



# TEST REPORT

**Test Report No. : UL-RPT-RP-11645399-216FCC**

**Manufacturer** : Casambi Technologies Oy  
**Model No.** : CBM-002B  
**Technology** : *Bluetooth – Low Energy*  
**Test Standard(s)** : FCC Parts 15.207, 15.209(a) & 15.247

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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 1.2– Supersede Version 1.1
5. Result of the tested sample: **PASS**

Prepared by: Abdoufataou Salifou  
Title: Laboratory Engineer  
Date: 17.10.2017

Approved by: Jakob Reschke  
Title: Test Engineer  
Date: 14.11.2017



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D-PL-19381-02-00

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The tests reported herein have been performed in  
accordance with its' terms of accreditation.

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## **1. Customer Information**

<b>Company Name:</b>	Casambi Technologies Oy
<b>Company Address:</b>	Linnoitustie 4, 02600 Espoo, Finland
<b>Contact Person:</b>	Kai Tötterman
<b>Contact E-Mail Address:</b>	kai.totterman@casambi.com
<b>Contact Phone No.:</b>	+358 45 137 9988

## **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>	47CFR15.209
<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>	16 February 2017
<b>EUT arrived:</b>	08 May 2017
<b>Test Dates:</b>	14 August 2017 to 16 October 2017
<b>EUT returned:</b>	-/-

## 2.2. Summary of Test Results

Clause	Measurement	Complied	Did not comply	Not performed	Not applicable
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	Only for Peak to Average calculation			
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(e)	Transmitter Power Spectral Density <sup>Note 1</sup>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" 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"/>
Part 15.207	Transmitter AC Conducted Emissions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Note:

In accordance with FCC KDB 558074 Section 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 v04 April 5, 2017
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247

## 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:	Casambi
Model Name or Number:	CBM-002B
Test Sample Serial Number:	Not marked or stated ( <i>Radiated sample</i> )
Hardware Version Number:	CBM-002B: v1.0
Software Version Number:	20.1
FCC ID:	2ALA3-CBM002B

Brand Name:	Casambi
Model Name or Number:	CBM-002B
Test Sample Serial Number:	Not marked or stated ( <i>Conducted sample with RF port</i> )
Hardware Version Number:	CBM-002B: v1.0
Software Version Number:	20.1
FCC ID:	2ALA3-CBM002B

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

The equipment under test was 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

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	3.0 VDC	
Maximum Conducted Output Power:	2.6 dBm		
Antenna Gain:	2.0 dBi		
Transmit Frequency Range:	2401 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	RF Channel	Channel Frequency (MHz)
	Bottom	0	2401
	Middle	19	2440
	Top	39	2480

### 3.5. Support Equipment

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

Item	Description	Brand Name	Model Name or Number	Serial Number
1	Power Cable (Length: 2 metres)	Not marked or stated	Not marked or stated	Not marked or stated
2	Laboratory Power Supply	Conrad Electronic Germany	PS -2403D	Not marked or stated
3	MP3 player	Apple	iPod Touch	CCQSCOZMGGK6



## **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.

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

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

The EUT was powered via a 3 VDC power supply for both conducted and radiated tests.

Controlled in test mode using a software application Utility installed on the MP3 player supplied by the customer. The application was used to enable a continuous transmission and to select the test channels as required. The customer supplied a document containing the setup instructions "Casambi\_radio\_testing.pdf" dated 01 August 2017.

The EUT conducted sample was used for the measurement of 6 dB bandwidth, power spectral density and maximum peak output power.

The EUT radiated sample was used for the measurement of Transmitter Radiated and Emissions Transmitter Band Edge Radiated Emissions.

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 September 2017
Test Sample Serial Number:	Not marked or stated ( <i>Conducted sample with RF port</i> )		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	FCC KDB 558074 Section 8.1 Option 1

#### Environmental Conditions:

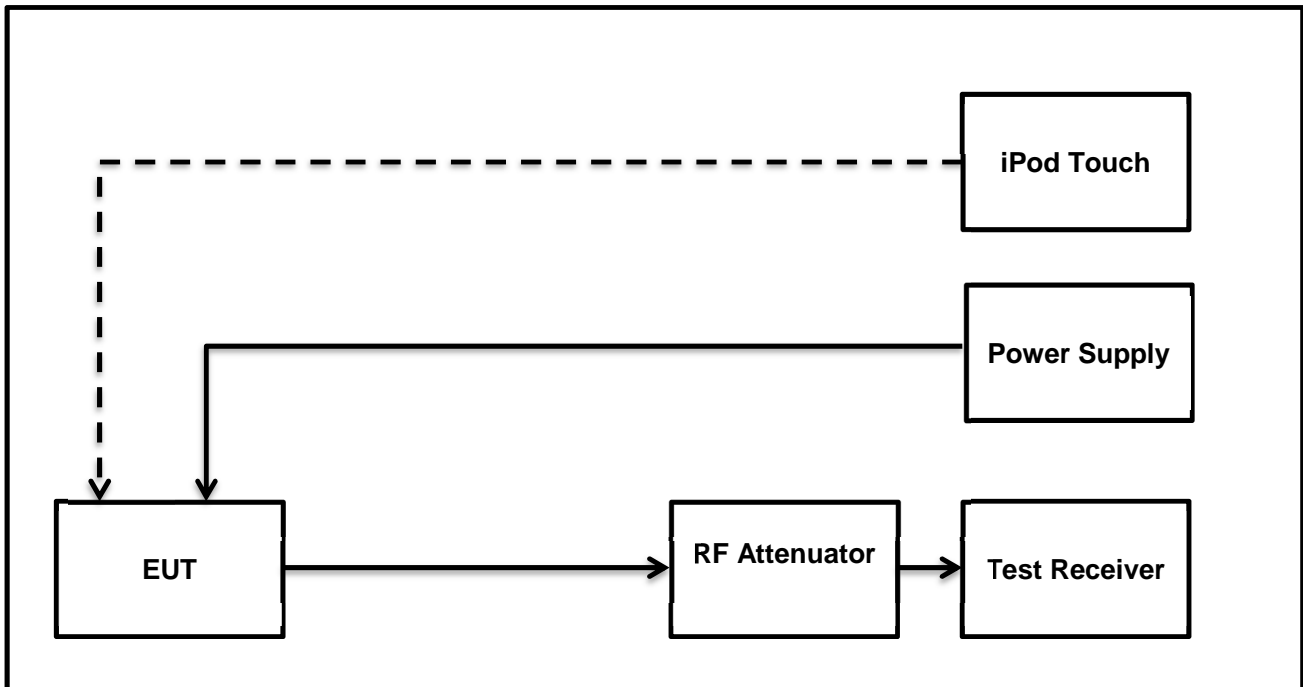
Temperature (°C):	24
Relative Humidity (%):	53

#### Note(s):

6 dB DTS bandwidth tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 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.

