TEST REPORT

Test Report No. : UL-RPT-RP10012646JD06A

Manufacturer	:	Bang & Olufsen a/s
Model No.	:	AW-AU397
FCC ID	:	TTUAW-AU397
Technology	:	WLAN (802.11 b/g/n)
Test Standard(s)	:	FCC Parts 15.207, 15.209(a) & 15.247

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. 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 4.0 supersedes all previous versions.

Date of Issue: 23 March 2015

Checked by:

pp

Ian Watch
Senior Engineer, Radio Laboratory

Issued by :

John Newell
Quality Manager,
UL VS LTD

ilac-MRA UKAS TESTING 0644

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

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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:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	28 November 2013 to 08 January 2014

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	✓
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.247(e)	Transmitter Power Spectral Density	✓
Part 15.247(d) & 15.209(a)	Transmitter Radiated Emissions	✓
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	✓

Key to Results

✓ = Complied ✗ = Did not comply

Note(s):

1. Duty cycle was measured and found to be >98%, therefore no plots have been included within this report. Duty cycle measurement plots are archived on the UL VS LTD IT server and available for inspection if required.
2. KDB558074 v03 r01 was used at the time of testing, as this was the latest version of KDB available. This testing has subsequently been reviewed, to ensure that the test methods comply with the latest requirements of KDB558074 v03 r02, 05 June 2014.

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
Reference:	KDB 558074 D01 DTS Meas Guidance v03r02 June 5, 2014
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247
Reference:	KDB 662911 D01 v02r01 October 31, 2013
Title:	Emissions Testing of Transmitters with Multiple Outputs in the Same Band

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
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:	Tyco
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) was an IEEE 802.11a/b/g/n 2 x 2 MIMO WLAN and *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

Technology Tested:	WLAN (IEEE 802.11b,g,n) / Digital Transmission System		
Type of Unit:	Transceiver		
Modulation Type:	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM		
Data Rates:	802.11b	1, 2, 5.5 & 11 Mbit/s	
	802.11g	6, 9, 12, 18, 24, 36, 48 & 54 Mbit/s	
	802.11n HT20	MCS0 to MCS15 (2 spatial streams)	
	802.11n HT40	MCS0 to MCS15 (2 spatial streams)	
Power Supply Requirement(s):	Nominal	3.3 VDC via 120 VAC 60 Hz	
Declared Antenna Gains:	3.0 dBi (UAM Antenna) 0.3 dBi (V100 Antenna)		
Channel Spacing:	20 MHz		
Transmit Frequency Range:	2412 MHz to 2462 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462
Transmit Frequency Range:	5725 MHz to 5850 MHz		
Transmit Channels (see Note 1):	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	149	5745
	Middle	157	5785
	Top	165	5825
Channel Spacing:	40 MHz		
Transmit Frequency Range:	2412 MHz to 2462 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	3	2422
	Middle	6	2437
	Top	9	2452

Note(s):

1. In accordance with FCC KDB 644545 D02(E), the testing of the 5 GHz frequency range under FCC Part 15.407, has been covered in test report UL-RPT-RP10012646JD07A.

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:

Type	Stated Gain (dBi)	Manufacturer	Antenna Model / Part No.	Used for Testing	Notes
Stamped Metal	3.0	Tyco	UAM / 1513472-5	X	1 & 2
PCB	0.3	Bang & Olufsen	V100 / 6143988	X	1 & 2

X = This antenna was used for testing purposes

Note(s):

1. The stated antenna gains are the maximum 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 with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.

4.2. Configuration and Peripherals

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

- The EUT was inserted into the supplied test jig. The test jig was powered via a 120 VAC 60 Hz to 5 VDC power supply using the Goobay AC to DC adaptor. The test jig then supplied the EUT with the required 3.3 VDC.
- The Lenovo ThinkPad X61 laptop PC was connected to the EUT via a USB cable. The EUT was initialised using a software application supplied by the manufacturer. Once initialised, the EUT was controlled by the Dell D610 laptop PC, which was connected to the ThinkPad X61 via a Linksys access point using a software application supplied by the manufacturer. The application was used to enable continuous transmission and to select the test channels as required.
- The EUT has two RF ports, both are transmit/receive RF ports (labelled as Port 0 and Port 1) and for 802.11n the EUT supports MIMO. Conducted measurements were performed on Port 0 and Port 1. For 802.11n, power related measurements have been summed.
- 802.11n MSC 0 to 7 is correlated and CCD. Antennas are not cross polarised.
- RF cables and attenuators connecting the test equipment to the EUT ports were calibrated before use and the calibration data incorporated into the conducted measurement results.
- All supported modes and channel widths were initially investigated on one channel, on both ports. The modes that produced the highest output power, highest power spectral density, narrowest and widest bandwidths were:
    - Highest output power
        - 802.11b – DQPSK / 11 Mbit/s
        - 802.11g – QPSK / 12 Mbit/s
        - 802.11n HT20 – QPSK / 39 Mbit/s / MCS10
        - 802.11n HT40 – QPSK / 81 Mbit/s / MCS10
    - Highest power spectral density
        - 802.11b – DQPSK / 2 Mbit/s
        - 802.11g – QPSK / 12 Mbit/s
        - 802.11n HT20 – QPSK / 39 Mbit/s / MCS10
        - 802.11n HT40 – QPSK / 81 Mbit/s / MCS10
    - Narrowest bandwidth (DTS bandwidth / 6 dB)
        - 802.11b – DQPSK / 11 Mbit/s
        - 802.11g – BPSK / 9 Mbit/s
        - 802.11n HT20 – QPSK / 39 Mbit/s / MCS10
        - 802.11n HT40 – QPSK / 40.5 Mbit/s / MCS2

Configuration and Peripherals (continued)

- Transmitter spurious emissions were performed with the EUT transmitting 802.11g 20 MHz channel bandwidth with one spatial stream and a data rate of 12 Mbit/s. This was found to have the highest power level and therefore deemed to be worst case.
- Radiated emissions tests were performed with all unused ports terminated.

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):	21
Relative Humidity (%):	40

Note(s):

1. The EUT was powered from the output of an AC to DC adaptor. The input of the AC to DC adaptor 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 (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.429	Live	50.1	57.3	7.2	Complied
0.474	Live	54.3	56.4	2.1	Complied
0.731	Live	48.3	56.0	7.7	Complied
0.987	Live	47.6	56.0	8.4	Complied
0.992	Live	46.6	56.0	9.4	Complied
1.284	Live	45.7	56.0	10.3	Complied
2.144	Live	44.4	56.0	11.6	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.389	Live	40.9	48.1	7.2	Complied
0.474	Live	44.4	46.4	2.0	Complied
0.650	Live	35.0	46.0	11.0	Complied
0.690	Live	37.9	46.0	8.1	Complied
0.735	Live	36.9	46.0	9.1	Complied
0.992	Live	36.1	46.0	9.9	Complied
1.032	Live	33.7	46.0	12.3	Complied

Transmitter AC Conducted Spurious Emissions (continued)

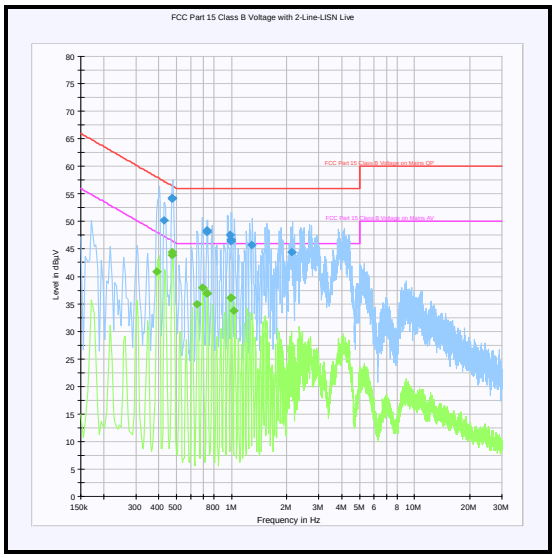
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.398	Neutral	45.7	57.9	12.2	Complied
0.474	Neutral	53.2	56.4	3.2	Complied
0.690	Neutral	48.2	56.0	7.8	Complied
0.870	Neutral	47.0	56.0	9.0	Complied
0.947	Neutral	47.9	56.0	8.1	Complied
1.208	Neutral	46.6	56.0	9.4	Complied
2.540	Neutral	45.6	56.0	10.4	Complied
3.930	Neutral	45.7	56.0	10.3	Complied

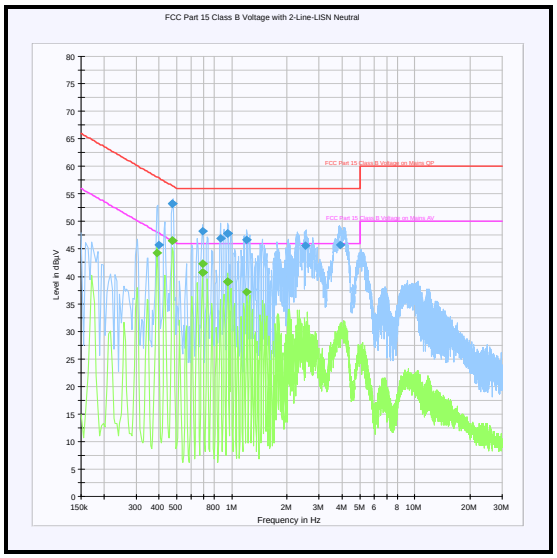
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.389	Neutral	44.3	48.1	3.8	Complied
0.474	Neutral	45.6	46.4	0.8	Complied
0.690	Neutral	42.3	46.0	3.7	Complied
0.951	Neutral	39.0	46.0	7.0	Complied
1.208	Neutral	37.2	46.0	8.8	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 Handelspunkt	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 Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	28 November 2013 & 20 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	As detailed in FCC KDB 558074 Section 8.1

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	33 to 35

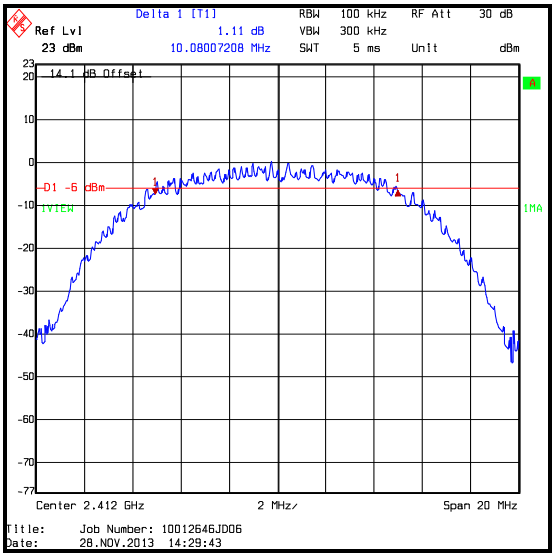
Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 8.1 Option 1 measurement procedure. The spectrum analyser resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and the trace mode was Max Hold. The DTS bandwidth was measured at 6 dB down from the peak of the signal. The data rates that produced the narrowest bandwidth and therefore deemed worst case were:
    a. 802.11b – DQPSK / 11 Mbit/s
    b. 802.11g – BPSK / 9 Mbit/s
    c. 802.11n HT20 – QPSK / 39 Mbit/s / MCS10
    d. 802.11n HT40 – 16QAM / 40.5 Mbit/s / MCS2
2. Final measurements were performed using the above configurations on the bottom, middle and top channels on both ports.
3. Plots for all data rates are archived on the UL VS LTD IT server and available for inspection upon request.
4. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable.
5. All plots for measurements performed on the 20th December have an incorrect title.

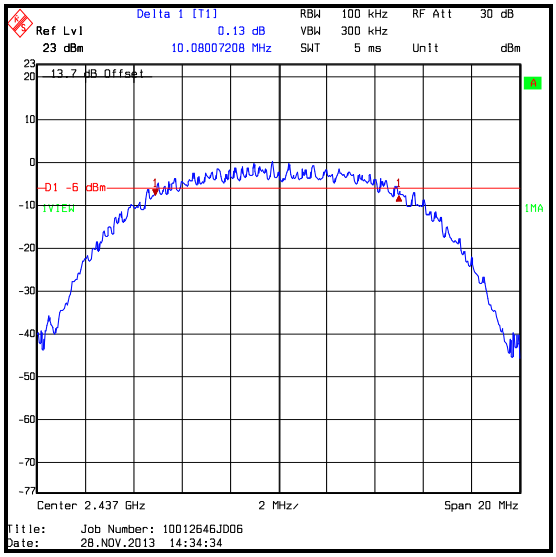
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11b / 20 MHz / DQPSK / 11 Mbit/s / Port 0

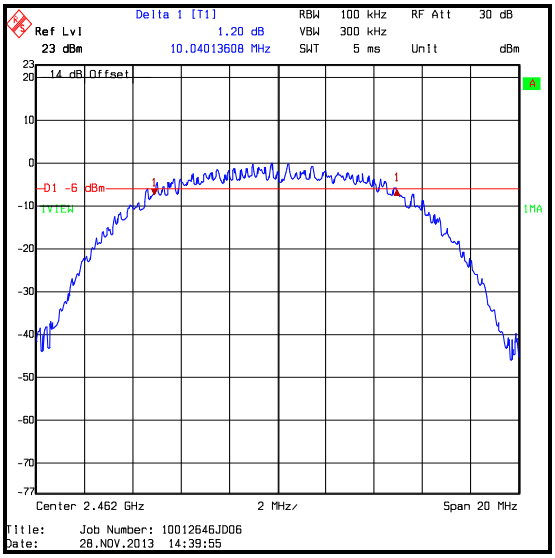
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	10080.072	≥500	9580.072	Complied
Middle	10080.072	≥500	9580.072	Complied
Top	10040.136	≥500	9540.136	Complied



Bottom Channel



Middle Channel

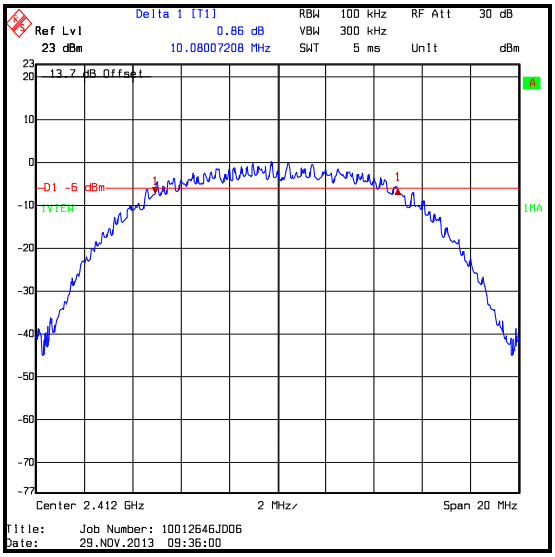


Top Channel

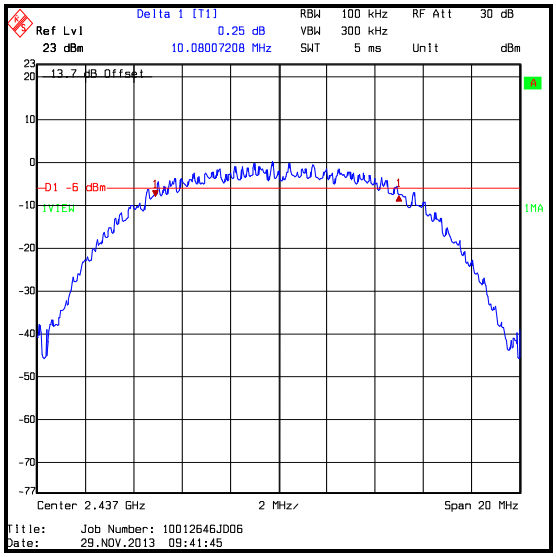
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11b / 20 MHz / DQPSK / 11 Mbit/s / Port 1

