



TEST REPORT

Test Report No. : UL-RPT-RP10012646JD03A V2.0

Manufacturer : Bang & Olufsen a/s
Model No. : AW-AU397
FCC ID : TTUAW-AU397
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: 20 May 2014

Checked by: *Sarah Williams*
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1. Customer Information












Company Name:	Bang & Olufsen a/s
Address:	Peter Bangs Vej 15 7600 Struer Denmark

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.247
Specification Reference:	47CFR15.207 and 47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	FCC: 209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	05 December 2013 to 11 April 2014

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)	Transmitter Conducted Emissions	
Part 15.247(d)/ 15.209(a)	Transmitter Radiated Emissions	
Part 15.247(d)	Transmitter Band Edge Conducted Emissions	
Part 15.247(d)/ 15.209(a)	Transmitter Band Edge Radiated Emissions	
Key to Results		
 = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices

2.4. Deviations from the Test Specification

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

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Bang & Olufsen
Model Name or Number:	AW-AU397
MAC Address:	240A546D213
Hardware Version Number:	5-PP001942 1213 V05
Software Version Number:	USB8797-14.69.11.p179-M3X14348-GPL-(FP69)
FCC ID:	TTUAW-AU397

Brand Name:	Bang & Olufsen
Description:	Antenna
Model Name or Number:	UAM

Brand Name:	Bang & Olufsen
Description:	Antenna
Model Name or Number:	V100

3.2. Description of EUT

The equipment under test (EUT) is an IEEE 802.11a/b/g/n 2X2 MIMO WLAN, Bluetooth and low energy Bluetooth module.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	<i>Bluetooth</i>		
Power Supply Requirement:	Nominal	5 VDC	
Type of Unit:	Transceiver		
Channel Spacing:	1 MHz		
Mode:	Basic Rate	Enhanced Data Rate	
Modulation:	GFSK	$\pi/4$ -DQPSK	8DQPSK
Packet Type: (Maximum Payload)	DH5	2DH5	3DH5
Data Rate (Mbit/s):	1	2	3
Maximum Conducted Output Power:	8.7 dBm		
Antenna Gain(s):	3.0 dBi (UAM Antenna) 0.3 dBi (V100 Antenna)		
Transmit Frequency Range:	2402 MHz to 2480 MHz		
Transmit Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	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:

Description:	Laptop PC
Brand Name:	Lenovo
Model Name or Number:	ThinkPad X61
Serial Number:	L3-C6073 07/12

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	D610
Serial Number:	UL Asset No. PC378NT

Description:	Test Jig
Brand Name:	AzureWave
Model Name or Number:	1213 adaptor
Serial Number:	Not marked or stated

Description:	AC to DC adaptor
Brand Name:	Goobay
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Description:	Router
Brand Name:	Linksys
Model Name or Number:	WAG54G
Serial Number:	CF610E100799

Description:	2 x 2 metre USB cables
Brand Name:	Not marked or stated
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

3.6. Antenna

The table below lists the antennas that the manufacturer intends to use with this product:

Manufacturer	Stated Gain (dBi)	Model	Part No.	Note(s)
Tyco	3.0	UAM	1513472-5	1 & 2
Bang & Olufsen	0.3	V100	6143988	1 & 2

Note(s):

1. The stated antenna gains are the highest gains for the frequency range 2400 MHz to 2483.5 MHz.
2. Transmitter radiated spurious emissions and band edge emissions were tested on both antennas.

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 bottom, middle and top 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):

- The EUT was inserted onto the supplied test jig, the test jig was powered via 120 VAC 60 Hz to 5 VDC power supply, using the Goobay AC to DC adaptor. The test jig then supplies the EUT with the required 3.3 VDC.
- A Lenovo ThinkPad X61 laptop PC was connected to the EUT via a USB cable. The EUT was initialised from the PC using a software application supplied by the manufacturer. Once initialised the EUT was controlled from the Dell D610 laptop PC, which was connected to the ThinkPad X61 via an access point. The application was used to enable continuous transmission and to select the test channels as required.
- The EUT was transmitting with a 100% duty cycle.
- The EUT has two RF ports labelled as Port 0 and Port 1. *Bluetooth* is only supported on Port 1.

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:	David Doyle	Test Date:	19 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Part 15.207
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	20
Relative Humidity (%):	41

Note(s):

1. The EUT was plugged into a USB cable which is connected to an AC charger. The AC charger was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. 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.
3. A pulse limiter was fitted between the LISN and the test receiver.

Transmitter AC Conducted Spurious Emissions (continued)**Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.443	Live	49.9	57.0	7.1	Complied
0.447	Live	51.2	56.9	5.7	Complied
0.591	Live	40.6	56.0	15.4	Complied
0.618	Live	39.8	56.0	16.2	Complied
0.875	Live	38.6	56.0	17.4	Complied
1.239	Live	35.3	56.0	20.7	Complied
1.991	Live	35.0	56.0	21.0	Complied
2.054	Live	35.2	56.0	20.8	Complied
2.094	Live	35.5	56.0	20.5	Complied
4.281	Live	32.7	56.0	23.3	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.452	Live	38.2	46.8	8.6	Complied
0.605	Live	28.8	46.0	17.2	Complied
0.893	Live	26.5	46.0	19.5	Complied
1.316	Live	24.8	46.0	21.2	Complied
1.743	Live	24.1	46.0	21.9	Complied
2.027	Live	24.1	46.0	21.9	Complied

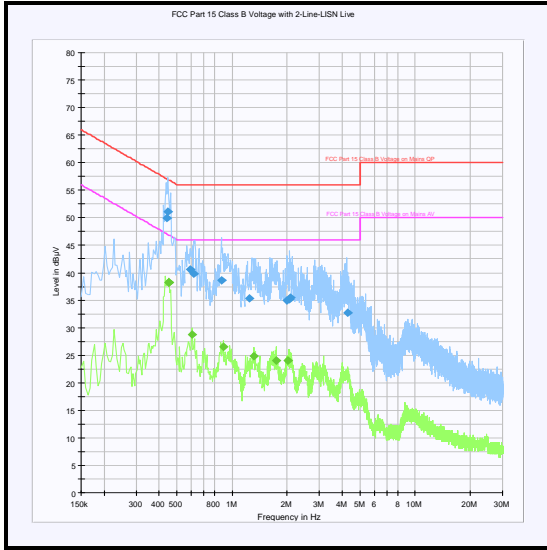
Transmitter AC Conducted Spurious Emissions (continued)**Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.447	Neutral	51.8	56.9	5.1	Complied
0.879	Neutral	41.1	56.0	14.9	Complied
1.158	Neutral	35.7	56.0	20.3	Complied
1.307	Neutral	37.1	56.0	18.9	Complied
1.581	Neutral	35.5	56.0	20.5	Complied
2.243	Neutral	34.0	56.0	22.0	Complied
3.318	Neutral	34.3	56.0	21.7	Complied
4.385	Neutral	35.1	56.0	20.9	Complied
4.493	Neutral	33.5	56.0	22.5	Complied

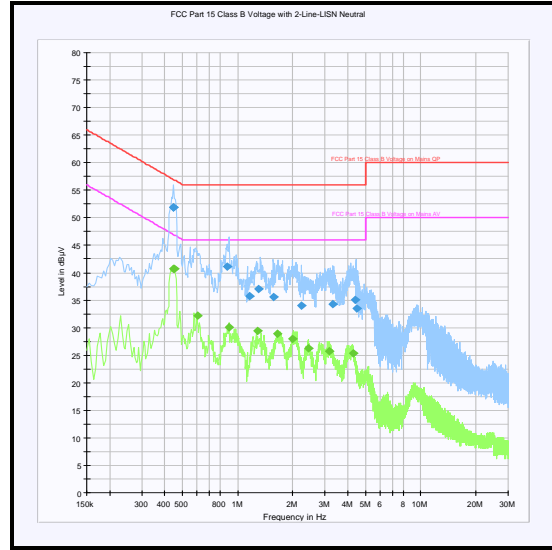
Results: Neutral / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.447	Neutral	40.8	46.9	6.1	Complied
0.452	Neutral	40.8	46.8	6.0	Complied
0.605	Neutral	32.2	46.0	13.8	Complied
0.893	Neutral	30.1	46.0	15.9	Complied
1.293	Neutral	29.4	46.0	16.6	Complied
1.649	Neutral	28.9	46.0	17.1	Complied
2.004	Neutral	28.0	46.0	18.0	Complied
2.432	Neutral	26.3	46.0	19.7	Complied
3.147	Neutral	25.8	46.0	20.2	Complied
4.268	Neutral	25.3	46.0	20.7	Complied

Transmitter AC Conducted Spurious Emissions (continued)



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)
M1625	Thermohygrometer	JM Handelpunkt	30.5015.06	None stated	09 Jan 2014	12
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	29 Apr 2014	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	14 Oct 2014	12

5.2.2. Transmitter 20 dB Bandwidth**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	05 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Part 15.247(a)(1)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.1

Environmental Conditions:

Temperature (°C):	26
Relative Humidity (%):	31

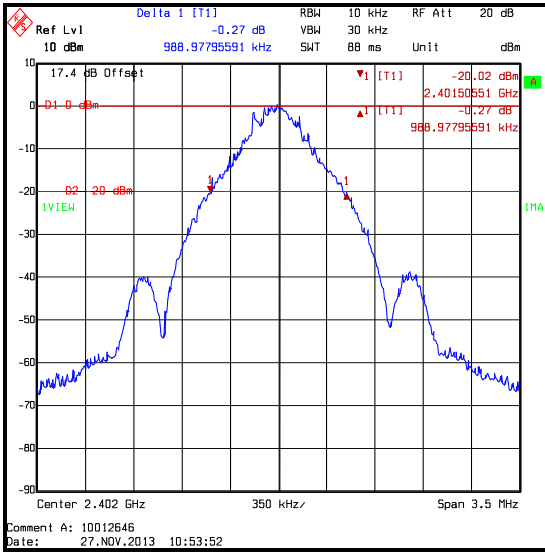
Note(s):

1. The test receiver resolution bandwidth was set to 10 kHz and video bandwidth 30 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The span was set to 3.5 MHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. These results are documented in the tables below.
2. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.

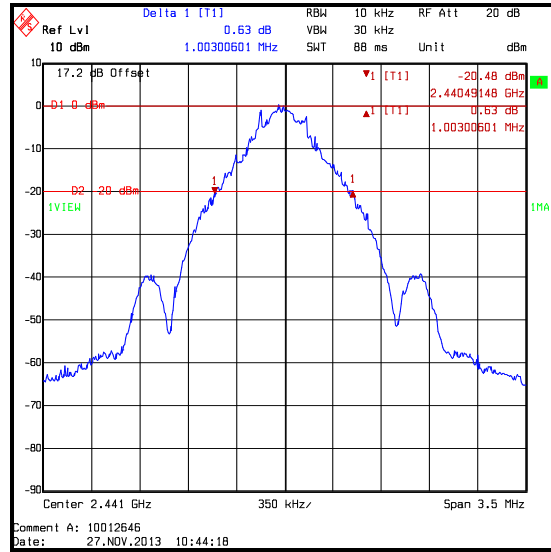
Transmitter 20 dB Bandwidth (continued)

Results DH5:

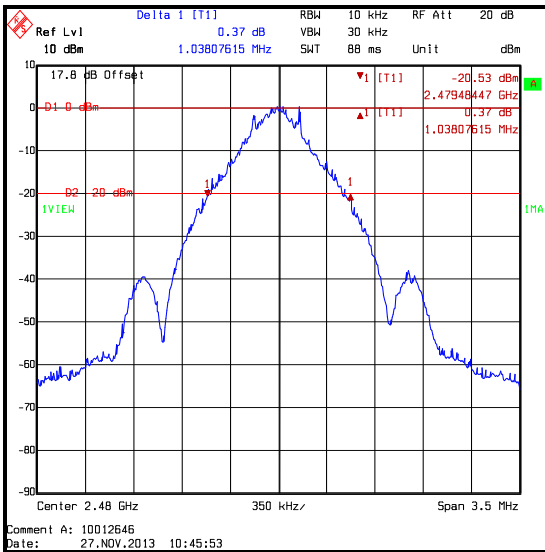
Channel	20 dB Bandwidth (kHz)
Bottom	988.978
Middle	1003.301
Top	1038.076



