Report On

FCC Testing of the Sharp SHL23 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Quad-band LTE (B1, B3, B11, B18) multi mode cellular phone with Bluetooth, WLAN, SRD (NFC,FeliCa) and GPS
In accordance with FCC CFR 47 Part 15E (RLAN)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00196

Document 75923862 Report 16 Issue 2 **November 2013**

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REPORT ON

FCC Testing of the
Sharp SHL23 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Quad-band LTE (B1, B3, B11, B18) multi mode cellular phone with Bluetooth, WLAN, SRD (NFC,FeliCa) and GPS
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November 2013

PREPARED FOR

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APPROVED BY

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DATED 04 November 2013

This report has been up-issued to Issue 2 to amend the model description.

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);

T Guy M Russell G Lawler A Galpin

Product Service

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Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHL23 Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Quad-band LTE
(B1, B3, B11, B18) multi mode cellular phone with
Bluetooth, WLAN, SRD (NFC,FeliCa) and GPS
In accordance with FCC CFR 47 Part 15E (RLAN)

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the FCC Testing of the Sharp SHL23 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Quad-band LTE (B1, B3, B11, B18) multi mode cellular phone with Bluetooth, WLAN, SRD (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)	SHL23
Serial Number(s)	IMEI 004401114893346 IMEI 004401114893148
Number of Samples Tested	2
Test Specification/Issue/Date	FCC CFR 47 Part 15E (2012)
Incoming Release Date	Application Form 24 September 2013
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	9860 25 September 2013
Start of Test	29 September 2013
Finish of Test	17 October 2013
Name of Engineer(s)	T Guy M Russell G Lawler A Galpin
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)				
2.1	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(n) - 5 GHz 20 MHz BW FCC				
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(n) - 5 GHz 40 MHz BW FCC				
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 20 MHz BW FCC				
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 FCC				
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	
2.4	2.1055 and 15.407 (g)	Frequency Stability	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 80 MHz BW FCC				
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	

Product Service

1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	SHL23
Part Number	DA215
Hardware Version	PP1
Software Version	A9100
FCC ID	APYHRO00196
Technical Description (Please provide a brief description of the intended use of the equipment)	Quad-band LTE(B1/B3/B11/B18), Dual-band WCDMA (FDDI/V), Quad-band GSM(850/900/1800/1900), Dual-band CDMA(BC0/BC6) Cellular Phone with Bluetooth, WLAN, NFC and GPS

TYPE OF EQUIPMENT	
☐	Master
☐	Client with Radar Detection
☒	Client without Radar Detection
☐	Wi-Fi Direct Support

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?
☐	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	16.0 dBm
Maximum Antenna Gain	0 dBi
EIRP	16.0 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.	
N/A - less than 500mW	

POWER SOURCE		
☐ AC mains supply		State voltage
AC supply frequency	(Hz)	VAC
☒ DC supply		
Nominal voltage	4.0	

SYSTEM ARCHITECTURE			
☒	Frame Based		
☐	IP Based		
☐	Other	If other please state	
☒	802.11(a)	Receiver Bandwidth:	20 MHz
☒	802.11(n) – 20 MHz	Receiver Bandwidth:	20/ 40 MHz
☒	802.11(n) – 40 MHz	Receiver Bandwidth:	20/ 40 MHz
☒	802.11(ac) – 20 MHz	Receiver Bandwidth:	20/ 40/ 80 MHz
☒	802.11(ac) – 40 MHz	Receiver Bandwidth:	20/ 40/ 80 MHz
☒	802.11(ac) – 80 MHz	Receiver Bandwidth:	20/ 40/ 80 MHz

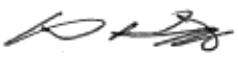
DECLARATION			
No parameter or information relating to the detected radar waveforms is available or accessible to the end user.			
☒	True	☐	False

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:	GCABBA480AFZZ
Antenna Maximum Gain:	0 dBi
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: 24th September, 2013

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp SHL23 Dual-band CDMA (BC0, BC6) & Quad-band GSM (GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Quad-band LTE (B1, B3, B11, B18) multi mode cellular phone with Bluetooth, WLAN, SRD (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 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 SHL23 Dual-band CDMA (BC0, BC6) & Quad-band GSM
(GSM850/GSM900/DCS1800/PCS1900) & Dual-band UMTS (FDDI, FDDV) & Quad-band LTE
(B1, B3, B11, B18) multi mode cellular phone with
Bluetooth, WLAN, SRD (NFC,FeliCa) and GPS
In accordance with FCC CFR 47 Part 15E (RLAN)

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

SHL23 S/N: IMEI 004401114893346 - Modification State 0

2.1.3 Date of Test

12 October 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.

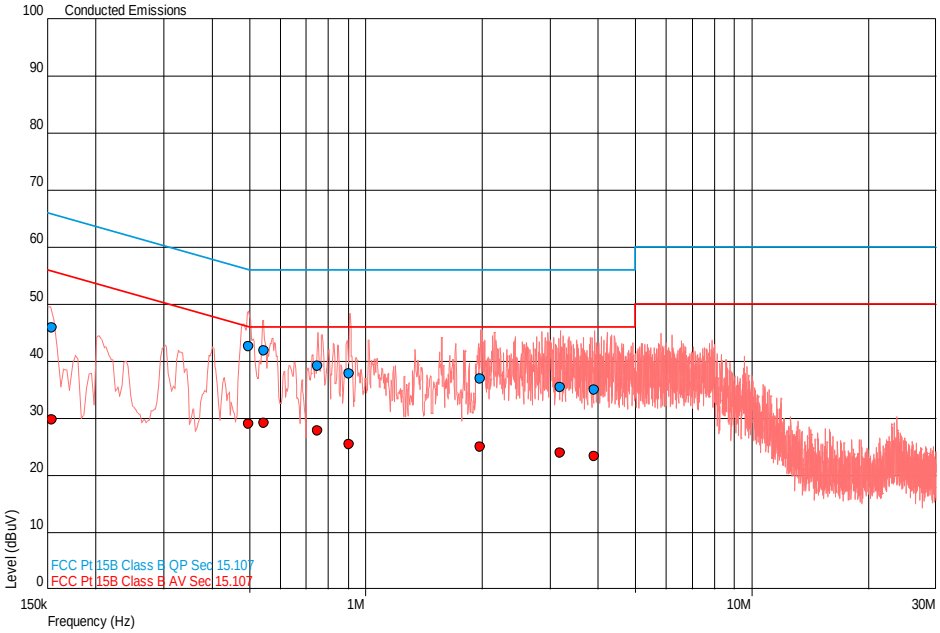
2.1.6 Environmental Conditions

Ambient Temperature	20.5°C
Relative Humidity	43.0%

2.1.7 Test Results

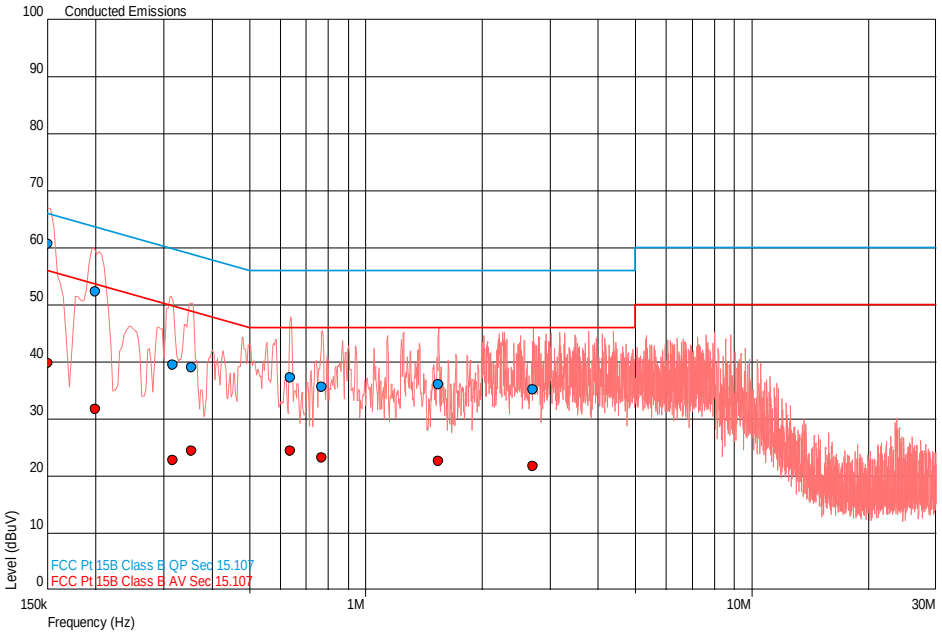
802.11(a)

Live Line



Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.155	45.9	65.7	-19.8	29.7	55.7	-26.0
0.498	42.6	56.0	-13.5	29.1	46.0	-17.0
0.545	41.8	56.0	-14.2	29.2	46.0	-16.8
0.752	39.2	56.0	-16.8	27.8	46.0	-18.2
0.907	37.8	56.0	-18.2	25.5	46.0	-20.5
1.982	36.9	56.0	-19.1	25.0	46.0	-21.0
3.194	35.4	56.0	-20.6	23.9	46.0	-22.1
3.911	34.9	56.0	-21.1	23.3	46.0	-22.7

Neutral Line



Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.150	60.7	66.0	-5.3	39.8	56.0	-16.2
0.200	52.4	63.6	-11.2	31.7	53.6	-21.9
0.317	39.4	59.8	-20.4	22.7	49.8	-27.1
0.354	39.0	58.9	-19.8	24.4	48.9	-24.5
0.640	37.2	56.0	-18.8	24.3	46.0	-21.7
0.770	35.6	56.0	-20.4	23.2	46.0	-22.8
1.542	36.0	56.0	-20.0	22.7	46.0	-23.3
2.713	35.1	56.0	-20.9	21.7	46.0	-24.3

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

SHL23 S/N: IMEI 004401114893148 - Modification State 0

2.2.3 Date of Test

29 September 2013, 30 September 2013, 2 October 2013, 7 October 2013 & 15 October 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 Peak Power Analyser 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	20.0 - 23.1°C
Relative Humidity	41.0 - 54.3%

2.2.7 Test Results

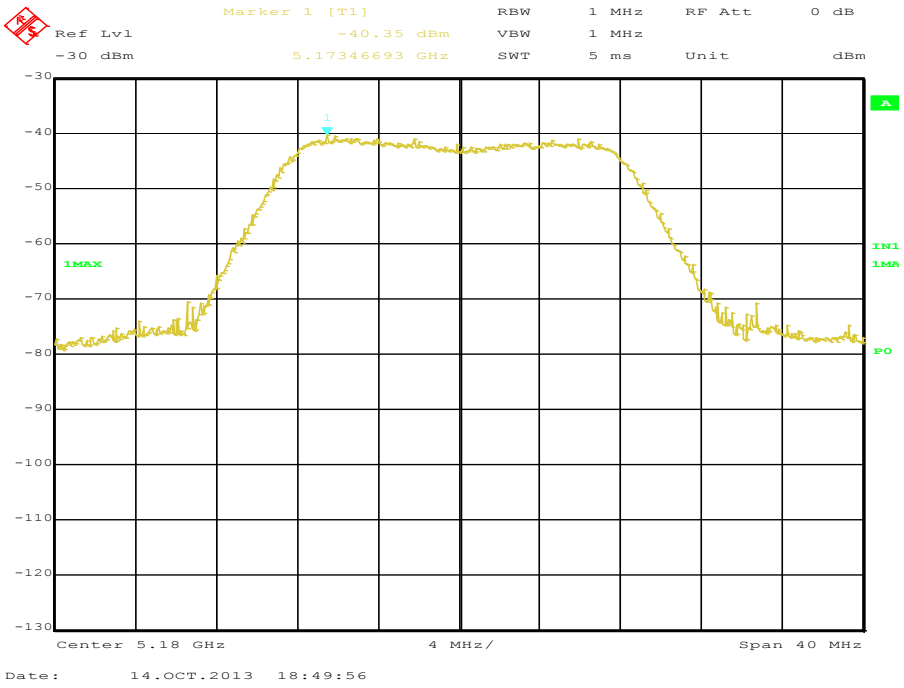
802.11(a)

Radiated

Frequency Band 1

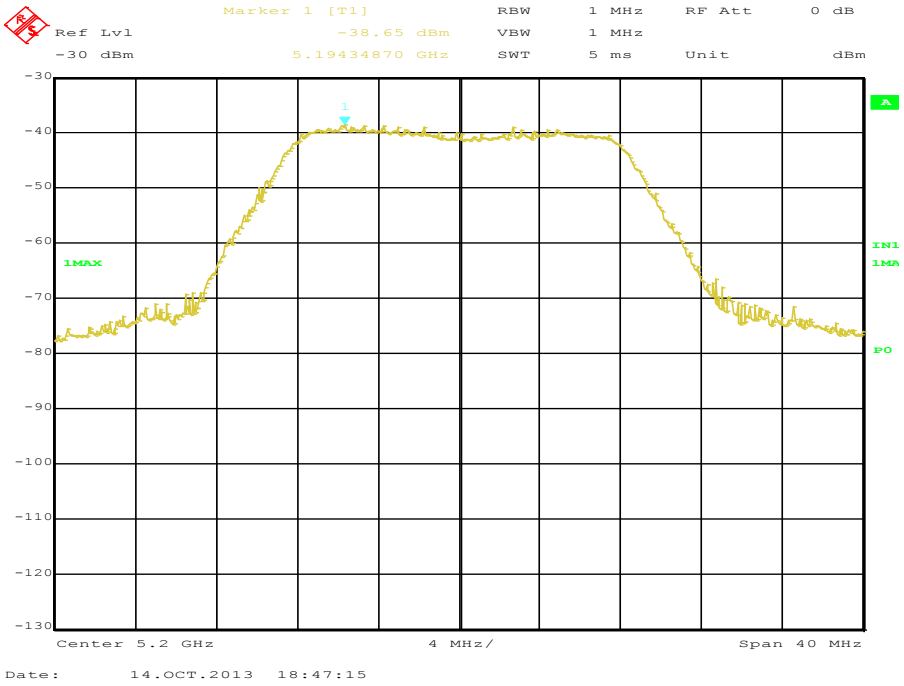
5180 MHz

EIRP (dBm)	EIRP (mW)
11.91	15.52



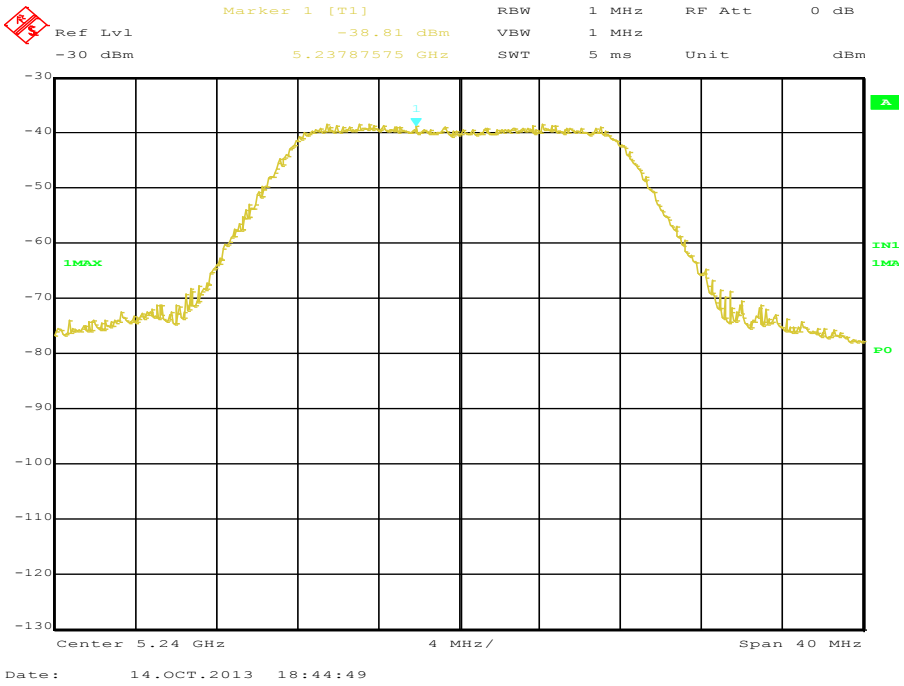
5200 MHz

EIRP (dBm)	EIRP (mW)
14.13	25.88



5240 MHz

EIRP (dBm)	EIRP (mW)
13.31	21.43

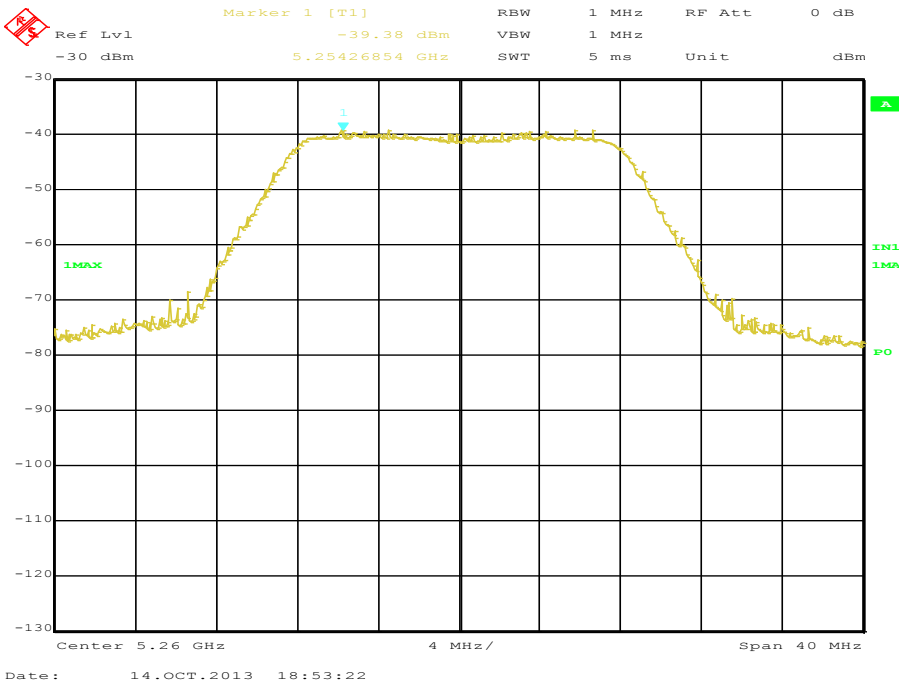


Radiated

Frequency Band 2

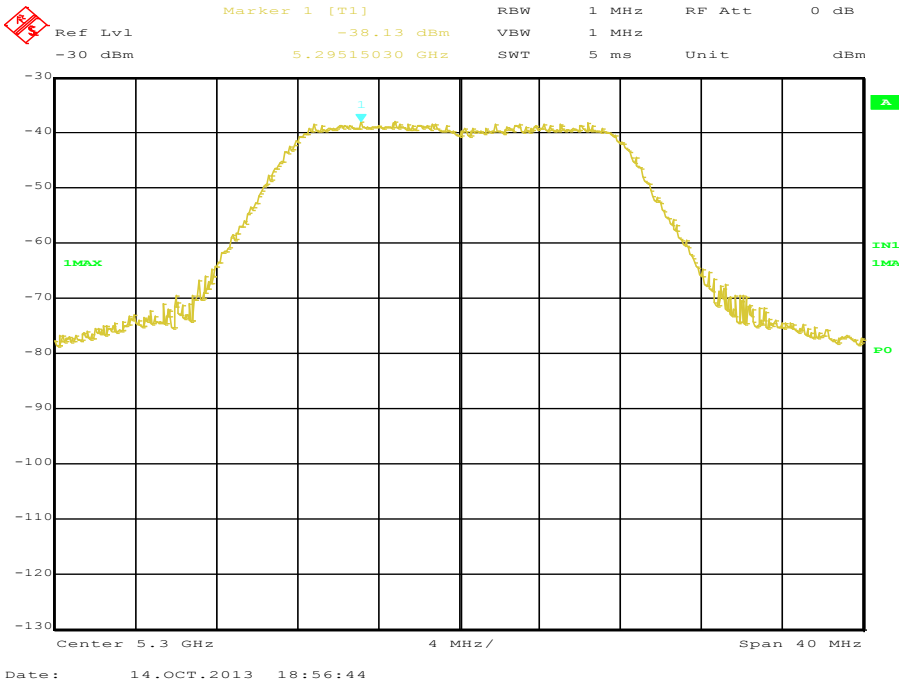
5260 MHz

EIRP (dBm)	EIRP (mW)
12.91	19.54



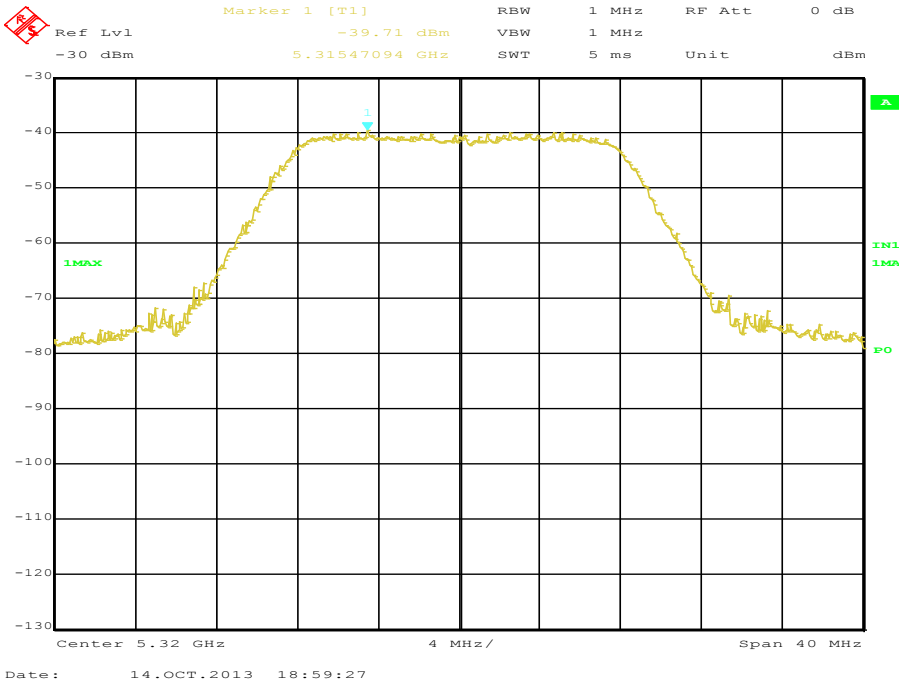
5300 MHz

EIRP (dBm)	EIRP (mW)
14.15	26.00



5320 MHz

EIRP (dBm)	EIRP (mW)
12.46	17.62

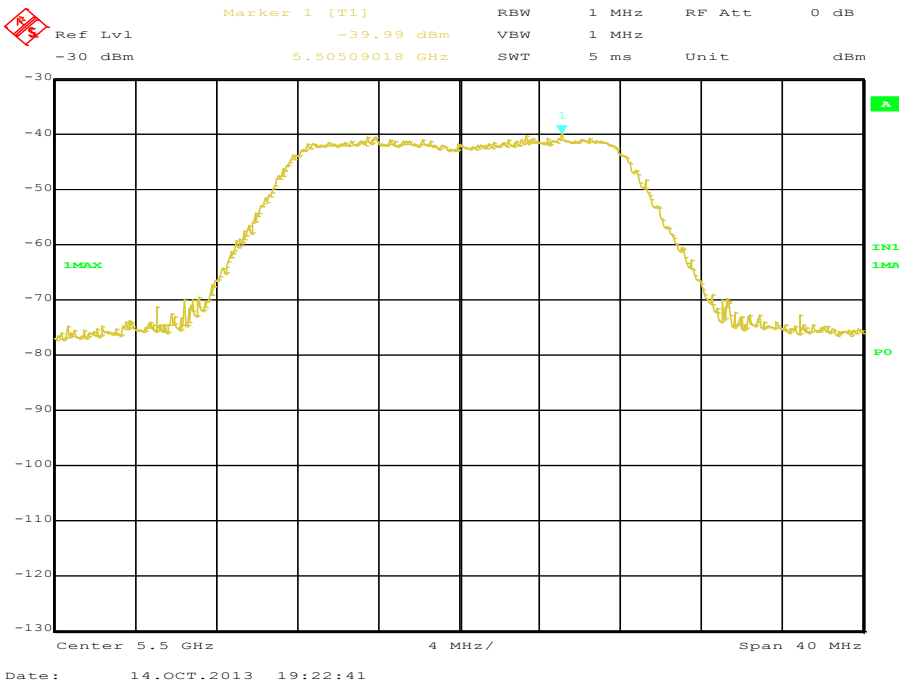


Radiated

Frequency Band 3

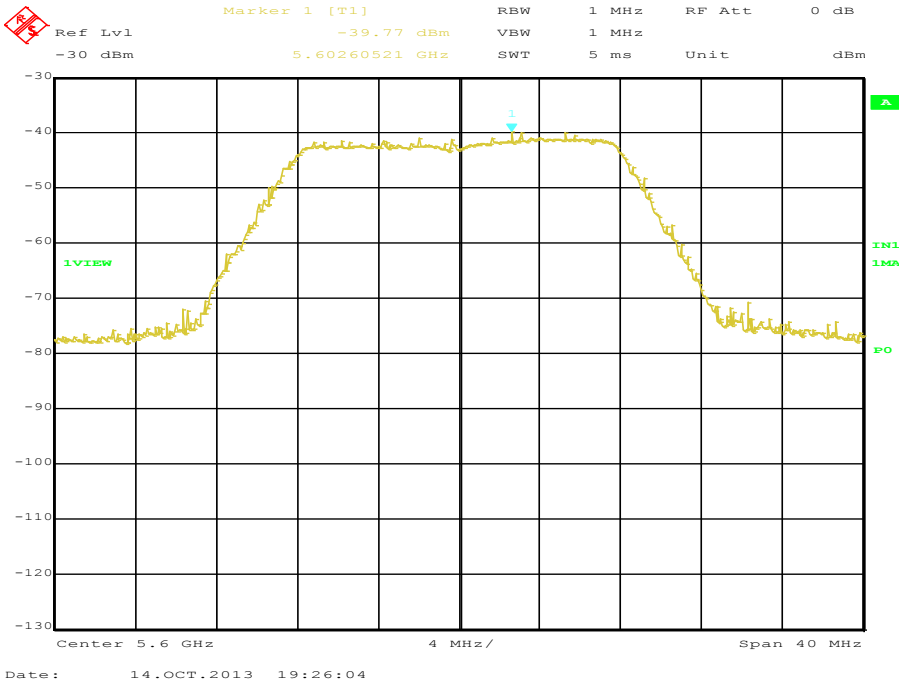
5500 MHz

EIRP (dBm)	EIRP (mW)
14.12	25.82



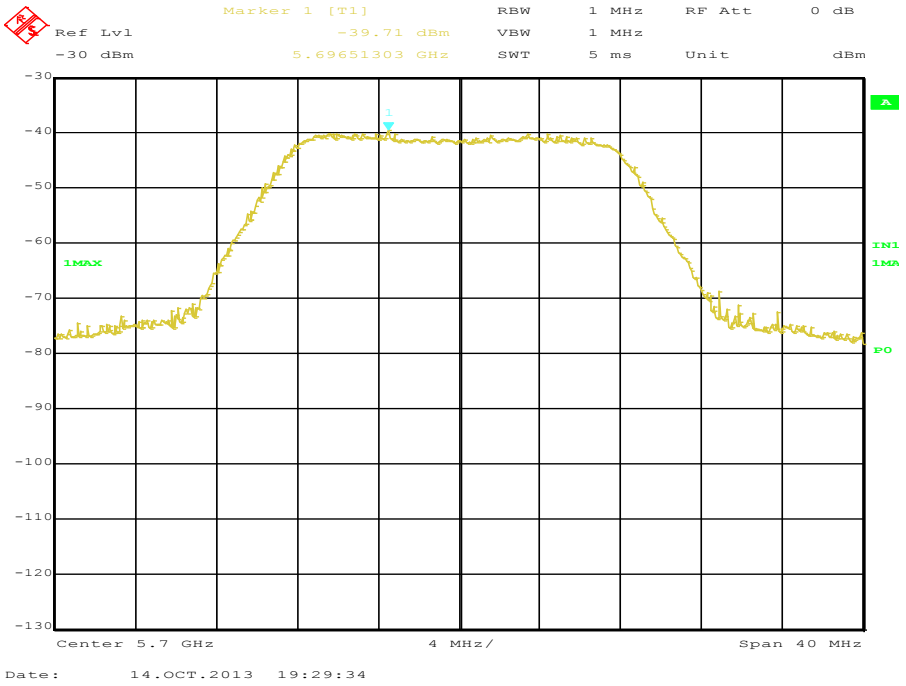
5600 MHz

EIRP (dBm)	EIRP (mW)
14.40	27.54



5700 MHz

EIRP (dBm)	EIRP (mW)
14.91	30.97



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)
13.50	22.39

5200 MHz

EIRP (dBm)	EIRP (mW)
14.33	27.19

5240 MHz

EIRP (dBm)	EIRP (mW)
14.39	27.48

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)
14.43	27.73

5300 MHz

EIRP (dBm)	EIRP (mW)
14.50	28.18

5320 MHz

EIRP (dBm)	EIRP (mW)
13.23	21.04

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)
13.31	21.43

5600 MHz

EIRP (dBm)	EIRP (mW)
13.21	20.94

5700 MHz

EIRP (dBm)	EIRP (mW)
12.97	19.82

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.

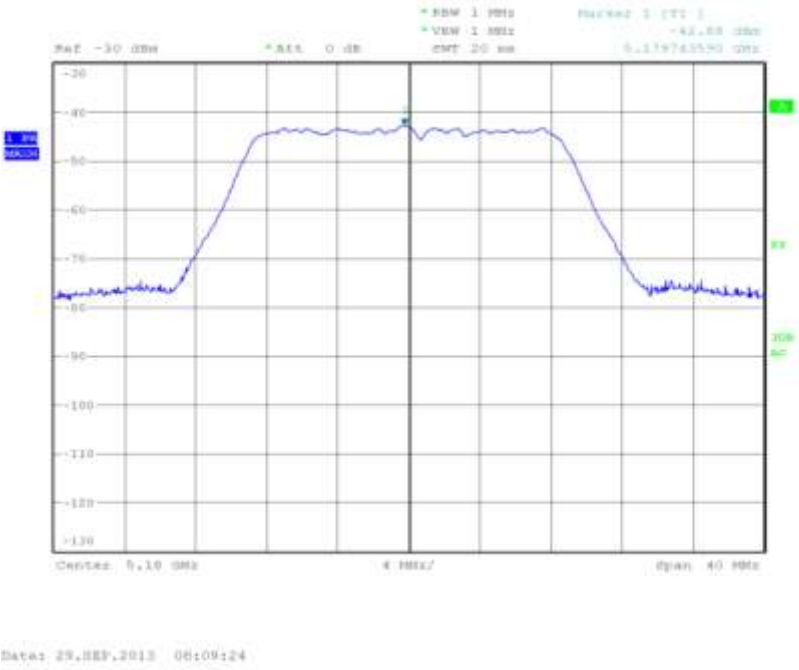
802.11(ac) - 5 GHz 20 MHz BW FCC

Radiated

Frequency Band 1

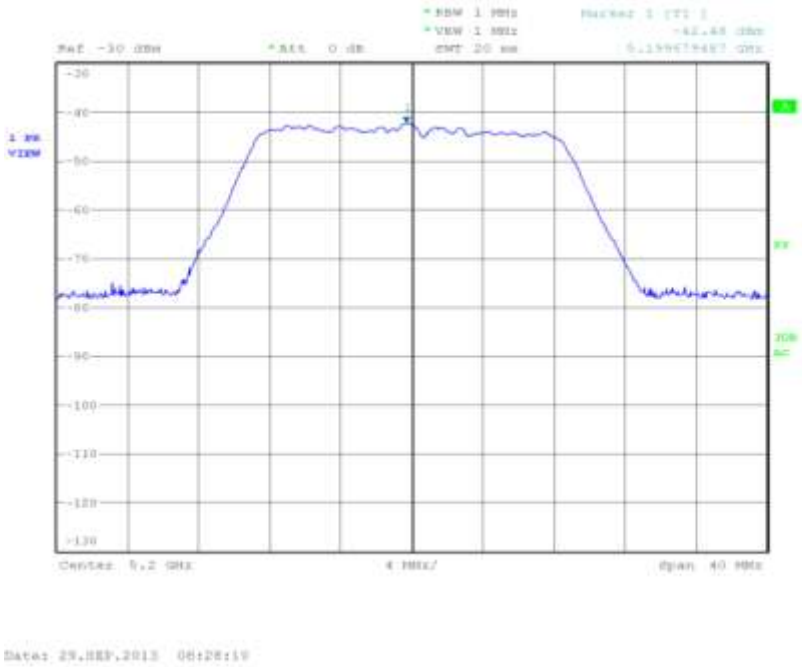
5180 MHz

EIRP (dBm)	EIRP (mW)
11.13	12.97



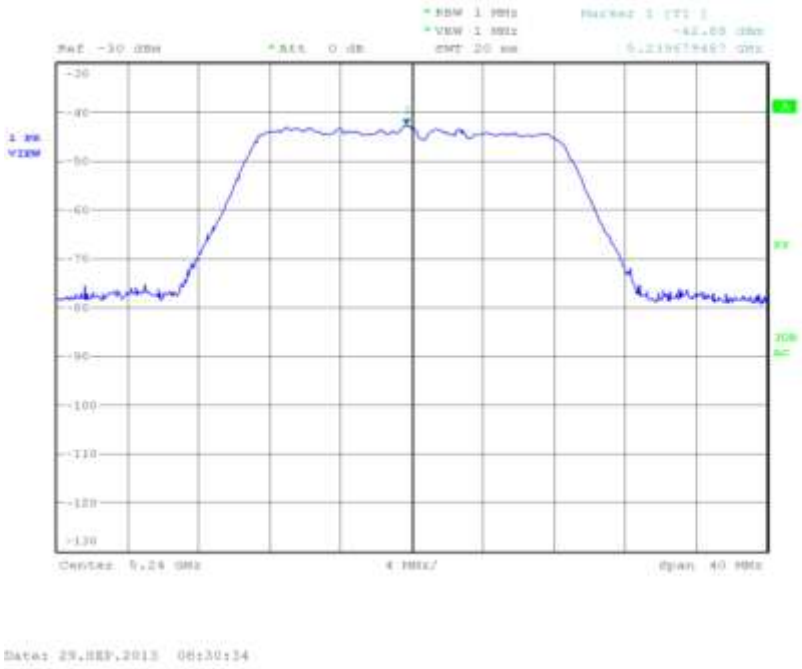
5200 MHz

EIRP (dBm)	EIRP (mW)
11.86	15.35



5240 MHz

EIRP (dBm)	EIRP (mW)
11.28	13.43

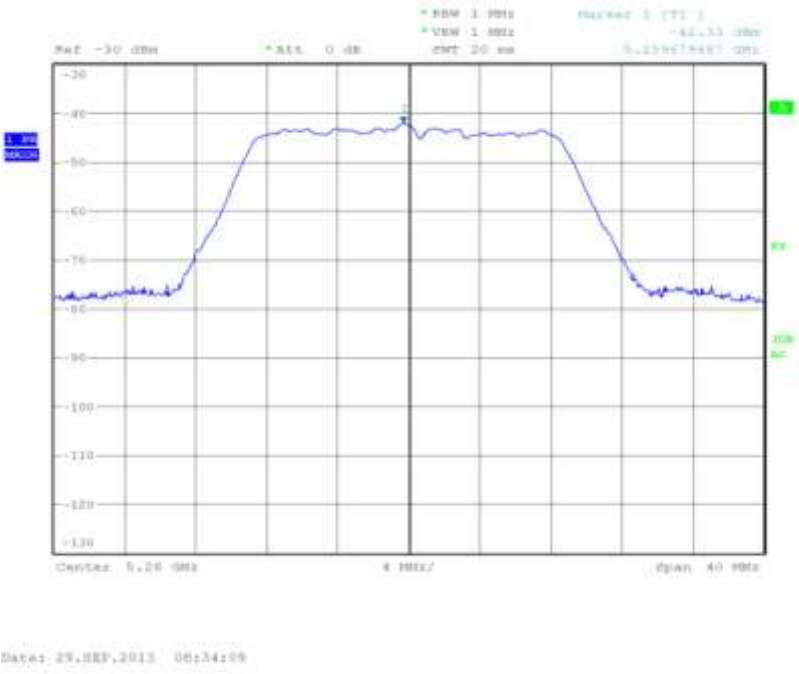


Radiated

Frequency Band 2

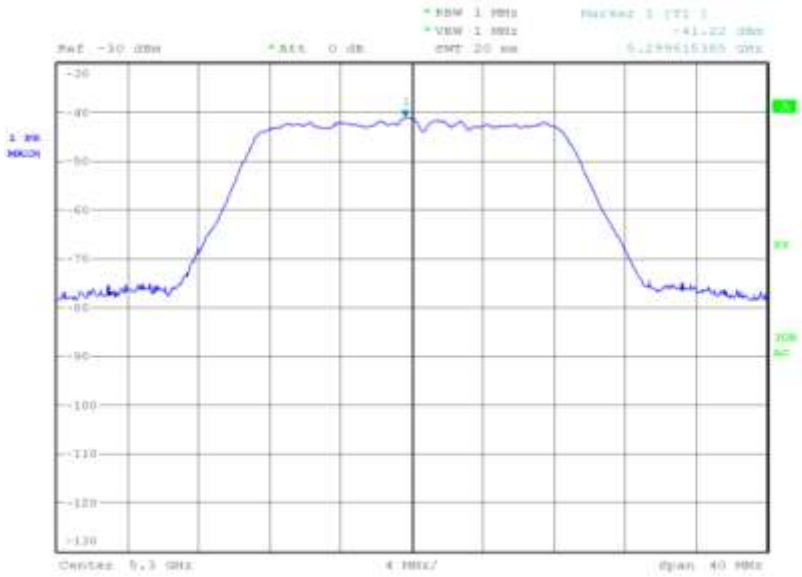
5260 MHz

EIRP (dBm)	EIRP (mW)
11.77	15.03



5300 MHz

EIRP (dBm)	EIRP (mW)
12.28	16.90



Date: 29.SEP.2013 06:37:15

5320 MHz

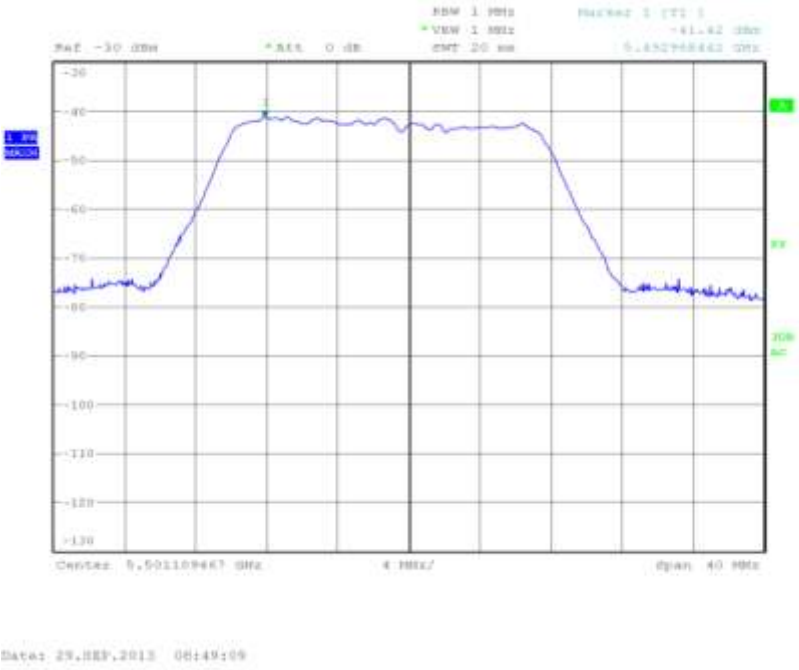
EIRP (dBm)	EIRP (mW)
11.86	15.35

Radiated

Frequency Band 3

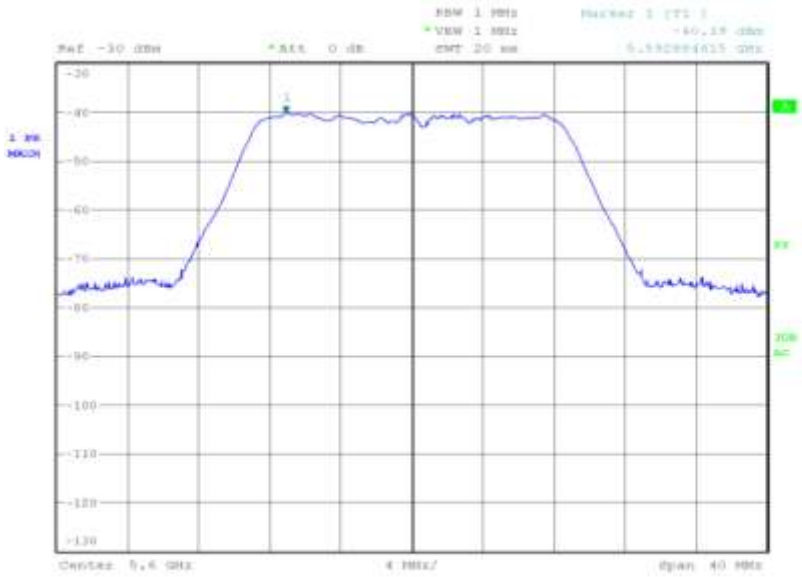
5500 MHz

EIRP (dBm)	EIRP (mW)
14.06	25.47



5600 MHz

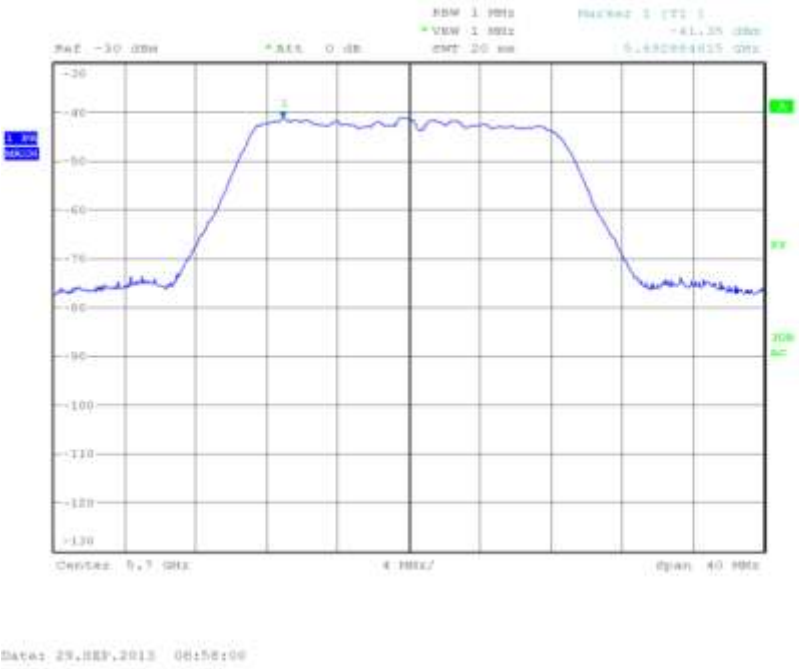
EIRP (dBm)	EIRP (mW)
15.50	35.48



Date: 29.SEP.2013 06:54:25

5700 MHz

EIRP (dBm)	EIRP (mW)
14.73	29.72



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)
13.54	22.59

5200 MHz

EIRP (dBm)	EIRP (mW)
13.27	21.23

5240 MHz

EIRP (dBm)	EIRP (mW)
12.90	19.50

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 MCS1.

Conducted

Frequency Band 2

5260 MHz

EIRP (dBm)	EIRP (mW)
13.32	21.48

5300 MHz

EIRP (dBm)	EIRP (mW)
13.63	23.07

5320 MHz

EIRP (dBm)	EIRP (mW)
13.05	20.18

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 MCS1.

Conducted

Frequency Band 3

5500 MHz

EIRP (dBm)	EIRP (mW)
13.26	21.18

5600 MHz

EIRP (dBm)	EIRP (mW)
13.33	21.53

5700 MHz

EIRP (dBm)	EIRP (mW)
12.74	18.79

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 MCS1.

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.

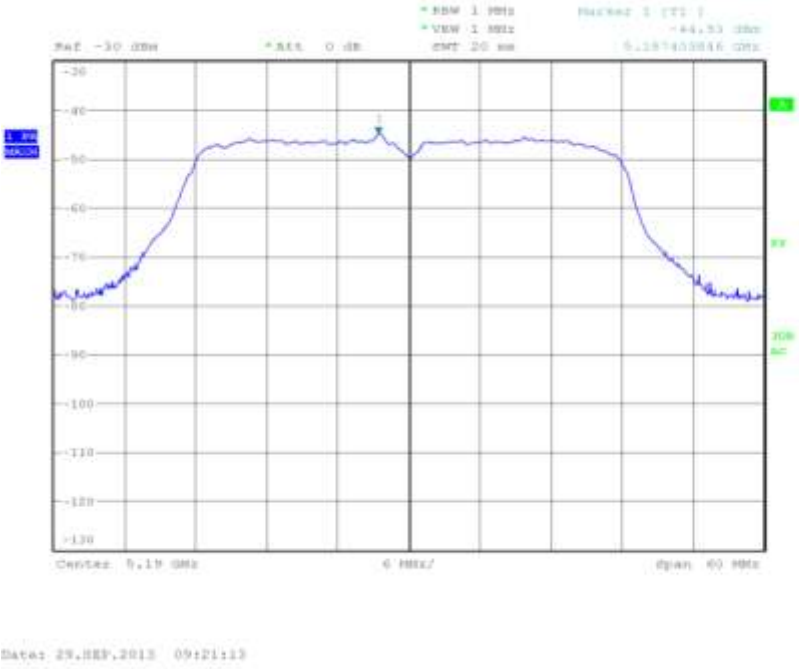
802.11(ac) - 5 GHz 40 MHz BW FCC

Radiated

Frequency Band 1

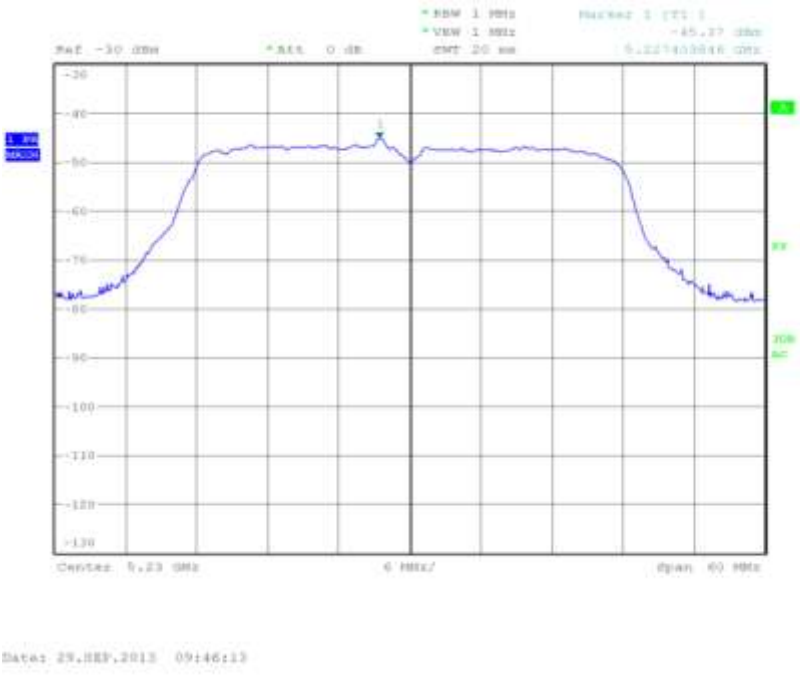
5190 MHz

EIRP (dBm)	EIRP (mW)
11.24	13.30



5230 MHz

EIRP (dBm)	EIRP (mW)
11.23	13.27

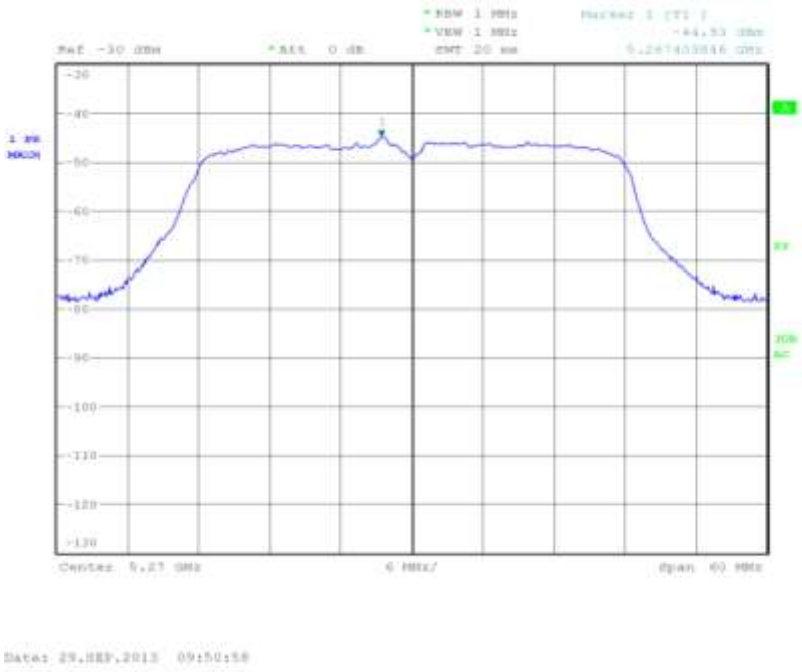


Radiated

Frequency Band 2

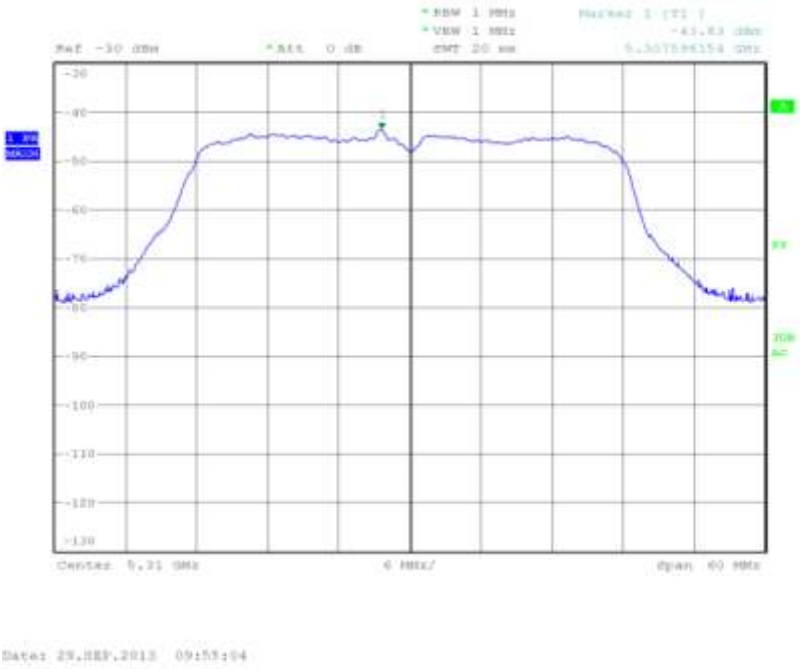
5270 MHz

EIRP (dBm)	EIRP (mW)
11.48	28.05



5310 MHz

EIRP (dBm)	EIRP (mW)
12.25	16.79

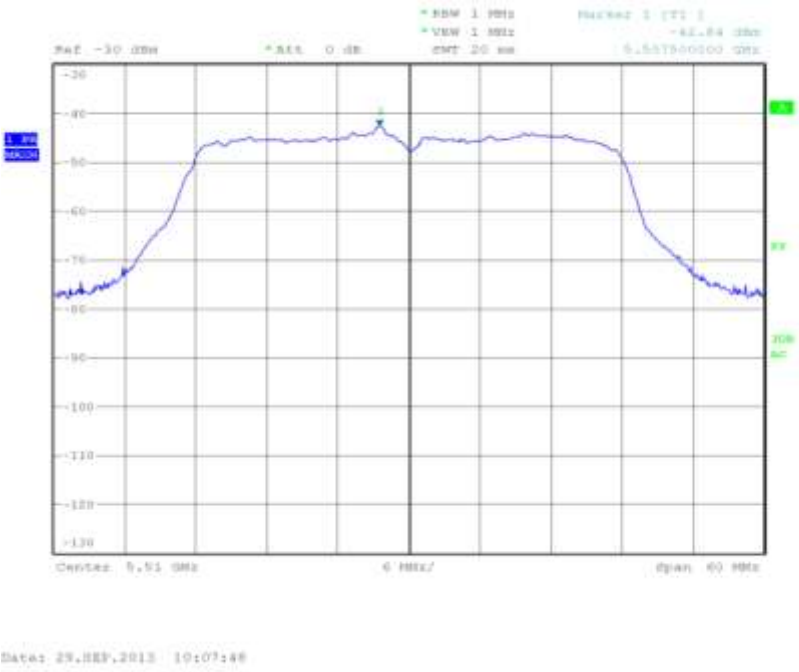


Radiated

Frequency Band 3

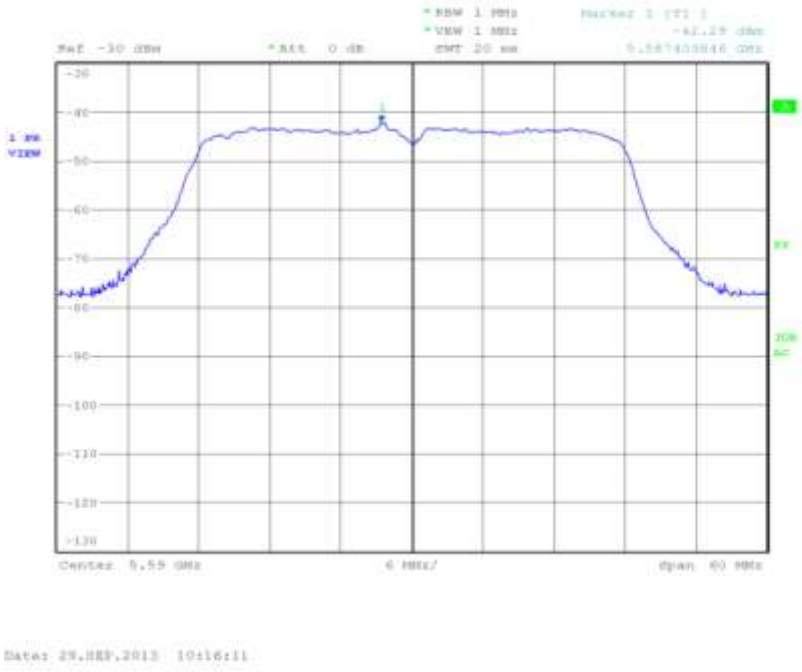
5510 MHz

EIRP (dBm)	EIRP (mW)
14.57	28.64



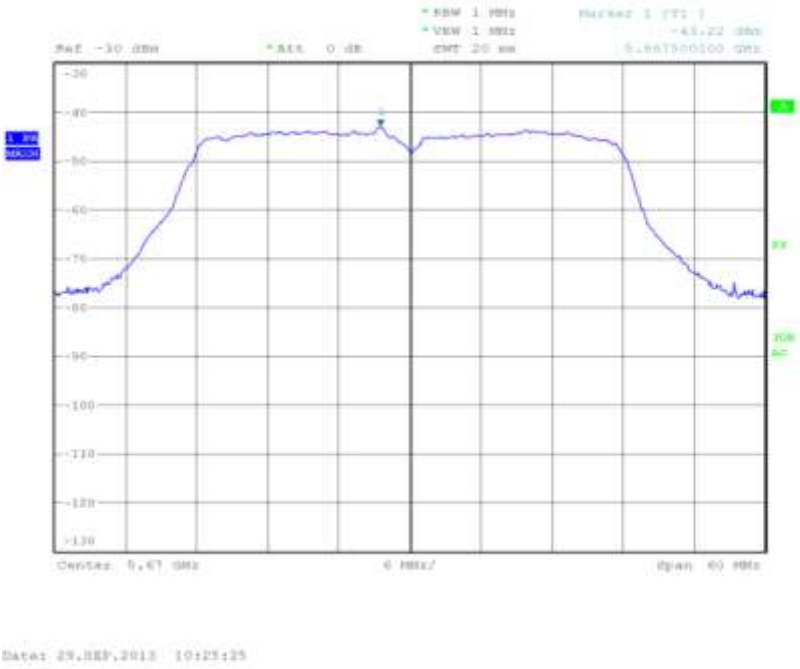
5590 MHz

EIRP (dBm)	EIRP (mW)
14.83	30.41



5670 MHz

EIRP (dBm)	EIRP (mW)
13.70	23.44



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)
13.31	21.43

5230 MHz

EIRP (dBm)	EIRP (mW)
13.22	20.99

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 MCS0.

Conducted

Frequency Band 2

5270 MHz

EIRP (dBm)	EIRP (mW)
13.34	21.43

5310 MHz

EIRP (dBm)	EIRP (mW)
13.38	21.78

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 MCS0.

Conducted

Frequency Band 3

5510 MHz

EIRP (dBm)	EIRP (mW)
13.52	22.49

5590 MHz

EIRP (dBm)	EIRP (mW)
13.34	21.58

5670 MHz

EIRP (dBm)	EIRP (mW)
12.78	18.97

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 MCS0.

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 FCC

Radiated

Frequency Band 1

5210 MHz

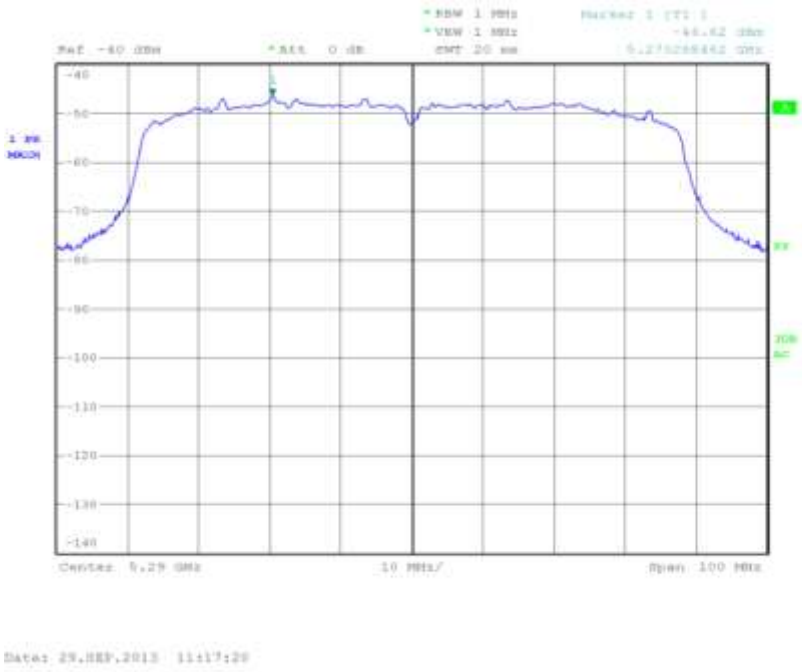
EIRP (dBm)	EIRP (mW)
11.23	13.27

Radiated

Frequency Band 2

5290 MHz

EIRP (dBm)	EIRP (mW)
12.00	15.85

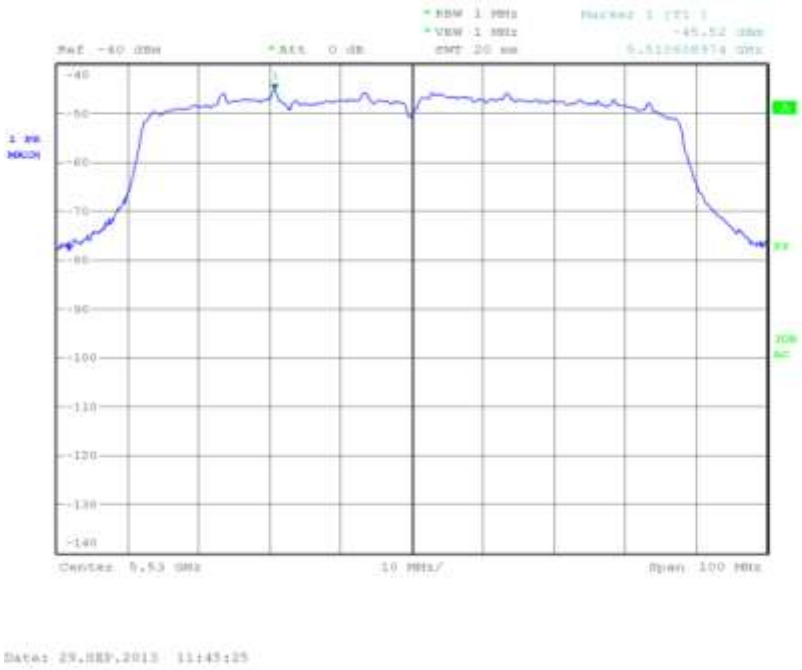


Radiated

Frequency Band 3

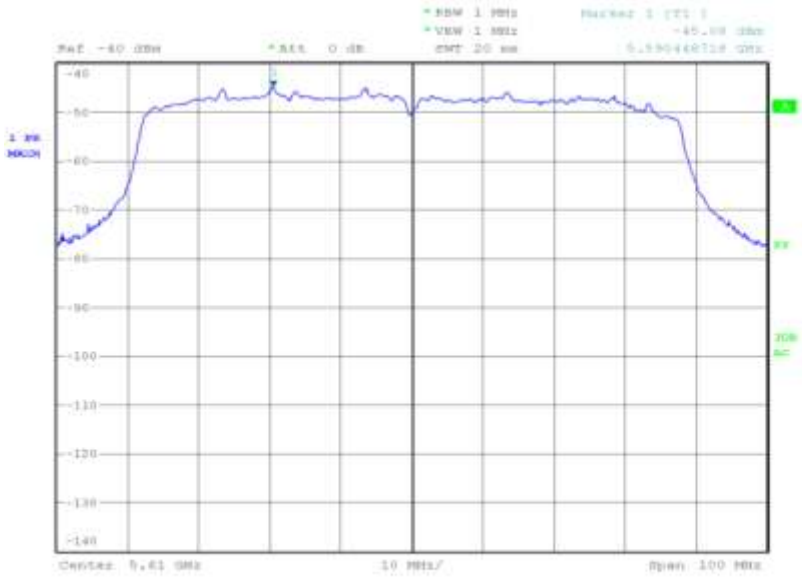
5530 MHz

EIRP (dBm)	EIRP (mW)
13.83	24.15



5610 MHz

EIRP (dBm)	EIRP (mW)
14.36	27.29



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)
13.33	21.53

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 MCS0.

Conducted

Frequency Band 2

5290 MHz

EIRP (dBm)	EIRP (mW)
13.54	22.59

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 MCS0.

Conducted

Frequency Band 3

5530 MHz

EIRP (dBm)	EIRP (mW)
13.04	22.59

5610 MHz

EIRP (dBm)	EIRP (mW)
13.50	22.39

The test was performed on the worst case data rate for 802.11ac) - 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 MCS0.

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.