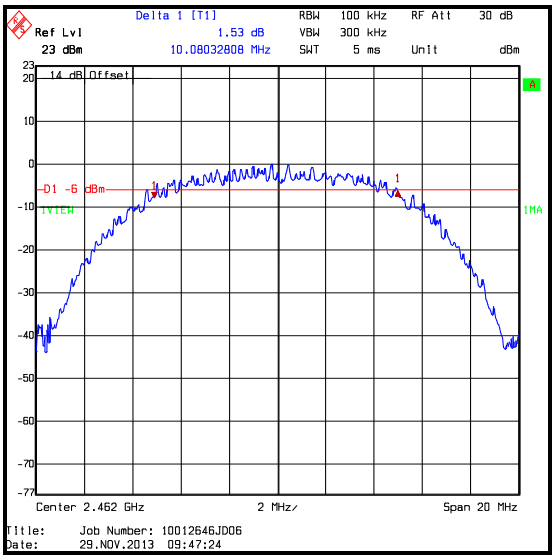
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	10080.072	≥500	9580.072	Complied
Middle	10080.072	≥500	9580.072	Complied
Top	10080.326	≥500	9580.326	Complied



Bottom Channel



Middle Channel

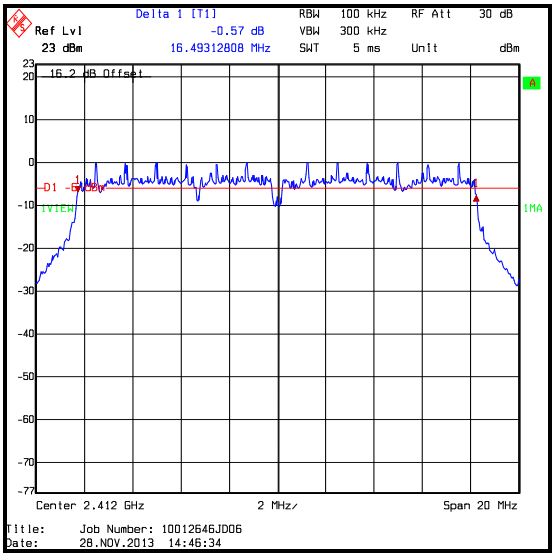


Top Channel

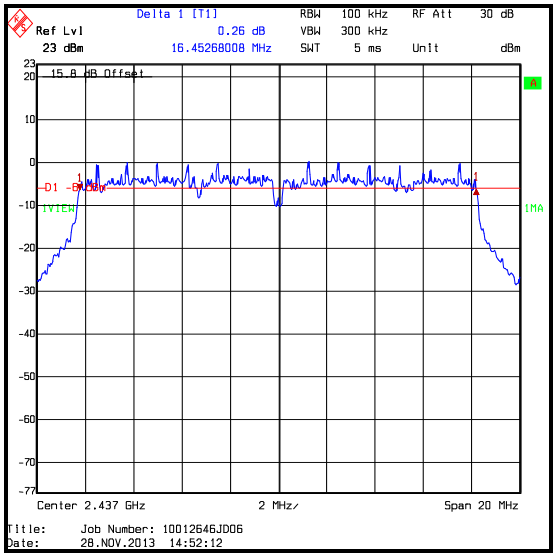
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11g / 20 MHz / BPSK / 9 Mbit/s / Port 0

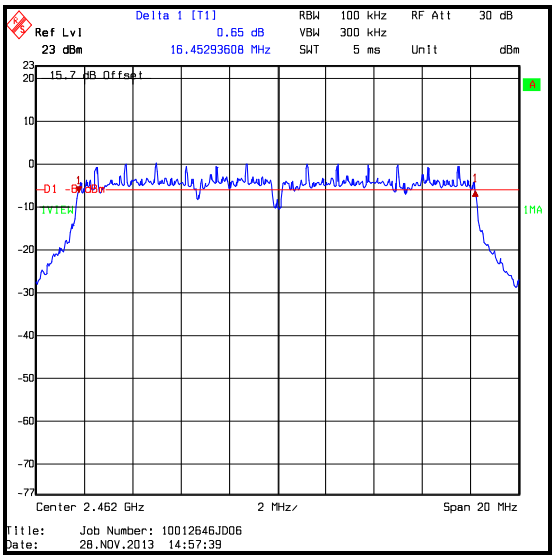
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16493.128	≥500	15993.128	Complied
Middle	16452.680	≥500	15952.680	Complied
Top	16452.936	≥500	15952.936	Complied



Bottom Channel



Middle Channel

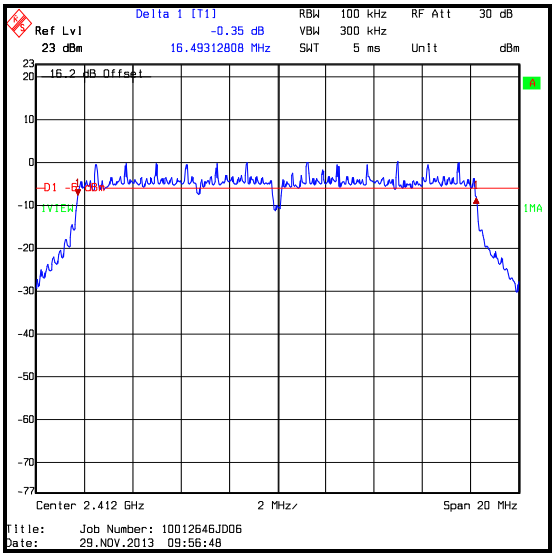


Top Channel

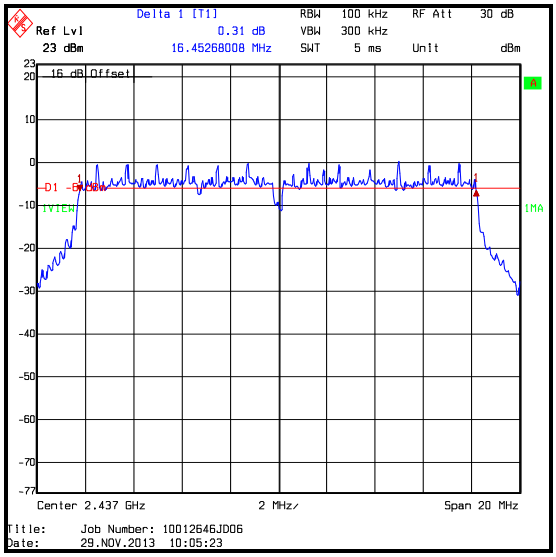
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11g / 20 MHz / BPSK / 9 Mbit/s / Port 1

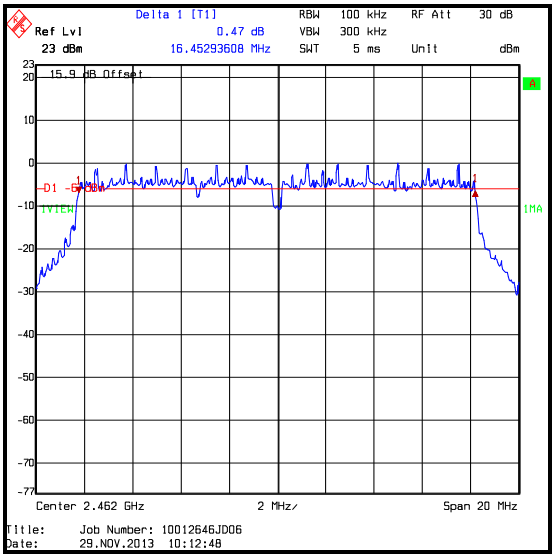
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16493.128	≥500	15993.128	Complied
Middle	16452.680	≥500	15952.680	Complied
Top	16452.936	≥500	15952.936	Complied



Bottom Channel



Middle Channel

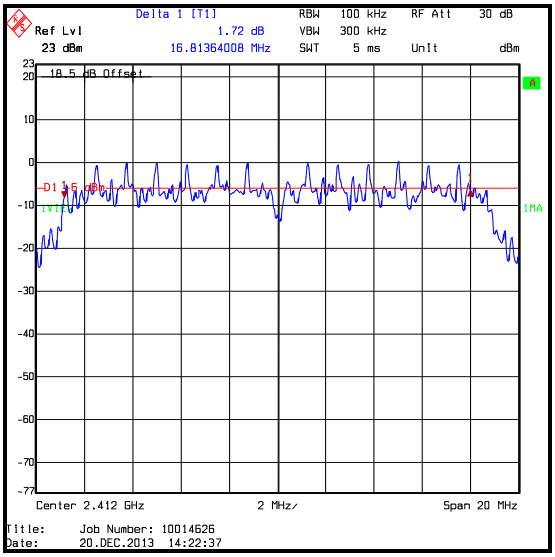


Top Channel

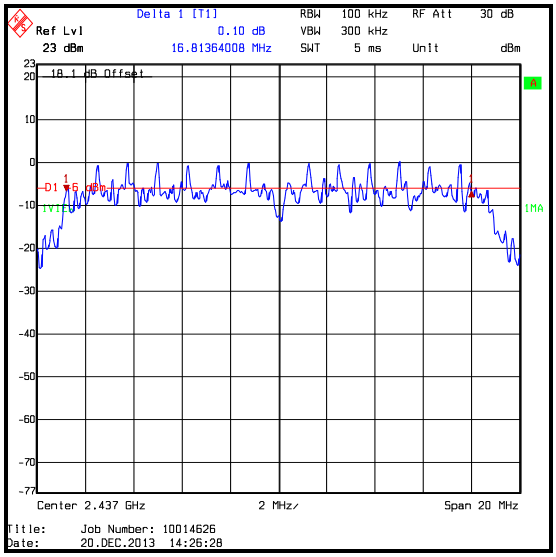
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10 / Port 0

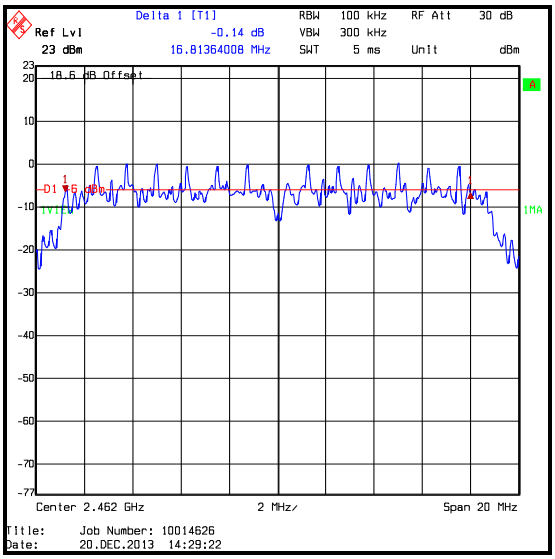
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16813.640	≥500	16313.640	Complied
Middle	16813.640	≥500	16313.640	Complied
Top	16813.640	≥500	16313.640	Complied



Bottom Channel



Middle Channel

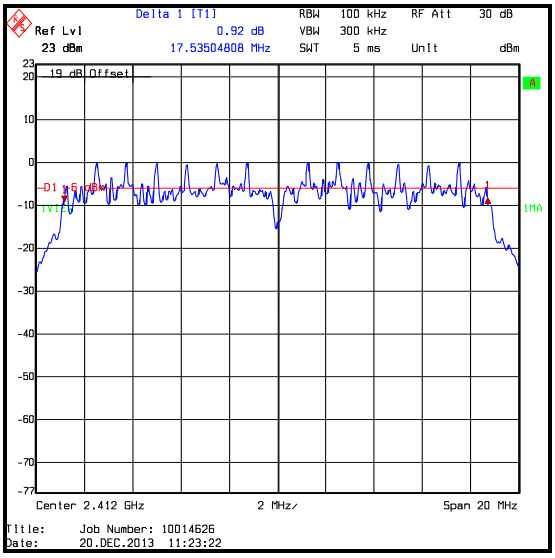


Top Channel

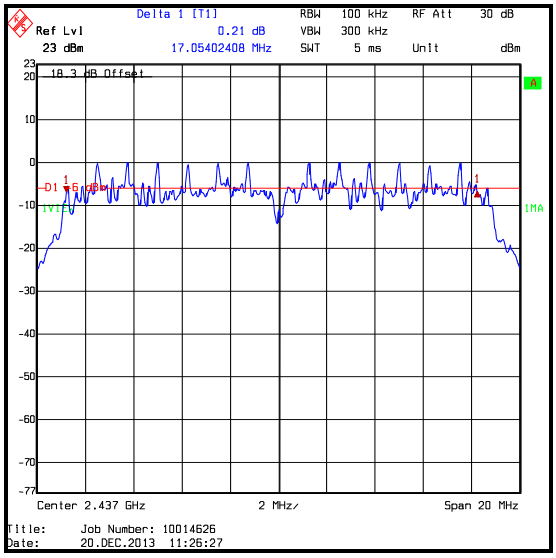
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10 / Port 1

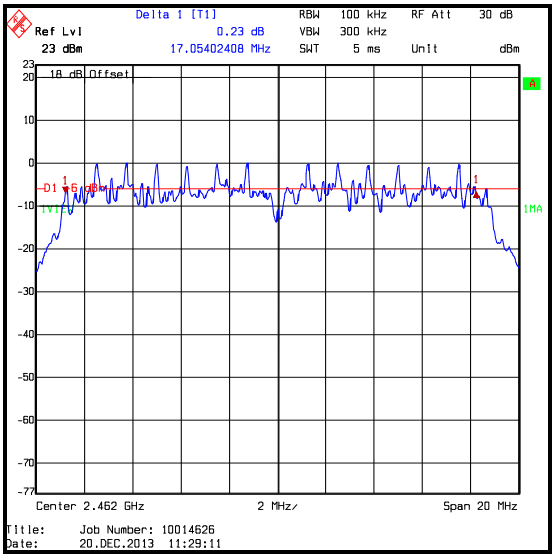
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17535.048	≥500	17035.048	Complied
Middle	17054.024	≥500	16554.024	Complied
Top	17054.024	≥500	16554.024	Complied



Bottom Channel



Middle Channel

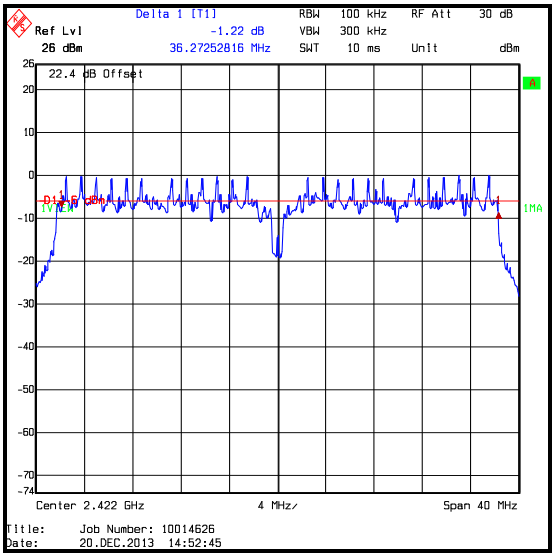


Top Channel

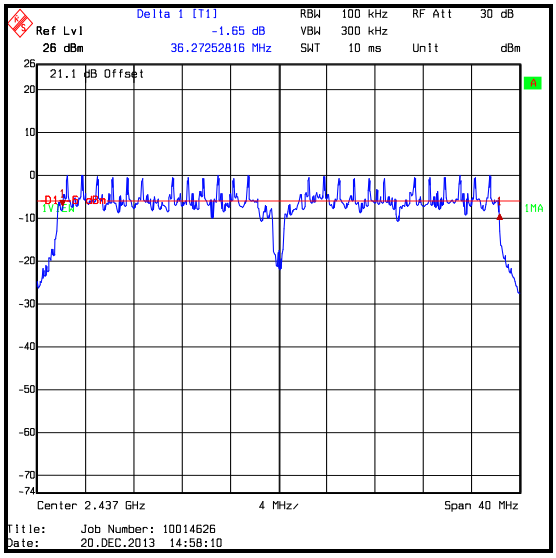
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 40 MHz / QPSK / 40.5 Mbit/s / MCS2 / Port 0