Bottom Channel



Middle Channel

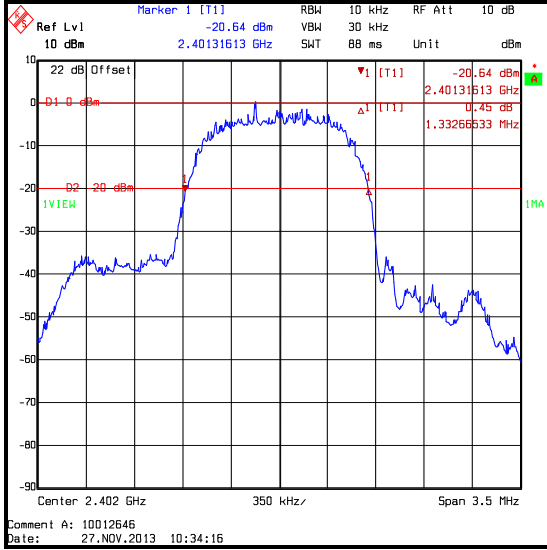


Top Channel

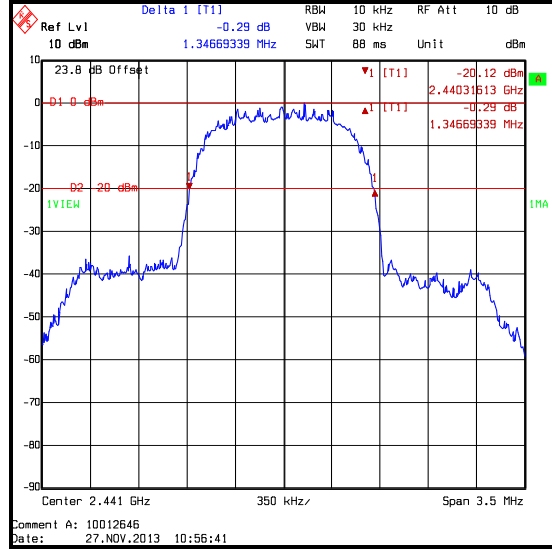
Transmitter 20 dB Bandwidth (continued)

Results 2DH5:

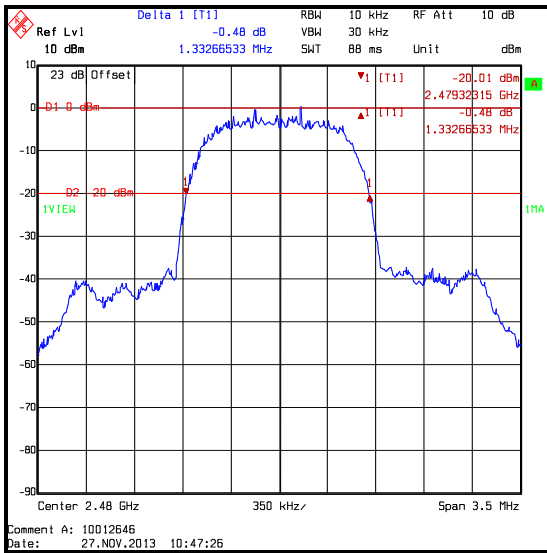
Channel	20 dB Bandwidth (kHz)
Bottom	1332.665
Middle	1346.693
Top	1332.665



Bottom Channel



Middle Channel

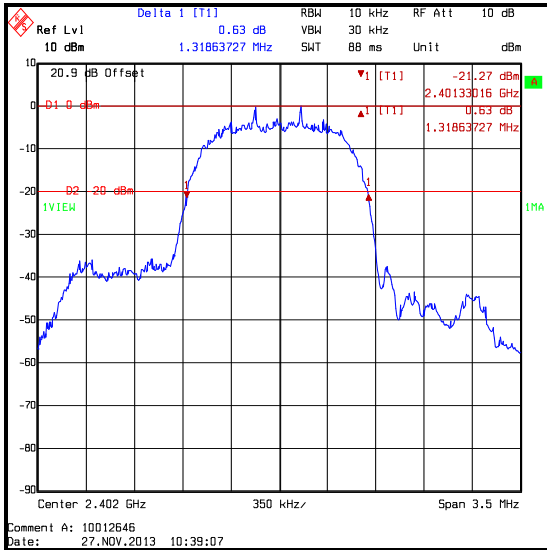


Top Channel

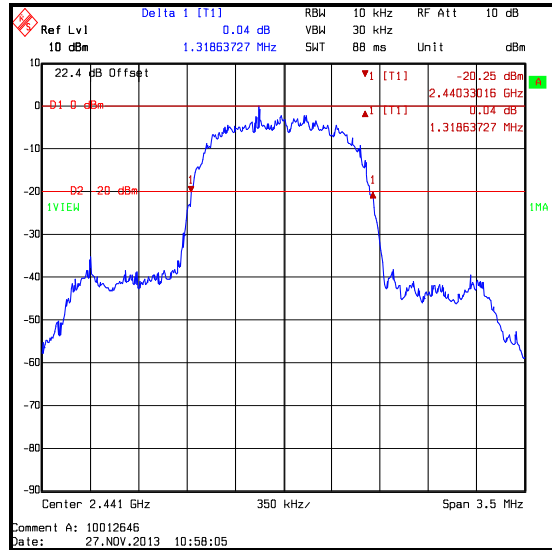
Transmitter 20 dB Bandwidth (continued)

Results 3DH5:

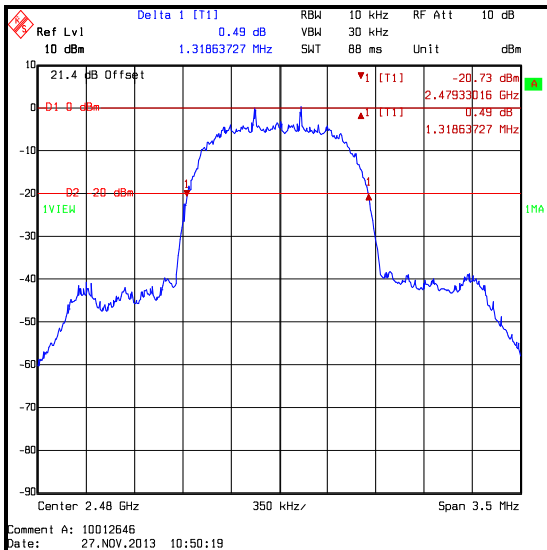
Channel	20 dB Bandwidth (kHz)
Bottom	1318.637
Middle	1318.637
Top	1318.637



Bottom Channel



Middle Channel



Top Channel

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12

5.2.3. Transmitter Carrier Frequency Separation

Test Summary:

Test Engineer:	Nick Steele	Test Date:	05 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Part 15.247(a)(1)
Test Method Used:	As detailed in ANSI C63.10 Section 7.7.2

Environmental Conditions:

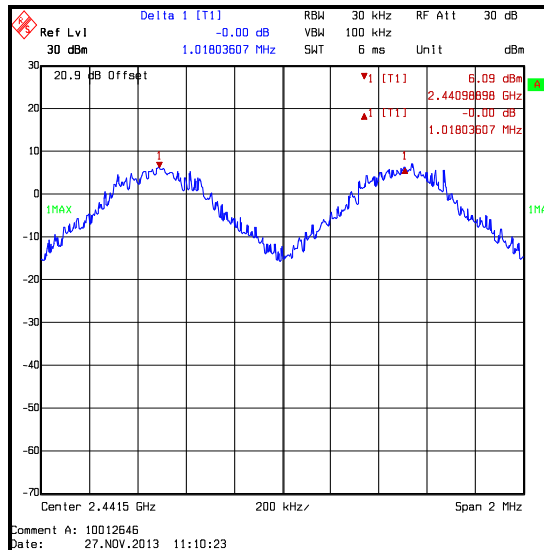
Temperature (°C):	24
Relative Humidity (%):	32

Note(s):

1. The 20 dB bandwidth measured for the middle channel operating at 2441 MHz was used to calculate the limit.
2. The test receiver 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 at the centre of one signal and then a delta marker was placed in the same place on the second signal, the results are recorded in the table below.
3. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.

Results: DH5

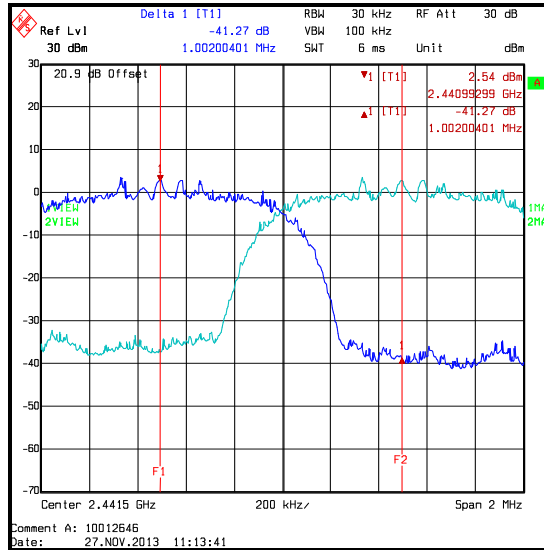
Carrier Frequency Separation (kHz)	Limit ($\frac{2}{3}$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1018.036	668.867	349.169	Complied



Transmitter Carrier Frequency Separation (continued)

Results: 2DH5

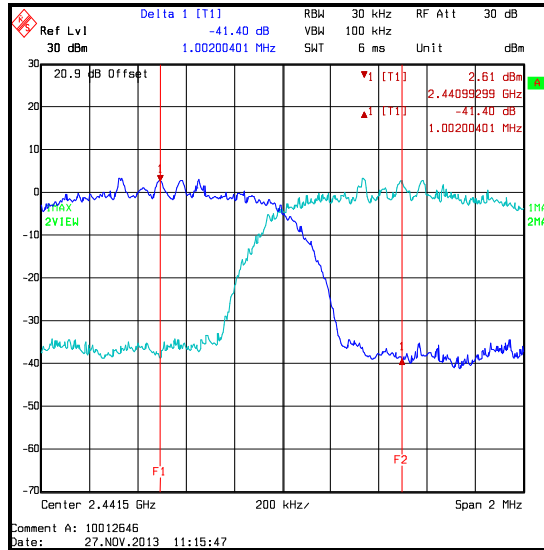
Carrier Frequency Separation (kHz)	Limit ($2/3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1002.004	897.795	104.209	Complied



Transmitter Carrier Frequency Separation (continued)

Results: 3DH5

Carrier Frequency Separation (kHz)	Limit ($2/3$ of 20 dB BW) (kHz)	Margin (kHz)	Result
1002.004	879.091	122.913	Complied



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelpunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12

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

Test Engineer:	Nick Steele	Test Date:	05 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Part 15.247(a)(1)(iii)
Test Method Used:	As detailed in ANSI C63.10 Section 7.7.3 & 7.7.4

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	32

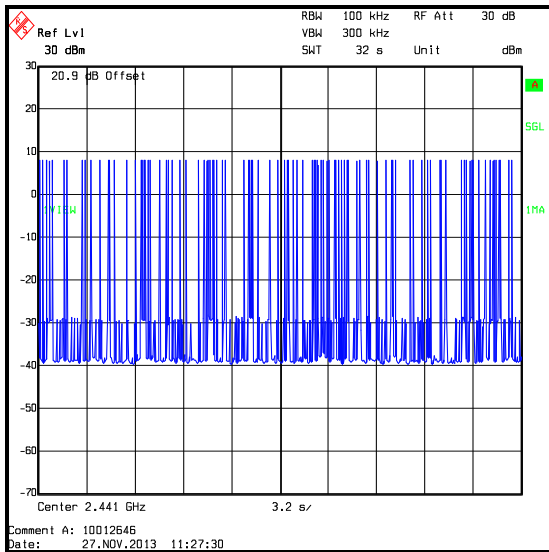
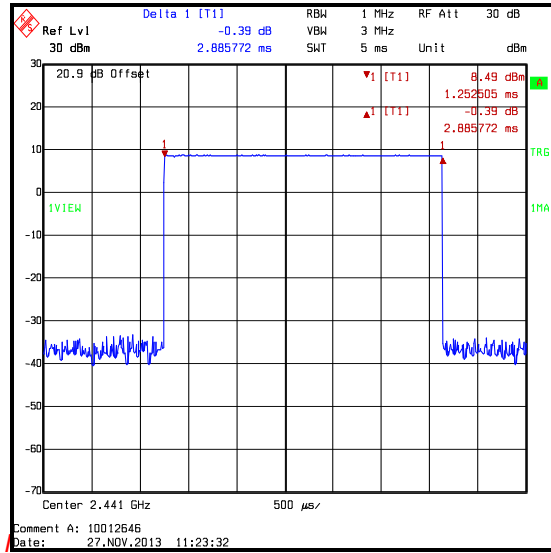
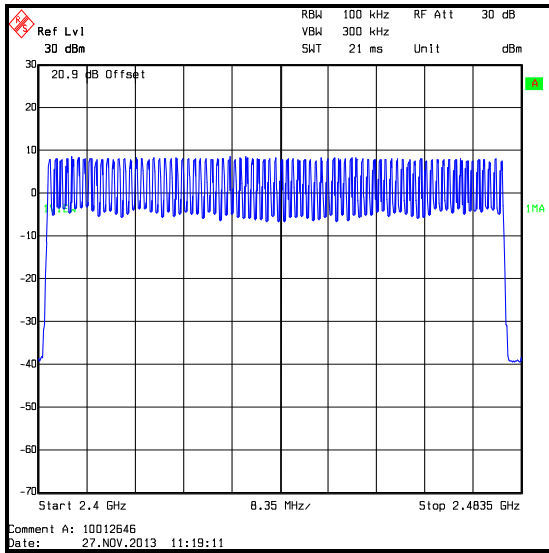
Note(s):

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. The test receiver was set up for the Number of Hopping Frequencies measurement as follows: the 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.
3. The test receiver was set up for the Emission Width measurement as follows: the resolution bandwidth was set to 1 MHz and video bandwidth of 3 MHz. A peak detector was used and sweep time was set to auto with a span of zero Hz. The test receiver 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 is recorded in the table below.
4. The test receiver was set up for the Number of Hopping Frequencies in 32 seconds measurement as follows: the 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 hopping frequencies were recorded in the table below.
5. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable.

