# Electromagnetic Compatibility Test Report

**Test Report No: APT 210720 Rev.4**
**Issued on:** July 21, 2020

**Product Name**
**SciO Cup**

**Tested According to**
**FCC 47 CFR, Part 15, Subparts C**

**Tests Performed for**
**VeriFood Ltd.**
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Certificate 1633.01
Electrical Testing

## Test Personnel

**Tests Performed By:** ----------

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**Report Approved By**: ----------

**Rami Nataf**
**EMC Lab. Manager**
**QualiTech EMC Laboratory**

## Test Report details:

Test commencement date: 28.06.2020

Test completion date: 13.07.2020

Customer's representative: Elad Heiman

Issued on: 21.07.2020

### Revision details:

| Version | Date | Details/Reasons |
|---|---|---|
| Rev. 1 | 21.07.2020 | - |
| Rev. 2 | 08.09.2020 | Corrected per TCB comments. |
| Rev. 3 | 17.09.2020 | Corrected per TCB comments. |
| Rev. 4 | 23.09.2020 | Corrected per TCB comments. |

## Assessment information:

This report contains an assessment of the EUT against Electromagnetic Compatibility based upon tests carried out on the samples submitted. The results contained in this report relate only to the items tested. Manufactured products will not necessarily give identical results due to production and measurement tolerances. QualiTech, EMC Lab does not assume responsibility for any conclusion and generalization drawn from the test results with regards to other specimens or samples of type of the equipment represented by test item.

The EUT was setup and exercised using the configuration, modes of operation and arrangements defined in this report only.

## Modifications:

**Modifications made to the EUT**

None

**Modifications made to the Test Standard**

None

## Summary of Compliance Status

The EUT was tested according to the following test methods.
Test results are given in full in section 4.

| Test Case | Test Spec. Clause | Remarks |
|---|---|---|
| 6dB Bandwidth | 47 CFR §15.247 (a) (2),ANSI C63.10 Subclause 11.8.2<br>Option 2 | Pass |
| Maximum Peak Output Power | 47 CFR §15.247 (b) (3), ANSI C63.10 Subclause 11.9.1.1 | Pass |
| DTS maximum power spectral density level in the fundamental emission | 47 CFR §15.247 (e) (1),ANSI C63.10 Subclause 11.10.2 | Pass |
| Radiated Spurious Emission in non-restricted frequency bands | 47 CFR §15.247 (d),ANSI C63.10 Subclause 11.11.1(a) | Pass |
| Radiated Spurious Emissions, Restricted Bands | 47 CFR §15.247 (d), §15.205, §15.209(a), ANSI C63.10. Subclause 11.12.1 | Pass |
| Band-edge compliance of RF Conducted Emission | 47 CFR §15.247 (d), ANSI C63.10. Subclause 11.13.2 | Pass |
| Antenna Connector Requirements | 47 CFR §15.203 | Pass |
| Power line Emission measurements | 47 CFR §15.207 | Pass |

# *Table of Contents*

# 1. General

## 1.1. Referenced documents:

| | |
|---|---|
| **FCC Part 15** | Code of Federal Regulations (Washington, DC: Federal Communications Commission), Title 47, Part 15, Subpart C |
| **ANSI C63.10:2013** | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |

## 1.2. General Description

**Product name: SCiO Cup**

**Model**: SCCUP01

**FCC ID:** 2AEKW-CP-SCM002

**Description:**

The SCiO cup is a portable Near Infrared device for grains and feed materials analysis

THE SCiO Cup is the world's fastest lab-grade dry matter analyzer, combining portability, accuracy, and ease of use. It revolutionizes feed analysis by moving decision making out of the lab and into the field, by using Near Infra-Red Spectroscopy (NIRS).

Maximum Radiated Peak Output Power: 1.047 mW

**Frequency range:** 2400-2483.5 GHz

**Type of Modulation:**

| Protocol | Modulation |
|---|---|
| Bluetooth | GFSK |

**Antenna Specification:**

Type:
Antenna Gain: 3dBi in the range 2.4 – 2.5 GHz

## 2. Method of Measurements

### 2.1. Radiated Emissions Measurements in the restricted bands:

For radiated emissions, which fall in the restricted bands the spectrum from 9 kHz to 25GHz was investigated following the guidelines in ANSI C63.10-2013, with the transmitter set to the lowest, middle and highest channel frequencies. Measurements were performed with peak detector and repeated averaged with VBW=10Hz. Only Peak detection plots are presented.

### 2.2. Radiated Emission measurements:

Measurements were performed at a 3-meter measurement distance in the semi-anechoic chamber in order to evaluate the radiated electromagnetic interference characteristics of the EUT. The EUT was placed on a non-metallic table/support, 0.8m for frequency below 1GHz and 1.5m for frequency above 1GHz above the turntable, was configured, arranged and operated in a manner consistent with typical application and load conditions. The test program of exercising the equipment ensured that various parts of the EUT were exercised to permit detection of all EUT disturbances.
An appropriate antenna depending upon the frequency range, per ANSI C63.10-2013 was used. While the turntable was being rotated, the height of the antenna was scanned from 1 to 4m. The highest radiated emission was detected by manipulating the system cables to the worst-case position. This process was repeated for both antenna polarizations. The spectrum up to 40GHz was investigated for spurious emissions, using a band-reject filter where appropriate.
The amplitudes of worst-case emission were measured with the detector modes and resolution bandwidths over various frequency ranges according to the requirements of ANSI C63.10-2013.

### 2.3. Worst Case Results:

Worst case result is determined as the channel with the highest output power and operating on charging mode with AC/DC adapter . Pre-scan has been conducted to determine the worst-case. Test result of various modulation modes/data rates and EUT's configurations(Battery operated mode, charging mode with AC/DC adapter) were investigated and worst case was reported.

FCC 15.31(e)
The EUT operates with AC/DC adaptor 110Vac ,60Hz with a new rechargeable battery
During power output measurement the AC input was varied between 85% and 115%
No change of power and frequency was observed-comply

### 2.4. Power Line Emission measurements:

The EUT was placed on a non-conductive table/support 80 cm above the reference ground plane. The EUT was configured in accordance with ANSI C63.10-2013 using a 50µH/50 ohm LISN.

Compliance with the provisions was based on the measurements of the radio frequency voltage between each line and the ground at the power terminal.

The EUT was operated in receive mode and then with DTS transmitters operating alternately and the worst case results were presented.

# 3. Test Facility & Uncertainty of Measurement

## 3.1. Accreditation/ Registration reference:

## 3.2. Accreditation/ Registration reference:

- *A2LA Certificate Number: 1633.01*
- *FCC Designation Number :IL1006*

## 3.3. Test Facility description

The tests were performed at the EMC Laboratory, QualiTech Division, ECI Telecom

**Address:** 30, Hasivim St., Petah Tikva, Israel.
Tel: 972-3-926-6994

**Semi Anechoic Configuration:**

| | |
|---|---|
| Measurement distance | 3m |
| Chamber dimensions | 9.5m x 6.5m x 5.2m |
| Antenna height | 1 - 4m |
| Shielding Effectiveness | Magnetic field ≥80dB at 15 kHz<br>≥90dB at 100 kHz<br>Electric field >120dB from 1MHz to 1GHz<br>>110dB from 1GHz to 10GHz |
| Absorbing material | Ferrite tiles on the walls and ceiling<br>Emerson and Cuming absorbing material in selected positions on the walls |
| Normalized Site Attenuation<br>measured at 5 positions | ±3.9dB, 30MHz to 200MHz<br>±3dB, 200MHz to 1000MHz |
| Transmission Loss<br>measured at 5 positions, at 1.5m height | ±3dB, 1GHz to 18GHz |

## 3.4. The measurement software used:

| Software Name | Software Version |
|---|---|
| Test Software “TILE | Version 7.1.4.1 |

# 4. BLE: Report of Measurements and examinations

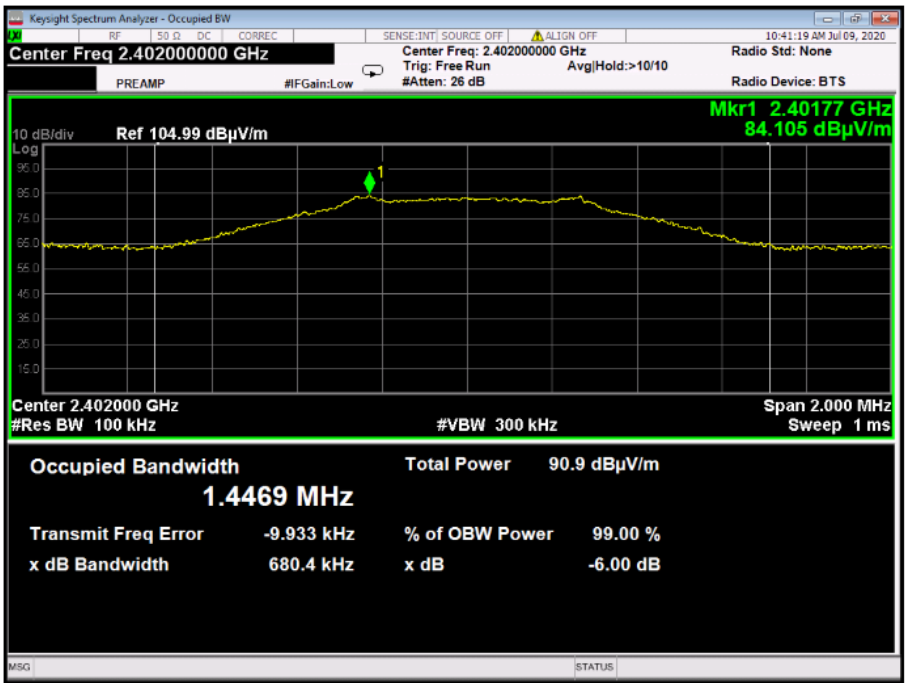
## 4.1. The minimum 6dB DTS bandwidth

| | | | |
|---|---|---|---|
| Reference document: | **47 CFR §15.247 (a) (2),**ANSI C63.10 Subclause 11.8.2 Option 2 | | |
| Test Requirements: | The minimum 6dB Bandwidth of DTS | | |
| Operating conditions: | Under normal test conditions | Pass | |
| Method of testing: | Radiated | | |
| S.A. Settings: | RBW: 100kHz, VBW: 300kHz, Span: 2MHz | | |
| Hopping function: | Disabled | | |
| Environment conditions: | Ambient Temperature: 24.3 °C | Relative Humidity: 49.8% | Atmospheric Pressure: 1011.4 hPa |
| Test Result: | See below | See Plot 4.1.1 – 4.1.3 | |

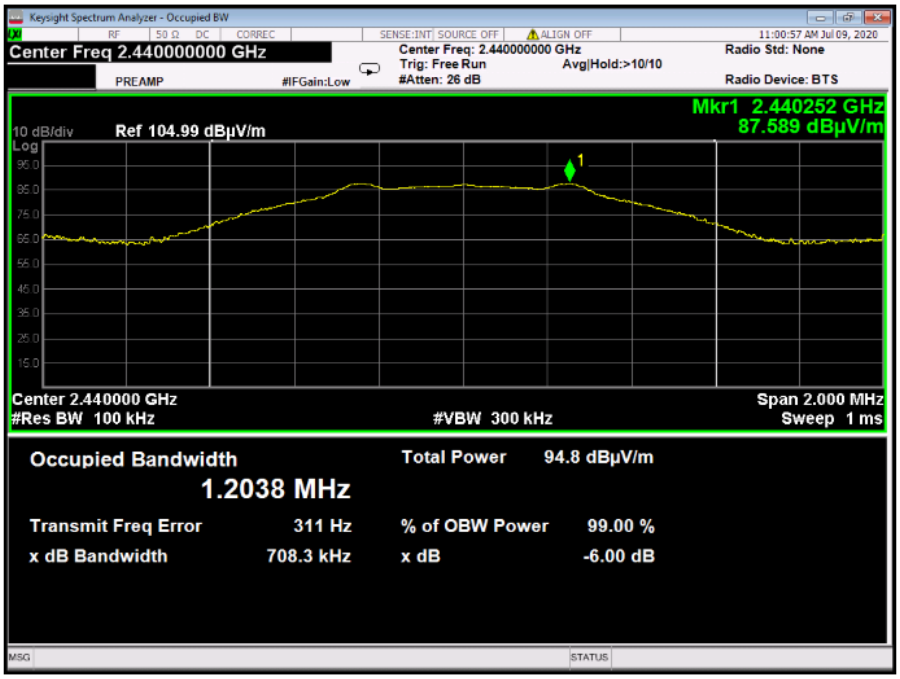
**Test results:**

| Channel | Frequency, [MHz] | 6dB BW, [kHz] | LIMIT([kHz] | Margin | PASS/FAIL |
|---|---|---|---|---|---|
| Low | 2402 | 680.4 | >500 | 180.4 | Pass |
| Mid | 2440 | 708.3 | >500 | 208.3 | Pass |
| High | 2480 | 698.0 | >500 | 198.0 | Pass |

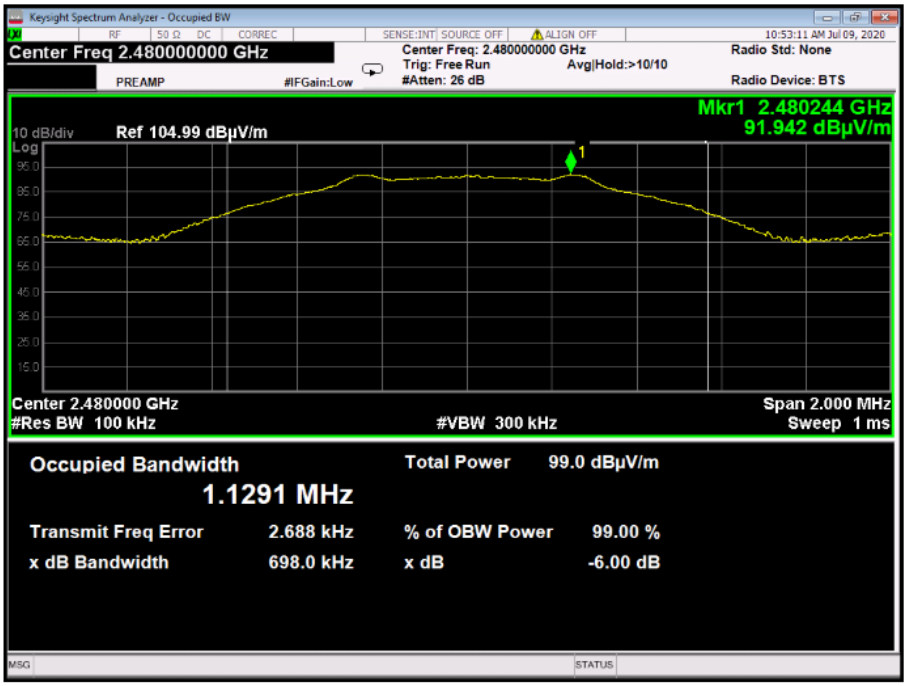
**Plot 4.1.1: 6 dB bandwidth test results, GFSK, channel 0 (LOW)**




**Plot 4.1.2: 6 dB bandwidth test results, GFSK, channel 39 (MID)**



**Plot 4.1.3: 6dB bandwidth test results, GFSK, channel 78 (HIGH)**



## 4.2. Maximum Peak Output Power

| | | | |
|---|---|---|---|
| Reference document: | **47 CFR §15.247 (b) (1), ANSI C63.10 Subclause 11.9.1.1** | | |
| Test Requirements: | The maximum peak output power shall not exceed 1Watt (30dBm) | | |
| Operating conditions: | Under normal test conditions | Pass | |
| Method of testing: | Conducted | | |
| S.A. Settings: | RBW: 1MHz, VBW: 3MHz, | | |
| Hopping function: | Disabled | | |
| Environment conditions: | Ambient Temperature: 24.9°C | Relative Humidity: 50.1% | Atmospheric Pressure: 1011.4 hPa |
| Test Result: | See below | See Plot 4.2.1 – Plot 4.2.6 | |

**Test results:**

| Type of modulation | Channel | Frequency (MHz) | Antenna position | Reading field (dBµV/m) | Max. peak output power*,** [dBm] EIRP | Antenna gain [dBi] | Max peak conducted output power [dBm] | Limit [dBm] | Delta [dB] | Pass/Fail |
|---|---|---|---|---|---|---|---|---|---|---|
| GFSK/BLE | Low | 2402 | H | 91.979 | -3.32 | 0.9 | -4.22 | 30.00 | -34.22 | Pass |
| | | | V | 93.467 | -1.83 | 0.9 | -2.73 | 30.00 | -32.73 | Pass |
| | Mid | 2440 | H | 91.255 | -4.05 | 0.9 | -4.95 | 30.00 | -34.95 | Pass |
| | | | V | 94.510 | -0.79 | 0.9 | -1.69 | 30.00 | -31.69 | Pass |
| | High | 2480 | H | 93.199 | -2.10 | 1.3 | -3.40 | 30.00 | -33.40 | Pass |
| | | | V | 95.497 | 0.20 | 1.3 | -1.10 | 30.00 | -31.10 | Pass |

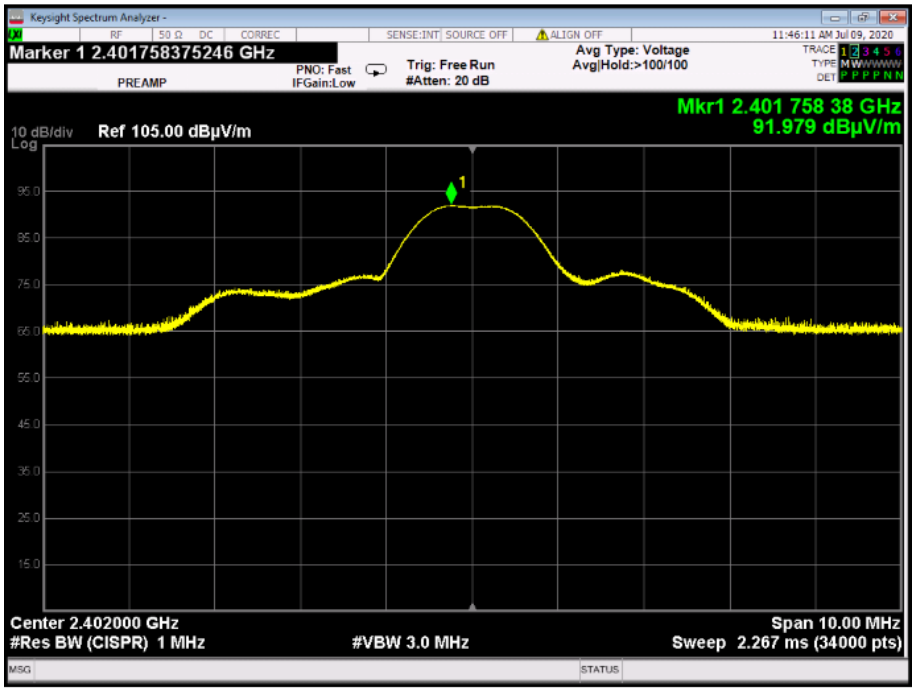
*Corrected for external attenuations & cable

