



TEST REPORT

Test Report No. : UL-RPT-RP10036198JD01A V2.0

Manufacturer : Dataflex Design Communications Ltd
Model No. : H601V2
FCC ID : 2AASBH601V2
Technology : IEEE 802.11
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.

Date of Issue: 12 November 2013

Checked by:

Ian Watch
Senior Engineer, Radio Laboratory

Issued by :

pp
John Newell
Group Quality Manager,
WiSE Basingstoke,
UL VS LTD



This laboratory is accredited by UKAS.
The tests reported herein have been
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UL VS LTD

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

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1. Customer Information











Company Name:	Dataflex Design Communications Ltd
Address:	8 Frederick Sanger Road Surrey Research Park Guildford Surrey GU2 7YD United Kingdom

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:	47CFR15.107 and 47CFR15.109
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart B (Unintentional Radiators) – Sections 15.107 and 15.109
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 August 2013 to 11 October 2013

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.107(a)	Receiver/Idle Mode AC Conducted Emissions	
Part 15.109	Receiver/Idle Mode Radiated Spurious Emissions	
Part 15.207	Transmitter AC Conducted Emissions	
Part 15.247(a)(2)	Transmitter Minimum 6 dB Bandwidth	
Part 15.247(e)	Transmitter Power Spectral Density	
Part 15.247(b)(3)	Transmitter Maximum Peak Output Power	
Part 15.247(d) & 15.209(a)	Transmitter Radiated Spurious 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
Reference:	KDB 558074 D01 v03 April 9, 2013
Title:	Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under 15.247

2.4. Deviations from the Test Specification

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

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Hera
Model Name or Number:	H601V2
Serial Number:	04423300813210200117
Hardware Version Number:	EPCB233002
Software Version Number:	331c_p33_patch1
FCC ID:	2AASBH601V2

3.2. Description of EUT

The Equipment Under Test was a 3G Router containing an 802.11b/g WLAN transceiver. The WLAN transceiver is SISO.

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) / Digital Transmission System		
Type of Unit:	Transceiver		
Modulation Types:	DBPSK, DQPSK, BPSK, QPSK, 16QAM & 64QAM		
Data Rates:	802.11b	1, 2, 5.5 & 11 Mbps	
	802.11g	6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
Power Supply Requirement(s):	Nominal	12 VDC via 120 VAC 60 Hz supply	
Maximum Conducted Output Power:	7.1 dBm		
Declared Antenna Gain:	2.0 dBi		
Duty Cycle:	> 98%		
Channel Spacing:	20 MHz		
Transmit/Receive Frequency Range:	2412 MHz to 2462 MHz		
Transmit/Receive Channels Tested:	Channel ID	Channel Number	Channel Frequency (MHz)
	Bottom	1	2412
	Middle	6	2437
	Top	11	2462

3.5. Support Equipment

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

Description:	WLAN Antenna
Brand Name:	Cortec
Model Name or Number:	AN2400-5505RS-01

Description:	GSM Terminal Antenna
Brand Name:	Asian Creation Communication Co, Ltd
Model Name or Number:	Q9018-24W

Brand Name:	GSM/UMTS Antenna
Description:	G-Antetech
Model Name or Number:	GA-GSM-06

Brand Name:	Not marked or stated
Description:	USB to RS232 Converter Lead
Model Name or Number:	Not marked or stated

Brand Name:	Not marked or stated
Description:	RS232 to RJ45 Converter Lead
Model Name or Number:	Not marked or stated

Brand Name:	Power Solve
Description:	Switching Adaptor
Model Name or Number:	FKS308HSC-1201250N

Brand Name:	Netgear
Description:	Ethernet Switch
Model Name or Number:	GS605 v3

Brand Name:	Dell
Description:	Test Laptop
Model Name or Number:	Precision M65

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 100% duty cycle with a modulated carrier at maximum power on the bottom, middle and top channels as required using the supported data rates/modulation types.
- Receive/Idle Mode in which the EUT was active but not transmitting.

4.2. Configuration and Peripherals

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

- The EUT was powered by 12 VDC via a 120 VAC 60 Hz power supply.
- Controlled using a bespoke application on a laptop PC supplied by the customer. The application was used to enable a continuous transmission mode and to select the test channels, data rates and modulation schemes as required.
- The customer confirmed that the maximum power levels used on the EUT relate to a power setting of 20,000 on the bespoke software and therefore all tests were done with this power setting.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest output power, highest power spectral density, narrowest and widest bandwidths were:
 - Highest output power
 - 802.11b – DQPSK / 11 Mbps
 - 802.11g – 16QAM / 24 Mbps
 - Highest power spectral density
 - 802.11b – DQPSK / 2 Mbps
 - 802.11g – BPSK / 9 Mbps
 - Narrowest bandwidth (DTS bandwidth / 6 dB)
 - 802.11b – DQPSK / 2 Mbps
 - 802.11g – 16QAM / 24 Mbps
 - Widest bandwidth (Occupied bandwidth / 99%)
 - 802.11b – DQPSK / 5.5 Mbps
 - 802.11g – BPSK / 6 Mbps
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 11 Mbps (DQPSK), as this was found to have the highest power level and therefore deemed to be worst case.
- Apart from the service port which the customer confirmed will not be used in normal operating life, AC Conducted Emissions and Radiated Spurious Emissions tests were performed with all other ports appropriately terminated using support equipment.

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. Receiver/Idle Mode AC Conducted Spurious Emissions****Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	03 October 2013
Test Sample Serial Number:	04423300813210200117		

FCC Reference:	Part 15.107
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	44

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.204	Live	53.1	63.4	10.3	Complied
0.272	Live	46.1	61.1	15.0	Complied
0.335	Live	41.8	59.3	17.5	Complied
0.546	Live	41.8	56.0	14.2	Complied
0.690	Live	34.4	56.0	21.6	Complied
1.005	Live	33.0	56.0	23.0	Complied

Results: Live / Average

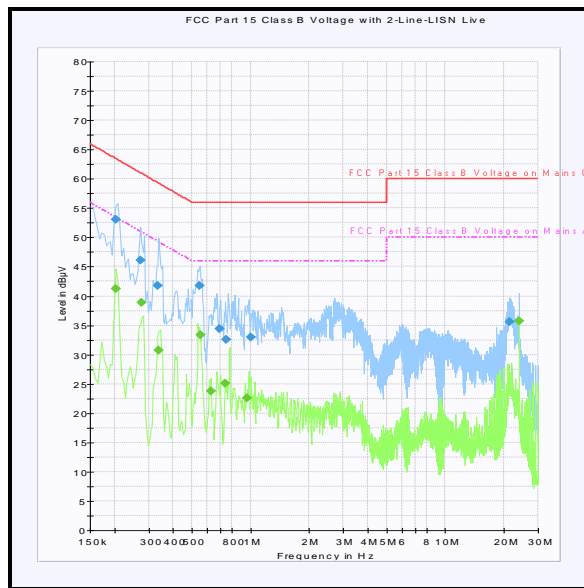
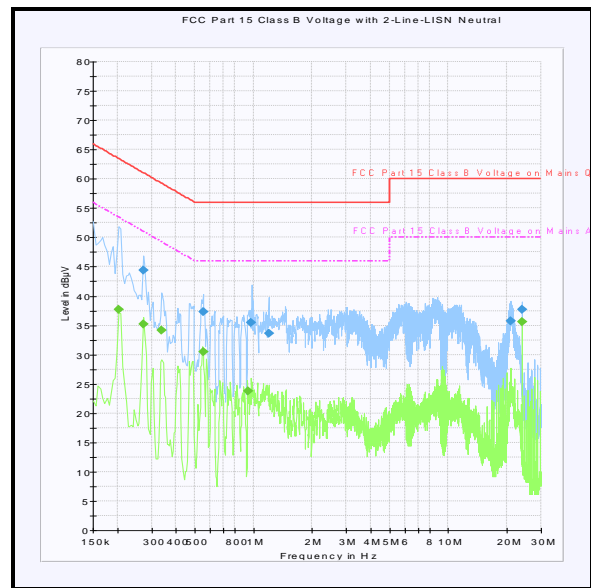
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.204	Live	41.2	53.4	12.2	Complied
0.276	Live	38.9	50.9	12.0	Complied
0.339	Live	30.7	49.2	18.5	Complied
0.551	Live	33.4	46.0	12.6	Complied
0.740	Live	25.0	46.0	21.0	Complied
24.000	Live	35.7	50.0	14.3	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)**Results: Neutral / Quasi Peak**

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.272	Neutral	44.4	61.1	16.7	Complied
0.551	Neutral	37.4	56.0	18.6	Complied
0.969	Neutral	35.4	56.0	20.6	Complied
1.208	Neutral	33.7	56.0	22.3	Complied
20.859	Neutral	35.8	60.0	24.2	Complied
24.000	Neutral	37.7	60.0	22.3	Complied

Results: Neutral / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.204	Neutral	37.8	53.4	15.6	Complied
0.272	Neutral	35.2	51.1	15.9	Complied
0.339	Neutral	34.1	49.2	15.1	Complied
0.551	Neutral	30.5	46.0	15.5	Complied
0.938	Neutral	23.8	46.0	22.2	Complied
24.000	Neutral	35.6	50.0	14.4	Complied

Receiver/Idle Mode 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	30.5015.13	None stated	09 Jan 2014	12
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	30 Oct 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
M1379	Test Receiver	Rohde & Schwarz	ESIB 7	100330	15 Oct 2013	12

