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# RADIO TEST REPORT FOR CERTIFICATION
# to
# FCC PART 15 Subpart C (Section 15.247)

| | |
|---|---|
| **Test Sample:** | Commercial refrigeration controller with Bluetooth LE connectivity |
| **Model:** | SCS Connect |
| **FCC ID:** | 2AHCE-SCS1 |
| **Report Number:** | M150729-1 Rev2<br>(This report replaces M150729-1 Rev1) |
| **Tested for:** | Wellington Drive Technologies Ltd |
| **Issue Date:** | 13 December 2016 |

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**to**
**FCC PART 15 Subpart C (Section 15.247)**

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| **FCC ID:** | 2AHCE-SCS1 |
| **Test Sample:** | Commercial refrigeration controller with Bluetooth LE connectivity |
| **Model Number:** | SCS Connect |
| **Serial Number:** | C82115 00482 |
| **Part Number:** | SCSLC1013 |
| **Manufacturer:** | Wellington Drive Technologies Ltd |
| **Equipment Type:** | Intentional Radiator (Transceiver) |
| **Manufacturer:** | Wellington Drive Technologies Ltd |
| **Address:** | 21 Arrenway Drive, Rosedale |
| **Phone:** | Auckland 0632, New Zealand |
| **Contact:** | Thomas Hong |
| **Email:** | Thomas.hong@wdtl.com |
| **Test Standards:** | **FCC Part 15** – Radio Frequency Devices<br>**FCC Part 15 Subpart C** – Intentional Radiators<br>**Section 15.247** – Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz<br><br>**ANSI C63.10 – 2013**<br>*American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices*<br><br>**KDB 558074 v03r05**<br>*Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247* |
| **Test Date:** | 21st, 24th of August and 5th of September 2015 |
| **Test Engineer:** | Mahan Ghassempouri |
| **Attestation:** | *I hereby certify that the device(s) described herein were tested as described in this report and that the data included is that which was obtained during such testing.* |
| **Authorised Signatory:** | **Chris Zombolas**<br>**Technical Director**<br>**EMC Technologies Pty Ltd** |

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## 1.0 INTRODUCTION

Radio tests were performed on the commercial refrigeration controller with BLE, Model: SCS Connect, in accordance with the methodology prescribed in 47 CFR Part 15. The EUT included a 2.4 GHz transmitter using Bluetooth Low Energy (BLE) protocol.

Test results and procedures were performed in accordance with the following Federal Communications Commission (FCC) standards/regulations:

| **47 CFR, Part 15, Subpart C** | **Rules for intentional radiators (particularly section 15.247)** |
|---|---|
| Section 15.203: | Antenna requirements |
| Section 15.205: | Restricted bands of operation |
| Section 15.207: | Conducted Emission Limits |
| Section 15.209: | Radiated Emission Limits (General requirements) |
| Section 15.247: | Operation in the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5850 MHz |

The test sample **complied** with the requirements of 47 CFR, Part 15 Subpart C - Section 15.247.

The measurement procedure used was in accordance with ANSI C63.10-2013. The instrumentation conformed to the requirements of ANSI C63.2-2009.

### 1.1 Summary of Results

| FCC Part 15 Subpart C | Test Performed | Results |
|---|---|---|
| 15.203 | Antenna requirement | Complied |
| 15.205 | Operation in restricted Band | Complied |
| 15.207 | Conducted emissions limits | Complied |
| 15.209 | Radiated emissions limits | Complied |
| 15.247 (a)(2) | Minimum 6 dB Bandwidth | Complied |
| 15.247 (b)(3) | Peak Output Power | Complied |
| 15.247 (c) | Antenna Gain > 6 dBi | N/A as the EUT used integral antenna with less than 6 dBi gain and no external antenna connector |
| 15.247 (d) | Out of Band Emissions | Complied |
| 15.247 (e) | Peak Power Spectral Density | Complied |
| 15.247 (f) | Hybrid Systems | N/A assessed to digital modulation requirements |
| 15.247 (g) | Hopping channel application | N/A assessed to digital modulation requirements |
| 15.247 (h) | Incorporation of intelligence within FHSS | N/A assessed to digital modulation requirements |
| 15.247 (i) | Radio Frequency Hazard | Complied, output power was less than 20 mW |
| 2.1049 | Occupied bandwidth | 1.026 MHz |

N/A: Not Applicable

### 1.2 Modifications by EMC Technologies

No modifications were required to achieve compliance.

## 2.0 GENERAL INFORMATION

(Information supplied by the Client)

### 2.1 EUT (Transmitter) Details

The RF transmitter was a Bluetooth Low Energy device operating in the 2.4 GHz band. It used a PCB antenna. A temporary UFL connector was mounted on the device to provide a means for measuring conducted output power. Transmitter specifications are shown in table below.

| | |
|---|---|
| **Test Sample:** | Commercial refrigeration controller with Bluetooth LE connectivity |
| **Model Number:** | SCS Connect |
| **Serial Number:** | C82115 00482 |
| **Part Number:** | SCSLC1013 |
| **Voltage Rating:** | 90 VAC – 240 VAC |
| **Supported Radio Standards:** | Bluetooth Low Energy (BLE) |
| **Operating Frequency Range:** | 2400 MHz to 2483.5 MHz<br>Low Channel: 2402 MHz<br>Middle Channel: 2440 MHz<br>High Channel: 2480 MHz |
| **Nominal Channel Bandwidth:** | 1 MHz |
| **Antenna Assembly Gain:** | -1.53 dBi |
| **Operating Temperature Range:** | -20 °C to 55 °C |

### 2.2 EUT (Host) Details

The EUT was a fridge controller to regulate temperature inside a cabinet. It incorporated a Bluetooth LE radio for configuration and tracking remotely.

The product was housed in a plastic enclosure approximately 8.1 x 10 x 3.6 cm (L x W x H).

### 2.3 Test Procedure

Radio measurements to demonstrate compliance with FCC part 47CFR15.247 were performed in accordance with the procedures of ANSI C63.10-2013 and KDB 558074 v03r05 - Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

### 2.4 Test Facility

#### 2.4.1 General

Measurements were performed at EMC Technologies' laboratory in Keilor Park, Victoria Australia. EMC Technologies Pty Ltd is listed by the FCC as a test laboratory able to perform compliance testing for the public. EMC Technologies is listed as an FCC part 47CFR2.948 test lab and may perform the testing required under Parts 15 and 18 – **FCC Registration Number 90560**

EMC Technologies Pty Ltd has also been accredited as a Conformity Assessment Body (CAB) by Australian Communications and Media Authority (ACMA) under the APECTEL MRA and is designated to perform compliance testing on equipment subject to Declaration of Conformity (DoC) and Certification under Parts 15 & 18 of the FCC Commission's rules – **Registration Number 494713 & Designation number AU0001.**

EMC Technologies' indoor open are test site (iOATS) has been accepted by Industry Canada for the performance of radiated measurements in accordance with RSS-Gen Issue 4 - **Industry Canada iOATS number - IC 3569B**

### 2.4.2 NATA Accreditation

NATA is the Australian National laboratory accreditation body and has accredited EMC Technologies to operate to the IEC/ISO17025 requirements. A major requirement for accreditation is the assessment of the company and its personnel as being technically competent in testing to the standards. This requires fully documented test procedures, continued calibration of all equipment to the National Standard at the National Measurements Institute (NMI), NPL (UK), NIST (USA) and an internal quality system to ISO 9002. NATA has mutual recognition agreements with the National Voluntary Laboratory Accreditation Program (NVLAP) and the American Association for Laboratory Accreditation ($A^2LA$).

EMC Technologies is accredited in Australia by the National Association of Testing Authorities (NATA). All testing in this report has been conducted in accordance with EMC Technologies' scope of NATA accreditation.

The current full scope of accreditation can be found on the NATA website: www.nata.com.au
It also includes a large number of emissions, immunity, SAR, EMR and Safety standards.

## 2.5 Test Equipment Calibration

Measurement instrumentation and transducers were calibrated in accordance with the applicable standards by an independent NATA registered laboratory such as Keysight Technologies (Australia) Pty Ltd, Rohde and Schwarz, NMI, NPL or NIST. All equipment calibration is traceable to Australia national standards at the National Measurements Institute. The reference antenna calibration was performed by NPL and the working antennas (BiLog and horn) calibrated by EMC Technologies. The complete list of test equipment used for the measurements, including calibration dates and traceability is contained in Appendix A

**FCC PART 15 Subpart C (Section 15.247)**

## 3.0 ANTENNA REQUIREMENT (§15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT used a permanently attached PCB antenna therefore considered sufficient to comply with the provisions of this section. There was no external antenna connector available to the user.

## 4.0 CONDUCTED EMISSIONS (§15.207)

### 4.1. Test procedure

The arrangement specified in ANSI C63.4: 2009 was adhered to for the conducted EMI measurements. The EUT was placed in the RF screened enclosure and a CISPR EMI Receiver as defined in ANSI C63.2: 2009 was used to perform the measurements.

The EMI Receiver was operated under program control using the Max-Hold function and automatic frequency scanning, measurement and data logging techniques. The specified 0.15 MHz to 30 MHz frequency range was sub-divided into sub-ranges to ensure that all short duration peaks were captured.

The various operating modes of the system were investigated. For each of the sub-ranges, the EMI receiver was set to continuous scan with the Peak detector set to Max-Hold mode. The Quasi-Peak detector and the Average detector were then invoked to measure the actual Quasi-Peak and Average level of the most significant peaks, which were detected.

The voltage levels were automatically measured in software and compared to the test limit. The method of calculation was as follows:

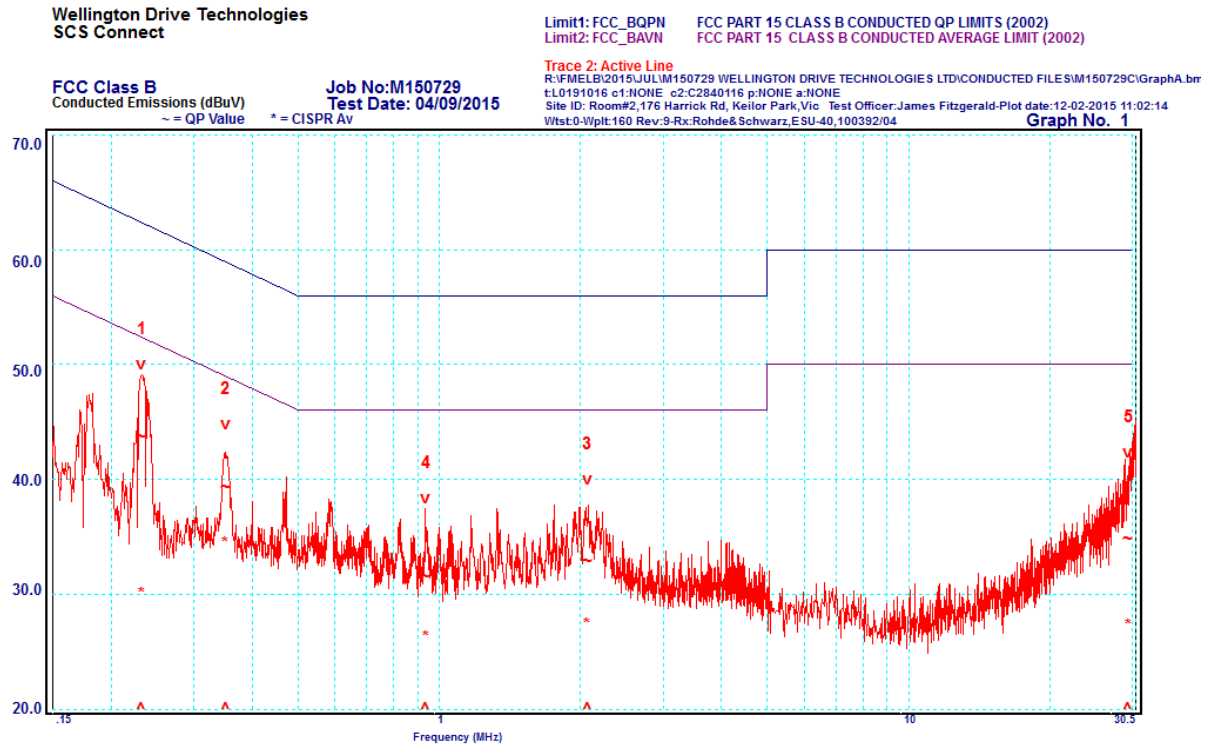
$$V_{EMI} = V_{Rx} + LBPF$$

Where: $V_{EMI}$ = the Measured EMI voltage in dBµV to be compared to the limit.
$V_{Rx}$ = the Voltage in dBµV read directly at the EMI receiver.
LBPF = the insertion loss in dB of the cables and the Limiter and Band Pass Filter.

