Report On

FCC Testing of the Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 15E

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00192

Document 75920802 Report 17 Issue 1 **June 2013**

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

REPORT ON

FCC Testing of the
Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 15E

Document 75920802 Report 17 Issue 1

June 2013

PREPARED FOR

Sharp Communication Compliance Ltd
Azure House
Basghot Road
Bracknell
Berkshire
RG12 7QY

PREPARED BY

Natalie Bennett
Senior Administrator (Technical)

APPROVED BY

Mark Jenkins
Authorised Signatory

DATED 27 June 2013

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47 Part 15E. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Lawler M Russell

Product Service

CONTENTS

Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE
(B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 15E

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS to the requirements of FCC CFR 47 Part 15E.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Sharp Corporation
Model Number(s)	SHL22
Serial Number(s)	IMEI 004401114764687 IMEI 004401114765106
Number of Samples Tested	2
Test Specification/Issue/Date	FCC CFR 47 Part 15E (2012)
Incoming Release Date	Application Form 14 May 2013
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	9676 30 April 2013
Start of Test	22 May 2013
Finish of Test	12 June 2013
Name of Engineer(s)	G Lawler M Russell
Related Document(s)	FCC 06-96: 2006; FCC Public Notice DA 02-2138: 2002; UKAS M3003: Edition 2: 2007; ETSI TR 100 028: 2001

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 15E is shown below.

Section	Spec Clause	Test Description	Result	Comments/Base Standard
802.11(a)				
2.2	15.407 (a)(1)(2)(3)	Power Limits	Pass	
2.3	15.407 (b)(1)(2)(3)(4)(6)(7)	Undesirable Emission Limits	Pass	
2.5	15.407 (a)	26 dB Bandwidth	Pass	
2.6	15.407 (a)(5)	Peak Power Spectral Density	Pass	
2.7	15.407 (a)(6)	Ratio of the Peak Excursion of the Modulation Envelope	Pass	
802.11(n) - 5 GHz 20 MHz BW				
2.2	15.407 (a)(1)(2)(3)	Power Limits	Pass	
2.3	15.407 (b)(1)(2)(3)(4)(6)(7)	Undesirable Emission Limits	Pass	
2.5	15.407 (a)	26 dB Bandwidth	Pass	
2.6	15.407 (a)(5)	Peak Power Spectral Density	Pass	
2.7	15.407 (a)(6)	Ratio of the Peak Excursion of the Modulation Envelope	Pass	
802.11(n) - 5 GHz 40 MHz BW				
2.2	15.407 (a)(1)(2)(3)	Power Limits	Pass	
2.3	15.407 (b)(1)(2)(3)(4)(6)(7)	Undesirable Emission Limits	Pass	
2.5	15.407 (a)	26 dB Bandwidth	Pass	
2.6	15.407 (a)(5)	Peak Power Spectral Density	Pass	
2.7	15.407 (a)(6)	Ratio of the Peak Excursion of the Modulation Envelope	Pass	

Section	Spec Clause	Test Description	Result	Comments/Base Standard
802.11(ac) - 5 GHz 20 MHz BW				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.407 (a)(1)(2)(3)	Power Limits	Pass	
2.3	15.407 (b)(1)(2)(3)(4)(6)(7)	Undesirable Emission Limits	Pass	
2.5	15.407 (a)	26 dB Bandwidth	Pass	
2.6	15.407 (a)(5)	Peak Power Spectral Density	Pass	
2.7	15.407 (a)(6)	Ratio of the Peak Excursion of the Modulation Envelope	Pass	
802.11(ac) - 5 GHz 40 MHz BW				
2.2	15.407 (a)(1)(2)(3)	Power Limits	Pass	
2.3	15.407 (b)(1)(2)(3)(4)(6)(7)	Undesirable Emission Limits	Pass	
2.5	15.407 (a)	26 dB Bandwidth	Pass	
2.6	15.407 (a)(5)	Peak Power Spectral Density	Pass	
2.7	15.407 (a)(6)	Ratio of the Peak Excursion of the Modulation Envelope	Pass	
802.11(ac) - 5 GHz 80 MHz BW				
2.2	15.407 (a)(1)(2)(3)	Power Limits	Pass	
2.3	15.407 (b)(1)(2)(3)(4)(6)(7)	Undesirable Emission Limits	Pass	
2.5	15.407 (a)	26 dB Bandwidth	Pass	
2.6	15.407 (a)(5)	Peak Power Spectral Density	Pass	
2.7	15.407 (a)(6)	Ratio of the Peak Excursion of the Modulation Envelope	Pass	
Unmodulated				
2.4	2.1055 and 15.407 (g)	Frequency Stability	Pass	

1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	SHL22
Part Number	DA208_A
Hardware Version	PP1
Software Version	A4100-2
FCC ID	APYHRO00192
Technical Description (Please provide a brief description of the intended use of the equipment)	Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1,B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS

TYPE OF EQUIPMENT	
☐	Master
☐	Client with Radar Detection
☒	Client without Radar Detection

TRANSMITTER TECHNICAL CHARACTERISTICS	
FREQUENCY CHARACTERISTICS	
☒	5.150 GHz to 5.250 GHz
☒	5.250 GHz to 5.350 GHz
☒	5.470 GHz to 5.725 GHz
☐	5.725 GHz to 5.825 GHz
☐	EUT operates in the frequency band 5600 – 5650 MHz? This shouldn't be checked as not allowed to operate in this band.
☐	Off Channel CAC Implemented Off Channel CAC within 5600 – 5650 MHz band hours, (1 – 24) Off Channel CAC outside 5600 – 5650 MHz band minutes, (6 – 240)
Note: DFS is not required in the ranges 5.15 – 5.25 GHz and 5.725 – 5.825 GHz	

TRANSMITTER RF POWER CHARACTERISTICS		
Maximum rated transmitter output power as stated by manufacturer (if applicable)		
Conducted Power	13.5 dBm	
Maximum Antenna Gain	2 dBi	
EIRP	15.5 dBm	
Minimum rated transmitter output power as stated by manufacturer (if applicable)		
Conducted Power	dBm	
Maximum Antenna Gain	dBi	
EIRP	dBm	
Is TPC supported?	☒ Yes	☐ No
If Yes, provide a description of operation.		
This equipment implements TPC accordance with IEEE802.11a/n and IEEE802.11h		

POWER SOURCE			
☐ AC mains supply		State voltage	
AC supply frequency	(Hz)	VAC	
☒ DC supply			
Nominal voltage	4		

SYSTEM ARCHITECTURE			
☒	Frame Based		
☐	IP Based		
☐	Other	If other please state	
☒	802.11(a)	Receiver Bandwidth:	20MHz
☒	802.11(n) – 20 MHz	Receiver Bandwidth:	20MHz
☒	802.11(n) – 40 MHz	Receiver Bandwidth:	20/40MHz

DECLARATION			
No parameter or information relating to the detected radar waveforms is available or accessible to the end user.			
☒	True	☐	False

MISCELLANEOUS	
Power-on cycle time*	N/A
* Time from switching on the UUT to the point at which Channel Availability Check (CAC) commences	

UNIFORM SPREADING
Describe how the meter provides, on aggregate, uniform channel loading of the spectrum across all channels.
N/A

ANTENNA OPTIONS	
Antenna 1	
Antenna Description:	Integral BT / WLAN strip line antenna
Antenna Model:	GCABBA469AFS*
Antenna Maximum Gain:	2dBi
Antenna Frequency Range:	Dual band: 2400MHz -2500MHz, 5100MHz- 5750MHz
Antenna 2	
Antenna Description:	
Antenna Model:	
Antenna Maximum Gain:	
Antenna Frequency Range:	
Antenna 3	
Antenna Description:	
Antenna Model:	
Antenna Maximum Gain:	
Antenna Frequency Range:	
Antenna 4	
Antenna Description:	
Antenna Model:	
Antenna Maximum Gain:	
Antenna Frequency Range:	
Antenna 5	
Antenna Description:	
Antenna Model:	
Antenna Maximum Gain:	
Antenna Frequency Range:	

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature:  Name: Hachiro Hidaka

Position held: Asst. Manager Date: 14th May, 2013

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE (B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 4.0 V DC supply.

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard or test plan were made during testing.

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.

Product Service

SECTION 2

TEST DETAILS

FCC Testing of the
Sharp SHL22 Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Tri-band LTE
(B1, B11, B18) multi mode cellular phone with Bluetooth, WLAN, NFC (FeliCa) and GPS
In accordance with FCC CFR 47 Part 15E

2.1 AC LINE CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC CFR 47 Part 15E, Clause 15.207

2.1.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114764687 - Modification State 0

2.1.3 Date of Test

10 June 2013

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

The EUT is set up on a test table 800mm above a horizontal ground plane. A vertical ground plane is also required and is placed 400mm from the EUT. Where a EUT is floor standing it will be stood on but insulated from the ground plane by up to 12mm.

The EUT is powered through a Line Impedance Stabilisation Network (LISN) which is bonded to the ground plane. The EUT is located so that the distance between the EUT and the LISN is no less than 800mm. Where possible the cable between the mains input of the EUT and the LISN is 1m. Where this is not possible the cable is non inductively bundled with the bundle not exceeding 400mm in length.

A preliminary profile of the Conducted Emissions is obtained over the frequency range 150kHz to 30MHz. Any points of interest are noted for formal measurements.

During formal measurements, the measuring receiver is tuned to the emission of interest where Quasi – Peak and Average measurements are performed in a 9kHz Video and Resolution Bandwidth.

2.1.6 Environmental Conditions

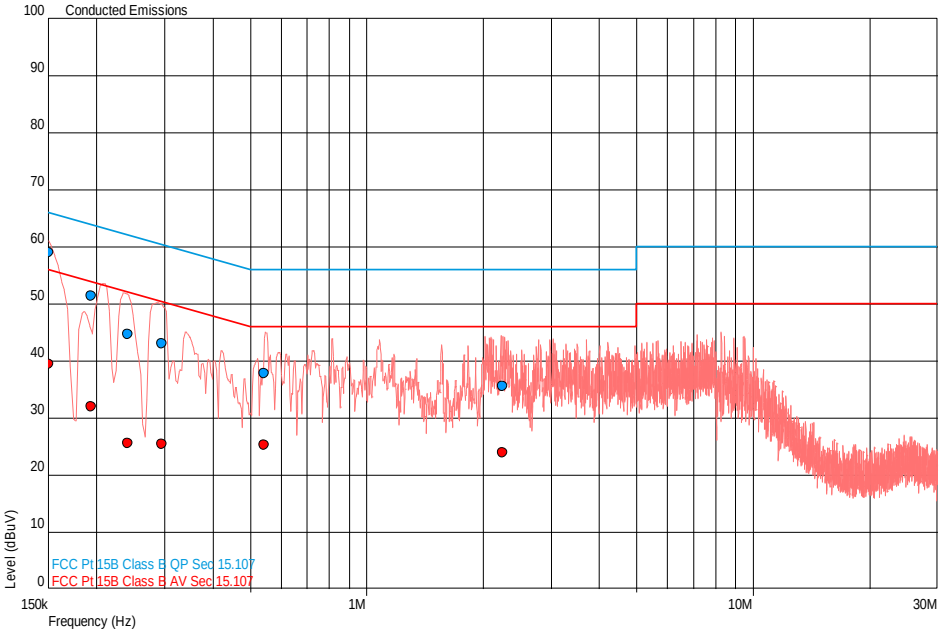
Ambient Temperature	20.9°C
Relative Humidity	35.0%

Product Service

2.1.7 Test Results

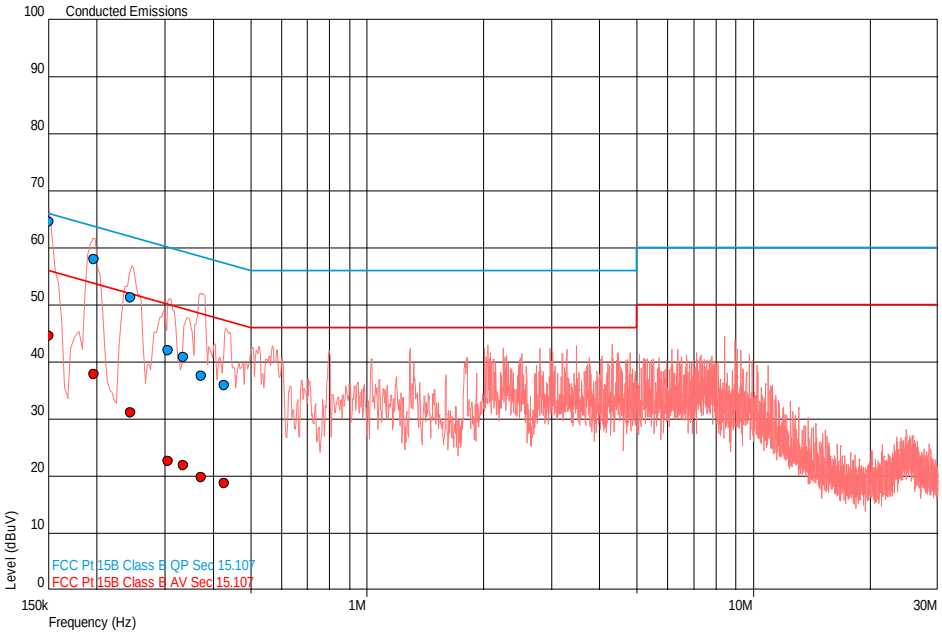
802.11(ac) - 5 GHz 20 MHz BW

Live Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.150	59.1	66.0	-6.9	39.4	56.0	-16.6
0.194	51.4	63.9	-12.5	32.0	53.9	-21.9
0.242	44.7	62.0	-17.3	25.6	52.0	-26.4
0.295	43.0	60.4	-17.4	25.4	50.4	-25.0
0.544	37.9	56.0	-18.1	25.2	46.0	-20.8
2.247	35.6	56.0	-20.4	23.9	46.0	-22.1

Neutral Line



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.150	64.5	66.0	-1.5	44.6	56.0	-11.4
0.197	58.0	63.7	-5.7	37.9	53.7	-15.9
0.245	51.3	61.9	-10.6	31.1	51.9	-20.8
0.306	42.0	60.1	-18.1	22.6	50.1	-27.5
0.335	40.8	59.3	-18.5	21.9	49.3	-27.5
0.372	37.5	58.4	-20.9	19.7	48.4	-28.7
0.429	35.9	57.3	-21.4	18.7	47.3	-28.6

2.2 POWER LIMITS

2.2.1 Specification Reference

FCC CFR 47 Part 15E, Clause 15.407 (a)(1)(2)(3)

2.2.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114764687 - Modification State 0

2.2.3 Date of Test

26 May 2013, 27 May 2013, 28 May 2013, 29 May 2013 & 12 June 2013

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

For conducted power, the EUT was transmitted at maximum power via a cable and attenuator to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement.

For radiated power, the EUT was transmitted at maximum power level. The signal was observed on the Spectrum Analyser using a Double Ridge Guide antenna at 3 metres from the EUT. The signal was maximised by rotating the EUT 360° and a height search of the measuring antenna. A substitution was then performed using a substitution antenna and signal generator.

This level was maximised by adjusting the height of the measuring antenna once more. The level from the signal generator was then adjusted to achieve the same raw result as with the EUT. This level was then corrected to account for cable loss and antenna factor. A calculation was then performed to obtain the final figure.

In both cases a Power Meter was then used to obtain a correction factor for the wideband signal and in terms of an rms-equivalent voltage.

2.2.6 Environmental Conditions

Ambient Temperature	17.2 - 23.8°C
Relative Humidity	34.0 - 55.4%

2.2.7 Test Results

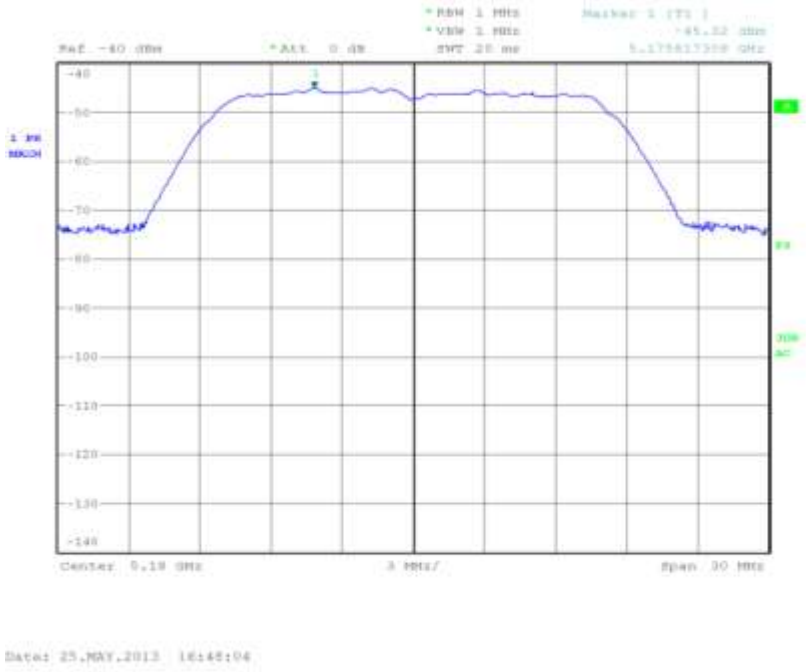
802.11(a)

Radiated

Frequency Band 1

5180 MHz

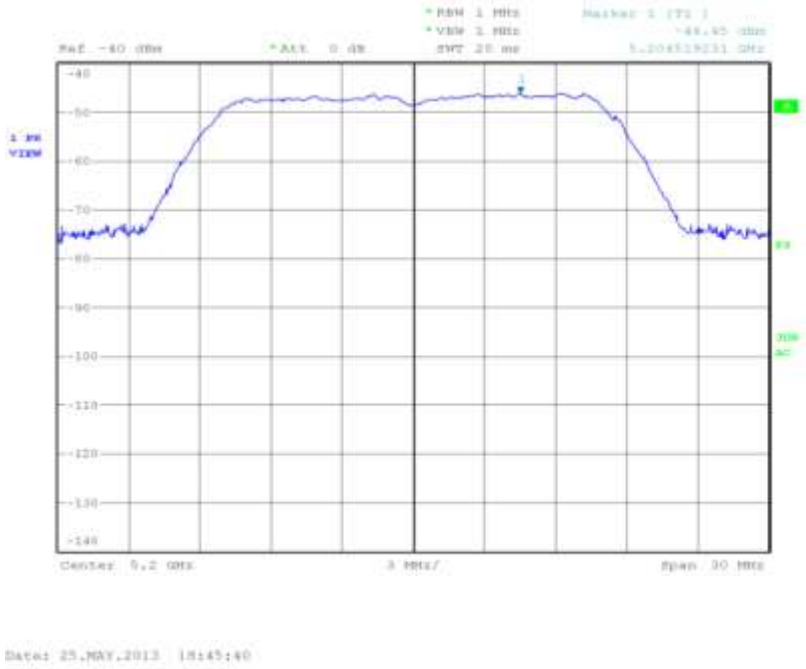
EIRP (dBm)	EIRP (mW)
8.32	6.79



Date: 25.MAY.2013 16:48:04

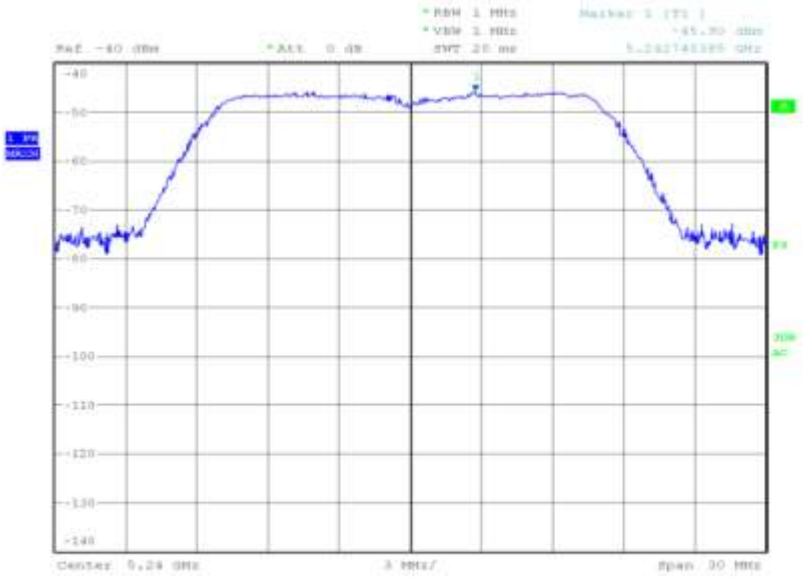
5200 MHz

EIRP (dBm)	EIRP (mW)
6.99	5.00



5240 MHz

EIRP (dBm)	EIRP (mW)
7.81	6.04

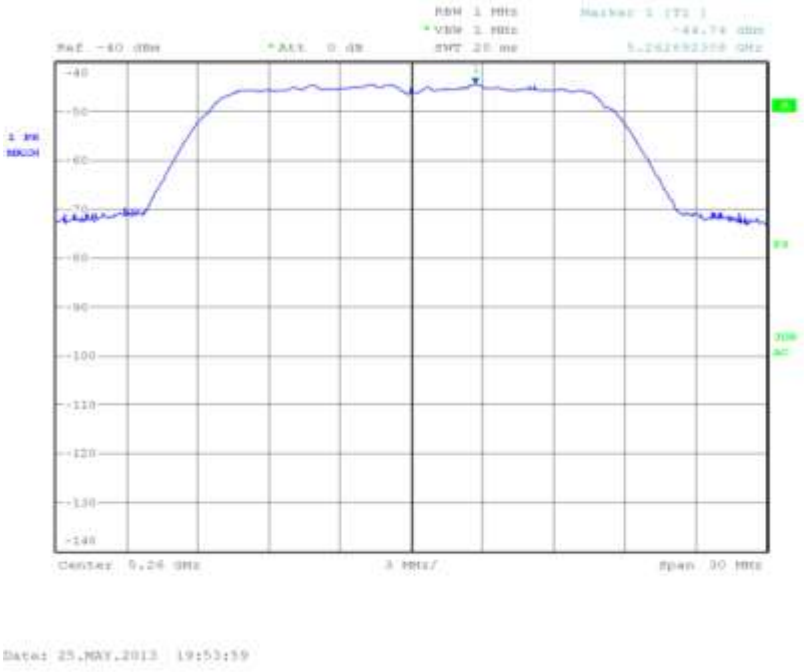


Radiated

Frequency Band 2

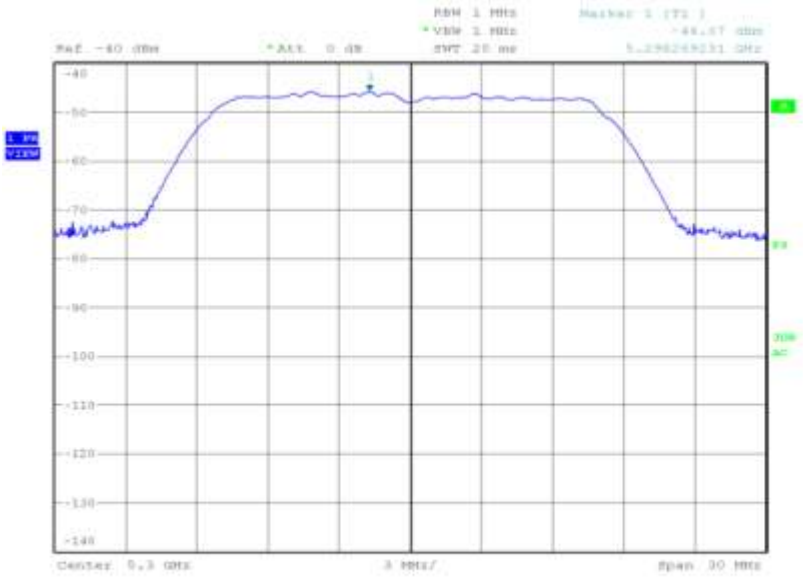
5260 MHz

EIRP (dBm)	EIRP (mW)
8.73	7.46



5300 MHz

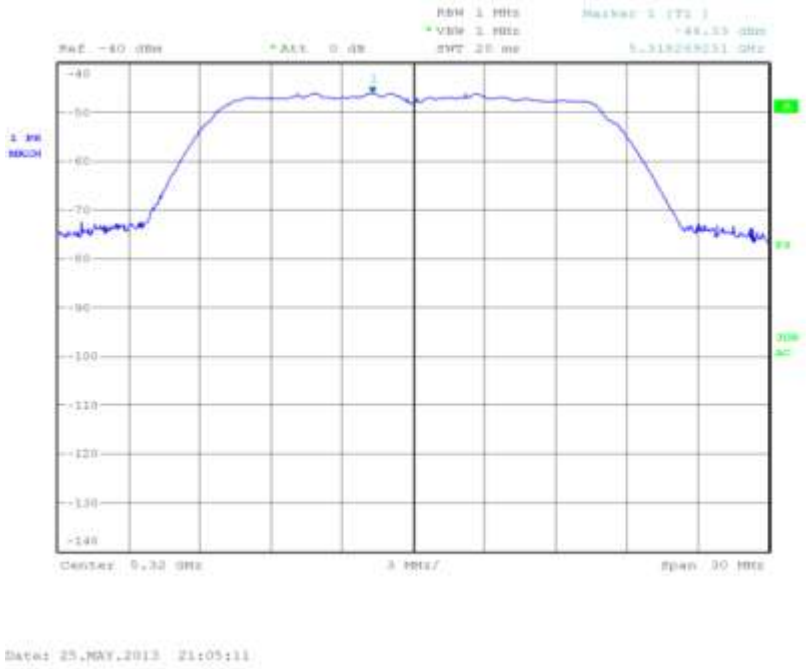
EIRP (dBm)	EIRP (mW)
7.25	5.31



Date: 25.MAY.2013 20:36:12

5320 MHz

EIRP (dBm)	EIRP (mW)
7.06	5.02

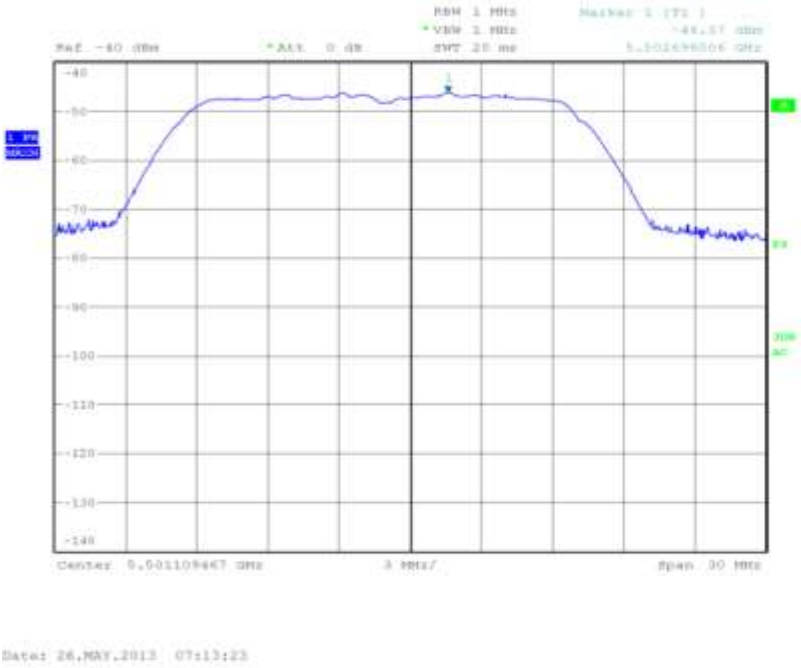


Radiated

Frequency Band 3

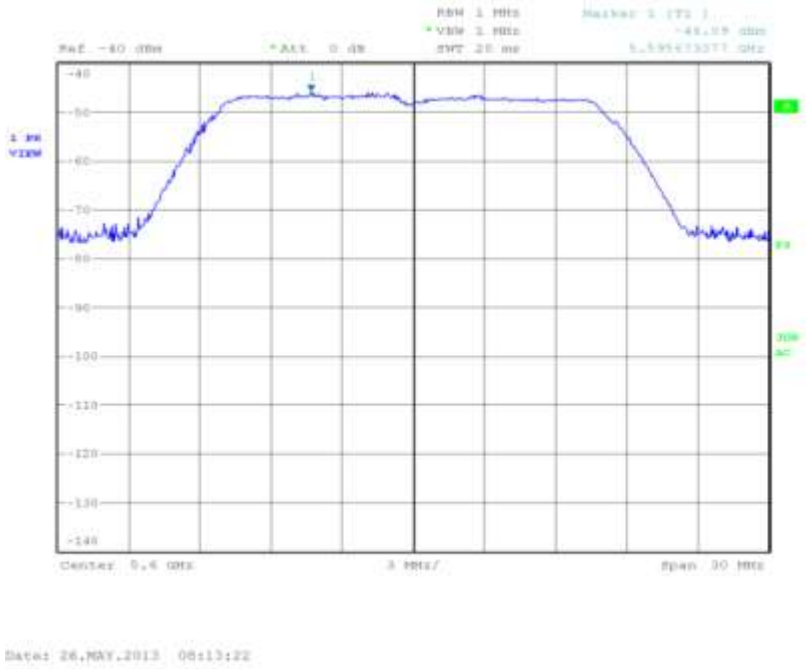
5500 MHz

EIRP (dBm)	EIRP (mW)
7.53	5.66



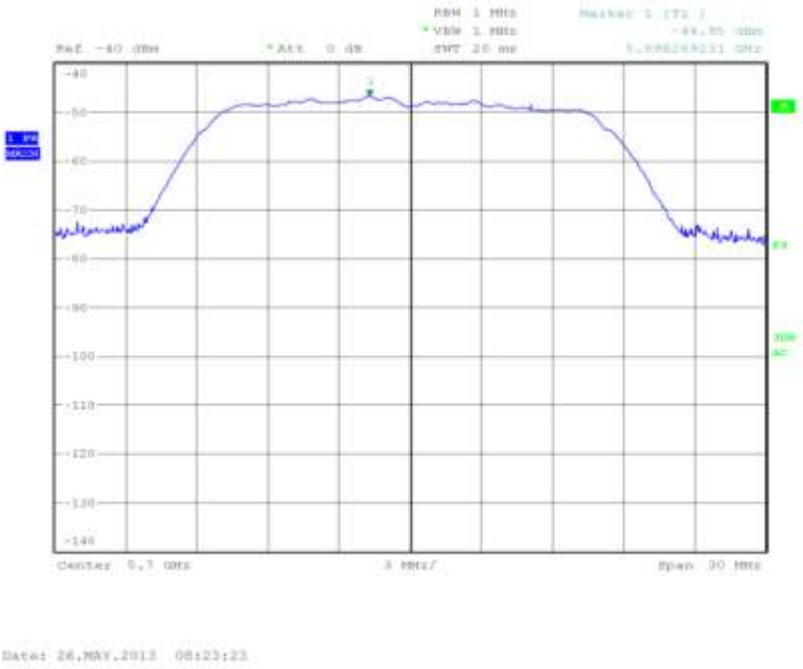
5600 MHz

EIRP (dBm)	EIRP (mW)
8.13	6.50



5700 MHz

EIRP (dBm)	EIRP (mW)
8.65	7.33



Limit for Radiated

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 200 mW or 10 dBm + 10 log B
5250 to 5350	Lesser of 1 W or 17 dBm + 10 log B
5470 to 5725	Lesser of 1 W or 17 dBm + 10 log B
5725 to 5825	Lesser of 4 W or 23 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

It is acceptable to have an antenna with up to 6 dBi gain, without reducing the conducted output power.

Conducted

Frequency Band 1

5180 MHz

EIRP (dBm)	EIRP (mW)
13.17	20.76

5200 MHz

EIRP (dBm)	EIRP (mW)
12.67	18.48

5240 MHz

EIRP (dBm)	EIRP (mW)
12.89	19.44

The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Conducted

Frequency Band 2

5260 MHz

EIRP (dBm)	EIRP (mW)
13.47	22.24

5300 MHz

EIRP (dBm)	EIRP (mW)
13.12	20.52

5320 MHz

EIRP (dBm)	EIRP (mW)
13.26	21.18

The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Conducted

Frequency Band 3

5500 MHz

EIRP (dBm)	EIRP (mW)
13.36	21.68

5600 MHz

EIRP (dBm)	EIRP (mW)
13.28	21.29

5700 MHz

EIRP (dBm)	EIRP (mW)
12.86	19.32

The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Limit for Conducted

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 50 mW or 4 dBm + 10 log B
5250 to 5350	Lesser of 250 mW or 11 dBm + 10 log B
5470 to 5725	Lesser of 250 mW or 11 dBm + 10 log B
5725 to 5825	Lesser of 1 W or 17 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

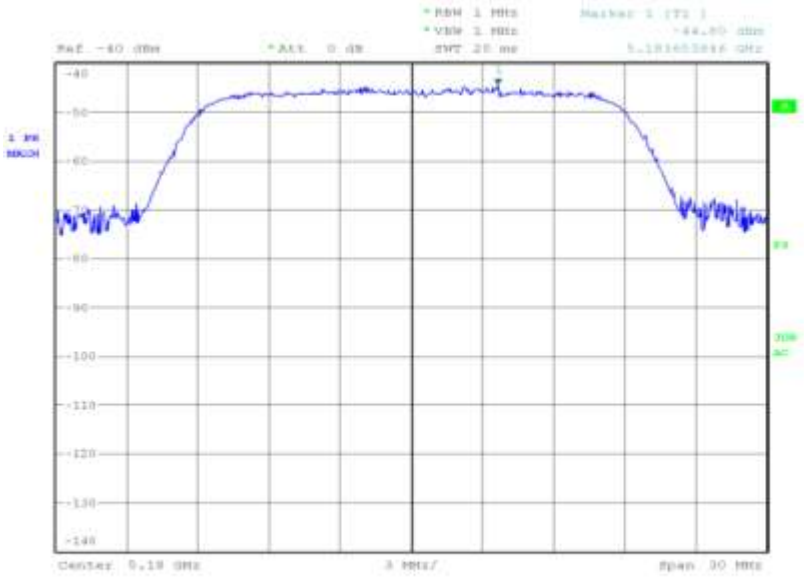
802.11(ac) - 5 GHz 20 MHz BW

Radiated

Frequency Band 1

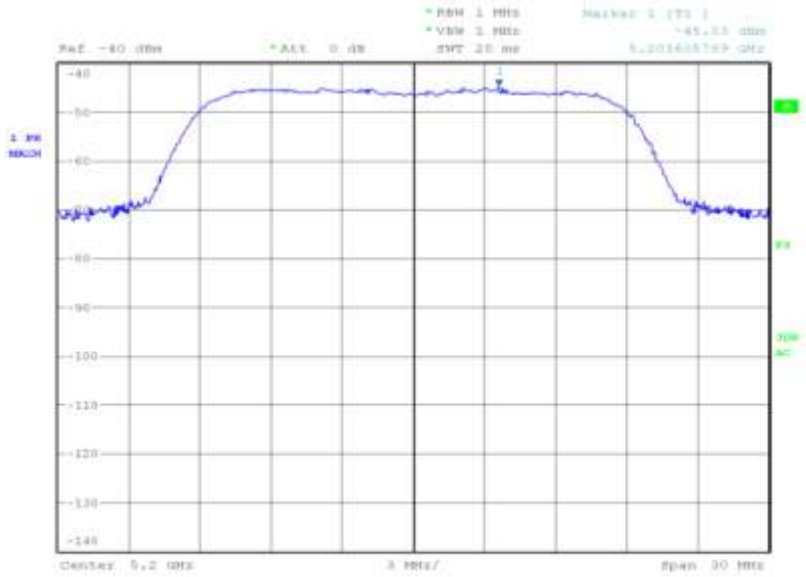
5180 MHz

EIRP (dBm)	EIRP (mW)
7.18	5.22



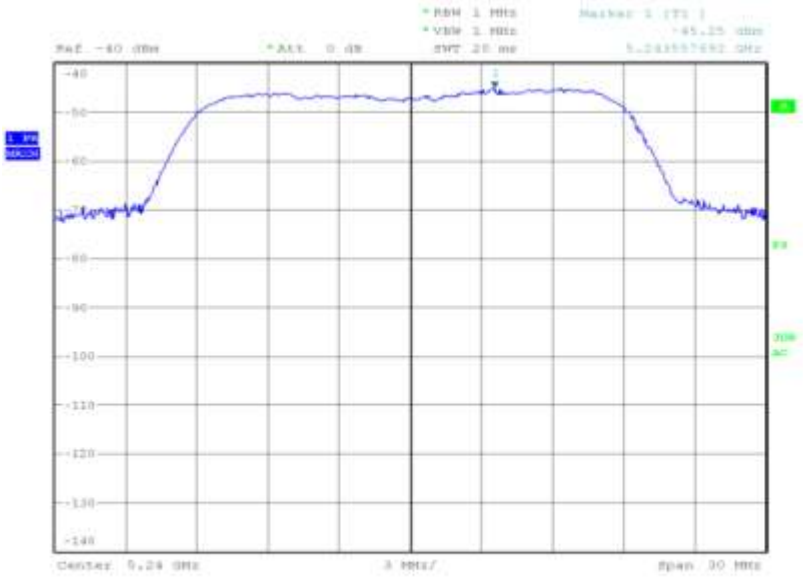
5200 MHz

EIRP (dBm)	EIRP (mW)
7.39	5.48



5240 MHz

EIRP (dBm)	EIRP (mW)
7.40	5.49

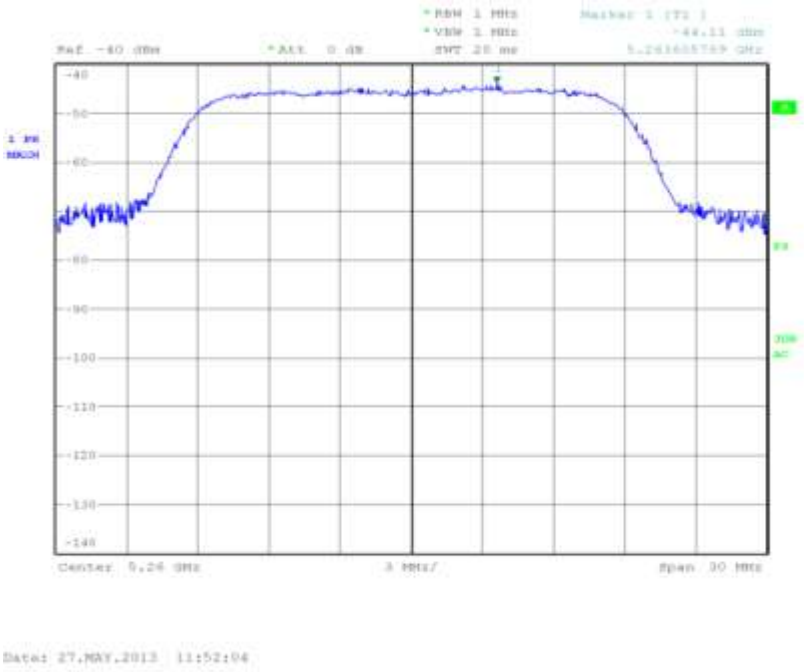


Radiated

Frequency Band 2

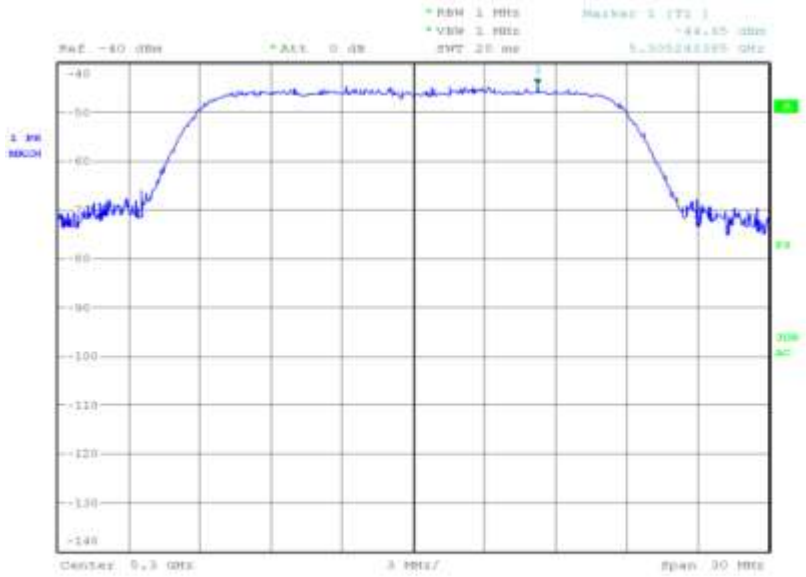
5260 MHz

EIRP (dBm)	EIRP (mW)
7.94	6.22



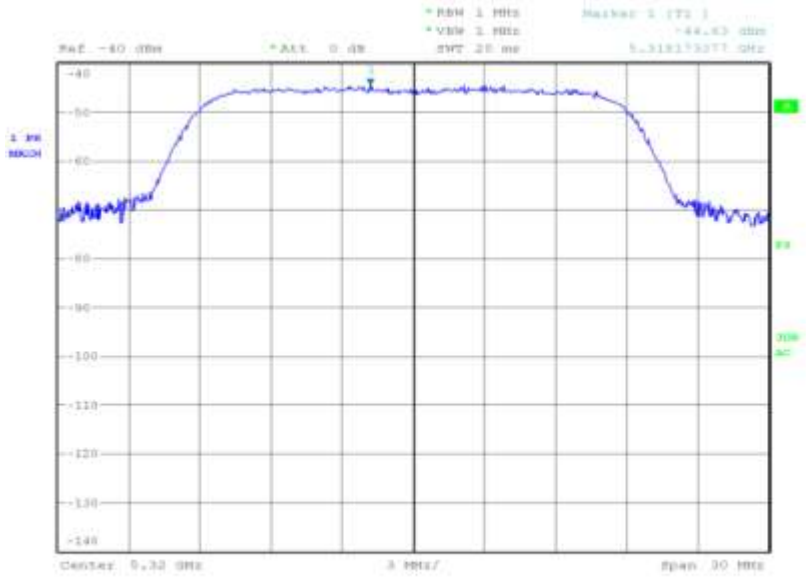
5300 MHz

EIRP (dBm)	EIRP (mW)
6.64	4.61



5320 MHz

EIRP (dBm)	EIRP (mW)
6.99	5.00

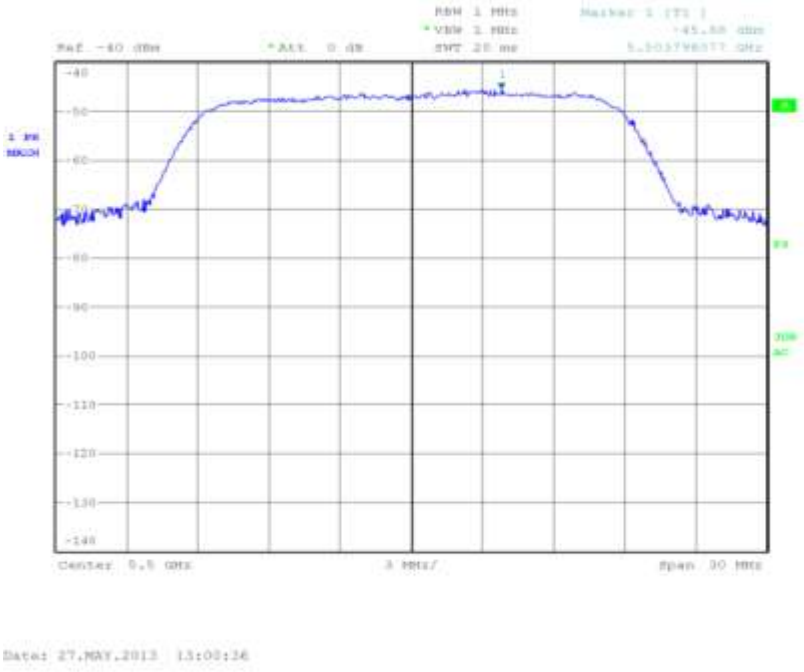


Radiated

Frequency Band 3

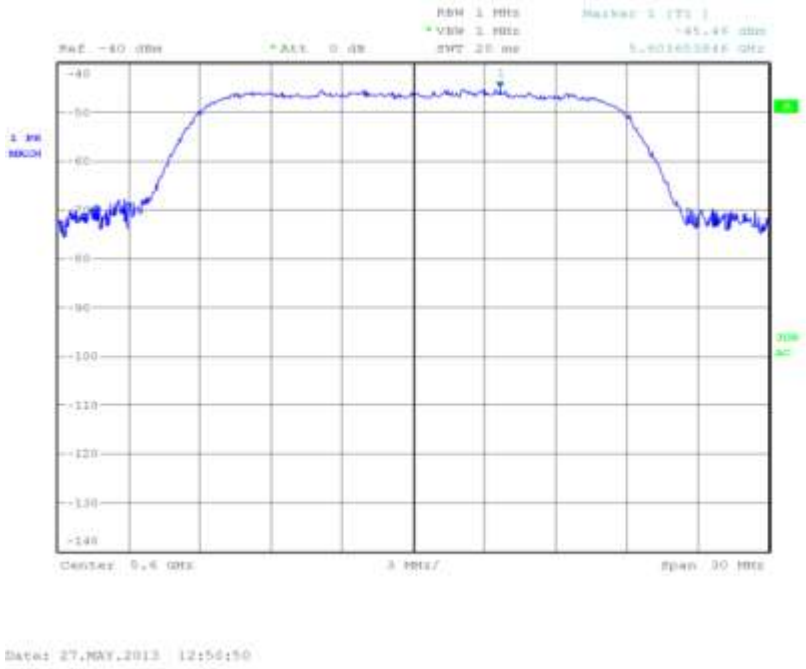
5500 MHz

EIRP (dBm)	EIRP (mW)
8.20	6.61



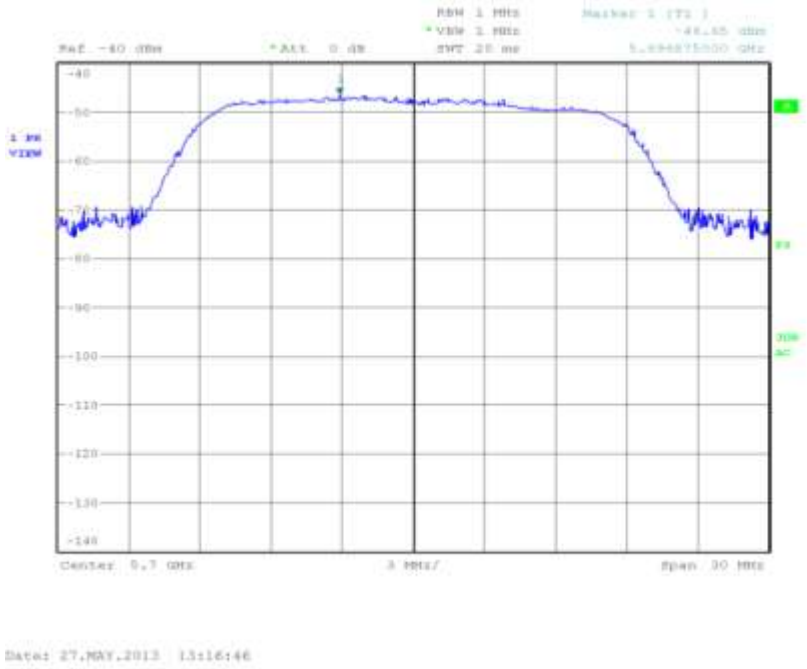
5600 MHz

EIRP (dBm)	EIRP (mW)
8.23	6.65



5700 MHz

EIRP (dBm)	EIRP (mW)
7.51	5.64



Limit for Radiated

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 200 mW or 10 dBm + 10 log B
5250 to 5350	Lesser of 1 W or 17 dBm + 10 log B
5470 to 5725	Lesser of 1 W or 17 dBm + 10 log B
5725 to 5825	Lesser of 4 W or 23 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

It is acceptable to have an antenna with up to 6 dBi gain, without reducing the conducted output power.

Conducted

Frequency Band 1

5180 MHz

EIRP (dBm)	EIRP (mW)
13.14	20.60

5200 MHz

EIRP (dBm)	EIRP (mW)
12.71	18.66

5240 MHz

EIRP (dBm)	EIRP (mW)
12.79	18.99

The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Conducted

Frequency Band 2

5260 MHz

EIRP (dBm)	EIRP (mW)
13.89	24.50

5300 MHz

EIRP (dBm)	EIRP (mW)
13.01	20.01

5320 MHz

EIRP (dBm)	EIRP (mW)
13.21	20.96

The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Conducted

Frequency Band 3

5500 MHz

EIRP (dBm)	EIRP (mW)
13.18	20.81

5600 MHz

EIRP (dBm)	EIRP (mW)
13.07	20.27

5700 MHz

EIRP (dBm)	EIRP (mW)
12.71	18.66

The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit for Conducted

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 50 mW or 4 dBm + 10 log B
5250 to 5350	Lesser of 250 mW or 11 dBm + 10 log B
5470 to 5725	Lesser of 250 mW or 11 dBm + 10 log B
5725 to 5825	Lesser of 1 W or 17 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

802.11(ac) - 5 GHz 40 MHz BW

Radiated

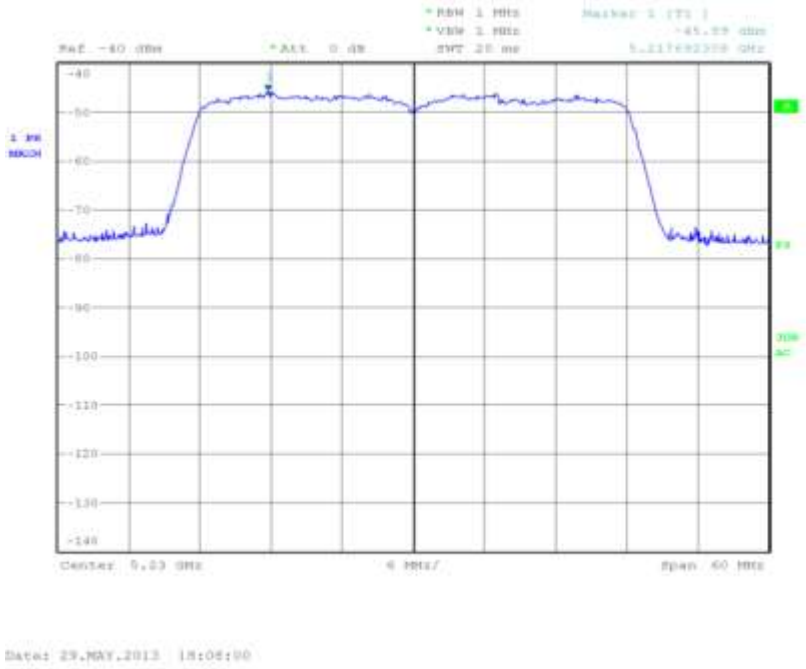
Frequency Band 1

5190 MHz

EIRP (dBm)	EIRP (mW)
10.38	10.91

5230 MHz

EIRP (dBm)	EIRP (mW)
9.08	8.09

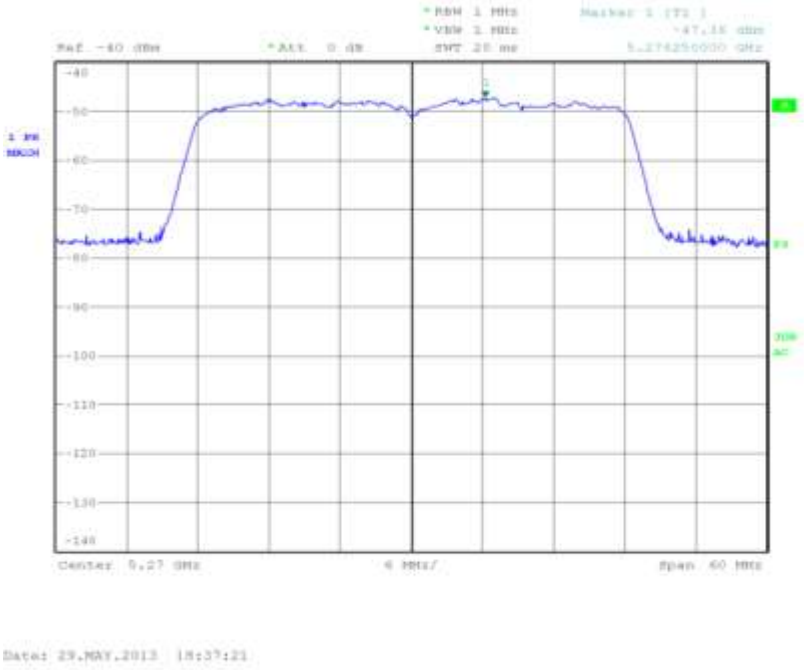


Radiated

Frequency Band 2

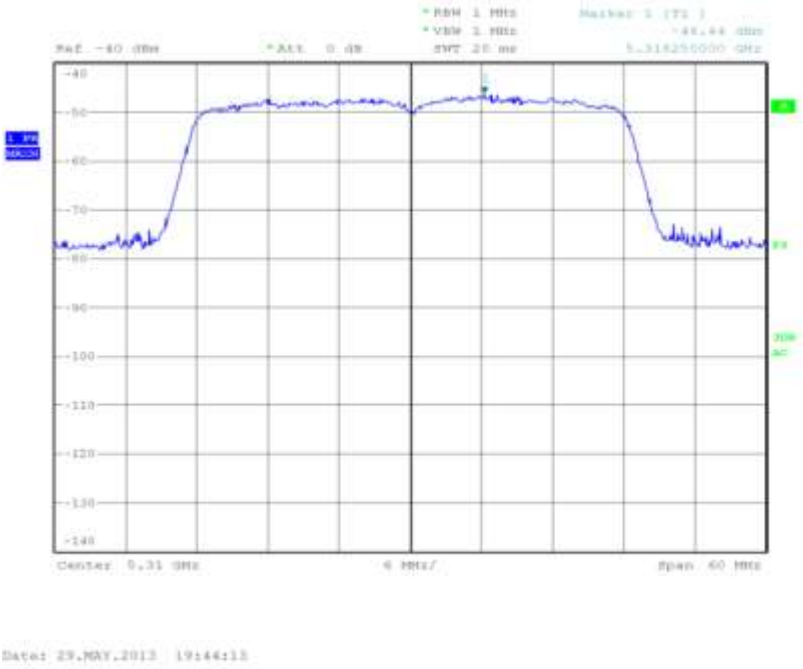
5270 MHz

EIRP (dBm)	EIRP (mW)
7.33	5.41



5310 MHz

EIRP (dBm)	EIRP (mW)
7.97	6.27

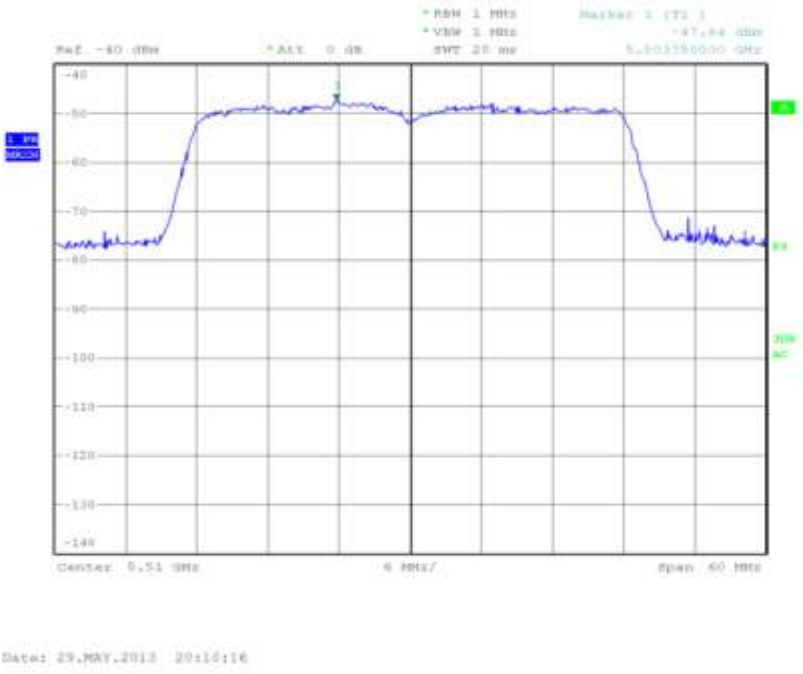


Radiated

Frequency Band 3

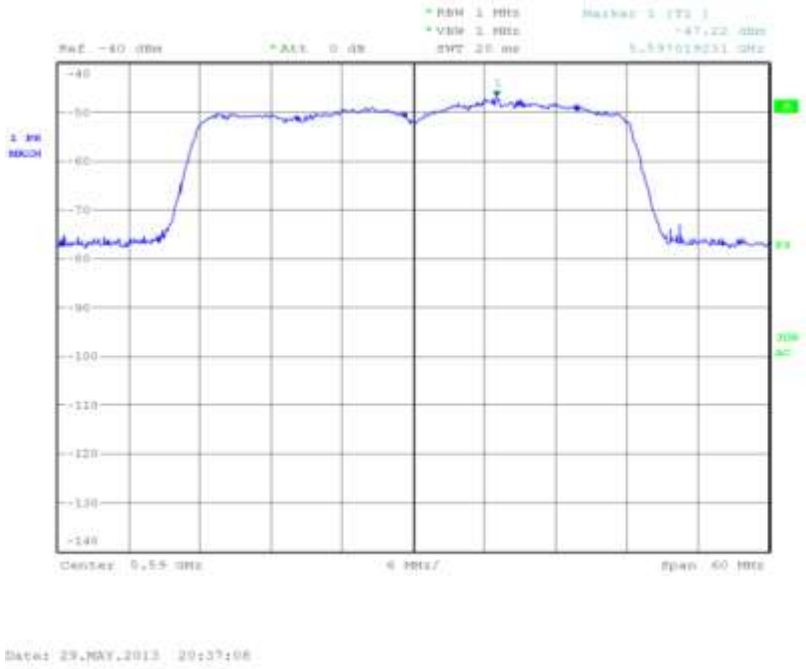
5510 MHz

EIRP (dBm)	EIRP (mW)
8.63	7.29



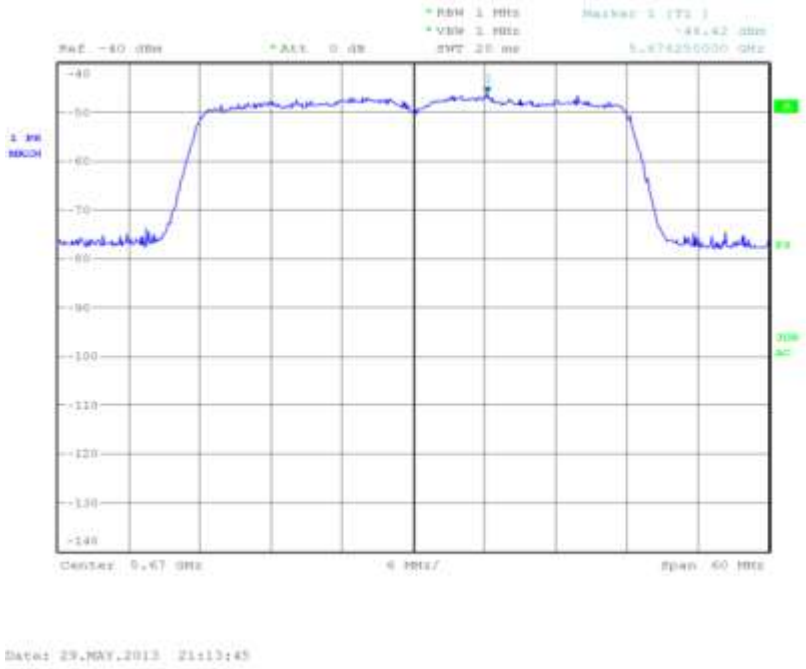
5590 MHz

EIRP (dBm)	EIRP (mW)
8.32	6.79



5670 MHz

EIRP (dBm)	EIRP (mW)
7.91	6.18



Limit for Radiated

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 200 mW or 10 dBm + 10 log B
5250 to 5350	Lesser of 1 W or 17 dBm + 10 log B
5470 to 5725	Lesser of 1 W or 17 dBm + 10 log B
5725 to 5825	Lesser of 4 W or 23 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

It is acceptable to have an antenna with up to 6 dBi gain, without reducing the conducted output power.

Conducted

Frequency Band 1

5190 MHz

EIRP (dBm)	EIRP (mW)
13.65	23.16

5230 MHz

EIRP (dBm)	EIRP (mW)
13.40	21.85

The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Conducted

Frequency Band 2

5270 MHz

EIRP (dBm)	EIRP (mW)
12.77	18.92

5310 MHz

EIRP (dBm)	EIRP (mW)
12.65	18.41

The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Conducted

Frequency Band 3

5510 MHz

EIRP (dBm)	EIRP (mW)
13.04	20.15

5590 MHz

EIRP (dBm)	EIRP (mW)
13.30	21.36

5670 MHz

EIRP (dBm)	EIRP (mW)
12.54	17.96

The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Limit for Conducted

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 50 mW or 4 dBm + 10 log B
5250 to 5350	Lesser of 250 mW or 11 dBm + 10 log B
5470 to 5725	Lesser of 250 mW or 11 dBm + 10 log B
5725 to 5825	Lesser of 1 W or 17 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

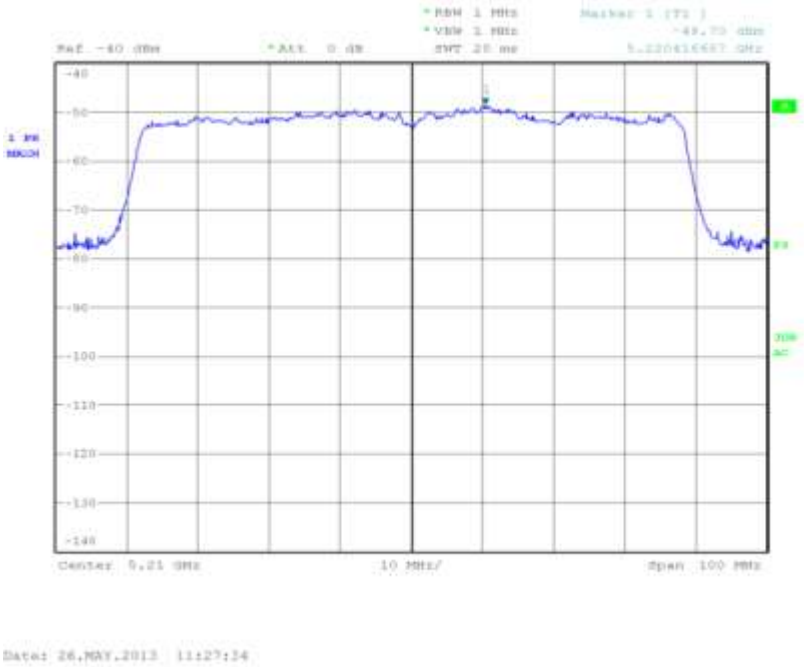
802.11(ac) - 5 GHz 80 MHz BW

Radiated

Frequency Band 1

5210 MHz

EIRP (dBm)	EIRP (mW)
9.53	8.974

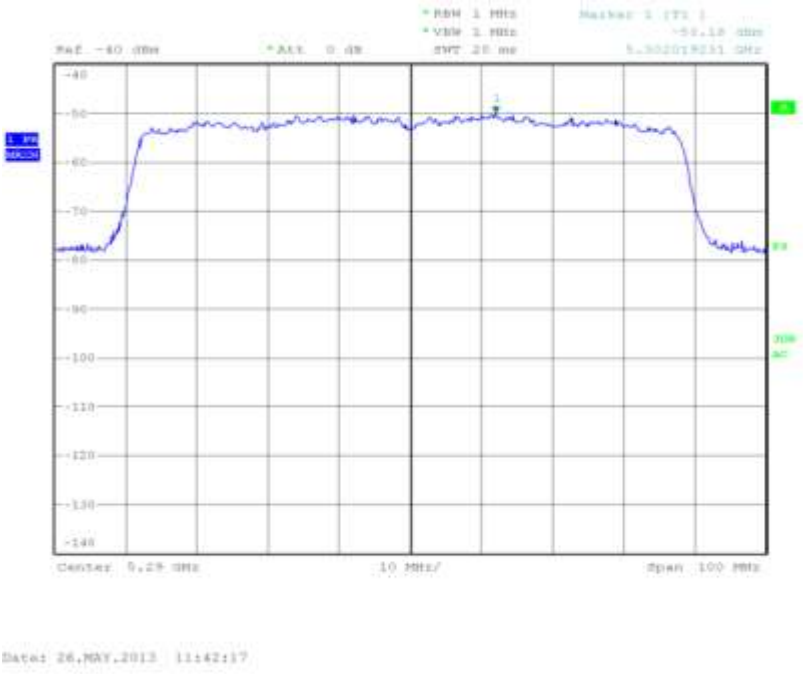


Radiated

Frequency Band 2

5290 MHz

EIRP (dBm)	EIRP (mW)
7.04	5.06



Radiated

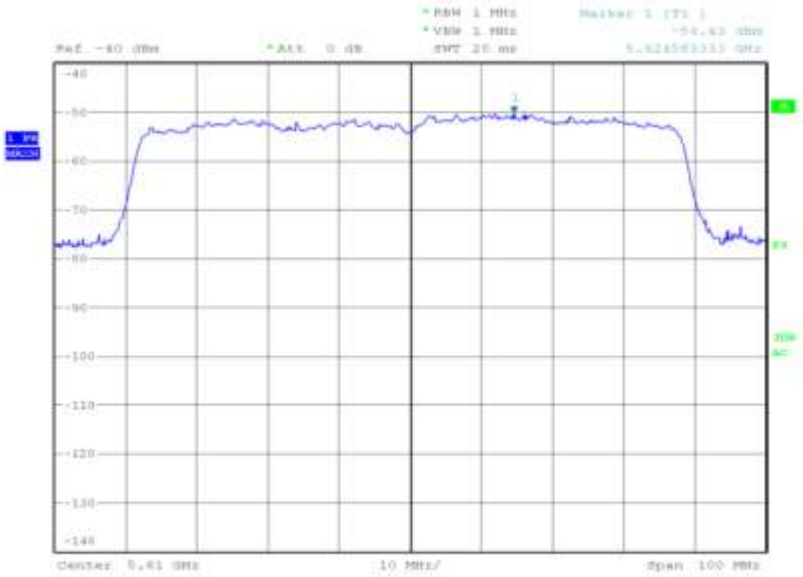
Frequency Band 3

5530 MHz

EIRP (dBm)	EIRP (mW)
7.16	5.20

5610 MHz

EIRP (dBm)	EIRP (mW)
6.27	4.24



Limit for Radiated

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 200 mW or 10 dBm + 10 log B
5250 to 5350	Lesser of 1 W or 17 dBm + 10 log B
5470 to 5725	Lesser of 1 W or 17 dBm + 10 log B
5725 to 5825	Lesser of 4 W or 23 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

It is acceptable to have an antenna with up to 6 dBi gain, without reducing the conducted output power.

