



# TEST REPORT

**Test Report No. : UL-RPT-RP-12189259-516-FCC**

**Applicant** : Eliwell Controls SRL  
**Model No.** : Dongle BTLE AIR  
**FCC ID** : 2AMLEDONGLEBTLE  
**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: Segun I., Adeniji  
Title: Engineer  
Date: 16.January.2019

Approved by: Ajit, Phadtare  
Title: Lead Test Engineer  
Date: 16.January.2019



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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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## **1. Customer Information**

### **1.1.Applicant Information**

<b>Company Name:</b>	Eliwell Control s.r.l
<b>Company Address:</b>	Via dell'Industria, 15 32016 Alpago, Belluno Italy
<b>Contact Person:</b>	Emanuela Cortina
<b>Contact E-Mail Address:</b>	emanuela.cortina@schneider-electric.com
<b>Contact Phone No.:</b>	+39 0437 986412

### **1.2.Manufacturer Information**

<b>Company Name:</b>	Eliwell Control s.r.l
<b>Company Address:</b>	Via dell'Industria, 15 32016 Alpago, Belluno Italy
<b>Contact Person:</b>	Emanuela Cortina
<b>Contact E-Mail Address:</b>	emanuela.cortina@schneider-electric.com
<b>Contact Phone No.:</b>	+39 0437 986412

## **2. Summary of Testing**

### **2.1. General Information**

#### **Applied Standards**

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

#### **Location**

<b>Location of Testing:</b>	UL International Germany GmbH Hedelfinger Str. 61 70327 Stuttgart Germany
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#### **Date information**

<b>Order Date:</b>	02 February 2018
<b>EUT arrived:</b>	12 November 2018
<b>Test Dates:</b>	15 November 2018 to 19 December 2018
<b>EUT returned:</b>	-/-

**2.2. Summary of Test Results**

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
Part 15.207	Transmitter AC Conducted Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input 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 15.247(e)	Transmitter Power Spectral Density	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" 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(s):**

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**

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 558074 D01 15.247 Meas Guidance v05 August 24, 2018
<b>Title:</b>	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
<b>Reference:</b>	KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
<b>Title:</b>	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)**

<b>Brand Name:</b>	Eliwell
<b>Model Name or Number:</b>	Dongle BTLE AIR
<b>Test Sample Serial Number:</b>	ADBT420xxx00xx ( <i>Conducted sample with RF port</i> )
<b>Hardware Version Number:</b>	5528736 (product code ADBT420xxx10xx)
<b>Firmware Version Number:</b>	FW-DTM-R2-REL.3.01
<b>FCC ID:</b>	2AMLEDONGLEBTLE

<b>Brand Name:</b>	Eliwell
<b>Model Name or Number:</b>	Dongle BTLE AIR
<b>Test Sample Serial Number:</b>	ADBT420xxx10xx ( <i>Radiated sample with RF port</i> )
<b>Hardware Version Number:</b>	5528736 (product code ADBT420xxx10xx)
<b>Firmware Version Number:</b>	FW-DTM-R2-REL.3.01
<b>FCC ID:</b>	2AMLEDONGLEBTLE

#### **3.2. Description of EUT**

The equipment under test was a Bluetooth-Modbus Interface with (ADBT420xxx10xx) Datalogging functionality integrating a Bluetooth low energy module.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

**3.4. Additional Information Related to Testing**

<b>Technology Tested:</b>	Bluetooth Low Energy (Digital Transmission System)		
<b>Type of Unit:</b>	Transceiver		
<b>Channel Spacing:</b>	2 MHz		
<b>Modulation:</b>	GFSK		
<b>Data Rate:</b>	1 Mbps		
<b>Power Supply Requirement(s):</b>	Nominal	3.3 VDC	
<b>Maximum Conducted Output Power:</b>	1.3 dBm		
<b>Antenna Gain:</b>	-2.1 dBi		
<b>Transmit Frequency Range:</b>	2402 MHz to 2480 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>RF Channel</b>	<b>Channel Frequency (MHz)</b>
	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	Lenovo	W530	Not marked/stated

**B. Support Equipment (Manufacturer supplied)**

Item	Description	Brand Name	Model Name or Number	Serial Number
1	UART TTL Cable	Not marked/stated	Not marked/stated	Not marked/stated



## **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 power level 4 in *Bluetooth* LE mode with modulation and maximum possible data length available

### **4.2. Configuration and Peripherals**

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

- The EUT was powered via 3.3 VDC external power supply
- The EUT was controlled with a test laptop and a third party test software application using commands supplied by the customer. Channels, packet lengths and other settings were then set using this software application as required.
- The CONFIG TX POWER setting was set to 4 dBm.
- The EUT was transmitting with 100% duty cycle therefore no duty cycle correction was required.
- The EUT conducted sample was used for 6 dB bandwidth and maximum peak output power.
- The EUT radiated sample was used for AC conducted emissions, radiated band edge measurement and radiated spurious emissions tests.

## **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:**

<b>Test Engineer:</b>	Bernd Woerl	<b>Test Date:</b>	19 December 2018
<b>Test Sample Serial Number:</b>	ADBT420xxx10xx		
<b>Test Site Identification</b>	SR 7/8		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	20
<b>Relative Humidity (%):</b>	33

**Settings of the Instrument**

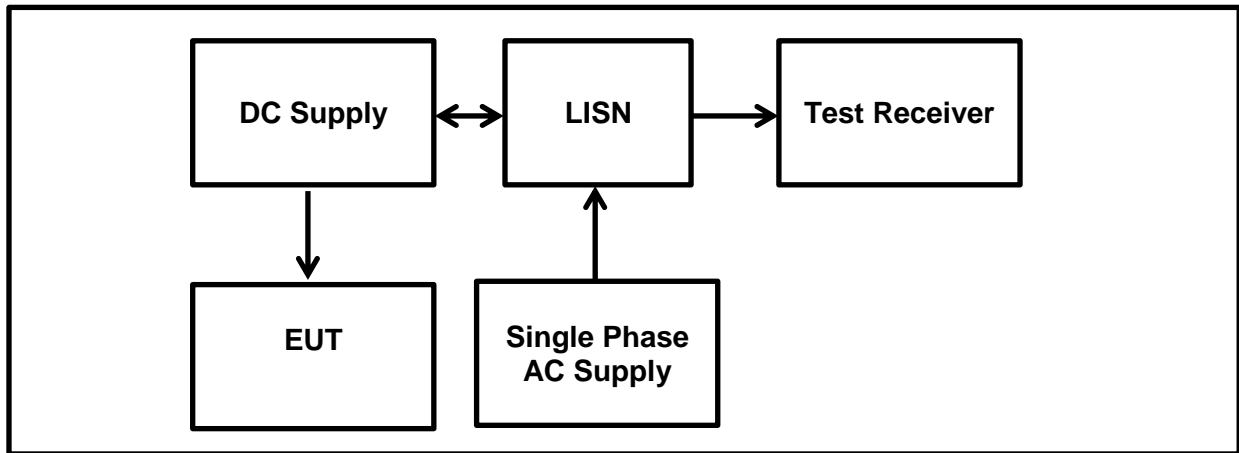
<b>Detector</b>	Quasi Peak/ Average Peak
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**Note(s):**

1. The EUT was connected to an AC/DC Power Supply.
2. The EUT was powered with an external power supply through an AC/DC Power Supply connected to a 120 VAC 60 Hz single phase supply via a LISN.
3. The final measured value, for the given emission, in the table below incorporates the cable loss.
4. 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.
5. 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.

