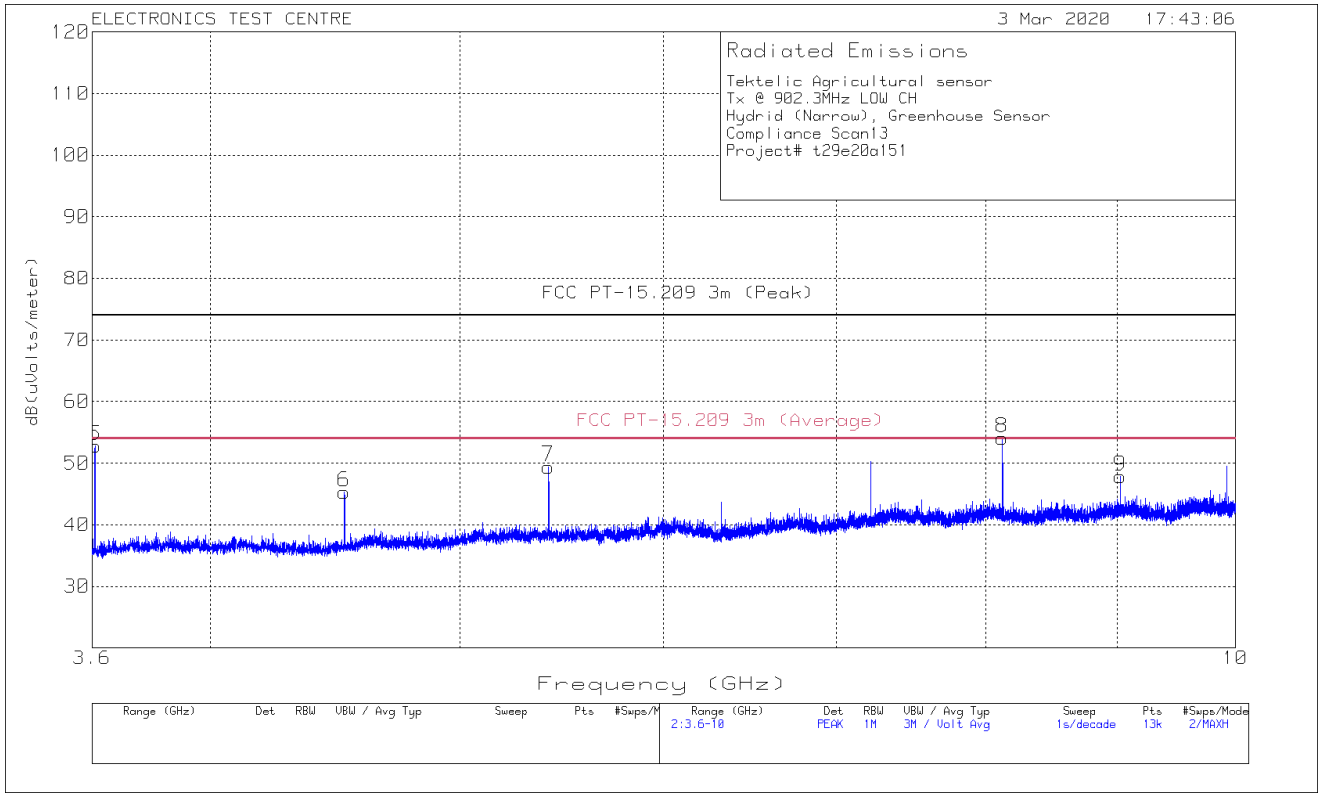

## Plot of Radiated Emissions: Vertical polarization



## Plot of Radiated Emissions: Horizontal polarization




## Plot of Radiated Emissions: Vertical polarization



## 2.11 RF Exposure

| | |
|---|---|
| **Test Lab: Electronics Test Centre, Airdrie** | **EUT: Agriculture Sensor** |
| **Test Personnel:** | **Standard: FCC PART 15.247** |
| **Date:** | |

**EUT status: Exempt**

**Compliant:** RF exposure assessment to be provided in a separate Exhibit.

# 3.0 TEST FACILITY

## 3.1 Location

The Agriculture Sensor was tested for emissions at the Electronics Test Centre laboratory located in Airdrie, Alberta, Canada. The Radio Frequency Anechoic Chamber (RFAC), identified as Chamber 1, has a usable working space measuring 10.6 m long x 7.3 m wide x 6.5 m high.

Measurements taken at this site are accepted by Industry Canada as evidence of conformity per registration file # 2046A. This site is also listed with the FCC under Registration Number CA2046.

The floor, walls and ceiling consist of annealed steel panels. The walls and ceiling are covered with ferrite tile, augmented by RF absorbant foam material on the end wall nearest the turntable, and on the adjacent walls and the ceiling. The chamber floor supports a 15 cm high internal floor, constructed of annealed steel panels, that forms the ground plane, and is bonded to the chamber walls.