Conducted

Frequency Band 1

5210 MHz

EIRP (dBm)	EIRP (mW)
13.39	21.83

The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Conducted

Frequency Band 2

5290 MHz

EIRP (dBm)	EIRP (mW)
12.74	18.79

The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Conducted

Frequency Band 3

5530 MHz

EIRP (dBm)	EIRP (mW)
12.84	19.23

5610 MHz

EIRP (dBm)	EIRP (mW)
13.26	21.18

The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Limit for Conducted

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 50 mW or 4 dBm + 10 log B
5250 to 5350	Lesser of 250 mW or 11 dBm + 10 log B
5470 to 5725	Lesser of 250 mW or 11 dBm + 10 log B
5725 to 5825	Lesser of 1 W or 17 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

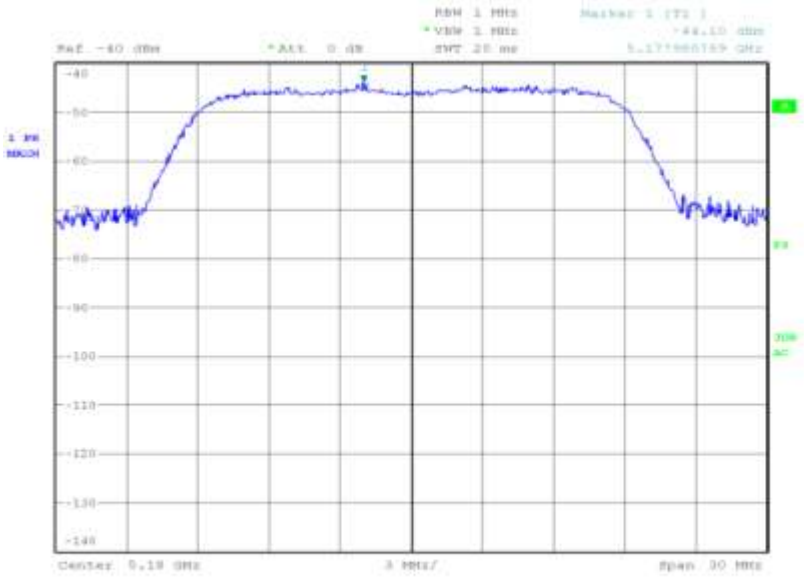
802.11(n) - 5 GHz 20 MHz BW

Radiated

Frequency Band 1

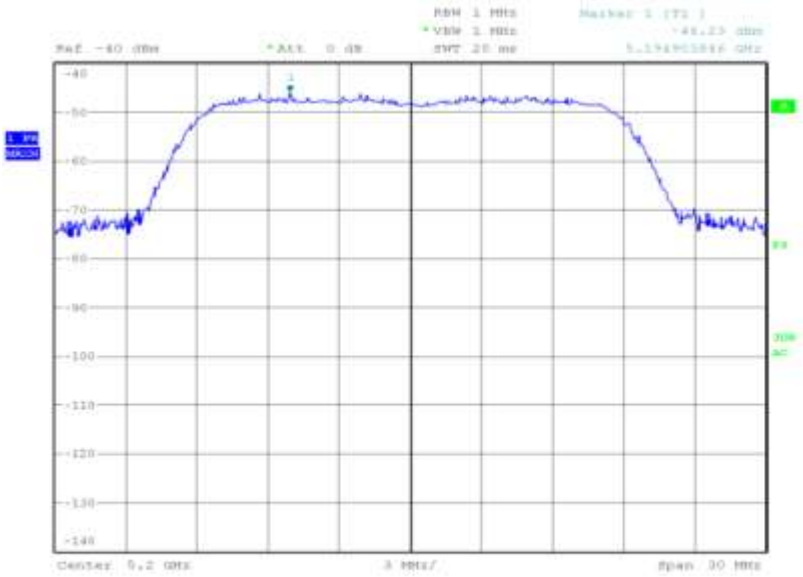
5180 MHz

EIRP (dBm)	EIRP (mW)
7.68	5.86



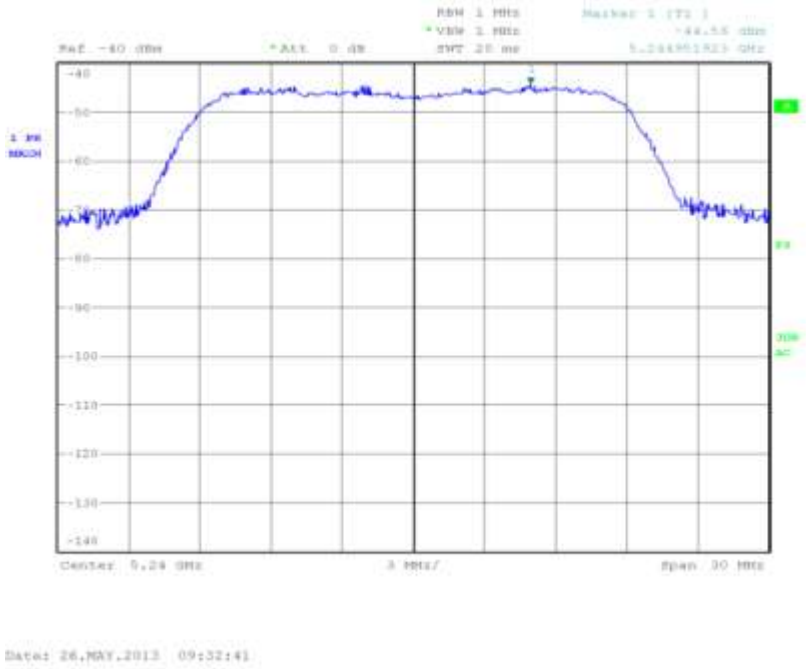
5200 MHz

EIRP (dBm)	EIRP (mW)
5.89	3.88



5240 MHz

EIRP (dBm)	EIRP (mW)
8.02	6.34

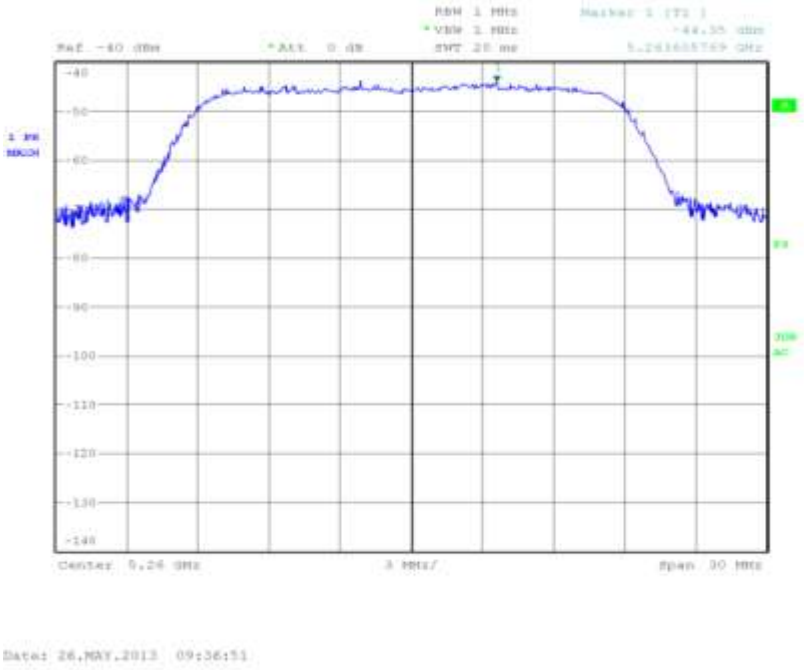


Radiated

Frequency Band 2

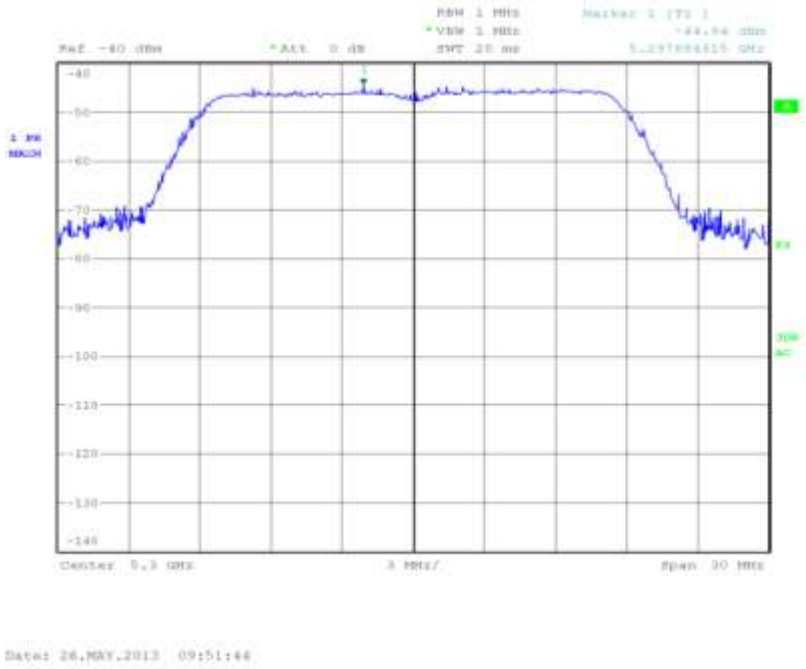
5260 MHz

EIRP (dBm)	EIRP (mW)
8.71	7.43



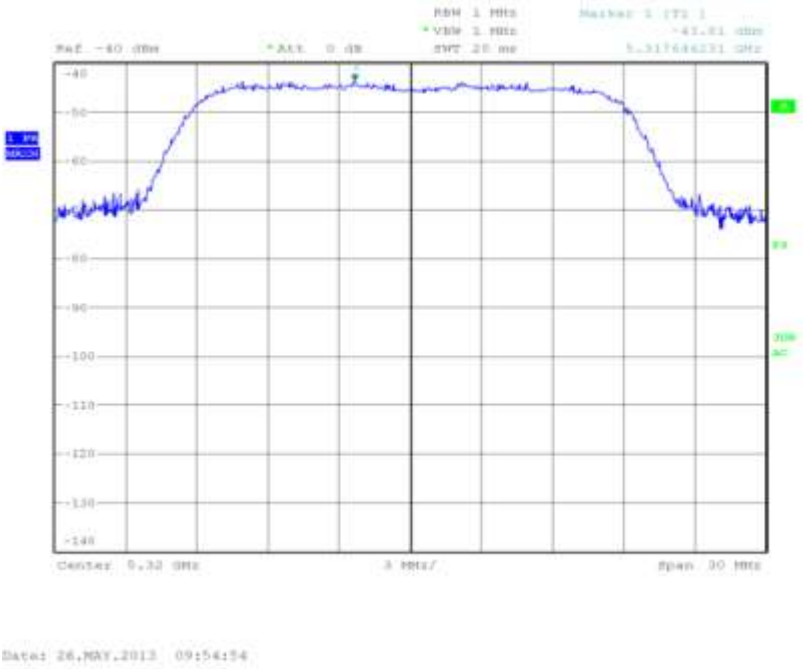
5300 MHz

EIRP (dBm)	EIRP (mW)
6.27	4.24



5320 MHz

EIRP (dBm)	EIRP (mW)
9.17	8.26

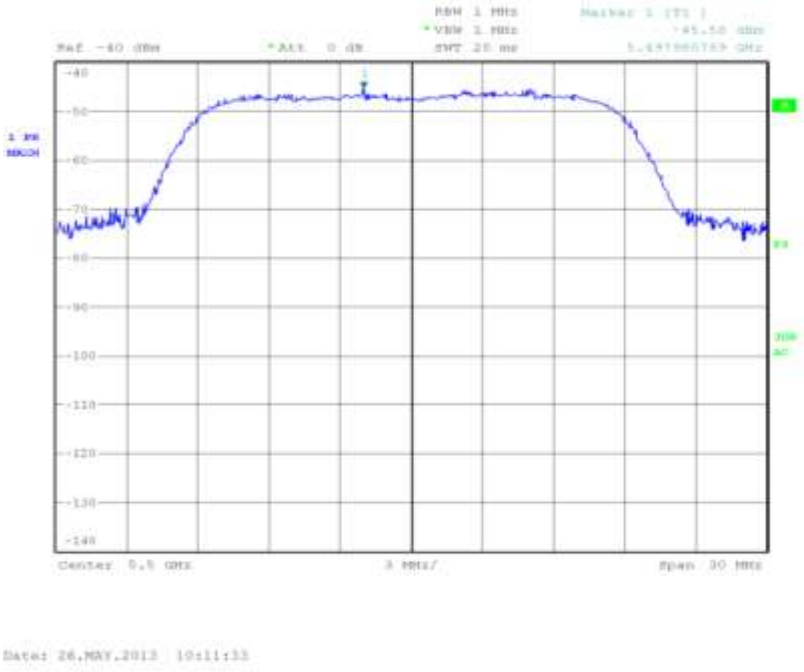


Radiated

Frequency Band 3

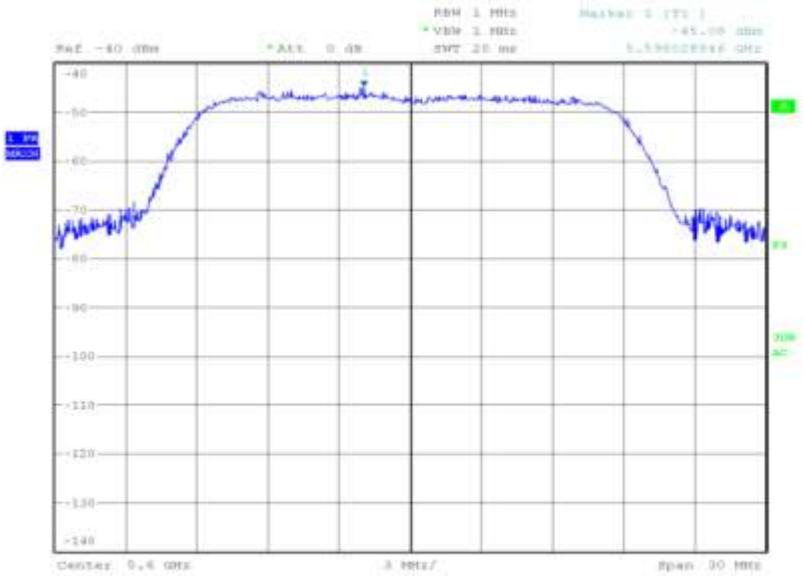
5500 MHz

EIRP (dBm)	EIRP (mW)
7.91	6.18



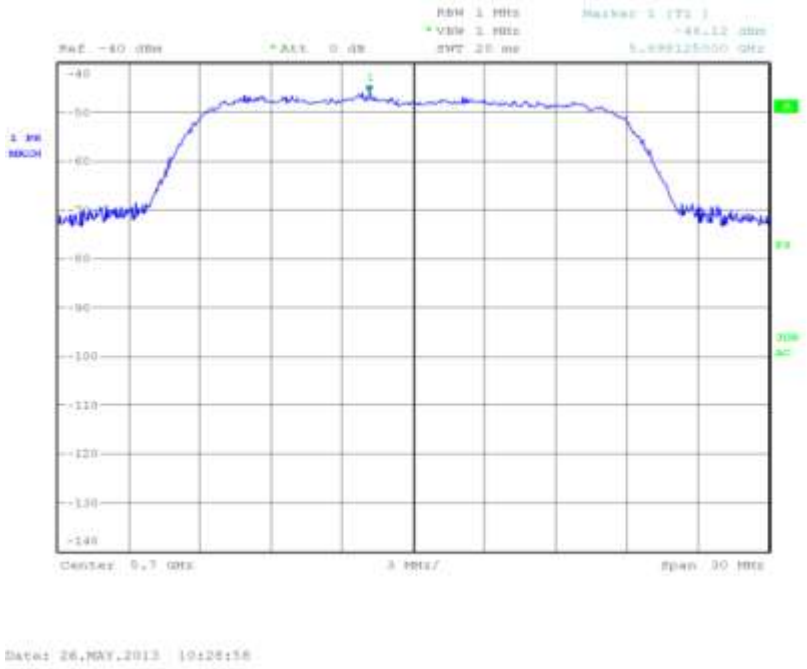
5600 MHz

EIRP (dBm)	EIRP (mW)
8.73	7.46



5700 MHz

EIRP (dBm)	EIRP (mW)
9.07	8.07



Limit for Radiated

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 200 mW or 10 dBm + 10 log B
5250 to 5350	Lesser of 1 W or 17 dBm + 10 log B
5470 to 5725	Lesser of 1 W or 17 dBm + 10 log B
5725 to 5825	Lesser of 4 W or 23 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

It is acceptable to have an antenna with up to 6 dBi gain, without reducing the conducted output power.

Conducted

Frequency Band 1

5180 MHz

EIRP (dBm)	EIRP (mW)
13.26	21.17

5200 MHz

EIRP (dBm)	EIRP (mW)
12.55	17.99

5240 MHz

EIRP (dBm)	EIRP (mW)
12.75	18.84

The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Conducted

Frequency Band 2

5260 MHz

EIRP (dBm)	EIRP (mW)
13.66	23.21

5300 MHz

EIRP (dBm)	EIRP (mW)
13.03	20.08

5320 MHz

EIRP (dBm)	EIRP (mW)
13.04	20.15

The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Conducted

Frequency Band 3

5500 MHz

EIRP (dBm)	EIRP (mW)
12.98	19.85

5600 MHz

EIRP (dBm)	EIRP (mW)
13.23	21.03

5700 MHz

EIRP (dBm)	EIRP (mW)
12.81	19.11

The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit for Conducted

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 50 mW or 4 dBm + 10 log B
5250 to 5350	Lesser of 250 mW or 11 dBm + 10 log B
5470 to 5725	Lesser of 250 mW or 11 dBm + 10 log B
5725 to 5825	Lesser of 1 W or 17 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

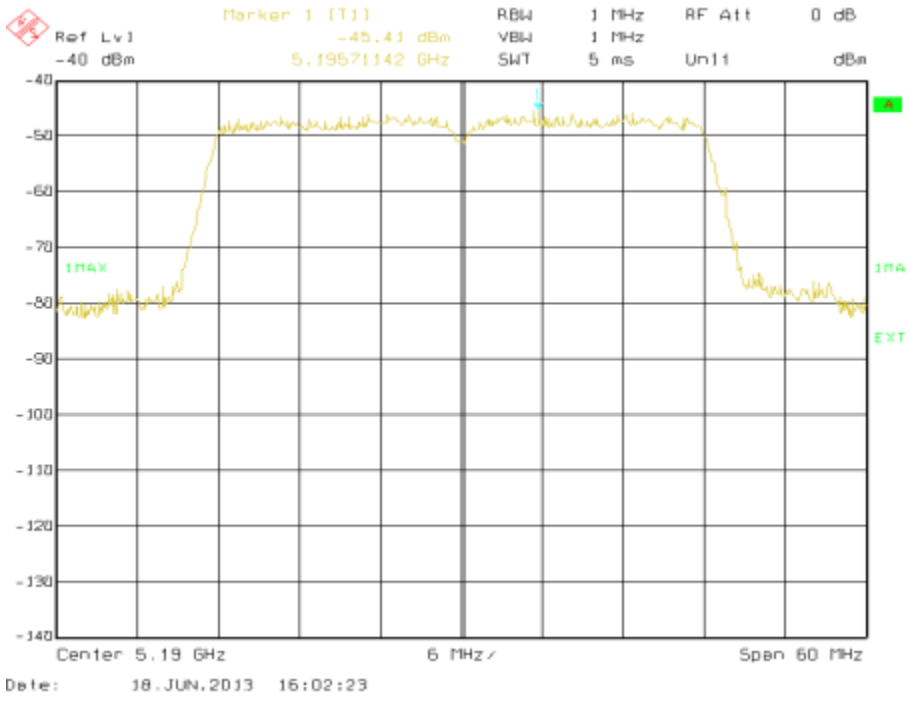
802.11(n) - 5 GHz 40 MHz BW

Radiated

Frequency Band 1

5190 MHz

EIRP (dBm)	EIRP (mW)
9.32	8.55



5230 MHz

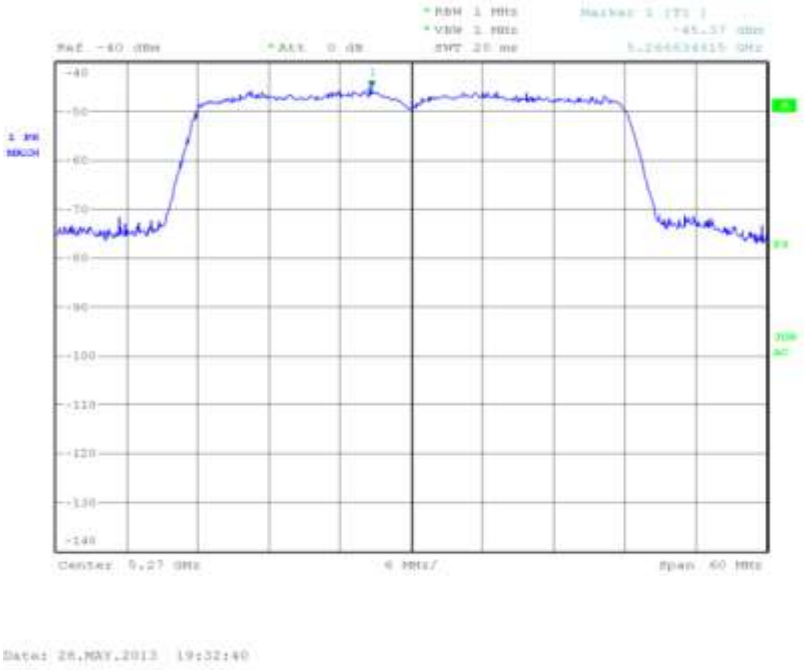
EIRP (dBm)	EIRP (mW)
8.54	7.14

Radiated

Frequency Band 2

5270 MHz

EIRP (dBm)	EIRP (mW)
8.67	7.36



Date: 28.MAY.2013 19:32:40

5310 MHz

EIRP (dBm)	EIRP (mW)
8.55	7.16

Radiated

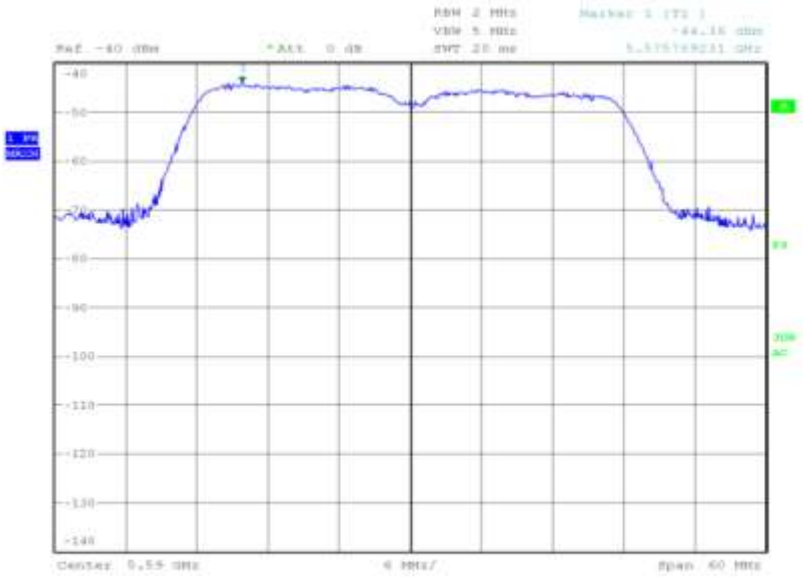
Frequency Band 3

5510 MHz

EIRP (dBm)	EIRP (mW)
12.27	16.87

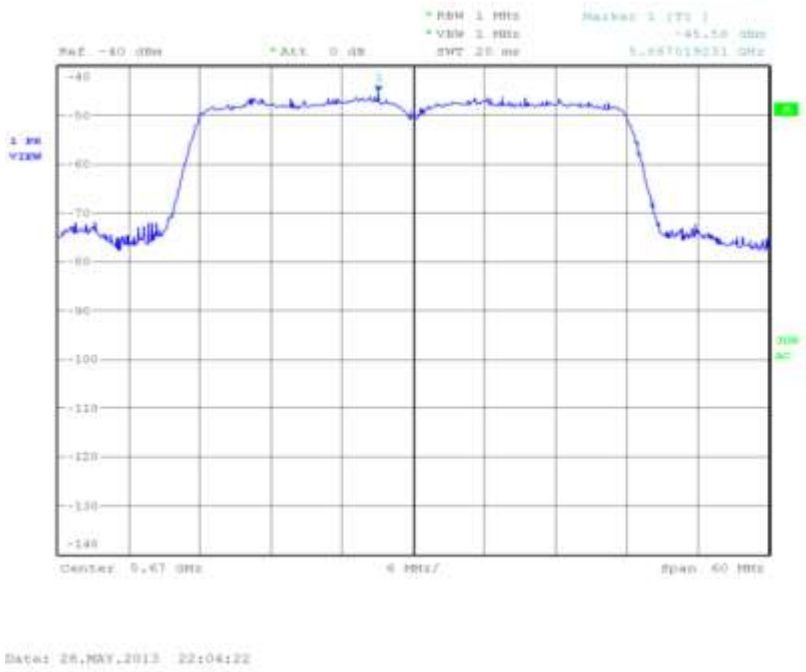
5590 MHz

EIRP (dBm)	EIRP (mW)
10.33	10.79



5670 MHz

EIRP (dBm)	EIRP (mW)
7.90	6.17



Limit for Radiated

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 200 mW or 10 dBm + 10 log B
5250 to 5350	Lesser of 1 W or 17 dBm + 10 log B
5470 to 5725	Lesser of 1 W or 17 dBm + 10 log B
5725 to 5825	Lesser of 4 W or 23 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

It is acceptable to have an antenna with up to 6 dBi gain, without reducing the conducted output power.

Conducted

Frequency Band 1

5190 MHz

EIRP (dBm)	EIRP (mW)
13.45	22.11

5230 MHz

EIRP (dBm)	EIRP (mW)
13.33	21.51

The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13 Mbps.

Conducted

Frequency Band 2

5270 MHz

EIRP (dBm)	EIRP (mW)
13.11	20.47

5310 MHz

EIRP (dBm)	EIRP (mW)
12.24	16.76

The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13 Mbps.

Conducted

Frequency Band 3

5510 MHz

EIRP (dBm)	EIRP (mW)
13.76	23.75

5590 MHz

EIRP (dBm)	EIRP (mW)
13.41	21.94

5670 MHz

EIRP (dBm)	EIRP (mW)
12.45	17.57

The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13 Mbps.

Limit for Conducted

Frequency Band (MHz)	FCC Limit
5150 to 5250	Lesser of 50 mW or 4 dBm + 10 log B
5250 to 5350	Lesser of 250 mW or 11 dBm + 10 log B
5470 to 5725	Lesser of 250 mW or 11 dBm + 10 log B
5725 to 5825	Lesser of 1 W or 17 dBm + 10 log B

Note:“B” = 26 dB Bandwidth.

2.3 UNDESIRABLE EMISSION LIMITS

2.3.1 Specification Reference

FCC CFR 47 Part 15E, Clause 15.407 (b)(1)(2)(3)(4)(6)(7)

2.3.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114764687 - Modification State 0
SHL22 S/N: IMEI 004401114765106 - Modification State 0

2.3.3 Date of Test

22 May 2013, 26 May 2013, 27 May 2013, 28 May 2013, 29 May 2013, 3 June 2013, 4 June 2013, 5 June 2013 & 9 June 2013

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

For conducted emissions, the EUT was set to operate at maximum power on the worst case data rate. The test was performed on the bottom, middle and top channels. The test was performed from 9 kHz to 40 GHz.

The measurement path loss in each relevant frequency band was measured and entered a s a reference level offset.

For radiated emissions, the test method described above was also used. However, the measurement was performed from 30 MHz to 40 GHz and the path loss is incorporated as a transducer factor and entered into the spectrum analyser. In each frequency span the level was maximised by rotating the EUT 360° and a height search of the measuring antenna.

The band edge measurements were performed in accordance with ANSI C63.10, Clause 6.9.3. The results were analysed to ensure compliance with restricted bands. The EUT was set to the lowest and highest operating frequencies.

2.3.6 Environmental Conditions

Ambient Temperature	17.2 - 23.5°C
Relative Humidity	34.0 - 45.0%

2.3.7 Test Results

802.11(a)

4.0 V DC Supply

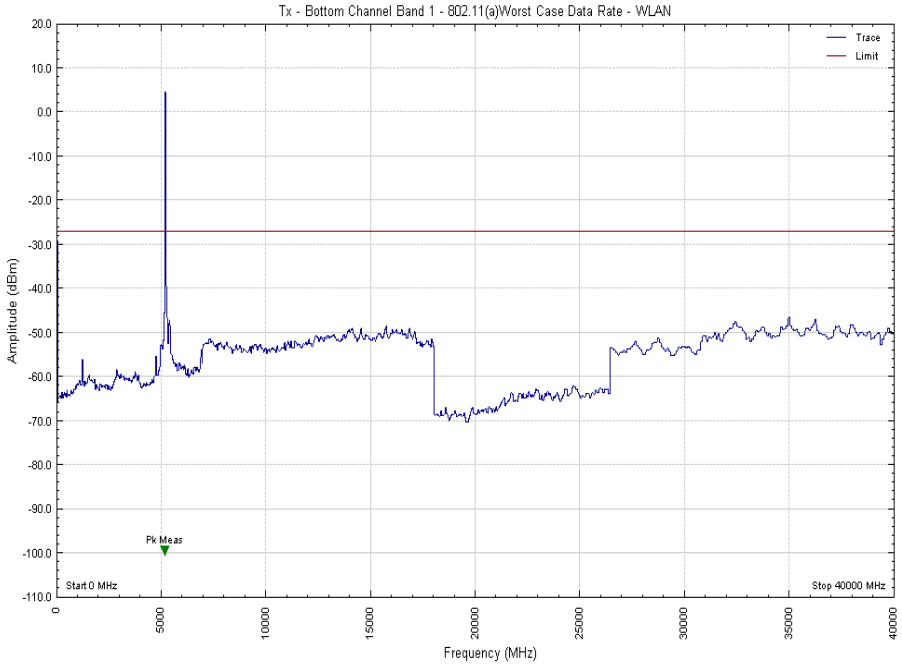
Spurious Conducted Emissions

6 Mbps

Frequency Band 1

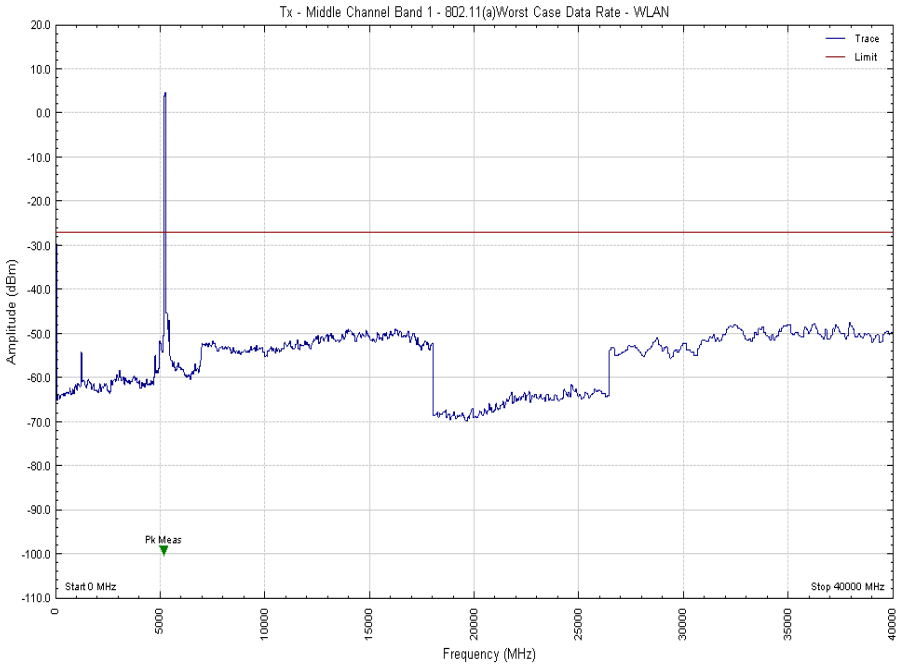
5180 MHz

9 kHz to 40 GHz



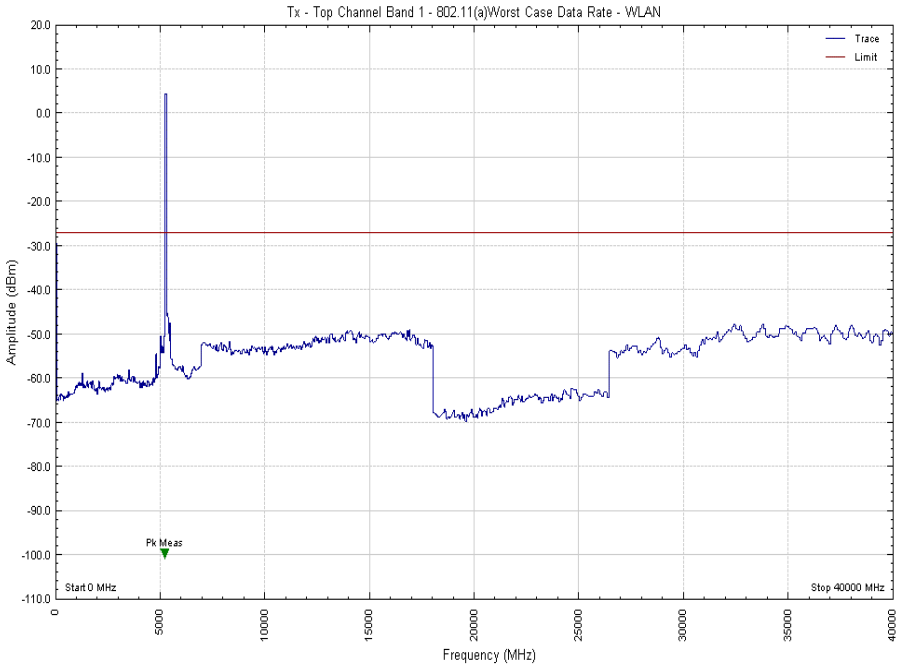
5220 MHz

9 kHz to 40 GHz



5240 MHz

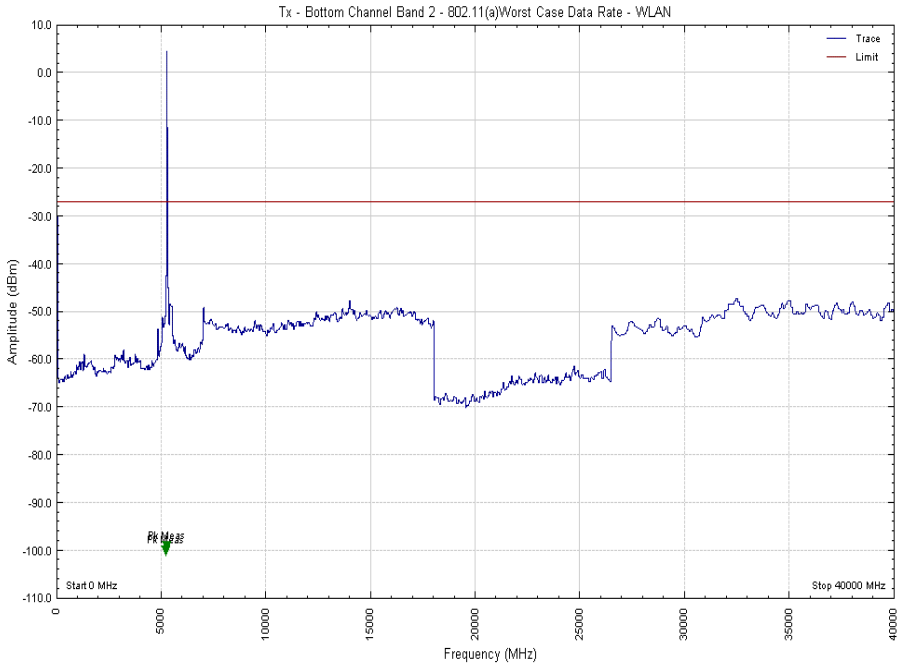
9 kHz to 40 GHz



Frequency Band 2

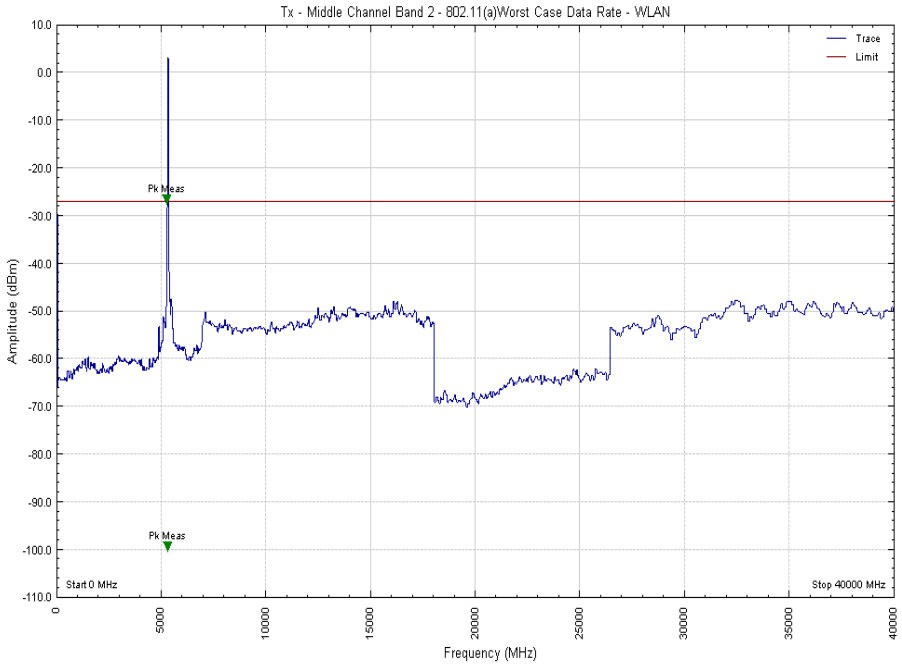
5260 MHz

9 kHz to 40 GHz



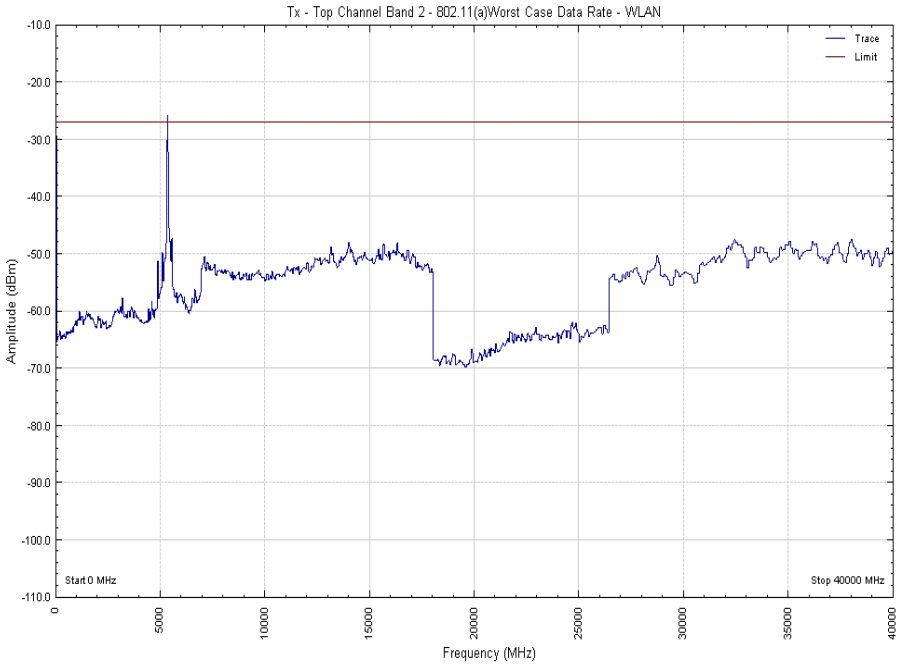
5300 MHz

9 kHz to 40 GHz



5320 MHz

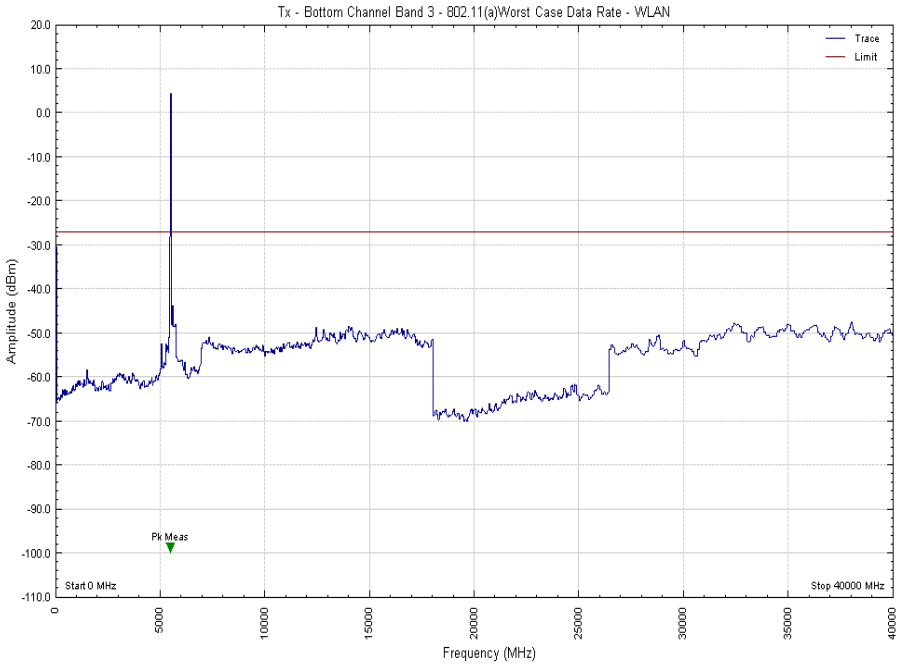
9 kHz to 40 GHz



Frequency Band 3

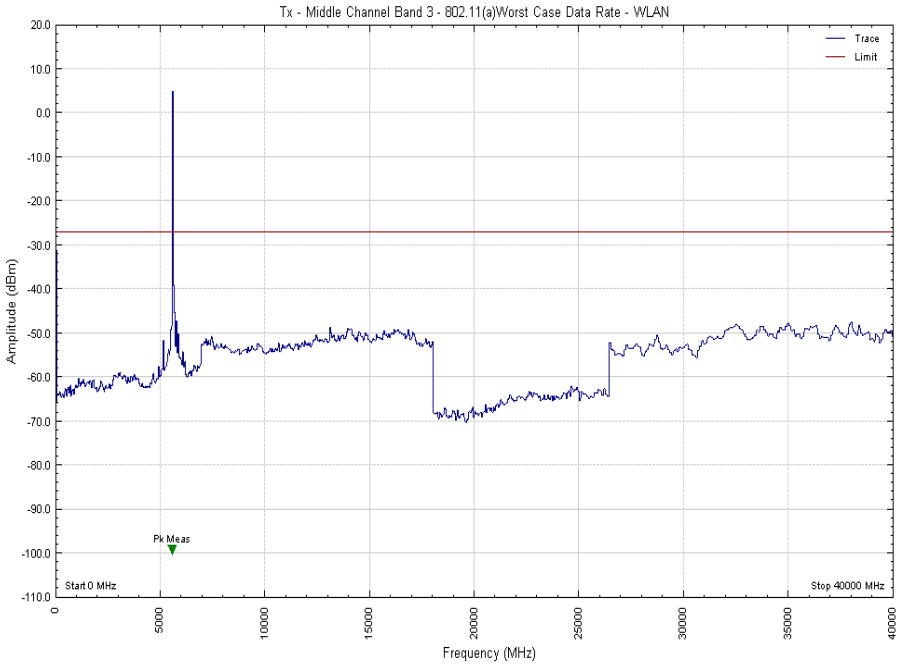
5500 MHz

9 kHz to 40 GHz



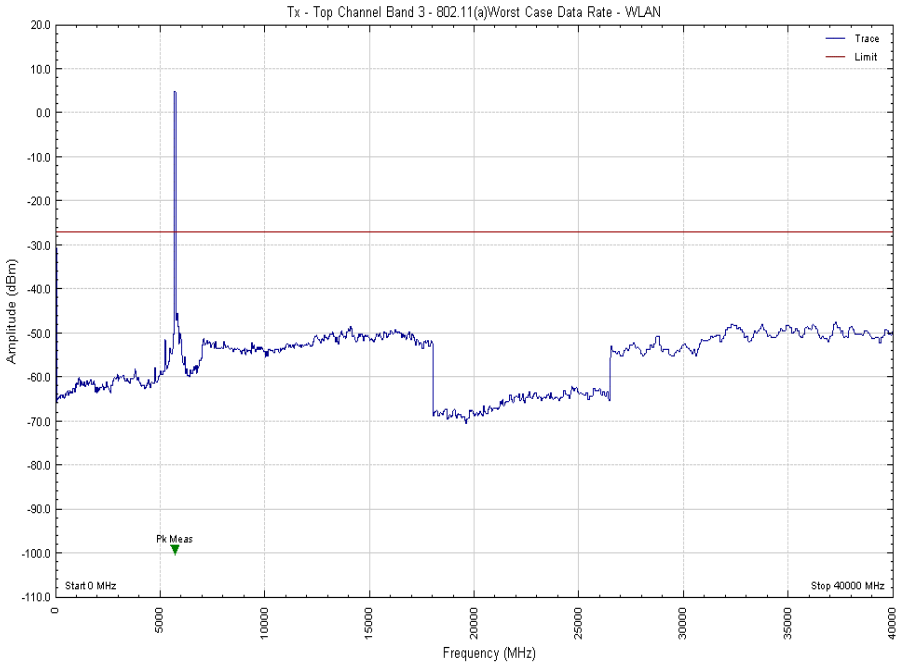
5600 MHz

9 kHz to 40 GHz



5700 MHz

9 kHz to 40 GHz



Limit Clause

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

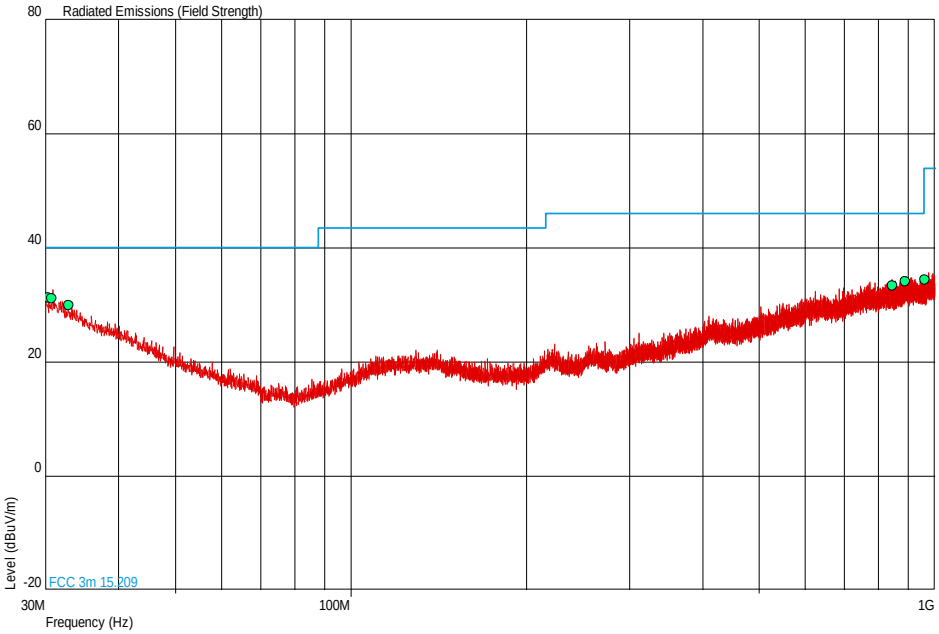
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.

Spurious Radiated Emissions

Frequency Band 1

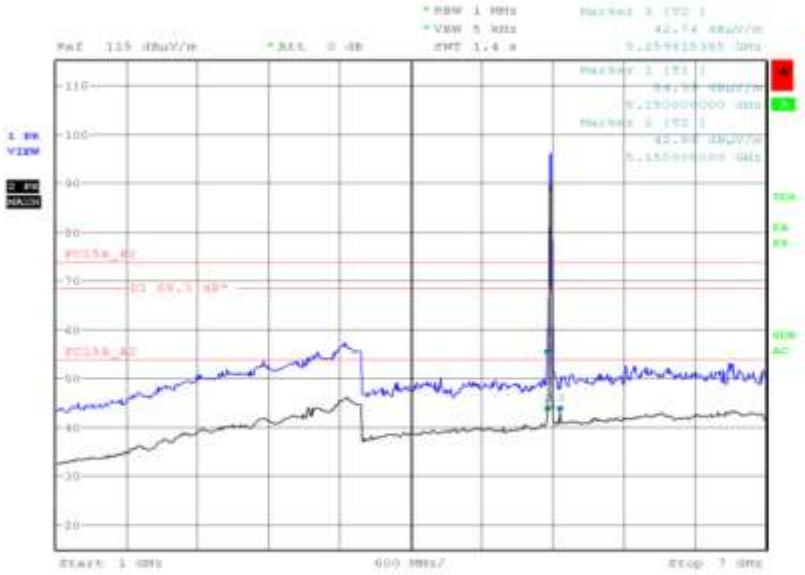
5180 MHz

30 MHz to 1 GHz



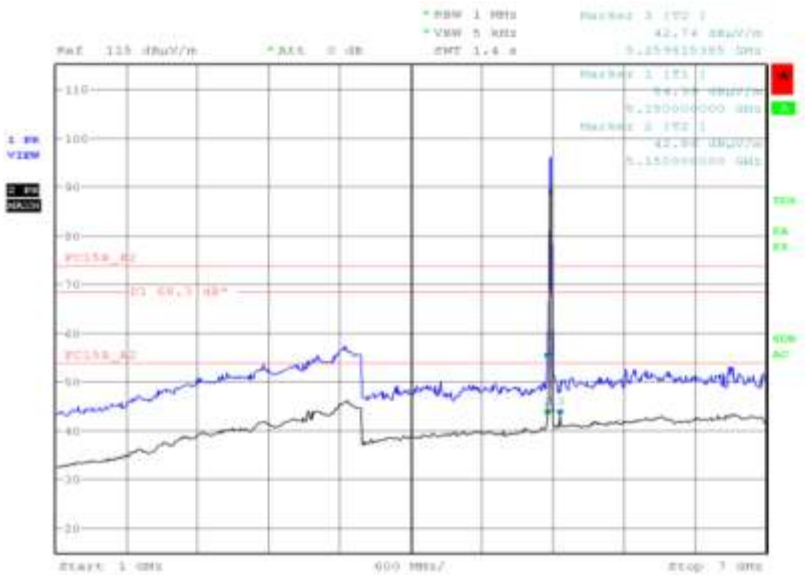
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.385	31.3	36.7	40.0	100	-8.7	63.3	360	1.00	Vertical
30.793	31.1	35.9	40.0	100	-8.9	64.1	204	1.00	Vertical
32.914	29.9	31.3	40.0	100	-10.1	68.7	175	1.00	Horizontal
848.234	33.3	46.2	46.0	200	-12.7	153.8	207	1.00	Horizontal
890.619	34.1	50.7	46.0	200	-11.9	149.3	172	1.00	Horizontal
960.529	34.5	53.1	54.0	501	-19.5	446.9	224	2.73	Horizontal

1 GHz to 7 GHz



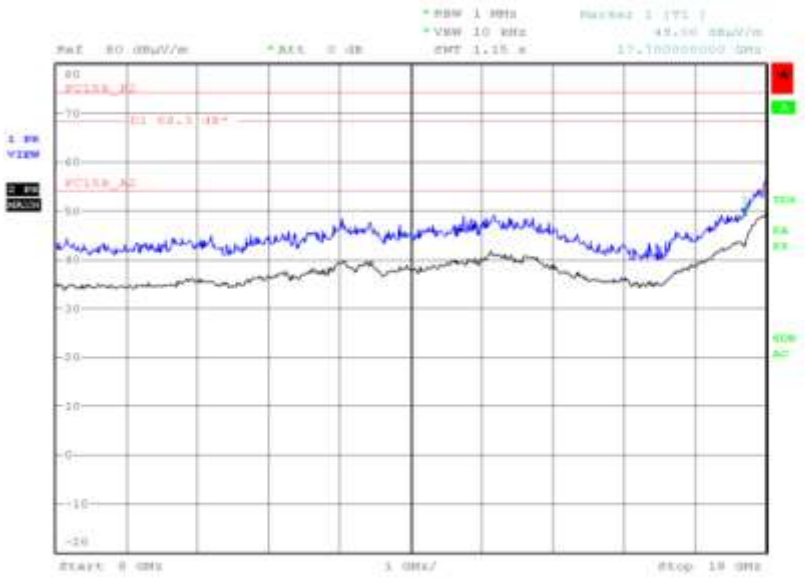
Date: 25.MAY.2013 18:26:31

7 GHz to 8 GHz



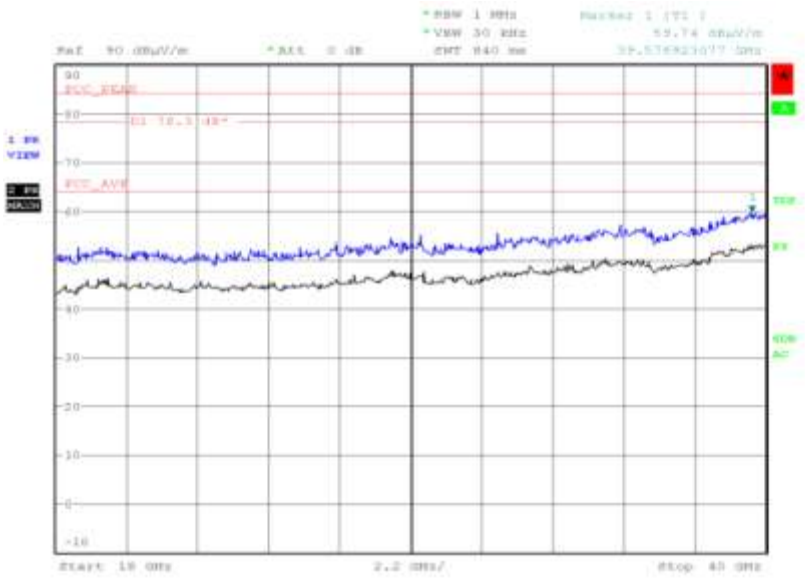
Date: 25.MAY.2013 18:26:31

8 GHz to 18 GHz



Date: 5.JUN.2013 17:35:02

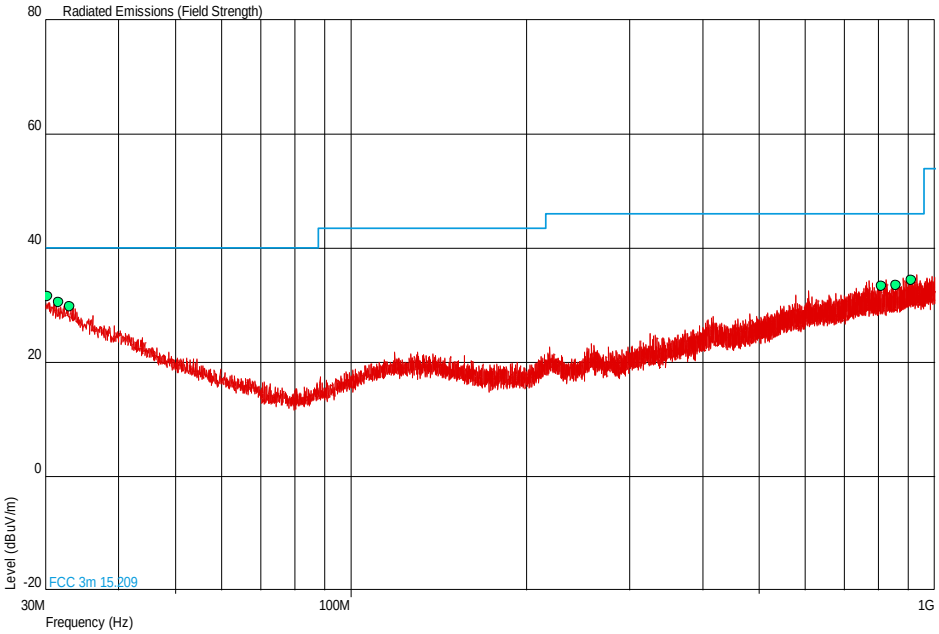
18 GHz to 40 GHz



Date: 9.JUN.2013 19:27:58

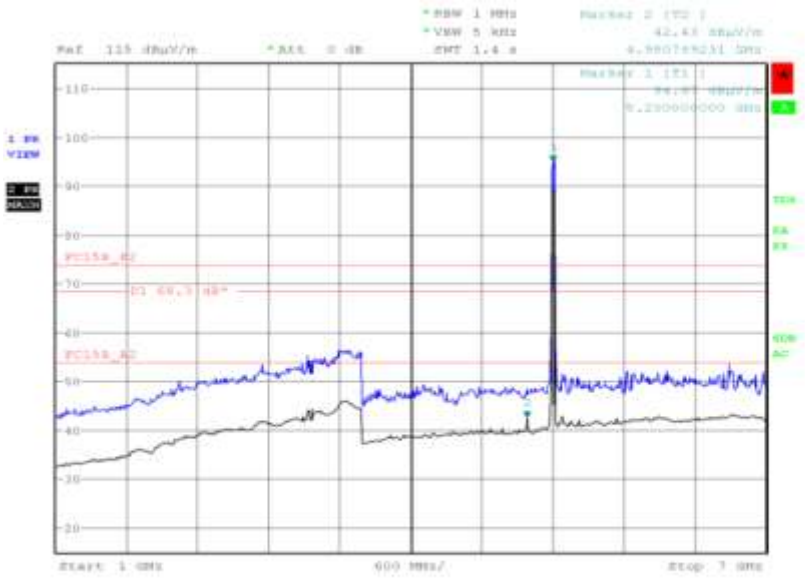
5200 MHz

30 MHz to 1 GHz

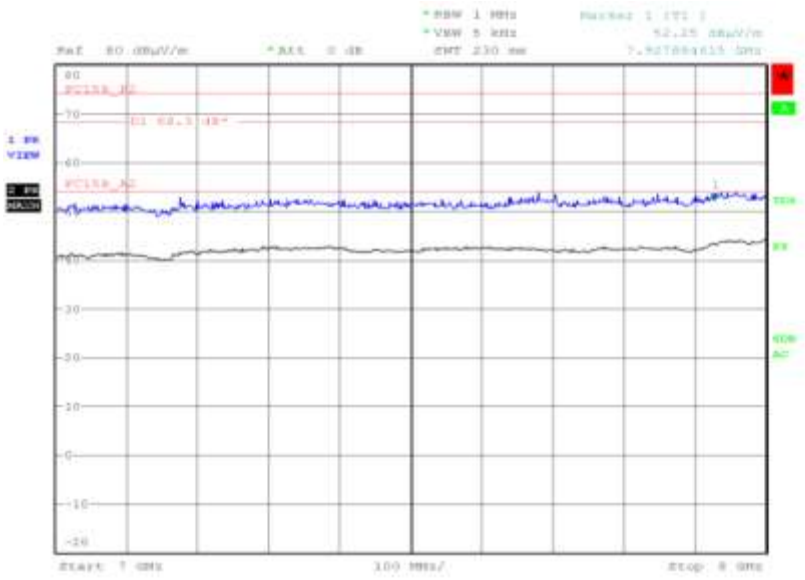


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.243	31.5	37.6	40.0	37.6	-8.5	62.4	180	1.00	Vertical
31.649	30.6	33.9	40.0	33.9	-9.4	66.1	180	1.00	Vertical
33.056	29.8	30.9	40.0	30.9	-10.2	69.1	180	1.00	Vertical
809.298	33.3	46.2	46.0	46.2	-12.7	153.8	180	1.00	Vertical
858.477	33.4	46.8	46.0	46.8	-12.6	153.2	0	1.00	Vertical
911.876	34.4	52.5	46.0	52.5	-11.6	147.5	0	1.00	Vertical

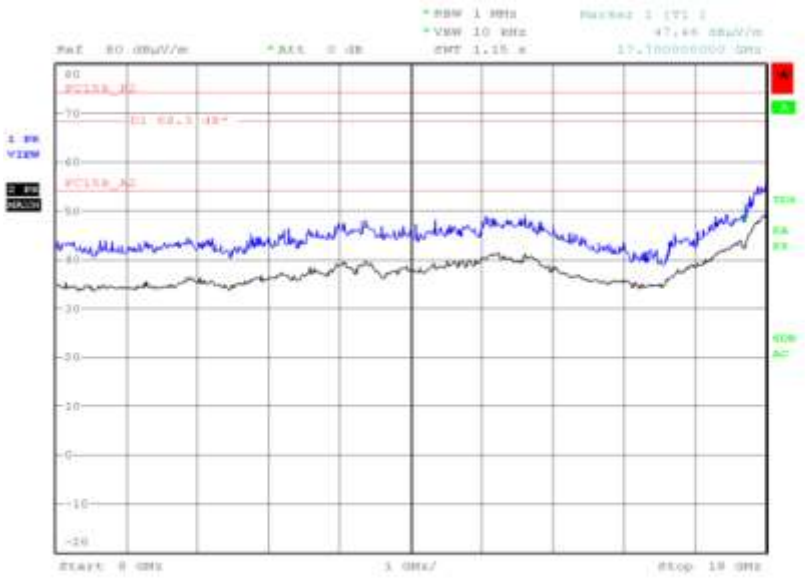
1 GHz to 7 GHz



7 GHz to 8 GHz

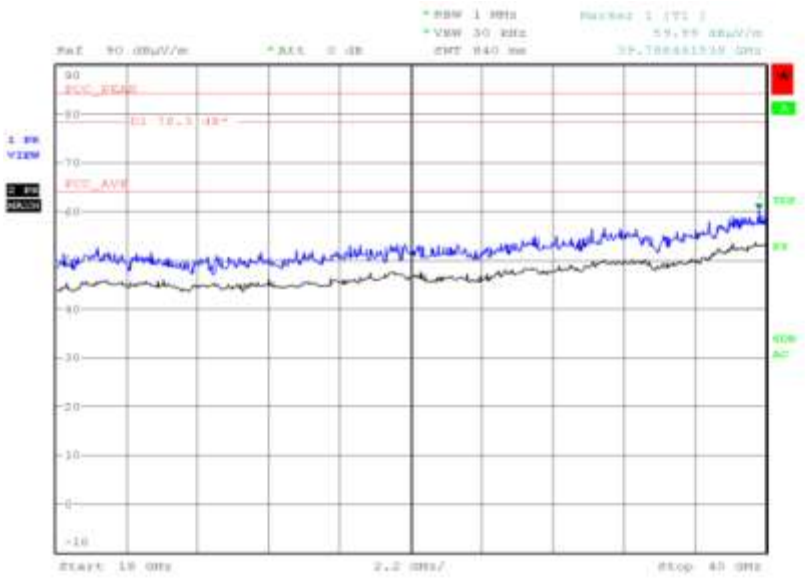


8 GHz to 18 GHz



Date: 5.JUN.2013 17:49:22

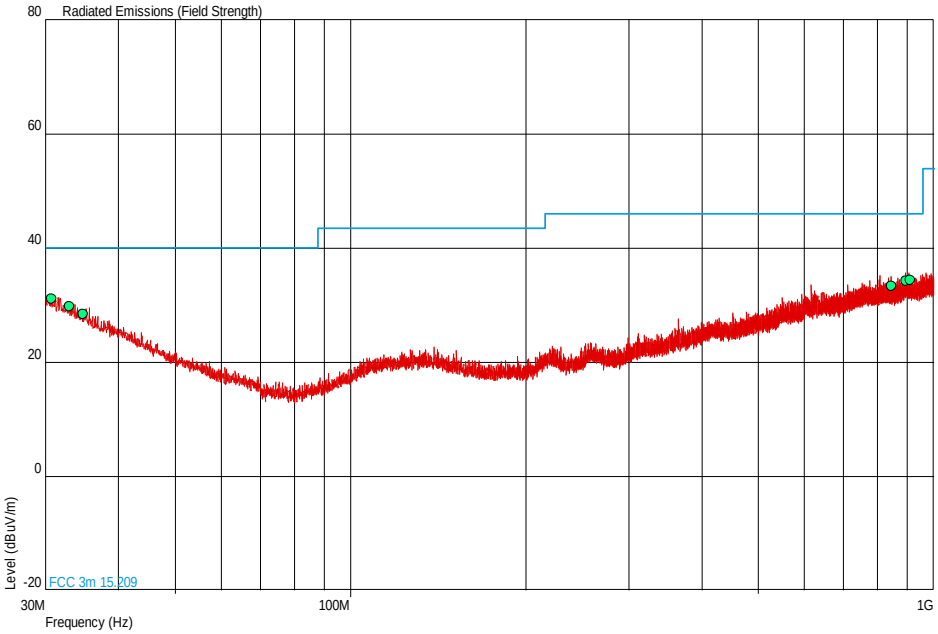
18 GHz to 40 GHz



Date: 9.JUN.2013 17:47:29

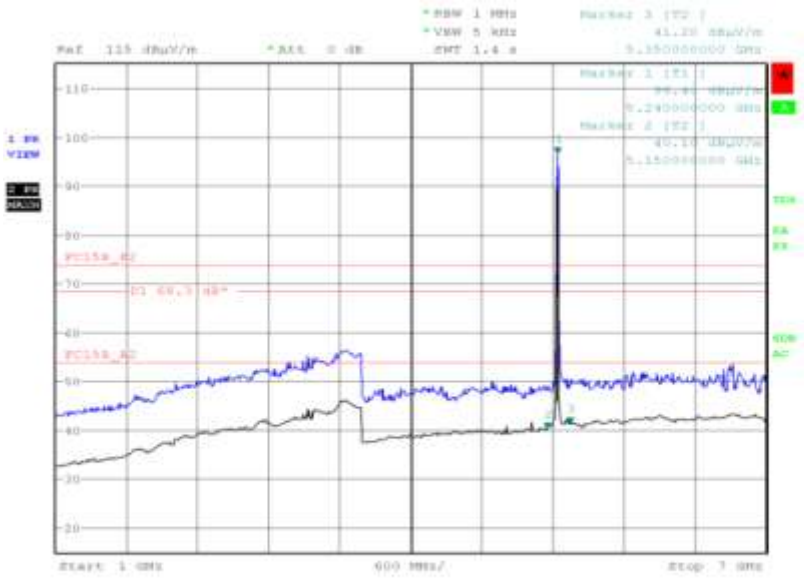
5240 MHz

30 MHz to 1 GHz



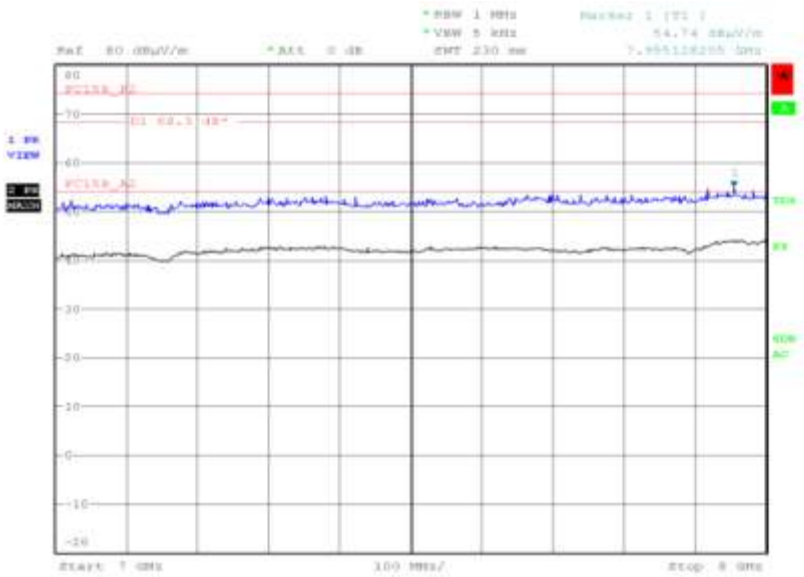
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.776	31.1	35.9	40.0	100	-8.9	64.1	0	1.00	Vertical
33.056	29.8	30.9	40.0	100	-10.2	69.1	90	1.00	Vertical
34.802	28.5	26.6	40.0	100	-11.5	73.4	45	1.00	Vertical
847.419	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Horizontal
897.326	34.2	51.3	46.0	200	-11.8	148.7	135	1.00	Horizontal
912.070	34.4	52.5	46.0	200	-11.6	147.5	45	1.00	Vertical

1 GHz to 7 GHz



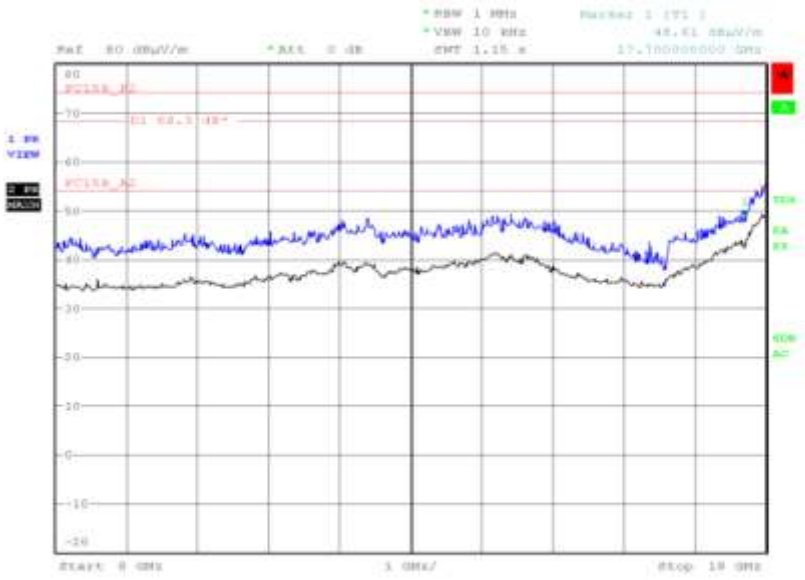
Date: 25.MAY.2013 19:36:21

7 GHz to 8 GHz



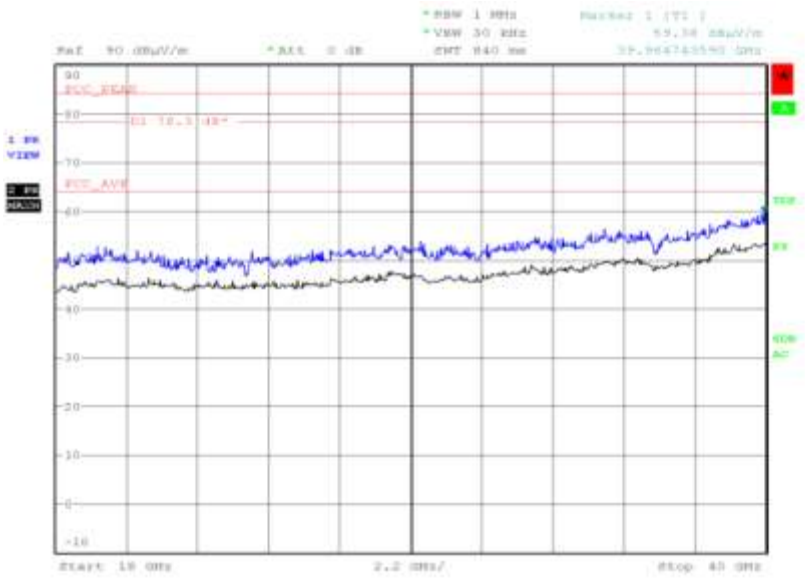
Date: 4.JUN.2013 22:07:41

8 GHz to 18 GHz



Date: 5.JUN.2013 16:02:48

18 GHz to 40 GHz

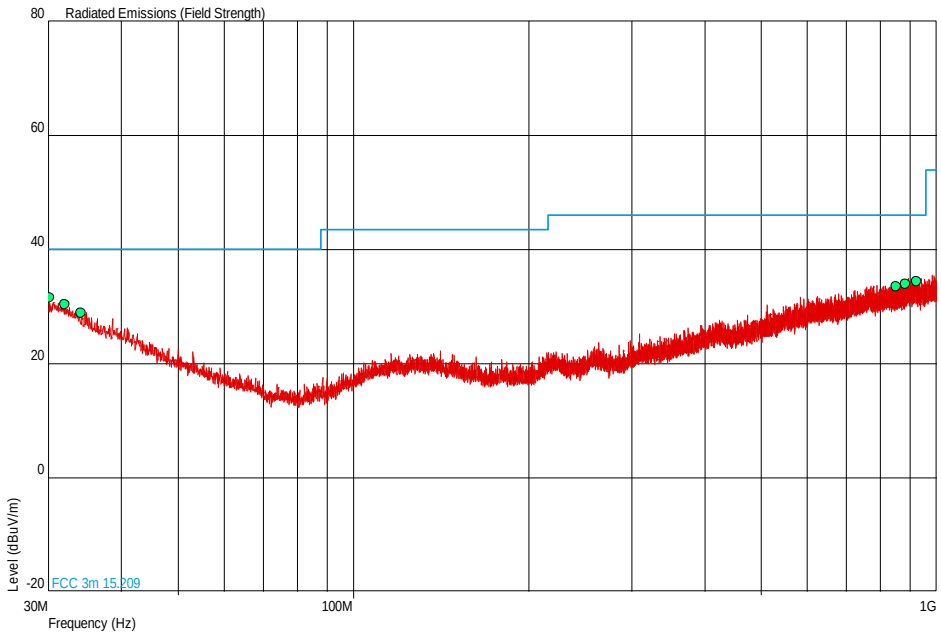


Date: 9.JUN.2013 17:58:21

Frequency Band 2

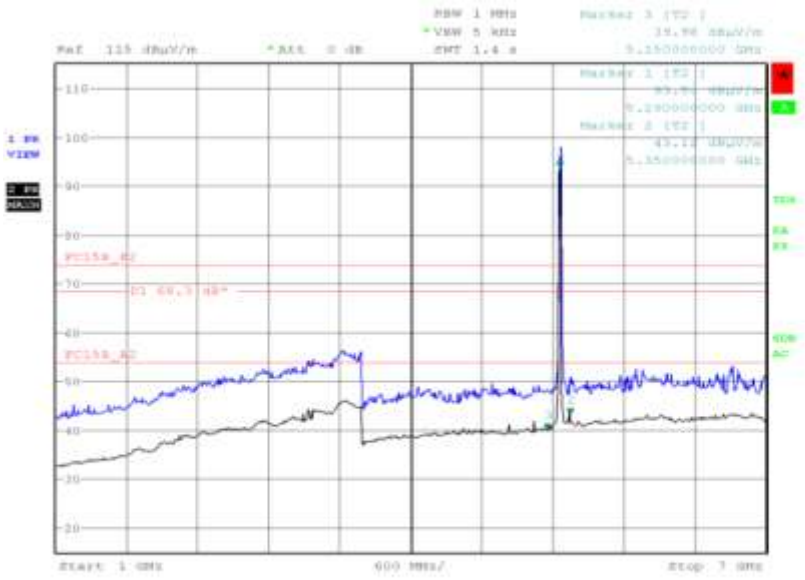
5260 MHz

30 MHz to 1 GHz



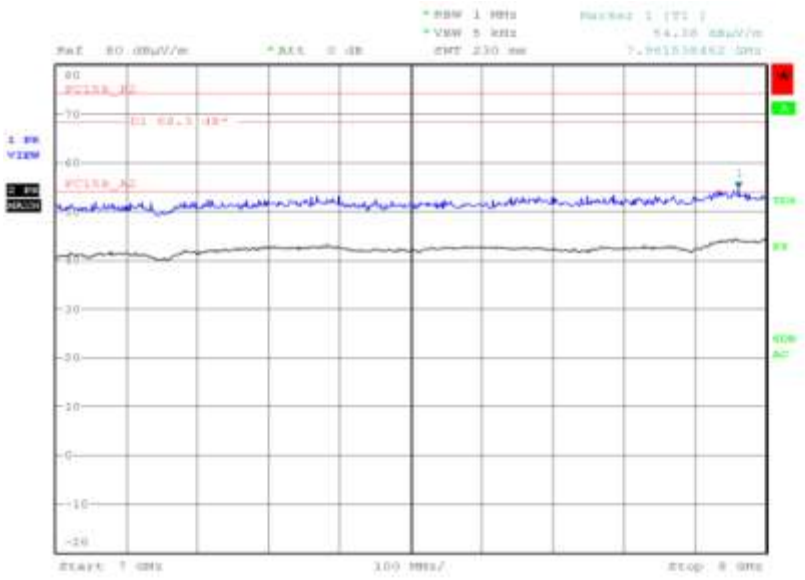
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.194	31.5	37.6	40.0	100	-8.5	62.4	180	1.00	Horizontal
31.989	30.4	33.1	40.0	100	-9.6	66.9	0	1.00	Vertical
34.171	28.9	27.9	40.0	100	-11.1	72.1	0	1.00	Horizontal
853.094	33.5	47.3	46.0	200	-12.5	152.7	180	1.00	Horizontal
885.928	33.9	49.5	46.0	200	-12.1	150.5	180	1.00	Vertical
922.885	34.3	51.9	46.0	200	-11.7	148.1	0	1.00	Vertical

