TEST REPORT

Test Report No. : UL-RPT-RP10616861JD01A V2.0

Manufacturer	:	Unmonday Ltd
Model No.	:	Unmonday Model 4.3 containing module CX870-3JB
FCC ID	:	2AAJM-UNM43
Technology	:	WLAN (802.11 b/g)
Test Standard(s)	:	FCC Parts 15.107, 15.109, 15.207, 15.209(a) & 15.247(d)

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2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 2.0 supersedes all previous versions.

Date of Issue: 10 April 2015

Checked by:

Sarah Williams
Engineer, Radio Laboratory

Issued by :

pp
John Newell
Quality Manager,
UL VS LTD

0644

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

UL VS LTD

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1. Customer Information

Company Name:	Unmonday Ltd
Address:	Laivakatu 3, 00150 HELSINKI FINLAND

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:	07 February 2015 to 21 February 2015

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.107(a)	Receiver/Idle Mode AC Conducted Spurious Emissions	✓
Part 15.109	Receiver/Idle Mode Radiated Spurious Emissions	✓
Part 15.207	Transmitter AC Conducted Spurious Emissions	✓
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		

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

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:	Unmonday
Model Name or Number:	Unmonday Model 4.3 containing module CX870-3JB
Test Sample Serial Number:	UN00655198
Hardware Version Number:	1.0
Software Version Number:	Module: 3.8.0-9604
FCC ID:	2AAJM-UNM43

3.2. Description of EUT

The equipment under test was an 802.11b/g WLAN module, part number CX870-3JB, contained in a wireless speaker (Unmonday model 4.3). The antenna, model number 2JWI01 is also part of the wireless speaker.

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 Type:	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	22 VDC via 120 VAC 60 Hz adaptor	
Declared Antenna Gain:	2.0 dBi		
Channel Spacing:	20 MHz		
Transmit Frequency Range:	2412 MHz to 2462 MHz		
Transmit Channels Tested:	**Channel Number**	**Channel Frequency (MHz)**	
	1	2412	
	6	2437	
	11	2462	
Receive Frequency Range:	2412 MHz to 2462 MHz		
Receive Channels Tested:	**Channel Number**	**Channel Frequency (MHz)**	
	1	2412	
	6	2437	
	11	2462	

3.5. Support Equipment

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

Brand Name:	Silabs
Description:	USB to UART Adapter
Model Name or Number:	CP210x
Serial Number:	Not marked or stated

Brand Name:	Not marked or stated
Description:	WiFi/Bluetooth antenna
Model Name or Number:	2JWI01
Serial Number:	Not marked or stated

Brand Name:	Not marked or stated
Description:	USB cable
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

Brand Name:	Dell
Description:	Laptop PC
Model Name or Number:	Latitude E5400
Serial Number:	UL Asset number: 01150

Brand Name:	Generic
Description:	AC power supply
Model Name or Number:	Not marked or stated
Serial Number:	Not marked or stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Continuously transmitting 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.

4.2. Configuration and Peripherals

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

- Controlled using a bespoke application on the 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 declared the following data rates to be used for all measurements as:
    - 802.11b – DBPSK / 1 Mbps
    - 802.11g – BPSK / 6 Mbps
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 1 Mbps. This was found to be the worst case modulation scheme with regards to emissions after preliminary investigations and, as this mode emits the highest output power level, it was deemed to be the worst case.
- Transmitter radiated spurious emissions and radiated band edge tests were performed with the 2JWI01 antenna connected.
- Transmitter radiated spurious emissions tests were performed with the AC Charger connected.
- For testing purposes only, the customer modified the EUT by connecting a USB to UART cable to the speaker to allow communication with the EUT.
- The EUT was configured using the power settings stated in the table below:

	Bottom Channel (1)	Middle Channel (6)	Top Channel (11)
802.11b / (1 Mbps)	8	8	9
802.11g / (6 Mbps)	2	0	2

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:	Andrew Edwards	**Test Date:**	17 February 2015
Test Sample Serial Number:	UN00655198		

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 (%):	34

Note(s):

1. The EUT was connected to an AC power cable. The AC charger was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
3. A pulse limiter was fitted between the LISN and the test receiver.

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.726	Live	45.6	56.0	10.4	Complied
0.830	Live	46.4	56.0	9.6	Complied
0.906	Live	44.2	56.0	11.8	Complied
1.500	Live	42.7	56.0	13.3	Complied
1.959	Live	41.6	56.0	14.4	Complied
2.108	Live	45.4	56.0	10.6	Complied
2.207	Live	46.0	56.0	10.0	Complied
2.909	Live	49.2	56.0	6.8	Complied
3.003	Live	48.8	56.0	7.2	Complied
3.134	Live	45.8	56.0	10.2	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.722	Live	39.9	46.0	6.1	Complied
0.825	Live	40.0	46.0	6.0	Complied
0.906	Live	38.8	46.0	7.2	Complied
1.005	Live	35.8	46.0	10.2	Complied
1.410	Live	34.6	46.0	11.4	Complied
1.464	Live	31.6	46.0	14.4	Complied
2.310	Live	37.2	46.0	8.8	Complied
2.868	Live	41.3	46.0	4.7	Complied
2.909	Live	41.0	46.0	5.0	Complied
3.017	Live	40.9	46.0	5.1	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)

