



TEST REPORT

Test Report No. : UL-RPT-RP-12720775-516-FCC

Applicant : Stanley Black & Decker Inc
Model No. : J6112BT
FCC ID : 2ANWF-STW
Technology : Bluetooth – Low Energy
Test Standard(s) : FCC Parts 15.207, 15.209(a) & 15.247

For details of applied tests refer to test result summary

1. This test report shall not be reproduced in full or partial, without the written approval of UL International Germany GmbH.
2. The results in this report apply only to the sample tested.
3. The test results in this report are traceable to the national or international standards.
4. Test Report Version 1.0
5. Result of the tested sample: **PASS**

Prepared by: Krume, Ivanov
Title: Laboratory Engineer
Date: 09 May 2019

Approved by: Ajit, Phadtare
Title: Lead Test Engineer
Date: 09 May 2019



Deutsche
Akkreditierungsstelle
D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been performed in
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UL INTERNATIONAL GERMANY GMBH

Hedelfinger Str. 61
70327 Stuttgart, Germany
STU.CTECHLab@ul.com

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1. Customer Information

1.1. Applicant Information

| | |
|--------------------------------|--|
| Company Name: | Stanley Black & Decker Inc |
| Company Address: | 400 Executive Blvd. S, Southington, CT 06489 USA |
| Contact Person: | Mr.Simon Aman |
| Contact E-Mail Address: | Simon.aman@sbdinc.com |
| Contact Phone No.: | + 1 (860)-406-9103 |

1.2. Manufacturer Information

| | |
|--------------------------------|--|
| Company Name: | Stanley Black & Decker Inc |
| Company Address: | Via Roma 5; Gemonio (VA° 21036 Italy |
| Contact Person: | Mr.Marco Zambon |
| Contact E-Mail Address: | Marco.zambon@sbdinc.com |
| Contact Phone No.: | 00390332790544 |

2. Summary of Testing

2.1. General Information

Applied Standards

| | |
|---------------------------------|---|
| Specification Reference: | 47CFR15.247 |
| Specification Title: | Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247 |
| Specification Reference: | 47CFR15.207 and 47CFR15.209 |
| Specification Title: | Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209 |
| Test Firm Registration: | 399704 |

Location

| | |
|-----------------------------|--|
| Location of Testing: | UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany |
|-----------------------------|--|

Date information

| | |
|----------------------|--------------------------------|
| Order Date: | 14 February 2019 |
| EUT arrived: | 21 March 2019 |
| Test Dates: | 21 March 2019 to 01 April 2019 |
| EUT returned: | -/- |

2.2. Summary of Test Results

| Clause | Measurement | Complied | Did not comply | Not performed | Not applicable |
|--------------------------|---|-------------------------------------|--------------------------|-------------------------------------|-------------------------------------|
| Part 15.207 | Transmitter AC Conducted Emissions ⁽¹⁾ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Part 15.247(a)(2) | Transmitter Minimum 6 dB Bandwidth | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Part 15.35(c) | Transmitter Duty Cycle | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Part 15.247(e) | Transmitter Power Spectral Density ⁽²⁾ | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Part 15.247(b)(3) | Transmitter Maximum Peak Output Power | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Part 15.247(d)/15.209(a) | Transmitter Radiated Emissions | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Part 15.247(d)/15.209(a) | Transmitter Band Edge Radiated Emissions | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Note:

1. The EUT cannot operate during charging, so no AC conducted measurements needed
2. In accordance with KDB 558074 D01 section 8.4 referencing ANSI C63.10:2013, subclause 11.10.1, PSD is not required if the maximum conducted output power is less than the PSD limit of 8 dBm / 3 kHz. The PSD level is therefore deemed to be equal to the measured total output power.

2.3. Methods and Procedures

| | |
|-------------------|--|
| Reference: | ANSI C63.10-2013 |
| Title: | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| Reference: | KDB 558074 D01 DTS Meas Guidance v05r01 February 11, 2019 |
| Title: | Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules |

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

| | |
|-----------------------------------|------------------------------------|
| Brand Name: | Proto Smart Torque Wrench |
| Model Name or Number: | J6112BT |
| Test Sample Serial Number: | X020005 (<i>Radiated sample</i>) |
| Hardware Version Number: | 1.4 |
| Software Version Number: | V0.27 |
| FCC ID: | 2ANWF-STW |

| | |
|-----------------------------------|--|
| Brand Name: | Proto Smart Torque Wrench |
| Model Name or Number: | J6112BT |
| Test Sample Serial Number: | X020005 (<i>Conducted sample with RF port</i>) |
| Hardware Version Number: | 1.4 |
| Software Version Number: | V0.27 |
| FCC ID: | 2ANWF-STW |

3.2. Description of EUT

The equipment under test was a Smart Torque Wrench supporting Bluetooth Low Energy.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

| | | | |
|--|---|-------------------------|--------------------------------|
| Technology Tested: | Bluetooth Low Energy (Digital Transmission System) | | |
| Type of Unit: | Transceiver | | |
| Channel Spacing: | 2 MHz | | |
| Modulation: | GFSK | | |
| Data Rate: | 1 Mbps | | |
| Power Supply Requirement(s): | Nominal | 3.6 V DC | |
| Power Supply Type(s): | Internal Rechargeable Battery | | |
| Maximum Conducted Output Power: | -8.4 dBm | | |
| Antenna Gain: | 0.5 dBi | | |
| Antenna Type: | Ceramic Chip Antenna | | |
| Antenna Details: | Manufacturer: Johanson Technology Model No.: 2450AT18A100 Version 1.3 | | |
| Transmit Frequency Range: | 2402 MHz to 2480 MHz | | |
| Transmit Channels Tested: | Channel ID | RF Channel Index | Channel Frequency (MHz) |
| | Bottom | 0 | 2402 |
| | Middle | 17 | 2440 |
| | Top | 39 | 2480 |

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

A. Support Equipment (In-house)

| Item | Description | Brand Name | Model Name or Number | Serial Number |
|------|-------------|------------|----------------------|---------------|
| 1 | -/- | -/- | -/- | -/- |

B. Support Equipment (Manufacturer supplied)

| Item | Description | Brand Name | Model Name or Number | Serial Number |
|------|-------------|------------|----------------------|---------------|
| 1 | -/- | -/- | -/- | -/- |

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

Transmitting at maximum power in Bluetooth LE mode with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- The EUT was powered via fully charged internal battery.
- Channels, packet lengths and other settings were set, using the on/off button of the EUT.
- The EUT conducted sample was used for 6 dB bandwidth and maximum peak output power.
- Before starting final radiated measurements “worst case verification” with EUT in Standing & EUT in Laying position was performed by Lab.
- EUT in Laying position found to be the worst case therefore this report includes relevant results.
- EMC32 V10.1.0 Software was used for the Radiated spurious emission measurement.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 6 *Measurement Uncertainty* for details.

In accordance with DAkkS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter Minimum 6 dB Bandwidth

Test Summary:

| | | | |
|-----------------------------------|--|-------------------|---------------|
| Test Engineer: | Abdoufataou Salifou | Test Date: | 29 March 2019 |
| Test Sample Serial Number: | X020005(Conducted sample with RF port) | | |
| Test Site Identification | SR 9 | | |

| | |
|--------------------------|--|
| FCC Reference: | Part 15.247(a)(2) |
| Test Method Used: | FCC KDB 558074 Section 8.2 referring ANSI C63.10:2013 Section 11.8.1 Option 1 |