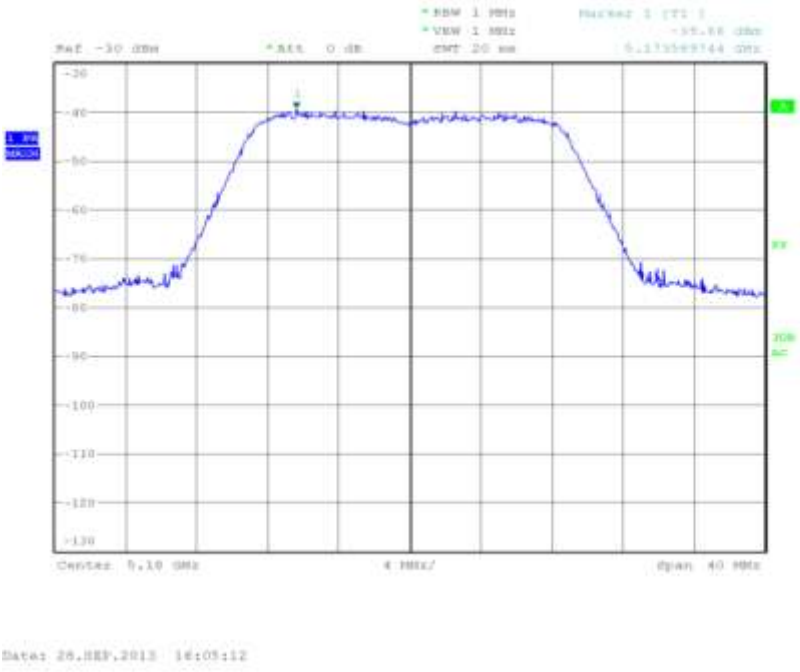
802.11(n) - 5 GHz 20 MHz BW FCC

Radiated

Frequency Band 1

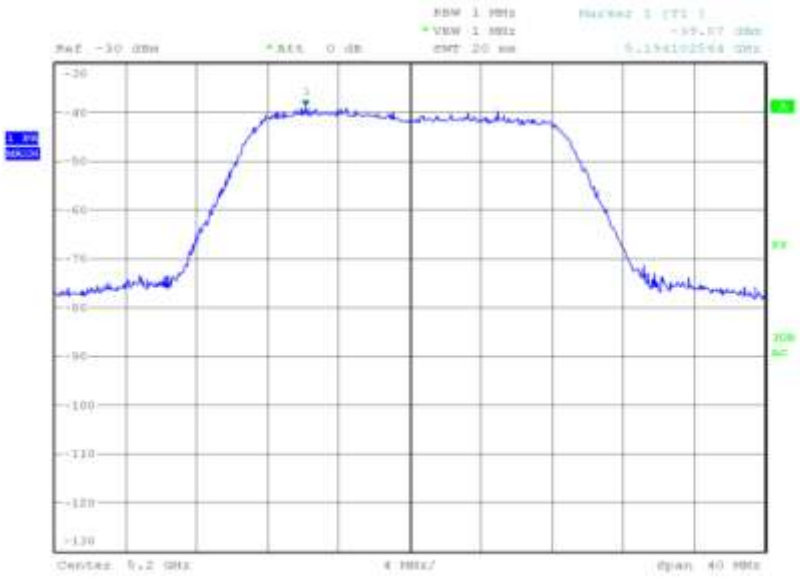
5180 MHz

EIRP (dBm)	EIRP (mW)
13.19	20.84



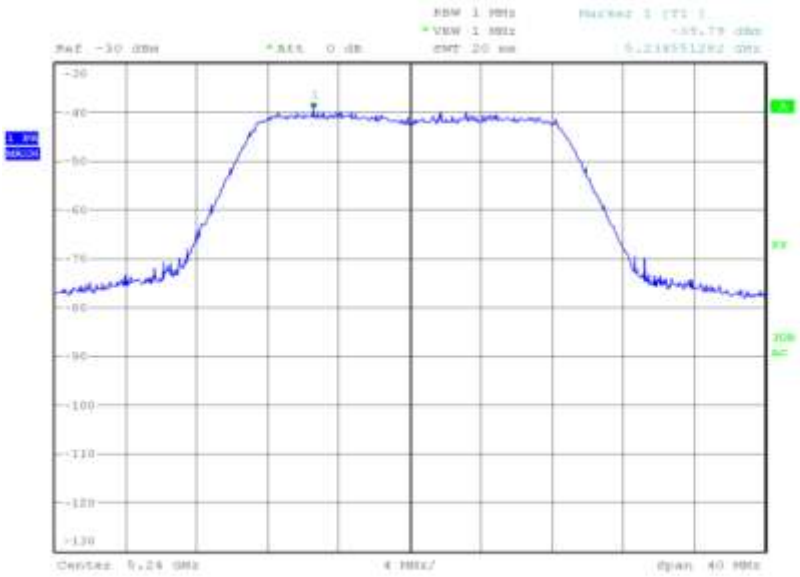
5200 MHz

EIRP (dBm)	EIRP (mW)
14.11	25.76



5240 MHz

EIRP (dBm)	EIRP (mW)
13.21	20.94

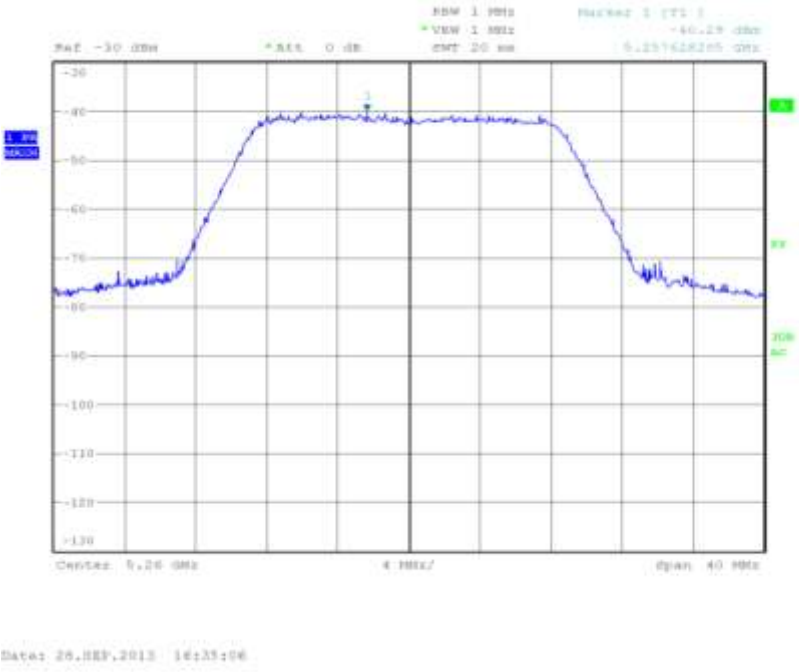


Radiated

Frequency Band 2

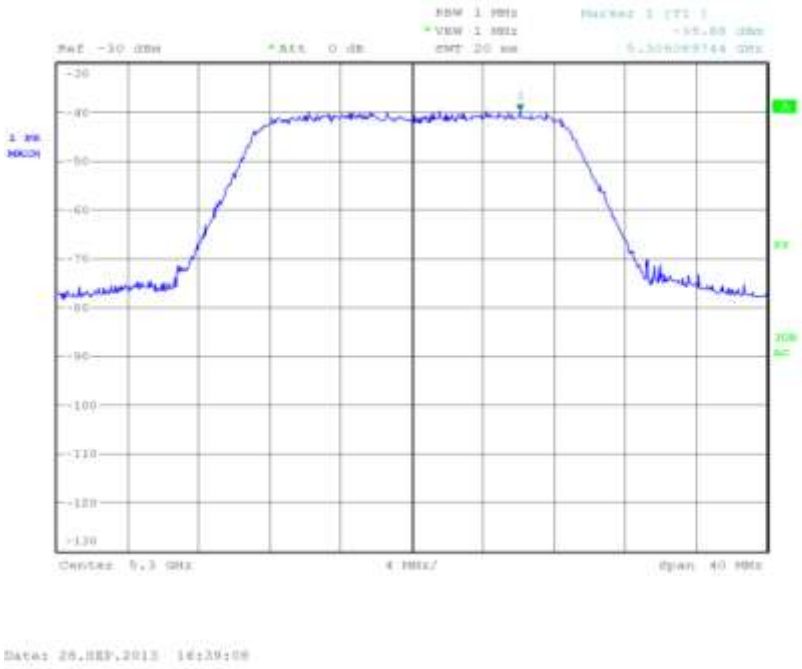
5260 MHz

EIRP (dBm)	EIRP (mW)
12.66	18.45



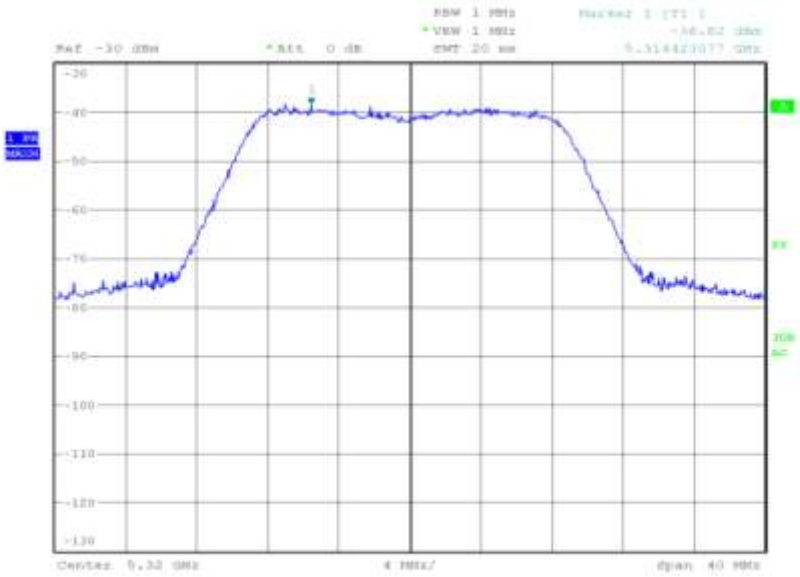
5300 MHz

EIRP (dBm)	EIRP (mW)
12.49	17.74



5320 MHz

EIRP (dBm)	EIRP (mW)
13.63	23.07

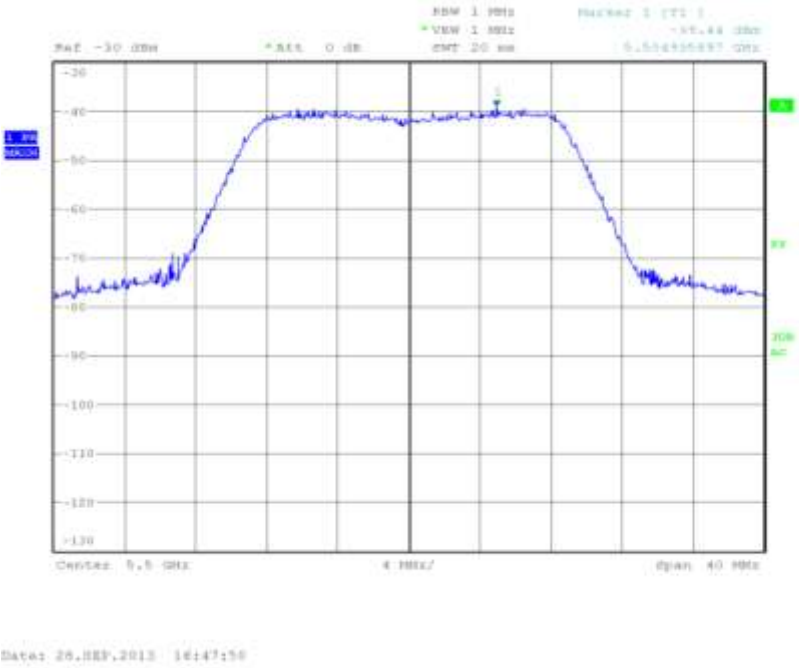


Radiated

Frequency Band 3

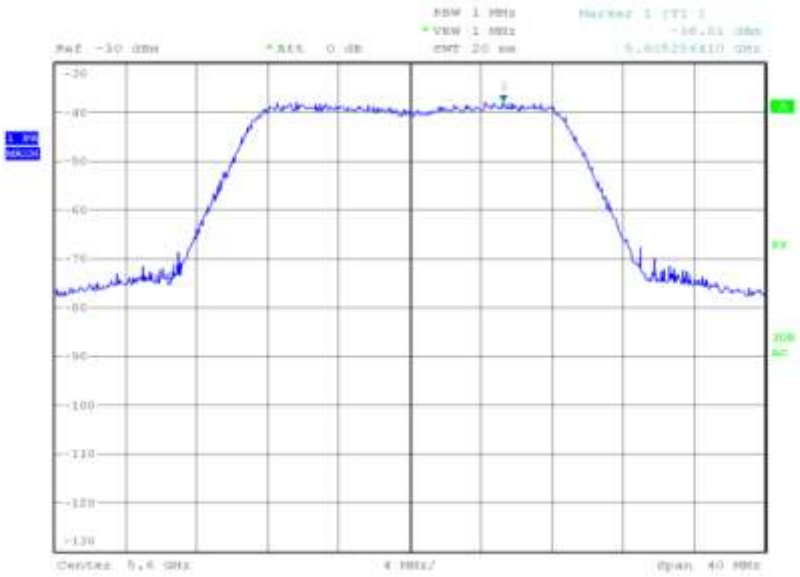
5500 MHz

EIRP (dBm)	EIRP (mW)
14.88	30.76



5600 MHz

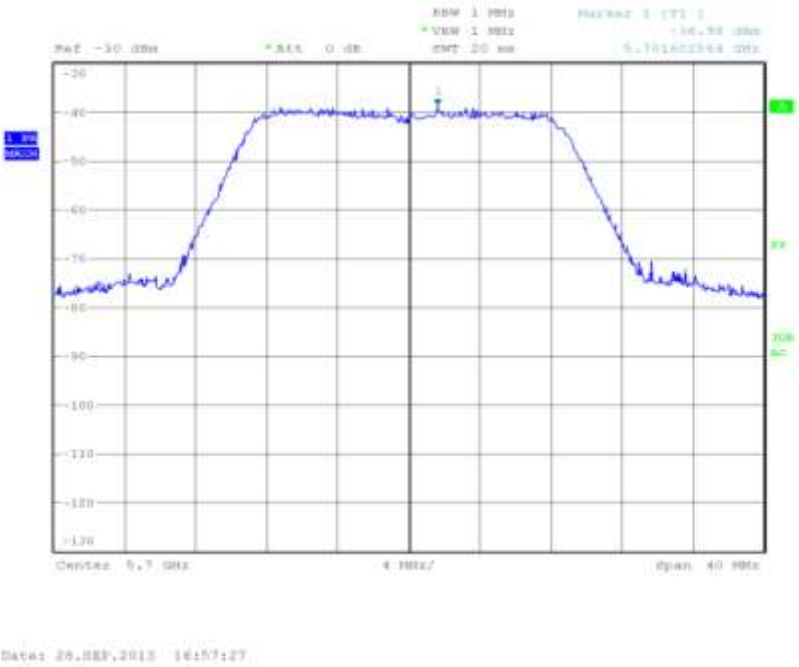
EIRP (dBm)	EIRP (mW)
16.72	46.99



Date: 26.SEP.2013 16:51:19

5700 MHz

EIRP (dBm)	EIRP (mW)
15.94	39.26



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)
12.81	19.10

5200 MHz

EIRP (dBm)	EIRP (mW)
12.60	18.20

5240 MHz

EIRP (dBm)	EIRP (mW)
12.35	17.99

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 MCS1.

Conducted

Frequency Band 2

5260 MHz

EIRP (dBm)	EIRP (mW)
12.45	17.58

5300 MHz

EIRP (dBm)	EIRP (mW)
12.51	17.82

5320 MHz

EIRP (dBm)	EIRP (mW)
12.22	16.67

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 MCS1.

Conducted

Frequency Band 3

5500 MHz

EIRP (dBm)	EIRP (mW)
12.00	15.85

5600 MHz

EIRP (dBm)	EIRP (mW)
12.36	17.22

5700 MHz

EIRP (dBm)	EIRP (mW)
11.83	15.24

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 MCS1.

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.

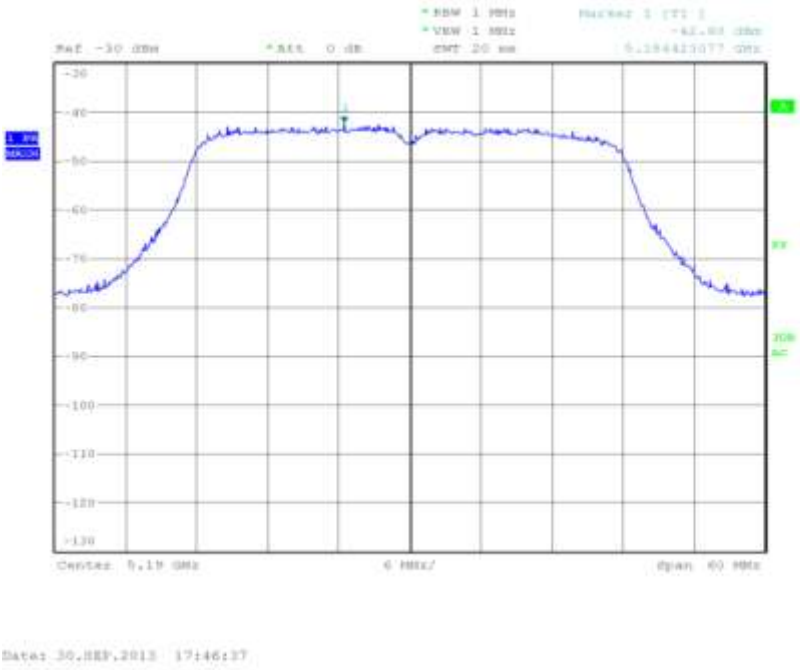
802.11(n) - 5 GHz 40 MHz BW FCC

Radiated

Frequency Band 1

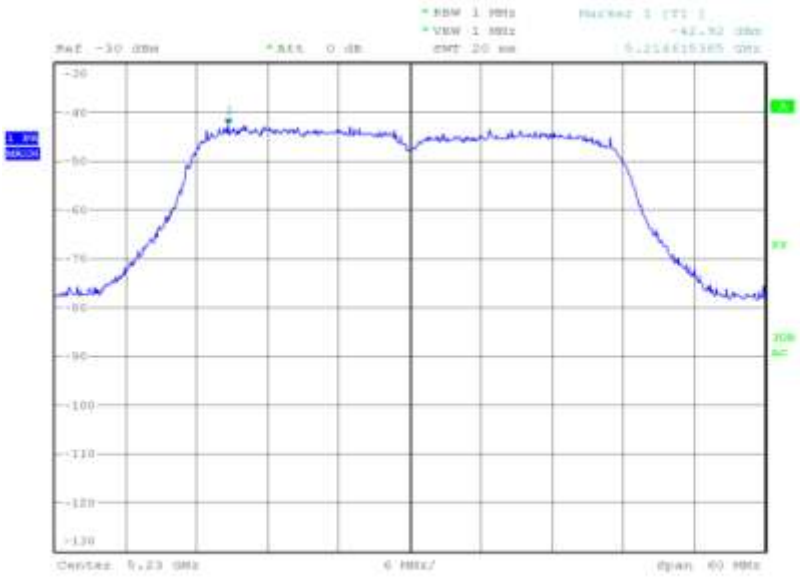
5190 MHz

EIRP (dBm)	EIRP (mW)
11.69	14.76



5230 MHz

EIRP (dBm)	EIRP (mW)
11.30	13.49

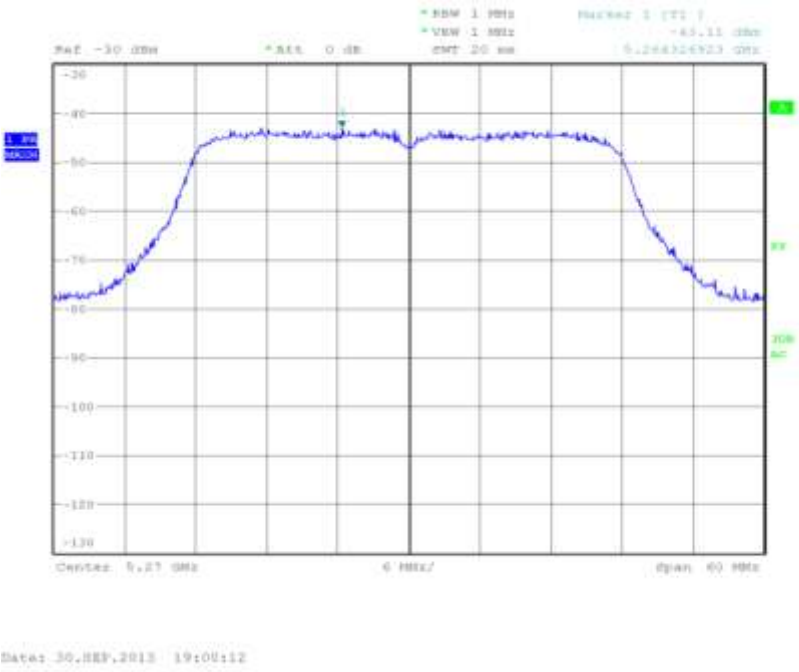


Radiated

Frequency Band 2

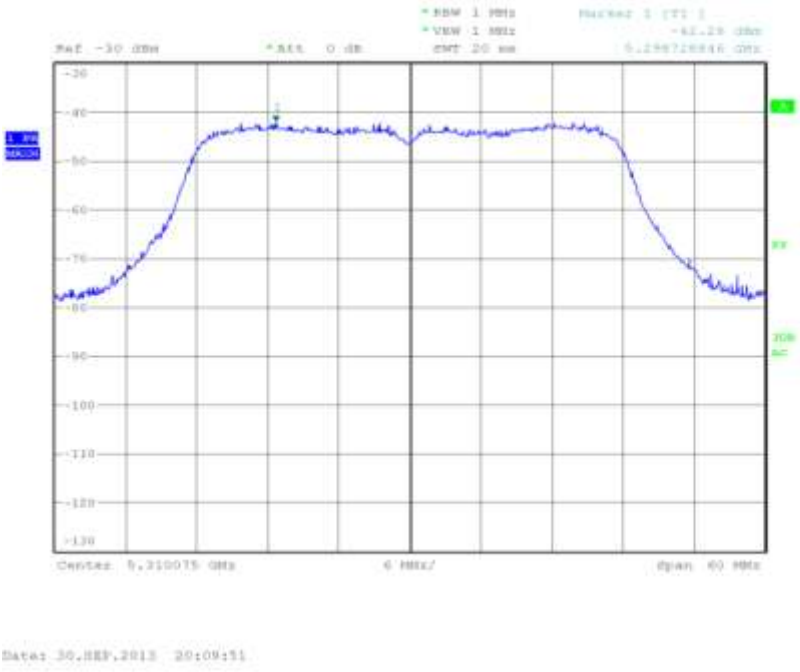
5270 MHz

EIRP (dBm)	EIRP (mW)
11.28	13.43



5310 MHz

EIRP (dBm)	EIRP (mW)
11.59	14.42

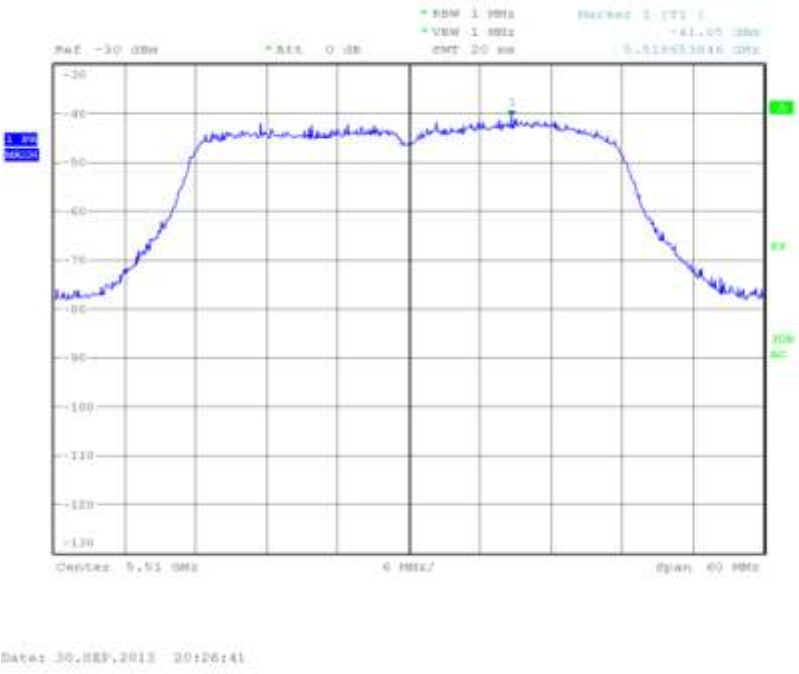


Radiated

Frequency Band 3

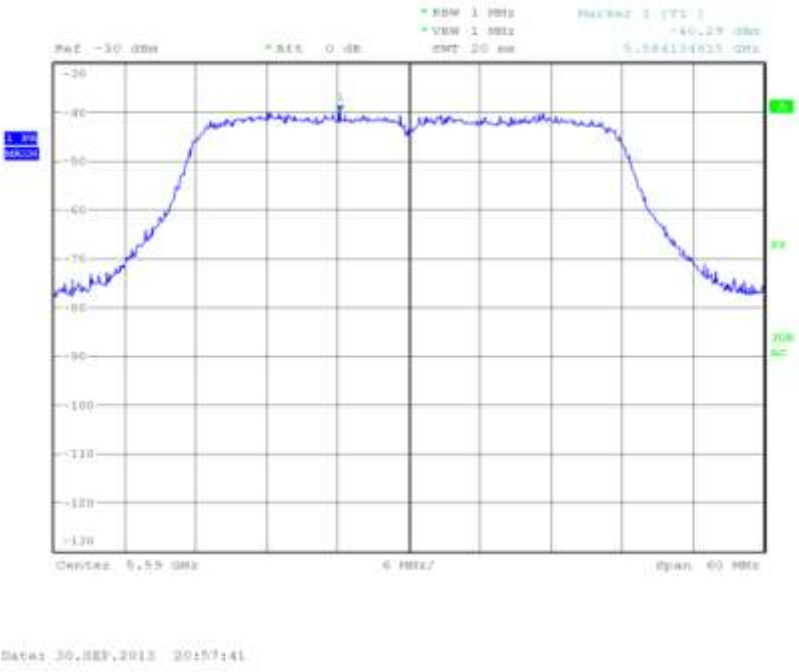
5510 MHz

EIRP (dBm)	EIRP (mW)
14.24	26.55



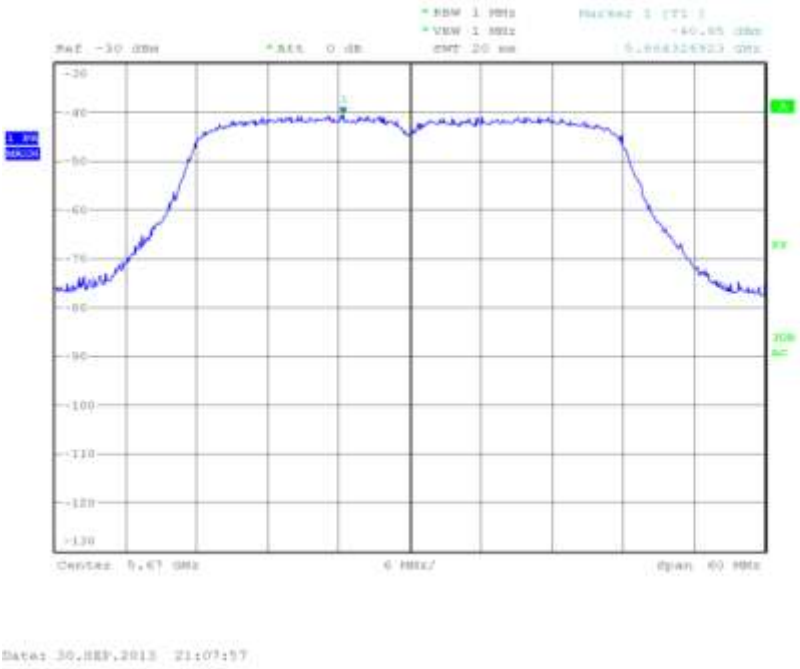
5590 MHz

EIRP (dBm)	EIRP (mW)
14.88	30.76



5670 MHz

EIRP (dBm)	EIRP (mW)
14.36	27.29



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)
12.51	17.82

5230 MHz

EIRP (dBm)	EIRP (mW)
12.12	16.29

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 MCS1.

Conducted

Frequency Band 2

5270 MHz

EIRP (dBm)	EIRP (mW)
12.15	16.41

5310 MHz

EIRP (dBm)	EIRP (mW)
12.44	17.54

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 MCS1.

Conducted

Frequency Band 3

5510 MHz

EIRP (dBm)	EIRP (mW)
11.83	15.24

5590 MHz

EIRP (dBm)	EIRP (mW)
12.22	16.67

5670 MHz

EIRP (dBm)	EIRP (mW)
11.31	13.52

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 MCS1.

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

SHL23 S/N: IMEI 004401114893148 - Modification State 0
SHL23 S/N: IMEI 004401114893346 - Modification State 0

2.3.3 Date of Test

29 September 2013, 30 September 2013, 1 October 2013, 2 October 2013, 15 October 2013, 16 October 2013 & 18 October 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	19.4 - 21.7°C
Relative Humidity	37.0 - 56.0%

2.3.7 Test Results

802.11(a)

4.0 V DC Supply

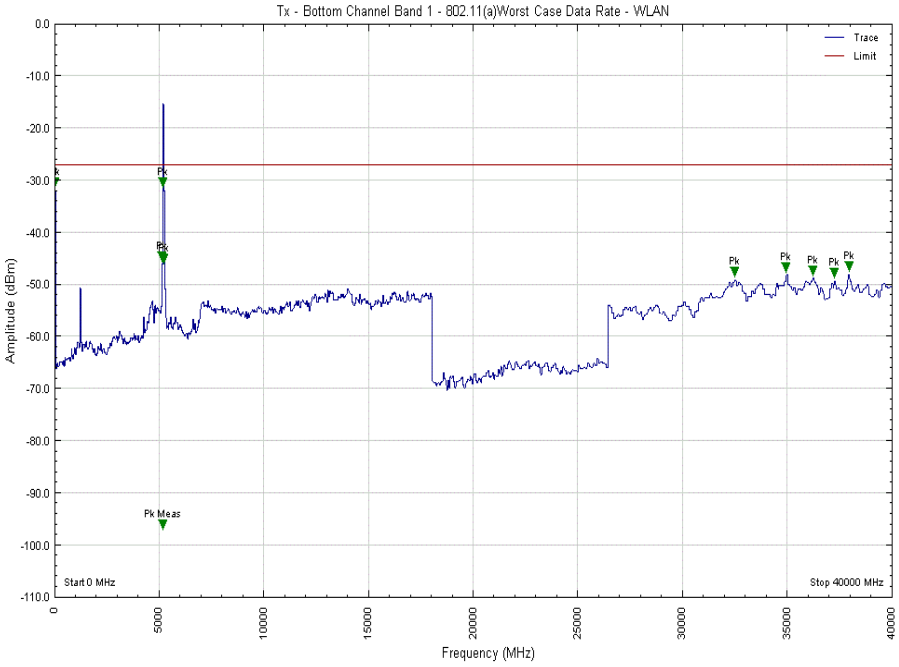
Spurious Conducted Emissions

6 Mbps

Frequency Band 1

5180 MHz

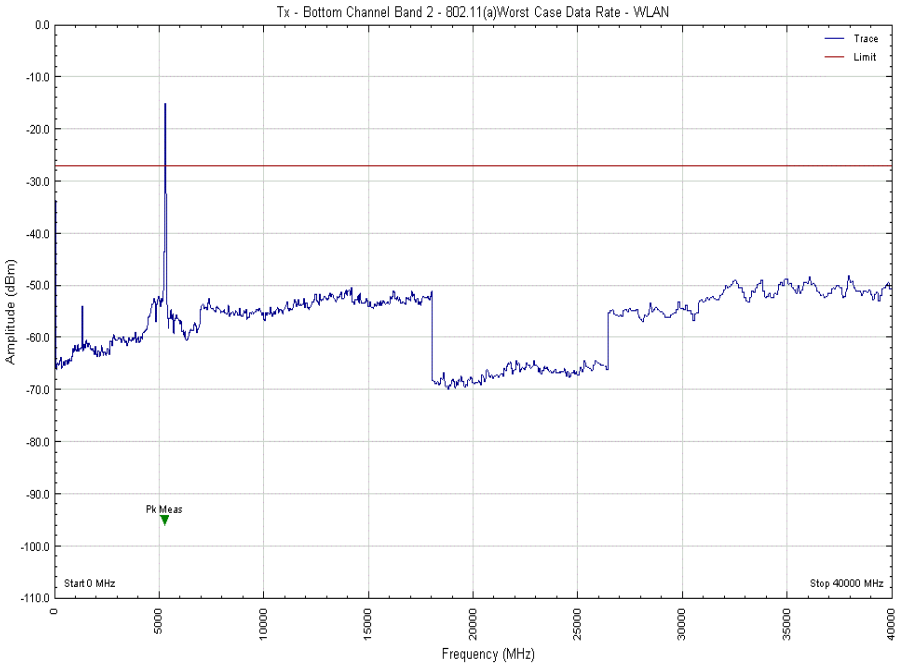
9 kHz to 40 GHz



Frequency Band 2

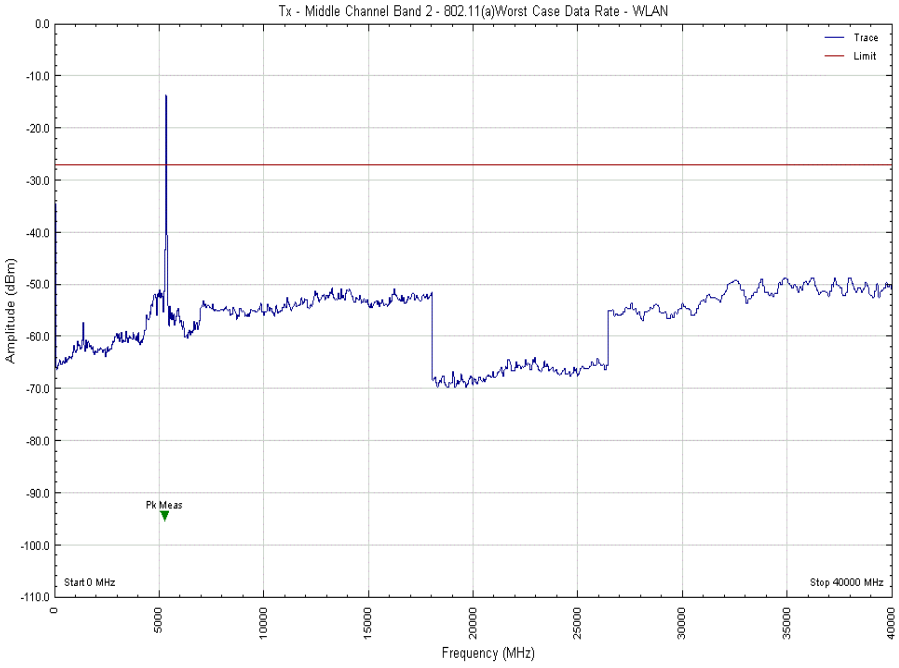
5260 MHz

9 kHz to 40 GHz



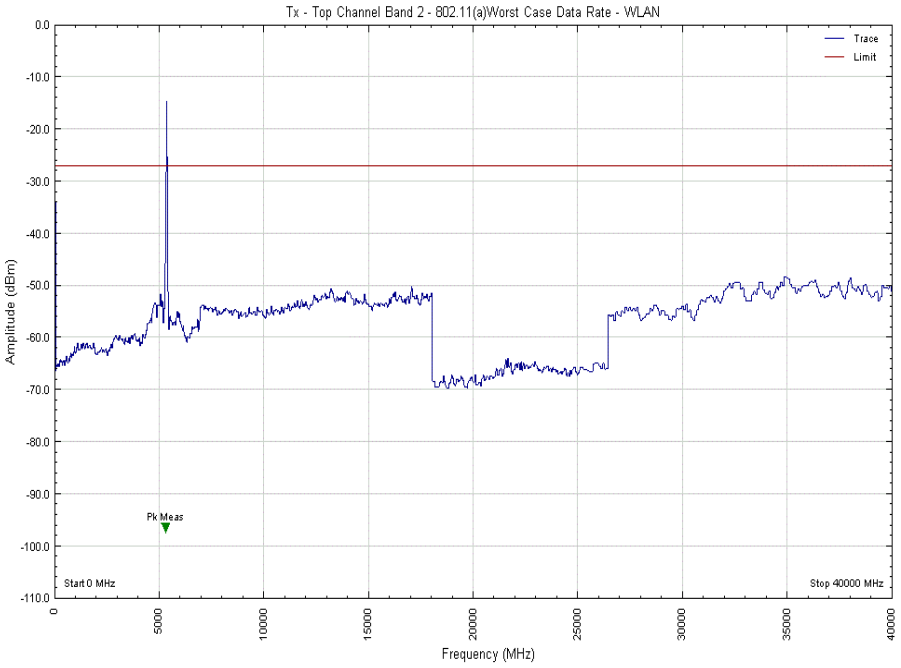
5300 MHz

9 kHz to 40 GHz



5320 MHz

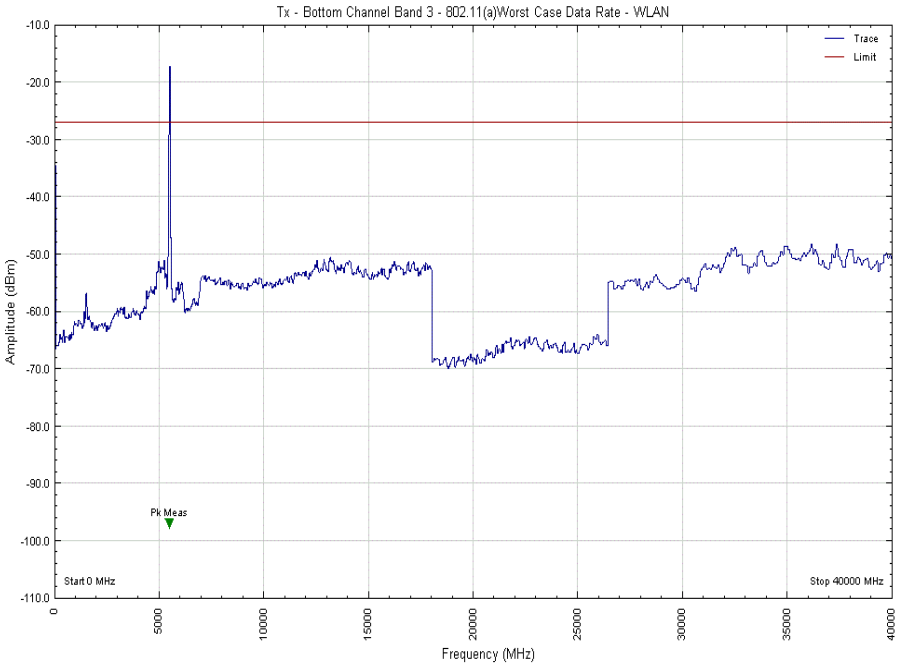
9 kHz to 40 GHz



Frequency Band 3

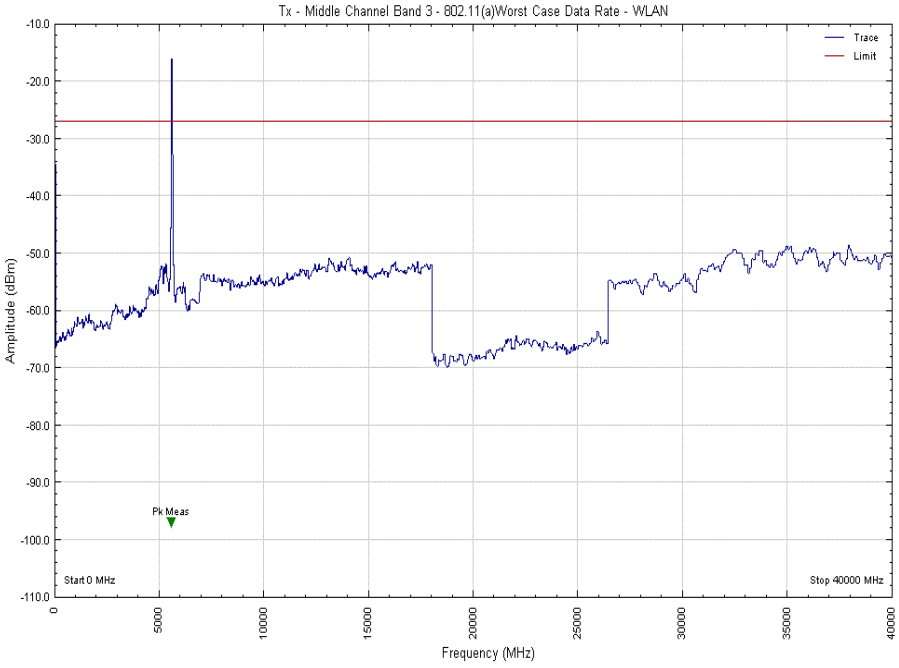
5500 MHz

9 kHz to 40 GHz



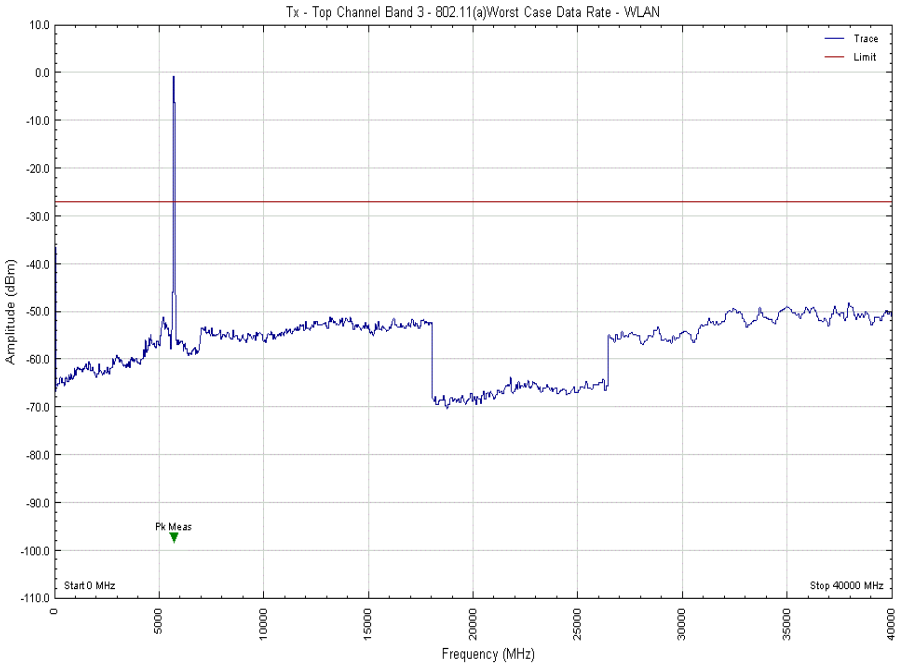
5600 MHz

9 kHz to 40 GHz



5700 MHz

9 kHz to 40 GHz



Limit Clause

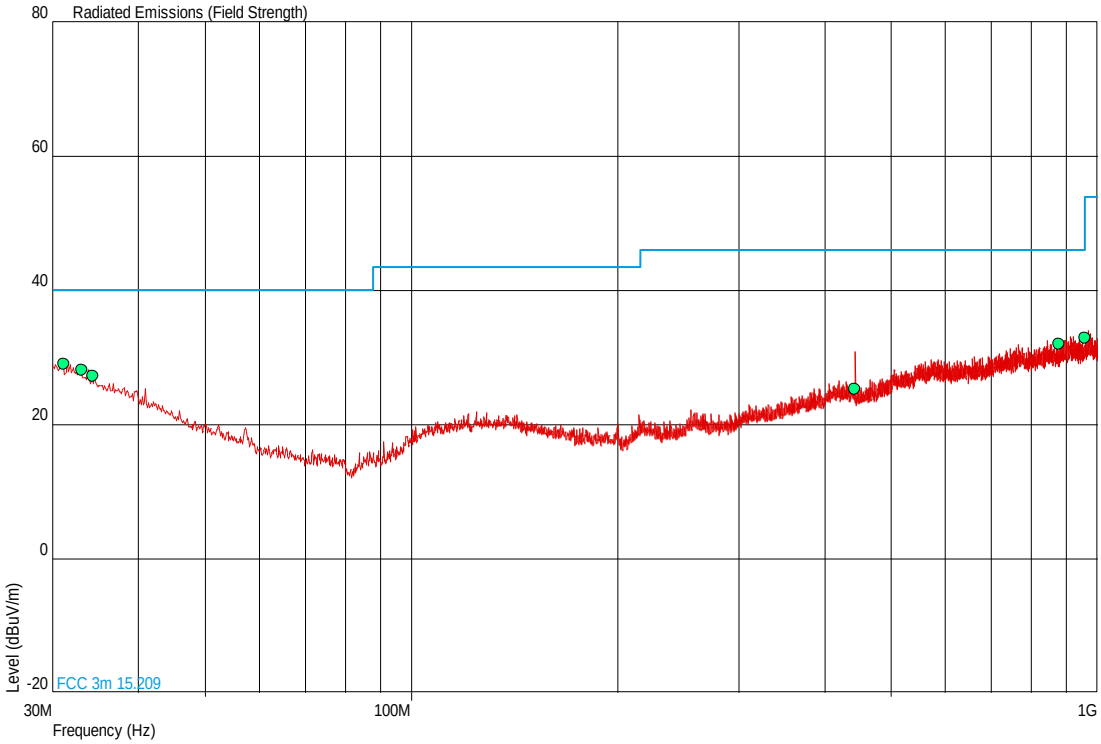
5.15 to 5.25 GHz	-27 dBm/MHz
5.25 to 5.35 GHz	
5.47 to 5.725 GHz	

Spurious Radiated Emissions

Frequency Band 1

5180 MHz

30 MHz to 1 GHz

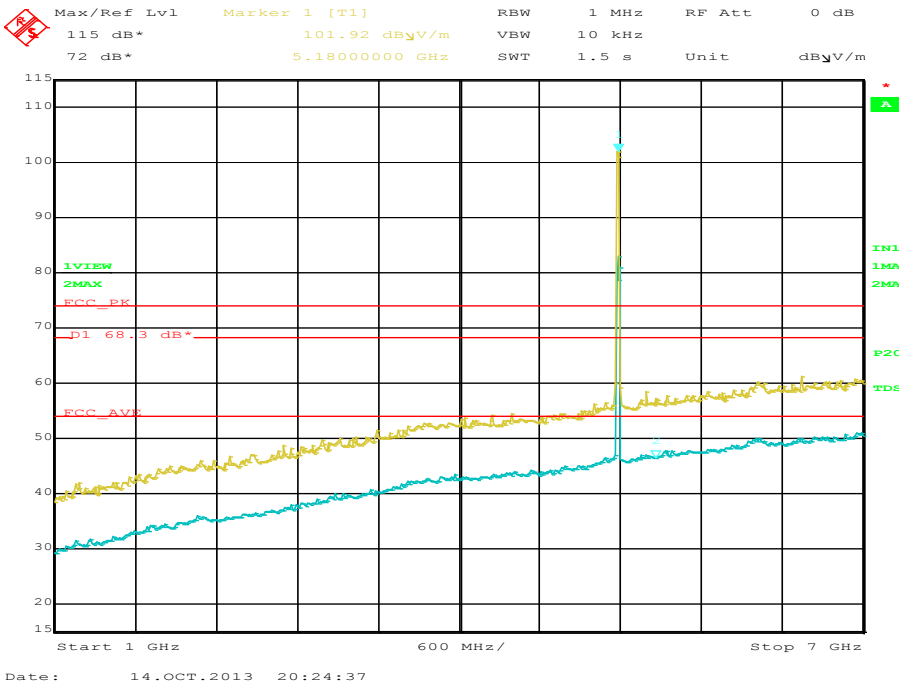


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.200	29.0	28.2	40.0	100	-11.0	71.8	0	1.00	Horizontal
33.150	28.1	25.4	40.0	100	-11.9	74.6	0	1.00	Vertical
34.350	27.3	23.2	40.0	100	-12.7	76.8	0	1.00	Horizontal
442.800	25.3	18.4	46.0	200	-20.7	181.6	0	1.00	Vertical
880.050	32.0	39.8	46.0	200	-14.0	160.2	0	1.00	Horizontal
957.900	32.9	44.2	46.0	200	-13.1	155.8	0	1.00	Vertical

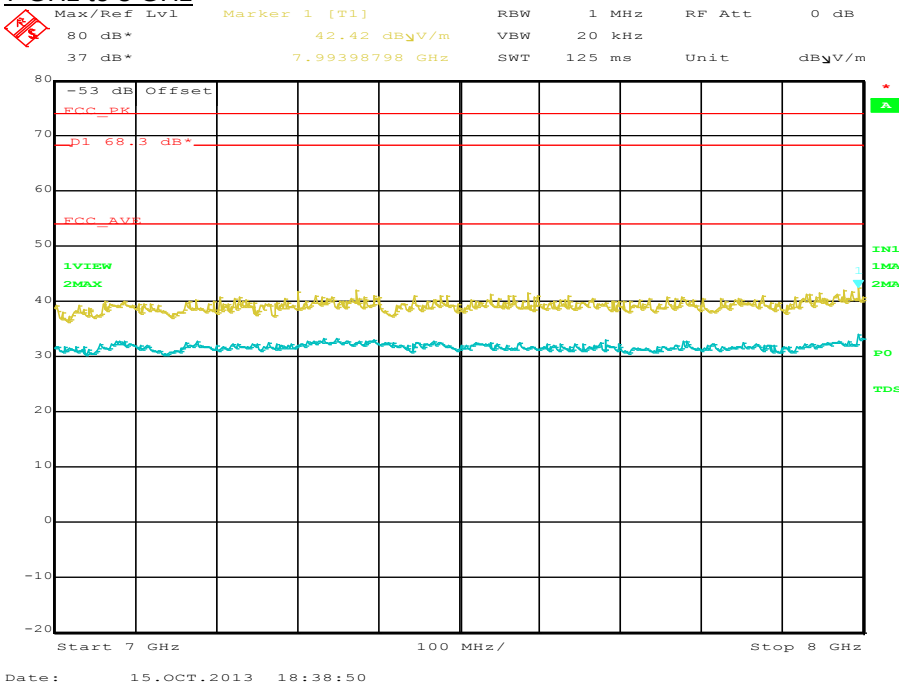
1GHz to 40GHz

Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
5.127	Vertical	100	224	57.5	44.7

1 GHz to 7 GHz

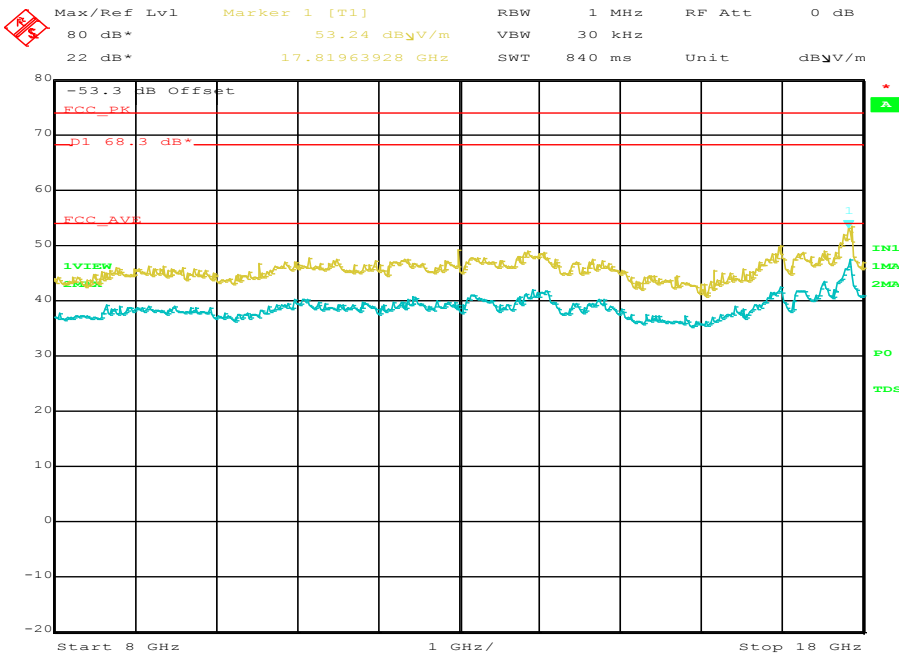


7 GHz to 8 GHz

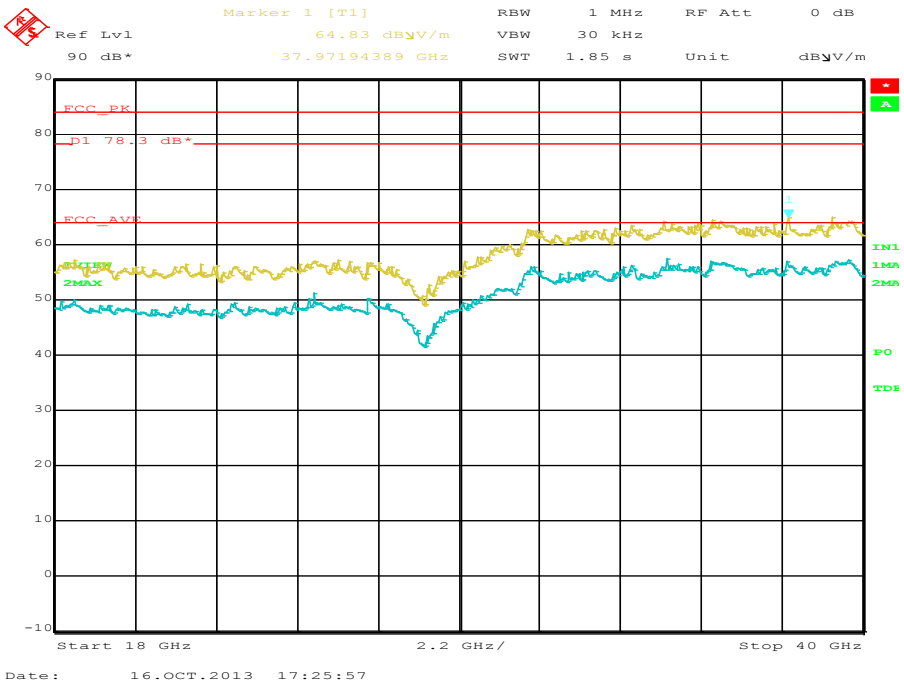


Product Service

8 GHz to 18 GHz

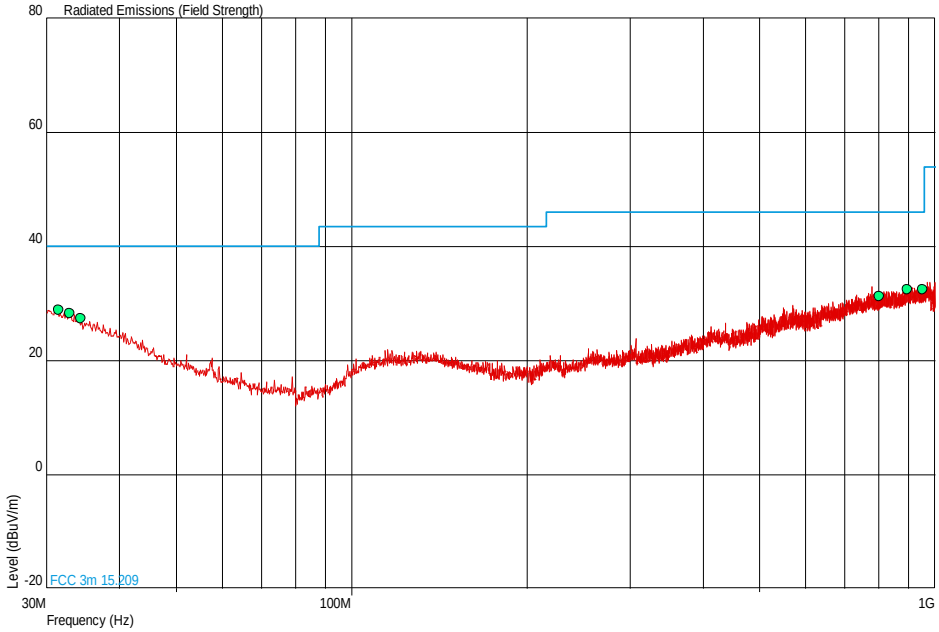


18 GHz to 40 GHz



5200 MHz

30 MHz to 1 GHz

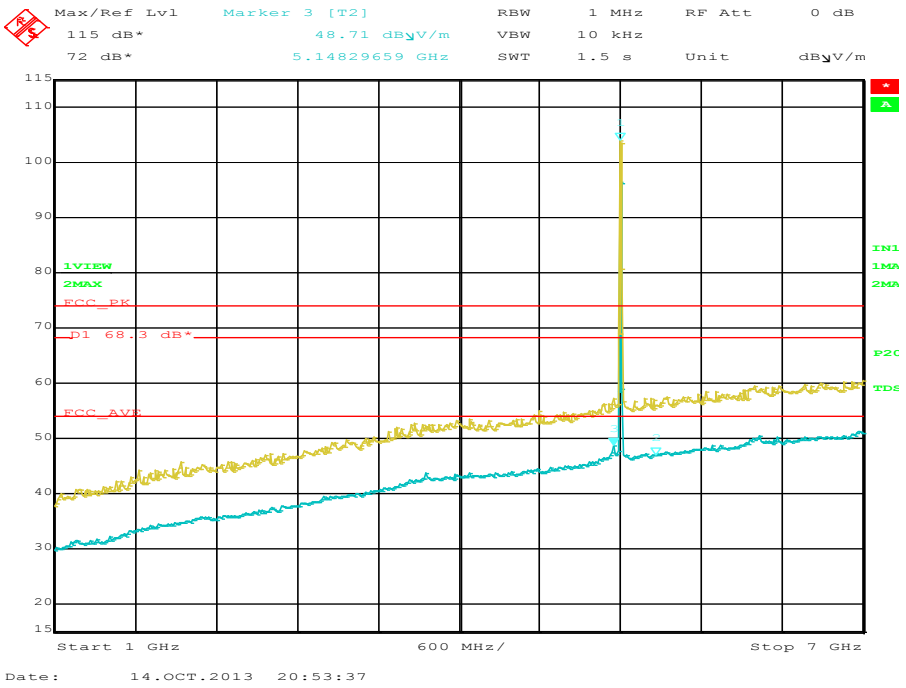


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.500	28.9	27.9	40.0	100	-11.1	72.1	0	1.00	Vertical
32.850	28.2	25.7	40.0	100	-11.8	74.3	0	1.00	Vertical
34.350	27.3	23.2	40.0	100	-12.7	76.8	0	1.00	Vertical
803.400	31.3	36.7	46.0	200	-14.7	163.3	0	1.00	Vertical
898.050	32.4	41.7	46.0	200	-13.6	158.3	0	1.00	Vertical
952.650	32.5	42.2	46.0	200	-13.5	157.8	0	1.00	Vertical

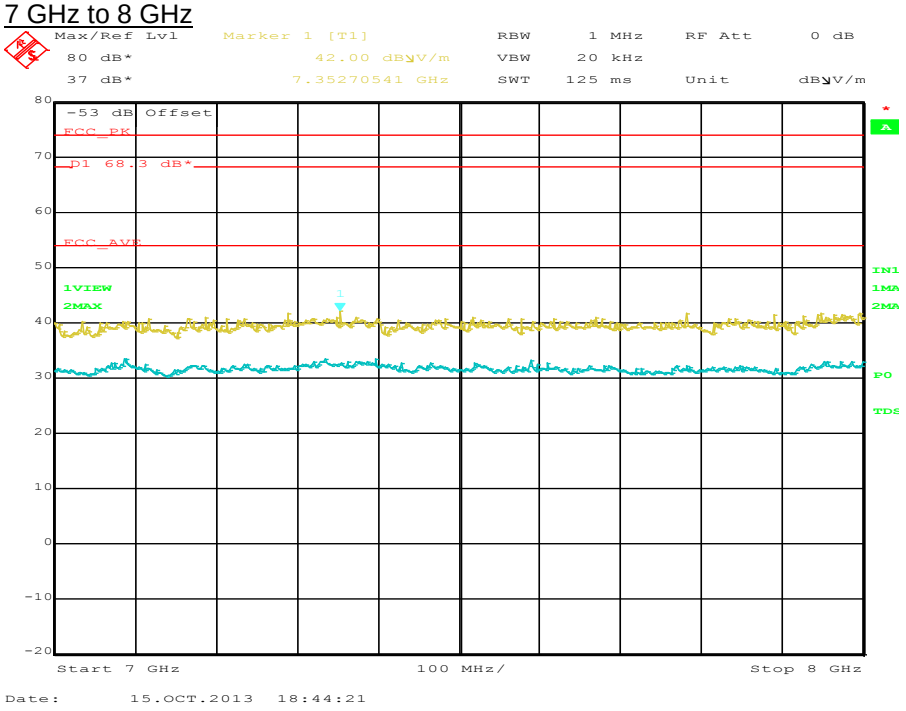
1 GHz to 40 GHz

Frequency (GHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBµV/m)	Final Average (dBµV/m)
5.147	Vertical	100	198	59.00	45.91