**Conversion formula from field strength to P

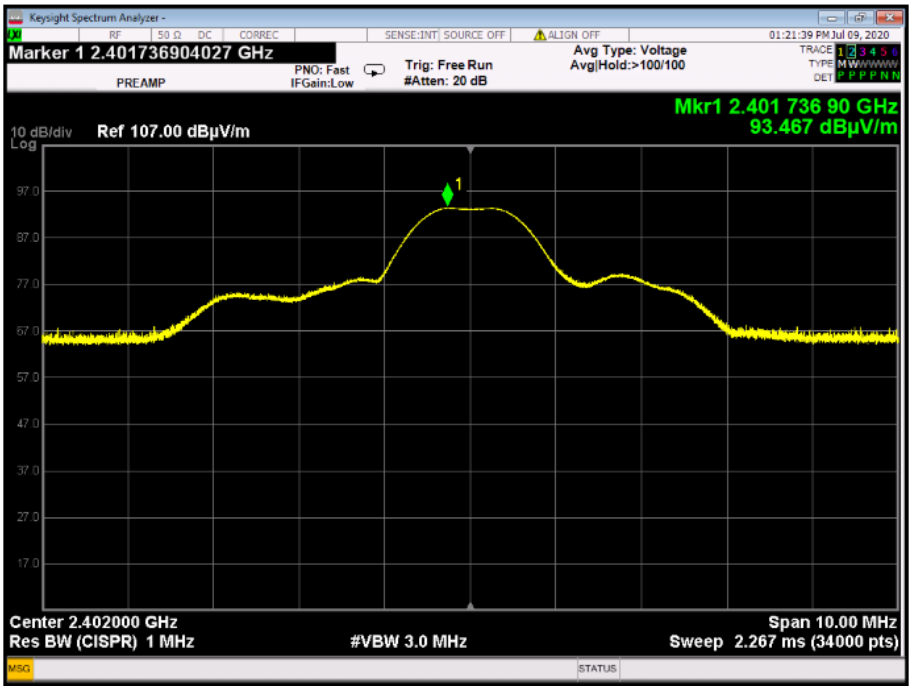
$$P = \frac{(E_{V/m} \times d)^2}{(30 \times G)} \text{ [W]}$$

**EIRP = P x G = (E (V/m) x d) ² /30**
Where:
**P** =Peak Power (W)
**G** = Antenna gain
**E** = electric field strength in V/m,
d = Measurement distance m-3m

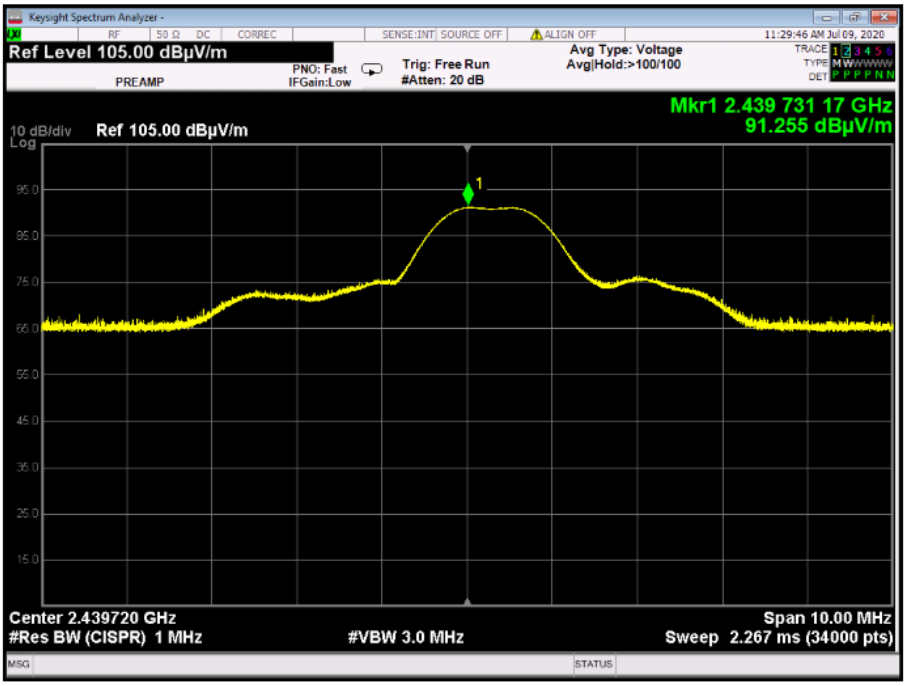
**Plot 4.2.1: Maximum Peak Output Power test results, GFSK, channel 0 Horizontal**



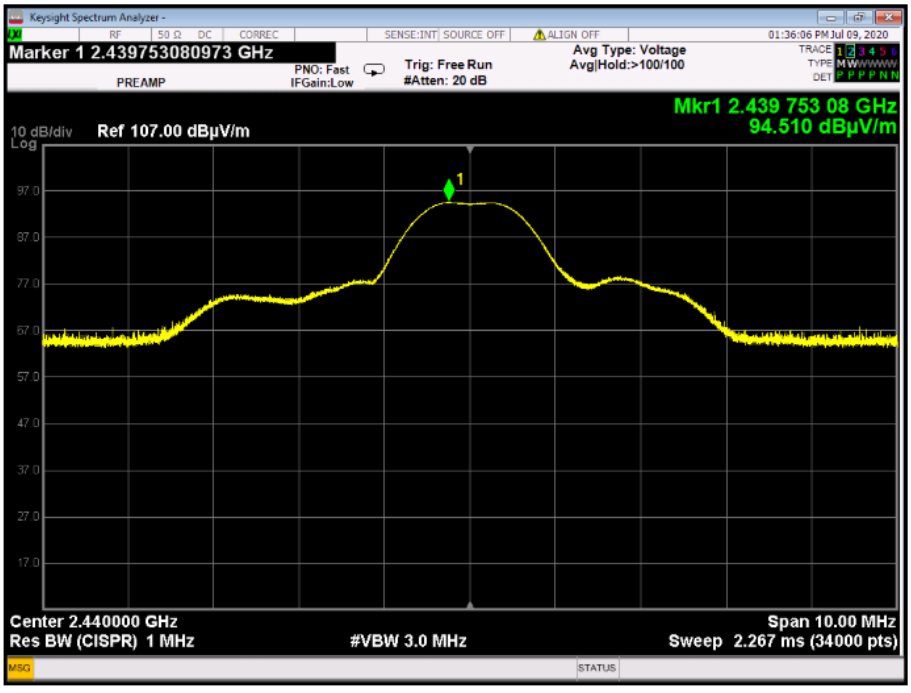

**Plot 4.2.2: Maximum Peak Output Power test results, GFSK, channel 0 Vertical**



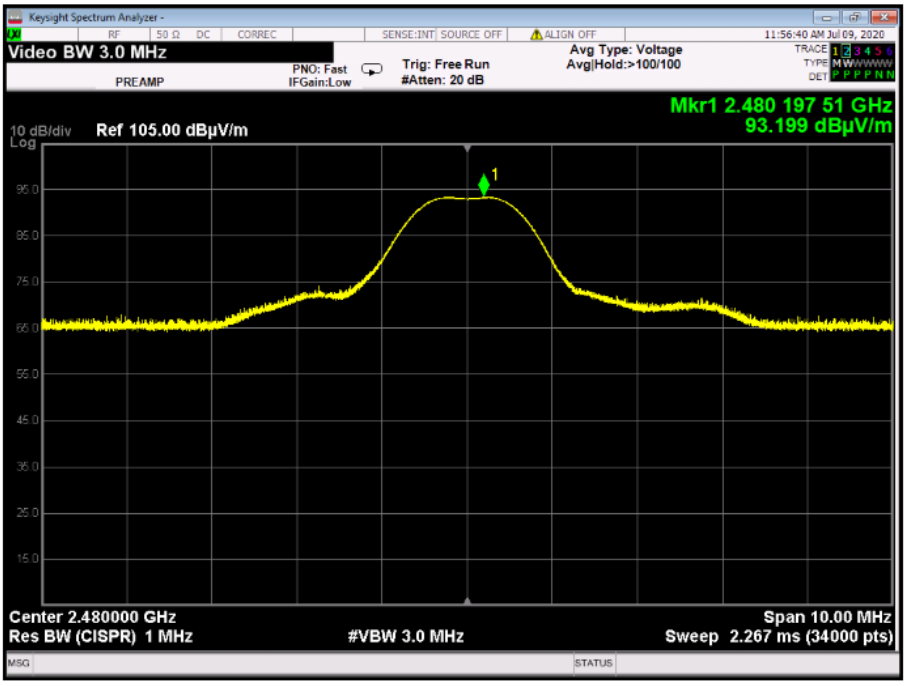
**Plot 4.2.3: Maximum Peak Output Power test results, GFSK, channel 39 Horizontal**



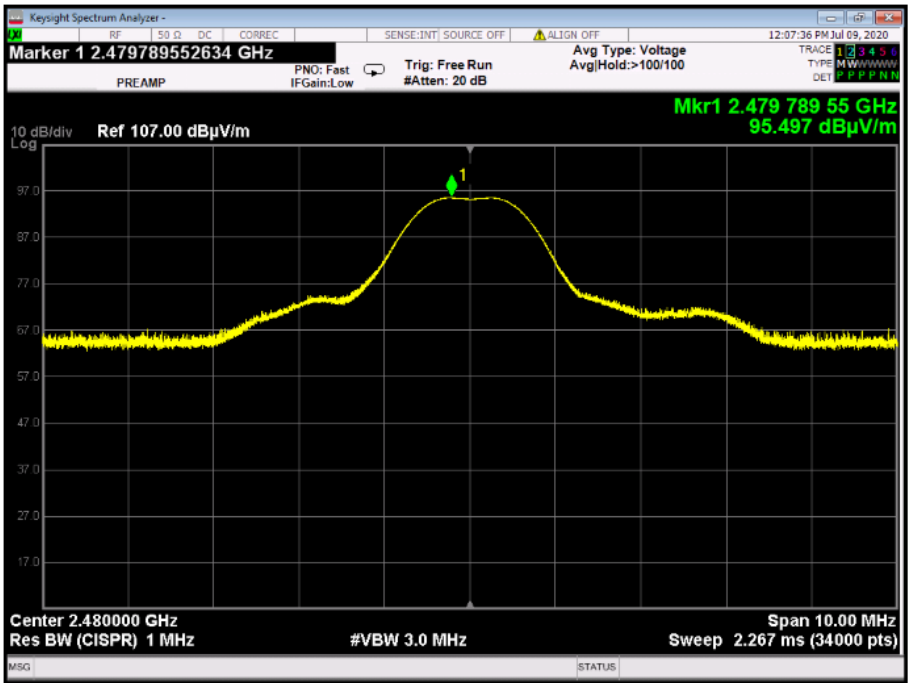

**Plot 4.2.4: Maximum Peak Output Power test results, GFSK, channel 39 Vertical**



**Plot 4.2.5: Maximum Peak Output Power test results, GFSK, channel 78 HORIZONTAL**




**Plot 4.2.6: Maximum Peak Output Power test results, GFSK, channel 78 VERTICAL**



## 4.3. DTS maximum power spectral density level in the fundamental emission

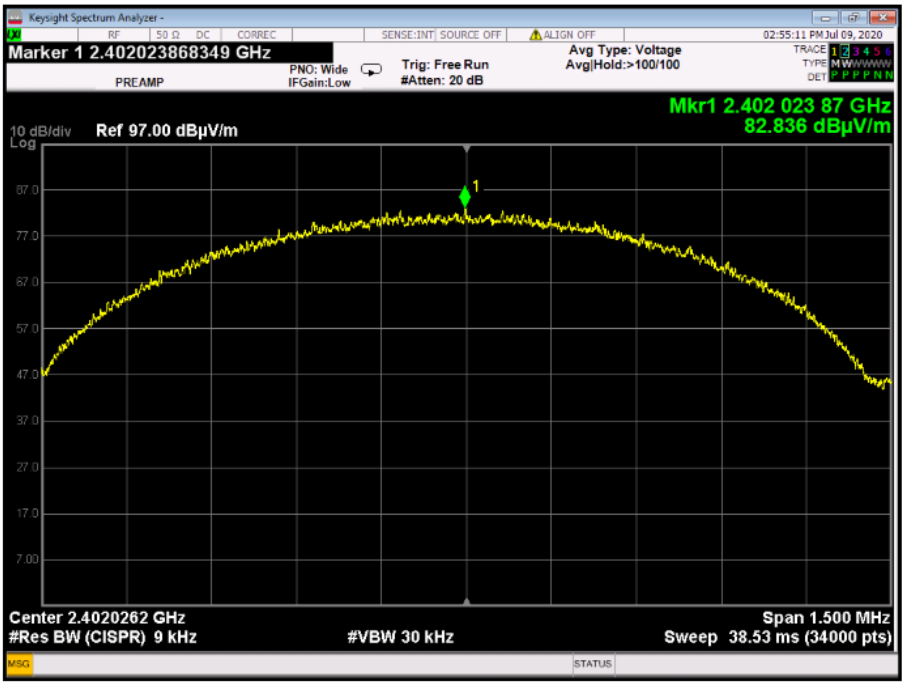
| | | | |
|---|---|---|---|
| Reference document: | **47 CFR §15.247 (e) (1), ANSI C63.10 Subclause 11.10.2** | | |
| Test Requirements: | DTS maximum power spectral density level in the fundamental emission | | |
| Operating conditions: | Under normal test conditions | Pass | |
| Method of testing: | Radiated | | |
| S.A. Settings: | RBW: 10KHz, VBW: 30KHz, | | |
| Hopping function: | Disabled | | |
| Environment conditions: | Ambient Temperature: 24.9°C | Relative Humidity: 50.1% | Atmospheric Pressure: 1011.4 hPa |
| Test Result: | See below | See Plot 4.3.1 – Plot 4.3.6 | |

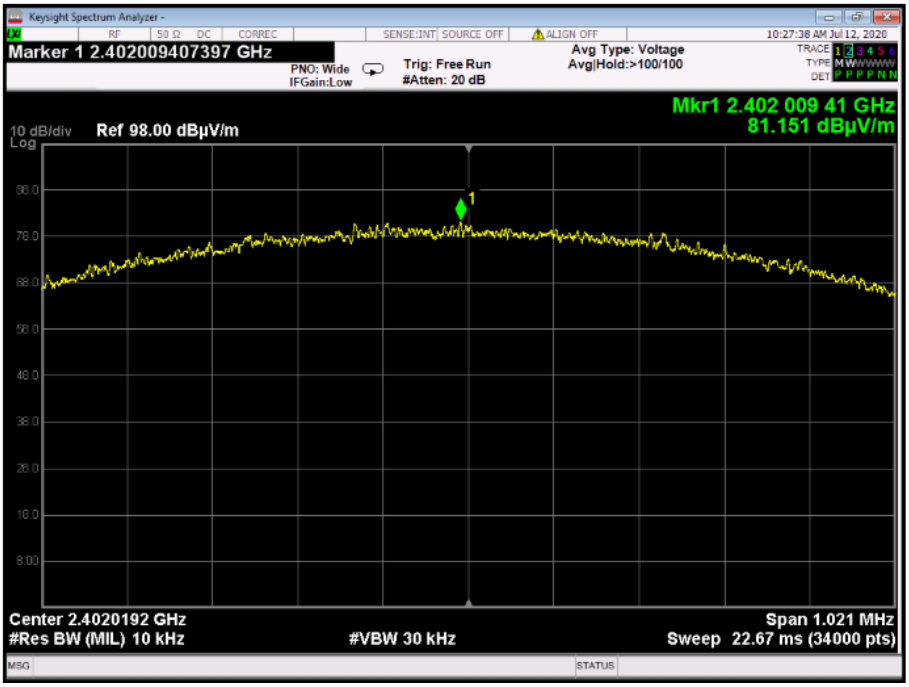
**Test results:**

| Type of modulation | Channel | Frequency (MHz) | Antenna position | Worst case reading (dBµV/m) | Max. power spectral density * [dBm] EIRP | Antenna gain [dBi] | Max conducted power spectral density [dBm] | Limit [dBm] | Delta [dB] | Pass/Fail |
|---|---|---|---|---|---|---|---|---|---|---|
| GFSK/BLE | Low | 2402 | H | 82.836 | -12.46 | 0.9 | -13.36 | 8.00 | -21.36 | Pass |
| | | | V | 84.447 | -10.85 | 0.9 | -11.75 | 8.00 | -19.75 | Pass |
| | Mid | 2440 | H | 82.716 | -12.58 | 0.9 | -13.48 | 8.00 | -21.48 | Pass |
| | | | V | 85.406 | -9.89 | 0.9 | -10.79 | 8.00 | -18.79 | Pass |
| | High | 2480 | H | 85.940 | -9.36 | 1.3 | -10.66 | 8.00 | -18.66 | Pass |
| | | | V | 85.808 | -9.49 | 1.3 | -10.79 | 8.00 | -18.79 | Pass |

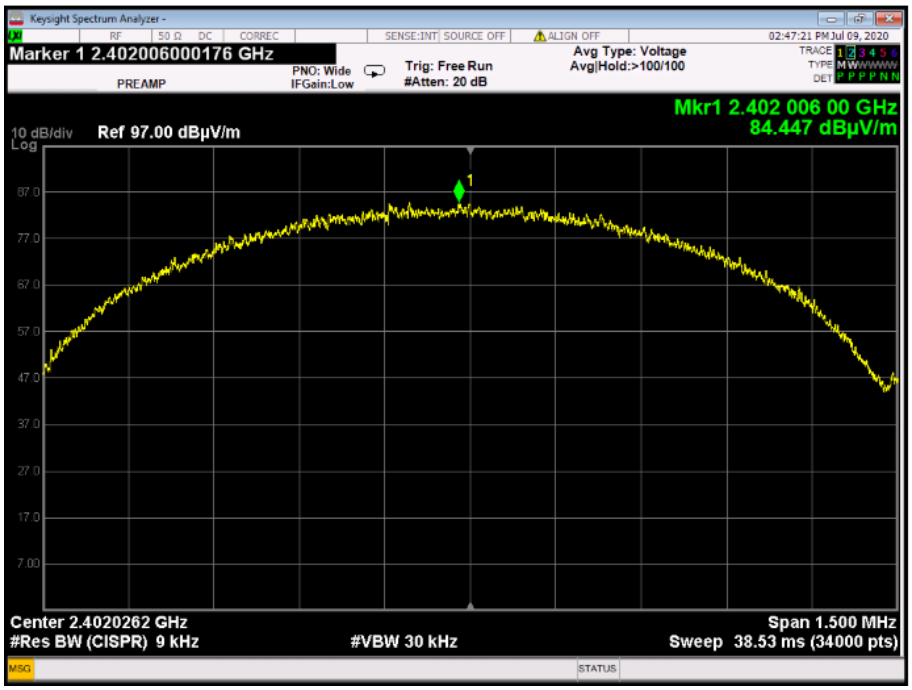
*Corrected for external attenuations & cable

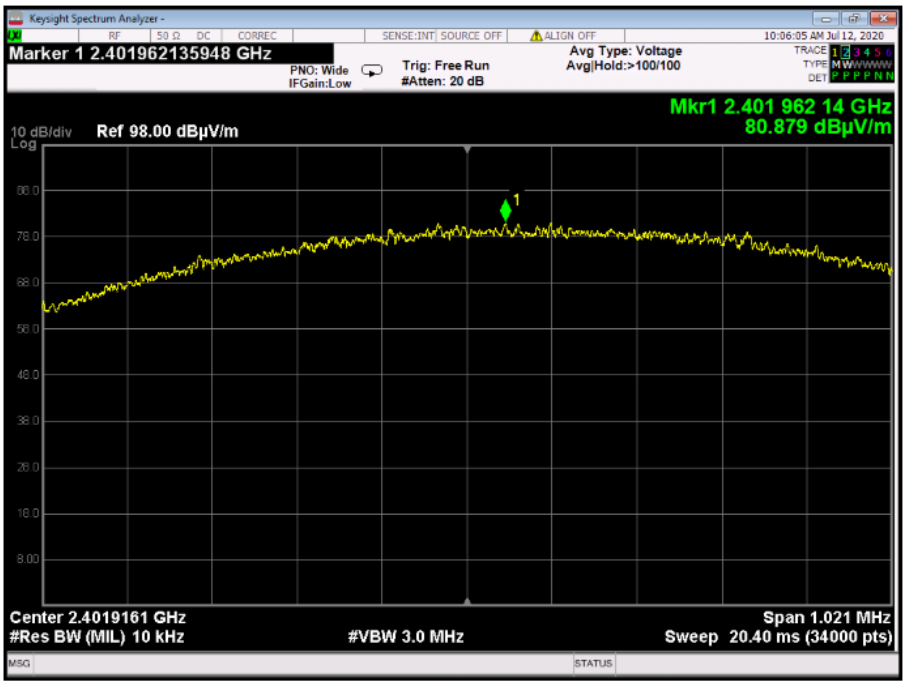
**Plot 4.3.1: DTS maximum power spectral density level in the fundamental emission, channel 0 Horizontal**



