TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: F@st 3965CV Managed Home Router

FCC ID: VW3FAST3965CV

To: FCC Part 15.407: 2011 Subpart E

Test Report Serial No.:
RFI-RPT-RP89496JD02A V3.0

Version 3.0 supersedes all previous versions

This Test Report Is Issued Under The Authority Of John Newell, Group Quality Manager:	
Checked By:	Steven White
Signature:	
Date of Issue:	03 October 2012

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RFI Global Services Ltd
Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number:2117901

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1. Customer Information

Company Name:	Sagemcom SAS
Address:	250 RTE De L`Empereur 92500 Rueil Malmaison France

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.407
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications) 2011: 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) 2011: 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) 2011: Part 15 Subpart C (Intentional Radiators) – Sections 15.207 and 15.209
Site Registration:	209735
Location of Testing:	RFI Global Services Ltd., RFI Global Services LtdWade Road, Basingstoke, Hampshire, RG24 8AH.
Test Dates:	17 August 2012 to 21 September 2012

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.107(a)	Receiver/Idle Mode AC Conducted Emissions	✓
Part 15.109	Receiver/Idle Mode Radiated Spurious Emissions	✓
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.403(i)	Transmitter 26 dB Emission Bandwidth	✓
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 band)	✓
Part 15.407(a)(2)	Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band)	✓
Part 15.407(a)(3)	Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band)	✓
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 band)	✓
Part 15.407(a)(2)	Transmitter Peak Power Spectral Density (5.47-5.725 GHz band)	✓
Part 15.407(a)(3)	Transmitter Peak Power Spectral Density (5.725-5.850 GHz band)	✓
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 1
Part 15.407(h)(1)	Transmitter Power Control	Note 2
Key to Results ✓ = Complied ✗ = Did not comply		

Note(s):

1. The Customer declared 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.
2. Transmit Power Control was not tested as the maximum EIRP is less than 500 mW (27 dBm) in U-NII Bands 2 & 3.
3. Dynamic Frequency Selection test results can be found in RFI test report RFI-RPT-RP89496JD02C

2.3. Methods and Procedures

Reference:	ANSI C63.4 (2009)
Title:	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
Reference:	ANSI C63.10 (2009)
Title:	American National Standard for Testing Unlicensed Wireless Devices
Reference:	FCC KDB 789033 D01 v01r01 3/5/2012
Title:	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E
Reference:	FCC KDB 662911 D01 v01r01 10/25/2011
Title:	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
Reference:	FCC KDB 644545 D02 v01 6/7/2012
Title:	Alternative Guidance for IEEE 802.11ac and Pre-ac Device Emissions Testing
Reference:	FCC Response To Inquiry
Title:	Tracking Number 969369 Date: 21 February 2012

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:	Sagemcom
Model Name or Number:	F@st 3965CV
Hardware Version:	253509713
Software Version:	2.7
Serial Number:	LK220202181
FCC ID:	VW3FAST3965CV

Brand Name:	Sagemcom
Model Name or Number:	F@st 3965CV
Hardware Version:	253509713
Software Version:	2.7
Serial Number:	LK220202177
FCC ID:	VW3FAST3965CV

Brand Name:	Sagemcom
Model Name or Number:	F@st 3965CV
Hardware Version:	253509713
Software Version:	2.7
Serial Number:	LK220202169
FCC ID:	VW3FAST3965CV

3.2. Description of EUT

The equipment under test was an IEEE 802.11a,b,g,n WLAN router operating in the 2.4 GHz and 5 GHz bands. The EUT has five internal antennas, two transmit/receive for 2.4 GHz band and three transmit/receive for 5 GHz band. The antennas are integral to the PCB and connected to the module via PCB tracks which incorporate a port on each track. When an RF cable is connected to the port the antenna is disconnected. For 802.11n operation the device uses MIMO – 2x2 for the 2.4 GHz band and 3x3 for the 5 GHz band. Depending on the 802.11 MCS, the device transmits 1, 2 or 3 spatial stream. The device uses spatial multiplexing and from an RF point of view the streams are correlated with unequal gain antennas.

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:	CCK, BPSK, QPSK, 16QAM, 64QAM		
Data rates:	802.11a	6, 9, 12, 18, 24, 36 ,48 & 54 Mbps	
	802.11n 20 MHz	6.5, 13, 19.5, 26, 39, 52, 58.5, 65, 78, 104, 117, 130, 156, 175.5 & 195 Mbps	
	802.11n 40 MHz	13.5, 27, 40.5, 54, 81, 108, 121.5, 135, 162, 216, 243, 270, 324, 364.5 & 405 Mbps	
Power Supply Requirement(s):	Nominal	120 VAC 60 Hz via 12 V adaptor	
Antenna Gain:	5150 to 5350 MHz	P2401 3.2 dBi, P2403 3.4 dBi, P2405 5.4 dBi	
	5470 to 5850 MHz	P2401 5.1 dBi, P2403 4.0 dBi, P2405 5.7 dBi	
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)

Transmit & Receive Frequency Band:	5725 MHz to 5850 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	149	5745
	Middle	157	5785
	Top	165	5825
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	110	5550
	Top	134	5670
Transmit & Receive Frequency Band:	5725 MHz to 5850 MHz		
Transmit & Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	151	5755
	Top	159	5795

3.5. Support Equipment

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

Description:	Network Adaptor
Brand Name:	Belkin
Model Name or Number:	Gigabit USB 3.0
Serial Number:	2210120201074

Description:	4 Port Hub
Brand Name:	Belkin
Model Name or Number:	F5U404-BLK
Serial Number:	D12-00047182

Description:	Ethernet router
Brand Name:	Netgear
Model Name or Number:	DG834 V4
Serial Number:	1PL596BD001A4

Description:	Laptop PC
Brand Name:	Dell
Model Name or Number:	Latitude D610
Serial Number:	RFI Asset No. PC471NT

Description:	AC Adaptor
Brand Name:	Sagemcom
Model Name or Number:	NBS24120200VU
Serial Number:	Not marked or stated

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

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

- Receiver/Idle mode. The 802.11 mode was active but not transmitting.
- Continuously transmitting with a modulated carrier at maximum power/widest bandwidth 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):

- Transmitting in test mode with >99% duty cycle and controlled using a bespoke application on a laptop PC using Telnet PC application. The application was used to enable continuous transmit mode or receive mode and to select the test channels, data rates and modulation schemes as required. The Customer supplied instructions on how to configure the EUT for test purposes.
- The EUT software power settings for the testing covered within this report are as defined in Annex A
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the highest power for all bands were:
    - 802.11a – 6 Mbps
    - 802.11n HT20 – 6.5 Mbps / MCS0
    - 802.11n HT40 – 13.5 Mbps / MCS0

  Measurements were performed on the required channels and ports dependant on each test case.
- All supported modes and channel widths were initially investigated on one channel. The modes that produced the widest bandwidth for all bands were:
    - 802.11a –6 Mbps
    - 802.11n HT20 – 6.5 Mbps / MCS0
    - 802.11n HT40 – 13.5 Mbps / MCS0

  Measurements were performed on the required channels and ports dependant on each test case.
- The EUT has three transmit/receive RF ports (labelled as P2401, P2403 and P2405). Conducted measurements were performed on all transmit ports. RF cables and attenuators connecting the test equipment to the EUT ports were calibrated before use and the calibration data incorporated into the conducted measurement results.
- Transmitter radiated spurious emissions final measurements were performed using the 802.11n HT40 – 13.5 Mbps / MCS0 configuration, as it provided the highest output power and was determined to be worst case.
- Radiated measurements and were performed using the EUT with serial number LK220202169.
- AC conducted measurements were performed using the EUT with serial number LK2202002181.
- All other measurements were performed using the EUT with serial number LK2202002177.

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:	Philip Harrison	**Test Date:**	17 August 2012
Test Sample Serial Number:	LK2202002181		

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):	28
Relative Humidity (%):	44

Note(s):

1. All other emissions were >30 dB below the applicable limits and therefore were not recorded.

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Live	54.6	66.0	11.4	Complied
0.159	Live	50.9	65.5	14.6	Complied
0.191	Live	46.3	64.0	17.7	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Live	38.6	56.0	17.4	Complied
0.425	Live	25.7	47.4	21.7	Complied

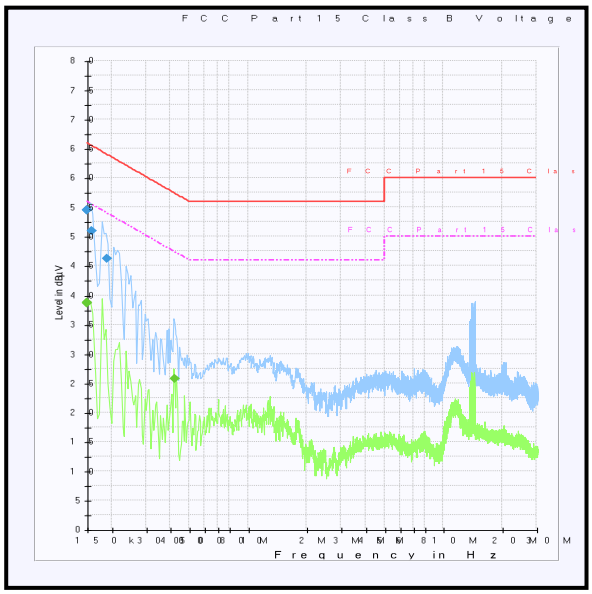
Results: Neutral / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Neutral	53.6	66.0	12.4	Complied
0.177	Neutral	49.2	64.6	12.4	Complied
0.209	Neutral	45.2	63.3	15.4	Complied
14.325	Neutral	20.3	60.0	18.1	Complied

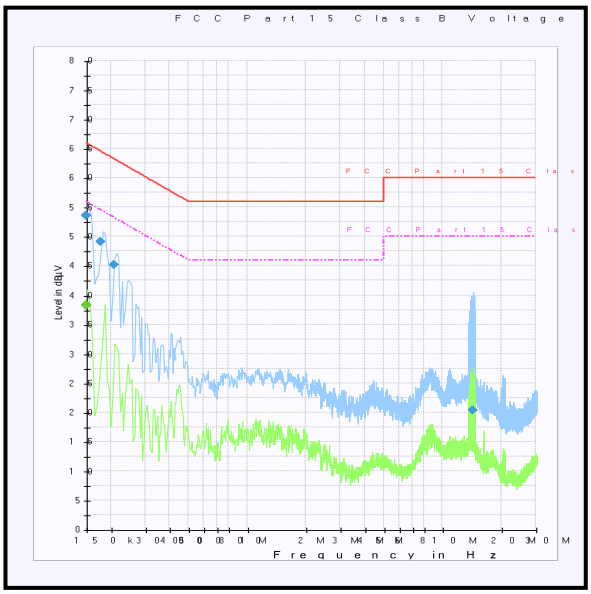
Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.150	Neutral	38.3	56.0	17.7	Complied

Receiver/Idle Mode AC Conducted Spurious Emissions (continued)



Live



Neutral

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

Test Equipment Used:

RFI ID	Instrument Description	Model Number	Calibration Due	Calibration Interval (Months)
M1379	Test Receiver	ESIB7	20 Oct 2012	12
A1830	Pulse Limiter	ESH3-Z2	25 Feb 2013	12
A649	LISN	ESH3-Z5	19 Feb 2013	12

5.2.2. Receiver/Idle Mode Radiated Spurious Emissions

Test Summary:

Test Engineer:	Steven White	**Test Date:**	24 August 2012
Test Sample Serial Number:	LK220202169		

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):	27
Relative Humidity (%):	39

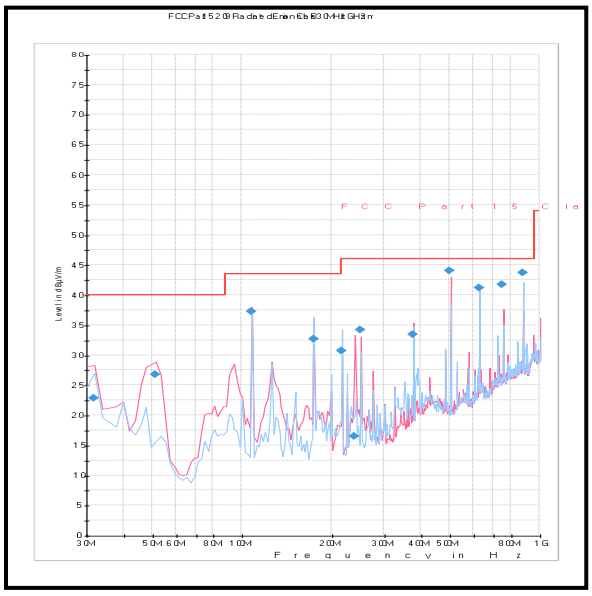
Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. Measurements below 1 GHz were performed in a semi-anechoic chamber (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
31.967	Vertical	22.9	40.0	17.1	Complied
51.243	Vertical	26.8	40.0	13.2	Complied
108.020	Vertical	37.3	43.5	6.2	Complied
175.006	Horizontal	32.7	43.5	10.8	Complied
216.050	Horizontal	30.7	46.0	15.3	Complied
239.001	Vertical	16.5	46.0	29.5	Complied
250.039	Vertical	34.2	46.0	11.8	Complied
374.997	Vertical	33.4	46.0	12.6	Complied
500.002	Vertical	44.0	46.0	2.0	Complied
625.026	Vertical	41.2	46.0	4.8	Complied
750.023	Vertical	41.7	46.0	4.3	Complied
875.028	Horizontal	43.8	46.0	2.2	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 ID	Instrument Description	Model Number	Calibration Due	Calibration Interval (Months)
M1273	Test Receiver	ESIB 26	03 Feb 2013	12
A553	Antenna	CB6111A	15 Feb 2013	12
G0543	Amplifier	310N	15 Oct 2013	3
A1834	Attenuator	8491B	29 Jan 2013	12

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Test Summary:

Test Engineer:	Andrew Edwards	**Test Date:**	31 August 2012 & 21 September 2012
Test Sample Serial Number:	LK220202169		

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):	24
Relative Humidity (%):	35

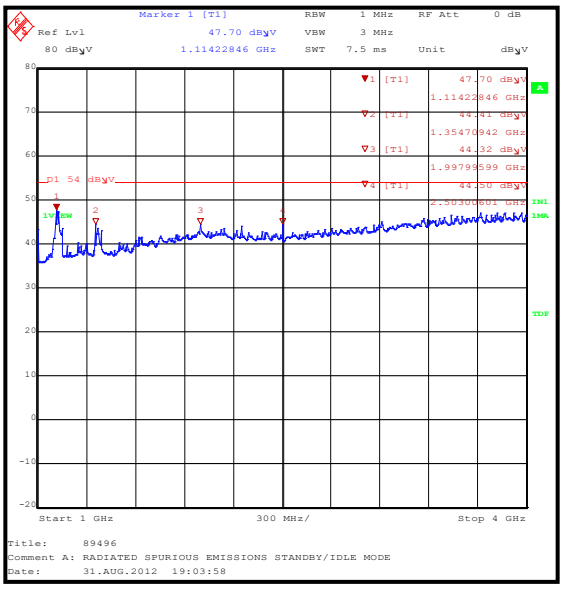
Note(s):

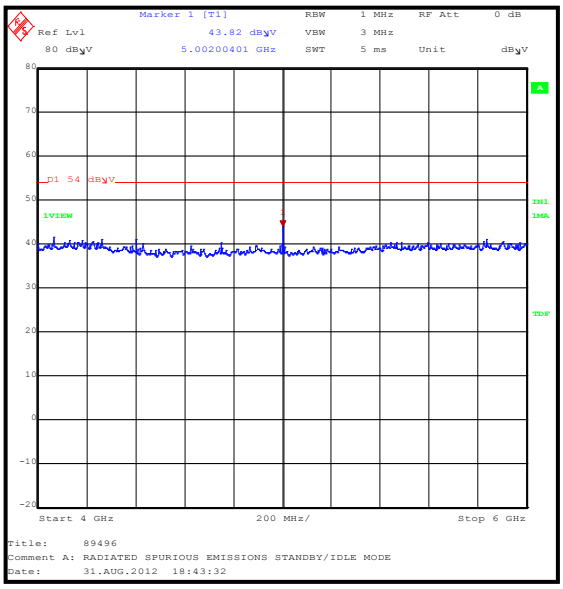
1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The peak level was compared to the average limit as opposed to being compared to the peak limit because this is the more onerous limit.
3. Pre-scans above 1 GHz were performed 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.

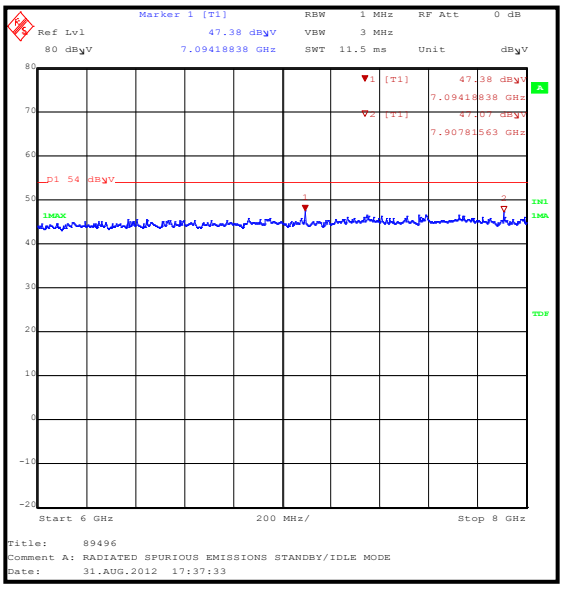
Results:

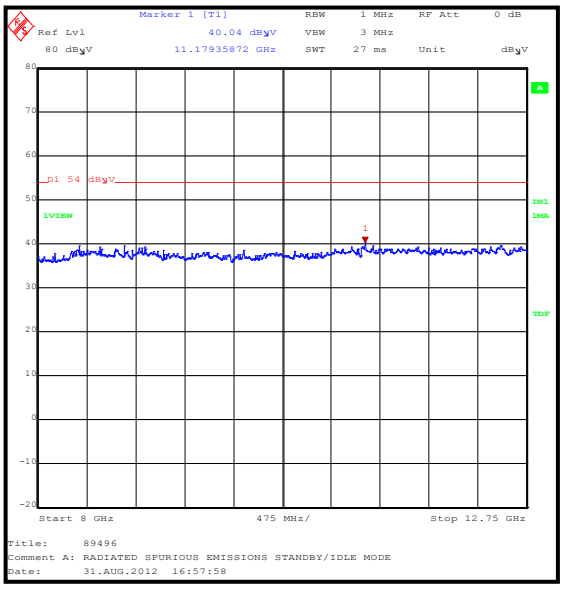
Frequency (MHz)	Antenna Polarity	Peak Level (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)	Result
1114.228	Horizontal	47.4	54.0	6.6	Complied
1354.709	Horizontal	47.4	54.0	6.6	Complied
1997.996	Horizontal	44.3	54.0	9.7	Complied
2503.006	Horizontal	44.5	54.0	9.5	Complied
4999.836	Horizontal	44.6	54.0	9.4	Complied
7093.297	Horizontal	49.8	54.0	4.2	Complied
15925.671	Horizontal	45.4	54.0	8.6	Complied

Receiver/Idle Mode Radiated Spurious Emissions (continued)

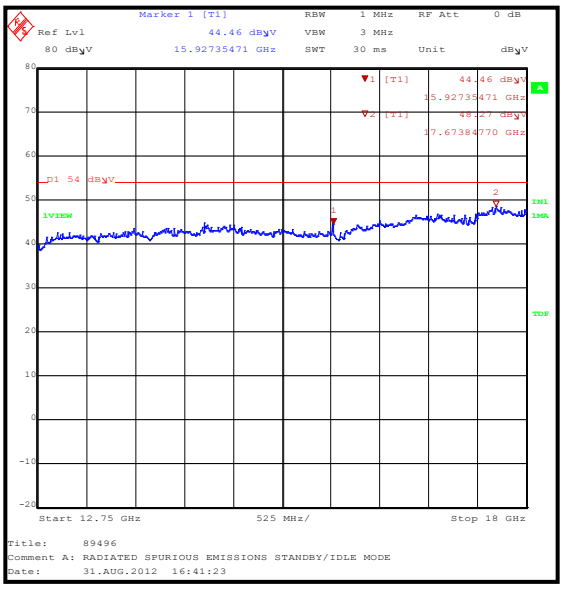


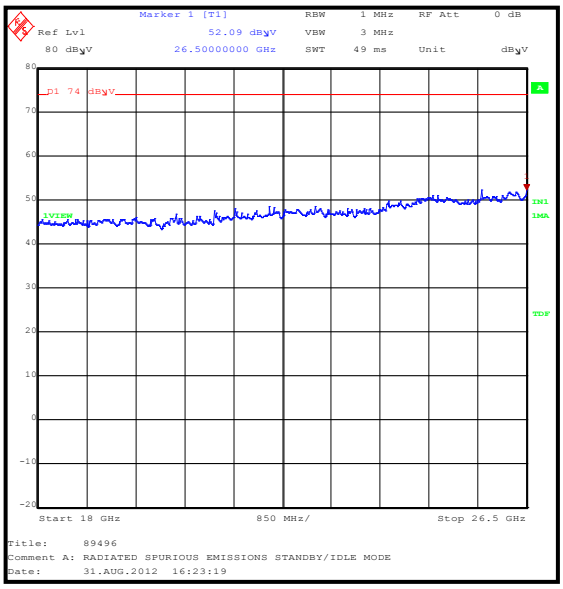




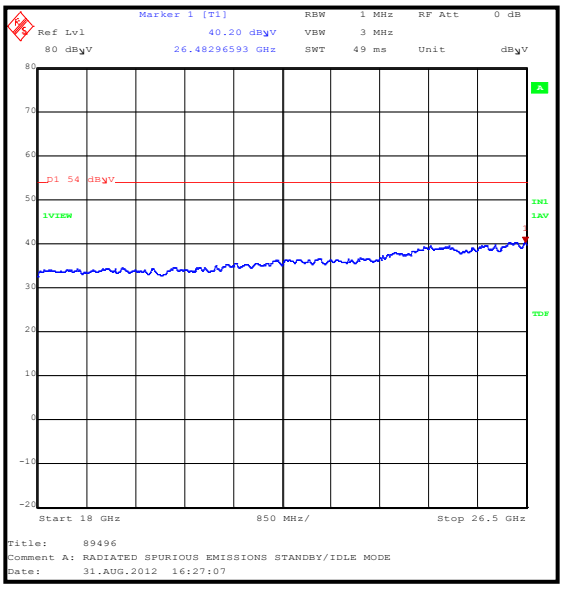


Receiver/Idle Mode Radiated Spurious Emissions (continued)

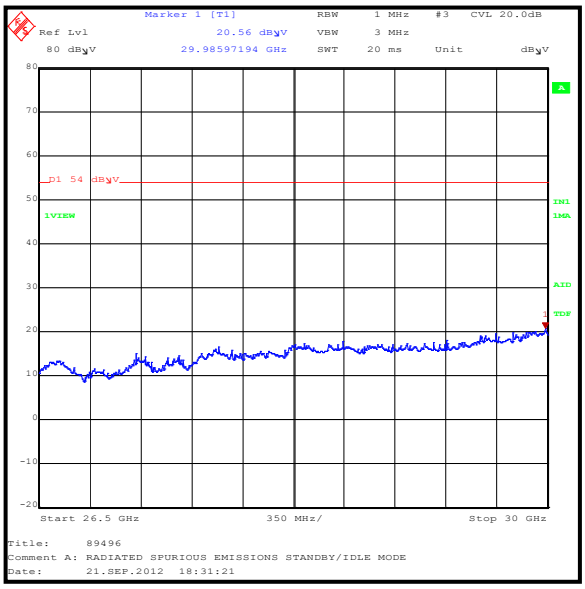




Peak Detector



Average Detector



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

Receiver/Idle Mode Radiated Spurious Emissions (continued)

Test Equipment Used:

RFI ID	Instrument Description	Model Number	Calibration Due	Calibration Interval (Months)
K0002	3m RSE Chamber	N/A	09 Oct 2012	12
M1124	Test Receiver	ESIB 26	14 Aug 2013	12
A1534	Pre Amplifier	8449B	09 Oct 2012	12
A1818	Antenna	3115	09 Oct 2012	12
A253	Antenna	12240-20	09 Oct 2012	12
A254	Antenna	14240-20	09 Oct 2012	12
A255	Antenna	16240-20	09 Oct 2012	12
A256	Antenna	18240-20	09 Oct 2012	12
A436	Antenna	20240-20	09 Oct 2012	12
A203	Antenna	22240-20	11 May 2013	36
M1390	Harmonic Mixer	WHMP 28	Calibrated before use	12
A1785	Pre-amplifier	FLNA-28-30	Calibrated before use	12
A366	Isolator	FRR-400	Calibrated before use	-
S0537	DC Power Supply Unit	EL302D	Calibrated before use	-
M1251	Digital Multimeter	175	30 Jul 2013	12

5.2.3. Transmitter AC Conducted Spurious Emissions

Test Summary:

Test Engineer:	Philip Harrison	**Test Date:**	17 August 2012
Test Sample Serial Number:	LK2202002181		

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):	28
Relative Humidity (%):	44

Results: Live / Quasi Peak

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.164	Live	51.8	65.3	13.5	Complied
0.168	Live	53.8	65.1	11.3	Complied
0.209	Live	46.1	63.3	17.3	Complied
0.258	Live	39.5	61.5	22.0	Complied
0.303	Live	37.4	60.2	22.8	Complied
0.416	Live	35.6	57.5	21.9	Complied
1.181	Live	34.3	56.0	21.7	Complied
1.743	Live	31.1	56.0	24.9	Complied

