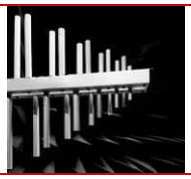
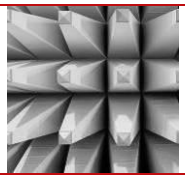




CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-6965/13-04-05-A

DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-01
Area of Testing:
Radio Communications & Compatibility Testing (RCT)

Applicant

Sony Mobile Communications AB
Nya Vattentornet
22188 Lund / SWEDEN
Phone: +46 46 19 30 00
Fax: -/-
Contact: Mikael Nilsson
e-mail: Micke.nilsson@sonymobile.com
Phone: +46 7 03 22 75 03

Manufacturer

Sony Mobile Communications AB
Nya Vattentornet
22188 Lund / SWEDEN

Test standard/s

47 CFR Part 27

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**Smart Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/IV/V/VIII; LTE FDD1/2/3/4/5/7/8/13/17/20; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS**
Type name:	**PM-0740-BV**
FCC ID:	**PY7PM-0740**
Frequency:	LTE FDD 4: 1710 MHz to 1755 MHz LTE FDD 7: 2500 MHz to 2570 MHz LTE FDD 13: 777 MHz to 787 MHz LTE FDD 17: 704 MHz to 716 MHz
Technology tested:	LTE FDD 4 / 7 / 13 / 17
Antenna:	Integrated antenna
Power supply:	3.7 V DC by Li - polymer battery
Temperature range:	-30°C to +60°C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorised:

cn=Andreas Luckenbill, o=CETECOM ICT Services GmbH, ou=LUC-111202, email=andreas.luckenbill@cetecom.com, c=DE
2014.01.22 15:21:52 +01'00'

Andreas Luckenbill
Expert

Test performed:

cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-100826, email=marco.bertolino@cetecom.com, c=DE
2014.01.22 15:25:40 +01'00'

Marco Bertolino
Testing Manager

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.
The testing service provided by CETECOM ICT Services GmbH has been rendered under the current "General Terms and Conditions for CETECOM ICT Services GmbH".
CETECOM ICT Services GmbH will not be liable for any loss or damage resulting from false, inaccurate, inappropriate or incomplete product information provided by the customer.
Under no circumstances does the CETECOM ICT Services GmbH test report include any endorsement or warranty regarding the functionality, quality or performance of any other product or service provided.
Under no circumstances does the CETECOM ICT Services GmbH test report include or imply any product or service warranties from CETECOM ICT Services GmbH, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by CETECOM ICT Services GmbH.
All rights and remedies regarding vendor's products and services for which CETECOM ICT Services GmbH has prepared this test report shall be provided by the party offering such products or services and not by CETECOM ICT Services GmbH.
In no case this test report can be considered as a Letter of Approval.

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2013-11-29
Date of receipt of test item:	2013-12-02
Start of test:	2013-12-04
End of test:	2013-12-19
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 27		Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services

4 Test environment

Temperature:	T_{nom}	+22	°C during room temperature tests
	T_{max}	+60	°C during high temperature tests
	T_{min}	-30	°C during low temperature tests
Relative humidity content:		46 %	
Barometric pressure:		not relevant for this kind of testing	
Power supply:	V_{nom}	3.7 V	DC by Li - polymer battery
	V_{max}	4.4 V	
	V_{min}	3.3 V	

5 Test item

Kind of test item	**:**	**Smart Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/IV/V/VIII; LTE FDD1/2/3/4/5/7/8/13/17/20; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS**
Type name	**:**	**PM-0740-BV**
S/N serial number	**:**	**Cond: CB5A1W1HRO, CB5A1W1HP7** **Rad: CB5A1W1HQ9, CB5A1W1HRX**
HW hardware status	**:**	**AP1.1**
SW software status	**:**	**17.0.A.0.256**
Frequency band [MHz]	**:**	**LTE FDD 4: 1710 MHz to 1755 MHz** **LTE FDD 7: 2500 MHz to 2570 MHz** **LTE FDD 13: 777 MHz to 787 MHz** **LTE FDD 17: 704 MHz to 716 MHz**
Type of modulation	**:**	**QPSK, 16 – QAM**
Antenna	**:**	**Integrated antenna**
Power supply	**:**	**3.7 V DC by Li - polymer battery**
Temperature range	**:**	**-30°C to +60 °C**

5.1 Additional information

Test setup- and EUT-photos are included in test report: 1-6965/13-04-01_AnnexA
1-6965/13-04-01_AnnexB
1-6965/13-04-01_AnnexC

6 Test laboratories sub-contracted

None

7 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 27	passed	2014-01-22	-/-

7.1 LTE – Band 4

Test Case	temperature conditions	power source voltages	Pass	Fail	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: NA = Not applicable; NP = Not performed

7.2 LTE – Band 7

Test Case	temperature conditions	power source voltages	Pass	Fail	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: NA = Not applicable; NP = Not performed

7.3 LTE – Band 13

Test Case	temperature conditions	power source voltages	Pass	Fail	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: NA = Not applicable; NP = Not performed

7.4 LTE – Band 17

Test Case	temperature conditions	power source voltages	Pass	Fail	NA	NP	Remark
RF Output Power	Nominal	Nominal	☒	☐	☐	☐	-/-
Frequency Stability	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Radiated	Nominal	Nominal	☒	☐	☐	☐	-/-
Spurious Emissions Conducted	Nominal	Nominal	☒	☐	☐	☐	-/-
Block Edge Compliance	Nominal	Nominal	☒	☐	☐	☐	-/-
Occupied Bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: NA = Not applicable; NP = Not performed

8 RF measurements

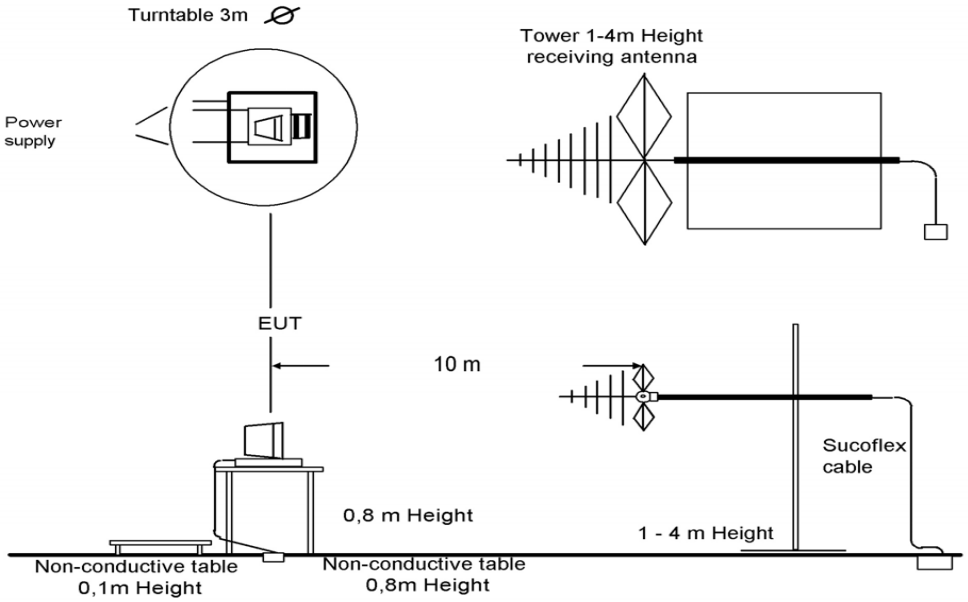
8.1 Description of test setup

For the spurious measurements we use the substitution method according TIA/EIA 603.

8.1.1 Radiated measurements

The radiated emissions from the EUT are performed in a semi anechoic chamber. The EUT is placed on a conductive turntable and powered with nominal voltage. The signalling is performed either from outside the chamber with a signalling unit (AP or other) by air link using a signalling antenna or directly by special test software from the customer.

Semi anechoic chamber



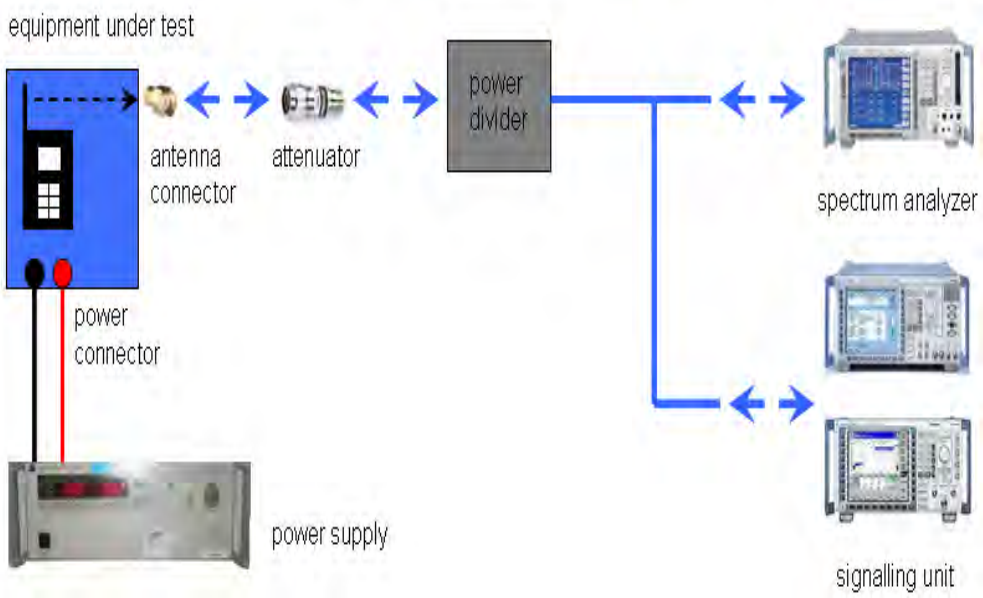
Picture 1: Diagram radiated measurements

9 kHz - 30 MHz:	active loop antenna
30 MHz – 1 GHz:	tri-log antenna
> 1 GHz:	horn antenna

Frequency being measured f	Measuring receiver bandwidth 6 dB	Spectrum analyser bandwidth 3dB
f < 150 kHz	200 Hz or	300 Hz
150 kHz ≤ f < 30 MHz	9 kHz or	10 kHz
30 MHz ≤ f < 1000 MHz	120 kHz or	100 kHz
1000 MHz ≤ f		1 MHz
NOTE: Specific requirements in CEPT/ERC/Recommendation 70-03 [2] shall be applied where applicable.		

8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the signalling unit (AP or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm. If special software is used, there is no power divider necessary.



Picture 2: Diagram conducted measurements

The term measuring receiver refers to either a selective voltmeter or a spectrum analyser.

Frequency being measured f	Measuring receiver bandwidth 6 dB	Spectrum analyser bandwidth 3dB
f < 1000 MHz	120 kHz or	100 kHz
1000 MHz ≤ f		1 MHz
NOTE: Specific requirements in CEPT/ERC/Recommendation 70-03 [2] shall be applied where applicable.		

8.2 LTE technologies supported by EUT

Channel bandwidth

	Band 4	Band 7	Band 13	Band 17
[MHz]				
1.4	☒	☐	☐	☐
3	☒	☐	☐	☐
5	☒	☒	☒	☒
10	☒	☒	☒	☒
15	☒	☒	☐	☐
20	☒	☒	☐	☐

8.3 Results LTE – Band 4

The EUT was set to transmit the maximum power.

8.3.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold

Limits:

FCC	-/-
Average E.I.R.P. Output Power	
+30.00 dBm In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (conducted)						
Bandwidth (MHz)	**Frequency (MHz)**	**Resource block allocation**	**Average Output Power (dBm) QPSK**	**Peak to Average Ratio (dB)**	**Average Output Power (dBm) 16-QAM**	**Peak to Average Ratio (dB)**
1.4	1710.7	1 RB low	22.2	4.86	21.4	5.54
		1 RB high	22.2	4.93	21.4	5.58
		50% RB mid	22.2	4.9	21.2	5.86
		100% RB	21.2	5.56	20.1	6.62
	1732.5	1 RB low	22.2	4.87	21.0	3.64
		1 RB high	22.1	4.77	21.0	3.65
		50% RB mid	22.0	4.65	21.3	3.91
		100% RB	21.1	5.8	20.2	5.09
	1754.3	1 RB low	22.3	4.55	21.4	5.54
		1 RB high	22.3	4.35	21.4	5.33
		50% RB mid	22.3	4.60	21.2	5.62
		100% RB	21.3	5.81	20.4	6.36
3	1711.5	1 RB low	22.3	5.55	21.4	4.80
		1 RB high	22.3	5.61	21.4	4.97
		50% RB mid	21.2	6.12	20.0	5.02
		100% RB	21.2	6.19	20.3	5.44
	1732.5	1 RB low	22.2	3.59	21.0	4.78
		1 RB high	22.1	3.68	20.9	4.87
		50% RB mid	21.1	4.62	20.2	5.50
		100% RB	21.1	5.30	20.1	6.14
	1753.5	1 RB low	22.3	5.97	21.3	4.89
		1 RB high	22.4	5.61	21.1	4.34
		50% RB mid	21.3	5.87	20.3	4.97
		100% RB	21.3	6.34	20.4	5.34
5	1712.5	1 RB low	22.3	4.85	21.2	5.68
		1 RB high	22.2	4.95	21.1	5.75
		50% RB mid	21.2	5.14	20.3	6.20
		100% RB	21.2	5.80	20.3	6.76
	1732.5	1 RB low	22.1	4.27	21.6	3.70
		1 RB high	22.1	4.34	21.5	3.72
		50% RB mid	21.1	5.67	20.1	4.69
		100% RB	21.1	6.11	20.1	5.14
	1752.5	1 RB low	22.3	4.98	21.0	5.98
		1 RB high	22.3	4.38	21.1	5.68
		50% RB mid	21.3	5.27	20.4	6.19
		100% RB	21.3	5.69	20.4	6.76

10	1715.0	1 RB low	22.3	5.56	21.4	4.93
		1 RB high	22.3	5.54	21.5	4.87
		50% RB mid	21.2	6.25	20.3	5.33
		100% RB	21.3	6.71	20.3	5.96
	1732.5	1 RB low	22.2	3.91	21.0	5.13
		1 RB high	22.4	3.87	21.1	5.12
		50% RB mid	21.1	4.66	20.2	5.53
		100% RB	21.2	5.32	20.3	6.05
	1750.0	1 RB low	22.3	5.96	21.0	4.88
		1 RB high	22.4	5.80	21.0	4.44
		50% RB mid	21.3	6.30	20.3	5.32
		100% RB	21.3	6.74	20.3	5.79
15	1717.5	1 RB low	22.3	4.99	21.4	5.62
		1 RB high	22.2	4.50	21.3	5.34
		50% RB mid	21.3	5.31	20.4	6.23
		100% RB	21.3	5.64	20.4	6.51
	1732.5	1 RB low	22.2	4.88	21.5	4.17
		1 RB high	22.3	4.93	21.7	4.24
		50% RB mid	21.1	5.69	20.1	4.70
		100% RB	21.2	5.97	20.3	5.18
	1747.5	1 RB low	22.3	4.53	21.1	5.71
		1 RB high	22.3	4.59	21.2	5.77
		50% RB mid	21.2	5.24	20.2	6.22
		100% RB	21.4	5.60	20.4	6.60
20	1720.0	1 RB low	22.3	5.76	21.3	4.91
		1 RB high	22.2	4.79	21.3	3.81
		50% RB mid	21.2	6.22	20.3	5.19
		100% RB	21.2	6.40	20.3	5.30
	1732.5	1 RB low	22.0	4.55	21.3	5.32
		1 RB high	22.1	4.77	21.4	5.44
		50% RB mid	21.2	4.68	20.2	5.67
		100% RB	21.2	5.25	20.3	5.88
	1745.0	1 RB low	22.1	4.75	21.4	3.99
		1 RB high	22.2	5.45	21.4	4.72
		50% RB mid	21.3	6.24	20.4	5.27
		100% RB	21.3	6.43	20.4	5.36
Measurement uncertainty			± 0.5 dB			

The output power radiated is measured with the mode wich have the highest conducted output power.

Output Power (radiated)			
Bandwidth (MHz)	**Frequency (MHz)**	**Average Output Power (dBm) QPSK**	**Average Output Power (dBm) 16-QAM**
1.4	1710.7	22.3	21.5
	1732.5	23.3	22.4
	1754.3	23.4	22.5
3	1711.5	22.4	21.5
	1732.5	23.3	22.1
	1753.5	23.5	22.4
5	1712.5	22.4	21.3
	1732.5	23.2	22.7
	1752.5	23.4	22.2
10	1715.0	22.4	21.6
	1732.5	23.5	22.2
	1750.0	23.5	22.1
15	1717.5	22.4	21.5
	1732.5	23.4	22.8
	1747.5	23.4	22.3
20	1720.0	22.4	21.4
	1732.5	23.2	22.5
	1745.0	23.3	22.5
Measurement uncertainty		± 3.0 dB	

Result: **Passed**

8.3.2 Frequency stability

Description:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMW500 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with V_{nom}, connected to the CMW500 and in a simulated call on channel 1412 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +60°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with V_{nom}. Vary supply voltage from V_{min} to V_{max}, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at V_{nom} for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

This measurement was performed with the highest channel bandwidth supported from the EUT on the middle channel

Measurement:

Measurement parameters	
Detector:	Measured with CMW500
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace-Mode:	

Limits:

FCC	-/-
Frequency Stability	
< 2.5 ppm	

Results:

FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
3.3	-8	-0.00000046	-0.0046
3.4	4	0.00000023	0.0023
3.5	12	0.00000069	0.0069
3.6	-12	-0.00000069	-0.0069
3.7	6	0.00000035	0.0035
3.8	-11	-0.00000063	-0.0063
3.9	-13	-0.00000075	-0.0075
4.0	12	0.00000069	0.0069
4.1	-9	-0.00000052	-0.0052
4.2	-9	-0.00000052	-0.0052
4.3	-10	-0.00000058	-0.0058
4.4	4	0.00000023	0.0023

FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-15	-0.00000087	-0.0087
-20	-17	-0.00000098	-0.0098
-10	10	0.00000058	0.0058
± 0	7	0.00000040	0.0040
10	16	0.00000092	0.0092
20	13	0.00000075	0.0075
30	17	0.00000098	0.0098
40	10	0.00000058	0.0058
50	13	0.00000075	0.0075
60	4	0.00000023	0.0023

Result: **Passed**

8.3.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2009 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1755 MHz. Measurement made up to 25 GHz. The resolution bandwidth is set as outlined in Part 27.53. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE band 4.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603.

Measurement:

Measurement parameters		
Detector:	Peak	
Sweep time:	2 sec.	
Video bandwidth:	below 150 kHz: 150 kHz ≤ f < 30 MHz: 30 MHz ≤ f < 1000 MHz: Above 1 GHz:	200 Hz 9 kHz 100 kHz 1 or 3MHz
Resolution bandwidth:	below 150 kHz: 150 kHz ≤ f < 30 MHz: 30 MHz ≤ f < 1000 MHz: Above 1 GHz:	200 Hz 9 kHz 100 kHz 1 MHz
Span:	100 MHz Steps	
Trace-Mode:	Max Hold	

Limits:

FCC	-/-
Spurious Emissions Radiated	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the LTE band 4 (1712.5 MHz, 1732.5 MHz and 1752.5 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band 4 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel at the channel bandwidth. If spurious were detected, the lowest and highest channel and all supported channel bandwidths were checked, too.

As can be seen from this data, the emissions from the test item were within the specification limit.

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3430.0	No peaks detected.	3465.0	No peaks detected.	3500.0	No peaks detected.
5145.0		5197.5		5250.0	
6860.0		6930.0		7000.0	
8575.0		8662.5		8750.0	
10290.0		10395.0		10500.0	
12005.0		12127.5		12250.0	
13720.0		13860.0		14000.0	
15435.0		15592.5		15750.0	
17150.0		17325.0		17500.0	
Measurement uncertainty			± 3dB		

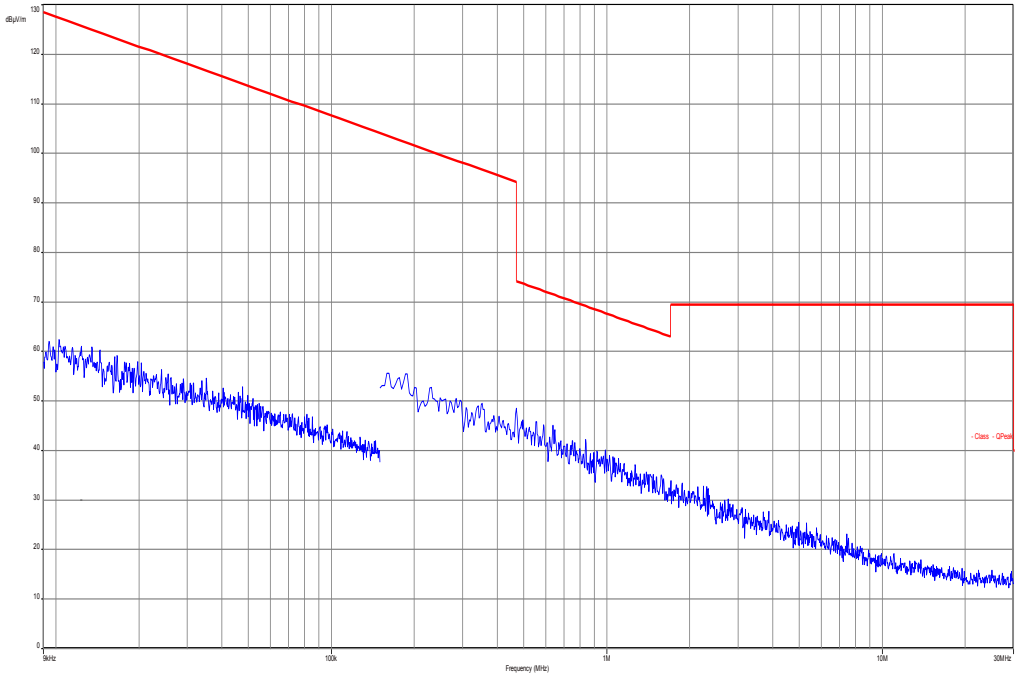
16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3430.0	No peaks detected.	3465.0	No peaks detected.	3500.0	No peaks detected.
5145.0		5197.5		5250.0	
6860.0		6930.0		7000.0	
8575.0		8662.5		8750.0	
10290.0		10395.0		10500.0	
12005.0		12127.5		12250.0	
13720.0		13860.0		14000.0	
15435.0		15592.5		15750.0	
17150.0		17325.0		17500.0	
Measurement uncertainty			± 3dB		

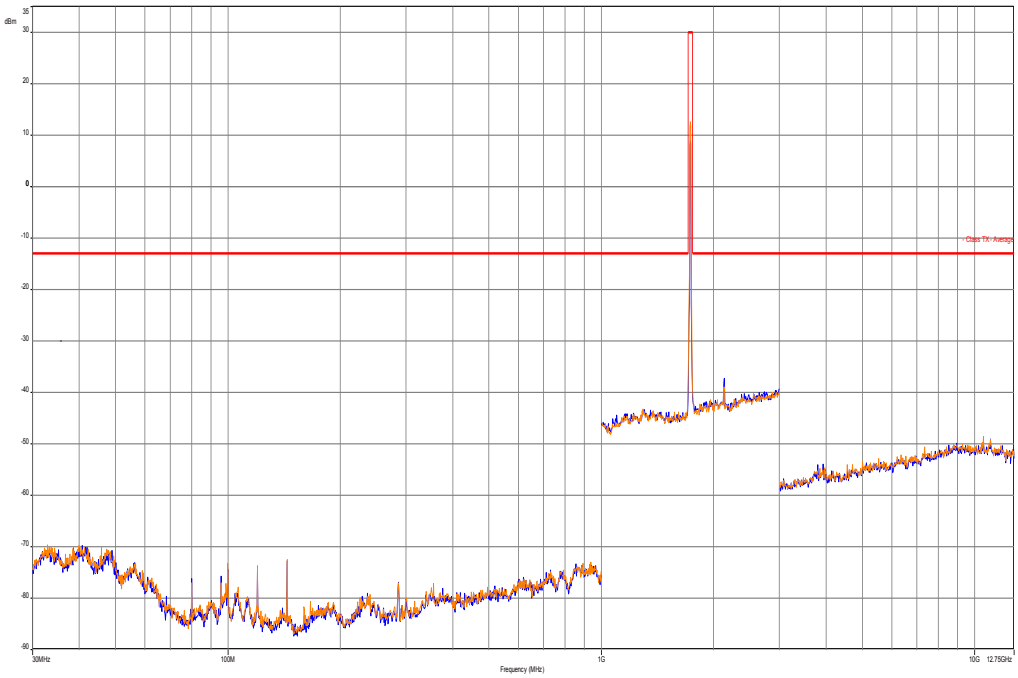
Result: Passed

QPSK with 10 MHz channel bandwidth

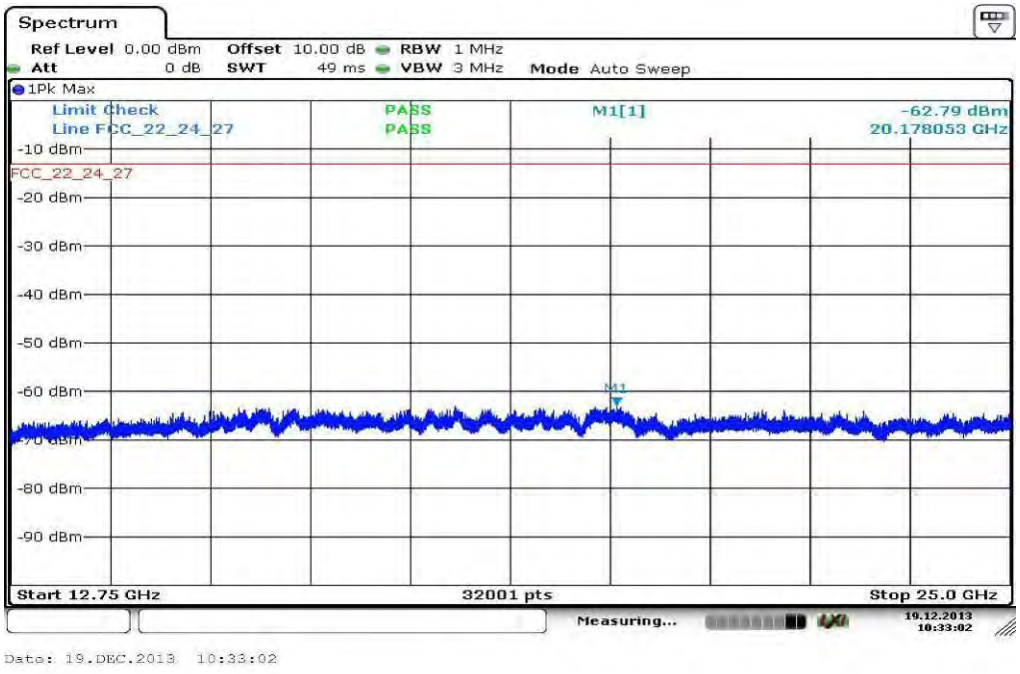
Plot 1: Middle channel, up to 30 MHz



Plot 2: Middle channel, 30 MHz to 12.75 GHz

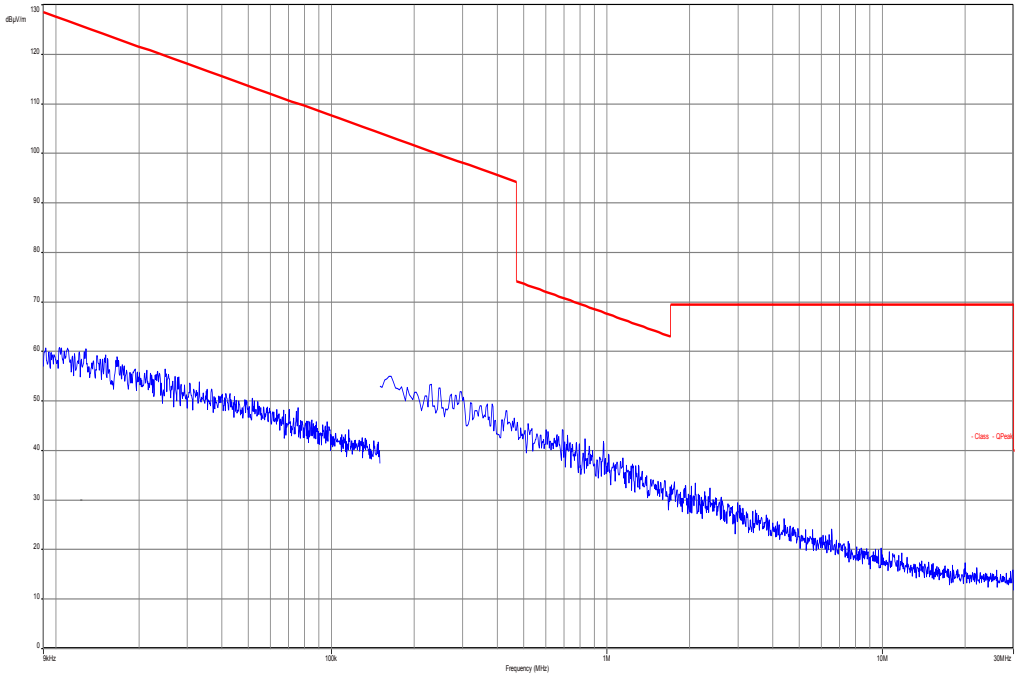


Plot 3: Middle channel, 12 GHz to 25 GHz

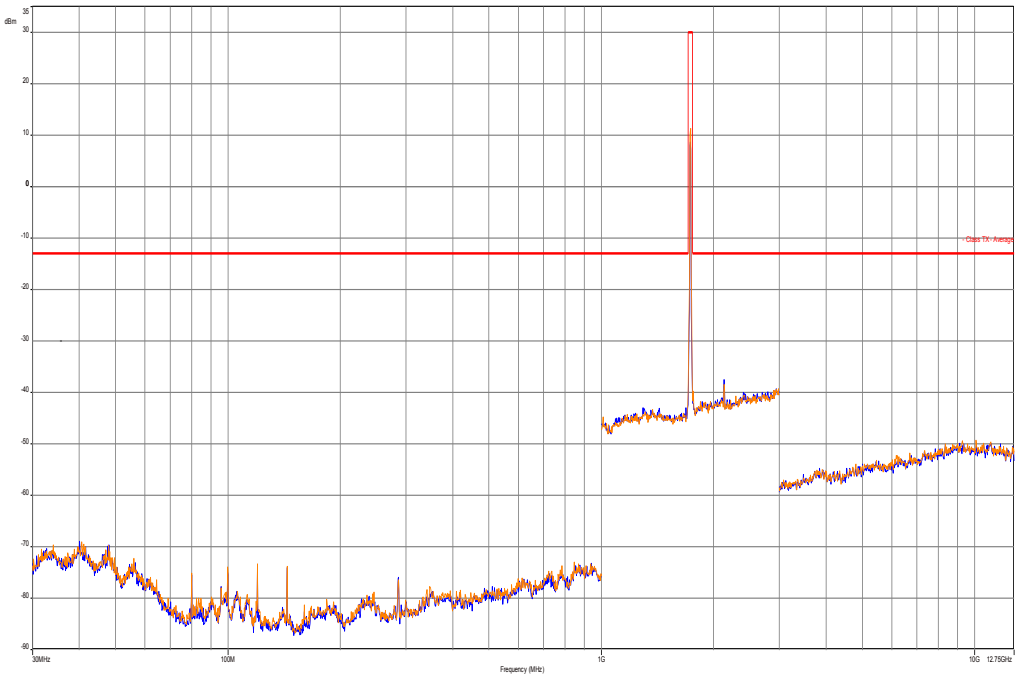


16-QAM with 10 MHz channel bandwidth

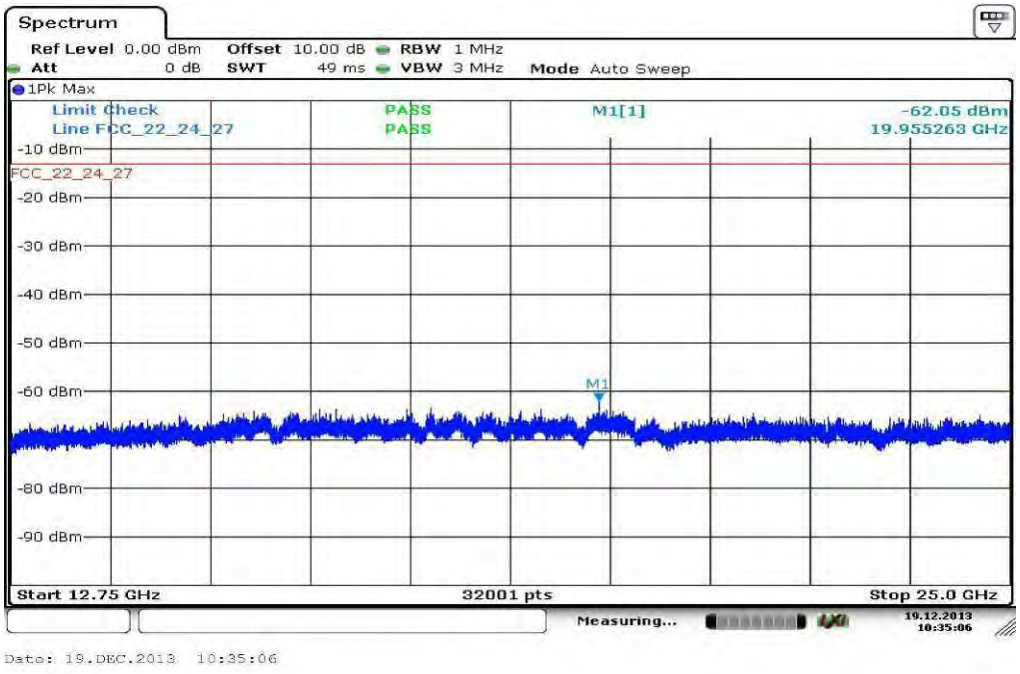
Plot 4: Middle channel, up to 30 MHz



Plot 5: Middle channel, 30 MHz to 12.75 GHz



Plot 6: Middle channel, 12 GHz to 25 GHz



8.3.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

For the measurement the lowest, middle and highest channel bandwidth was used. If spurious were found the other bandwidths were measured, too.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement below 1 GHz with 100 kHz Above 1 GHz with 1 MHz
Resolution bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement below 1 GHz with 100 kHz Above 1 GHz with 1 MHz
Span:	10 MHz – 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC	-/-
Spurious Emissions Conducted	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results: for 1.4 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3421.4	No spurious emissions detected!	3465.0	No spurious emissions detected!	3508.6	No spurious emissions detected!
5132.1		5197.5		5262.9	
6842.8		6930.0		7017.2	
8553.5		8662.5		8771.5	
10264.2		10395.0		10525.8	
11974.9		12127.5		12280.1	
13685.6		13860.0		14034.4	
15396.3		15592.5		15788.7	
17107.0		17325.0		17543.0	
Measurement uncertainty			± 3dB		