Results:

Emission Width (μs)	Number of Hops in 31.6 Seconds	Average Time of Occupancy (s)	Limit (s)	Margin (s)	Result
2885.772	100	0.289	0.4	0.111	Complied

Transmitter Number of Hopping Frequencies and Average Time of Occupancy (continued)



Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12

5.2.5. Transmitter Maximum Peak Output Power**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	05 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Part 15.247(b)(1)
Test Method Used:	As detailed in ANSI C63.10 Section 6.10.1

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	33

Note(s):

1. The test receiver resolution bandwidth was set to 2 MHz and video bandwidth of 10 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The span was set to 7.5 MHz. A marker was placed at the peak of the signal and the results recorded in the tables below.
2. The test receiver was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF offset level was entered on the test receiver to compensate for the loss of the attenuator and RF cable.

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

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	8.7	30.0	21.3	Complied
Middle	8.7	30.0	21.3	Complied
Top	8.3	30.0	21.7	Complied

De Facto EIRP Limit Comparison – UAM Antenna

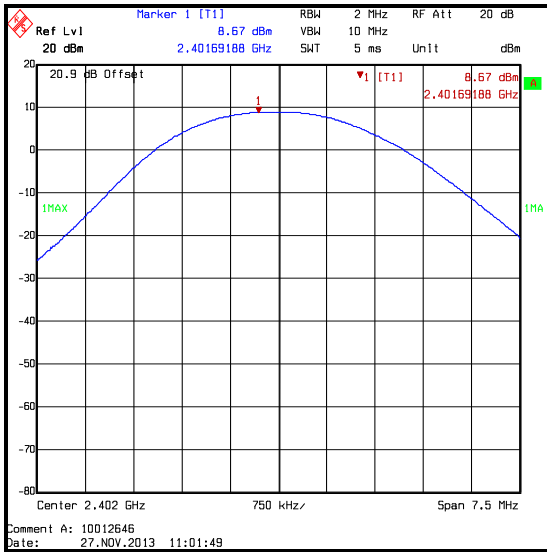
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.7	3.0	11.7	36.0	24.3	Complied
Middle	8.7	3.0	11.7	36.0	24.3	Complied
Top	8.3	3.0	11.3	36.0	24.7	Complied

De Facto EIRP Limit Comparison – V100 Antenna

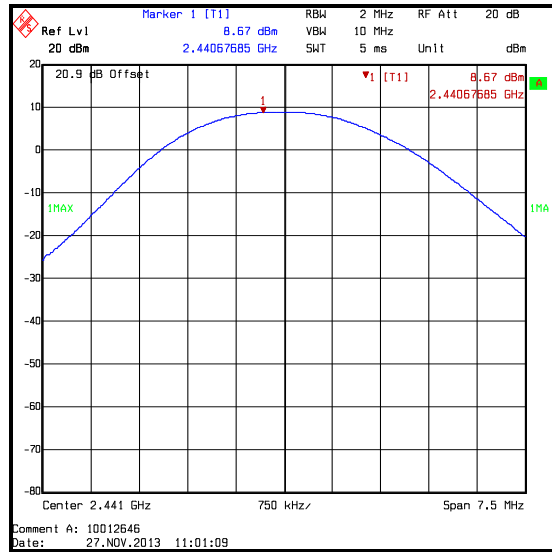
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	8.7	0.3	9.0	36.0	27.0	Complied
Middle	8.7	0.3	9.0	36.0	27.0	Complied
Top	8.3	0.3	8.6	36.0	27.4	Complied

Transmitter Maximum Peak Output Power (continued)

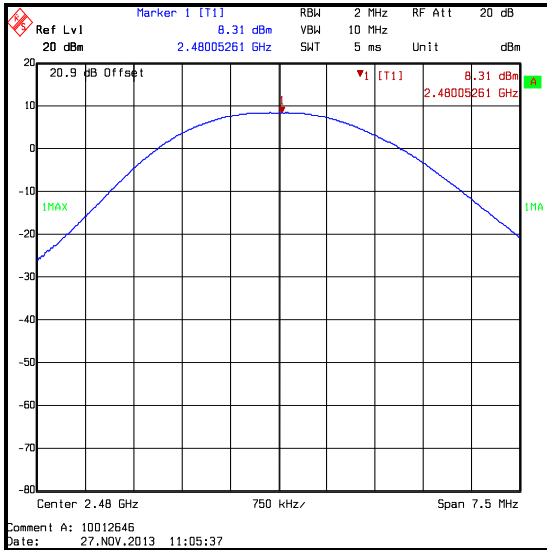
Results: DH5



Bottom Channel



Middle Channel



Top Channel

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

Channel	Conducted Peak Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	7.4	21.0	13.6	Complied
Middle	7.4	21.0	13.6	Complied
Top	7.0	21.0	14.0	Complied

De Facto EIRP Limit Comparison – UAM Antenna

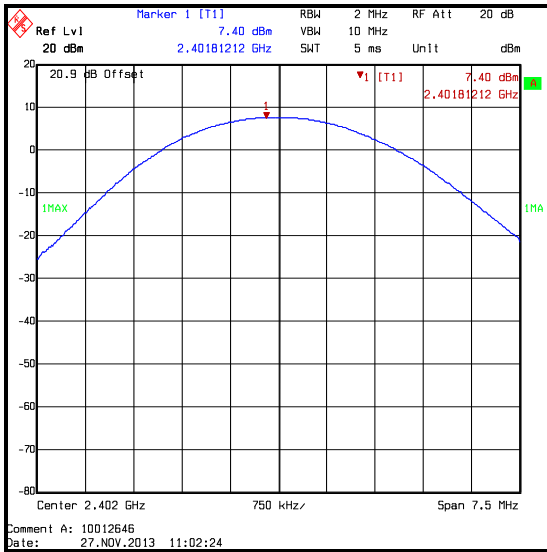
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	7.4	3.0	10.4	27.0	16.6	Complied
Middle	7.4	3.0	10.4	27.0	16.6	Complied
Top	7.0	3.0	10.0	27.0	17.0	Complied

De Facto EIRP Limit Comparison – V100 Antenna

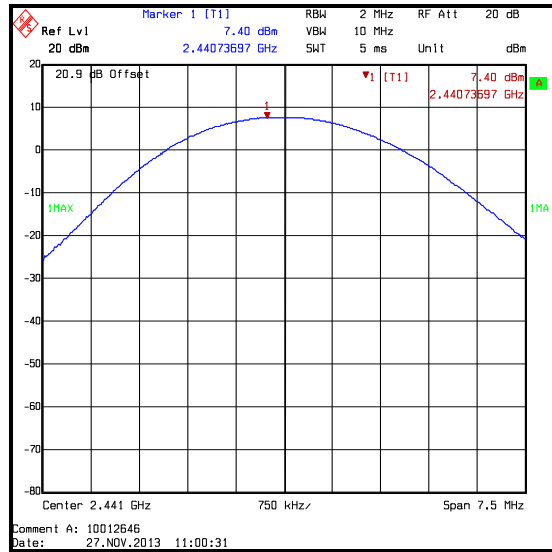
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	7.4	0.3	7.7	27.0	19.3	Complied
Middle	7.4	0.3	7.7	27.0	19.3	Complied
Top	7.0	0.3	7.3	27.0	19.7	Complied

Transmitter Maximum Peak Output Power (continued)

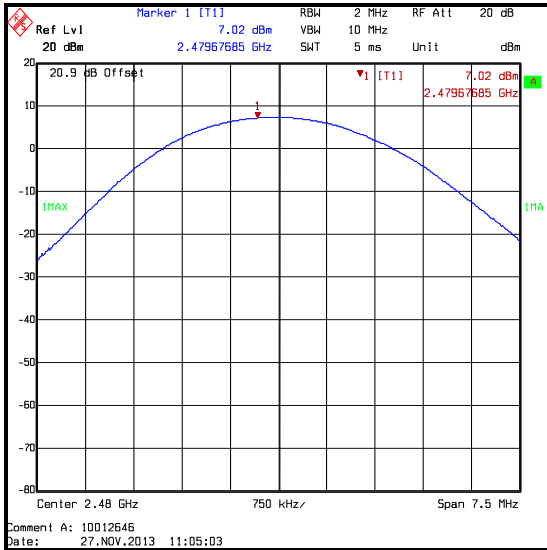
Results: 2DH5



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	7.8	21.0	13.2	Complied
Middle	7.8	21.0	13.2	Complied
Top	7.5	21.0	13.5	Complied

De Facto EIRP Limit Comparison – UAM Antenna

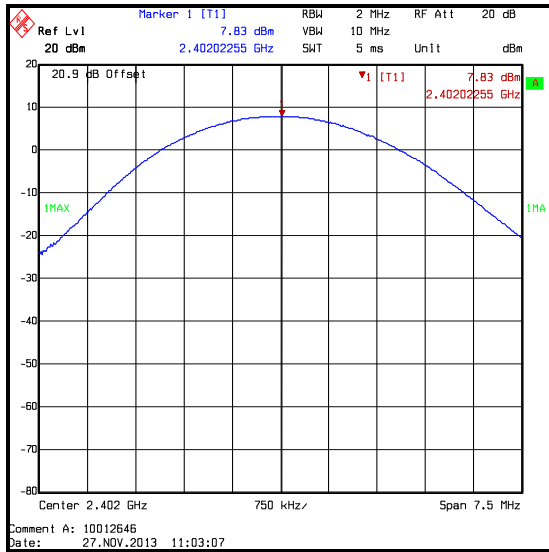
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	7.8	3.0	10.8	27.0	16.2	Complied
Middle	7.8	3.0	10.8	27.0	16.2	Complied
Top	7.5	3.0	10.5	27.0	16.5	Complied

De Facto EIRP Limit Comparison – V100 Antenna

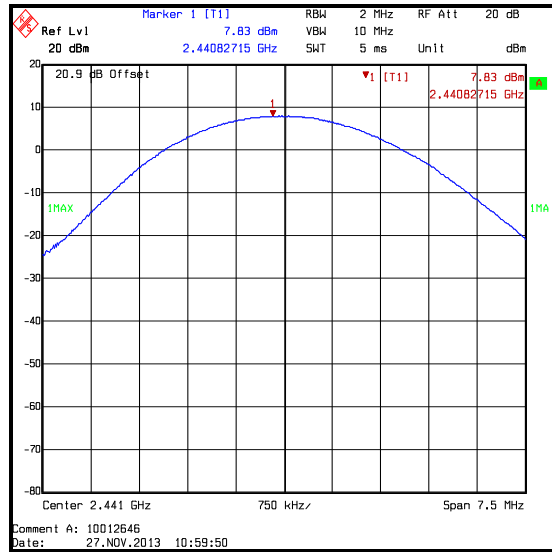
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	7.8	0.3	8.1	27.0	18.9	Complied
Middle	7.8	0.3	8.1	27.0	18.9	Complied
Top	7.5	0.3	7.8	27.0	19.2	Complied

Transmitter Maximum Peak Output Power (continued)

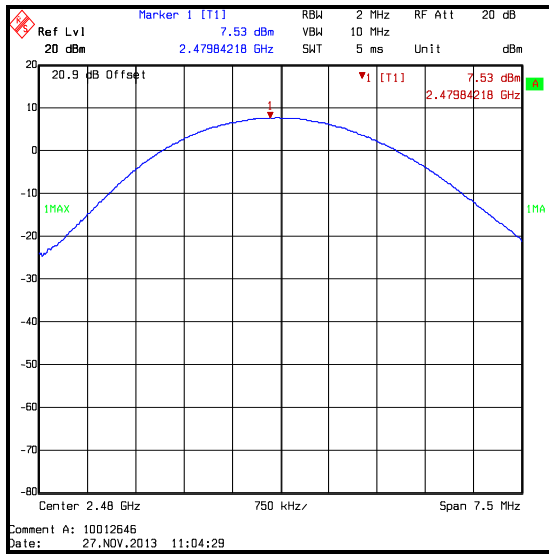
Results: 3DH5



Bottom Channel



Middle Channel



Top Channel

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12
A199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	25 Jun 2014	12

5.2.6. Transmitter Radiated Emissions - UAM Antenna**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	13 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

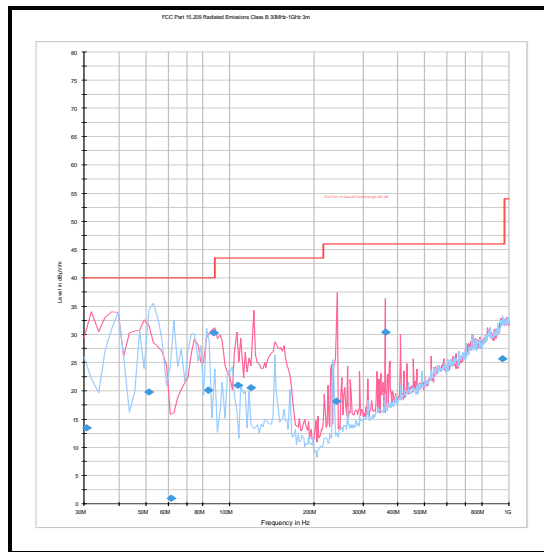
Temperature (°C):	23
Relative Humidity (%):	47

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 top 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 wide enough to see the whole emission.