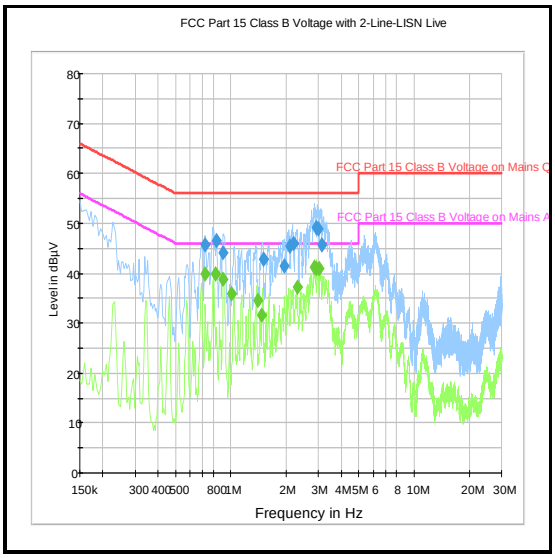
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Neutral	49.8	66.0	16.2	Complied
0.807	Neutral	46.8	56.0	9.2	Complied
1.104	Neutral	40.7	56.0	15.3	Complied
1.203	Neutral	41.2	56.0	14.8	Complied
1.302	Neutral	40.0	56.0	16.0	Complied
2.090	Neutral	37.7	56.0	18.3	Complied
2.814	Neutral	42.6	56.0	13.4	Complied
2.918	Neutral	42.2	56.0	13.8	Complied
3.170	Neutral	40.3	56.0	15.7	Complied

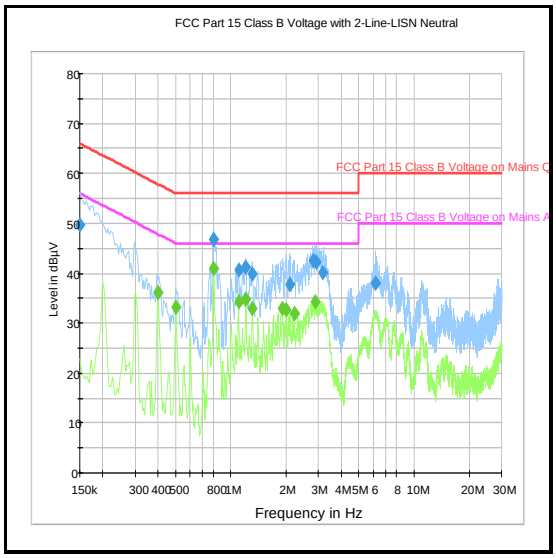
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.402	Neutral	36.1	47.8	11.7	Complied
0.501	Neutral	33.1	46.0	12.9	Complied
0.807	Neutral	41.0	46.0	5.0	Complied
1.109	Neutral	34.2	46.0	11.8	Complied
1.208	Neutral	34.7	46.0	11.3	Complied
1.307	Neutral	33.0	46.0	13.0	Complied
1.910	Neutral	32.9	46.0	13.1	Complied
2.009	Neutral	32.6	46.0	13.4	Complied
2.211	Neutral	32.0	46.0	14.0	Complied
2.873	Neutral	34.3	46.0	11.7	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	30.5015.06	None stated	07 Jan 2016	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	14 Aug 2015	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	27 Feb 2015	12
M1263	Test Receiver	Rohde & Schwarz	ESI7	100265	14 Oct 2015	12

5.2.2. Receiver/Idle Mode Radiated Spurious Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	20 February 2015
Test Sample Serial Number:	UN00655198		

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):	22
Relative Humidity (%):	33

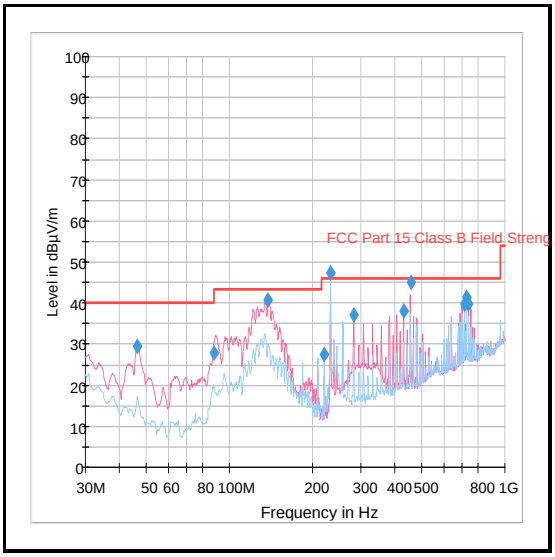
Note(s):

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. 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: Quasi Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
46.234	Vertical	29.6	40.0	10.4	Complied
88.125	Vertical	27.7	43.5	15.8	Complied
137.575	Vertical	40.7	43.5	2.8	Complied
221.164	Horizontal	27.5	46.0	18.5	Complied
233.458	Horizontal	45.9	46.0	0.1	Complied
282.606	Vertical	37.2	46.0	8.8	Complied
430.057	Vertical	38.1	46.0	7.9	Complied
454.631	Vertical	44.9	46.0	1.1	Complied
712.658	Vertical	39.9	46.0	6.1	Complied
724.945	Vertical	41.5	46.0	4.5	Complied
737.253	Vertical	39.7	46.0	6.3	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)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	14 Mar 2015	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046K	06 Oct 2015	12
G0543	Amplifier	Sonoma	310N	230801	04 Mar 2015	3
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12
A1834	Attenuator	Hewlett Packard	8491B	10444	Calibrated before use	-

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	19 February 2015
Test Sample Serial Number:	UN00655198		

FCC Reference:	Part 15.109
Test Method Used:	As detailed in ANSI C63.10 Sections 6.3 and 6.6 referencing ANSI C63.4
Frequency Range:	1 GHz to 12.75 GHz

