

# Report on the FCC and ISED Testing of:

Sepura Ltd

Portable TETRA Handset, Model: SC2124

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

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

FCC ID: XX6SC2124

IC: 8739A-SC2124



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Inspire trust.

## COMMERCIAL-IN-CONFIDENCE

Document Number: 75944487-04 | Issue: 01

### SIGNATURE

| NAME          | JOB TITLE           | RESPONSIBLE FOR      | ISSUE DATE       |
|---------------|---------------------|----------------------|------------------|
| Simon Bennett | Innovations Manager | Authorised Signatory | 11 December 2019 |

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, ISED RSS-247 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

### SIGNATURE

| NAME             | JOB TITLE     | RESPONSIBLE FOR | ISSUE DATE       |
|------------------|---------------|-----------------|------------------|
| Graeme Lawler    | Test Engineer | Testing         | 11 December 2019 |
| Mehadi Choudhury | Test Engineer | Testing         | 11 December 2019 |

FCC Accreditation

90987 Octagon House, Fareham Test Laboratory

ISED 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 (2018), ISED RSS-247 Issue 2 (2017-02) and ISED RSS-GEN Issue 5 + A1 (2019-03).



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# 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           | 11 December 2019 |

**Table 1**

## 1.2 Introduction

|                               |                                                                                                     |
|-------------------------------|-----------------------------------------------------------------------------------------------------|
| Applicant                     | Sepura Ltd                                                                                          |
| Manufacturer                  | Sepura Ltd                                                                                          |
| Model Number(s)               | SC2124                                                                                              |
| Serial Number(s)              | 1) 2PS001845GM55XT<br>2) 2PS001845GM55YP                                                            |
| Hardware Version(s)           | Production                                                                                          |
| Software Version(s)           | 1) 1754 006 07367<br>2) 2001 684 07367                                                              |
| Number of Samples Tested      | 2                                                                                                   |
| Test Specification/Issue/Date | FCC 47 CFR Part 15C (2018)<br>ISED RSS-247 Issue 2 (2017-02)<br>ISED RSS-GEN Issue 5 + A1 (2019-03) |
| Order Number                  | PLC-PO011393-1                                                                                      |
| Date                          | 07-December-2018                                                                                    |
| Date of Receipt of EUT        | 18-March-2019                                                                                       |
| Start of Test                 | 17-May-2019                                                                                         |
| Finish of Test                | 07-June-2019                                                                                        |
| Name of Engineer(s)           | Graeme Lawler and Mehadi Choudhury                                                                  |
| 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, ISED RSS-247 and ISED RSS-GEN is shown below.

| Section                                      | Specification Clause  |         |         | Test Description                                       | Result | Comments/Base Standard |
|----------------------------------------------|-----------------------|---------|---------|--------------------------------------------------------|--------|------------------------|
|                                              | Part 15C              | RSS-247 | RSS-GEN |                                                        |        |                        |
| Configuration and Mode: Bluetooth - Transmit |                       |         |         |                                                        |        |                        |
| 2.1                                          | 15.247 (b)            | 5.4     | 6.12    | Maximum Conducted Output Power                         | Pass   | ANSI C63.10 (2013)     |
| 2.2                                          | 15.247 (a)(1)         | 5.1     | -       | Frequency Hopping Systems - Average Time of Occupancy  | Pass   | ANSI C63.10 (2013)     |
| 2.3                                          | 15.247 (a)(1)         | 5.1     | -       | Frequency Hopping Systems - Channel Separation         | Pass   | ANSI C63.10 (2013)     |
| 2.4                                          | 15.247 (a)(1)         | 5.1     | -       | Frequency Hopping Systems - Number of Hopping Channels | Pass   | ANSI C63.10 (2013)     |
| 2.5                                          | 15.247 (a)(1)         | 5.1     | -       | Frequency Hopping Systems - 20 dB Bandwidth            | Pass   | ANSI C63.10 (2013)     |
| 2.6                                          | 15.247 (d)            | 5.5     | -       | Authorised Band Edges                                  | Pass   | ANSI C63.10 (2013)     |
| 2.7                                          | 15.205                | -       | 8.10    | Restricted Band Edges                                  | Pass   | ANSI C63.10 (2013)     |
| 2.8                                          | 15.247 (d) and 15.205 | 5.5     | 6.13    | Spurious Radiated Emissions                            | Pass   | ANSI C63.10 (2013)     |

**Table 2**



## 1.4 Application Form

| EQUIPMENT DESCRIPTION                                                                           |                                                             |
|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Model Name/Number                                                                               | SC2124                                                      |
| Part Number                                                                                     | N/A                                                         |
| Hardware Version                                                                                | Production                                                  |
| Software Version                                                                                | 1) 1754 006 07367<br>2) 2001 684 07367                      |
| FCC ID (if applicable)                                                                          | XX6SC2124                                                   |
| Industry Canada ID (if applicable)                                                              | 8739A-SC2124                                                |
| Technical Description (Please provide a brief description of the intended use of the equipment) | Portable TETRA Radio for use by the emergency services etc. |

| INTENTIONAL RADIATORS |                      |                                       |                    |                               |                      |                         |                     |        |      |
|-----------------------|----------------------|---------------------------------------|--------------------|-------------------------------|----------------------|-------------------------|---------------------|--------|------|
| Technology            | Frequency Band (MHz) | Conducted Declared Output Power (dBm) | Antenna Gain (dBi) | Supported Bandwidth (s) (MHz) | Modulation Scheme(s) | ITU Emission Designator | Test Channels (MHz) |        |      |
|                       |                      |                                       |                    |                               |                      |                         | Bottom              | Middle | Top  |
| TETRA                 | 403-470              | 34                                    | >-1                | 25 kHz                        | $\pi$ /4DQPS K       | 22K0DXW                 | 403                 | 436.5  | 470  |
| TETRA                 | 403-470              | 34                                    | >-1                | 22 kHz                        | $\pi$ /4DQPS K       | 20K0DXW                 | 403                 | 436.5  | 470  |
| Bluetooth             | 2402-2480            | 7.382                                 | 2.5                | 1.0                           | 8PSK, DQPSK, GFSK    | 1M00F1D                 | 2402                | 2441   | 2480 |

| UN-INTENTIONAL RADIATOR                                                                                            |  |
|--------------------------------------------------------------------------------------------------------------------|--|
| Highest frequency generated or used in the device or on which the device operates or tunes                         |  |
| Lowest frequency generated or used in the device or on which the device operates or tunes                          |  |
| Class A Digital Device (Use in commercial, industrial or business environment) <input checked="" type="checkbox"/> |  |
| Class B Digital Device (Use in residential environment only) <input type="checkbox"/>                              |  |

| Power Source                           |                 |             |                                                                     |
|----------------------------------------|-----------------|-------------|---------------------------------------------------------------------|
| AC                                     | Single Phase    | Three Phase | Nominal Voltage                                                     |
|                                        |                 |             |                                                                     |
| External DC                            | Nominal Voltage |             | Maximum Current                                                     |
|                                        | 7.4V DC         |             | 2A                                                                  |
| Battery                                | Nominal Voltage |             | Battery Operating End Point Voltage                                 |
|                                        | 7.4V DC         |             | 6.2V DC                                                             |
| Can EUT transmit whilst being charged? |                 |             | Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> |

| EXTREME CONDITIONS  |    |    |                            |
|---------------------|----|----|----------------------------|
| Maximum temperature | 65 | °C | Minimum temperature -30 °C |



| Ancillaries                                                       |
|-------------------------------------------------------------------|
| Please list all ancillaries which will be used with the device.   |
| Remote speaker microphone, leather cases, pocket clips, earpieces |

| ANTENNA CHARACTERISTICS             |                             |                 |           |
|-------------------------------------|-----------------------------|-----------------|-----------|
| <input type="checkbox"/>            | Antenna connector           | State impedance | Ohm       |
| <input checked="" type="checkbox"/> | Temporary antenna connector | State impedance | 50 Ohm    |
| <input checked="" type="checkbox"/> | Integral antenna            | Type            | Bluetooth |
| <input type="checkbox"/>            | External antenna            | Type            |           |

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

Name: Chris Beecham

Position held: Conformance Engineer Date: 06/12/2019

## 1.5 Product Information

### 1.5.1 Technical Description

Portable TETRA Radio for use by the emergency services etc.

### 1.5.2 Test Setup Diagram(s)

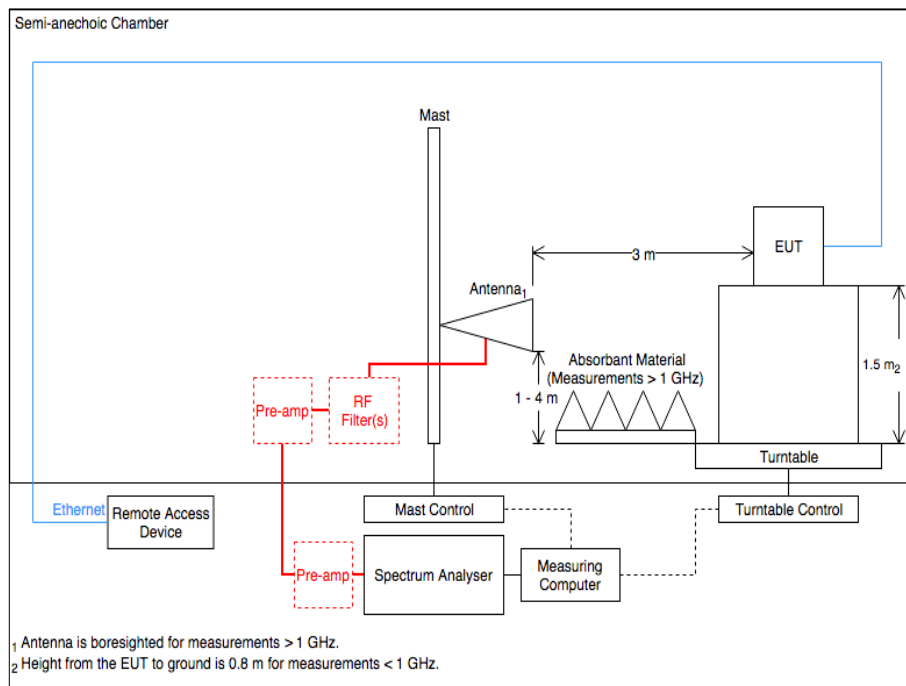


Figure 1 - Radiated Emissions

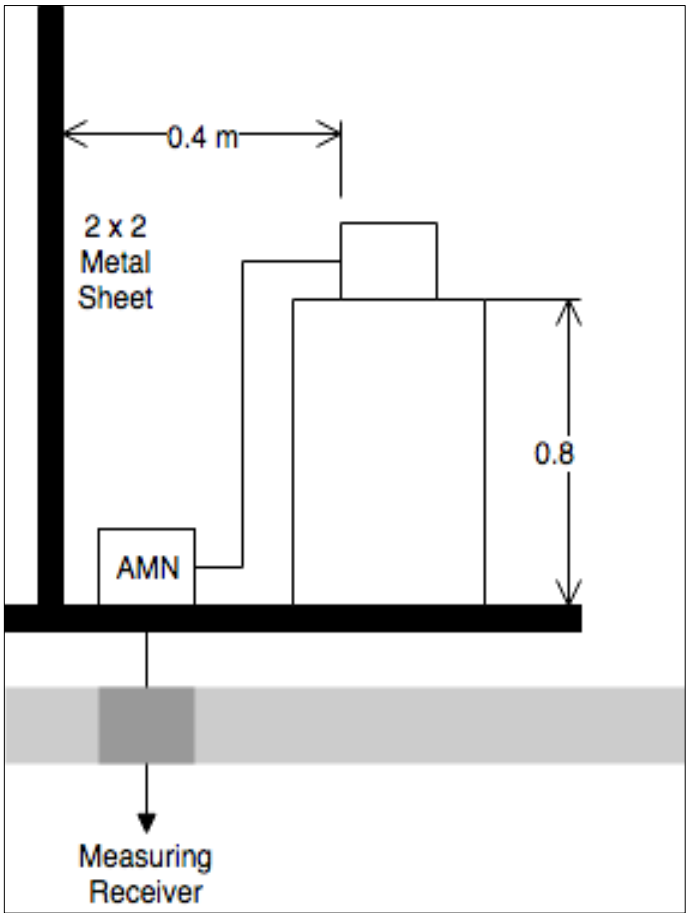


Figure 2 - AC Line Conducted Emissions

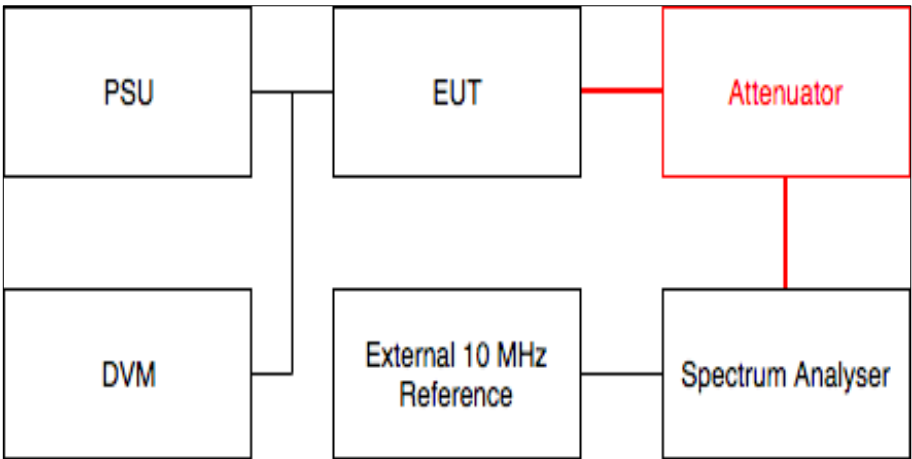


Figure 3 - Conducted Tests





### 1.5.3 EUT Configuration and Rationale for Radiated Spurious Emissions

The EUT was placed on the non-conducting platform in a manner typical of a normal installation.

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.

### 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 |
|--------------------------------|-------------------------------------------------|------------------------|--------------------------|
| Serial Number: 2PS001845GM55XT |                                                 |                        |                          |
| 0                              | As supplied by the customer                     | Not Applicable         | Not Applicable           |
| Serial Number: 2PS001845GM55YP |                                                 |                        |                          |
| 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: Bluetooth - Transmit           |                     |               |
| Maximum Conducted Output Power                         | Mehadi Choudhury    | UKAS          |
| Frequency Hopping Systems - Average Time of Occupancy  | Mehadi Choudhury    | UKAS          |
| Frequency Hopping Systems - Channel Separation         | Mehadi Choudhury    | UKAS          |
| Frequency Hopping Systems - Number of Hopping Channels | Mehadi Choudhury    | UKAS          |
| Frequency Hopping Systems - 20 dB Bandwidth            | Mehadi Choudhury    | UKAS          |
| Authorised Band Edges                                  | Graeme Lawler       | UKAS          |
| Restricted Band Edges                                  | Graeme Lawler       | UKAS          |
| Spurious Radiated Emissions                            | Graeme Lawler       | UKAS          |

**Table 4**

Office Address:

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



## 2 Test Details

### 2.1 Maximum Conducted Output Power

#### 2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)  
ISED RSS-247, Clause 5.4  
ISED RSS-GEN, Clause 6.12

#### 2.1.2 Equipment Under Test and Modification State

SC2124, S/N: 2PS001845GM55YP - Modification State 0

#### 2.1.3 Date of Test

17-May-2019

#### 2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 11.9.1.1.

#### 2.1.5 Environmental Conditions

Ambient Temperature 24.4 °C  
Relative Humidity 34.4 %

#### 2.1.6 Test Results

Bluetooth - Transmit

Testing was performed on the modulation/packet type with the highest conducted output power. This modulation/packet type was 8-DPSK/3DH5.

| Frequency (MHz) | Maximum Output Power |      |
|-----------------|----------------------|------|
|                 | dBm                  | mW   |
| 2402            | 7.55                 | 5.69 |
| 2441            | 7.86                 | 6.11 |
| 2480            | 8.37                 | 6.87 |

**Table 5 - Maximum Conducted Output Power Results**

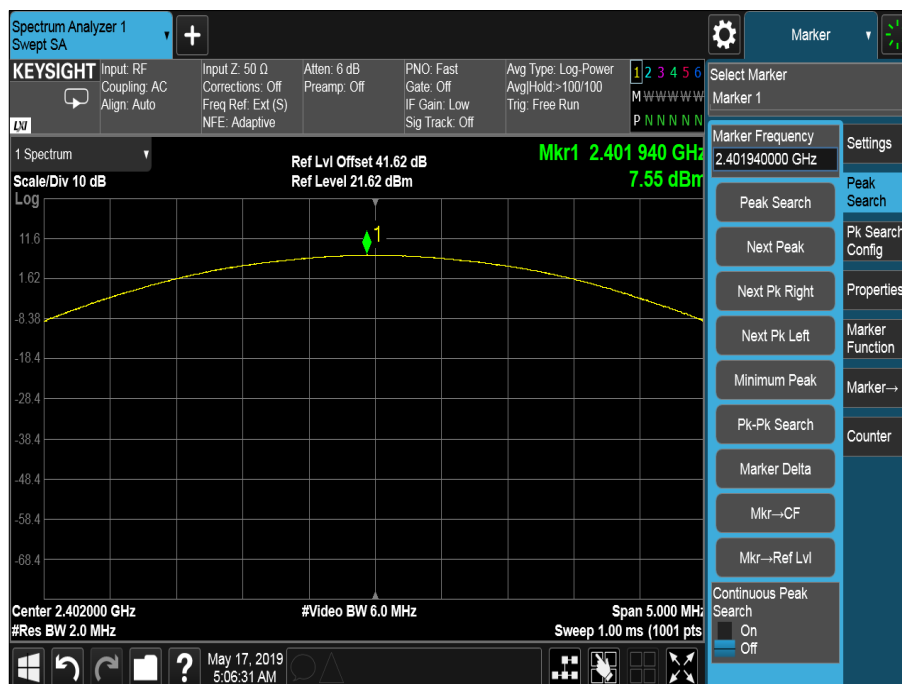


Figure 4 - 2402 MHz - Maximum Output Power

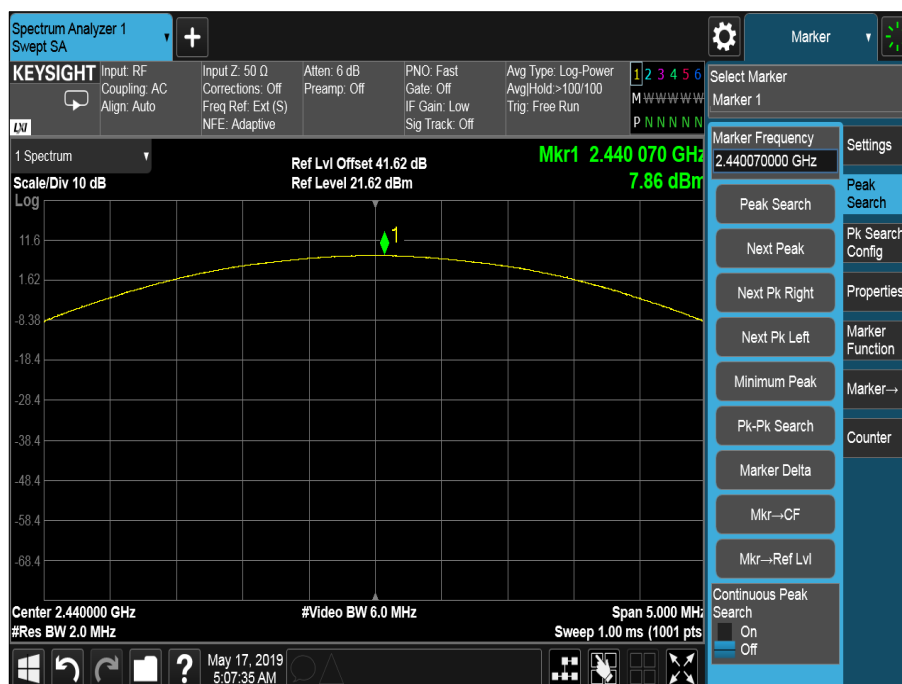


Figure 5 - 2441 MHz - Maximum Output Power



**Figure 6 - 2480 MHz - Maximum Output Power**

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

ISED RSS-247, Limit Clause 5.4 (b)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channel; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channel. The e.i.r.p. shall not exceed 4 W except as provided in section 5.4(e) of the specification.



### 2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 3.

| Instrument                    | Manufacturer          | Type No                   | TE No | Calibration Period (months) | Calibration Due |
|-------------------------------|-----------------------|---------------------------|-------|-----------------------------|-----------------|
| Attenuator (10dB/250W)        | Weinschel             | 45-10-43                  | 383   | 12                          | 23-Oct-2019     |
| 50dB/2W Attenuator            | Narda                 | 4772-50                   | 458   | -                           | TU              |
| Multimeter                    | Fluke                 | 79 Series III             | 611   | 12                          | 07-Sep-2019     |
| Hygrometer                    | Rotronic              | I-1000                    | 3220  | 12                          | 13-Sep-2019     |
| Signal Generator, 9kHz - 3GHz | Rohde & Schwarz       | SMA 100A                  | 3504  | 12                          | 22-Aug-2019     |
| Signal Analyser               | Rohde & Schwarz       | FSQ 26                    | 3545  | 12                          | 18-Mar-2020     |
| Network Analyser              | Rohde & Schwarz       | ZVA 40                    | 3548  | 12                          | 17-Oct-2019     |
| 'N' - 'N' RF Cable (1m)       | Rhophase              | NPS-1803-1000-NPS         | 3701  | -                           | O/P Mon         |
| Calibration Unit              | Rohde & Schwarz       | ZV-Z54                    | 4368  | 12                          | 22-Oct-2019     |
| Frequency Standard            | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 15-Oct-2019     |
| 1 metre N-Type Cable          | Florida Labs          | NMS-235SP-39.4-NMS        | 4510  | 12                          | 10-Jul-2019     |
| Attenuator (20dB, 100W)       | Weinschel             | 48-20-43                  | 4870  | 12                          | 17-Jul-2019     |
| EXA                           | Keysight Technologies | N9010B                    | 4968  | 24                          | 21-Dec-2019     |
| Cable (18 GHz)                | Rosenberger           | LU7-071-1000              | 5099  | 12                          | 04-Oct-2019     |

**Table 6**

TU - Traceability Unscheduled

O/P Mon – Output Monitored using Calibrated Equipment



## **2.2 Frequency Hopping Systems - Average Time of Occupancy**

### **2.2.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)  
ISED RSS-247, Clause 5.1

### **2.2.2 Equipment Under Test and Modification State**

SC2124, S/N: 2PS001845GM55YP - Modification State 0

### **2.2.3 Date of Test**

18-May-2019

### **2.2.4 Test Method**

The test was performed in accordance with ANSI C63.10, clause 7.8.4.

### **2.2.5 Environmental Conditions**

Ambient Temperature 22.9 °C  
Relative Humidity 27.1 %

### **2.2.6 Test Results**

#### Bluetooth - Transmit

| Packet Type | Dwell Time (ms) | Number of Transmissions | Average Occupancy Time (ms) |
|-------------|-----------------|-------------------------|-----------------------------|
| DH1         | 0.404           | 320                     | 129.280                     |
| DH3         | 1.660           | 158                     | 262.280                     |
| DH5         | 2.904           | 104                     | 302.016                     |

**Table 7**

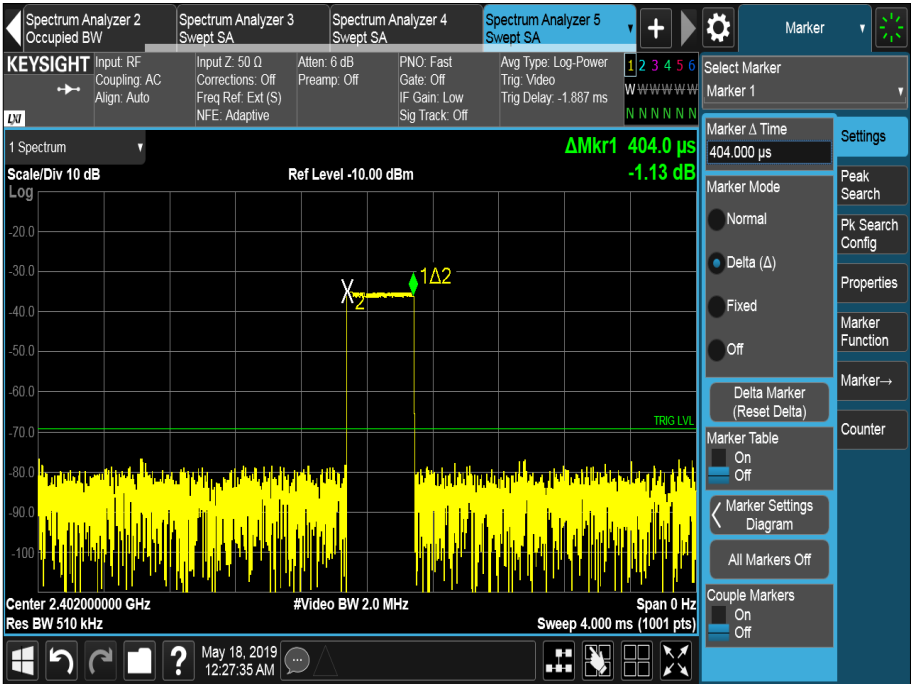


Figure 7 - DH1, Dwell Time

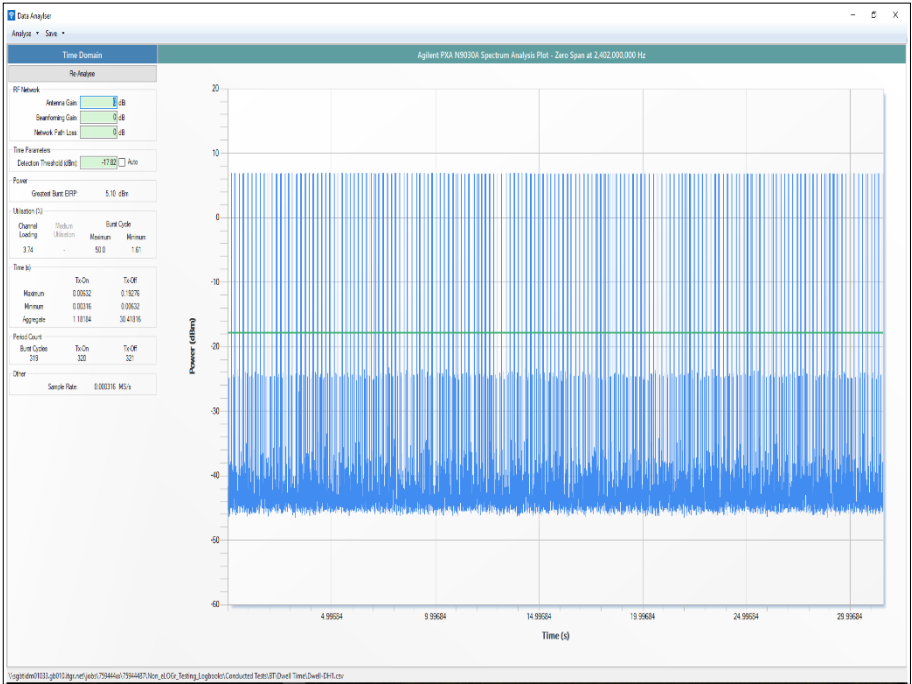


Figure 8 - DH1, Total Average Time of Occupancy





Figure 9 - DH3, Dwell Time

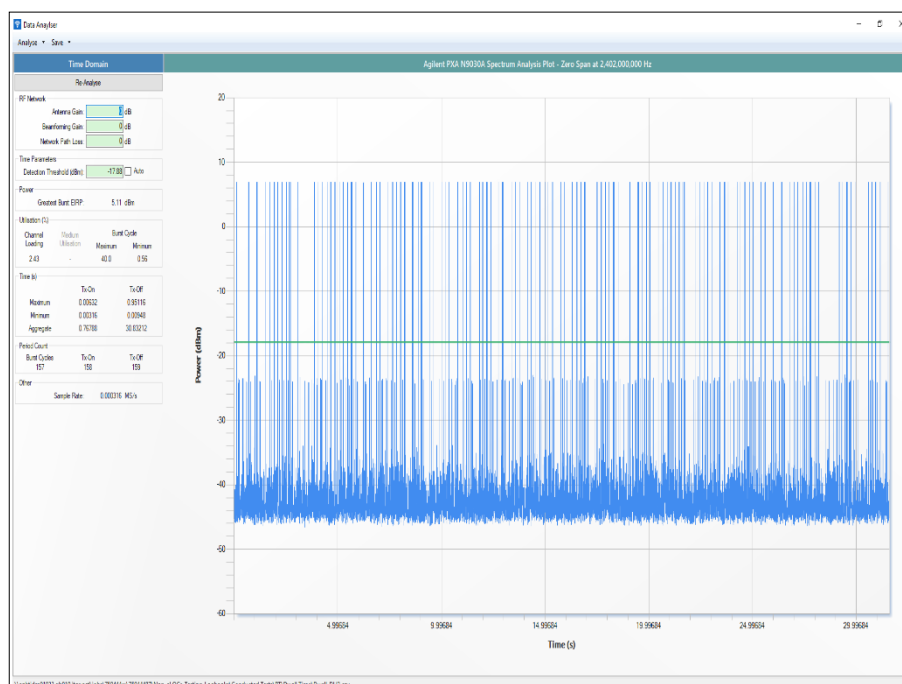


Figure 10 - DH3, Total Average Time of Occupancy

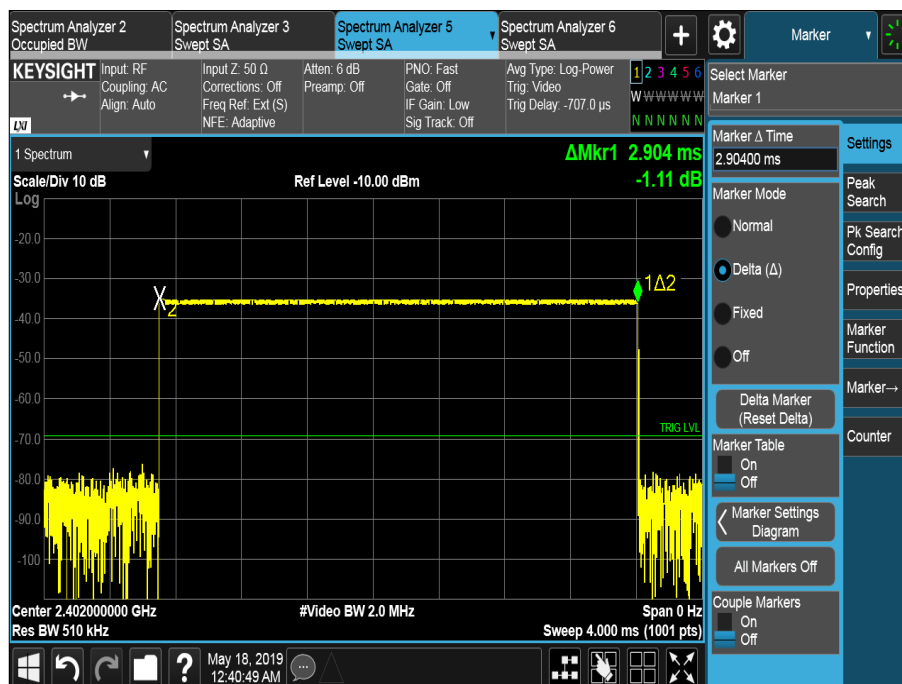


Figure 11 - DH5, Dwell Time

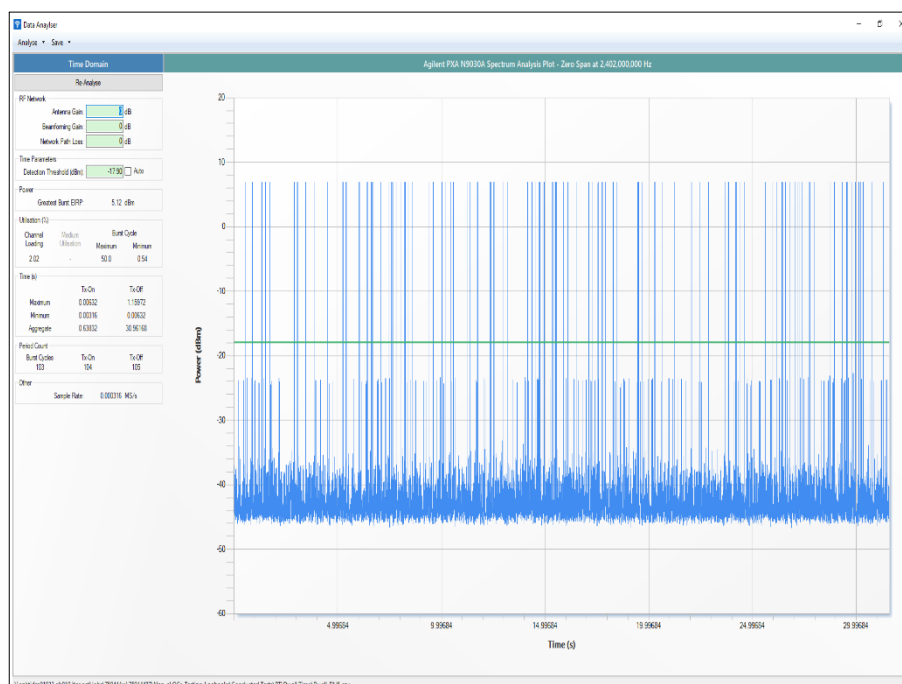


Figure 12 - DH5, Total Average Time of Occupancy



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii)

