TEST REPORT

Test Report No. : UL-RPT-RP90385JD15A

Manufacturer	:	Panasonic Mobile Communications Development of Europe Ltd
Model No.	:	NTT docomo EB-4063
FCC ID	:	UCE312057A
Technology	:	WLAN
Test Standard(s)	:	FCC Parts 15.107(a), 15.109, 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. This 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 1.0

Date of Issue: 03 December 2012

Checked by:

Ian Watch
WiSE Senior Engineer

Issued by :

pp
John Newell
Group Quality Manager, WiSE
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UL Verification Services

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

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Table of Contents

1. Customer Information

Company Name:	Panasonic Mobile Communications Development of Europe Ltd
Address:	Panasonic House Willoughby Road Bracknell Berkshire RG12 8FP United Kingdom

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.247
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: 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) 2012: 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) 2012: Part 15 Subpart C (Intentional Radiators) - Sections 15.207 and 15.209
Site Registration:	FCC: 209735
Location of Testing:	RFI Global Services Ltd trading as UL, Wade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	11 November 2012 to 27 November 2012

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 15.35(c)	Transmitter Duty Cycle	Note 1
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 Emissions	✓
Part 15.247(d) & 15.209(a)	Transmitter Band Edge Radiated Emissions	✓

Key to Results

✓ = Complied ✗ = Did not comply

Note(s):

1. The measurement was performed to assist in the calculation of the level of maximum peak output power, power spectral density and emissions as the EUT employs pulsed operation.

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 v02 10/04/2012
Title:	Guidance for Performing Compliance Measurements on Digital Transmission System (DTS) devices 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:	NTT docomo
Model Name or Number:	EB-4063
IMEI:	353740050011927*(Radiated sample)*
Hardware Version Number:	Rev B-2
Software Version Number:	ACPU: rupy-jb-10-0336 CCPU: 101033_DCM_00.12
FCC ID:	UCE312057A

Brand Name:	NTT docomo
Model Name or Number:	EB-4063
IMEI:	353740050010663 *(Conducted RF port sample)*
Hardware Version Number:	Rev B-2
Software Version Number:	ACPU: rupy-jb-10-0336 CCPU: 101033_DCM_00.12
FCC ID:	UCE312057A

Brand Name:	NTT docomo
Description:	Battery
Model Name or Number:	P29

Brand Name:	NTT docomo
Description:	AC Charger
Model Name or Number:	AC 04

Brand Name:	NTT docomo
Description:	Charge/USB Data cable
Model Name or Number:	Type 01

Brand Name:	NTT docomo
Description:	Personal Hands-Free
Model Name or Number:	Type 02

3.2. Description of EUT

The equipment under test was a Multi-Mode LTE/UMTS/GSM Mobile Phone with WLAN, Bluetooth and RFID.

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 802.11a,b,g,n) / Digital Transmission System		
Type of Unit:	Transceiver		
Modulation Type:	DBPSK, DQPSK, CCK, BPSK, QPSK, 16 QAM & 64QAM		
Data Rates:	802.11b	1, 2, 5.5 & 11 Mbps	
	802.11g	6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20	6.5, 13, 19.5, 26, 39, 52, 58.5, 65, 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65 & 72.2 Mbps	
Power Supply Requirement(s):	Nominal	3.8 V	
Maximum Conducted Output Power:	15.4 dBm		
Declared Antenna Gain:	-1.8 dBi		
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
Receive Frequency Range:	2412 MHz to 2462 MHz		
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:

Brand Name:	Panasonic
Description:	Laptop PC
Model Name or Number:	Toughbook CF-74

Brand Name:	Not marked or stated
Description:	2 GB Micro SD Card
Model Name or 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):

- Receiver/Idle mode.
- 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):

- Controlled using a bespoke application on the laptop PC supplied by the Customer. The application was used to enable continuous transmission and receive mode and to select the test channels, data rates and modulation schemes as required.
- Receive/Idle tests: The 802.11 mode was active but not transmitting.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power, narrowest and widest bandwidth for all bands were:
    - Highest power
        - 802.11b – CCK / 11 Mbps
        - 802.11g – 16QAM / 36 Mbps
        - 802.11n HT20 – 64QAM / 58.5 Mbps / MCS6
    - Narrowest bandwidth
        - 802.11b – DQPSK / 2 Mbps
        - 802.11g – BPSK / 6 Mbps
        - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0
    - Widest bandwidth
        - 802.11b – CCK / 11 Mbps
        - 802.11g – 64QAM / 54 Mbps
        - 802.11n HT20 – 64QAM / 65 Mbps / MCS7
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 11 Mbps, as this was found to have the highest power level and therefore deemed to be worst case.
- Idle and transmitter radiated spurious emissions tests were performed with the AC charger and PHF connected to the EUT as this was found to be the worst case during pre-scans. All the accessories were individually connected and measurements made during the pre-scans to determine the worst case combination.
- Radiated emissions tests were performed with all unused ports terminated.
- The conducted sample with IMEI 353740050010663 was used for 6 dB bandwidth maximum output power and power spectral density tests.
- The radiated sample with IMEI 353740050011927 was used for all other tests.

5. Measurements, Examinations and Derived Results

5.1. General Comments

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

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Receiver/Idle Mode AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	15 November 2012
Test Sample IMEI:	353740050011927		

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

Environmental Conditions:

Temperature (°C):	21
Relative Humidity (%):	41

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.479	Live	42.3	56.4	14.1	Complied
2.558	Live	34.6	56.0	21.4	Complied
4.259	Live	36.0	56.0	20.0	Complied
4.493	Live	37.9	56.0	18.1	Complied
5.325	Live	36.5	60.0	23.5	Complied
5.694	Live	36.2	60.0	23.8	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.474	Live	35.9	46.4	10.5	Complied
2.832	Live	33.4	46.0	12.6	Complied
4.335	Live	28.8	46.0	17.2	Complied
4.515	Live	30.6	46.0	15.4	Complied
5.357	Live	29.4	50.0	20.6	Complied
5.681	Live	29.9	50.0	20.1	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)

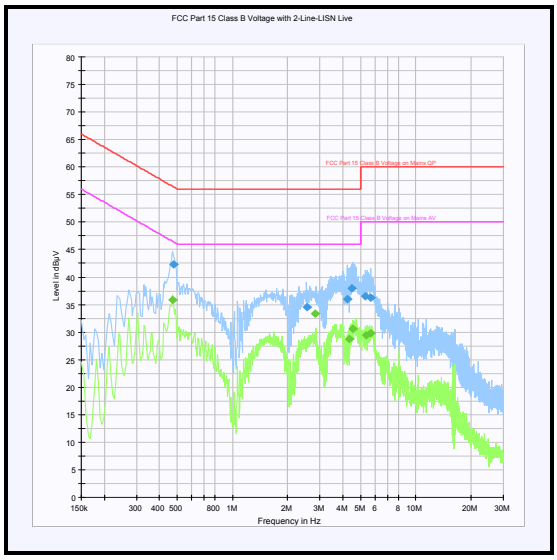
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.209	Neutral	34.6	63.3	28.7	Complied
2.004	Neutral	22.1	56.0	33.9	Complied
2.526	Neutral	23.7	56.0	32.3	Complied
3.539	Neutral	28.8	56.0	27.2	Complied
4.812	Neutral	36.7	56.0	19.3	Complied
5.240	Neutral	36.4	60.0	23.6	Complied
5.645	Neutral	36.2	60.0	23.8	Complied

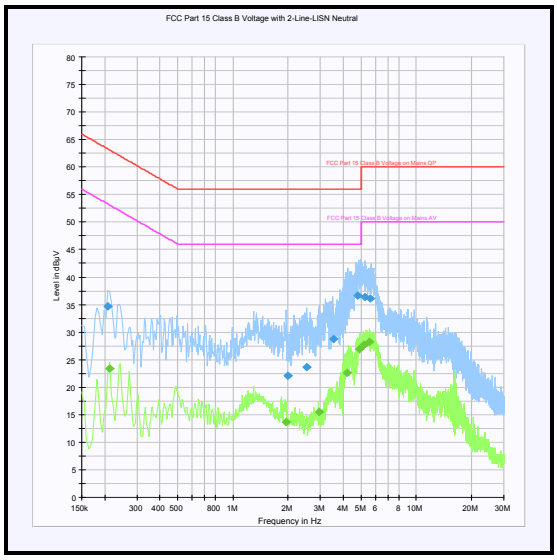
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.213	Neutral	23.4	53.1	29.7	Complied
1.950	Neutral	13.6	46.0	32.4	Complied
2.949	Neutral	15.6	46.0	30.4	Complied
4.205	Neutral	22.6	46.0	23.4	Complied
4.920	Neutral	26.9	46.0	19.1	Complied
5.177	Neutral	27.7	50.0	22.3	Complied
5.573	Neutral	28.3	50.0	21.7	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:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	19 Feb 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	25 Feb 2013	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	09 Aug 2013	12

5.2.2. Receiver/Idle Mode Radiated Spurious Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	11 November 2012
Test Sample IMEI:	353740050011927		

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):	23
Relative Humidity (%):	33

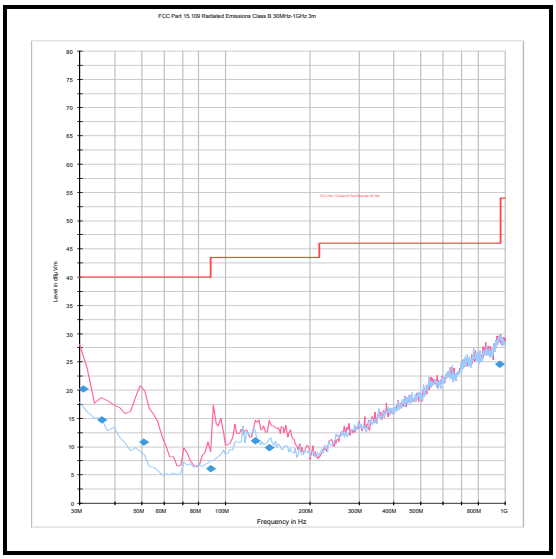
Note(s):

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 (RFI 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
956.932	Vertical	24.6	46.0	21.4	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:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A553	Antenna	Chase	CBL6111A	1593	15 Feb 2013	12
G0543	Amplifier	Sonoma	310N	230801	02 Jan 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	03 Feb 2013	12

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	13 November 2012
Test Sample IMEI:	353740050011927		

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 (%):	41

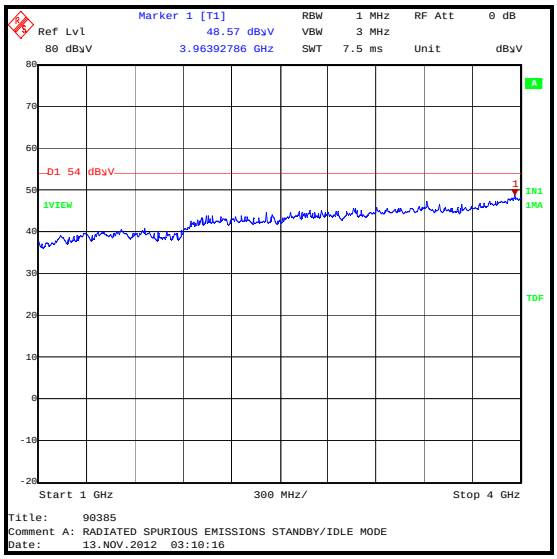
Note(s):

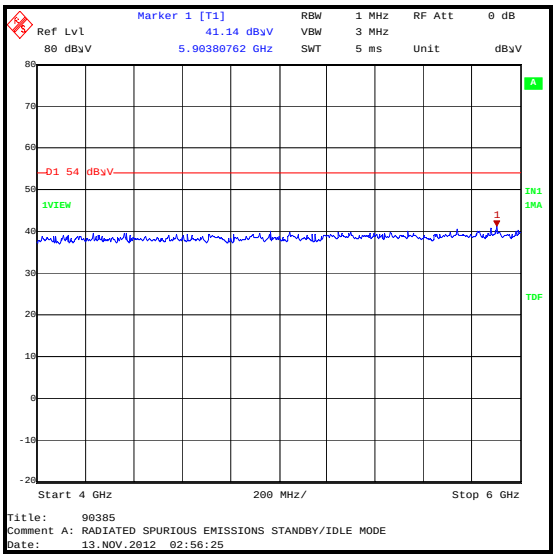
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table above. 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 (RFI 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 (RFI 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.