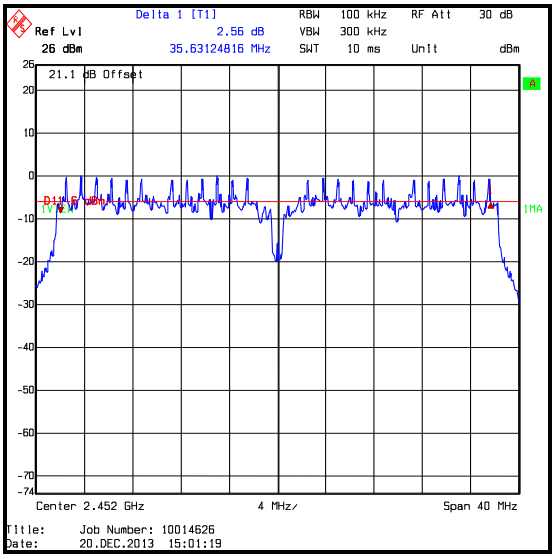
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	36272.528	≥500	35772.528	Complied
Middle	36272.528	≥500	35772.528	Complied
Top	35631.248	≥500	35131.248	Complied



Bottom Channel



Middle Channel

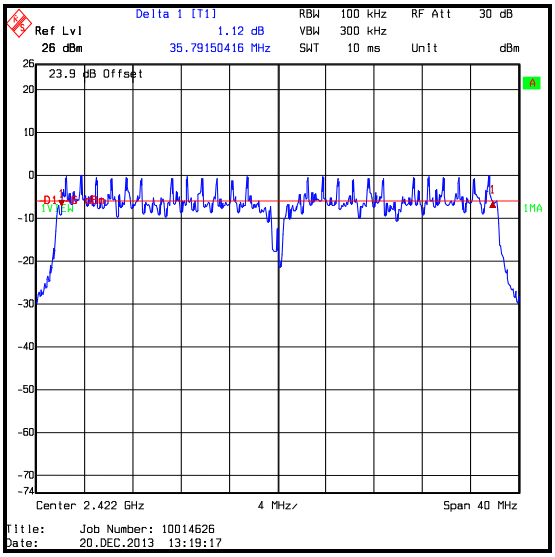


Top Channel

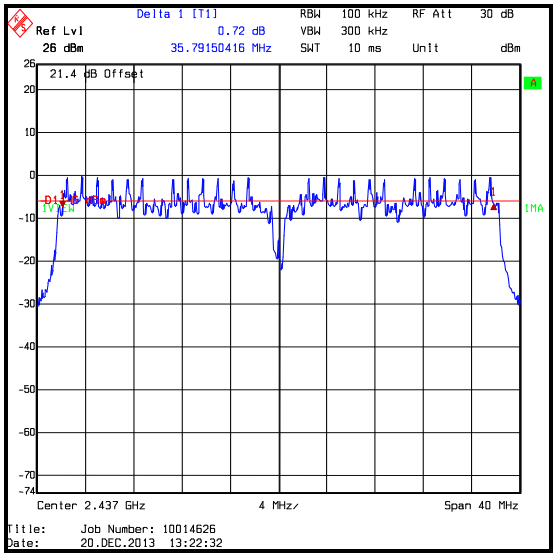
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 40 MHz / QPSK / 40.5 Mbit/s / MCS2 / Port 1

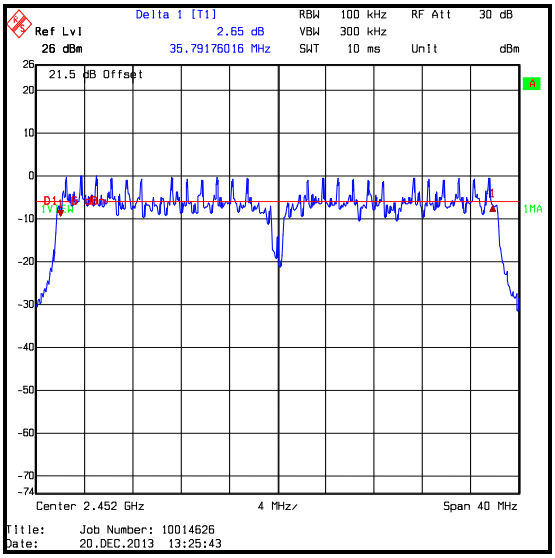
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	35791.504	≥500	35291.504	Complied
Middle	35791.504	≥500	35291.504	Complied
Top	35791.760	≥500	35291.760	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Minimum 6 dB Bandwidth (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
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
A1999	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12

5.2.3. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Nick Steele	**Test Dates:**	28 November 2013 & 20 December 2013
Test Sample MAC Address:	240A546D213		

FCC Reference:	Part 15.247(e)
Test Method Used:	As detailed in FCC KDB 558074 Section 10.2

Environmental Conditions:

Temperature (°C):	23 to 24
Relative Humidity (%):	33 to 35

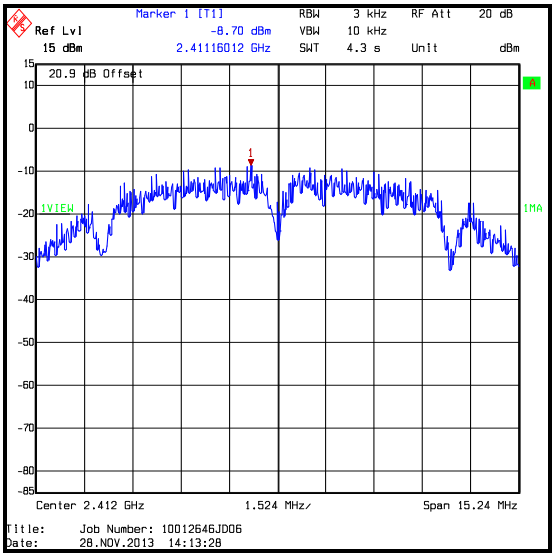
Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 10.2 measurement procedure Method PKPSD (peak PSD). The data rates that produced the highest power and therefore deemed worst case were:
    - 802.11b – DQPSK / 2 Mbit/s
    - 802.11g – QPSK / 12 Mbit/s
    - 802.11n HT20 – QPSK / 39 Mbit/s / MCS10
    - 802.11n HT40 - QPSK / 81 Mbit/s / MCS10
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. For 802.11b and 802.11g, port 0 produced the highest power.
4. For 802.11n, PSD was measured on both ports and then combined using the measure-and-sum method stated in FCC KDB 662911 D01 E)2)a).
5. The EUT was transmitting at >98% duty cycle.
6. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. An RF level offset was entered on the spectrum analyser to compensate for the loss of the attenuator and RF cable.
7. Plots for all data rates for both ports, are archived on the UL VS LTD IT server and are available for inspection on request.
8. All plots for measurements performed on the 20th December have an incorrect title.

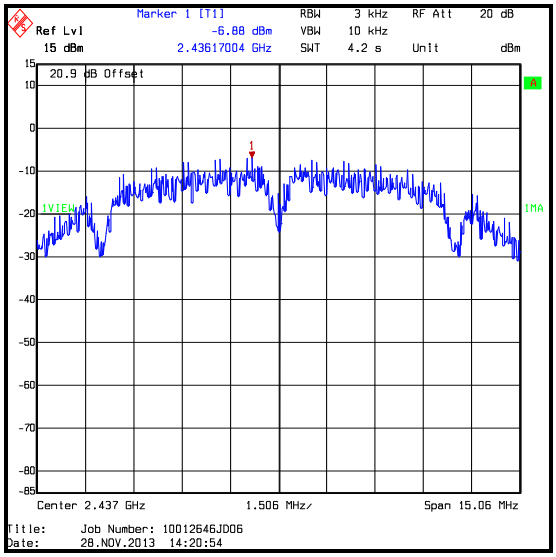
Transmitter Power Spectral Density (continued)

Results: 802.11b / 20 MHz / DQPSK / 2 Mbit/s / Port 0

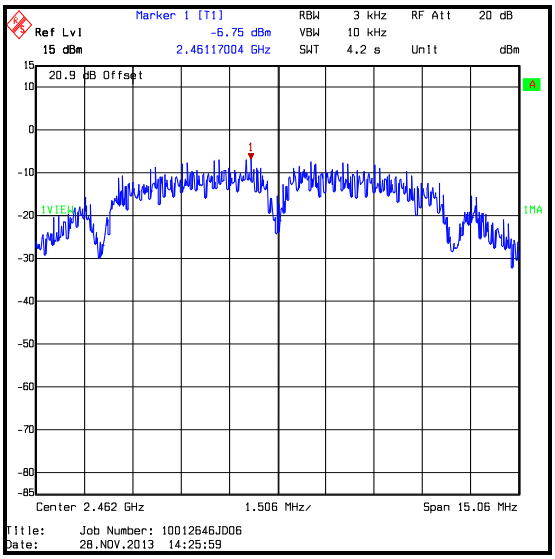
Channel	PSD (dBm / 3 kHz)	PSD Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-8.7	8.0	16.7	Complied
Middle	-6.9	8.0	14.9	Complied
Top	-6.8	8.0	14.8	Complied



Bottom Channel



Middle Channel

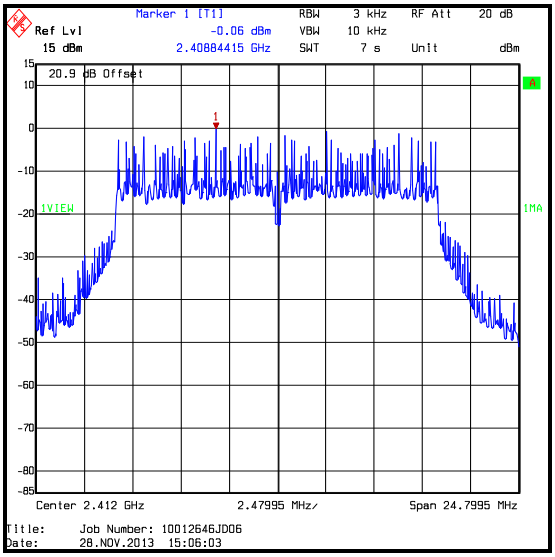


Top Channel

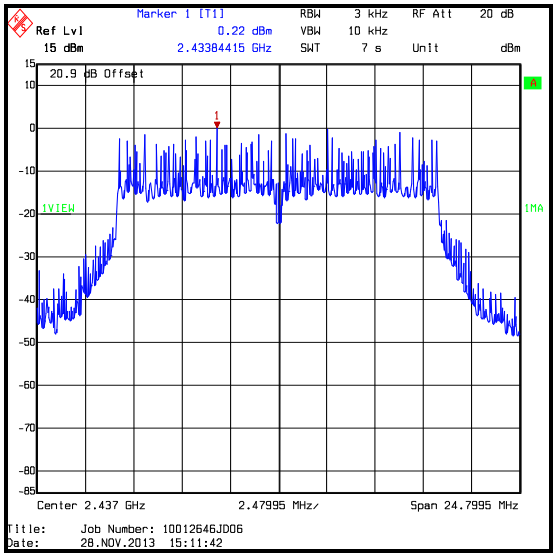
Transmitter Power Spectral Density (continued)

Results: 802.11g / 20 MHz / QPSK / 12 Mbit/s / Port 0

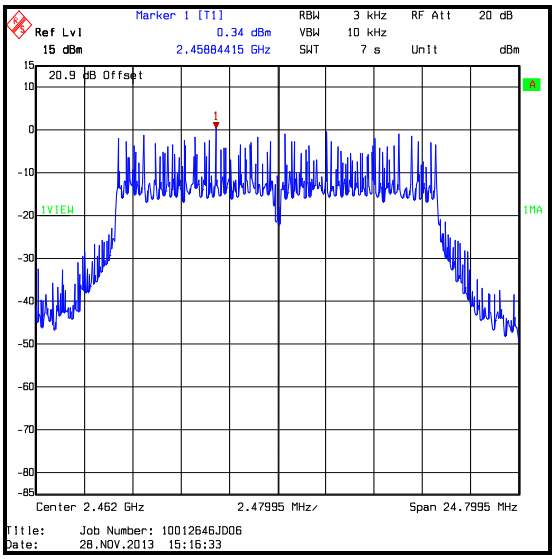
Channel	PSD (dBm / 3 kHz)	PSD Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-0.1	8.0	8.1	Complied
Middle	0.2	8.0	7.8	Complied
Top	0.3	8.0	7.7	Complied



Bottom Channel



Middle Channel



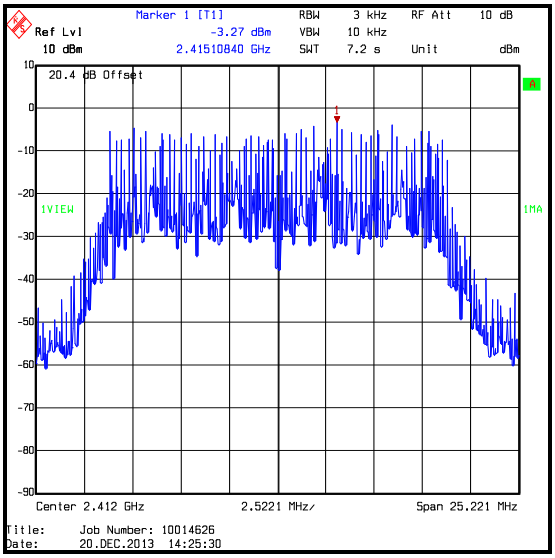
Top Channel

Transmitter Power Spectral Density (continued)

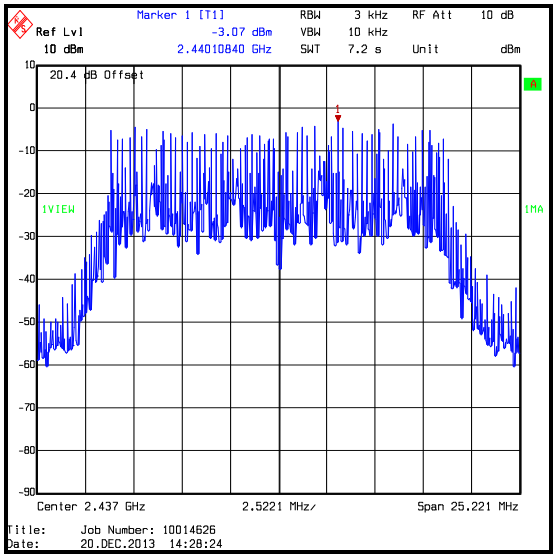
Results: 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10

Channel	PSD at Port 0 (dBm / 3 kHz)	PSD at Port 1 (dBm / 3 kHz)	Combined PSD (dBm / 3 kHz)	PSD Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-3.3	-4.4	-0.8	8.0	8.8	Complied
Middle	-3.1	-3.8	-0.4	8.0	8.4	Complied
Top	-3.4	-3.9	-0.6	8.0	8.6	Complied

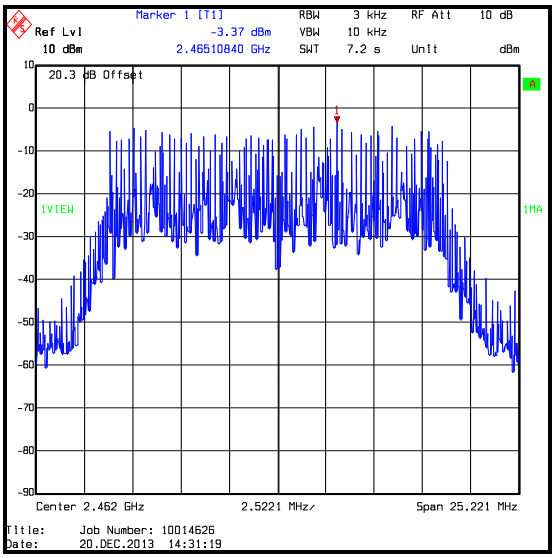
Results: 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10 / Port 0