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

ISED RSS-247, Limit Clause 5.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

## 2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument             | Manufacturer          | Type No                   | TE No | Calibration Period (months) | Calibration Due |
|------------------------|-----------------------|---------------------------|-------|-----------------------------|-----------------|
| Attenuator (10dB/250W) | Weinschel             | 45-10-43                  | 383   | 12                          | 23-Oct-2019     |
| Multimeter             | Fluke                 | 79 Series III             | 611   | 12                          | 07-Sep-2019     |
| Hygrometer             | Rotronic              | I-1000                    | 3220  | 12                          | 13-Sep-2019     |
| Network Analyser       | Rohde & Schwarz       | ZVA 40                    | 3548  | 12                          | 17-Oct-2019     |
| Calibration Unit       | Rohde & Schwarz       | ZV-Z54                    | 4368  | 12                          | 22-Oct-2019     |
| Frequency Standard     | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 15-Oct-2019     |
| EXA                    | Keysight Technologies | N9010B                    | 4968  | 24                          | 21-Dec-2019     |
| Cable (18 GHz)         | Rosenberger           | LU7-071-1000              | 5099  | 12                          | 04-Oct-2019     |

**Table 8**



2.3 Frequency Hopping Systems - Channel Separation

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)  
ISED RSS-247, Clause 5.1

2.3.2 Equipment Under Test and Modification State

SC2124, S/N: 2PS001845GM55YP - Modification State 0

2.3.3 Date of Test

17-May-2019

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.2.

2.3.5 Environmental Conditions

Ambient Temperature 24.4 °C  
Relative Humidity 34.4 %

2.3.6 Test Results

Bluetooth - Transmit

| Modulation | Channel Separation (MHz) |
|------------|--------------------------|
| GFSK       | 1.002                    |
| 8-DPSK     | 1.002                    |
| pi/4DQPSK  | 1.002                    |

Table 9



Figure 13 - GFSK



Figure 14 - 8-DPSK



Figure 15 - pi/4DQPSK



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)

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

Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

ISED RSS-247, Limit Clause 5.1 (b)

FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

**2.3.7 Test Location and Test Equipment Used**

This test was carried out in RF Laboratory 1.

| Instrument             | Manufacturer          | Type No                   | TE No | Calibration Period (months) | Calibration Due |
|------------------------|-----------------------|---------------------------|-------|-----------------------------|-----------------|
| Attenuator (10dB/250W) | Weinschel             | 45-10-43                  | 383   | 12                          | 23-Oct-2019     |
| Multimeter             | Fluke                 | 79 Series III             | 611   | 12                          | 07-Sep-2019     |
| Hygrometer             | Rotronic              | I-1000                    | 3220  | 12                          | 13-Sep-2019     |
| Network Analyser       | Rohde & Schwarz       | ZVA 40                    | 3548  | 12                          | 17-Oct-2019     |
| Calibration Unit       | Rohde & Schwarz       | ZV-Z54                    | 4368  | 12                          | 22-Oct-2019     |
| Frequency Standard     | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 15-Oct-2019     |
| EXA                    | Keysight Technologies | N9010B                    | 4968  | 24                          | 21-Dec-2019     |
| Cable (18 GHz)         | Rosenberger           | LU7-071-1000              | 5099  | 12                          | 04-Oct-2019     |

**Table 10**

## 2.4 Frequency Hopping Systems - Number of Hopping Channels

### 2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)  
 ISEDC RSS-247, Clause 5.1

### 2.4.2 Equipment Under Test and Modification State

SC2124, S/N: 2PS001845GM55YP - Modification State 0

### 2.4.3 Date of Test

17-May-2019

### 2.4.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.3.

### 2.4.5 Environmental Conditions

Ambient Temperature 24.4 °C  
 Relative Humidity 34.4 %

### 2.4.6 Test Results

Bluetooth - Transmit

Number of Hopping Channels: 79

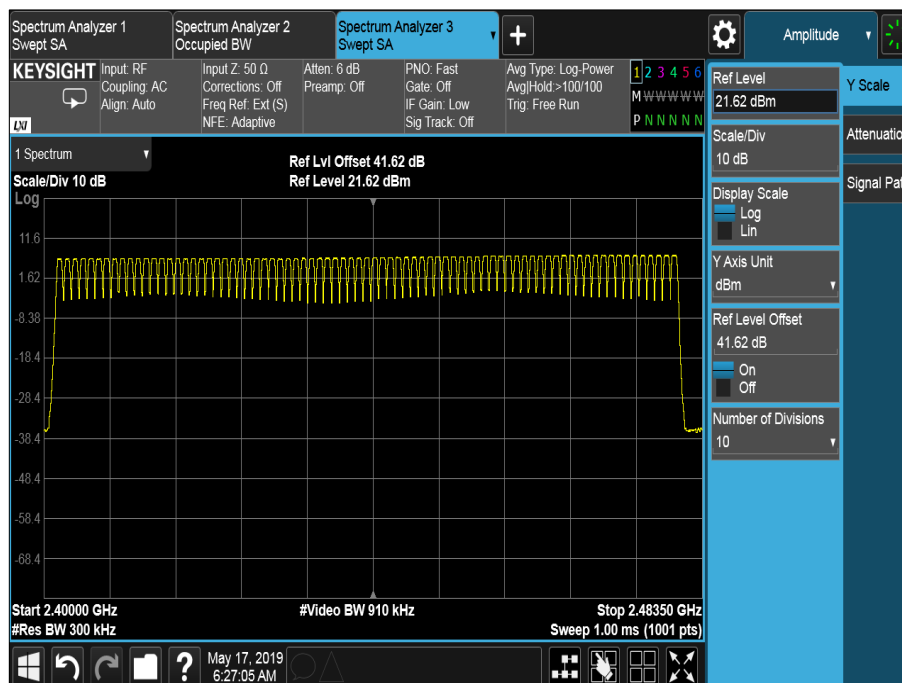


Figure 16 - Measurement Frequency Range: 2400 MHz to 2483.5 MHz



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii)

≥ 15 channels

ISED RSS-247, Limit Clause 5.1 (d)

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

#### **2.4.7 Test Location and Test Equipment Used**

This test was carried out in RF Laboratory 1.

| Instrument             | Manufacturer          | Type No                   | TE No | Calibration Period (months) | Calibration Due |
|------------------------|-----------------------|---------------------------|-------|-----------------------------|-----------------|
| Attenuator (10dB/250W) | Weinschel             | 45-10-43                  | 383   | 12                          | 23-Oct-2019     |
| Multimeter             | Fluke                 | 79 Series III             | 611   | 12                          | 07-Sep-2019     |
| Hygrometer             | Rotronic              | I-1000                    | 3220  | 12                          | 13-Sep-2019     |
| Network Analyser       | Rohde & Schwarz       | ZVA 40                    | 3548  | 12                          | 17-Oct-2019     |
| Calibration Unit       | Rohde & Schwarz       | ZV-Z54                    | 4368  | 12                          | 22-Oct-2019     |
| Frequency Standard     | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 15-Oct-2019     |
| EXA                    | Keysight Technologies | N9010B                    | 4968  | 24                          | 21-Dec-2019     |
| Cable (18 GHz)         | Rosenberger           | LU7-071-1000              | 5099  | 12                          | 04-Oct-2019     |

**Table 11**





## 2.5 Frequency Hopping Systems - 20 dB Bandwidth

### 2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)  
ISED RSS-247, Clause 5.1

### 2.5.2 Equipment Under Test and Modification State

SC2124, S/N: 2PS001845GM55YP - Modification State 0

### 2.5.3 Date of Test

17-May-2019

### 2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.2.

### 2.5.5 Environmental Conditions

Ambient Temperature 24.4 °C  
Relative Humidity 34.4 %

### 2.5.6 Test Results

Bluetooth - Transmit

| Frequency (MHz) | 20 dB Bandwidth (kHz) |               |         |
|-----------------|-----------------------|---------------|---------|
|                 | GFSK (BDR)            | $\pi/4$ DQPSK | 8-DPSK  |
| 2402            | 953.60                | 1369.00       | 1357.00 |
| 2440            | 956.00                | 1369.00       | 1356.00 |
| 2480            | 956.00                | 1369.00       | 1356.00 |

**Table 12**



Figure 17 - 2402 MHz - GFSK

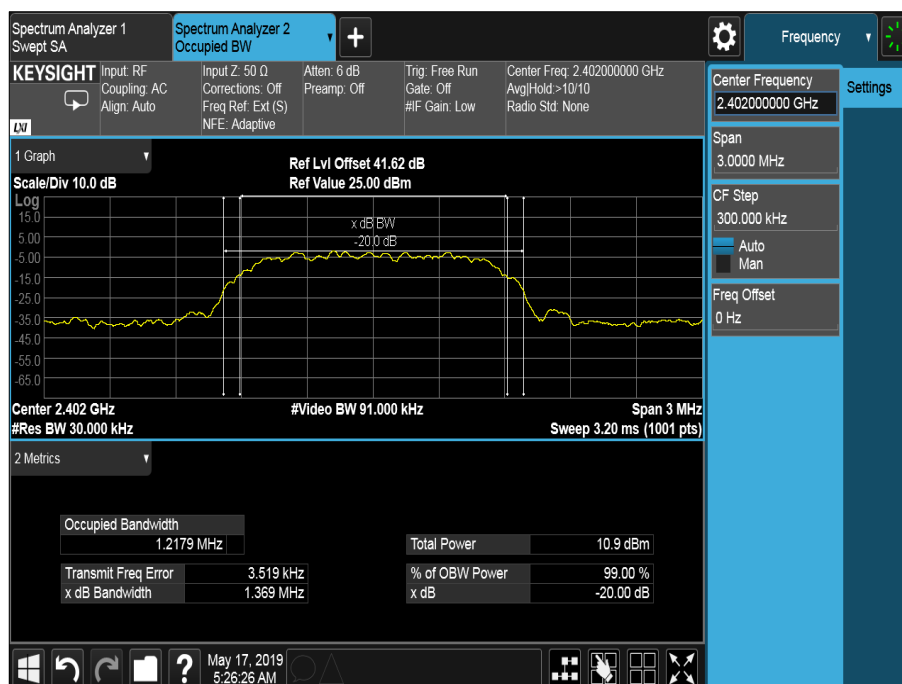


Figure 18 - 2402 MHz -  $\pi/4$  DQPSK

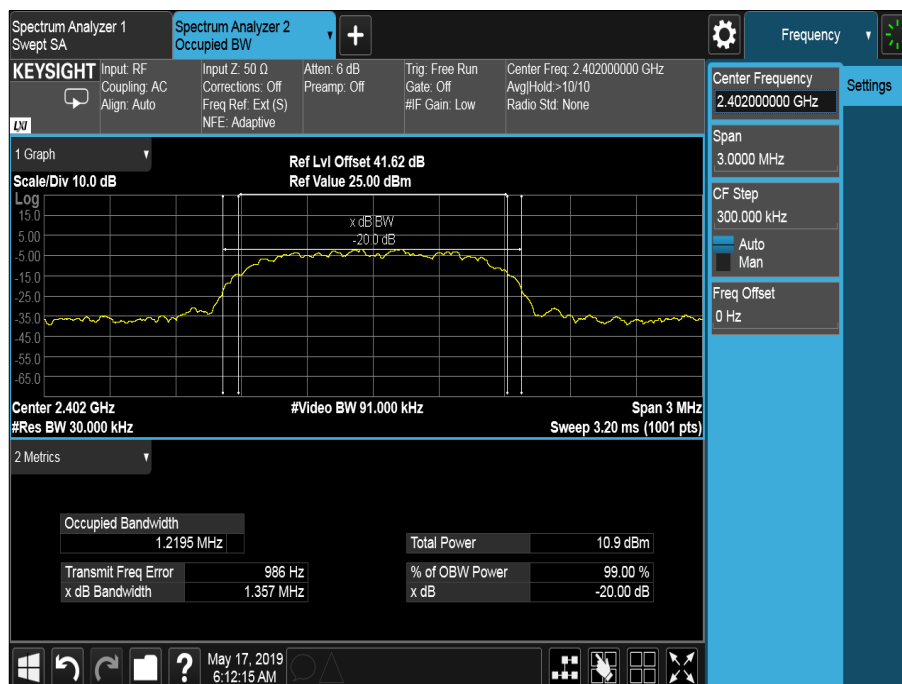


Figure 19 - 2402 MHz - 8-DPSK



Figure 20 - 2440 MHz - GFSK

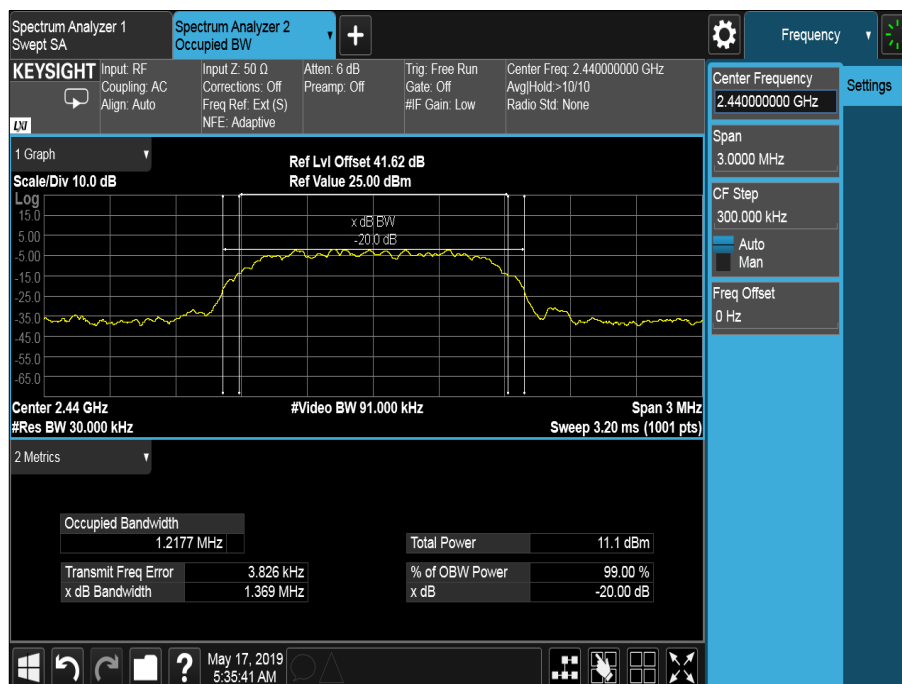


Figure 21 - 2440 MHz -  $\pi/4$  DQPSK

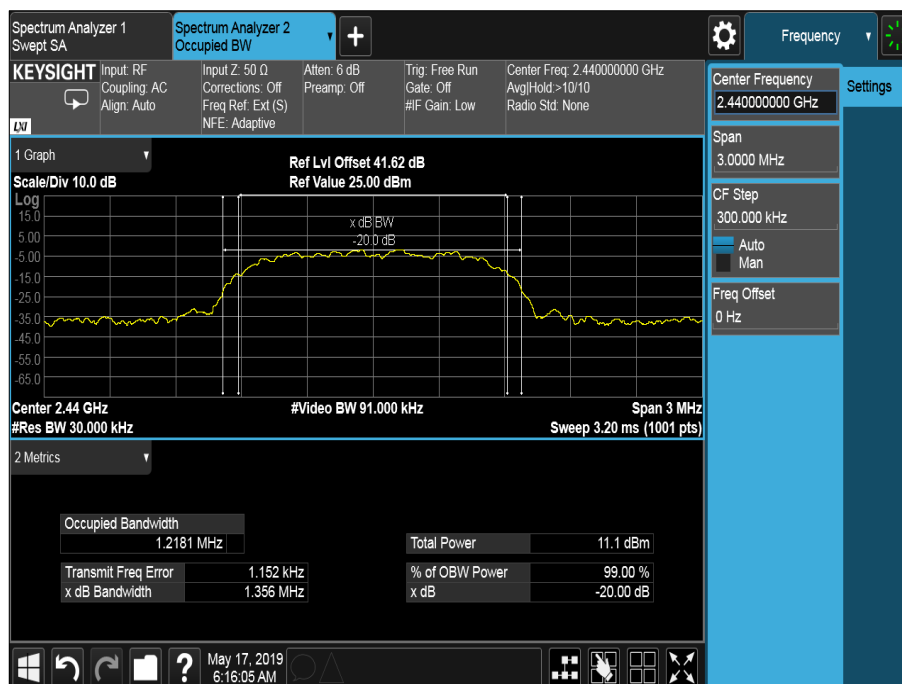


Figure 22 - 2440 MHz - 8-DPSK



Figure 23 - 2480 MHz - GFSK

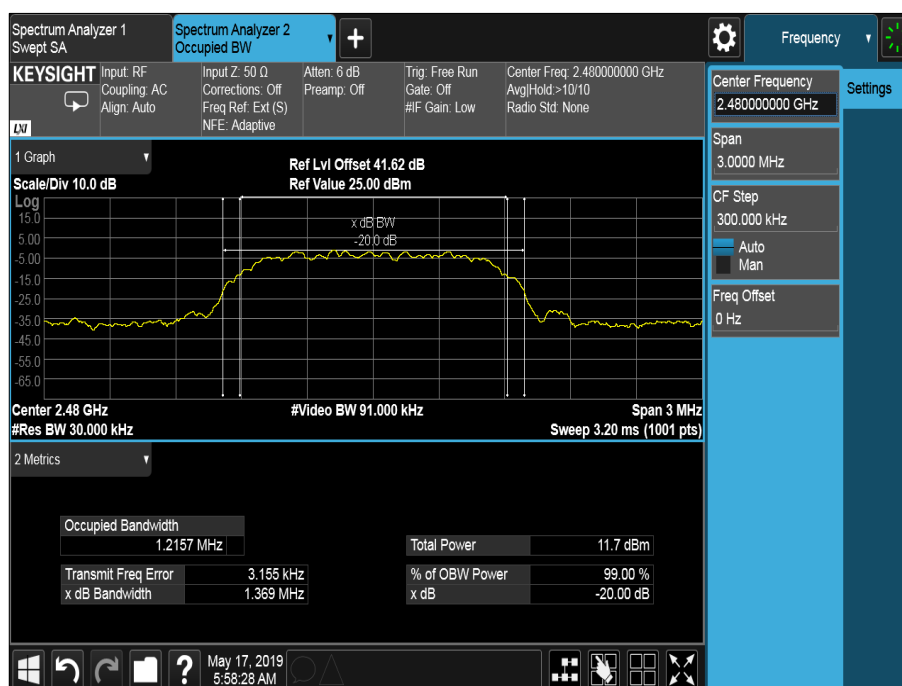


Figure 24 - 2480 MHz -  $\pi/4$  DQPSK

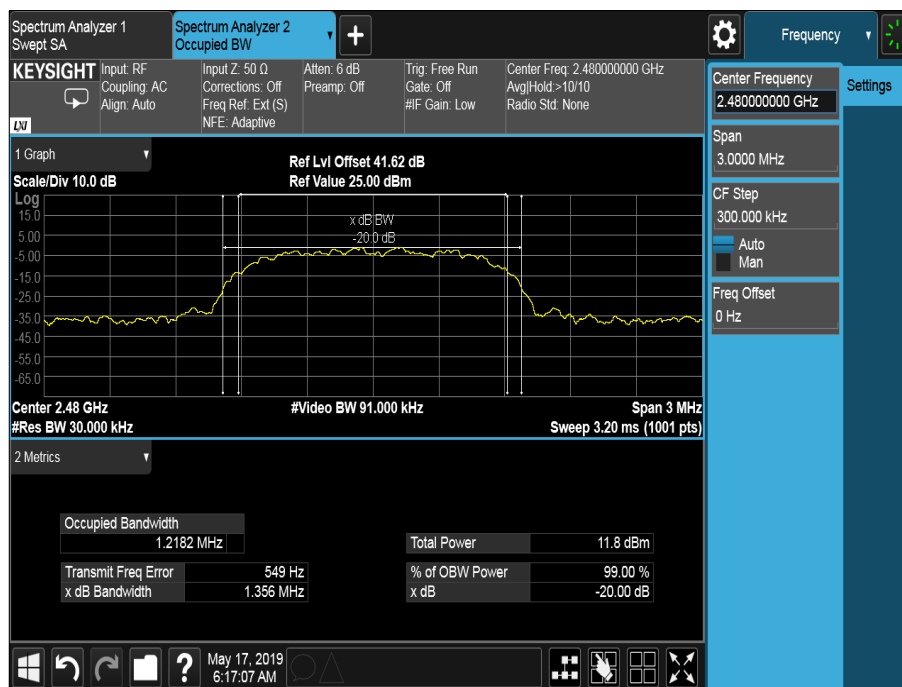


Figure 25 - 2480 MHz - 8-DPSK

## 2.5.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument             | Manufacturer          | Type No                   | TE No | Calibration Period (months) | Calibration Due |
|------------------------|-----------------------|---------------------------|-------|-----------------------------|-----------------|
| Attenuator (10dB/250W) | Weinschel             | 45-10-43                  | 383   | 12                          | 23-Oct-2019     |
| Multimeter             | Fluke                 | 79 Series III             | 611   | 12                          | 07-Sep-2019     |
| Hygrometer             | Rotronic              | I-1000                    | 3220  | 12                          | 13-Sep-2019     |
| Network Analyser       | Rohde & Schwarz       | ZVA 40                    | 3548  | 12                          | 17-Oct-2019     |
| Calibration Unit       | Rohde & Schwarz       | ZV-Z54                    | 4368  | 12                          | 22-Oct-2019     |
| Frequency Standard     | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 15-Oct-2019     |
| EXA                    | Keysight Technologies | N9010B                    | 4968  | 24                          | 21-Dec-2019     |
| Cable (18 GHz)         | Rosenberger           | LU7-071-1000              | 5099  | 12                          | 04-Oct-2019     |

Table 13



## 2.6 Authorised Band Edges

### 2.6.1 Specification Reference

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

### 2.6.2 Equipment Under Test and Modification State

SC2124, S/N: 2PS001845GM55XT - Modification State 0

### 2.6.3 Date of Test

05-June-2019

### 2.6.4 Test Method

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

The following conversion can be applied to convert from dB $\mu$ V/m to  $\mu$ V/m:  
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$ .

