




# TEST REPORT

**Test Report No. : UL-RPT-RP-11829235-1516-FCC**

**Applicant** : Visteon Electronics Germany GmbH  
**Model No.** : MFA2  
**FCC ID** : 2AA98-DBMFA2C5  
**Technology** : WLAN (b/g/n)  
**Test Standard(s)** : FCC Parts 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 1.6 – Supersede Version 1.5
5. Result of the tested sample: **PASS**

  
Prepared by: Segun Adeniji  
Title: Laboratory Engineer  
Date: 23.03.2018

  
Approved by: Jakob, Reschke  
Title: Test Engineer  
Date: 25.05.2018



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The tests reported herein have been performed in  
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**UL INTERNATIONAL GERMANY GMBH**

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## **1. Customer Information**

### **1.1.Applicant Information**

<b>Company Name:</b>	Visteon Electronics Germany GmbH
<b>Company Address:</b>	Visteonstrasse 4-10 50170 Kerpen Germany
<b>Contact Person:</b>	Dr.-Ing. Dennis Prill
<b>Contact E-Mail Address:</b>	<a href="mailto:dprill@visteon.com">dprill@visteon.com</a>
<b>Contact Phone No.:</b>	+49 721 4766 1026

### **1.2.Manufacturer Information**

<b>Company Name:</b>	Visteon Electronics Germany GmbH
<b>Company Address:</b>	Visteonstrasse 4-10 50170 Kerpen Germany
<b>Contact Person:</b>	Dr.-Ing. Dennis Prill
<b>Contact E-Mail Address:</b>	<a href="mailto:dprill@visteon.com">dprill@visteon.com</a>
<b>Contact Phone No.:</b>	+49 721 4766 1026

## **2. Summary of Testing**

### **2.1. General Information**

<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) - 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>	21 June 2017
<b>EUT arrived:</b>	28 September 2017
<b>Test Dates:</b>	28 November 2017 to 22 March 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 type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.35(c)	Transmitter Duty Cycle	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(e)	Transmitter Power Spectral Density	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Part 15.247(b)(3)	Transmitter Maximum (Average) 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):**

Device is an in car/vehicle device. No connection to AC mains. Due to this fact Part 15.207 (AC conducted measurements) is not applicable.

## **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 DTS Meas Guidance v04 April 5, 2017
<b>Title:</b>	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §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)**

<b>Sample Identification</b>	Sample for all other measurements except conducted spurious emission
<b>Brand Name:</b>	Visteon
<b>Model Name or Number:</b>	MFA2
<b>Serial Number:</b>	WAAZ000217
<b>Hardware Version Number:</b>	VPJMKF-10849
<b>Software Version Number:</b>	11.0.11
<b>FCC ID:</b>	2AA98-DBMFA2C5

<b>Sample Identification</b>	Conducted Spurious emission sample
<b>Brand Name:</b>	Visteon
<b>Model Name or Number:</b>	MFA2
<b>Serial Number:</b>	WAAZ000551
<b>Hardware Version Number:</b>	VPJMKF-10849
<b>Software Version Number:</b>	13.0.5
<b>FCC ID:</b>	2AA98-DBMFA2C5

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

The equipment under test (EUT) was an infotainment system that supports Bluetooth and WLAN functionality for use within different vehicles. The WLAN functionality is the subject of this test report. The EUT has an external antenna as detailed above in section 3.5 below

#### **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>	WLAN (IEEE 802.11b,g,n) / Digital Transmission System	
<b>Type of Unit:</b>	Transceiver	
<b>Modulation Type:</b>	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM	
<b>Data Rates:</b>	802.11b	1, 2, 5.5 & 11 Mbps
	802.11g	6, 9, 12, 18, 24, 36, 48 & 54 Mbps
	802.11n HT20	MCS0 to MCS7
	802.11n HT40	MCS0 to MCS7
<b>Power Supply Requirement(s):</b>	Nominal	13.5 VDC
<b>Channel Bandwidth:</b>	20 MHz	
<b>Transmit Frequency Range:</b>	2412 MHz to 2462 MHz	
<b>Transmit Channels Tested:</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	1	2412
	6	2437
	11	2452
<b>Channel Bandwidth:</b>	40 MHz	
<b>Transmit Frequency Range:</b>	2422 MHz to 2452 MHz	
<b>Transmit Channels Tested:</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	3	2422
	9	2452

### 3.5. Additional Antenna Information

<b>Antenna Gain:</b>	2.0 dBi
<b>Antenna Type:</b>	Patch-Antenna (external antenna)
<b>Manufacturer</b>	Rosenberger
<b>Part Number</b>	A 177 905 29 02

### **3.6. 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	Laptop Computer	DELL	LATITUDE E5530	249945
2	Power supply wires (Length 2 metres)	Not marked or stated	Not marked or stated	Not marked or stated
3	Wire Harness	Not marked or stated	Not marked or stated	Not marked or stated
4	CAN Interface	Vector Informatik GmbH	VN1630A CAN/LIN Interface	Not marked or stated
5	USB cable (Length 1 metres)	Not marked or stated	Not marked or stated	Not marked or stated
6	Laboratory Power Supply	Conrad Electronic Germany	PS -2403D	Not marked or stated



## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

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

- ☒ Continuously transmitting with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.

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

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

- Controlled using a terminal application on the laptop PC along with instructions provided by the customer. The document was called "MFA2| WLAN SDIO interface-CLK Signal Investigation", WiFi\_BT-RBS\_Spec(5)
- The application was used to enable a continuous transmission mode and to select the test channels, data rates and modulation schemes and power settings as required.
- The customer declared the following data rates to be used for all measurements as:
  - 802.11b – 1, 2, 5.5 & 11 Mbps
  - 802.11g – 6, 9, 12, 18, 24, 36, 48 & 54 Mbps
  - 802.11n HT20 – MCS0 to MCS7
  - 802.11n HT40 – MCS0 to MCS7
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and widest bandwidth for all bands were:
  - Highest power
    - 802.11b –DQPSK / 5.5 Mbps
    - 802.11g –BPSK / 9 Mbps
    - 802.11n HT20 – QPSK / 14.4 Mbps / MCS1
    - 802.11n HT40 – BPSK / 15 Mbps / MCS0
  - Highest power spectral density
    - 802.11b –DQPSK / 5.5 Mbps
    - 802.11g –BPSK / 9 Mbps
    - 802.11n HT20 – QPSK / 14.4 Mbps / MCS1
    - 802.11n HT40 – BPSK / 15 Mbps / MCS0
  - Widest bandwidth
    - 802.11b – DBPSK / 5.5 Mbps
    - 802.11g –BPSK / 9 Mbps
    - 802.11n HT20 – QPSK / 14.4 Mbps / MCS1
    - 802.11n HT40 – BPSK / 15 Mbps / MCS0
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 9 Mbps. This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and, as this mode emits the highest output power level, it was deemed to be the worst case.
- The cabinet radiated spurious emissions were performed with the EUT in normal position at the center of a table in 3 m Semi- Anechoic chamber at a distance of 3 m to receiving measurement antennas whilst the device in operation. The RF Port of the device was terminated with a 50 Ohms load for cabinet radiation and with antenna for the radiated band edge compliance.

- Power level 15 was used for all measurements except on the 2.4 GHz HT40 Mode where power setting 11 was used.
- Software EMC32 V10.1.0

## **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:**

<b>Test Engineer:</b>	Abdoufataou Salifou	<b>Test Date:</b>	29 November 2017 22 March 2018
<b>Test Sample Serial Number:</b>	WAAZ000217		
<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 8.1

#### **Environmental Conditions:**

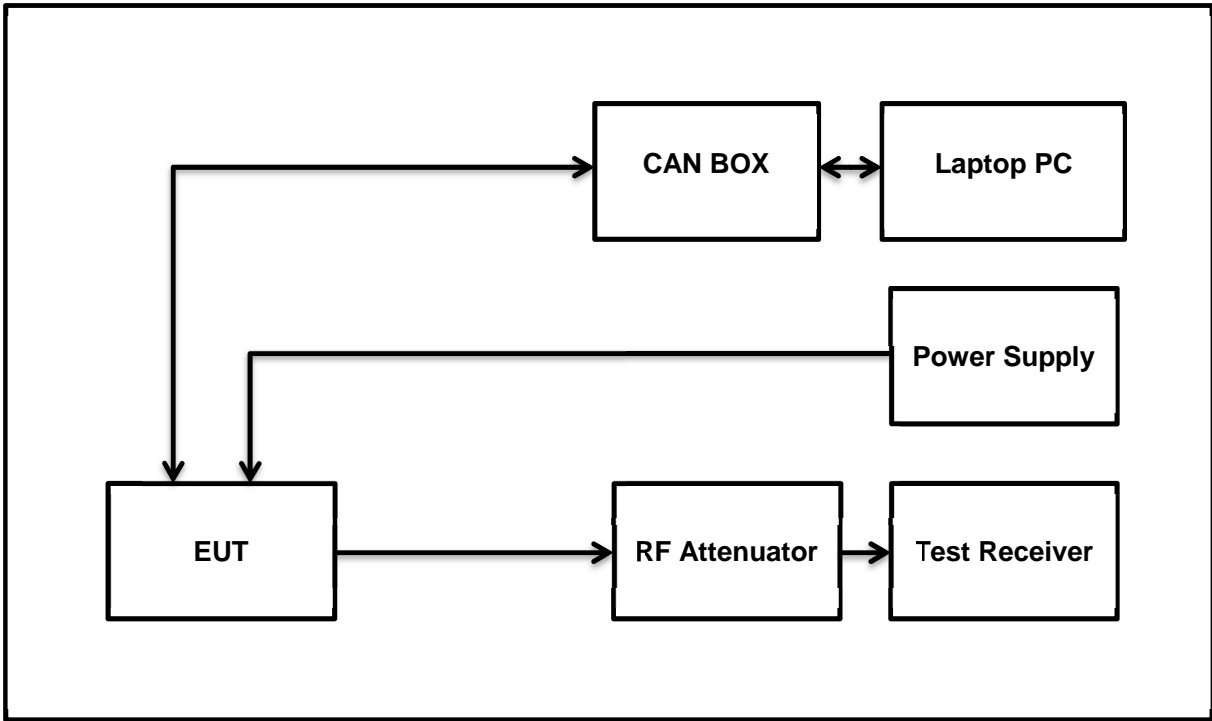
<b>Temperature (°C):</b>	22.4
<b>Relative Humidity (%):</b>	34

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

<b>RBW/VBW</b>	100 KHz / 300 KHz
<b>Span</b>	30 MHz
<b>Sweep time</b>	Auto
<b>Detector</b>	Peak

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

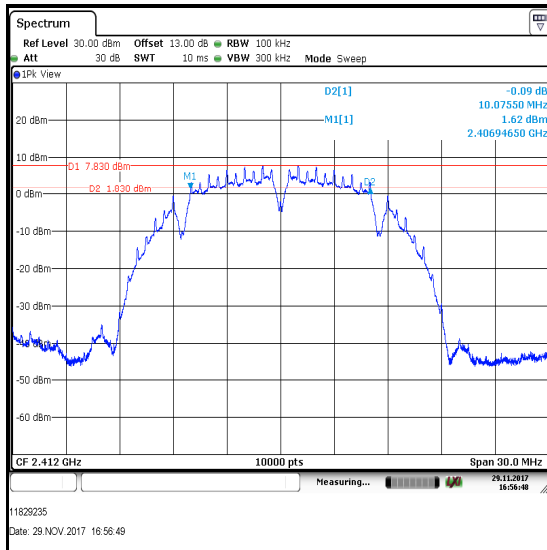
1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 8.1 Option 1 measurement procedure. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 30 MHz. The DTS bandwidth was measured at 6 dB down from the peak of the signal. The data rates that produced the narrowest bandwidth and therefore deemed worst case were:
  - 802.11b – DBPSK / 1 Mbps
  - 802.11g – BPSK / 6 Mbps
  - 802.11n HT20 – QPSK / 14.4 Mbps / MCS1
  - 802.11n HT40 – BPSK / 15 Mbps / MCS0
2. Final measurements were performed using the above configurations on the bottom, middle and top channels in accordance with KDB 558074 Section 8.1 Option 1 measurement procedure.
3. Plots for all data rates are archived on the company server and available for inspection upon request.
4. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

**Transmitter Minimum 6 dB Bandwidth (continued)****Test Setup:**

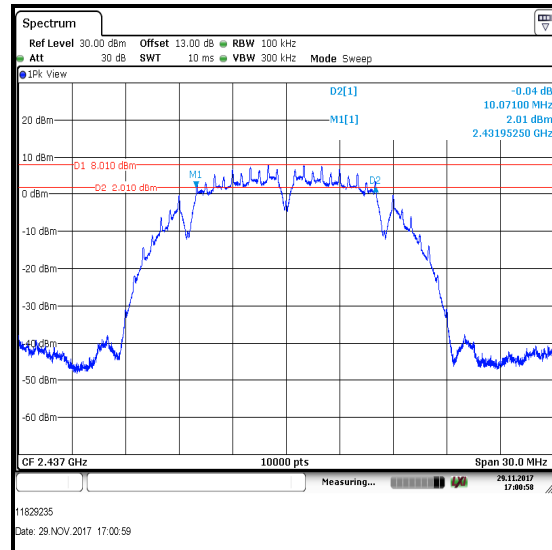
# Transmitter Minimum 6 dB Bandwidth (continued)

## Results: 802.11b / 20 MHz / DBPSK / 1 Mbps

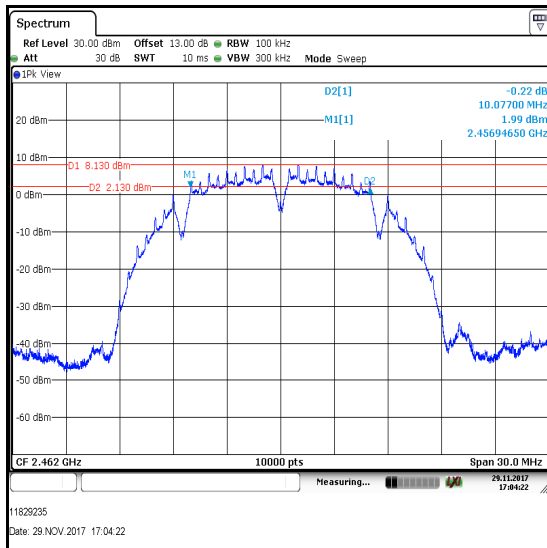
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	10075.500	≥500	9575.500	Complied
Middle	10071.000	≥500	9571.000	Complied
Top	10077.000	≥500	9577.000	Complied