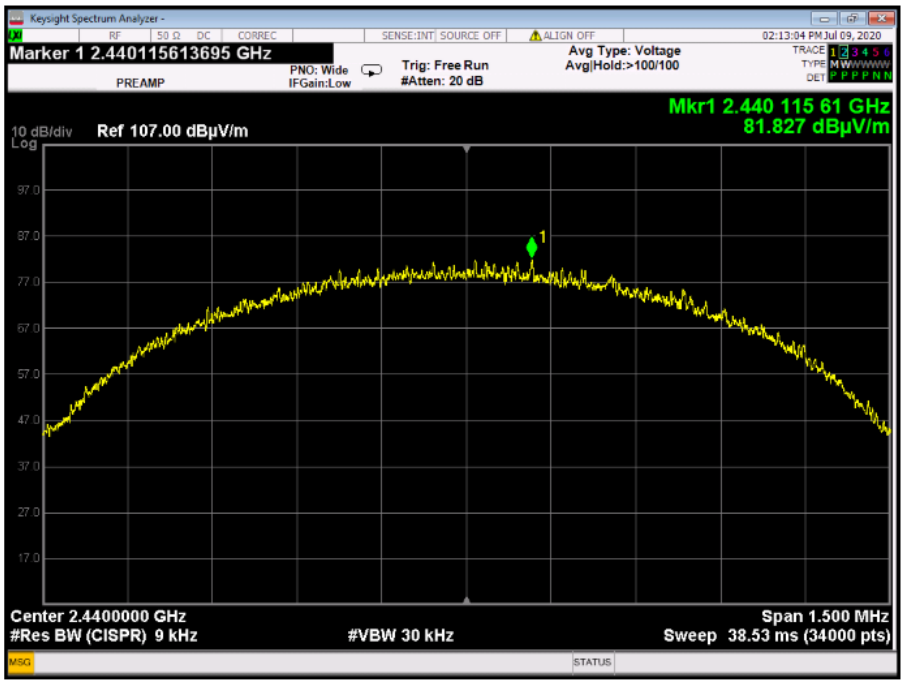



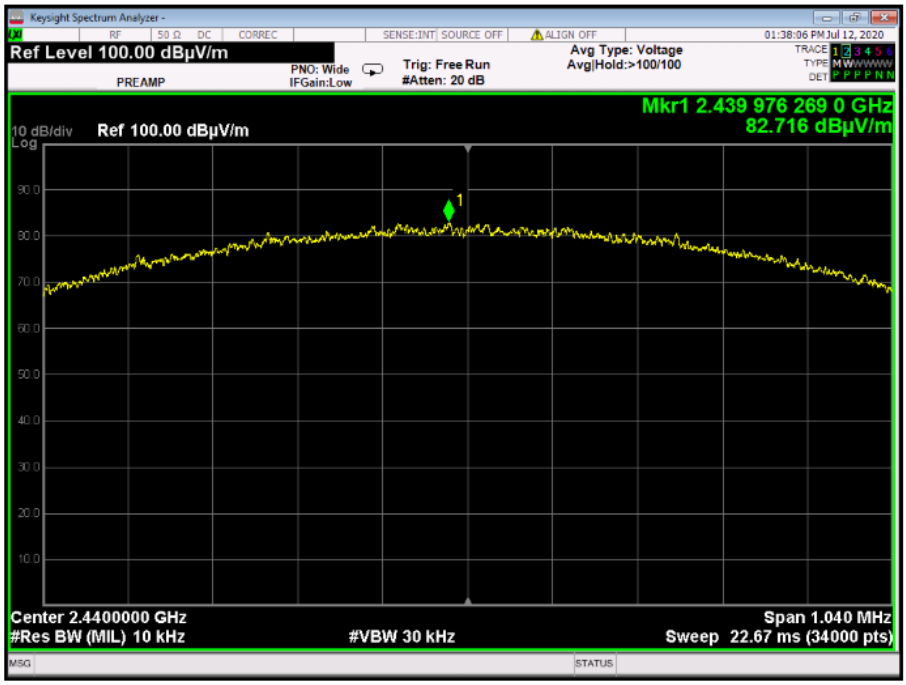
**Plot 4.3.2: DTS maximum power spectral density level in the fundamental emission, channel 0 Vertical**



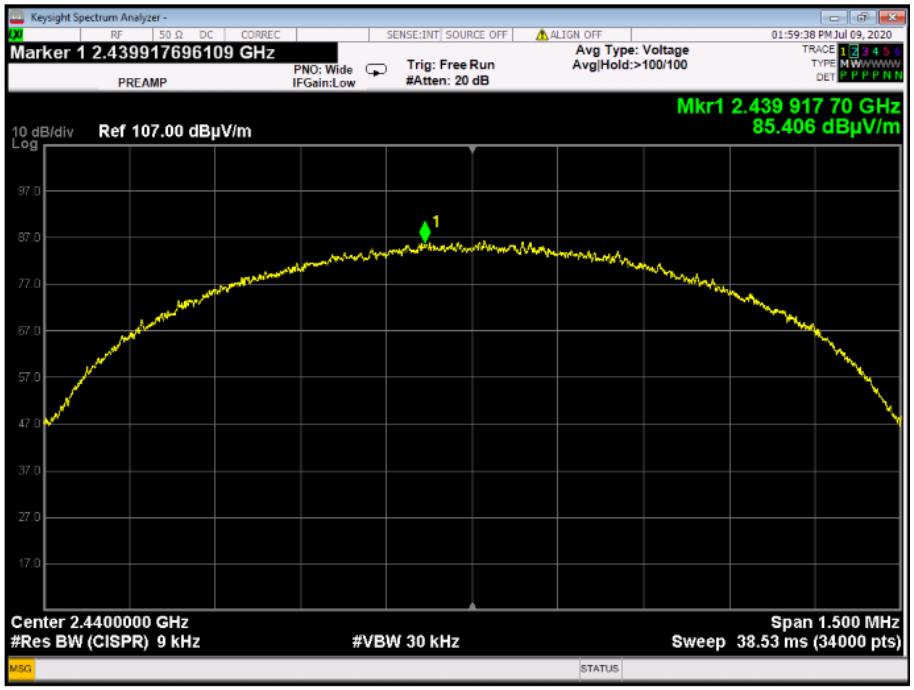



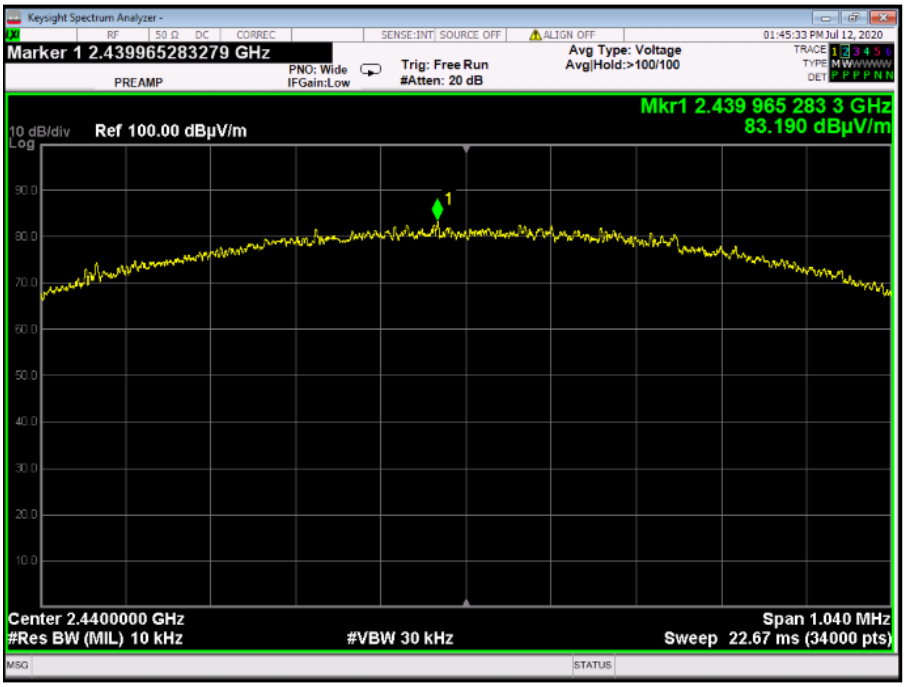
**Plot 4.3.3: DTS maximum power spectral density level in the fundamental emission, channel 39 Horizontal**



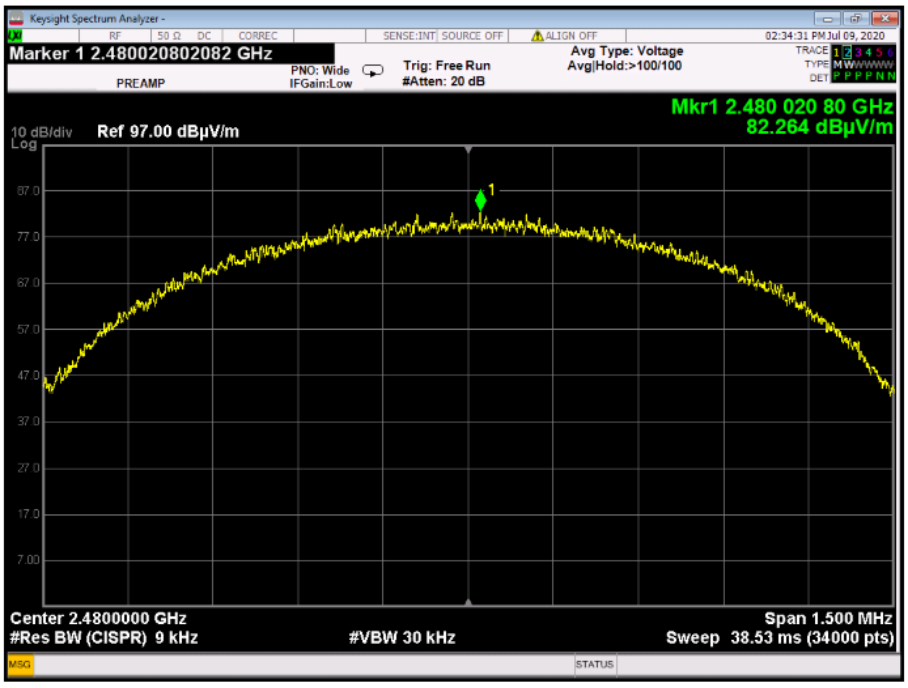



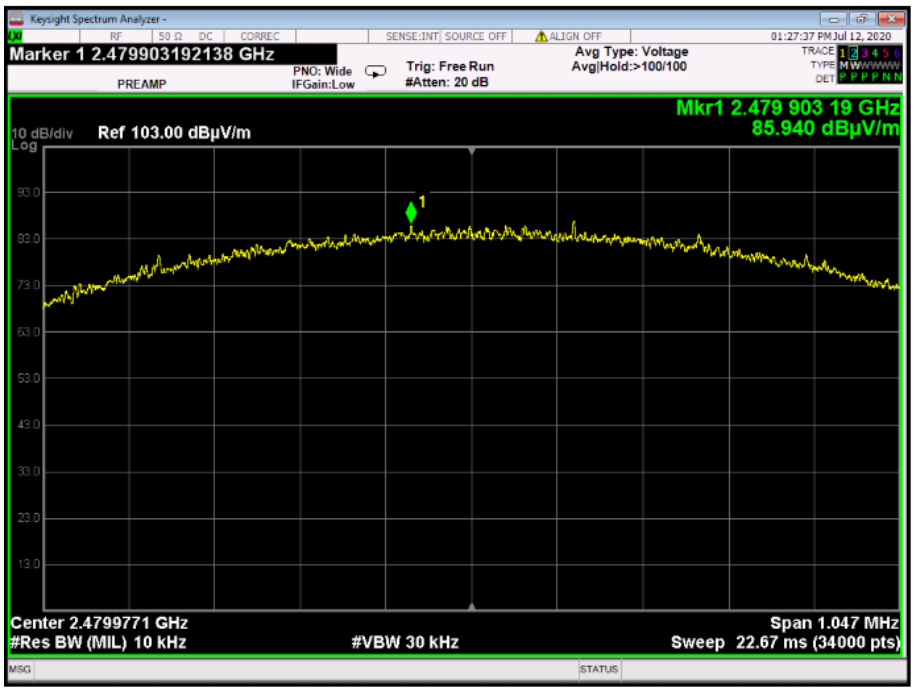
**Plot 4.3.4: DTS maximum power spectral density level in the fundamental emission, channel 39 Vertical**



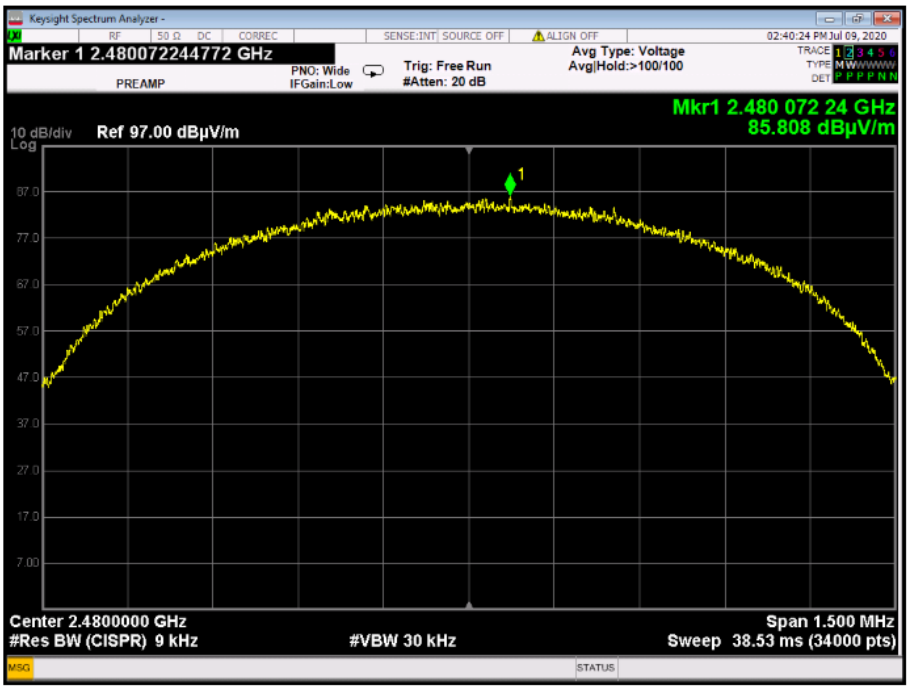



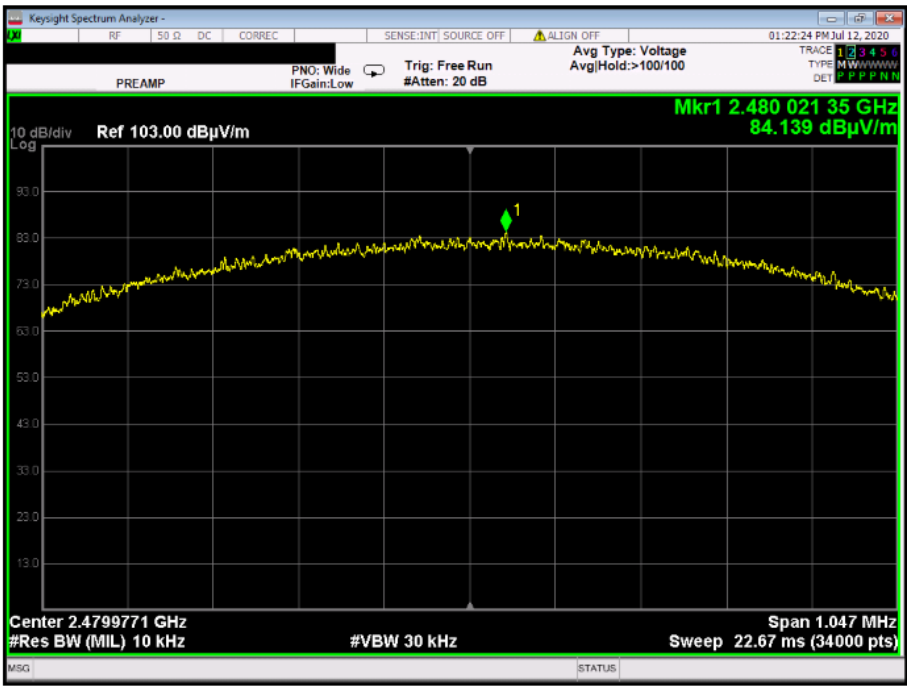
**Plot 4.3.5: DTS maximum power spectral density level in the fundamental emission, channel 78 Horizontal**



**Plot 4.3.6: DTS maximum power spectral density level in the fundamental emission, channel 78 Vertical**



## 4.4. Spurious Emissions – Radiated Measurements

| | | | |
|---|---|---|---|
| Reference document: | **47 CFR §15.247 (d), ANSI C63.10 Subclause 11.11.1(a)** | | |
| Test Requirements: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in Section 15.209(a) is not required. | | |
| Operating conditions: | Under normal test conditions | **Pass** | |
| Method of testing: | Radiated | | |
| S.A. Settings: | f >1GHz: Peak: RBW= 1MHz, VBW= 3MHz, Average: VBW= 1 kHz<br>f<1GHz: RBW: 100kHz,VBW: 300kHz | | |
| Hopping function: | Disabled (lowest, middle, and highest channels to be investigated) | | |
| Environment conditions: | Ambient Temperature: 24.9°C | Relative Humidity: 50.1% | Atmospheric Pressure: hPa |
| Test Result: | See below | Plots 4.4.1 – Plot 4.4.19 | |

All measurements were done in horizontal and vertical polarizations; the results show the worst case.

