



# TEST REPORT

**Test Report No. : UL-RPT-RP10895558JD02C V2.0**

**Manufacturer** : Bang & Olufsen a/s  
**Model No.** : WUS-AC08V  
**FCC ID** : TTUWUSAC08V  
**Technology** : *Bluetooth* – Basic Rate & EDR  
**Test Standard(s)** : FCC Parts 15.207, 15.209(a) & 15.247

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2. The results in this report apply only to the sample(s) tested.
3. The 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 2.0 supersedes all previous versions.

**Date of Issue:** 19 December 2016

**Checked by:**

Sarah Williams  
Engineer, Radio Laboratory

**Company Signatory:**

Ian Watch  
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.

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## **UL VS LTD**

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## **1. Customer Information**

<b>Company Name:</b>	Bang & Olufsen A/S
<b>Address:</b>	Peter Bangs Vej 15 7600 Struer Denmark

## 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>	47CFR15.207 and 47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
<b>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>	20 October 2015 to 18 May 2016

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(1)	Transmitter 20 dB Bandwidth	✓
Part 15.247(a)(1)	Transmitter Carrier Frequency Separation	✓
Part 15.247(a)(1)(iii)	Transmitter Number of Hopping Frequencies and Average Time of Occupancy	✓
Part 15.247(b)(1)	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	

### 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>	FCC KDB 174176 D01 Line Conducted FAQ v01r01 June 3, 2015
<b>Title:</b>	AC Power-Line Conducted Emissions Frequently Asked Questions

### 2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

### **3. Equipment Under Test (EUT)**

#### **3.1. Identification of Equipment Under Test (EUT)**

<b>Brand Name:</b>	WUS-AC08V
<b>Model Name or Number:</b>	WUS-AC08V
<b>Test Sample MAC address:</b>	542AA22F8F19 ( <i>Conducted sample</i> )
<b>Hardware Version:</b>	A1G
<b>Software Version:</b>	4.2.3.5
<b>FCC ID:</b>	TTUWUSAC08V

#### **3.1.1 Host Product Details**

<b>Brand Name:</b>	BeoVision Avant 55 NG
<b>Model Name or Number:</b>	BeoVision Avant 55 NG
<b>Test Sample Serial Number:</b>	92777 ( <i>Radiated sample</i> )
<b>Hardware Version:</b>	8009004
<b>Software Version:</b>	7.77

<b>Description:</b>	AC power 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

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

The equipment under test was a *Bluetooth Basic Rate + EDR, Bluetooth Low Energy, IEEE 802.11a,b,g,n,ac* WLAN module operating in the 2.4 GHz and 5 GHz bands, which was incorporated into a 55" Television. The EUT has two external antenna ports with two transmit chains and MIMO is supported. For 802.11a/g/n/ac operation the device uses two by two MIMO transmitters. Depending on the 802.11 data rate, the device transmits 1 or 2 spatial stream. The device uses spatial multiplexing and from an RF point of view the streams are correlated.

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

No modifications were applied to the EUT during testing.

### **3.4. Additional Information Related to Testing**

<b>Tested Technology:</b>	<i>Bluetooth</i>				
<b>Power Supply Requirement(s):</b>	Nominal	Module	3.3 VDC		
	TV	120/240 VAC 60 Hz			
<b>Type of Unit:</b>	Transceiver				
<b>Channel Spacing:</b>	1 MHz				
<b>Mode:</b>	Basic Rate	Enhanced Data Rate			
<b>Modulation:</b>	GFSK	$\pi/4$ -DQPSK	8DPSK		
<b>Packet Type: (Maximum Payload):</b>	DH5	2DH5	3DH5		
<b>Data Rate (Mbps):</b>	1	2	3		
<b>Maximum Conducted Output Power:</b>	0.3 dBm				
<b>Antenna Gain:</b>	4.2 dBi				
<b>Transmit Frequency Range:</b>	2402 MHz to 2480 MHz				
<b>Transmit Channels Tested:</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>		
	Bottom	0	2402		
	Middle	39	2441		
	Top	78	2480		

### **3.5. Support Equipment**

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

<b>Description:</b>	Laptop Computer
<b>Brand Name:</b>	Lenovo
<b>Model Name or Number:</b>	T61
<b>Serial Number:</b>	L3-E7586 07/11

<b>Description:</b>	USB Interface adaptor
<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>	USB-A to USB-B 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

**Support Equipment (continued)**

<b>Description:</b>	Remote control for 55" Television
<b>Brand Name:</b>	Bang & Olufsen a/s
<b>Model Name or Number:</b>	BeoRemote One T30
<b>Serial Number:</b>	25143484

<b>Description:</b>	External BTLE box to turn on the TV
<b>Brand Name:</b>	Alpha Network
<b>Model Name or Number:</b>	WUS-AC08V
<b>Serial Number:</b>	H11145216

<b>Description:</b>	HDMI cable. Quantity 4. Length 2m
<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>	Now TV set top box
<b>Brand Name:</b>	Sky
<b>Model Name or Number:</b>	2400SK
<b>Serial Number:</b>	1MM4DE006281

<b>Description:</b>	Now TV set top box
<b>Brand Name:</b>	Sky
<b>Model Name or Number:</b>	2400SK
<b>Serial Number:</b>	1MM4D8006255

<b>Description:</b>	HDMI media player
<b>Brand Name:</b>	SUMVISION
<b>Model Name or Number:</b>	Cyclone Micro
<b>Serial Number:</b>	SUM091104017

<b>Description:</b>	Ethernet cable. Quantity 3. Length 2m
<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

**Support Equipment (continued)**

<b>Description:</b>	Ethernet cable. Quantity 3. Length 3m
<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>	Ethernet cable. Quantity 1. Length 5m
<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>	Ethernet cable. Quantity 1. Length 10m
<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>	5 port switch
<b>Brand Name:</b>	Netgear
<b>Model Name or Number:</b>	GS605 v3
<b>Serial Number:</b>	1YG194390218E

<b>Description:</b>	5 port switch
<b>Brand Name:</b>	Netgear
<b>Model Name or Number:</b>	GS605 v3
<b>Serial Number:</b>	1YG19430021A1

<b>Description:</b>	3.5 mm Male to 2xRCA male audio 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>	Aerial cable. Quantity 1. Length 2m
<b>Brand Name:</b>	Belkin
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

**Support Equipment (continued)**

<b>Description:</b>	Freeview HD Set Top Box
<b>Brand Name:</b>	Technika
<b>Model Name or Number:</b>	STBHDIS2010
<b>Serial Number:</b>	GRTB58073912047

<b>Description:</b>	USB cable type A male to type A male. Quantity 1. Length 1.5m
<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>	USB Hub
<b>Brand Name:</b>	Belkin
<b>Model Name or Number:</b>	Not marked or stated
<b>Serial Number:</b>	Not marked or stated

<b>Description:</b>	USB extension lead. Quantity 1. Length 2m
<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>	22" HD Television
<b>Brand Name:</b>	LOGIK
<b>Model Name or Number:</b>	22FE12A
<b>Serial Number:</b>	1309020661

<b>Description:</b>	Laptop Computer
<b>Brand Name:</b>	Lenovo
<b>Model Name or Number:</b>	E555
<b>Serial Number:</b>	Not stated

<b>Description:</b>	Freeview HD Set Top Box
<b>Brand Name:</b>	Sagem
<b>Model Name or Number:</b>	251657024
<b>Serial Number:</b>	441901036882

## **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 stated maximum power on bottom, middle and top channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.
- Continuously transmitting at stated maximum power in hopping mode on all channels in Basic Rate (DH5 packets) or EDR (2DH5 or 3DH5 packets) as required.

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

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

- Transmit tests: The EUT (TV or module) was placed into *RF Test* mode using a laptop PC and the *Combo Tool* application. *Pattern* was set to Tx PRBS, *Packet type* was set to DH5, 2DH5 or 3DH5 as required. *Data length* was the default maximum allowed for each packet type. The EUT was set to a particular single test channel, or hopping mode, as required.
- Controlled using a test application, *WCN Combo Tool* (version 2.1434.00, build Aug 18, 2014) by MediaTek Inc, supplied by the customer. The relevant instructions for using the tool on the EUT were contained within the document *MT7662 BT tool user manual v0\_20141204.pdf*.
- Transmit tests: The continuous transmit power level was set on the test application. *Tx Power Level* was set to 5 for all tests, at the request of the customer.
- Both EDR/Basic rate modes were compared and tests were performed with the mode that presented the worst case result. For output power, bandwidth, band edge and channel separation, all modes were tested.
- For all conducted measurements the EUT, being the module, was connected to a DC power supply and powered by 3.3 VDC. The module consisted of a PCB fitted with an 8-pin in-line connector. The customer supplied a bespoke USB adaptor assembly that allowed a USB-B socket to interface to the 8-pin connector. Additionally the USB adaptor was fitted with two flying leads that connected to an external laboratory power supply to provide DC voltage to the EUT.
- For all radiated measurements the EUT, being the TV, was connected to 120 or 240 VAC 60 Hz depending on the test case. The customer had fitted a USB cable to the module that was inside the TV. This was used to place the TV into test mode as required.
- The customer supplied UFL micro-coax to SMA RF cables with the EUT in order to perform conducted measurements. This additional path loss was measured in band as 0.7 dB, and was included in any path loss calculations.
- The module did not have an internal integral antenna but was fitted with a UFL antenna connector. All radiated measurements were performed with the module placed in its end host device, the 55" television.
- Radiated measurements: In order to operate the EUT the TV needed to be enabled. This was done by turning on the TV and pairing it with T30 remote control with the external BTLE box which was connected to the TV. The BTLE box had a 0.83m cable with a USB type A male connector. Once the TV was enabled, the EUT could be controlled using the WCN Combo Tool application.
- For all radiated tests the support equipment was used to terminate all active ports.
- The conducted sample with MAC address 542AA22F8F19 was used for 20 dB bandwidth, carrier frequency separation, number of hopping frequencies and average time of occupancy and maximum peak output power tests.
- The radiated sample with serial number 92777 was used for AC conducted emission and radiated emissions tests.

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

### **5.1. General Comments**

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

In accordance with 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 AC Conducted Spurious Emissions**

#### **Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	04 April 2016
Test Sample Serial Number:	92777		

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

#### **Environmental Conditions:**

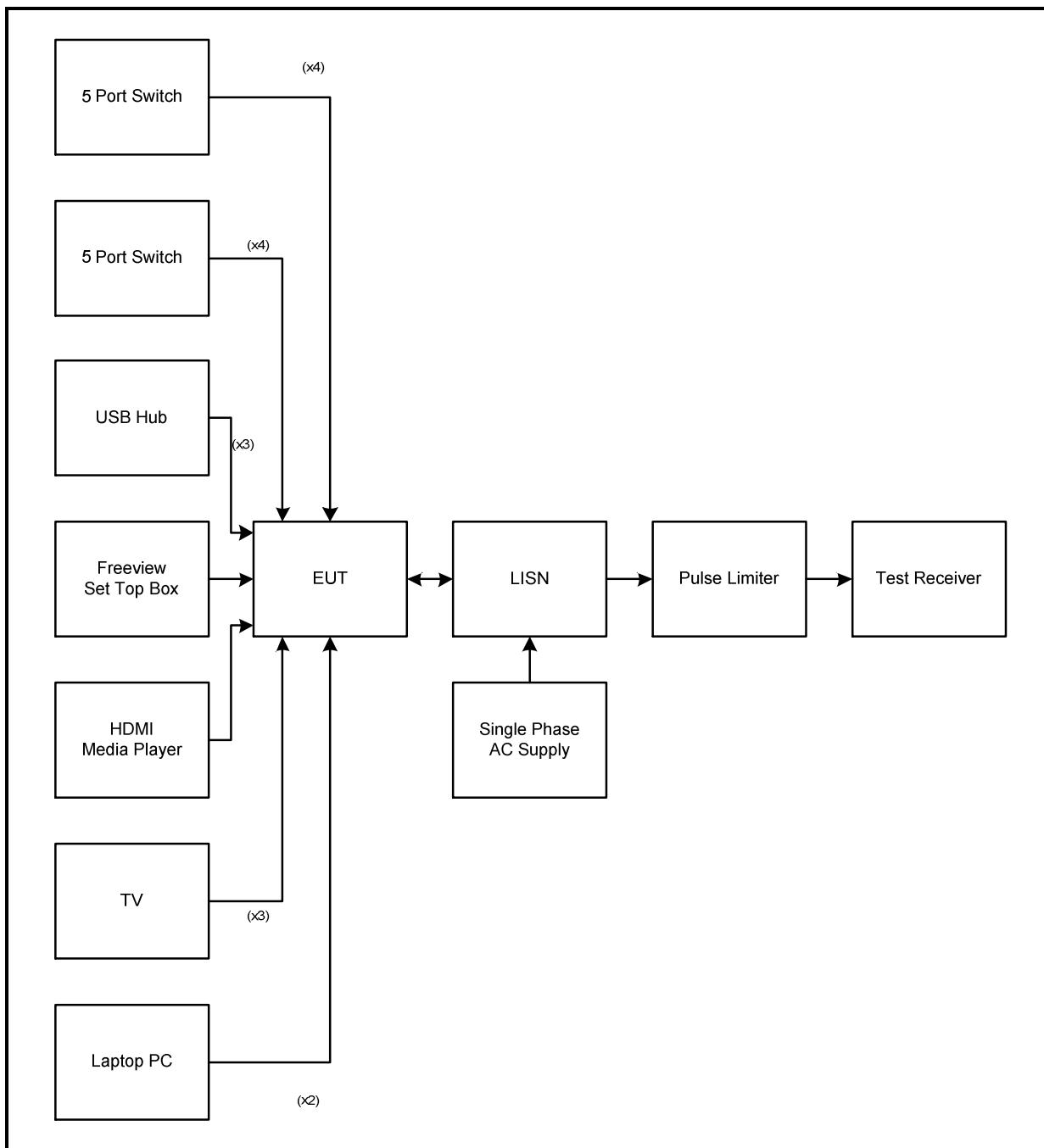
Temperature (°C):	22
Relative Humidity (%):	40