### 2.6.5 Environmental Conditions

Ambient Temperature 21.6 °C  
Relative Humidity 49.2 %

### 2.6.6 Test Results

#### Bluetooth - Transmit

| Mode    | Modulation    | Packet Type | Frequency (MHz) | Measured Frequency (MHz) | Level (dBc) |
|---------|---------------|-------------|-----------------|--------------------------|-------------|
| Static  | GFSK          | DH5         | 2402            | 2400.0                   | -56.27      |
| Static  | $\pi/4$ DQPSK | 2DH5        | 2402            | 2400.0                   | -50.12      |
| Static  | 8-DPSK        | 3DH5        | 2402            | 2400.0                   | -48.75      |
| Static  | GFSK          | DH5         | 2480            | 2483.5                   | -55.74      |
| Static  | $\pi/4$ DQPSK | 2DH5        | 2480            | 2483.5                   | -51.48      |
| Static  | 8-DPSK        | 3DH5        | 2480            | 2483.5                   | -53.01      |
| Hopping | GFSK          | DH5         | 2402            | 2400.0                   | -59.20      |
| Hopping | $\pi/4$ DQPSK | 2DH5        | 2402            | 2400.0                   | -55.83      |
| Hopping | 8-DPSK        | 3DH5        | 2402            | 2400.0                   | -56.63      |
| Hopping | GFSK          | DH5         | 2480            | 2483.5                   | -53.93      |
| Hopping | $\pi/4$ DQPSK | 2DH5        | 2480            | 2483.5                   | -55.69      |
| Hopping | 8-DPSK        | 3DH5        | 2480            | 2483.5                   | -55.22      |

Table 14

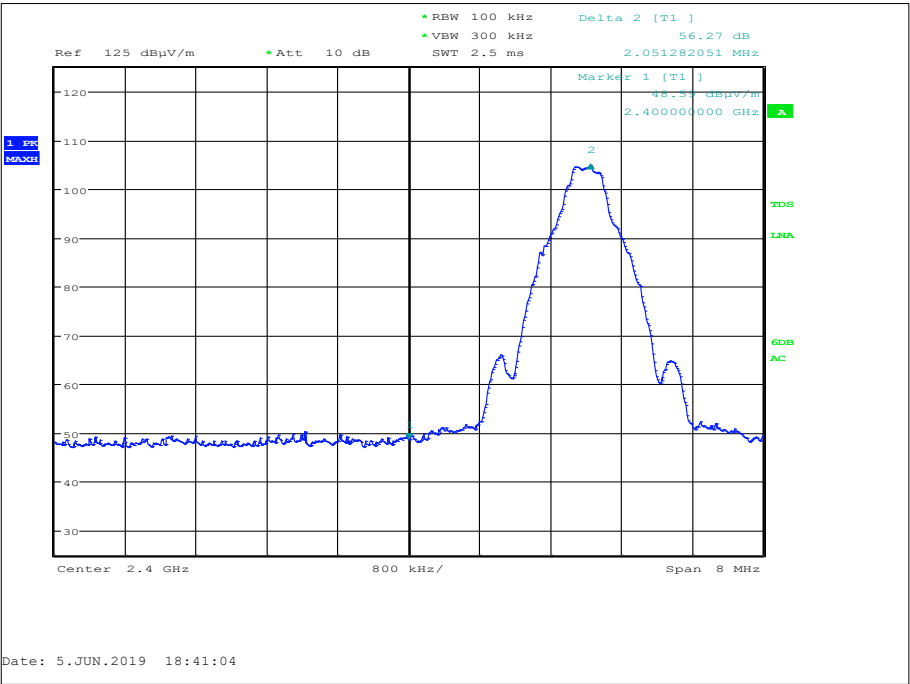


Figure 26 - Static - GFSK/DH5 - 2402 MHz - Measured Frequency 2400.0 MHz

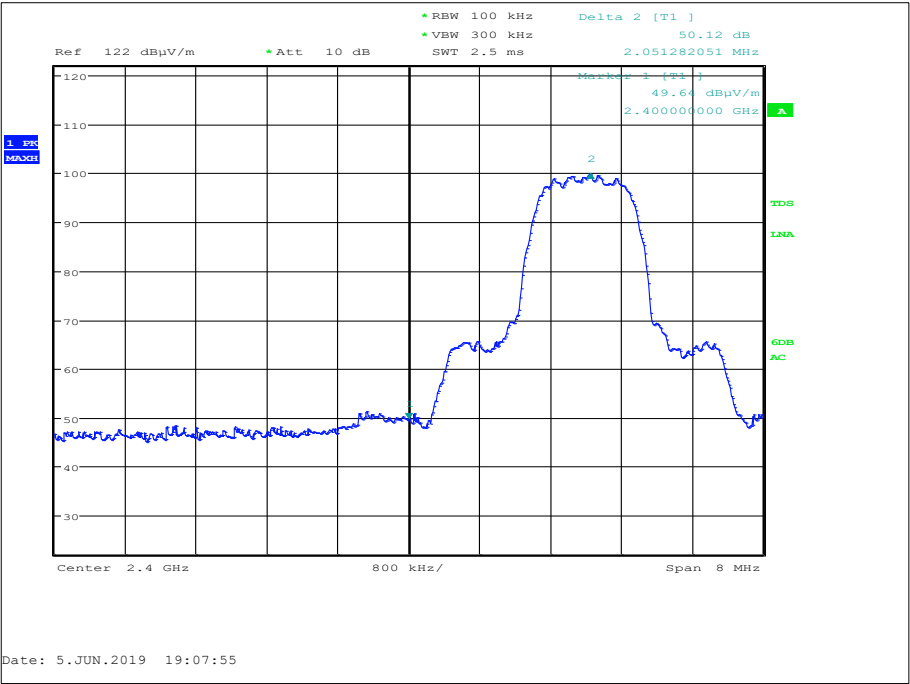


Figure 27 - Static -  $\pi/4$  DQPSK/2DH5 - 2402 MHz - Measured Frequency 2400.0 MHz



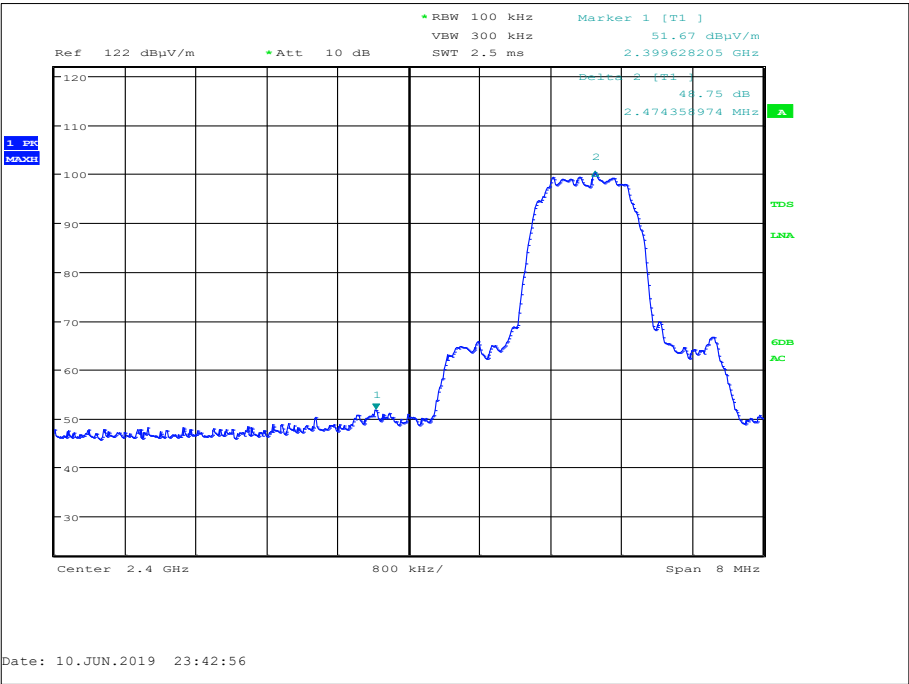


Figure 28 - Static - 8-DPSK/3DH5 - 2402 MHz - Measured Frequency 2400.0 MHz

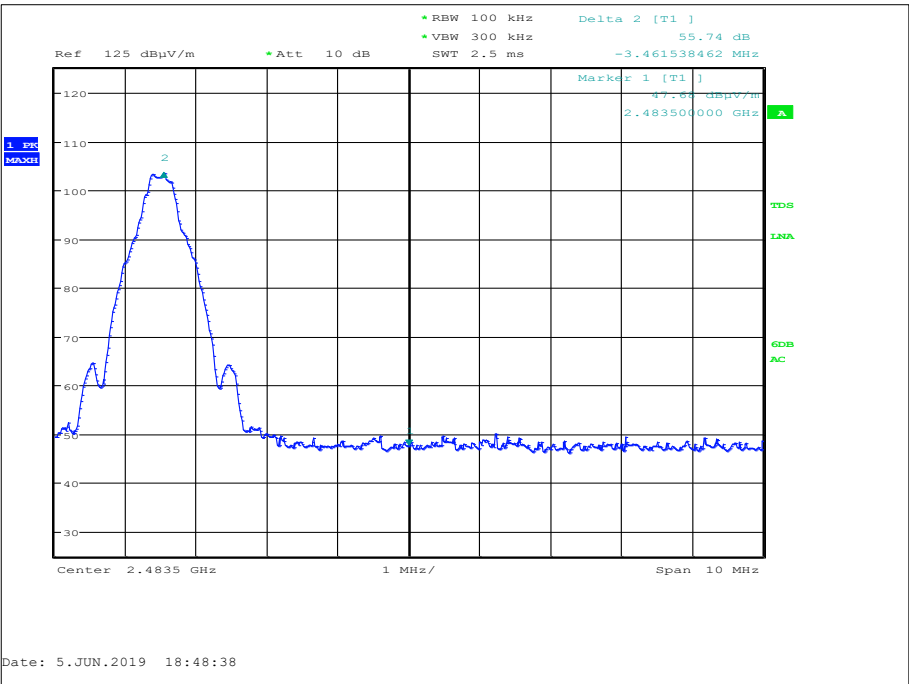


Figure 29 - Static - GFSK/DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

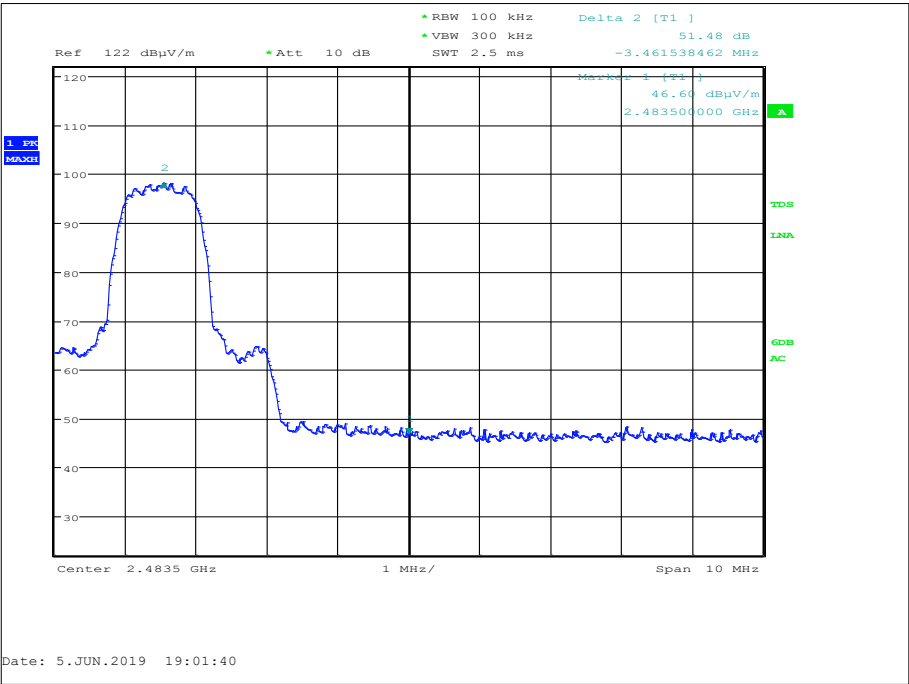


Figure 30 - Static -  $\pi/4$  DQPSK/2DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

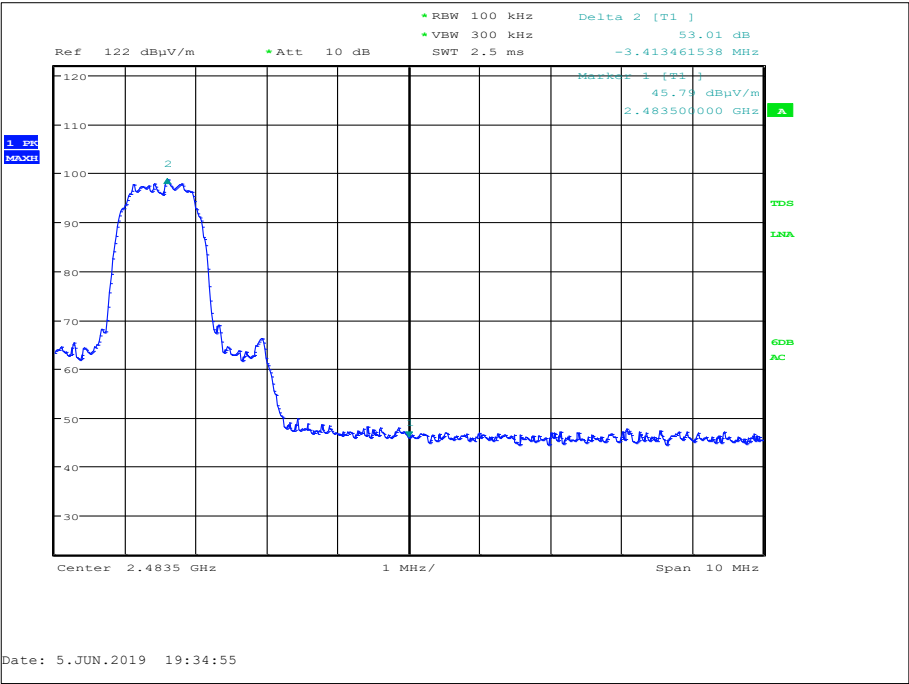


Figure 31 - Static - 8-DPSK/3DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

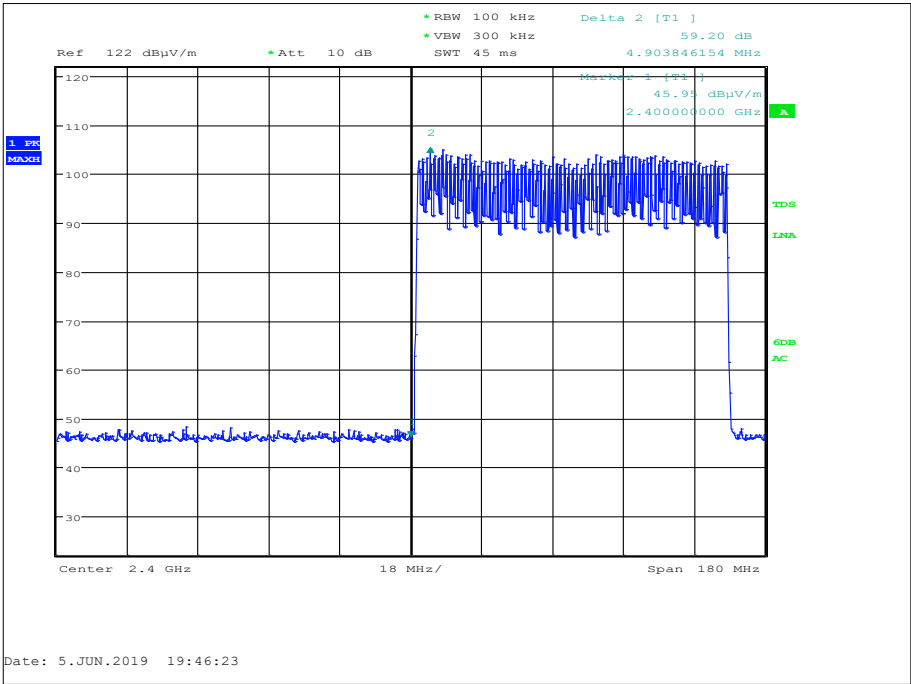


Figure 32 - Hopping - GFSK/DH5 - 2402 MHz - Measured Frequency 2400.0 MHz

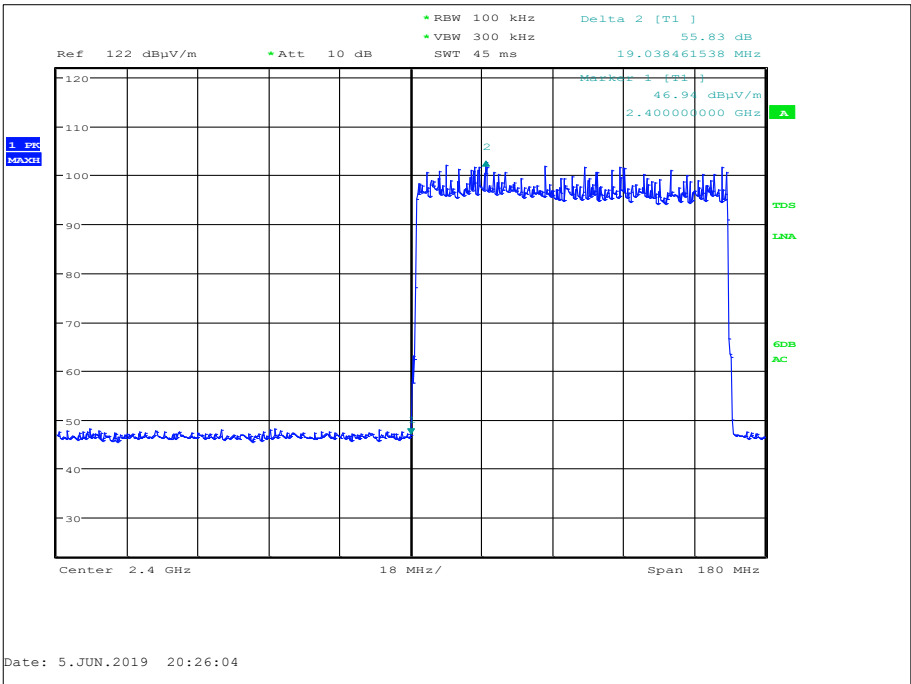


Figure 33 - Hopping -  $\pi/4$  DQPSK/2DH5 - 2402 MHz - Measured Frequency 2400.0 MHz

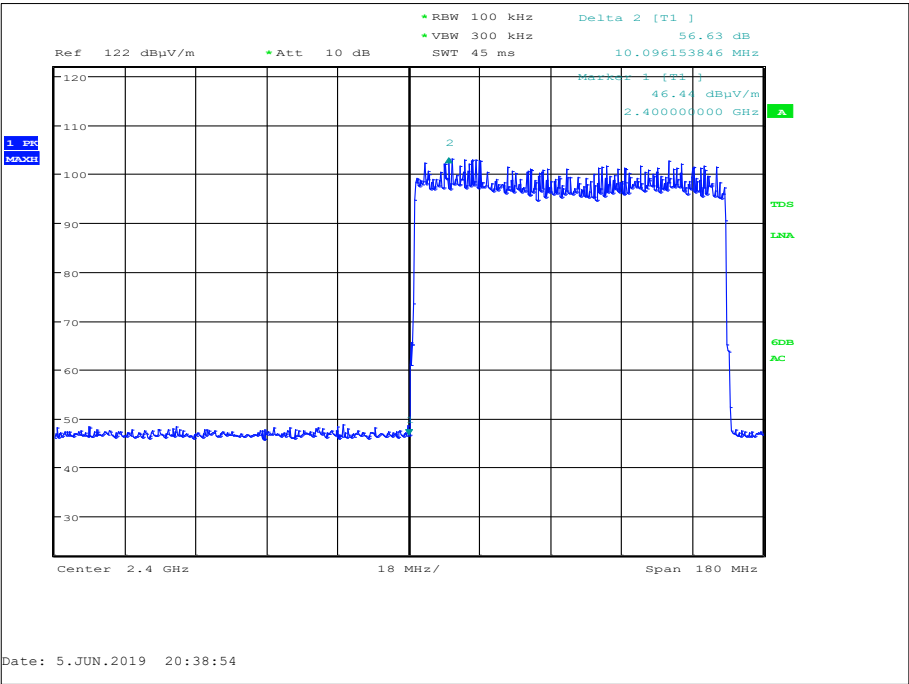


Figure 34 - Hopping - 8-DPSK/3DH5 - 2402 MHz - Measured Frequency 2400.0 MHz

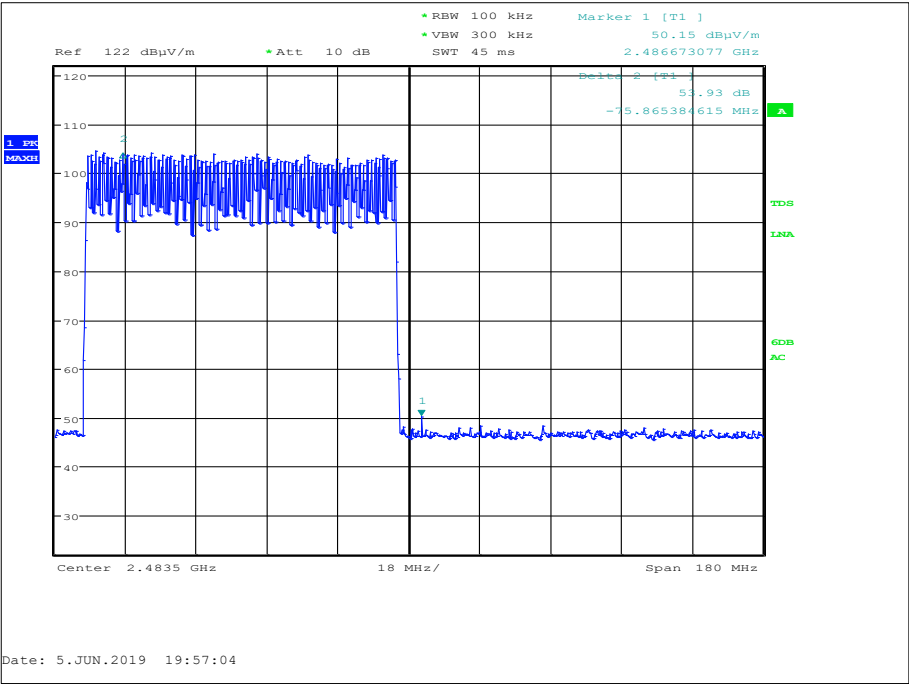


Figure 35 - Hopping - GFSK/DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

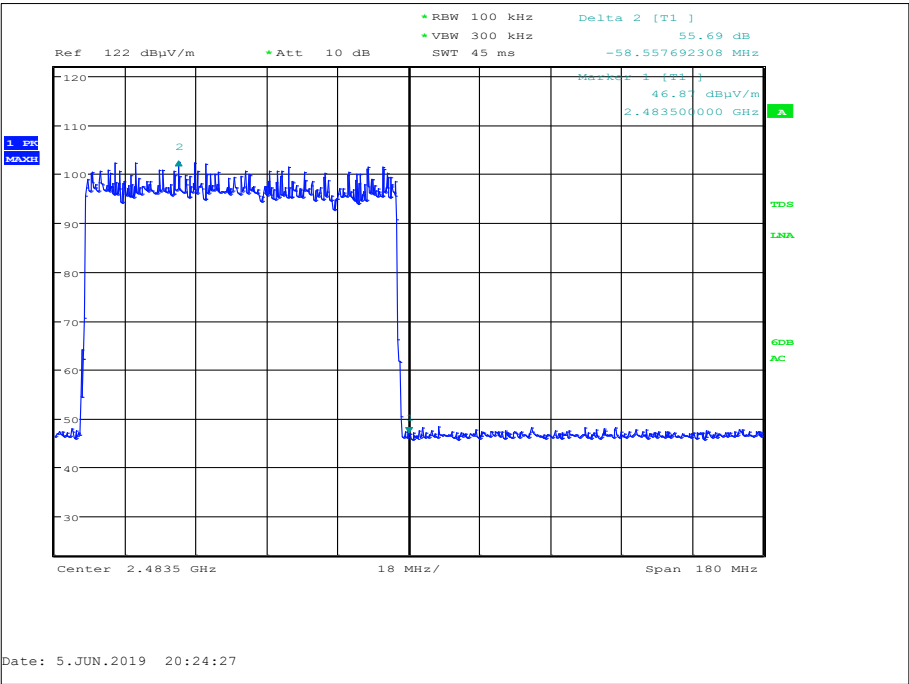


Figure 36 - Hopping -  $\pi/4$  DQPSK/2DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

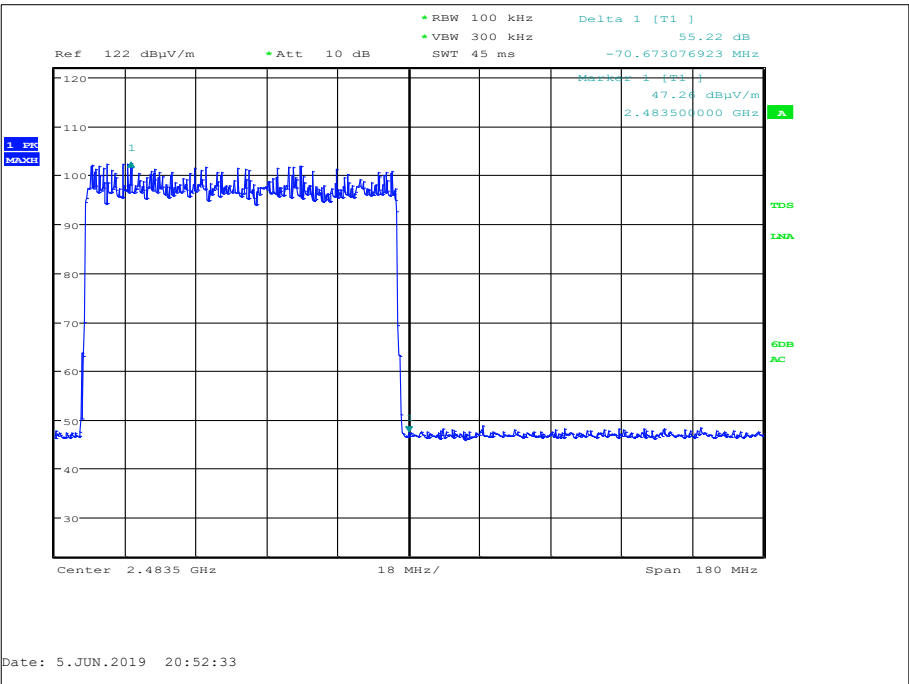


Figure 37 - Hopping - 8-DPSK/3DH5 - 2480 MHz - Measured Frequency 2483.5 MHz



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.

ISED 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.

## 2.6.7 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        | HYGROPALM 1       | 2338  | 12                          | 15-Nov-2019     |
| Hygrometer                          | Rotronic        | A1                | 2677  | 12                          | 20-Feb-2020     |
| EMI Test Receiver                   | Rohde & Schwarz | ESU40             | 3506  | 12                          | 17-Dec-2019     |
| Cable (Rx, Km-Km 2m)                | Scott Cables    | KPS-1501-2000-KPS | 4526  | 6                           | 26-Apr-2019     |
| 1 - 18GHz DRG Antenna               | ETS-Lindgren    | 3117              | 4738  | 12                          | 05-Mar-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     |
| 8m N-Type RF Cable                  | Teledyne        | PR90-088-8MTR     | 5093  | 12                          | 04-Oct-2019     |
| Cable (18 GHz)                      | Rosenberger     | LU7-071-2000      | 5109  | 12                          | 05-Oct-2019     |
| EmX Software                        | TUV SUD         | EmX               | 5125  | -                           | Software        |

**Table 15**

TU - Traceability Unscheduled



## 2.7 Restricted Band Edges

### 2.7.1 Specification Reference

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

### 2.7.2 Equipment Under Test and Modification State

SC2124, S/N: 2PS001845GM55XT - Modification State 0

### 2.7.3 Date of Test

05-June-2019

### 2.7.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5.

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3.

These are shown for information purposes and were used to determine the worst case measurement point. Final average measurements were then taken in accordance with ANSI C63.10 clause 4.1.4.2.2. to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dBμV/m to μV/m:  
 $10^{(\text{Field Strength in dB}\mu\text{V/m}/20)}$ .

### 2.7.5 Environmental Conditions

Ambient Temperature 21.6 °C  
Relative Humidity 49.2 %

### 2.7.6 Test Results

#### Bluetooth - Transmit

| Mode    | Modulation | Packet Type | Frequency (MHz) | Measured Frequency (MHz) | Peak Level (dBμV/m) | Average Level (dBμV/m) |
|---------|------------|-------------|-----------------|--------------------------|---------------------|------------------------|
| Static  | GFSK       | DH5         | 2402            | 2390.0                   | 55.84               | 43.12                  |
| Static  | π/4 DQPSK  | 2DH5        | 2402            | 2390.0                   | 53.62               | 42.72                  |
| Static  | 8-DPSK     | 3DH5        | 2402            | 2390.0                   | 53.46               | 42.84                  |
| Static  | GFSK       | DH5         | 2480            | 2483.5                   | 55.91               | 44.15                  |
| Static  | π/4 DQPSK  | 2DH5        | 2480            | 2483.5                   | 55.69               | 44.82                  |
| Static  | 8-DPSK     | 3DH5        | 2480            | 2483.5                   | 56.34               | 44.96                  |
| Hopping | GFSK       | DH5         | 2402            | 2390.0                   | 53.75               | 43.25                  |
| Hopping | π/4 DQPSK  | 2DH5        | 2402            | 2390.0                   | 54.20               | 42.26                  |
| Hopping | 8-DPSK     | 3DH5        | 2402            | 2390.0                   | 53.99               | 42.24                  |
| Hopping | GFSK       | DH5         | 2480            | 2483.5                   | 53.12               | 45.00                  |
| Hopping | π/4 DQPSK  | 2DH5        | 2480            | 2483.5                   | 53.75               | 45.25                  |
| Hopping | 8-DPSK     | 3DH5        | 2480            | 2483.5                   | 53.48               | 43.09                  |

Table 16

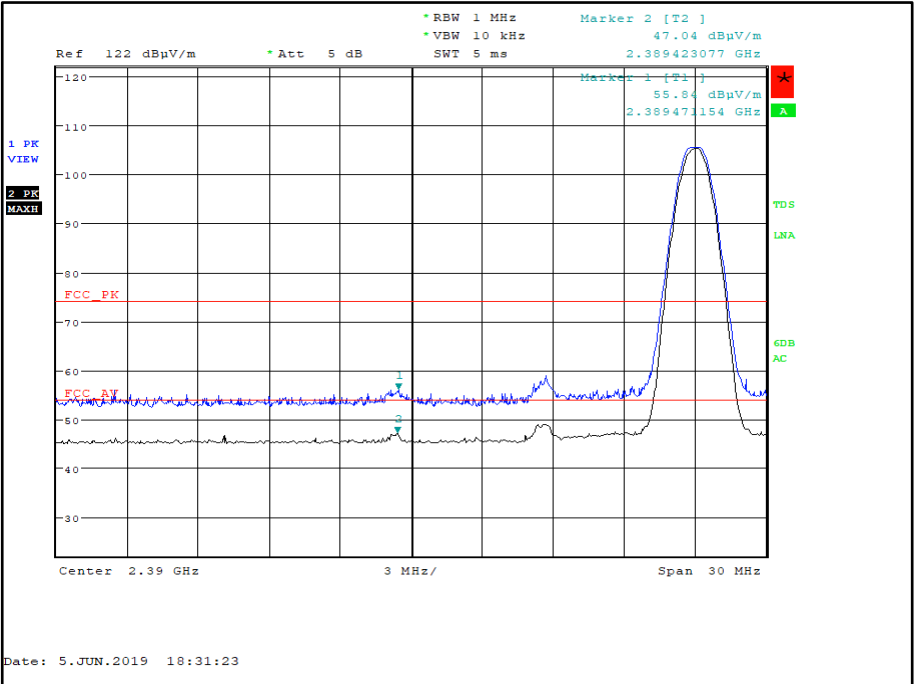


Figure 38 - Static - GFSK/DH5 - 2402 MHz - Measured Frequency 2390.0 MHz

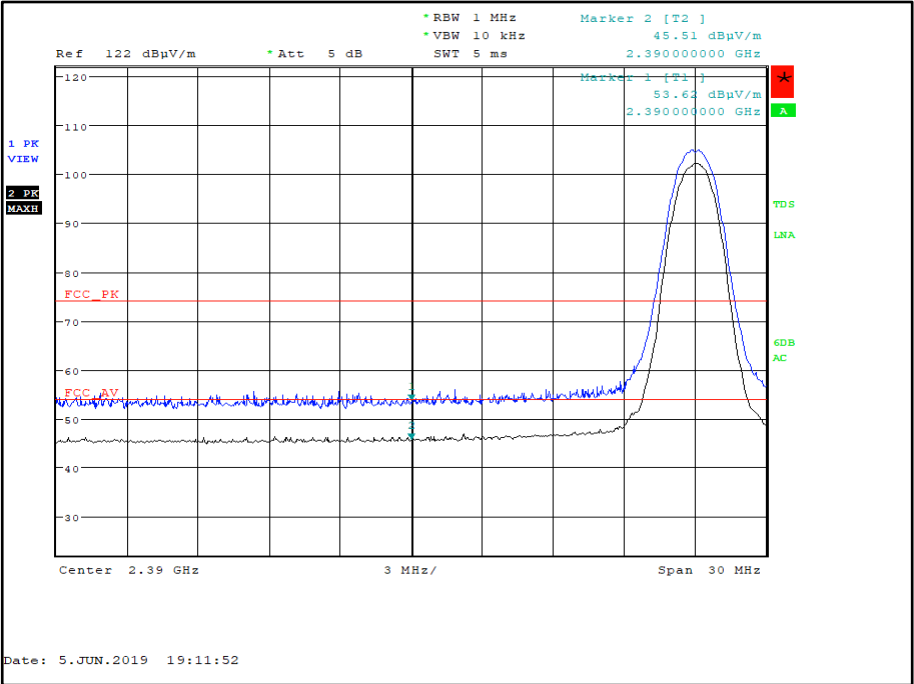


Figure 39 - Static -  $\pi/4$  DQPSK/2DH5 - 2402 MHz - Measured Frequency 2390.0 MHz



