TEST REPORT

Test Report No. : UL-RPT-RP92315JD09A

Manufacturer	:	Panasonic Mobile Communications Development of Europe Ltd
Model No.	:	NTT docomo P-03E
FCC ID	:	UCE313058A
Technology	:	WLAN
Test Standard(s)	:	FCC Parts 15.107(a), 15.109, 15.207, 15.209(a), 15.403(i) & 15.407

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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: 15 April 2013

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ilac-MRA UKAS TESTING 0644

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

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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:	47CFR15.407 and 47CFR15.403
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2012: Part 15 Subpart E (Unlicensed National Information Infrastructure Devices) – Sections 15.403 and 15.407
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:	209735
Location of Testing:	RFI Global Services Ltd trading as UL, Wade Road, Basingstoke, Hampshire, RG24 8AH
Test Dates:	26 March 2013 to 10 April 2013

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.107(a)	Receiver/Idle Mode AC Conducted Emissions	✓
Part 15.109	Receiver/Idle Mode Radiated Spurious Emissions	✓
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.403(i)	Transmitter 26 dB Emission Bandwidth	✓
Part 15.35(c)	Transmitter Duty Cycle	Note 1
Part 15.407(a)(1)	Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band)	✓
Part 15.407(a)(2)	Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands)	✓
Part 15.407(a)(1)	Transmitter Peak Power Spectral Density (5.15-5.25 GHz band)	✓
Part 15.407(a)(2)	Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands)	✓
Part 15.407(a)(6)	Transmitter Peak Excursion	✓
Part 15.407(b)/ 15.209(a)	Transmitter Out of Band Radiated Emissions	✓
Part 15.407(b)/ 15.209(a)	Transmitter Band Edge Radiated Emissions	✓
Part 15.407(g)	Transmitter Frequency Stability (Temperature & Voltage Variation)	Note 2
Part 15.407(h)(1)	Transmitter Power Control	Note 3

Key to Results

✓ = Complied ✗ = Did not comply

Note(s):

1. The measurement was performed to assist in the calculation of the level of average output power, peak power spectral density, peak excursion and emissions as the EUT employs pulsed operation.
2. Frequency stability is better than 20 ppm which ensures that the signal remains in the allocated bands under all operational conditions stated in the user manual.
3. Transmit Power Control was not tested as the maximum EIRP is less than 500 mW (27 dBm).

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2003)
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:	FCC KDB 789033 D01 v01r02 26/9/2012
Title:	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E

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 specifications identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	NTT docomo
Model Name or Number:	P-03E
IMEI:	355335050017244 *(Radiated sample #1)*
Hardware Version Number:	Rev B
Software Version Number:	ACPU: zoro-jb-10-0371 CCPU: 161022_DCM_00.15
FCC ID:	UCE313058A

Brand Name:	NTT docomo
Model Name or Number:	P-03E
IMEI:	355335050017228 *(Radiated sample #2)*
Hardware Version Number:	Rev B
Software Version Number:	ACPU: zoro-jb-10-0371 CCPU: 161022_DCM_00.15
FCC ID:	UCE313058A

Brand Name:	NTT docomo
Model Name or Number:	P-03E
IMEI:	355335050017236 *(Radiated sample #3)*
Hardware Version Number:	Rev B
Software Version Number:	ACPU: zoro-jb-10-0371 CCPU: 161022_DCM_00.15
FCC ID:	UCE313058A

Brand Name:	NTT docomo
Model Name or Number:	P-03E
Serial Number:	355335050017095 *(Conducted RF port sample)*
Hardware Version Number:	Rev B
Software Version Number:	ACPU: zoro-jb-10-0371 CCPU: 161022_DCM_00.15
FCC ID:	UCE313058A

Brand Name:	NTT docomo
Description:	AC Charger
Model Name or Number:	AC04

Identification of Equipment Under Test (EUT) (continued)

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.

The EUT supports DFS as a Client without Radar Detection.

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:	IEEE 802.11		
Type of Unit:	Transceiver		
Modulation:	BPSK, QPSK, 16QAM, 64QAM		
Data rates:	802.11a	6, 9, 12, 18, 24, 36 ,48 & 54 Mbps	
	802.11n HT20	MCS0 to MCS7 (1 spatial stream) GI = 800 ns or 400 ns Greenfield & Mixed modes	
	802.11n HT40	MCS0 to MCS7 (1 spatial stream) GI = 800 ns or 400 ns Greenfield & Mixed modes	
Power Supply Requirement(s):	Nominal	3.8 VDC via 120 VAC 60 Hz adaptor	
Antenna Gains:	5.15 to 5.35 GHz	-2.5 dBi	
	5.47 to 5.725 GHz	-2.5 dBi	
Maximum Conducted Output Power:	7.1 dBm		
Channel Spacing:	20 MHz		
Transmit & Receive Frequency Band:	5150 MHz to 5250 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	36	5180
	Middle	40	5200
	Top	48	5240
Transmit & Receive Frequency Band:	5250 MHz to 5350 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	52	5260
	Middle	56	5280
	Top	64	5320
Transmit & Receive Frequency Band:	5470 MHz to 5725 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	100	5500
	Middle	116	5580
	Top	140	5700

Additional Information Related to Testing (continued)

Channel Spacing:	40 MHz		
Transmit & Receive Frequency Band:	5150 MHz to 5250 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	38	5190
	Top	46	5230
Transmit & Receive Frequency Band:	5250 MHz to 5350 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	54	5270
	Top	62	5310
Transmit & Receive Frequency Band:	5470 MHz to 5725 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	102	5510
	Middle	118	5590
	Top	134	5670

3.5. Support Equipment

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

Description:	Laptop
Brand Name:	Panasonic
Model Name or Number:	CF74
Serial Number:	CF-74C3BBDE (MCUK 7397)

Description:	2 GB Micro SD Card
Brand Name:	Not marked or stated
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. The 802.11 mode was active but not transmitting.
- 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 modes 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 and widest bandwidth for all bands were:
    - Highest power
        - 802.11a – BPSK / 6 Mbps
        - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0 (Greenfield mode)
        - 802.11n HT40 – QPSK / 27 Mbps / MCS1 (Mixed mode)
    - Widest bandwidth
        - 802.11a – BPSK / 6 Mbps
        - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0 (Mixed mode)
        - 802.11n HT40 – BPSK / 13.5 Mbps / MCS0 (Greenfield mode)
- Idle and transmitter radiated spurious emissions tests were performed with the PHF and AC charger 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.
- Transmitter spurious emissions were performed with the EUT transmitting with a data rate of 6.5 Mbps / MCS0 / Greenfield mode, as this was found to have the highest power level and therefore deemed to be worst case.
- The conducted sample with IMEI 355335050017095 was used for 26 dB bandwidth, maximum output power, peak power spectral density and peak excursion tests.
- The radiated sample with IMEI 355335050017244 was used for receiver radiated spurious emissions above 1 GHz tests.
- The radiated sample with IMEI 355335050017236 was used for receiver radiated spurious emissions below 1 GHz, transmitter AC conducted emissions and transmitter out of band radiated emissions below 1 GHz tests.
- The radiated sample with IMEI 355335050017228 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:	Nick Steele	**Test Date:**	29 March 2013
Test Sample IMEI:	355335050017228		

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):	20
Relative Humidity (%):	30

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.155	Live	51.0	65.8	14.8	Complied
0.231	Live	46.2	62.4	16.2	Complied
0.398	Live	39.5	57.9	18.4	Complied
1.622	Live	39.5	56.0	16.5	Complied
1.856	Live	38.8	56.0	17.2	Complied
1.964	Live	39.7	56.0	16.3	Complied
2.252	Live	37.4	56.0	18.6	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
2.022	Live	28.2	46.0	17.8	Complied
2.594	Live	29.2	46.0	16.8	Complied
15.351	Live	30.0	50.0	20.0	Complied
15.414	Live	30.9	50.0	19.1	Complied
15.747	Live	32.6	50.0	17.4	Complied
15.842	Live	34.8	50.0	15.2	Complied
15.945	Live	30.0	50.0	20.0	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)

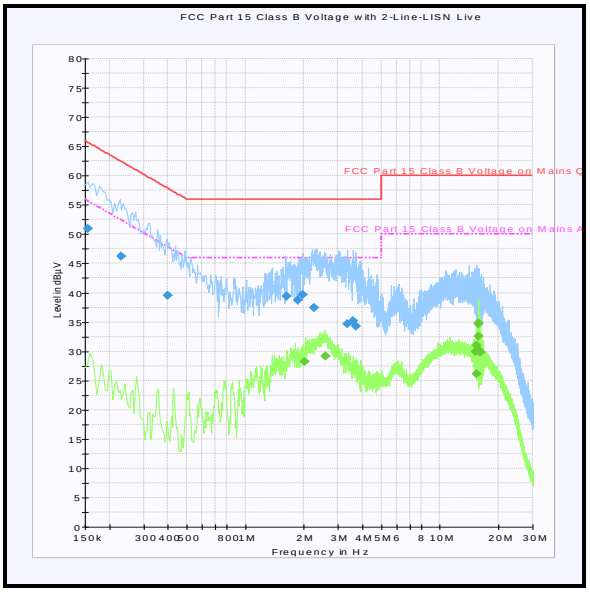
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.155	Neutral	57.3	65.8	8.5	Complied
0.245	Neutral	52.7	61.9	9.2	Complied
0.267	Neutral	51.8	61.2	9.4	Complied
0.285	Neutral	50.8	60.7	9.9	Complied
0.303	Neutral	50.5	60.2	9.7	Complied
0.335	Neutral	48.8	59.3	10.5	Complied
0.344	Neutral	49.1	59.1	10.0	Complied
0.384	Neutral	46.5	58.2	11.7	Complied
0.411	Neutral	44.9	57.6	12.7	Complied
0.443	Neutral	45.5	57.0	11.5	Complied

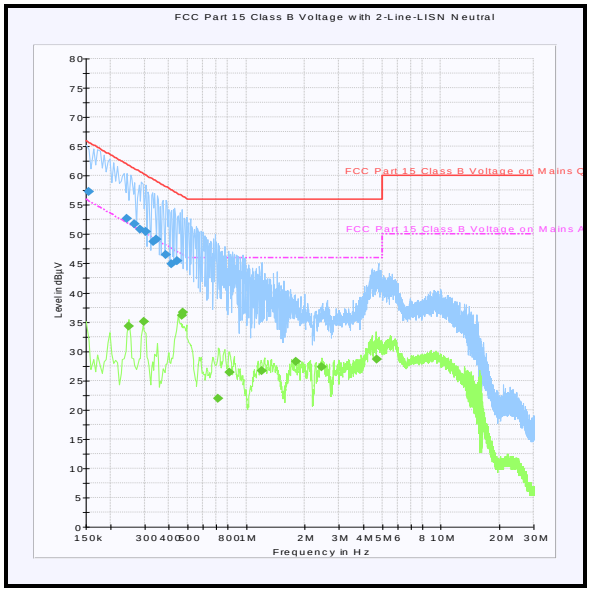
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.249	Neutral	34.3	51.8	17.5	Complied
0.299	Neutral	35.1	50.3	15.2	Complied
0.465	Neutral	36.1	46.6	10.5	Complied
0.474	Neutral	36.6	46.4	9.8	Complied
0.816	Neutral	26.4	46.0	19.6	Complied
1.199	Neutral	26.7	46.0	19.3	Complied
1.806	Neutral	28.3	46.0	17.7	Complied
2.432	Neutral	27.3	46.0	18.7	Complied
4.668	Neutral	28.7	46.0	17.3	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 Apr 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	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:	Sarah Williams	**Test Date:**	29 March 2013
Test Sample IMEI:	355335050017236		

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 (%):	26

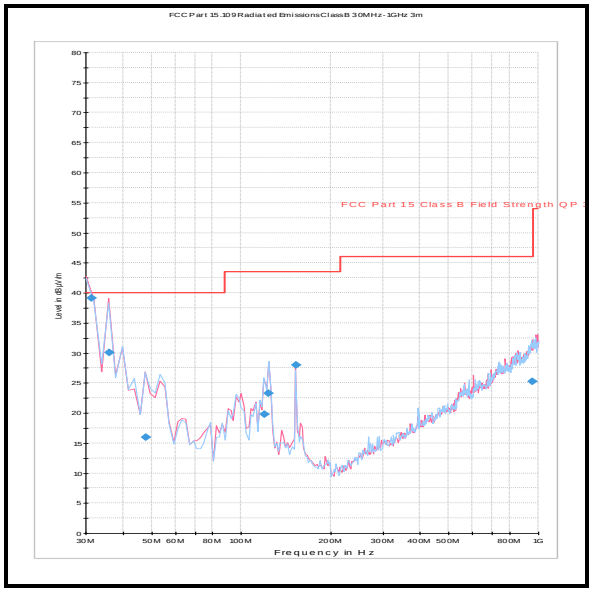
Note(s):

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
31.337	Vertical	39.1	40.0	0.9	Complied
36.096	Vertical	30.0	40.0	10.0	Complied
123.571	Horizontal	23.3	43.5	20.2	Complied
153.307	Vertical	28.0	43.5	15.5	Complied
956.200	Vertical	25.3	46.0	20.7	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)



Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table.

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1834	Attenuator	Hewlett Packard	8491B	10444	27 Jan 2014	12
A490	Antenna	Chase	CBL6111A	1590	14 May 2013	12
G0543	Amplifier	Sonoma	310N	230801	03 Apr 2013	3
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Test Summary:

Test Engineers:	Nick Steele & David Doyle	**Test Dates:**	26 March 2013 & 05 April 2013
Test Sample IMEI:	355335050017244		

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 30 GHz

Environmental Conditions:

Temperature (°C):	19 to 23
Relative Humidity (%):	29 to 30

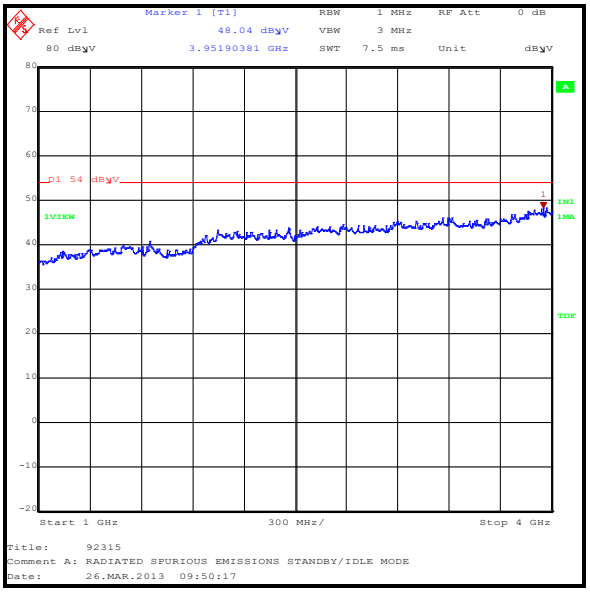
Note(s):

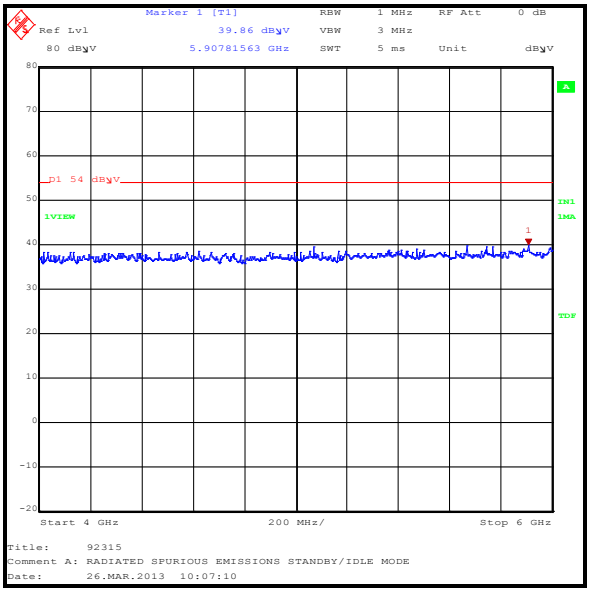
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded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

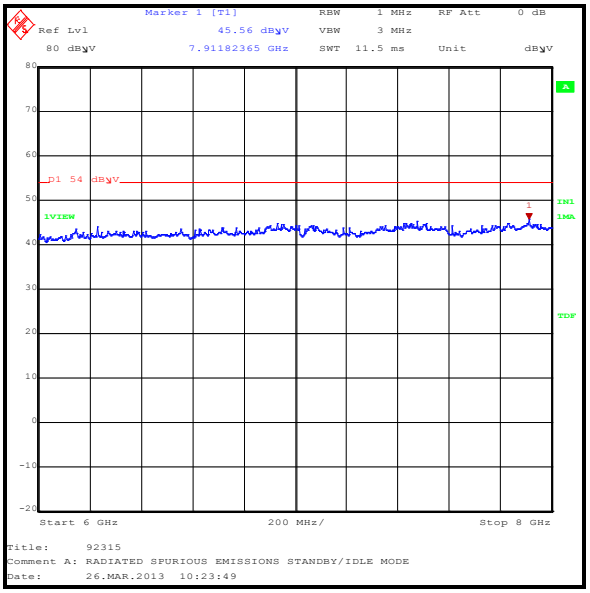
Results:

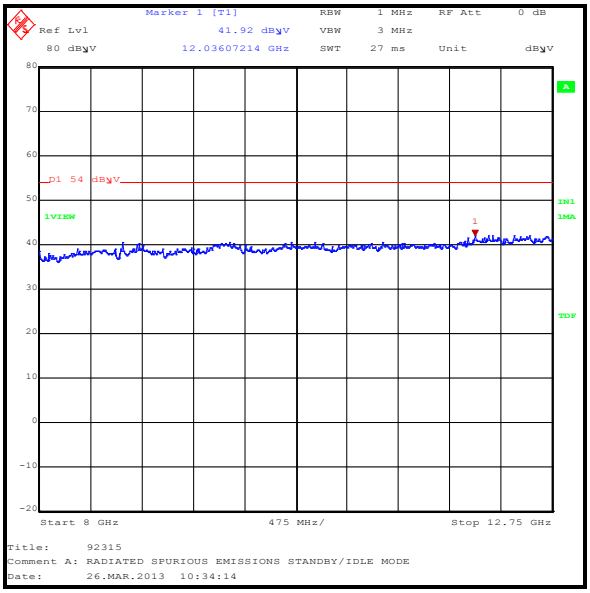
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
16979.459	Vertical	50.6	54.0	3.4	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)

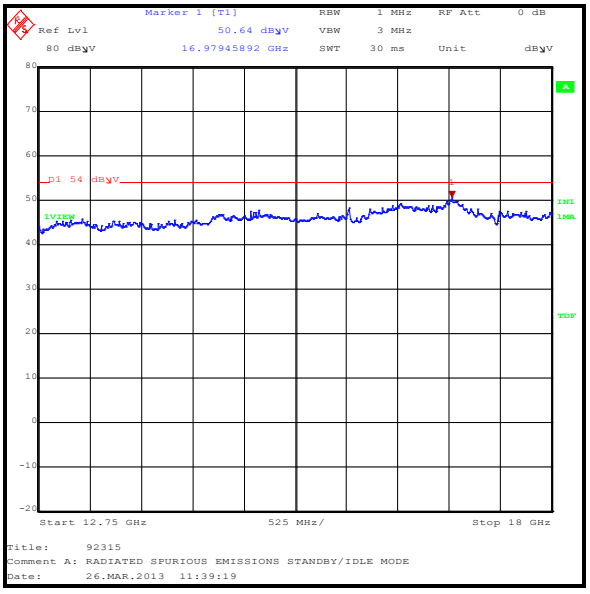


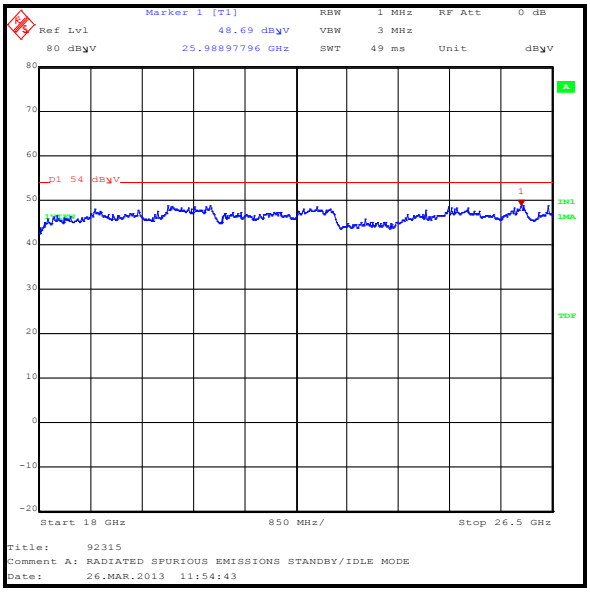


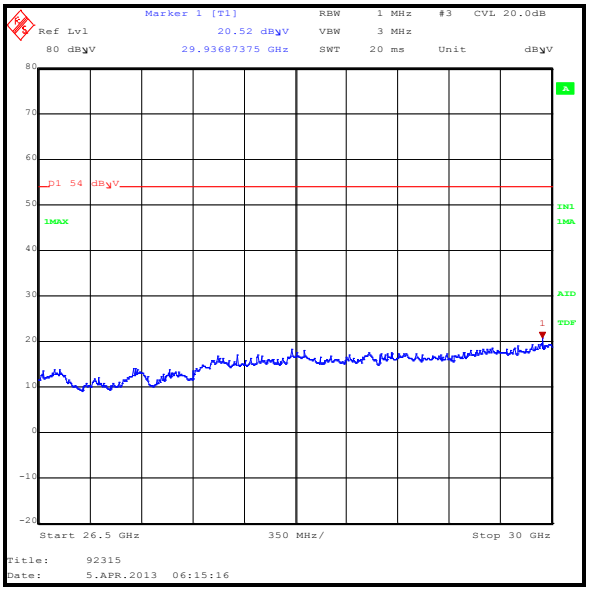




Receiver/Idle Mode Radiated Spurious Emissions (continued)







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	N/A	N/A	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	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
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann Microwave	20240-20	330	04 Nov 2013	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated before use	-
A366	Isolator	MRI	FRR-400	169	Calibrated before use	-
A203	Antenna	Flann Microwave	22240-20	343	11 May 2013	36
A1785	Pre-Amplifier	Farran Technology	FLNA-28-30	FTL 6483	Calibrated before use	-

5.2.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Patrick Jones	**Test Date:**	09 April 2013
Test Sample IMEI:	355335050017236		

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):	24
Relative Humidity (%):	33

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Live	60.5	66.0	5.5	Complied
0.155	Live	59.7	65.8	6.1	Complied
0.164	Live	59.6	65.3	5.7	Complied
0.177	Live	59.1	64.6	5.5	Complied
0.191	Live	58.1	64.0	5.9	Complied
0.200	Live	57.6	63.6	6.0	Complied
0.236	Live	56.2	62.3	6.1	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
1.208	Live	28.3	46.0	17.7	Complied
1.959	Live	23.3	46.0	22.7	Complied
2.846	Live	26.4	46.0	19.6	Complied
3.714	Live	27.7	46.0	18.3	Complied
4.092	Live	26.6	46.0	19.4	Complied
6.554	Live	31.7	50.0	18.3	Complied
15.743	Live	26.2	50.0	23.8	Complied

Transmitter AC Conducted Spurious Emissions (continued)

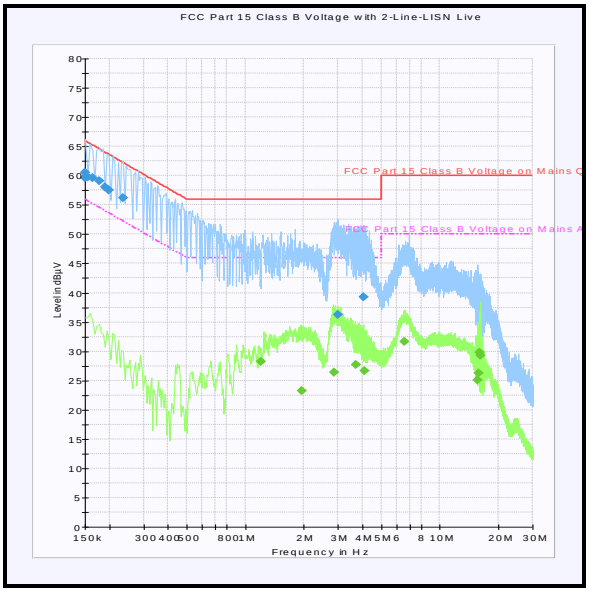
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Neutral	63.7	66.0	2.3	Complied
0.164	Neutral	63.2	65.3	2.1	Complied
0.191	Neutral	61.7	64.0	2.3	Complied
0.236	Neutral	59.7	62.3	2.6	Complied
0.285	Neutral	58.0	60.7	2.7	Complied
0.317	Neutral	56.2	59.8	3.6	Complied
0.330	Neutral	55.7	59.5	3.8	Complied

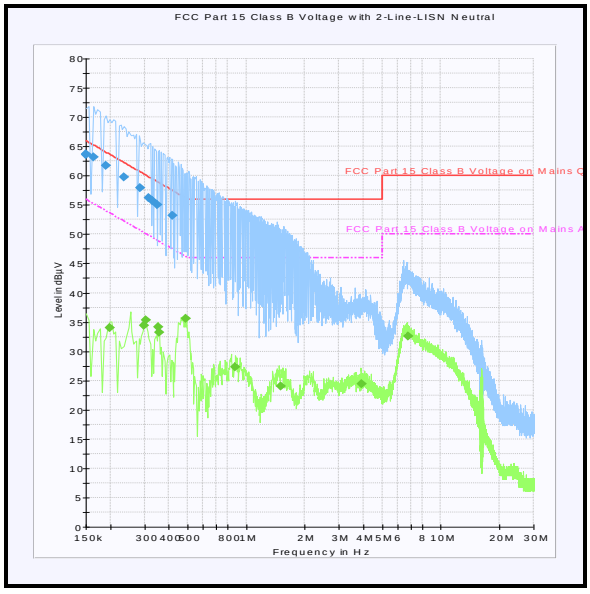
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.200	Neutral	34.0	53.6	19.6	Complied
0.299	Neutral	34.4	50.3	15.9	Complied
0.303	Neutral	35.3	50.2	14.9	Complied
0.353	Neutral	34.1	48.9	14.8	Complied
0.357	Neutral	33.3	48.8	15.5	Complied
0.488	Neutral	35.6	46.2	10.6	Complied
0.879	Neutral	27.4	46.0	18.6	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 Apr 2013	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	19 Feb 2014	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	09 Aug 2013	12

5.2.4. Transmitter 26 dB Emission Bandwidth

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	05 April 2013
Test Sample IMEI:	355335050017095		

FCC Reference:	Part 15.403(i)
Test Method Used:	FCC KDB 789033 Section D)

Environmental Conditions:

Temperatures (°C):	24
Relative Humidity (%):	26

Note(s):

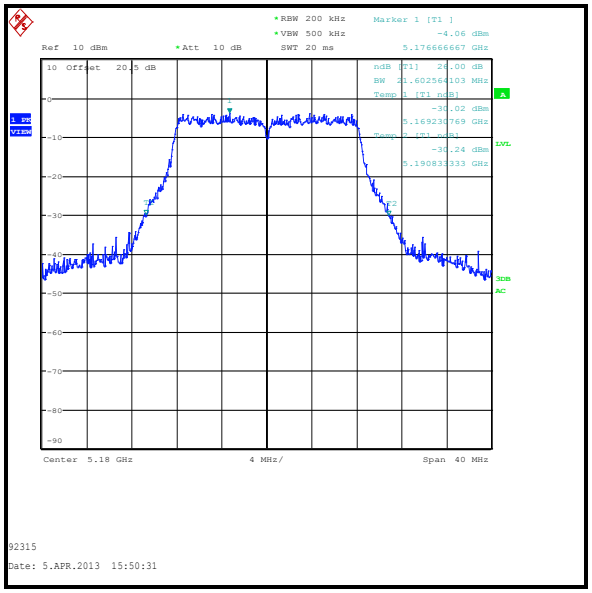
1. All configurations supported by the EUT were investigated on the top channel in accordance with KDB 789033 Section D emission bandwidth test procedure. The data rates that produced the widest bandwidth (worst case) have been reported as detailed below:
    - 802.11a – BPSK / 6 Mbps
    - 802.11n HT20 - BPSK / 6.5 Mbps / MCS0 (Mixed mode)
    - 802.11n HT40 – BPSK / 13.5 Mbps / MCS0 (Greenfield mode)
2. Final measurements were performed in each supported operating band using the above configurations on the bottom, middle and top channels.
3. For the power measurements in this report, the highest power output level was recorded when the EUT was configured as:
    - 802.11a – BPSK / 6 Mbps
    - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0 (Greenfield mode)
    - 802.11n HT40 – QPSK / 27 Mbps / MCS1 (Mixed mode)

    For 802.11n, emission bandwidth plots in these configurations have been included as ‘Reference plots’ at the end of this Section and the results used for calculations in Section 5.2.6.