Results: Live / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.173	Live	37.3	54.8	17.5	Complied
0.425	Live	28.4	47.4	19.0	Complied
0.542	Live	23.8	46.0	22.2	Complied
0.555	Live	24.1	46.0	21.9	Complied
0.767	Live	23.9	46.0	22.1	Complied
1.203	Live	24.3	46.0	21.7	Complied
1.505	Live	22.5	46.0	23.5	Complied
1.707	Live	23.0	46.0	23.0	Complied

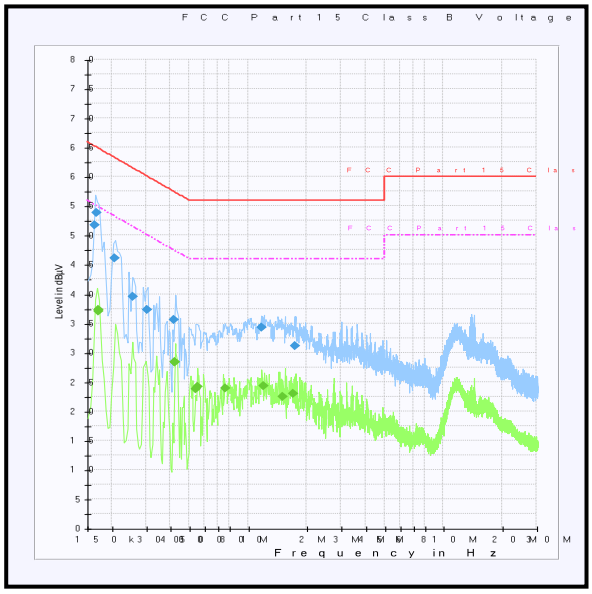
Transmitter AC conducted emissions (continued)

Results: Neutral / Quasi Peak

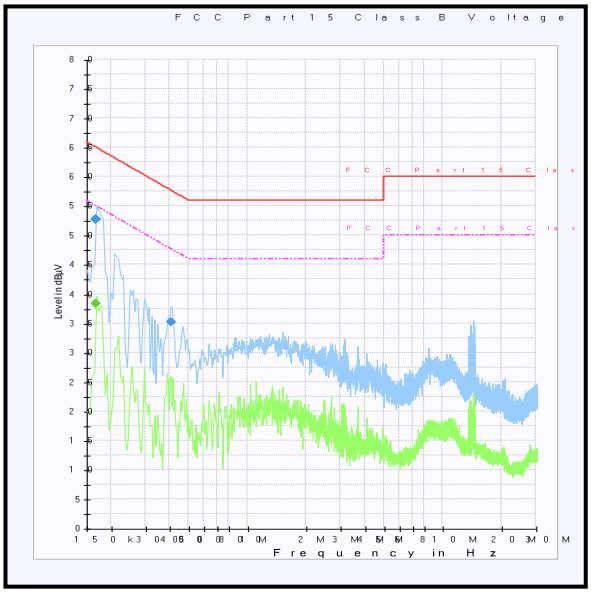
Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.168	Neutral	52.8	65.1	12.3	Complied
0.407	Neutral	35.2	57.7	22.5	Complied

Results: Neutral / Average

Frequency (MHz)	Line	Level (dBµV)	Limit (dBµV)	Margin (dB)	Result
0.168	Neutral	38.3	55.1	16.8	Complied



Live



Neutral

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

Test Equipment Used:

RFI ID	Instrument Description	Model Number	Calibration Due	Calibration Interval (Months)
M1379	Test Receiver	ESIB7	20 Oct 2012	12
A1830	Pulse Limiter	ESH3-Z2	25 Feb 2013	12
A649	LISN	ESH3-Z5	19 Feb 2013	12

5.2.4. Transmitter 26 dB Emission Bandwidth

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	24 August 2012 & 27 August 2012
Test Sample Serial Number:	LK220202177		

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

Environmental Conditions:

Temperature (°C):	25
Relative Humidity (%):	52

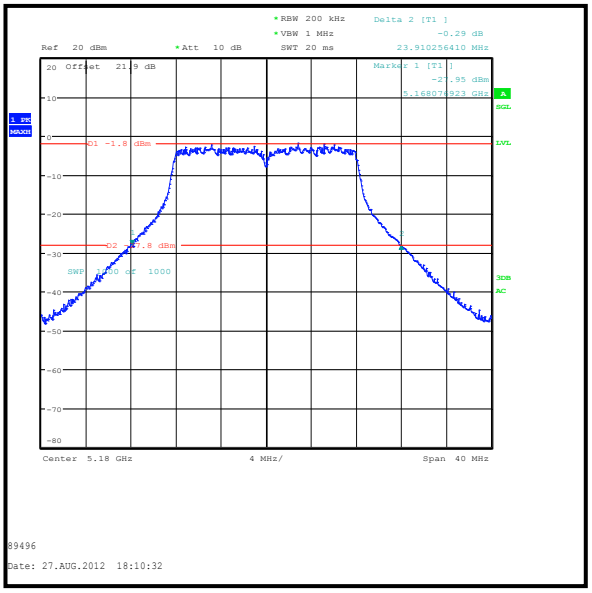
Note(s):

1. All configurations supported by the EUT were investigated on the bottom 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 20 MHz channel – BPSK / 6 Mbps
    - 802.11n 20 MHz channel – BPSK / 6.5 Mbps / MCS0
    - 802.11n 40 MHz channel – BPSK / 13.5 Mbps / MCS0
2. All 3 ports were measured and P2403 had the widest bandwidth. All tests were performed on this port.
3. Final measurements were performed in each supported operating band using the above configurations on the bottom, middle and top channels.

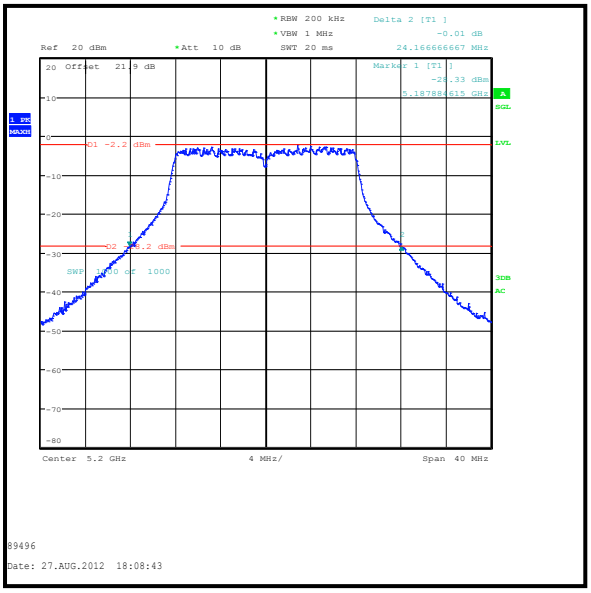
Transmitter 26 dB Emission Bandwidth (continued)

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

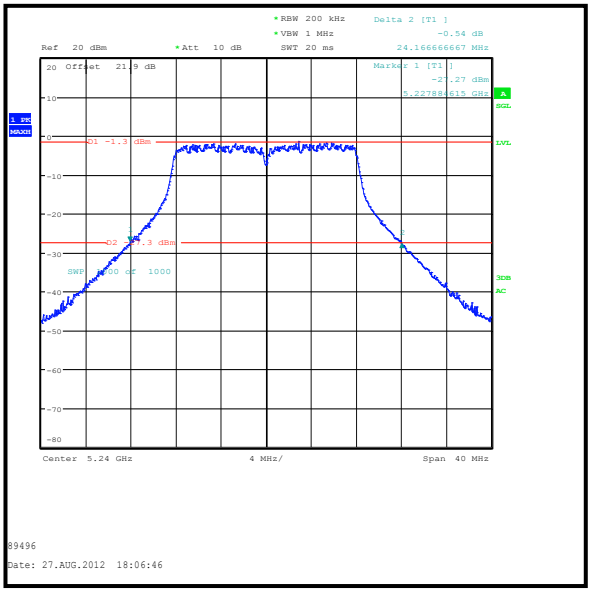
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5180	BPSK	6	23.910
Middle	5200	BPSK	6	24.167
Top	5240	BPSK	6	24.167



Bottom Channel



Middle Channel

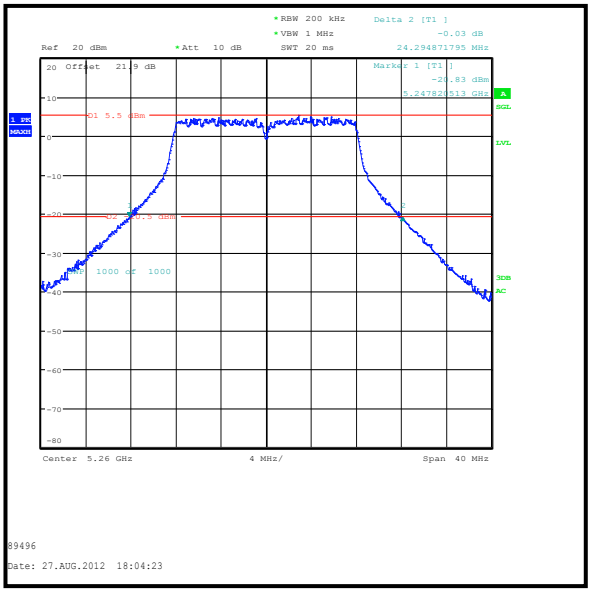


Top Channel

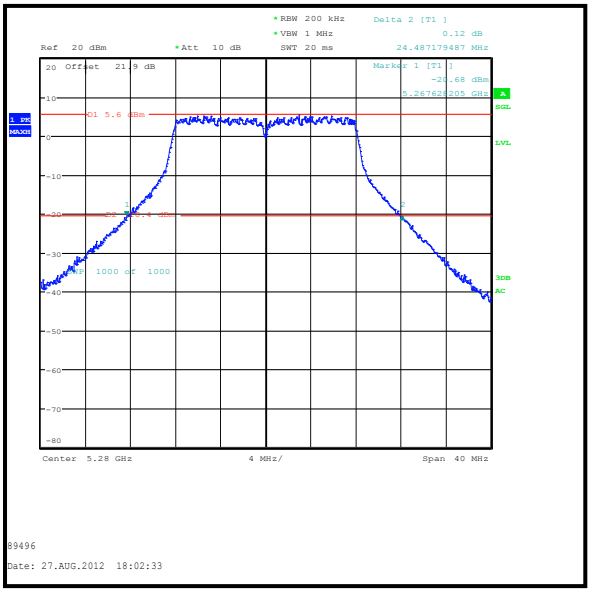
Transmitter 26 dB Emission Bandwidth (continued)

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

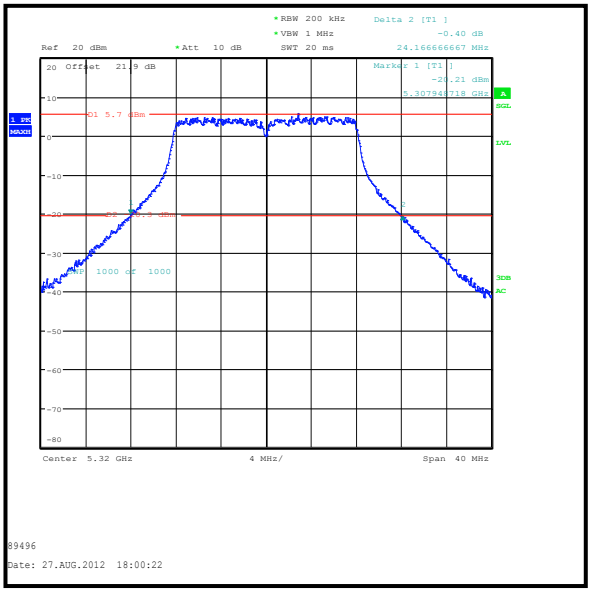
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5260	BPSK	6	24.295
Middle	5280	BPSK	6	24.487
Top	5320	BPSK	6	24.167



Bottom Channel



Middle Channel

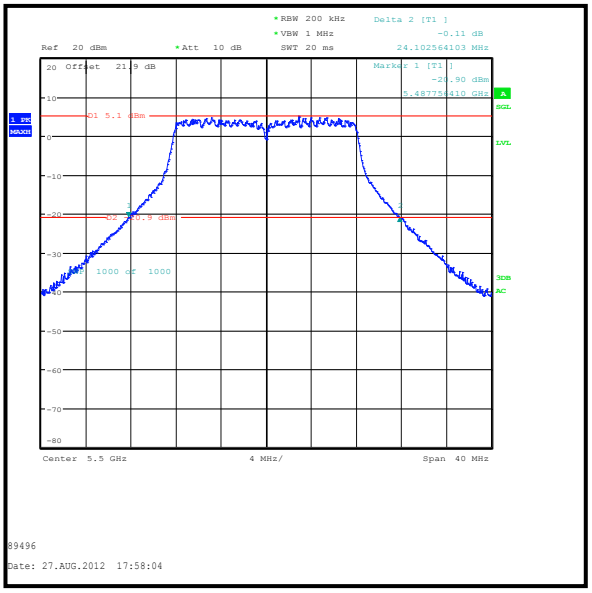


Top Channel

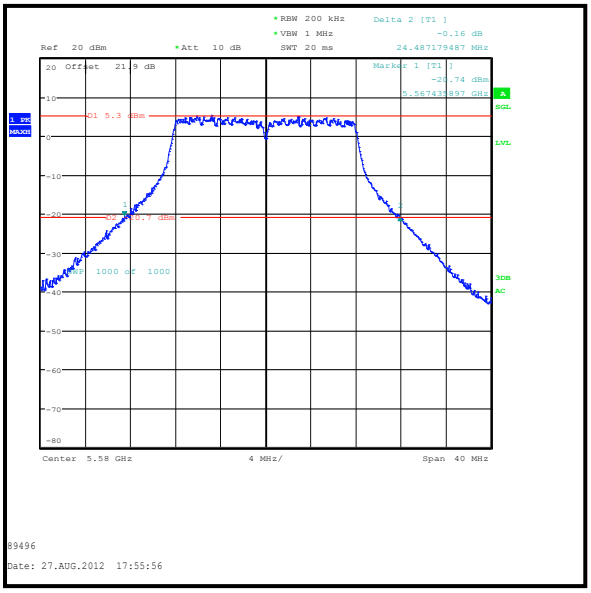
Transmitter 26 dB Emission Bandwidth (continued)

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

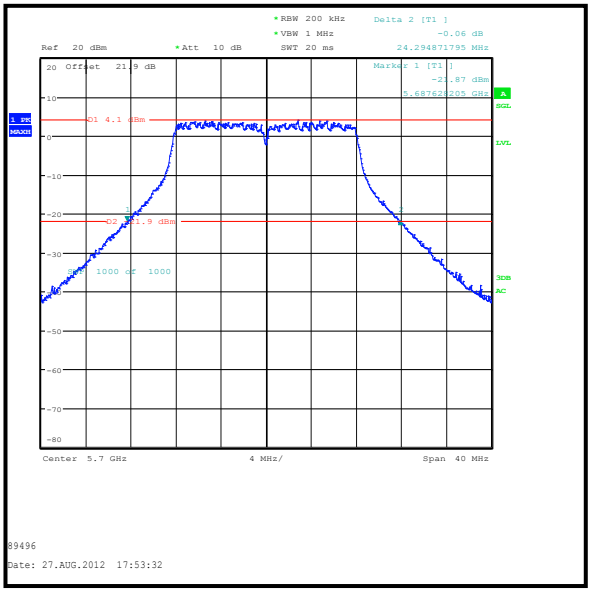
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5500	BPSK	6	24.103
Middle	5580	BPSK	6	24.487
Top	5700	BPSK	6	24.295



Bottom Channel



Middle Channel

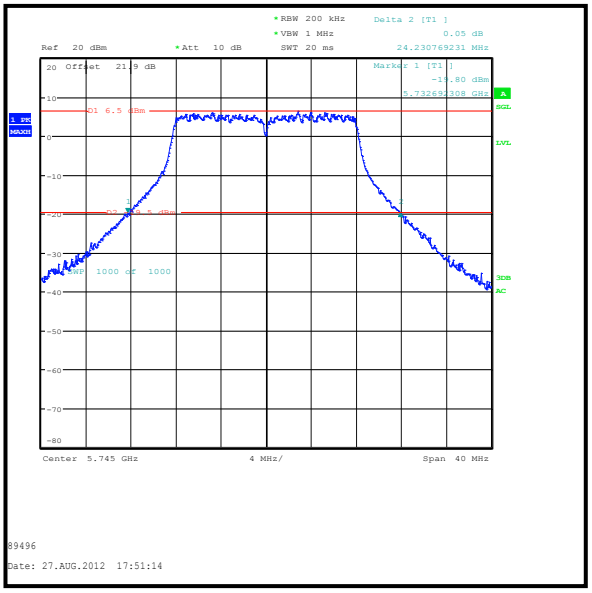


Top Channel

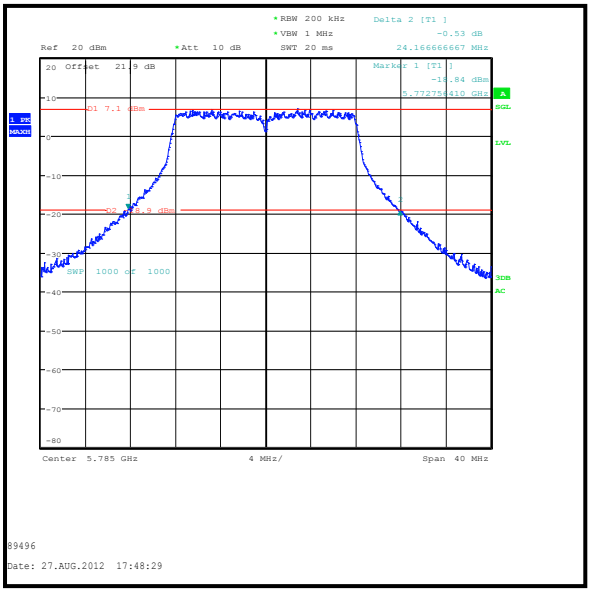
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11a / 20 MHz / 5.725-5.850 GHz band

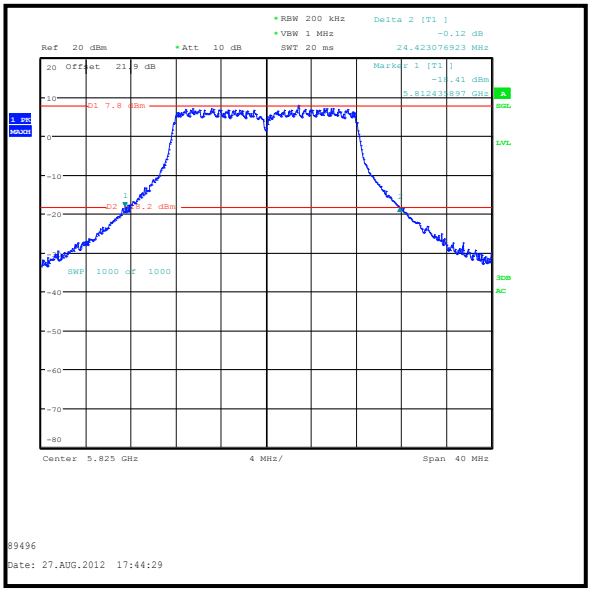
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps	26 dB Emission Bandwidth (MHz)
Bottom	5745	BPSK	6	24.231
Middle	5785	BPSK	6	24.167
Top	5825	BPSK	6	24.423



Bottom Channel



Middle Channel

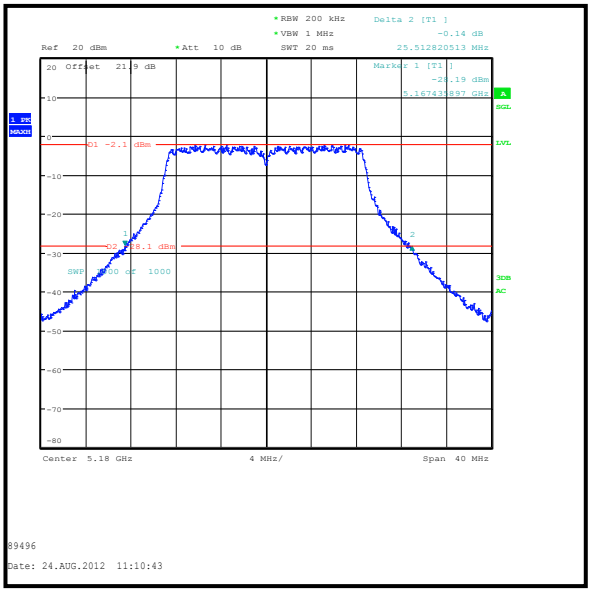


Top Channel

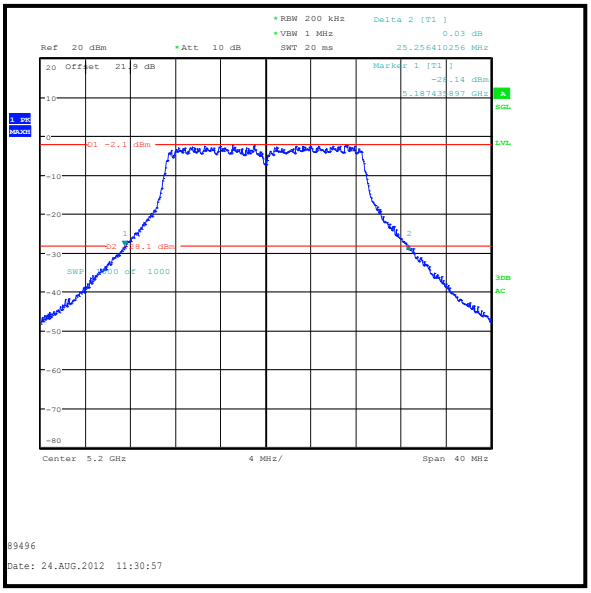
Transmitter 26 dB Emission Bandwidth (continued)

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

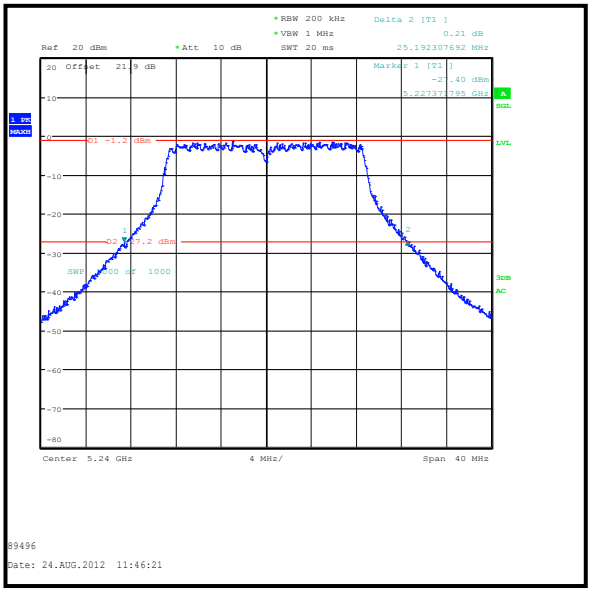
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5180	BPSK	6.5 / 0	25.513
Middle	5200	BPSK	6.5 / 0	25.256
Top	5240	BPSK	6.5 / 0	25.192



Bottom Channel



Middle Channel

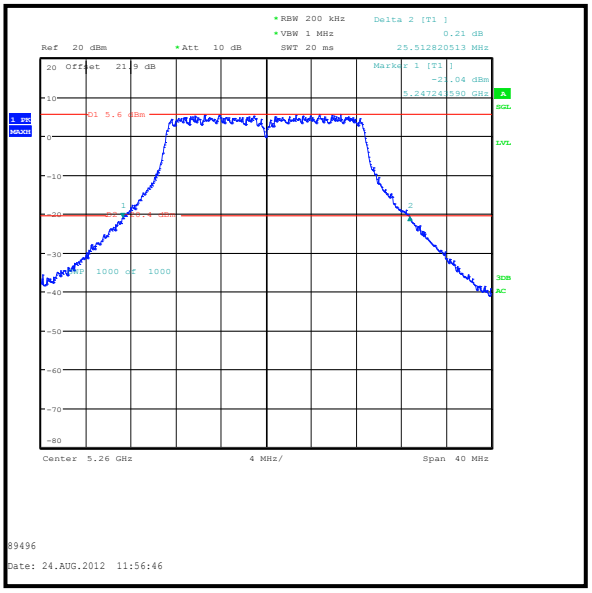


Top Channel

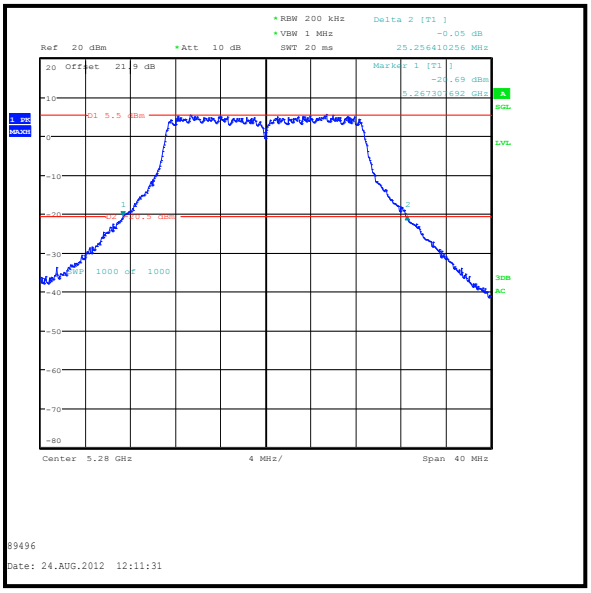
Transmitter 26 dB Emission Bandwidth (continued)