**Transmitter AC Conducted Spurious Emissions (continued)**

**Test setup:**



**Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.47728	Live	11.9	56.4	44.5	Complied
1.36609	Live	21.6	56.0	34.4	Complied
1.69225	Live	15.9	56.0	40.1	Complied
4.88724	Live	19.0	56.0	37.0	Complied
5.16724	Live	22.5	60.0	37.5	Complied
9.87296	Live	22.3	60.0	37.7	Complied

**Results: Live / Average / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.47728	Live	5.2	46.4	41.2	Complied
1.36609	Live	4.3	46.0	41.7	Complied
1.69225	Live	3.4	46.0	42.6	Complied
4.88724	Live	5.2	46.0	40.8	Complied
5.16724	Live	5.9	50.0	44.1	Complied
9.87296	Live	5.3	50.0	44.7	Complied

**Results: Neutral / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1987	Neutral	17.4	63.7	46.3	Complied
0.43926	Neutral	11.2	57.1	45.9	Complied
1.36364	Neutral	24.4	56.0	31.6	Complied
3.96699	Neutral	13.6	56.0	42.4	Complied
4.87146	Neutral	19.1	56.0	36.9	Complied
5.19389	Neutral	20.7	60.0	39.3	Complied
8.69394	Neutral	16.7	60.0	43.3	Complied
9.08325	Neutral	15.1	60.0	44.9	Complied
9.90173	Neutral	23.1	60.0	36.9	Complied

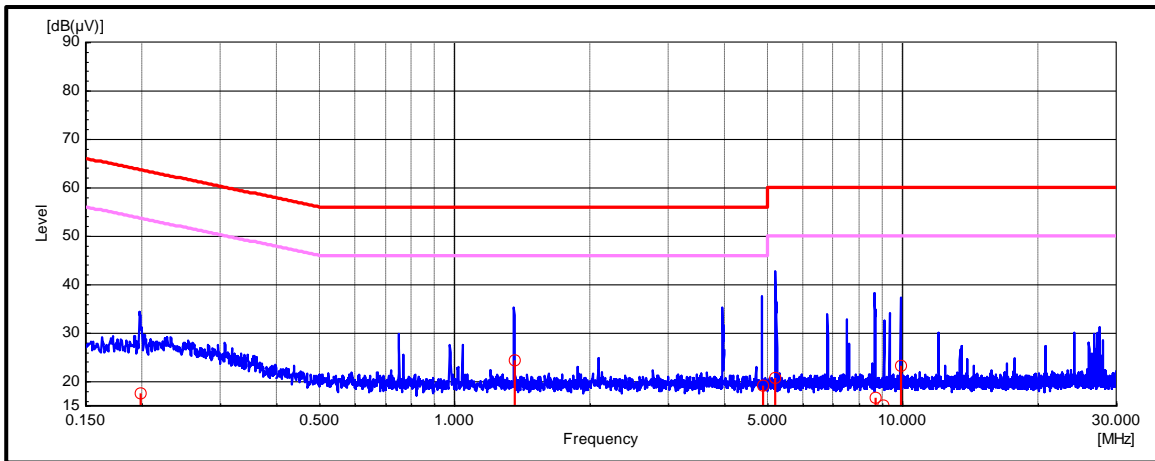
**Results: Neutral / Average / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.1987	Neutral	11.9	53.7	41.8	Complied
0.43926	Neutral	5.9	47.1	41.2	Complied
1.36364	Neutral	4.3	46.0	41.7	Complied
3.96699	Neutral	4.3	46.0	41.7	Complied
4.87146	Neutral	5.9	46.0	40.1	Complied
5.19389	Neutral	5.9	50.0	44.1	Complied
8.69394	Neutral	5.3	50.0	44.7	Complied
9.08325	Neutral	5.3	50.0	44.7	Complied
9.90173	Neutral	5.3	50.0	44.7	Complied

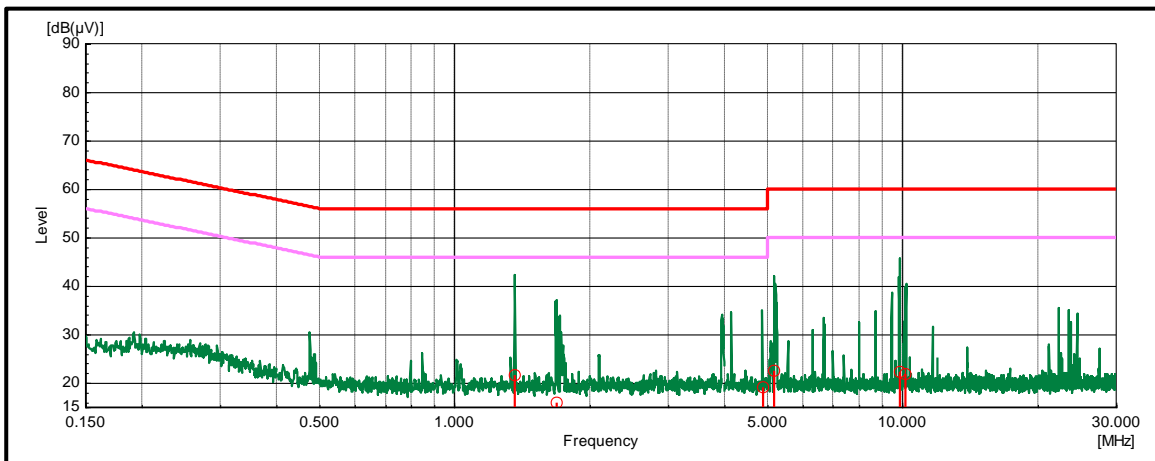
**Result: Pass**

**Plot: Live and Neutral Line**

**Neutral**



**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:**

<b>Test Engineer:</b>	Segun Adeniji	<b>Test Date:</b>	15 November 2018
<b>Test Sample Serial Number:</b>	ADBT420xxx00xx		
<b>Test Site Identification</b>	SR 9		