5.2.2. Receiver/Idle Mode Radiated Spurious Emissions**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	04 October 2013
Test Sample Serial Number:	04423300813210200117		

FCC Reference:	Part 15.109
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:

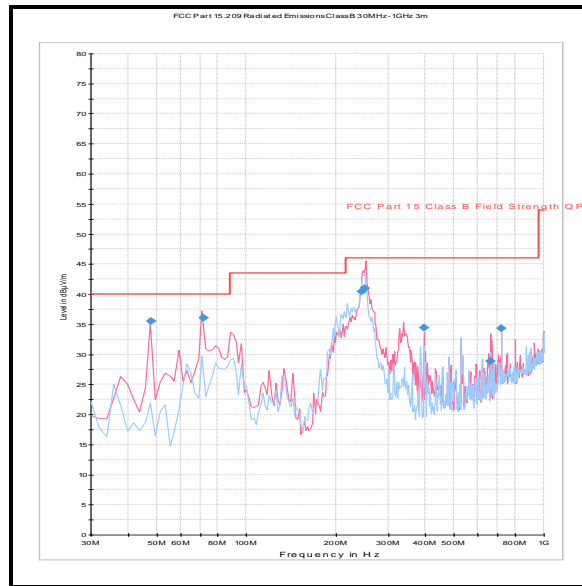
Temperature (°C):	24
Relative Humidity (%):	55

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. 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:

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
48.000	Vertical	35.5	40.0	4.5	Complied
72.010	Vertical	36.1	40.0	3.9	Complied
243.574	Vertical	40.4	46.0	5.6	Complied
249.848	Vertical	40.9	46.0	5.1	Complied
396.004	Vertical	34.5	46.0	11.5	Complied
663.453	Vertical	28.9	46.0	17.1	Complied
719.998	Vertical	34.3	46.0	11.7	Complied

Receiver/Idle Mode Radiated Spurious Emissions (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)
A490	Antenna	Chase	CBL6111A	1590	09 Apr 2014	12
A1843	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12
G0543	Pre Amplifier	Sonoma	310N	230801	05 Oct 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
M1622	Thermohygrometer	JM Handelspunkt	30.5015.06	Not Stated	24 May 2014	12

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.

Receiver/Idle Mode Radiated Spurious Emissions (continued)**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	02 October 2013
Test Sample Serial Number:	04423300813210200117		

FCC Reference:	Part 15.109
Test Method Used:	As detailed in ANSI C63.4 Section 8
Frequency Range	1 GHz to 25 GHz

Environmental Conditions:

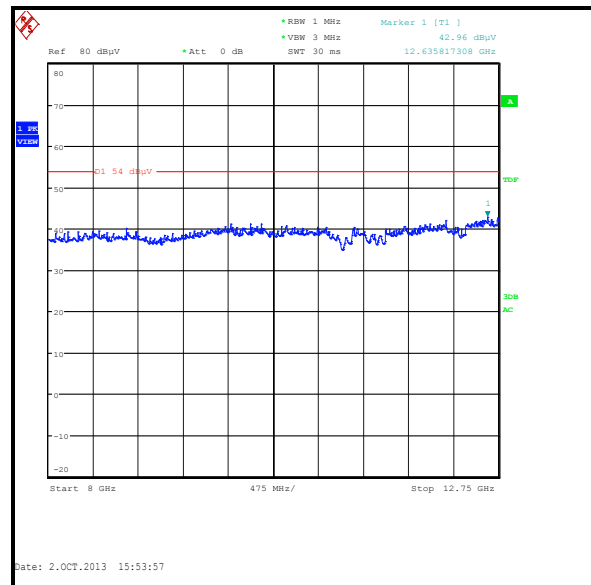
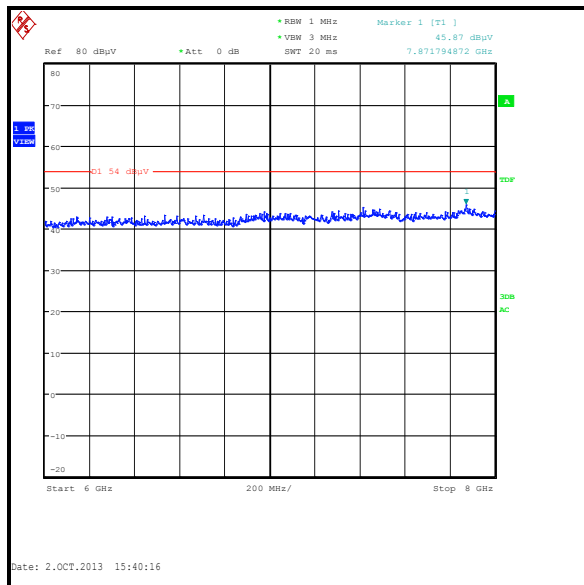
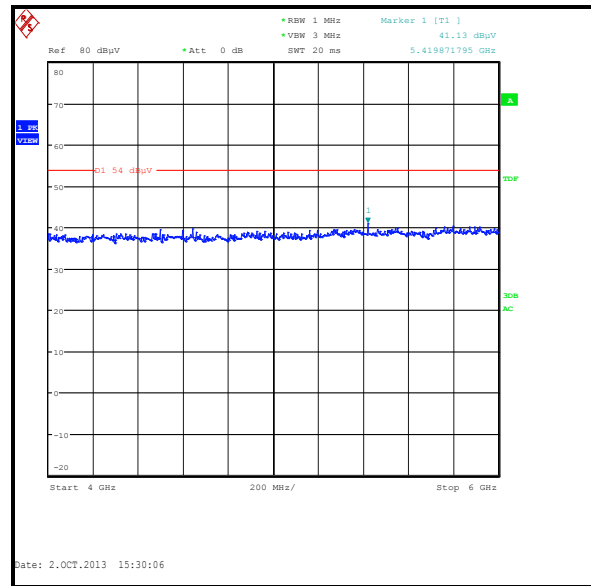
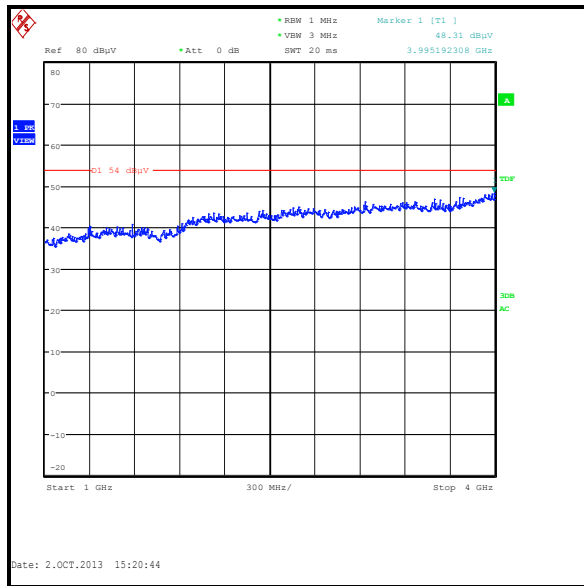
Temperature (°C):	25
Relative Humidity (%):	50

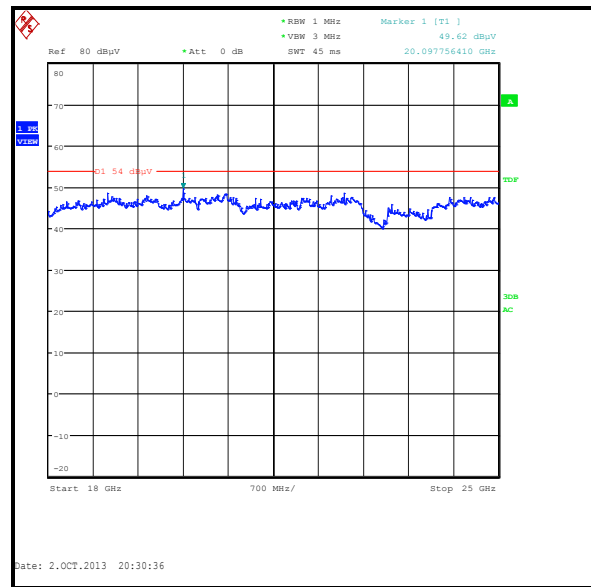
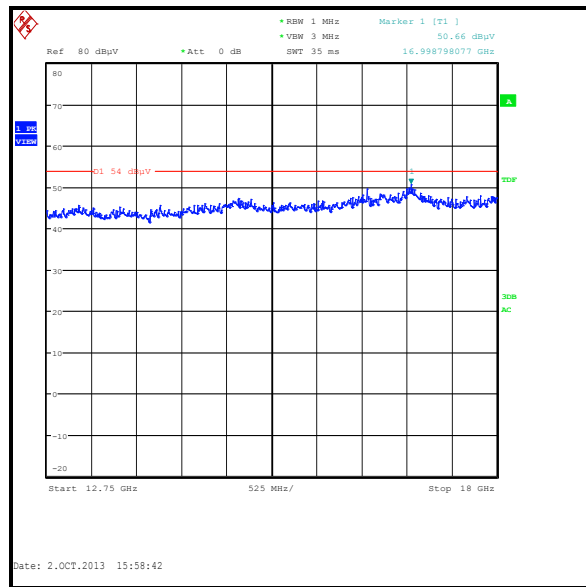
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
3. 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.

