



# TEST REPORT

**Test Report No. : UL-RPT-RP11373196JD02A**

**Manufacturer** : ALBRECHT JUNG GmbH & CO. KG  
**Model No.** : ZLLS5004M-01  
**FCC ID** : 2AJR7ZLLS5004M01  
**Technology** : ZigBee (IEEE 802.15.4)  
**Test Standard(s)** : FCC Parts 15.209(a) & 15.247

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. This sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

**Date of Issue:**

05 January 2017

**Checked by:**

Ian Watch  
Senior Engineer, Radio Laboratory

**Company Signatory:**

Sarah Williams  
Senior Engineer, Radio Laboratory  
UL VS LTD



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

---

**UL VS LTD**

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK  
Telephone: +44 (0)1256 312000  
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

**Table of Contents**

<b>1. Customer Information.....</b>	<b>4</b>
<b>2. Summary of Testing.....</b>	<b>5</b>
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
<b>3. Equipment Under Test (EUT) .....</b>	<b>6</b>
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	7
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>8</b>
4.1. Operating Modes	8
4.2. Configuration and Peripherals	8
<b>5. Measurements, Examinations and Derived Results.....</b>	<b>9</b>
5.1. General Comments	9
5.2. Test Results	10
5.2.1. Transmitter Minimum 6 dB Bandwidth	10
5.2.2. Transmitter Maximum Peak Output Power	13
5.2.3. Transmitter Radiated Emissions	16
5.2.4. Transmitter Band Edge Radiated Emissions	23
<b>6. Measurement Uncertainty .....</b>	<b>27</b>
<b>7. Report Revision History .....</b>	<b>28</b>

## **1. Customer Information**

<b>Company Name:</b>	ALBRECHT JUNG GmbH & CO. KG
<b>Address:</b>	Volmestrasse 1 Schalksmuehle 58579 Germany

## 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) – Section 15.209
<b>Site Registration:</b>	209735
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	26 October 2016 to 13 November 2016

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	✓
Part 15.247(e)	Transmitter Power Spectral Density	Note 1
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	✓
Part 15.247(d)/15.209(a)	Transmitter Radiated Emissions	✓
Part 15.247(d)/15.209(a)	Transmitter Band Edge Radiated Emissions	✓
<b>Key to Results</b>		
 = Complied	 = Did not comply	

#### Note(s):

1. In accordance with FCC KDB 558074 Section 10.1, PSD measurements are 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 equal to the measured total output power.

### 2.3. Methods and Procedures

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
<b>Reference:</b>	KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016
<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>Brand Name:</b>	ZigBee radio transmitter module 4-gang
<b>Model Name or Number:</b>	ZLLLS5004M-01
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Radiated Sample</i> )
<b>Hardware Version:</b>	V00
<b>Software Version:</b>	V00
<b>FCC ID:</b>	2AJR7ZLLS5004M01

<b>Brand Name:</b>	ZigBee radio transmitter module 4-gang
<b>Model Name or Number:</b>	ZLLLS5004M-01
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Conducted RF Sample</i> )
<b>Hardware Version:</b>	V00
<b>Software Version:</b>	V00
<b>FCC ID:</b>	2AJR7ZLLS5004M01

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

The Equipment Under Test was a 4-gang, wall-mounted, remote control for control of lighting using ZigBee Light Link. The EUT contains 2.4 GHz ZigBee with integral antenna. It is powered from a lithium CR2450N battery.

#### **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>	IEEE 802.15.4 (Digital Transmission System)		
<b>Type of Unit:</b>	Transceiver		
<b>Modulation:</b>	O-QPSK		
<b>Data Rate:</b>	250 kbit/s		
<b>Power Supply Requirement(s):</b>	Nominal	3.0 VDC	
<b>Antenna Gain:</b>	2.2 dBi		
<b>Transmit Frequency Range:</b>	2405 MHz to 2480 MHz		
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	Bottom	11	2405
	Middle	18	2440
	Top	26	2480

### **3.5. Support Equipment**

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

<b>Description:</b>	IPDA development board with ribbon cable
<b>Brand Name:</b>	Not marked or stated
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	Laptop Computer
<b>Brand Name:</b>	Dell
<b>Model Name or Number:</b>	Latitude E5410
<b>Serial Number:</b>	UL VS LTD Asset Number 00763

<b>Description:</b>	USB type A to Micro B cable, length 1 metre
<b>Brand Name:</b>	Motorola
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	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 at maximum power on the bottom, middle and top channels as required.