1 GHz to 7 GHz

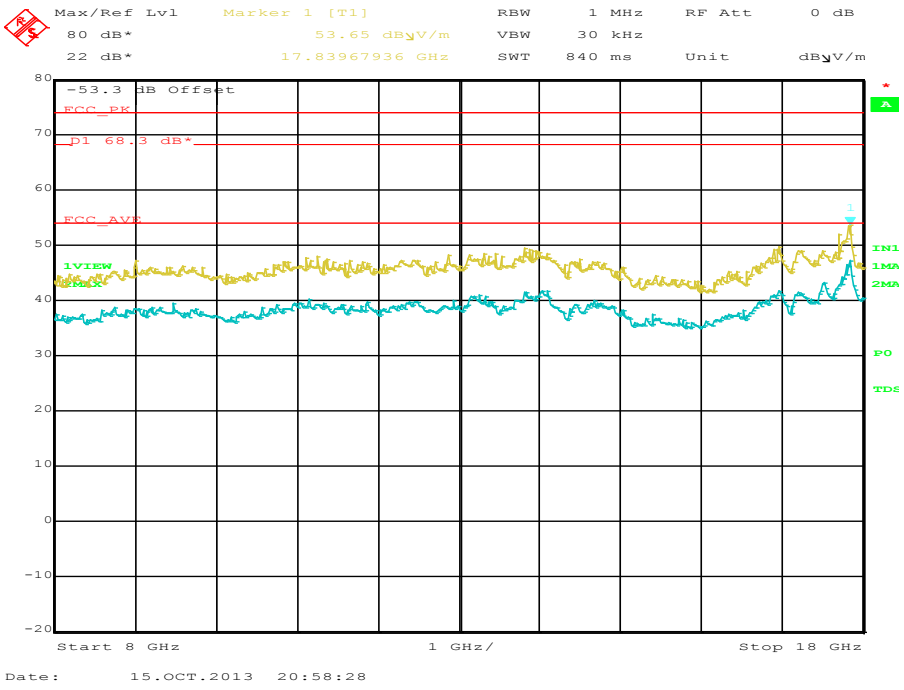


7 GHz to 8 GHz

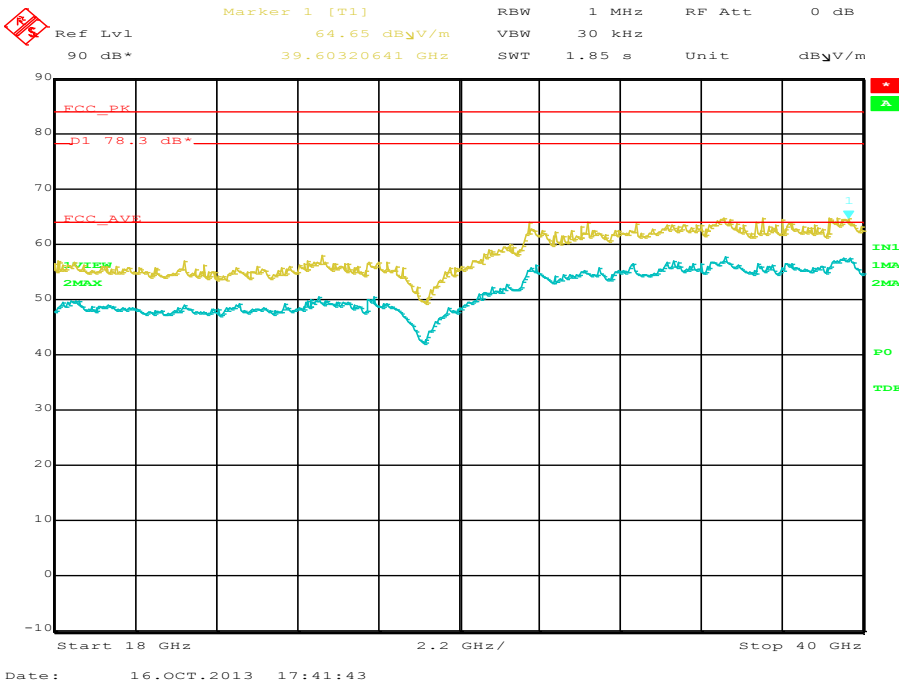


Product Service

8 GHz to 18 GHz

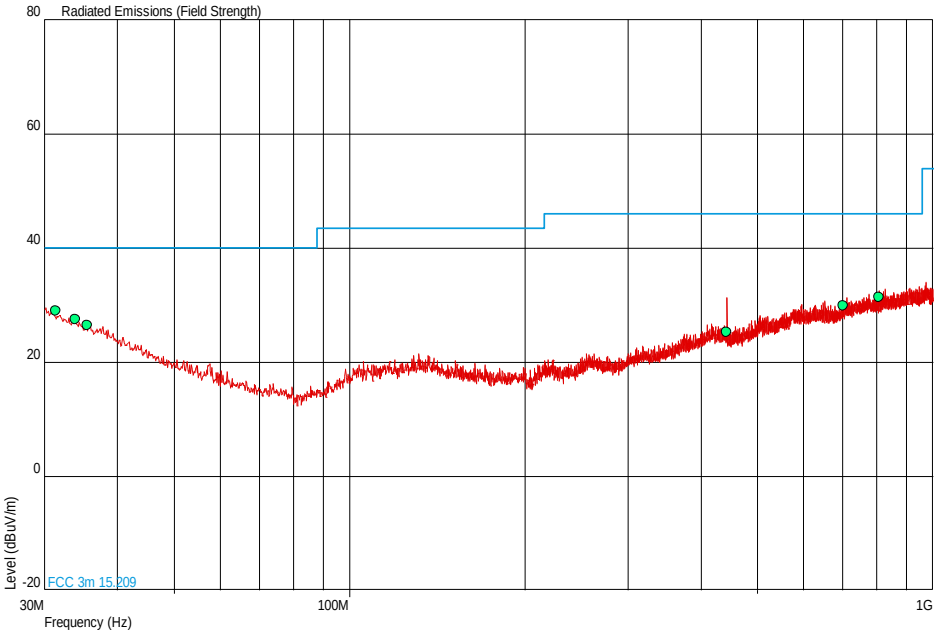


18 GHz to 40 GHz



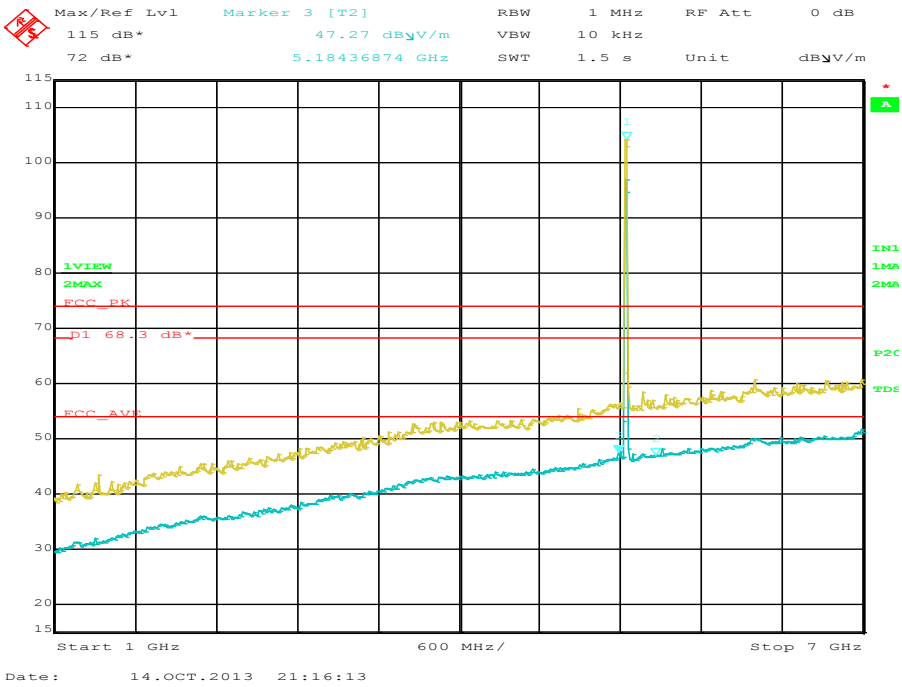
5240 MHz

30 MHz to 1 GHz

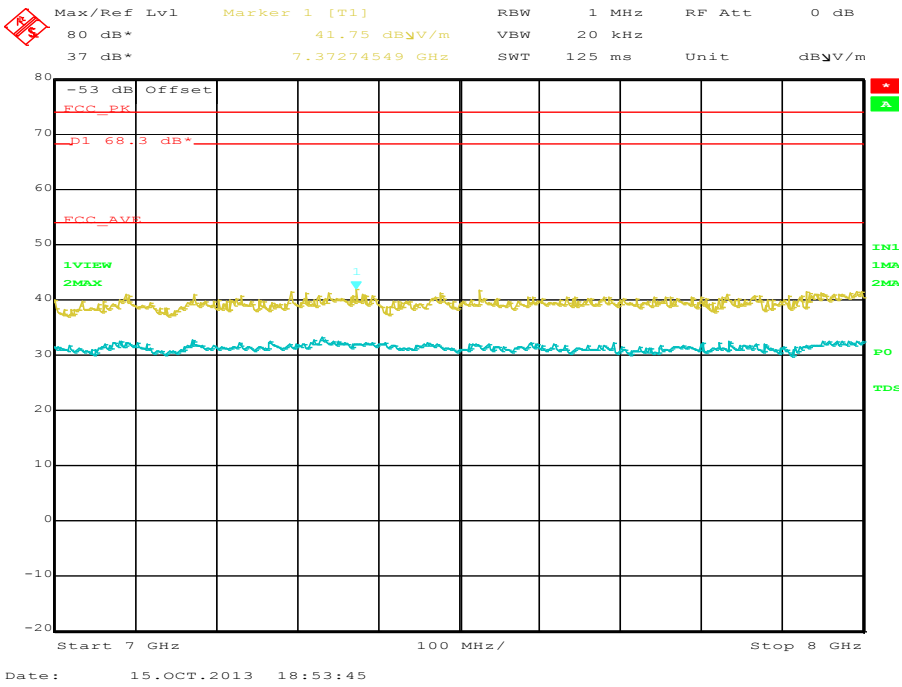


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.350	29.0	28.2	40.0	100	-11.0	71.8	0	1.00	Vertical
33.900	27.6	24.0	40.0	100	-12.4	76.0	0	1.00	Vertical
35.550	26.5	21.1	40.0	100	-13.5	78.9	0	1.00	Vertical
442.800	25.3	18.4	46.0	200	-20.7	181.6	0	1.00	Vertical
700.500	30.0	31.6	46.0	200	-16.0	168.4	0	1.00	Vertical
806.850	31.5	37.6	46.0	200	-14.5	162.4	0	1.00	Vertical

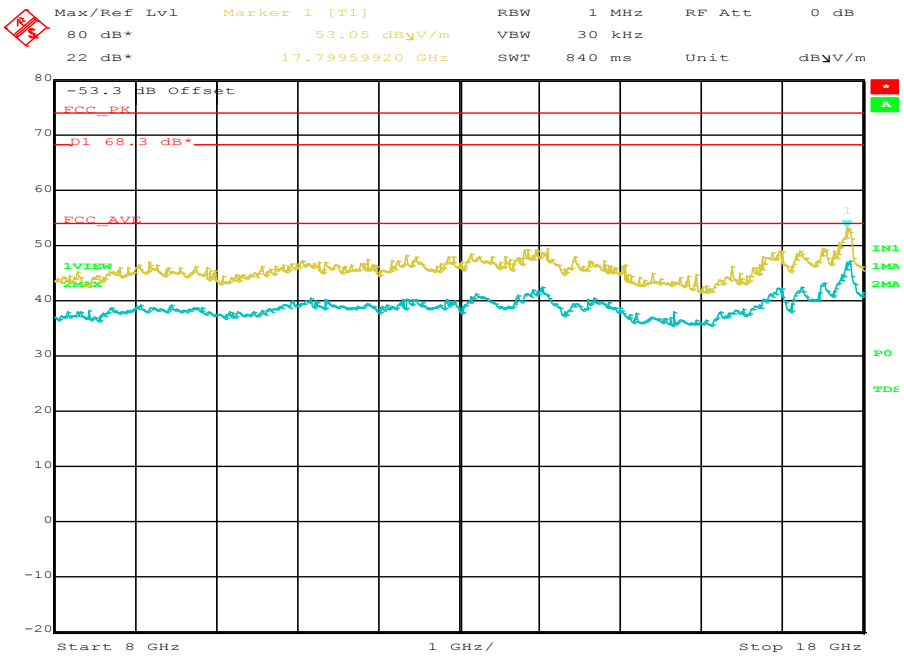
1 GHz to 7 GHz



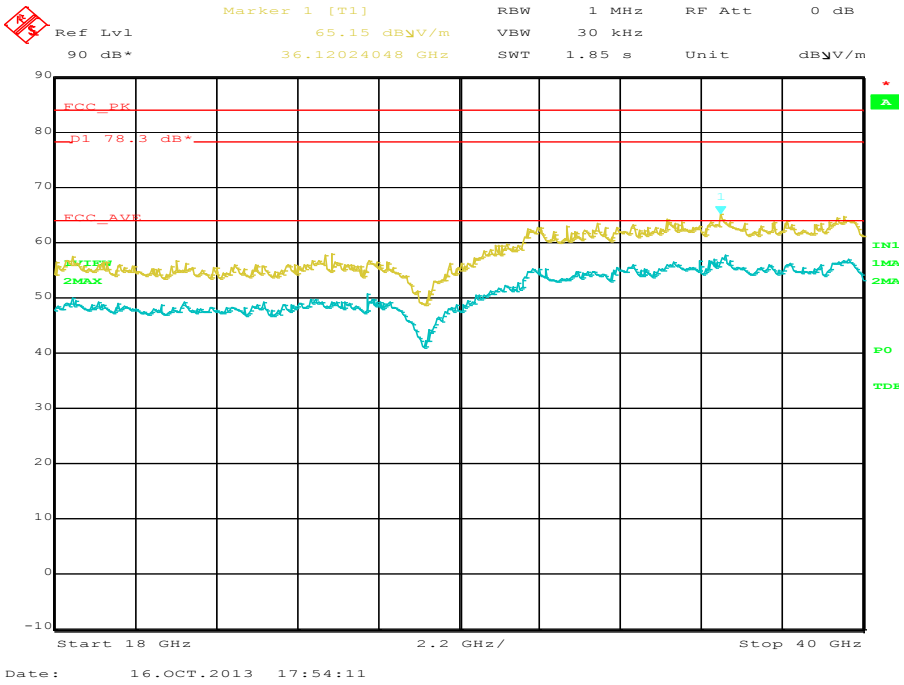
7 GHz to 8 GHz



8 GHz to 18 GHz



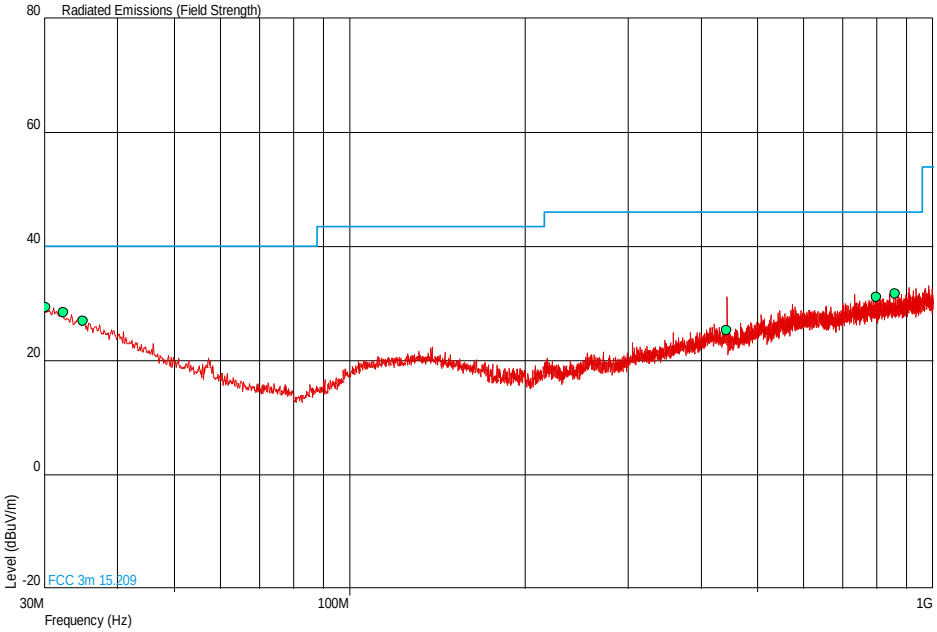
18 GHz to 40 GHz



Frequency Band 2

5260 MHz

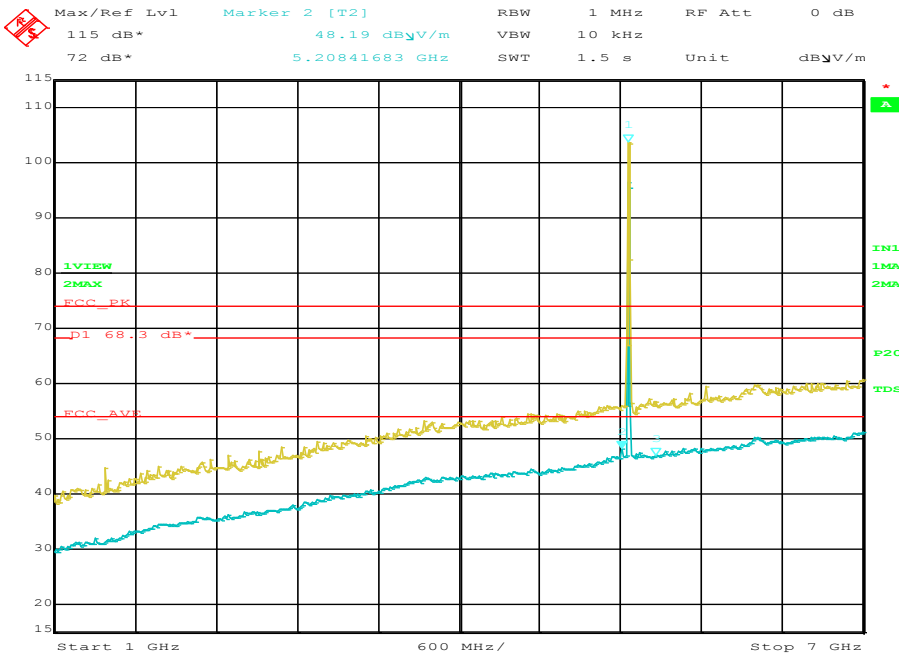
30 MHz to 1 GHz



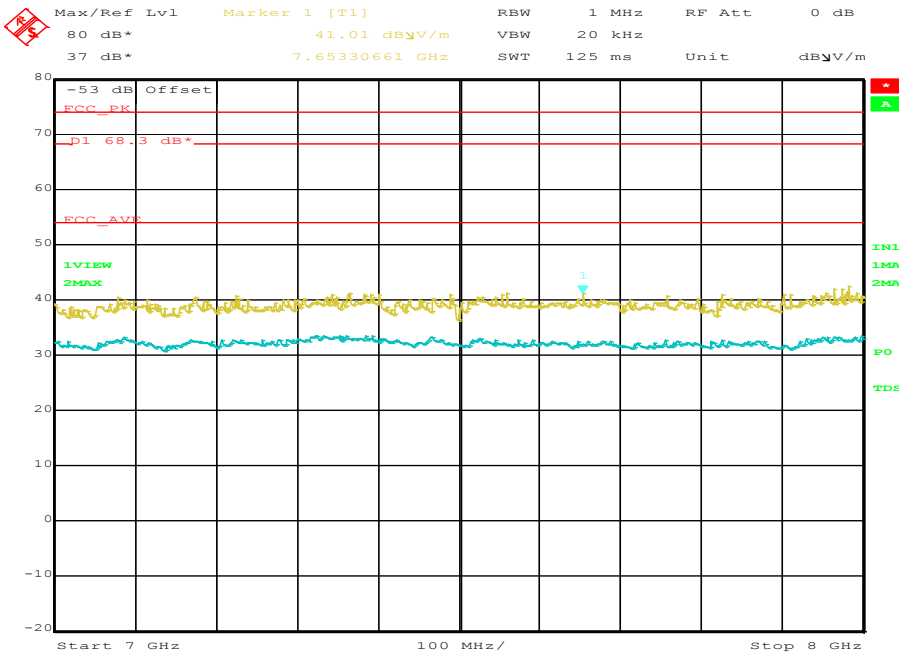
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.150	29.4	29.5	40.0	100	-10.6	70.5	0	1.00	Vertical
32.400	28.5	26.6	40.0	100	-11.5	73.4	0	1.00	Vertical
34.950	26.9	22.1	40.0	100	-13.1	77.9	0	1.00	Vertical
442.800	25.3	18.4	46.0	200	-20.7	181.6	0	1.00	Vertical
800.100	31.1	35.9	46.0	200	-14.9	164.1	0	1.00	Vertical
861.600	31.7	38.5	46.0	200	-14.3	161.5	0	1.00	Vertical

Product Service

1 GHz to 7 GHz

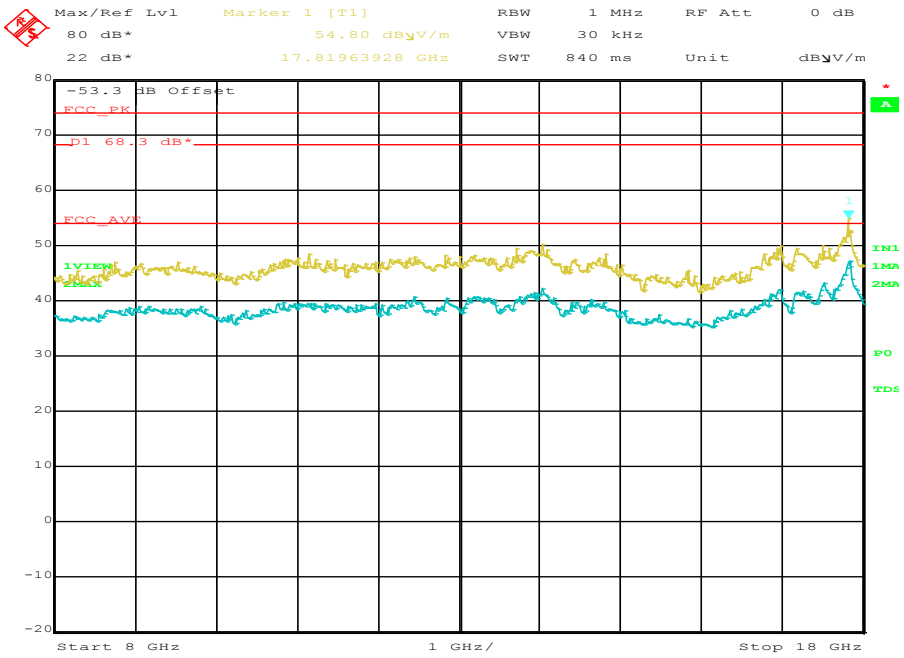


7 GHz to 8 GHz

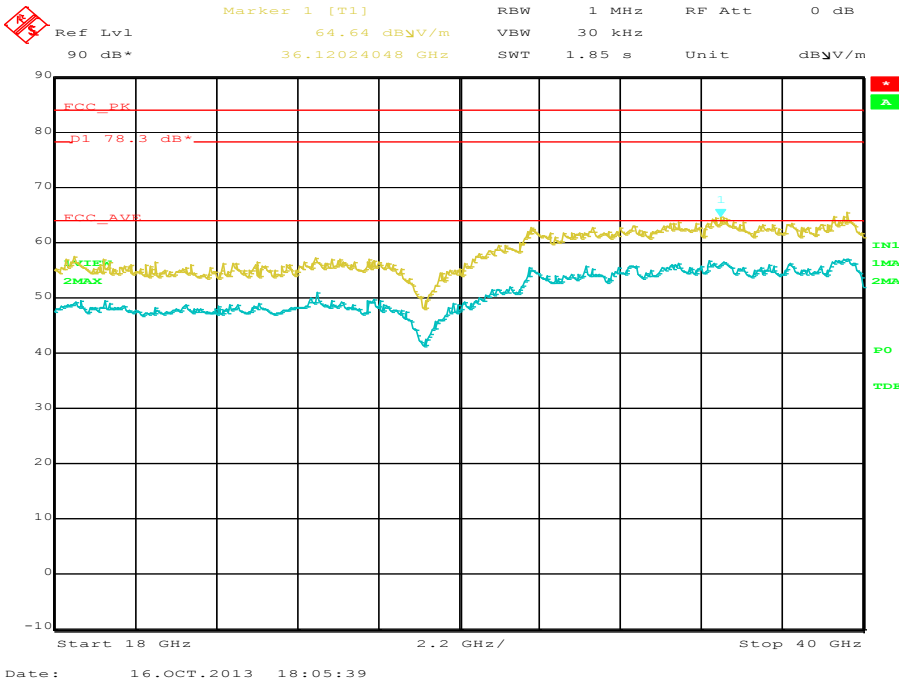


Product Service

8 GHz to 18 GHz

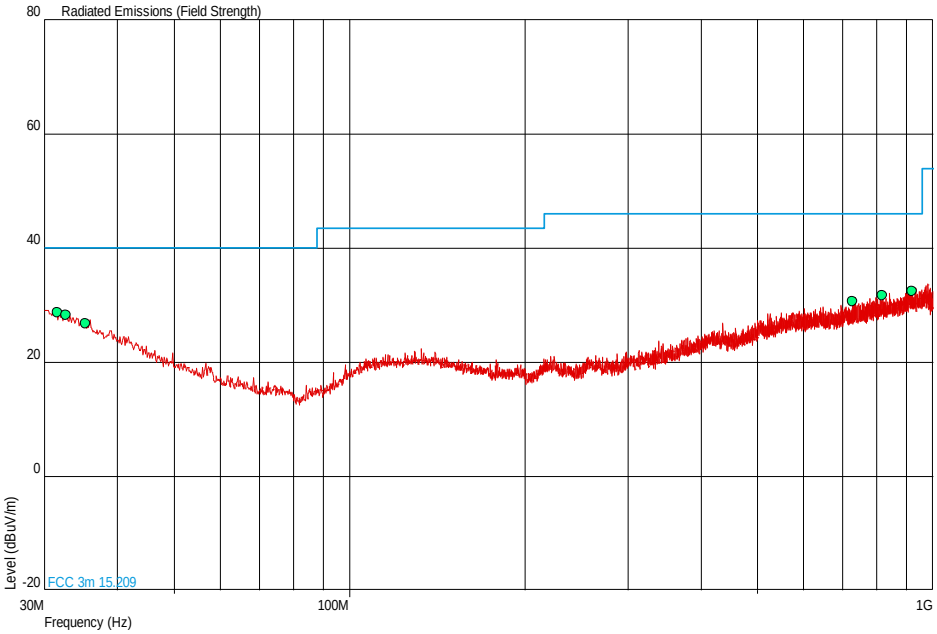


18 GHz to 40 GHz



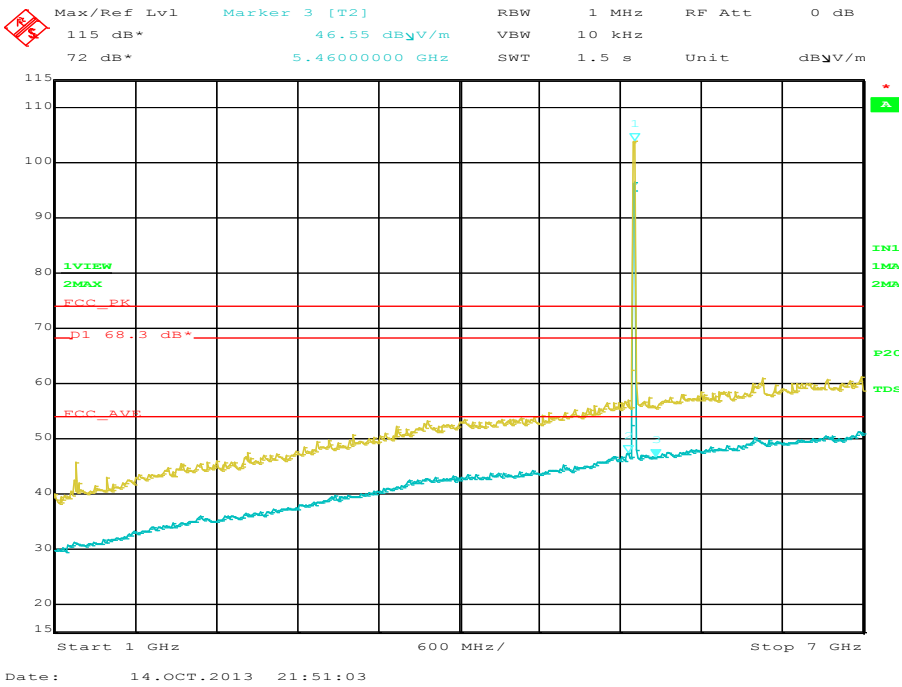
5300 MHz

30 MHz to 1 GHz

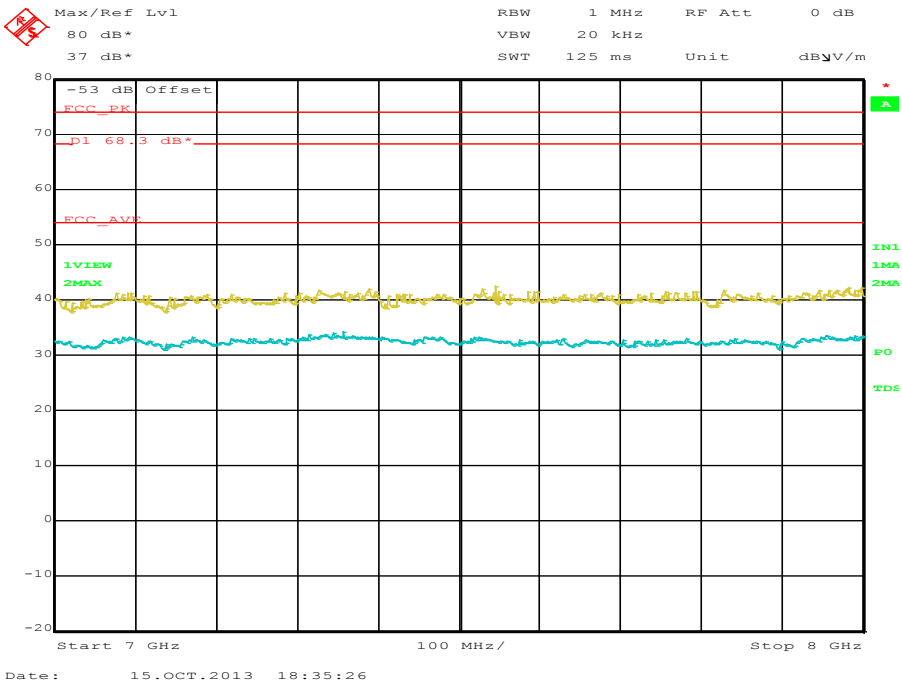


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.650	28.8	27.5	40.0	100	-11.2	72.5	0	1.00	Vertical
32.700	28.2	25.7	40.0	100	-11.8	74.3	0	1.00	Horizontal
35.250	26.7	21.6	40.0	100	-13.3	78.4	0	1.00	Horizontal
728.250	30.7	34.3	46.0	200	-15.3	165.7	0	1.00	Vertical
818.850	31.7	38.5	46.0	200	-14.3	161.5	0	1.00	Vertical
920.250	32.5	42.2	46.0	200	-13.5	157.8	0	1.00	Horizontal

1 GHz to 7 GHz

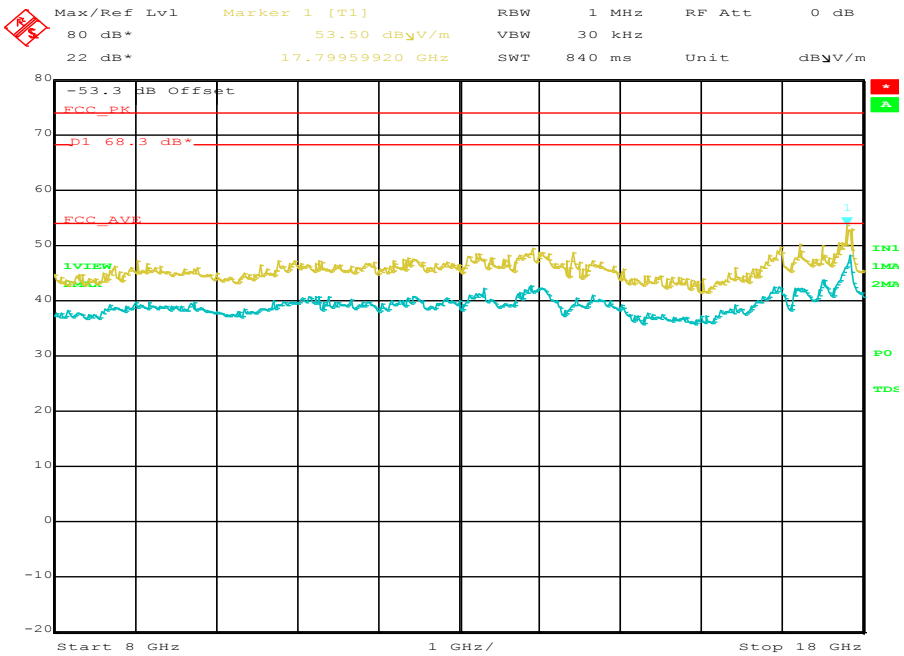


7 GHz to 8 GHz

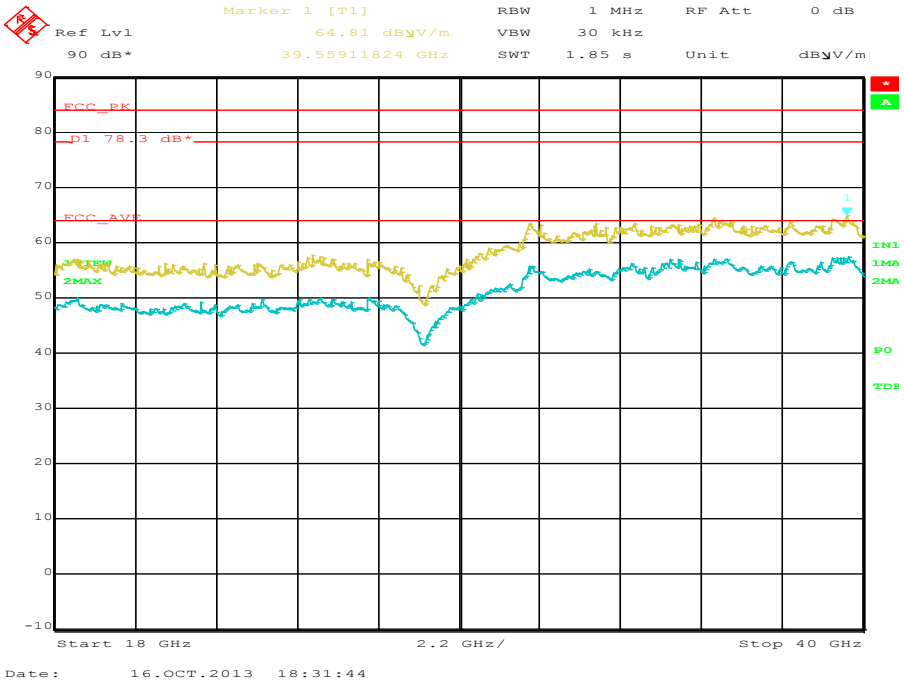


Product Service

8 GHz to 18 GHz

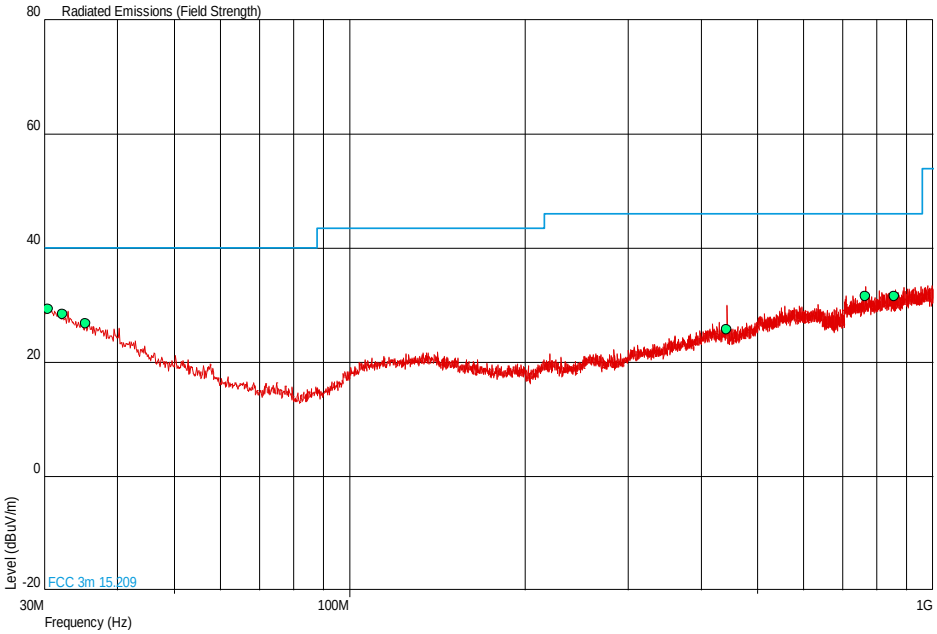


18 GHz to 40 GHz



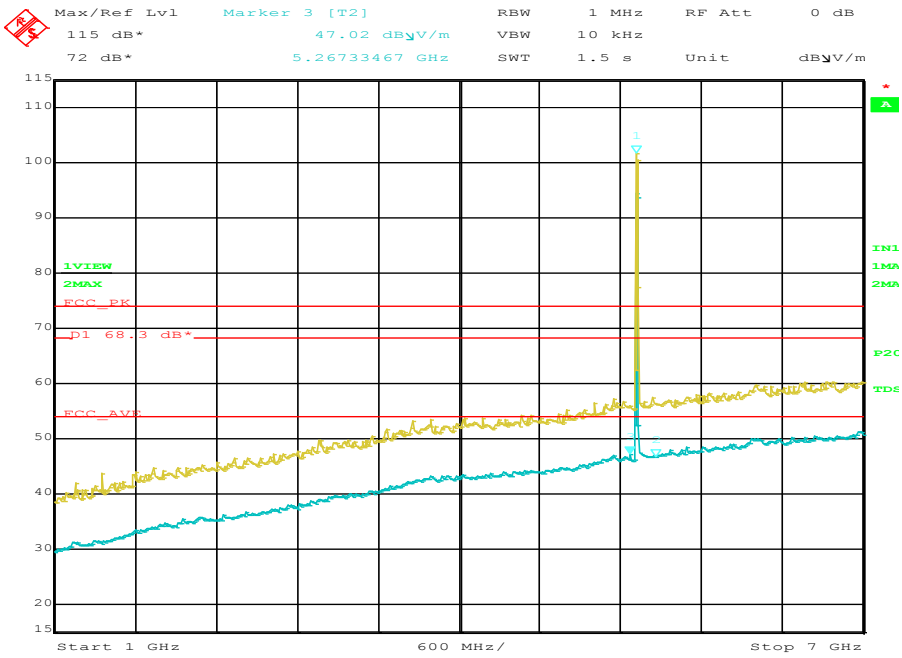
5320 MHz

30 MHz to 1 GHz

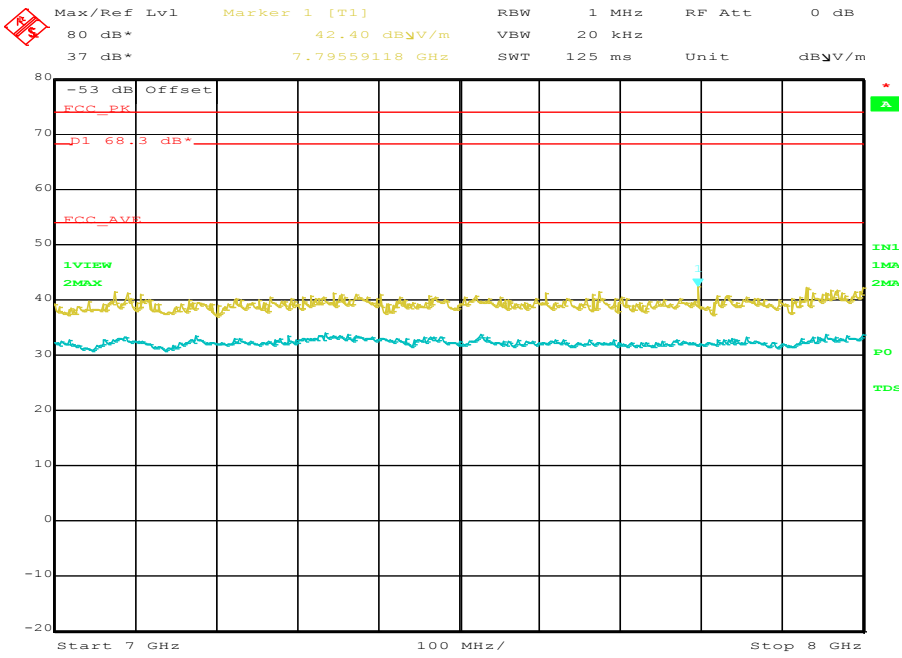


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.450	29.3	29.2	40.0	100	-10.7	70.8	0	1.00	Vertical
32.250	28.5	26.6	40.0	100	-11.5	73.4	0	1.00	Vertical
35.250	26.7	21.6	40.0	100	-13.3	78.4	0	1.00	Vertical
443.100	25.7	19.3	46.0	200	-20.3	180.7	0	1.00	Vertical
764.700	31.5	37.6	46.0	200	-14.5	162.4	0	1.00	Vertical
859.350	31.6	38.0	46.0	200	-14.4	162.0	0	1.00	Vertical

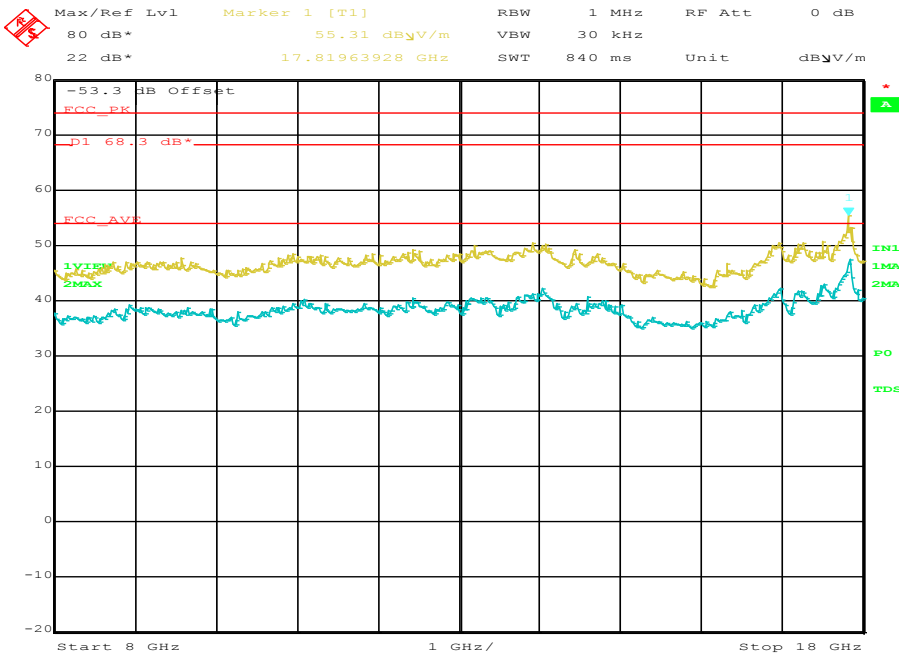
1 GHz to 7 GHz



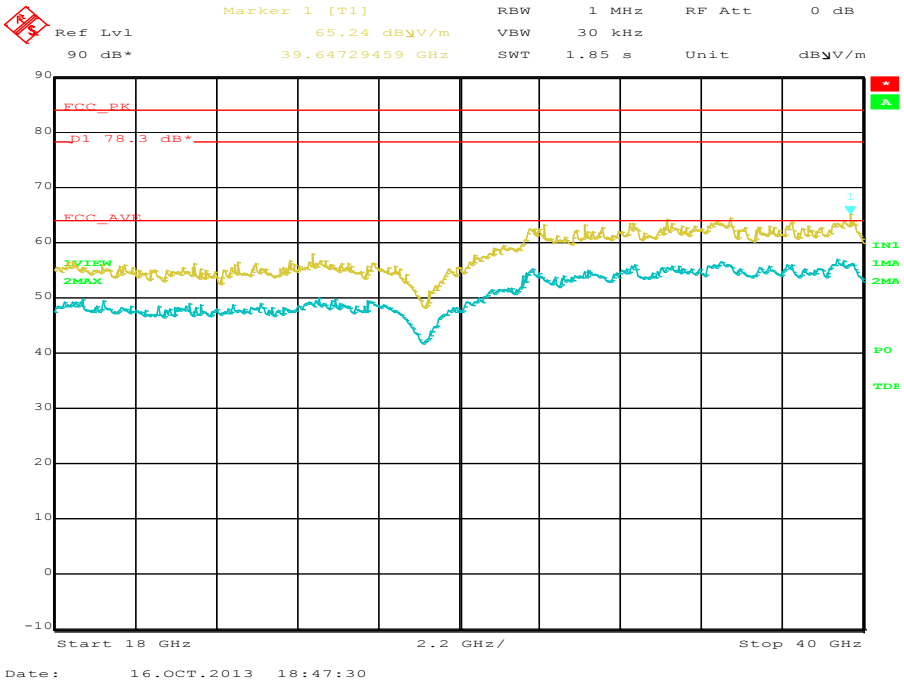
7 GHz to 8 GHz



8 GHz to 18 GHz



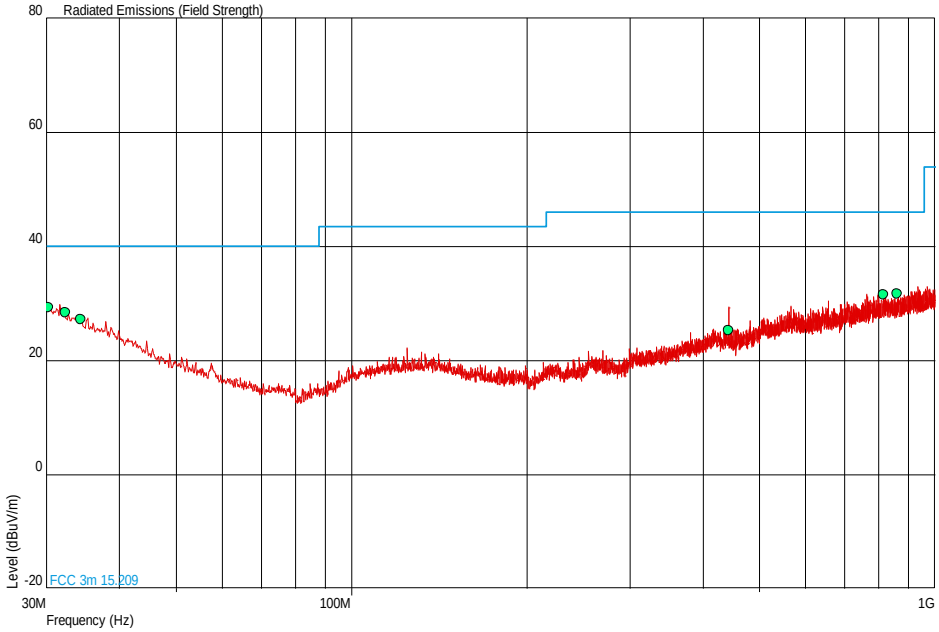
18 GHz to 40 GHz



Frequency Band 3

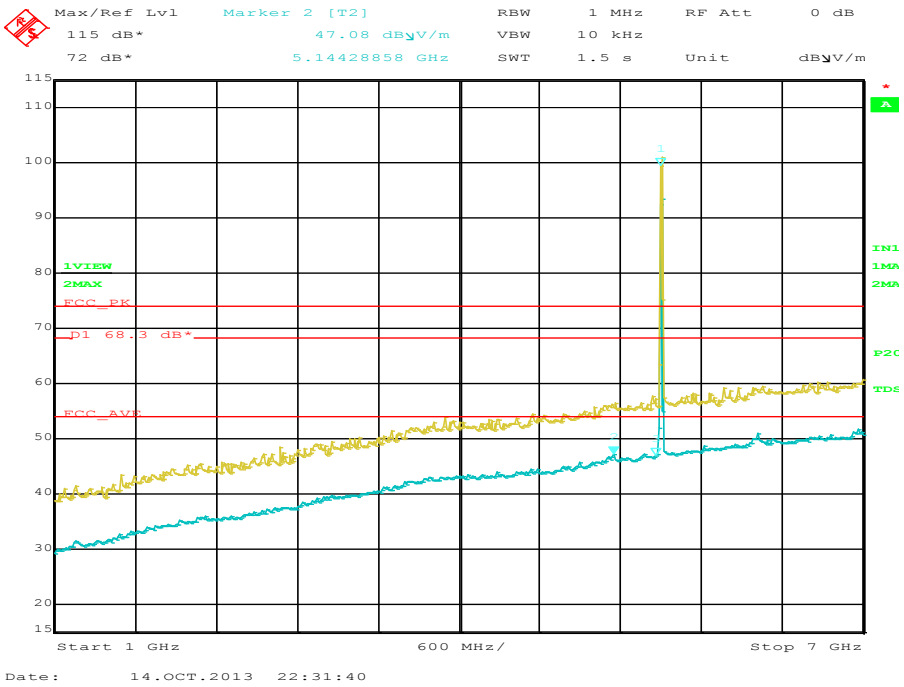
5500 MHz

30 MHz to 1 GHz

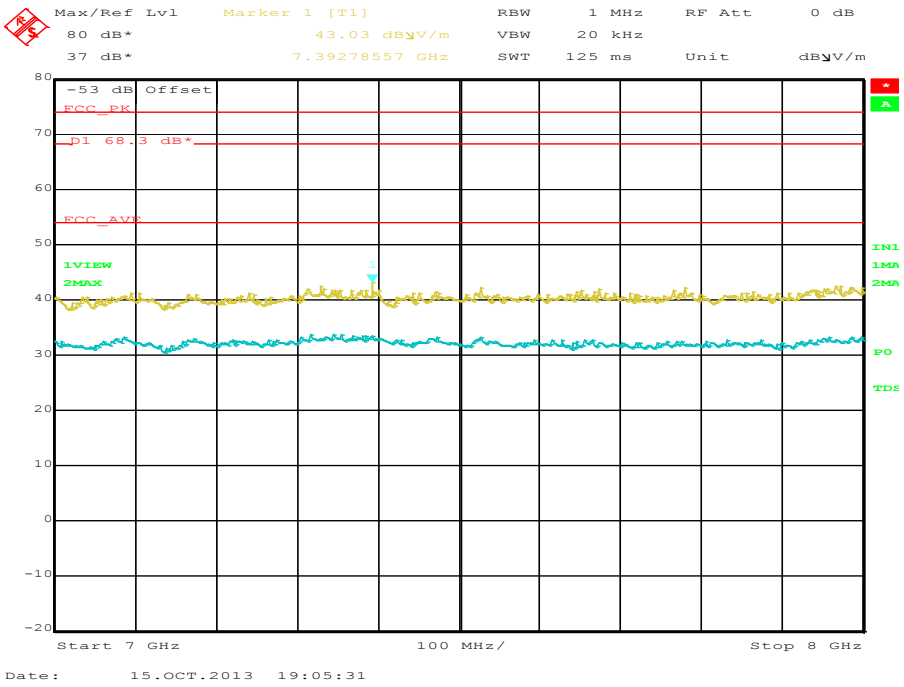


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.300	29.3	29.2	40.0	100	-10.7	70.8	0	1.00	Vertical
32.400	28.5	26.6	40.0	100	-11.5	73.4	0	1.00	Vertical
34.350	27.3	23.2	40.0	100	-12.7	76.8	0	1.00	Vertical
442.650	25.3	18.4	46.0	200	-20.7	181.6	0	1.00	Vertical
814.800	31.6	38.0	46.0	200	-14.4	162.0	0	1.00	Vertical
861.150	31.7	38.5	46.0	200	-14.3	161.5	0	1.00	Vertical

1 GHz to 7 GHz

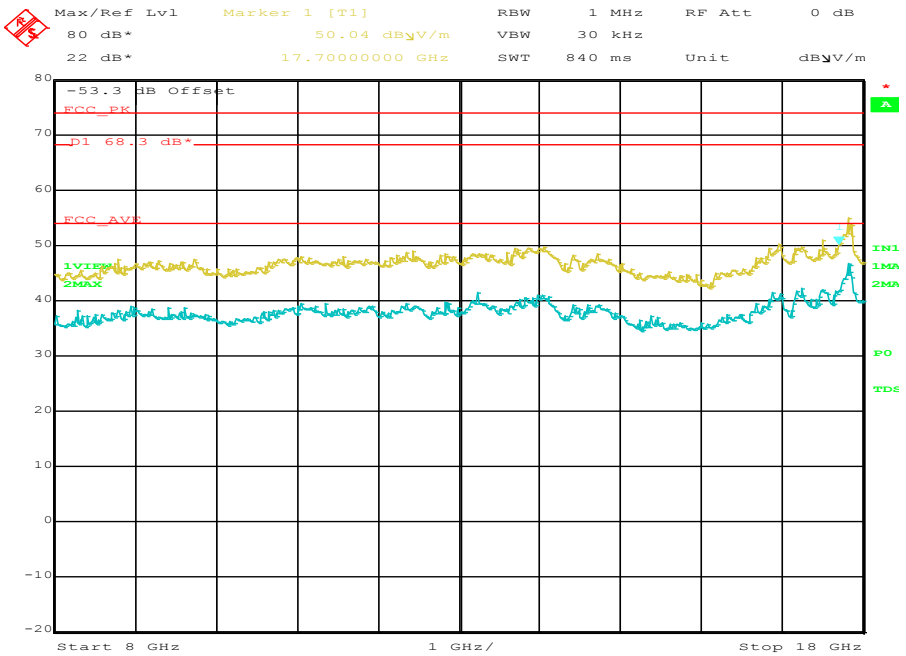


7 GHz to 8 GHz



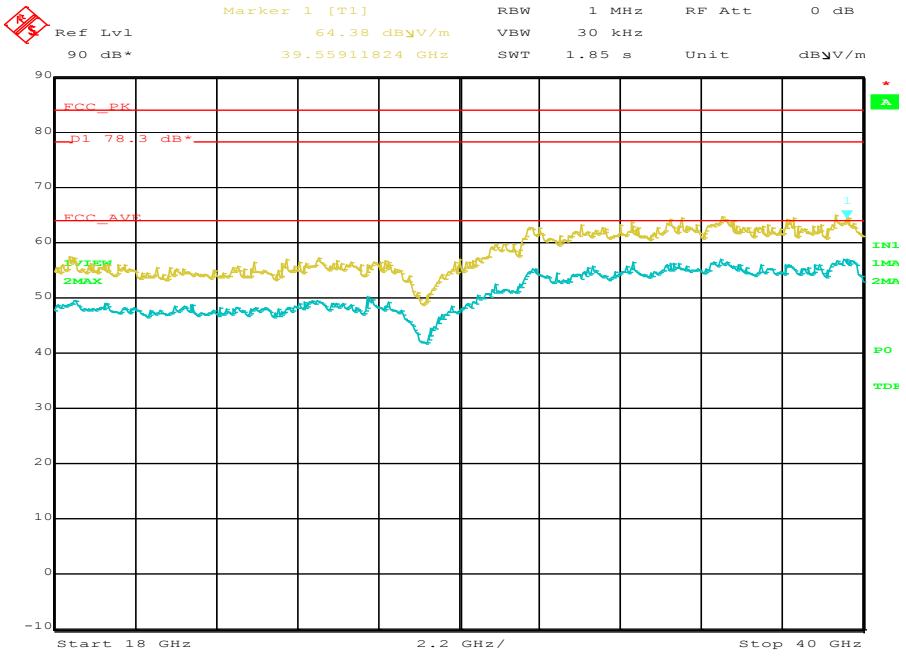
Product Service

8 GHz to 18 GHz



Date: 15.OCT.2013 21:28:06

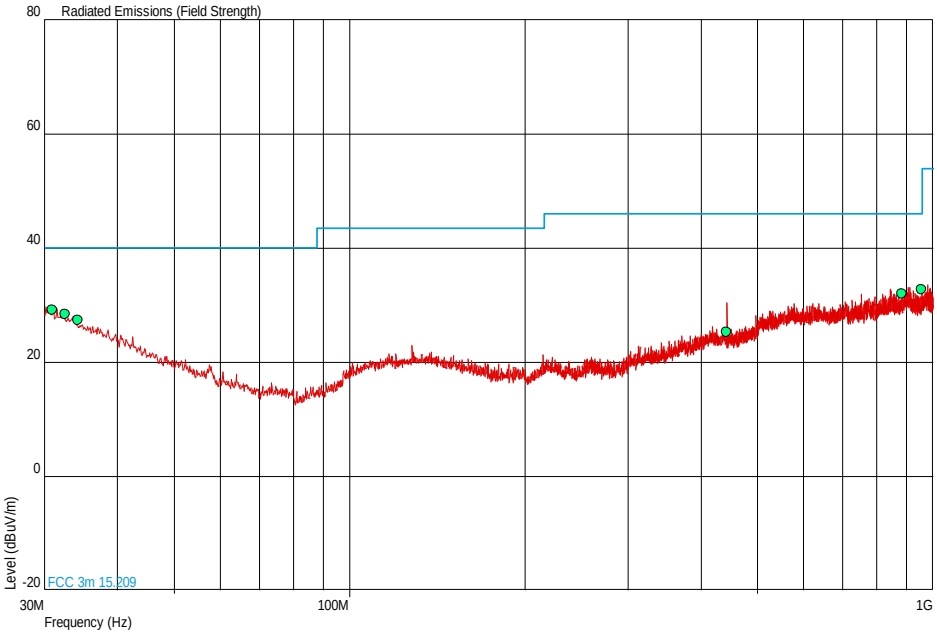
18 GHz to 40 GHz



Date: 16.OCT.2013 19:02:57

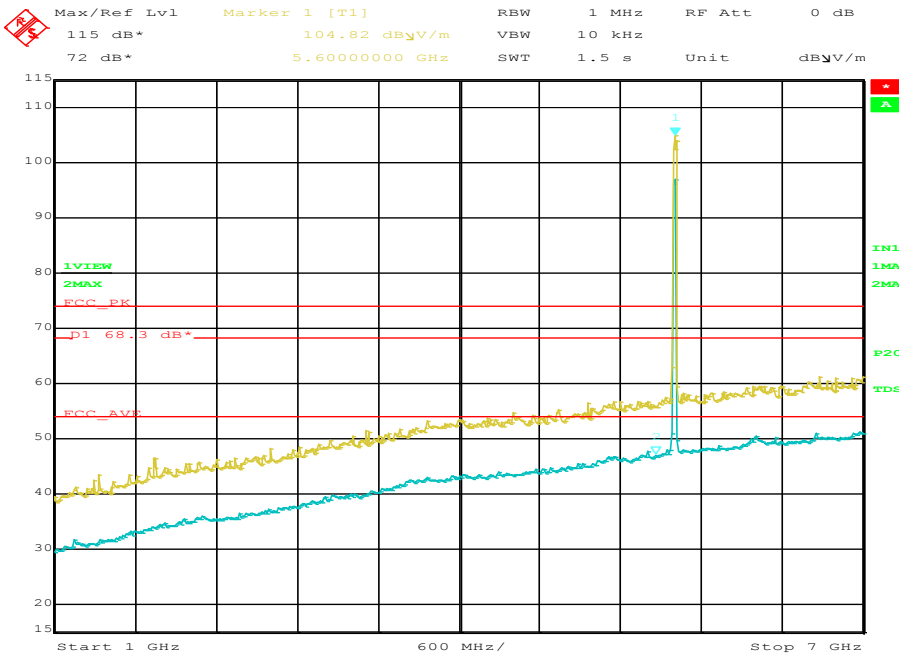
5600 MHz

30 MHz to 1 GHz

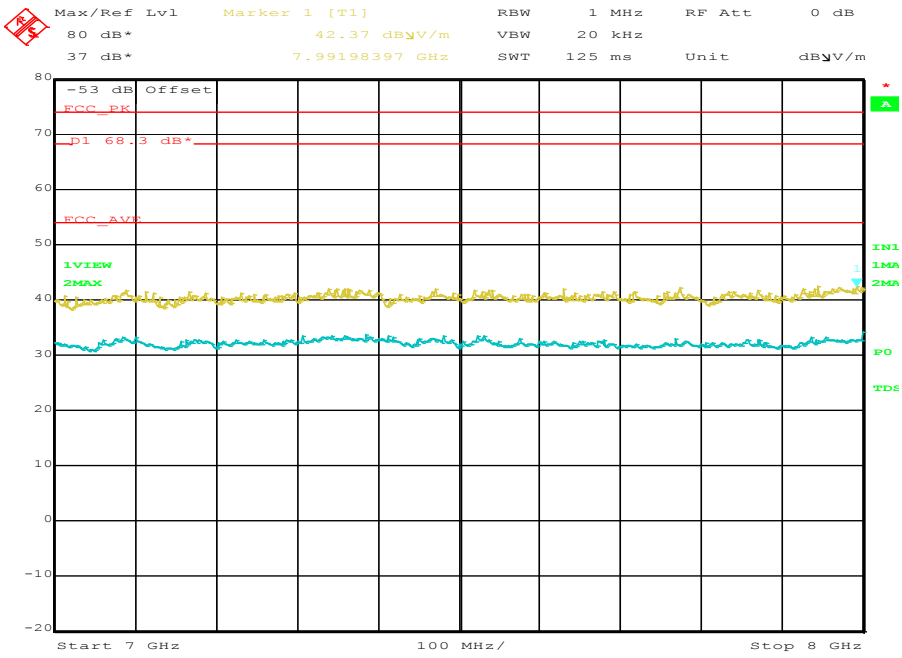


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.972	29.2	28.8	40.0	100	-10.8	71.2	0	0.00	Horizontal
32.592	28.4	26.3	40.0	100	-11.6	73.7	0	0.00	Horizontal
34.200	27.4	23.4	40.0	100	-12.6	76.6	0	1.00	Vertical
442.650	25.3	18.4	46.0	200	-20.7	181.6	0	1.00	Vertical
883.200	32.1	40.3	46.0	200	-13.9	159.7	0	1.00	Vertical
956.550	32.8	43.7	46.0	200	-13.2	156.3	0	1.00	Vertical