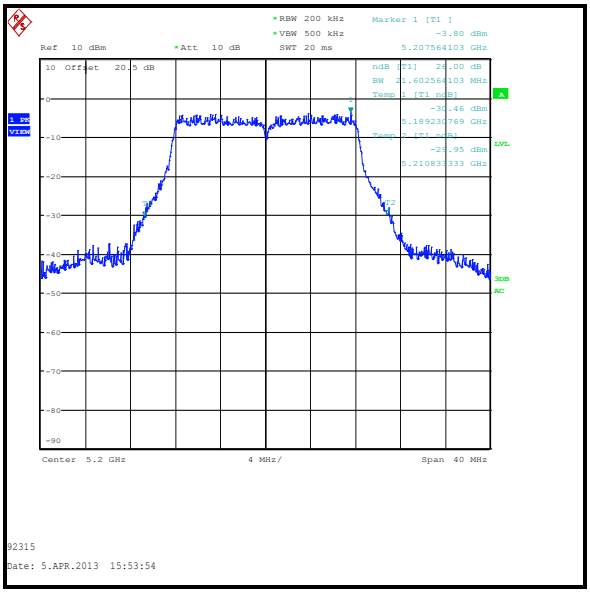
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11a / 20 MHz / 5.15-5.25 GHz band

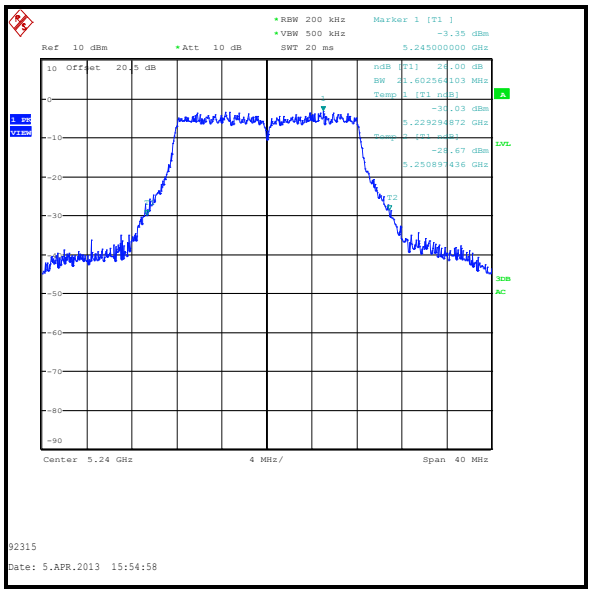
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5180	BPSK	6	21.603
Middle	5200	BPSK	6	21.603
Top	5240	BPSK	6	21.603



Bottom Channel



Middle Channel

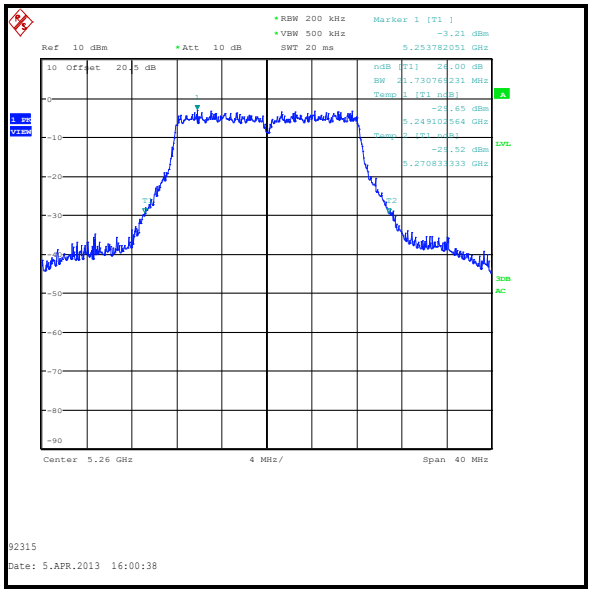


Top Channel

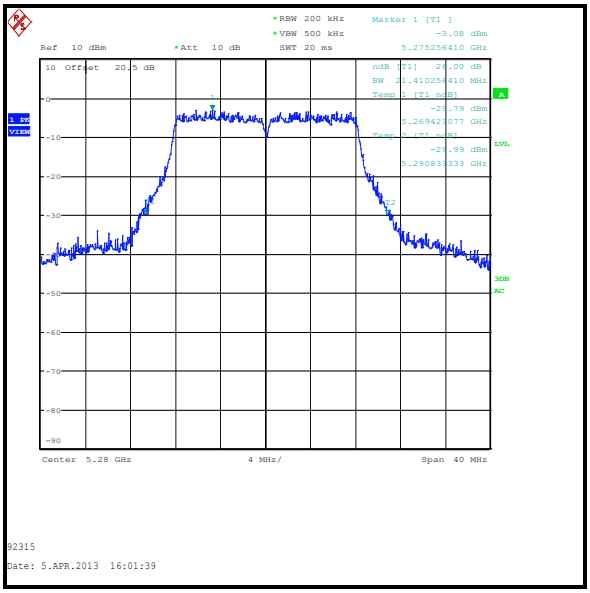
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11a / 20 MHz / 5.25-5.35 GHz band

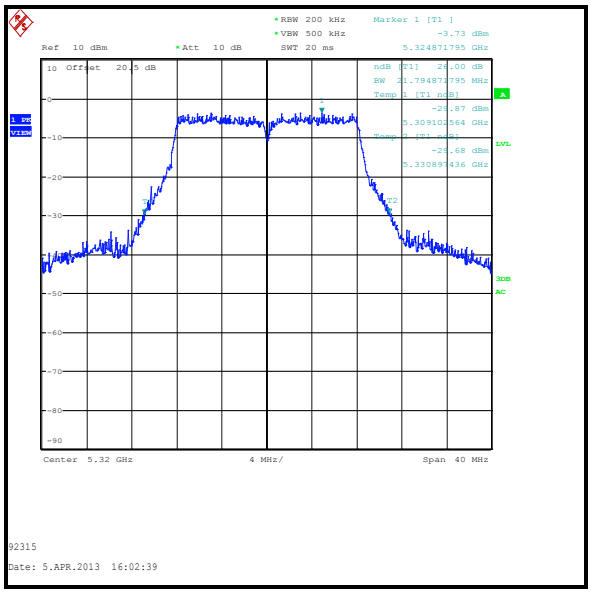
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5260	BPSK	6	21.731
Middle	5280	BPSK	6	21.410
Top	5320	BPSK	6	21.795



Bottom Channel



Middle Channel

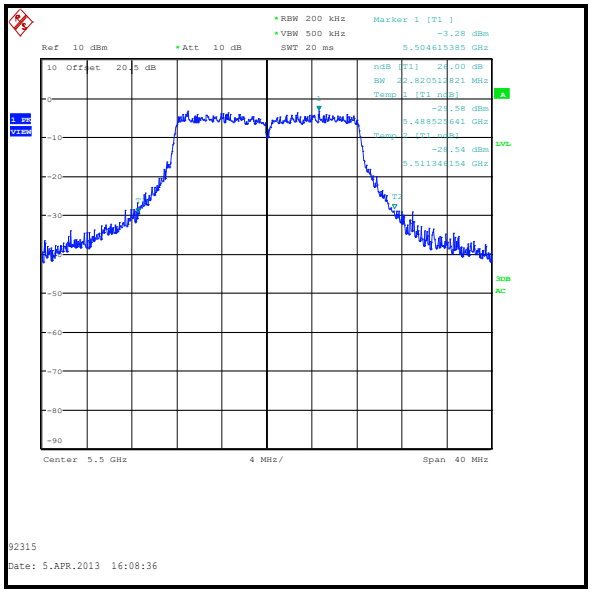


Top Channel

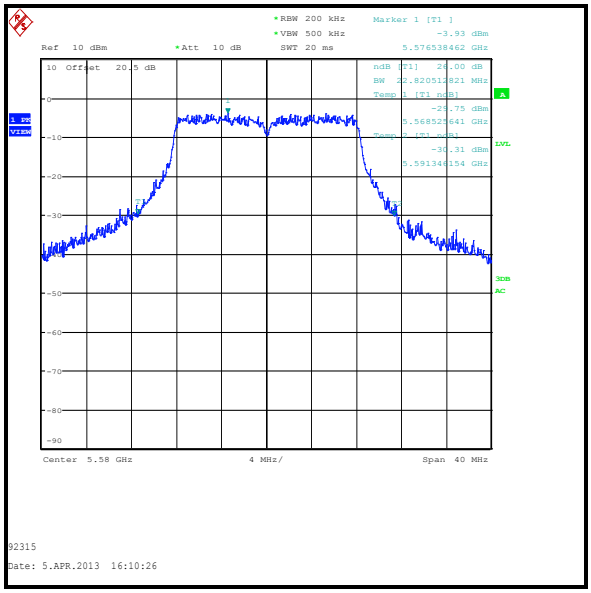
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11a / 20 MHz / 5.47-5.725 GHz band

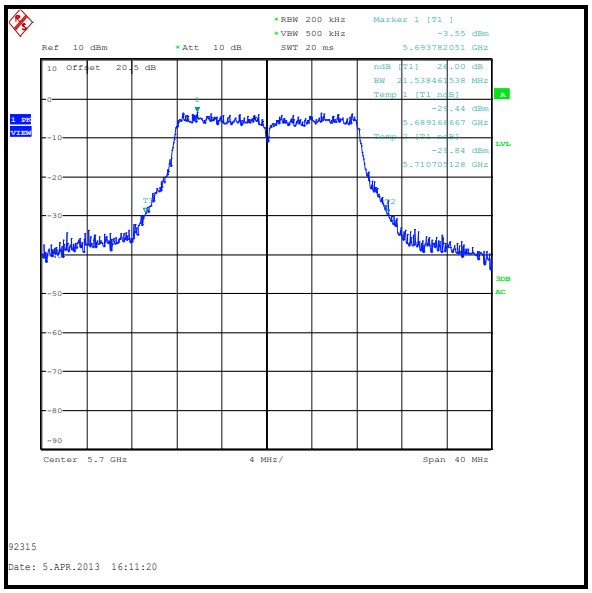
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5500	BPSK	6	22.821
Middle	5580	BPSK	6	22.821
Top	5700	BPSK	6	21.538



Bottom Channel



Middle Channel

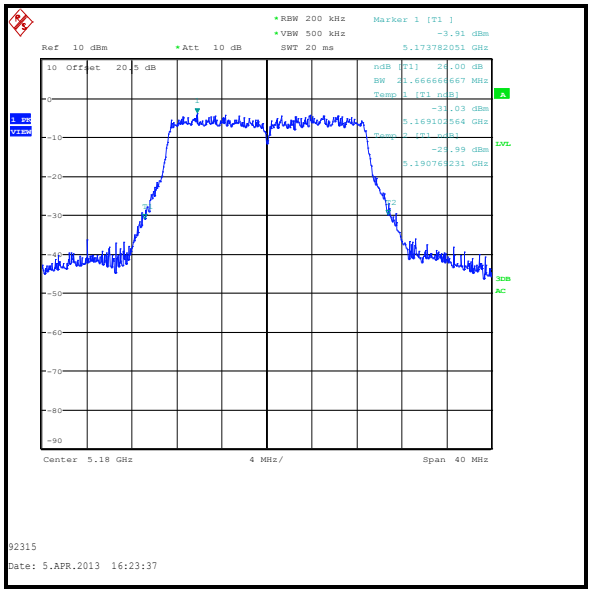


Top Channel

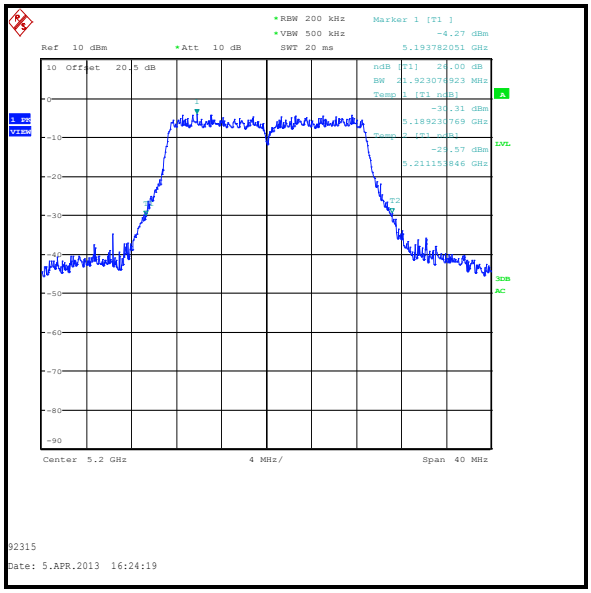
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / 5.15-5.25 GHz band

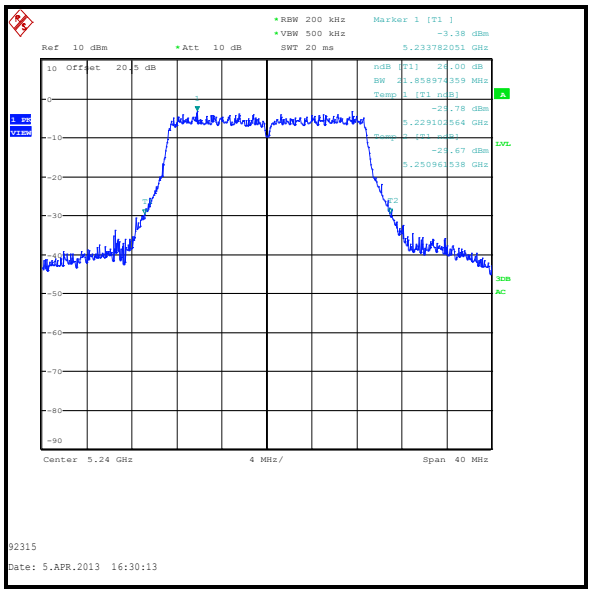
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5180	BPSK	6.5 / MCS0	21.667
Middle	5200	BPSK	6.5 / MCS0	21.923
Top	5240	BPSK	6.5 / MCS0	21.859



Bottom Channel



Middle Channel

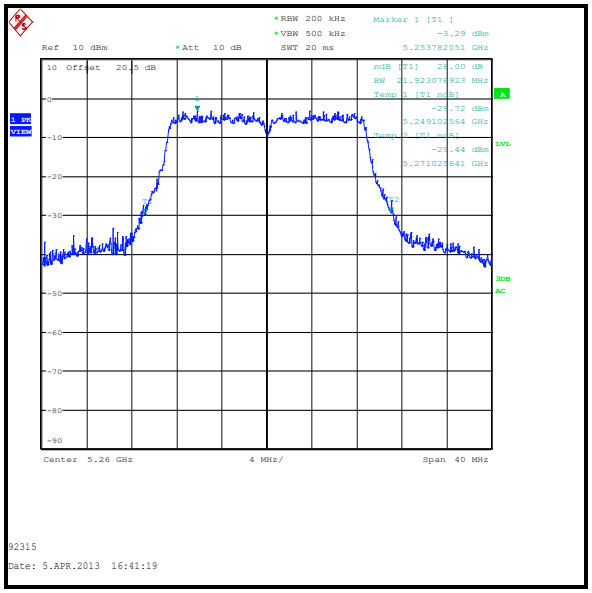


Top Channel

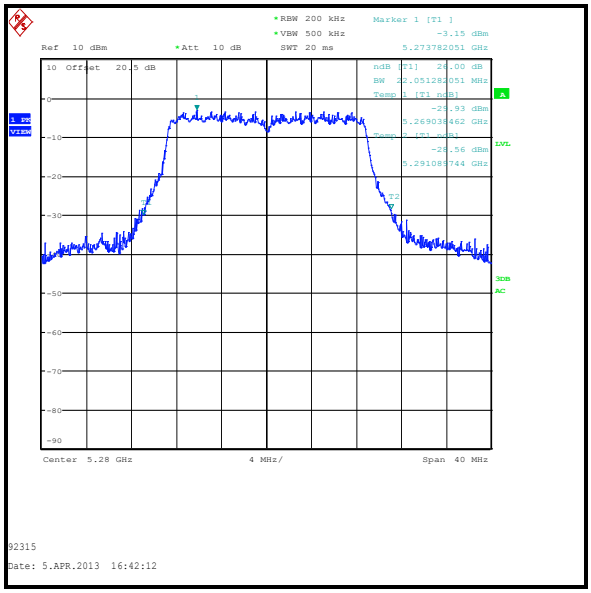
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / 5.25-5.35 GHz band

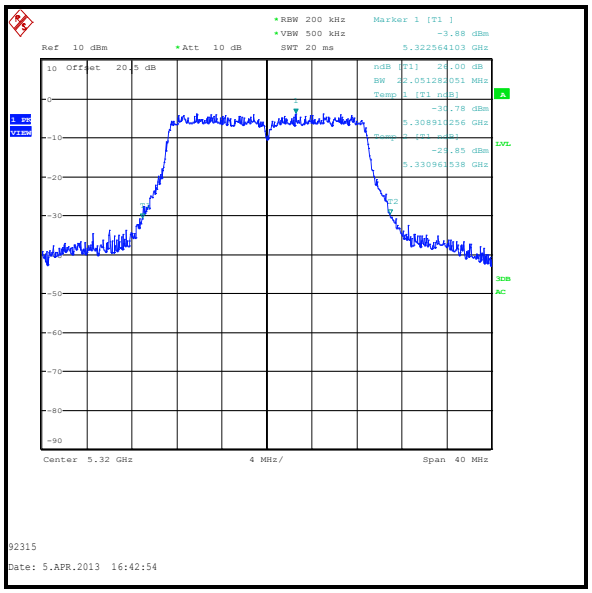
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5260	BPSK	6.5 / MCS0	21.923
Middle	5280	BPSK	6.5 / MCS0	22.051
Top	5320	BPSK	6.5 / MCS0	22.051



Bottom Channel



Middle Channel

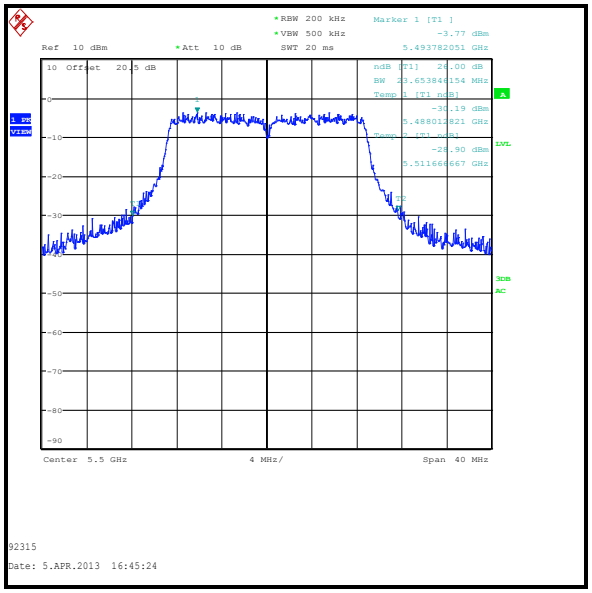


Top Channel

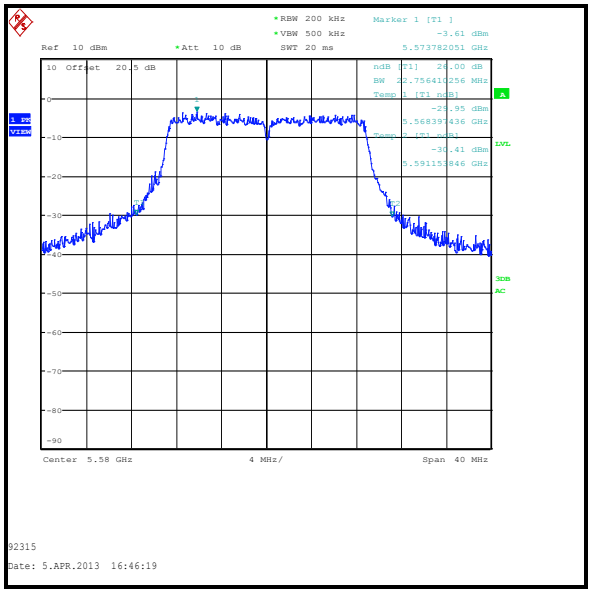
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / 5.47-5.725 GHz band

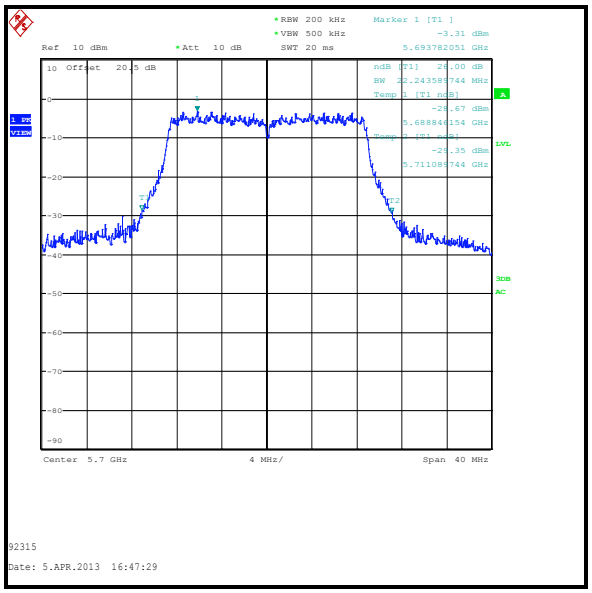
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5500	BPSK	6.5 / MCS0	23.654
Middle	5580	BPSK	6.5 / MCS0	22.756
Top	5700	BPSK	6.5 / MCS0	22.244



Bottom Channel



Middle Channel

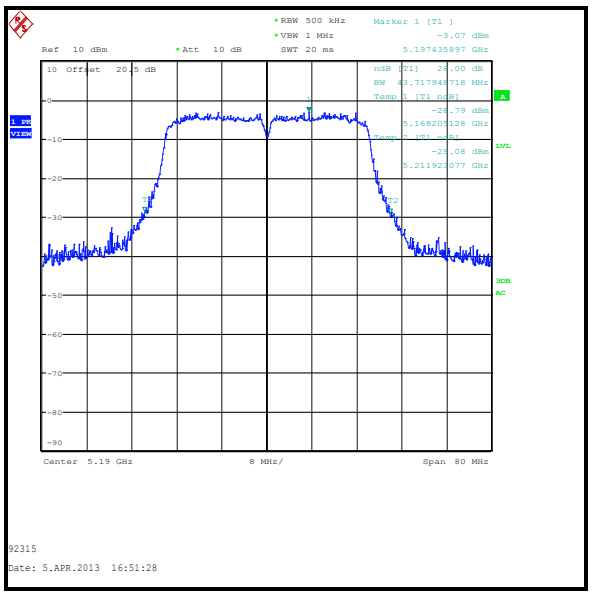


Top Channel

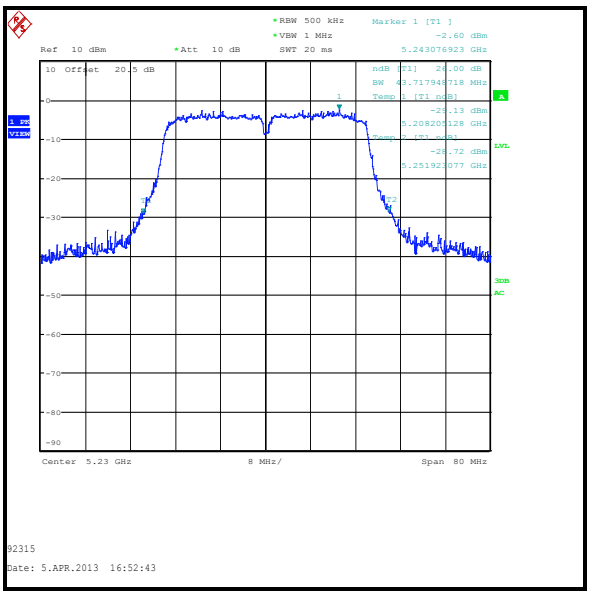
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 40 MHz / 5.15-5.25 GHz band

Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5190	BPSK	13.5 / MCS0	43.718
Top	5230	BPSK	13.5 / MCS0	43.718



Bottom Channel

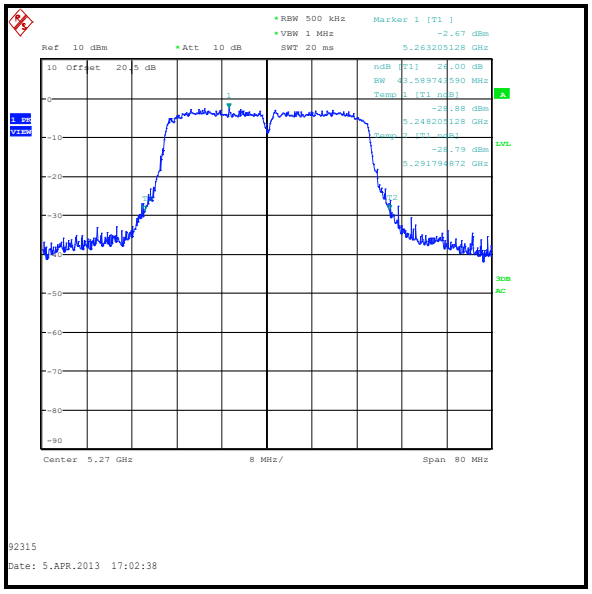


Top Channel

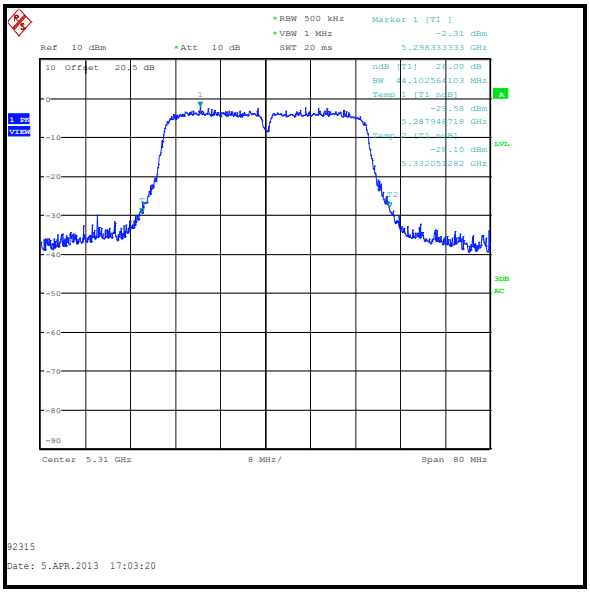
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 40 MHz / 5.25-5.35 GHz band

Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5270	BPSK	13.5 / MCS0	43.590
Top	5310	BPSK	13.5 / MCS0	44.103



Bottom Channel

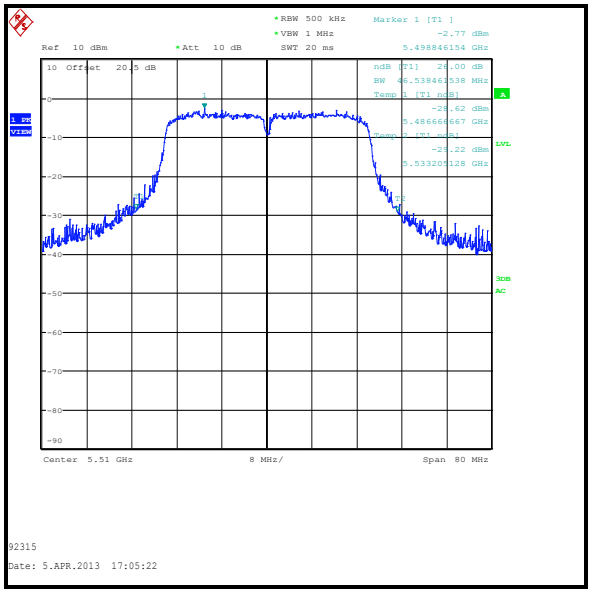


Top Channel

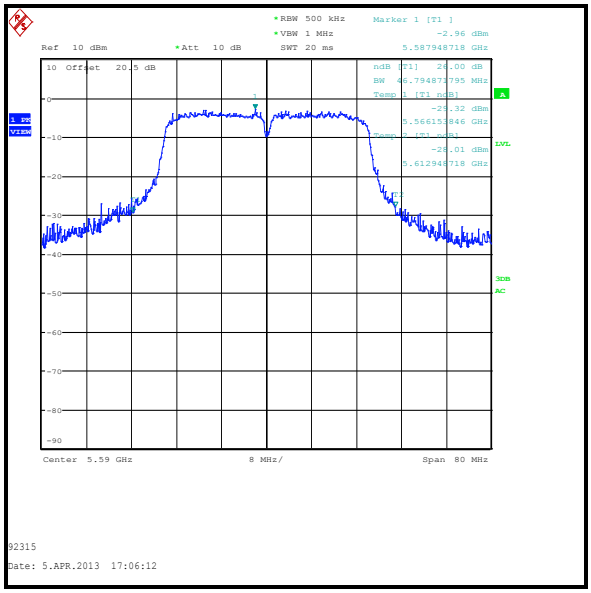
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 40 MHz / 5.47-5.725 GHz band

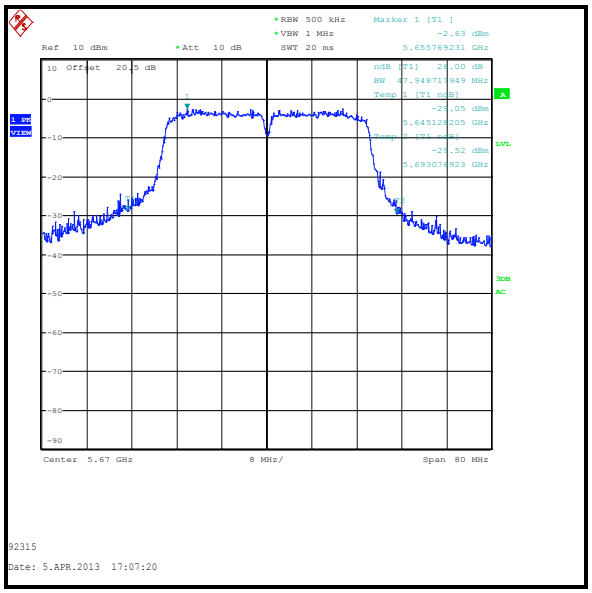
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5510	BPSK	13.5 / MCS0	46.538
Middle	5590	BPSK	13.5 / MCS0	46.795
Top	5670	BPSK	13.5 / MCS0	47.949



Bottom Channel



Middle Channel

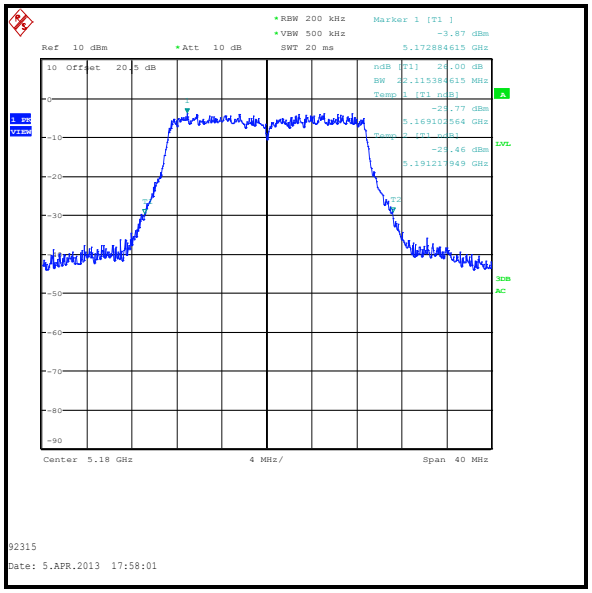


Top Channel

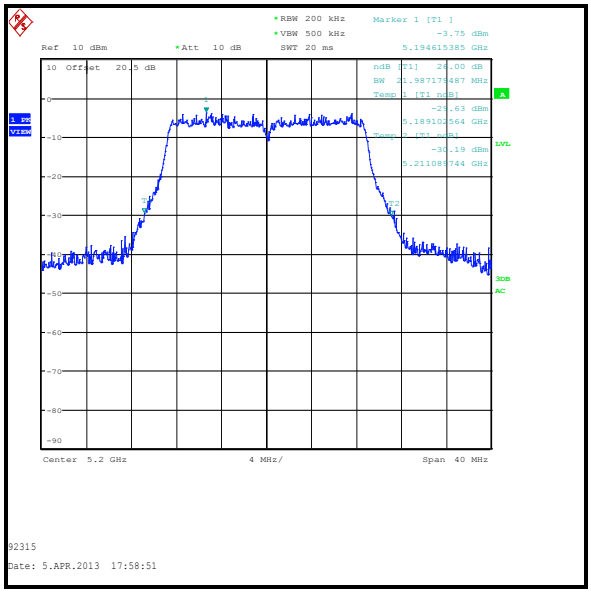
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / 5.15-5.25 GHz band (Reference plots)

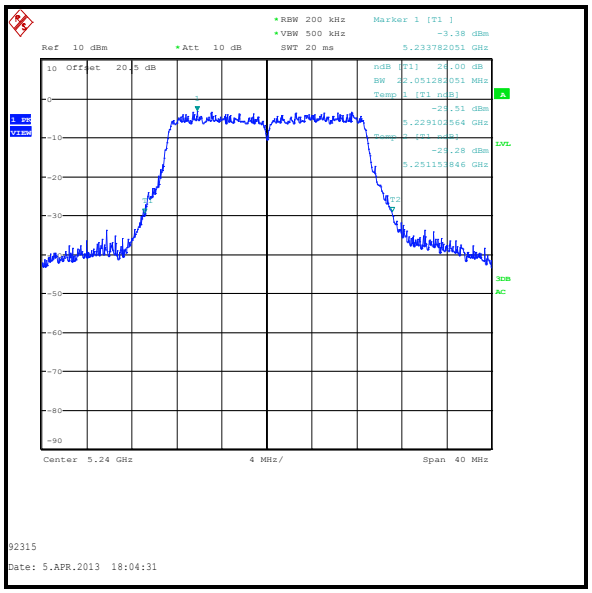
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5180	BPSK	6.5 / MCS0	22.115
Middle	5200	BPSK	6.5 / MCS0	21.987
Top	5240	BPSK	6.5 / MCS0	22.051



