# FCC and ISEDC Test Report

## Sepura Ltd
## Tetra Handset, Model: SC2028

## In accordance with FCC 47 CFR Part 15C, ISEDC RSS-247 and ISEDC RSS-GEN

Prepared for: Sepura Ltd
9000 Cambridge Research Park
Beach Drive, Waterbeach
Cambridge, CB25 9TL
United Kingdom

Add value.
Inspire trust.

FCC ID: XX6SC2028 IC: 8739A-SC2028

## COMMERCIAL-IN-CONFIDENCE

Document 75947270-03 Issue 01

| SIGNATURE | | | |
|---|---|---|---|
|  | | | |
| **NAME** | **JOB TITLE** | **RESPONSIBLE FOR** | **ISSUE DATE** |
| Jon Kenny | Senior Engineer | Authorised Signatory | 10 February 2020 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

**ENGINEERING STATEMENT**

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C, ISEDC RSS-247 and ISEDC RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| Testing | Connor Lee | 10 February 2020 |  |

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISEDC Accreditation
12669A Octagon House, Fareham Test Laboratory

**EXECUTIVE SUMMARY**

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C, ISEDC RSS-247 and ISEDC RSS-GEN: 2018, Issue 2 (2017-02) and Issue 5 A1 (2019-03) for the tests detailed in section 1.3.



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# Contents

# 1 Report Summary

## 1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue |
|---|---|---|
| 1 | First Issue | 10 February 2020 |

**Table 1**

## 1.2 Introduction

| | |
|---|---|
| Applicant | Sepura Ltd |
| Manufacturer | Sepura Ltd |
| Model Number(s) | SC2028 |
| Serial Number(s) | 1PR001925GK63ZJ |
| Hardware Version(s) | Pre-Production |
| Software Version(s) | 2001 730 07367 |
| Number of Samples Tested | 1 |
| Test Specification/Issue/Date | FCC 47 CFR Part 15C: 2018<br>ISEDC RSS-247: Issue 2 (2017-02)<br>ISEDC RSS-GEN: Issue 5 (2018-04) + A1 (2019-03) |
| Order Number<br>Date | PLC-PO014257-2<br>11-October-2019 |
| Date of Receipt of EUT | 22-October-2019 and 06-December-2019 |
| Start of Test | 06-December-2019 |
| Finish of Test | 20-December-2019 |
| Name of Engineer(s) | Connor Lee |
| Related Document(s) | ANSI C63.10 (2013) |

## 1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, ISEDC RSS-247 and ISEDC RSS-GEN is shown below.

| Section | Specification Clause | | | Test Description | Result | Comments/Base Standard |
|---|---|---|---|---|---|---|
| | Part 15C | RSS-247 | RSS-GEN | | | |
| Configuration and Mode: 2.4 GHz Bluetooth - BDR/EDR | | | | | | |
| - | 15.247 (a)(1) | - | 5.1 | Frequency Hopping Systems - Average Time of Occupancy | N/T | Refer to Document 75944487-04* |
| - | 15.247 (a)(1) | - | 5.1 | Frequency Hopping Systems - Channel Separation | N/T | Refer to Document 75944487-04* |
| - | 15.247 (a)(1) | - | 5.1 | Frequency Hopping Systems - Number of Hopping Channels | N/T | Refer to Document 75944487-04* |
| - | 15.247 (a)(1) | - | 5.1 | Frequency Hopping Systems - 20 dB Bandwidth | N/T | Refer to Document 75944487-04* |
| - | 15.247 (b) | 5.4 | 6.12 | Maximum Conducted Output Power | N/T | Refer to Document 75944487-04* |
| - | 15.207 | - | 8.8 | AC Power Line Conducted Emissions | N/T | Only needs to be performed in the mode with the highest output power which was Bluetooth Low Energy. This has been tested and reported in document 75947270-04. |
| 2.1 | 15.247 (d) | 5.5 | - | Authorised Band Edges | Pass | ANSI C63.10 (2013) |
| 2.2 | 15.205 | - | 8.10 | Restricted Band Edges | Pass | ANSI C63.10 (2013) |
| 2.3 | 15.247 (d) and 15.205 | 5.5 | 6.13 | Spurious Radiated Emissions | Pass | ANSI C63.10 (2013) |

**Table 2**

N/T – Not Tested
* EUT contains the same pre-approved module

## 1.4 Application Form

### Equipment Description

| | |
|---|---|
| Technical Description:<br>*(Please provide a brief description of the intended use of the equipment)* | The SC2028 hand-portable terminal is a TETRA enabled radio with Bluetooth and Wi-Fi capability |
| Manufacturer: | Sepura Limited |
| Model: | SC2028 |
| Part Number: | N/A |
| Hardware Version: | Pre-Production |
| Software Version: | 2001 730 07367 |
| FCC ID (if applicable) | XX6SC2028 |
| IC ID (if applicable) | 8739A-SC2028 |

### Intentional Radiators

| Technology | TETRA | TETRA | BT Classic/EDR | BLE | WLAN |
|---|---|---|---|---|---|
| Frequency Band (MHz) | 806-824 | 851-869 | 2402-2480 | 2402-2480 | 2412-2462 |
| Conducted Declared Output Power (dBm) | 34 | 34 | 7.382 | 7.382 | 16.5 |
| Antenna Gain (dBi) | > 0 | > 0 | 2.5 | 2.5 | 2.5 |
| Supported Bandwidth(s) (MHz) | 25 kHz | 25 kHz | 1 | 2 | 16.5<br>22 |
| Modulation Scheme(s) | π/4 DQPSK | π/4 DQPSK | 8-DPSK, π/4DQPSK, GFSK | 8PSK, DQPSK, GFSK | BPSK, 16-QAM, 64-QAM |
| ITU Emission Designator | 22K0DXW | 22K0DXW | 1M00F1D | 2M00F1D | 16M5G1D<br>22M0G1D |
| Bottom Frequency (MHz) | 806 | 851 | 2402 | 2402 | 2412 |
| Middle Frequency (MHz) | 815 | 860 | 2441 | 2441 | 2437 |
| Top Frequency (MHz) | 824 | 869 | 2480 | 2480 | 2462 |

### Un-intentional Radiators

| | |
|---|---|
| Highest frequency generated or used in the device or on which the device operates or tunes | 2480 MHz |
| Lowest frequency generated or used in the device or on which the device operates or tunes | 32.768 kHz |
| Class A Digital Device (Use in commercial, industrial or business environment) ☒<br>Class B Digital Device (Use in residential environment only) ☐ | |

## DC Power Source

| | | |
|---|---|---|
| Nominal voltage: | 7.4 | V |
| Extreme upper voltage: | 7.4 | V |
| Extreme lower voltage: | 6.2 | V |
| Max current: | 2 | A |

## Battery Power Source

| | | |
|---|---|---|
| Voltage: | 7.4 | V |
| End-point voltage: | 6.2 | V *(Point at which the battery will terminate)* |
| Alkaline ☐ Leclanche ☒ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)* | | |
| Other ☐ Please detail: | | |

## Charging

| | |
|---|---|
| Can the EUT transmit whilst being charged | Yes ☒ No ☐ |

## Temperature

| | | |
|---|---|---|
| Minimum temperature: | -30 | °C |
| Maximum temperature: | +65 | °C |

## Antenna Characteristics

| | | | | | |
|---|---|---|---|---|---|
| Antenna connector ☒ TETRA | | | State impedance | 50 | Ohm |
| Temporary antenna connector ☐ | | | State impedance | | Ohm |
| Integral antenna ☒ | Type: | PCB | State impedance | 50 | Ohm |
| External antenna ☐ | Type: | | State impedance | | dBI |

## Ancillaries (if applicable)

| | | | |
|---|---|---|---|
| Manufacturer: | | Part Number: | |
| Model: | | Country of Origin: | |

The SC2028 may be used with standard SC20 accessories, batteries, chargers, belt clips, holsters, remote speaker and microphones, earpieces etc

I hereby declare that the information supplied is correct and complete.

Name: Chris Beecham
Position held: Conformance Engineer
Date: 21 October 2019

## 1.5 Product Information

### 1.5.1 Technical Description

The SC2028 hand-portable terminal is a TETRA enabled radio with Bluetooth and Wi-Fi capability.

## 1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

## 1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

| Modification State | Description of Modification still fitted to EUT | Modification Fitted By | Date Modification Fitted |
|---|---|---|---|
| Model: SC2028, Serial Number: 1PR001925GK63ZJ | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |

**Table 3**

## 1.8 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

| Test Name | Name of Engineer(s) | Accreditation |
|---|---|---|
| Configuration and Mode: 2.4 GHz Bluetooth - BDR/EDR | | |
| Authorised Band Edges | Connor Lee | UKAS |
| Restricted Band Edges | Connor Lee | UKAS |
| Spurious Radiated Emissions | Connor Lee | UKAS |

**Table 4**

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

# 2 Test Details

## 2.1 Authorised Band Edges

### 2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
ISEDC RSS-247, Clause 5.5

### 2.1.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001925GK63ZJ - Modification State 0

### 2.1.3 Date of Test

06-December-2019

### 2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

### 2.1.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 17.7 °C |
| Relative Humidity | 46.0 % |

### 2.1.6 Test Results

2.4 GHz Bluetooth - BDR/EDR

| Mode | Modulation | Packet Type | Channel Frequency (MHz) | Band Edge Frequency (MHz) | Level (dBc) |
|---|---|---|---|---|---|
| Static | GFSK | DH5 | 2402.0 | 2400.0 | -52.19 |
| Hopping | GFSK | DH5 | - | 2400.0 | -50.51 |
| Static | π/4 DQPSK | 2DH5 | 2402.0 | 2400.0 | -46.67 |
| Hopping | π/4 DQPSK | 2DH5 | - | 2400.0 | -48.83 |
| Static | 8-DPSK | 3DH5 | 2402.0 | 2400.0 | -45.26 |
| Hopping | 8-DPSK | 3DH5 | - | 2400.0 | -47.62 |

**Table 5 - Authorised Band Edge Results**

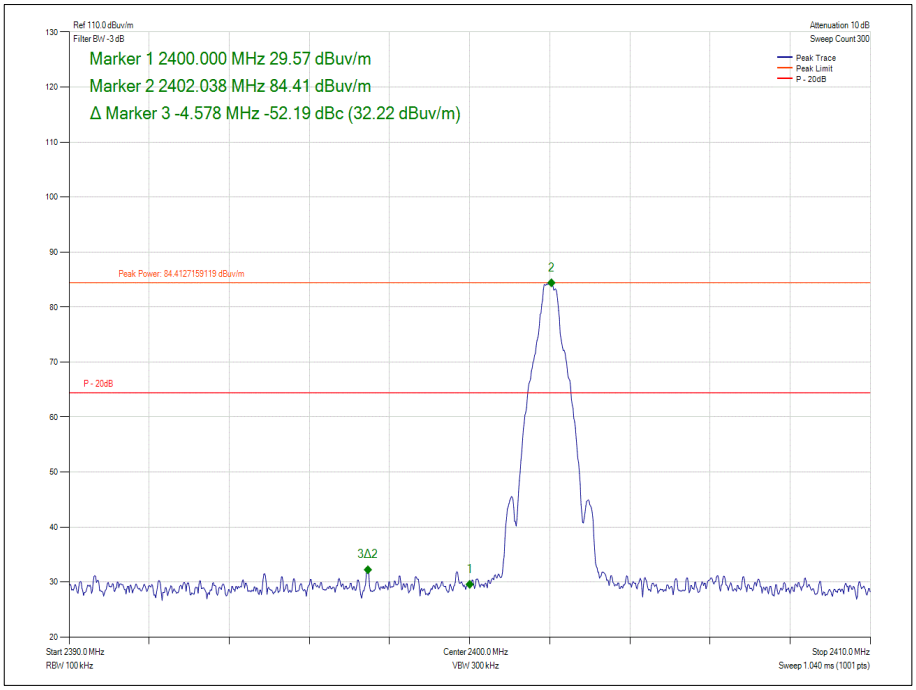



**Figure 1 - Static - GFSK/DH5 – 2402.0 MHz - Measured Frequency 2400.0 MHz**

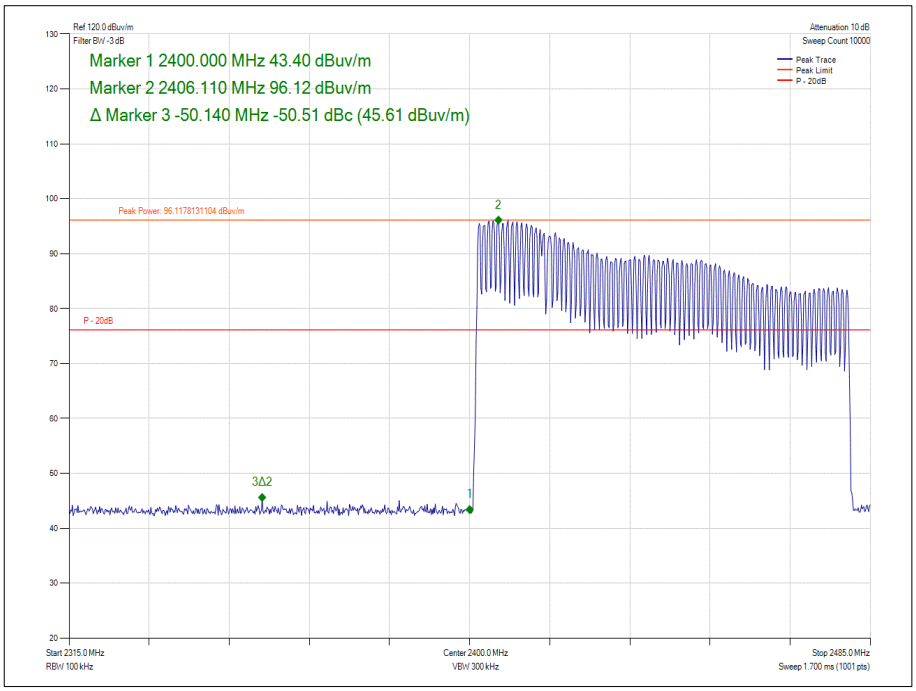



**Figure 2 - Hopping - GFSK/DH5 - Measured Frequency 2400.0 MHz**

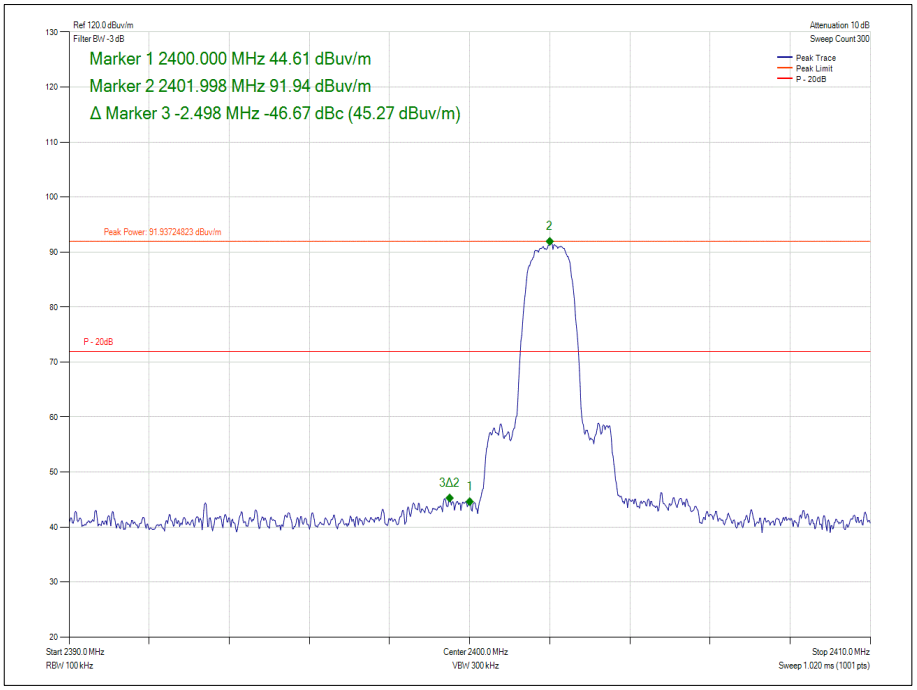



**Figure 3 - Static - π/4 DQPSK/2DH5 – 2402.0 MHz - Measured Frequency 2400.0 MHz**

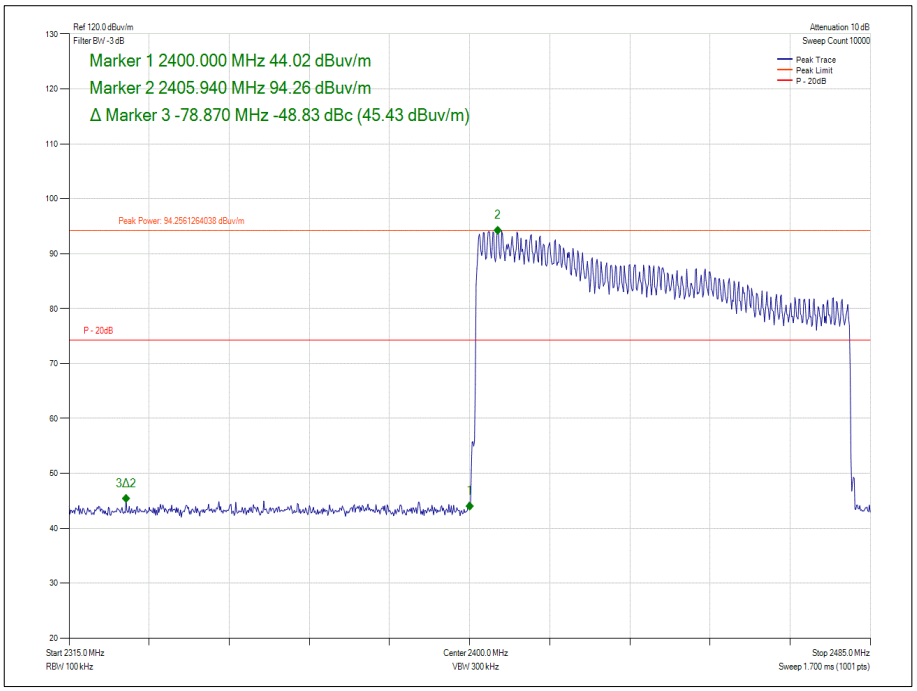



**Figure 4 - Hopping - π/4 DQPSK/2DH5 - Measured Frequency 2400.0 MHz**

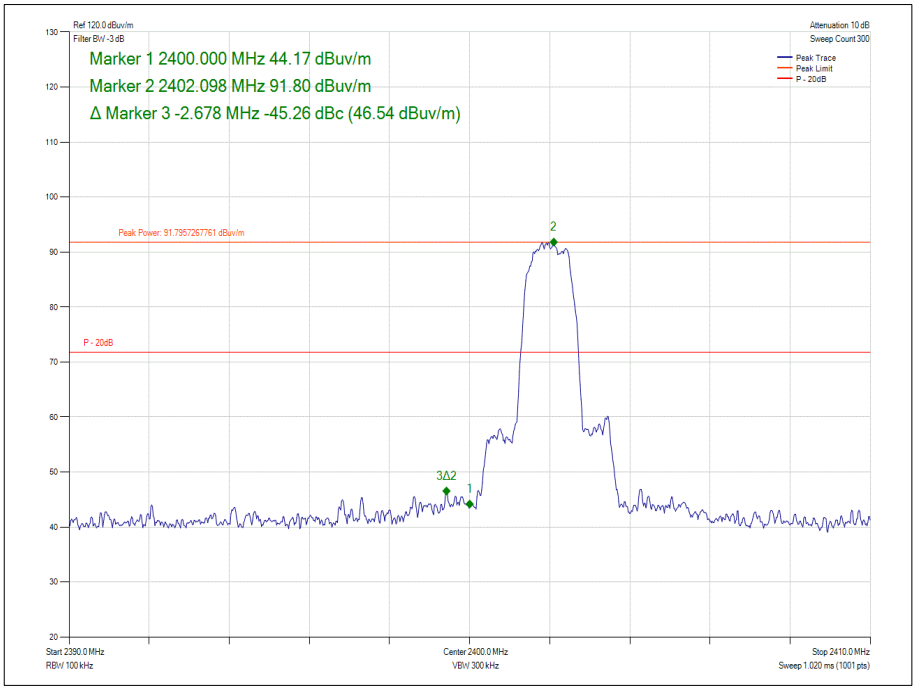



**Figure 5 - Static - 8-DPSK/3DH5 – 2402.0 MHz - Measured Frequency 2400.0 MHz**

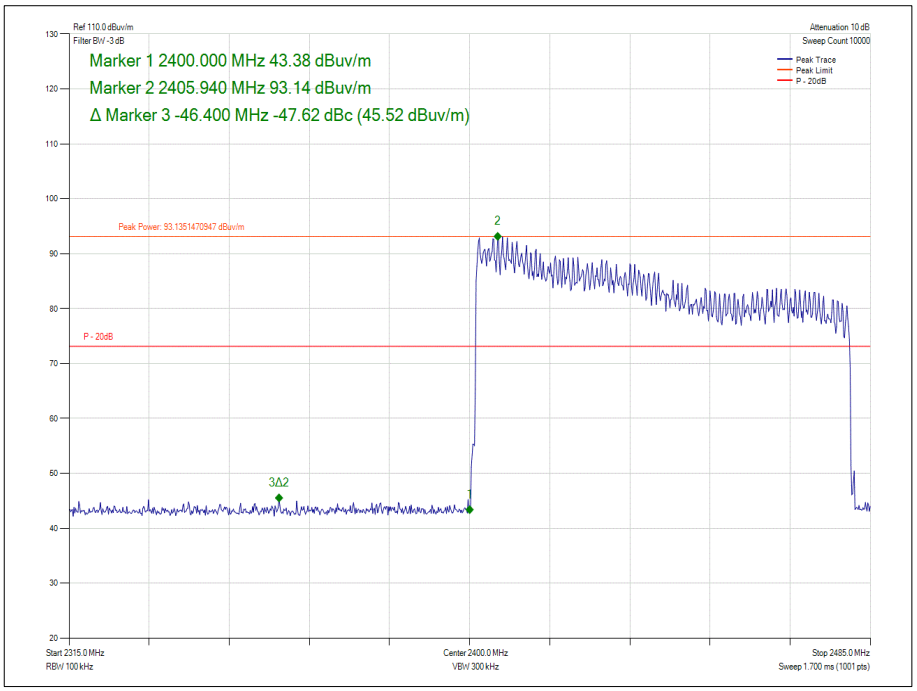



**Figure 6 - Hopping - 8-DPSK/3DH5 - Measured Frequency 2400.0 MHz**

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

ISEDC RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### 2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 23-Jan-2021 |
| Turntable Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Hygrometer | Rotronic | A1 | 2677 | 12 | 20-Feb-2020 |
| '2.92mm' - '2.92mm' RF Cable (2m) | Rhophase | KPS-1503-2000-KPS | 3695 | 12 | 11-Jun-2020 |
| Mast Controller | Maturo Gmbh | NCD | 4810 | - | TU |
| Tilt Antenna Mast | Maturo Gmbh | TAM 4.0-P | 4811 | - | TU |
| Double Ridge Broadband Horn Antenna | Schwarzbeck | BBHA 9120 B | 4848 | 12 | 11-Mar-2020 |
| EmX Emissions Software | TUV SUD | EmX V.V1.5.3 | 5125 | - | Software |
| 8 Meter Cable | Teledyne | PR90-088-8MTR | 5212 | 12 | 30-Aug-2020 |
| EMI Test Receiver | Rohde & Schwarz | ESW44 | 5382 | 12 | 8-Oct-2020 |