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3421.4	No spurious emissions detected!	3465.0	No spurious emissions detected!	3508.6	No spurious emissions detected!
5132.1		5197.5		5262.9	
6842.8		6930.0		7017.2	
8553.5		8662.5		8771.5	
10264.2		10395.0		10525.8	
11974.9		12127.5		12280.1	
13685.6		13860.0		14034.4	
15396.3		15592.5		15788.7	
17107.0		17325.0		17543.0	
Measurement uncertainty			± 3dB		

Result: Passed

Results: for 3 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3423.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3507.0	No spurious emissions detected!
5134.5		5197.5		5260.5	
6846.0		6930.0		7014.0	
8557.5		8662.5		8767.5	
10269.0		10395.0		10521.0	
11980.5		12127.5		12274.5	
13692.0		13860.0		14028.0	
15403.5		15592.5		15781.5	
17115.0		17325.0		17535.0	
Measurement uncertainty			± 3dB		

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3423.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3507.0	No spurious emissions detected!
5134.5		5197.5		5260.5	
6846.0		6930.0		7014.0	
8557.5		8662.5		8767.5	
10269.0		10395.0		10521.0	
11980.5		12127.5		12274.5	
13692.0		13860.0		14028.0	
15403.5		15592.5		15781.5	
17115.0		17325.0		17535.0	
Measurement uncertainty			± 3dB		

Result: Passed

Results: for 5 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3425.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3505.0	No spurious emissions detected!
5137.5		5197.5		5257.5	
6850.0		6930.0		7010.0	
8562.5		8662.5		8762.5	
10275.0		10395.0		10515.0	
11987.5		12127.5		12267.5	
13700.0		13860.0		14020.0	
15412.5		15592.5		15772.5	
17125.0		17325.0		17525.0	
Measurement uncertainty			± 3dB		

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3425.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3505.0	No spurious emissions detected!
5137.5		5197.5		5257.5	
6850.0		6930.0		7010.0	
8562.5		8662.5		8762.5	
10275.0		10395.0		10515.0	
11987.5		12127.5		12267.5	
13700.0		13860.0		14020.0	
15412.5		15592.5		15772.5	
17125.0		17325.0		17525.0	
Measurement uncertainty			± 3dB		

Result: Passed

Results: for 10 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3430.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3500.0	No spurious emissions detected!
5145.0		5197.5		5250.0	
6860.0		6930.0		7000.0	
8575.0		8662.5		8750.0	
10290.0		10395.0		10500.0	
12005.0		12127.5		12250.0	
13720.0		13860.0		14000.0	
15435.0		15592.5		15750.0	
17150.0		17325.0		17500.0	
Measurement uncertainty			± 3dB		

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3430.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3500.0	No spurious emissions detected!
5145.0		5197.5		5250.0	
6860.0		6930.0		7000.0	
8575.0		8662.5		8750.0	
10290.0		10395.0		10500.0	
12005.0		12127.5		12250.0	
13720.0		13860.0		14000.0	
15435.0		15592.5		15750.0	
17150.0		17325.0		17500.0	
Measurement uncertainty			± 3dB		

Result: Passed

Results: for 15 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3435.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3495.0	No spurious emissions detected!
5152.5		5197.5		5242.5	
6870.0		6930.0		6990.0	
8587.5		8662.5		8737.5	
10305.0		10395.0		10485.0	
12022.5		12127.5		12232.5	
13740.0		13860.0		13980.0	
15457.5		15592.5		15727.5	
17175.0		17325.0		17475.0	
Measurement uncertainty			± 3dB		

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3435.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3495.0	No spurious emissions detected!
5152.5		5197.5		5242.5	
6870.0		6930.0		6990.0	
8587.5		8662.5		8737.5	
10305.0		10395.0		10485.0	
12022.5		12127.5		12232.5	
13740.0		13860.0		13980.0	
15457.5		15592.5		15727.5	
17175.0		17325.0		17475.0	
Measurement uncertainty			± 3dB		

Result: Passed

Results: for 20 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3440.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3490.0	No spurious emissions detected!
5160.0		5197.5		5235.0	
6880.0		6930.0		6980.0	
8600.0		8662.5		8725.0	
10320.0		10395.0		10470.0	
12040.0		12127.5		12215.0	
13760.0		13860.0		13960.0	
15480.0		15592.5		15705.0	
17200.0		17325.0		17450.0	
Measurement uncertainty		± 3dB			

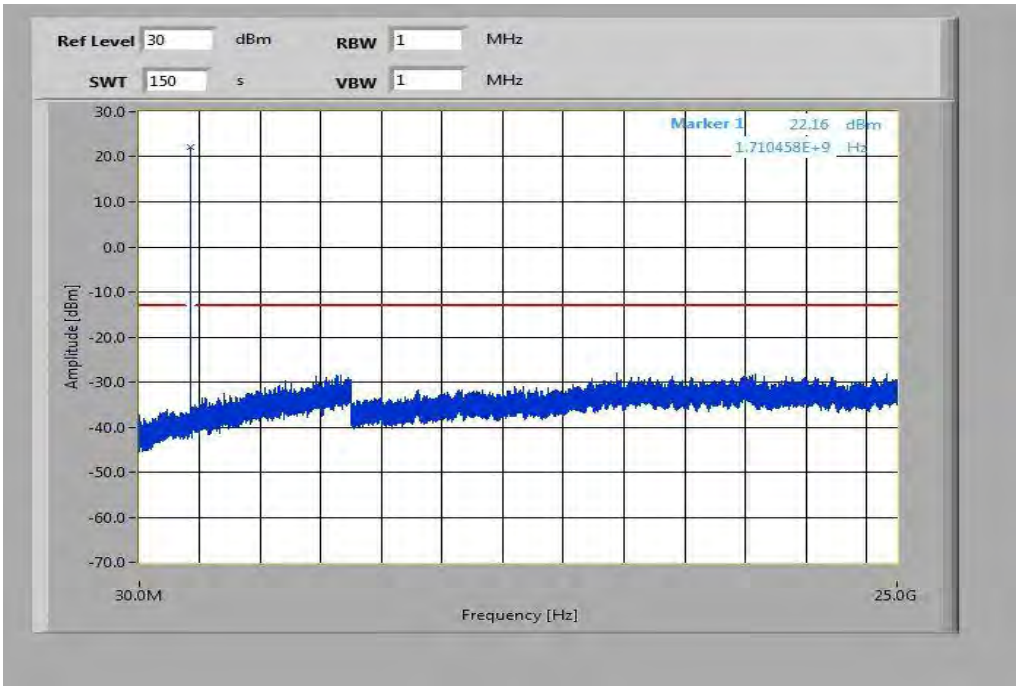
16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3440.0	No spurious emissions detected!	3465.0	No spurious emissions detected!	3490.0	No spurious emissions detected!
5160.0		5197.5		5235.0	
6880.0		6930.0		6980.0	
8600.0		8662.5		8725.0	
10320.0		10395.0		10470.0	
12040.0		12127.5		12215.0	
13760.0		13860.0		13960.0	
15480.0		15592.5		15705.0	
17200.0		17325.0		17450.0	
Measurement uncertainty		± 3dB			

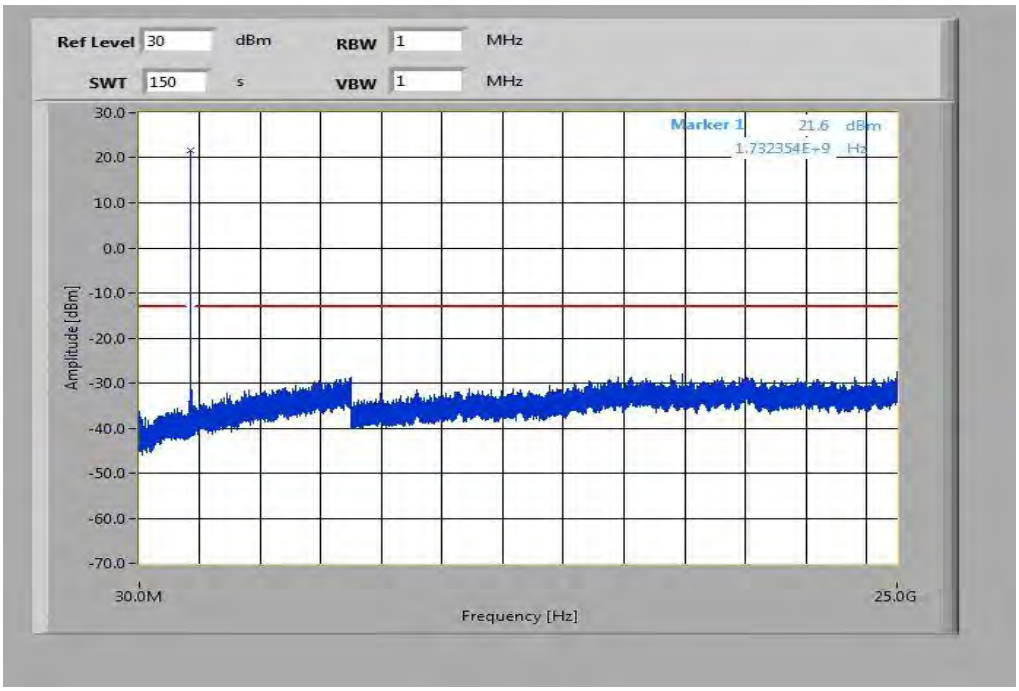
Result: Passed

Plots for 1.4 MHz channel bandwidth, QPSK

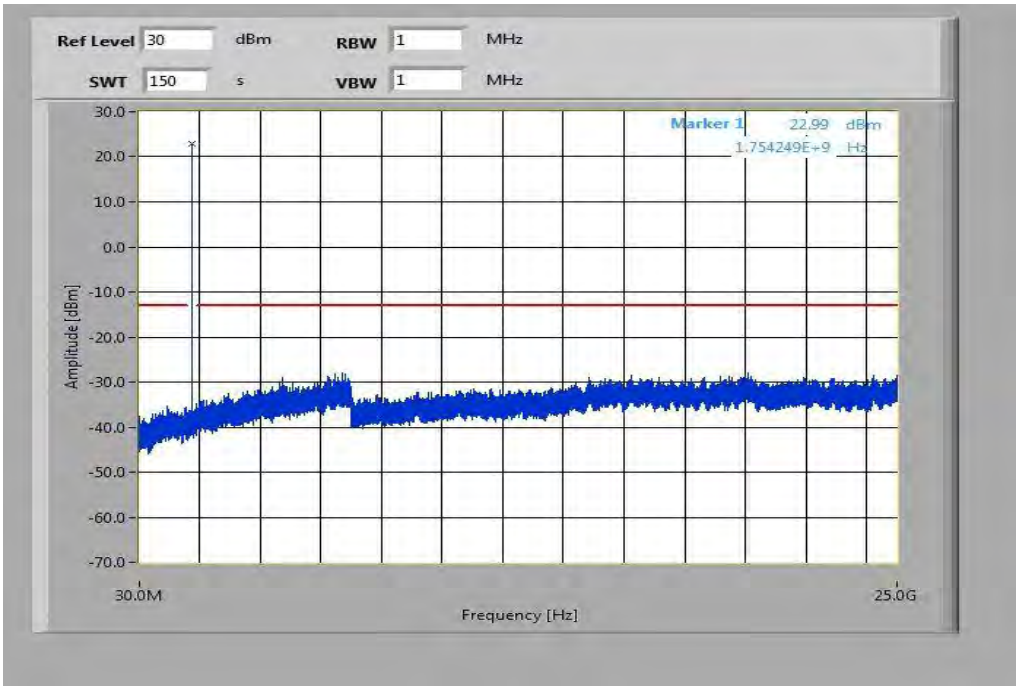
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

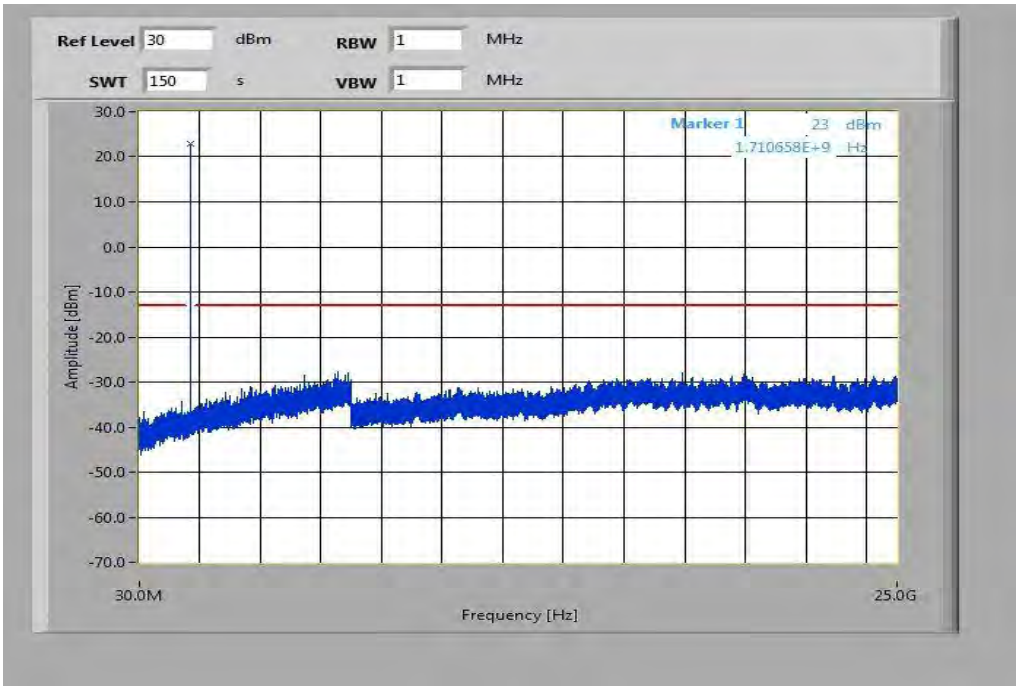


Plot 3: Highest channel, 30 MHz to 25 GHz

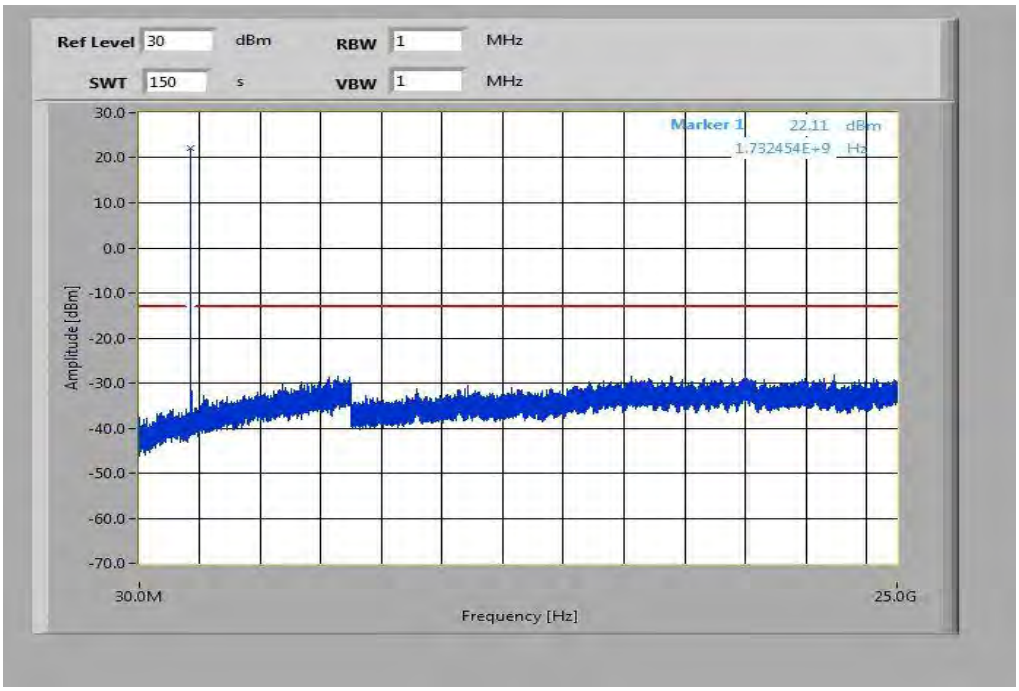


Plots for 1.4 MHz channel bandwidth, 16-QAM

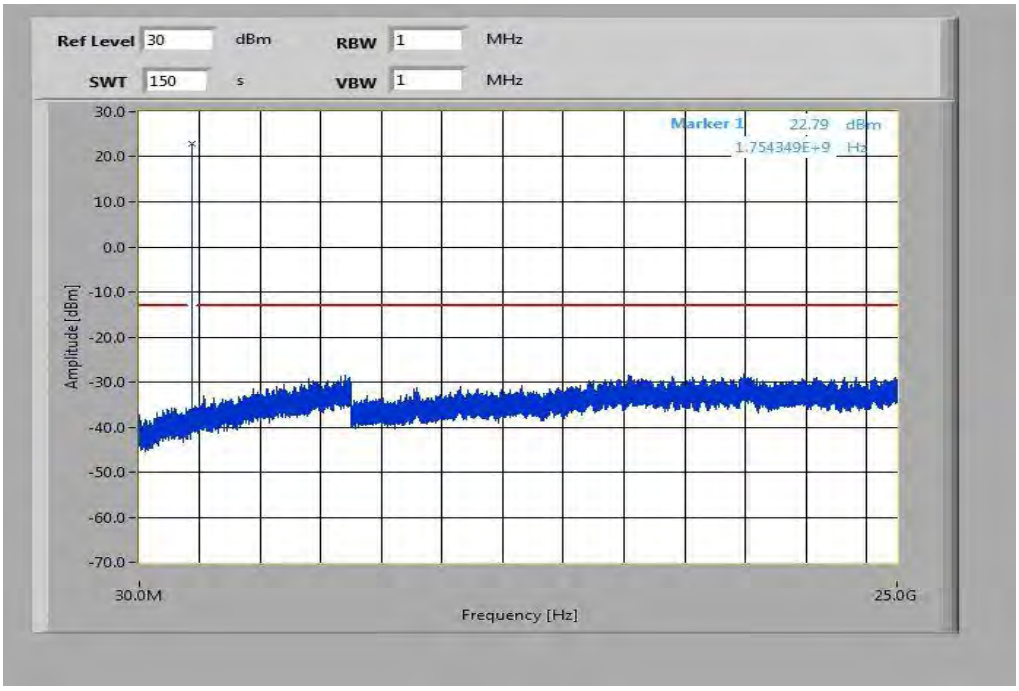
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

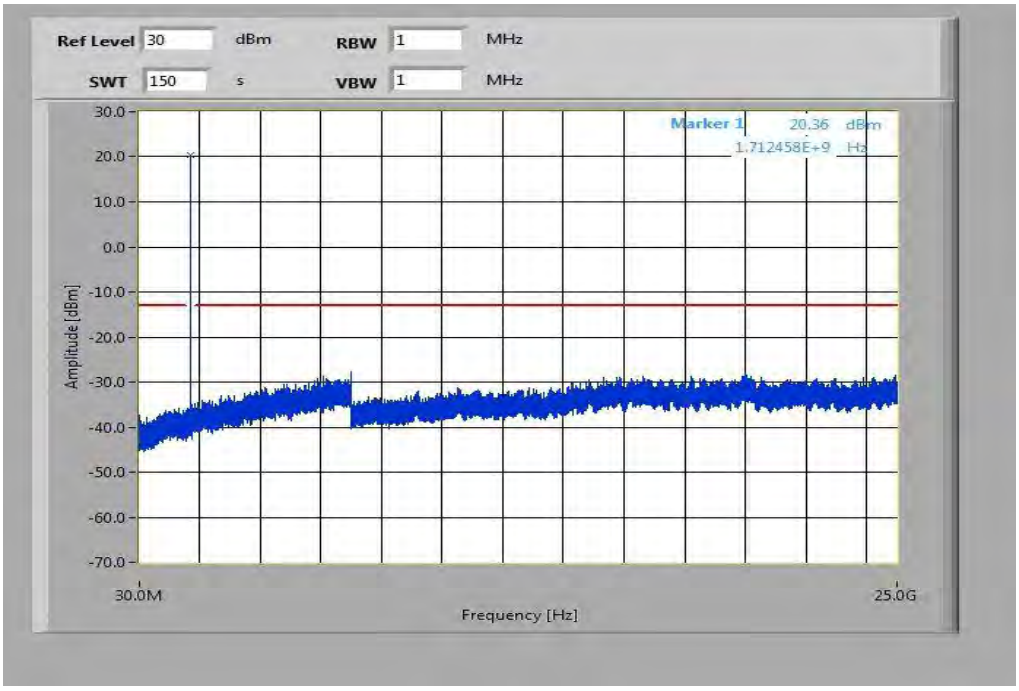


Plot 6: Highest channel, 30 MHz to 25 GHz

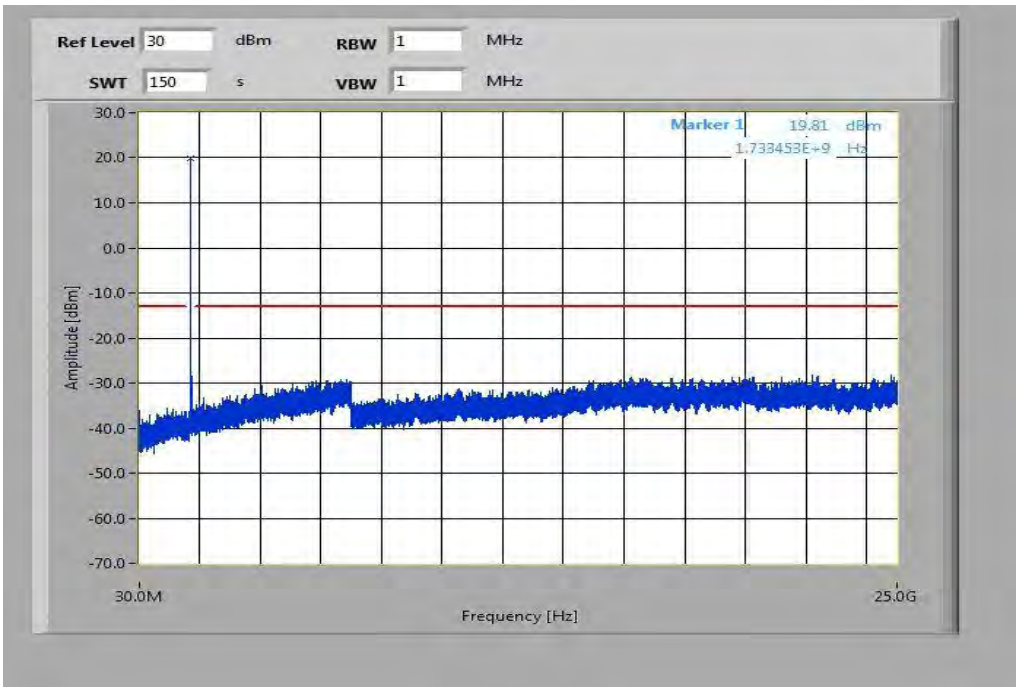


Plots for 3 MHz channel bandwidth, QPSK

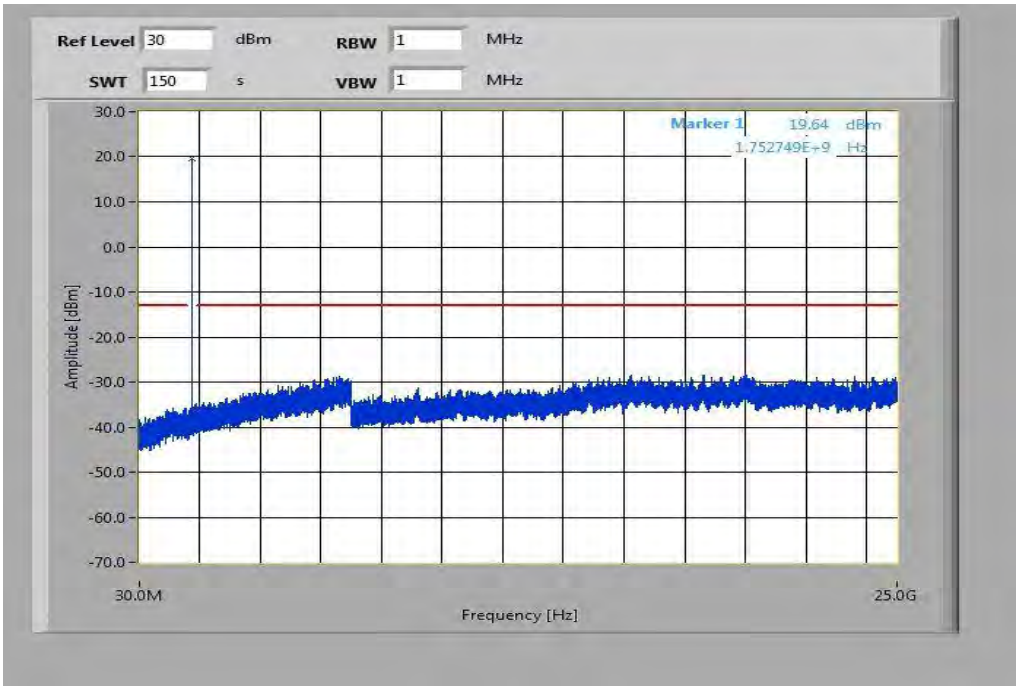
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

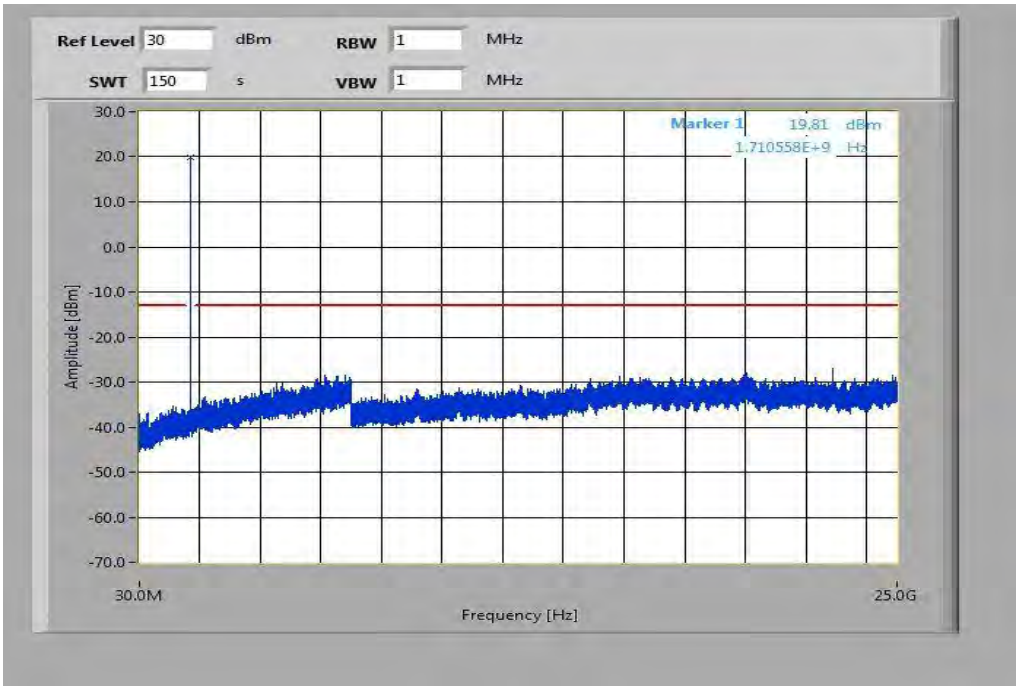


Plot 3: Highest channel, 30 MHz to 25 GHz

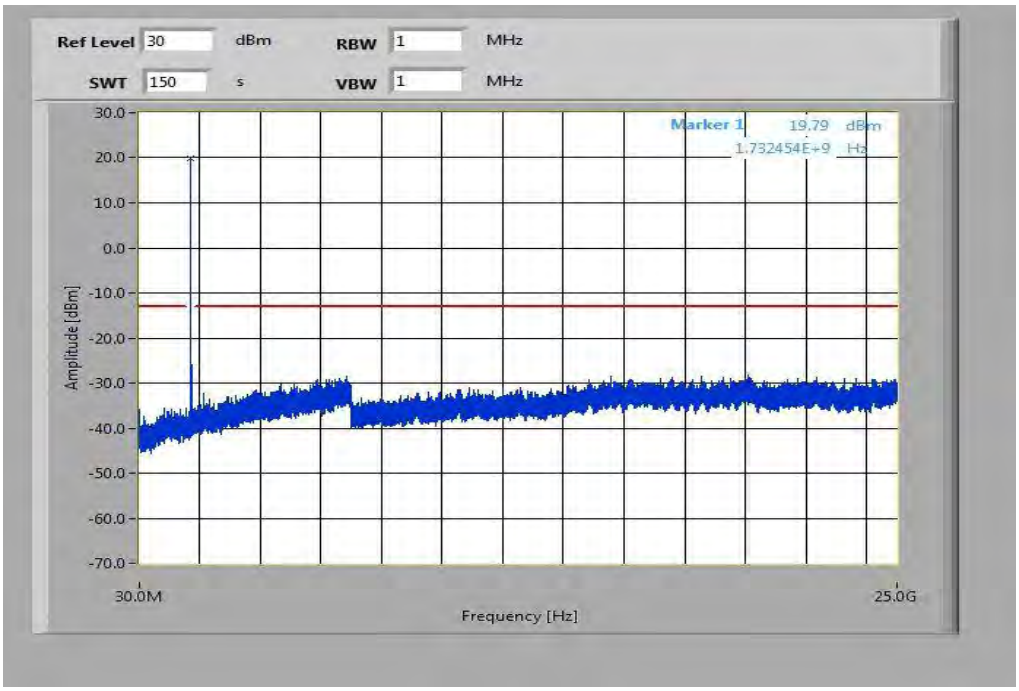


Plots for 3 MHz channel bandwidth, 16-QAM

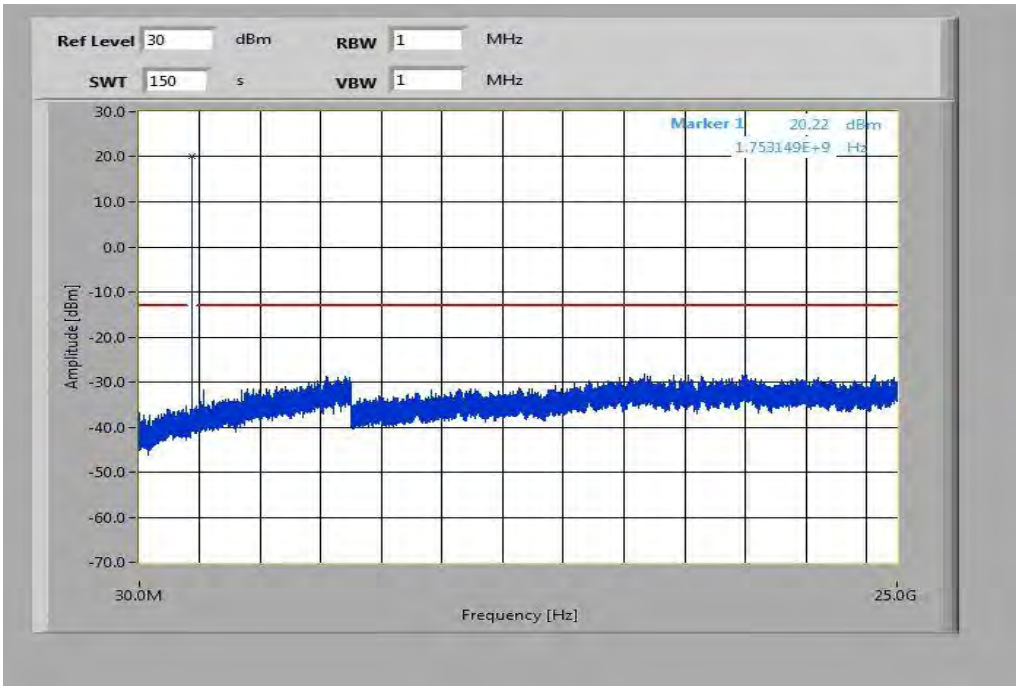
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