1 GHz to 7 GHz



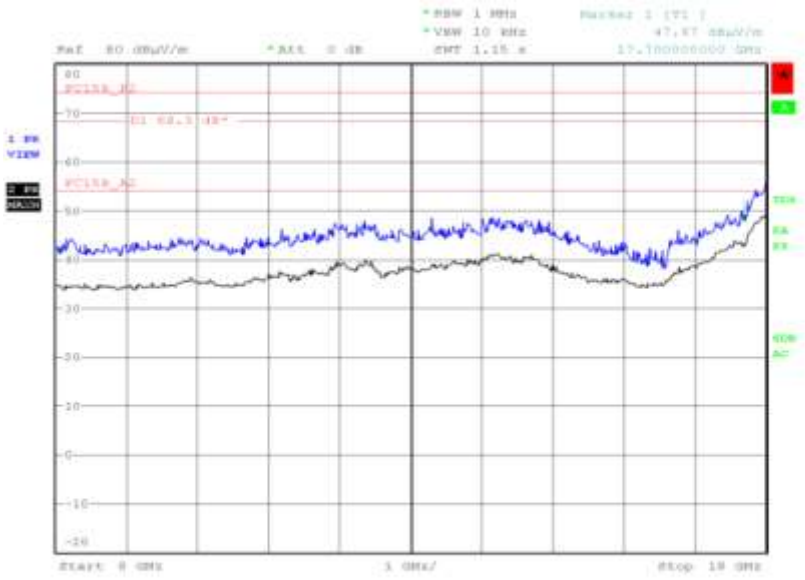
Date: 25.MAY.2013 20:17:11

7 GHz to 8 GHz



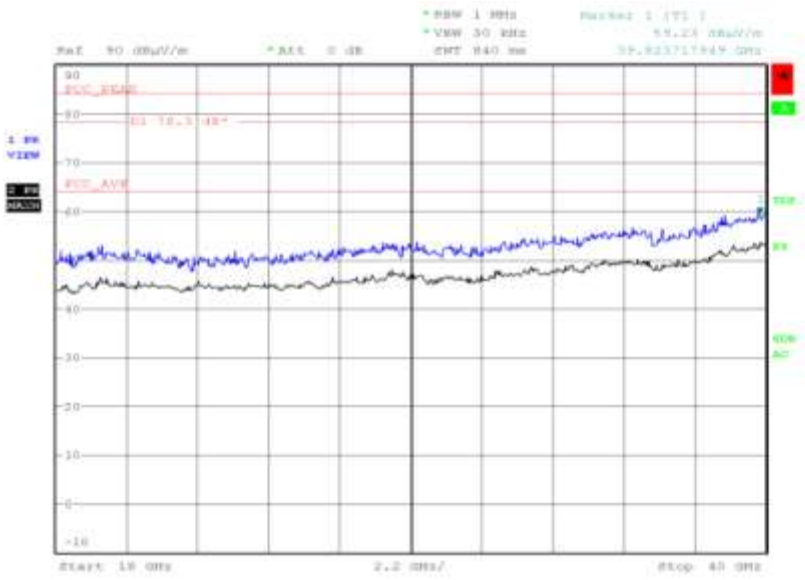
Date: 4.JUN.2013 22:17:53

8 GHz to 18 GHz



Date: 5.JUN.2013 16:20:58

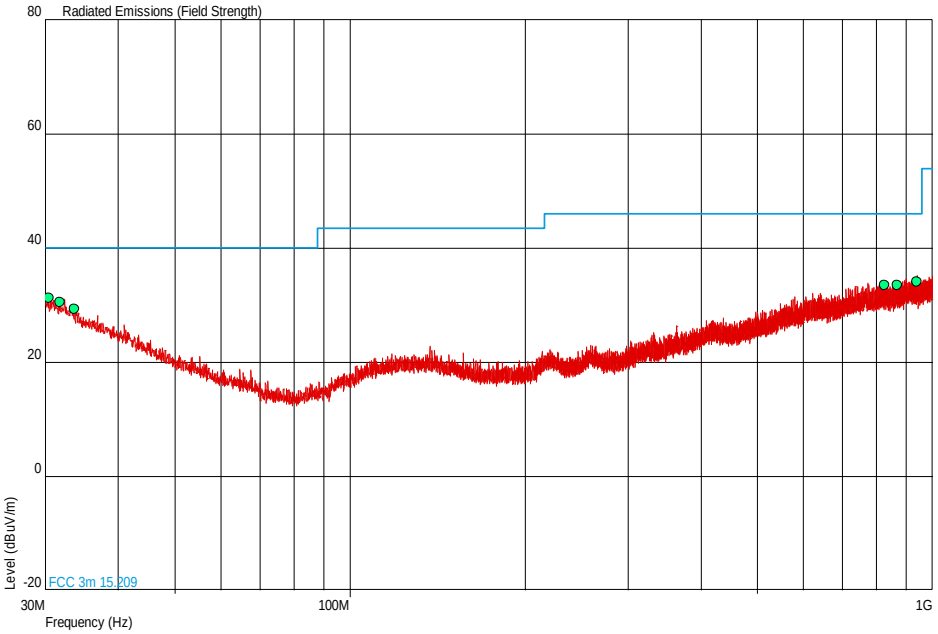
18 GHz to 40 GHz



Date: 9.JUN.2013 21:00:35

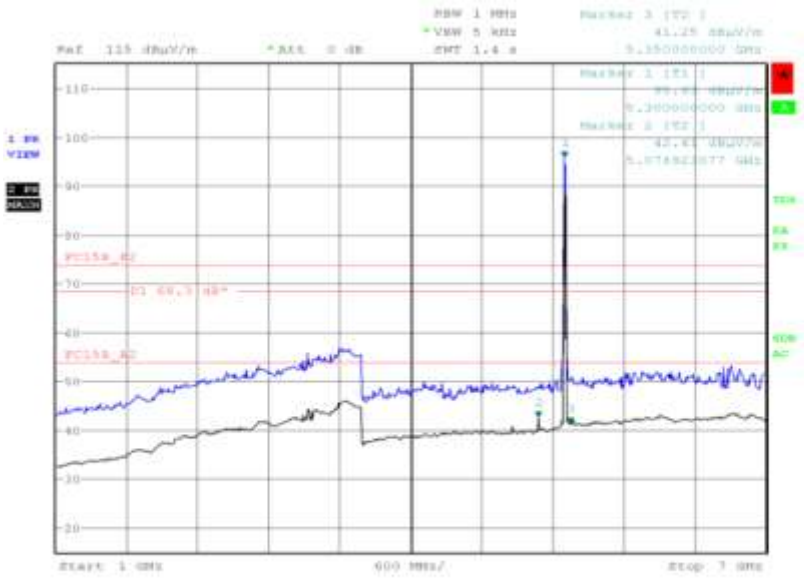
5300 MHz

30 MHz to 1 GHz



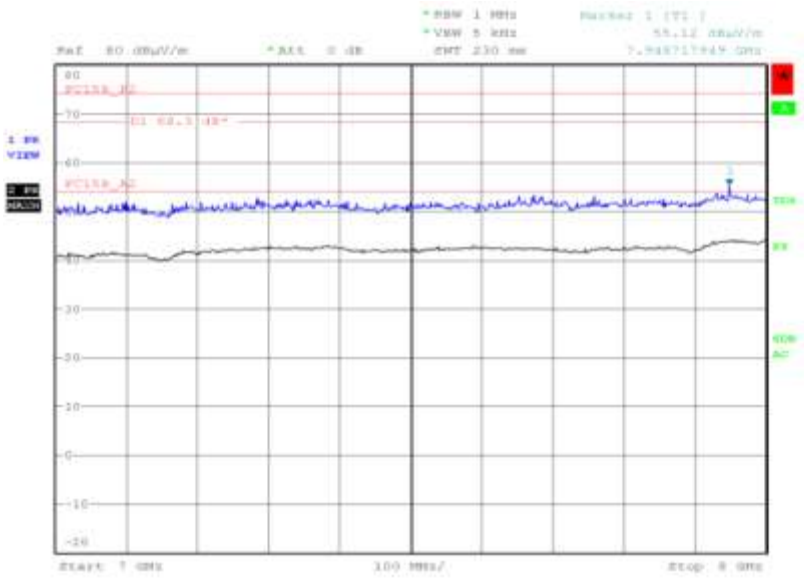
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.437	31.2	36.3	40.0	100	-8.8	63.7	0	1.00	Vertical
31.843	30.5	33.5	40.0	100	-9.5	66.5	0	1.00	Vertical
33.735	29.3	29.2	40.0	100	-10.7	70.8	0	1.00	Horizontal
826.225	33.5	47.3	46.0	200	-12.5	152.7	180	1.00	Vertical
870.166	33.6	47.9	46.0	200	-12.4	152.1	180	1.00	Horizontal
941.267	34.1	50.7	46.0	200	-11.9	149.3	180	1.00	Horizontal

1 GHz to 7 GHz



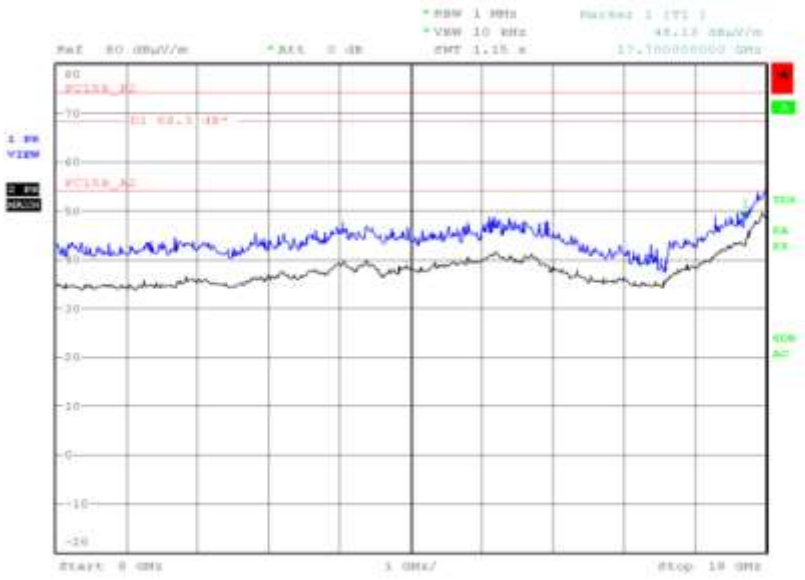
Date: 25.MAY.2013 21:01:24

7 GHz to 8 GHz



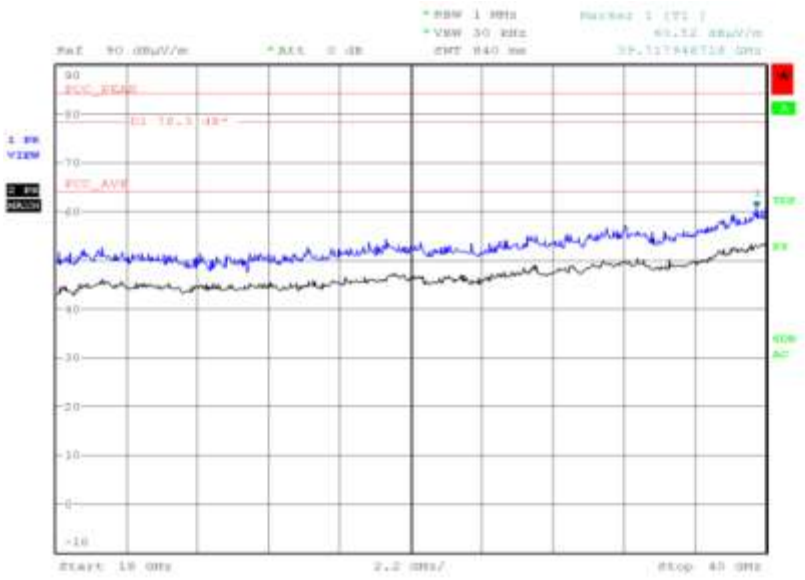
Date: 4.JUN.2013 22:23:01

8 GHz to 18 GHz



Date: 5.JUN.2013 16:34:27

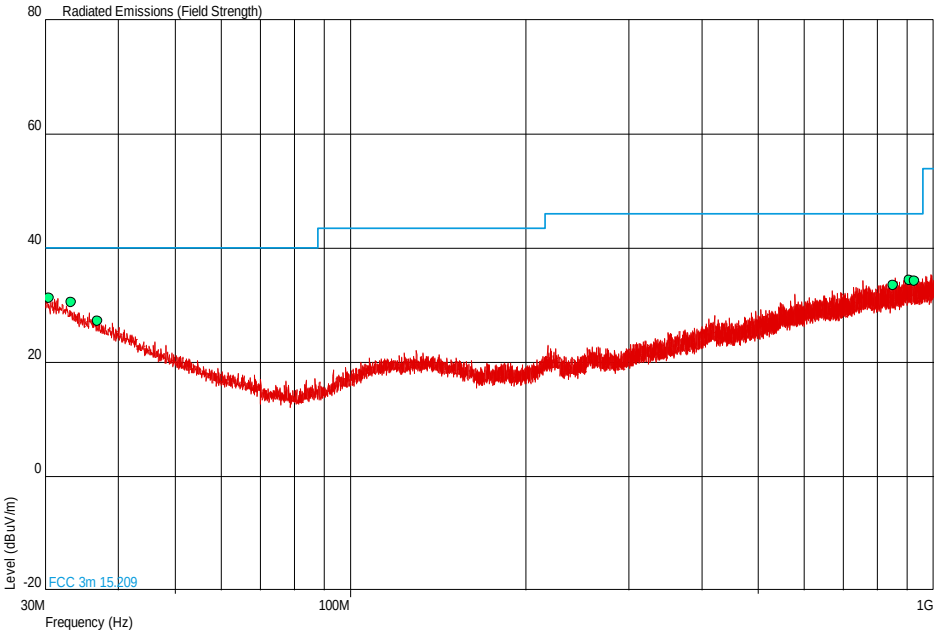
18 GHz to 40 GHz



Date: 9.JUN.2013 21:10:04

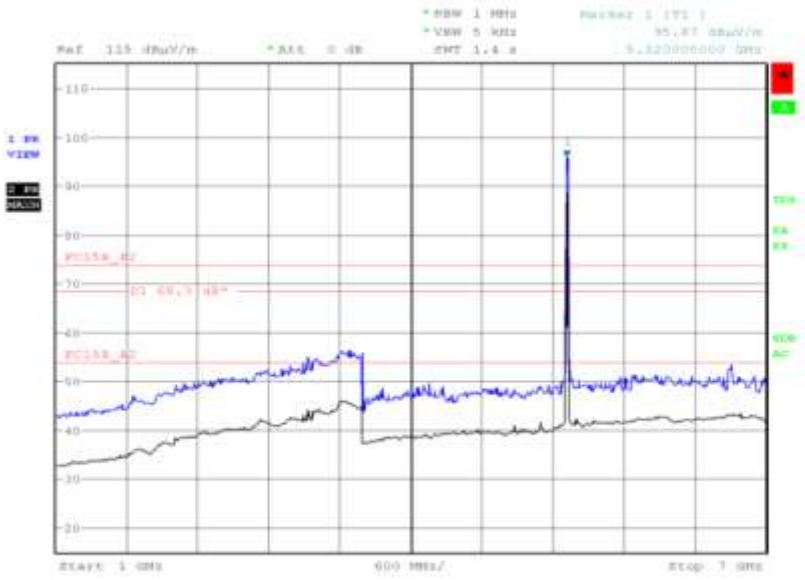
5320 MHz

30 MHz to 1 GHz



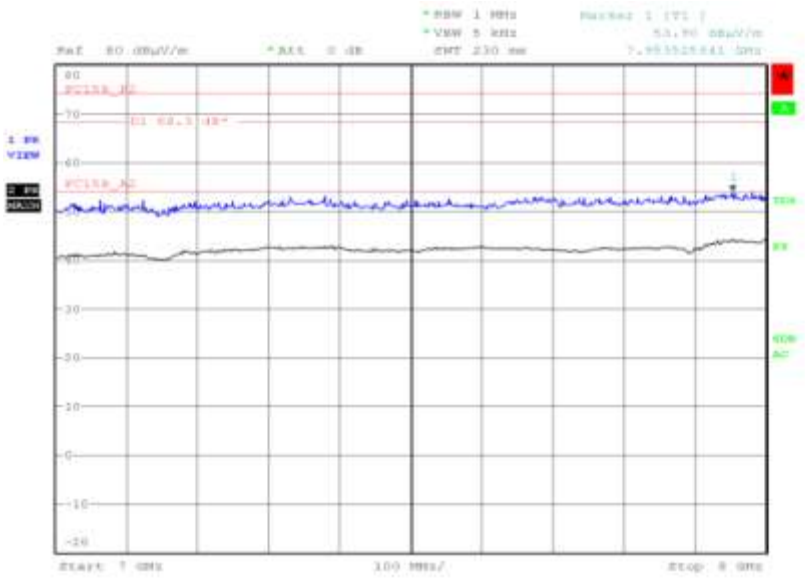
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.437	31.3	36.7	40.0	100	-8.7	63.3	0	1.00	Vertical
33.250	30.5	33.5	40.0	100	-9.5	66.5	0	1.00	Vertical
36.839	27.3	23.2	40.0	100	-12.7	76.8	180	1.00	Vertical
852.948	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Horizontal
908.820	34.4	52.5	46.0	200	-11.6	147.5	0	1.00	Horizontal
926.377	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Horizontal

1 GHz to 7 GHz



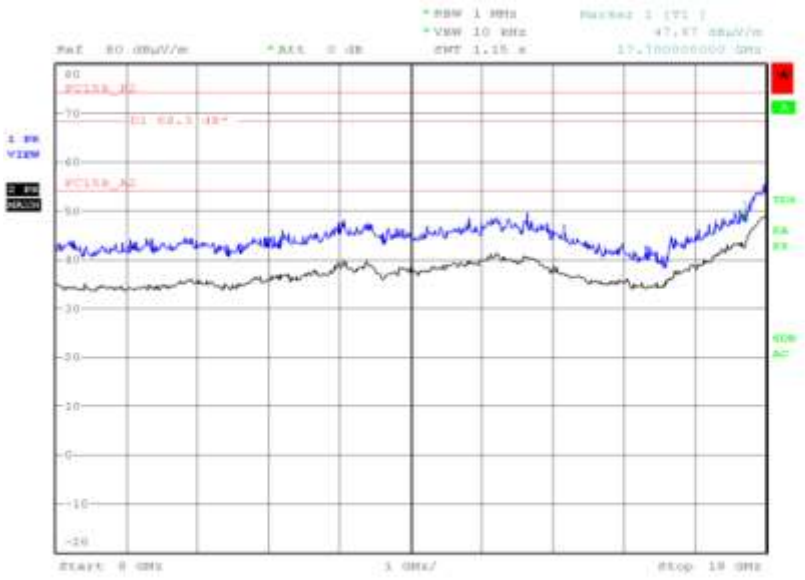
Date: 25.MAY.2013 21:42:00

7 GHz to 8 GHz



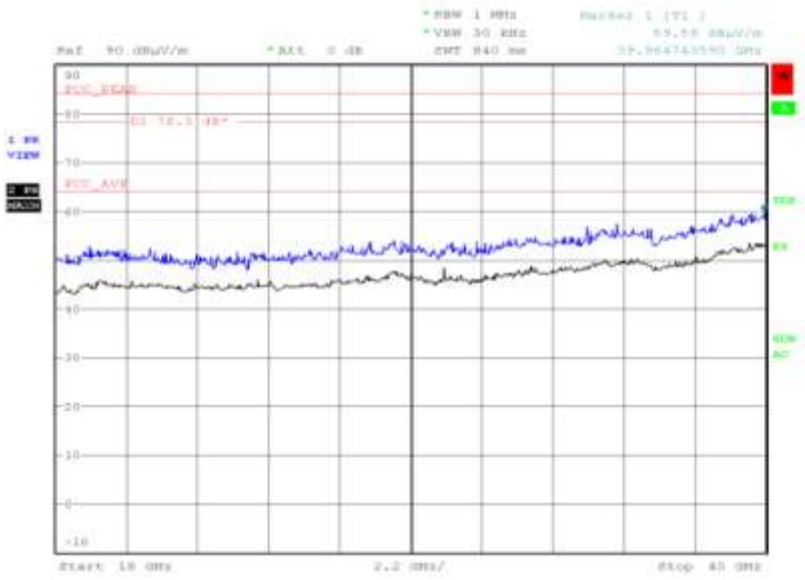
Date: 4.JUN.2013 22:31:17

8 GHz to 18 GHz



Date: 5.JUN.2013 16:57:00

18 GHz to 40 GHz

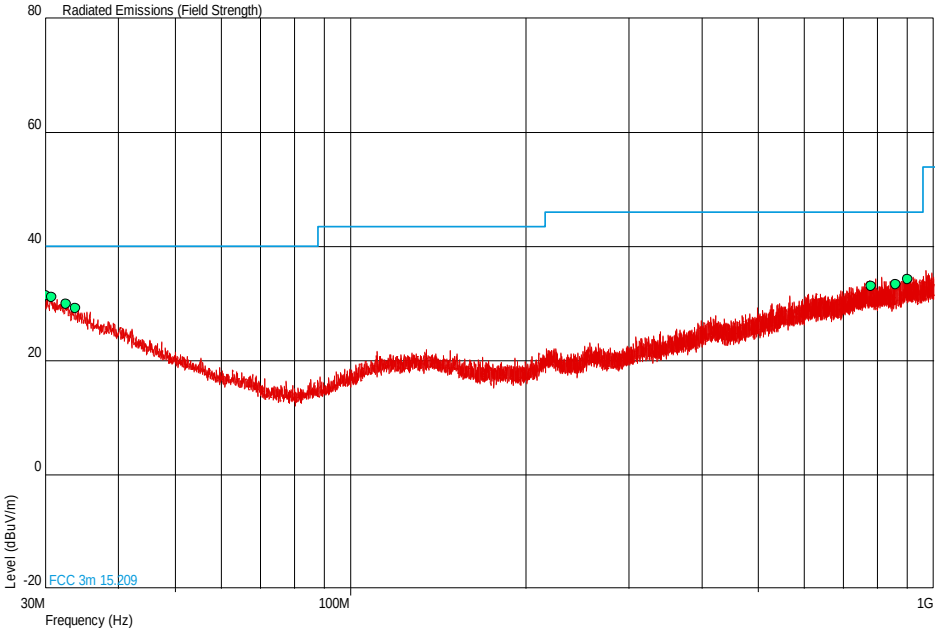


Date: 9.JUN.2013 21:18:41

Frequency Band 3

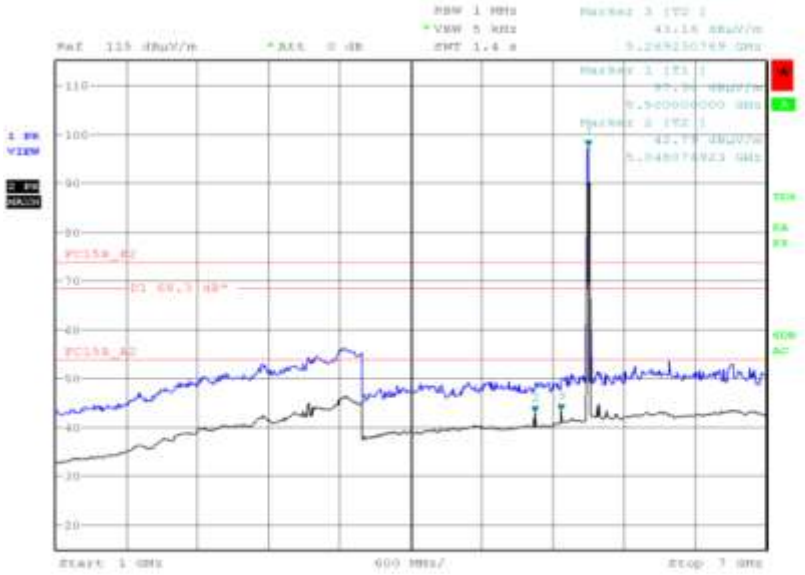
5500 MHz

30 MHz to 1 GHz



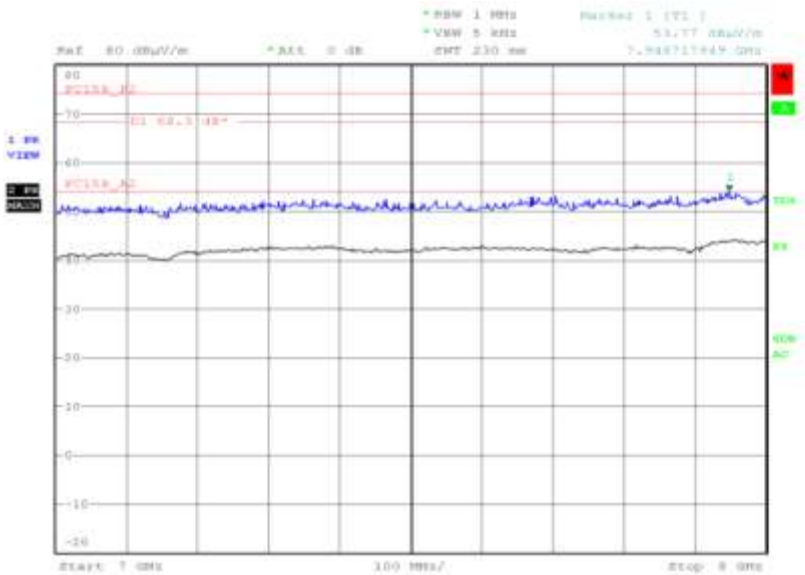
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.049	31.4	37.2	40.0	100	-8.6	62.8	180	1.00	Vertical
30.776	31.1	35.9	40.0	100	-8.9	64.1	0	1.00	Horizontal
32.619	30.0	31.6	40.0	100	-10.0	68.4	180	1.00	Vertical
33.832	29.2	28.8	40.0	100	-10.8	71.2	180	1.00	Horizontal
780.053	33.1	45.2	46.0	200	-12.9	154.8	180	1.00	Horizontal
860.272	33.4	46.8	46.0	200	-12.6	153.2	180	1.00	Horizontal
903.388	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Vertical

1 GHz to 7 GHz



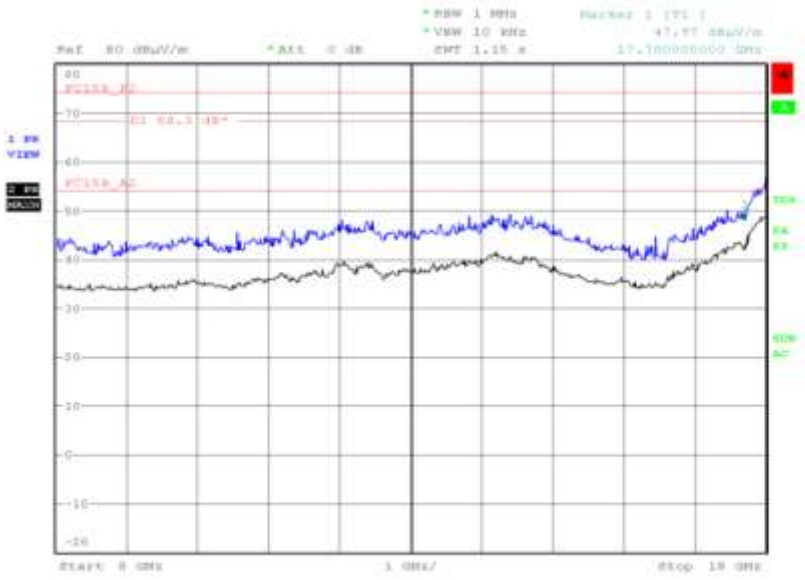
Date: 26.MAY.2013 07:38:51

7 GHz to 8 GHz



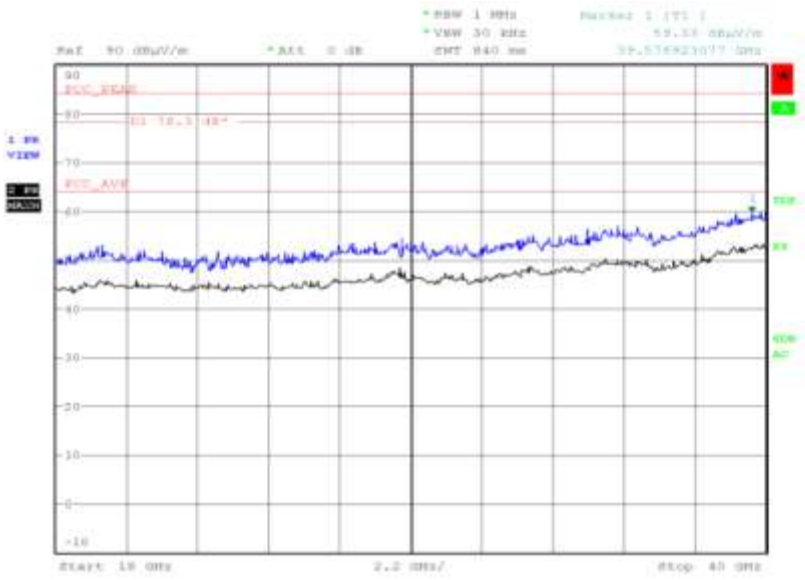
Date: 4.JUN.2013 22:38:14

8 GHz to 18 GHz



Date: 5.JUN.2013 19:11:25

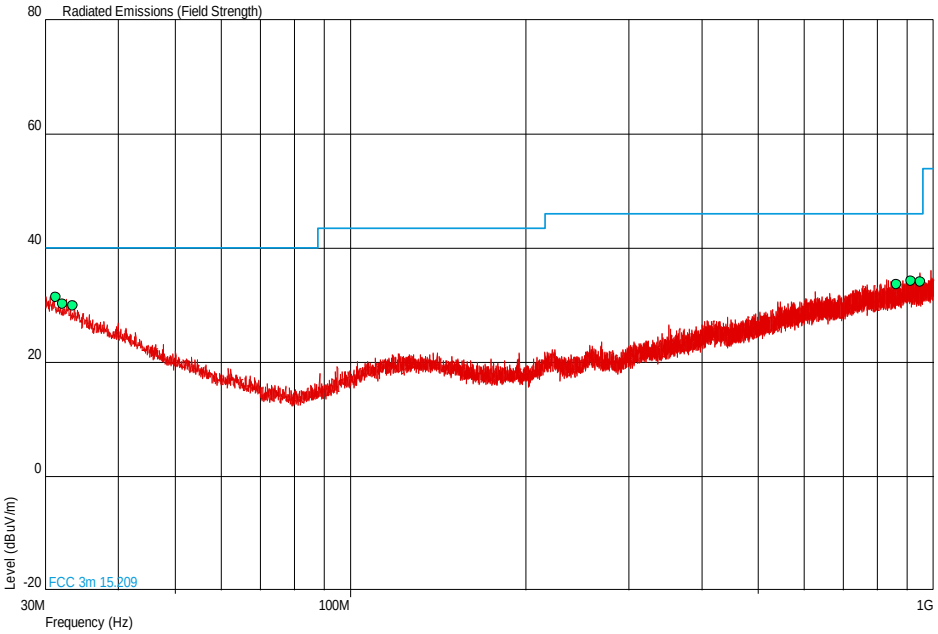
18 GHz to 40 GHz



Date: 9.JUN.2013 18:10:40

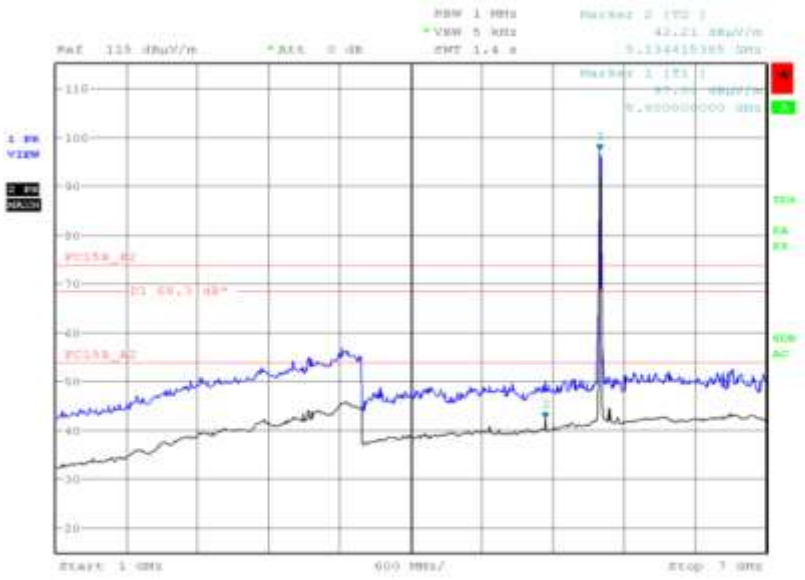
5600 MHz

30 MHz to 1 GHz

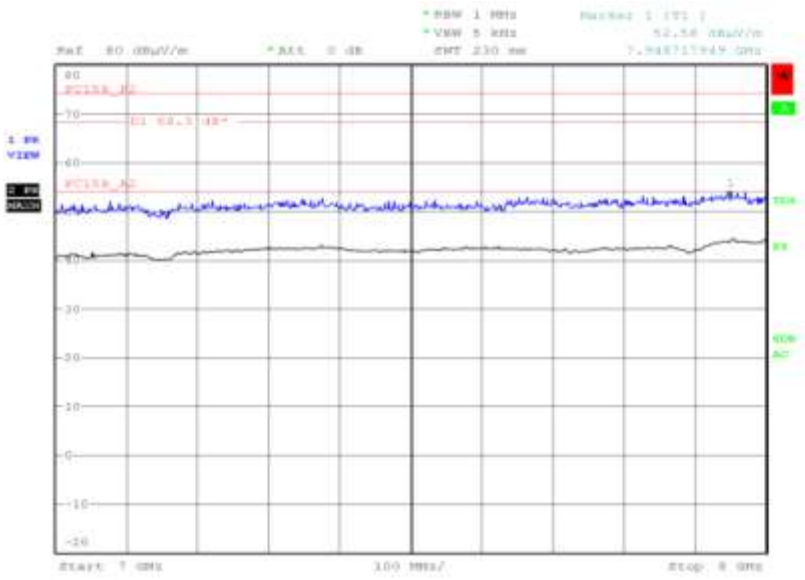


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.261	31.4	37.2	40.0	100	-8.6	62.8	0	1.00	Horizontal
32.183	30.2	32.4	40.0	100	-9.8	67.6	180	1.00	Vertical
33.444	29.9	31.3	40.0	100	-10.1	68.7	180	1.00	Vertical
863.618	33.6	47.9	46.0	200	-12.4	152.1	0	1.00	Vertical
914.883	34.3	51.9	46.0	200	-11.7	148.1	0	1.00	Vertical
950.530	34.1	50.7	46.0	200	-11.9	149.3	0	1.00	Horizontal

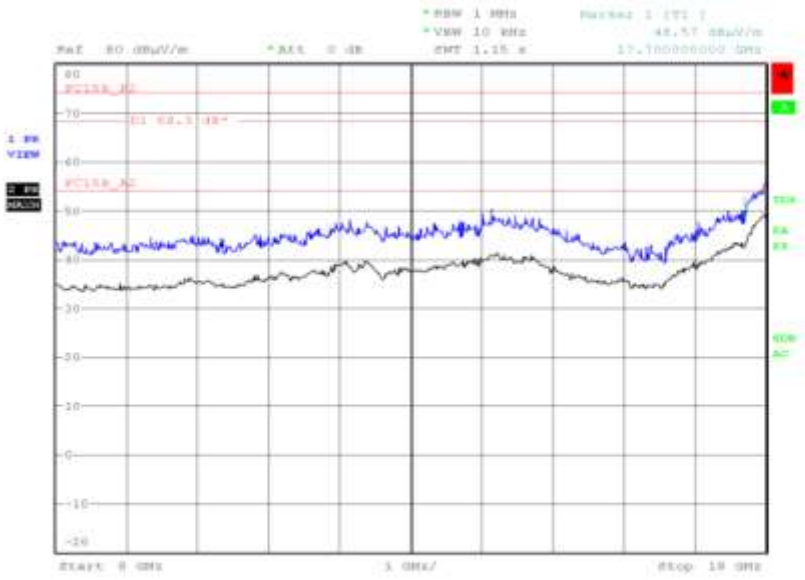
1 GHz to 7 GHz



7 GHz to 8 GHz

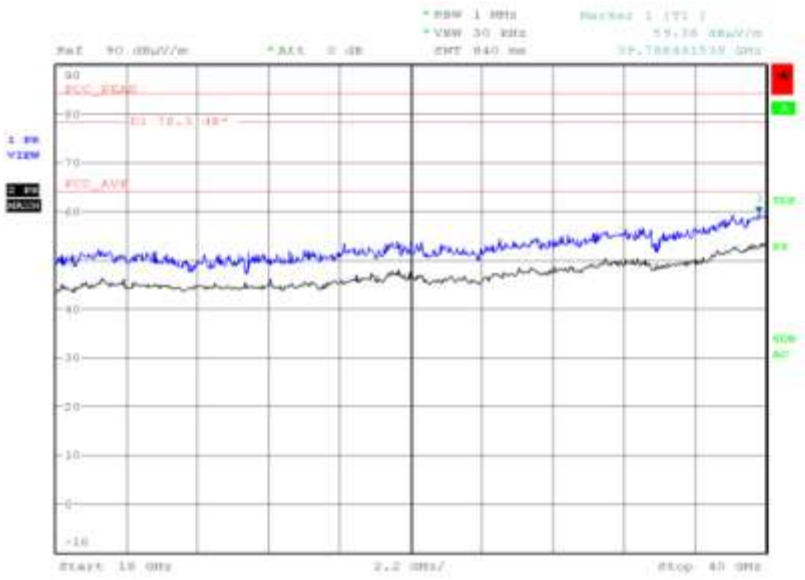


8 GHz to 18 GHz



Date: 5.JUN.2013 19:19:26

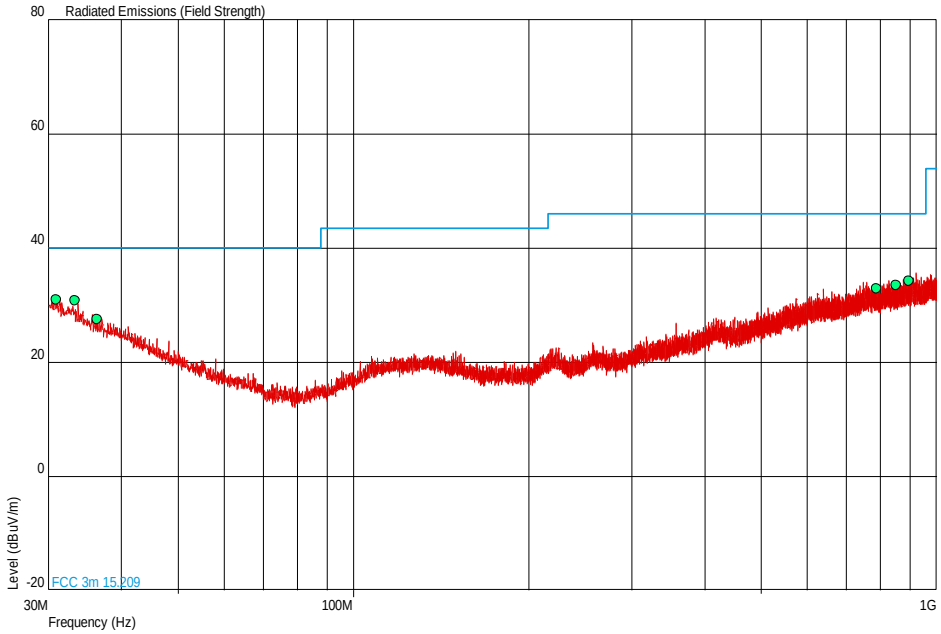
18 GHz to 40 GHz



Date: 9.JUN.2013 18:23:01

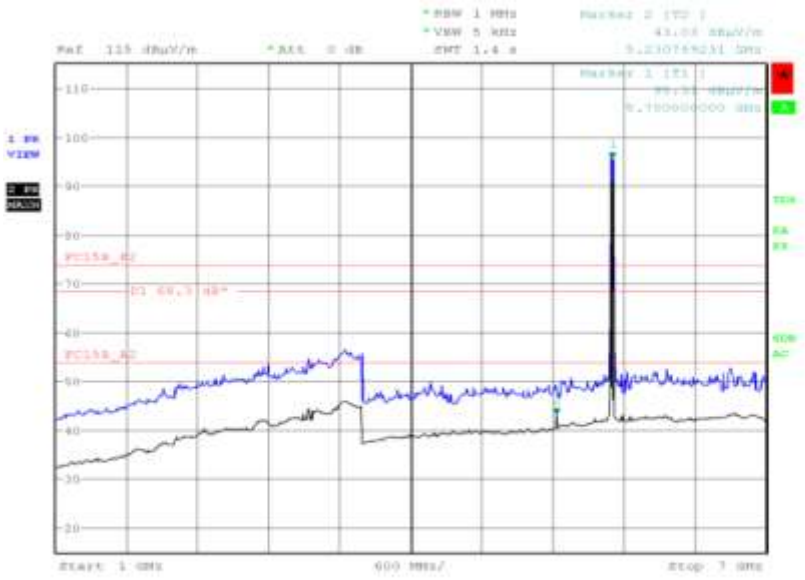
5700 MHz

30 MHz to 1 GHz



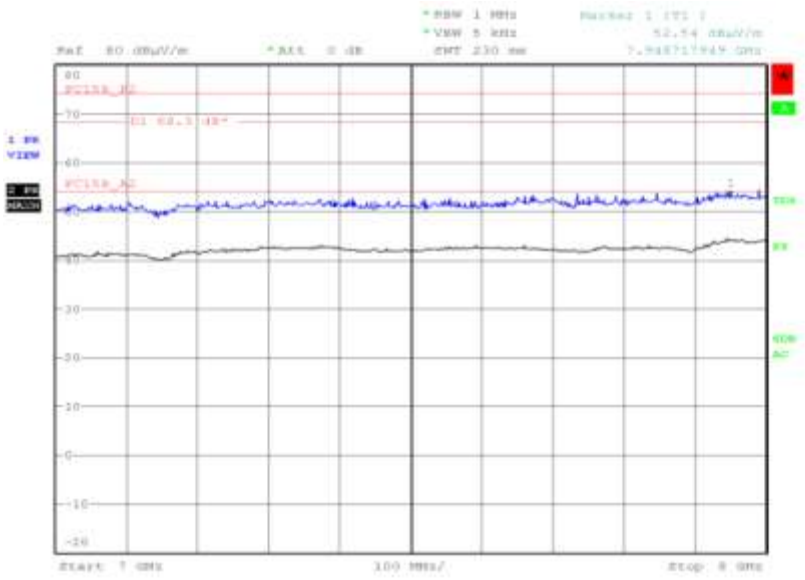
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.972	31.0	35.5	40.0	100	-9.0	64.5	180	1.00	Horizontal
33.347	30.8	34.7	40.0	100	-9.2	65.3	180	1.00	Horizontal
36.354	27.5	23.7	40.0	100	-12.5	76.3	0	1.00	Horizontal
789.995	32.9	44.2	46.0	200	-13.1	155.8	0	1.00	Horizontal
853.821	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Horizontal
897.617	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Horizontal

1 GHz to 7 GHz



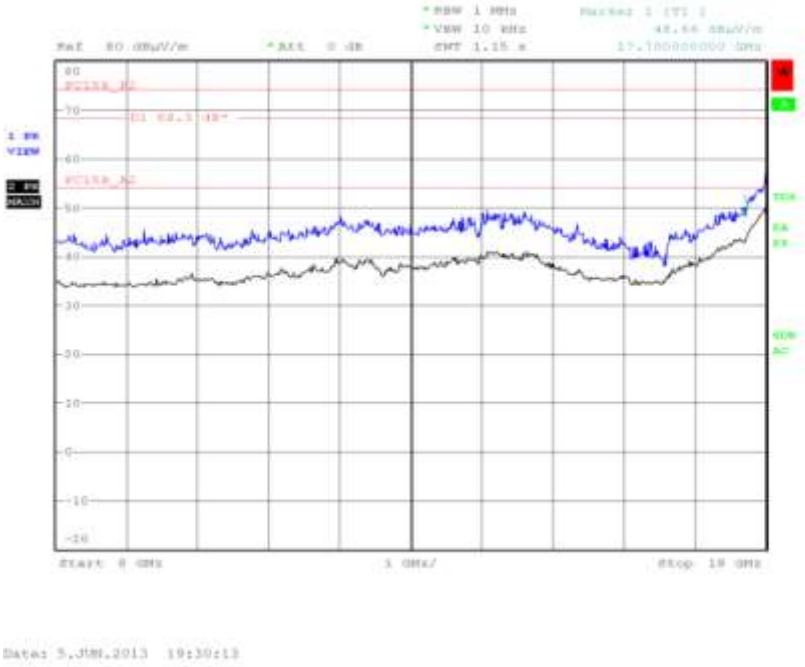
Date: 26.MAY.2013 08:43:29

7 GHz to 8 GHz

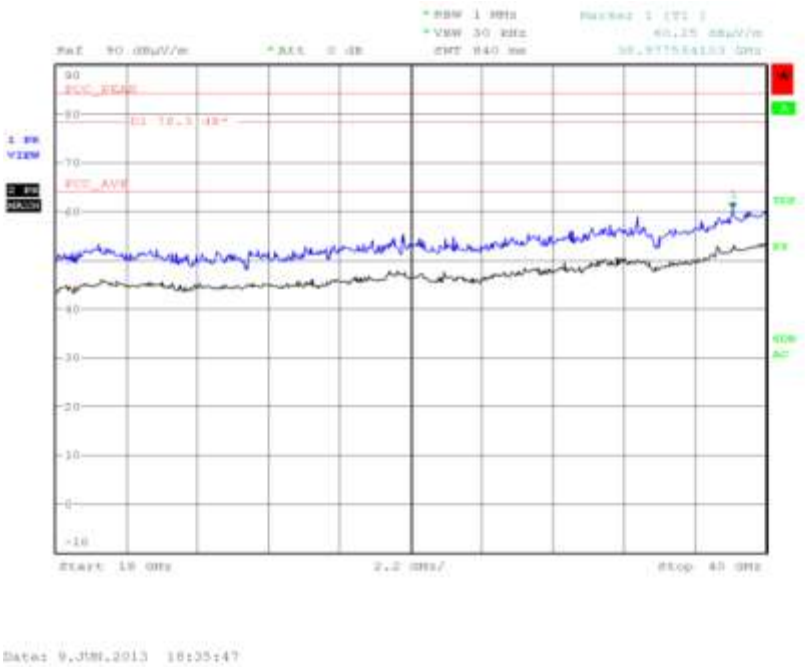


Date: 4.JUN.2013 22:54:16

8 GHz to 18 GHz



18 GHz to 40 GHz



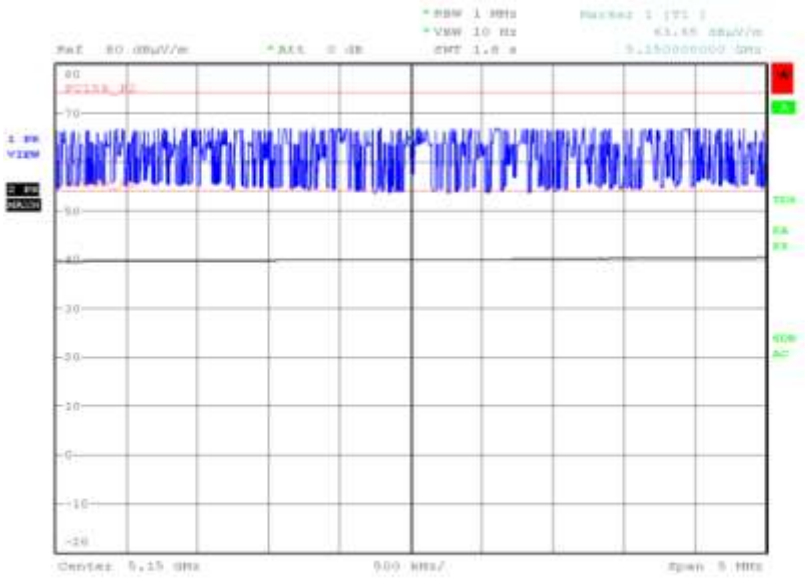
Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

Band Edge Emissions

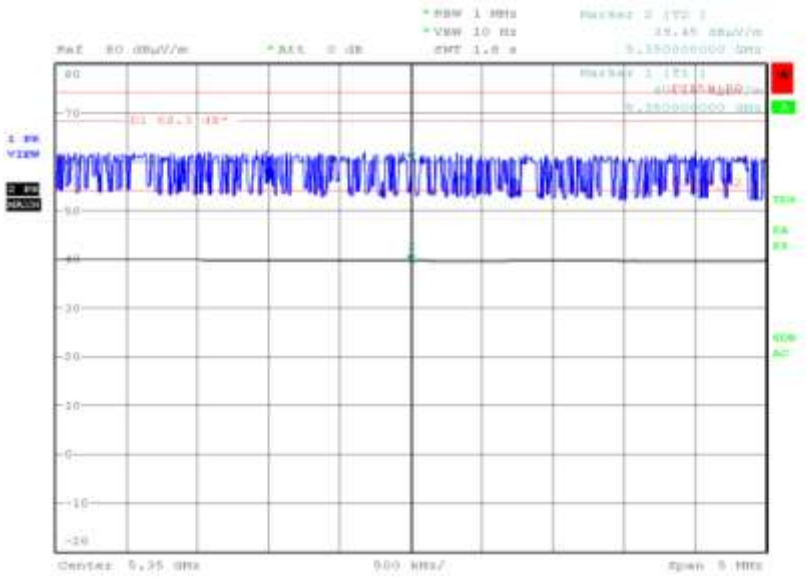
5180 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	63.65	40.05



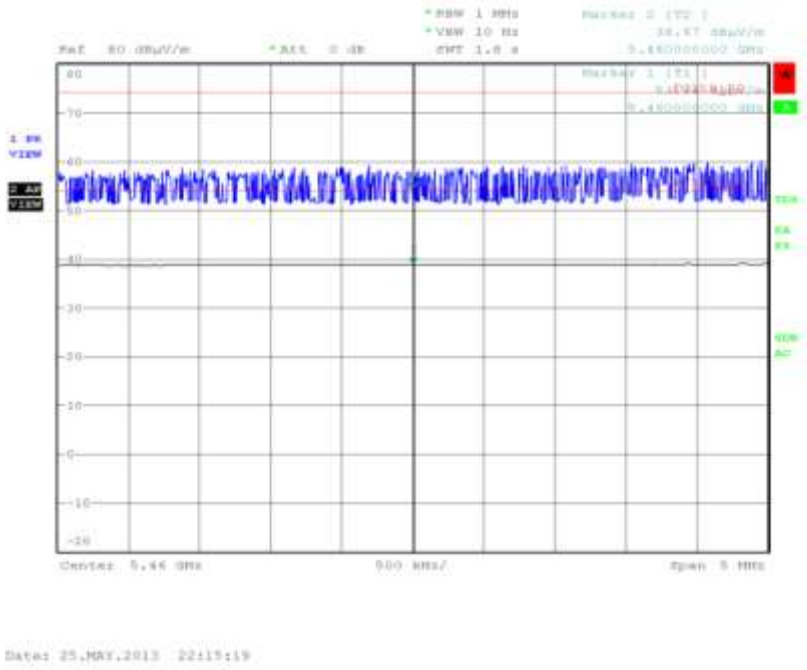
5320 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	60.10	39.45



5500 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	53.96	38.67



Limit

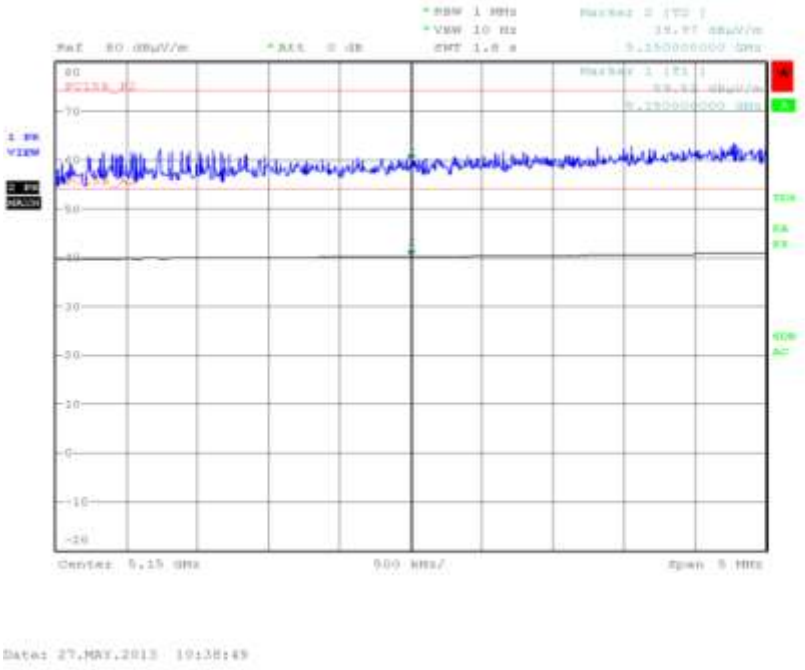
Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

802.11(ac) - 5 GHz 20 MHz BW

Band Edge Emissions

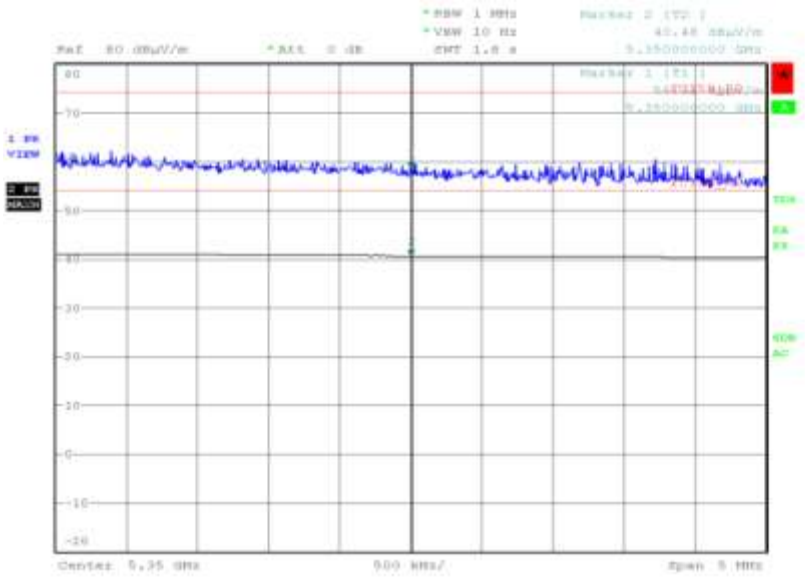
5180 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	59.52	39.37



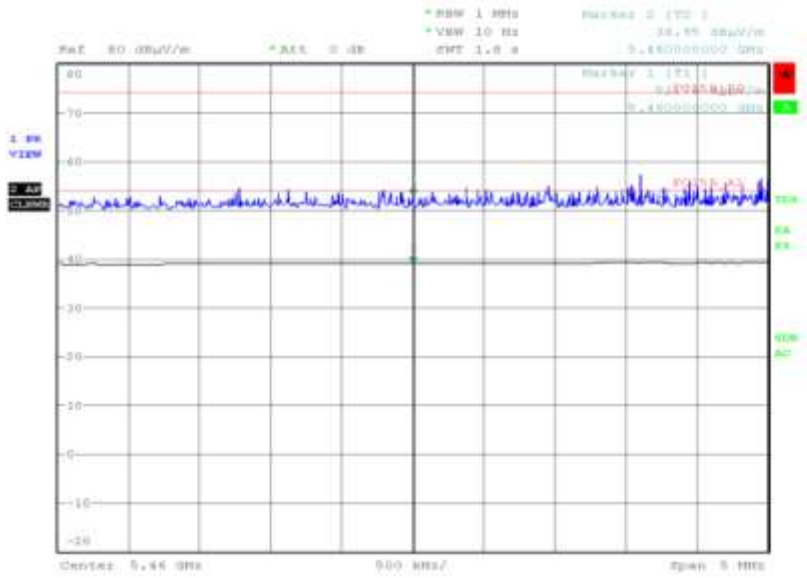
5320 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	58.32	40.48



5500 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Horizontal	52.70	38.95



Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

802.11(ac) - 5 GHz 40 MHz BW

4.0 V DC Supply

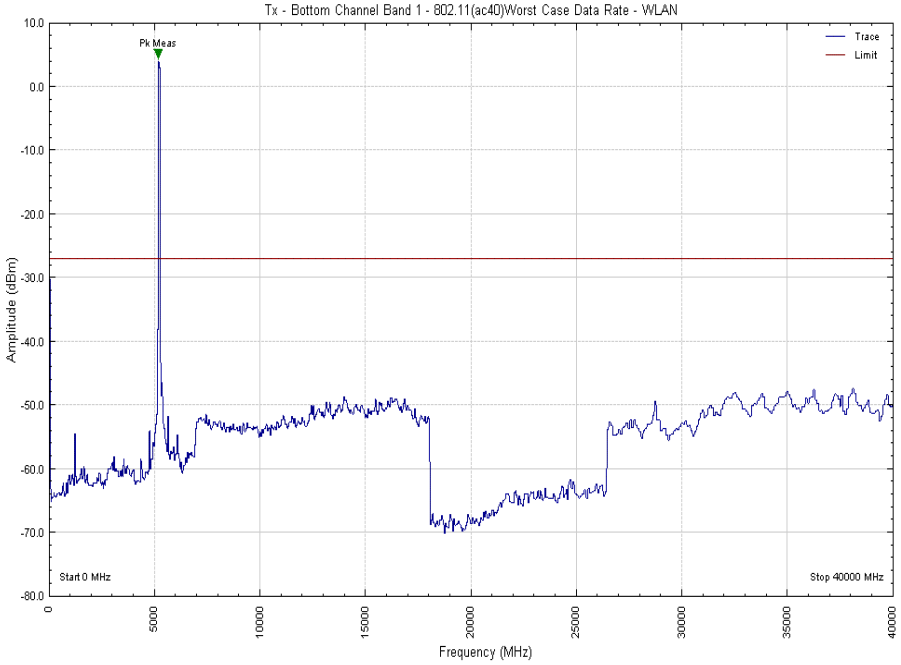
Spurious Conducted Emissions

7.20 Mbps

Frequency Band 1

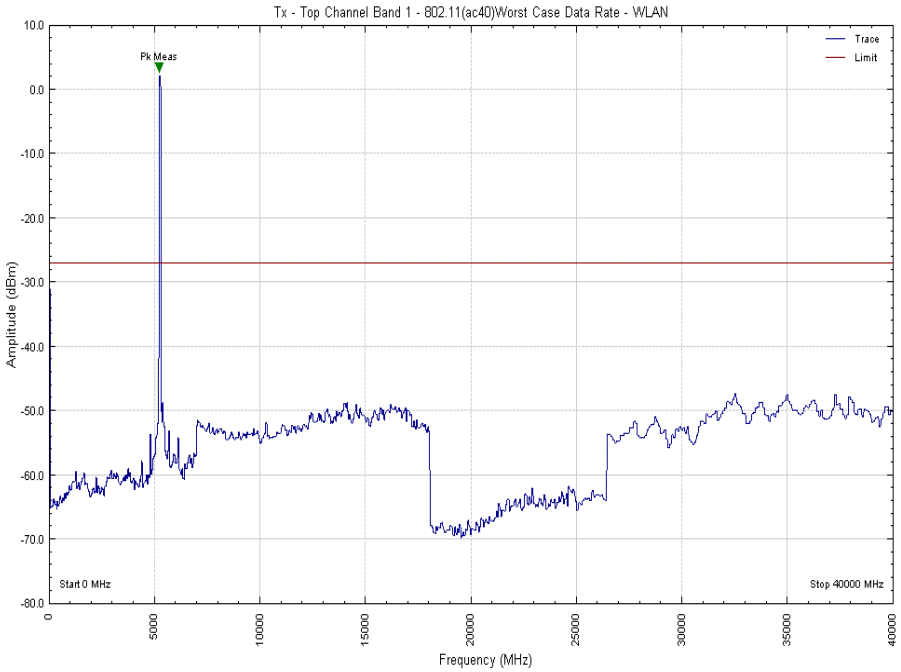
5190 MHz

9 kHz to 40 GHz



5230 MHz

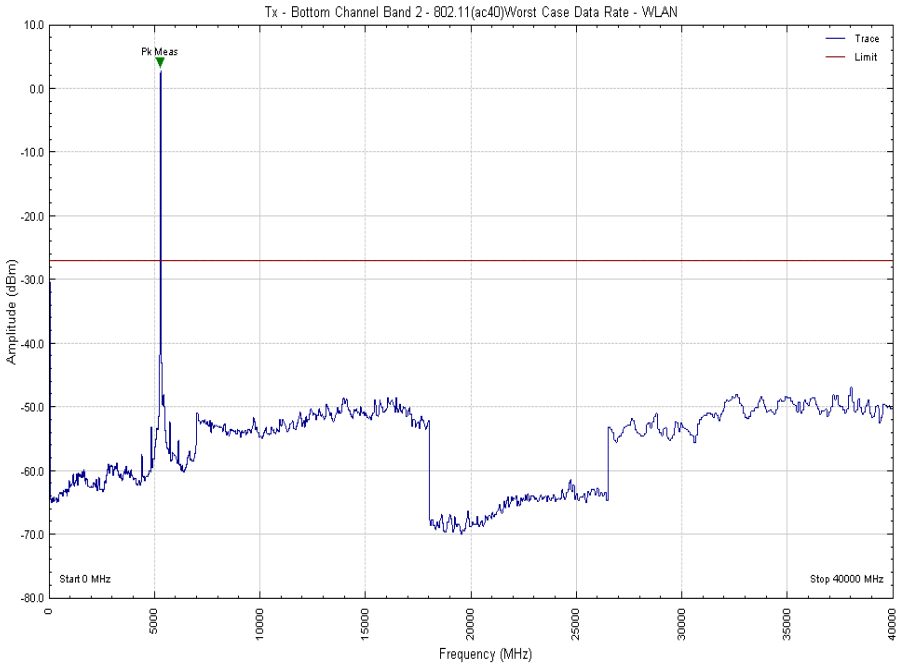
9 kHz to 40 GHz



Frequency Band 2

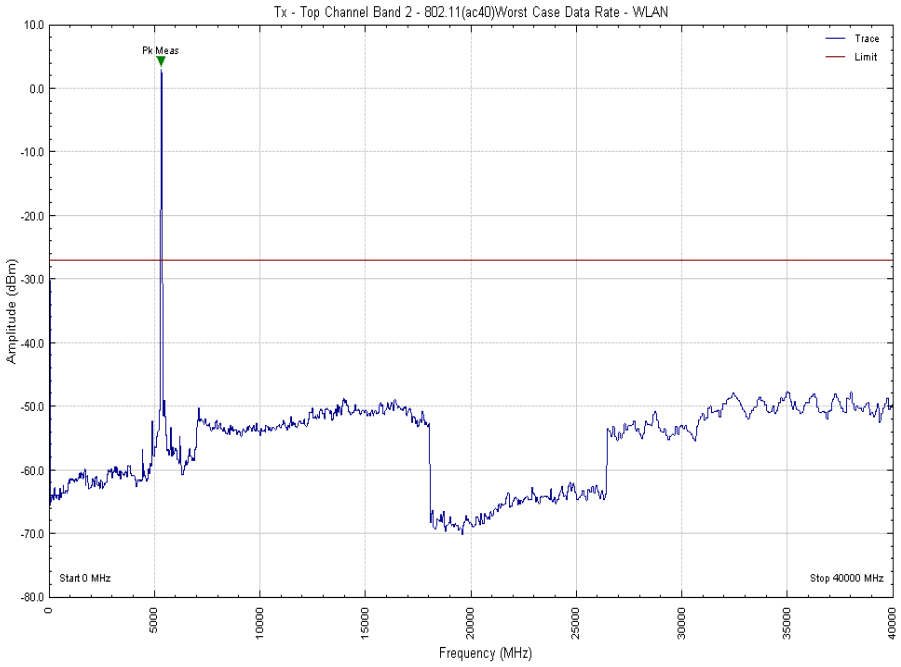
5270 MHz

9 kHz to 40 GHz



5310 MHz

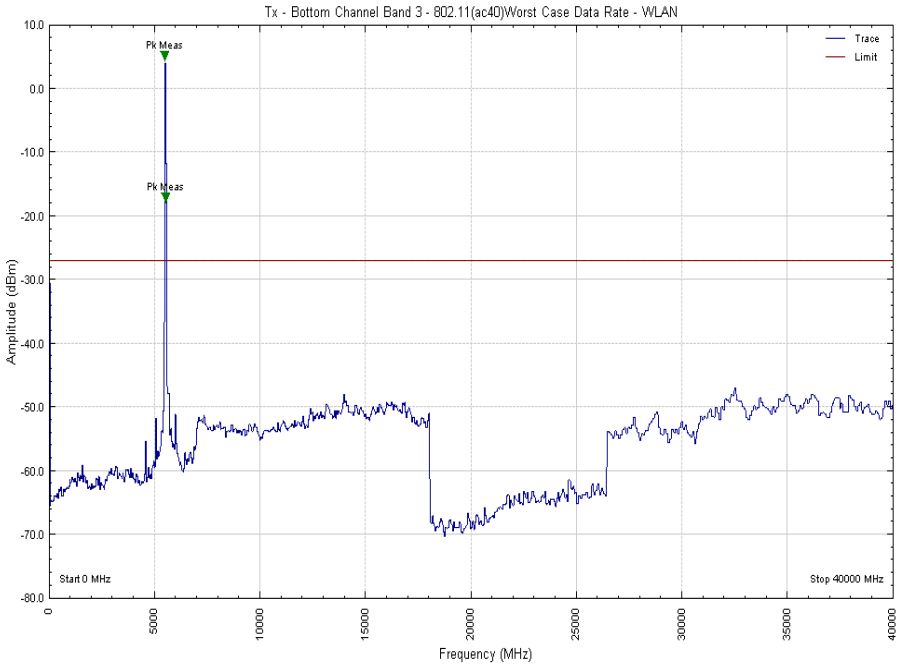
9 kHz to 40 GHz



Frequency Band 3

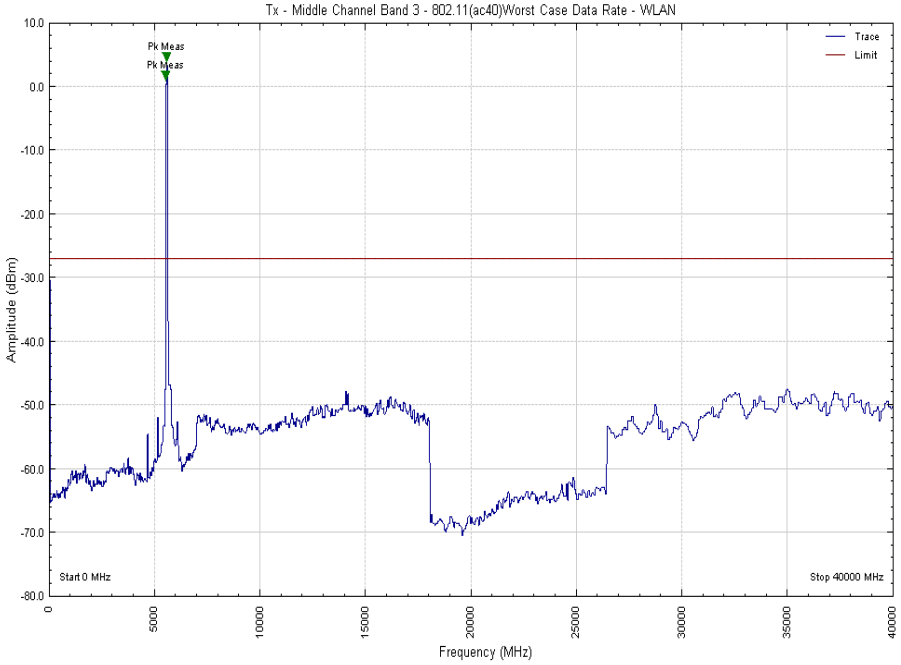
5510 MHz

9 kHz to 40 GHz



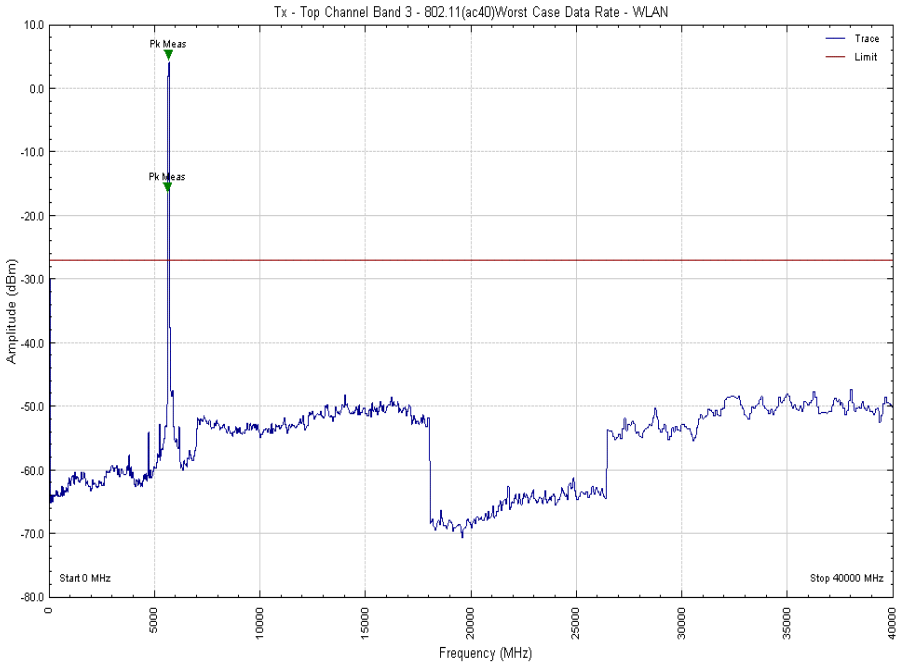
5590 MHz

9 kHz to 40 GHz



5670 MHz

9 kHz to 40 GHz



Limit Clause

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

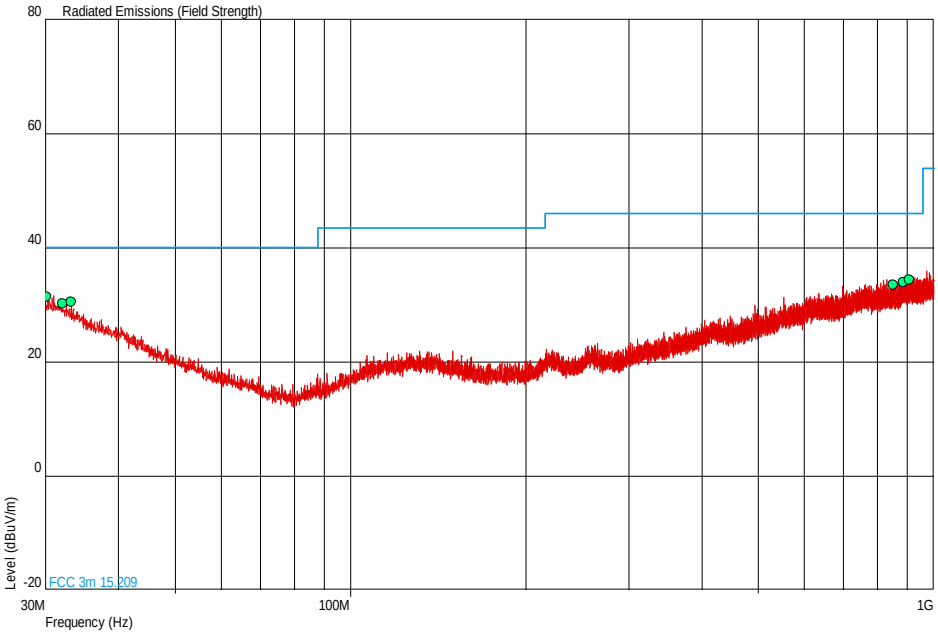
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.