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

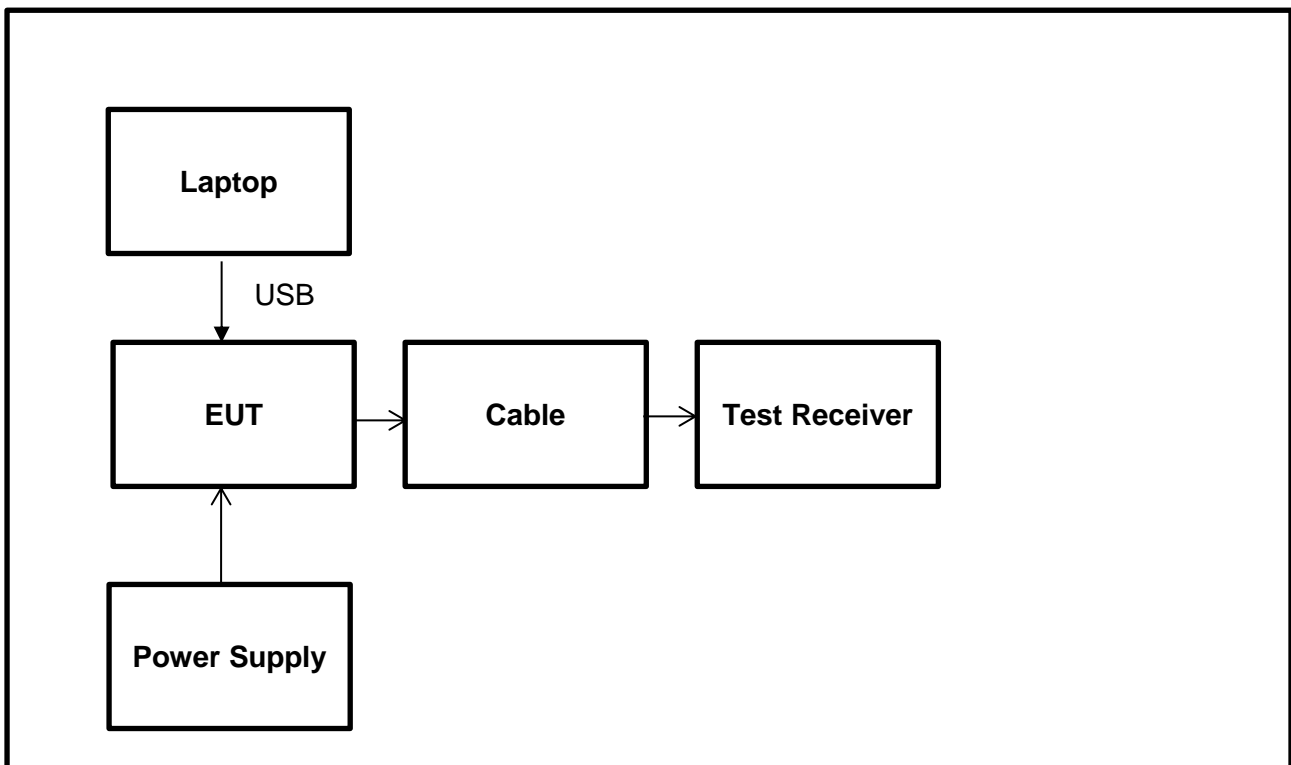
**Environmental Conditions:**

<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	33

**Note(s):**

- 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.
- The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

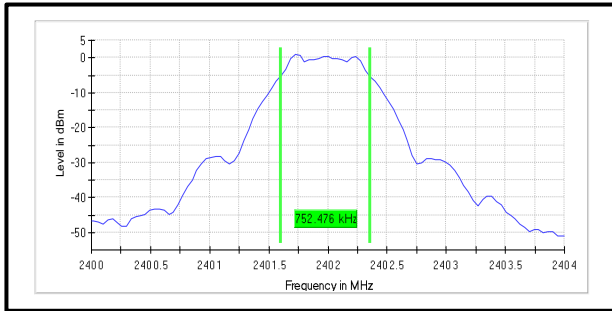
**Test Setup:**



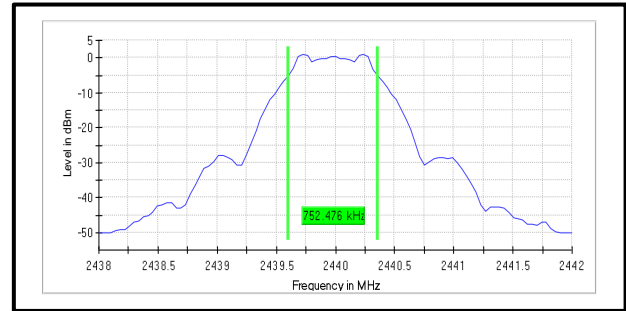


**Results:**

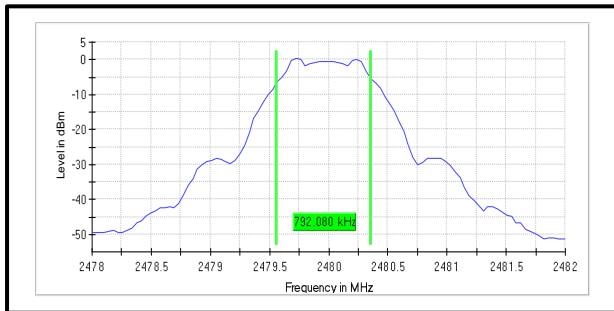
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	752.47	≥500	252.47	Complied
Middle	752.47	≥500	252.47	Complied
Top	792.08	≥500	292.08	Complied



**Bottom Channel**



**Middle Channel**



**Top Channel**

**Result: Pass**

**System Measurement Settings:**

Setting	Instrument Value	Target Value
Span	4.000 MHz	4.000 MHz
RBW	100.000 kHz	~ 100.000 kHz
VBW	300.000 kHz	~ 300.000 kHz
SweepPoints	101	~ 40
Sweeptime	18.938 μs	AUTO
Reference Level	0.000 dBm	0.000 dBm
Attenuation	20.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
Sweeptype	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	12 / max. 150	max. 150
Stable	5 / 5	5
Max Stable Difference	0.13 dB	0.50 dB

### **5.2.3. Transmitter Maximum Peak Output Power**

#### **Test Summary:**

<b>Test Engineer:</b>	Segun Adeniji	<b>Test Date:</b>	15 November 2018
<b>Test Sample Serial Number:</b>	ADBT420xxx00xx		
<b>Test Site Identification</b>	SR 9		

<b>FCC Reference:</b>	Part 15.247(b)(3)
<b>Test Method Used:</b>	FCC KDB 558074 Section 8.3.1 referring ANSI C63.10 Section 11.9.1.1

