TEST REPORT

Test Report No. : UL-RPT-RP-12809660-1016-FCC

Applicant	:	Nox Medical
Model No.	:	NOXBLEMOD
FCC ID	:	V5A-NOXBLEMOD
Technologies	:	Bluetooth – Low Energy and Bluetooth Industry 5.0
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.247
		For details of applied tests refer to test result summary

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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: Abdoufataou Salifou
Title: Laboratory Engineer
Date: 09 July 2019

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

Deutsche Akkreditierungsstelle D-PL-19381-02-00

This laboratory is accredited by DAkkS.
The tests reported herein have been performed in accordance with its' terms of accreditation.

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STU.CTECHLab@ul.com

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1. Customer Information

1.1.Applicant Information

Company Name:	Nox Medical
Company Address:	Katrinartun 2, 105 Reykjavik, Iceland
Contact Person:	Ingibjörg Þóranna Steinudóttir
Contact E-Mail Address:	inga@noxmedical.com
Contact Phone No.:	+354-5707178

1.2.Manufacturer Information

Company Name:	Nox Medical
Company Address:	Katrinartun 2, 105 Reykjavik, Iceland
Contact Person:	Ingibjörg Þóranna Steinudóttir
Contact E-Mail Address:	inga@noxmedical.com
Contact Phone No.:	+354-5707178

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:	20 February 2019
EUT arrived:	21 May 2019
Test Dates:	17 June 2019 to 28 June 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	☒	☐	☐	☐
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	☒	☐	☐	☐
Part 15.35(c)	Transmitter Duty Cycle	☒	☐	☐	☐
Part 15.247(e)	Transmitter Power Spectral Density(1)	☐	☐	☒	☐
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	☒	☐	☐	☐
Part 15.247(d)/15.209(a)	Transmitter Radiated Emissions	☒	☐	☐	☐
Part 15.247(d)/15.209(a)	Transmitter Band Edge Radiated Emissions	☒	☐	☐	☐

Notes:

1. 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
Reference:	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
Title:	AC Power-Line Conducted Emissions Frequently Asked Questions

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:	Nox Bluetooth Module
Model Name or Number:	NOXBLEMOD
Test Sample Serial Number:	4 (Conducted Test Sample)
Hardware Version Number:	4
Firmware Version Number:	6.1.1
FCC ID:	V5A-NOXBLEMOD

Brand Name:	Nox Bluetooth Module
Model Name or Number:	NOXBLEMOD
Test Sample Serial Number:	3 (Radiated Test Sample)
Hardware Version Number:	4
Firmware Version Number:	6.1.1
FCC ID:	V5A-NOXBLEMOD

3.2. Description of EUT

The equipment under test was a Bluetooth Module that supports Low Energy and Industry v5.0. The module was part of a host evaluation board.

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) Bluetooth Industry 5.0 (Digital Transmission System)		
Type of Unit:	Transceiver		
Channel Spacing:	2 MHz		
Modulation:	GFSK		
Data Rate:	1 Mbps (Bluetooth Low Energy)		
	2 Mbps (Bluetooth Industry 5.0)		
Power Supply Requirement(s):	Nominal	1.5 V DC	
Power Supply Type(s):	External		
Measured Maximum Conducted Output Power:	6.6 dBm (Bluetooth Low Energy)		
	6.7 dBm (Bluetooth Industry 5.0)		
Antenna Gain:	- 6.0 dBi		
Antenna Type:	PCB Trace Antenna		
Transmit Frequency Range: Bluetooth Low Energy | Bluetooth Industry 5.0	2402 MHz to 2480 MHz		
Transmit Channels Tested: Bluetooth Low Energy | Bluetooth Industry 5.0	**Channel ID**	**RF Channel Index**	**Channel Frequency (MHz)**
	Bottom	0	2402
	Middle	19	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	Laptop PC	HP	HP ProBook 650 G1	5CG6143YWB
2	Lab DC Power Supply	Conrad Electronic	PS-2403D	Not stated
3	Lab DC Power Supply	GW Instrument Co. LTD	GPC-1850D	7662217

B. Support Equipment (Manufacturer supplied)

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Pitch FPC Adapter	Adafruit Industrys LLC	1492	Not stated
2	--	--	--	--

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):
☒ Bluetooth Low Energy : Transmitting at maximum power with modulation, maximum possible data length available and Pseudorandom Bit Sequence 9.
☒ Bluetooth Industry 5.0 : Transmitting at maximum power 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 customer supplied a document containing the setup instructions “nox_ble_module_FCC_BLESIG_test_setup_v2.pdf".
- The EUT was configured into test mode; using a software application” automatic_hwtester.exe” supplied by the customer on the test laptop PC.
- In EUT’s test mode continuous transmission, relevant test channels, packet lengths and other settings were then set using this software application as required.
- The CONFIG TX POWER setting was set to 8 dBm.
- The EUT was transmitting continuously with duty cycle > 98 %, therefore no duty cycle correction was required.
- The conducted sample was used for duty cycle, bandwidth, output power measurements.
- The radiated sample was used for radiated spurious emission, radiated band edge & AC conducted emission measurements.
- Before starting final radiated spurious emission measurements “worst case verification” with the EUT in Standing-position & Laying-position was performed by Lab.
- The EUT in Standing-position was found to be the worst case therefore this report includes relevant results.
- Radiated spurious emissions were performed with the EUT positioned on the turn table and rotating 360 degrees while the antenna height varies from 1 to 4 m over the measurement frequency range.
- EMC32 V10.1.0 Software was used for the Radiated spurious emission measurement.
- For AC-Conducted line emissions measurements the Toyo EMI Software EP5/CE Ver 4.0.1. was used.

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 AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	28 June 2019
Test Sample Serial Number:	3		
Test Site Identification	SR 7/8		

Clause:	Part 15.207
Test Method:	ANSI C63.10 Section 6.2 / FCC KDB 174176 and notes below

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	35

Settings of the Instrument

Detector	Quasi Peak/ Average Peak

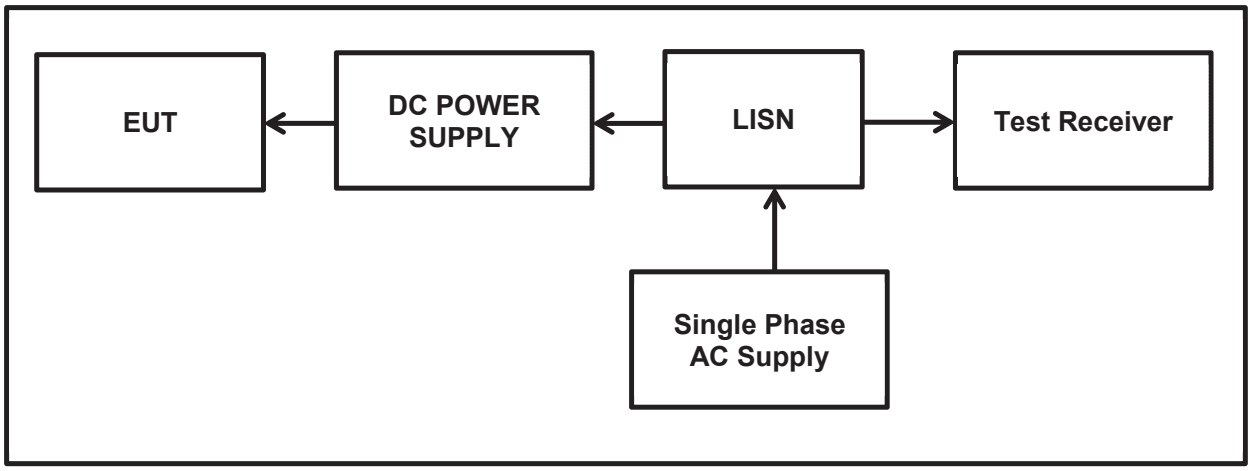
Note(s):

1. Measurement software used: Toyo EMI Software; CE measurement software EP5/CE Ver 4.0.1.
2. The EUT was powered by supplying 1.5 V DC via Laboratory DC Power Supply (Type: GPC-1850D).
3. In accordance with FCC KDB 174176 Q4; the Laboratory DC Power Supply was connected to 120 VAC 60 Hz single phase supply via a LISN.
4. The EUT was transmitting continuously with duty cycle > 98 %, therefore no duty cycle correction was required.
5. The EUT was configured in following test modes:
   - Bluetooth Low Energy : Bottom Channel
   - Bluetooth Industry 5.0: Bottom Channel
6. Measurements were performed in shielded room (SR7/ 8 Asset Number 1603671). The EUT was placed at a height of 80 cm above the reference ground plane and in a distance of 40 cm from the vertical ground plane at the edge of the table.
7. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
8. 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.
9. The final measured value, for the given emission, in the table below incorporates the cable loss. Calculation: Level = test receiver reading + path loss (cable attenuation + correction LISN).

1.

Transmitter AC Conducted Spurious Emissions (continued)

Test setup:



Results: Bluetooth Low Energy

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21891	Live	16.8	62.9	46.1	Complied
0.23488	Live	16.6	62.3	45.7	Complied
0.6703	Live	7.4	56	48.6	Complied
0.72962	Live	6.7	56	49.3	Complied
1.04923	Live	6.7	56	49.3	Complied
1.17843	Live	6.6	56	49.4	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21891	Live	11.6	52.9	41.3	Complied
0.23488	Live	11.6	52.3	40.7	Complied
0.6703	Live	4.4	46	41.6	Complied
0.72962	Live	4.4	46	41.6	Complied
1.04923	Live	2.5	46	43.5	Complied
1.17843	Live	3.4	46	42.6	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.18959	Neutral	17.0	64.1	47.1	Complied
0.21891	Neutral	16.8	62.9	46.1	Complied
0.23488	Neutral	16.6	62.3	45.7	Complied
0.6703	Neutral	7.4	56	48.6	Complied
0.72962	Neutral	6.7	56	49.3	Complied
1.04923	Neutral	6.7	56	49.3	Complied