Bottom Channel



Middle Channel



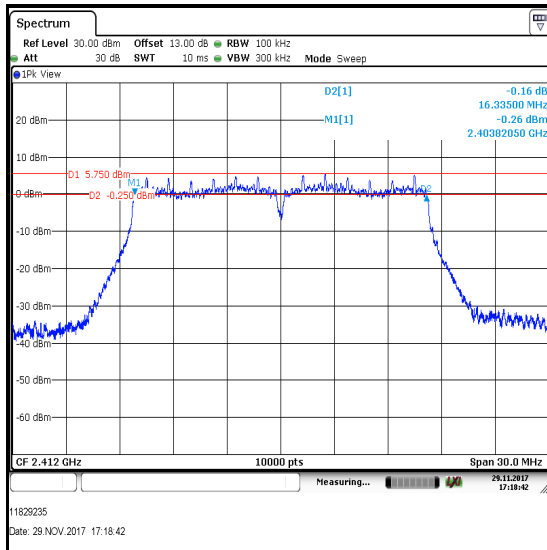
Top Channel

Result: **Pass**

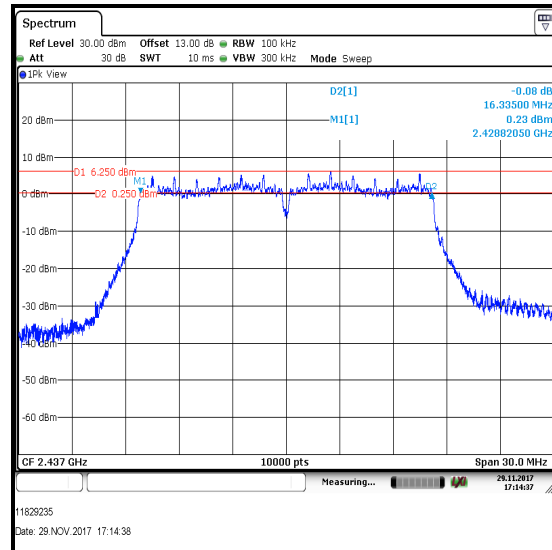
# Transmitter Minimum 6 dB Bandwidth (continued)

## Results: 802.11g / 20 MHz / BPSK / 6 Mbps

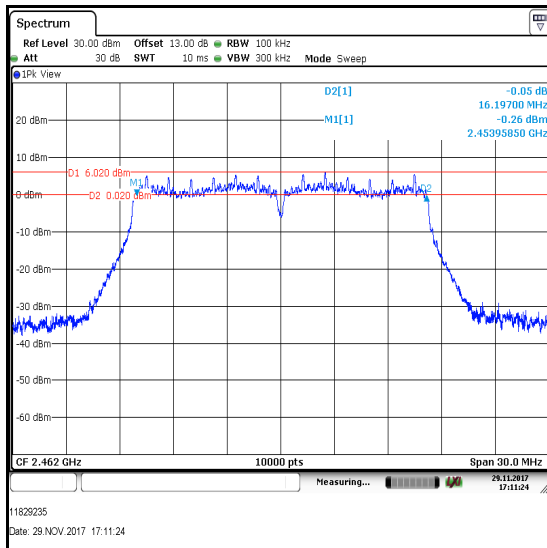
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16335.000	≥500	16835.000	Complied
Middle	16335.000	≥500	16835.000	Complied
Top	16197.000	≥500	15697.000	Complied



Bottom Channel



Middle Channel



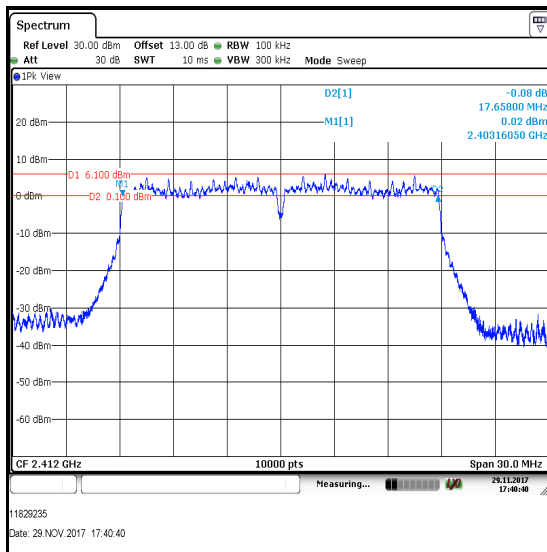
Top Channel

Result: **Pass**

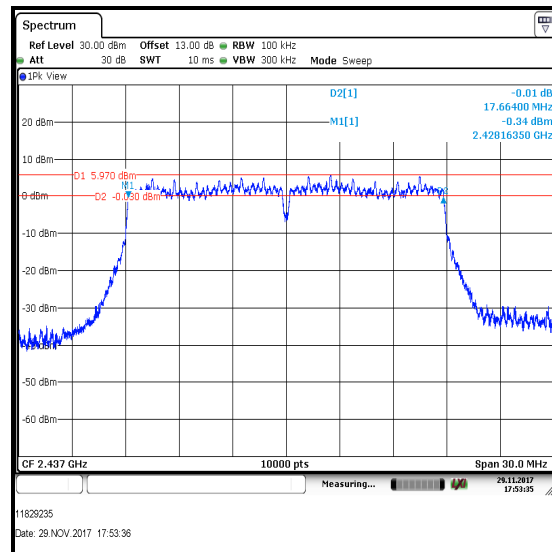
### Transmitter Minimum 6 dB Bandwidth (continued)

**Results: 802.11n / HT20 / QPSK / MCS1**

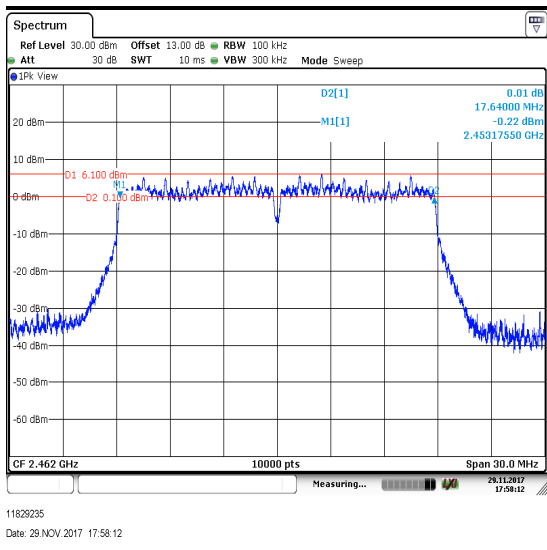
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17658	≥500	17158	Complied
Middle	17664	≥500	17164	Complied
Top	17640	≥500	17140	Complied



### Bottom Channel



## Middle Channel



### Top Channel

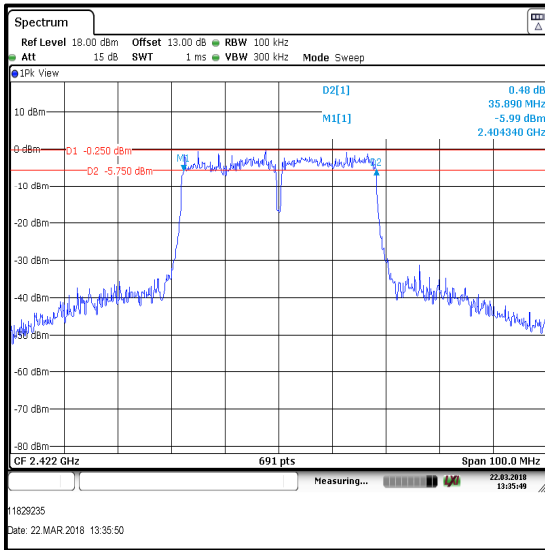
**Result: Pass**



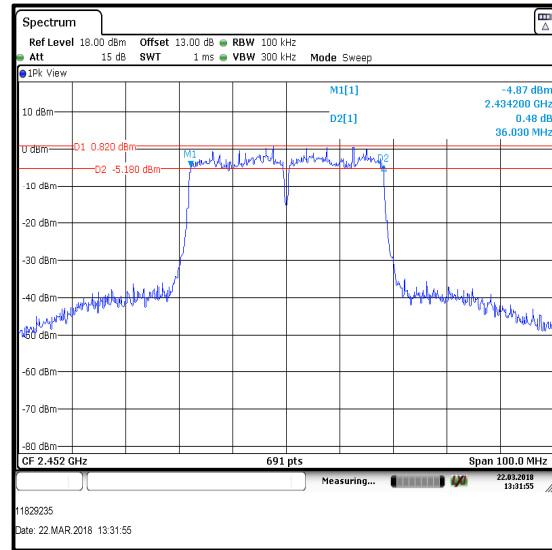
**Transmitter Minimum 6 dB Bandwidth (continued)**

**Results: 802.11n / 40 MHz / BPSK / MCS 0**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35890.0	≥500	35620.0	Complied
Top	36030.0	≥500	35970.0	Complied



Bottom Channel



Top Channel

Result: **Pass**

### 5.2.2. Transmitter Duty Cycle

#### Test Summary:

Test Engineer:	Abdoufataou Salifou	Test Date:	30 November 2017 27 January 2018
Test Sample Serial Number:	WAAZ000217		
Test Site Identification	SR 9		

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

#### Environmental Conditions:

Temperature (°C):	21.8
Relative Humidity (%):	33

#### Settings of the Instrument

RBW/VBW	28 MHz / 28 MHz
Span	Zero
Detector	Average

#### Note(s):

- In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

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

802.11b / 20 MHz / 5.5 Mbps duty cycle  $10 \log (1 / (2.462/4.052)) = 2.2 \text{ dB}$

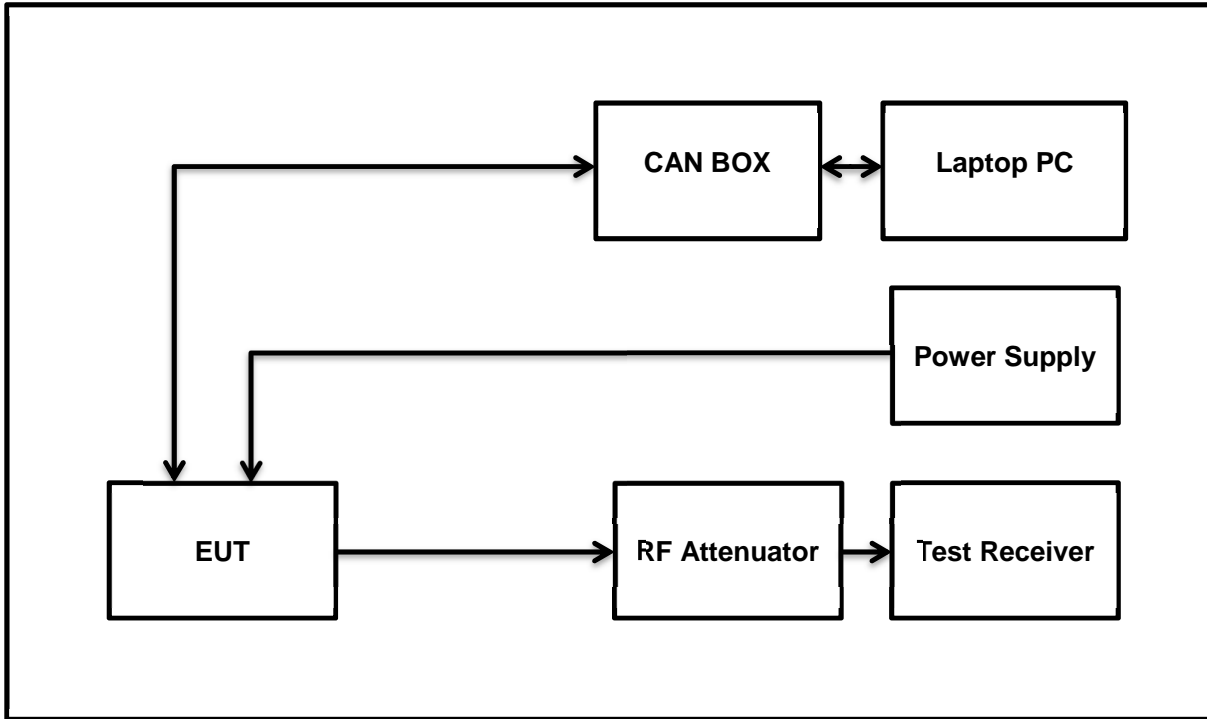
802.11g / 20 MHz / 9 Mbps duty cycle  $10 \log (1 / (1.413/2.209)) = 1.9 \text{ dB}$

802.11n / HT20 / MCS1 / duty cycle:  $10 \log (1 / 0.988/3.954)) = 6.0 \text{ dB}$

802.11n / HT40 / MCS0 / duty cycle:  $10 \log (1 / (0.9545/5.9093)) = 7.9 \text{ dB}$

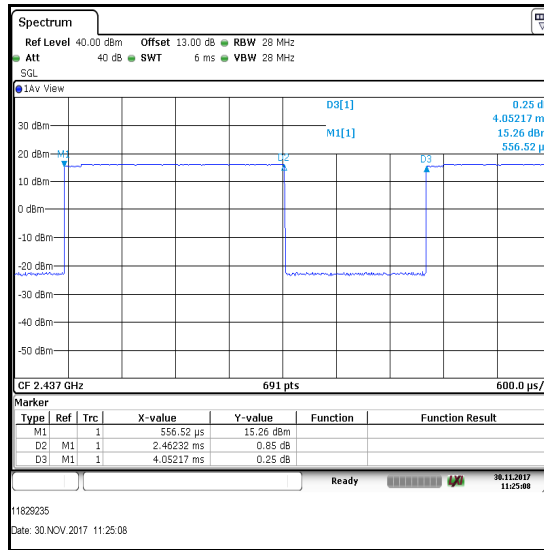
**Transmitter Duty Cycle (continued)**

**Test setup:**



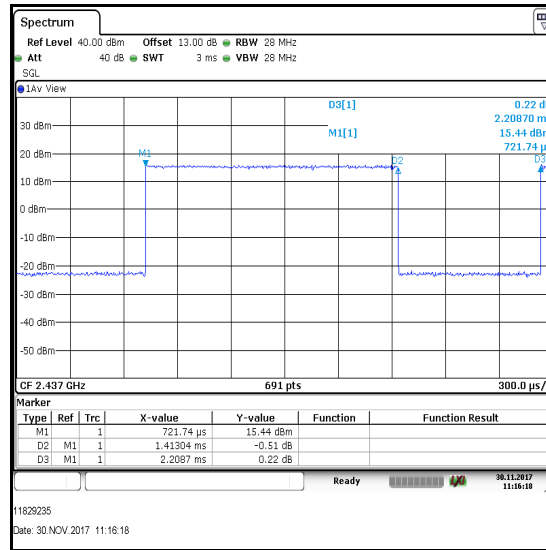
**Transmitter Duty Cycle (continued)****Results: 802.11b / 20 MHz / 5.5 Mbps**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
2.462	4.052	2.2