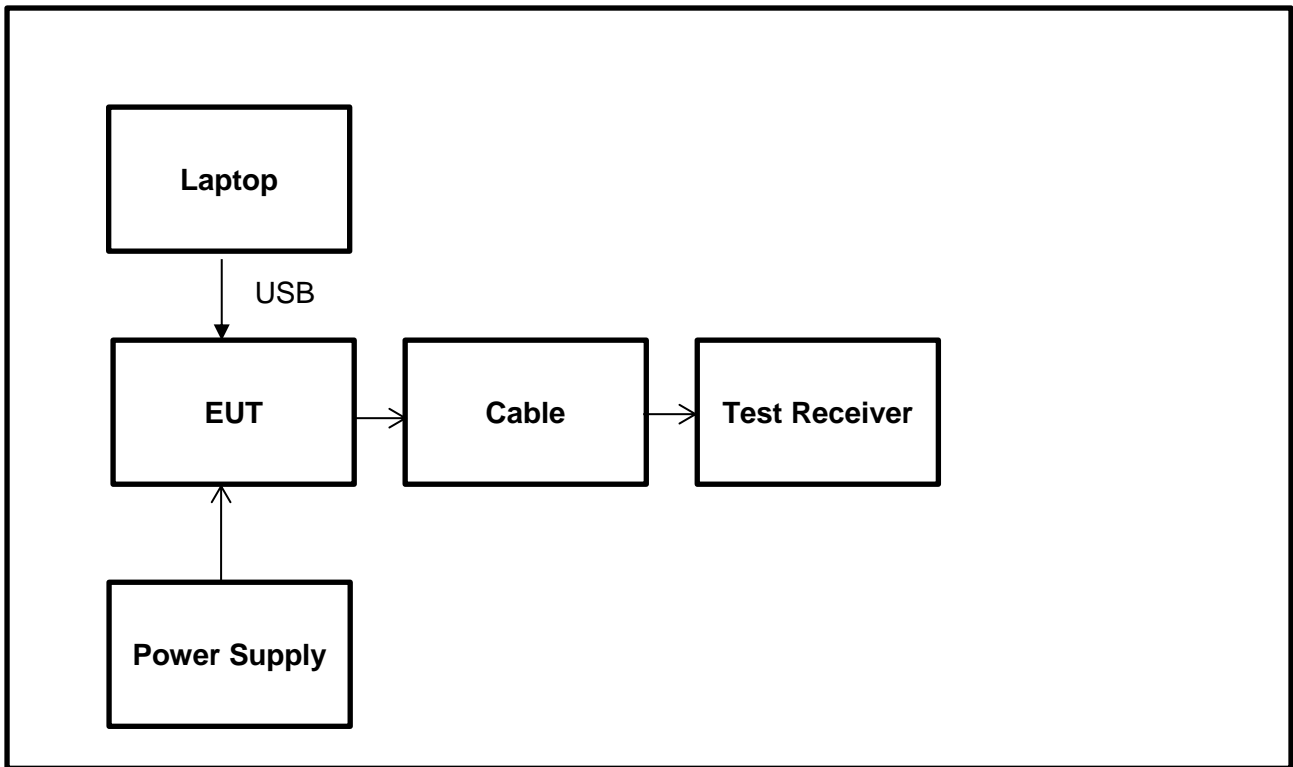
#### **Environmental Conditions:**

<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	33

#### **Note(s):**

1. Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 8.3.1 with the RBW  $\geq$  *DTS bandwidth* referring ANSI C63.10 Section 11.9.1.1.
2. The signal analyser resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 3 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.
3. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.
4. The EUT was transmitting with 100% duty cycle therefore no duty cycle correction was required.
5. The declared antenna gain was added to conducted power to obtain the EIRP.

**Test Setup:**

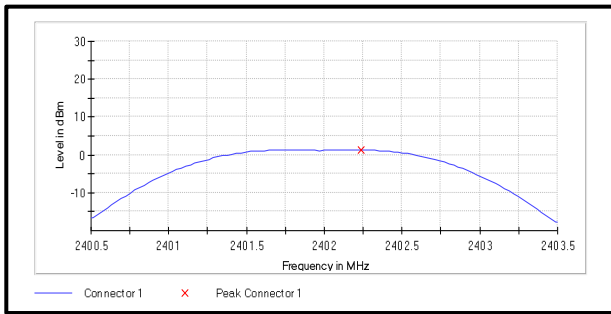


**Results:**

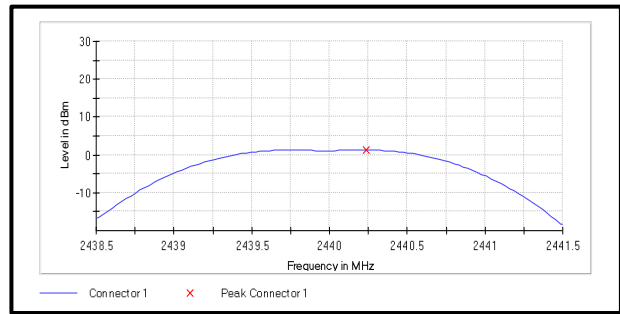
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	1.3	30.0	28.7	Complied
Middle	1.3	30.0	28.7	Complied
Top	0.9	30.0	29.1	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	1.3	-2.1	-0.8	36.0	36.8	Complied
Middle	1.3	-2.1	-0.8	36.0	36.8	Complied
Top	0.9	-2.1	-1.2	36.0	37.2	Complied

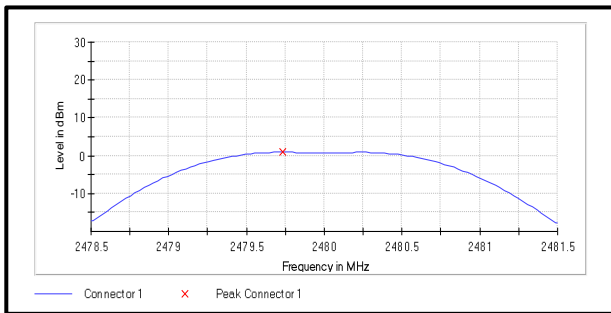
**Transmitter Maximum Peak Output Power (continued)**



**Bottom Channel**



**Middle Channel**



**Top Channel**

**Result: Pass**

**Measurement**

Setting	Instrument Value	Target Value
Start Frequency	2.47850 GHz	2.47850 GHz
Stop Frequency	2.48150 GHz	2.48150 GHz
Span	3.000 MHz	3.000 MHz
RBW	1.000 MHz	>= 792.081 kHz
VBW	3.000 MHz	>= 3.000 MHz
SweepPoints	101	~ 101
SweepTime	1.907 µs	AUTO
Reference Level	10.000 dBm	10.000 dBm
Attenuation	30.000 dB	AUTO
Detector	MaxPeak	MaxPeak
SweepCount	100	100
Filter	3 dB	3 dB
Trace Mode	Max Hold	Max Hold
SweepType	FFT	AUTO
Preamp	off	off
Stablemode	Trace	Trace
Stablevalue	0.50 dB	0.50 dB
Run	-1 / max. 150	max. 150
Stable	-1 / 3	3
Max Stable Difference	-1.00 dB	0.50 dB

**5.2.4. Transmitter Radiated Emissions**

**Test Summary:**

<b>Test Engineer:</b>	Segun Adeniji	<b>Test Date:</b>	10 December 2018
<b>Test Sample Serial Number:</b>	ADBT420xxx10xx		
<b>Test Site Identification</b>	SR 1/2		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	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
<b>Frequency Range</b>	30 MHz to 1000 MHz