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

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

- Controlled using an Atmel Studio 6.2.121.0 application installed on a laptop PC. The application was used to enable continuous transmission mode and to select the test channels following instructions provided by the customer in 'Start-up guide.PDF' dated 08 August 2016.
- In order for the EUT to communicate to the Atmel test tool, an IPDA development board was connected via a ribbon cable. The development board was connected to the laptop via a USB cable. Once the EUT had been configured, the ribbon cable was disconnected and the EUT continued to transmit in test mode.
- The EUT was powered by a 3.0 Volt CR2450N battery. The voltage was monitored with a calibrated digital voltmeter.
- Radiated spurious emissions were performed with the EUT in its worst case orientation/position and with the EUT in its normal configuration with no ancillaries attached.
- The EUT conducted sample was used for 6 dB bandwidth and maximum peak output power tests.
- The EUT radiated sample was used for all other tests.

## **5. Measurements, Examinations and Derived Results**

### **5.1. General Comments**

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

In accordance with UKAS 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>	Andrew Edwards	<b>Test Date:</b>	26 October 2016
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Conducted RF Sample</i> )		

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

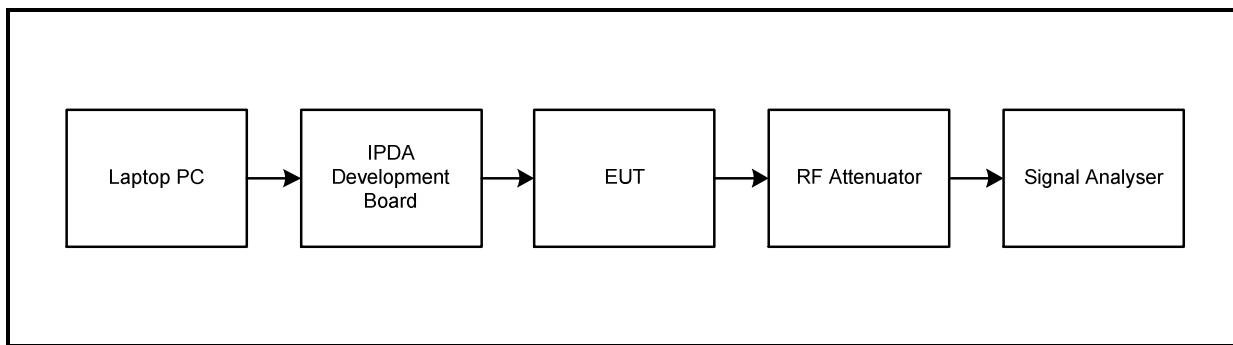
#### **Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	50