**Test results below 1GHz:**

| Channel | Emission Frequency [MHz] | Detector Type | Antenna Polarization | Emission Level, [dBµV/m] | Ref.level, [dBµV/m] | Delta [dBc] | Limit, [dBc] | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| Low | 180.01 | Peak | H | 40.5 | 94.8 | -54.2 | -20.0 | Pass |
| | 539.96 | Peak | H | 43.4 | 94.8 | -51.3 | -20.0 | Pass |
| | 570.02 | Peak | H | 51.6 | 94.8 | -43.2 | -20.0 | Pass |
| | 570.31 | Peak | V | 46.3 | 94.8 | -48.4 | -20.0 | Pass |
| Mid | 180.01 | Peak | H | 42.3 | 94.8 | -52.5 | -20.0 | Pass |
| | 510.02 | Peak | H | 44.4 | 94.8 | -50.4 | -20.0 | Pass |
| | 569.96 | Peak | H | 51.8 | 94.8 | -42.9 | -20.0 | Pass |
| | 570.02 | Peak | V | 46.1 | 94.8 | -48.7 | -20.0 | Pass |
| High | 569.96 | Peak | H | 43.1 | 94.8 | -51.7 | -20.0 | Pass |
| | 899.98 | Peak | H | 43.6 | 94.8 | -51.2 | -20.0 | Pass |
| | 570.02 | Peak | V | 44.9 | 94.8 | -49.8 | -20.0 | Pass |

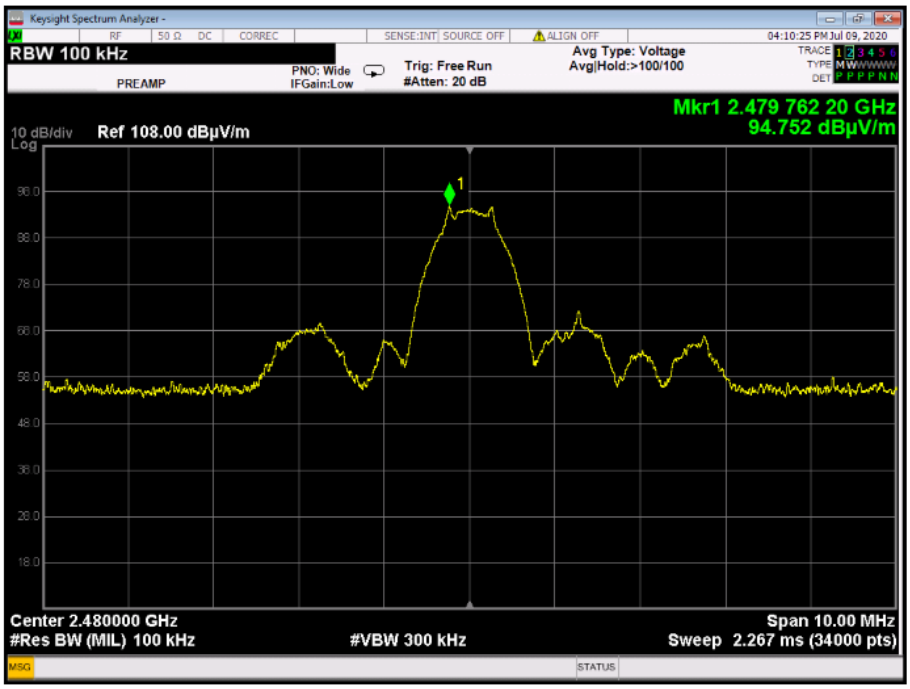
**Test results above 1GHz:**

| Channel | Emission Frequency [GHz] | Detector Type | Antenna Polarization, | Emission Level, [dBµV/m] | Reference Level,, [dBµV/m] | Delta, [dBc] | Limit Delta, [dBc] | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| Low | 4.804 | Peak | H | 49.48 | 94.8 | -45.3 | -20.0 | Pass |
| | 7.2056 | Peak | H | 49.16 | 94.8 | -45.6 | -20.0 | Pass |
| | 4.804 | Peak | V | 47.85 | 94.8 | -46.9 | -20.0 | Pass |
| | 7.206 | Peak | V | 50.25 | 94.8 | -44.5 | -20.0 | Pass |
| Mid | 7.320 | Peak | H | 49.63 | 94.8 | -45.1 | -20.0 | Pass |
| | 7.320 | Peak | V | 50.58 | 94.8 | -44.2 | -20.0 | Pass |
| High | 7.440 | Peak | H | 52.24 | 94.8 | -42.5 | -20.0 | Pass |
| | 7.440 | Peak | V | 51.64 | 94.8 | -43.1 | -20.0 | Pass |

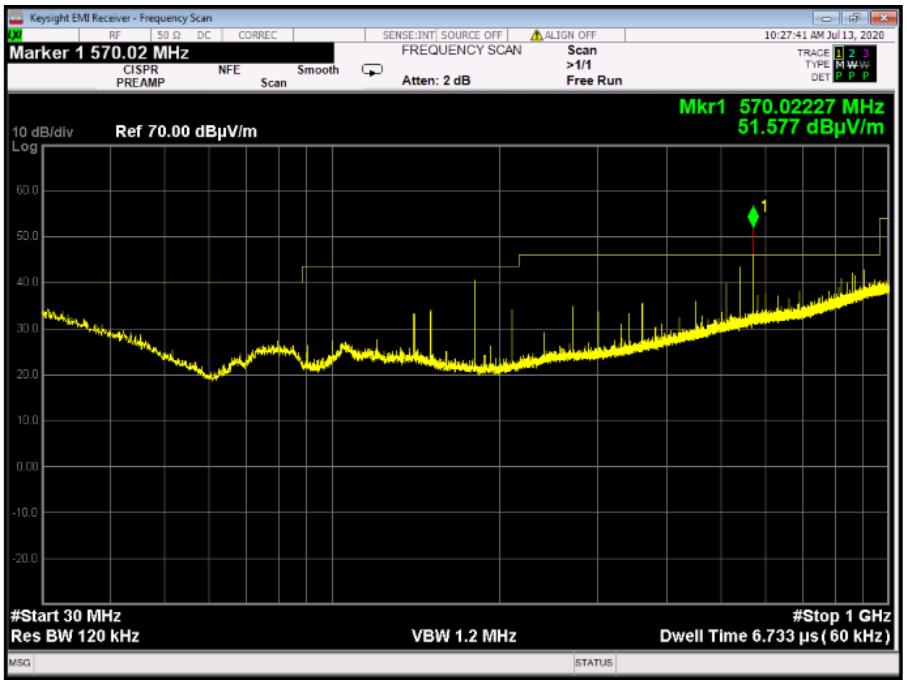
**Note**: Emission Level [dBµV/m] = Measured Emission [dBµV] + Correction-factor [dB (1/m)]

Correction Factor = Antenna factor + Cable Loss + Filter I/L

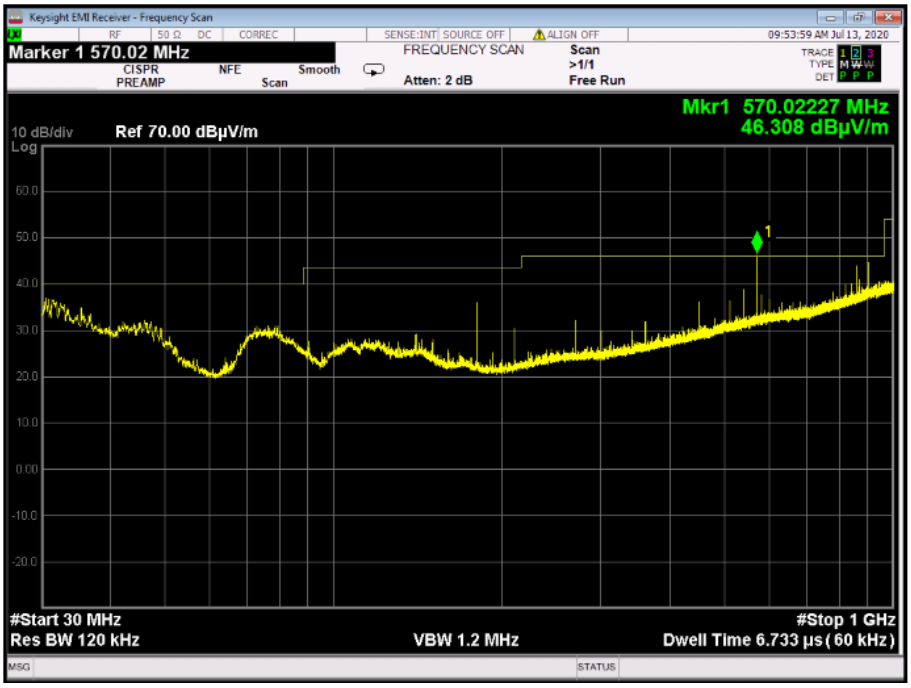
**Plot 4.4.1: The maximum PSD Reference level Vertical Polarization**



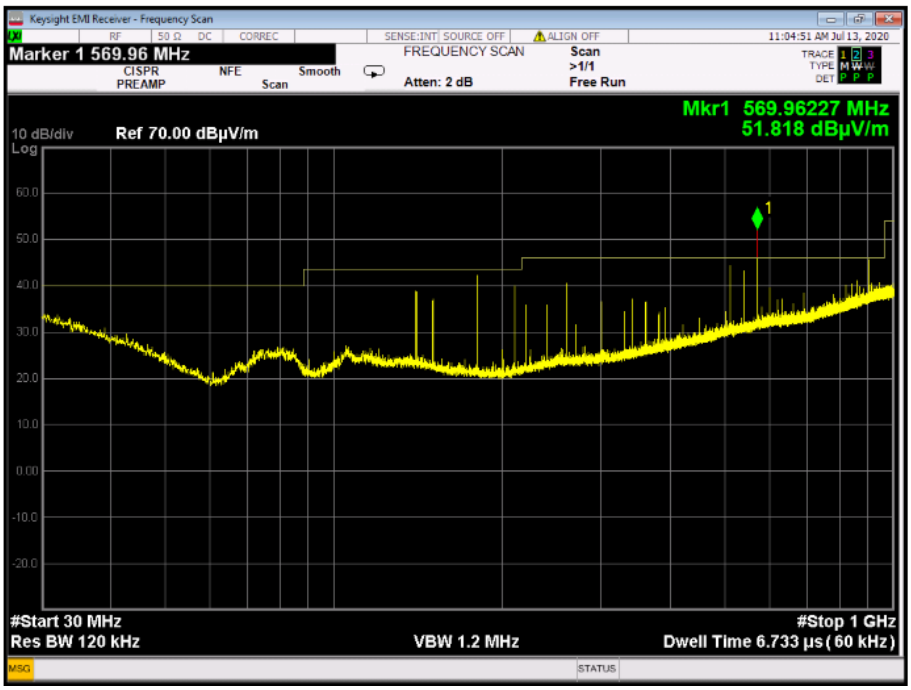

**Plot 4.4.2: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2402 MHz, Horizontal Polarization**



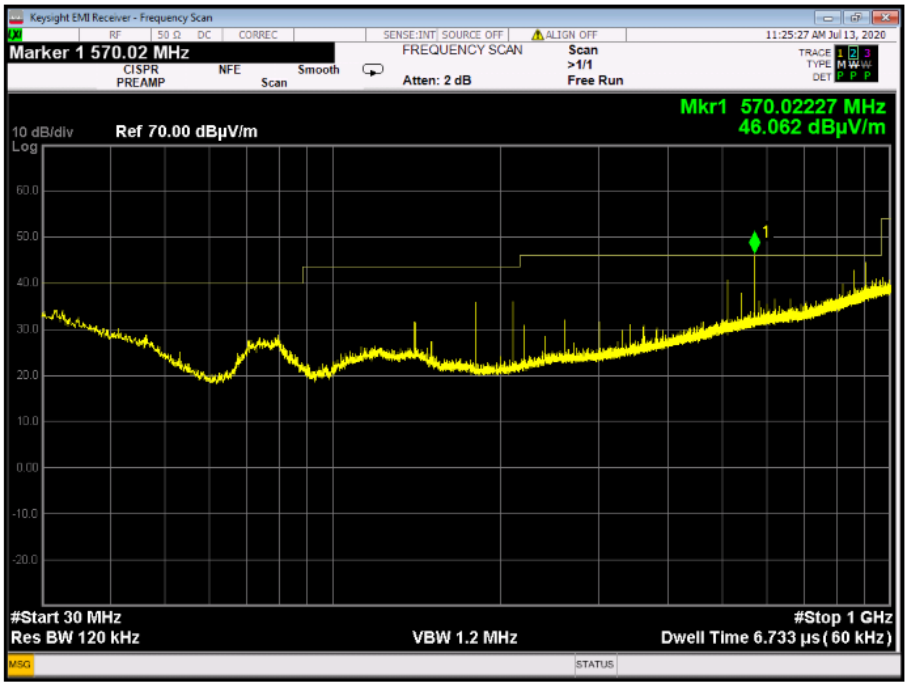
**Plot 4.4.3: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2402 MHz, Vertical Polarization**



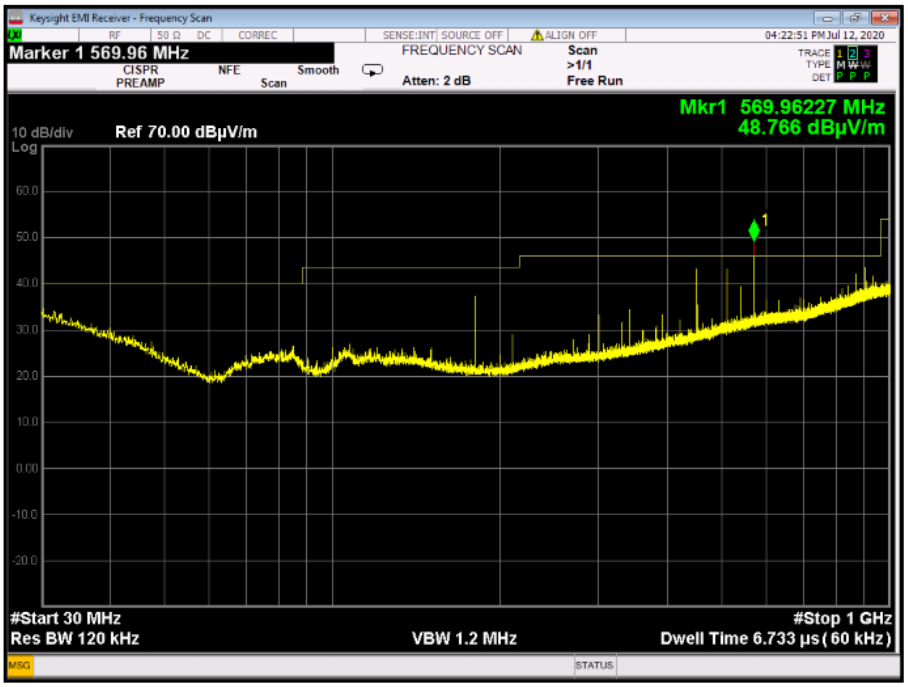

**Plot 4.4.4: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2440 MHz, Horizontal Polarization**



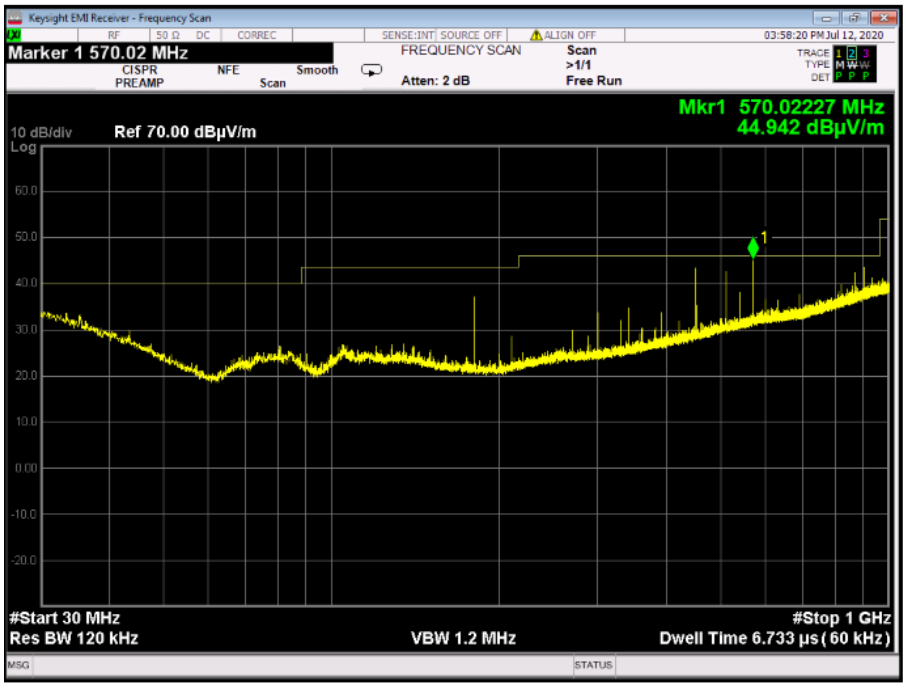
**Plot 4.4.5: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2440 MHz, Vertical Polarization**



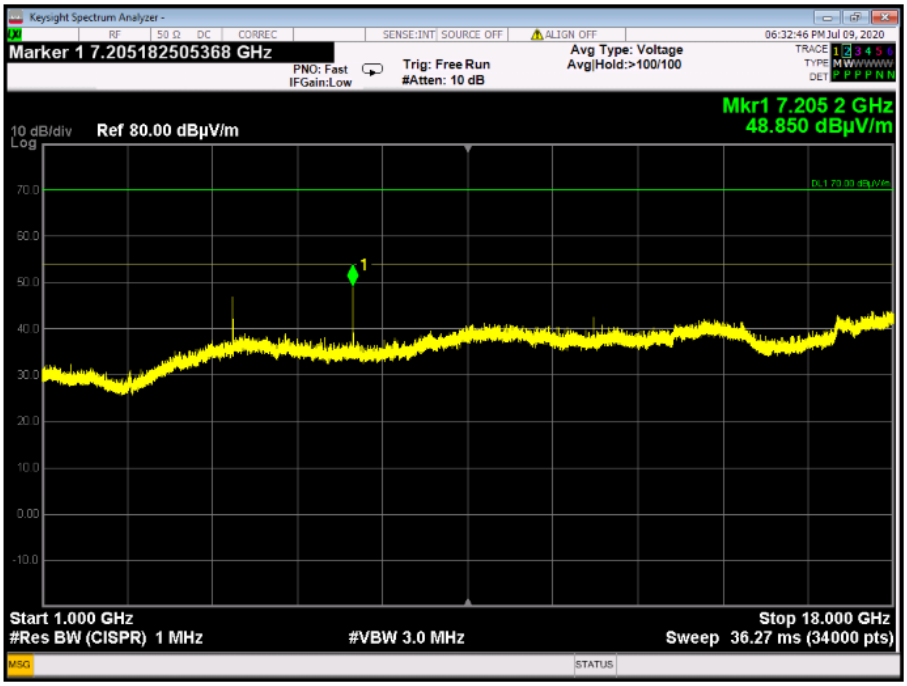

**Plot 4.4.6: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2480 MHz, Horizontal Polarization**



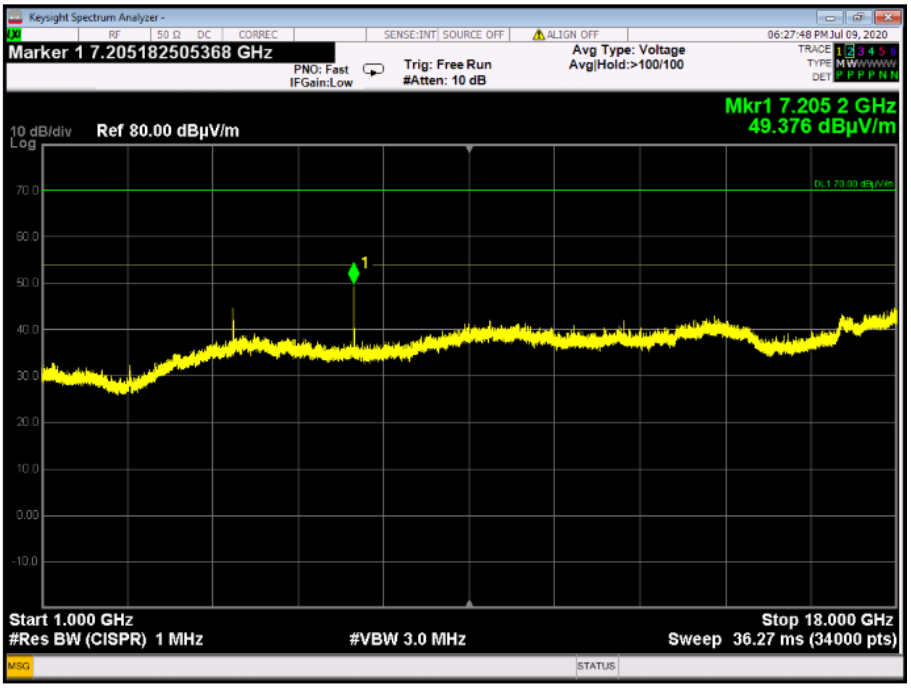
**Plot 4.4.7: Radiated Spurious Emission in 30 MHz – 1 GHz range, Fc = 2480 MHz, Vertical Polarization**