**Plot: Duty Cycle****Result: Pass**

**Transmitter Duty Cycle (continued)****Results: 802.11g / 20 MHz / 9 Mbps**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
1.413	2.209	1.9

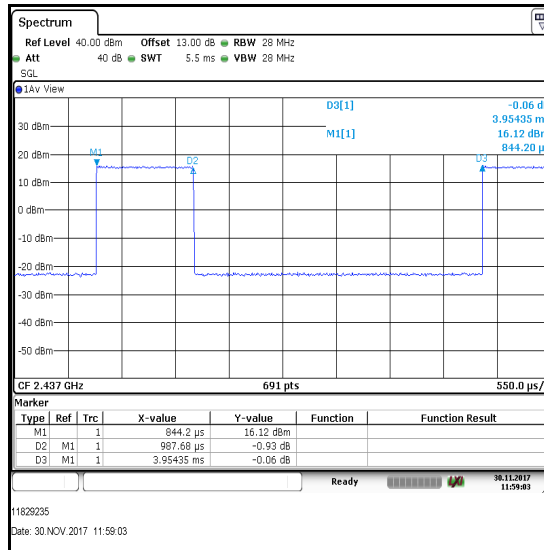
**Plot: Duty Cycle****Result: Pass**

## Transmitter Duty Cycle (continued)

### Results: 802.11n / HT20 / MCS1

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
0.988	3.954	6.0

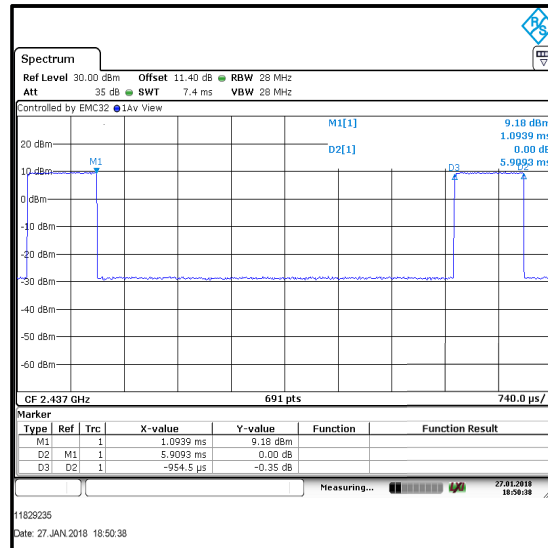
Plot: Duty Cycle



Result: **Pass**

**Transmitter Duty Cycle (continued)****Results: 802.11n / HT40 / MCS0**

Pulse Duration (ms)	Period (ms)	Duty Cycle (dB)
0.9545	5.9093	7.9



### **5.2.3. Transmitter Power Spectral Density**

#### **Test Summary:**

<b>Test Engineer:</b>	Abdoufataou Salifou	<b>Test Date:</b>	30 November 2017 22 March 2018
<b>Test Sample Serial Number:</b>	WAAZ000217		
<b>Test Site Identification</b>	SR 9		

<b>FCC Reference:</b>	Part 15.247(e)
<b>Test Method Used:</b>	FCC KDB 558074 Sections 10.3 &10.7

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	22.3
<b>Relative Humidity (%):</b>	33

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

<b>RBW/VBW</b>	3 KHz / 10KHz
<b>Span</b>	3 * OBW
<b>Sweep time</b>	(number of points in sweep) *transmission period
<b>Detector</b>	RMS

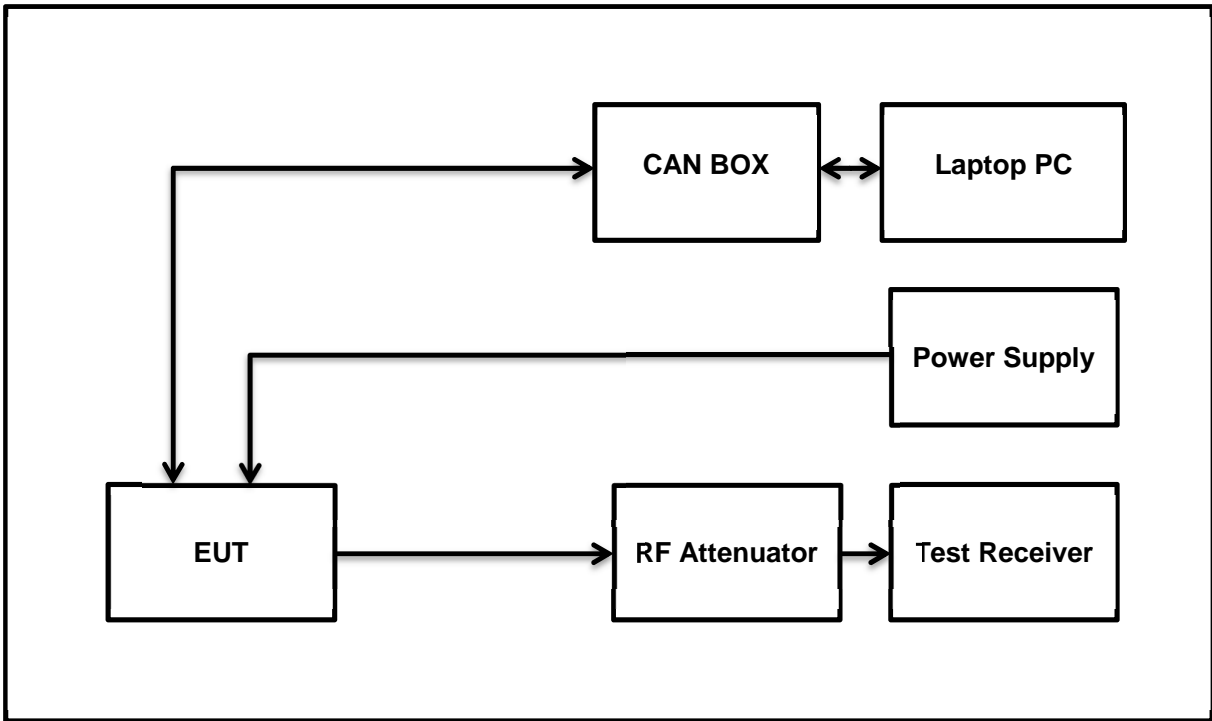
#### **Note(s):**

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 10.7 measurement procedure AVGPDS-3. The data rates that produced the highest power and therefore deemed worst case were:
  - o 802.11b - DQPSK / 5.5 Mbps
  - o 802.11g - BPSK / 9 Mbps
  - o 802.11n HT20 - QPSK / 14.4 Mbps / MCS1
  - o 802.11n HT40 – BPSK / 15 Mbps / MCS0
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. The EUT was transmitting at <98% duty cycle. Testing was performed in accordance with KDB 558074 Section 10.7 Method AVGPDS-3 due to the inconstant duty cycle. The test receiver resolution bandwidth was set to 3 kHz and video bandwidth 10 kHz. The span was set to 1.5 times the 99% occupied emission bandwidth and an RMS detector was used. Number of sweep points was more than 2 times Span/RBW. The sweep time was set manually to not exceed (the number of sweep points) x transmission period and should be greater than the auto sweep time. The highest peak of the measured signal was recorded. The calculated duty cycle in section 5.2.2 was added to the measured average power spectral density in order to compute the average power spectral density during the actual transmission time.
4. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.



**Transmitter Power Spectral Density (continued)**

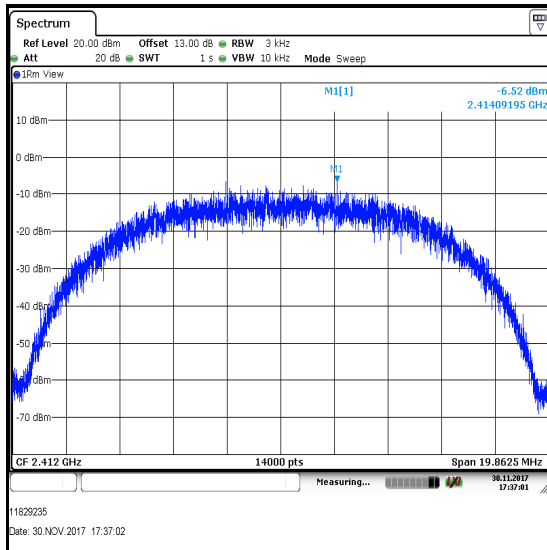
**Test Setup:**



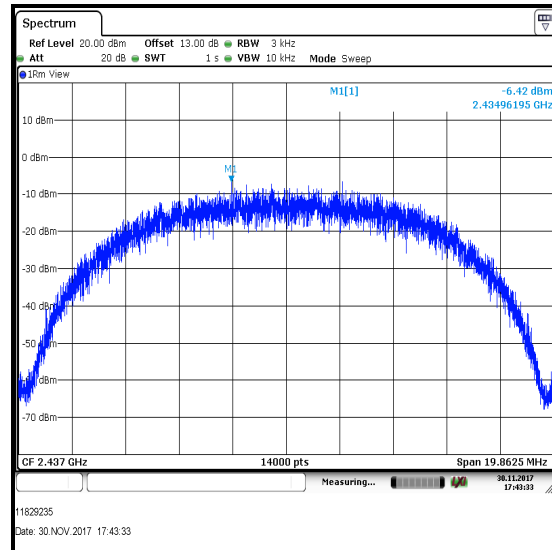
# Transmitter Power Spectral Density (continued)

**Results: 802.11b / 20 MHz / DQPSK / 5.5 Mbps**

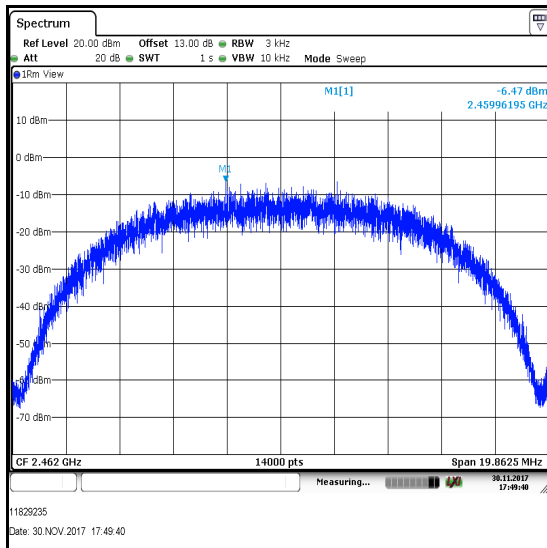
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	-6.5	8.0	13.5	Complied
Middle	-6.4	8.0	13.4	Complied
Top	-6.5	8.0	13.5	Complied



**Bottom Channel**



**Middle Channel**

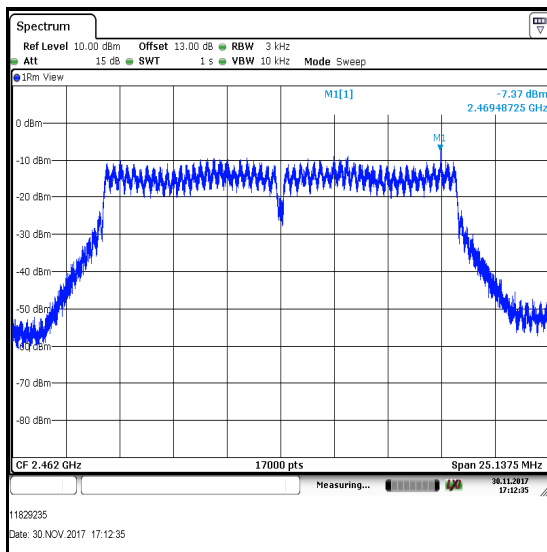
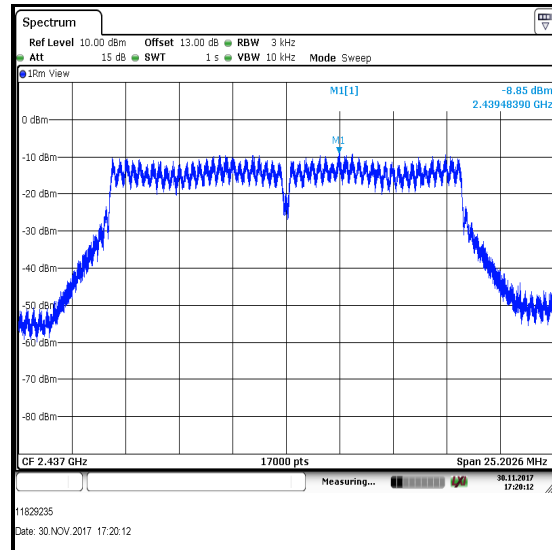
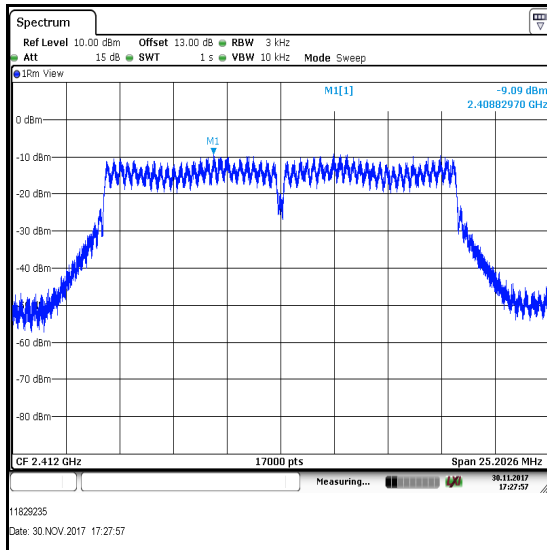