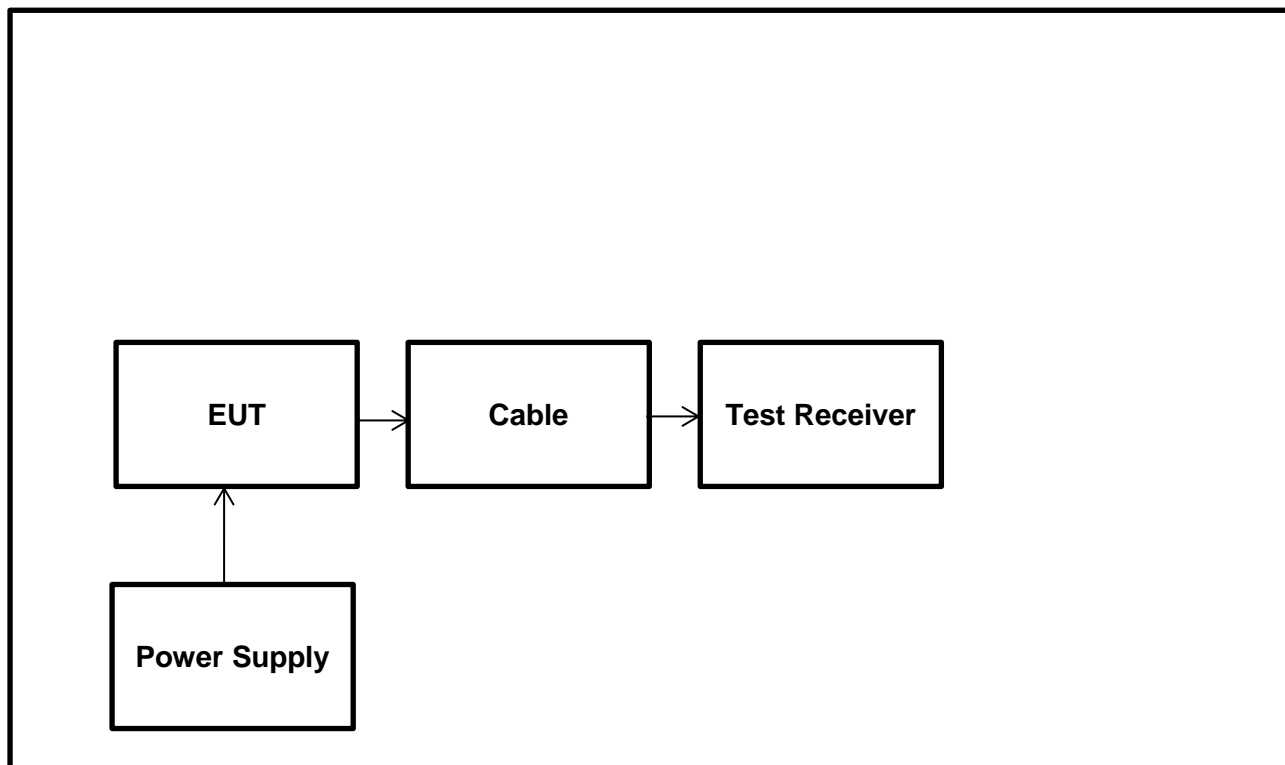
Environmental Conditions:

| | |
|-------------------------------|------|
| Temperature (°C): | 23.0 |
| Relative Humidity (%): | 27 |

Notes:

1. 6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.2 referring ANSI C63.10:2013 Section 11.8.1 Option 1 measurement procedure. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors. The RF cable attenuation (1.0 dB@2.4GHz) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input was added as a reference level offset (11.0 dB) to each of the conducted plots.

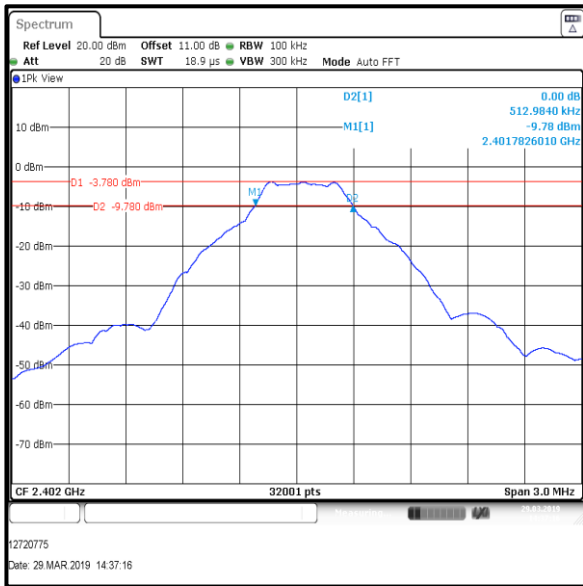
Test Setup:



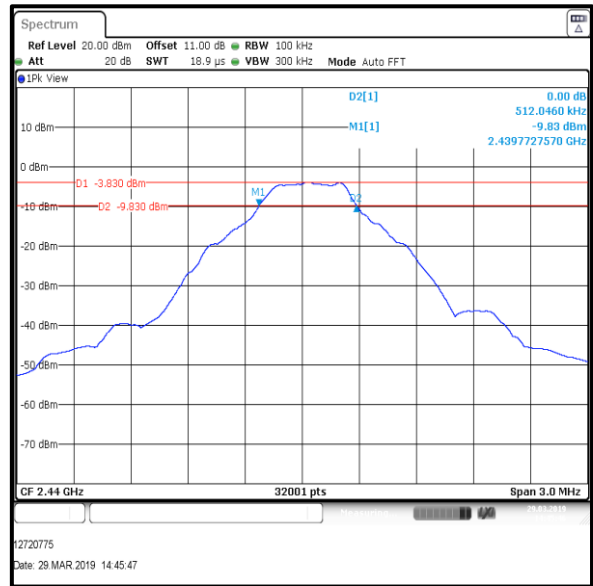
Transmitter Minimum 6 dB Bandwidth (continued)

Results:

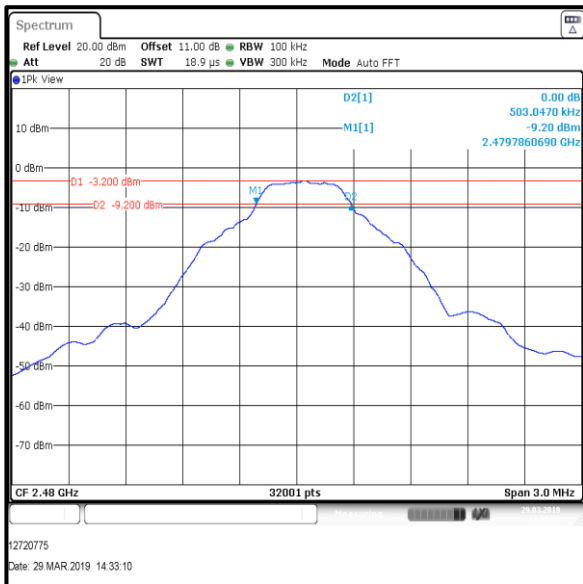
| Test Channel | 6 dB Bandwidth (kHz) | Limit (kHz) | Margin (kHz) | Result |
|--------------|----------------------|-------------|--------------|----------|
| Bottom | 512.984 | ≥500 | 12.984 | Complied |
| Middle | 512.046 | ≥500 | 12.046 | Complied |
| Top | 503.047 | ≥500 | 3.047 | Complied |



Bottom Channel



Middle Channel



Top Channel

Result: Pass



5.2.2. Transmitter Duty Cycle

Test Summary:

| | | | |
|-----------------------------------|--|-------------------|---------------|
| Test Engineer: | Abdoufataou Salifou | Test Date: | 29 March 2019 |
| Test Sample Serial Number: | X020005(Conducted sample with RF port) | | |
| Test Site Identification | SR 9 | | |

| | |
|--------------------------|----------------------------|
| FCC Reference: | Part 15.35(c) |
| Test Method Used: | FCC KDB 558074 Section 6.0 |

Environmental Conditions:

| | |
|-------------------------------|------|
| Temperature (°C): | 23.1 |
| Relative Humidity (%): | 27 |

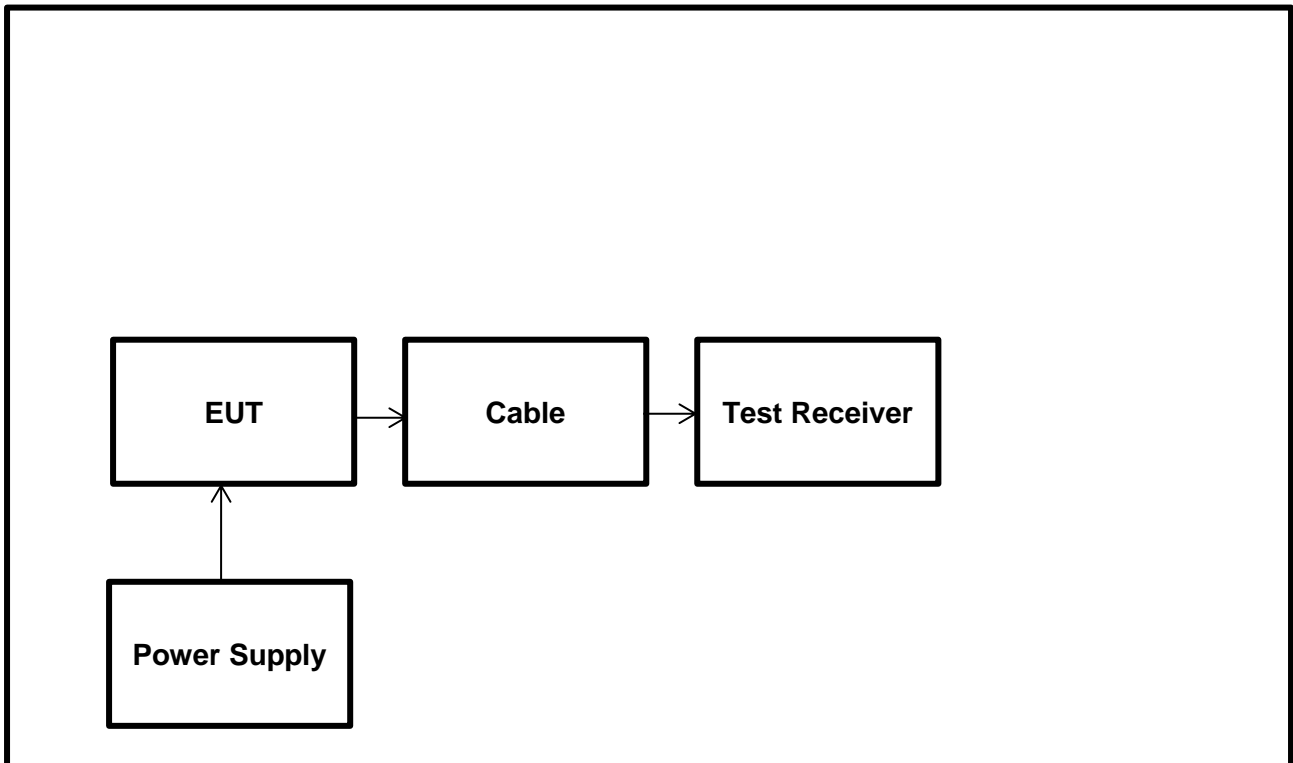
Note:

The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

$10 \log (1 / (\text{On Time} / [\text{Period or } 100 \text{ ms whichever is the lesser}]))$.

BLE duty cycle: $10 \log (1 / (2102.063 \mu\text{s} / 2226.563\mu\text{s})) = 0.3 \text{ dB}$

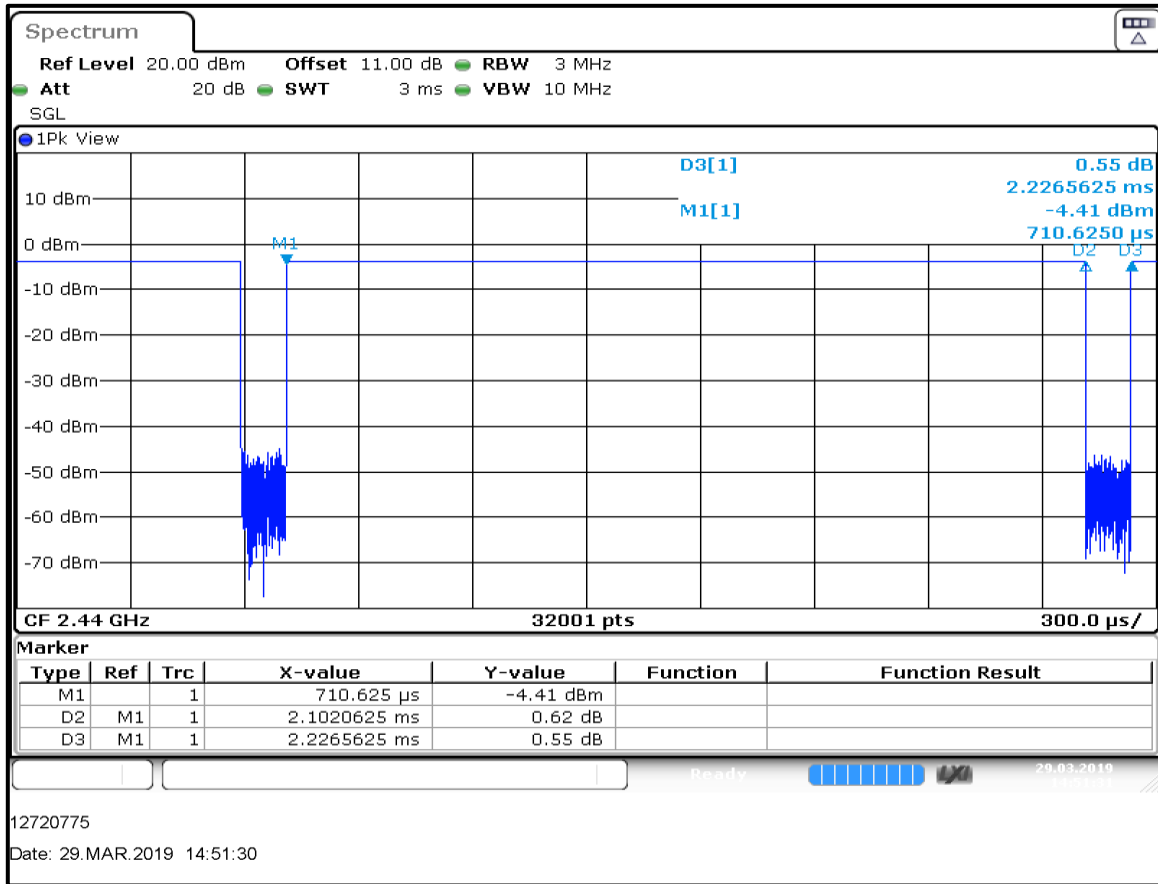
Test Setup:



Transmitter Duty Cycle (continued)

Results:

| Pulse Duration (µs) | Period (µs) | Duty Cycle Correction (dB) |
|---------------------|-------------|----------------------------|
| 2102.063 | 2226.563 | 0.3 |



5.2.3. Transmitter Maximum Peak Output Power

Test Summary:

| | | | |
|-----------------------------------|---|-------------------|---------------|
| Test Engineer: | Abdoufataou Salifou | Test Date: | 29 March 2019 |
| Test Sample Serial Number: | X020005(<i>Conducted sample with RF port</i>) | | |
| Test Site Identification | SR 9 | | |

| | |
|--------------------------|--|
| FCC Reference: | Part 15.247(b)(3) |
| Test Method Used: | FCC KDB 558074 Section 8.3.1.1 referring ANSI C63.10 Section 11.9.1.1 |

Environmental Conditions:

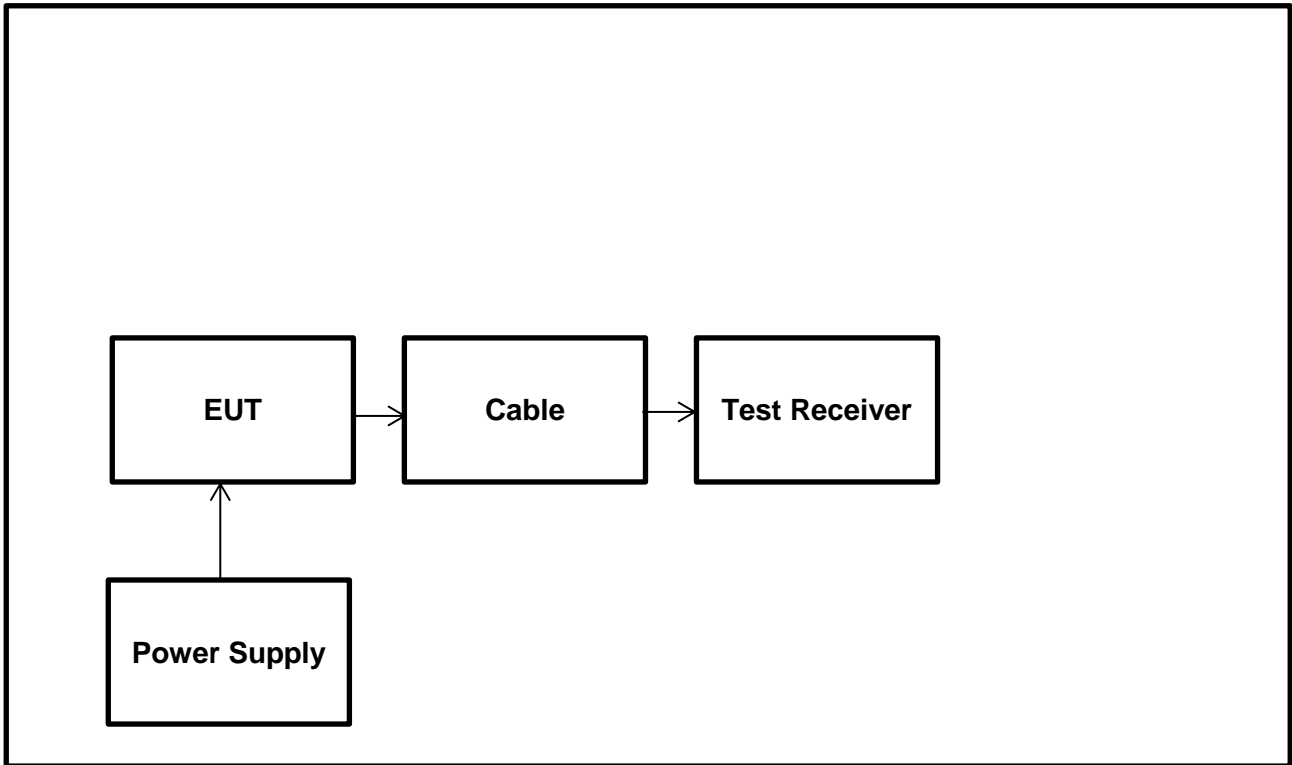
| | |
|-------------------------------|------|
| Temperature (°C): | 23.2 |
| Relative Humidity (%): | 27 |

Notes:

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.3.1.1 referring ANSI C63.10 Section 11.9.1.1 with the $RBW \geq DTS \text{ bandwidth}$ procedure.
2. The signal analyser resolution bandwidth was set to 3 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 10 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.
3. The RF port on the EUT was connected to the spectrum analyser using suitable attenuation and RF cable. The measured values takes into consideration the external attenuation correction factors. The RF cable attenuation (1.0 dB@2.4GHz) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input was added as a reference level offset (11.0 dB) to each of the conducted plots.
4. The measurement was made with highest possible duty cycle.
5. The conducted power was added to the declared antenna gain to obtain the EIRP.