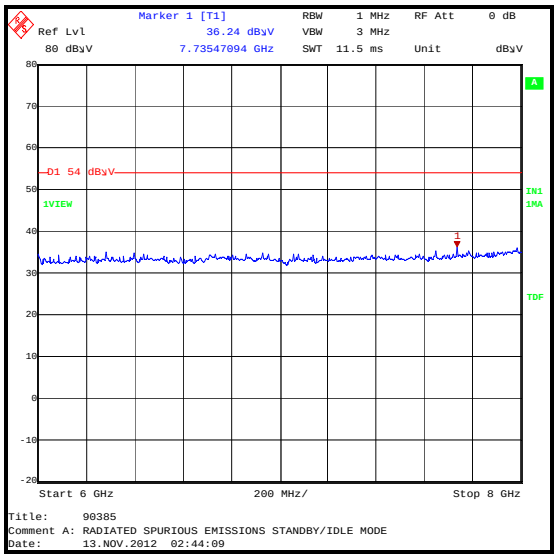
Results:

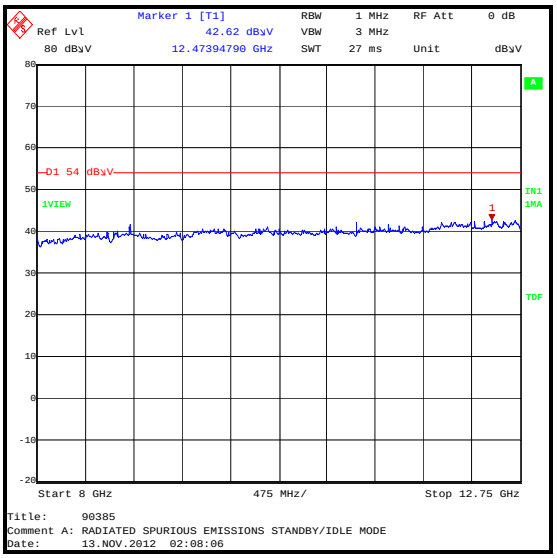
Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
3963.928	Vertical	48.6	54.0	5.4	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)









Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	N/A	14 Aug 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
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

5.2.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	21 November 2012
Test Sample IMEI:	353740050011927		

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):	19
Relative Humidity (%):	46

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Live	55.6	66.0	10.4	Complied
0.222	Live	51.7	62.7	11.0	Complied
0.416	Live	44.0	57.5	13.5	Complied
0.812	Live	37.0	56.0	19.0	Complied
1.613	Live	38.0	56.0	18.0	Complied
1.977	Live	40.0	56.0	16.0	Complied
2.049	Live	40.2	56.0	15.8	Complied
2.225	Live	40.7	56.0	15.3	Complied
2.396	Live	39.2	56.0	16.8	Complied
2.486	Live	37.7	56.0	18.3	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.438	Live	29.8	47.1	17.3	Complied
0.875	Live	26.2	46.0	19.8	Complied
1.226	Live	26.7	46.0	19.3	Complied
2.099	Live	29.7	46.0	16.3	Complied
2.369	Live	29.9	46.0	16.1	Complied
5.010	Live	30.0	50.0	20.0	Complied
15.549	Live	28.9	50.0	21.1	Complied
16.269	Live	31.5	50.0	18.5	Complied
16.346	Live	33.3	50.0	16.7	Complied
16.427	Live	30.6	50.0	19.4	Complied

Transmitter AC Conducted Spurious Emissions (continued)

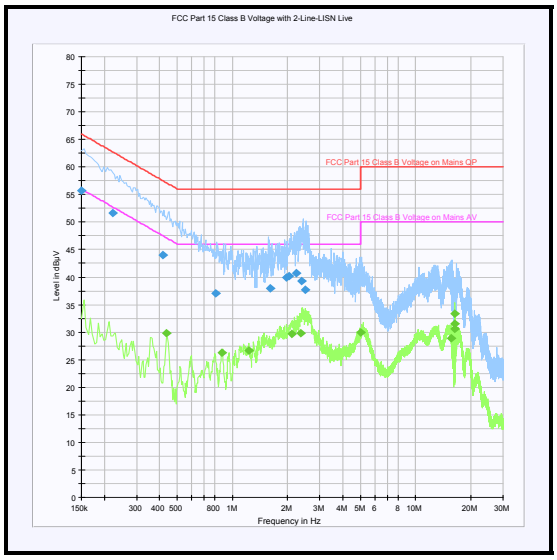
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Neutral	53.1	66.0	12.9	Complied
0.164	Neutral	53.3	65.3	12.0	Complied
0.195	Neutral	54.1	63.8	9.7	Complied
0.222	Neutral	52.4	62.7	10.3	Complied
0.240	Neutral	52.4	62.1	9.7	Complied
0.240	Neutral	52.9	62.1	9.2	Complied
0.276	Neutral	47.9	60.9	13.0	Complied
0.344	Neutral	46.5	59.1	12.6	Complied

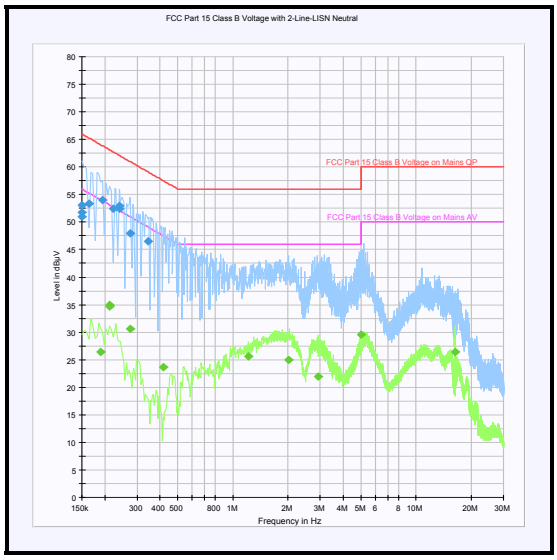
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.213	Neutral	34.9	53.1	18.2	Complied
0.276	Neutral	30.5	50.9	20.4	Complied
1.212	Neutral	25.7	46.0	20.3	Complied
2.018	Neutral	25.0	46.0	21.0	Complied
5.006	Neutral	29.5	50.0	20.5	Complied
16.346	Neutral	26.4	50.0	23.6	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:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A649	LISN	Rohde & Schwarz	ESH3-Z5	825562/008	19 Feb 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	25 Feb 2013	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	09 Aug 2013	12

5.2.4. Transmitter Minimum 6 dB Bandwidth

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	21 November 2012
Test Sample IMEI:	353740050010663		

FCC Reference:	Part 15.247(a)(2)
Test Method Used:	As detailed in FCC KDB 558074 Section 7.0 Option 1

Environmental Conditions:

Temperature (°C):	26 to 27
Relative Humidity (%):	31 to 32

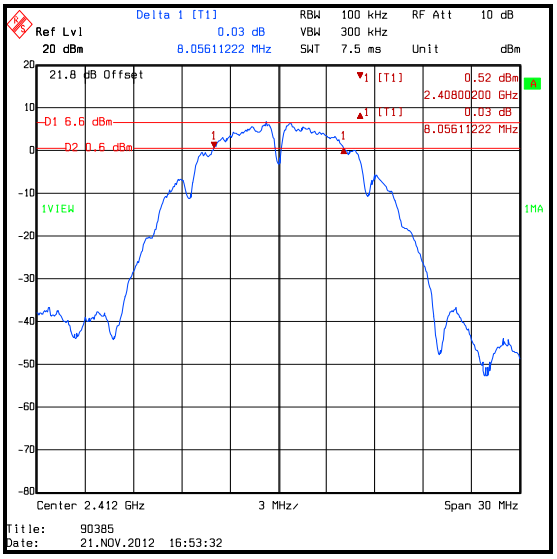
Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 7.1 DTS channel bandwidth measurement procedure. The data rates that produced the narrowest bandwidth and therefore deemed worst case were:
    - 802.11b – DQPSK / 2 Mbps
    - 802.11g – BPSK / 6 Mbps
    - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.

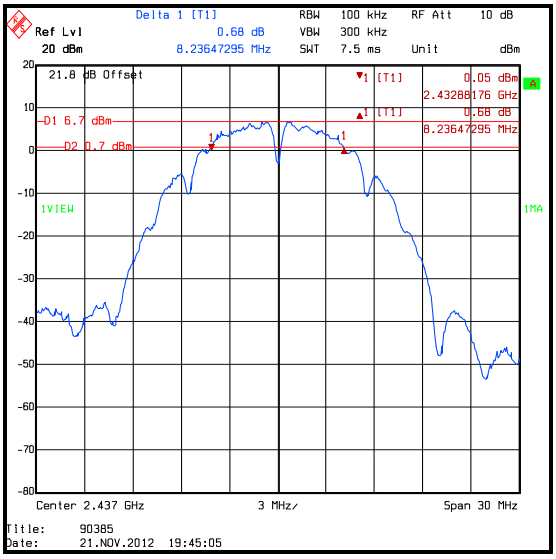
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11b / 20 MHz / DQPSK / 2 Mbps

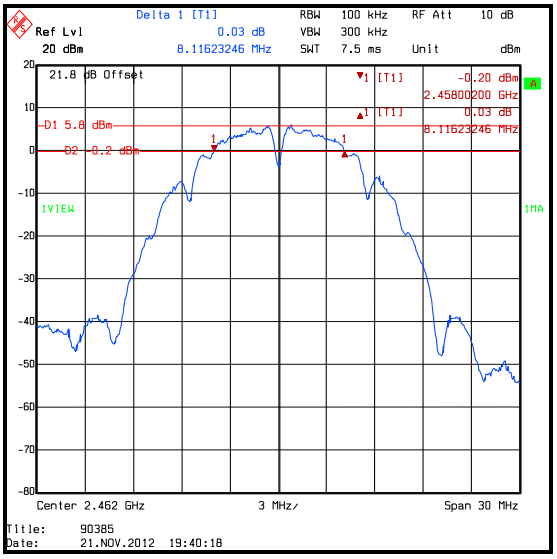
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	8056.112	≥500	7556.112	Complied
Middle	8236.473	≥500	7736.473	Complied
Top	8116.232	≥500	7616.232	Complied