Results: Quasi-Peak / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
119.097	Vertical	20.5	43.5	23.0	Complied

Transmitter Radiated Emissions - UAM Antenna (continued)

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)
M1622	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	31 Dec 2014	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
A490	Antenna	Chase	CBL6111A	1590	09 Apr 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
A1834	Attenuator	Hewlett Packard	8941B	10444	15 Nov 2014	12
G0543	Amplifier	Sonoma	310N	230801	15 Feb 2014	12

Transmitter Radiated Emissions - UAM Antenna (continued)**Test Summary:**

Test Engineer:	Nick Steele	Test Dates:	06 December 2013, 09 December 2013, 10 December 2013 & 11 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	23 to 25
Relative Humidity (%):	31 to 36

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 emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental at 2480 MHz.
4. 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.
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 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.

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

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12009.137	Vertical	55.2	74.0	18.8	Complied

Results: Average / Bottom Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4803.905	Horizontal	43.5	54.0	10.5	Complied
12009.137	Horizontal	46.7	54.0	7.3	Complied

Results: Peak / Middle Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12204.959	Horizontal	63.8	74.0	10.2	Complied

Results: Average / Middle Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4882.077	Vertical	42.3	54.0	11.7	Complied
7323.045	Vertical	44.1	54.0	9.9	Complied
12204.959	Horizontal	52.7	54.0	1.3	Complied

Results: Peak / Top Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7440.545	Vertical	58.5	74.0	15.5	Complied
12399.171	Horizontal	56.8	74.0	17.2	Complied

Results: Average / Top Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
4960.045	Vertical	43.9	54.0	10.1	Complied
7440.044	Vertical	50.0	54.0	4.0	Complied
12400.045	Horizontal	46.2	54.0	7.8	Complied

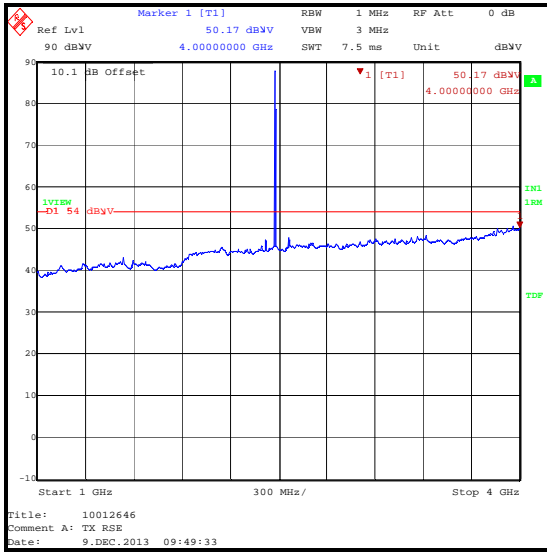
Transmitter Radiated Emissions - UAM Antenna (continued)**Results: Peak / Hopping Mode / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7407.460	Vertical	55.2	74.0	18.8	Complied
12014.193	Horizontal	57.7	74.0	16.3	Complied

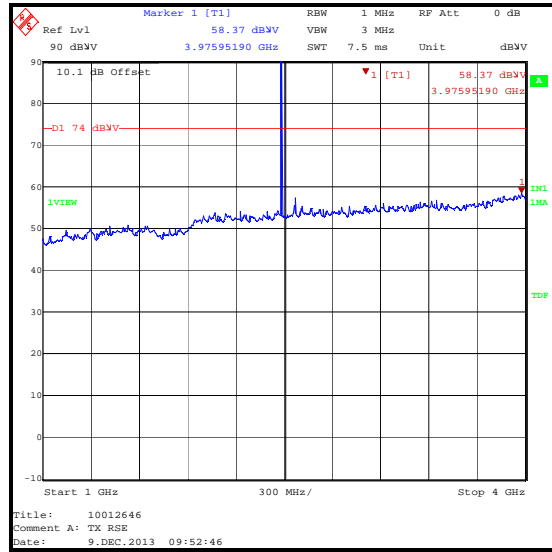
Results: Average / Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
12014.193	Vertical	32.4	54.0	21.6	Complied

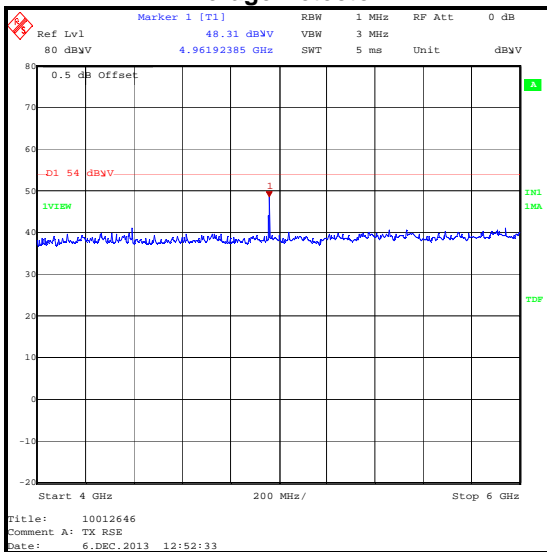
Transmitter Radiated Emissions - UAM Antenna (continued)



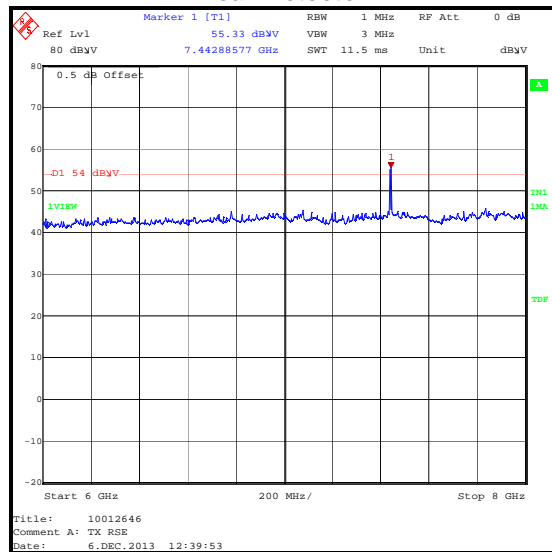
Average Detector



Peak Detector

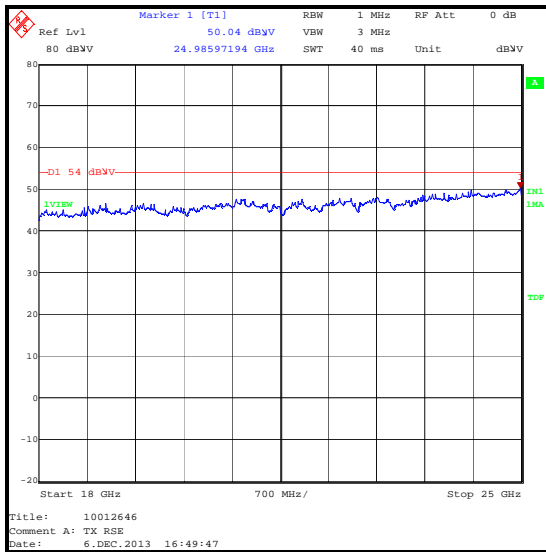
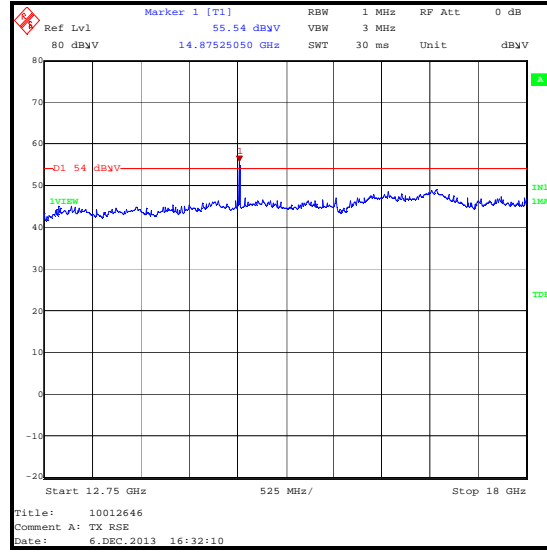
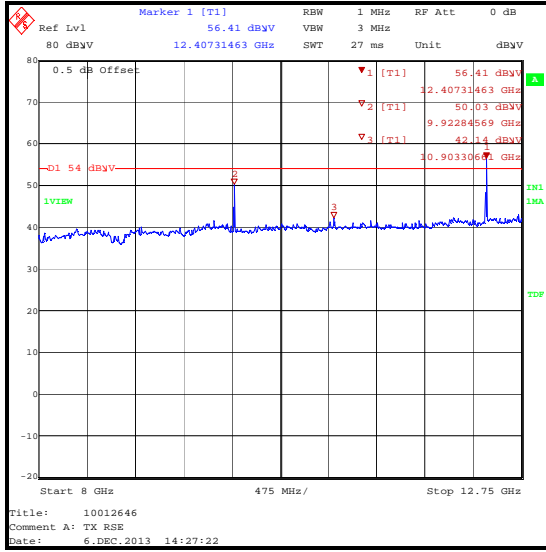


Average Detector



Peak Detector

Transmitter Radiated Emissions - UAM Antenna (continued)



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

Transmitter Radiated Emissions - UAM Antenna (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	24 May 2014	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	14 Nov 2014	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	19 Apr 2014	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12
A253	Antenna	Flann Microwave	12240-20	128	14 Nov 2014	12
A254	Antenna	Flann Microwave	14240-20	139	14 Nov 2014	12
A255	Antenna	Flann Microwave	16240-20	519	14 Nov 2014	12
A256	Antenna	Flann Microwave	18240-20	400	14 Nov 2014	12
A436	Antenna	Flann Microwave	20240-20	330	14 Nov 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12

5.2.7. Transmitter Radiated Emissions - V100 Antenna**Test Summary:**

Test Engineer:	David Doyle	Test Date:	21 February 2014
Test Sample MAC Address:	240A546D213		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

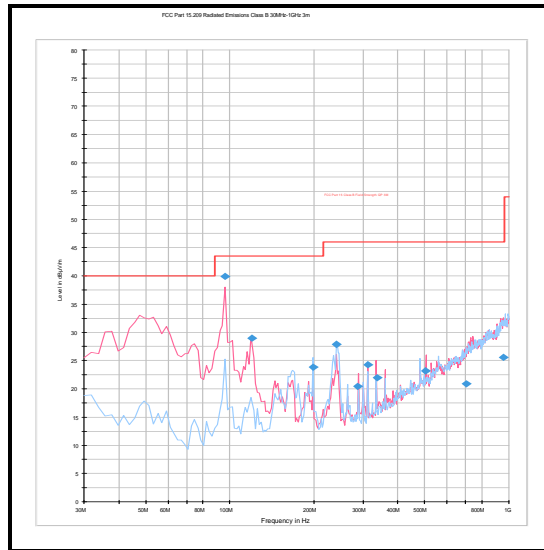
Temperature (°C):	22
Relative Humidity (%):	45

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 top 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 wide enough to see the whole emission.