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

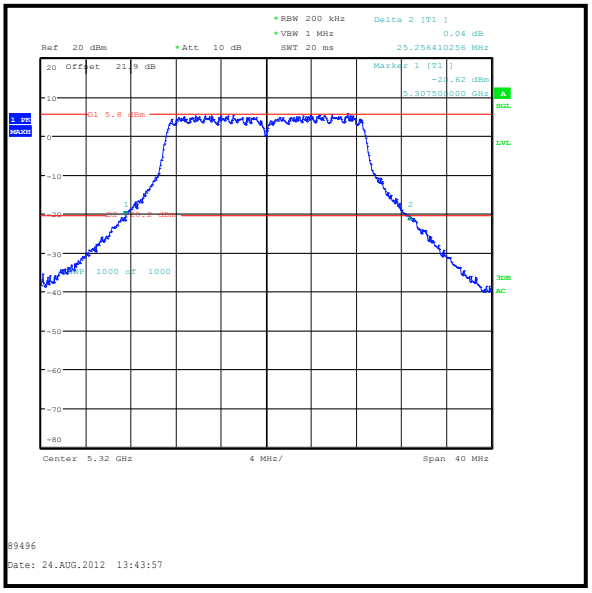
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5260	BPSK	6.5 / 0	25.513
Middle	5280	BPSK	6.5 / 0	25.256
Top	5320	BPSK	6.5 / 0	25.256



Bottom Channel



Middle Channel

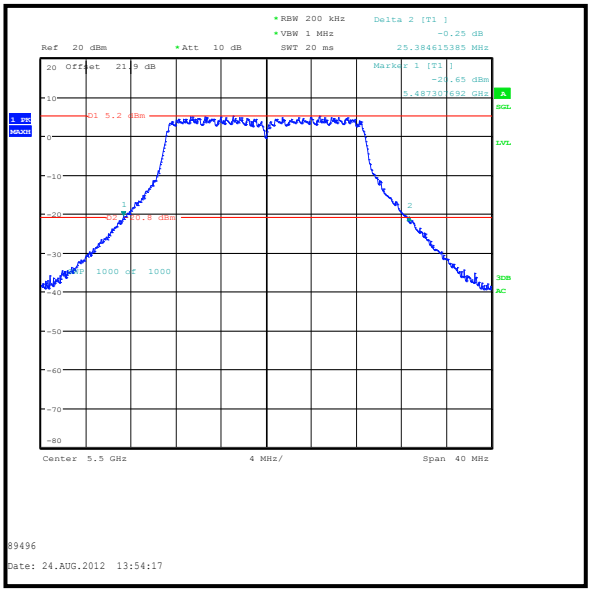


Top Channel

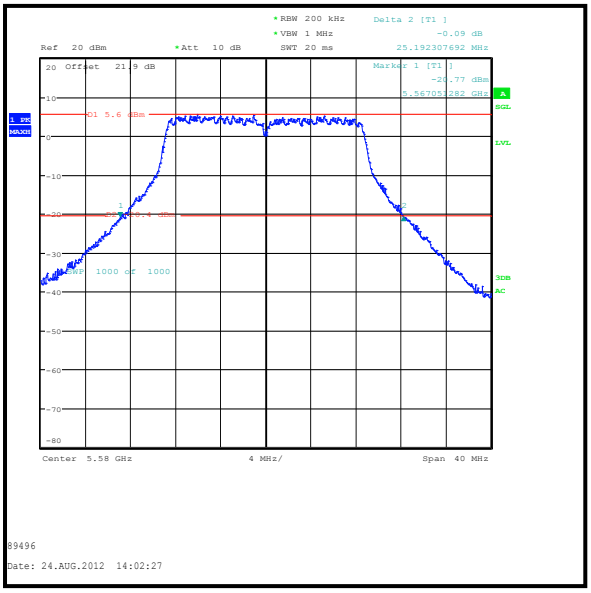
Transmitter 26 dB Emission Bandwidth (continued)

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

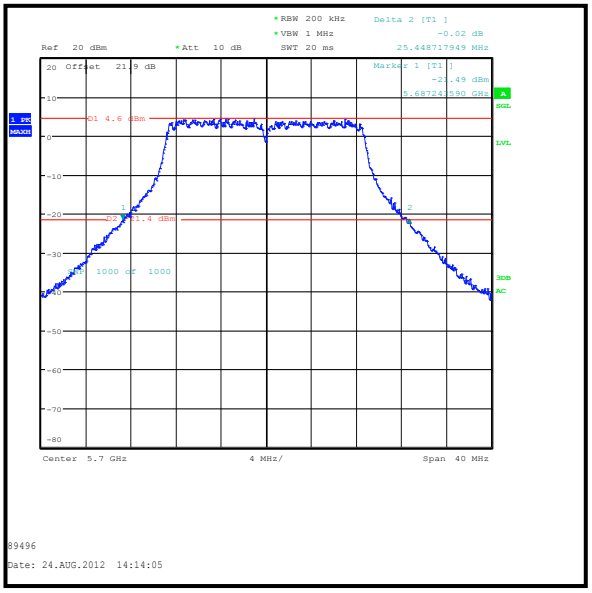
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5500	BPSK	6.5 / 0	25.385
Middle	5580	BPSK	6.5 / 0	25.192
Top	5700	BPSK	6.5 / 0	25.449



Bottom Channel



Middle Channel

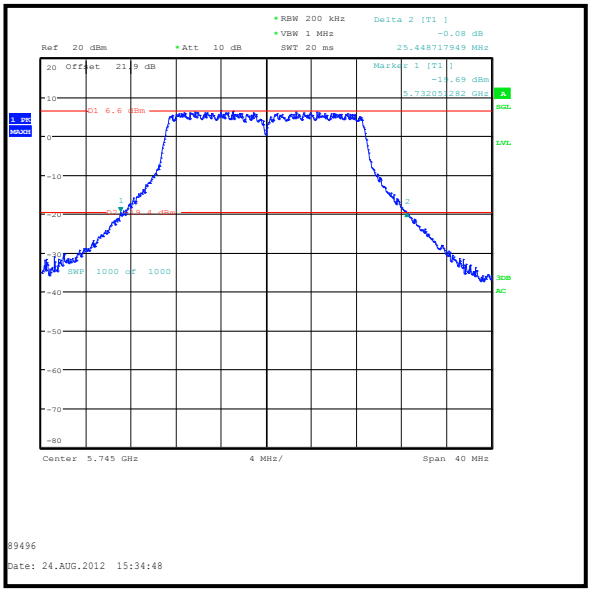


Top Channel

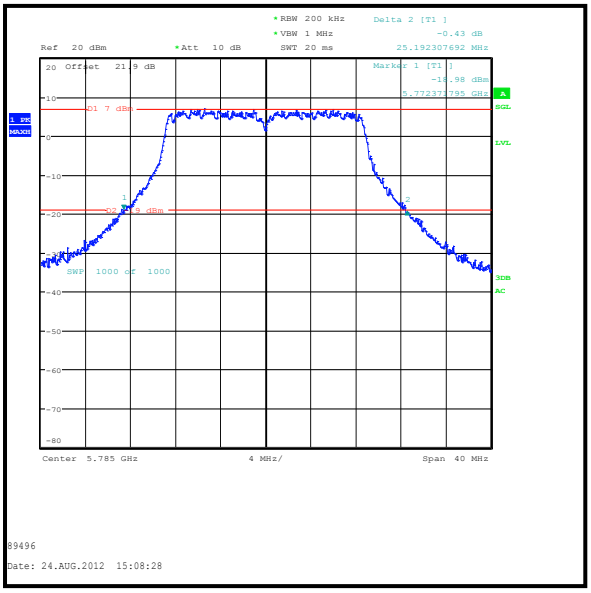
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 20 MHz / 5.725-5.850 GHz band

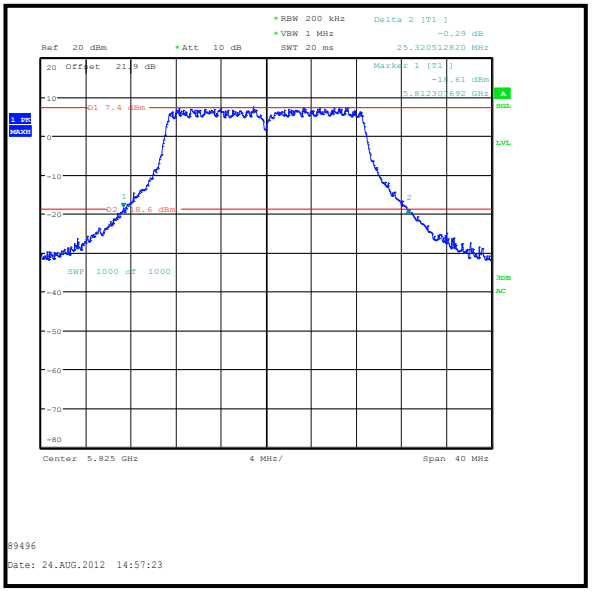
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5745	BPSK	6.5 / 0	25.449
Middle	5785	BPSK	6.5 / 0	25.192
Top	5825	BPSK	6.5 / 0	25.321



Bottom Channel



Middle Channel

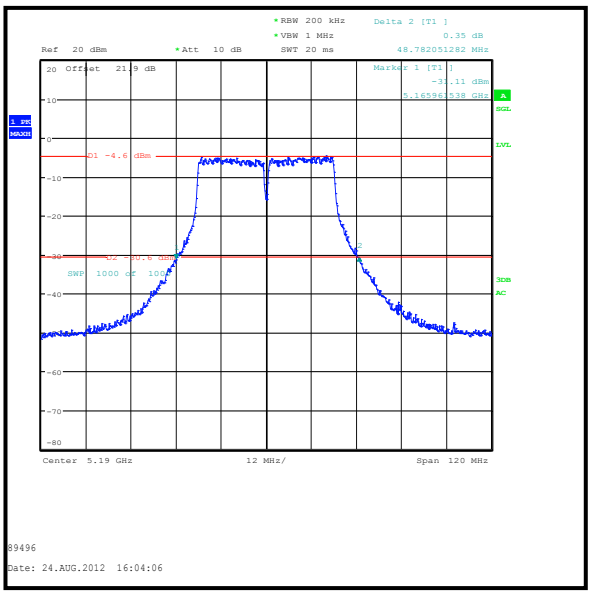


Top Channel

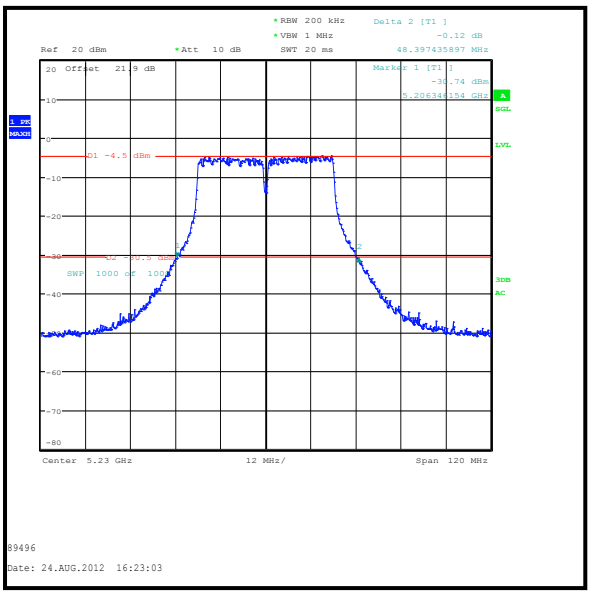
Transmitter 26 dB Emission Bandwidth (continued)

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 / 0	48.782
Top	5230	BPSK	13.5 / 0	48.397



Bottom Channel

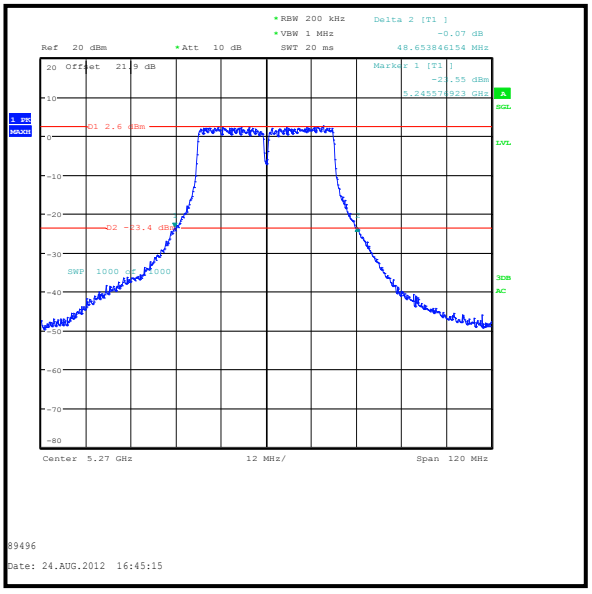


Top Channel

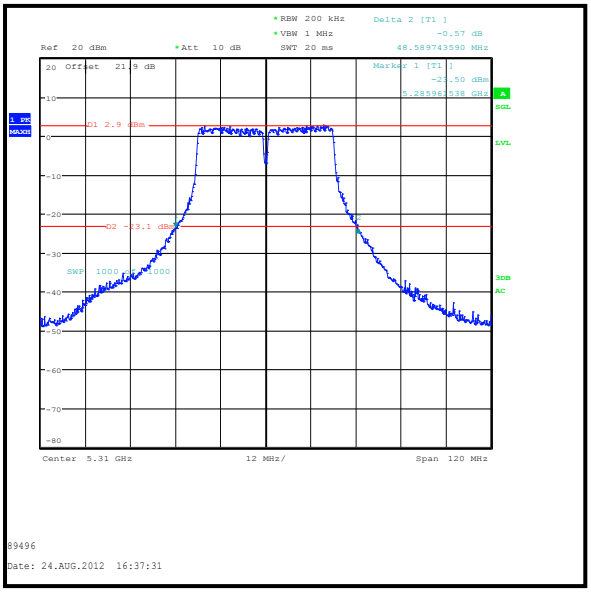
Transmitter 26 dB Emission Bandwidth (continued)

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 / 0	48.654
Top	5310	BPSK	13.5 / 0	48.590



Bottom Channel

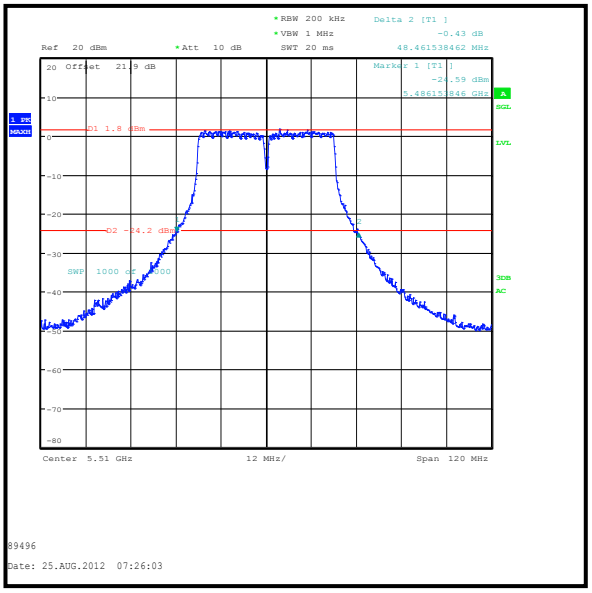


Top Channel

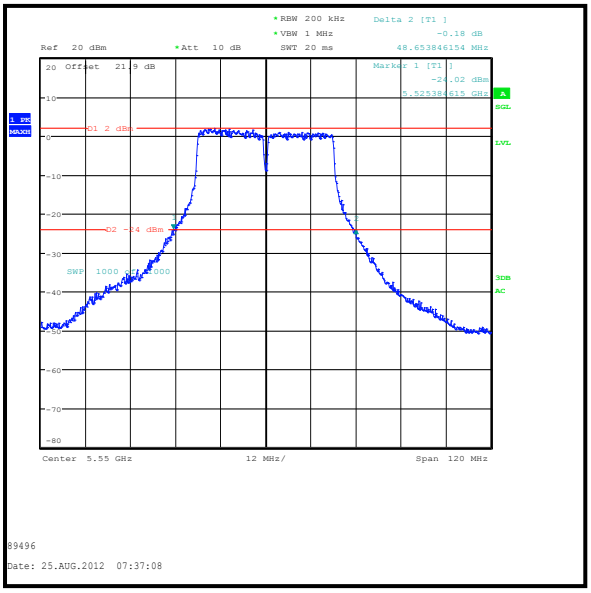
Transmitter 26 dB Emission Bandwidth (continued)

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

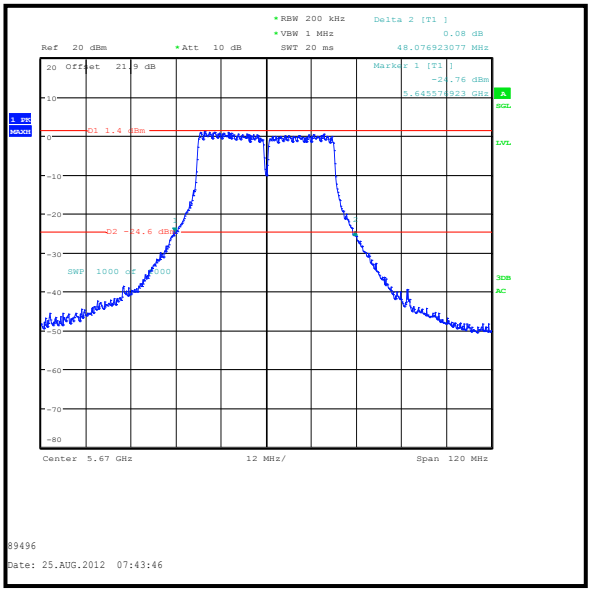
Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5510	BPSK	13.5 / 0	48.462
Middle	5550	BPSK	13.5 / 0	48.654
Top	5670	BPSK	13.5 / 0	48.077



Bottom Channel



Middle Channel

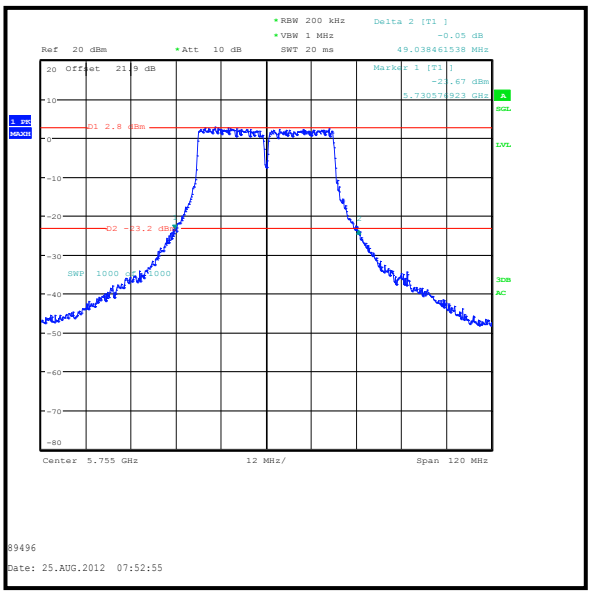


Top Channel

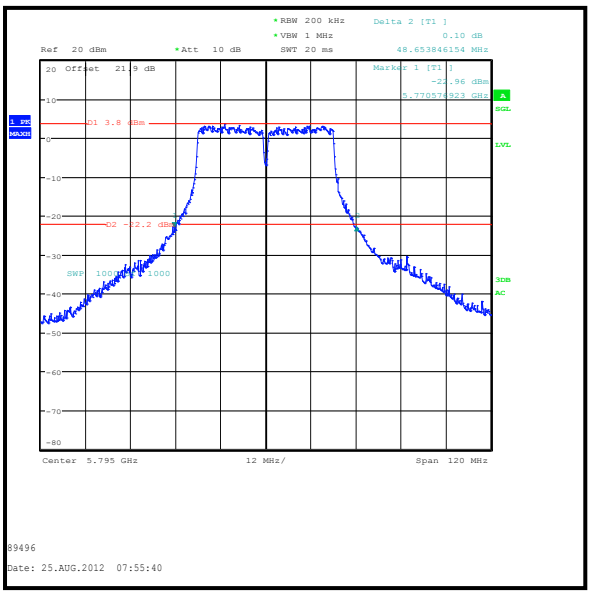
Transmitter 26 dB Emission Bandwidth (continued)

Results: 802.11n / 40 MHz / 5.725-5.850 GHz band

Channel	Frequency (MHz)	Modulation scheme	Data Rate Mbps / MCS	26 dB Emission Bandwidth (MHz)
Bottom	5755	BPSK	13.5 / 0	49.038
Top	5795	BPSK	13.5 / 0	48.654



Bottom Channel



Top Channel

Test Equipment Used:

RFI ID	Instrument Description	Model Number	Calibration Due	Calibration Interval (Months)
A1393	Attenuator	6820.17.B	06 Jul 2013	12
M1630	Test Receiver	ESU40	13 Jan 2013	12

5.2.5. Transmitter Maximum Conducted Output Power

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

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	25 August 2012 & 27 August 2012
Test Sample Serial Number:	LK220202177		

FCC Reference:	Part 15.407(a)(1)
Test Method Used:	FCC KDB 789033 D01 Section C)3)b) & FCC KDB 662911 D01

Environmental Conditions:

Temperature (°C):	20 to 22
Relative Humidity (%):	55 to 61

Note(s):

1. All conducted power tests were performed using a test receiver in accordance with FCC KDB 789033 D01 C)3)b) Method SA-1.
2. The EUT has three RF ports, P2401, P2403 and Port 2405. Power from all ports were measured and combined using the measure-and-sum method stated in FCC KDB 662911 D01.
3. 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 – 6 Mbps
    - 802.11n HT20 – 6.5 Mbps / MCS0
    - 802.11n HT40 – 13.5 Mbps / MCS0

    Measurements were then performed on the relevant mode on bottom, middle and top channels on all ports.
4. The EUT was transmitting at >99% duty cycle.
5. The EUT was configured with a power setting of 8.5 dBm for all channels and channel bandwidths.
6. 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 = $4\ dBm + 10\ log_{10}\ 23.9 = 17.8\ dBm$
    802.11a 20 MHz channel width / Middle channel = $4\ dBm + 10\ log_{10}\ 24.2 = 17.8\ dBm$
    802.11a 20 MHz channel width / Top channel = $4\ dBm + 10\ log_{10}\ 24.2 = 17.8\ dBm$
    802.11n 20 MHz channel width / Bottom channel = $4\ dBm + 10\ log_{10}\ 25.5 = 18.1\ dBm$
    802.11n 20 MHz channel width / Middle channel = $4\ dBm + 10\ log_{10}\ 25.3 = 18.0\ dBm$
    802.11n 20 MHz channel width / Top channel = $4\ dBm + 10\ log_{10}\ 25.2 = 18.0\ dBm$
    802.11n 40 MHz channel width / Bottom channel = $4\ dBm + 10\ log_{10}\ 48.8 = 20.9\ dBm$
    802.11n 40 MHz channel width / Top channel = $4\ dBm + 10\ log_{10}\ 48.4 = 20.8\ dBm$

    Therefore the lesser of the two limits is the fixed limit of 50 mW (17 dBm).
7. The Customer declared that the transmit signals from all 3 ports are correlated. The Customer stated that the 3 antennas used have unequal antenna gains: G1 = 3.2 dBi, G2 = 3.4 dBi and G3 = 5.4 dBi. The directional gain was calculated in accordance with FCC KDB 662911 D01 Directional Gain Calculations:

    $$10\ log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2/3]$$

    The total array gain was calculated as:

    $$10\ log[(10^{3.2/20} + 10^{3.4/20} + 10^{5.4/20})^2/3] = 8.8\ dBi$$

    In accordance with 15.407(a)(1), 8.8 dBi is 2.8 dB over the directional gain of 6 dBi therefore the fixed limit of 17 dBm is reduced to 14.2 dBm.