### 4.2. Results

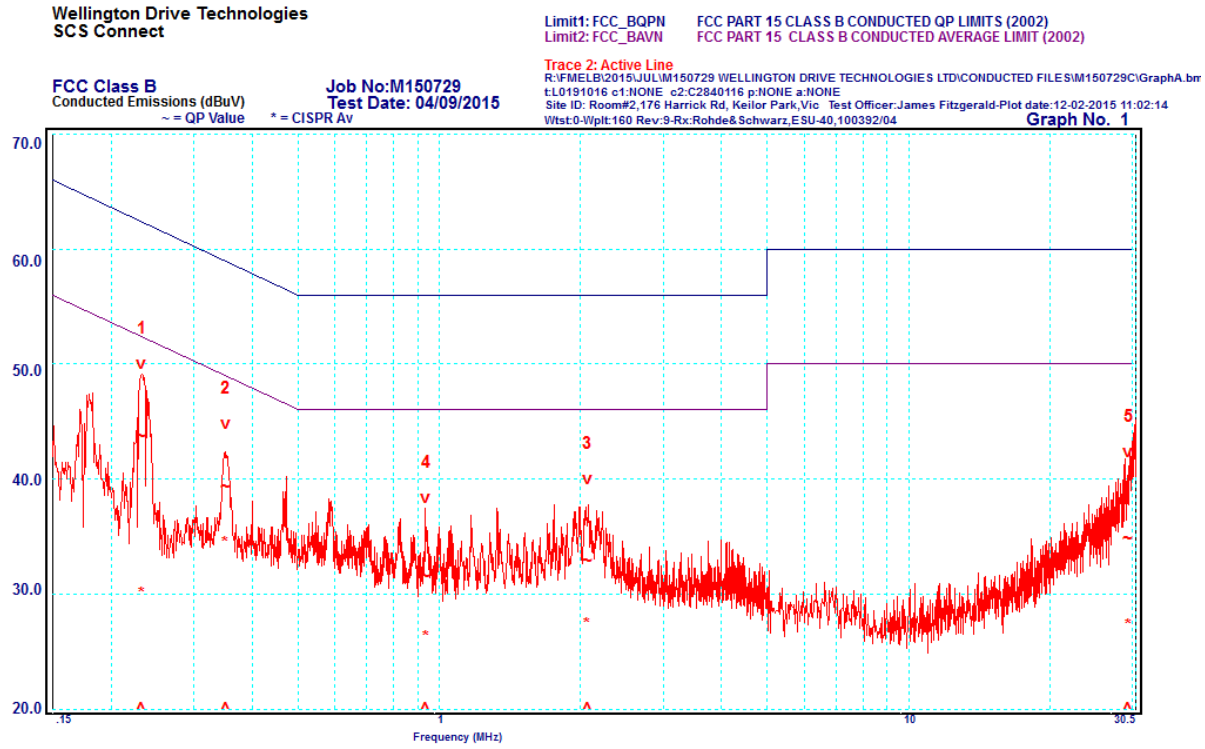
The measurement data pertaining to each frequency sub-range were concatenated to form a single graph of (peak) amplitude versus frequency. This was performed for both Active and Neutral lines and the composite graph was subsequently plotted. A list of the highest relevant peaks and the respective Quasi-Peak and Average values were also plotted on the graph.

## Active Line, 0.15 - 30 MHz




| Peak | Frequency MHz | Line | Measured QP Level dBµV | QP Limit dBµV | ΔQP ±dB | Measured AV Level dBµV | AV Limit dBµV | ΔAV ±dB |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.233 | Active | 43.7 | 62.4 | -18.7 | 30.0 | 52.4 | -22.4 |
| 2 | 0.351 | Active | 39.2 | 58.9 | -19.7 | 34.4 | 48.9 | -14.5 |
| 3 | 2.074 | Active | 32.8 | 56.0 | -23.2 | 27.3 | 46.0 | -18.7 |
| 4 | 0.937 | Active | 31.5 | 56.0 | -24.5 | 26.2 | 46.0 | -19.8 |
| 5 | 29.43 | Active | 34.8 | 60.0 | -25.2 | 27.2 | 50.0 | -22.8 |

## Neutral Line, 0.15 - 30 MHz



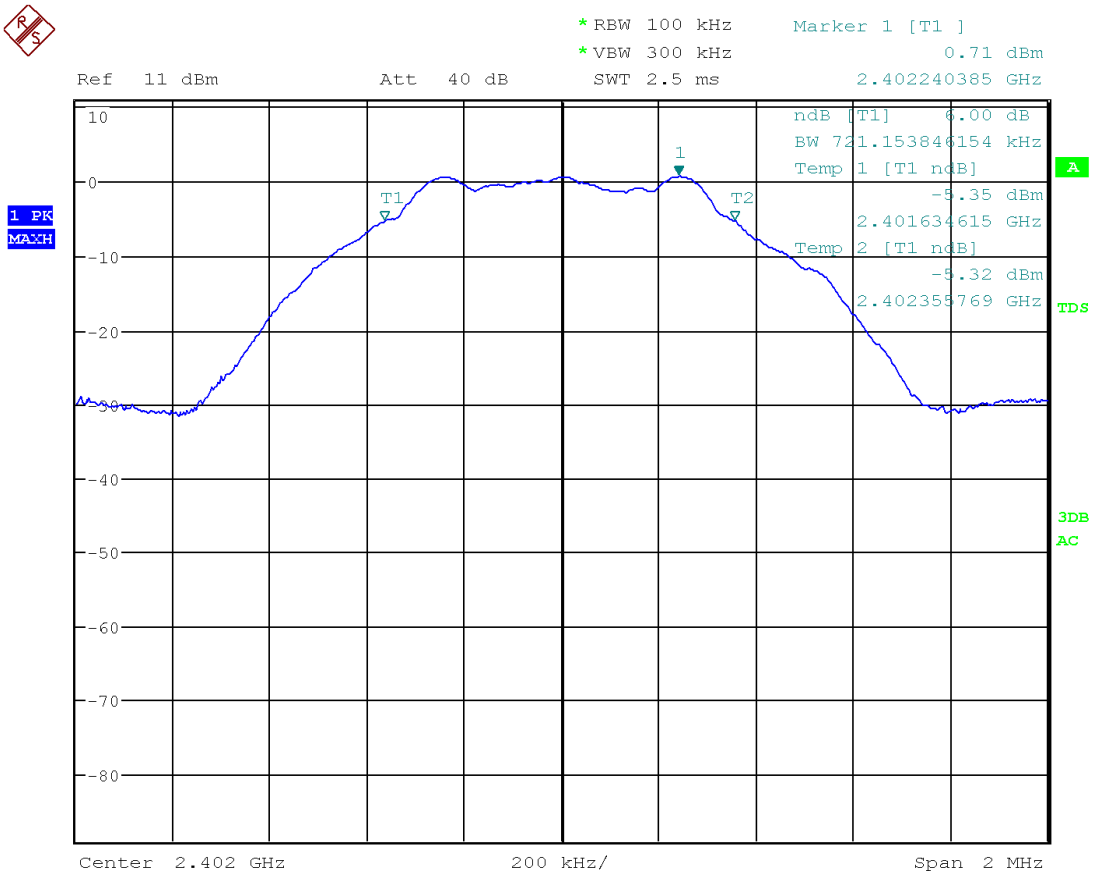

| Peak | Frequency MHz | Line | Measured QP Level dBµV | QP Limit dBµV | ΔQP ±dB | Measured AV Level dBµV | AV Limit dBµV | ΔAV ±dB |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.234 | Neutral | 45.6 | 62.3 | -16.7 | 30.9 | 52.3 | -21.4 |
| 2 | 0.585 | Neutral | 33.5 | 56.0 | -22.5 | 28.3 | 46.0 | -17.7 |
| 3 | 0.180 | Neutral | 41.7 | 64.5 | -22.8 | 29.5 | 54.5 | -25.0 |
| 4 | 2.105 | Neutral | 32.0 | 56.0 | -24.0 | 26.0 | 46.0 | -20.0 |
| 5 | 29.84 | Neutral | 32.0 | 60.0 | -28.0 | 24.9 | 50.0 | -25.1 |

## 5.0 DTS 6 dB BANDWIDTH (§15.247 (a)(2))

Minimum 6 dB bandwidth shall be at least 500 kHz. Measurements were performed on low, middle and high channel. Care was taken so that the bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

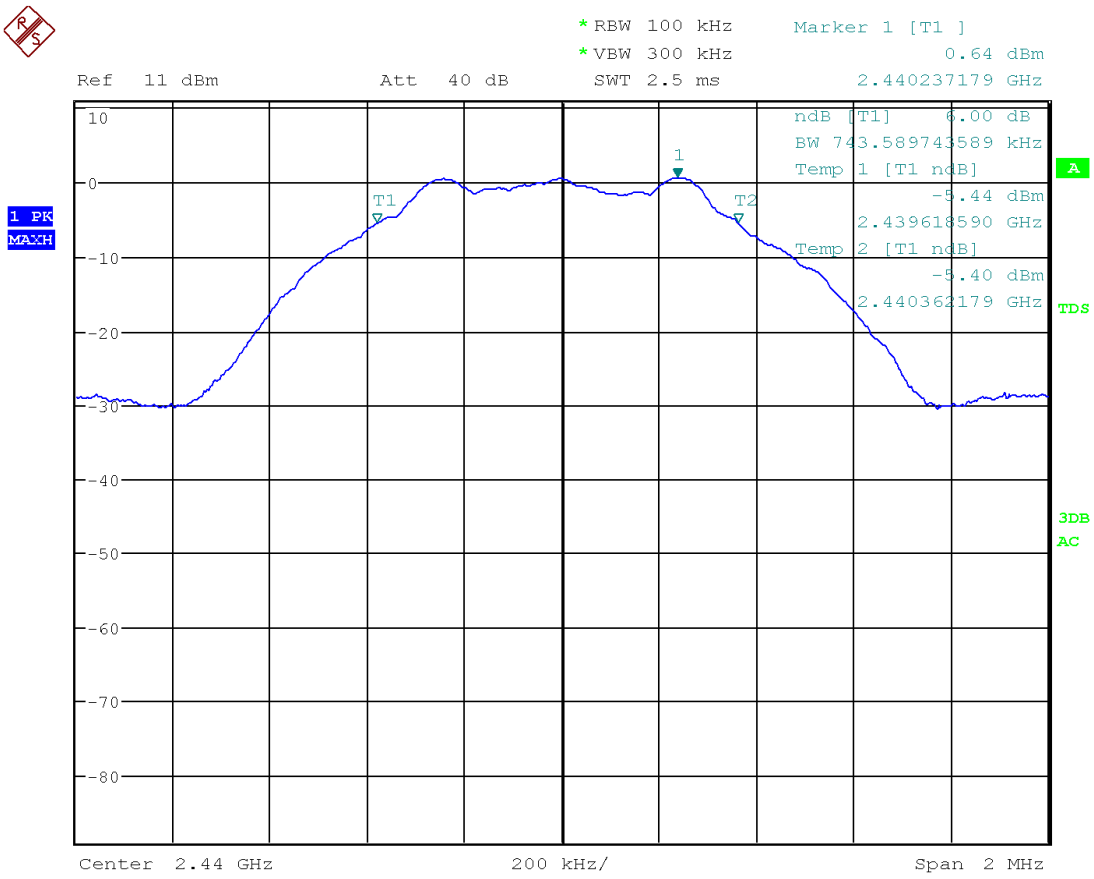
## 5.1. Results

Measurement results are shown in the following graphs.



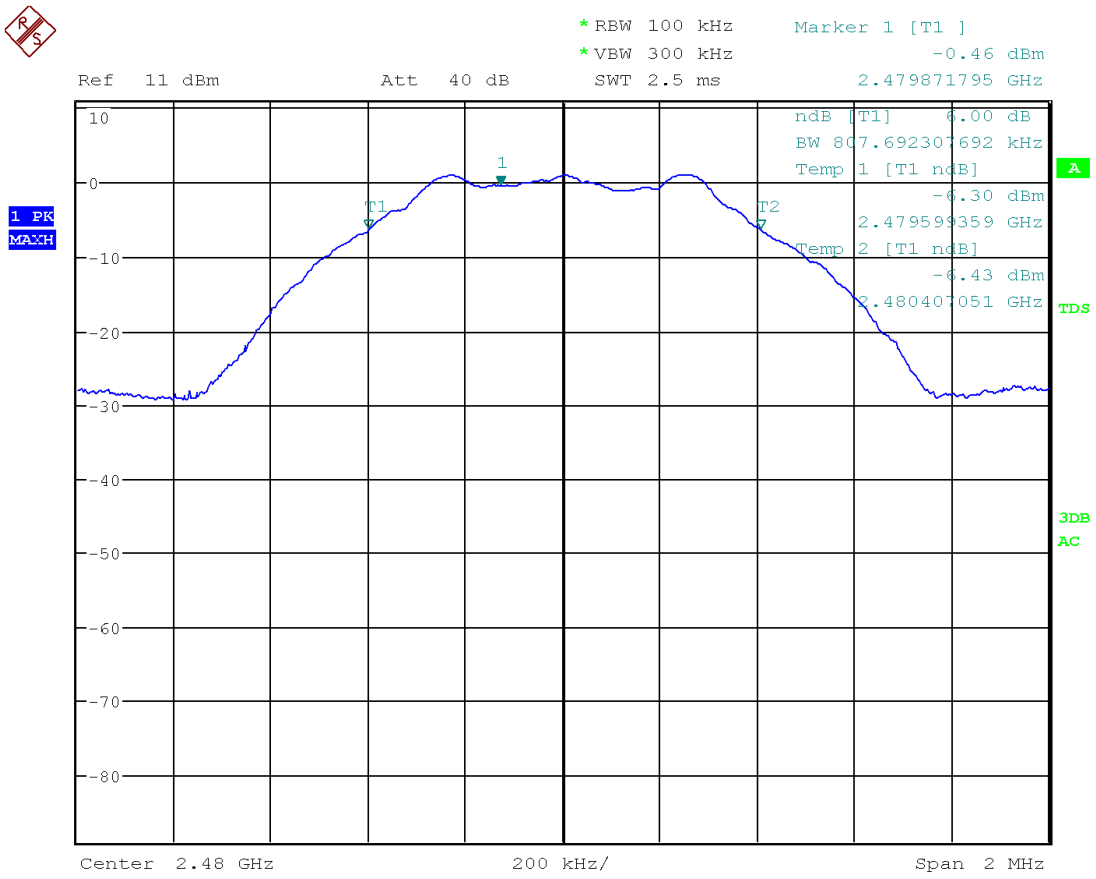

| Modulation | 6 dB Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| BLE | 721.15 | > 500 | Pass |