1 GHz to 7 GHz

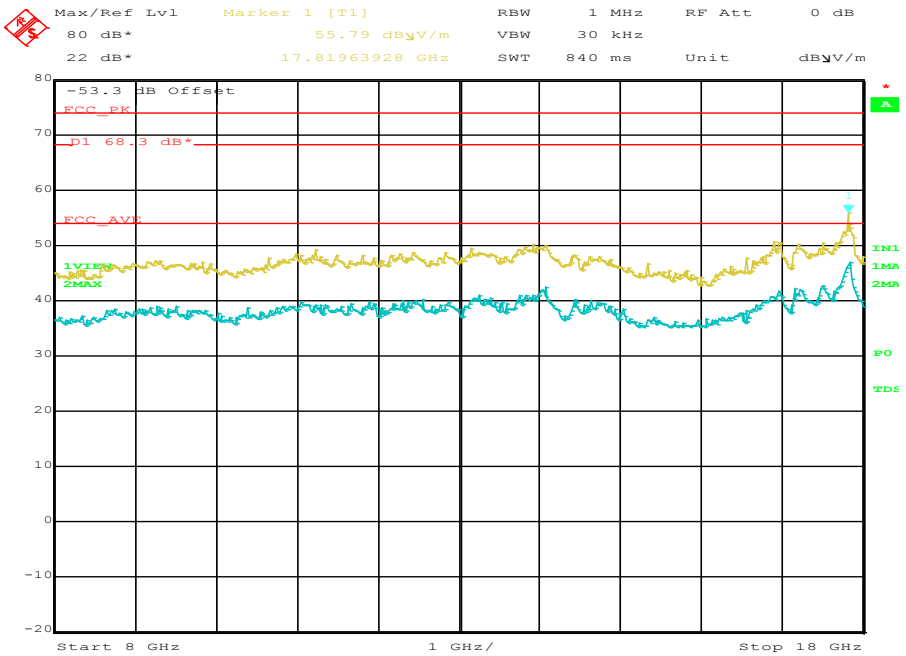


7 GHz to 8 GHz

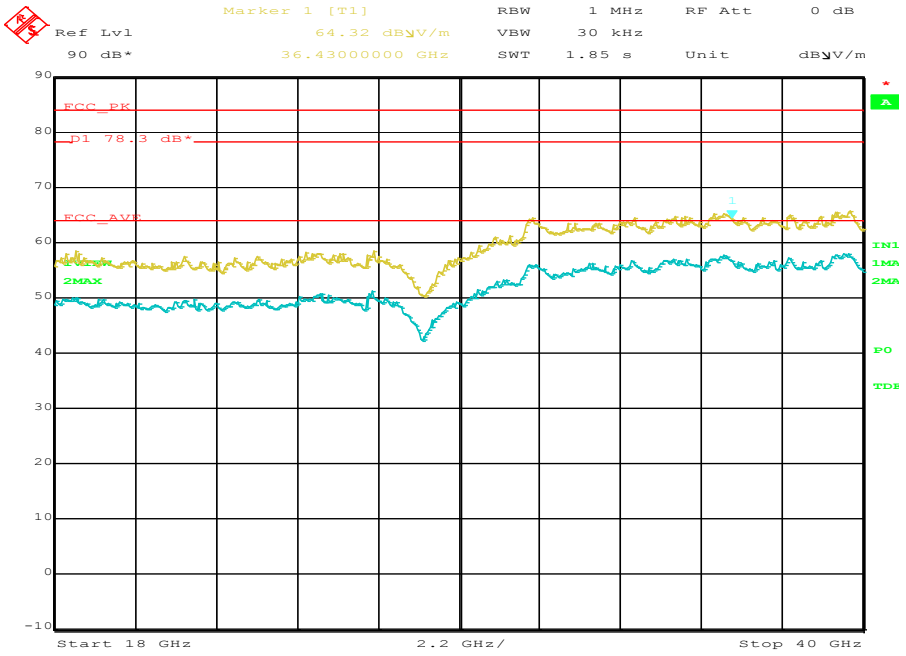


Product Service

8 GHz to 18 GHz

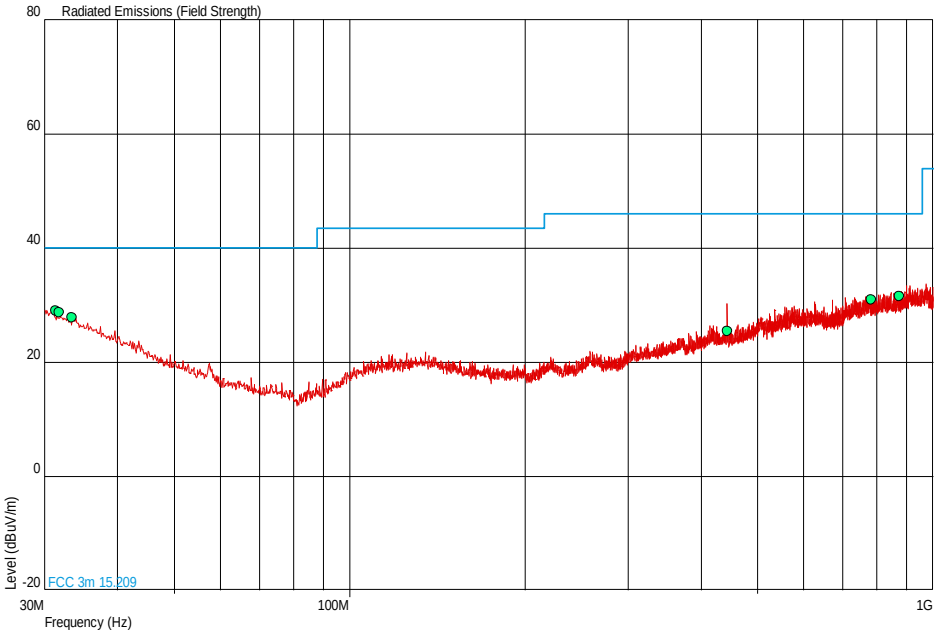


18 GHz to 40 GHz



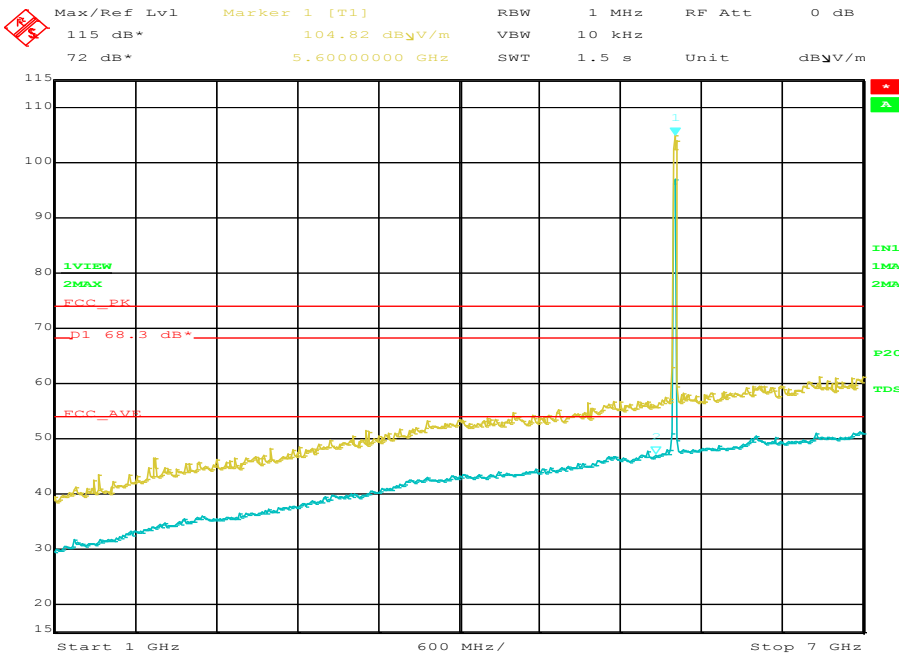
5700 MHz

30 MHz to 1 GHz

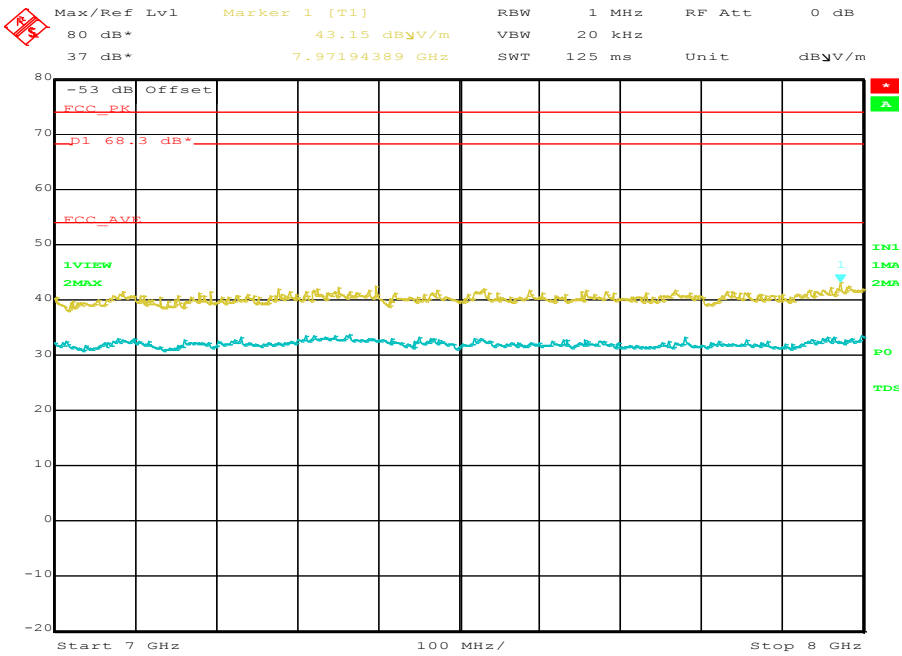


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.350	29.0	28.2	40.0	100	-11.0	71.8	0	1.00	Vertical
31.800	28.7	27.2	40.0	100	-11.3	72.8	0	1.00	Vertical
33.450	27.9	24.8	40.0	100	-12.1	75.2	0	1.00	Vertical
444.993	25.5	18.8	46.0	200	-20.5	181.2	0	1.00	Vertical
783.150	31.0	35.5	46.0	200	-15.0	164.5	0	1.00	Vertical
876.600	31.6	38.0	46.0	200	-14.4	162.0	0	1.00	Vertical

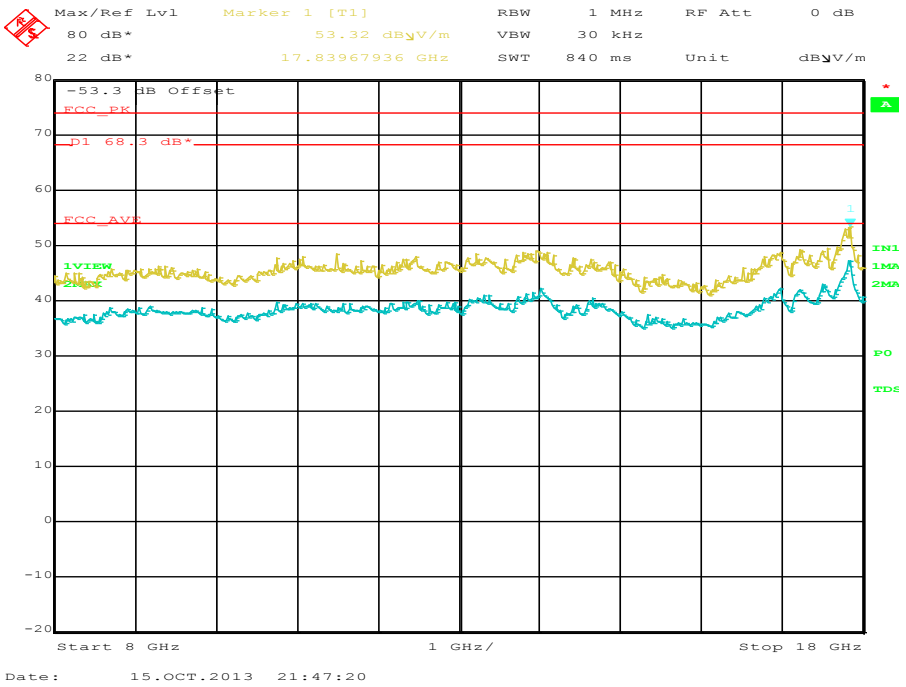
1 GHz to 7 GHz



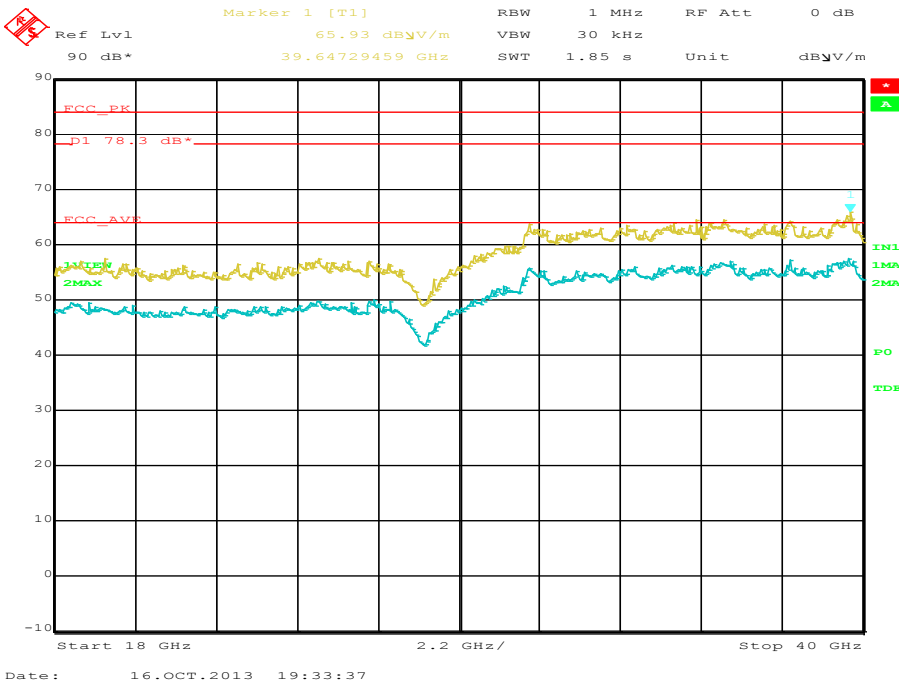
7 GHz to 8 GHz



8 GHz to 18 GHz



18 GHz to 40 GHz



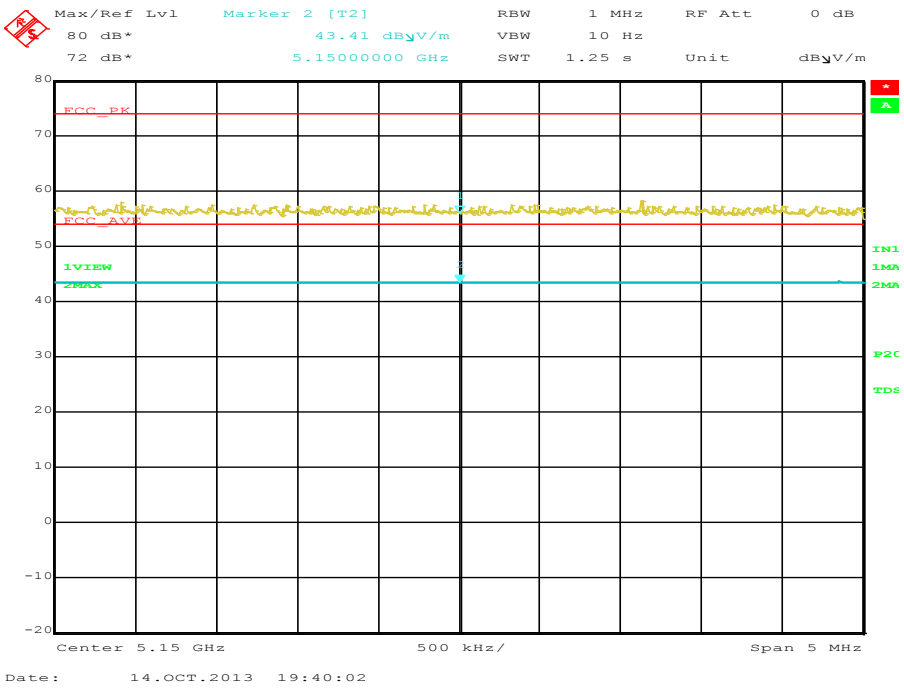
Limit

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

Band Edge Emissions

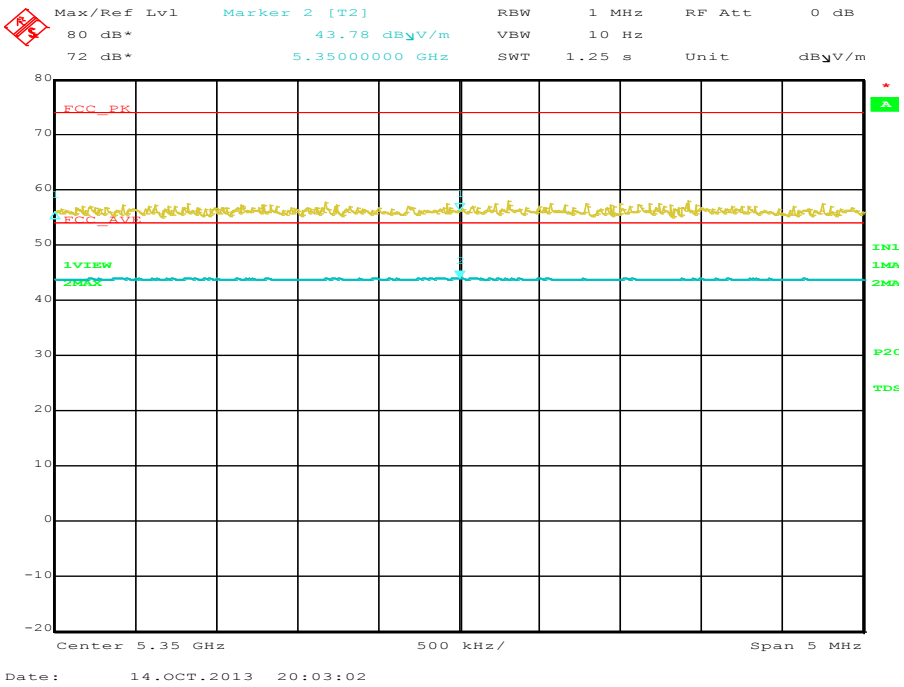
5180 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	55.96	43.41



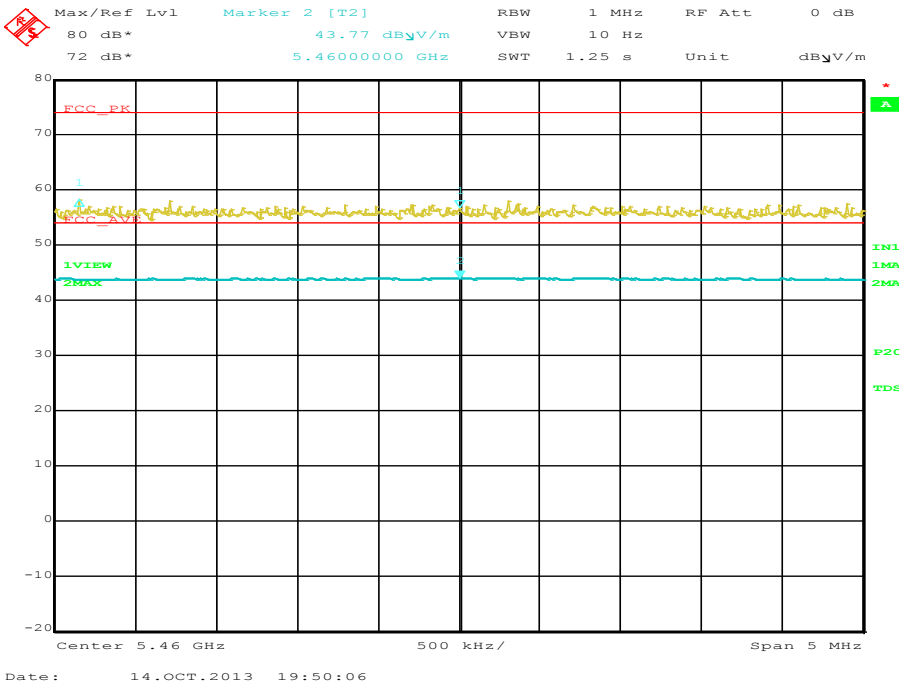
5320 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	56.24	43.78



5500 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	56.70	43.70



Limit

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

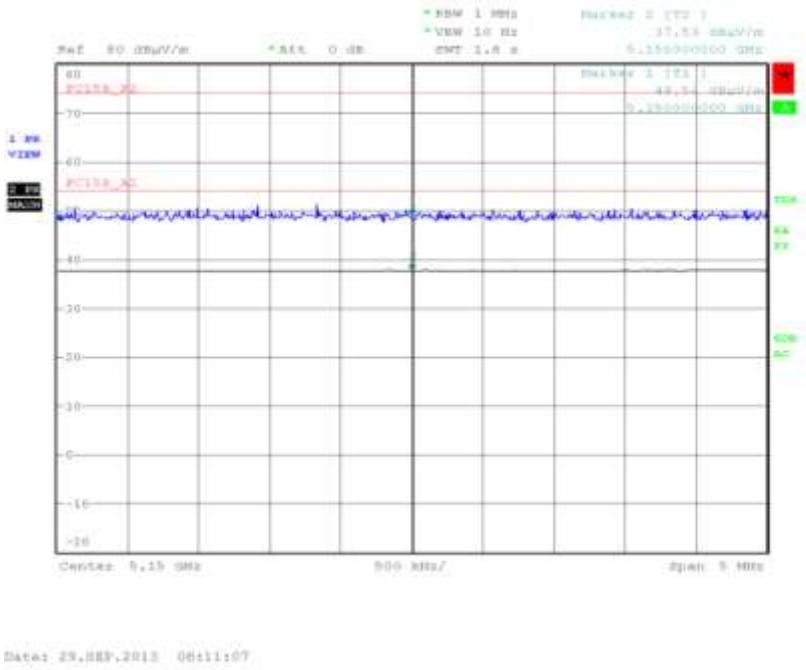
802.11(ac) - 5 GHz 20 MHz BW FCC

4.0 V DC Supply

Band Edge Emissions

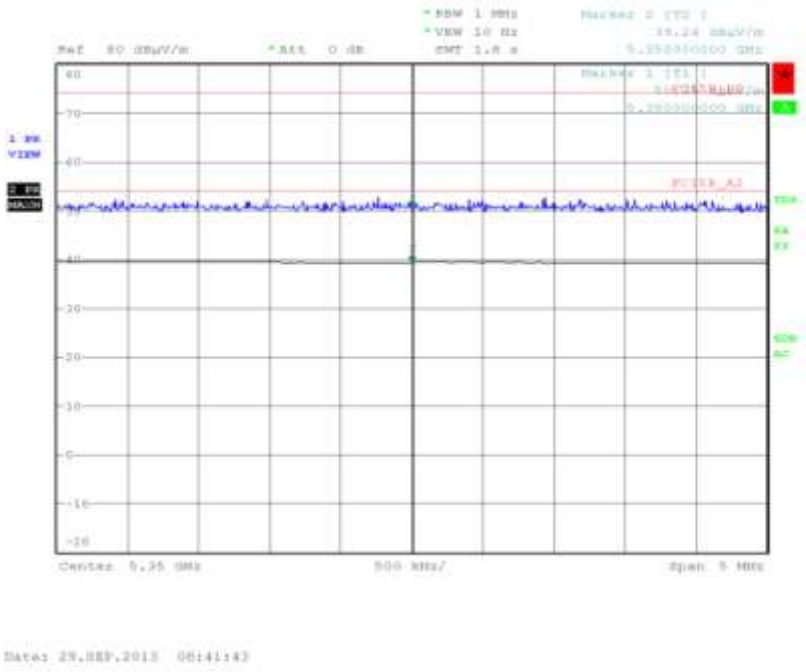
5180 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	48.54	37.53



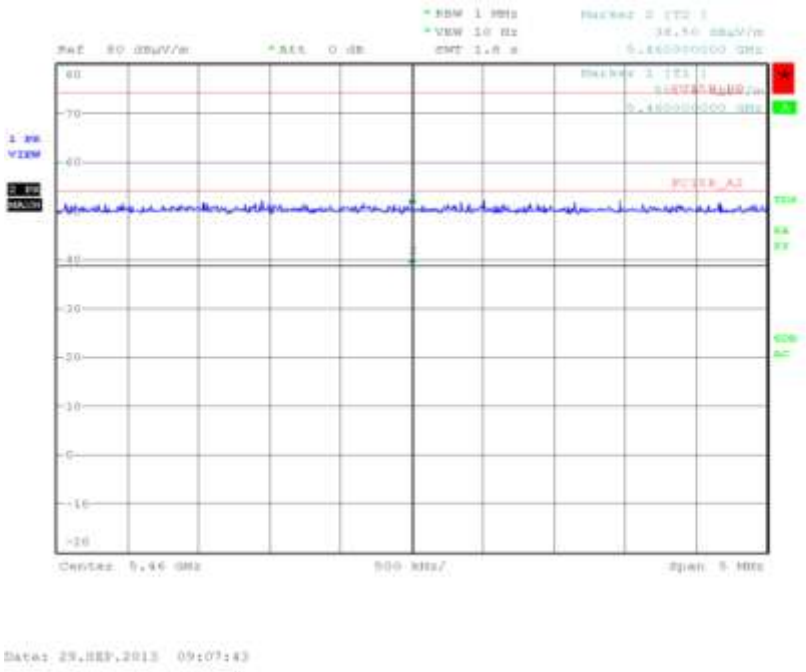
5320 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	50.35	39.24



5500 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	50.78	38.50



Limit

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

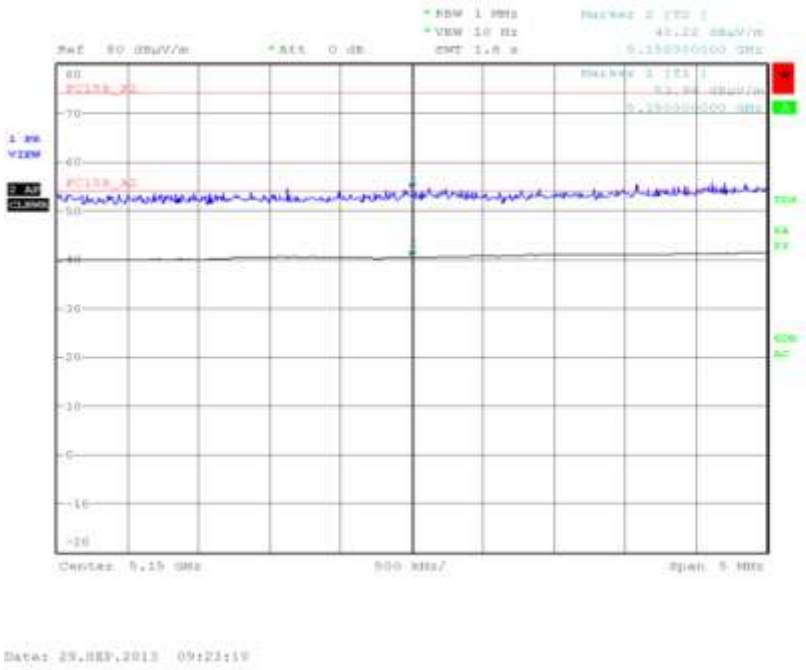
802.11(ac) - 5 GHz 40 MHz BW FCC

4.0 V DC Supply

Band Edge Emissions

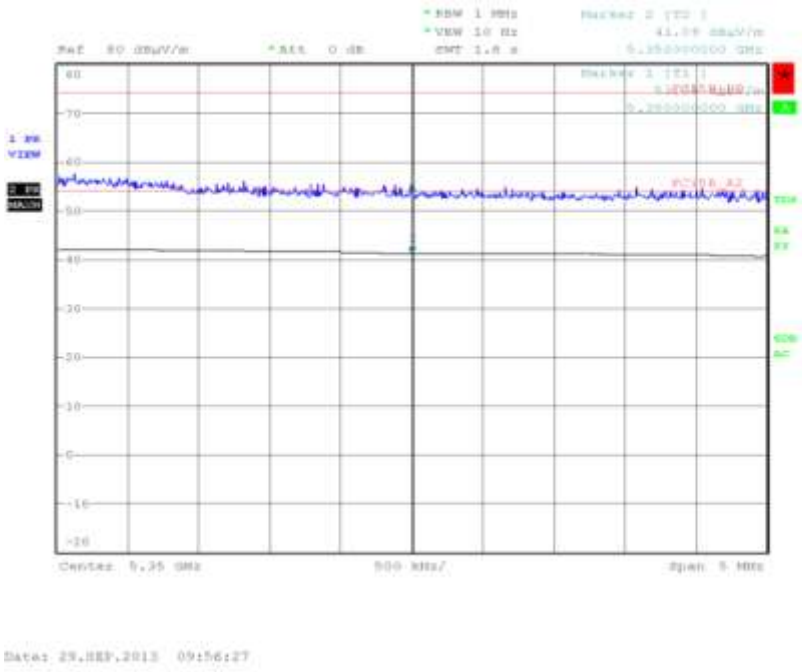
5190 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	53.96	40.22



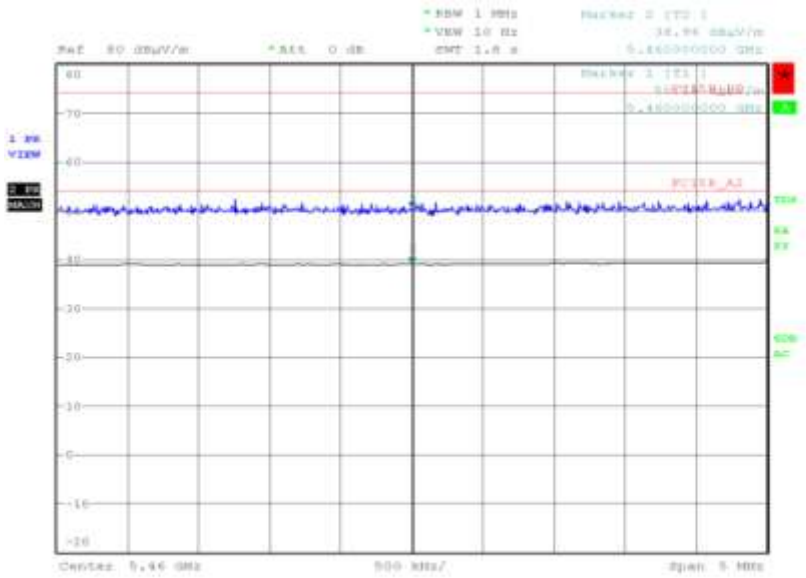
5310 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	53.08	41.09



5510 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	50.18	38.96



Limit

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

802.11(ac) - 5 GHz 80 MHz BW FCC

4.0 V DC Supply

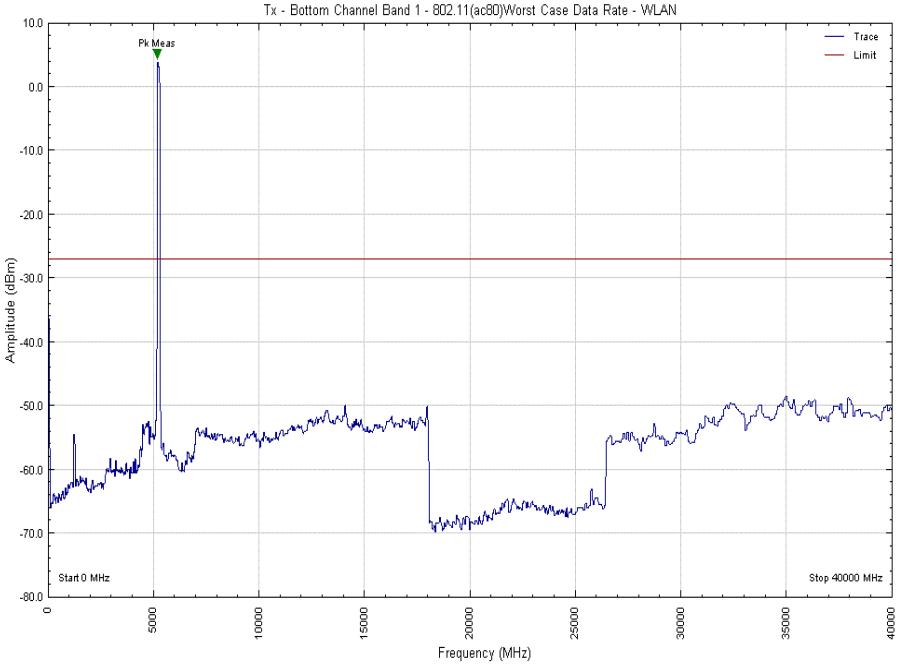
Spurious Conducted Emissions

MCS0

Frequency Band 1

5210 MHz

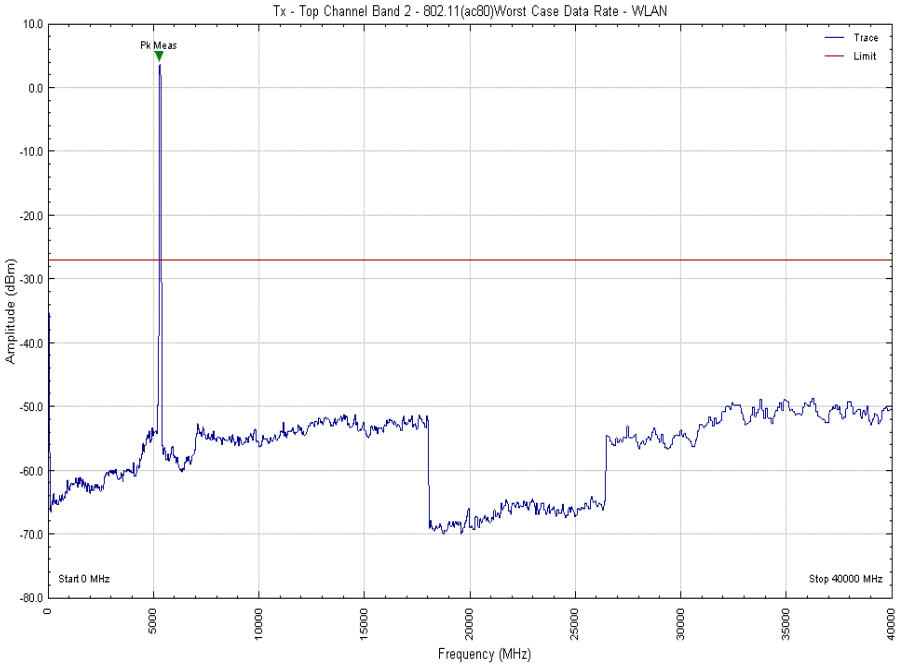
9 kHz to 40 GHz



Frequency Band 2

5290 MHz

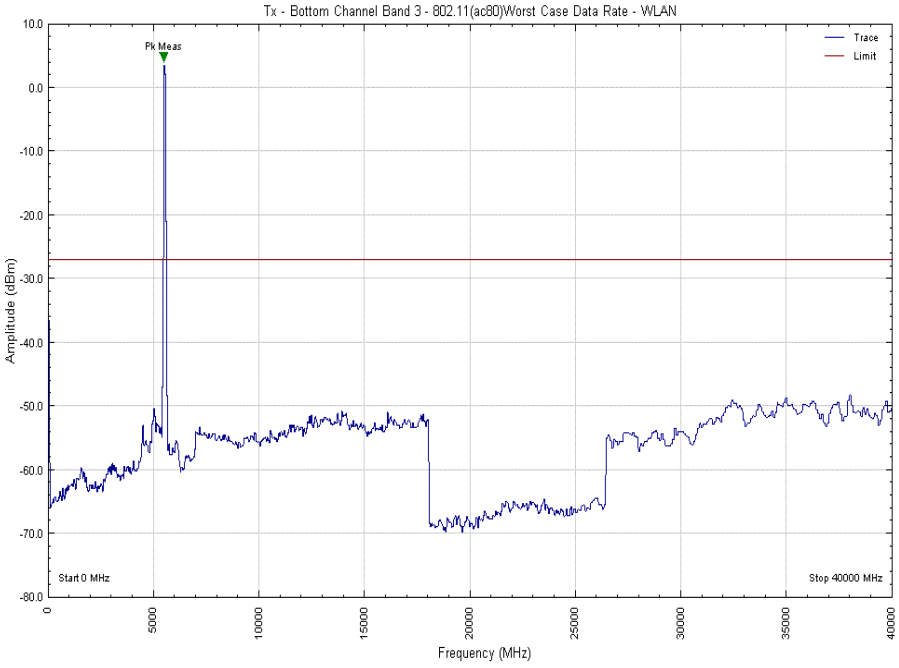
9 kHz to 40 GHz



Frequency Band 3

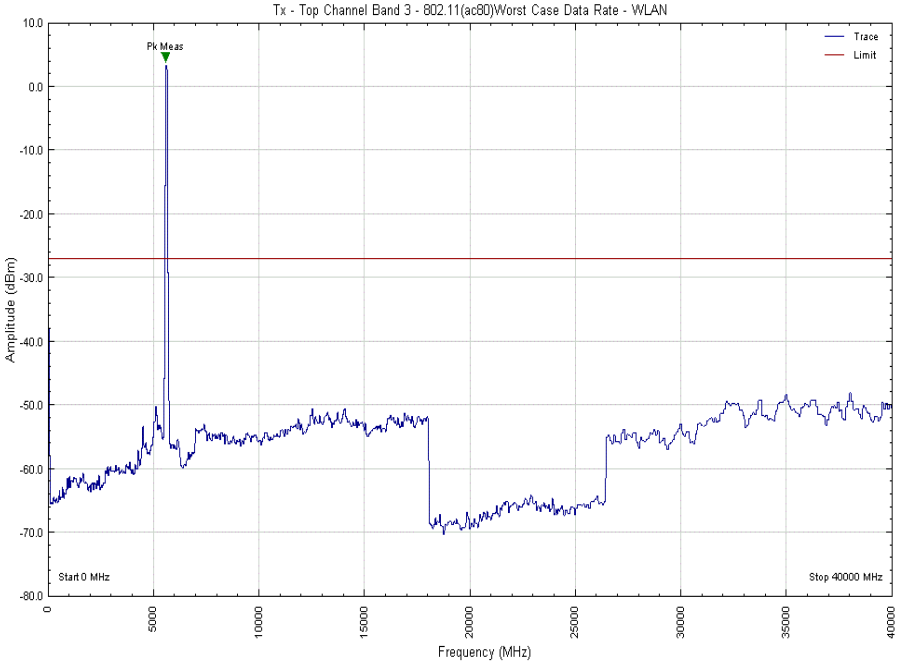
5530 MHz

9 kHz to 40 GHz



5610 MHz

9 kHz to 40 GHz



Limit Clause

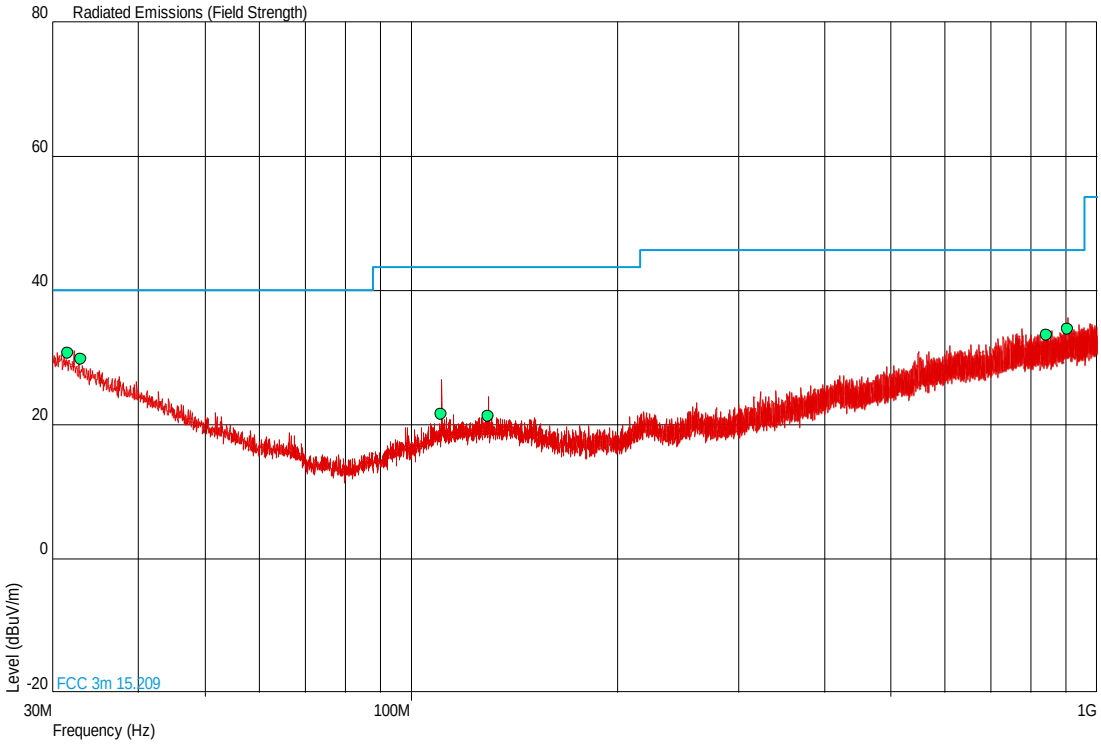
5.15 to 5.25 GHz	-27 dBm/MHz
5.25 to 5.35 GHz	
5.47 to 5.725 GHz	

Spurious Radiated Emissions

Frequency Band 1

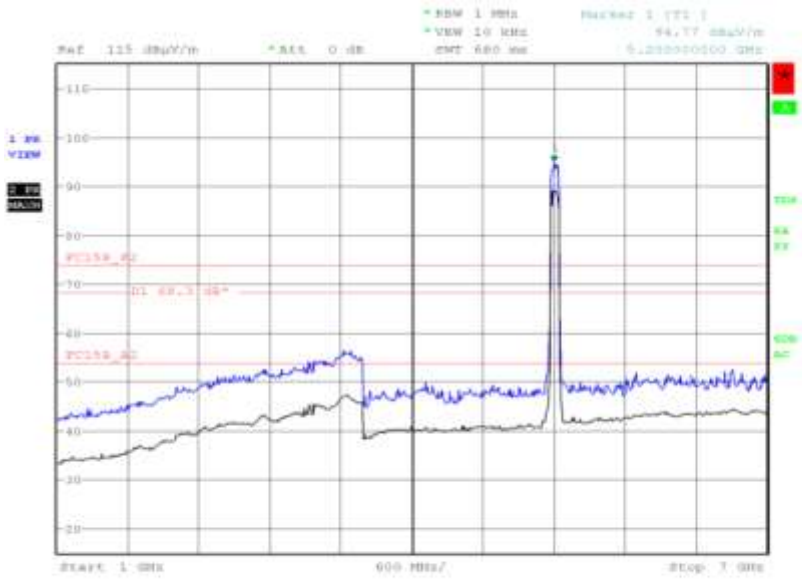
5210 MHz

30 MHz to 1 GHz



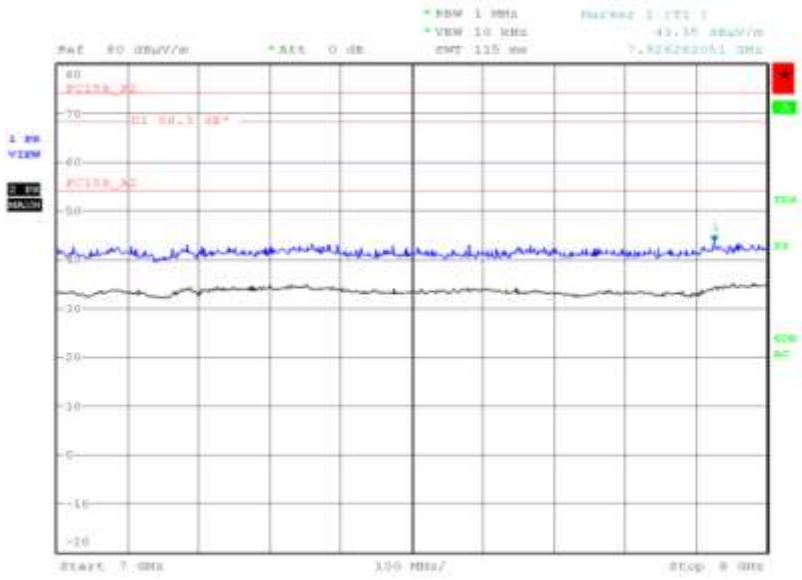
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.601	30.7	34.3	40.0	100	-9.3	65.7	0	1.00	Vertical
33.056	29.8	30.9	40.0	100	-10.2	69.1	180	1.00	Vertical
110.801	21.6	12.0	43.5	150	-21.9	138.0	180	1.00	Vertical
129.474	21.3	11.6	43.5	150	-22.2	138.4	0	1.00	Vertical
844.703	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Vertical
904.407	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Vertical

1 GHz to 7 GHz



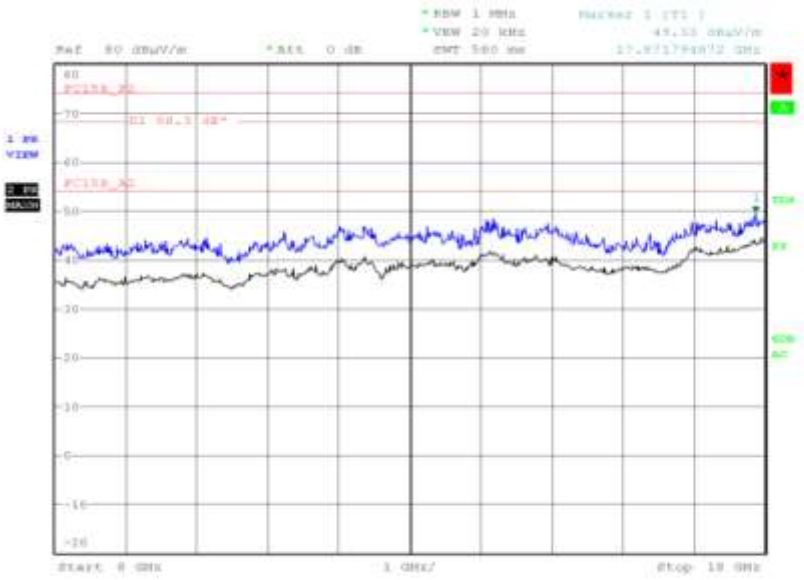
Date: 29.SEP.2013 11:09:33

7 GHz to 8 GHz



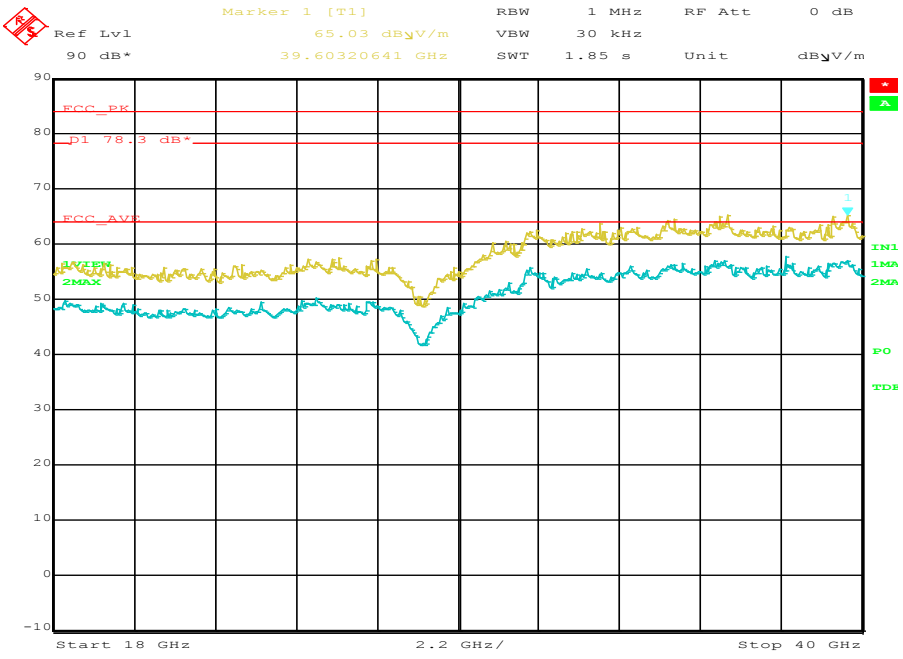
Date: 1.OCT.2013 17:07:16

8 GHz to 18 GHz



Date: 1.OCT.2013 20:36:19

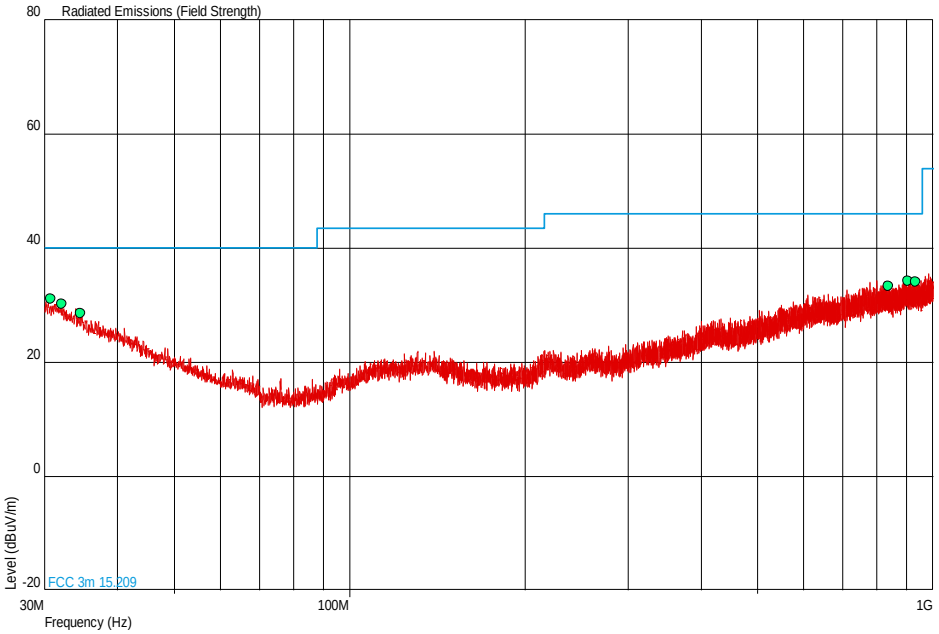
18 GHz to 40 GHz



Date: 16.OCT.2013 21:03:11

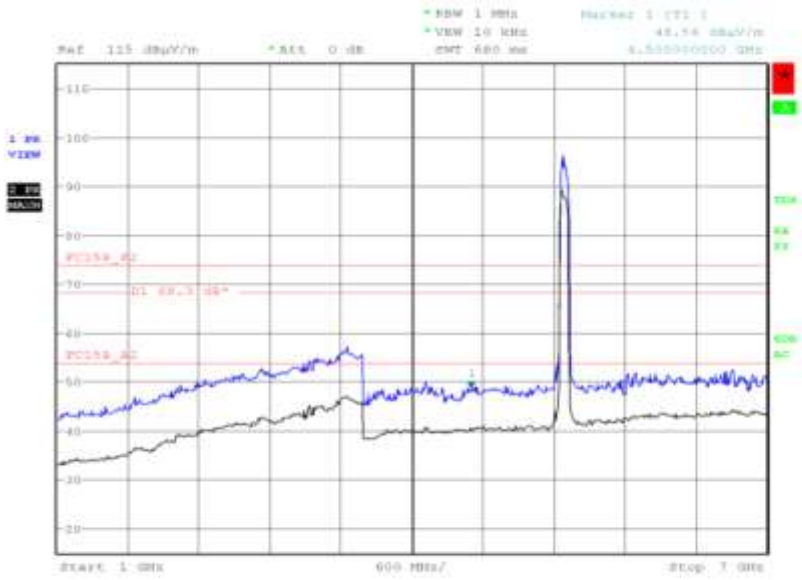
5290 MHz

30 MHz to 1 GHz



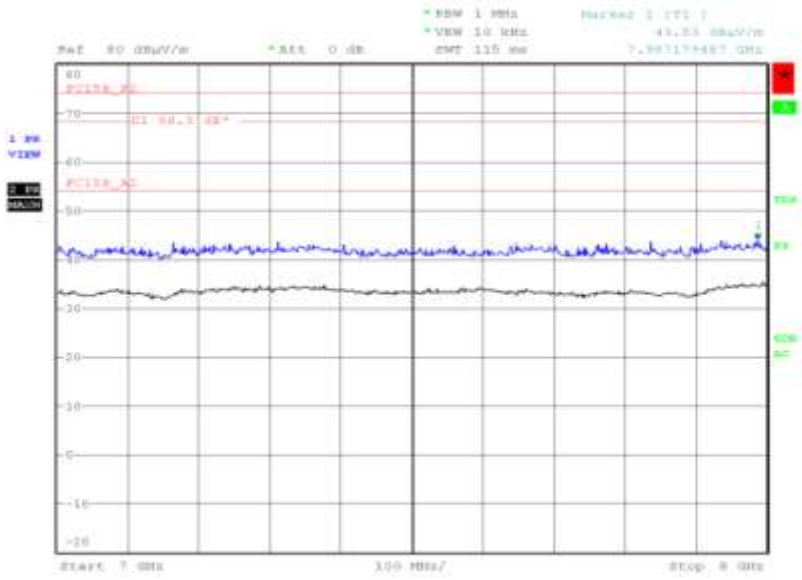
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.776	31.1	35.9	40.0	100	-8.9	64.1	0	1.00	Horizontal
32.183	30.3	32.7	40.0	100	-9.7	67.3	0	1.00	Vertical
34.656	28.6	26.9	40.0	100	-11.4	73.1	0	1.00	Vertical
837.962	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Horizontal
907.074	34.3	51.9	46.0	200	-11.7	148.1	0	1.00	Vertical
933.943	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Horizontal

1 GHz to 7 GHz



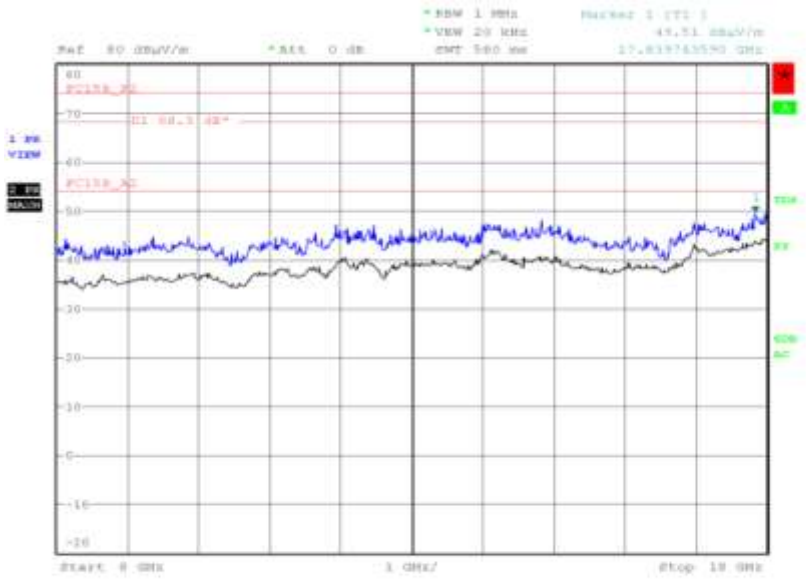
Date: 29.SEP.2013 11:35:36

7 GHz to 8 GHz



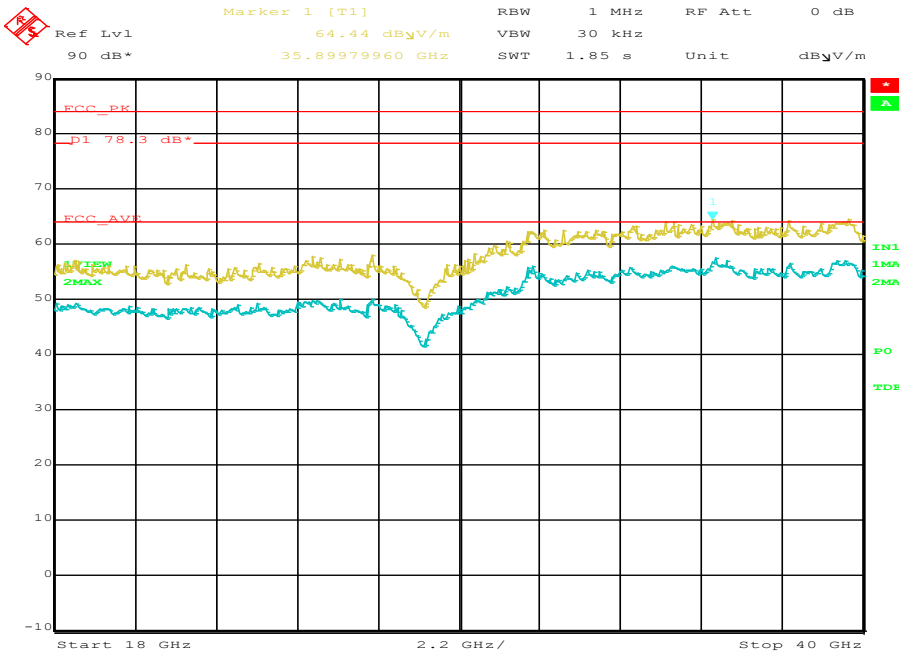
Date: 1.OCT.2013 17:11:01

8 GHz to 18 GHz



Date: 1.OCT.2013 20:53:51

18 GHz to 40 GHz

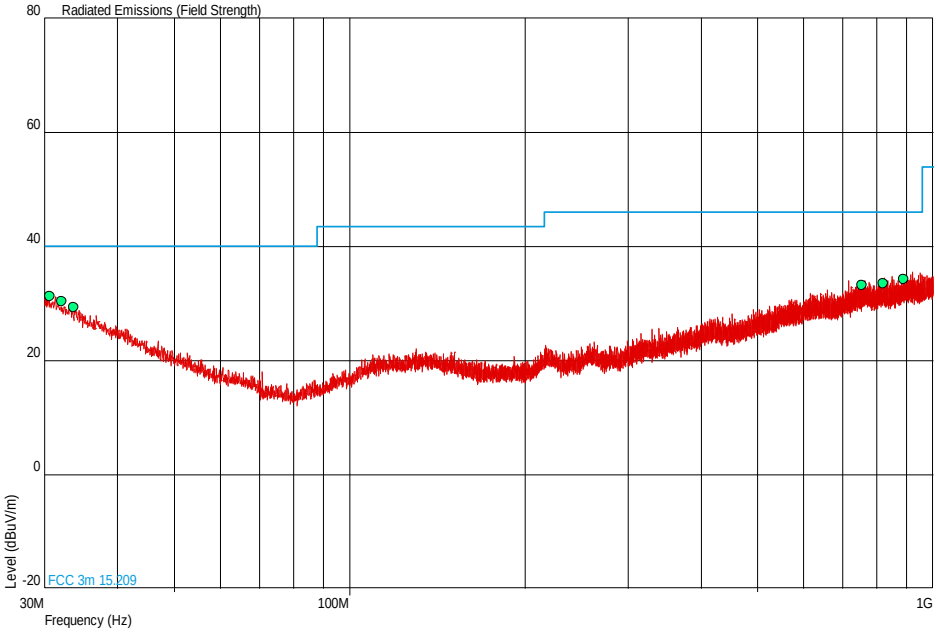


Date: 16.OCT.2013 21:12:23

Frequency Band 3

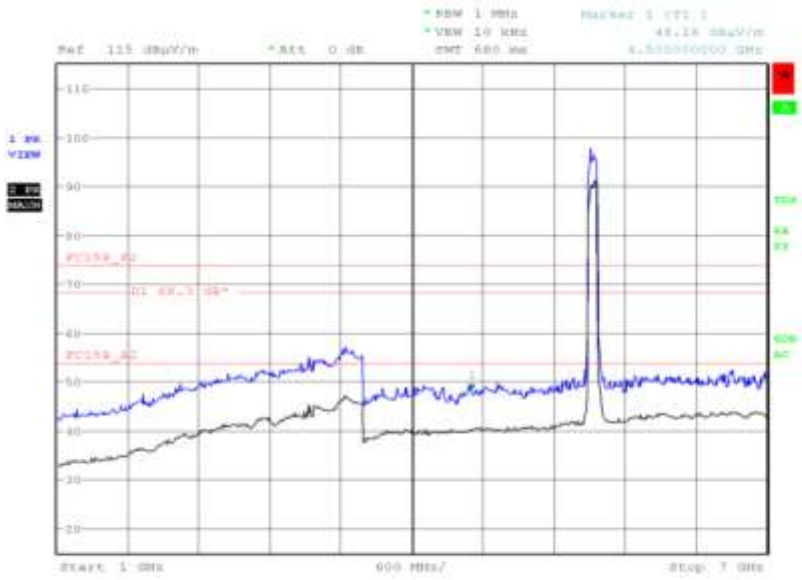
5530 MHz

30 MHz to 1 GHz

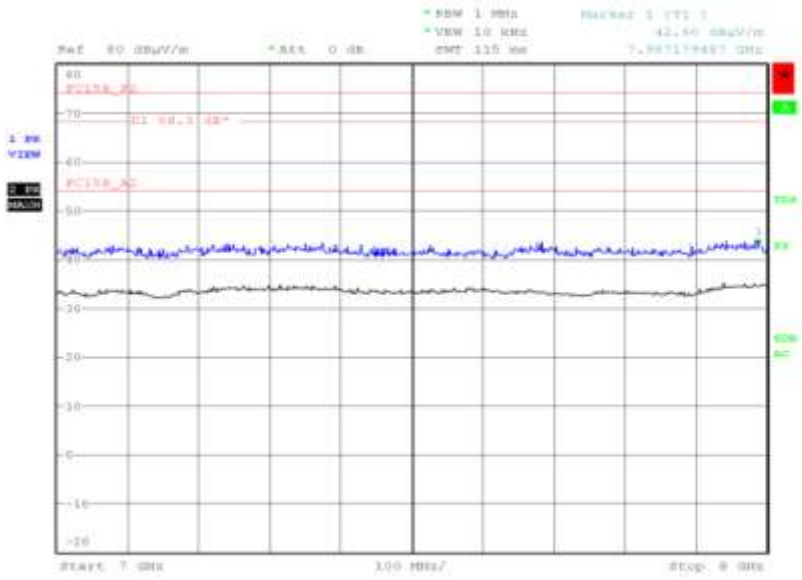


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.631	31.3	36.7	40.0	100	-8.7	63.3	180	1.00	Vertical
32.183	30.3	32.7	40.0	100	-9.7	67.3	0	1.00	Vertical
33.735	29.3	29.2	40.0	100	-10.7	70.8	0	1.00	Horizontal
755.997	33.2	45.7	46.0	200	-12.8	154.3	180	1.00	Horizontal
820.987	33.5	47.3	46.0	200	-12.5	152.7	180	1.00	Vertical
891.603	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Horizontal

1 GHz to 7 GHz

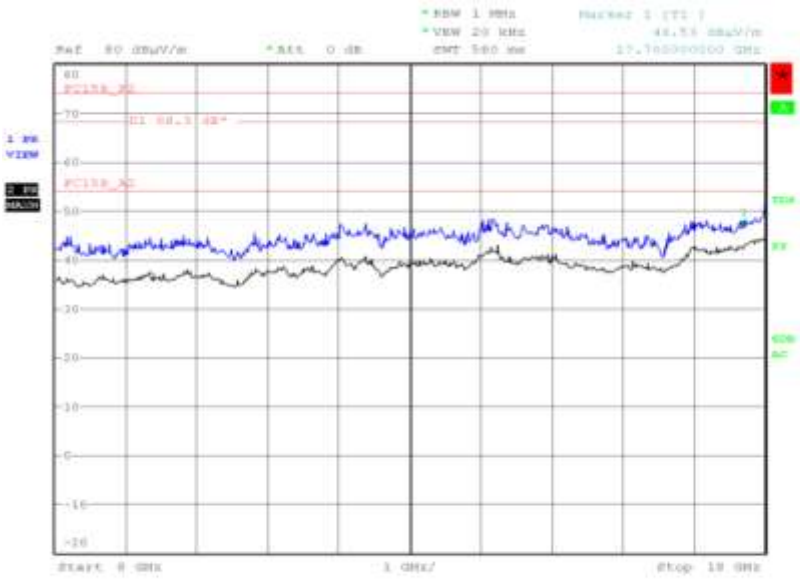


7 GHz to 8 GHz



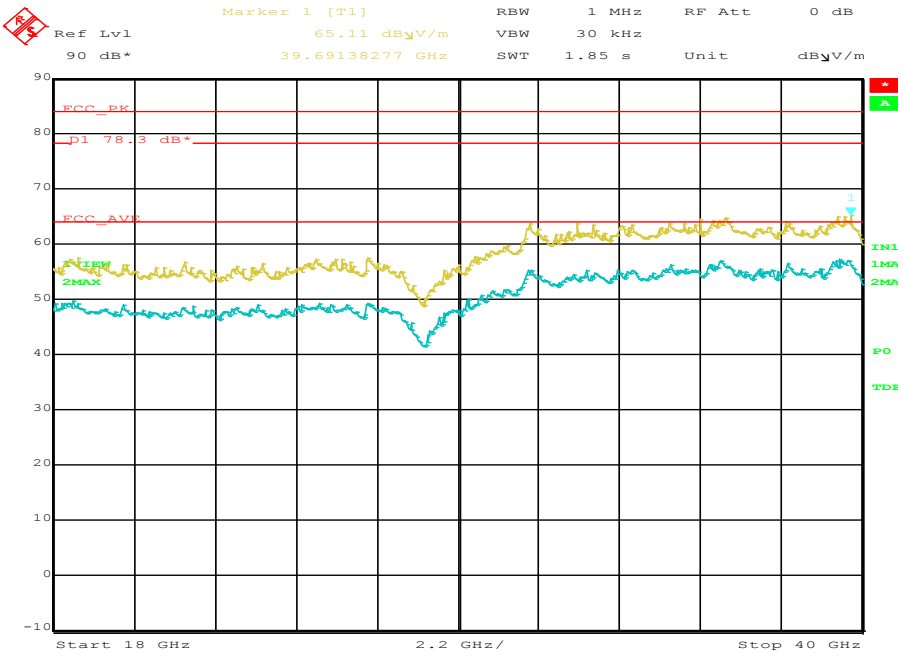
Product Service

8 GHz to 18 GHz



Date: 1.OCT.2013 21:12:12

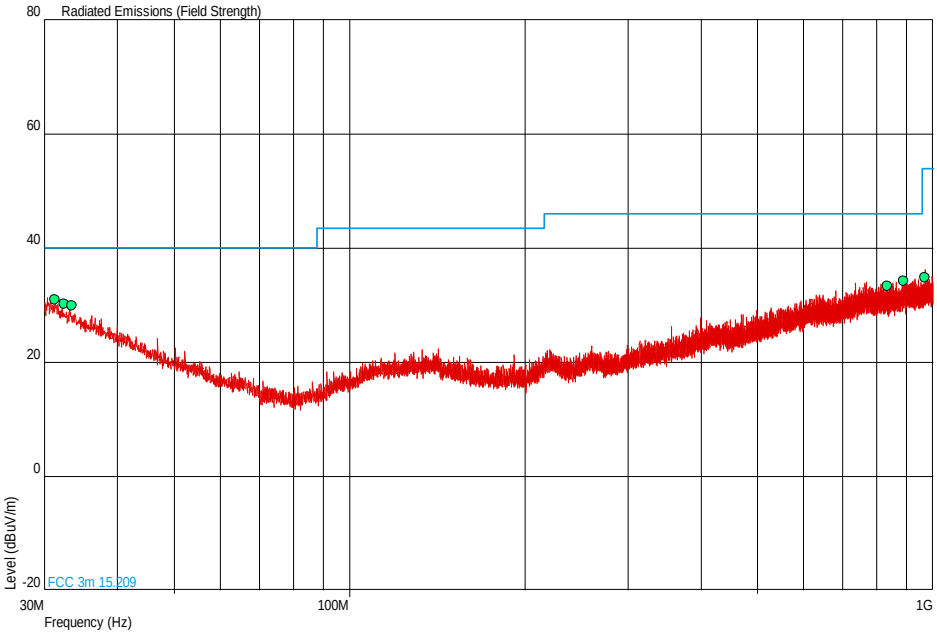
18 GHz to 40 GHz



Date: 16.OCT.2013 21:22:51

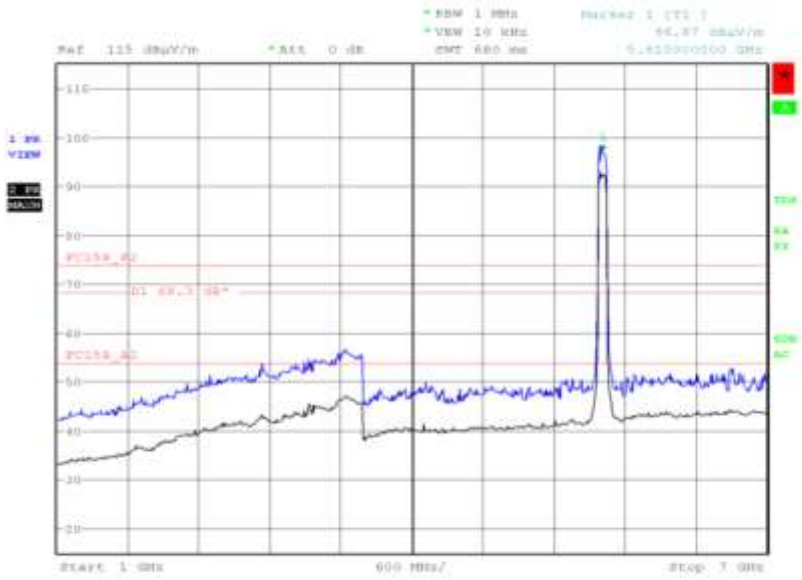
5610 MHz

30 MHz to 1 GHz



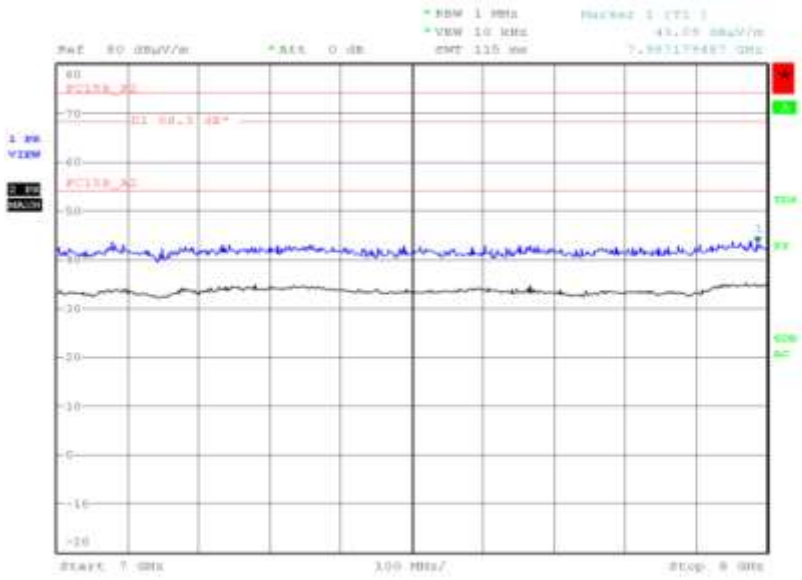
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.310	31.0	35.5	40.0	100	-9.0	64.5	0	1.00	Vertical
32.425	30.2	32.4	40.0	100	-9.8	67.6	180	1.00	Vertical
33.444	29.9	31.3	40.0	100	-10.1	68.7	180	1.00	Vertical
836.555	33.4	46.8	46.0	200	-12.6	153.2	180	1.00	Vertical
891.845	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Vertical
968.475	34.9	55.6	54.0	501	-19.1	444.4	180	1.00	Vertical