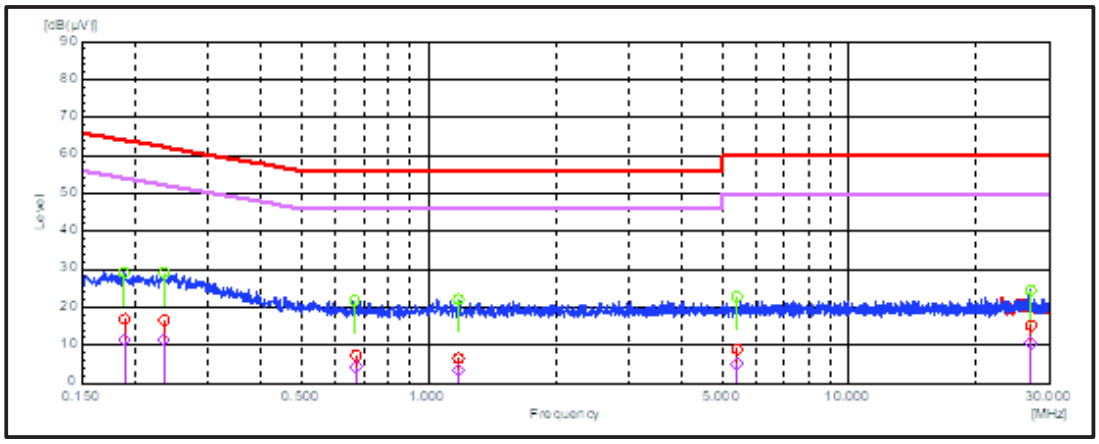
Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.18959	Neutral	11.6	54.1	42.5	Complied
0.21891	Neutral	11.6	52.9	41.3	Complied
0.23488	Neutral	11.6	52.3	40.7	Complied
0.6703	Neutral	4.4	46	41.6	Complied
0.72962	Neutral	4.4	46	41.6	Complied
1.04923	Neutral	2.5	46	43.5	Complied

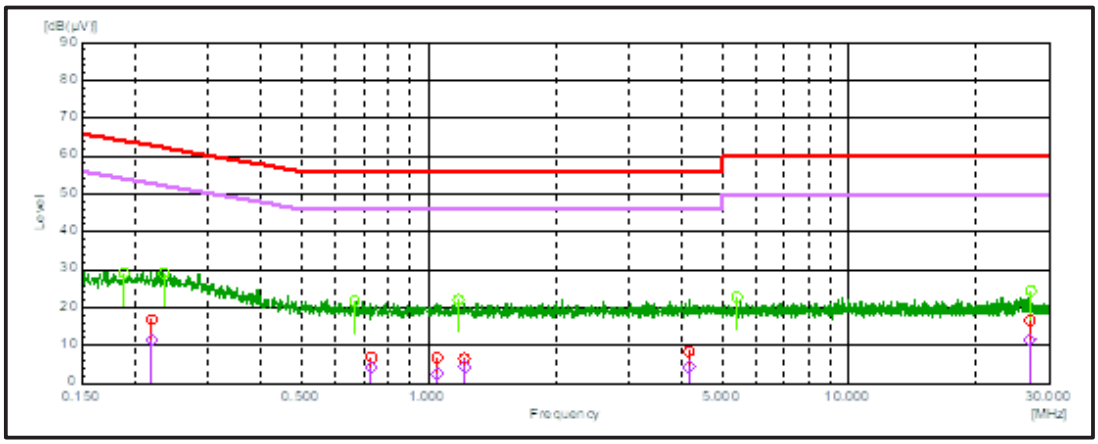
Result: Pass

Results: Bluetooth Low Energy

Plot: Neutral Line



Plot: Live Line



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

Results: Bluetooth Industry 5.0

Results: Live / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.16957	Live	17.0	65	48	Complied
0.25364	Live	16.5	61.6	45.1	Complied
0.54923	Live	7.9	56	48.1	Complied
5.12502	Live	8.9	60	51.1	Complied
23.24543	Live	11.9	60	48.1	Complied
26.95543	Live	16.9	60	43.1	Complied

Results: Live / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.16957	Live	11.6	55	43.4	Complied
0.25364	Live	11.1	51.6	40.5	Complied
0.54923	Live	4.3	46	41.7	Complied
5.12502	Live	4.3	50	45.7	Complied
23.24543	Live	7.6	50	42.4	Complied
26.95543	Live	11.9	50	38.1	Complied

Results: Neutral / Quasi Peak / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21115	Neutral	17.0	63.2	46.2	Complied
0.23553	Neutral	16.8	62.3	45.5	Complied
1.34111	Neutral	6.6	56	49.4	Complied
5.40691	Neutral	8.9	60	51.1	Complied
22.98106	Neutral	11.1	60	48.9	Complied
26.96791	Neutral	16.7	60	43.3	Complied

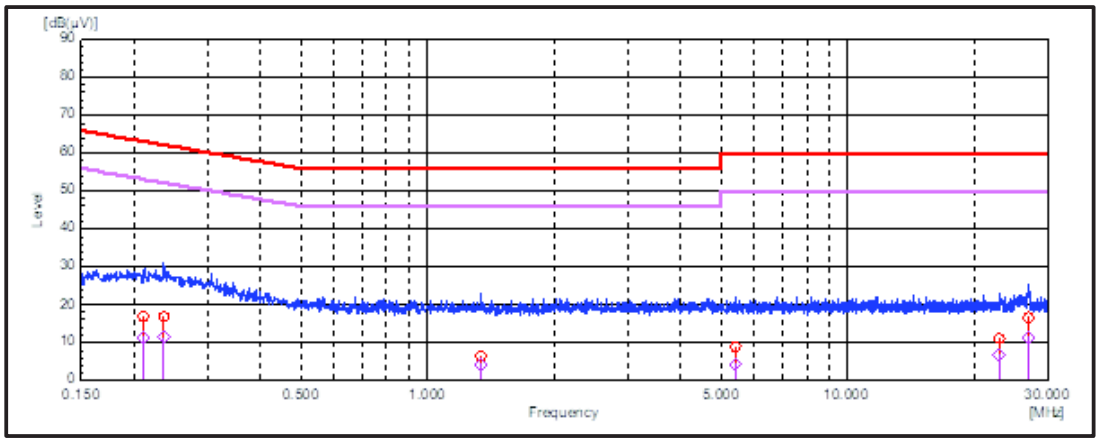
Results: Neutral / Average / 120 VAC 60 Hz

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.21115	Neutral	11.6	53.2	41.6	Complied
0.23553	Neutral	11.6	52.3	40.7	Complied
1.34111	Neutral	4.3	46	41.7	Complied
5.40691	Neutral	4.3	50	45.7	Complied
22.98106	Neutral	6.9	50	43.1	Complied
26.96791	Neutral	11.5	50	38.5	Complied

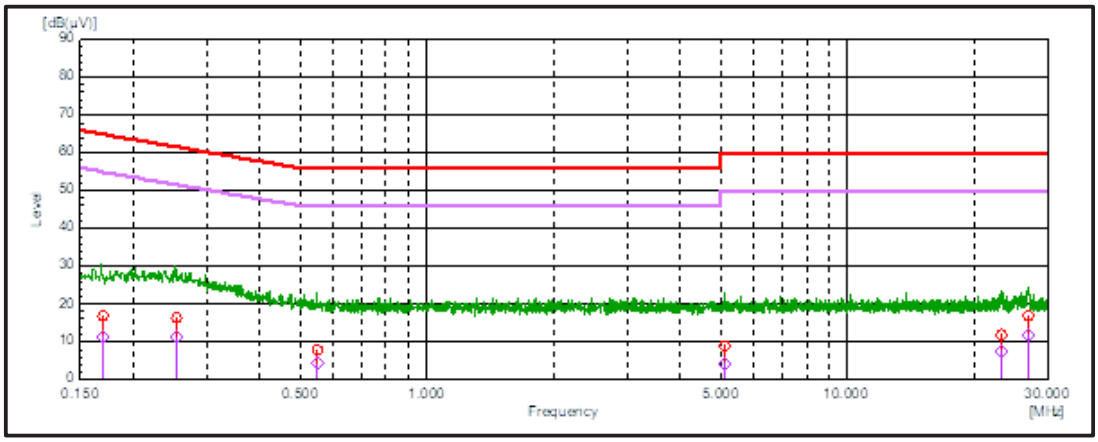
Result: Pass

Results: Bluetooth Industry 5.0

Plot: Neutral Line



Plot: Live Line



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

5.2.2. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	19 June 2019
Test Sample Serial Number:	4		
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

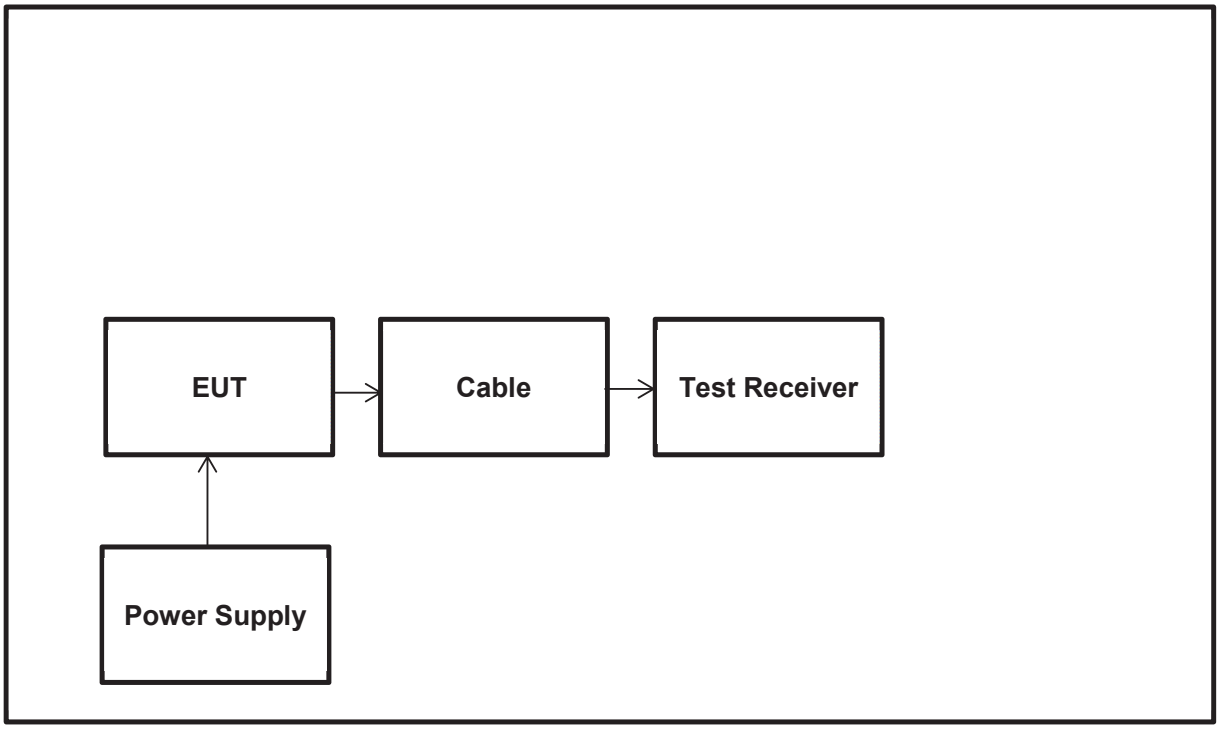
Environmental Conditions:

Temperature (°C):	21.4
Relative Humidity (%):	34

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 Section 11.8 (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 (maximum 0.4 dB@2.4GHz) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input and 1.1 dB for the UFL cable attenuation was added as a reference level offset (11.5 dB) to each of the conducted plots.