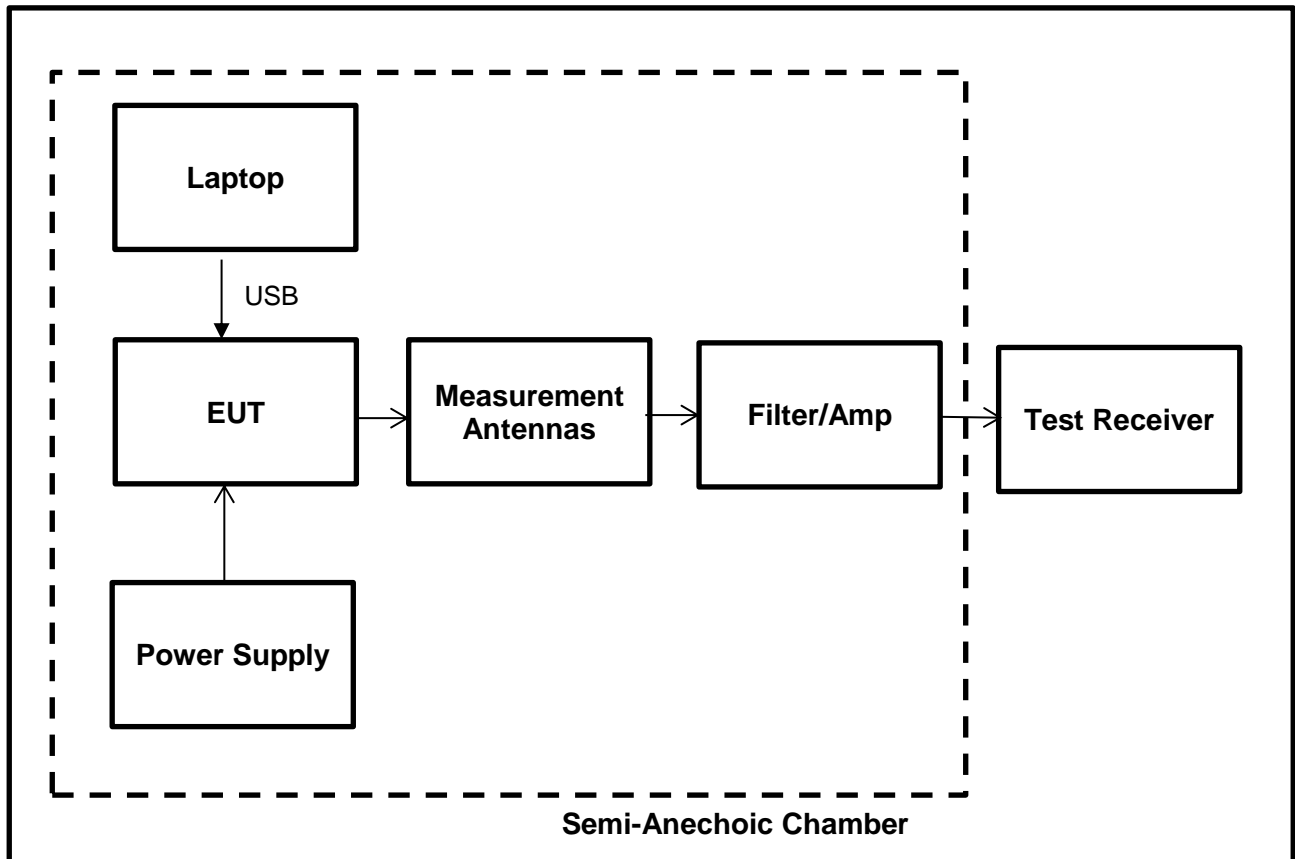
**Environmental Conditions:**

<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	31

**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. Measurements below 1 GHz were performed in a semi-anechoic chamber 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.
4. 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.
5. Since no critical spurious was found even with peak detector measurement, hence no Quasi-peak detector remeasurement was required.

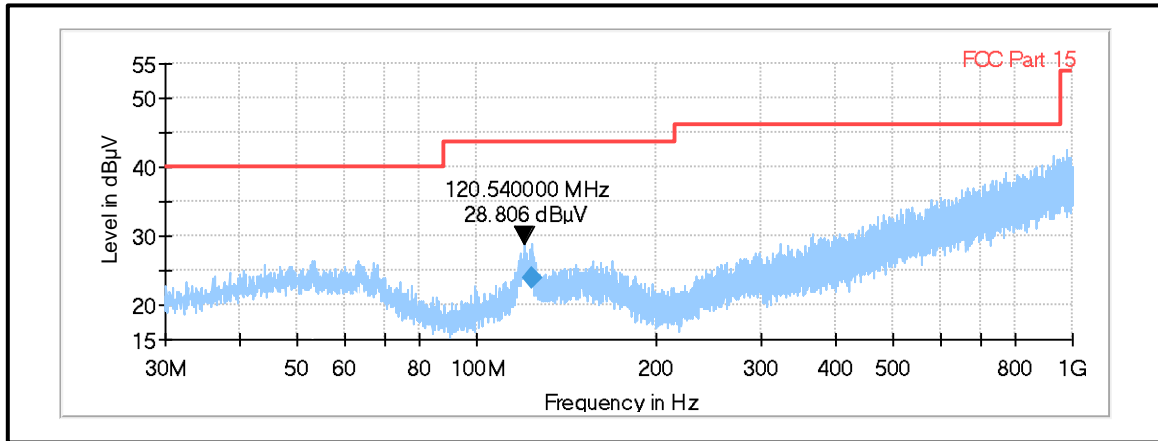
**Test Setup:**



**Results: Middle Channel**

Frequency (MHz)	Antenna Polarization	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
120.54	Vertical	28.81	43.50	14.69	Complied

**Plot: 30 MHz – 1GHz**



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

**Result: Pass**



**Test Summary:**

<b>Test Engineer:</b>	Segun Adeniji	<b>Test Date:</b>	15 November 2018 and 10 December 2018
<b>Test Sample Serial Number:</b>	ADBT420xxx10xx		
<b>Test Site Identification</b>	SR 1/2		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	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
<b>Frequency Range</b>	1 GHz to 25 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	41

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All the spurious emissions detected were re-investigated and re-measured with an average detector and in this case the emission was compared to the peak limit. 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. 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. Only the middle channel plot was included in the report as similar result was obtained on both bottom and top channels.
3. The emission shown around the 2.4 GHz is the EUT fundamental.
4. Measurements above 1 GHz were performed in a semi-anechoic chamber 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.
5. 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.
6. \*In accordance with ANSI C63.10:2013 Section 6.6.4.3, Note 1, if the peak measured value complies with the average limit, it is not necessary to perform an average measurement.
7. The reference level for the emission in the non-restricted band was established by following KDB 558074 Section 8.5 referring Section 11.11 of ANSI C63.10.