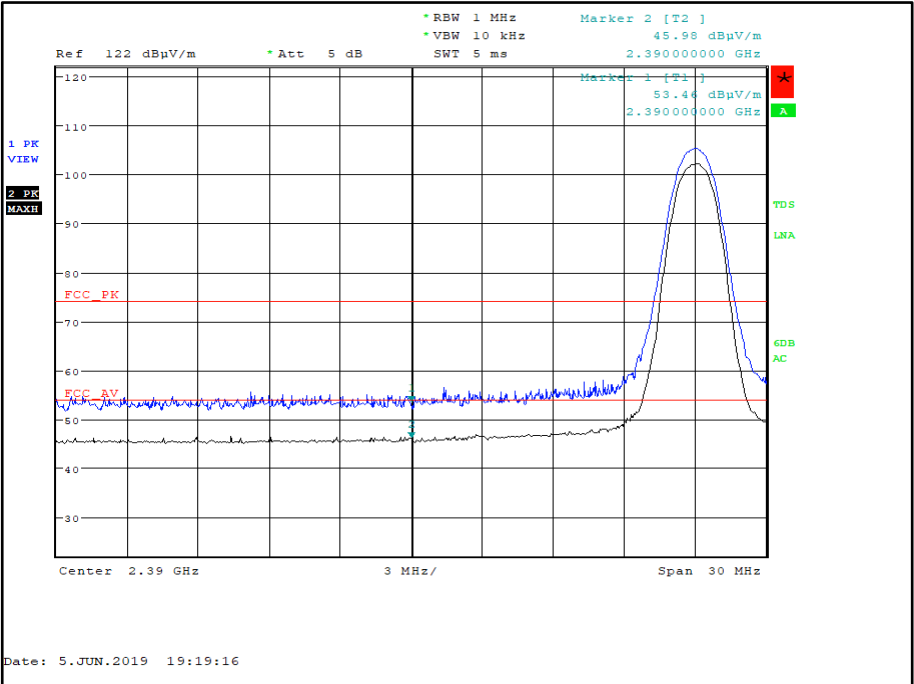


Figure 40 - Static - 8-DPSK/3DH5 - 2402 MHz - Measured Frequency 2390.0 MHz

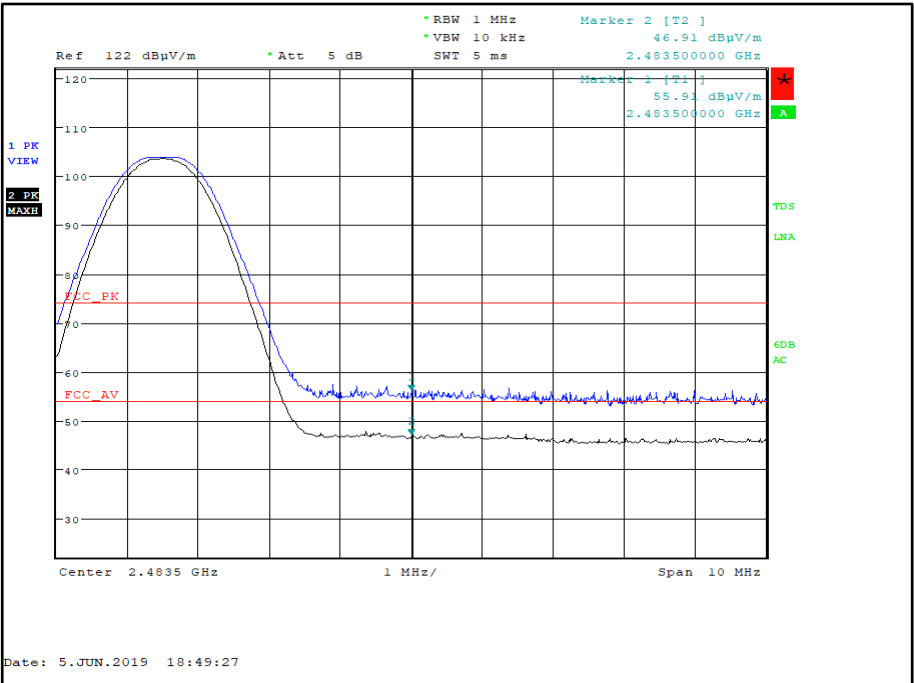


Figure 41 - Static - GFSK/DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

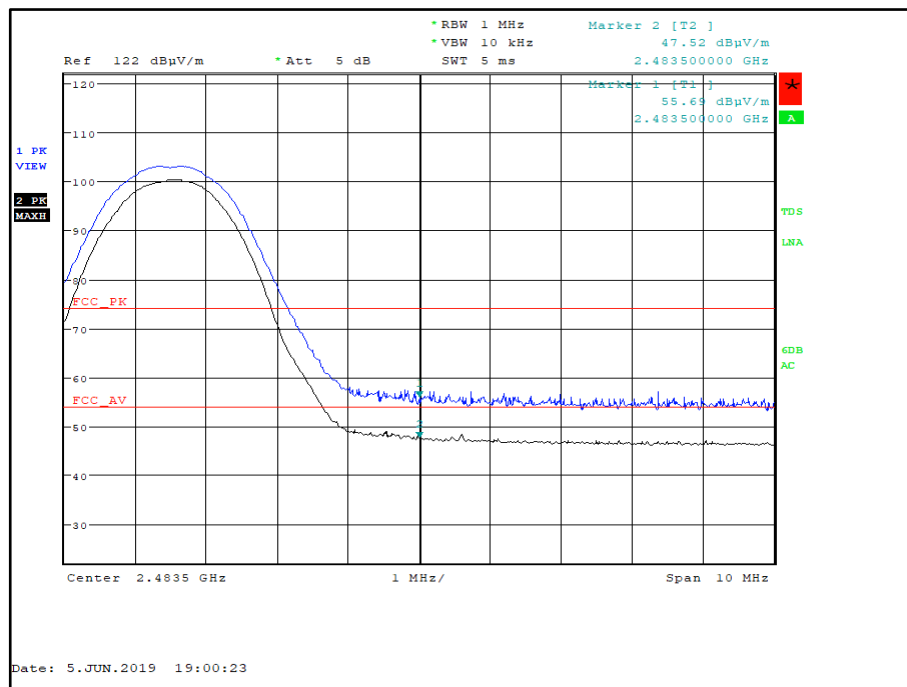


Figure 42 - Static -  $\pi/4$  DQPSK/2DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

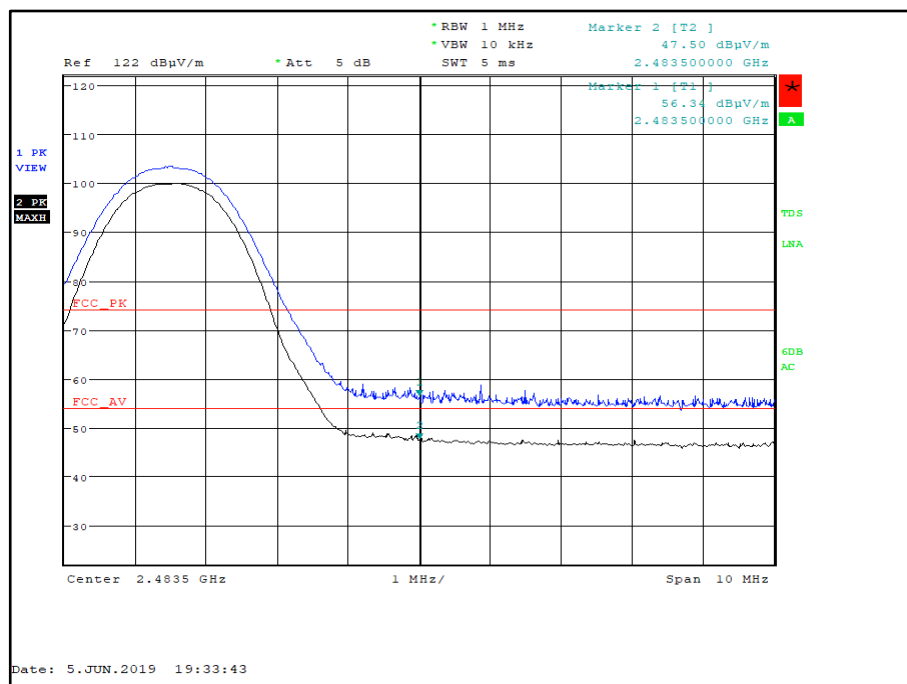


Figure 43 - Static - 8-DPSK/3DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

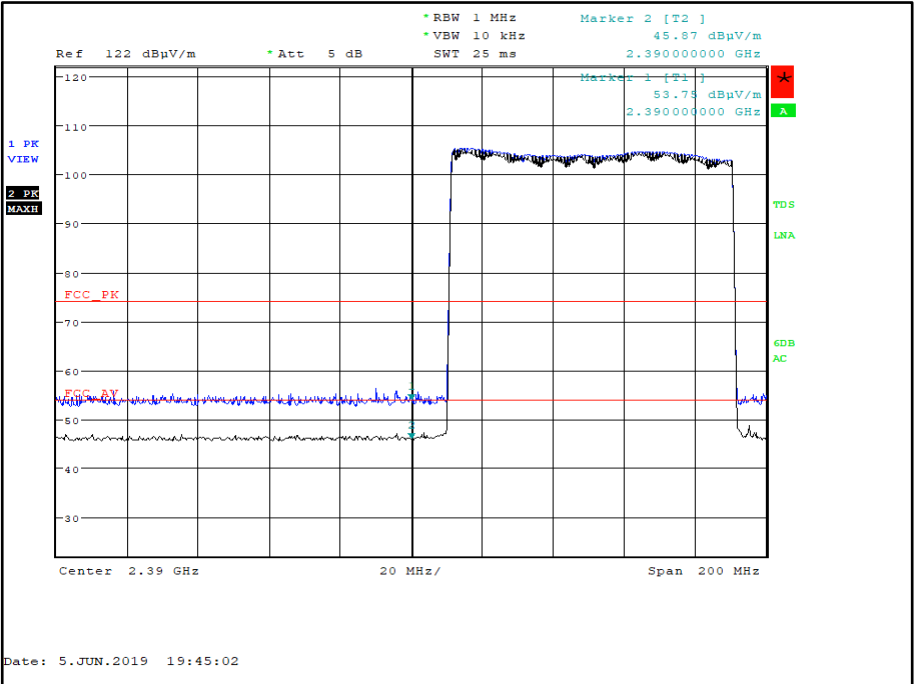


Figure 44 - Hopping - GFSK/DH5 - 2402 MHz - Measured Frequency 2390.0 MHz

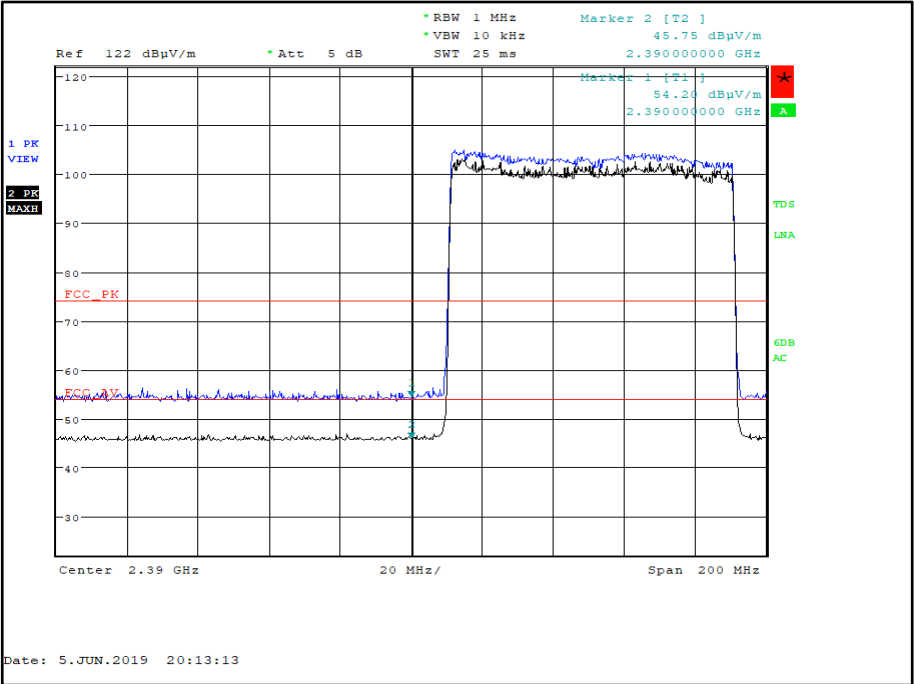


Figure 45 - Hopping -  $\pi/4$  DQPSK/2DH5 - 2402 MHz - Measured Frequency 2390.0 MHz

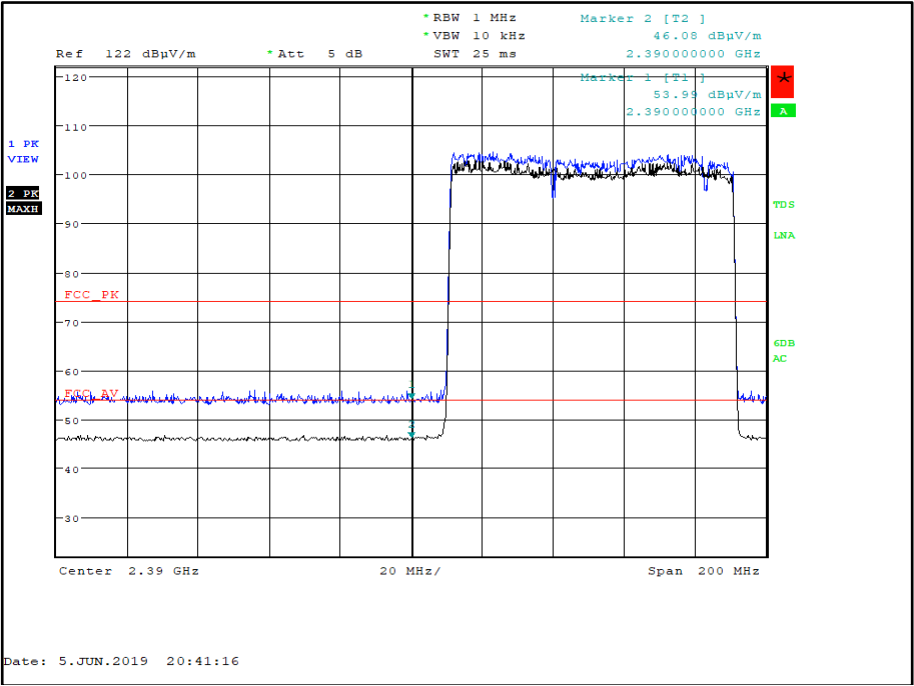


Figure 46 - Hopping - 8-DPSK/3DH5 - 2402 MHz - Measured Frequency 2390.0 MHz

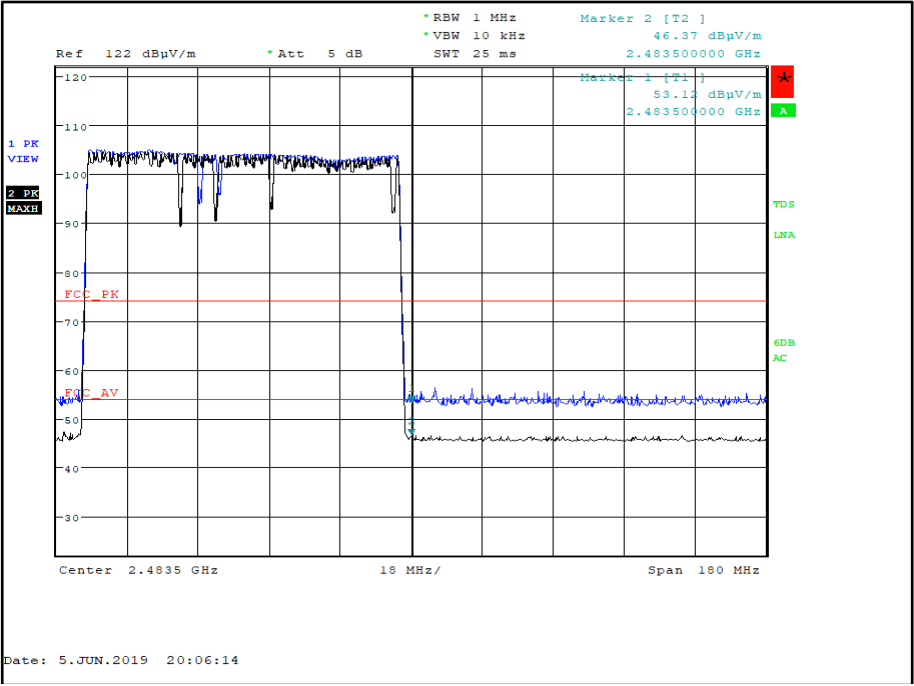


Figure 47 - Hopping - GFSK/DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

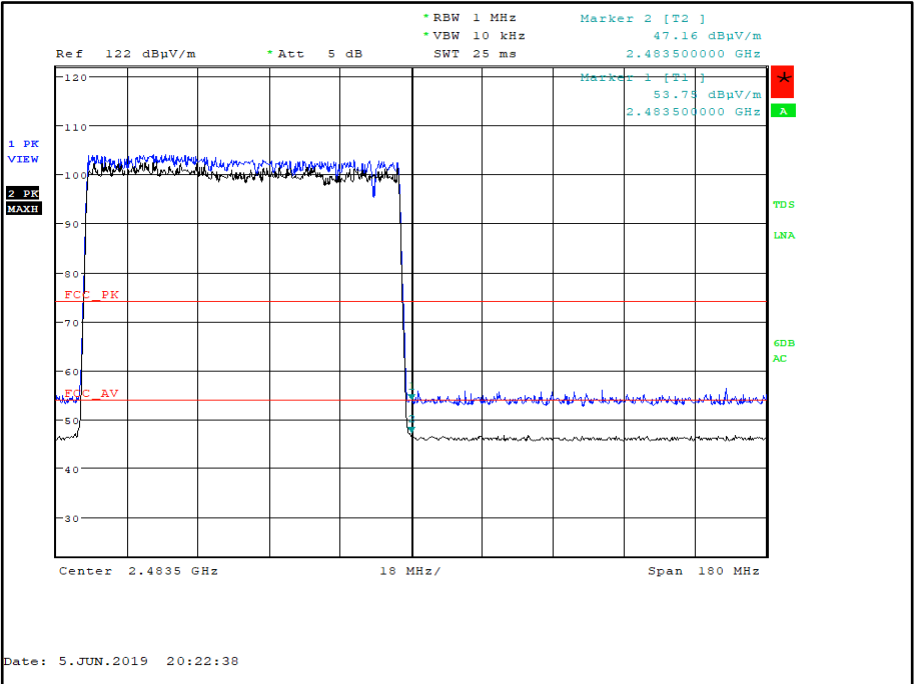


Figure 48 - Hopping -  $\pi/4$  DQPSK/2DH5 - 2480 MHz - Measured Frequency 2483.5 MHz

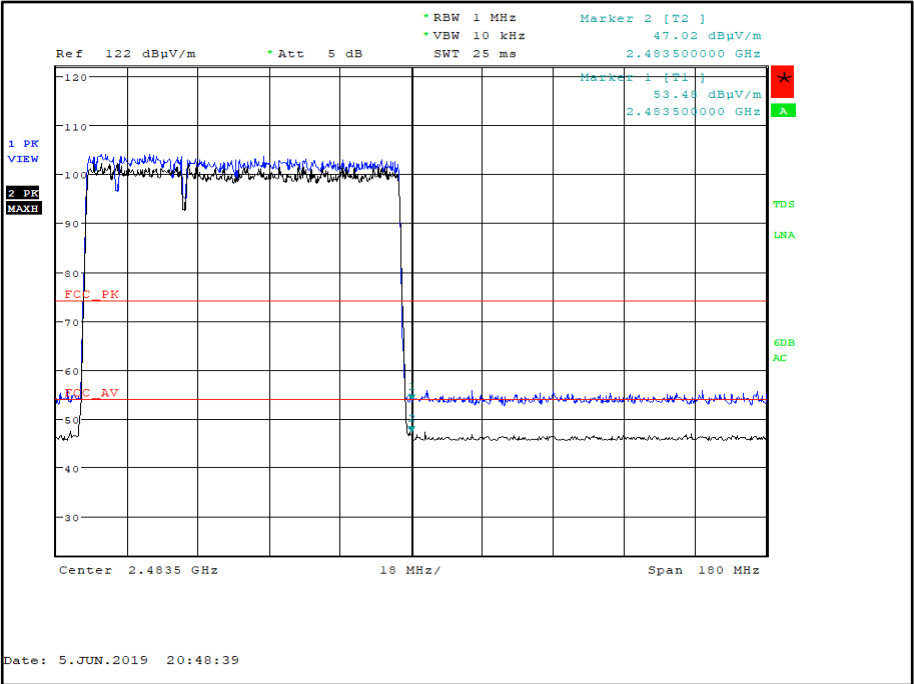


Figure 49 - Hopping - 8-DPSK/3DH5 - 2480 MHz - Measured Frequency 2483.5 MHz



FCC 47 CFR Part 15, Limit Clause 15.209

| Frequency (MHz) | Field Strength ( $\mu\text{V}/\text{m}$ at 3 m) |
|-----------------|-------------------------------------------------|
| 30 to 88        | 100                                             |
| 88 to 216       | 150                                             |
| 216 to 960      | 200                                             |
| Above 960       | 500                                             |

**Table 17**

ISED RSS-GEN, Limit Clause 8.9

| Frequency (MHz) | Field Strength ( $\mu\text{V}/\text{m}$ at 3 metres) |
|-----------------|------------------------------------------------------|
| 30-88           | 100                                                  |
| 88-216          | 150                                                  |
| 216-960         | 200                                                  |
| Above 960*      | 500                                                  |

**Table 18**

\*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.



## 2.7.7 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        | HYGROPALM 1       | 2338  | 12                          | 15-Nov-2019     |
| Hygrometer                          | Rotronic        | A1                | 2677  | 12                          | 20-Feb-2020     |
| EMI Test Receiver                   | Rohde & Schwarz | ESU40             | 3506  | 12                          | 17-Dec-2019     |
| Cable (Rx, Km-Km 2m)                | Scott Cables    | KPS-1501-2000-KPS | 4526  | 6                           | 11-June-2019    |
| 1 - 18GHz DRG Antenna               | ETS-Lindgren    | 3117              | 4738  | 12                          | 05-Mar-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     |
| 8m N-Type RF Cable                  | Teledyne        | PR90-088-8MTR     | 5093  | 12                          | 04-Oct-2019     |
| Cable (18 GHz)                      | Rosenberger     | LU7-071-2000      | 5109  | 12                          | 05-Oct-2019     |
| EmX Software                        | TUV SUD         | EmX               | 5125  | -                           | Software        |

**Table 19**

TU - Traceability Unscheduled



## **2.8 Spurious Radiated Emissions**

### **2.8.1 Specification Reference**

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

### **2.8.2 Equipment Under Test and Modification State**

SC2124, S/N: 2PS001845GM55XT - Modification State 0

### **2.8.3 Date of Test**

05-June-2019 to 07-June-2019

### **2.8.4 Test Method**

This test was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6. The plots show 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.

For frequencies greater than 1 GHz, plots for average measurements were taken with an RMS detector and a max hold trace 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.

If emissions were found to be pulsed, final measurements were taken in accordance with ANSI C63.10 clause 7.5. A peak measurement is performed. A duty cycle correction factor is then determined by the expression  $\text{duty (dB)} = 20\log(\text{On Time}/(\text{On Time} + \text{Off Time}))$ . This factor is then added to the peak value to determine the average value.

The following conversion can be applied to convert from dBuV/m to uV/m:  $10^{(\text{Field Strength in dBuV/m}/20)}$ .

For frequencies greater than 18 GHz, the measurement distance was reduced to 1 meter and the limit line was increased by  $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$ .

### **2.8.5 Environmental Conditions**

|                     |         |
|---------------------|---------|
| Ambient Temperature | 20.1 °C |
| Relative Humidity   | 58.8 %  |





2.8.6 Test Results

Bluetooth - Transmit

Testing was performed on the modulation and packet type which resulted in the highest conducted output power. The Modulation/Packet type was 8-DPSK/3DH5.

| Frequency (MHz) | Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|-----------------|----------------|----------------|-------------|----------|-----------|-------------|--------------|-------------|
| *               |                |                |             |          |           |             |              |             |

Table 20 - 2402 MHz - 30 MHz to 1 GHz Emissions Results

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

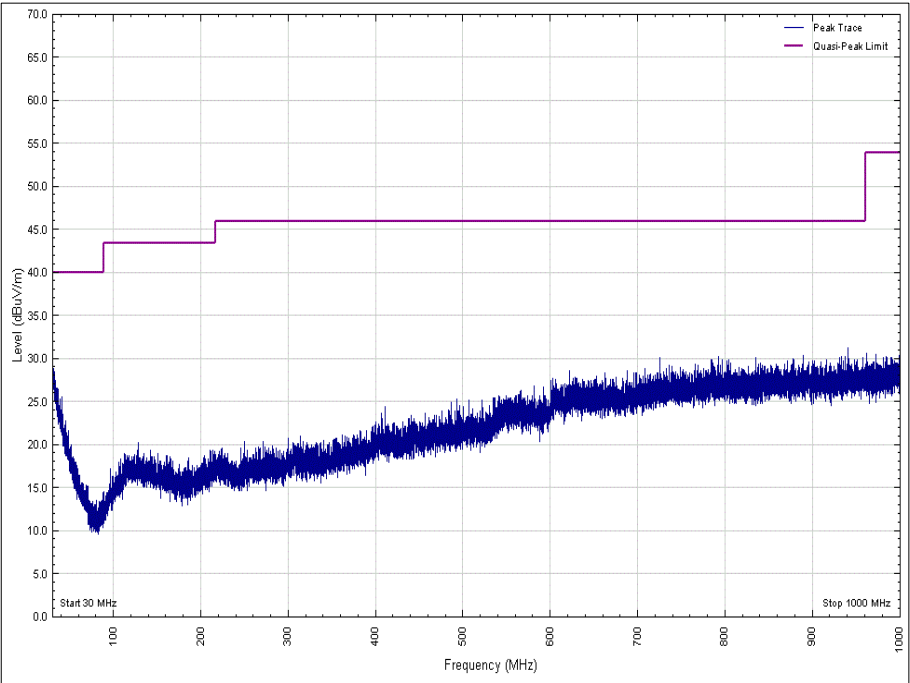
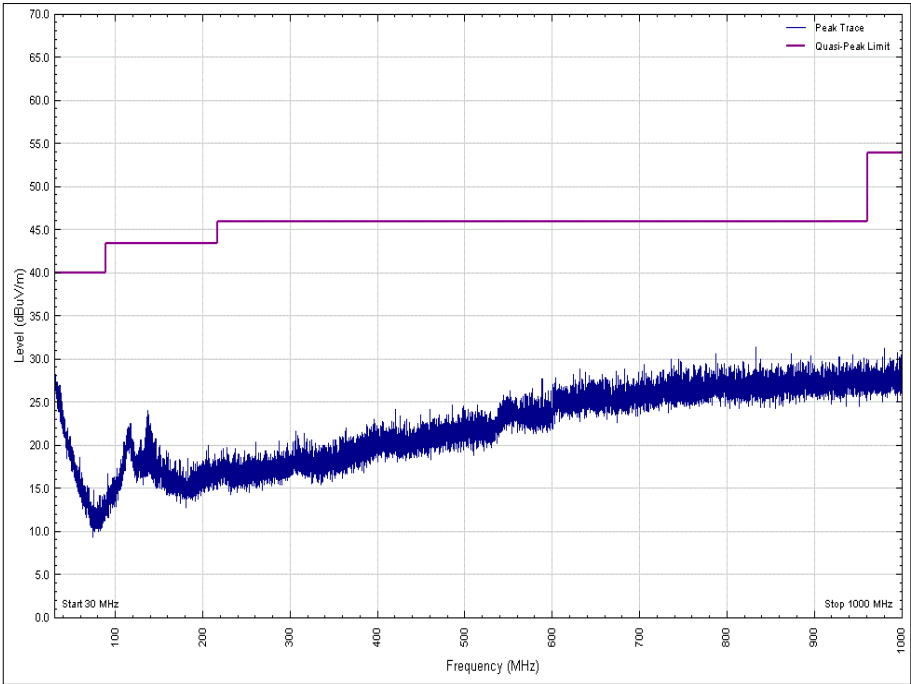
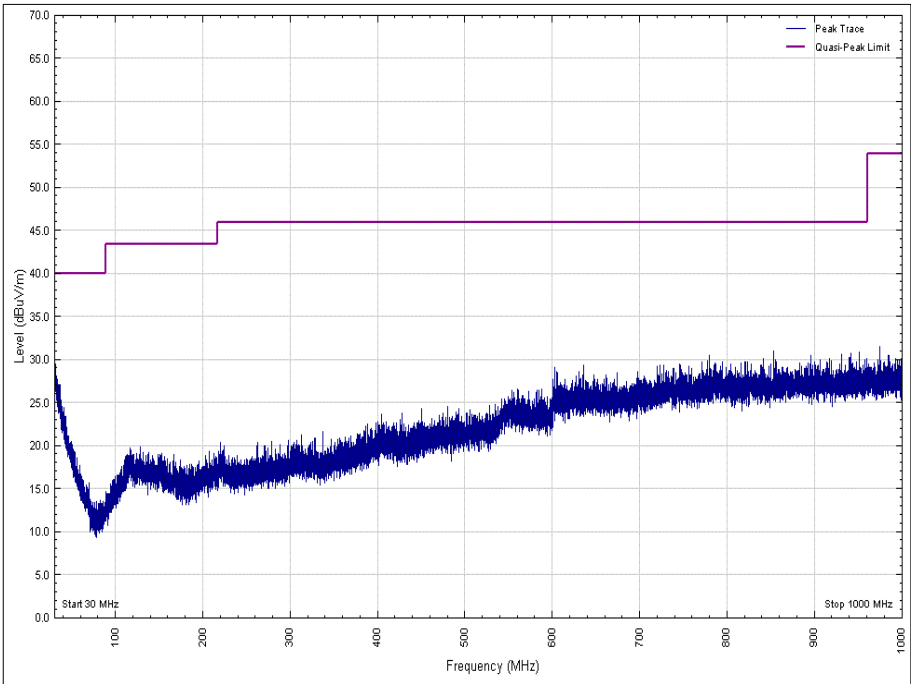