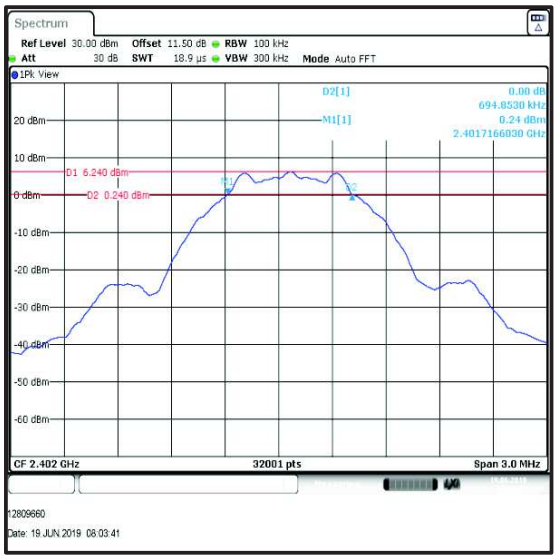
Test Setup:



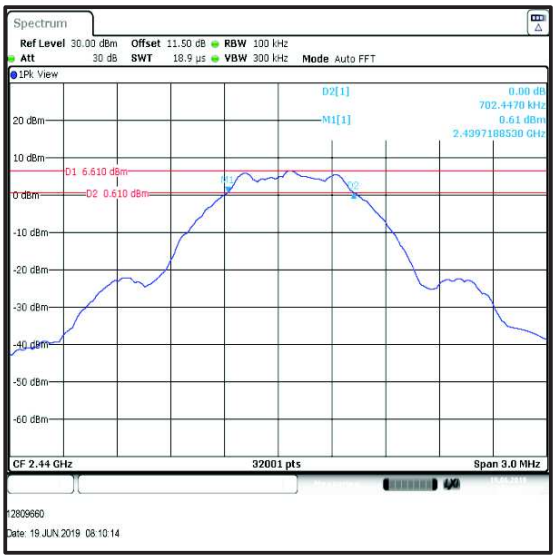
Transmitter Minimum 6 dB Bandwidth (continued)

Results: Bluetooth Low Energy

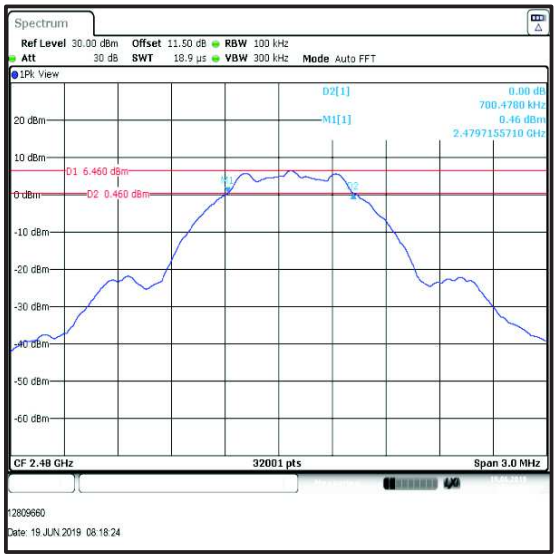
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	694.853	≥500	194.853	Complied
Middle	702.447	≥500	202.447	Complied
Top	700.478	≥500	200.478	Complied



Bottom Channel



Middle Channel



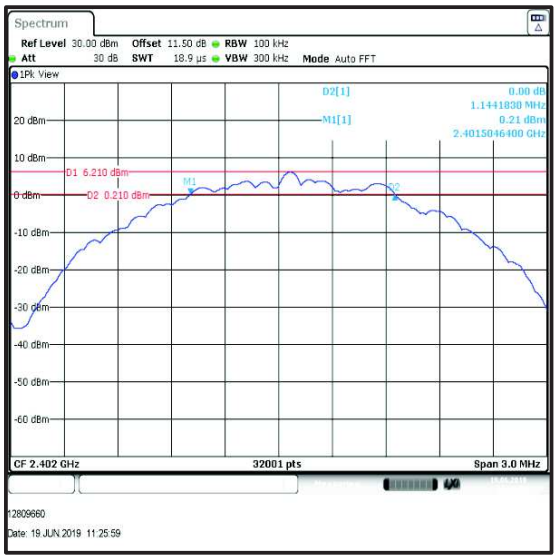
Top Channel

Result: Pass

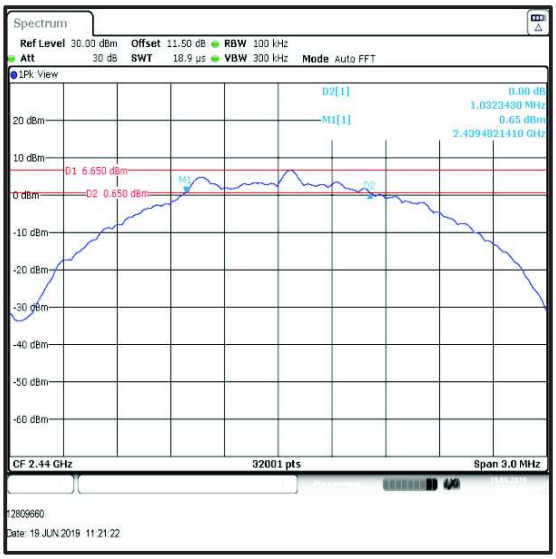
Transmitter Minimum 6 dB Bandwidth (continued)

Results: Bluetooth Industry 5.0

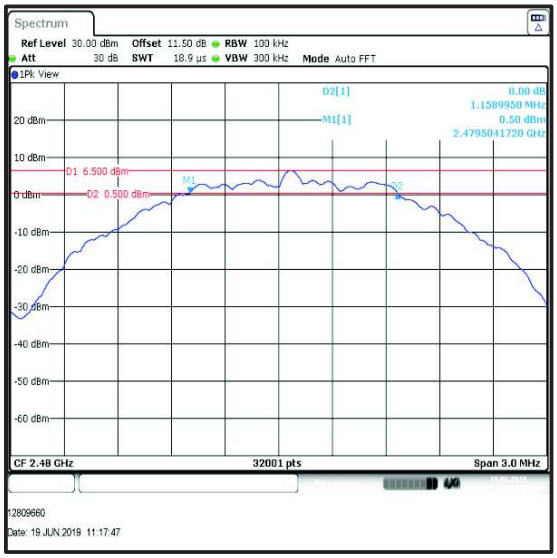
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	1144.183	≥500	644.183	Complied
Middle	1032.343	≥500	532.343	Complied
Top	1158.995	≥500	658.995	Complied



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.3. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Abdoufataou Salifou	**Test Date:**	19 June 2019
Test Sample Serial Number:	4		
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

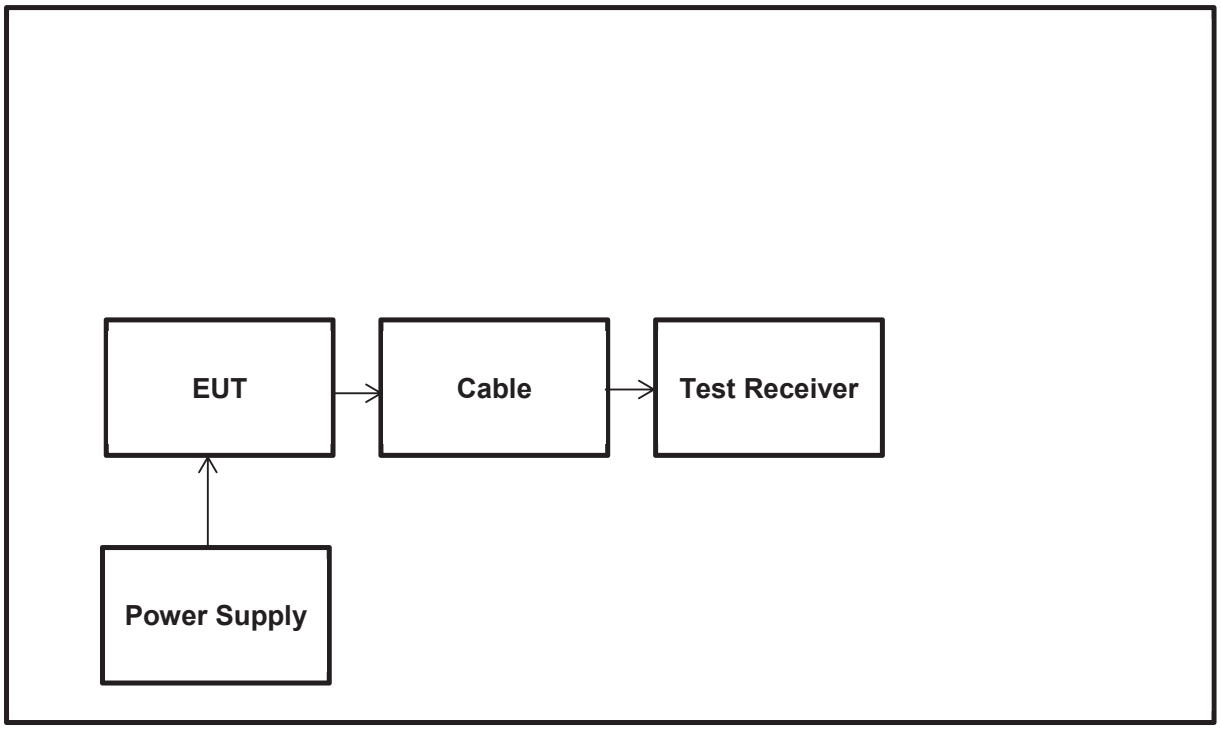
Environmental Conditions:

Temperature (°C):	21.9
Relative Humidity (%):	35

Notes:

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.3.1.1 with the RBW ≥ DTS bandwidth referring ANSI C63.10 Section 11.9.1.1.
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 (maximum 0.4 dB@2.4GHz) from the EUT to Analyzer including the 10 dB attenuation at the Spectrum Analyzer input and 1.1 dB for the UFL cable attenuation was added as a reference level offset (11.5 dB) to each of the conducted plots.
4. The EUT was transmitting continuously with duty cycle > 98 %, therefore no duty cycle correction was required.
5. The declared antenna gain was added to conducted power to obtain the EIRP.