Results:

Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
16998.798	Vertical	50.7	54.0	3.3	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Receiver/Idle Mode Radiated Spurious Emissions (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	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann Microwave	20240-20	330	04 Nov 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	24 May 2014	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12

5.2.3. Transmitter AC Conducted Spurious Emissions**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	03 October 2013
Test Sample Serial Number:	04423300813210200117		

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):	23
Relative Humidity (%):	44

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.200	Live	51.7	63.6	11.9	Complied
0.281	Live	43.4	60.8	17.4	Complied
0.303	Live	42.7	60.2	17.5	Complied
0.537	Live	39.6	56.0	16.4	Complied
0.933	Live	33.9	56.0	22.1	Complied
21.503	Live	36.3	60.0	23.7	Complied

Results: Live / Average

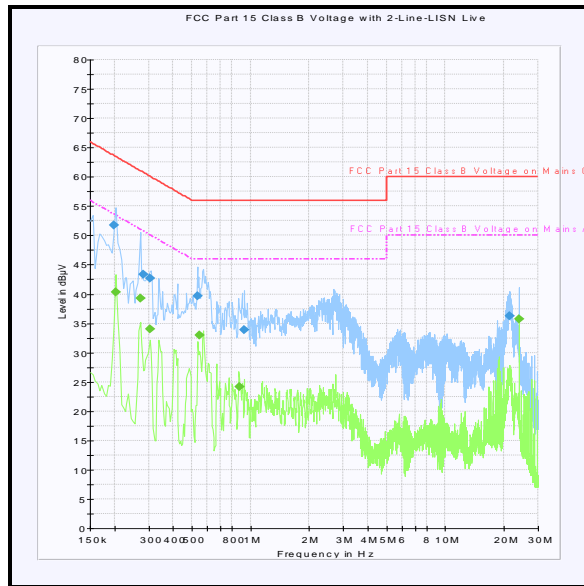
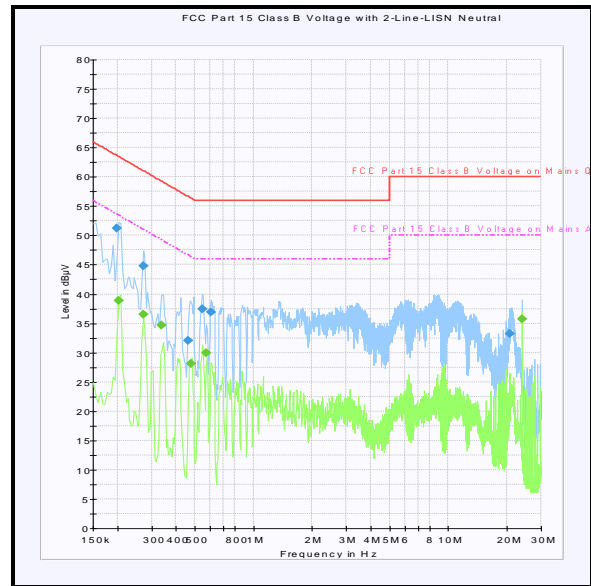
Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.204	Live	40.3	53.4	13.1	Complied
0.272	Live	39.2	51.1	11.9	Complied
0.303	Live	34.1	50.2	16.1	Complied
0.546	Live	33.0	46.0	13.0	Complied
0.875	Live	24.2	46.0	21.8	Complied
24.000	Live	35.7	50.0	14.3	Complied

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

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.200	Neutral	51.2	63.6	12.4	Complied
0.272	Neutral	44.8	61.1	16.3	Complied
0.461	Neutral	32.0	56.7	24.7	Complied
0.546	Neutral	37.4	56.0	18.6	Complied
0.605	Neutral	36.9	56.0	19.1	Complied
20.760	Neutral	33.2	60.0	26.8	Complied

Results: Neutral / Average

Frequency (MHz)	Line	Level (dB μ V)	Limit (dB μ V)	Margin (dB)	Result
0.204	Neutral	38.9	53.4	14.5	Complied
0.272	Neutral	36.5	51.1	14.6	Complied
0.339	Neutral	34.6	49.2	14.6	Complied
0.479	Neutral	28.1	46.4	18.3	Complied
0.573	Neutral	30.0	46.0	16.0	Complied
24.000	Neutral	35.7	50.0	14.3	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	30.5015.13	None stated	09 Jan 2014	12
A004	LISN	Rohde & Schwarz	ESH3-Z5	890604/027	30 Oct 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
M1379	Test Receiver	Rohde & Schwarz	ESIB 7	100330	15 Oct 2013	12

5.2.4. Transmitter Minimum 6 dB Bandwidth**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	11 October 2013
Test Sample Serial Number:	04423300813210200117		

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

Environmental Conditions:

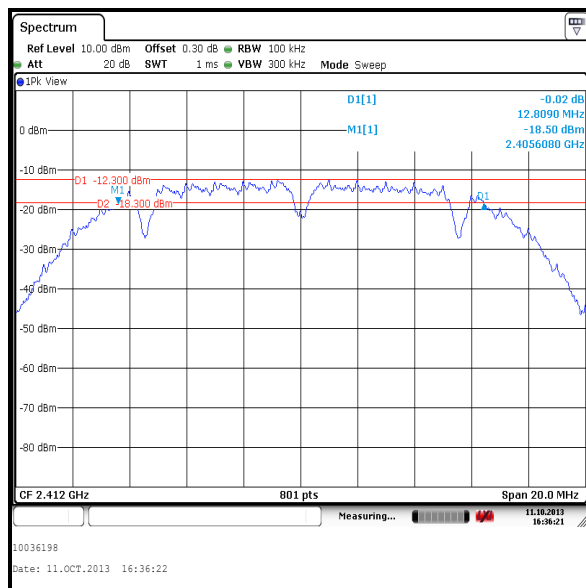
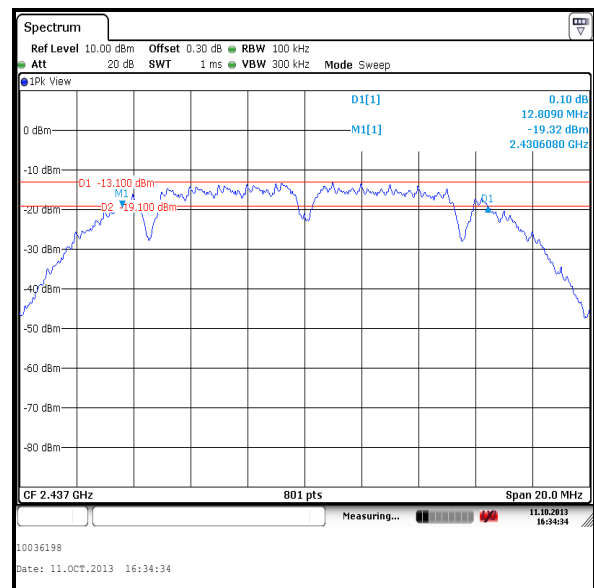
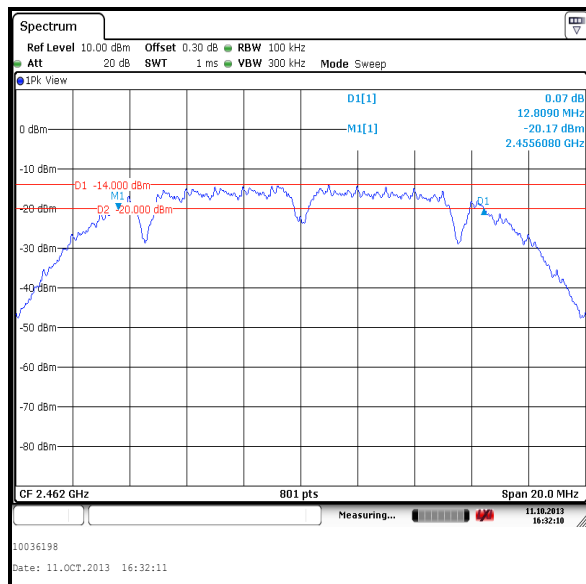
Temperature (°C):	25
Relative Humidity (%):	36

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 data rates that produced the narrowest bandwidth and therefore deemed worst case were:
 - 802.11b – DQPSK / 2 Mbps
 - 802.11g – 16QAM / 24 Mbps
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. Plots for all data rates are archived on the UL VS LTD IT server and available for inspection upon request.