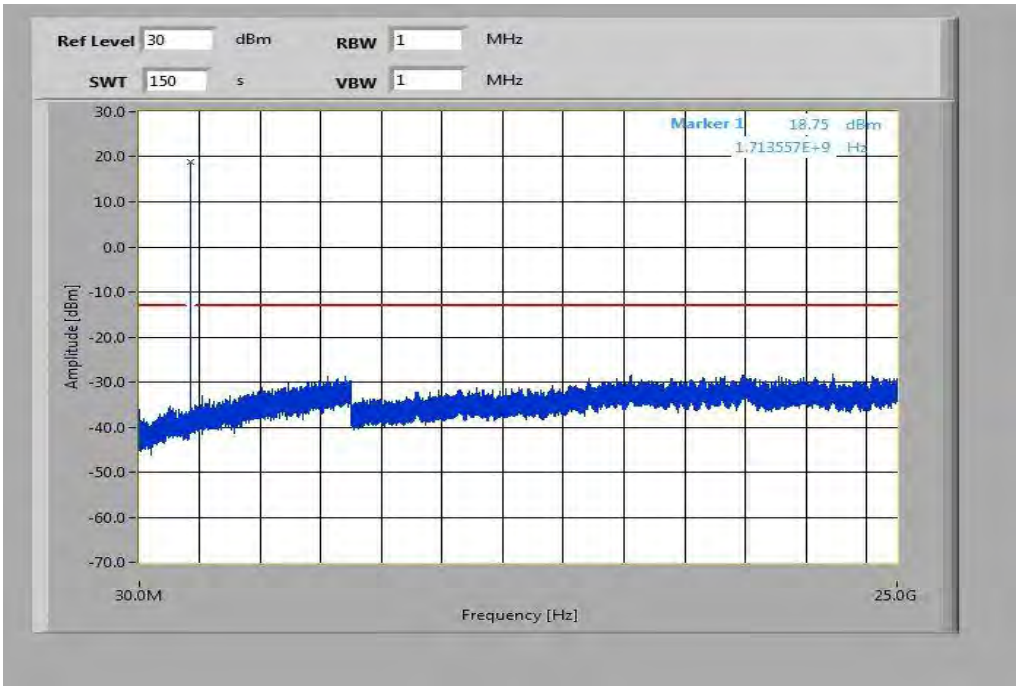


Plot 6: Highest channel, 30 MHz to 25 GHz

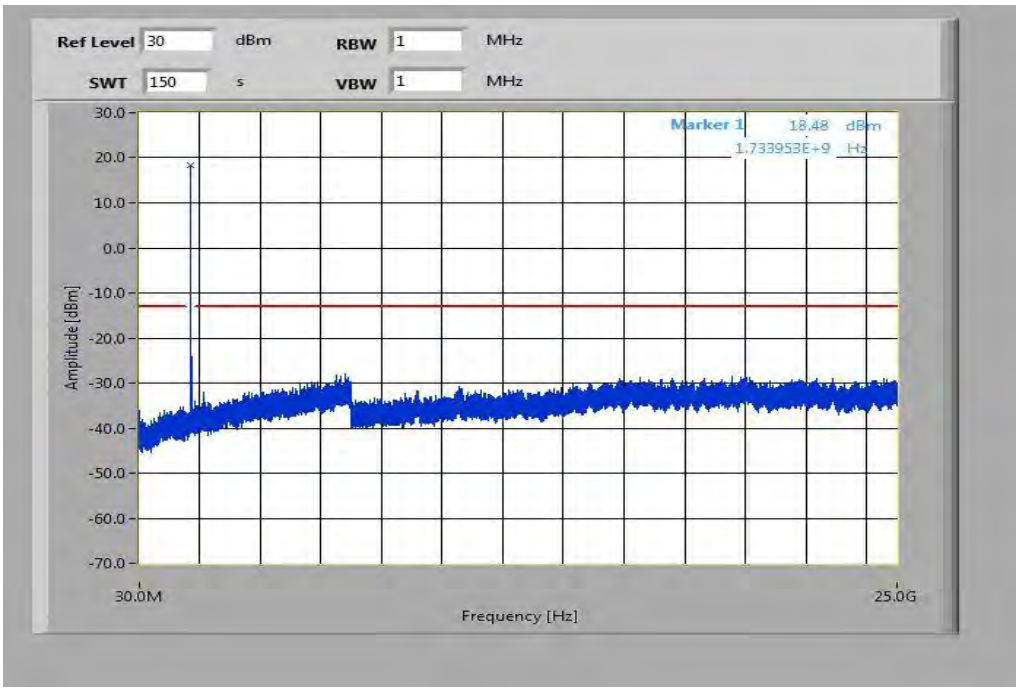


Plots for 5 MHz channel bandwidth, QPSK

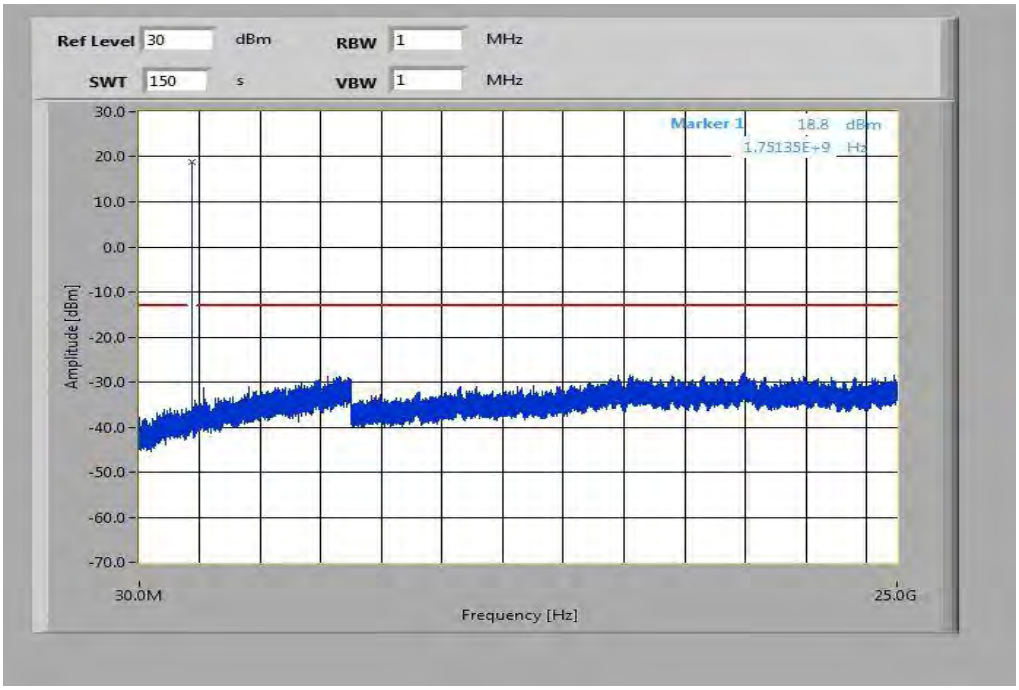
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

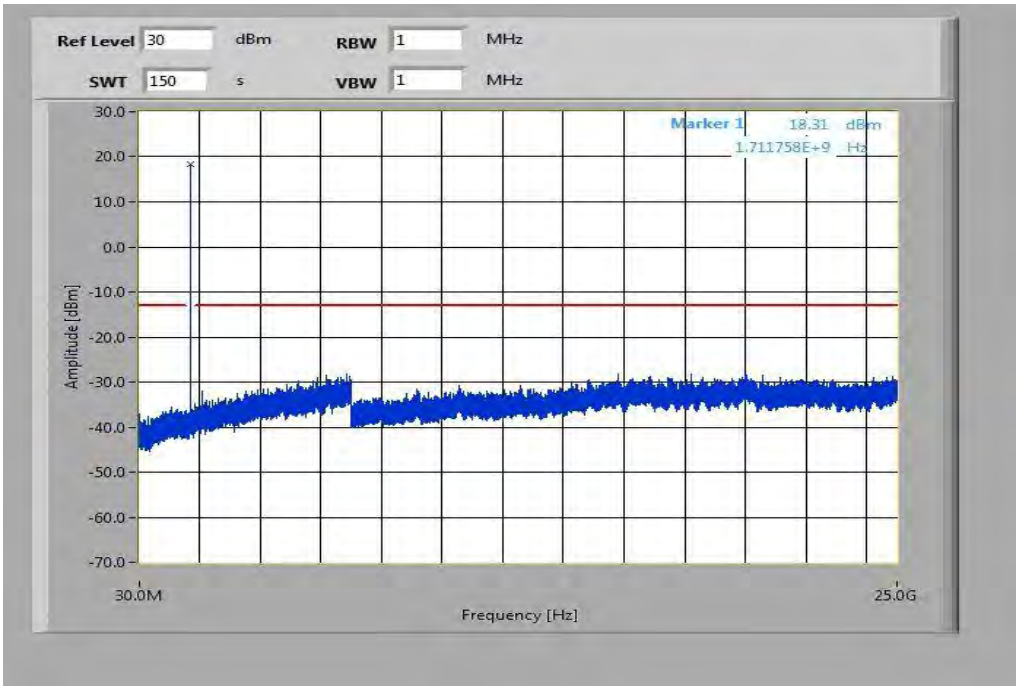


Plot 3: Highest channel, 30 MHz to 25 GHz

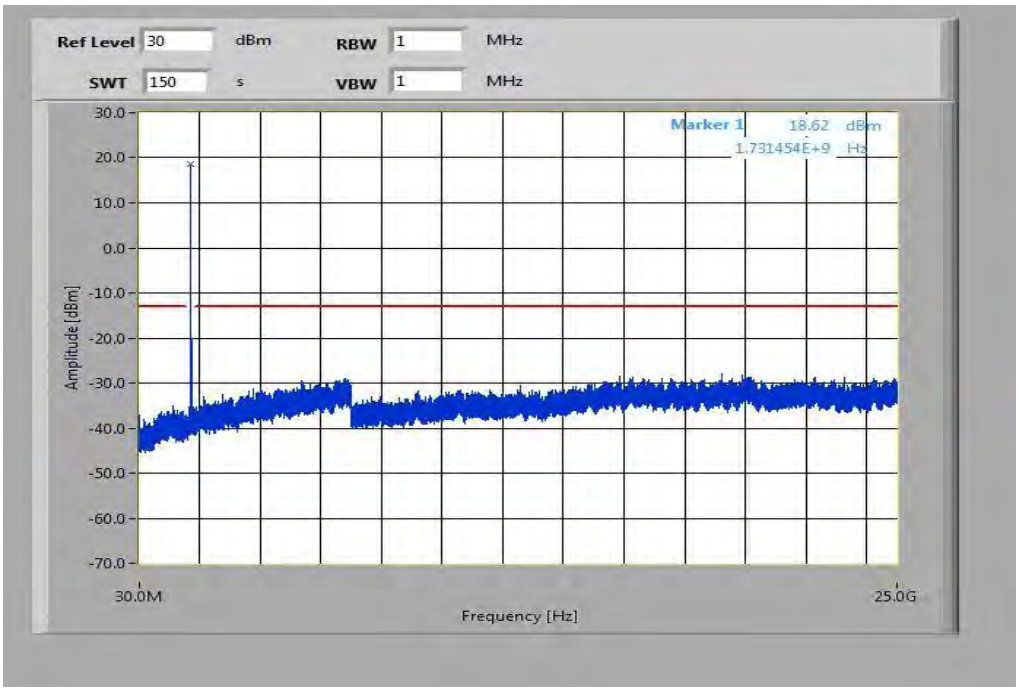


Plots for 5 MHz channel bandwidth, 16-QAM

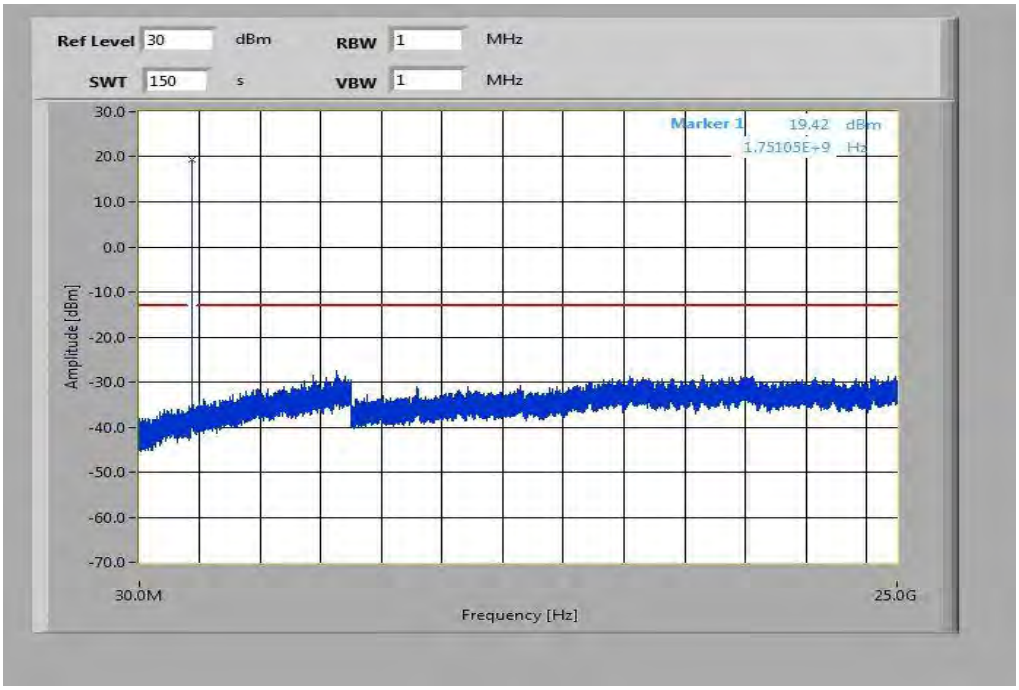
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

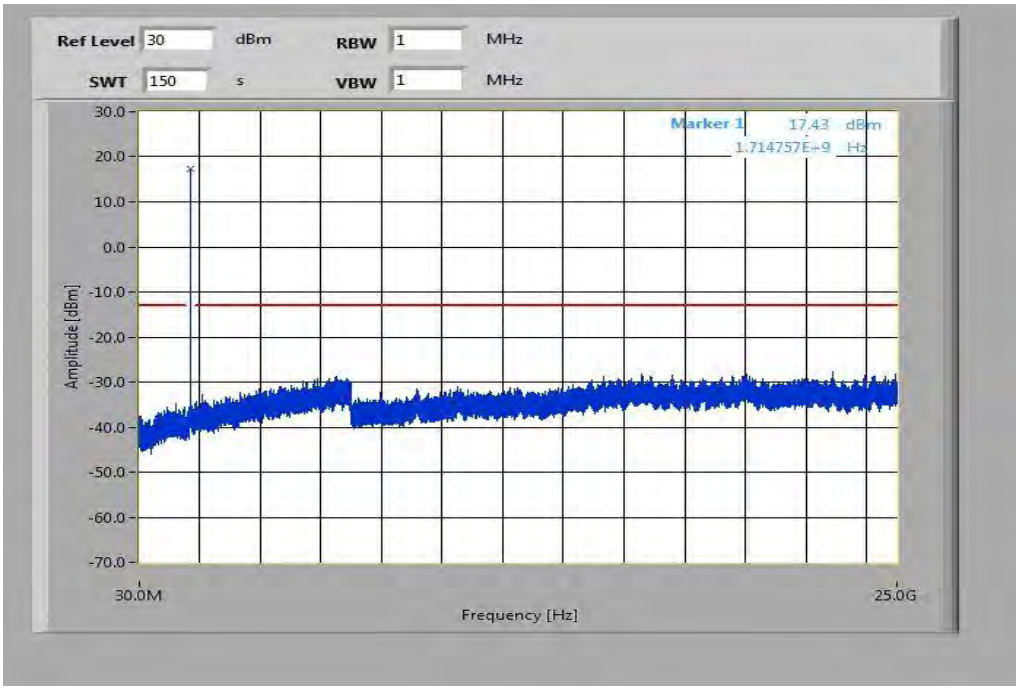


Plot 6: Highest channel, 30 MHz to 25 GHz

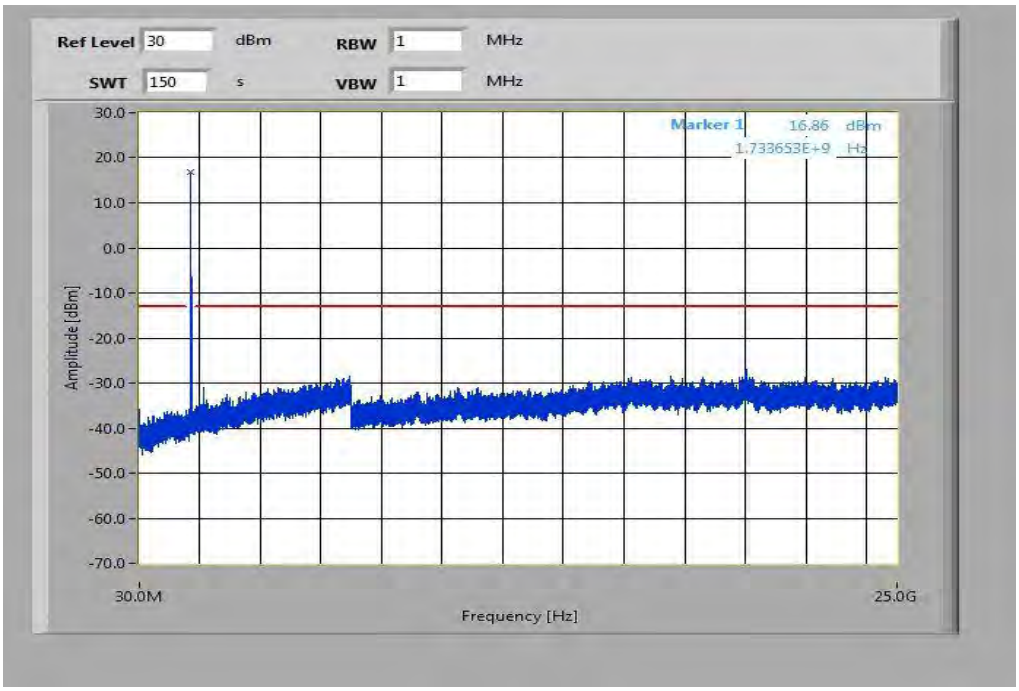


Plots for 10 MHz channel bandwidth, QPSK

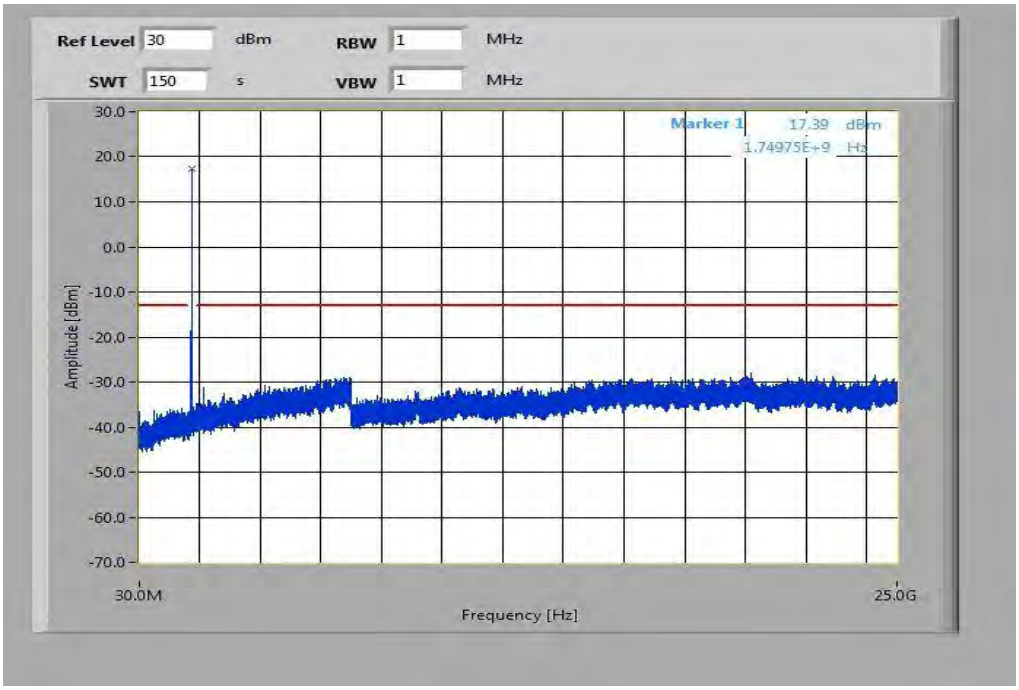
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

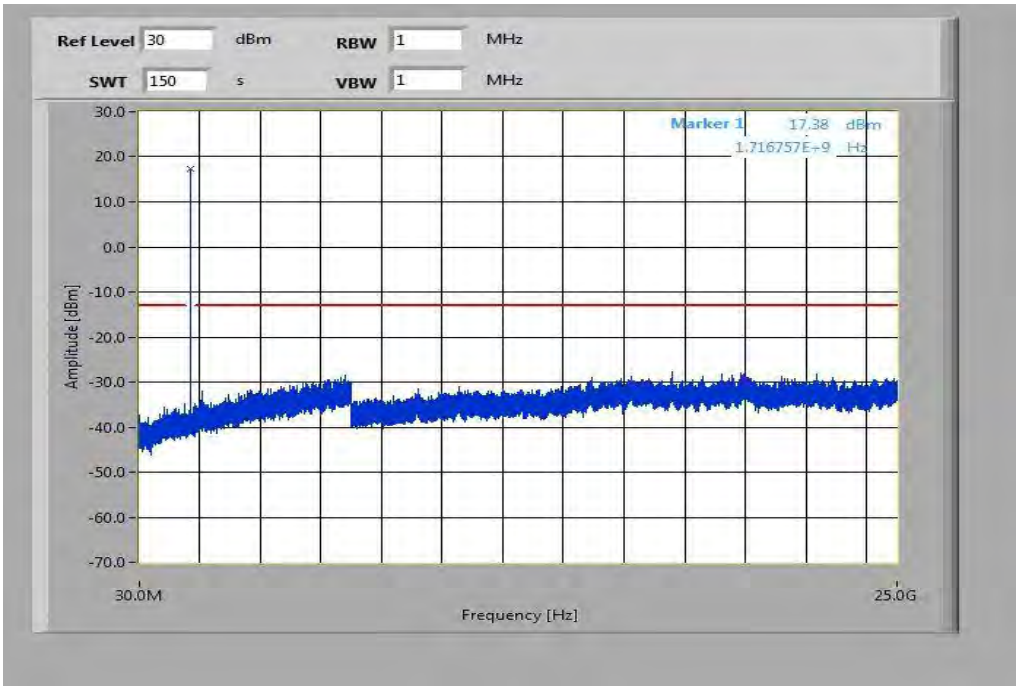


Plot 3: Highest channel, 30 MHz to 25 GHz

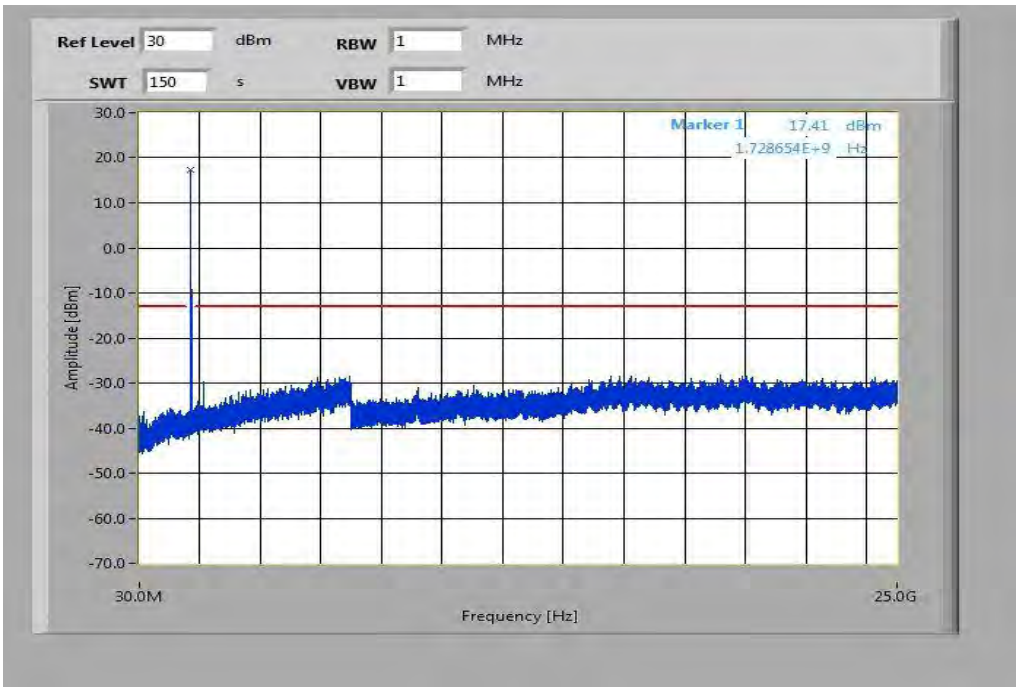


Plots for 10 MHz channel bandwidth, 16-QAM

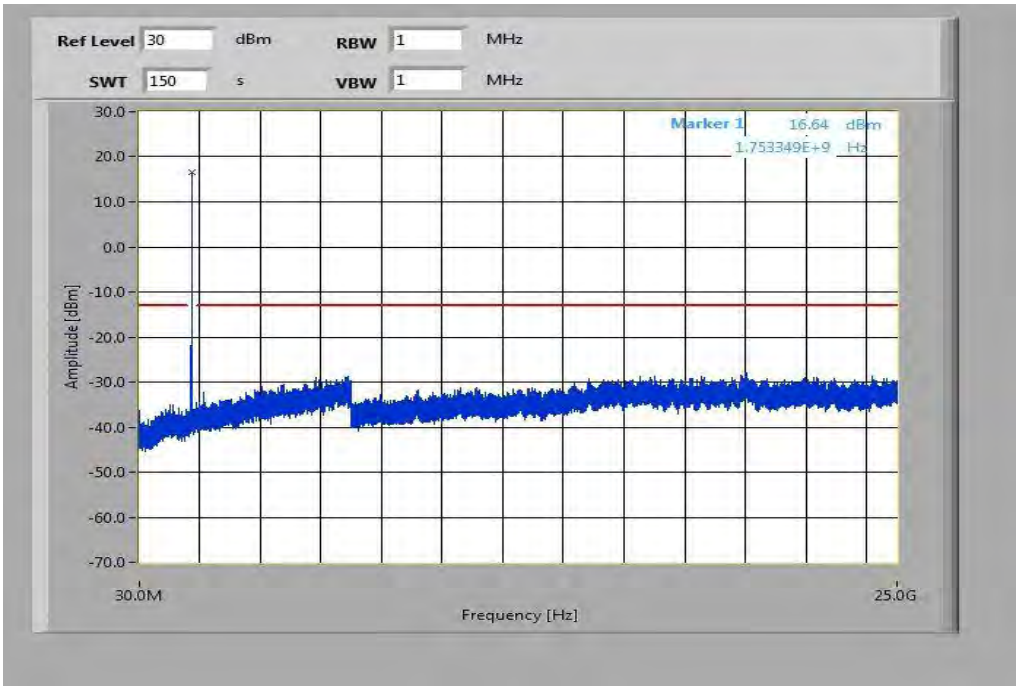
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

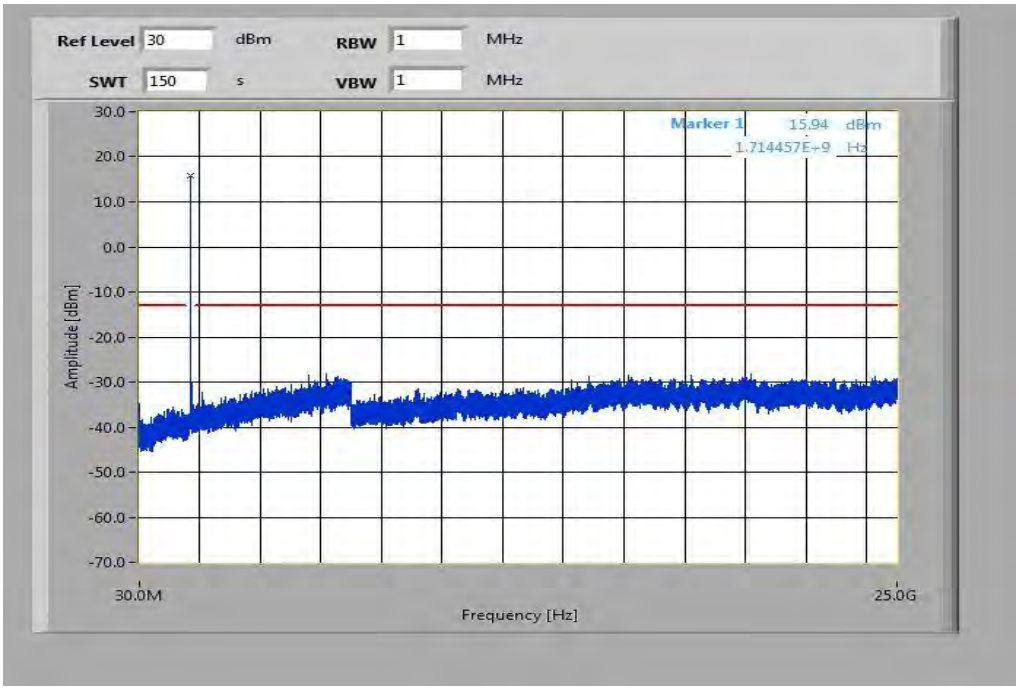


Plot 6: Highest channel, 30 MHz to 25 GHz

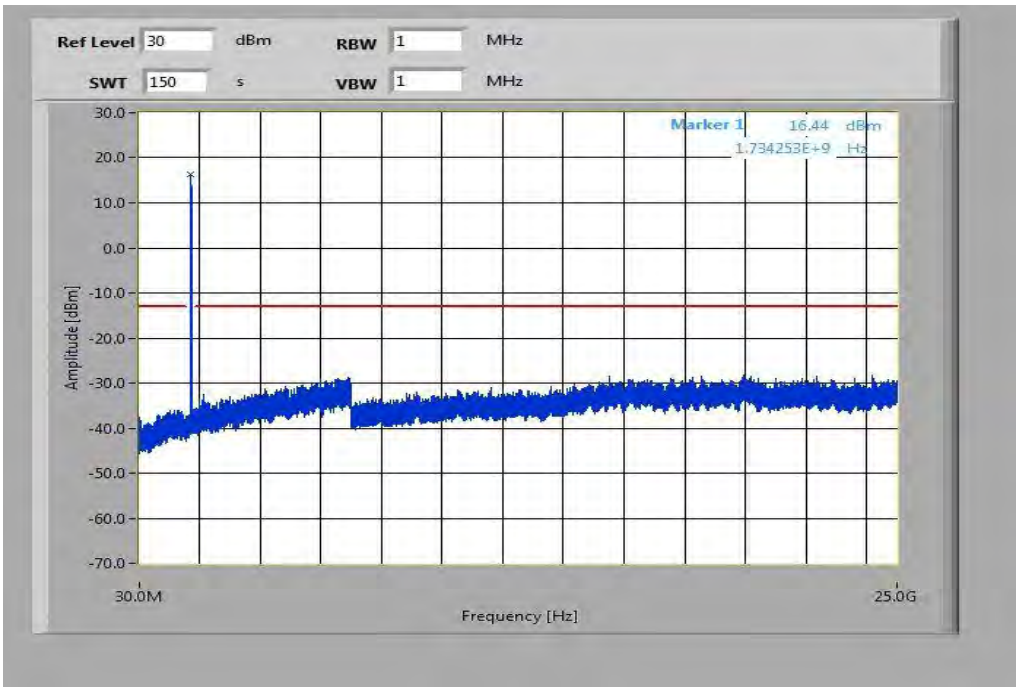


Plots for 15 MHz channel bandwidth, QPSK

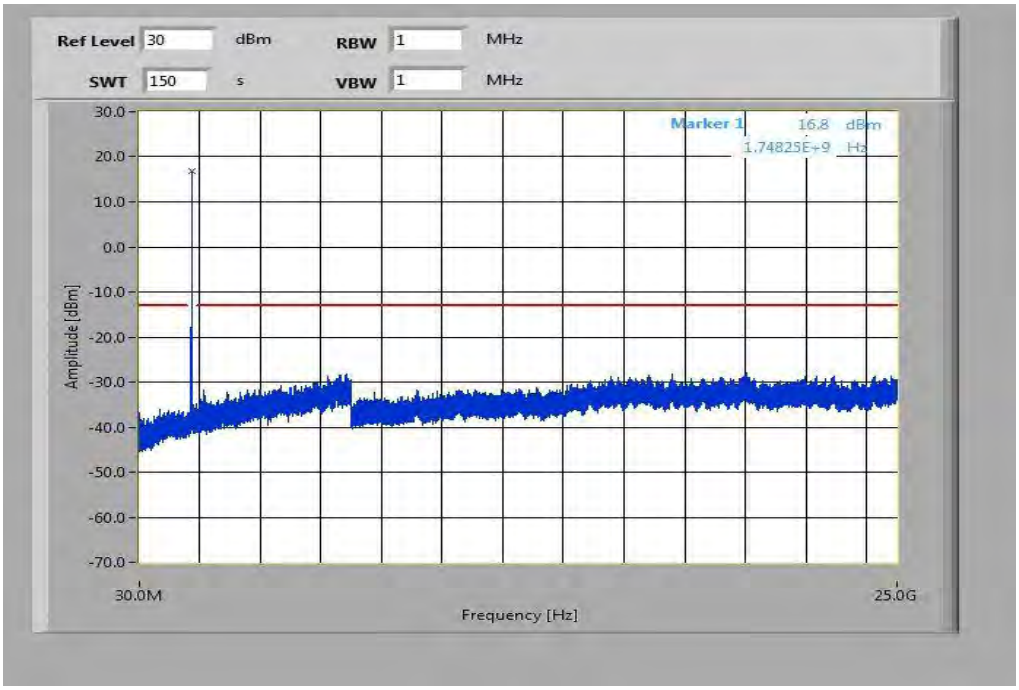
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