Bottom Channel



Middle Channel

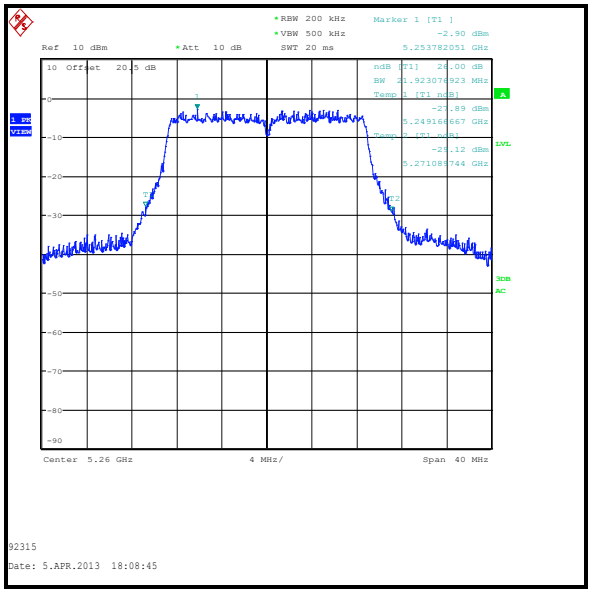


Top Channel

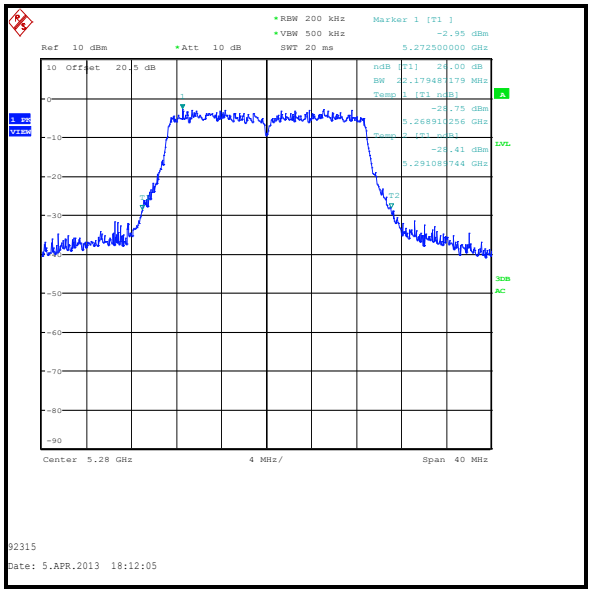
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / 5.25-5.35 GHz band (Reference plots)

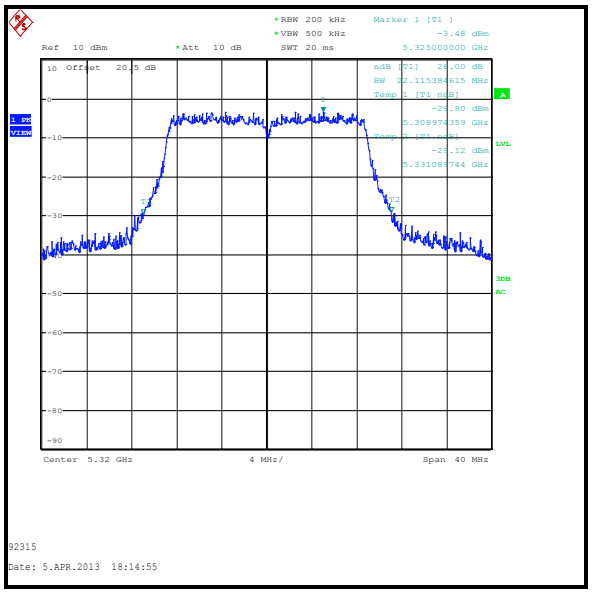
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5260	BPSK	6.5 / MCS0	21.923
Middle	5280	BPSK	6.5 / MCS0	21.179
Top	5320	BPSK	6.5 / MCS0	22.115



Bottom Channel



Middle Channel

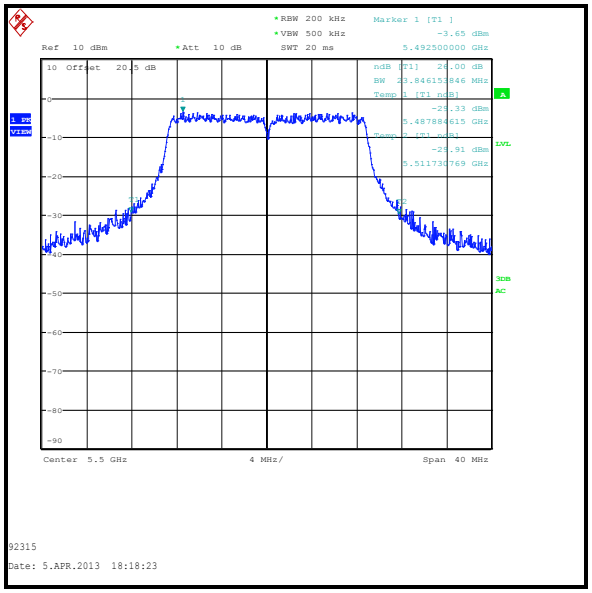


Top Channel

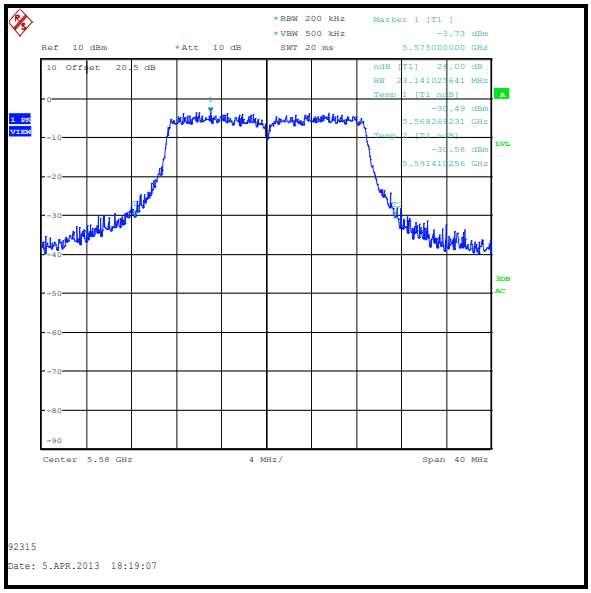
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / 5.47-5.725 GHz band (Reference plots)

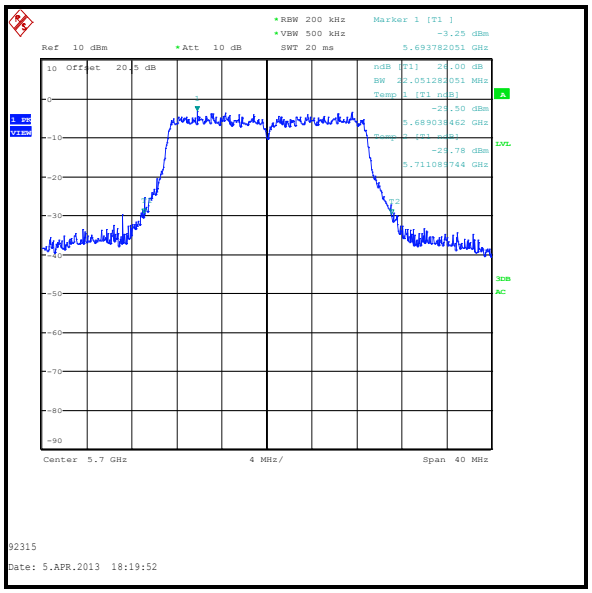
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5500	BPSK	6.5 / MCS0	23.846
Middle	5580	BPSK	6.5 / MCS0	23.141
Top	5700	BPSK	6.5 / MCS0	22.051



Bottom Channel



Middle Channel

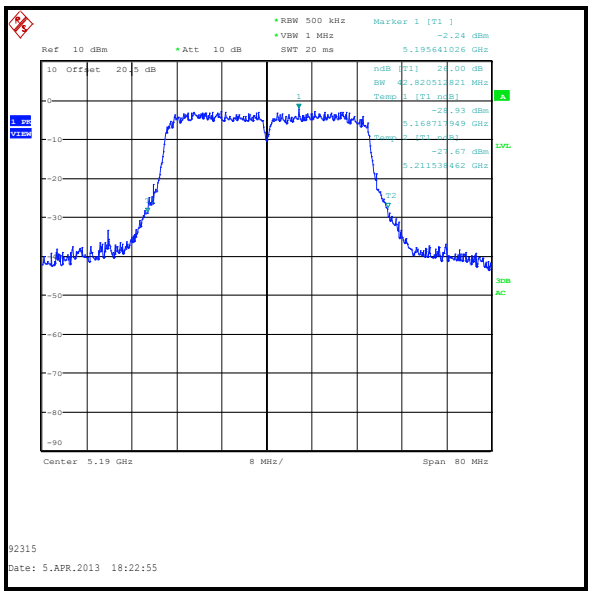


Top Channel

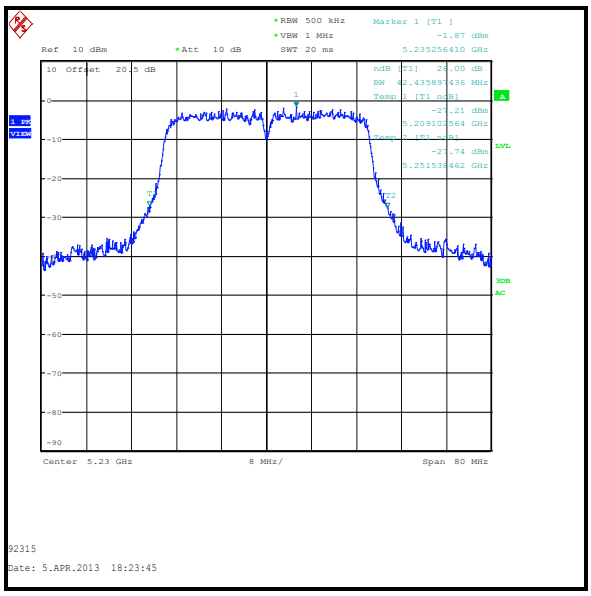
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 40 MHz / 5.15-5.25 GHz band (Reference plots)

Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5190	QPSK	27 / MCS1	42.821
Top	5230	QPSK	27 / MCS1	42.436



Bottom Channel

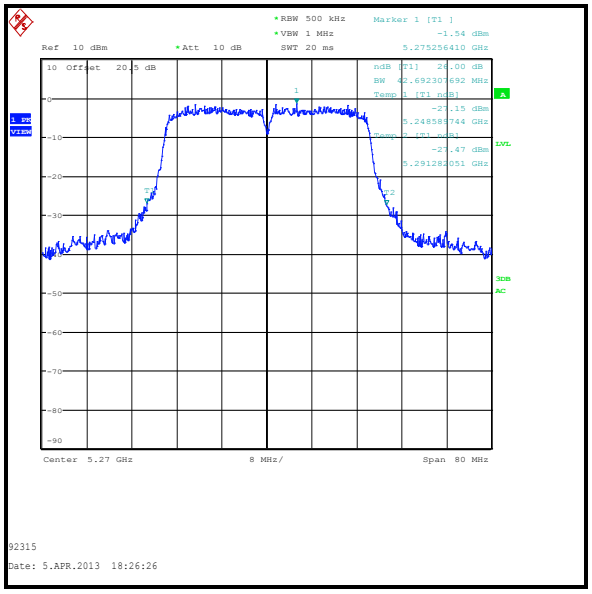


Top Channel

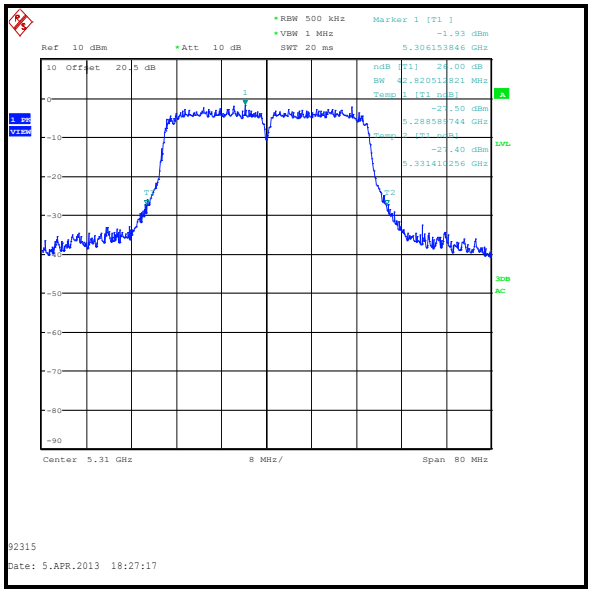
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 40 MHz / 5.25-5.35 GHz band (Reference plots)

Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5270	QPSK	27 / MCS1	42.692
Top	5310	QPSK	27 / MCS1	42.821



Bottom Channel

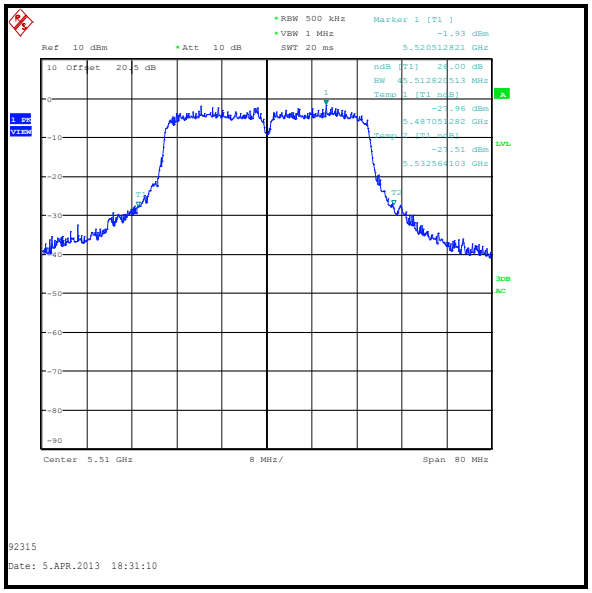


Top Channel

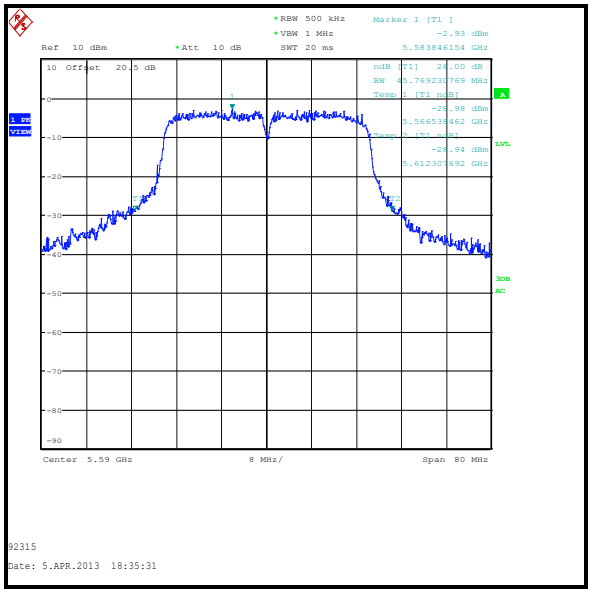
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 40 MHz / 5.47-5.725 GHz band (Reference plots)

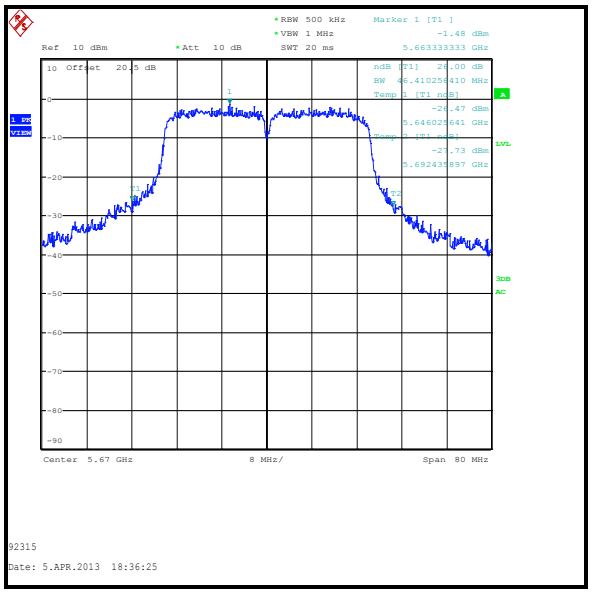
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5510	QPSK	27 / MCS1	45.513
Middle	5590	QPSK	27 / MCS1	45.769
Top	5670	QPSK	27 / MCS1	46.410



Bottom Channel



Middle Channel



Top Channel

Transmitter 26 dB Emission Bandwidth (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2143	Attenuator	Atlantic Microwave	AN18-20	081120-23	25 May 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12

5.2.5.Transmitter Duty Cycle

Test Summary:

Test Engineer:	Sandeep Bharat	**Test Date:**	05 April 2013
Test Sample IMEI:	355335050017095		

FCC Part:	15.35(c)
Test Method Used:	FCC KDB 789033 Section B)

Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	26

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])

802.11a / 6 Mbps duty cycle: 10 log (1 / (1.378 / 1.580)) = 0.6

802.11n HT20 / MCS0 Greenfield mode duty cycle: 10 log (1 / (1.272 / 1.474)) = 0.6

802.11n HT20 / MCS0 Mixed mode duty cycle: 10 log (1 / (1.287 / 1.489)) = 0.6

802.11n HT40 / MCS1 Mixed mode duty cycle: 10 log (1 / (325.321 / 426.282)) = 1.2

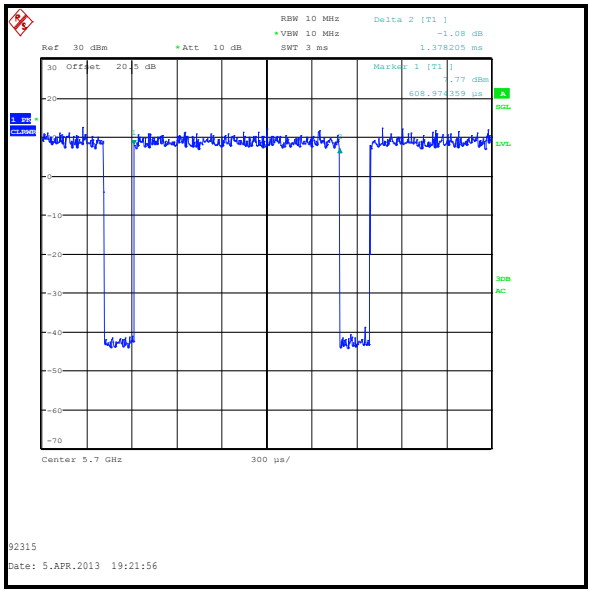
802.11n HT40 / MCS0 Greenfield mode duty cycle: 10 log (1 / (636.218 / 738.782)) = 0.6

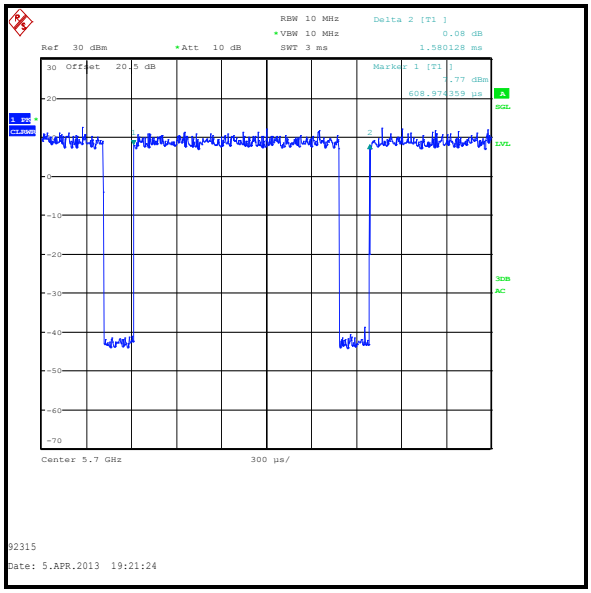
Transmitter Duty Cycle (continued)

Results: 802.11a / 20 MHz / 6 Mbps

Pulse Duration (ms)	Duty Cycle Correction (dB)
1.378	0.6

Period (ms)
1.580



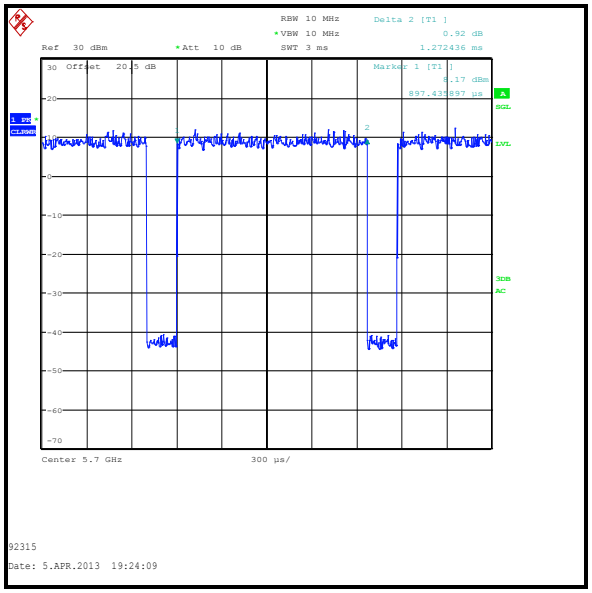


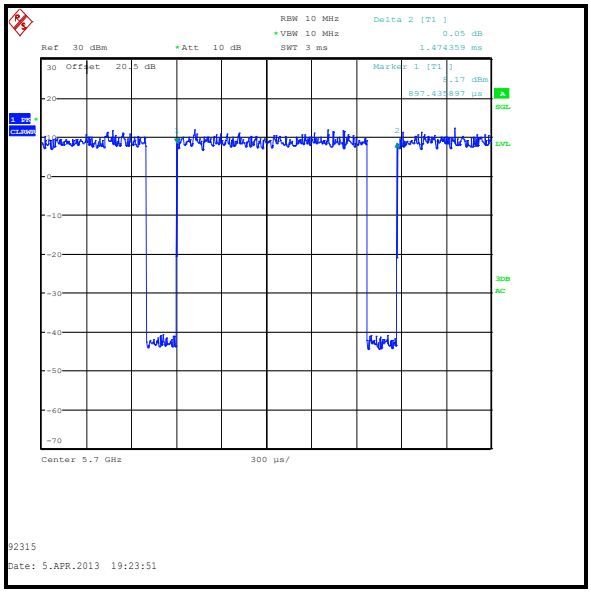
Transmitter Duty Cycle (continued)

Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / Greenfield mode

Pulse Duration (ms)	Duty Cycle Correction (dB)
1.272	0.6

Period (ms)
1.474



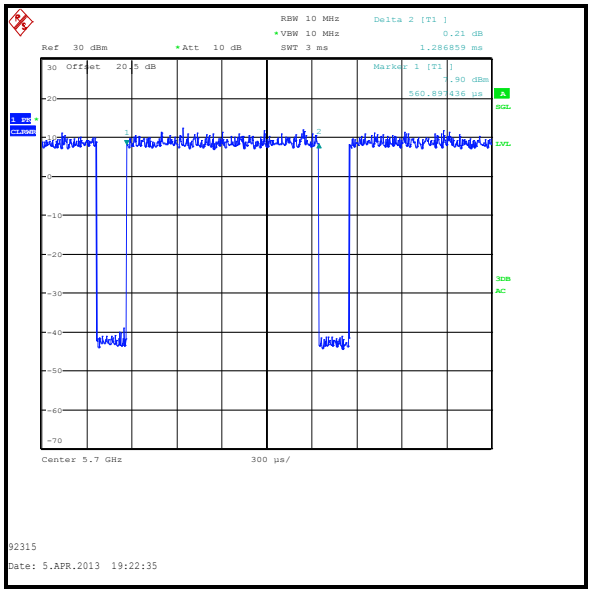


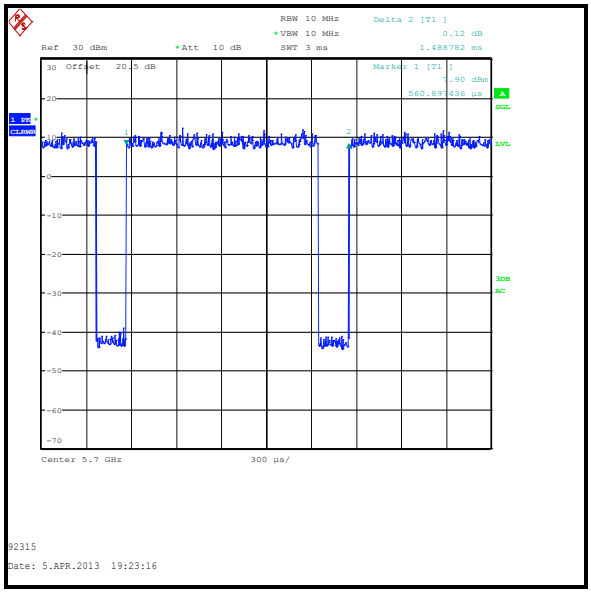
Transmitter Duty Cycle (continued)

Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / Mixed mode

Pulse Duration (ms)	Duty Cycle Correction (dB)
1.287	0.6

Period (ms)
1.489



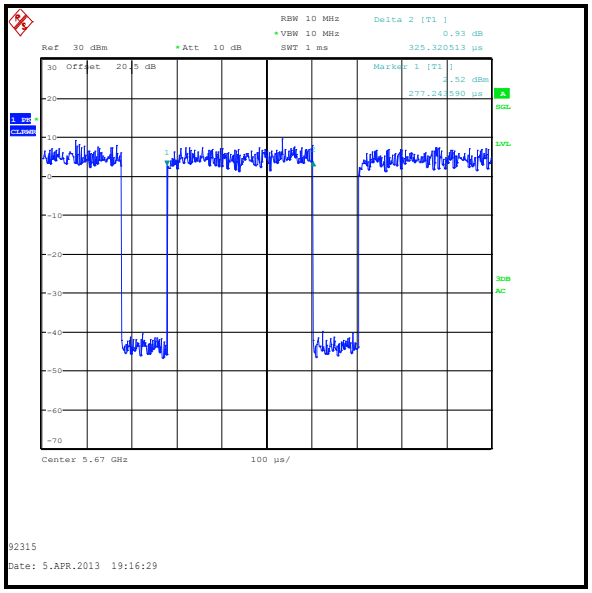


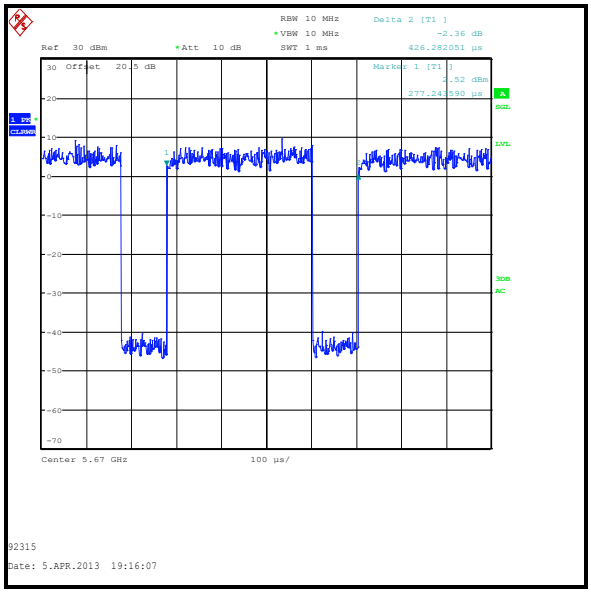
Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / 27Mbps / MCS1 / Mixed mode

Pulse Duration (µs)	Duty Cycle Correction (dB)
325.321	1.2

Period (µs)
426.282



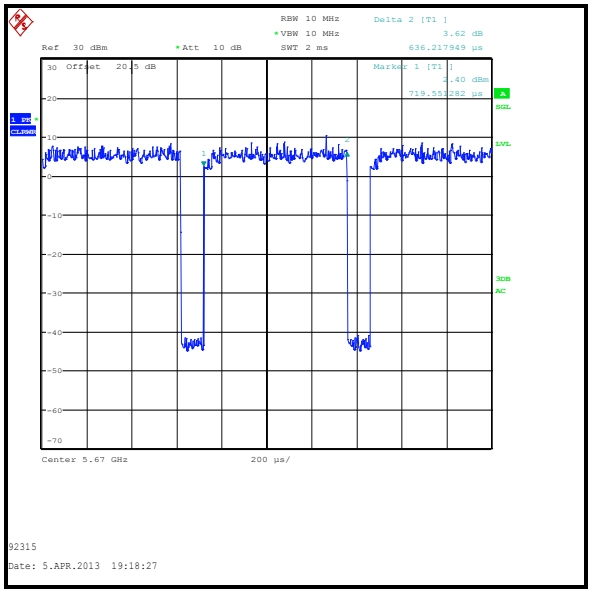


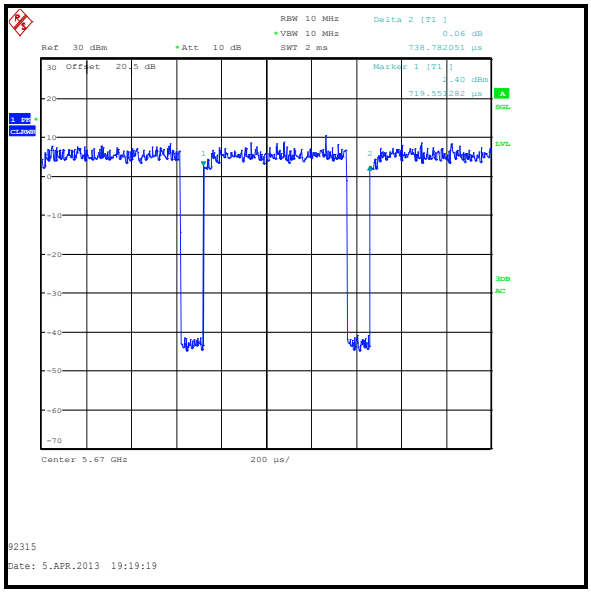
Transmitter Duty Cycle (continued)

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / Greenfield mode

Pulse Duration (µs)	Duty Cycle Correction (dB)
636.218	0.6

Period (µs)
738.782





Transmitter Duty Cycle (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2143	Attenuator	Atlantic Microwave	AN18-20	081120-23	25 May 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU 40	100233	07 Feb 2014	12

5.2.6. Transmitter Maximum Conducted Output Power

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	05 April 2013
Test Sample IMEI:	355335050017095		

FCC Reference:	Part 15.407(a)(1)
Test Method Used:	FCC KDB 789033 D01 Section C)3)e)

Environmental Conditions:

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

Note(s):

1. All conducted power tests were performed using a test receiver in accordance with FCC KDB 789033 D01 C)3)e) Method SA-2 Alternative.
2. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power (i.e. worst case) for band 5.15-5.25 GHz were:
    - 802.11a – BPSK / 6 Mbps
    - 802.11n HT20 - BPSK / 6.5 Mbps / MCS0 (Greenfield mode)
    - 802.11n HT40 – QPSK / 27 Mbps / MCS1 (Mixed mode)
3. The EUT was transmitting at <98% duty cycle. The calculated duty cycle in section 5.2.5 was added to the measured power in order to compute the average power during the actual transmission time.
4. The EUT antenna has a gain of <6 dBi.
5. The Part 15.407(a)(1) limit is the lesser of 50 mW (17.0 dBm) or 4 dBm + 10 $\log_{10}$ B, where B is the previously measured 26 dB emission bandwidth in MHz. The limit for each channel was calculated as below:

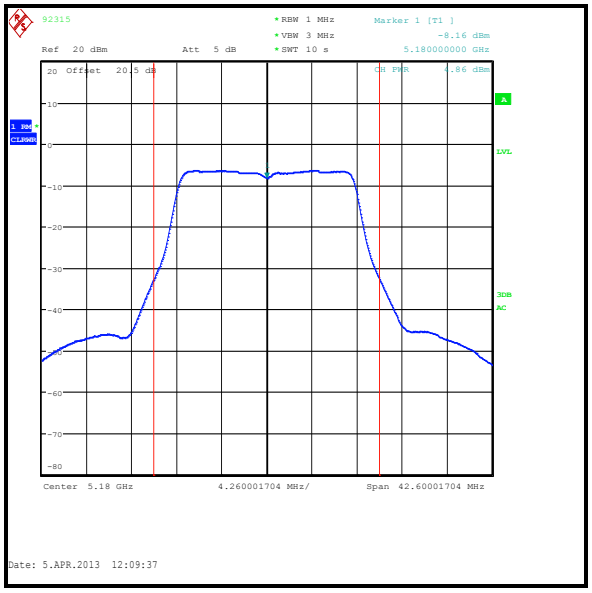
    802.11a 20 MHz channel width / Bottom channel = *4 dBm + 10 log_{10} 21.6 = 17.3 dBm*
    802.11a 20 MHz channel width / Middle channel = *4 dBm + 10 log_{10} 21.6 = 17.3 dBm*
    802.11a 20 MHz channel width / Top channel = *4 dBm + 10 log_{10} 21.6 = 17.3 dBm*
    802.11n 20 MHz channel width / Bottom channel = *4 dBm + 10 log_{10} 22.1 = 17.4 dBm*
    802.11n 20 MHz channel width / Middle channel = *4 dBm + 10 log_{10} 22.0 = 17.4 dBm*
    802.11n 20 MHz channel width / Top channel = *4 dBm + 10 log_{10} 22.0 = 17.4 dBm*
    802.11n 40 MHz channel width / Bottom channel = *4 dBm + 10 log_{10} 42.8 = 20.3 dBm*
    802.11n 40 MHz channel width / Top channel = *4 dBm + 10 log_{10} 42.4 = 20.3 dBm*

    Therefore the lesser of the two limits is the fixed limit of 50 mW (17 dBm). This was applied to the results.