Spurious Radiated Emissions

Frequency Band 1

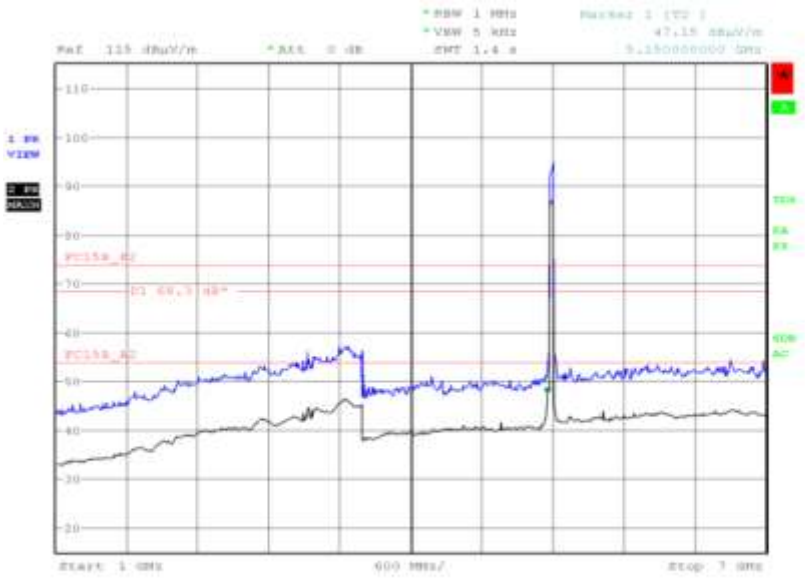
5190 MHz

30 MHz to 1 GHz



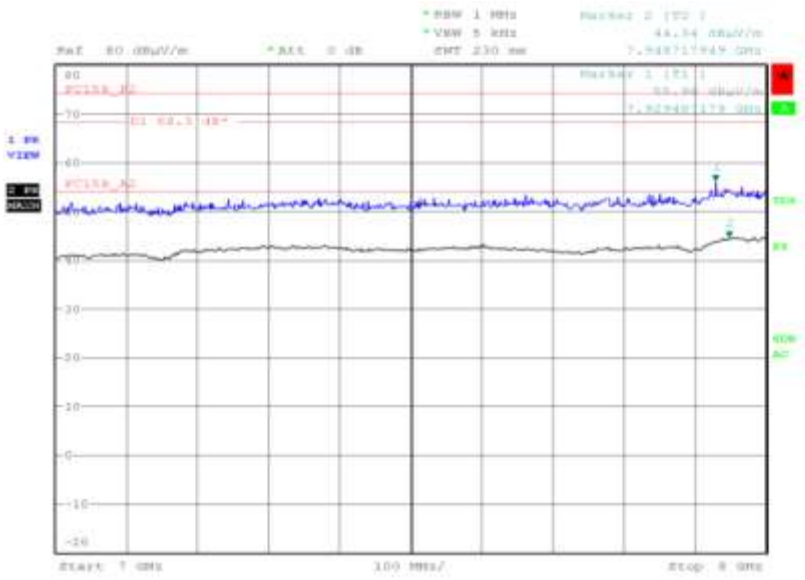
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.194	31.5	37.6	40.0	100	-8.5	62.4	0	1.00	Horizontal
32.183	30.3	32.7	40.0	100	-9.7	67.3	180	1.00	Horizontal
33.250	30.5	33.5	40.0	100	-9.5	66.5	180	1.00	Horizontal
852.706	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Horizontal
886.365	33.9	49.5	46.0	200	-12.1	150.5	180	1.00	Vertical
909.742	34.4	52.5	46.0	200	-11.6	147.5	0	1.00	Vertical

1 GHz to 7 GHz



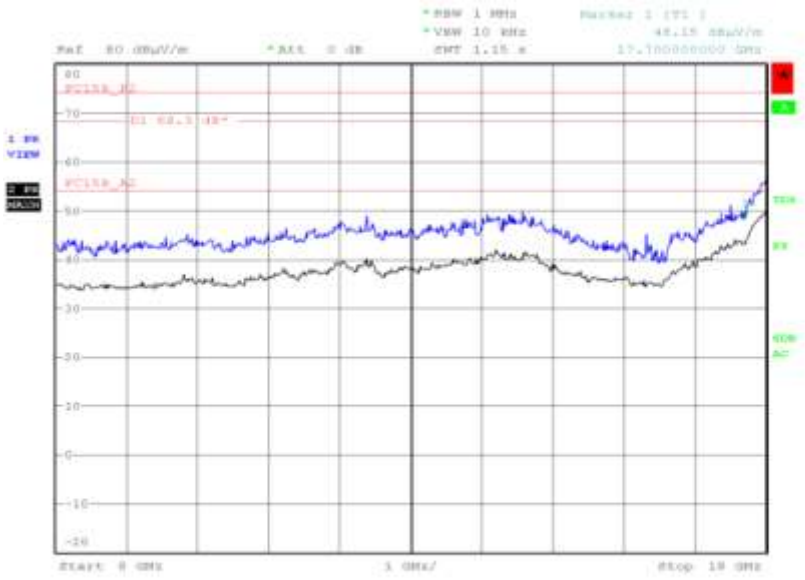
Date: 29.MAY.2013 17:36:52

7 GHz to 8 GHz



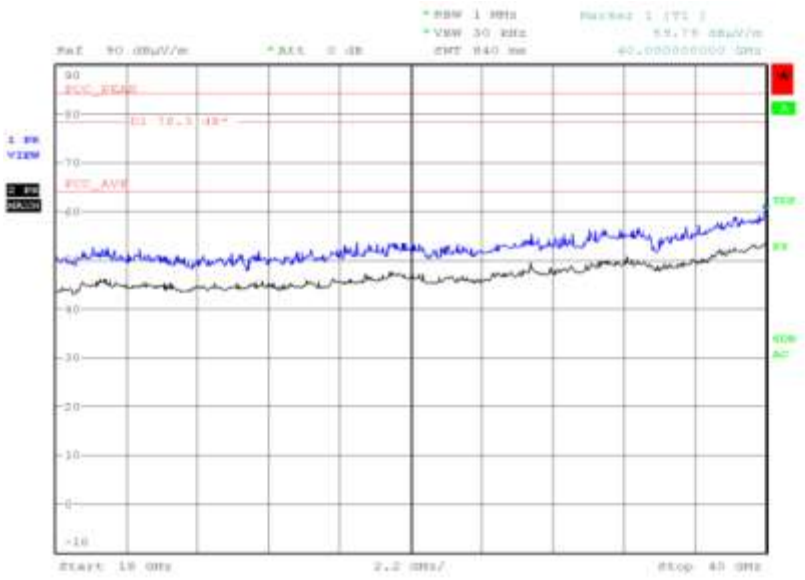
Date: 29.MAY.2013 22:04:07

8 GHz to 18 GHz



Date: 5.JUN.2013 21:22:02

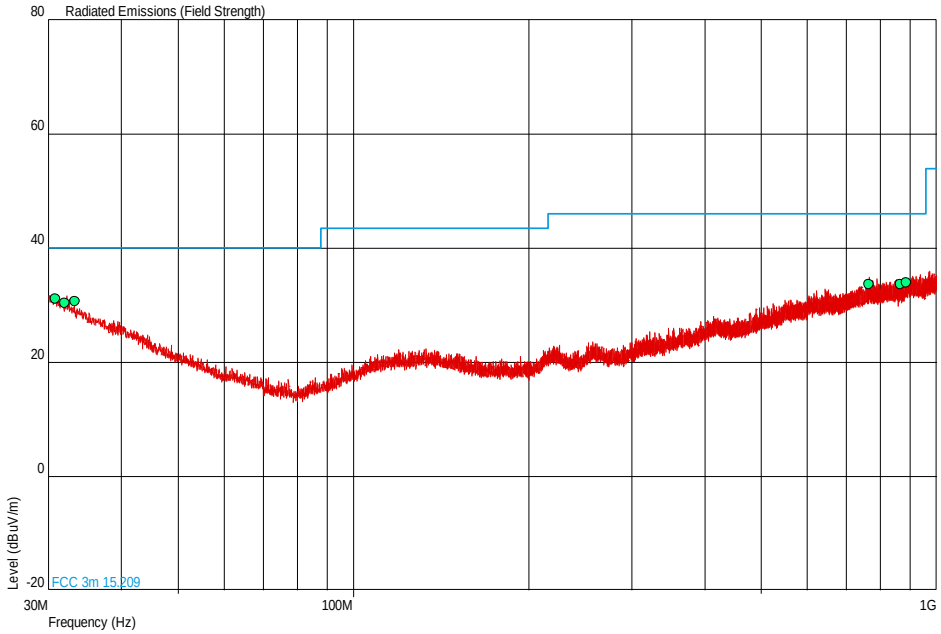
18 GHz to 40 GHz



Date: 9.JUN.2013 20:19:52

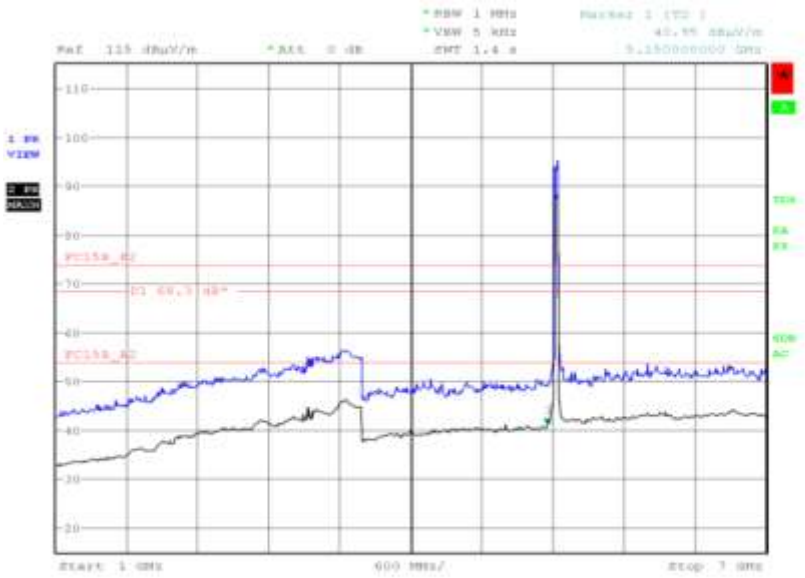
5230 MHz

30 MHz to 1 GHz



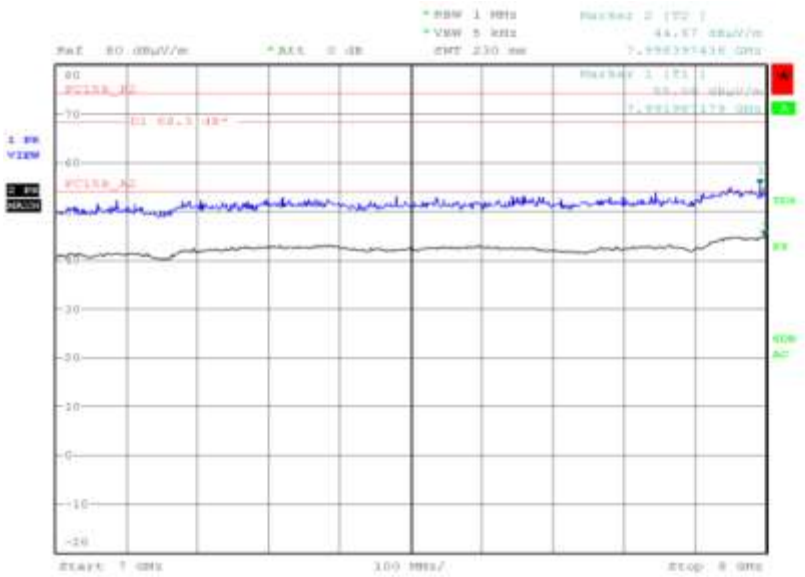
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.825	31.1	35.9	40.0	100	-8.9	64.1	90	1.00	Vertical
31.989	30.3	32.7	40.0	100	-9.7	67.3	90	1.00	Vertical
33.347	30.7	34.3	40.0	100	-9.3	65.7	45	1.00	Horizontal
764.436	33.7	48.4	46.0	200	-12.3	151.6	315	1.00	Horizontal
865.655	33.7	48.4	46.0	200	-12.3	151.6	90	1.00	Horizontal
886.462	33.9	49.5	46.0	200	-12.1	150.5	45	1.00	Horizontal

1 GHz to 7 GHz



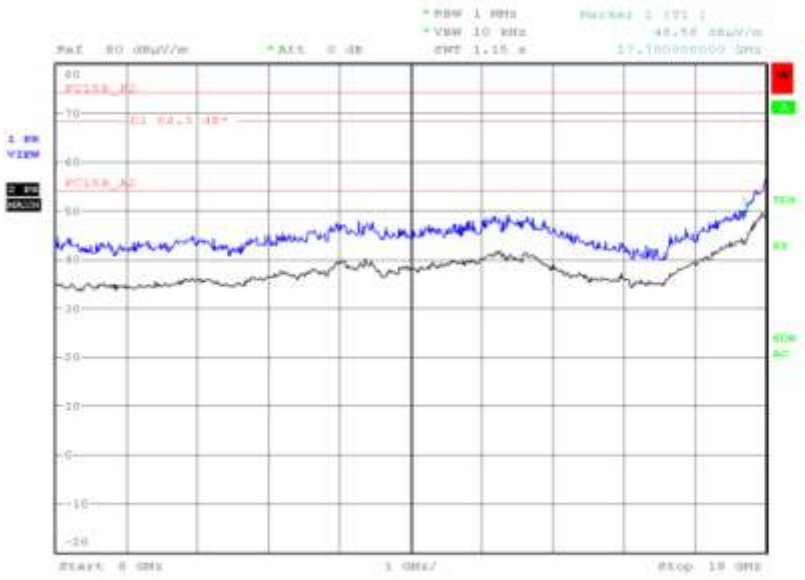
Date: 29.MAY.2013 17:59:24

7 GHz to 8 GHz



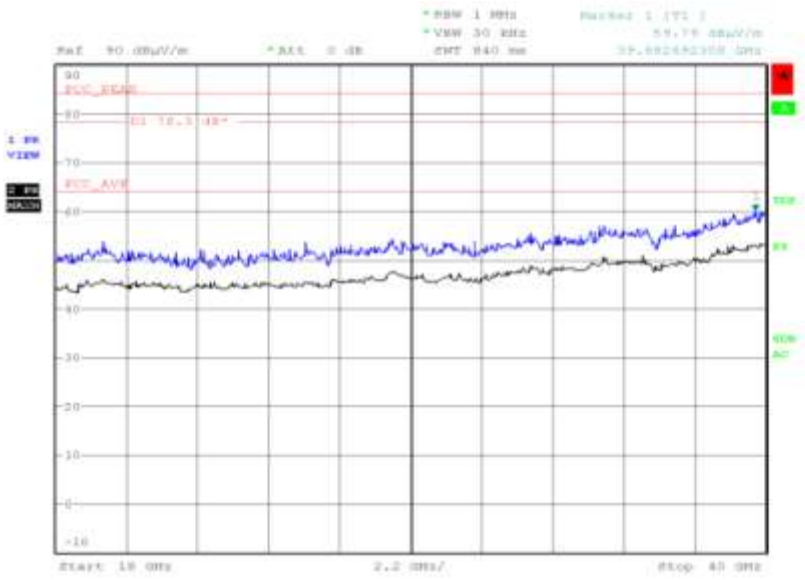
Date: 29.MAY.2013 22:08:42

8 GHz to 18 GHz



Date: 5.JUN.2013 21:56:44

18 GHz to 40 GHz

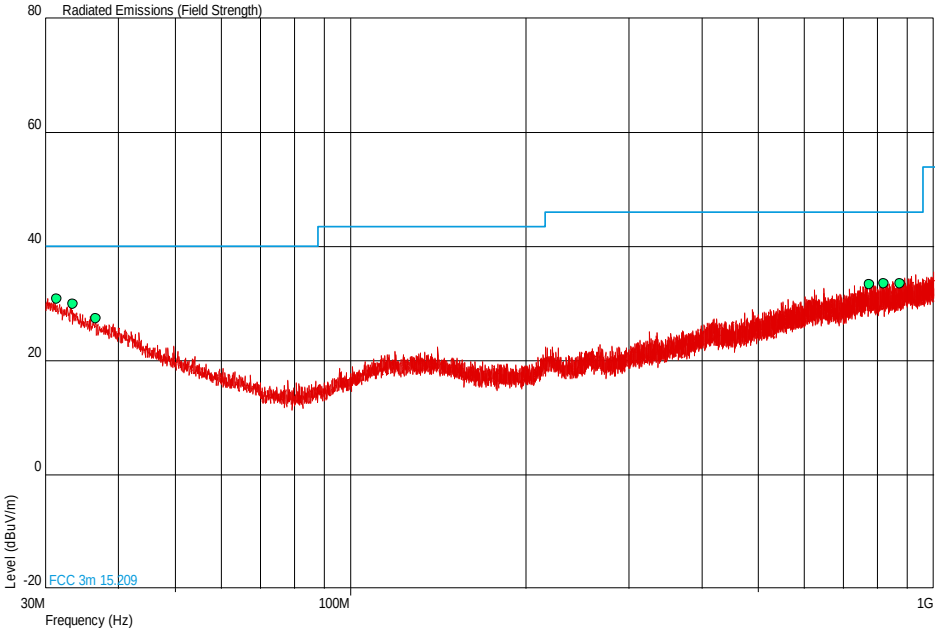


Date: 9.JUN.2013 20:29:42

Frequency Band 2

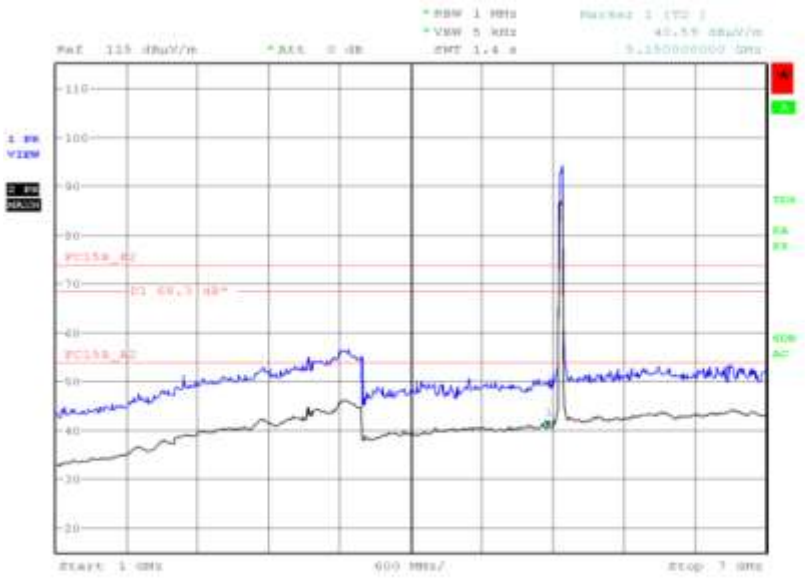
5270 MHz

30 MHz to 1 GHz



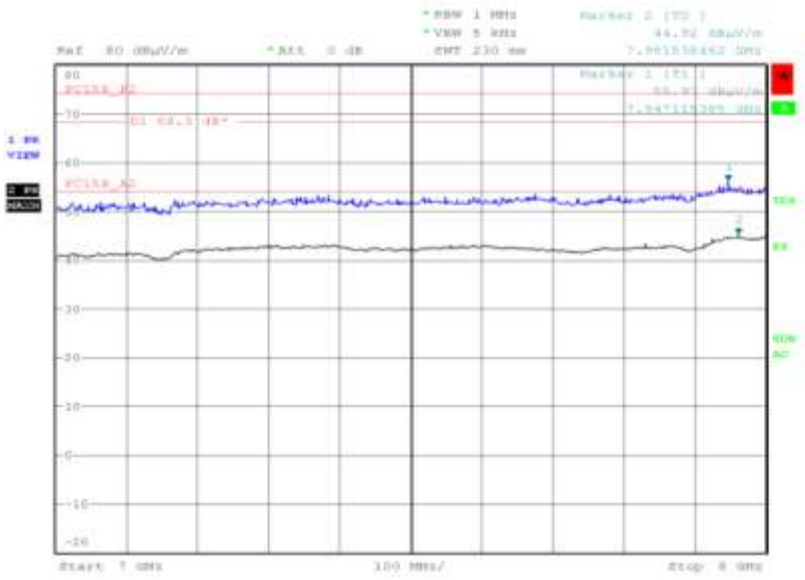
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.369	30.8	34.7	40.0	100	-9.2	65.3	0	0.00	Horizontal
33.434	29.9	31.3	40.0	100	-10.1	68.7	0	0.00	Horizontal
36.693	27.4	23.4	40.0	100	-12.6	76.6	180	1.00	Vertical
774.912	33.3	46.2	46.0	200	-12.7	153.8	0	1.00	Vertical
820.744	33.5	47.3	46.0	200	-12.5	152.7	180	1.00	Vertical
875.307	33.5	47.3	46.0	200	-12.5	152.7	180	1.00	Vertical

1 GHz to 7 GHz



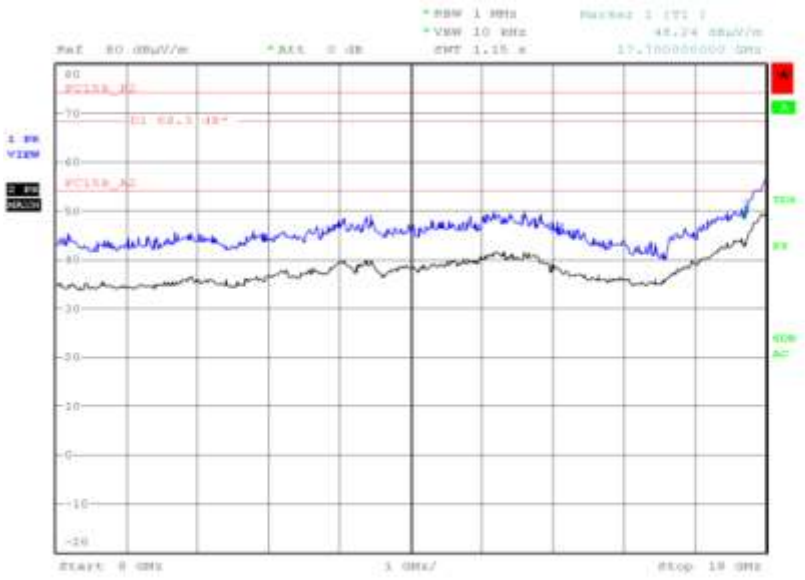
Date: 29.MAY.2013 19:09:18

7 GHz to 8 GHz



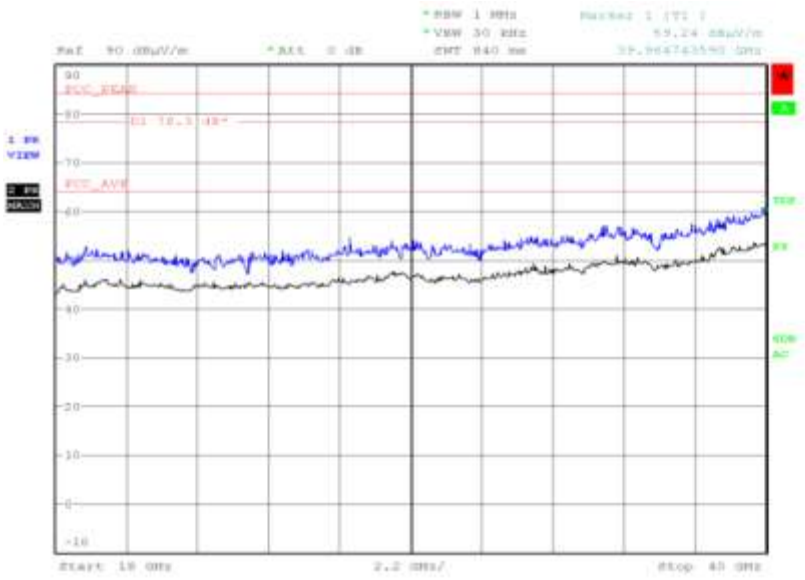
Date: 29.MAY.2013 22:20:05

8 GHz to 18 GHz



Date: 5.JUN.2013 21:55:09

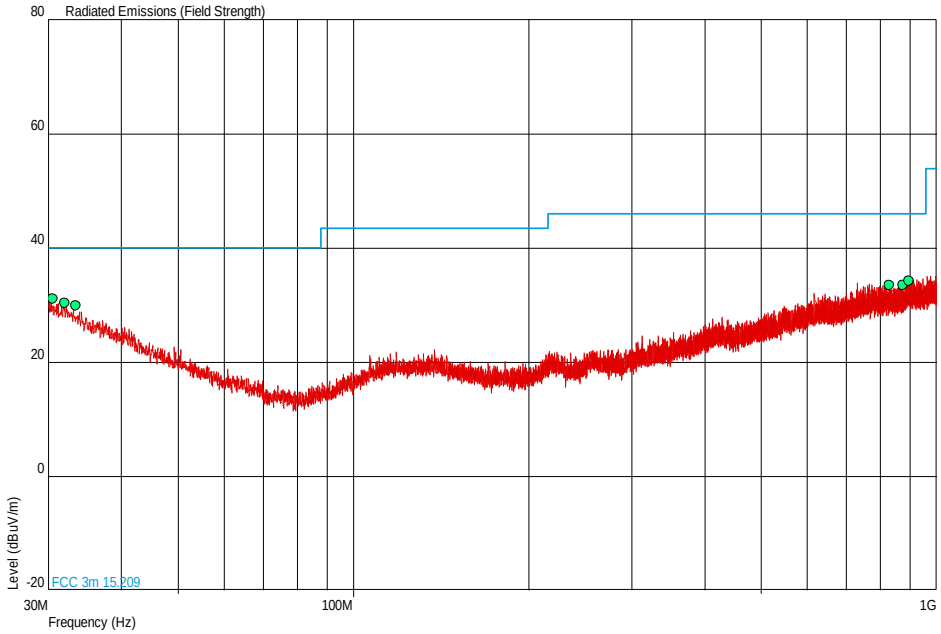
18 GHz to 40 GHz



Date: 9.JUN.2013 20:41:04

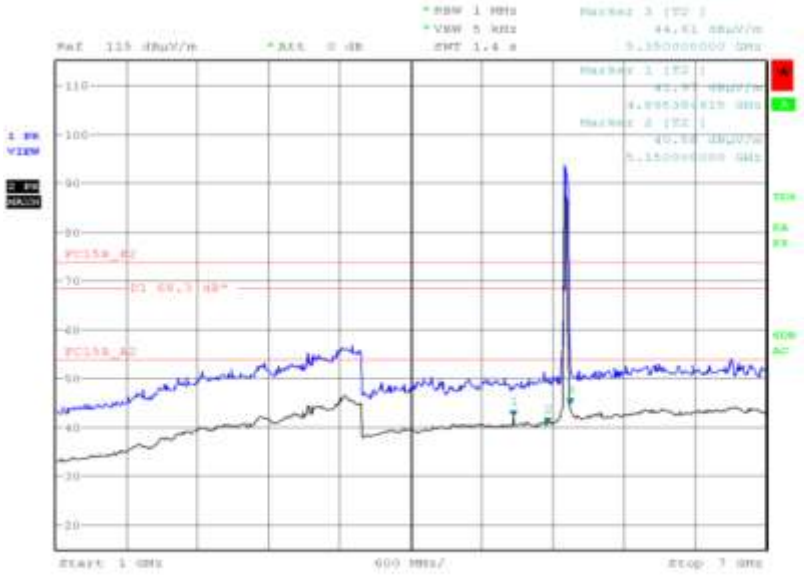
5310 MHz

30 MHz to 1 GHz



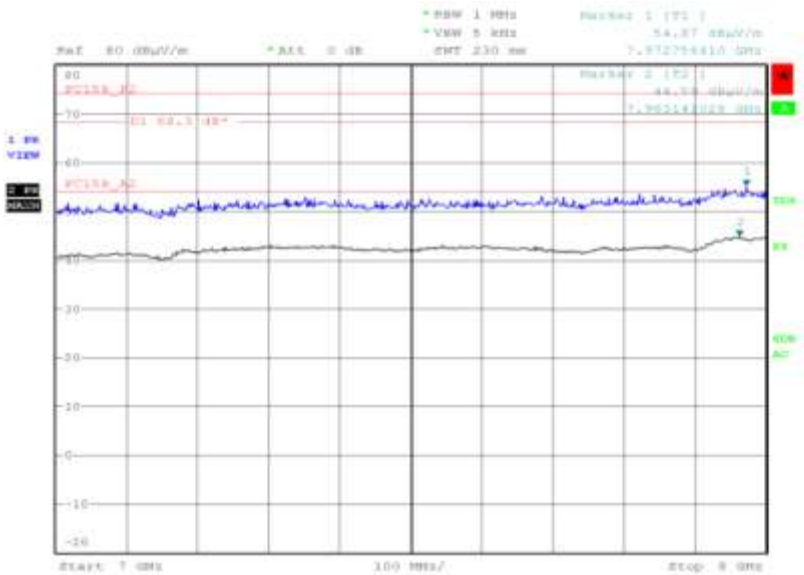
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.582	31.1	35.9	40.0	100	-8.9	64.1	0	1.00	Vertical
31.989	30.3	32.7	40.0	100	-9.7	67.3	180	1.00	Vertical
33.444	29.9	31.3	40.0	100	-10.1	68.7	180	1.00	Vertical
831.269	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Vertical
874.773	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Vertical
897.374	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Vertical

1 GHz to 7 GHz



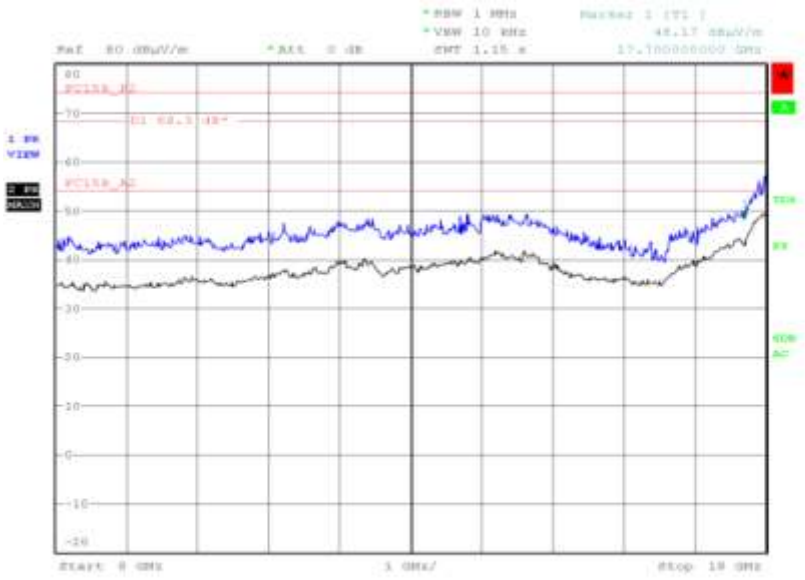
Date: 29.MAY.2013 19:31:42

7 GHz to 8 GHz



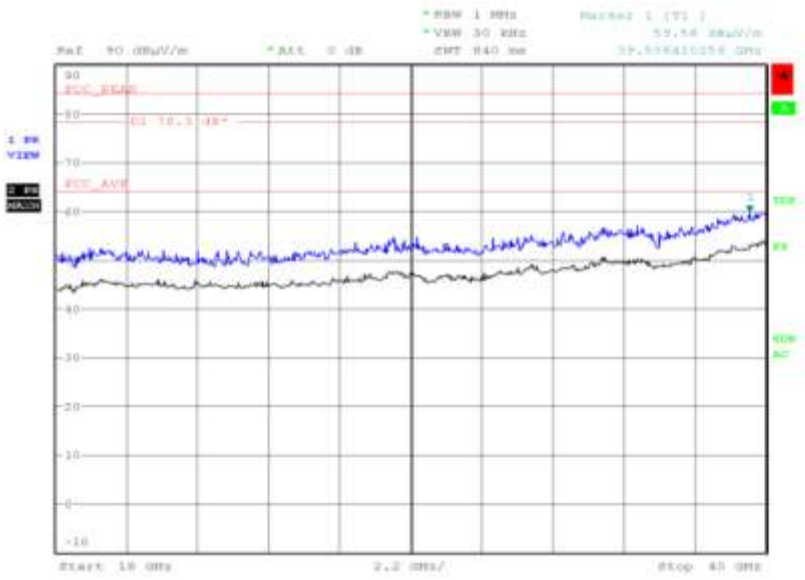
Date: 29.MAY.2013 22:24:30

8 GHz to 18 GHz



Date: 5.JUN.2013 22:05:42

18 GHz to 40 GHz

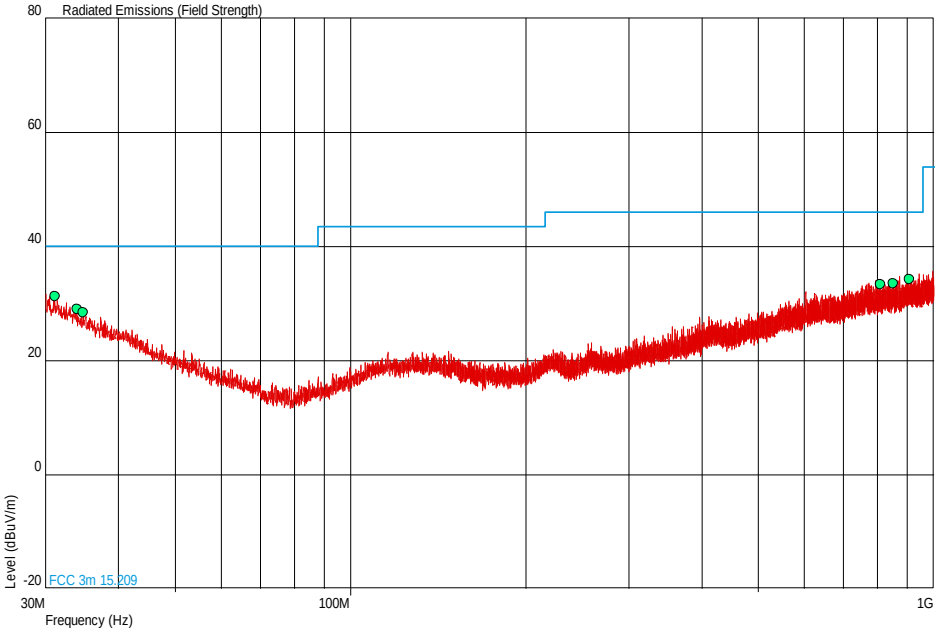


Date: 9.JUN.2013 20:50:58

Frequency Band 3

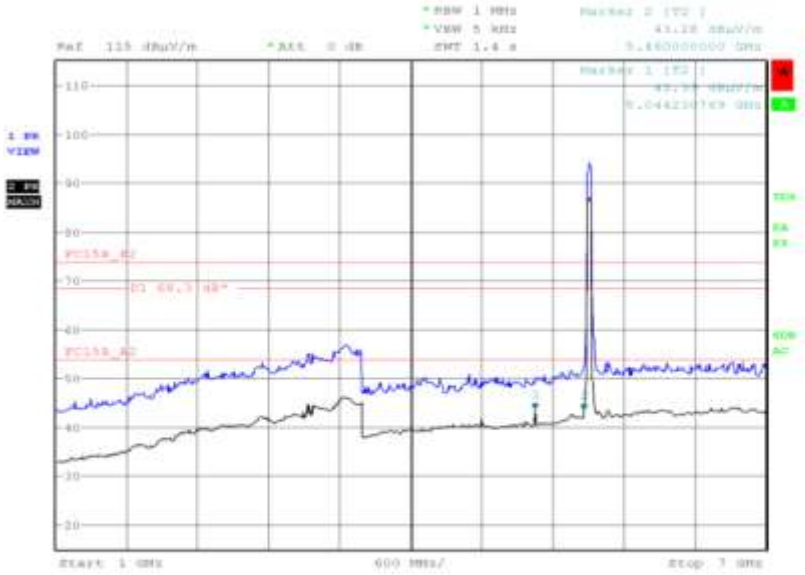
5510 MHz

30 MHz to 1 GHz



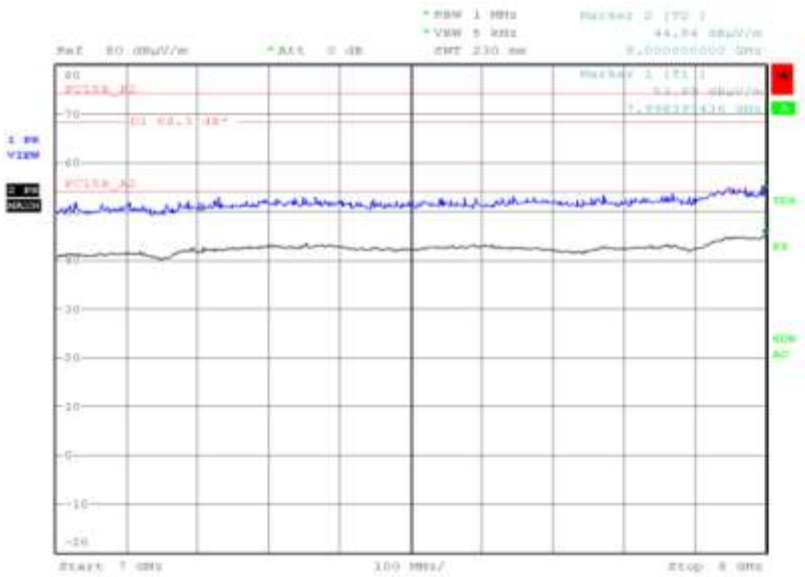
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.170	31.3	36.7	40.0	100	-8.7	63.3	0	0.00	Horizontal
33.977	29.1	28.5	40.0	100	-10.9	71.5	0	1.00	Vertical
34.850	28.4	26.3	40.0	100	-11.6	73.7	180	1.00	Vertical
810.511	33.3	46.2	46.0	200	-12.7	153.8	0	1.00	Vertical
852.706	33.5	47.3	46.0	200	-12.5	152.7	180	1.00	Vertical
908.966	34.3	51.9	46.0	200	-11.7	148.1	0	1.00	Vertical

1 GHz to 7 GHz



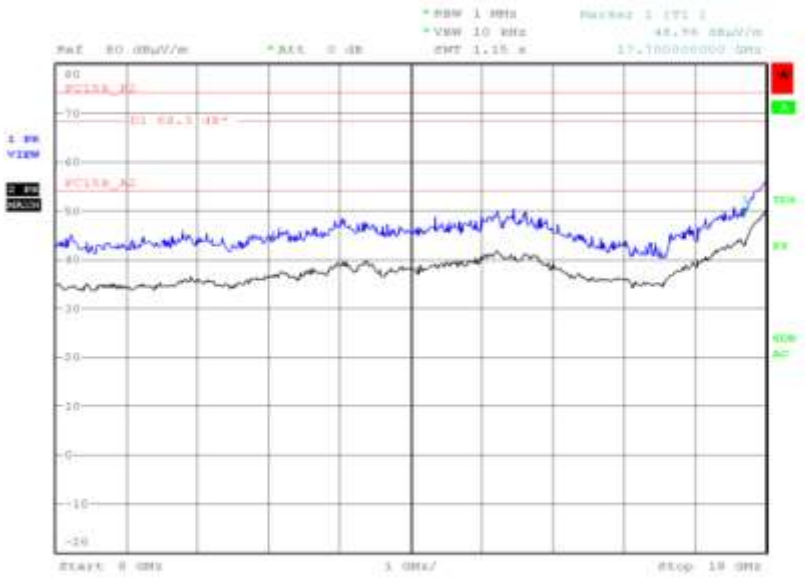
Date: 29.MAY.2013 20:30:17

7 GHz to 8 GHz



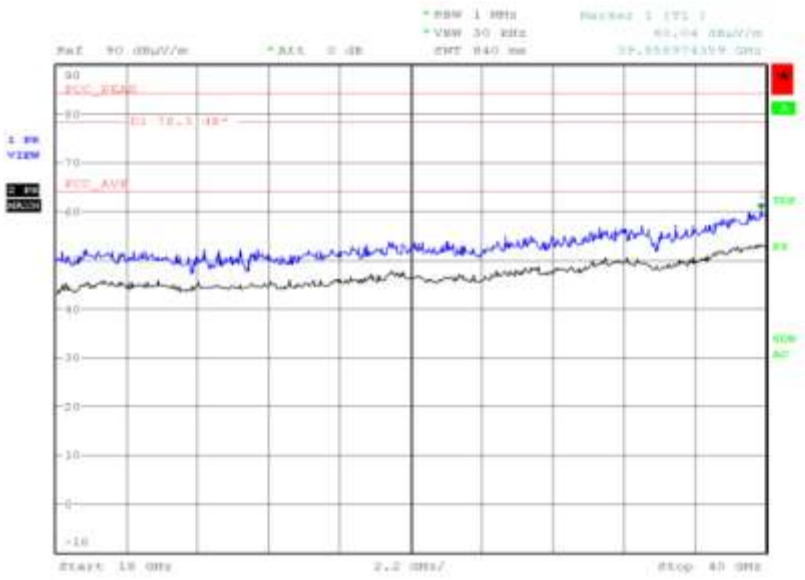
Date: 29.MAY.2013 22:32:48

8 GHz to 18 GHz



Date: 5.JUN.2013 22:21:16

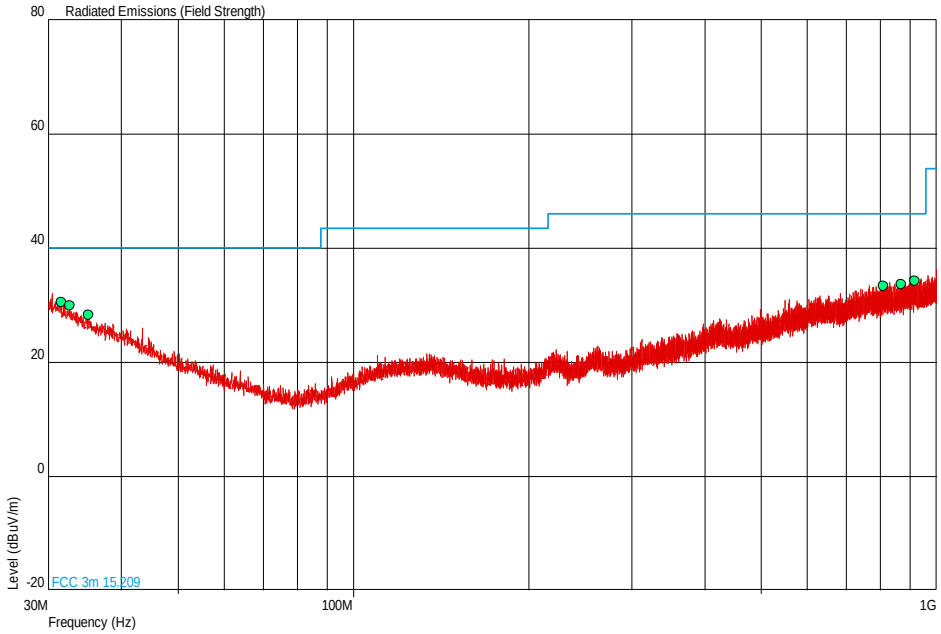
18 GHz to 40 GHz



Date: 9.JUN.2013 19:42:16

5590 MHz

30 MHz to 1 GHz

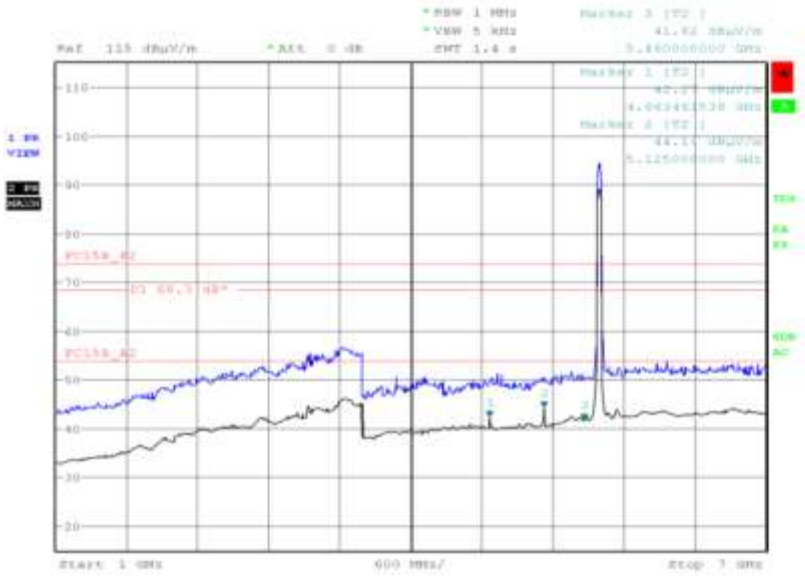


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.649	30.5	33.5	40.0	100	-9.5	66.5	180	1.00	Vertical
32.716	30.0	31.6	40.0	100	-10.0	68.4	0	1.00	Vertical
35.141	28.2	25.7	40.0	100	-11.8	74.3	0	1.00	Vertical
811.335	33.4	46.8	46.0	200	-12.6	153.2	180	1.00	Vertical
870.990	33.6	47.9	46.0	200	-12.4	152.1	0	1.00	Vertical
918.860	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Vertical

1GHz to 40GHz

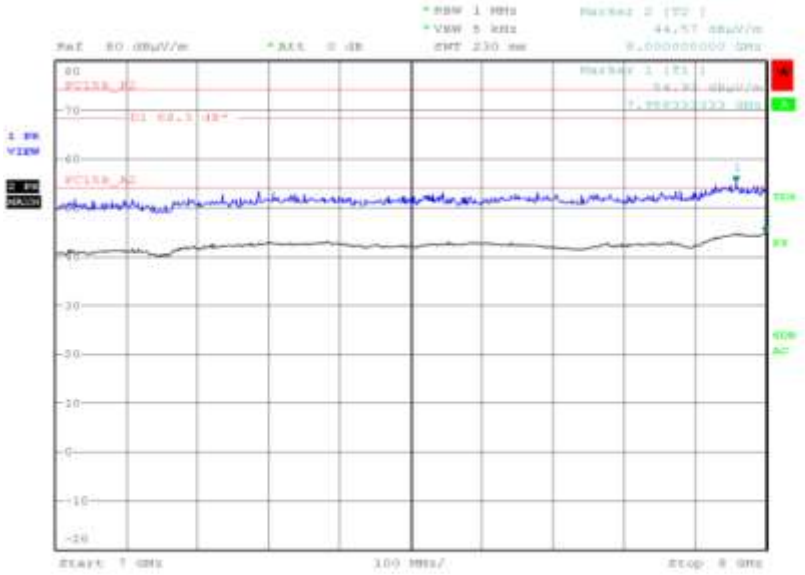
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
5.125	Vertical	110	238	53.66	43.70

1 GHz to 7 GHz



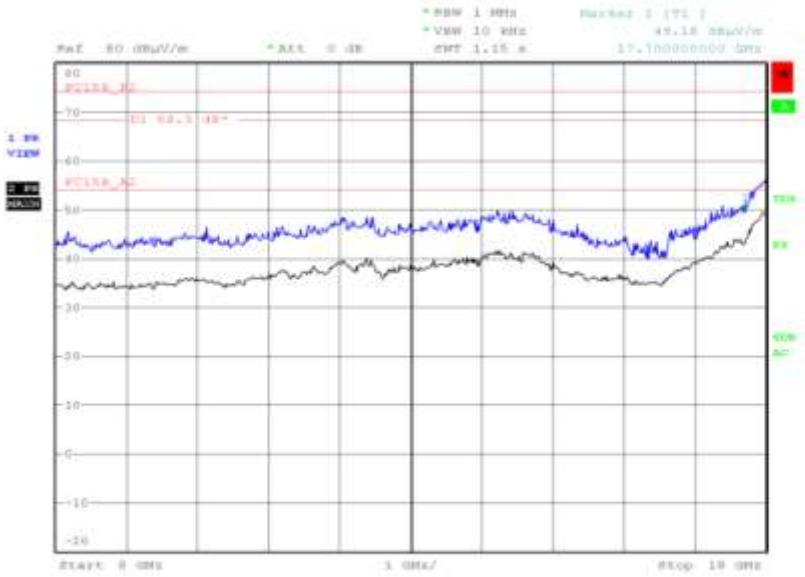
Date: 29.MAY.2013 20:45:14

7 GHz to 8 GHz



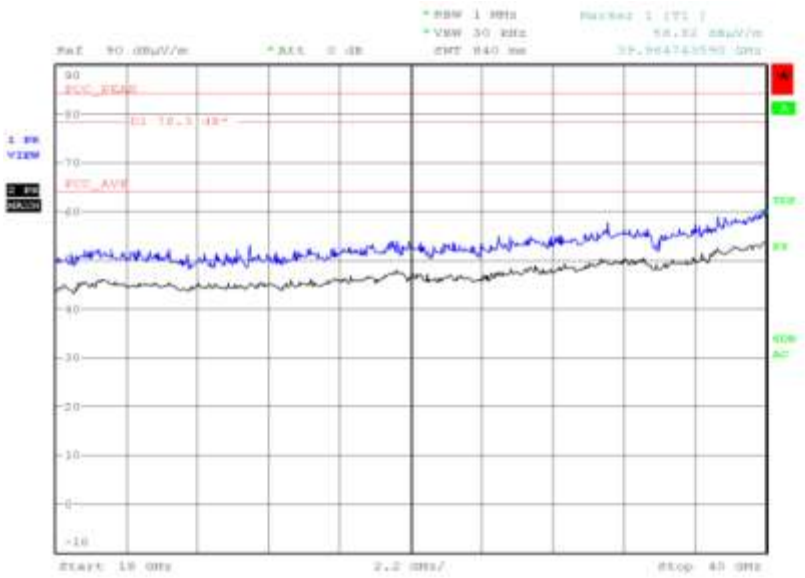
Date: 29.MAY.2013 22:37:51

8 GHz to 18 GHz



Date: 5.JUN.2013 23:31:12

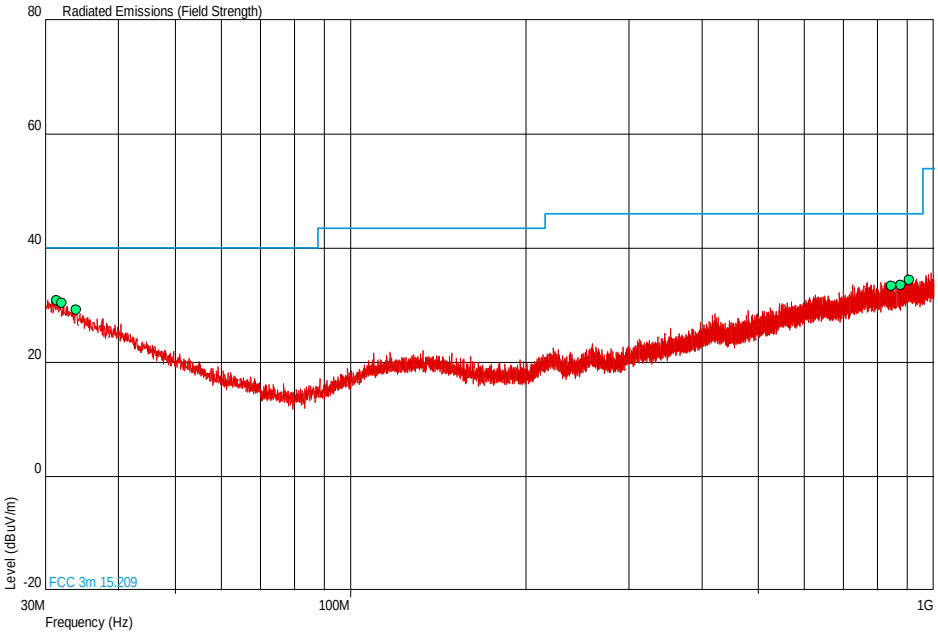
18 GHz to 40 GHz



Date: 9.JUN.2013 19:56:51

5670 MHz

30 MHz to 1 GHz

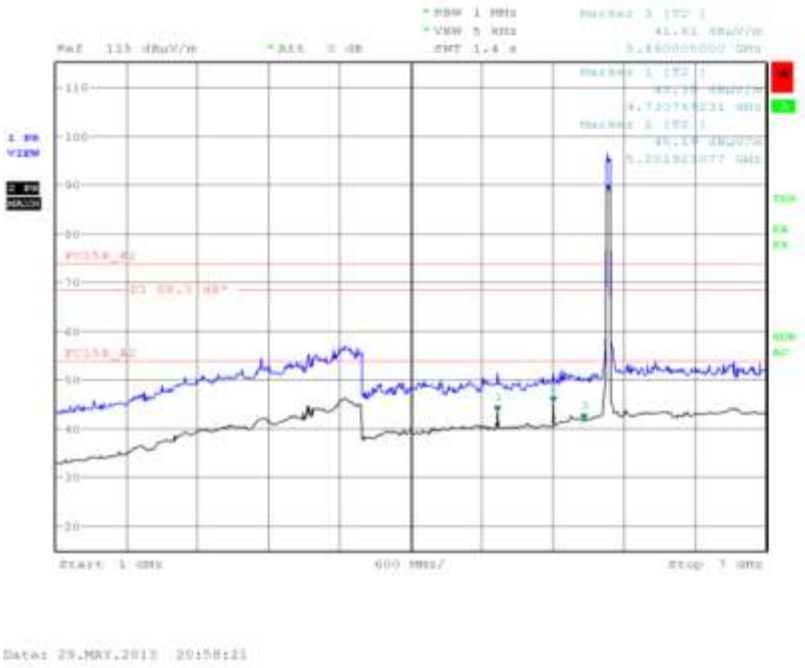


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.358	30.9	35.1	40.0	100	-9.1	64.9	0	1.00	Horizontal
31.989	30.4	33.1	40.0	100	-9.6	66.9	0	1.00	Vertical
33.880	29.1	28.5	40.0	100	-10.9	71.5	0	1.00	Horizontal
847.807	33.3	46.2	46.0	200	-12.7	153.8	0	1.00	Vertical
877.247	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Horizontal
909.305	34.4	52.5	46.0	200	-11.6	147.5	180	1.00	Vertical

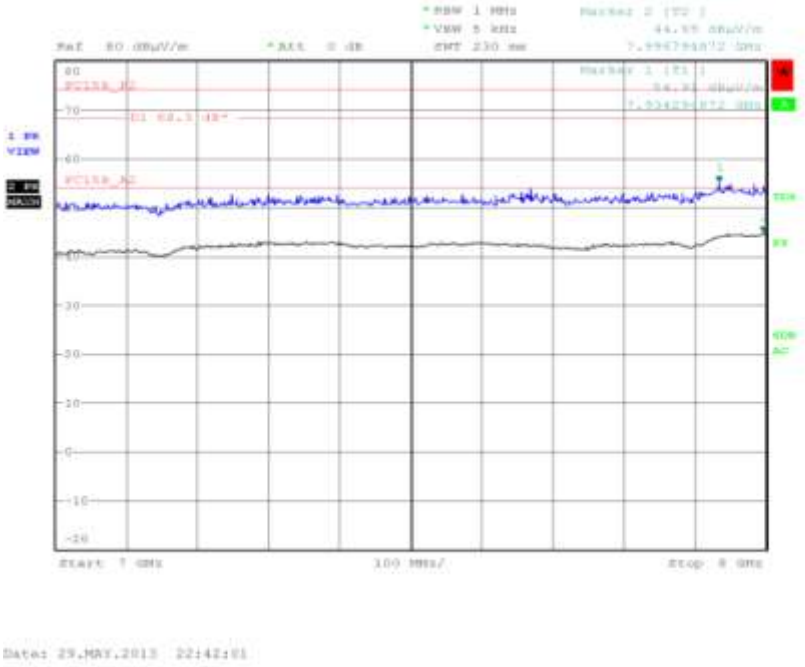
1GHz to 40GHz

Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
5.202	Horizontal	100	237	54.27	44.95

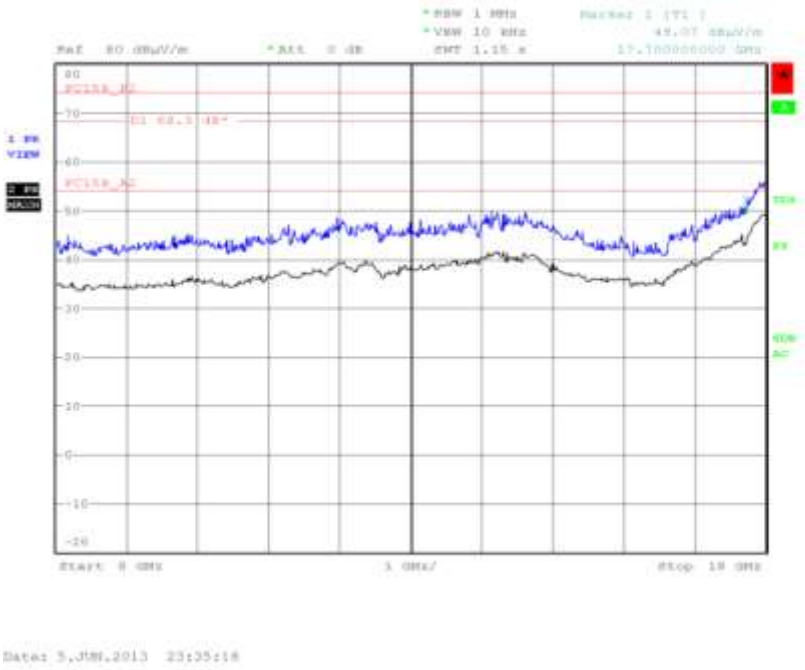
1 GHz to 7 GHz



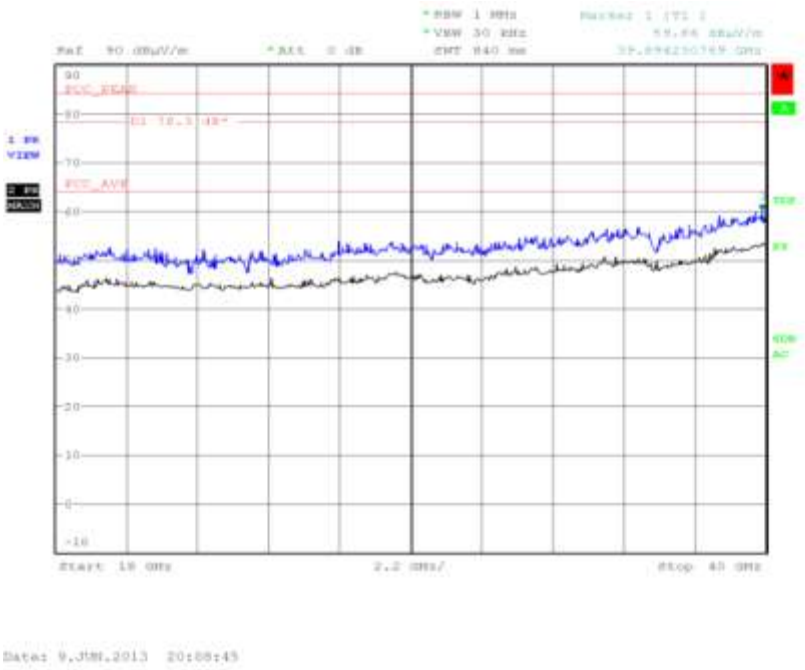
7 GHz to 8 GHz



8 GHz to 18 GHz



18 GHz to 40 GHz



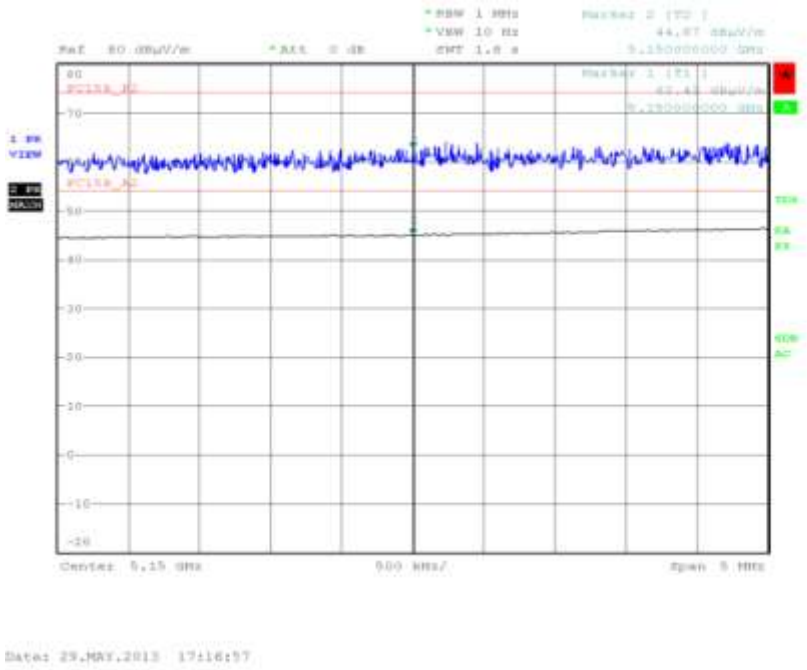
Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

Band Edge Emissions

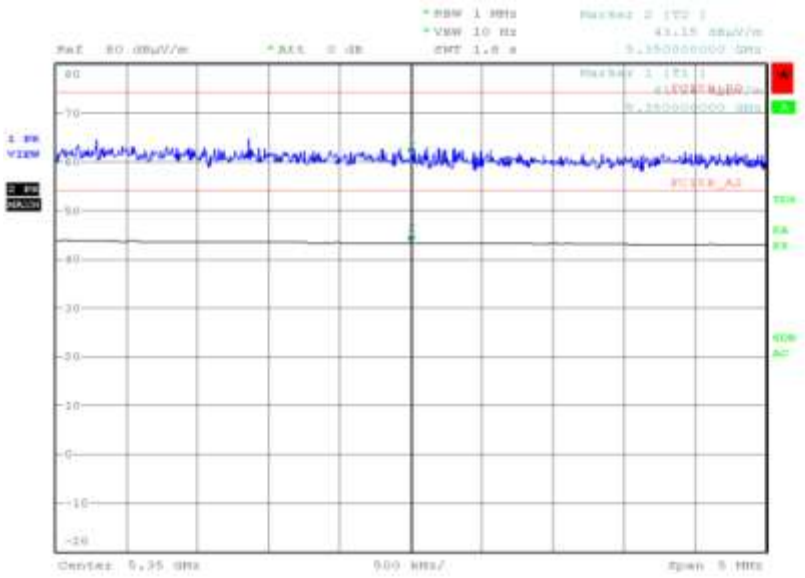
5190 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	62.42	44.87



5310 MHz

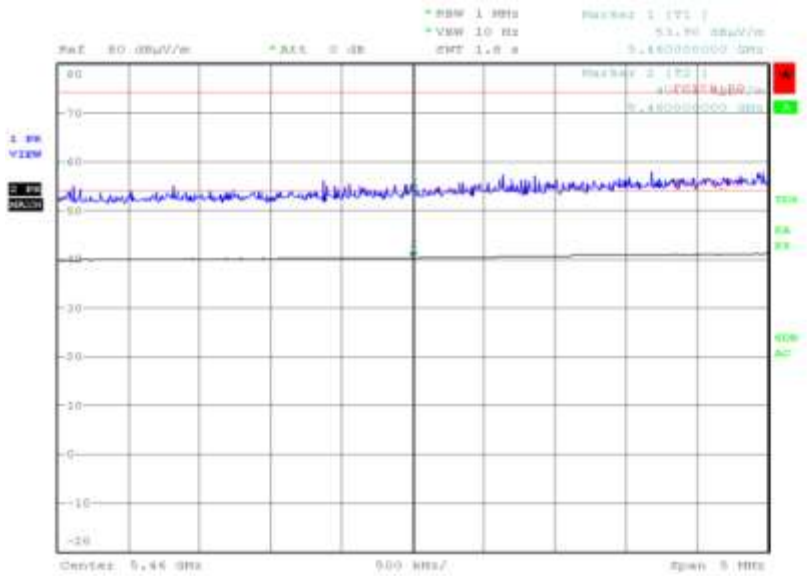
Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	61.28	43.15



Date: 29.MAY.2013 19:42:35

5510 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	53.90	40.05



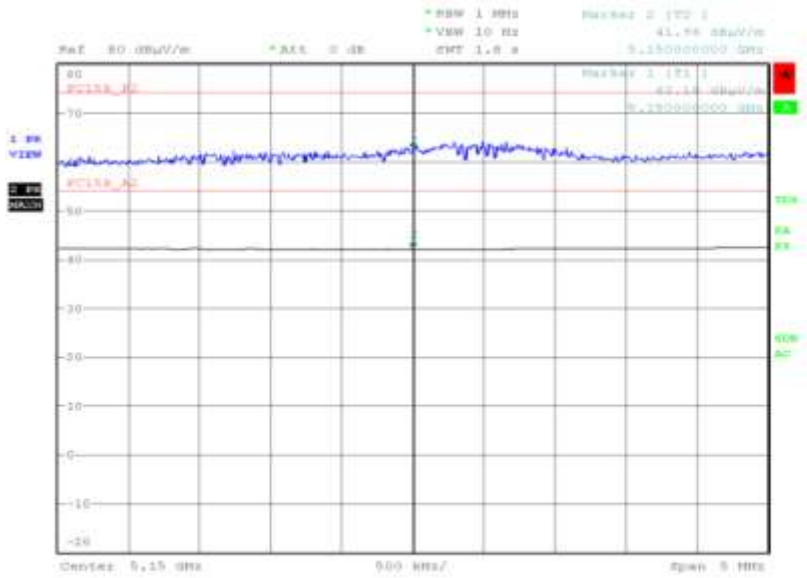
Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

Band Edge Emissions

5210 MHz

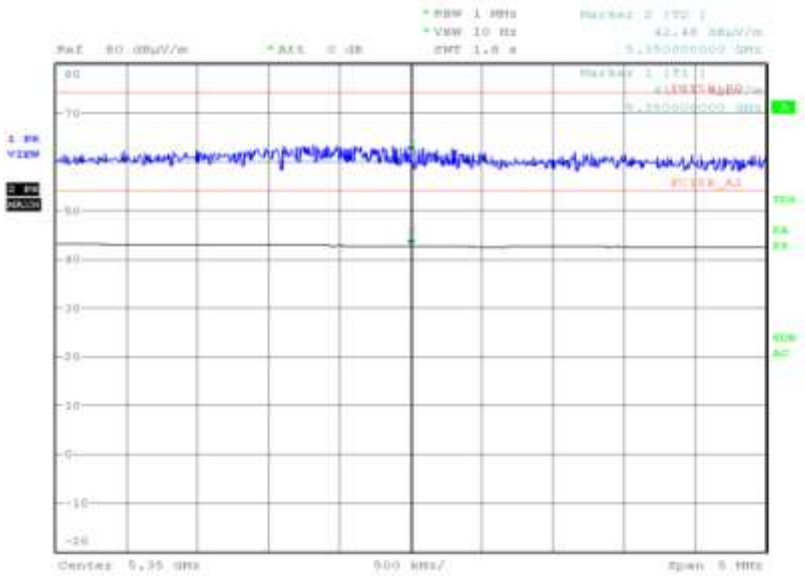
Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	62.18	41.96



Date: 26.MAY.2013 11:31:34

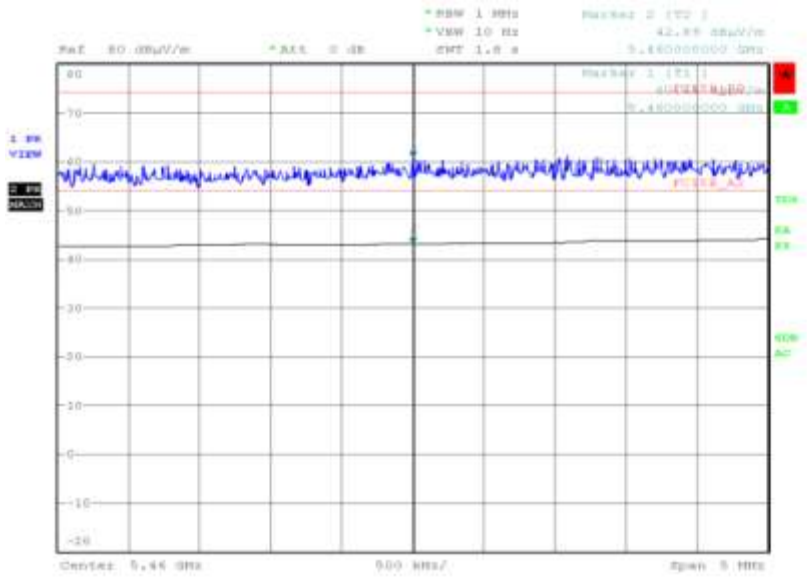
5290 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	61.57	42.48