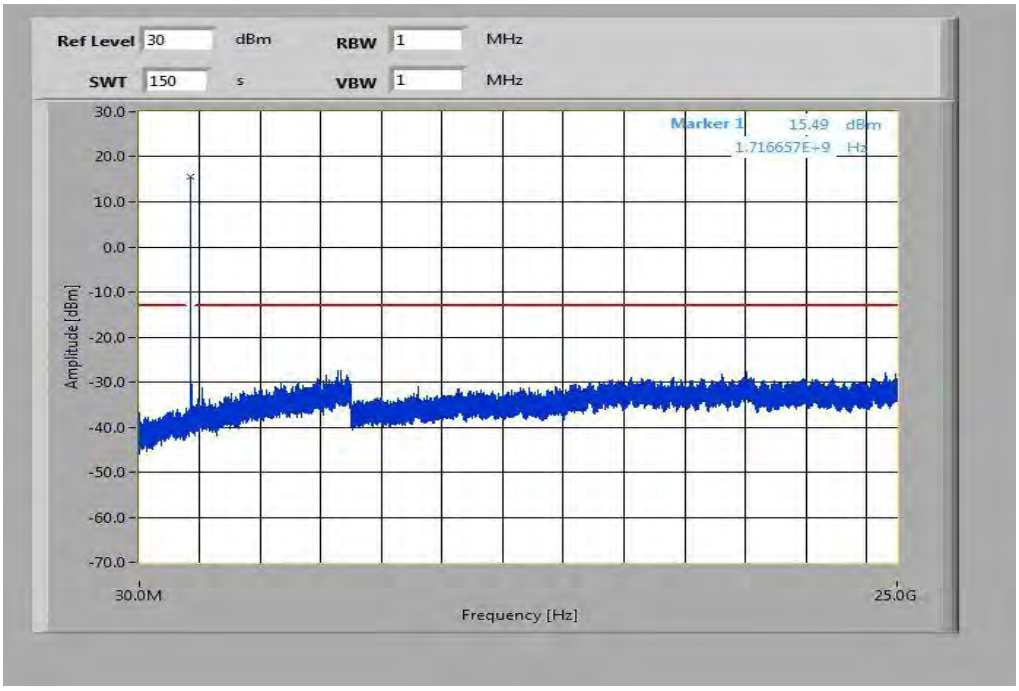


Plot 3: Highest channel, 30 MHz to 25 GHz

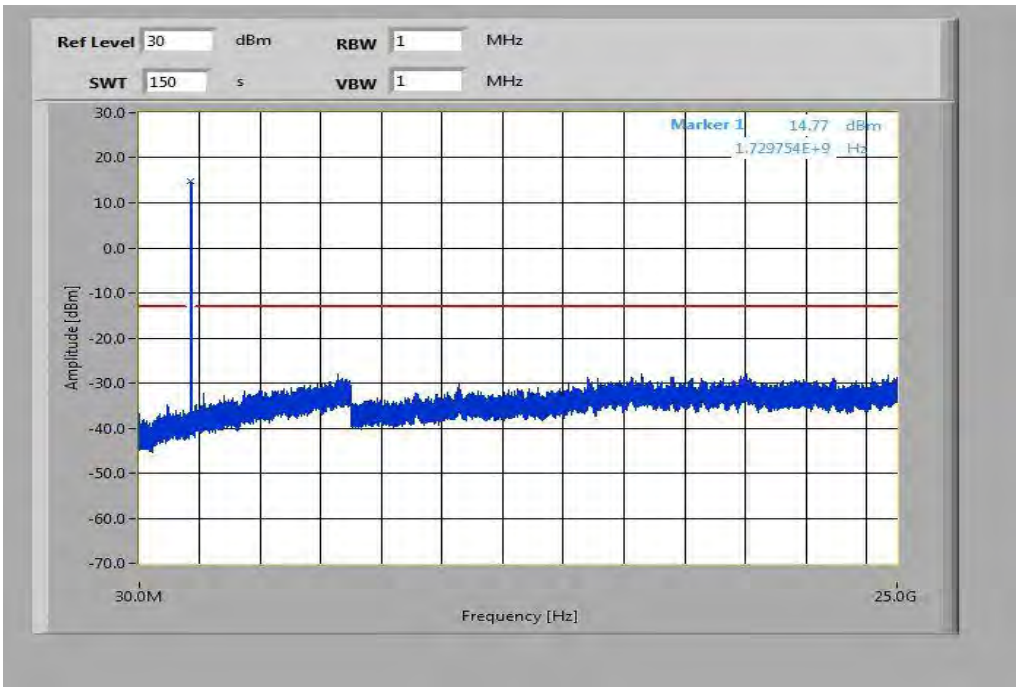


Plots for 15 MHz channel bandwidth, 16-QAM

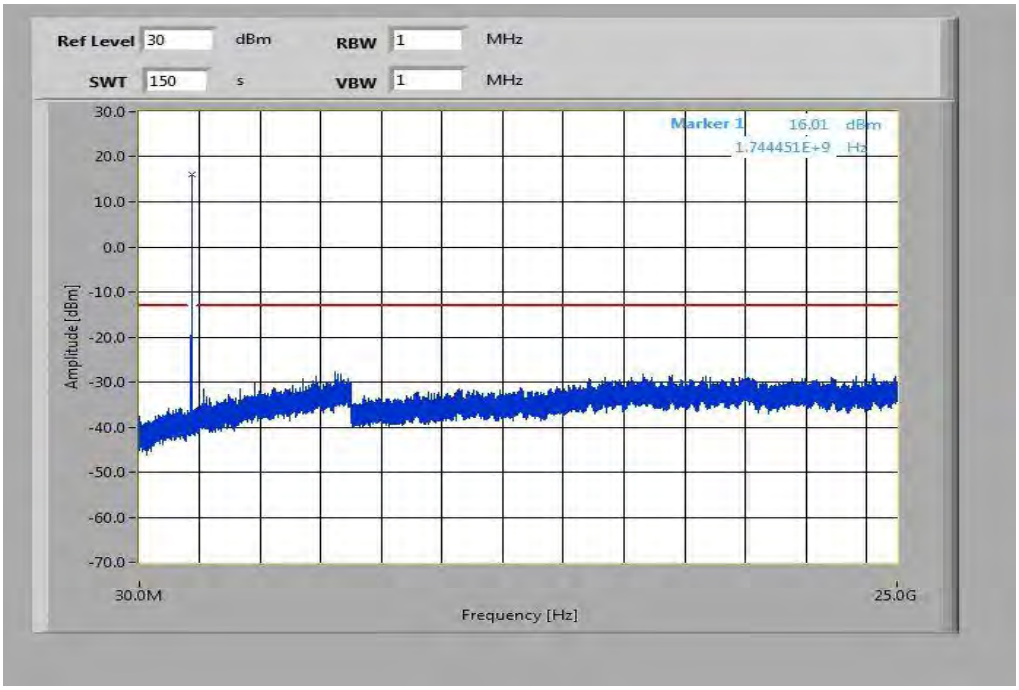
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

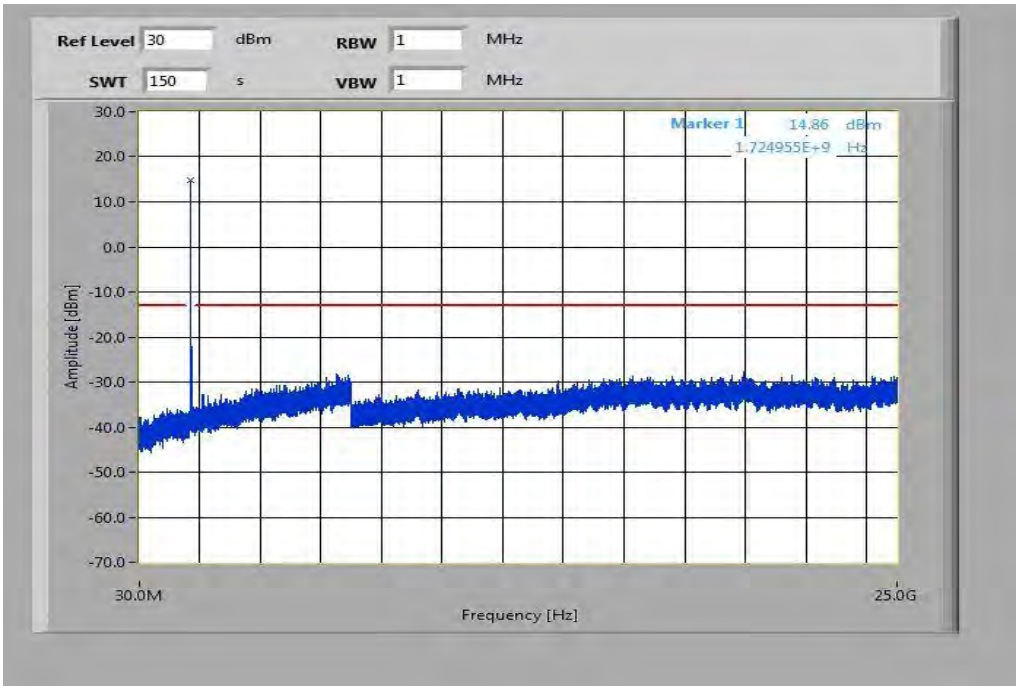


Plot 6: Highest channel, 30 MHz to 25 GHz

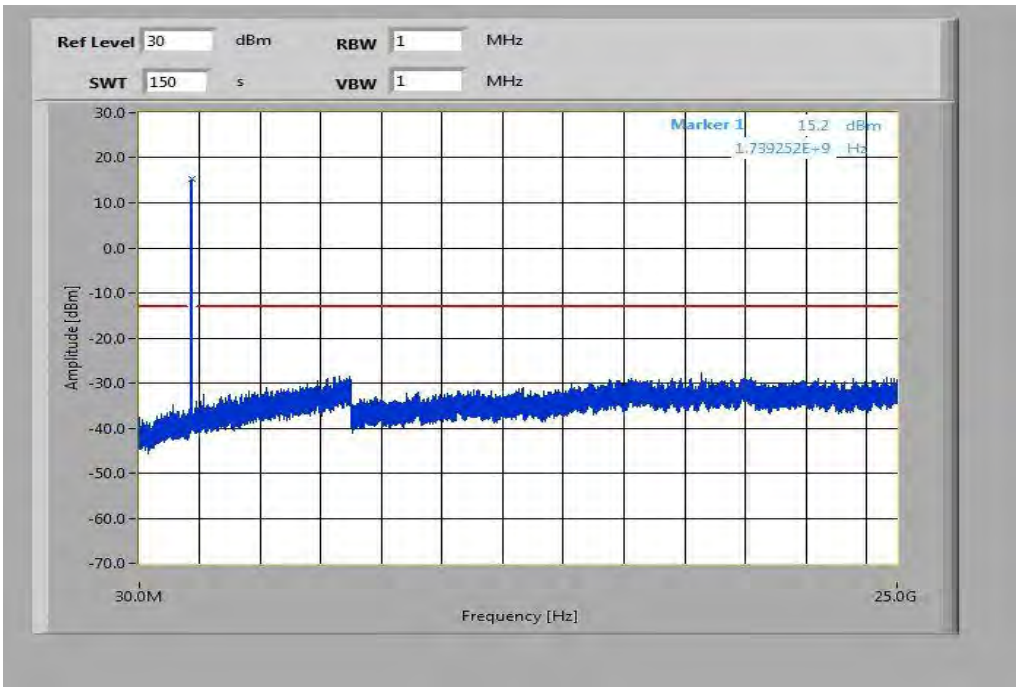


Plots for 20 MHz channel bandwidth, QPSK

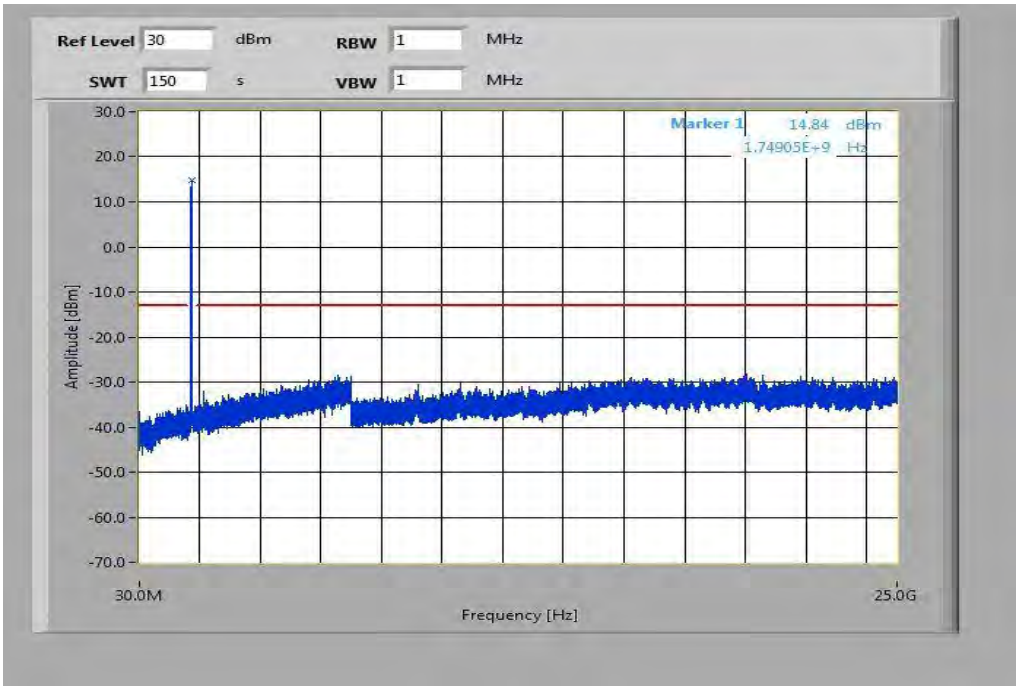
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

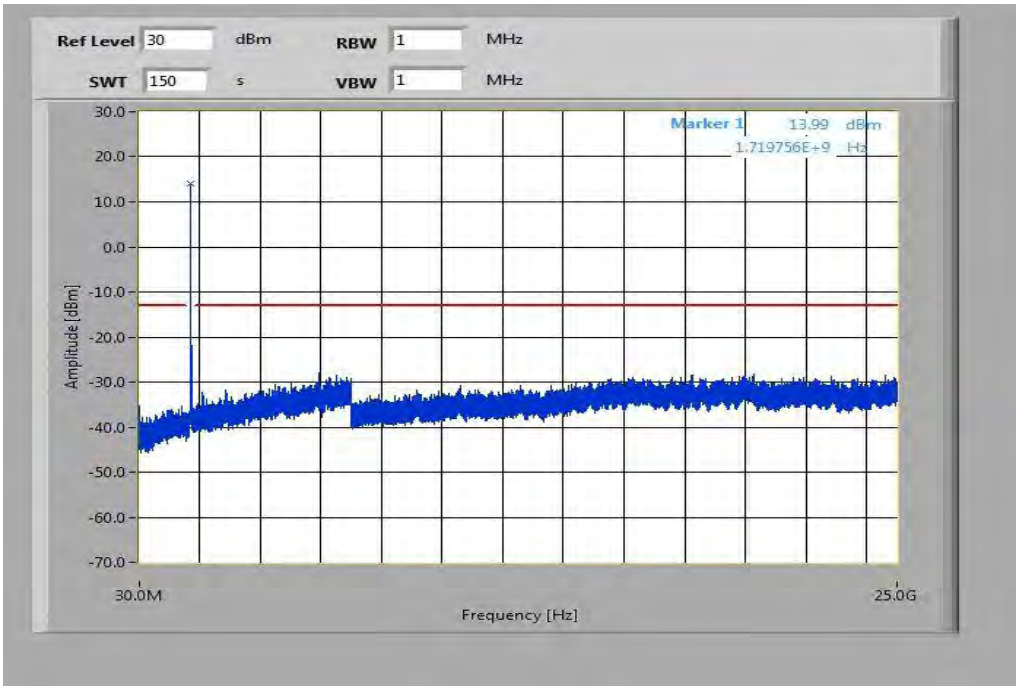


Plot 3: Highest channel, 30 MHz to 25 GHz

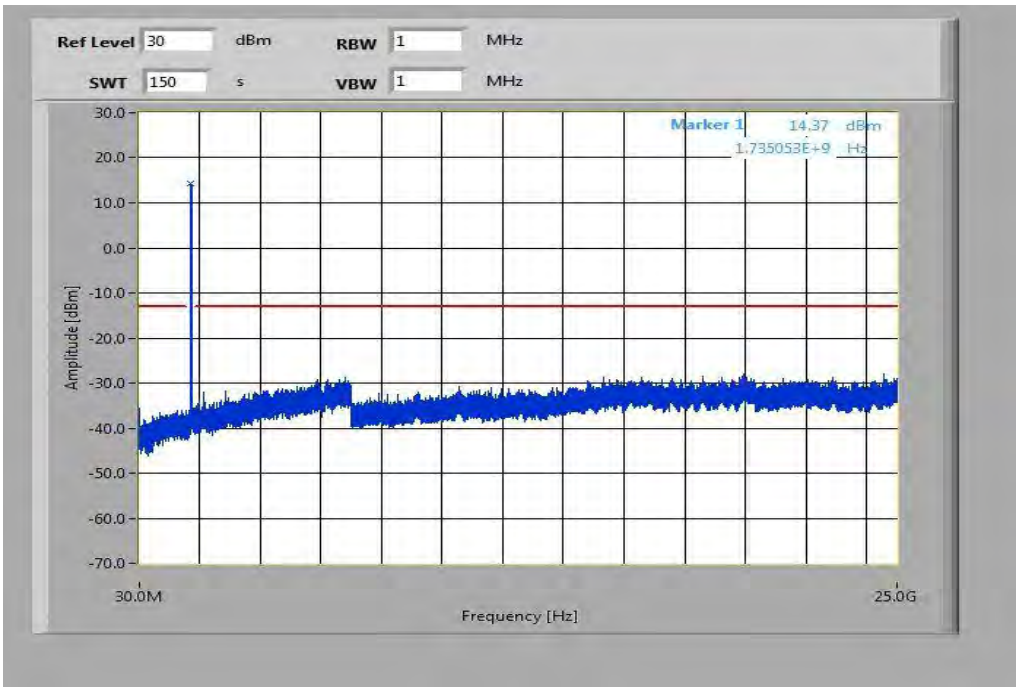


Plots for 20 MHz channel bandwidth, 16-QAM

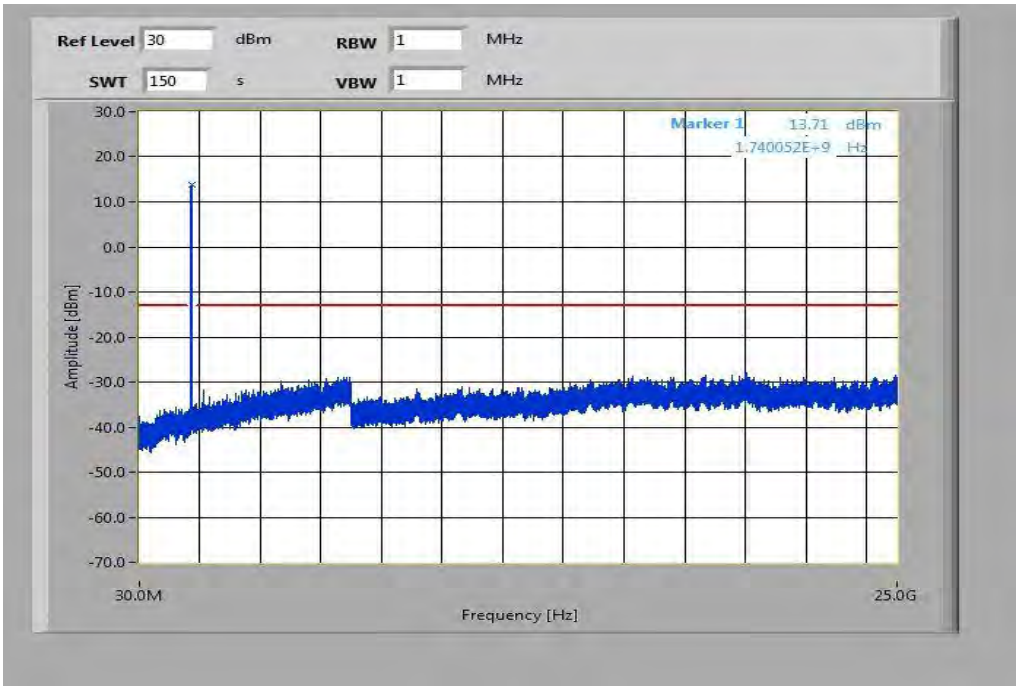
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz



Plot 6: Highest channel, 30 MHz to 25 GHz



8.3.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

For the measurement the lowest, middle and highest channel bandwidth was used. If spurious were found the other bandwidths were measured, too.

Measurement:

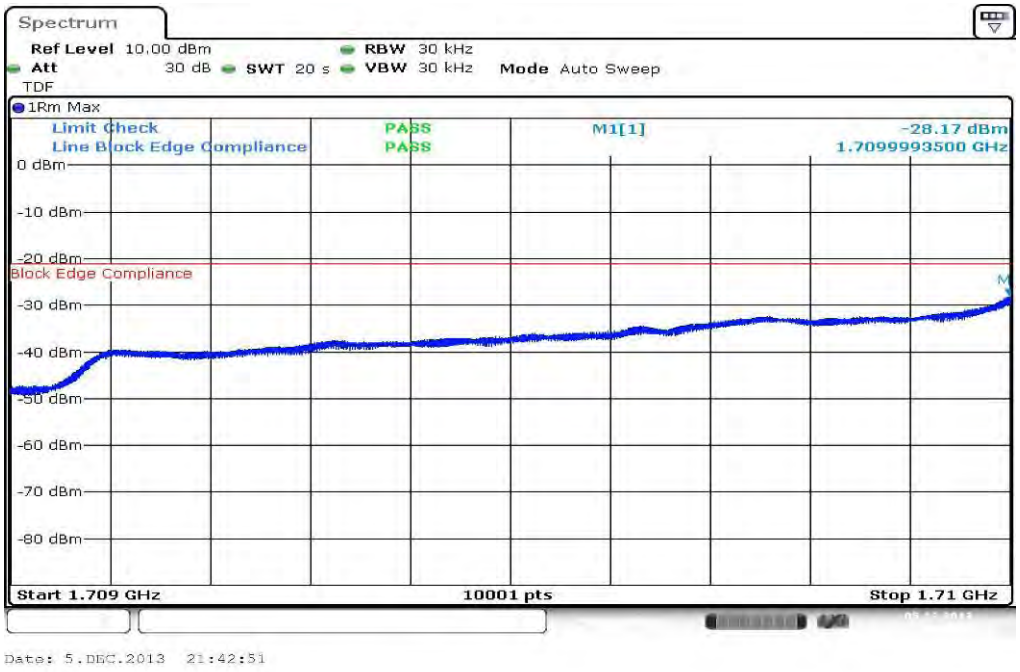
Measurement parameters	
Detector:	RMS
Sweep time:	20 sec.
Video bandwidth:	30 kHz
Resolution bandwidth:	30 kHz
Span:	1 MHz
Trace-Mode:	Max Hold

Limits:

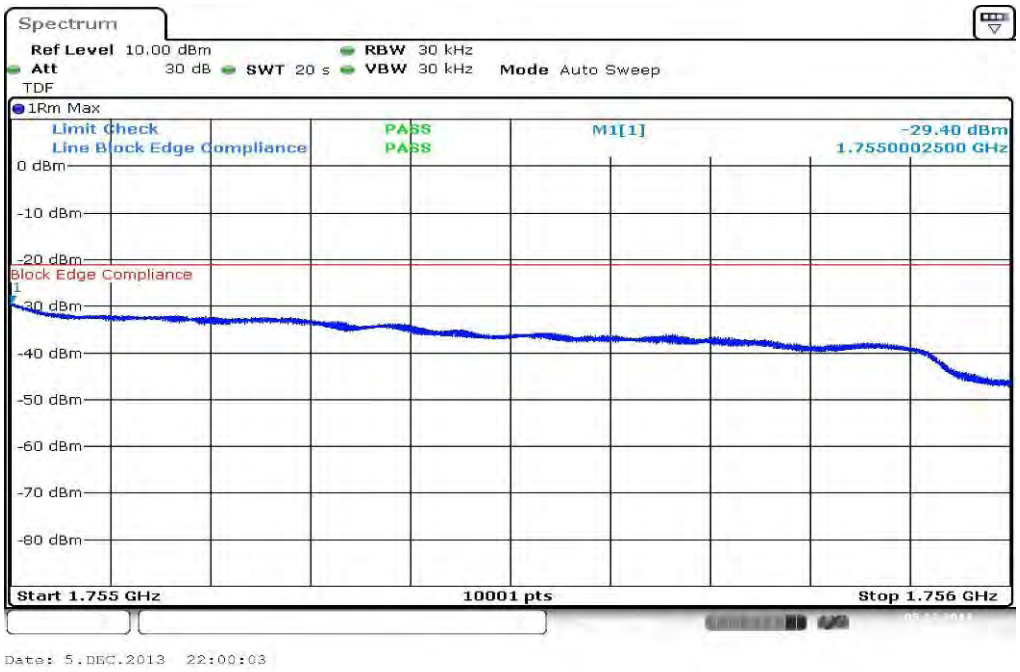
FCC	-/-
Block Edge Compliance	
Part 27.53 specifies that “the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.” However, in publication number 890810, The FCC Office of Engineering and Technology specified the following correction to the limits when a resolution bandwidth smaller than 1% of the emission bandwidth is used: “An alternative is to add an additional correction factor of 10 Log (RBW1/ RBW2) to the 43 +10 log(P) limit. RBW1 is the narrower measurement resolution bandwidth and RBW2 is either the 1% emissions bandwidth or 1 MHz.” When using a 30 kHz bandwidth, this yields a -8.239 adjustment to the limit [10 log(30kHz/200kHz) = -8.239]. When this adjustment is applied to the limit, the limit becomes -21.239.	
-21.24dBm	

Results: **1.4 MHz channel bandwidth**

Plot 1: Lowest channel, QPSK modulation

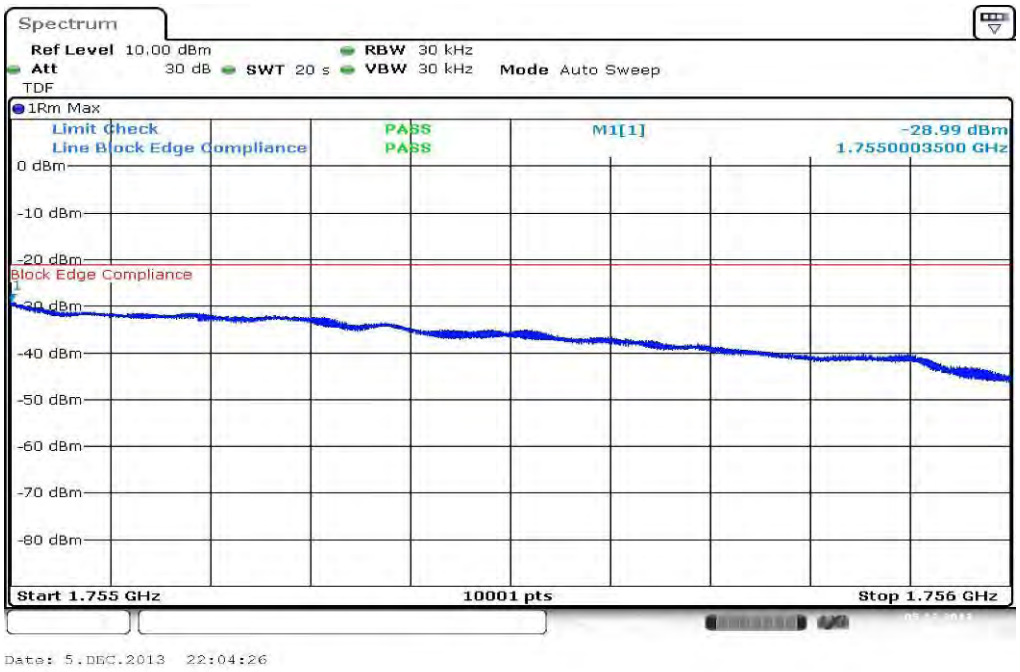


Plot 2: Highest channel, QPSK modulation



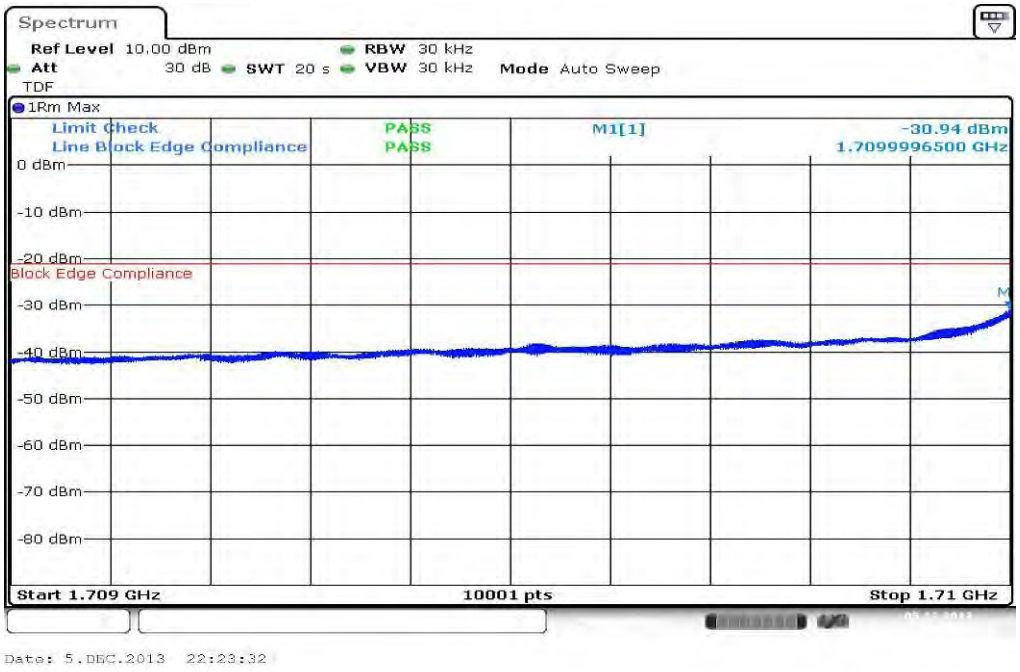
Plot 3: Lowest channel, 16 – QAM modulation

Plot 4: Highest channel, 16 – QAM modulation

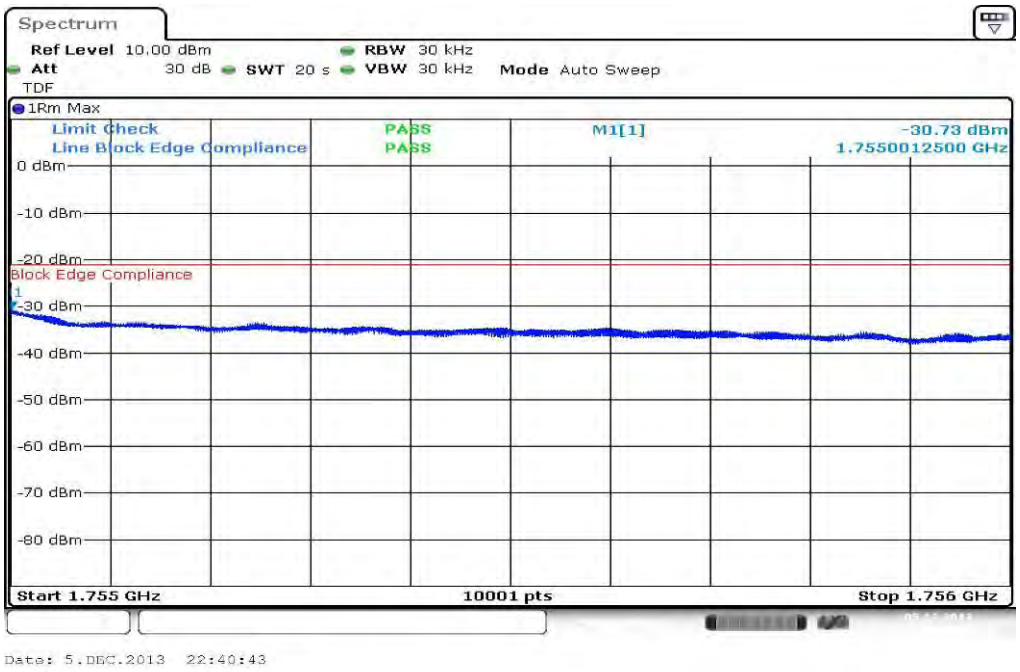


Results: **3 MHz channel bandwidth**

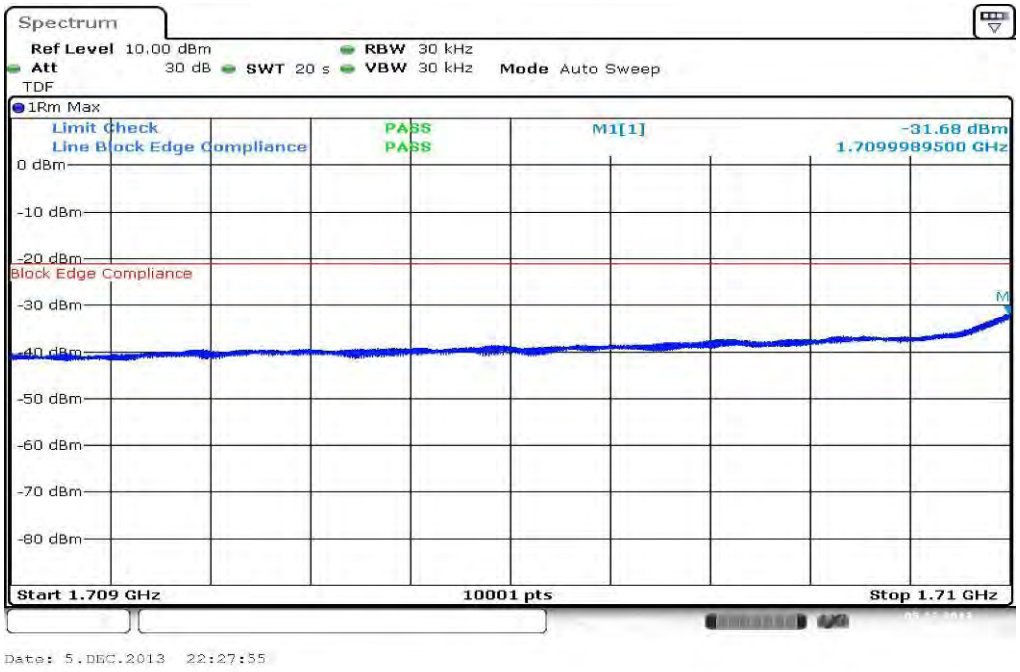
Plot 1: Lowest channel, QPSK modulation



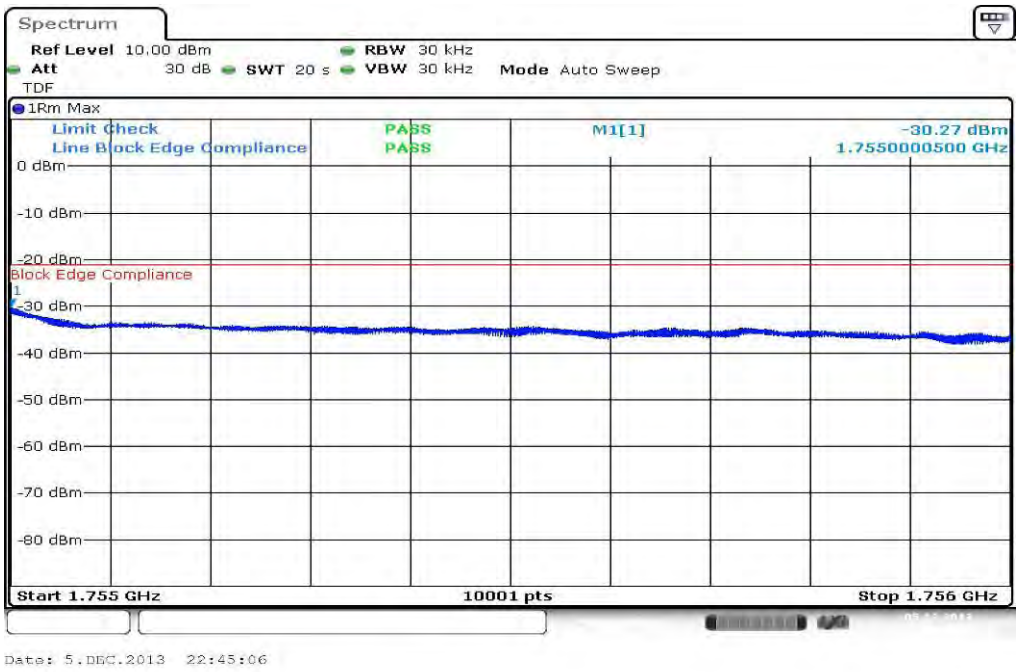
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