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

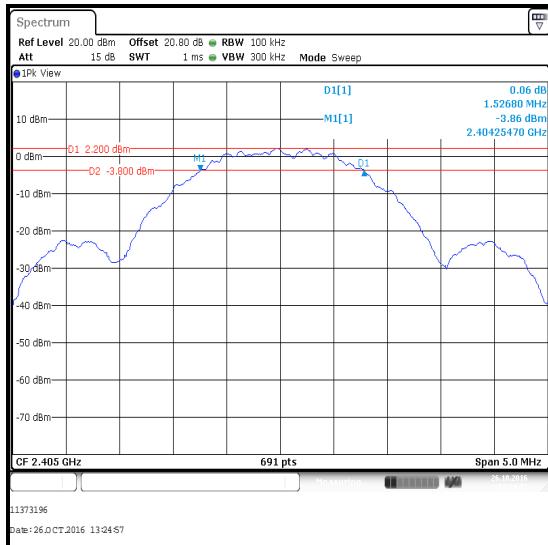
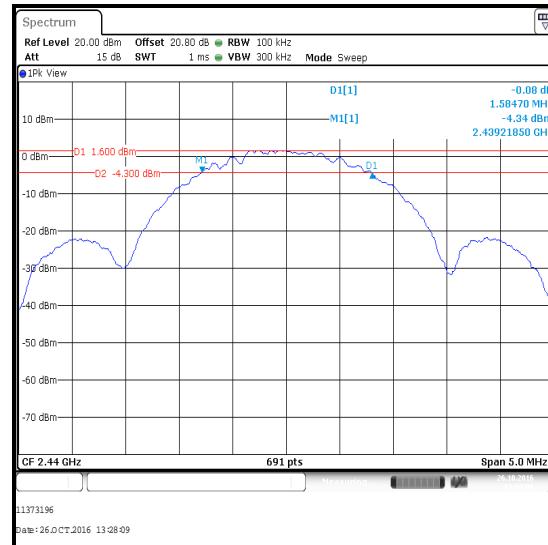
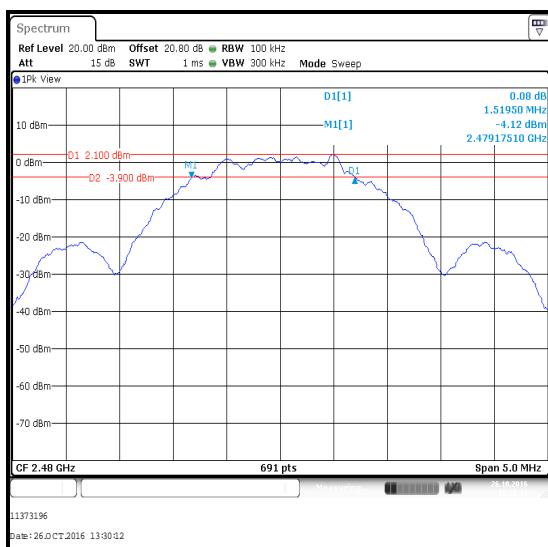
1. 6 dB DTS bandwidth tests were performed using a signal analyser in accordance with FCC KDB 558074 Section 8.1 Option 1 measurement procedure. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal.
2. The signal 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	1526.800	≥500	1026.800	Complied
Middle	1584.700	≥500	1084.700	Complied
Top	1519.500	≥500	1019.500	Complied

**Bottom Channel****Middle Channel****Top Channel**

**Transmitter Minimum 6 dB Bandwidth (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2001	Thermohygrometer	Testo	608-H1	45041824	02 Apr 2017	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	27 Jun 2017	12
A2526	Attenuator	AtlanTecRF	AN18W5-20	832828#1	Calibrated before use	-
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	11 Apr 2018	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	15 Apr 2018	24
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	10 May 2019	36

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

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	26 October 2016
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Conducted RF Sample</i> )		

<b>FCC Reference:</b>	Part 15.247(b)(3)
<b>Test Method Used:</b>	FCC KDB 558074 Section 9.1.1

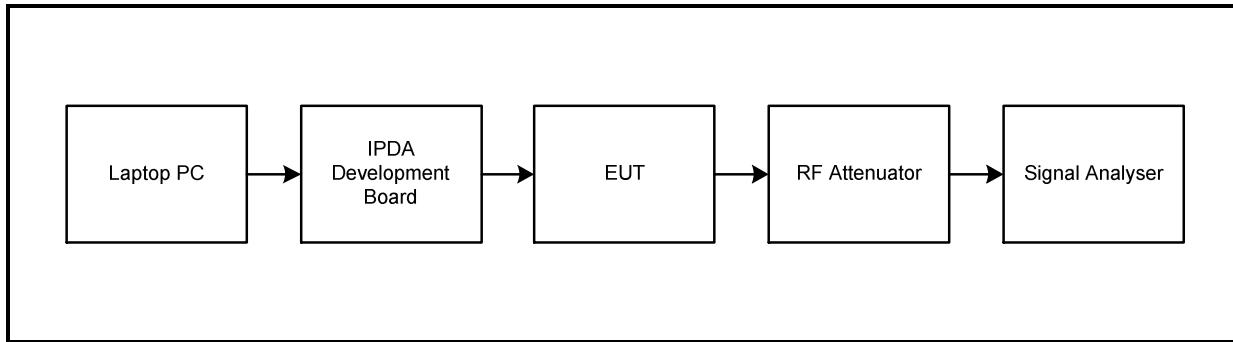
#### **Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	50