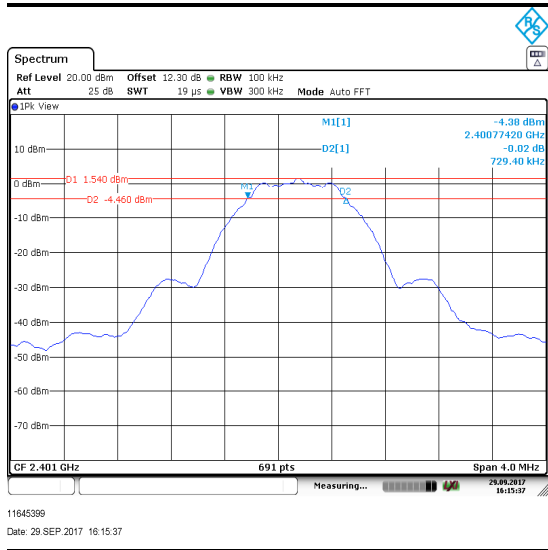
#### Test setup:



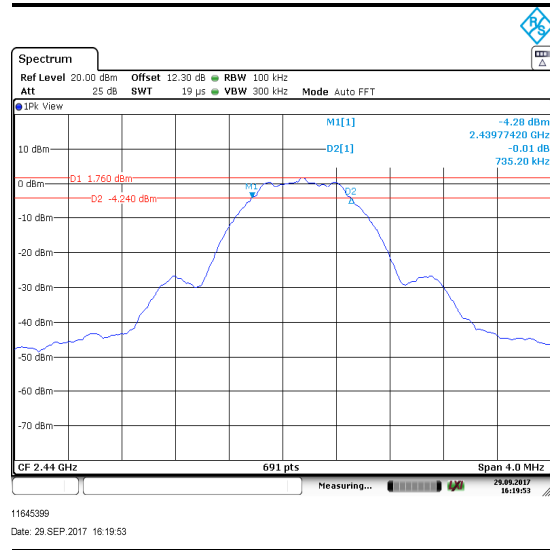
## Transmitter Minimum 6 dB Bandwidth continued

### Results:

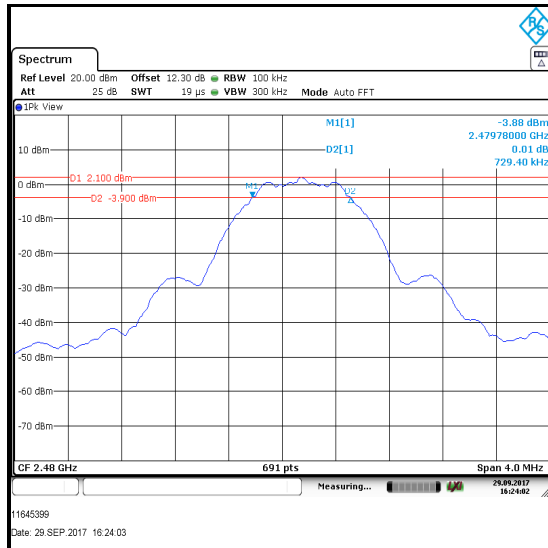
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	729.400	≥500	229.400	Complied
Middle	735.200	≥500	235.200	Complied
Top	729.400	≥500	229.400	Complied



Bottom Channel



Middle Channel



Top Channel

Result: **Pass**

### 5.2.2. Transmitter Duty Cycle

#### Test Summary:

Test Engineer:	Abdoufataou Salifou	Test Date:	29 September 2017
Test Sample Serial Number:	Not marked or stated (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):	24
Relative Humidity (%):	44

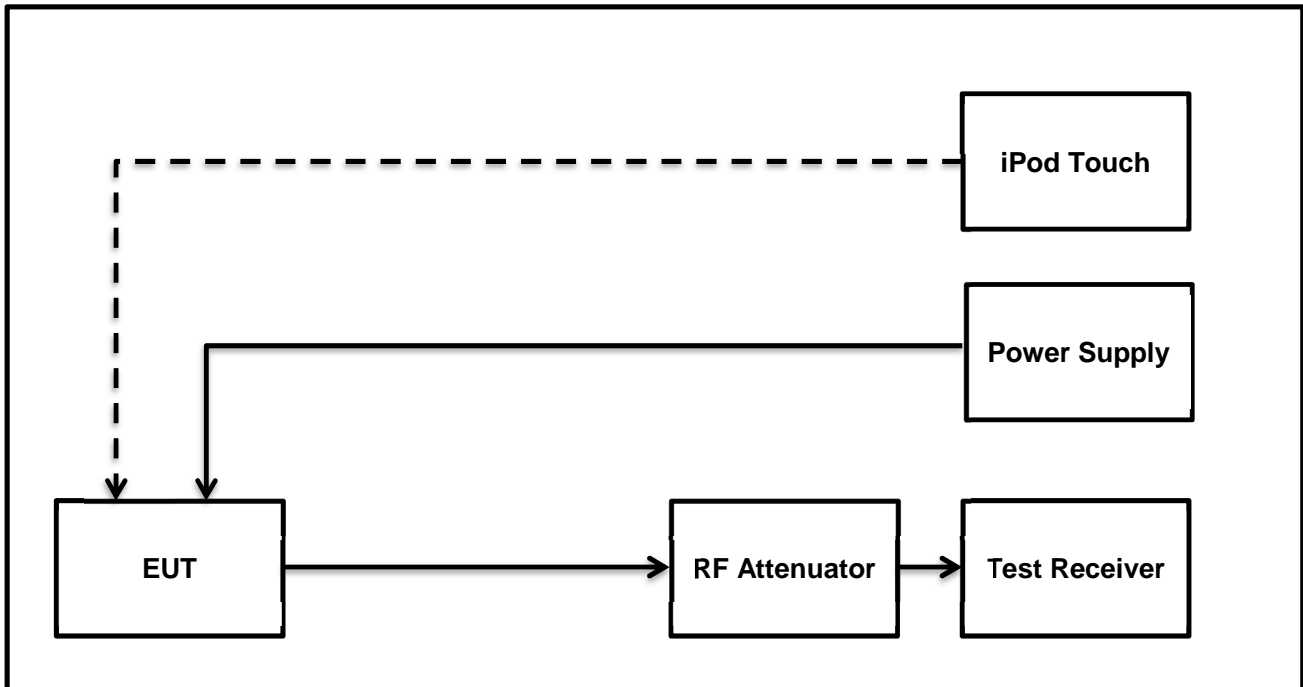
#### Note(s):