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

1. The EUT was connected to the power supply input which was connected to a 120 VAC 60 Hz single phase supply via a LISN.
2. In accordance with FCC KDB 174176 Q4, the test was repeated with 240 VAC 60 Hz single phase supply as this was within the voltage of the Television power supply.
3. A pulse limiter was fitted between the LISN and the test receiver.
4. Pre-scans were performed on live and neutral for all technologies that the EUT supported. As the emissions were the same for all technologies, final measurements were performed with the mode that produced the highest EIRP. The EUT was set to 5 GHz WLAN mode, transmitting with a data rate of 802.11a / 6 Mbps / SISO / DAC0 at 5200 MHz.
5. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
6. In accordance with ANSI C63.10 Section 6.2.5, the six highest emissions were recorded in the tables below.
7. In the block diagram below, the number in brackets relates to the quantity of cables which were connected between the TV and the support equipment.

### Transmitter AC Conducted Spurious Emissions (continued)

### Test setup:



**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak / 120 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
1.199	Live	37.7	56.0	18.3	Complied
1.901	Live	37.6	56.0	18.4	Complied
2.045	Live	38.3	56.0	17.7	Complied
3.732	Live	37.5	56.0	18.5	Complied
7.251	Live	42.7	60.0	17.3	Complied
7.391	Live	42.6	60.0	17.4	Complied

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

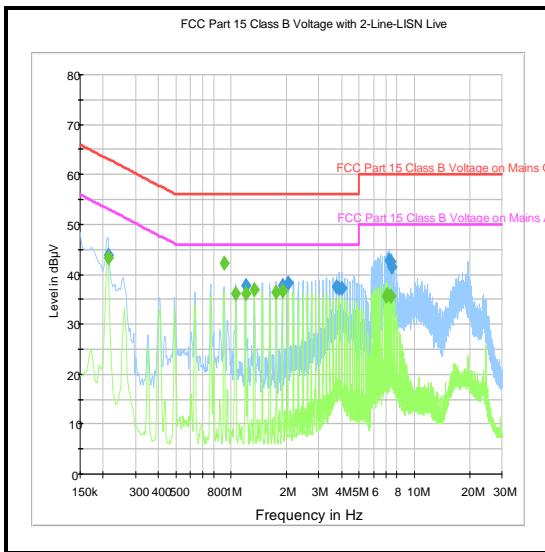
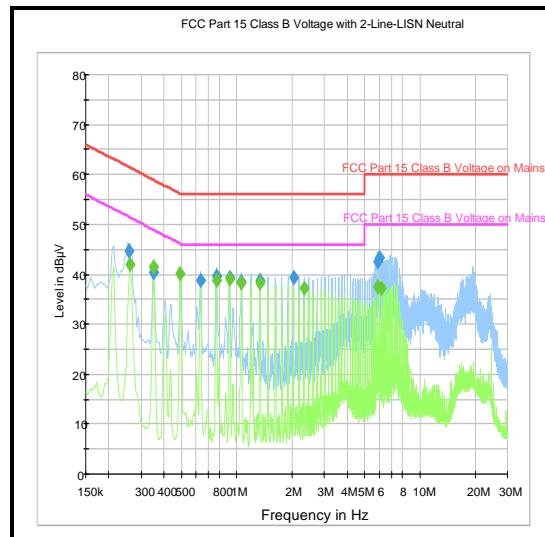
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.213	Live	43.4	53.1	9.7	Complied
0.915	Live	42.3	46.0	3.7	Complied
1.199	Live	36.3	46.0	9.7	Complied
1.338	Live	37.0	46.0	9.0	Complied
1.761	Live	36.5	46.0	9.5	Complied
1.901	Live	36.6	46.0	9.4	Complied

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

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.258	Neutral	44.8	61.5	16.7	Complied
0.776	Neutral	39.5	56.0	16.5	Complied
0.915	Neutral	39.2	56.0	16.8	Complied
1.338	Neutral	38.8	56.0	17.2	Complied
2.045	Neutral	39.2	56.0	16.8	Complied
5.982	Neutral	43.4	60.0	16.6	Complied

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

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.353	Neutral	41.5	48.9	7.4	Complied
0.492	Neutral	40.2	46.1	5.9	Complied
0.776	Neutral	38.9	46.0	7.1	Complied
0.915	Neutral	39.0	46.0	7.0	Complied
1.055	Neutral	38.2	46.0	7.8	Complied
1.338	Neutral	38.3	46.0	7.7	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: 120 VAC 60 Hz****Live****Neutral**

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

**Transmitter AC Conducted Spurious Emissions (continued)****Results: Live / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.371	Live	45.6	58.5	12.9	Complied
0.631	Live	40.3	56.0	15.7	Complied
0.776	Live	41.0	56.0	15.0	Complied
0.915	Live	41.1	56.0	14.9	Complied
1.055	Live	40.4	56.0	15.6	Complied
1.338	Live	40.3	56.0	15.7	Complied

**Results: Live / Average / 240 VAC 60 Hz**

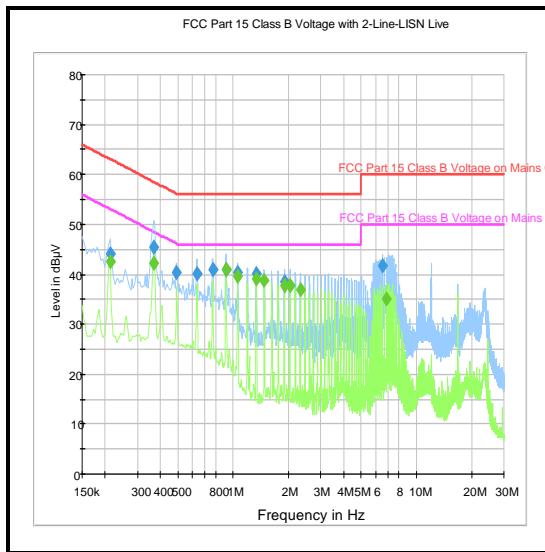
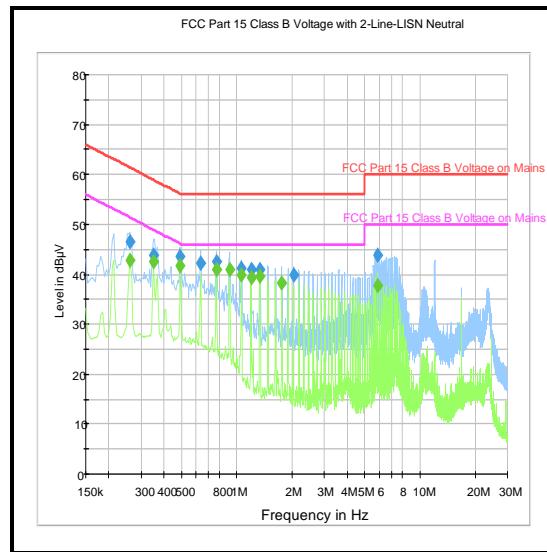
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.371	Live	42.2	48.5	6.3	Complied
0.915	Live	40.8	46.0	5.2	Complied
1.055	Live	39.5	46.0	6.5	Complied
1.338	Live	38.9	46.0	7.1	Complied
1.478	Live	38.8	46.0	7.2	Complied
1.901	Live	37.8	46.0	8.2	Complied

**Results: Neutral / Quasi Peak / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.263	Neutral	46.5	61.4	14.9	Complied
0.492	Neutral	43.5	56.1	12.6	Complied
0.632	Neutral	42.3	56.0	13.7	Complied
0.776	Neutral	42.6	56.0	13.4	Complied
1.055	Neutral	41.3	56.0	14.7	Complied
1.199	Neutral	41.0	56.0	15.0	Complied

**Results: Neutral / Average / 240 VAC 60 Hz**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
0.353	Neutral	42.6	48.9	6.3	Complied
0.492	Neutral	41.7	46.1	4.4	Complied
0.776	Neutral	40.9	46.0	5.1	Complied
0.915	Neutral	40.9	46.0	5.1	Complied
1.055	Neutral	39.9	46.0	6.1	Complied
1.338	Neutral	39.6	46.0	6.4	Complied

**Transmitter AC Conducted Spurious Emissions (continued)****Results: 240 VAC 60 Hz****Live****Neutral**

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

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1624	Thermohygrometer	JM Handelpunkt	30.5015.10	Not stated	11 Jan 2017	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	16 Oct 2016	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	27 Aug 2016	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	08 Mar 2017	12
M1251	Digital Multimeter	Fluke	175	89170179	26 May 2016	12
S0539	Variable AC Power Supply	Kikusui	PCR 1000L	13010170	Calibrated before use	-

### **5.2.2. Transmitter 20 dB Bandwidth**

### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	18 May 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

<b>FCC Reference:</b>	Part 15.247(a)(1)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.9.2

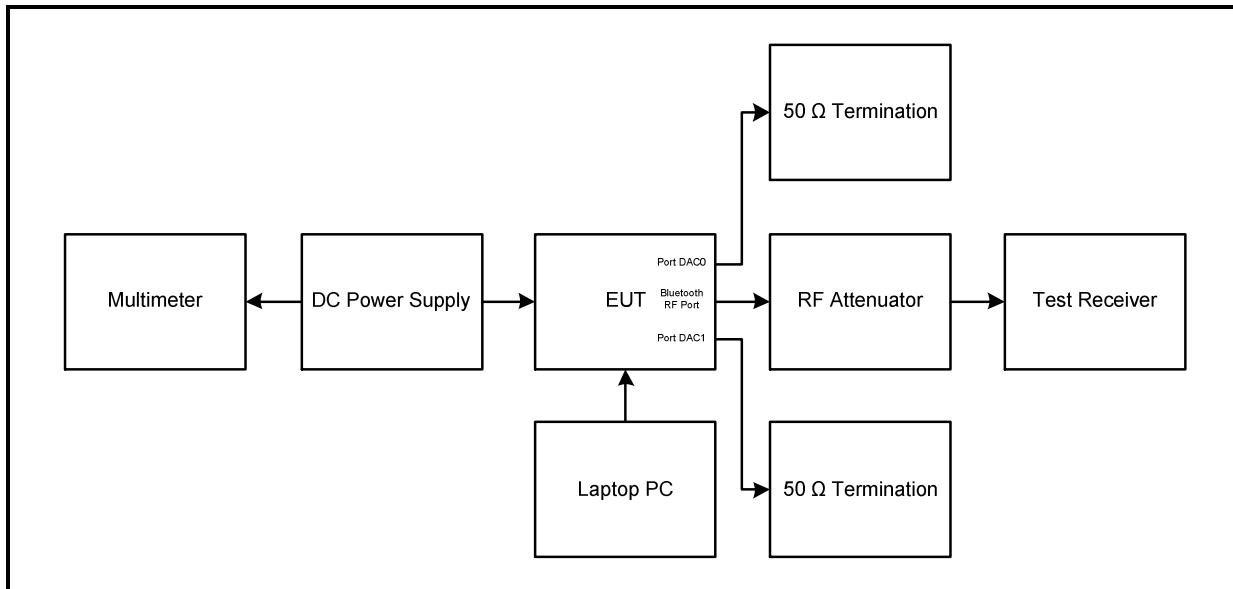
### **Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	33