1 GHz to 7 GHz



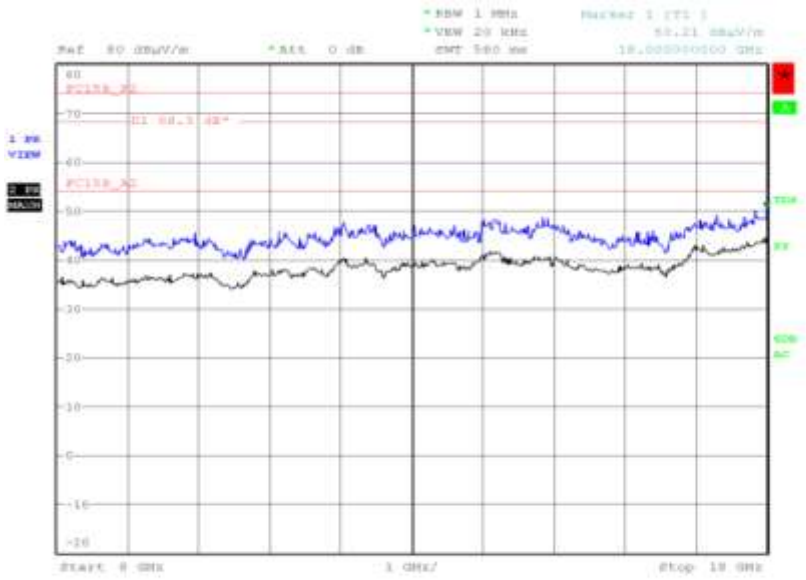
Date: 29.SEP.2013 12:26:27

7 GHz to 8 GHz

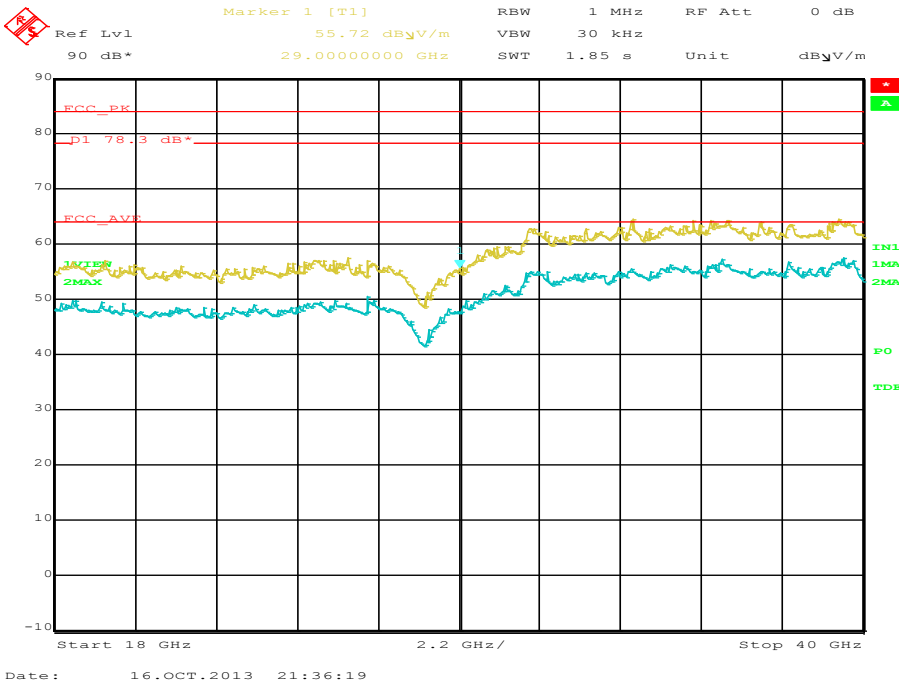


Date: 1.OCT.2013 17:19:37

8 GHz to 18 GHz



18 GHz to 40 GHz



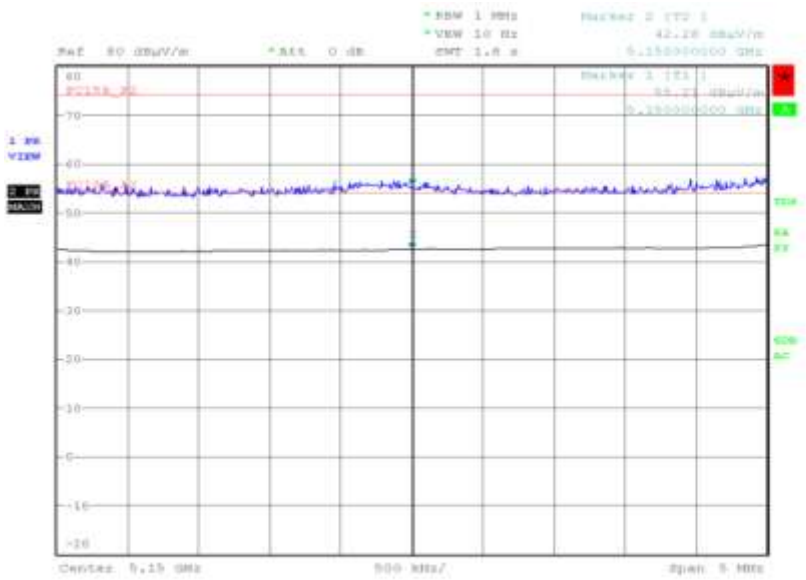
Limit

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

Band Edge Emissions

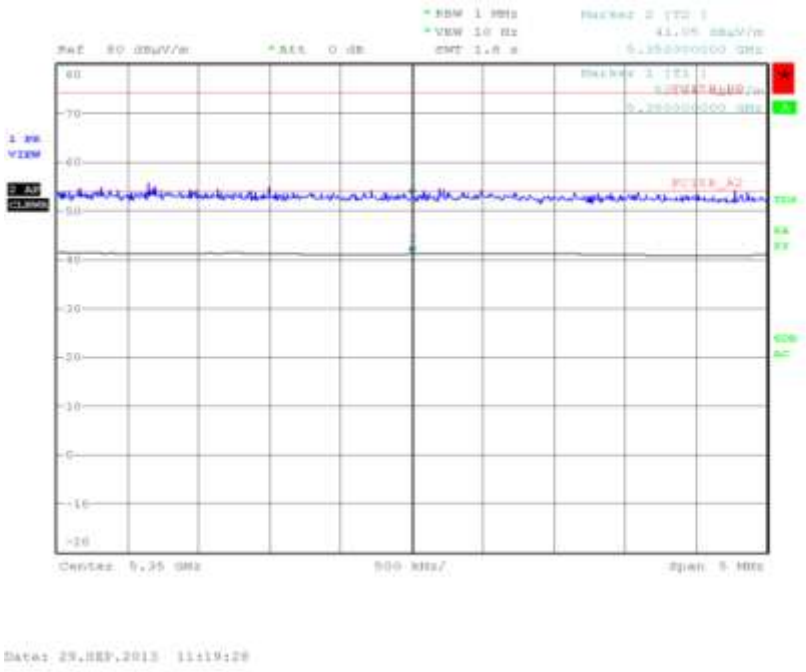
5210 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	55.21	42.28



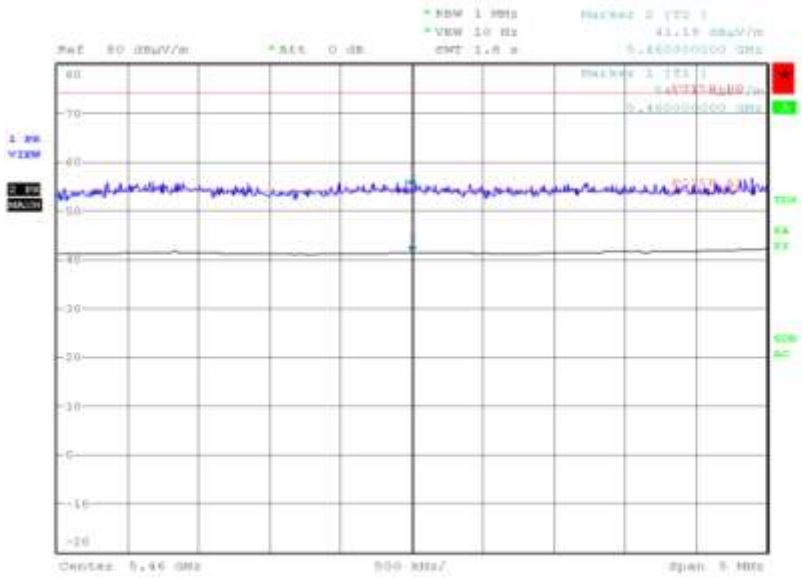
5290 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	52.86	41.05



5530 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	54.71	41.19



Limit

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

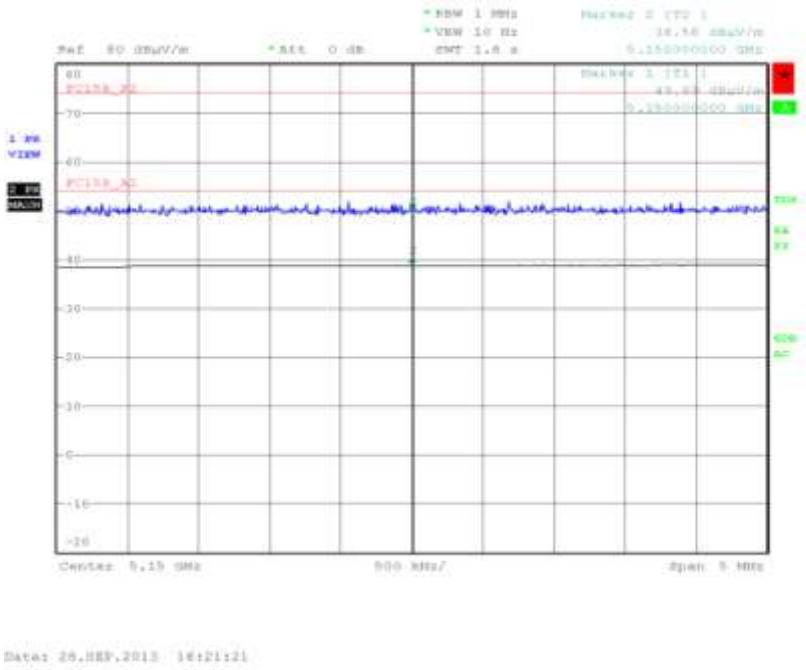
802.11(n) - 5 GHz 20 MHz BW FCC

4.0 V DC Supply

Band Edge Emissions

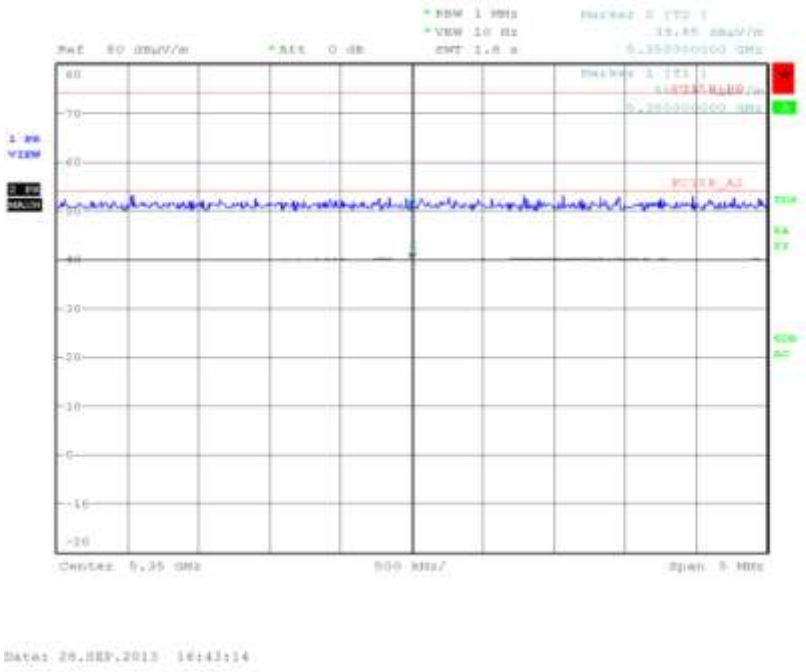
5180 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	49.89	38.59



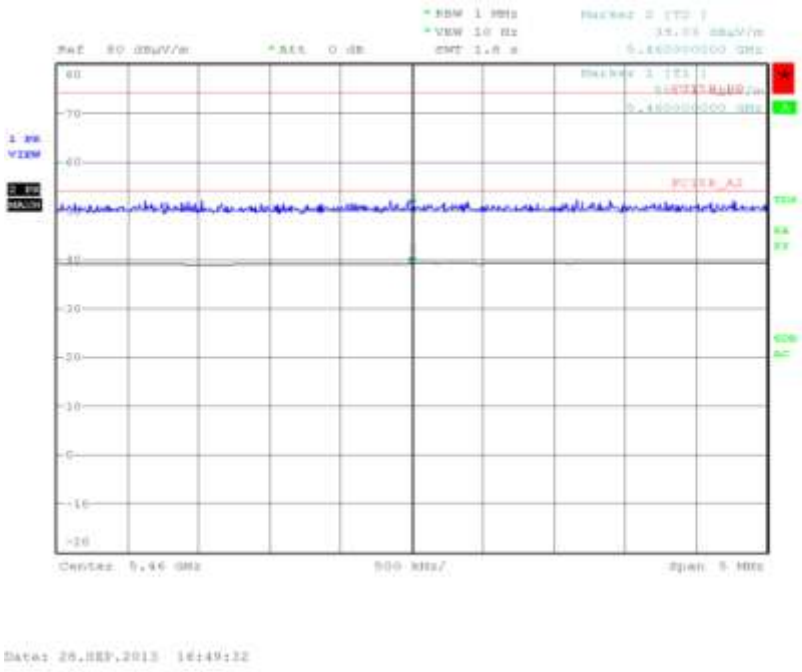
5320 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	50.39	39.85



5500 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	50.71	39.03



Limit

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

802.11(n) - 5 GHz 40 MHz BW FCC

4.0 V DC Supply

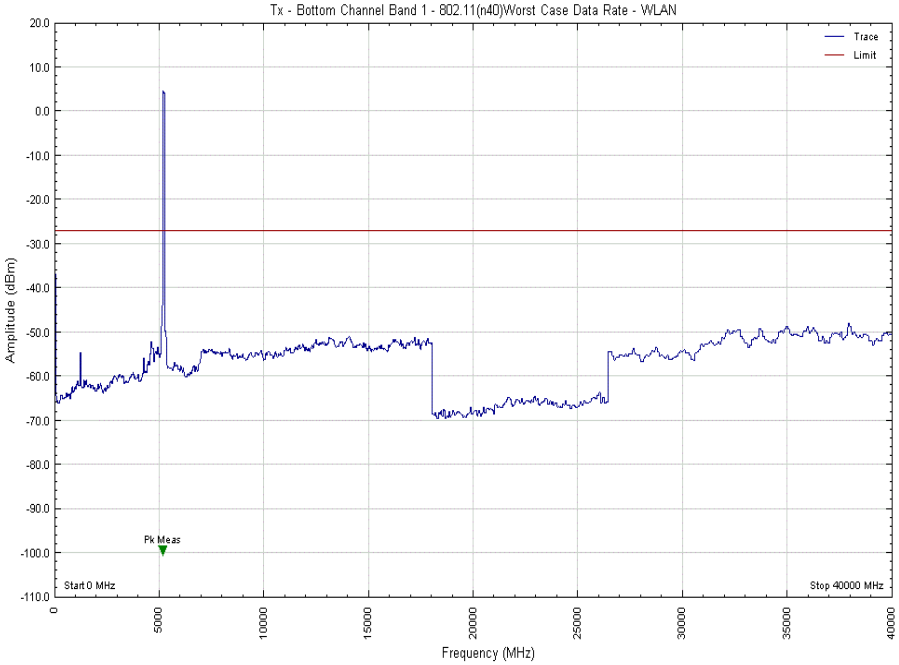
Spurious Conducted Emissions

MCS1

Frequency Band 1

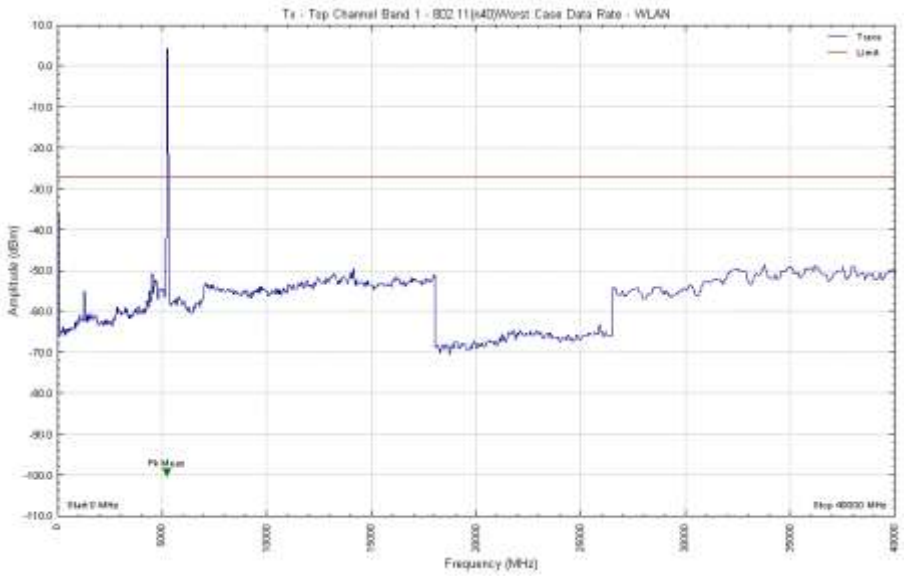
5190 MHz

9 kHz to 40 GHz



5270 MHz

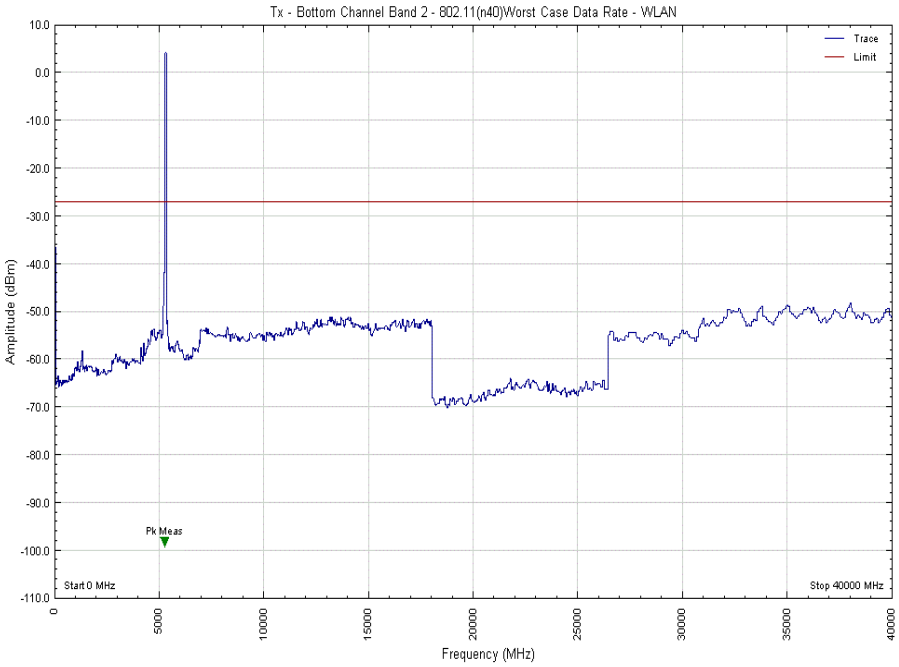
9 kHz to 40 GHz



Frequency Band 2

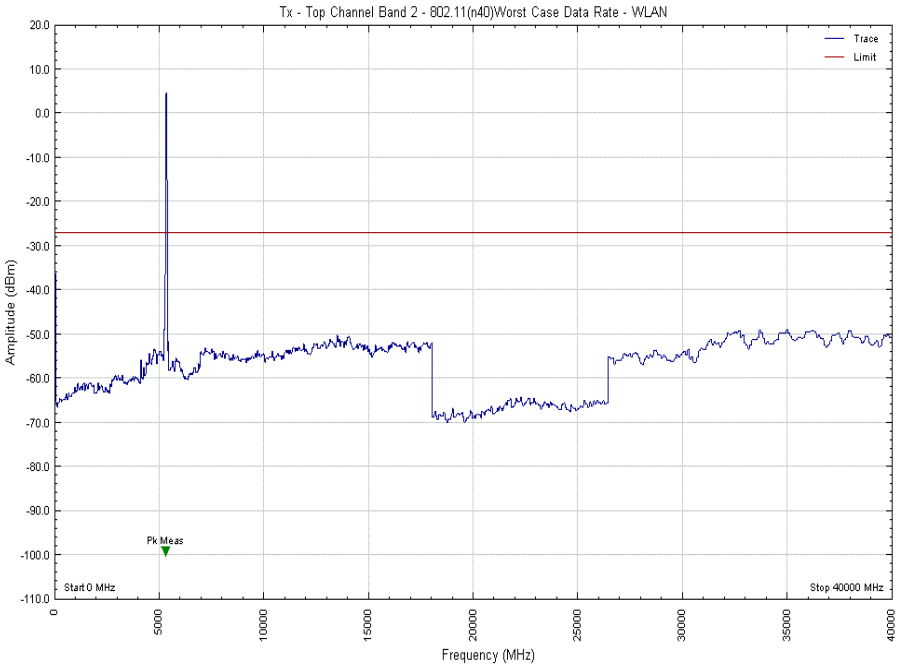
5270 MHz

9 kHz to 40 GHz



5310 MHz

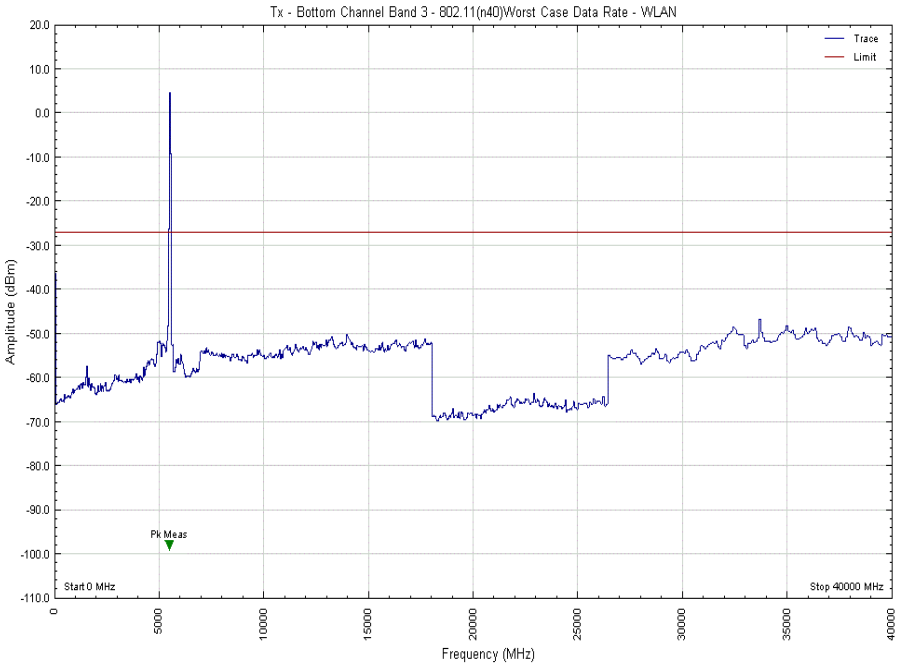
9 kHz to 40 GHz



Frequency Band 3

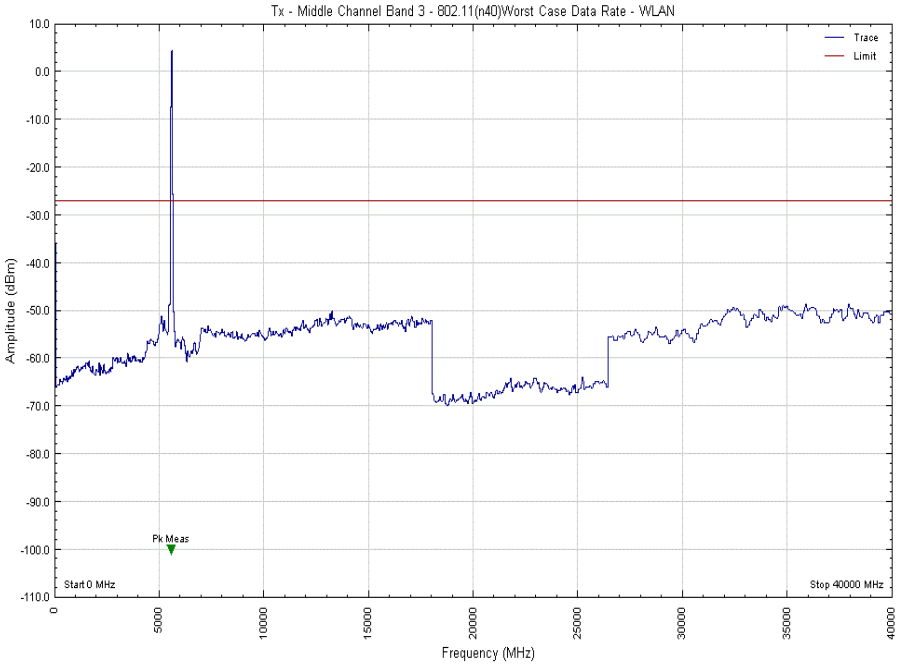
5510 MHz

9 kHz to 40 GHz



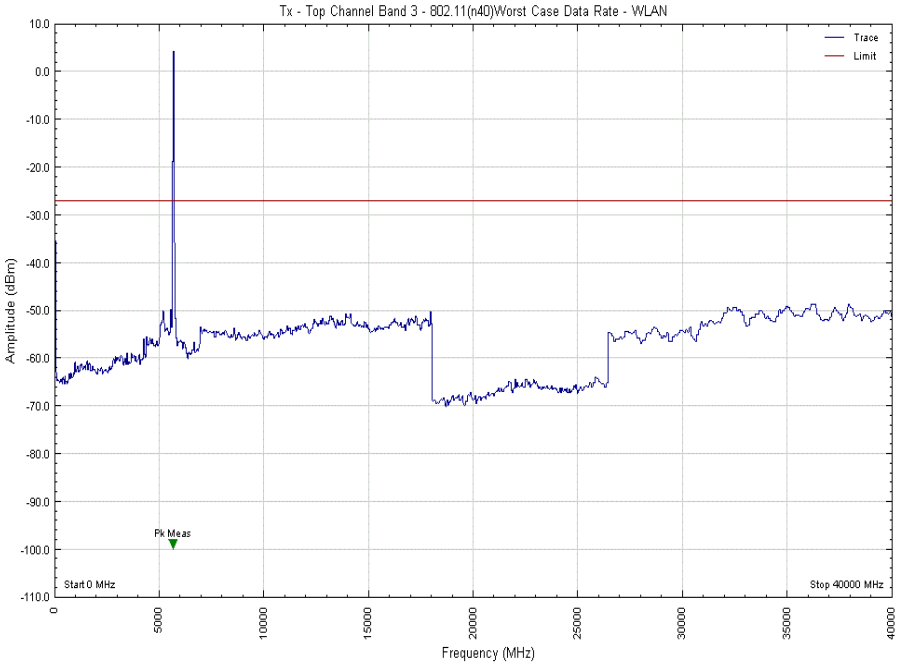
5590 MHz

9 kHz to 40 GHz



5670 MHz

9 kHz to 40 GHz



Limit Clause

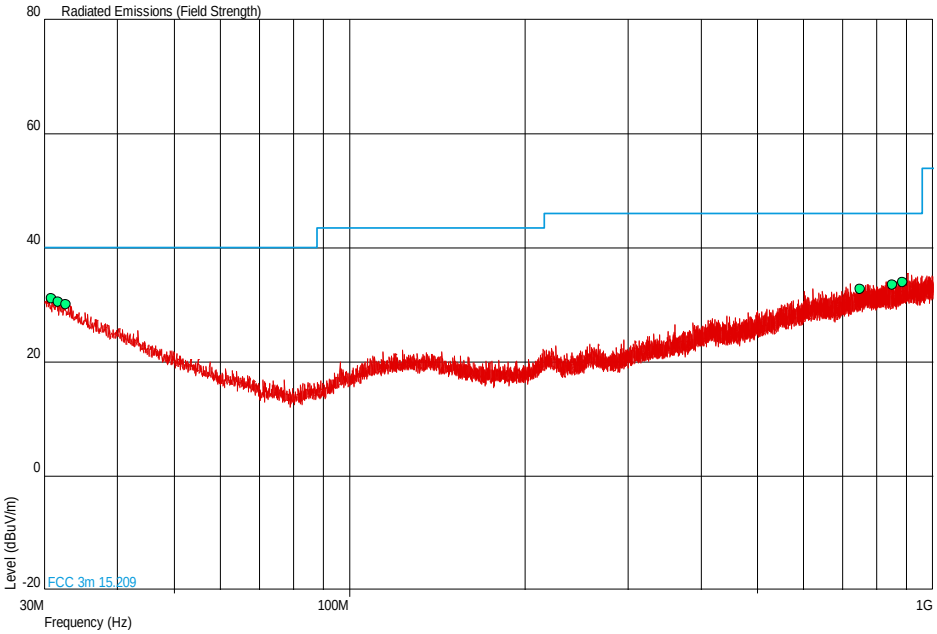
5.15 to 5.25 GHz	-27 dBm/MHz
5.25 to 5.35 GHz	
5.47 to 5.725 GHz	

Spurious Radiated Emissions

Frequency Band 1

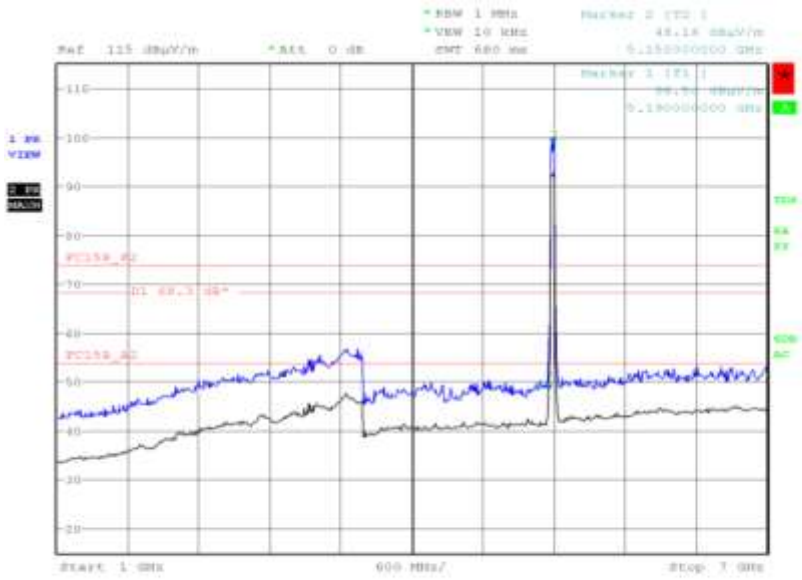
5190 MHz

30 MHz to 1 GHz



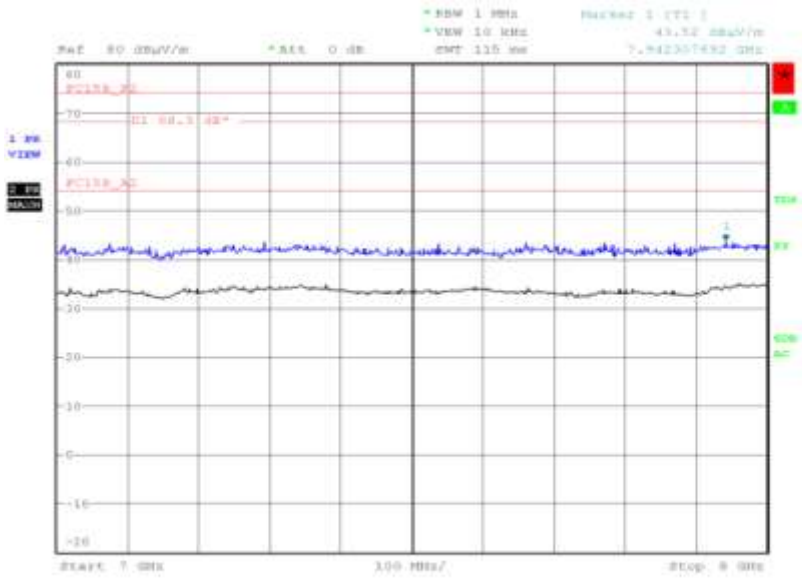
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.825	31.2	36.3	40.0	100	-8.8	63.7	0	1.00	Horizontal
31.746	30.5	33.5	40.0	100	-9.5	66.5	180	1.00	Horizontal
32.668	30.0	31.6	40.0	100	-10.0	68.4	180	1.00	Vertical
750.225	32.8	43.7	46.0	200	-13.2	156.3	0	1.00	Vertical
853.579	33.5	47.3	46.0	200	-12.5	152.7	0	1.00	Horizontal
887.383	34.0	50.1	46.0	200	-12.0	149.9	0	1.00	Vertical

1 GHz to 7 GHz



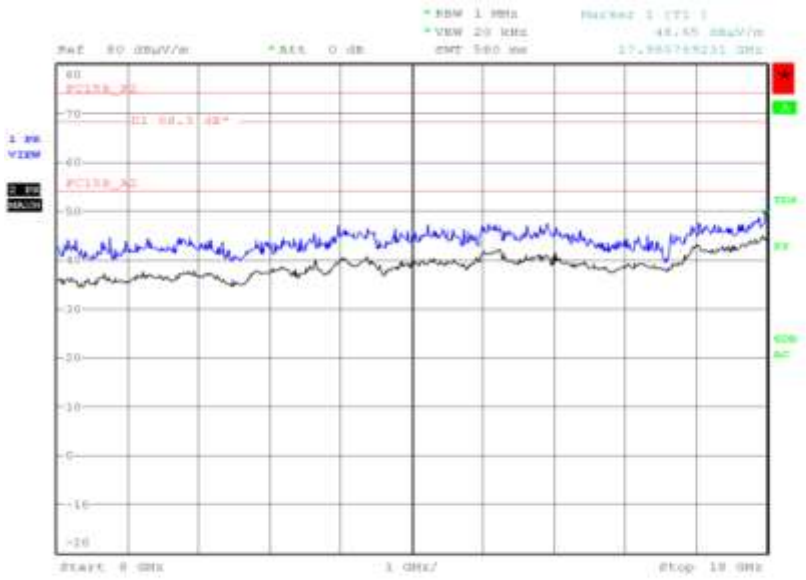
Date: 30.SEP.2013 18:31:14

7 GHz to 8 GHz



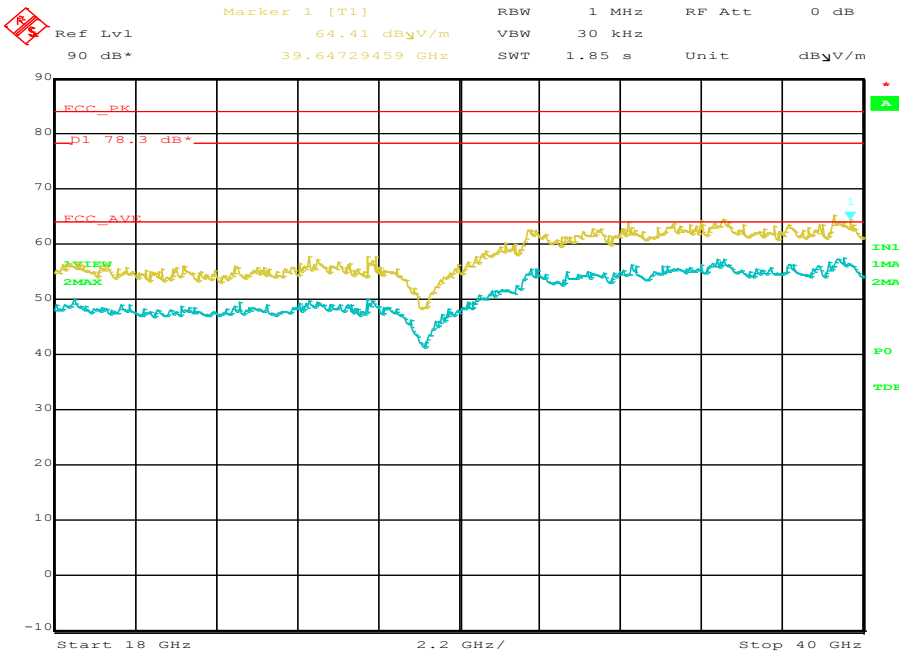
Date: 1.OCT.2013 18:11:29

8 GHz to 18 GHz



Date: 1.OCT.2013 19:02:45

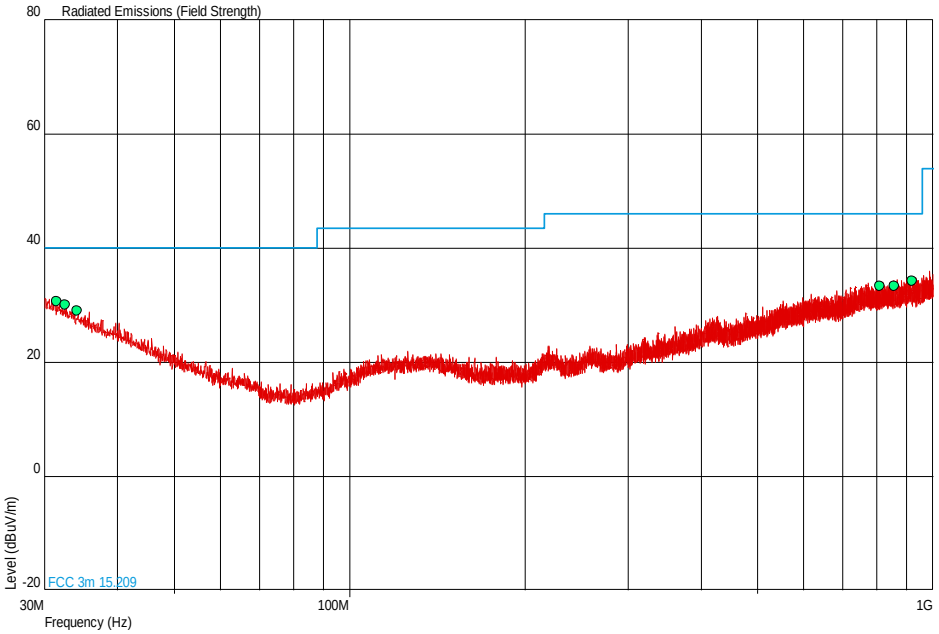
18 GHz to 40 GHz



Date: 16.OCT.2013 19:47:24

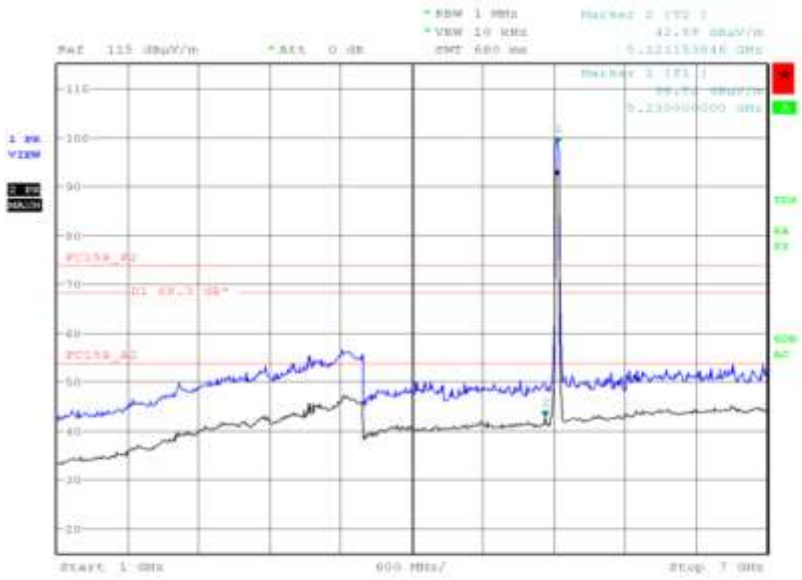
5230 MHz

30 MHz to 1 GHz



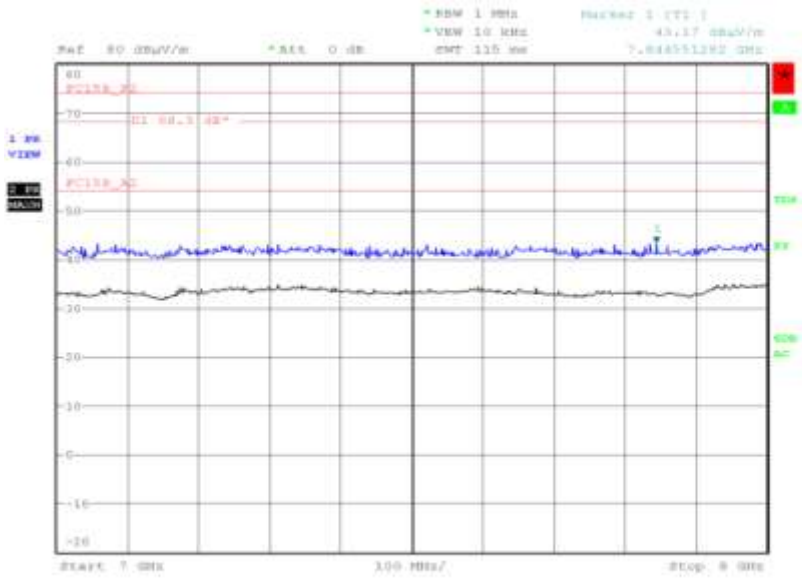
Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.455	30.7	34.3	40.0	100	-9.3	65.7	180	1.00	Vertical
32.619	30.1	32.0	40.0	100	-9.9	68.0	180	1.00	Vertical
34.123	29.1	28.5	40.0	100	-10.9	71.5	180	1.00	Vertical
810.365	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Vertical
858.623	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Vertical
920.751	34.3	51.9	46.0	200	-11.7	148.1	180	1.00	Horizontal

1 GHz to 7 GHz



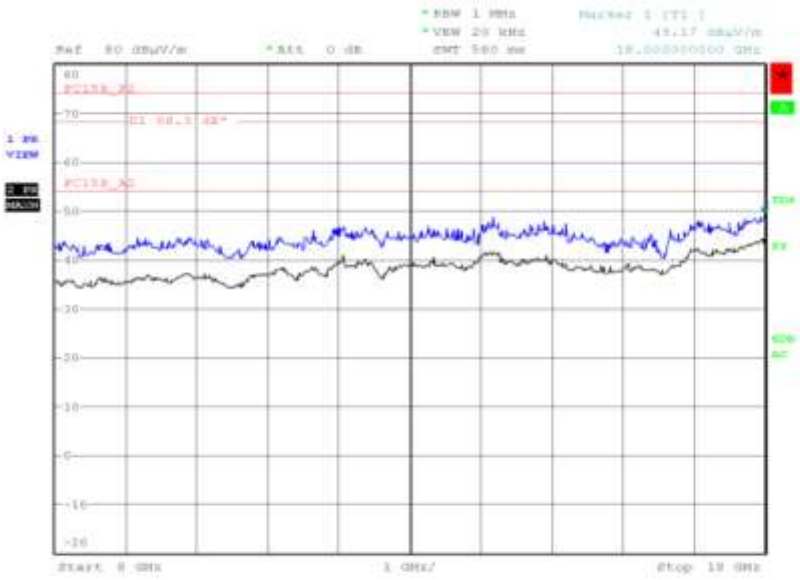
Date: 30.SEP.2013 18:46:12

7 GHz to 8 GHz



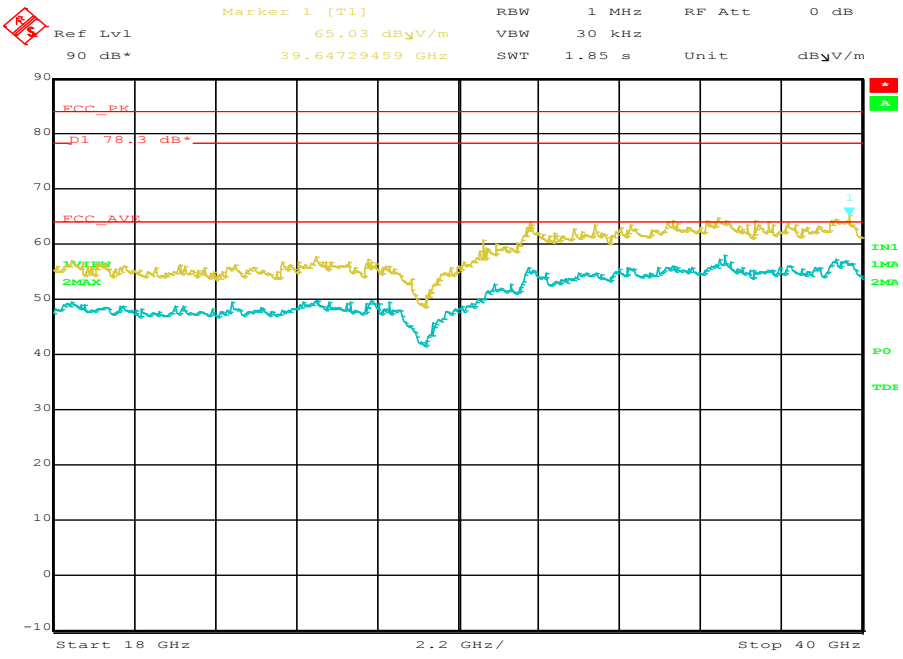
Date: 1.OCT.2013 18:15:09

8 GHz to 18 GHz



Date: 1.OCT.2013 19:15:48

18 GHz to 40 GHz

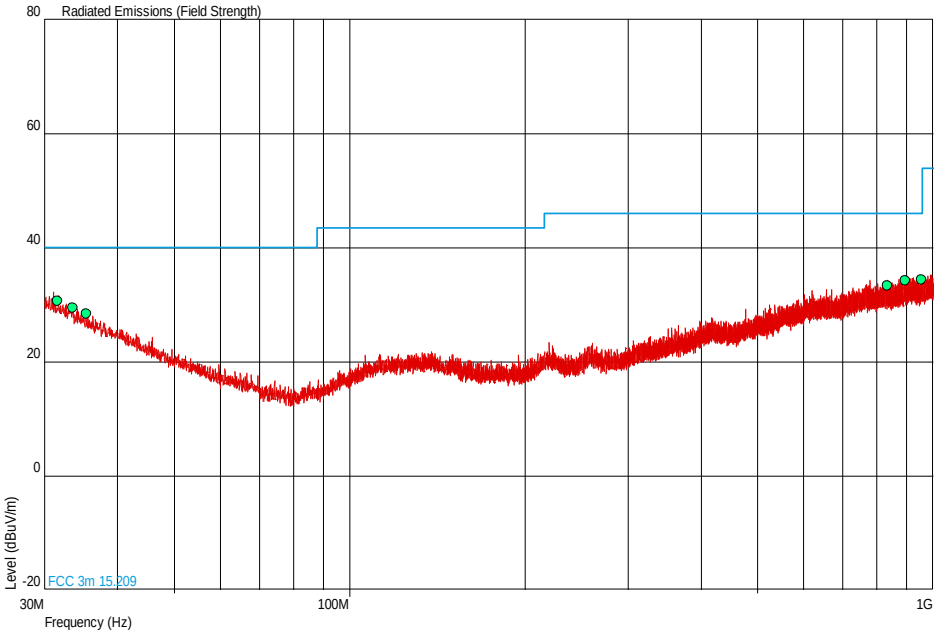


Date: 16.OCT.2013 19:54:41

Frequency Band 2

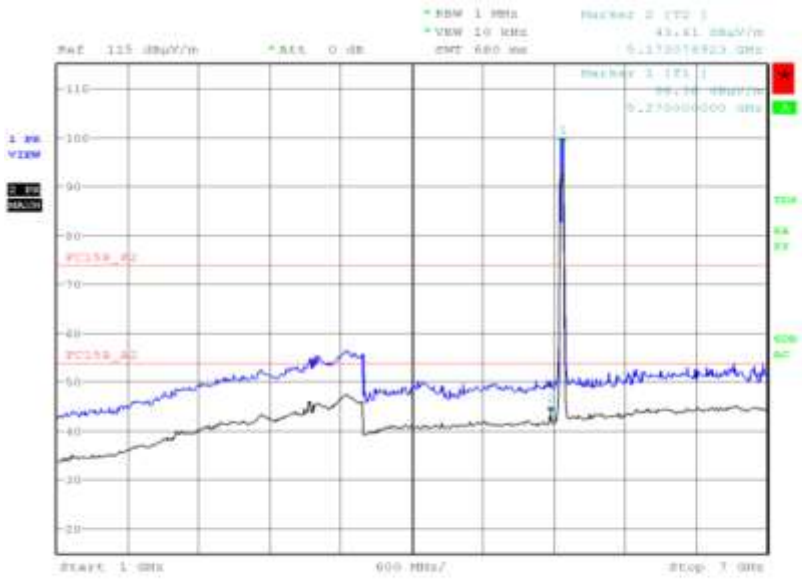
5270 MHz

30 MHz to 1 GHz

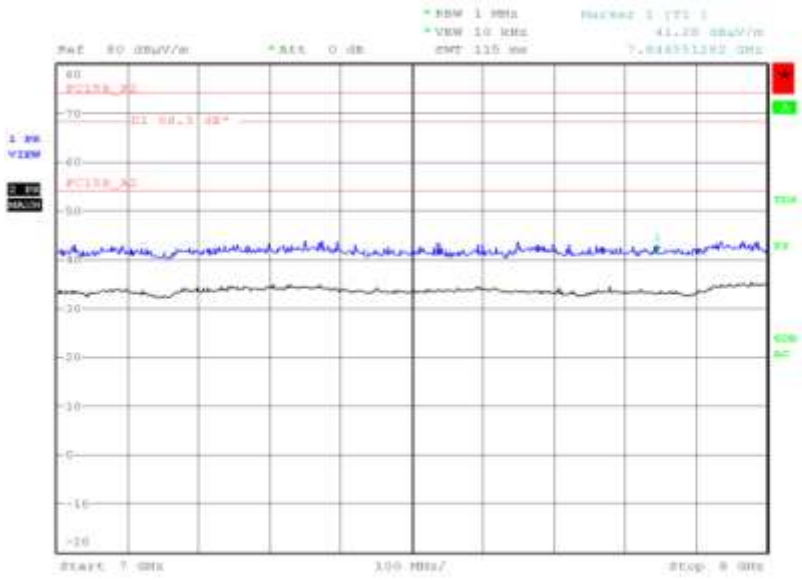


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
31.601	30.6	33.9	40.0	100	-9.4	66.1	0	1.00	Vertical
33.589	29.4	29.5	40.0	100	-10.6	70.5	0	1.00	Horizontal
35.481	28.5	26.6	40.0	100	-11.5	73.4	180	1.00	Horizontal
836.555	33.3	46.2	46.0	200	-12.7	153.8	180	1.00	Vertical
897.714	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Horizontal
956.399	34.4	52.5	46.0	200	-11.6	147.5	180	1.00	Horizontal

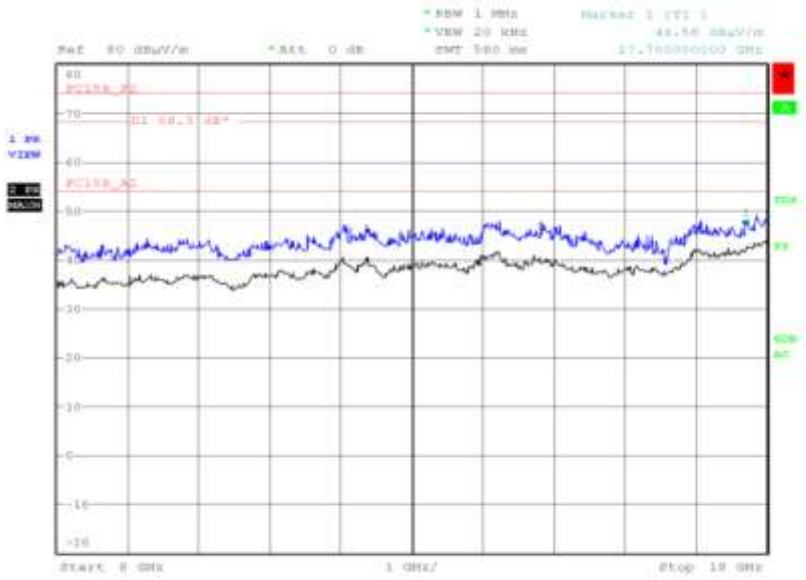
1 GHz to 7 GHz



7 GHz to 8 GHz

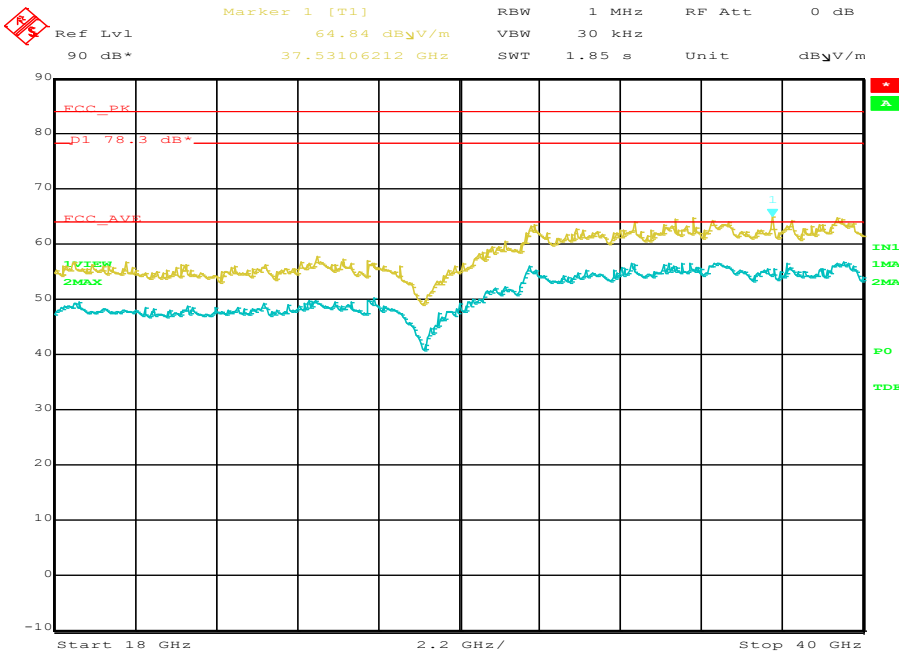


8 GHz to 18 GHz



Date: 1.OCT.2013 19:26:08

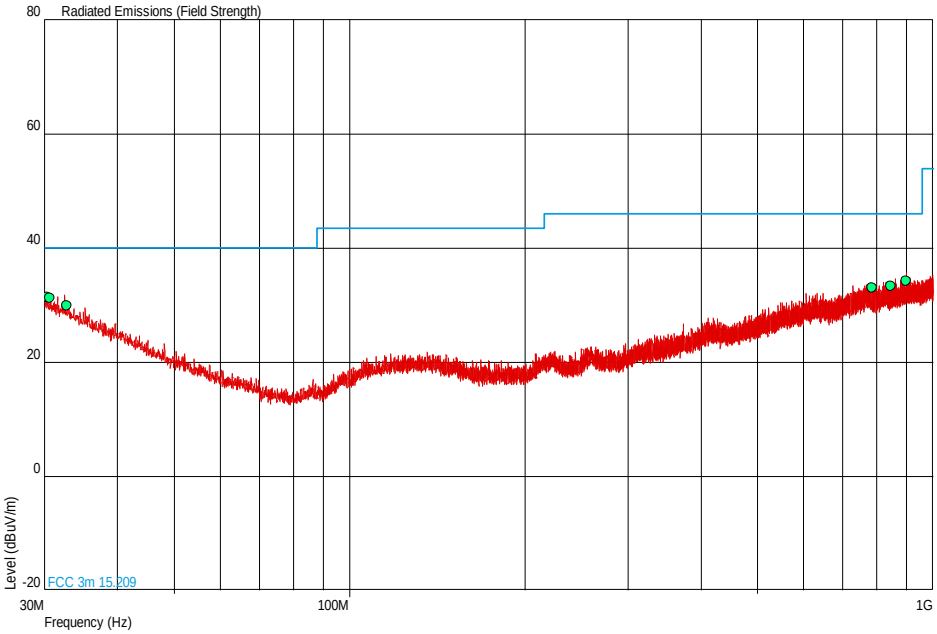
18 GHz to 40 GHz



Date: 16.OCT.2013 20:05:03

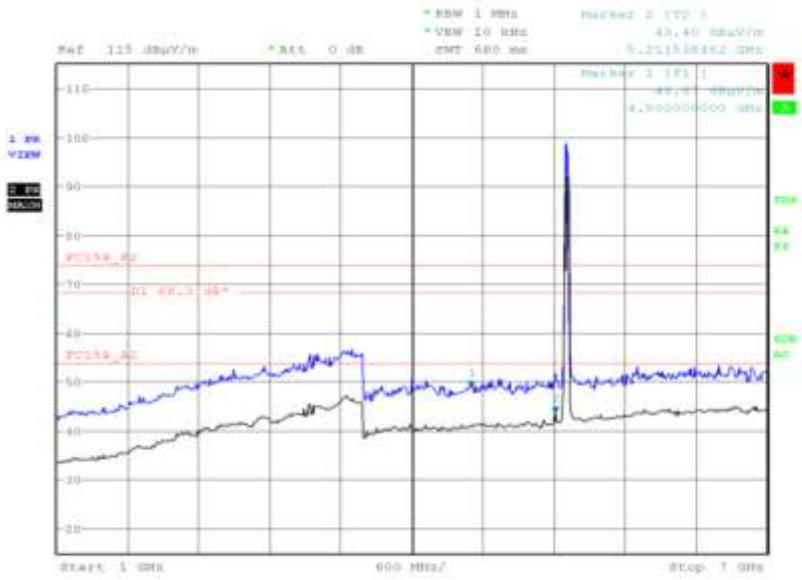
5310 MHz

30 MHz to 1 GHz

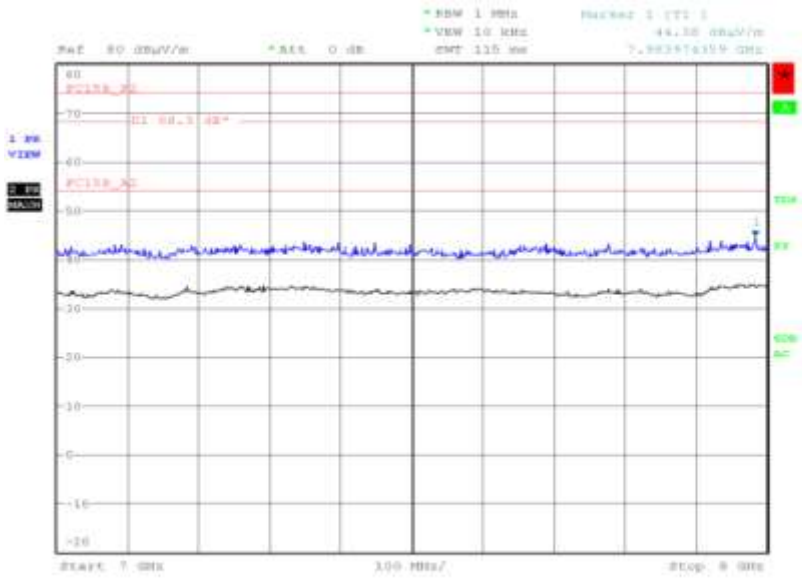


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.388	31.4	37.2	40.0	100	-8.6	62.8	180	1.00	Vertical
30.631	31.2	36.3	40.0	100	-8.8	63.7	0	1.00	Horizontal
32.813	30.0	31.6	40.0	100	-10.0	68.4	180	1.00	Horizontal
785.194	33.0	44.7	46.0	200	-13.0	155.3	0	1.00	Vertical
846.110	33.4	46.8	46.0	200	-12.6	153.2	0	1.00	Horizontal
899.702	34.2	51.3	46.0	200	-11.8	148.7	180	1.00	Vertical