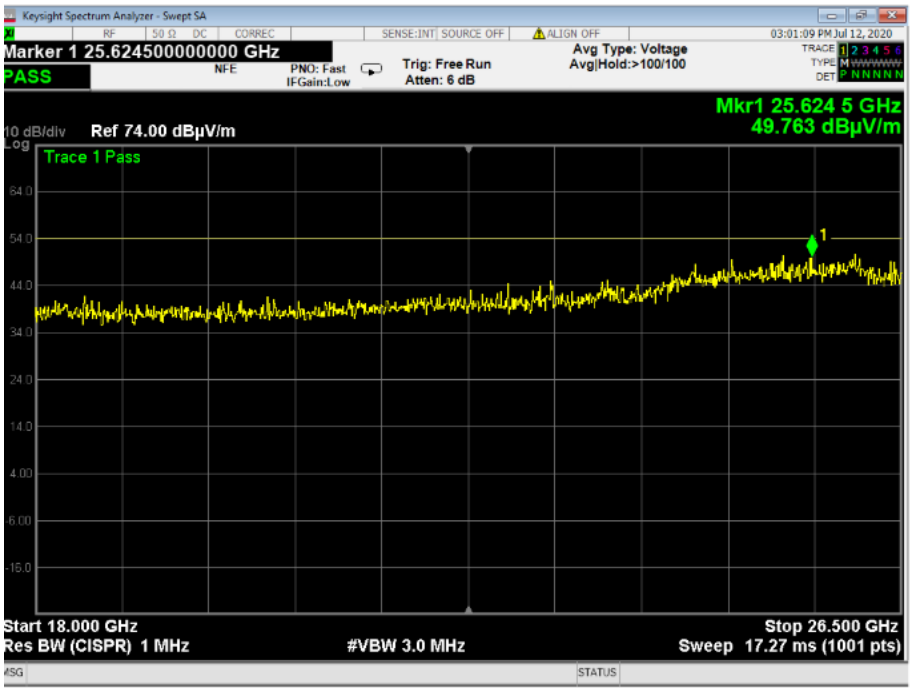

**Plot 4.4.8 Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2402 MHz, Horizontal Polarization, Peak**



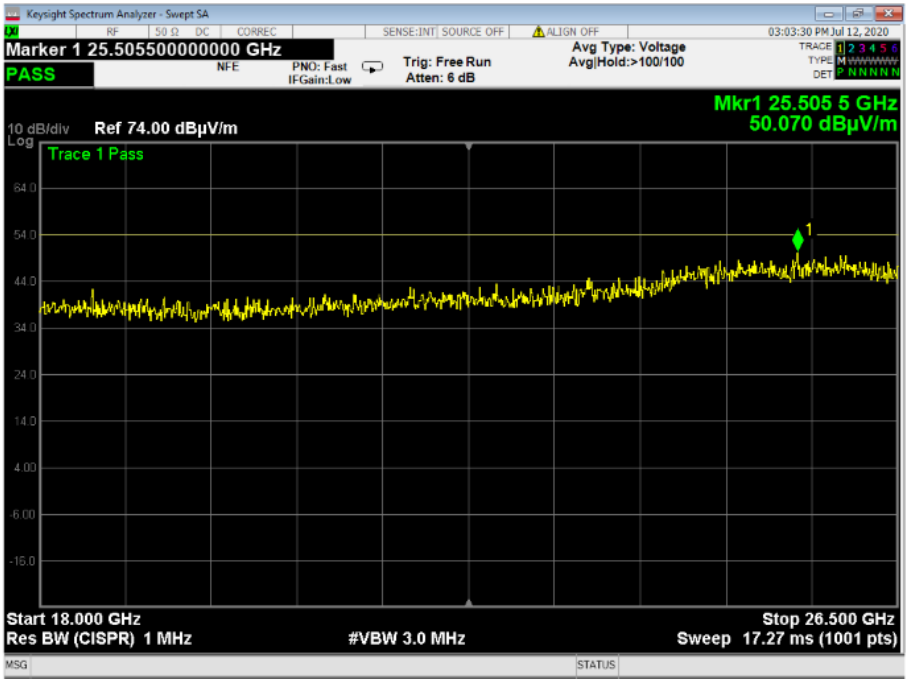
**Plot 4.4.9 Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2402 MHz, Vertical Polarization, Peak**



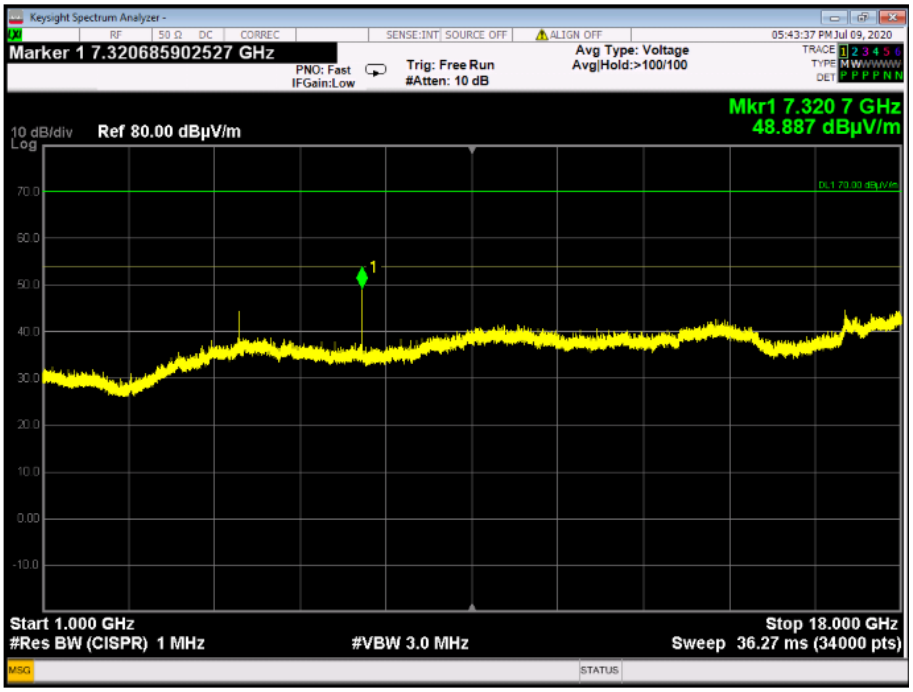

**Plot 4.4.10: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2402 MHz, Horizontal Polarization**



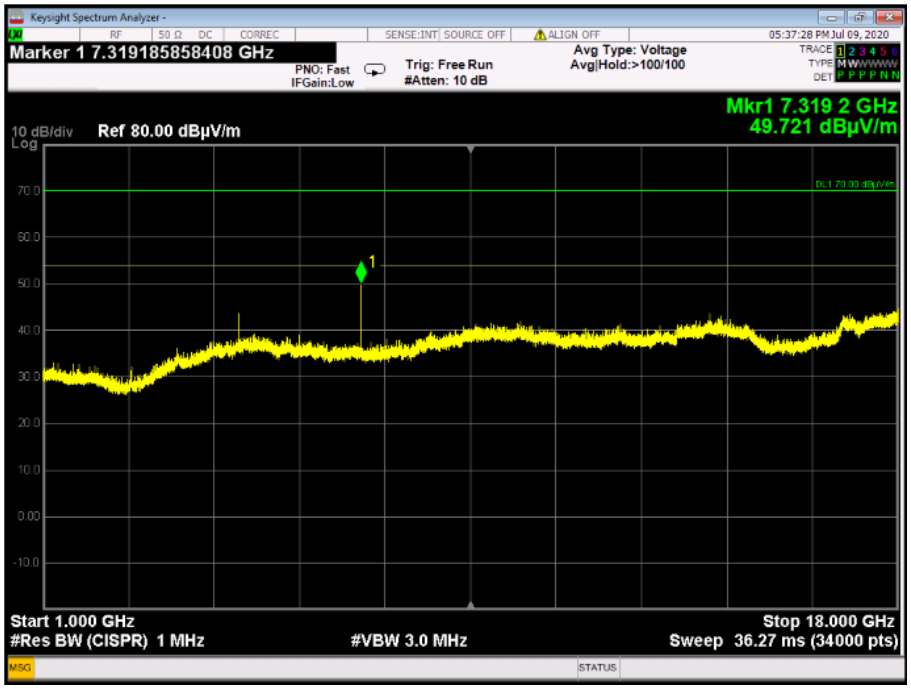
**Plot 4.4.11: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2402 MHz, Vertical Polarization**



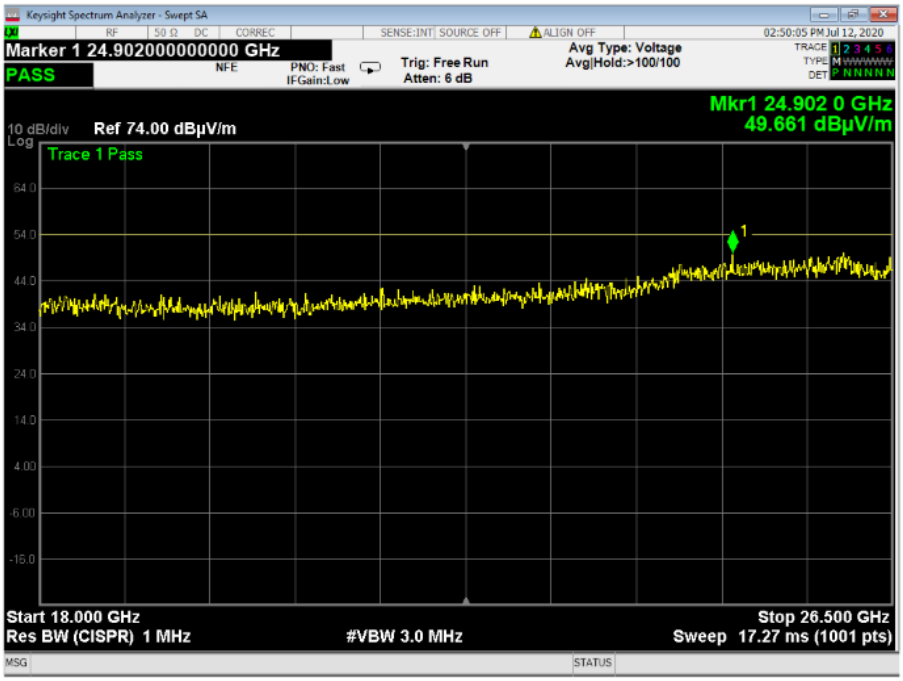

**Plot 4.4.12: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2440 MHz, Horizontal Polarization, Peak**



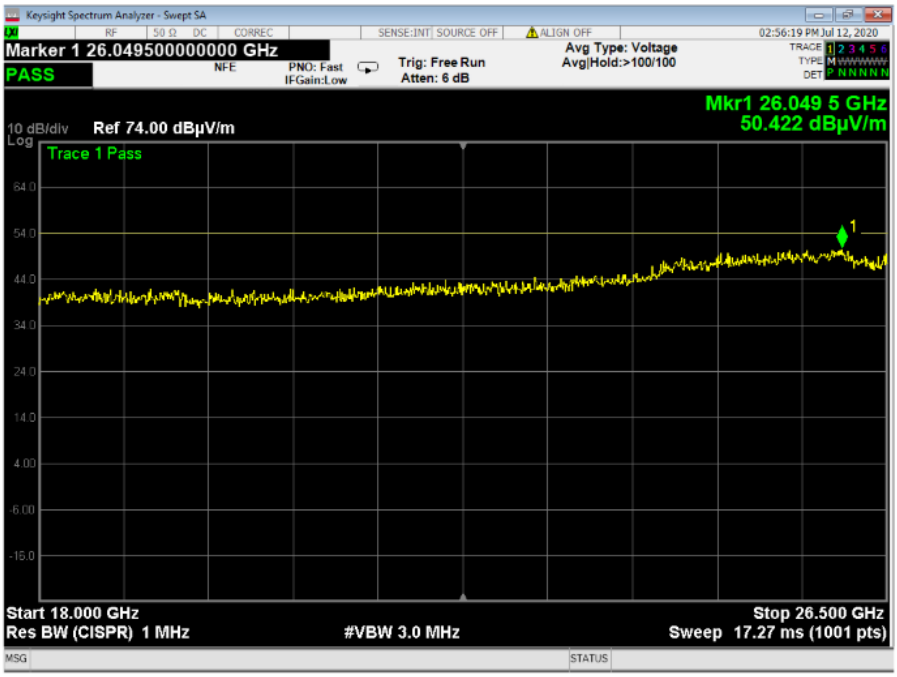
**Plot 4.4.13: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2440 MHz, Vertical Polarization, Peak**



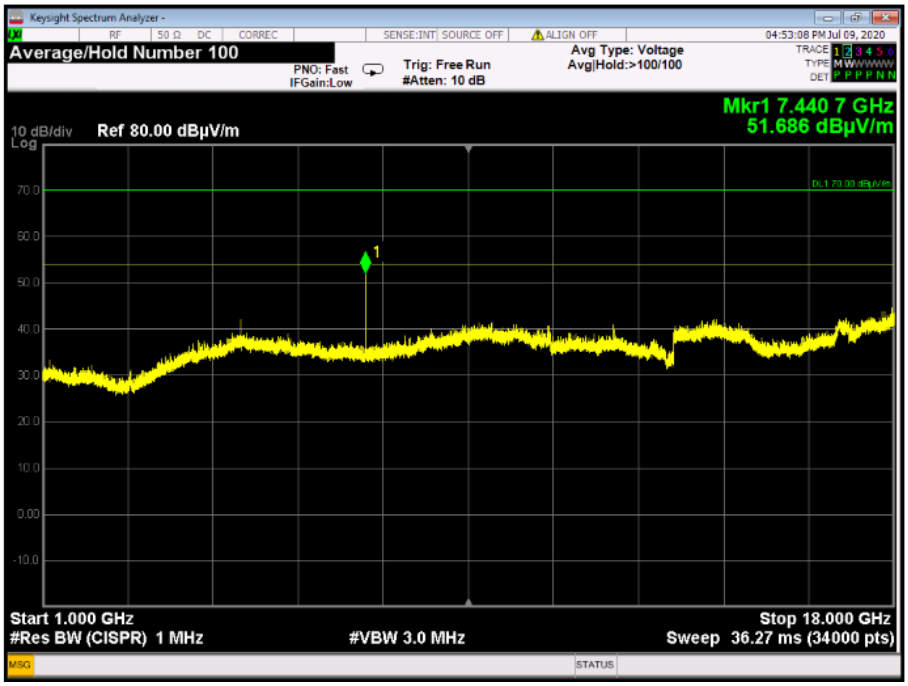

**Plot 4.4.14: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2440 MHz, Horizontal Polarization**



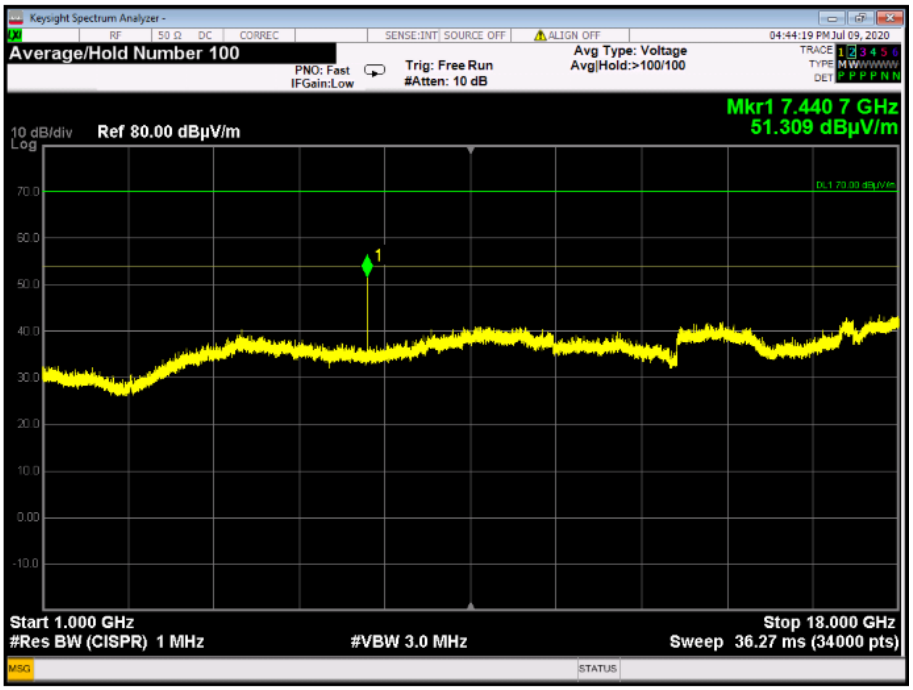
**Plot 4.4.15: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2440 MHz, Vertical Polarization**



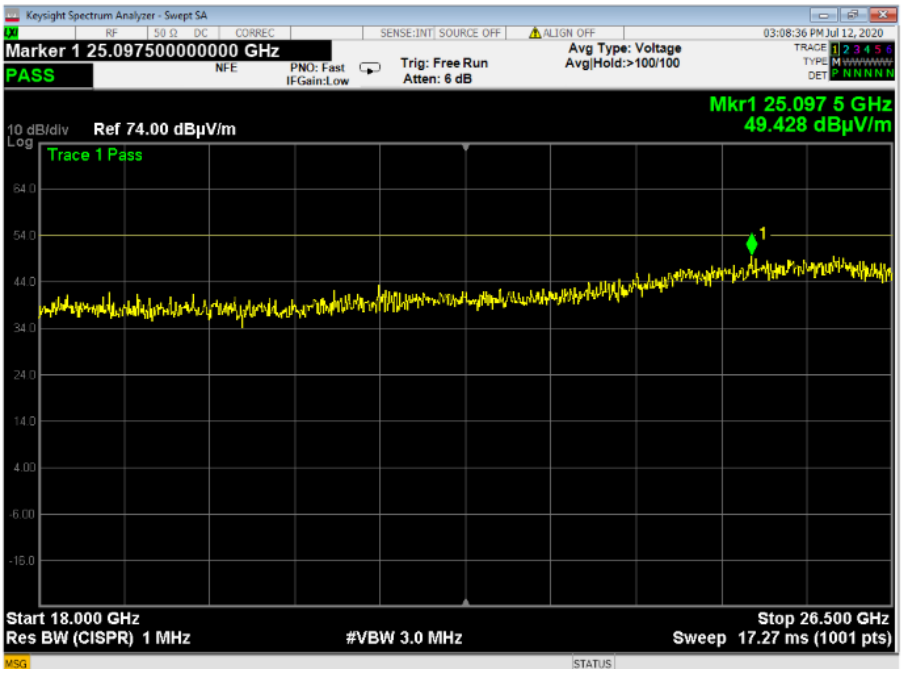

**Plot 4.4.16: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2480 MHz, Horizontal Polarization Peak**



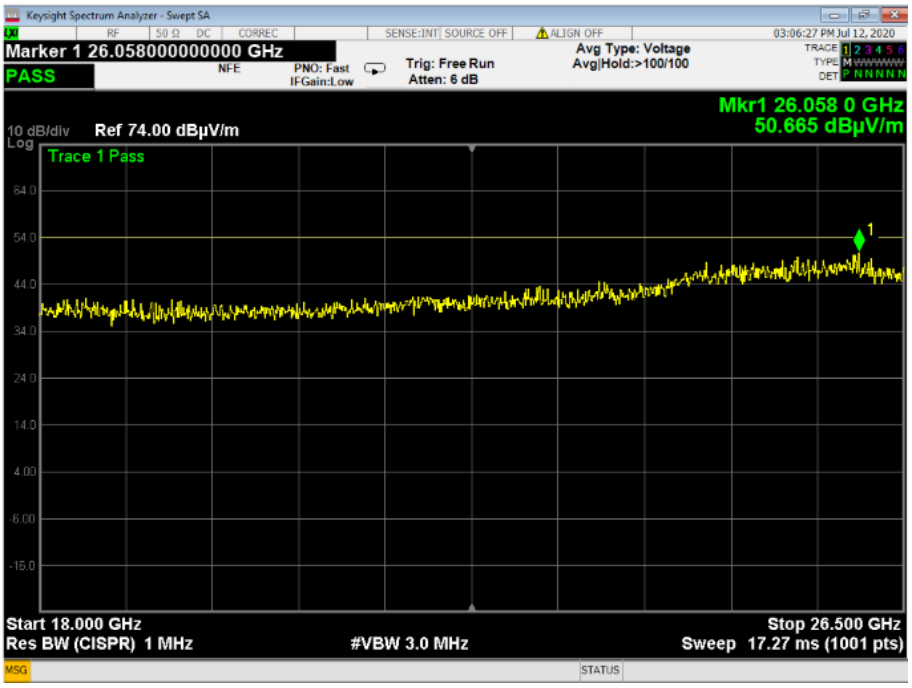
**Plot 4.4.17: Radiated Spurious Emission in 1 – 18 GHz range, Fc = 2480 MHz, Vertical Polarization, Peak**