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

1. Conducted power tests were performed using a signal analyser in accordance with FCC KDB 558074 Section 9.1.1 Measurement Procedure.
2. The signal analyser resolution bandwidth was set to 3 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 10 MHz. A marker was placed at the peak of the signal and the results recorded in the table below.
3. The 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 spectrum analyser to compensate for the loss of the attenuator and RF cable.
4. The conducted power was added to the declared antenna gain to obtain the EIRP.

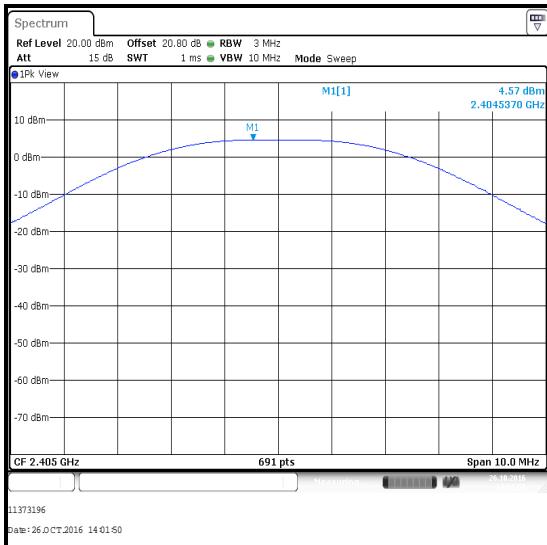
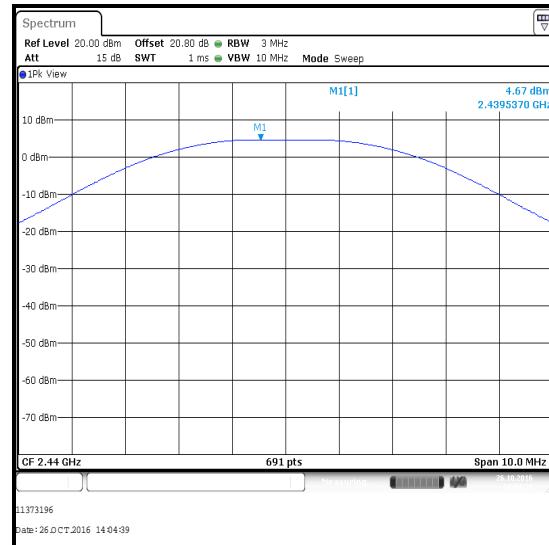
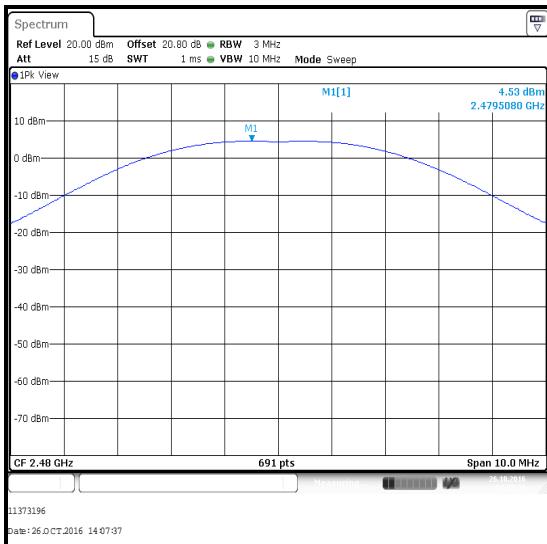
#### **Test setup:**



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

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	4.6	30.0	25.4	Complied
Middle	4.7	30.0	25.3	Complied
Top	4.5	30.0	25.5	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	4.6	2.2	6.8	36.0	29.2	Complied
Middle	4.7	2.2	6.9	36.0	29.1	Complied
Top	4.5	2.2	6.7	36.0	29.3	Complied