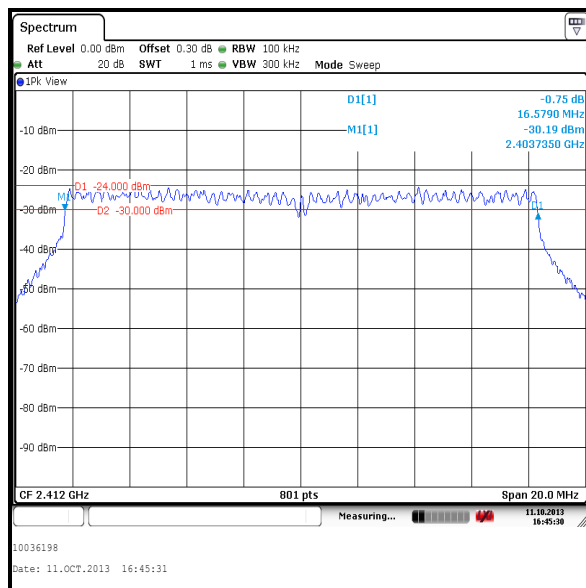
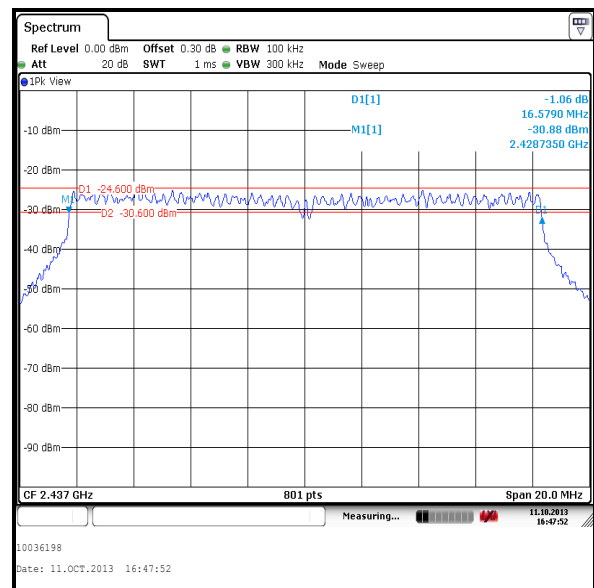
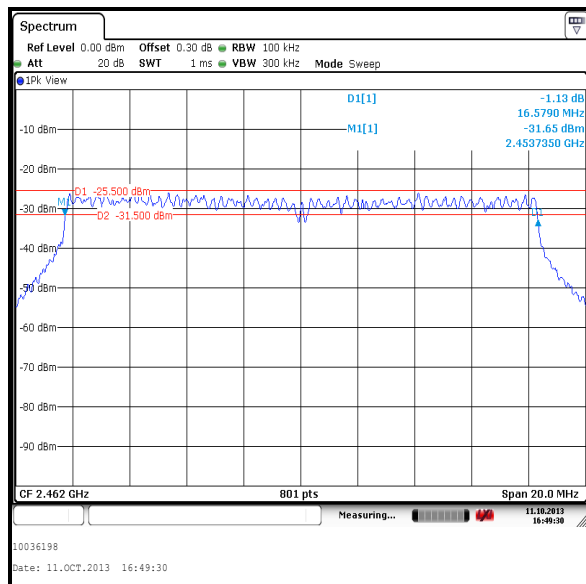
Transmitter Minimum 6 dB Bandwidth (continued)**Results: 802.11b / DQPSK / 2 Mbps**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	12809	≥500	12309	Complied
Middle	12809	≥500	12309	Complied
Top	12809	≥500	12309	Complied

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

Transmitter Minimum 6 dB Bandwidth (continued)**Results: 802.11g / 16QAM / 24 Mbps**

Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16590	≥500	16090	Complied
Middle	16590	≥500	16090	Complied
Top	16590	≥500	16090	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
L1028	Signal Analyser	Rohde & Schwarz	FSV 30	100854	23 May 2014	12

5.2.5. Transmitter Power Spectral Density**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	11 October 2013
Test Sample Serial Number:	04423300813210200117		

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

Environmental Conditions:

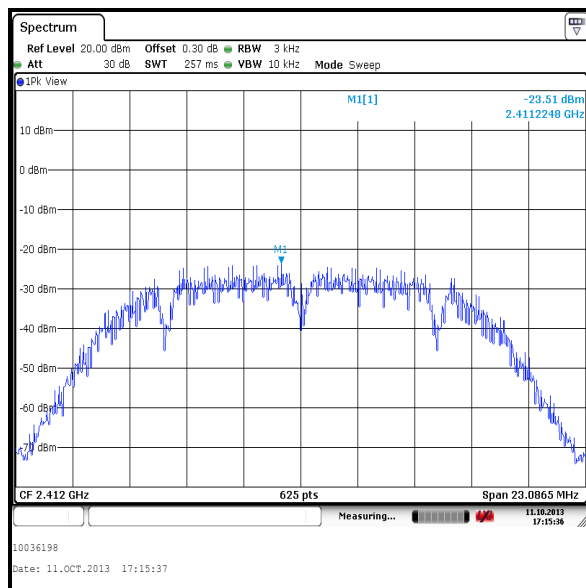
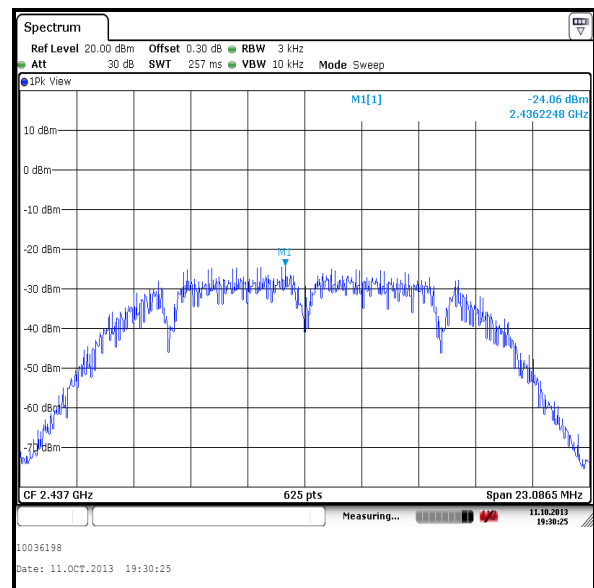
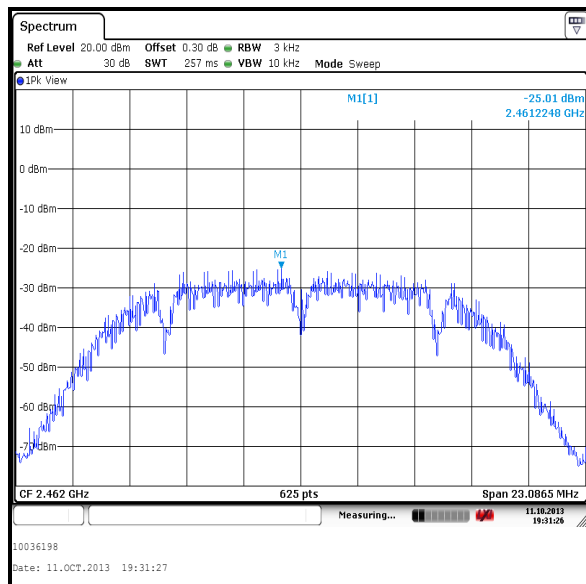
Temperature (°C):	25
Relative Humidity (%):	36

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 as maximum peak conducted output power was measured to demonstrate compliance with the output power limits. The data rates that produced the highest levels and therefore deemed worst case were:
 - 802.11b – DQPSK / 2 Mbps
 - 802.11g – BPSK / 9 Mbps
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. Plots for all data rates are archived on UL VS Ltd IT server and available for inspection upon request.
4. The customer confirmed that the high level emission in the centre of the 802.11g carrier is correct.

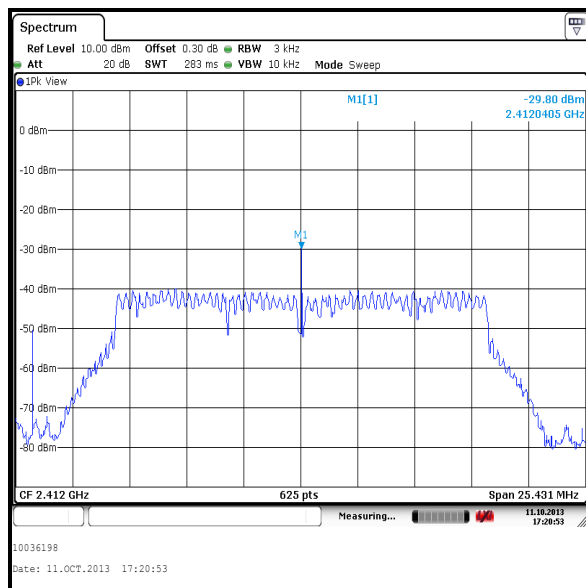
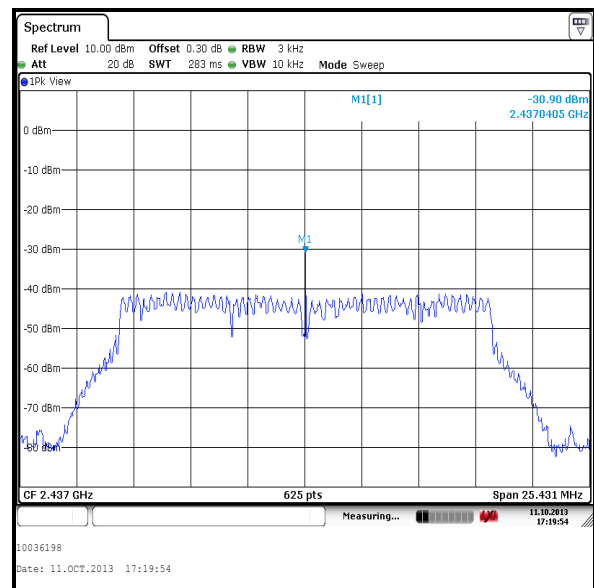
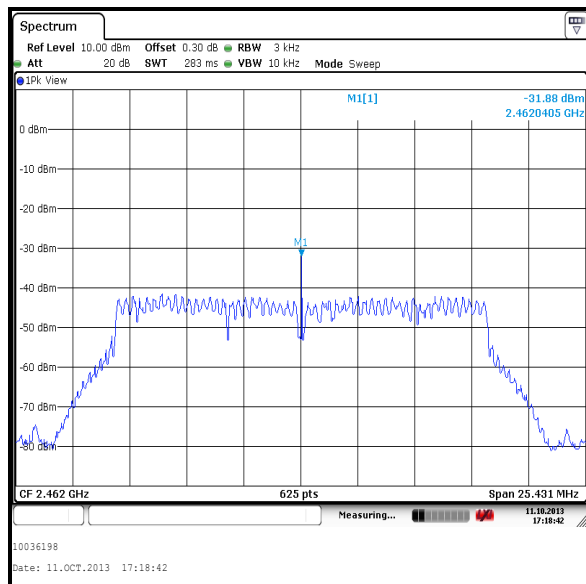
Transmitter Power Spectral Density (continued)**Results: 802.11b / DQPSK / 2 Mbps**

Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-23.5	8.0	31.5	Complied
Middle	-24.1	8.0	32.1	Complied
Top	-25.0	8.0	33.0	Complied

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

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

Channel	Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-29.8	8.0	37.8	Complied
Middle	-30.9	8.0	38.9	Complied
Top	-31.9	8.0	39.9	Complied

**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
L1028	Signal Analyser	Rohde & Schwarz	FSV 30	100854	23 May 2014	12

5.2.6. Transmitter Maximum Output Power**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	03 October 2013
Test Sample Serial Number:	04423300813210200117		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	As detailed in FCC KDB 558074 Section 9.1.2

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	48

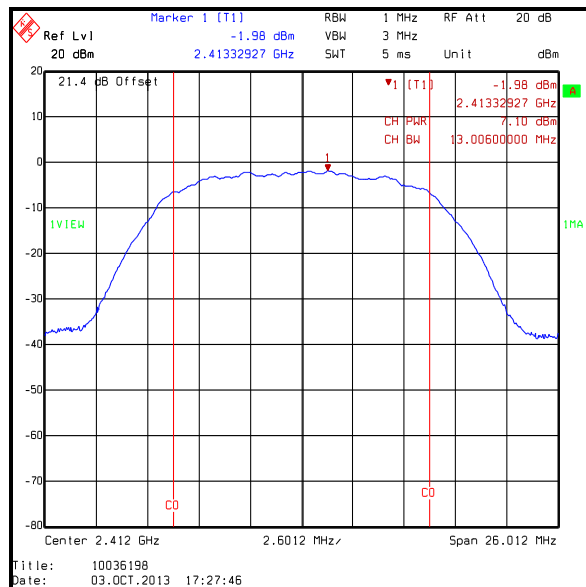
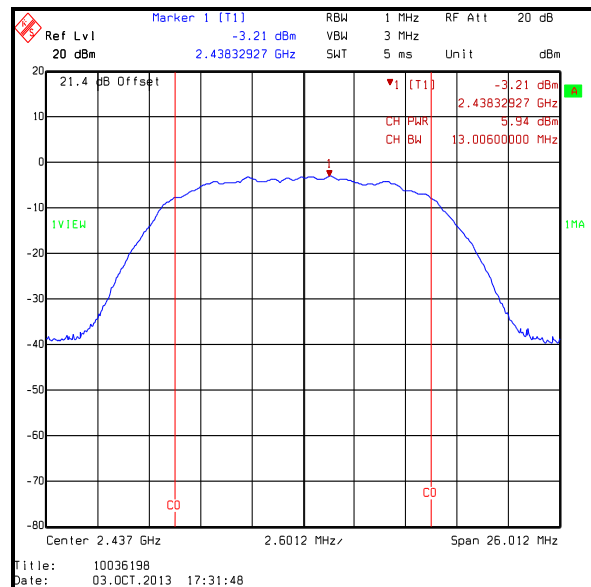
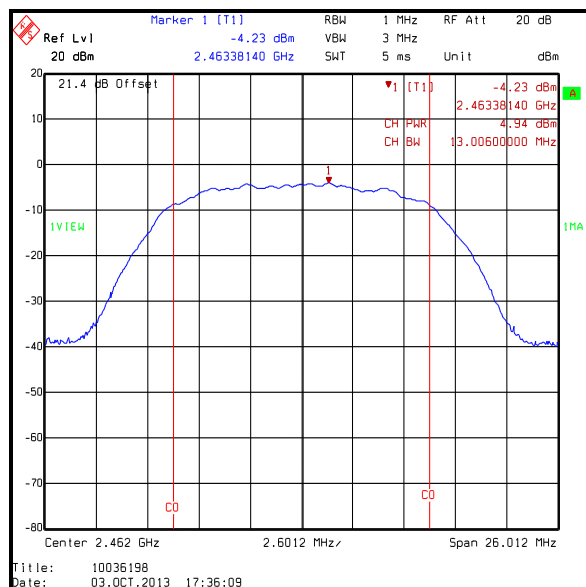
Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 9.1.2 Integrated Band Power Method. The data rates that produced the highest power and therefore deemed worst case were:
 - 802.11b – DQPSK / 11 Mbps
 - 802.11g – 16QAM / 24 Mbps
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. 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.

Transmitter Maximum Output Power (continued)**Results: 802.11b / DQPSK / 11 Mbps**

Channel	Conducted Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	7.1	30.0	22.9	Complied
Middle	5.9	30.0	24.1	Complied
Top	4.9	30.0	25.1	Complied

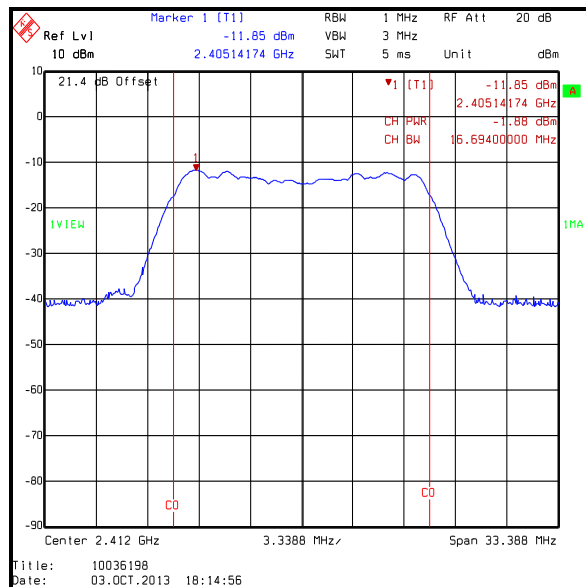
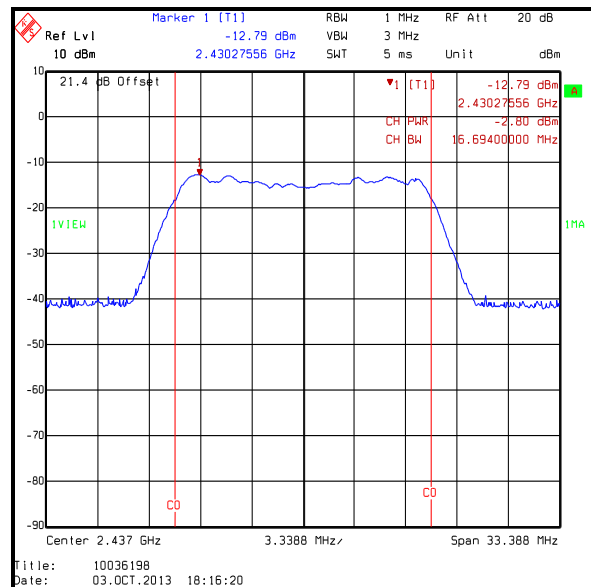
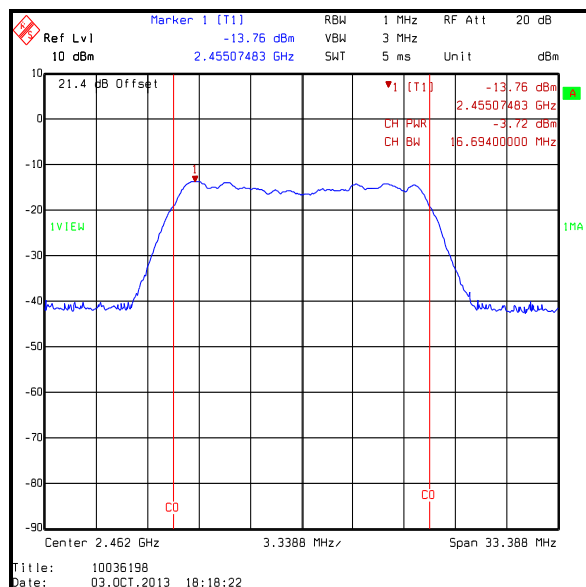
Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	7.1	2.0	9.1	36.0	26.9	Complied
Middle	5.9	2.0	7.9	36.0	28.1	Complied
Top	4.9	2.0	6.9	36.0	29.1	Complied

Transmitter Maximum Output Power (continued)**Results: 802.11b / DQPSK / 11 Mbps****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Output Power (continued)**Results: 802.11g / 16QAM / 24 Mbps**

Channel	Conducted Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	-1.9	30.0	31.9	Complied
Middle	-2.8	30.0	32.8	Complied
Top	-3.7	30.0	33.7	Complied

Channel	Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	-1.9	2.0	0.1	36.0	35.9	Complied
Middle	-2.8	2.0	-0.8	36.0	36.8	Complied
Top	-3.7	2.0	-1.7	36.0	37.7	Complied