5530 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	60.65	42.89



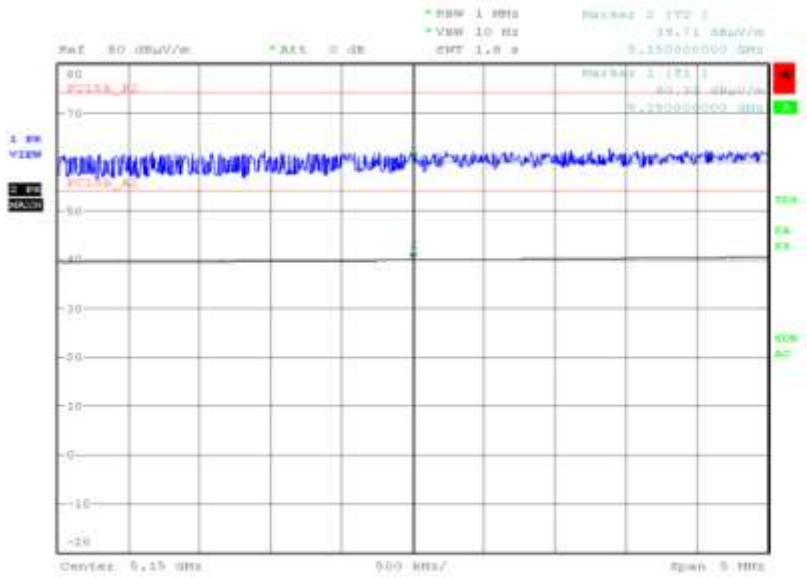
Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

Band Edge Emissions

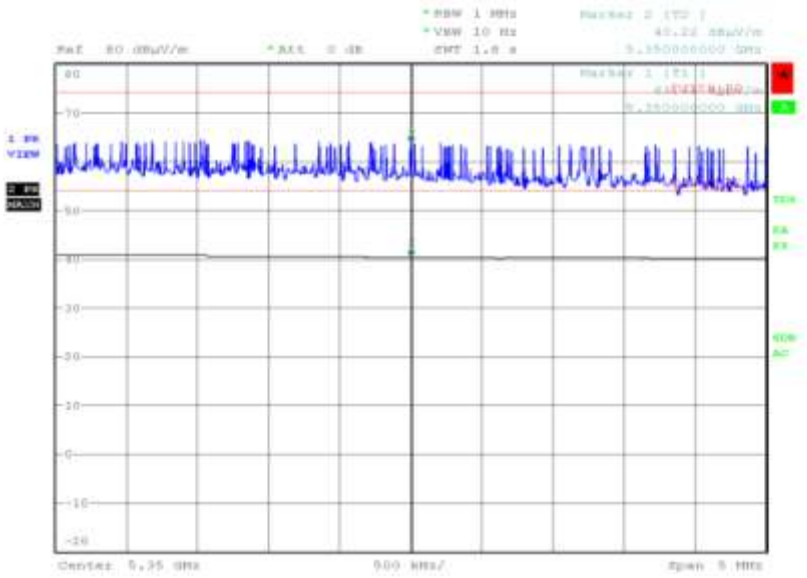
5180 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	60.32	39.71



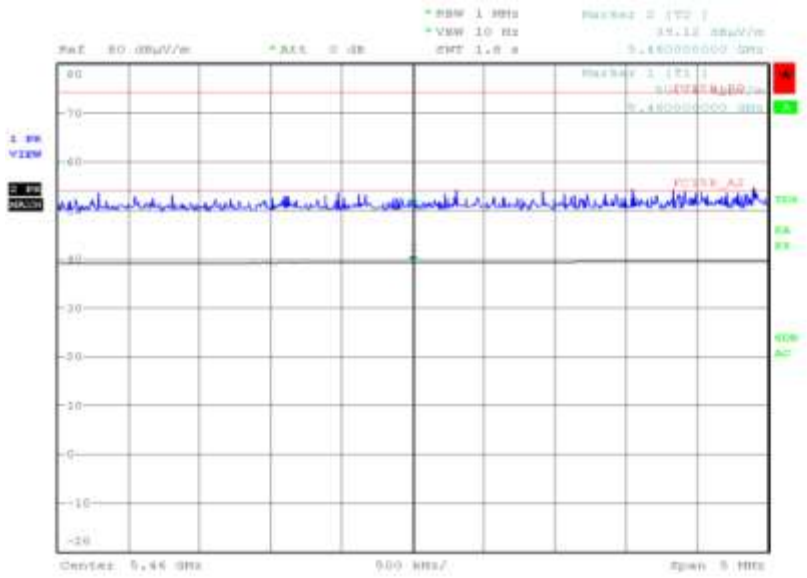
5320 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	63.43	40.22



5500 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	50.78	39.12



Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

802.11(n) - 5 GHz 40 MHz BW

4.0 V DC Supply

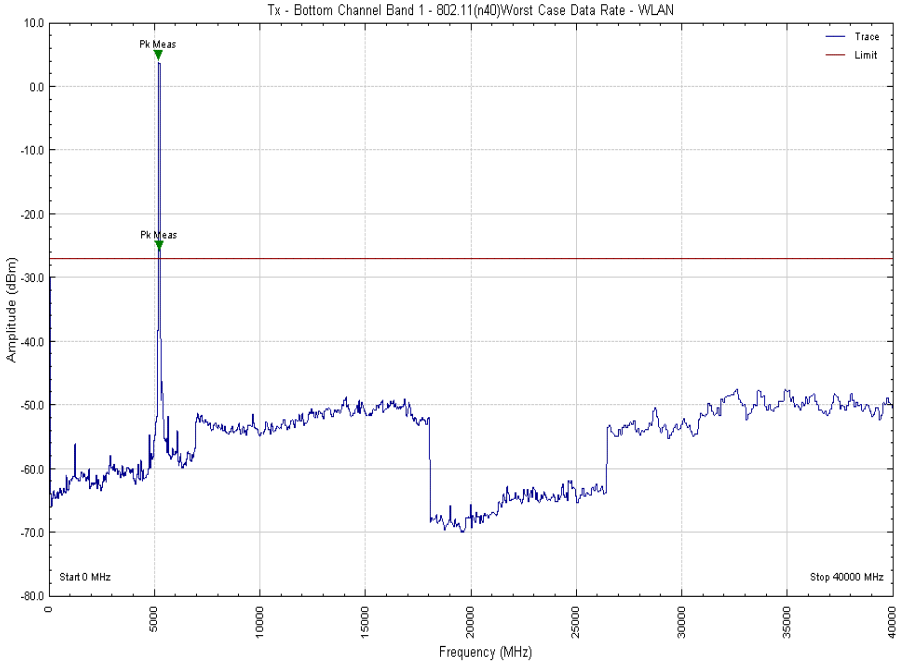
Spurious Conducted Emissions

7.20 Mbps

Frequency Band 1

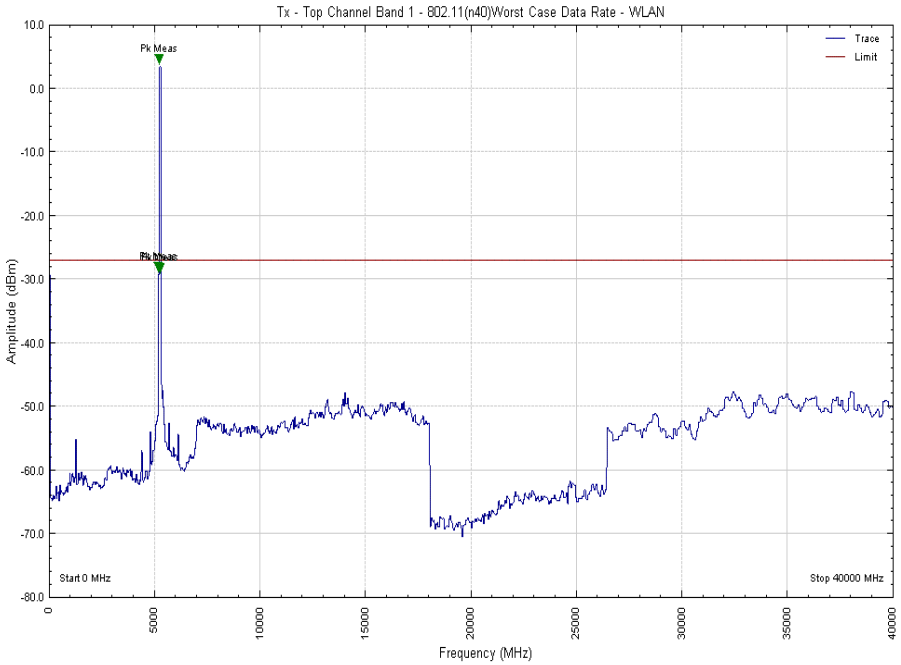
5190 MHz

9 kHz to 40 GHz



5320 MHz

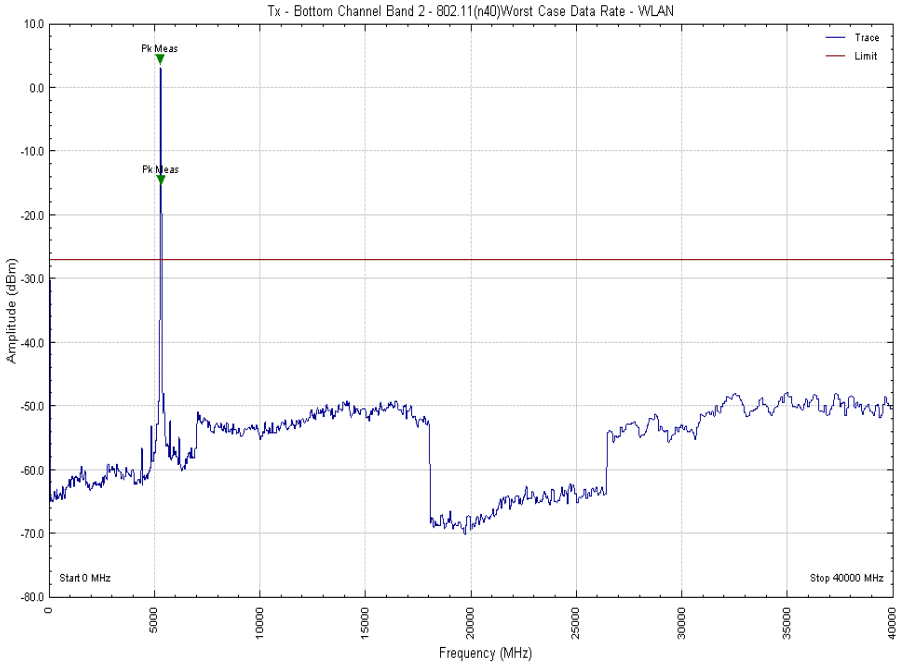
9 kHz to 40 GHz



Frequency Band 2

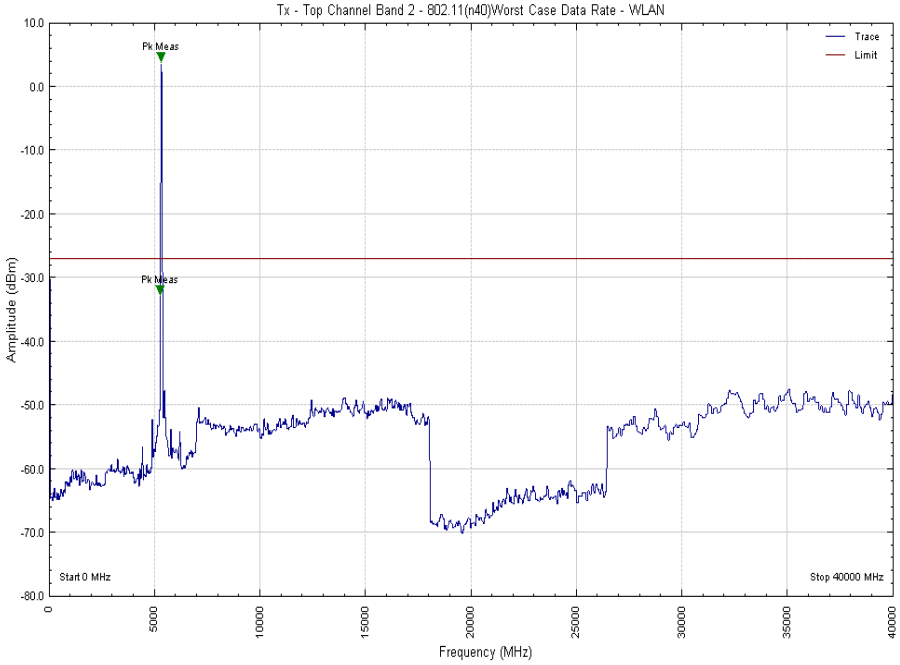
5270 MHz

9 kHz to 40 GHz



5310 MHz

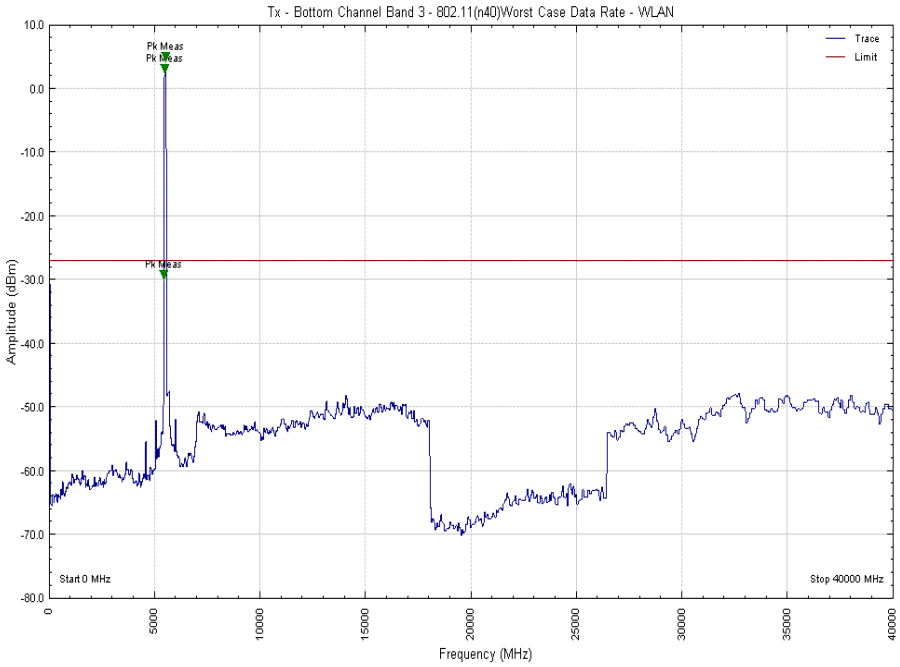
9 kHz to 40 GHz



Frequency Band 3

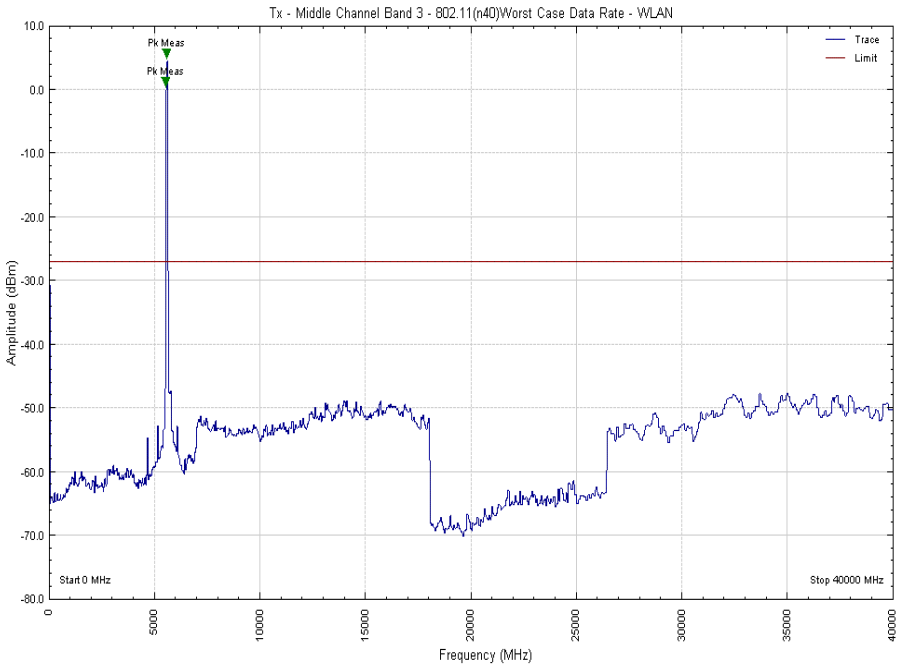
5510 MHz

9 kHz to 40 GHz



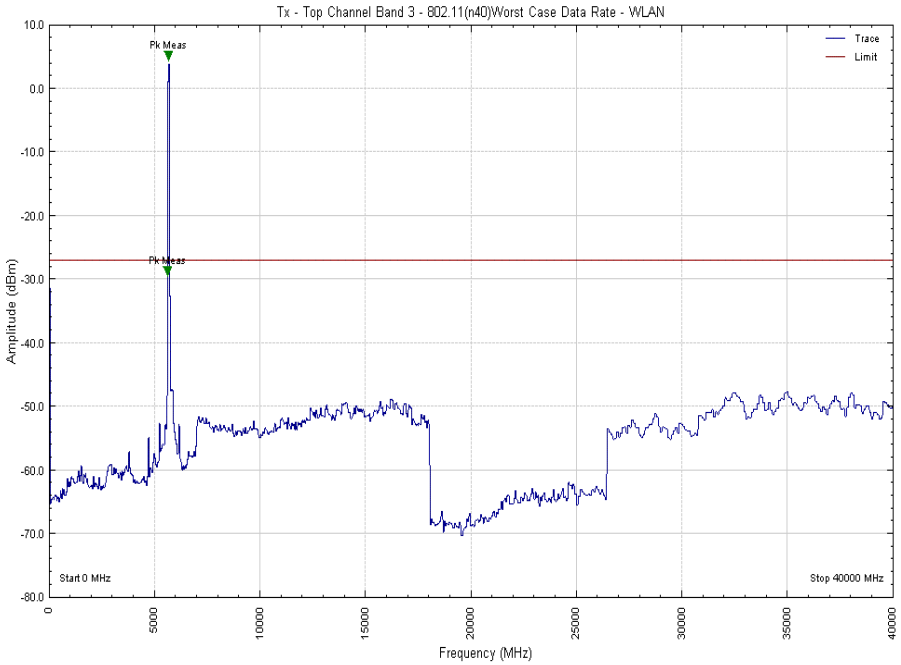
5590 MHz

9 kHz to 40 GHz



5670 MHz

9 kHz to 40 GHz



Limit Clause

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

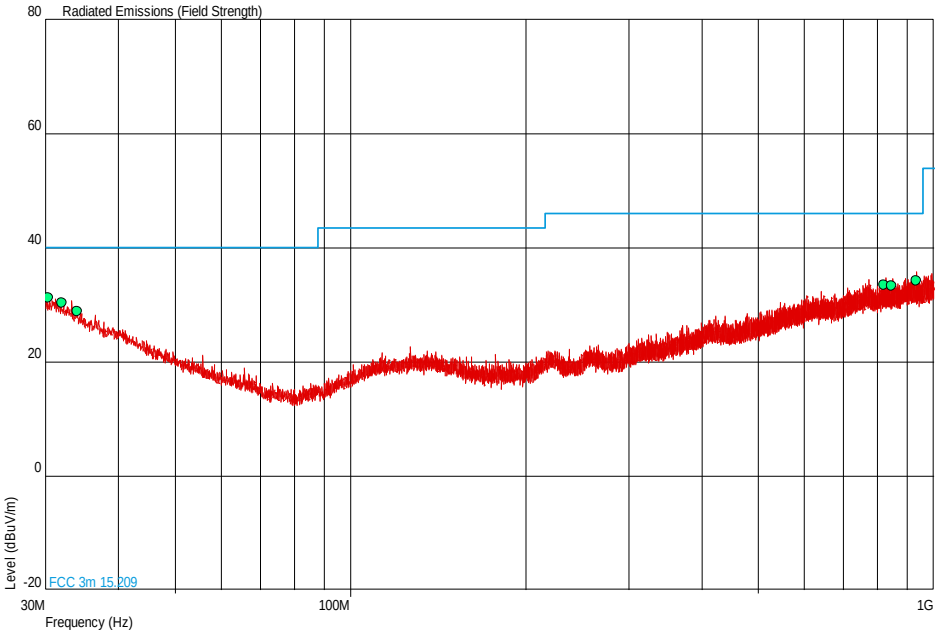
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval the attenuation required shall be 30 dB instead of 20 dB.

Spurious Radiated Emissions

Frequency Band 1

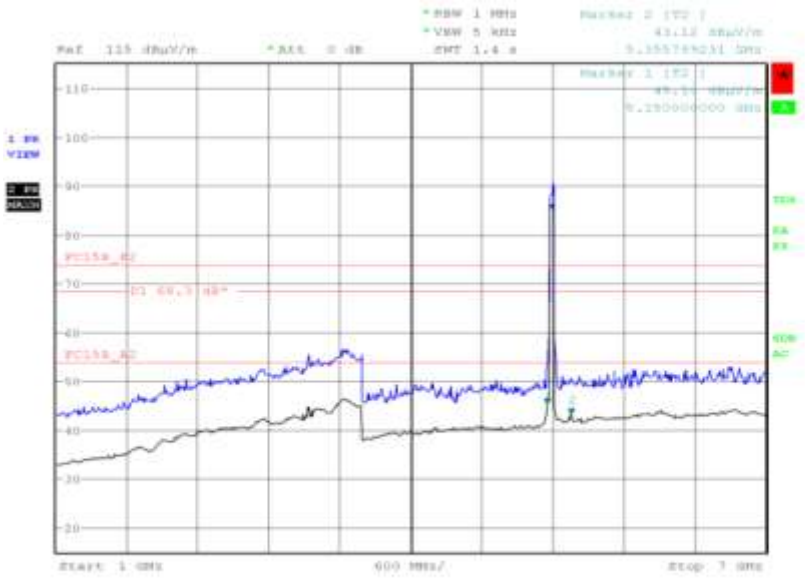
5190 MHz

30 MHz to 1 GHz



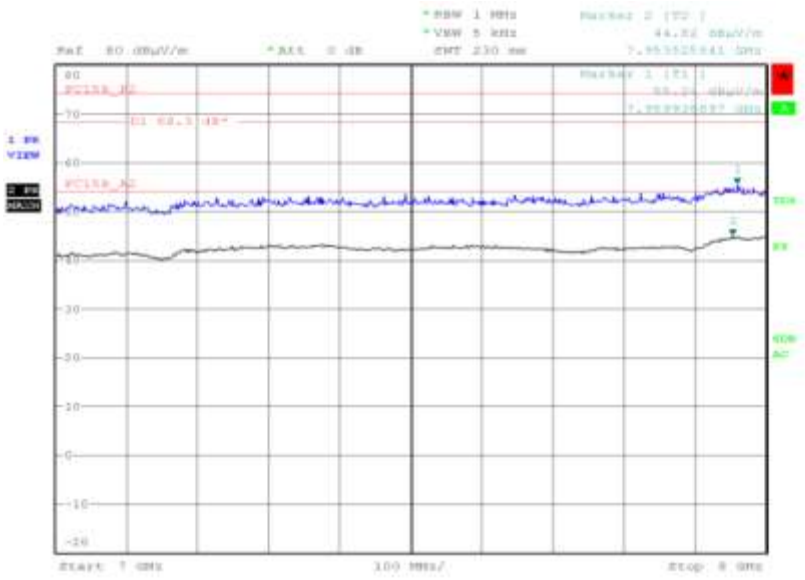
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.388	31.2	36.3	40.0	100	-8.8	63.7	180	1.00	Horizontal
31.989	30.4	33.1	40.0	100	-9.6	66.9	0	1.00	Horizontal
34.080	28.9	27.9	40.0	100	-11.1	72.1	180	1.00	Horizontal
822.345	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Vertical
847.177	33.3	46.2	46.0	200	-12.7	153.8	0	1.00	Vertical
932.779	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Vertical

1 GHz to 7 GHz



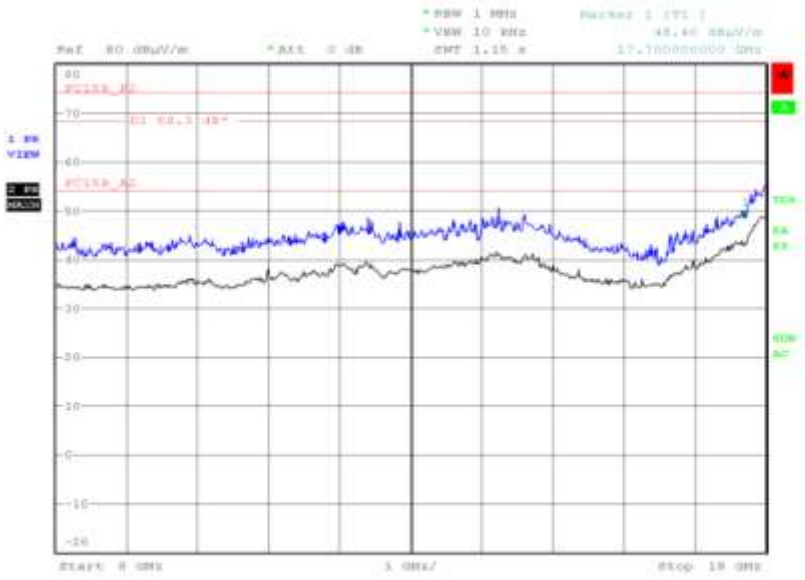
Date: 28.MAY.2013 18:35:14

7 GHz to 8 GHz



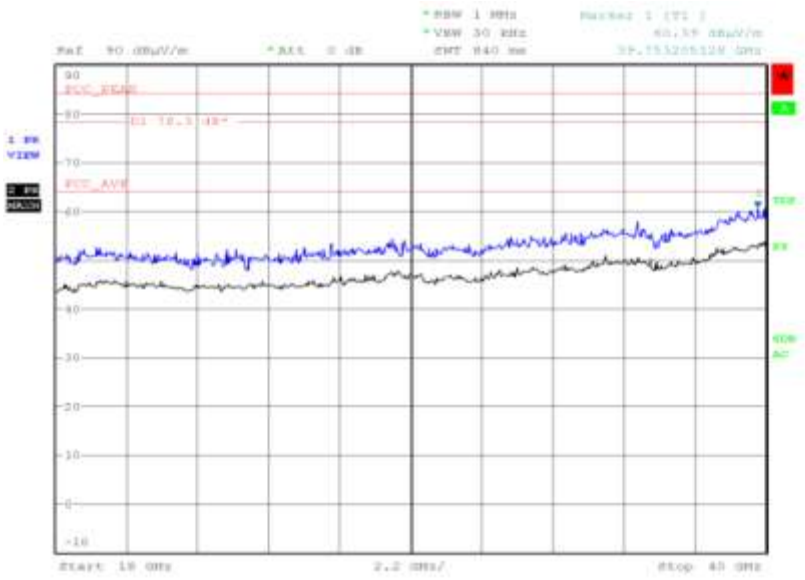
Date: 29.MAY.2013 22:51:53

8 GHz to 18 GHz



Date: 5.JUN.2013 19:45:06

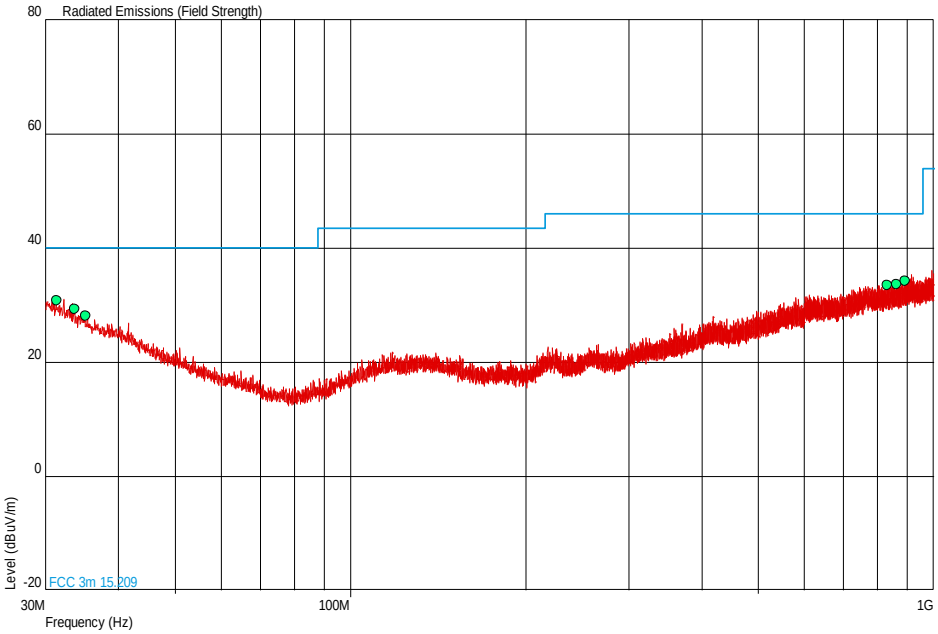
18 GHz to 40 GHz



Date: 9.JUN.2013 21:28:39

5230 MHz

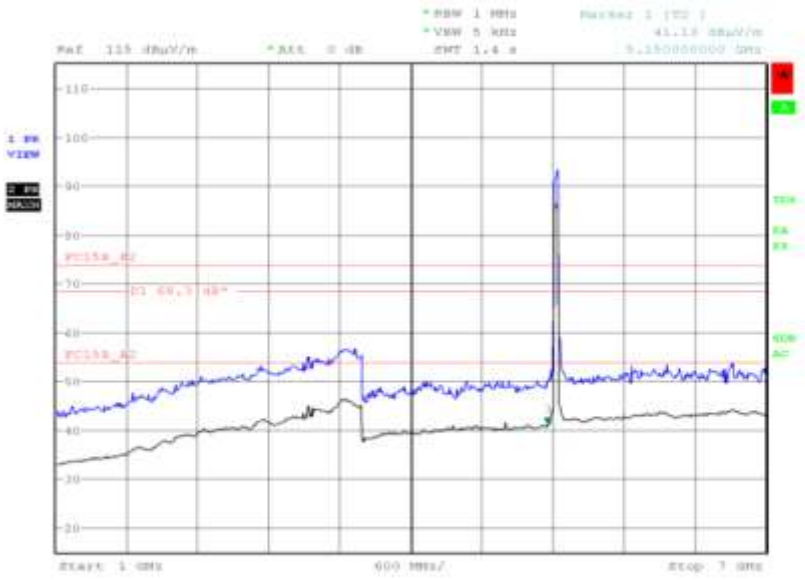
30 MHz to 1 GHz



Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.369	30.8	34.7	40.0	100	-9.2	65.3	0	0.00	Horizontal
33.735	29.3	29.2	40.0	100	-10.7	70.8	0	1.00	Horizontal
35.190	28.1	25.4	40.0	100	-11.9	74.6	180	1.00	Horizontal
831.414	33.6	47.9	46.0	200	-12.4	152.1	180	1.00	Horizontal
864.782	33.7	48.4	46.0	200	-12.3	151.6	0	1.00	Vertical
892.961	34.3	51.9	46.0	200	-11.7	148.1	180	1.00	Vertical

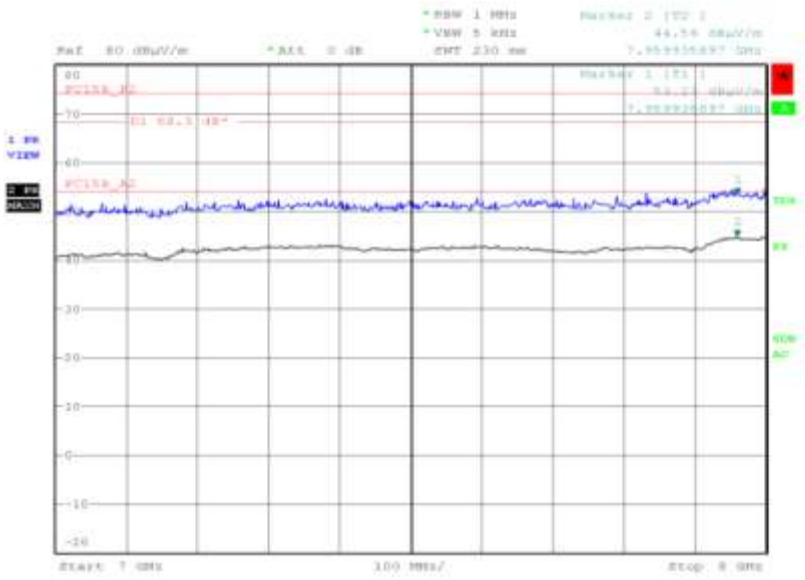
Product Service

1 GHz to 7 GHz



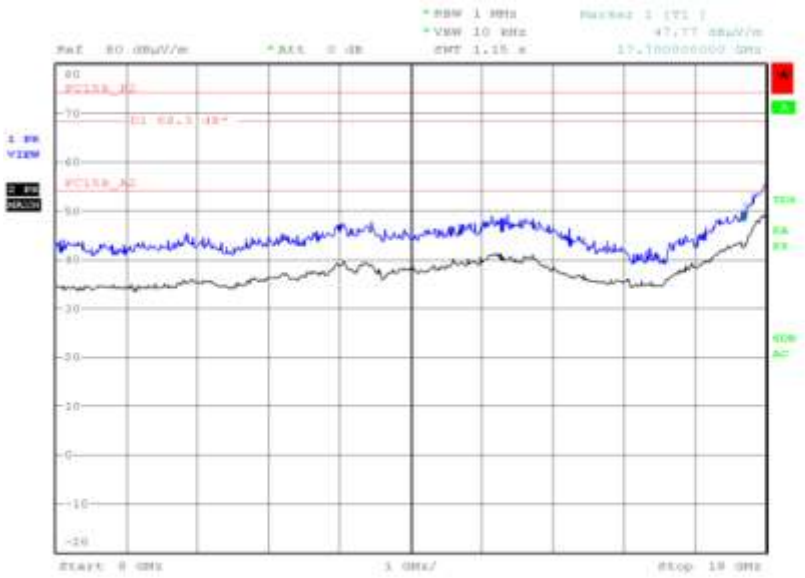
Date: 28.MAY.2013 18:58:50

7 GHz to 8 GHz



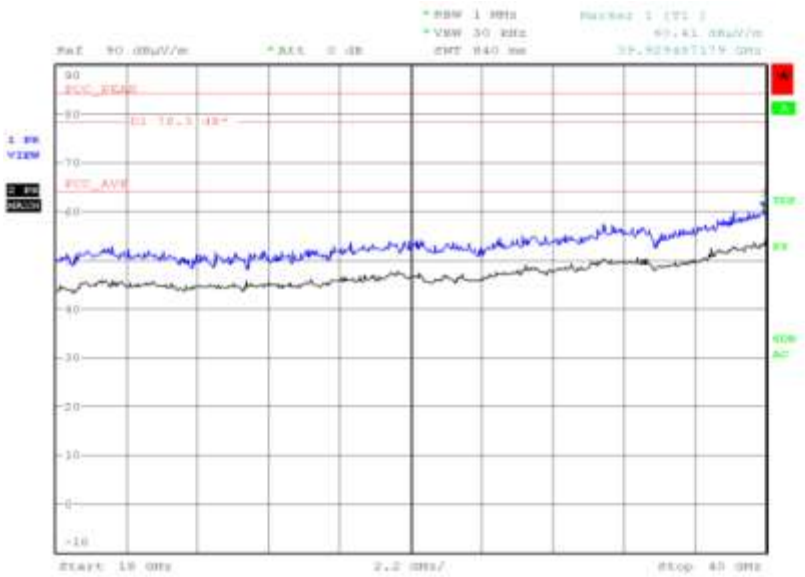
Date: 29.MAY.2013 22:55:42

8 GHz to 18 GHz



Date: 5.JUN.2013 19:57:11

18 GHz to 40 GHz

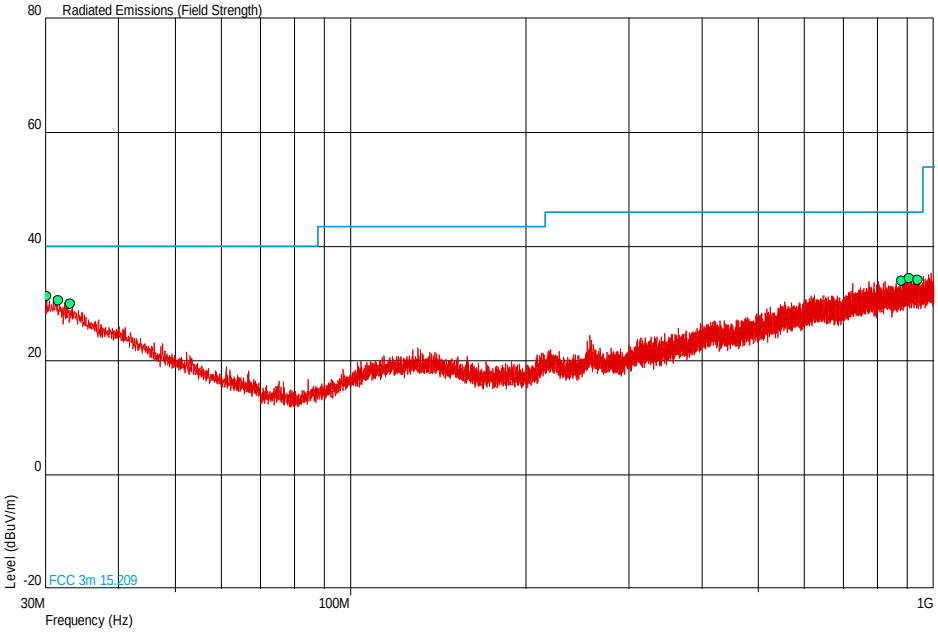


Date: 9.JUN.2013 21:38:23

Frequency Band 2

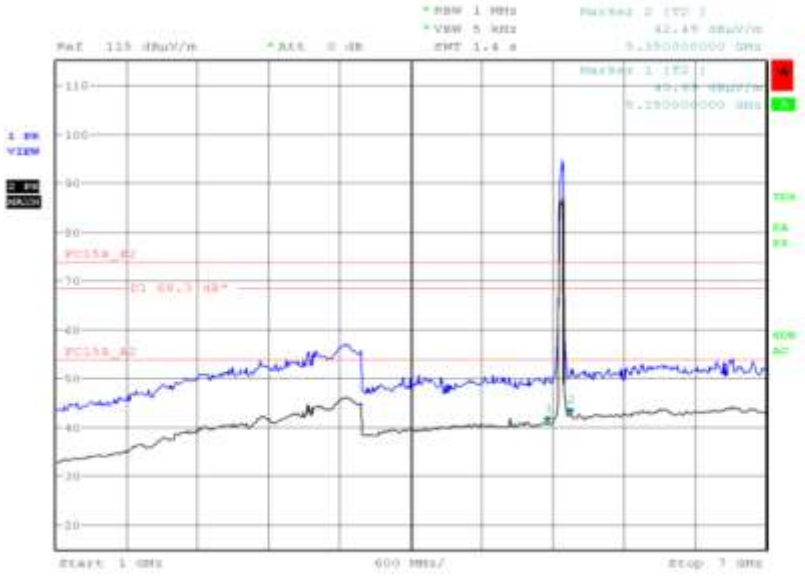
5270 MHz

30 MHz to 1 GHz



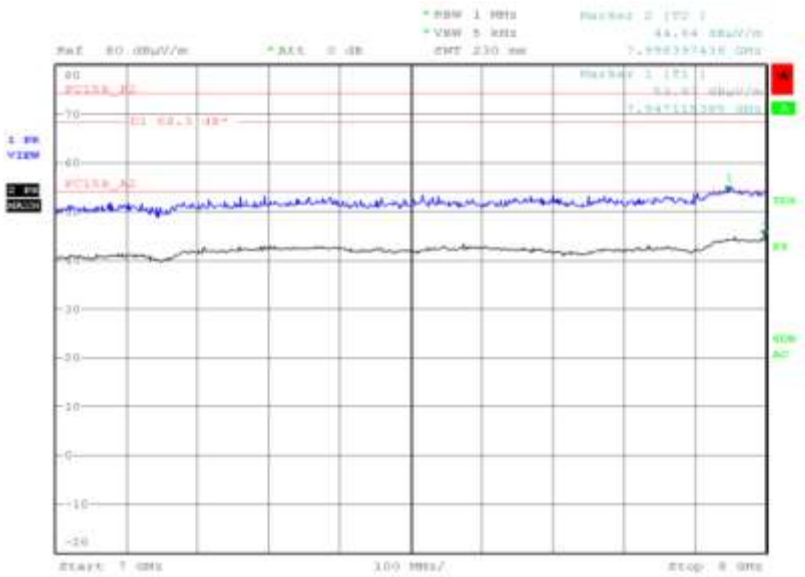
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.194	31.3	36.7	40.0	100	-8.7	63.3	180	1.00	Vertical
31.601	30.6	33.9	40.0	100	-9.4	66.1	180	1.00	Vertical
33.104	29.9	31.3	40.0	100	-10.1	68.7	0	1.00	Vertical
881.272	33.9	49.5	46.0	200	-12.1	150.5	180	1.00	Vertical
909.499	34.4	52.5	46.0	200	-11.6	147.5	0	1.00	Vertical
938.599	34.1	50.7	46.0	200	-11.9	149.3	180	1.00	Vertical

1 GHz to 7 GHz



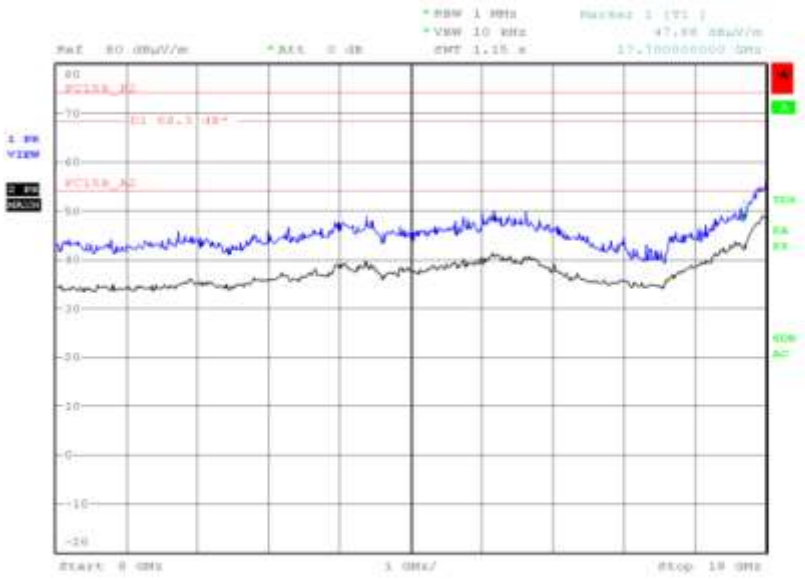
Date: 28.MAY.2013 20:02:04

7 GHz to 8 GHz



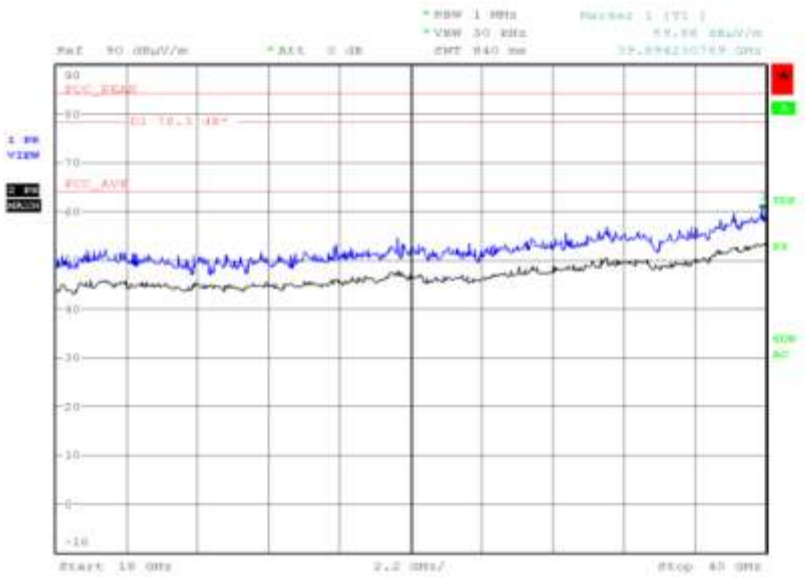
Date: 29.MAY.2013 23:03:36

8 GHz to 18 GHz



Date: 5.JUN.2013 20:07:10

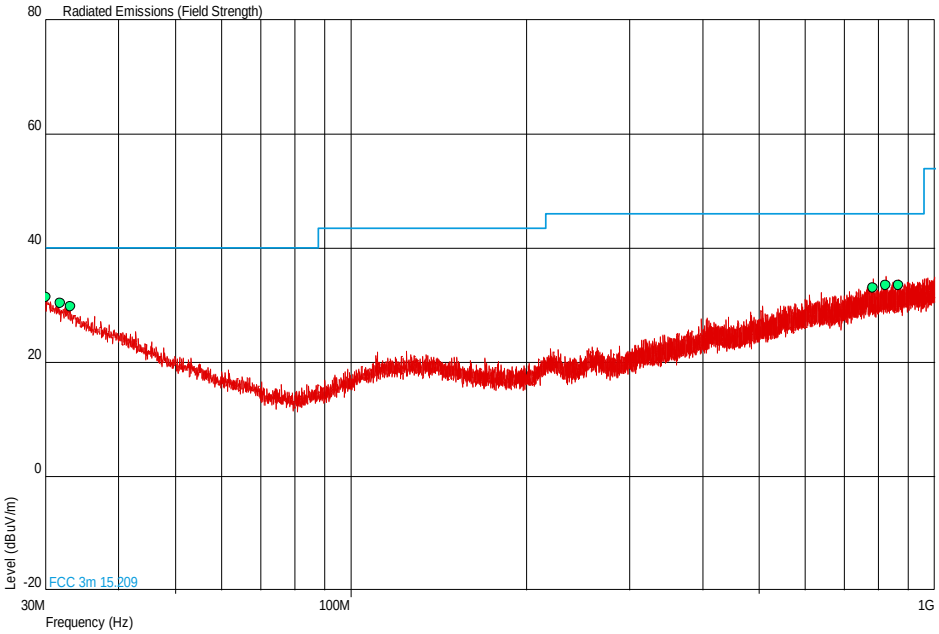
18 GHz to 40 GHz



Date: 9.JUN.2013 21:47:27

5310 MHz

30 MHz to 1 GHz

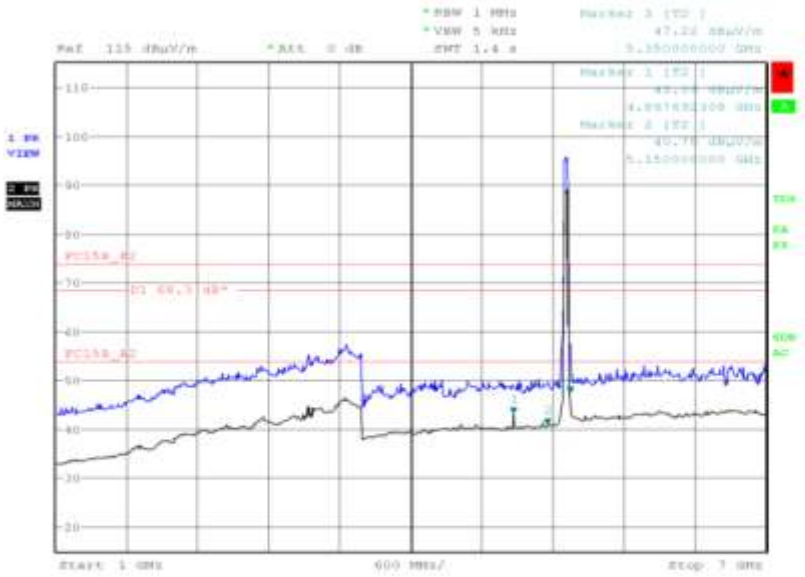


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.097	31.4	37.2	40.0	100	-8.6	62.8	0	1.00	Vertical
31.843	30.4	33.1	40.0	100	-9.6	66.9	0	1.00	Vertical
33.153	29.8	30.9	40.0	100	-10.2	69.1	0	1.00	Vertical
785.048	33.1	45.2	46.0	200	-12.9	154.8	180	1.00	Vertical
823.509	33.5	47.3	46.0	200	-12.5	152.7	180	1.00	Vertical
867.013	33.6	47.9	46.0	200	-12.4	152.1	180	1.00	Vertical

1GHz to 40GHz

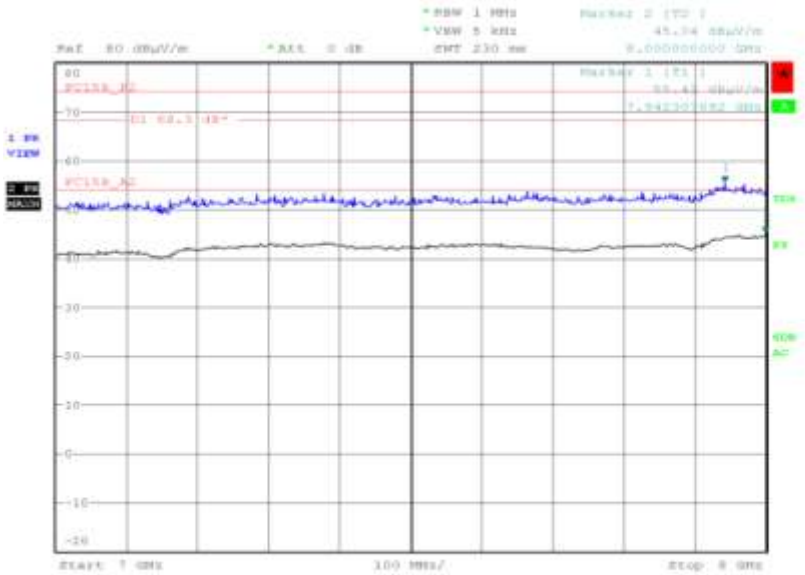
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
4.867	Vertical	119	263	53.26	43.88

1 GHz to 7 GHz



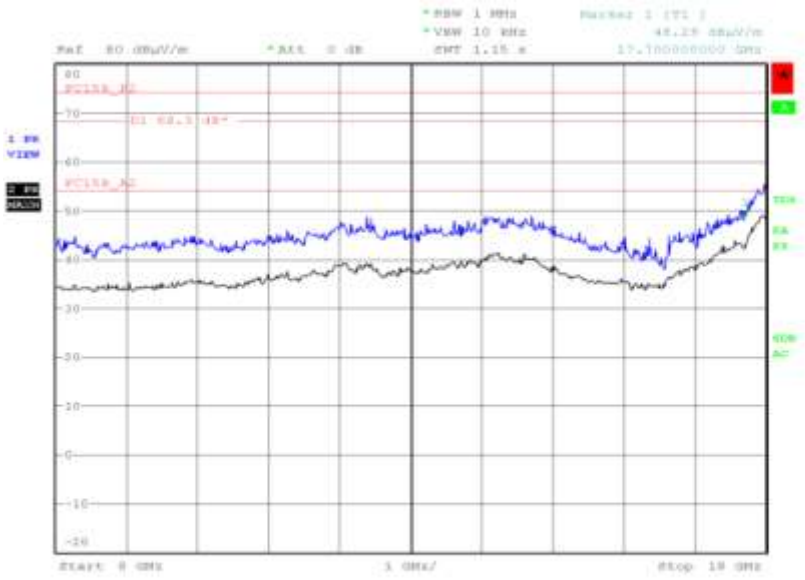
Date: 28.MAY.2013 20:16:30

7 GHz to 8 GHz



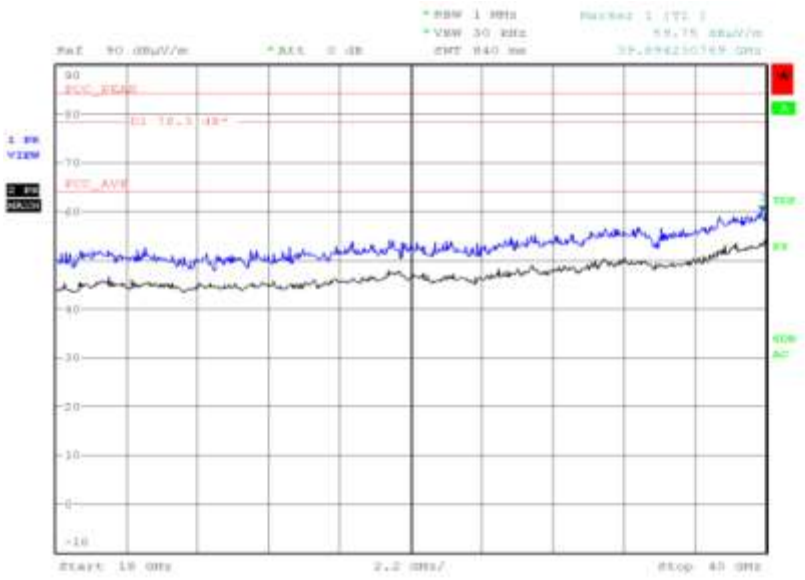
Date: 29.MAY.2013 23:09:58

8 GHz to 18 GHz



Date: 5.JUN.2013 20:16:25

18 GHz to 40 GHz

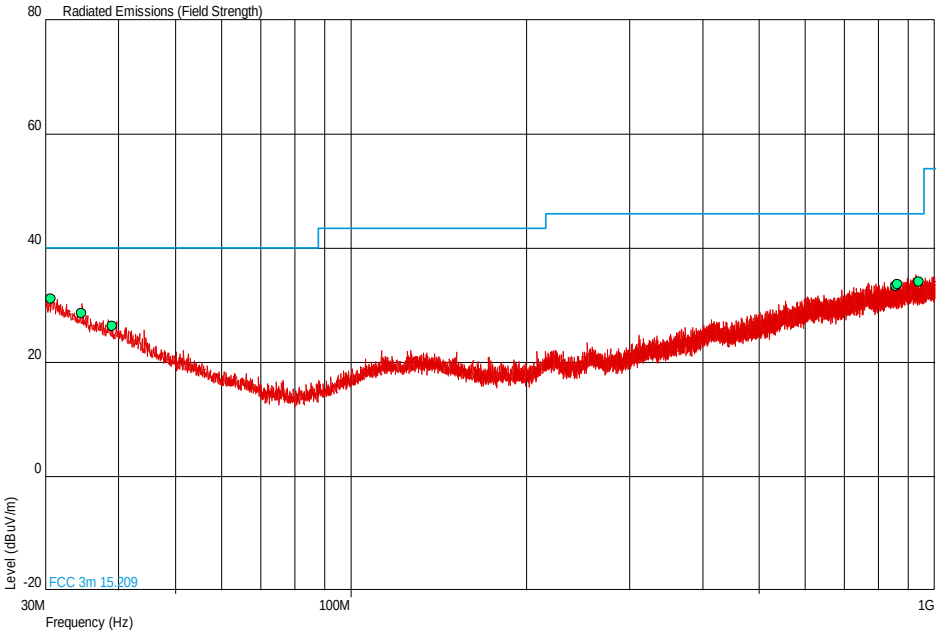


Date: 9.JUN.2013 21:56:03

Frequency Band 3

5510 MHz

30 MHz to 1 GHz

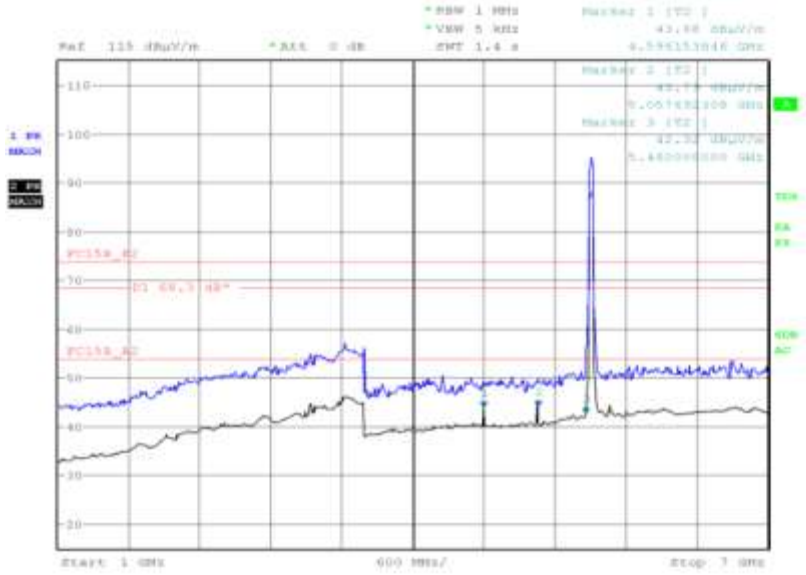


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.679	31.1	35.9	40.0	100	-8.9	64.1	0	1.00	Vertical
34.608	28.6	26.9	40.0	100	-11.4	73.1	180	1.00	Horizontal
39.070	26.4	20.9	40.0	100	-13.6	79.1	0	1.00	Horizontal
858.138	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Horizontal
863.618	33.6	47.9	46.0	200	-12.4	152.1	180	1.00	Horizontal
938.260	34.1	50.7	46.0	200	-11.9	149.3	0	1.00	Vertical

1GHz to 40GHz

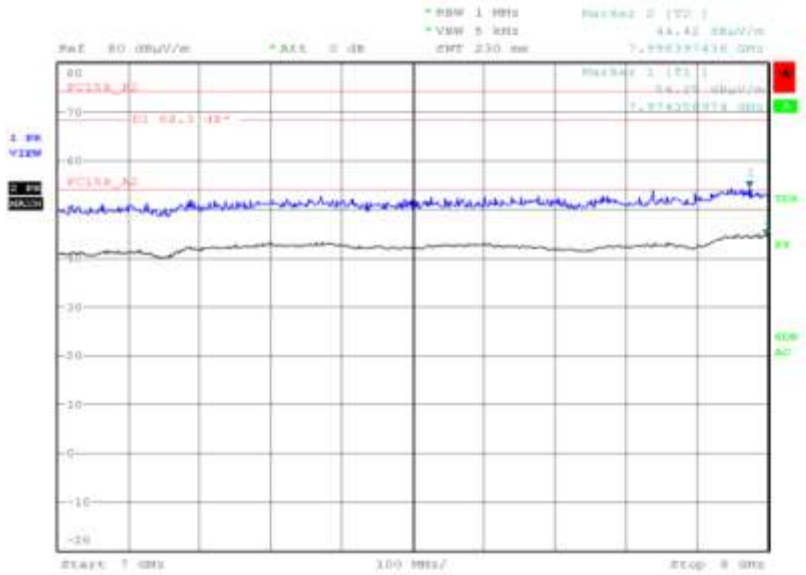
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
4.596	Vertical	100	267	53.95	42.60
5.057	Vertical	180	289	53.81	44.46

1 GHz to 7 GHz



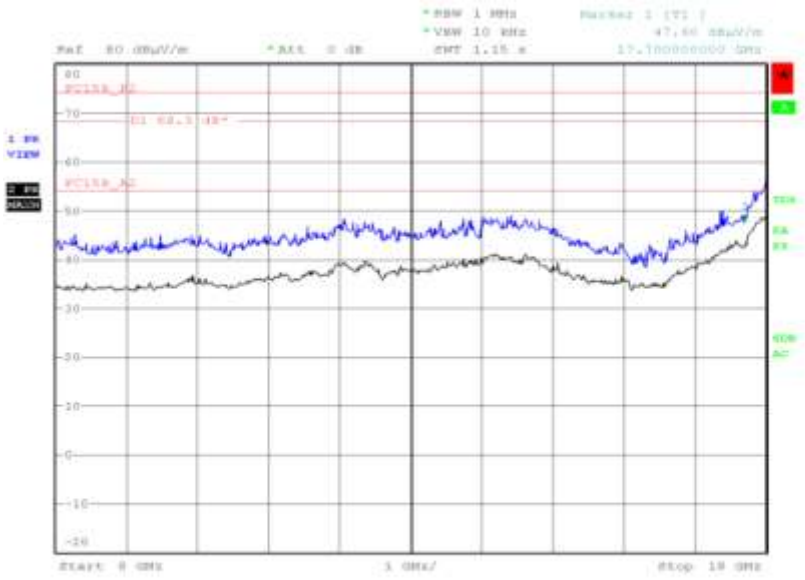
Date: 28.MAY.2013 21:19:14

7 GHz to 8 GHz



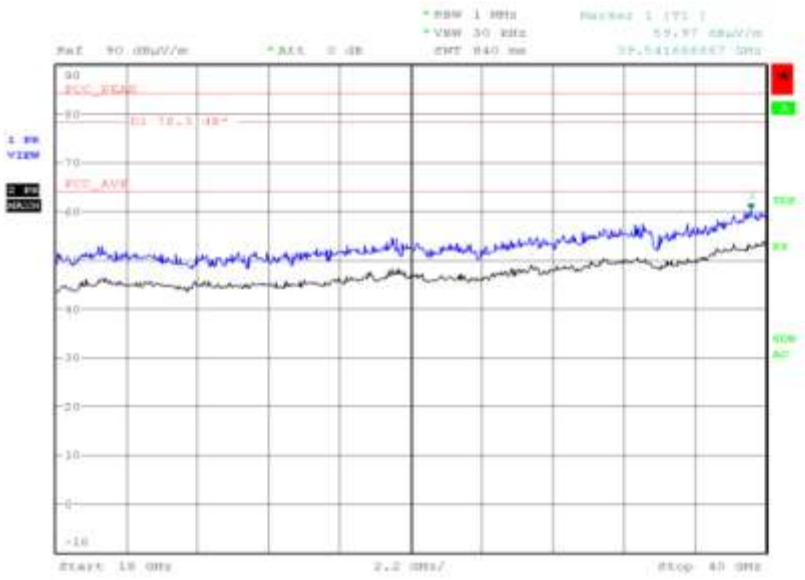
Date: 29.MAY.2013 23:13:33

8 GHz to 18 GHz



Date: 5.JUN.2013 20:30:39

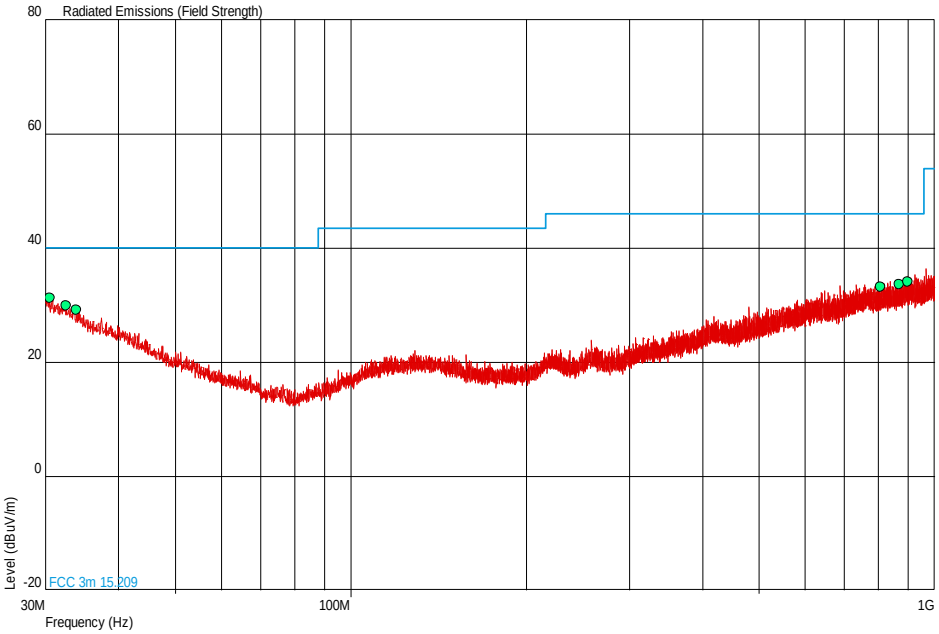
18 GHz to 40 GHz



Date: 9.JUN.2013 18:49:24

5590 MHz

30 MHz to 1 GHz

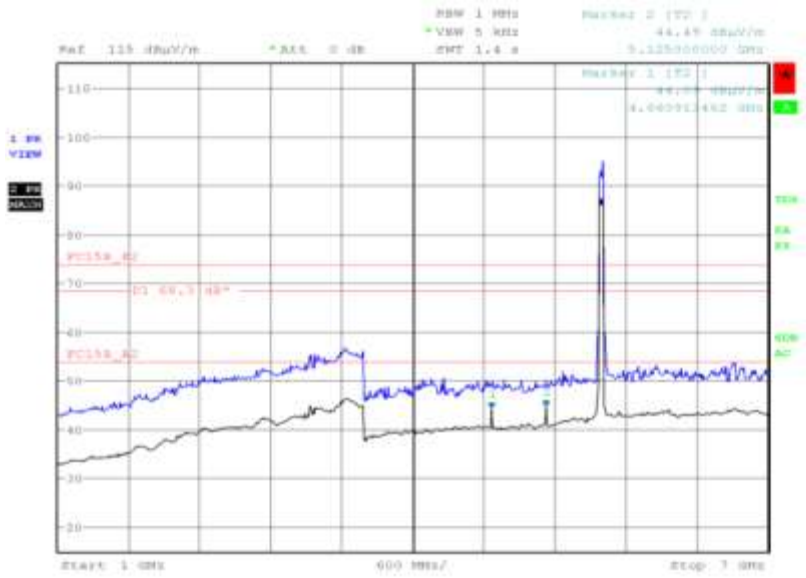


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.534	31.2	36.3	40.0	100	-8.8	63.7	0	1.00	Vertical
32.619	30.0	31.6	40.0	100	-10.0	68.4	180	1.00	Vertical
33.880	29.2	28.8	40.0	100	-10.8	71.2	180	1.00	Vertical
807.601	33.2	45.7	46.0	200	-12.8	154.3	0	1.00	Vertical
869.535	33.6	47.9	46.0	200	-12.4	152.1	0	1.00	Vertical
898.296	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Horizontal

1GHz to 40GHz

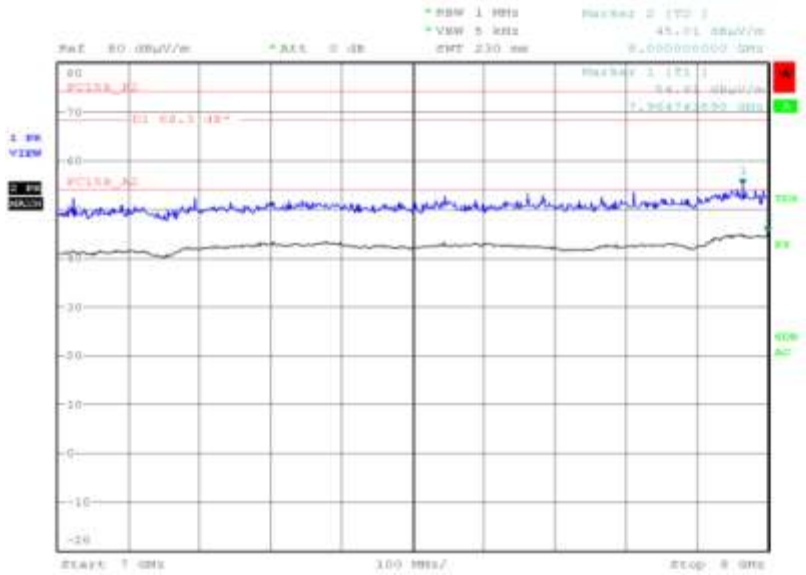
Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
4.661	Vertical	100	253	53.36	42.83
5.125	Vertical	105	189	53.87	42.71