**Table 6**

TU – Traceability Unscheduled

## 2.2 Restricted Band Edges

### 2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
ISEDC RSS-GEN, Clause 8.10

### 2.2.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001925GK63ZJ - Modification State 0

### 2.2.3 Date of Test

20-December-2019

### 2.2.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5 in a semi-anechoic chamber at a test distance of 3 m.

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.5.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

### 2.2.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 17.7 °C |
| Relative Humidity | 44.0 - 47.0 % |

### 2.2.6 Test Results

2.4 GHz Bluetooth - BDR/EDR

| Mode | Modulation | Packet Type | Channel Frequency (MHz) | Measured Frequency (MHz) | Peak Level (dBµV/m) | Average Level (dBµV/m) |
|---|---|---|---|---|---|---|
| Static | GFSK | DH5 | 2402.0 | 2390.0 | 41.50 | 29.70 |
| Static | π/4 DQPSK | 2DH5 | 2402.0 | 2390.0 | 54.43 | 40.21 |
| Static | 8-DPSK | 3DH5 | 2402.0 | 2390.0 | 53.81 | 40.28 |
| Static | GFSK | DH5 | 2402.0 | 2483.5 | 52.45 | 40.67 |
| Static | π/4 DQPSK | 2DH5 | 2402.0 | 2483.5 | 53.16 | 41.03 |
| Static | 8-DPSK | 3DH5 | 2402.0 | 2483.5 | 52.82 | 41.07 |
| Hopping | GFSK | DH5 | - | 2390.0 | 54.95 | 40.13 |
| Hopping | π/4 DQPSK | 2DH5 | - | 2390.0 | 55.16 | 40.12 |
| Hopping | 8-DPSK | 3DH5 | - | 2390.0 | 55.57 | 40.11 |
| Hopping | GFSK | DH5 | - | 2483.5 | 54.16 | 40.65 |
| Hopping | π/4 DQPSK | 2DH5 | - | 2483.5 | 54.23 | 40.64 |
| Hopping | 8-DPSK | 3DH5 | - | 2483.5 | 53.93 | 40.64 |