**Transmitter Maximum Peak Output Power (continued)****Bottom Channel****Middle Channel****Top Channel****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2001	Thermohygrometer	Testo	608-H1	45041824	02 Apr 2017	12
M1873	Signal Analyser	Rohde & Schwarz	FSV30	103074	27 Jun 2017	12
A2526	Attenuator	AtlanTecRF	AN18W5-20	832828#1	Calibrated before use	-
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	11 Apr 2018	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	15 Apr 2018	24
G0607	Signal Generator	Rohde & Schwarz	SMU200A	100943	10 May 2019	36

### **5.2.3. Transmitter Radiated Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Mark Perry	<b>Test Date:</b>	13 November 2016
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Radiated Sample</i> )		

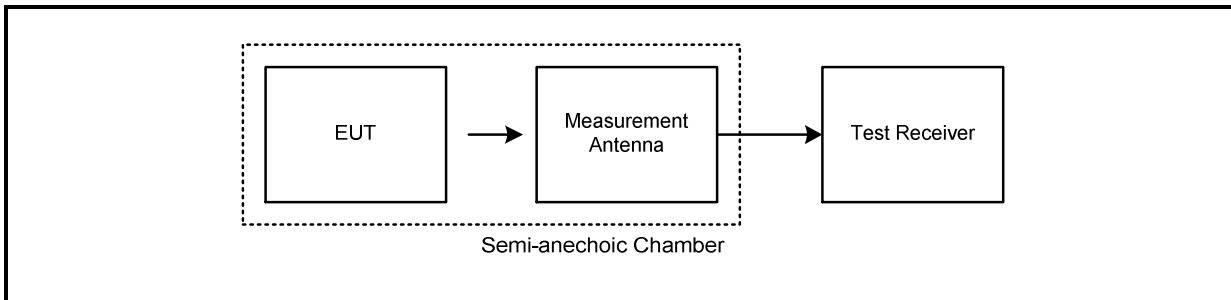
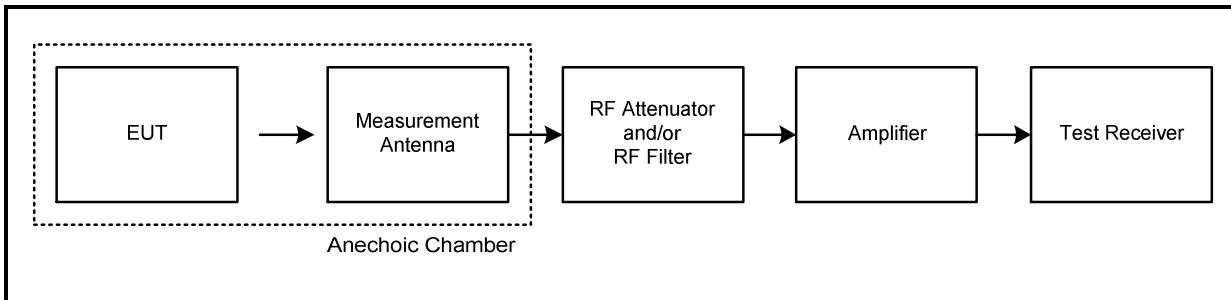
<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range</b>	30 MHz to 1000 MHz

#### **Environmental Conditions:**

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

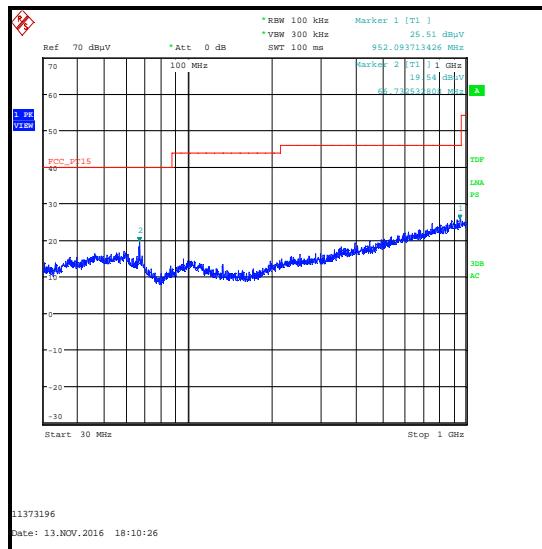
#### **Note(s):**

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. 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.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) 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 for radiated measurements:****Radiated Measurements < 1GHz****Radiated Measurements > 1GHz**