1 GHz to 7 GHz



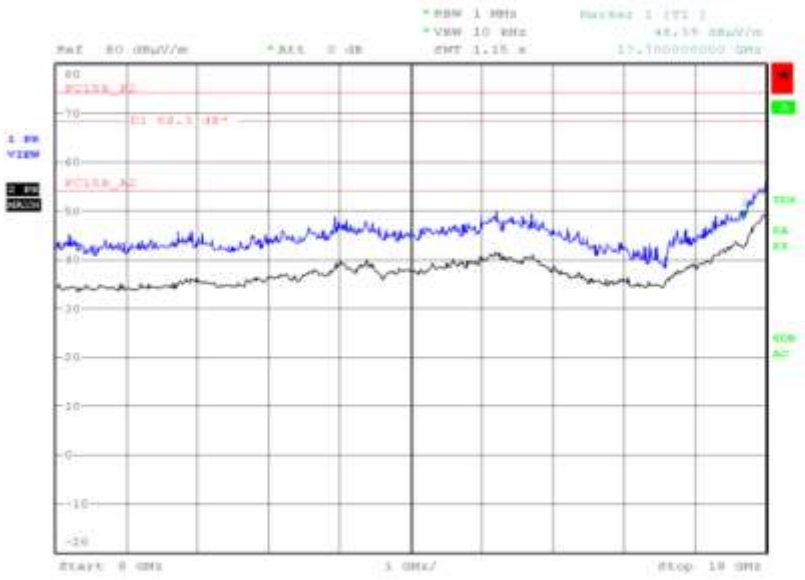
Date: 28.MAY.2013 21:49:27

7 GHz to 8 GHz



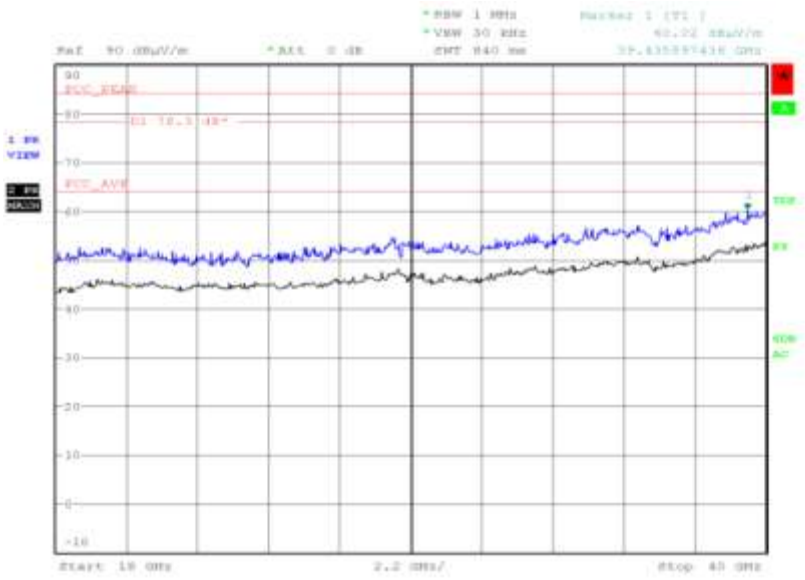
Date: 29.MAY.2013 23:18:47

8 GHz to 18 GHz



Date: 5.JUN.2013 20:45:36

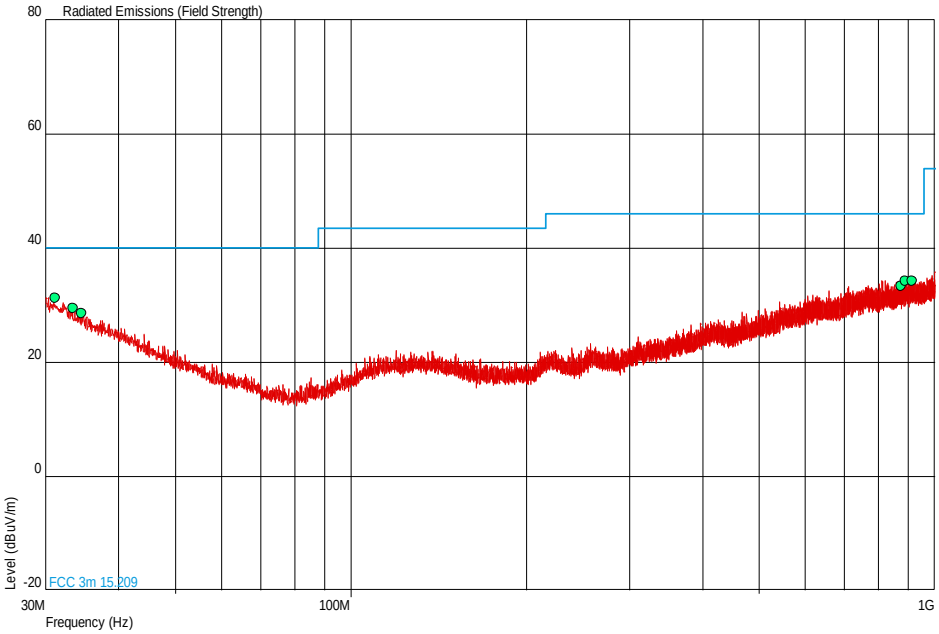
18 GHz to 40 GHz



Date: 9.JUN.2013 19:09:11

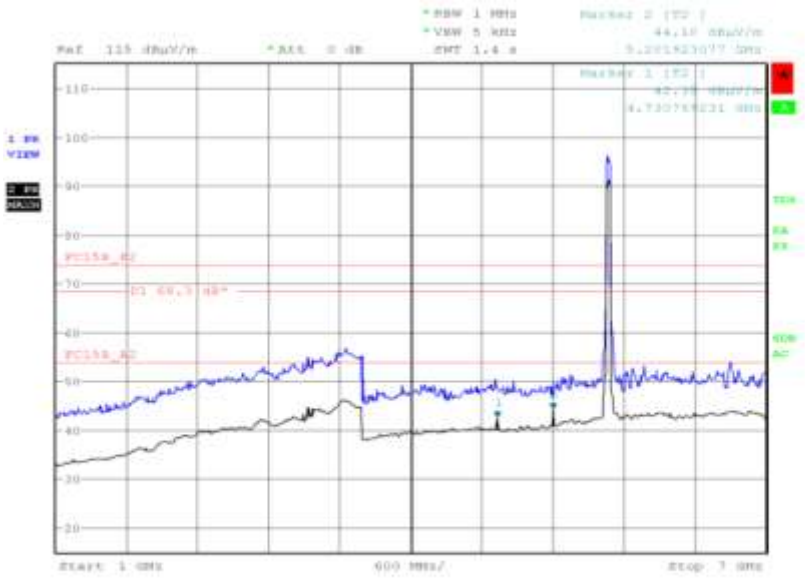
5670 MHz

30 MHz to 1 GHz



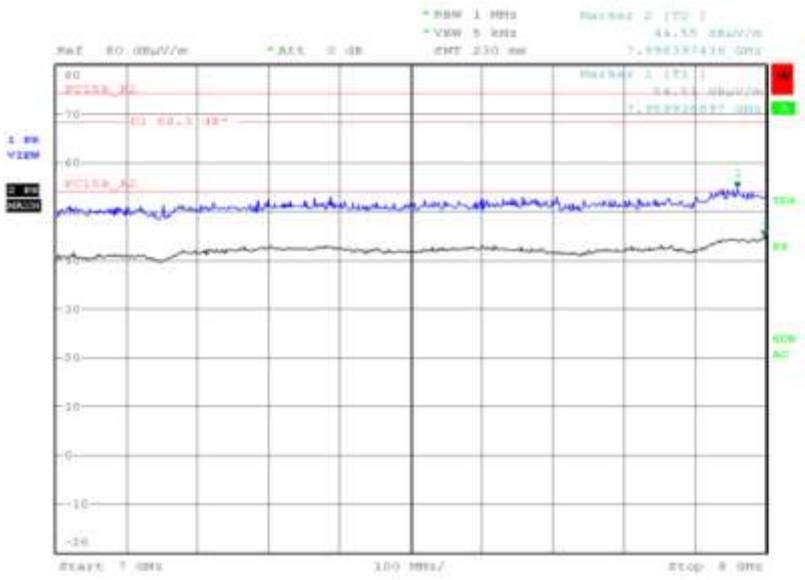
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.170	31.2	36.3	40.0	100	-8.8	63.7	0	0.00	Horizontal
33.492	29.5	29.9	40.0	100	-10.5	70.1	0	1.00	Horizontal
34.559	28.6	26.9	40.0	100	-11.4	73.1	0	1.00	Vertical
876.083	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Horizontal
891.651	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Horizontal
915.562	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Horizontal

1 GHz to 7 GHz



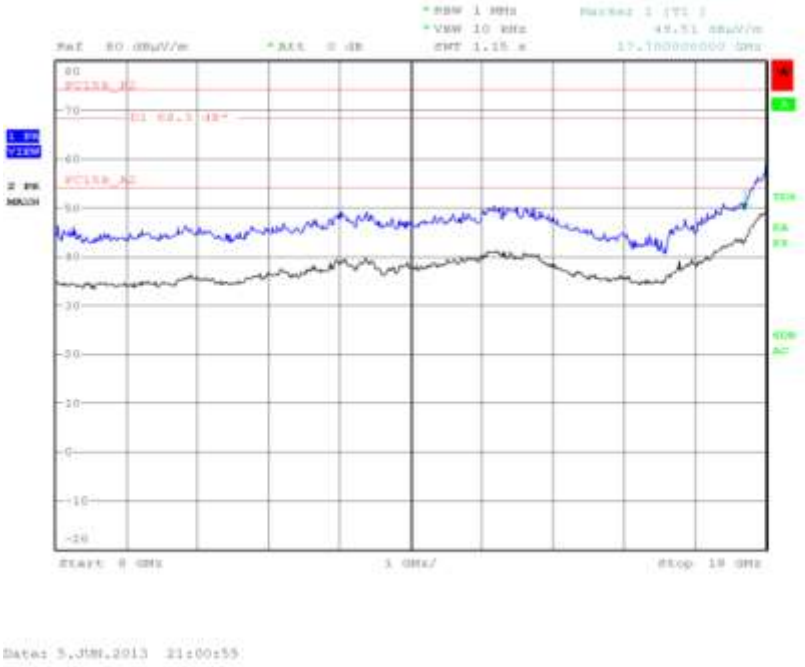
Date: 28.MAY.2013 22:10:20

7 GHz to 8 GHz

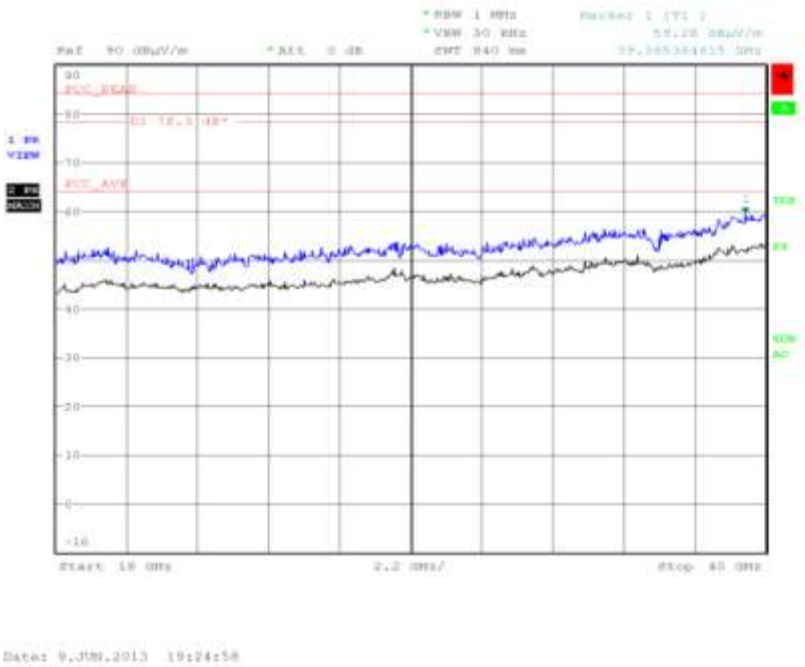


Date: 29.MAY.2013 23:24:41

8 GHz to 18 GHz



18 GHz to 40 GHz



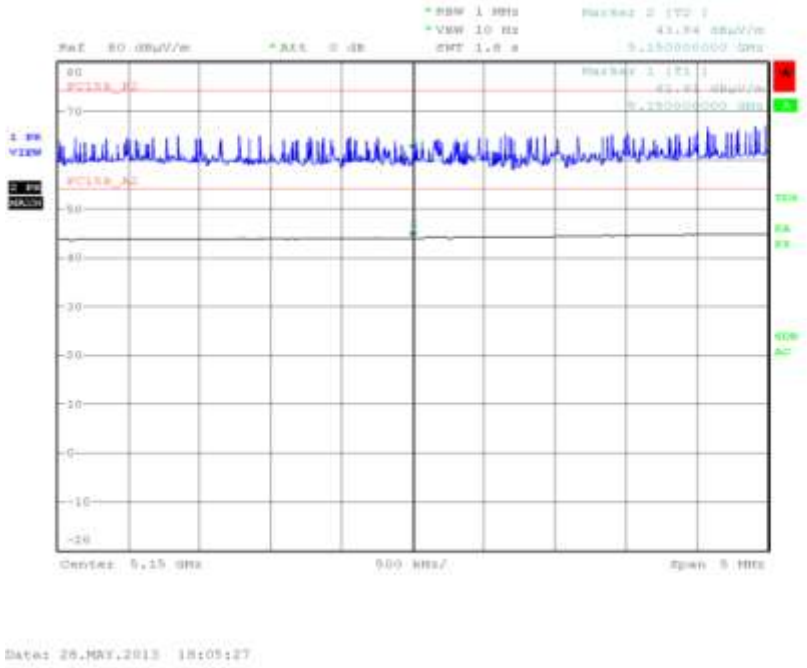
Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

Band Edge Emissions

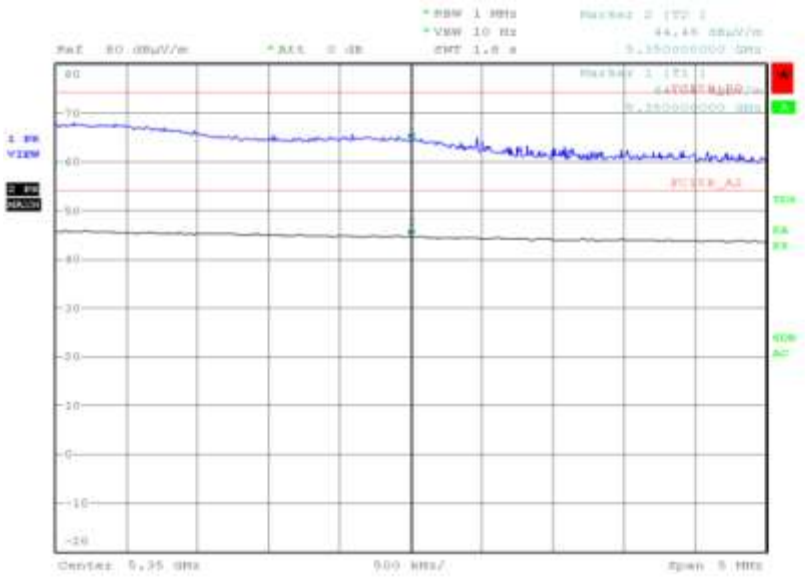
5190 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	61.61	43.84



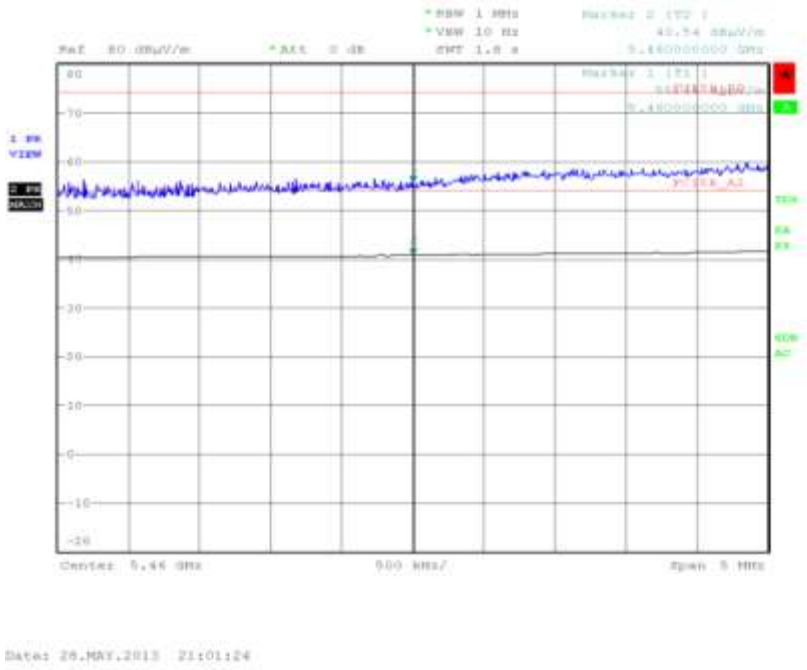
5310 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	64.08	44.06



5510 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	55.45	40.54



Limit

Peak (dBµV/m)	Average (dBµV/m)
74.0	54.0

2.4 FREQUENCY STABILITY

2.4.1 Specification Reference

FCC CFR 47 Part 15E, Clause 2.1055 and 15.407 (g)

2.4.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114765106 - Modification State 0

2.4.3 Date of Test

11 June 2013

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

The EUT was set to transmit on maximum power with an unmodulated carrier. In accordance with 2.1055, the temperature was varied from -30°C to +50° in 10° steps. Testing was performed on the middle channel only 2132.4MHz, Channel 1637.

2.4.6 Environmental Conditions

Ambient Temperature	22.8°C
Relative Humidity	58.2%

2.4.7 Test Results

Unmodulated

4.0 V DC Supply

Frequency Band 1

Hand Carrier Battery Powered

Temperature Interval	Supply Voltage	Frequency Error (ppm)	
		5180 MHz	5240 MHz
-10°C	4.0 V DC	9.040	10.019
	3.8 V DC	9.987	10.019
0°C	4.0 V DC	6.899	7.065
	3.8 V DC	6.961	7.218
+10°C	4.0 V DC	4.641	4.771
	3.8 V DC	4.703	4.802
+20°C	4.0 V DC	0.758	1.040
	3.8 V DC	0.959	1.162
	4.0 V DC	0.758	1.040
-30°C	4.0 V DC	-1.036	-1.025
	3.8 V DC	-0.944	-0.963
+40°C	4.0 V DC	-1.222	-1.514
	3.8 V DC	-1.269	-1.376
+50°C	4.0 V DC	-1.980	-1.866
	3.8 V DC	-1.918	-1.927
+55°C	4.0 V DC	-1.980	-1.713
	3.8 V DC	-1.887	-1.804
Maximum Frequency Error (Hz)		9.987	10.019

Frequency Band 2

Hand Carrier Battery Powered

Temperature Interval	Supply Voltage	Frequency Error (ppm)	
		5260 MHz	5320 MHz
-10°C	4.0 V DC	9.981	9.977
	3.8 V DC	10.054	10.013
0°C	4.0 V DC	7.282	7.350
	3.8 V DC	7.434	7.501
+10°C	4.0 V DC	4.783	4.820
	3.8 V DC	4.997	4.850
+20°C	4.0 V DC	1.112	1.235
	3.8 V DC	1.264	1.386
	4.0 V DC	1.112	1.235
-30°C	4.0 V DC	-1.021	-0.994
	3.8 V DC	-0.963	-0.949
+40°C	4.0 V DC	-1.645	-1.792
	3.8 V DC	-1.660	-1.687
+50°C	4.0 V DC	-1.813	-1.732
	3.8 V DC	-1.828	-1.838
+55°C	4.0 V DC	-1.706	-1.597
	3.8 V DC	-1.706	-1.717
Maximum Frequency Error (Hz)		10.054	10.013

Frequency Band 3

Hand Carrier Battery Powered

Temperature Interval	Supply Voltage	Frequency Error (ppm)	
		5500 MHz	5700 MHz
-10°C	4.0 V DC	9.965	9.953
	3.8 V DC	10.035	10.020
0°C	4.0 V DC	7.488	7.647
	3.8 V DC	7.663	7.488
+10°C	4.0 V DC	4.808	4.808
	3.8 V DC	5.012	4.864
+20°C	4.0 V DC	1.267	1.364
	3.8 V DC	1.399	1.532
	4.0 V DC	1.267	1.364
-30°C	4.0 V DC	-0.991	-1.167
	3.8 V DC	-0.874	-1.082
+40°C	4.0 V DC	-1.792	-1.884
	3.8 V DC	-1.807	-1.814
+50°C	4.0 V DC	-1.734	-1.842
	3.8 V DC	-1.952	-1.898
+55°C	4.0 V DC	-1.486	-1.631
	3.8 V DC	-1.515	-1.603
Maximum Frequency Error (Hz)		10.035	10.020

Limit

Maintained within the band of operation under all conditions of normal operations as specified in the user's manual.

2.5 26 dB BANDWIDTH

2.5.1 Specification Reference

FCC CFR 47 Part 15E, Clause 15.407 (a)

2.5.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114765106 - Modification State 0

2.5.3 Date of Test

28 May 2013

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

The EUT was transmitted at maximum power via an attenuator and cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth were set appropriately to perform the measurement correctly.

2.5.6 Environmental Conditions

Ambient Temperature	23.8°C
Relative Humidity	39.8%

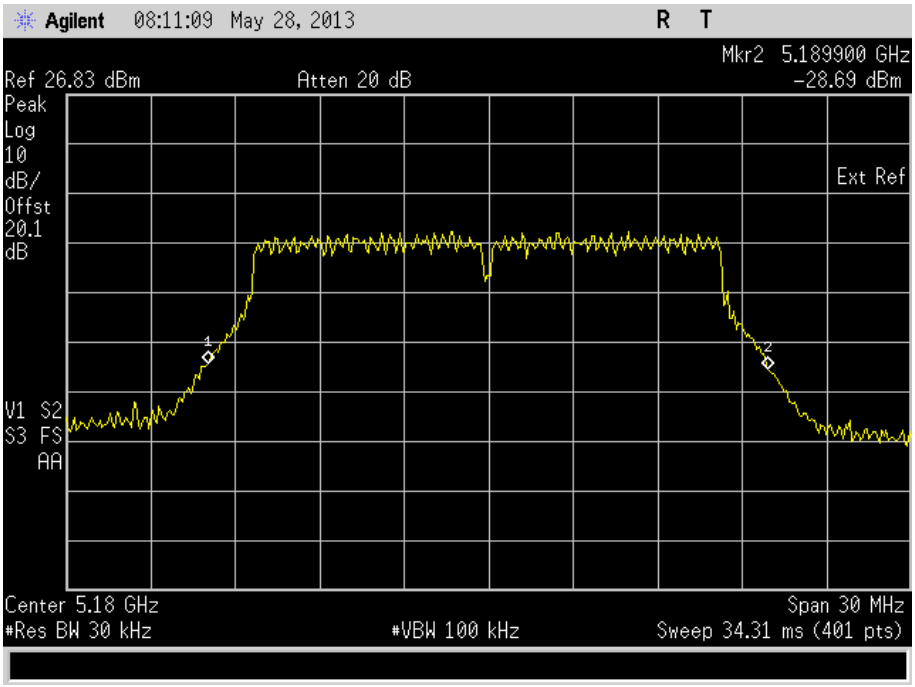
2.5.7 Test Results

802.11(a)

Frequency Band 1

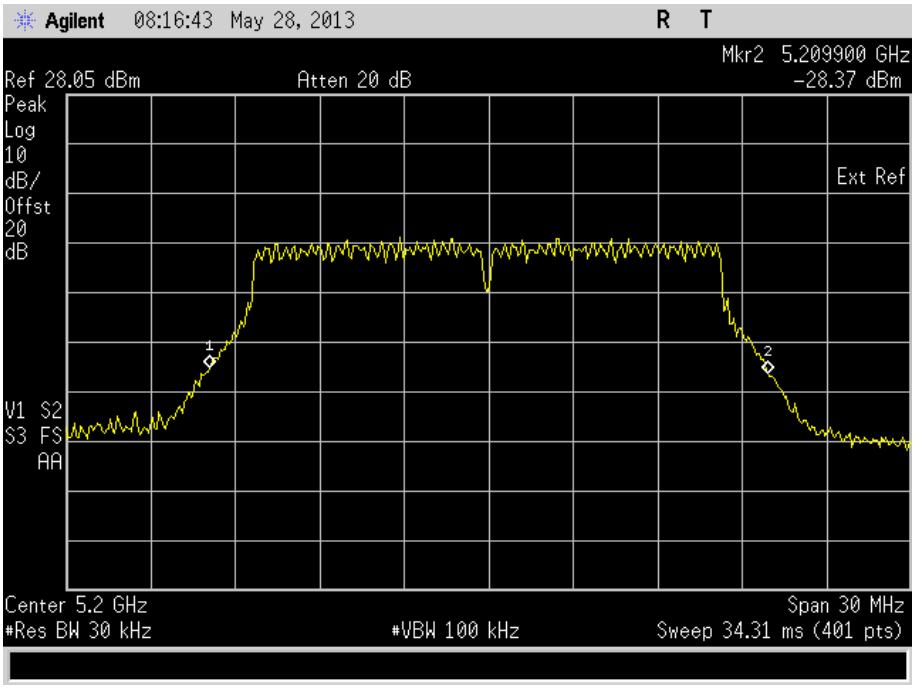
5180 MHz

26 dB Bandwidth (MHz)	19875



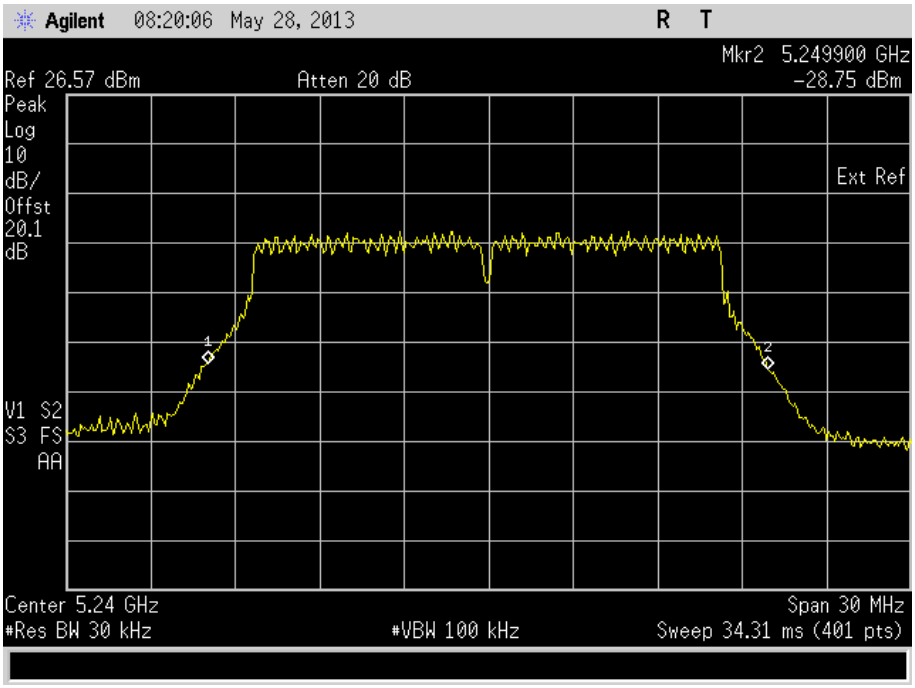
5200 MHz

26 dB Bandwidth (MHz)	19800



5240 MHz

26 dB Bandwidth (MHz)	19875

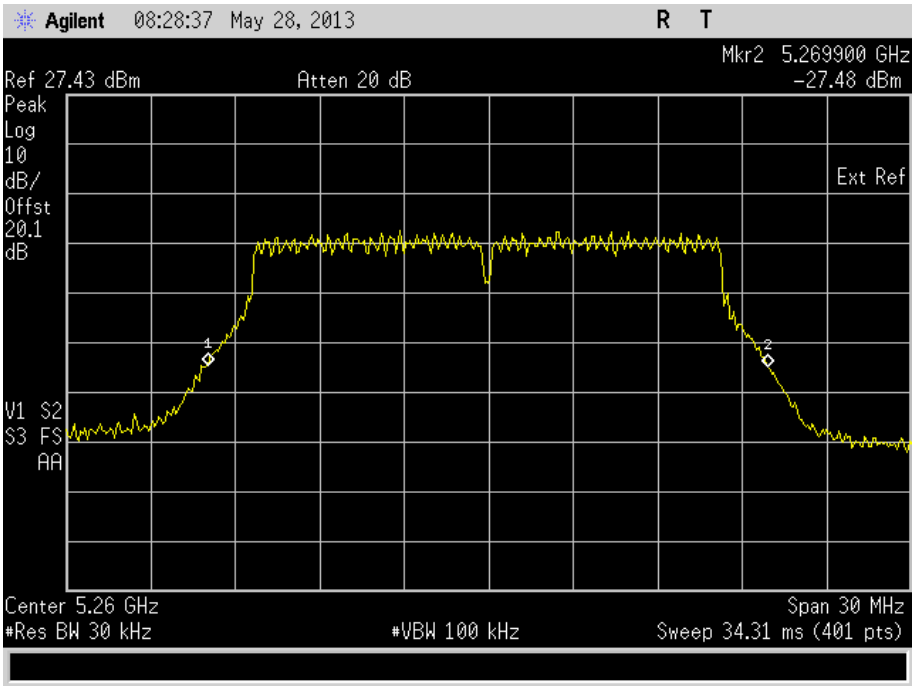


The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Frequency Band 2

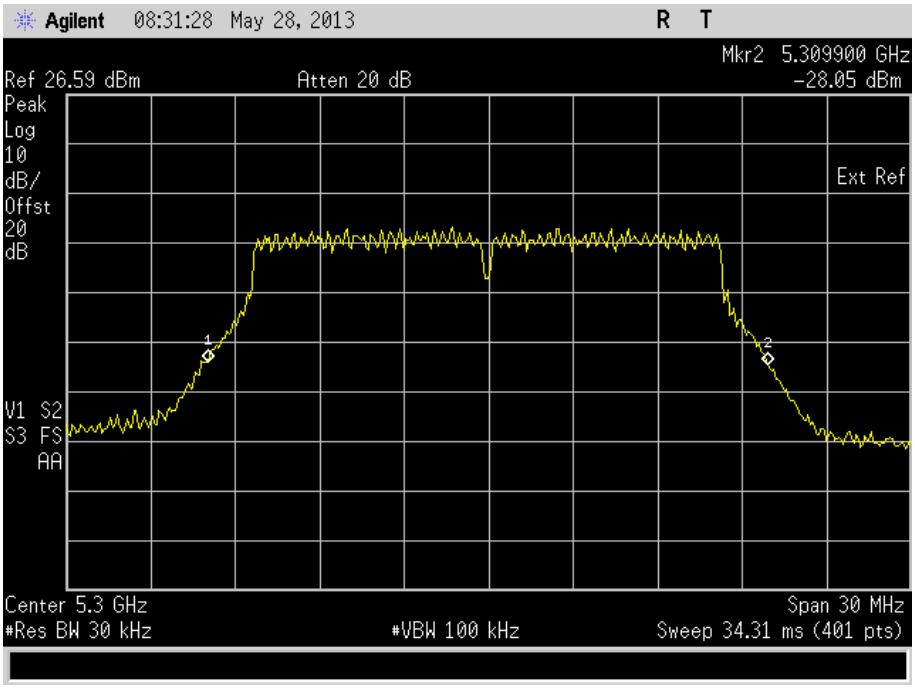
5260 MHz

26 dB Bandwidth (MHz)	19875



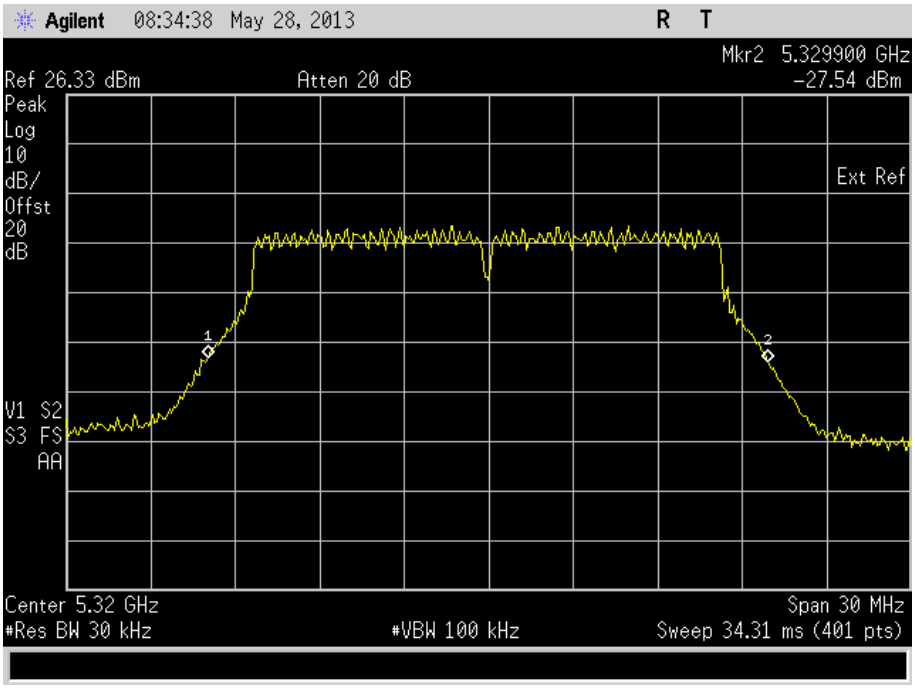
5300 MHz

26 dB Bandwidth (MHz)	19875



5320 MHz

26 dB Bandwidth (MHz)	19875

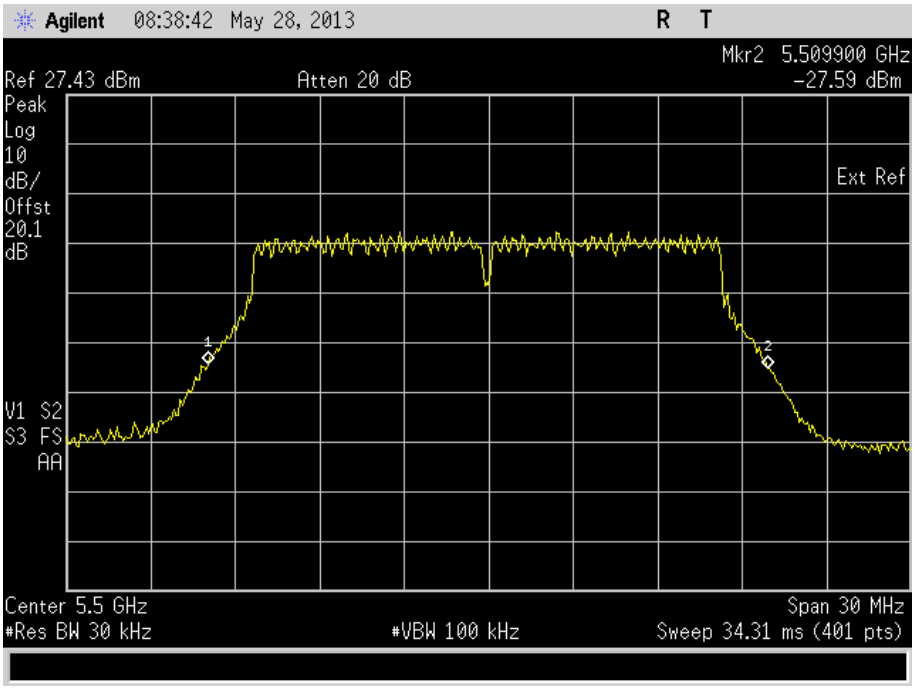


The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Frequency Band 3

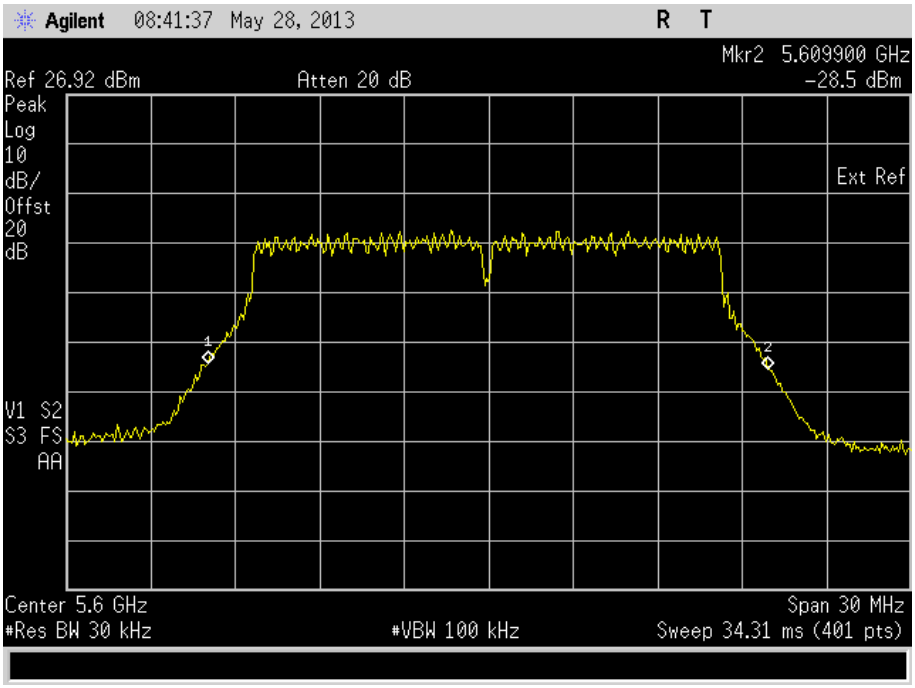
5500 MHz

26 dB Bandwidth (MHz)	19875



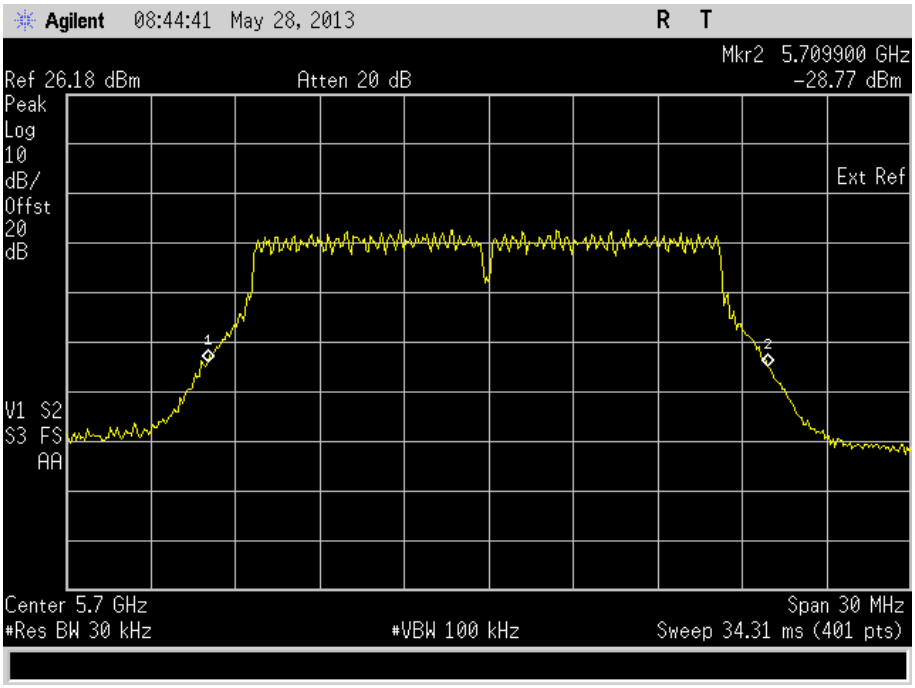
5600 MHz

26 dB Bandwidth (MHz)	19875



5700 MHz

26 dB Bandwidth (MHz)	19875



The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Limit

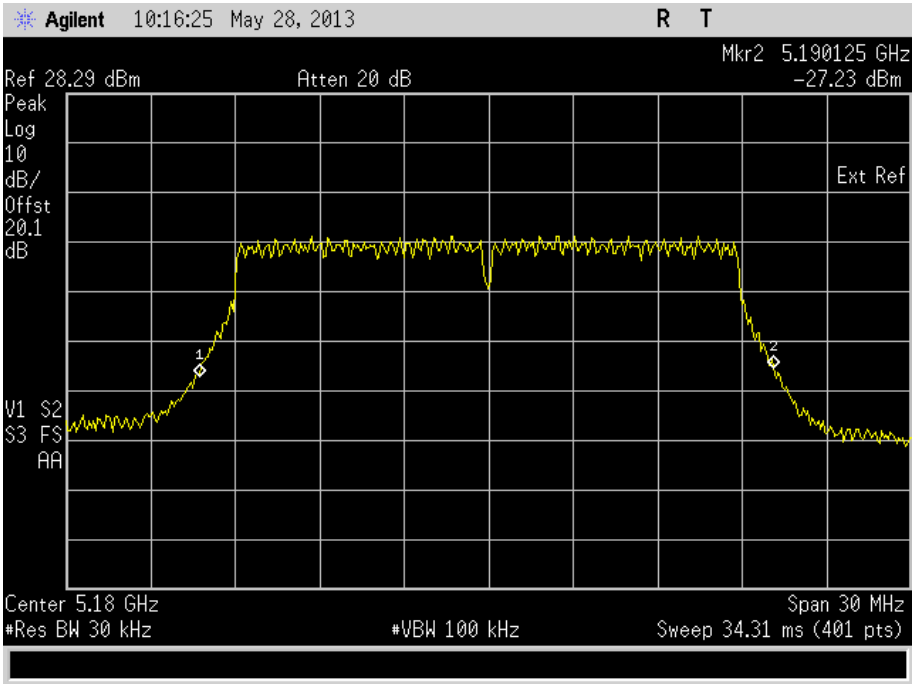
Not specified.

802.11(ac) - 5 GHz 20 MHz BW

Frequency Band 1

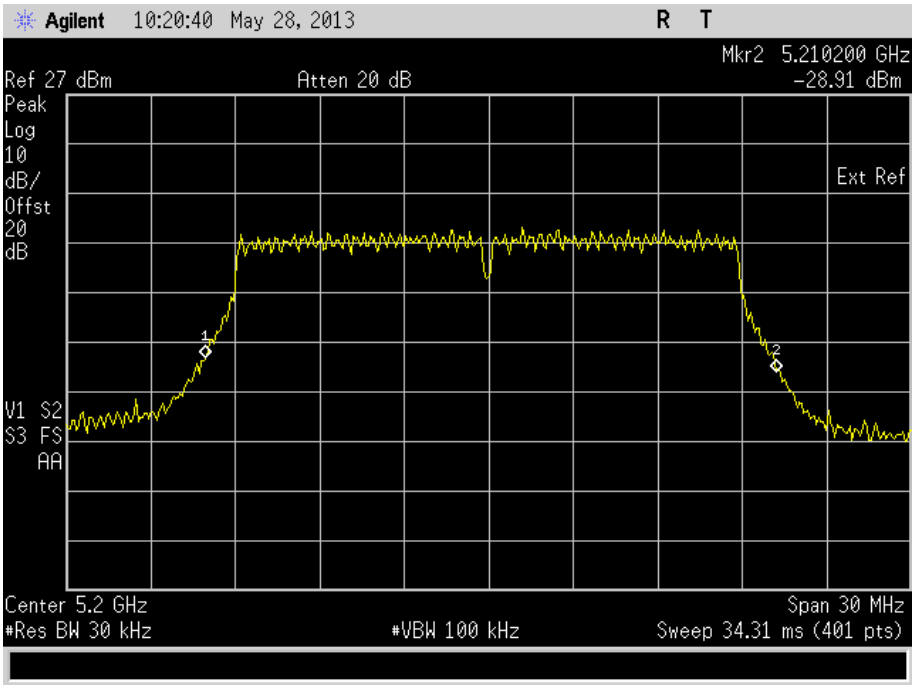
5180 MHz

26 dB Bandwidth (MHz)	20400



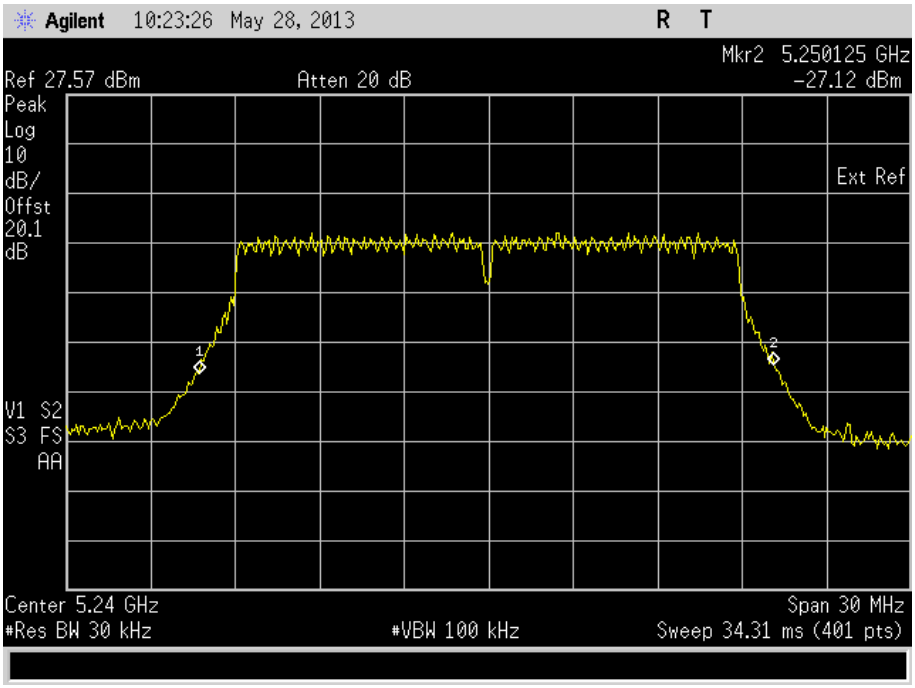
5200 MHz

26 dB Bandwidth (MHz)	20250



5240 MHz

26 dB Bandwidth (MHz)	20400

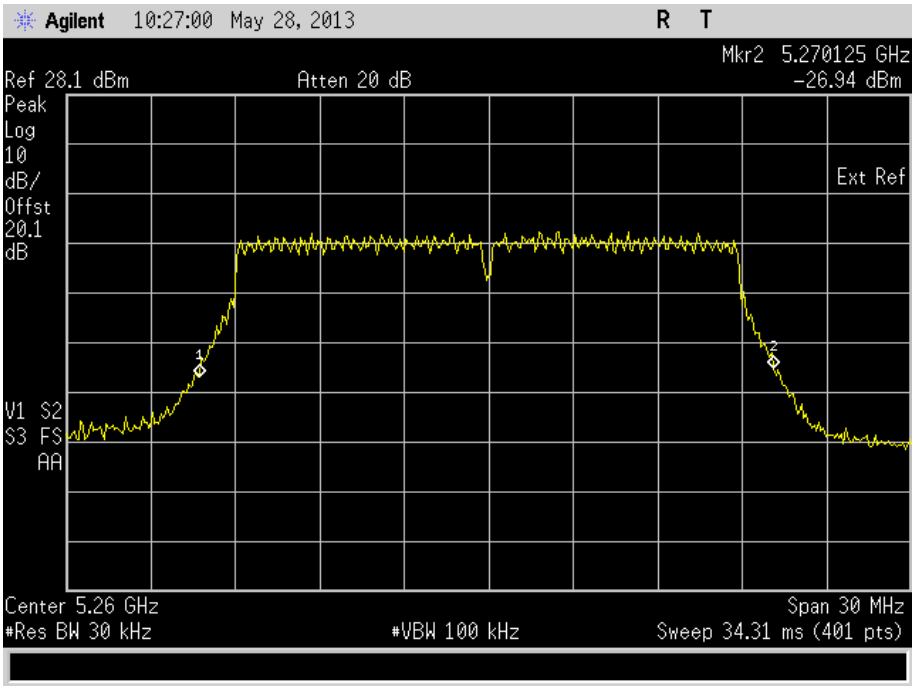


The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 2

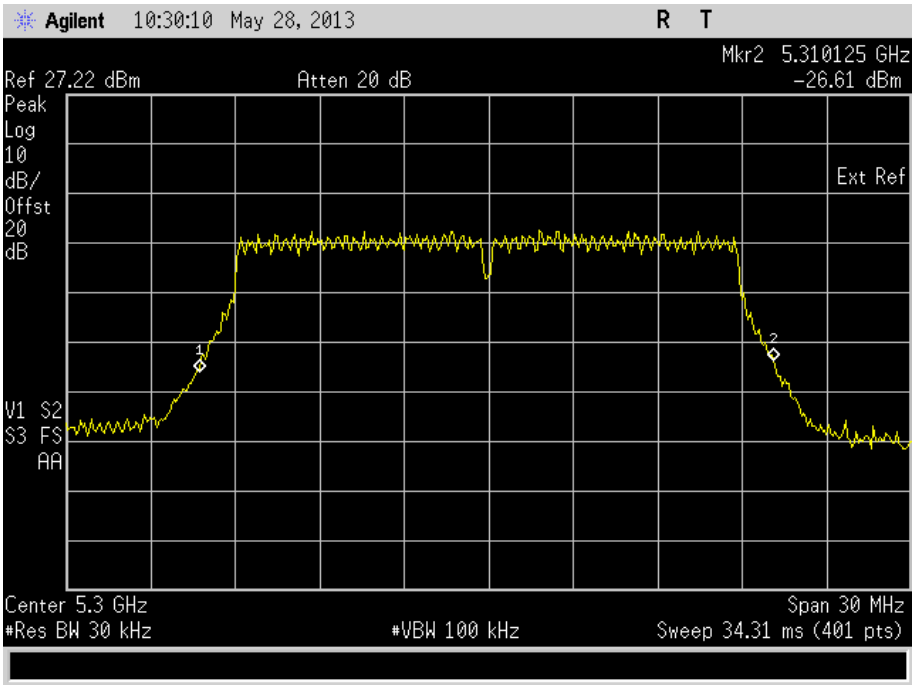
5260 MHz

26 dB Bandwidth (MHz)	20400



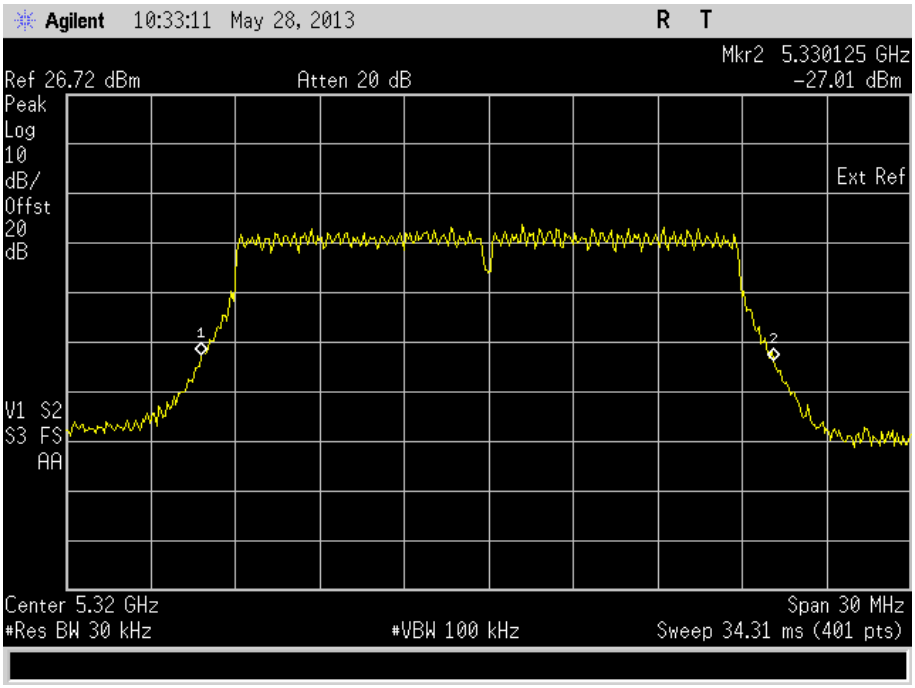
5300 MHz

26 dB Bandwidth (MHz)	20400



5320 MHz

26 dB Bandwidth (MHz)	20325

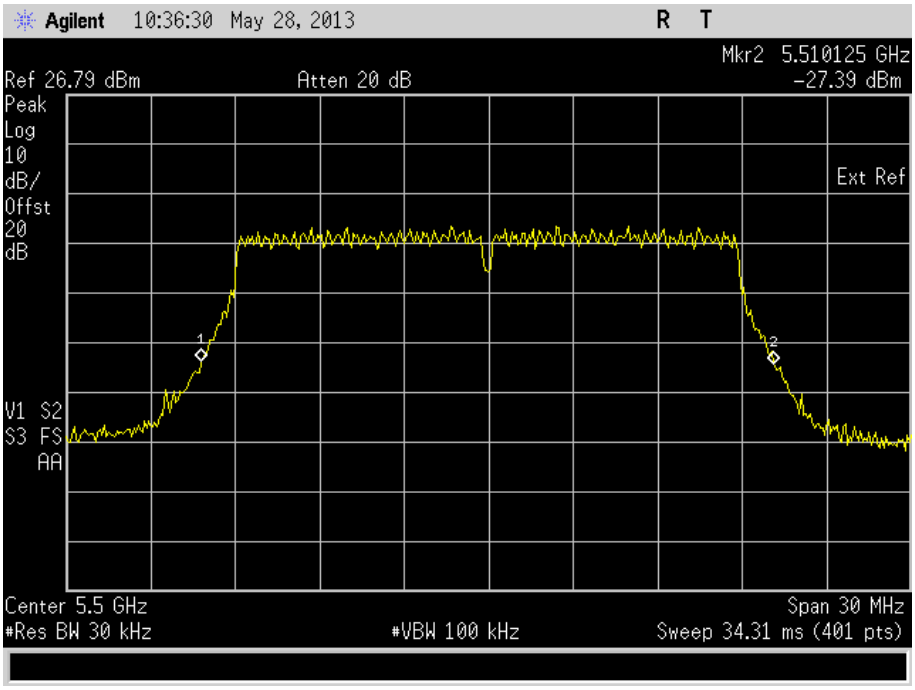


The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 3

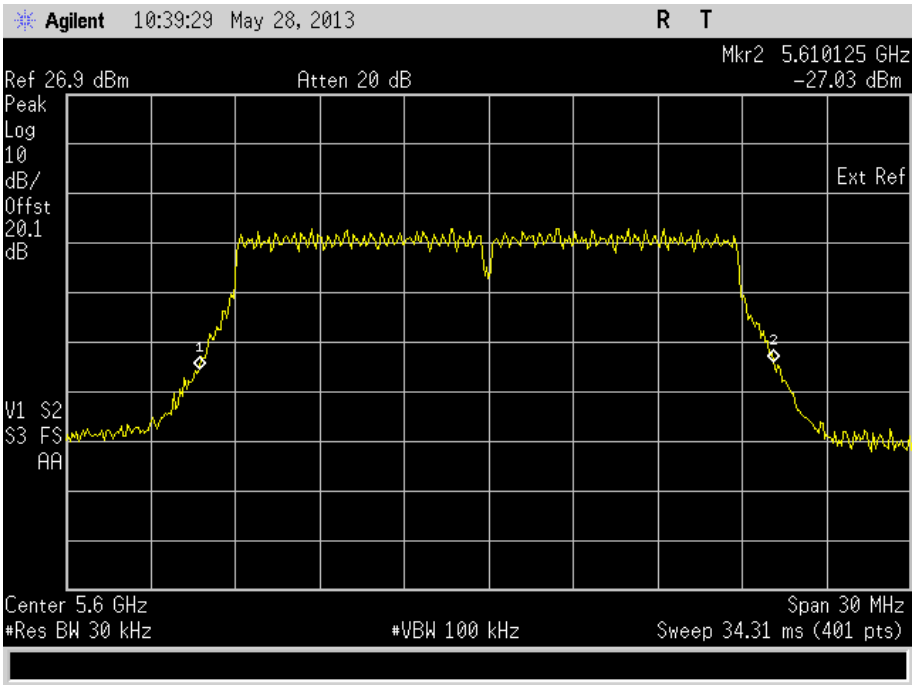
5500 MHz

26 dB Bandwidth (MHz)	20325



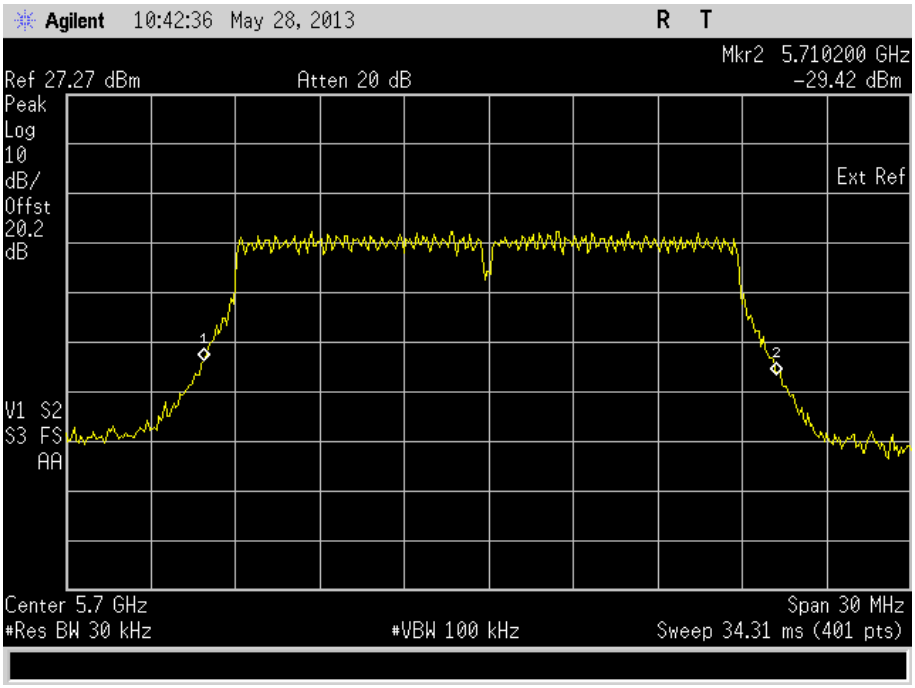
5600 MHz

26 dB Bandwidth (MHz)	20400



5700 MHz

26 dB Bandwidth (MHz)	20325



The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit

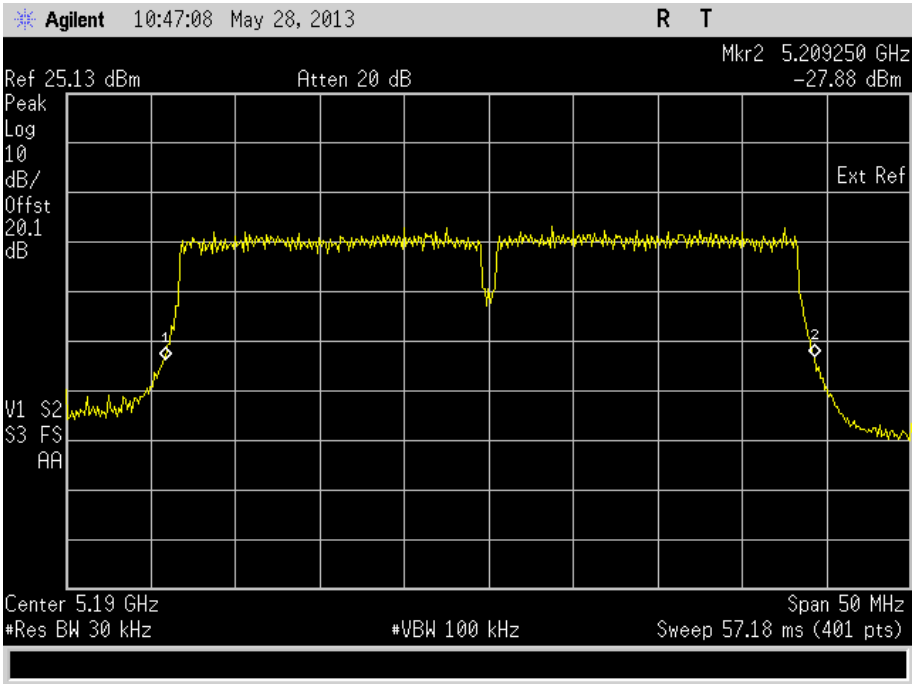
Not specified.

802.11(ac) - 5 GHz 40 MHz BW

Frequency Band 1

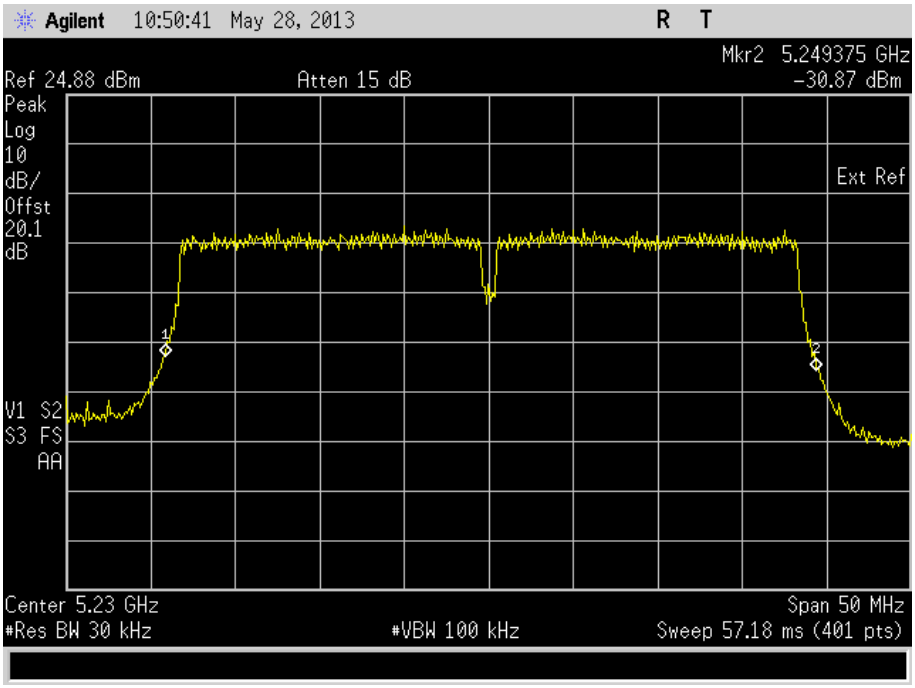
5190 MHz

26 dB Bandwidth (MHz)	38375



5230 MHz

26 dB Bandwidth (MHz)	38500

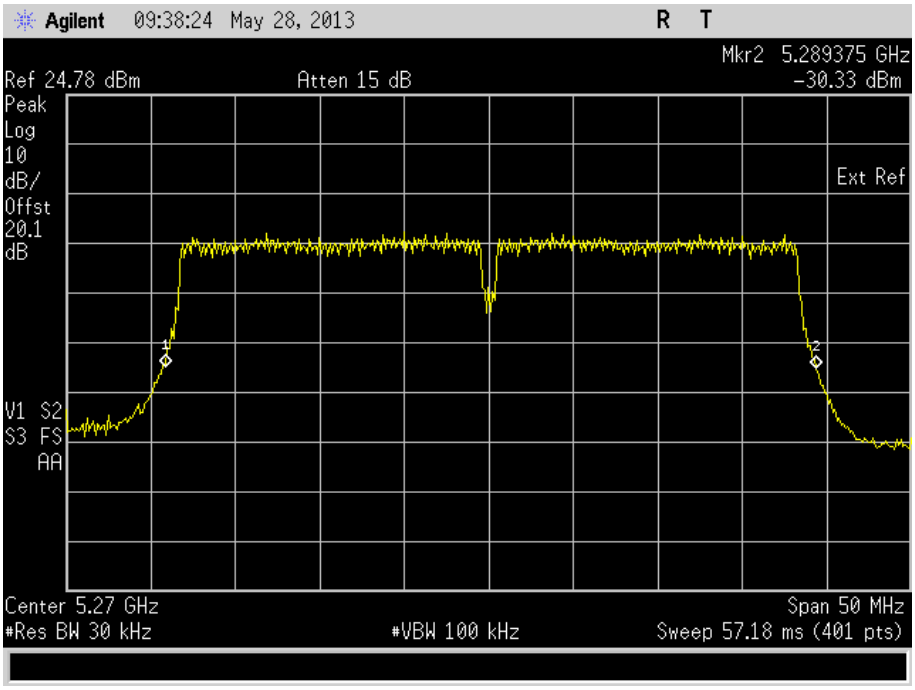


The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 2

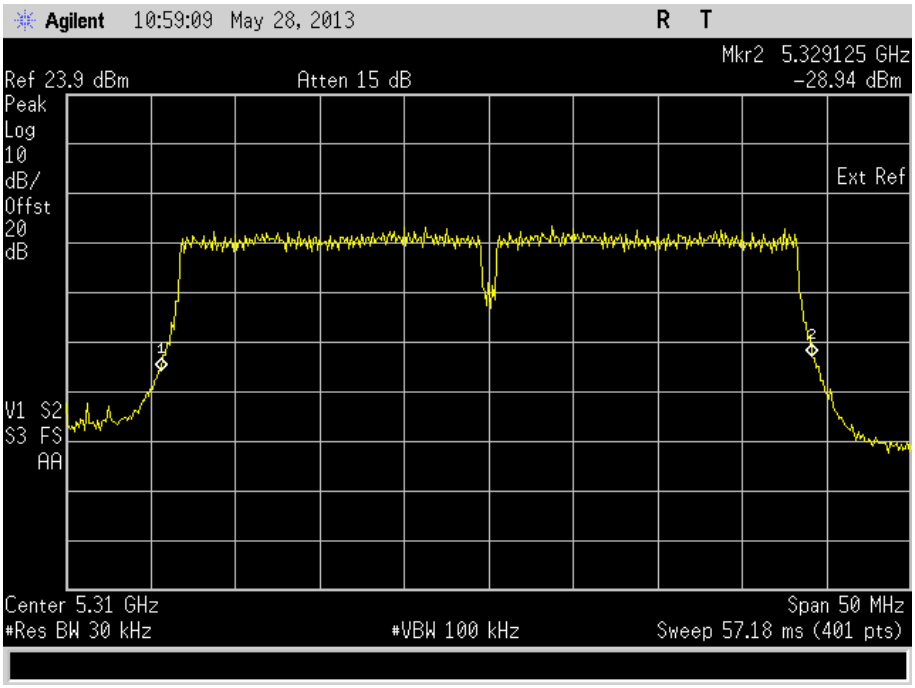
5270 MHz

26 dB Bandwidth (MHz)	38500



5310 MHz

26 dB Bandwidth (MHz)	38500

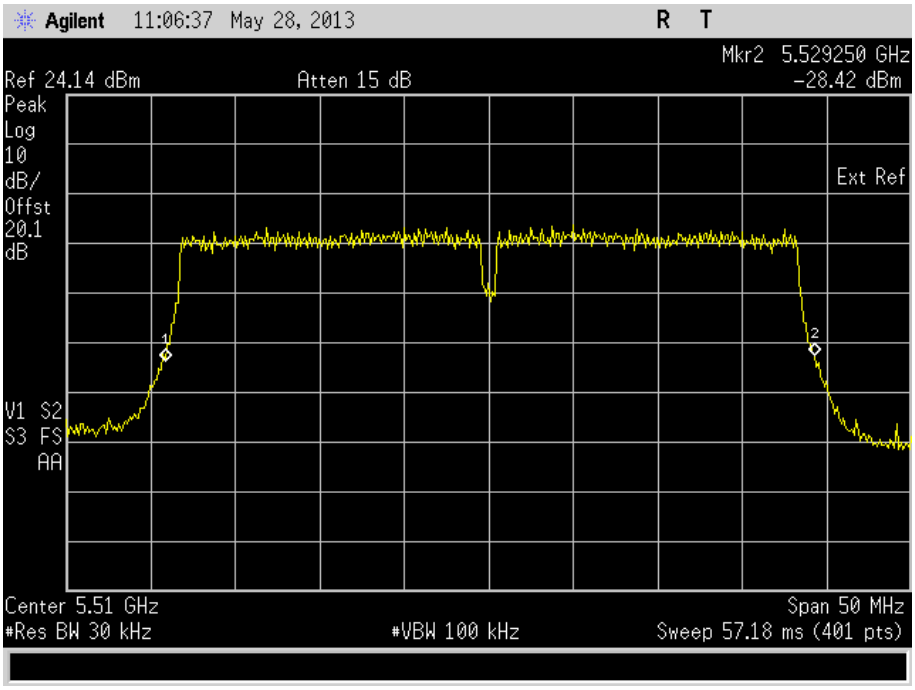


The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 3

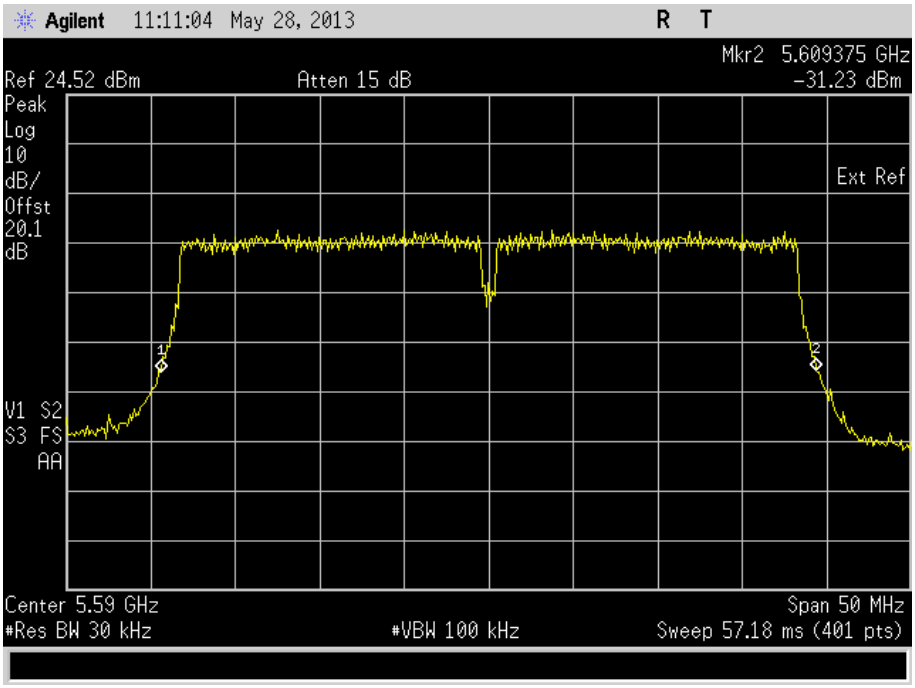
5510 MHz

26 dB Bandwidth (MHz)	38375



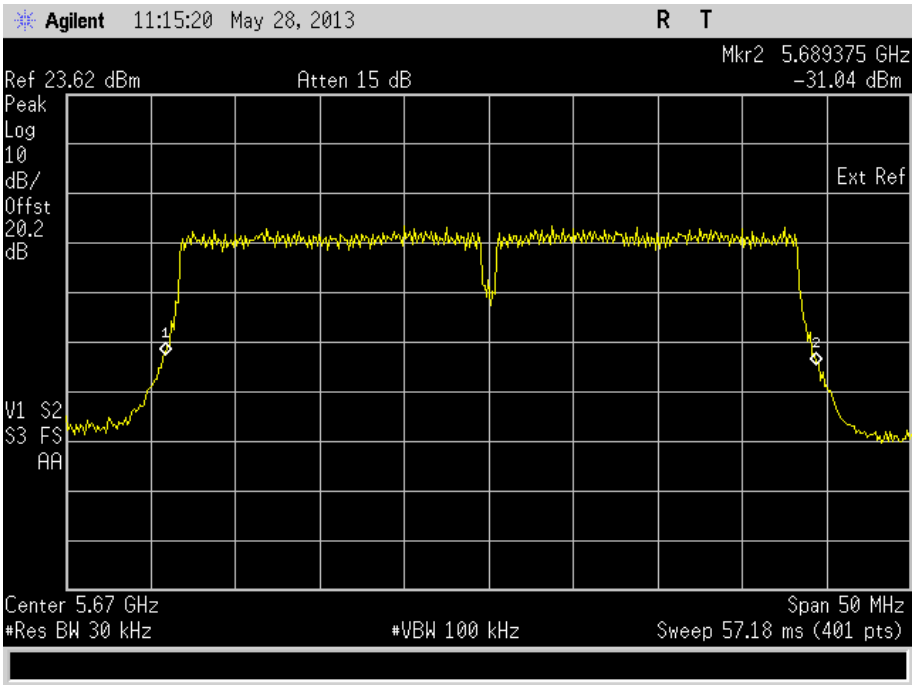
5590 MHz

26 dB Bandwidth (MHz)	38750



5670 MHz

26 dB Bandwidth (MHz)	38500



The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Limit

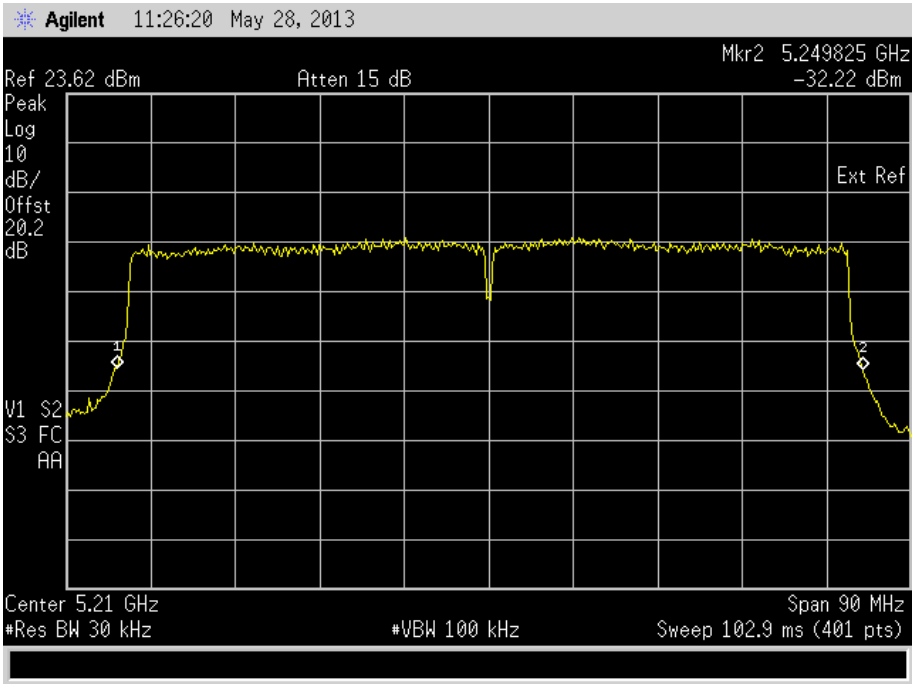
Not specified.