Transmitter Maximum Peak Output Power (continued)

Test setup:



Transmitter Maximum Peak Output Power (continued)

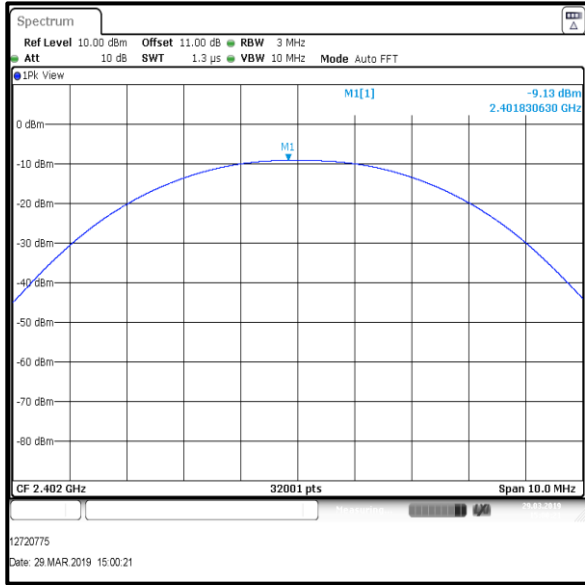
Results:

| Test Channel | Conducted Peak Power (dBm) | Conducted Peak Power Limit (dBm) | Margin (dB) | Result |
|--------------|----------------------------|----------------------------------|-------------|----------|
| Bottom | -9.1 | 30.0 | 39.1 | Complied |
| Middle | -9.0 | 30.0 | 39.0 | Complied |
| Top | -8.4 | 30.0 | 38.4 | Complied |

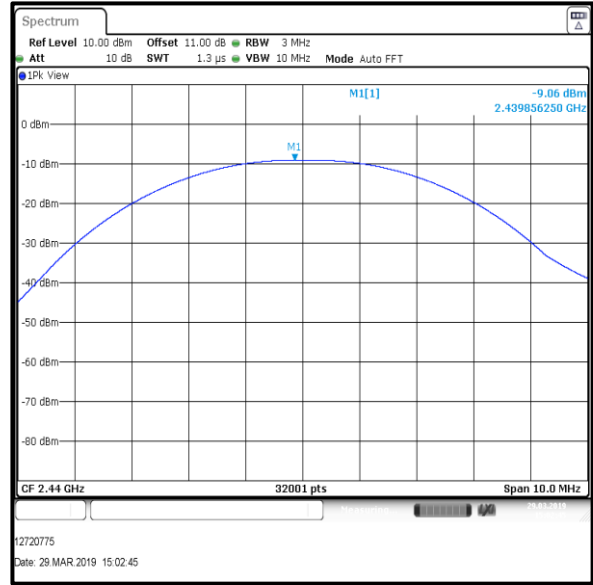
| Test Channel | Corrected Conducted Peak Power (dBm) | Declared Antenna Gain (dBi) | EIRP (dBm) | De Facto EIRP Limit (dBm) | Margin (dB) | Result |
|--------------|--------------------------------------|-----------------------------|------------|---------------------------|-------------|----------|
| Bottom | -9.1 | 0.5 | -8.6 | 36.0 | 44.6 | Complied |
| Middle | -9.0 | 0.5 | -8.5 | 36.0 | 44.5 | Complied |
| Top | -8.4 | 0.5 | -7.9 | 36.0 | 43.9 | Complied |

Result: Pass

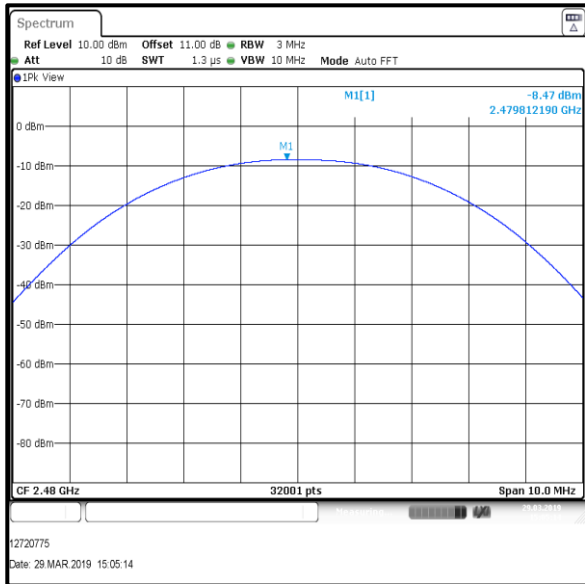
Transmitter Maximum Peak Output Power (continued)



Bottom Channel



Middle Channel



Top Channel

5.2.4. Transmitter Radiated Emissions**Test Summary:**

| | | | |
|-----------------------------------|---------------------------|-------------------|--------------------|
| Test Engineer: | Krume Ivanov | Test Date: | 21 & 22 March 2019 |
| Test Sample Serial Number: | X020005 (Radiated sample) | | |
| Test Site Identification | SR 1/2 | | |

| | |
|--------------------------|--|
| FCC Reference: | Parts 15.247(d) & 15.209(a) |
| Test Method Used: | FCC KDB 558074 Sections 8.5 & 8.6 referring ANSI C63.10 Sections 11.10 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5 |
| Frequency Range | 30 MHz to 1000 MHz |

Environmental Conditions:

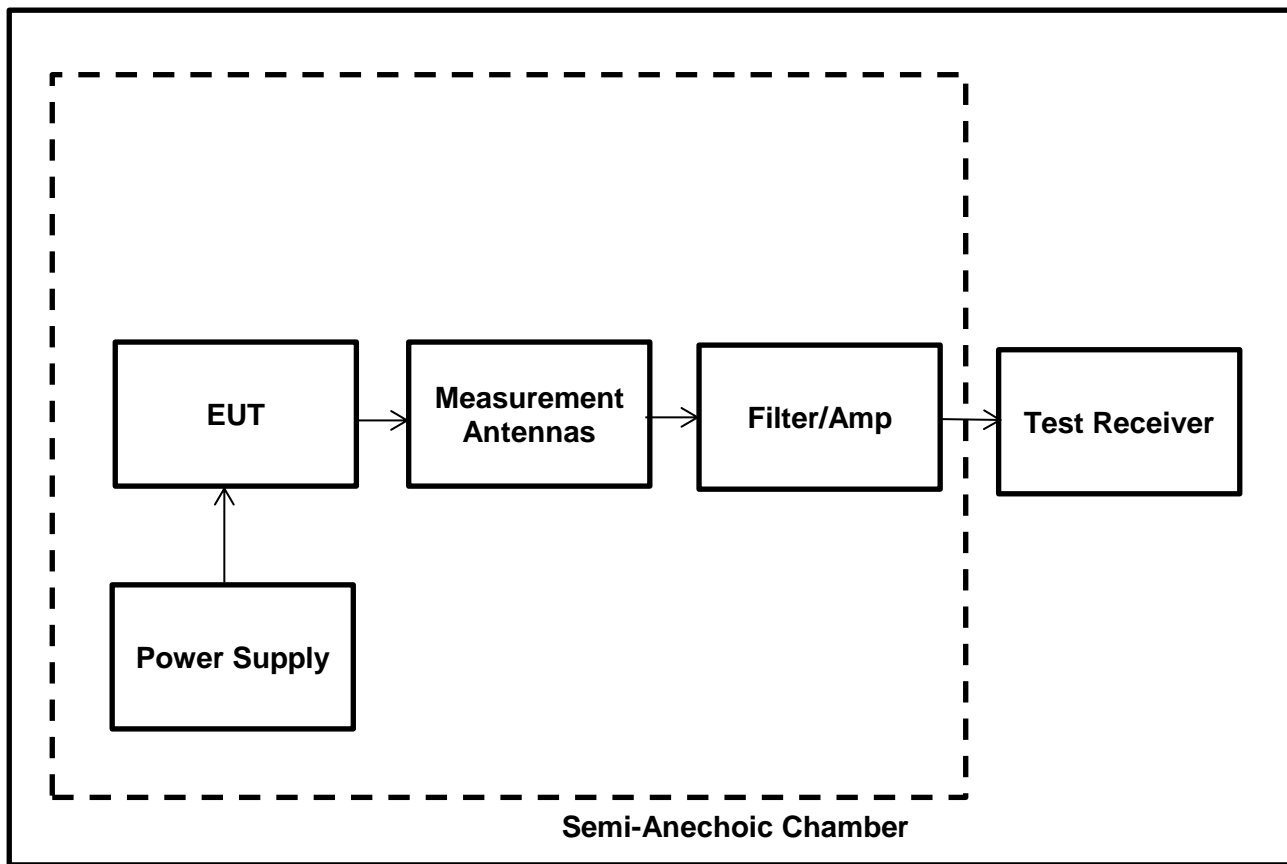
| | |
|-------------------------------|----|
| Temperature (°C): | 21 |
| Relative Humidity (%): | 21 |