Figure 50 - 2402 MHz - 30 MHz to 1 GHz  
Polarity: Vertical, EUT Orientation: X



**Figure 51 - 2402 MHz - 30 MHz to 1 GHz**  
**Polarity: Horizontal, EUT Orientation: X**



**Figure 52 - 2402 MHz - 30 MHz to 1 GHz**  
**Polarity: Vertical, EUT Orientation: Y**

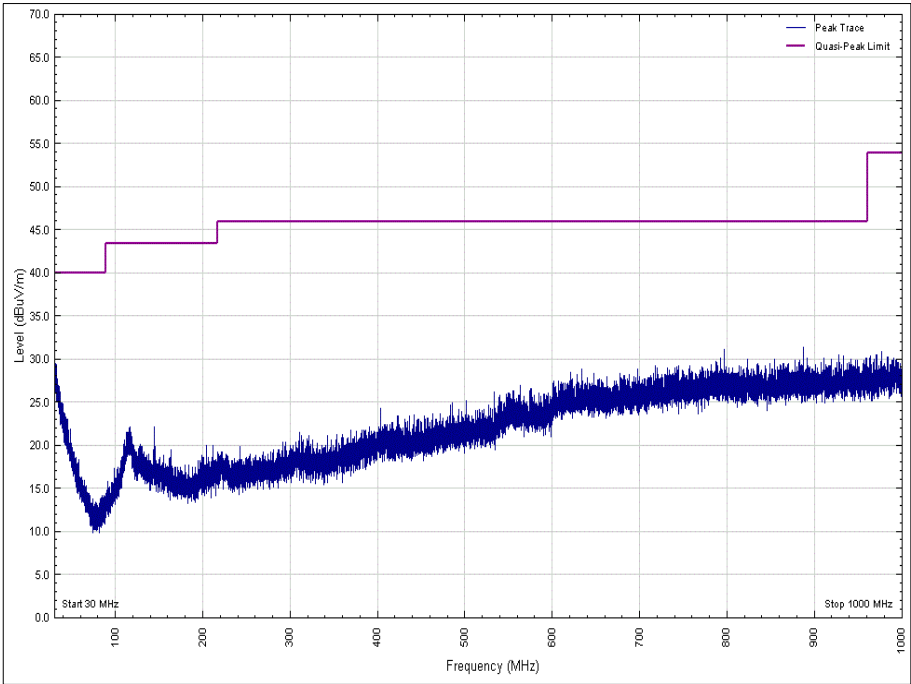


Figure 53 - 2402 MHz - 30 MHz to 1 GHz  
Polarity: Horizontal, EUT Orientation: Y

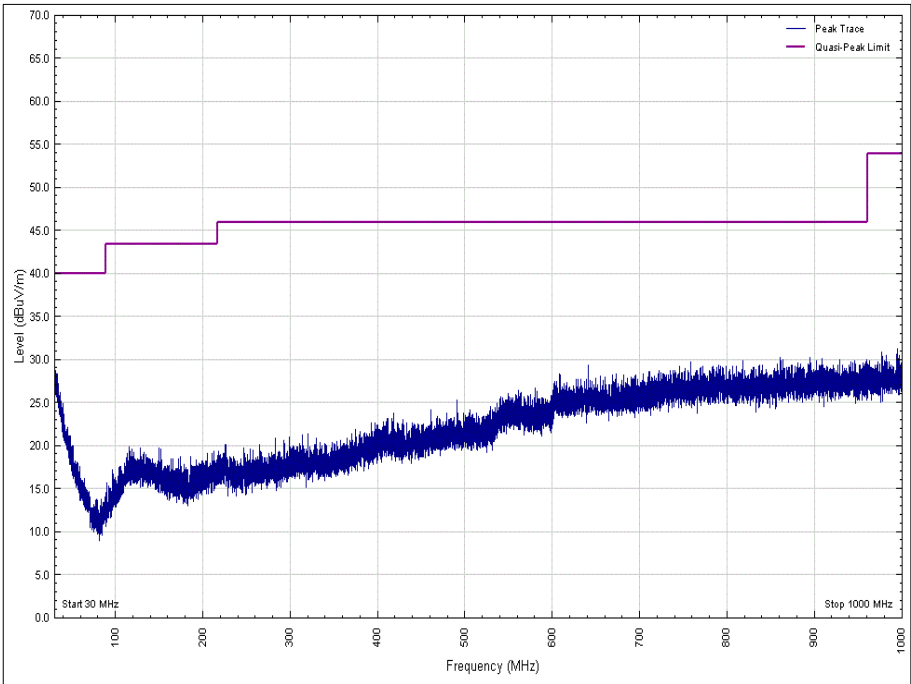
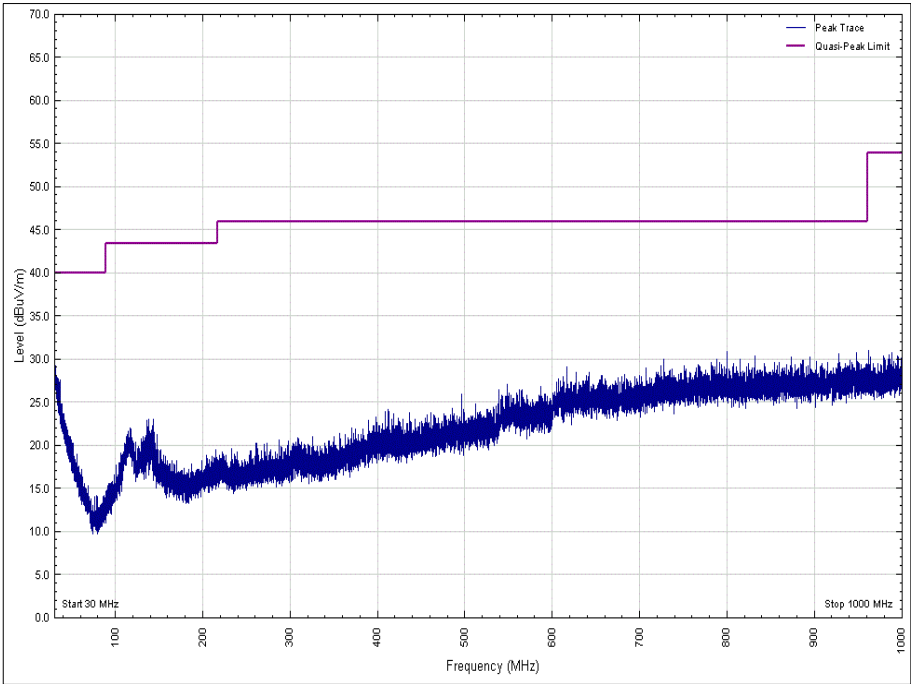


Figure 54 - 2402 MHz - 30 MHz to 1 GHz  
Polarity: Vertical, EUT Orientation: Z



**Figure 55 - 2402 MHz - 30 MHz to 1 GHz**  
**Polarity: Horizontal, EUT Orientation: Z**



| Frequency (GHz) | Result (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dBµV/m) |         |
|-----------------|-----------------|---------|----------------|---------|-----------------|---------|
|                 | Peak            | Average | Peak           | Average | Peak            | Average |
| *               |                 |         |                |         |                 |         |

Table 21 - 2402 MHz - 1 GHz to 25 GHz Emissions Results

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

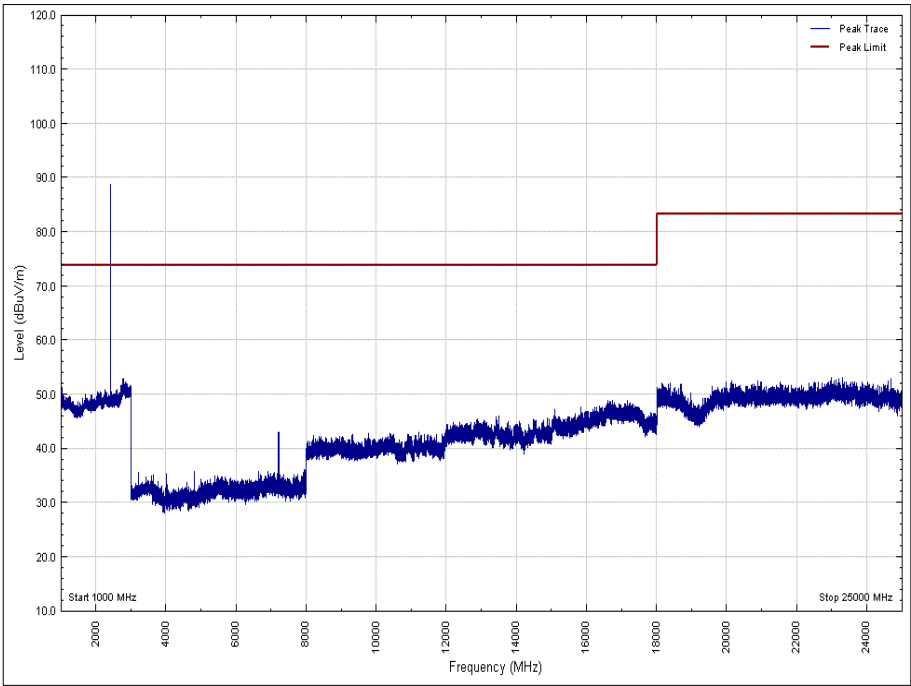
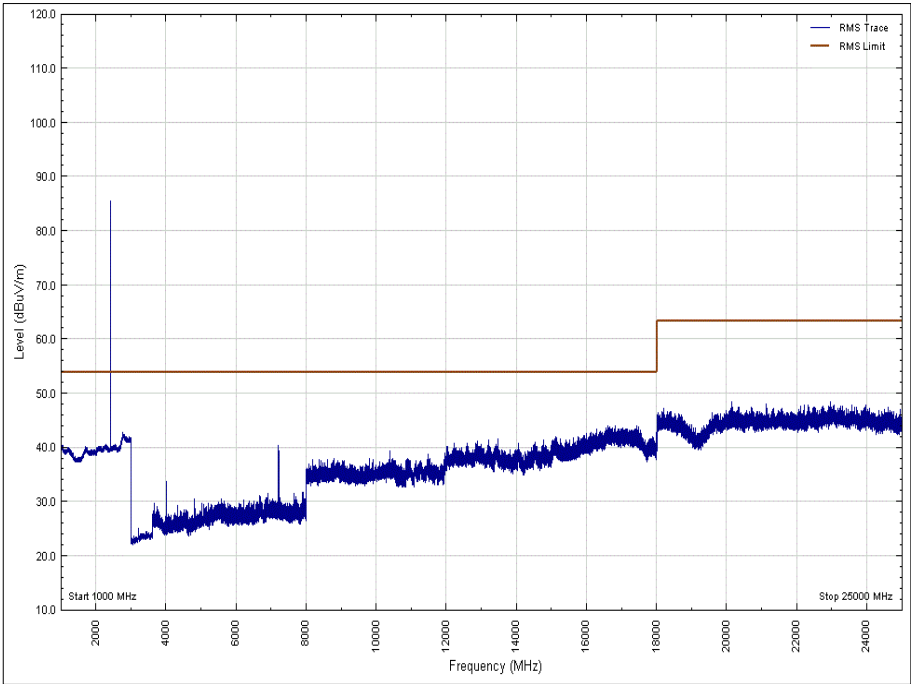
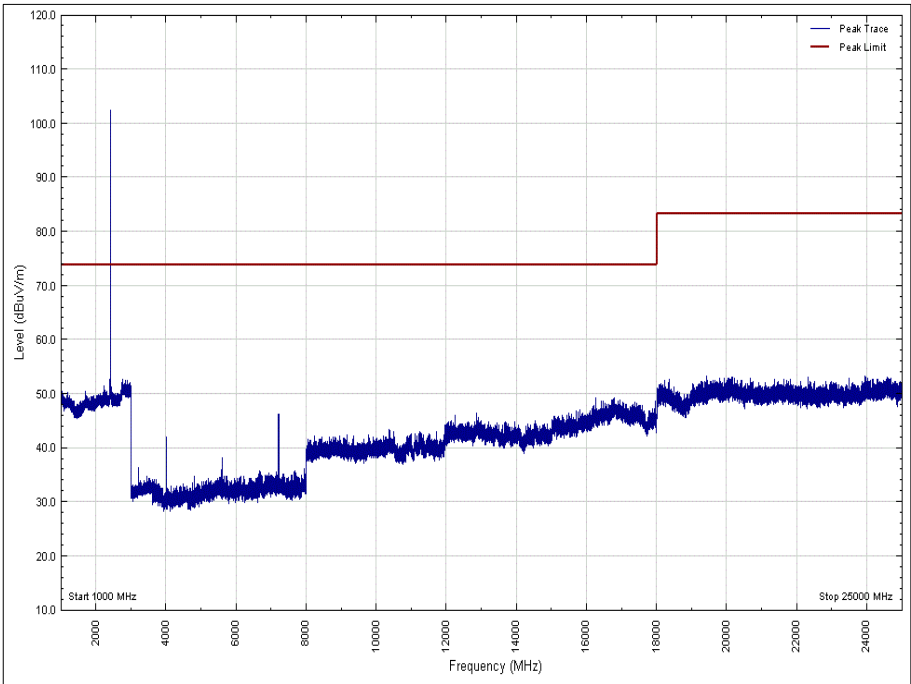


Figure 56 - 2402 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: X



**Figure 57 - 2402 MHz - 1 GHz to 25 GHz - Average**  
**Polarity: Vertical, EUT Orientation: X**



**Figure 58 - 2402 MHz - 1 GHz to 25 GHz - Peak**  
**Polarity: Horizontal, EUT Orientation: X**

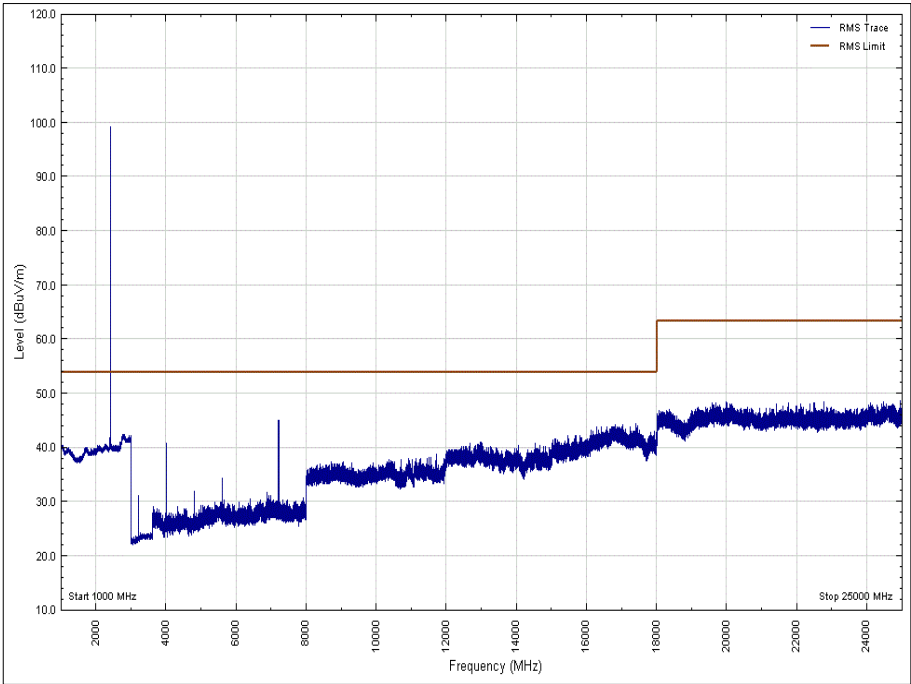


Figure 59 - 2402 MHz - 1 GHz to 25 GHz - Average  
Polarity: Horizontal, EUT Orientation: X

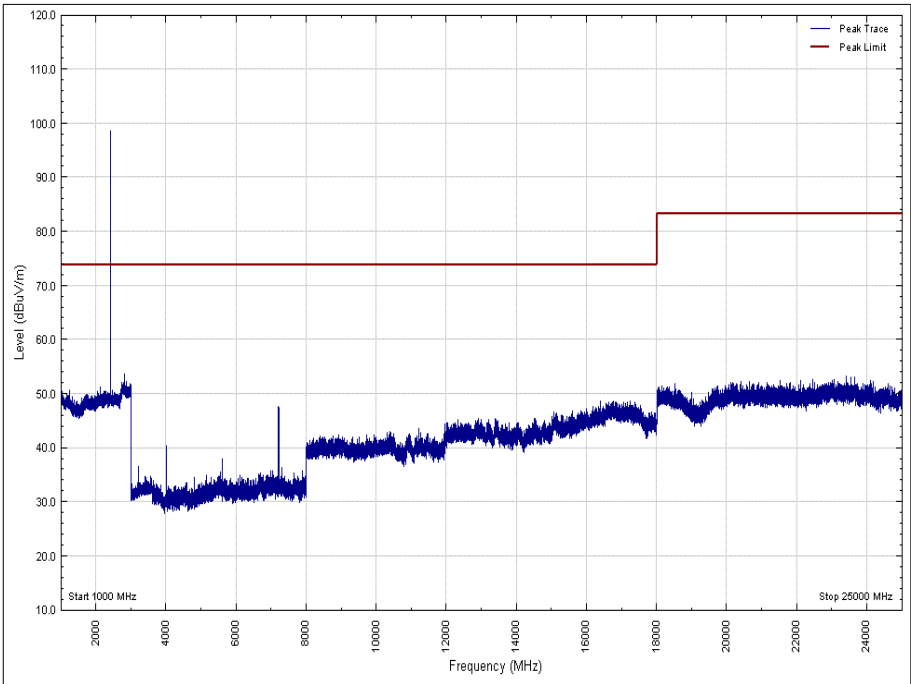


Figure 60 - 2402 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: Y

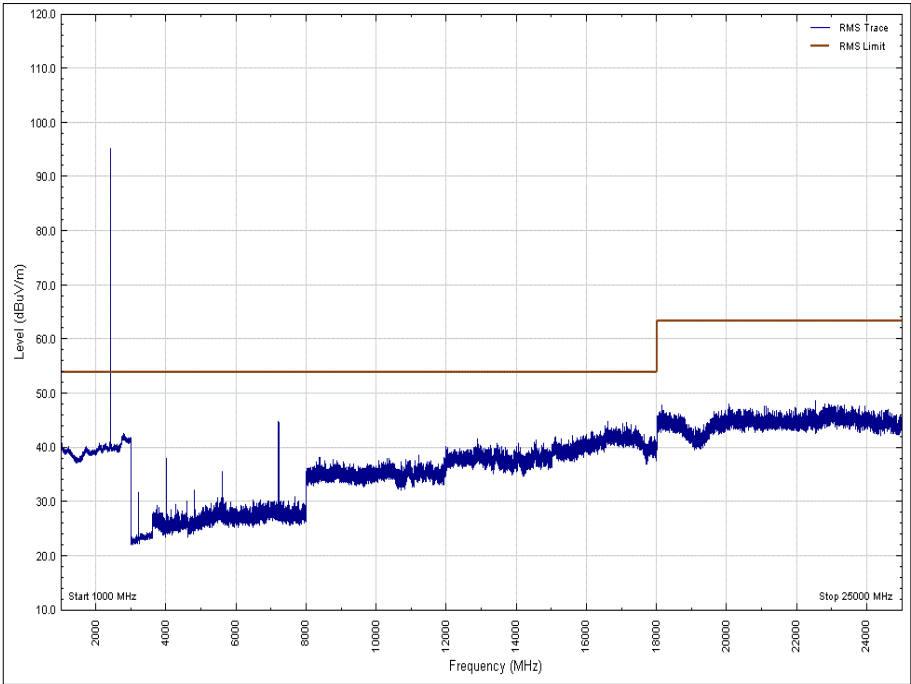


Figure 61 - 2402 MHz - 1 GHz to 25 GHz - Average  
Polarity: Vertical, EUT Orientation: Y

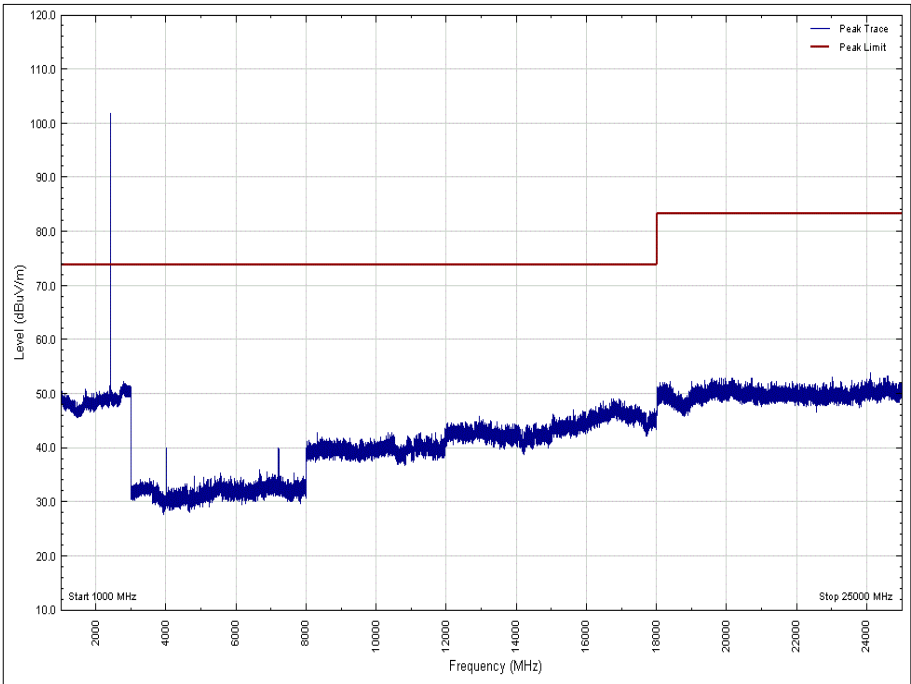


Figure 62 - 2402 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Horizontal, EUT Orientation: Y



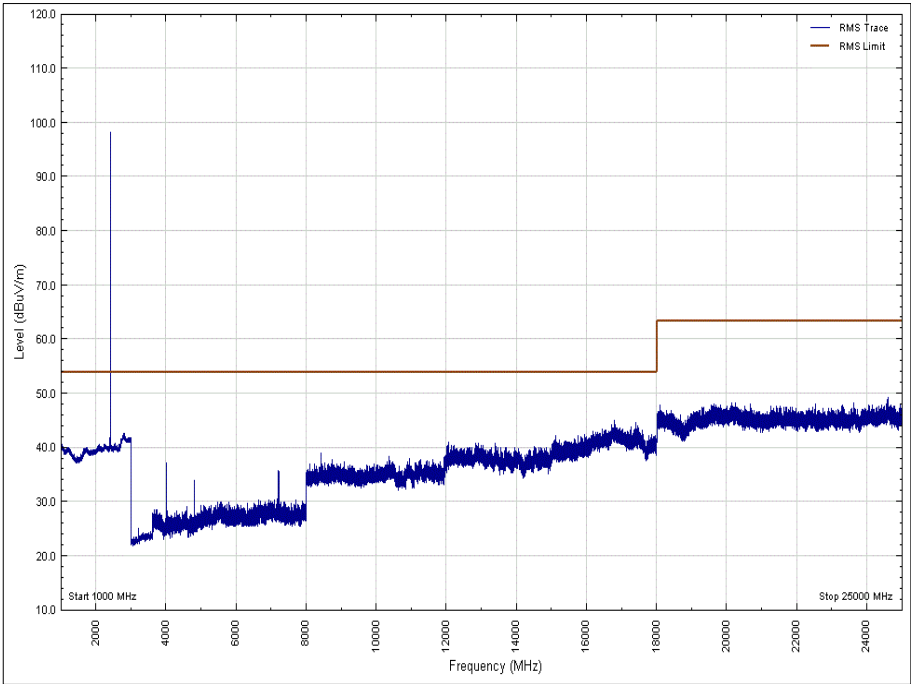


Figure 63 - 2402 MHz - 1 GHz to 25 GHz - Average  
Polarity: Horizontal, EUT Orientation: Y

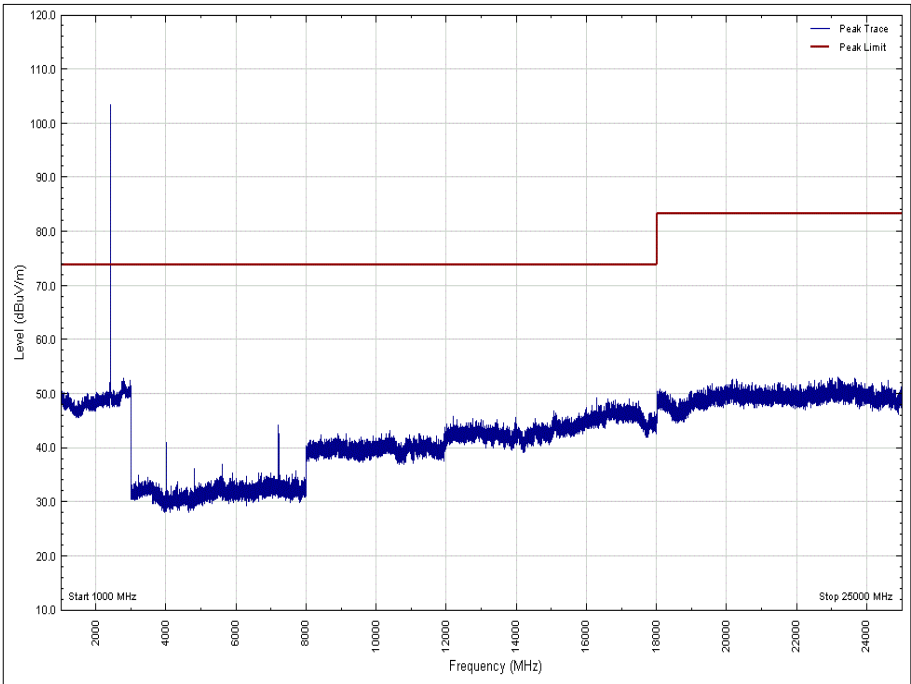


Figure 64 - 2402 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: Z

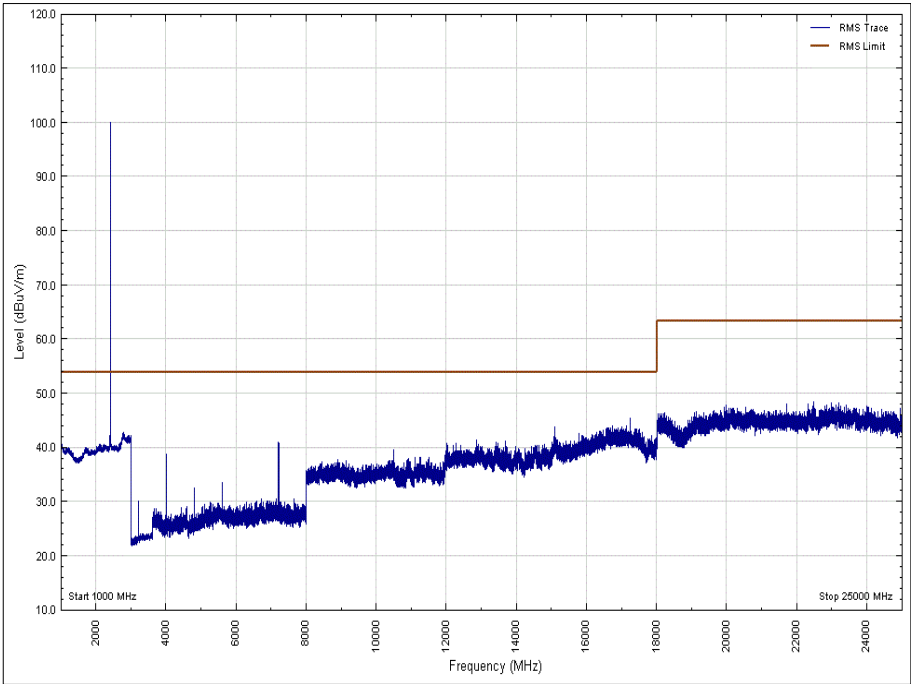


Figure 65 - 2402 MHz - 1 GHz to 25 GHz - Average  
Polarity: Vertical, EUT Orientation: Z