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:  $20 \log (1 / (724.6 \mu\text{s} / 15507.000 \mu\text{s})) = 26.4 \text{ dB}$

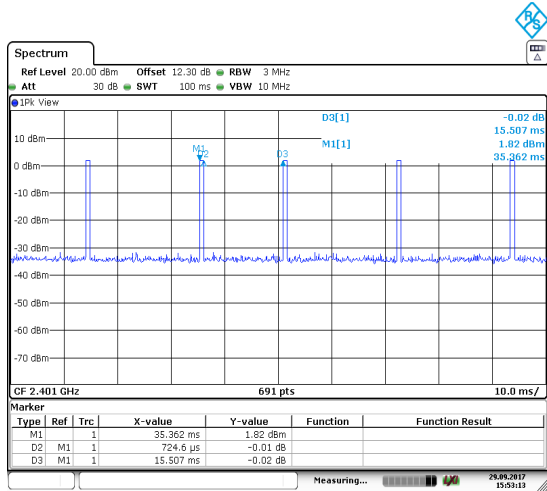
#### Test setup:



## Transmitter Duty Cycle continued

### Results:

Pulse Duration ( $\mu$ s)	Period ( $\mu$ s)	Duty Cycle (dB)
724.6	15507.000	26.4



11645399  
Date: 29 SEP 2017 15:53:13

### 5.2.3. Transmitter Maximum Peak Output Power

#### Test Summary:

Test Engineer:	Abdoufataou Salifou	Test Date:	13 October 2017
Test Sample Serial Number:	Not marked or stated ( <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 9.1.1 and Notes below

#### Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	44

#### Note(s):

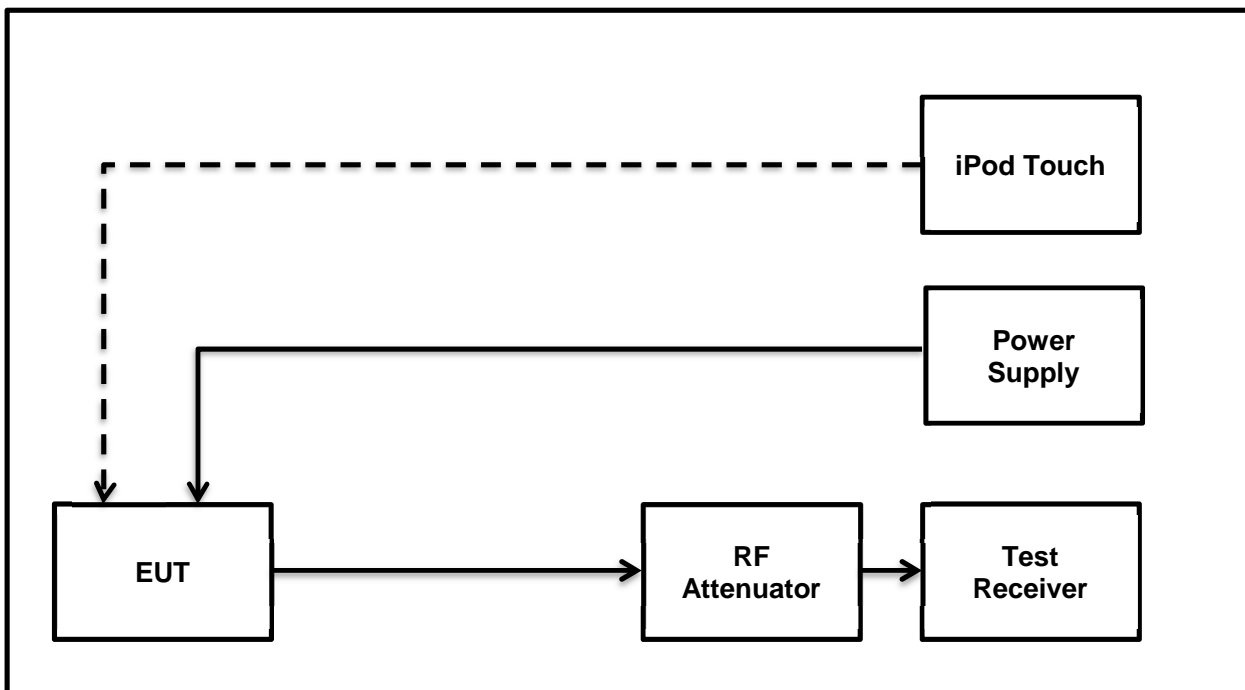
Conducted power tests were performed using a spectrum analyser in accordance with FCC KDB 558074 Section 9.1.1 with the RBW > *DTS bandwidth* procedure.

The signal analyser resolution bandwidth was set to 2 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 8 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.

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.

The conducted power was added to the declared antenna gain to obtain the EIRP.