Bottom Channel



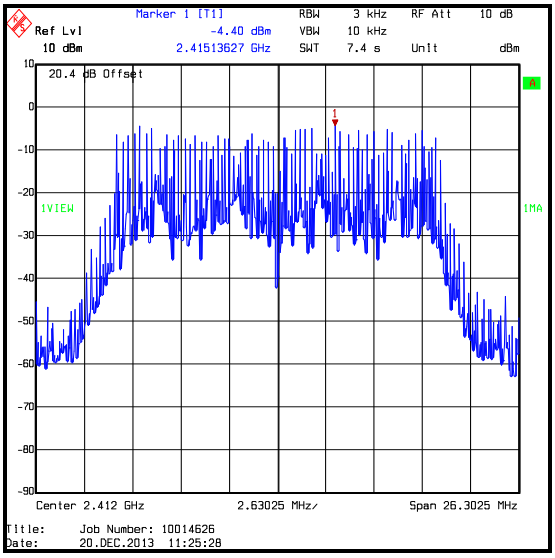
Middle Channel



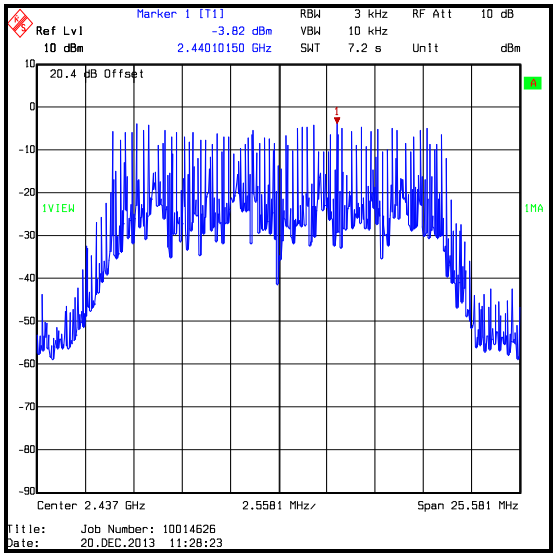
Top Channel

Transmitter Power Spectral Density (continued)

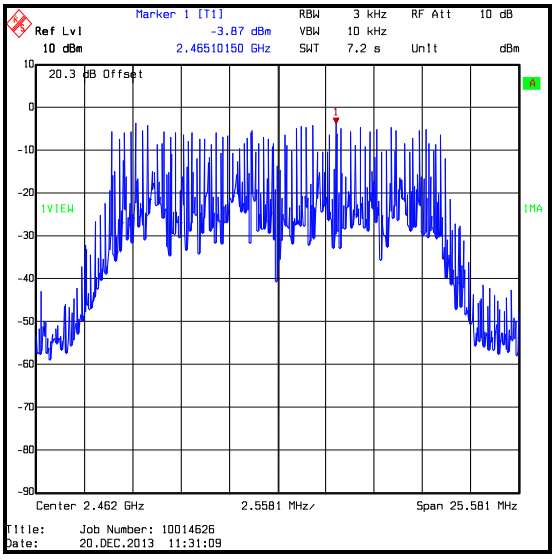
Results: 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10 / Port 1



Bottom Channel



Middle Channel



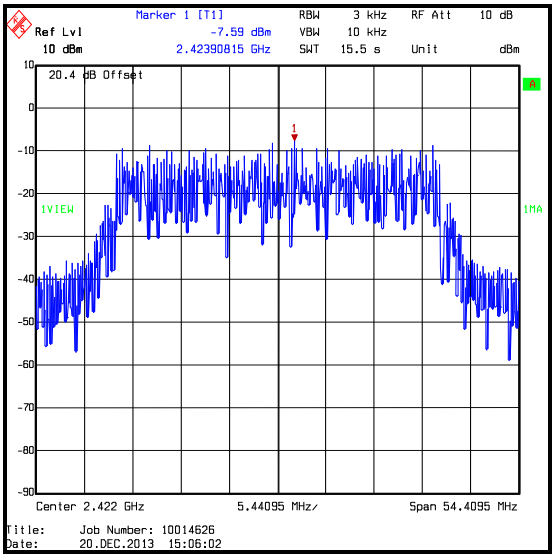
Top Channel

Transmitter Power Spectral Density (continued)

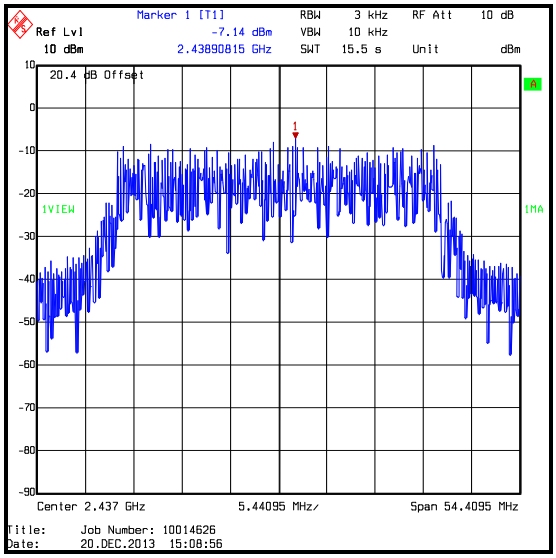
Results: 802.11n / 40 MHz / QPSK / 81 Mbit/s / MCS10

Channel	PSD at Port 0 (dBm / 3 kHz)	PSD at Port 1 (dBm / 3 kHz)	Combined PSD (dBm / 3 kHz)	PSD Limit (dBm / 3 kHz)	Margin (dB)	Result
Bottom	-7.6	-6.5	-4.0	8.0	12.0	Complied
Middle	-7.1	-6.0	-3.5	8.0	11.5	Complied
Top	-7.4	-6.0	-3.6	8.0	11.6	Complied

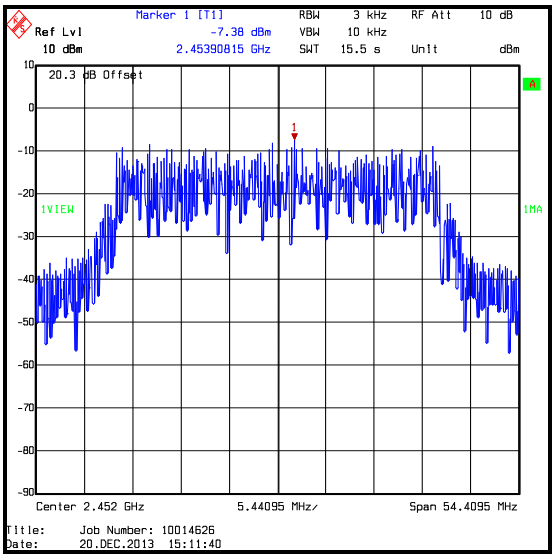
Results: 802.11n / 40 MHz / QPSK / 81 Mbit/s / MCS10 / Port 0



Bottom Channel



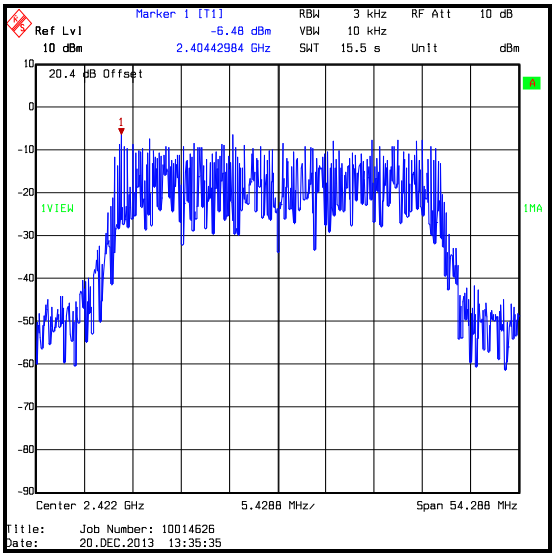
Middle Channel



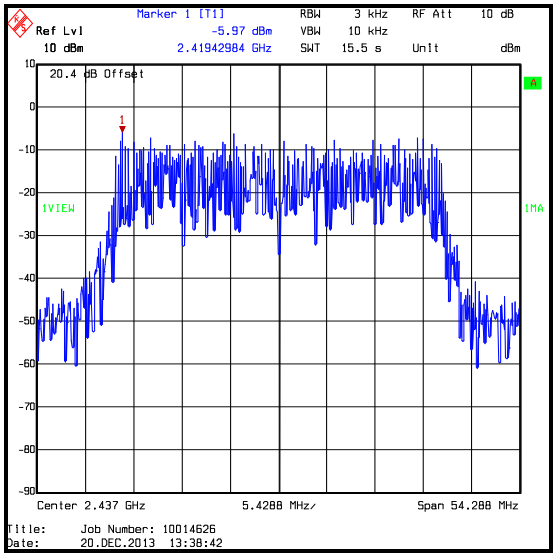
Top Channel

Transmitter Power Spectral Density (continued)

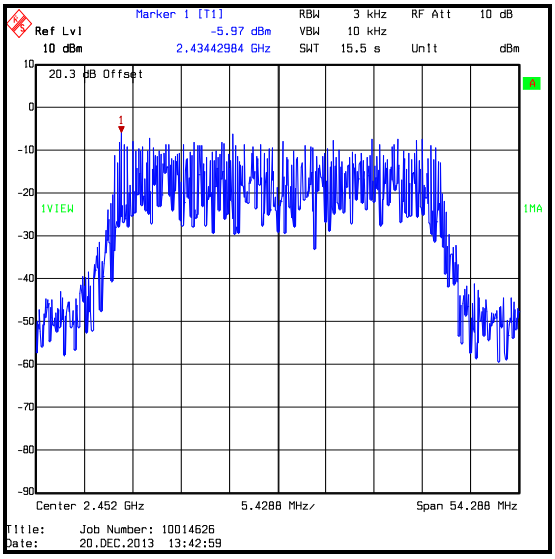
Results: 802.11n / 40 MHz / QPSK / 81 Mbit/s / MCS10 / Port 1



Bottom Channel



Middle Channel



Top Channel

Transmitter Power Spectral Density (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	842659/016	19 Aug 2014	12
A1998	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12
A1999	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12
M260	Signal Generator	Rohde & Schwarz	SMP02	829076/008	25 Jun 2014	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	15 May 2014	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	14 May 2014	12

5.2.4. Transmitter Radiated Emissions – UAM Antenna

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	03 January 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):	23
Relative Humidity (%):	40

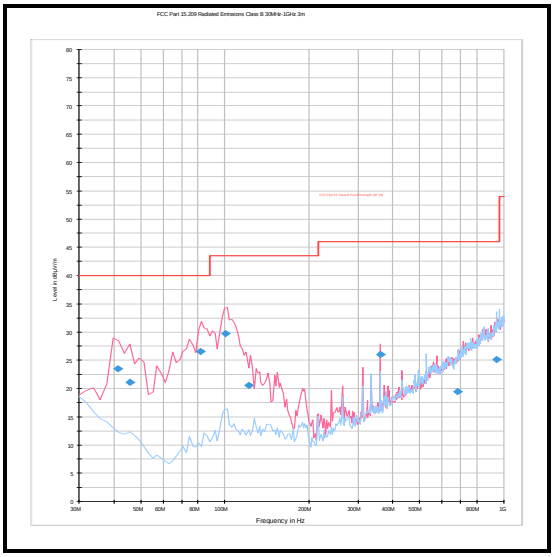
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the top channel only.
3. All 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. Therefore the highest measured level of the noise floor is recorded in the table below.
4. 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.

Results: Top Channel / 802.11g / 20 MHz / 12 Mbit/s

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
100.794	Vertical	29.8	43.5	13.7	Complied

Transmitter Radiated Emissions (continued)



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
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
A490	Antenna	Chase	CBL6111A	1590	09 Apr 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:	David Doyle	**Test Date:**	20 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):	22
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. All other emissions shown on the pre-scan plots were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. The emission shown approximately at 2462 MHz on the 1 GHz to 4 GHz plot is the EUT fundamental.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number 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. *Emissions in restricted bands: In accordance with C63.10 section 6.6.4.2, Note 1, where the peak-detected amplitude was shown to comply with the average limit, an average measurement was not performed.
6. **-20 dBc limit.

Transmitter Radiated Emissions - UAM Antenna (continued)

Results: Peak / Bottom Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4822.275	Horizontal	42.3	54.0*	11.7	Complied
7241.473	Vertical	56.3	81.4**	25.1	Complied

Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4881.294	Horizontal	43.2	54.0*	10.8	Complied
7302.776	Vertical	55.3	74.0	18.7	Complied

Results: Average / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
7314.078	Vertical	41.3	54.0	12.7	Complied

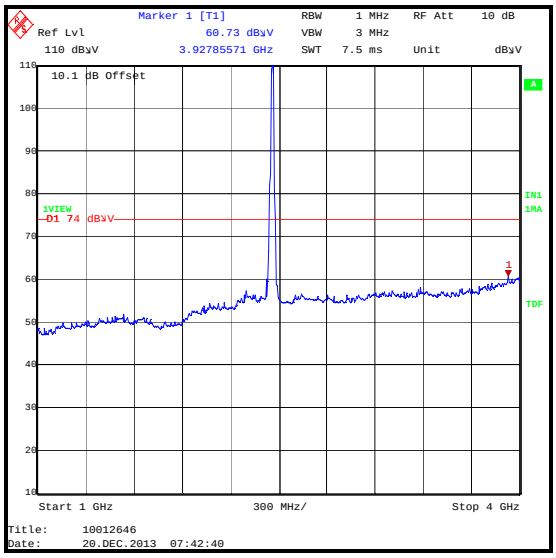
Results: Peak / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4930.736	Horizontal	45.2	54.0*	8.8	Complied
7385.125	Vertical	56.2	74.0	17.8	Complied

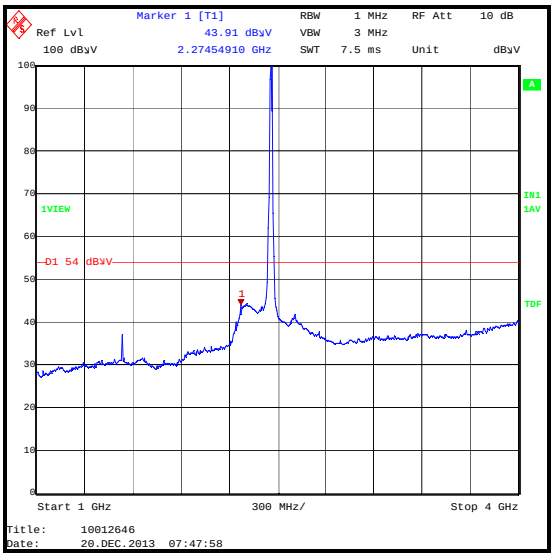
Results: Average / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
7389.093	Vertical	40.5	54.0	13.5	Complied

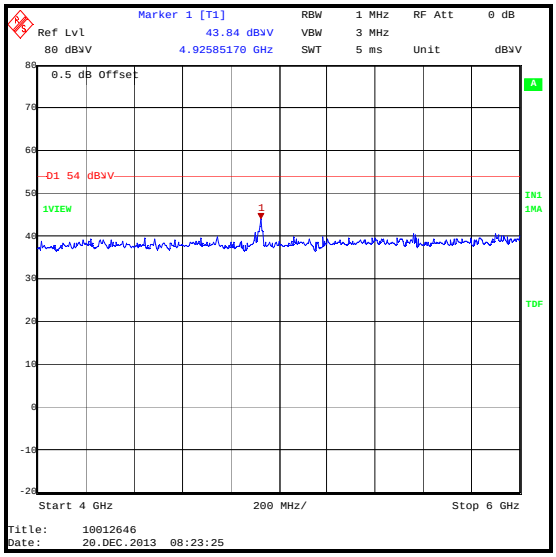
Transmitter Radiated Emissions – UAM Antenna (continued)