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
3. All emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. All other emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor and therefore not recorded.
5. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.
6. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
7. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
8. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span big enough to see the whole emission.

Transmitter Radiated Emissions (continued)

Test Setup:

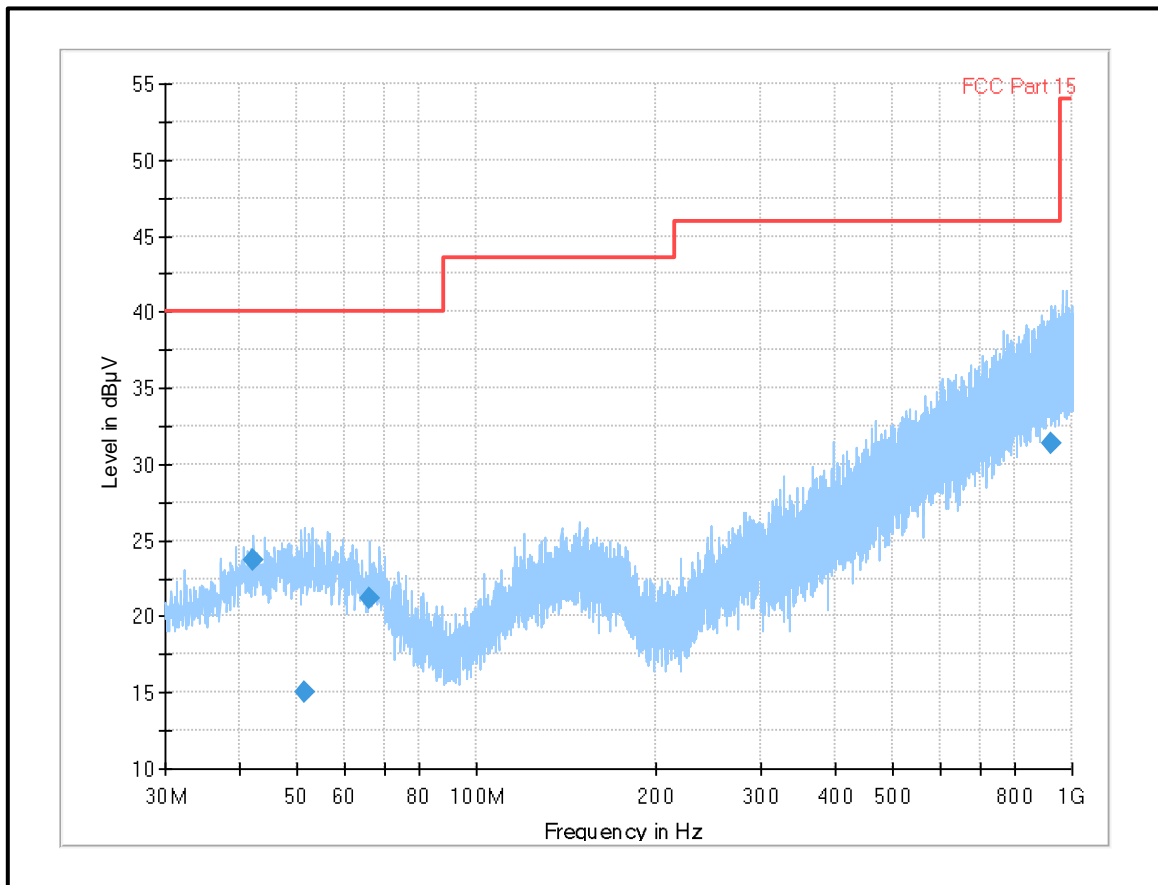


Transmitter Radiated Emissions

Results: Peak / Middle Channel

| Frequency (MHz) | Antenna Polarization | Peak Level (dB μ V/m) | Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------|----------------------|---------------------------|----------------------|-------------|----------|
| 42.240 | Vertical | 23.76 | 40.00 | 16.24 | Complied |
| 51.555 | Vertical | 14.98 | 40.00 | 25.02 | Complied |
| 65.955 | Vertical | 21.23 | 40.00 | 18.77 | Complied |
| 920.125 | Vertical | 31.33 | 46.00 | 14.67 | Complied |

Plot: 30 MHz – 1GHz (middle channel) with Peak detector



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Result: Pass

Transmitter Radiated Emissions (continued)**Test Summary:**

| | | | |
|-----------------------------------|---------------------------|-------------------|---|
| Test Engineer: | Krume Ivanov | Test Date: | 21 & 22 & 27 March 2019 & 01 April 2019 |
| Test Sample Serial Number: | X020005 (Radiated sample) | | |
| Test Site Identification | SR 1/2 | | |

| | |
|--------------------------|--|
| FCC Reference: | Parts 15.247(d) & 15.209(a) |
| Test Method Used: | FCC KDB 558074 Sections 8.5 & 8.6 referring ANSI C63.10 Sections 11.10 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6 |
| Frequency Range | 1 GHz to 25 GHz |

Environmental Conditions:

| | |
|-------------------------------|----------------|
| Temperature (°C): | 21 & 22.6 & 23 |
| Relative Humidity (%): | 21 & 27 & 22 |

Notes:

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
4. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
6. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.
7. *In accordance with ANSI C63.10 Section 6.6.4.3, Note 1, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.
8. The reference level for the emission in the non-restricted band was established by following KDB 558074 Section 11.2 procedure.
9. ** -20 dBc limit applies in non-restricted band as the conducted output power measurements were performed using a peak detector.
10. For frequency range between 18 GHz and 25 GHz, no critical emission was found so only the measurement receiver noise floor level has been measured and recorded in the table .
11. The preliminary scans showed similar emission levels above 18 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.

Transmitter Radiated Emissions (continued)

Results: Peak / Bottom Channel

| Frequency (MHz) | Antenna Polarization | Level (dB μ V/m) | Average Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------------|----------------------|----------------------|------------------------------|-------------|--------|
| No spurious was found | | | | | |

Results: Peak / Middle Channel

| Frequency (MHz) | Antenna Polarization | Level (dB μ V/m) | Average Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------------|----------------------|----------------------|------------------------------|-------------|--------|
| No spurious was found | | | | | |