**Graph 1: 6 dB bandwidth, low channel**




| Modulation | 6 dB Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| BLE | 743.59 | > 500 | Pass |

**Graph 2: 6 dB bandwidth, middle channel**




| Modulation | 6 dB Bandwidth (kHz) | Limit (kHz) | Result |
|---|---|---|---|
| BLE | 807.69 | >500 | Pass |

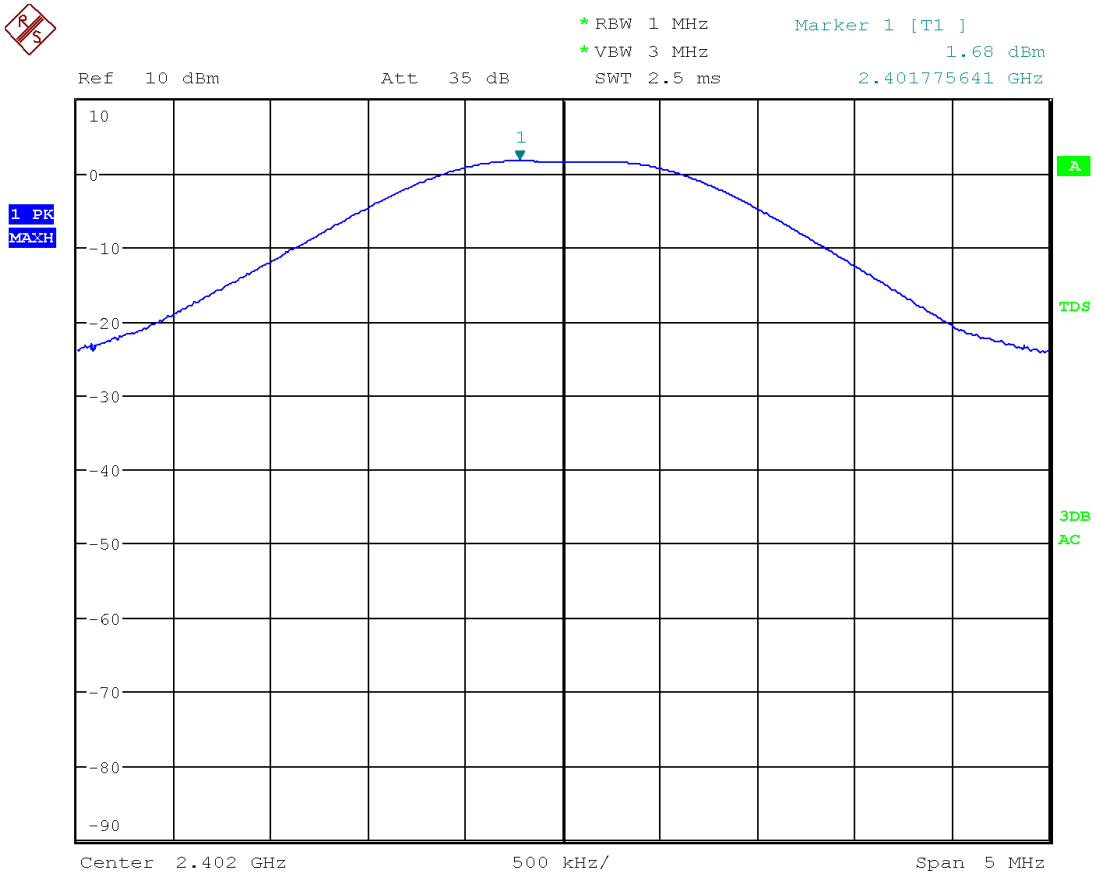
**Graph 3: 6 dB bandwidth, high channel**

## 6.0 PEAK OUTPUT POWER (§15.247 (b)(3))

As there was a temporary antenna connector available on the PCB the test was performed using conducted measurement. Maximum peak conducted power method (clause 9.1.1 of KDB 558074 v03r05) was used for measurement. Cable loss between connector and spectrum analyser were accounted for in reading.

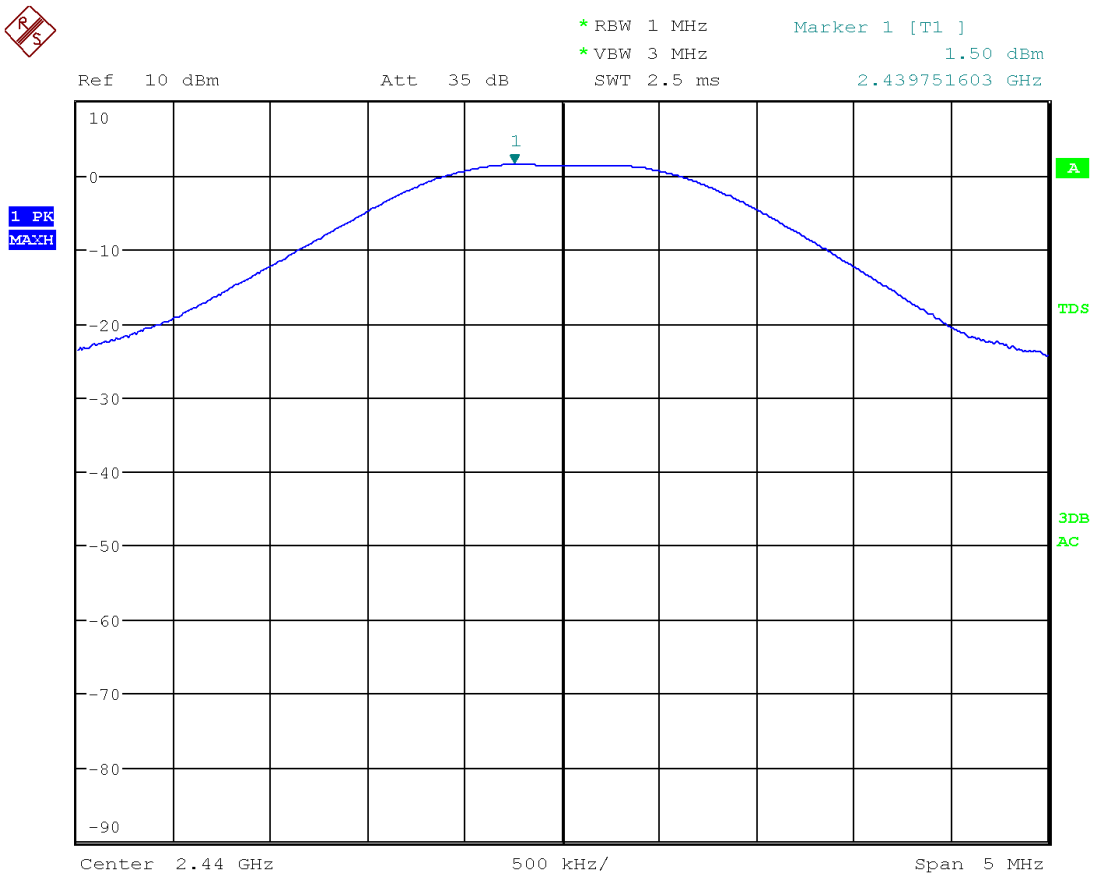
## 6.1. Results

Measurement results are shown in the following graphs.



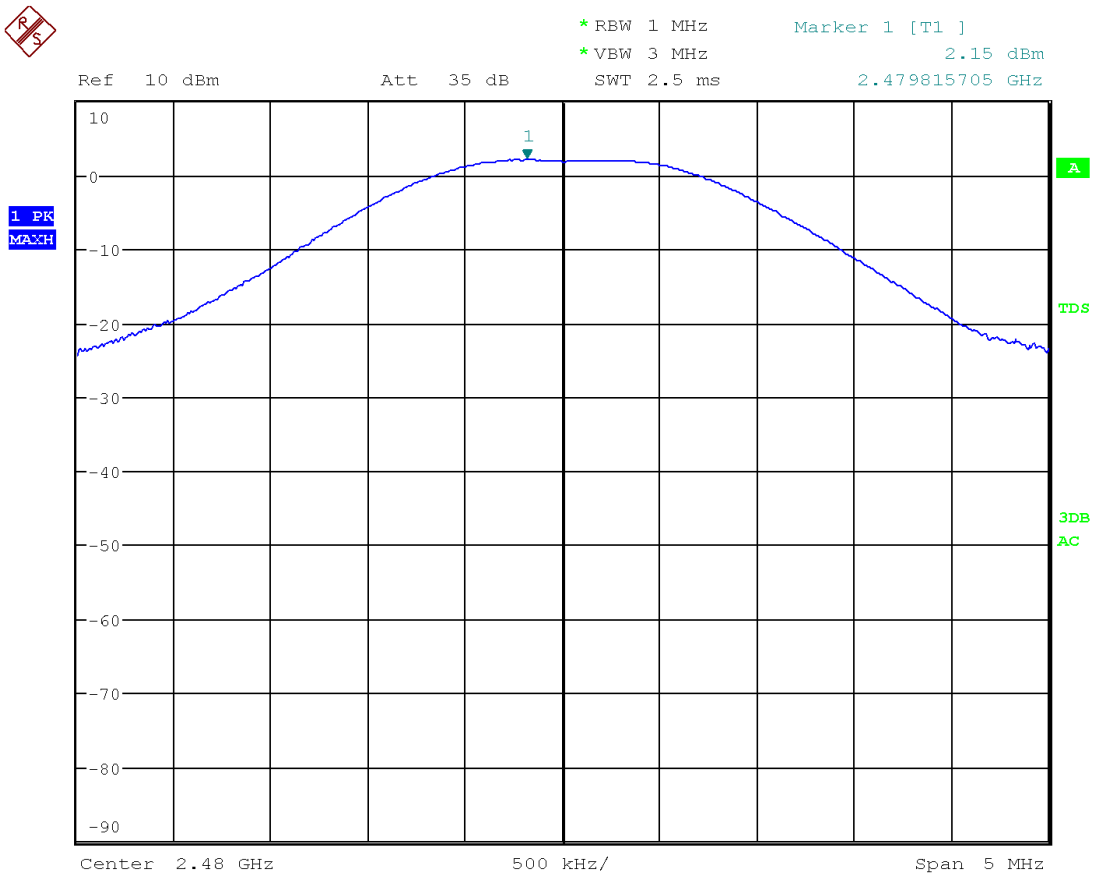

| Channel | Conducted Power (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| Low | 1.68 | 30 | -28.32 | Pass |

**Graph 4: Conducted power, low channel**




| Channel | Conducted Power (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| Middle | 1.50 | 30 | -28.50 | Pass |

**Graph 5: Conducted power, middle channel**




| Channel | Conducted Power (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| High | 2.15 | 30 | -27.85 | Pass |