802.11(ac) - 5 GHz 80 MHz BW

Frequency Band 1

5210 MHz

26 dB Bandwidth (MHz)	79.750

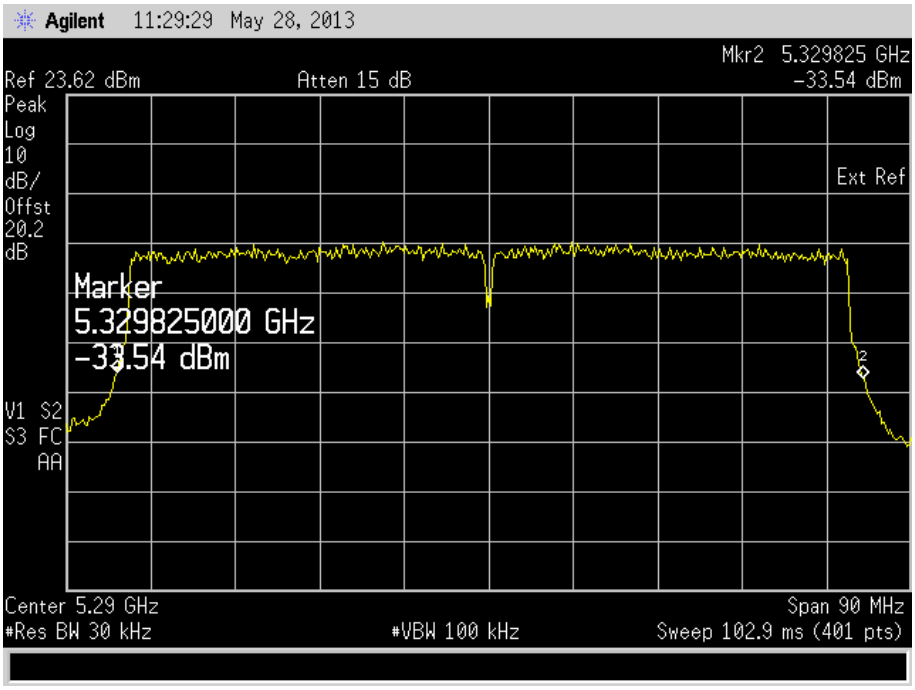


The test was performed on the worst case data rate for 802.11(ac) - 70 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Frequency Band 2

5290 MHz

26 dB Bandwidth (MHz)	79.425

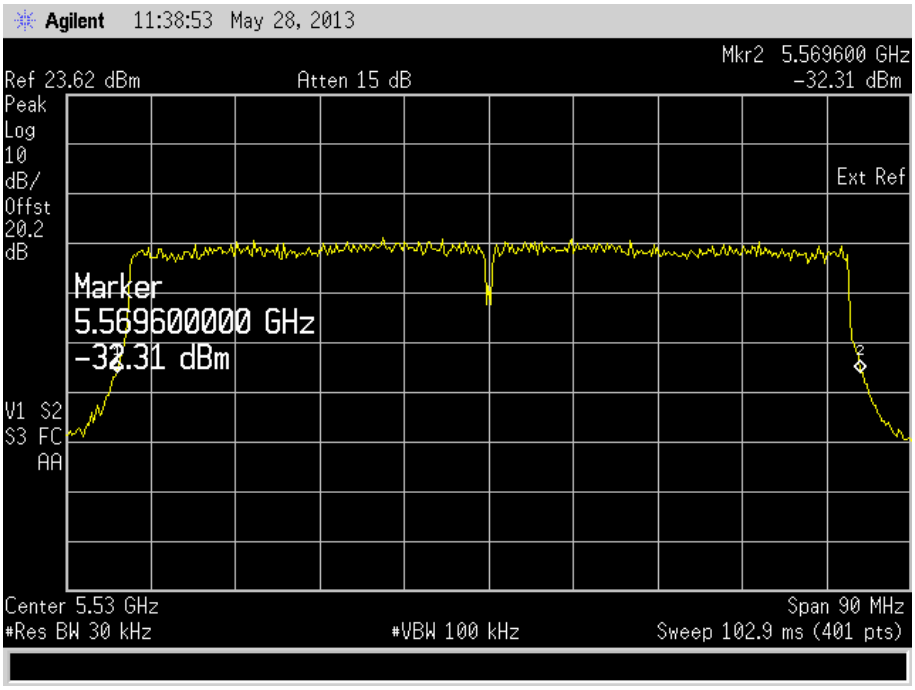


The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Frequency Band 3

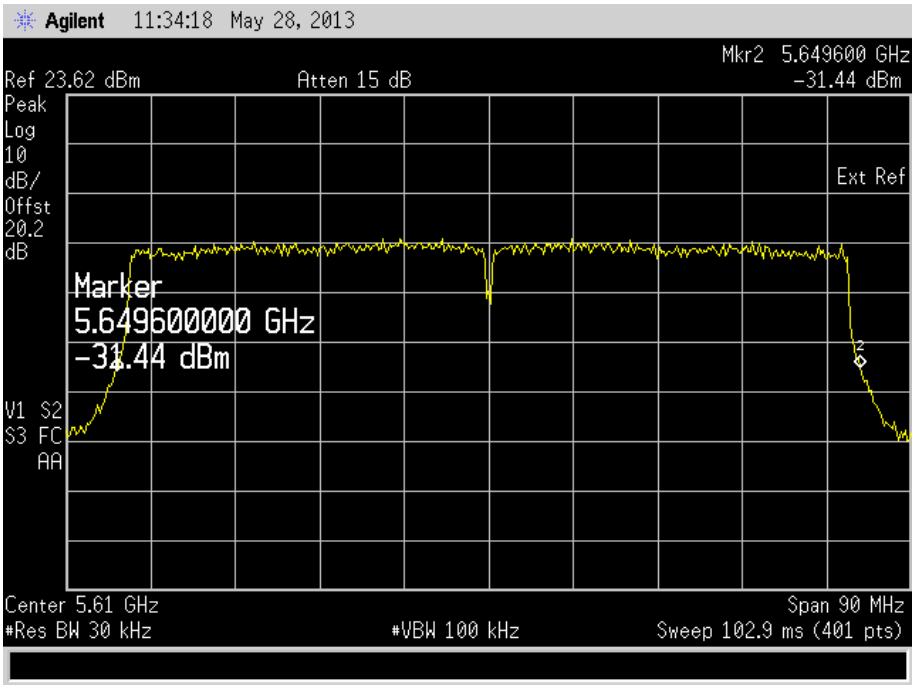
5530 MHz

26 dB Bandwidth (MHz)	79.2



5610 MHz

26 dB Bandwidth (MHz)	79.2



The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Limit

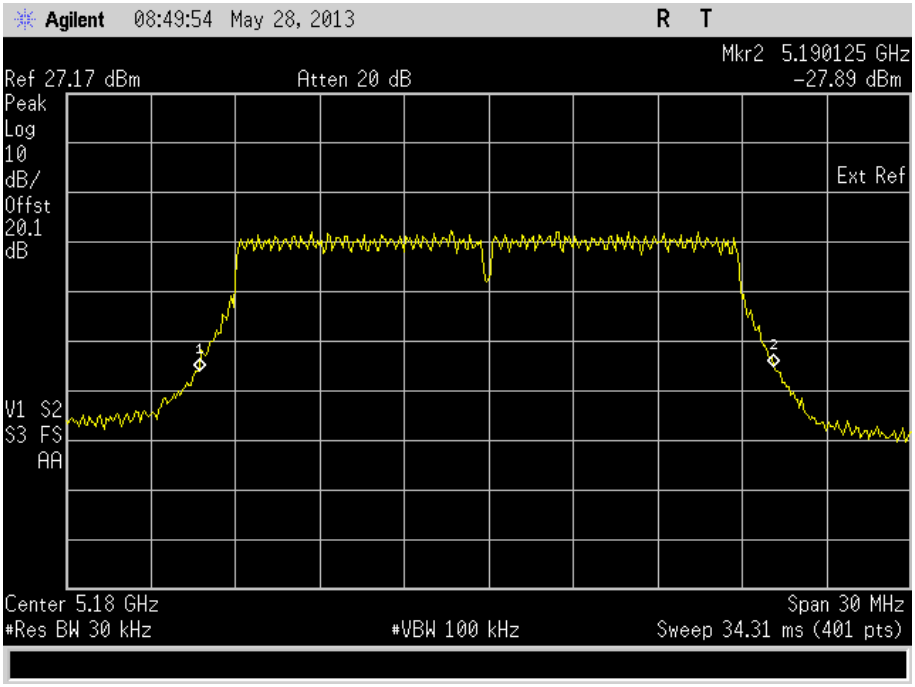
Not specified.

802.11(n) - 5 GHz 20 MHz BW

Frequency Band 1

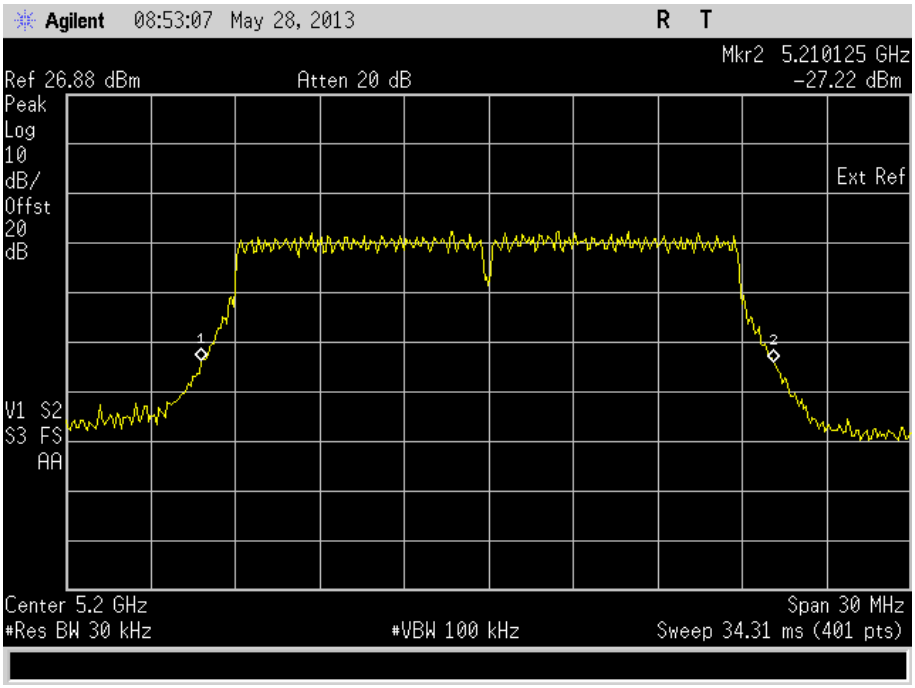
5180 MHz

26 dB Bandwidth (MHz)	20400



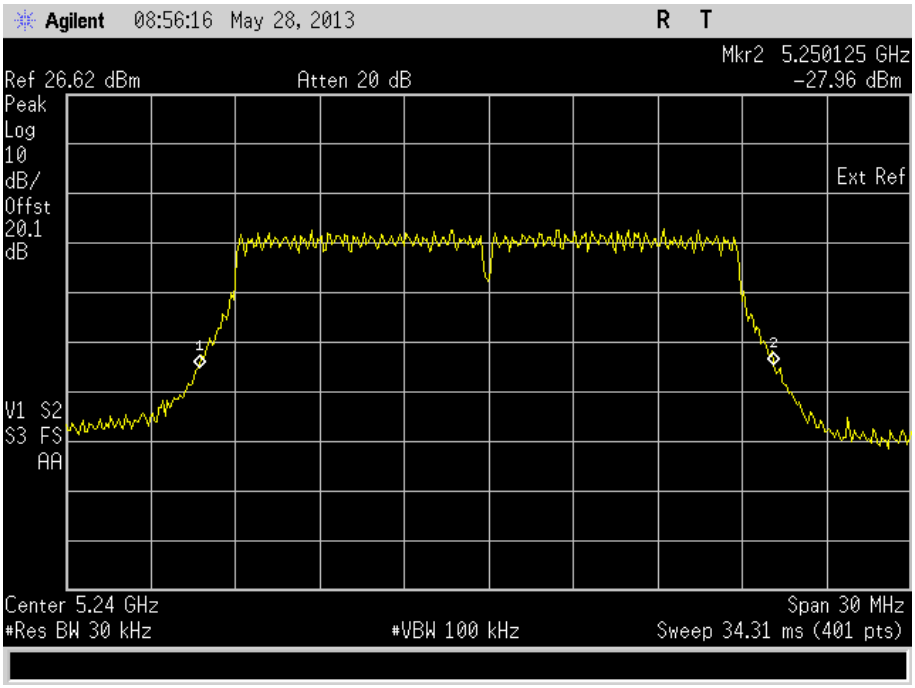
5200 MHz

26 dB Bandwidth (MHz)	20325



5240 MHz

26 dB Bandwidth (MHz)	20400

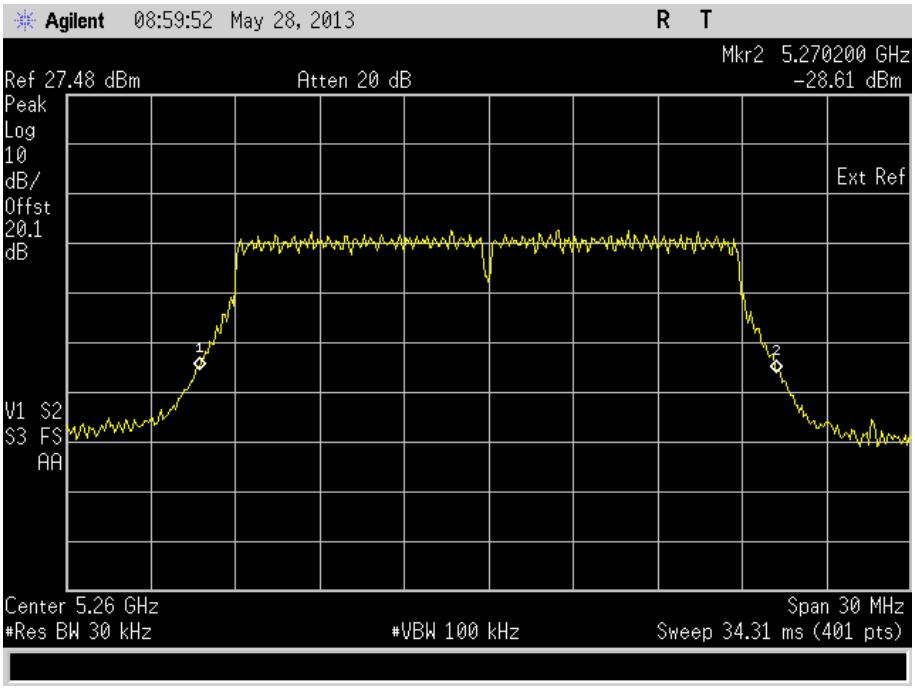


The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 2

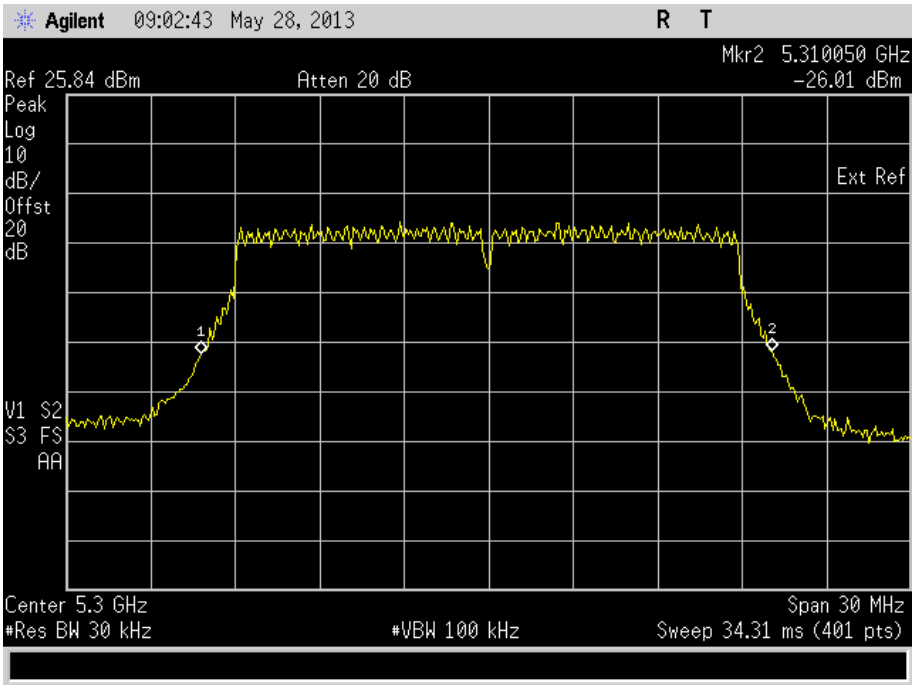
5260 MHz

26 dB Bandwidth (MHz)	20475



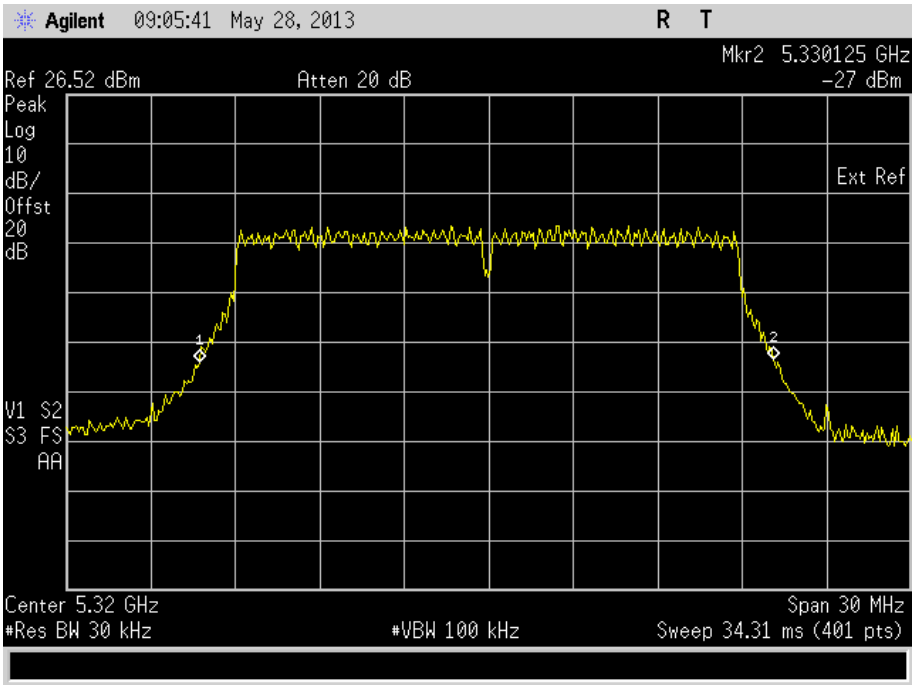
5300 MHz

26 dB Bandwidth (MHz)	20250



5320 MHz

26 dB Bandwidth (MHz)	20400

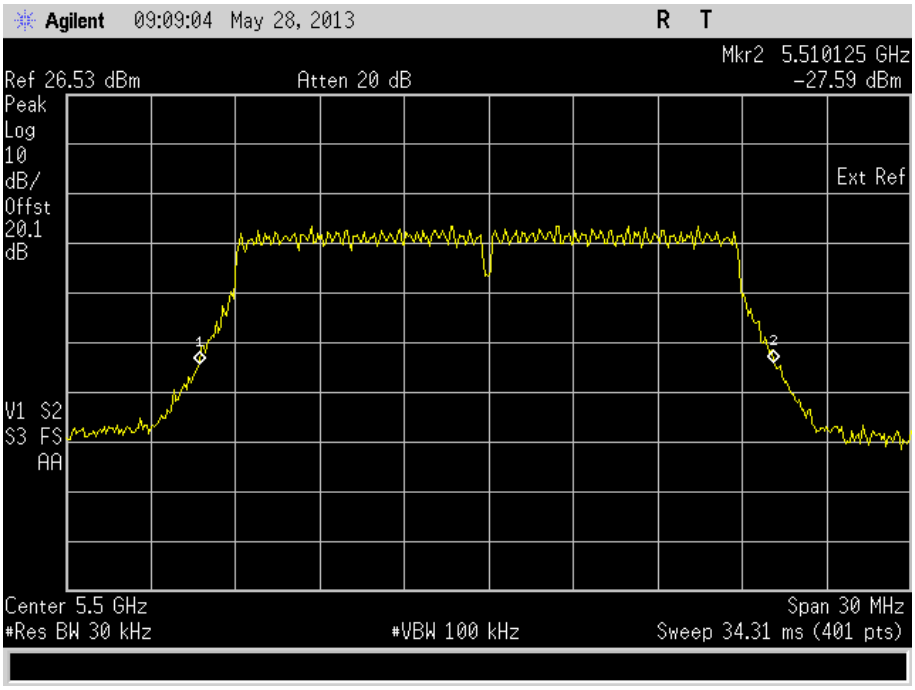


The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 3

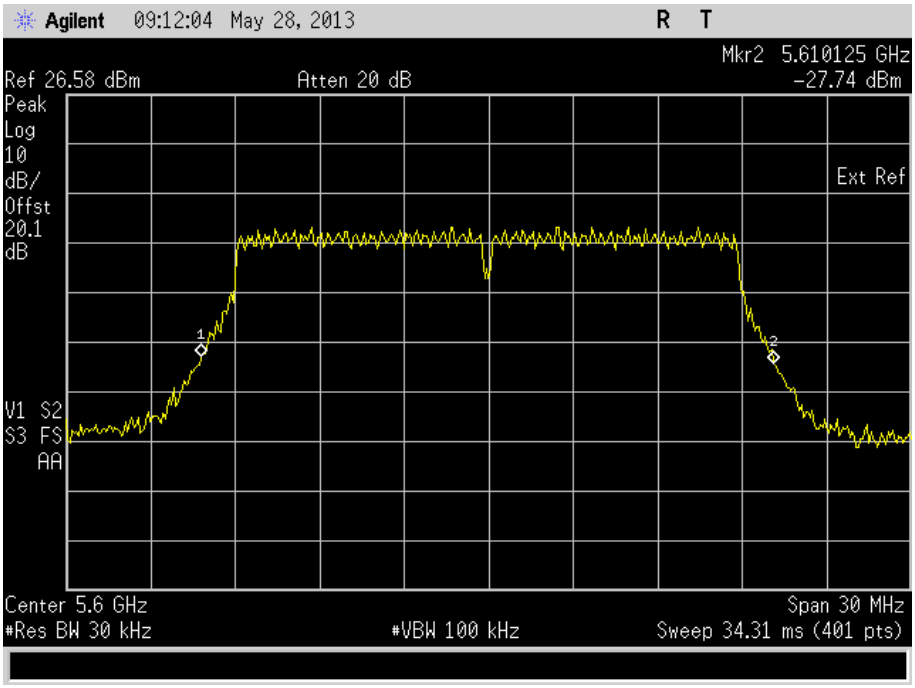
5500 MHz

26 dB Bandwidth (MHz)	20400



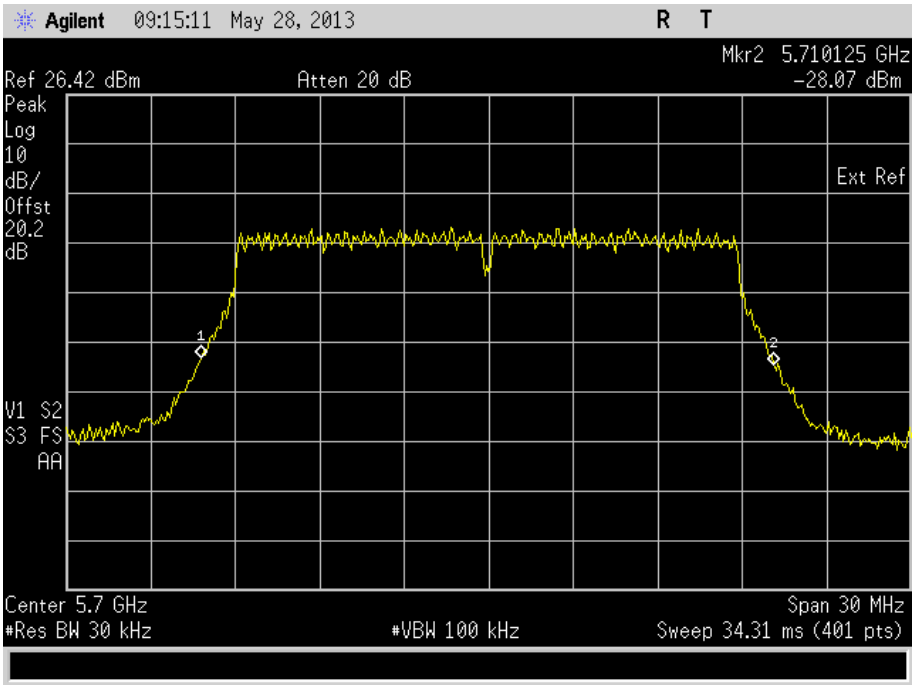
5600 MHz

26 dB Bandwidth (MHz)	20325



5700 MHz

26 dB Bandwidth (MHz)	20325



The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit

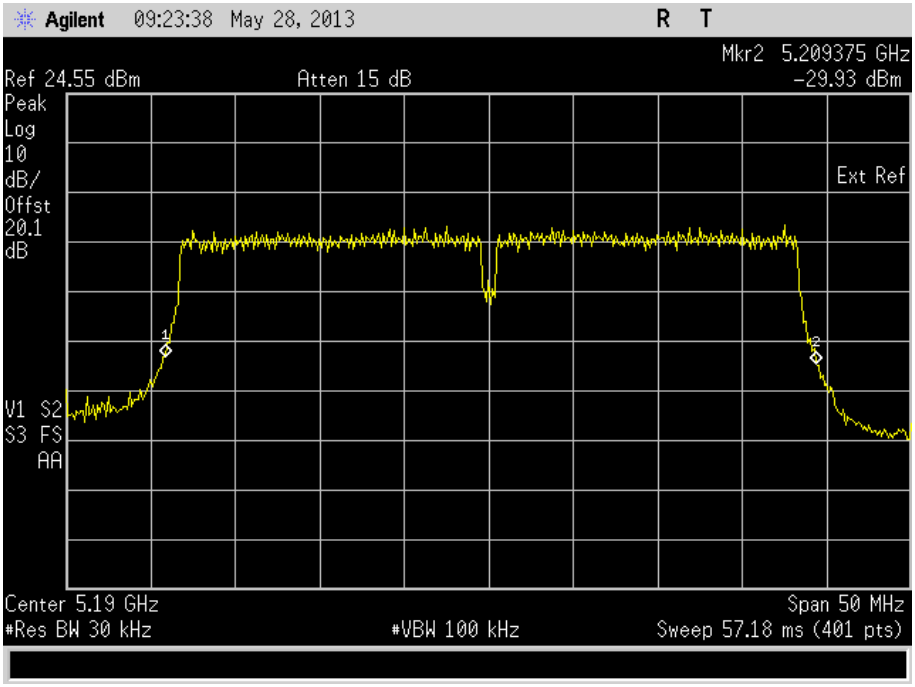
Not specified.

802.11(n) - 5 GHz 40 MHz BW

Frequency Band 1

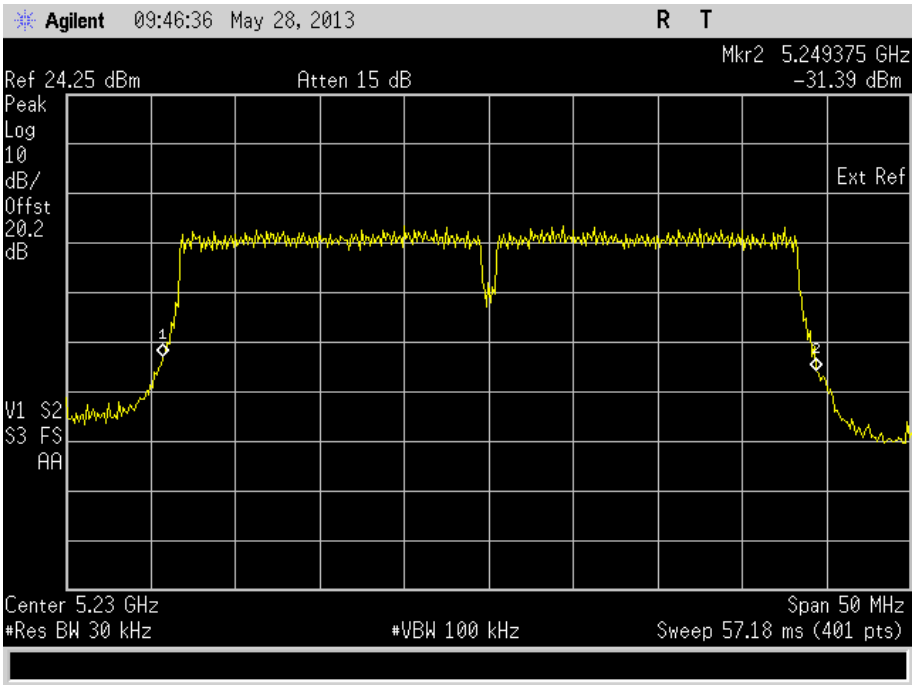
5190 MHz

26 dB Bandwidth (MHz)	38500



5230 MHz

26 dB Bandwidth (MHz)	38625

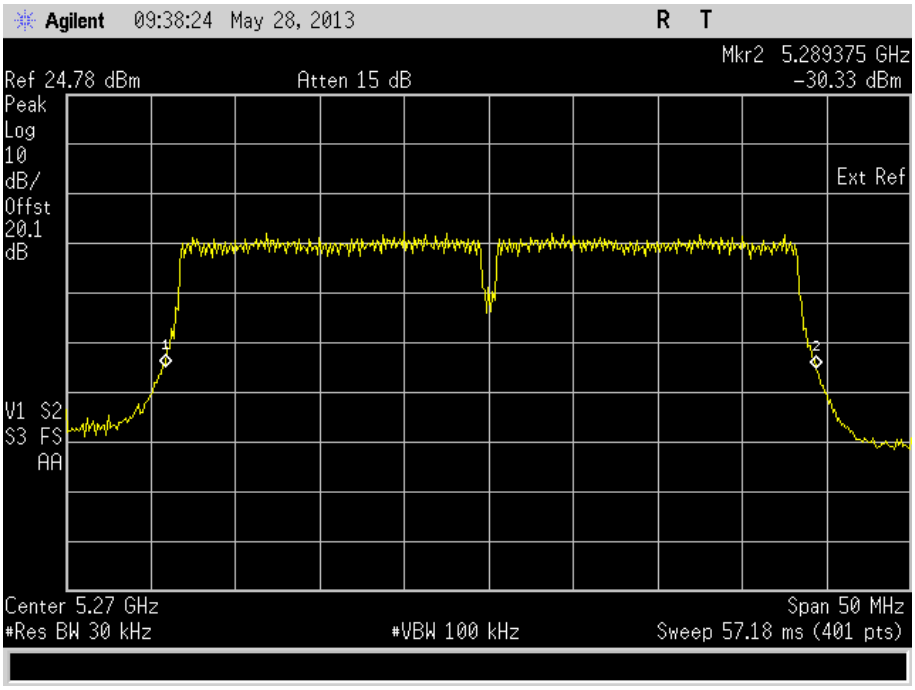


The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13 Mbps.

Frequency Band 2

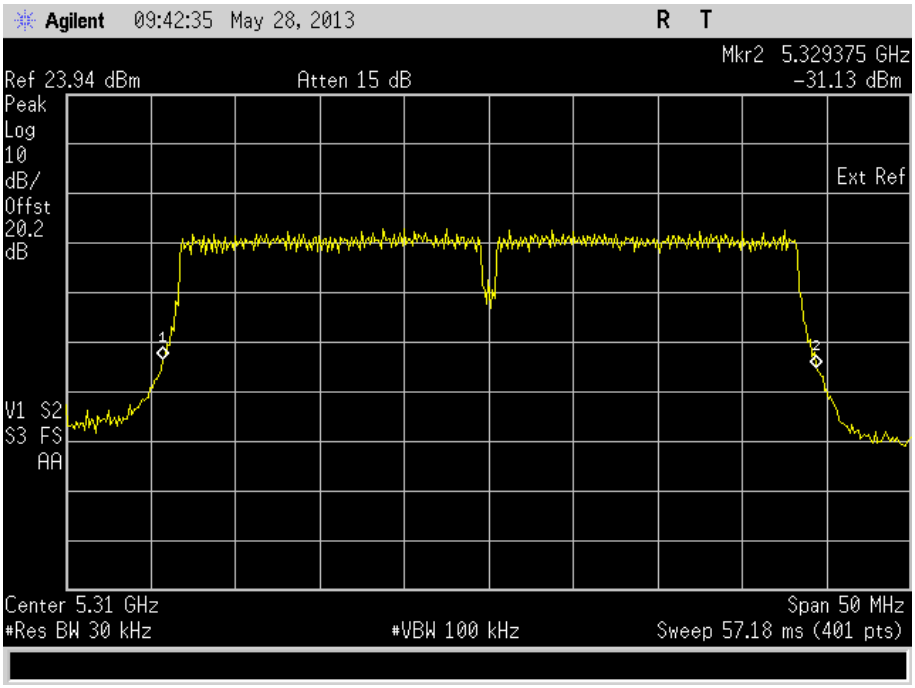
5270 MHz

26 dB Bandwidth (MHz)	38500



5310 MHz

26 dB Bandwidth (MHz)	38625

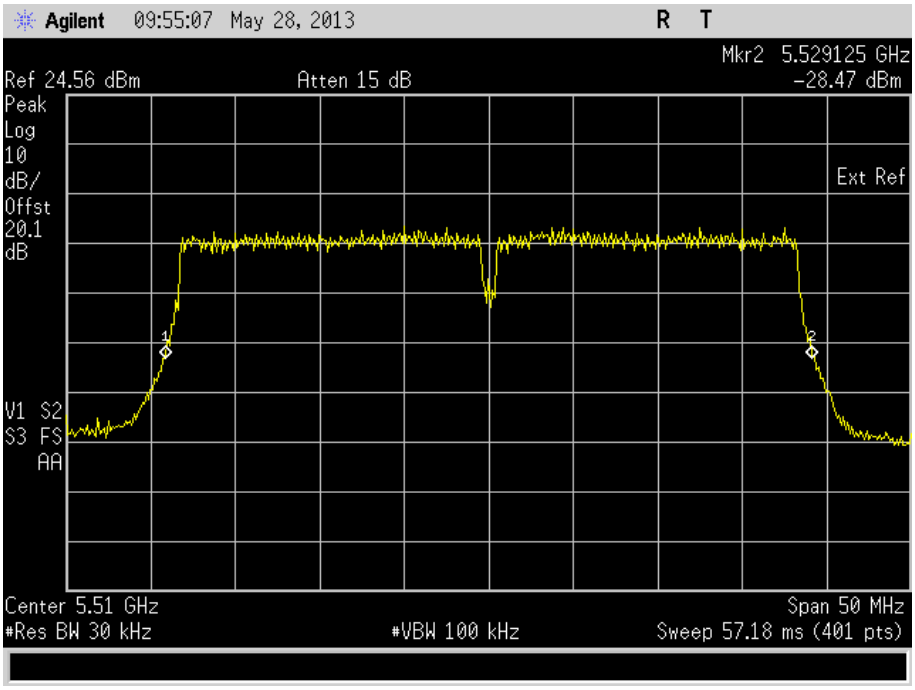


The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13 Mbps.

Frequency Band 3

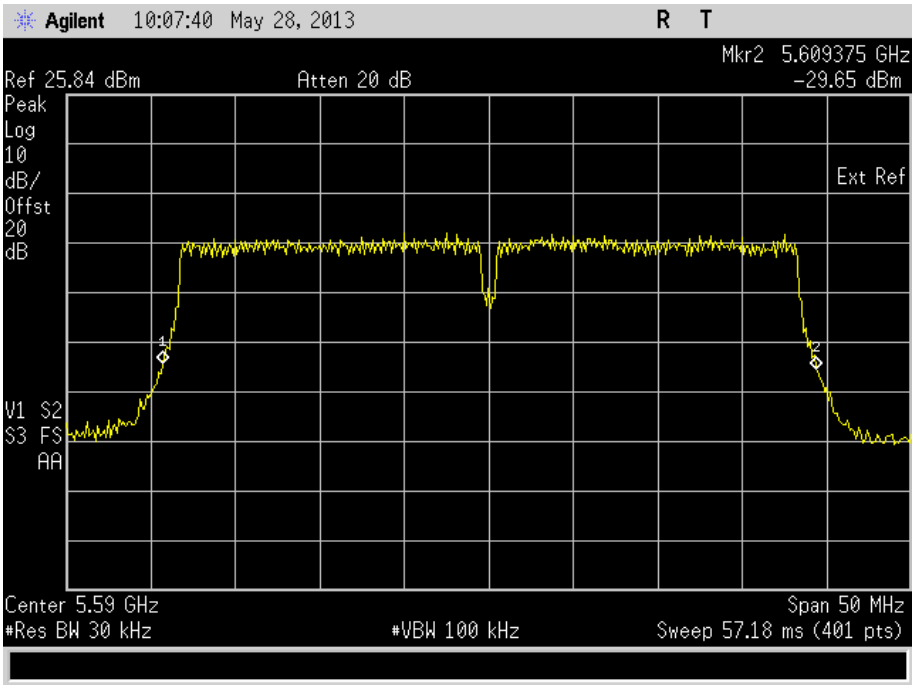
5510 MHz

26 dB Bandwidth (MHz)	38250



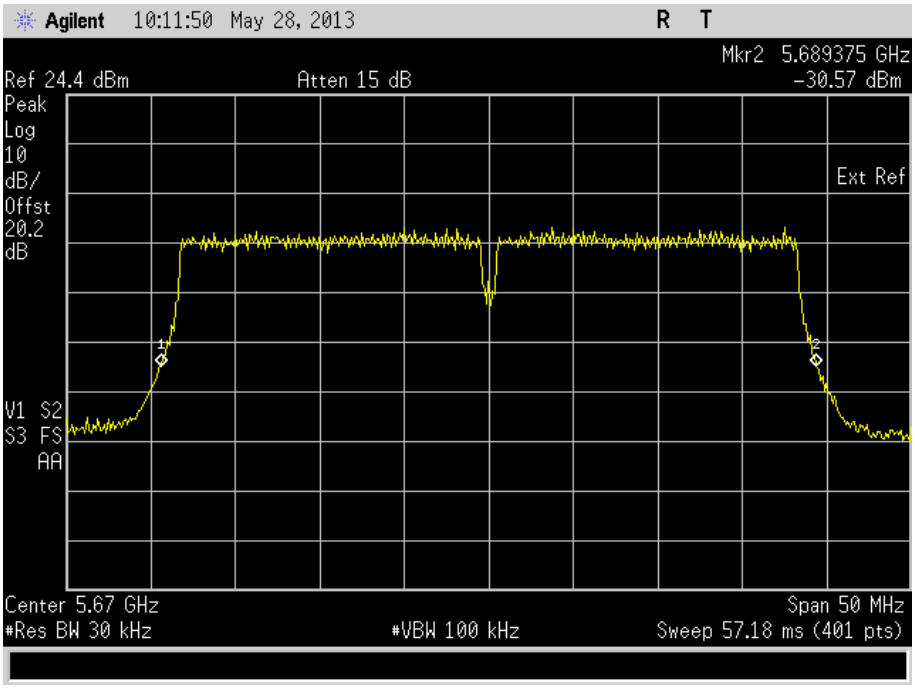
5590 MHz

26 dB Bandwidth (MHz)	38625



5670 MHz

26 dB Bandwidth (MHz)	38750



The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13 Mbps.

Limit

Not specified.

2.6 PEAK POWER SPECTRAL DENSITY

2.6.1 Specification Reference

FCC CFR 47 Part 15E, Clause 15.407 (a)(5)

2.6.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114765106 - Modification State 0

2.6.3 Date of Test

31 May 2013

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

The EUT was transmitted at maximum power via an attenuator and cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The resolution bandwidth and video bandwidth were set to 3 kHz and 10 kHz respectively. The trace was set to Max Hold and the peak of the level was measured.

2.6.6 Environmental Conditions

Ambient Temperature	24.0°C
Relative Humidity	43.2%

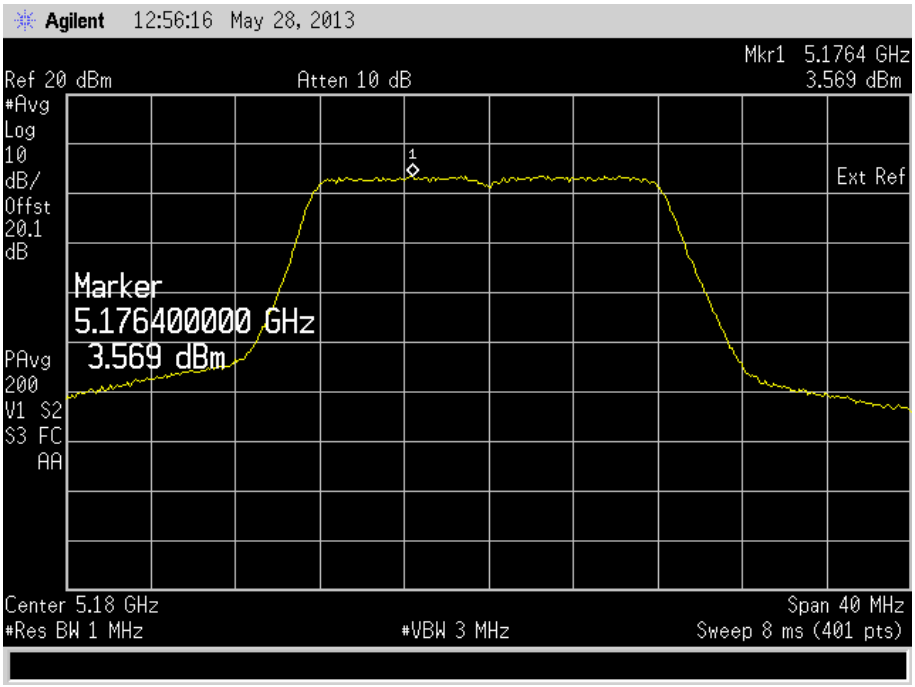
2.6.7 Test Results

802.11(a)

Frequency Band 1

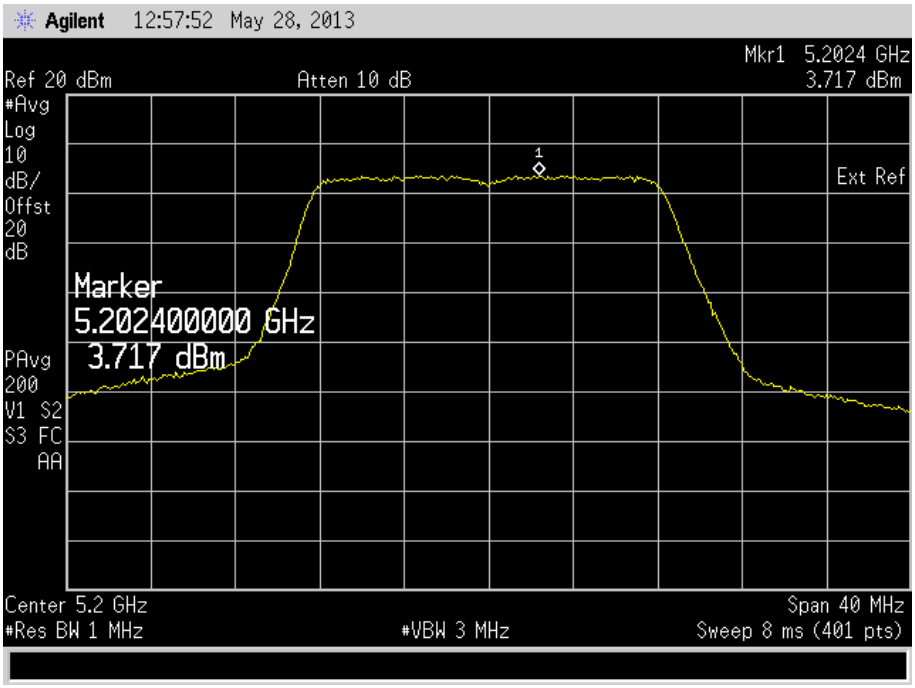
5180 MHz

Peak Power Spectral Density (dBm)	3.569



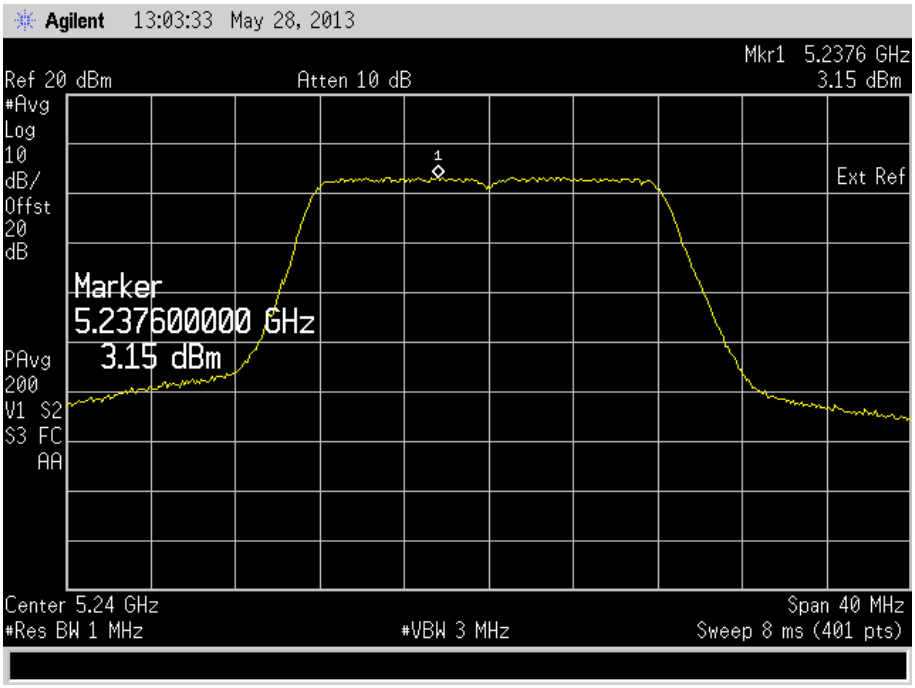
5200 MHz

Peak Power Spectral Density (dBm)	3.717



5240 MHz

Peak Power Spectral Density (dBm)	3.15

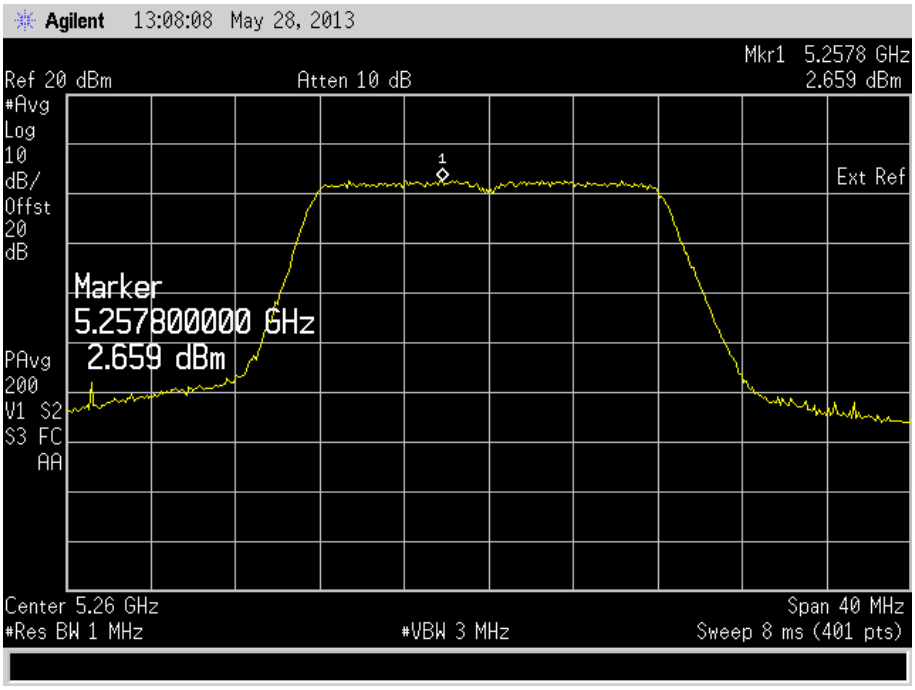


The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Frequency Band 2

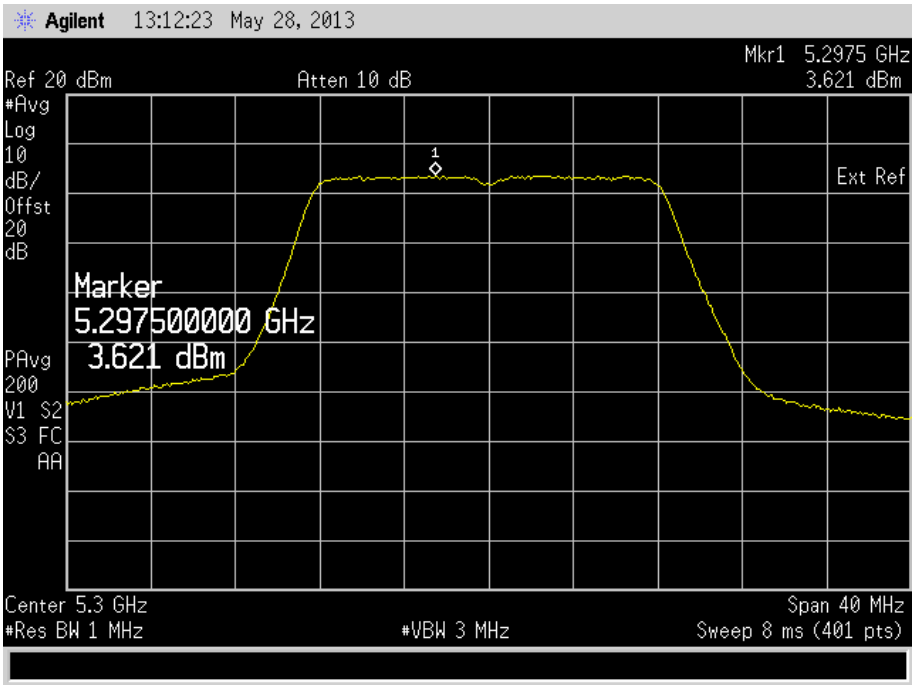
5260 MHz

Peak Power Spectral Density (dBm)	2.659



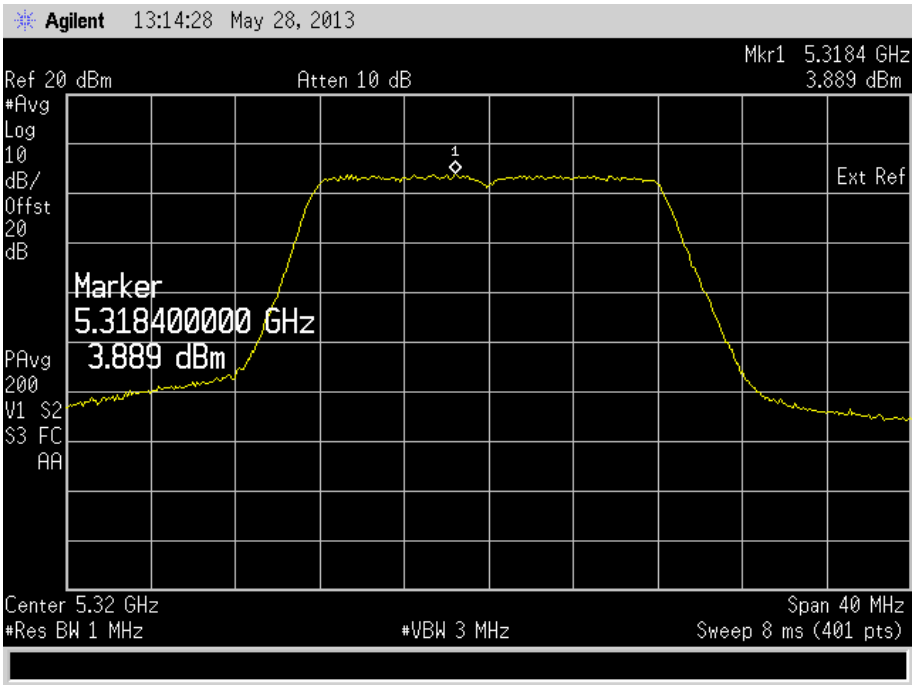
5300 MHz

Peak Power Spectral Density (dBm)	3.621



5320 MHz

Peak Power Spectral Density (dBm)	3.889

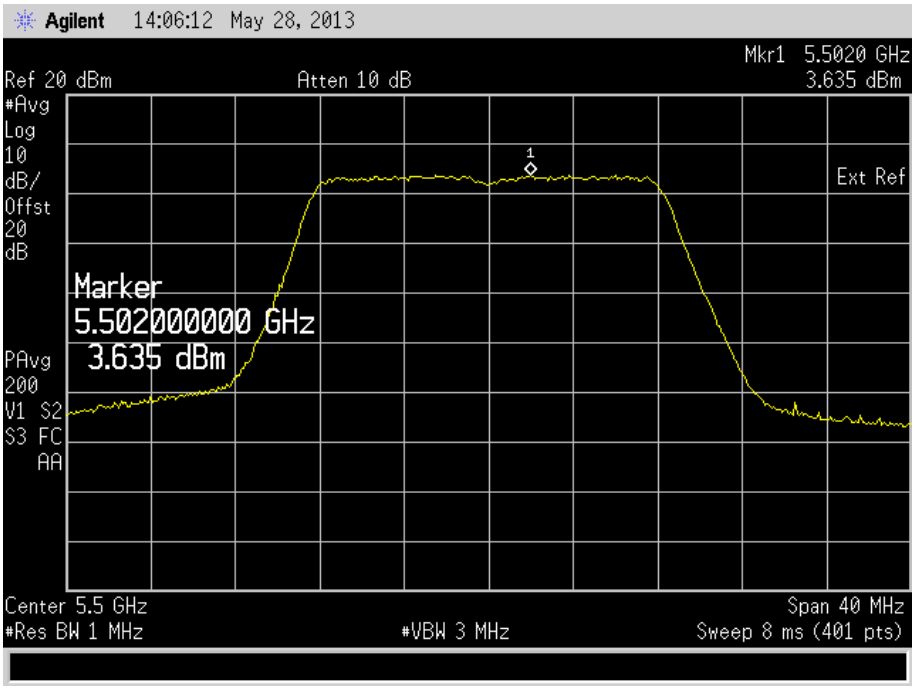


The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Frequency Band 3

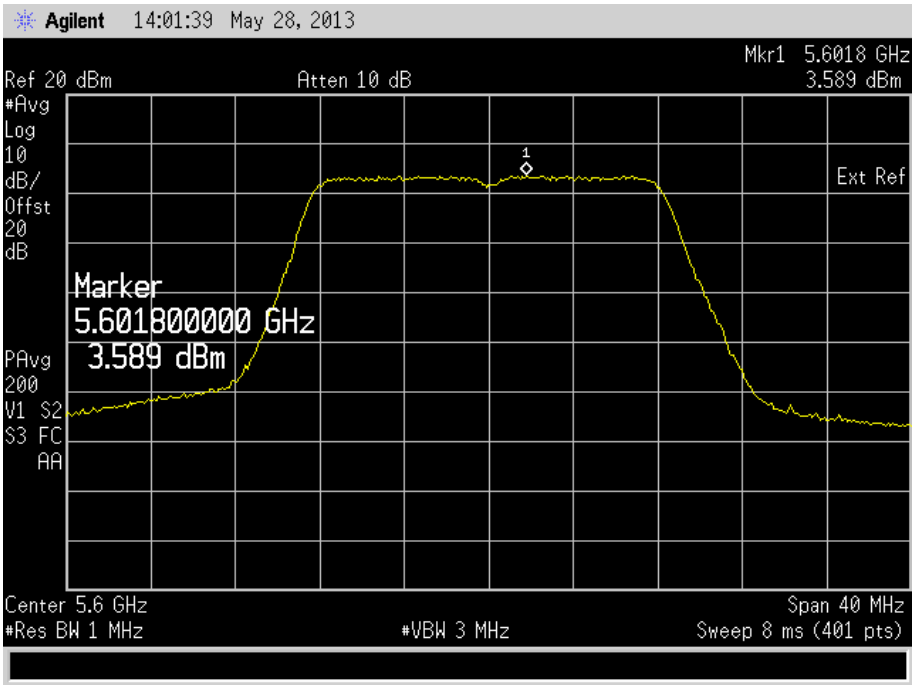
5500 MHz

Peak Power Spectral Density (dBm)	3.635



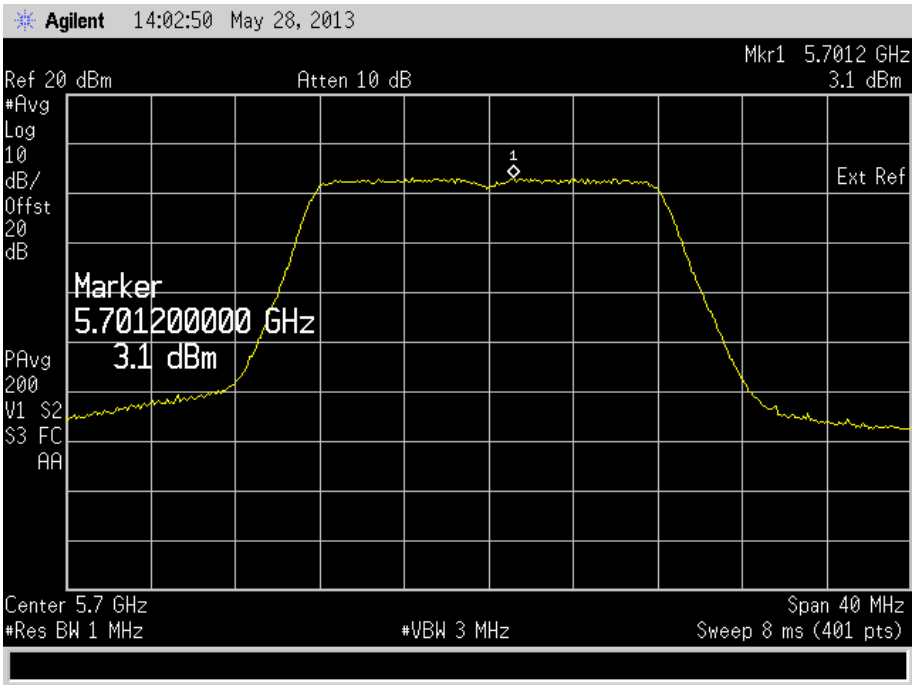
5600 MHz

Peak Power Spectral Density (dBm)	3.10



5700 MHz

Peak Power Spectral Density (dBm)	3.589



The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Limit

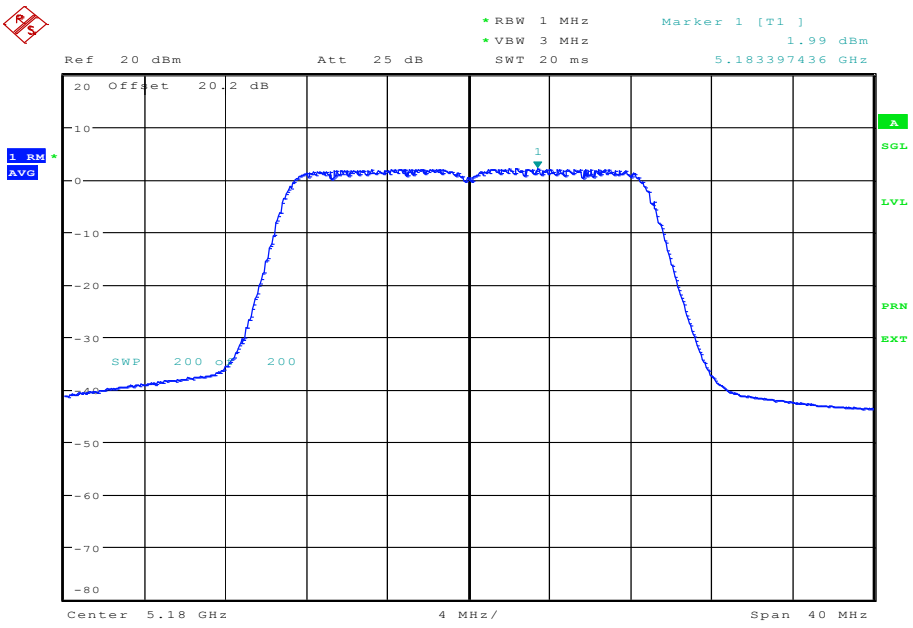
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(ac) - 5 GHz 20 MHz BW

Frequency Band 1

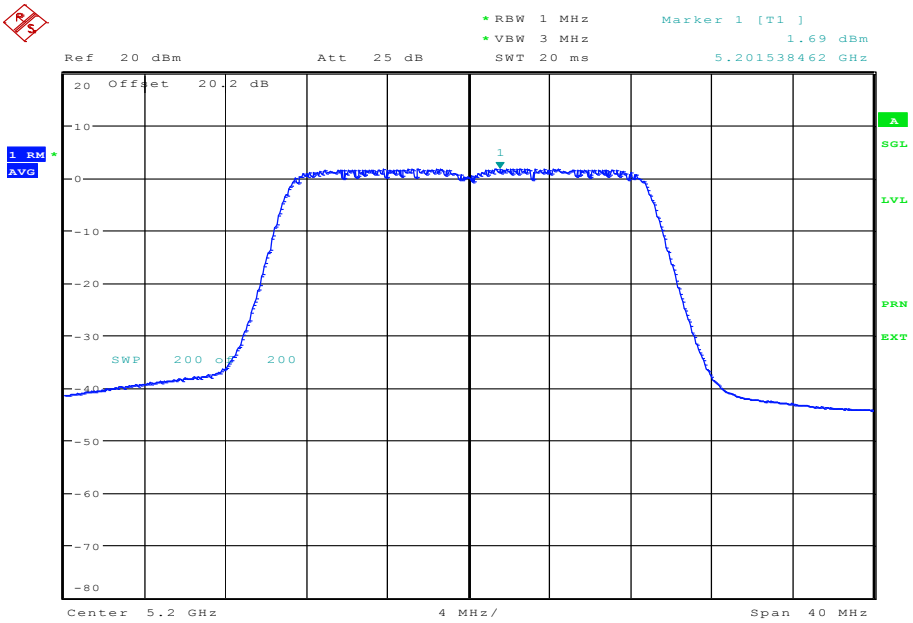
5180 MHz

Peak Power Spectral Density (dBm)	1.99



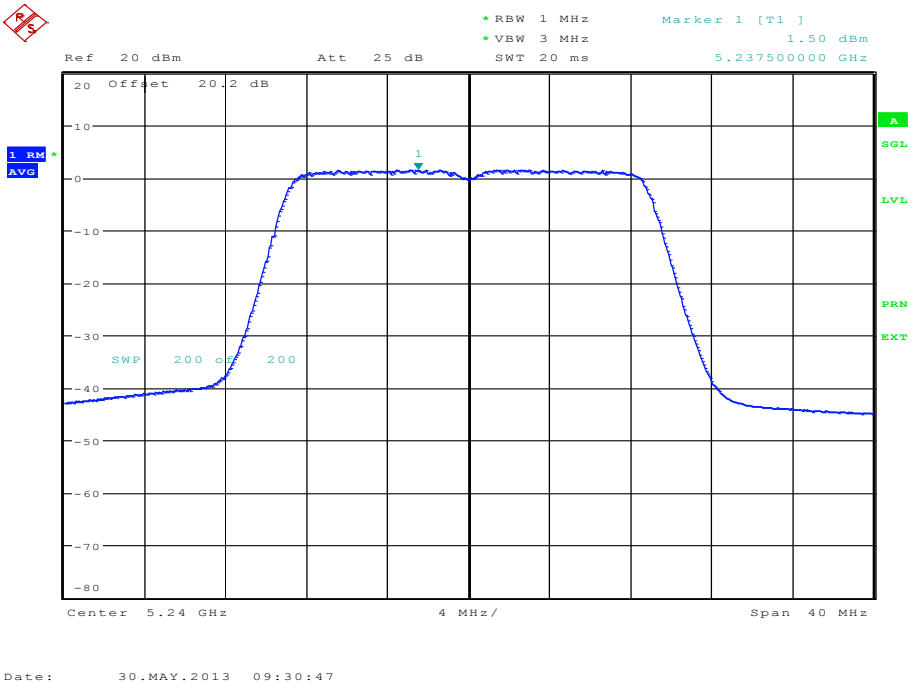
5200 MHz

Peak Power Spectral Density (dBm)	1.69



5240 MHz

Peak Power Spectral Density (dBm)	1.50

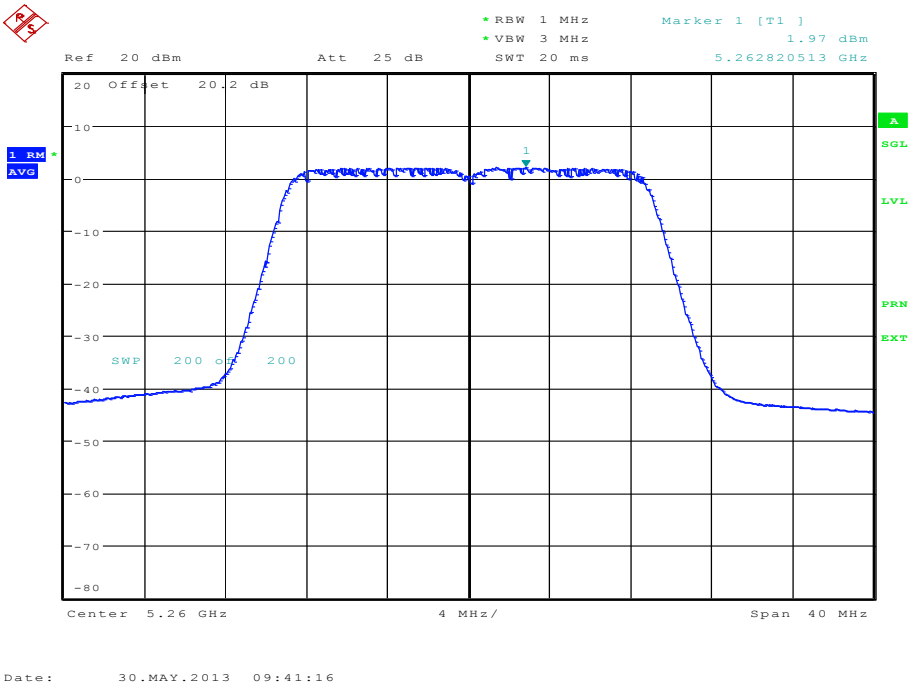


The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 2

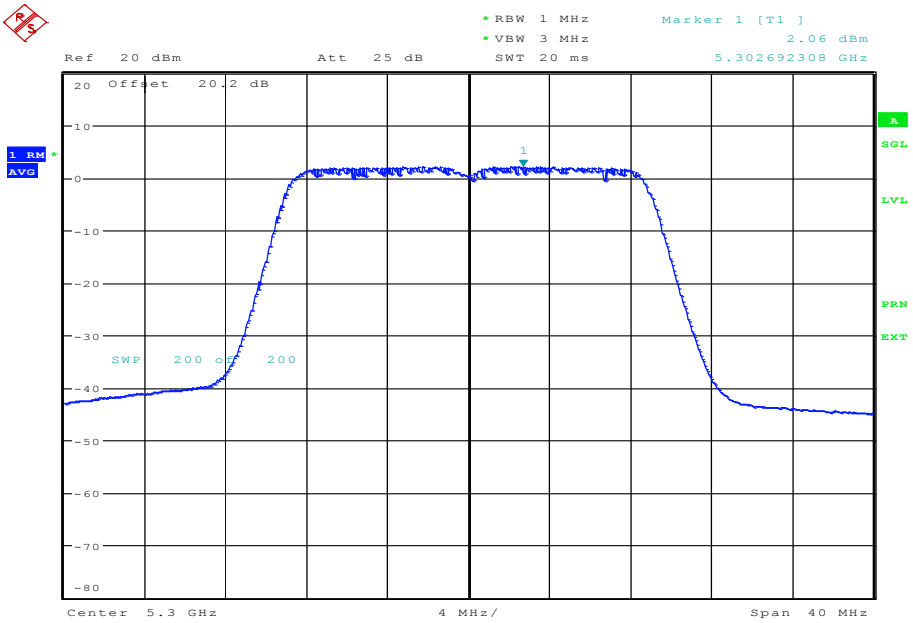
5260 MHz

Peak Power Spectral Density (dBm)	1.97



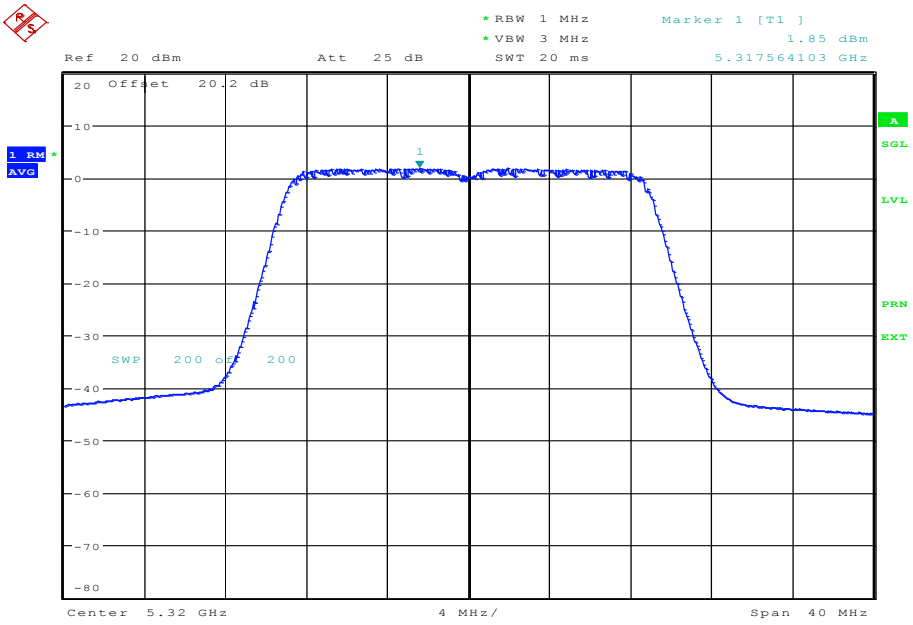
5300 MHz

Peak Power Spectral Density (dBm)	2.06



5320 MHz

Peak Power Spectral Density (dBm)	1.85

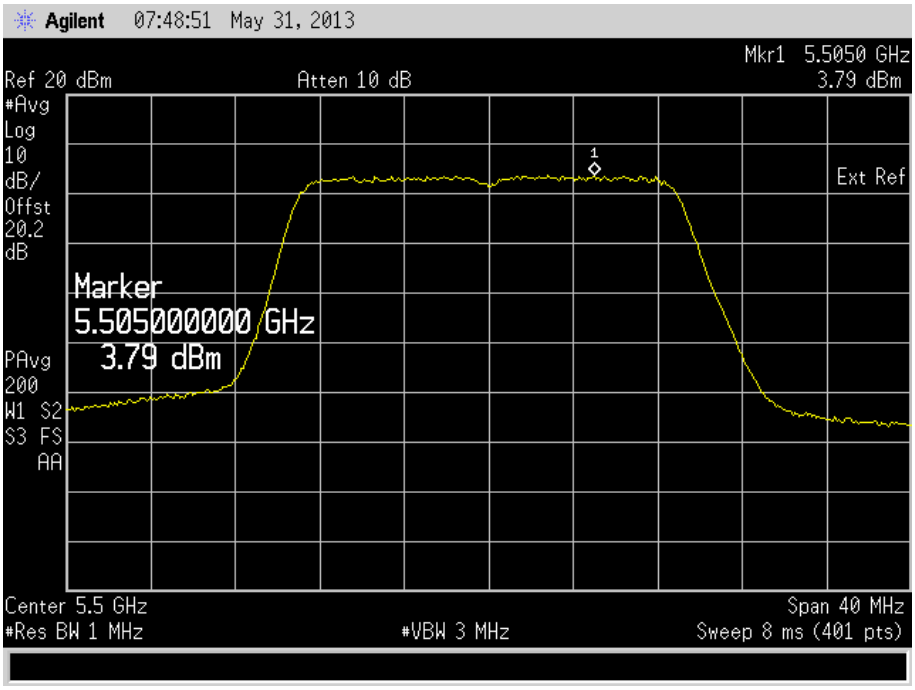


The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 3

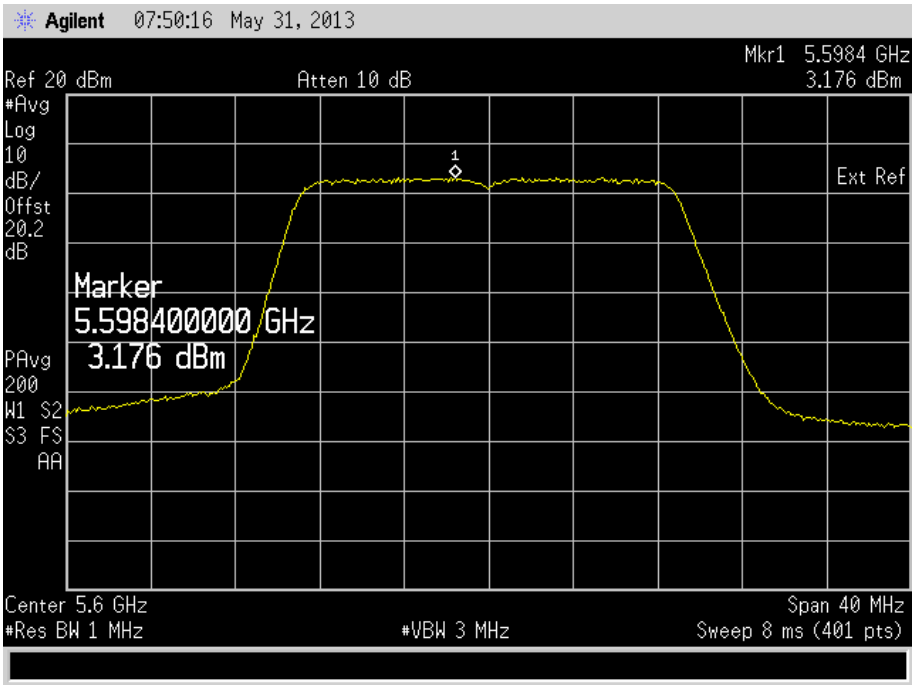
5500 MHz

Peak Power Spectral Density (dBm)	3.79



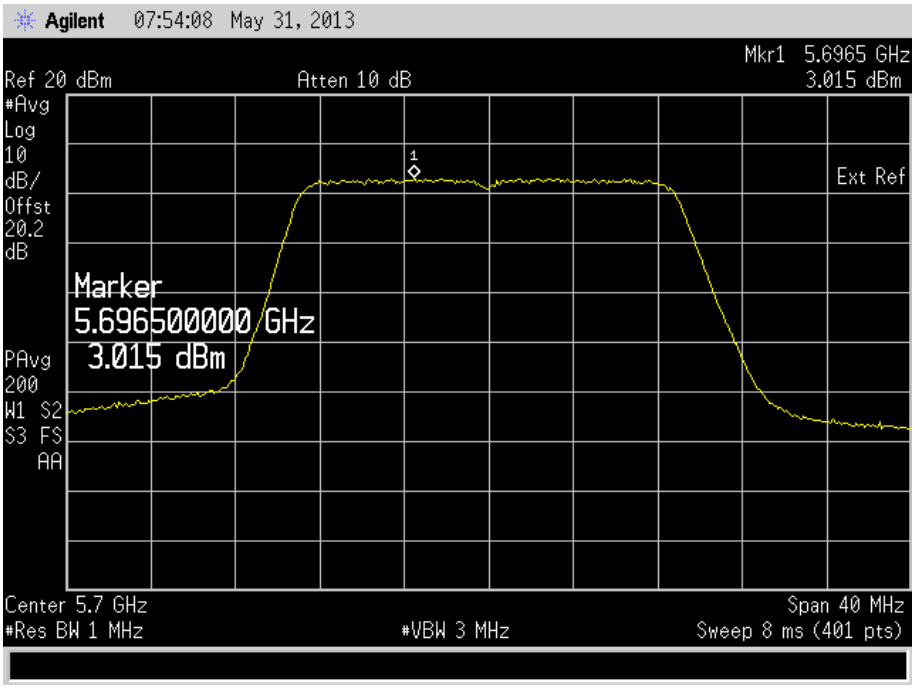
5600 MHz

Peak Power Spectral Density (dBm)	3.176



5700 MHz

Peak Power Spectral Density (dBm)	3.015



The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit

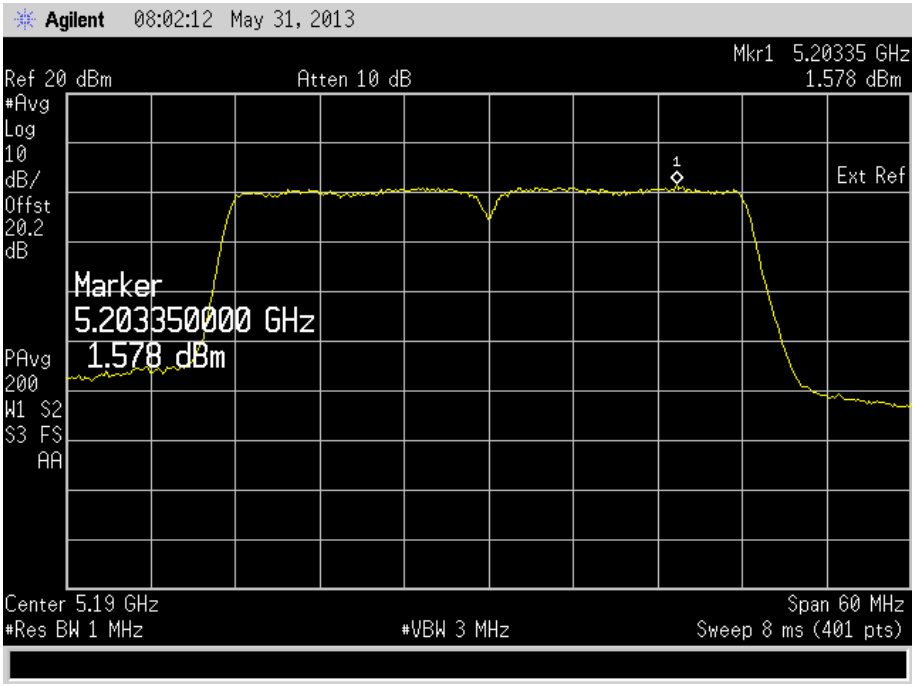
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(ac) - 5 GHz 40 MHz BW