**Top Channel**

**Result: Pass**

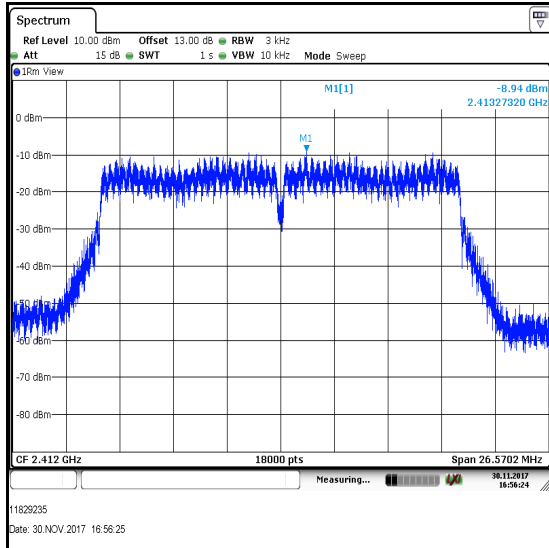
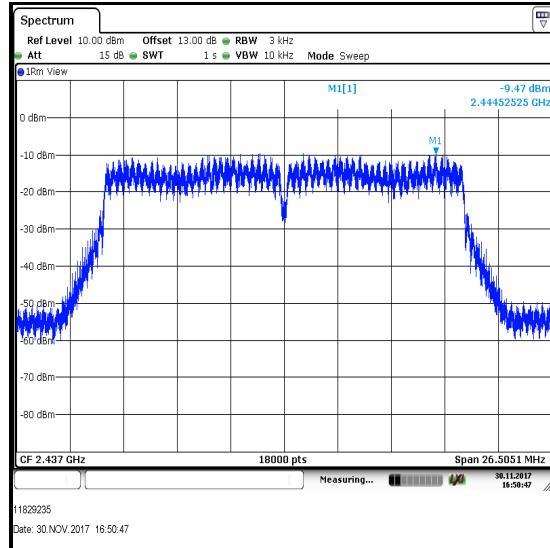
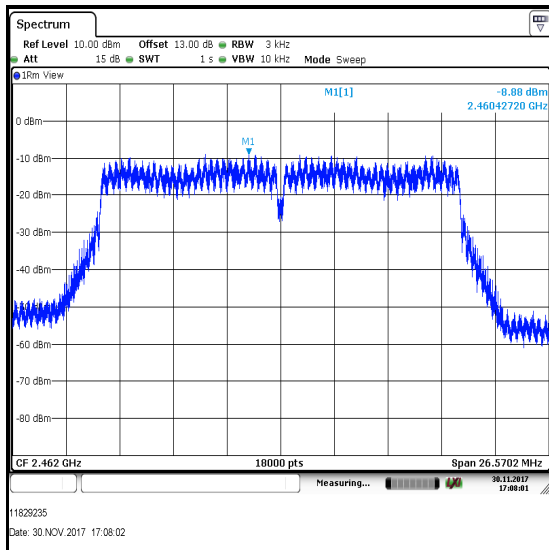
**Transmitter Power Spectral Density (continued)****Results: 802.11g / 20 MHz / BPSK / 9 Mbps**

Channel	Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	-9.1	8.0	17.1	Complied
Middle	-9.5	8.0	17.5	Complied
Top	-7.4	8.0	15.4	Complied

**Result: Pass**

**Transmitter Power Spectral Density (continued)****Results: 802.11n / HT20 / QPSK / MCS1**

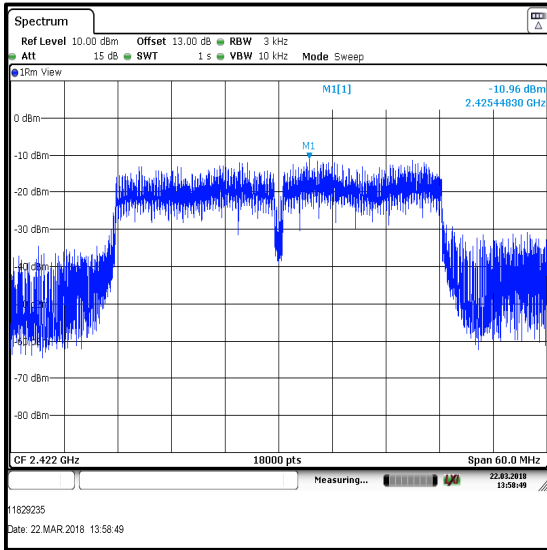
Channel	Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	-8.9	8.0	16.9	Complied
Middle	-9.5	8.0	17.5	Complied
Top	-8.9	8.0	16.9	Complied

**Bottom Channel****Middle Channel****Top Channel****Result: Pass**

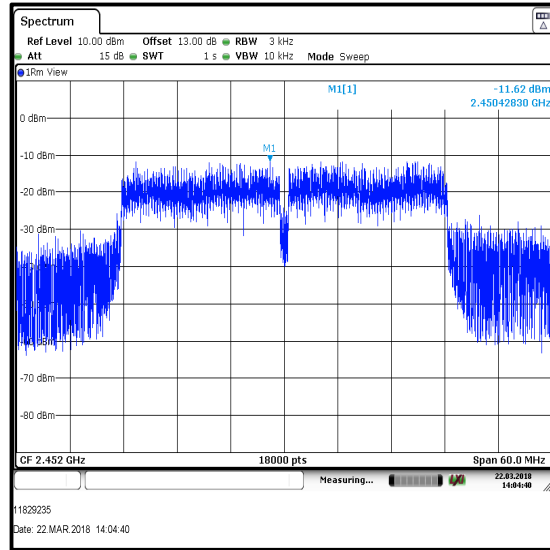
# **Transmitter Power Spectral Density (continued)**

**Results: 802.11n / HT40 / BPSK / MCS0**

Channel	Output Power (dBm/3 kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	-10.96	8.0	18.96	Complied
Top	-11.62	8.0	19.62	Complied



Bottom Channel



Top Channel

**Result: Pass**

#### 5.2.4. Transmitter Maximum (Average) Output Power

##### Test Summary:

Test Engineer:	Abdoufataou Salifou	Test Date:	30 November 2017 22 March 2018
Test Sample Serial Number:	WAAZ000217		
Test Site Identification	SR 9		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	FCC KDB 558074 Sections 9.2.2.2 & 9.2.2.6

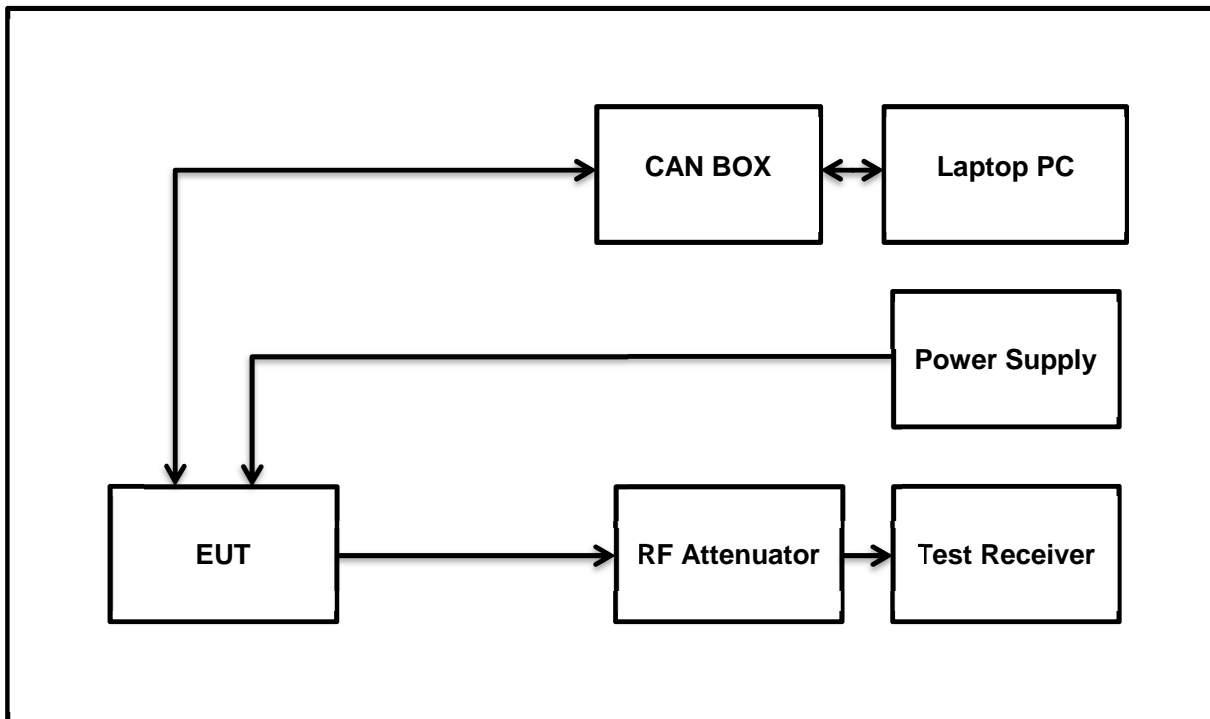
##### Environmental Conditions:

Temperature (°C):	22.7
Relative Humidity (%):	32

##### Settings of the Instrument

RBW/VBW	300 KHz / 1 MHz
Span	1.5 * OBW
Sweep time	(number of points in sweep) * transmission period,
Detector	RMS

##### Test Setup:



**Transmitter Maximum (Average) Output Power (continued)****Note(s):**

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 9.2.2.6 measurement procedure AVGSA-3. The data rates that produced the highest power and therefore deemed worst case were:
  - 802.11b - DQPSK / 5.5 Mbps
  - 802.11g - BPSK / 9 Mbps
  - 802.11n HT20 - QPSK / MCS1
  - 802.11n HT40 – BPSK / 15 Mbps / MCS0
2. Final measurements were performed using the above configurations on the bottom, middle and top channels. The power has been integrated over the 99% emission bandwidth. Plots for the occupied bandwidth are archived on the company server and available for inspection upon request.
3. The EUT was transmitting at <98% duty cycle and testing was performed in accordance with KDB 558074 Section 9.2.2.5 Method AVGSA-3 due to the inconstant duty cycle. The test receiver's integration function was used to integrate across the 99% occupied bandwidth. The test receiver resolution bandwidth was set to 300 kHz and video bandwidth 1 MHz. An RMS detector was used and sweep time set manually to not exceed (the number of sweep points) x transmission period and greater than the auto sweep time. The span was set to greater than 1.5 times the 99% occupied emission bandwidth.
4. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11b / 20 MHz / DQPSK / 5.5 Mbps****Conducted Peak Limit Comparison**

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	22.7	30.0	7.3	Complied
Middle	22.8	30.0	7.2	Complied
Top	23.0	30.0	7.0	Complied

**De Facto EIRP Limit Comparison**

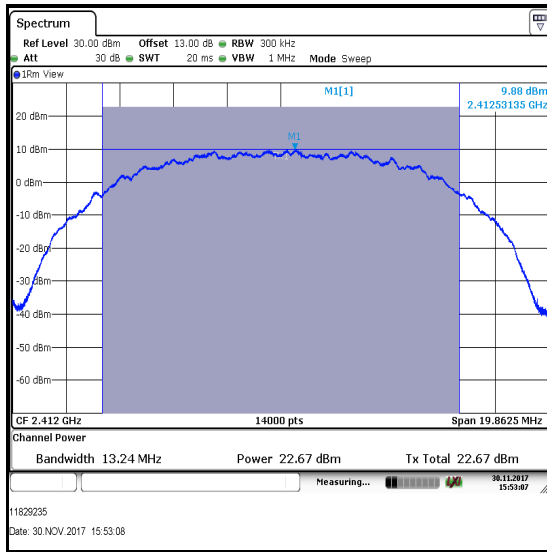
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	22.7	2.0	24.7	36.0	11.3	Complied
Middle	22.8	2.0	24.8	36.0	11.2	Complied
Top	23.0	2.0	25.0	36.0	11.0	Complied

**Result: Pass**

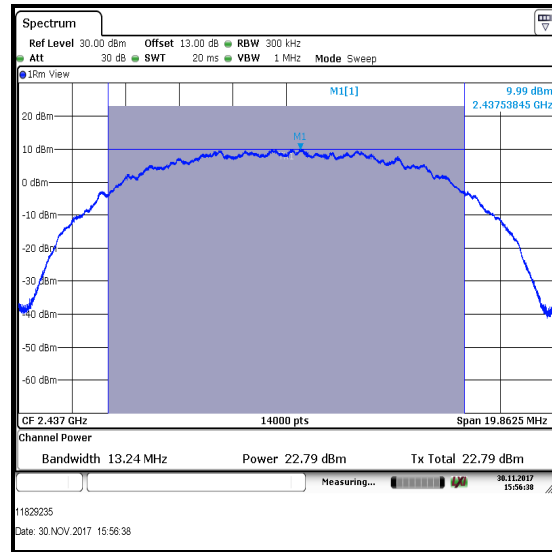


## Transmitter Maximum (Average) Output Power (continued)

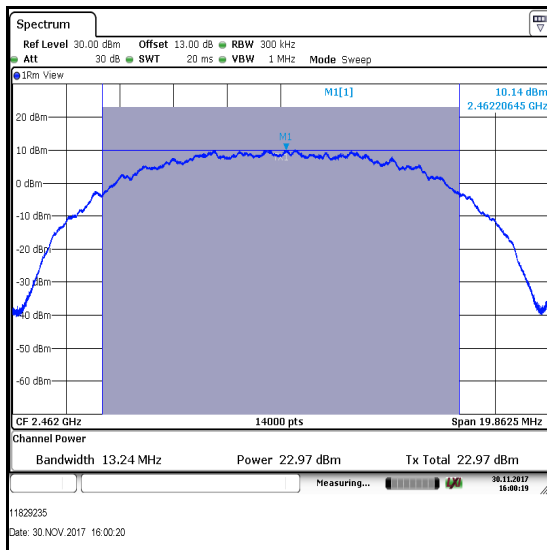
**Results: 802.11b / 20 MHz / DQPSK / 5.5 Mbps**



Bottom Channel



Middle Channel



Top Channel

**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11g / 20 MHz / BPSK / 9 Mbps****Conducted Peak Limit Comparison**

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	23.6	30.0	6.4	Complied
Middle	23.9	30.0	6.1	Complied
Top	23.6	30.0	6.4	Complied