**Results: Peak Detector / Bottom Channel**

Frequency (MHz)	Antenna Polarization	Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Margin (dB)	Result
4804.33	Horizontal	57.17	74.0	16.83	Complied
7205.33	Vertical	61.34	74.0	12.66	Complied

**Results: Average Method / Bottom Channel**

Frequency (MHz)	Antenna Polarization	Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4804.0	Horizontal	53.08	54.0	0.92	Complied
7205.5	Vertical	53.39	54.0	0.61	Complied

**Results: Peak Detector / Middle Channel\***

Frequency (MHz)	Antenna Polarization	Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4880.0	Horizontal	52.95	54.0	1.05	Complied

**Results: Peak Detector / Top Channel**

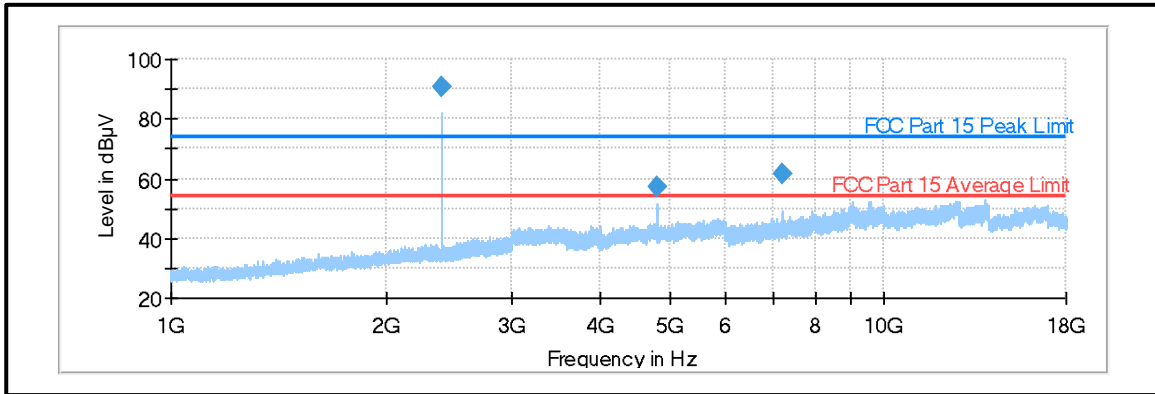
Frequency (MHz)	Antenna Polarization	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
5228.7	Horizontal	53.62	54.0*	0.38	Complied
7439.3	Vertical	60.35	74.0	13.65	Complied

**Results: Average Method / Top Channel**

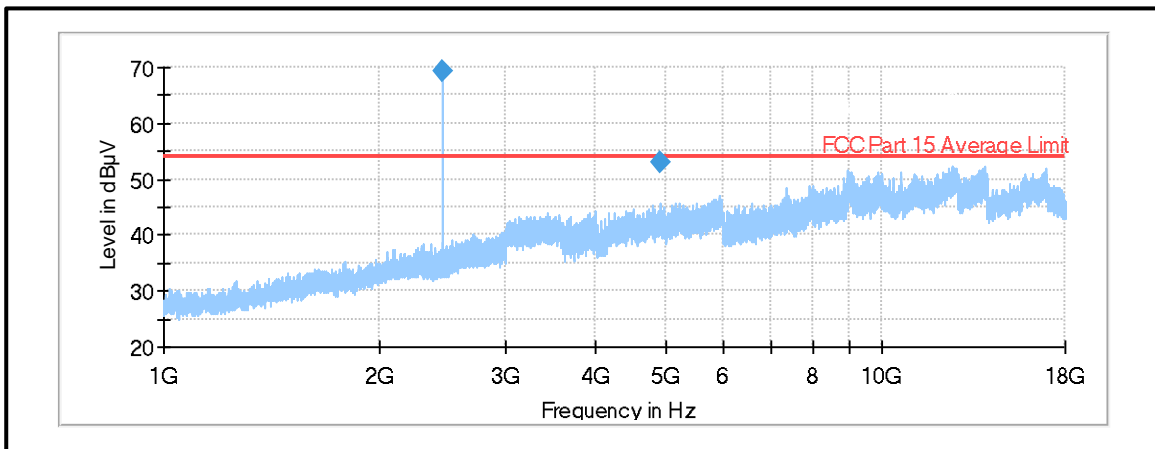
Frequency (MHz)	Antenna Polarization	Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
7439.5	Vertical	52.93	54.0	1.07	Complied

Result: **Pass**

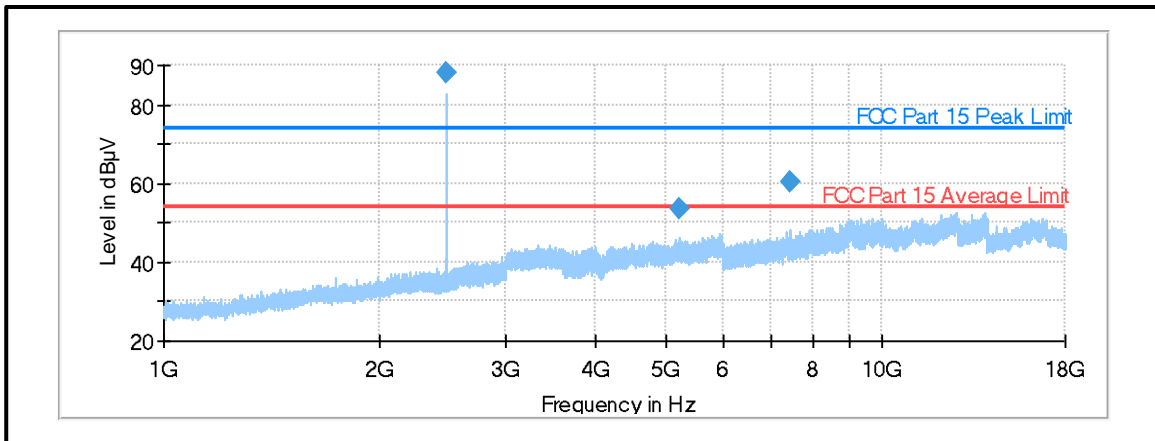
**Plot: 1 GHz – 18GHz (Bottom channel) with Peak detector**