Transmitter Maximum Output Power (continued)**Results: 802.11g / 16QAM / 24 Mbps****Bottom Channel****Middle Channel****Top Channel**

Transmitter Maximum Output Power (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
A1999	Attenuator	Huber & Suhner	6820.17.B	07101	05 Apr 2014	12

5.2.7. Transmitter Radiated Spurious Emissions**Test Summary:**

Test Engineer:	Sandeep Bharat	Test Date:	04 October 2013
Test Sample Serial Number:	04423300813210200117		

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:

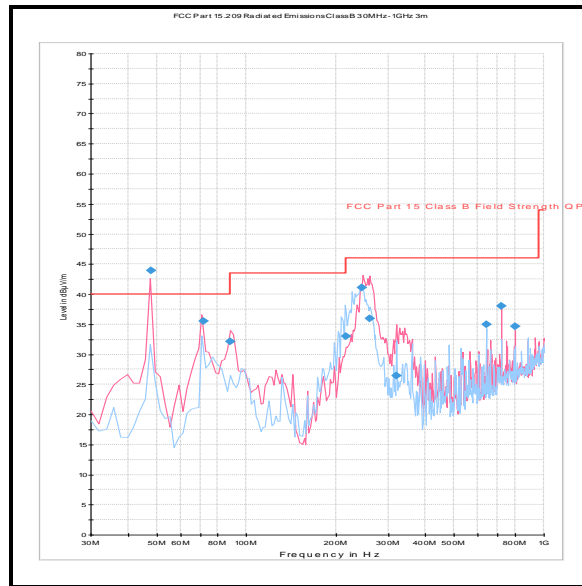
Temperature (°C):	24
Relative Humidity (%):	55

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. 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.
4. All other emissions shown in the plot were investigated and found to be > 20 dB below the limit.
5. *-20 dBc limit.

Results: Top Channel / 802.11b / DQPSK / 11 Mbps

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
48.000	Vertical	43.9	54.8*	10.9	Complied
244.872	Vertical	41.1	46.0	4.9	Complied
259.816	Vertical	36.0	46.0	10.0	Complied

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A490	Antenna	Chase	CBL6111A	1590	09 Apr 2014	12
A1843	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12
G0543	Pre Amplifier	Sonoma	310N	230801	05 Oct 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	07 Feb 2014	12
M1622	Thermohygrometer	JM Handelspunkt	30.5015.06	Not Stated	24 May 2014	12

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.

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

Test Engineer:	Sandeep Bharat	Test Date:	02 October 2013 & 07 October 2013
Test Sample Serial Number:	04423300813210200117		

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 (%):	38 to 50

Note(s):

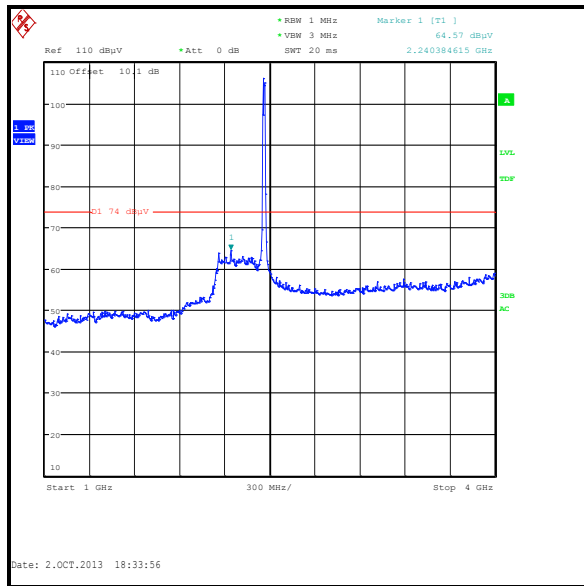
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss
2. The emission shown approximately at 2462 MHz on the 1 GHz to 4 GHz plot is the EUT fundamental.
3. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset 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.
4. The emissions recorded below were investigated with the EUT transmitting on top, middle and bottom channels and the levels were found to be the same irrespective of the transmit channel or data rate.

Results: Top Channel / 802.11b / DQPSK / 11 Mbps / Peak

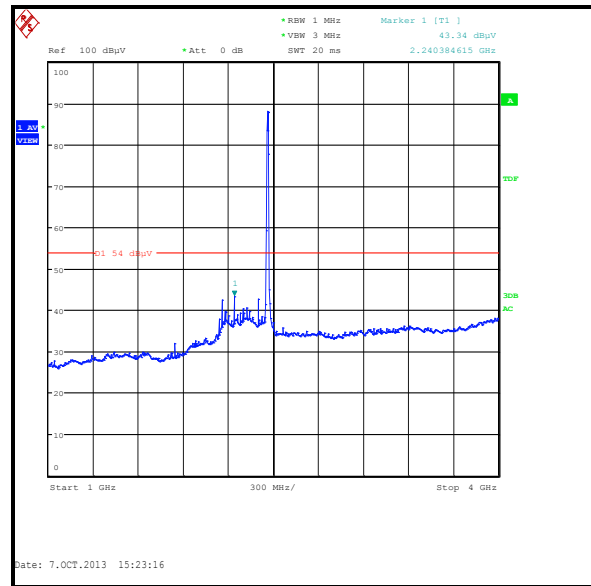
Frequency (MHz)	Antenna Polarity	Peak Level (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)	Result
2240.0	Vertical	66.1	74.0	7.9	Complied

Results: Top Channel / 802.11b / DQPSK / 11 Mbps / Average

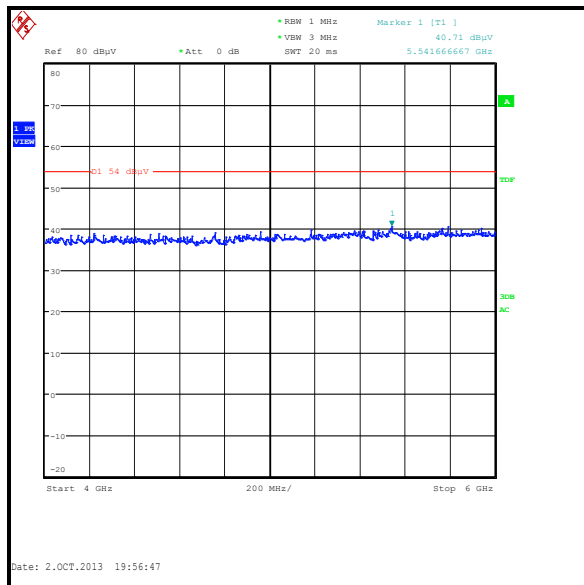
Frequency (MHz)	Antenna Polarity	Average Level (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)	Result
2240.0	Vertical	52.8	54.0	1.2	Complied

Transmitter Radiated Spurious Emissions (continued)