Transmitter Maximum Peak Output Power (continued)
Test setup



Transmitter Maximum Peak Output Power (continued)

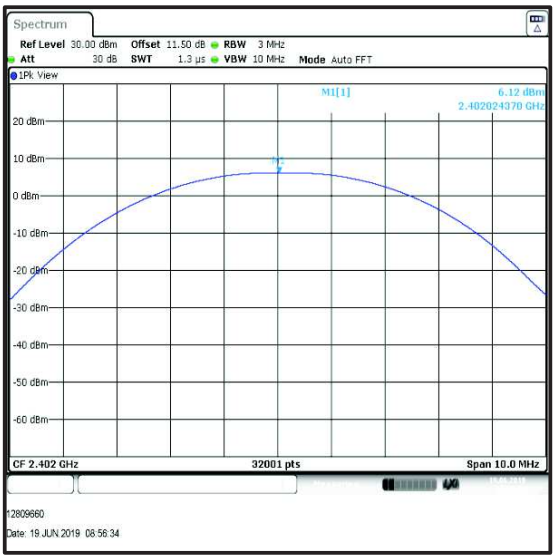
Results: Bluetooth Low Energy

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	6.1	30.0	23.9	Complied
Middle	6.6	30.0	23.4	Complied
Top	6.5	30.0	23.5	Complied

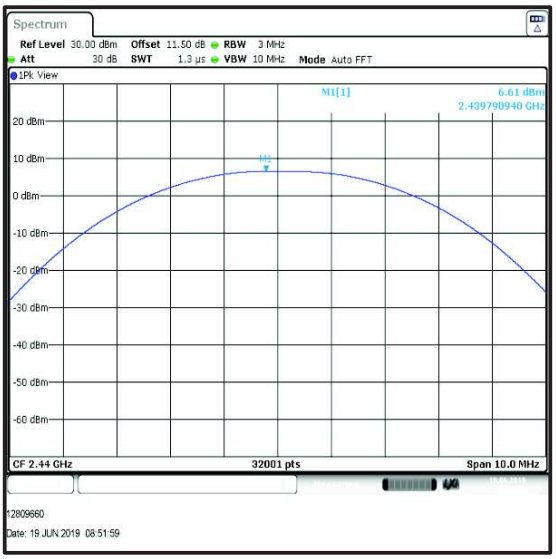
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	6.1	-6.0	0.1	36.0	35.9	Complied
Middle	6.6	-6.0	0.6	36.0	35.4	Complied
Top	6.5	-6.0	0.5	36.0	35.5	Complied

Transmitter Maximum Peak Output Power (continued)

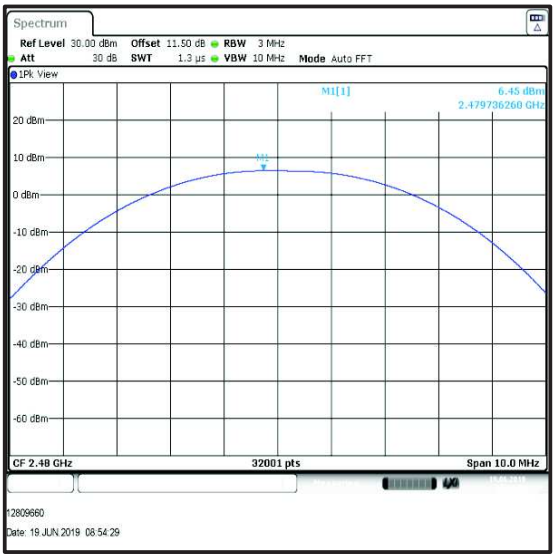
Results: Bluetooth Low Energy



Bottom Channel



Middle Channel



Top Channel

Result: Pass

Transmitter Maximum Peak Output Power (continued)

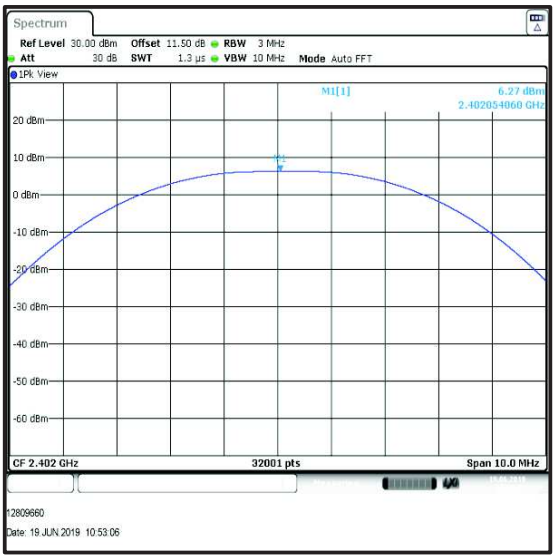
Results: Bluetooth Industry 5.0:

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	6.3	30.0	23.7	Complied
Middle	6.7	30.0	23.3	Complied
Top	6.6	30.0	23.4	Complied

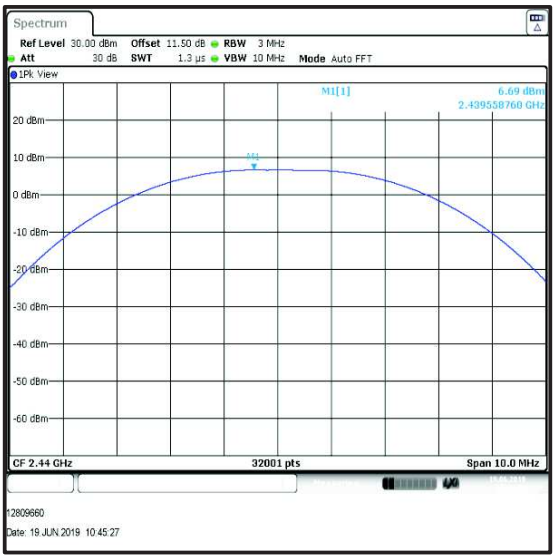
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	6.3	-6.0	0.3	36.0	35.7	Complied
Middle	6.7	-6.0	0.7	36.0	35.3	Complied
Top	6.6	-6.0	0.6	36.0	35.4	Complied

Transmitter Maximum Peak Output Power (continued)

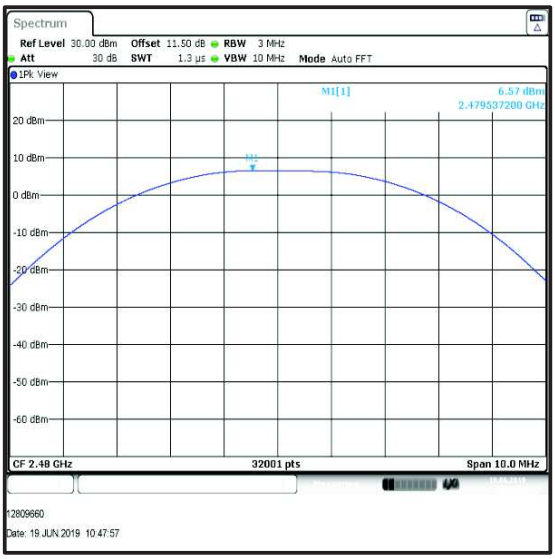
Results: Bluetooth Industry 5.0:



Bottom Channel



Middle Channel



Top Channel

Result: Pass

5.2.4. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	17 June 2019
Test Sample Serial Number:	3		
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 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

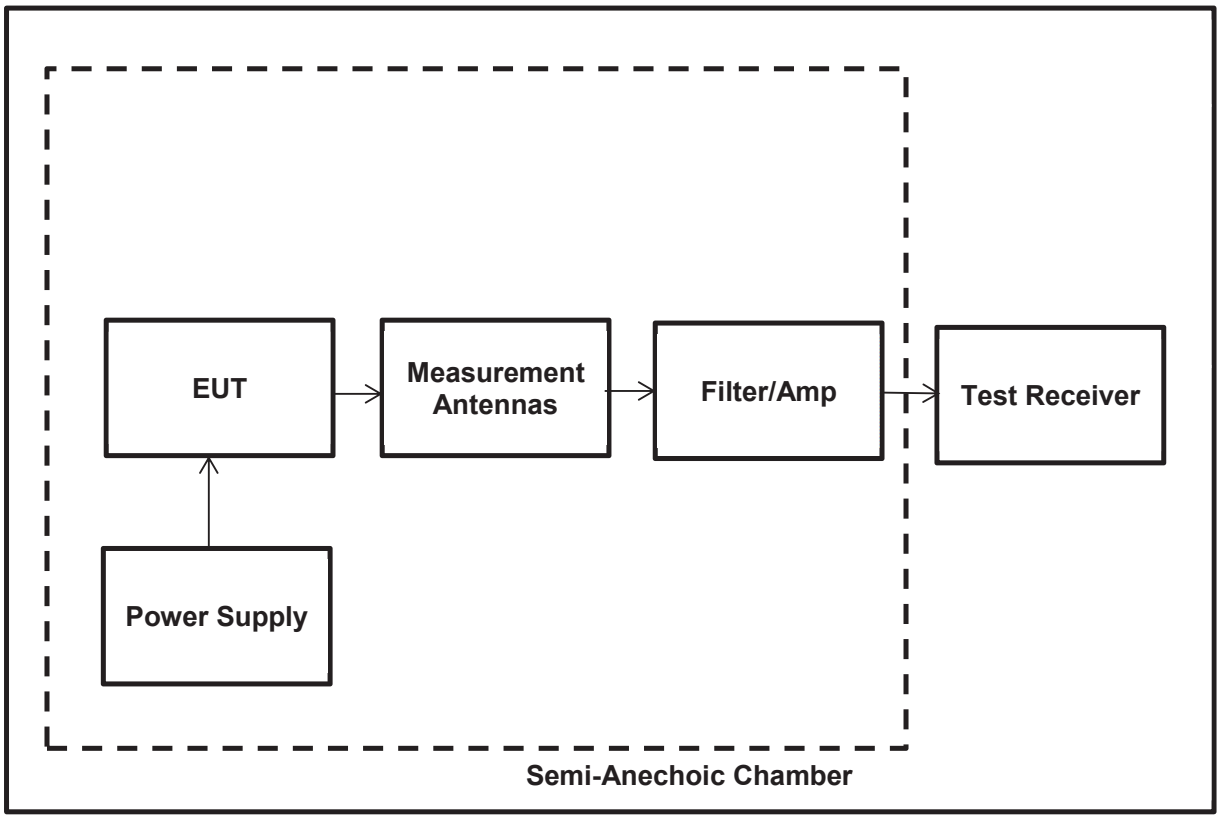
Temperature (°C):	23
Relative Humidity (%):	40