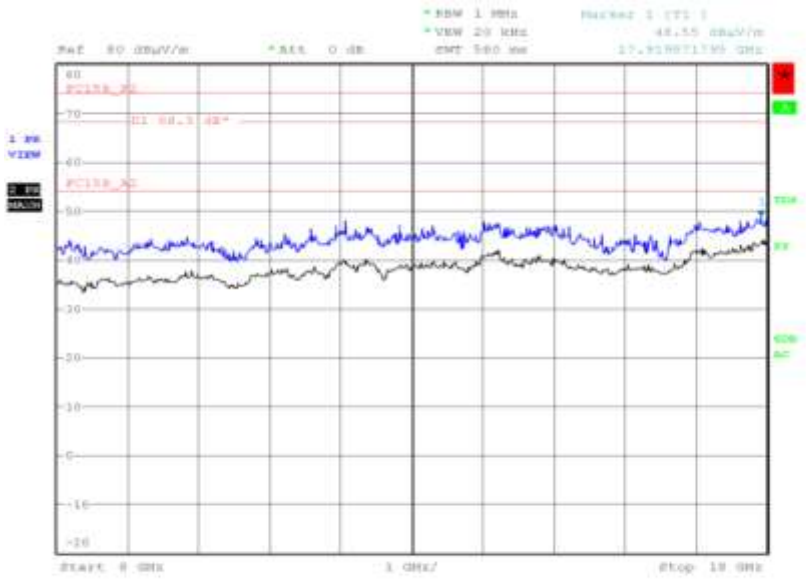
1 GHz to 7 GHz



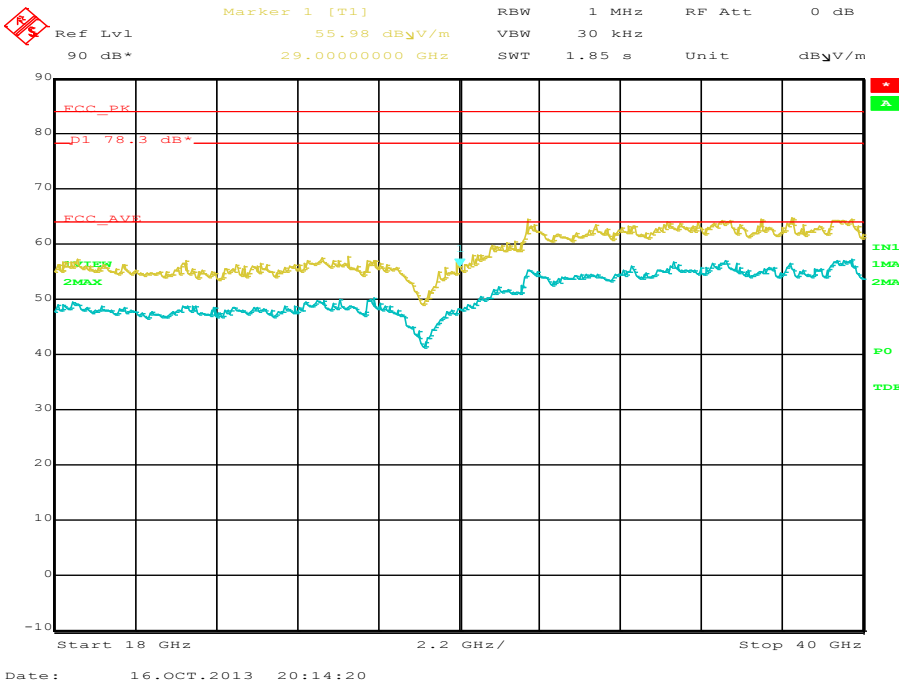
7 GHz to 8 GHz



8 GHz to 18 GHz



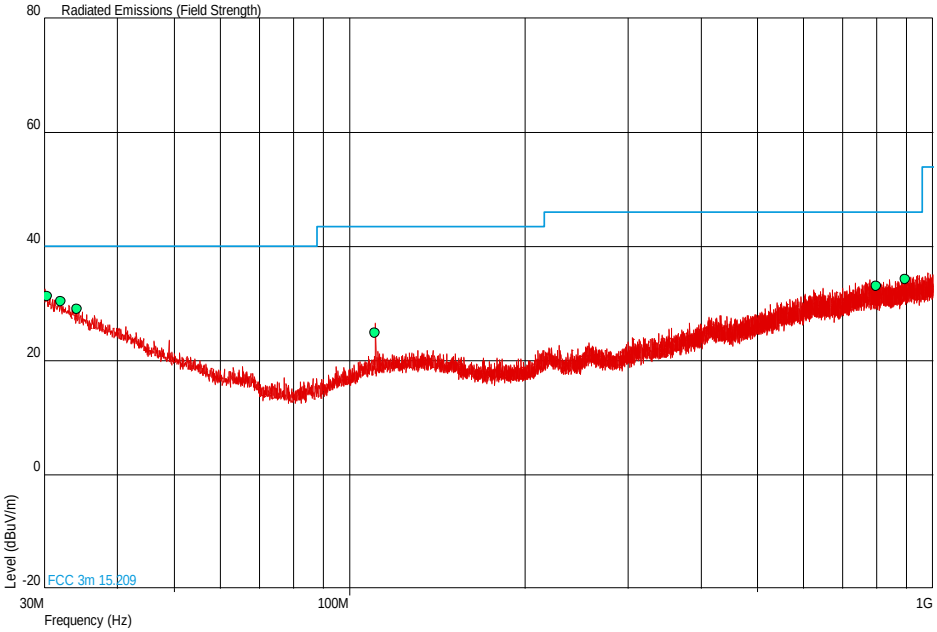
18 GHz to 40 GHz



Frequency Band 3

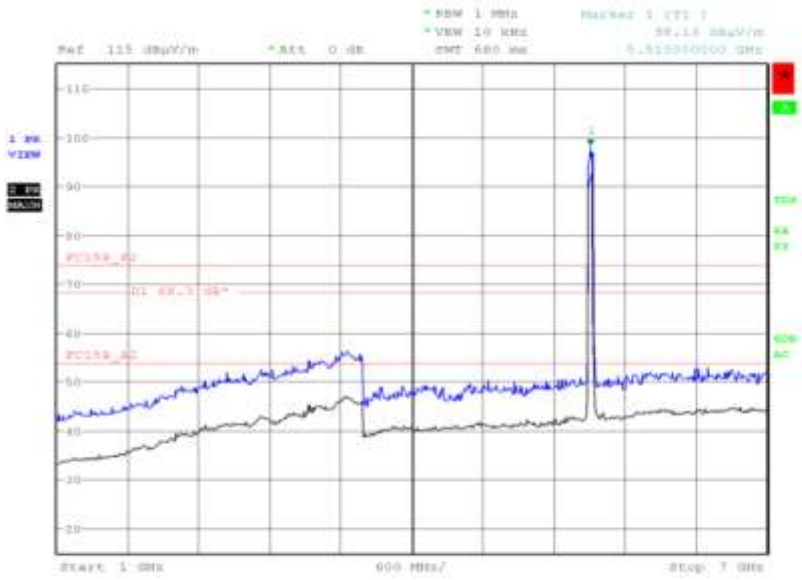
5510 MHz

30 MHz to 1 GHz

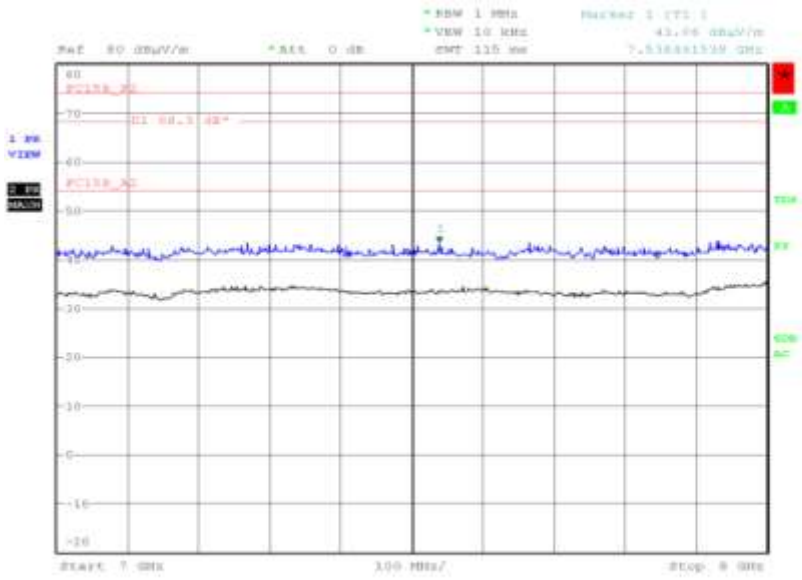


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.388	31.3	36.7	40.0	100	-8.7	63.3	0	1.00	Vertical
32.037	30.4	33.1	40.0	100	-9.6	66.9	180	1.00	Horizontal
34.123	29.0	28.2	40.0	100	-11.0	71.8	0	1.00	Horizontal
110.753	24.8	17.4	43.5	150	-18.7	132.6	0	1.00	Vertical
800.908	33.0	44.7	46.0	200	-13.0	155.3	180	1.00	Vertical
897.520	34.2	51.3	46.0	200	-11.8	148.7	0	1.00	Vertical

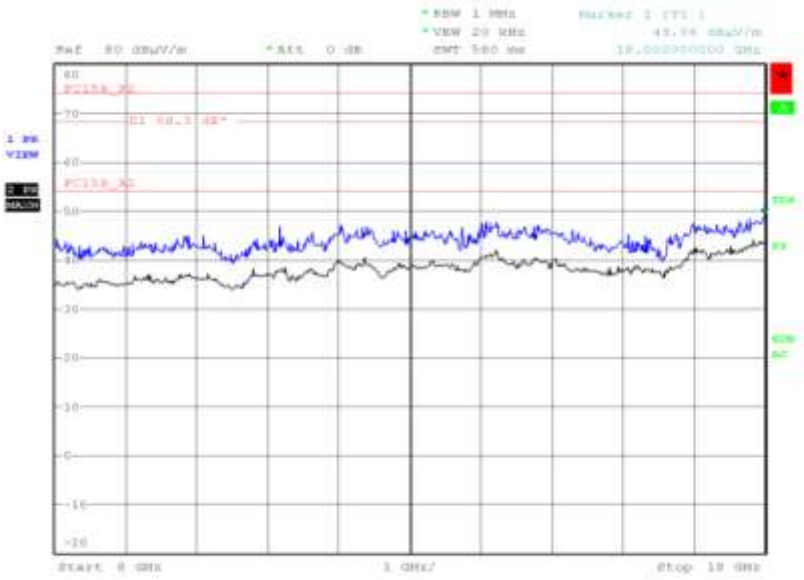
1 GHz to 7 GHz



7 GHz to 8 GHz

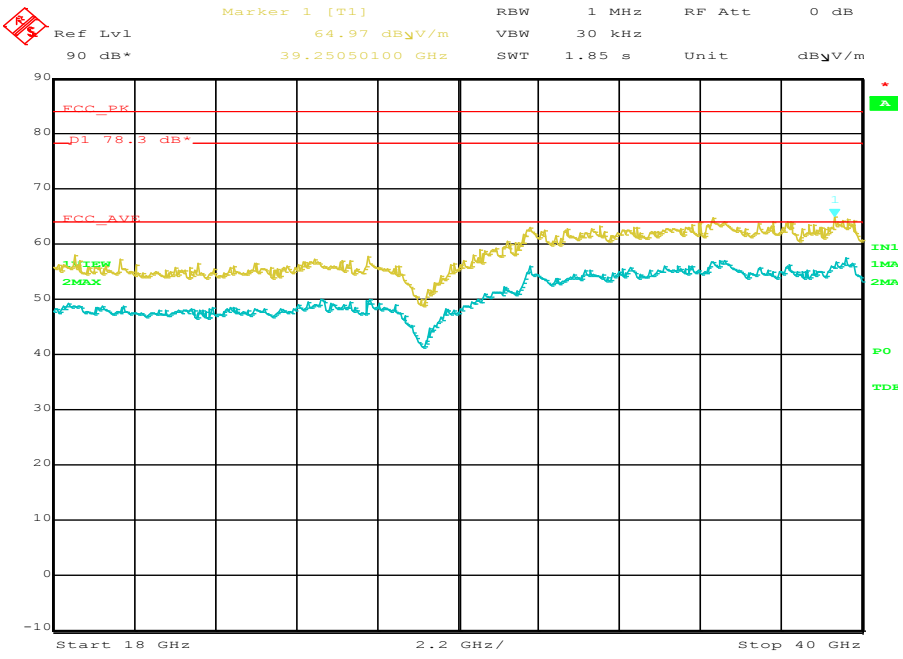


8 GHz to 18 GHz



Date: 1.OCT.2013 19:54:29

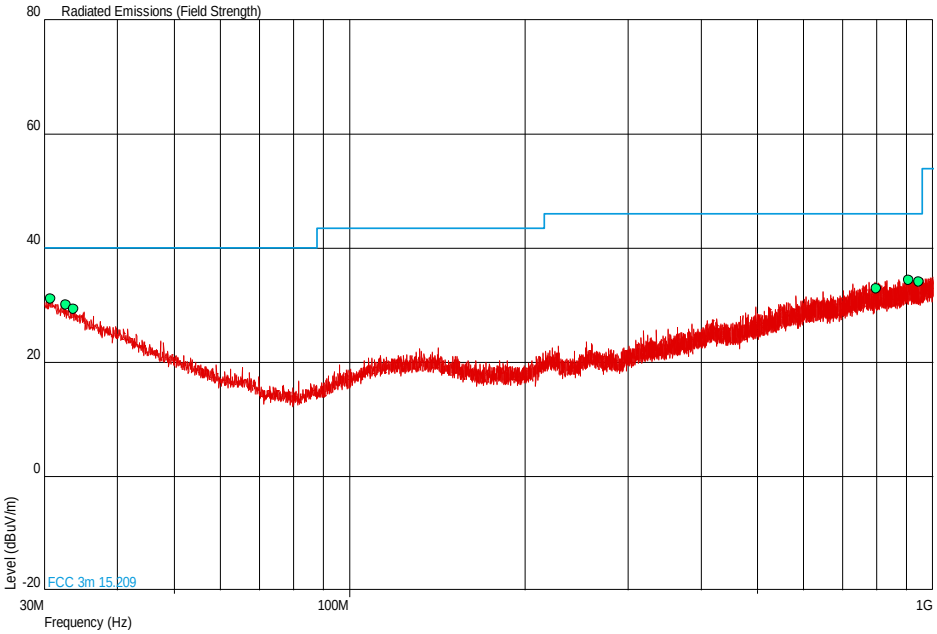
18 GHz to 40 GHz



Date: 16.OCT.2013 20:21:45

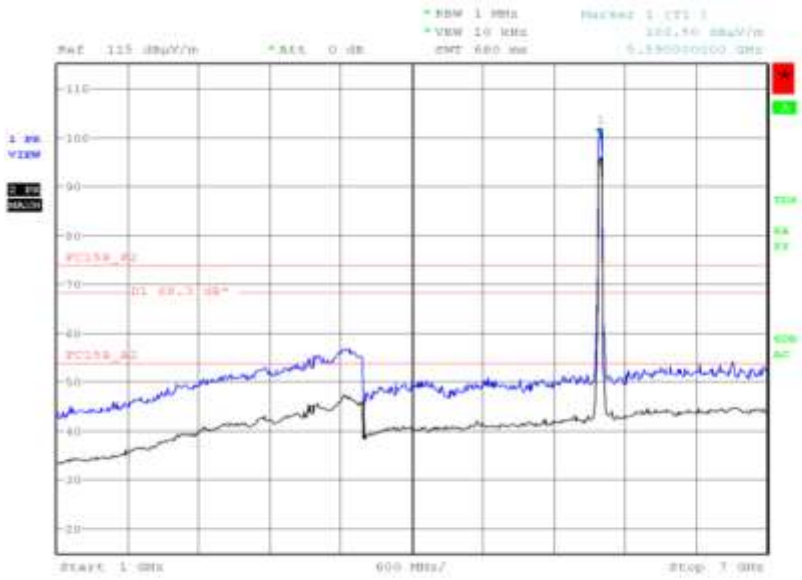
5590 MHz

30 MHz to 1 GHz

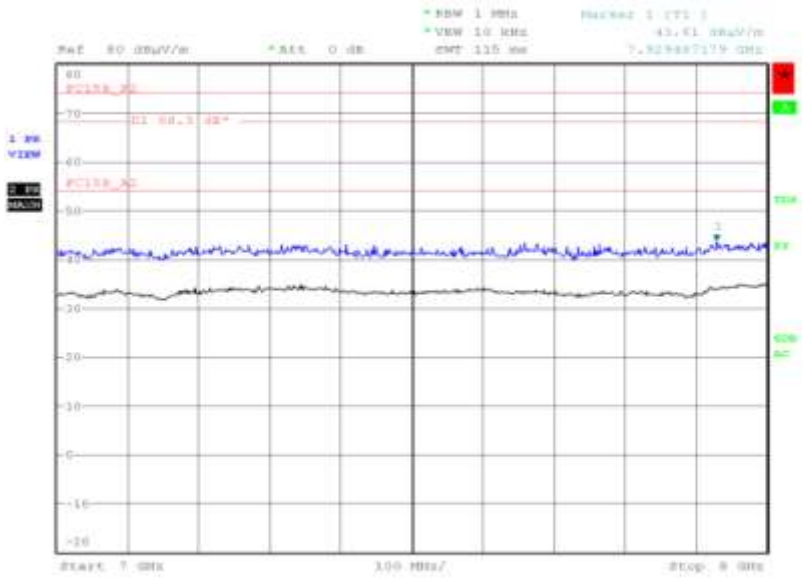


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.776	31.1	35.9	40.0	100	-8.9	64.1	180	1.00	Horizontal
32.716	30.0	31.6	40.0	100	-10.0	68.4	180	1.00	Vertical
33.638	29.3	29.2	40.0	100	-10.7	70.8	180	1.00	Horizontal
800.083	33.0	44.7	46.0	200	-13.0	155.3	180	1.00	Horizontal
908.966	34.3	51.9	46.0	200	-11.7	148.1	0	1.00	Vertical
944.516	34.1	50.7	46.0	200	-11.9	149.3	0	1.00	Horizontal

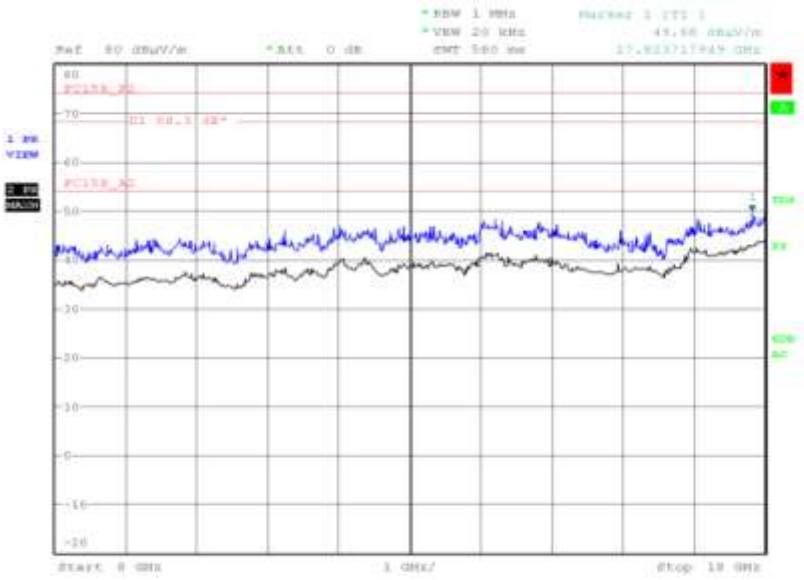
1 GHz to 7 GHz



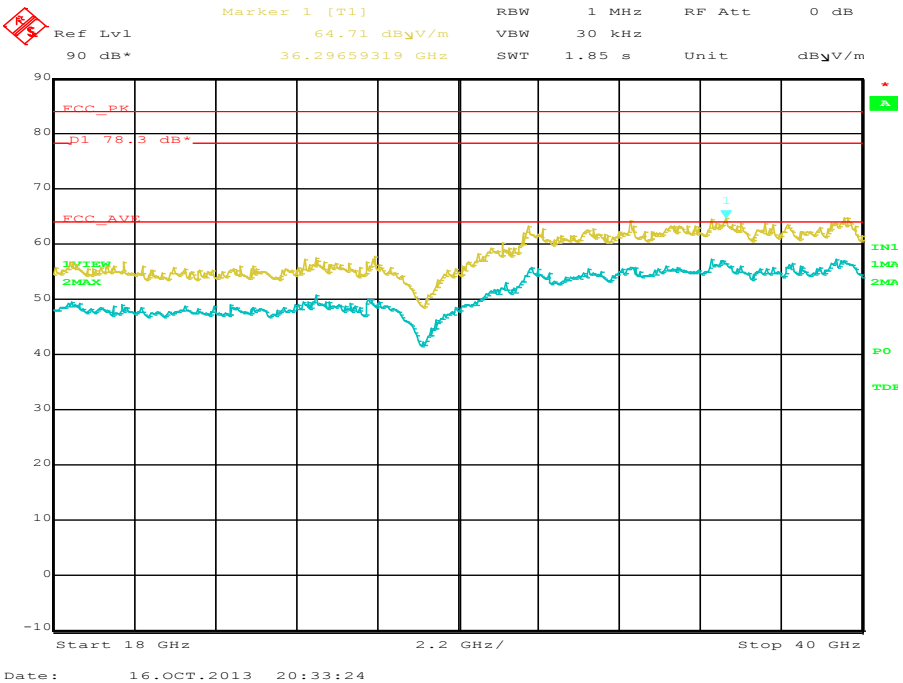
7 GHz to 8 GHz



8 GHz to 18 GHz

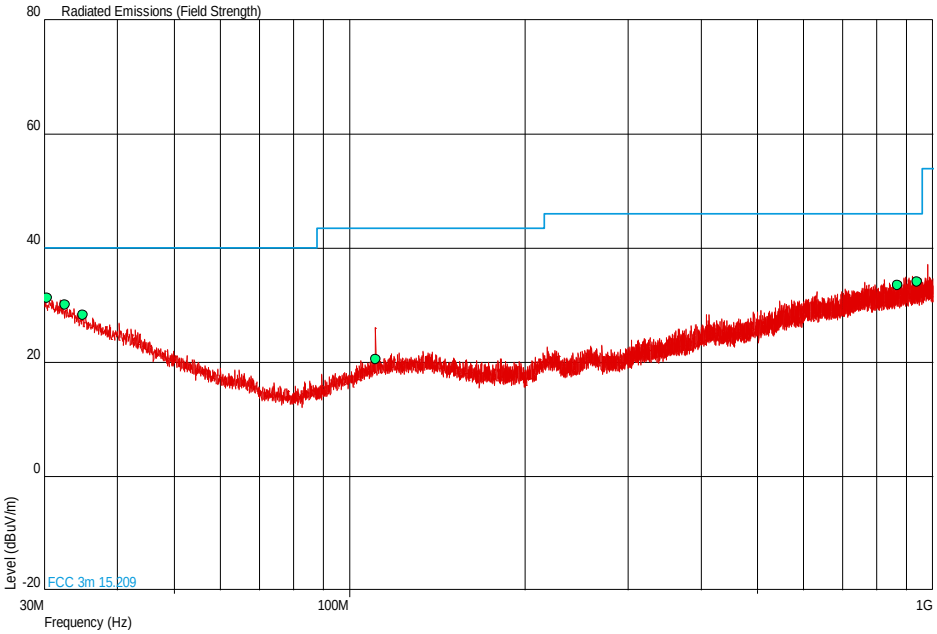


18 GHz to 40 GHz



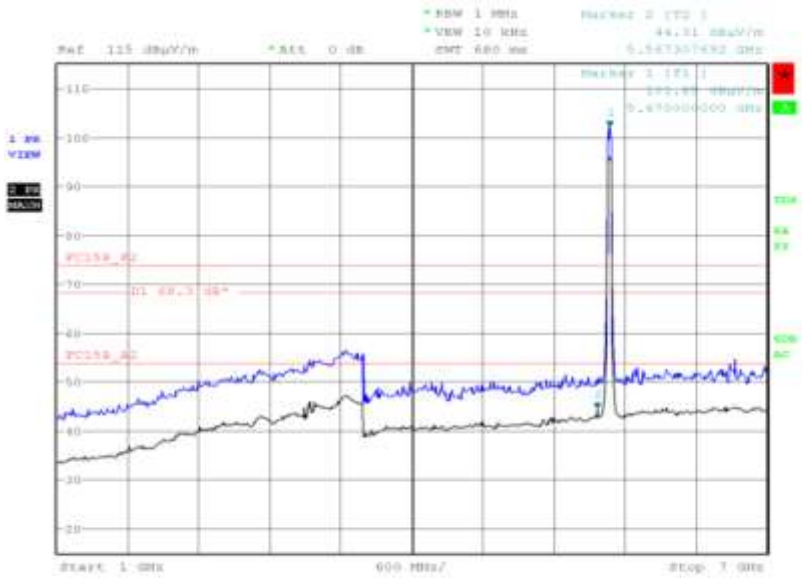
5670 MHz

30 MHz to 1 GHz

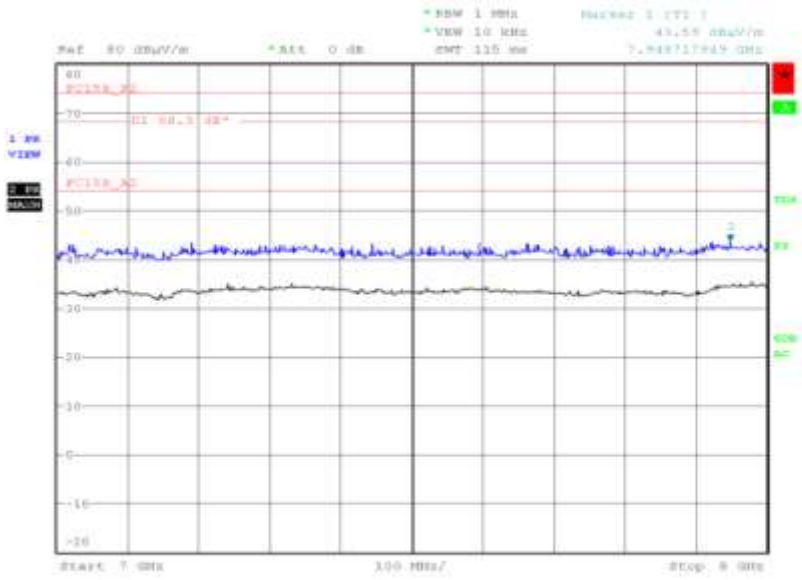


Frequency (MHz)	QP Level (dBµV/m)	QP Level (µV/m)	QP Limit (dBµV/m)	QP Limit (µV/m)	QP Margin (dBµV/m)	QP Margin (µV/m)	Angle (Deg)	Height (m)	Polarity
30.388	31.3	36.7	40.0	100	-8.7	63.3	180	1.00	Horizontal
32.619	30.0	31.6	40.0	100	-10.0	68.4	180	1.00	Vertical
34.996	28.3	26.0	40.0	100	-11.7	74.0	180	1.00	Vertical
110.851	20.6	10.7	43.5	150	-22.9	139.3	180	1.00	Vertical
869.584	33.6	47.9	46.0	200	-12.4	152.1	0	1.00	Horizontal
938.357	34.1	50.7	46.0	200	-11.9	149.3	0	1.00	Horizontal

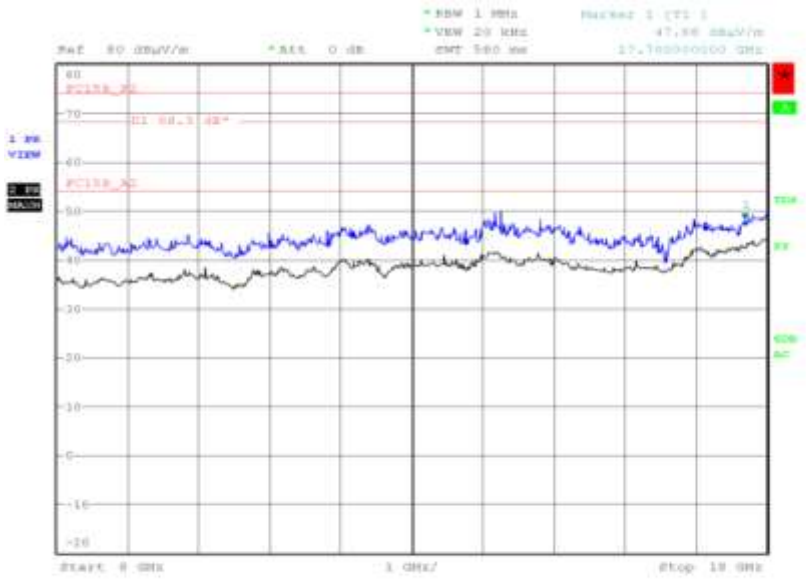
1 GHz to 7 GHz



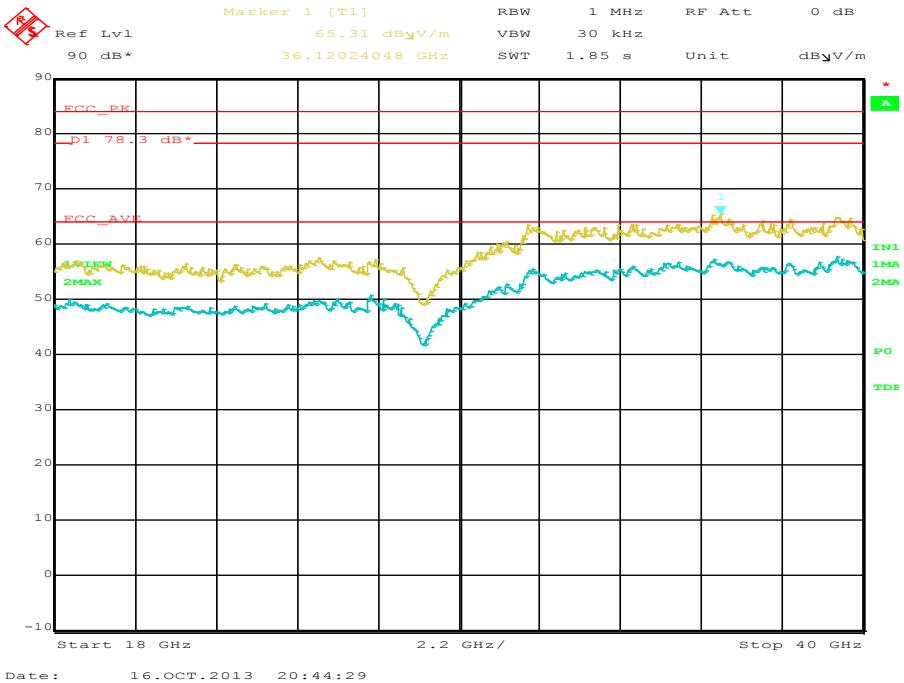
7 GHz to 8 GHz



8 GHz to 18 GHz



18 GHz to 40 GHz



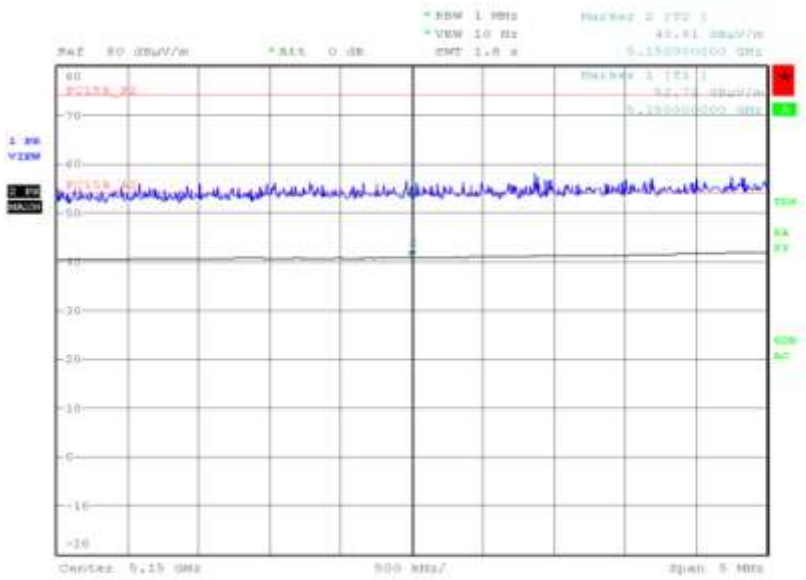
Limit

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

Band Edge Emissions

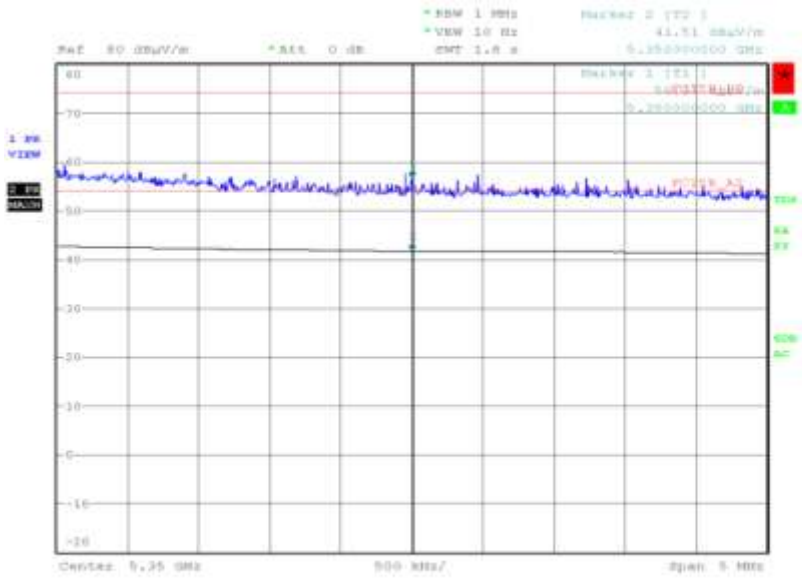
5190 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	52.72	40.61



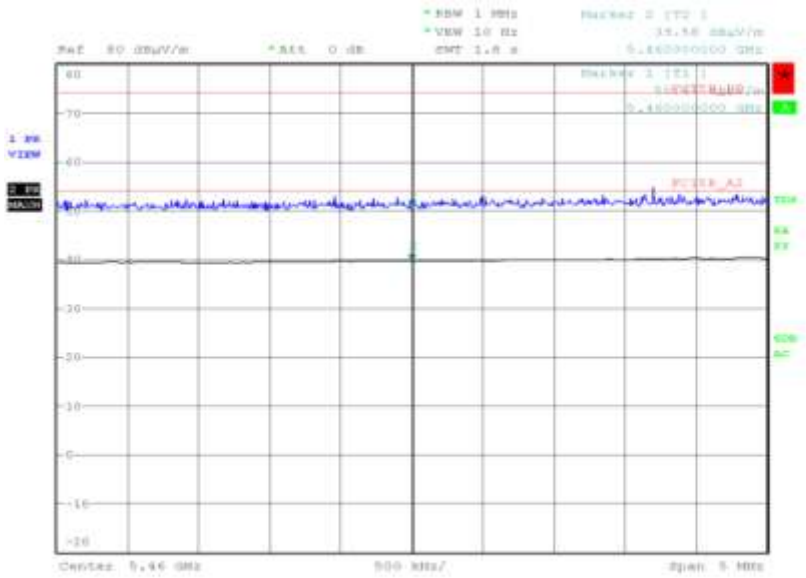
5310 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	56.37	41.51



5510 MHz

Polarisation	Final Peak (dBµV/m)	Final Average (dBµV/m)
Vertical	50.67	39.58



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

SHL23 S/N: IMEI 004401114893148 - Modification State 0

2.4.3 Date of Test

17 October 2013 & 18 October 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

2.4.6 The EUT was set to transmit on maximum power. In accordance with 2.1055, the temperature was varied from +55°C to -10°C in 10° steps. Testing was performed on bottom/middle/top channels of each sub band where applicable.

This test was performed with the transmitter modulated.

2.4.7 Environmental Conditions

Ambient Temperature	24.8°C
Relative Humidity	49.4%

2.4.8 Test Results

802.11(ac) - 5 GHz 40 MHz BW FCC

4.0 V DC Supply

Frequency Band 1

Hand Carried Battery Powered

Temperature Interval	Supply Voltage	Frequency Error (ppm)	
		5190 MHz	5230 MHz
-10°C	4.0 V DC	-1.45	-1.43
	3.7 V DC	-0.72	-1.20
0°C	4.0 V DC	-3.13	-2.87
	3.7 V DC	-1.42	-1.91
+10°C	4.0 V DC	-5.30	-5.74
	3.7 V DC	-5.54	-5.74
+20°C	4.0 V DC	-11.58	-11.28
	3.7 V DC	-10.50	-10.42
	4.0 V DC	-11.58	-11.28
-30°C	4.0 V DC	-10.12	-10.52
	3.7 V DC	-10.60	-9.94
+40°C	4.0 V DC	-10.84	-11.23
	3.7 V DC	-11.32	-11.23
+50°C	4.0 V DC	-11.56	-11.95
	3.7 V DC	-11.75	-12.19
+55°C	4.0 V DC	-12.04	-12.43
	3.7 V DC	-12.04	-12.67
Maximum Frequency Error (ppm)		-12.43	-12.67

Frequency Band 2

Hand Carried Battery Powered

Temperature Interval	Supply Voltage	Frequency Error (ppm)	
		5270 MHz	5310 MHz
-10°C	4.0 V DC	-1.19	-1.18
	3.7 V DC	-0.95	-0.94
0°C	4.0 V DC	-3.08	-3.06
	3.7 V DC	-2.61	-2.82
+10°C	4.0 V DC	-6.17	-6.12
	3.7 V DC	-5.93	-5.65
+20°C	4.0 V DC	-10.86	-10.93
	3.7 V DC	-10.49	-10.56
	4.0 V DC	-10.86	-10.93
-30°C	4.0 V DC	-10.44	-10.59
	3.7 V DC	-10.20	-10.36
+40°C	4.0 V DC	-11.15	-10.83
	3.7 V DC	-11.39	-11.06
+50°C	4.0 V DC	-11.62	-11.30
	3.7 V DC	-11.86	-11.70
+55°C	4.0 V DC	-12.10	-11.77
	3.7 V DC	-12.33	-12.24
Maximum Frequency Error (ppm)		-12.10	-12.24

Frequency Band 3

Hand Carried Battery Powered

Temperature Interval	Supply Voltage	Frequency Error (ppm)	
		5510 MHz	5670 MHz
-10°C	4.0 V DC	-0.91	-0.44
	3.7 V DC	-0.45	-0.66
0°C	4.0 V DC	-2.50	-2.87
	3.7 V DC	-2.72	0.88
+10°C	4.0 V DC	-5.67	-5.51
	3.7 V DC	-5.67	-5.07
+20°C	4.0 V DC	-10.59	-9.90
	3.7 V DC	-10.62	-9.89
	4.0 V DC	-10.59	-9.89
-30°C	4.0 V DC	-9.98	-9.92
	3.7 V DC	-10.21	-10.06
+40°C	4.0 V DC	-10.89	-10.58
	3.7 V DC	-10.66	-10.50
+50°C	4.0 V DC	-11.57	-11.46
	3.7 V DC	-11.34	-11.02
+55°C	4.0 V DC	-12.02	-11.90
	3.7 V DC	-11.80	-11.46
Maximum Frequency Error (ppm)		-12.02	-11.46

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

SHL23 S/N: IMEI 004401114893148 - Modification State 0

2.5.3 Date of Test

15 October 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 as shown in the plots. The peak of the signal was found and the markers were positioned to the -26dBc points. The difference between the markers was calculated to give the result.

2.5.6 Environmental Conditions

Ambient Temperature	23.8°C
Relative Humidity	36.1%

Product Service

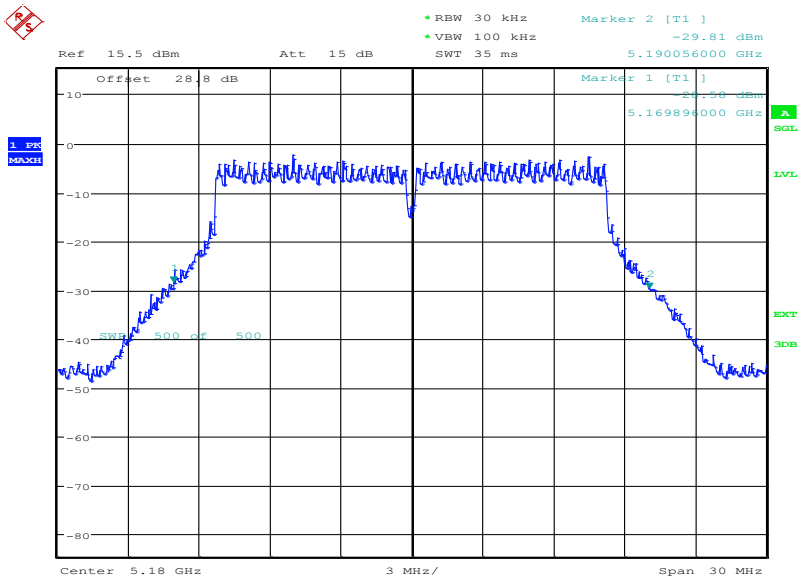
2.5.7 Test Results

802.11(a)

Frequency Band 1

5180 MHz

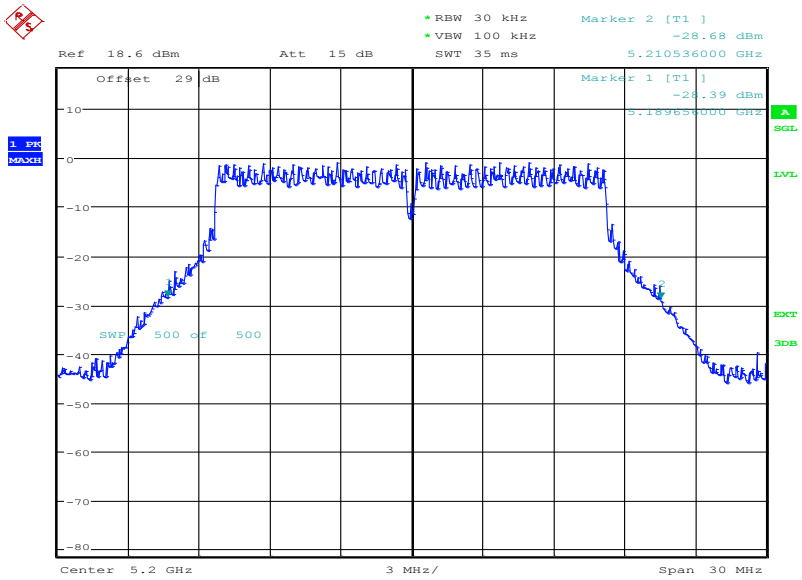
26 dB Bandwidth (MHz)	20.160



Date: 15.OCT.2013 11:24:34

5200 MHz

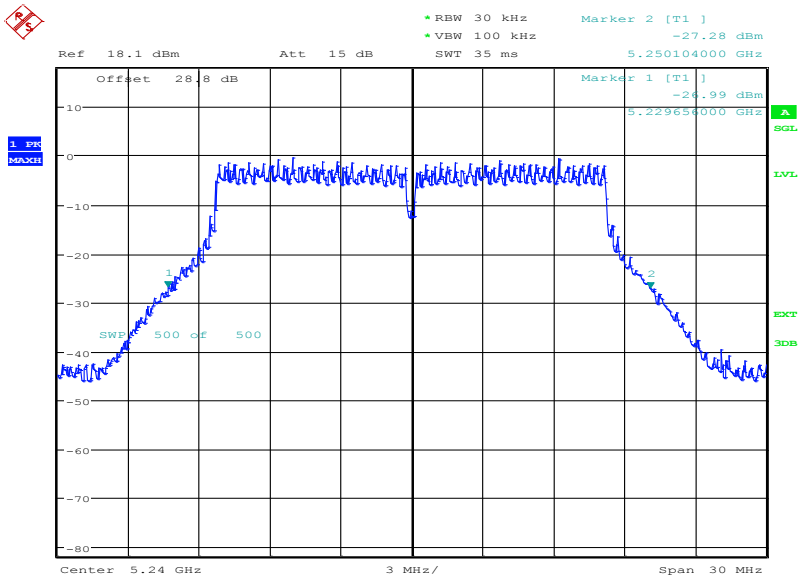
26 dB Bandwidth (MHz)	20.880



Date: 15.OCT.2013 11:26:16

5240 MHz

26 dB Bandwidth (MHz)	20.448



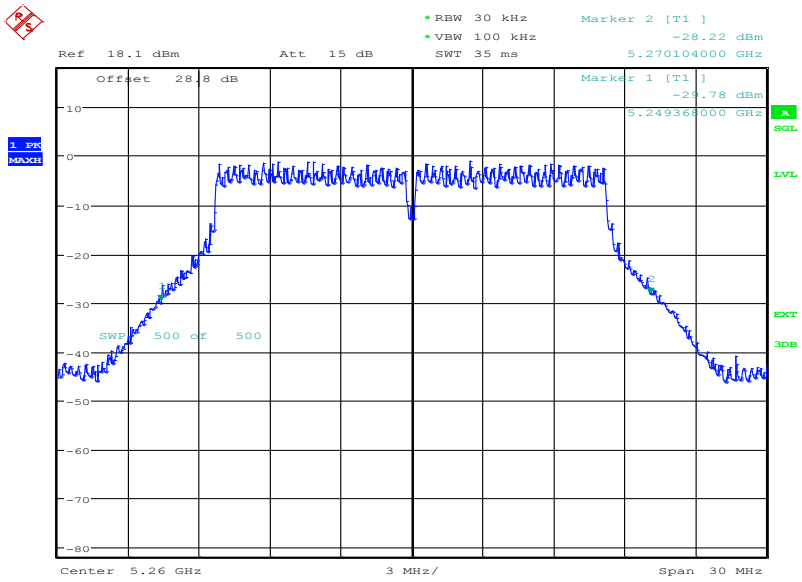
Date: 15.OCT.2013 11:29:53

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

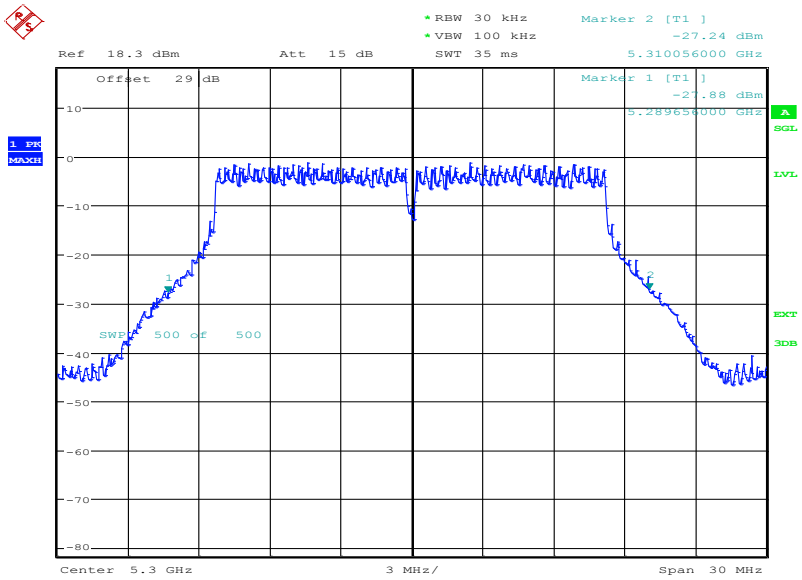
26 dB Bandwidth (MHz)	20.736



Date: 15.OCT.2013 11:16:19

5300 MHz

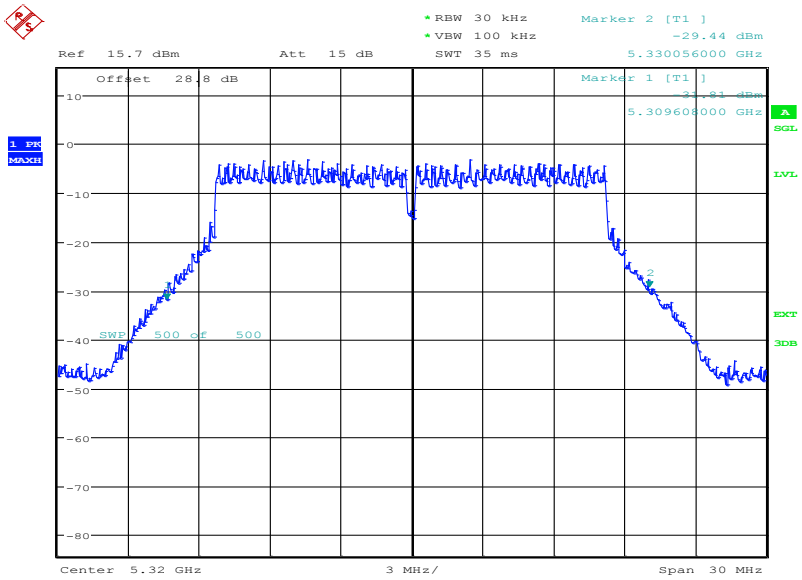
26 dB Bandwidth (MHz)	20.400



Date: 15.OCT.2013 11:18:16

5320 MHz

26 dB Bandwidth (MHz)	20.448



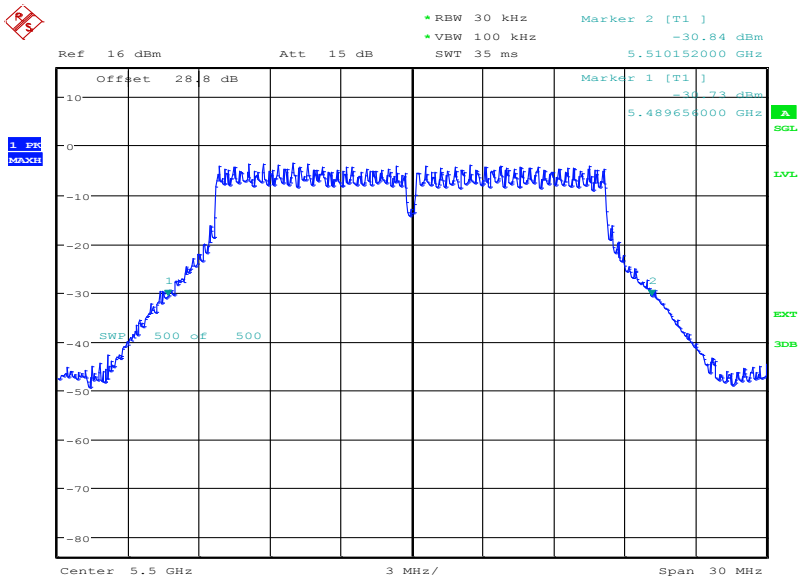
Date: 15.OCT.2013 11:19:42

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

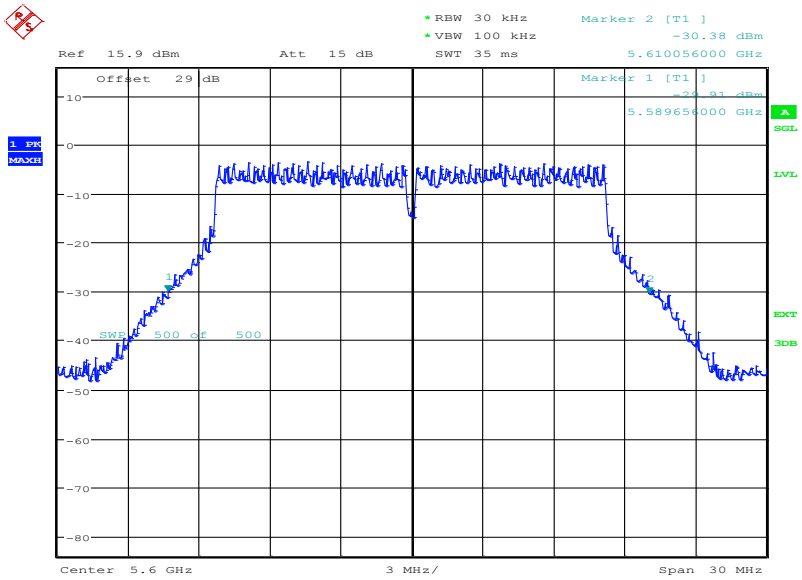
26 dB Bandwidth (MHz)	20.496



Date: 15.OCT.2013 11:32:11

5600 MHz

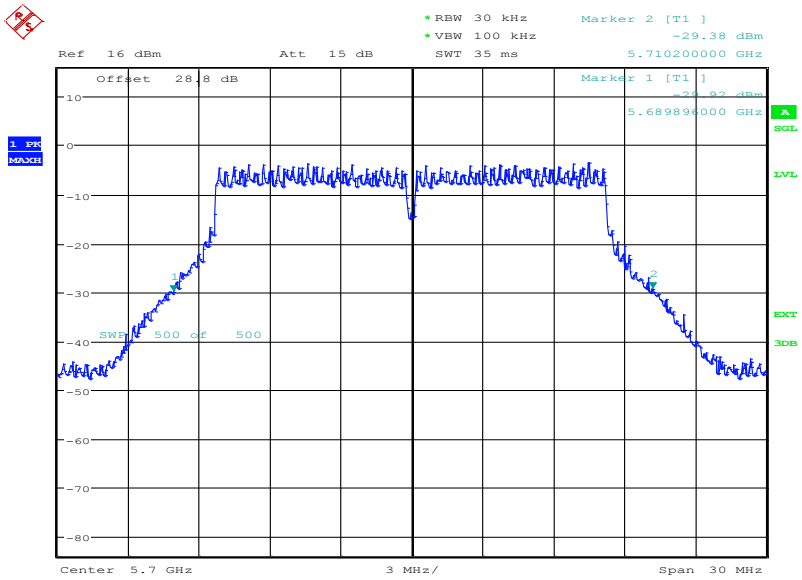
26 dB Bandwidth (MHz)	20.400



Date: 15.OCT.2013 11:33:37

5700 MHz

26 dB Bandwidth (MHz)	20.304



Date: 15.OCT.2013 11:34:55

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

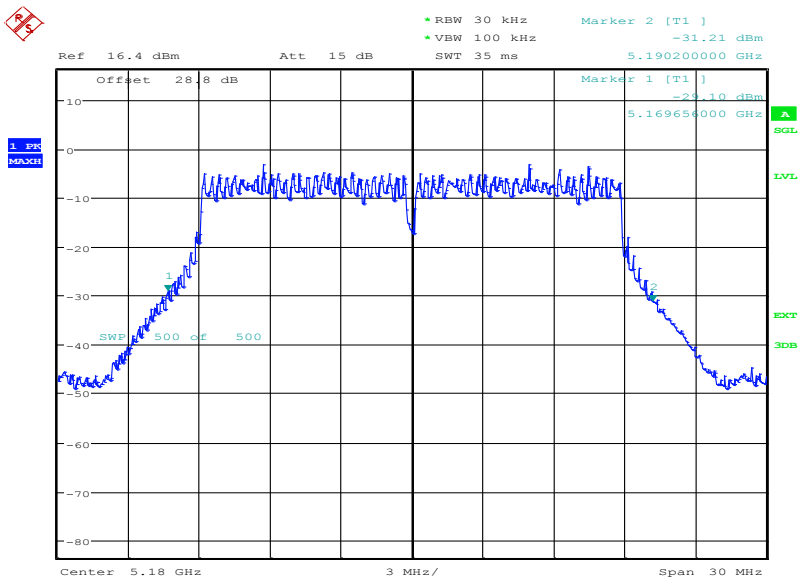
Not specified.

802.11(ac) - 5 GHz 20 MHz BW FCC

Frequency Band 1

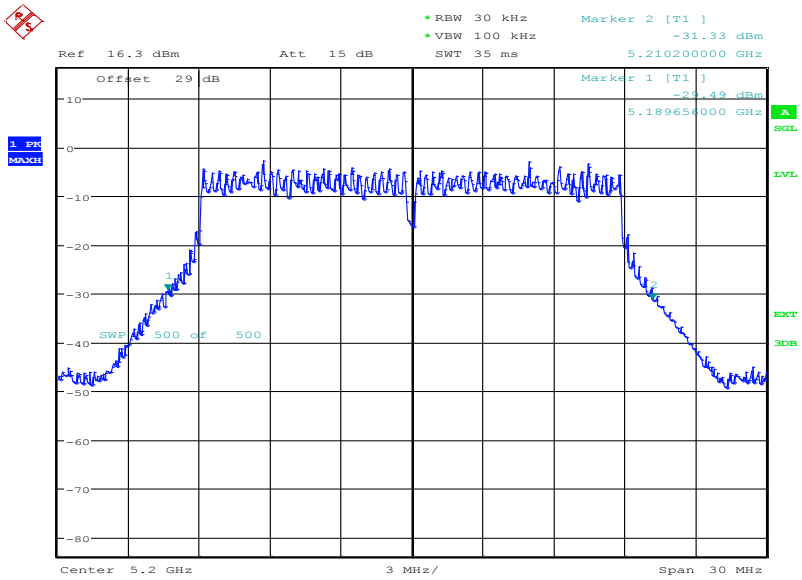
5180 MHz

26 dB Bandwidth (MHz)	20.544



5200 MHz

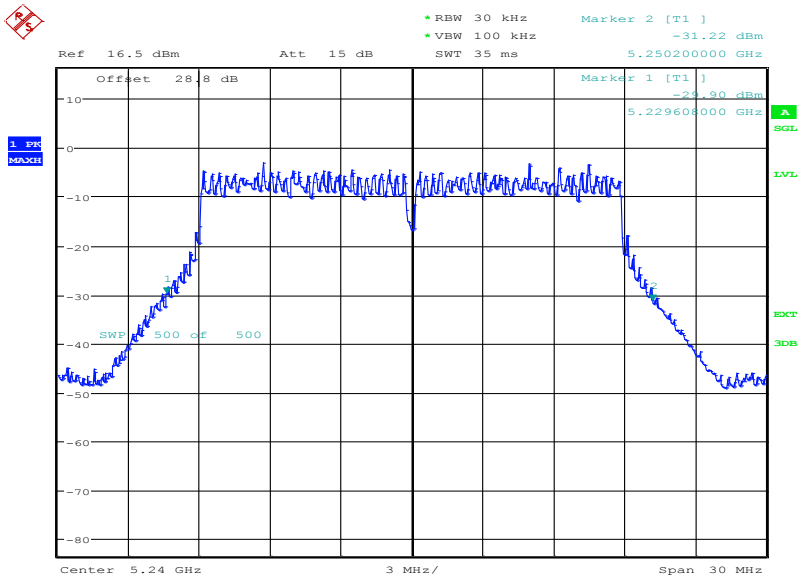
26 dB Bandwidth (MHz)	20.544



Date: 15.OCT.2013 12:50:26

5240 MHz

26 dB Bandwidth (MHz)	20.592



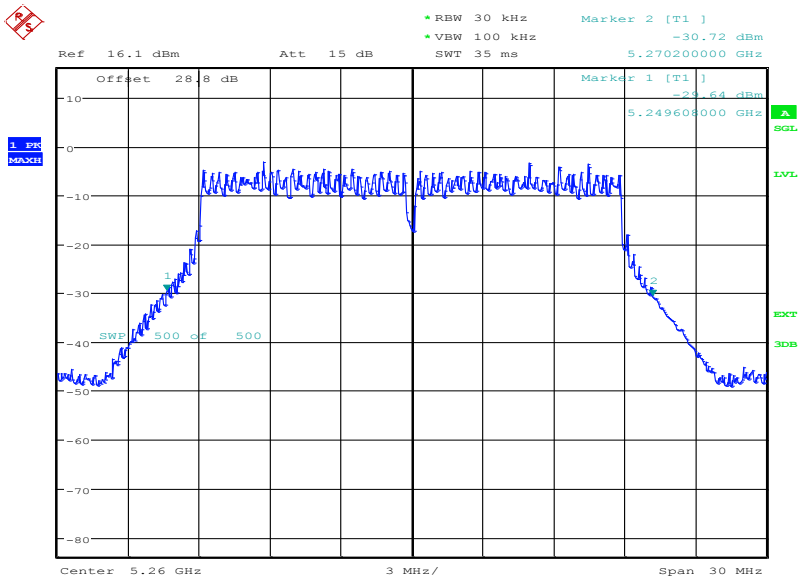
Date: 15.OCT.2013 12:52:37

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 MCS0.

Frequency Band 2

5260 MHz

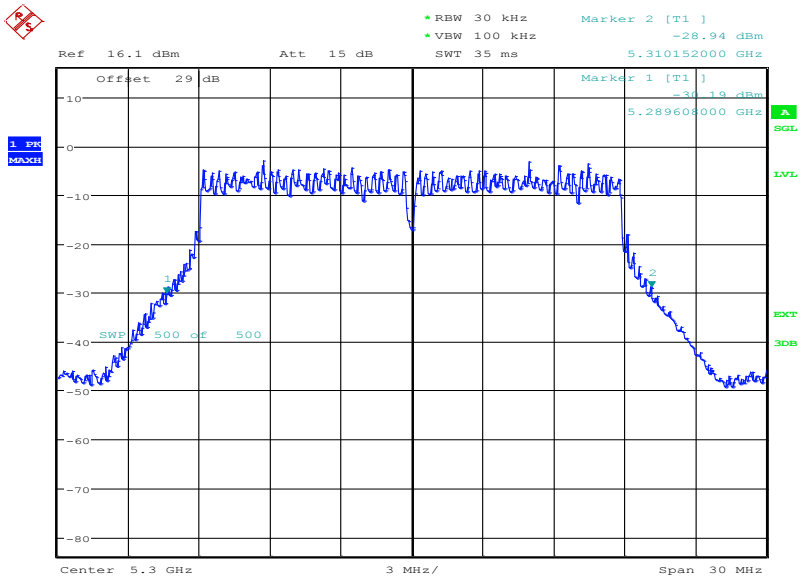
26 dB Bandwidth (MHz)	20.592



Date: 15.OCT.2013 12:54:42

5300 MHz

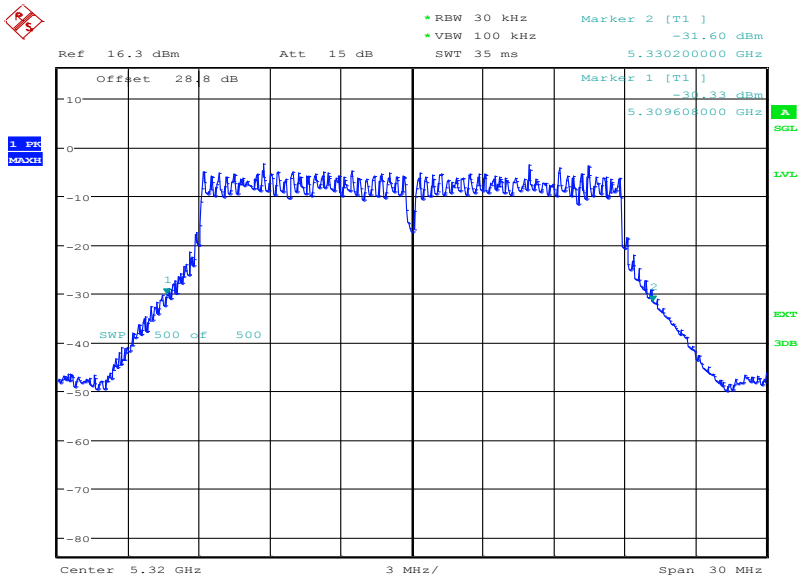
26 dB Bandwidth (MHz)	20.544



Date: 15.OCT.2013 12:56:27

5320 MHz

26 dB Bandwidth (MHz)	20.592



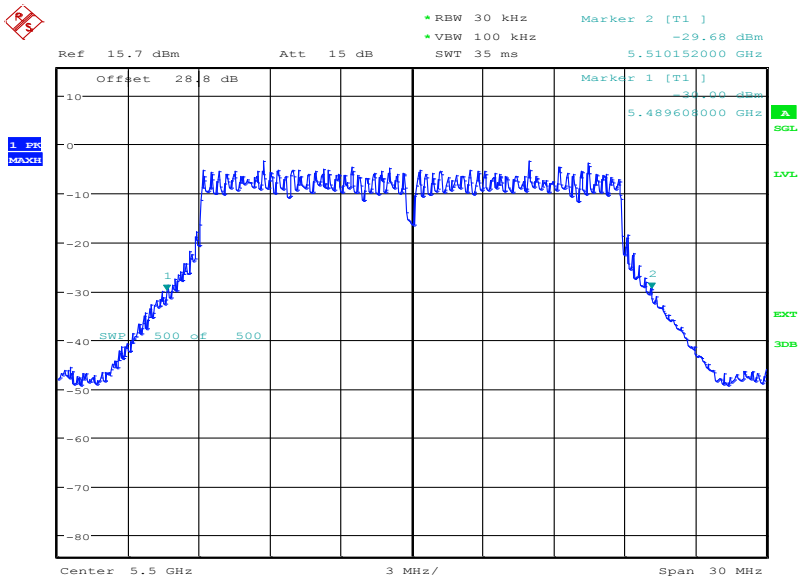
Date: 15.OCT.2013 12:57:45

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 MCS0.