**Table 7 - Restricted Band Edge Results**

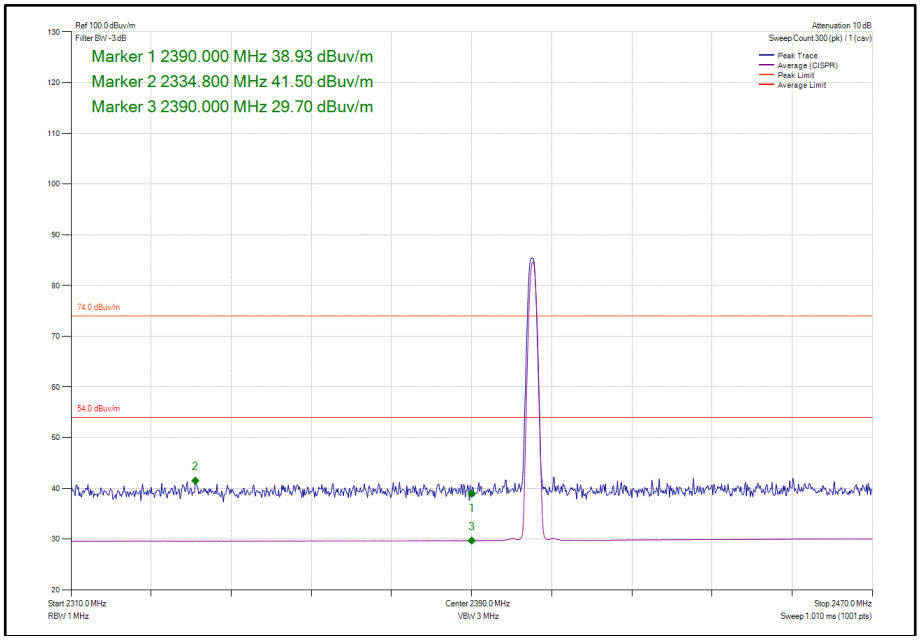



**Figure 7 - Static - GFSK/DH5 - 2402.0 MHz - Measured Frequency 2390.0 MHz**

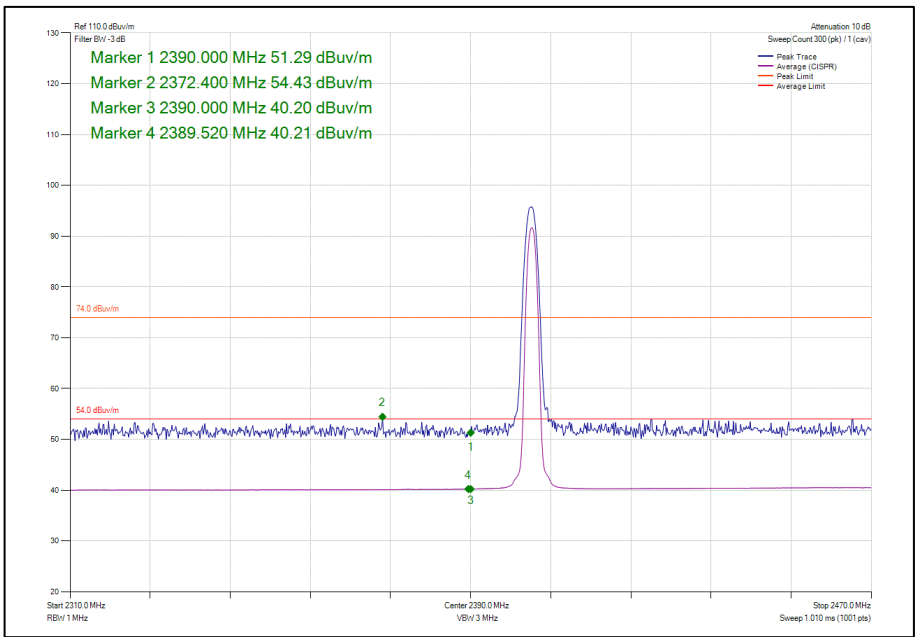



**Figure 8 - Static - π/4 DQPSK/2DH5 - 2402.0 MHz - Measured Frequency 2390.0 MHz**

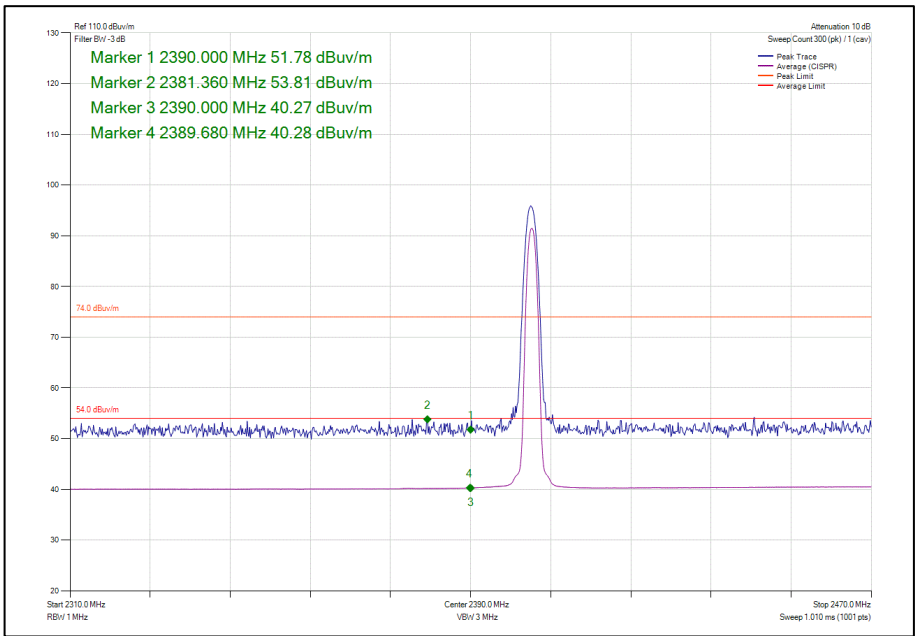



**Figure 9 - Static - 8-DPSK/3DH5 - 2402.0 MHz - Measured Frequency 2390.0 MHz**

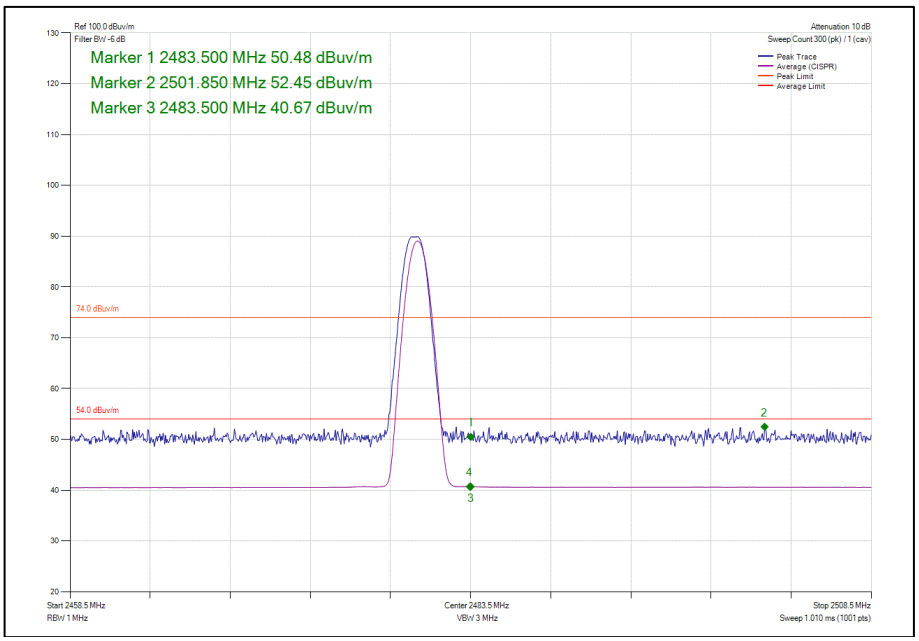



**Figure 10 - Static - GFSK/DH5 - 2402.0 MHz - Measured Frequency 2483.5 MHz**

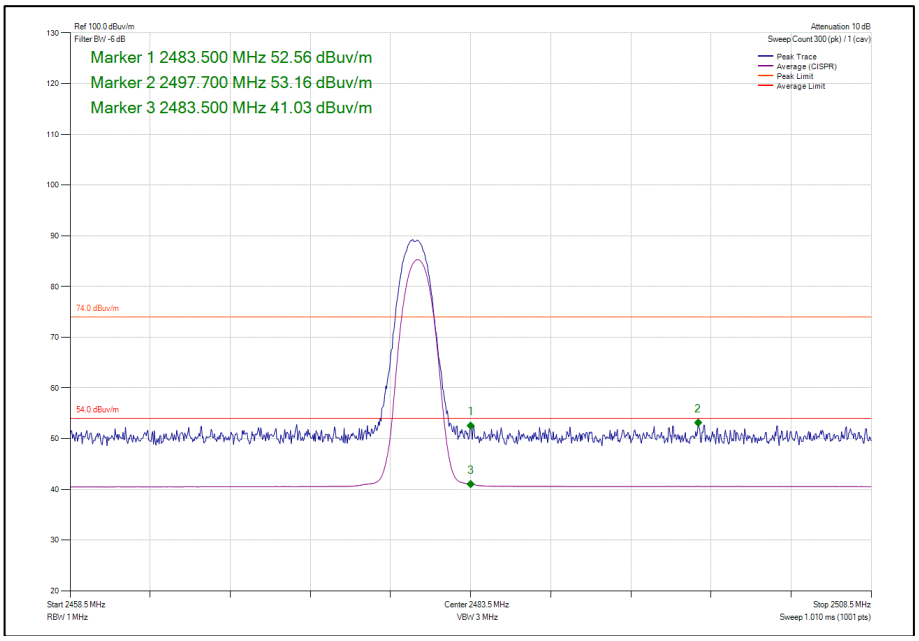



**Figure 11 - Static - π/4 DQPSK/2DH5 - 2402.0 MHz - Measured Frequency 2483.5 MHz**

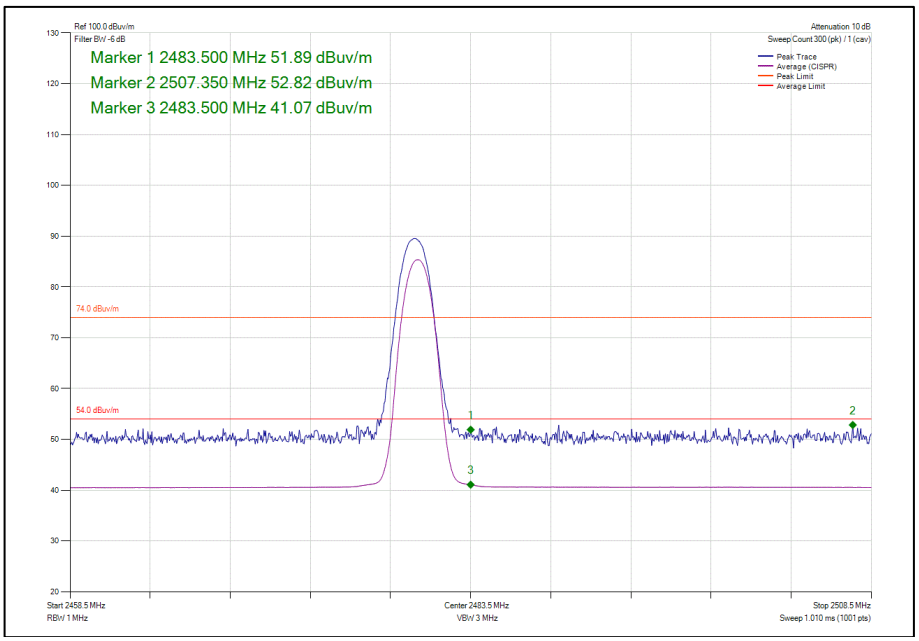



**Figure 12 - Static - 8-DPSK/3DH5 - 2402.0 MHz - Measured Frequency 2483.5 MHz**

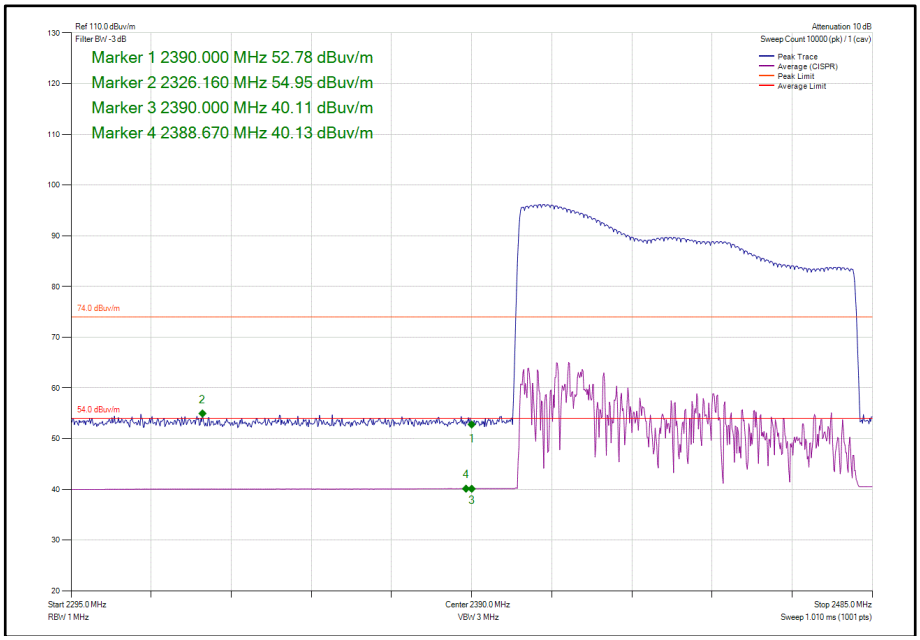



**Figure 13 - Hopping - GFSK/DH5 - Measured Frequency 2390.0 MHz**

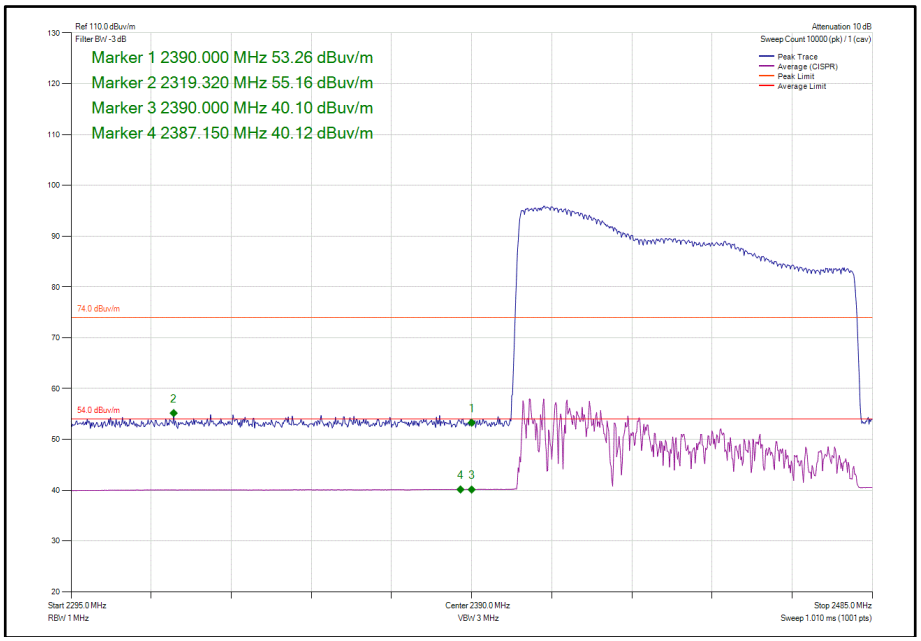



**Figure 14 - Hopping - π/4 DQPSK/2DH5 - Measured Frequency 2390.0 MHz**

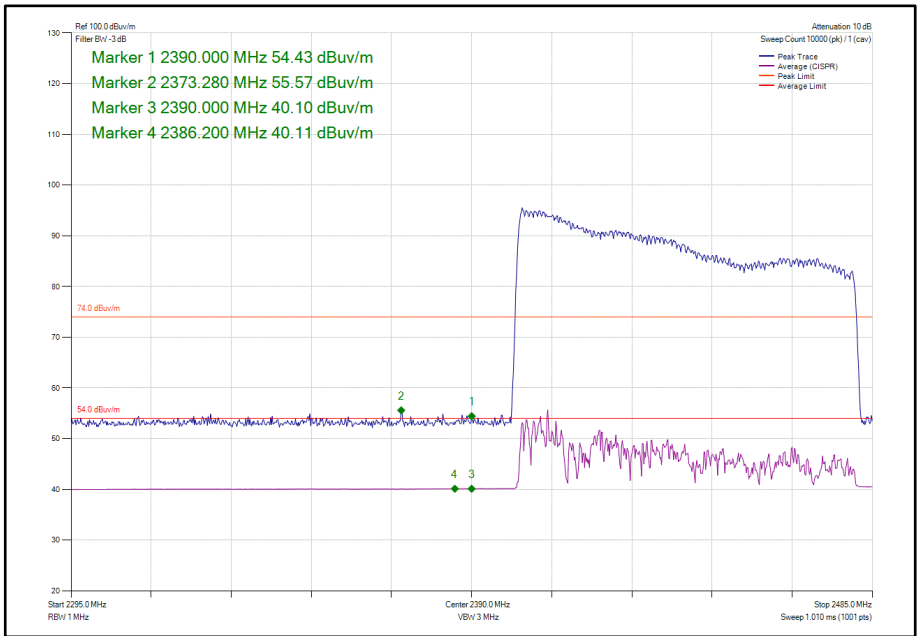



**Figure 15 - Hopping - 8-DPSK/3DH5 - Measured Frequency 2390.0 MHz**

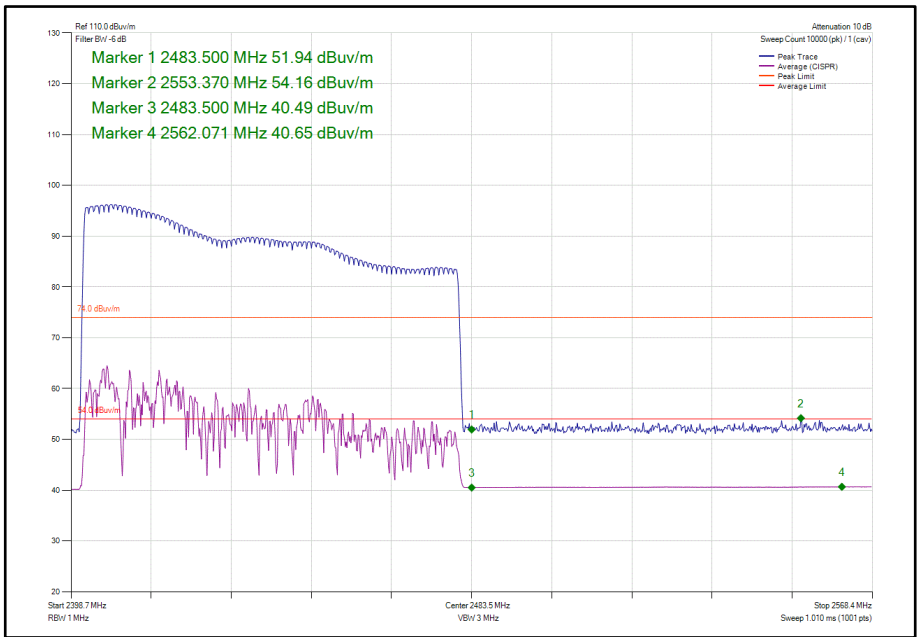



**Figure 16 - Hopping - GFSK/DH5 - Measured Frequency 2483.5 MHz**

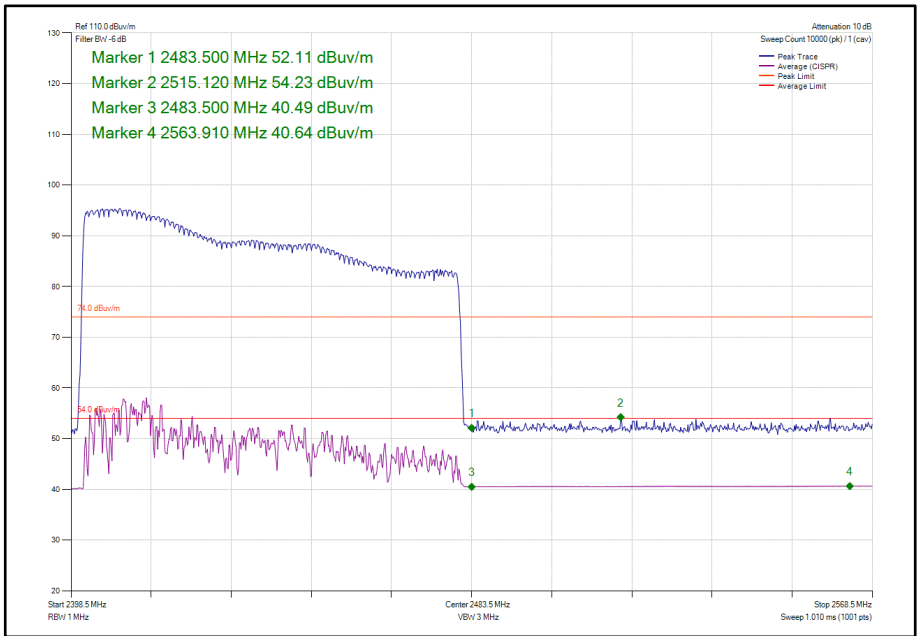



**Figure 17 - Hopping - π/4 DQPSK/2DH5 - Measured Frequency 2483.5 MHz**

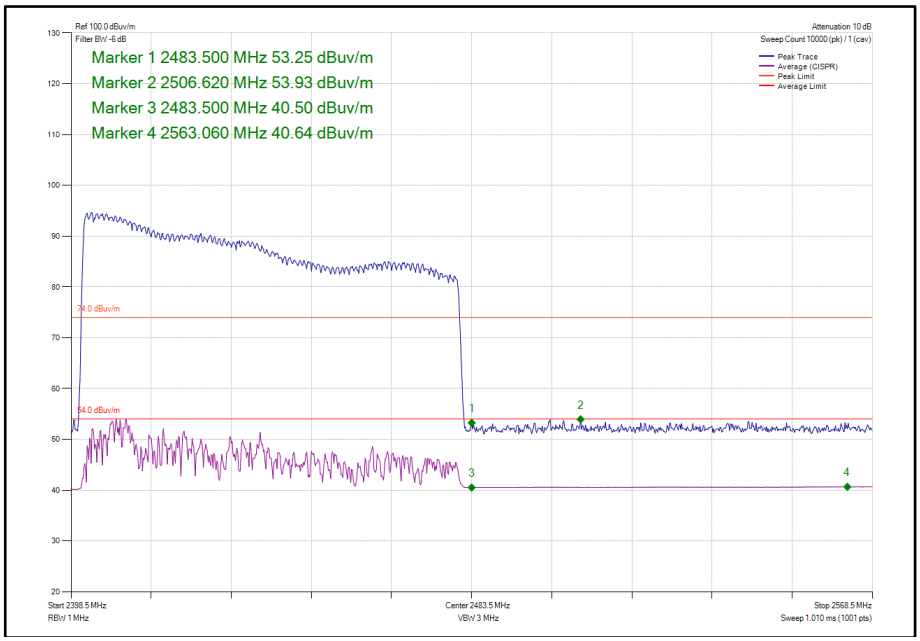



**Figure 18 - Hopping - 8-DPSK/3DH5 - Measured Frequency 2483.5 MHz**

FCC 47 CFR Part 15, Limit Clause 15.209

| Frequency (MHz) | Field Strength (µV/m at 3 m) |
|---|---|
| 30 to 88 | 100 |
| 88 to 216 | 150 |
| 216 to 960 | 200 |
| Above 960 | 500 |

**Table 8**

ISEDC RSS-GEN, Limit Clause 8.9

| Frequency (MHz) | Field Strength (µV/m at 3 metres) |
|---|---|
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |
| Above 960* | 500 |

**Table 9**

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

### 2.2.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 23-Jan-2021 |
| Turntable Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Hygrometer | Rotronic | A1 | 2677 | 12 | 20-Feb-2020 |
| '2.92mm' - '2.92mm' RF Cable (2m) | Rhophase | KPS-1503-2000-KPS | 3695 | 12 | 11-Jun-2020 |
| Mast Controller | Maturo Gmbh | NCD | 4810 | - | TU |
| Tilt Antenna Mast | Maturo Gmbh | TAM 4.0-P | 4811 | - | TU |
| Double Ridge Broadband Horn Antenna | Schwarzbeck | BBHA 9120 B | 4848 | 12 | 11-Mar-2020 |
| EmX Emissions Software | TUV SUD | EmX V.V1.5.3 | 5125 | - | Software |
| 8 Meter Cable | Teledyne | PR90-088-8MTR | 5212 | 12 | 30-Aug-2020 |
| EMI Test Receiver | Rohde & Schwarz | ESW44 | 5382 | 12 | 8-Oct-2020 |

**Table 10**

TU – Traceability Unscheduled

## 2.3 Spurious Radiated Emissions

### 2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205
ISEDC RSS-247, Clause 5.5
ISEDC RSS-GEN, Clause 6.13

### 2.3.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001925GK63ZJ - Modification State 0

### 2.3.3 Date of Test

12-December-2019

### 2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

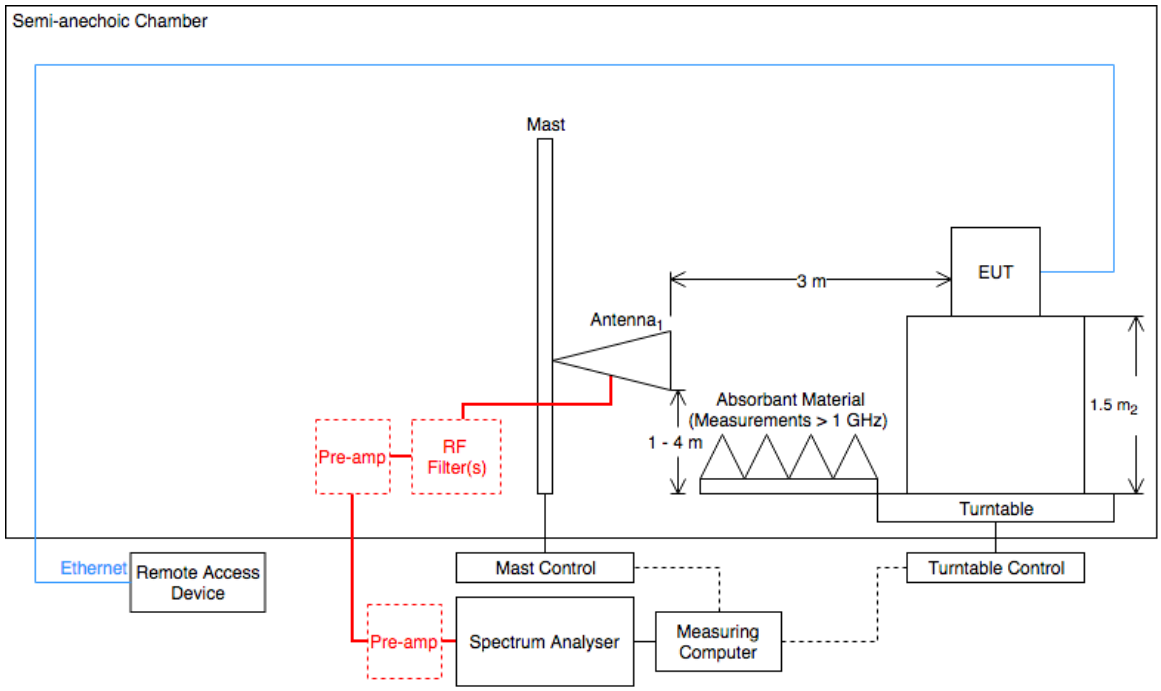