**Note(s):**

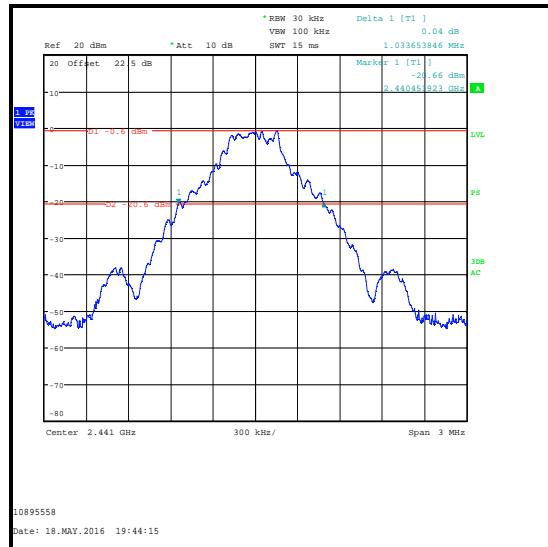
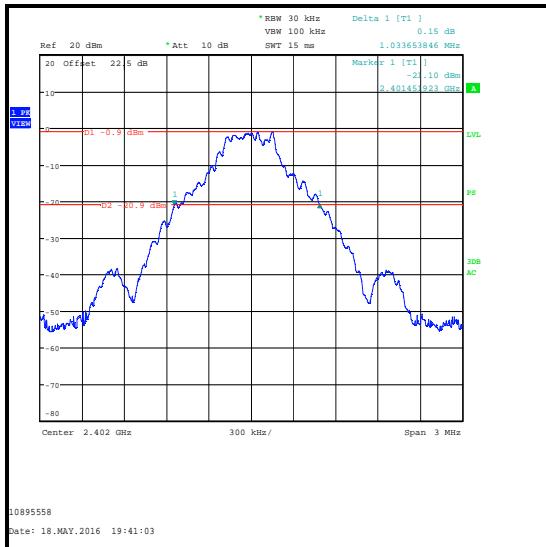
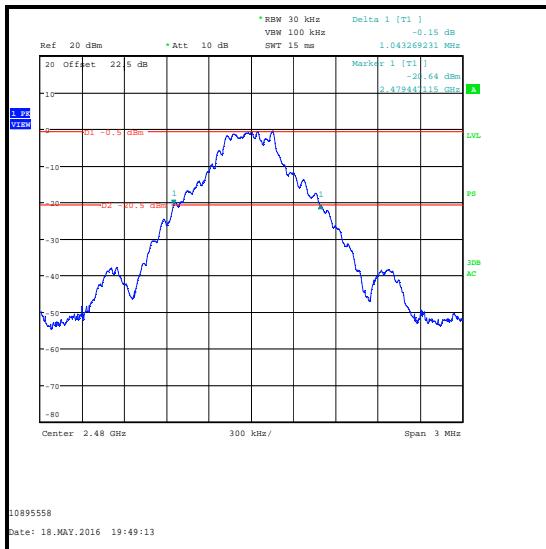
1. The test receiver resolution bandwidth was set to 30 kHz and video bandwidth 100 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 3 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. These results are documented in the table below.
2. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.

### Test setup:



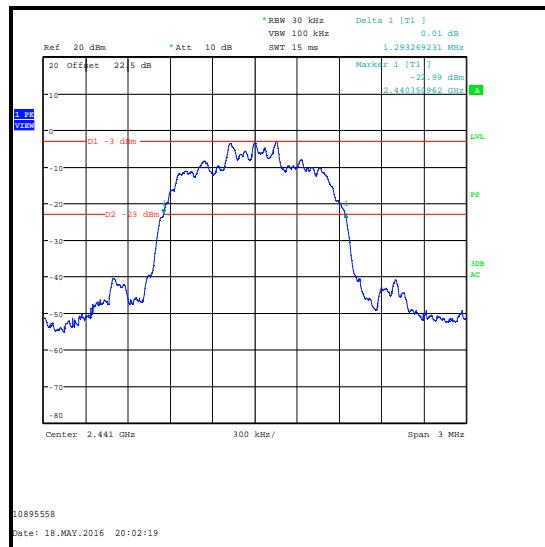
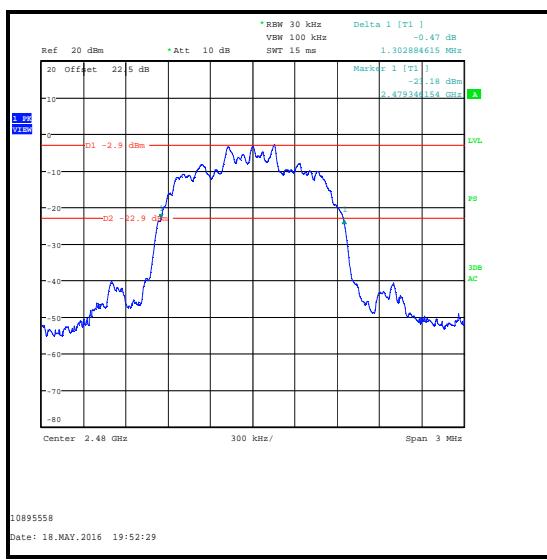
**Transmitter 20 dB Bandwidth (continued)****Results DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	1033.654
Middle	1033.654
Top	1043.269

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

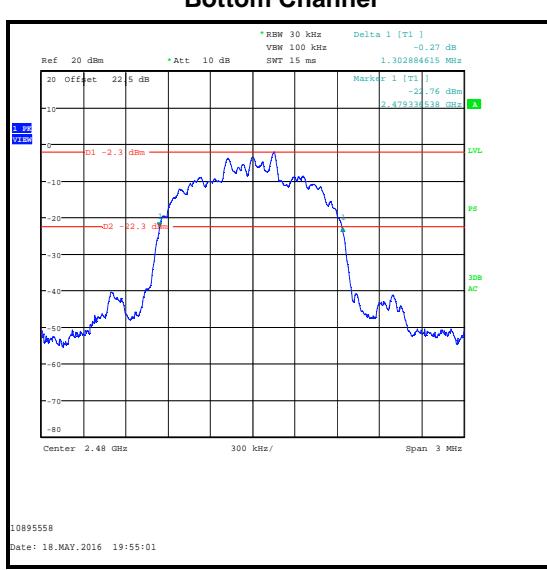
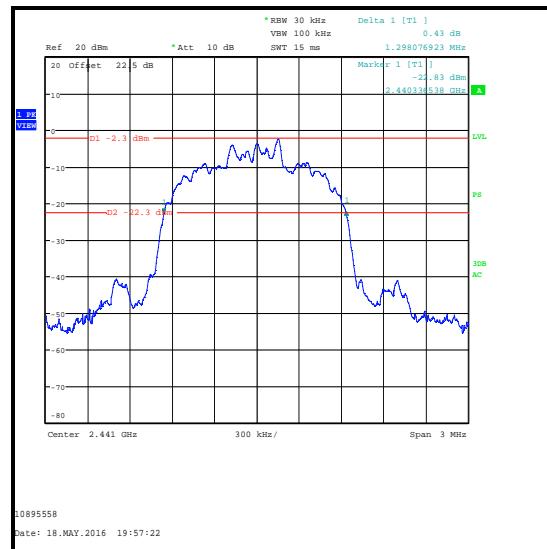
**Transmitter 20 dB Bandwidth (continued)****Results 2DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	1293.269
Middle	1293.269
Top	1302.885

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

**Transmitter 20 dB Bandwidth (continued)****Results 3DH5:**

Channel	20 dB Bandwidth (kHz)
Bottom	1302.885
Middle	1298.077
Top	1302.885



**Transmitter 20 dB Bandwidth (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1625	Thermohygrometer	JM Handelpunkt	30.5015.06	None stated	11 Jan 2017	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	11 Apr 2017	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
S0579	Power Supply	TTi	EX1810R	444110	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	13 May 2017	12
G0615	Vector Signal Generator	Rohde & Schwarz	SMBV100A	260473	22 May 2017	36

### **5.2.3. Transmitter Carrier Frequency Separation**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	04 April 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

<b>FCC Reference:</b>	Part 15.247(a)(1)
<b>Test Method Used:</b>	ANSI C63.10 Section 7.8.2

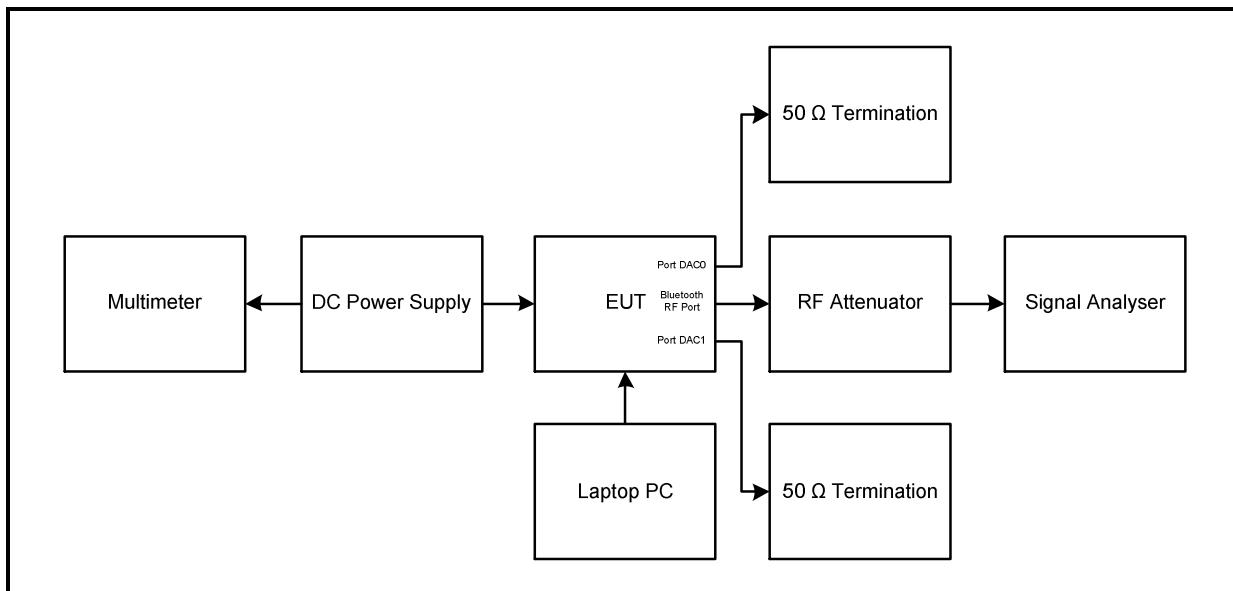
#### **Environmental Conditions:**

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

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

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The signal analyser centre frequency was set at the mid frequency of channels 39 and 40. The resolution bandwidth was set to 30 kHz and video bandwidth of 100 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 2 MHz. A marker was placed on each of the corresponding peaks of the adjacent channels, with the frequency difference recorded in the tables below for each mode of operation.
3. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

#### **Test setup:**

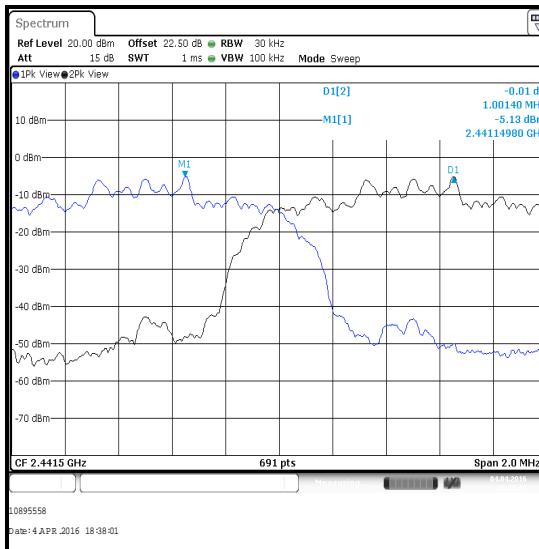


**Transmitter Carrier Frequency Separation (continued)****Results: DH5**

Carrier Frequency Separation (kHz)	Limit $\frac{2}{3}$ of 20 dB BW (kHz)	Margin (kHz)	Result
992.800	689.103	303.697	Complied