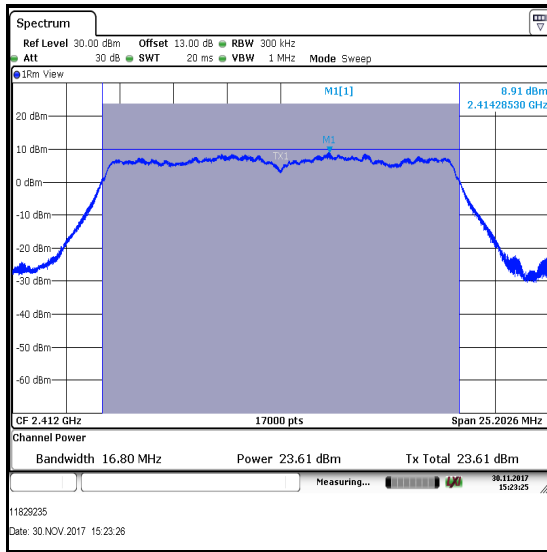
**De Facto EIRP Limit Comparison**

Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	23.6	2.0	25.6	36.0	10.4	Complied
Middle	23.9	2.0	25.9	36.0	10.1	Complied
Top	23.6	2.0	25.6	36.0	10.4	Complied

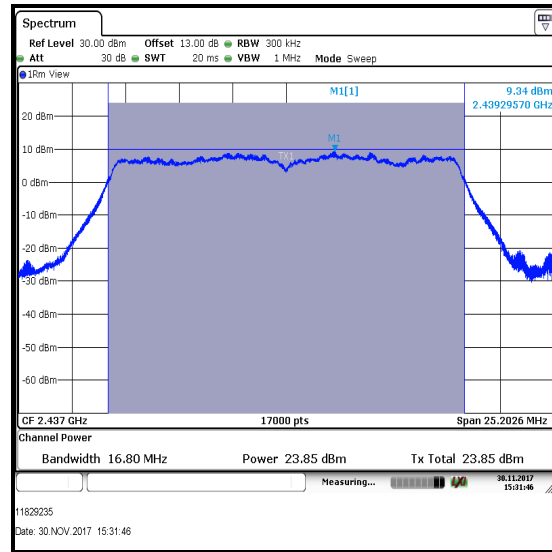
**Result: Pass**

## Transmitter Maximum (Average) Output Power (continued)

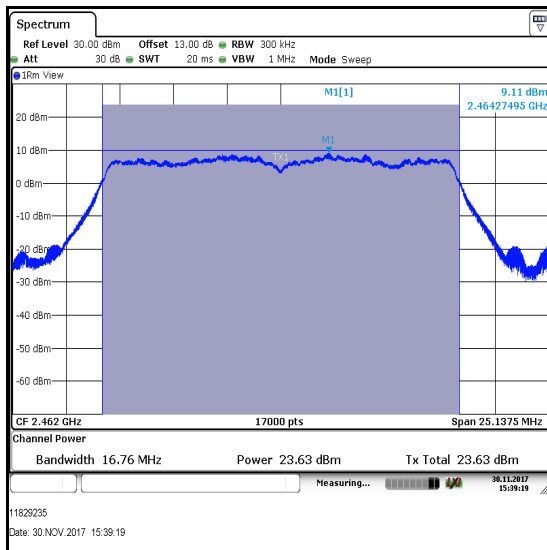
**Results: 802.11g / 20 MHz / BPSK / 9 Mbps**



Bottom Channel



Middle Channel



Top Channel

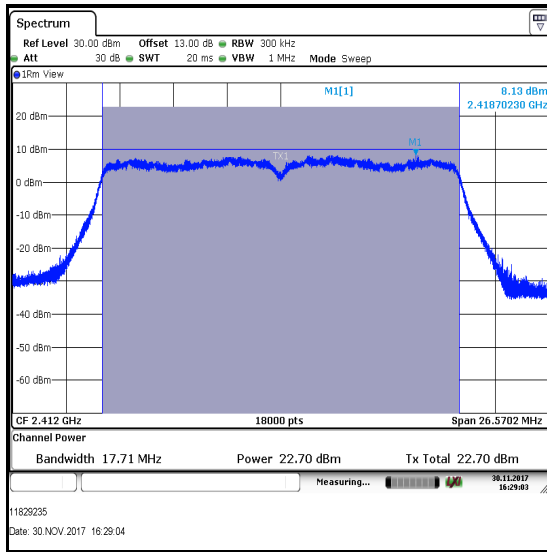
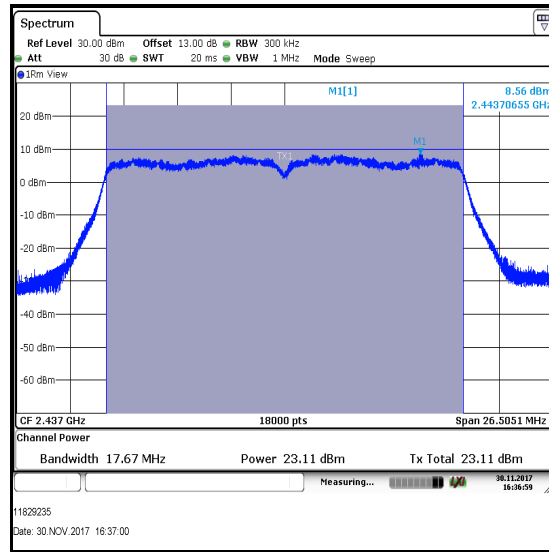
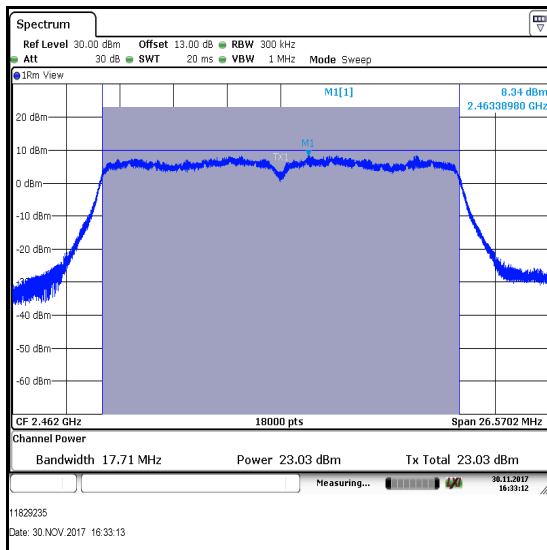
**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11n / HT20 / QPSK / MCS1****Conducted Peak Limit Comparison**

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	22.7	30.0	7.3	Complied
Middle	23.0	30.0	7.0	Complied
Top	23.1	30.0	6.9	Complied

**De Facto EIRP Limit Comparison**

Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	22.7	2.0	24.7	36.0	11.3	Complied
Middle	23.0	2.0	25.0	36.0	11.0	Complied
Top	23.1	2.0	25.1	36.0	10.9	Complied

**Result: Pass**

**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11n / HT20 / QPSK / MCS1****Bottom Channel****Middle Channel****Top Channel**

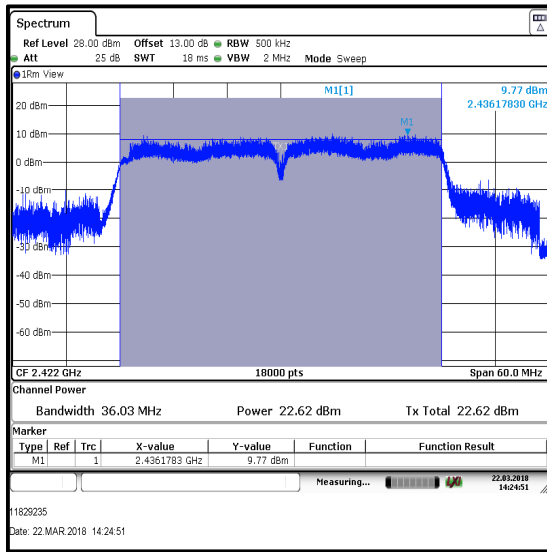
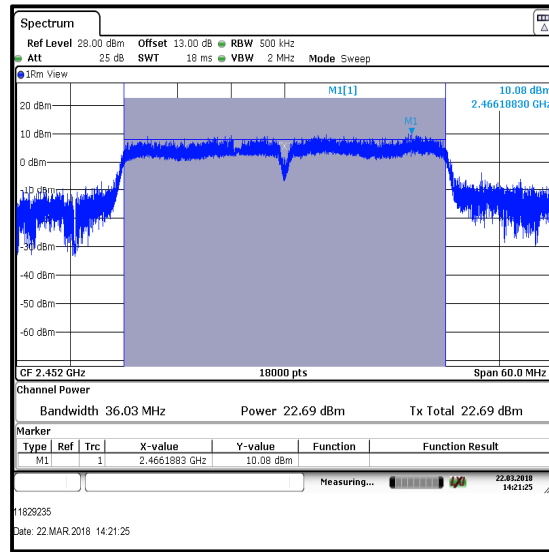
**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11n / HT40 / BPSK / MCS0****Conducted Peak Limit Comparison**

Channel	Conducted Power (dBm)	Conducted Power Limit (dBm)	Margin (dB)	Result
Bottom	22.62	30.0	7.38	Complied
Top	22.69	30.0	7.31	Complied

**De Facto EIRP Limit Comparison**

Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	22.62	2.0	24.62	36.0	11.38	Complied
Top	22.69	2.0	24.69	36.0	11.31	Complied

**Result: Pass**

**Transmitter Maximum (Average) Output Power (continued)****Results: 802.11n / HT40 / BPSK / MCS0****Bottom Channel****Top Channel**

### **5.2.5. Transmitter Emissions (Conducted)**

#### **Test Summary:**

<b>Test Engineer:</b>	Segun Adeniji	<b>Test Date:</b>	17 January 2018
<b>Test Sample Serial Number:</b>	WABU000551		
<b>Test Site Identification</b>	SR 9		

<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>	35

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

<b>RBW/VBW</b>	100 kHz / 300 kHz
<b>Detector</b>	Peak

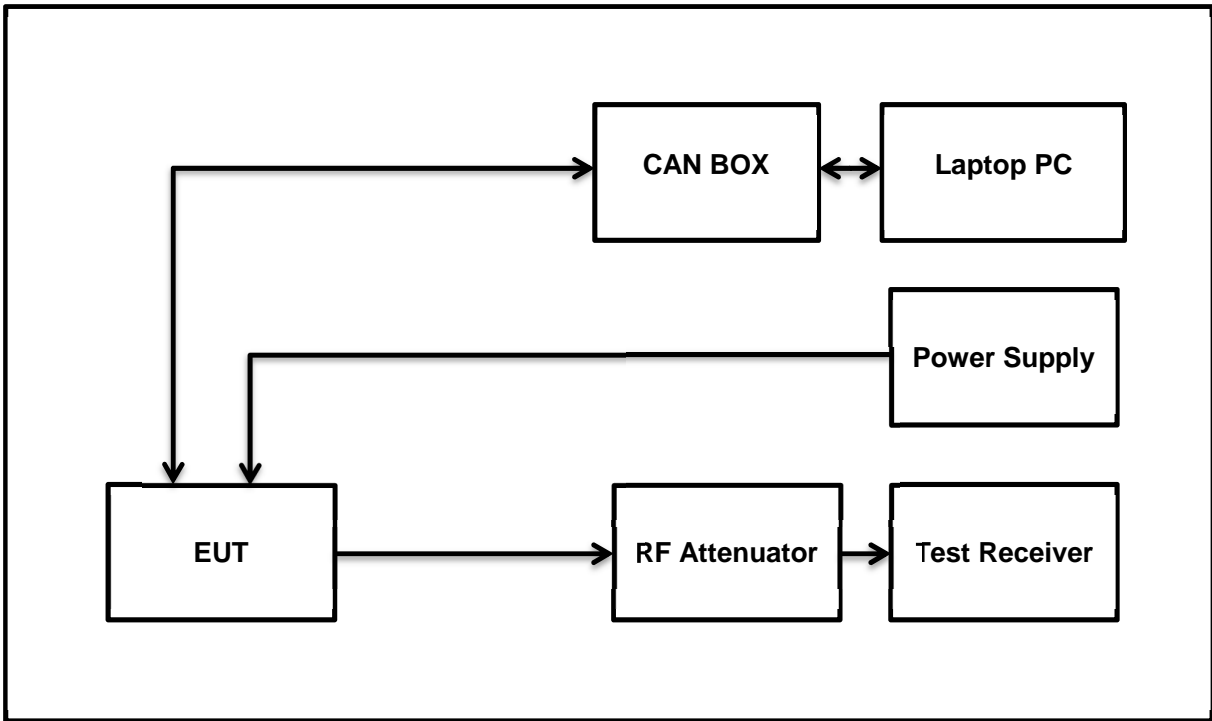
#### **Note(s):**

1. Transmitter conducted spurious emissions tests were performed with the EUT transmitting in 802.11g – BPSK / 9 Mbps mode as this was found to transmit the highest power and therefore deemed worst case. The measurement was done at the EUT antenna port.
2. The final measured value, for the given emission, in the table below incorporates the attenuator value and cable loss.
3. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final emissions measurements were performed with the EUT set to the middle channel only.
4. All emissions shown on the pre-scan plot were investigated and found to be below the applicable limit or below the measurement system noise floor.
5. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
6. Since the EUT complied to the spurious emission limit with peak detector, therefore no quasi-peak measurement was necessary according to ANSI C63.10.