The EUT was placed on the non-conducting platform in a manner typical of a normal installation. For an EUT which could reasonable be used in multiple planes, pre-scans were performed with the EUT orientated in X, Y and Z planes with reference to the ground plane.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4. For EUT's with multiple connectors of the same type, additional interconnecting cables were connected, and pre-scans performed to determine whether the level of the emissions were increased by >2 dB.

For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.5 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.2.

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to -20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).




1 Antenna is boresighted for measurements < 1 GHz.
2 Height from the EUT to ground is 0.8 m for measurements < 1 GHz.

**Figure 19 - Radiated Emissions Test Setup Diagram**

### 2.3.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 17.0 °C |
| Relative Humidity | 37.0 % |

### 2.3.6 Test Results

2.4 GHz Bluetooth - BDR/EDR

Testing was performed on the modulation and packet type which resulted in the highest conducted output power. The Modulation/Packet type was GFSK/DH5.

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|---|---|---|---|---|---|---|---|---|
| 923.941 | 26.5 | 46.0 | -19.5 | Peak | 83 | 138 | Vertical | X |
| 937.456 | 37.0 | 46.0 | -9.0 | Peak | 45 | 169 | Horizontal | X |
| 924.994 | 28.0 | 46.0 | -18.0 | Peak | 17 | 149 | Vertical | Y |
| 938.279 | 33.4 | 46.0 | -12.6 | Peak | 8 | 105 | Horizontal | Y |
| 924.828 | 31.7 | 46.0 | -14.3 | Peak | 344 | 314 | Vertical | Z |
| 922.698 | 27.3 | 46.0 | -18.7 | Peak | 282 | 275 | Horizontal | Z |

**Table 11 - Radiated Emissions Results, 30 MHz to 1 GHz - 2402 MHz**

No other emissions were detected within 10 dB of the limit.

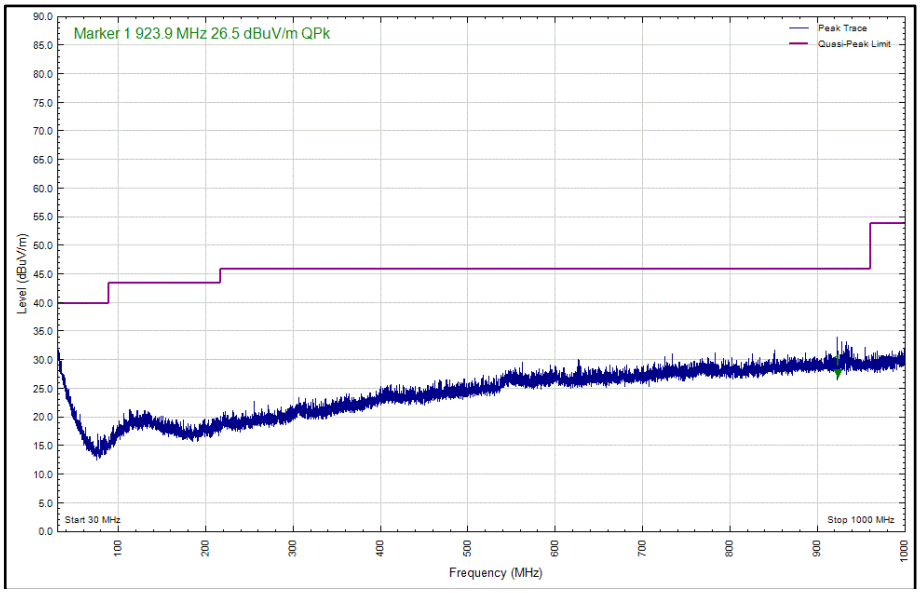



**Figure 20 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Vertical, EUT Orientation X**

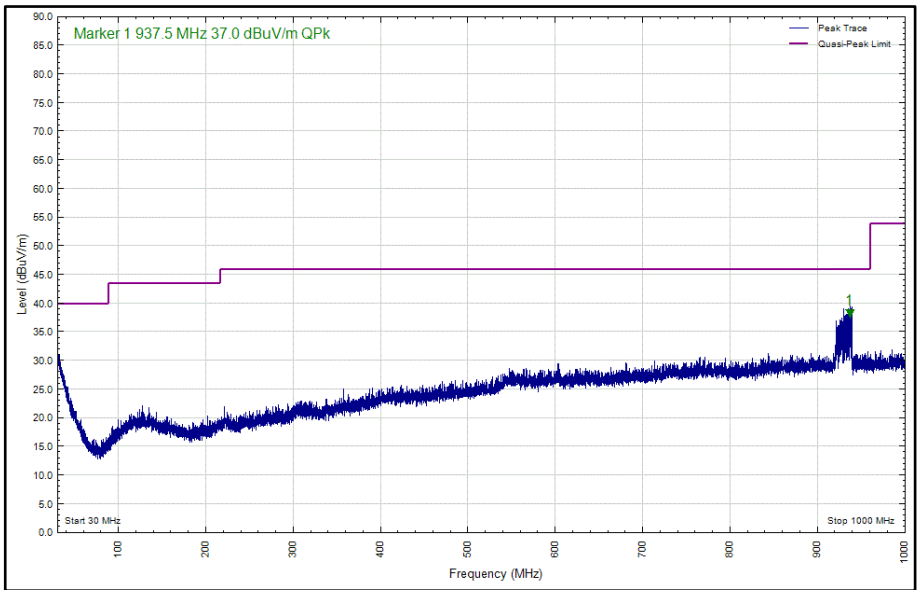



**Figure 21 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Horizontal, EUT Orientation X**

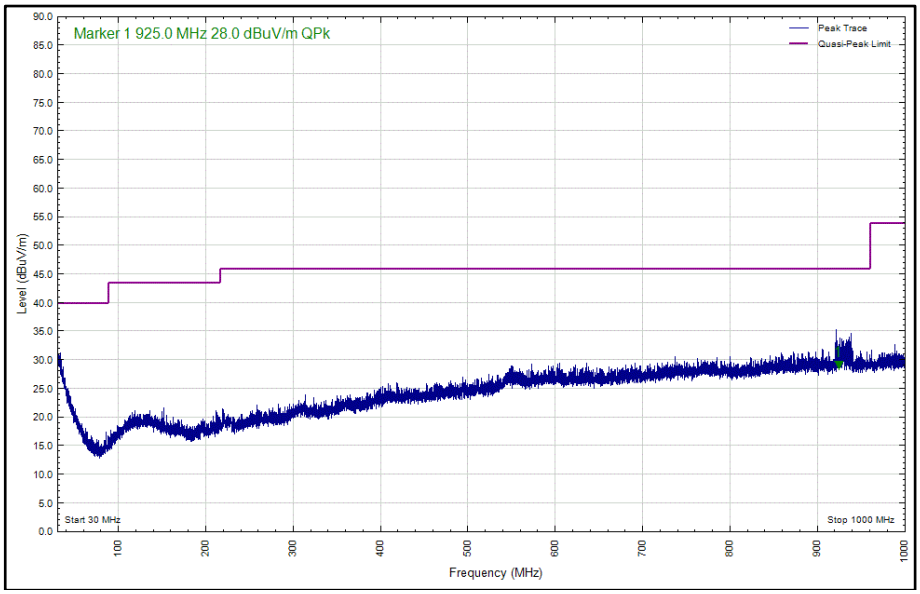



**Figure 22 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Vertical, EUT Orientation Y**

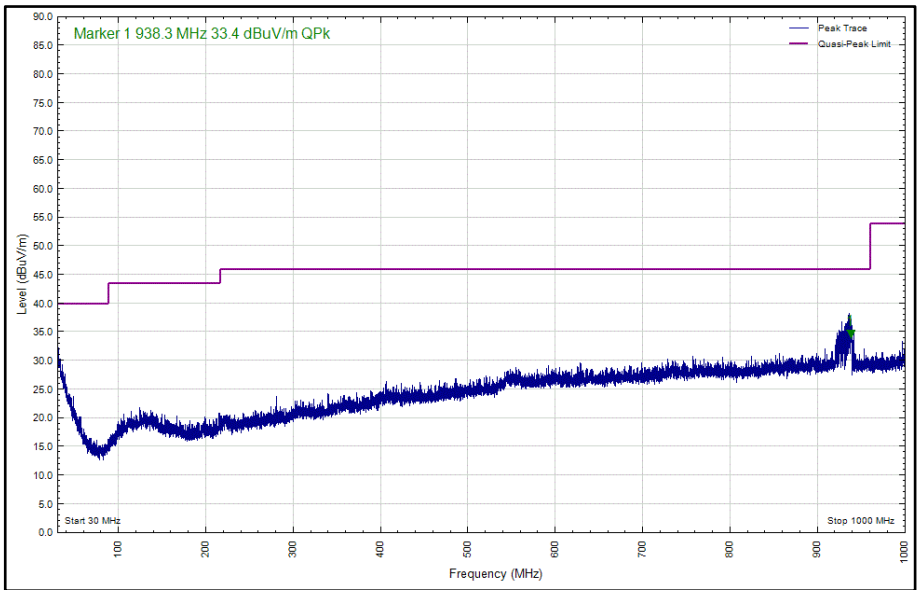



**Figure 23 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Horizontal, EUT Orientation Y**

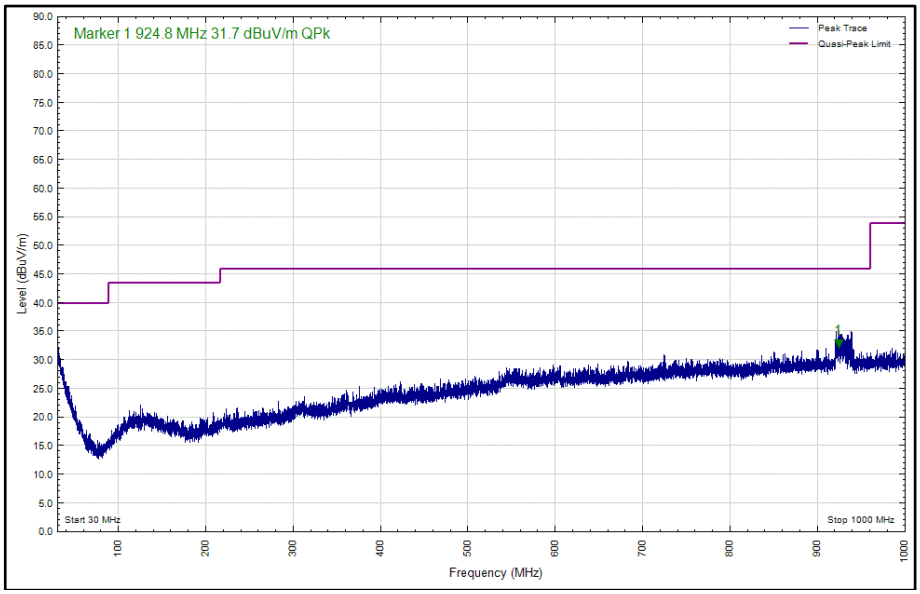



**Figure 24 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Vertical, EUT Orientation Z**

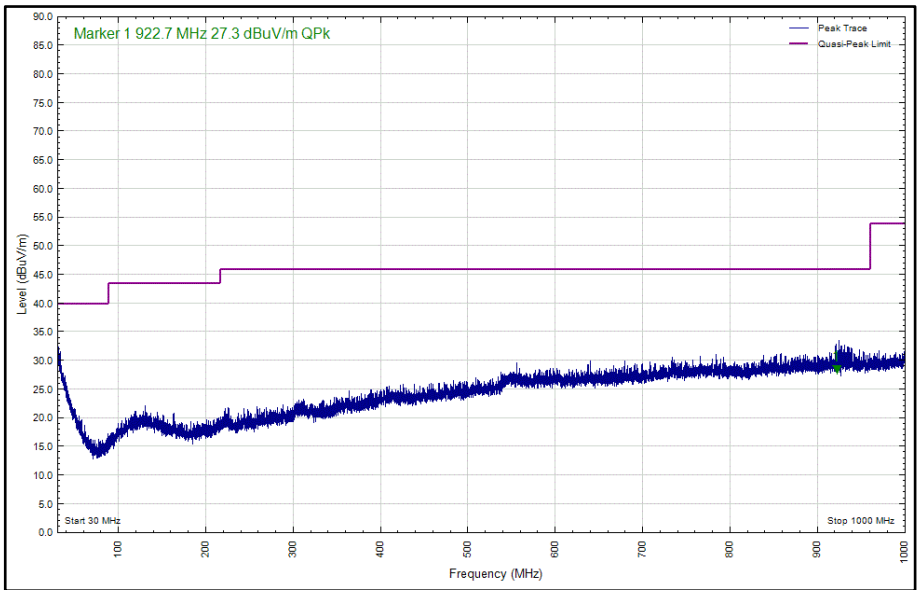



**Figure 25 - 30 MHz to 1 GHz, 2402 MHz, Polarity: Horizontal, EUT Orientation Z**

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|---|---|---|---|---|---|---|---|---|
| 4804.246 | 34.5 | 54.0 | -19.5 | Average | 61 | 101 | Vertical | X |
| 4638.837 | 35.7 | 54.0 | -18.3 | Average | 204 | 100 | Horizontal | X |
| 4804.191 | 39.2 | 54.0 | -14.9 | Average | 151 | 297 | Horizontal | X |
| 4653.929 | 36.3 | 54.0 | -17.7 | Average | 55 | 102 | Vertical | Y |
| 4803.806 | 36.6 | 54.0 | -17.4 | Average | 52 | 103 | Horizontal | Y |
| 4678.968 | 37.6 | 74.0 | -16.4 | Peak | 8 | 296 | Vertical | Z |
| 3202.748 | 35.9 | 54.0 | -18.1 | Average | 316 | 110 | Horizontal | Z |

**Table 12 - 2402 MHz - 1 GHz to 26 GHz Emissions Results**

No other emissions were detected within 10 dB of the limit.