Environmental Conditions:

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

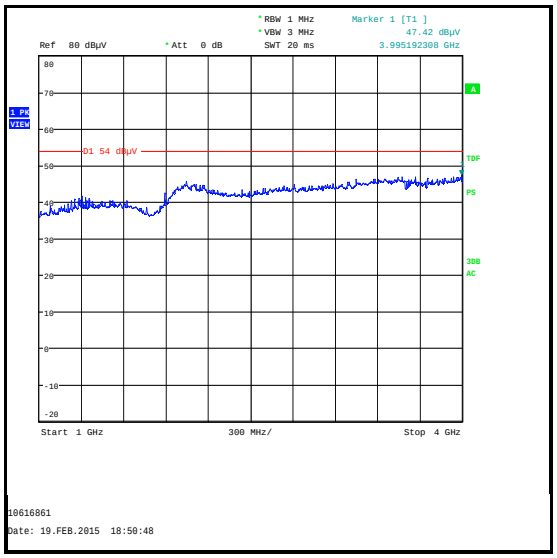
Note(s):

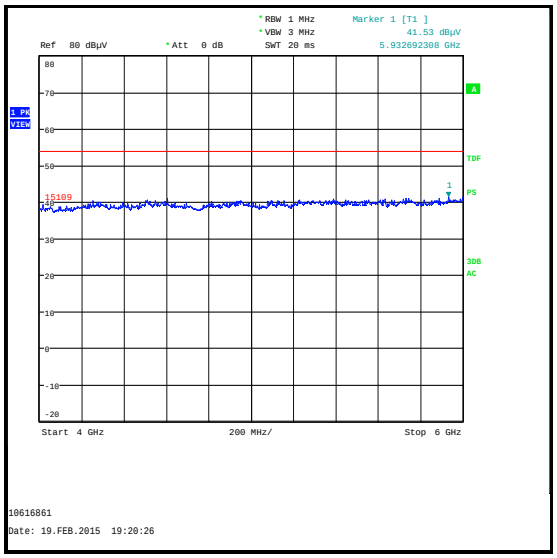
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The emission shown on the pre-scan plot was investigated and found to be >20 dB below the applicable limit. Therefore the highest peak noise floor reading of the measuring receiver was recorded in the table below.
3. Measurements 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. 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.

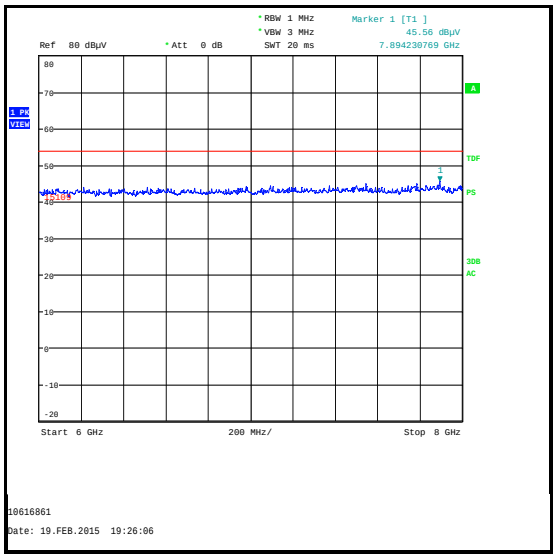
Results:

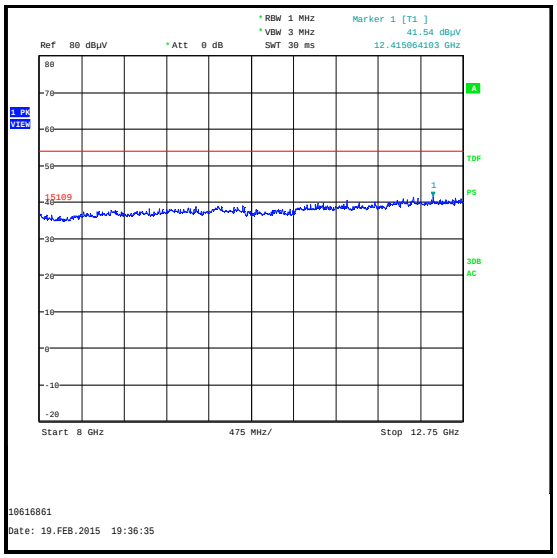
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
3995.192	Horizontal	47.4	54.0	6.6	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)









Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	31 Mar 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	Flann Microwave	3115	00075692	20 Dec 2015	12
A253	Antenna	Flann Microwave	12240-20	128	20 Dec 2015	12
A254	Antenna	Flann Microwave	14240-20	139	20 Dec 2015	12
A255	Antenna	Flann Microwave	16240-20	519	20 Dec 2015	12

5.2.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	17 February 2015
Test Sample Serial Number:	UN00655198		

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):	22
Relative Humidity (%):	34

Note(s):

1. The EUT was connected to an AC power cable. The AC charger was connected to 120 VAC 60 Hz single phase supply via a LISN.
2. Pre-scans were performed and markers placed on the highest live and neutral measured levels. Final measurements were performed on the marker frequencies and the results entered into the tables below.
3. A pulse limiter was fitted between the LISN and the test receiver.