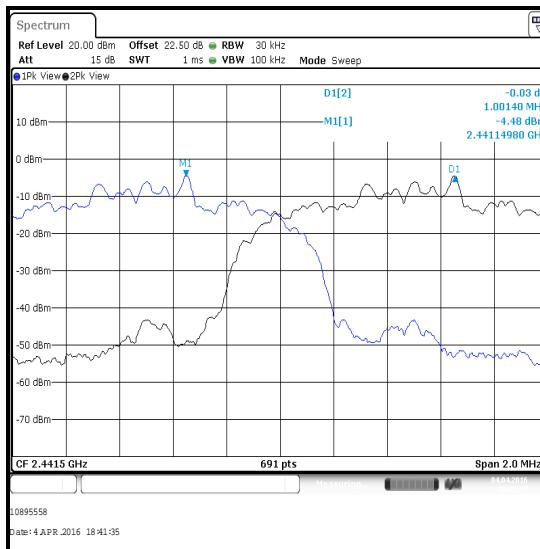
**Results: 2DH5**

Carrier Frequency Separation (kHz)	Limit $\frac{2}{3}$ of 20 dB BW (kHz)	Margin (kHz)	Result
1001.400	862.179	139.221	Complied



**Transmitter Carrier Frequency Separation (continued)****Results: 3DH5**

Carrier Frequency Separation (kHz)	Limit $\frac{2}{3}$ of 20 dB BW (kHz)	Margin (kHz)	Result
1001.400	865.385	136.015	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1783	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	23 Apr 2016	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
S0576	DC Power Supply	TTI	PL330QMD	066701	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	26 May 2016	12
G0614	Signal Generator	Rohde & Schwarz	SMB100A	177687	01 May 2017	36

**5.2.4. Transmitter Number of Hopping Frequencies and Average Time of Occupancy****Test Summary:**

Test Engineer:	Keith Tucker	Test Date:	20 October 2015
Test Sample MAC address:	542AA22F8F19		

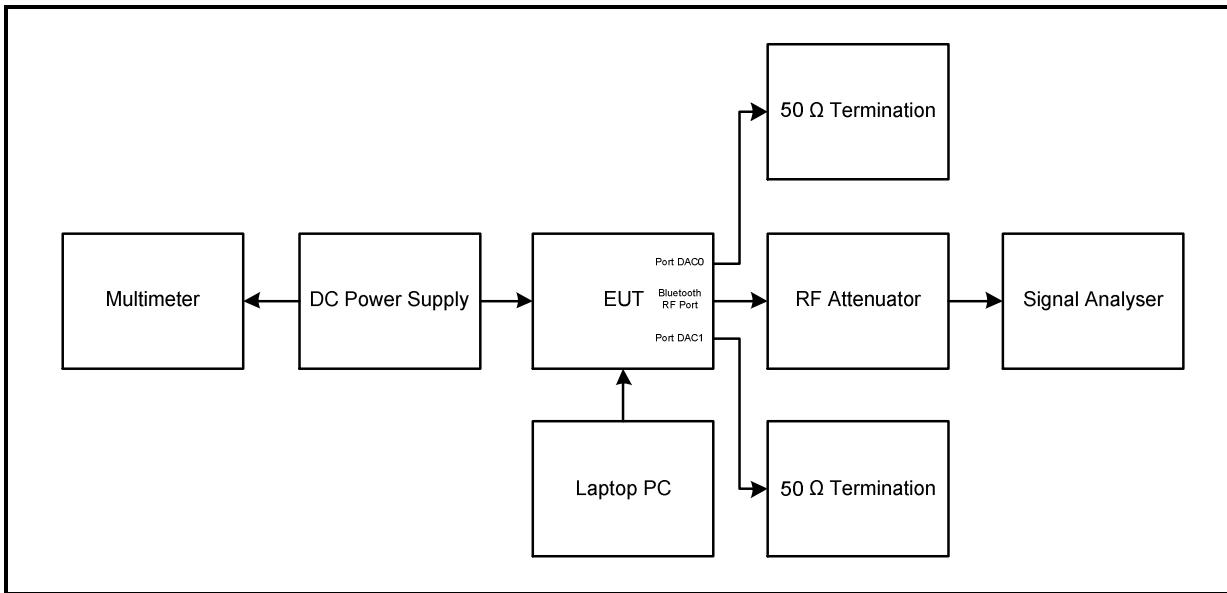
FCC Reference:	Part 15.247(a)(1)(iii)
Test Method Used:	ANSI C63.10 Sections 7.8.3 & 7.8.4

**Environmental Conditions:**

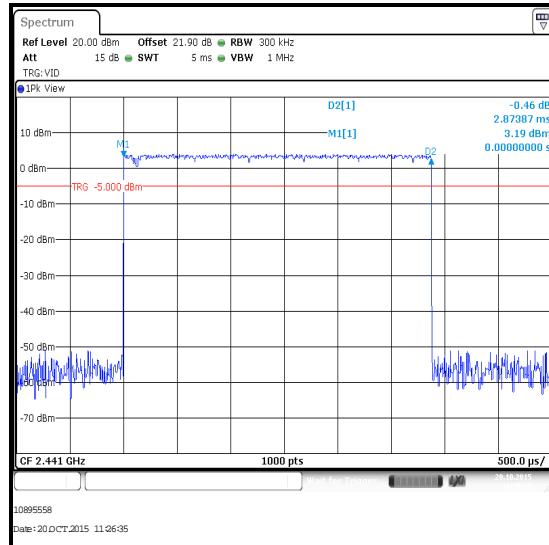
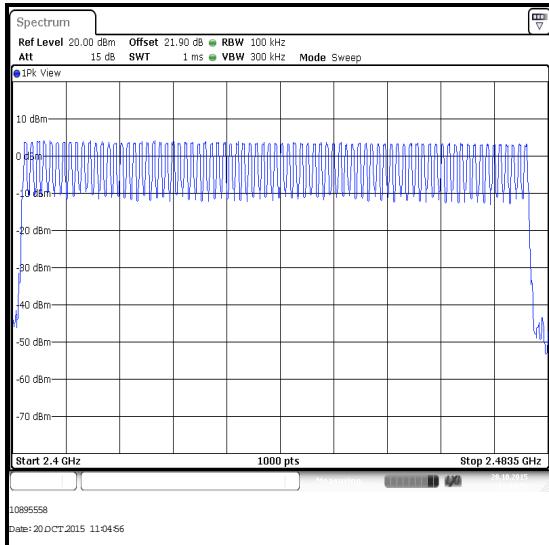
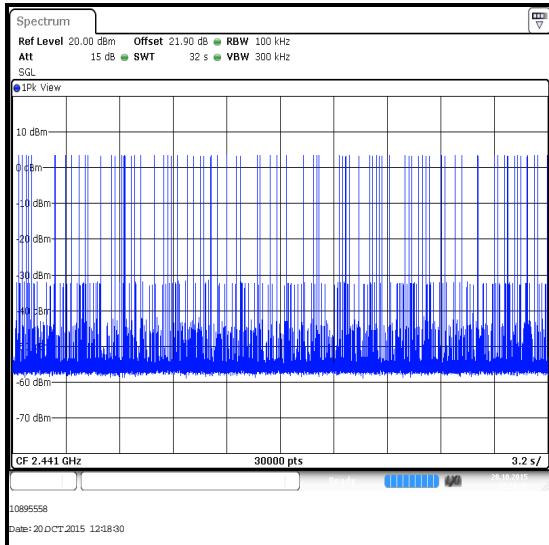
Temperature (°C):	25
Relative Humidity (%):	41

**Note(s):**

1. Tests were performed to identify the average time of occupancy in number of channels (79) x 0.4 seconds. The calculated period is 31.6 seconds.
2. Number of Hopping Frequencies test: The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 83.5 MHz which covers the frequency band of operation. The number of hopping frequencies was recorded.
3. Emission Width test: The signal analyser resolution bandwidth was set to 300 kHz and video bandwidth of 1 MHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The signal analyser was set to trigger at 1 ms, with a marker placed at the start of the emission and a delta marked place at the end of the emission. The emission width was recorded.
4. Number of Hops in a 32 second period test: The centre channel was monitored. The signal analyser resolution bandwidth was set to 100 kHz and video bandwidth of 300 kHz. A peak detector was used and sweep time was set to 32 seconds. The EUT was set to transmit in a hopping frequency mode with zero span. The total number of hops on the centre channel observed in a 32 second period was recorded.
5. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.

**Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)****Test setup:****Results:**

Emission Width (μs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2873.870	80	0.230	0.4	0.170	Complied

**Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)****Number of Hopping Frequencies****Emission Width****Number of Hopping Frequencies in 32 s****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
S0558	Power Supply	TTi	EL303R	395825	Calibrated before use	-
M1269	Multimeter	Fluke	179	90250210	26 May 2016	12
M1783	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
A2521	Attenuator	AtlanTecRF	AN18-20	832797#2	Calibrated before use	-
M1883	Signal Analyser	Rohde & Schwarz	FSV30	103084	23 Jul 2016	12
G0614	Signal Generator	Rohde & Schwarz	SMB100A	177687	01 May 2017	36

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

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	04 April 2016
<b>Test Sample MAC address:</b>	542AA22F8F19		

<b>FCC Reference:</b>	Part 15.247(b)(1)
<b>Test Method Used:</b>	ANSI C63.10 Section 7.8.5

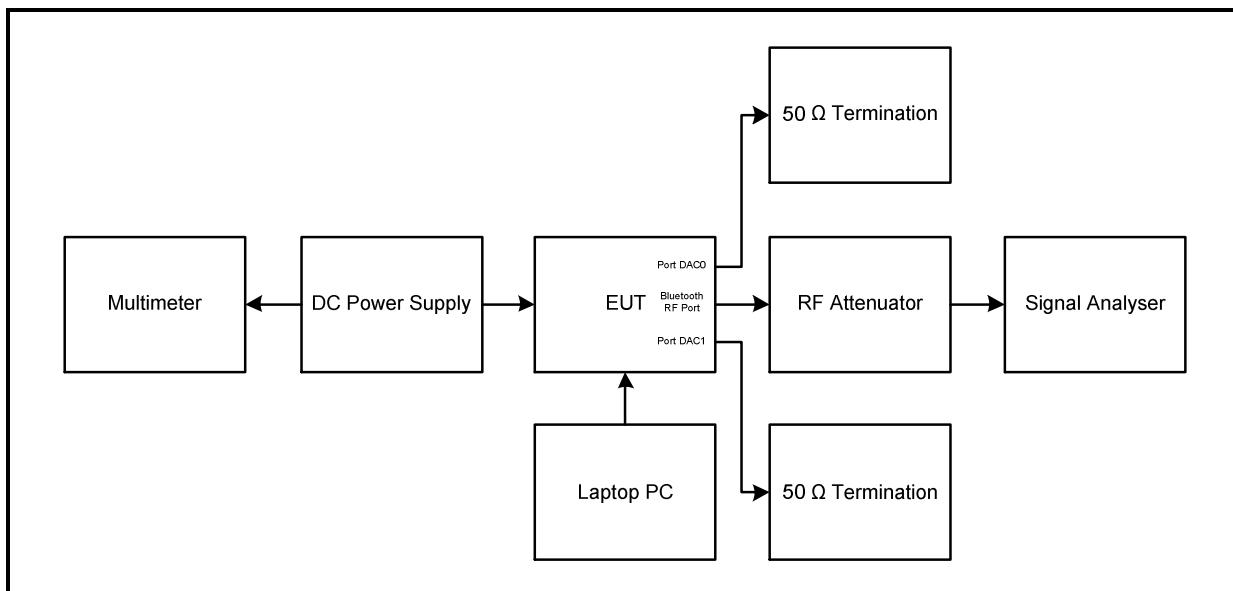
#### **Environmental Conditions:**

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

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

1. The signal analyser resolution bandwidth was set to 2 MHz (greater than the 20 dB bandwidth) 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 6.5 MHz (approximately five times the 20 dB bandwidth). A marker was placed at the peak of the signal and the results recorded in the tables below.
2. The declared antenna gain was added to the conducted peak power to obtain the EIRP.
3. The signal analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the signal analyser to compensate for the loss of the attenuator and RF cable.