Bottom Channel



Middle Channel

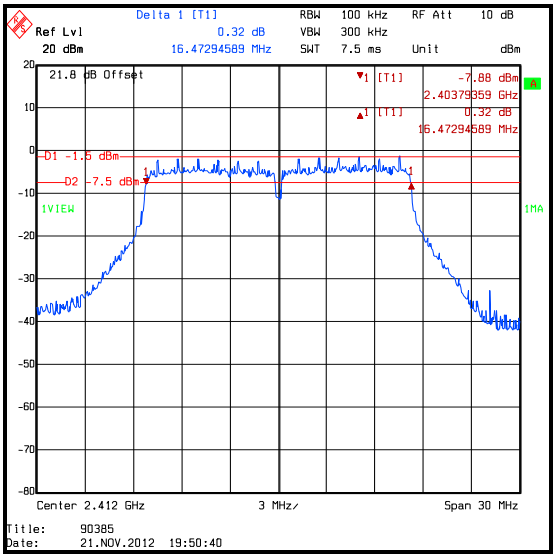


Top Channel

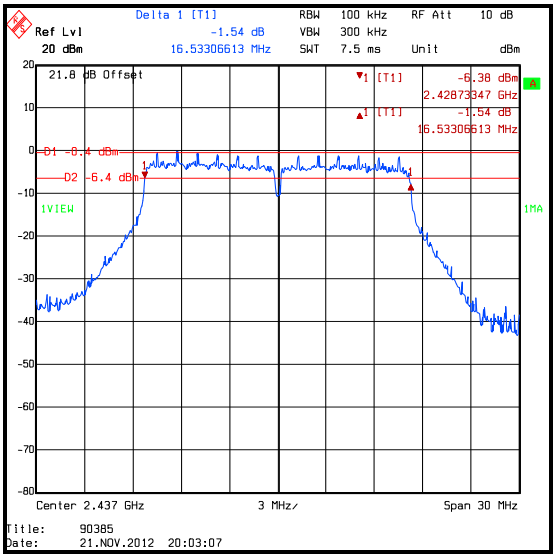
Transmitter Minimum 6 dB Bandwidth (continued)

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

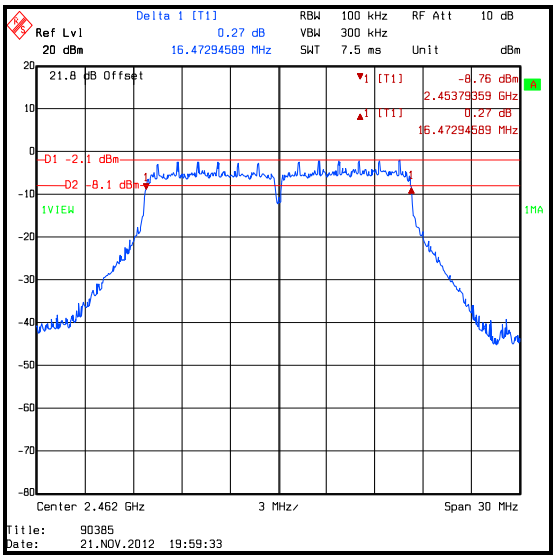
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	16472.946	≥500	15972.946	Complied
Middle	16533.066	≥500	16033.066	Complied
Top	16472.946	≥500	15972.946	Complied



Bottom Channel



Middle Channel

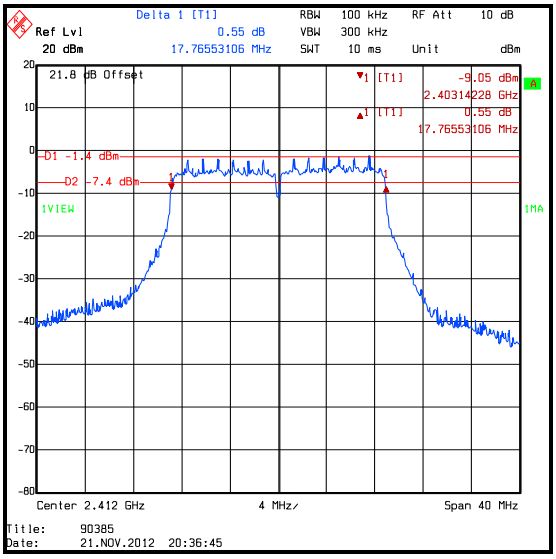


Top Channel

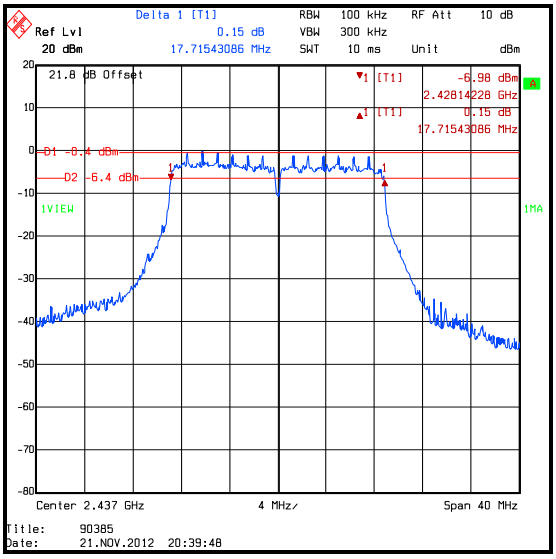
Transmitter Minimum 6 dB Bandwidth (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0

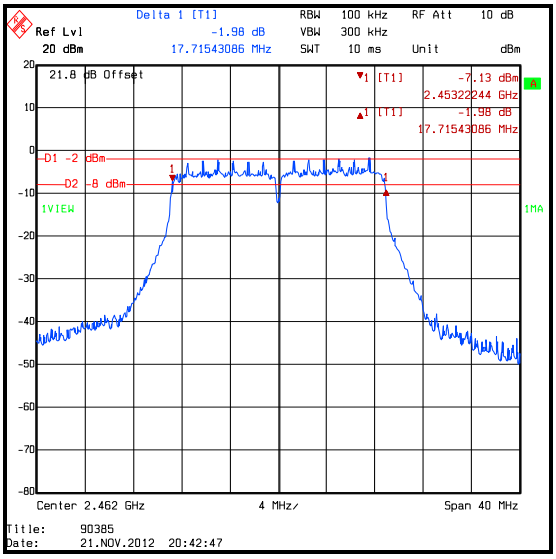
Channel	6 dB Bandwidth (kHz)	Limit (kHz)	Margin (kHz)	Result
Bottom	17765.531	≥500	17265.531	Complied
Middle	17715.431	≥500	17215.431	Complied
Top	17715.431	≥500	17215.431	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Minimum 6 dB Bandwidth (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2142	Attenuator	Atlan TecRF	AN18-20	081120-23	25 May 2013	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	13 Aug 2013	12

5.2.5.Transmitter Duty Cycle

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	21 November 2012
Test Sample IMEI:	353740050010663		

FCC Part:	15.35(c)
Test Method Used:	FCC KDB 558074 Section 5.0

Environmental Conditions:

Temperature (°C):	27
Relative Humidity (%):	31

Note(s):

1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by using the following calculation:

10 log (1 / (On Time / [Period or 100mS whichever is the lesser])).

802.11b duty cycle: 10 log (1 / (0.932/1.112)) = 0.8 dB

802.11g duty cycle 10 log (1 / (0.236/0.433)) = 2.6 dB

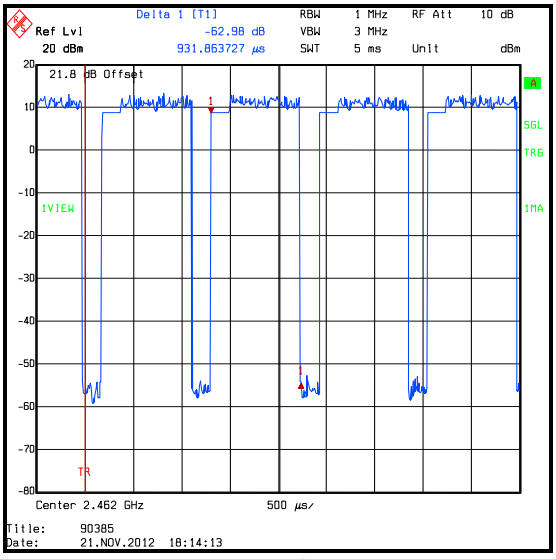
802.11n HT20 duty cycle: 10 log (1 / (0.160/0.353)) = 3.4 dB

Transmitter Duty Cycle (continued)

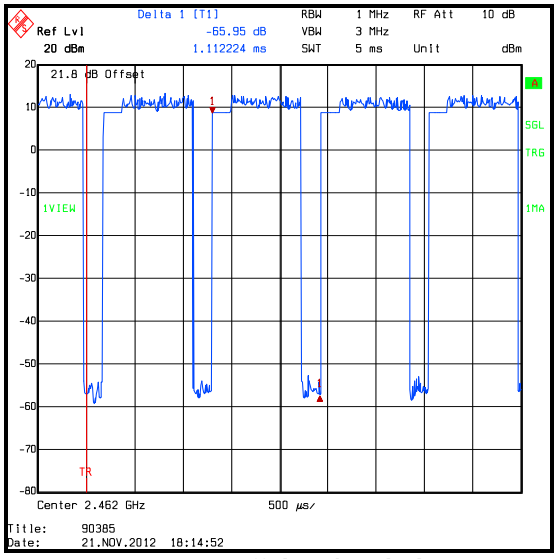
Results: 802.11b / 20 MHz / 11 Mbps

Pulse Duration (mS)	Duty Cycle (dB)
0.932	0.8

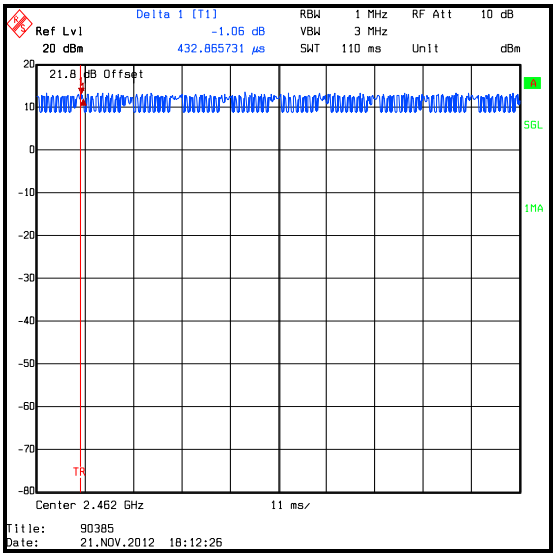
Period (mS)
1.112



TX on time



TX on + off time / period



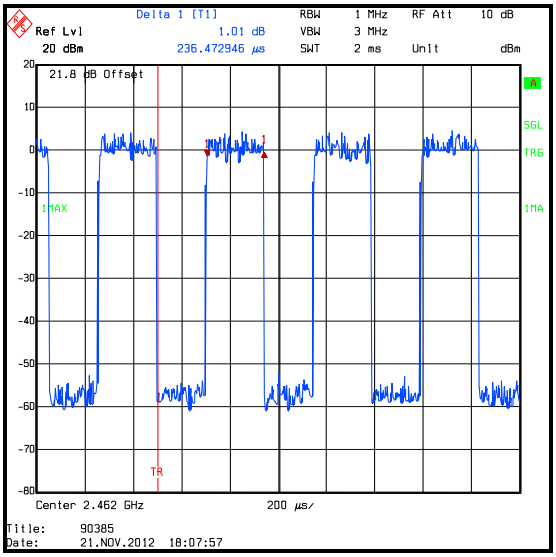
100 ms

Transmitter Duty Cycle (continued)