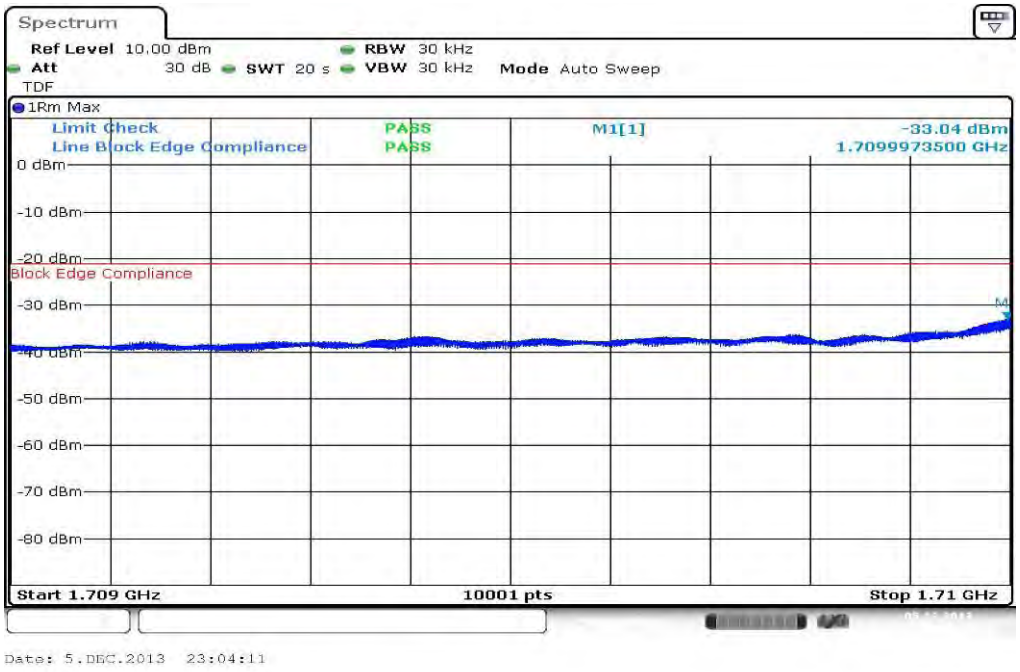


Plot 4: Highest channel, 16 – QAM modulation

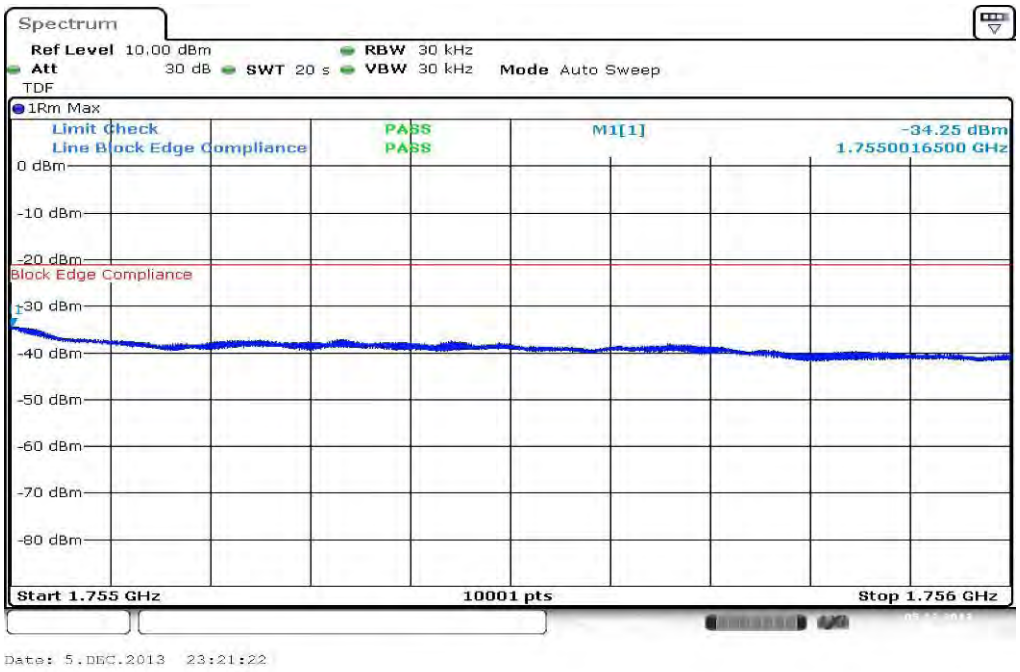


Results: **5 MHz channel bandwidth**

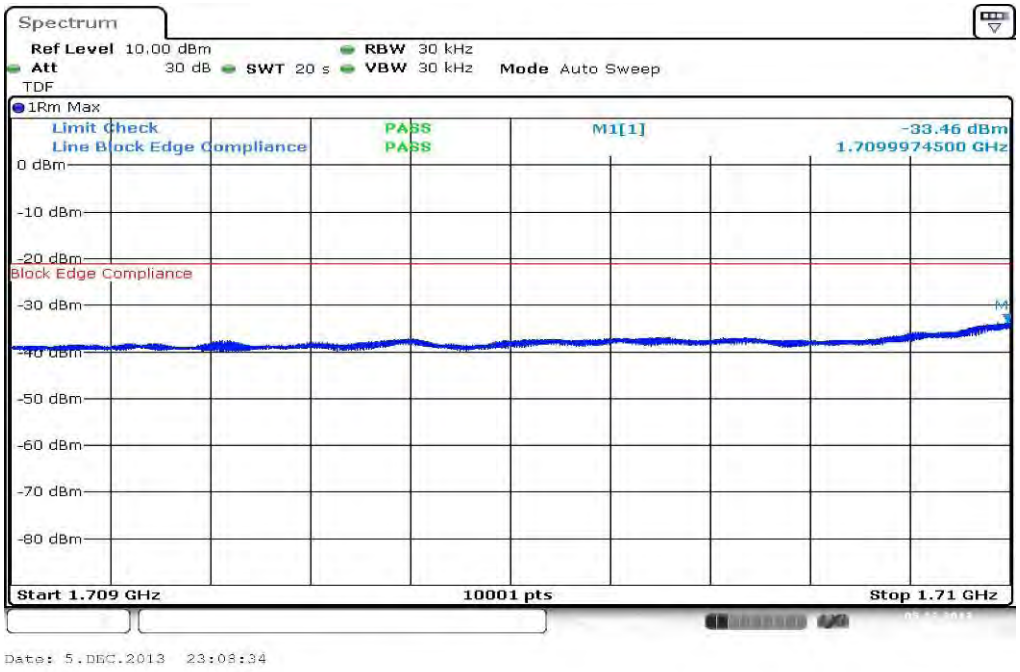
Plot 1: Lowest channel, QPSK modulation



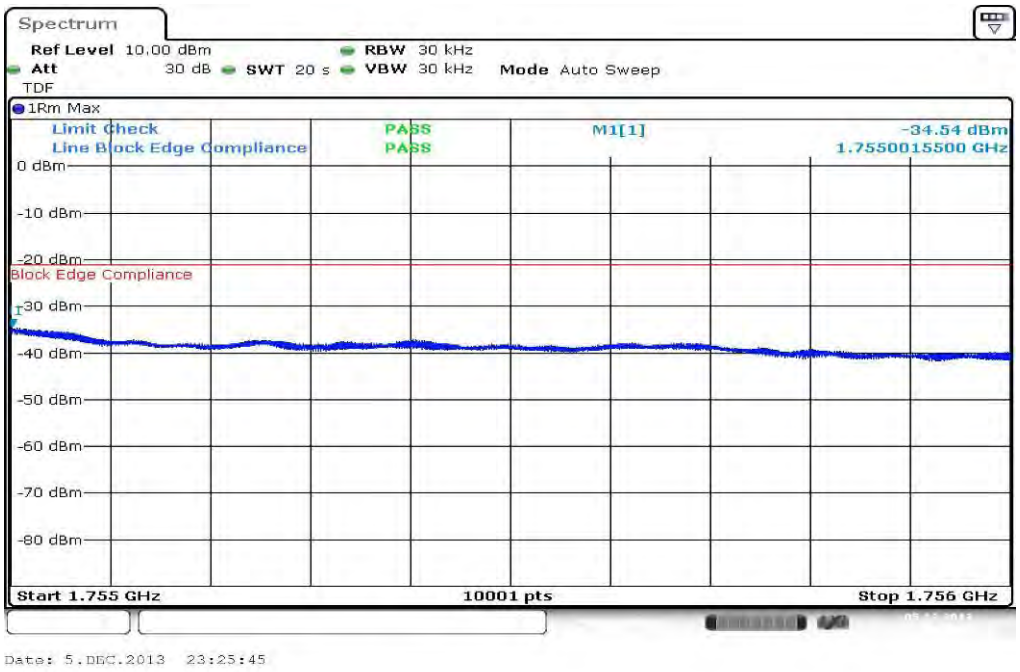
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

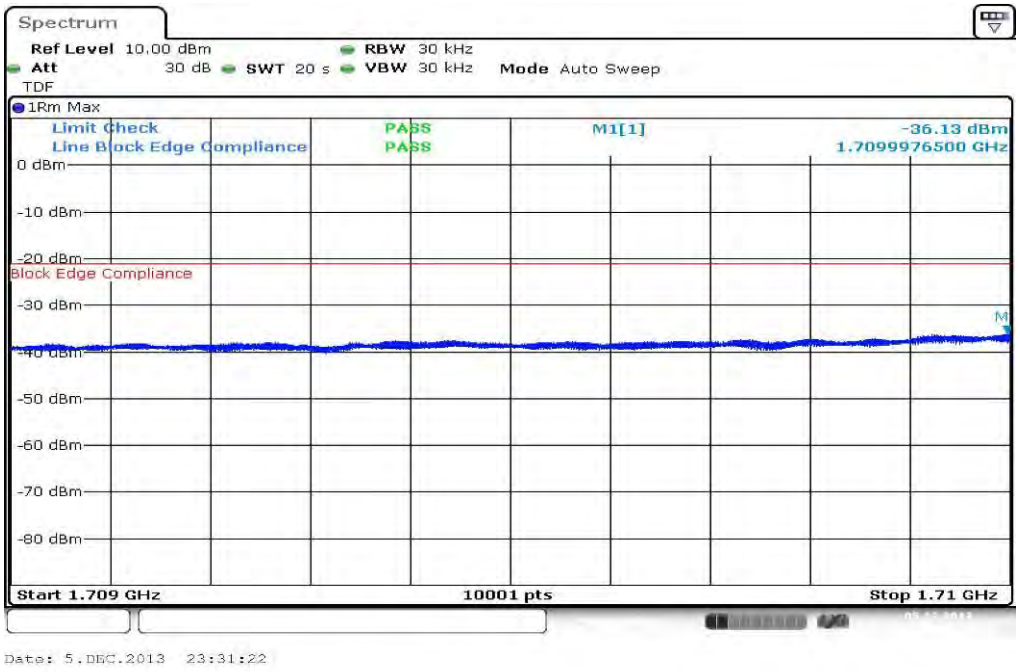


Plot 4: Highest channel, 16 – QAM modulation

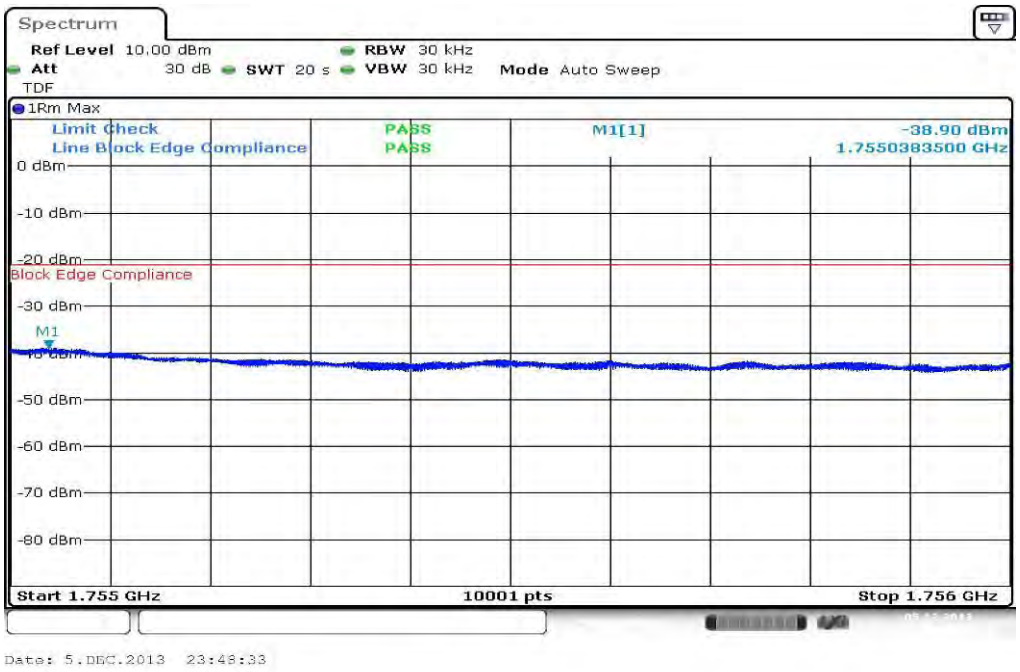


Results: **10 MHz channel bandwidth**

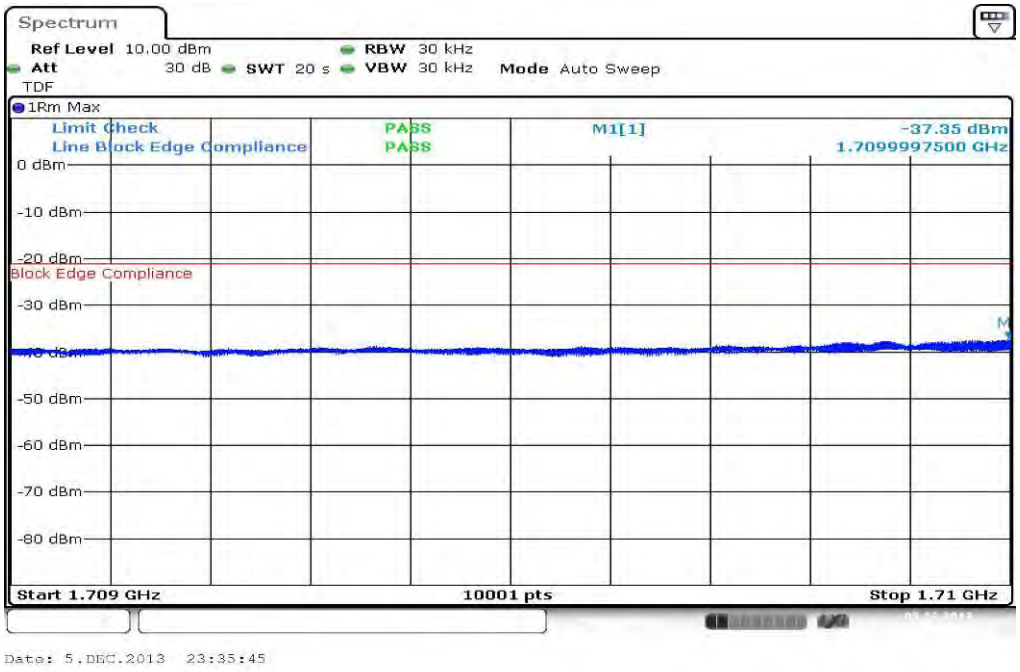
Plot 1: Lowest channel, QPSK modulation



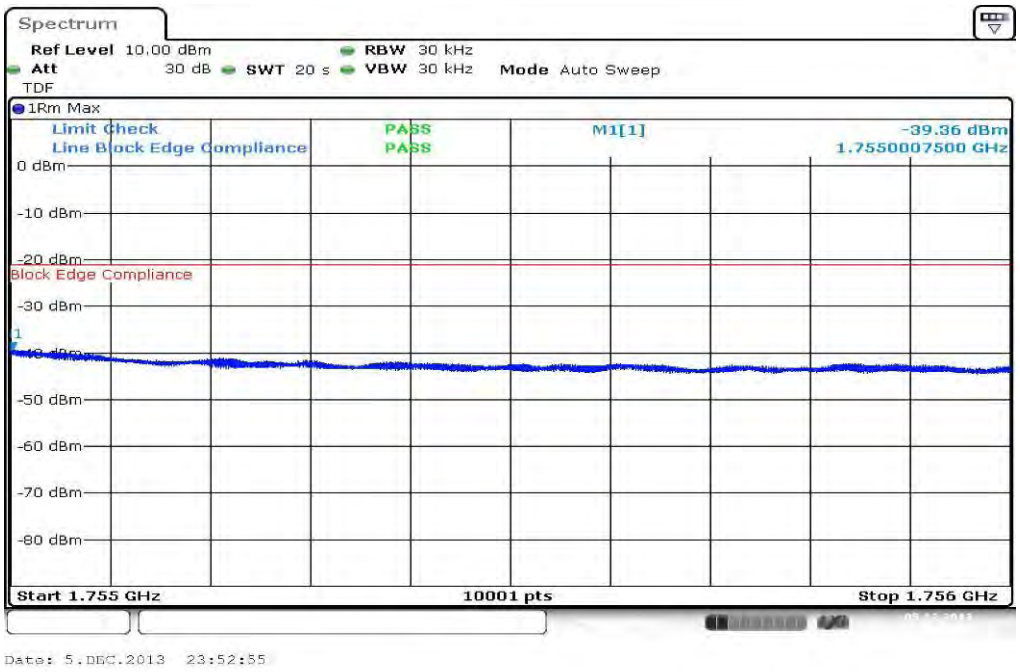
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

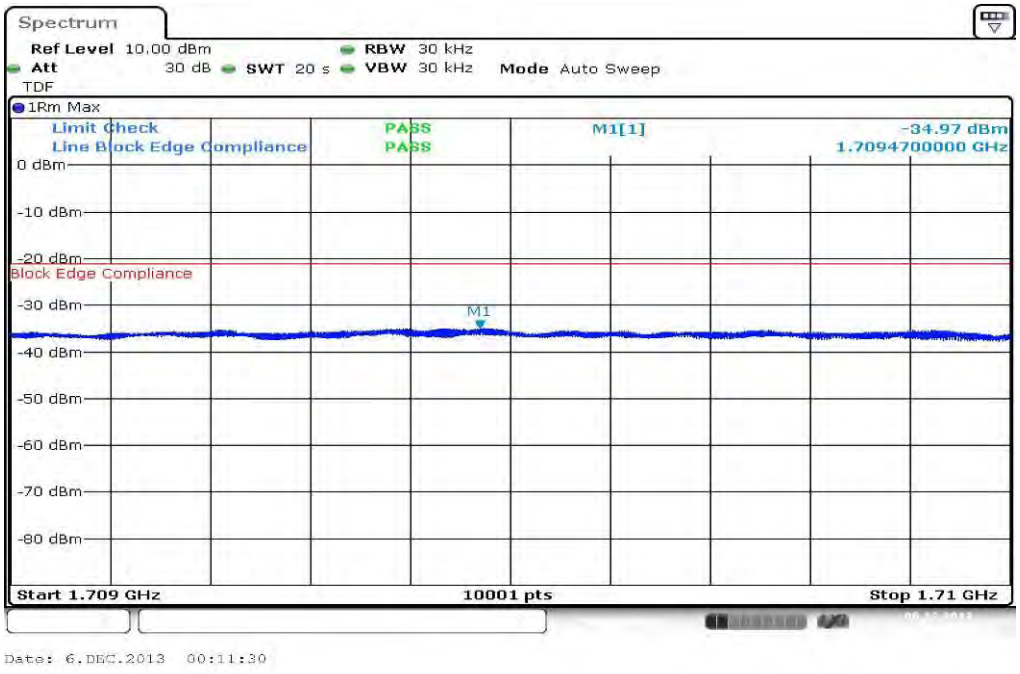


Plot 4: Highest channel, 16 – QAM modulation

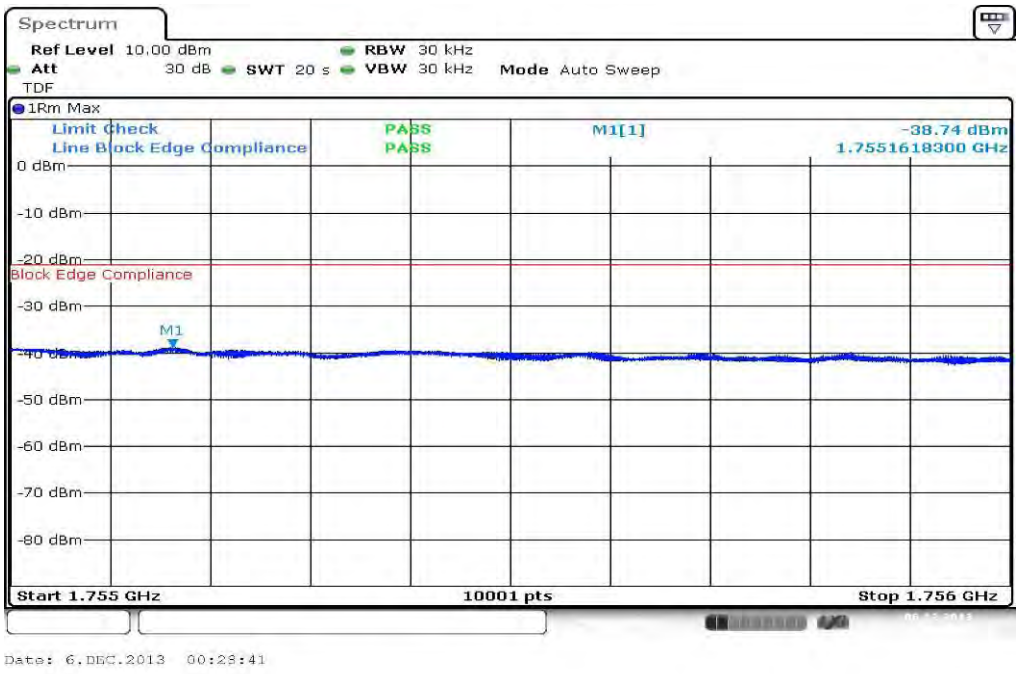


Results: **15 MHz channel bandwidth**

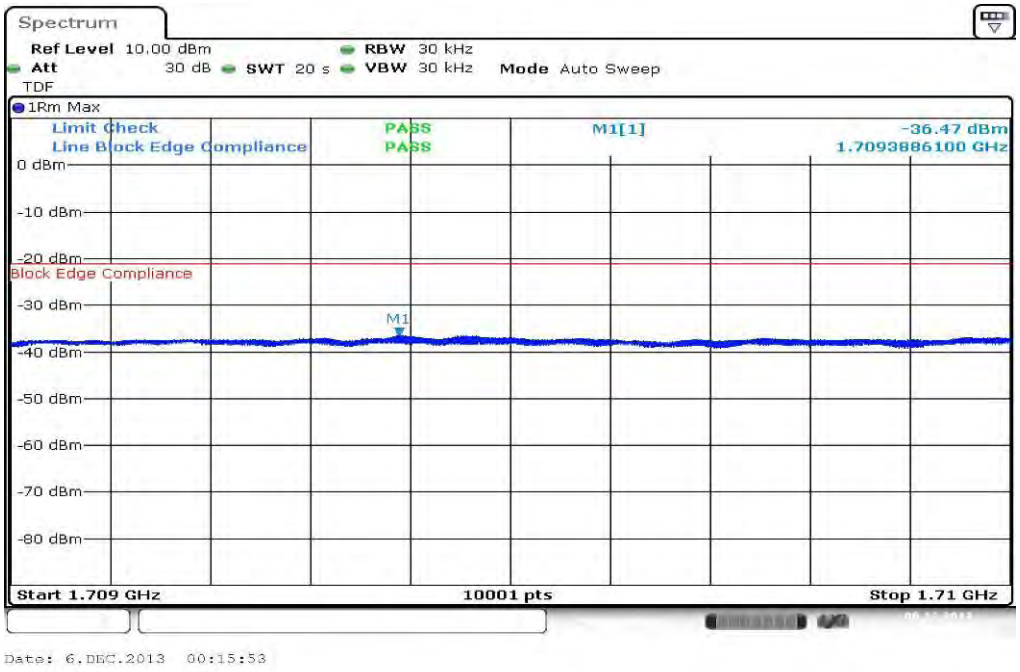
Plot 1: Lowest channel, QPSK modulation



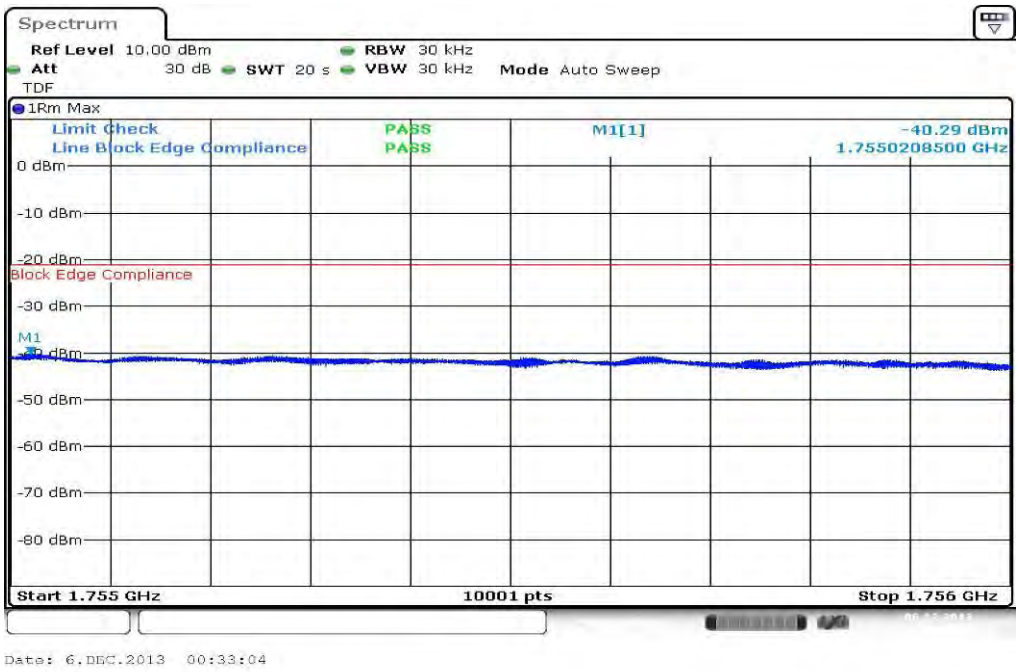
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

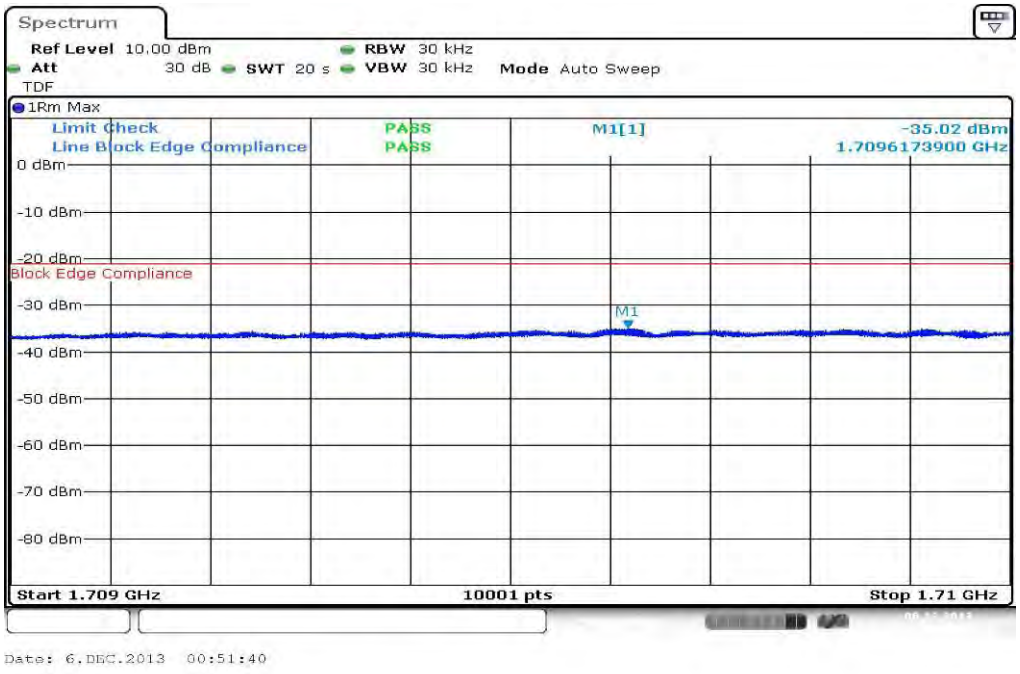


Plot 4: Highest channel, 16 – QAM modulation

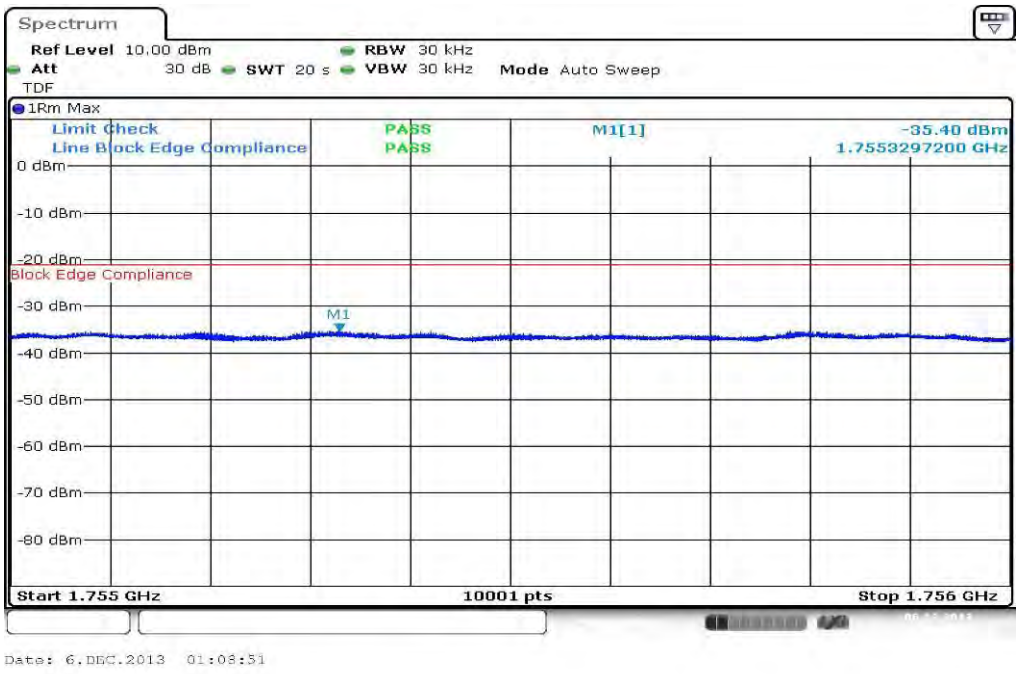


Results: **20 MHz channel bandwidth**

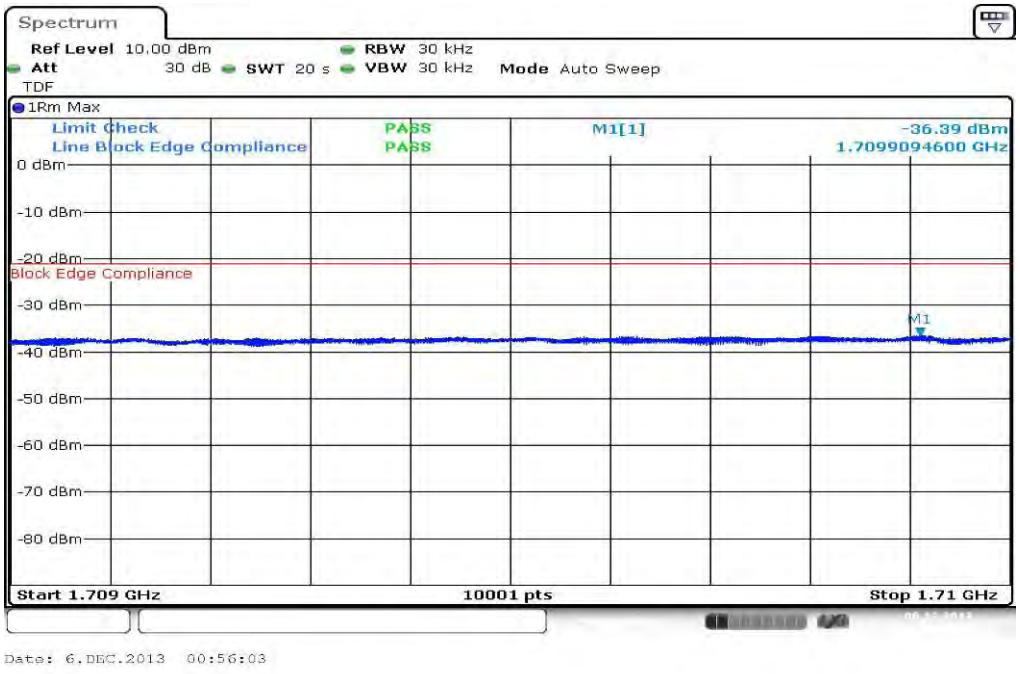
Plot 1: Lowest channel, QPSK modulation



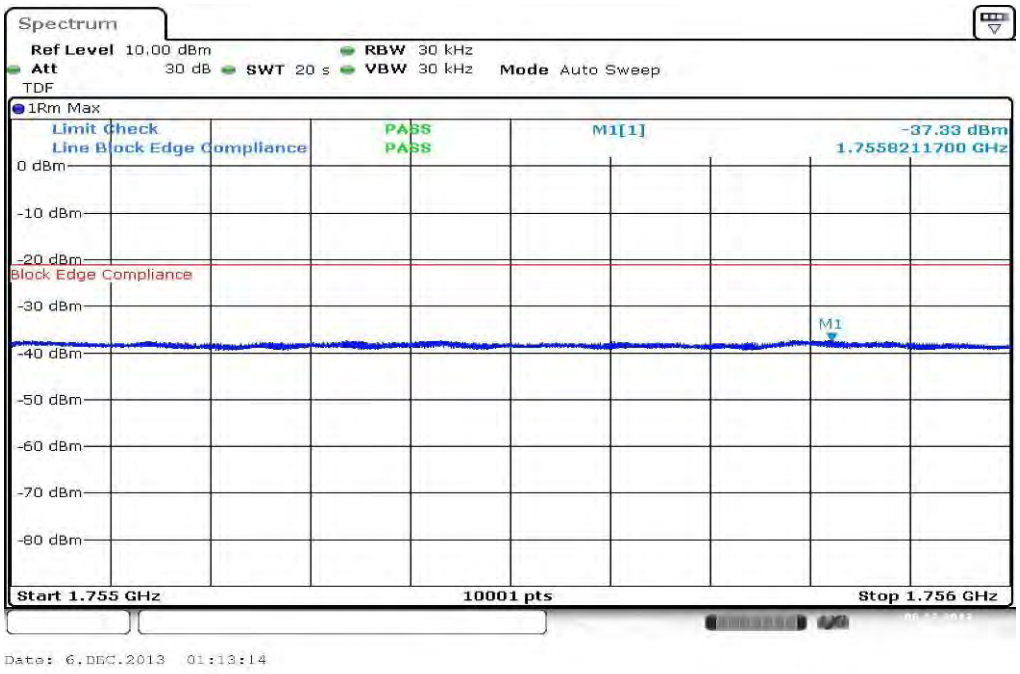
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation



Plot 4: Highest channel, 16 – QAM modulation



Result: **Passed**

8.3.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE band 4 frequency band. The table below lists the measured 99% power and 26dB occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 27.53 requires a measurement bandwidth of at least 1% of the occupied bandwidth.