#### Test setup:



**Transmitter Maximum Peak Output Power continued**

**Results:**

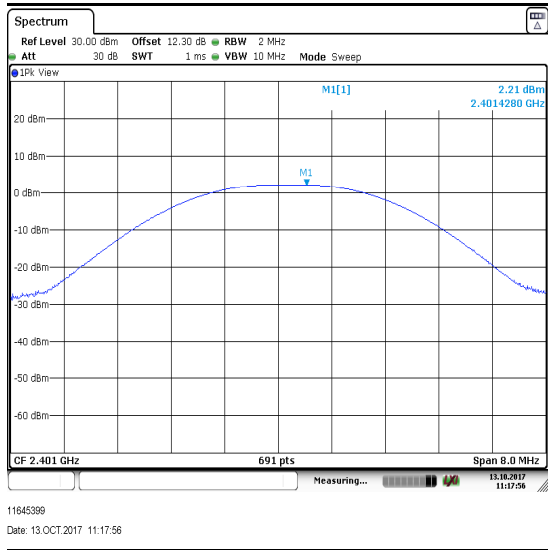
Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	2.2	30.0	27.8	Complied
Middle	2.3	30.0	27.7	Complied
Top	2.6	30.0	27.4	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	2.2	2.0	4.2	36.0	31.8	Complied
Middle	2.3	2.0	4.3	36.0	31.7	Complied
Top	2.6	2.0	4.6	36.0	31.4	Complied

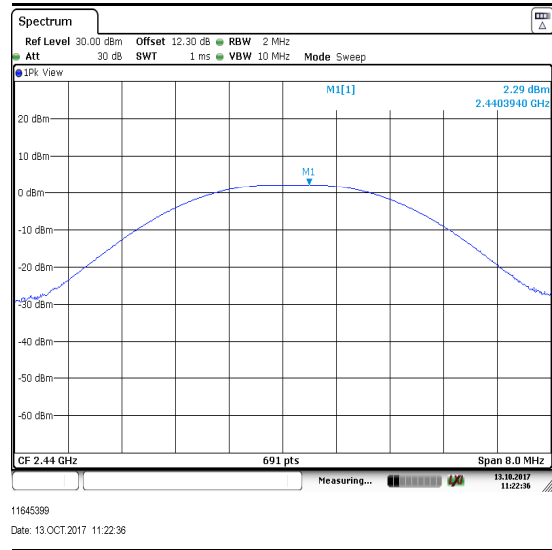
**Result: Pass**



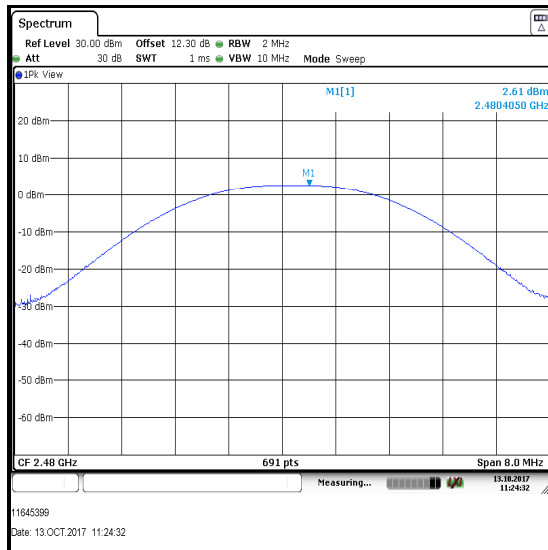
## Transmitter Maximum Peak Output Power continued



Bottom Channel



Middle Channel



Top Channel

#### **5.2.4. Transmitter AC Conducted Spurious Emissions**

##### **Test Summary:**

<b>Test Engineer:</b>	Asim Shahzad	<b>Test Date:</b>	16.10.2017
<b>Test Sample Serial Number:</b>	Not marked or stated		
<b>Test Site Identification</b>	SR 7/8		

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

##### **Environmental Conditions:**

<b>Temperature (°C):</b>	22
<b>Relative Humidity (%):</b>	35

##### **Settings of the Instrument**

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

The EUT including its 3VDC power supply was connected to a 120 VAC 60 Hz single phase supply via LISN.

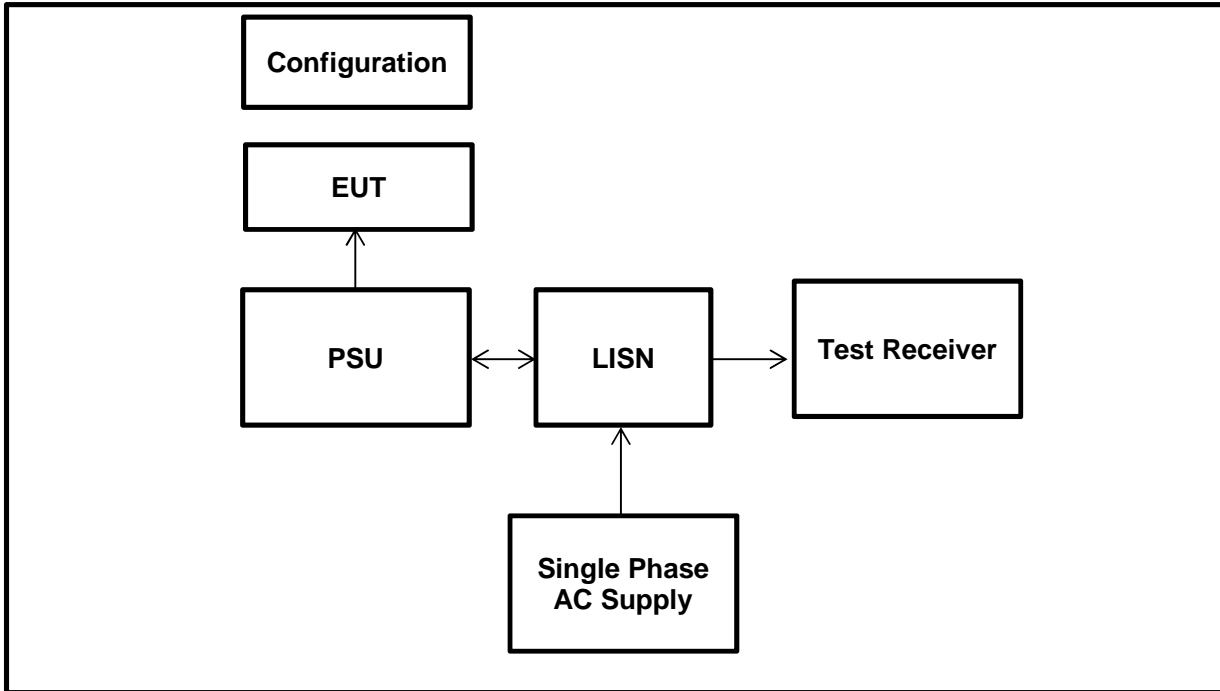
The final measured value, for the given emission, in the table below incorporates the cable loss.