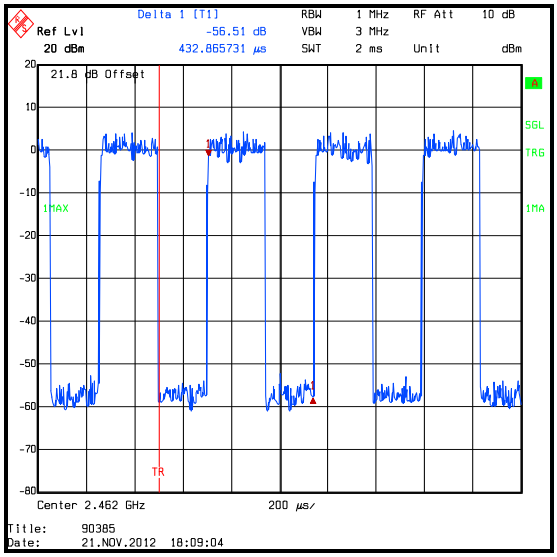
Results: 802.11g / 20 MHz / 36 Mbps

Pulse Duration (mS)	Duty Cycle (dB)
0.236	2.6

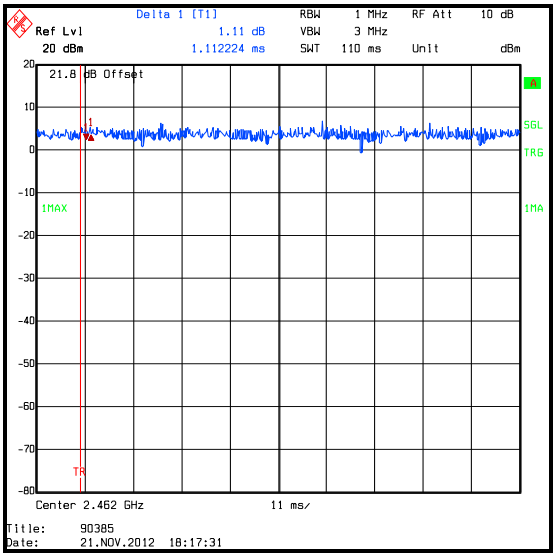
Period (mS)
0.433



TX on time



TX on + off time / period



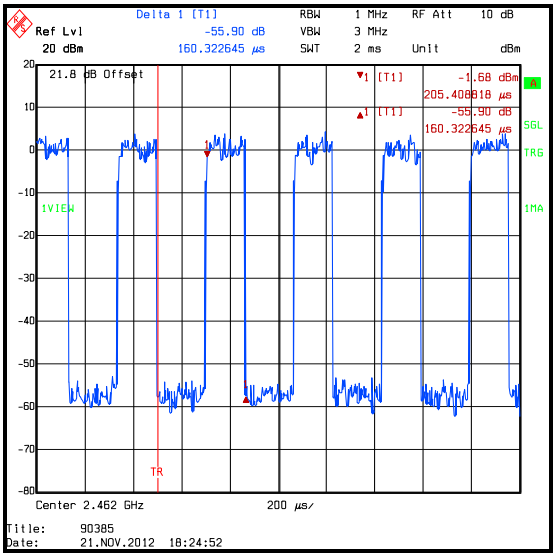
100 ms

Transmitter Duty Cycle (continued)

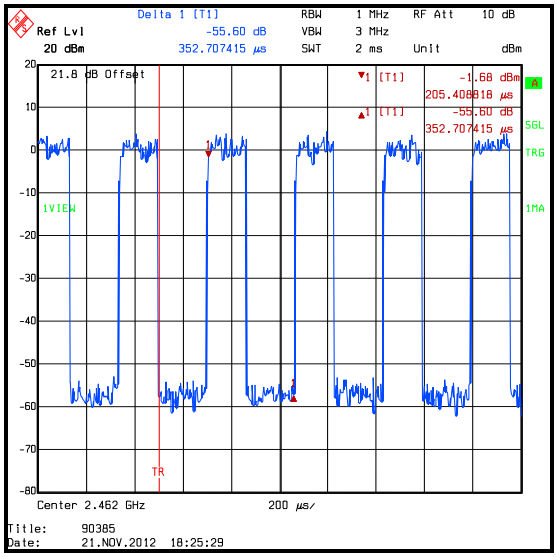
Results: 802.11n / 20 MHz / 58.5 Mbps / MCS6

Pulse Duration (µS)	Duty Cycle (dB)
0.160	3.4

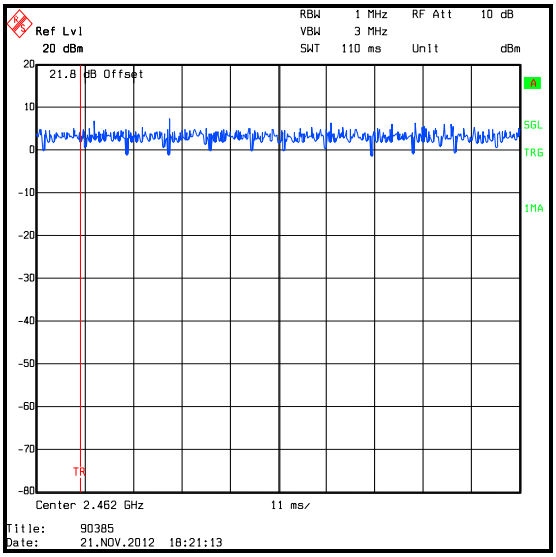
Period (µS)
0.353



TX on time



TX on + off time / period



100 ms

Transmitter Duty Cycle (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2142	Attenuator	Atlan TecRF	AN18-20	081120-23	25 May 2013	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	13 Aug 2013	12

5.2.6. Transmitter Power Spectral Density

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	21 November 2012
Test Sample IMEI:	353740050010663		

FCC Reference:	Part 15.247(e)
Test Method Used:	As detailed in FCC KDB 558074 Section 9.0 Option 3 / Alternative 1

Environmental Conditions:

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

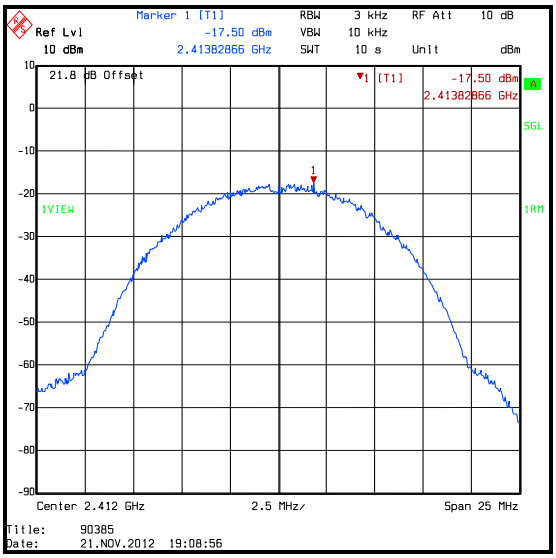
Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 9.3 Option 3 measurement procedure. The data rates that produced the highest power and therefore deemed worst case were:
    - 802.11b – CCK / 11 Mbps
    - 802.11g – 16QAM / 36 Mbps
    - 802.11n HT20 – 64QAM / 58.5 Mbps / MCS6
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. The EUT was transmitting at <98% duty cycle. The calculated duty cycle in section 5.2.5 was added to the measured average power spectral density in order to compute the power spectral density.

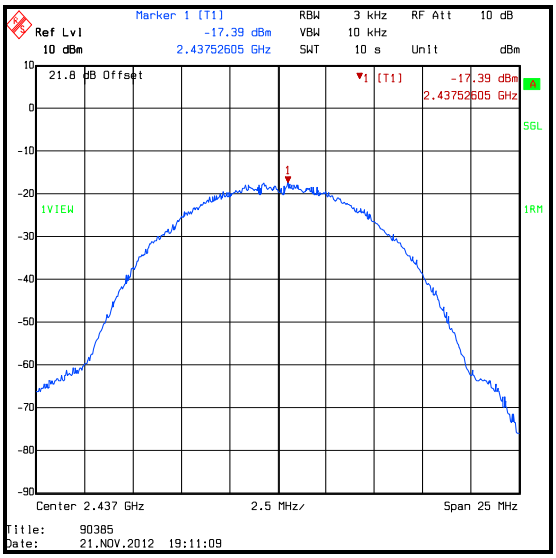
Transmitter Power Spectral Density (continued)

Results: 802.11b / 20 MHz / CCK / 11 Mbps

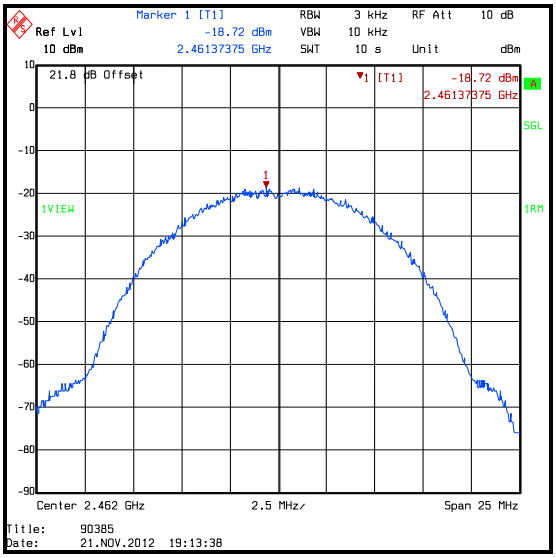
Channel	Output Power (dBm/3 kHz)	Duty cycle correction (dB)	Corrected Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-17.5	0.8	-16.7	8.0	24.7	Complied
Middle	-17.4	0.8	-16.6	8.0	24.6	Complied
Top	-18.7	0.8	-17.9	8.0	25.9	Complied