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 & both modes of operation. Therefore final radiated emissions measurements were performed with the EUT set to the bottom channel only.
3. The EUT was transmitting continuously with duty cycle > 98 %, therefore no duty cycle correction was required.
4. All emissions shown on the pre-scan plots were investigated and found to be ambient or > 20 dB below the appropriate limit.
5. 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.
6. 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.
7. 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:

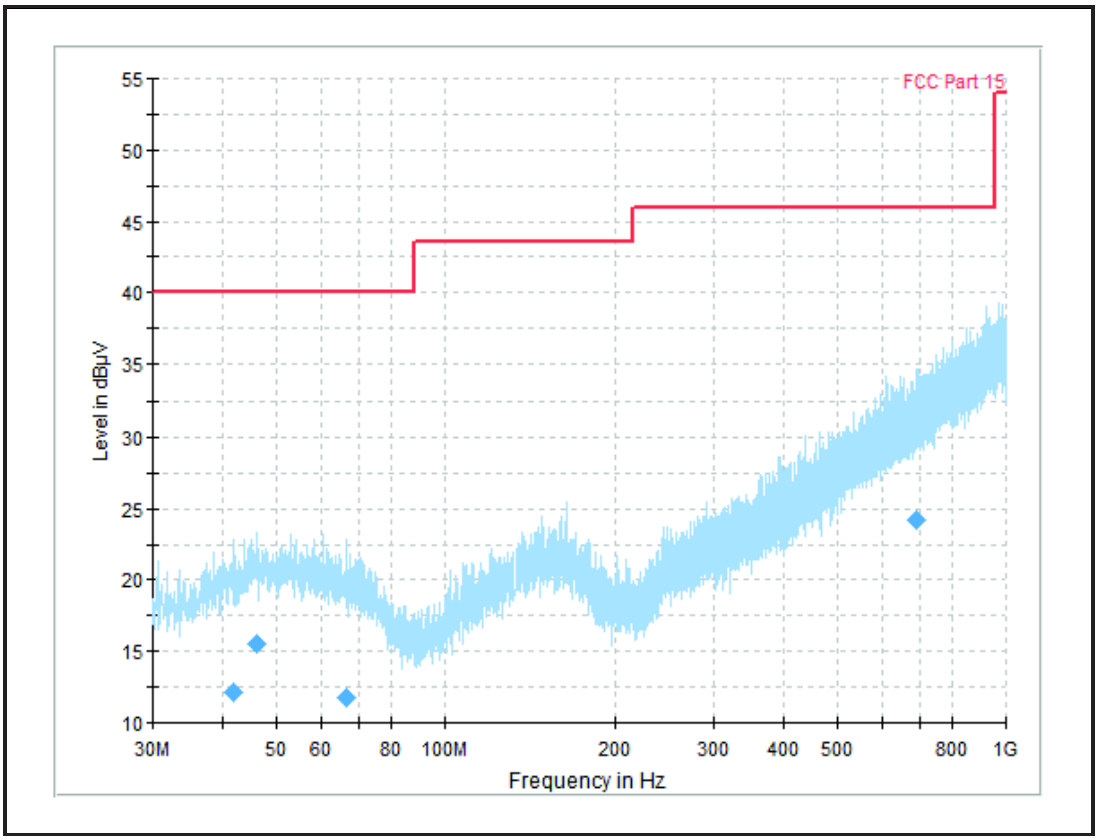


Transmitter Radiated Emissions (continued)

Results: Bluetooth Low Energy / Peak Method / Bottom Channel

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

Plot:30 MHz-1 GHz: Bluetooth Low Energy / Bottom Channel



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

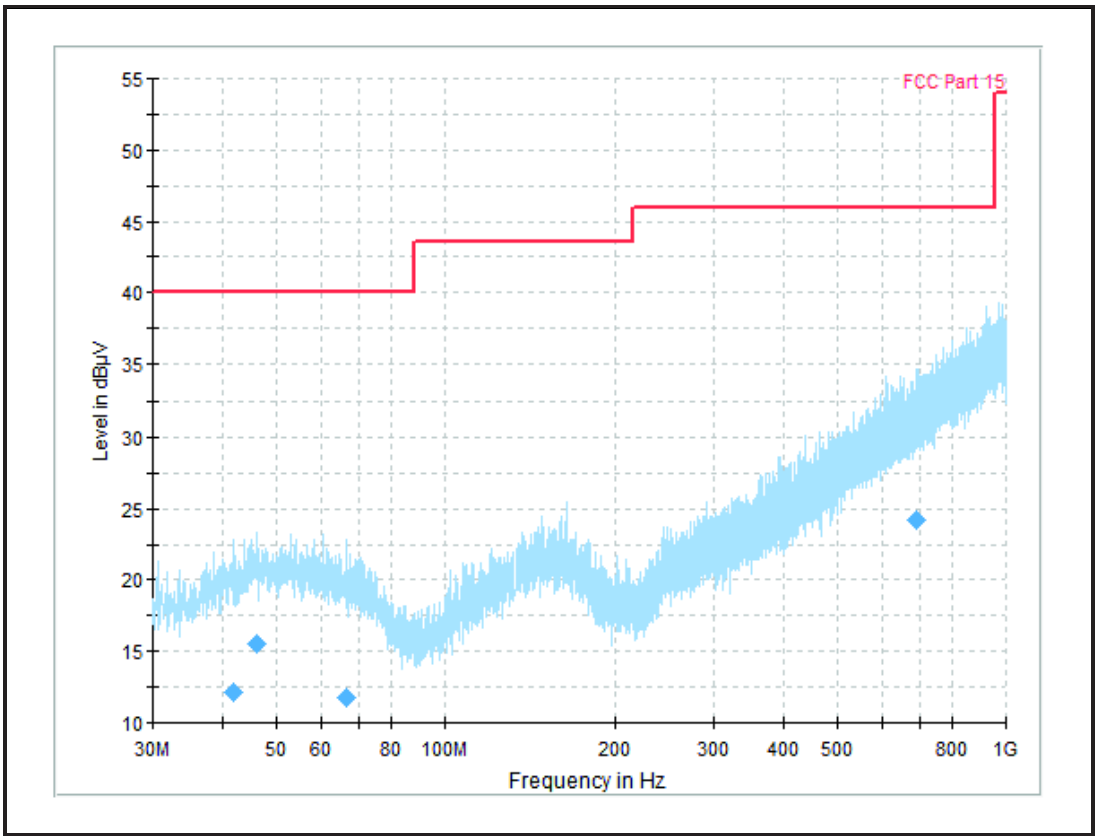
Result: Pass

Transmitter Radiated Emissions (continued)

Results: Bluetooth Industry 5.0 / Peak Method / Bottom Channel

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

Plot:30 MHz-1 GHz: Bluetooth Industry 5.0 / Bottom Channel



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

Result: Pass

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	18 & 19 June 2019 25 June 2019
Test Sample Serial Number:	3		
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 11.11 and 11.12 ANSI C63.10:2013 Sections 6.3 and 6.6
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	23 & 29 & 27
Relative Humidity (%):	40 & 36 & 48

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak and average noise floor readings of the measuring receiver were recorded as shown in the tables below.
3. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the appropriate limit or below the measurement system noise floor.
4. The emission shown approximately at 2.4-2.4835 GHz on the 1 GHz to 18 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 preliminary scans showed similar emission levels above 18 GHz, for each channel & both modes of operation. Therefore final radiated emissions measurements were performed with the EUT set to the bottom channel only.
9. The EUT was transmitting continuously with duty cycle > 98 %, therefore no duty cycle correction was required.

Transmitter Radiated Emissions (continued)

Results: Bluetooth Low Energy / Peak Method / Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

Results: Bluetooth Low Energy / Peak Method / Middle Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

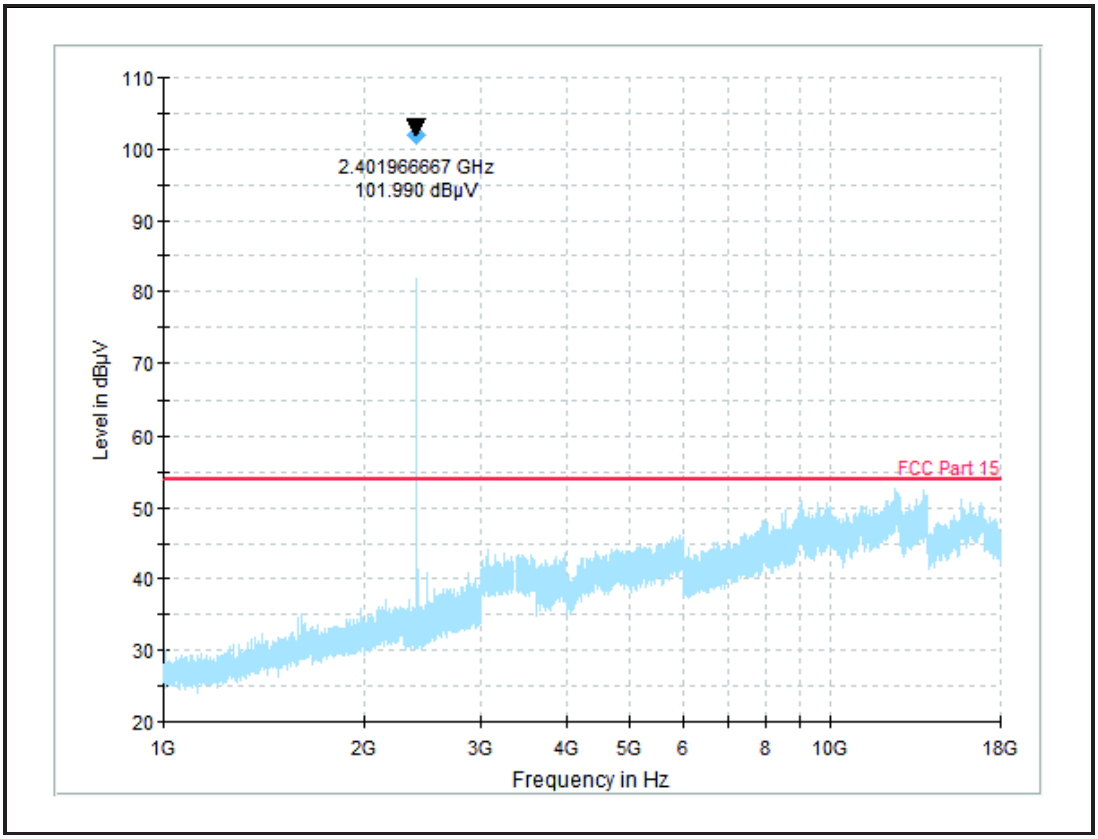
Results: Bluetooth Low Energy / Peak Method / Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