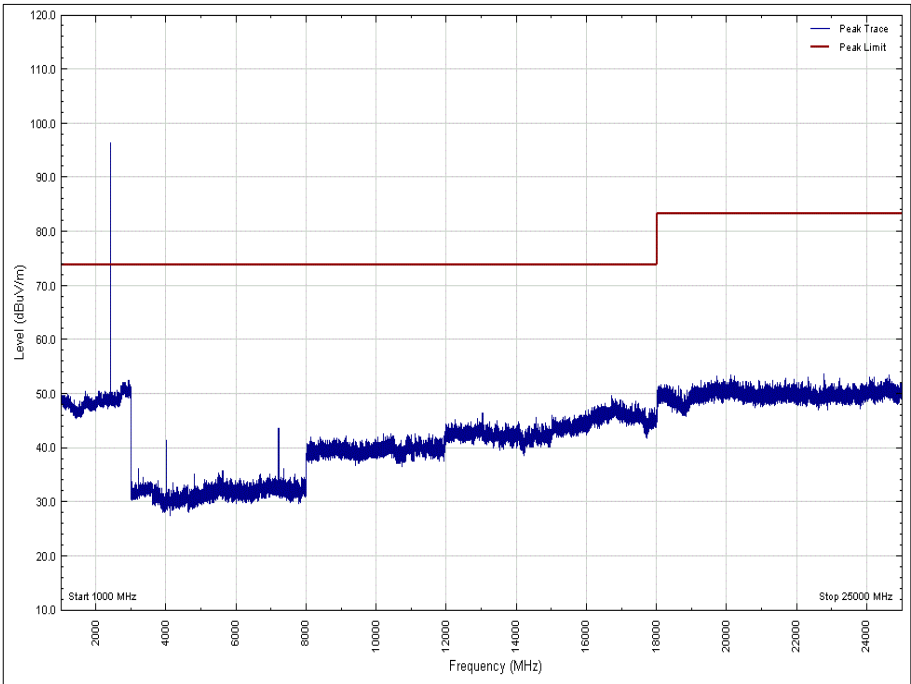
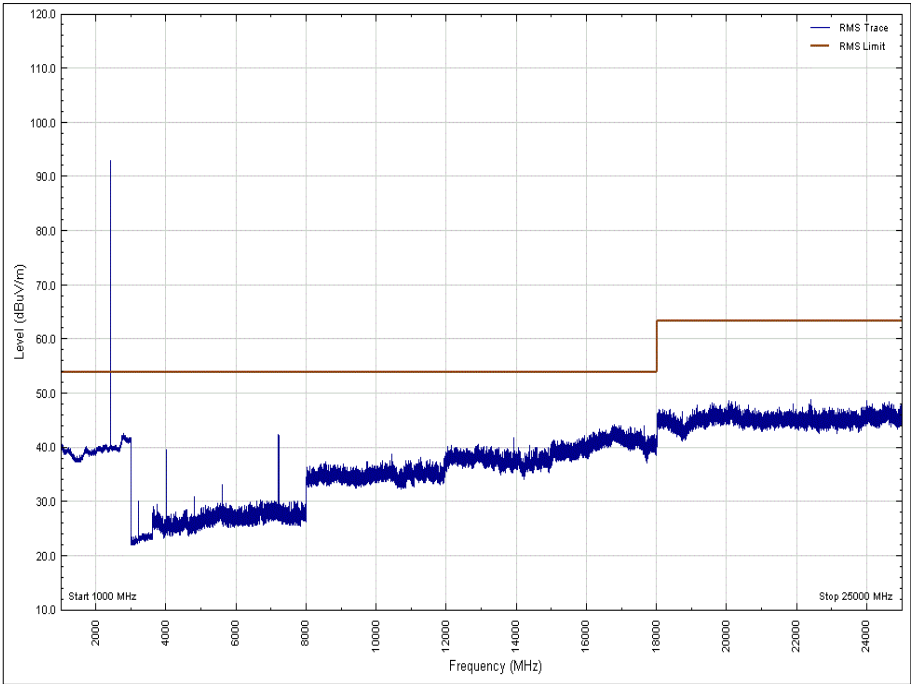


Figure 66 - 2402 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Horizontal, EUT Orientation: Z



**Figure 67 - 2402 MHz - 1 GHz to 25 GHz - Average  
Polarity: Horizontal, EUT Orientation: Z**



| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|-----------------|----------------|----------------|-------------|----------|-----------|-------------|--------------|-------------|
| *               |                |                |             |          |           |             |              |             |

Table 22 - 2441 MHz - 30 MHz to 1 GHz Emissions Results

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

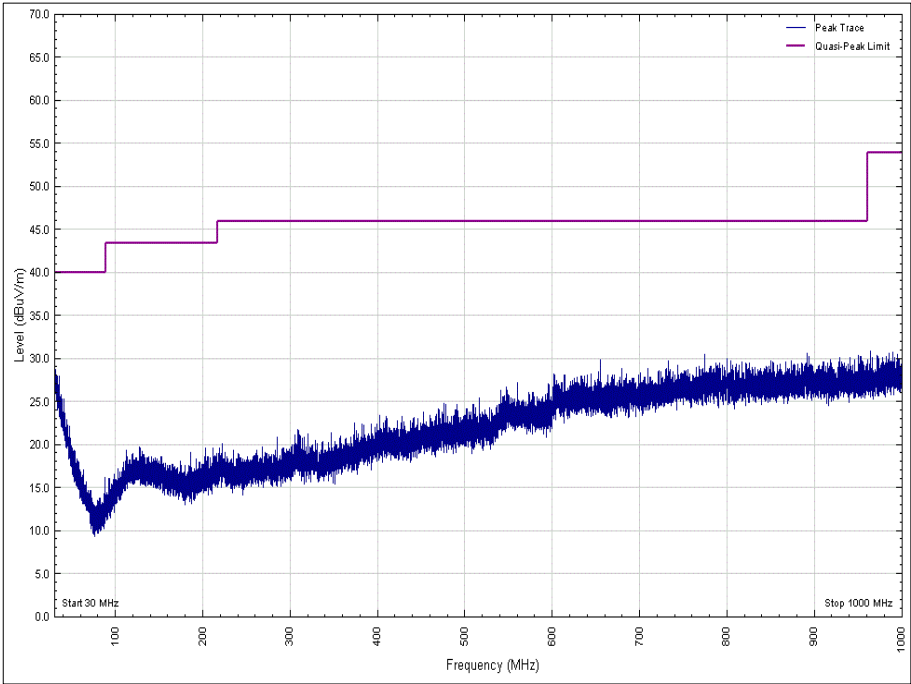
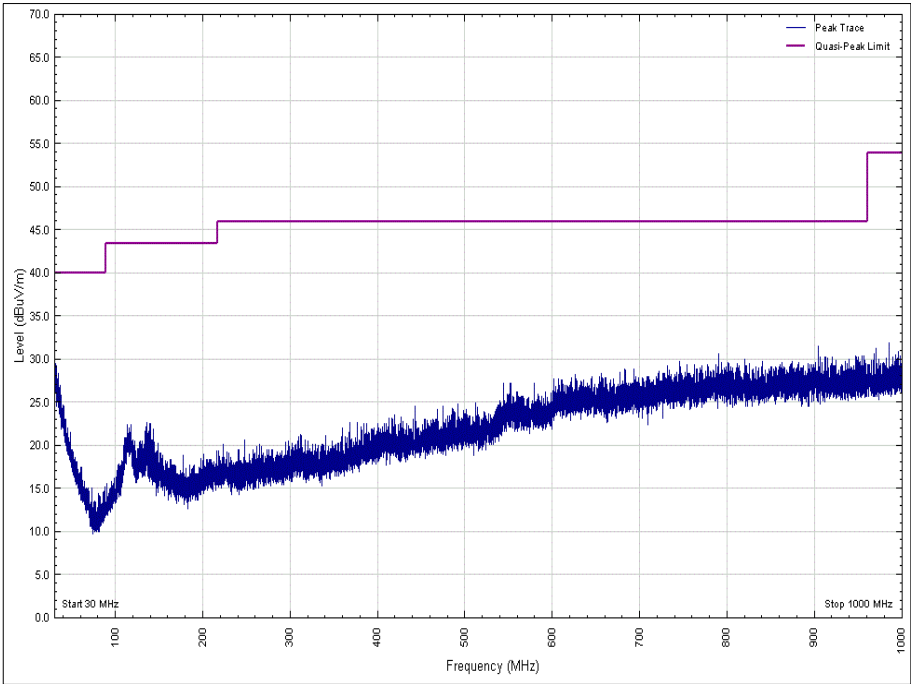
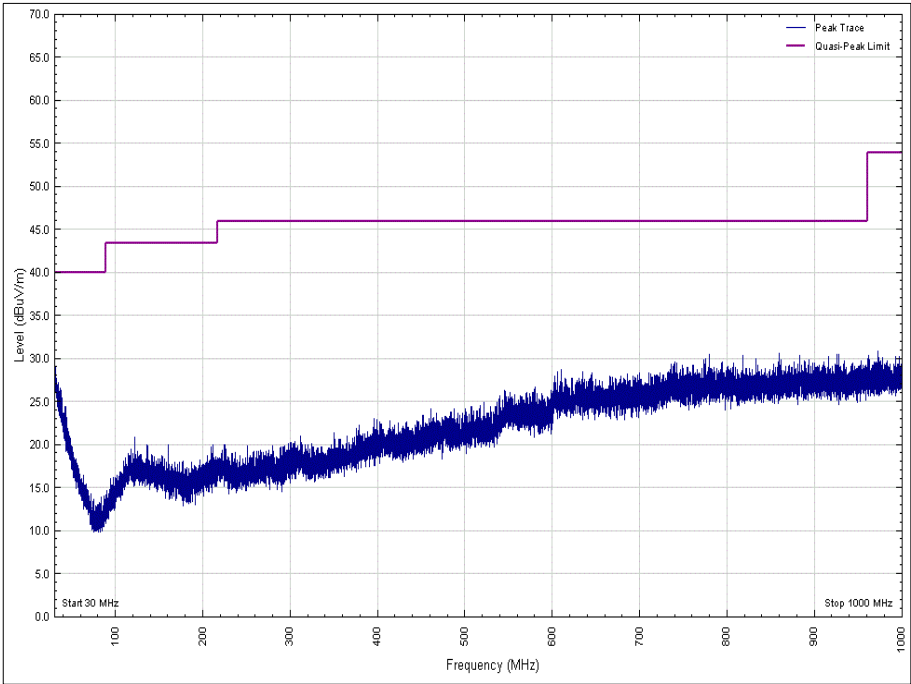


Figure 68 - 2441 MHz - 30 MHz to 1 GHz  
Polarity: Vertical, EUT Orientation: X



**Figure 69 - 2441 MHz - 30 MHz to 1 GHz**  
**Polarity: Horizontal, EUT Orientation: X**



**Figure 70 - 2441 MHz - 30 MHz to 1 GHz**  
**Polarity: Vertical, EUT Orientation: Y**

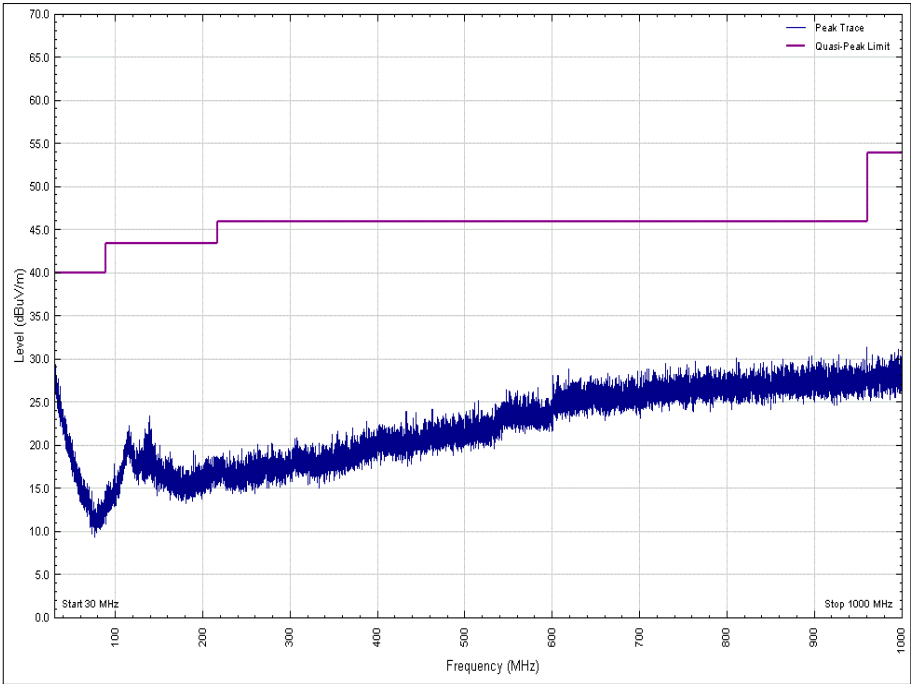


Figure 71 - 2441 MHz - 30 MHz to 1 GHz  
Polarity: Horizontal, EUT Orientation: Y

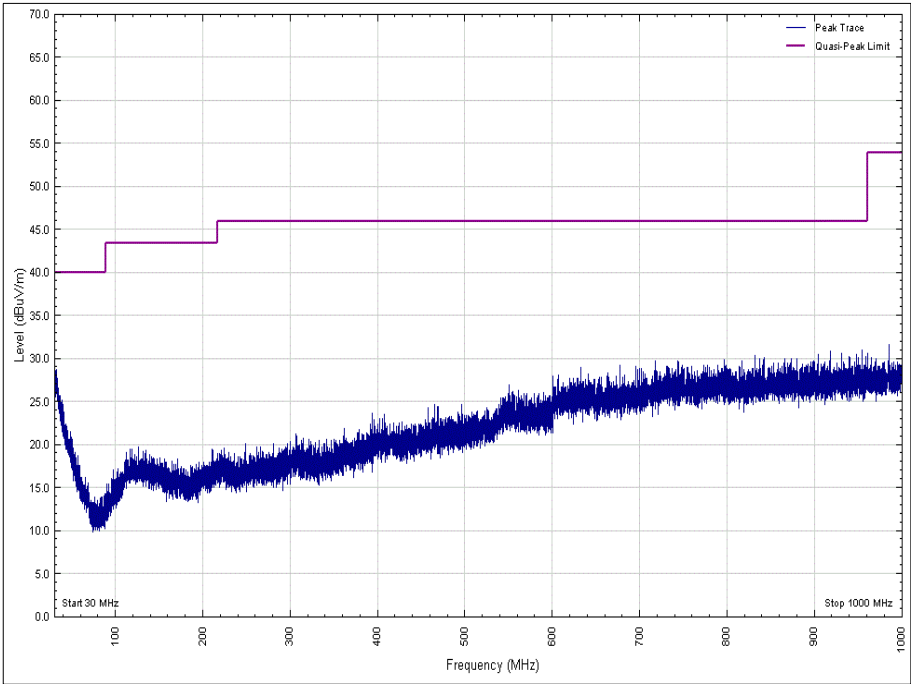
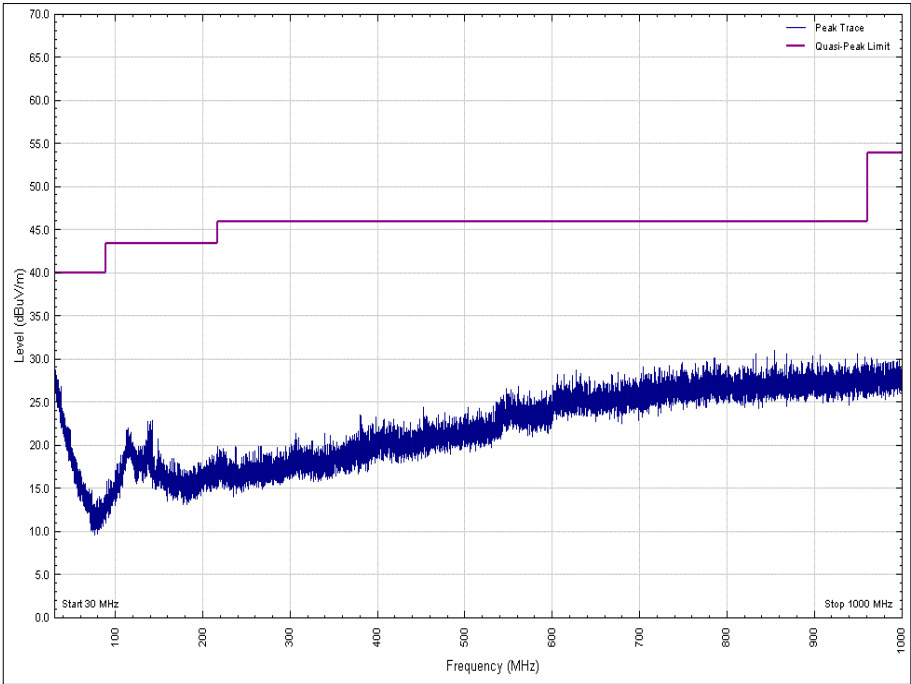


Figure 72 - 2441 MHz - 30 MHz to 1 GHz  
Polarity: Vertical, EUT Orientation: Z



**Figure 73 - 2441 MHz - 30 MHz to 1 GHz**  
**Polarity: Horizontal, EUT Orientation: Z**



| Frequency (GHz) | Result (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dBµV/m) |         |
|-----------------|-----------------|---------|----------------|---------|-----------------|---------|
|                 | Peak            | Average | Peak           | Average | Peak            | Average |
| *               |                 |         |                |         |                 |         |

Table 23 - 2441 MHz - 1 GHz to 25 GHz Emissions Results

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

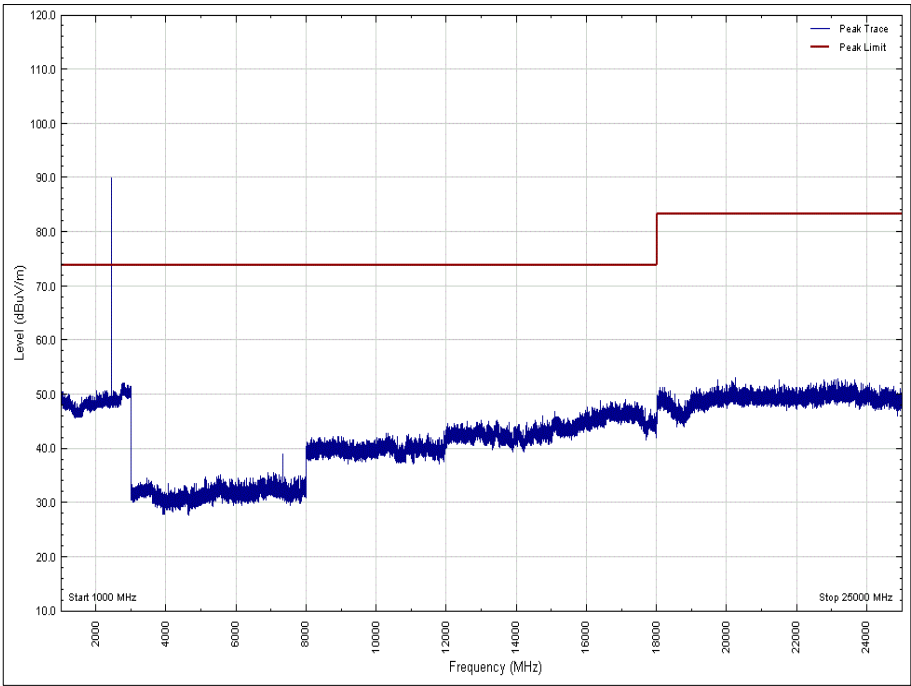


Figure 74 - 2441 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: X



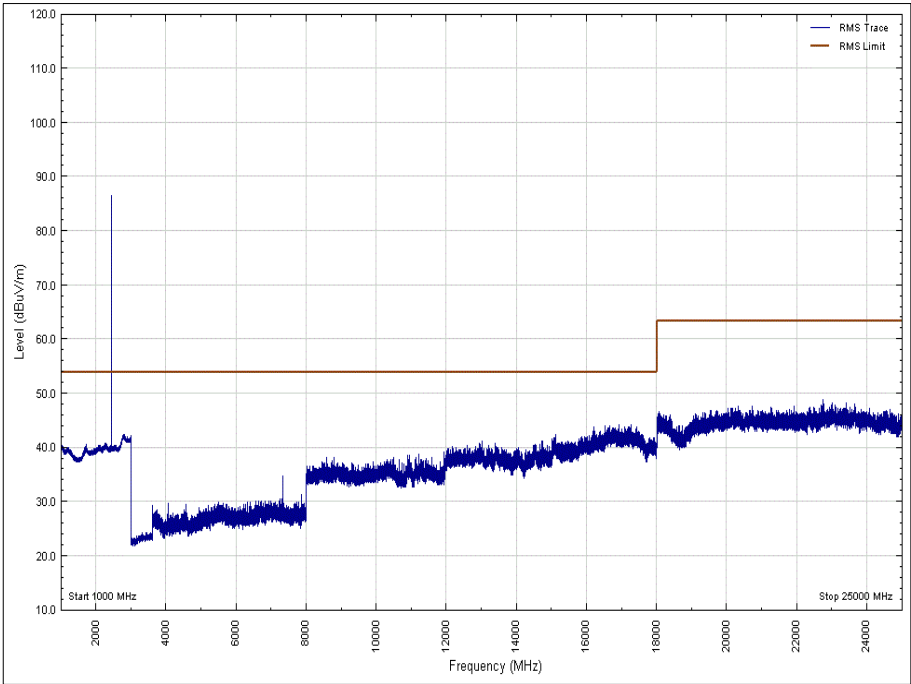


Figure 75 - 2441 MHz - 1 GHz to 25 GHz - Average  
Polarity: Vertical, EUT Orientation: X

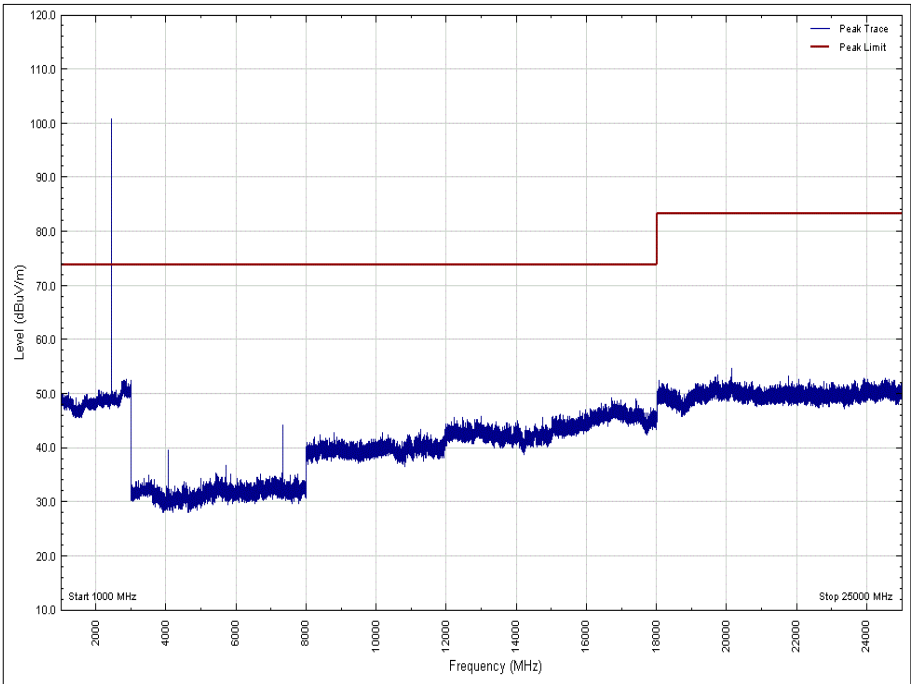


Figure 76 - 2441 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Horizontal, EUT Orientation: X

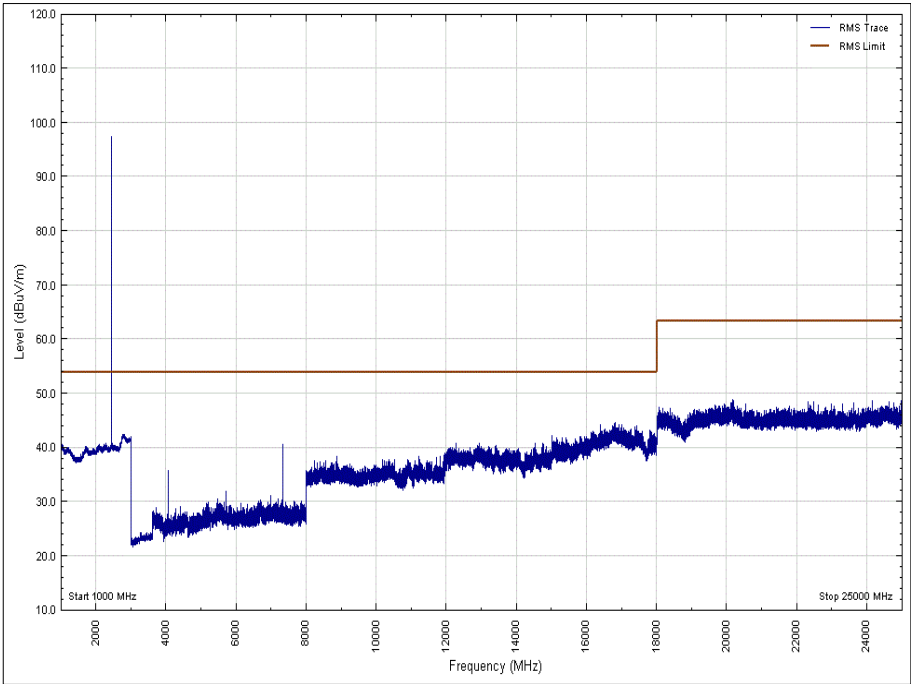


Figure 77 - 2441 MHz - 1 GHz to 25 GHz - Average  
Polarity: Horizontal, EUT Orientation: X

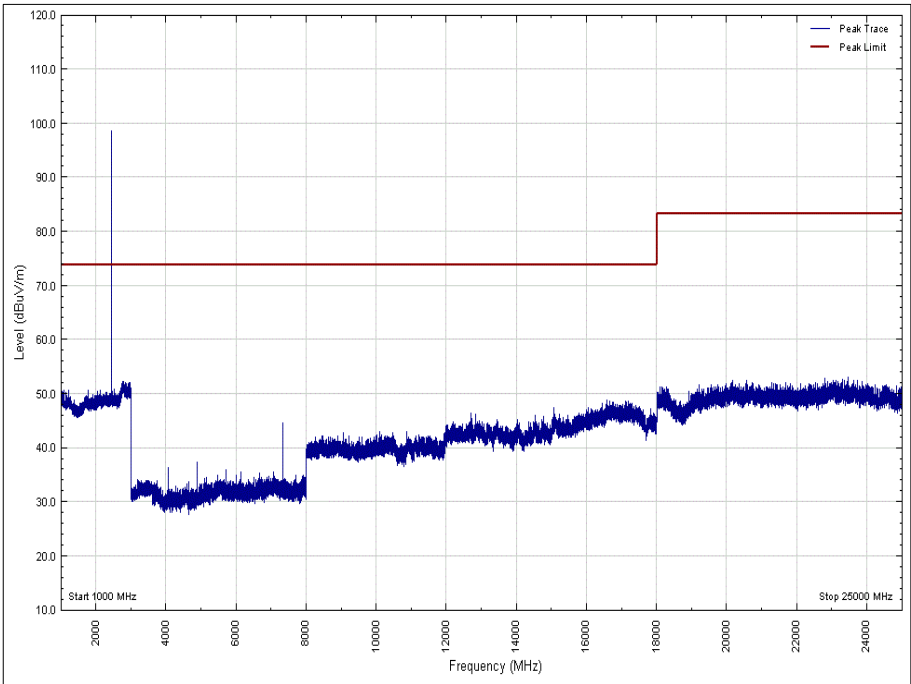


Figure 78 - 2441 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: Y

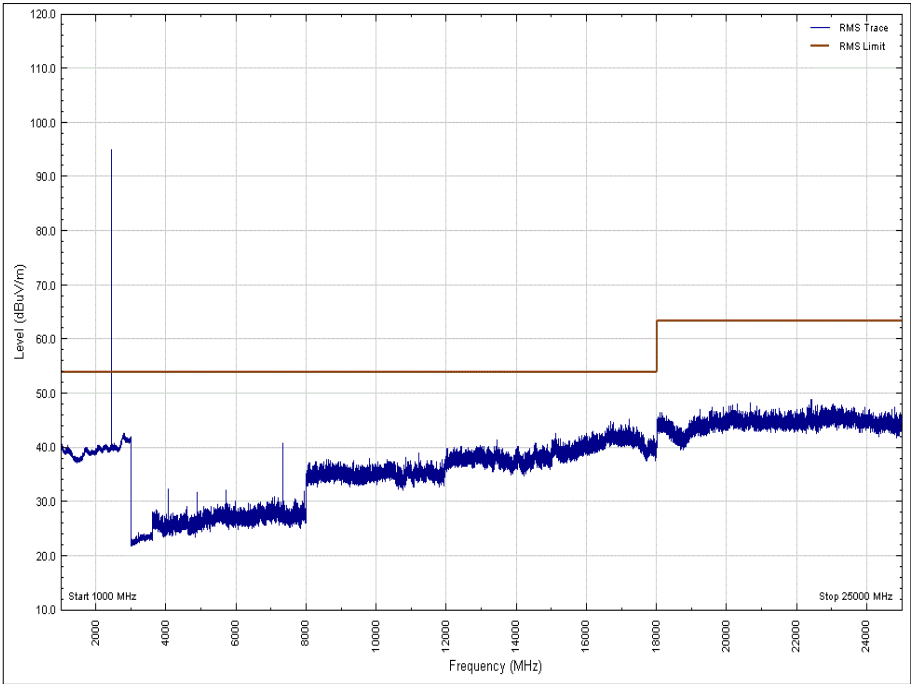


Figure 79 - 2441 MHz - 1 GHz to 25 GHz - Average  
Polarity: Vertical, EUT Orientation: Y