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.

Measurements were performed in a 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**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.44269	L	33.9	57	23.1	Pass
0.8932	L	36.7	56	19.3	Pass
1.33529	L	40.8	56	15.2	Pass
3.1078	L	43.2	56	12.8	Pass
5.33228	L	43.9	60	16.1	Pass
7.07042	L	47	60	13	Pass

**Results: Live / Average**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.44269	L	17.1	47	29.9	Pass
0.8932	L	16.6	46	29.4	Pass
1.33529	L	23.2	46	22.8	Pass
3.1078	L	23.9	46	22.1	Pass
5.33228	L	28.8	50	21.2	Pass
7.07042	L	30.1	50	19.9	Pass

**Result: Pass**

**Results: Neutral / Quasi Peak**

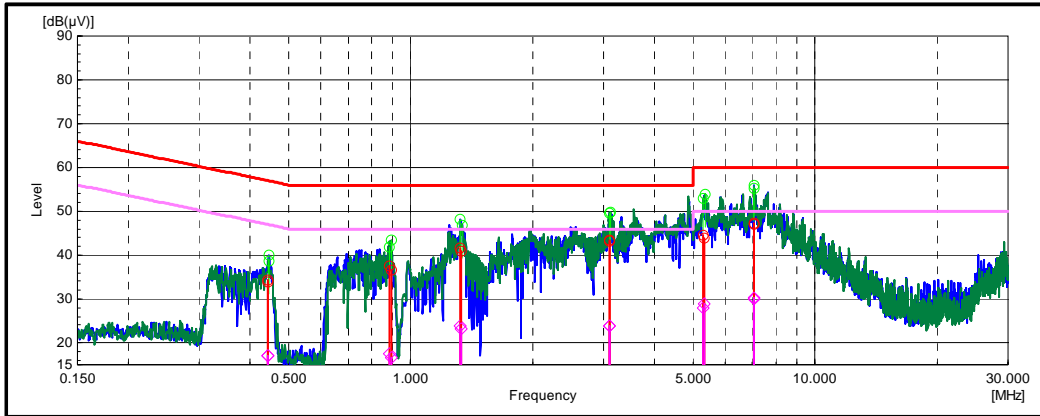
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.44409	N	34.3	57	22.7	Pass
0.88756	N	37.5	56	18.5	Pass
1.32313	N	41.6	56	14.4	Pass
3.10258	N	43.4	56	12.6	Pass
5.2937	N	44.5	60	15.5	Pass
7.06292	N	47.2	60	12.8	Pass

**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.44409	N	17.1	47	29.9	Pass
0.88756	N	17.4	46	28.6	Pass
1.32313	N	23.9	46	22.1	Pass
3.10258	N	23.8	46	22.2	Pass
5.2937	N	27.9	50	22.1	Pass
7.06292	N	30.1	50	19.9	Pass

**Result: Pass**

### **Transmitter Mode Conducted Spurious Emissions (continued)**



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

### **5.2.5. Transmitter Radiated Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Abdoufataou Salifou	<b>Test Date:</b>	14 August 2017 and 13 October
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Radiated sample</i> )		
<b>Test Site Identification</b>	SR 1/2		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range</b>	30 MHz to 1000 MHz

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	38

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

The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

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.

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.

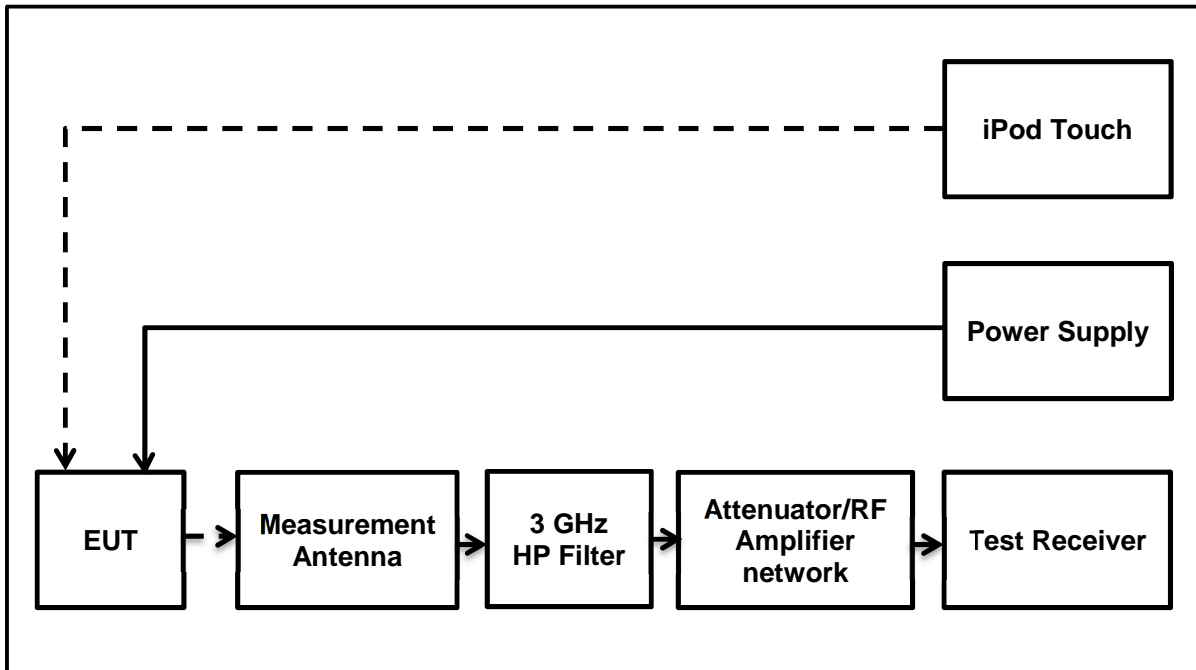
Measurements below 1 GHz were performed in a semi-anechoic chamber at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.

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.