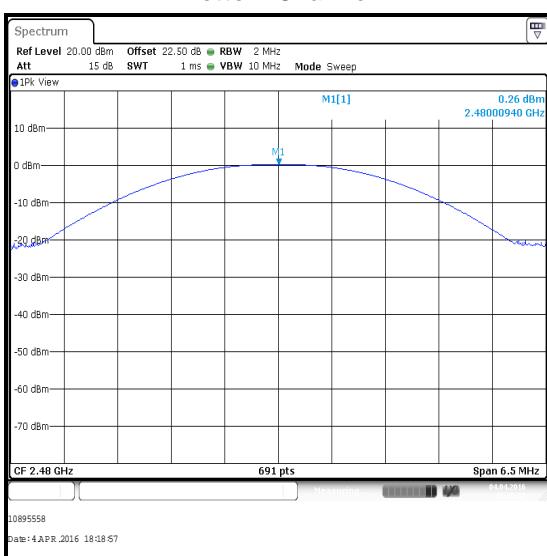
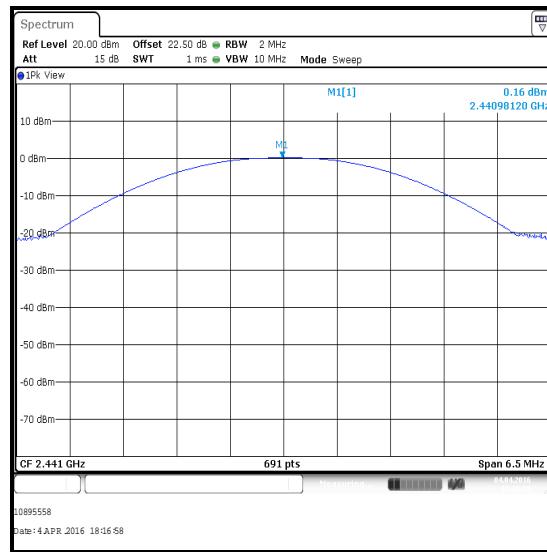
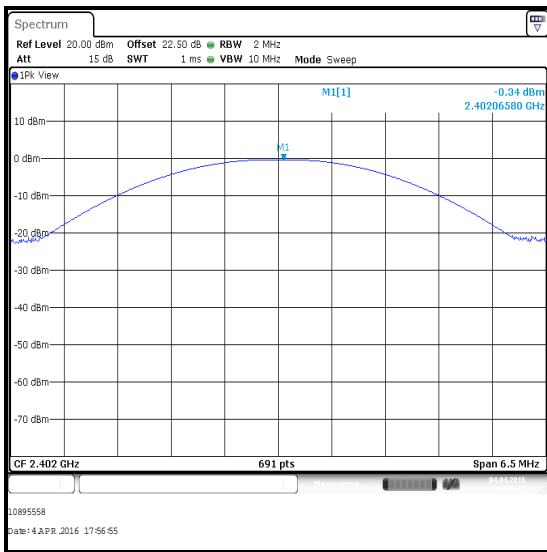
#### **Test setup:**



**Transmitter Maximum Peak Output Power (continued)****Results: DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-0.3	30.0	30.3	Complied
Middle	0.2	30.0	29.8	Complied
Top	0.3	30.0	29.7	Complied

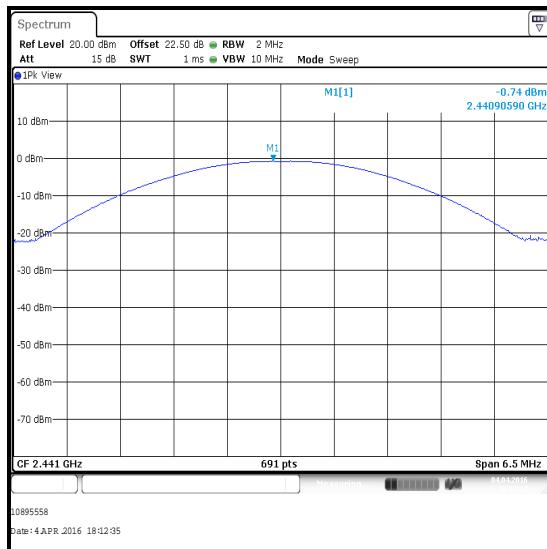
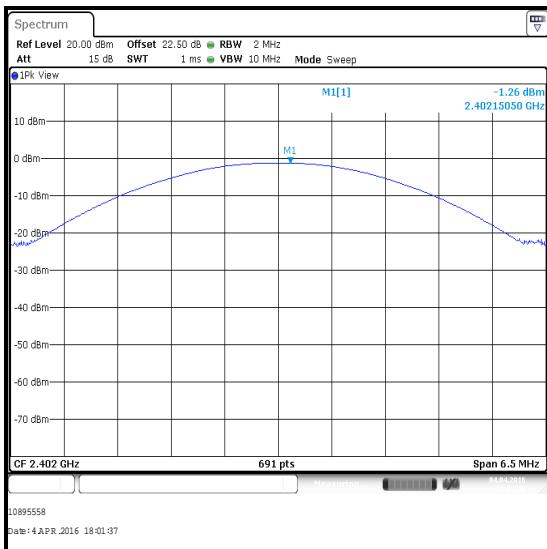
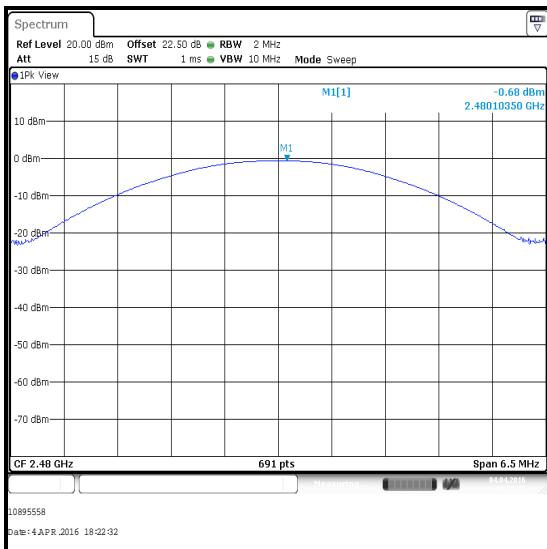
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-0.3	4.2	3.9	36.0	31.1	Complied
Middle	0.2	4.2	4.4	36.0	31.6	Complied
Top	0.3	4.2	4.5	36.0	31.5	Complied

**Transmitter Maximum Peak Output Power (continued)****Results: DH5**

**Transmitter Maximum Peak Output Power (continued)****Results: 2DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-1.3	21.0	22.3	Complied
Middle	-0.7	21.0	21.7	Complied
Top	-0.7	21.0	21.7	Complied

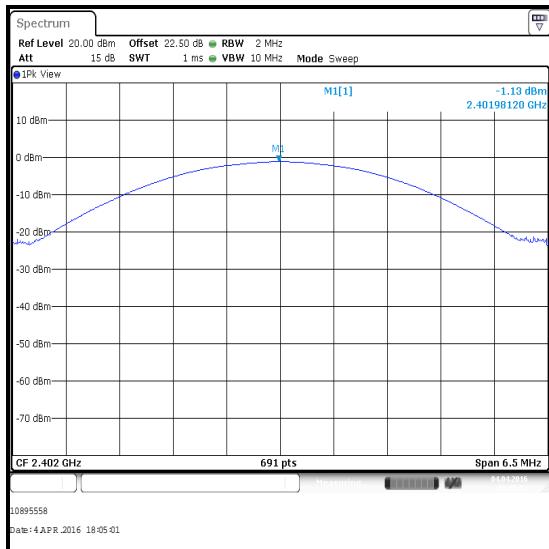
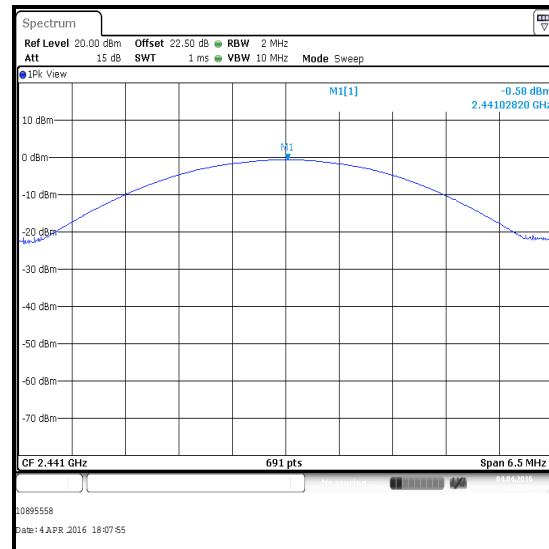
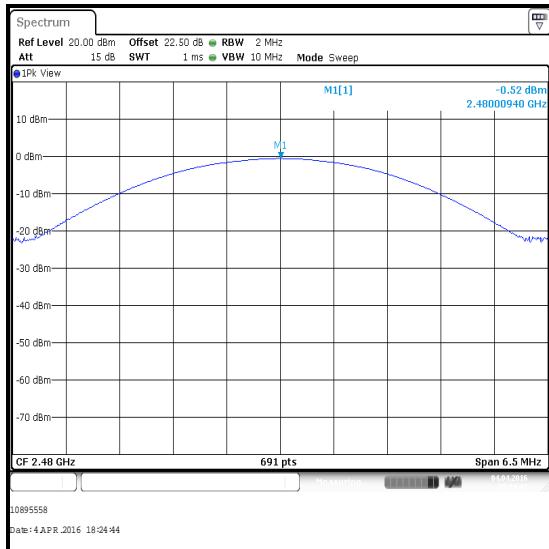
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-1.3	4.2	2.9	27.0	24.1	Complied
Middle	-0.7	4.2	3.5	27.0	23.5	Complied
Top	-0.7	4.2	3.5	27.0	23.5	Complied

**Transmitter Maximum Peak Output Power (continued)****Results: 2DH5****Bottom Channel****Middle Channel****Top Channel**

**Transmitter Maximum Peak Output Power (continued)****Results: 3DH5**

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-1.1	21.0	22.1	Complied
Middle	-0.6	21.0	21.6	Complied
Top	-0.5	21.0	21.5	Complied

Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-1.1	4.2	3.1	27.0	23.9	Complied
Middle	-0.6	4.2	3.6	27.0	23.4	Complied
Top	-0.5	4.2	3.7	27.0	23.3	Complied

**Transmitter Maximum Peak Output Power (continued)****Results: 3DH5****Bottom Channel****Middle Channel****Top Channel**

**Transmitter Maximum Peak Output Power (continued)****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1783	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	23 Apr 2016	12
M1835	Signal Analyser	Rohde & Schwarz	FSV30	103050	26 Feb 2017	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	Calibrated before use	-
S0576	DC Power Supply	TTI	PL330QMD	066701	Calibrated before use	-
M1251	Multimeter	Fluke	175	89170179	26 May 2016	12
G0615	Vector Signal Generator	Rohde & Schwarz	SMBV100A	260473	22 May 2017	36
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	08 Apr 2016	24
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	23 Apr 2016	24

### **5.2.6. Transmitter Radiated Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	17 March 2016
<b>Test Sample Serial Number:</b>	92777		