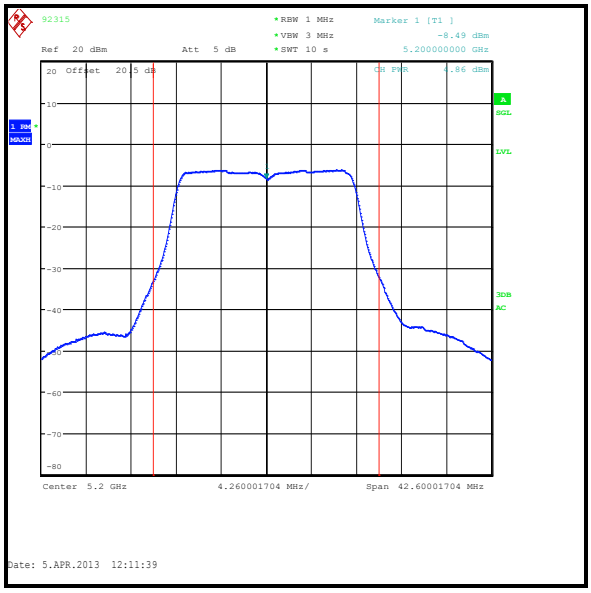
Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (Continued)

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

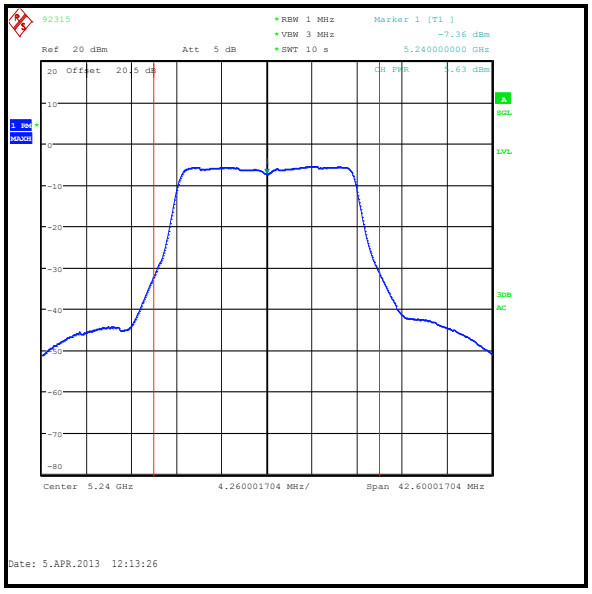
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	4.9	0.6	5.5	17.0	11.5	Complied
Middle	5200	4.9	0.6	5.5	17.0	11.5	Complied
Top	5240	5.6	0.6	6.2	17.0	10.8	Complied



Bottom Channel



Middle Channel

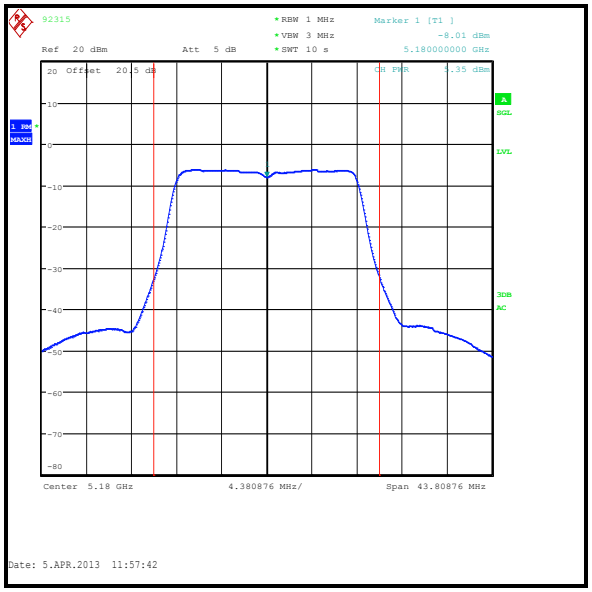


Top Channel

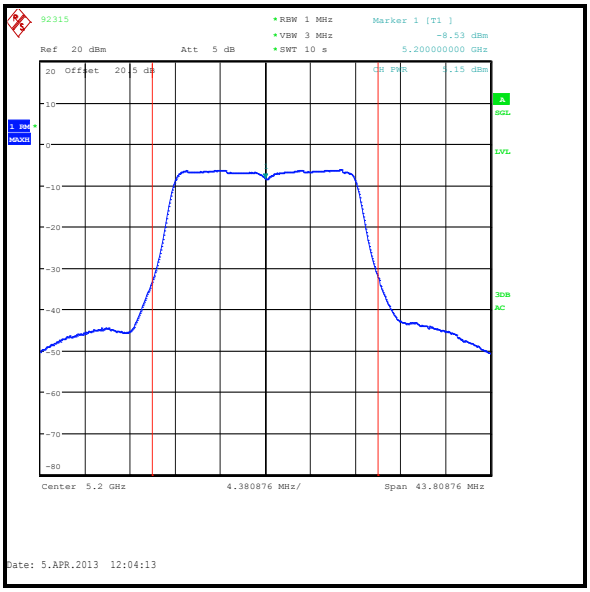
Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (Continued)

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

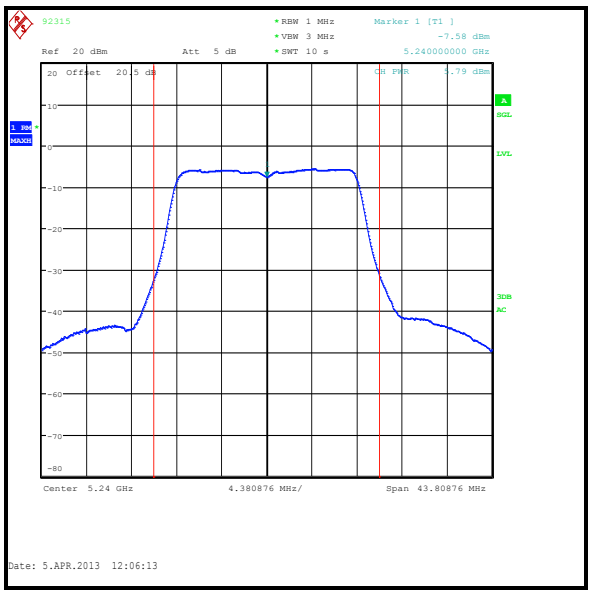
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	5.4	0.6	6.0	17.0	11.0	Complied
Middle	5200	5.2	0.6	5.8	17.0	11.2	Complied
Top	5240	5.8	0.6	6.4	17.0	10.6	Complied



Bottom Channel



Middle Channel

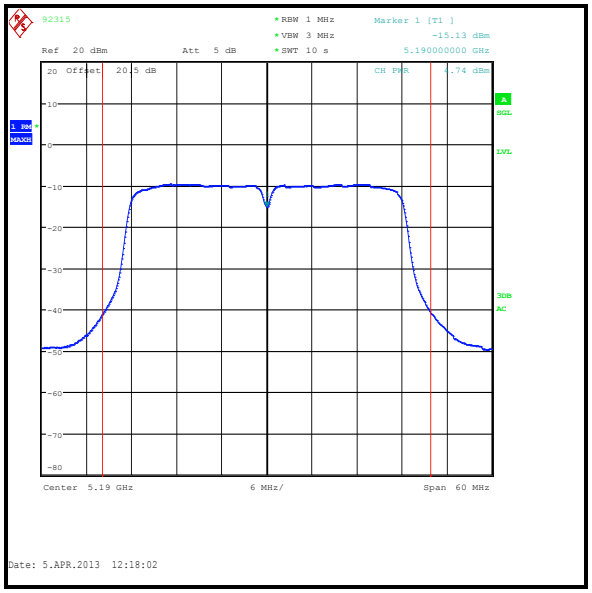


Top Channel

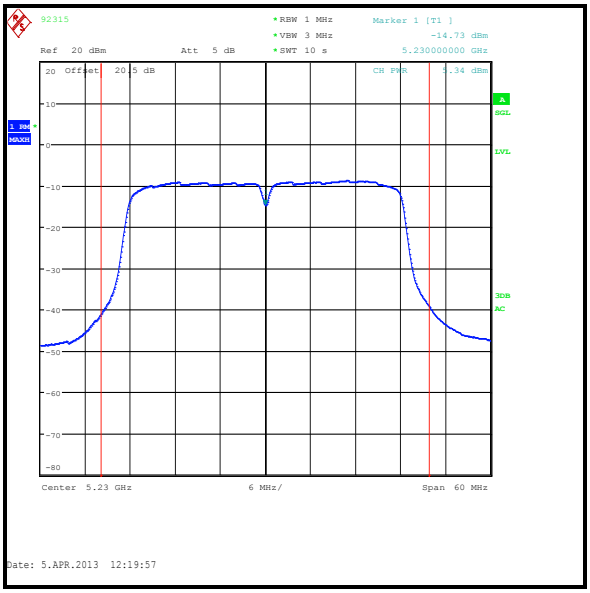
Transmitter Maximum Conducted Output Power (5.15-5.25 GHz band) (Continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5190	4.7	1.2	5.9	17.0	11.1	Complied
Top	5230	5.3	1.2	6.5	17.0	10.5	Complied



Bottom Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands)

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	05 April 2013
Test Sample IMEI:	355335050017095		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	FCC KDB 789033 D01 Section C)3)e)

Environmental Conditions:

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

Note(s):

1. The FCC Part 15.407(a)(2) limit is the lesser of 250 mW (24.0 dBm) or 11 dBm + 10 $\log_{10}$ B, where B is the previously measured 26 dB emission bandwidth in MHz. The limit for each channel was calculated as below:

5.25-5.35 GHz band

802.11a 20 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 21.7 = 24.4 dBm*
802.11a 20 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 21.4 = 24.3 dBm*
802.11a 20 MHz channel width / Top channel = *11 dBm + 10 log_{10} 21.8 = 24.4 dBm*
802.11n 20 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 21.9 = 24.4 dBm*
802.11n 20 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 21.2 = 24.3 dBm*
802.11n 20 MHz channel width / Top channel = *11 dBm + 10 log_{10} 22.1 = 24.4 dBm*
802.11n 40 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 42.7 = 27.3 dBm*
802.11n 40 MHz channel width / Top channel = *11 dBm + 10 log_{10} 42.8 = 27.3 dBm*

5.47-5.725 GHz band

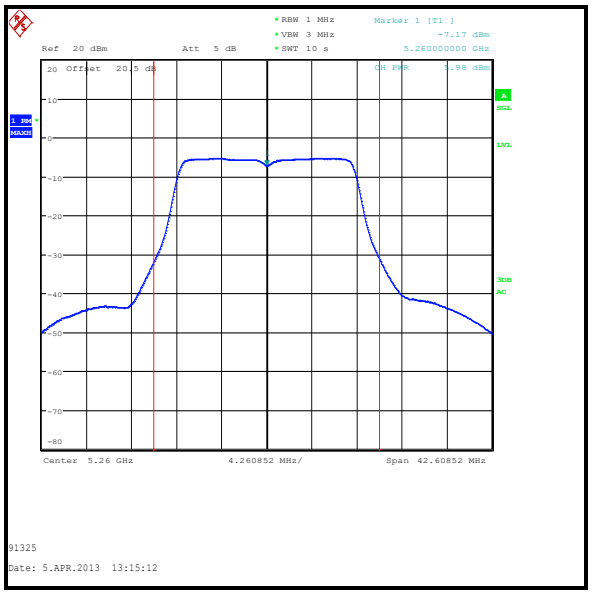
802.11a 20 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 22.8 = 24.6 dBm*
802.11a 20 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 22.8 = 24.6 dBm*
802.11a 20 MHz channel width / Top channel = *11 dBm + 10 log_{10} 21.5 = 24.3 dBm*
802.11n 20 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 23.8 = 24.8 dBm*
802.11n 20 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 23.1 = 24.6 dBm*
802.11n 20 MHz channel width / Top channel = *11 dBm + 10 log_{10} 22.1 = 24.4 dBm*
802.11n 40 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 45.5 = 27.6 dBm*
802.11n 40 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 45.8 = 27.6 dBm*
802.11n 40 MHz channel width / Top channel = *11 dBm + 10 log_{10} 46.4 = 27.7 dBm*

The lesser of the two limits is the fixed limit of 250 mW (24.0 dBm). This was applied to the results.

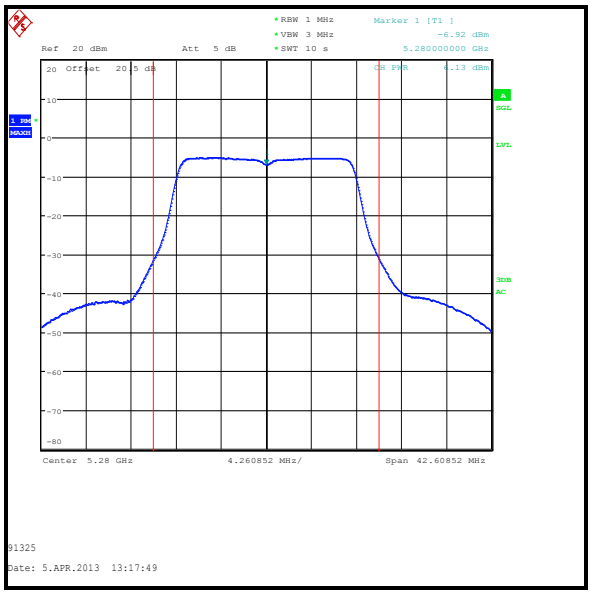
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11a / 20 MHz / BPSK / 6 Mbps / 5.25-5.35 GHz band

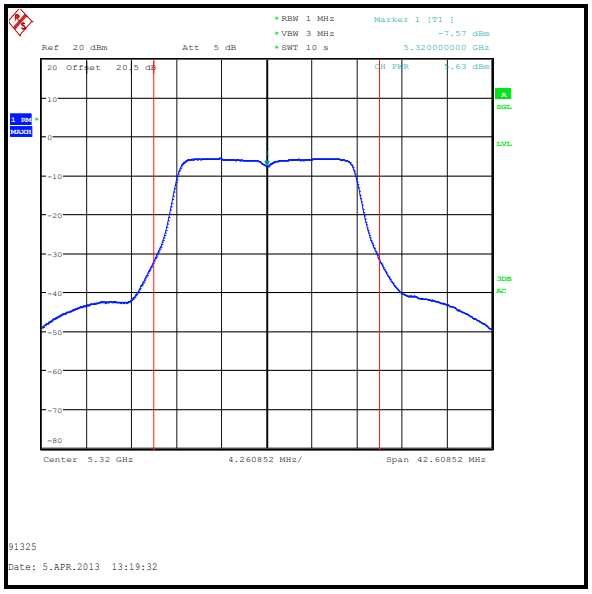
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	6.0	0.6	6.6	24.0	17.4	Complied
Middle	5280	6.1	0.6	6.7	24.0	17.3	Complied
Top	5320	5.6	0.6	6.2	24.0	17.8	Complied



Bottom Channel



Middle Channel

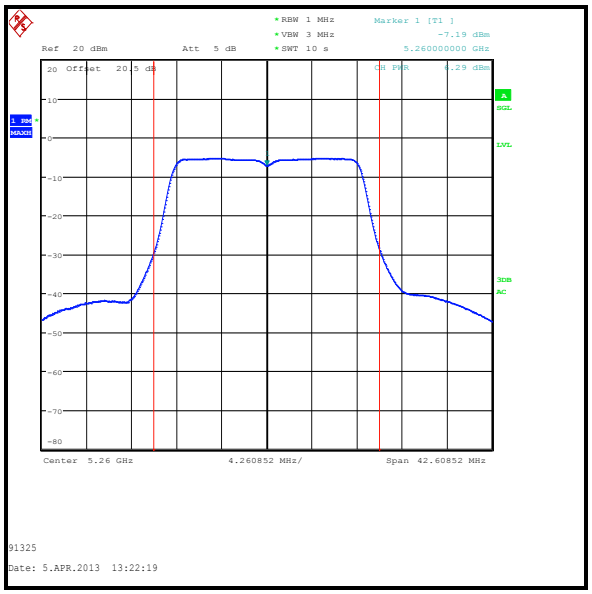


Top Channel

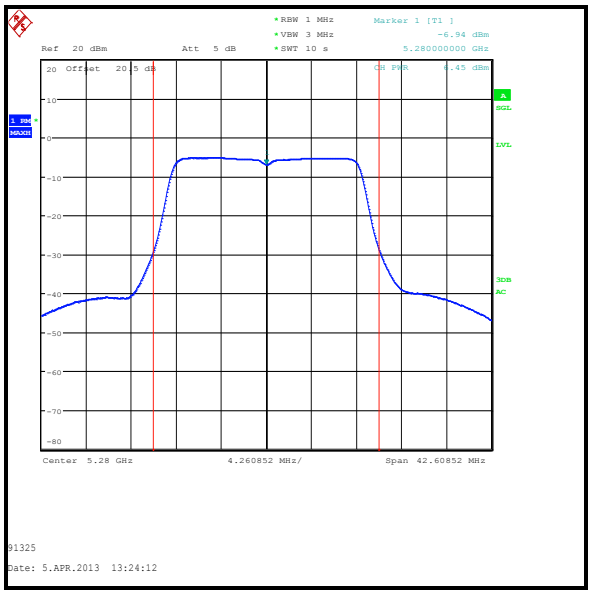
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / 5.25-5.35 GHz band

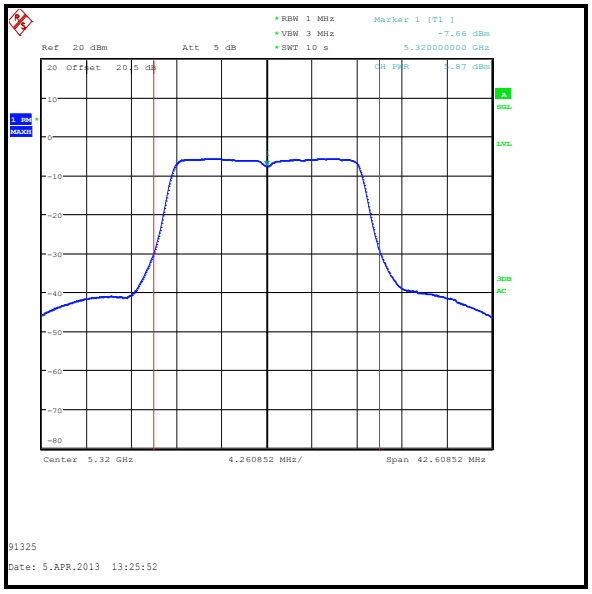
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	6.3	0.6	6.9	24.0	17.1	Complied
Middle	5280	6.5	0.6	7.1	24.0	16.9	Complied
Top	5320	5.9	0.6	6.5	24.0	17.5	Complied



Bottom Channel



Middle Channel

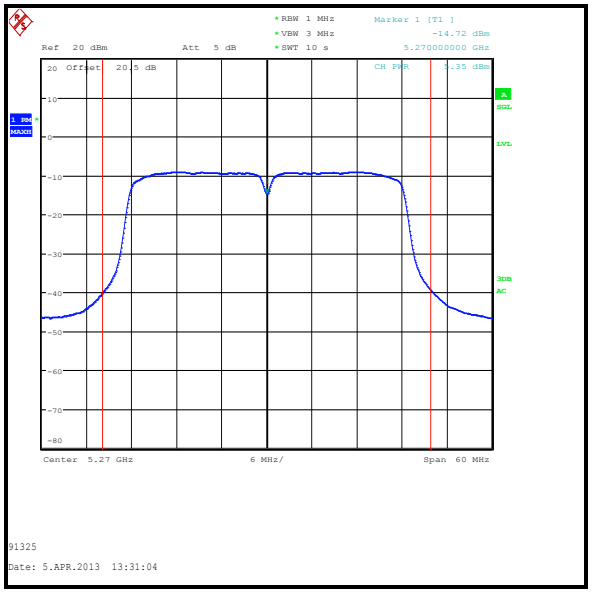


Top Channel

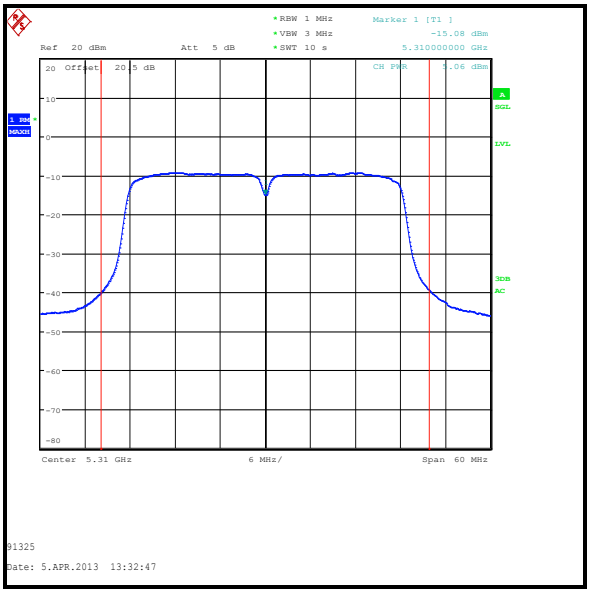
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / 5.25-5.35 GHz band

Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5270	5.4	1.2	6.6	24.0	17.4	Complied
Top	5310	5.1	1.2	6.3	24.0	17.7	Complied



Bottom Channel

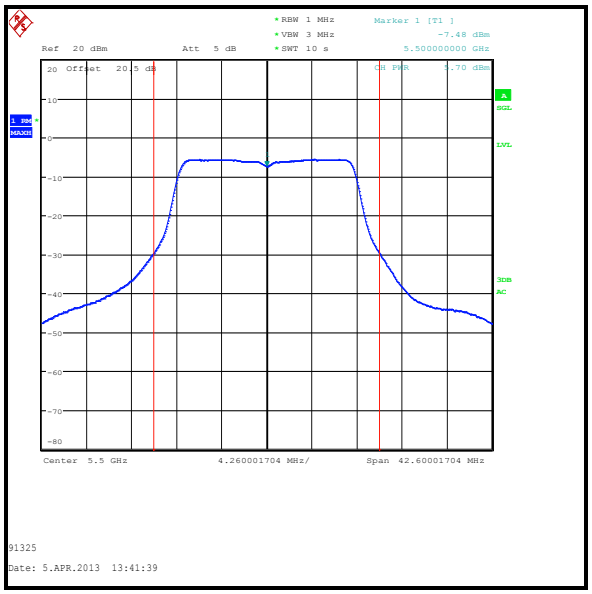


Top Channel

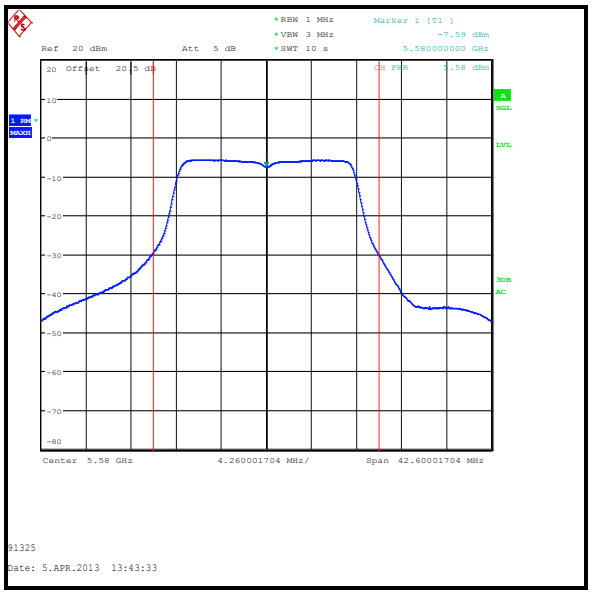
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11a / 20 MHz / BPSK / 6 Mbps / 5.47-5.725 GHz band

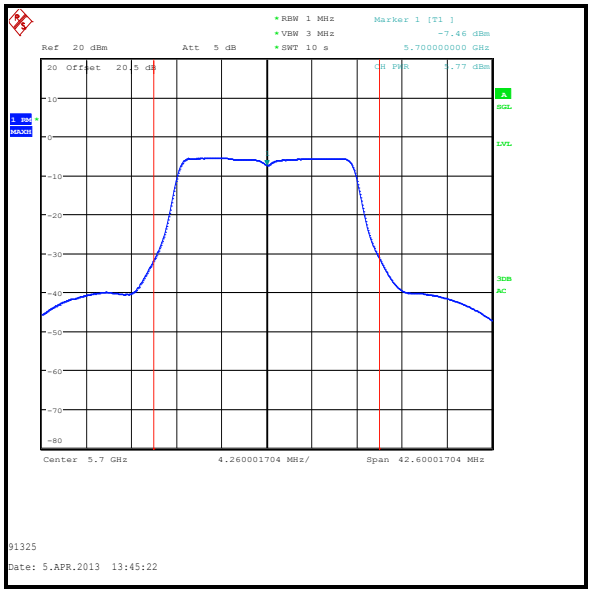
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	5.7	0.6	6.3	24.0	17.7	Complied
Middle	5580	5.6	0.6	6.2	24.0	17.8	Complied
Top	5700	5.8	0.6	6.4	24.0	17.6	Complied



Bottom Channel



Middle Channel

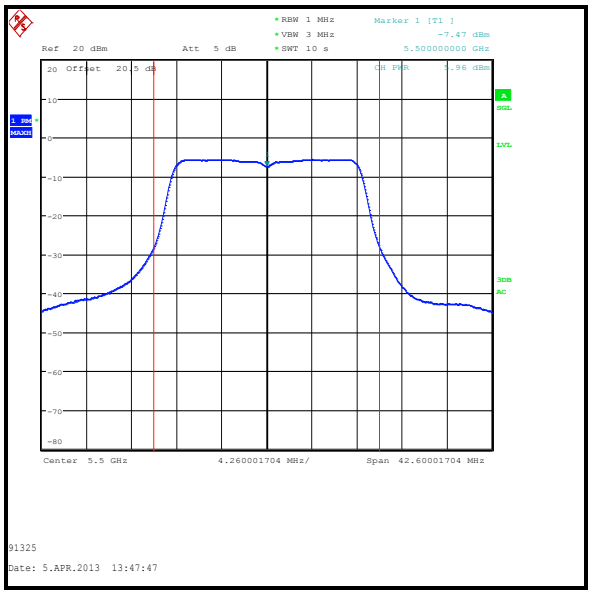


Top Channel

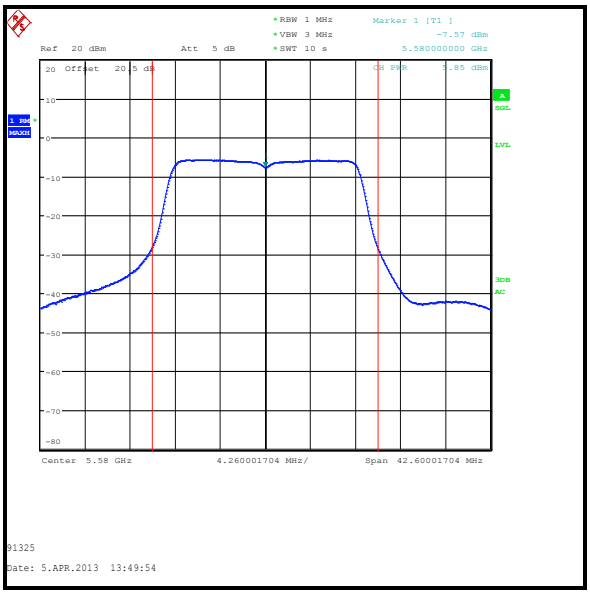
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / 5.47-5.725 GHz band

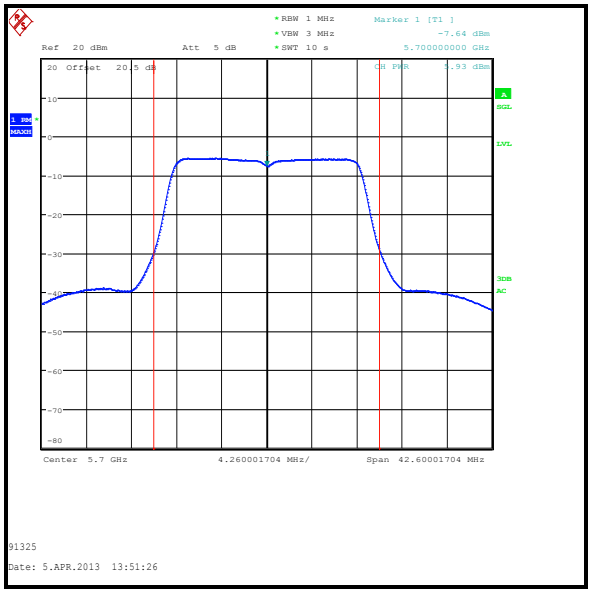
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	6.0	0.6	6.6	24.0	17.4	Complied
Middle	5580	5.9	0.6	6.5	24.0	17.5	Complied
Top	5700	5.9	0.6	6.5	24.0	17.5	Complied



Bottom Channel



Middle Channel

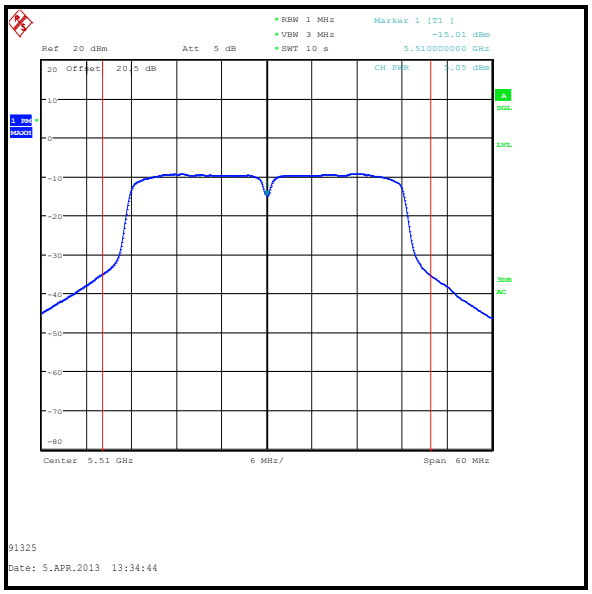


Top Channel

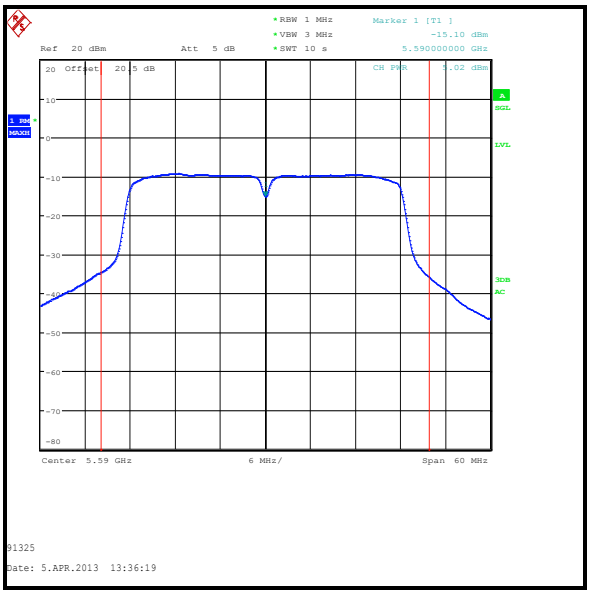
Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / 5.47-5.725 GHz band

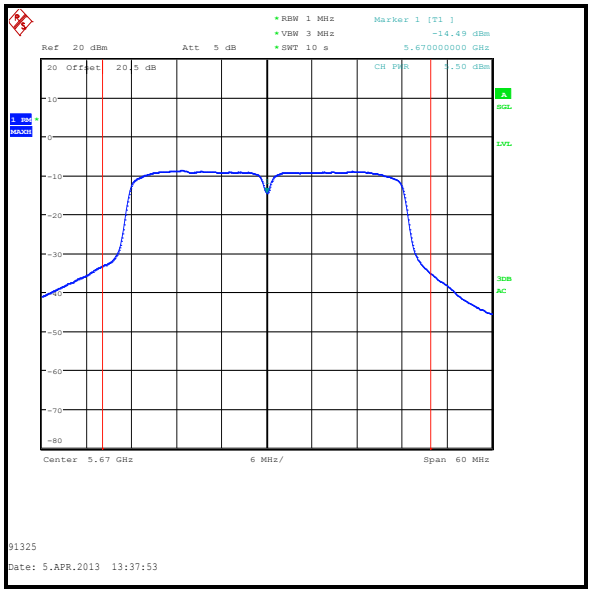
Channel	Frequency (MHz)	Conducted Power (dBm)	Duty cycle correction factor (dB)	Corrected Conducted Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5510	5.1	1.2	6.3	24.0	17.7	Complied
Middle	5590	5.0	1.2	6.2	24.0	17.8	Complied
Top	5670	5.5	1.2	6.7	24.0	17.3	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2143	Attenuator	Atlan TecRF	AN18-20	081120-23	25 May 2013	12
M260	Signal Generator	Rohde & Schwarz	1035.5005.02	829076/008	14 Jun 2013	12
M1267	Thermal Power Sensor	Rohde & Schwarz	NRV-Z52	100155	07 Jun 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	07 Feb 2014	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	07 Jun 2013	12

5.2.7. Transmitter Peak Power Spectral Density

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	05 April 2013
Test Sample IMEI:	355335050017095		

FCC Reference:	Part 15.407(a)(1)
Test Method Used:	FCC KDB 789033 E) referencing KDB 789033 C)3)e), Method SA-2 Alternative

Environmental Conditions:

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

Note(s):

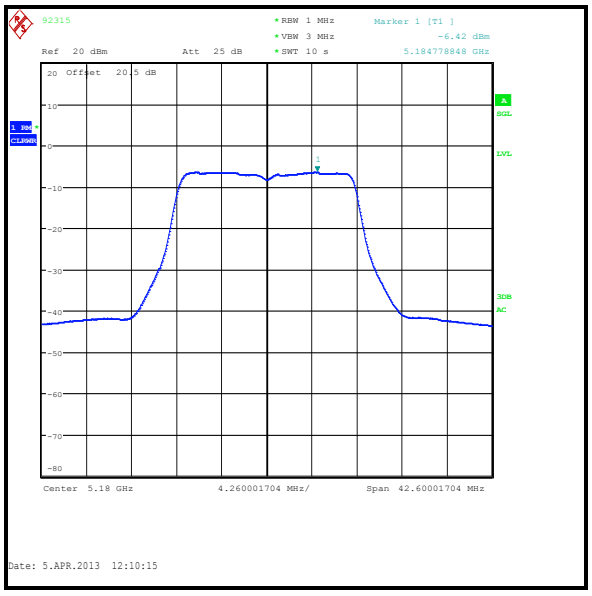
1. Transmitter Peak Power Spectral Density tests in all bands were performed using a test receiver in accordance with FCC KDB 789033 D01 C)3)e) Method SA-2 Alternative.
2. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power were:
    - 802.11a – BPSK / 6 Mbps
    - 802.11n HT20 - BPSK / 6.5 Mbps / MCS0 (Greenfield mode)
    - 802.11n HT40 – QPSK / 27 Mbps / MCS1 (Mixed mode)

    Measurements were then performed in these modes on bottom, middle and top channels in all operating bands.
3. The EUT was transmitting at <98% duty cycle. The calculated duty cycle in section 5.2.5 was added to the measured peak power spectral density in order to compute the average peak power spectral density during the actual transmission time.
4. The EUT antenna has a gain of <6 dBi.