**Transmitter Radiated Emissions (continued)**

**Test setup for radiated measurements:**

**Semi-anechoic chamber**

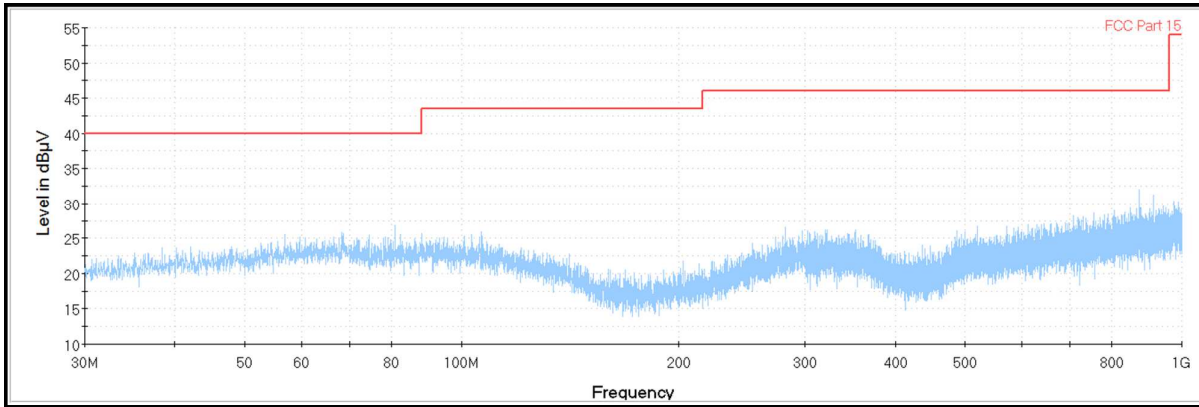




## Transmitter Radiated Emissions (continued)

### Results: Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
939.833	Horizontal	30.2	46.0	15.8	Complied



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>	Abdoufataou Salifou	<b>Test Date:</b>	14 August 2017 and 13 October 2017
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Radiated sample</i> )		
<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 11 & 12 referencing ANSI C63.10 Sections 6.3 and 6.6
<b>Frequency Range</b>	1 GHz to 25 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	38

**Note(s):**

The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental.

Pre-scans above 1 GHz were performed in a semi anechoic chamber with absorber on the floor 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. 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.

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.

**Transmitter Radiated Emissions (continued)**

**Results:**

**Results: Peak / Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2273.133	Vertical	52.2	80.8	28.6	Complied

**Results: Average / Bottom Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2273.133	Vertical	25.8	54.0	28.2	Complied

**Results: Peak / Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4880.666	Vertical	53.6	88.4	34.8	Complied

**Results: Average / Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4880.666	Vertical	27.2	54.0	26.8	Complied

**Results: Peak / Top Channel**

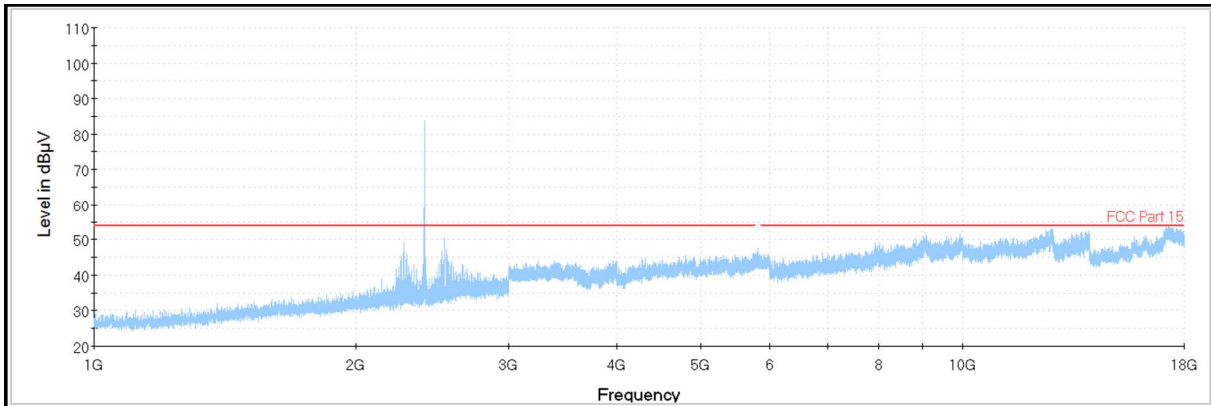
Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
12653.291	Vertical	53.4	80.7	27.3	Complied

**Results: Average / Top Channel**

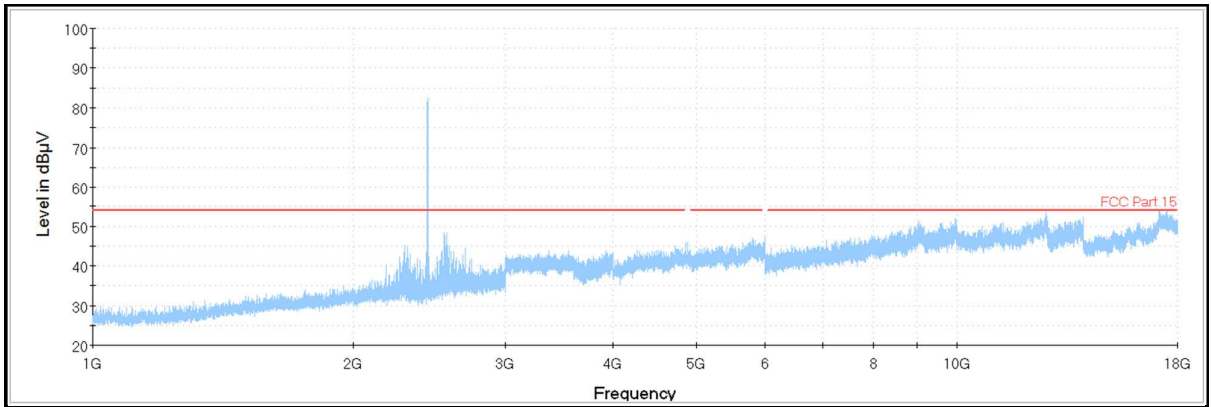
Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
4881.000	Vertical	27.0	54.0	27.0	Complied