Results: Quasi-Peak / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
120.001	Vertical	29.0	43.5	14.5	Complied

Transmitter Radiated Emissions - V100 Antenna (continued)

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)
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
G0543	Amplifier	Sonoma	310N	230801	18 May 2014	3
A1834	Attenuator	Hewlett Packard	8491B	10444	15 Nov 2014	12
A490	Antenna	Chase	CBL6111A	1590	18 Apr 2014	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	11 Feb 2015	12
M1622	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	31 Dec 2014	12

Transmitter Radiated Emissions - V100 Antenna (continued)**Test Summary:**

Test Engineer:	Mark Percival	Test Dates:	21 February 2014 & 21 March 2014
Test Sample MAC Address:	240A546D213		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	36 to 38

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 emission shown on the 1 GHz to 4 GHz plot is the EUT fundamental at 2480 MHz.
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 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.
5. * -20 dBc limit.

Transmitter Radiated Emissions - V100 Antenna (continued)**Results: Peak / Bottom Channel / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
9607.324	Horizontal	58.7	73.7*	15.0	Complied
12010.792	Vertical	55.8	74.0	18.2	Complied
14410.947	Horizontal	56.1	73.7*	17.6	Complied

Results: Average / Bottom Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7206.042	Horizontal	43.5	54.0	10.5	Complied
12010.051	Vertical	44.5	54.0	9.5	Complied

Results: Peak / Middle Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
9764.622	Horizontal	57.5	78.3*	20.8	Complied
12205.782	Vertical	58.3	74.0	15.7	Complied
14644.956	Vertical	61.9	78.3*	16.4	Complied

Results: Average / Middle Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7323.016	Horizontal	43.5	54.0	10.5	Complied
12205.020	Vertical	45.9	54.0	8.1	Complied

Results: Peak / Top Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
9919.331	Horizontal	63.6	75.9*	12.3	Complied
12399.128	Vertical	59.3	74.0	14.7	Complied
14878.941	Horizontal	61.0	75.9*	14.9	Complied

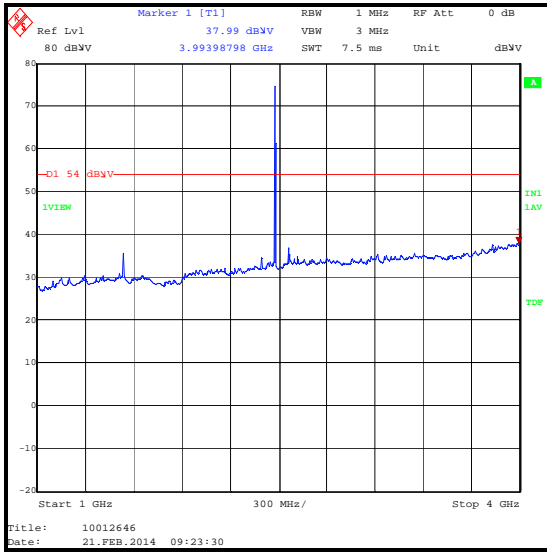
Results: Average / Top Channel / DH5

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
7440.010	Horizontal	39.2	54.0	14.8	Complied
12399.950	Vertical	46.9	54.0	7.1	Complied

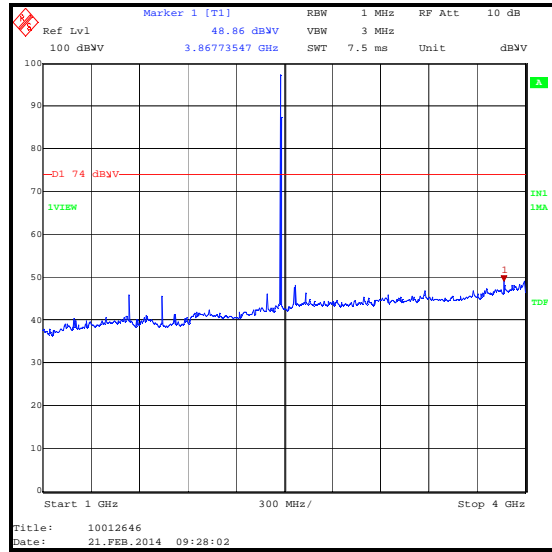
Transmitter Radiated Emissions - V100 Antenna (continued)**Results: Peak / Hopping Mode / DH5**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
9863.206	Horizontal	62.3	78.3*	16.0	Complied
14728.657	Horizontal	62.0	78.3*	16.3	Complied

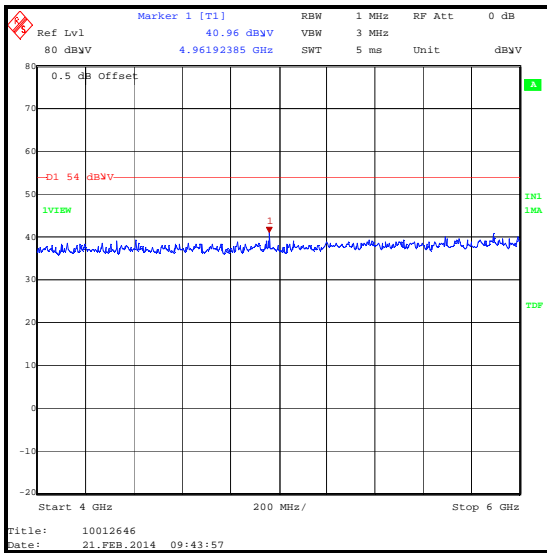
Transmitter Radiated Emissions - V100 Antenna (continued)



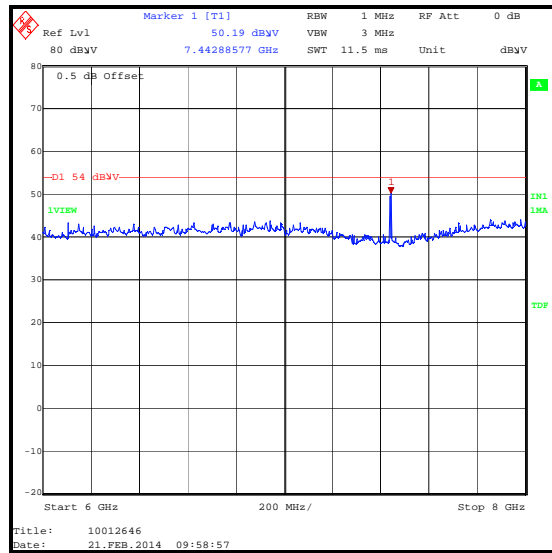
Average Detector



Peak Detector

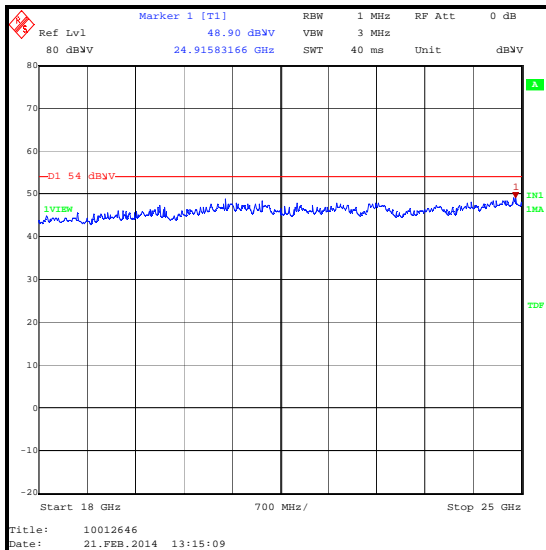
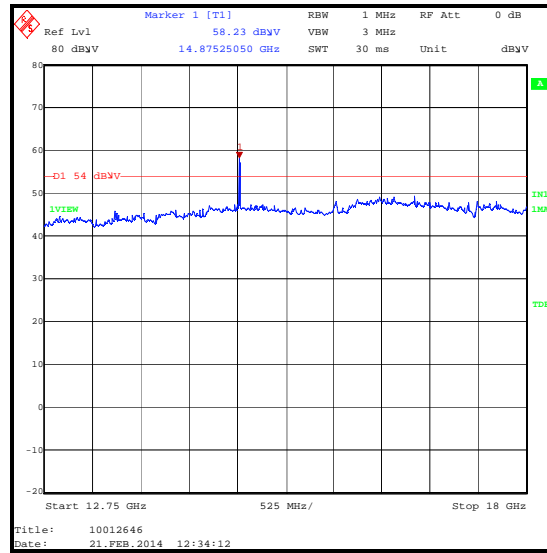
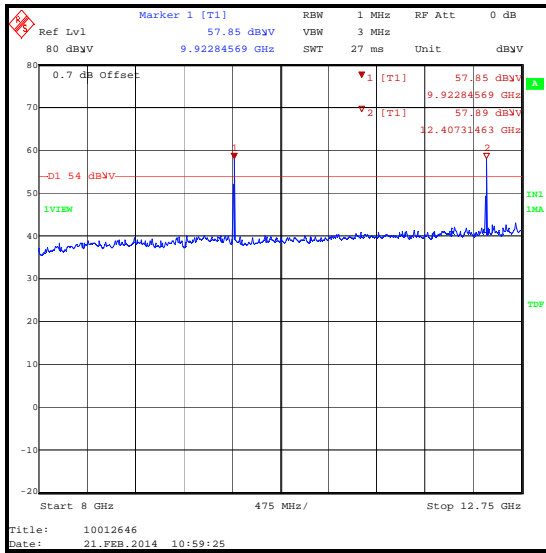


Average Detector



Peak Detector

Transmitter Radiated Emissions - V100 Antenna (continued)



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

Transmitter Radiated Emissions – V100 Antenna (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	24 May 2014	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	14 Nov 2014	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	19 Apr 2014	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12
A253	Antenna	Flann Microwave	12240-20	128	14 Nov 2014	12
A254	Antenna	Flann Microwave	14240-20	139	14 Nov 2014	12
A255	Antenna	Flann Microwave	16240-20	519	14 Nov 2014	12
A256	Antenna	Flann Microwave	18240-20	400	14 Nov 2014	12
A436	Antenna	Flann Microwave	20240-20	330	14 Nov 2014	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
G0543	Amplifier	Sonoma	310N	230801	18 May 2014	3
A1834	Attenuator	Hewlett Packard	8491B	10444	15 Nov 2014	12
A490	Antenna	Chase	CBL6111A	1590	18 Apr 2014	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	11 Feb 2015	12
M1622	Thermohygrometer	JM Handelpunkt	30.5015.06	Not Stated	31 Dec 2014	12

5.2.8. Transmitter Band Edge Radiated Emissions – UAM Antenna**Test Summary:**

Test Engineer:	Nick Steele	Test Date:	11 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.9.2 and Notes below

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	34

Note(s):

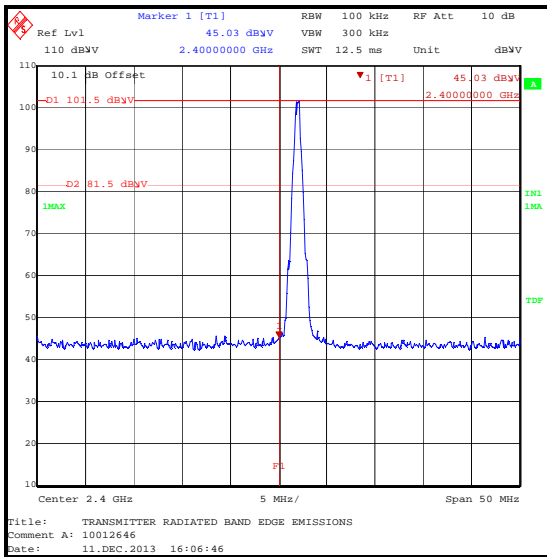
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. For the lower band edge measurements: As the lower band edge falls within the non-restricted band only peak measurements are required. The test receiver resolution bandwidth 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. For the upper band edge measurements: As the upper band edge falls within restricted band both peak and average measurements were recorded by placing a marker at the edge of the band (2483.5 MHz). For peak measurements the test receiver resolution bandwidth was set to 1 MHz and 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 video bandwidth 10 Hz. 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 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. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

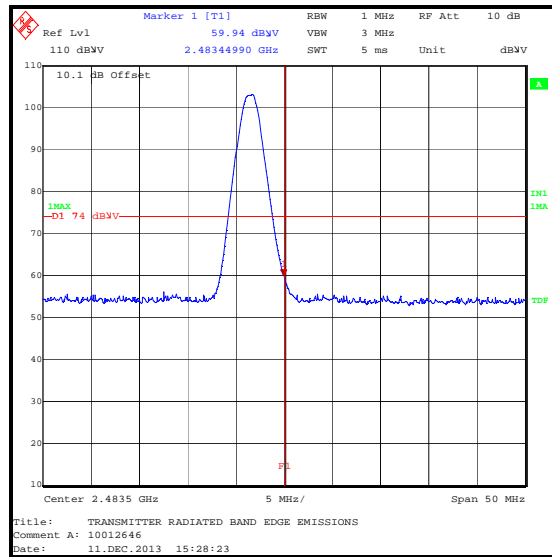
Results: Static Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	45.0	81.5*	36.5	Complied
2483.5	Horizontal	59.9	74.0	14.1	Complied