**Graph 6: Conducted power, high channel**

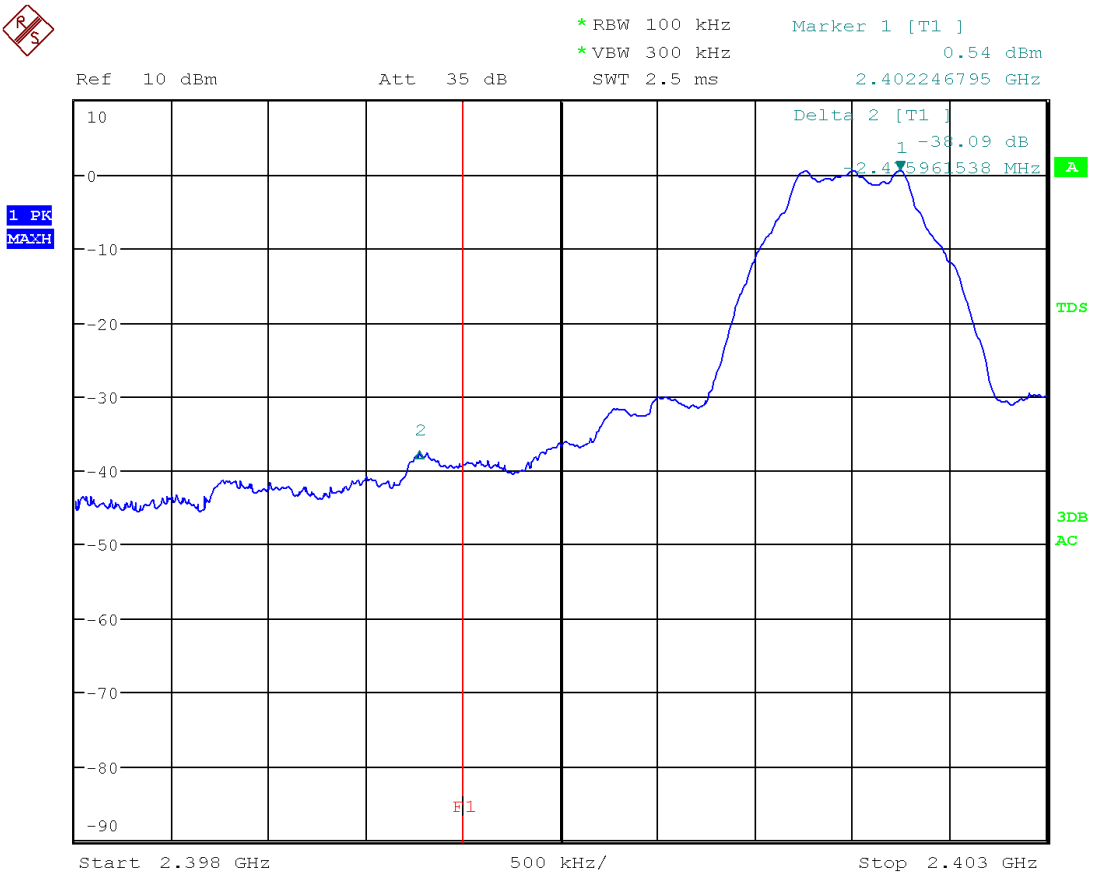
## 7.0 BAND-EDGE EMISSION MEASUREMENTS

Band edge emission were investigated according to KDB 558074 D01 v03r05 clause 13. Emissions within 2 MHz of an authorized band edge were measured using the marker-delta method (KDB 558074 D01 v03r05 clause 13.2). Results from section 6 of this report were used for in band emission values. In band emission were obtained using 3 MHz resolution bandwidth, instead of 1 MHz, which represents worse case.

### 7.1. Results

All emissions above and below the edge of the authorised band were more than 20 dB below the in band intentional emission.

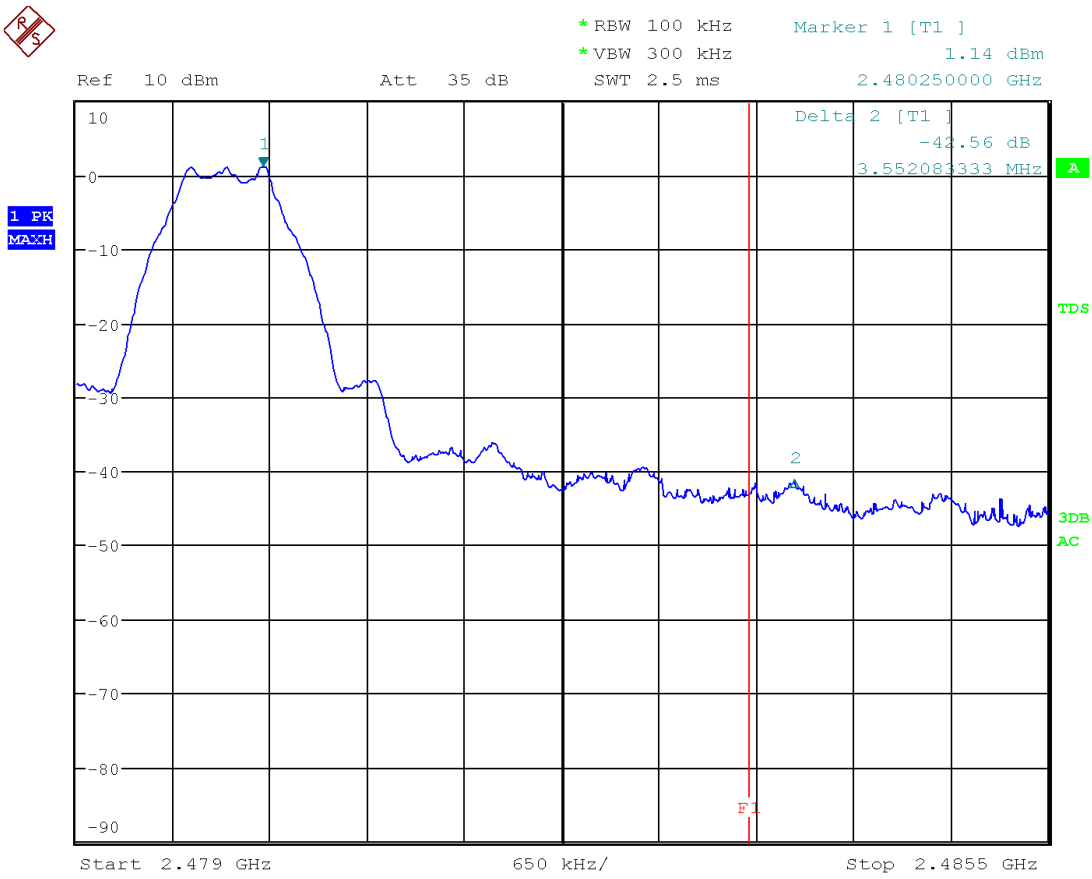
Measurement results are shown in the following graphs.




Vertical marker F1 was positioned at 2400 MHz.

| In Band Emission (dBm) | Delta (dB) | Band Edge Emission (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 1.68 | -38.09 | -36.41 | -18.32 | -18.09 | Pass |

**Graph 7: Lower band-edge emissions**




Vertical marker F1 was positioned at 2483.5 MHz.

| In Band Emission (dBm) | Delta (dB) | Band Edge Emission (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|
| 2.15 | -42.56 | -40.41 | -17.85 | -22.56 | Pass |

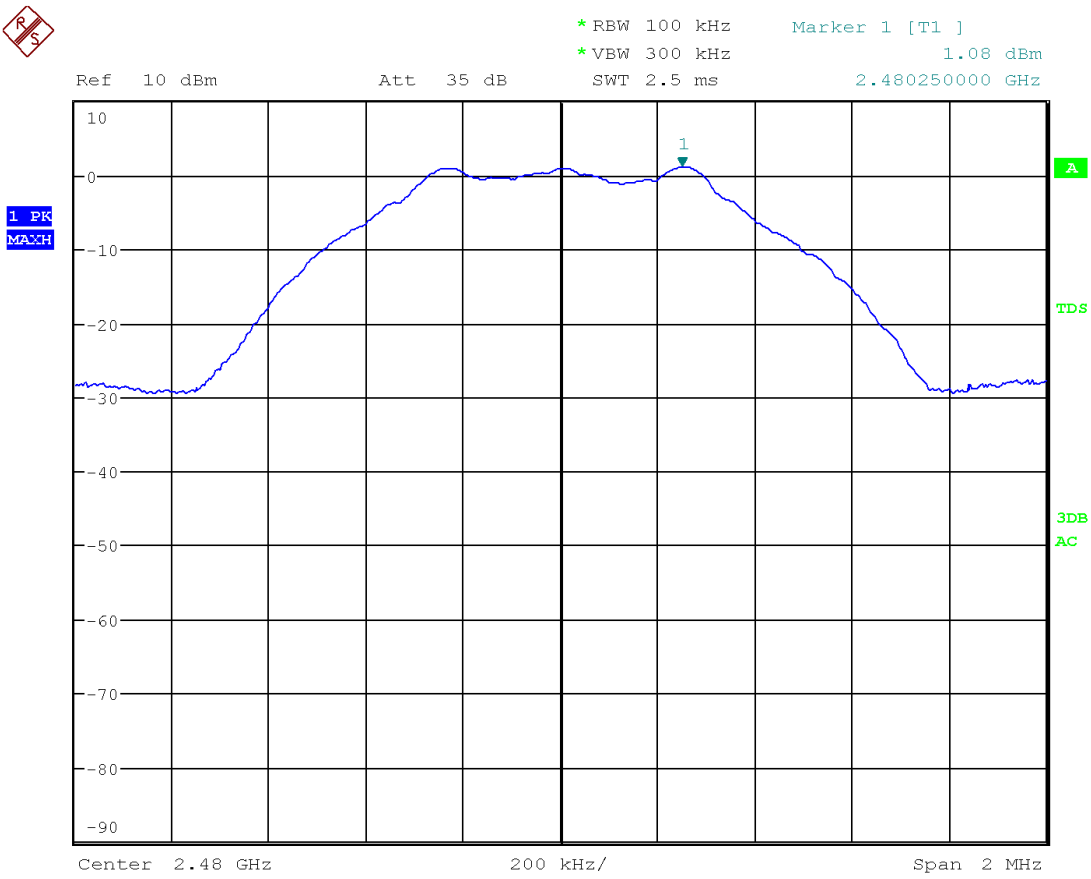
**Graph 8: Upper band-edge emissions**

## 8.0 SPURIOUS EMISSION MEASUREMENTS (§15.247 (d))

### 8.1. Emission in non-restricted bands

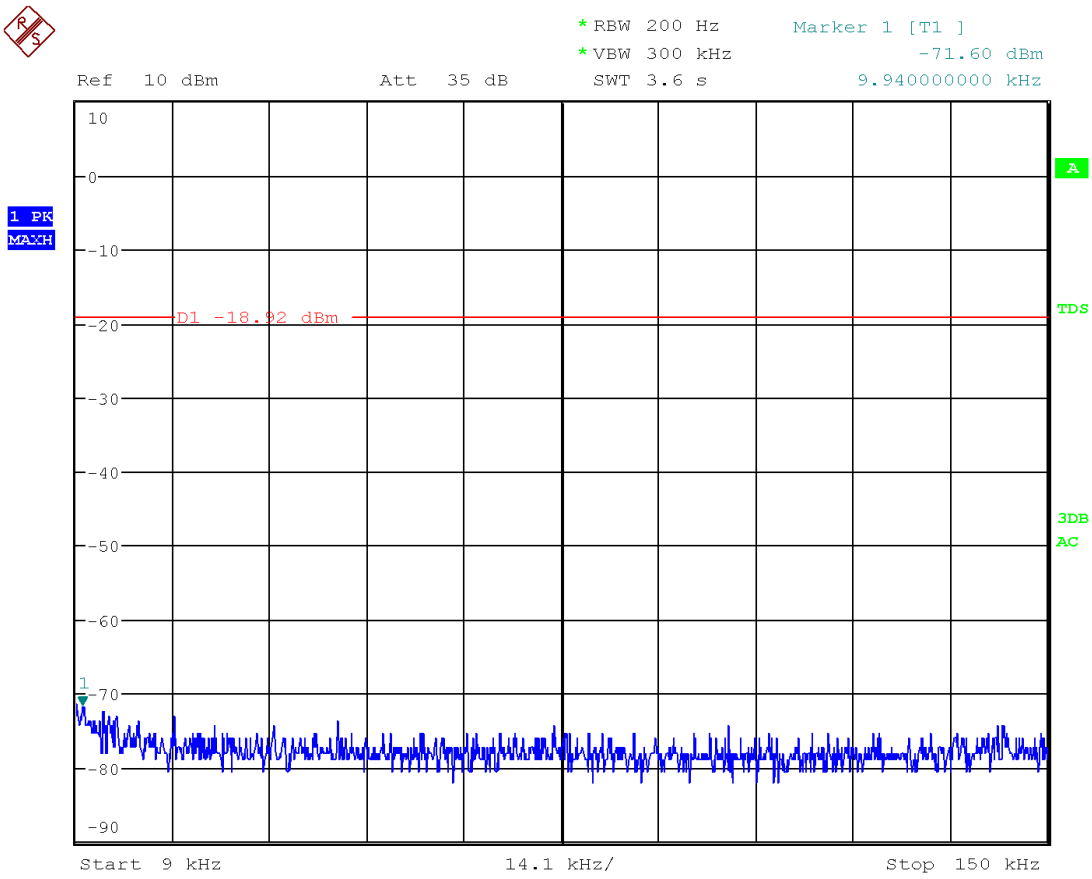
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Conducted method was used according to clause 11 of KDB 558074 D01.