**Result: Pass**

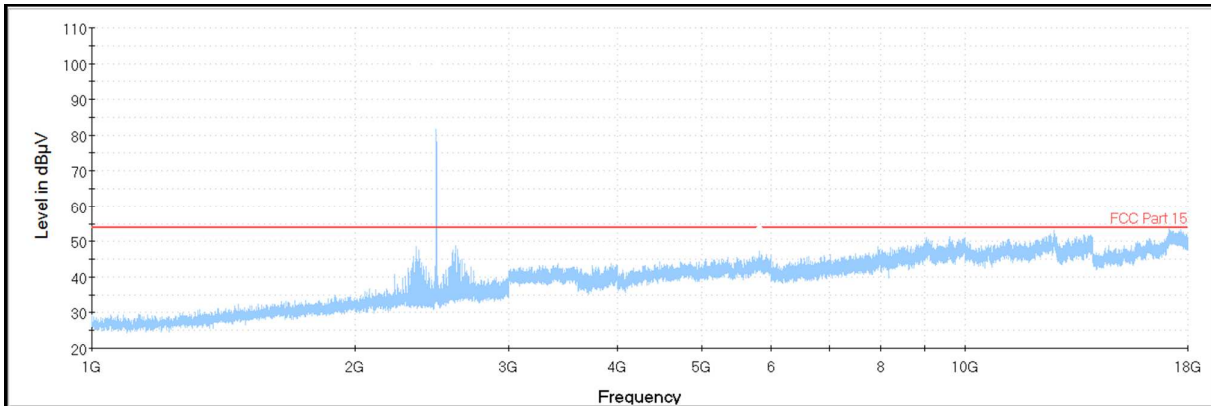
## Transmitter Radiated Emissions (continued)



**Bottom channel**



**Middle channel**

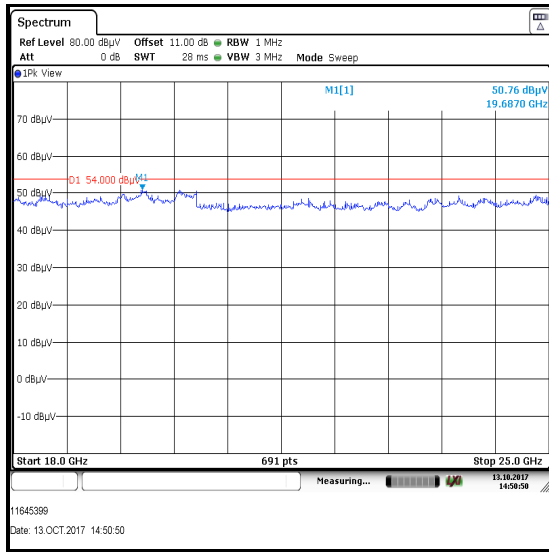


**Top channel**

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

**Result: Pass**

## Transmitter Radiated Emissions (continued)



### From 18 GHz to 25 GHz

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

**Result: Pass**

### **5.2.6. Transmitter Band Edge Radiated Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Abdoufataou Salifou	<b>Test Date:</b>	14 August 2017 and 13 October 2017
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Radiated sample</i> )		
<b>Test Site Identification</b>	SR 1/2		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	KDB 558074 Section 11 & 12

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	40

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

The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

The maximum peak conducted output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.

As the lower band edge is adjacent to a non-restricted band, only peak measurements are required. In accordance with FCC KDB 558074 Section 11.1, the test method in Section 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 conducted (average) output power was measured using an RMS detector in accordance with FCC KDB 558074 Section 9.2.2.4 an out-of-band limit line was placed 20 dB (FCC KDB 558074 Section 11.1(b)) below the peak level. 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 is adjacent to 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 RMS detector was used, sweep time was set to auto and trace mode was trace averaging over 300 sweeps. 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.

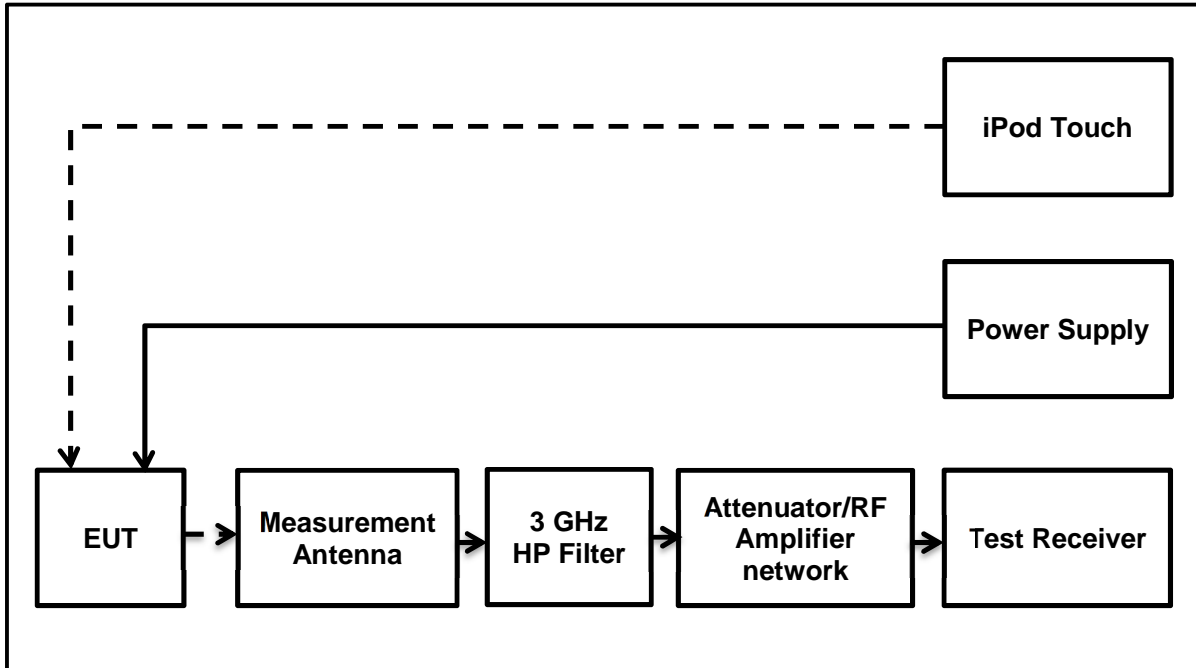
There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.