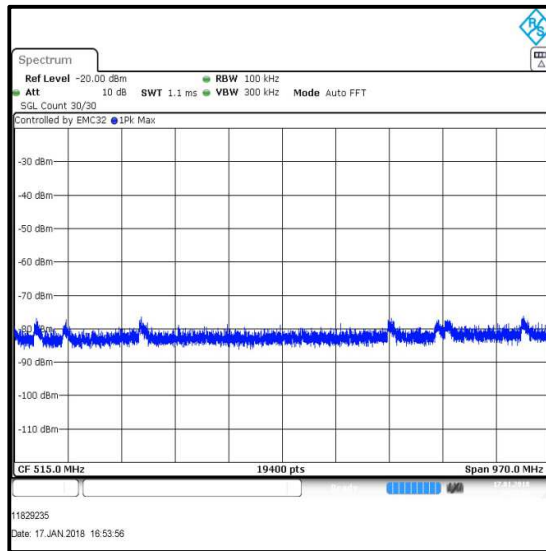
**Transmitter Spurious Emissions (continued)**

**Test Setup:**



**Results: Middle Channel / 802.11g / BPSK / 9 Mbps**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
243.083	Horizontal	29.8	46.0	16.2	Complied
641.292	Vertical	28.9	46.0	17.1	Complied

**Transmitter Spurious Emissions (Conducted) Plot from 30 MHz to 1 GHz**

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>	17 January 2018
<b>Test Sample Serial Number:</b>	WABU000551		
<b>Test Site Identification</b>	SR 9		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	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>	35

**Settings of the Instrument**

<b>RBW/VBW</b>	1 MHz / 3 MHz
<b>Detector</b>	Peak

**Note(s):**

1. Transmitter conducted spurious emissions tests were performed with the EUT transmitting in 802.11g – BPSK / 9 Mbps mode as this was found to transmit the highest power and therefore deemed worst case. The measurement was done at the EUT antenna port.
2. Initial pre-scan was performed from 30 MHz-26 GHz. The result for the measurement up to 1 GHz has already been presented in the preceding section.
3. The final measured value, for the given emission, in the table below incorporates the attenuator and cable loss.
4. During the initial pre-scan, it was discovered that the worst case spurious emission was found when the EUT was set to a particular channel on the middle channel compared to bottom channel, top channel or the hopping mode. Therefore the plots have only shown the middle channel results.
5. The emission shown on the 1 GHz to 4 GHz plot between 2.4 GHz and 2.48 GHz are the EUT fundamentals.
6. \*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.
7. All emissions including the carrier second harmonic shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the average limit.
8. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.

**Results: Peak / Bottom channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
9044.333	Horizontal	51.9	54.0	2.1	Complied
12536.417	Vertical	53.1	54.0	0.9	Complied

**Results: Peak / Middle channel**

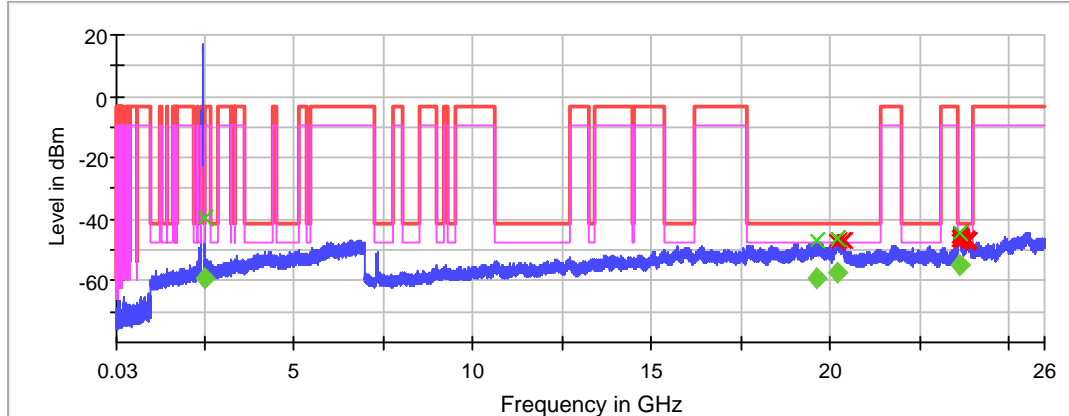
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
9966.000	Horizontal	51.7	54.0	2.3	Complied
12679.875	Horizontal	53.6	54.0	0.4	Complied

**Results: Peak / Top channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
9065.333	Horizontal	51.3	54.0	2.7	Complied
12672.083	Vertical	54.0	54.0	0.0	Complied

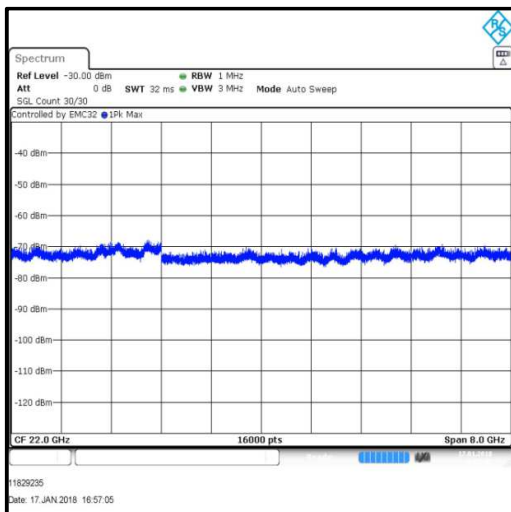
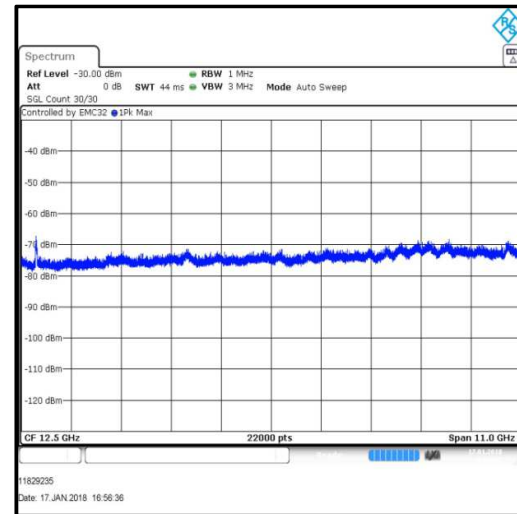
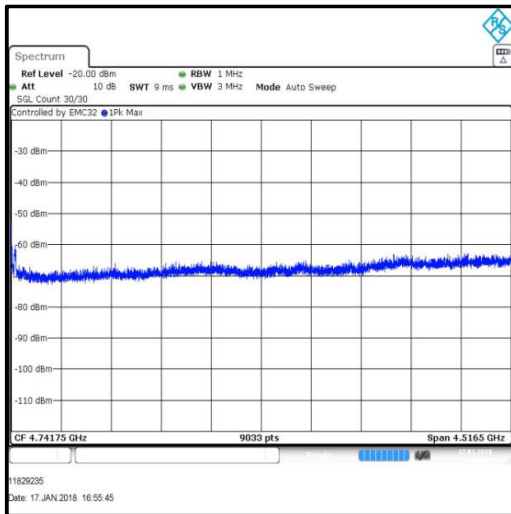
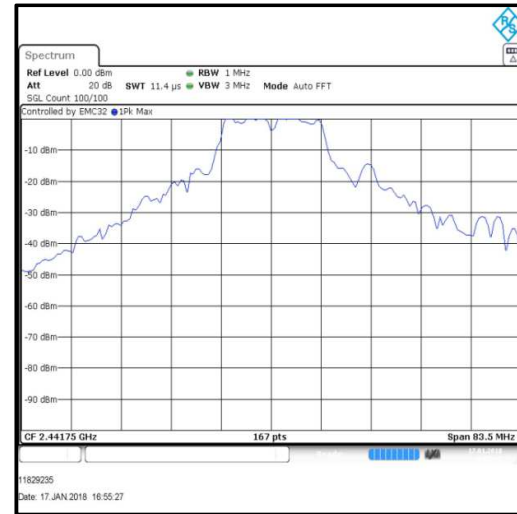
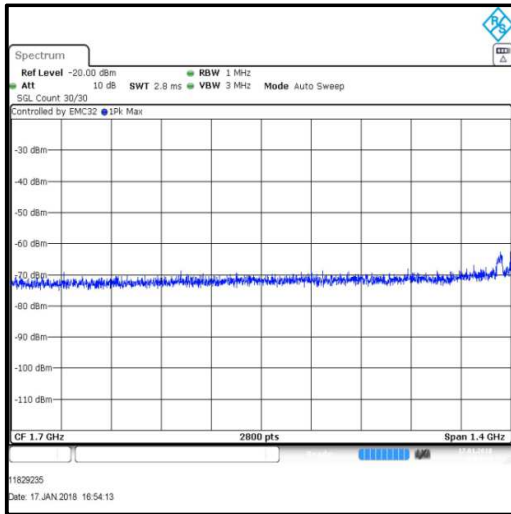
**Result: Pass**

**Transmitter Spurious Emissions (Conducted) Plot from 30 MHz to 26 GHz**



Initial Spurious emission pre-scan from 30 MHz- 26 GHz with Peak detector

**Transmitter Spurious Emissions (Conducted) Plot from 30 MHz to 26 GHz segmented**



Segmented scan plots with peak detector. Note that they are for indication purposes only therefore for final measurements, see accompanying tables.

### **5.2.6. Transmitter Radiated Emissions (Cabinet Radiation)**

#### **Test Summary:**

<b>Test Engineer:</b>	Abdoufataou Salifou	<b>Test Date:</b>	29 November 2017
<b>Test Sample Serial Number:</b>	WAAZ000217		
<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:**

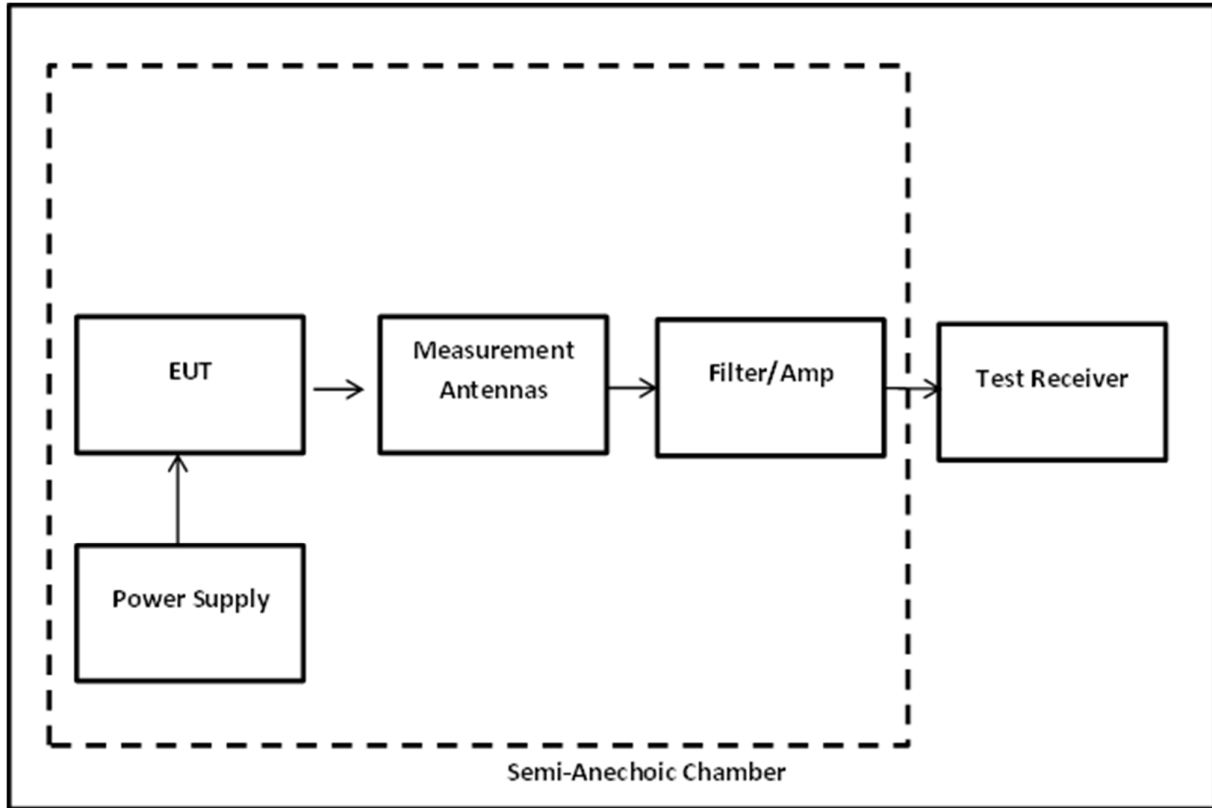
<b>Temperature (°C):</b>	22.3
<b>Relative Humidity (%):</b>	24

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

<b>RBW/VBW</b>	100 KHz / 300 KHz
<b>Trace Mode</b>	Max Hold
<b>Sweep time</b>	Auto
<b>Detector</b>	Peak

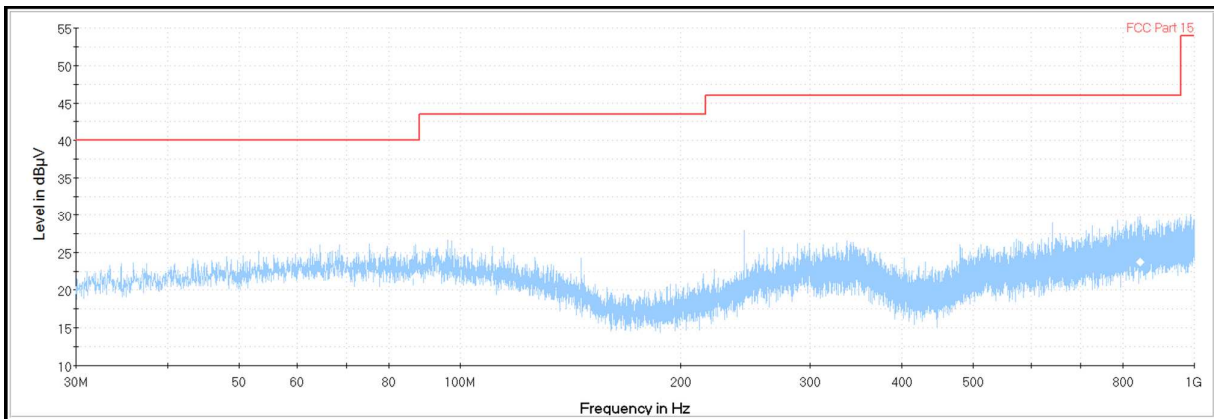
#### **Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
3. All emissions shown on the pre-scan plots were investigated and found to be ambient, or >20 dB below the applicable limit or below the measurement system noise floor. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
4. 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.
5. 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:****Semi-anechoic chamber**

**Transmitter Radiated Emissions (continued)****Results: Middle Channel / 802.11g / BPSK / 9 Mbps**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
243.083	Horizontal	29.8	46.0	16.2	Complied
641.292	Vertical	28.9	46.0	17.1	Complied

**Transmitter Spurious Emissions (Radiated) Plot from 30 MHz to 1 GHz**

*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>	29 November 2017 8 December 2017
<b>Test Sample Serial Number:</b>	WAAZ000217		
<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 6.6
<b>Frequency Range</b>	1 GHz to 25 GHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	22.5
<b>Relative Humidity (%):</b>	24

**Settings of the Instrument**

<b>RBW/VBW</b>	1 MHz / 3 MHz
<b>Trace Mode</b>	Max Hold
<b>Sweep time</b>	Auto
<b>Detector</b>	Peak

**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. The emissions shown approximately between 2.4GHz to 2.5GHz are the EUT fundamental.
4. \*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.
5. 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. 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.