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

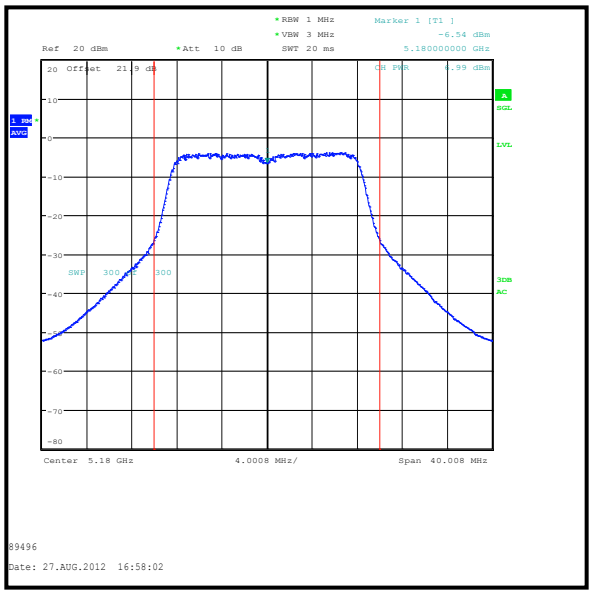
Results: 802.11a / 20 MHz / 6 Mbps / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5180	7.0	6.7	6.4	11.5
Middle	5200	6.9	6.6	6.1	11.3
Top	5240	7.3	7.5	6.4	11.9

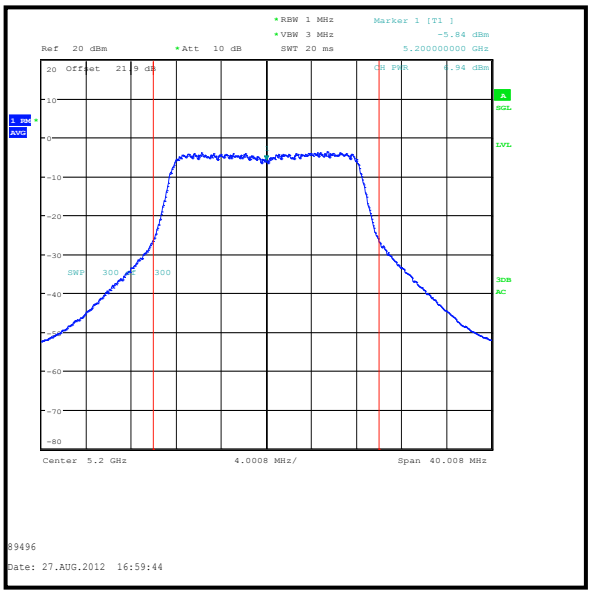
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	11.5	14.2	2.7	Complied
Middle	5200	11.3	14.2	2.9	Complied
Top	5240	11.9	14.2	2.3	Complied

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

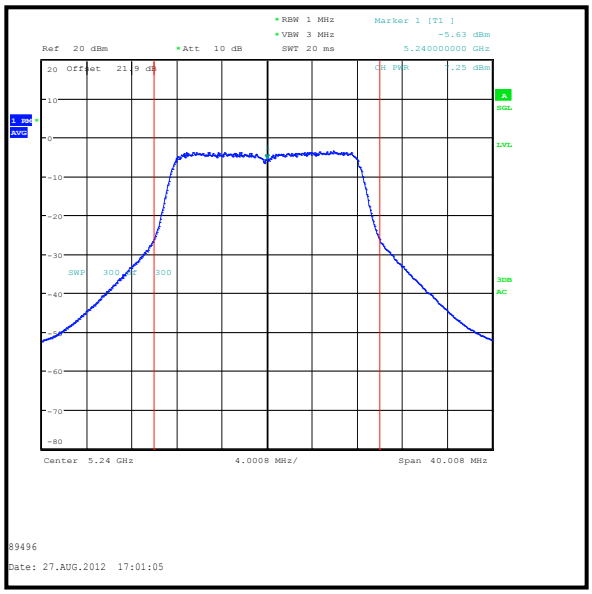
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / P2401



Bottom Channel



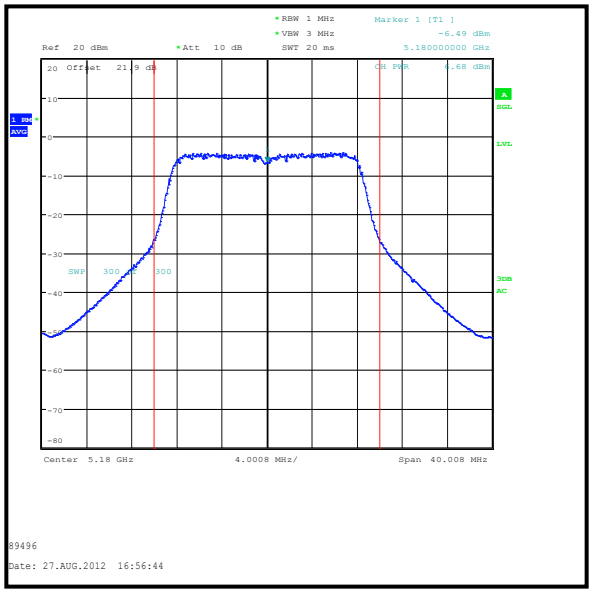
Middle Channel



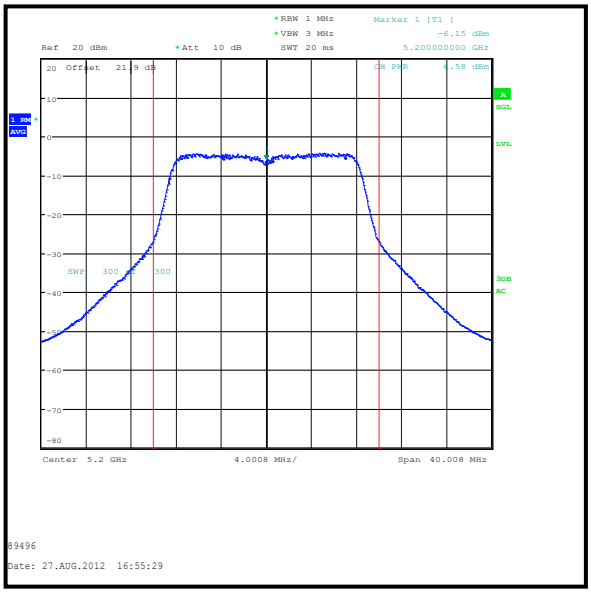
Top Channel

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

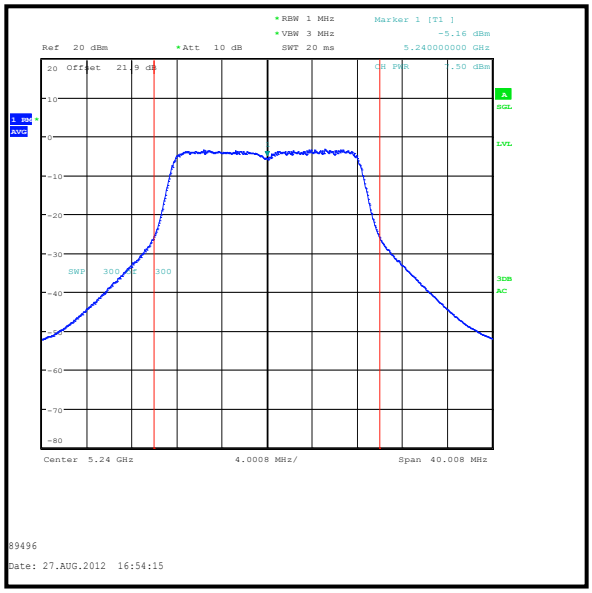
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / P2403



Bottom Channel



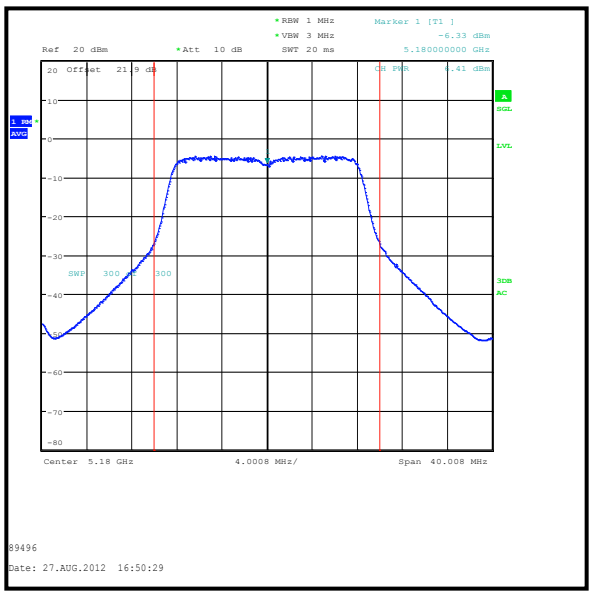
Middle Channel



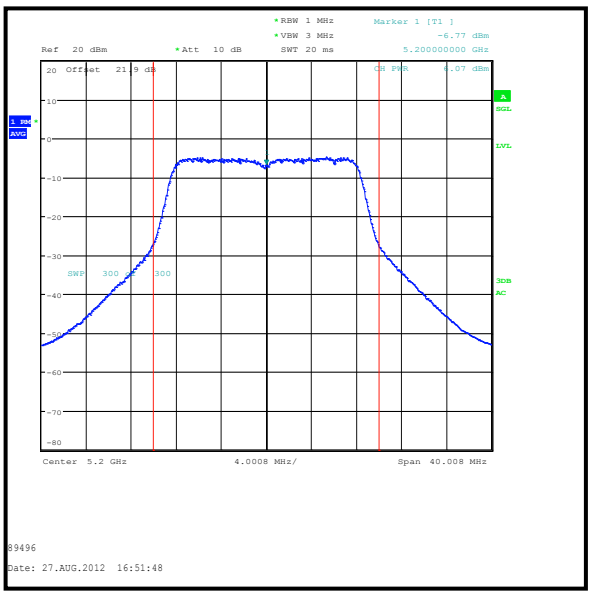
Top Channel

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

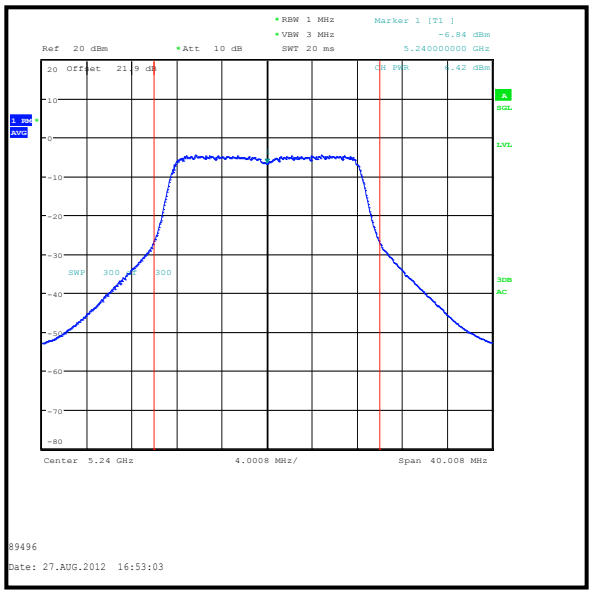
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / P2405



Bottom Channel



Middle Channel



Top Channel

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

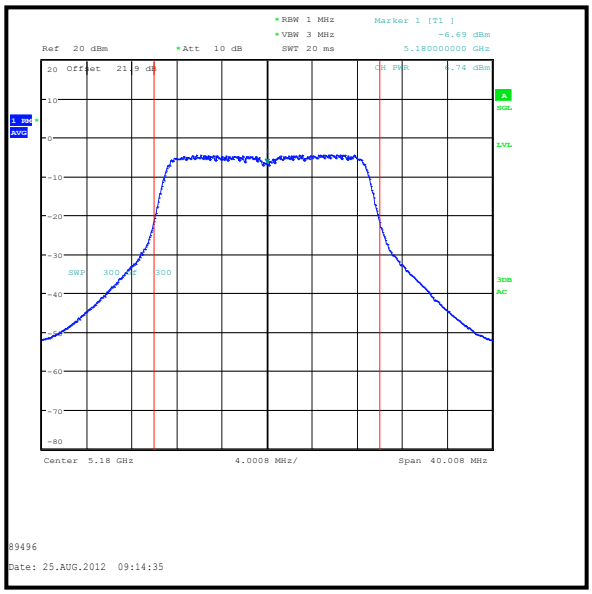
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5180	6.7	6.7	6.3	11.3
Middle	5200	6.8	6.3	5.9	11.1
Top	5240	6.9	7.4	6.2	11.6

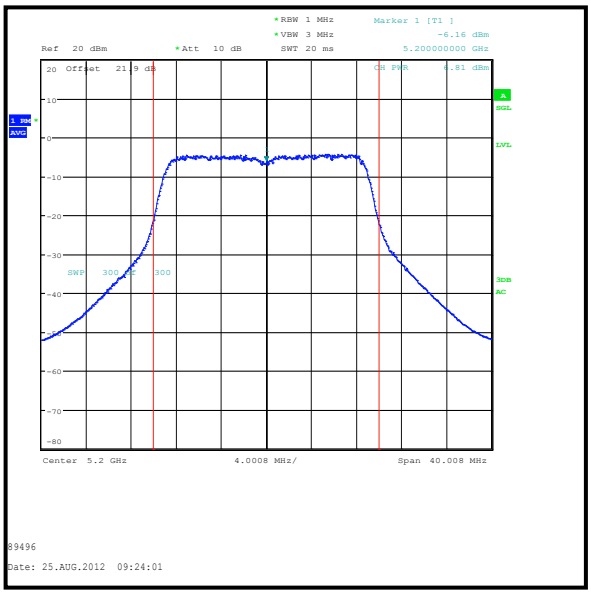
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5180	11.3	14.2	2.9	Complied
Middle	5200	11.1	14.2	3.1	Complied
Top	5240	11.6	14.2	2.6	Complied

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

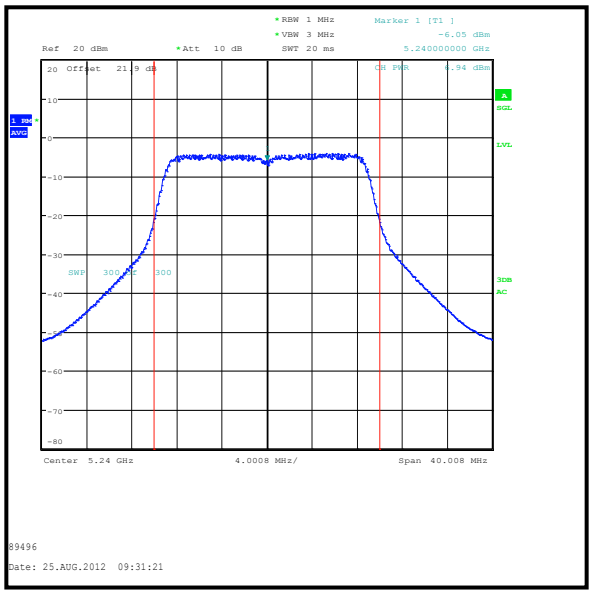
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2401



Bottom Channel



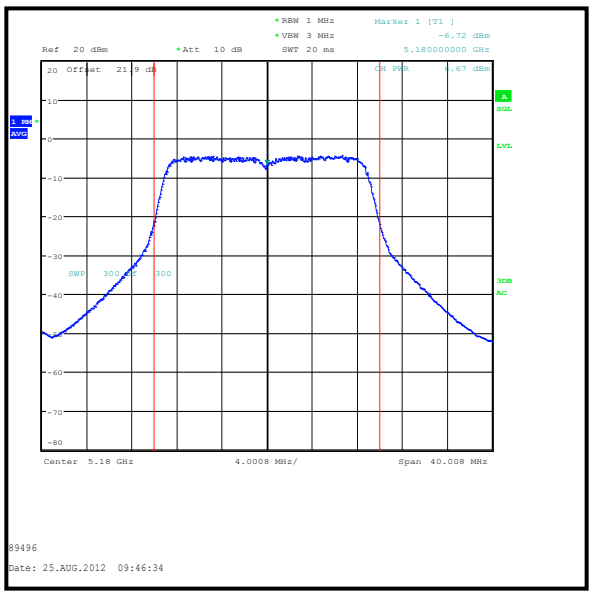
Middle Channel



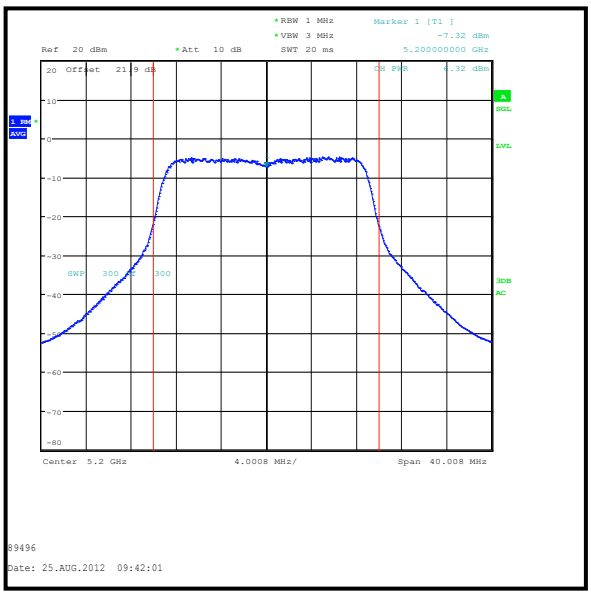
Top Channel

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

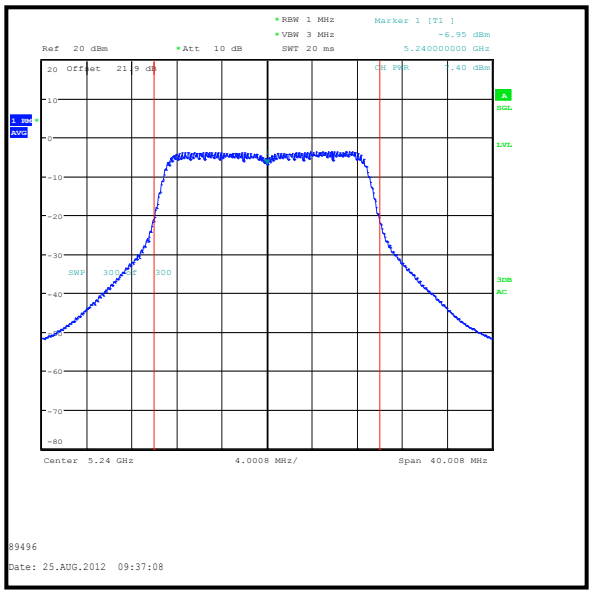
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2403



Bottom Channel



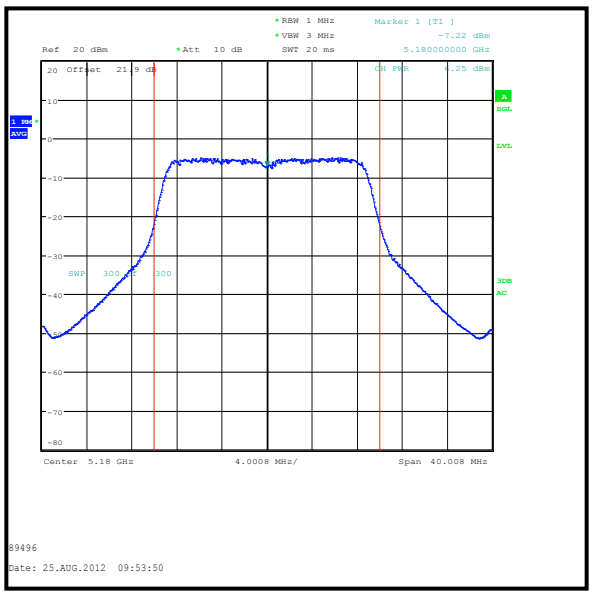
Middle Channel



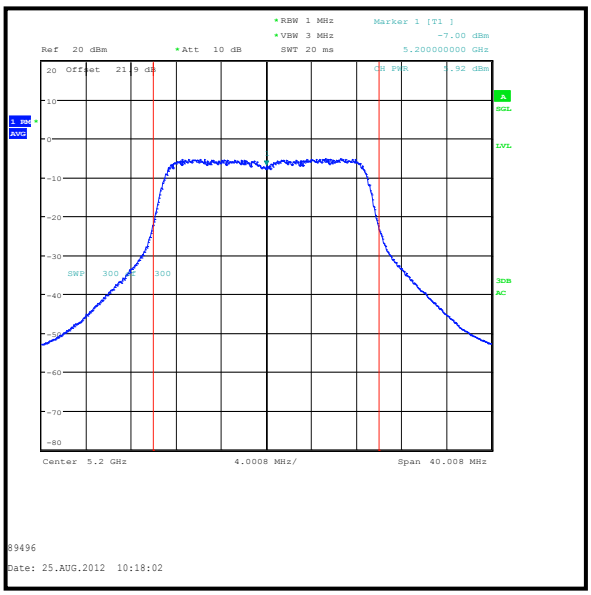
Top Channel

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

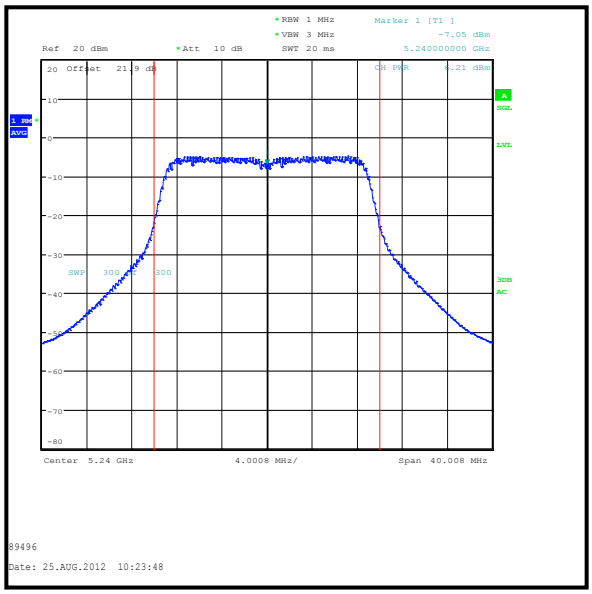
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

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

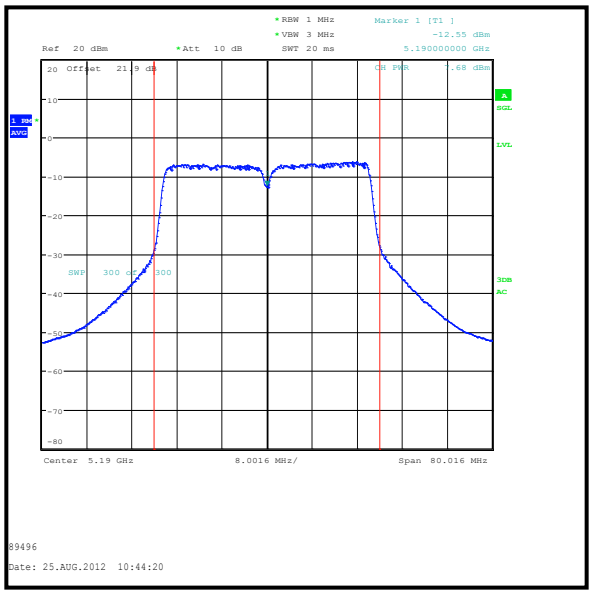
Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5190	7.7	7.3	6.9	12.1
Top	5230	7.6	7.6	6.3	12.0

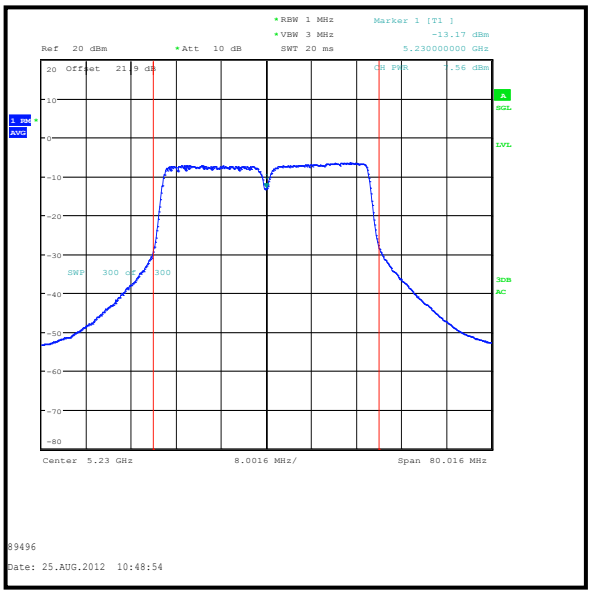
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5190	12.1	14.2	2.1	Complied
Top	5230	12.0	14.2	2.2	Complied

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

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2401



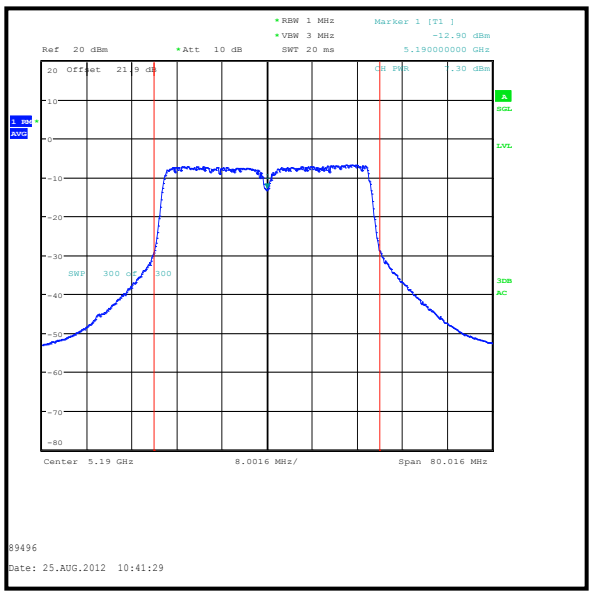
Bottom Channel



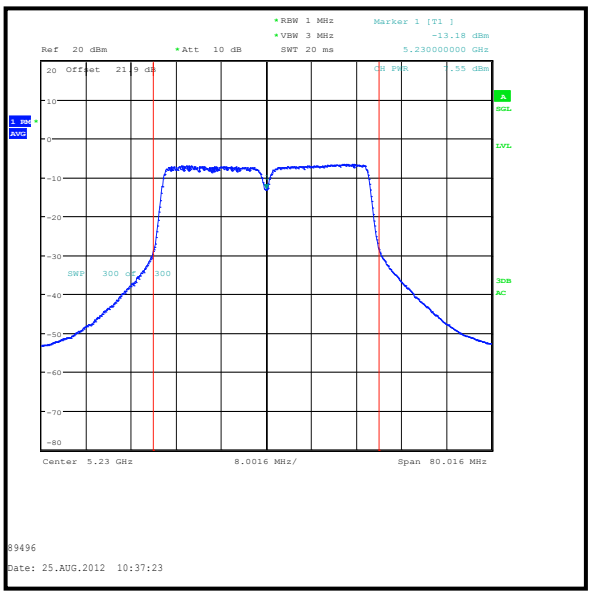
Top Channel

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

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2403



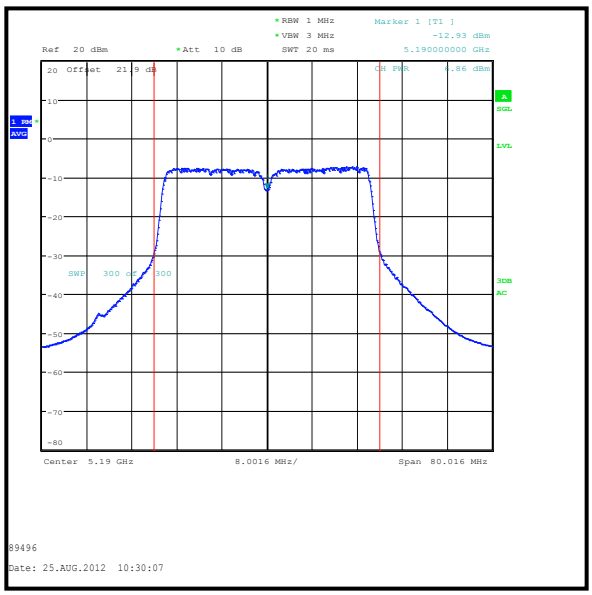
Bottom Channel



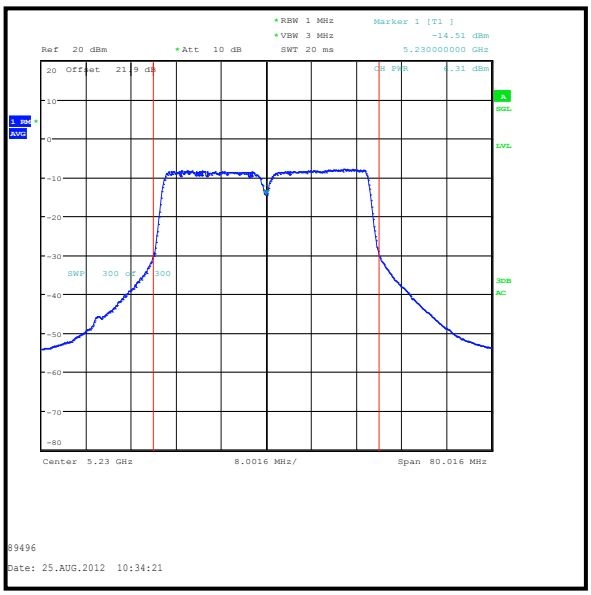
Top Channel

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

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band)

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	17 September 2012 & 18 September 2012
Test Sample Serial Number:	LK220202177		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	FCC KDB 789033 D01 Section C)3)b) & FCC KDB 662911 D01

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	41 to 43

Note(s):

1. 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 5.25-5.35 GHz were:
    - 802.11a – 6 Mbps
    - 802.11n HT20 – 6.5 Mbps / MCS0
    - 802.11n HT40 – 13.5 Mbps / MCS0

    Measurements were then performed on the relevant mode on bottom, middle and top channels on all ports.
2. The EUT was configured with a power setting of 14.0 dBm for all channels and channel bandwidths.
3. 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:

802.11a 20 MHz channel width / Bottom channel = $11\ dBm + 10\ log_{10}\ 24.3 = 24.9\ dBm$
802.11a 20 MHz channel width / Middle channel = $11\ dBm + 10\ log_{10}\ 24.5 = 24.9\ dBm$
802.11a 20 MHz channel width / Top channel = $11\ dBm + 10\ log_{10}\ 24.2 = 24.8\ dBm$
802.11n 20 MHz channel width / Bottom channel = $11\ dBm + 10\ log_{10}\ 25.5 = 25.1\ dBm$
802.11n 20 MHz channel width / Middle channel = $11\ dBm + 10\ log_{10}\ 25.3 = 25.0\ dBm$
802.11n 20 MHz channel width / Top channel = $11\ dBm + 10\ log_{10}\ 25.3 = 25.0\ dBm$
802.11n 40 MHz channel width / Bottom channel = $11\ dBm + 10\ log_{10}\ 48.7 = 27.9\ dBm$
802.11n40 MHz channel width / top channel = $11\ dBm + 10\ log_{10}\ 48.6 = 27.9\ dBm$

The lesser of the two limits is the fixed limit of 250 mW (24.0 dBm).