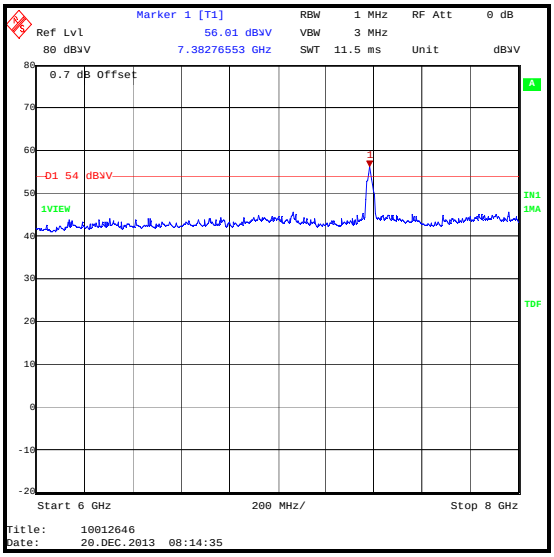


Peak detector

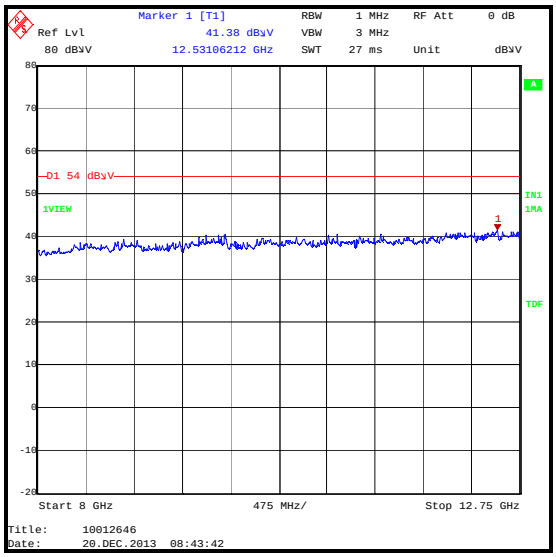


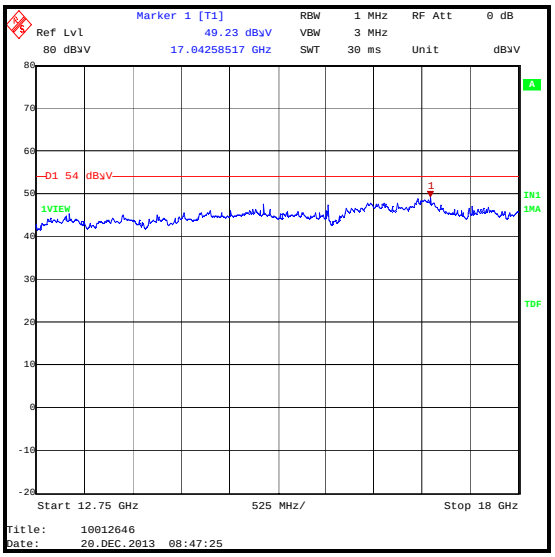
Average detector

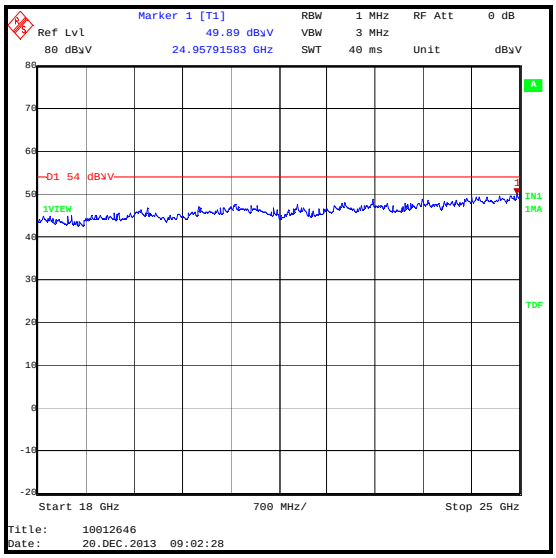




Transmitter Radiated Emissions – UAM Antenna (continued)







Transmitter Radiated Emissions – UAM Antenna (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
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
A1818	Antenna	EMCO	3115	00075692	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
A1981	High Pass Filter	AtlanTecRF	AFH-05000	09110200090	19 Apr 2014	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 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
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
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12

5.2.5. Transmitter Radiated Emissions – V100 Antenna

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	08 January 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 (%):	43

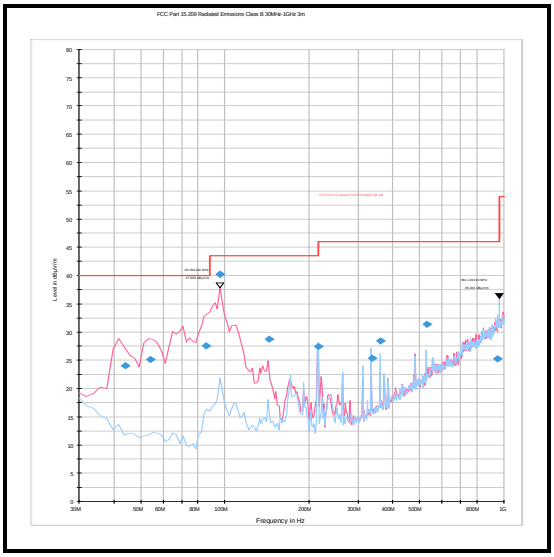
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The 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.
3. All 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. Therefore the highest measured level of the noise floor was recorded in the table below.
4. 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.

Results: Top Channel / 802.11g / 20 MHz / 12 Mbit/s

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
961.122	Vertical	35.9	54.0	18.1	Complied

Transmitter Radiated Emissions (continued)



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
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Nov 2014	12
A490	Antenna	Chase	CBL6111A	1590	09 Apr 2014	12
A1834	Attenuator	Hewlett Packard	8941B	10444	15 Nov 2014	12
G0543	Amplifier	Sonoma	310N	230801	15 Feb 2014	12

Transmitter Radiated Emissions – V100 Antenna (continued)

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	07 January 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
Relative Humidity (%):	41

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. All other emissions shown on the pre-scan plot were investigated and found to be ambient or >20 dB below the applicable limit or below the measurement system noise floor.
3. The emission shown approximately at 2462 MHz on the 1 GHz to 4 GHz plot is the EUT fundamental.
4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number 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. *Emissions in restricted bands: In accordance with C63.10 section 6.6.4.2, Note 1, where the peak-detected amplitude was shown to comply with the average limit, an average measurement was not performed.

Transmitter Radiated Emissions – V100 Antenna (continued)

Results: Peak / Bottom Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4817.287	Vertical	42.2	54.0*	11.8	Complied

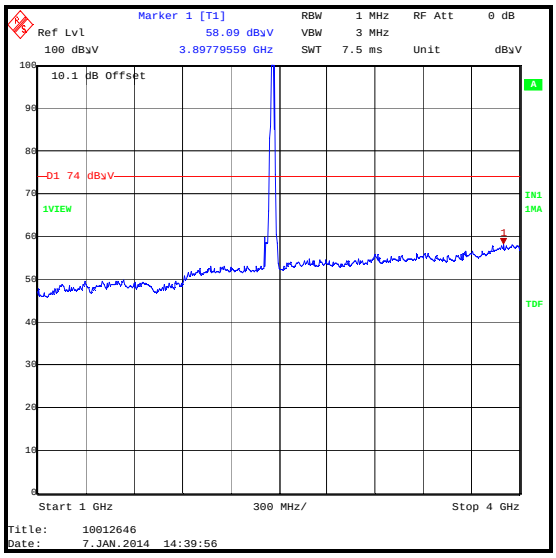
Results: Peak / Middle Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4880.713	Vertical	47.8	54.0*	6.2	Complied
7316.511	Vertical	48.2	54.0*	5.8	Complied

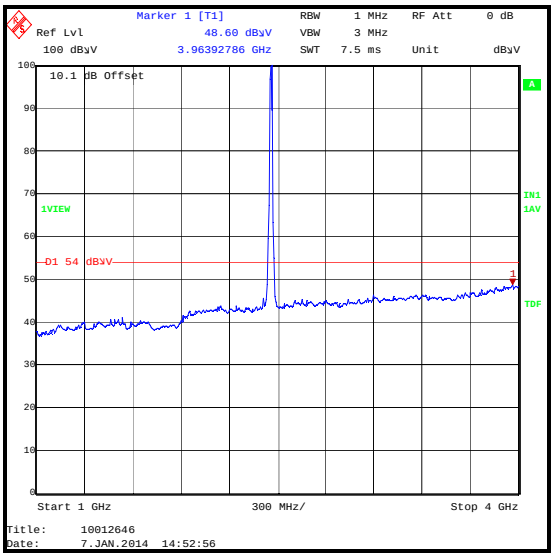
Results: Peak / Top Channel

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
4923.900	Vertical	49.4	54.0*	4.6	Complied
7398.926	Vertical	50.5	54.0*	3.5	Complied

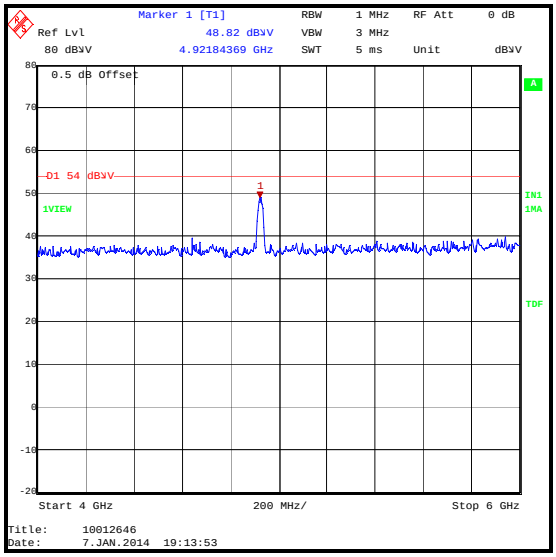
Transmitter Radiated Emissions – V100 Antenna (continued)

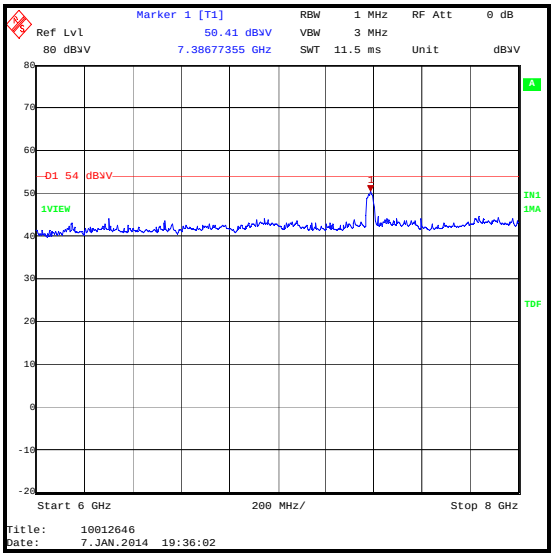


Peak detector

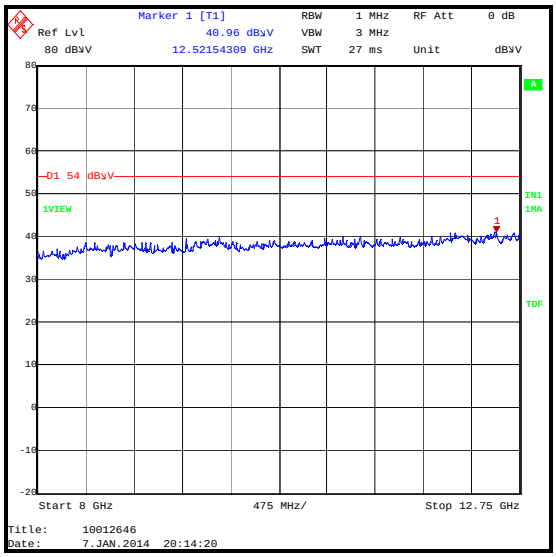


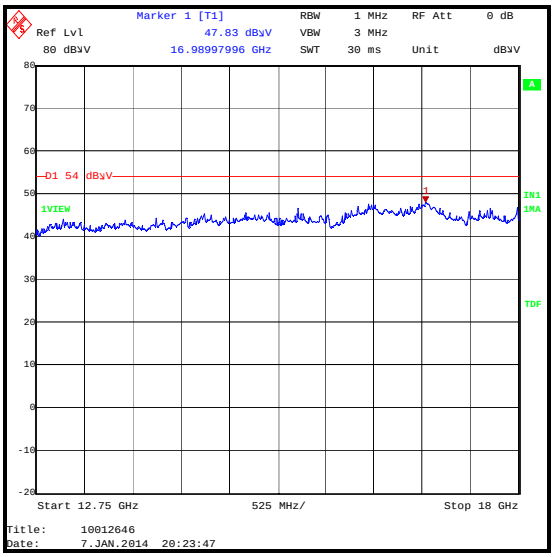
Average detector

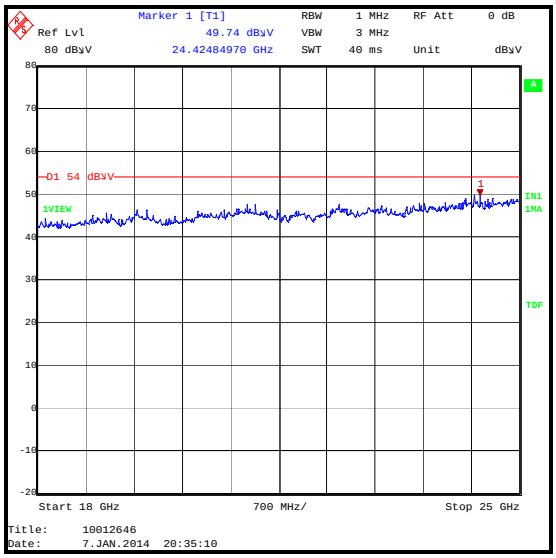




Transmitter Radiated Emissions – V100 Antenna (continued)







Transmitter Radiated Emissions – V100 Antenna (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
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
A1818	Antenna	EMCO	3115	00075692	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
A1981	High Pass Filter	AtlanTecRF	AFH-05000	09110200090	19 Apr 2014	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 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
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
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12

5.2.6. Transmitter Band Edge Radiated Emissions – UAM Antenna

Test Summary:

Test Engineers:	David Doyle & Sandeep Bharat	**Test Date:**	20 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 Section 6.9.2

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	35

Note(s):

1. All configurations supported by the EUT were investigated on one channel. The data rates that produced the highest power and widest bandwidth were therefore deemed worst case:
    - 802.11b – DQPSK / 11 Mbit/s & DBPSK / 2 Mbit/s
    - 802.11g – QPSK / 12 Mbit/s
    - 802.11n HT20 – QPSK / 39 Mbit/s / MCS10 & 16QAM / 52 Mbit/s / MCS11
    - 802.11n HT40 – QPSK / 81 Mbit/s / MCS10 & 16QAM / 108 Mbit/s / MCS11
2. Final measurements were performed with the above configurations.
3. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
4. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
5. * -20 dBc limit.
6. For 802.11g and 802.11n, the lower band edge plots show an incorrect display line at -30 dBc. The limit in the results tables has been corrected to -20 dBc.
7. Some upper band edge peak measurements were performed with a reference level of 120 dBµV (ANSI C63.10 Section 6.9.2 procedure requirement is 110 dBµV) as the peak of the carrier exceeded 110 dBµV. This has no effect on the test result and the measured band edge levels for these configurations were compliant.