Frequency Band 1

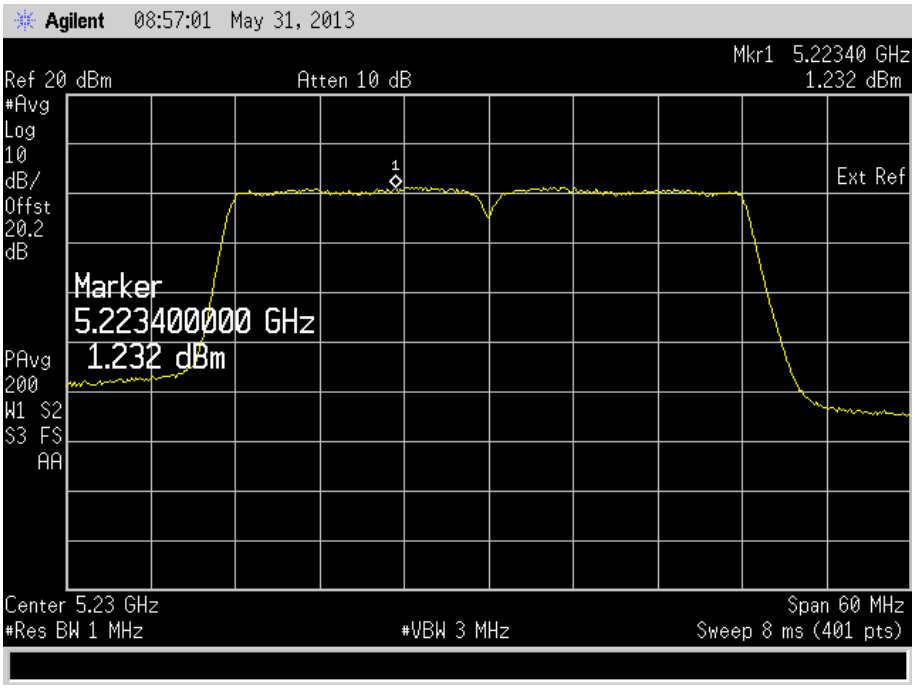
5190 MHz

Peak Power Spectral Density (dBm)	1.578



5230 MHz

Peak Power Spectral Density (dBm)	1.232

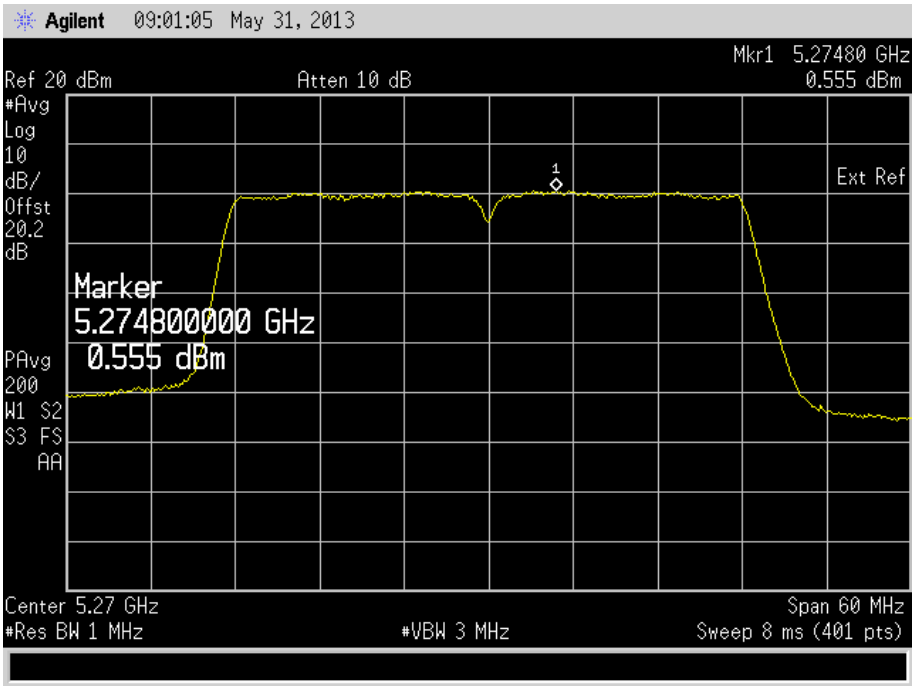


The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 2

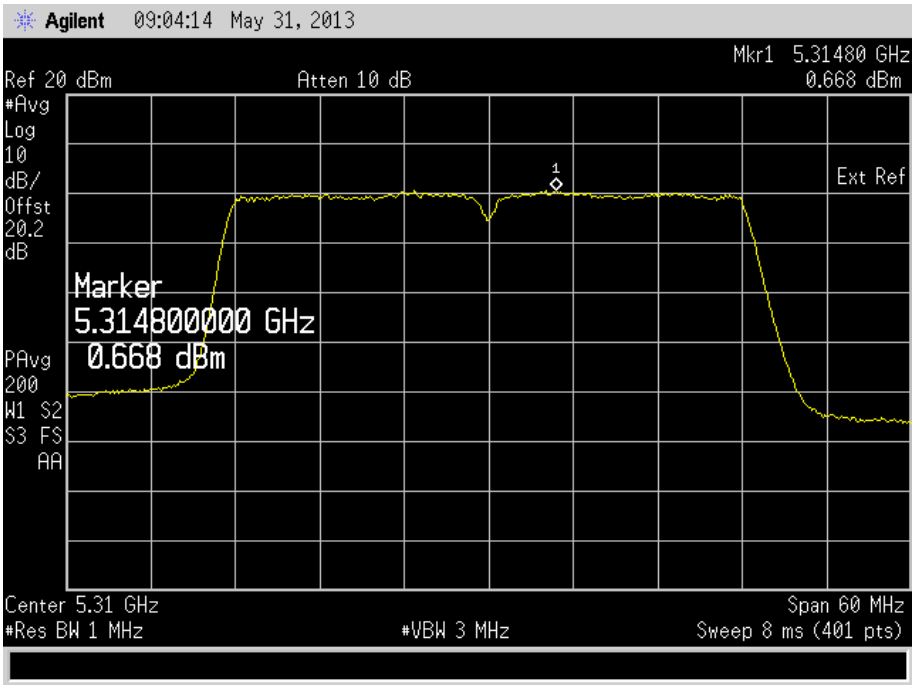
5270 MHz

Peak Power Spectral Density (dBm)	0.555



5310 MHz

Peak Power Spectral Density (dBm)	0.668

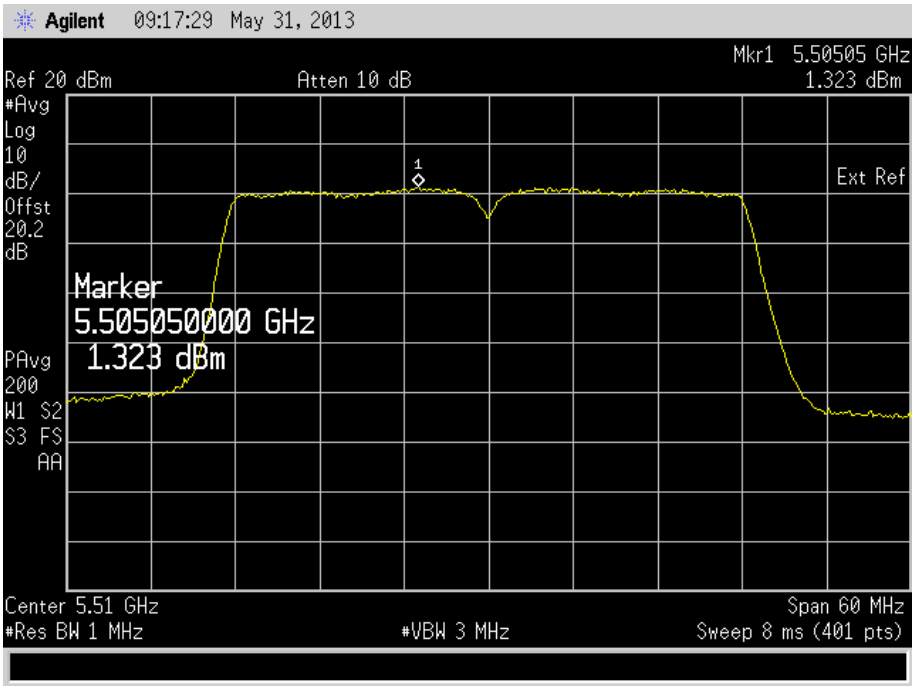


The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 3

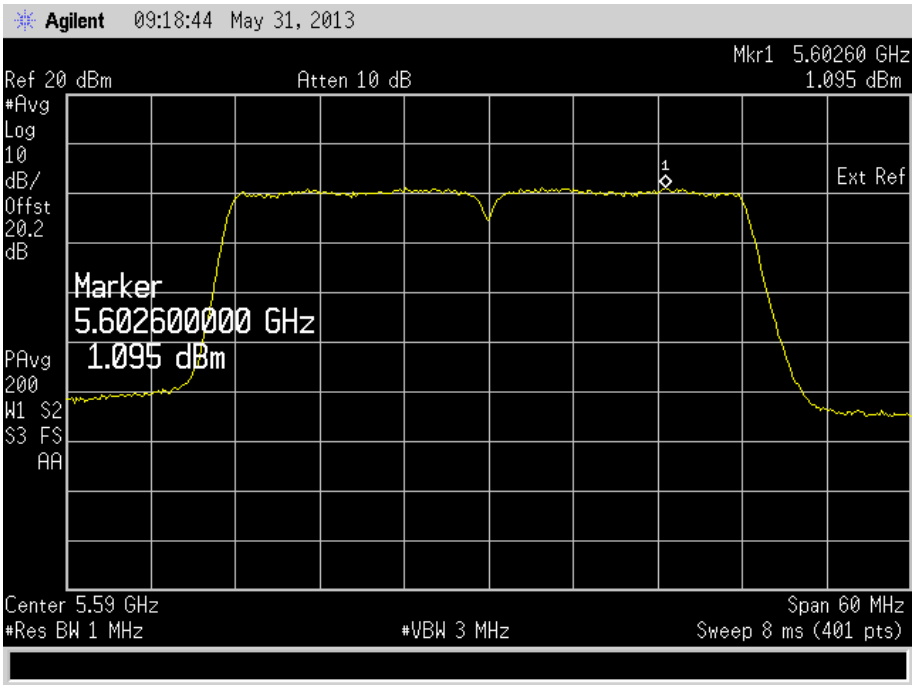
5510 MHz

Peak Power Spectral Density (dBm)	1.323



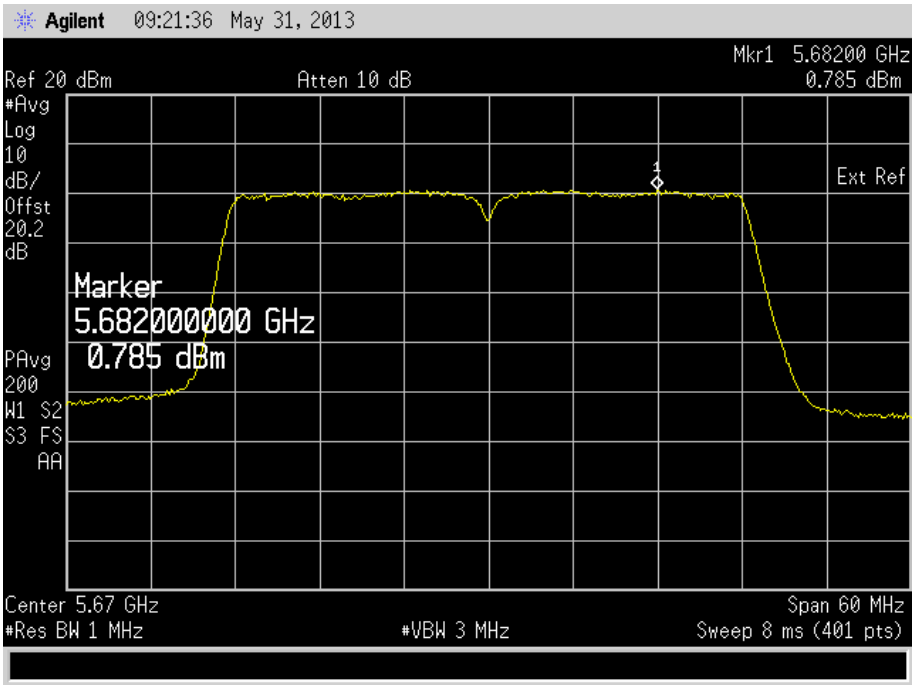
5590 MHz

Peak Power Spectral Density (dBm)	1.095



5670 MHz

Peak Power Spectral Density (dBm)	0.785



The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Limit

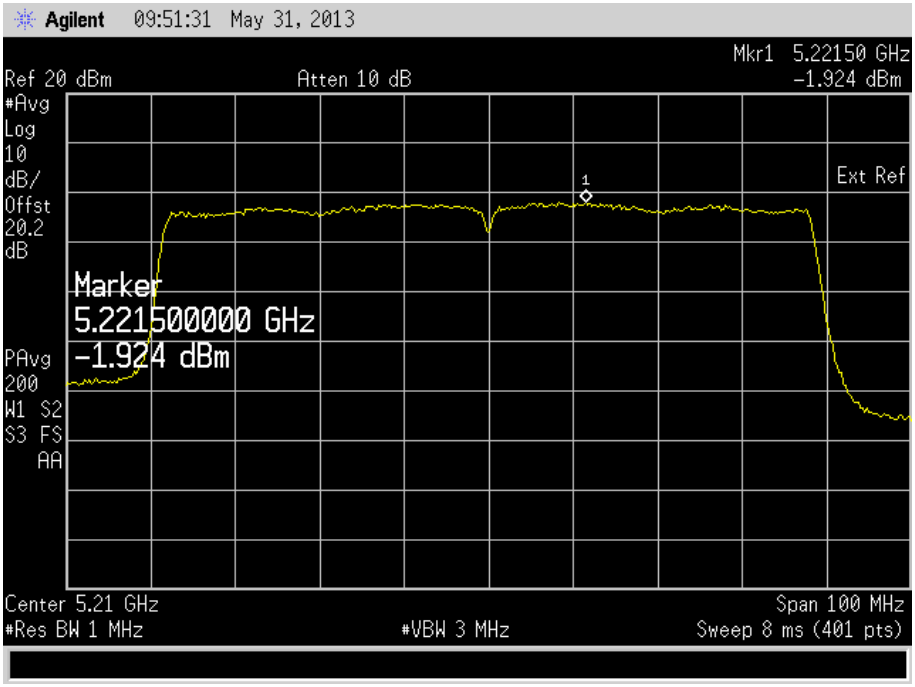
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(ac) - 5 GHz 80 MHz BW

Frequency Band 1

5210 MHz

Peak Power Spectral Density (dBm)	1.095

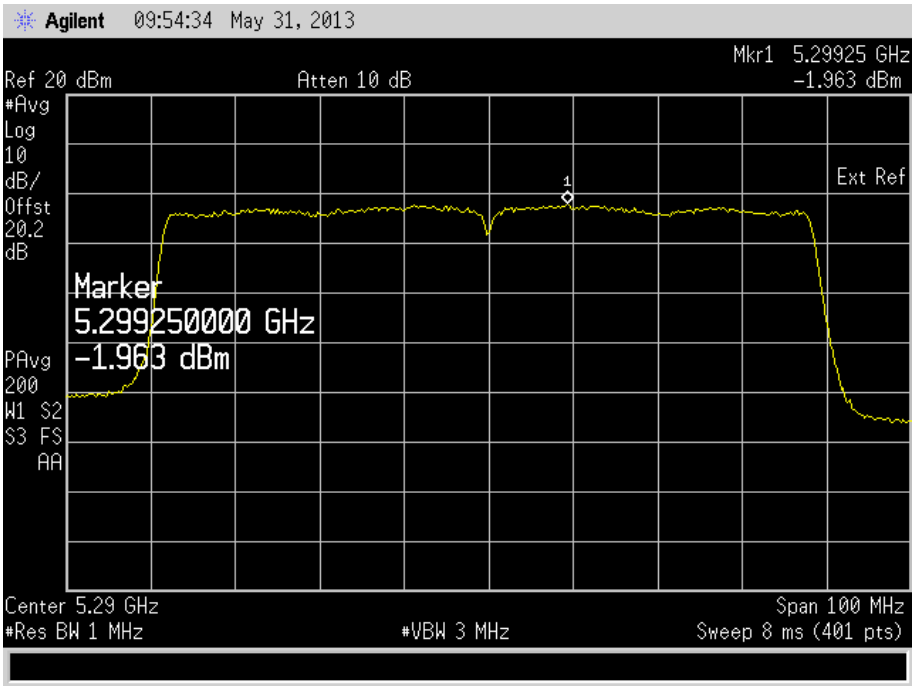


The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Frequency Band 2

5290 MHz

Peak Power Spectral Density (dBm)	-1.963

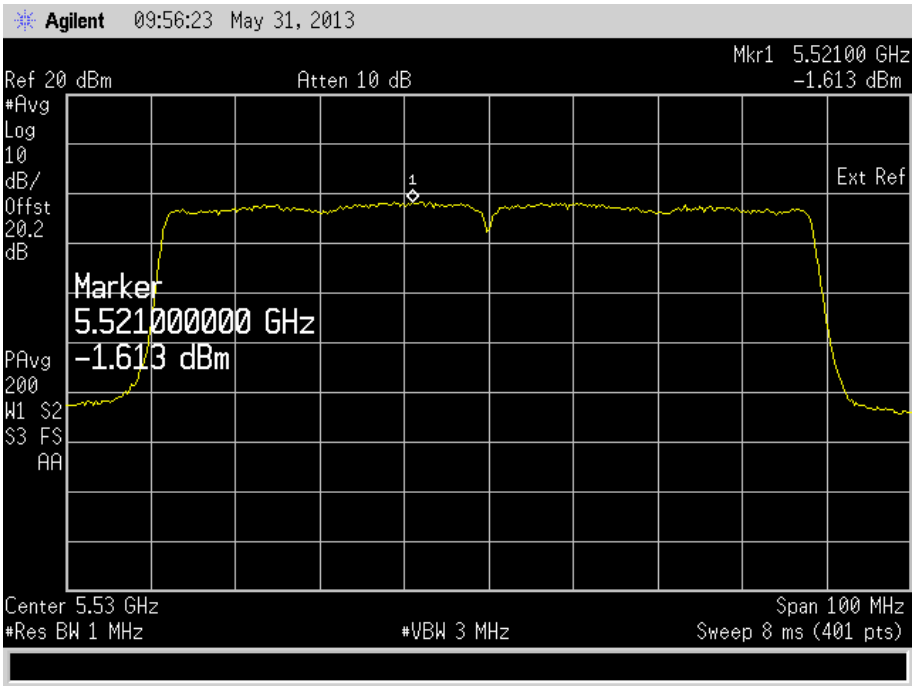


The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Frequency Band 3

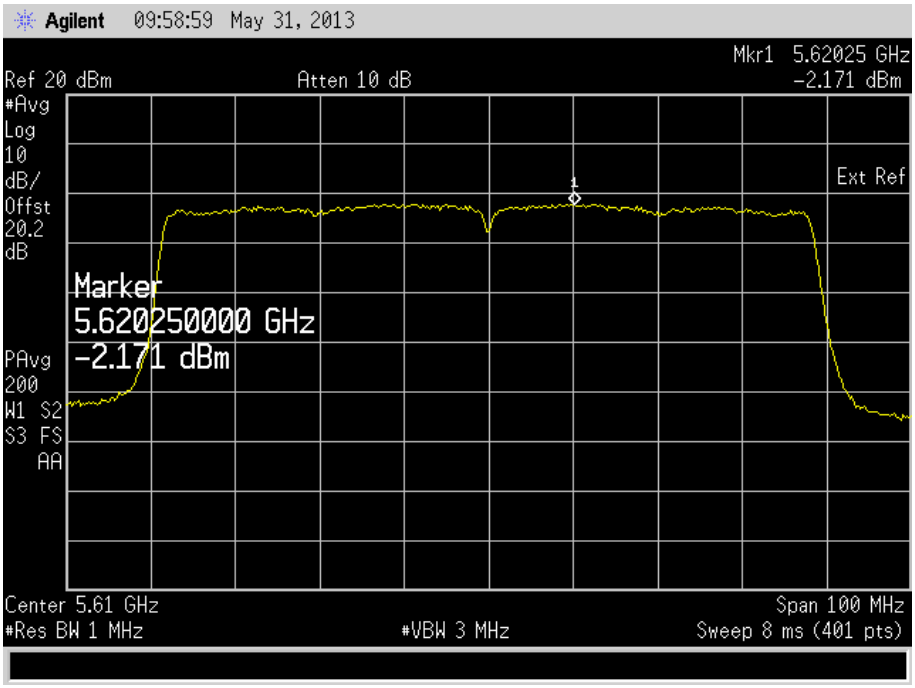
5530 MHz

Peak Power Spectral Density (dBm)	-1.163



5610 MHz

Peak Power Spectral Density (dBm)	-2.171



The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Limit

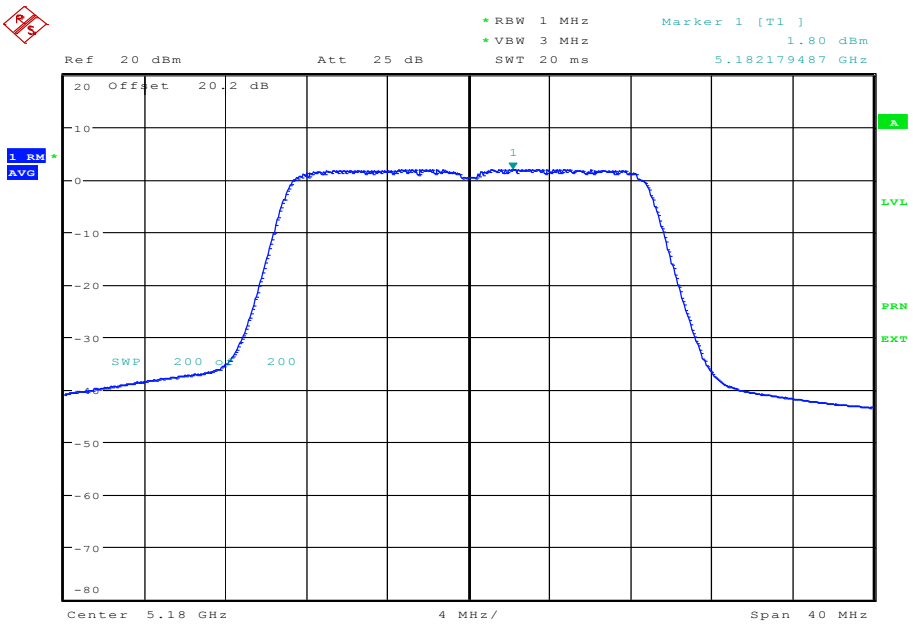
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(n) - 5 GHz 20 MHz BW

Frequency Band 1

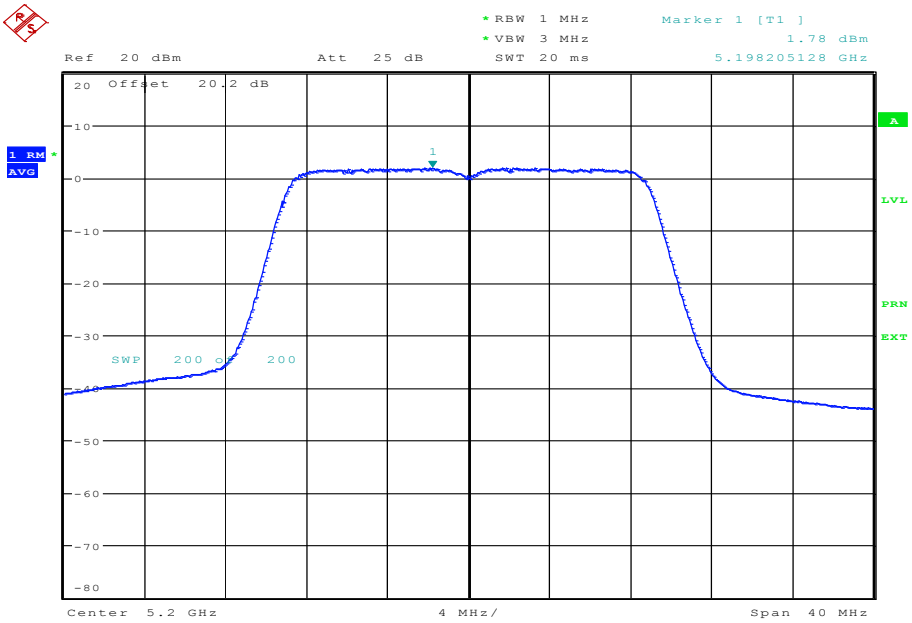
5180 MHz

Peak Power Spectral Density (dBm)	1.80



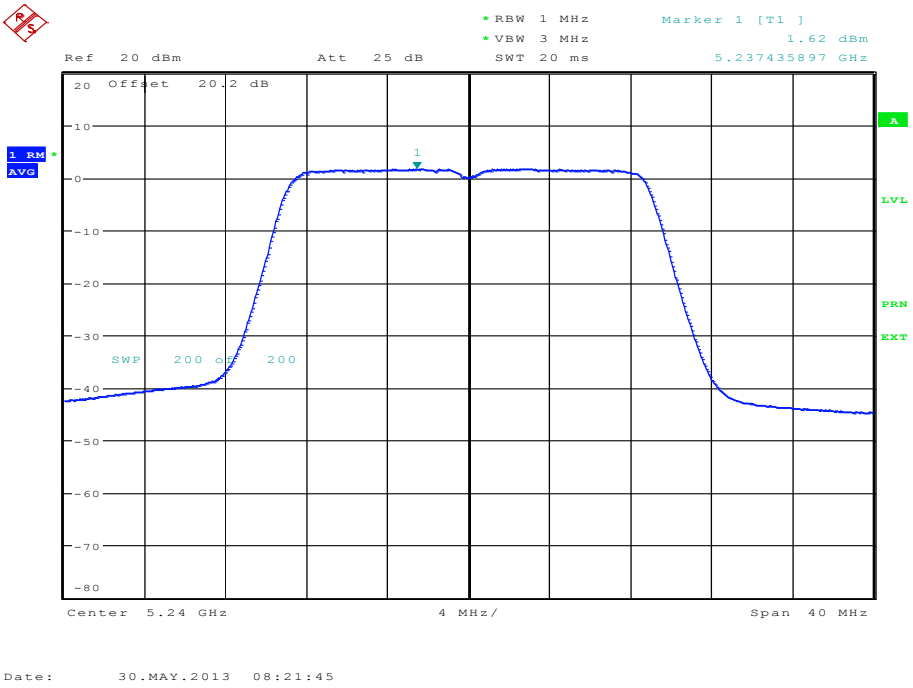
5200 MHz

Peak Power Spectral Density (dBm)	1.78



5240 MHz

Peak Power Spectral Density (dBm)	1.62

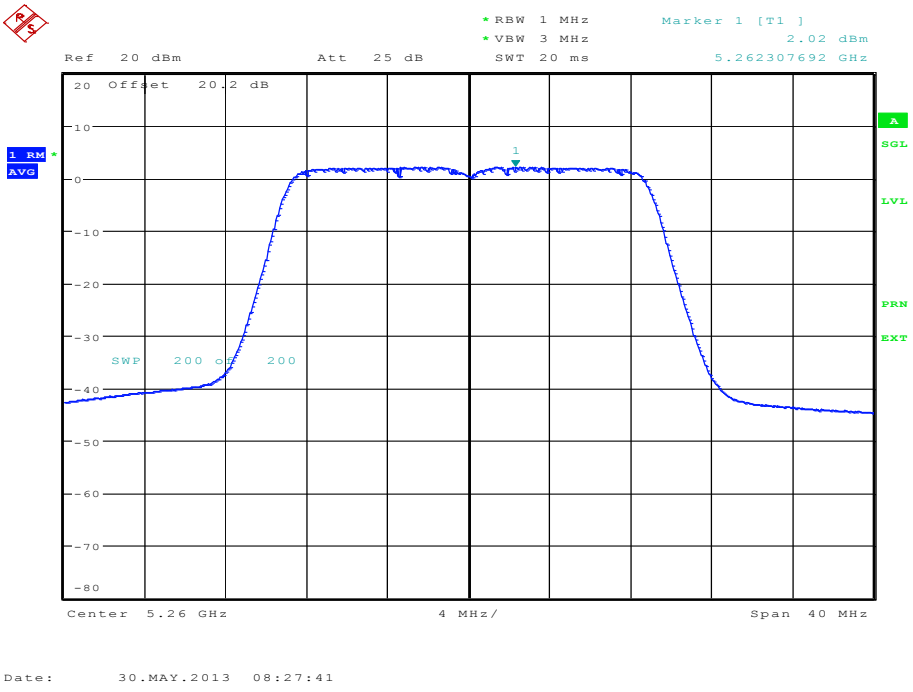


The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 2

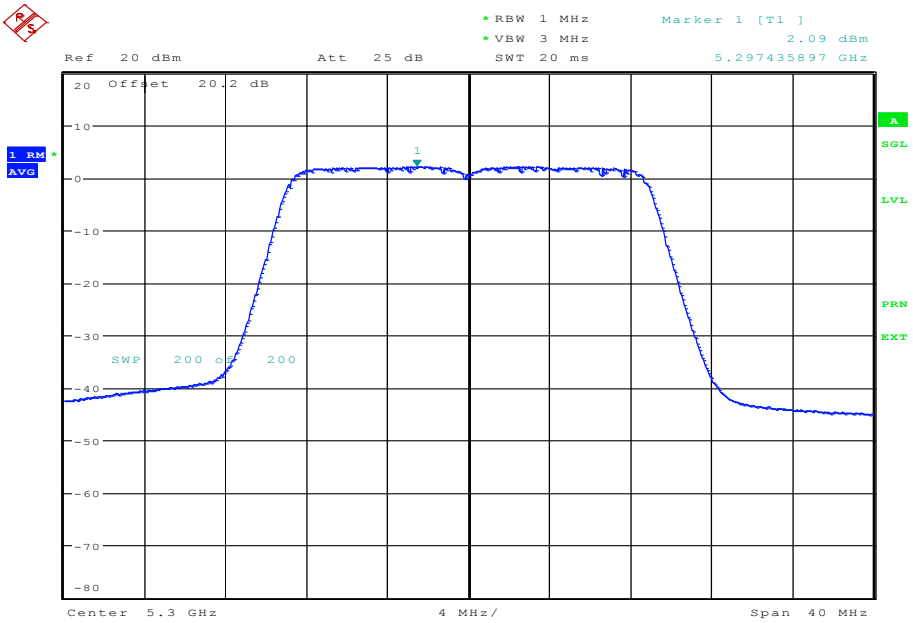
5260 MHz

Peak Power Spectral Density (dBm)	2.02



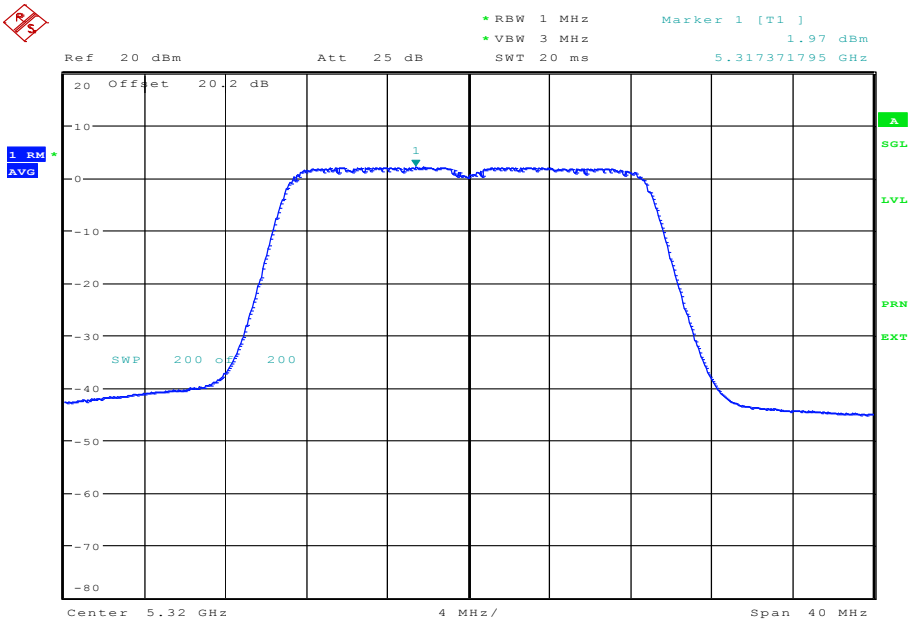
5300 MHz

Peak Power Spectral Density (dBm)	2.09



5320 MHz

Peak Power Spectral Density (dBm)	1.97

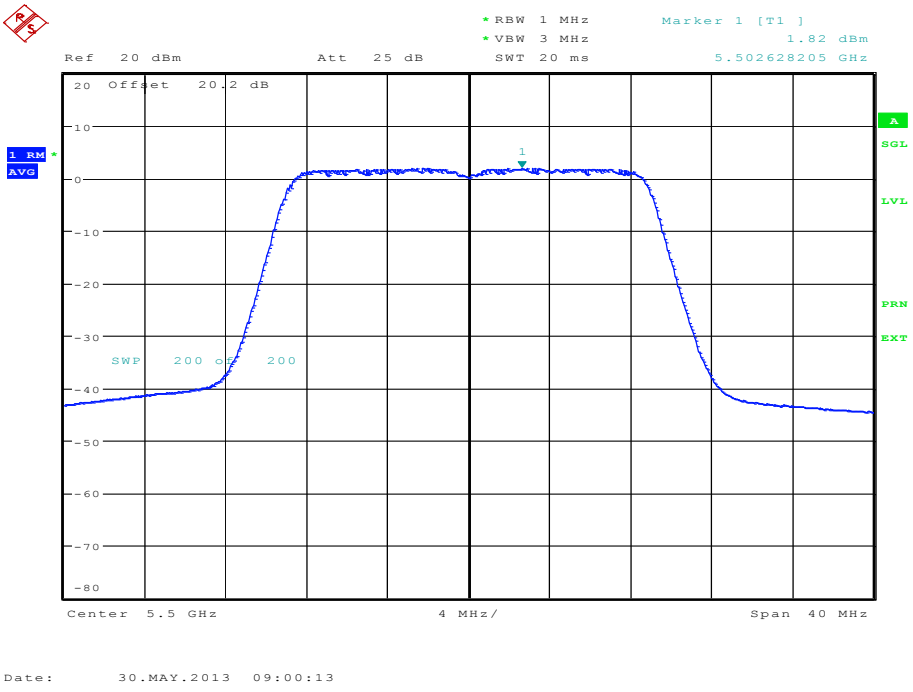


The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 3

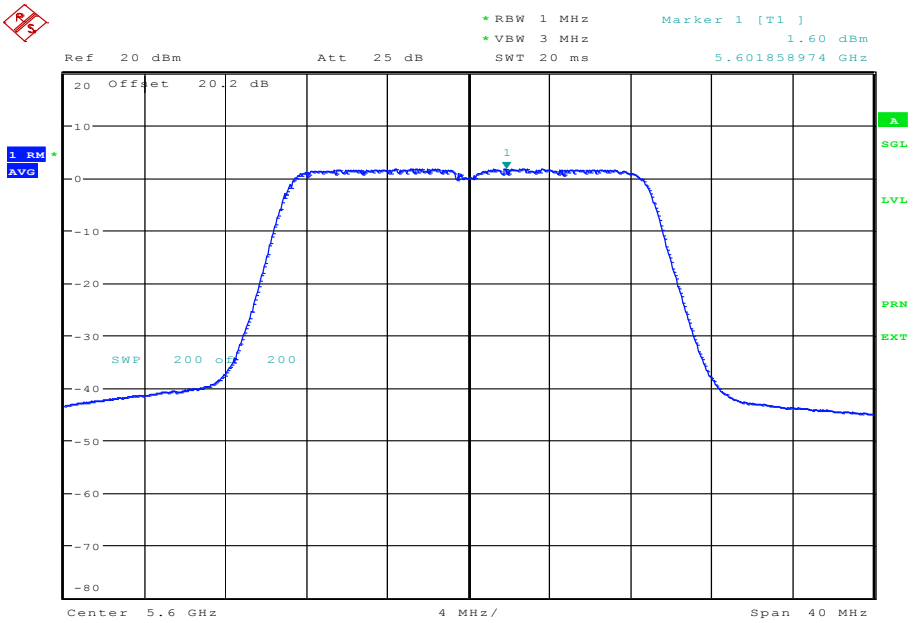
5500 MHz

Peak Power Spectral Density (dBm)	1.82



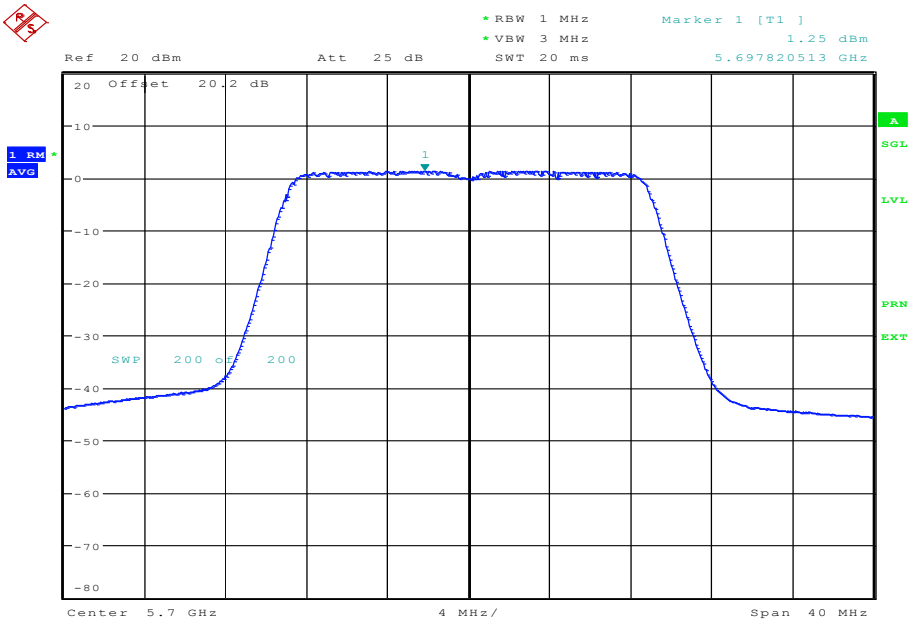
5600 MHz

Peak Power Spectral Density (dBm)	1.60



5700 MHz

Peak Power Spectral Density (dBm)	1.25



The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit

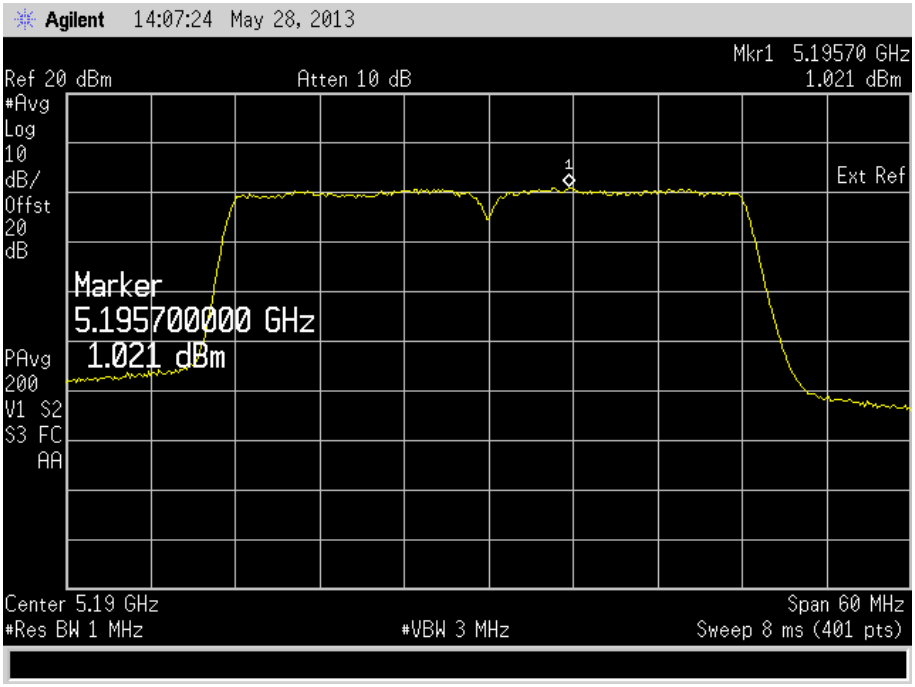
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(n) - 5 GHz 40 MHz BW

Frequency Band 1

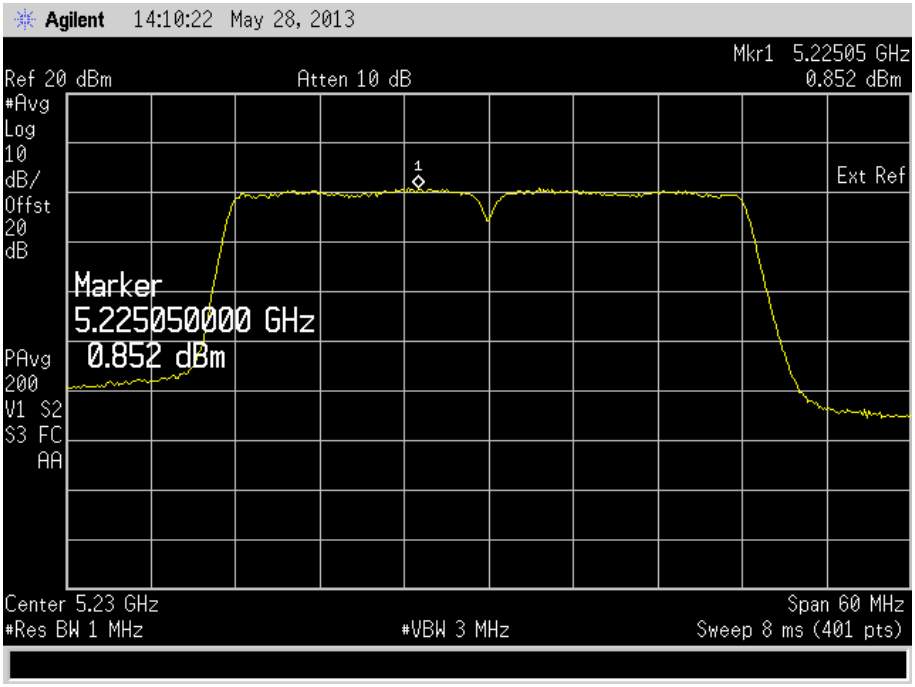
5190 MHz

Peak Power Spectral Density (dBm)	1.021



5230 MHz

Peak Power Spectral Density (dBm)	0.852

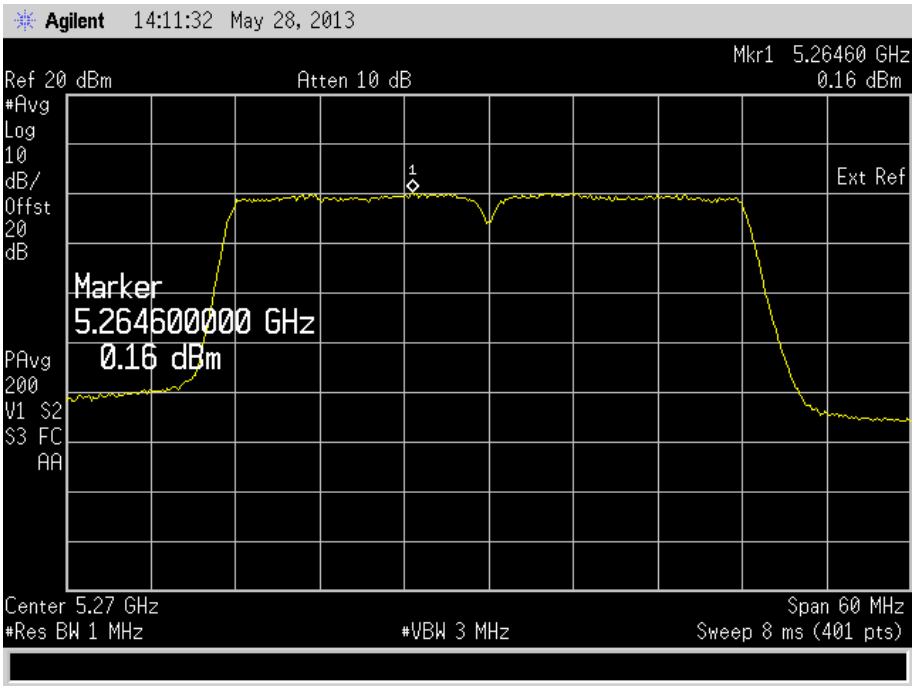


The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 2

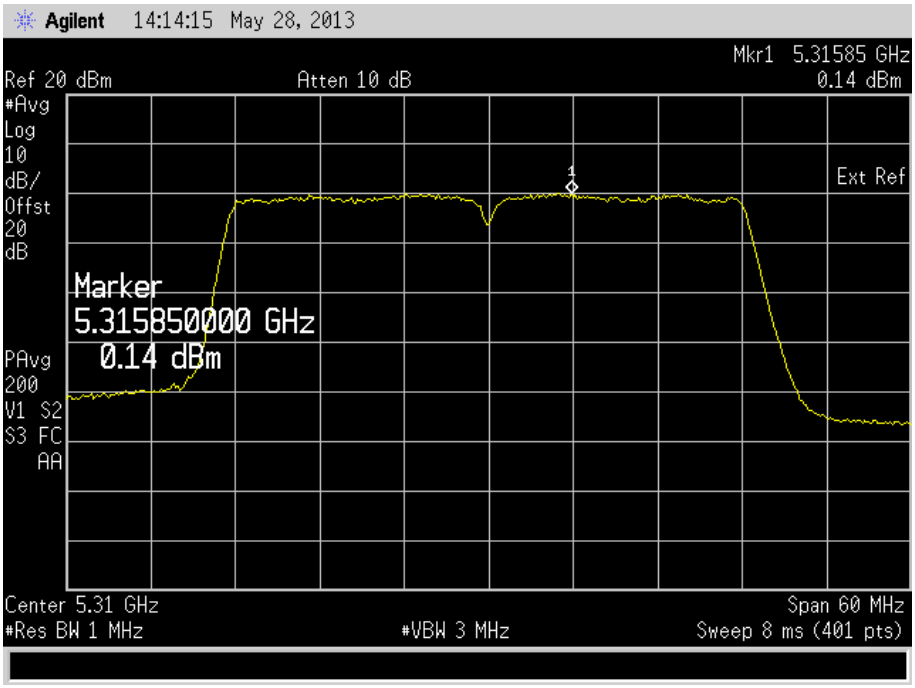
5270 MHz

Peak Power Spectral Density (dBm)	0.160



5310 MHz

Peak Power Spectral Density (dBm)	0.140

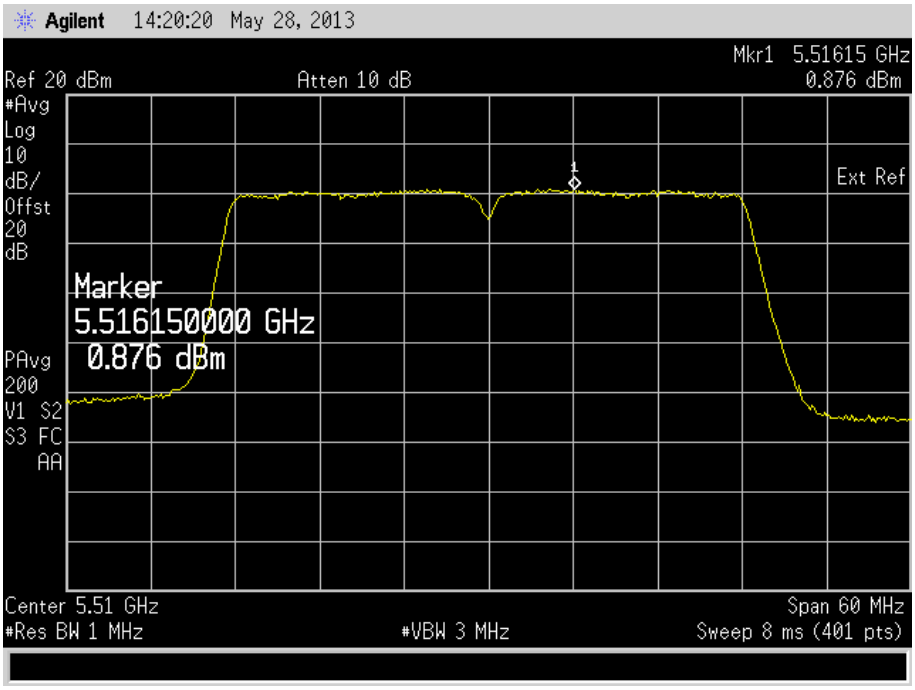


The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 3

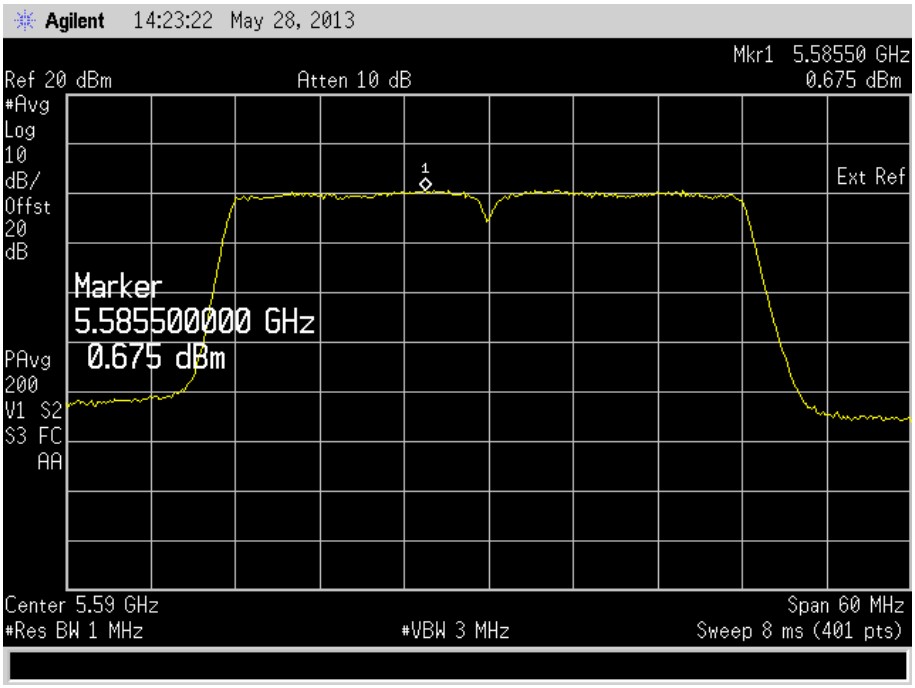
5510 MHz

Peak Power Spectral Density (dBm)	0.876



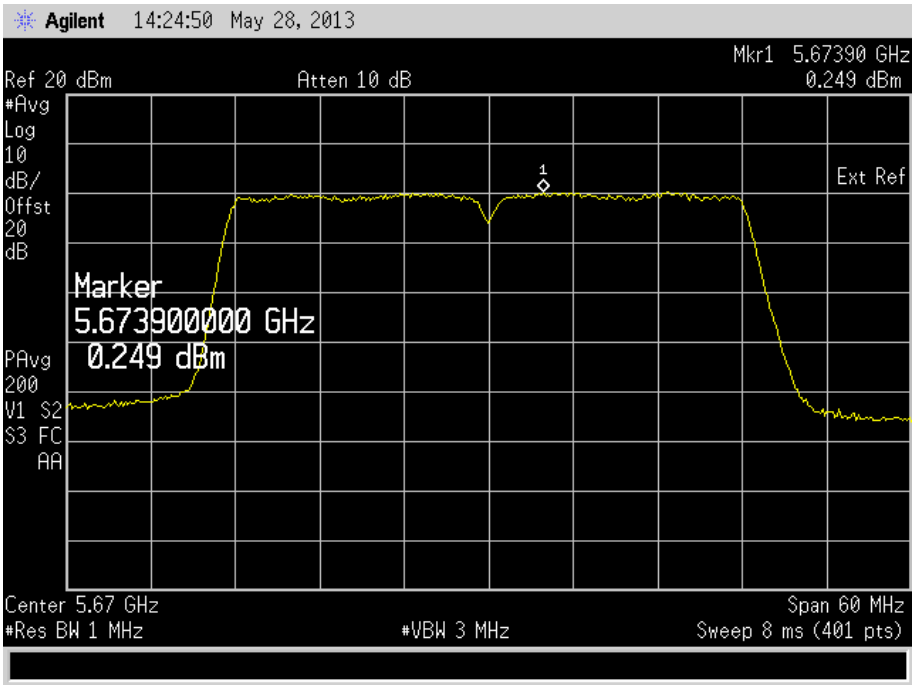
5590 MHz

Peak Power Spectral Density (dBm)	0.675



5670 MHz

Peak Power Spectral Density (dBm)	0.249



The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Limit

Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

2.7 RATIO OF THE PEAK EXCURSION OF THE MODULATION ENVELOPE

2.7.1 Specification Reference

FCC CFR 47 Part 15E, Clause 15.407 (a)(6)

2.7.2 Equipment Under Test and Modification State

SHL22 S/N: IMEI 004401114765106 - Modification State 0

2.7.3 Date of Test

31 May 2013

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Procedure

The EUT was transmitted at maximum power via an attenuator and cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen. The resolution bandwidth and video bandwidth were set to 1 MHz and 1 MHz respectively. The trace was set to Max Hold and the peak excursion of the modulation envelope was measured. The ratio of this measurement to the maximum conducted output power was measured.

2.7.6 Environmental Conditions

Ambient Temperature	24.0°C
Relative Humidity	43.2%

2.7.7 Test Results

802.11(a)

Frequency Band 1

5180 MHz

Ratio (dB)	9.081

5200 MHz

Ratio (dB)	9.073

5240 MHz

Ratio (dB)	9.240

The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Frequency Band 2

5260 MHz

Ratio (dB)	10.401

5300 MHz

Ratio (dB)	9.179

5320 MHz

Ratio (dB)	8.641

The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Frequency Band 3

5500 MHz

Ratio (dB)	9.255

5600 MHz

Ratio (dB)	9.520

5700 MHz

Ratio (dB)	8.731

The test was performed on the worst case data rate for 802.11(a) modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6 Mbps.

Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

802.11(ac) - 5 GHz 20 MHz BW

Frequency Band 1

5180 MHz

Ratio (dB)	10.83

5200 MHz

Ratio (dB)	10.52

5240 MHz

Ratio (dB)	10.64

The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 2

5260 MHz

Ratio (dB)	10.84

5300 MHz

Ratio (dB)	10.31

5320 MHz

Ratio (dB)	10.89

The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 3

5500 MHz

Ratio (dB)	10.320

5600 MHz

Ratio (dB)	10.544

5700 MHz

Ratio (dB)	10.525

The test was performed on the worst case data rate for 802.11(ac) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

802.11(ac) - 5 GHz 40 MHz BW

Frequency Band 1

5190 MHz

Ratio (dB)	9.172

5230 MHz

Ratio (dB)	9.298

The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 2

5270 MHz

Ratio (dB)	9.825

5310 MHz

Ratio (dB)	9.962

The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 3

5510 MHz

Ratio (dB)	10.137

5590 MHz

Ratio (dB)	10.055

5670 MHz

Ratio (dB)	9.625

The test was performed on the worst case data rate for 802.11(ac) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

802.11(ac) - 5 GHz 80 MHz BW

Frequency Band 1

5210 MHz

Ratio (dB)	9.801

The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Frequency Band 2

5290 MHz

Ratio (dB)	9.193

The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Frequency Band 3

5530 MHz

Ratio (dB)	9.193

5610 MHz

Ratio (dB)	10.300

The test was performed on the worst case data rate for 802.11(ac) - 80 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 29.3 Mbps.

Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

802.11(n) - 5 GHz 20 MHz BW

Frequency Band 1

5180 MHz

Ratio (dB)	10.75

5200 MHz

Ratio (dB)	10.34

5240 MHz

Ratio (dB)	10.74

The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 2

5260 MHz

Ratio (dB)	10.19

5300 MHz

Ratio (dB)	9.85

5320 MHz

Ratio (dB)	10.47

The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Frequency Band 3

5500 MHz

Ratio (dB)	9.58

5600 MHz

Ratio (dB)	9.77

5700 MHz

Ratio (dB)	9.63

The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 6.5 Mbps.

Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

802.11(n) - 5 GHz 40 MHz BW

Frequency Band 1

5190 MHz

Ratio (dB)	10.029

5230 MHz

Ratio (dB)	9.598

The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 2

5270 MHz

Ratio (dB)	10.07

5310 MHz

Ratio (dB)	9.765

The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Frequency Band 3

5510 MHz

Ratio (dB)	9.734

5590 MHz

Ratio (dB)	9.485

5670 MHz

Ratio (dB)	9.891

The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was 13.5 Mbps.

Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

Product Service

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1– AC Line Conducted Emissions					
LISN	Rohde & Schwarz	ESH2-Z5	17	12	31-Jul-2013
3 phase LISN	Rohde & Schwarz	ESH2-Z5	323	12	15-Jan-2014
Transient Limiter	Hewlett Packard	11947A	1032	12	28-Jun-2013
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Section 2.2 - Power Limits					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	9-Nov-2013
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	24-Jul-2013
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	24-Jul-2013
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	7-Aug-2013
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Power Supply	Hewlett Packard	6104A	1948	-	TU
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	3-Oct-2013
Antenna (Log Periodic)	Schaffner	UPA6108	3108	12	5-Apr-2014
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	23-Jun-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
Combiner/Splitter	Weinschel	1506A	3878	12	19-Mar-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
P-Series Power Meter	Agilent	N1911A	3980	12	17-Sep-2013
P-Series Power Meter	Agilent	N1911A	3981	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3983	12	17-Sep-2013
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4100	12	25-Oct-2013
1 Metre K Type Cable	Rhophase	KPS-1501A-1000-KPS	4105	12	25-Oct-2013

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.3 – Undesirable Emission Limits					
Radiocommunications Tester	Rohde & Schwarz	CMU 200	39	12	21-Dec-2013
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	13-Sep-2013
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	9-Nov-2013
Load (50ohm, 30W)	JFW	50T-054	284	12	13-Jun-2013
Antenna (Bilog)	Schaffner	CBL6143	287	24	18-Jan-2014
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
Antenna (Active Loop, 9kHz-30MHz)	Rohde & Schwarz	HFH2-Z2	333	24	30-Oct-2014
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	24-Jul-2013
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	20-Feb-2014
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Pre-Amplifier	Phase One	PS04-0086	1533	12	27-Sep-2013
Pre-Amplifier	Phase One	PSO4-0087	1534	12	28-Sep-2013
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Power Supply	Hewlett Packard	6104A	1948	-	TU
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	3-Oct-2013
High Pass Filter (4GHz)	RLC Electronics	F-100-4000-5-R	2773	12	1-Feb-2014
Filter	Daden Anthony Ass	MH-1500-7SS	2778	-	O/P Mon
Test Receiver	Rohde & Schwarz	ESIB40	2941	12	23-Oct-2013
Attenuator (20dB, 2W)	Pasternack	PE 7004-20	2943	12	27-Mar-2014
Amplifier (1 - 8GHz)	Phase One	PS06-0060	3175	12	10-Jul-2013
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	10-Jul-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
3 GHz High Pass Filter	K&L Microwave	11SH10-3000/X18000-O/O	3552	12	1-Feb-2014
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3694	12	25-Oct-2013
'2.92mm' - '2.92mm' RF Cable (2m)	Rhophase	KPS-1503-2000-KPS	3695	12	15-Oct-2013
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Data Logger	Yokogawa	MV1024	3948	12	7-Jun-2013
1 metre, SMA to SMA	Suhner	Sucoflex armoured cable	4048	-	O/P Mon
Section 2.4 - Frequency Stability					
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Multimeter	White Gold	WG022	190	12	30-Oct-2013
RF Coupler	TUV SUD Product Service	TÜV	415	-	TU
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	30-Nov-2013
Attenuator (20dB, 2W)	Pasternack	PE 7004-20	2943	12	27-Mar-2014
Thermocouple Thermometer	Fluke	51	3172	12	30-Jul-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.5 – 26 dB Bandwidth					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Attenuator 10dB/10W)	Trilithic	HFP-50N	454	12	24-Jul-2013
Attenuator: 6dB/10W	Trilithic	HFP-50N	476	12	24-Jul-2013
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply	Hewlett Packard	6104A	1948	-	TU
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	3-Oct-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	23-Jun-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
Combiner/Splitter	Weinschel	1506A	3878	12	19-Mar-2014
P-Series Power Meter	Agilent	N1911A	3980	12	17-Sep-2013
P-Series Power Meter	Agilent	N1911A	3981	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3983	12	17-Sep-2013
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4100	12	25-Oct-2013
1 Metre K Type Cable	Rhophase	KPS-1501A-1000-KPS	4105	12	25-Oct-2013
Section2.6 - Peak Power Spectral Density					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
P-Series Power Meter	Agilent	N1911A	3981	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	17-Sep-2013
Section 2.7 - Ratio of the Peak Excursion of the Modulation Envelope					
Multimeter	White Gold	WG022	190	12	30-Oct-2013
Spectrum Analyser	Hewlett Packard	E4407B	1154	12	17-Jul-2013
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	23-Jul-2013
Power Supply Unit	Farnell	TSV-70	2043	-	O/P Mon
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	30-Nov-2013
Hygrometer	Rotronic	I-1000	3220	12	13-Jun-2013
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	11-Dec-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	31-Aug-2013
Combiner/Splitter	Weinschel	1506A	3877	12	19-Mar-2014
P-Series Power Meter	Agilent	N1911A	3981	12	17-Sep-2013
50 MHz-18 GHz Wideband Power Sensor	Agilent	N1921A	3982	12	17-Sep-2013

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
Frequency Stability	± 90.32 Hz
Power Limits	Conducted: ± 0.70 dB Radiated: 30MHz to 1GHz: ± 5.1 dB Radiated: 1GHz to 40GHz: ± 6.3 dB
26 dB Bandwidth	± 5.72 kHz
Undesirable Emission Limits	Conducted: ± 3.454 dB Radiated: ± 3.08 dB
Ratio of the Peak Excursion of the Modulation Envelope	± 0.70 dB
AC Line Conducted Emissions	± 3.2 dB
Peak Power Spectral Density	± 3.0 dB

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).