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Depends on Channel Bandwidth
Trace-Mode:	Max Hold

Limits:

FCC	-/-
Occupied Bandwidth	
Spectrum must fall completely in the specified band	

Results:

Occupied Bandwidth - QPSK		
Bandwidth [MHz]	**99% OBW (kHz)**	**26 dB bandwidth (kHz)**
1.4	1091	1293
3	2732	3055
5	4502	5000
10	9065	10203
15	13442	14696
20	17934	19690
Measurement uncertainty	± 30 kHz to ± 500 kHz depending on channel bandwidth	

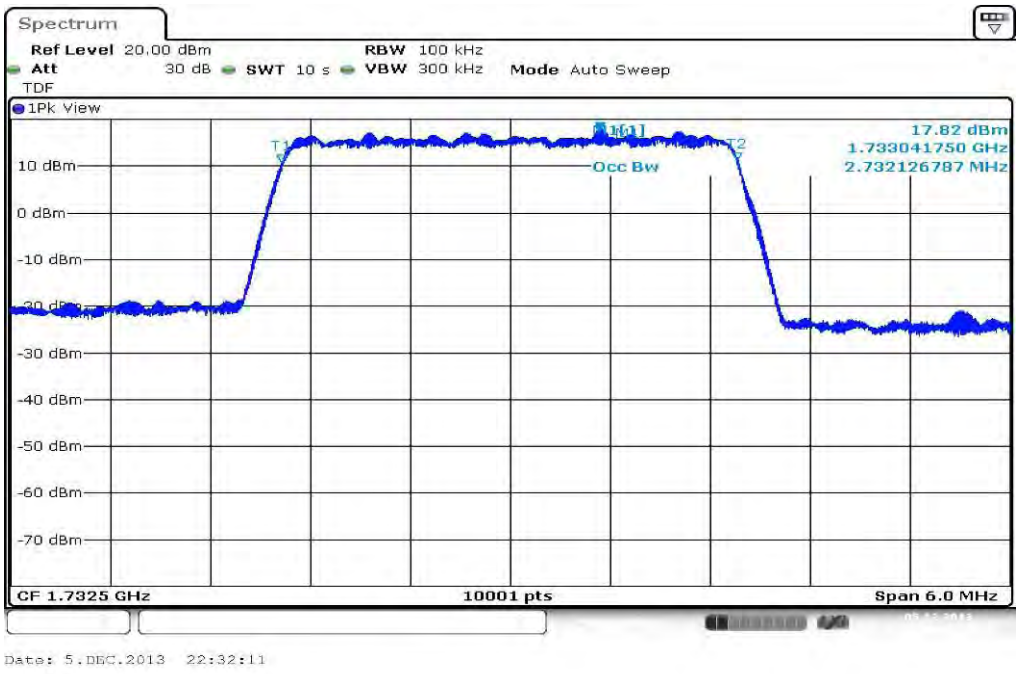
Occupied Bandwidth – 16-QAM		
Bandwidth [MHz]	**99% OBW (kHz)**	**26 dB bandwidth (kHz)**
1.4	1096	1302
3	2726	3056
5	4518	5025
10	9065	10073
15	13433	14738
20	17938	19662
Measurement uncertainty	± 30 kHz to ± 500 kHz depending on channel bandwidth	

Result: **Passed**

Plots: QPSK

Plot 1: 1.4 MHz, 99% OBW

Plot 2: 3 MHz, 99% OBW

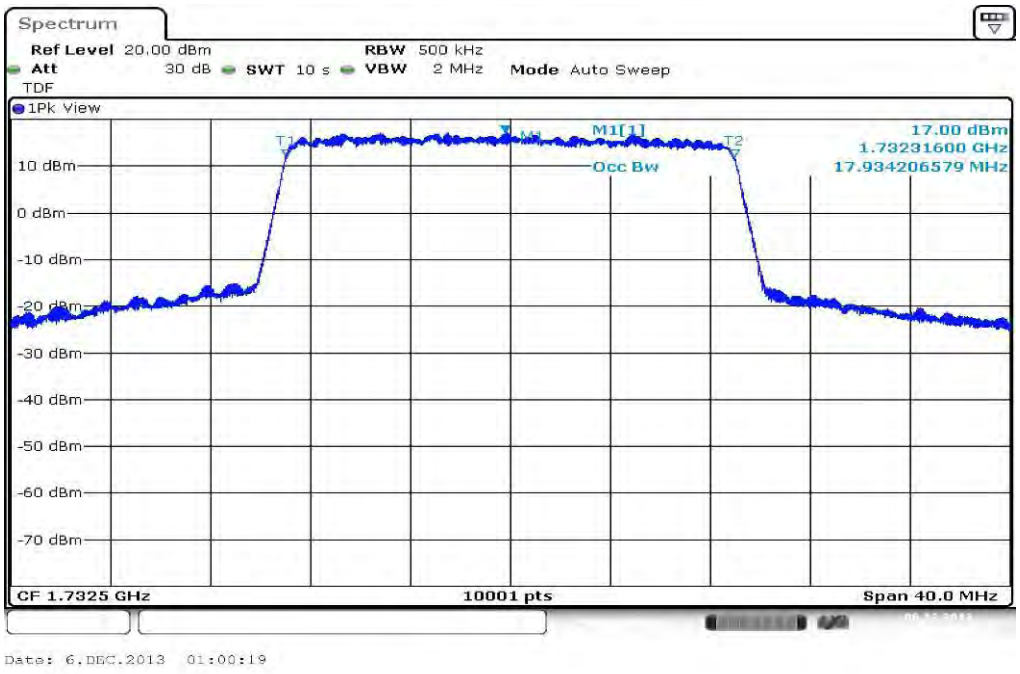


Plot 3: 5 MHz, 99% OBW

Plot 4: 10 MHz, 99% OBW

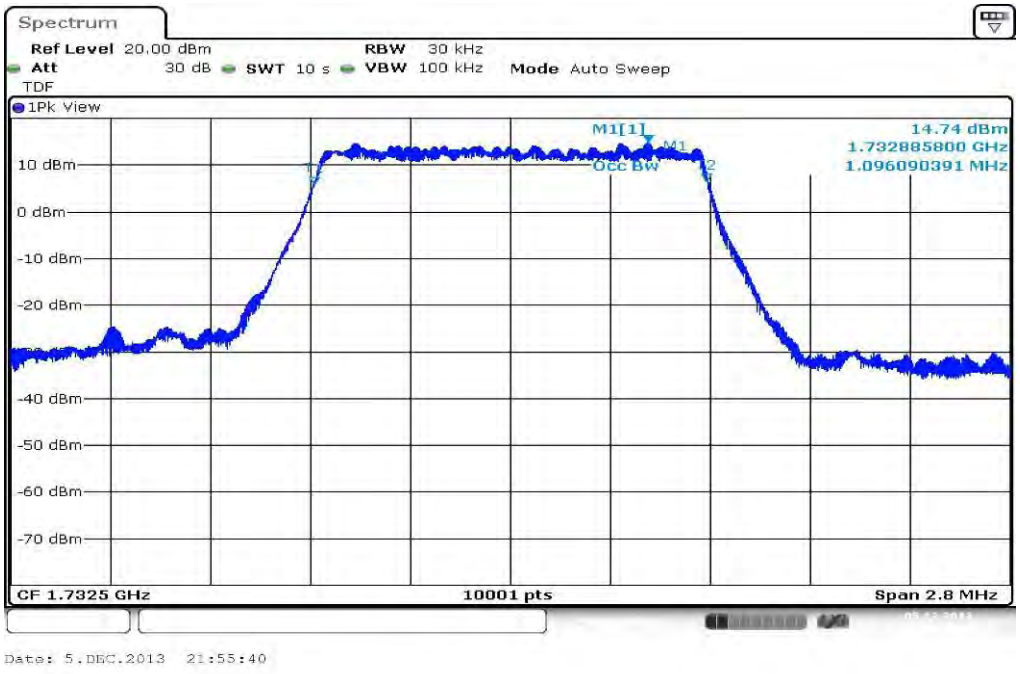
Plot 5: 15 MHz, 99% OBW

Plot 6: 20 MHz, 99% OBW

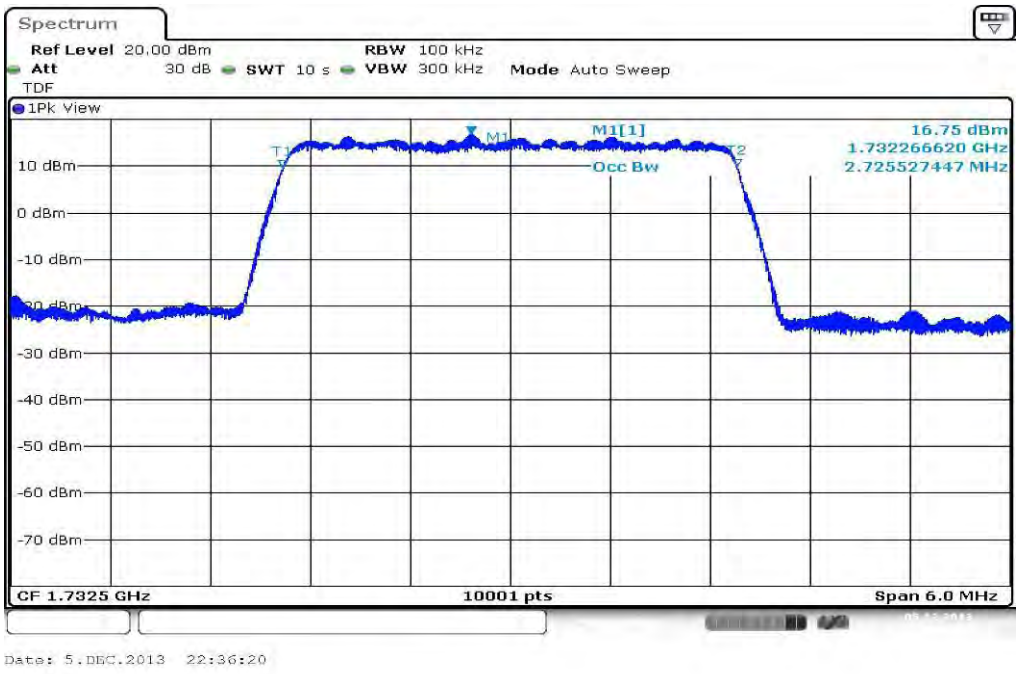


Plots: 16-QAM

Plot 1: 1.4 MHz, 99% OBW



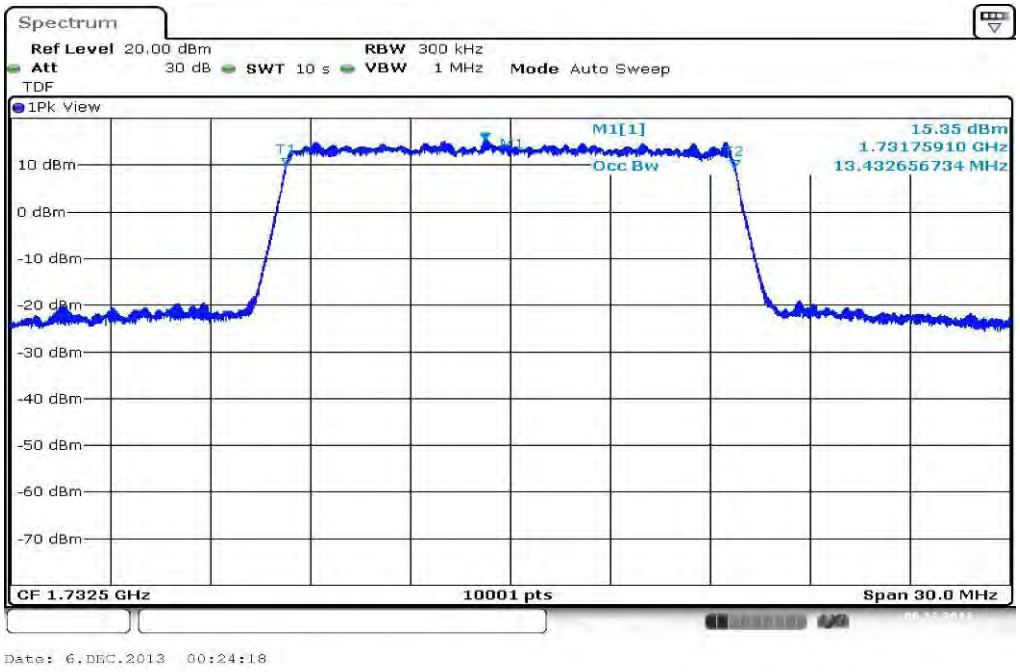
Plot 2: 3 MHz, 99% OBW



Plot 3: 5 MHz, 99% OBW

Plot 4: 10 MHz, 99% OBW

Plot 5: 15 MHz, 99% OBW



Plot 6: 20 MHz, 99% OBW

8.4 Results LTE – Band 7

The EUT was set to transmit the maximum power.

8.4.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP measurements for the mobile station. In all cases, the peak output power is within the required mask (this mask is specified in the JTC standards, TIA PN3389 Vol. 1 Chap 7, and is no FCC requirement).

Measurement:

The mobile was set up for the maximum output power with pseudo random data modulation.

To determine the Peak-To-Average Power Ratio (PAPR) the measurement was performed with the Power Complementary Cumulative Distribution Function (CCDF).

Measurement parameters	
Detector:	Peak and RMS (Power in Burst)
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Zero Span
Trace-Mode:	Max Hold

Limits:

FCC	-/-
AVG: 33 dBm	Peak: 33 dBm
Max Output Power	
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (conducted)						
Bandwidth (MHz)	**Frequency (MHz)**	**Resource block allocation**	**Average Output Power (dBm) QPSK**	**Peak to Average Ratio (dB)**	**Average Output Power (dBm) 16-QAM**	**Peak to Average Ratio (dB)**
5	2502.5	1 RB low	20.1	4.5	19.0	5.4
		1 RB high	20.0	4.7	18.8	4.4
		50% RB mid	19.0	5.0	18.0	6.0
		100% RB	19.0	5.7	18.1	6.6
	2535	1 RB low	19.9	4.4	19.4	4.0
		1 RB high	19.9	4.5	19.4	4.0
		50% RB mid	19.1	5.8	18.1	4.8
		100% RB	19.1	6.3	18.1	5.3
	2567.5	1 RB low	20.4	4.7	19.1	4.7
		1 RB high	20.3	4.7	19.0	4.9
		50% RB mid	19.2	5.2	18.4	6.1
		100% RB	19.2	5.7	18.4	6.8
10	2505	1 RB low	20.2	5.4	19.2	4.7
		1 RB high	20.1	4.7	19.3	3.8
		50% RB mid	19.0	6.0	18.2	5.2
		100% RB	19.0	6.6	18.2	6.2
	2535	1 RB low	20.0	4.1	18.9	5.2
		1 RB high	20.1	3.9	19.0	5.1
		50% RB mid	19.1	4.8	18.2	5.6
		100% RB	19.2	5.4	18.2	6.1
	2565	1 RB low	20.6	4.9	19.3	4.7
		1 RB high	20.3	5.3	19.0	4.8
		50% RB mid	19.2	6.1	18.4	4.6
		100% RB	19.2	7.2	18.4	6.3
15	2507.5	1 RB low	20.3	4.6	19.4	5.4
		1 RB high	20.5	3.7	19.6	4.7
		50% RB mid	19.1	4.6	18.3	5.5
		100% RB	19.1	5.8	18.2	6.5
	2535	1 RB low	20.0	4.7	19.4	4.1
		1 RB high	20.3	4.5	19.7	3.9
		50% RB mid	19.2	5.7	18.2	4.6
		100% RB	19.2	6.0	18.2	5.2
	2562.5	1 RB low	20.7	4.7	19.4	4.7
		1 RB high	20.4	4.8	19.1	5.9
		50% RB mid	19.4	5.1	18.5	6.1
		100% RB	19.5	5.9	18.6	6.6

20	2510	1 RB low	20.1	5.4	19.1	4.5
		1 RB high	20.2	4.8	19.2	3.8
		50% RB mid	19.0	5.6	18.1	4.7
		100% RB	19.1	6.4	18.2	5.4
	2535	1 RB low	19.8	3.9	19.2	4.7
		1 RB high	20.2	3.7	19.5	4.5
		50% RB mid	19.1	4.6	18.1	5.6
		100% RB	19.2	4.9	18.2	6.4
	2560	1 RB low	20.6	4.3	19.7	4.7
		1 RB high	20.2	5.3	19.4	4.8
		50% RB mid	19.5	6.0	18.6	5.2
		100% RB	19.5	6.5	18.7	6.1
Measurement uncertainty			± 0.5 dB			

The output power radiated is measured with the mode which has the highest conducted output power.

Output Power (radiated)			
Bandwidth (MHz)	**Frequency (MHz)**	**Average Output Power (dBm) QPSK**	**Average Output Power (dBm) 16-QAM**
5	2502.5	20.4	19.3
	2535	19.5	19.0
	2567.5	20.6	19.3
10	2505	20.5	19.6
	2535	19.7	18.6
	2565	20.8	19.5
15	2507.5	20.8	19.9
	2535	19.9	19.3
	2562.5	20.9	19.6
20	2510	20.5	19.5
	2535	19.8	19.1
	2560	20.8	19.9
Measurement uncertainty		± 3.0 dB	

Result: Passed

8.4.2 Frequency stability

Description:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station in a “call mode”. This is accomplished with the use of a R&S CMW500 DIGITAL RADIOCOMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the mobile station to overnight soak at -30 C.
3. With the mobile station, powered with V_{nom}, connected to the CMW500 and in a simulated call on channel 1412 (centre channel), measure the carrier frequency. These measurements should be made within two minutes of powering up the mobile station, to prevent significant self warming.
4. Repeat the above measurements at 10°C increments from -30°C to +60°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with V_{nom}. Vary supply voltage from V_{min} to V_{max}, in 0.1 Volt steps remeasuring carrier frequency at each voltage. Pause at V_{nom} for 1.5 hours unpowered, to allow any self heating to stabilize, before continuing.
6. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

This measurement was performed with the highest channel bandwidth supported from the EUT on the middle channel

Measurement:

Measurement parameters	
Detector:	Measured with CMW500
Sweep time:	
Video bandwidth:	
Resolution bandwidth:	
Span:	
Trace-Mode:	

Limits:

FCC	-/-
Frequency Stability	
< 2.5 ppm	

Results:

FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
3.3	49	0.00000193	0.0193
3.4	28	0.00000110	0.0110
3.5	-29	-0.00000114	-0.0114
3.6	14	0.00000055	0.0055
3.7	42	0.00000166	0.0166
3.8	-38	-0.00000150	-0.0150
3.9	53	0.00000209	0.0209
4.0	55	0.00000217	0.0217
4.1	36	0.00000142	0.0142
4.2	-17	-0.00000067	-0.0067
4.3	-20	-0.00000079	-0.0079
4.4	-31	-0.00000122	-0.0122

FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-48	-0.00000189	-0.0189
-20	57	0.00000225	0.0225
-10	-17	-0.00000067	-0.0067
± 0	-28	-0.00000110	-0.0110
10	53	0.00000209	0.0209
20	-26	-0.00000103	-0.0103
30	37	0.00000146	0.0146
40	-28	-0.00000110	-0.0110
50	15	0.00000059	0.0059
60	49	0.00000193	0.0193

Result: Passed

8.4.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4:2009 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 9 kHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 2569.3 MHz. This was rounded up to 26 GHz. The resolution bandwidth is set as outlined in Part 27.53. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE band 7.

The final open field emission (here 10m semi-anechoic chamber listed by FCC) test procedure is as follows:

a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.
b) The antenna output was terminated in a 50 ohm load (if possible).
c) A double ridged wave guide antenna was placed on an adjustable height antenna mast 3 meters from the test item for emission measurements.
d) Detected emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. The radiated emission measurements of the harmonics of the transmit frequency through the 10th harmonic were measured with peak detector and 1 MHz bandwidth. If the harmonic could not be detected above the noise floor, the ambient level was recorded. The equivalent power into a dipole antenna was calculated from the field intensity levels measured at 3 meters.
e) Now each detected emissions were substituted by the substitution method, in accordance with the TIA/EIA 603.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	2 sec.
Video bandwidth:	below 150 kHz: 200 Hz 150 kHz ≤ f < 30 MHz: 9 kHz 30 MHz ≤ f < 700 MHz: 100 kHz Above 700 MHz: 1 MHz
Resolution bandwidth:	below 150 kHz: 200 Hz 150 kHz ≤ f < 30 MHz: 9 kHz 30 MHz ≤ f < 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Span:	100 MHz Steps
Trace-Mode:	Max Hold

Limits:

FCC	-/-
Spurious Emissions Radiated	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the upper, center, and lower carrier frequencies of the LTE band 7. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band 7 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

The final open field radiated levels are presented on the next pages.
All measurements were done in horizontal and vertical polarization; the plots show the worst case.
The plots show only the middle channel with full resource blocks. If spurious were detected, the lowest and highest channel and all supported channel bandwidths were checked, too.

As can be seen from this data, the emissions from the test item were within the specification limit.

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5010.0	No emissions detected.	5070.0	No emissions detected.	5130.0	No emissions detected.
7515.0		7605.0		7695.0	
10020.0		10140.0		10260.0	
12525.0		12675.0		12825.0	
15030.0		15210.0		15390.0	
17535.0		17745.0		17955.0	
20040.0		20280.0		20520.0	
22545.0		22815.0		23085.0	
25050.0		25350.0		25650.0	
Measurement uncertainty			± 3dB		

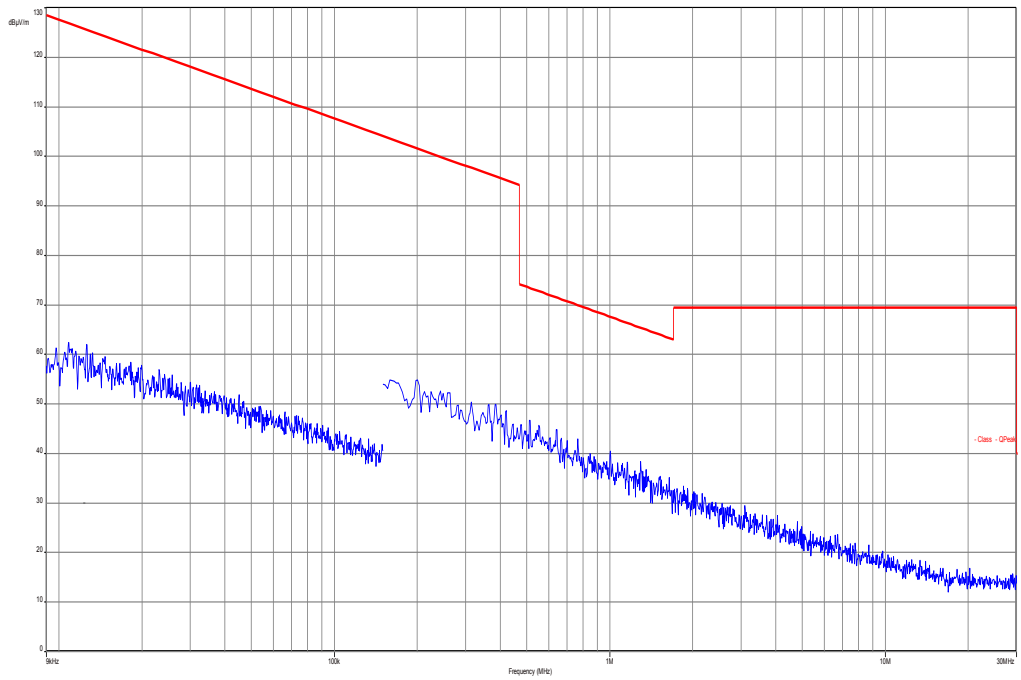
16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5010.0	No emissions detected.	5070.0	No emissions detected.	5130.0	No emissions detected.
7515.0		7605.0		7695.0	
10020.0		10140.0		10260.0	
12525.0		12675.0		12825.0	
15030.0		15210.0		15390.0	
17535.0		17745.0		17955.0	
20040.0		20280.0		20520.0	
22545.0		22815.0		23085.0	
25050.0		25350.0		25650.0	
Measurement uncertainty			± 3dB		

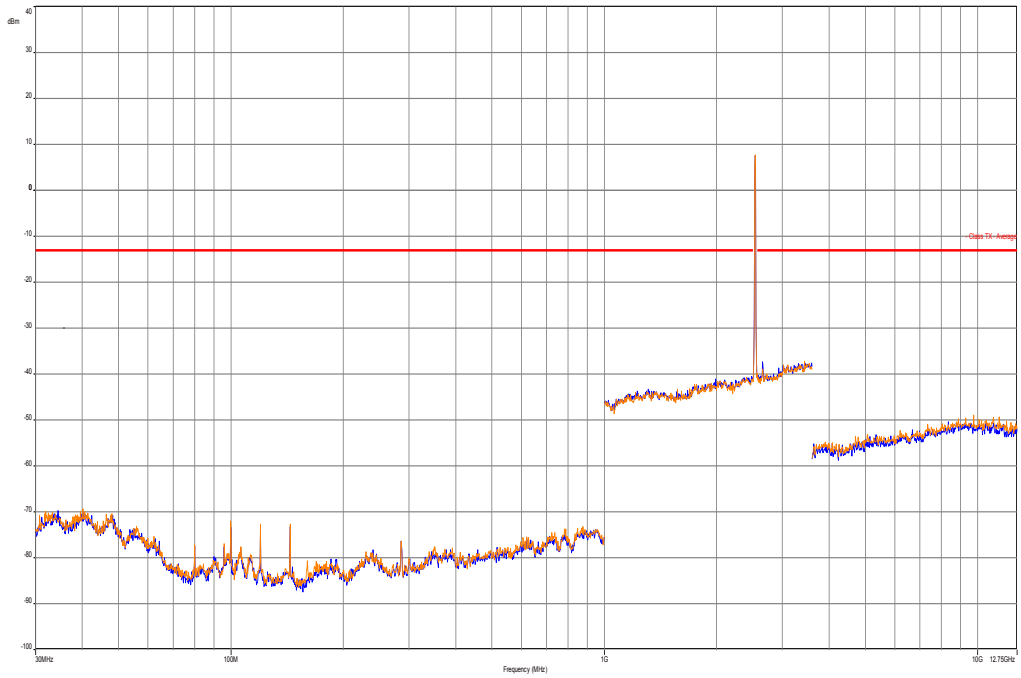
Result: Passed

QPSK with 10 MHz channel bandwidth

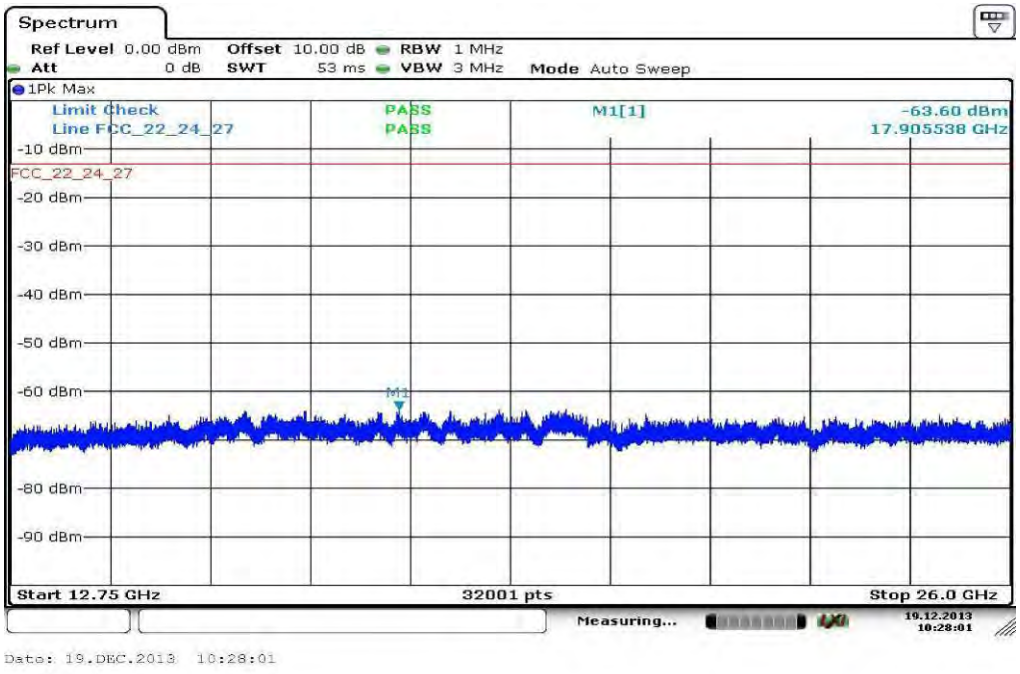
Plot 1: Middle channel, up to 30 MHz



Plot 2: Middle channel, 30 MHz to 12.75 GHz

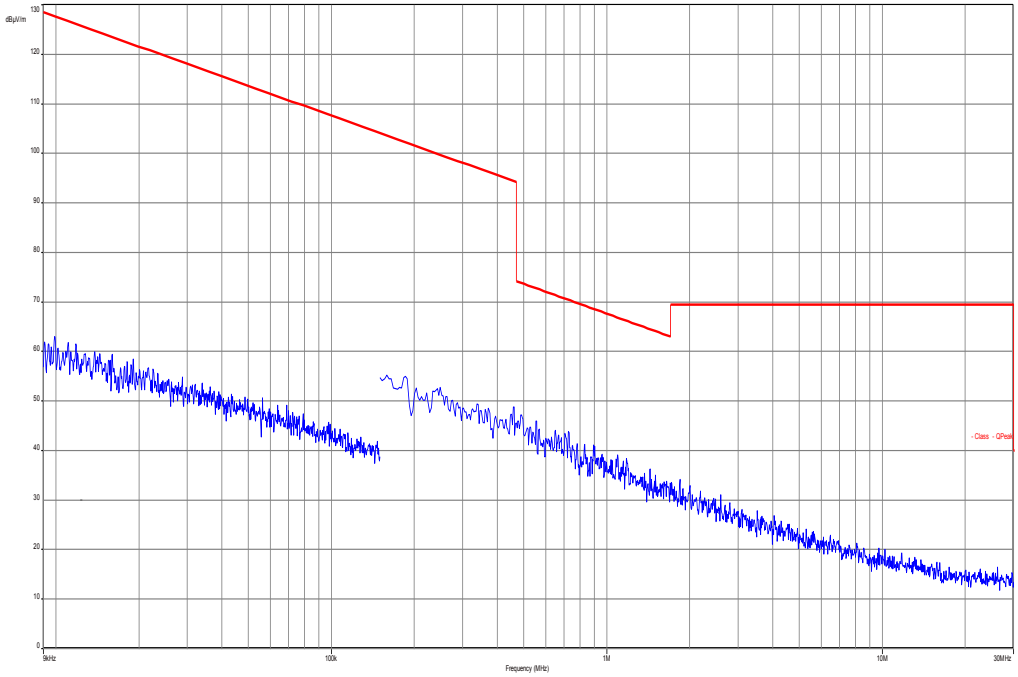


Plot 3: Middle channel, 12 GHz to 26 GHz

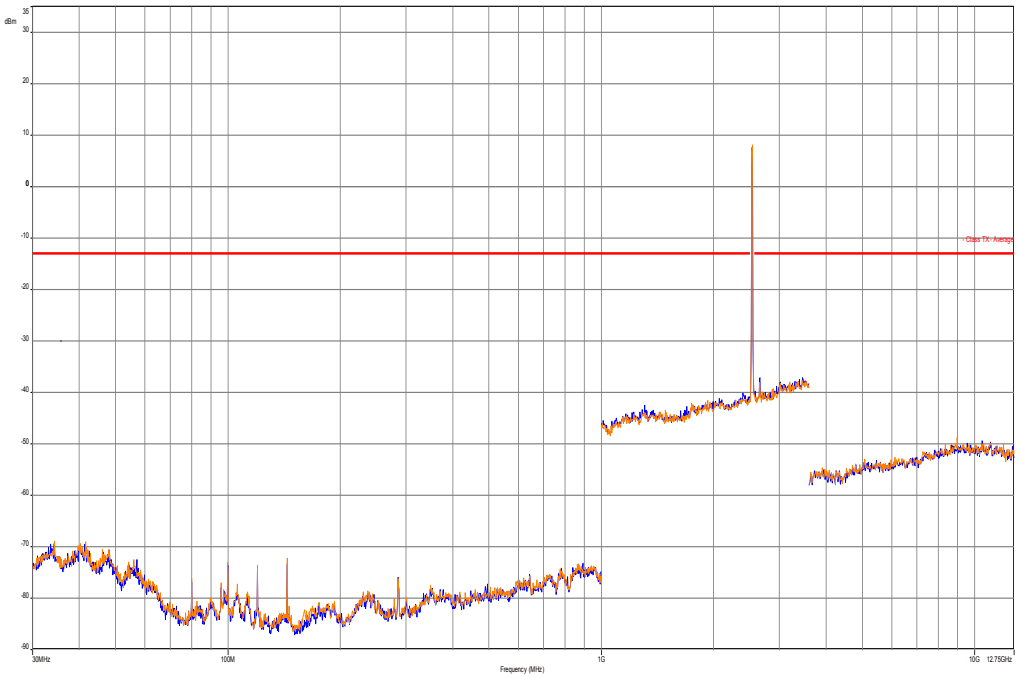


16-QAM with 10 MHz channel bandwidth

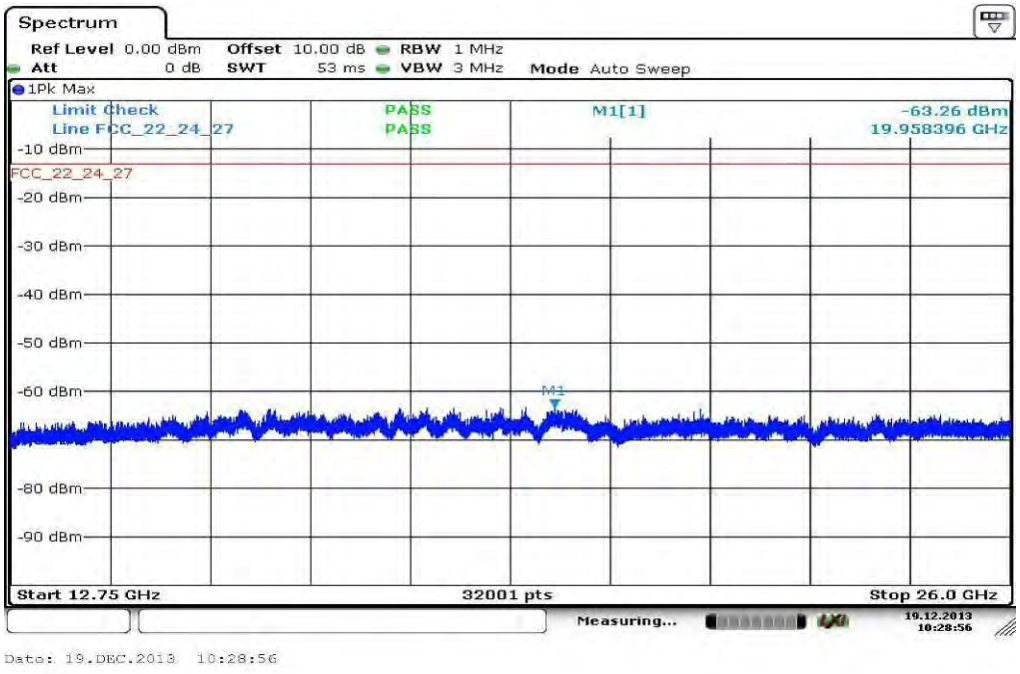
Plot 4: Middle channel, up to 30 MHz



Plot 5: Middle channel, 30 MHz to 12.75 GHz



Plot 6: Middle channel, 12 GHz to 26 GHz



8.4.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency.
2. Determine mobile station transmits frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