Frequency Band 3

5500 MHz

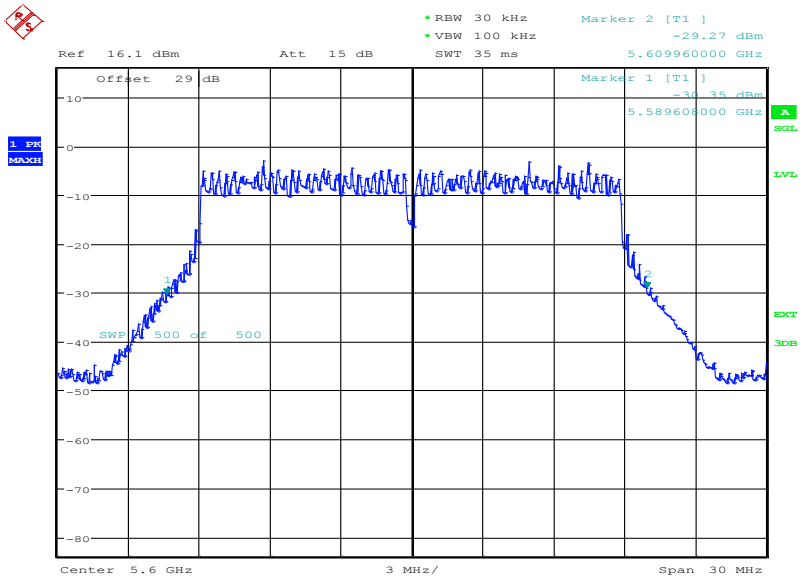
26 dB Bandwidth (MHz)	20.544



Date: 15.OCT.2013 12:59:55

5600 MHz

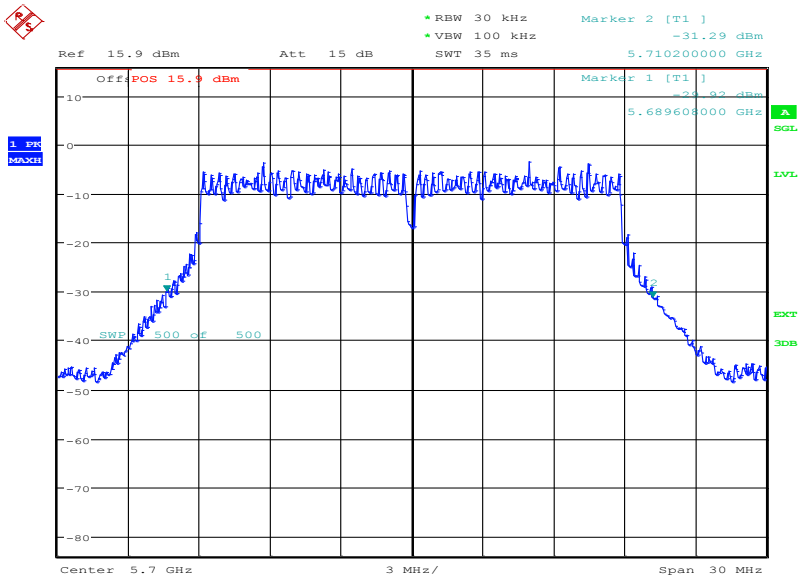
26 dB Bandwidth (MHz)	20.352



Date: 15.OCT.2013 13:01:04

5700 MHz

26 dB Bandwidth (MHz)	20.592



Date: 15.OCT.2013 13:02:34

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 MCS0.

Limit

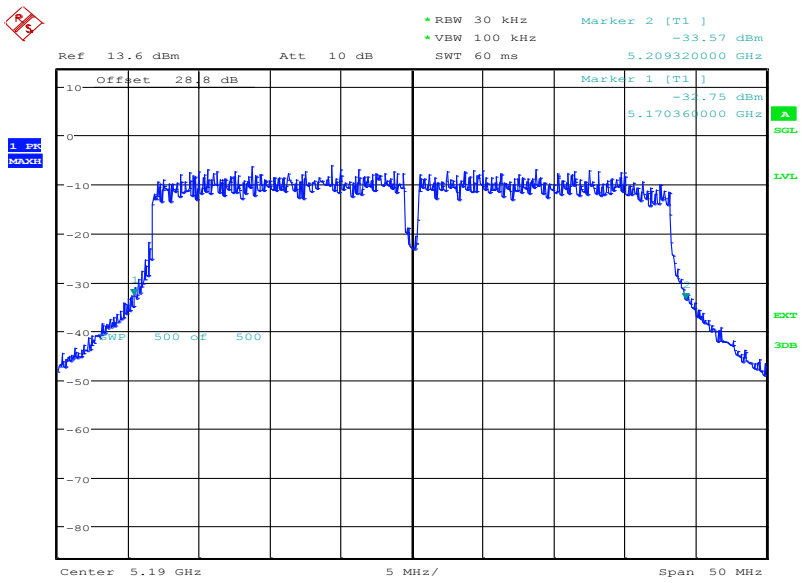
Not specified.

802.11(ac) - 5 GHz 40 MHz BW FCC

Frequency Band 1

5190 MHz

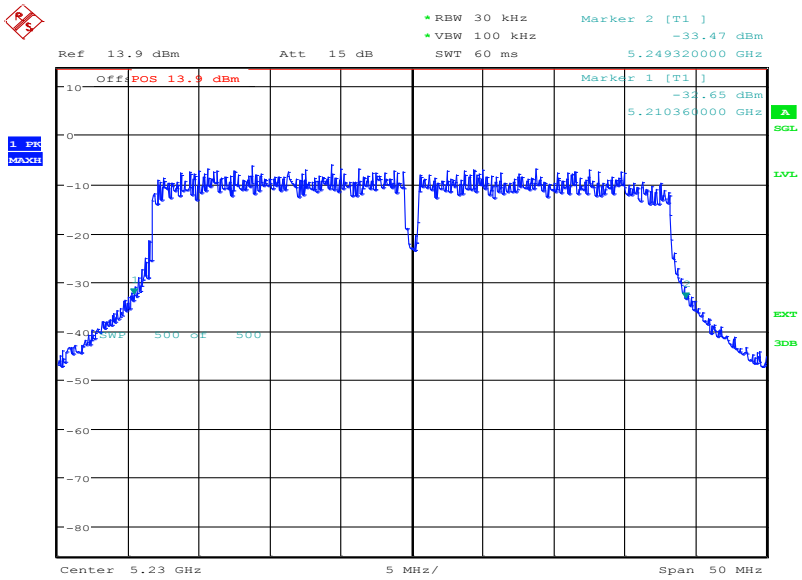
26 dB Bandwidth (MHz)	38.960



Date: 15.OCT.2013 13:52:33

5230 MHz

26 dB Bandwidth (MHz)	38.960



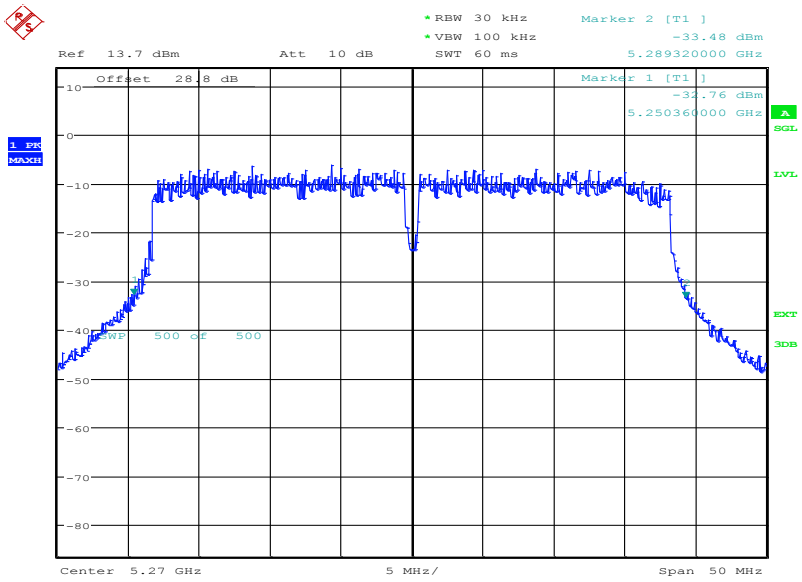
Date: 15.OCT.2013 13:54:18

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 MCS0.

Frequency Band 2

5270 MHz

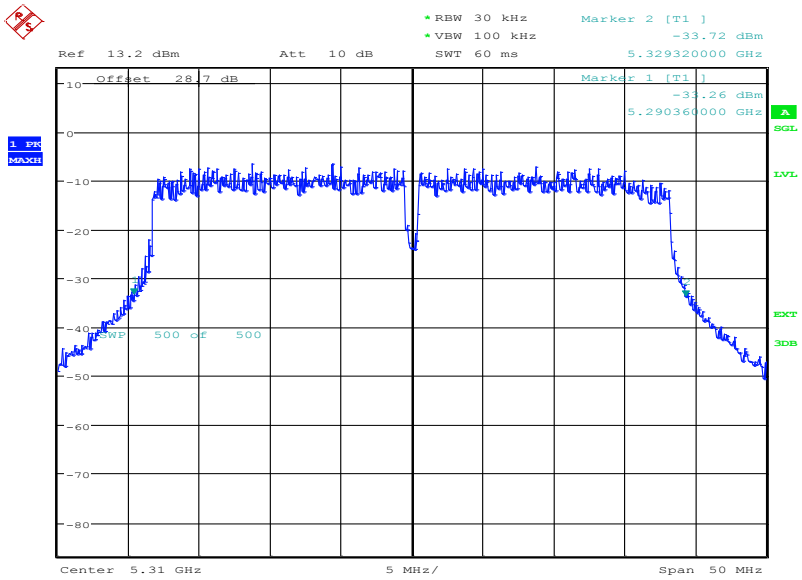
26 dB Bandwidth (MHz)	38.960



Date: 15.OCT.2013 13:56:57

5310 MHz

26 dB Bandwidth (MHz)	38.960



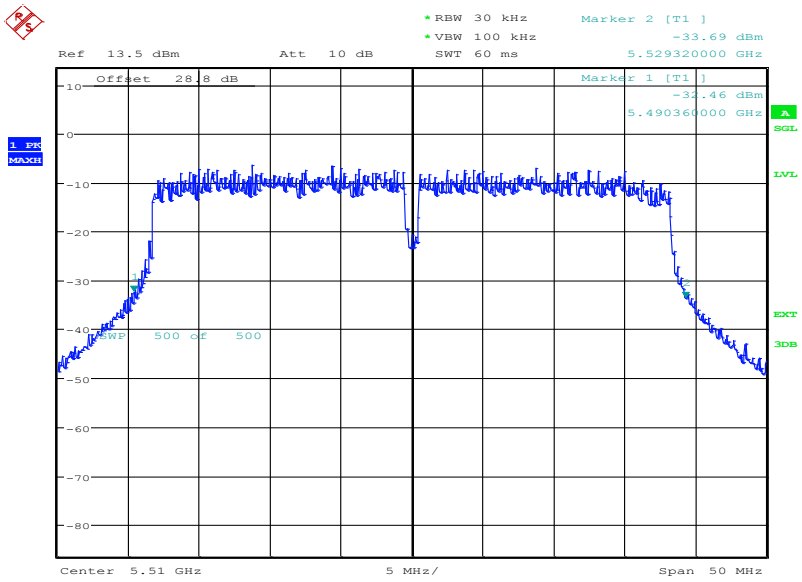
Date: 15.OCT.2013 13:58:53

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 MCS0.

Frequency Band 3

5510 MHz

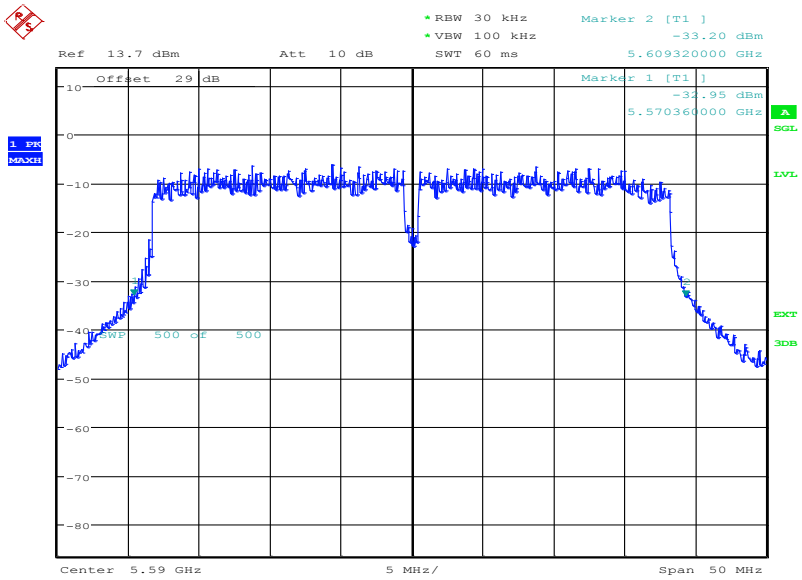
26 dB Bandwidth (MHz)	38.960



Date: 15.OCT.2013 14:01:14

5590 MHz

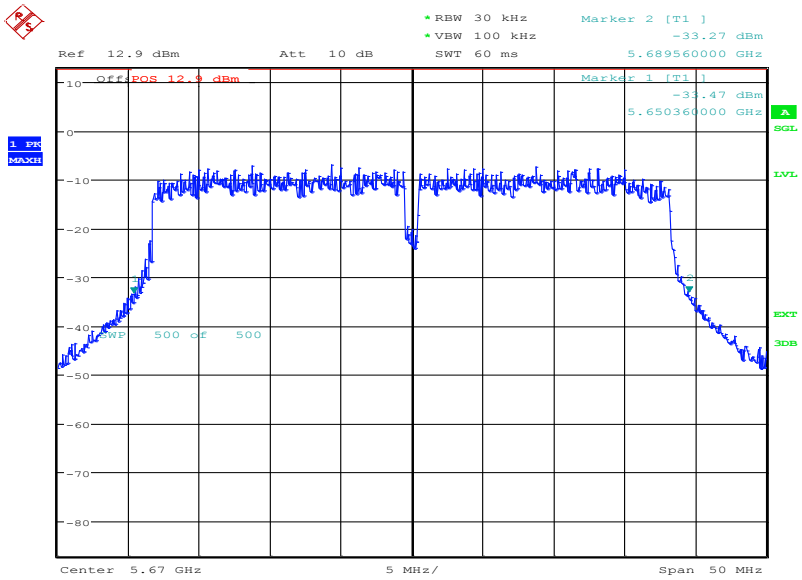
26 dB Bandwidth (MHz)	38.960



Date: 15.OCT.2013 14:02:42

5670 MHz

26 dB Bandwidth (MHz)	39.200



Date: 15.OCT.2013 14:04:33

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 MCS0.

Limit

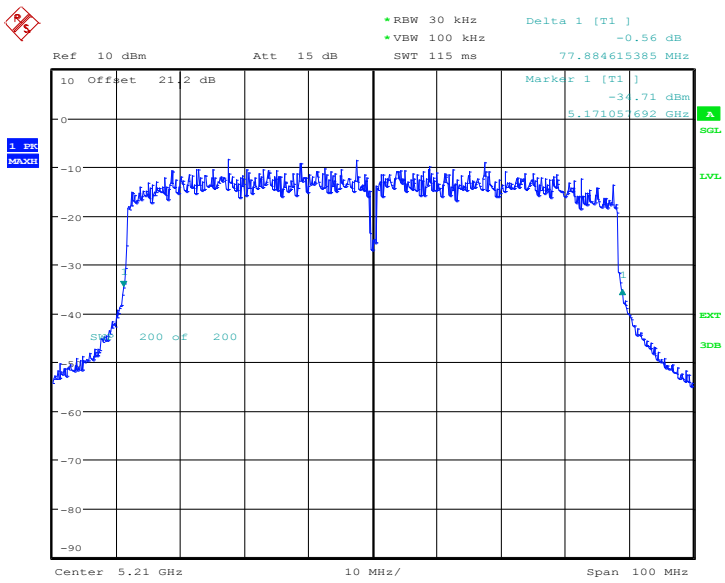
Not specified.

802.11(ac) - 5 GHz 80 MHz BW FCC

Frequency Band 1

5210 MHz

26 dB Bandwidth (MHz)	77.88



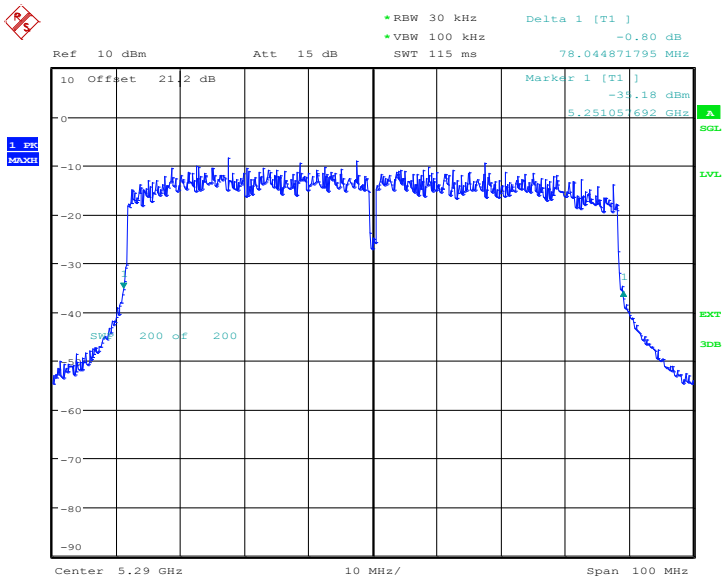
Date: 18.OCT.2013 17:03:30

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 MCS0.

Frequency Band 2

5290 MHz

26 dB Bandwidth (MHz)	78.04



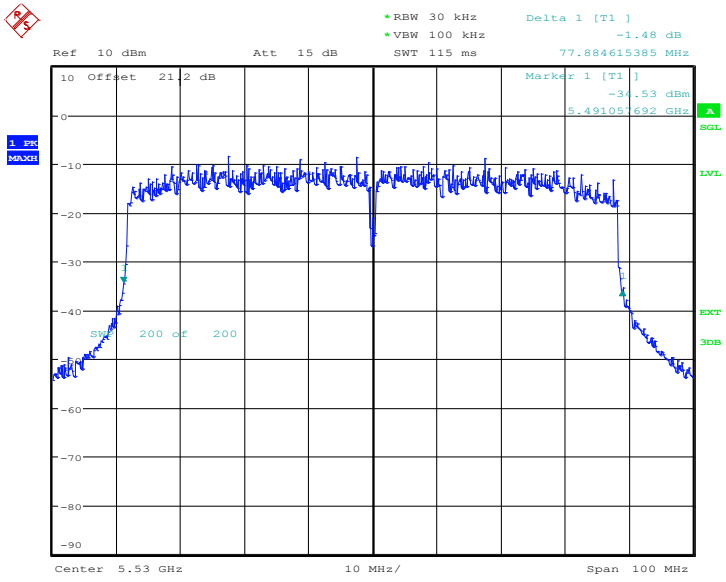
Date: 18.OCT.2013 17:01:46

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 MCS0.

Frequency Band 3

5530 MHz

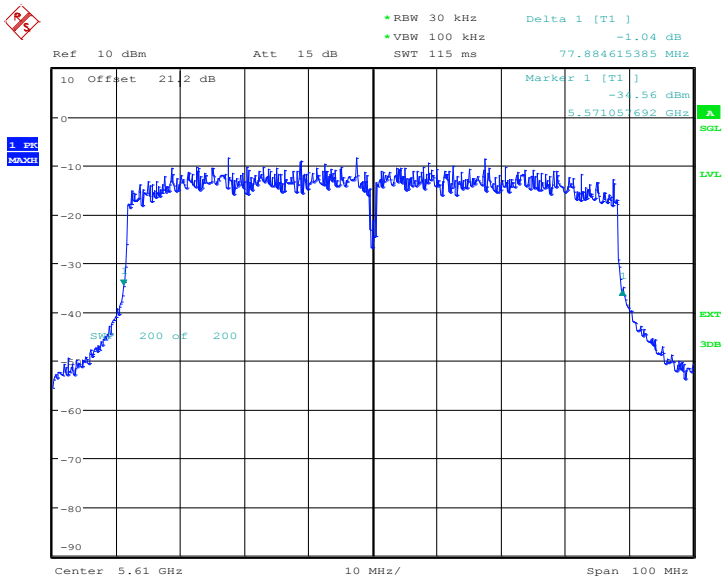
26 dB Bandwidth (MHz)	77.88



Date: 18.OCT.2013 17:05:04

5610 MHz

26 dB Bandwidth (MHz)	77.88



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 MCS0.

Limit

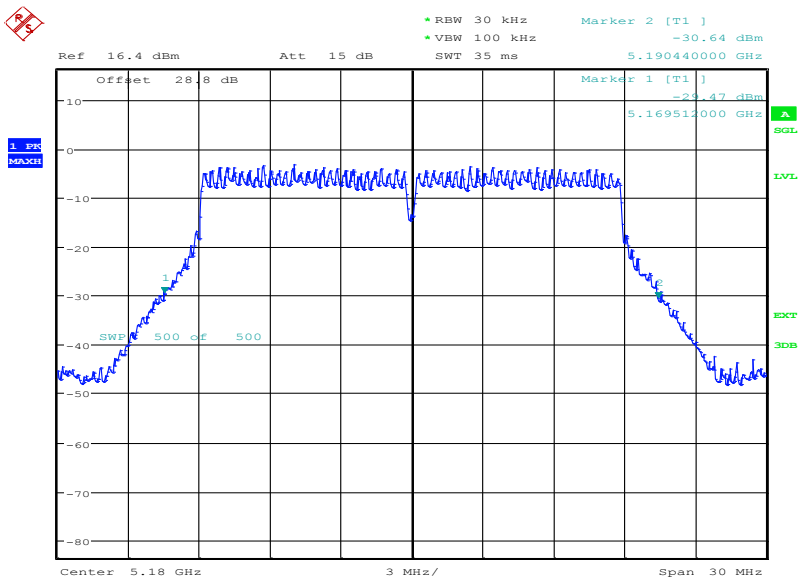
Not specified.

802.11(n) - 5 GHz 20 MHz BW FCC

Frequency Band 1

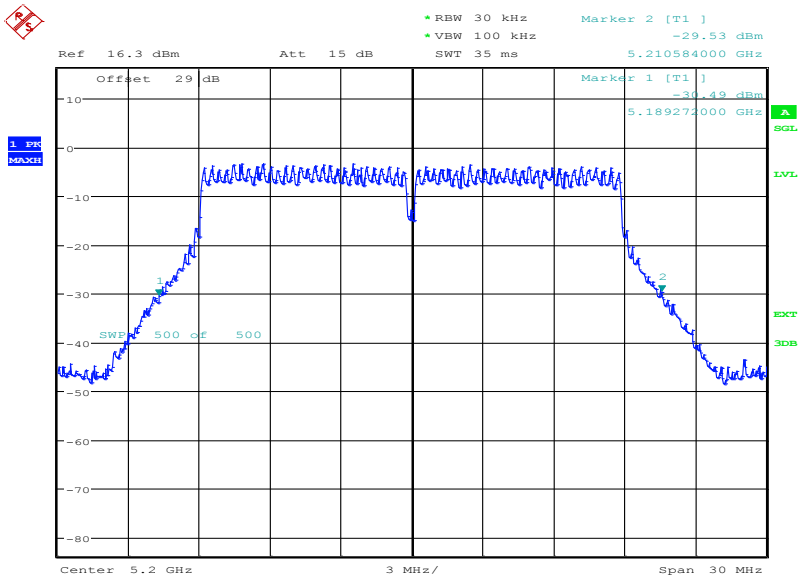
5180 MHz

26 dB Bandwidth (MHz)	20.928



5200 MHz

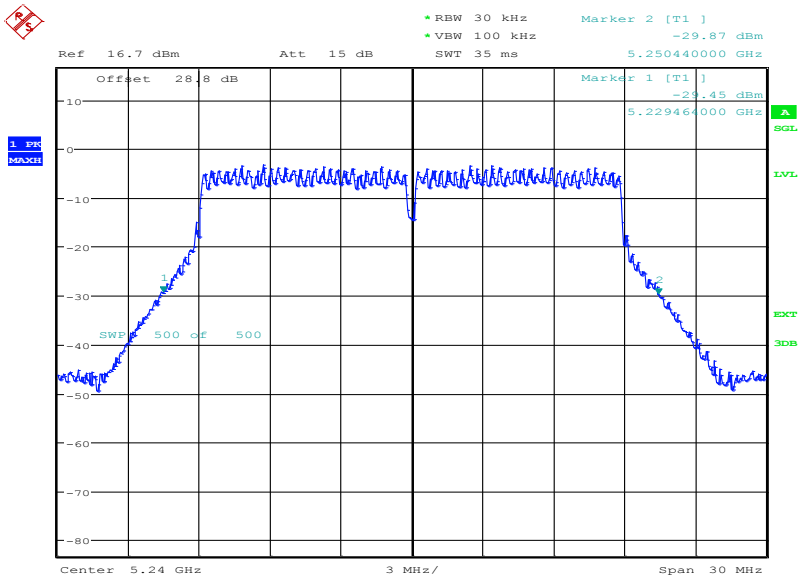
26 dB Bandwidth (MHz)	21.312



Date: 15.OCT.2013 11:47:40

5240 MHz

26 dB Bandwidth (MHz)	20.976



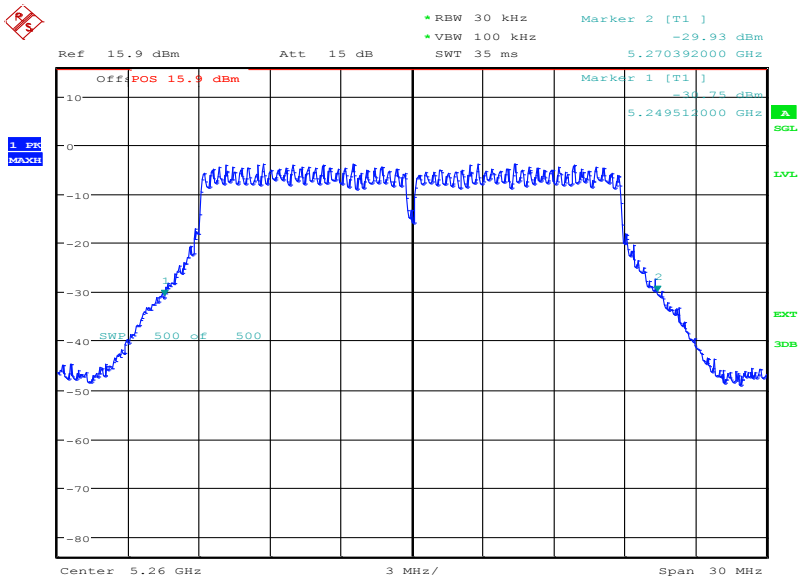
Date: 15.OCT.2013 11:50:25

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 MCS1.

Frequency Band 2

5260 MHz

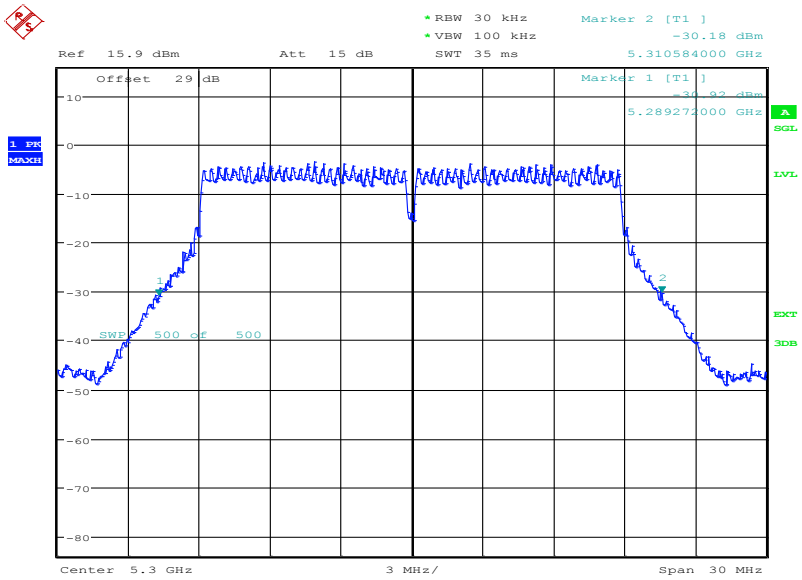
26 dB Bandwidth (MHz)	20.880



Date: 15.OCT.2013 11:52:56

5300 MHz

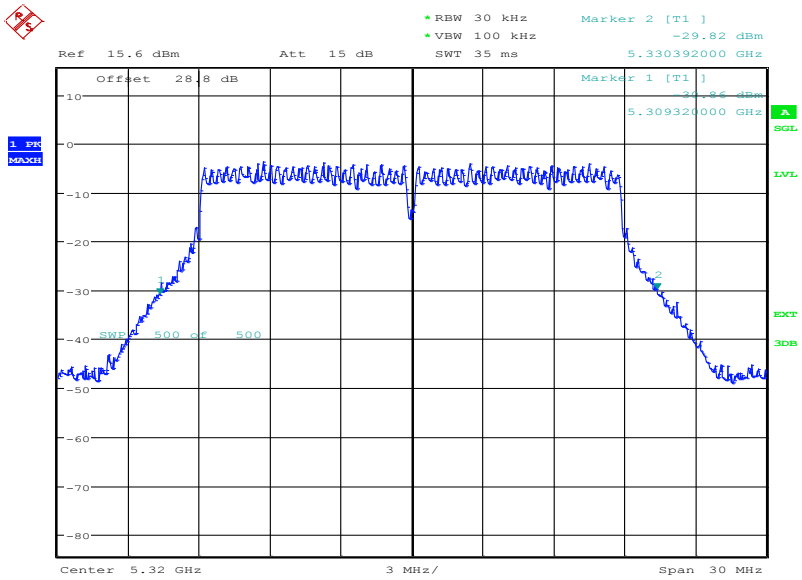
26 dB Bandwidth (MHz)	21.312



Date: 15.OCT.2013 11:54:28

5320 MHz

26 dB Bandwidth (MHz)	21.072



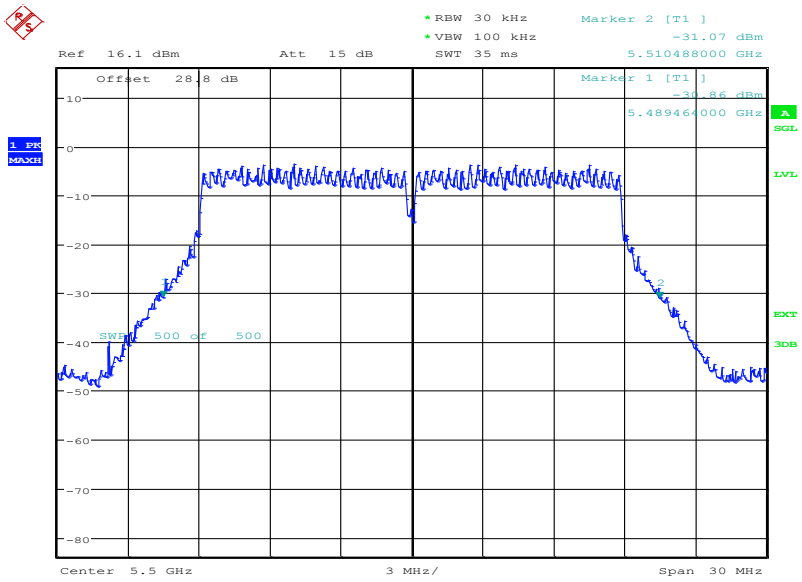
Date: 15.OCT.2013 11:55:53

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 MCS1.

Frequency Band 3

5500 MHz

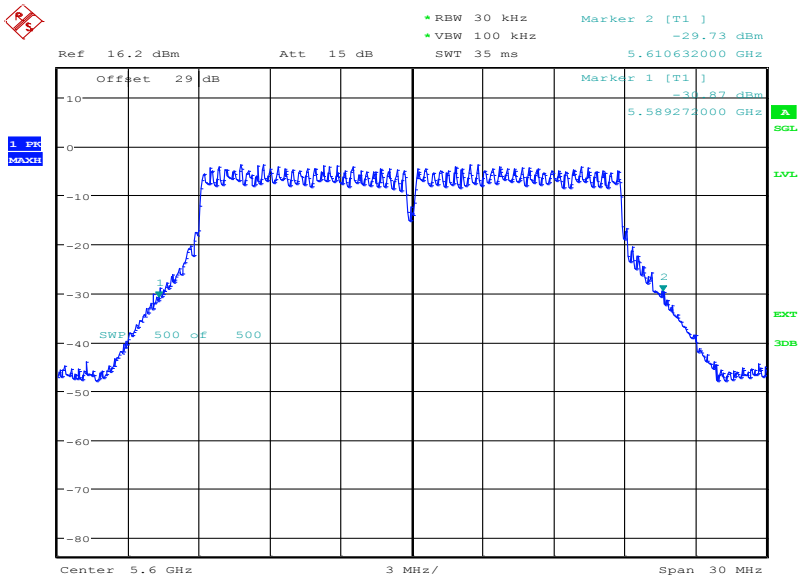
26 dB Bandwidth (MHz)	21.024



Date: 15.OCT.2013 11:57:49

5600 MHz

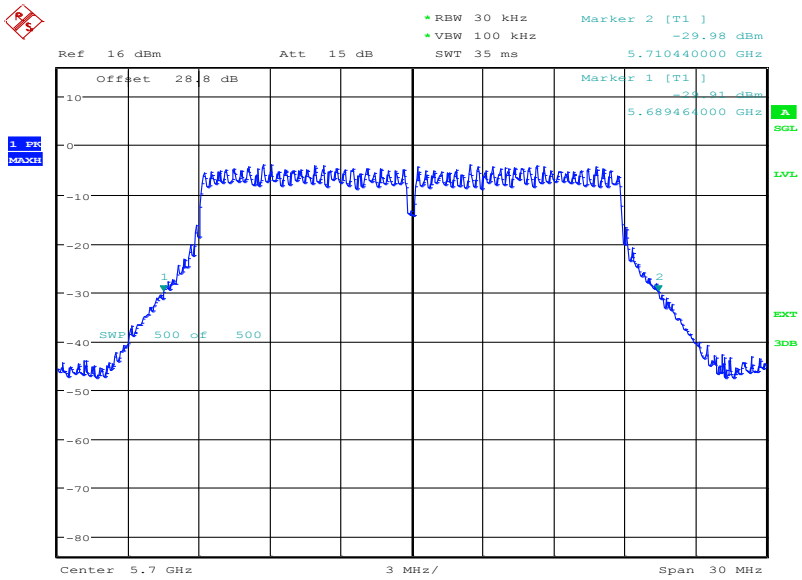
26 dB Bandwidth (MHz)	21.360



Date: 15.OCT.2013 11:59:13

5700 MHz

26 dB Bandwidth (MHz)	20.976



Date: 15.OCT.2013 12:00:38

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 MCS1.

Limit

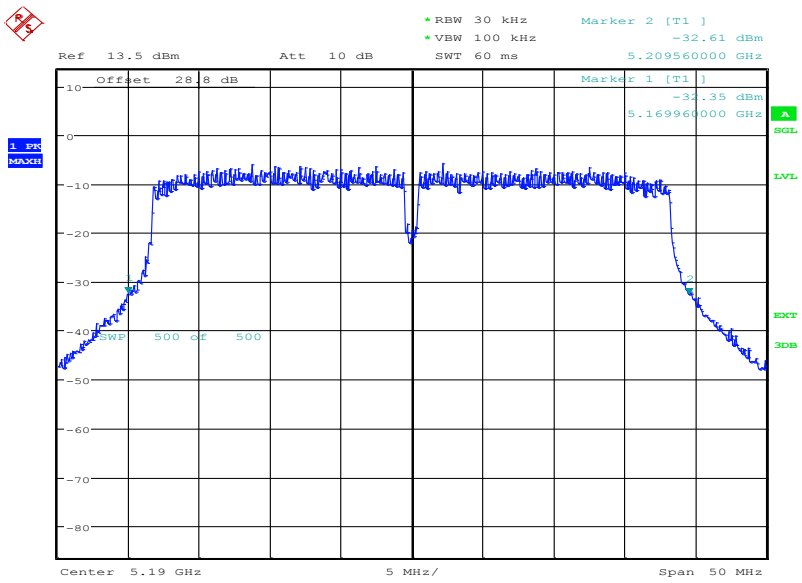
Not specified.

802.11(n) - 5 GHz 40 MHz BW FCC

Frequency Band 1

5190 MHz

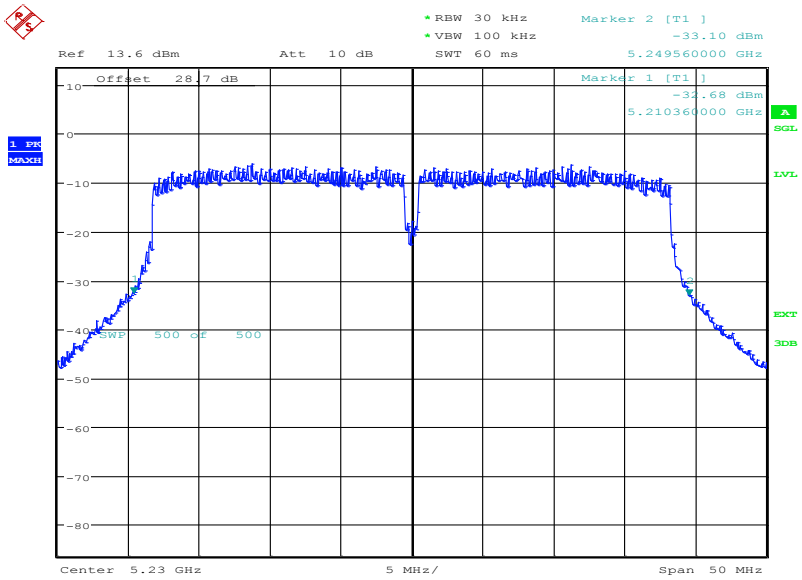
26 dB Bandwidth (MHz)	39.600



Date: 15.OCT.2013 13:11:12

5230 MHz

26 dB Bandwidth (MHz)	39.200



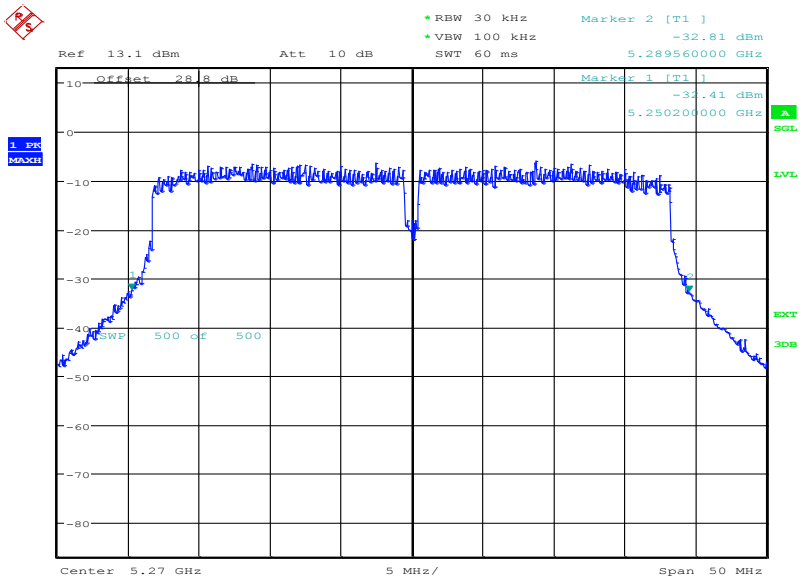
Date: 15.OCT.2013 13:12:36

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 MCS1.

Frequency Band 2

5270 MHz

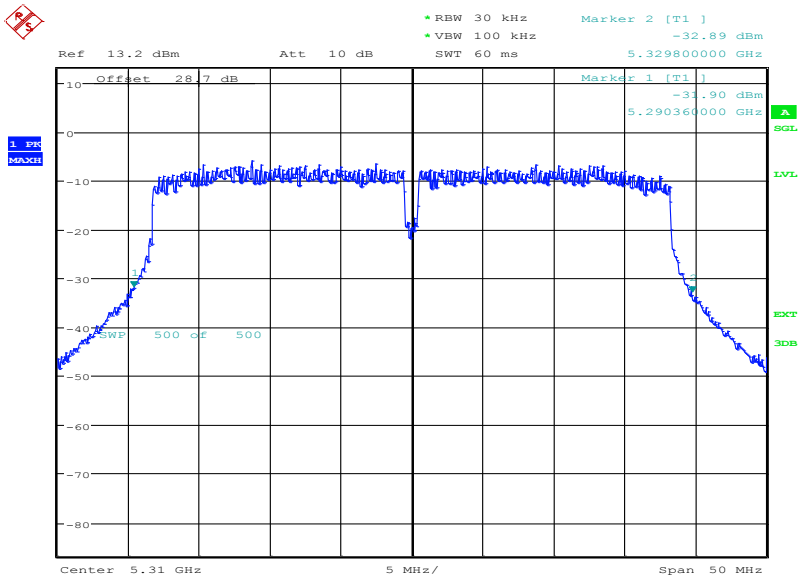
26 dB Bandwidth (MHz)	39.360



Date: 15.OCT.2013 13:14:53

5310 MHz

26 dB Bandwidth (MHz)	39.440



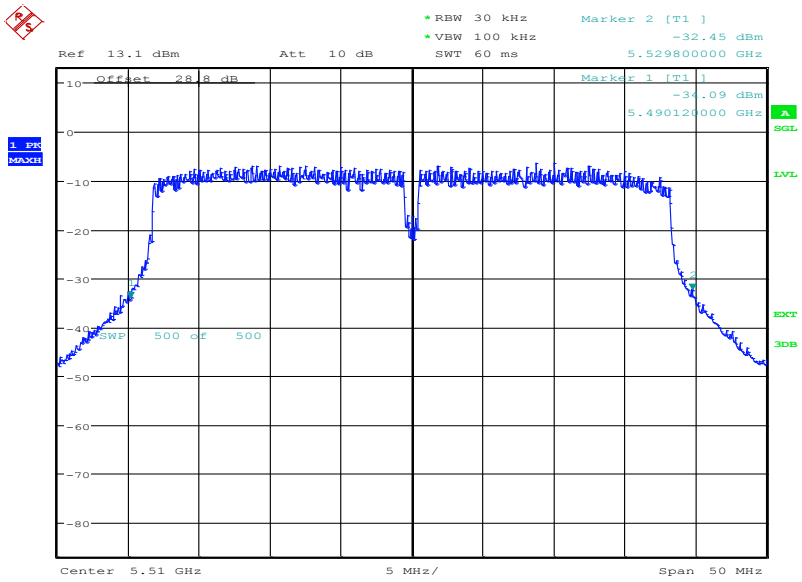
Date: 15.OCT.2013 13:16:20

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 MCS1.

Frequency Band 3

5510 MHz

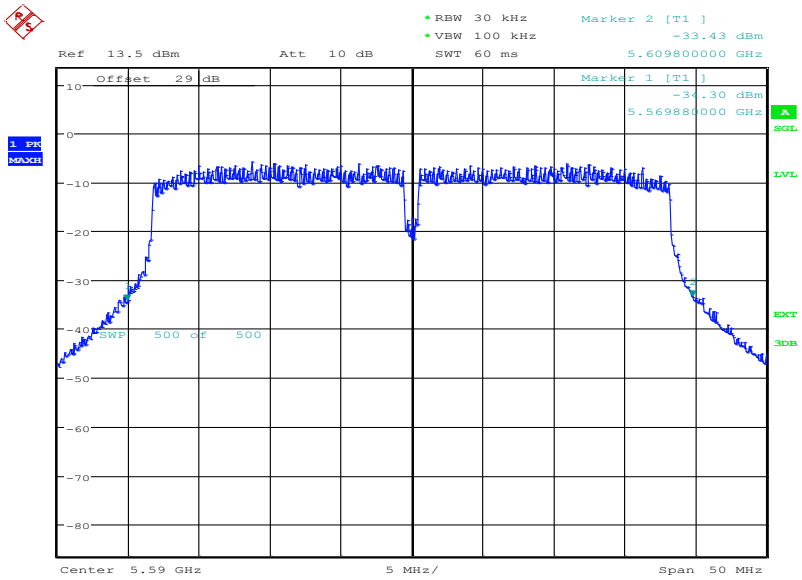
26 dB Bandwidth (MHz)	39.680



Date: 15.OCT.2013 13:18:45

5590 MHz

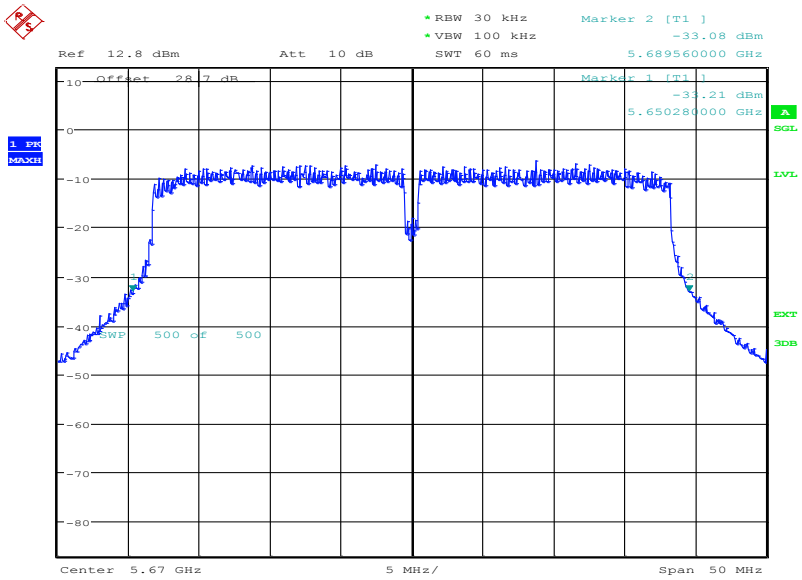
26 dB Bandwidth (MHz)	39.920



Date: 15.OCT.2013 13:20:12

5670 MHz

26 dB Bandwidth (MHz)	39.280



Date: 15.OCT.2013 13:21:45

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 MCS1.

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

SHL23 S/N: IMEI 004401114893148 - Modification State 0

2.6.3 Date of Test

14 October 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 1 MHz and 3 MHz respectively. The trace was set to Average using an RMS detector and the maximum value was recorded.

2.6.6 Environmental Conditions

Ambient Temperature	22.4°C
Relative Humidity	40.3%

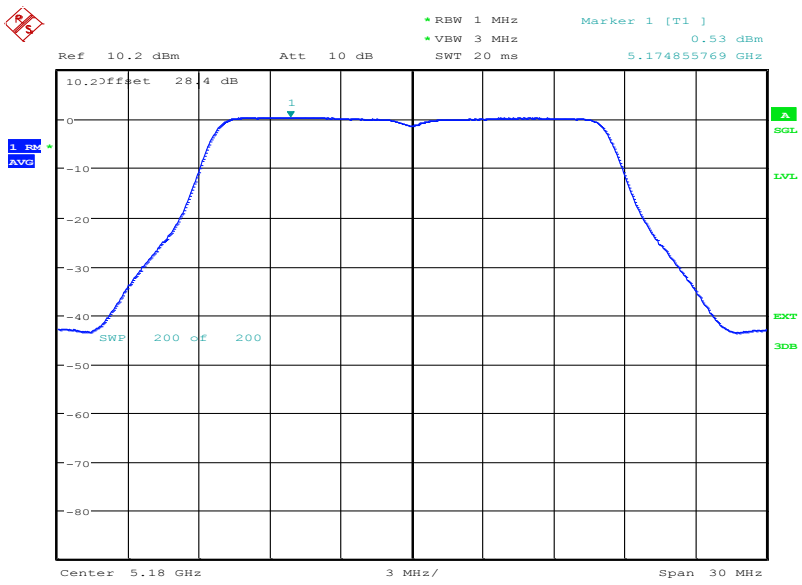
2.6.7 Test Results

802.11(a)

Frequency Band 1

5180 MHz

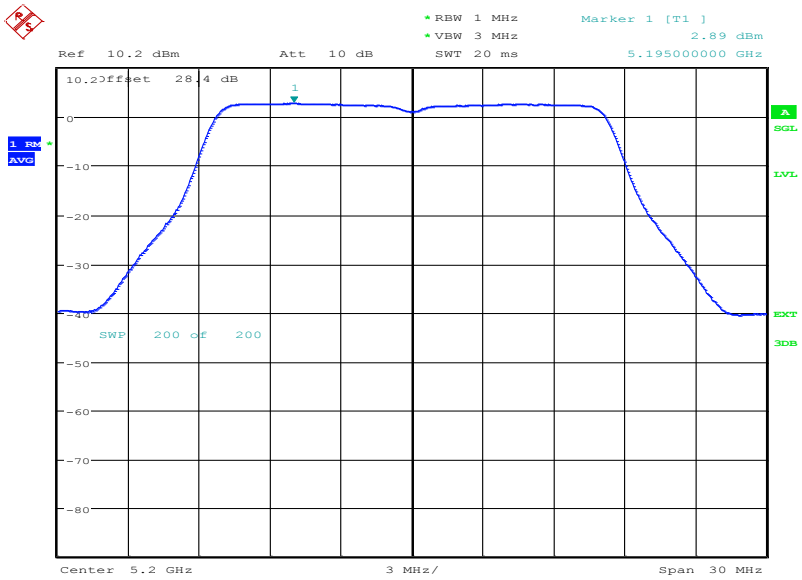
Peak Power Spectral Density (dBm)	0.53



Date: 9.OCT.2013 12:01:06

5200 MHz

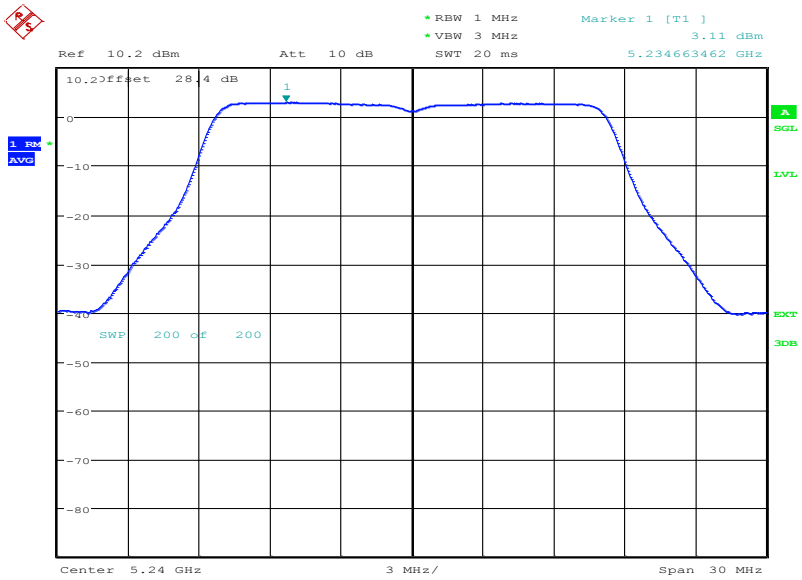
Peak Power Spectral Density (dBm)	2.89



Date: 9.OCT.2013 12:02:17

5240 MHz

Peak Power Spectral Density (dBm)	3.11



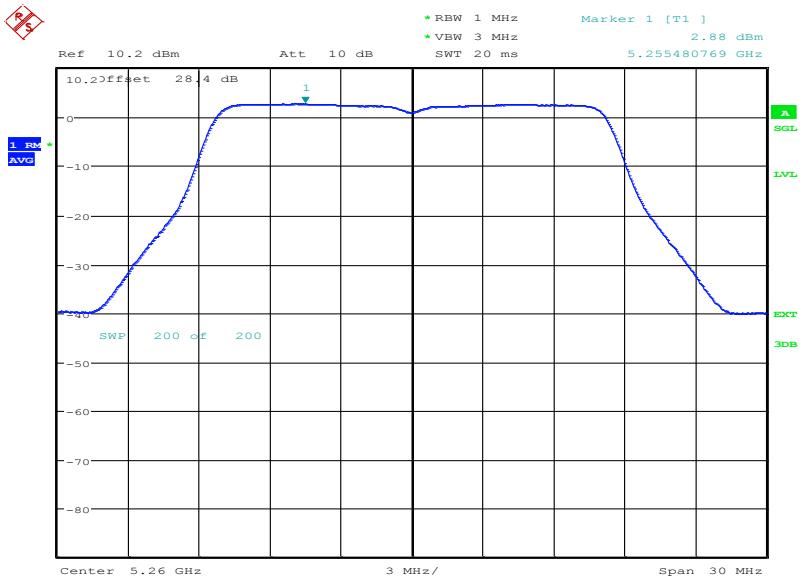
Date: 9.OCT.2013 12:03:14

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

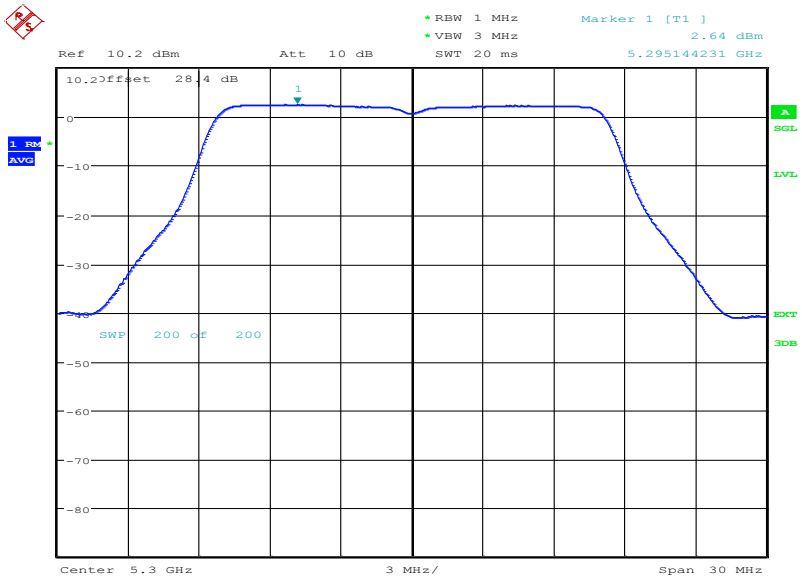
5260 MHz

Peak Power Spectral Density (dBm)	2.88



5300 MHz

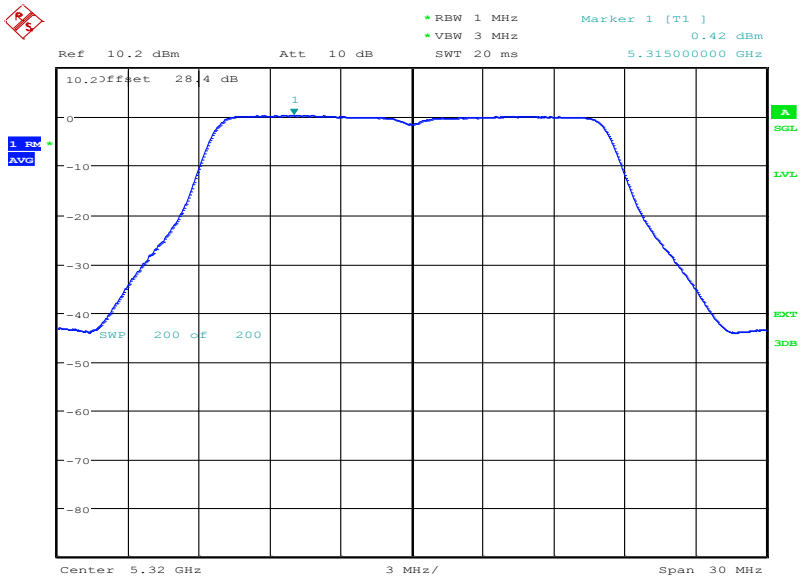
Peak Power Spectral Density (dBm)	2.64



Date: 9.OCT.2013 12:05:11

5320 MHz

Peak Power Spectral Density (dBm)	0.42



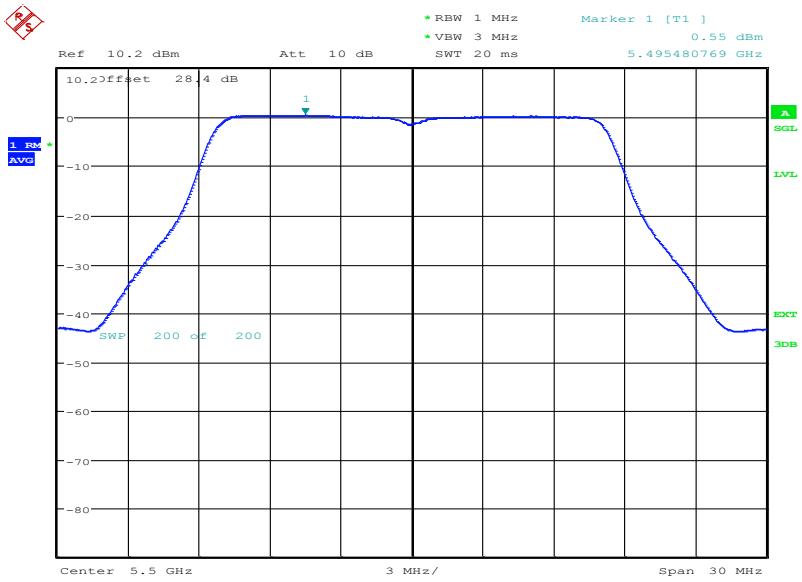
Date: 9.OCT.2013 12:06:14

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

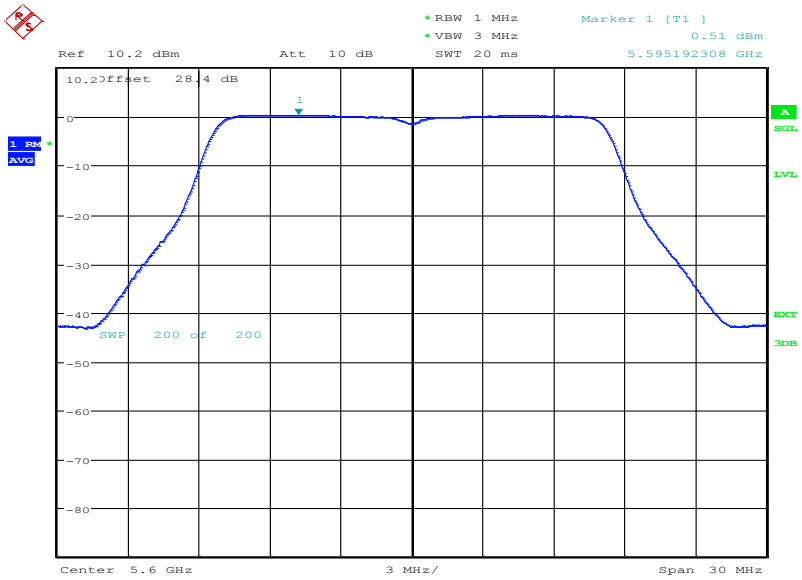
5500 MHz

Peak Power Spectral Density (dBm)	0.55



5600 MHz

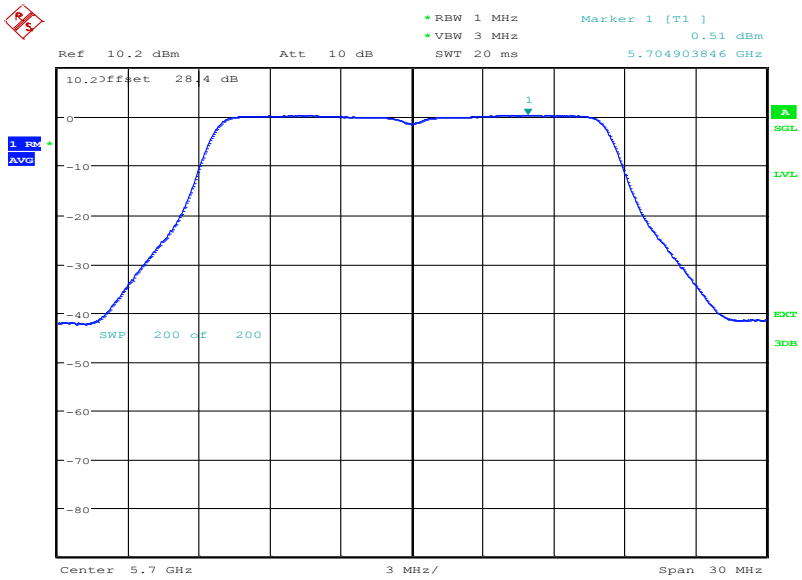
Peak Power Spectral Density (dBm)	0.51



Date: 9.OCT.2013 12:07:56

5700 MHz

Peak Power Spectral Density (dBm)	0.51



Date: 9.OCT.2013 12:08:41

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

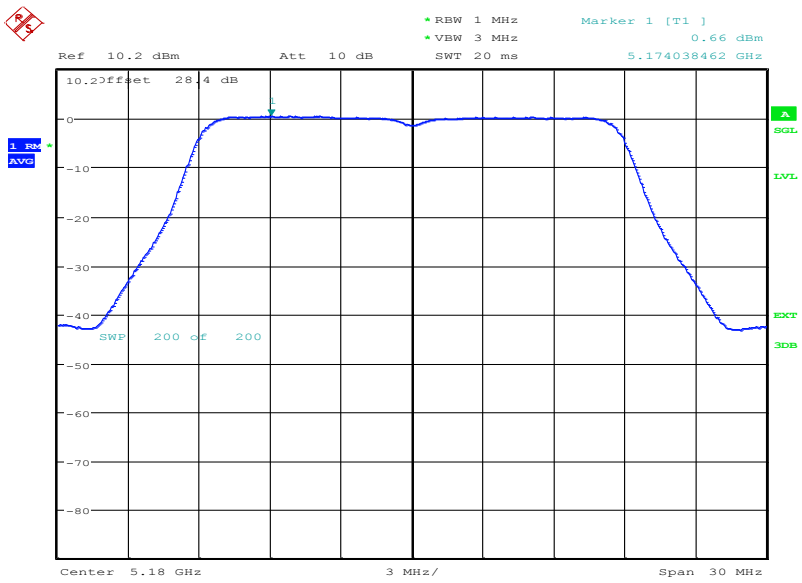
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(ac) - 5 GHz 20 MHz BW FCC

Frequency Band 1

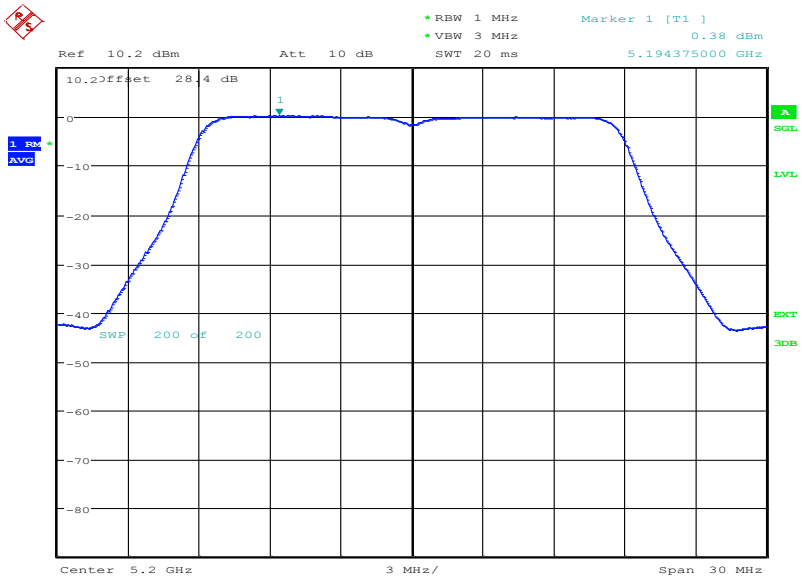
5180 MHz

Peak Power Spectral Density (dBm)	0.66



5200 MHz

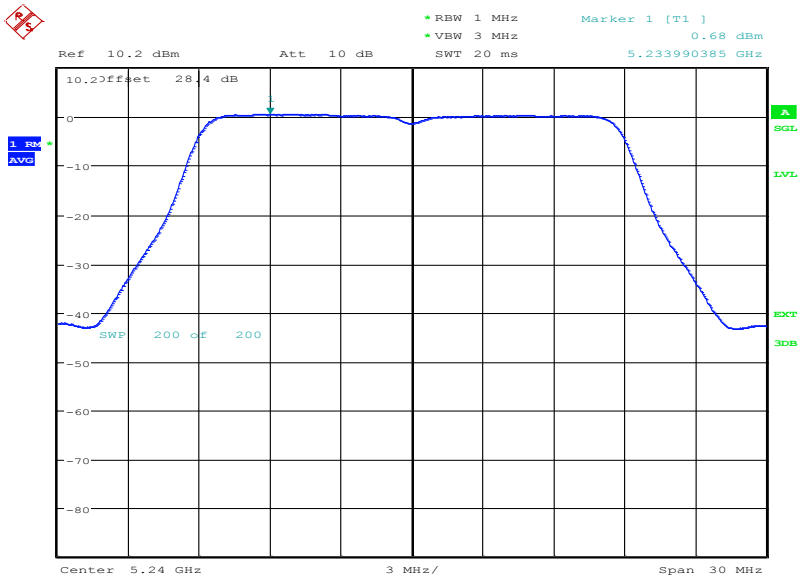
Peak Power Spectral Density (dBm)	0.38



Date: 9.OCT.2013 15:36:23

5240 MHz

Peak Power Spectral Density (dBm)	0.68



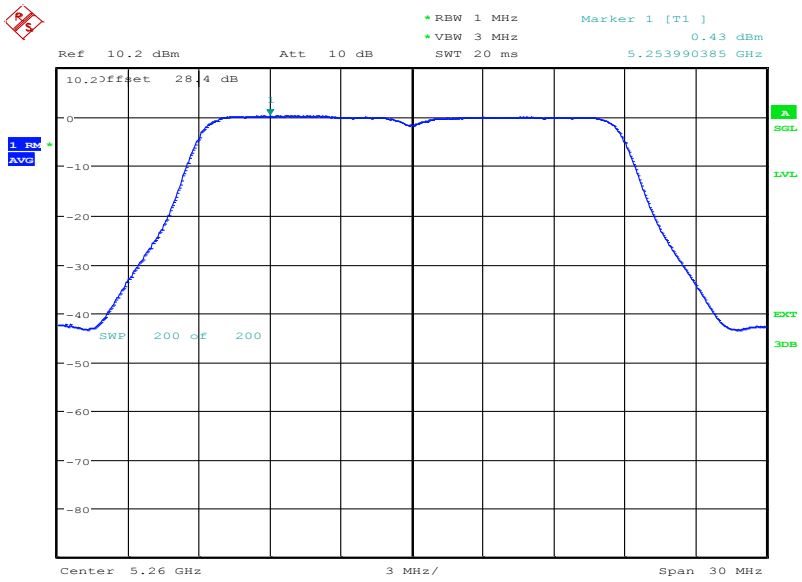
Date: 9.OCT.2013 15:37:08

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 MCS1.