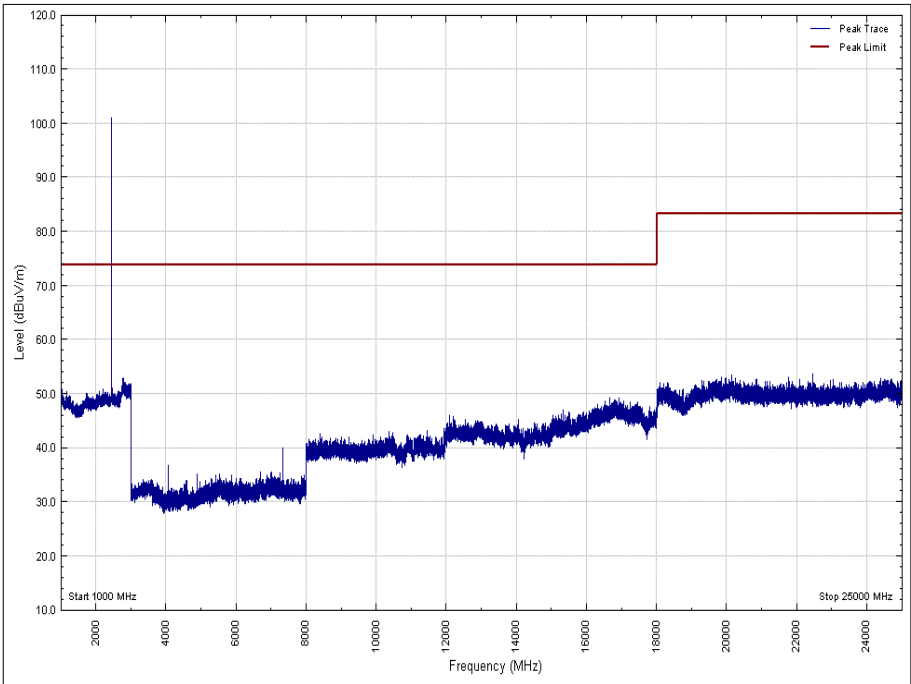


Figure 80 - 2441 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Horizontal, EUT Orientation: Y

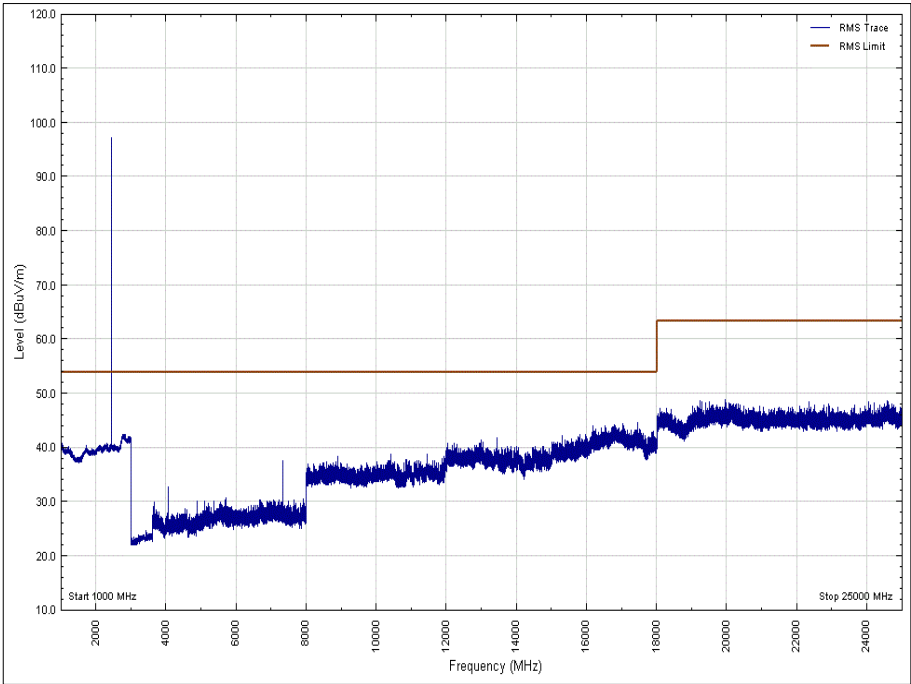


Figure 81 - 2441 MHz - 1 GHz to 25 GHz - Average  
Polarity: Horizontal, EUT Orientation: Y

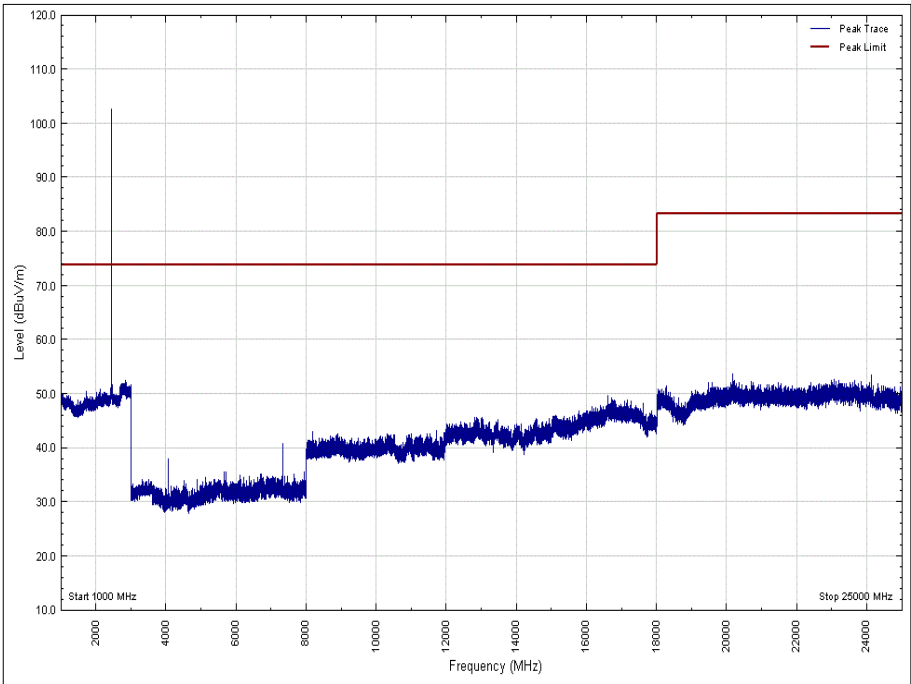


Figure 82 - 2441 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: Z

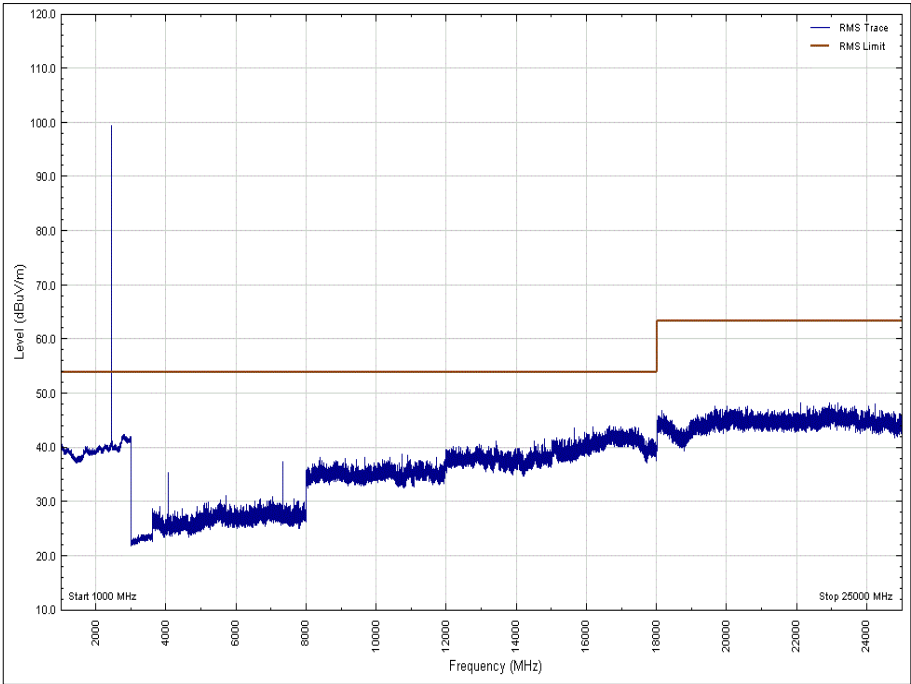


Figure 83 - 2441 MHz - 1 GHz to 25 GHz - Average  
Polarity: Vertical, EUT Orientation: Z

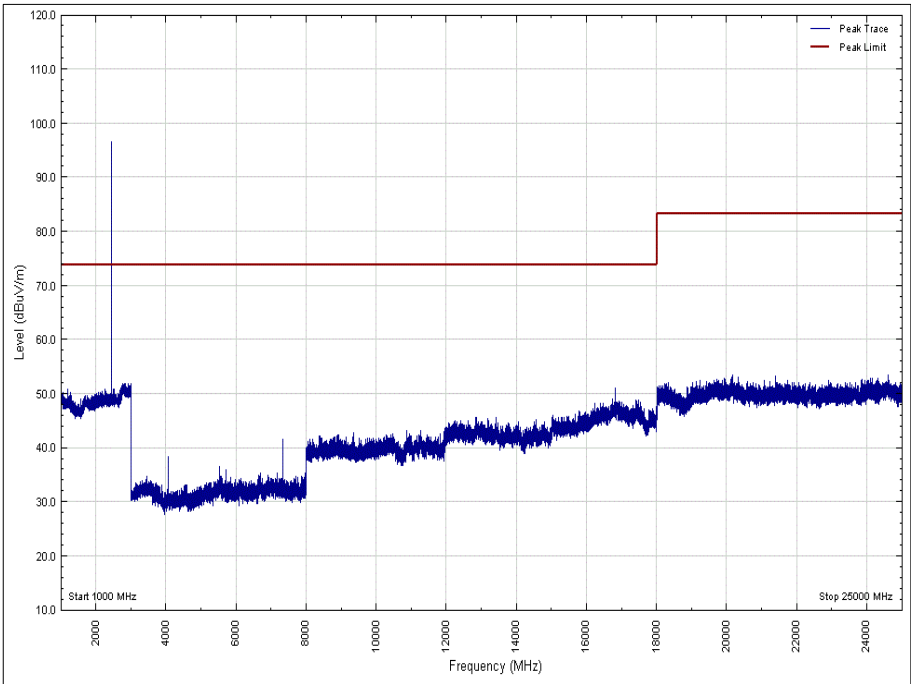
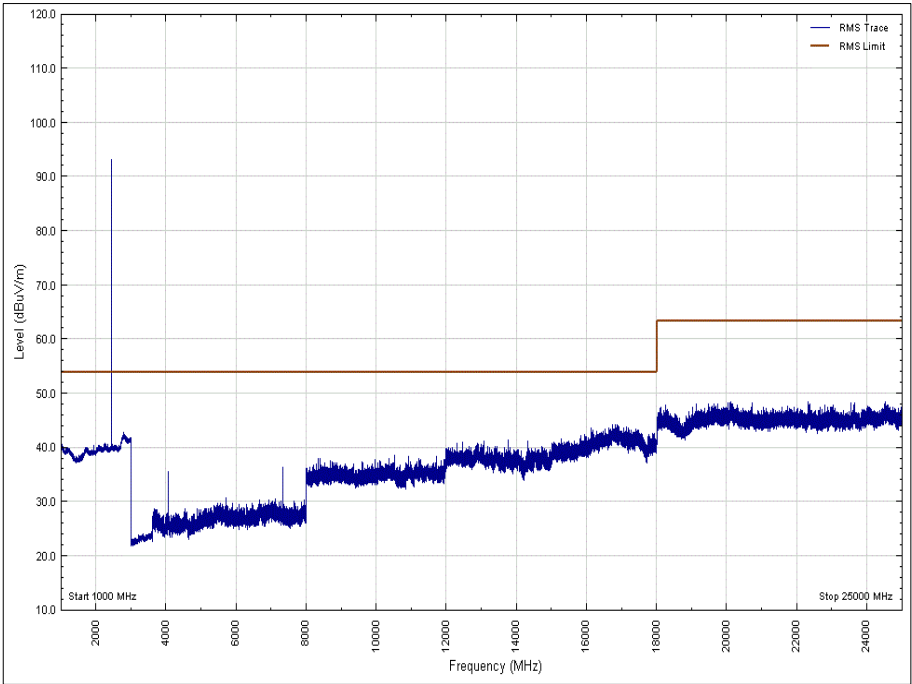


Figure 84 - 2441 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Horizontal, EUT Orientation: Z



**Figure 85 - 2441 MHz - 1 GHz to 25 GHz - Average**  
**Polarity: Horizontal, EUT Orientation: Z**



| Frequency (MHz) | Level (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Detector | Angle (°) | Height (cm) | Polarisation | Orientation |
|-----------------|----------------|----------------|-------------|----------|-----------|-------------|--------------|-------------|
| *               |                |                |             |          |           |             |              |             |

Table 24 - 2480 MHz - 30 MHz to 1 GHz Emissions Results

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

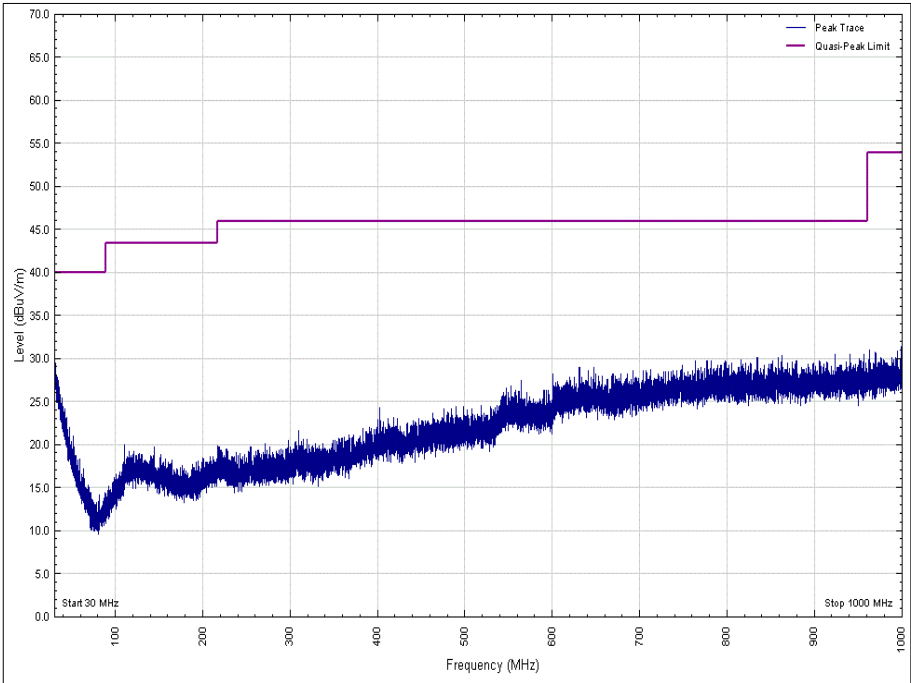
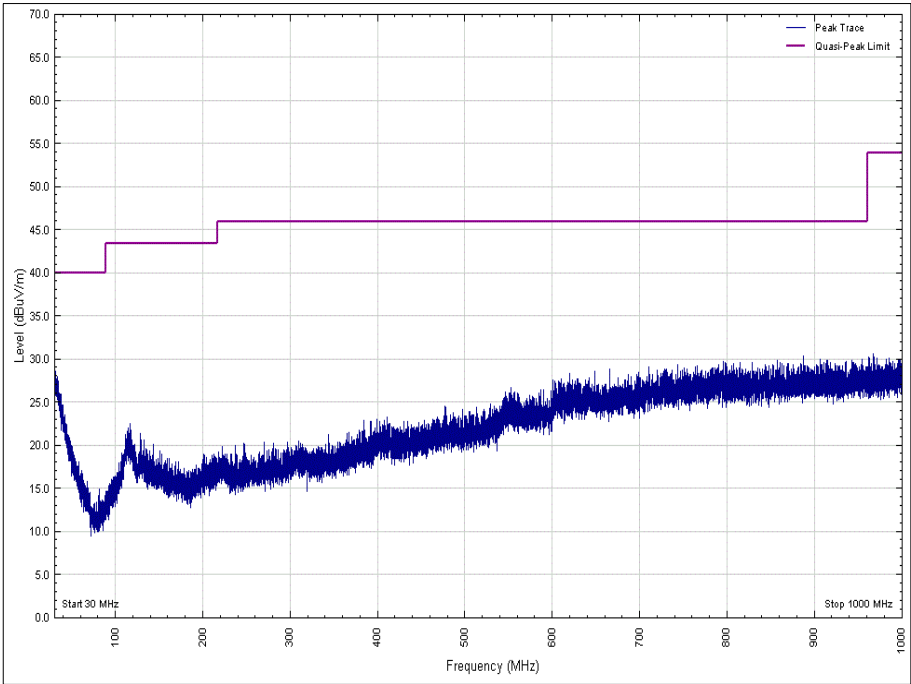
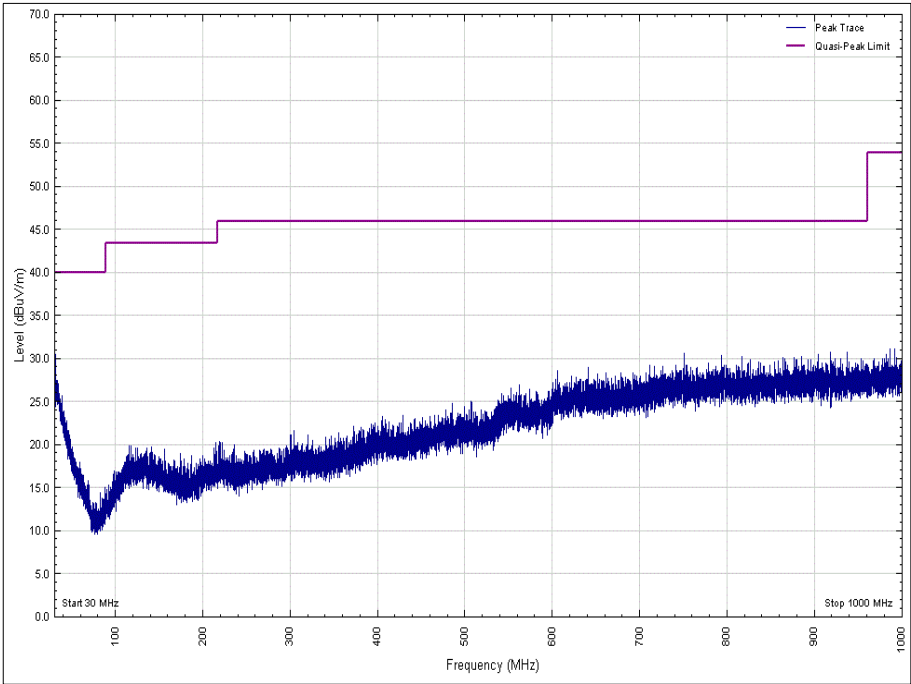


Figure 86 - 2480 MHz - 30 MHz to 1 GHz  
Polarity: Vertical, EUT Orientation: X

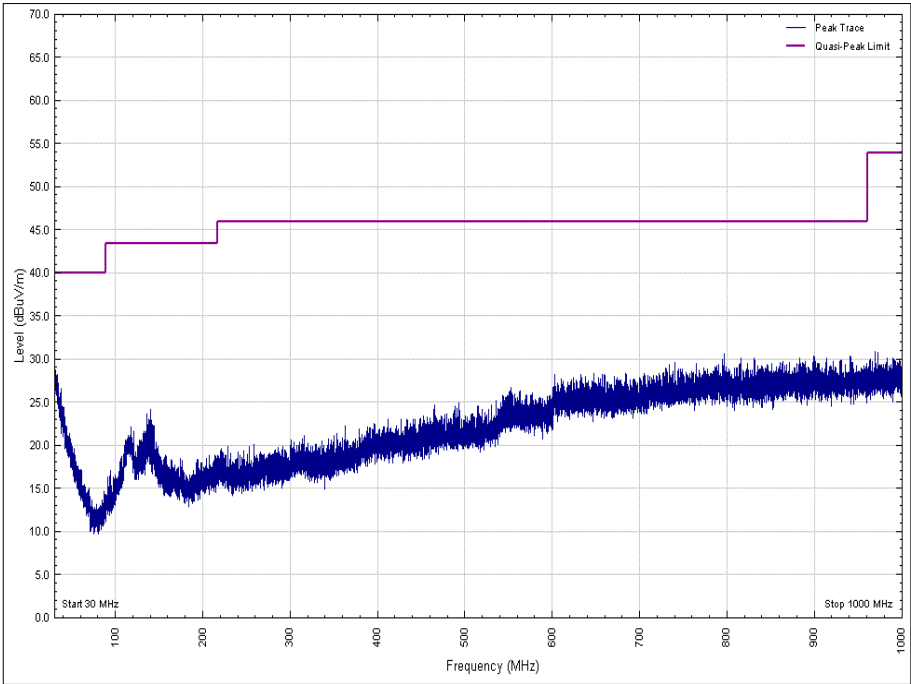


**Figure 87 - 2480 MHz - 30 MHz to 1 GHz**  
**Polarity: Horizontal, EUT Orientation: X**

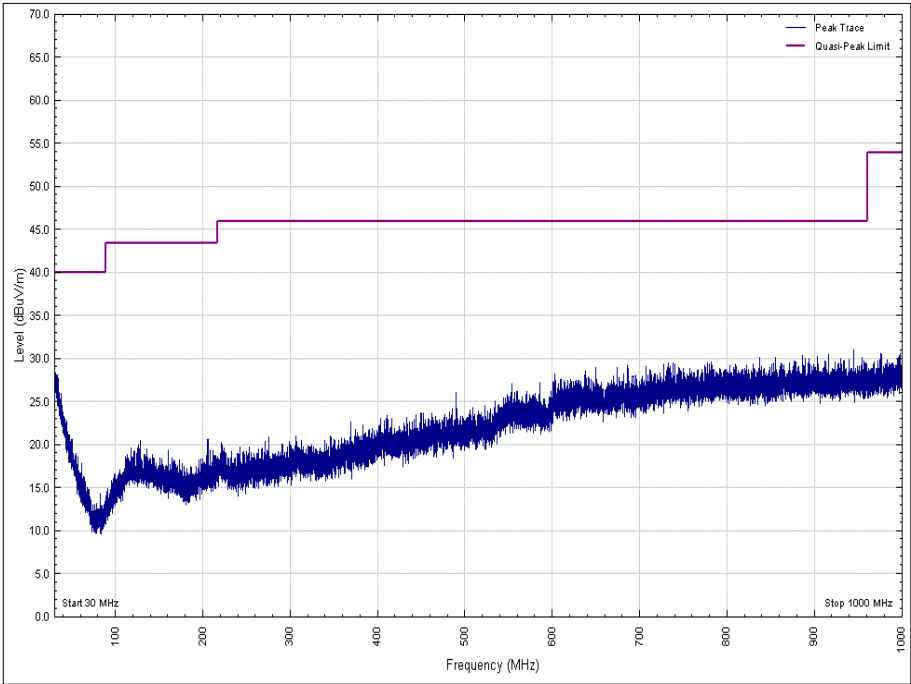


**Figure 88 - 2480 MHz - 30 MHz to 1 GHz**  
**Polarity: Vertical, EUT Orientation: Y**

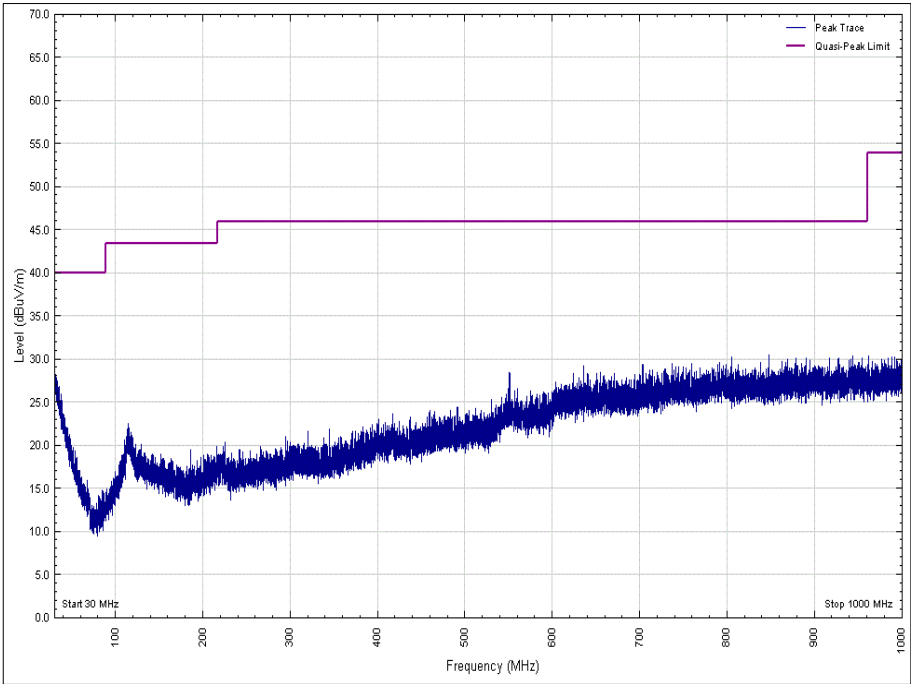




**Figure 89 - 2480 MHz - 30 MHz to 1 GHz**  
**Polarity: Horizontal, EUT Orientation: Y**



**Figure 90 - 2480 MHz - 30 MHz to 1 GHz**  
**Polarity: Vertical, EUT Orientation: Z**



**Figure 91 - 2480 MHz - 30 MHz to 1 GHz**  
**Polarity: Horizontal, EUT Orientation: Z**



| Frequency (GHz) | Result (dBµV/m) |         | Limit (dBµV/m) |         | Margin (dBµV/m) |         |
|-----------------|-----------------|---------|----------------|---------|-----------------|---------|
|                 | Peak            | Average | Peak           | Average | Peak            | Average |
| *               |                 |         |                |         |                 |         |

Table 25 - 2480 MHz - 1 GHz to 25 GHz Emissions Results

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

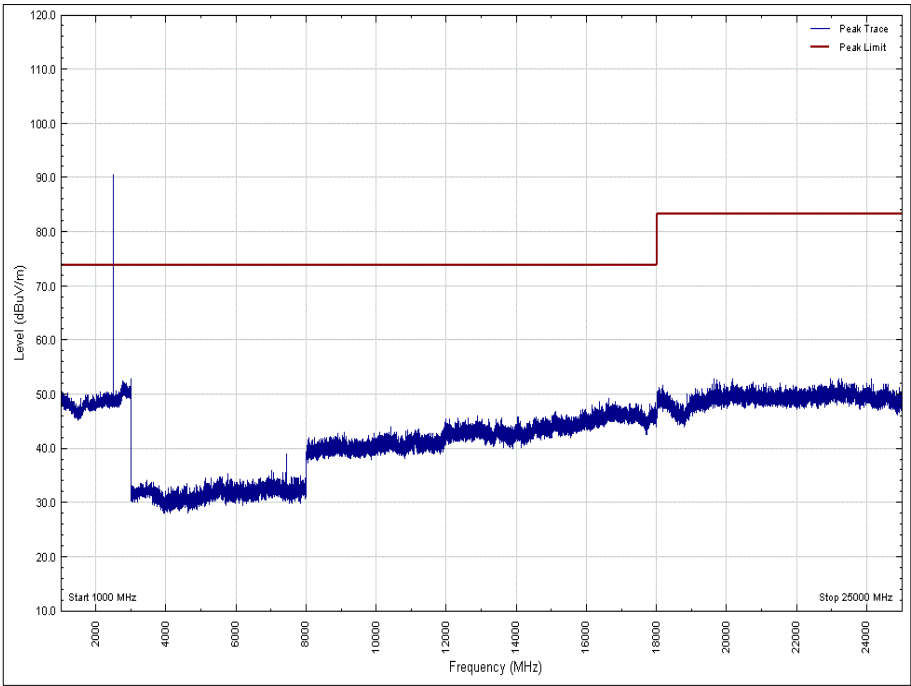


Figure 92 - 2480 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: X

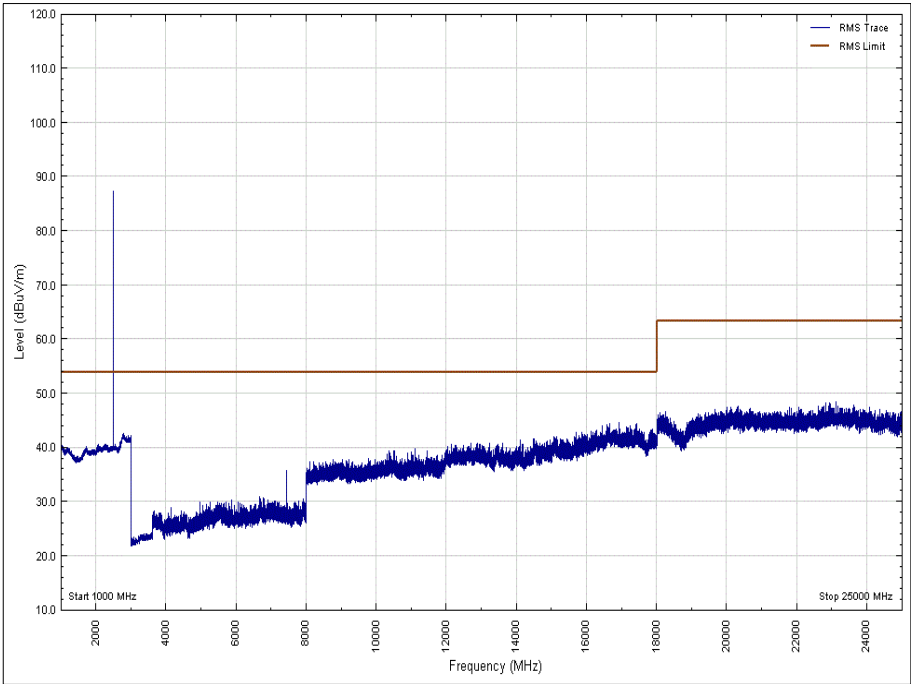


Figure 93 - 2480 MHz - 1 GHz to 25 GHz - Average  
Polarity: Vertical, EUT Orientation: X