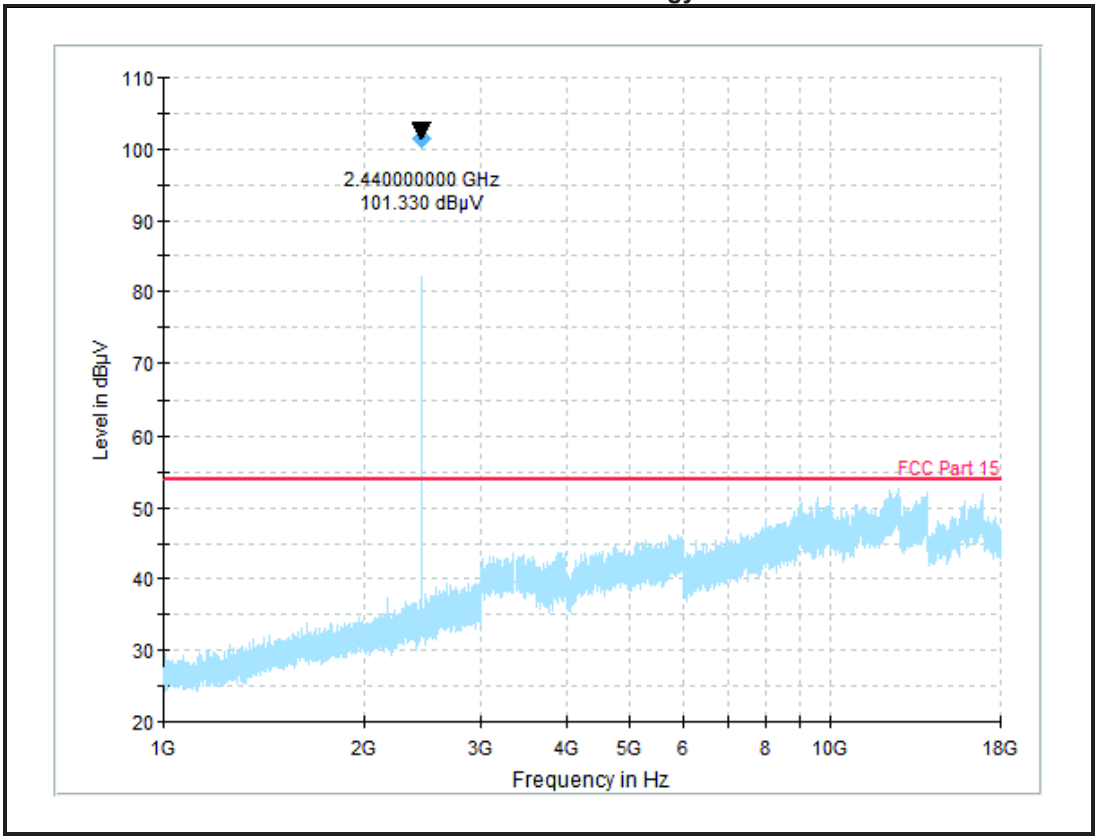
Result: Pass

Transmitter Radiated Emissions (continued)

Plot:1 GHz-18 GHz: Bluetooth Low Energy / Bottom Channel

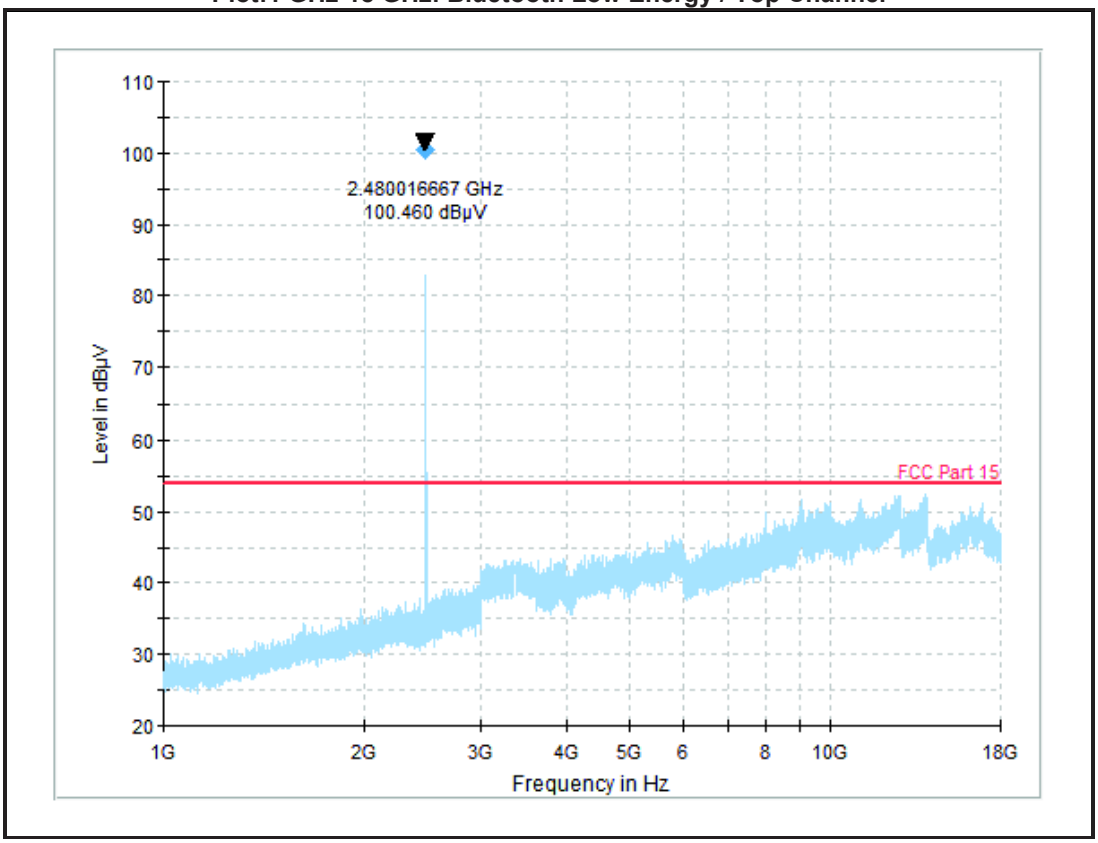


Plot:1 GHz-18 GHz: Bluetooth Low Energy / Middle Channel



Transmitter Radiated Emissions (continued)

Plot:1 GHz-18 GHz: Bluetooth Low Energy / Top Channel



Transmitter Radiated Emissions (continued)

Results: Bluetooth Industry 5.0 / Peak Method / Bottom Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

Results: Bluetooth Industry 5.0 / Peak Method / Middle Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

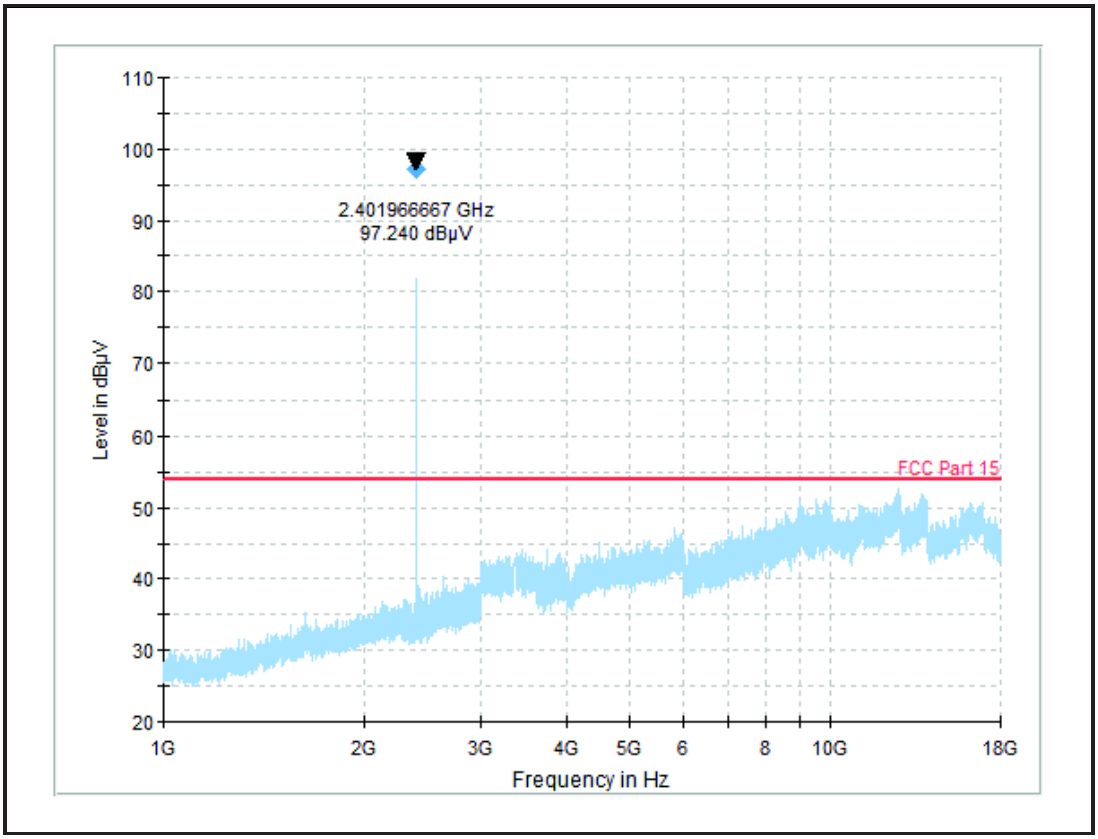
Results: Bluetooth Industry 5.0 / Peak Method / Top Channel