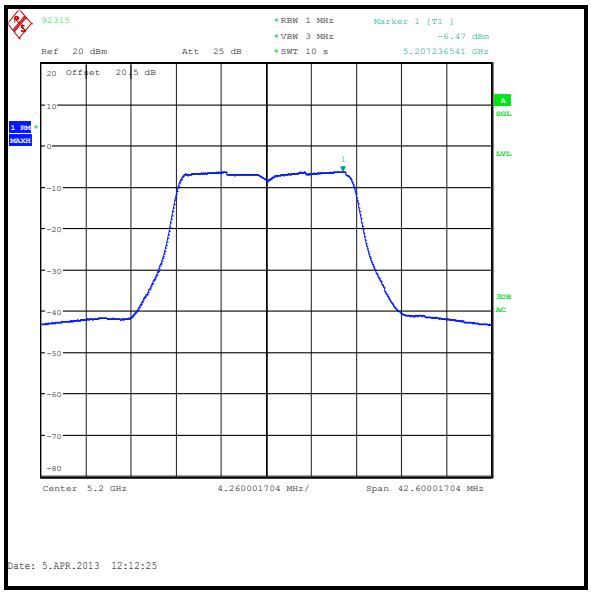
Transmitter Peak Power Spectral Density (5.15-5.25 GHz band) (continued)

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

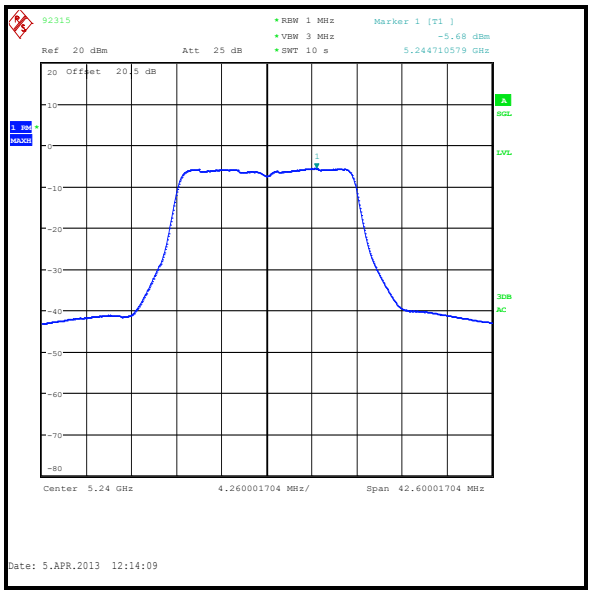
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	-6.4	0.6	-5.8	4.0	9.8	Complied
Middle	5200	-6.5	0.6	-5.9	4.0	9.9	Complied
Top	5240	-5.7	0.6	-5.1	4.0	9.1	Complied



Bottom Channel



Middle Channel

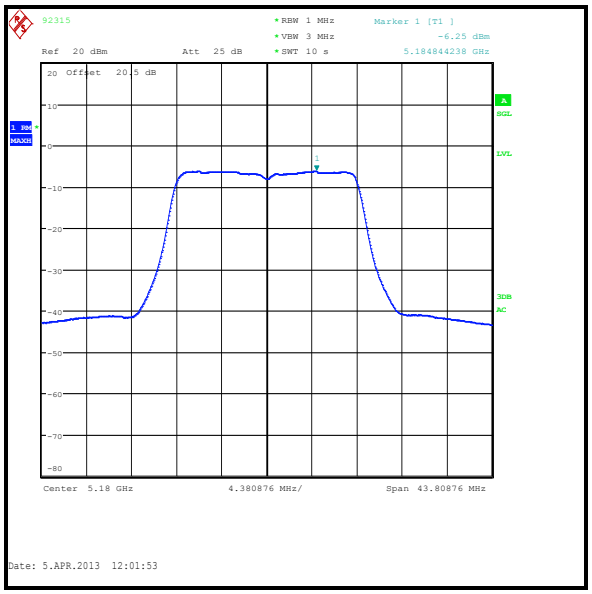


Top Channel

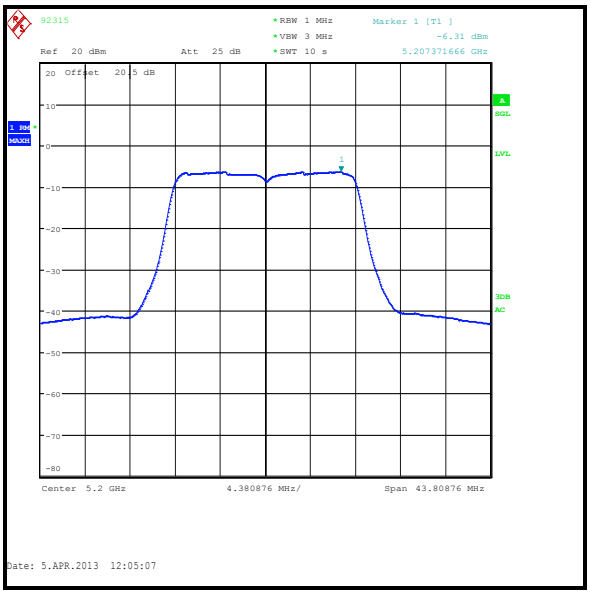
Transmitter Peak Power Spectral Density (5.15-5.25 GHz band) (continued)

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

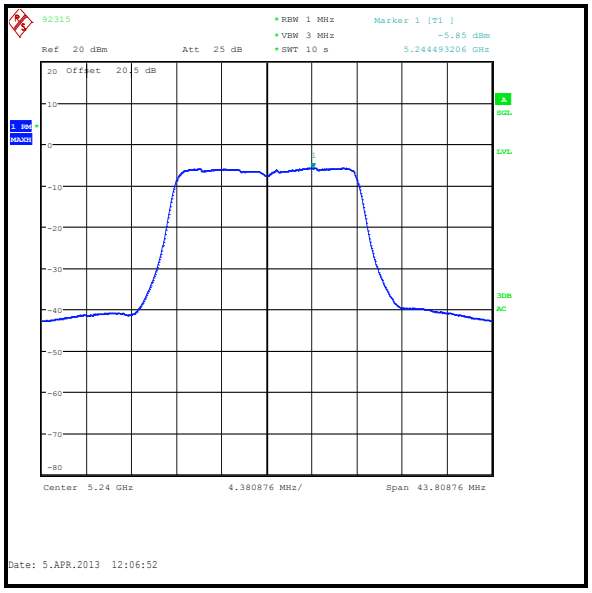
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5180	-6.3	0.6	-5.7	4.0	9.7	Complied
Middle	5200	-6.3	0.6	-5.7	4.0	9.7	Complied
Top	5240	-5.9	0.6	-5.3	4.0	9.3	Complied



Bottom Channel



Middle Channel

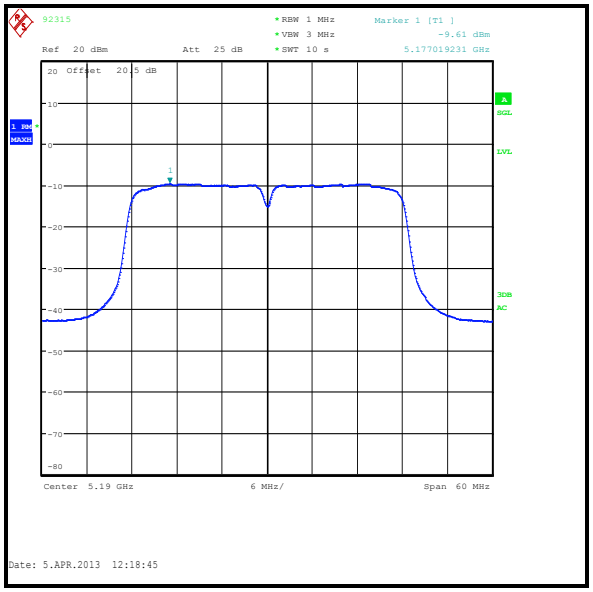


Top Channel

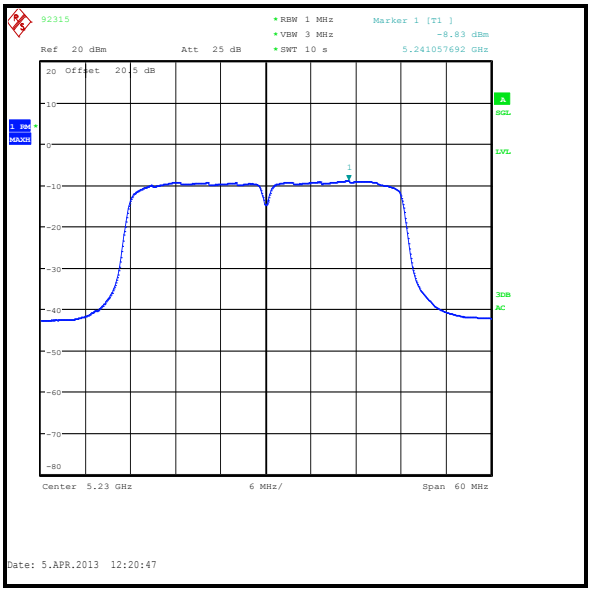
Transmitter Peak Power Spectral Density (5.15-5.25 GHz band) (continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5190	-9.6	1.2	-8.4	4.0	12.4	Complied
Top	5230	-8.8	1.2	-7.6	4.0	11.6	Complied



Bottom Channel



Top Channel

Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands)

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	05 April 2013
Test Sample IMEI:	355335050017095		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	FCC KDB 789033 E) referencing KDB 789033 C)3)c), Method SA-2 Alternative

Environmental Conditions:

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

Note(s):

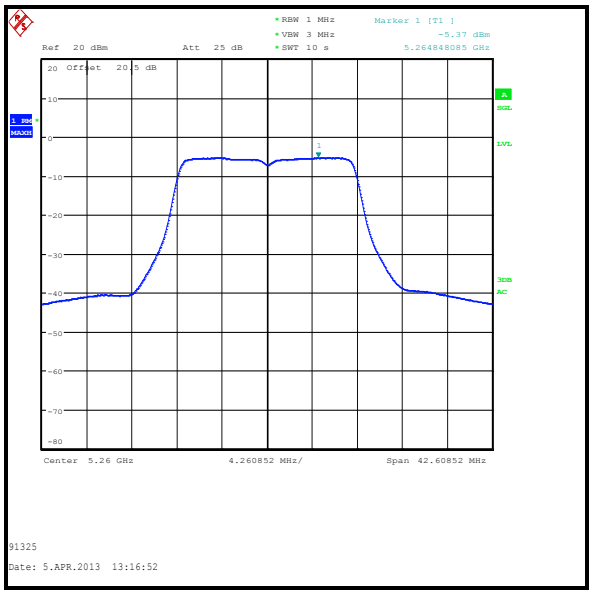
1. FCC Part 15.407(a)(2) for PPSD in the 5.25-5.35 GHz and 5.47-5.725 GHz operating bands is <11 dBm/MHz.
2. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power were:
    - 802.11a – BPSK / 6 Mbps
    - 802.11n HT20 - BPSK / 6.5 Mbps / MCS0 (Greenfield mode)
    - 802.11n HT40 – QPSK / 27 Mbps / MCS1 (Mixed mode)

    Measurements were then performed in these modes on bottom, middle and top channels in all operating bands.

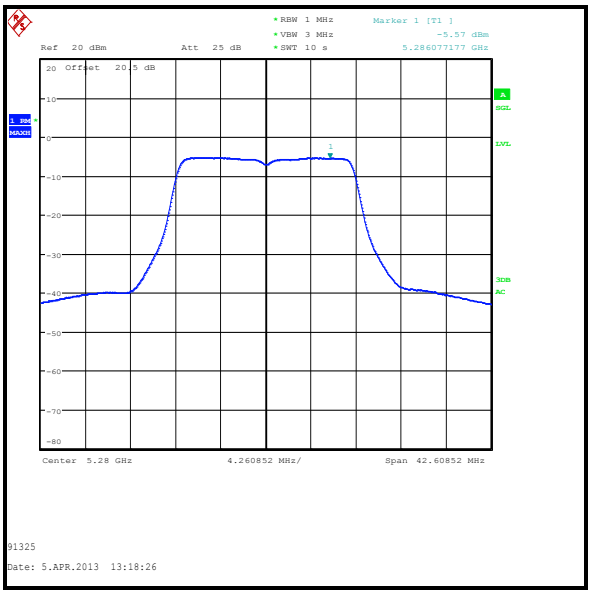
Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11a / 20 MHz / BPSK / 6 Mbps / 5.25-5.35 GHz band

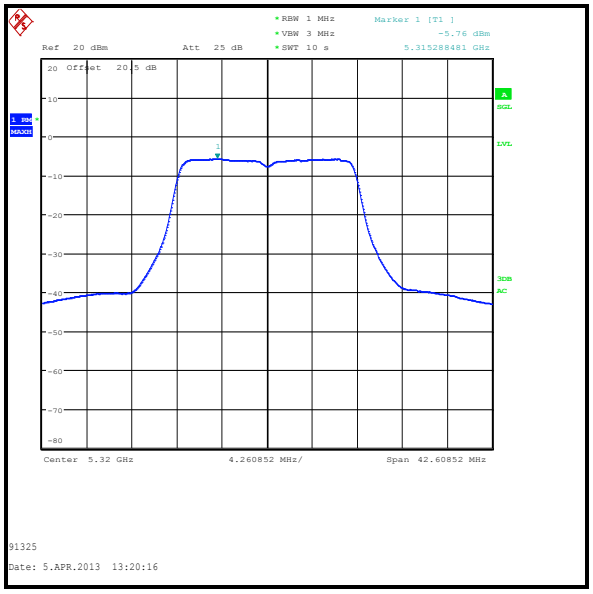
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5260	-5.4	0.6	-4.8	11.0	15.8	Complied
Middle	5280	-5.6	0.6	-5.0	11.0	16.0	Complied
Top	5320	-5.8	0.6	-5.2	11.0	16.2	Complied



Bottom Channel



Middle Channel

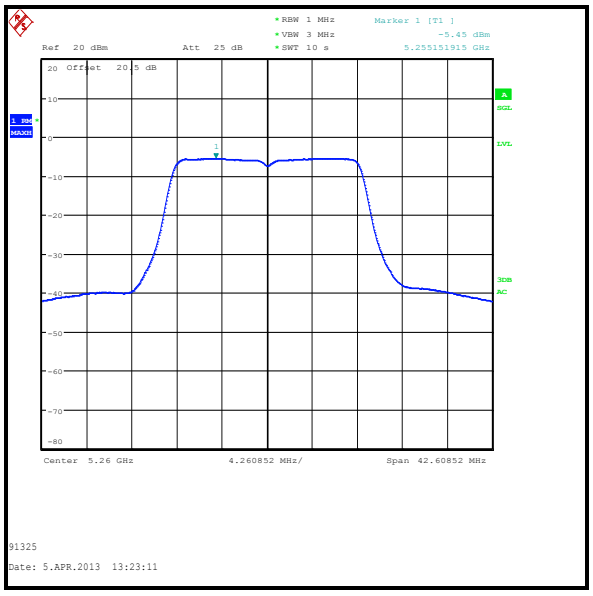


Top Channel

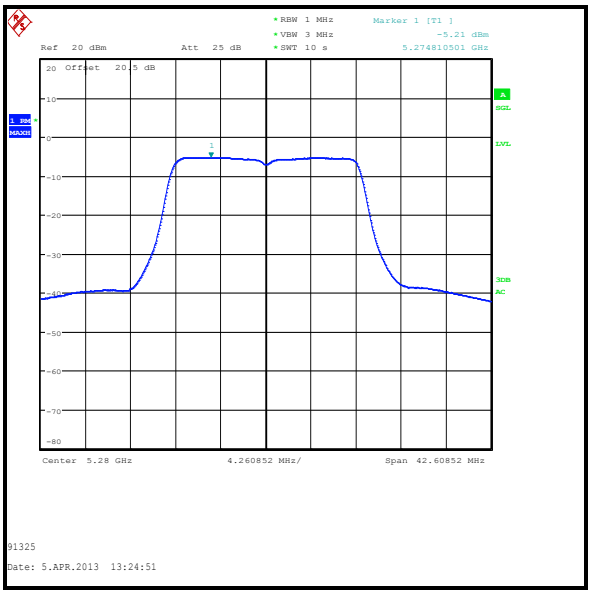
Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / 5.25-5.35 GHz band

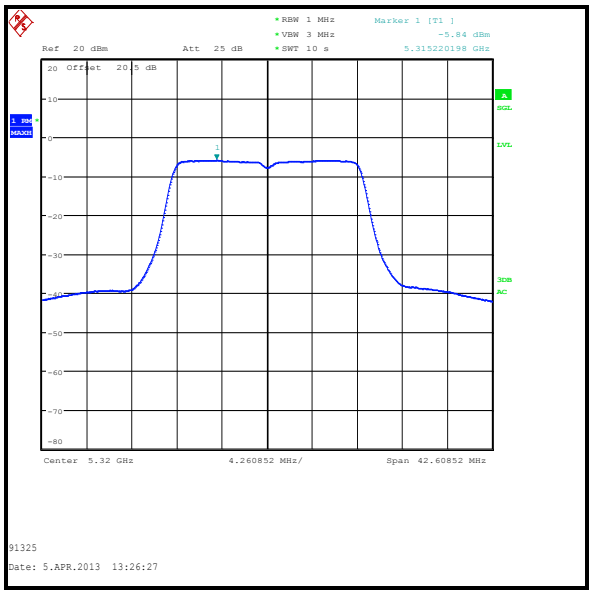
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5260	-5.5	0.6	-4.9	11.0	15.9	Complied
Middle	5280	-5.2	0.6	-4.6	11.0	15.6	Complied
Top	5320	-5.8	0.6	-5.2	11.0	16.2	Complied



Bottom Channel



Middle Channel

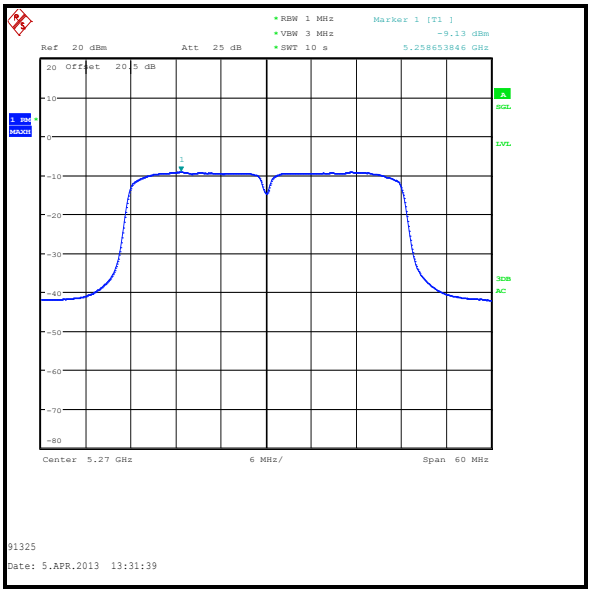


Top Channel

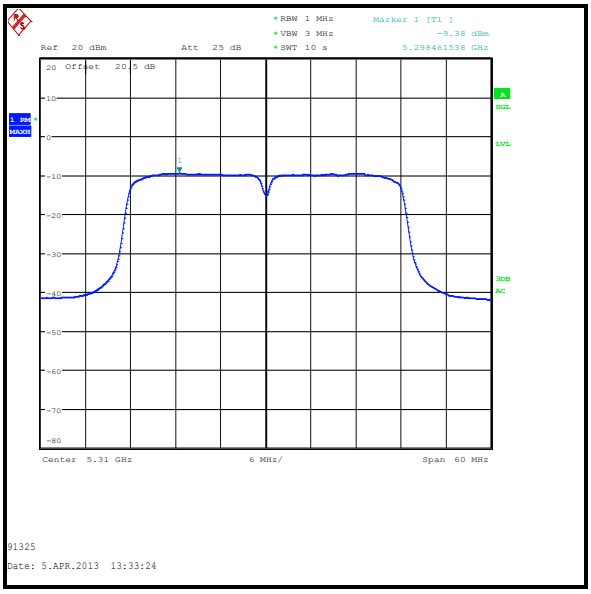
Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / 5.25-5.35 GHz band

Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5270	-9.1	1.2	-7.9	11.0	18.9	Complied
Top	5310	-9.4	1.2	-8.2	11.0	19.2	Complied



Bottom Channel

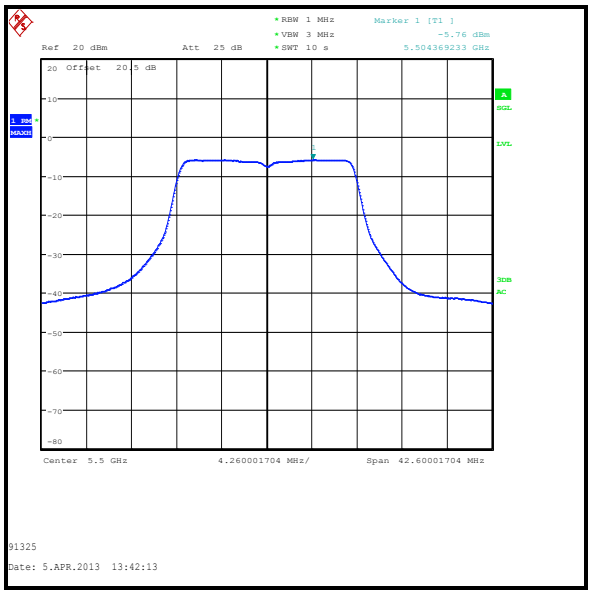


Top Channel

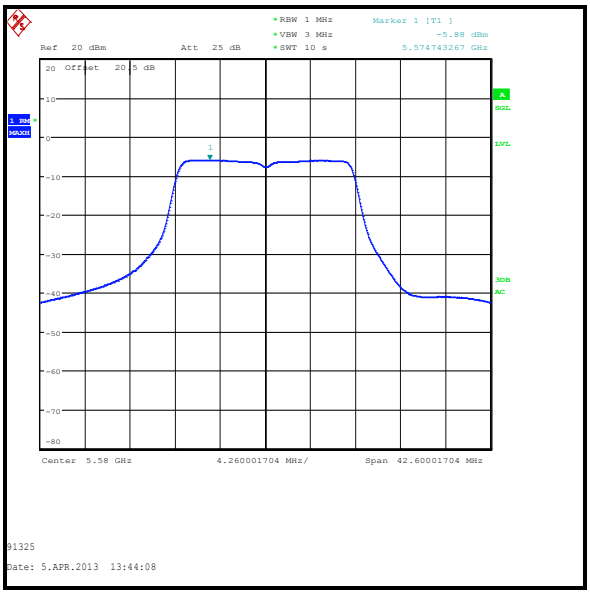
Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11a / 20 MHz / BPSK / 6 Mbps / 5.47-5.725 GHz band

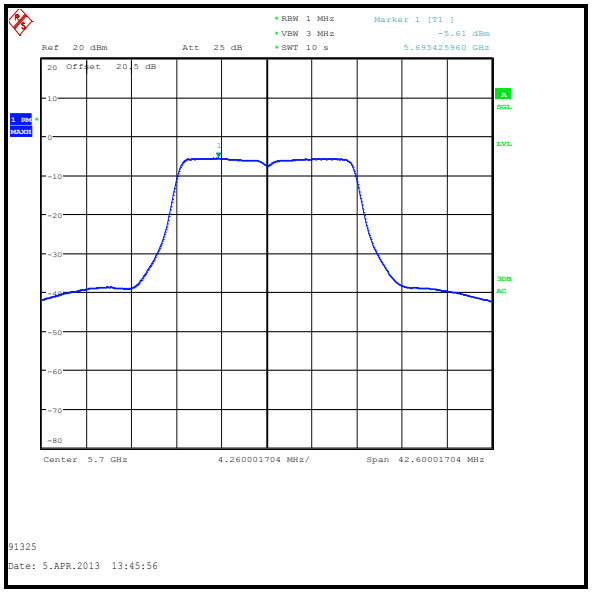
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5500	-5.8	0.6	-5.2	11.0	16.2	Complied
Middle	5580	-5.9	0.6	-5.3	11.0	16.3	Complied
Top	5700	-5.6	0.6	-5.0	11.0	16.0	Complied



Bottom Channel



Middle Channel

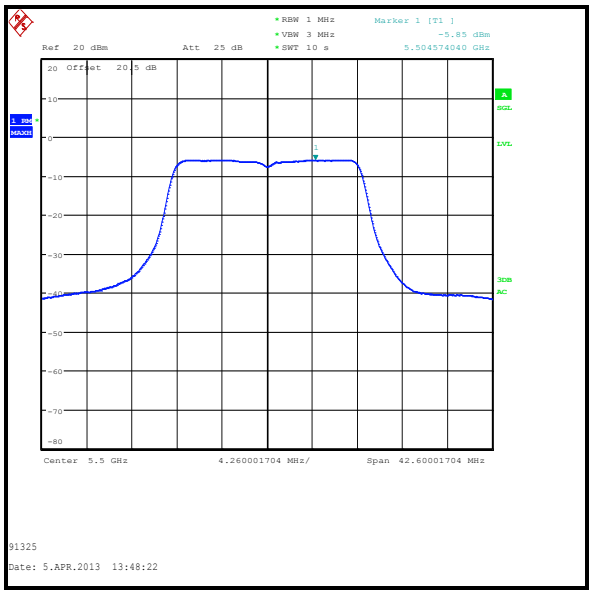


Top Channel

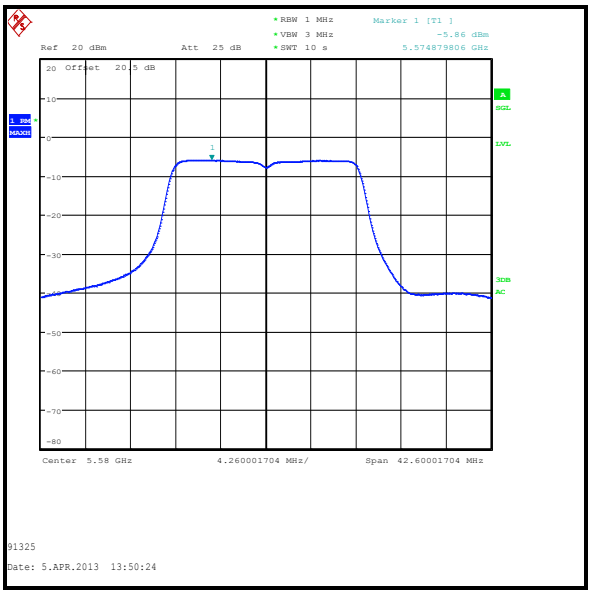
Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / 5.47-5.725 GHz band

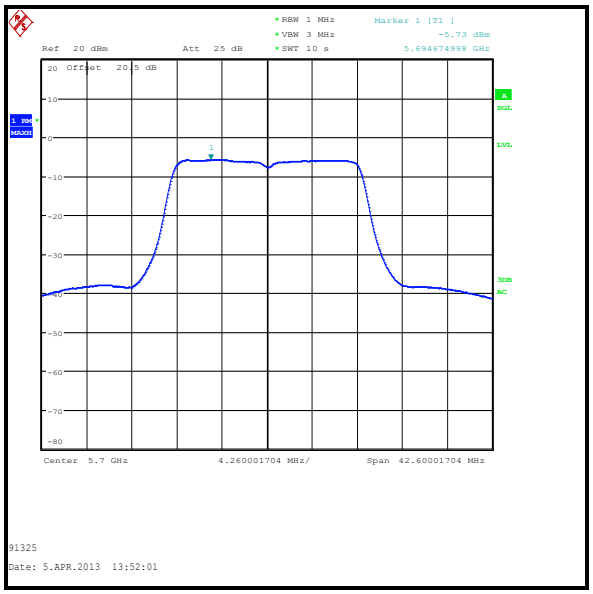
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5500	-5.9	0.6	-5.3	11.0	16.3	Complied
Middle	5580	-5.9	0.6	-5.3	11.0	16.3	Complied
Top	5700	-5.7	0.6	-5.1	11.0	16.1	Complied