The reference level was set to 118 dBµV in order to achieve sufficient headroom.

**Transmitter Band Edge Radiated Emissions continued**

**Test setup for Band Edge Radiated Emissions Measurement**

**Semi-anechoic chamber**



**Results: Peak**

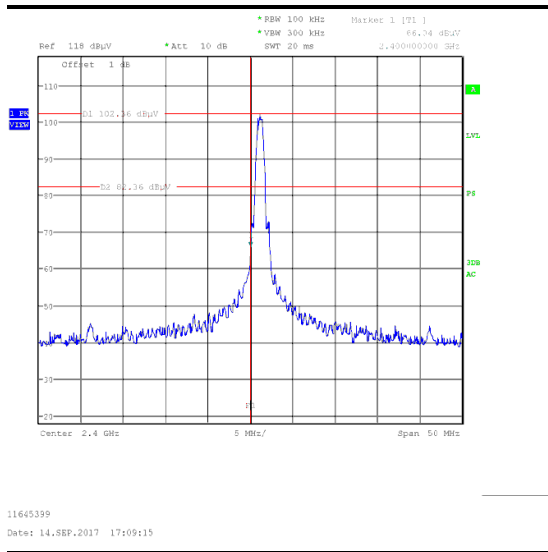
Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.0	66.0	82.4	16.4	Complied
2483.5	66.1	74.0	7.9	Complied

**Results: Average**

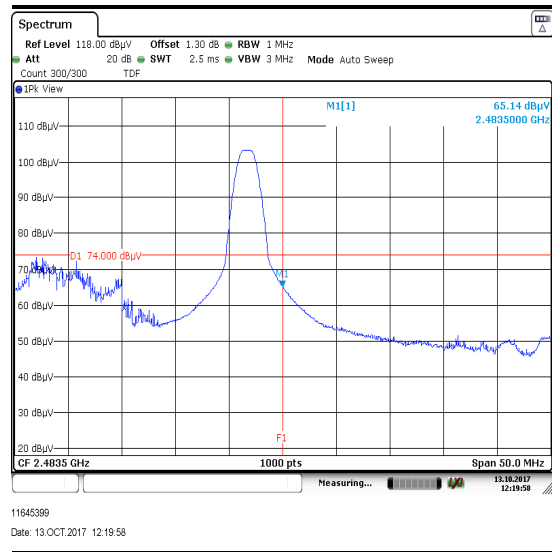
Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	34.3	54.0	19.7	Complied



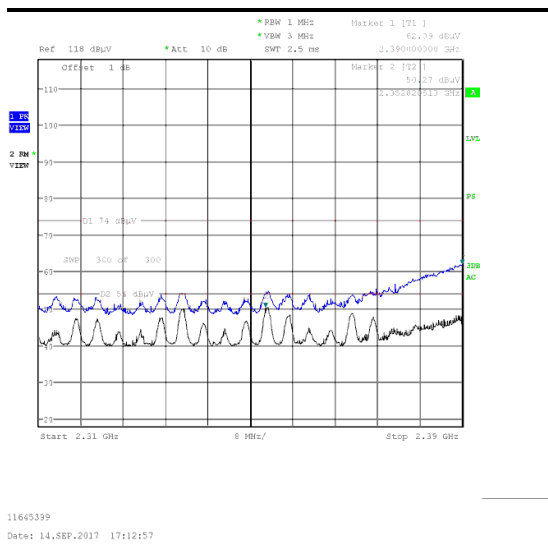
## Transmitter Band Edge Radiated Emissions continued



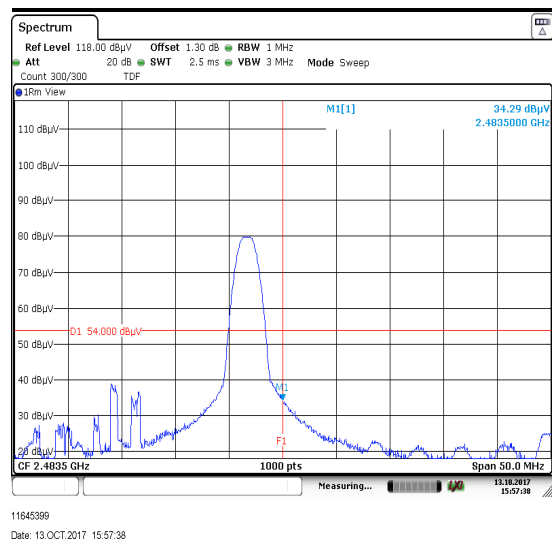
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Average Measurement

## **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	Range	Confidence Level (%)	Calculated Uncertainty
Radiated Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±2.53 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±0.89 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±2.53 dB
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Radiated Spurious Emissions	1 GHz to 26.5 GHz	95%	±2.53 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
350	Rohde & Schwarz	Receiver, EMI Test	ESIB7	836697/014	7/13/2017	12
377	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 0118-1A	025294B	7/11/2017	12
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	055929	7/12/2017	12
460	Deisl	Turntable	DT 4250 S		n/a	n/a
465	Schwarzbeck	Antenna, Trilog Broadband	VULB 9168	9168-240	8/8/2016	36
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	7/20/2016	24
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	7/12/2017	12
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
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
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	24
634	Rohde & Schwarz	Wireless Devices Test System	TS8997		7/11/2017	12
636	Rohde & Schwarz	switching unit	OSP120	101698	7/14/2017	12
637	Rohde & Schwarz	Spectrum Analyzer	FSV40	101587	7/11/2017	12
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	7/12/2017	12
215	Rohde & Schwarz	Artificial Mains Network	9 kHz - 30 MHz; 3 phase	879675/002	7/12/2017	12
350	Rohde & Schwarz	Receiver, EMI Test	20 Hz - 7 GHz	836697/014	7/13/2017	12
616	Rohde & Schwarz	ISN	8 wire ISN for CAT6	101656	7/13/2017	12

## **8. Report Revision History**

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version
1.1	8, 16	3.4, 5.2.3	Corrected antenna gain Re-calculated EIRP
1.2	18, 23,24, 31	5.2.4, 5.2.5, 5.2.6	Setup diagram, test dates and equipment list was updated

--- END OF REPORT ---