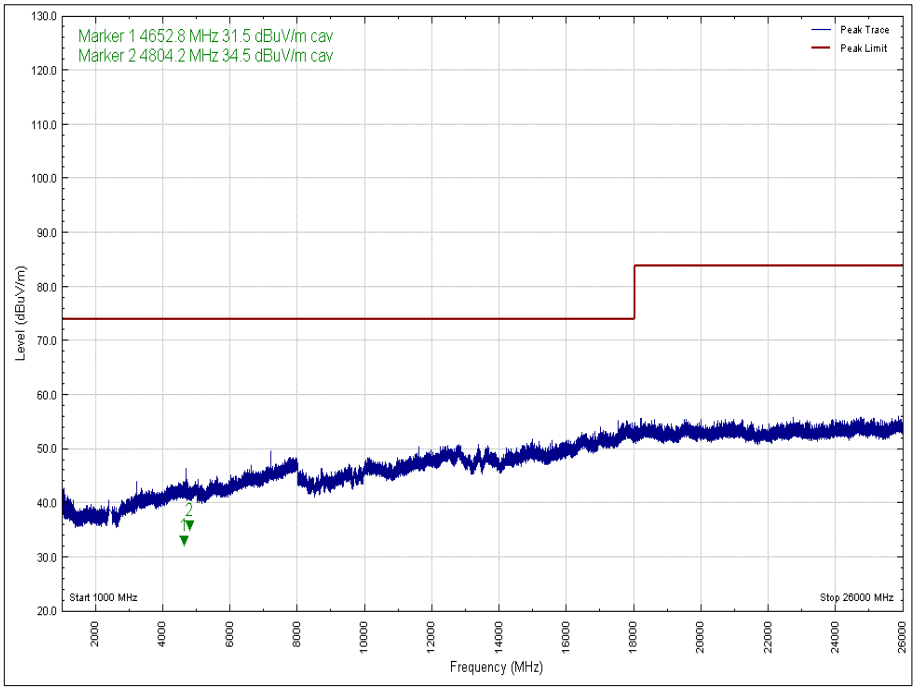



**Figure 26 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Peak**

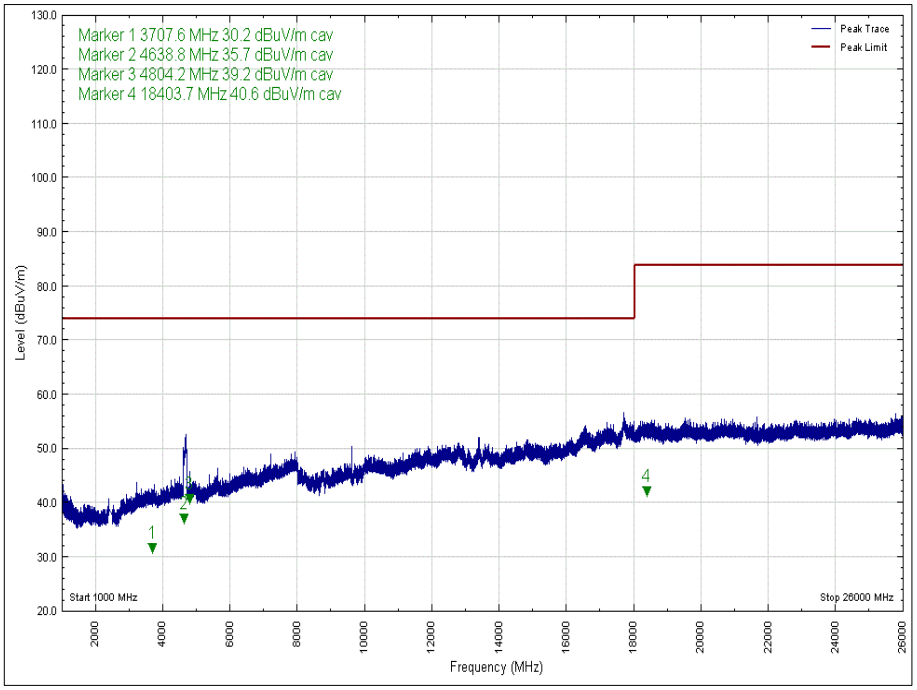



**Figure 27 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Peak**

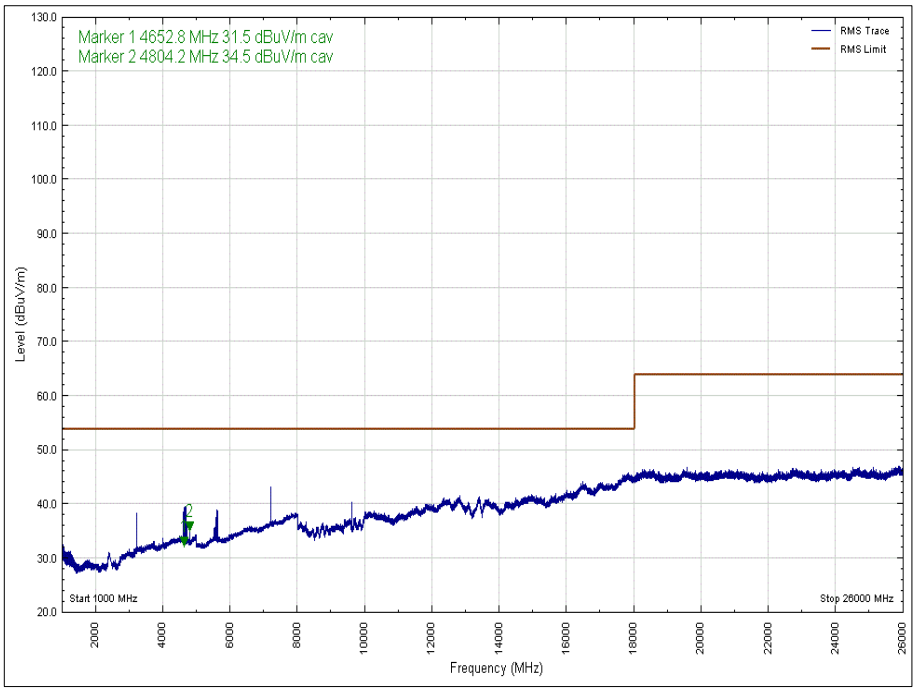



**Figure 28 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Average**

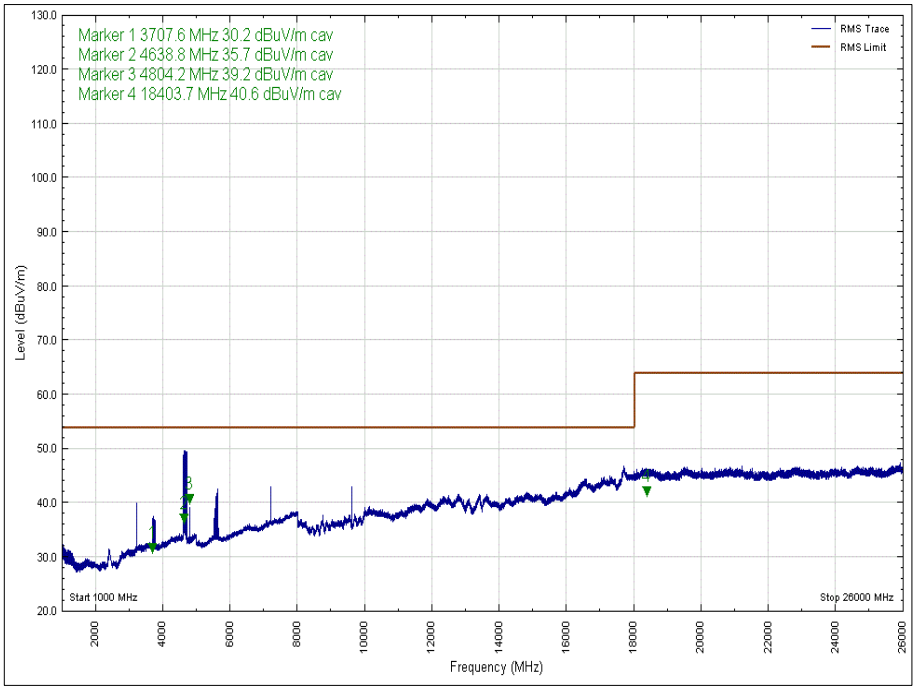



**Figure 29 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Average**

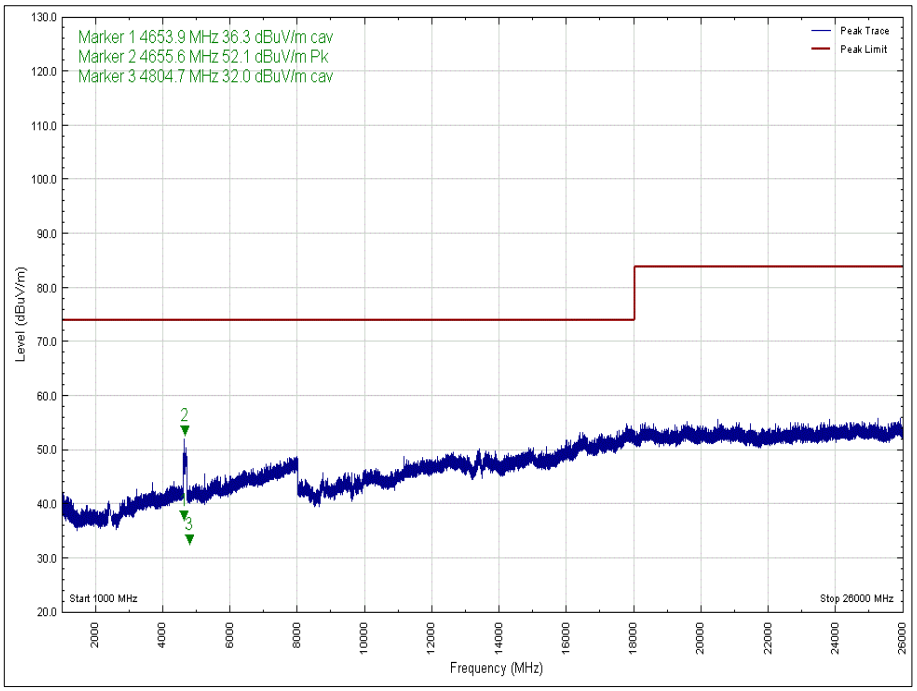



**Figure 30 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Peak**

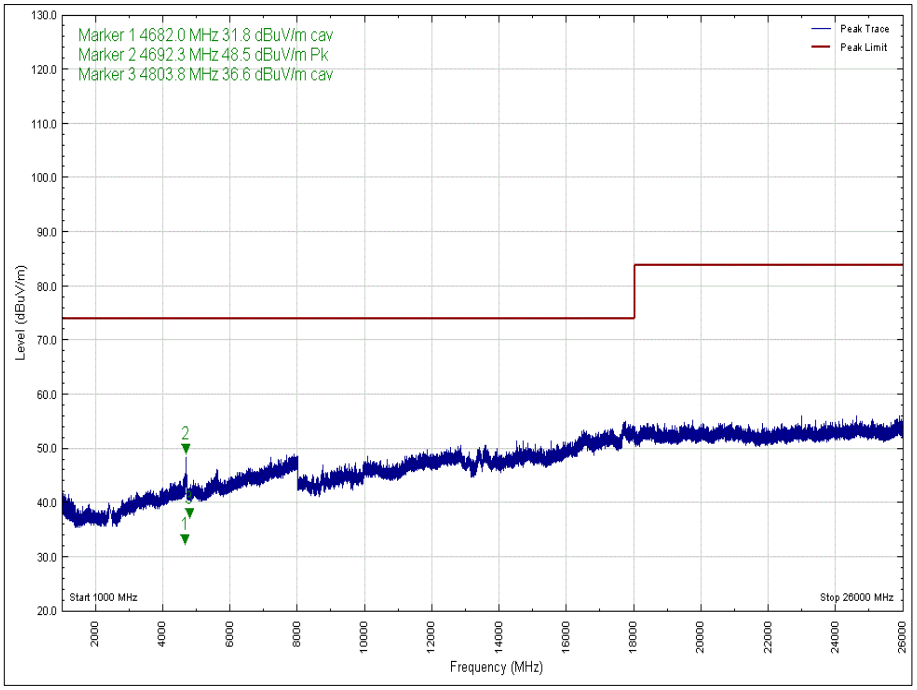



**Figure 31 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Peak**

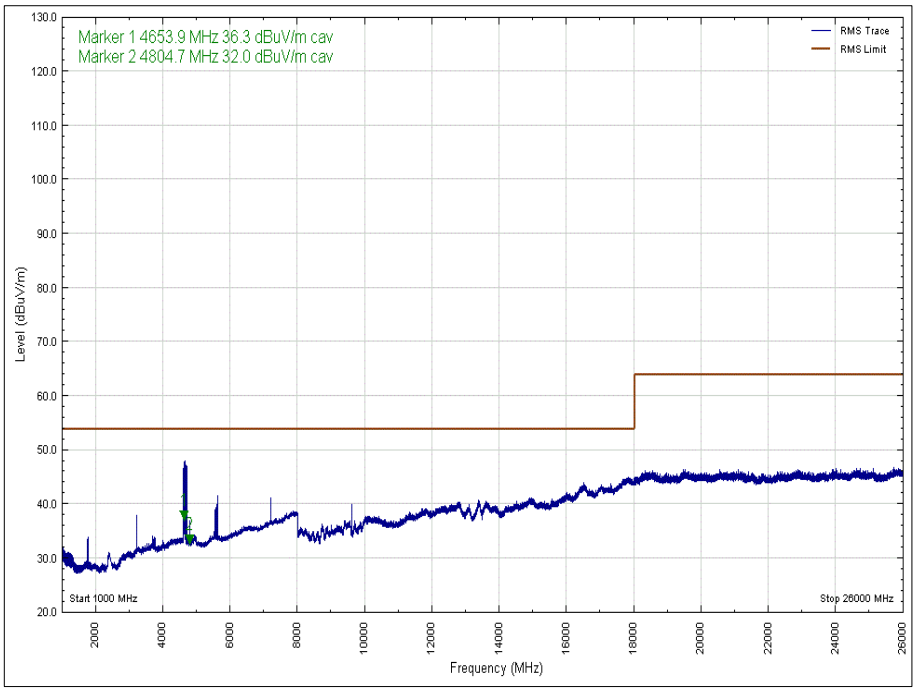



**Figure 32 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Average**

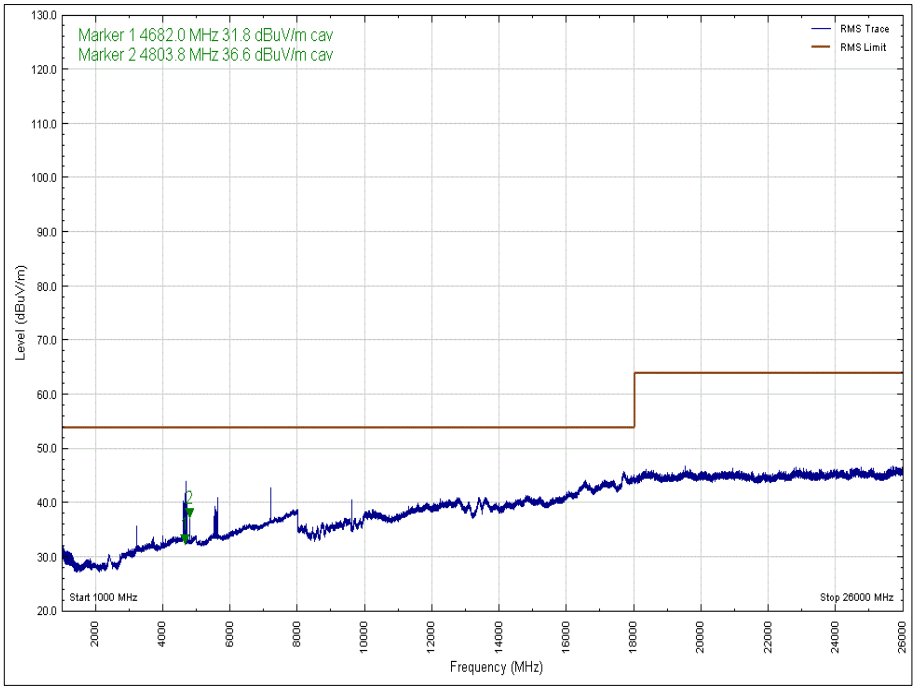



**Figure 33 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Average**

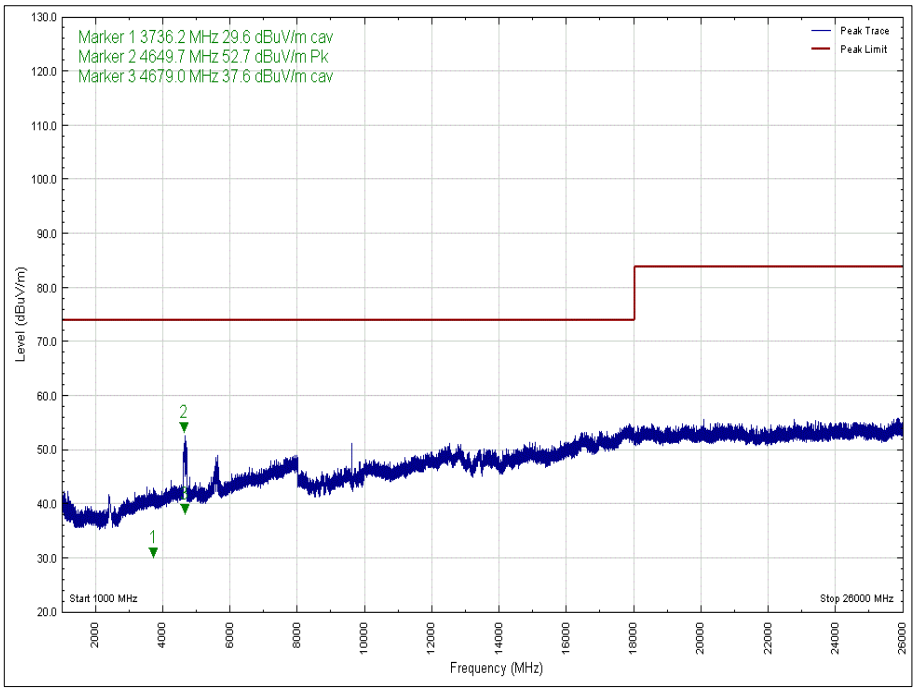



**Figure 34 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Peak**

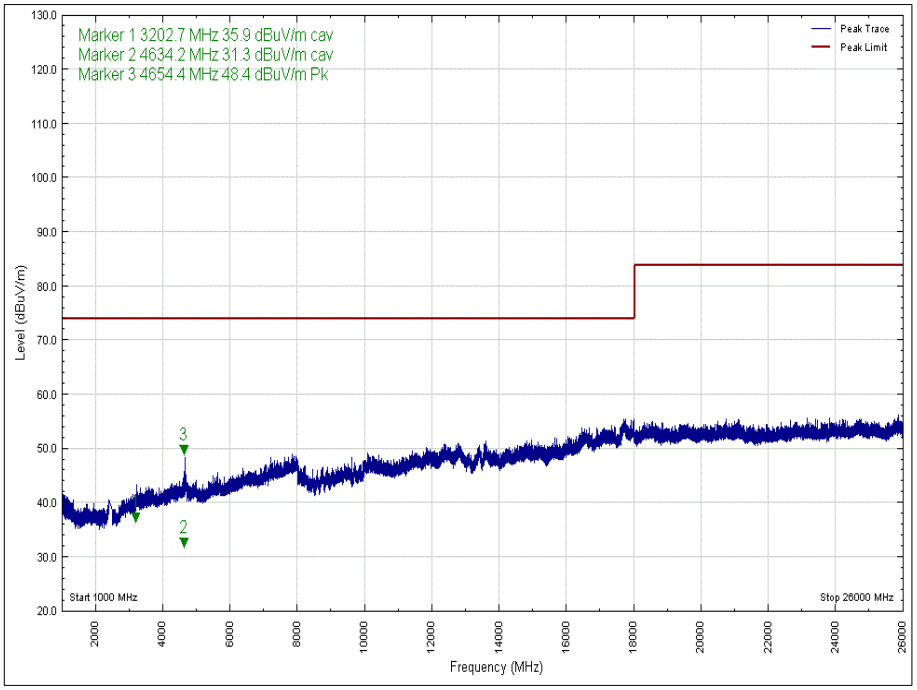



**Figure 35 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Peak**

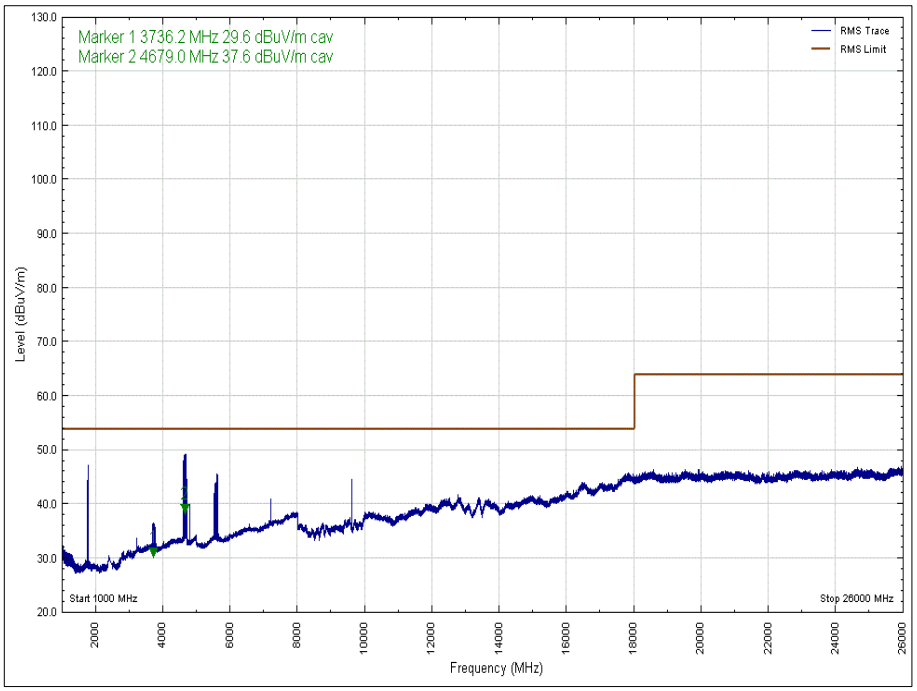



**Figure 36 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Average**

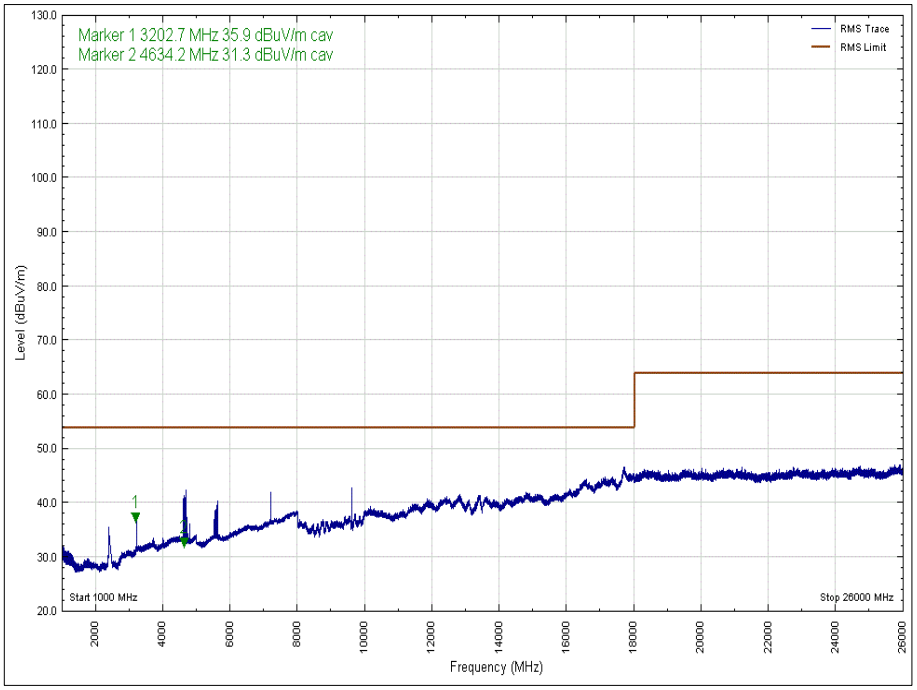



**Figure 37 - 2402 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Average**

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|---|---|---|---|---|---|---|---|---|
| 937.172 | 36.4 | 46.0 | -9.6 | Peak | 59 | 173 | Horizontal | X |
| 928.944 | 28.4 | 46.0 | -17.6 | Peak | 53 | 213 | Vertical | Y |
| 938.794 | 33.6 | 46.0 | -12.4 | Peak | 36 | 170 | Horizontal | Y |
| 935.334 | 31.6 | 46.0 | -14.4 | Peak | 154 | 390 | Vertical | Z |
| 928.312 | 25.4 | 46.0 | -20.6 | Peak | 126 | 102 | Horizontal | Z |

**Table 13 - Radiated Emissions Results, 30 MHz to 1 GHz - 2441 MHz**

No other emissions were detected within 10 dB of the limit.

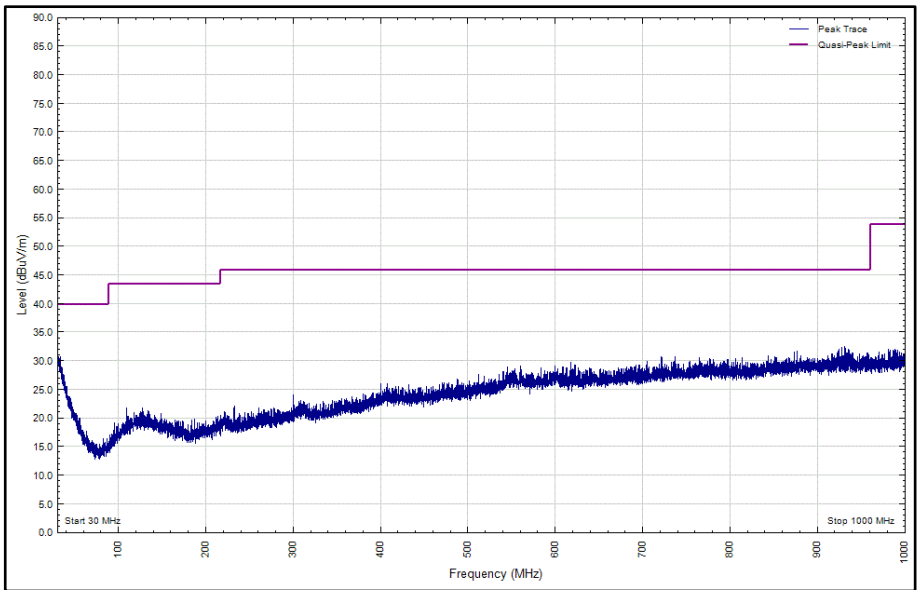



**Figure 38 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Vertical, EUT Orientation X**

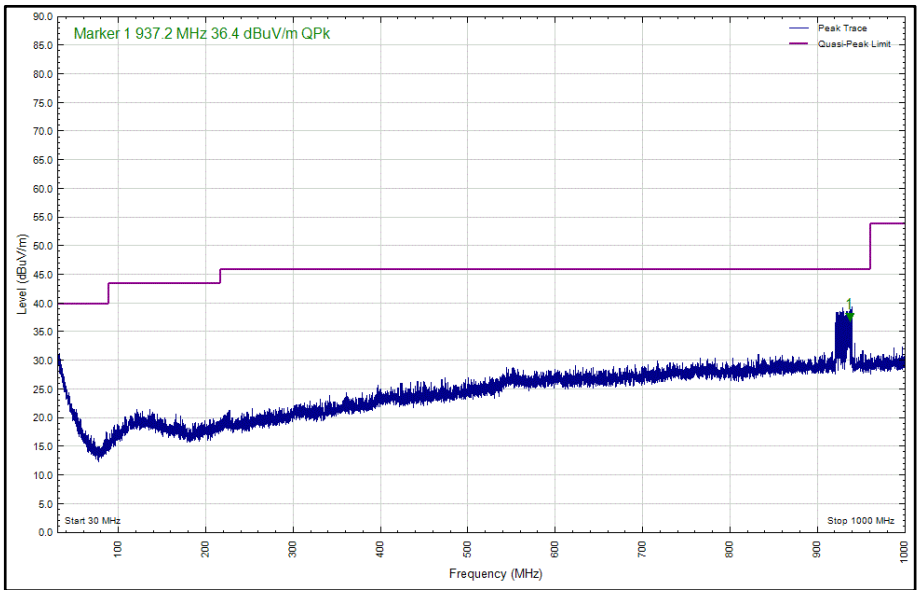



**Figure 39 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Horizontal, EUT Orientation X**

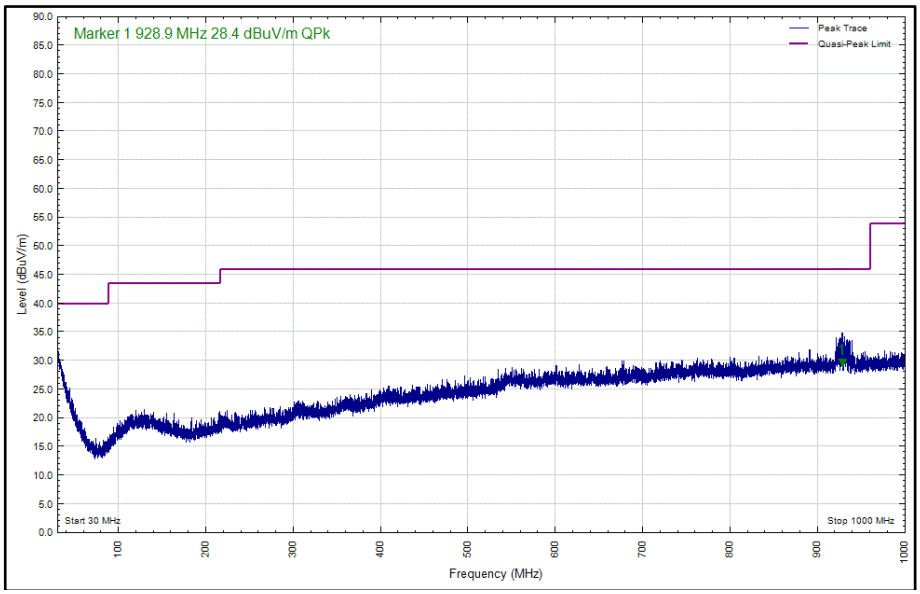



**Figure 40 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Vertical, EUT Orientation Y**

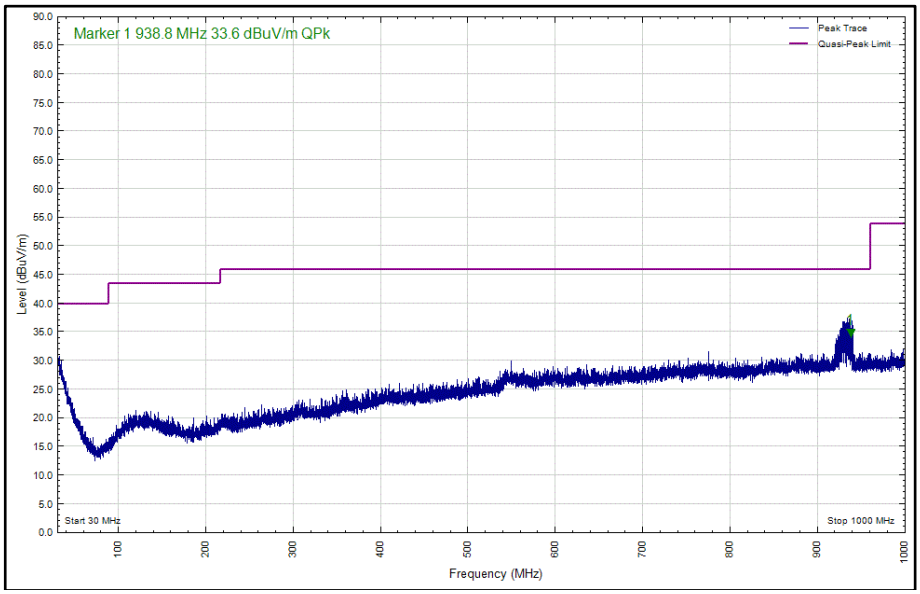



**Figure 41 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Horizontal, EUT Orientation Y**

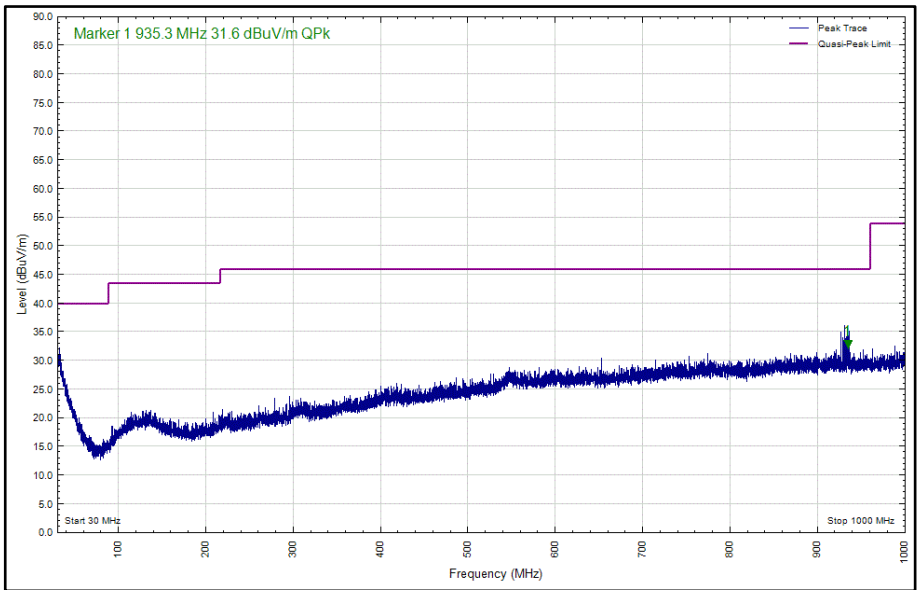



**Figure 42 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Vertical, EUT Orientation Z**

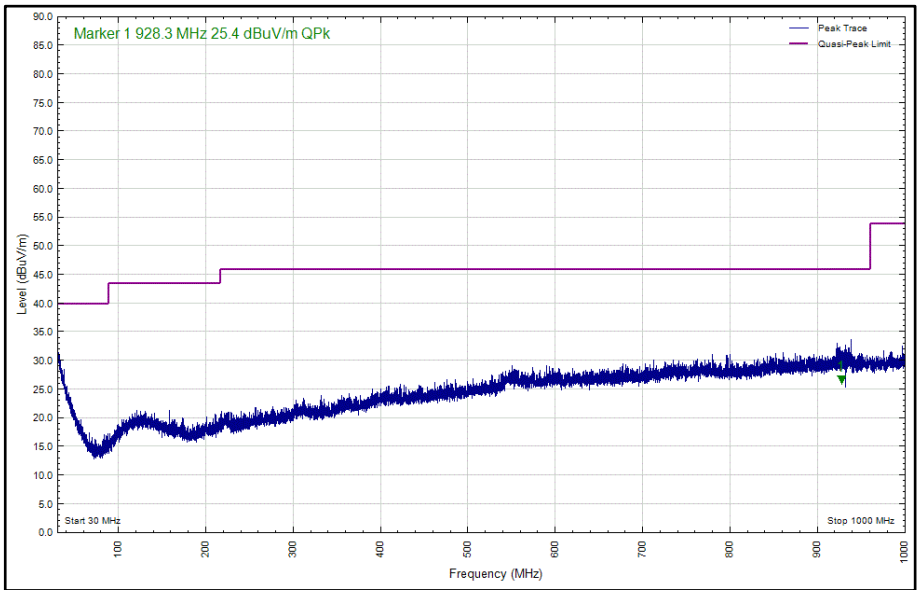



**Figure 43 - 30 MHz to 1 GHz, 2441 MHz, Polarity: Horizontal, EUT Orientation Z**

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|---|---|---|---|---|---|---|---|---|
| 4690.753 | 32.4 | 54.0 | -21.6 | Average | 174 | 175 | Vertical | X |
| 4880.051 | 37.2 | 54.0 | -16.8 | Average | 67 | 104 | Vertical | X |
| 7319.534 | 38.3 | 54.0 | -15.8 | Average | 278 | 130 | Vertical | X |
| 4678.478 | 38.0 | 54.0 | -16.0 | Average | 162 | 100 | Horizontal | X |
| 3749.166 | 30.4 | 54.0 | -23.6 | Average | 251 | 103 | Horizontal | X |
| 4880.301 | 36.6 | 54.0 | -17.4 | Average | 152 | 233 | Horizontal | X |
| 7320.064 | 38.8 | 54.0 | -15.2 | Average | 179 | 238 | Horizontal | X |
| 4635.393 | 36.1 | 54.0 | -17.9 | Average | 41 | 108 | Vertical | Y |
| 7319.549 | 37.4 | 54.0 | -16.6 | Average | 263 | 292 | Vertical | Y |
| 4685.030 | 49.3 | 74.0 | -24.7 | Peak | 83 | 190 | Horizontal | Y |
| 4696.250 | 31.7 | 54.0 | -22.3 | Average | 88 | 146 | Horizontal | Y |
| 4880.151 | 37.2 | 54.0 | -16.8 | Average | 54 | 107 | Horizontal | Y |
| 7319.649 | 39.3 | 54.0 | -14.7 | Average | 244 | 100 | Horizontal | Y |
| 3728.201 | 29.4 | 54.0 | -24.7 | Average | 351 | 104 | Vertical | Z |
| 4666.431 | 53.0 | 74.0 | -21.0 | Peak | 353 | 199 | Vertical | Z |
| 4680.644 | 37.3 | 54.0 | -16.8 | Average | 350 | 274 | Vertical | Z |
| 4678.669 | 33.0 | 54.0 | -21.0 | Average | 275 | 193 | Horizontal | Z |
| 7319.569 | 38.0 | 54.0 | -16.0 | Average | 11 | 100 | Horizontal | Z |
| 7320.354 | 38.5 | 54.0 | -15.5 | Average | 3256 | 137 | Horizontal | Z |