4. The Customer declared that the transmit signals from all 3 ports are correlated. The Customer stated that the 3 antennas used have unequal antenna gains: G1 = 3.2 dBi, G2 = 3.4 dBi and G3 = 5.4 dBi. The directional gain was calculated in accordance with FCC KDB 662911 D01 Directional Gain Calculations:

$$10\ log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2/3]$$

The total array gain was calculated as:

$$10\ log[(10^{3.2/20} + 10^{3.4/20} + 10^{5.4/20})^2/3] = 8.8\ dBi$$

In accordance with 15.407(a)(2), 8.8 dBi is 2.8 dB over the directional gain of 6 dBi therefore the fixed limit of 24 dBm is reduced to 21.2 dBm.

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

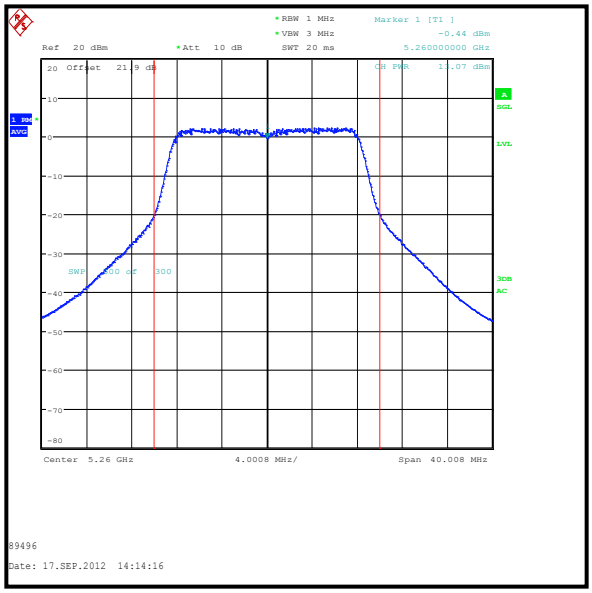
Results: 802.11a / 20 MHz / 6 Mbps / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5260	13.1	12.3	11.2	17.0
Middle	5280	13.0	12.7	11.6	17.2
Top	5320	13.0	12.7	11.7	17.3

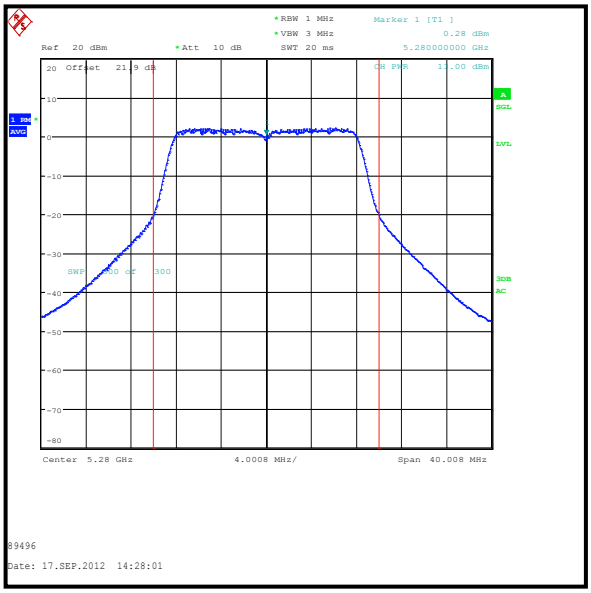
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	17.0	21.2	4.2	Complied
Middle	5280	17.2	21.2	4.0	Complied
Top	5320	17.3	21.2	3.9	Complied

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

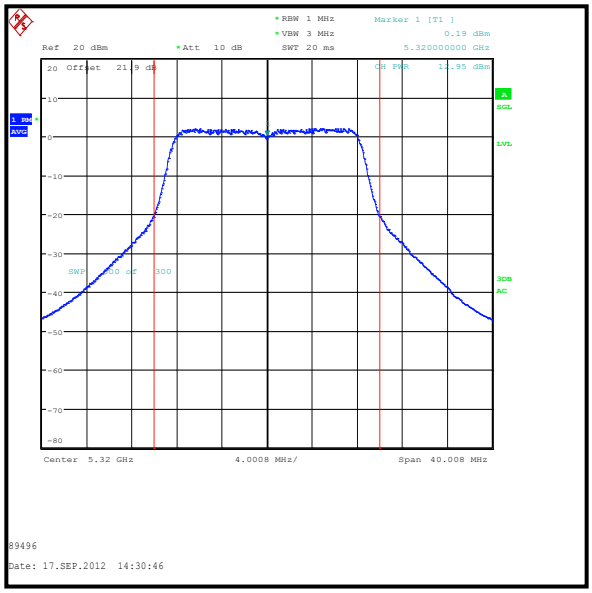
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2401



Bottom Channel



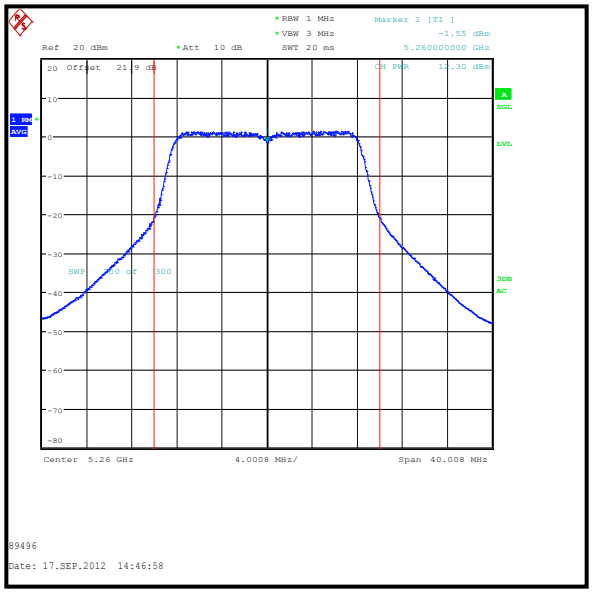
Middle Channel



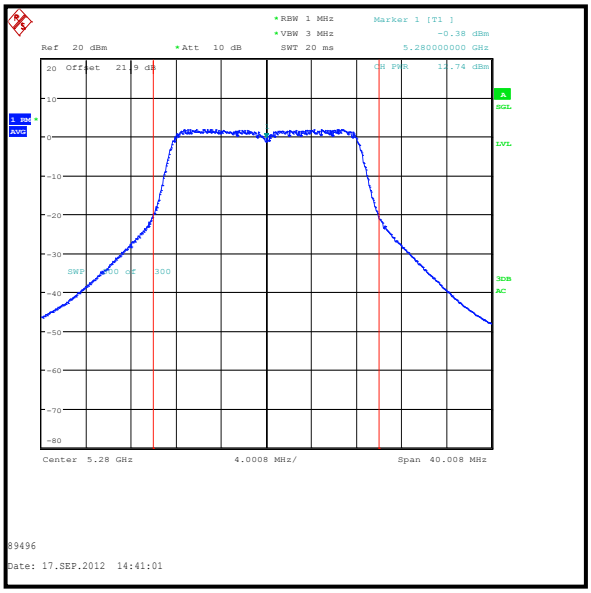
Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

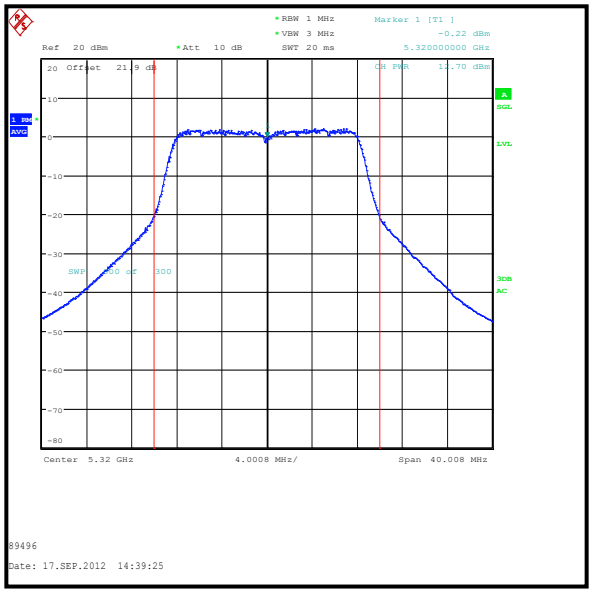
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2403



Bottom Channel



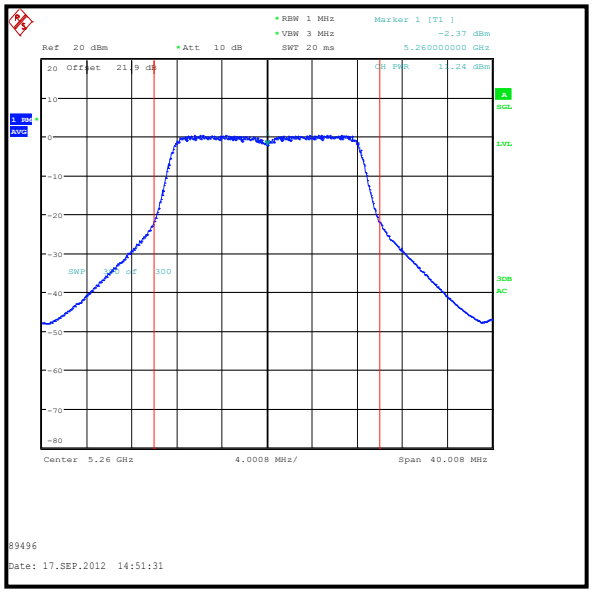
Middle Channel



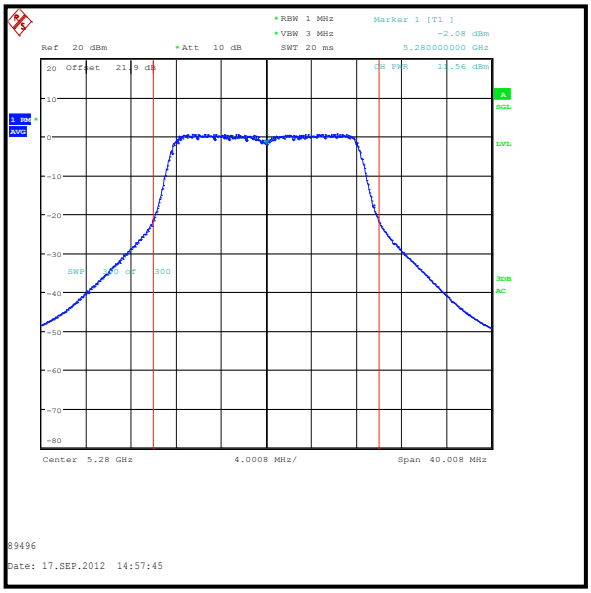
Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

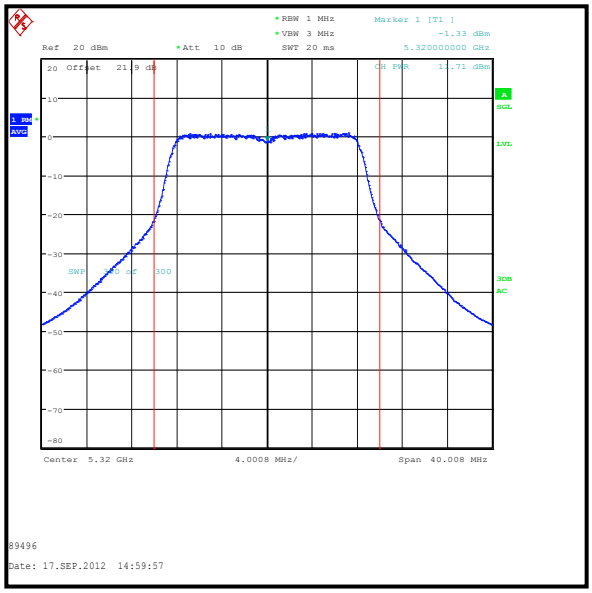
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (Continued)

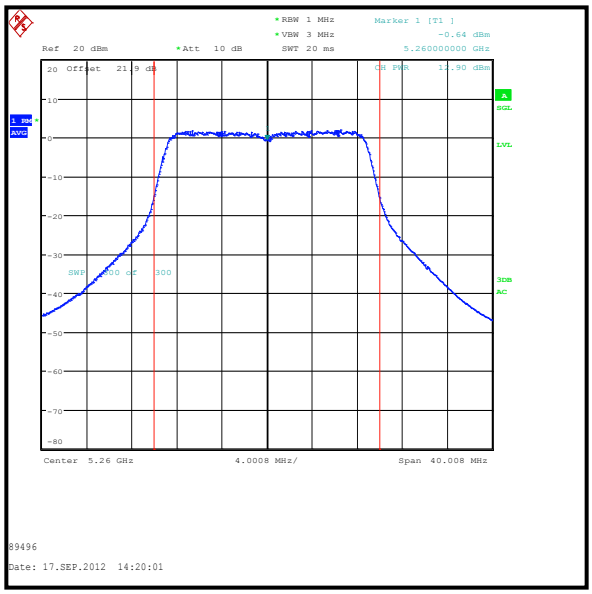
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5260	12.9	12.4	11.1	17.0
Middle	5280	12.7	12.7	11.4	17.1
Top	5320	13.1	12.7	11.6	17.3

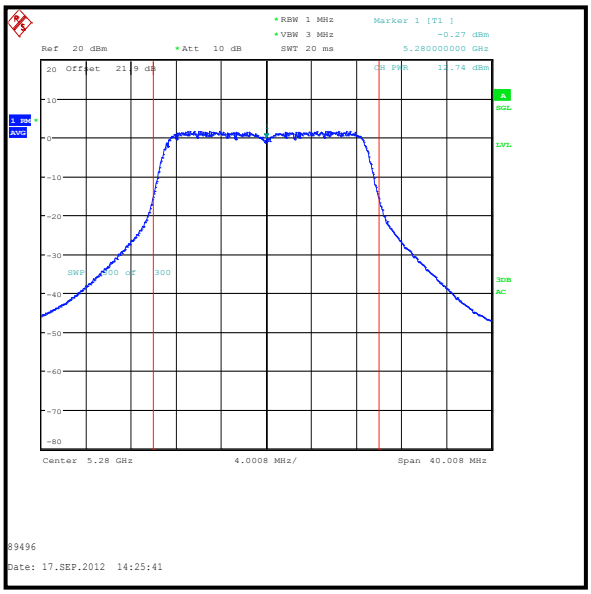
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5260	17.0	21.2	4.2	Complied
Middle	5280	17.1	21.2	4.1	Complied
Top	5320	17.3	21.2	3.9	Complied

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

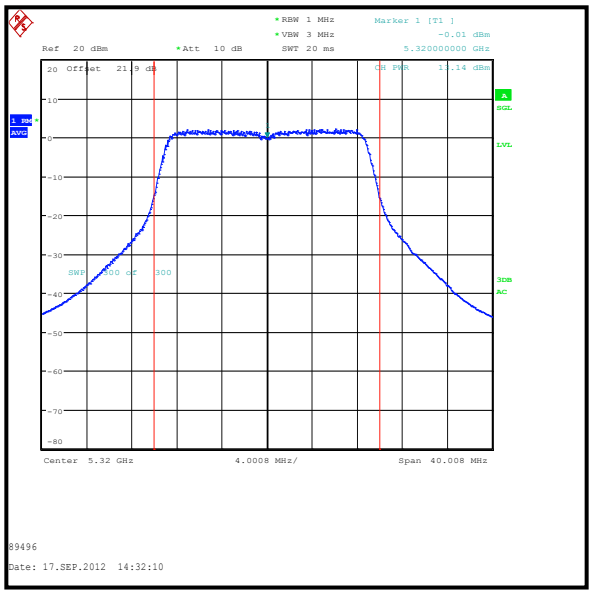
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2401



Bottom Channel



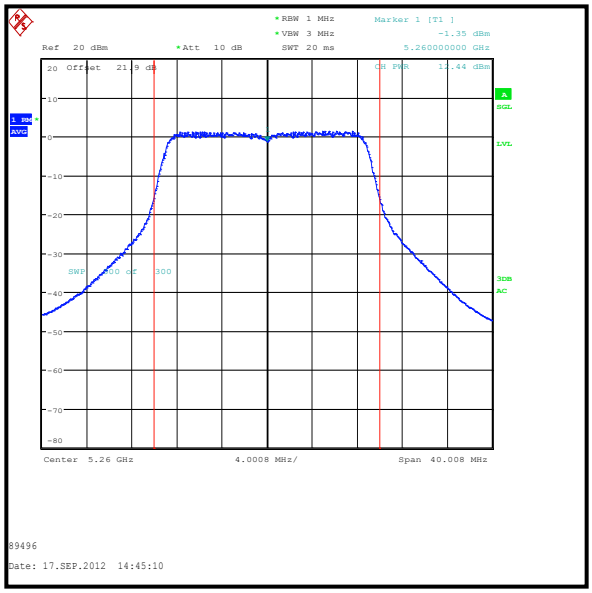
Middle Channel



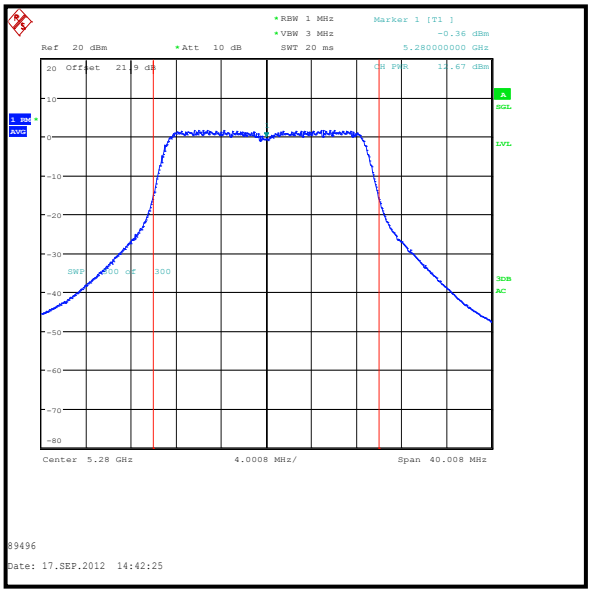
Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

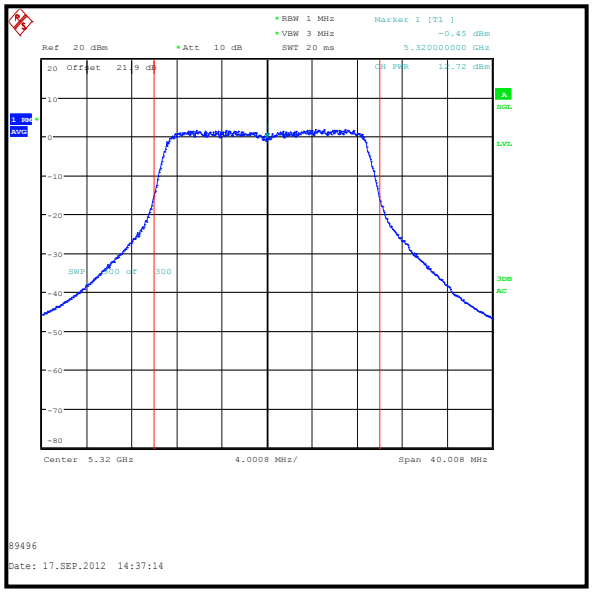
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2403



Bottom Channel



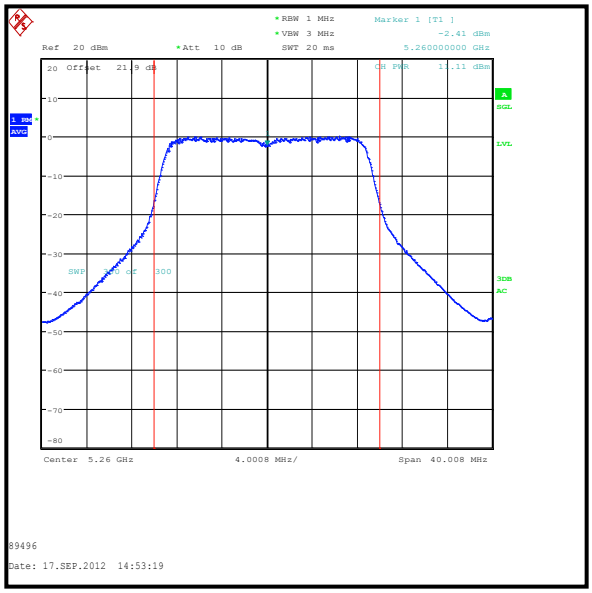
Middle Channel



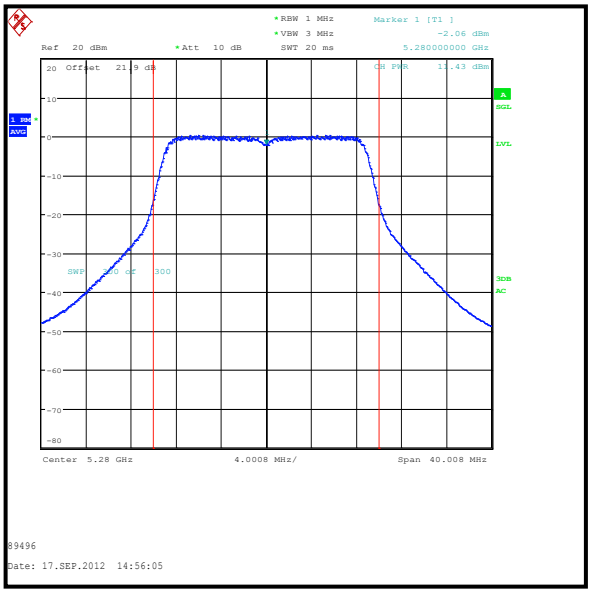
Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