#### 8.1.1. Results

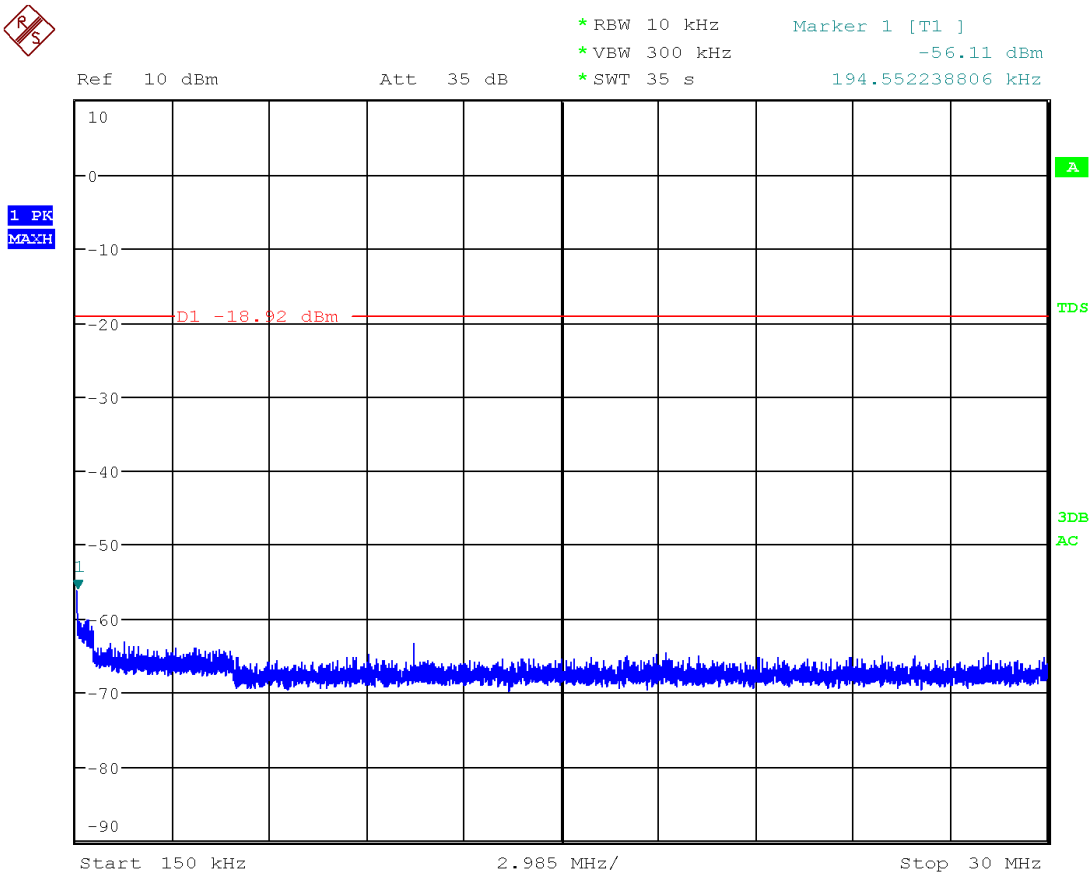



| Peak | Frequency (MHz) | SA Reading (dBm) | Limit (dBm) |
|---|---|---|---|
| 1 | 2480.25 | 1.08 | -18.92 (1.08 – 20) |

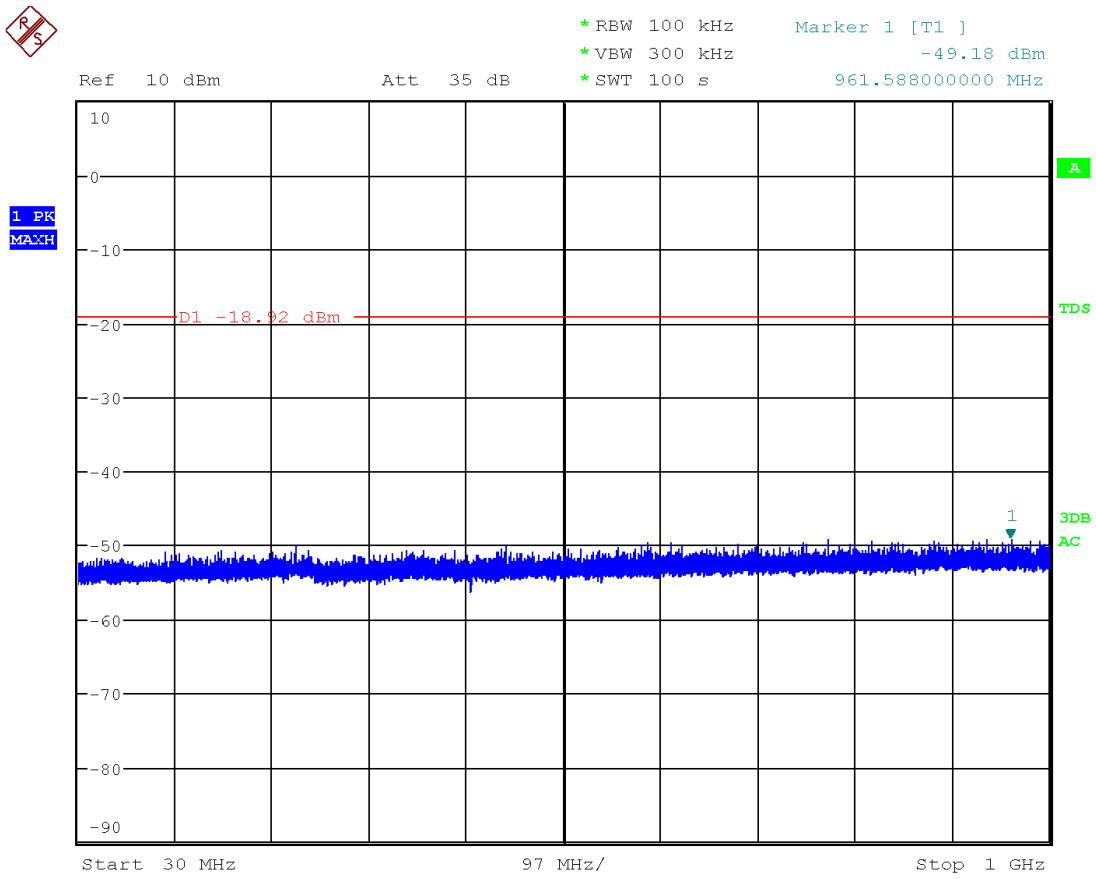
**Graph 9: Reference level measurement (in band emission)**



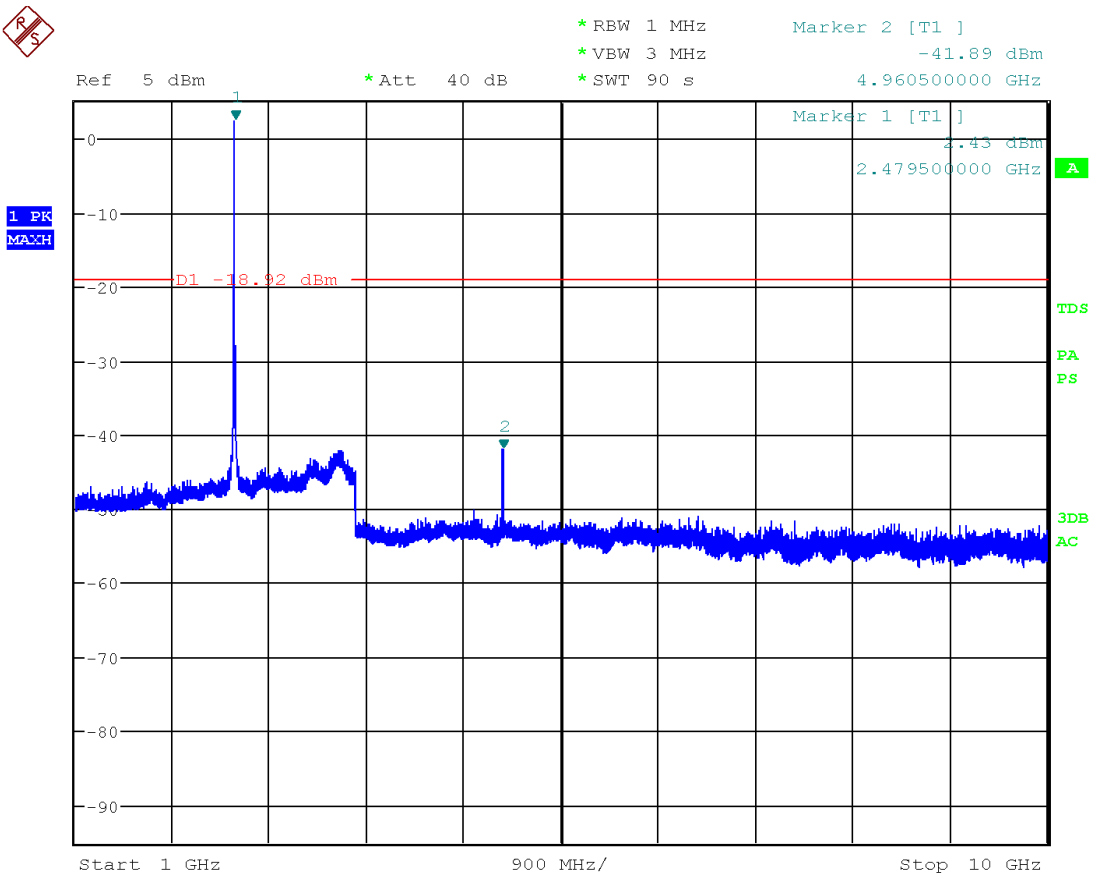

**Graph 10: Conducted spurious emissions, 9 kHz-150 kHz**



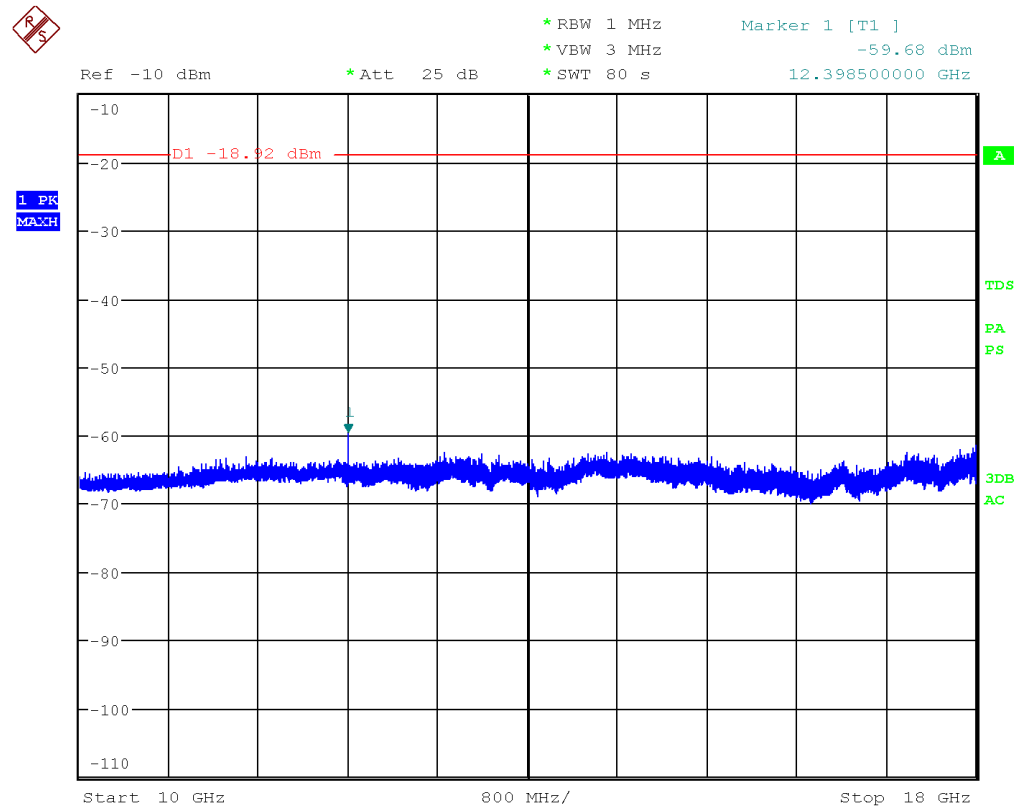

**Graph 11: Conducted spurious emissions, 150 kHz-30 MHz**



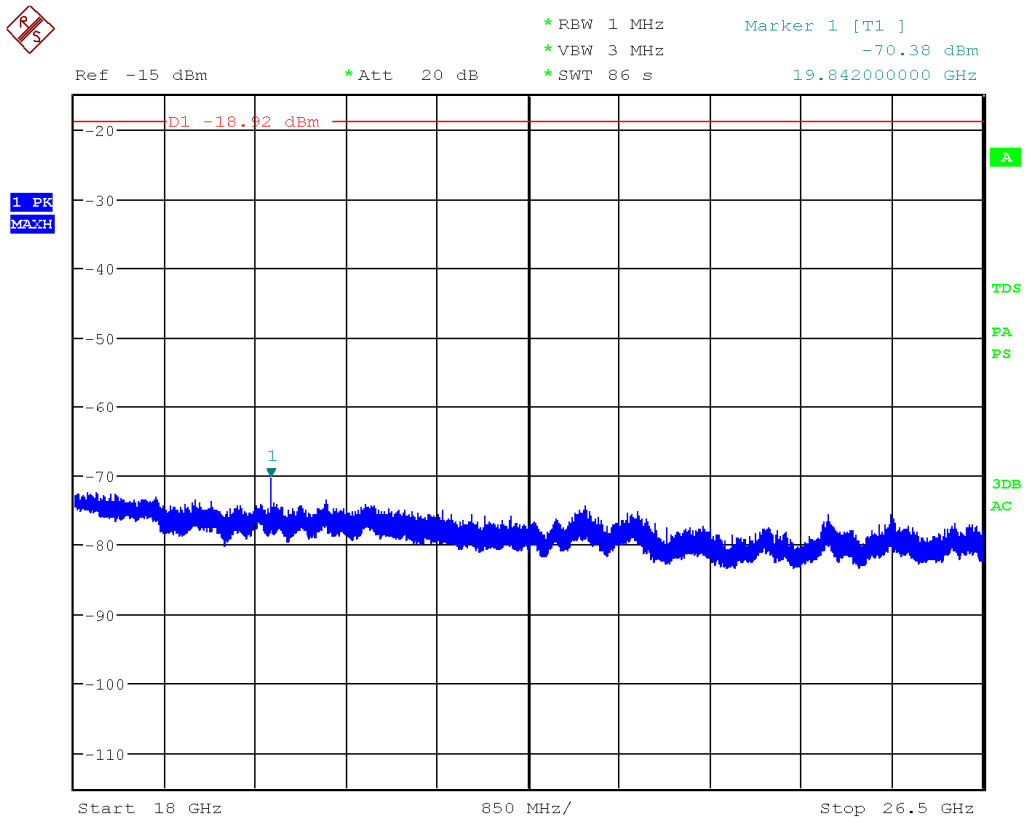

**Graph 12: Conducted spurious emissions, 30 MHz-1 GHz**




**Graph 13: Conducted spurious emissions, 1 GHz-10 GHz**




**Graph 14: Conducted spurious emissions, 10 GHz-18 GHz**




**Graph 15: Conducted spurious emissions, 18 GHz-26.5 GHz**

Horizontal line D1 was set to the level 20 dB lower than in band emission (figure 9).