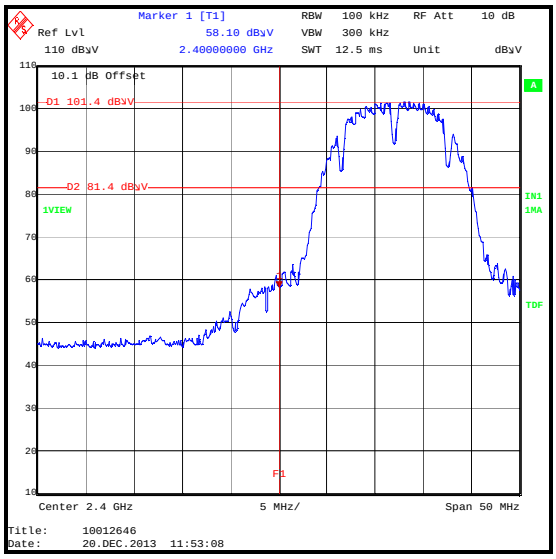
Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

Results: Peak / 802.11b / 20 MHz / DBPSK / 2 Mbit/s

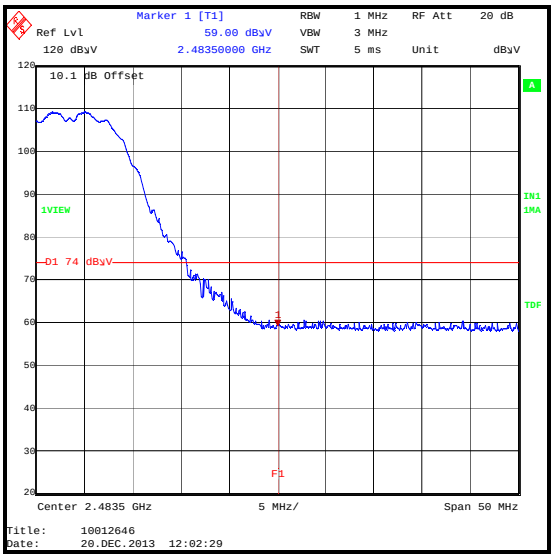
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	58.1	81.4*	23.3	Complied
2483.5	59.0	74.0	15.0	Complied

Results: Average / 802.11b / 20 MHz / DBPSK / 2 Mbit/s

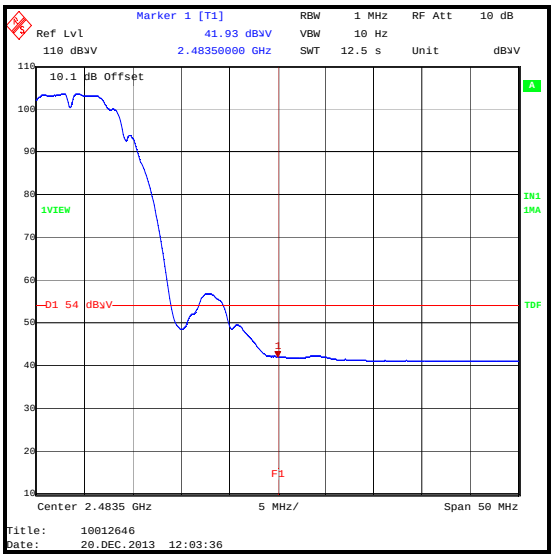
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	41.9	54.0	12.1	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

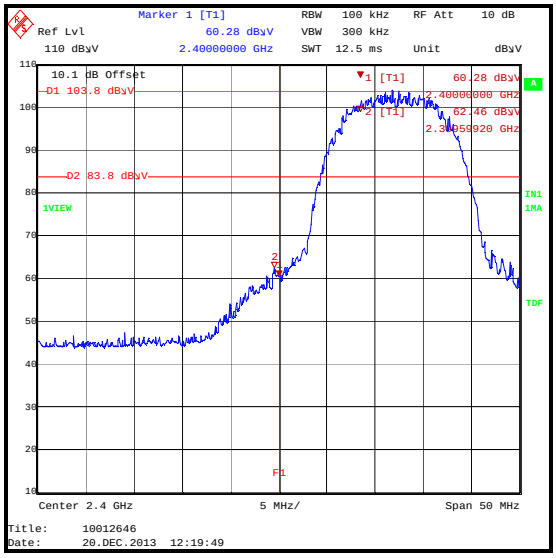
Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

Results: Peak / 802.11b / 20 MHz / DQPSK / 11 Mbit/s

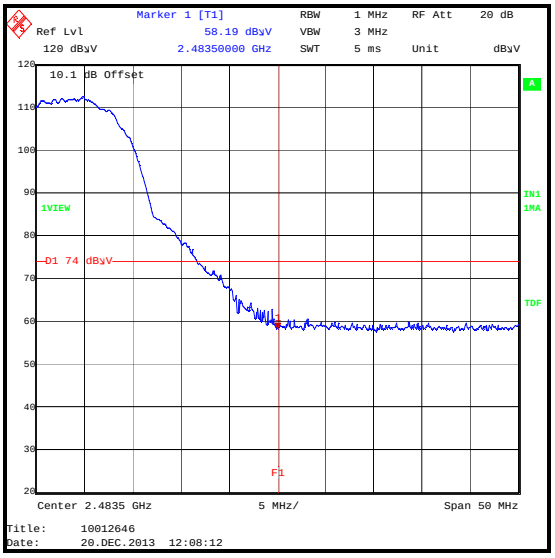
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.599	62.5	83.8*	21.3	Complied
2400	60.3	83.8*	23.5	Complied
2483.5	58.2	74.0	15.8	Complied

Results: Average / 802.11b / 20 MHz / DQPSK / 11 Mbit/s

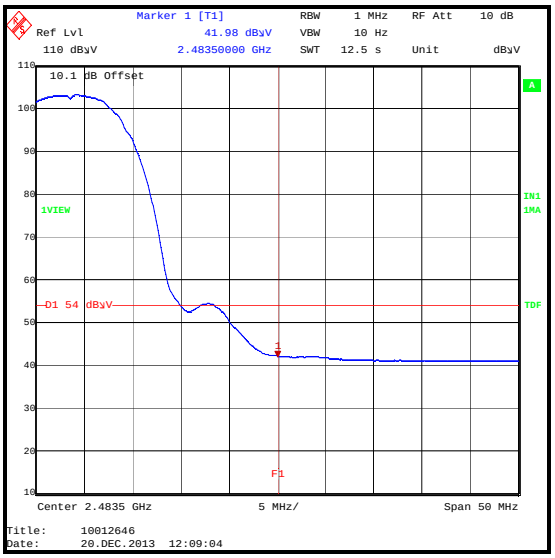
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	42.0	54.0	12.0	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

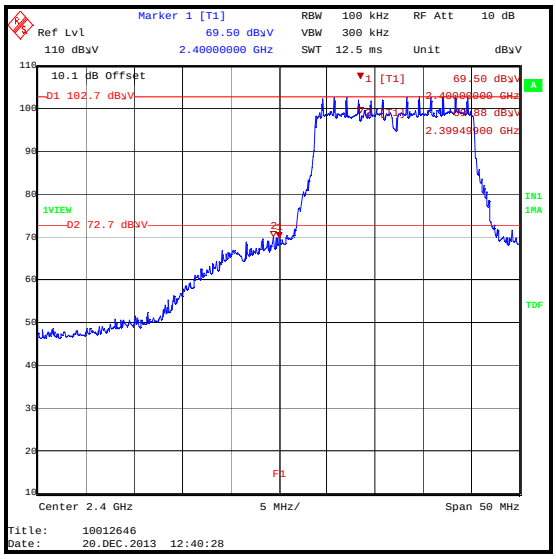
Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

Results: Peak / 802.11g / 20 MHz / QPSK / 12 Mbit/s

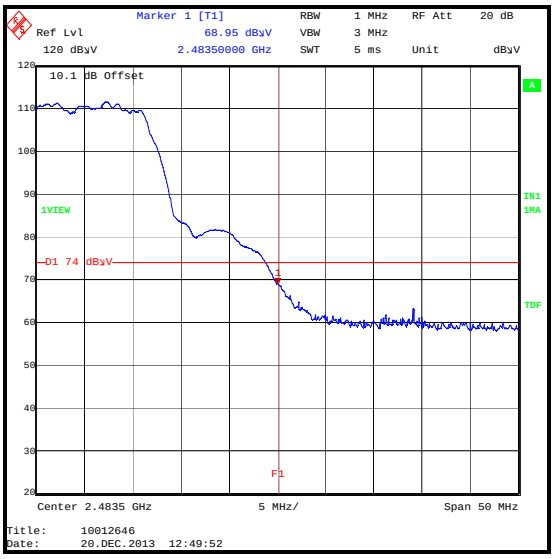
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	69.5	82.7*	13.2	Complied
2483.5	69.0	74.0	5.0	Complied

Results: Average / 802.11g / 20 MHz / QPSK / 12 Mbit/s

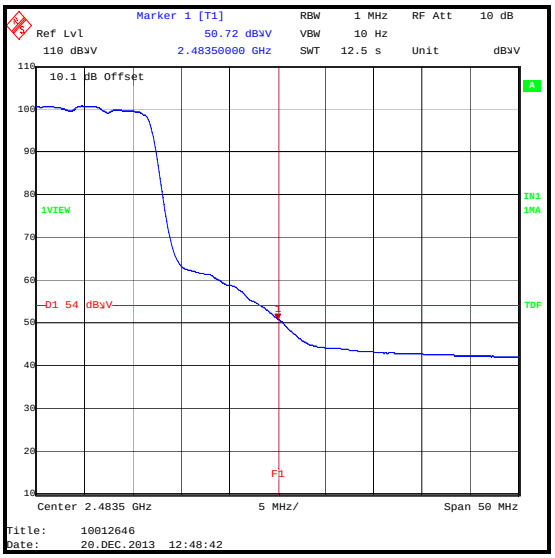
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	50.7	54.0	3.3	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

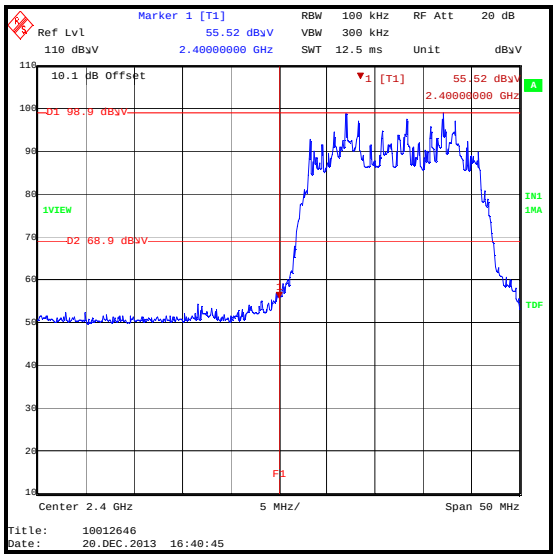
Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

Results: Peak / 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10

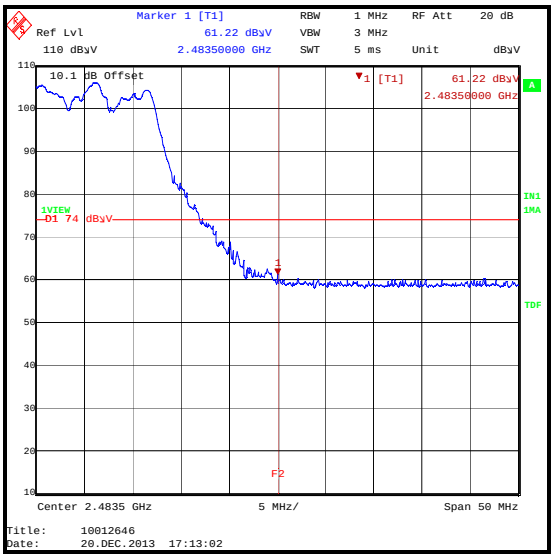
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	55.5	78.9*	23.4	Complied
2483.5	61.2	74.0	12.8	Complied

Results: Average / 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10

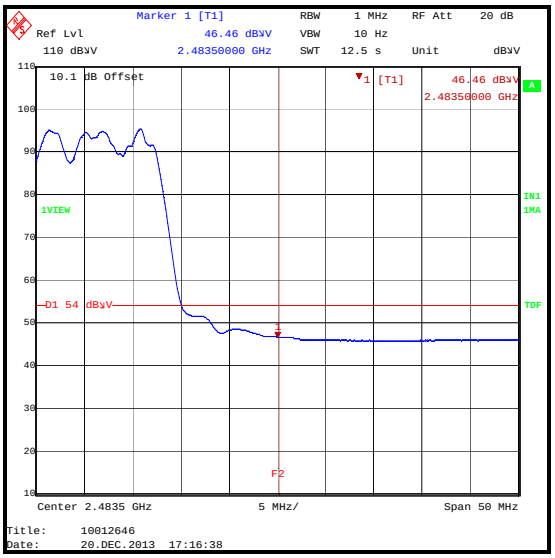
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	46.5	54.0	7.5	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

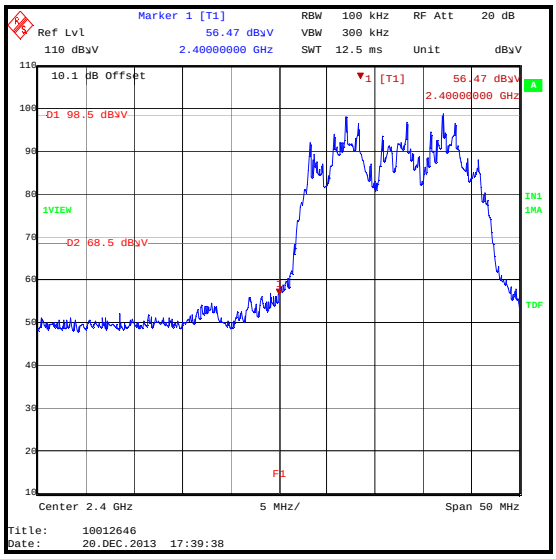
Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

Results: Peak / 802.11n / 20 MHz / 16QAM / 52 Mbit/s / MCS11

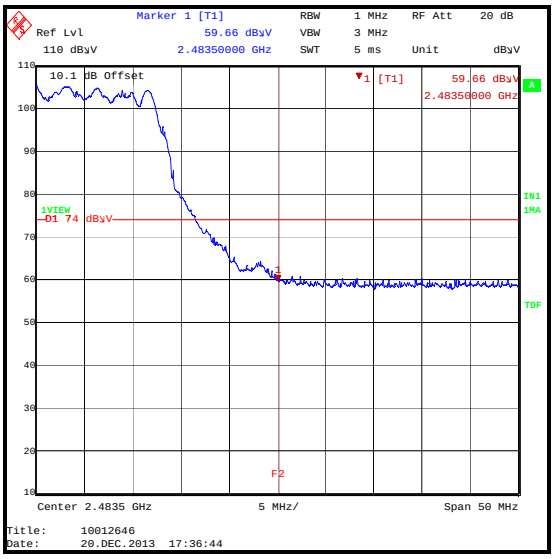
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	56.5	78.5*	22.0	Complied
2483.5	59.7	74.0	14.3	Complied

Results: Average / 802.11n / 20 MHz / 16QAM / 52 Mbit/s / MCS11

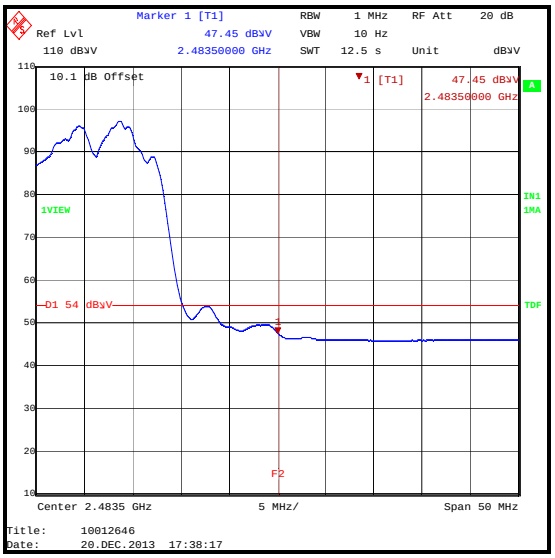
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	47.5	54.0	6.5	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