**Transmitter Radiated Emissions (continued)****Results: Peak / Bottom channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
9044.333	Horizontal	51.9	54.0	2.1	Complied
12536.417	Vertical	53.1	54.0	0.9	Complied

**Results: Peak / Middle channel**

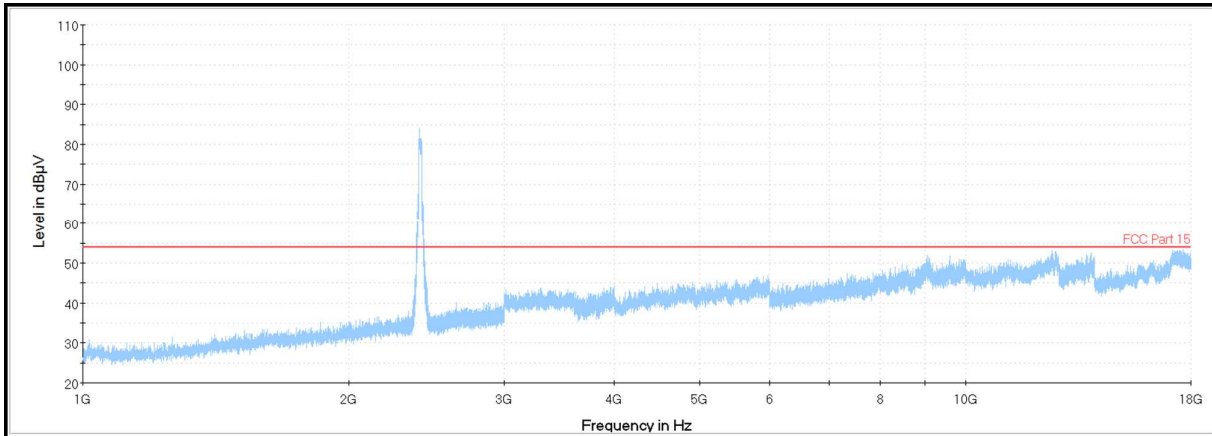
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
9966.000	Horizontal	51.7	54.0	2.3	Complied
12679.875	Horizontal	53.6	54.0	0.4	Complied

**Results: Peak / Top channel**

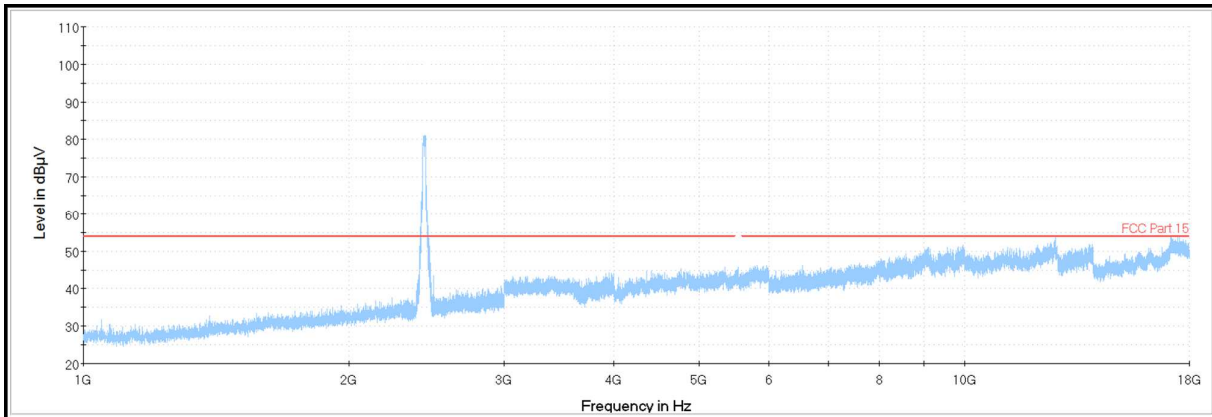
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
9065.333	Horizontal	51.3	54.0	2.7	Complied
12672.083	Vertical	54.0	54.0	0.0	Complied

**Transmitter Radiated Emissions (continued)**

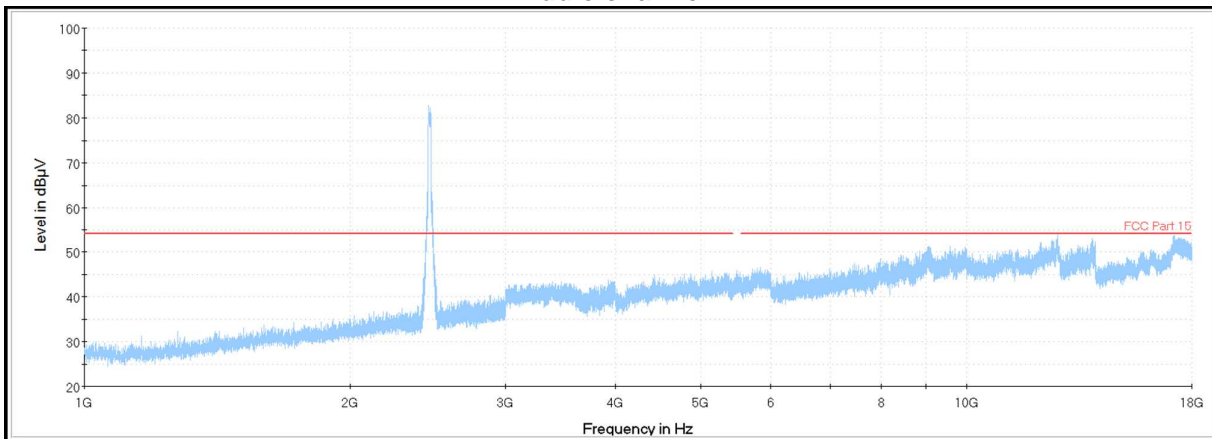
**Transmitter Spurious Emissions (Radiated) Plot from 1 GHz to 18 GHz**



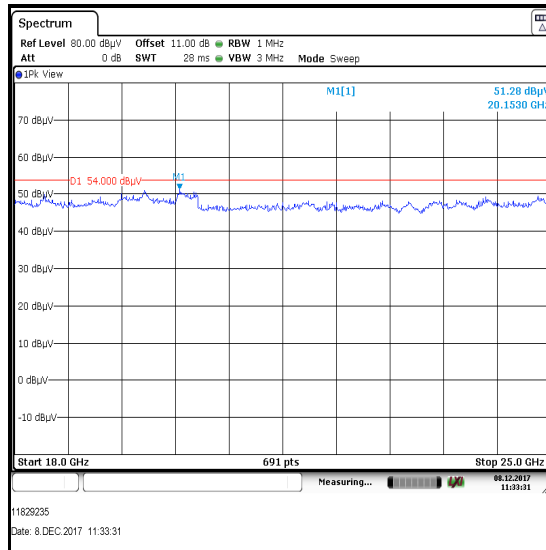
**Bottom channel**



**Middle channel**



**Top channel**

**Transmitter Radiated Emissions (continued)****Transmitter Spurious Emissions (Radiated) Plot from 18 GHz to 26 GHz**

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

### 5.2.7. Transmitter Band Edge Radiated Emissions

#### Test Summary:

Test Engineer:	Abdoufataou Salifou	Test Date:	16 November 2017, 28 November 2017 & 29 January 2018
Test Sample Serial Number:	WAAZ000217 with connected antenna		
Test Site Identification	SR 1/2		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10 & FCC KDB 558074 Sections 11 & 12

#### Environmental Conditions:

Temperature (°C):	23.2
Relative Humidity (%):	24

#### Note(s):

1. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and widest bandwidths were:

- 802.11b – DQPSK / 5.5 Mbps
- 802.11g – BPSK / 9 Mbps
- 802.11n HT20 SISO – QPSK / 14.4 Mbps / MCS1
- 802.11n HT40 SISO – BPSK / 15 Mbps / MCS0

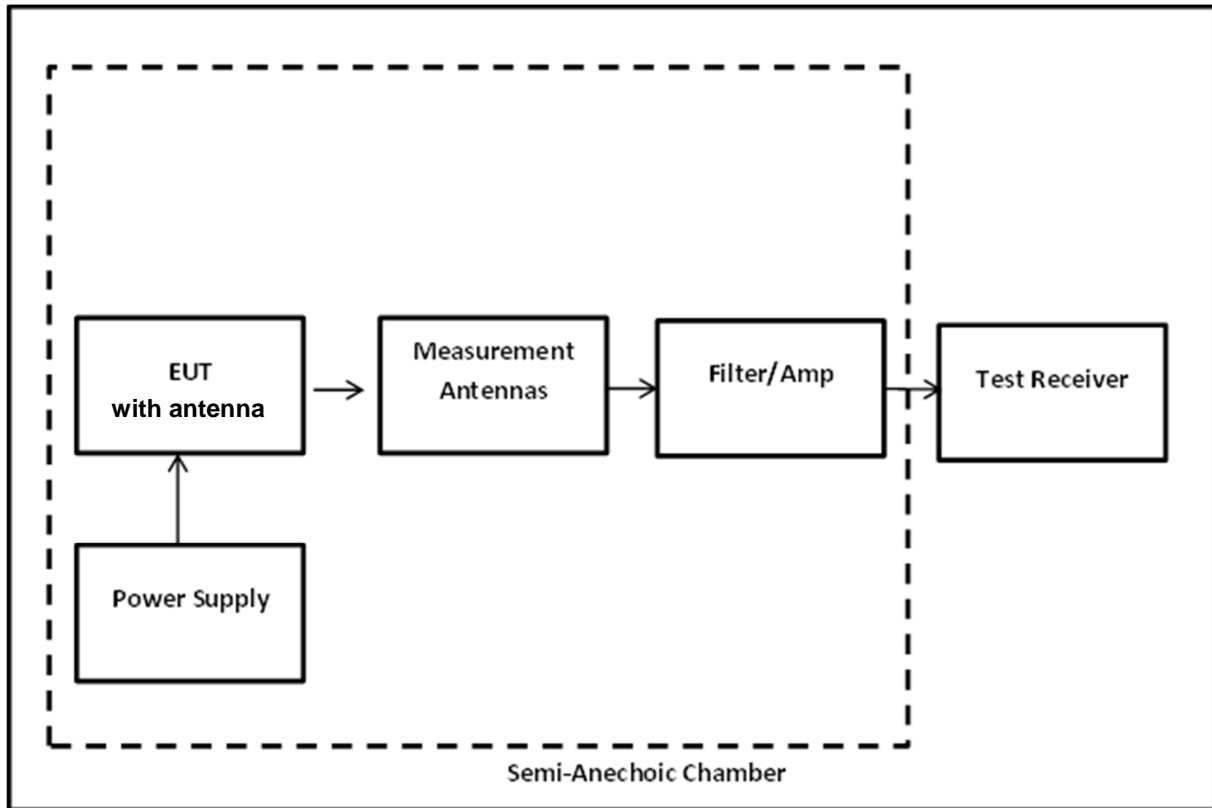
Final measurements were performed with the above configurations.

2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. The maximum conducted (average) output power was previously measured. In accordance with FCC KDB 558074 Section 11.1(b), the lower band edge measurement should be performed with a peak detector and the -30 dBc limit applied.
4. As the lower band edge falls within 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 30 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.
5. 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.
6. The restricted band plot for 2310 MHz to 2390 MHz can be found under the results for 802.11g / 9 Mbps

as this mode had the highest output power and was therefore deemed worst case.

### **Transmitter Band Edge Radiated Emissions (continued)**

#### **Test Setup:**



**Transmitter Band Edge Radiated Emissions (continued)****Results: Peak / 802.11b / 20 MHz / DQPSK / 5.5 Mbps****Results: Lower Band Edge**

Frequency (MHz)	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2397.035	54.2	69.0	14.8	Complied
2400	50.2	69.0	18.8	Complied

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

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	48.9	74.0	25.1	Complied
2500.888	50.3	74.0	23.7	Complied

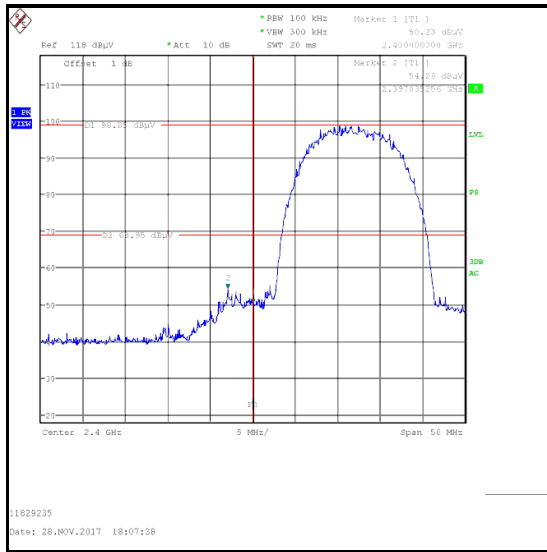
**Results: Upper Band Edge / Restricted Band / Average**

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.3	54.0	13.7	Complied
2496.561	41.4	54.0	12.6	Complied

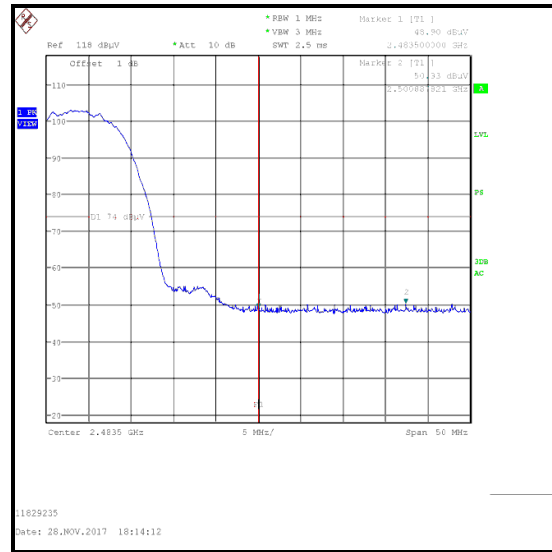
**Result: Pass**

## Transmitter Band Edge Radiated Emissions (continued)

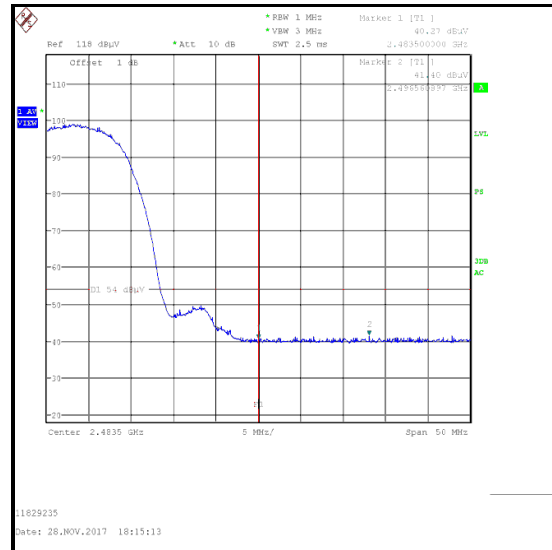
**Results: Peak / 802.11b / 20 MHz / DQPSK / 5.5 Mbps**