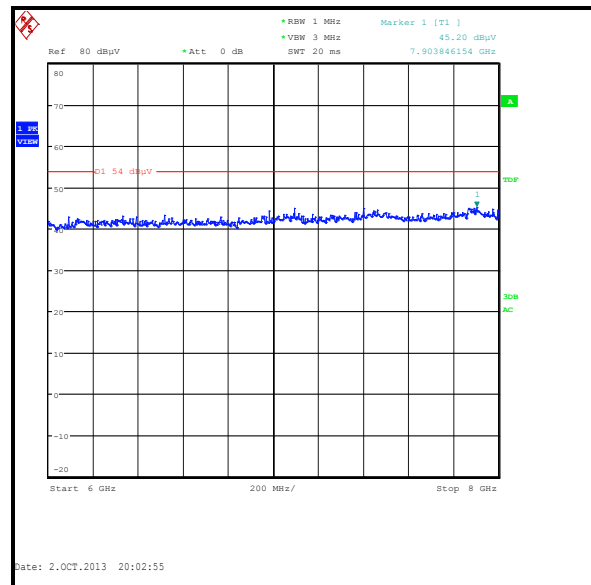
1 GHz to 4 GHz - Peak detector



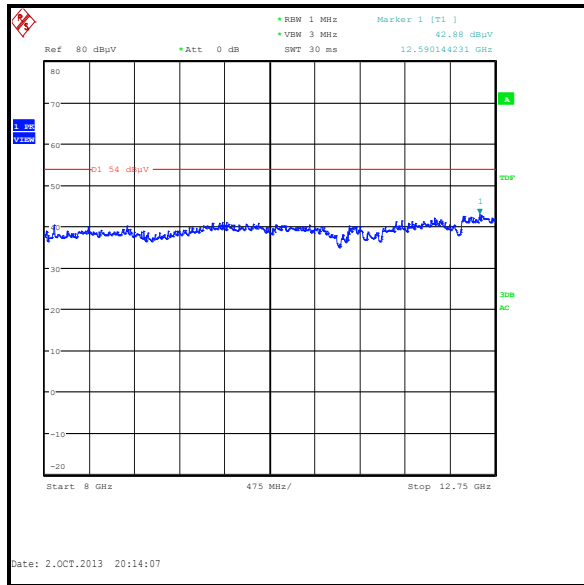
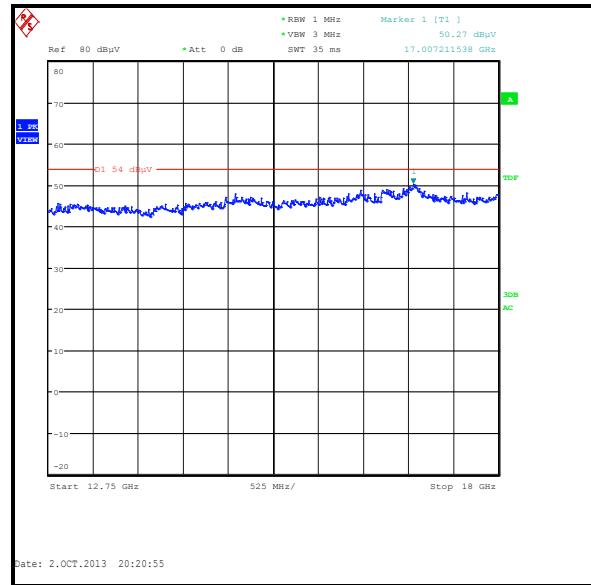
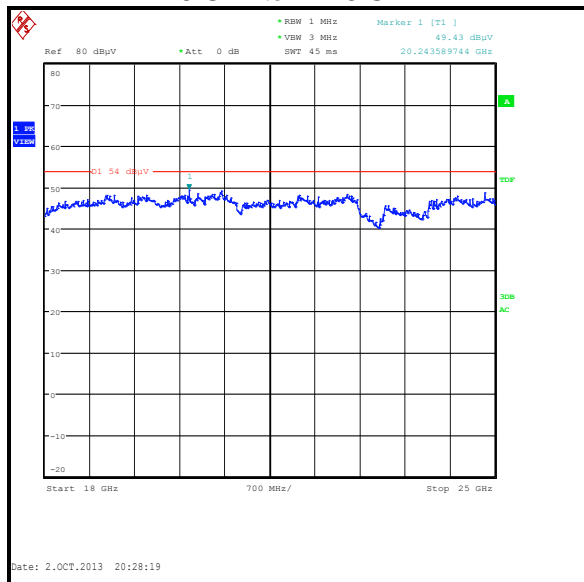
1GHz to 4 GHz - Average detector



4 GHz to 6 GHz



6 GHz to 8 GHz

Transmitter Radiated Spurious Emissions (continued)**8 GHz to 12.75 GHz****12.75 GHz to 18 GHz****18 GHz to 25 GHz**

Transmitter Radiated Spurious Emissions (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	04 Nov 2013	12
A254	Antenna	Flann Microwave	14240-20	139	04 Nov 2013	12
A255	Antenna	Flann Microwave	16240-20	519	04 Nov 2013	12
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann Microwave	20240-20	330	04 Nov 2013	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	10 May 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12

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

Test Engineer:	Sandeep Bharat	Test Date:	07 October 2013
Test Sample Serial Number:	04423300813210200117		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.2 & KDB 558074 Section 11.1(a)

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	52

Note(s):

1. All configurations supported by the EUT were investigated on one channel. The data rates that produced the following parameters were deemed worst case and chosen for further testing.

Highest power:

- 802.11b – DQPSK / 11 Mbps
- 802.11g – 16QAM / 24 Mbps

Widest bandwidth:

- 802.11b – DQPSK / 5.5 Mbps
- 802.11g – BPSK / 6 Mbps

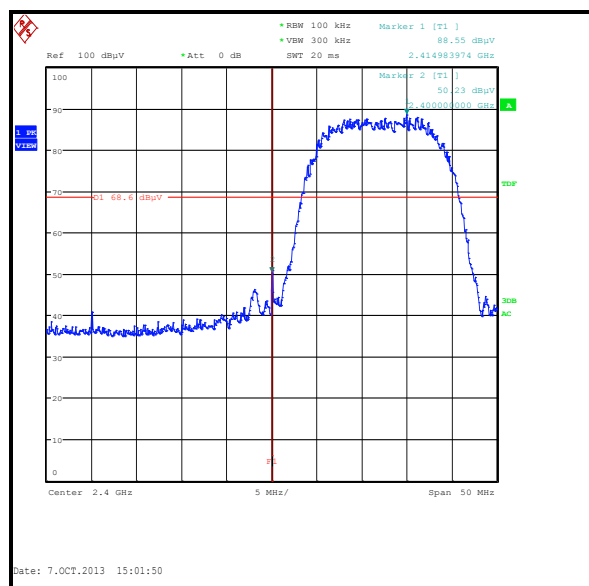
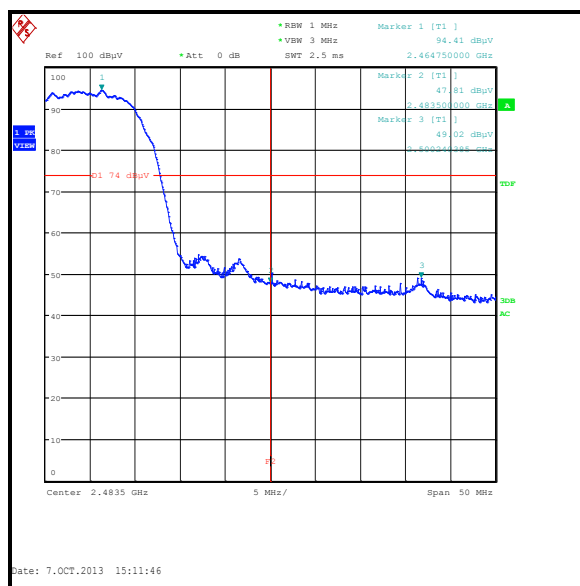
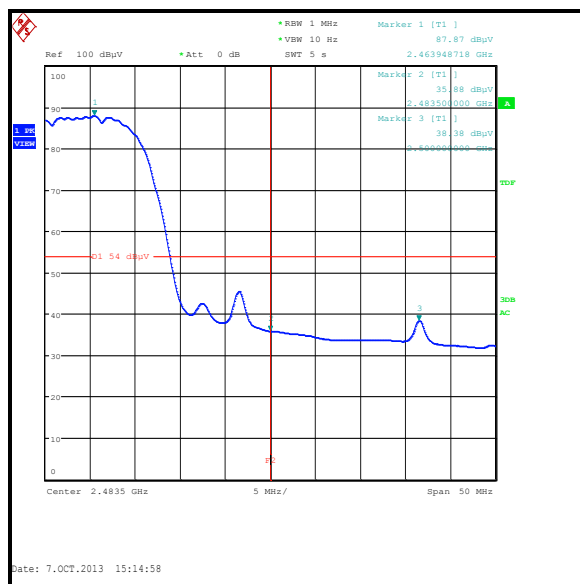
2. Final measurements were performed with the above configurations.
3. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
4. The maximum peak conducted power was previously measured on the EUT. In accordance with FCC KDB 558074 Section 11.1(a), the lower band edge measurement should therefore be performed with a peak detector and the -20 dBc limit applied.
5. The emission shown at approximately 2.5 GHz on the pre-scan plots was investigated and found to be centred exactly at 2.5 GHz, therefore the restricted band limit was applied.
6. * -20 dBc limit.

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

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	50.2	68.6*	18.4	Complied
2483.5	47.8	74.0	26.2	Complied

Results: Average / 802.11b / DQPSK / 5.5 Mbps

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	35.9	54.0	18.1	Complied
2500.0	38.4	54.0	15.6	Complied

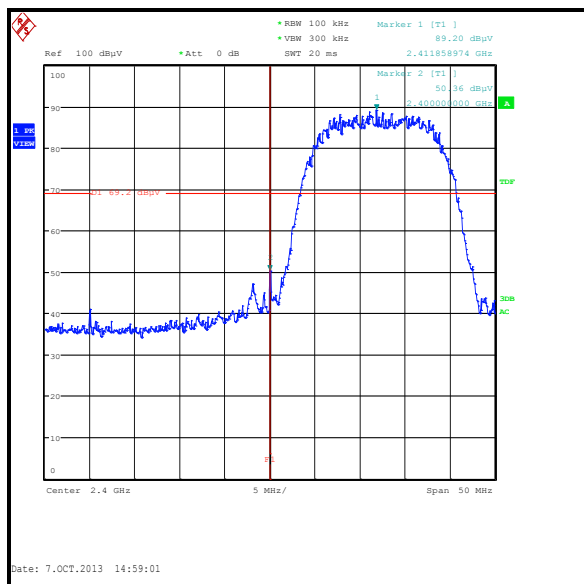
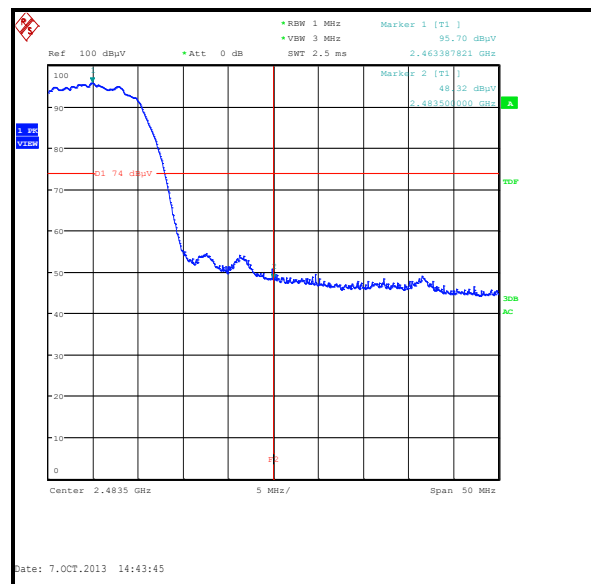
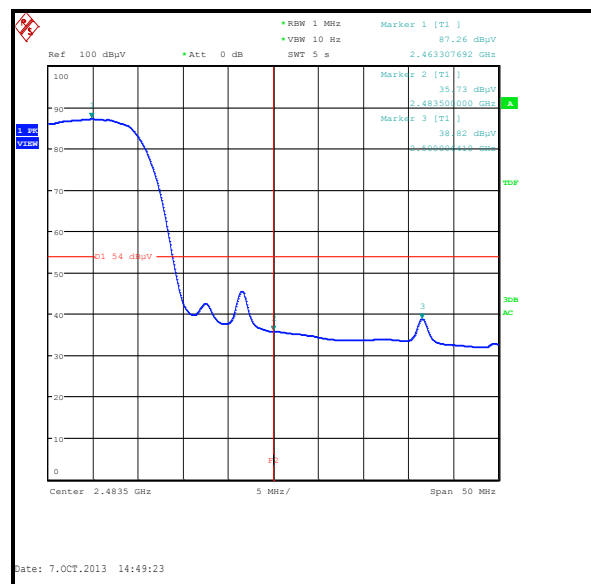
**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Upper Band Edge Average Measurement**