Bottom Channel



Middle Channel

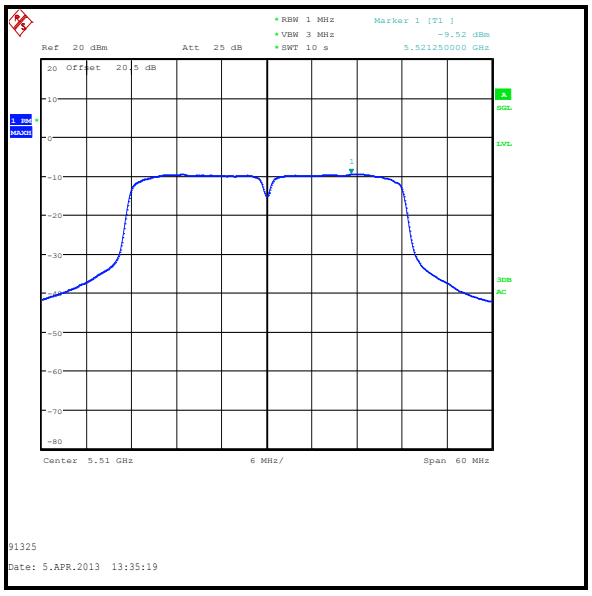


Top Channel

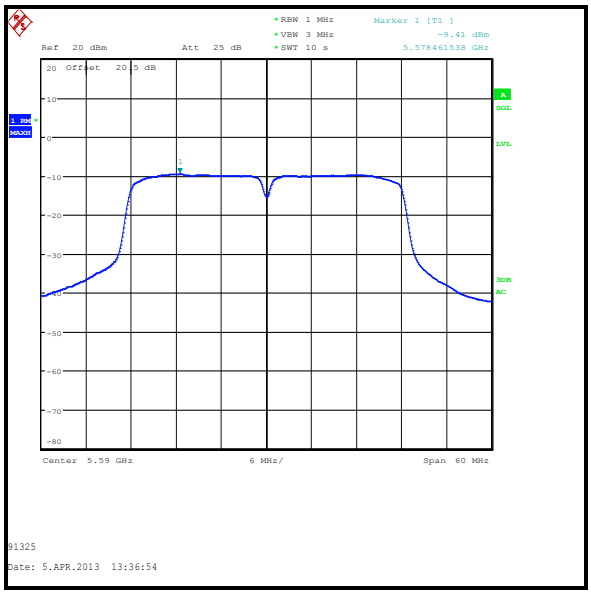
Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / 5.47-5.725 GHz band

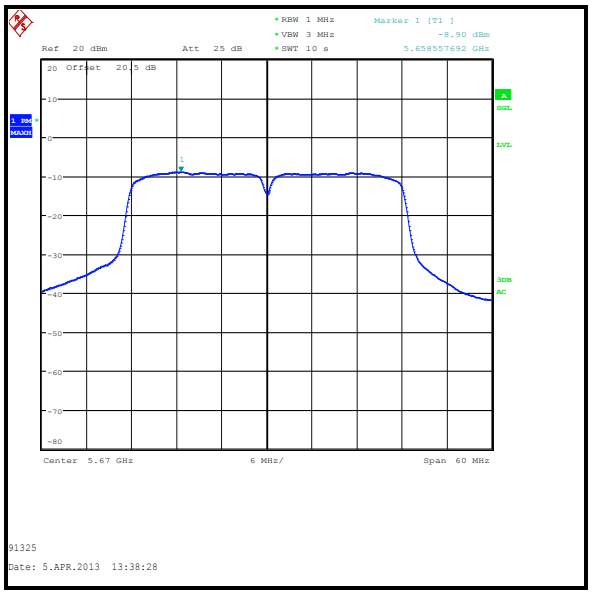
Channel	Frequency (MHz)	PPSD (dBm /MHz)	Duty cycle correction factor (dB)	Corrected PPSD (dBm /MHz)	Limit (dBm /MHz)	Margin (dB)	Result
Bottom	5510	-9.5	1.2	-8.3	11.0	19.3	Complied
Middle	5590	-9.4	1.2	-8.2	11.0	19.2	Complied
Top	5670	-8.9	1.2	-7.7	11.0	18.7	Complied



Bottom Channel



Middle Channel



Top Channel

Transmitter Peak Power Spectral Density (5.25-5.35 GHz & 5.47-5.725 GHz bands) (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2143	Attenuator	Atlan TecRF	AN18-20	081120-23	25 May 2013	12
M260	Signal Generator	Rohde & Schwarz	1035.5005.02	829076/008	14 Jun 2013	12
M1267	Thermal Power Sensor	Rohde & Schwarz	NRV-Z52	100155	07 Jun 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	07 Feb 2014	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	07 Jun 2013	12

5.2.8. Transmitter Peak Excursion

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	05 April 2013
Test Sample IMEI:	355335050017095		

FCC Reference:	Part 15.407(a)(6)
Test Method Used:	FCC KDB 789033 F)

Environmental Conditions:

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

Note(s):

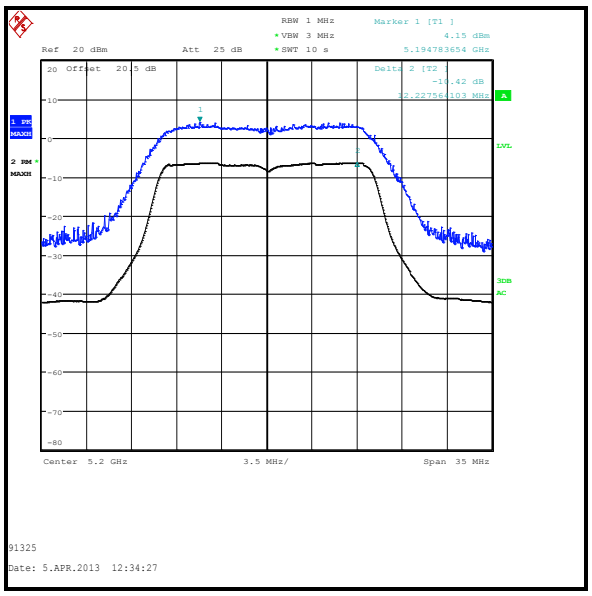
1. All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power and widest bandwidth for all bands were:
    - 802.11a – BPSK / 6 Mbps
    - 802.11n HT20 – BPSK / 6.5 Mbps / MCS0 (Greenfield mode) & BPSK / 6.5 Mbps / MCS0 (Mixed mode).
    - 802.11n HT40 - QPSK / 27 Mbps / MCS1 (Mixed mode) & BPSK / 13.5 Mbps / MCS0 (Greenfield mode).

    Measurements were then performed in these modes on middle channels for 802.11a and 802.11n 20 MHz, however 802.11n 40 MHz was tested on top channels.
2. The peak measurement (first trace) was performed in accordance with FCC KDB 789033 F) using a peak detector. The second measurement (trace 2) was performed in accordance with FCC KDB 789033 E) and FCC KDB 789033 C)3)e) Method SA-2 Alternative using an RMS detector. A marker was placed at the peak of the first trace. A delta marker was placed of at the peak of the second trace. As the EUT had a duty cycle <98%, the correction factor has been taken into account in order to calculate the final results. The peak excursion is the delta between the two markers and the addition of the duty cycle correction factor calculated in Section 5.2.5.

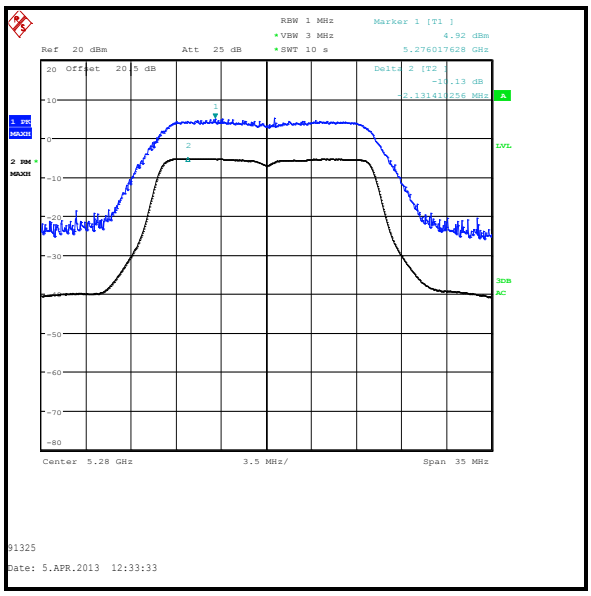
Transmitter Peak Excursion (continued)

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

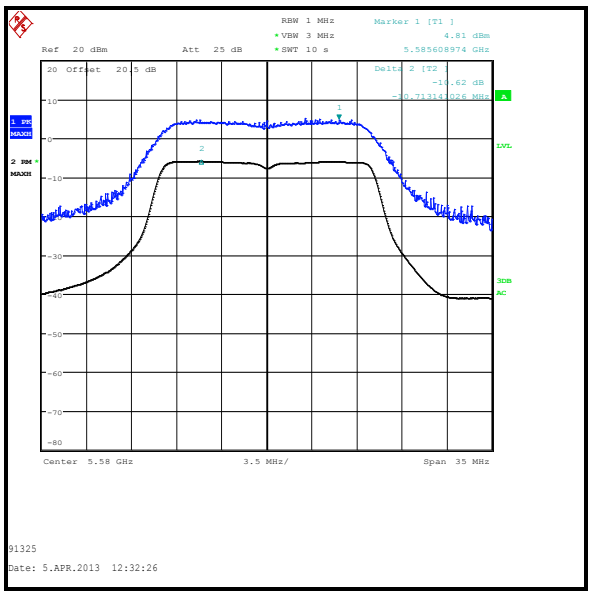
Band (GHz)	Middle Frequency (MHz)	Peak Excursion (dB)	Duty cycle correction (dB)	Corrected Peak Excursion (dB)	Limit (dB)	Lowest Margin (dB)	Result
5.15-5.25	5200	10.4	0.6	9.8	13.0	3.2	Complied
5.25-5.35	5280	10.1	0.6	9.5	13.0	3.5	Complied
5.47-5.725	5580	10.6	0.6	10.0	13.0	3.0	Complied



Middle Channel / 5.15-5.25 GHz band



Middle Channel / 5.25-5.35 GHz band

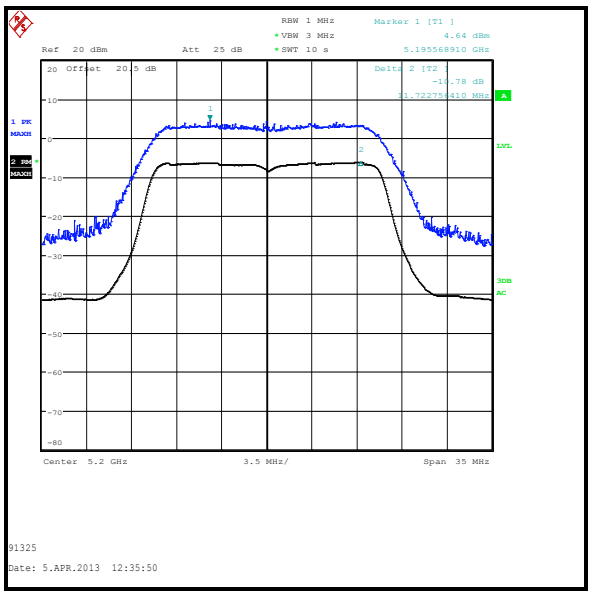


Middle Channel / 5.47-5.725 GHz band

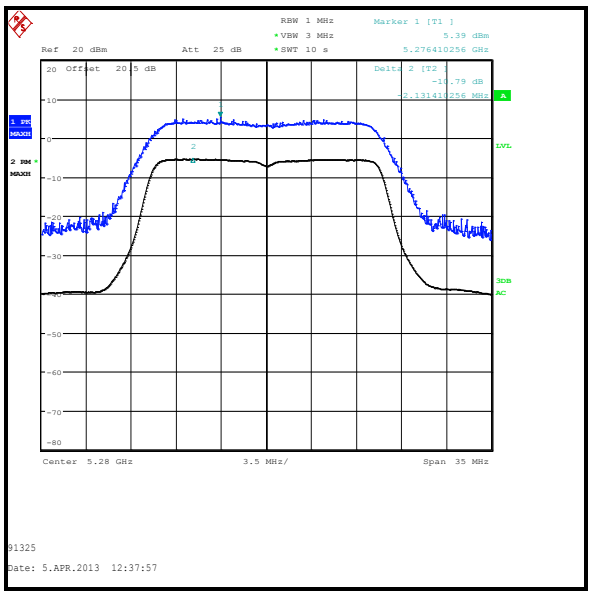
Transmitter Peak Excursion (continued)

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

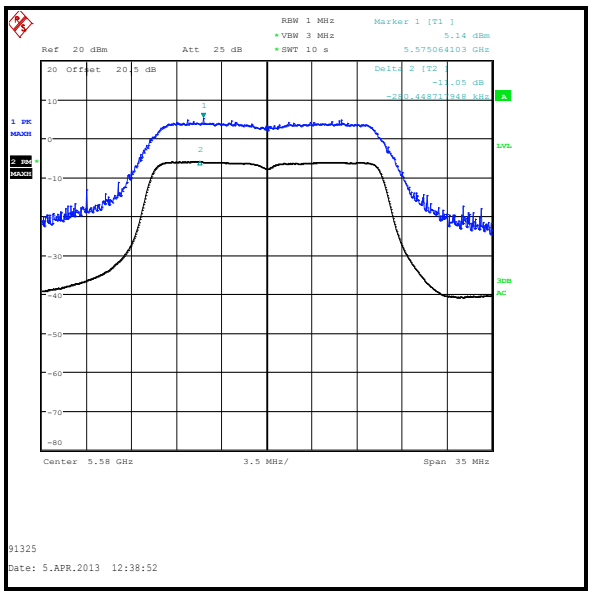
Band (GHz)	Middle Frequency (MHz)	Peak Excursion (dB)	Duty cycle correction (dB)	Corrected Peak Excursion (dB)	Limit (dB)	Lowest Margin (dB)	Result
5.15-5.25	5200	10.8	0.6	10.2	13.0	2.8	Complied
5.25-5.35	5280	10.8	0.6	10.2	13.0	2.8	Complied
5.47-5.725	5580	11.1	0.6	10.5	13.0	2.5	Complied



Middle Channel / 5.15-5.25 GHz band



Middle Channel / 5.25-5.35 GHz band

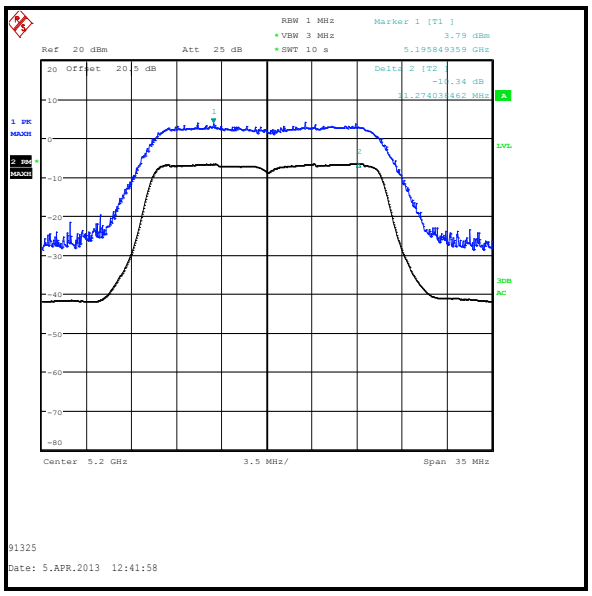


Middle Channel / 5.47-5.725 GHz band

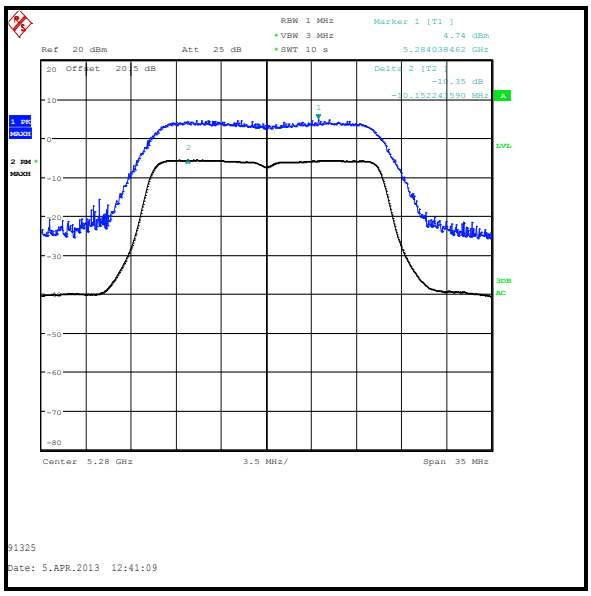
Transmitter Peak Excursion (continued)

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

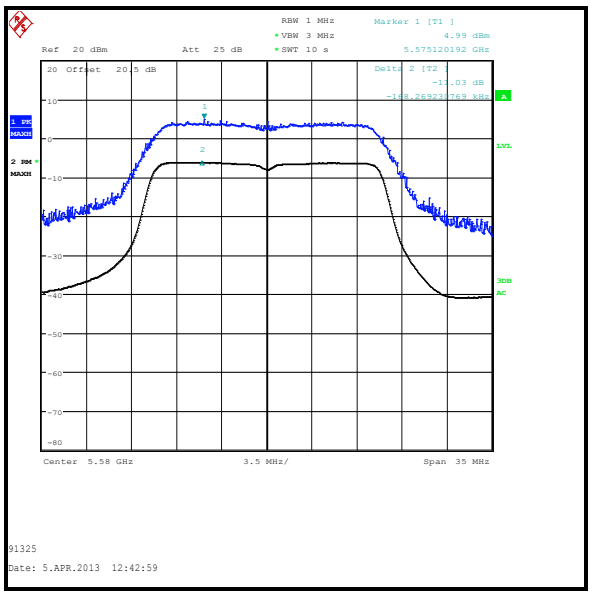
Band (GHz)	Middle Frequency (MHz)	Peak Excursion (dB)	Duty cycle correction (dB)	Corrected Peak Excursion (dB)	Limit (dB)	Lowest Margin (dB)	Result
5.15-5.25	5200	10.3	0.6	9.7	13.0	3.3	Complied
5.25-5.35	5280	10.4	0.6	9.8	13.0	3.2	Complied
5.47-5.725	5580	11.0	0.6	10.4	13.0	2.6	Complied



Middle Channel / 5.15-5.25 GHz band



Middle Channel / 5.25-5.35 GHz band

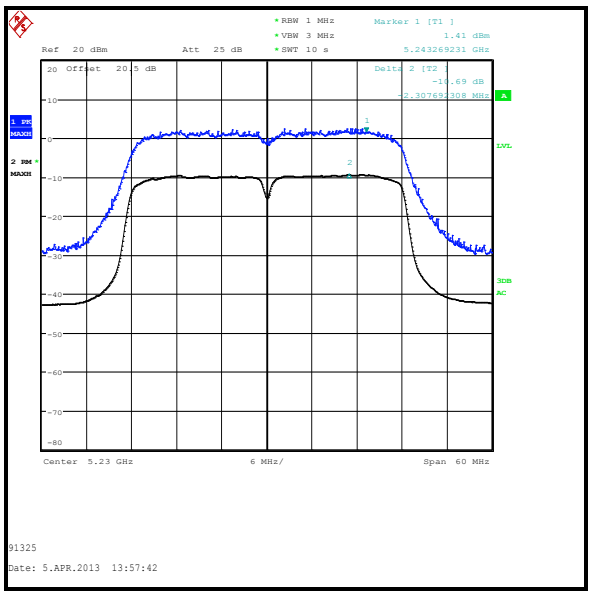


Middle Channel / 5.47-5.725 GHz band

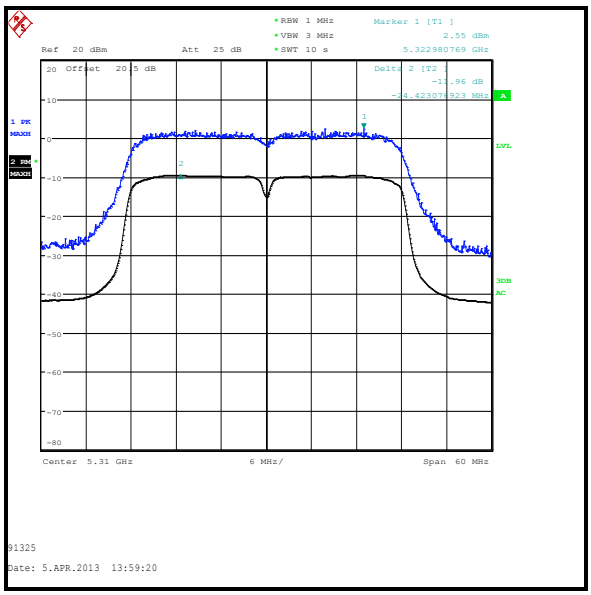
Transmitter Peak Excursion (continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / Mixed mode

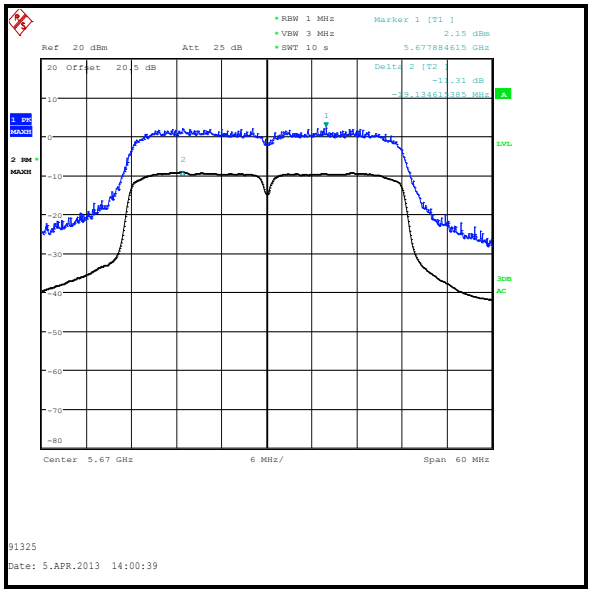
Band (GHz)	Top Frequency (MHz)	Peak Excursion (dB)	Duty cycle correction (dB)	Corrected Peak Excursion (dB)	Limit (dB)	Lowest Margin (dB)	Result
5.15-5.25	5230	10.7	1.2	9.5	13.0	3.5	Complied
5.25-5.35	5310	12.0	1.2	10.8	13.0	2.2	Complied
5.47-5.725	5670	11.3	1.2	10.1	13.0	2.9	Complied



Top Channel / 5.15-5.25 GHz band



Top Channel / 5.25-5.35 GHz band

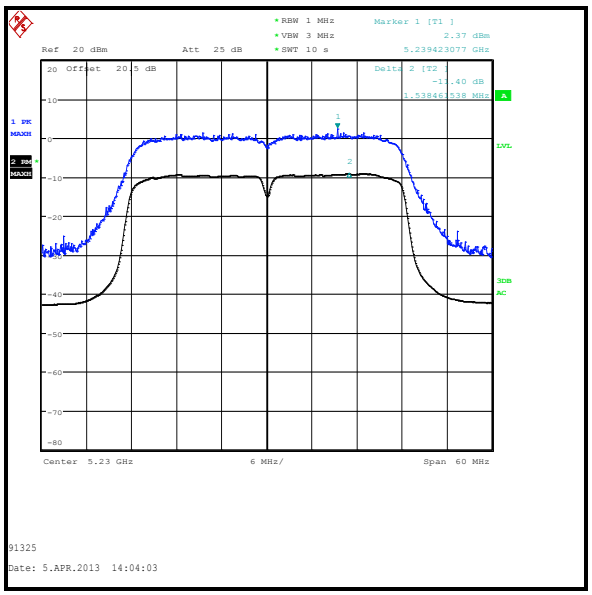


Top Channel / 5.47-5.725 GHz band

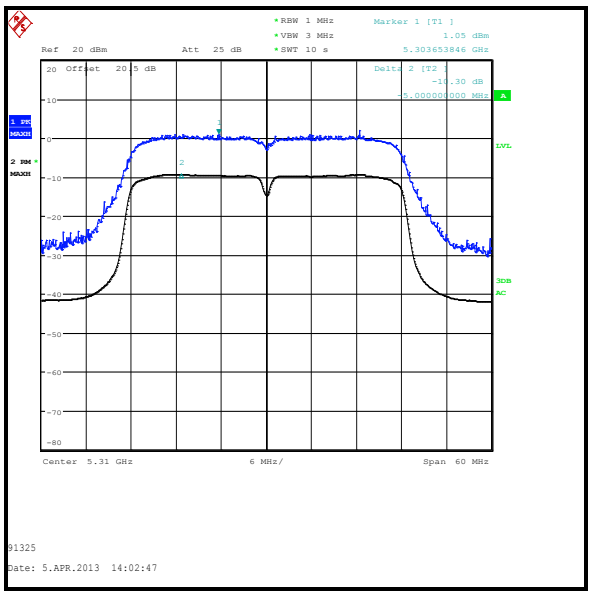
Transmitter Peak Excursion (continued)

Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode

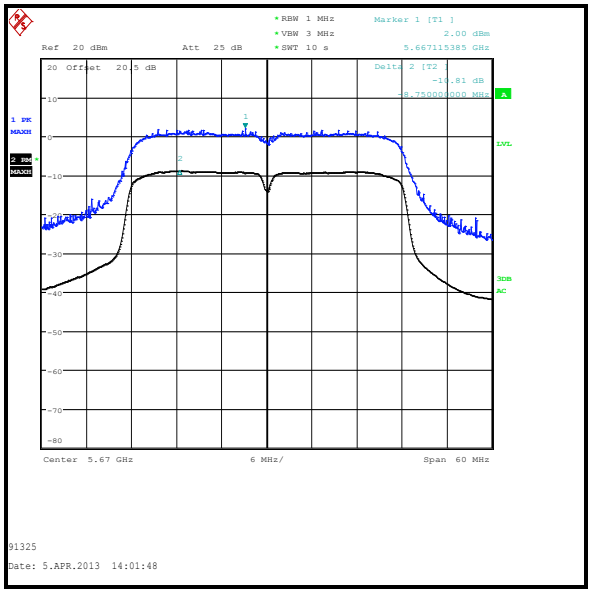
Band (GHz)	Top Frequency (MHz)	Peak Excursion (dB)	Duty cycle correction (dB)	Corrected Peak Excursion (dB)	Limit (dB)	Lowest Margin (dB)	Result
5.15-5.25	5230	11.4	0.6	10.8	13.0	2.2	Complied
5.25-5.35	5310	10.3	0.6	9.7	13.0	3.3	Complied
5.47-5.725	5670	10.8	0.6	10.2	13.0	2.8	Complied



Top Channel / 5.15-5.25 GHz band



Top Channel / 5.25-5.35 GHz band



Top Channel / 5.47-5.725 GHz band

Transmitter Peak Excursion (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A2143	Attenuator	Atlan TecRF	AN18-20	081120-23	25 May 2013	12
M260	Signal Generator	Rohde & Schwarz	1035.5005.02	829076/008	14 Jun 2013	12
M1267	Thermal Power Sensor	Rohde & Schwarz	NRV-Z52	100155	07 Jun 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	07 Feb 2014	12
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	07 Jun 2013	12

5.2.9. Transmitter Out of Band Radiated Emissions

Test Summary:

Test Engineer:	Nick Steele	**Test Date:**	09 April 2013
Test Sample IMEI:	355335050017236		

FCC Reference:	Parts 15.407(b)(2),(6),(7) & 15.209(a)
Test Method Used:	FCC KDB 789033 G) & ANSI C63.10 Sections 6.3 and 6.5
Frequency Range:	30 MHz to 1000 MHz

Environmental Conditions:

Temperature (°C):	23
Relative Humidity (%):	25

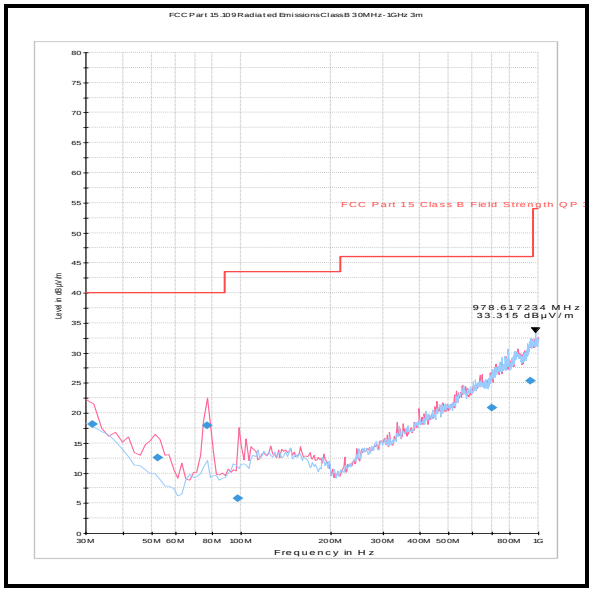
Note(s):

1. Measurements below 1 GHz were limited to the 5.25-5.35 GHz band, the EUT was transmitting with a data rate of 6.5 Mbps / MCS0 (802.11n, 20 MHz Channel Bandwidth, Greenfield mode) as it produced the highest conducted output power and was therefore deemed worst case.
2. Pre-scans with the EUT transmitting on the top channel were measured according to FCC Part 15.407(b)(2) which states for transmitters operating in the band 5.25 to 5.35 GHz: all emissions outside of the 5.15 to 5.35 GHz band shall not exceed -27 dBm/MHz. Part(b)(6) states unwanted emissions below 1 GHz must comply with the general field strength limits set forth in 15.209. Part(b)(7) states the provisions of 15.205 apply, e.g. restricted bands of operation.
3. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
4. 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.
5. 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 / Field Strength

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
978.617	Vertical	33.3	54.0	20.7	Complied

Transmitter Out of Band Radiated Emissions (5.25-5.35 GHz band operation) (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	27 Jan 2014	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	15 Feb 2014	12
G0543	Amplifier	Sonoma	310N	230801	04 Jul 2013	3
A259	Antenna	Chase	CBL6111	1513	27 Mar 2014	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	24 Oct 2013	12

Transmitter Out of Band Radiated Emissions (5.25-5.35 GHz band operation) (continued)

Test Summary:

Test Engineers:	David Doyle & Sandeep Bharat	**Test Dates:**	05 April 2013 & 08 April 2013
Test Sample IMEI:	355335050017228		

FCC Part:	15.407(b)(2),(7) & 15.209(a)
Test Method Used:	FCC KDB 789033 G) & ANSI C63.10 Sections 6.3 and 6.6
Frequency Range:	1 GHz to 40 GHz

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	29

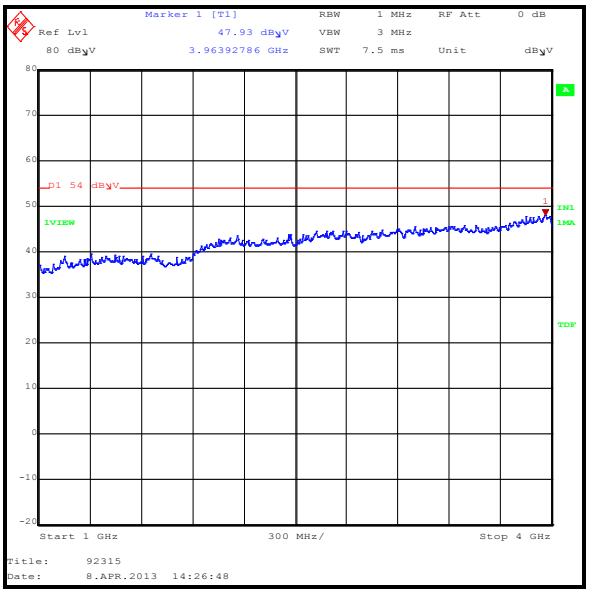
Note(s):