For the measurement the lowest, middle and highest channel bandwidth was used. If spurious were found the other bandwidths were measured, too.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement below 1 GHz with 100 kHz Above 1 GHz with 1 MHz
Resolution bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement below 1 GHz with 100 kHz Above 1 GHz with 1 MHz
Span:	30 MHz – 25 GHz
Trace-Mode:	Max Hold

Limits:

FCC	-/-
Spurious Emissions Conducted	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results: for 5 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5005.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5135.0	No spurious emissions detected!
7507.5		7605.0		7702.5	
10010.0		10140.0		10270.0	
12512.5		12675.0		12837.5	
15015.0		15210.0		15405.0	
17517.5		17745.0		17972.5	
20020.0		20280.0		20540.0	
22522.5		22815.0		23107.5	
25025.0		25350.0		25675.0	
Measurement uncertainty		± 3dB			

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5005.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5135.0	No spurious emissions detected!
7507.5		7605.0		7702.5	
10010.0		10140.0		10270.0	
12512.5		12675.0		12837.5	
15015.0		15210.0		15405.0	
17517.5		17745.0		17972.5	
20020.0		20280.0		20540.0	
22522.5		22815.0		23107.5	
25025.0		25350.0		25675.0	
Measurement uncertainty		± 3dB			

Result: Passed

Results: for 10 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5130.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5010.0	No spurious emissions detected!
7695.0		7605.0		7515.0	
10260.0		10140.0		10020.0	
12825.0		12675.0		12525.0	
15390.0		15210.0		15030.0	
17955.0		17745.0		17535.0	
20520.0		20280.0		20040.0	
23085.0		22815.0		22545.0	
25650.0		25350.0		25050.0	
Measurement uncertainty			± 3dB		

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5130.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5010.0	No spurious emissions detected!
7695.0		7605.0		7515.0	
10260.0		10140.0		10020.0	
12825.0		12675.0		12525.0	
15390.0		15210.0		15030.0	
17955.0		17745.0		17535.0	
20520.0		20280.0		20040.0	
23085.0		22815.0		22545.0	
25650.0		25350.0		25050.0	
Measurement uncertainty			± 3dB		

Result: Passed

Results: for 15 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5015.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5125.0	No spurious emissions detected!
7522.5		7605.0		7687.5	
10030.0		10140.0		10250.0	
12537.5		12675.0		12812.5	
15045.0		15210.0		15375.0	
17552.5		17745.0		17937.5	
20060.0		20280.0		20500.0	
22567.5		22815.0		23062.5	
25075.0		25350.0		25625.0	
Measurement uncertainty			± 3dB		

16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5015.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5125.0	No spurious emissions detected!
7522.5		7605.0		7687.5	
10030.0		10140.0		10250.0	
12537.5		12675.0		12812.5	
15045.0		15210.0		15375.0	
17552.5		17745.0		17937.5	
20060.0		20280.0		20500.0	
22567.5		22815.0		23062.5	
25075.0		25350.0		25625.0	
Measurement uncertainty			± 3dB		

Result: Passed

Results: for 20 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5020.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5120.0	No spurious emissions detected!
7530.0		7605.0		7680.0	
10040.0		10140.0		10240.0	
12550.0		12675.0		12800.0	
15060.0		15210.0		15360.0	
17570.0		17745.0		17920.0	
20080.0		20280.0		20480.0	
22590.0		22815.0		23040.0	
25100.0		25350.0		25600.0	
Measurement uncertainty		± 3dB			

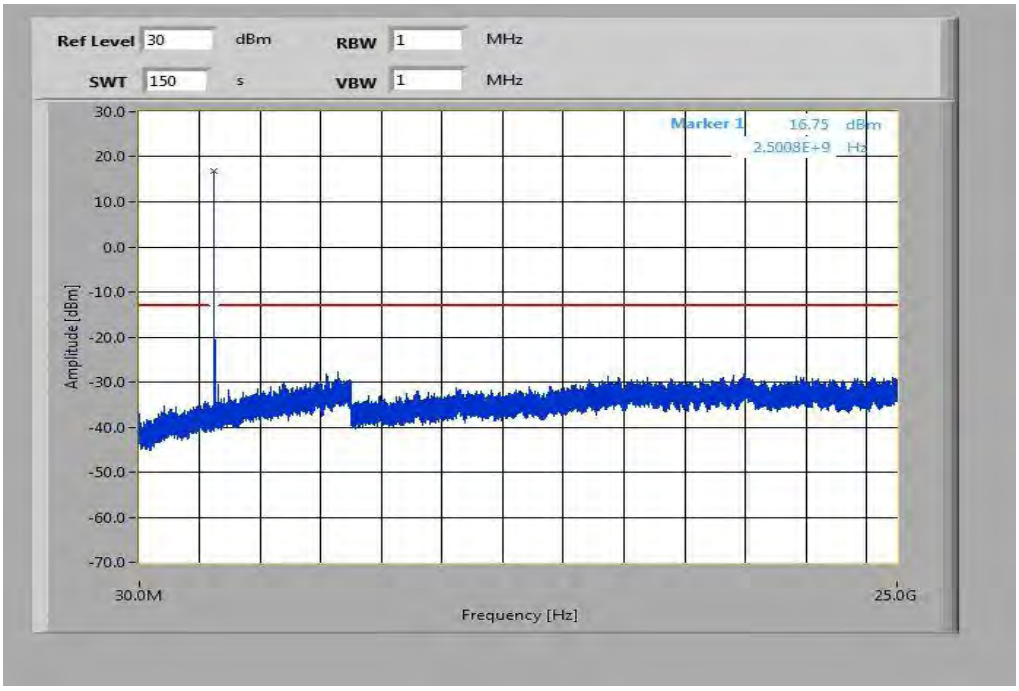
16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
5020.0	No spurious emissions detected!	5070.0	No spurious emissions detected!	5120.0	No spurious emissions detected!
7530.0		7605.0		7680.0	
10040.0		10140.0		10240.0	
12550.0		12675.0		12800.0	
15060.0		15210.0		15360.0	
17570.0		17745.0		17920.0	
20080.0		20280.0		20480.0	
22590.0		22815.0		23040.0	
25100.0		25350.0		25600.0	
Measurement uncertainty		± 3dB			

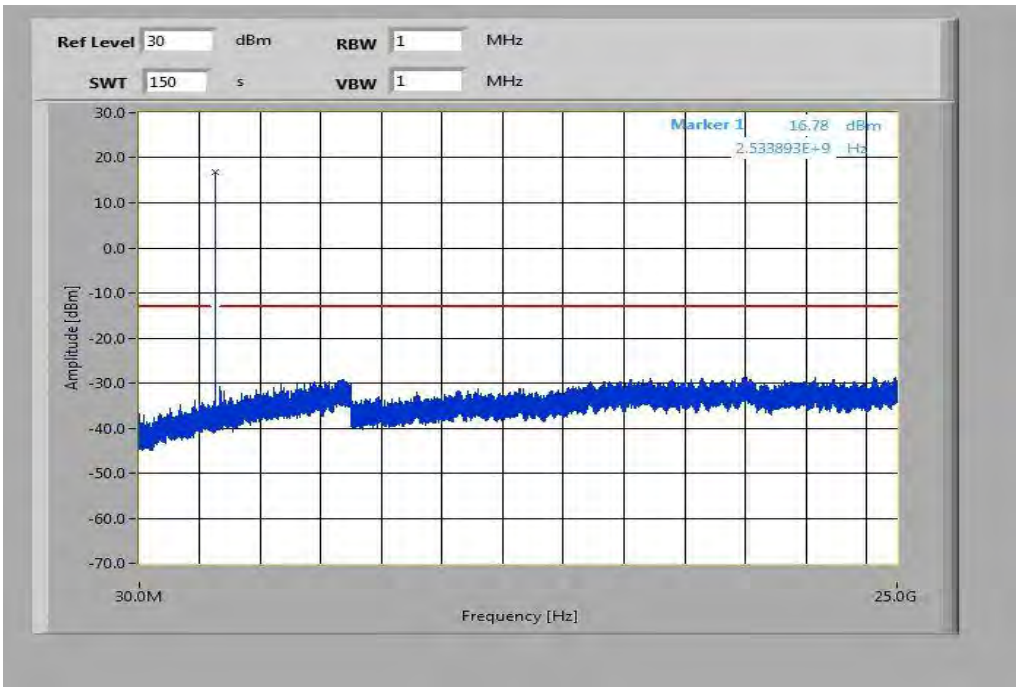
Result: Passed

Plots for 5 MHz channel bandwidth, QPSK

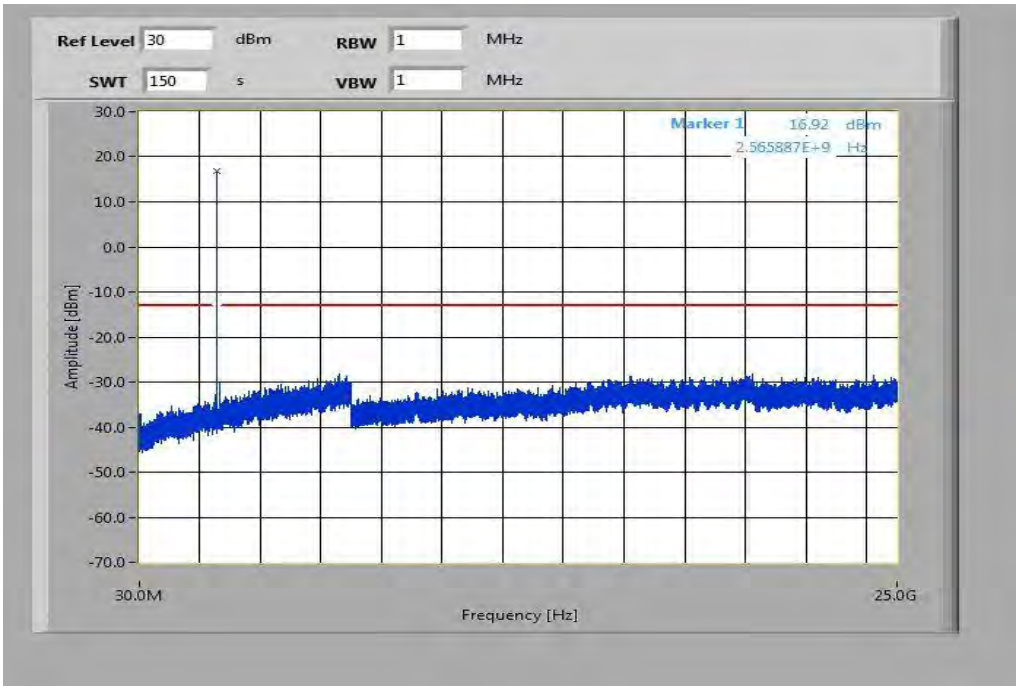
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

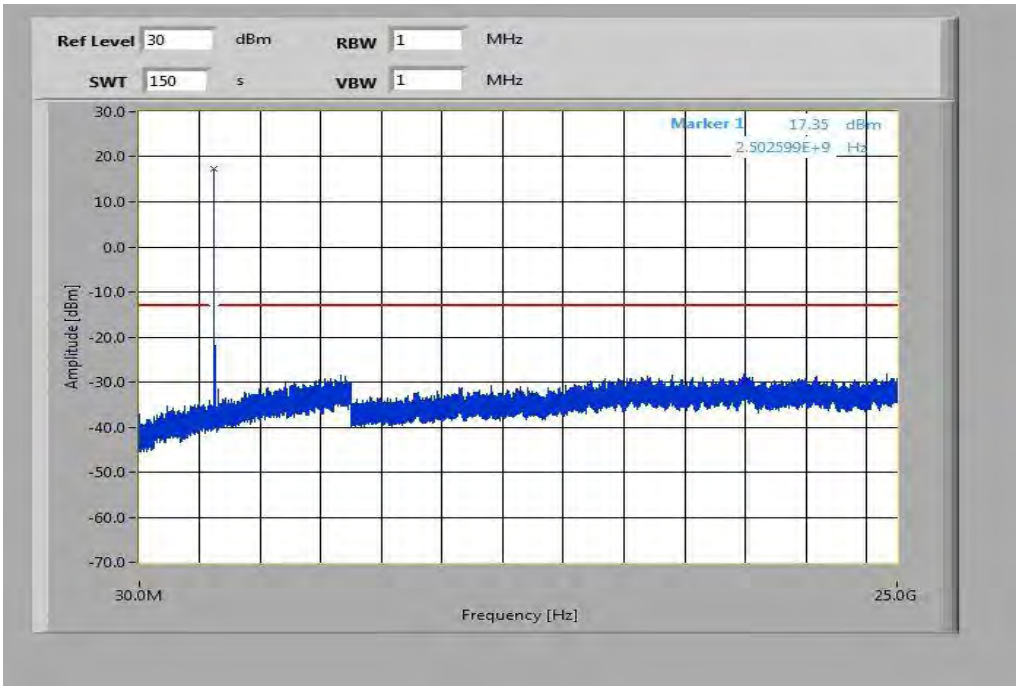


Plot 3: Highest channel, 30 MHz to 25 GHz

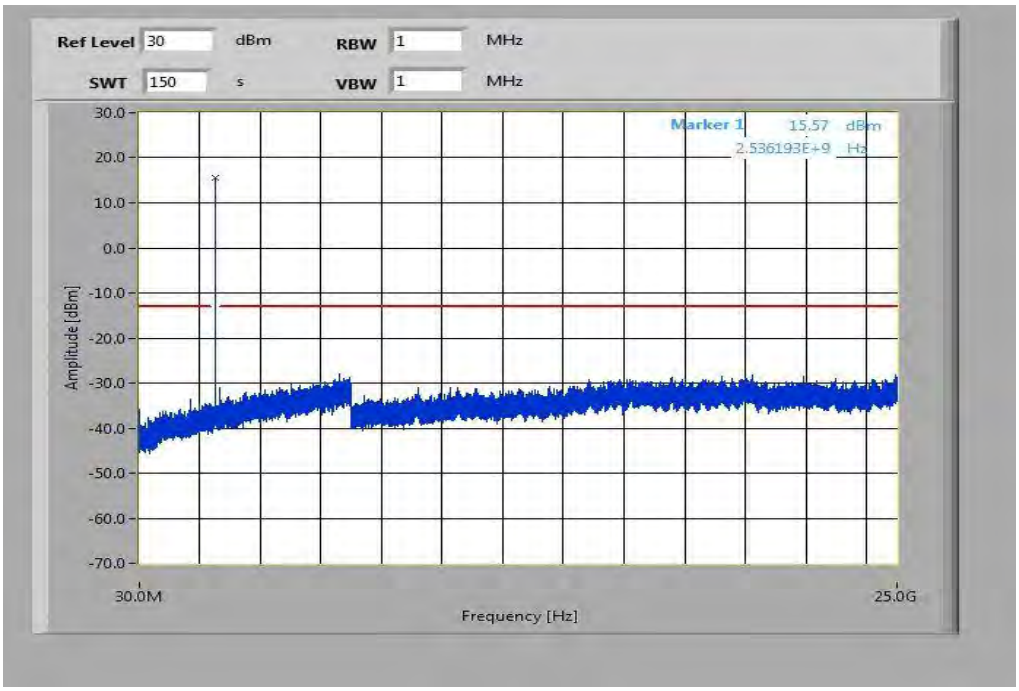


Plots for 5 MHz channel bandwidth, 16-QAM

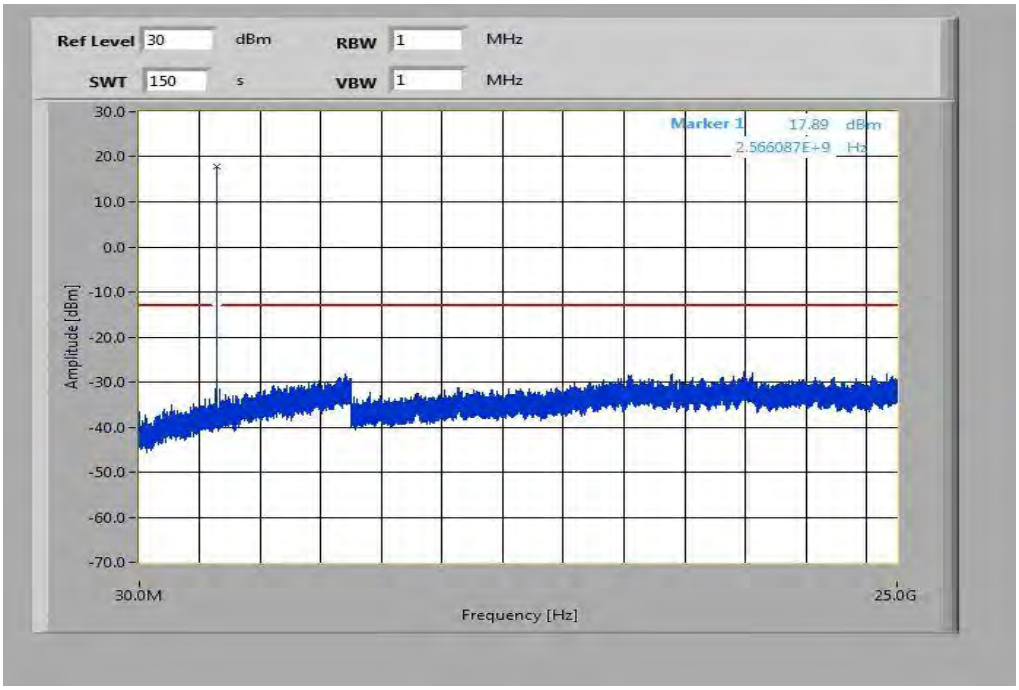
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

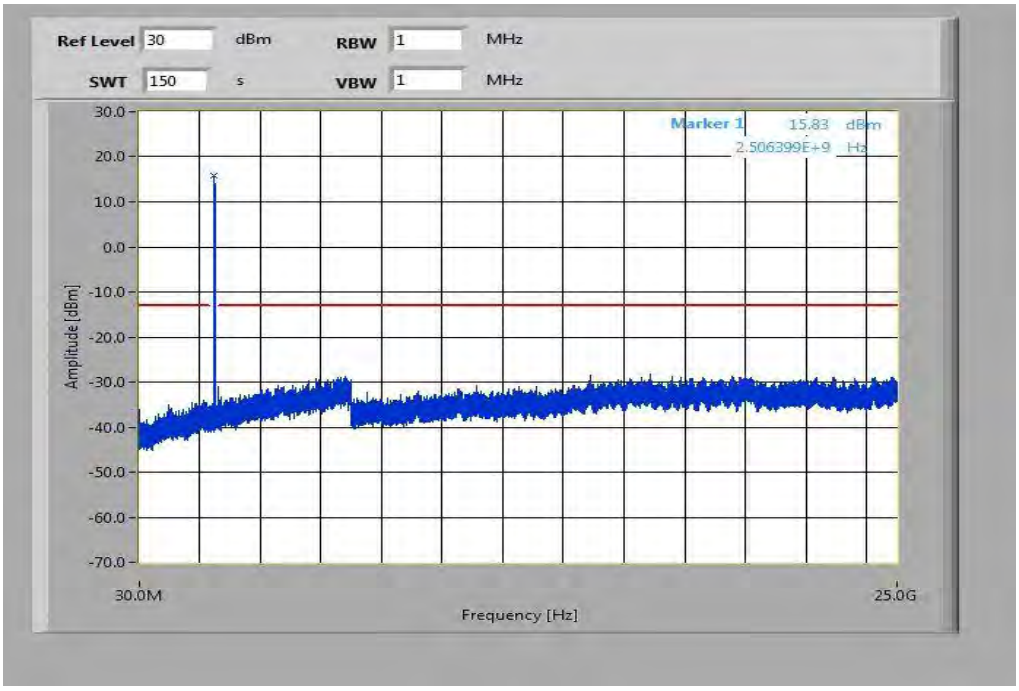


Plot 6: Highest channel, 30 MHz to 25 GHz

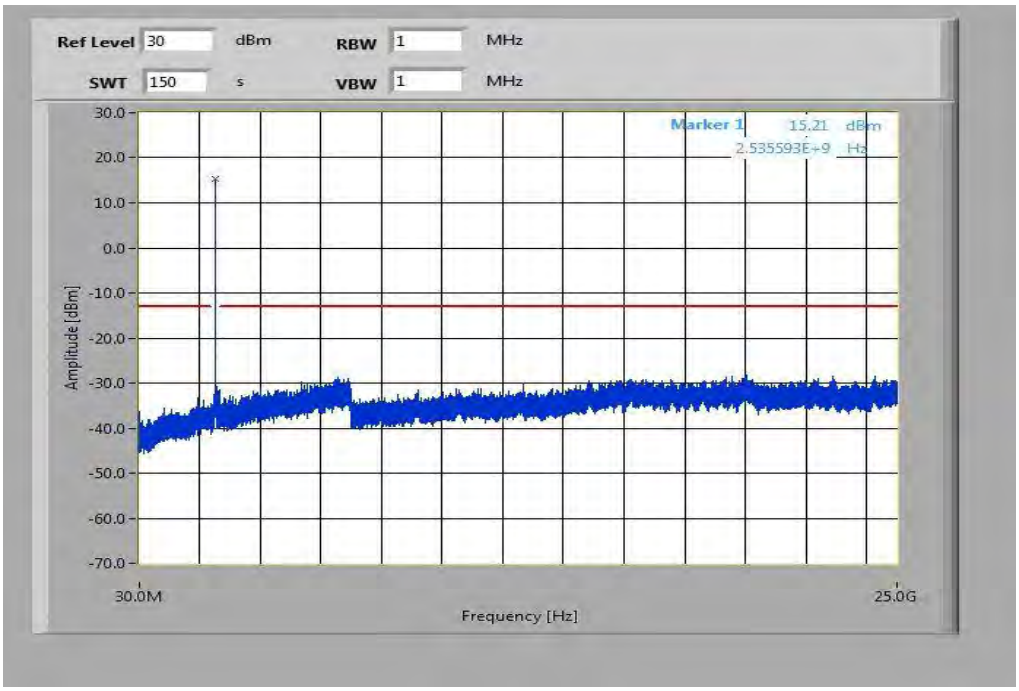


Plots for 10 MHz channel bandwidth, QPSK

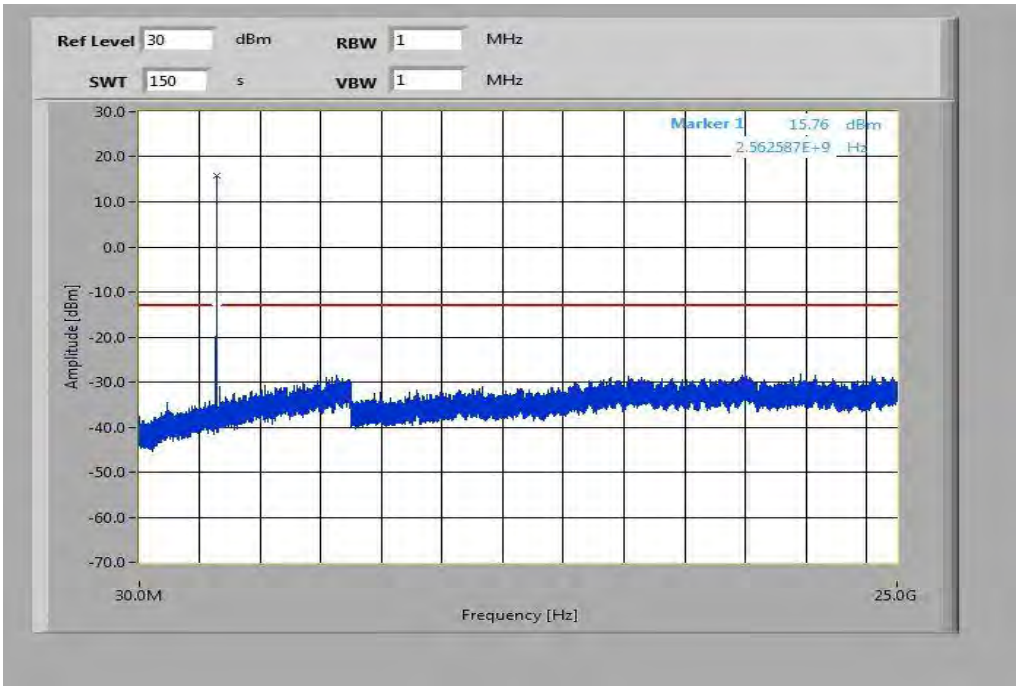
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

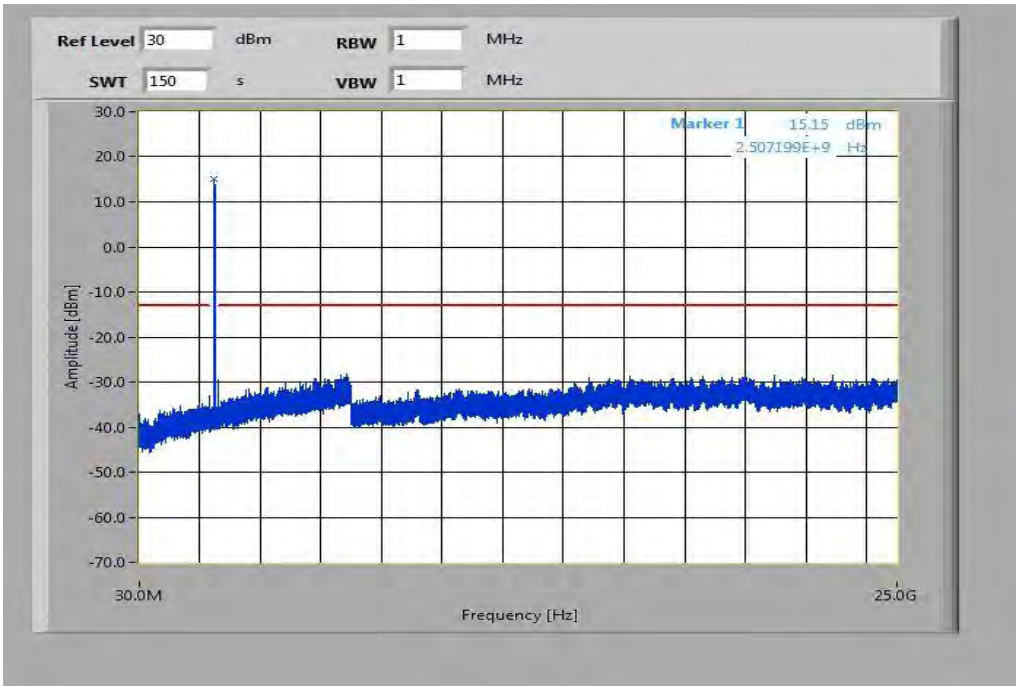


Plot 3: Highest channel, 30 MHz to 25 GHz

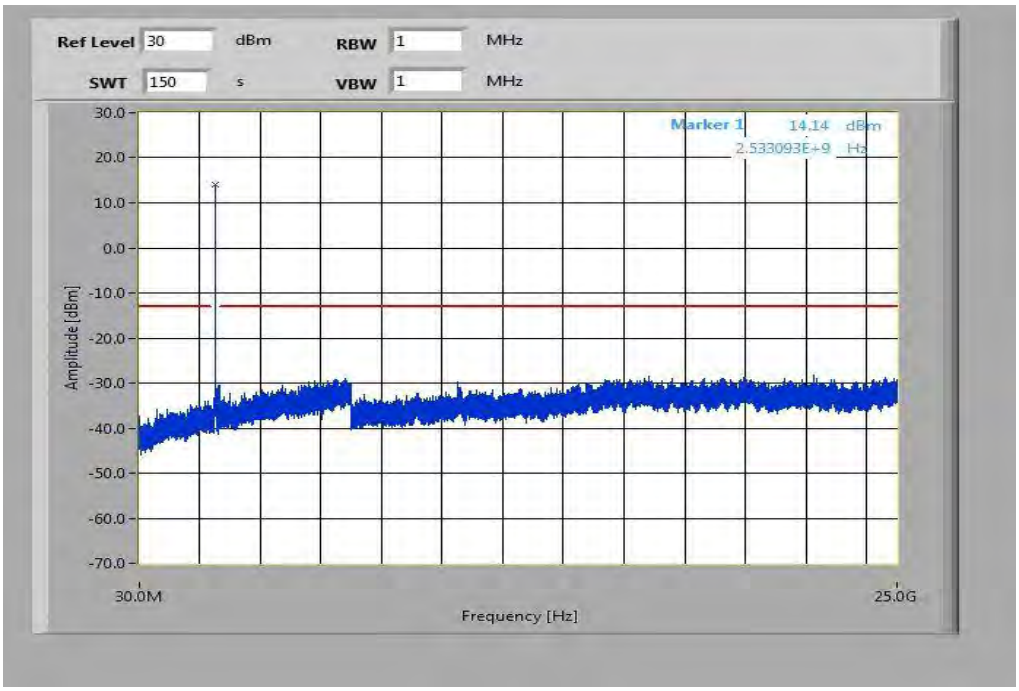


Plots for 10 MHz channel bandwidth, 16-QAM

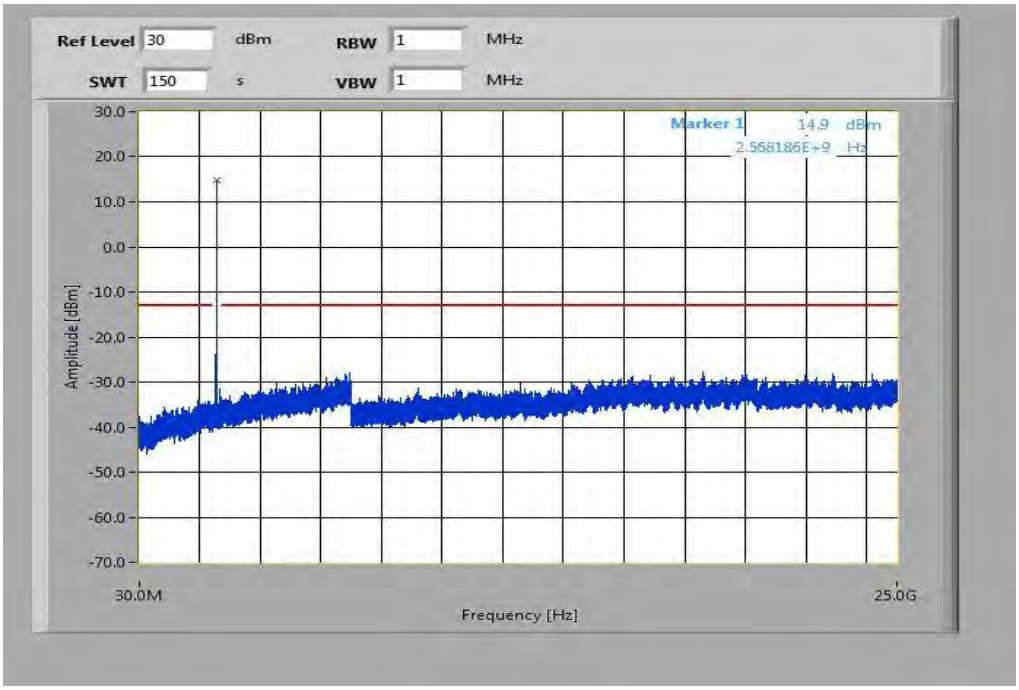
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