**Transmitter Radiated Emissions (continued)****Results: Middle Channel**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
952.094	Vertical	25.5	54.0	28.5	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	06 May 2017	12

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

<b>Test Engineers:</b>	David Doyle & Andrew Edwards	<b>Test Dates:</b>	27 October 2016 & 31 October 2016
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Radiated Sample</i> )		

<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>	23 to 24
<b>Relative Humidity (%):</b>	45 to 46

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plots were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. The emission shown on the 1 GHz to 3 GHz plot is the EUT fundamental.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. \*Emissions in restricted bands: In accordance with C63.10 section 6.6.4.3, Note 1, where the peak detected amplitude was shown to comply with the average limit, an average measurement was not performed.

**Transmitter Radiated Emissions (continued)****Results: Bottom Channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4810.849	Horizontal	47.3*	54.0	6.7	Complied

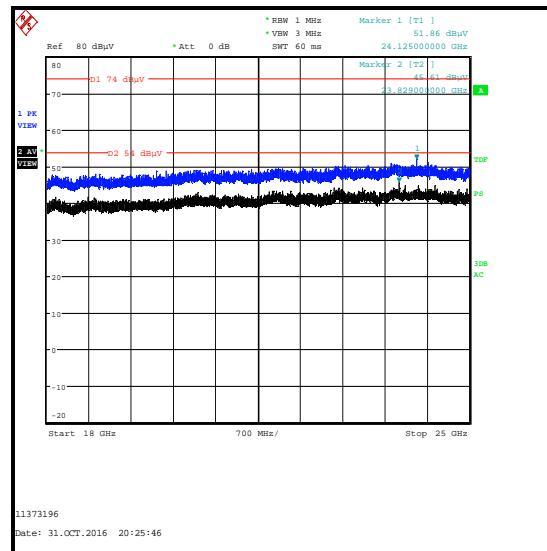
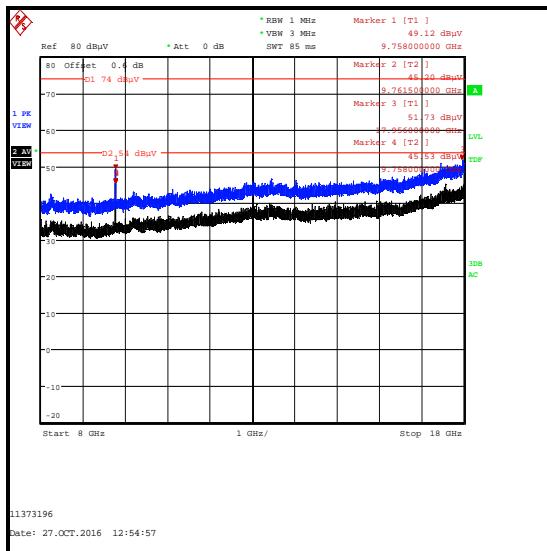
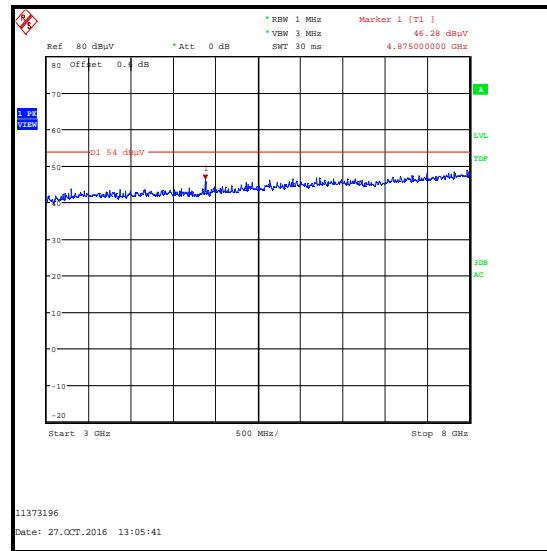
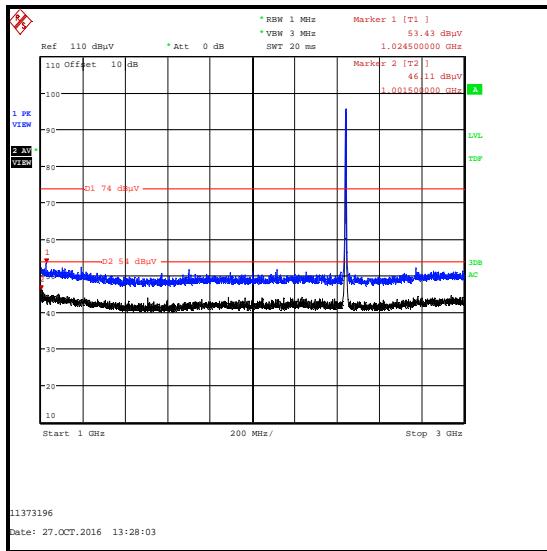
**Results: Middle Channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4878.934	Horizontal	48.8*	54.0	5.2	Complied