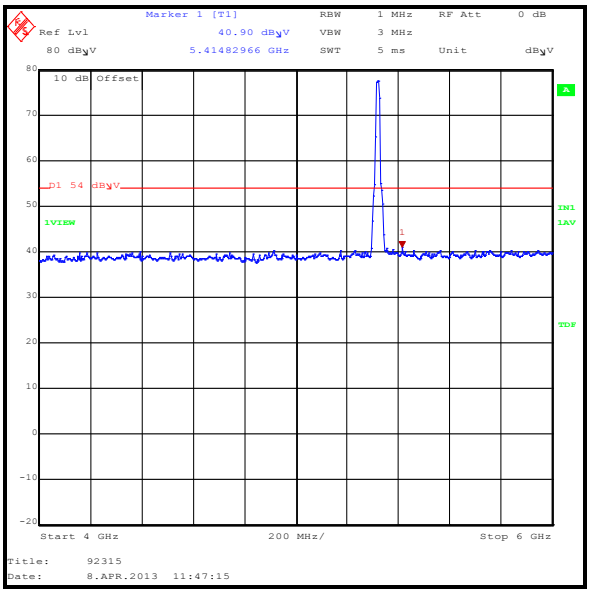
1. FCC Part 15.407(b)(2) states for transmitters operating in the band 5.25 to 5.35 GHz band: all emissions outside of the 5.15 to 5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Part 15.407(b)(7) states the provisions of 15.205 apply e.g. restricted bands of operation.
2. No spurious emissions 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.
3. Pre-scans were performed with the EUT transmitting on the top channel in this band. An enquiry was made to the FCC and the response was pre-scans could be performed in the band with the highest conducted output power and all final measurements should be performed on any emission seen for each band.
4. The final measured value, for the given emission in the field strength result tables, incorporates the calibrated antenna factor and cable loss.
5. The emission shown on the 4 GHz to 6 GHz plot is the EUT fundamental.
6. For transmitters operating in the 5.47-5.725 GHz band, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also at 5.35-5.46 GHz. Measurements were performed across the two restricted bands closest to the bands of operation with the EUT transmitting on the top channel in the 5.47 to 5.725 GHz band. Plots are included in this section of the test report. Peak and average measurements were made. No emissions were observed above the noise floor of the measurements system.
7. 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:

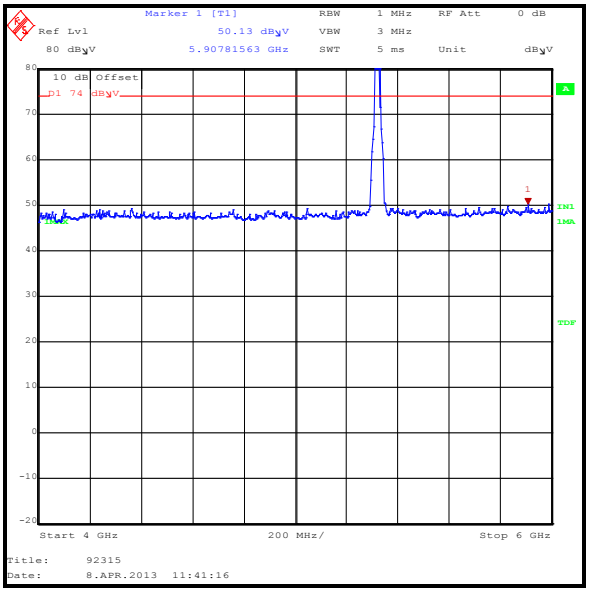
Frequency (MHz)	Antenna Polarity	Level (dBm)	Limit (dBm)	Margin (dB)	Result
37429.860	Vertical	50.7	54.0	3.3	Complied

Transmitter Out of Band Radiated Emissions (5.25-5.35 GHz band operation) (continued)

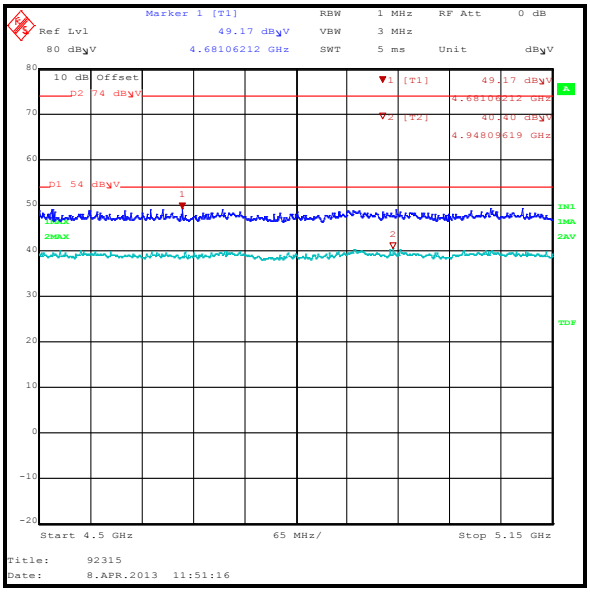




Average Detector

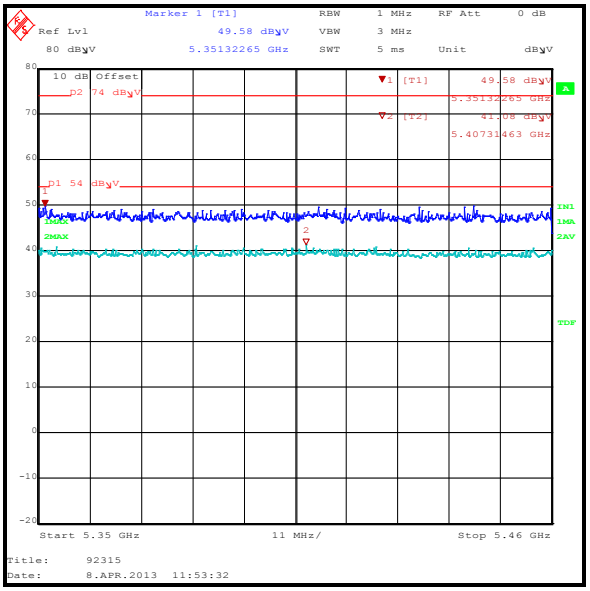


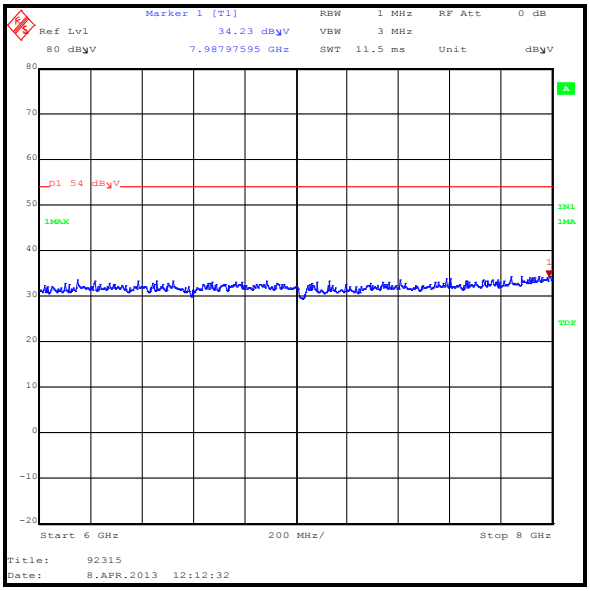
Peak Detector



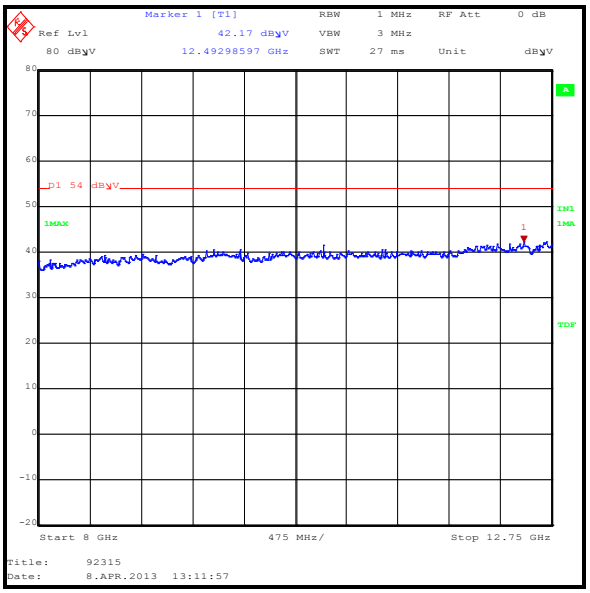
Restricted Band 4.5 GHz to 5.15 GHz

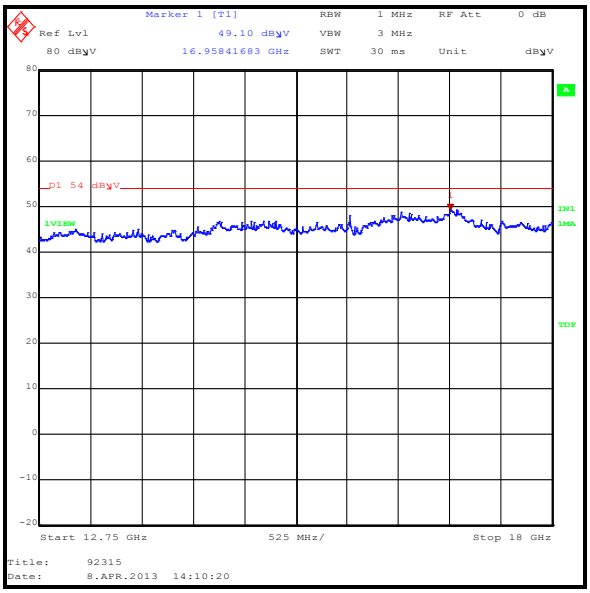
Transmitter Out of Band Radiated Emissions (5.25-5.35 GHz band operation) (continued)



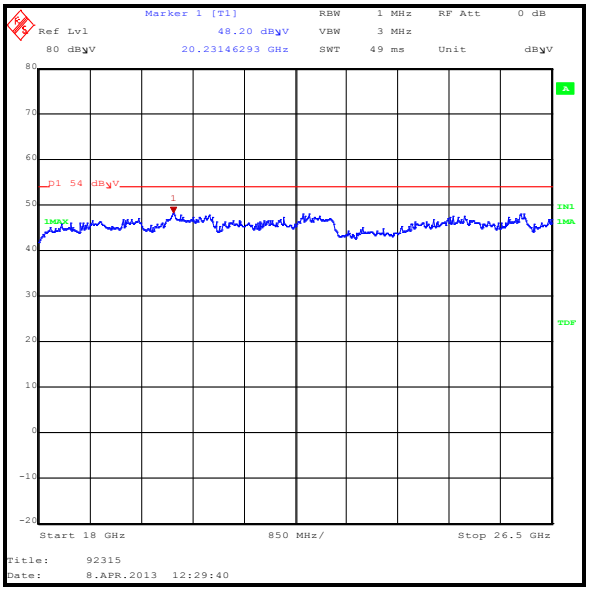


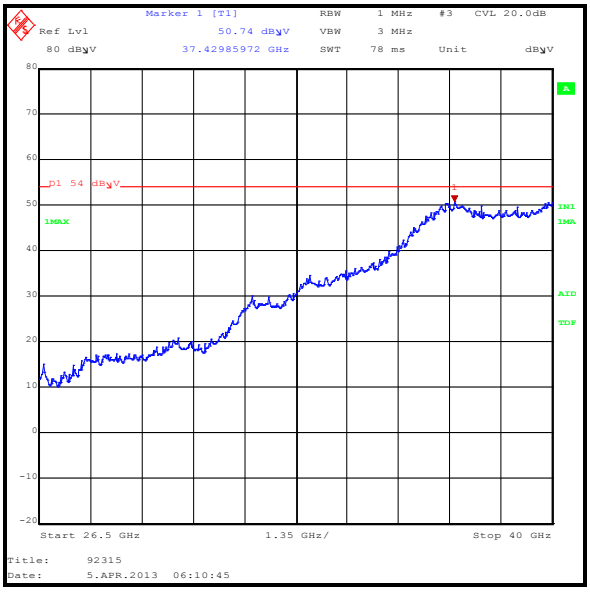
Restricted Band 5.35 GHz to 5.46 GHz





Transmitter Out of Band Radiated Emissions (5.25-5.35 GHz band operation) (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
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 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
A256	Antenna	Flann Microwave	18240-20	400	04 Nov 2013	12
A436	Antenna	Flann Microwave	20249-20	330	04 Nov 2013	12
M1390	Harmonic Mixer	Farran Technology	WHMP 28	FTL1677B	Calibrated before use	-
A366	Isolator	MRI	FRR-400	169	Calibrated before use	-
A203	Antenna	Flann Microwave	22240-20	343	11 May 2013	36
A1785	Pre-Amplifier	Farran Technology	FLNA-28-30	FTL 6483	Calibrated before use	-

5.2.10.Transmitter Band Edge Radiated Emissions

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	08 April 2013
Test Sample IMEI:	355335050017228		

FCC Reference:	Parts 15.407(b)(1), 15.407(b)(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.9.2 & FCC KDB 789033 G)6)c) Method AD

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	29

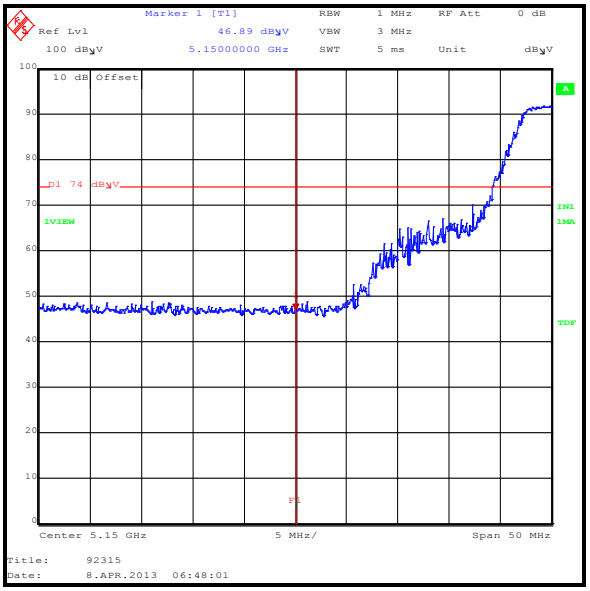
Note(s):

1. An inquiry was made to the FCC and the response confirmed band edge measurements need only be performed in the EUT modes that produce the highest power and the widest bandwidths. The modes that produced the highest power and widest bandwidth were:
    - 802.11a - BPSK / 6 Mbps.
    - 802.11n HT20 - BPSK / 6.5 Mbps / MCS0 (Greenfield mode) & BPSK / 6.5 Mbps / MCS0 (Mixed mode).
    - 802.11n HT40 - QPSK / 27 Mbps / MCS1 (Mixed mode) & BPSK / 13.5 Mbps / MCS0 (Greenfield mode).
2. Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
3. For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also above the upper band edge at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply.
4. In accordance with FCC KDB 789033 Section G)1)c) if the peak measurement is below the average limit, it is not necessary to perform a separate average measurement.
5. For average measurements the duty cycle correction factor calculated in section 5.2.5 was added to the measured result as the duty cycle was < 98 %.
6. The duty cycle was <98%. In accordance with FCC KDB 789033 G)6)c) Method AD (vi), the average measurements were performed using an increased number of sweeps as recalculated below:
    - 802.11a / 6 Mbps – 115 sweeps
    - 802.11n HT20 / 6.5 Mbps / MCS0 / Greenfield mode – 116 sweeps
    - 802.11n HT20 / 6.5 Mbps / MCS0 / Mixed mode – 116 sweeps
    - 802.11n HT40 / 27 Mbps / MCS1 / Mixed mode – 131 sweeps
    - 802.11n HT40 / 13.5 Mbps / MCS0 / Greenfield mode – 115 sweeps

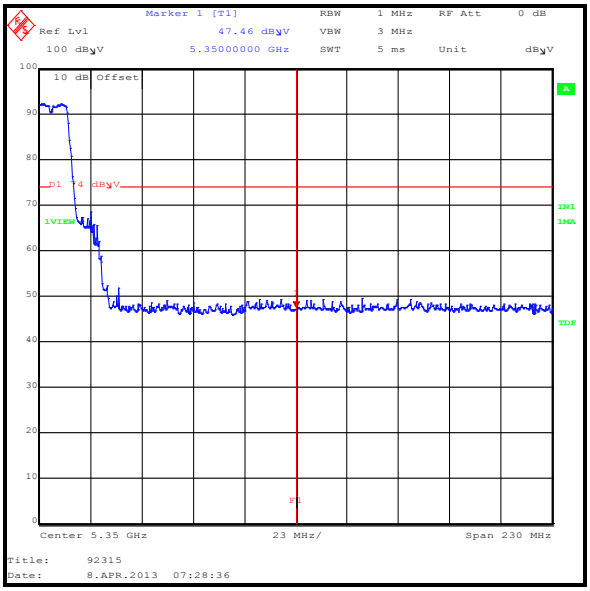
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

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

Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	46.9	54.0	7.1	Complied
5350	47.5	54.0	6.5	Complied



Lower Band Edge Peak Measurement

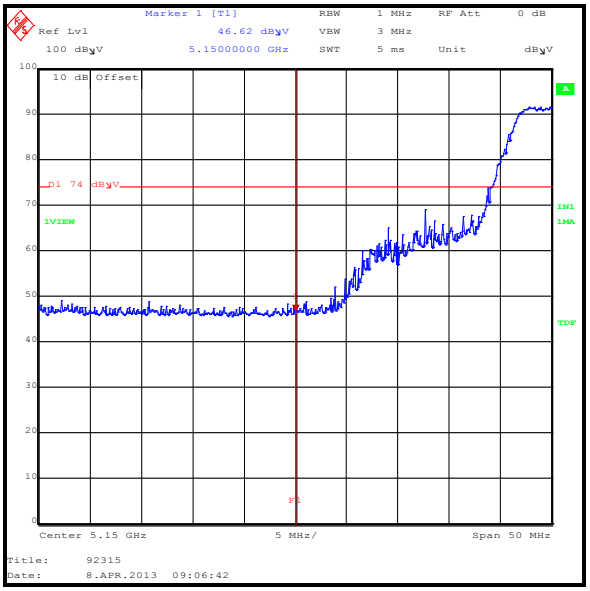


Upper Band Edge Peak Measurement

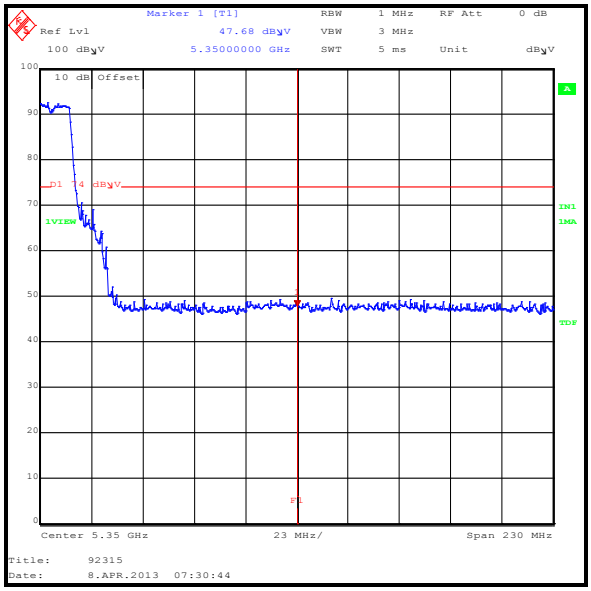
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / Greenfield mode / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	46.6	54.0	7.4	Complied
5350	47.7	54.0	6.3	Complied



Lower Band Edge Peak Measurement

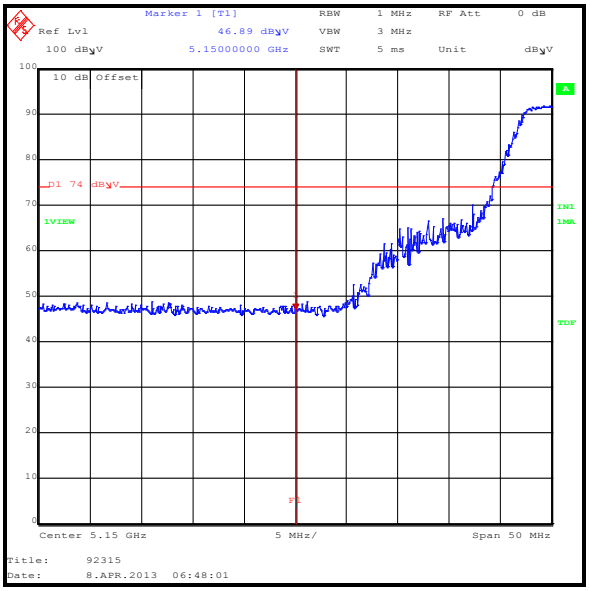


Upper Band Edge Peak Measurement

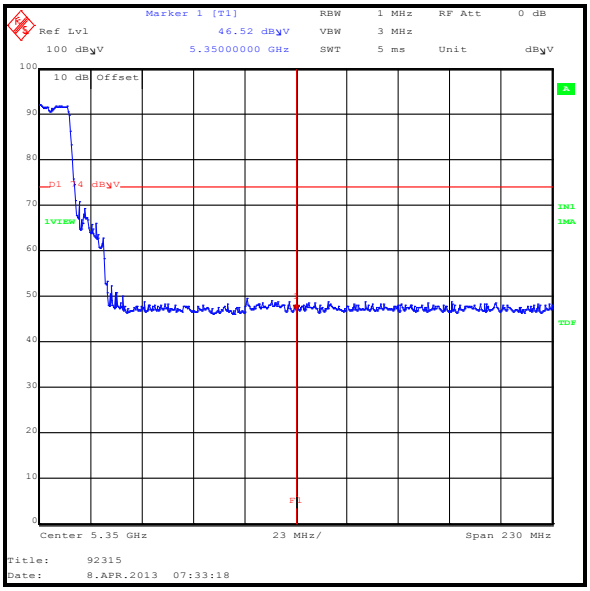
Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / Mixed mode / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	46.9	54.0	7.1	Complied
5350	46.5	54.0	7.5	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / Mixed mode / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5148.297	60.4	74.0	13.6	Complied
5150	58.2	74.0	15.8	Complied

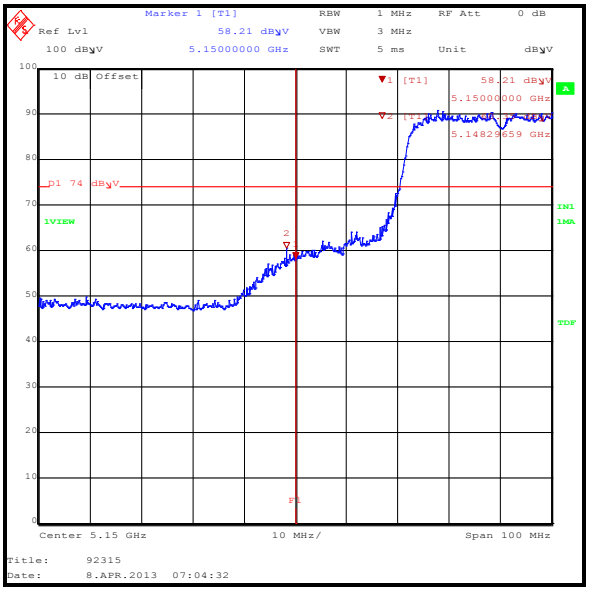
Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5350	47.7	54.0	6.3	Complied

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / Mixed mode / Average

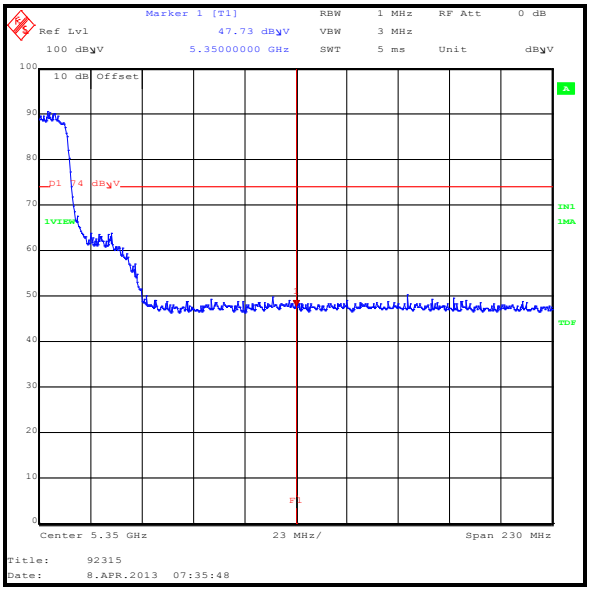
Frequency (MHz)	Level (dBµV/m)	Duty cycle correction (dB)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5150	41.0	1.2	42.2	54.0	11.8	Complied

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

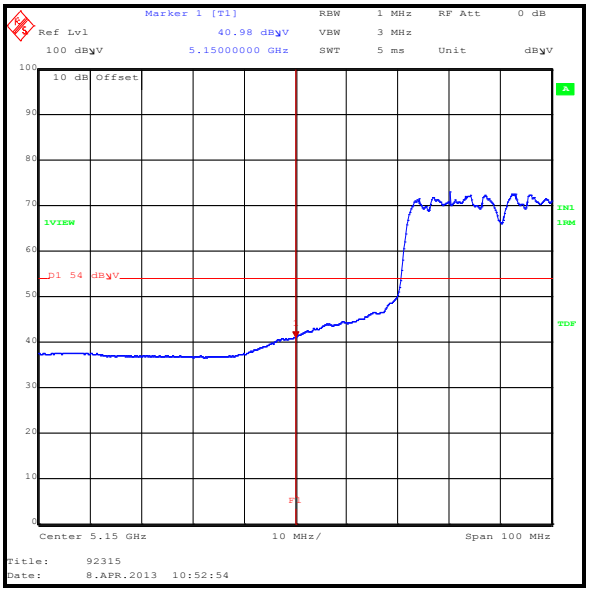
Results: 802.11n / 40 MHz / QPSK / 27.0 Mbps / MCS1 / Mixed mode



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Lower Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5149.499	60.4	74.0	13.6	Complied
5150	56.4	74.0	17.6	Complied

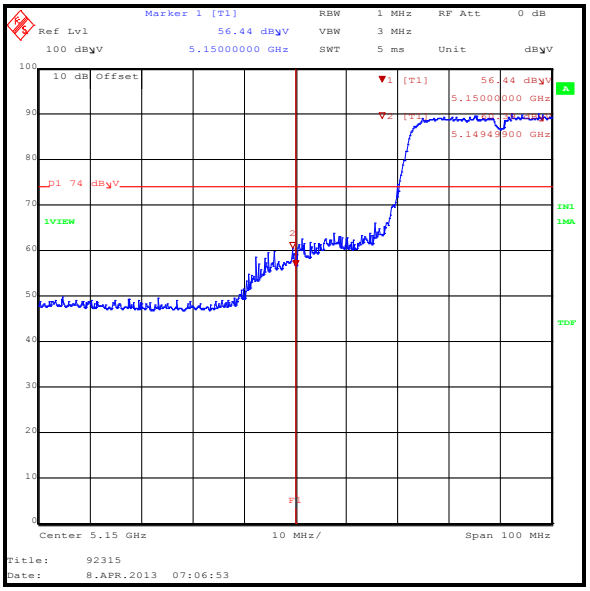
Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5350	48.3	54.0	5.7	Complied

Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode / Average

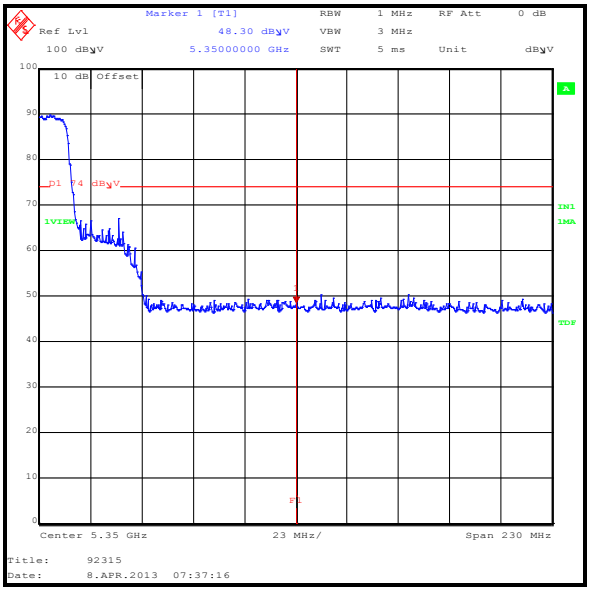
Frequency (MHz)	Level (dBµV/m)	Duty cycle correction (dB)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5150	41.9	0.6	42.5	54.0	11.5	Complied

Transmitter Band Edge Radiated Emissions (5.15-5.25 GHz band operation) (continued)

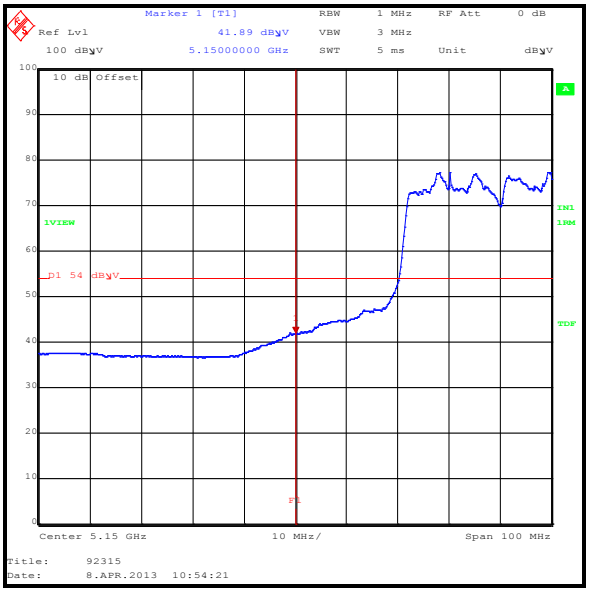
Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Lower Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band)

Test Summary:

Test Engineer:	David Doyle	**Test Date:**	08 April 2013
Test Sample IMEI:	355335050017228		

FCC Reference:	Parts 15.407(b)(2), 15.407(b)(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.9.2 & FCC KDB 789033 G)6)c) Method AD

Environmental Conditions:

Temperature (°C):	22
Relative Humidity (%):	29

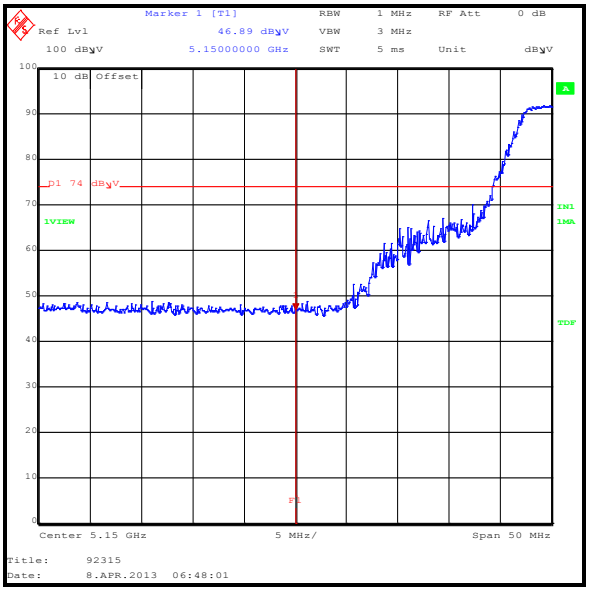
Note(s):