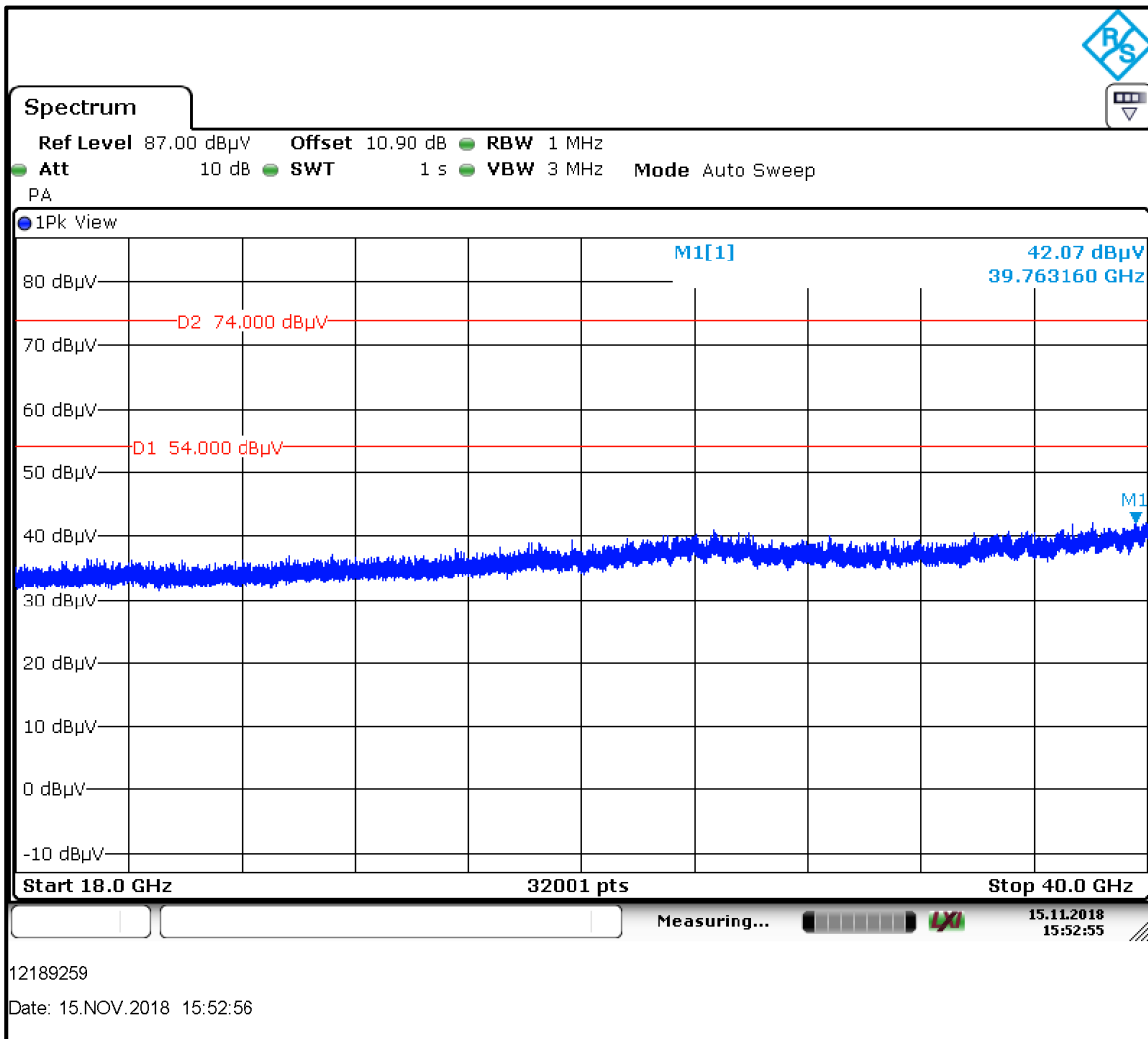
**Plot: 1 GHz – 18GHz (Middle channel) with Peak detector**



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



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



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

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

<b>Test Engineer:</b>	Segun Adeniji	<b>Test Date:</b>	10 December 2018
<b>Test Sample Serial Number:</b>	ADBT420xxx10xx		
<b>Test Site Identification</b>	SR 1/2		

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

**Environmental Conditions:**

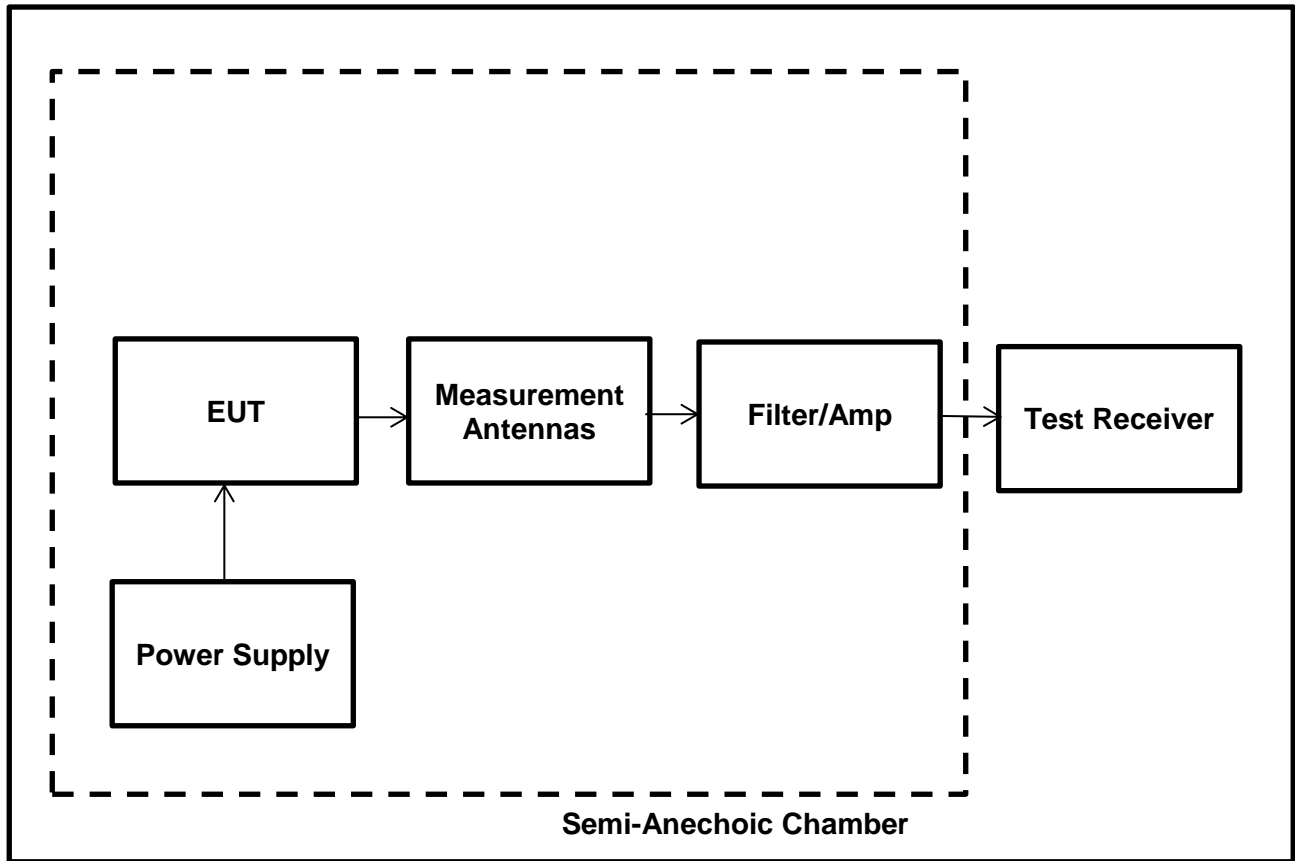
<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	37

**Note(s):**

- As the lower band edges fall within non-restricted bands, only peak measurements are required. In accordance with ANSI C63.10:2013 Section 11.11.1. The test method in Section 11.11.3 was followed. 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. As the maximum peak conducted output power was measured using a peak detector, a marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
- 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 3 MHz. An average 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.
- 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.

\*Emissions in restricted bands: In accordance with ANSI C63.10:2013 Section 6.6.4.3, Note 1, where the peak detected amplitude was shown to comply with the average limit, an average measurement was not performed.