Bottom Channel



Middle Channel

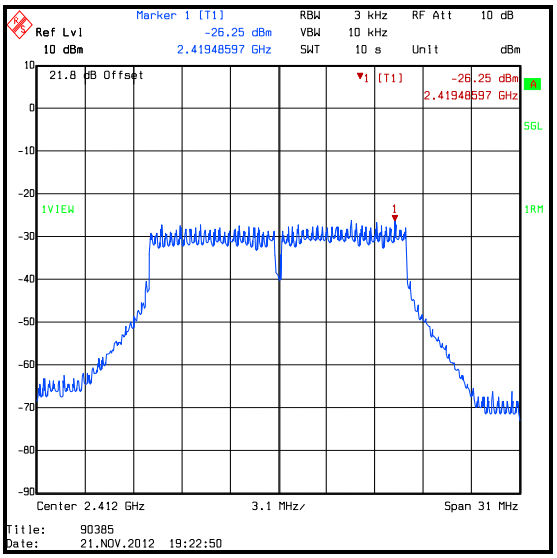


Top Channel

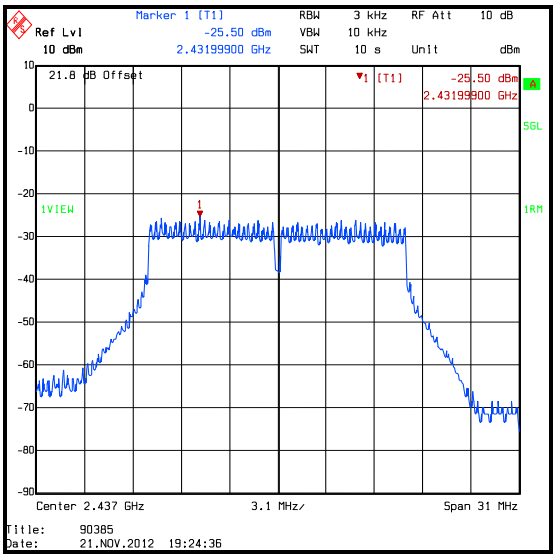
Transmitter Power Spectral Density (continued)

Results: 802.11g / 20 MHz / 16QAM / 36 Mbps

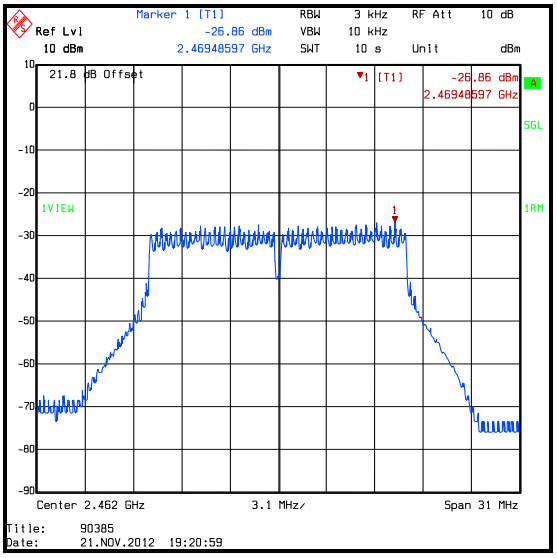
Channel	Output Power (dBm/3 kHz)	Duty cycle correction (dB)	Corrected Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-26.3	2.6	-23.7	8.0	31.7	Complied
Middle	-25.5	2.6	-22.9	8.0	30.9	Complied
Top	-26.9	2.6	-24.3	8.0	32.3	Complied



Bottom Channel



Middle Channel

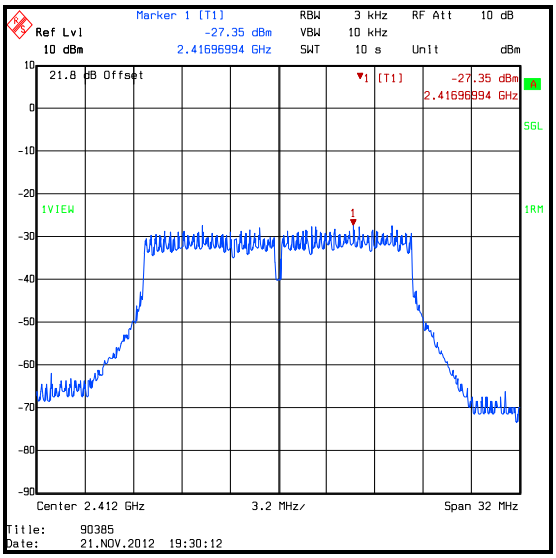


Top Channel

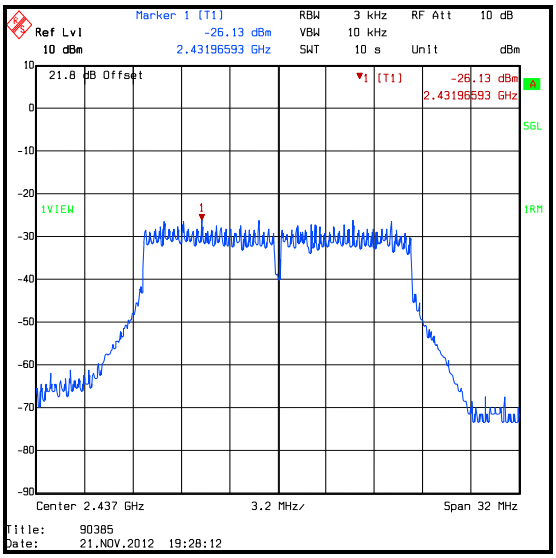
Transmitter Power Spectral Density (continued)

Results: 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6

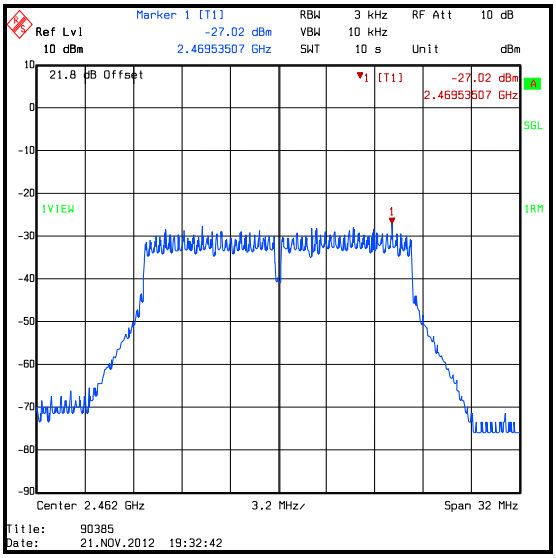
Channel	Output Power (dBm/3 kHz)	Duty cycle correction (dB)	Corrected Output Power (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Result
Bottom	-27.4	3.4	-24.0	8.0	32.0	Complied
Middle	-26.1	3.4	-22.7	8.0	30.7	Complied
Top	-27.0	3.4	23.6	8.0	31.6	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Power Spectral Density (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2142	Attenuator	Atlan TecRF	AN18-20	081120-23	25 May 2013	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	13 Aug 2013	12
M1021	Signal Generator	Rohde & Schwarz	SMP02	833286/004	09 Jan 2013	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	07 Jun 2013	12
M1267	Thermal Power Sensor	Rohde & Schwarz	NRV-Z52	100155	07 Jun 2013	12

5.2.7. Transmitter Maximum Peak Output Power

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	21 November 2012
Test Sample IMEI:	353740050010663		

FCC Reference:	Part 15.247(b)(3)
Test Method Used:	As detailed in FCC KDB 558074 Section 8.2 / Alternative 1

Environmental Conditions:

Temperature (°C):	27
Relative Humidity (%):	31

Note(s):

1. All configurations supported by the EUT were investigated on one channel in accordance with KDB 558074 Section 8.2.2 measurement procedure and 8.2.4 Alternative 1. The spectrum analyser was connected to the RF port on the EUT using suitable attenuation and RF cable. The data rates that produced the highest power and therefore deemed worst case were:
    - 802.11b – CCK / 11 Mbps
    - 802.11g – 16QAM / 36 Mbps
    - 802.11n HT20 – 64QAM / 58.5 Mbps / MCS6
2. Final measurements were performed using the above configurations on the bottom, middle and top channels.
3. The EUT was transmitting at <98% duty cycle. The calculated duty cycle in section 5.2.5 was added to the measured average power in order to compute the power during the actual transmission time.

Transmitter Maximum Peak Output Power (continued)

Results: 802.11b / 20 MHz / CCK / 11 Mbps

Conducted Peak Limit Comparison

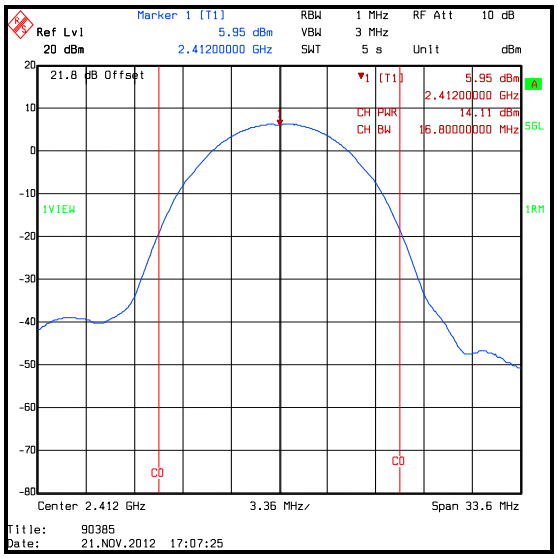
Channel	Conducted Power (dBm)	Duty cycle correction (dB)	Corrected Conducted Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	14.1	0.8	14.9	30.0	15.1	Complied
Middle	14.6	0.8	15.4	30.0	14.6	Complied
Top	13.1	0.8	13.9	30.0	16.1	Complied

De Facto EIRP Limit Comparison

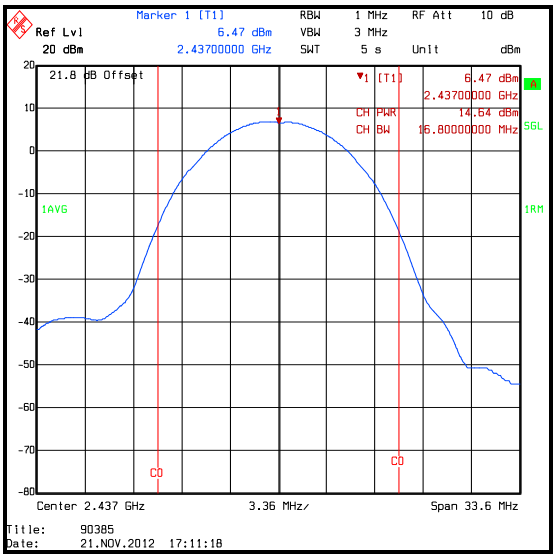
Channel	Corrected Conducted Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	14.9	-1.8	13.1	36.0	22.9	Complied
Middle	15.4	-1.8	13.6	36.0	22.4	Complied
Top	13.9	-1.8	12.1	36.0	23.9	Complied

Transmitter Maximum Peak Output Power (continued)

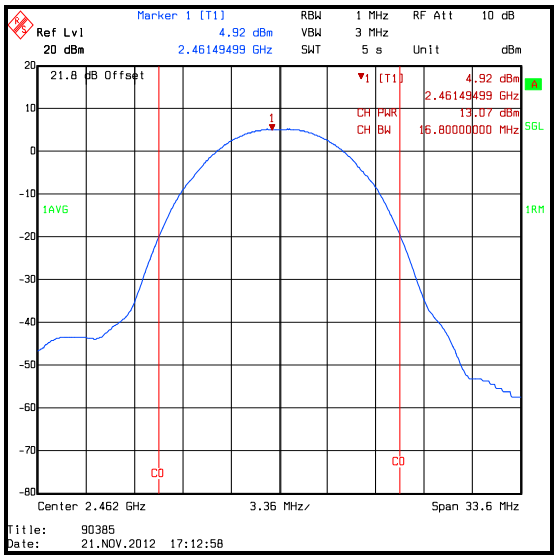
Results: 802.11b / 20 MHz / 11 Mbps



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results: 802.11g / 20 MHz / 16QAM / 36 Mbps