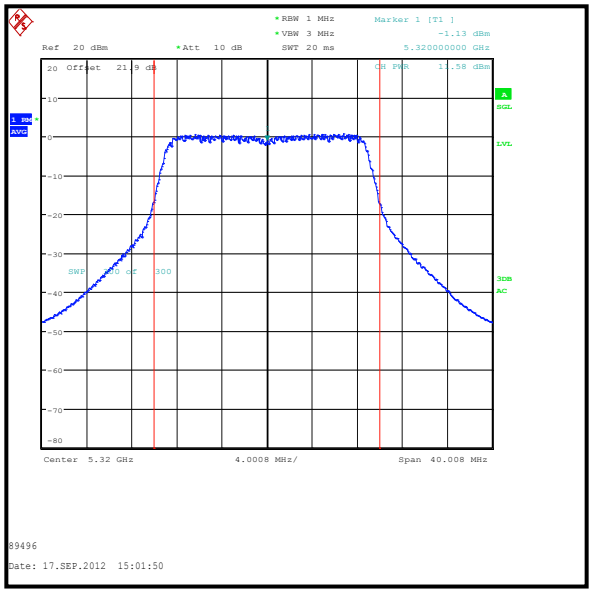
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (Continued)

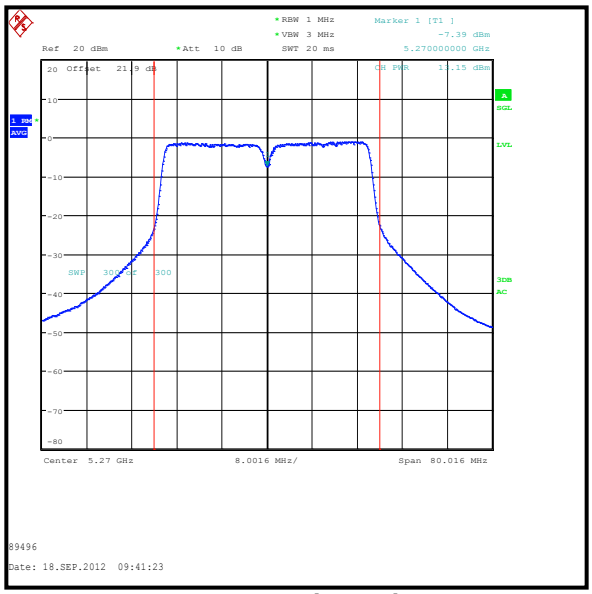
Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5270	13.2	12.5	11.3	17.2
Top	5310	13.1	13.3	12.0	17.6

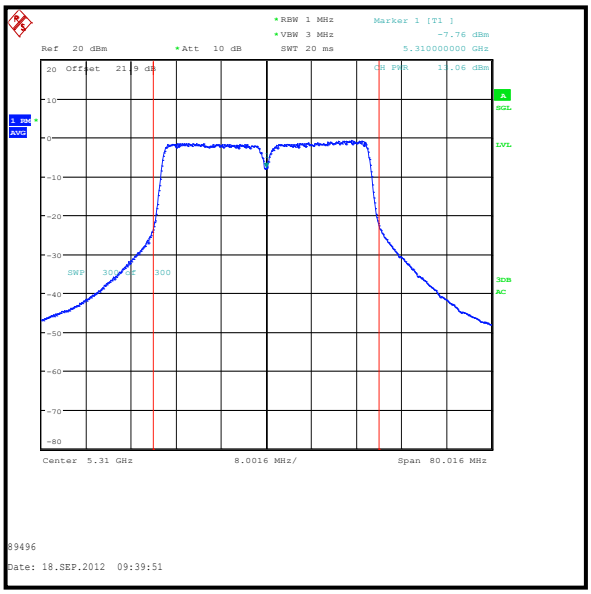
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5270	17.2	21.2	4.0	Complied
Top	5310	17.6	21.2	3.6	Complied

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2401



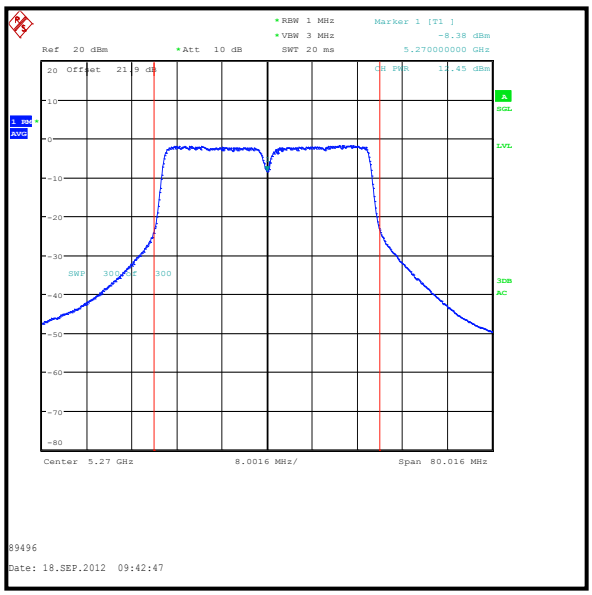
Bottom Channel



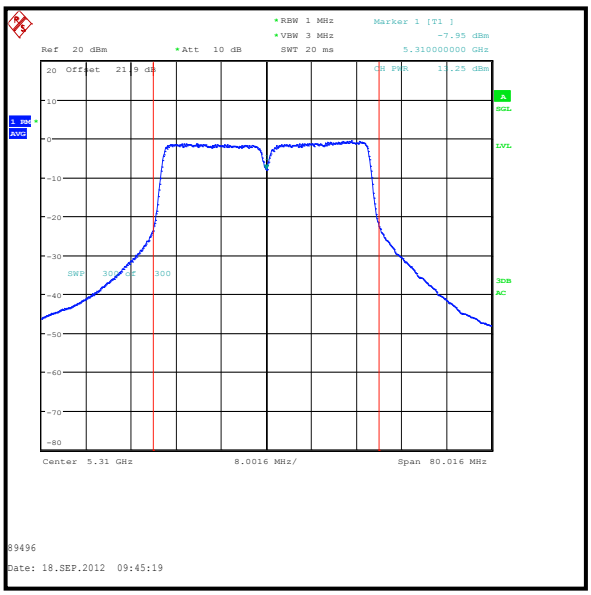
Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2403



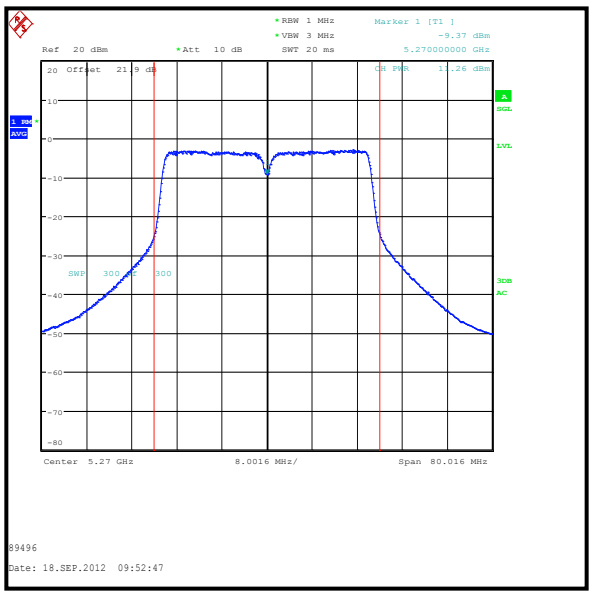
Bottom Channel



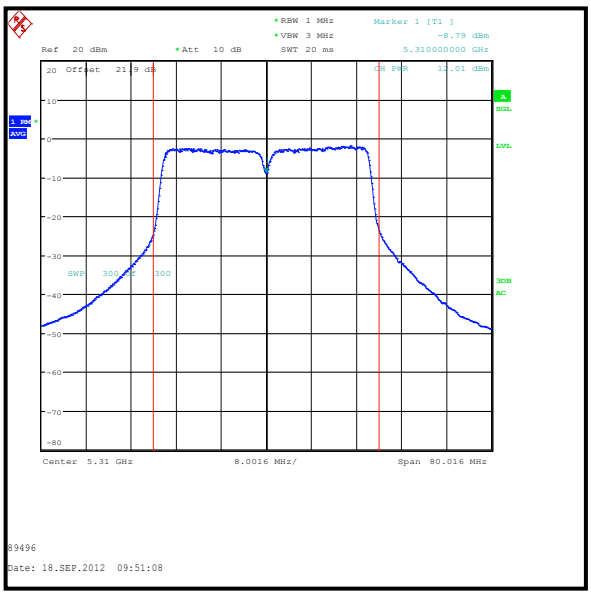
Top Channel

Transmitter Maximum Conducted Output Power (5.25-5.35 GHz band) (continued)

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band)

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	17 September 2012 & 18 September 2012
Test Sample Serial Number:	LK220202177		

FCC Reference:	Part 15.407(a)(2)
Test Method Used:	FCC KDB 789033 D01 Section C)3)b) & FCC KDB 662911 D01

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	41 to 43

Note(s):

1. 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 5.47-5.725 GHz were:
    - 802.11a –6 Mbps
    - 802.11n HT20 – 6.5 Mbps / MCS0
    - 802.11n HT40 – 13.5 Mbps / MCS0

    Measurements were then performed on the relevant mode on bottom, middle and top channels on all ports.
2. The EUT was configured with a power setting of 14.0 dBm for 20 MHz bottom and middle channels, 13.5 dBm for 20 MHz top channel, 12.0 dBm for 40 MHz bottom channel and 14.0 dBm for 40 MHz middle and top channels.
3. 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:

802.11a 20 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 24.1 = 24.8 dBm*
802.11a 20 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 24.5 = 24.9 dBm*
802.11a 20 MHz channel width / Top channel = *11 dBm + 10 log_{10} 24.3 = 24.9 dBm*
802.11n 20 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 25.4 = 25.0 dBm*
802.11n 20 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 25.2 = 25.0 dBm*
802.11n 20 MHz channel width / Top channel = *11 dBm + 10 log_{10} 25.4 = 25.0 dBm*
802.11n 40 MHz channel width / Bottom channel = *11 dBm + 10 log_{10} 48.5 = 27.9 dBm*
802.11n 40 MHz channel width / Middle channel = *11 dBm + 10 log_{10} 48.7 = 27.9 dBm*
802.11n 40 MHz channel width / Top channel = *11 dBm + 10 log_{10} 48.1 = 27.8 dBm*

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

5. The Customer declared that the transmit signals from all 3 ports are correlated. The Customer stated that the 3 antennas used have unequal antenna gains: G1 = 5.1 dBi, G2 = 4.0 dBi and G3 = 5.7 dBi. The directional gain was calculated in accordance with FCC KDB 662911 D01 Directional Gain Calculations:

$$10 \log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2/3]$$

The total array gain was calculated as:

$$10 \log[(10^{5.1/20} + 10^{4.0/20} + 10^{5.7/20})^2/3] = 9.7 \text{ dBi}$$

In accordance with 15.407(a)(2), 9.7 dBi is 3.7 dB over the directional gain of 6 dBi therefore the fixed limit of 24 dBm is reduced to 20.3 dBm.

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

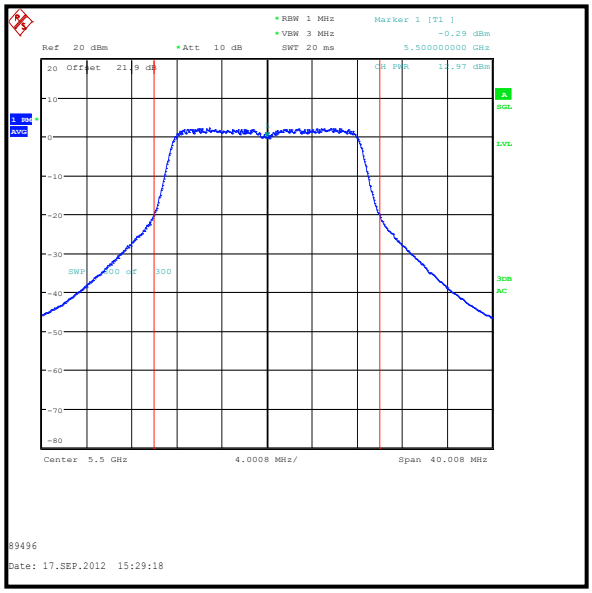
Results: 802.11a / 20 MHz / 6 Mbps / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5500	13.0	12.6	12.0	17.3
Middle	5580	12.0	12.5	11.0	16.6
Top	5700	10.7	11.4	11.0	15.8

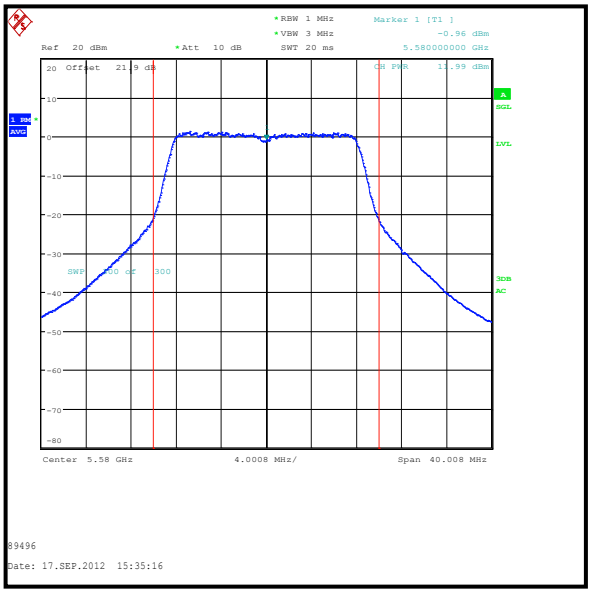
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	17.3	20.3	3.0	Complied
Middle	5580	16.6	20.3	3.7	Complied
Top	5700	15.8	20.3	4.5	Complied

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

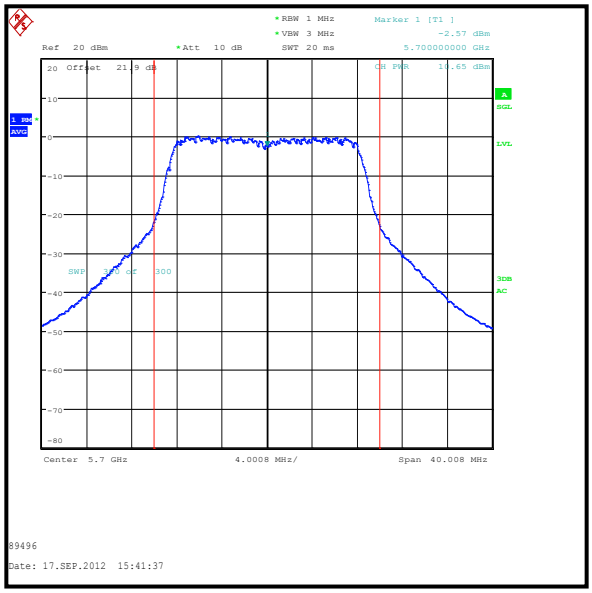
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2401



Bottom Channel



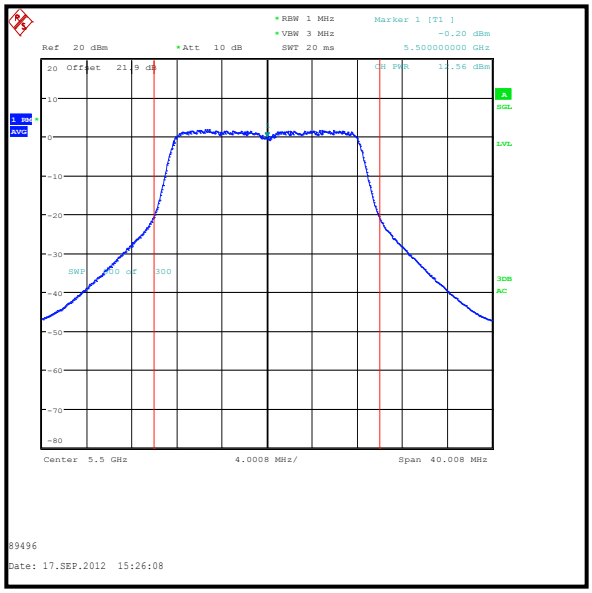
Middle Channel



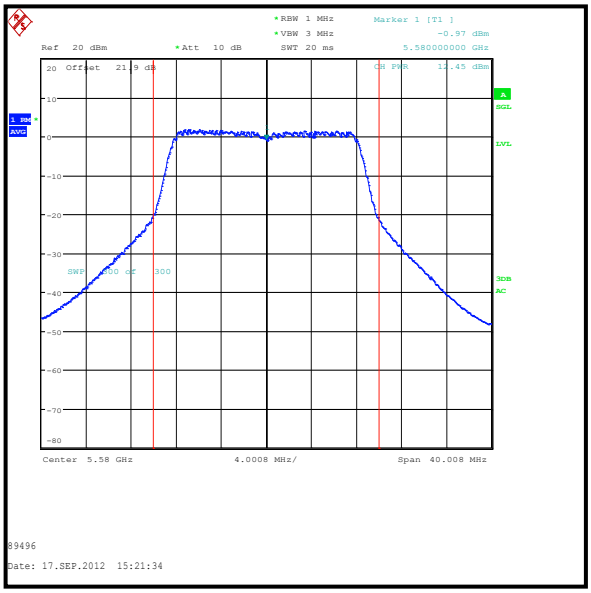
Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

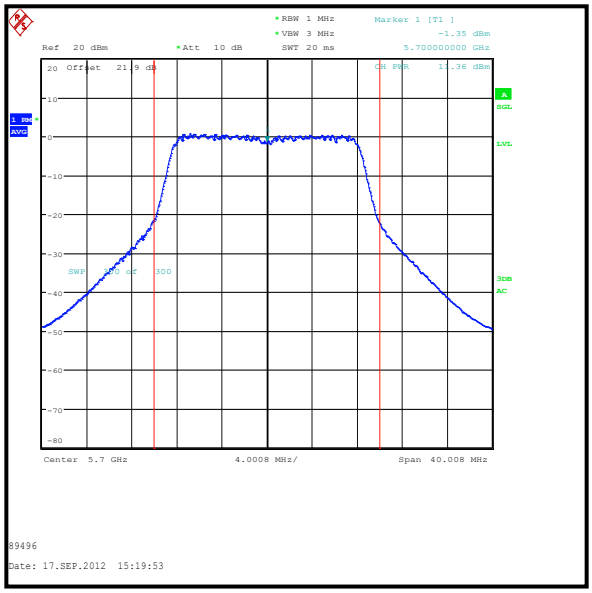
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2403



Bottom Channel



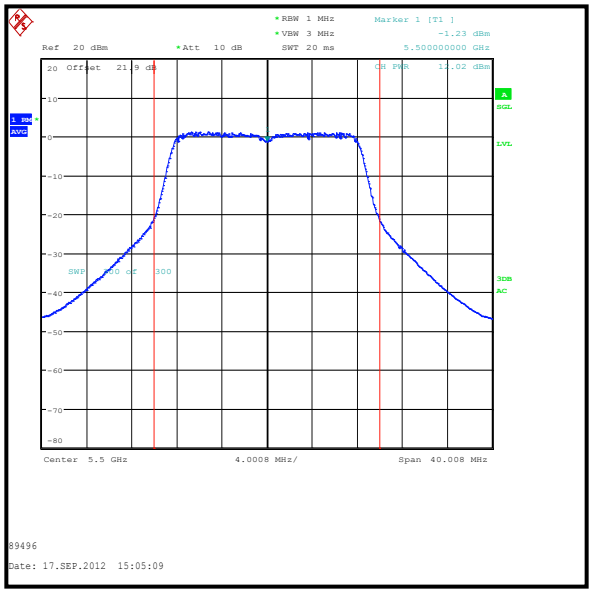
Middle Channel



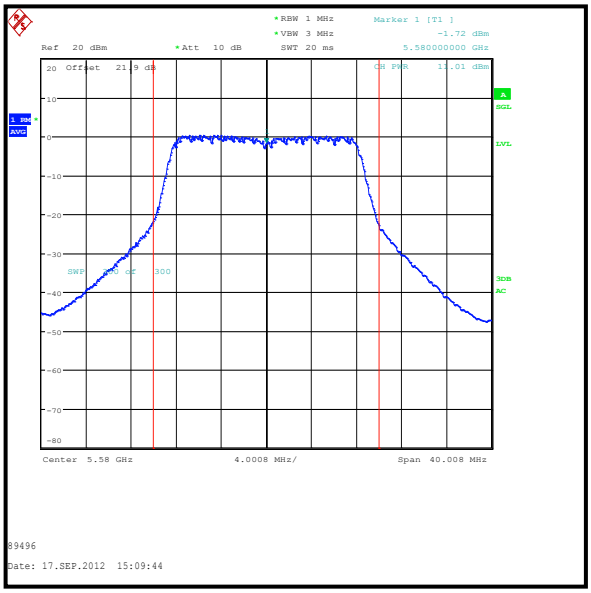
Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

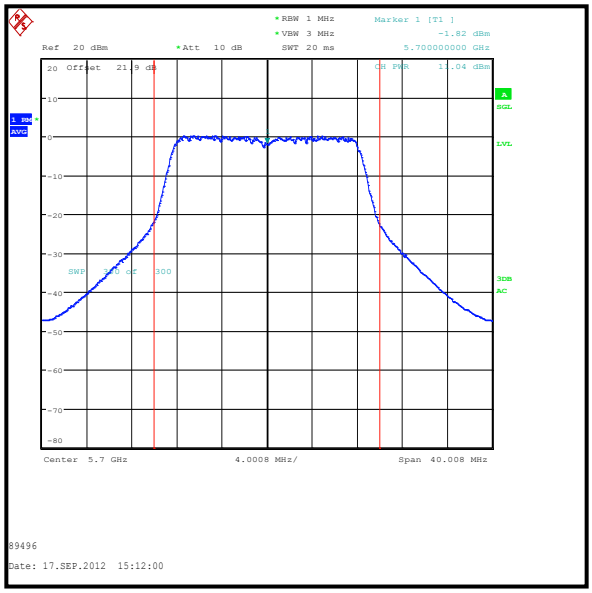
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (Continued)

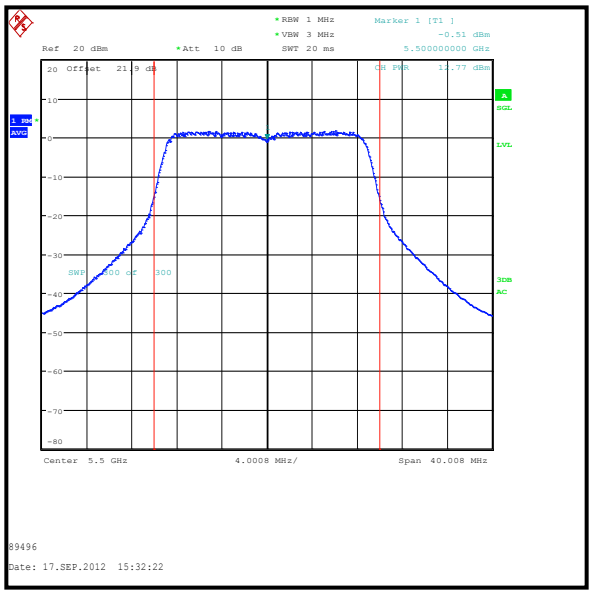
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5500	12.8	12.7	11.8	17.2
Middle	5580	12.1	12.6	11.1	16.7
Top	5700	10.7	11.3	10.9	15.7

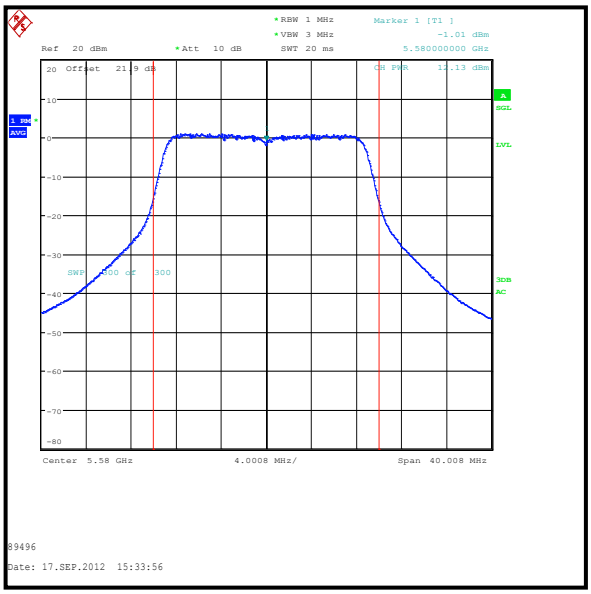
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5500	17.2	20.3	3.1	Complied
Middle	5580	16.7	20.3	3.6	Complied
Top	5700	15.7	20.3	4.6	Complied

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

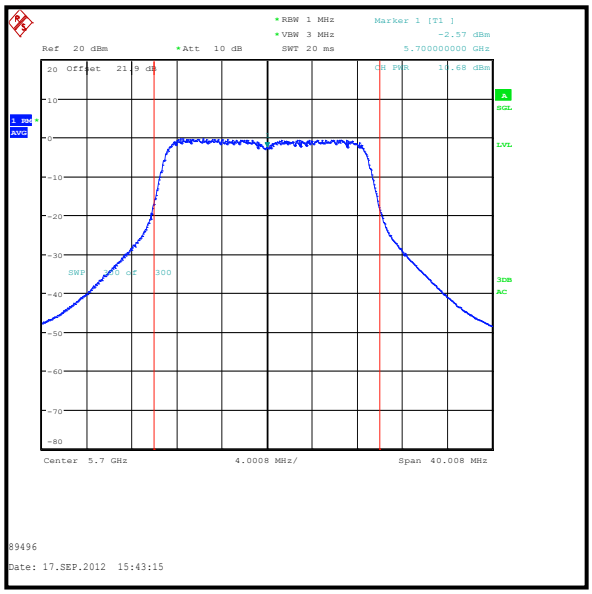
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2401