**Plot 4.4.18: Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2480 MHz, Horizontal Polarization**



**Plot 4.4.19 Radiated Spurious Emission in 18 – 25 GHz range, Fc = 2480 MHz, Vertical Polarization**



## 4.5. Spurious Emissions in Restricted Bands Radiated Measurements

| | | | |
|---|---|---|---|
| Reference document: | **47 CFR §15.247 (d) & §15.205& §15.209(a), ANSI C63.10. Subclause 11.12.1** | | |
| Test Requirements: | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c). | | |
| Operating conditions: | Under normal test conditions | **Pass** | |
| Method of testing: | Radiated | | |
| S.A. Settings: | f >1GHz: Peak: RBW= 1MHz, VBW= 3MHz, Average: VBW= 1 kHz<br>f<1GHz: RBW: 100kHz,VBW: 300kHz | | |
| Hopping function: | Disabled/Enabled | | |
| Environment conditions: | Ambient Temperature: 23.8°c | Relative Humidity: 51.6% | Atmospheric Pressure: hPa |
| Test Result: | See below | See Plot 4.5.1 – Plot 4.5.14 | |

### Test results below 1GHz:

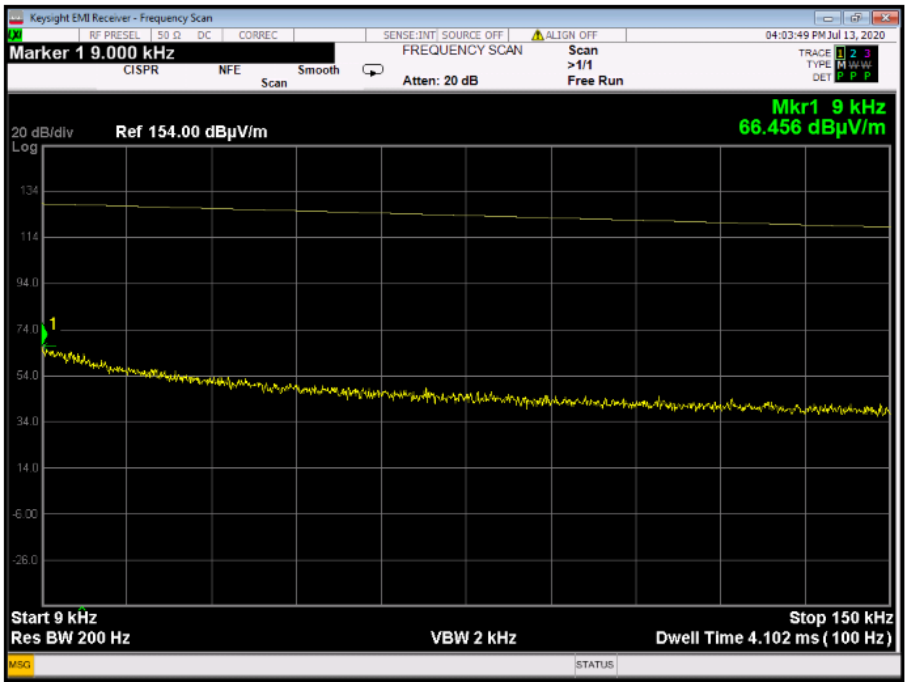
| Channel | Emission Frequency [MHz] | Detector Type | Antenna Polarization | Emission Level, [dBµV/m] | Limit, [dBµV/m] | Delta, [dB] | Pass/Fail |
|---|---|---|---|---|---|---|---|
| Low | 150.00 | Peak | H | 34.0 | 43.5 | -9.5 | Pass |
| | 270.01 | Peak | H | 34.9 | 46.0 | -11.1 | Pass |
| Mid | 150.00 | Peak | H | 37.1 | 43.5 | -6.4 | Pass |
| | 259.99 | Peak | H | 40.6 | 46.0 | -5.4 | Pass |
| High | 150.00 | Peak | H | 36.5 | 43.5 | -7.0 | Pass |
| | 270.00 | Peak | H | 38.6 | 46.0 | -7.4 | Pass |

**Test results above 1GHz:**

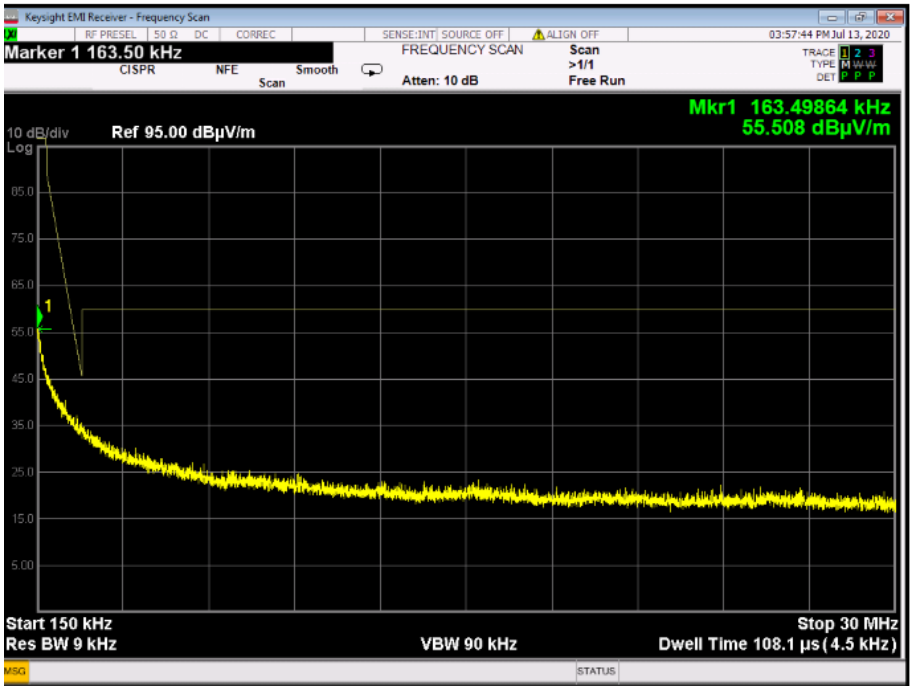
| Channel | Emission Frequency, [MHz] | Detector Type | Antenna Polarization , | Emission Level, [dBµV/m] | Limit, [dBµV/m] | Delta, [dB] | Pass/Fail |
|---|---|---|---|---|---|---|---|
| Low | 4.804 | Peak | H | 49.48 | 74.0 | -24.5 | Pass |
| | | Average | H | 44.590 | 54.0 | -9.4 | Pass |
| | 7.20524 | Peak | H | 49.16 | 74.0 | -24.8 | Pass |
| | | Average | H | 43.740 | 54.0 | -10.3 | Pass |
| | 4.804 | Peak | V | 47.85 | 74.0 | -26.2 | Pass |
| | | Average | V | 42.347 | 54.0 | -11.7 | Pass |
| | 7.205316 | Peak | V | 50.25 | 74.0 | -23.8 | Pass |
| | | Average | V | 45.293 | 54.0 | -8.7 | Pass |
| Mid | 7.31933 | Peak | H | 49.63 | 74.0 | -24.4 | Pass |
| | | Average | H | 44.163 | 54.0 | -9.8 | Pass |
| | 7.31926 | Peak | V | 50.58 | 74.0 | -23.4 | Pass |
| | | Average | V | 45.415 | 54.0 | -8.6 | Pass |
| High | 7.440694 | Peak | H | 52.237 | 74.0 | -21.8 | Pass |
| | | Average | H | 47.417 | 54.0 | -6.6 | Pass |
| | 7.44067 | Peak | V | 51.64 | 74.0 | -22.4 | Pass |
| | | Average | V | 46.279 | 54.0 | -7.7 | Pass |

**Note**: Radiated Emission [dBµV/m] = Measured Emission [dBµV] + Correction-factor [dB (1/m)]
Correction Factor = Antenna factor + Cable Loss

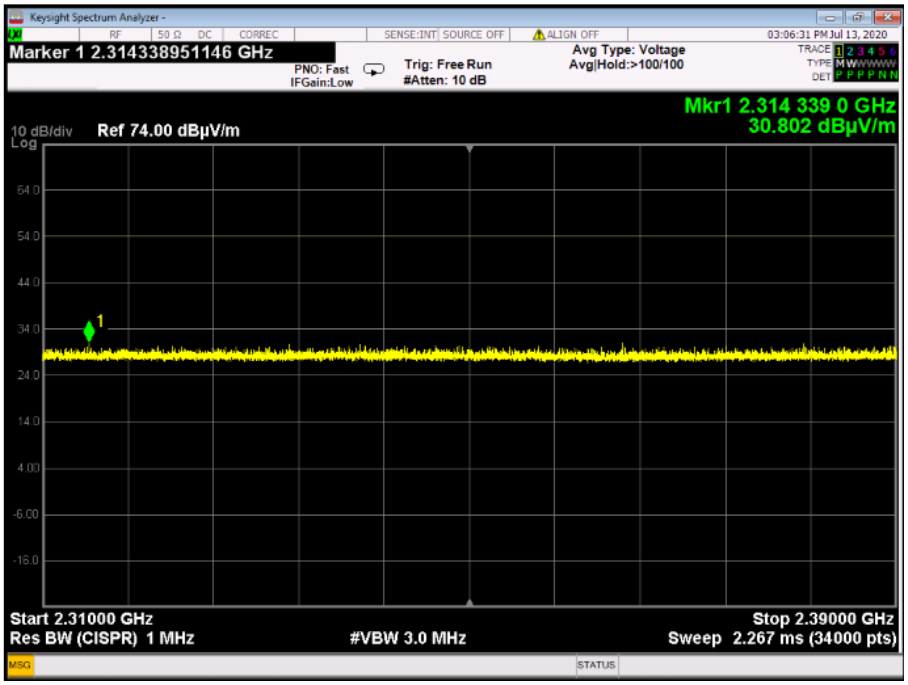
**Plot 4.5.1: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Horizontal Polarization, 9 k-150 KHz**



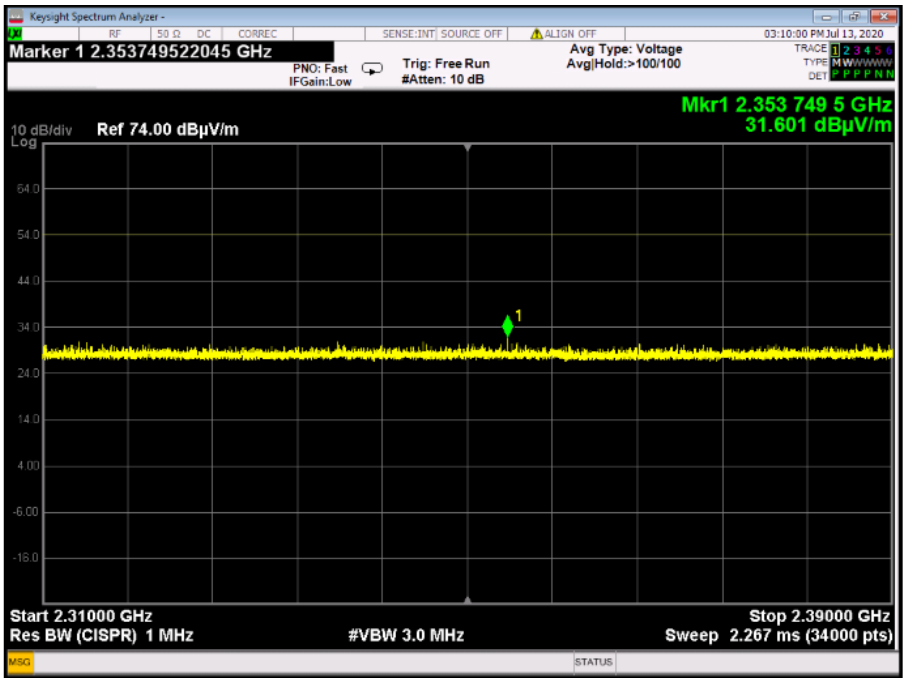

**Plot 4.5.2: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Horizontal Polarization, 150K-30MHz**



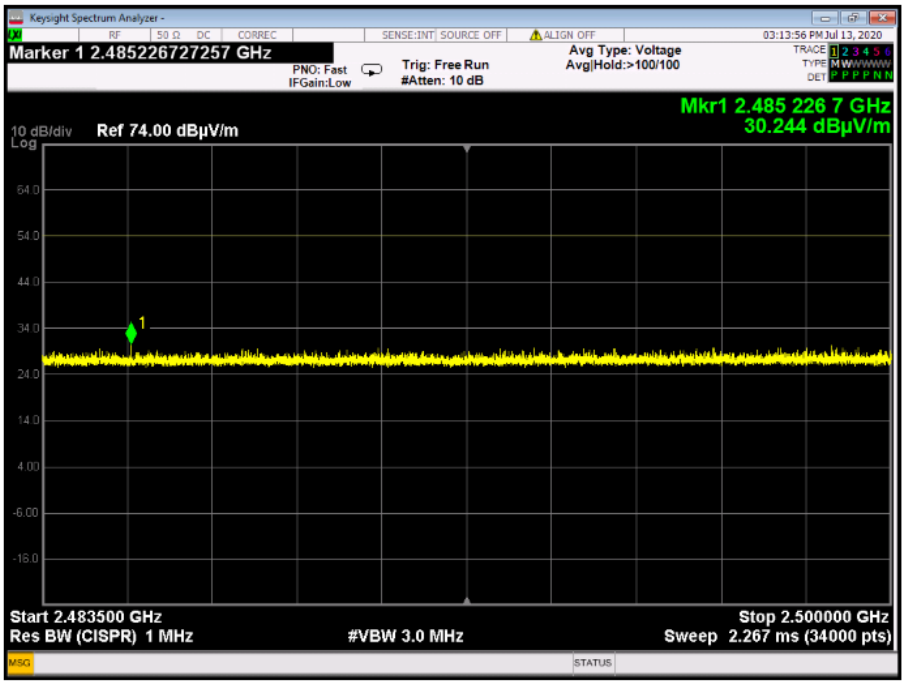
**Plot 4.5.3: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Horizontal Polarization, 2310-2390MHz**



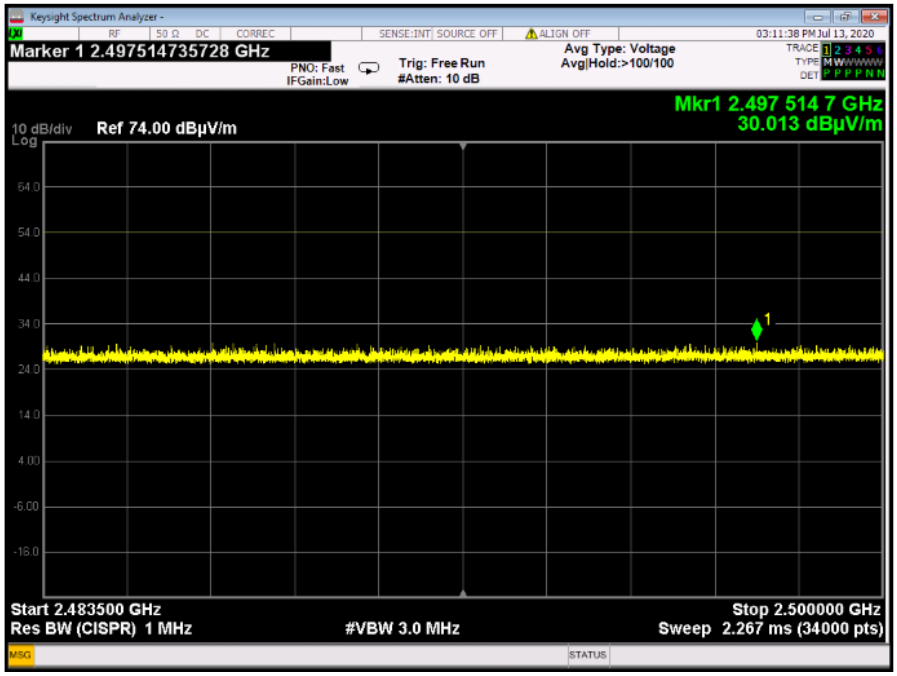

**Plot 4.5.4: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Vertical Polarization 2310-2390MHz**



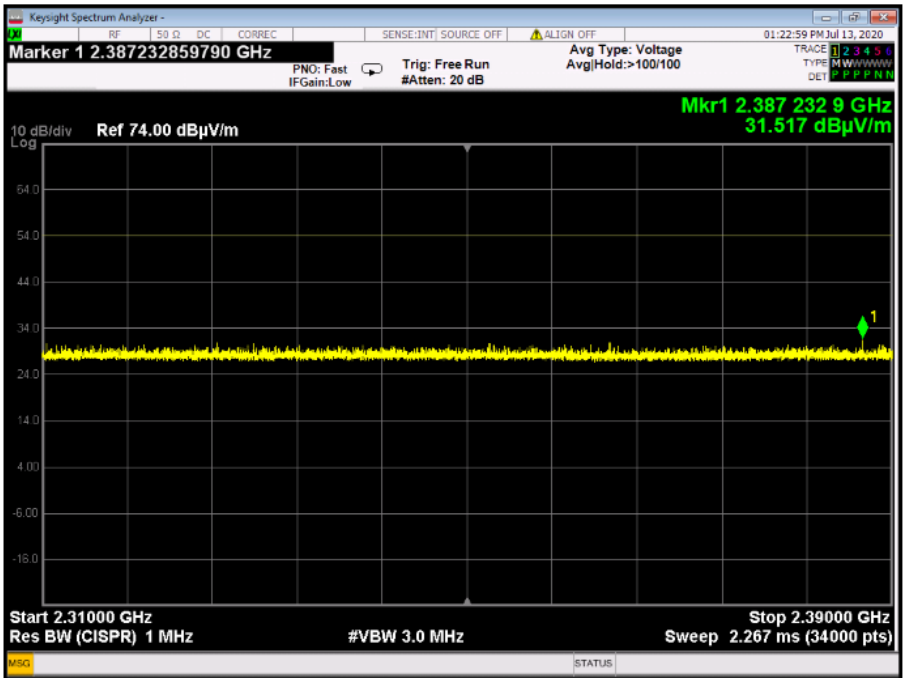
**Plot 4.5.5: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Horizontal Polarization, 2483.5-2500MHz**