**Results: Top Channel**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
4961.073	Horizontal	50.9*	54.0	3.1	Complied

## Transmitter Radiated Emissions (continued)



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

**Transmitter Radiated Emissions (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	02 Apr 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
A436	Antenna	Flann Microwave	20240-20	330	19 Dec 2016	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2863	Pre Amplifier	Agilent	8449B	3008A02100	07 Jan 2017	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	07 Apr 2017	12
A2890	Antenna	Schwarzbeck	HWRD 750	014	06 May 2017	12
A2891	Pre Amplifier	Schwarzbeck	BBV 9718	9718-306	07 Apr 2017	12
A2914	High Pass Filter	AtlanTecRF	AFH-03000	2155	19 May 2017	12
A2947	High Pass Filter	AtlanTecRF	AFH-07000	1601900001	01 Jun 2017	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	19 May 2017	12
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12

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

#### **Test Summary:**

<b>Test Engineer:</b>	David Doyle	<b>Test Date:</b>	27 October 2016
<b>Test Sample Serial Number:</b>	Not marked or stated ( <i>Radiated Sample</i> )		

<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.10.4, 6.10.5 & KDB 558074 Section 11 & 13

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	43

#### **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 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.
3. As the lower band edges fall within non-restricted bands, 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 peak conducted output power was measured using a peak detector in accordance with FCC KDB 558074 Section 9.1.1 an out-of-band limit line was placed 20 dB below the peak level (FCC KDB 558074 Section 11.1(a)). 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.
4. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 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.
5. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.
6. \*Emissions in restricted bands: In accordance with C63.10 Section 6.6.4.3, Note 1, where the peak detected amplitude was shown to comply with the average limit, an average measurement was not performed.
7. \*\*The final upper band edge average measurement was performed using the integration method stated in FCC KDB 558074 Section 13.3.1 and the result was compliant.

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

Frequency (MHz)	Level (dB $\mu$ V/m)	-20 dBc Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.000	52.9	72.7	19.8	Complied

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

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	66.1	74.0	7.9	Complied

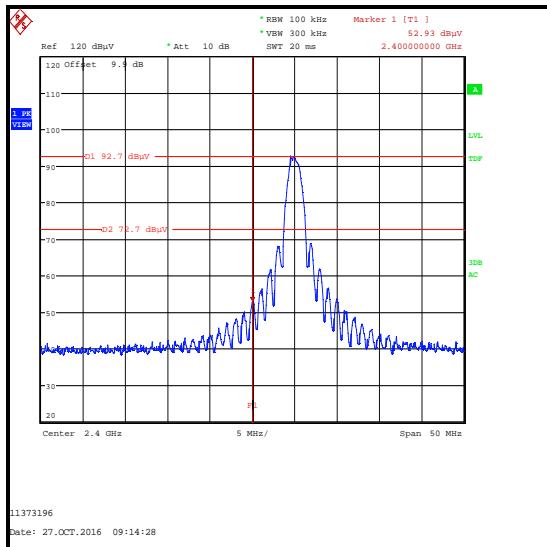
**Results: Upper Band Edge / Restricted Band / Average**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.500	53.9**	54.0	0.1	Complied