All emissions were more than 20 dB below the maximum in-band emission.

## 8.2. Radiated Spurious Emissions

In order to ensure the compliance to the requirements of emission in restricted bands, radiated measurements were performed. Frequency range of 9 kHz to 26.5 GHz was investigated for any emissions falling in restricted frequency bands. Limits of FCC 15.209 were applied.

The EUT was placed 1.5 metres above the floor during the test (note: deviation from ANSI C63.10: 2013). The EUT was checked in three orthogonal planes to determine maximum emission, only the worst case is reproduced for the report.

Radiated EMI tests were performed inside a compliant CISPR16-1-4 semi-anechoic chamber for a 2m x 2m x 2m test volume up to 18 GHz, at a test distance of 10, 3 and 1 metres. The EUT was set up on the table top (placed on turntable) of total height 150 cm above the ground plane. The test frequency range was sub-divided into smaller bands with sufficient frequency resolution to permit reliable display and identification of possible EMI peaks while also permitting fast frequency scan times. A calibrated loop antenna was used for measurements between 9 kHz and 30 MHz. A calibrated Biconilog antenna was used for measurements between 30 MHz and 1000 MHz. Calibrated EMCO standard gain horn antennas were used for measurements between 1 to 26.5 GHz.

- The measurement of emissions between 9 - 150 kHz was measured with the resolution bandwidth of 200 Hz and the video bandwidth of 1 kHz.
- The measurement of emissions between 150 kHz - 30 MHz was measured with the resolution bandwidth of 9 kHz and the video bandwidth of 30 kHz.
- The measurement of emissions between 30 - 1000 MHz was measured with the resolution bandwidth of 120 kHz and the video bandwidth of 300 kHz.
- The measurement of emissions above 1000 MHz was measured using a following setting:
  Peak measurements setting: RBW = VBW = 1 MHz
  Average measurements setting: RBW = 1 MHz and VBW = 10 Hz

The receiver bandwidth was set to 6 dB.

The EUT was slowly rotated with the Peak Detector set to Max-Hold. This was performed for two antenna heights. When an emission was located, it was positively identified and its maximum level found by rotating the automated turntable and by varying the antenna height. The procedure was repeated with the device orientated in three orthogonal axis to further maximise the emission.

Each significant peak was investigated with the Quasi-peak, Peak or Average Detectors as appropriate. The measurement data for each frequency range was corrected for cable losses, antenna factors and preamplifier gain. This process was performed for both horizontal and vertical antenna polarisations.

The field strength was calculated automatically by the software using all the pre-stored calibration data. The method of calculation is shown below:

**E = V + AF - G + L**
Where:

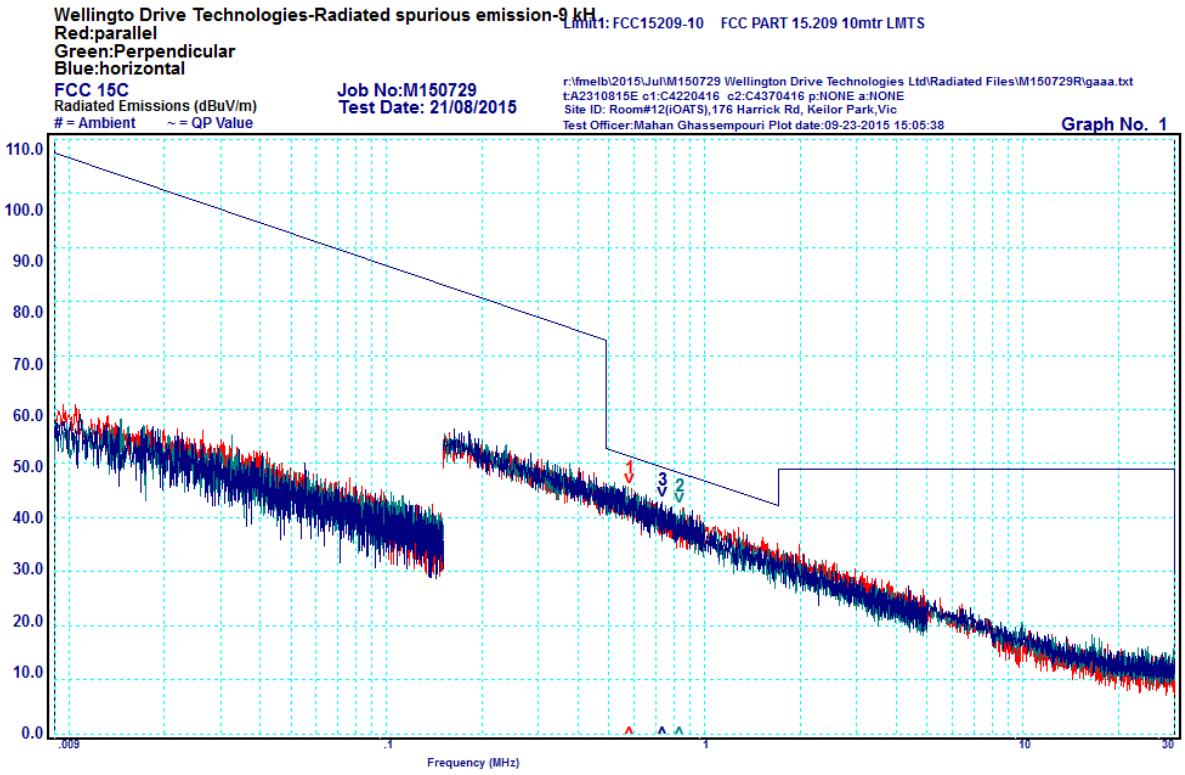
| | | |
|---|---|---|
| **E** | = | Radiated Field Strength in dBµV/m. |
| **V** | = | EMI Receiver Voltage in dBµV. (measured value) |
| **AF** | = | Antenna Factor in dB. (stored as a data array) |
| **G** | = | Preamplifier Gain in dB. (stored as a data array) |
| **L** | = | Cable loss in dB. (stored as a data array of Insertion Loss versus frequency) |

- **Example Field Strength Calculation**

Assuming a receiver reading of 34.0 dBµV is obtained at 90 MHz, the Antenna Factor at that frequency is 9.2 dB. The cable loss is 1.9 dB while the preamplifier gain is 20 dB. The resulting Field Strength is therefore as follows:

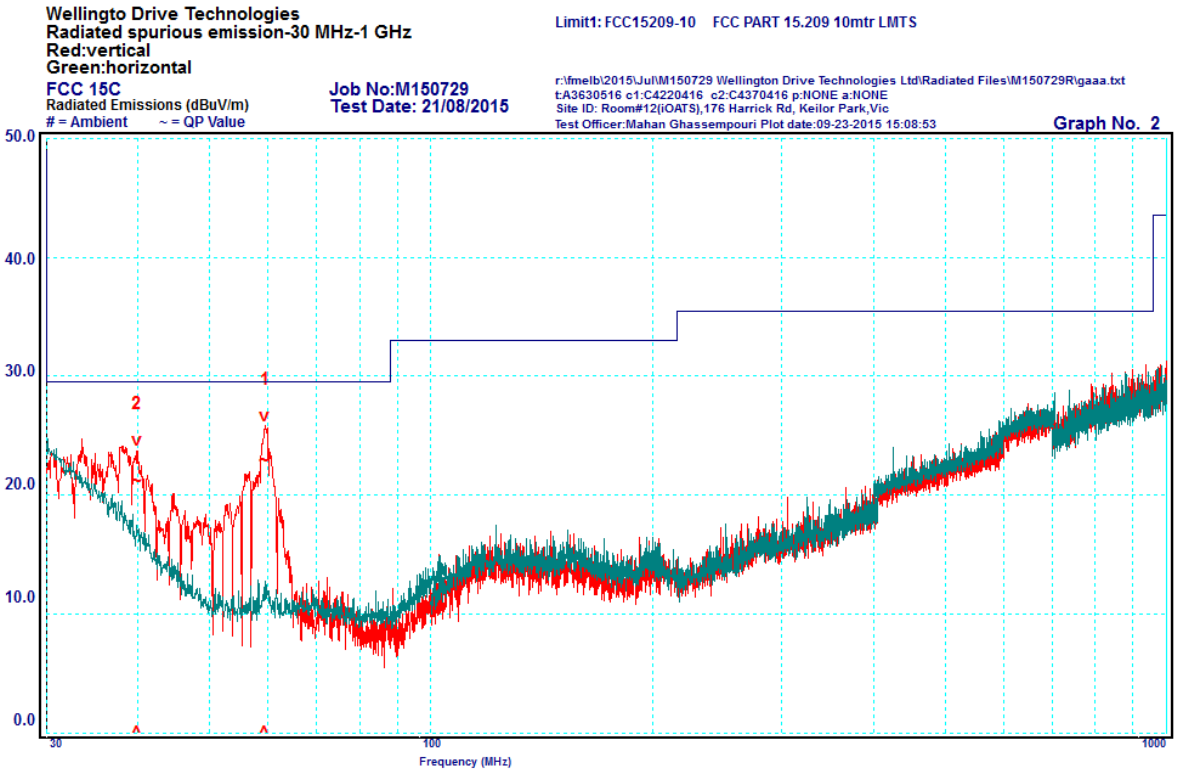
**34.0 + 9.2 + 1.9 - 20 = 25.1 dBµV/m**

### 8.2.1. Results



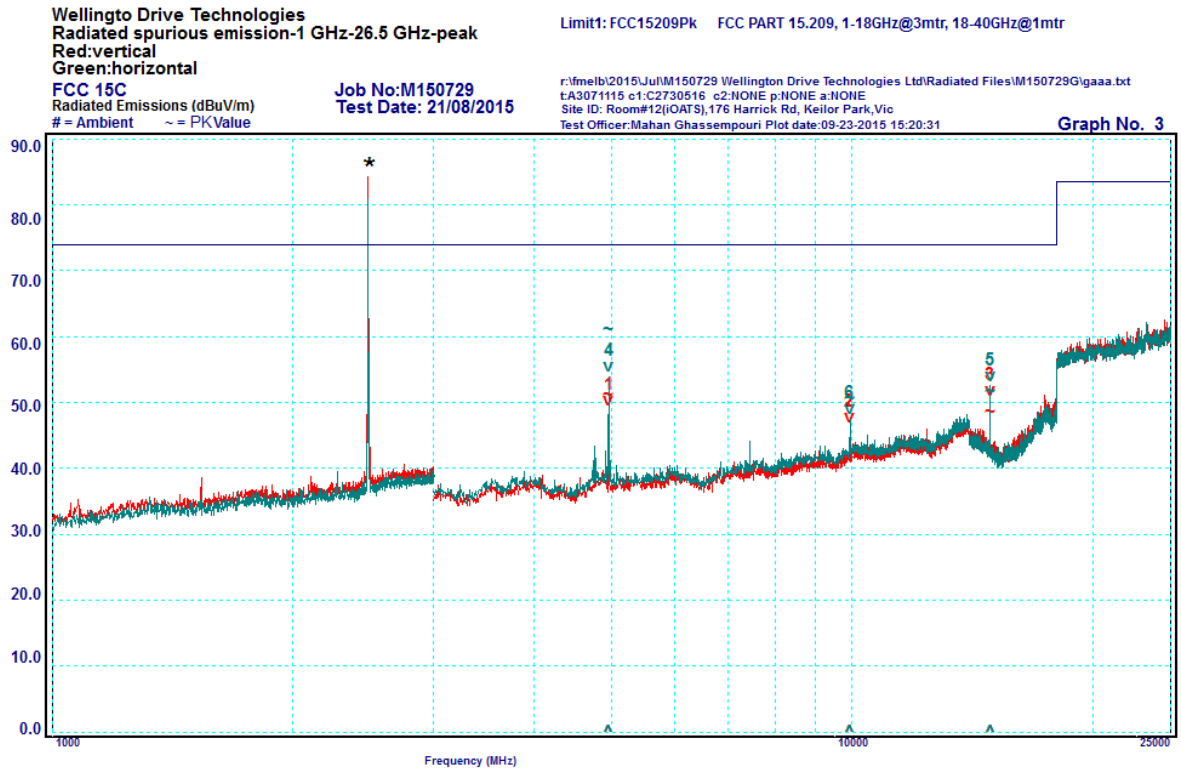

No emissions from the EUT were detected above the system noise floor.