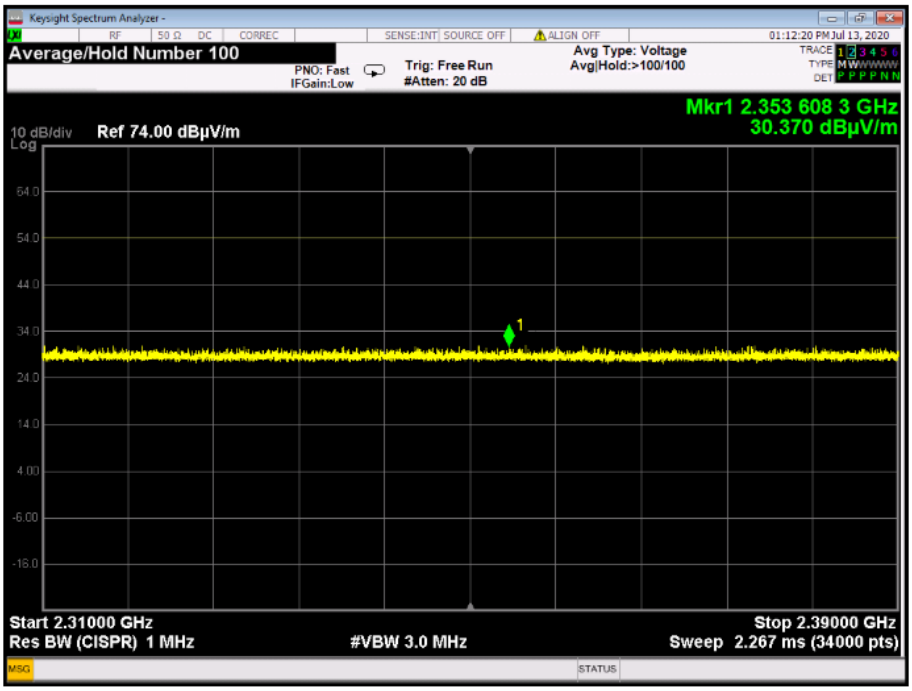

**Plot 4.5.6: Spurious Emissions in Restricted Bands, Single mode, Fc = 2402MHz, Vertical Polarization 2483.5-2500MHz**



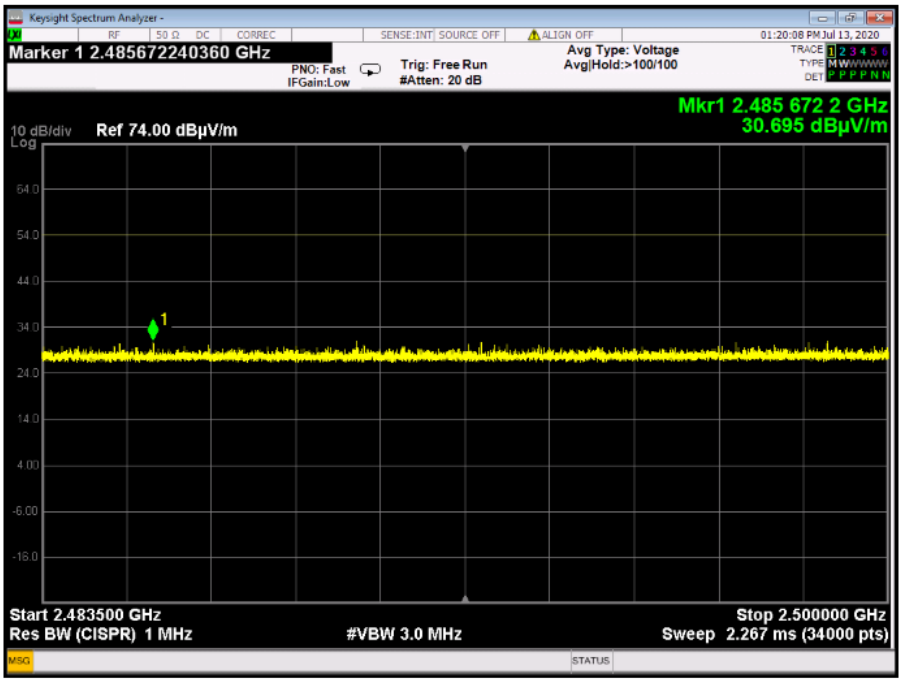
**Plot 4.5.7: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Horizontal Polarization, 2310-2390MHz**



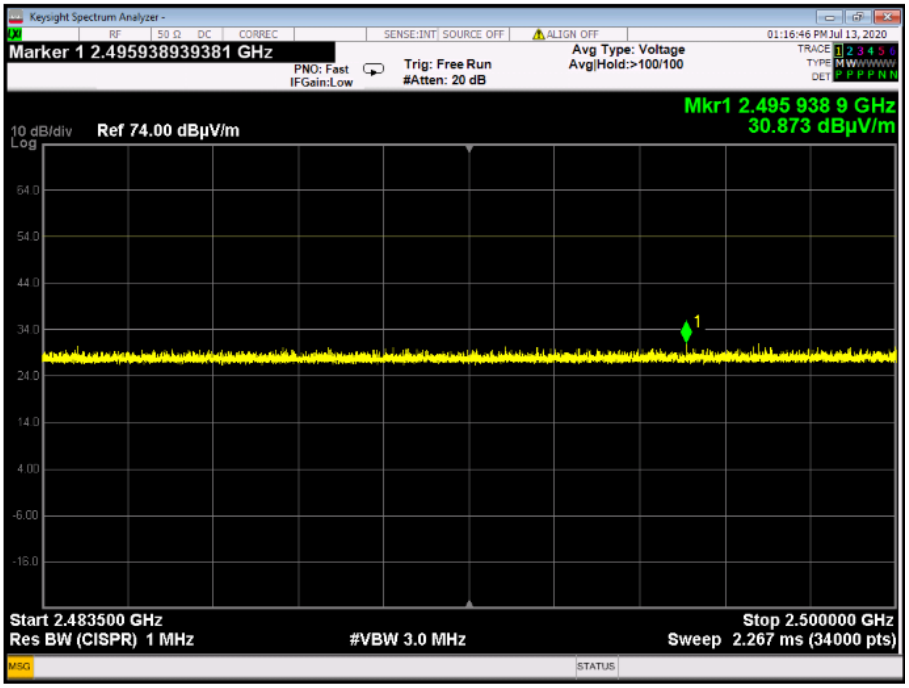

**Plot 4.5.8: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Vertical Polarization 2310-2390MHz**



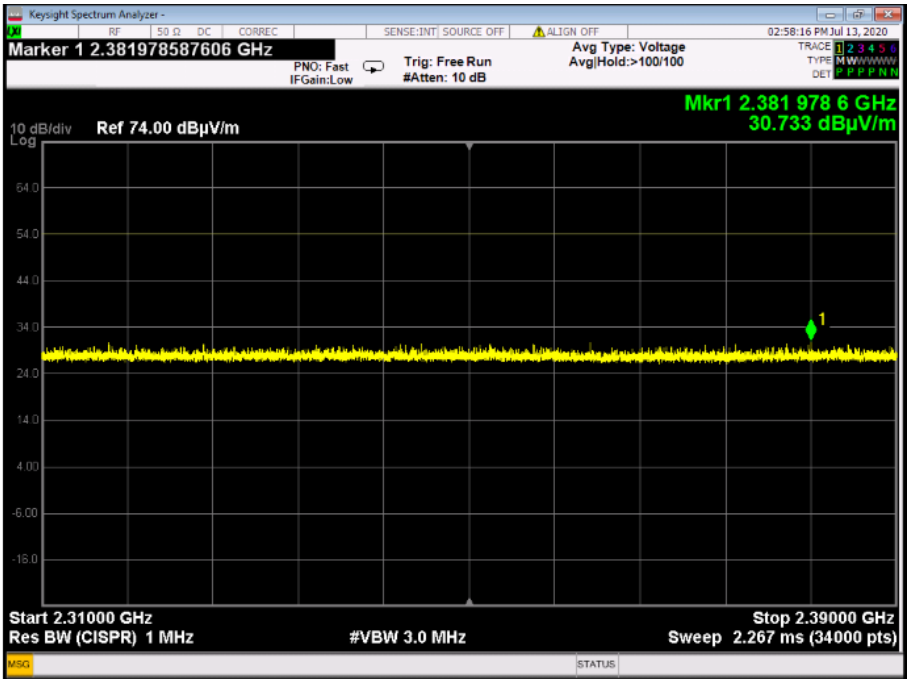
**Plot 4.5.9: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Horizontal Polarization, 2483.5-2500MHz**



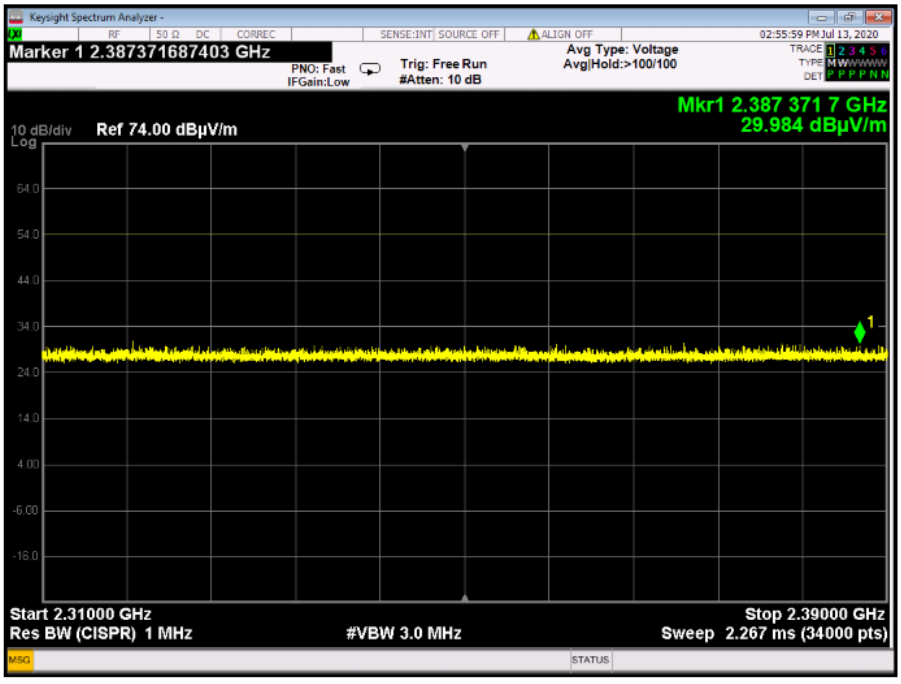

**Plot 4.5.10: Spurious Emissions in Restricted Bands, Single mode, Fc = 2440MHz, Vertical Polarization 2483.5-2500MHz**



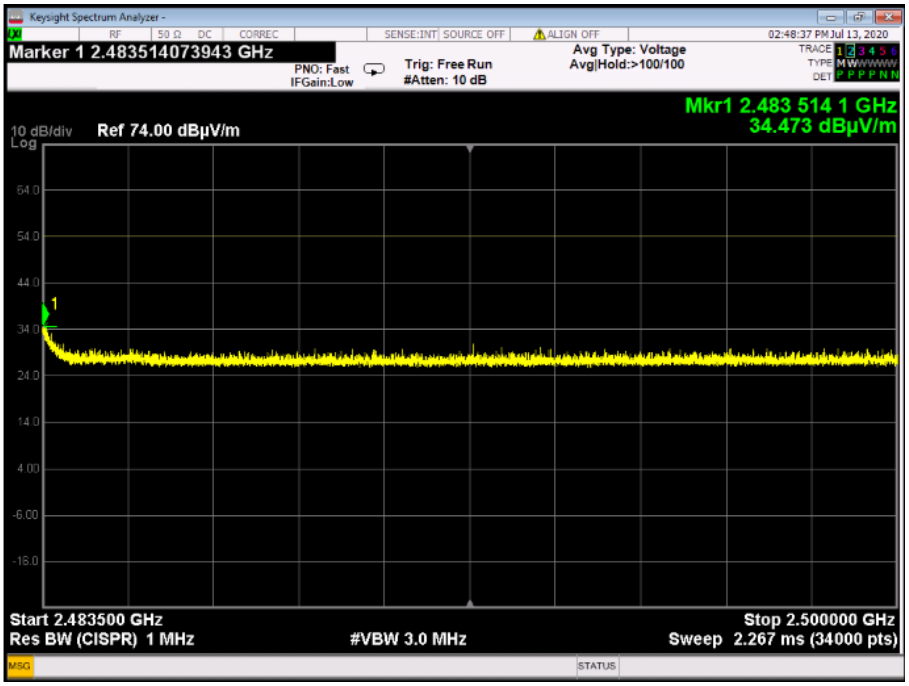
**Plot 4.5.11: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Horizontal Polarization, 2310-2390MHz**



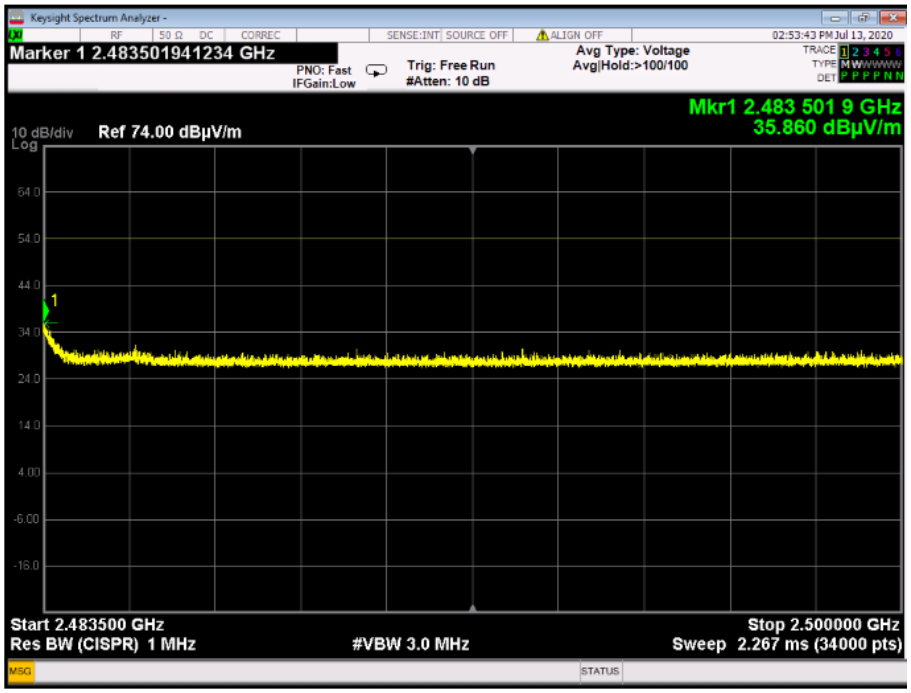

**Plot 4.5.12: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Vertical Polarization 2310-2390MHz**



**Plot 4.5.13: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Horizontal Polarization, 2483.5-2500MHz**




**Plot 4.5.14: Spurious Emissions in Restricted Bands, Single mode, Fc = 2480MHz, Vertical Polarization 2483.5-2500MHz**



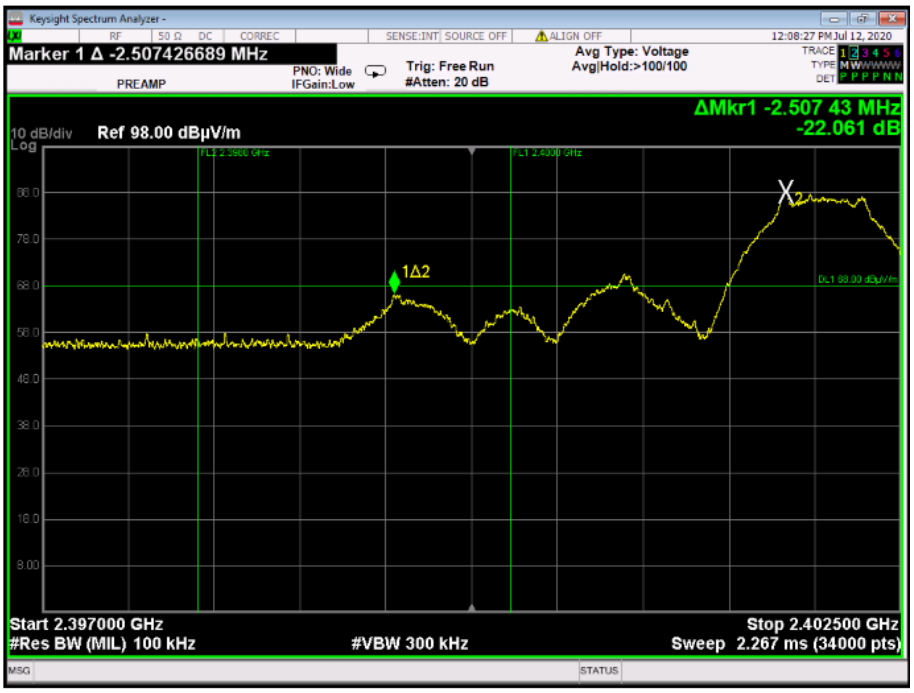
## 4.6. Band-edge compliance of RF Radiated Emission

| | | | |
|---|---|---|---|
| Reference document: | **47 CFR §15.247 (d), ANSI C63.10:2013 section 11.13.2** | | |
| Test Requirements and limit: | In any 100 kHz bandwidth outside the frequency band in which the digitally modulated 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 30dB instead of 20dB. Attenuation below the general limits specified in Section §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). | | |
| Operating conditions: | Under normal test conditions | Pass | |
| Method of testing: | Radiated | | |
| S.A. Settings: | RBW: 100kHz, VBW: 300kHz | | |
| Hopping function: | NO | | |
| Environment conditions: | Ambient Temperature: 23.6°C | Relative Humidity: 49.1% | Atmospheric Pressure: 1011.4 hPa |
| Test Result: | See below | See Plot 4.6.1 – Plot 4.6.4 | |

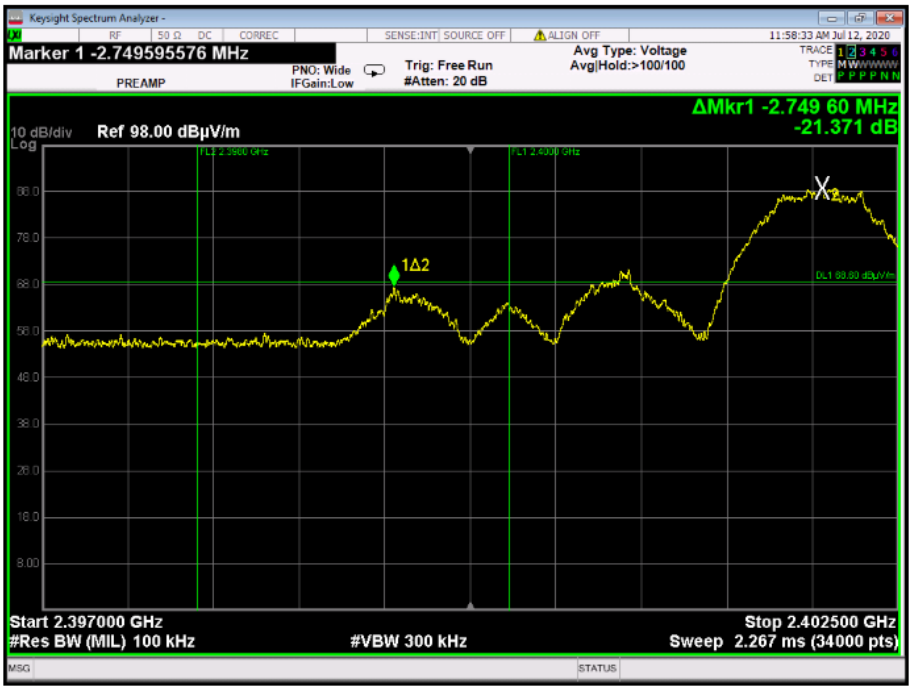
### Test results

| Antenna Position | Channel | Measured emission, [dBc] | Limit, [dBc] | Margin(db) | Result |
|---|---|---|---|---|---|
| horizontal | Low | -22.061 | -20.00 | -2.061 | Pass |
| vertical | Low | -21.371 | -20.00 | -1.371 | Pass |