Bottom Channel



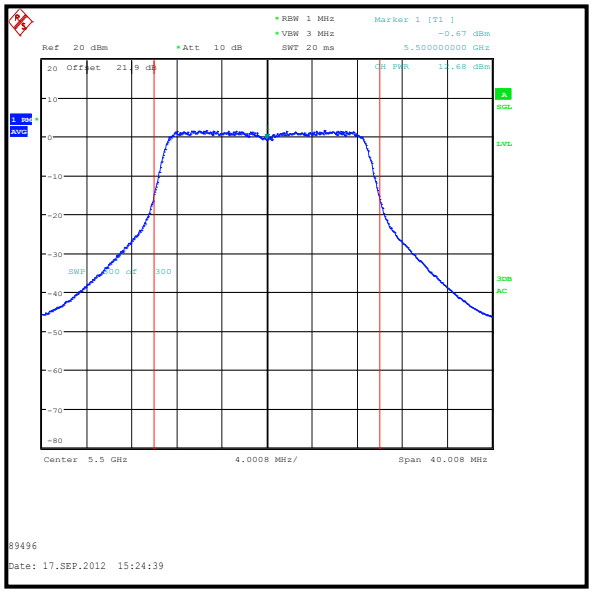
Middle Channel



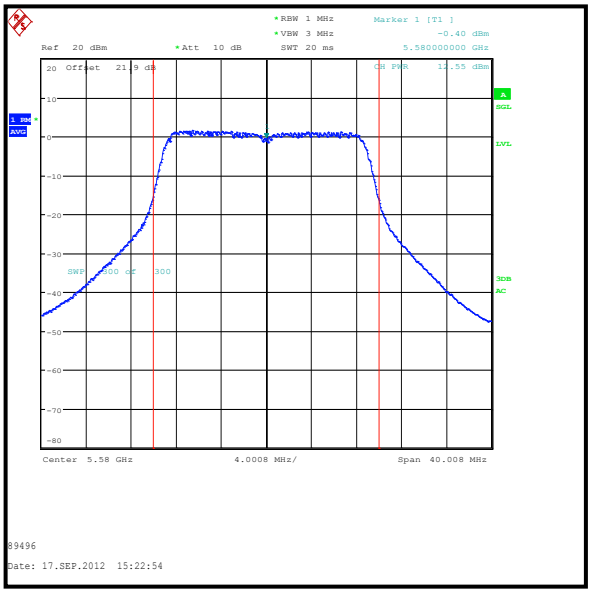
Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

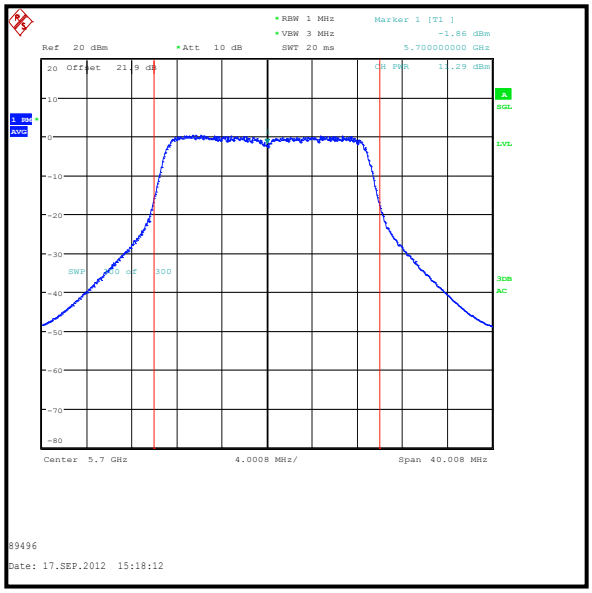
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2403



Bottom Channel



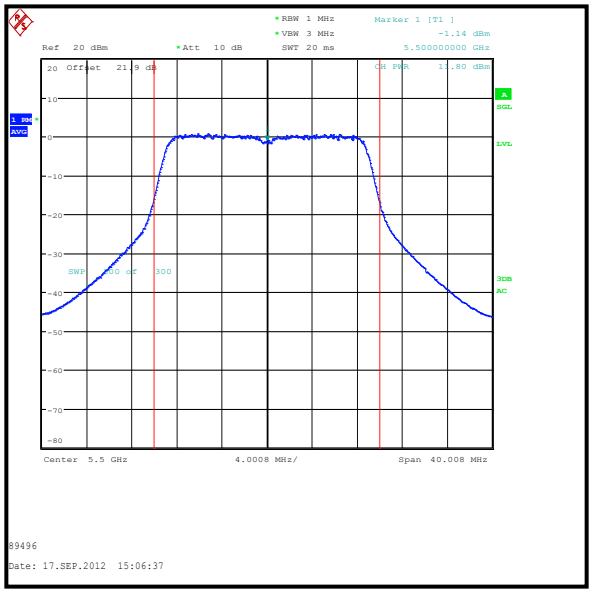
Middle Channel



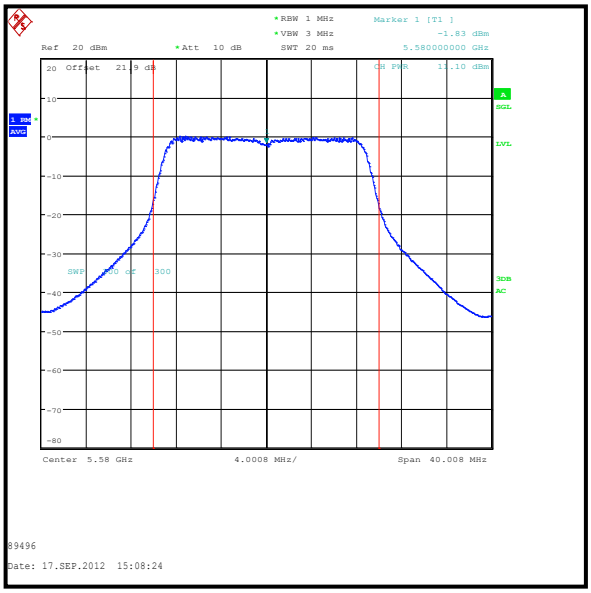
Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

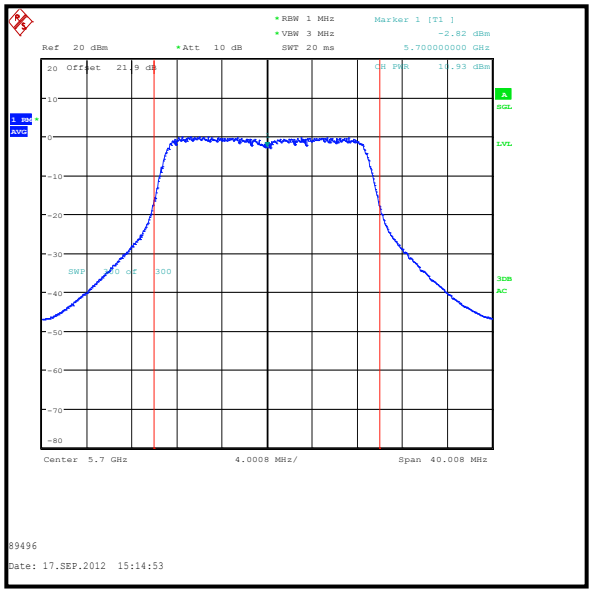
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (Continued)

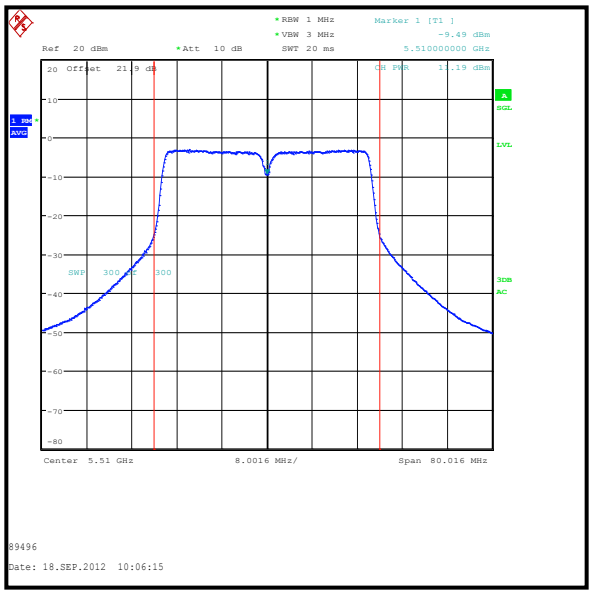
Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5510	11.2	10.7	9.9	15.4
Middle	5550	12.7	12.8	11.9	17.3
Top	5670	11.0	11.8	11.2	16.1

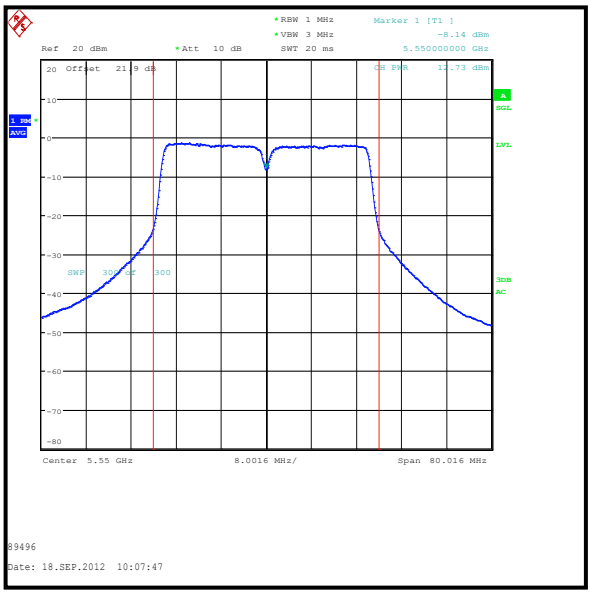
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5510	15.4	20.3	4.9	Complied
Middle	5550	17.3	20.3	3.0	Complied
Top	5670	16.1	20.3	4.2	Complied

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

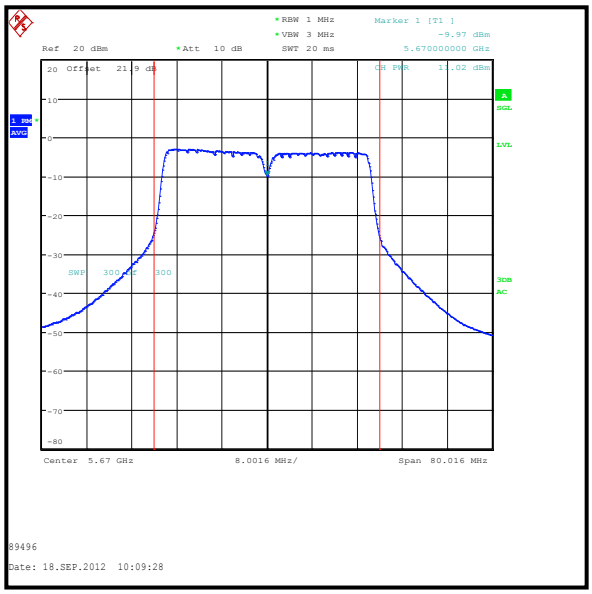
Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2401



Bottom Channel



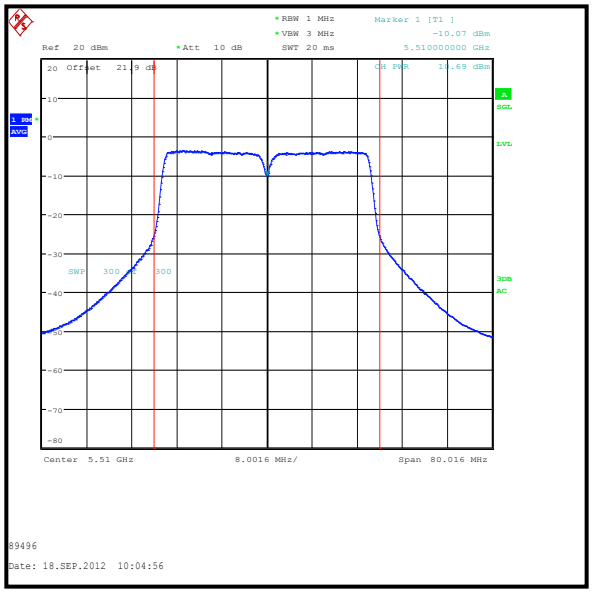
Middle Channel



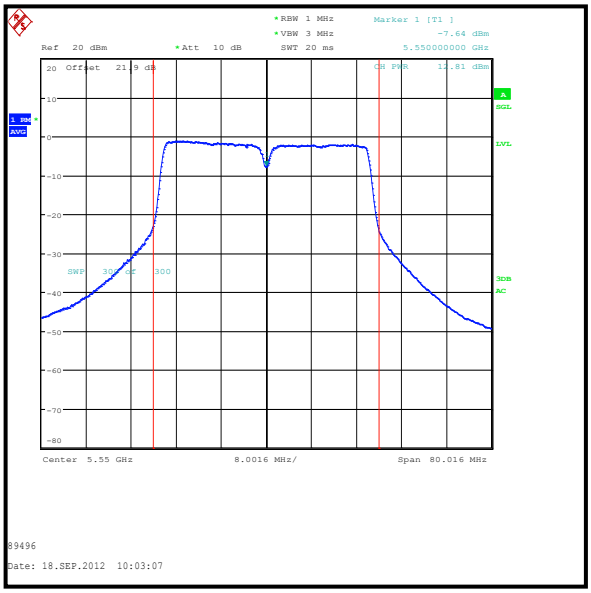
Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

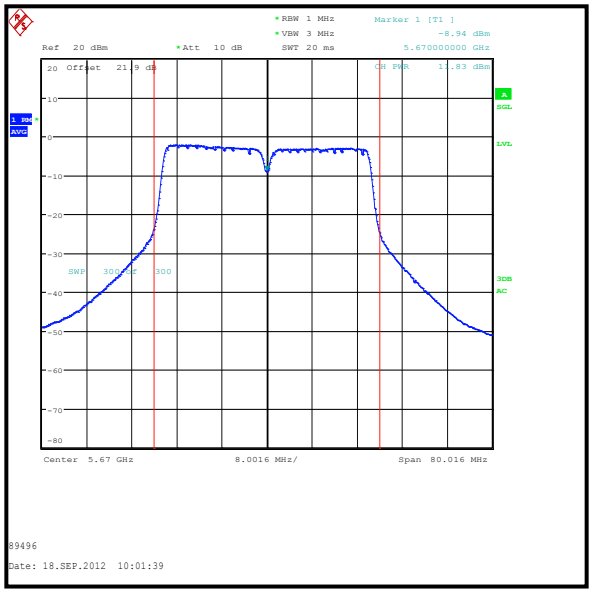
Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2403



Bottom Channel



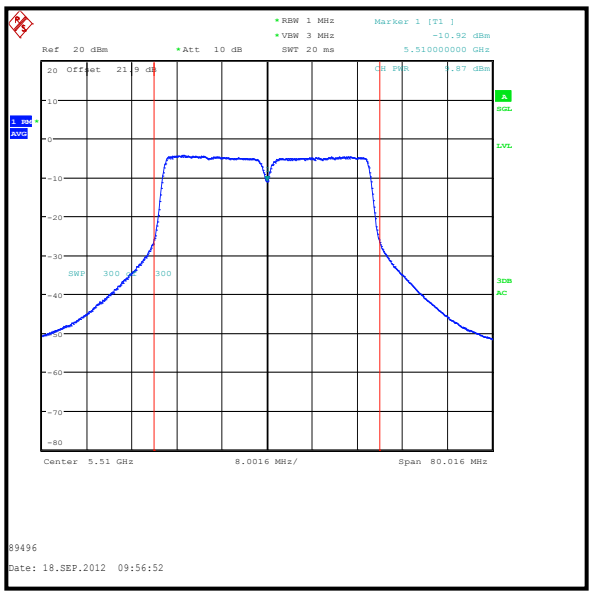
Middle Channel



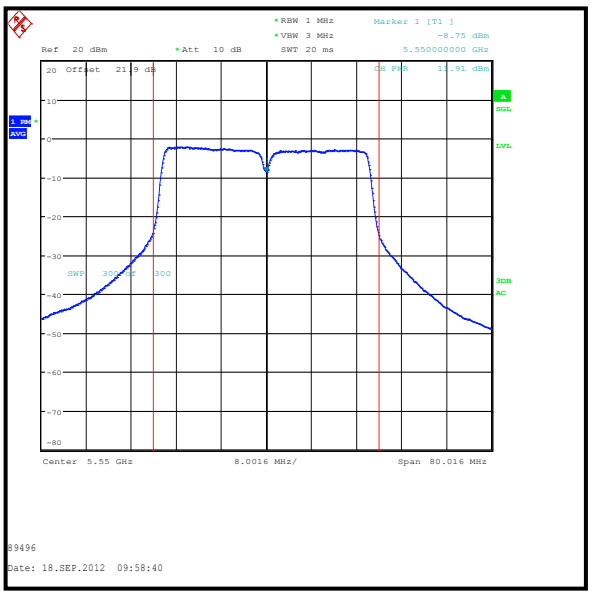
Top Channel

Transmitter Maximum Conducted Output Power (5.47-5.725 GHz band) (continued)

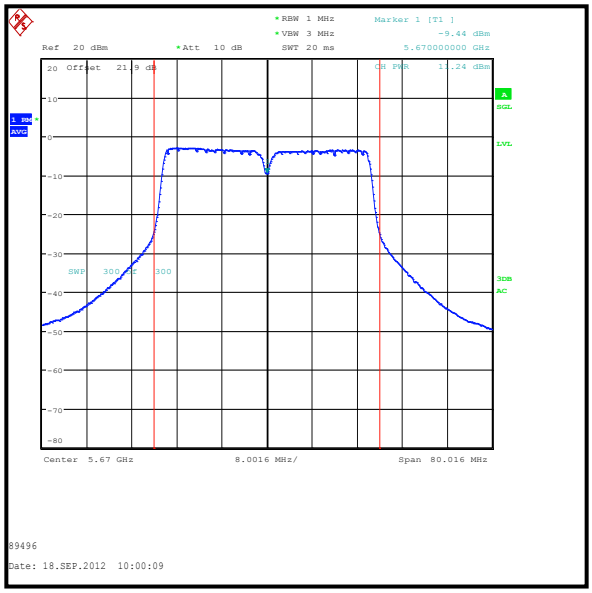
Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band)

Test Summary:

Test Engineer:	Sarah Williams	**Test Dates:**	17 September 2012 & 18 September 2012
Test Sample Serial Number:	LK220202177		

FCC Reference:	Part 15.407(a)(3)
Test Method Used:	FCC KDB 789033 D01 Section C) 4) & FCC KDB 662911 D01

Environmental Conditions:

Temperature (°C):	22 to 23
Relative Humidity (%):	41 to 43

Note(s):

1. 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 5.725-5.850 GHz were:
    - 802.11a – 6 Mbps
    - 802.11n HT20 – 6.5 Mbps / MCS0
    - 802.11n HT40 – 13.5 Mbps / MCS0

    Measurements were then performed on the relevant mode on bottom, middle and top channels on all ports.
2. The EUT was configured with a power setting of 14.0 dBm for 20 MHz bottom channel, 13.0 dBm for middle channel, 12.5 dBm for 802.11a 20 MHz top channel, 11.5 dBm for 802.11n 20 MHz top channel, 9.5 dBm for 40 MHz bottom channel and 13.0 dBm for 40 MHz top channel.
3. FCC Part 15.407(a)(3) limit is the lesser of 1 W (30.0 dBm) or 17 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 = $17\ dBm + 10\ log_{10}\ 24.2 = 30.8\ dBm$
802.11a 20 MHz channel width / Middle channel = $17\ dBm + 10\ log_{10}\ 24.2 = 30.8\ dBm$
802.11a 20 MHz channel width / Top channel = $17\ dBm + 10\ log_{10}\ 24.4 = 30.9\ dBm$
802.11n 20 MHz channel width / Bottom channel = $17\ dBm + 10\ log_{10}\ 25.4 = 31.0\ dBm$
802.11n 20 MHz channel width / Middle channel = $17\ dBm + 10\ log_{10}\ 25.2 = 31.0\ dBm$
802.11n 20 MHz channel width / Top channel = $17\ dBm + 10\ log_{10}\ 25.3 = 31.0\ dBm$
802.11n 40 MHz channel width / Bottom channel = $17\ dBm + 10\ log_{10}\ 49.0 = 33.9\ dBm$
802.11n 40 MHz channel width / Top channel = $17\ dBm + 10\ log_{10}\ 48.7 = 33.9\ dBm$

The lesser of the two limits is the fixed limit of 1 W (30.0 dBm).

4. The Customer declared that the transmit signals from all 3 ports are correlated. The Customer stated that the 3 antennas used have unequal antenna gains: G1 = 5.1 dBi, G2 = 4.0 dBi and G3 = 5.7 dBi. The directional gain was calculated in accordance with FCC KDB 662911 D01 Directional Gain Calculations:

$$10\ log[(10^{G1/20} + 10^{G2/20} + 10^{G3/20})^2/3]$$

    The total array gain was calculated as:

$$10\ log[(10^{5.1/20} + 10^{4.0/20} + 10^{5.7/20})^2/3] = 9.7\ dBi$$

In accordance with 15.407(a)(3), 9.7 dBi is 3.7 dB over the directional gain of 6 dBi therefore the fixed limit of 30 dBm is reduced to 26.3 dBm.

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

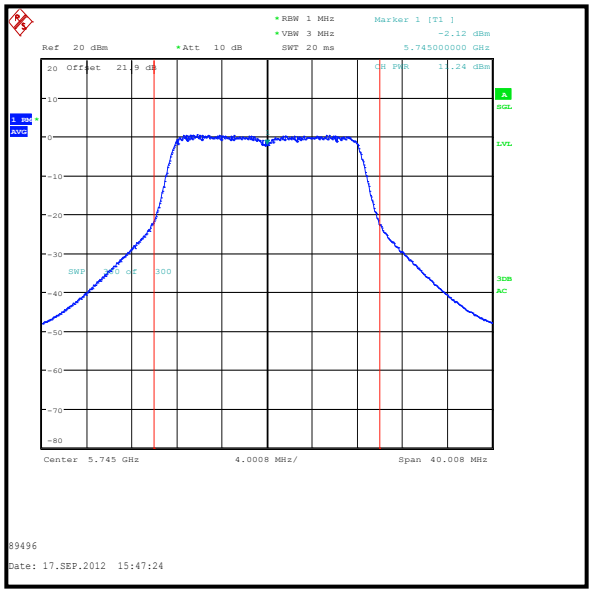
Results: 802.11a / 20 MHz / 6 Mbps / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5745	11.2	11.9	11.2	16.2
Middle	5785	11.0	11.4	10.7	15.8
Top	5825	10.7	11.2	9.8	15.4

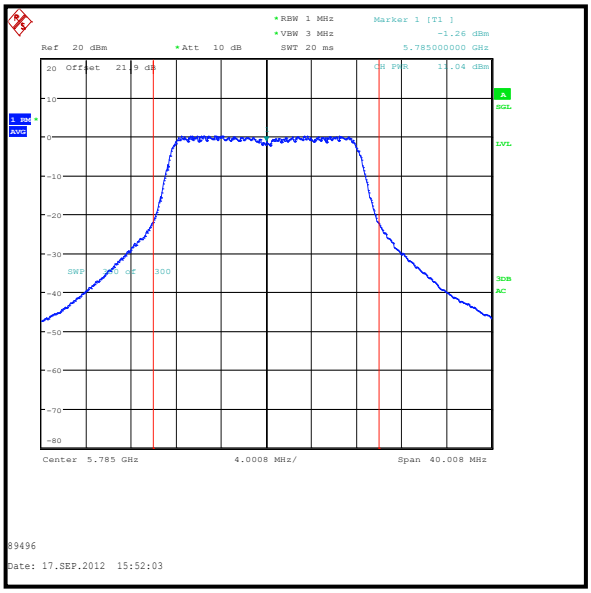
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	16.2	26.3	10.1	Complied
Middle	5785	15.8	26.3	10.5	Complied
Top	5825	15.4	26.3	10.9	Complied

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

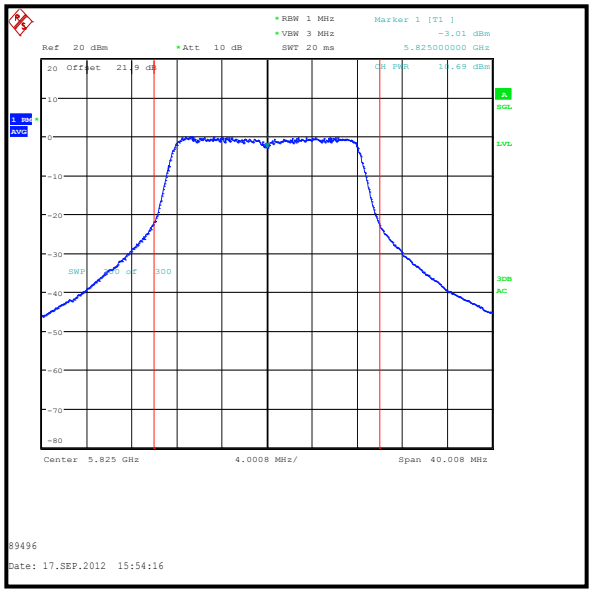
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2401