Transmitter AC Conducted Spurious Emissions (continued)

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Live	48.1	66.0	17.9	Complied
0.731	Live	41.5	56.0	14.5	Complied
0.798	Live	47.8	56.0	8.2	Complied
0.911	Live	46.3	56.0	9.7	Complied
2.054	Live	47.0	56.0	9.0	Complied
2.166	Live	48.1	56.0	7.9	Complied
2.693	Live	48.5	56.0	7.5	Complied
2.751	Live	49.6	56.0	6.4	Complied
2.868	Live	50.4	56.0	5.6	Complied
2.949	Live	50.3	56.0	5.7	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.686	Live	41.1	46.0	4.9	Complied
0.803	Live	43.2	46.0	2.8	Complied
0.915	Live	41.9	46.0	4.1	Complied
2.063	Live	39.6	46.0	6.4	Complied
2.175	Live	40.0	46.0	6.0	Complied
2.283	Live	38.3	46.0	7.7	Complied
2.859	Live	42.5	46.0	3.5	Complied
2.972	Live	42.5	46.0	3.5	Complied
3.093	Live	41.5	46.0	4.5	Complied
3.201	Live	40.4	46.0	5.6	Complied

Transmitter AC Conducted Spurious Emissions (continued)

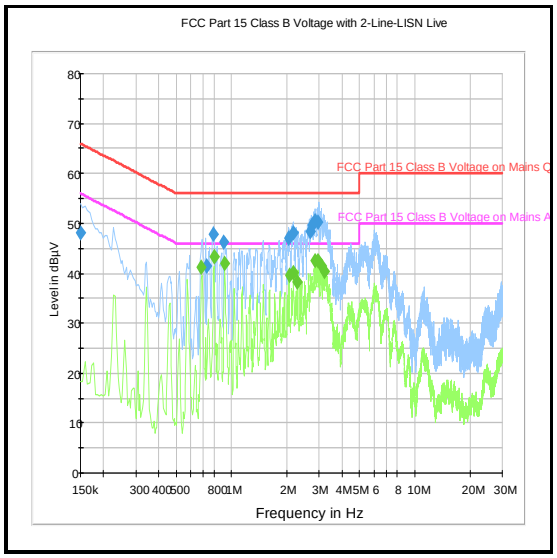
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Neutral	47.1	66.0	18.9	Complied
0.227	Neutral	48.8	62.6	13.8	Complied
0.825	Neutral	45.4	56.0	10.6	Complied
0.830	Neutral	44.6	56.0	11.4	Complied
1.140	Neutral	42.9	56.0	13.1	Complied
1.253	Neutral	42.5	56.0	13.5	Complied
2.058	Neutral	43.0	56.0	13.0	Complied
2.625	Neutral	43.6	56.0	12.4	Complied
2.742	Neutral	44.9	56.0	11.1	Complied
2.837	Neutral	43.9	56.0	12.1	Complied

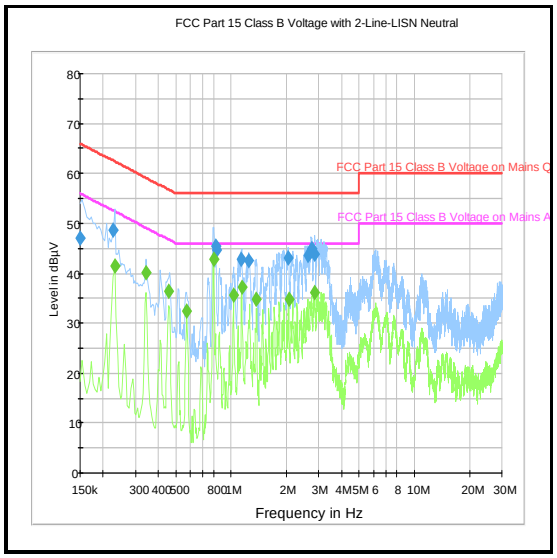
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.231	Neutral	41.4	52.4	11.0	Complied
0.344	Neutral	40.2	49.1	8.9	Complied
0.456	Neutral	36.4	46.8	10.4	Complied
0.573	Neutral	32.4	46.0	13.6	Complied
0.803	Neutral	42.9	46.0	3.1	Complied
1.032	Neutral	35.5	46.0	10.5	Complied
1.145	Neutral	37.1	46.0	8.9	Complied
1.374	Neutral	34.7	46.0	11.3	Complied
2.063	Neutral	34.8	46.0	11.2	Complied
2.864	Neutral	36.3	46.0	9.7	Complied

Transmitter AC Conducted Spurious Emissions (continued)



Live



Neutral

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

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1625	Thermohygrometer	JM Handelspunkt	30.5015.06	None stated	07 Jan 2016	12
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002	14 Aug 2015	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	27 Feb 2015	12
M1263	Test Receiver	Rohde & Schwarz	ESI7	100265	14 Oct 2015	12

5.2.4. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	21 February 2014
Test Sample Serial Number:	UN00655198		

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 (%):	33

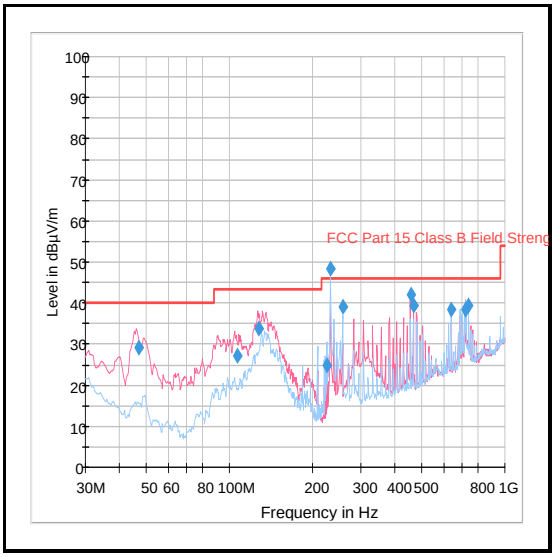
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The preliminary scans showed similar emission levels below 1 GHz, for each channel of operation. Therefore final radiated emissions measurements were performed with the EUT set to the middle channel only.
3. 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. Therefore the highest peak noise floor reading of the measuring receiver 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.
5. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.
6. Final measurements were performed on the marker frequencies and the results entered into the table below. The test receiver resolution bandwidth was set to 120 kHz, using a CISPR quasi-peak detector and span big enough to see the whole emission.