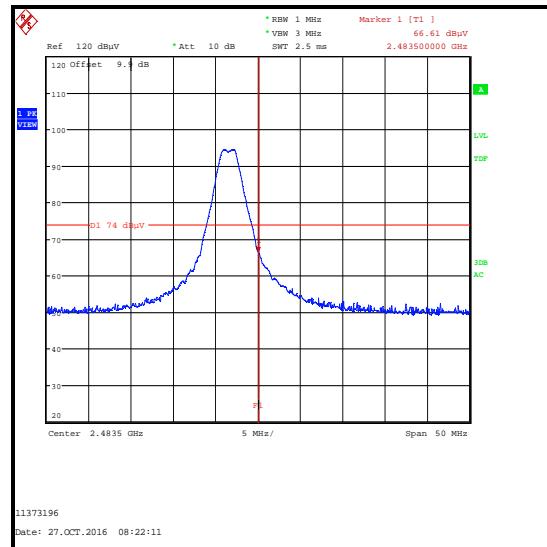
**Results: 2310 to 2390 MHz Restricted Band**

Frequency (MHz)	Peak Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Margin (dB)	Result
2314.744	52.2*	54.0	1.8	Complied

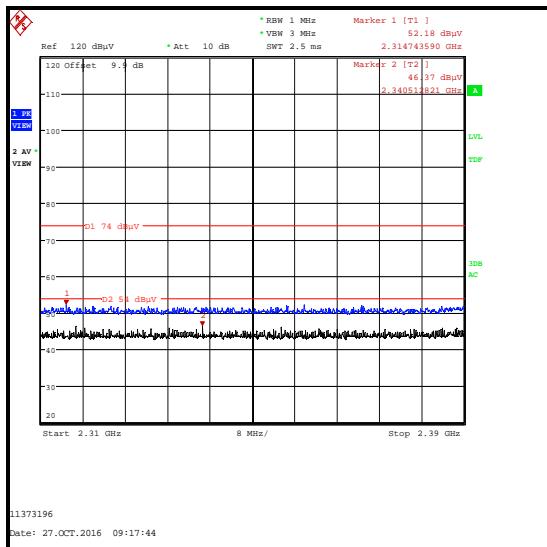
## Transmitter Band Edge Radiated Emissions (continued)



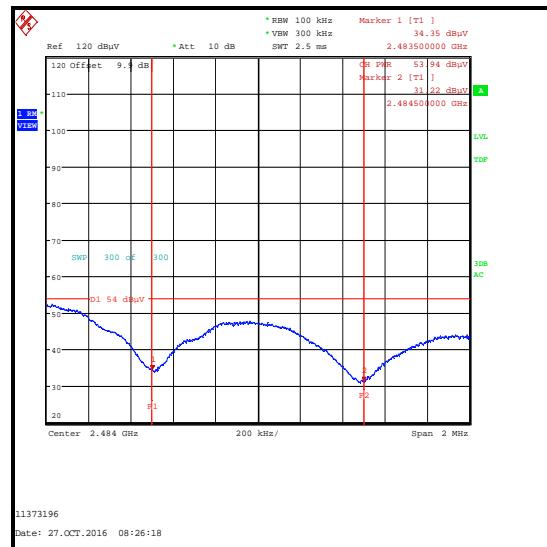
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band



Upper Band Edge Average / Integrated

**Transmitter Band Edge Radiated Emissions (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2889	Antenna	Schwarzbeck	BBHA 9120 B	BBHA 9120 B 653	07 Apr 2017	12
A2863	Pre-Amplifier	Agilent	8449B	3008A02100	07 Jan 2017	12
A2916	Attenuator	AtlanTecRF	AN18W5-10	832827#1	19 May 2017	12

## **6. Measurement Uncertainty**

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

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
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Minimum 6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	1 GHz to 26.5 GHz	95%	±2.94 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. Report Revision History**

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

**--- END OF REPORT ---**