Conducted Peak Limit Comparison

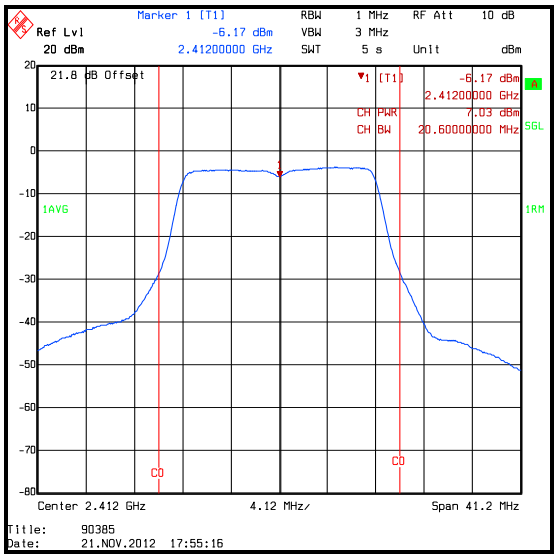
Channel	Conducted Peak Power (dBm)	Duty cycle correction (dB)	Corrected Conducted Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	7.0	2.6	9.6	30.0	20.4	Complied
Middle	7.9	2.6	10.5	30.0	19.5	Complied
Top	6.8	2.6	9.4	30.0	20.6	Complied

De Facto EIRP Limit Comparison

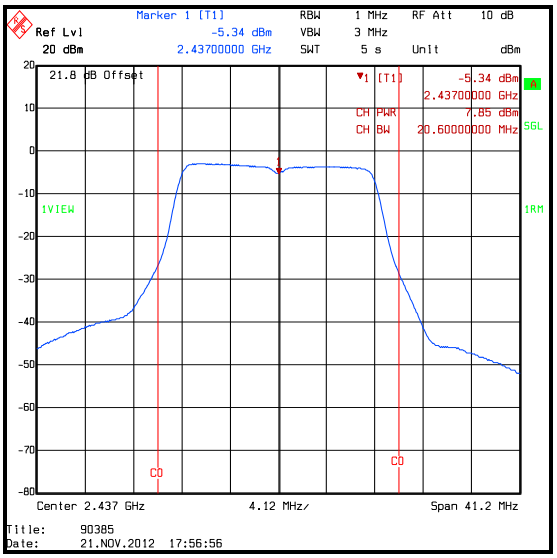
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	9.6	-1.8	7.8	36.0	28.2	Complied
Middle	10.5	-1.8	8.7	36.0	27.3	Complied
Top	9.4	-1.8	7.6	36.0	28.4	Complied

Transmitter Maximum Peak Output Power (continued)

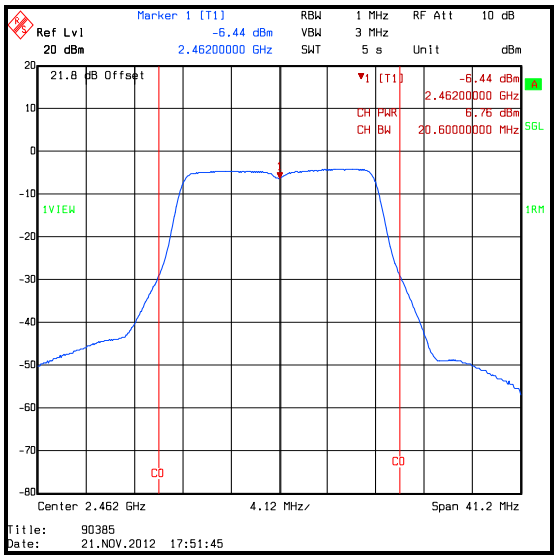
Results: 802.11g / 20 MHz / 16QAM / 36 Mbps



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Peak Output Power (continued)

Results: 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6

Conducted Peak Limit Comparison

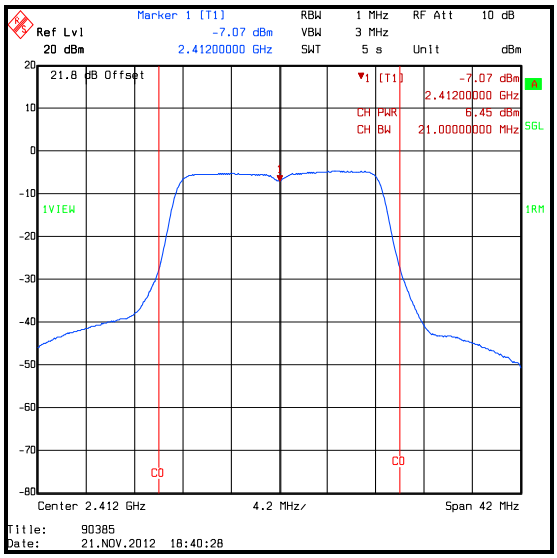
Channel	Conducted Peak Power (dBm)	Duty cycle correction (dB)	Corrected Conducted Power (dBm)	Conducted Peak Power Limit (dBm)	Margin (dB)	Result
Bottom	6.5	3.4	9.9	30.0	20.1	Complied
Middle	7.3	3.4	10.7	30.0	19.3	Complied
Top	5.9	3.4	9.3	30.0	20.7	Complied

De Facto EIRP Limit Comparison

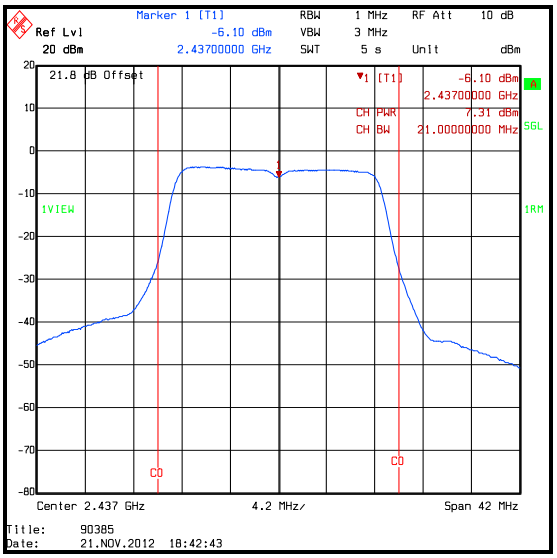
Channel	Conducted Peak Power (dBm)	Declared Antenna Gain (dBi)	EIRP (dBm)	De Facto EIRP Limit (dBm)	Margin (dB)	Result
Bottom	9.9	-1.8	8.1	36.0	27.9	Complied
Middle	10.7	-1.8	8.9	36.0	27.1	Complied
Top	9.3	-1.8	7.5	36.0	28.5	Complied

Transmitter Maximum Peak Output Power (continued)

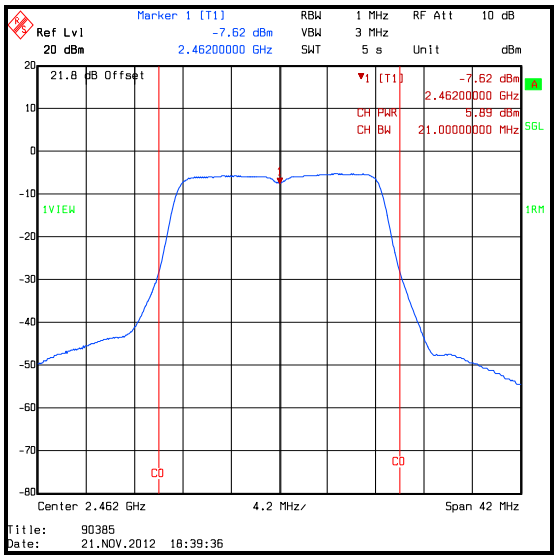
Results: 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6



Bottom Channel



Middle Channel



Top Channel

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2142	Attenuator	Atlan TecRF	AN18-20	081120-23	25 May 2013	12
M127	Spectrum Analyser	Rohde & Schwarz	FSEB 30	842 659/016	13 Aug 2013	12
M1021	Signal Generator	Rohde & Schwarz	SMP02	833286/004	09 Jan 2013	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	07 Jun 2013	12
M1267	Thermal Power Sensor	Rohde & Schwarz	NRV-Z52	100155	07 Jun 2013	12

5.2.8. Transmitter Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	11 November 2012
Test Sample IMEI:	353740050011927		

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 (%):	33

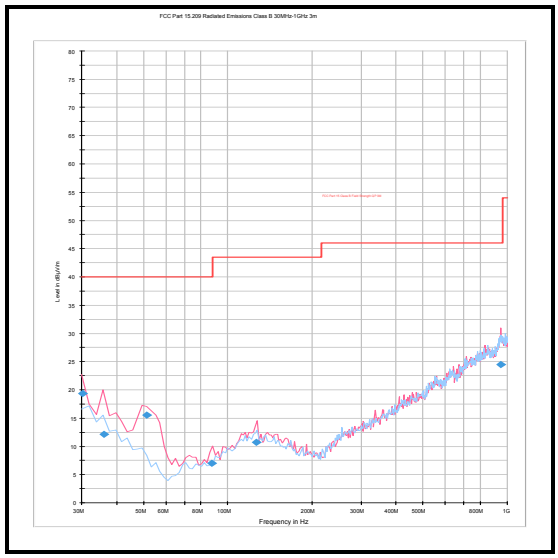
Note(s):

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 top channel only.
3. All other emissions were at least 20 dB below the appropriate limit or below the noise floor of the measurement system.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI 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 / 802.11b / 20 MHz / CCK / 11 Mbps

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
126.786	Vertical	10.7	43.5	32.8	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:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1834	Attenuator	Hewlett Packard	8491B	10444	29 Jan 2013	12
A553	Antenna	Chase	CBL6111A	1593	15 Feb 2013	12
G0543	Amplifier	Sonoma	310N	230801	02 Jan 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	03 Feb 2013	12

Transmitter Radiated Emissions (continued)

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	14 November 2012
Test Sample IMEI:	353740050011927		

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 (%):	42

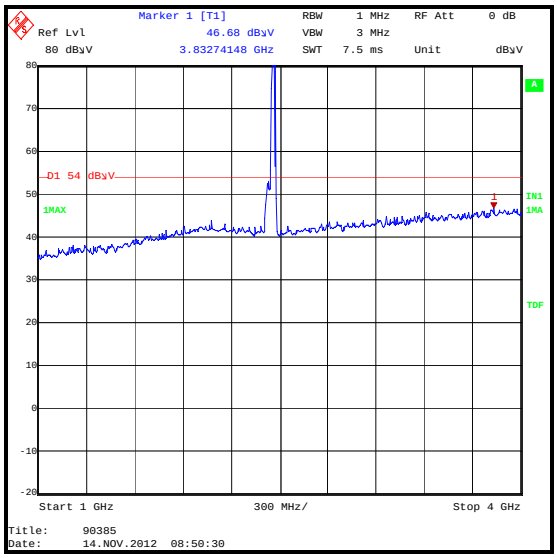
Note(s):

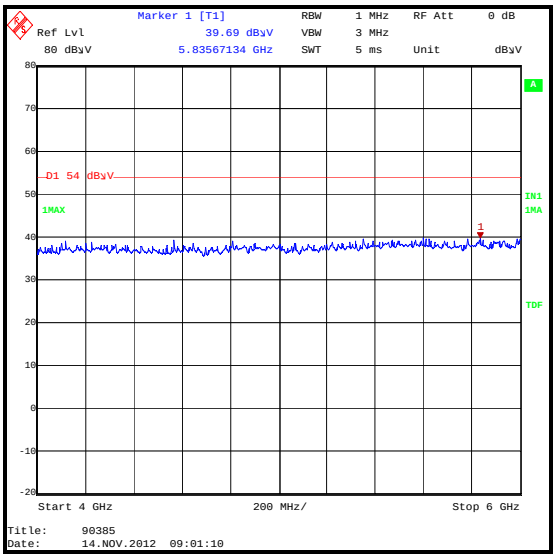
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded 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. The emission shown at approximately 2480 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 (RFI 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 (RFI 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.