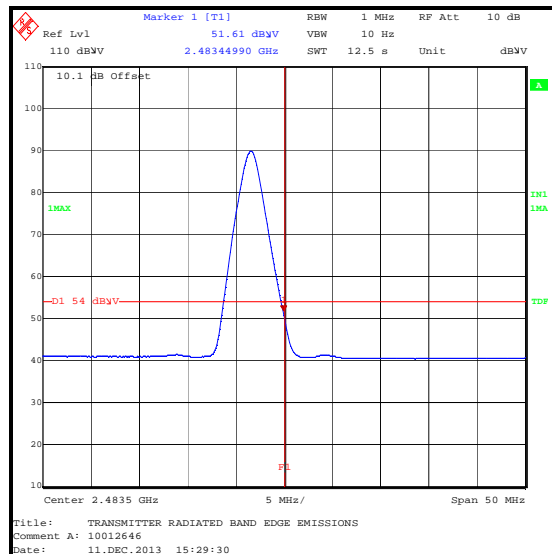
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	51.6	54.0	2.4	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



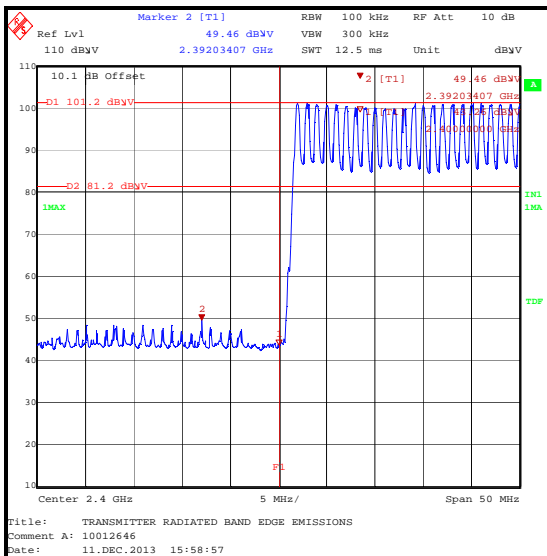
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

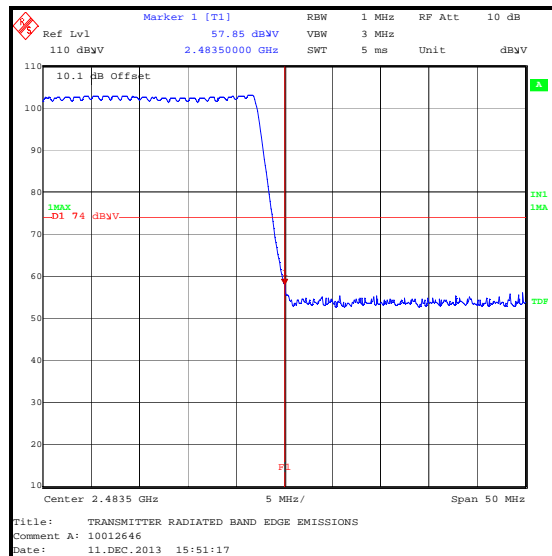
Results: Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2392.034	Horizontal	49.5	81.2*	51.7	Complied
2400.0	Horizontal	43.3	81.2*	37.9	Complied
2483.5	Horizontal	57.9	74.0	16.1	Complied

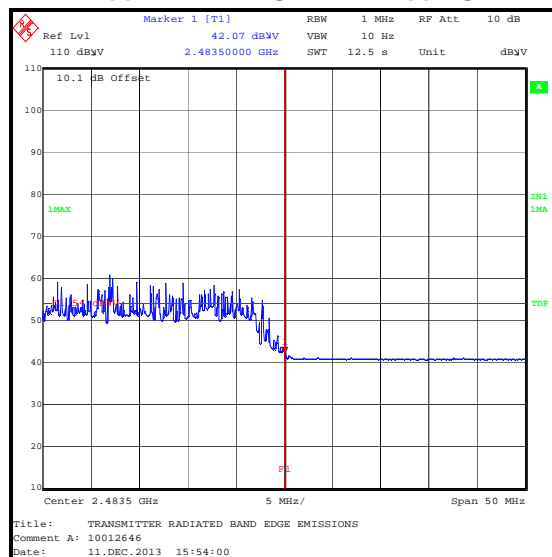
Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2483.5	Horizontal	42.1	54.0	11.9	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



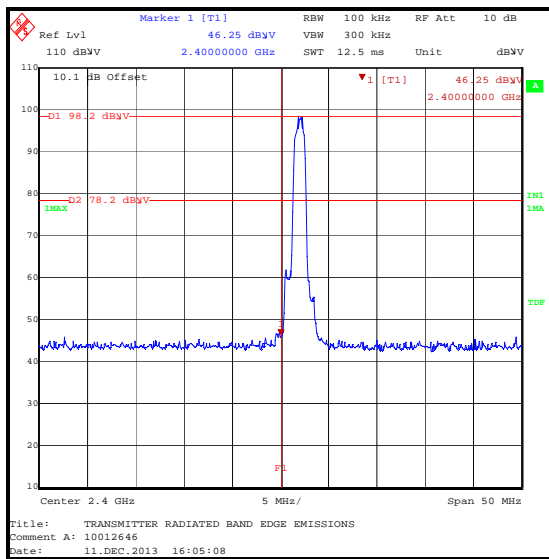
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

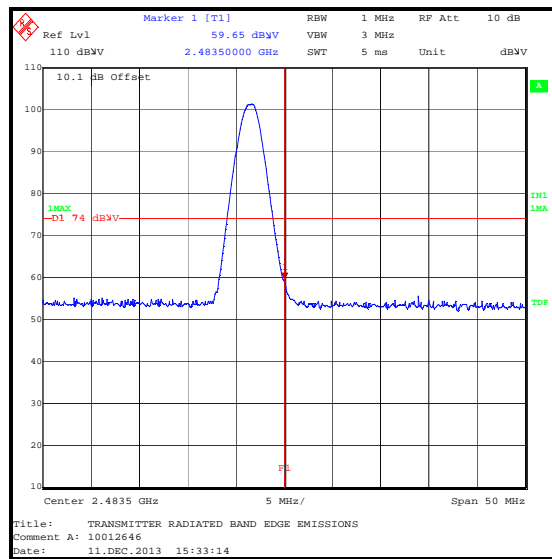
Results: Static Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	Horizontal	46.3	78.2	29.9	Complied
2483.5	Horizontal	59.7	74.0	14.3	Complied

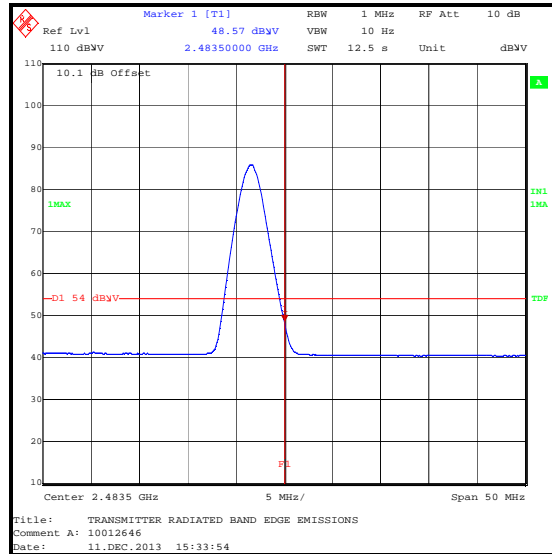
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	48.6	54.0	5.4	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



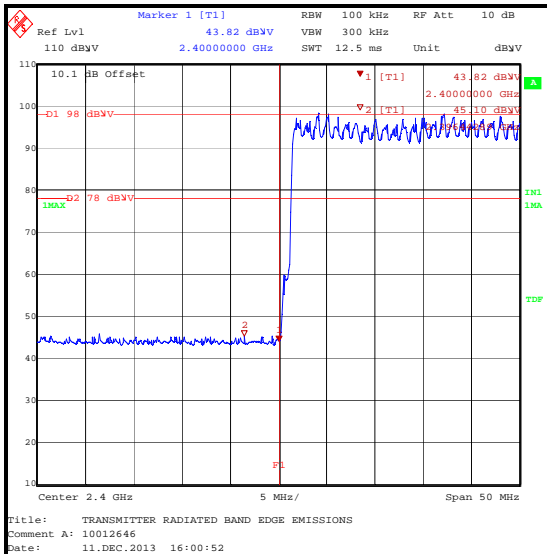
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

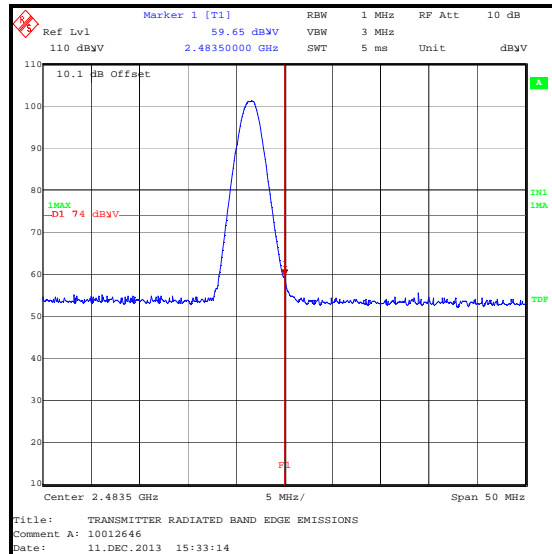
Results: Hopping Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2396.443	Horizontal	45.1	78.0*	32.9	Complied
2400.0	Horizontal	43.8	78.0*	34.2	Complied
2483.5	Horizontal	59.7	74.0	14.3	Complied

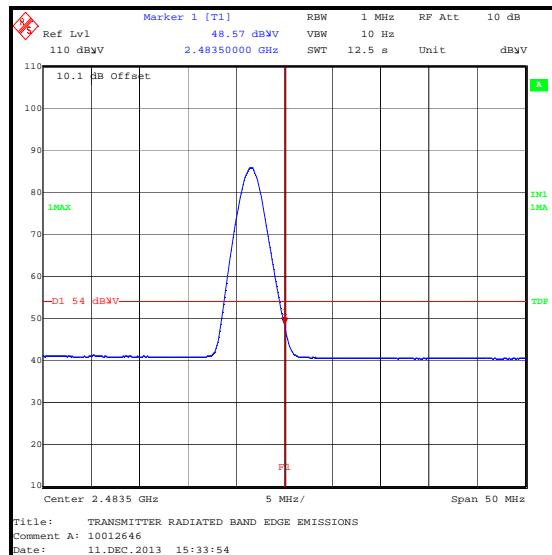
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	48.6	54.0	5.4	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



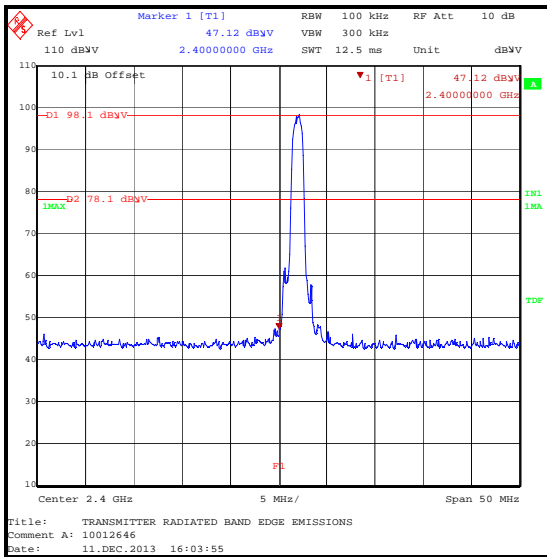
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

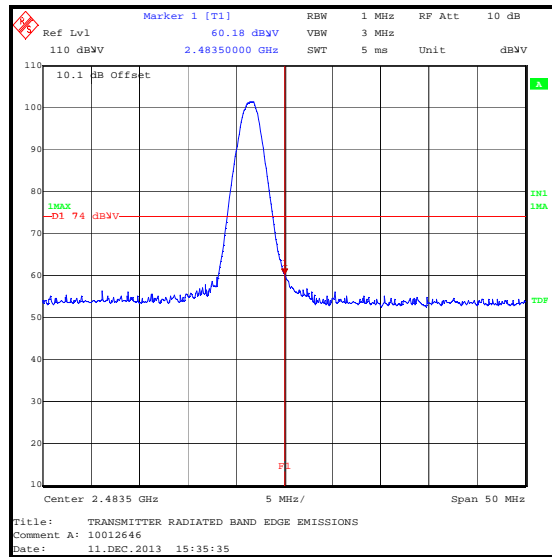
Results: Static Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	Horizontal	47.1	78.1*	31.0	Complied
2483.5	Horizontal	60.2	74.0	13.8	Complied