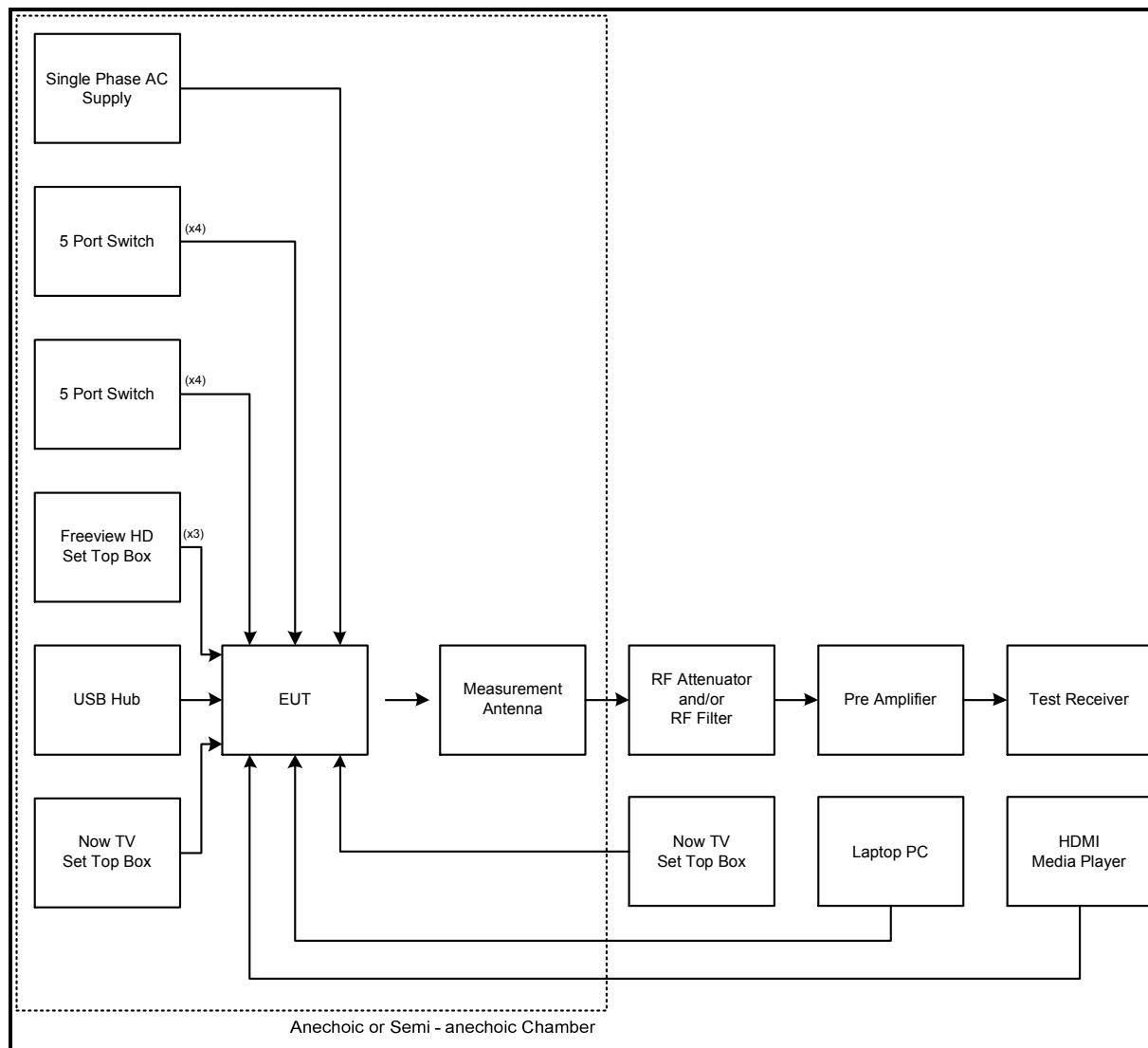
<b>FCC Reference:</b>	Parts 15.247(d) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range</b>	30 MHz to 1000 MHz

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	34

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

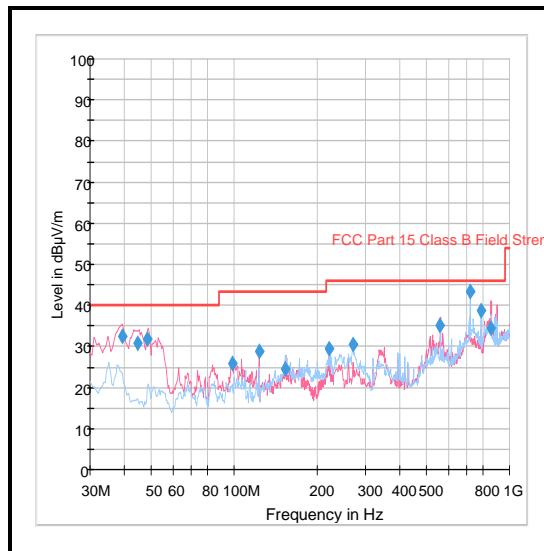
1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. 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.
4. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
5. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
6. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
7. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span big enough to see the whole emission.

**Transmitter Radiated Emissions (continued)****Test setup for radiated measurements:**

*Note: The number in brackets relates to the quantity of cables which were connected between the TV and the support equipment.*

**Transmitter Radiated Emissions (continued)****Results: Quasi-Peak / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
270.333	Horizontal	30.6	46.0	15.4	Complied



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

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	None stated	23 Apr 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12
G0543	Amplifier	Sonoma	310N	230801	29 May 2016	3
A259	Antenna	Chase	CBL6111	1513	09 Apr 2016	12
A1834	Attenuator	Hewlett Packard	8491B	10444	30 Mar 2017	12

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

<b>Test Engineers:</b>	Andrew Edwards & Nick Steele	<b>Test Date:</b>	15 March 2016
<b>Test Sample Serial Number:</b>	92777		

<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>	23
<b>Relative Humidity (%):</b>	33

**Note(s):**

1. Transmitter radiated spurious emissions tests were performed with the EUT transmitting in DH5 mode as this was found to transmit the highest power and therefore deemed worst case.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. All other emissions shown on the pre-scans were investigated and found to be ambient, or > 20 dB below the appropriate limit or below the noise floor of the measurement system.
4. The emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental at 2441 MHz.
5. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
6. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.
7. Pre-scan plot for 4 to 6 GHz was performed with a peak detector vs average limit, all other pre-scans were performed using a peak and average detector against their appropriate limits.
8. \*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.
9. The six highest spurious emissions relative to the limit were recorded in table below, as stated in ANSI C63.10 Section 6.6.4.3.
10. Radiated measurements were performed under a different job number as shown on the plots below.

**Transmitter Radiated Emissions (continued)****Results: Peak / Bottom Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1142.444	Vertical	50.5	54.0*	3.5	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
1709.889	Vertical	54.3	74.0	19.7	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.945	Horizontal	52.1	54.0*	1.9	Complied

**Results: Average / Bottom Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1708.038	Vertical	44.7	54.0	9.3	Complied
2860.499	Vertical	45.1	54.0	8.9	Complied

**Results: Peak / Middle Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1142.444	Vertical	50.5	54.0*	3.5	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
1709.889	Vertical	54.3	74.0	19.7	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.737	Horizontal	52.4	54.0*	1.6	Complied

**Results: Average / Middle Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1708.038	Vertical	44.7	54.0	9.3	Complied
2860.499	Vertical	45.1	54.0	8.9	Complied

**Transmitter Radiated Emissions (continued)****Results: Peak / Top Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1142.444	Vertical	50.5	54.0*	3.5	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
1709.889	Vertical	54.3	74.0	19.7	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.891	Horizontal	51.6	54.0*	2.4	Complied

**Results: Average / Top Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1708.038	Vertical	44.7	54.0	9.3	Complied
2860.499	Vertical	45.1	54.0	8.9	Complied

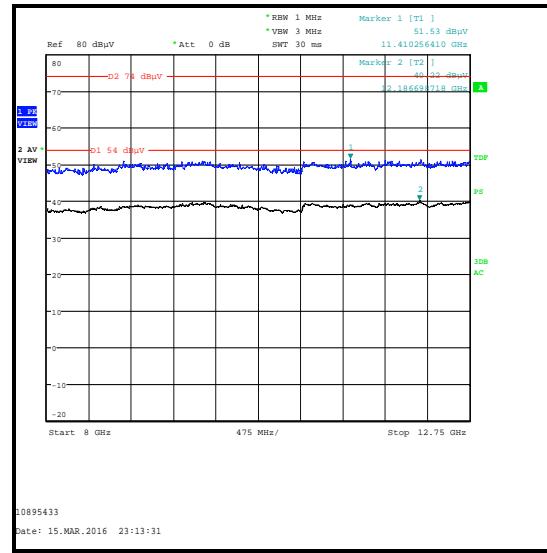
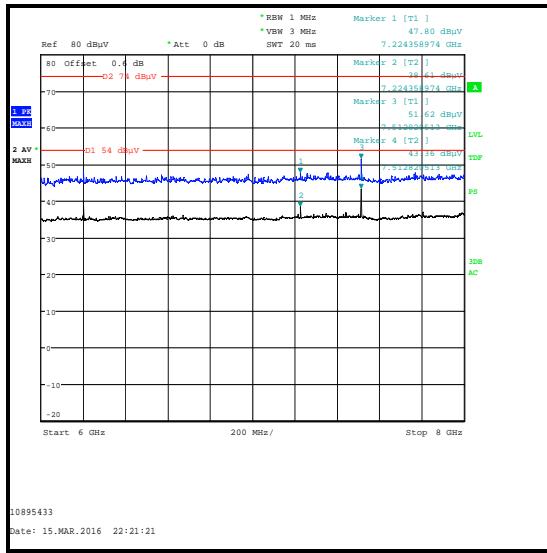
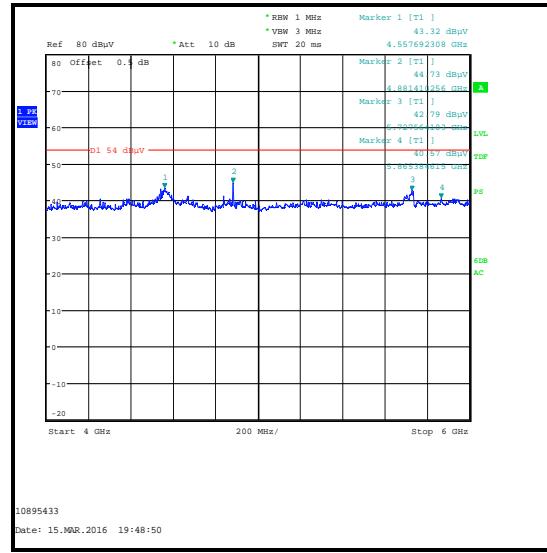
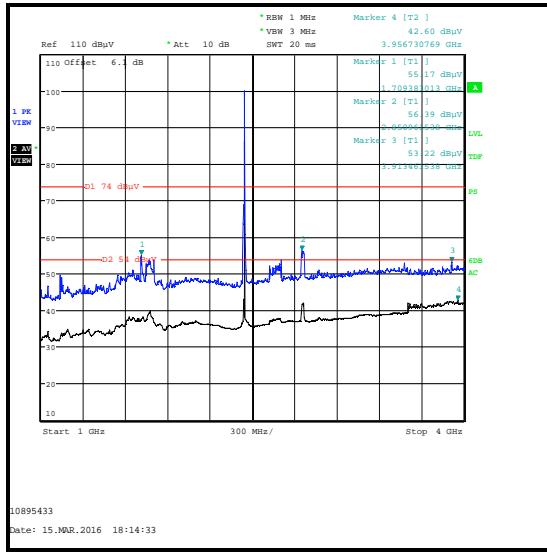
**Results: Peak / Hopping Mode / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1048.718	Horizontal	49.7	54.0*	4.3	Complied
1142.444	Vertical	50.5	54.0*	3.5	Complied
1187.865	Horizontal	48.0	54.0*	6.0	Complied
1709.889	Vertical	54.3	74.0	19.7	Complied
2857.454	Vertical	56.1	74.0	17.9	Complied
7511.795	Horizontal	51.9	54.0*	2.1	Complied

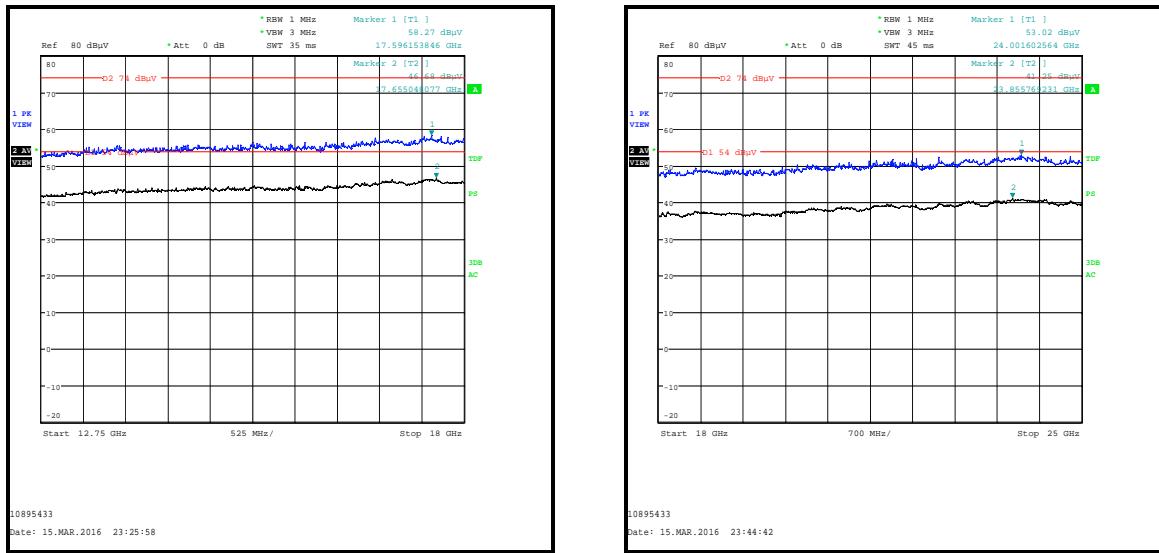
**Results: Average / Hopping Mode / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1708.038	Vertical	44.7	54.0	9.3	Complied
2860.499	Vertical	45.1	54.0	8.9	Complied