**Lower Band Edge Peak Measurement**



**Upper Band Edge Peak Measurement**



**Upper Band Edge Average Measurement**



**Transmitter Band Edge Radiated Emissions (continued)****Results: Peak / 802.11g / 20 MHz / BPSK / 9 Mbps****Results: Lower Band Edge**

Frequency (MHz)	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2398.478	67.4	68.4	1.0	Complied
2400	64.0	68.4	4.4	Complied

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

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	69.7	74.0	4.3	Complied

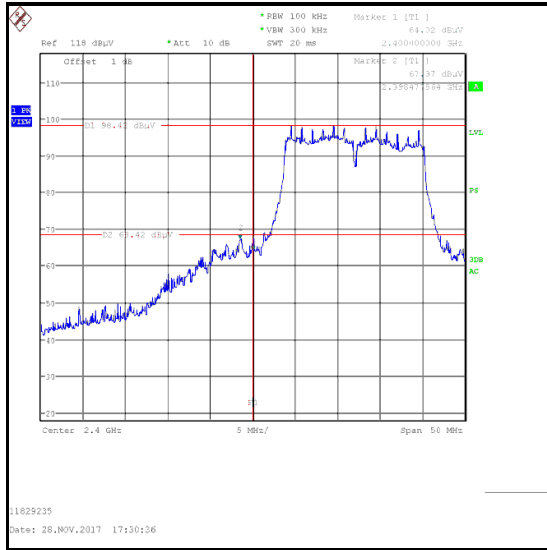
**Results: Upper Band Edge / Restricted Band / Average**

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	51.9	54.0	2.1	Complied
2483.901	52.5	54.0	1.5	Complied

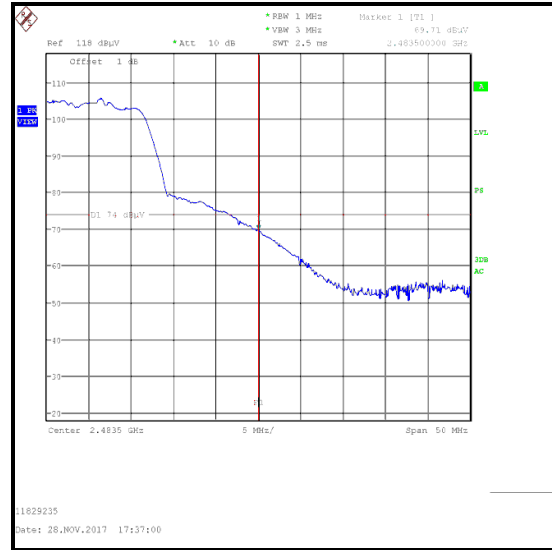
**Result: Pass**

## Transmitter Band Edge Radiated Emissions (continued)

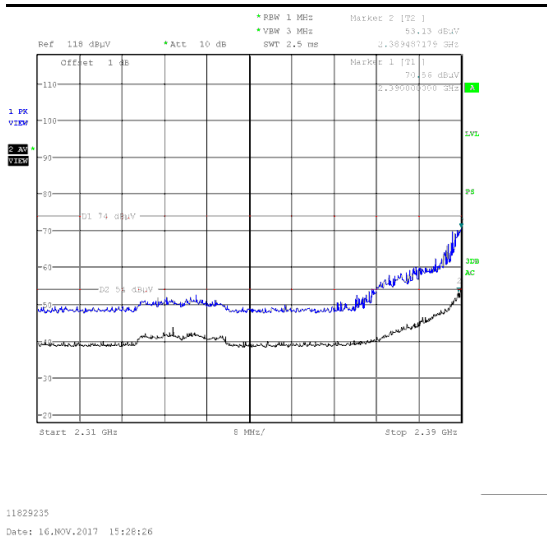
Results: Peak / 802.11g / 20 MHz / BPSK / 9 Mbps



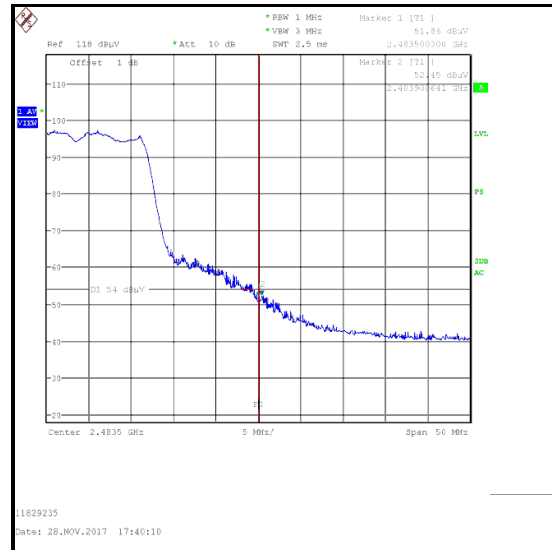
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Average Measurement

**Transmitter Band Edge Radiated Emissions (continued)****Results: Peak / 802.11n HT20 / QPSK / MCS1****Results: Lower Band Edge**

Frequency (MHz)	Level (dBµV/m)	-30 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.760	62.8	68.0	5.2	Complied
2400	60.4	68.0	7.6	Complied

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

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	65.4	74.0	8.6	Complied
2483.901	66.3	74.0	7.7	Complied

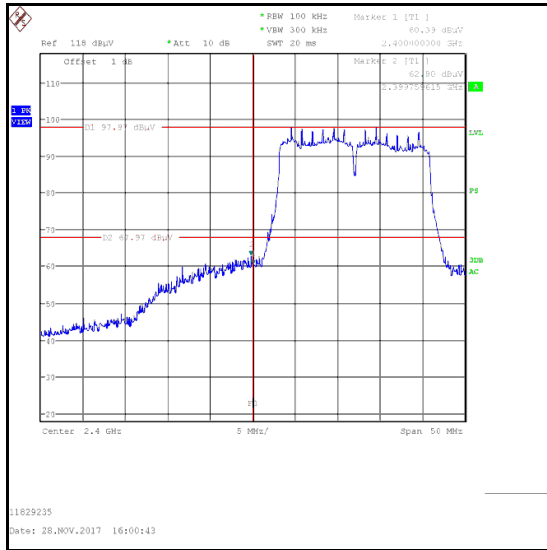
**Results: Upper Band Edge / Restricted Band / Average**

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	51.3	54.0	2.7	Complied
2483.740	52.6	54.0	1.4	Complied

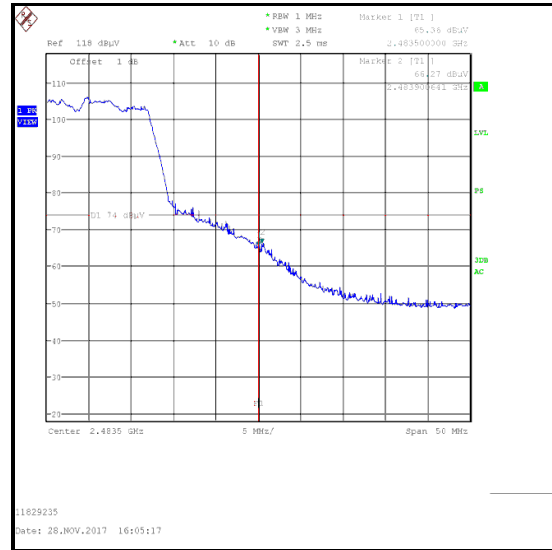
**Result: Pass**

## Transmitter Band Edge Radiated Emissions (continued)

### Results: Peak / 802.11n HT20 / QPSK / MCS1



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

**Transmitter Band Edge Radiated Emissions (continued)****Results: 802.11n / HT40 / BPSK / MCS0****Results: Lower Band Edge**

Frequency (MHz)	Level (dBμV/m)	-30 dBc Limit (dBμV/m)	Margin (dB)	Result
2400	51.6	62.55	10.95	Complied

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

Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2483.5	67.01	74.0	6.99	Complied
2508.0	70.09	74.0	3.91	Complied

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

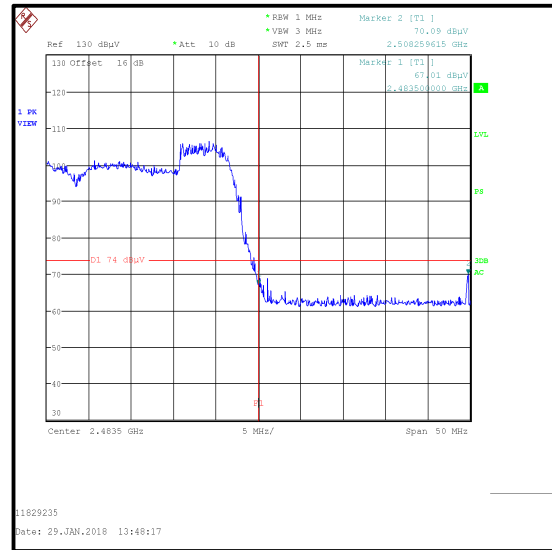
Frequency (MHz)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2484.7	53.62	54.0	0.38	Complied
2483.5	48.7	54.0	5.30	Complied

## Transmitter Band Edge Radiated Emissions (continued)

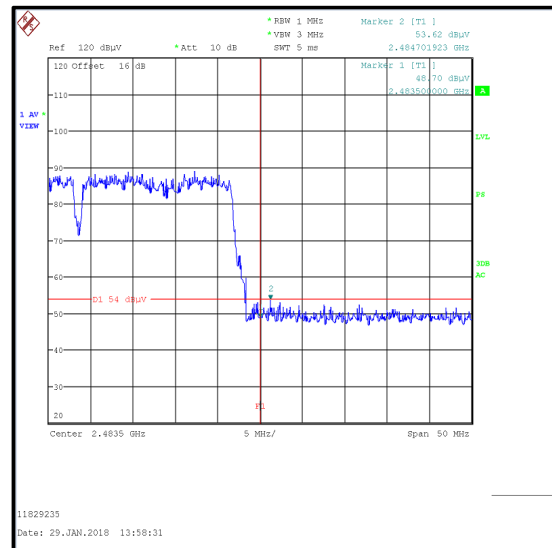
**Results: 802.11n / HT40 / BPSK / MCS0**



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



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	Confidence Level (%)	Calculated Uncertainty
Conducted Maximum Peak Output Power	95%	$\pm 0.59$ dB
Radiated Spurious Emissions	95%	$\pm 3.10$ dB
Band Edge Radiated Emissions	95%	$\pm 3.10$ dB
Transmitter Duty Cycle	95%	$\pm 3.4\%$
Minimum 6 dB Bandwidth	95%	$\pm 0.87\%$
99% Emission Bandwidth	95%	$\pm 0.87\%$
Spectral Power Density	95%	$\pm 0.59$ 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
1	Rohde & Schwarz	Antenna, Loop	HFH2-Z2	831247/012	8/5/2016	36
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	7/12/2017	12
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
383	Rohde & Schwarz	Antenna, Rod	HFH2-Z1	890151/11	7/14/2017	24
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	055929	7/12/2017	12
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	24
425	Agilent	Generator, CW Signal	E8247C	MY43320849	7/19/2016	24
426	Agilent	Spectrum Analyzer	E4446A	US44020316	7/20/2016	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	7/20/2016	24
495	Rohde & Schwarz	Antenna, Log.- Periodical	HL050	100296	7/20/2016	24
496	Rohde & Schwarz	Antenna, log. - periodical	HL050	100297	7/20/2016	24
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	7/12/2017	12
607	Schwarzbeck	Antenna broadband horn antenna	BBHA 9170	9170-561	7/28/2016	24
608	Rohde & Schwarz	Switch Matrix	OSP 120	101227	4/8/2014	60
363	Wainwright	Notch Filter GSM900	WW-NF9	100002	Lab verification	n/a
611	Wainwright Instruments	Band Reject Filter DL LTE	WRCGV8-	1	Lab verification	n/a
612	Wainwright Instruments	Band Reject Filter UL LTE	WRCGV8-	1	Lab verification	n/a
613	Wainwright Instruments	Band Reject Filter WLAN/ BT	WRCTF12-	1	Lab verification	n/a
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	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
424	EMCO	Antenna, Horn	EMCO 3116	00046537	7/28/2016	24
472	Rohde & Schwarz	Generator, Vektorsignal	SMU200A	102409	7/11/2017	12
592	Rohde & Schwarz	Wideband Radio Communication tester	CMW 500	119593	8/15/2017	12
622	Rohde & Schwarz	Step Attenuator	RSC	101904	7/13/2017	12
625	Schwarzbeck	Antenna, H-field	HFSL 7101	109	Verification - only relative measurements	n/a
626	Rohde & Schwarz	Bluetooth Tester	CBT	100481	Signaling Only	24
635	Rohde & Schwarz	Signal generator	SMB100A	179875	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
423	Bonn Elektronik	Amplifier, Low Noise Pre	BLMA 1840-1A	55929	7/21/2016	24
451	Rohde & Schwarz	Power Meter, Dual Channel	NRVD	101190	7/10/2017	12
427	Rohde & Schwarz	Probe, Power Sensor	NRV-Z5	1019	7/11/2017	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

## 8. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	61	-	Initial Version
1.1	4	1	Applicant and Manufacturer changed (from Karlsruhe to Kerpen)
1.2	1,6	3	Model number changed
1.3	15,27,37	5	Updated channel frequency and plots
1.4	1,6	3	Model number changed
1.5	7	3.5	Added antenna information
1.6	4.2	9	Added clarification regarding antenna termination
	53,54	5.2.7	Added that antenna was used for Band Edge measurements

--- END OF REPORT ---