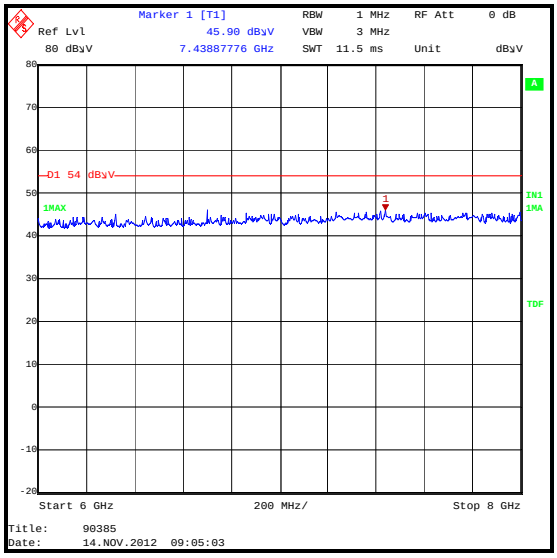
Results:

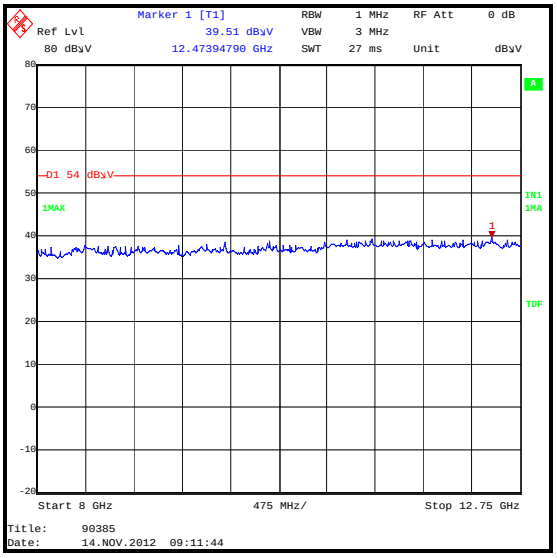
Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
24761.523	Vertical	49.6	54.0	4.4	Complied

Transmitter Radiated Emissions (continued)

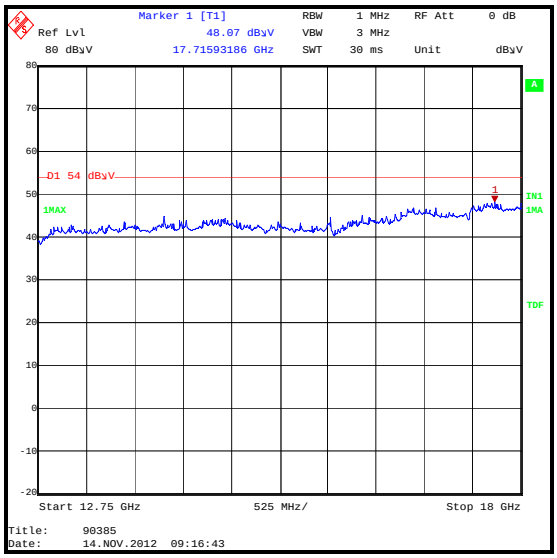


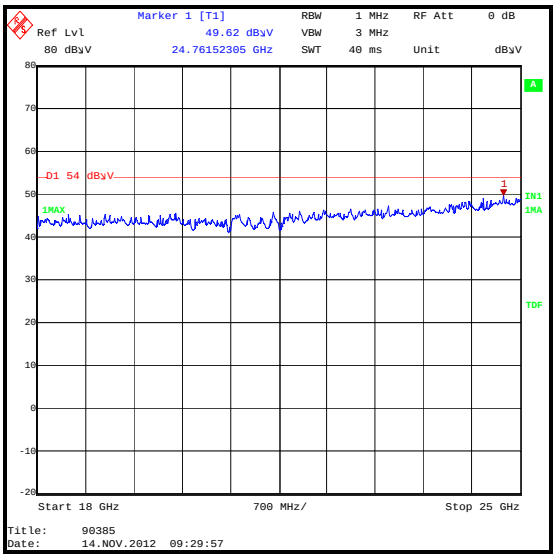






Transmitter Radiated Emissions (continued)





Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
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

5.2.9. Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	27 November 2012
Test Sample IMEI:	353740050011927		

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):	24
Relative Humidity (%):	36

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 and therefore deemed worst case were:
    - highest power
        - 802.11b – CCK / 11 Mbps
        - 802.11g – 16QAM / 36 Mbps
        - 802.11n HT20 – 64QAM / 58.5 Mbps / MCS6
    - widest bandwidth
        - 802.11b – CCK / 2 Mbps
        - 802.11g – 64QAM / 54 Mbps
        - 802.11n HT20 – 64QAM / 65 Mbps / MCS7
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. * -20 dBc limit.

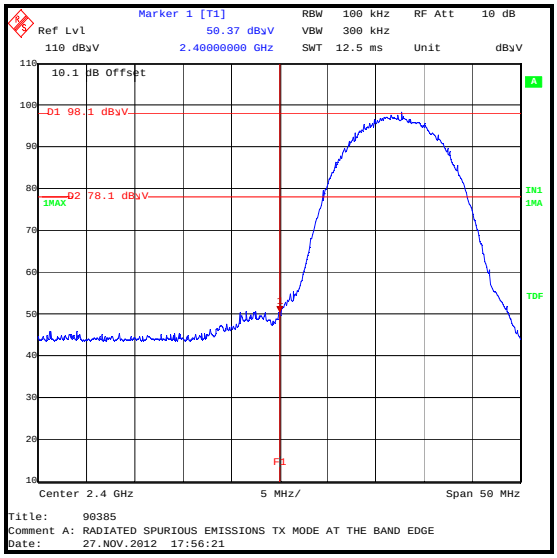
Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11b / 20 MHz / CCK / 11 Mbps

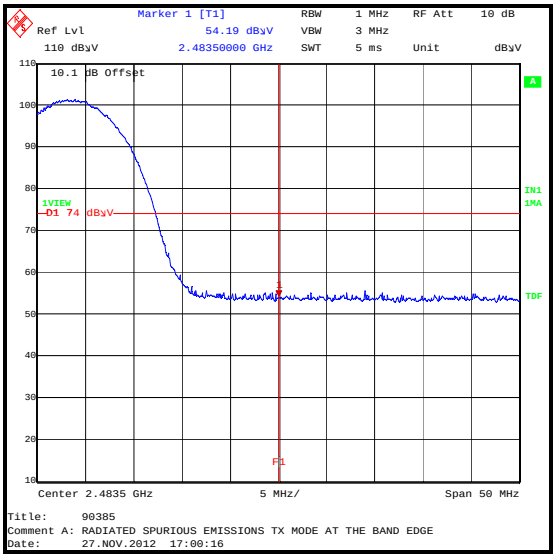
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	50.4	78.1*	27.7	Complied
2483.5	54.2	74.0	19.8	Complied

Results: Average / 802.11b / 20 MHz / CCK / 11 Mbps

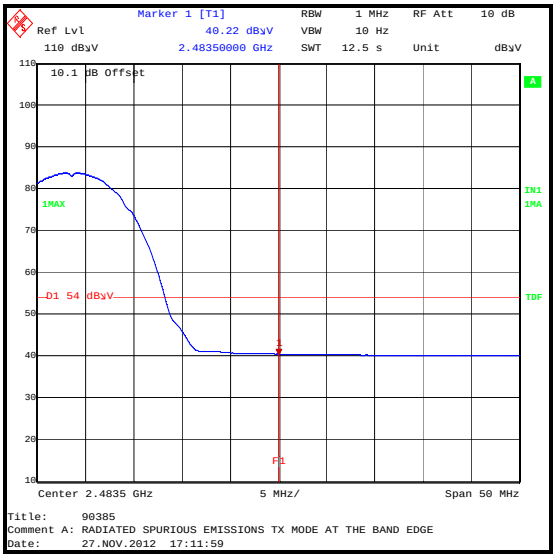
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.2	54.0	13.8	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

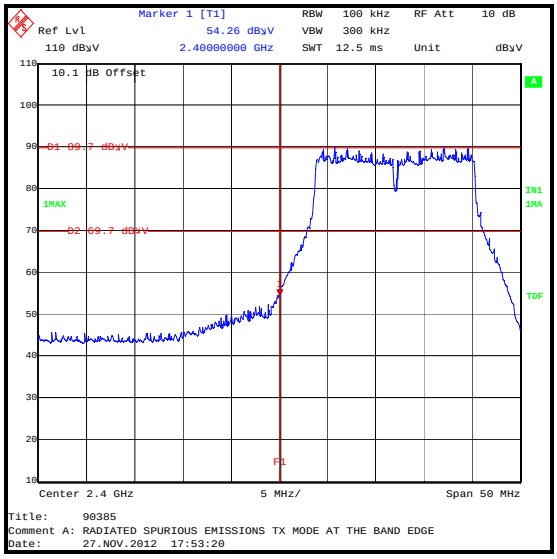
Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11g / 20 MHz / 16QAM / 36 Mbps

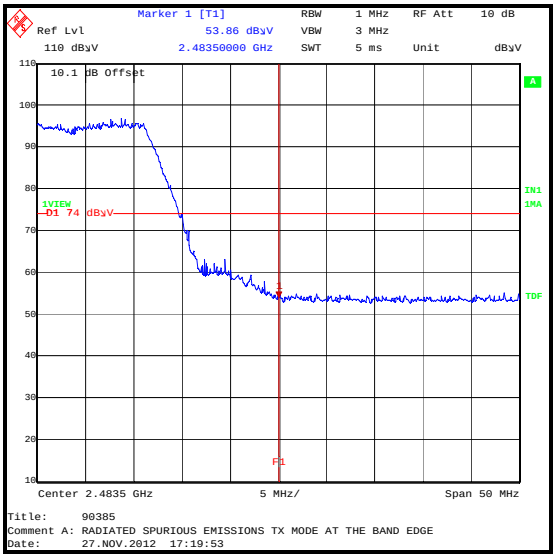
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	54.3	69.7*	15.4	Complied
2483.5	53.9	74.0	20.1	Complied