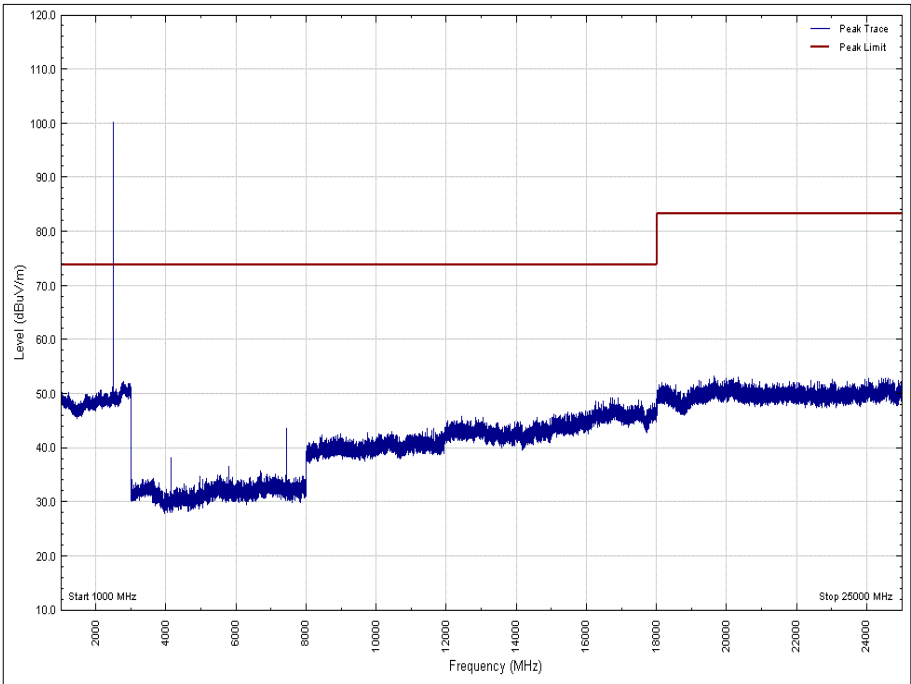


Figure 94 - 2480 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Horizontal, EUT Orientation: X

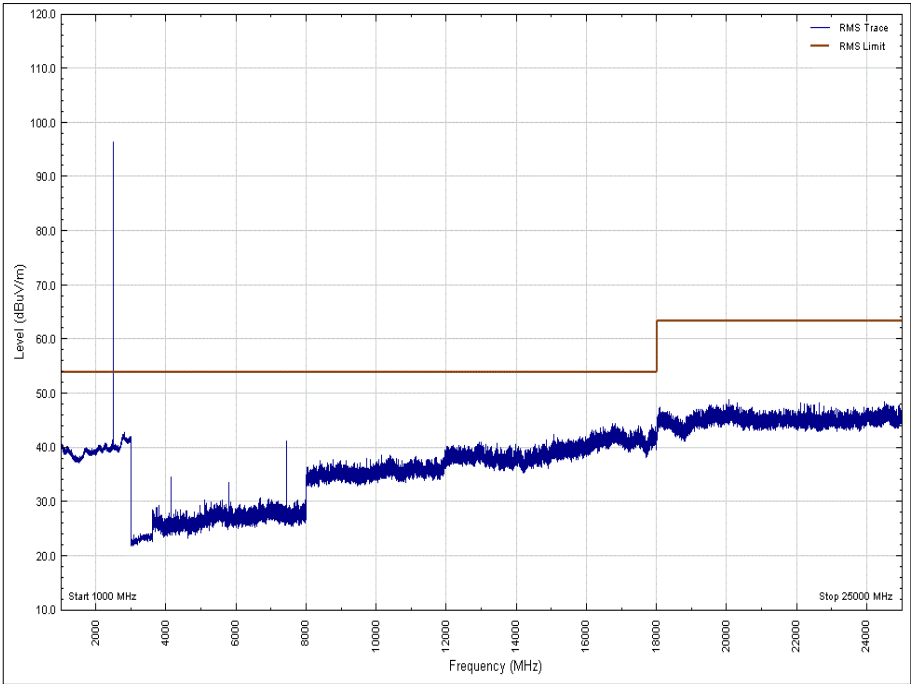


Figure 95 - 2480 MHz - 1 GHz to 25 GHz - Average  
Polarity: Horizontal, EUT Orientation: X

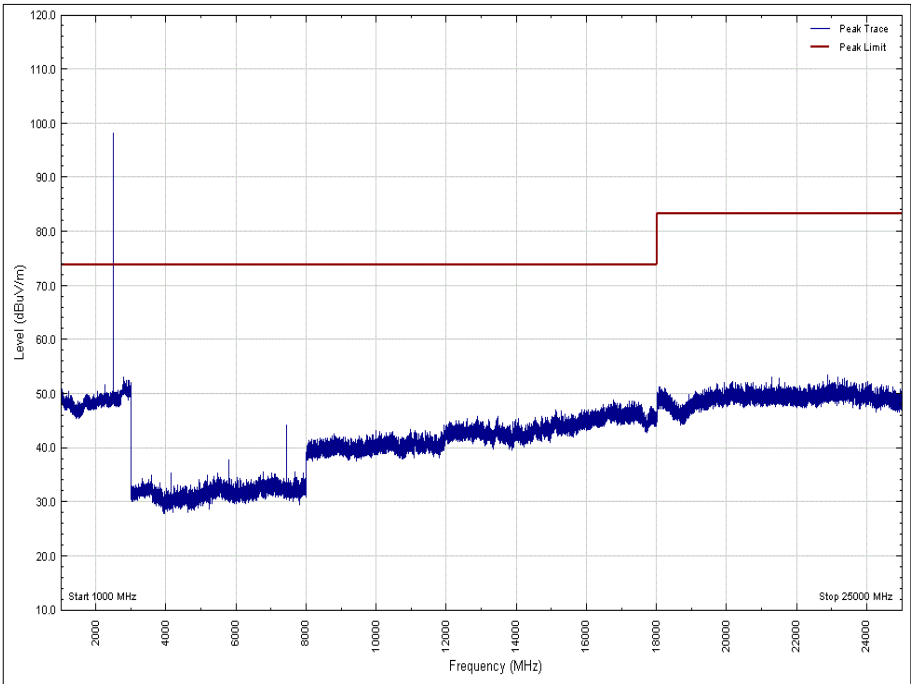


Figure 96 - 2480 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: Y

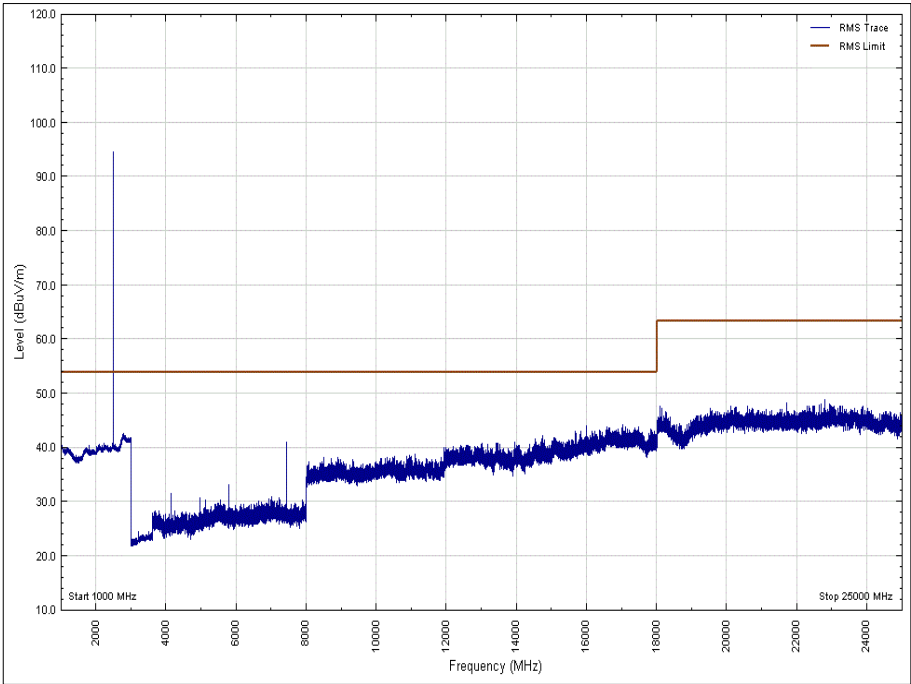


Figure 97 - 2480 MHz - 1 GHz to 25 GHz - Average  
Polarity: Vertical, EUT Orientation: Y

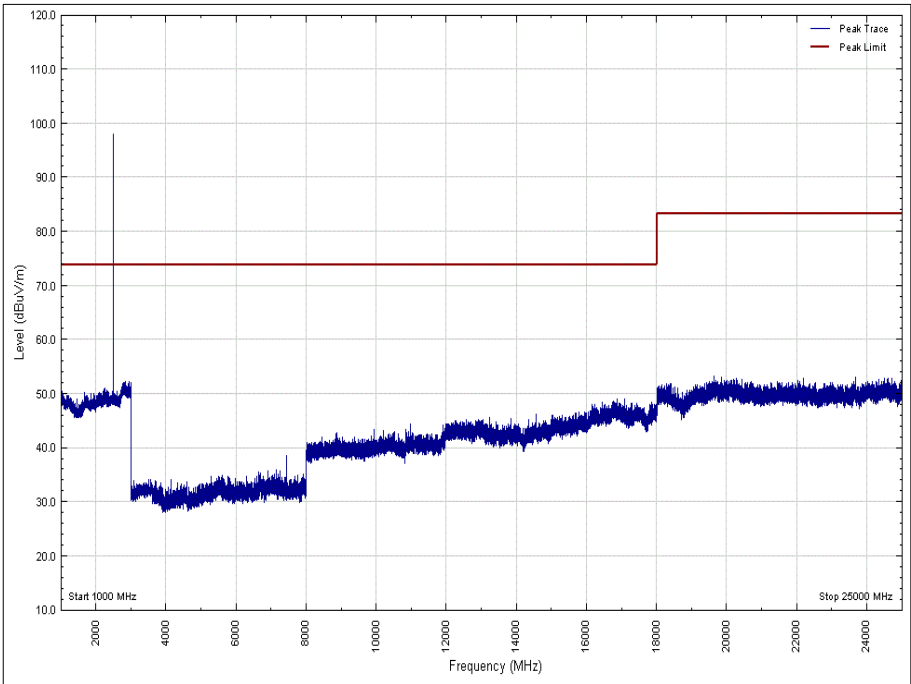


Figure 98 - 2480 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Horizontal, EUT Orientation: Y

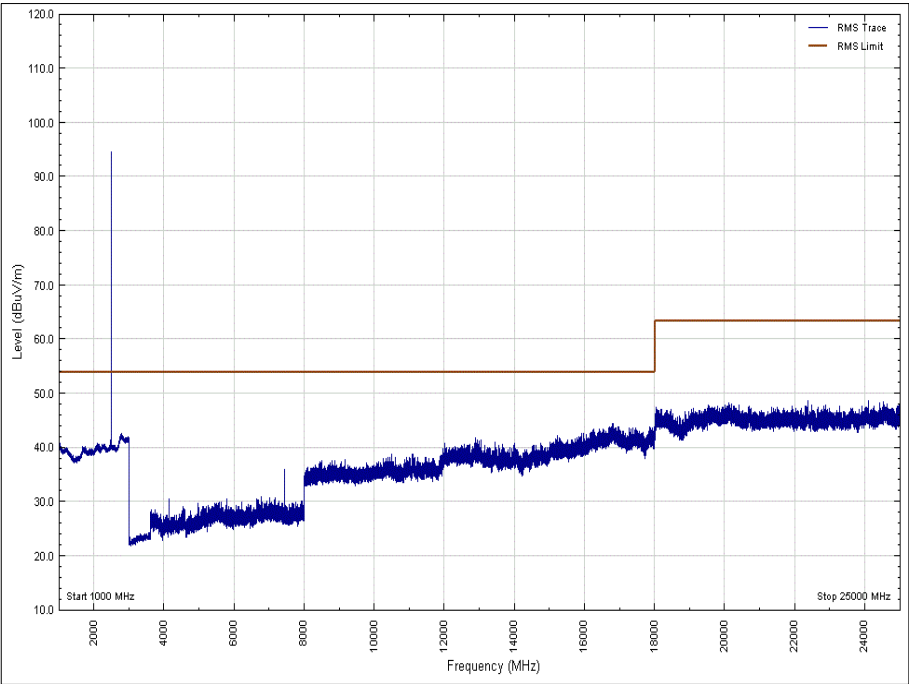


Figure 99 - 2480 MHz - 1 GHz to 25 GHz - Average  
Polarity: Horizontal, EUT Orientation: Y

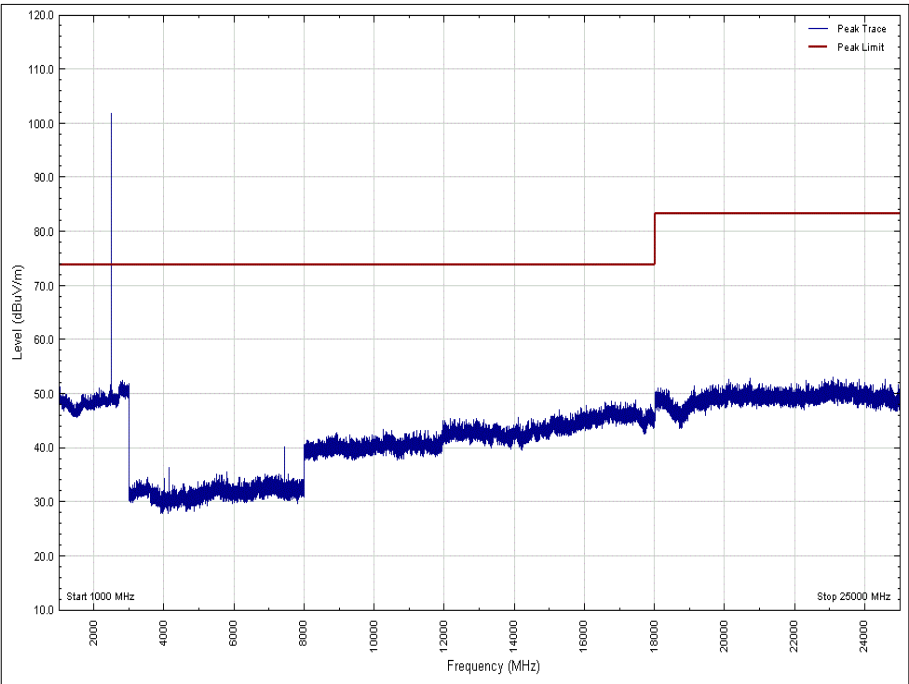
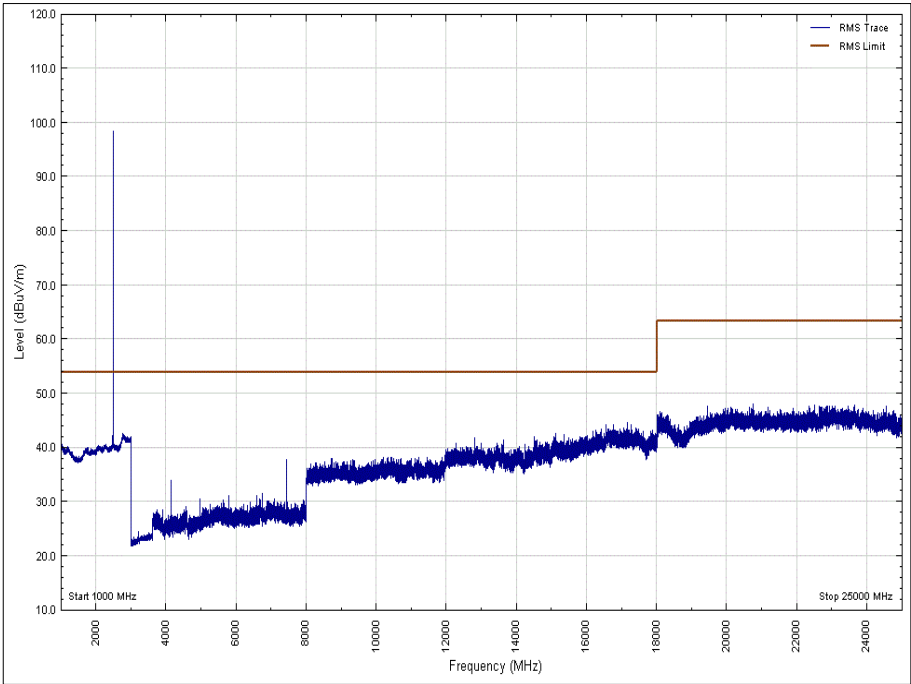
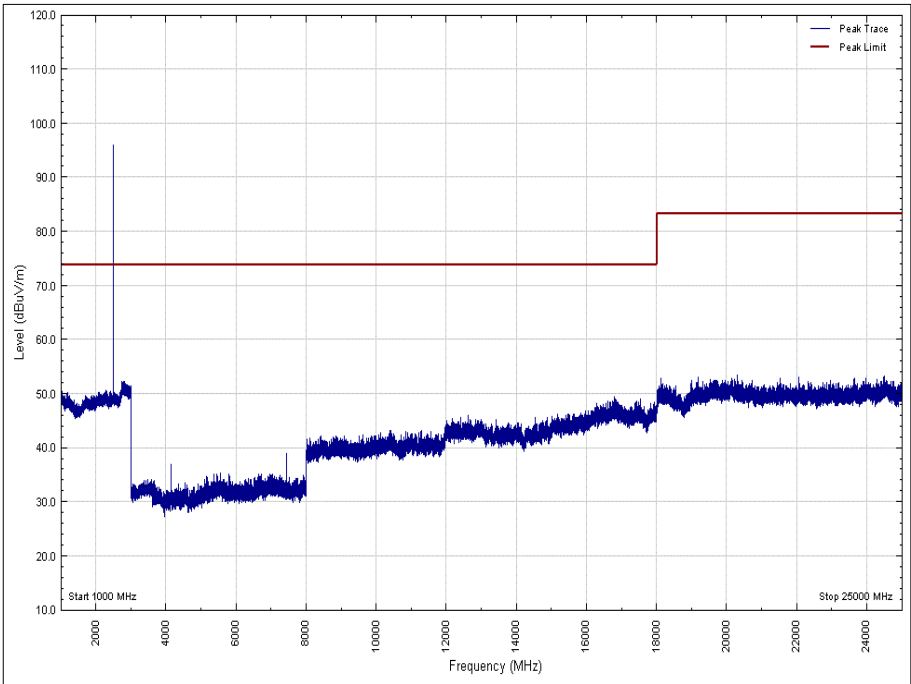


Figure 100 - 2480 MHz - 1 GHz to 25 GHz - Peak  
Polarity: Vertical, EUT Orientation: Z

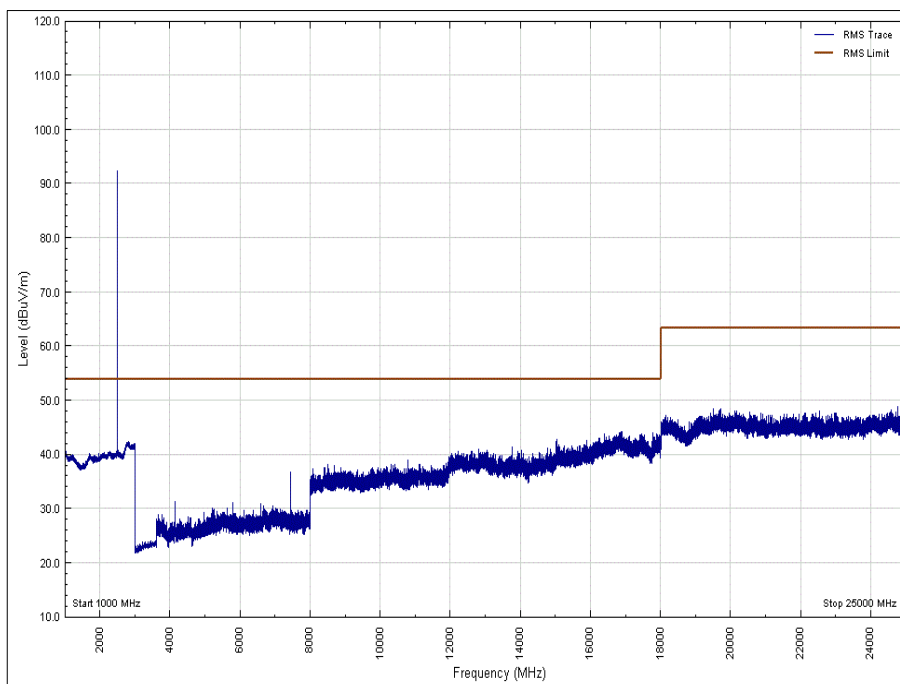


**Figure 101 - 2480 MHz - 1 GHz to 25 GHz - Average**  
**Polarity: Vertical, EUT Orientation: Z**



**Figure 102 - 2480 MHz - 1 GHz to 25 GHz - Peak**  
**Polarity: Horizontal, EUT Orientation: Z**





**Figure 103 - 2480 MHz - 1 GHz to 25 GHz - Average  
 Polarity: Horizontal, EUT Orientation: Z**

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)

ISED 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.



## 2.8.7 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                          | 02-May-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     |
| Screened Room (5)                         | Rainford            | Rainford                    | 1545  | 36                          | 23-Jan-2021     |
| Turntable Controller                      | Inn-Co GmbH         | CO 1000                     | 1606  | -                           | TU              |
| Hygrometer                                | Rotronic            | HYGROPALM 1                 | 2338  | 12                          | 15-Nov-2019     |
| Hygromer                                  | Rotronic            | A1                          | 2677  | 12                          | 20-Feb-2020     |
| Antenna with permanent attenuator (Bilog) | Chase               | CBL6143                     | 2904  | 24                          | 08-Aug-2019     |
| Comb Generator                            | Schaffner           | RSG1000                     | 3034  | -                           | TU              |
| EMI Test Receiver                         | Rohde & Schwarz     | ESU40                       | 3506  | 12                          | 17-Dec-2019     |
| Cable 1503 2M 2.92(P)m 2.92(P)m           | Rhophase            | KPS-1503A-2000-KPS          | 4293  | 12                          | 26-Oct-2019     |
| 1GHz to 8GHz Low Noise Amplifier          | Wright Technologies | APS04-0085                  | 4365  | 12                          | 25-Oct-2019     |
| Cable (Rx, Km-Km 2m)                      | Scott Cables        | KPS-1501-2000-KPS           | 4526  | 6                           | 11-Jun-2019     |
| Cable (Yellow, Rx, Km-Km 2m)              | Scott Cables        | KPS-1501-2000-KPS           | 4527  | 6                           | 15-Aug-2018     |
| High Pass Filter (4GHz)                   | K&L Microwave       | 11SH10-4000/X18000-0/0      | 4599  | 12                          | 04-Sep-2019     |
| Double Ridged Waveguide Horn Antenna      | ETS-Lindgren        | 3117                        | 4722  | 12                          | 05-Mar-2020     |
| 1 - 18GHz DRG Antenna                     | ETS-Lindgren        | 3117                        | 4738  | 12                          | 05-Mar-2020     |
| Mast Controller                           | Maturo GmbH         | NCD                         | 4810  | -                           | TU              |
| Tilt Antenna Mast                         | Maturo GmbH         | TAM 4.0-P                   | 4811  | -                           | TU              |
| 4dB Attenuator                            | Pasternack          | PE7047-4                    | 4935  | 24                          | 28-Nov-2019     |
| 8m N-Type RF Cable                        | Teledyne            | PR90-088-8MTR               | 5093  | 12                          | 04-Oct-2019     |
| Cable (18 GHz)                            | Rosenberger         | LU7-071-2000                | 5109  | 12                          | 05-Oct-2019     |
| EmX Software                              | TUV SUD             | EmX                         | 5125  | -                           | Software        |
| 1.5m 40GHz RF Cable                       | Scott Cables        | KPS-1501-2000-KPS           | 5126  | 6                           | 26-Apr-2019     |
| 3 GHz High pass filter                    | Wainwright          | WHKX12-2580-3000-18000-80SS | 5220  | 12                          | 15-Feb-2020     |

**Table 26**

TU - Traceability Unscheduled

## 3 Photographs

### 3.1 Test Setup Photographs



Figure 104 - 30 MHz to 1 GHz - Orientation Y



**Figure 105 - 30 MHz to 1 GHz - Orientation X**



**Figure 106 - 1 GHz to 18 GHz - Orientation Y**



**Figure 107 - 1 GHz to 18 GHz - Orientation X**



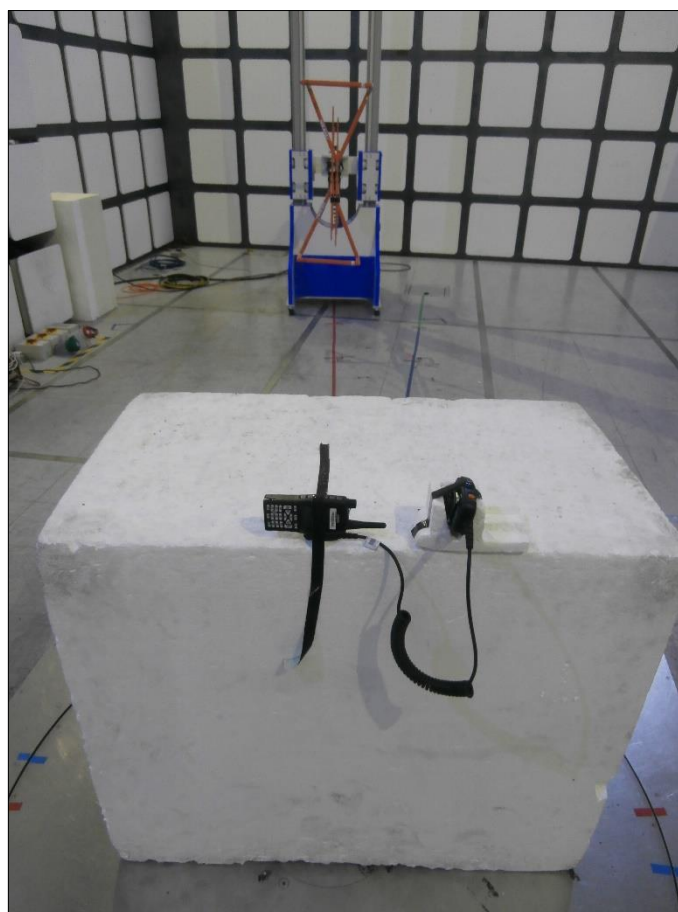
Figure 108 - 18 GHz to 25 GHz - Orientation Y





**Figure 109 - 18 GHz to 25 GHz - Orientation X**





**Figure 110 - 30 MHz to 1 GHz - Orientation Z**



**Figure 111 - 1 GHz to 18 GHz - Orientation Z**



**Figure 112 - 18 GHz to 25 GHz - Orientation Z**



## 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: $\pm 5.2$ dB<br>1 GHz to 40 GHz: $\pm 6.3$ dB |
| Restricted Band Edges                                  | 30 MHz to 1 GHz: $\pm 5.2$ dB<br>1 GHz to 40 GHz: $\pm 6.3$ dB |
| Authorised Band Edges                                  | 30 MHz to 1 GHz: $\pm 5.2$ dB<br>1 GHz to 40 GHz: $\pm 6.3$ dB |
| Frequency Hopping Systems - 20 dB Bandwidth            | $\pm 30.43$ kHz                                                |
| Frequency Hopping Systems - Number of Hopping Channels | -                                                              |
| Frequency Hopping Systems - Channel Separation         | $\pm 30.43$ kHz                                                |
| Frequency Hopping Systems - Average Time of Occupancy  | -                                                              |
| Maximum Conducted Output Power                         | $\pm 3.2$ dB                                                   |

**Table 27**

### 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.