**Graph 16: Radiated emission, 9 kHz-30 MHz, loop antenna, radiated emissions with restricted band limit applied over full range**




**Graph 17: 25 MHz – 1 GHz, radiated emissions radiated emissions with restricted band limit applied over full range**

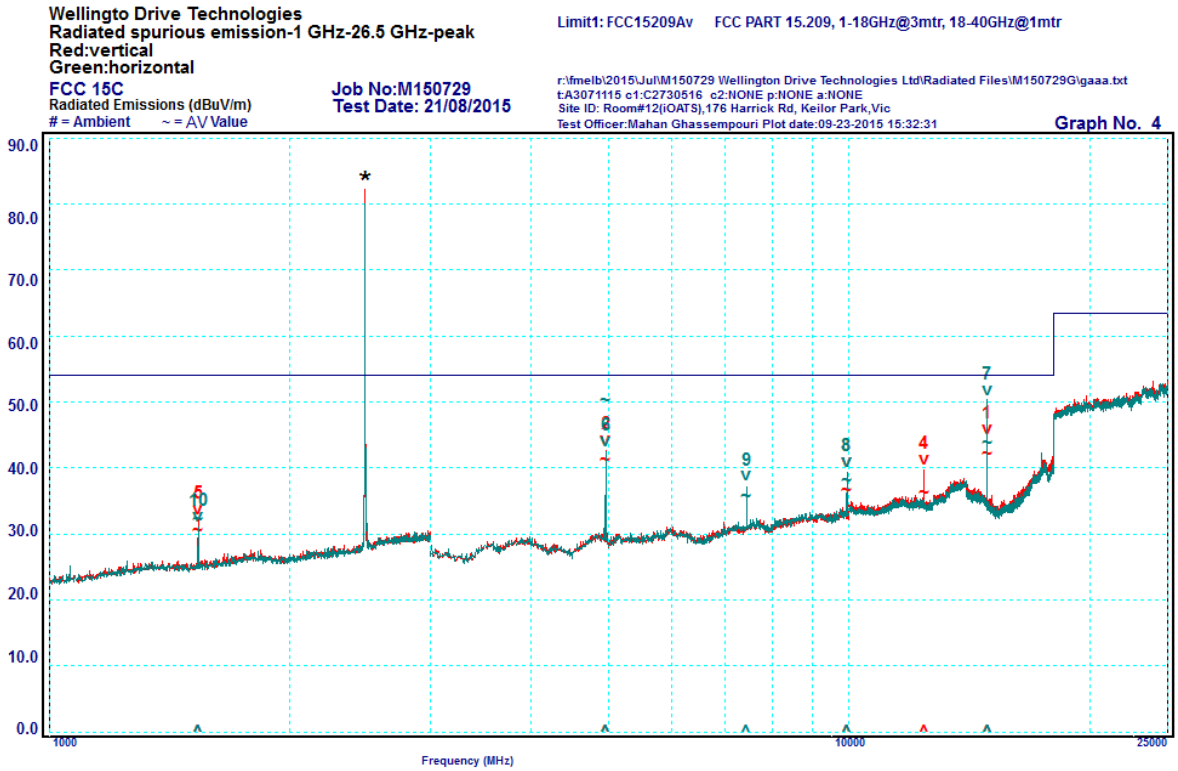
| Peak | Frequency (MHz) | Polarisation | Measured QP Level (dBµV/m) | QP Limit (dBµV/m) | ΔQP ±dB |
|---|---|---|---|---|---|
| 1 | 59.45 | Vertical | 22.90 | 29.50 | -6.6 |
| 2 | 39.86 | Vertical | 21.10 | 29.50 | -8.4 |




**Graph 18: 1 GHz – 26.5 GHz, radiated emissions with restricted band limit applied over full range, peak detector**

| Peak | Frequency (MHz) | Polarisation | Measured Peak Level (dBµV/m) | Peak Limit (dBµV/m) | ΔPeak ±dB |
|---|---|---|---|---|---|
| 1 | 4959.45 | Vertical | 51.20 | 74.00 | -22.80 |
| 2 | 9919.01 | Vertical | 49.50 | 74.00 | -24.50 |
| 3 | 14877.44 | Vertical | 48.60 | 74.00 | -25.40 |
| 4 | 4952.42 | Horizontal | 61.10 | 74.00 | -12.90 |
| 5 | 14877.63 | Horizontal | 51.60 | 74.00 | -22.40 |
| 6 | 9918.98 | Horizontal | 50.60 | 74.00 | -23.40 |

Note: Intentional radiation is excluded from measurement




**Graph 19: 1 GHz – 26.5 GHz, radiated emissions with restricted band limit applied over full range, average detector**

| Peak | Frequency (MHz) | Polarisation | Measured AV Level (dBµV/m) | AV Limit (dBµV/m) | ΔAV ±dB |
|---|---|---|---|---|---|
| 1 | 14878.52 | Vertical | 42.20 | 54.00 | -11.80 |
| 2 | 4959.54 | Vertical | 41.10 | 54.00 | -12.90 |
| 3 | 9918.82 | Vertical | 36.50 | 54.00 | -17.50 |
| 4 | 12398.69 | Vertical | 36.10 | 54.00 | -17.90 |
| 5 | 1536.02 | Vertical | 30.50 | 54.00 | -23.50 |
| 6 | 4959.65 | Horizontal | 50.10 | 54.00 | -3.90 |
| 7 | 14878.29 | Horizontal | 43.70 | 54.00 | -10.30 |
| 8 | 9918.89 | Horizontal | 38.00 | 54.00 | -16.00 |
| 9 | 7439.32 | Horizontal | 35.70 | 54.00 | -18.30 |
| 10 | 1536.11 | Horizontal | 32.10 | 54.00 | -21.90 |

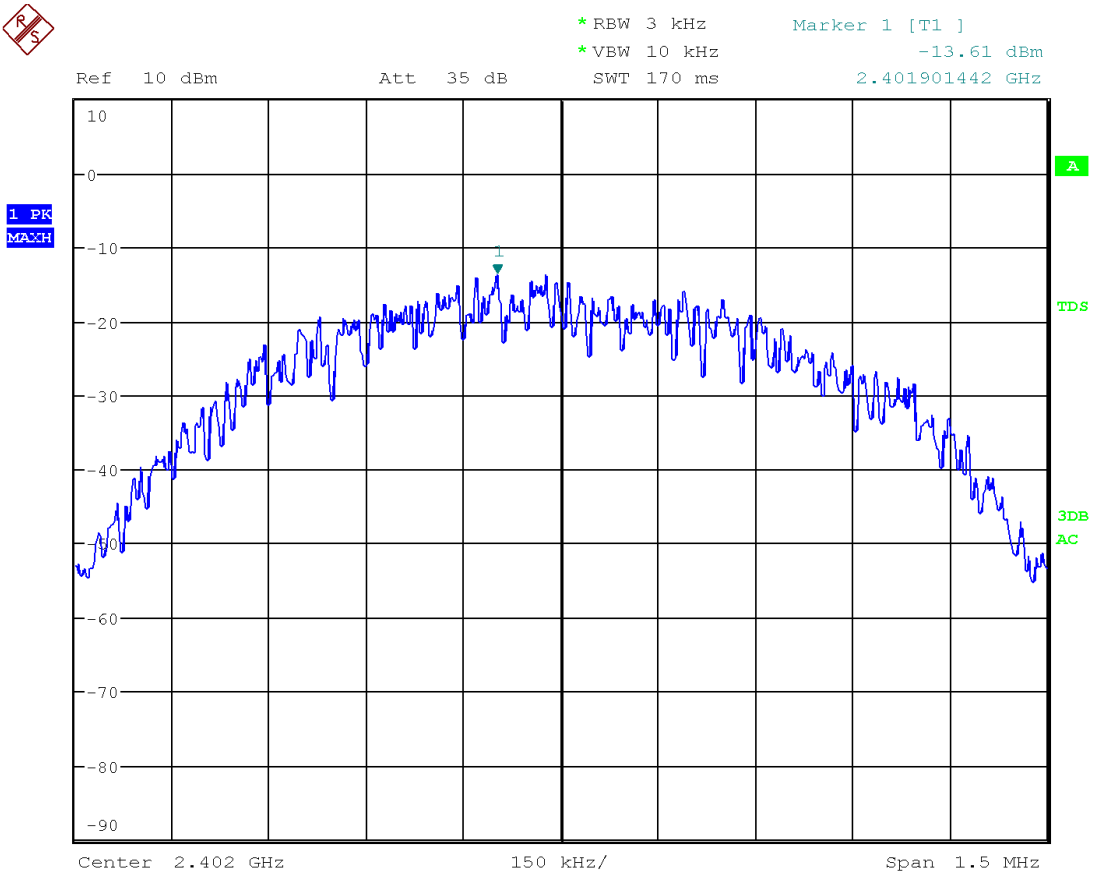
Note: Intentional radiation is excluded from measurement

## 9.0 POWER SPECTRAL DENSITY (§15.247 (d))

The PKPSD method according to KDB 558074 was used to demonstrate compliance.

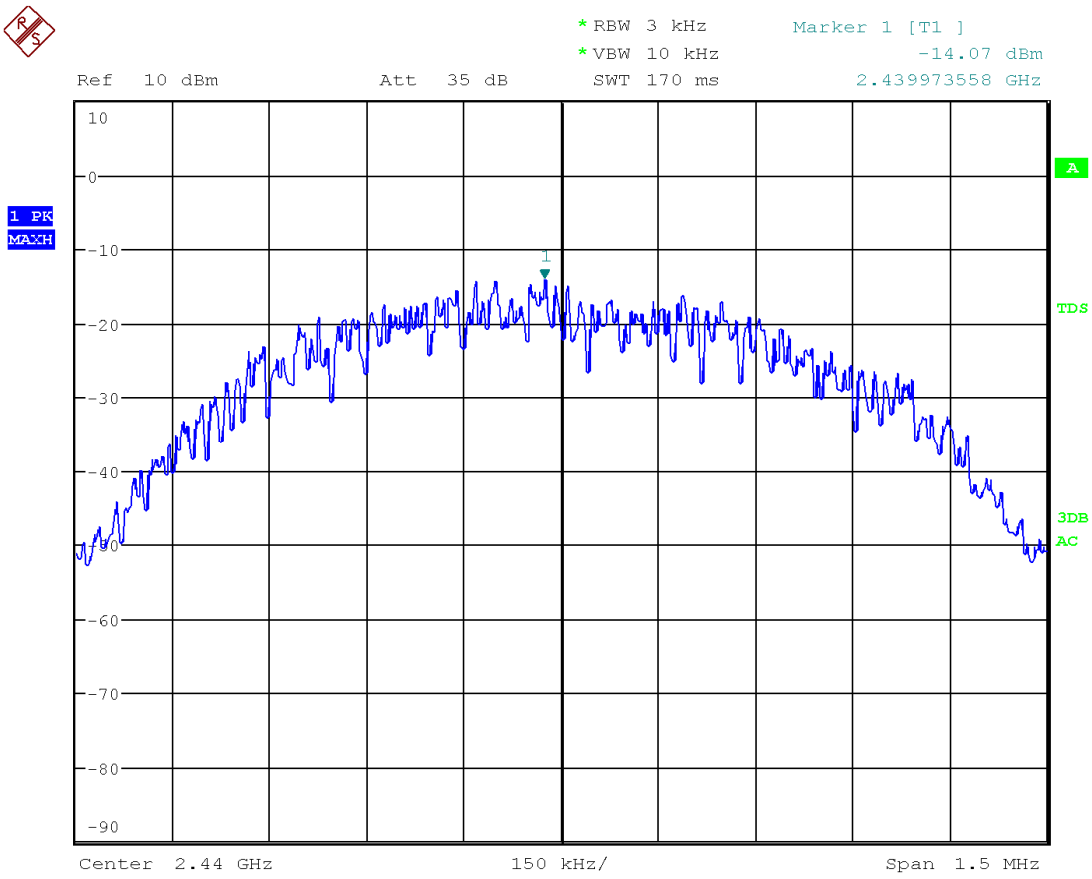
### 9.1. Results

Measurement results are shown in the following graphs.