## Transmitter Radiated Emissions (continued)



## Transmitter Radiated Emissions (continued)



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

### Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
A1818	Antenna	EMCO	3115	00075692	17 Dec 2016	12
A253	Antenna	Flann Microwave	12240-20	128	17 Dec 2016	12
A254	Antenna	Flann Microwave	14240-20	139	17 Dec 2016	12
A255	Antenna	Flann Microwave	16240-20	519	17 Dec 2016	12
A256	Antenna	Flann Microwave	18240-20	400	17 Dec 2016	12
A436	Antenna	Flann Microwave	20240-20	330	19 Dec 2016	12
A239	Attenuator	Huber & Suhner	6806.17.B	Not stated	05 May 2016	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	17 Apr 2016	12
M1945	Thermohygrometer	JM Handelspunkt	30.5015.01	None stated	23 Apr 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB26	100275	19 Mar 2016	12

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

Test Engineer:	Nick Steele	Test Date:	16 March 2016
Test Sample Serial Number:	92777		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.10.4 & 6.10.5

**Environmental Conditions:**

Temperature (°C):	23
Relative Humidity (%):	31

**Note(s):**

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The lower band edge falls within a non-restricted band. 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. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent band (where a higher level emission was present). Marker frequencies and levels were recorded.
3. The upper band edge falls within a restricted band. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. Peak and average measurements were performed with their respective detectors, 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 band (where a higher level emission was present). Marker frequencies and levels were recorded.
4. 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.
5. The restricted band plot for 2310 MHz to 2390 MHz can be found under the results for DH5 static as this mode had the highest output power and was therefore deemed worst case.
6. \* -20 dBc limit.
7. Radiated measurements were performed under a different job number as shown on the plots below.

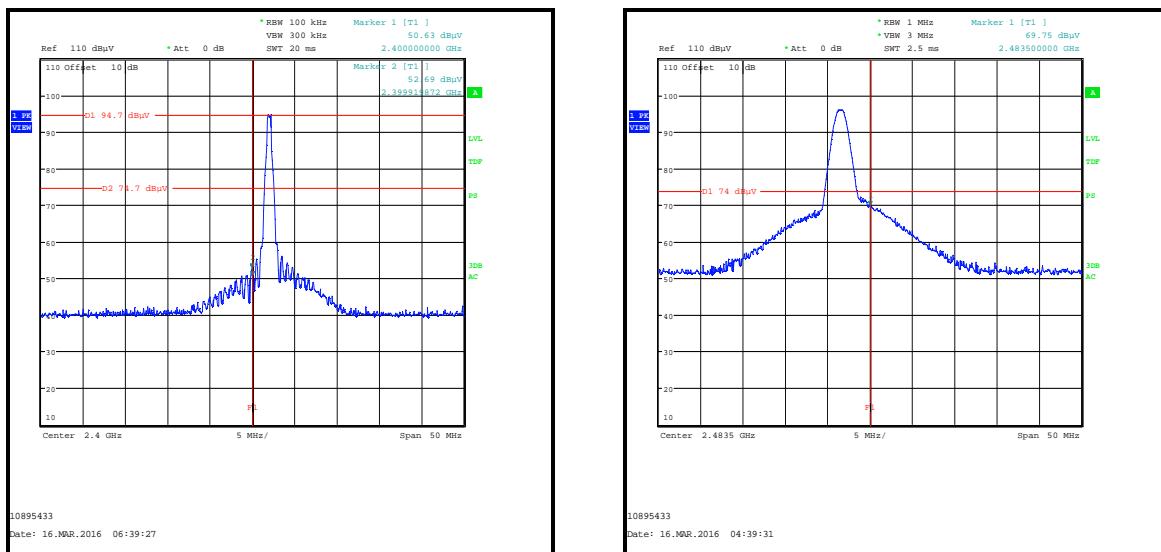
**Transmitter Band Edge Radiated Emissions (continued)****Results: Static Mode / DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2390.000	Horizontal	54.7	74.0	19.3	Complied
2399.920	Horizontal	52.7	74.7*	22.0	Complied
2400.0	Horizontal	50.6	74.7*	24.1	Complied
2483.5	Horizontal	69.8	74.0	4.2	Complied

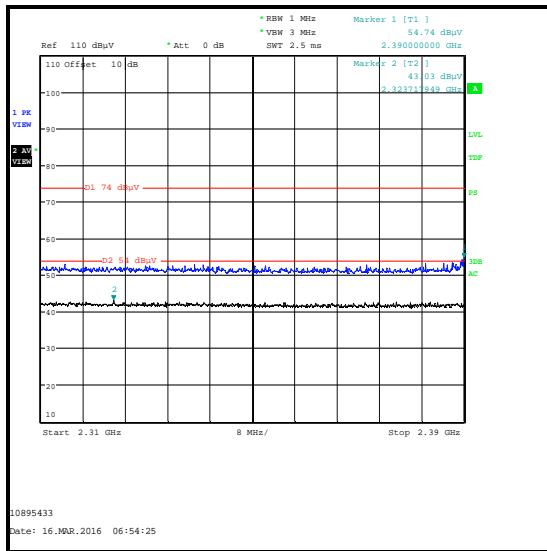
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2323.718	Horizontal	43.0	54.0	11.0	Complied
2483.5	Horizontal	52.4	54.0	1.6	Complied

## Transmitter Band Edge Radiated Emissions (continued)

### Results: Static Mode / DH5

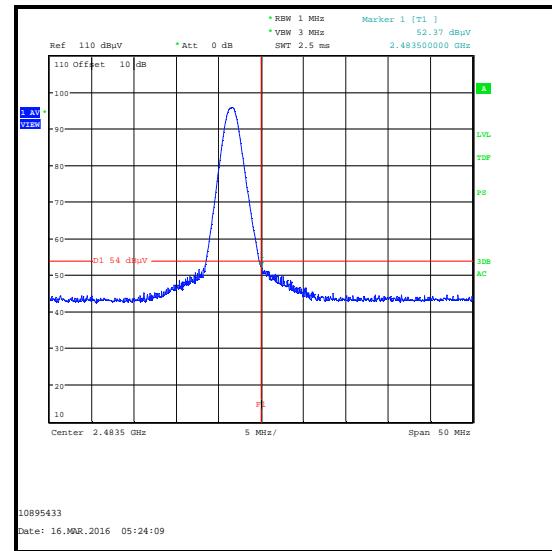


Lower Band Edge Peak Static



2310 MHz to 2390 MHz Restricted Band Plot

Upper Band Edge Peak Static

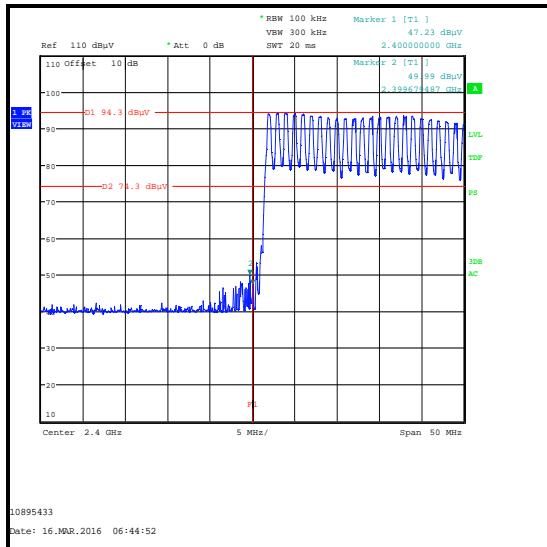


Upper Band Edge Average Static

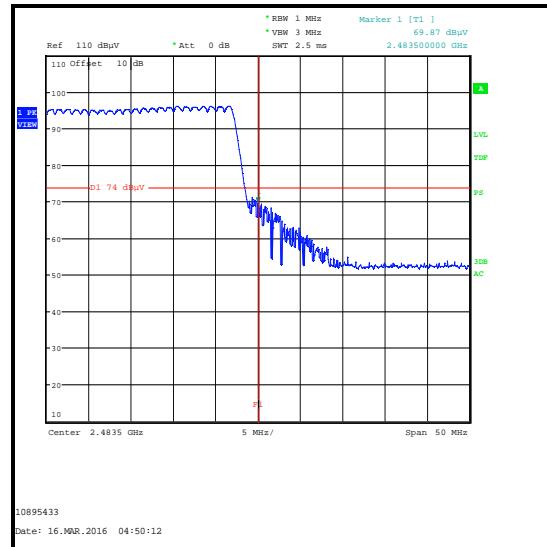
Transmitter Band Edge Radiated Emissions (continued)Results: Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2399.679	Horizontal	50.0	74.3*	24.3	Complied
2400.0	Horizontal	47.2	74.3*	27.1	Complied
2483.5	Horizontal	69.9	74.0	4.1	Complied

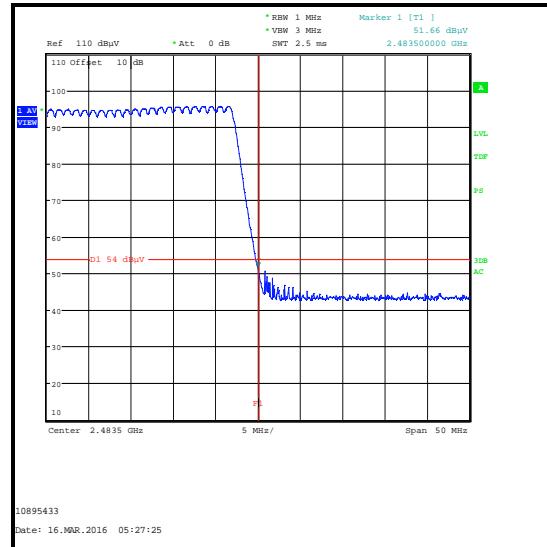
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	51.7	54.0	2.3	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping

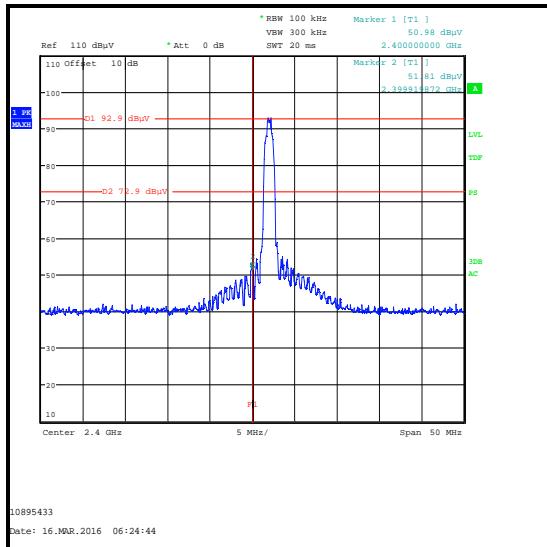


Upper Band Edge Average Hopping

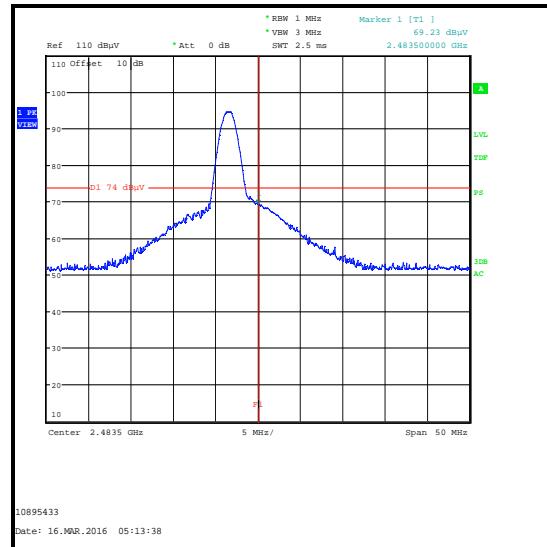
**Transmitter Band Edge Radiated Emissions (continued)****Results: Static Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2399.920	Horizontal	51.8	72.9*	21.1	Complied
2400.0	Horizontal	51.0	72.9*	21.9	Complied
2483.5	Horizontal	69.2	74.0	4.8	Complied