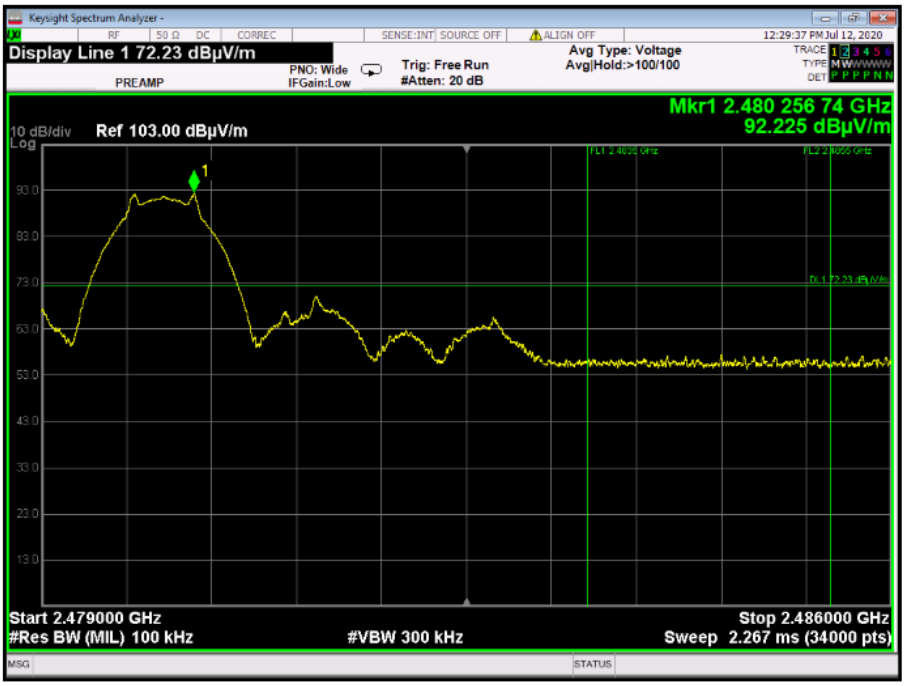
**Plot 4.6.1: Band-edge test results, GFSK, channel 0, Horizontal Polarization**



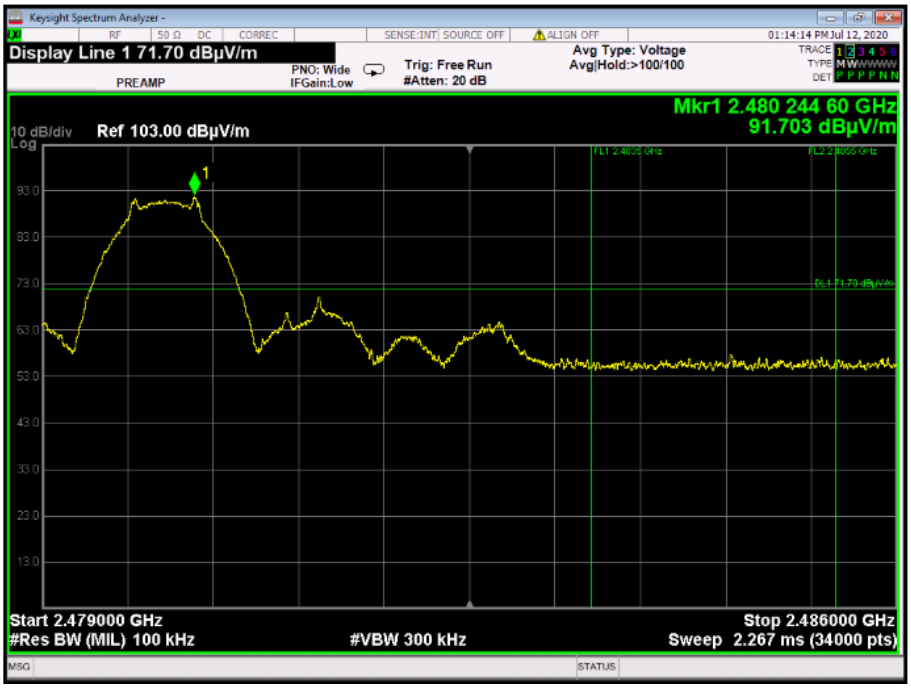

**Plot 4.6.2: Band-edge test results, GFSK, channel 0, Vertical Polarization**



**Plot 4.6.3: Band-edge test results, GFSK, channel 78, Horizontal Polarization**




**Plot 4.6.4: Band-edge test results, GFSK, channel 78, Vertical Polarization**



## 4.7. Antenna Connector Requirements

| | |
|---|---|
| Reference document: | **47 CFR §15.203 RSS-Gen, Section 7.1.4** |
| Test Requirements: | An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with provisions of this section. |
| Verdict | Integral Antenna -Comply |

## 4.8. Power Line Emissions measurements

| | | | |
|---|---|---|---|
| Reference document: | **47 CFR §207** | | |
| Test Requirements: | The emissions from an intentional radiator shall not exceed the field strength levels specified in §15.207.Any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Sec.15.207. | | |
| Operating conditions: | Under normal test conditions | **Pass** | |
| Method of testing: | Conducted Emissions | | |
| S.A. Settings: | f <30MHz: RBW: 9kHz, VBW:30kHz | | |
| Radio device: | Transmitting | | |
| Environment conditions: | Ambient Temperature: 23.2°c | Relative Humidity: 48.1% | Atmospheric Pressure: 1011.4 hPa |
| Test Result: | See below | See Plot 4.8.1 - Plot 4.8.2 | |

**Test Results:**

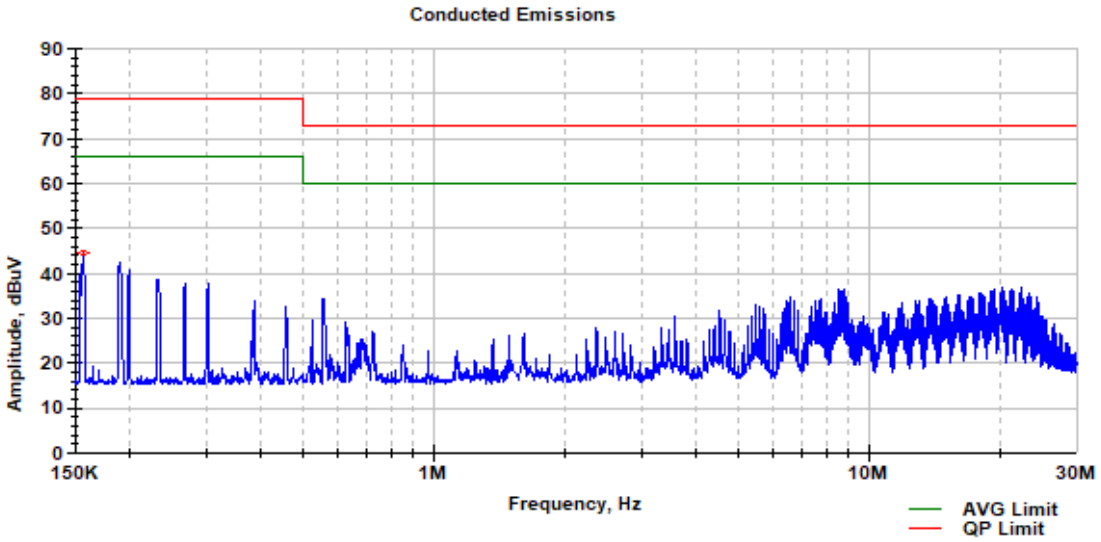
**"Phase" Lead**

| Frequency (MHz) | Peak (dBuV) | QP (dBuV) | QP Limit (dBuV) | QP Margin (dBuV) | AVG (dBuV) | AVG Limit (dBuV) | AVG Margin (dBuV) | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| 0.152 | 46.1 | 41.8 | 79.0 | -37.2 | 19.6 | 66.0 | -46.4 | Pass |
| 8.614 | 37.1 | 33.4 | 73.0 | -39.6 | 22.6 | 60.0 | -37.4 | Pass |
| 8.624 | 37.3 | 33.0 | 73.0 | -40.0 | 21.7 | 60.0 | -38.3 | Pass |
| 20.167 | 37.0 | 33.4 | 73.0 | -39.6 | 23.2 | 60.0 | -36.8 | Pass |
| 20.247 | 37.1 | 33.7 | 73.0 | -39.3 | 23.3 | 60.0 | -36.7 | Pass |
| 22.379 | 36.6 | 32.8 | 73.0 | -40.2 | 21.7 | 60.0 | -38.3 | Pass |

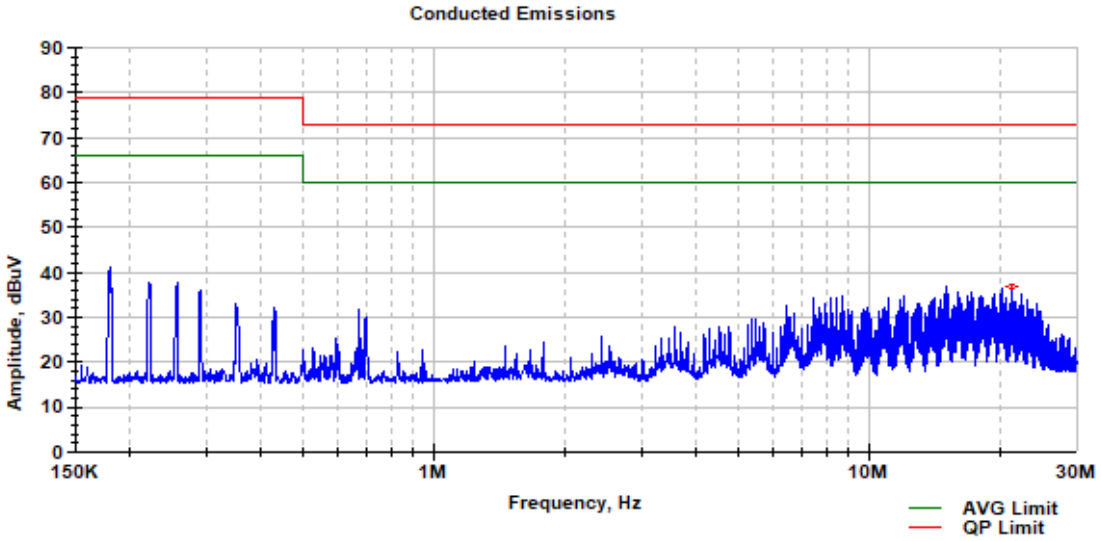
**"Neutral" Lead**

| Frequency (MHz) | Peak (dBuV) | QP (dBuV) | QP Limit (dBuV) | QP Margin (dBuV) | AVG (dBuV) | AVG Limit (dBuV) | AVG Margin (dBuV) | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| 14.993 | 35.7 | 31.1 | 73.0 | -41.9 | 21.1 | 60.0 | -38.9 | Pass |
| 15.958 | 36.9 | 30.8 | 73.0 | -42.2 | 20.7 | 60.0 | -39.3 | Pass |
| 17.334 | 36.3 | 30.4 | 73.0 | -42.6 | 19.7 | 60.0 | -40.3 | Pass |
| 20.230 | 36.9 | 31.9 | 73.0 | -41.1 | 21.5 | 60.0 | -38.5 | Pass |
| 21.273 | 37.0 | 31.7 | 73.0 | -41.3 | 21.1 | 60.0 | -38.9 | Pass |
| 22.230 | 35.4 | 30.7 | 73.0 | -42.3 | 20.0 | 60.0 | -40.0 | Pass |

**Plot 4.8.1: Power Supply Port, Phase Lead**



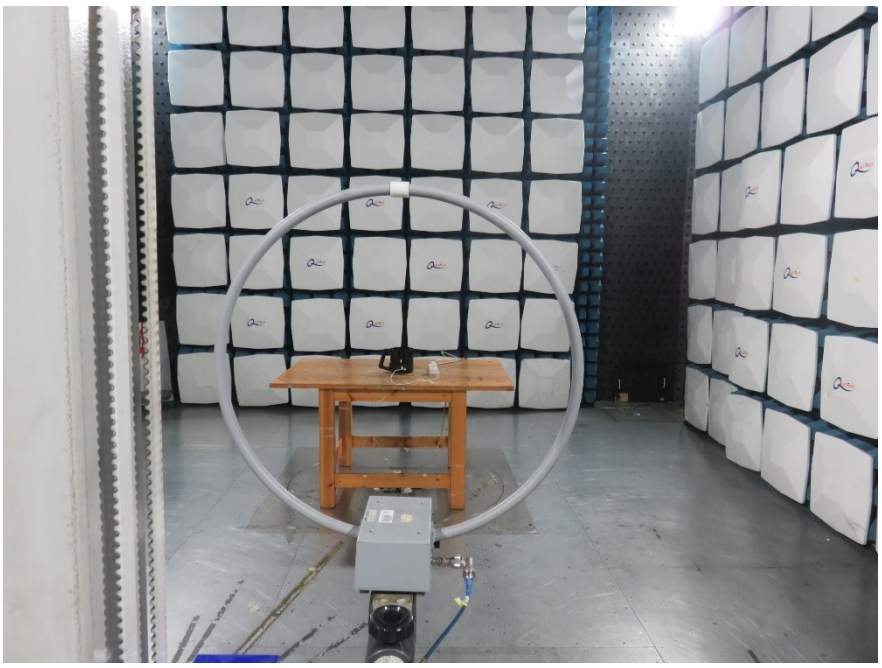

**Plot 4.8.2: Power Supply Port, Neutral Lead**



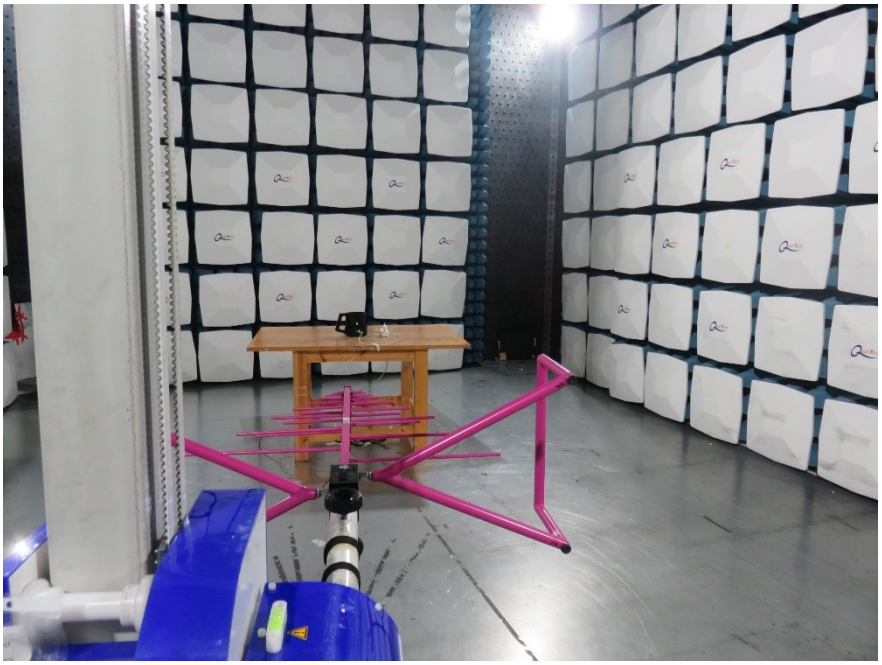
# 5. Appendix

## Appendix A: Test Photographs

**Photograph 1: Radiated Emission Testing 9kHz-30MHz**



**Photograph 2: Radiated Emission Testing 30MHz-1000MHz**



**Photograph 3: Radiated Emission Testing 1GHz-18GHz**

**Photograph 4: Conducted Emission Testing on AC Power Supply Port**

## Appendix B: List of Measuring Equipment used:

| Description | Manufacturer | Model | Serial No. | Last Cal | Cal Due |
|---|---|---|---|---|---|
| Signal Generator | Marconi | 2024 | 1122681029 | 20/05/2020 | 20/05/2021 |
| RF Filter Section (2.9GHz) | HP | 85460A | 3448A00282 | 08/08/2019 | 08/08/2020 |
| EMI Receiver (2.9GHz) | HP | 8546A | 3617A00318 | 07/08/2019 | 07/08/2020 |
| Signal Generator | Marconi | 2025 | 202301940 | 18/02/2020 | 18/02/2021 |
| Temp & Hum Meter | Zico | Zi-9622 | 141101658 | 20/02/2020 | 20/02/2021 |
| EMC Analyzer | Agilent | E7405A | US41160436 | 12/09/2019 | 12/09/2020 |
| Spectrum Analyzer 3Hz-44GHz | Agilent | E4446A | MY46180602 | 25/10/2018 | 25/10/2020 |
| Spectrum Analyzer 9KHz-22GHz | Agilent/HP | 8593EM | 3536A00131 | 08/09/2019 | 08/09/2021 |
| Spectrum Analyzer 3Hz-44GHz | Agilent | E4446A | MY43360126 | 14/01/2020 | 14/01/2022 |
| DCAMN (LISN) 150 kHz to 30 MHz | Schwarzbeck | PVDC 8300 | 30 | 19/04/2020 | 19/04/2023 |
| Horn Antenna (EMM) 1-18GHz | A.R.A | DRG-118/A | 17188 | 15/09/2019 | 15/09/2020 |
| Horn Antenna (for IMM) 1-18GHz | EMCO | 3115 | 9602-4677 | 15/09/2019 | 15/09/2022 |
| RF Transient Limiter | Agilent | 11947A | 3107A04119 | 20/11/2019 | 20/11/2020 |
| LISN | FCC | 50/250-25-2 | 9705 | 20/11/2019 | 20/11/2020 |
| LISN | Schwarzbeck | NNBL 8226-2 | 8226120 | 05/12/2019 | 05/12/2020 |
| Line impedance stabilization network, 9 kHz to 30 MHz, 3-Phase | Schwarzbeck | NNLK 8121 | 8121-526 | 10/09/2019 | 10/09/2020 |
| Horn Antenna 15-40 GHz | Schwarzbeck | BBHA 9170 | BBHA9170214 | 12/03/2018 | 12/03/2021 |
| Bilog Antenna 30MHz - 1000MHz | Teseq | CBL 6141B | 34119 | 18/03/2019 | 18/03/2022 |
| Spectrum Analyzer (9KHz-3.6GHz) | Agilent | N9010A | MY50060093 | 27/09/2017 | 27/09/2022 |
| Universal Telecom ISN | FCC | F-071115-1057-1 | 20616 | 25/02/2020 | 25/02/2023 |
| True RMS Multimeter | FLUKE | 289 | 18910242 | 24/12/2019 | 24/12/2020 |
| True RMS Multimeter | FLUKE | 87 | 57990807 | 17/02/2020 | 17/02/2021 |

## Appendix C: Accreditation Certificate

# Accredited Laboratory

A2LA has accredited

**QUALITECH**

*Petah-Tikva, Israel*

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 31st day of May 2018.

President and CEO
For the Accreditation Council
Certificate Number 1633.01
Valid to October 31, 2020
Revised June 2, 2020

*For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.*

***End of the Test Report***