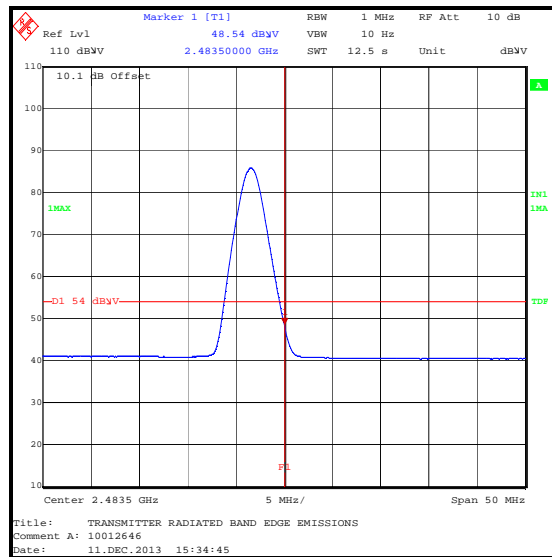
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	48.5	54.0	5.5	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



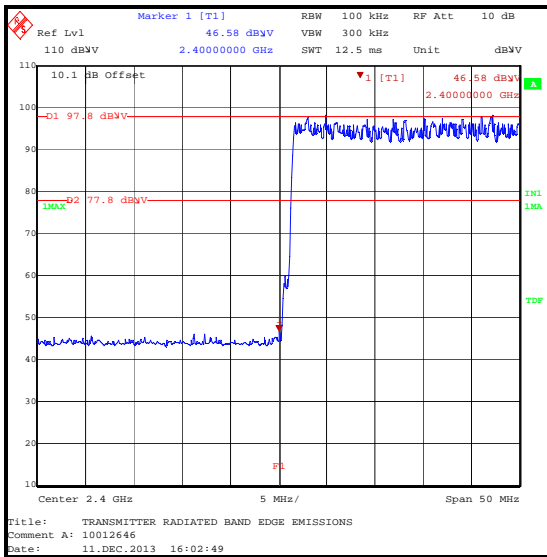
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

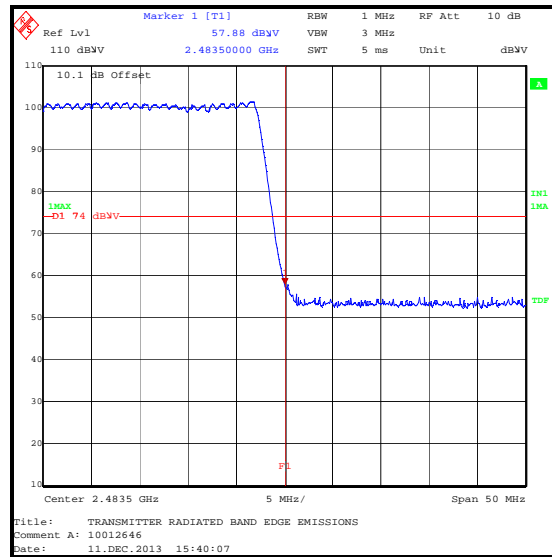
Results: Hopping Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	Horizontal	46.6	77.8*	31.2	Complied
2483.5	Horizontal	57.9	74.0	16.1	Complied

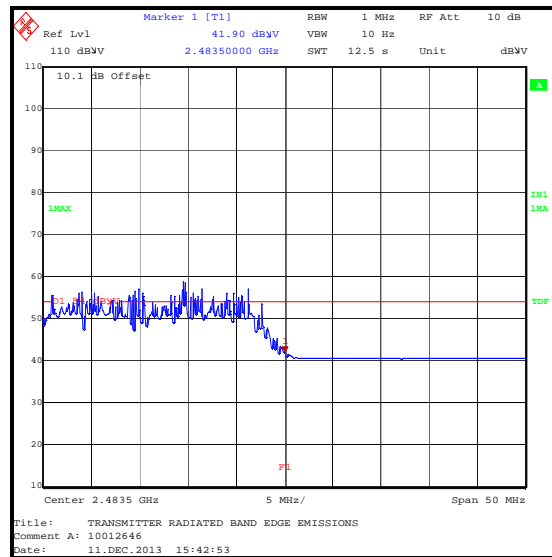
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	41.9	54.0	12.1	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



Upper Band Edge Average Hopping

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	1 Oct 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	14 Nov 2014	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
A1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not Stated	24 May 2014	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12

5.2.9. Transmitter Band Edge Radiated Emissions – V100 Antenna**Test Summary:**

Test Engineer:	Mark Percival	Test Dates:	26 February 2014 to 11 April 2014
Test Sample MAC Address:	240A546D213		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Sections 6.9.2 and Notes below

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	34 to 36

Note(s):

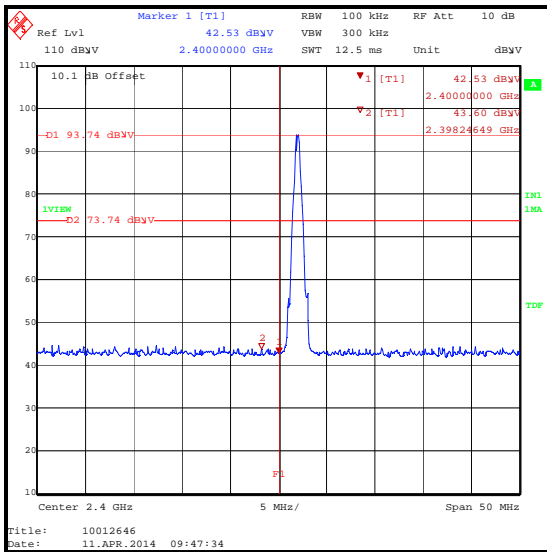
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. For the lower band edge measurements: As the lower band edge falls within the non-restricted band only peak measurements are required. The test receiver resolution bandwidth 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. For the upper band edge measurements: As the upper band edge falls within restricted band both peak and average measurements were recorded by placing a marker at the edge of the band (2483.5 MHz). For peak measurements the test receiver resolution bandwidth was set to 1 MHz and 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 video bandwidth 10 Hz. 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 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. * -20 dBc limit.

Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

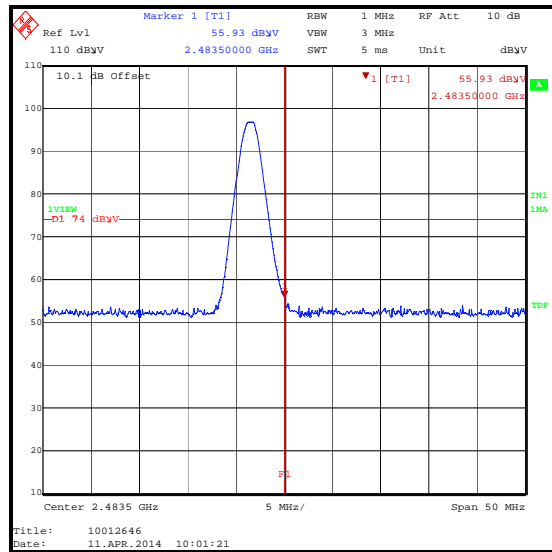
Results: Static Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2398.247	Horizontal	43.6	73.7*	30.1	Complied
2400.0	Horizontal	42.5	73.7*	31.2	Complied
2483.5	Horizontal	55.9	74.0	18.1	Complied

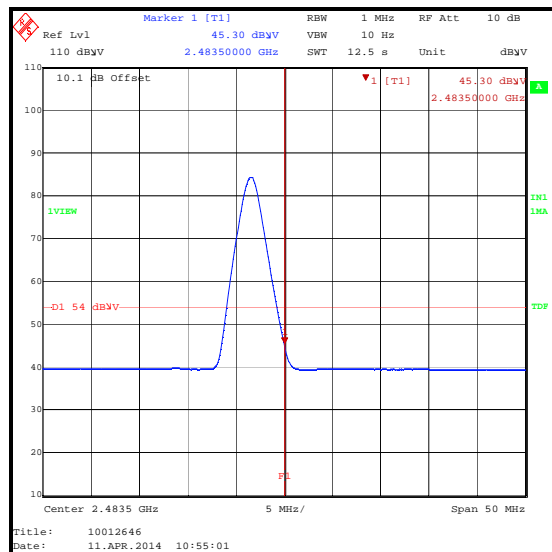
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	45.3	54.0	8.7	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



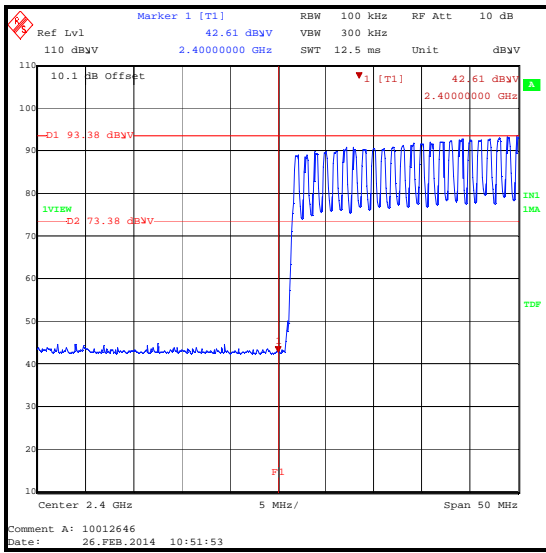
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

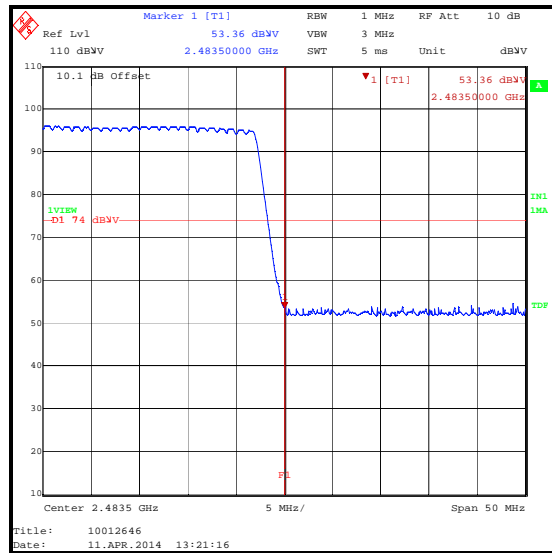
Results: Hopping Mode / DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2400.0	Horizontal	42.6	73.4*	30.8	Complied
2483.5	Horizontal	53.4	74.0	20.6	Complied

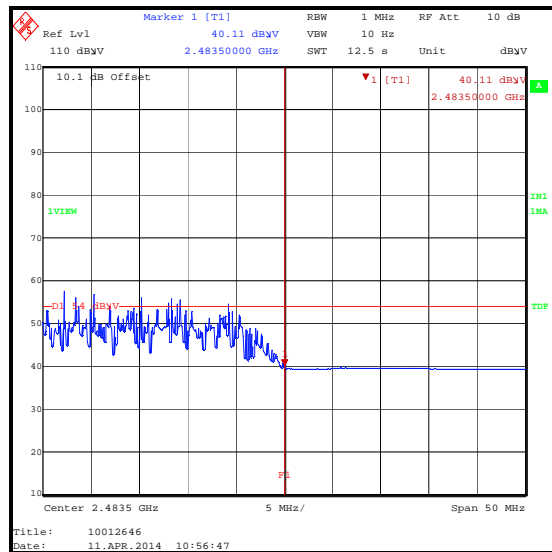
Frequency (MHz)	Antenna Polarity	Average Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2483.5	Horizontal	40.1	54.0	13.9	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



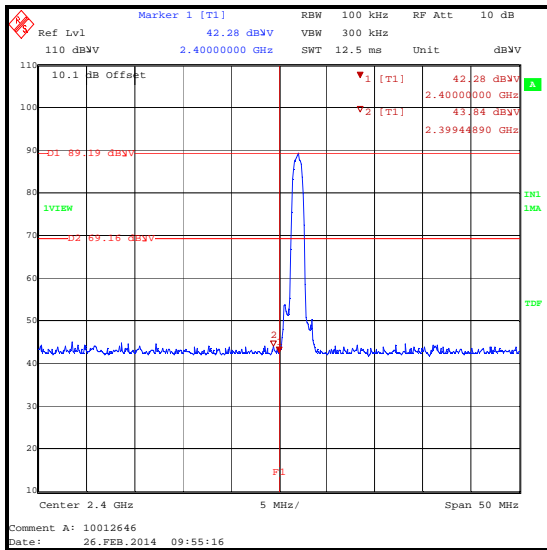
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