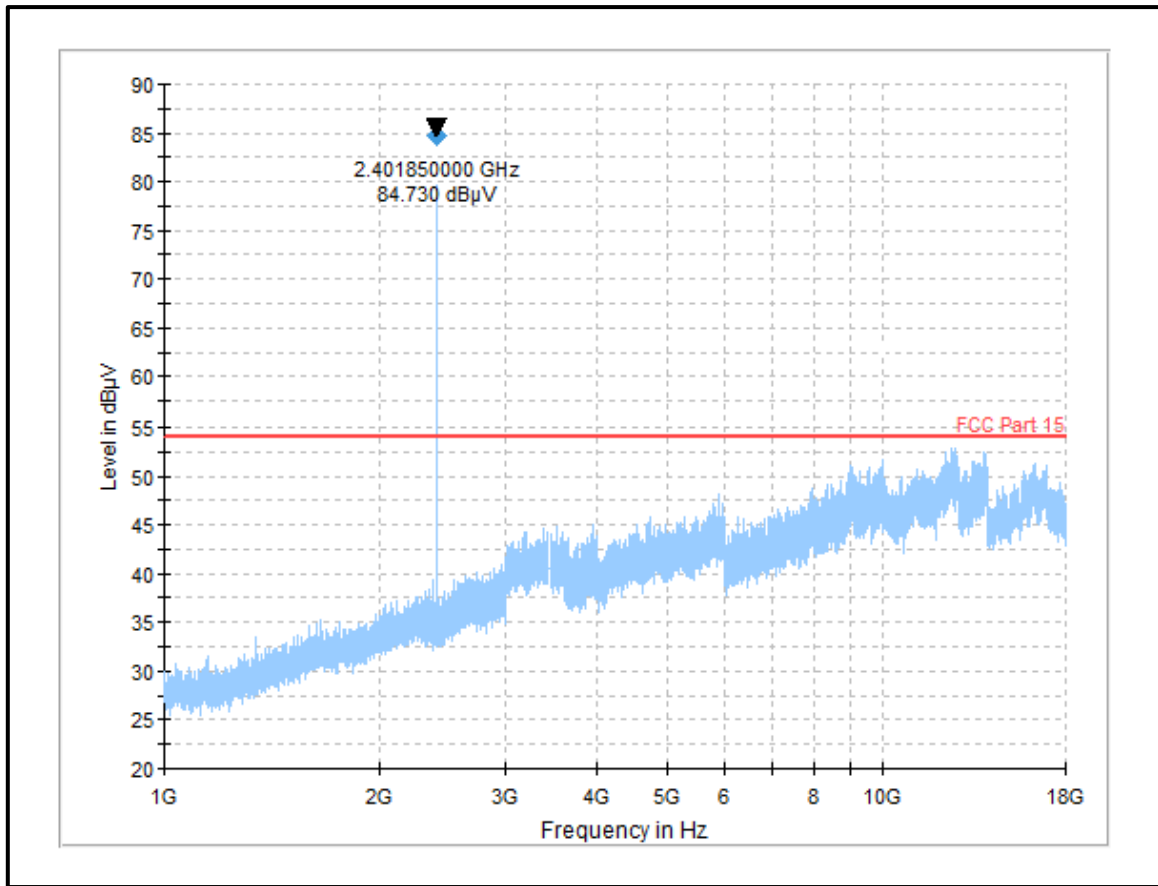
Results: Peak / Top Channel

| Frequency (MHz) | Antenna Polarization | Level (dB μ V/m) | Average Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------------|----------------------|----------------------|------------------------------|-------------|--------|
| No spurious was found | | | | | |

Result: Pass

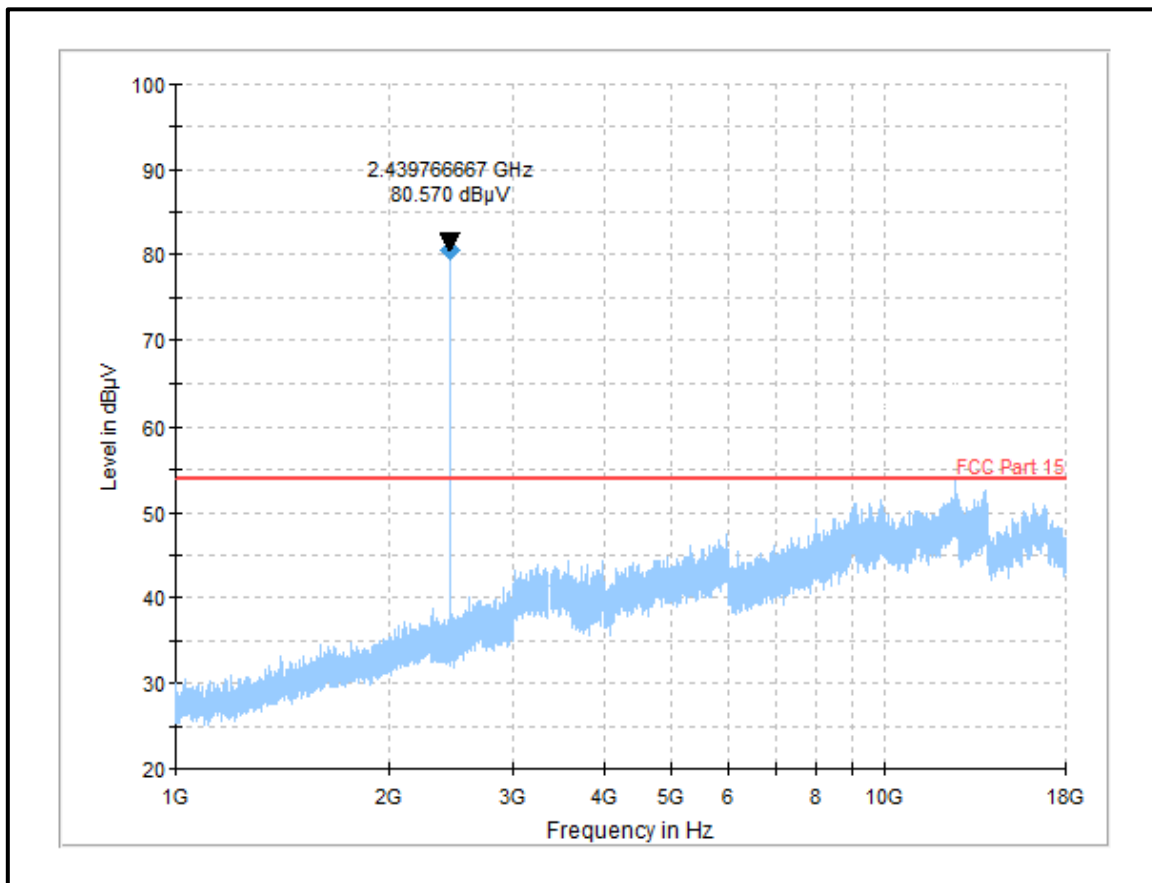
Transmitter Radiated Emissions (continued)

Plot: 1 GHz – 18GHz (bottom channel) with Peak detector



Note: The above plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

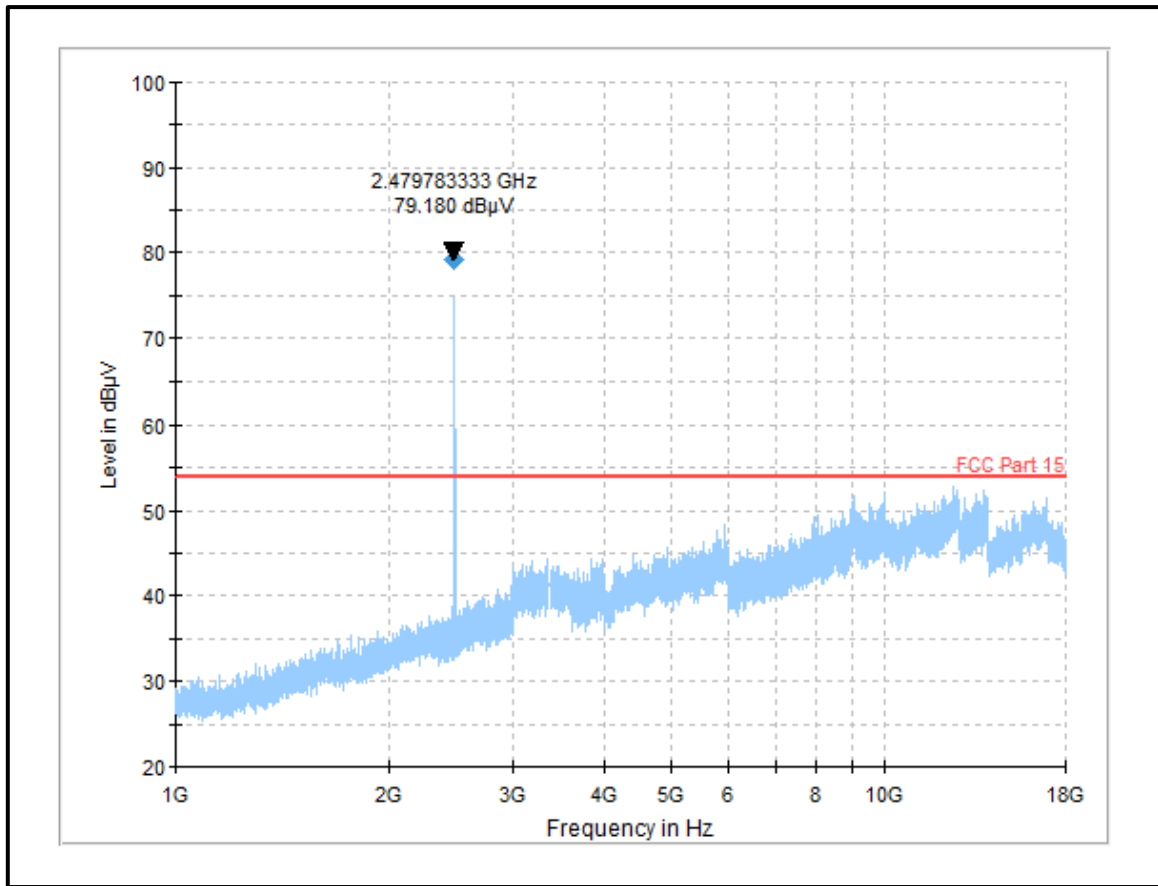
Plot: 1 GHz – 18GHz (middle channel) with Peak detector