Results: Middle Channel / 802.11b / 1 Mbps

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
127.640	Vertical	33.8	43.5	9.7	Complied
258.017	Horizontal	39.0	46.0	7.0	Complied

Transmitter Radiated 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)
M1657	Thermohygrometer	JM Handelspunkt	30.5015.13	Not stated	14 Mar 2015	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	26 Mar 2015	12
M1124	Test Receiver	Rohde & Schwarz	ESIB26	100046K	06 Oct 2015	12
G0543	Amplifier	Sonoma	310N	230801	04 Mar 2015	3
A490	Antenna	Chase	CBL6111A	1590	29 Apr 2015	12
A1834	Attenuator	Hewlett Packard	8491B	10444	Calibrated before use	-

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	07 February 2015
Test Sample IMEI:	UN00655198		

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):	24
Relative Humidity (%):	29

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 2437 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. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.
6. Testing was performed in accordance with ANSI C63.10 section 6.6.4.2 –Note 1, the peak level complied with the average limit; therefore average results were not required.
7. The plot for the average detector (1 to 4 GHz) has an incorrect limit line of 74 dBµV/m. It should be 54.0 dBµV/m.

Transmitter Radiated Emissions (continued)

Results: Bottom Channel

Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4823.872	Horizontal	46.0	54.0	8.0	Complied

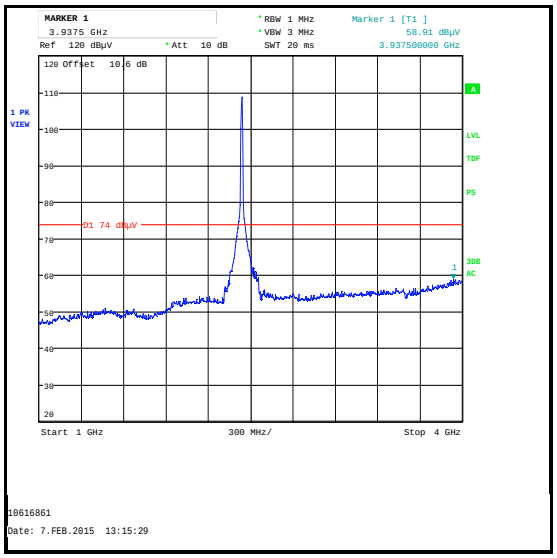
Results: Middle Channel

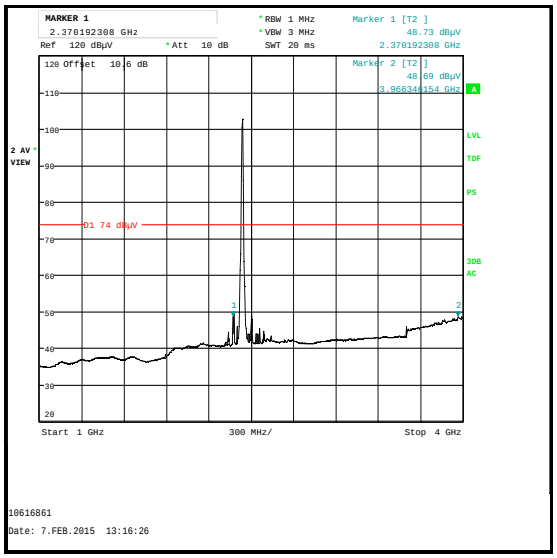
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4873.807	Horizontal	45.4	54.0	8.6	Complied
7308.574	Horizontal	49.5	54.0	4.5	Complied

Results: Top Channel

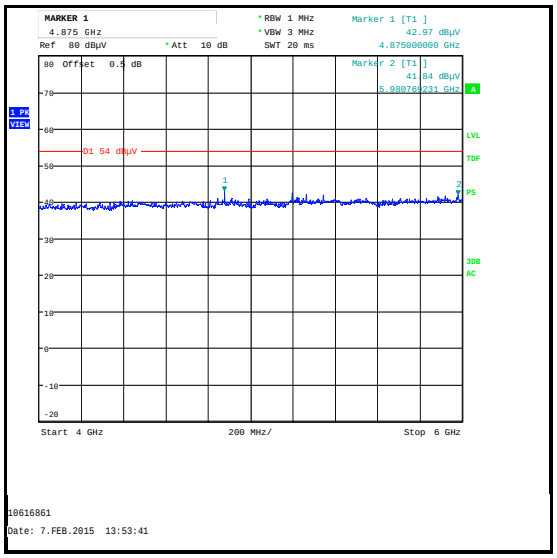
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
4923.647	Vertical	43.0	54.0	11.0	Complied
7391.769	Horizontal	46.1	54.0	7.9	Complied

Transmitter Radiated Emissions (continued)