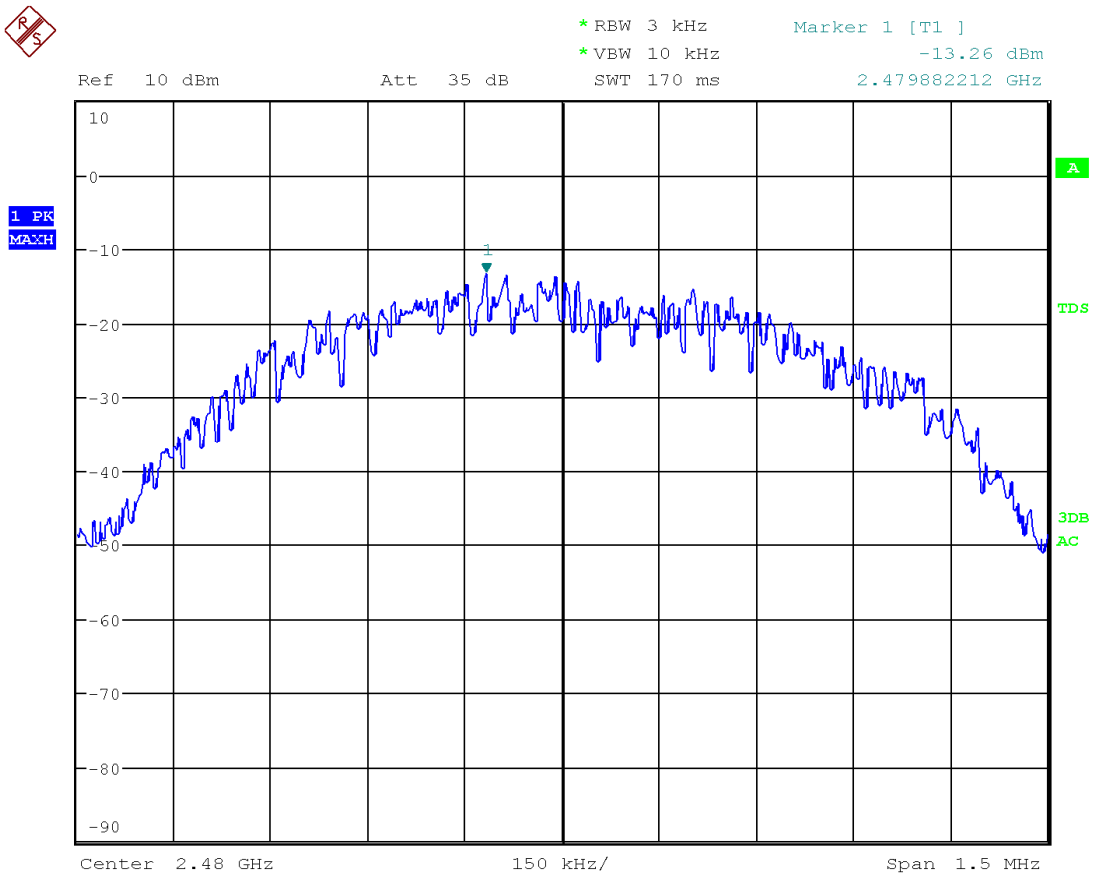

| Channel | Peak PSD (dBm/3 kHz) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| Low | -13.61 | 8 | 21.61 | Pass |

**Graph 20: Transmitter peak power spectral density, low channel**




| Channel | Peak PSD (dBm/3 kHz) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| Middle | -14.07 | 8 | 22.07 | Pass |

**Graph 21: Transmitter peak power spectral density, middle channel**

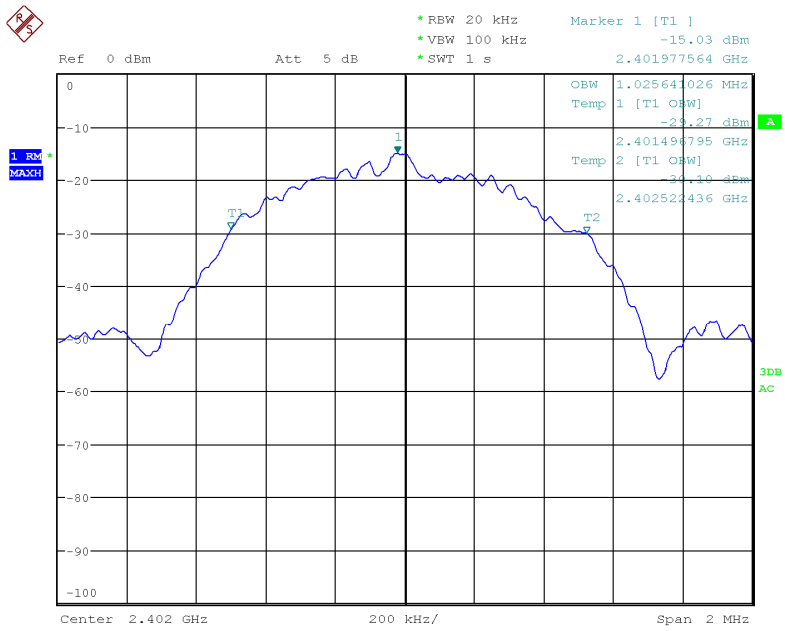



| Channel | Peak PSD (dBm/3 kHz) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| High | -13.26 | 8 | 21.26 | Pass |

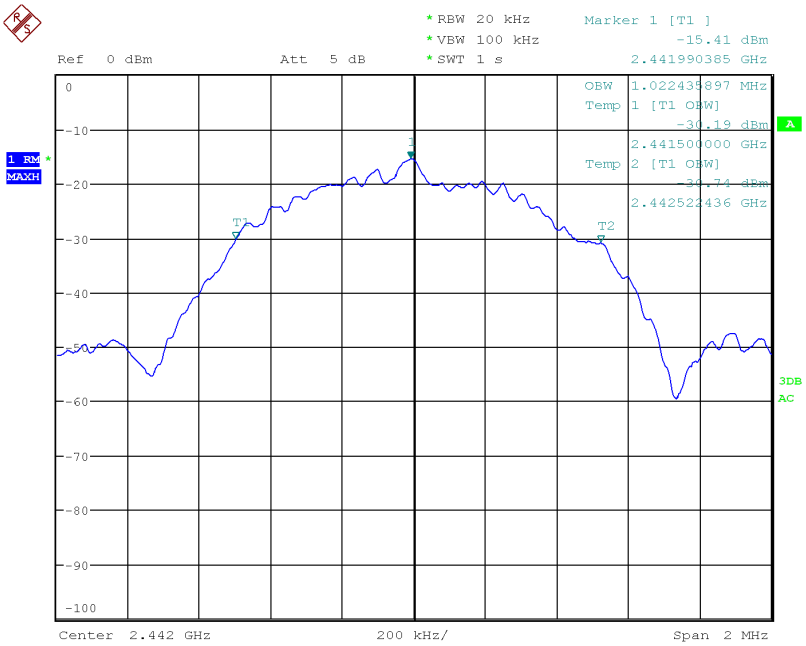
**Graph 20: Transmitter peak power spectral density, high channel**

## 10.0 §2.1049 OCCUPIED BANDWIDTH – 99% POWER

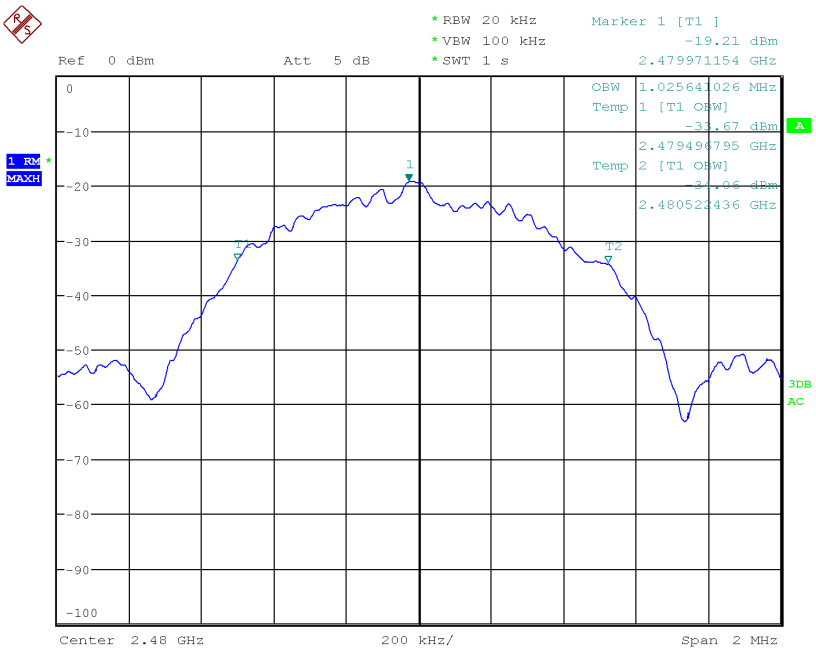
The bandwidth containing 99% power of the transmitted signal was measured using the procedure from ANSI C63.10 section 6.9.




The lowest channel 99% power bandwidth was **1.026 MHz**.




The middle channel 99% power bandwidth was **1.022 MHz**.




The highest channel 99% power bandwidth was **1.026 MHz**.

## 11.0 COMPLIANCE STATEMENT

Commercial refrigeration controller with Bluetooth LE connectivity, Model: SCS Connect (part number: SCSLC1013) tested on behalf of Wellington Drive Technologies Ltd, **complied** with the requirements of 47 CFR, Part 15 Subpart C - Rules for Radio Frequency Devices (intentional radiators), Section 15.247 - Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

Summary of results are shown in below table:

| FCC Part 15 Subpart C | Test Performed | Results |
|---|---|---|
| 15.203 | Antenna requirement | Complied |
| 15.205 | Operation in restricted Band | Complied |
| 15.207 | Conducted emissions limits | Complied |
| 15.209 | Radiated emissions limits | Complied |
| 15.247 (a)(2) | Minimum 6 dB bandwidth | Complied |
| 15.247 (b)(3) | Peak output power | Complied |
| 15.247 (c) | Antenna gain > 6 dBi | N/A as the EUT uses integral antenna with less than 6 dBi gain and there is no external antenna connector |
| 15.247 (d) | Out of band emissions | Complied |
| 15.247 (e) | Peak power spectral density | Complied |
| 15.247 (f) | Hybrid systems | N/A as the EUT uses digital modulation |
| 15.247 (g) | Hopping channel application | N/A as the EUT uses digital modulation |
| 15.247 (h) | Incorporation of intelligence within FHSS | N/A as the EUT uses digital modulation |
| 15.247 (i) | Radio Frequency Hazard | Complied, output power was less than 20 mW |
| 2.1049 | Occupied bandwidth | 1.026 MHz |

## 12.0 UNCERTAINTY

EMC Technologies has evaluated the equipment and the methods used to perform the emissions testing. The estimated measurement uncertainty for emissions tests shown within this report are as follows:

| | | |
|---|---|---|
| **Conducted Emissions:** | 9 kHz to 30 MHz | ±3.2 dB |
| **Radiated Emissions:** | 9 kHz to 30 MHz | ±4.1 dB |
| | 30 MHz to 300 MHz | ±5.1 dB |
| | 300 MHz to 1000 MHz | ±4.7 dB |
| | 1 GHz to 18 GHz | ±4.6 dB |
| | 18 GHz to 26 GHz | ±5.1 dB |
| **Peak Output Power:** | | ±1.5 dB |
| **Peak Power Spectral Density:** | | ±1.5 dB |

The above expanded uncertainties are based on standard uncertainties multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

## APPENDIX A

## MEASUREMENT INSTRUMENT DETAILS

| Equipment Type | Make/Model/Serial Number | Last Cal. dd/mm/yy | Due Date dd/mm/yy | Cal. Interval |
|---|---|---|---|---|
| **Chamber** | Frankonia SAC-10-2<br>(R-139) | 8/1/2015 | 8/1/2016 | 1 Year, *1 |
| | | | | |
| **EMI Receiver** | R&S ESU40<br>20 Hz – 40 GHz<br>Sn: 100392 (R-140) | 09/10/2014 | 09/10/2015 | 1 Year, *2 |
| | R&S ESU40<br>20 Hz – 40 GHz<br>Sn: 100182 (R-037) | 12/02/2015 | 12/02/2016 | 1 Year, *2 |
| | | | | |
| **Antennas** | EMCO 6502 Active Loop A-231<br>9kHz-30MHz<br>Sn. 9311-2801 | 20/07/2015 | 20/07/2018 | 3 Year, *2 |
| | SUNOL JB6 BICONILOG<br>30 – 6000 MHz<br>Sn. A012312 (A-363) | 16/05/2014 | 16/05/2016 | 2 Year, *2 |
| | EMCO 3115 Broadband Horn<br>1 – 18 GHz<br>Sn. 8908-3282 (A-004) | 09/05/2013 | 09/05/2016 | 3 Year, *1 |
| | ETS-Lindgren Horn 3160-09<br>18-26.5 GHz<br>Sn. 66032 (A-307) | 12/11/2012 | 12/11/2015 | 3 Year, *1 |
| | ETS-Lindgren Horn 3160-10<br>26.5-40 GHz<br>Sn. 66032 (A-306) | 12/11/2012 | 12/11/2015 | 3 Year, *1 |

Note *1. Internal NATA calibration.
Note *2. External NATA / A2LA calibration