Bottom Channel



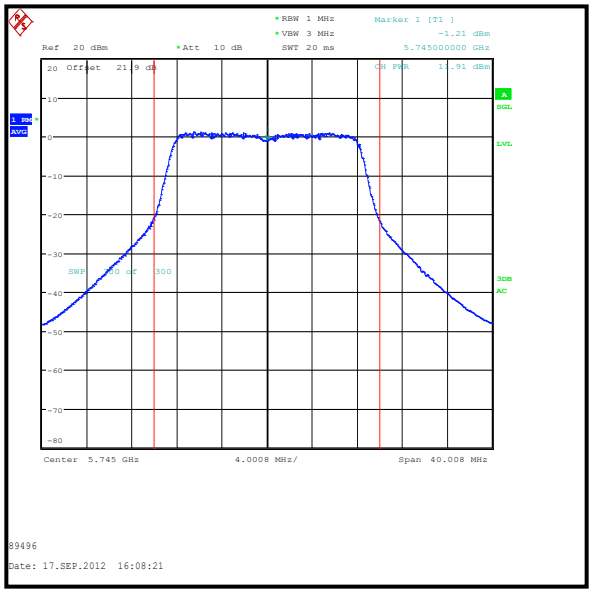
Middle Channel



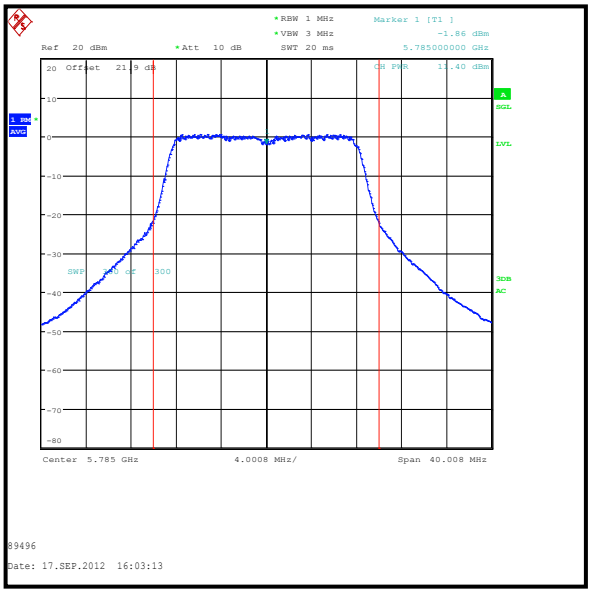
Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

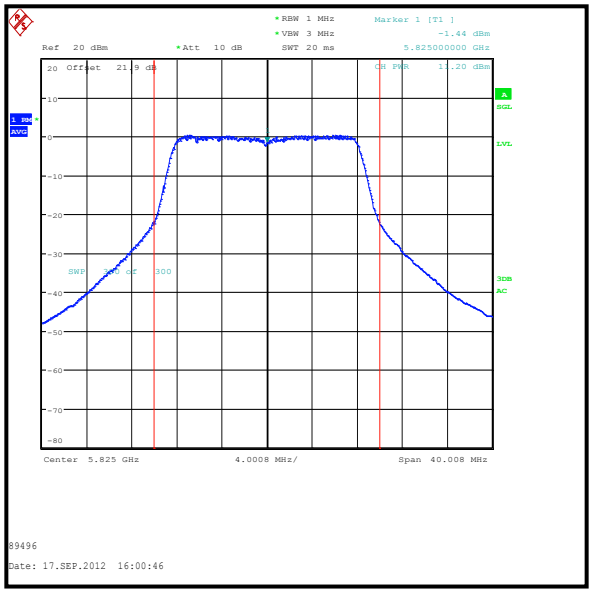
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2403



Bottom Channel



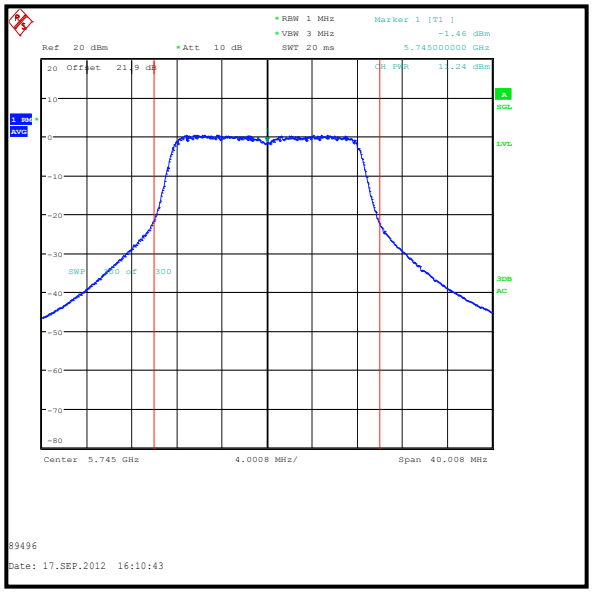
Middle Channel



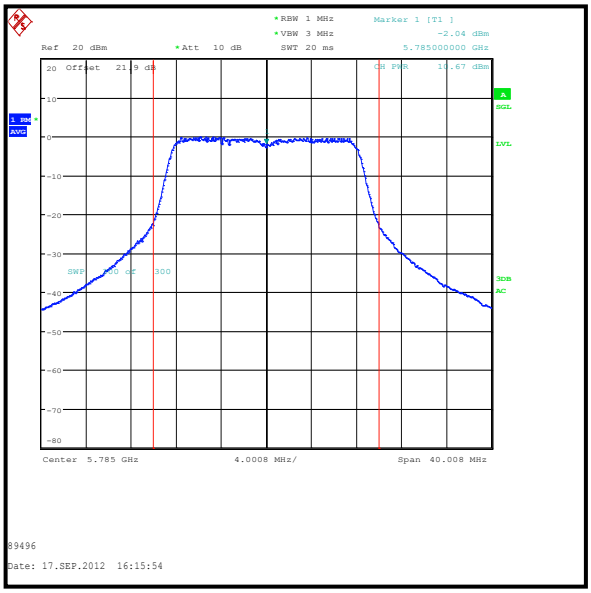
Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

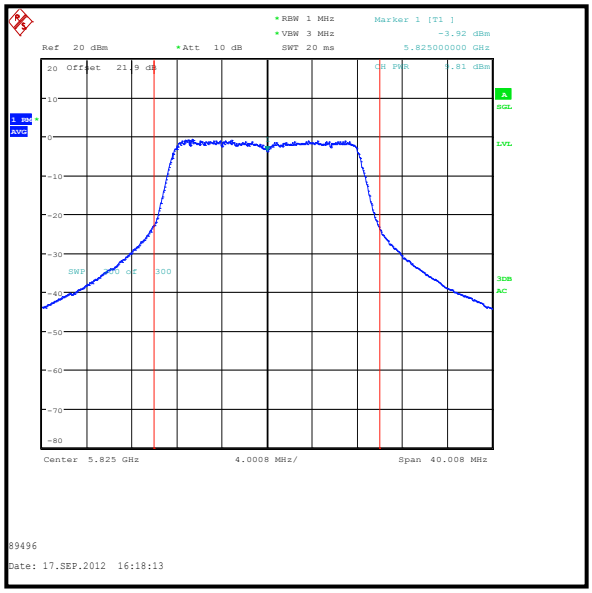
Results: 802.11a / 20 MHz / 6 Mbps / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (Continued)

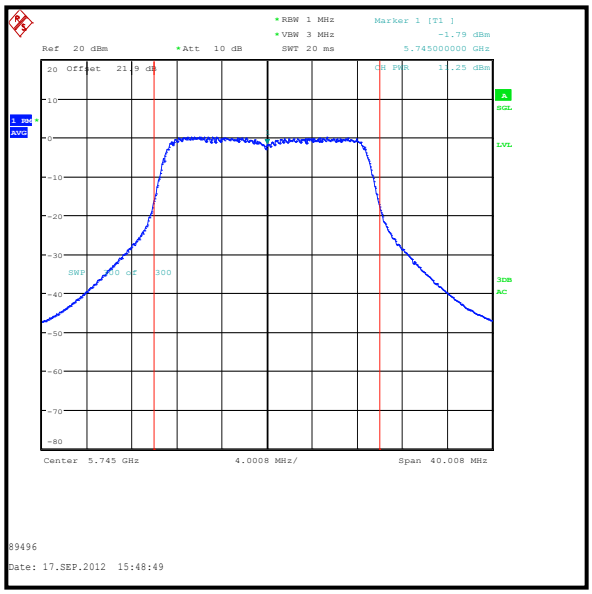
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5745	11.3	11.9	11.4	16.3
Middle	5765	10.7	11.2	10.6	15.6
Top	5805	9.8	10.3	8.8	14.4

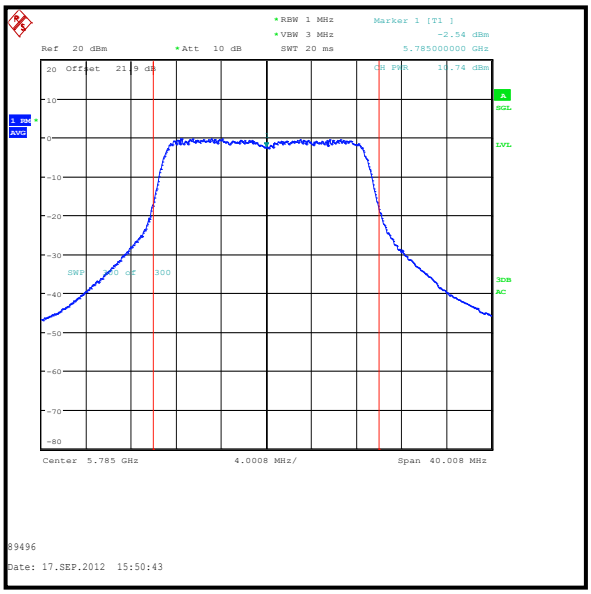
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5745	16.3	26.3	10.0	Complied
Middle	5765	15.6	26.3	10.7	Complied
Top	5805	14.4	26.3	11.9	Complied

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

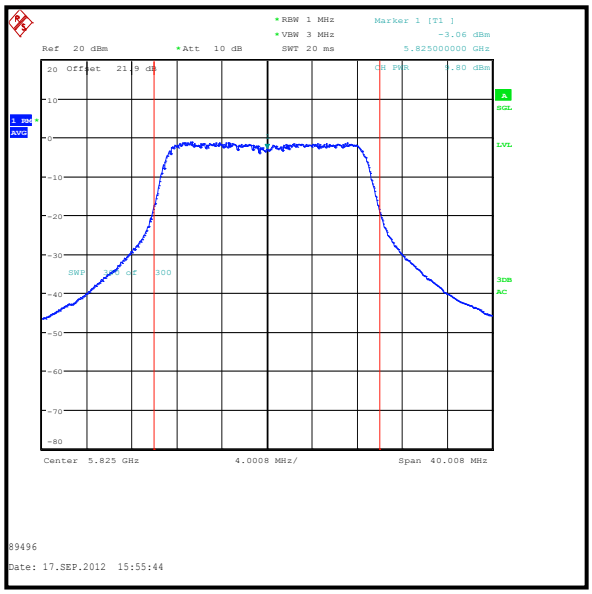
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2401



Bottom Channel



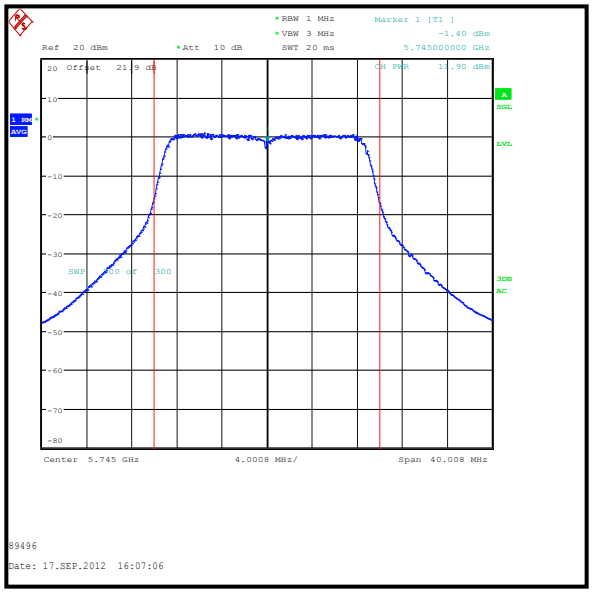
Middle Channel



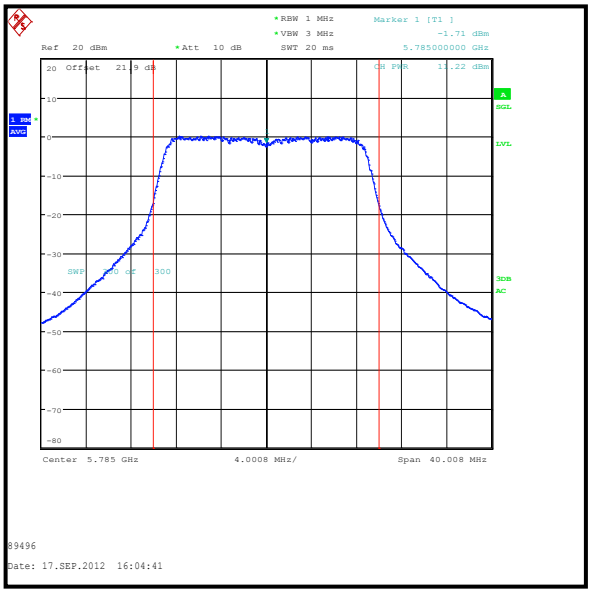
Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

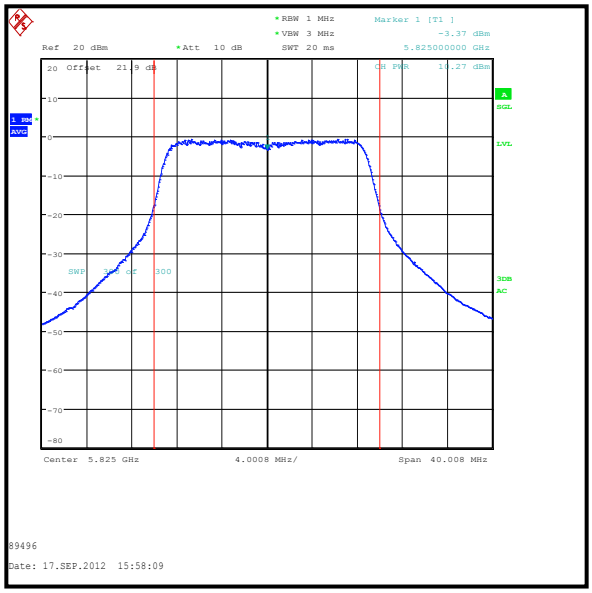
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2403



Bottom Channel



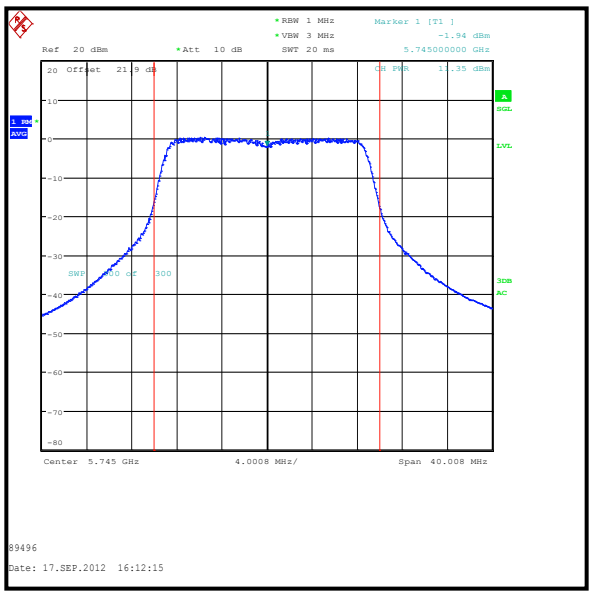
Middle Channel



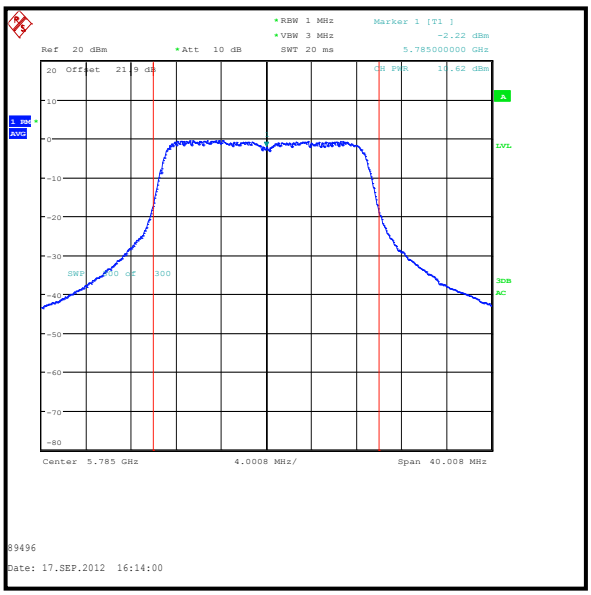
Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

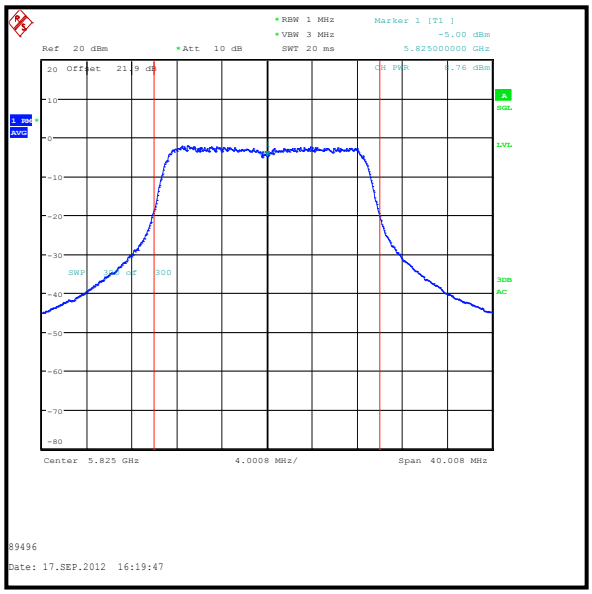
Results: 802.11n / 20 MHz / 6.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Middle Channel



Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (Continued)

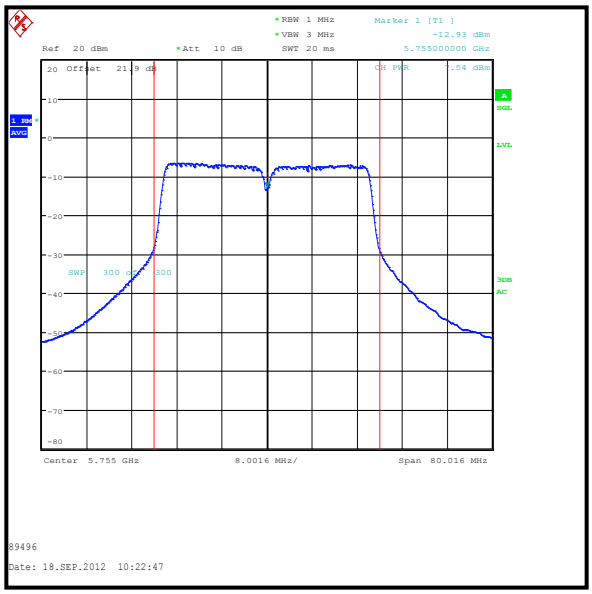
Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK

Channel	Frequency (MHz)	P2401 Power (dBm)	P2403 Power (dBm)	P2405 Power (dBm)	Combined Power (dBm)
Bottom	5755	7.5	7.4	7.5	12.2
Top	5795	10.6	11.2	10.2	15.5

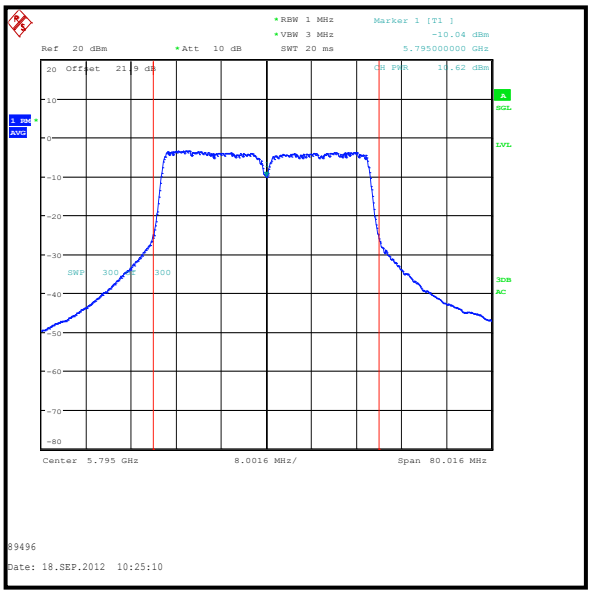
Channel	Frequency (MHz)	Combined Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	5755	12.2	26.3	14.1	Complied
Top	5795	15.5	26.3	10.8	Complied

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2401



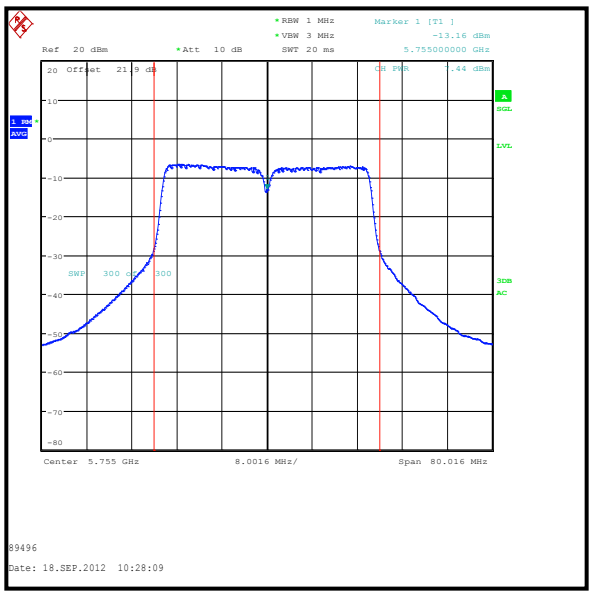
Bottom Channel



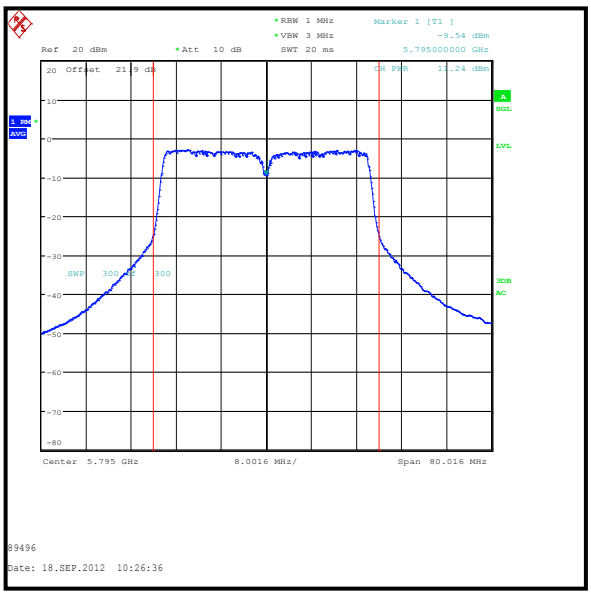
Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2403



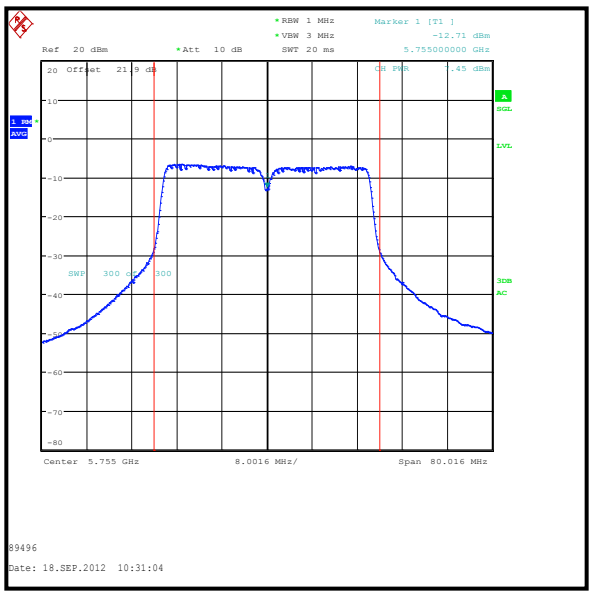
Bottom Channel



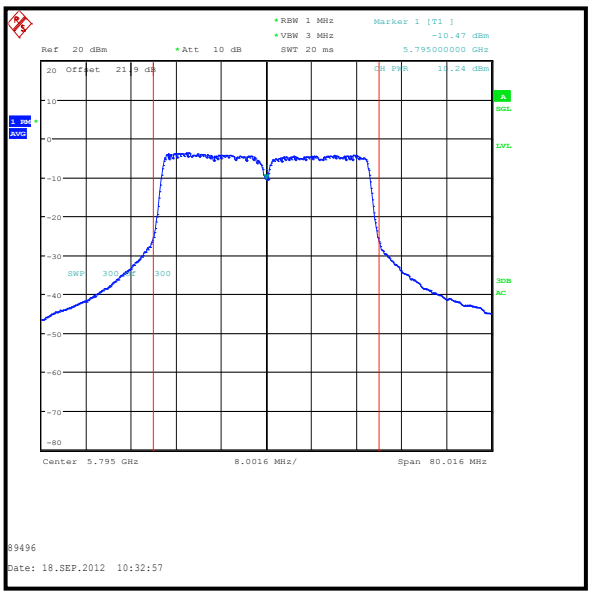
Top Channel

Transmitter Maximum Conducted Output Power (5.725-5.850 GHz band) (continued)

Results: 802.11n / 40 MHz / 13.5 Mbps / MCS0 / BPSK / Port 2405



Bottom Channel



Top Channel

Test Equipment Used:

RFI ID	Instrument Description	Model Number	Calibration Due	Calibration Interval (Months)
A1393	Attenuator	6820.17.B	06 Jul 2013	12
A1999	Attenuator	6820.17.B	04 Apr 2013	12
M1630	Test Receiver	ESU40	13 Jan 2013	12