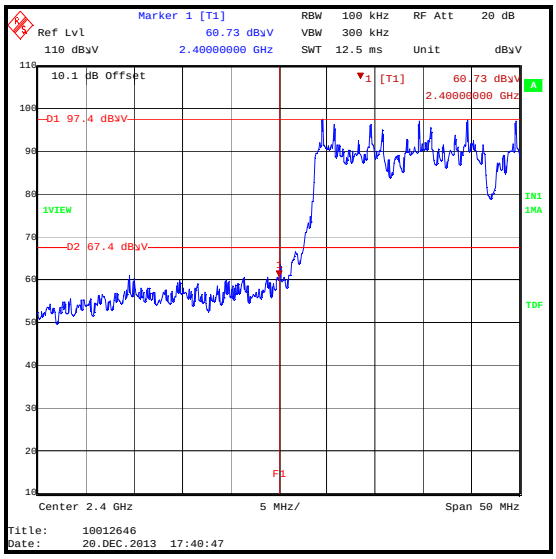
Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

Results: Peak / 802.11n / 40 MHz / QPSK / 81 Mbit/s / MCS10

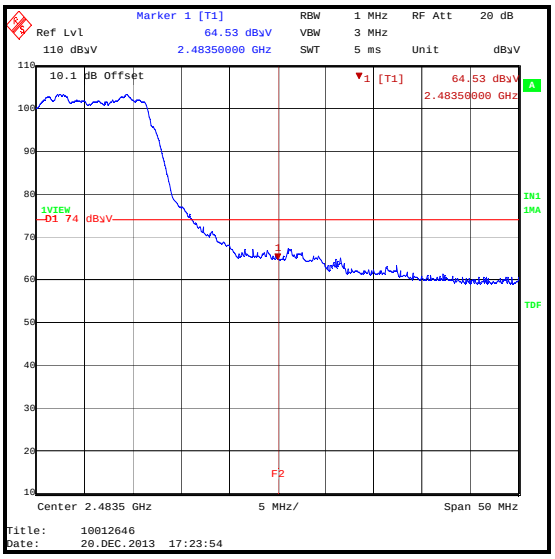
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	60.7	77.4*	16.7	Complied
2483.5	64.5	74.0	9.5	Complied

Results: Average / 802.11n / 40 MHz / QPSK / 81 Mbit/s / MCS10

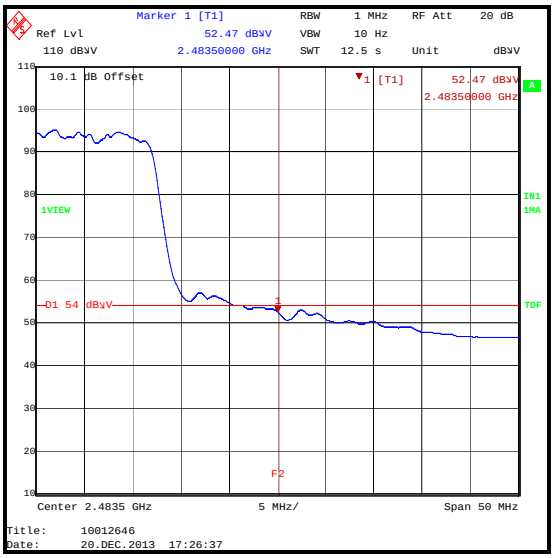
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	52.5	54.0	1.5	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

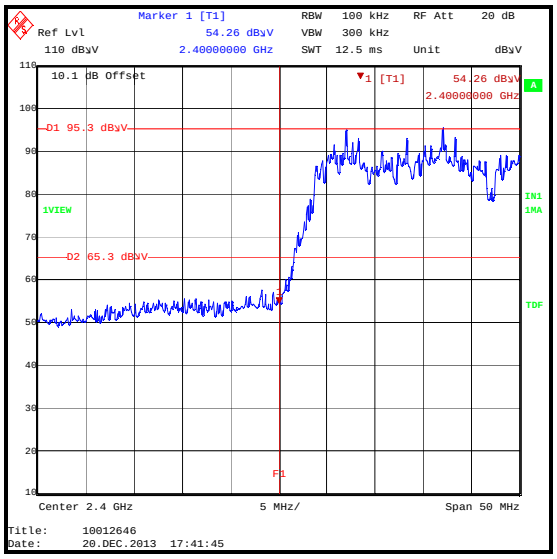
Transmitter Band Edge Radiated Emissions – UAM Antenna (continued)

Results: Peak / 802.11n / 40 MHz / 16QAM / 108 Mbit/s / MCS11

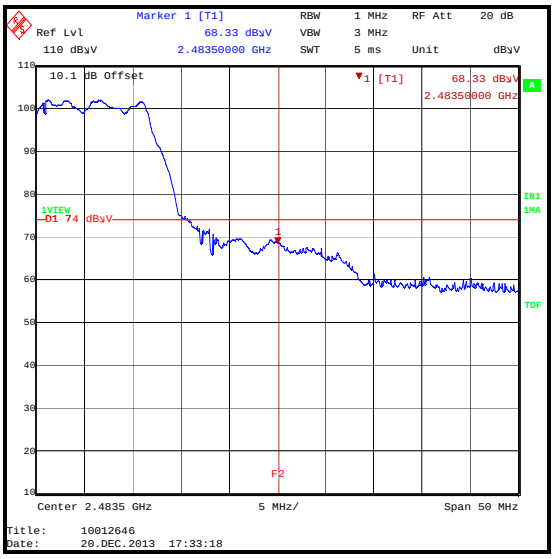
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	54.3	75.3*	21.0	Complied
2483.5	68.3	74.0	5.7	Complied

Results: Average / 802.11n / 40 MHz / 16QAM / 108 Mbit/s / MCS11

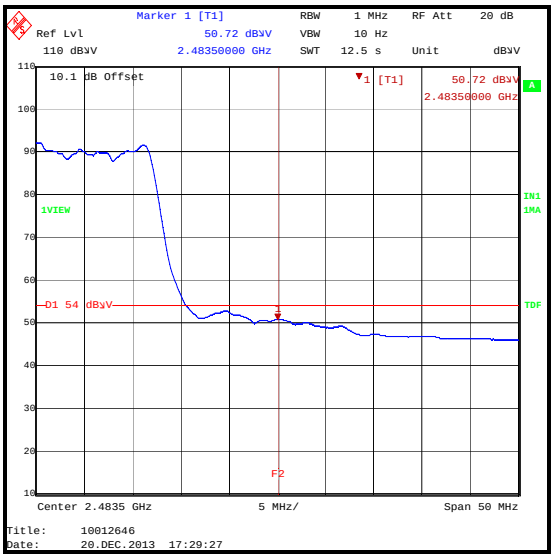
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	50.7	54.0	3.3	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

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)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	14 Nov 2014	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
A1818	Antenna	EMCO	3115	00075692	14 Nov 2014	12

5.2.7. Transmitter Band Edge Radiated Emissions – V100 Antenna

Test Summary:

Test Engineers:	David Doyle & Sandeep Bharat	**Test Date:**	07 January 2014
Test Sample MAC Address:	240A546D213		

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

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	41

Note(s):

1. All configurations supported by the EUT were investigated on one channel. The data rates that produced the highest power and widest bandwidth were therefore deemed worst case :
    - 802.11b – DQPSK / 11 Mbit/s & DBPSK / 2 Mbit/s
    - 802.11g – QPSK / 12 Mbit/s
    - 802.11n HT20 – QPSK / 39 Mbit/s / MCS10 & 16QAM / 52 Mbit/s / MCS11
    - 802.11n HT40 – QPSK / 81 Mbit/s / MCS10 & 16QAM / 108 Mbit/s / MCS11
2. Final measurements were performed with the above configurations.
3. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
4. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement was performed with a peak detector and the -20 dBc limit applied.
5. * -20 dBc limit.

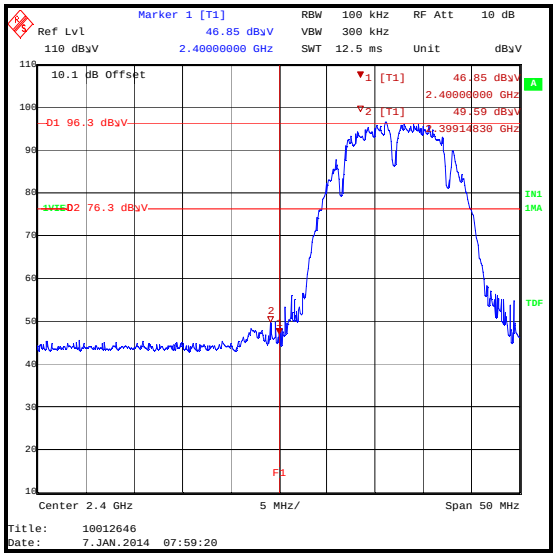
Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

Results: Peak / 802.11b / 20 MHz / DBPSK / 2 Mbit/s

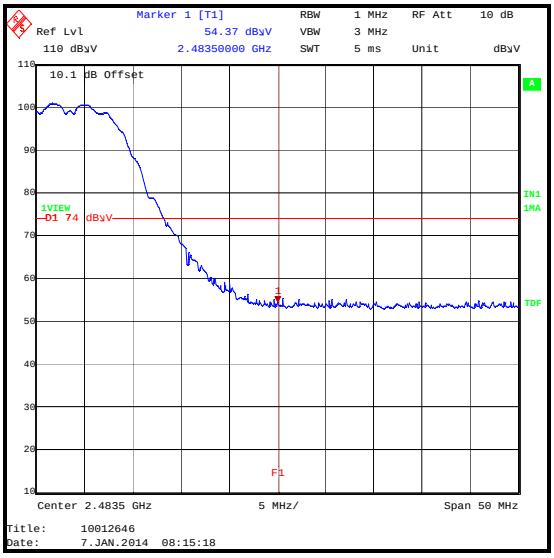
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2399.148	49.6	76.3*	26.7	Complied
2400	46.9	76.3*	29.4	Complied
2483.5	54.4	74.0	19.6	Complied

Results: Average / 802.11b / 20 MHz / DBPSK / 2 Mbit/s

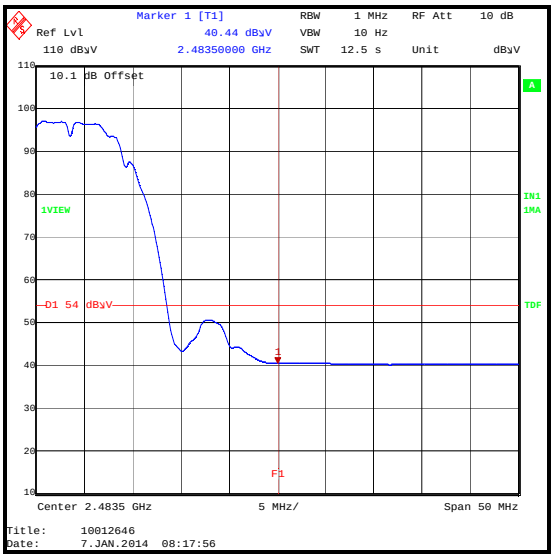
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.4	54.0	13.6	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

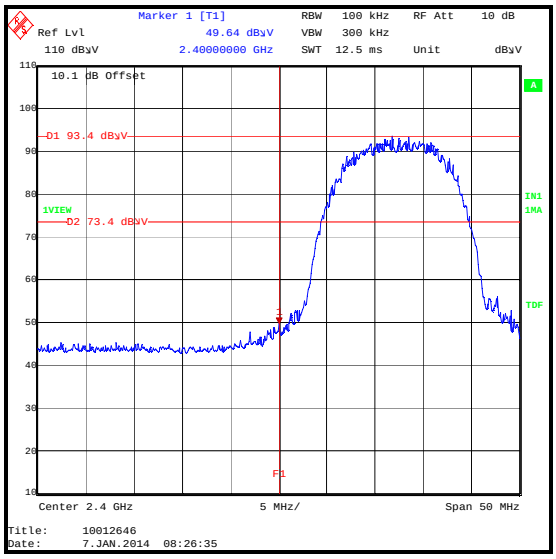
Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

Results: Peak / 802.11b / 20 MHz / DQPSK / 11 Mbit/s

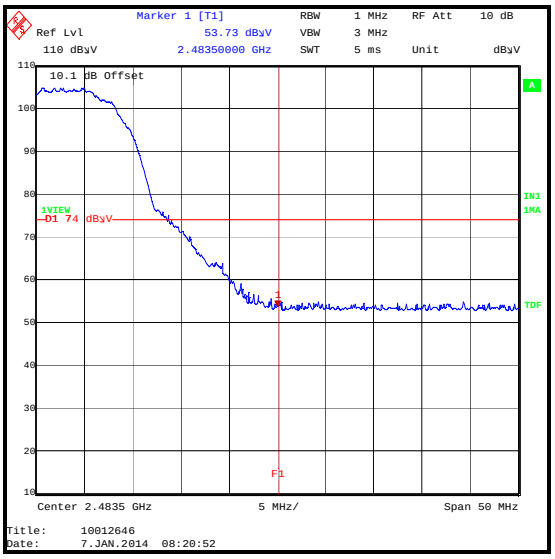
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	49.6	73.4*	23.8	Complied
2483.5	53.7	74.0	20.3	Complied

Results: Average / 802.11b / 20 MHz / DQPSK / 11 Mbit/s

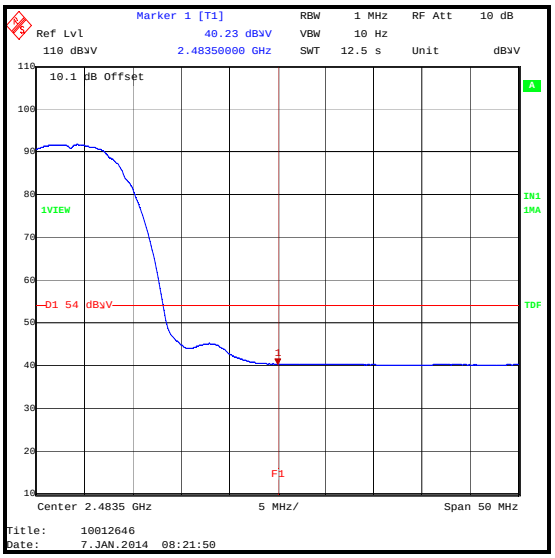
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.2	54.0	13.8	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

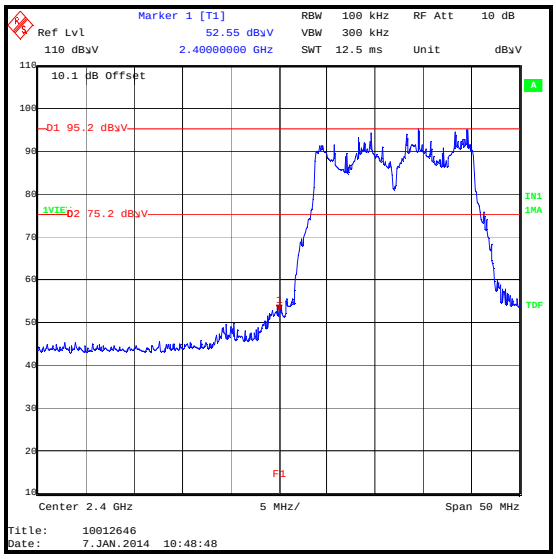
Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