Results: Average / 802.11g / 20 MHz / 16QAM / 36 Mbps

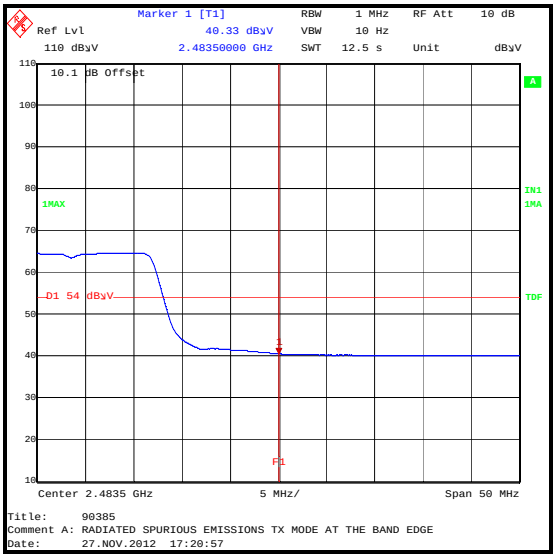
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.3	54.0	13.7	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

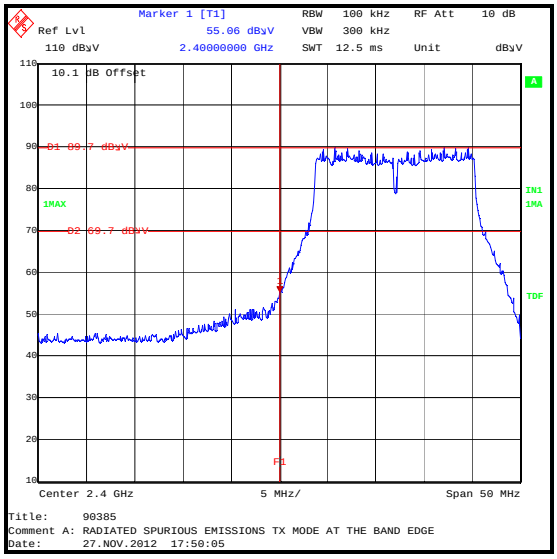
Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11g / 20 MHz / 64QAM / 54 Mbps

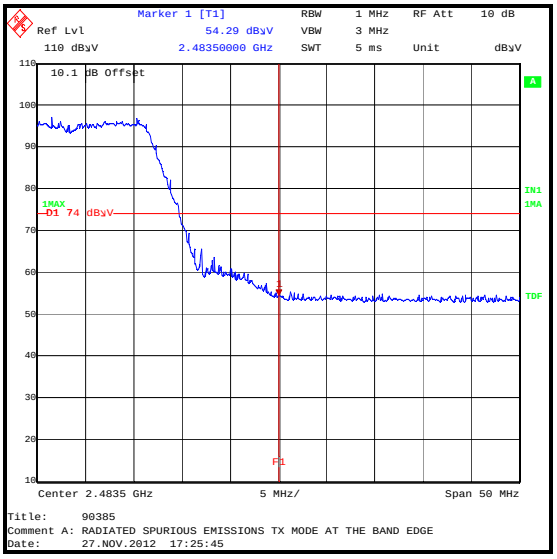
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	55.1	69.7*	14.6	Complied
2483.5	54.3	74.0	19.7	Complied

Results: Average / 802.11g / 20 MHz / 64QAM / 54 Mbps

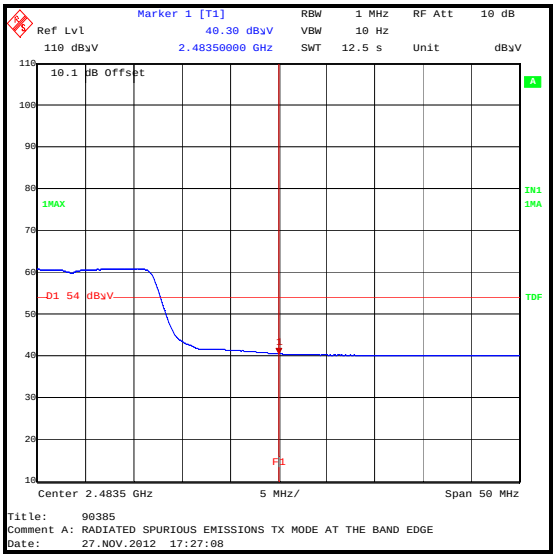
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.3	54.0	13.7	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

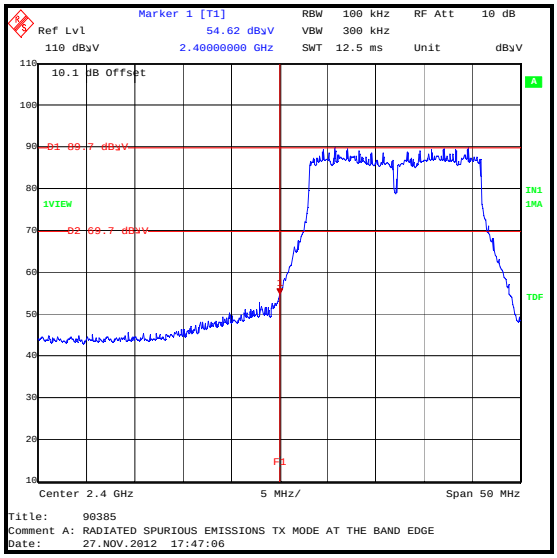
Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6

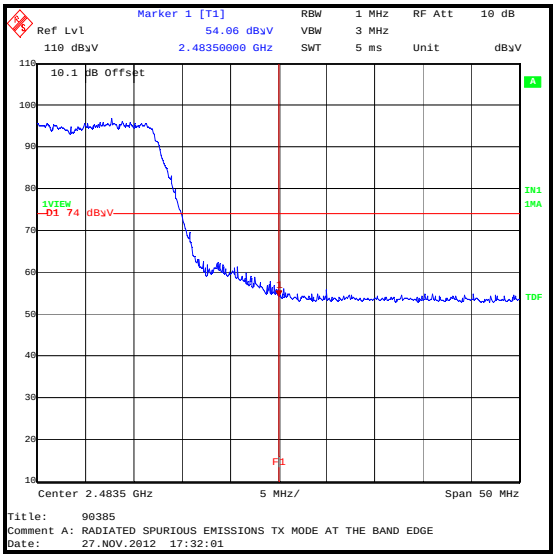
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	54.6	69.7*	15.1	Complied
2483.5	54.1	74.0	19.9	Complied

Results: Average / 802.11n / 20 MHz / 64QAM / 58.5 Mbps / MCS6

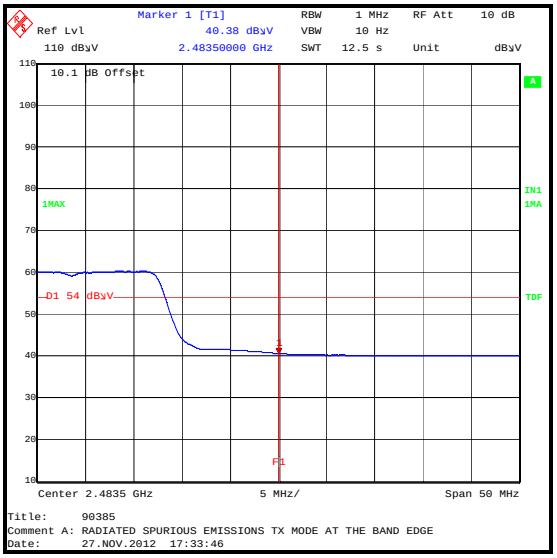
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.4	54.0	13.6	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

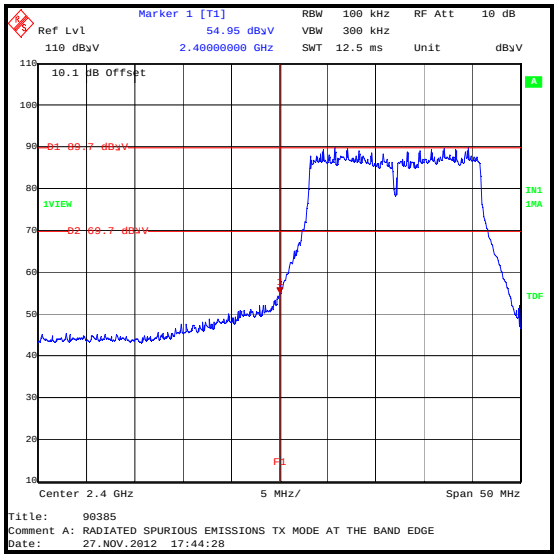
Transmitter Band Edge Radiated Emissions (continued)

Results: Peak / 802.11n / 20 MHz / 64QAM / 65 Mbps / MCS7

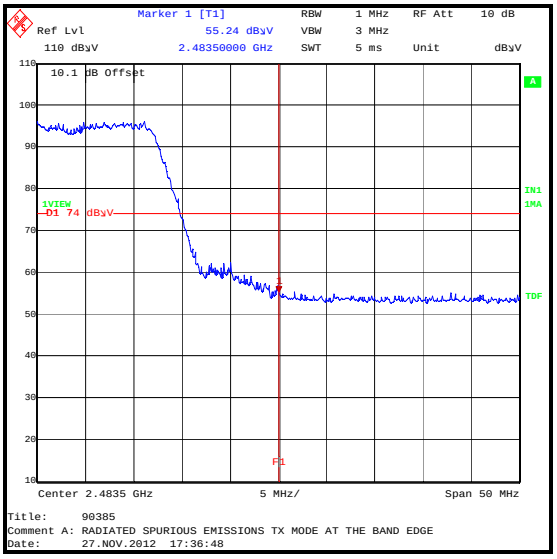
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2400	55.0	69.7*	14.7	Complied
2483.5	55.2	74.0	18.8	Complied

Results: Average / 802.11n / 20 MHz / 64QAM / 65 Mbps / MCS7

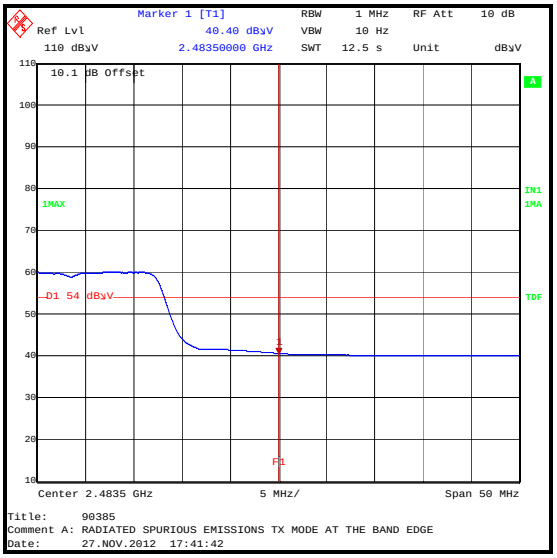
Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2483.5	40.4	54.0	13.6	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1818	Antenna	EMCO	3115	00075692	04 Nov 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12
K0002	3m RSE Chamber	Rainford	N/A	N/A	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%	±3.25 dB
Conducted Maximum Peak Output Power	2.4 GHz to 2.4835 GHz	95%	±0.28 dB
Spectral Power Density	2.4 GHz to 2.4835 GHz	95%	±0.28 dB
6 dB Bandwidth	2.4 GHz to 2.4835 GHz	95%	±0.92 ppm
Radiated Spurious Emissions	30 MHz 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