**Table 14 - 2441 MHz - 1 GHz to 26 GHz Emissions Results**

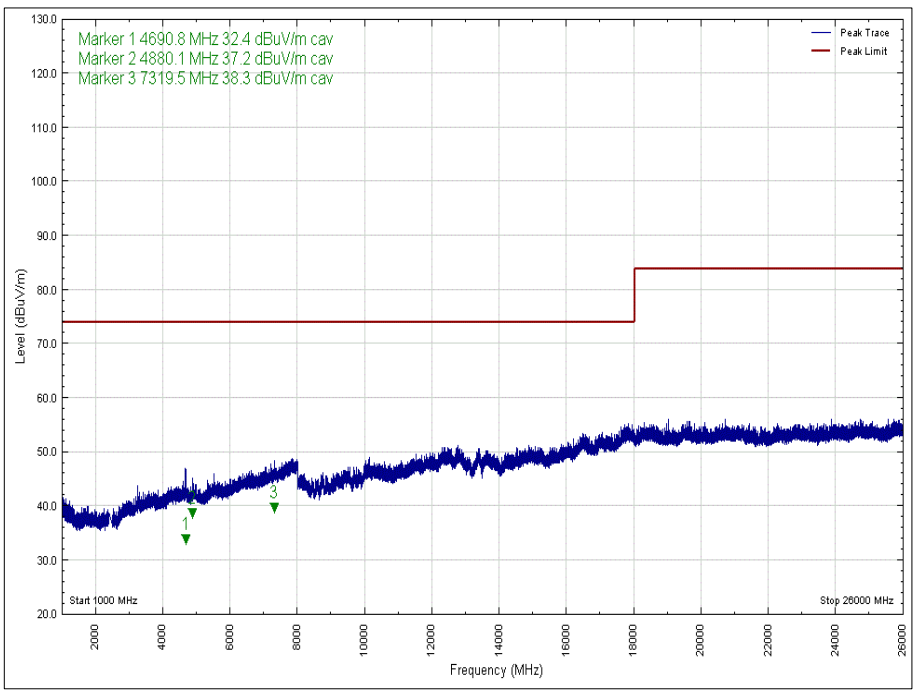



**Figure 44 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Peak**

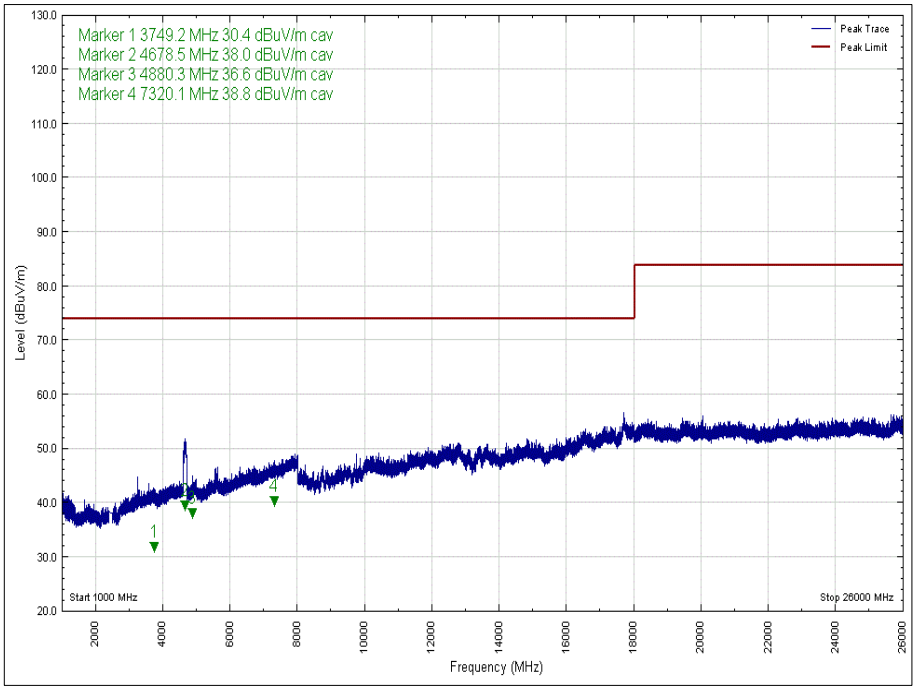



**Figure 45 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Peak**

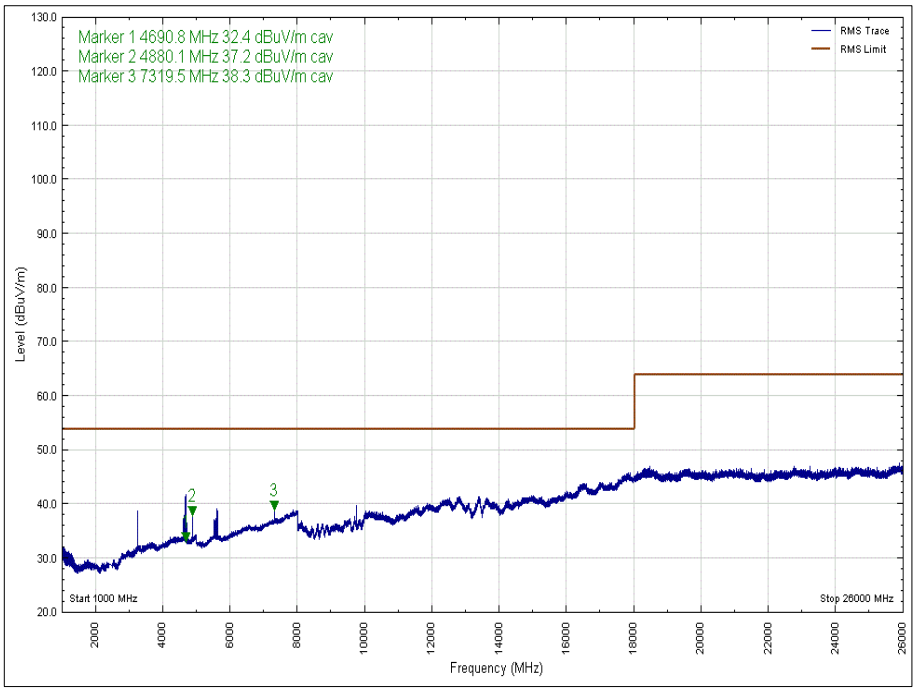



**Figure 46 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Average**

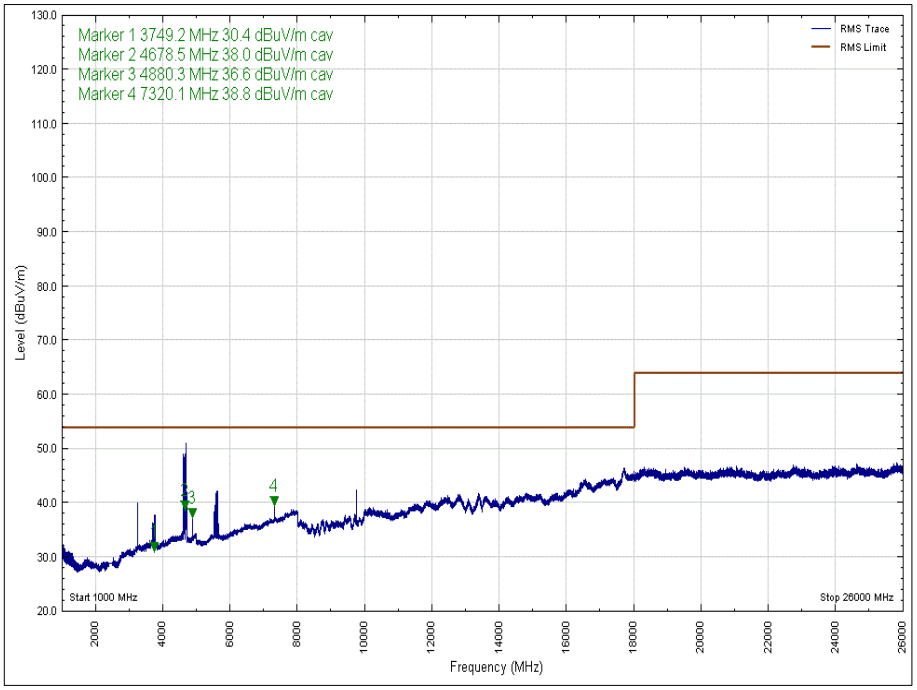



**Figure 47 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Average**

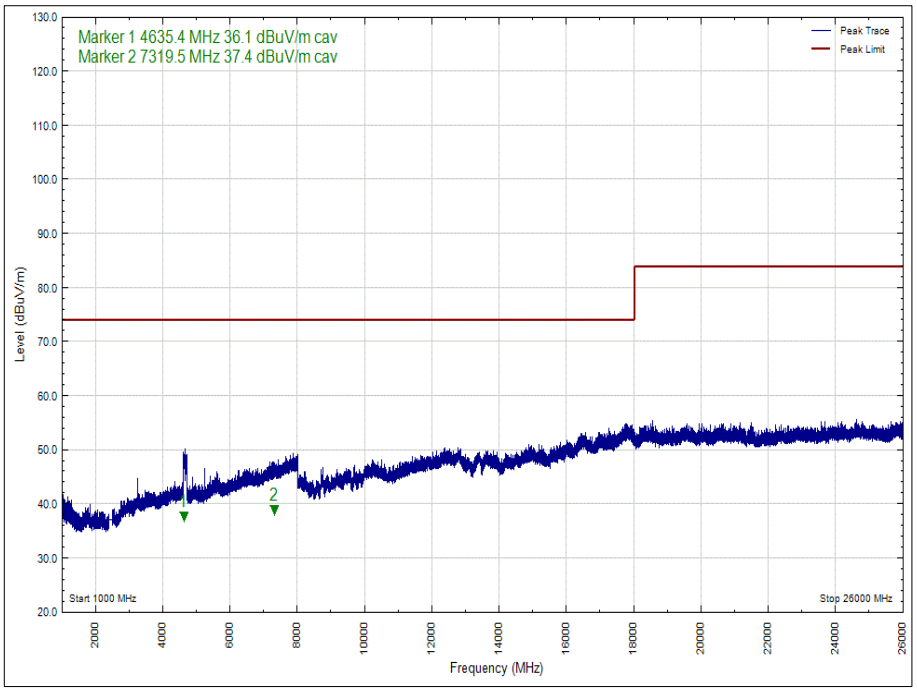



**Figure 48 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Peak**

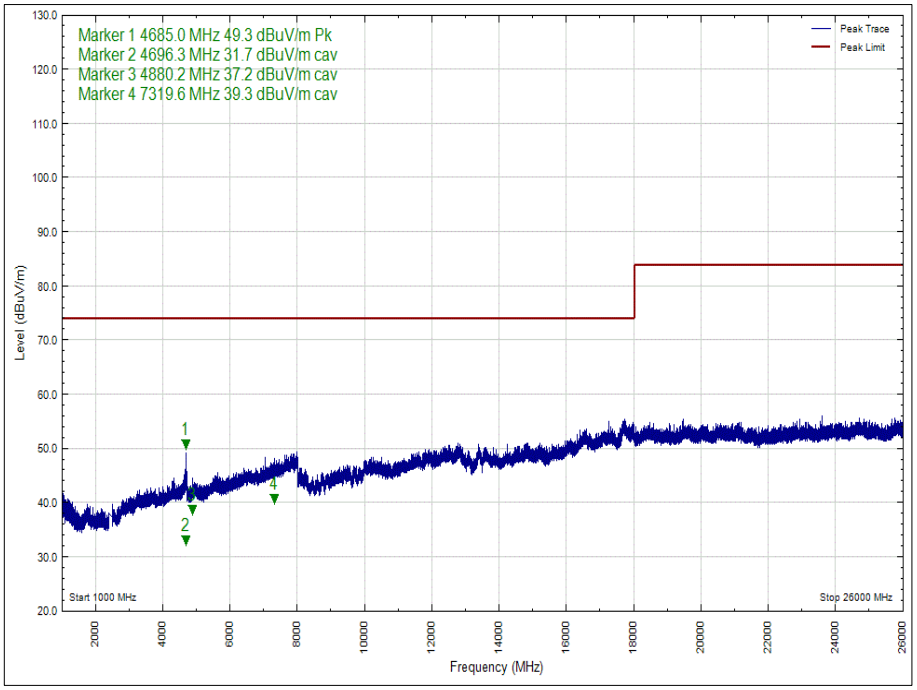



**Figure 49 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Peak**

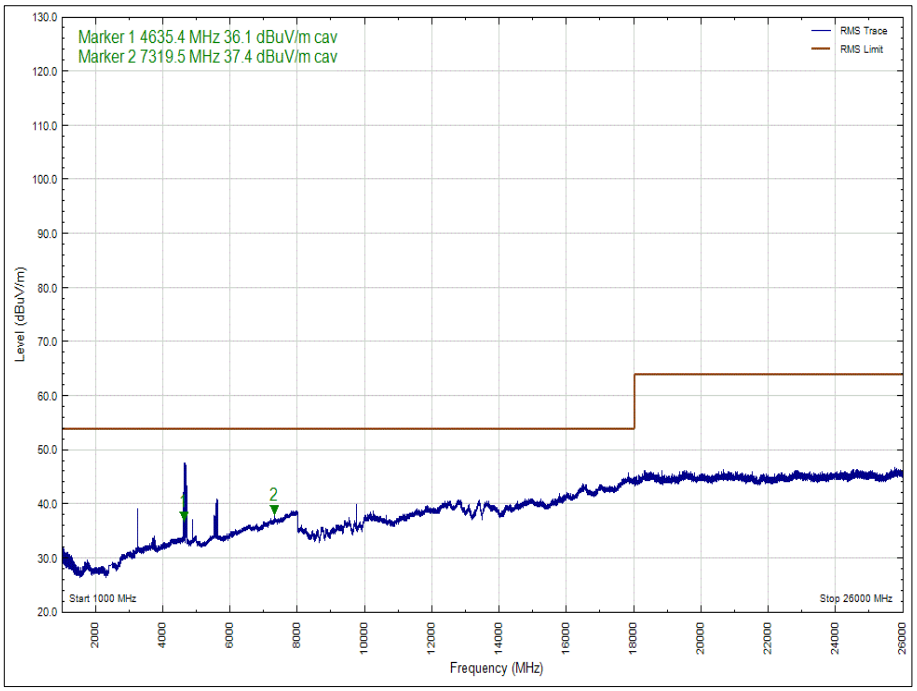



**Figure 50 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Average**

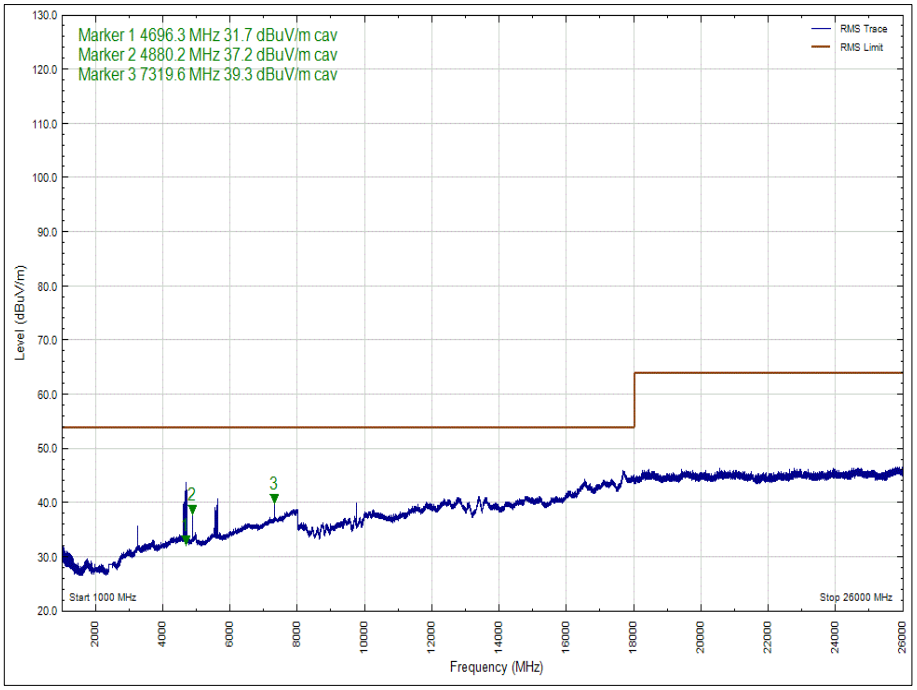



**Figure 51 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Average**

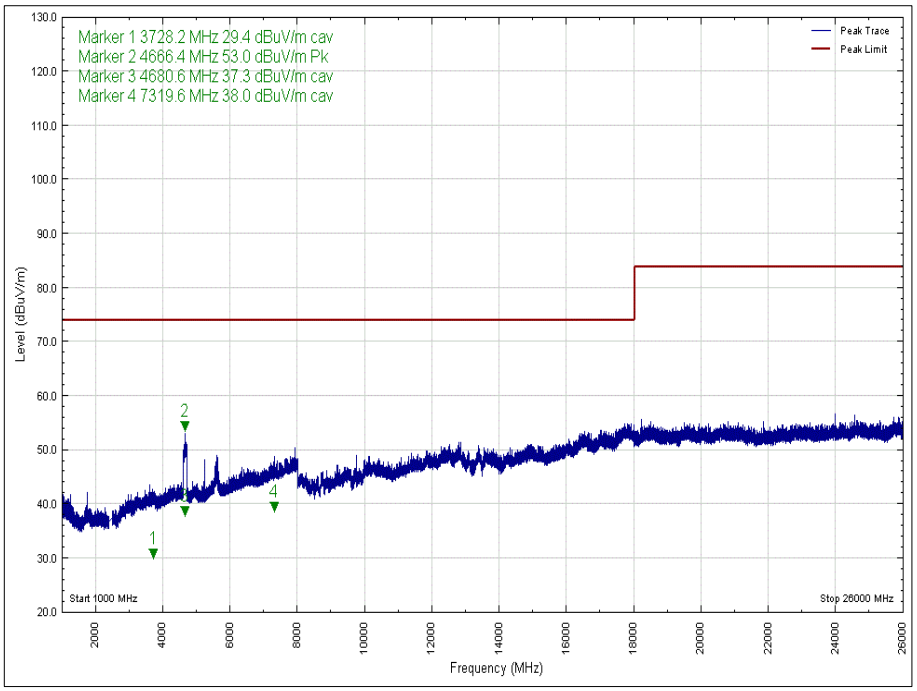



**Figure 52 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Peak**

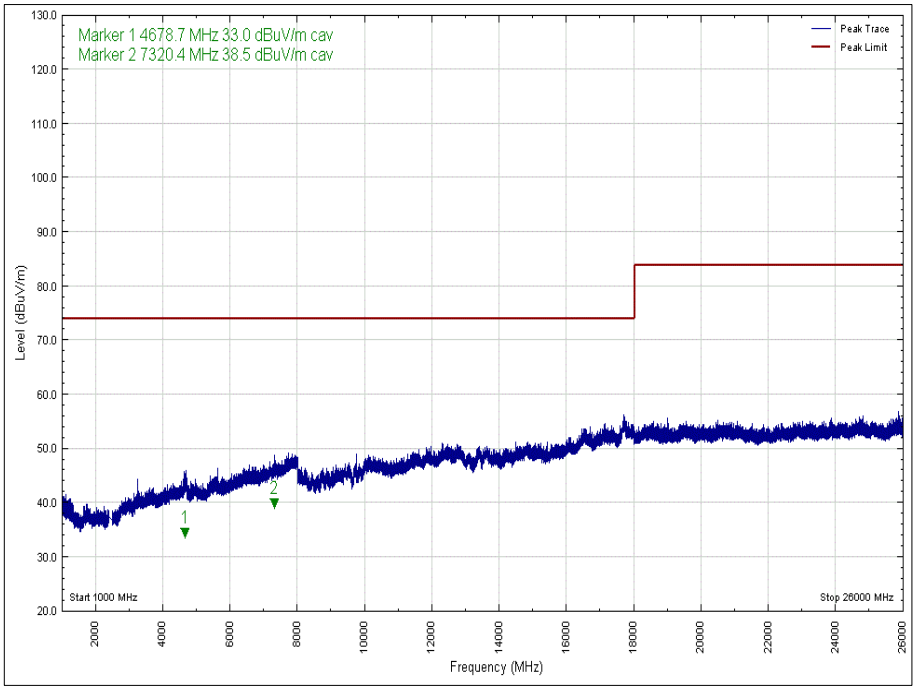



**Figure 53 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Peak**

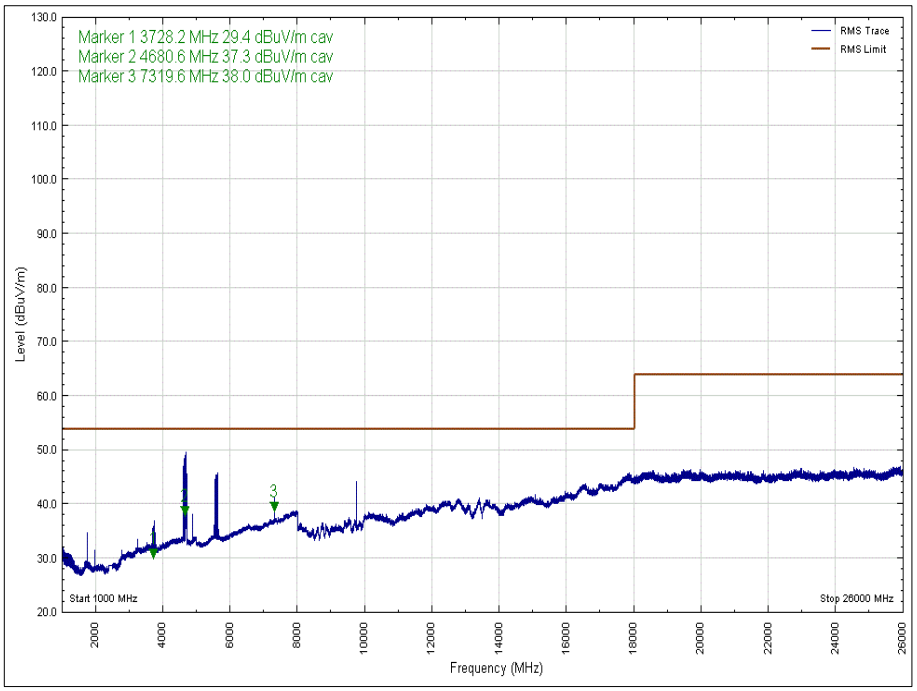



**Figure 54 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Average**

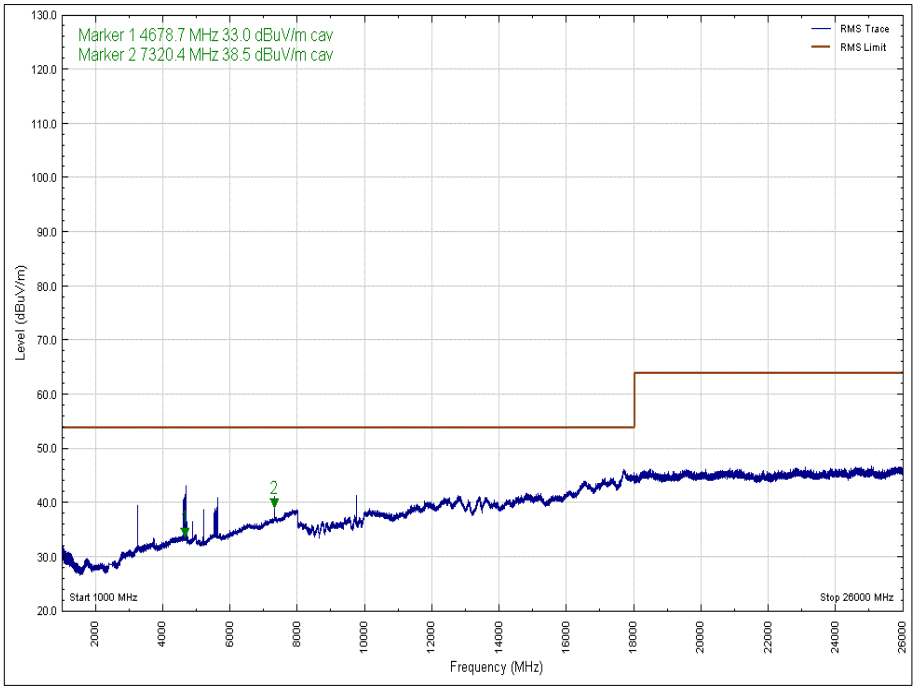



**Figure 55 - 2441 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Average**

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|---|---|---|---|---|---|---|---|---|
| 932.000 | 29.3 | 46.0 | -16.7 | Peak | 285 | 124 | Vertical | X |
| 938.050 | 32.9 | 46.0 | -13.1 | Peak | 301 | 110 | Horizontal | X |
| 924.651 | 24.7 | 46.0 | -17.2 | Peak | 65 | 101 | Vertical | Y |
| 934.152 | 32.9 | 46.0 | -18.1 | Peak | 4 | 158 | Horizontal | Y |
| 929.523 | 30.1 | 46.0 | -15.0 | Peak | 85 | 339 | Vertical | Z |
| 936.810 | 28.9 | 46.0 | -19.4 | Peak | 93 | 294 | Horizontal | Z |

**Table 15 - Radiated Emissions Results, 30 MHz to 1 GHz - 2480 MHz**

No other emissions were detected within 10 dB of the limit.