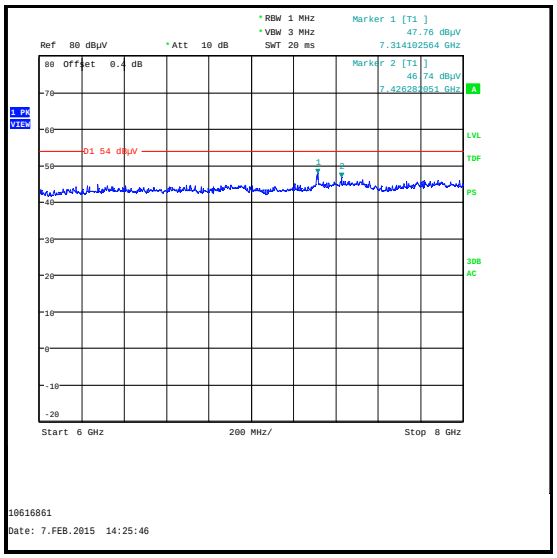




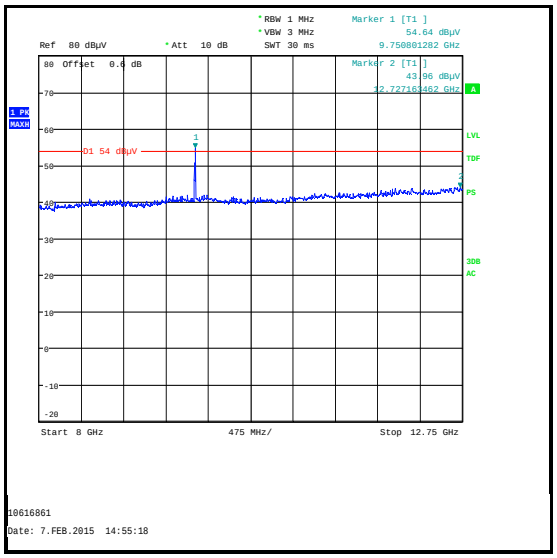
Peak detector

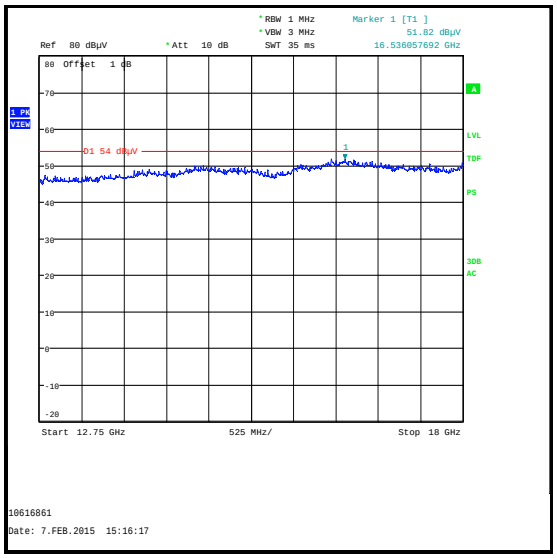


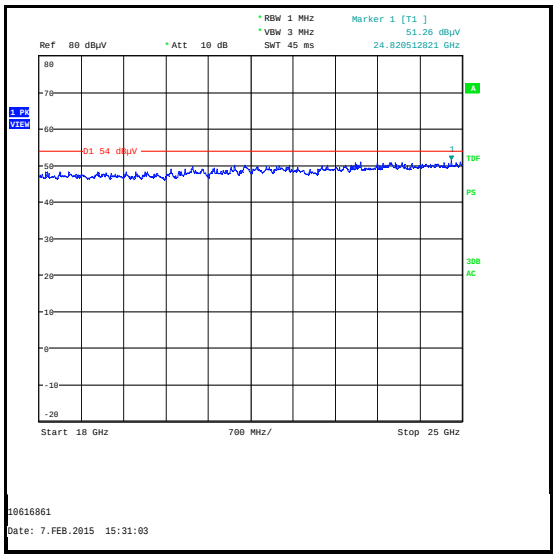
Average detector



Transmitter Radiated Emissions (continued)







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

Transmitter Radiated Emissions (continued)

Test Equipment Used:

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	13 Feb 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	Flann Microwave	3115	00075692	20 Dec 2015	12
A253	Antenna	Flann Microwave	12240-20	128	20 Dec 2015	12
A254	Antenna	Flann Microwave	14240-20	139	20 Dec 2015	12
A255	Antenna	Flann Microwave	16240-20	519	20 Dec 2015	12
A256	Antenna	Flann Microwave	18240-20	400	20 Dec 2015	12
A436	Antenna	Flann Microwave	20240-20	330	21 Dec 2015	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	02 May 2015	12
A1975	High Pass Filter	AtlanTecRF	AFH-03000	090424010	12 Apr 2015	12
A2176	High Pass Filter	AtlanTecRF	AFH-07000	800980	12 Apr 2015	12

5.2.5. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	07 February 2015
Test Sample Serial Number:	UN00655198		

FCC Reference:	Parts 15.247(d) & 15.209(a)
Test Method Used:	As detailed in ANSI C63.10 Section 6.9.2 & FCC KDB 558074 Section 11

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	29

Note(s):

1. The customer declared the following data rates to be used for all measurements as:
    - 802.11b – DBPSK / 1 Mbps
    - 802.11g – BPSK / 6 Mbps

    Final measurements were performed with the above configurations.
2. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
3. As the lower band edge falls within a non-restricted band, only peak measurements are required. In accordance with FCC KDB 558074 Section 11.1, the test method in Section 11.3 was followed: the test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker and corresponding reference level line were placed on the peak of the carrier. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent non-restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
4. As the upper band edge falls within a restricted band both peak and average measurements were recorded by placing a marker at the edge of the band. For peak measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 3 MHz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. For average measurements the test receiver resolution bandwidth was set to 1 MHz and the video bandwidth 10 Hz. A peak detector was used, sweep time was set to auto and trace mode was Max Hold. The test receiver was left to sweep for a sufficient length of time in order to maximise the carrier level and out-of-band emissions. A marker was placed on the band edge spot frequencies and a second marker placed on the highest emission level in the adjacent restricted band of operation (where a higher level emission was present). Marker frequencies and levels were recorded.
5. There is a restricted band 10 MHz below the lower band edge. The test receiver was set up as follows: the RBW set to 1 MHz, the VBW set to 3 MHz, with the sweep time set to auto couple. Peak and average measurements were performed with their respective detectors. Markers were placed on the highest point on each trace.

Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11b / 20 MHz / DBPSK / 1 Mbps

Results: Lower Band Edge

Frequency (MHz)	Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2396.955	68.9	83.4	14.5	Complied
2400	66.1	83.4	17.3	Complied

Results: Upper Band Edge / Restricted Band / Peak

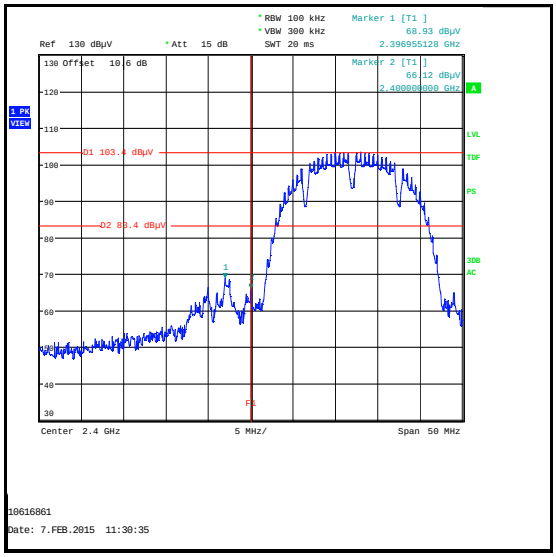
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2387.051	69.6	74.0	4.4	Complied
2483.5	72.9	74.0	1.1	Complied

Results: Upper Band Edge / Restricted Band / Average

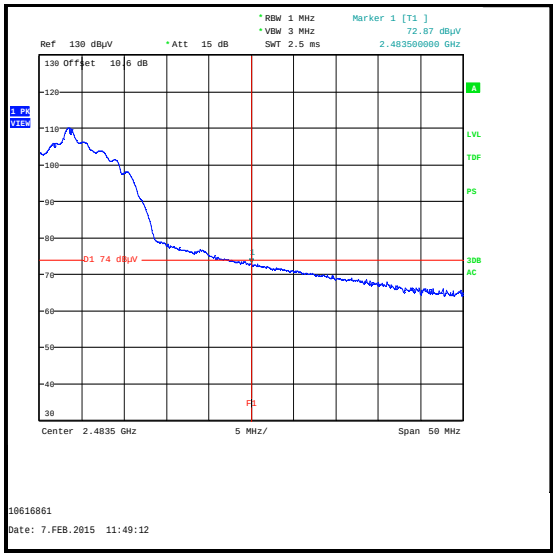
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2348.718	48.7	54.0	5.3	Complied
2387.051	50.4	54.0	3.6	Complied
2483.5	45.9	54.0	8.1	Complied
2487.779	47.2	54.0	6.8	Complied

Transmitter Band Edge Radiated Emissions (continued)

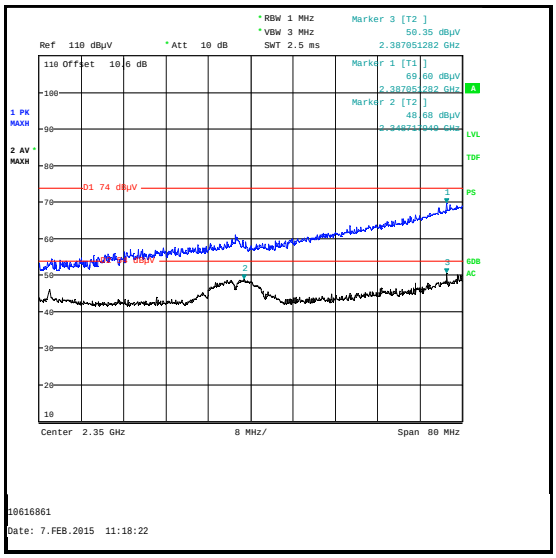
Results: Peak / 802.11b / 20 MHz / DBPSK / 1 Mbps



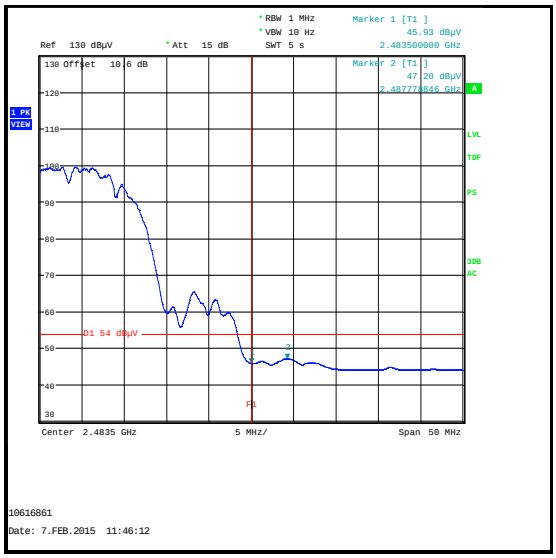
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11g / 20 MHz / BPSK / 6 Mbps