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak / 802.11b / DQPSK / 11 Mbps**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	50.4	69.2*	18.8	Complied
2483.5	48.3	74.0	25.7	Complied

Results: Average / 802.11b / DQPSK / 11 Mbps

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	35.7	54.0	18.3	Complied
2500.0	38.8	54.0	15.2	Complied

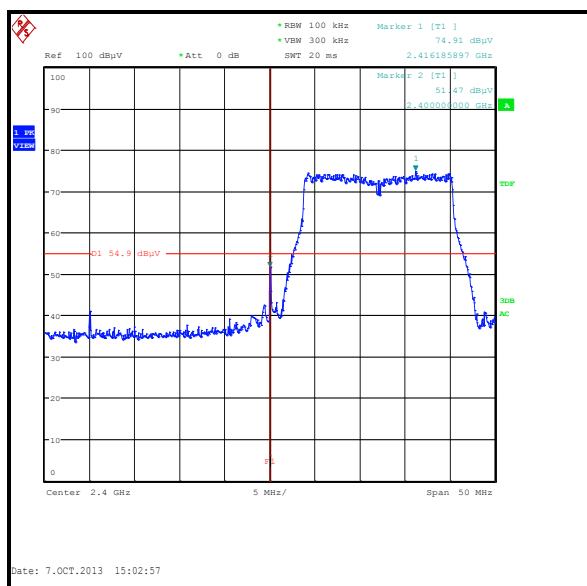
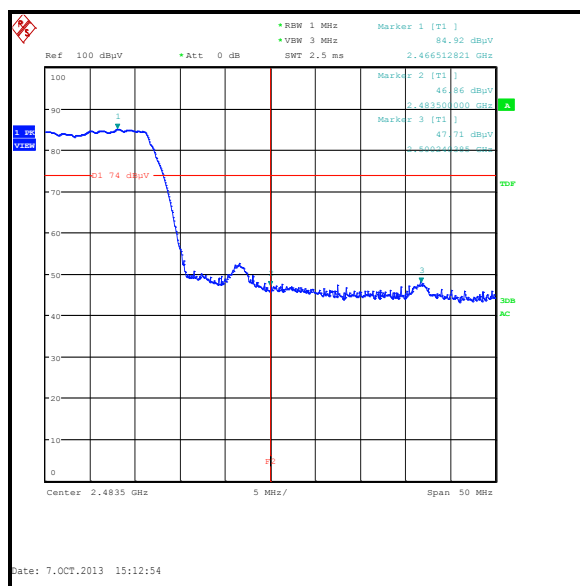
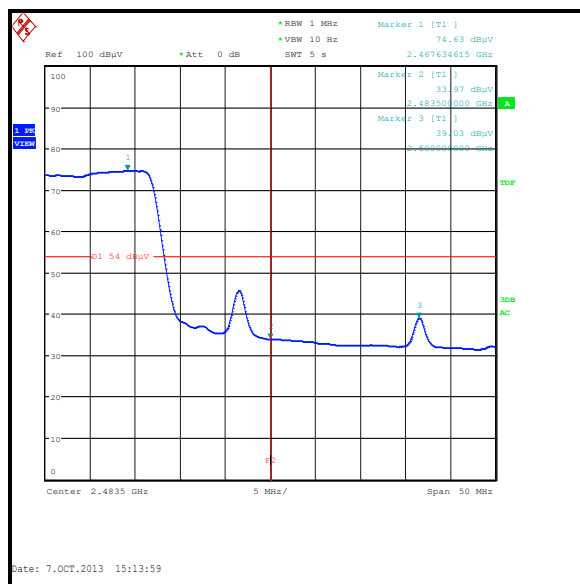
**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Upper Band Edge Average Measurement**

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak / 802.11g / BPSK / 6 Mbps**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	51.5	54.9*	3.4	Complied
2483.5	46.9	74.0	27.1	Complied

Results: Average / 802.11g / BPSK / 6 Mbps

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	34.0	54.0	20.0	Complied
2500.0	39.0	54.0	15.0	Complied

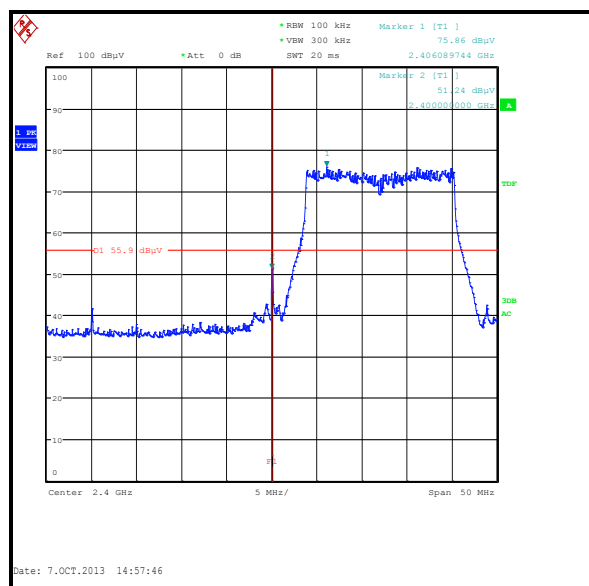
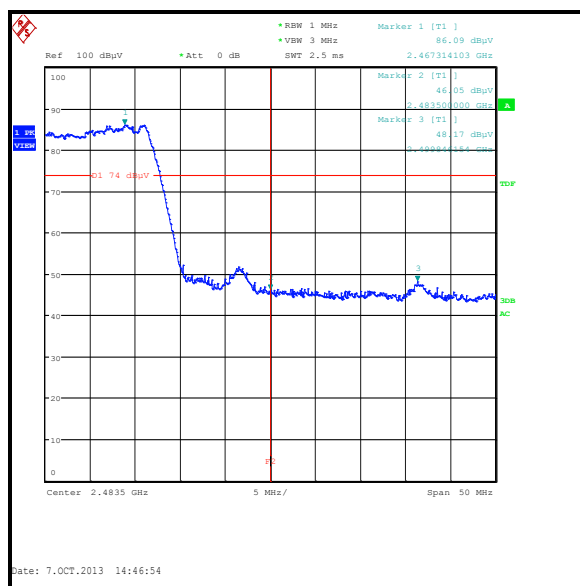
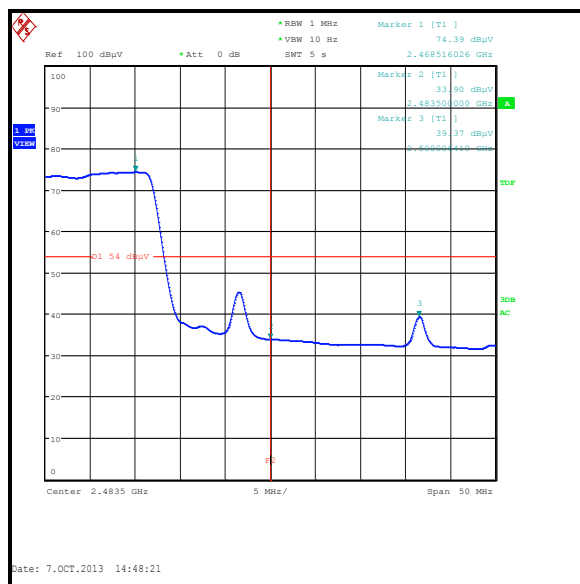
**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Upper Band Edge Average Measurement**

Transmitter Band Edge Radiated Emissions (continued)**Results: Peak / 802.11g / 16QAM / 24 Mbps**

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2400.0	51.2	55.9*	4.7	Complied
2483.5	46.1	74.0	27.9	Complied

Results: Average / 802.11g / 16QAM / 24 Mbps

Frequency (MHz)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
2483.5	33.9	54.0	20.1	Complied
2500.0	39.4	54.0	14.6	Complied

**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Upper Band Edge Average Measurement**

Transmitter Band Edge Radiated Emissions (continued)**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	24 Oct 2013	12
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	24 May 2014	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	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 Output Power	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±1.13 dB
Minimum 6 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 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	8 15 37	-	Corrected WLAN Antenna model number Added calibration note under test equipment list Added calibration note under test equipment list