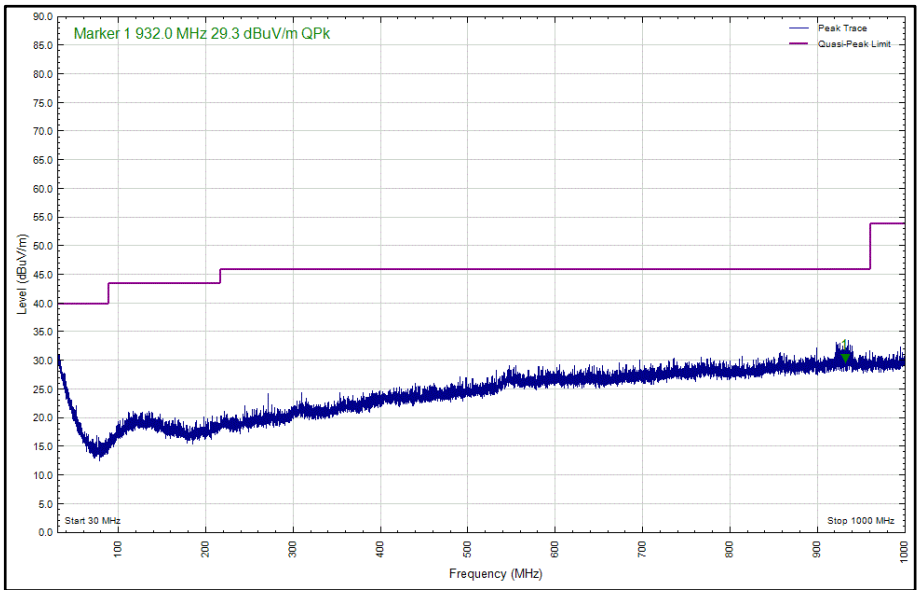



**Figure 56 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Vertical, EUT Orientation X**

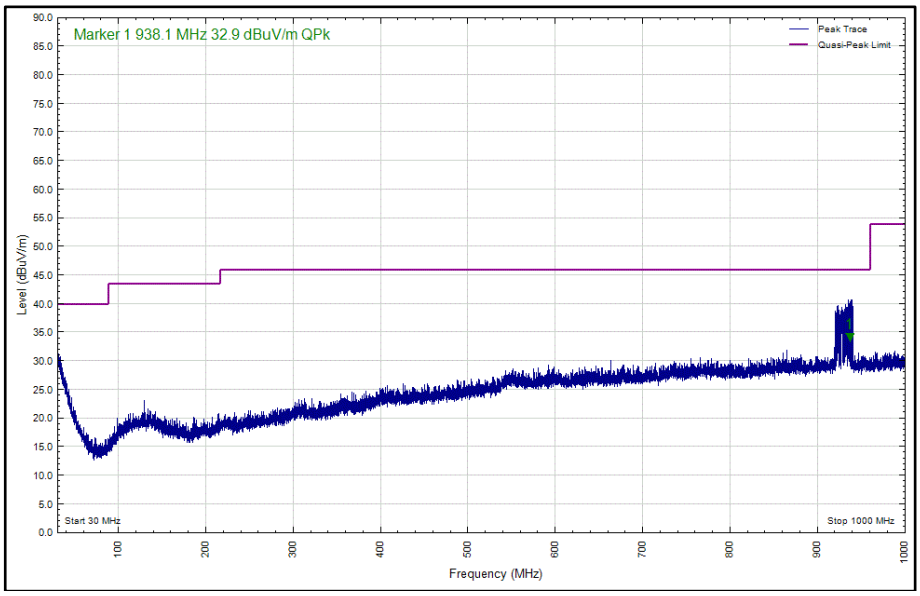



**Figure 57 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Horizontal, EUT Orientation X**

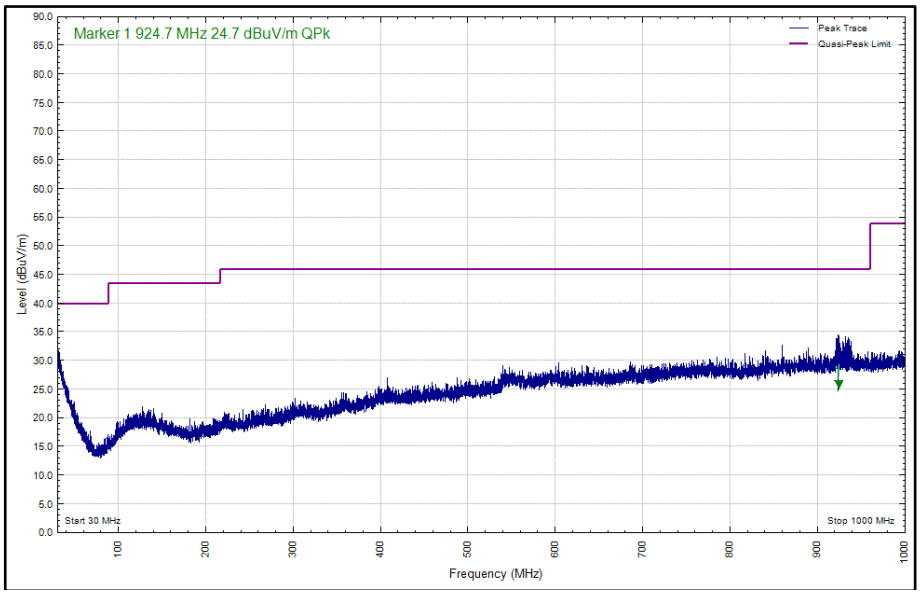



**Figure 58 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Vertical, EUT Orientation Y**

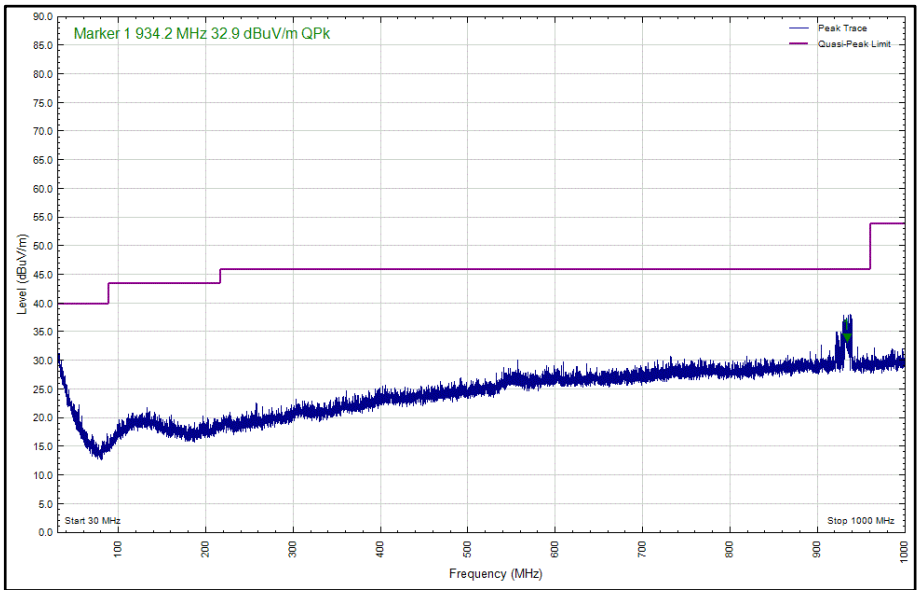



**Figure 59 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Horizontal, EUT Orientation Y**

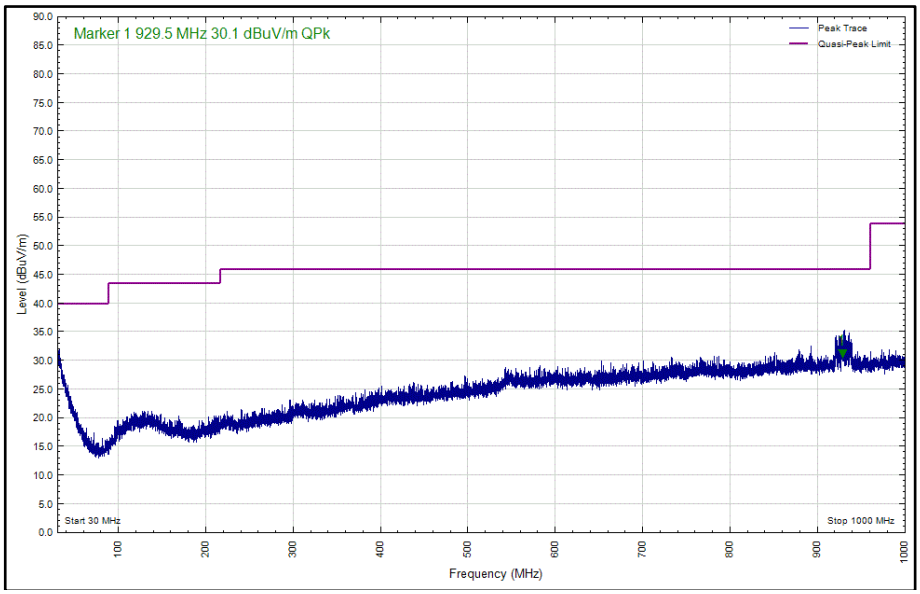



**Figure 60 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Vertical, EUT Orientation Z**

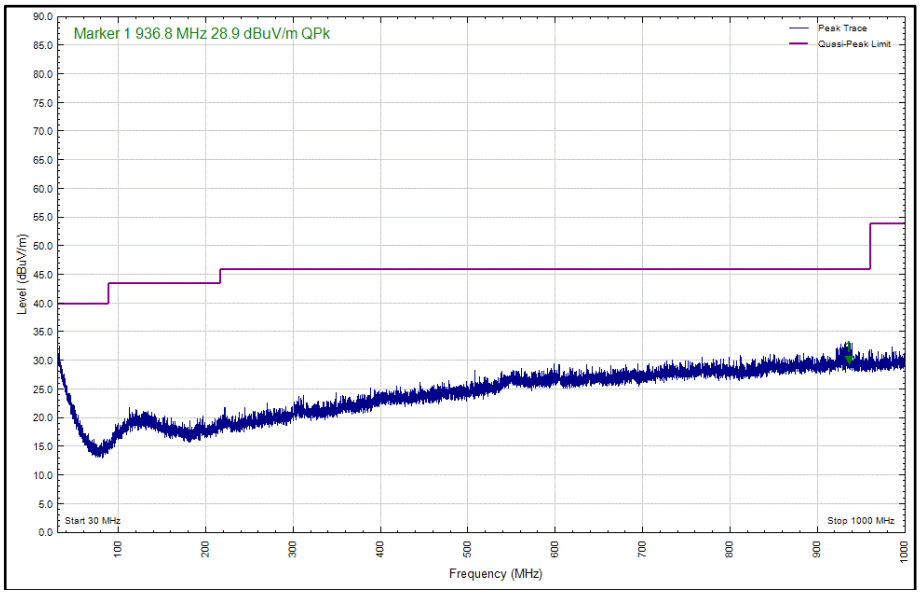



**Figure 61 - 30 MHz to 1 GHz, 2480 MHz, Polarity: Horizontal, EUT Orientation Z**

| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|---|---|---|---|---|---|---|---|---|
| 4960.247 | 44.3 | 54.0 | -9.7 | Average | 58 | 143 | Vertical | X |
| 7439.834 | 40.9 | 54.0 | -13.1 | Average | 76 | 127 | Vertical | X |
| 4677.260 | 37.6 | 54.0 | -16.4 | Average | 162 | 113 | Horizontal | X |
| 4960.202 | 45.1 | 54.0 | -9.0 | Average | 229 | 108 | Horizontal | X |
| 7440.739 | 37.6 | 54.0 | -16.4 | Average | 176 | 102 | Horizontal | X |
| 7439.864 | 35.9 | 54.0 | -18.1 | Average | 24 | 210 | Vertical | Y |
| 4633.172 | 36.4 | 54.0 | -17.6 | Average | 350 | 100 | Vertical | Y |
| 7440.629 | 39.8 | 54.0 | -14.2 | Average | 68 | 130 | Horizontal | Y |
| 3306.769 | 35.2 | 54.0 | -18.8 | Average | 206 | 127 | Horizontal | Y |
| 4653.484 | 37.0 | 54.0 | -17.0 | Average | 10 | 188 | Vertical | Z |
| 7439.654 | 42.4 | 54.0 | -11.6 | Average | 64 | 162 | Vertical | Z |
| 7440.449 | 39.4 | 54.0 | -14.6 | Average | 335 | 107 | Horizontal | Z |

**Table 16 - 2480 MHz - 1 GHz to 26 GHz Emissions Results**

*No other emissions were detected within 10 dB of the limit.