The 3-m diameter turntable is flush-mounted with the floor. A sub-floor cable-way is provided to route cables between the turntable pit and EUT support equipment located in the Control Room. Cables reach the EUT through an opening in the centre of the turntable.

Test instrumentation and EUT support equipment is located in the Control Room, consisting of two shielded vestibules joined together at the side of the main room. Cables are routed through bulkhead panels between the rooms and the test chamber as required. Power feeds are routed into the main room and vestibules through line filters providing at least 100 dB of attenuation between 10 kHz and 10 GHz.

Either floor mounted or table-top equipment can be tested at this facility.

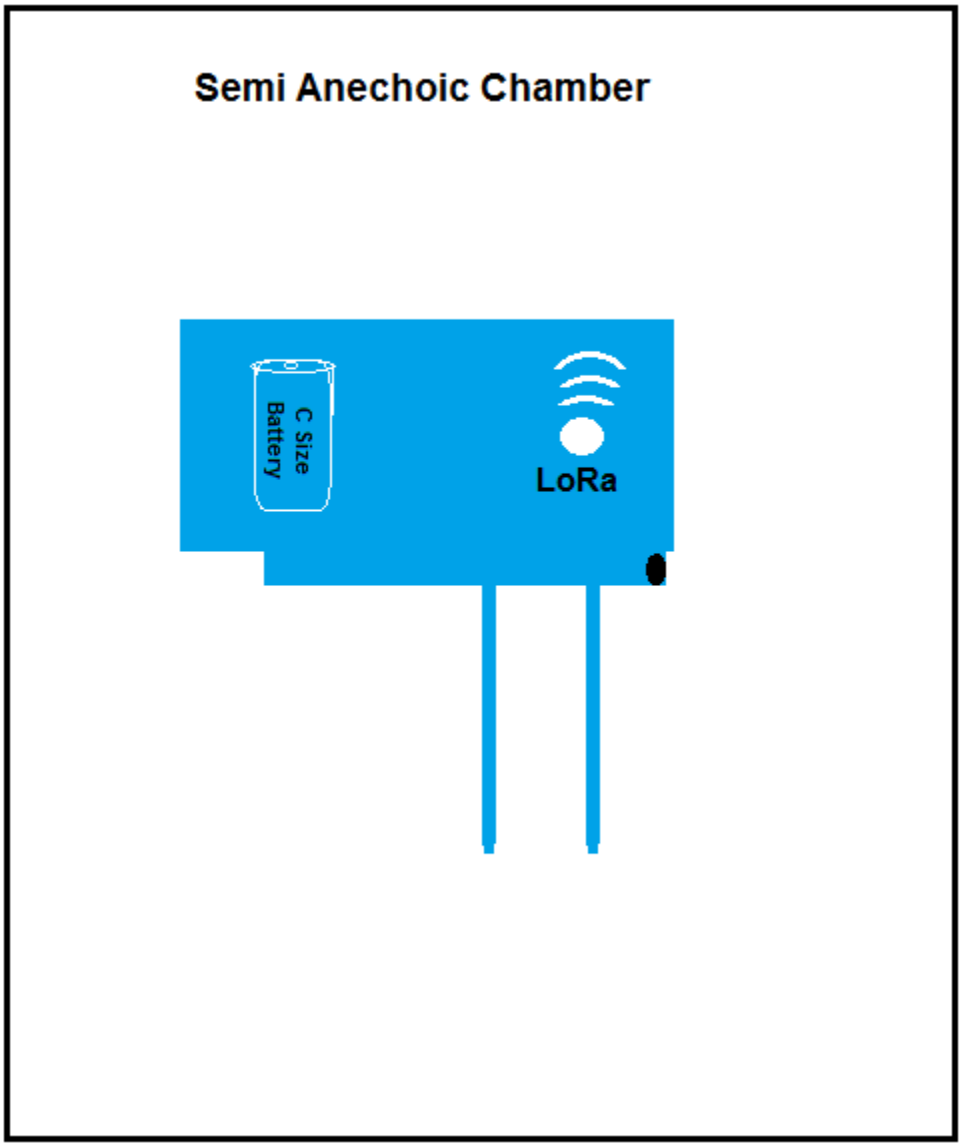
## 3.2 Grounding Plan

The Agriculture Sensor was placed at the center of the test chamber turntable on top of polystyrene foam table. It is enclosed in a non-conductive plastic case and has no earth ground provisioning.

## 3.3 Power Supply

The Agricultural Sensor is powered from a Lithium Thionyl Chloride (LTC), C-size, bobbin cell.

## Appendix A (Worse Emission variant test setup Block Diagram)



# End of Document