Results: Lower Band Edge

Frequency (MHz)	Level (dBµV/m)	-20 dBc Limit (dBµV/m)	Margin (dB)	Result
2399.439	65.4	77.3	11.9	Complied
2400	65.0	77.3	12.3	Complied

Results: Upper Band Edge / Restricted Band / Peak

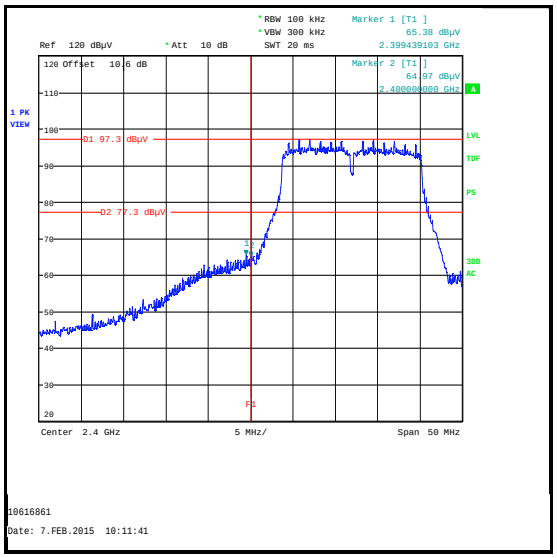
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2345.513	59.3	74.0	14.7	Complied
2390.000	67.0	74.0	7.0	Complied
2483.5	66.8	74.0	7.2	Complied

Results: Upper Band Edge / Restricted Band / Average

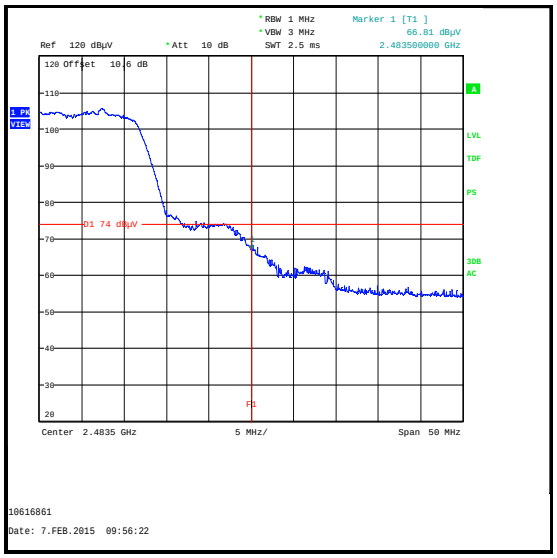
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2349.872	50.0	54.0	4.0	Complied
2389.744	50.9	54.0	3.1	Complied
2483.5	47.2	54.0	6.8	Complied

Transmitter Band Edge Radiated Emissions (continued)

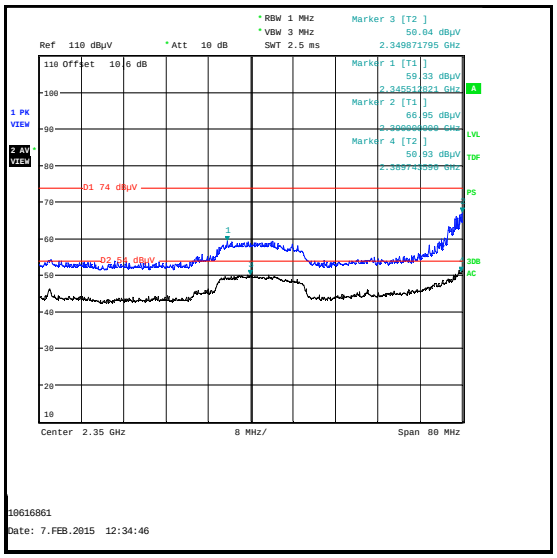
Results: Peak / 802.11g / 20 MHz / BPSK / 6 Mbps



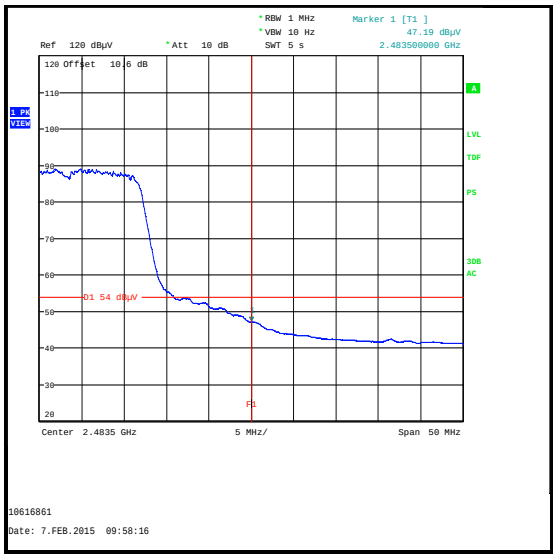
Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



2310 MHz to 2390 MHz Restricted Band Plot



Upper Band Edge Average Measurement

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	14 Mar 2015	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	13 Feb 2015	12
M1874	Test Receiver	Rohde & Schwarz	ESU26	100553	13 May 2015	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	21 Dec 2015	12
A1818	Antenna	EMCO	3115	00075692	20 Dec 2015	12
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	02 May 2015	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
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	-	-	Sections 3.1, 3.2, 3.5 & 4.2 updated

--- END OF REPORT ---