Note: The above plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Emissions (continued)

Plot: 1 GHz – 18GHz (top channel) with Peak detector



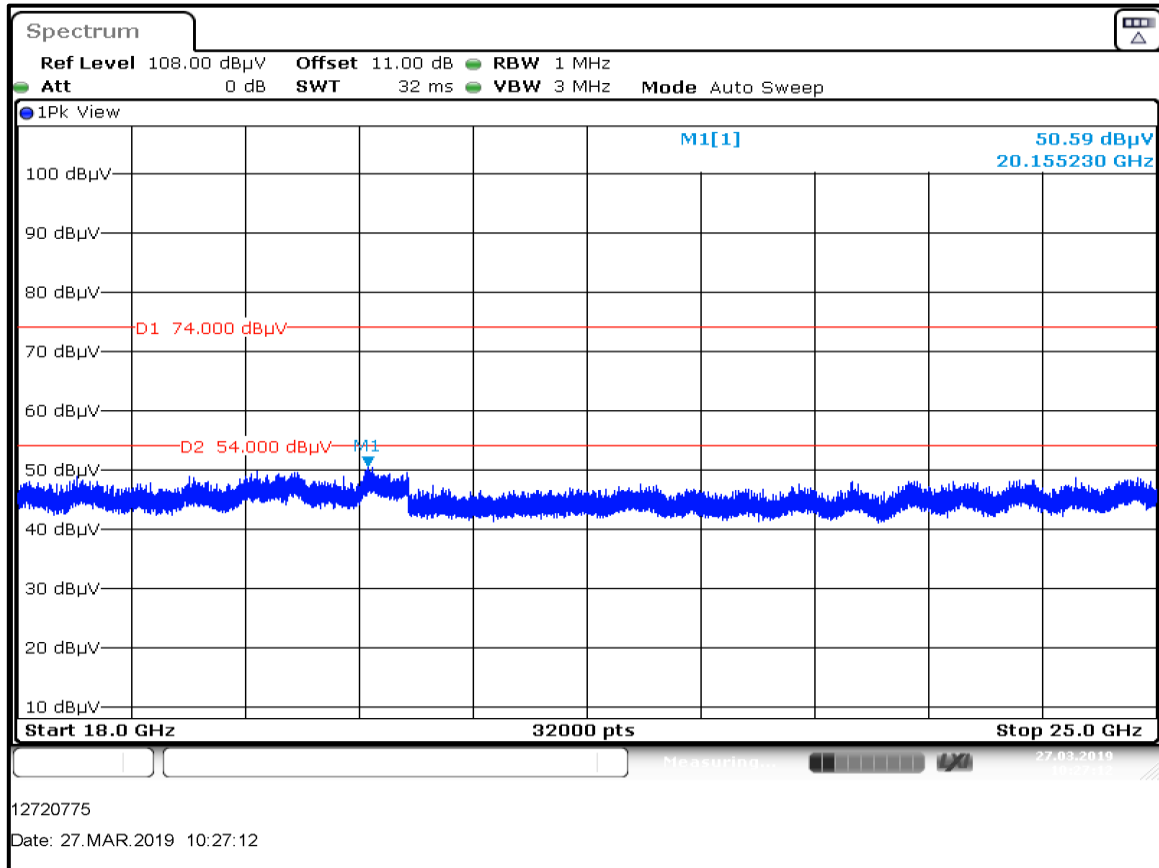
Note: The above plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Emissions (continued)

Results: Peak / Bottom Channel

| Frequency (MHz) | Antenna Polarization | Peak Level (dB μ V/m) | Average Limit (dB μ V/m) | Margin (dB) | Result |
|--------------------------------|----------------------|---------------------------|------------------------------|-------------|--------|
| No critical spurious was found | | | | | |

Plot: 18 GHz – 25GHz (middle channel) with Peak detector



Note: The above plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

5.2.5. Transmitter Band Edge Radiated Emissions**Test Summary:**

| | | | |
|-----------------------------------|---------------------------|-------------------|------------------------------------|
| Test Engineer: | Krume Ivanov | Test Date: | 21 & 22 March 2019 & 01 April 2019 |
| Test Sample Serial Number: | X020005 (Radiated sample) | | |
| Test Site Identification | SR 1/2 | | |

| | |
|--------------------------|--|
| FCC Reference: | Parts 15.247(d) & 15.209(a) |
| Test Method Used: | FCC KDB 558074 Sections 8.7 referring ANSI C63.10:2013 Section 6.10.4, 6.10.5 & Section 11.11 |

Environmental Conditions:

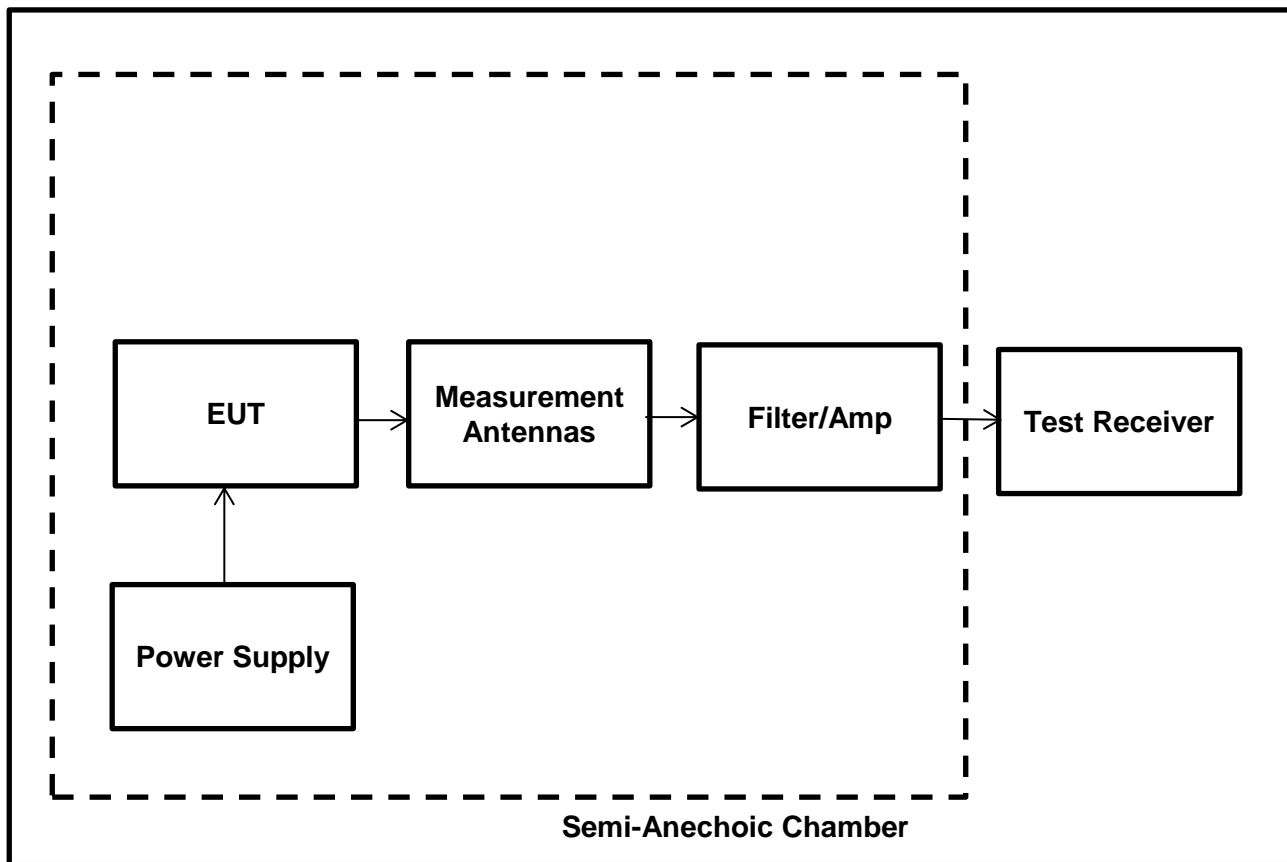
| | |
|-------------------------------|-----------|
| Temperature (°C): | 21 & 22.8 |
| Relative Humidity (%): | 21 & 22 |

Notes:

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 8.7 lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
3. As the lower band edge falls within a non-restricted band, only peak measurements are required. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. Marker frequencies and levels were recorded.
4. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 10 Hz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
5. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
6. The measured Average Level has been corrected by adding Duty Cycle Correction Factor (0.3 dB) into it.