Frequency Band 2

5260 MHz

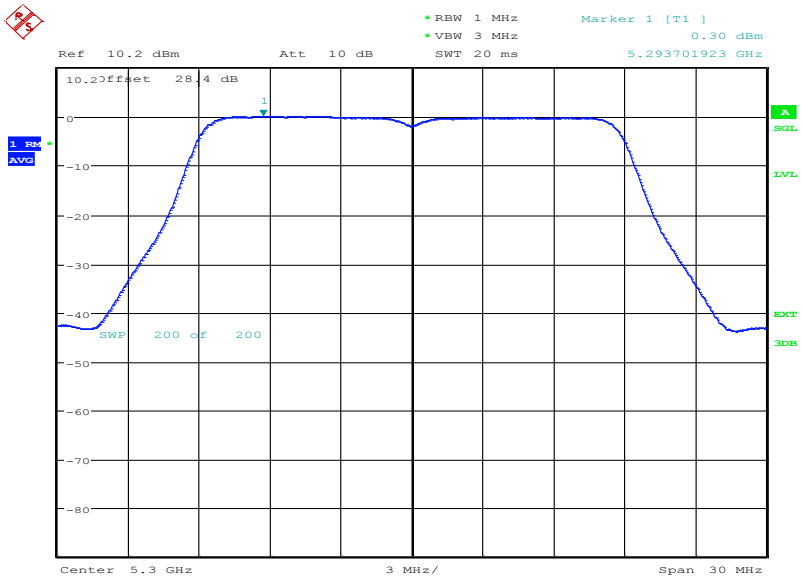
Peak Power Spectral Density (dBm)	0.43



Date: 9.OCT.2013 15:38:10

5300 MHz

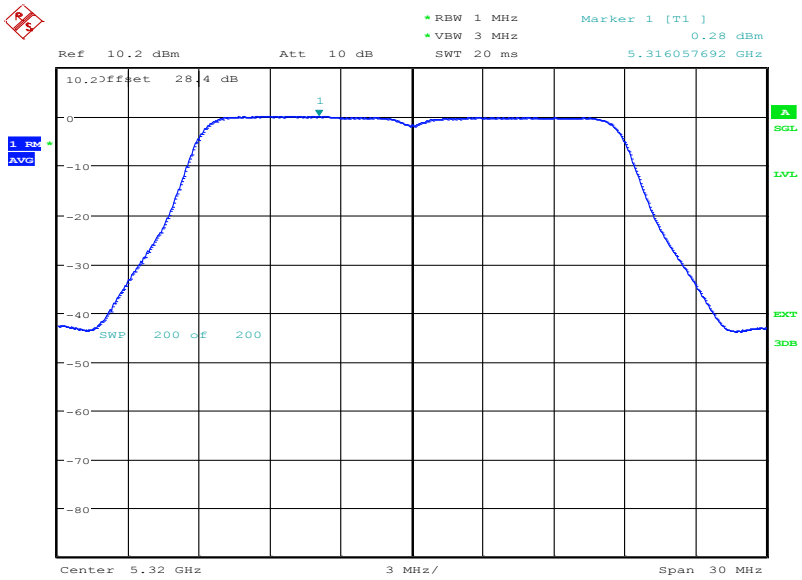
Peak Power Spectral Density (dBm)	0.3



Date: 9.OCT.2013 15:38:55

5320 MHz

Peak Power Spectral Density (dBm)	0.28



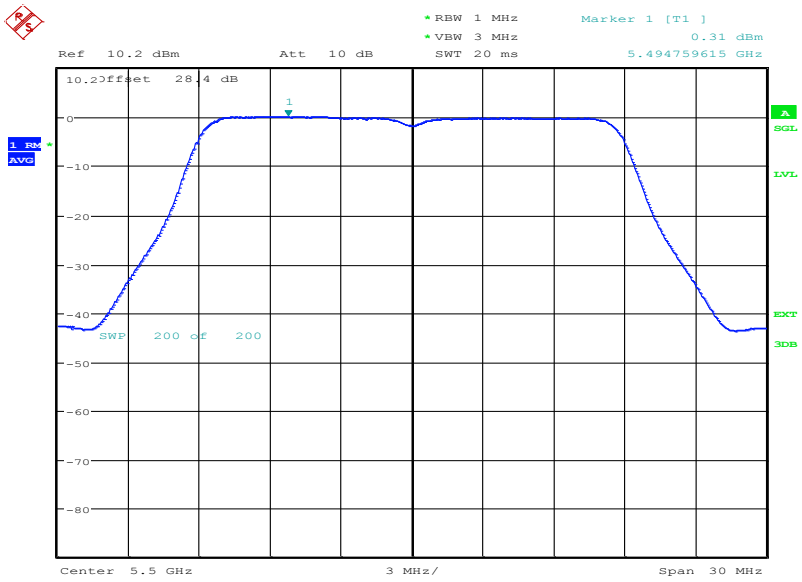
Date: 9.OCT.2013 15:39:49

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 MCS1.

Frequency Band 3

5500 MHz

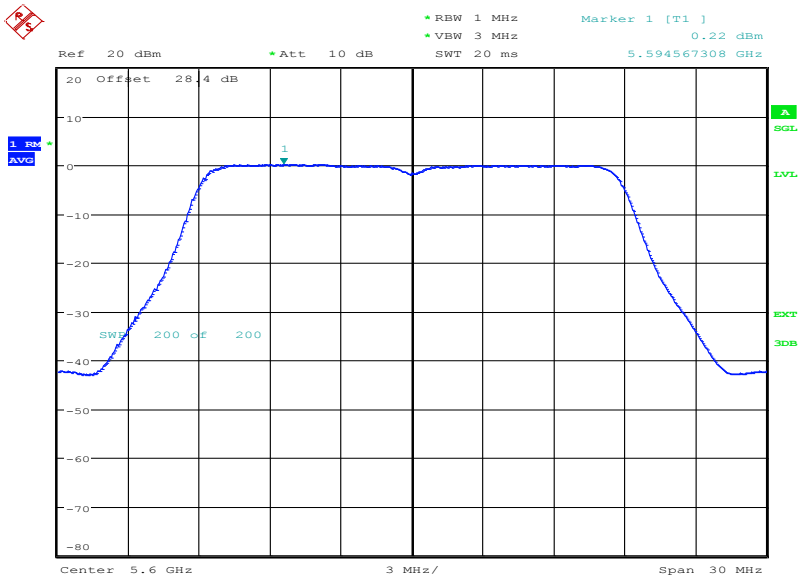
Peak Power Spectral Density (dBm)	0.31



Date: 9.OCT.2013 15:40:38

5600 MHz

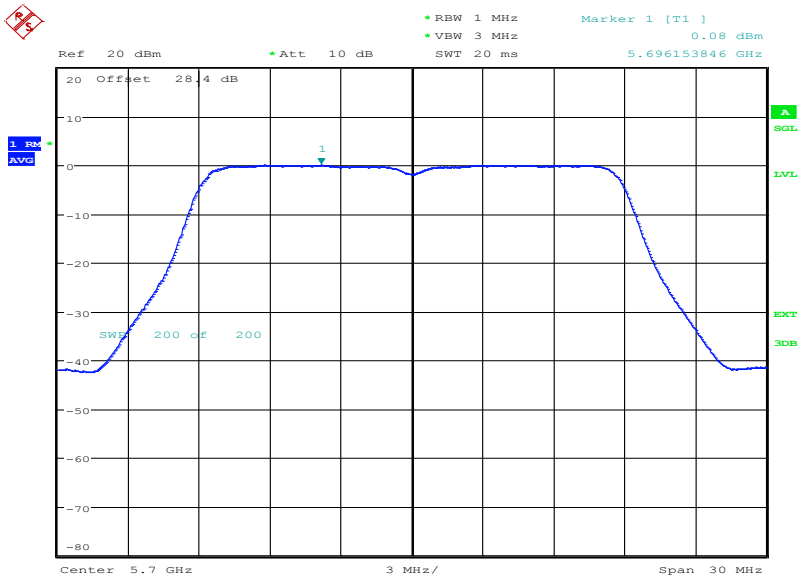
Peak Power Spectral Density (dBm)	0.22



Date: 14.OCT.2013 15:12:25

5700 MHz

Peak Power Spectral Density (dBm)	0.08



Date: 14.OCT.2013 15:10:17

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 MCS1.

Limit

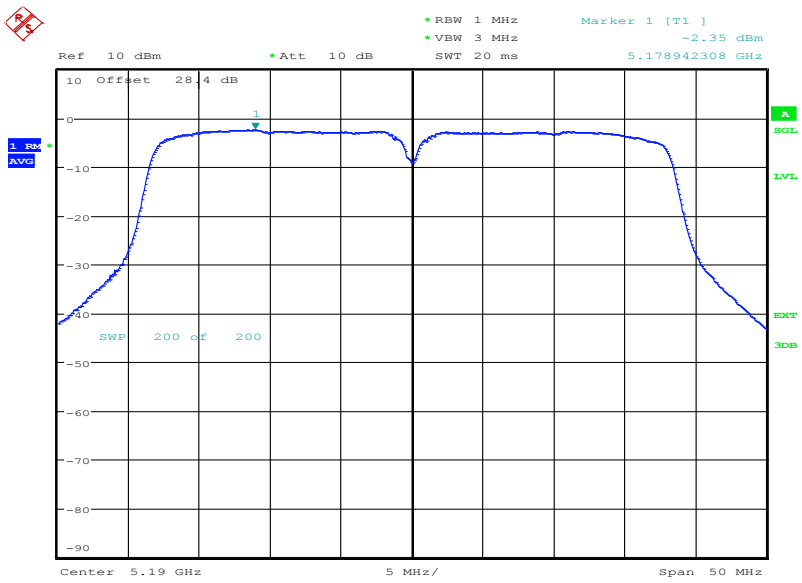
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(ac) - 5 GHz 40 MHz BW FCC

Frequency Band 1

5190 MHz

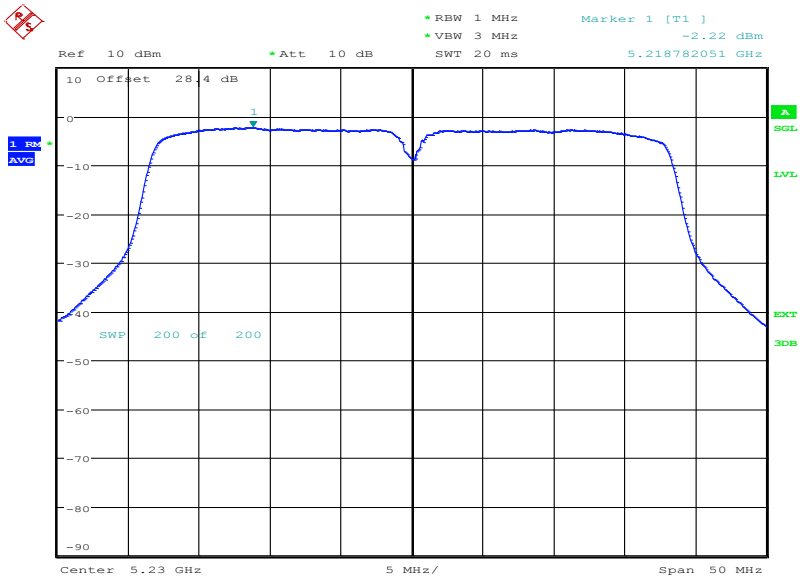
Peak Power Spectral Density (dBm)	-2.35



Date: 14.OCT.2013 10:49:00

5230 MHz

Peak Power Spectral Density (dBm)	-2.22



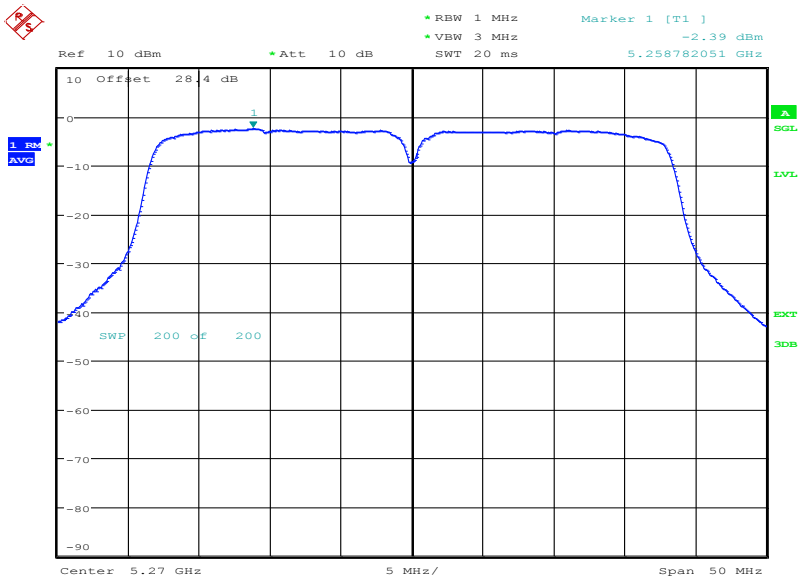
Date: 14.OCT.2013 10:51:21

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 MCS0.

Frequency Band 2

5270 MHz

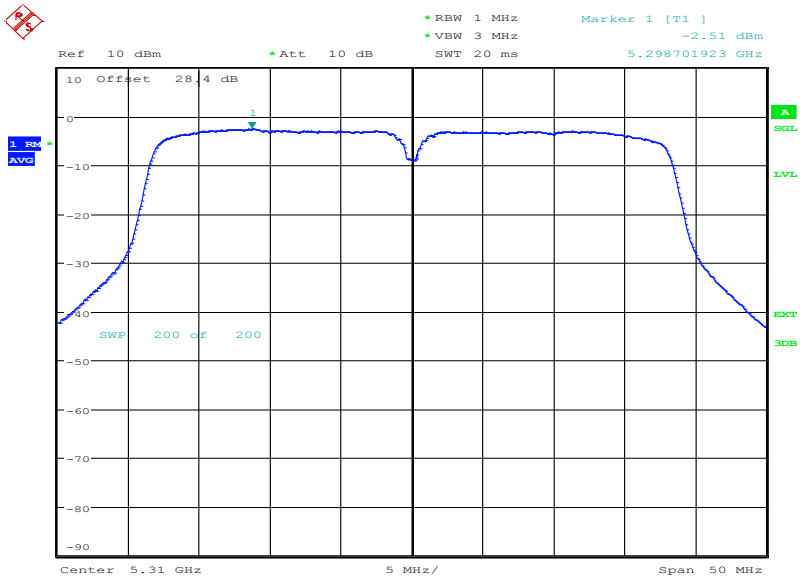
Peak Power Spectral Density (dBm)	-2.39



Date: 14.OCT.2013 10:53:23

5310 MHz

Peak Power Spectral Density (dBm)	-2.51



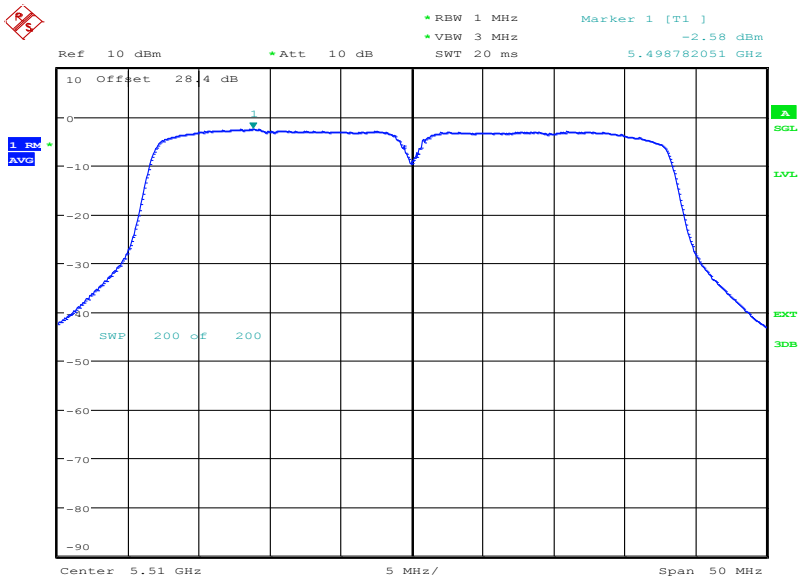
Date: 14.OCT.2013 10:55:22

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 MCS0.

Frequency Band 3

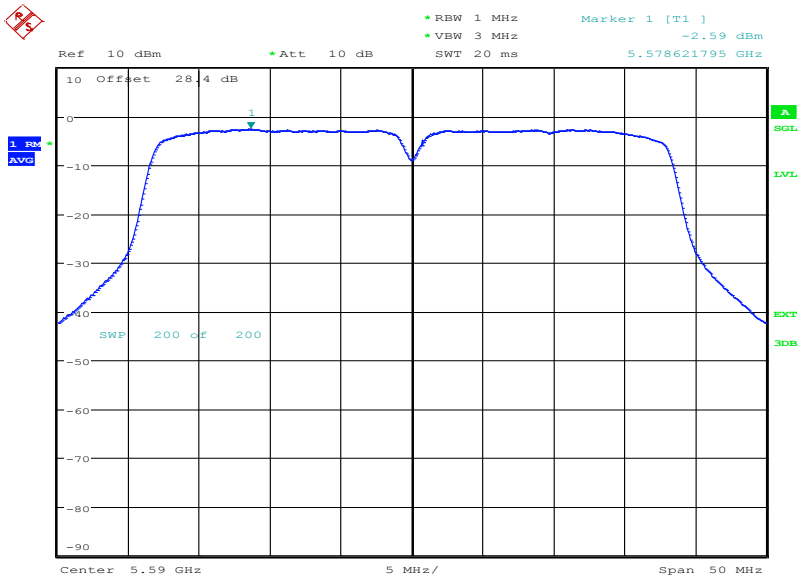
5510 MHz

Peak Power Spectral Density (dBm)	-2.58



5590 MHz

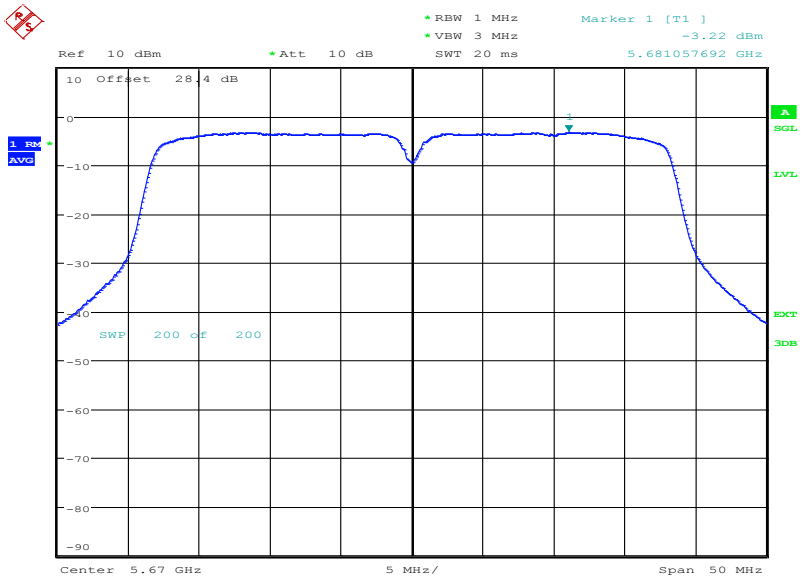
Peak Power Spectral Density (dBm)	-2.59



Date: 14.OCT.2013 10:58:06

5670 MHz

Peak Power Spectral Density (dBm)	-3.22



Date: 14.OCT.2013 10:59:07

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 MCS0.

Limit

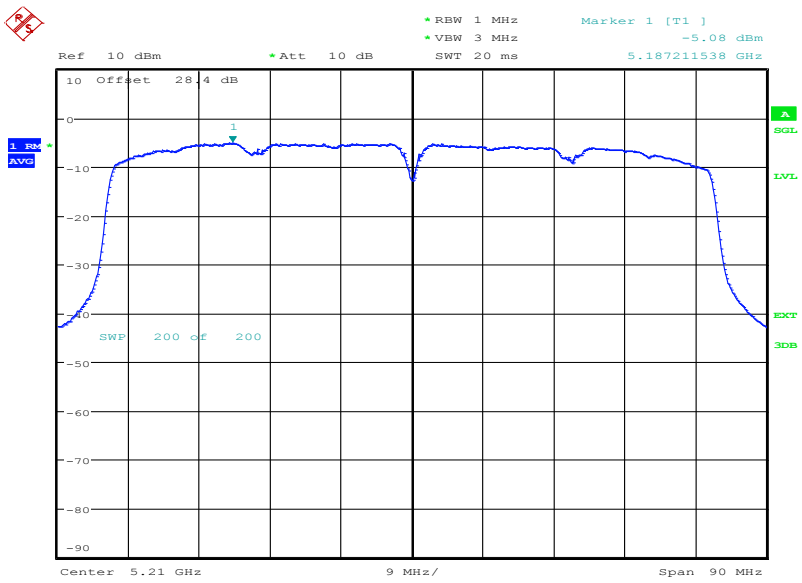
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(ac) - 5 GHz 80 MHz BW FCC

Frequency Band 1

5210 MHz

Peak Power Spectral Density (dBm)	-5.08



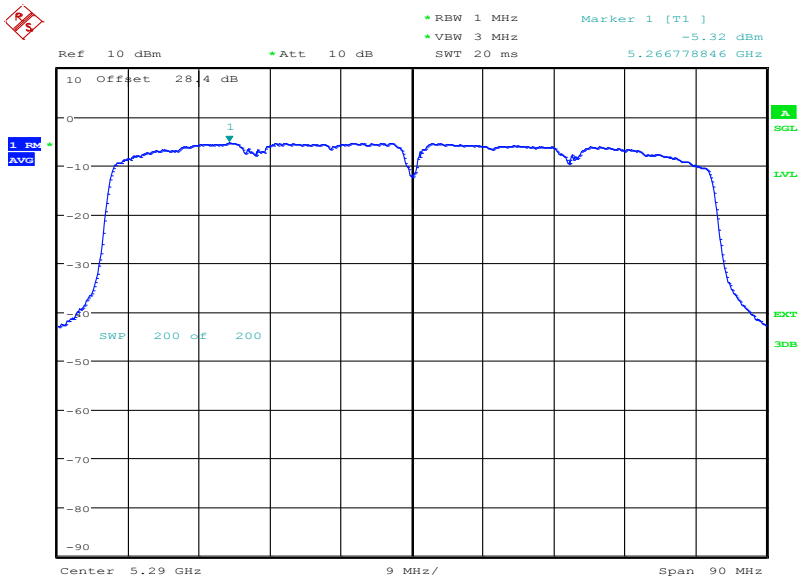
Date: 14.OCT.2013 10:46:47

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 MCS0.

Frequency Band 2

5290 MHz

Peak Power Spectral Density (dBm)	-5.32



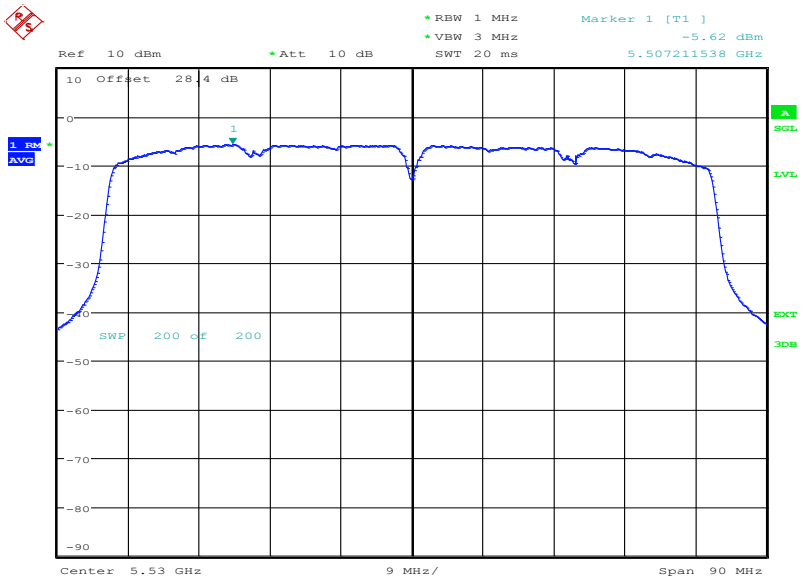
Date: 14.OCT.2013 10:45:18

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 MCS0.

Frequency Band 3

5530 MHz

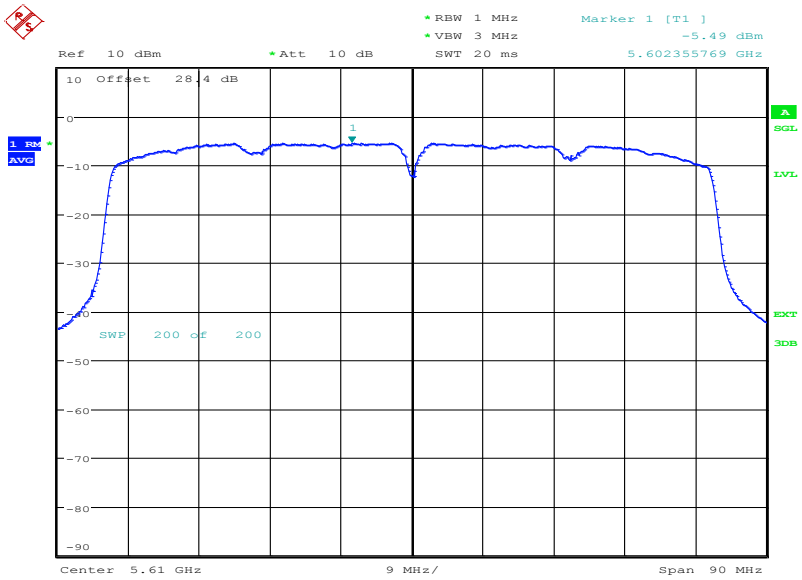
Peak Power Spectral Density (dBm)	-5.62



Date: 14.OCT.2013 10:43:36

5610 MHz

Peak Power Spectral Density (dBm)	-5.49



Date: 14.OCT.2013 10:42:34

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 MCS0.

Limit

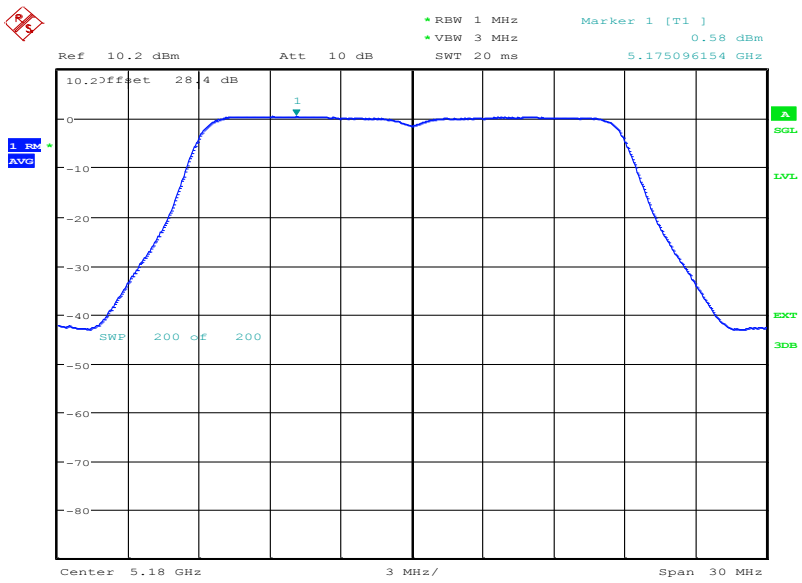
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(n) - 5 GHz 20 MHz BW FCC

Frequency Band 1

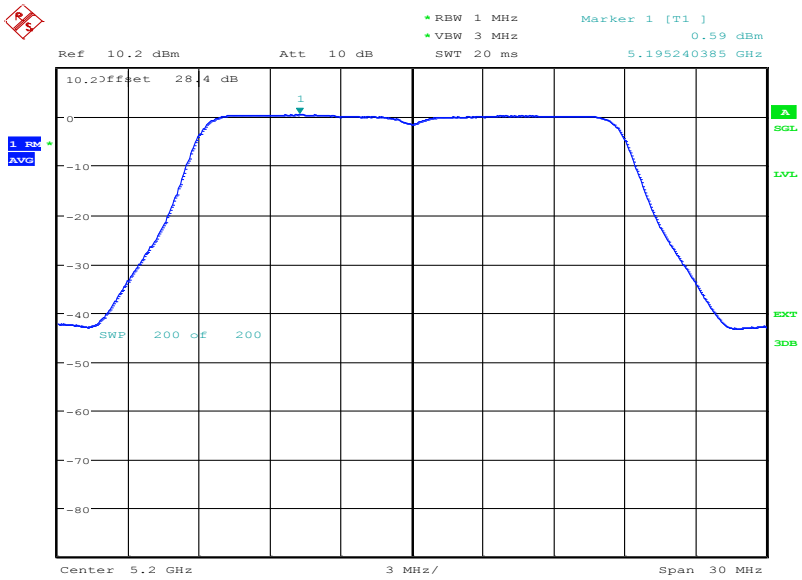
5180 MHz

Peak Power Spectral Density (dBm)	0.58



5200 MHz

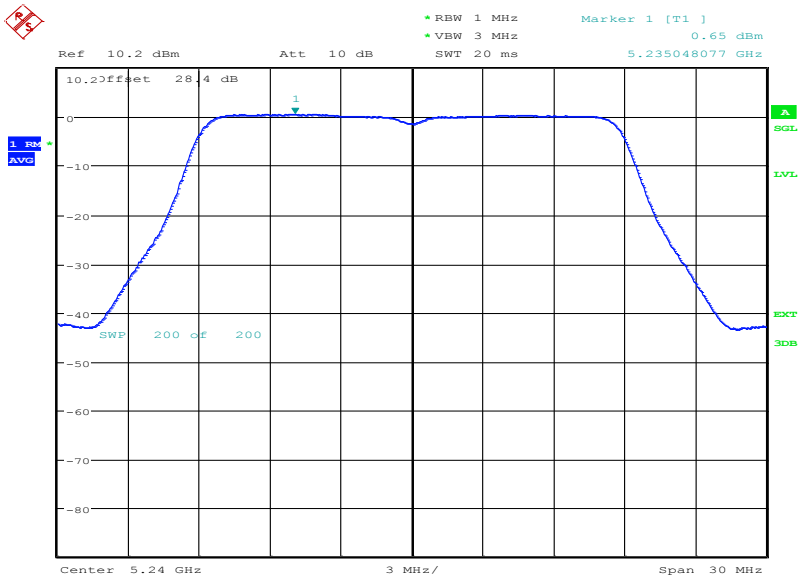
Peak Power Spectral Density (dBm)	0.59



Date: 9.OCT.2013 12:49:55

5240 MHz

Peak Power Spectral Density (dBm)	0.65



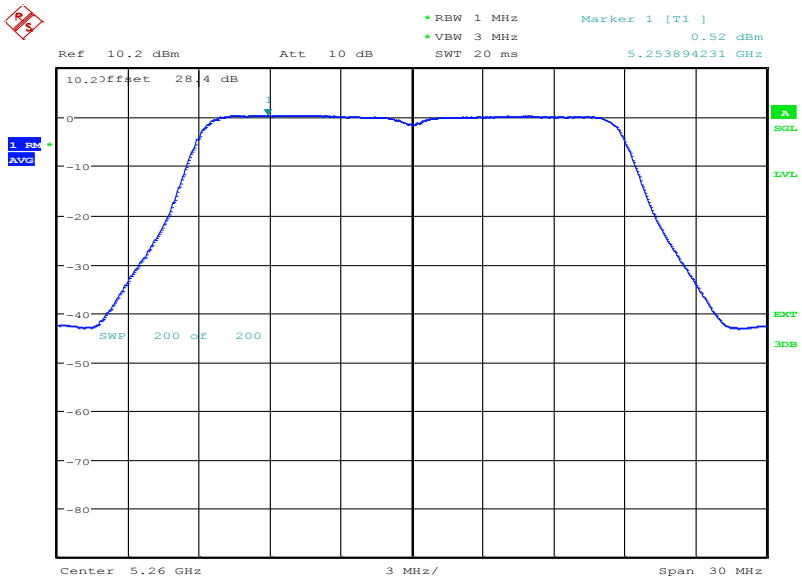
Date: 9.OCT.2013 12:50:51

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 MCS1.

Frequency Band 2

5260 MHz

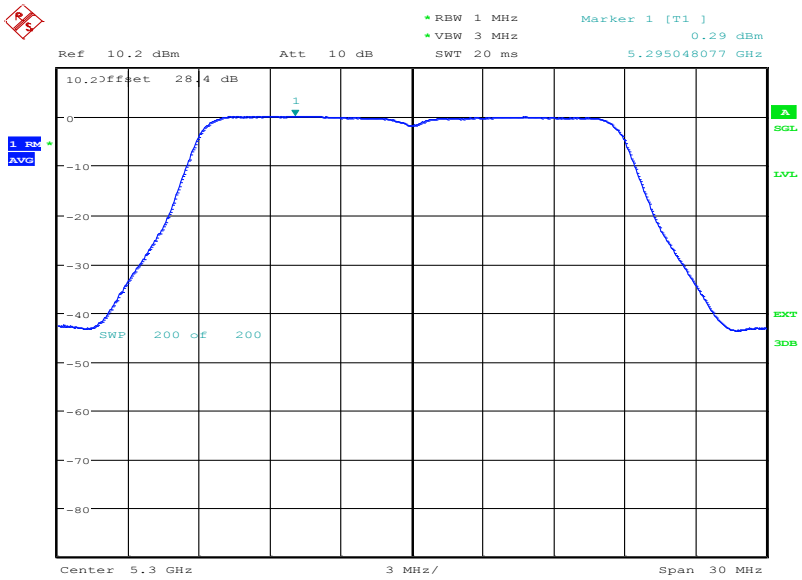
Peak Power Spectral Density (dBm)	0.52



Date: 9.OCT.2013 12:51:57

5300 MHz

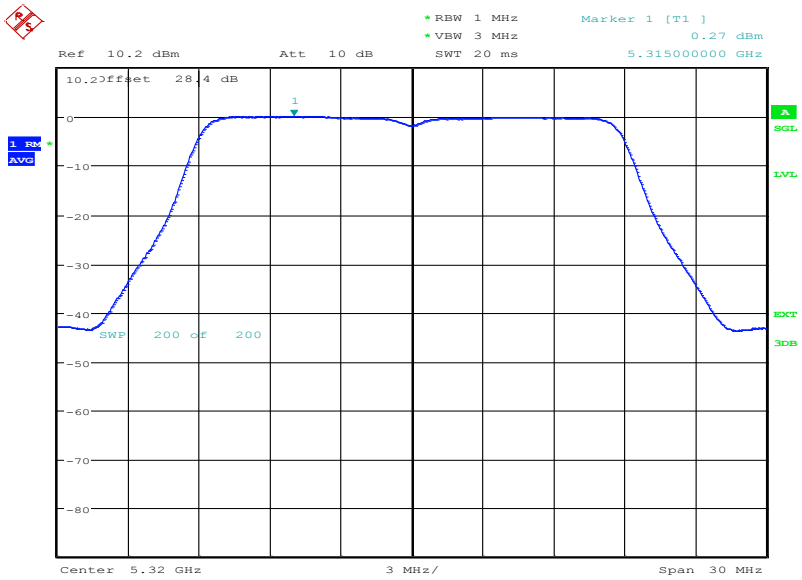
Peak Power Spectral Density (dBm)	0.29



Date: 9.OCT.2013 15:12:33

5320 MHz

Peak Power Spectral Density (dBm)	0.27

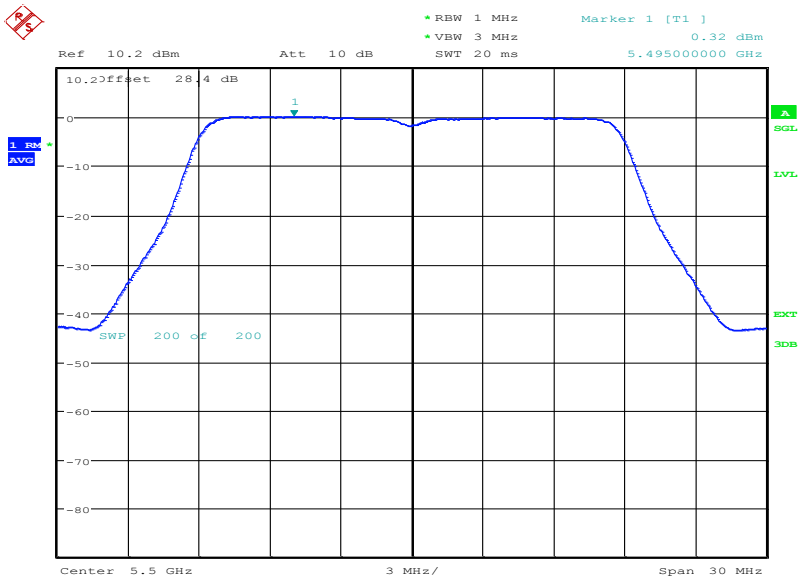


The test was performed on the worst case data rate for 802.11(n) - 20 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was MCS1.

Frequency Band 3

5500 MHz

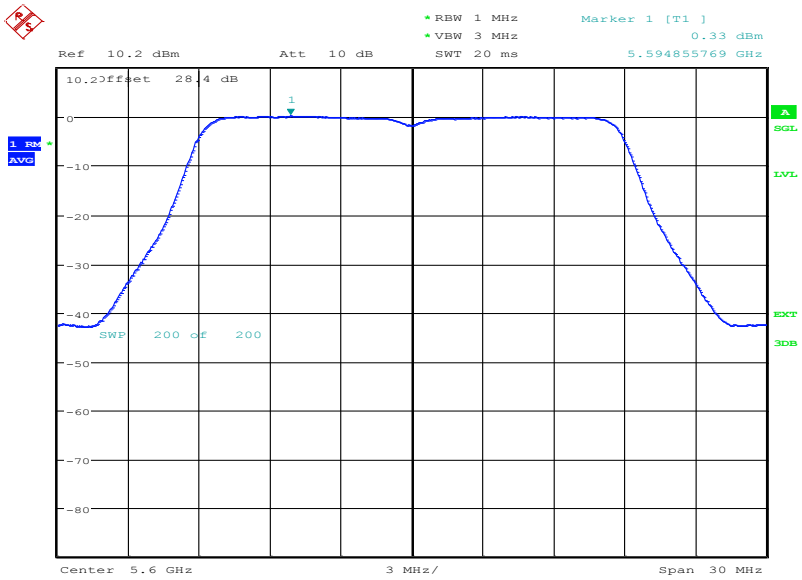
Peak Power Spectral Density (dBm)	0.32



Date: 9.OCT.2013 15:14:00

5600 MHz

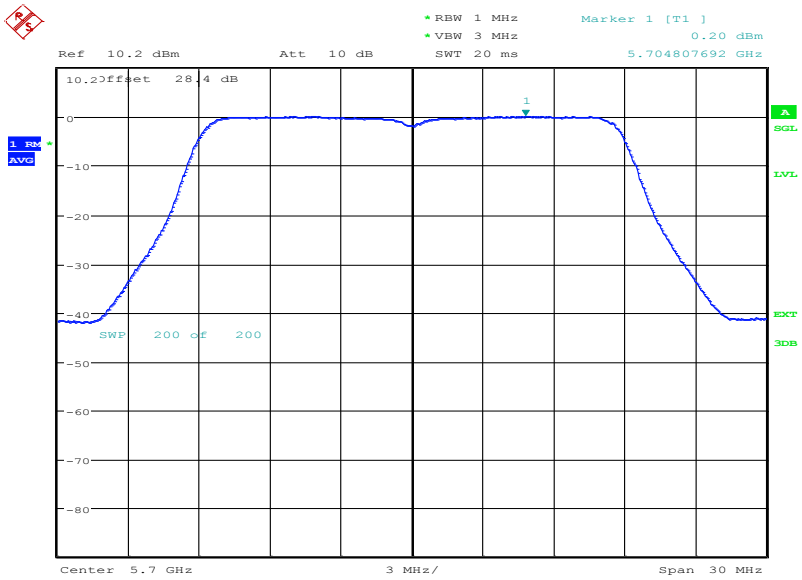
Peak Power Spectral Density (dBm)	0.33



Date: 9.OCT.2013 15:14:47

5700 MHz

Peak Power Spectral Density (dBm)	0.2



Date: 9.OCT.2013 15:16:38

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 MCS1.

Limit

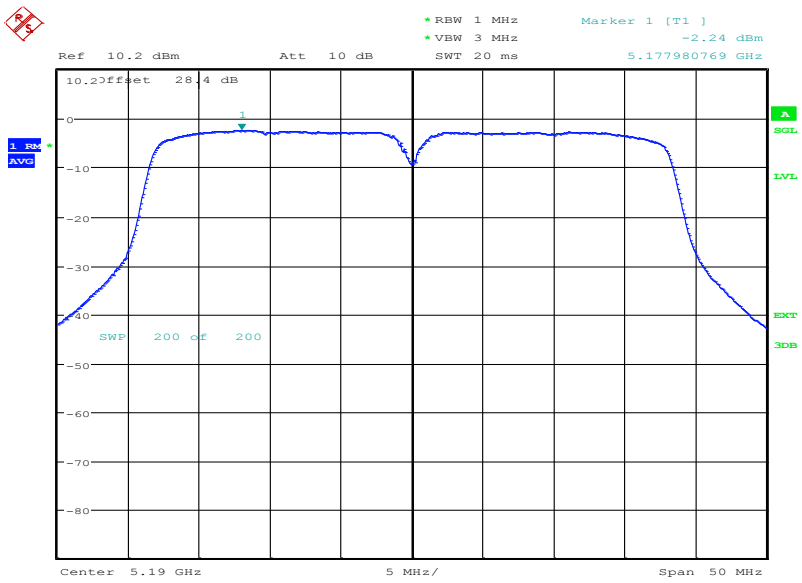
Frequency Band (MHz)	FCC Limit	IC Limit
5150 to 5250	<4 dBm / 1 MHz	<10 dBm / 1 MHz
5250 to 5350	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5470 to 5725	<11 dBm / 1 MHz	<11 dBm / 1 MHz
5725 to 5825	<17 dBm / 1 MHz	<17 dBm / 1 MHz

802.11(n) - 5 GHz 40 MHz BW FCC

Frequency Band 1

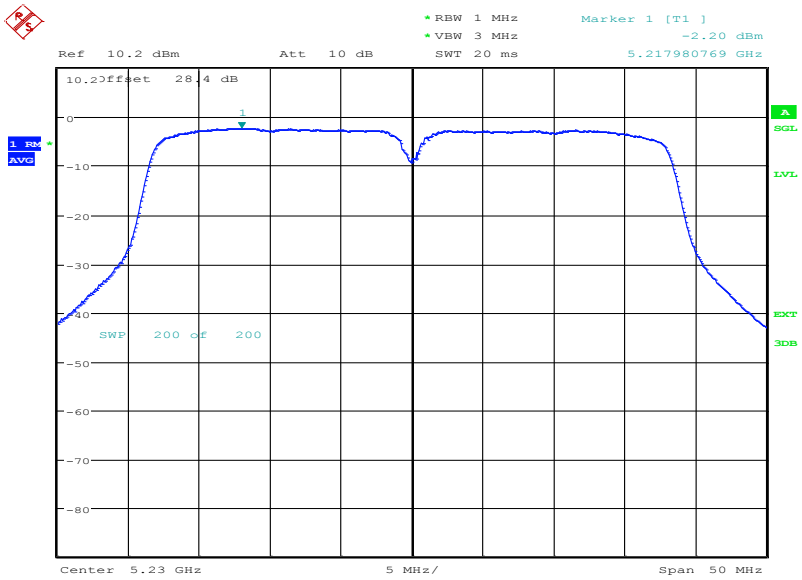
5190 MHz

Peak Power Spectral Density (dBm)	-2.24



5230 MHz

Peak Power Spectral Density (dBm)	-2.2

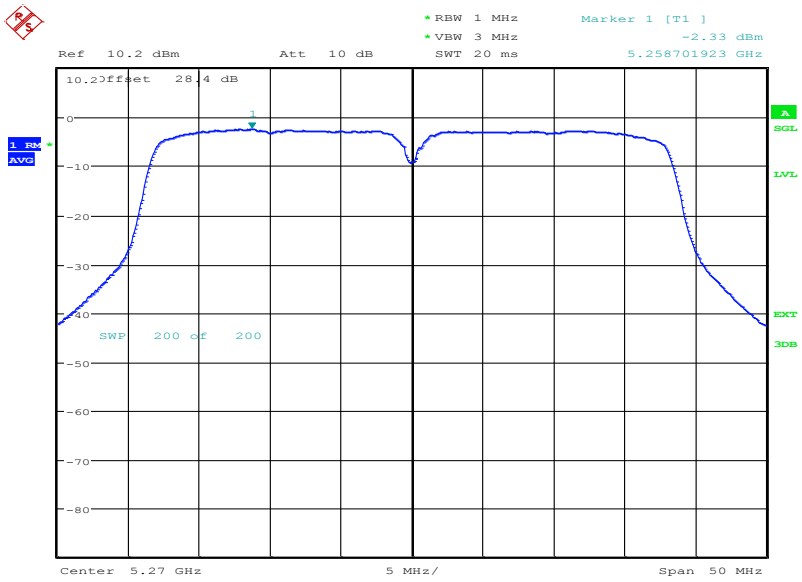


The test was performed on the worst case data rate for 802.11(n) - 40 MHz BW modulation. The worst case was deemed as the data rate which produced the highest level of conducted average power. This data rate was MCS1.

Frequency Band 2

5270 MHz

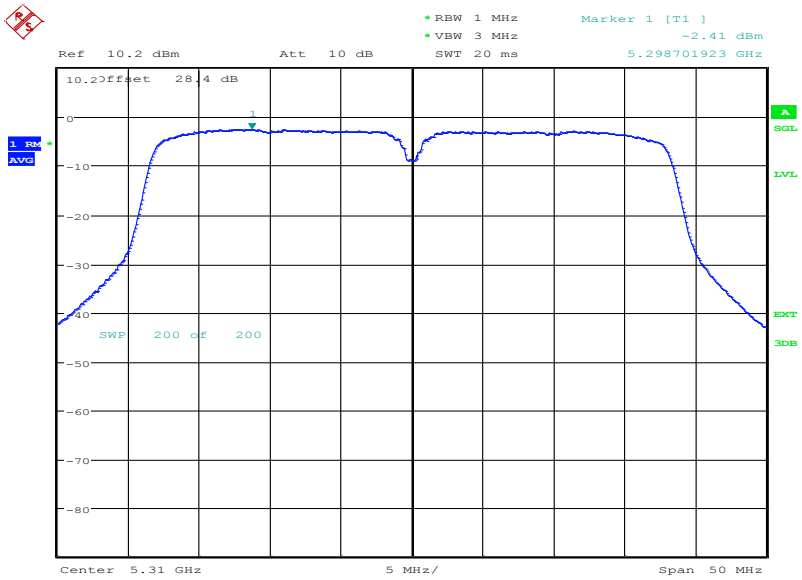
Peak Power Spectral Density (dBm)	-2.33



Date: 9.OCT.2013 15:46:45

5310 MHz

Peak Power Spectral Density (dBm)	-2.41



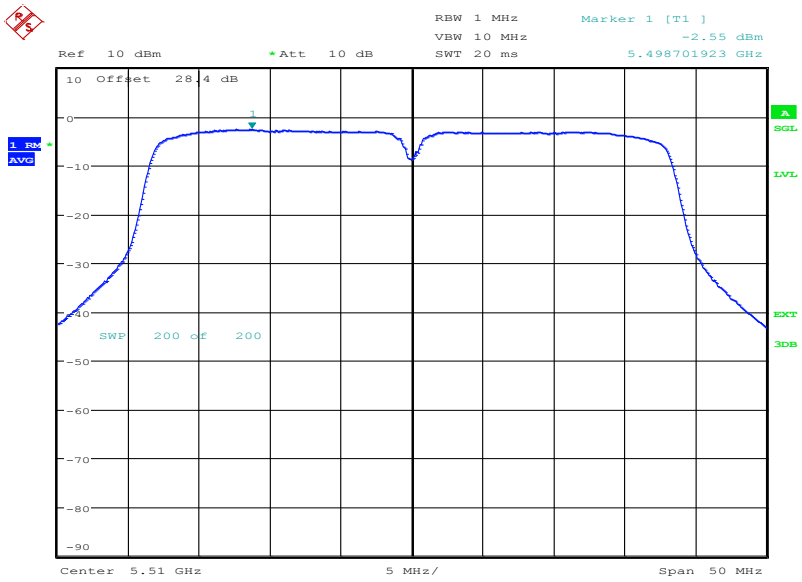
Date: 9.OCT.2013 15:47:28

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 MCS1.

Frequency Band 3

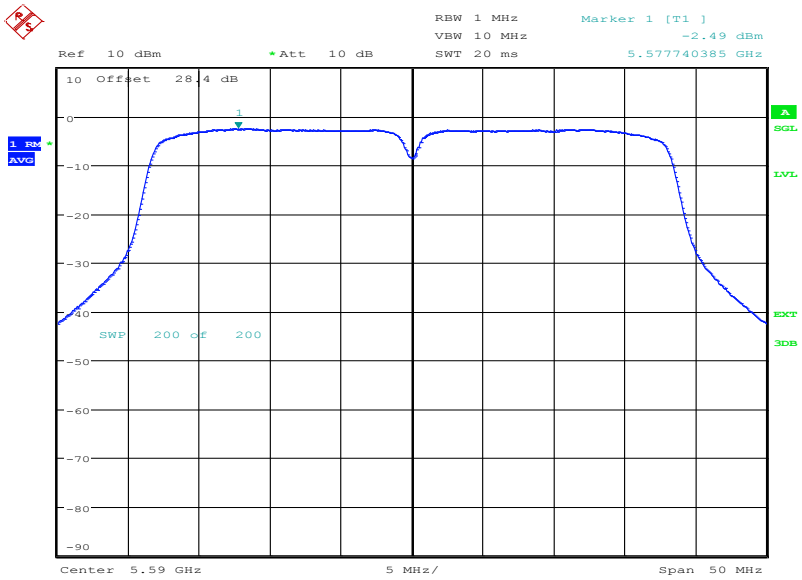
5510 MHz

Peak Power Spectral Density (dBm)	-2.55



5590 MHz

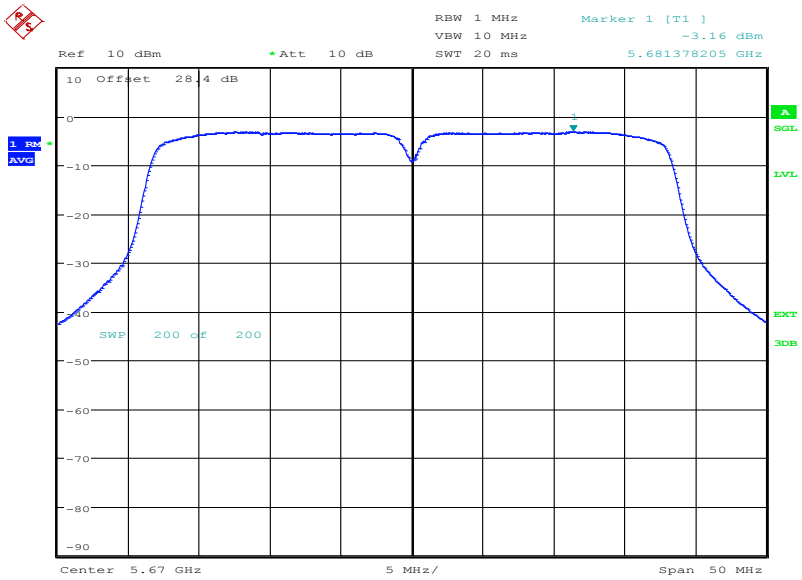
Peak Power Spectral Density (dBm)	-2.49



Date: 14.OCT.2013 09:27:09

5670 MHz

Peak Power Spectral Density (dBm)	-3.16



Date: 14.OCT.2013 09:28:42

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 MCS1.

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

SHL23 S/N: IMEI 004401114893148 - Modification State 0

2.7.3 Date of Test

14 October 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	22.4°C
Relative Humidity	40.3%

2.7.7 Test Results

802.11(a)

Frequency Band 1

5180 MHz

Ratio (dB)	10.29

5200 MHz

Ratio (dB)	9.60

5240 MHz

Ratio (dB)	10.02

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)	9.51

5300 MHz

Ratio (dB)	9.35

5320 MHz

Ratio (dB)	9.49

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)	9.65

5600 MHz

Ratio (dB)	10.39

5700 MHz

Ratio (dB)	9.81

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. Temperature and humidity was entered the wrong way round. Please correct in report.

802.11(ac) - 5 GHz 20 MHz BW FCC

Frequency Band 1

5180 MHz

Ratio (dB)	9.09

5200 MHz

Ratio (dB)	9.08

5240 MHz

Ratio (dB)	8.89

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 MCS1.

Frequency Band 2

5260 MHz

Ratio (dB)	9 .00

5300 MHz

Ratio (dB)	9.05

5320 MHz

Ratio (dB)	8.98

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 MCS1.

Frequency Band 3

5500 MHz

Ratio (dB)	9.16

5600 MHz

Ratio (dB)	9.30

5700 MHz

Ratio (dB)	9.24

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 MCS1.

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 FCC

Frequency Band 1

5190 MHz

Ratio (dB)	11.53

5230 MHz

Ratio (dB)	11.26

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 MCS0.

Frequency Band 2

5270 MHz

Ratio (dB)	11.15

5310 MHz

Ratio (dB)	11.41

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 MCS0.

Frequency Band 3

5510 MHz

Ratio (dB)	11.45

5590 MHz

Ratio (dB)	11.33

5670 MHz

Ratio (dB)	11.46

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 MCS0.

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 FCC

Frequency Band 1

5210 MHz

Ratio (dB)	9.93

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 MCS0.

Frequency Band 2

5290 MHz

Ratio (dB)	9.72

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 MCS0.

Frequency Band 3

5530 MHz

Ratio (dB)	9.84

5610 MHz

Ratio (dB)	9.68

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 MCS0.

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 FCC

Frequency Band 1

5180 MHz

Ratio (dB)	10.54

5200 MHz

Ratio (dB)	10.29

5240 MHz

Ratio (dB)	10.27

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 MCS1.

Frequency Band 2

5260 MHz

Ratio (dB)	10.32

5300 MHz

Ratio (dB)	10.22

5320 MHz

Ratio (dB)	10.17

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 MCS1.

Frequency Band 3

5500 MHz

Ratio (dB)	9.77

5600 MHz

Ratio (dB)	9.91

5700 MHz

Ratio (dB)	9.86

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 MCS1.

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 FCC

Frequency Band 1

5190 MHz

Ratio (dB)	10.43

5230 MHz

Ratio (dB)	10.43

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 MCS1.

Frequency Band 2

5270 MHz

Ratio (dB)	10.82

5310 MHz

Ratio (dB)	10.36

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 MCS1.

Frequency Band 3

5510 MHz

Ratio (dB)	10.2

5590 MHz

Ratio (dB)	10.86

5670 MHz

Ratio (dB)	10.23

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 MCS1.

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	1-Aug-2014
LISN (1 Phase)	Chase	MN 2050	336	12	28-Mar-2014
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Transient Limiter	Hewlett Packard	11947A	2377	12	13-Feb-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
Test Receiver	Rohde & Schwarz	ESIB	2941	12	23-Oct-2013
Section 2.2 - Power Limits					
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
Power Divider	Weinschel	1506A	604	12	23-May-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Screened Room (5)	Rainford	Rainford	1545	36	25-Dec-2013
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Power Supply	Farnell	LT30-2	2903	-	TU
Test Receiver	Rohde & Schwarz	ESIB40	2941	12	23-Oct-2013
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	10-Sep-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	13-Sep-2014
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	18-Sep-2014
True RMS Multimeter	Fluke	179	4007	12	19-Mar-2014
Attenuator (20dB/100W)	Weinschel	48-20-43	4138	9	8-Nov-2013
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	18-Sep-2014

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.3 - Undesirable Emission Limits					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	3-Apr-2014
Antenna (Bilog)	Schaffner	CBL6143	287	24	18-Jan-2014
Filter (High Pass)	Lorch	SHP7-7000-SR	566	12	20-Feb-2014
Multimeter	Fluke	79 Series III	611	12	16-Aug-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Antenna (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	7-Nov-2014
Pre-Amplifier	Phase One	PSO4-0087	1534	12	30-Sep-2014
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
Test Receiver	Rohde & Schwarz	ESIB40	2941	12	23-Oct-2013
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	3171	12	10-Sep-2014
Amplifier (1 - 8GHz)	Phase One	PS06-0060	3175	12	9-Aug-2014
Amplifier (8 - 18GHz)	Phase One	PS06-0061	3176	12	9-Aug-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	11-Oct-2013
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
1 Metre SMA Cable	Rhophase	3PS-1801A-1000-3PS	4099	12	26-Oct-2013
Attenuator (20dB/100W)	Weinschel	48-20-43	4138	9	8-Nov-2013
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	20-Apr-2014
1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4358	12	5-Sep-2014
Section 2.4 - Frequency Stability					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Communications Tester	Rohde & Schwarz	CMU 200	442	12	1-Nov-2013
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	18-Oct-2013
Multimeter	Fluke	79 Series III	611	12	16-Aug-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Power Supply	Hewlett Packard	6104A	1948	-	TU
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Power Divider	Weinschel	1506A	3345	12	23-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	18-Sep-2014
True RMS Multimeter	Fluke	179	4007	12	19-Mar-2014
Attenuator (20dB/100W)	Weinschel	48-20-43	4138	9	8-Nov-2013
Section 2.5 - 26 dB Bandwidth					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	18-Oct-2013
Multimeter	Fluke	79 Series III	611	12	16-Aug-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Power Divider	Weinschel	1506A	3345	12	23-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	18-Sep-2014

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6 - Peak Power Spectral Density					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	18-Oct-2013
Multimeter	Fluke	79 Series III	611	12	16-Aug-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Power Divider	Weinschel	1506A	3345	12	23-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	18-Sep-2014
Section 2.7 - Ratio of the Peak Excursion of the Modulation Envelope					
Power Supply Unit	Farnell	LT-30-2	41	-	O/P Mon
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	18-Oct-2013
Multimeter	Fluke	79 Series III	611	12	16-Aug-2014
GPS Frequency Standard	Rapco	GPS-804/3	1312	6	24-Jan-2014
Hygrometer	Rotronic	I-1000	3220	12	16-Jul-2014
Power Divider	Weinschel	1506A	3345	12	23-May-2014
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	4-Jul-2014
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	18-Sep-2014
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	18-Sep-2014

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).