Results: Peak / 802.11g / 20 MHz / QPSK /12 Mbit/s

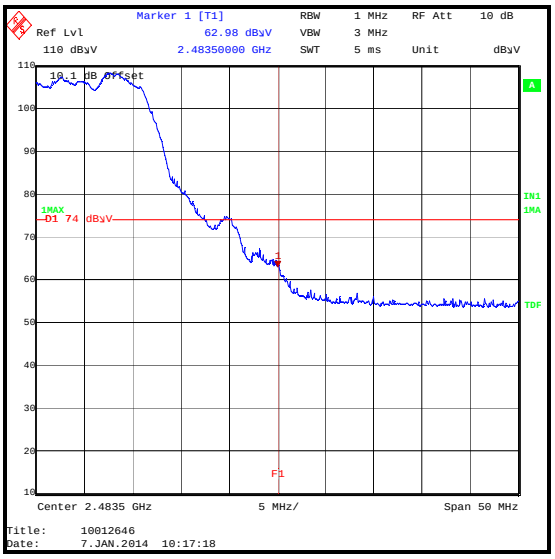
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	52.6	75.2*	22.6	Complied
2483.5	63.0	74.0	11.0	Complied

Results: Average / 802.11g / 20 MHz / QPSK / 12 Mbit/s

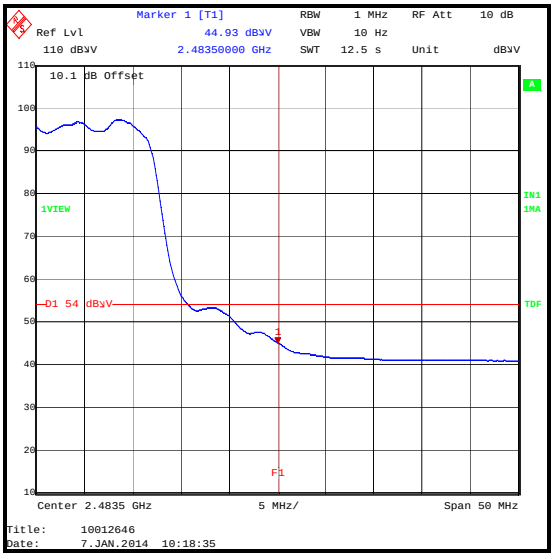
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	44.9	54.0	9.1	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

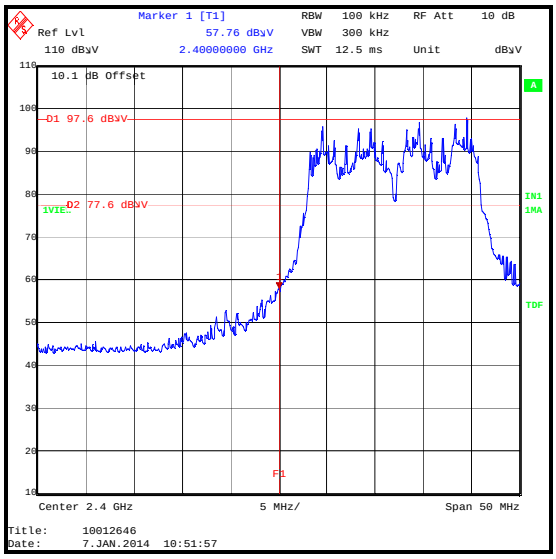
Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

Results: Peak / 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10

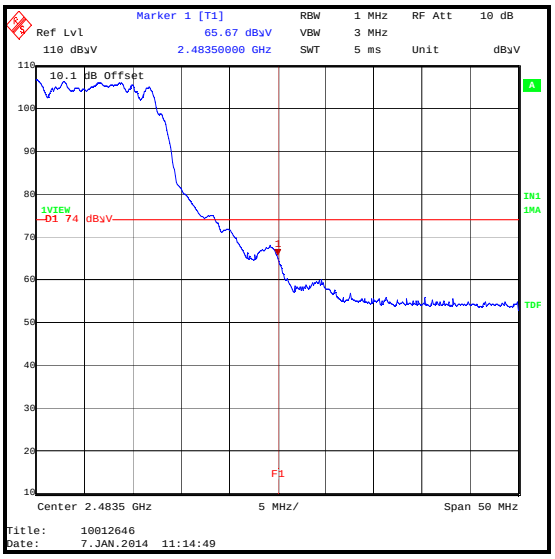
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	57.8	77.6*	19.8	Complied
2483.5	65.7	74.0	8.3	Complied

Results: Average / 802.11n / 20 MHz / QPSK / 39 Mbit/s / MCS10

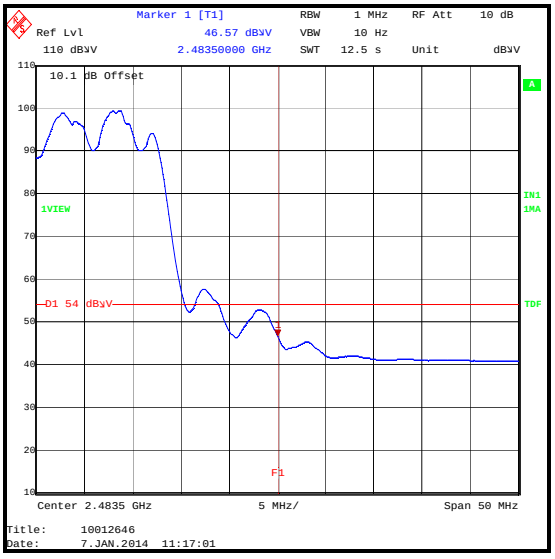
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	46.6	54.0	7.4	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

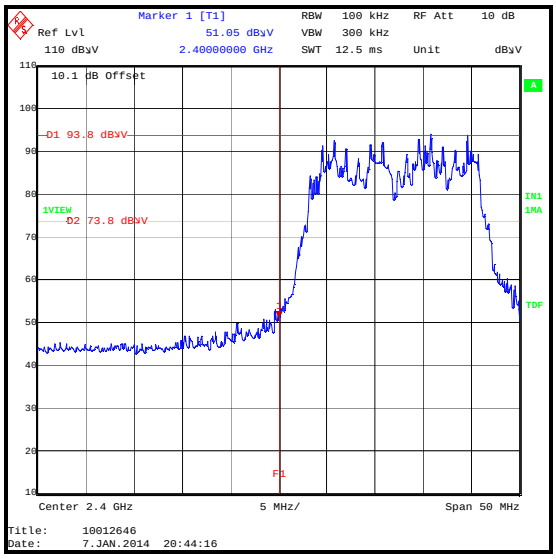
Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

Results: Peak / 802.11n / 20 MHz / 16QAM / 52 Mbit/s / MCS11

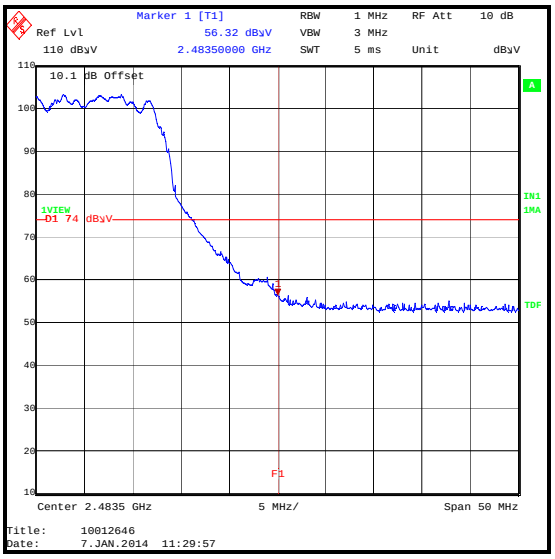
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	51.1	73.8*	22.7	Complied
2483.5	56.3	74.0	17.7	Complied

Results: Average / 802.11n / 20 MHz / 16QAM / 52 Mbit/s / MCS11

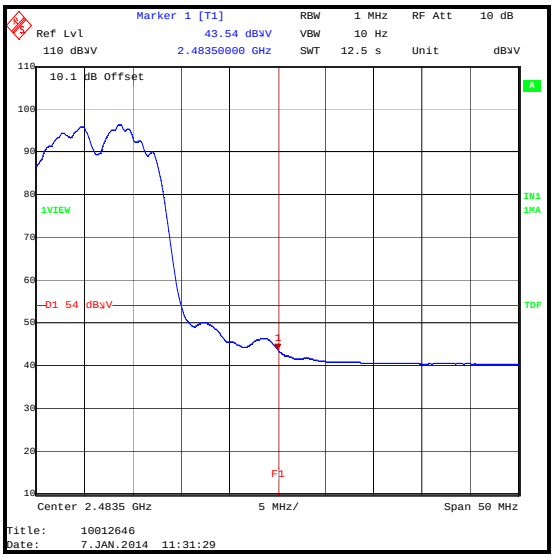
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	43.5	54.0	10.5	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

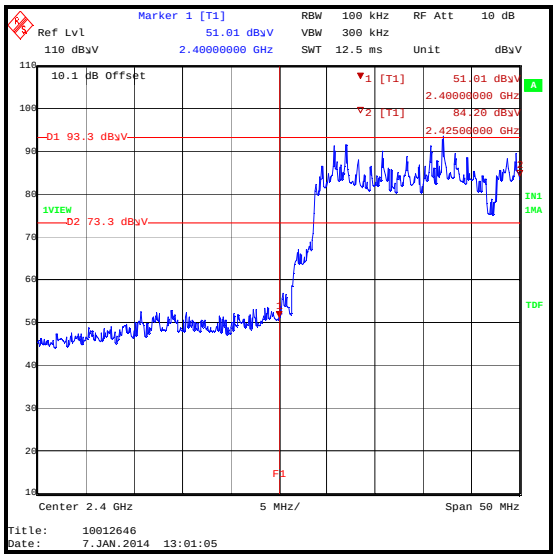
Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

Results: Peak / 802.11n / 40 MHz / QPSK / 81 Mbit/s / MCS10

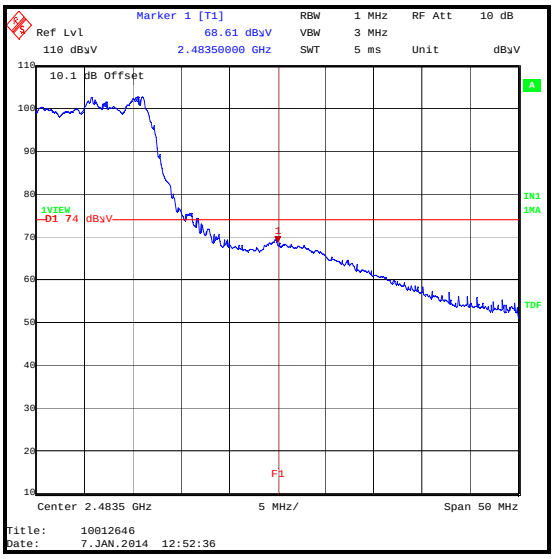
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	51.0	73.3*	22.3	Complied
2483.5	68.6	74.0	5.4	Complied

Results: Average / 802.11n / 40 MHz / QPSK / 81 Mbit/s / MCS10

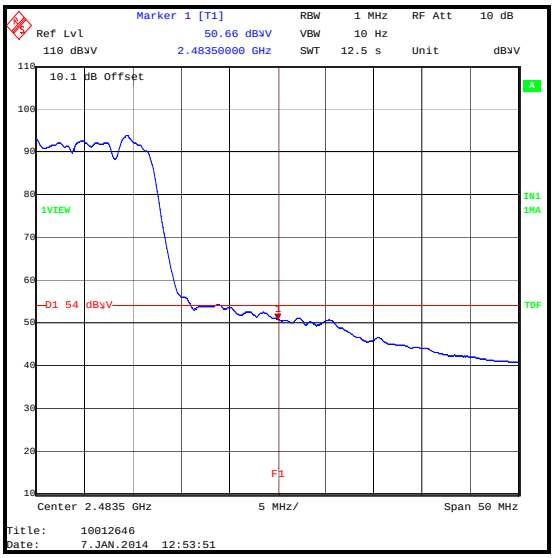
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	50.7	54.0	3.3	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

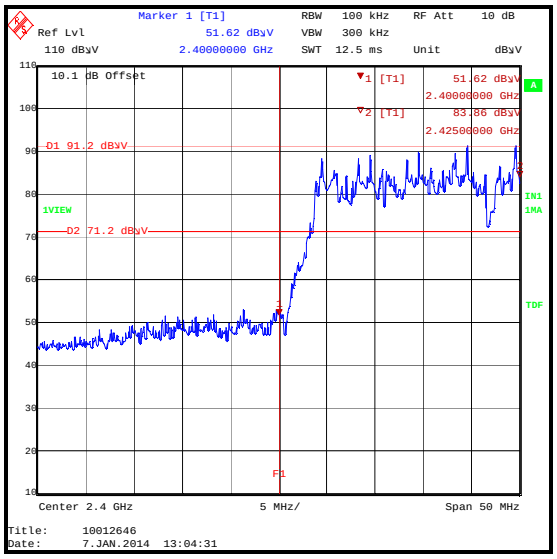
Transmitter Band Edge Radiated Emissions – V100 Antenna (continued)

Results: Peak / 802.11n / 40 MHz / 16QAM / 108 Mbit/s / MCS11

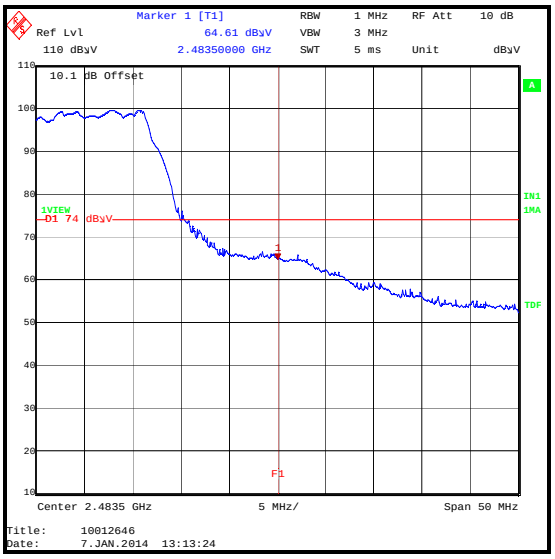
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	51.6	71.2*	19.6	Complied
2483.5	64.6	74.0	9.4	Complied

Results: Average / 802.11n / 40 MHz / 16QAM / 108 Mbit/s / MCS11

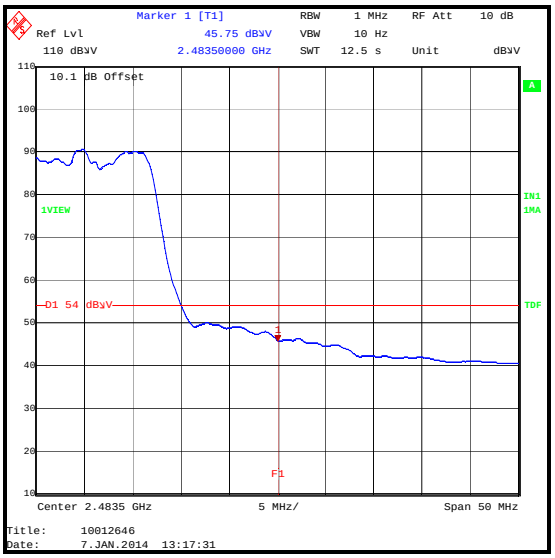
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	45.8	54.0	8.2	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

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)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	24 May 2014	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	14 Nov 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	14 Nov 2014	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	01 Oct 2014	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 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
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Occupied 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 25 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	36,41 & 44	-	Corrected directional gain calculations for V100 antenna in 802.11n MCS10 mode
3.0	5 & 8 36 to 47	-	Removed references to output power measurements Removed output power measurements section
4.0	-	-	Updated KDB references

--- END OF REPORT ---