Transmitter Band Edge Radiated Emissions (continued)

Test Setup:



Transmitter Band Edge Radiated Emissions (continued)**Results: Lower Band Edge/Peak**

| Frequency (MHz) | Peak Level (dB μ V/m) | -20 dBc Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------|---------------------------|------------------------------|-------------|----------|
| 2399.59 | 37.02 | 64.3 | 27.28 | Complied |

Results: Upper Band Edge/Peak

| Frequency (MHz) | Peak Level (dB μ V/m) | Peak Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------|---------------------------|---------------------------|-------------|----------|
| 2483.50 | 45.81 | 74.0 | 28.19 | Complied |

Results: Upper Band Edge/Average

| Frequency (MHz) | Measured Average Level (dB μ V/m) | Corrected Average Level (dB μ V/m) | Average Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------|---------------------------------------|--|------------------------------|-------------|----------|
| 2483.50 | 36.07 | 36.37 | 54.0 | 17.63 | Complied |

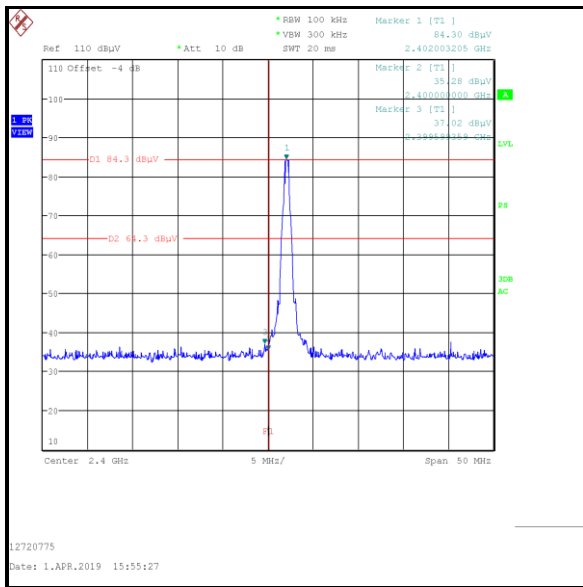
Results: 2310 to 2390 MHz Restricted Band/Peak

| Frequency (MHz) | Peak Level (dB μ V/m) | Peak Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------|---------------------------|---------------------------|-------------|----------|
| 2317.56 | 44.86 | 74.0 | 29.14 | Complied |

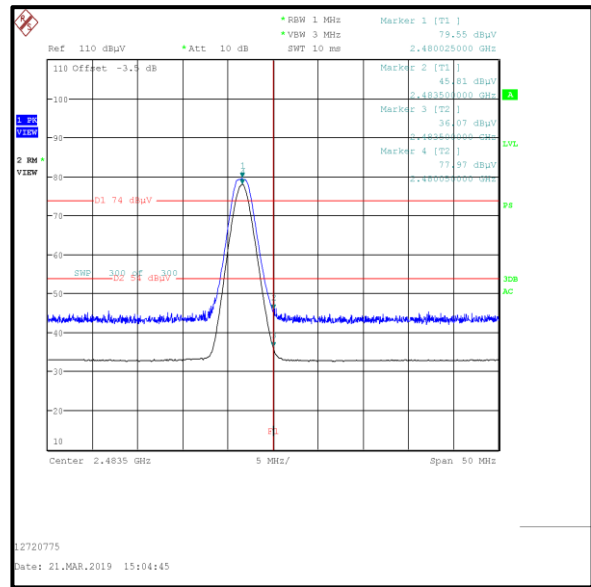
Results: 2310 to 2390 MHz Restricted Band/Average

| Frequency (MHz) | Measured Average Level (dB μ V/m) | Corrected Average Level (dB μ V/m) | Average Limit (dB μ V/m) | Margin (dB) | Result |
|-----------------|---------------------------------------|--|------------------------------|-------------|----------|
| 2337.94 | 32.45 | 32.75 | 54.0 | 21.25 | Complied |

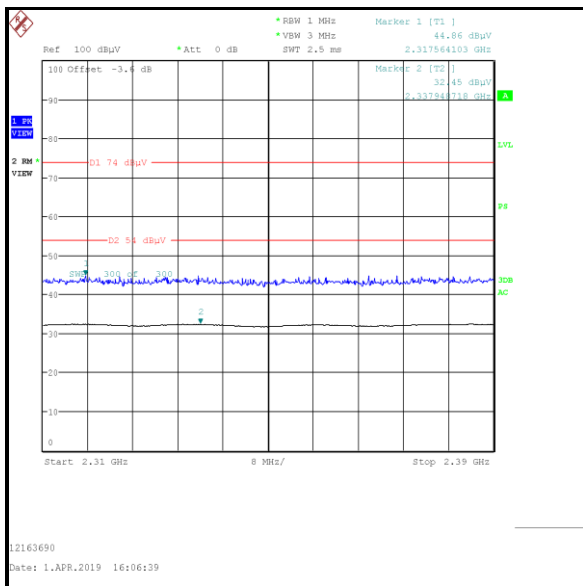
Transmitter Band Edge Radiated Emissions (continued)



Lower Band Edge Peak Measurement



Upper Band Edge Peak & Average Measurement



2310 MHz to 2390 MHz Restricted Band Plot

6. Measurement Uncertainty

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

| Measurement Type | Confidence Level (%) | Calculated Uncertainty |
|-------------------------------------|-----------------------------|-------------------------------|
| Conducted Maximum Peak Output Power | 95% | ±0.59 dB |
| Radiated Spurious Emissions | 95% | ±3.10 dB |
| Band Edge Radiated Emissions | 95% | ±3.10 dB |
| Minimum 6 dB Bandwidth | 95% | ±0.87 % |

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Used equipment

Test site: SR 1/2

| ID | Manufacturer | Type | Model | Serial No. | Calibration Date | Cal. Cycle |
|-----------|------------------------|---------------------------|---------------|-------------------|-------------------------|-------------------|
| 377 | BONN Elektronik | Amplifier, Low Noise Pre | BLMA 0118-1A | 025294B | 7/12/2018 | 12 |
| 383 | Rohde & Schwarz | Antenna, Rod | HFH2-Z1 | 890151/11 | 7/14/2017 | 24 |
| 423 | Bonn Elektronik | Amplifier, Low Noise Pre | BLMA 1840-1A | 055929 | 7/12/2018 | 12 |
| 460 | Deisl | Turntable | DT 4250 S | | n/a | n/a |
| 465 | Schwarzbeck | Antenna, Trilog Broadband | VULB 9168 | 9168-240 | 8/8/2016 | 36 |
| 495 | Rohde & Schwarz | Antenna, Log.- Periodical | HL050 | 100296 | 7/20/2016 | 36 |
| 587 | Maturo | antenna mast, tilting | TAM 4.0-E | 011/7180311 | n/a | n/a |
| 588 | Maturo | Controller | NCD | 029/7180311 | n/a | n/a |
| 591 | Rohde & Schwarz | Receiver | ESU 40 | 100244/040 | 7/12/2018 | 12 |
| 608 | Rohde & Schwarz | Switch Matrix | OSP 120 | 101227 | 4/8/2014 | 60 |
| 615 | Wainwright Instruments | Highpass Filter 1GHz | WHKX12- | 3 | Lab verification | n/a |
| 620 | Bonn Elektronik | pre-amplifier | BLNA 0110-01N | 1510111 | 7/12/2017 | 24 |
| 628 | Maturo | Antenna mast | CAM 4.0-P | 224/19590716 | n/a | n/a |
| 629 | Maturo | Kippenrichtung | KE 2.5-R-M | MAT002 | n/a | n/a |

Test site: SR 9

| ID | Manufacturer | Type | Model | Serial No. | Calibration Date | Cal. Cycle |
|-----------|---------------------|--------------------------|--------------|-------------------|-------------------------|-------------------|
| 636 | Rohde & Schwarz | switching unit | OSP120 | 101698 | 7/12/2018 | 12 |
| 637 | Rohde & Schwarz | Spectrum Analyzer | FSV40 | 101587 | 7/11/2018 | 12 |
| 423 | Bonn Elektronik | Amplifier, Low Noise Pre | BLMA 1840-1A | 55929 | 7/12/2018 | 24 |
| 195 | SPS | Power Supply | TOE8842-24 | 51455 | Verified by Multimeter | 12 |
| 216 | Agilent | Multimeter | 34401A | US36017458 | 7/11/2017 | 24 |

8. Report Revision History

| Version Number | Revision Details | | |
|----------------|------------------|--------|-----------------|
| | Page No(s) | Clause | Details |
| 1.0 | - | - | Initial Version |