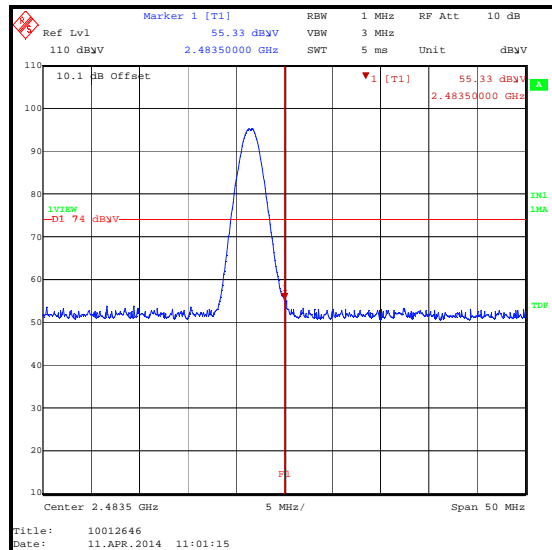
Results: Static Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2399.449	Horizontal	43.8	69.2*	25.4	Complied
2400.0	Horizontal	42.3	69.2*	26.9	Complied
2483.5	Horizontal	55.3	74.0	18.7	Complied

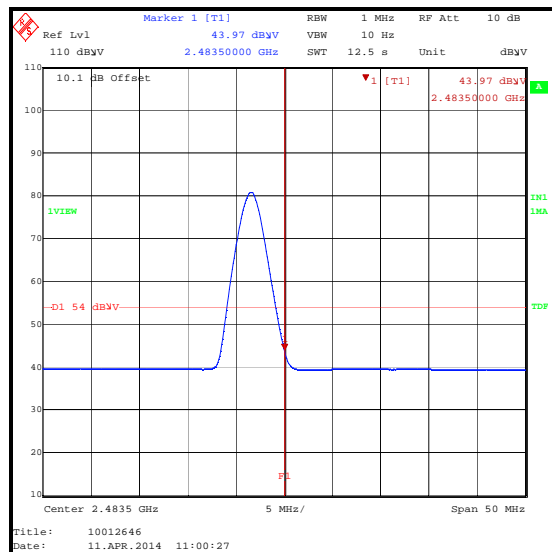
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	44.0	54.0	10.0	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



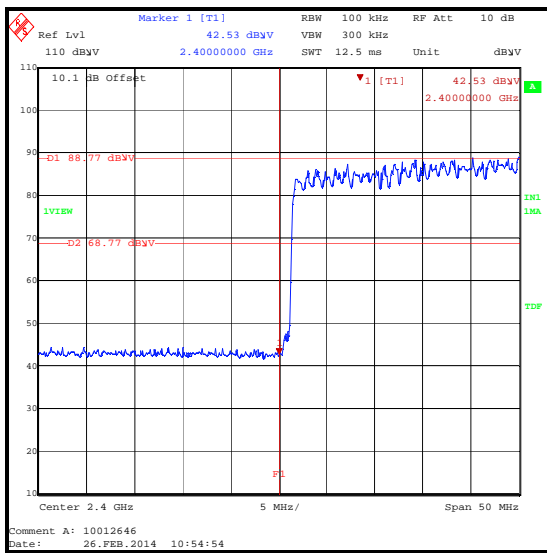
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

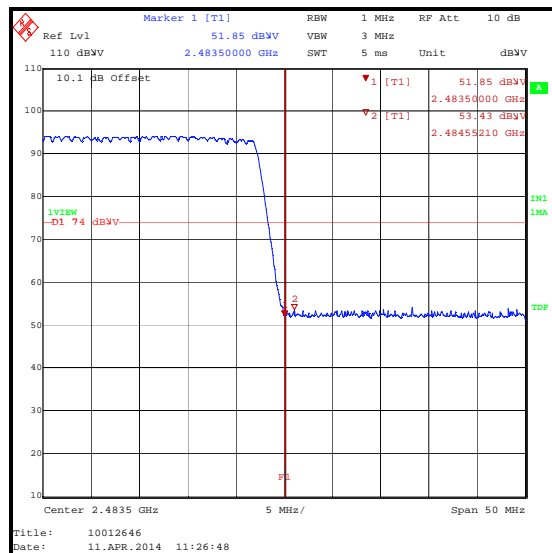
Results: Hopping Mode / 2DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400.0	Horizontal	42.5	68.8*	26.3	Complied
2483.5	Horizontal	51.9	74.0	22.1	Complied

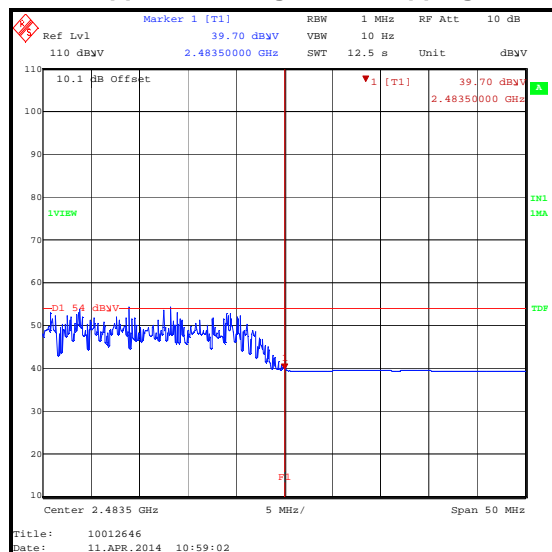
Frequency (MHz)	Antenna Polarity	Average Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	Horizontal	39.7	54.0	14.3	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



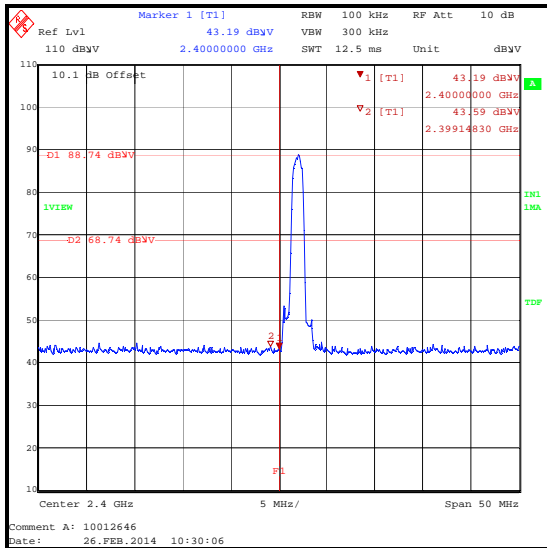
Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

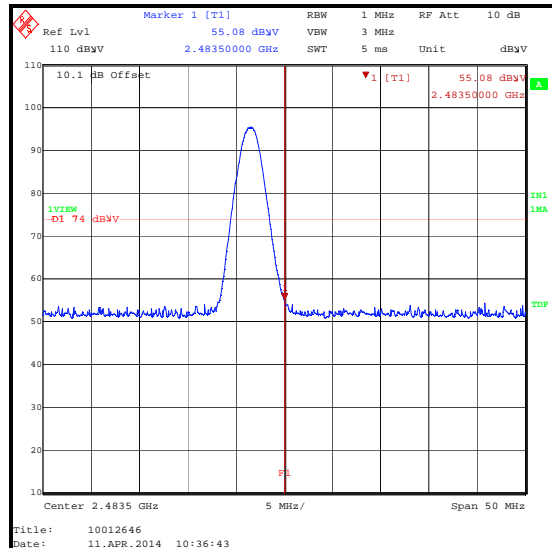
Results: Static Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2399.148	Horizontal	43.6	68.7*	25.1	Complied
2400.0	Horizontal	43.2	68.7*	25.5	Complied
2483.5	Horizontal	55.1	74.0	18.9	Complied

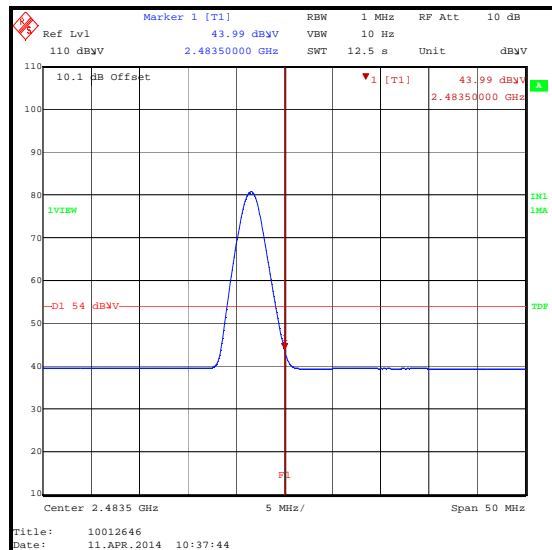
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	44.0	54.0	10.0	Complied



Lower Band Edge Peak Static



Upper Band Edge Peak Static



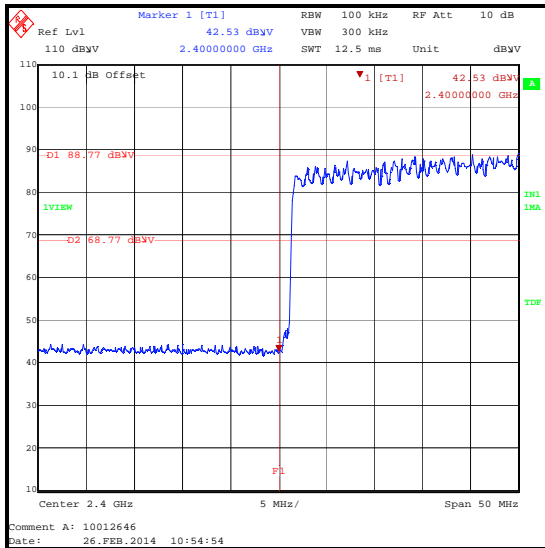
Upper Band Edge Average Static

Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

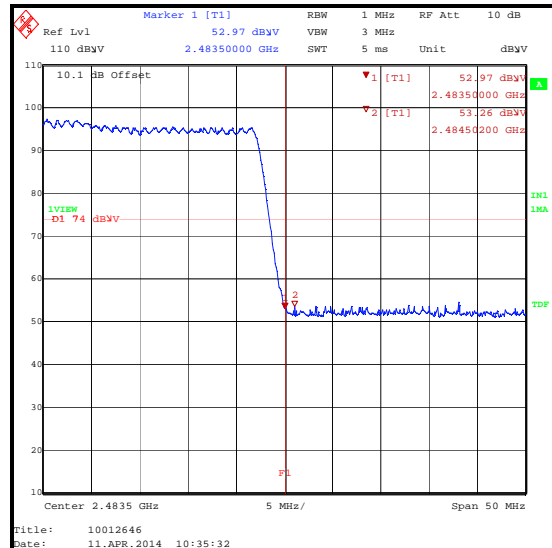
Results: Hopping Mode / 3DH5

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	Horizontal	42.5	68.8*	26.3	Complied
2483.5	Horizontal	53.0	74.0	21.0	Complied
2484.502	Horizontal	53.3	74.0	20.7	Complied

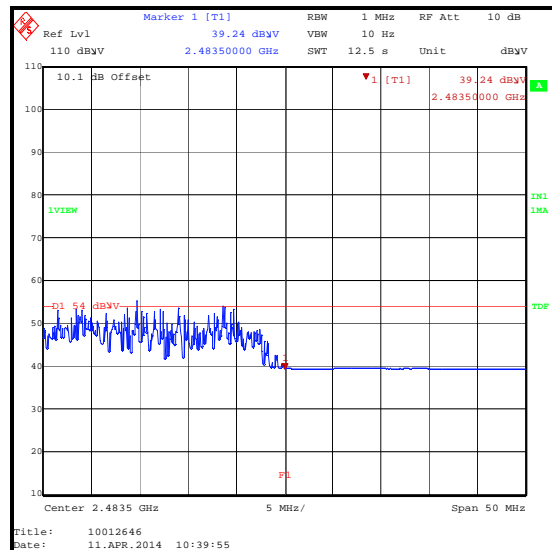
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	Horizontal	39.2	54.0	14.8	Complied



Lower Band Edge Peak Hopping



Upper Band Edge Peak Hopping



Upper Band Edge Average Hopping

Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	14 Nov 2014	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not Stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	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%	±0.92 ppm
Average Time of Occupancy	2.4 GHz to 2.4835 GHz	95%	±0.3 ns
20 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±3.92%
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 updated