**Test Setup:**



**Results: Lower Band Edge/Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.00	51.54	89.54	38.0	Complied

**Results: Upper Band Edge / Restricted Band / Peak**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.50	54.60	74.0	19.40	Complied

**Results: Upper Band Edge / Restricted Band / Average**

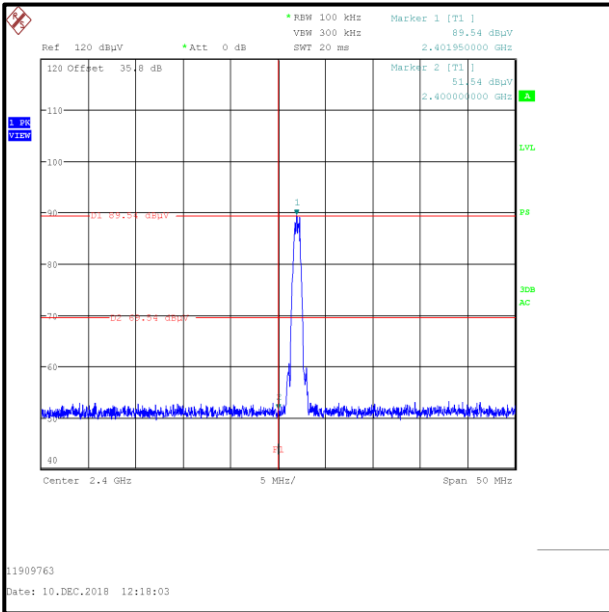
Frequency (MHz)	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.50	47.54	54.0	6.46	Complied

**Results: 2310 to 2390 MHz Restricted Band / Peak**

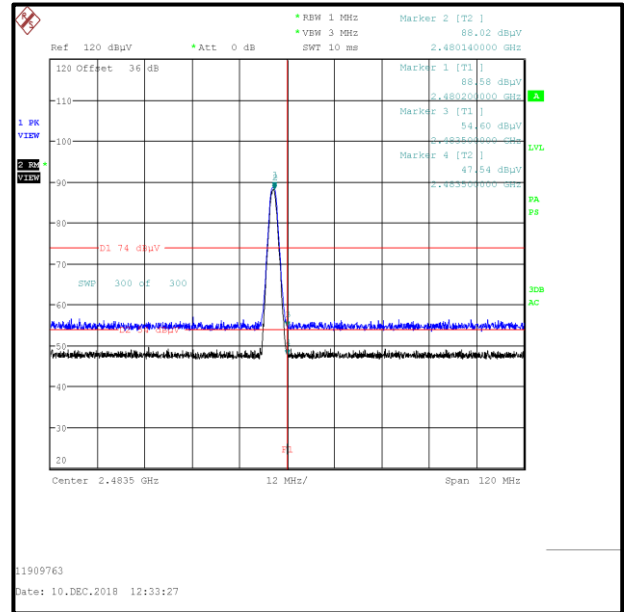
Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2388.07	56.71	74.0	17.29	Complied

**Results: 2310 to 2390 MHz Restricted Band / Average**

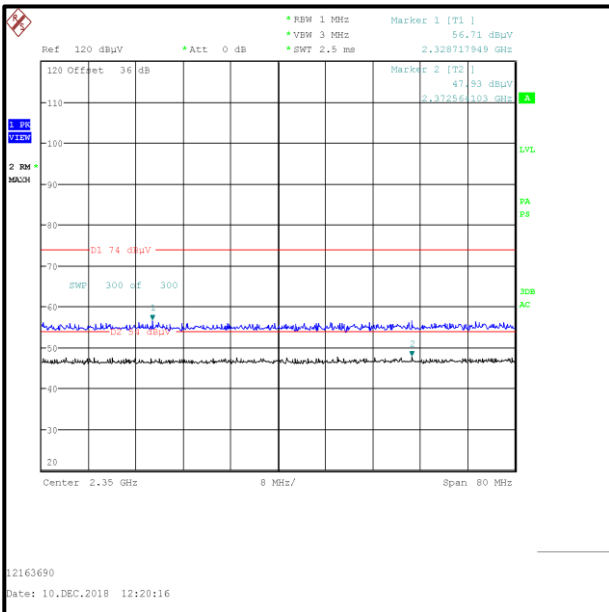
Frequency (MHz)	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2389.35	47.93	54.0	6.09	Complied



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”.

<b>Measurement Type</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
AC Conducted Spurious Emissions	95%	±2.49 dB
Radiated Maximum Peak Output Power	95%	±3.10 dB
Radiated Spurious Emissions	95%	±3.10 dB
Band Edge Radiated Emissions	95%	±3.10 dB
Minimum 6 dB Bandwidth	95%	±0.87 %
Spectral Power Density	95%	±0.59 dB

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
103	EMCO	Antenna, Horn	3115	9008/3485	7/20/2016	36
104	EMCO	Antenna, Horn	3115	9008/3486	7/20/2016	36
156	Rohde & Schwarz	V-Network	ESH3-Z6	843864/004	7/11/2018	12
350	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/014	7/12/2018	12
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
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	36
425	Agilent	Generator, CW Signal	E8247C	MY43320849	7/10/2018	24
426	Agilent	Spectrum Analyzer	E4446A	US44020316	7/11/2018	24
460	Deisl	Turntable	DT 4250 S		n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	8/8/2016	36
474	Agilent	Analyzer, ENA Network	E5071C	MY46100912	7/13/2018	24
495	Rohde & Schwarz	Antenna, Log.- Periodical	HL050	100296	7/20/2016	36
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	7/20/2016	36
497	Schwarzbeck	Antenna, Biconical	VHBB 9124	423	7/7/2016	36
499	Schwarzbeck	Antenna, log.-per	VUSLP 9111	317	8/2/2016	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 broadband horn antenna	BBHA 9170	9170-561	7/28/2016	36
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	4/8/2014	60
614	Wainwright Instruments	Highpass Filter 3GHz	WHKX10-	1	Lab verification	n/a
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
624	Wainwright	6 GHz high-pass filter	WHKX10-5850-6500-18000-40SS	5	Lab verification	n/a
628	Maturo	Antenna mast	CAM 4.0-P	224/19590716	n/a	n/a
629	Maturo	Kipheinrichtung	KE 2.5-R-M	MAT002	n/a	n/a

**Test site: SR 9**

ID	Manufacturer	Type	Model	Serial No.	Calibration Date	Cal. Cycle
472	Rohde & Schwarz	Generator, Vektorsignal	SMU200A	102409	7/11/2018	12
592	Rohde & Schwarz	Wideband Radio Communication tester	CMW 500	119593	8/15/2017	12
622	Rohde & Schwarz	Step Attenuator	RSC	101904	7/12/2018	12
625	Schwarzbeck	Antenna, H-field	HFSL 7101	109	Verification - only relative measurements	n/a
635	Rohde & Schwarz	Signal generator	SMB100A	179875	7/10/2018	12
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
451	Rohde & Schwarz	Power Meter, Dual Channel	NRVD	101190	7/10/2018	12
427	Rohde & Schwarz	Probe, Power Sensor	NRV-Z5	100106	7/12/2018	12
195	SPS	Power Supply	TOE8842-24	51455	Verified by Multimeter	12
216	Agilent	Multimeter	34401A	US36017458	7/11/2017	24
378	ESPEC/ Thermotec	Climatic Chamber	PL-1FT	5100869	8/9/2016	36

**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