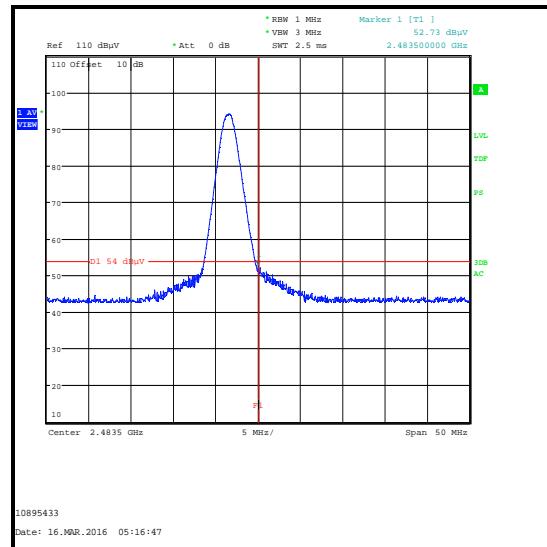
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	52.7	54.0	1.3	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static

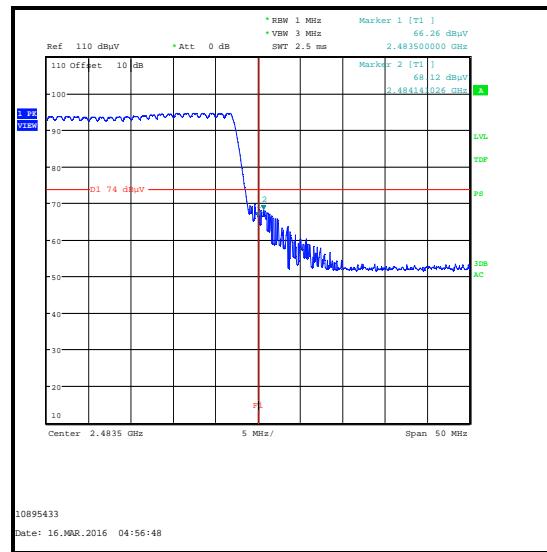
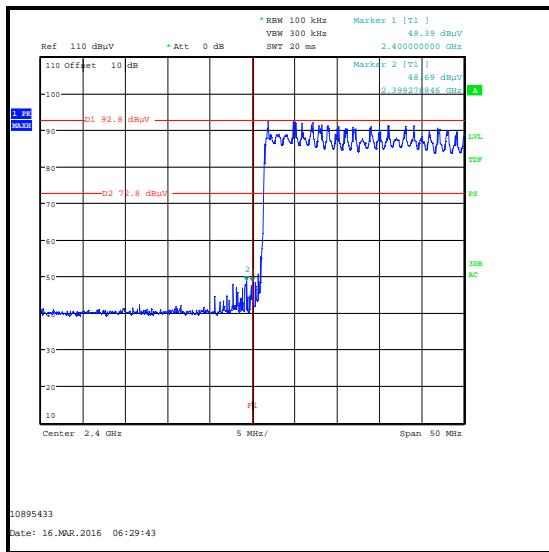
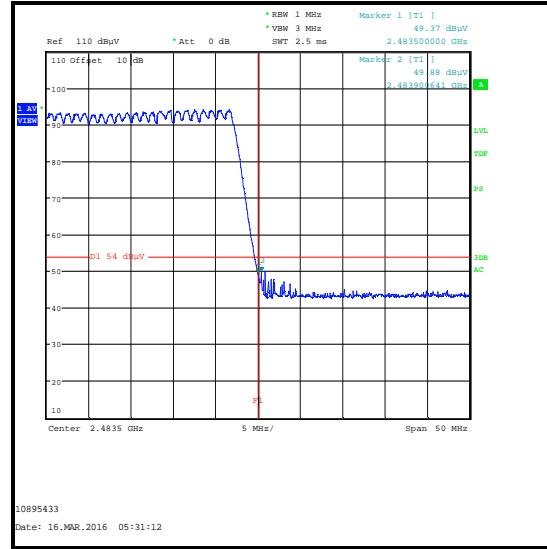


Upper Band Edge Average Static

**Transmitter Band Edge Radiated Emissions (continued)****Results: Hopping Mode / 2DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2399.279	Horizontal	48.7	72.8*	24.1	Complied
2400.0	Horizontal	48.4	72.8*	24.4	Complied
2483.5	Horizontal	66.3	74.0	7.7	Complied
2484.141	Horizontal	68.1	74.0	5.9	Complied

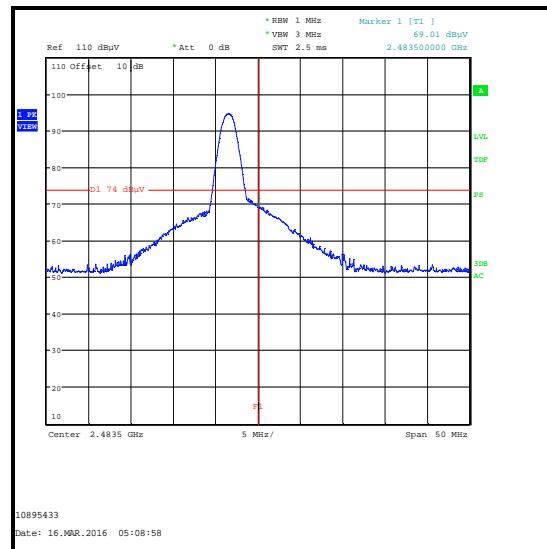
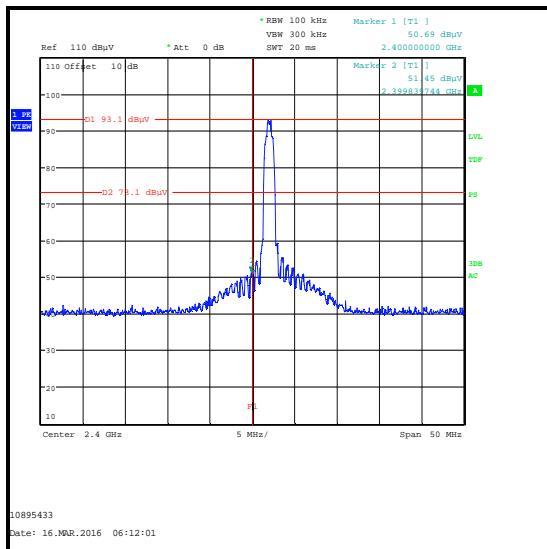
Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	49.4	54.0	4.6	Complied
2483.901	Horizontal	49.9	54.0	4.1	Complied

**Transmitter Band Edge Radiated Emissions (continued)****Results: Hopping Mode / 2DH5****Lower Band Edge Peak Hopping****Upper Band Edge Peak Hopping****Upper Band Edge Average Hopping**

**Transmitter Band Edge Radiated Emissions (continued)****Results: Static Mode / 3DH5**

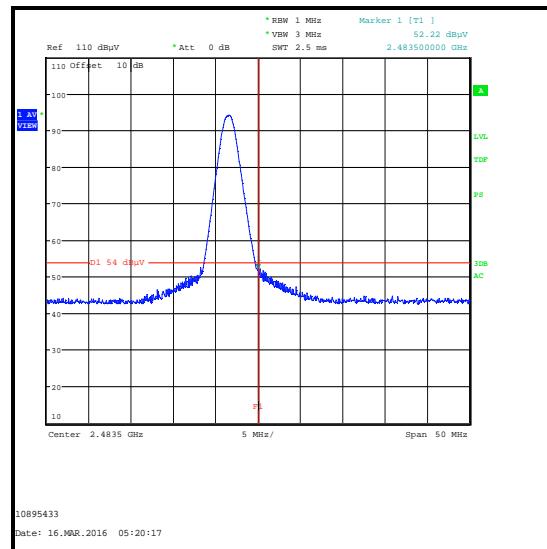
Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.0	Horizontal	50.7	73.1*	22.4	Complied
2483.5	Horizontal	69.0	74.0	5.0	Complied

Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	52.2	54.0	1.8	Complied



Lower Band Edge Peak Static

Upper Band Edge Peak Static

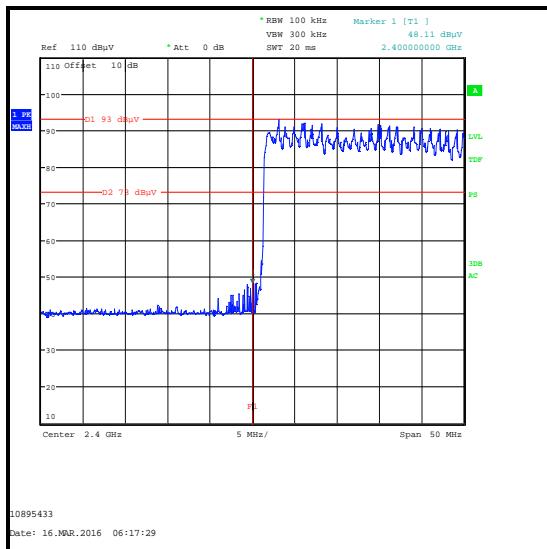
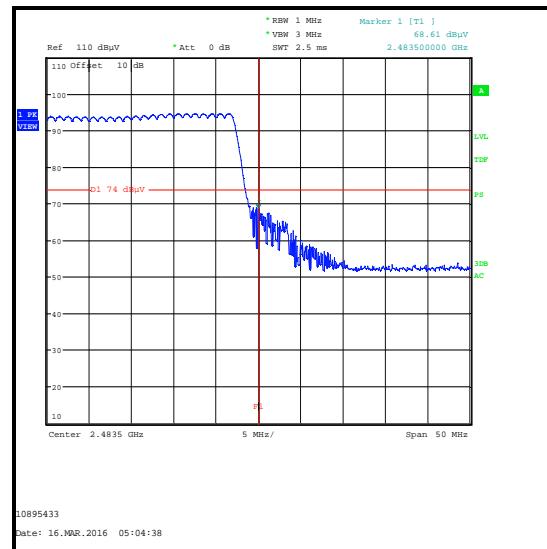
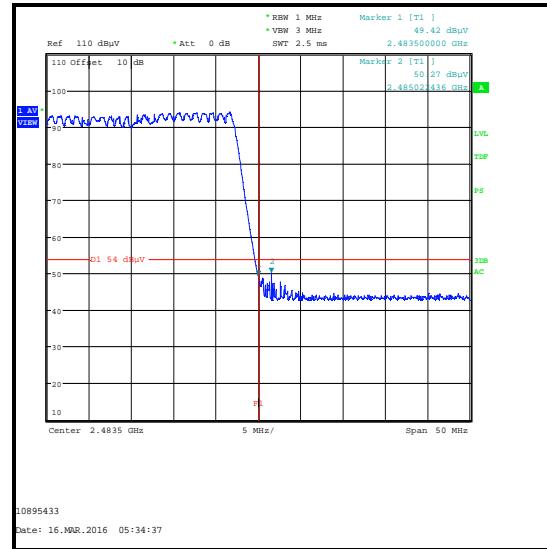


Upper Band Edge Average Static

**Transmitter Band Edge Radiated Emissions (continued)****Results: Hopping Mode / 3DH5**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2400.0	Horizontal	48.1	73.0*	24.9	Complied
2483.5	Horizontal	68.6	74.0	5.4	Complied

Frequency (MHz)	Antenna Polarity	Average Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2483.5	Horizontal	49.4	54.0	4.6	Complied
2485.022	Horizontal	50.3	54.0	3.7	Complied

**Lower Band Edge Peak Hopping****Upper Band Edge Peak Hopping****Upper Band Edge Average Hopping**

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	23 Apr 2016	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	12 Jun 2016	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
A1818	Antenna	EMCO	3115	00075692	17 Dec 2016	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	05 May 2016	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
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Carrier Frequency Separation	2.4 GHz to 2.4835 GHz	95%	±4.59 %
Average Time of Occupancy	2.4 GHz to 2.4835 GHz	95%	±3.53 ns
20 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
2.0	-	-	Model Number & Section 3.1 updated

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