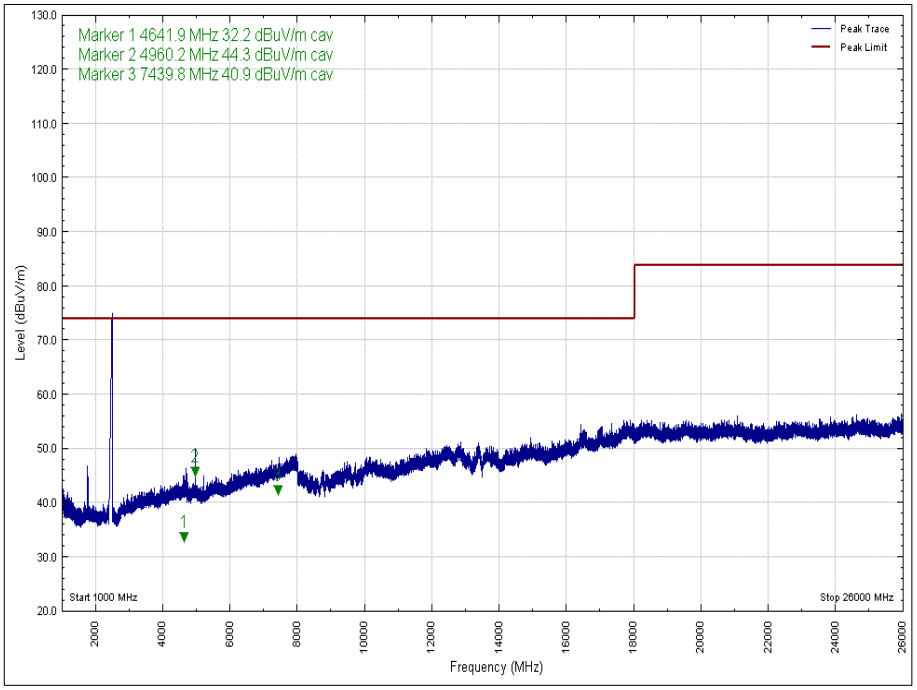



**Figure 62 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Peak**

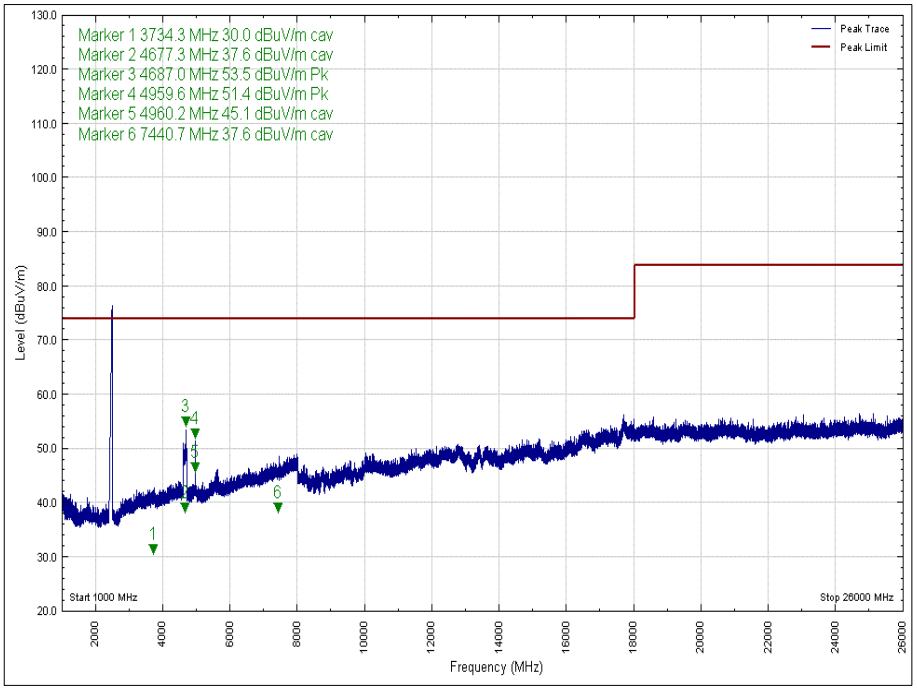



**Figure 63 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Peak**

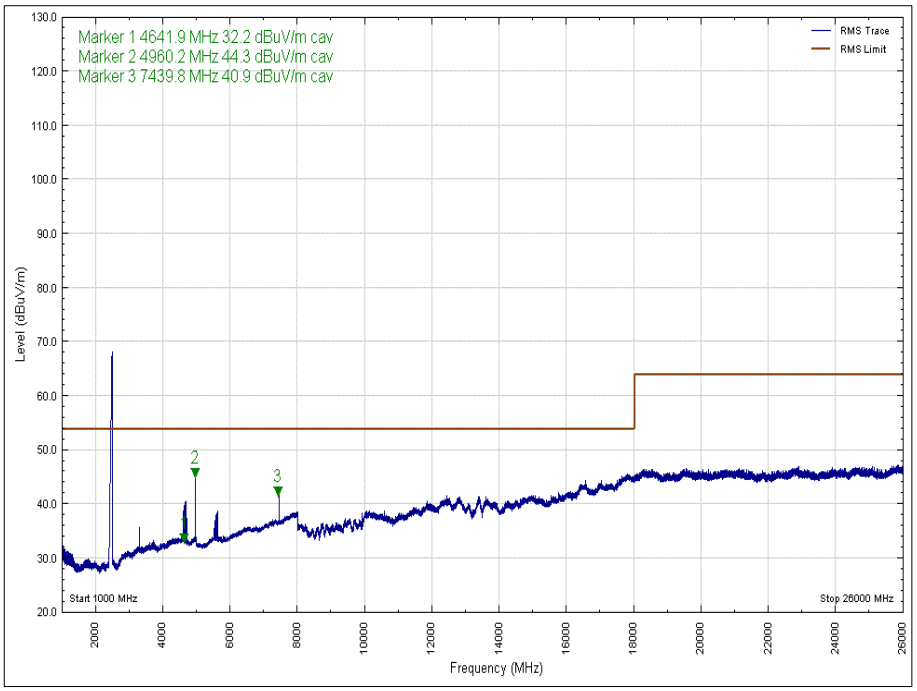



**Figure 64 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: X, Average**

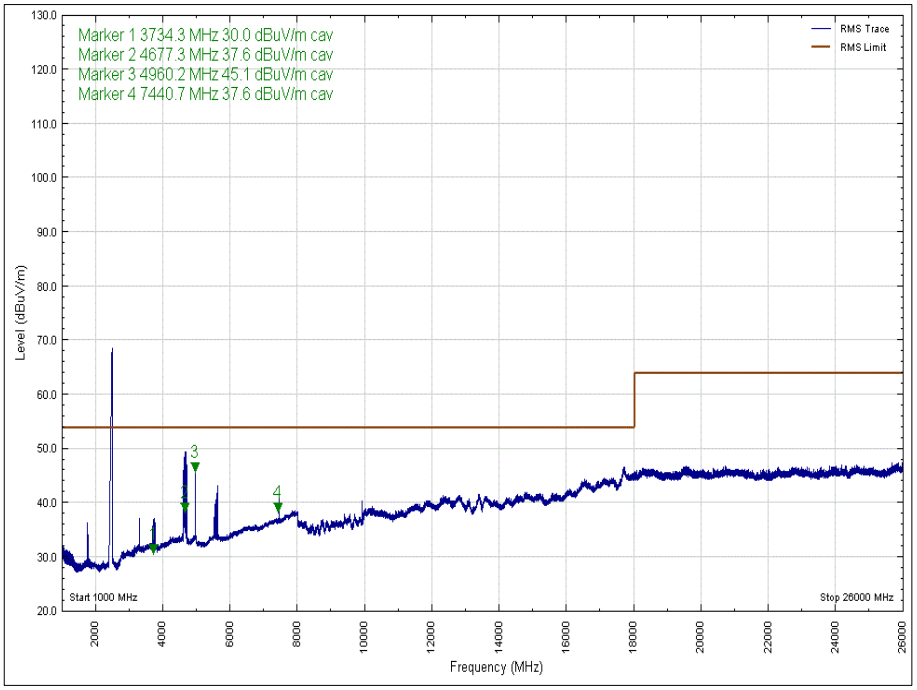



**Figure 65 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: X, Average**

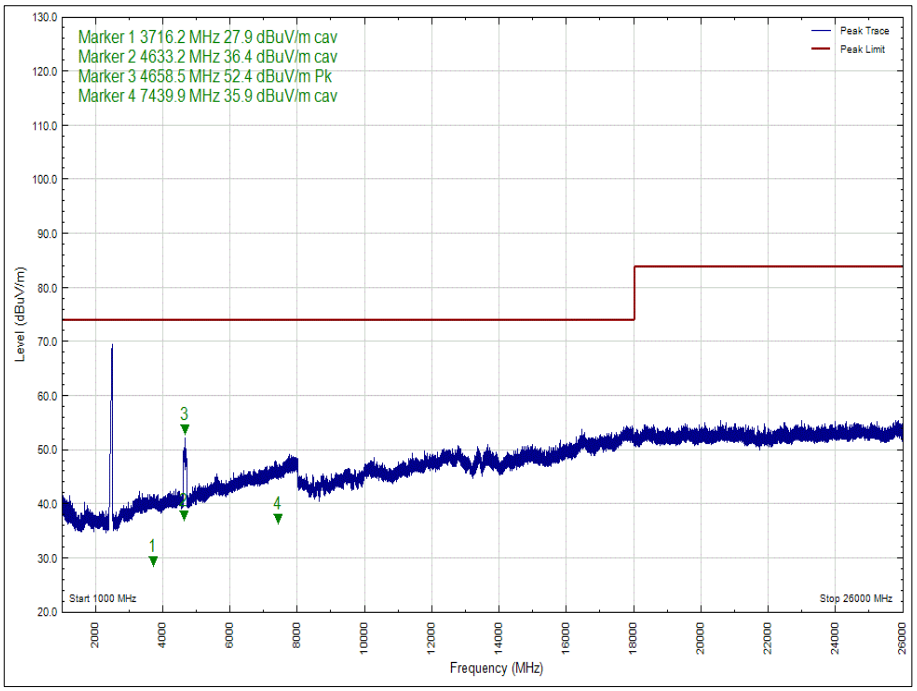



**Figure 66 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Peak**

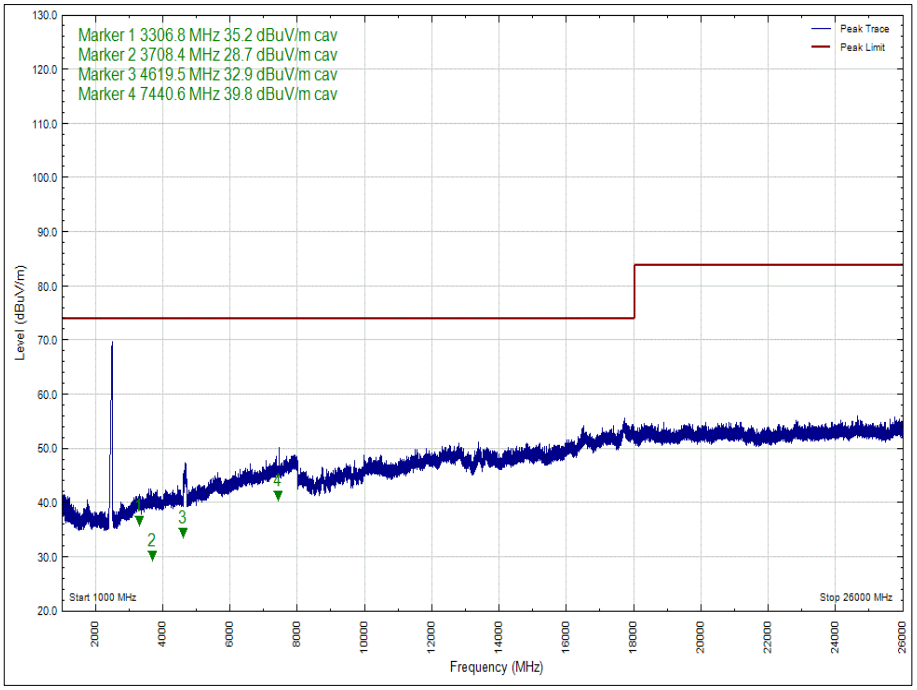



**Figure 67 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Peak**

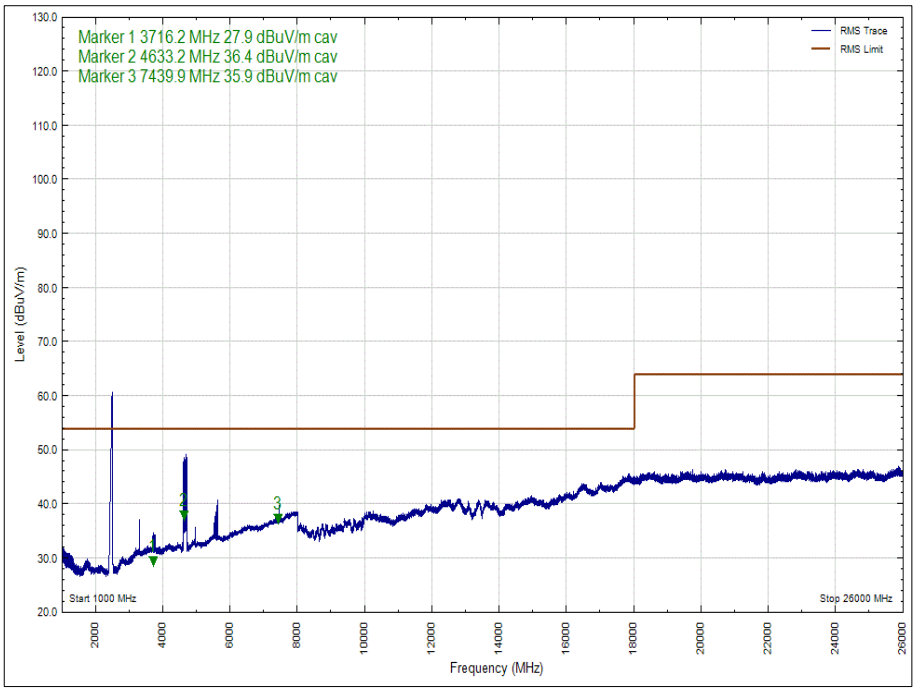



**Figure 68 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Y, Average**

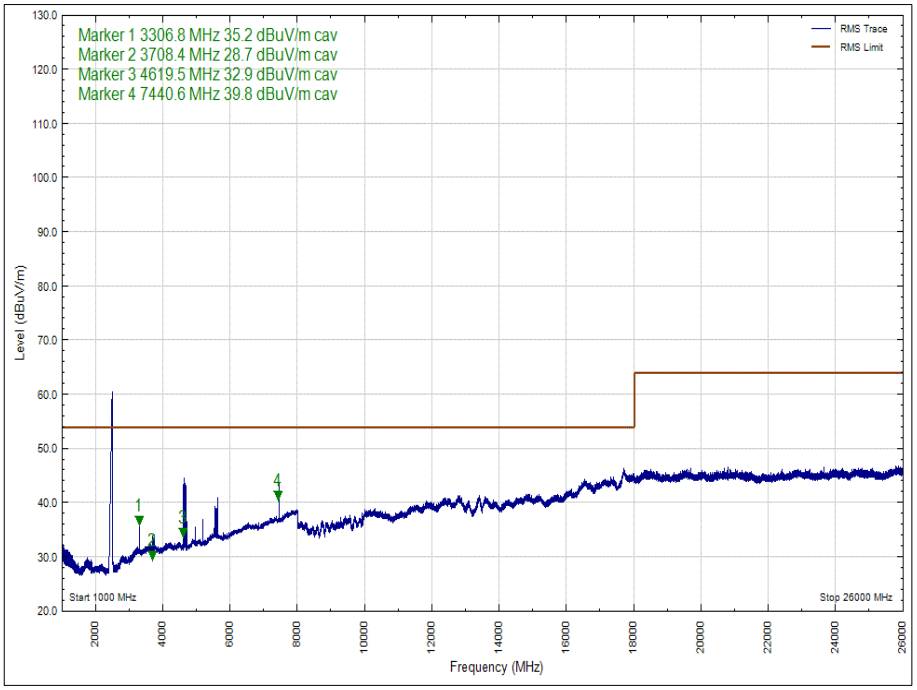



**Figure 69 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Y, Average**

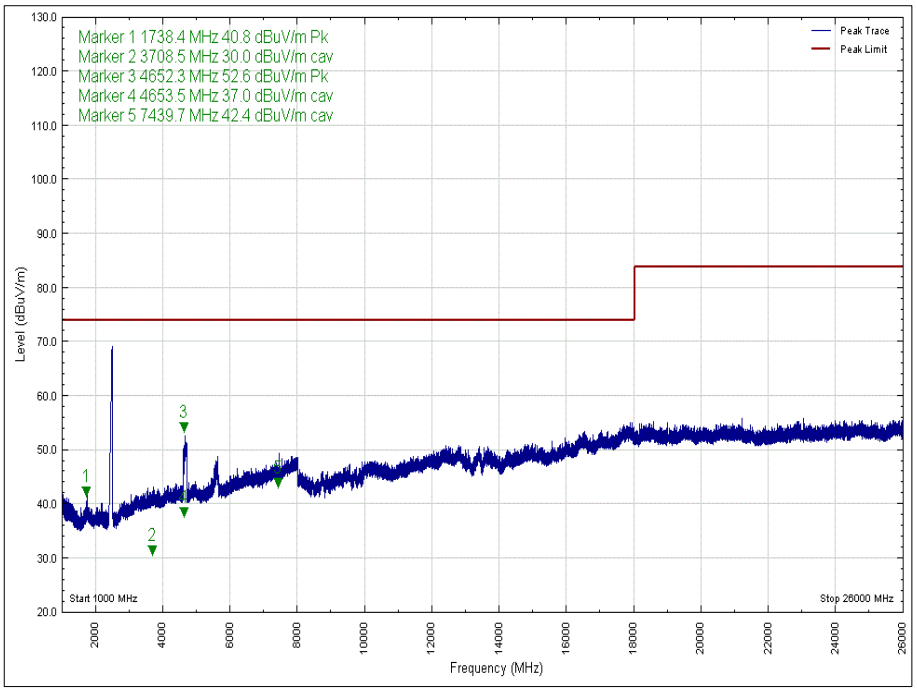



**Figure 70 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Peak**

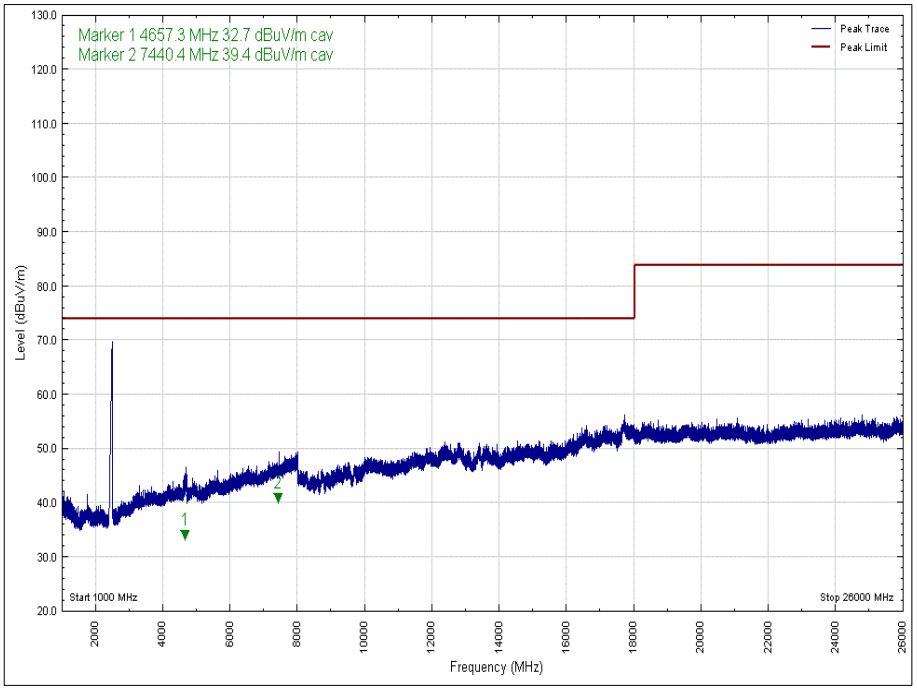



**Figure 71 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Peak**

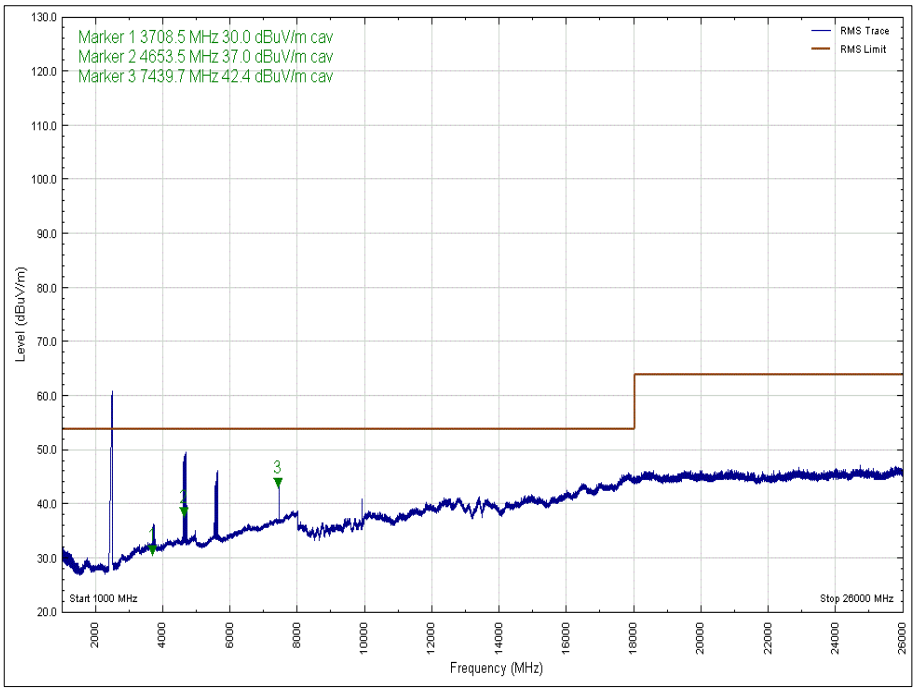



**Figure 72 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Vertical, EUT Orientation: Z, Average**

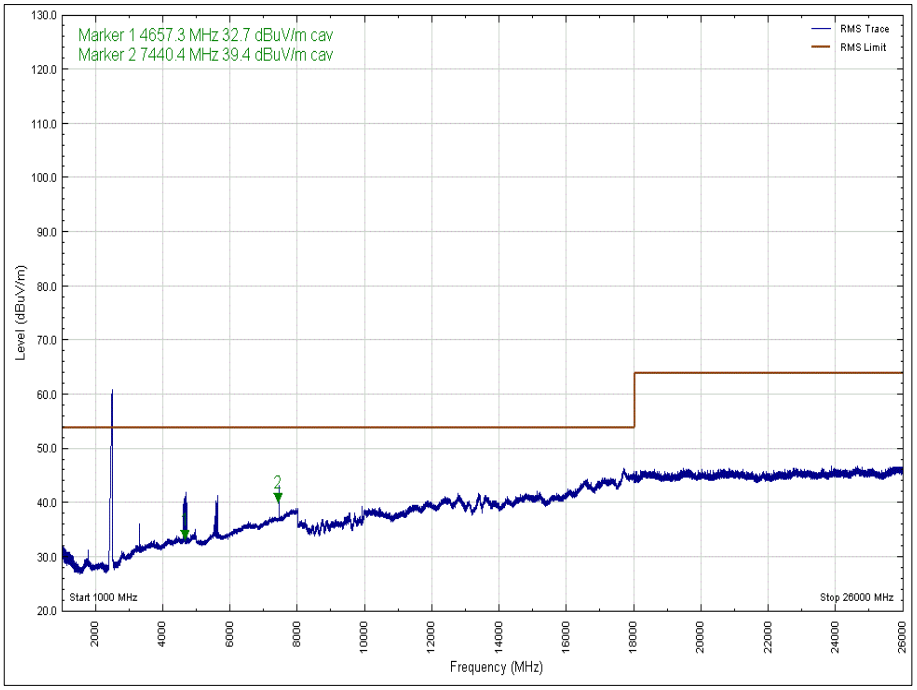



**Figure 73 - 2480 MHz - 1 GHz to 26 GHz, Polarity: Horizontal, EUT Orientation: Z, Average**

FCC 47 CFR Part 15, Limit Clause 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)

ISEDC RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### 2.3.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Antenna 18-40GHz (Double Ridge Guide) | Link Microtek Ltd | AM180HA-K-TU2 | 230 | 24 | 2-May-2020 |
| Filter (High Pass) | Lorch | SHP7-7000-SR | 566 | 12 | 06-Jun-2020 |
| Pre-Amplifier | Phase One | PS04-0086 | 1533 | 12 | 08-Feb-2020 |
| 18GHz - 40GHz Pre-Amplifier | Phase One | PSO4-0087 | 1534 | 12 | 05-Feb-2020 |
| Turntable Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Hygrometer | Rotronic | A1 | 2677 | 12 | 20-Feb-2020 |
| '2.92mm' - '2.92mm' RF Cable (2m) | Rhophase | KPS-1503-2000-KPS | 3695 | 12 | 11-Jun-2020 |
| High Pass Filter (4GHz) | K&L Microwave | 11SH10-4000/X18000-0/0 | 4599 | 12 | 05-Sep-2020 |
| Double Ridged Waveguide Horn Antenna | ETS-Lindgren | 3117 | 4722 | 12 | 05-Mar-2020 |
| Mast Controller | Maturo Gmbh | NCD | 4810 | - | TU |
| Double Ridge Broadband Horn Antenna | Schwarzbeck | BBHA 9120 B | 4848 | 12 | 11-Mar-2020 |
| Band Reject Filter - 2.425 GHz | Wainwright | WRCGV14-2390-2400-2450-2460-50SS | 5067 | 12 | 01-Oct-2020 |
| Band Reject Filter - 2.4585 GHz | Wainwright | WRCGV14-2423.5-2433.5-2483.5-2493.5-50SS | 5069 | 12 | 01-Oct-2020 |
| 1.5m 40GHz RF Cable | Scott Cables | KPS-1501-2000-KPS | 5127 | 6 | 20-Jan-2020 |
| 8 Meter Cable | Teledyne | PR90-088-8MTR | 5212 | 12 | 30-Aug-2020 |
| Preamplifier (30dB 1GHz to 18GHz) | Schwarzbeck | BBV 9718 C | 5261 | 12 | 26-Mar-2020 |
| EMI Test Receiver | Rohde & Schwarz | ESW44 | 5382 | 12 | 08-Oct-2020 |

**Table 17**

TU – Traceability Unscheduled

# 3 Photographs

## 3.1 Test Setup Photographs

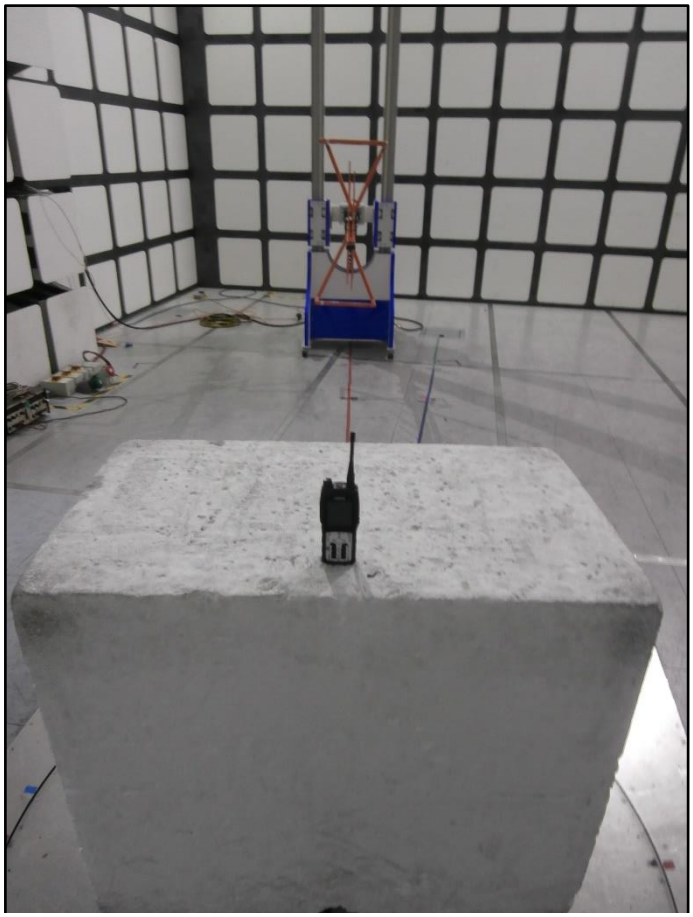


**Figure 74 – 30 MHz to 1 GHz**

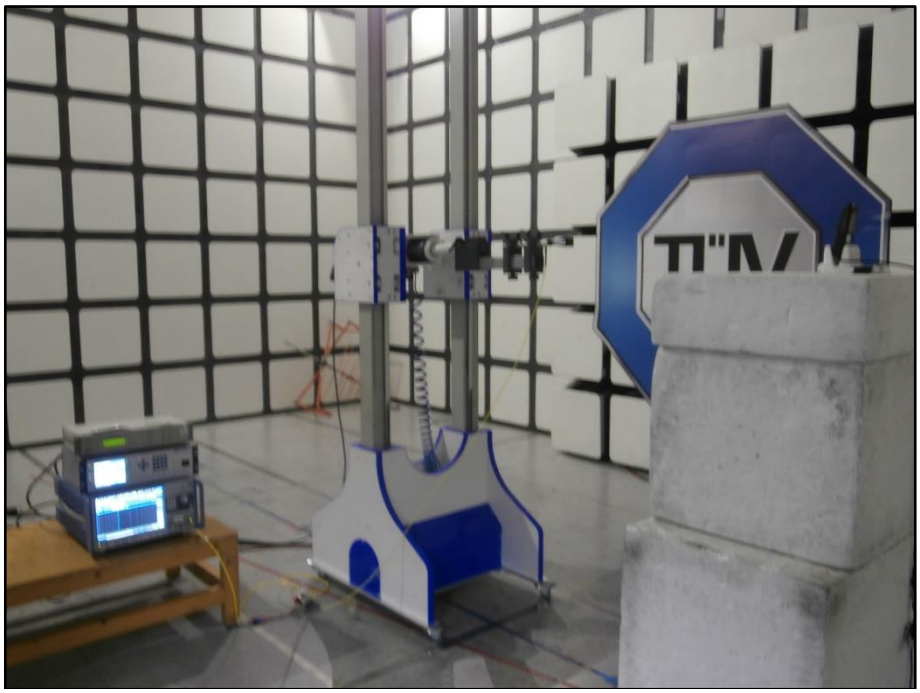


**Figure 75 – 1 GHz to 26 GHz**

# 4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

| Test Name | Measurement Uncertainty |
|---|---|
| Spurious Radiated Emissions | 30 MHz to 1 GHz: ± 5.2 dB<br>1 GHz to 40 GHz: ± 6.3 dB |
| Restricted Band Edges | 30 MHz to 1 GHz: ± 5.2 dB<br>1 GHz to 40 GHz: ± 6.3 dB |
| Authorised Band Edges | 30 MHz to 1 GHz: ± 5.2 dB<br>1 GHz to 40 GHz: ± 6.3 dB |

**Table 18**

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.