1. An inquiry was made to the FCC and the response confirmed band edge measurements need only be performed in the EUT modes that produce the highest power and the widest bandwidths. The modes that produced the highest power and widest bandwidth were:
    - 802.11a - BPSK / 6 Mbps.
    - 802.11n HT20 - BPSK / 6.5 Mbps / MCS0 (Greenfield mode) & BPSK / 6.5 Mbps / MCS0 (Mixed mode).
    - 802.11n HT40 - QPSK / 27 Mbps / MCS1 (Mixed mode) & BPSK / 13.5 Mbps / MCS0 (Greenfield mode).
2. Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
3. For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also above the upper band edge at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply.
4. In accordance with FCC KDB 789033 Section G)1)c) if the peak measurement is below the average limit, it is not necessary to perform a separate average measurement.
5. For average measurements the duty cycle correction factor calculated in section 5.2.5 was added to the measured result as the duty cycle was < 98 %.
6. The duty cycle was <98%. In accordance with FCC KDB 789033 G)6)c) Method AD (vi), the average measurements were performed using an increased number of sweeps as recalculated below:
    - 802.11a / 6 Mbps – 115 sweeps
    - 802.11n HT20 / 6.5 Mbps / MCS0 / Greenfield mode – 116 sweeps
    - 802.11n HT20 / 6.5 Mbps / MCS0 / Mixed mode – 116 sweeps
    - 802.11n HT40 / 27 Mbps / MCS1 / Mixed mode – 131 sweeps
    - 802.11n HT40 / 13.5 Mbps / MCS0 / Greenfield mode – 115 sweeps

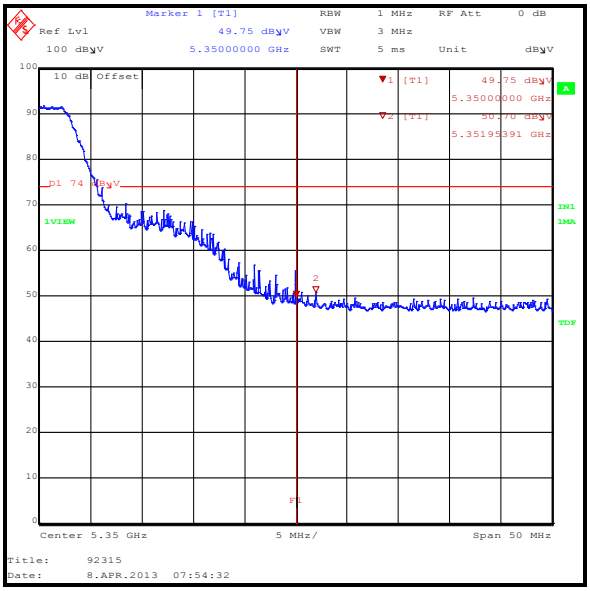
Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)

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

Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	46.9	54.0	7.1	Complied
5350	49.8	54.0	4.2	Complied
5351.954	50.7	54.0	3.3	Complied



Lower Band Edge Peak Measurement

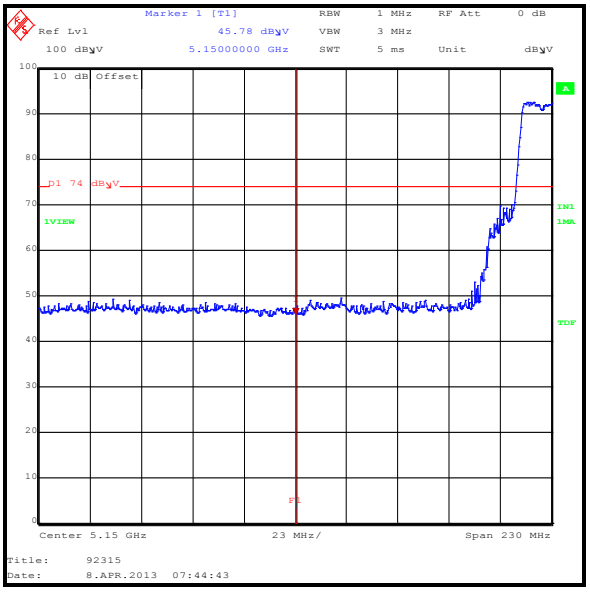


Upper Band Edge Peak Measurement

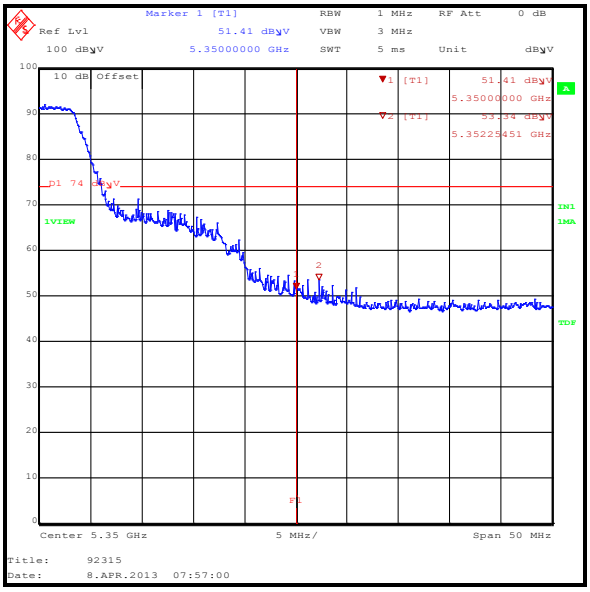
Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / Greenfield mode / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	45.8	54.0	8.2	Complied
5350	51.4	54.0	2.6	Complied
5352.255	53.3	54.0	0.7	Complied



Lower Band Edge Peak Measurement

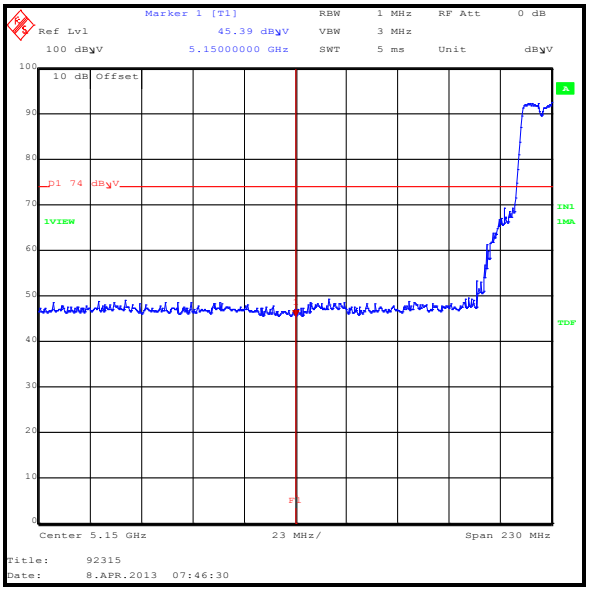


Upper Band Edge Peak Measurement

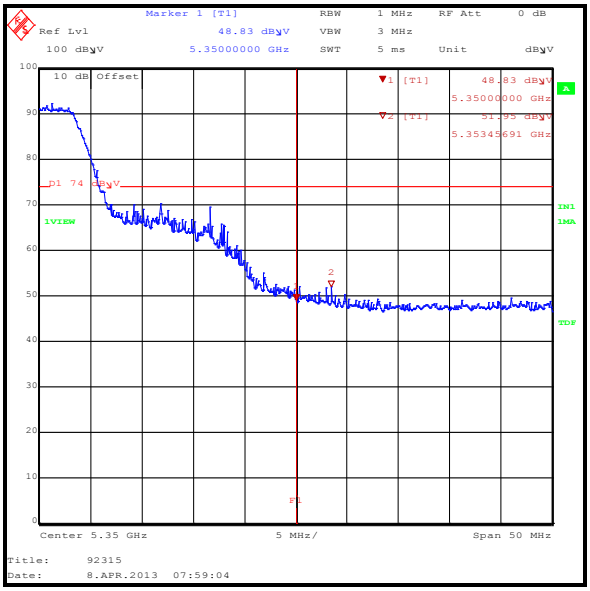
Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)

Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / Mixed mode / Peak

Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	45.4	54.0	8.6	Complied
5350	48.8	54.0	5.2	Complied
5353.457	52.0	54.0	2.0	Complied



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / Mixed mode / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5350	62.5	74.0	11.5	Complied

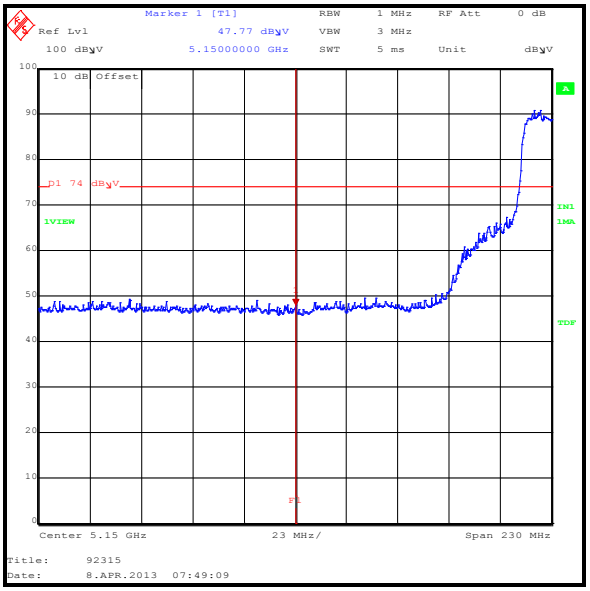
Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	47.8	54.0	6.2	Complied

Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / Mixed mode / Average

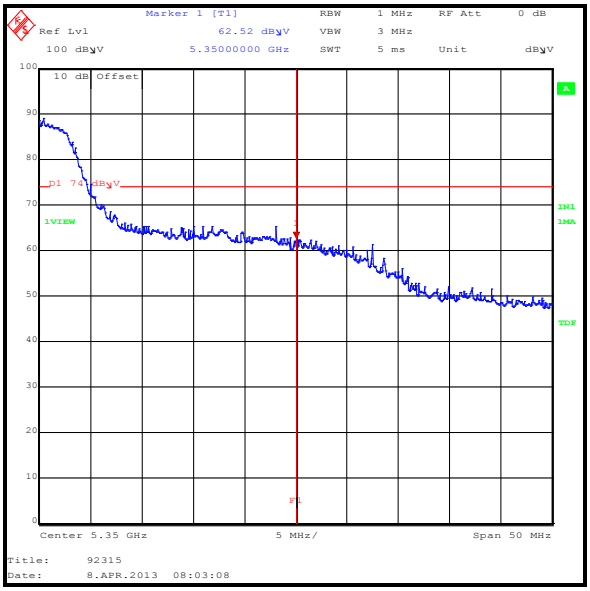
Frequency (MHz)	Level (dBµV/m)	Duty Cycle correction (dB)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5350	45.0	1.2	46.2	54.0	7.8	Complied

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)

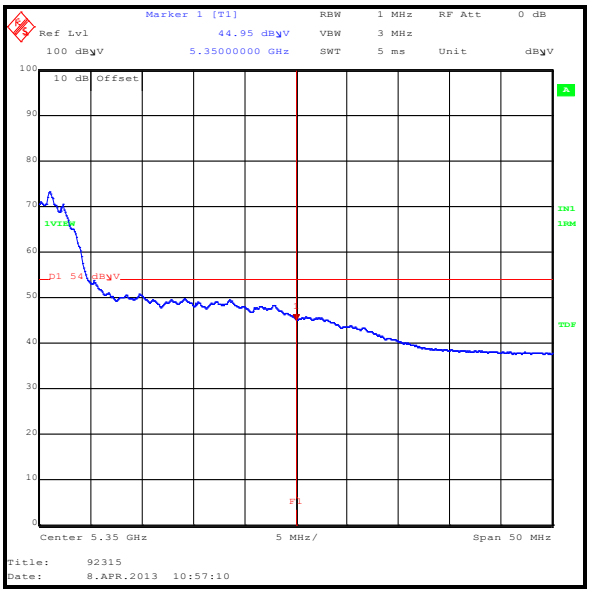
Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / Mixed mode



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)

Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode / Peak

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5350	61.6	74.0	12.4	Complied
5350.852	64.5	74.0	9.5	Complied

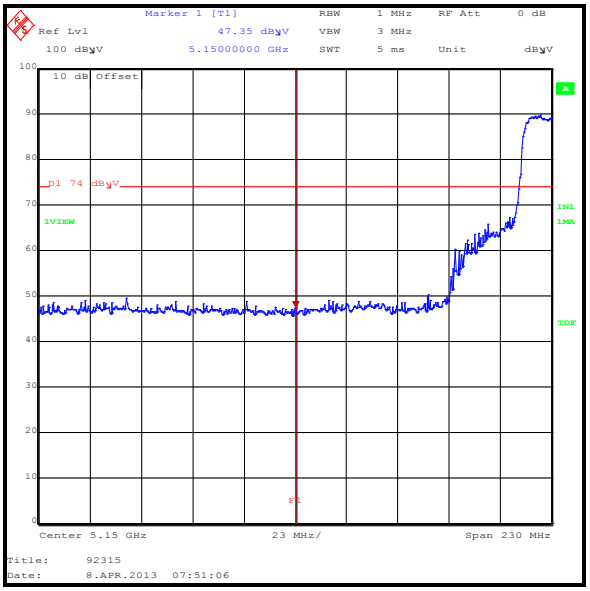
Frequency (MHz)	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
5150	47.4	54.0	6.6	Complied

Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode / Average

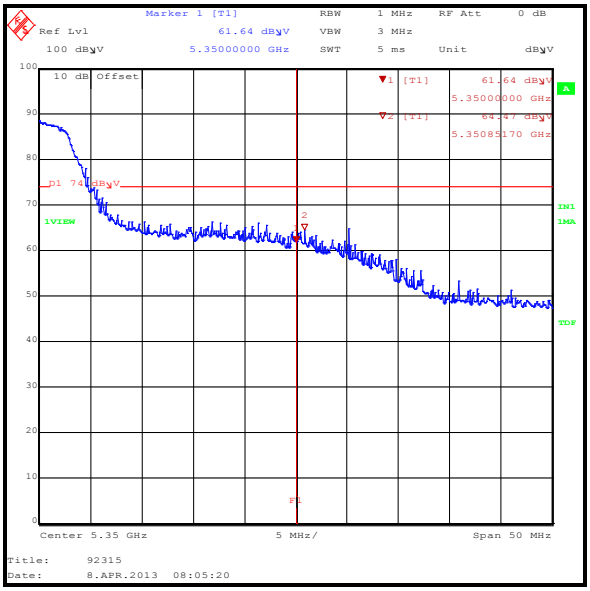
Frequency (MHz)	Level (dBµV/m)	Duty Cycle correction (dB)	Corrected Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5350	47.2	0.6	47.8	54.0	6.2	Complied

Transmitter Band Edge Radiated Emissions (5.25-5.35 GHz band operation) (continued)

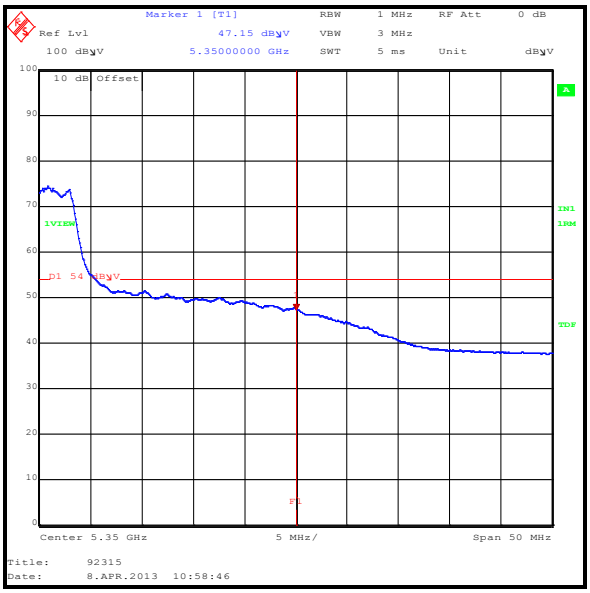
Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode



Lower Band Edge Peak Measurement



Upper Band Edge Peak Measurement



Upper Band Edge Average Measurement

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band)

Test Summary:

Test Engineer:	David Doyle	**Test Dates:**	08 April 2013 & 10 April 2013
Test Sample IMEI:	355335050017228		

FCC Reference:	Parts 15.407(b)(3), 15.407(b)(7), 15.205 & 15.209(a)
Test Method Used:	ANSI C63.10 Section 6.9.2 & FCC KDB 789033 G)6)c) Method AD

Environmental Conditions:

Temperature (°C):	21 to 22
Relative Humidity (%):	29 to 32

Note(s):

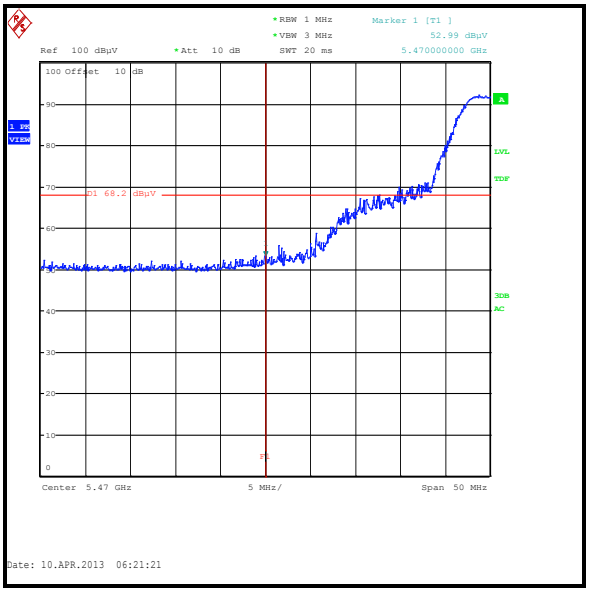
1. An inquiry was made to the FCC and the response confirmed band edge measurements need only be performed in the EUT modes that produce the highest power and the widest bandwidths. The modes that produced the highest power and widest bandwidth for the 5.47-5.725 GHz band were:
    - 802.11a - BPSK / 6 Mbps.
    - 802.11n HT20 - BPSK / 6.5 Mbps / MCS0 (Greenfield mode) & BPSK / 6.5 Mbps / MCS0 (Mixed mode).
    - 802.11n HT40 - QPSK / 27 Mbps / MCS1 (Mixed mode) & BPSK / 13.5 Mbps / MCS0 (Greenfield mode).
2. Lower band edge measurements were performed with the EUT transmitting on the bottom channel. Upper band edge measurements were performed with the EUT transmitting on the top channel.
3. For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz. However, there are restricted bands of operation below the lower band edge at 4.5-5.15 GHz and also at 5.35-5.46 GHz therefore the provisions of FCC Part 15.205 apply. Tests were performed in these restricted bands of operation with the EUT transmitting on the bottom and top channels within 5.47-5.725 GHz band, the results are included in the transmitter 5.47-5.725 GHz band radiated spurious emissions section of this test report.
4. For completeness, results are also shown as EIRP measured at a distance of 3 metres in dBm and also as field strength in dBµV/m. Measured field strength was converted to EIRP in accordance with FCC KDB 789033G)3)d)(iii) using a conversion factor of 95.2.

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)

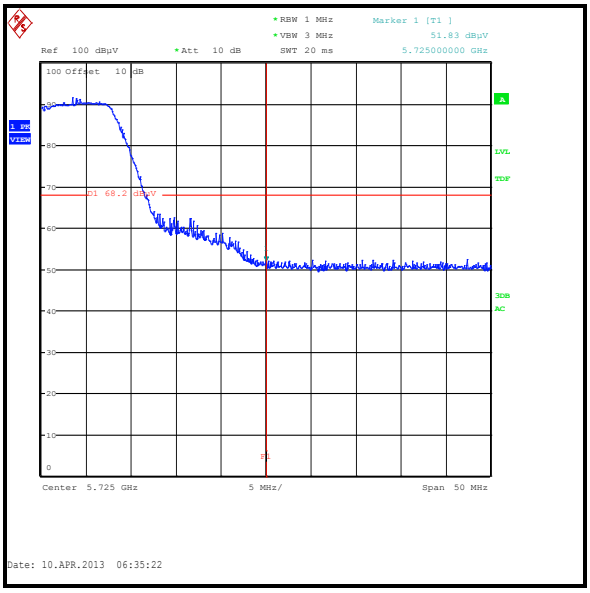
Results: 802.11a / 20 MHz / BPSK / 6 Mbps / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5470	-42.2	-27.0	15.2	Complied
5725	-43.4	-27.0	16.4	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5470	53.0	68.2	15.2	Complied
5725	51.8	68.2	16.4	Complied



Lower Band Edge Measurement



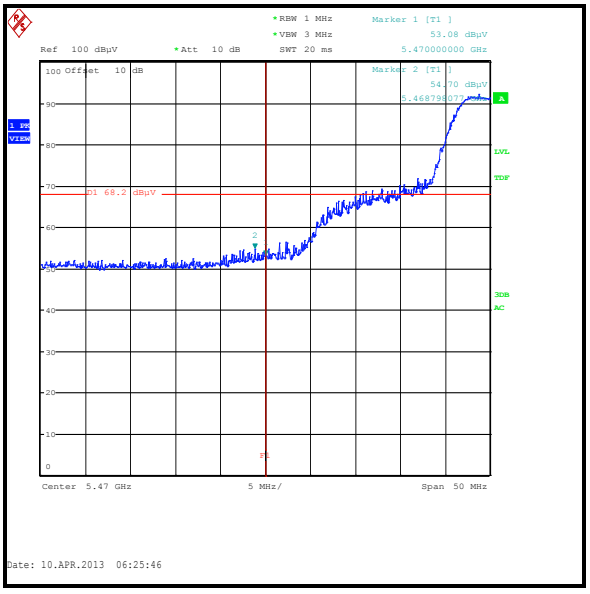
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)

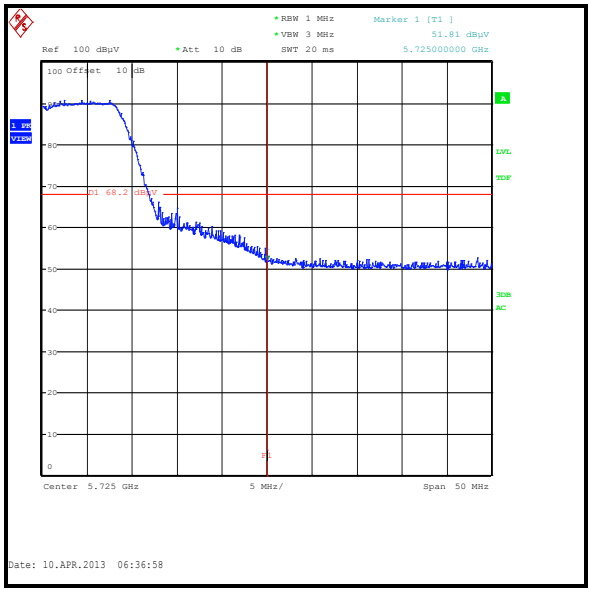
Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / Greenfield mode / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5468.798	-40.5	-27.0	13.5	Complied
5470	-42.1	-27.0	15.1	Complied
5725	-43.4	-27.0	16.4	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5468.798	54.7	68.2	13.5	Complied
5470	53.1	68.2	15.1	Complied
5725	51.8	68.2	16.4	Complied



Lower Band Edge Measurement



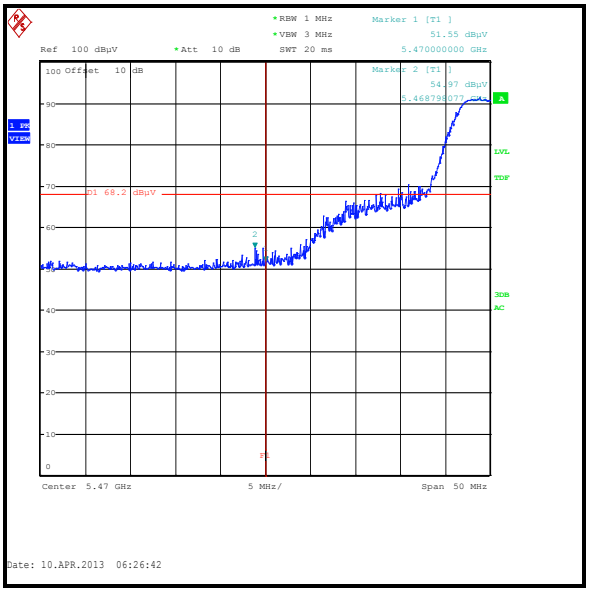
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)

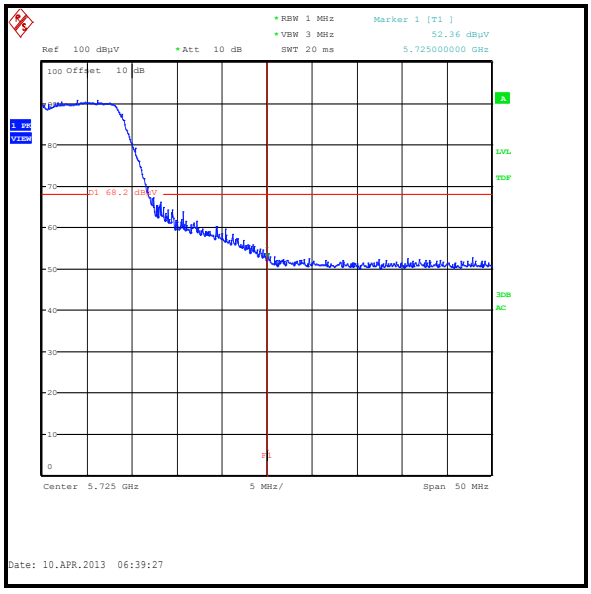
Results: 802.11n / 20 MHz / BPSK / 6.5 Mbps / MCS0 / Mixed mode / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5468.798	-40.2	-27.0	13.2	Complied
5470	-43.6	-27.0	16.6	Complied
5725	-42.8	-27.0	15.8	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5468.798	55.0	68.2	13.2	Complied
5470	51.6	68.2	16.6	Complied
5725	52.4	68.2	15.8	Complied



Lower Band Edge Measurement



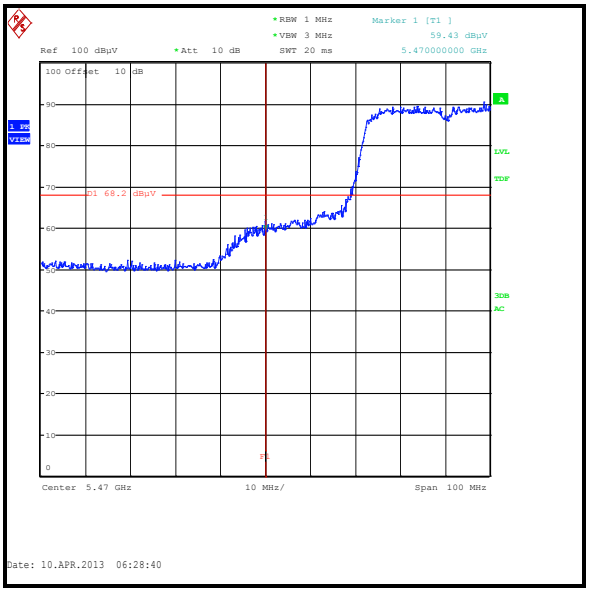
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)

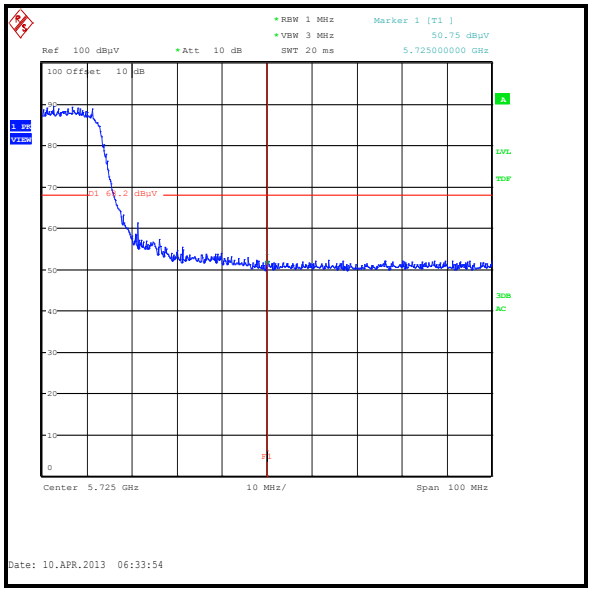
Results: 802.11n / 40 MHz / QPSK / 27 Mbps / MCS1 / Mixed mode / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5470	-35.8	-27.0	8.8	Complied
5725	-44.4	-27.0	17.4	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5470	59.4	68.2	8.8	Complied
5725	50.8	68.2	17.4	Complied



Lower Band Edge Measurement



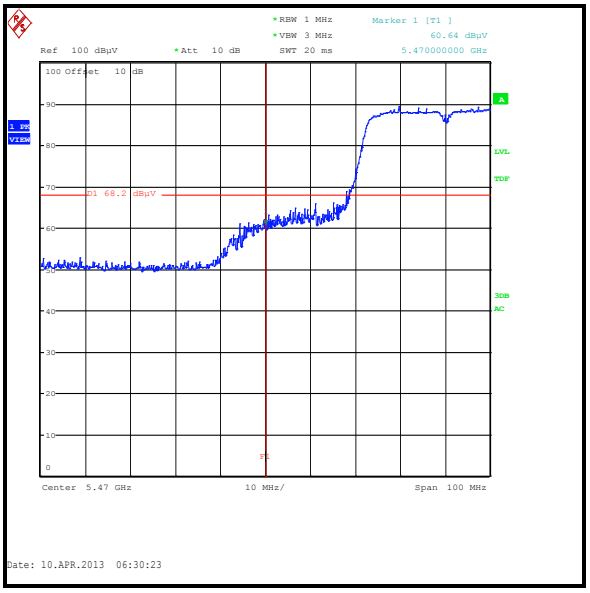
Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)

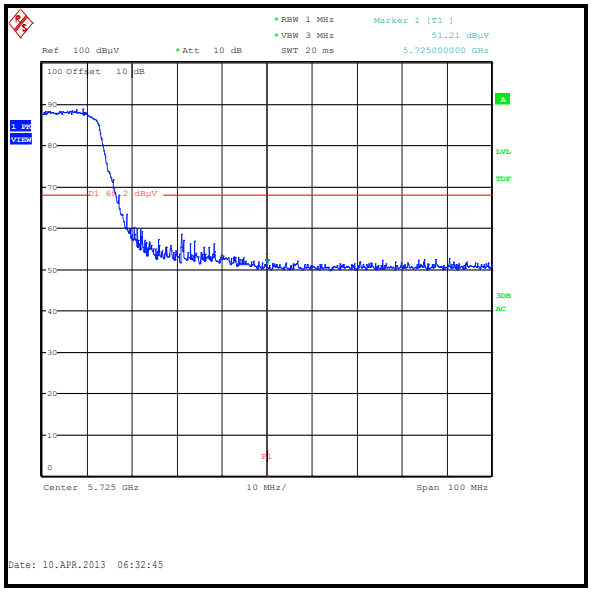
Results: 802.11n / 40 MHz / BPSK / 13.5 Mbps / MCS0 / Greenfield mode / Peak

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
5470	-34.6	-27.0	7.6	Complied
5725	-44.0	-27.0	17.0	Complied

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
5470	60.6	68.2	7.6	Complied
5725	51.2	68.2	17.0	Complied



Lower Band Edge Measurement



Upper Band Edge Measurement

Transmitter Band Edge Radiated Emissions (5.47-5.725 GHz band operation) (continued)

Test Equipment Used:

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
A1396	Attenuator	Huber & Suhner	6810.17.B	757987	06 Jul 2013	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	04 Nov 2013	12
A253	Antenna	Flann Microwave	12240-20	128	04 Nov 2013	12
K0002	3m RSE Chamber	Rainford	N/A	N/A	04 Nov 2013	12
M1630	Test Receiver	Rohde & Schwarz	ESU40	100233	07 Feb 2014	12
M1124	Test Receiver	Rohde & Schwarz	ESIB 26	100046K	14 Aug 2013	12

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±4.69 dB
Maximum Conducted Output Power	5.15 GHz to 5.725 GHz	95%	±1.13 dB
Peak Power Spectral Density	5.15 GHz to 5.725 GHz	95%	±1.13 dB
Peak Excursion	5.15 GHz to 5.725 GHz	95%	±1.13 dB
26 dB Emission Bandwidth	5.15 GHz to 5.725 GHz	95%	±0.92 ppm
Radiated Spurious Emissions	30 MHz to 40 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