Frequency (MHz)	Antenna Polarization	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
No critical spurious was found					

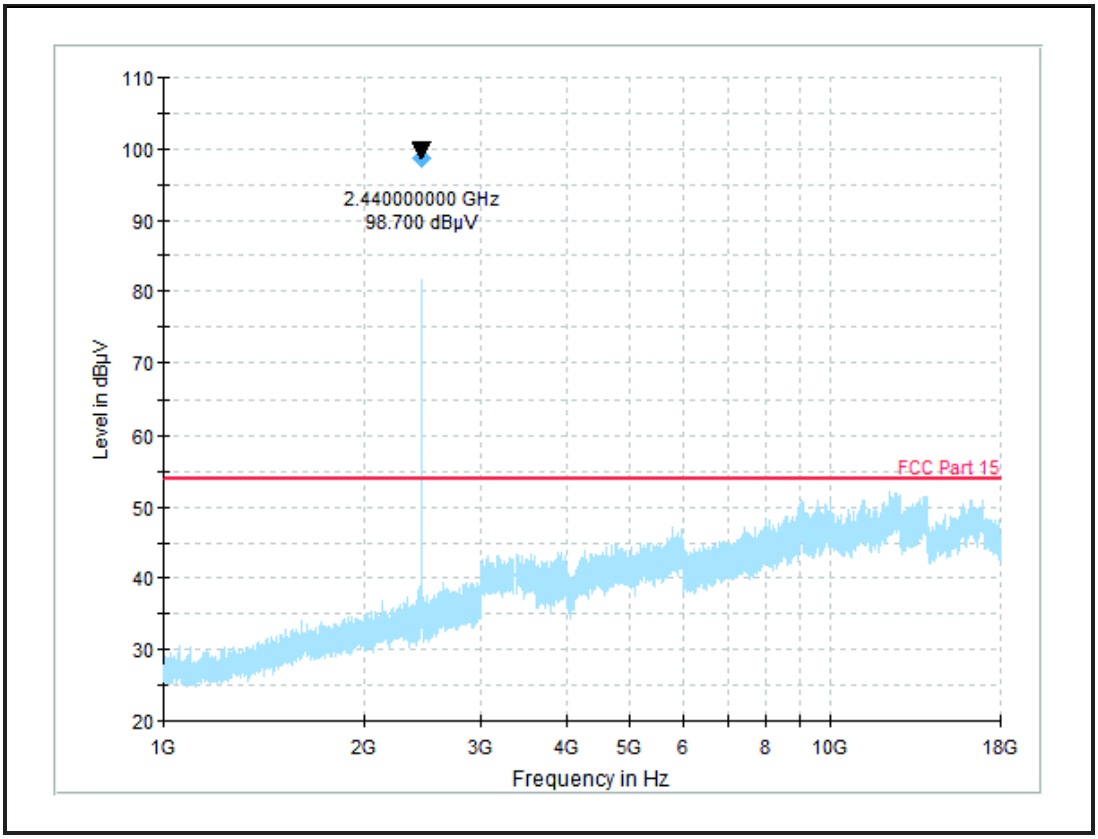
Result: Pass

Transmitter Radiated Emissions (continued)

Plot:1 GHz-18 GHz: Bluetooth Industry 5.0 / Bottom Channel

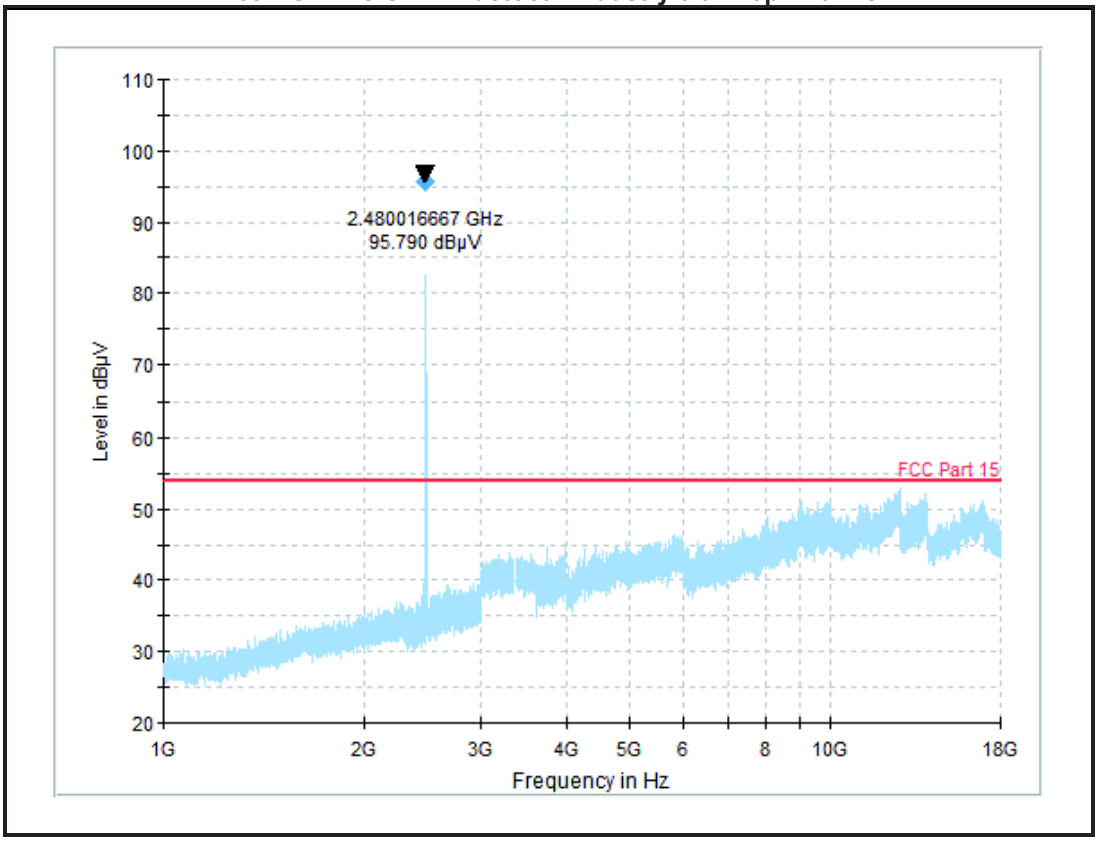


Plot:1 GHz-18 GHz: Bluetooth Industry 5.0 / Middle Channel



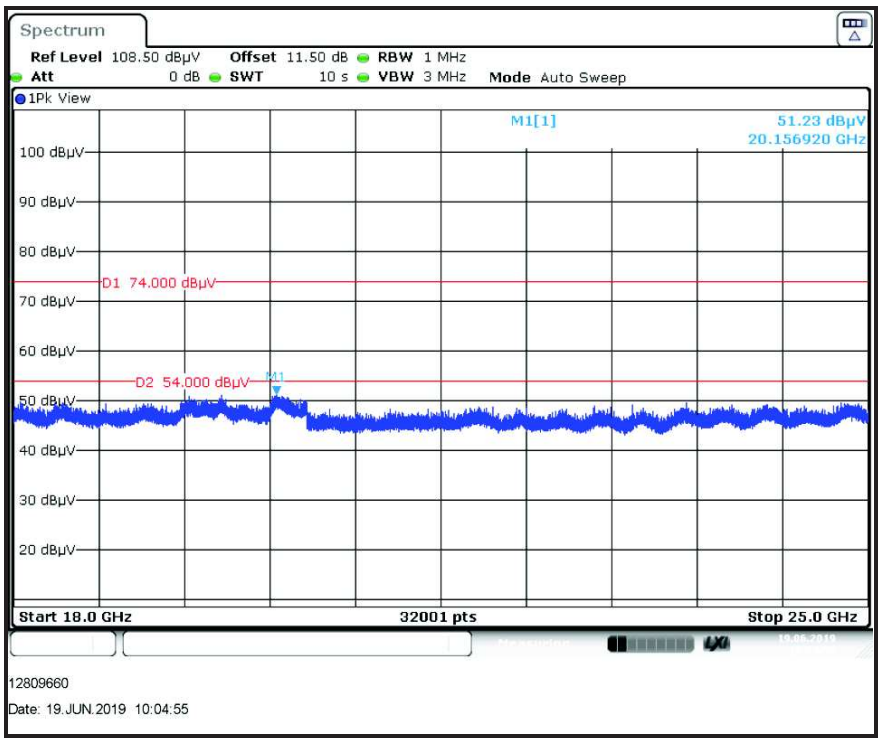
Transmitter Radiated Emissions (continued)

Plot:1 GHz-18 GHz: Bluetooth Industry 5.0 / Top Channel



Transmitter Radiated Emissions (continued)

Plot:1 GHz-18 GHz: Bluetooth Lowe Energy / Bottom Channel
Plot:1 GHz-18 GHz: Bluetooth Industry 5.0 / Bottom Channel



5.2.5. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Krume Ivanov	**Test Date:**	18 June 2019 & 25 June 2019
Test Sample Serial Number:	3		
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, 11.2 ,11.13

Environmental Conditions:

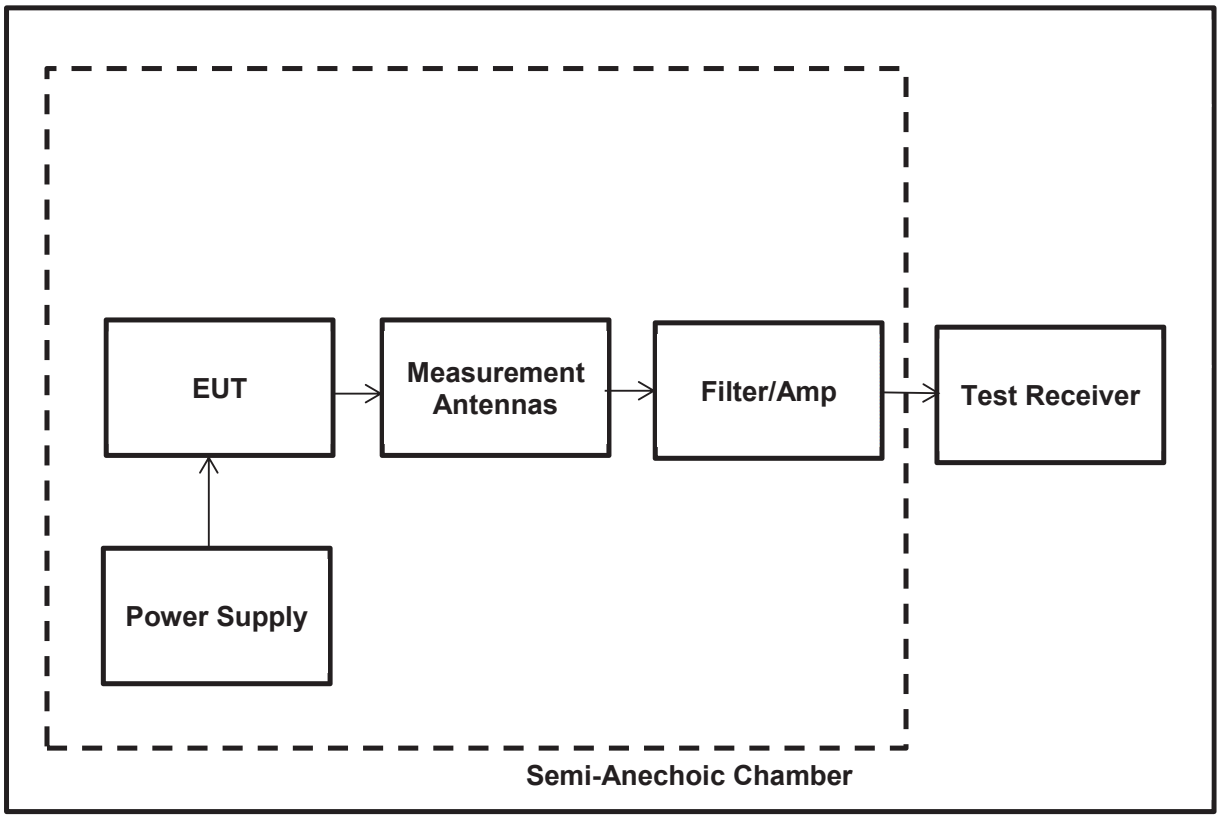
Temperature (°C):	23 & 27
Relative Humidity (%):	40 & 48

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. As 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 EUT was transmitting continuously with duty cycle > 98 %, therefore no duty cycle correction was required.

Transmitter Band Edge Radiated Emissions (Continued)

Test Setup:



Transmitter Band Edge Radiated Emissions (Continued)

Results: Bluetooth Low Energy

Results: Lower Band Edge

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.95	44.95	79.94	35.00	Complied
2400	45.22	79.94	31.72	Complied

Results: Lower Band Edge / Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2388.58	45.20	74.0	28.80	Complied

Results: Lower Band Edge / Restricted Band / Peak and Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2389.87	33.21	54.0	20.79	Complied

Results: Upper Band Edge / Restricted Band / Peak

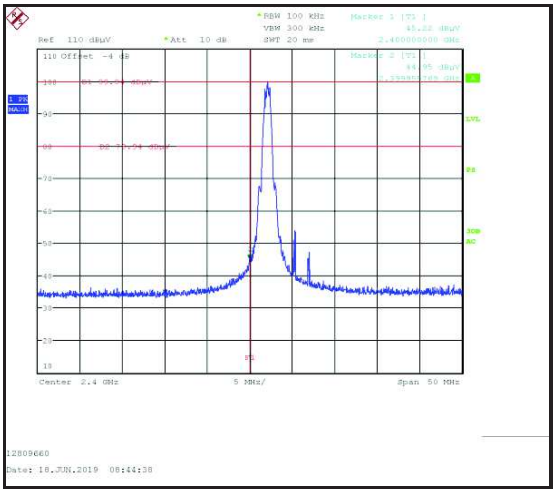
Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	56.91	74.0	17.09	Complied
2483.90	52.93	74.0	21.07	Complied

Results: Upper Band Edge / Restricted Band / Average

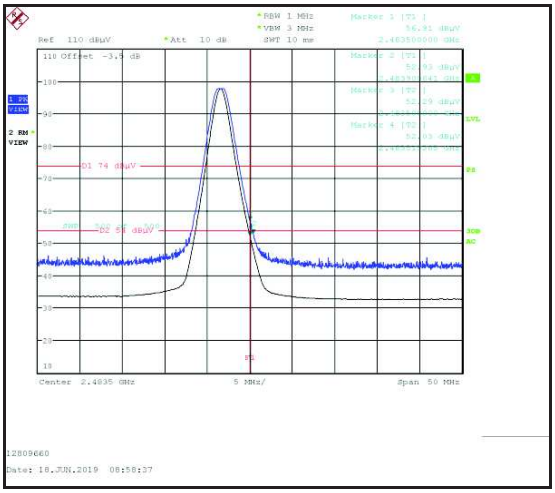
Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	52.29	54.0	1.71	Complied
2483.51	52.03	54.0	1.97	Complied

Transmitter Band Edge Radiated Emissions (Continued)

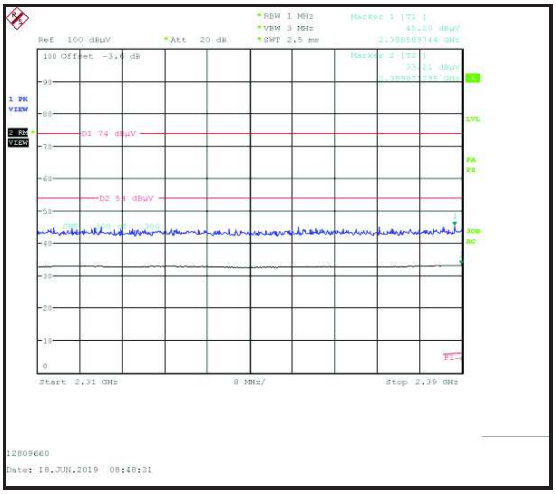
Results: Bluetooth Low Energy



Lower Band Edge Peak Measurement



Upper Band Edge Peak and Average Measurement



2310 MHz to 2390 MHz Restricted Band Plot

Transmitter Band Edge Radiated Emissions (Continued)

Results: Bluetooth Industry 5.0

Results: Lower Band Edge / Peak

Frequency (MHz)	Peak Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2400.00	55.39	73.05	17.66	Complied
2399.87	54.15	73.05	18.90	Complied

Results: Lower Band Edge / Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2316.41	45.24	74.0	28.76	Complied

Results: Lower Band Edge / Restricted Band / Average

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2389.35	33.39	54.0	20.61	Complied

Results: Upper Band Edge / Restricted Band / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)	Result
2483.50	56.57	74.0	17.43	Complied
2483.90	53.88	74.0	20.12	Complied

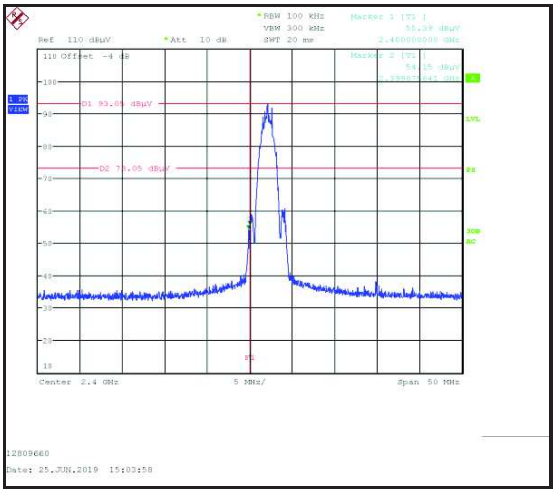
Results: Upper Band Edge / Restricted Band / Average*

Frequency (MHz)	Average Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
2483.50	47.34	54.0	6.66	Complied
2492.79	33.65	54.0	20.35	Complied

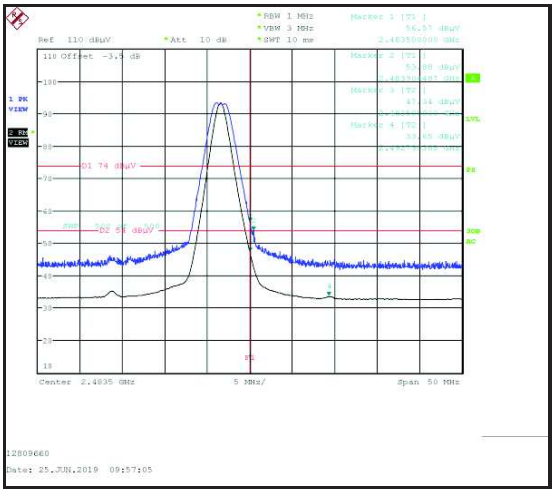
Result: Pass

Transmitter Band Edge Radiated Emissions (Continued)

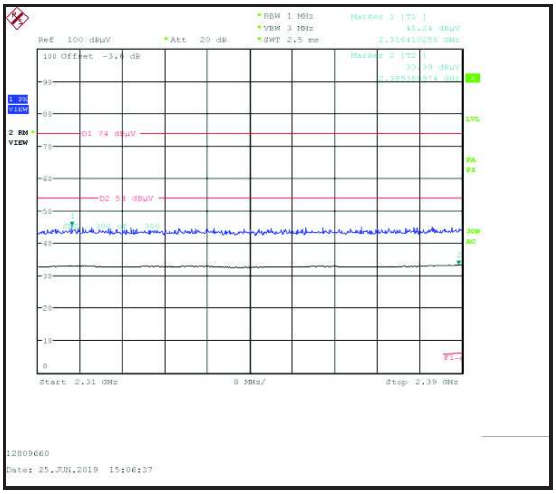
Results: Bluetooth Industry 5.0



Lower Band Edge Peak Measurement



Upper Band Edge Peak and 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
AC Conducted Spurious Emissions	95%	±2.49 dB
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
607	Schwarzbeck	Antenna, Horn	BBHA 9170	BBHA9170561	07/01/2016	36
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	Kippeinrichtung	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

Test site: SR 7/8

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
22	Rohde & Schwarz	Artificial Mains	50 Ohm// 50uH	831767/014	7/11/2018	12
215	Rohde & Schwarz	Artificial Mains Network	9 kHz - 30 MHz; 3 phase	879675/002	7/11/2018	12
349	Rohde & Schwarz	Receiver, EMI Test	20 Hz - 7 GHz	836697/009	7/10/2018	12
616	Rohde & Schwarz	ISN	8 wire ISN for CAT6	101656	7/12/2018	12

8. Report Revision History

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

--- END OF REPORT ---