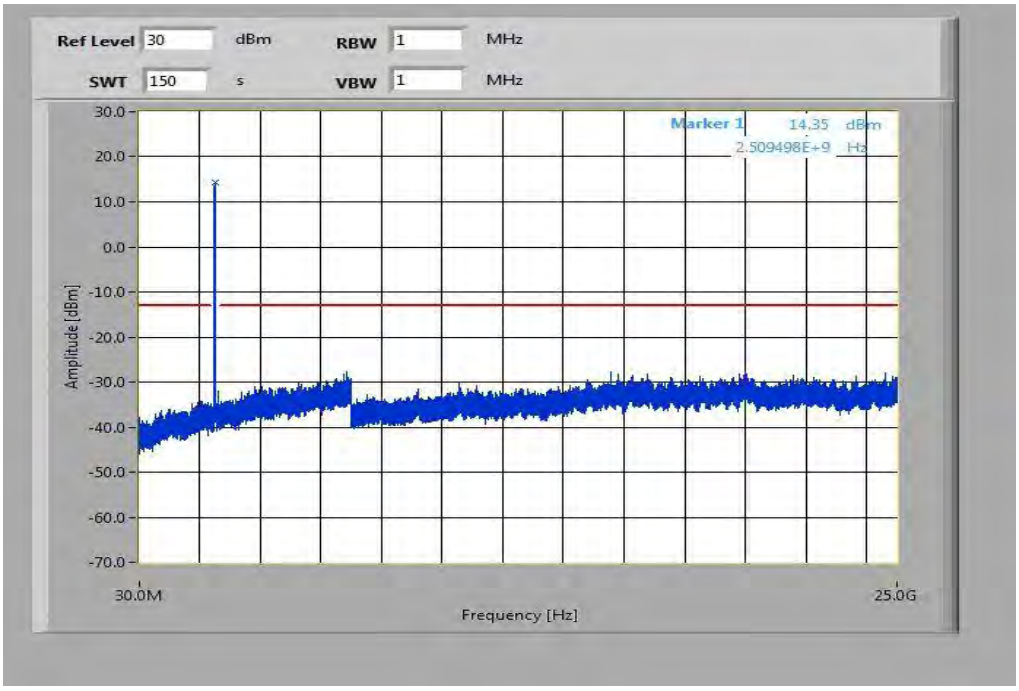


Plot 6: Highest channel, 30 MHz to 25 GHz

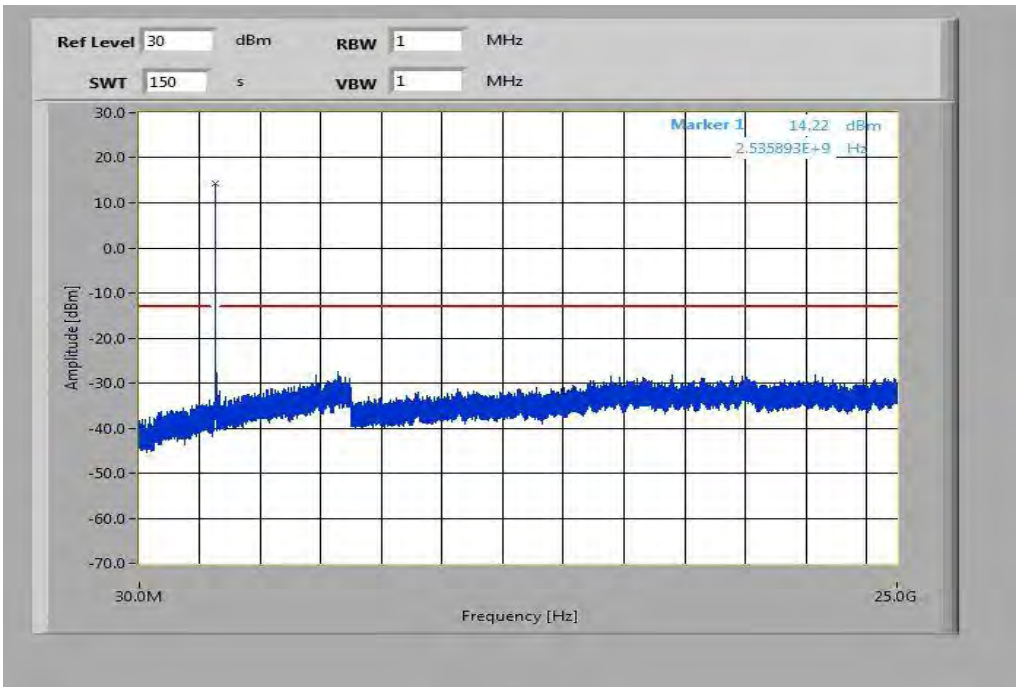


Plots for 15 MHz channel bandwidth, QPSK

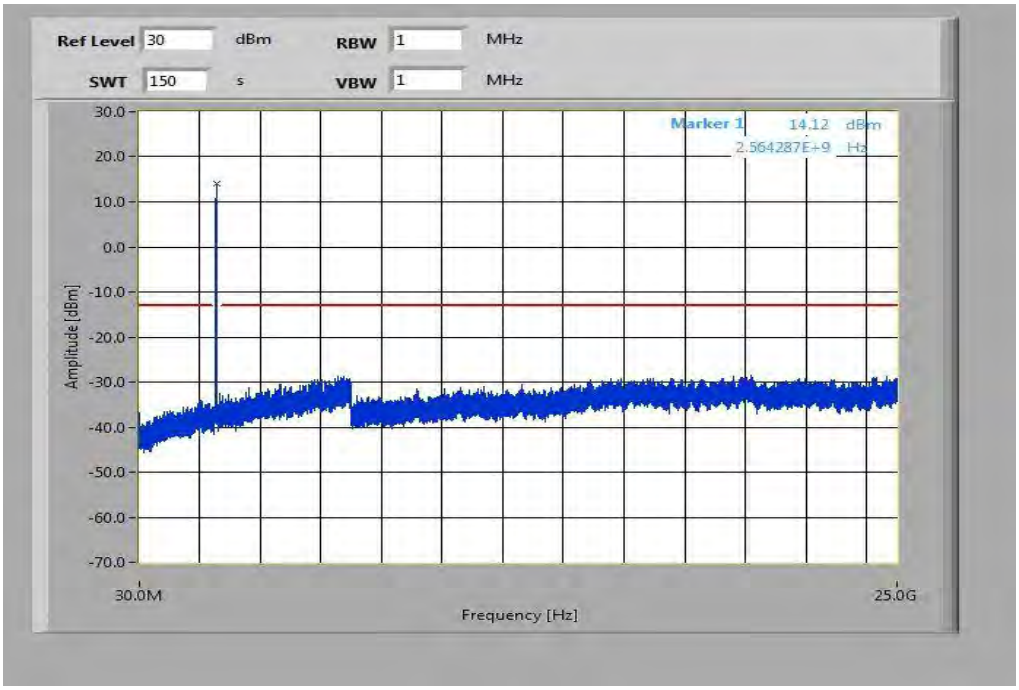
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

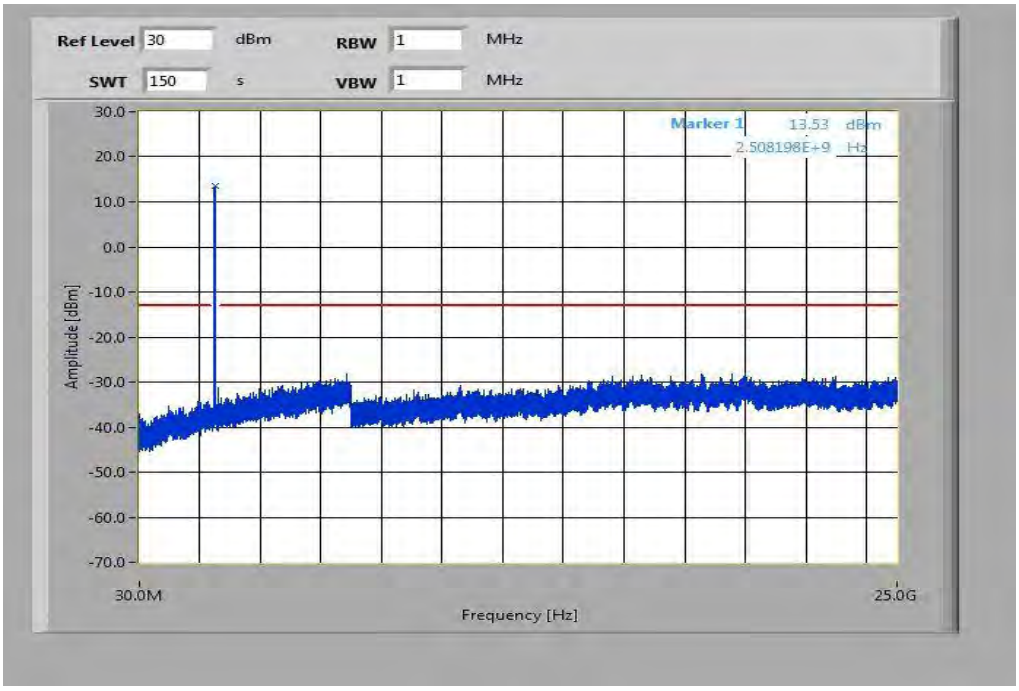


Plot 3: Highest channel, 30 MHz to 25 GHz

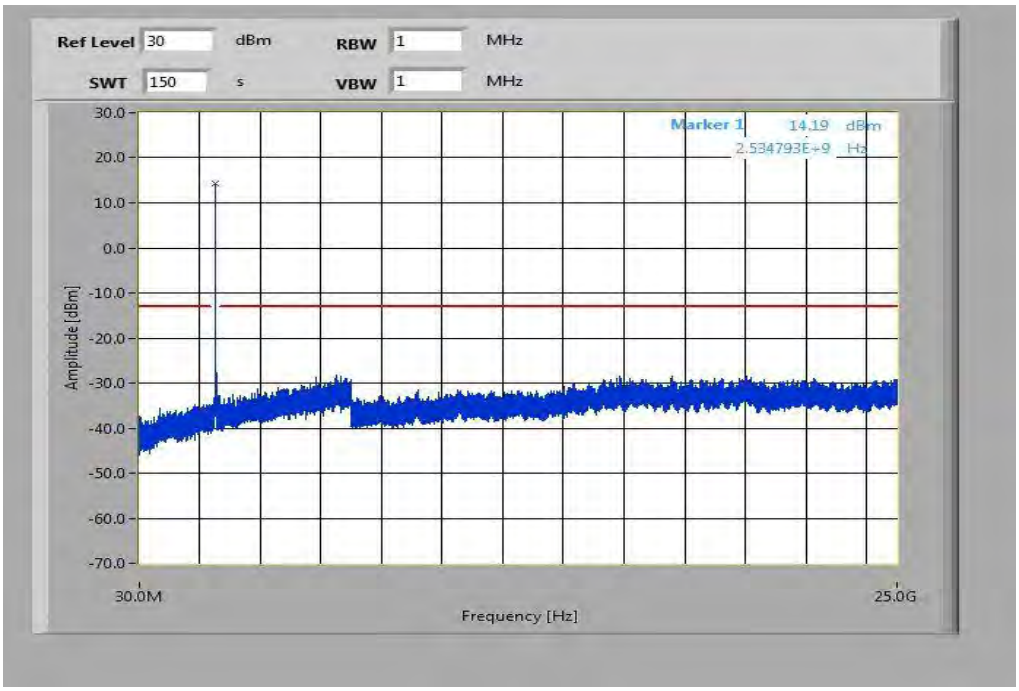


Plots for 15 MHz channel bandwidth, 16-QAM

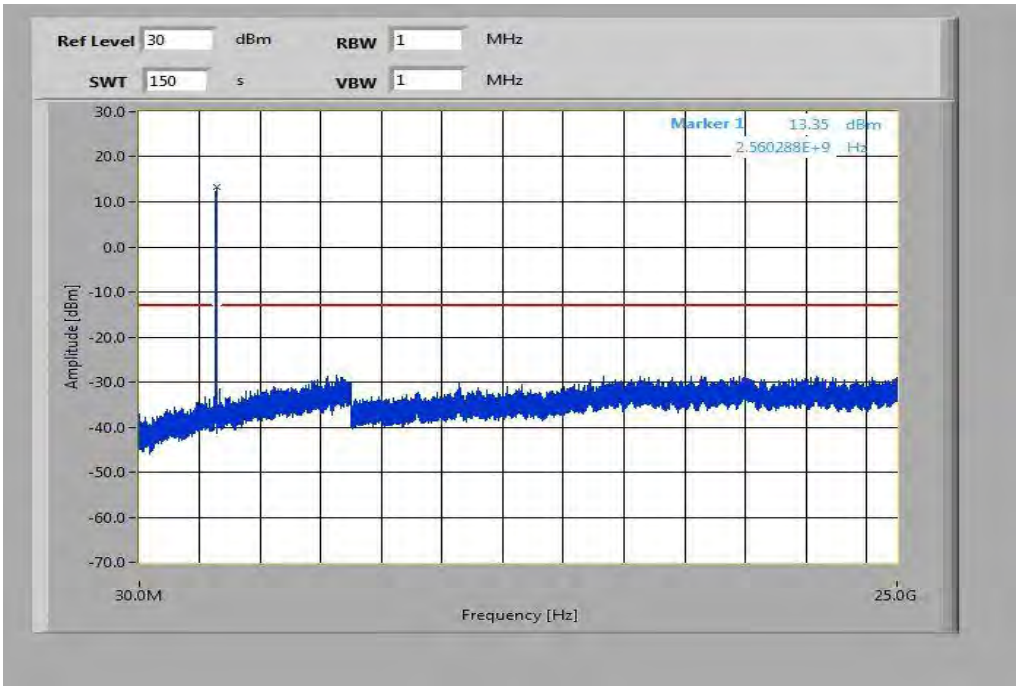
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz

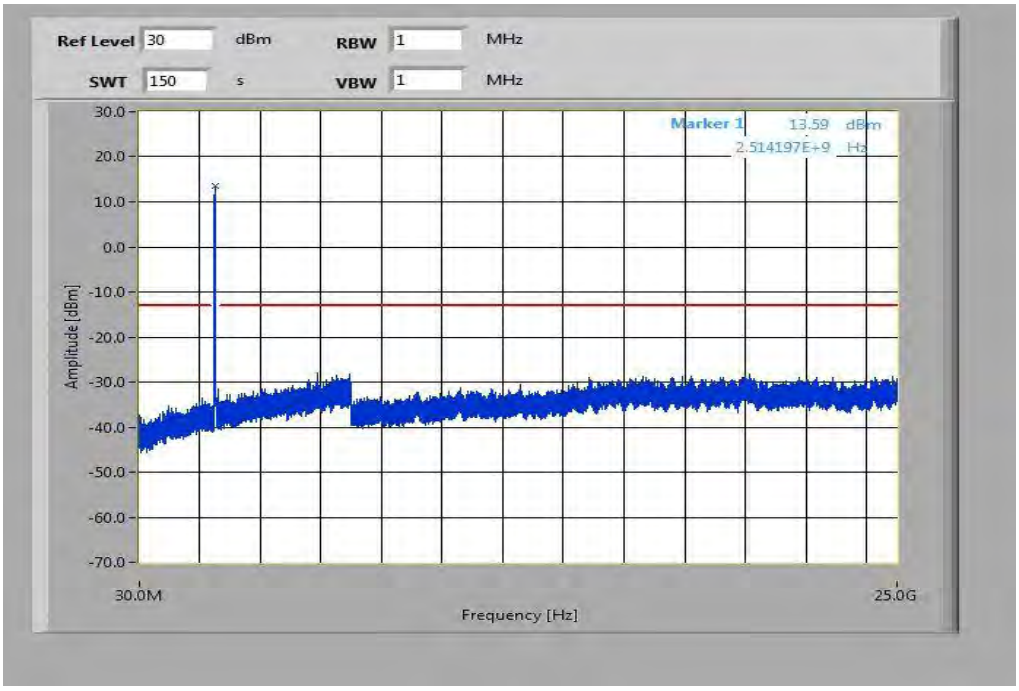


Plot 6: Highest channel, 30 MHz to 25 GHz

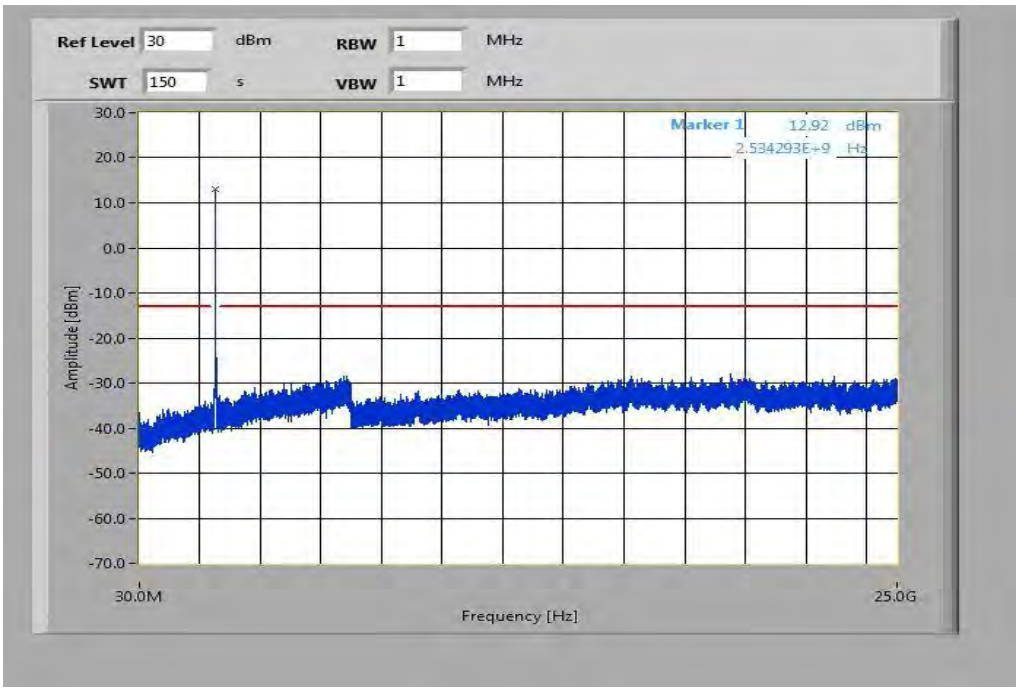


Plots for 20 MHz channel bandwidth, QPSK

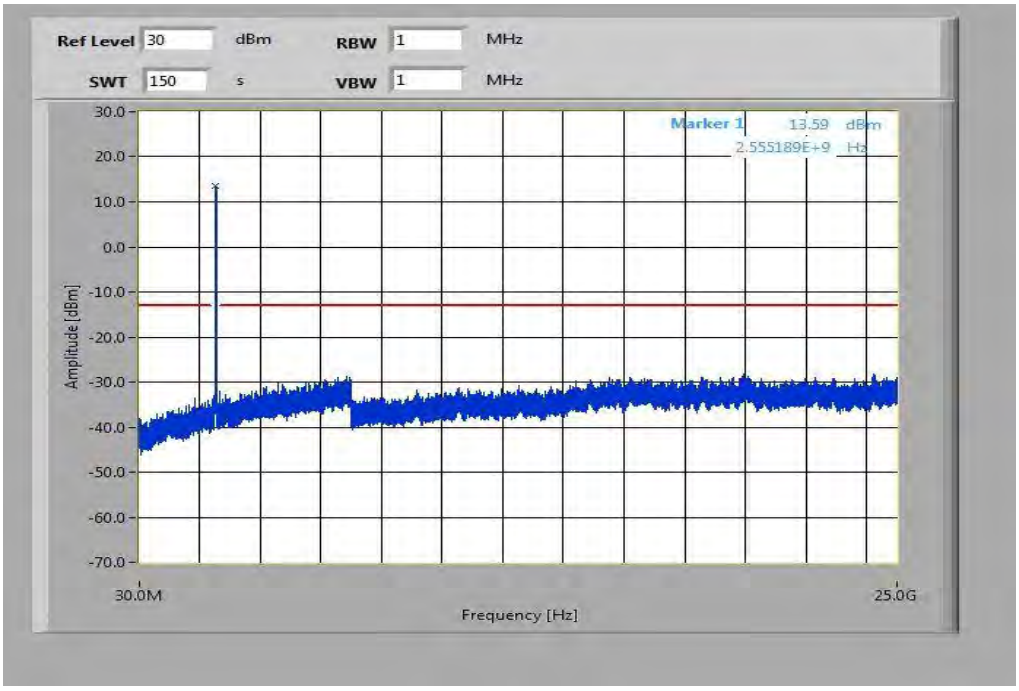
Plot 1: Lowest channel, 30 MHz to 25 GHz



Plot 2: Middle channel, 30 MHz to 25 GHz

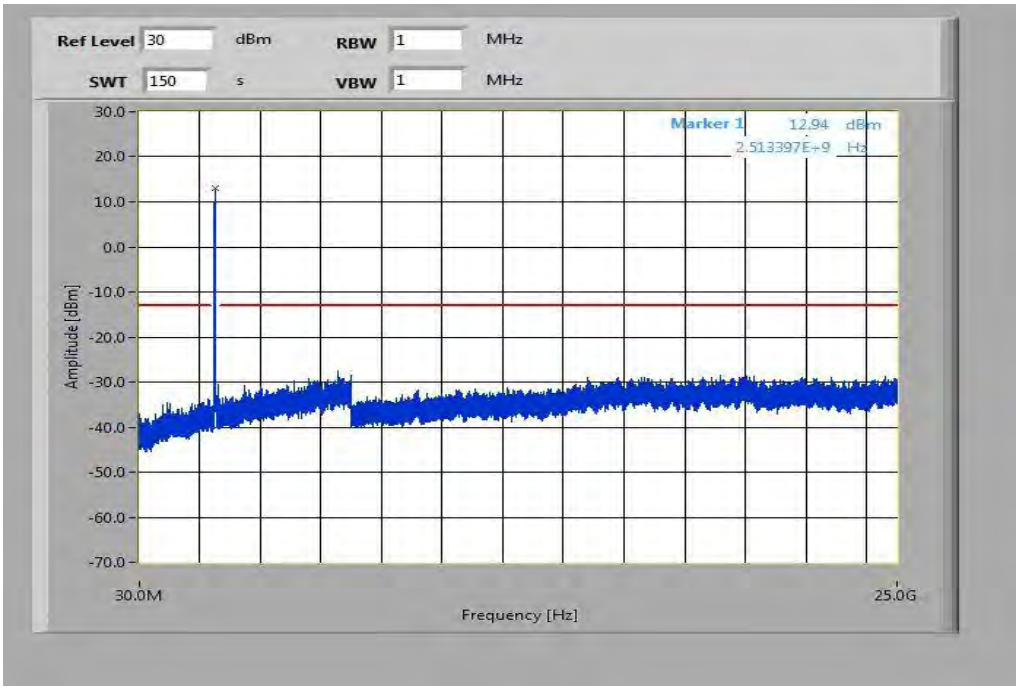


Plot 3: Highest channel, 30 MHz to 25 GHz

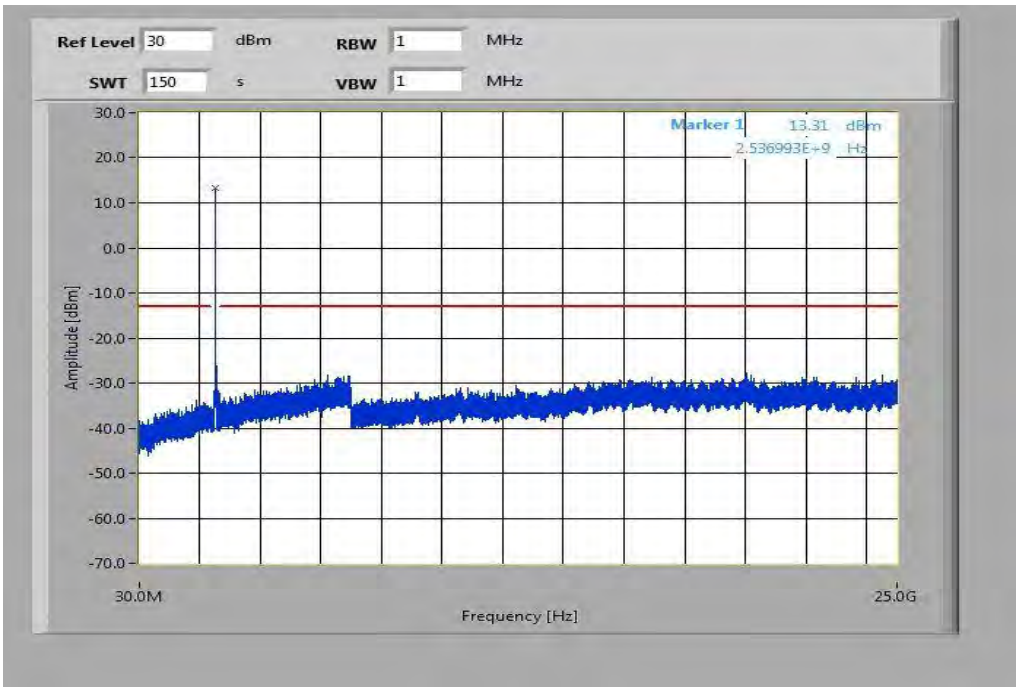


Plots for 20 MHz channel bandwidth, 16-QAM

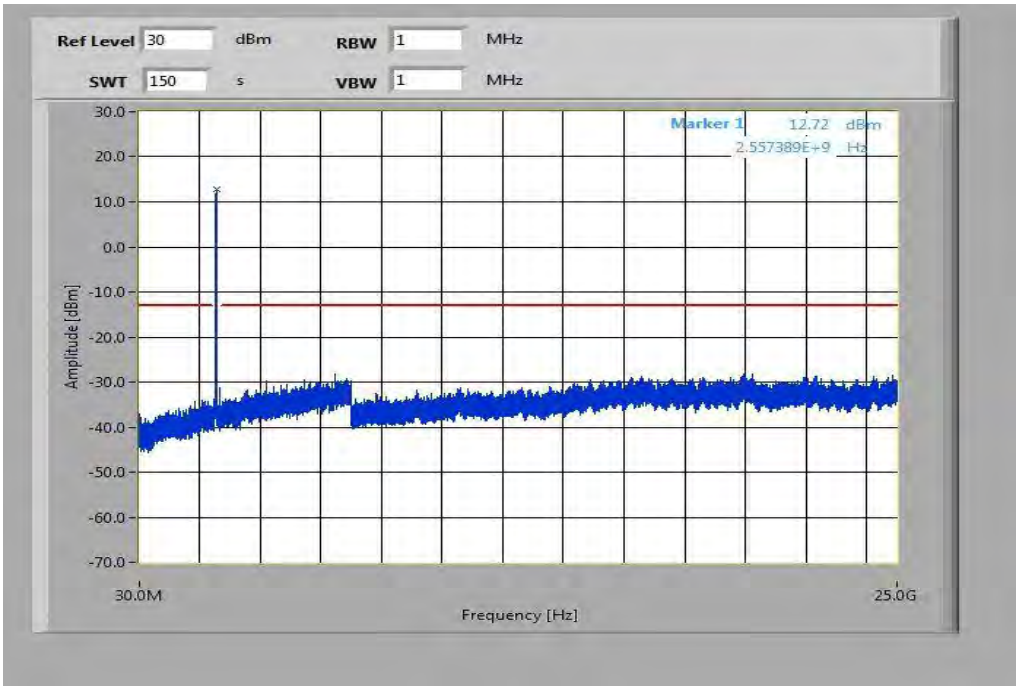
Plot 4: Lowest channel, 30 MHz to 25 GHz



Plot 5: Middle channel, 30 MHz to 25 GHz



Plot 6: Highest channel, 30 MHz to 25 GHz



8.4.5 Block edge compliance

Description:

The spectrum at the band edges must comply with the spurious emissions limits.

For the measurement the lowest, middle and highest channel bandwidth was used. If spurious were found the other bandwidths were measured, too.

Measurement:

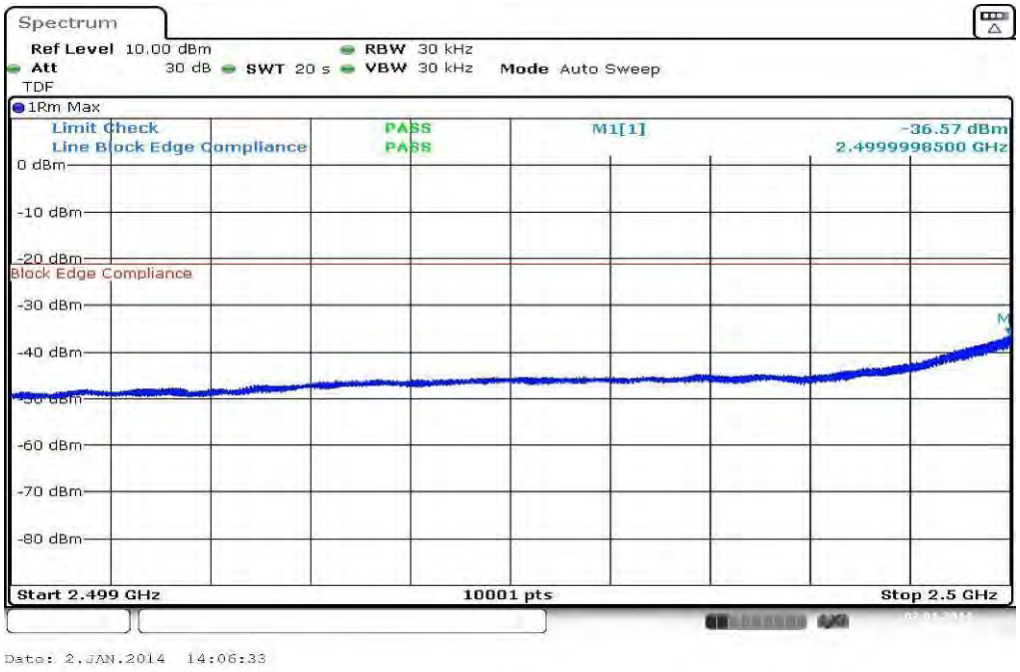
Measurement parameters	
Detector:	RMS
Sweep time:	20 sec.
Video bandwidth:	30 kHz
Resolution bandwidth:	30 kHz
Span:	1 MHz
Trace-Mode:	Max Hold

Limits:

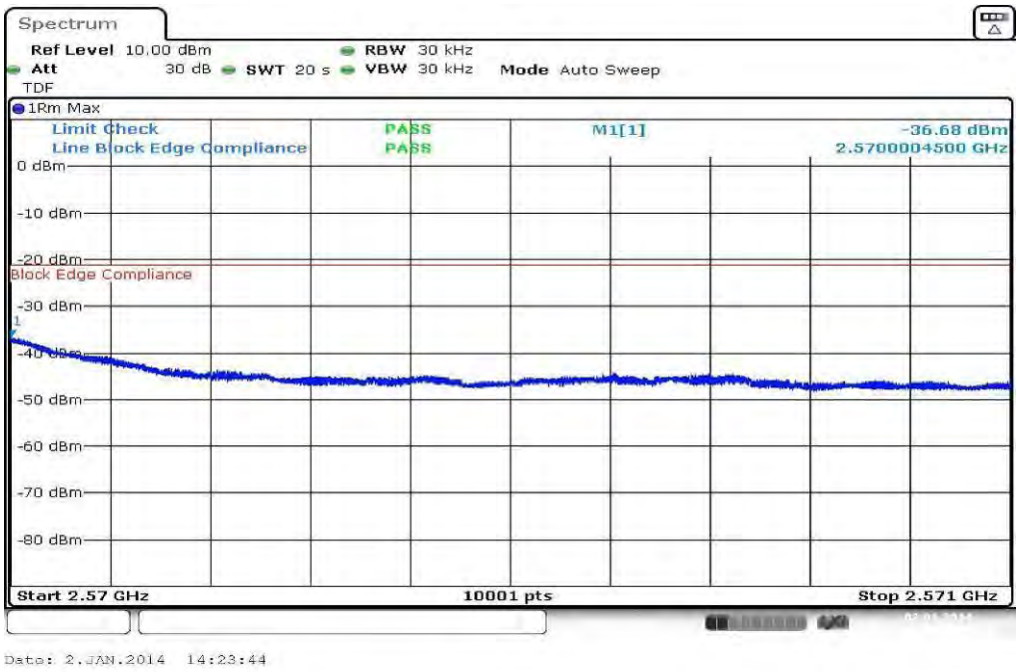
FCC	-/-
Block Edge Compliance	
Part 27.53 specifies that “the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.” However, in publication number 890810, The FCC Office of Engineering and Technology specified the following correction to the limits when a resolution bandwidth smaller than 1% of the emission bandwidth is used: “An alternative is to add an additional correction factor of 10 Log (RBW1/ RBW2) to the 43 +10 log(P) limit. RBW1 is the narrower measurement resolution bandwidth and RBW2 is either the 1% emissions bandwidth or 1 MHz.” When using a 30 kHz bandwidth, this yields a -8.239 adjustment to the limit [10 log(30kHz/200kHz) = -8.239]. When this adjustment is applied to the limit, the limit becomes -15.2185.	
-21.24 dBm	

Results: **5 MHz channel bandwidth**

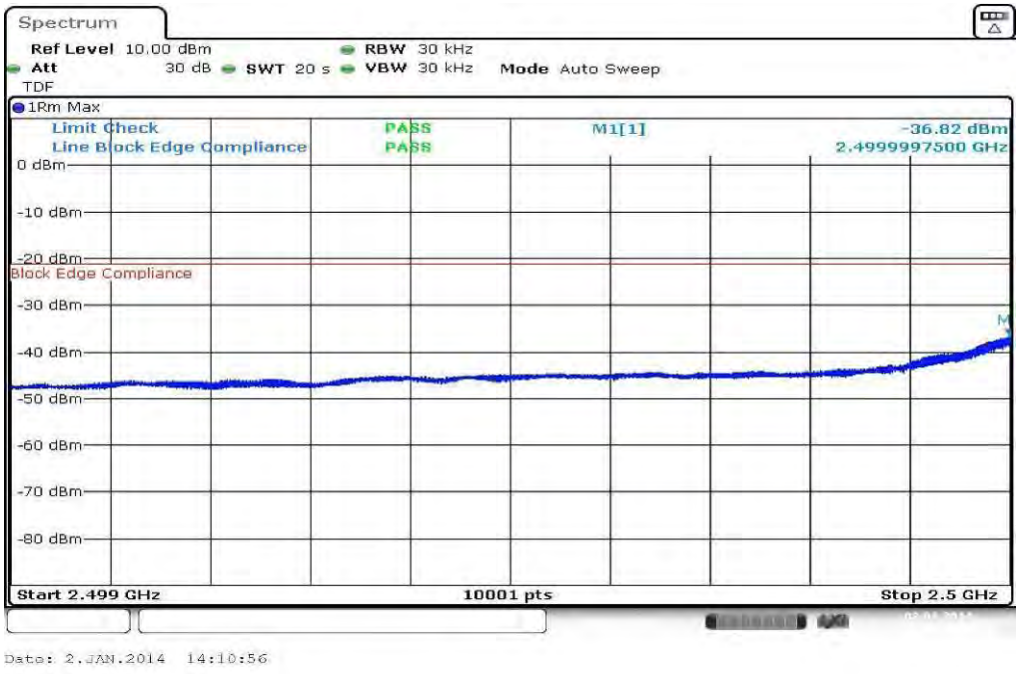
Plot 1: Lowest channel, QPSK modulation



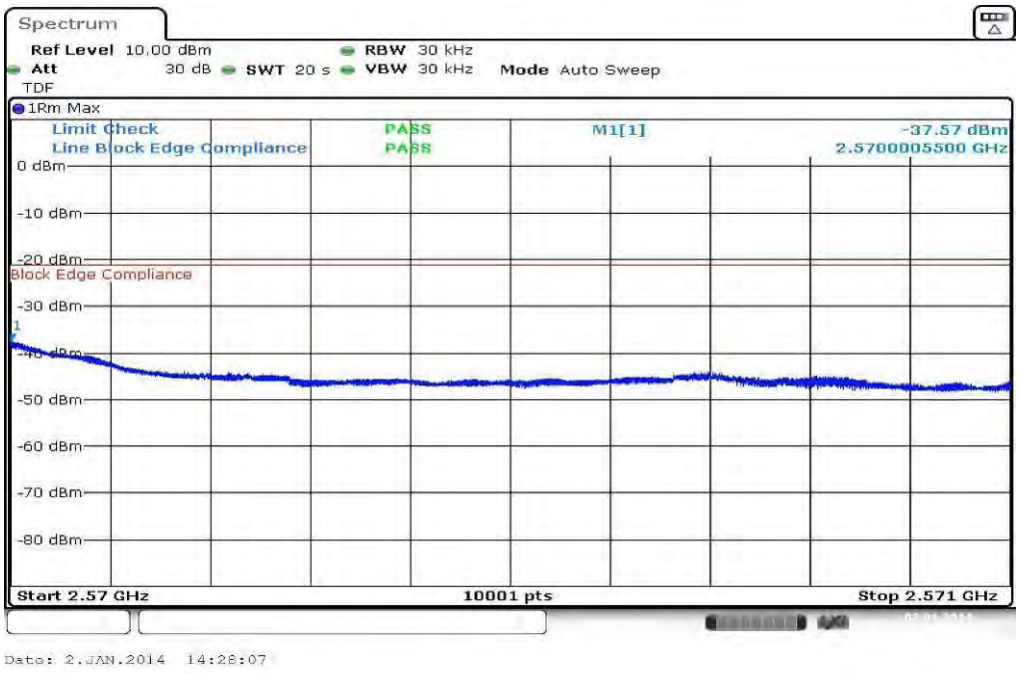
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

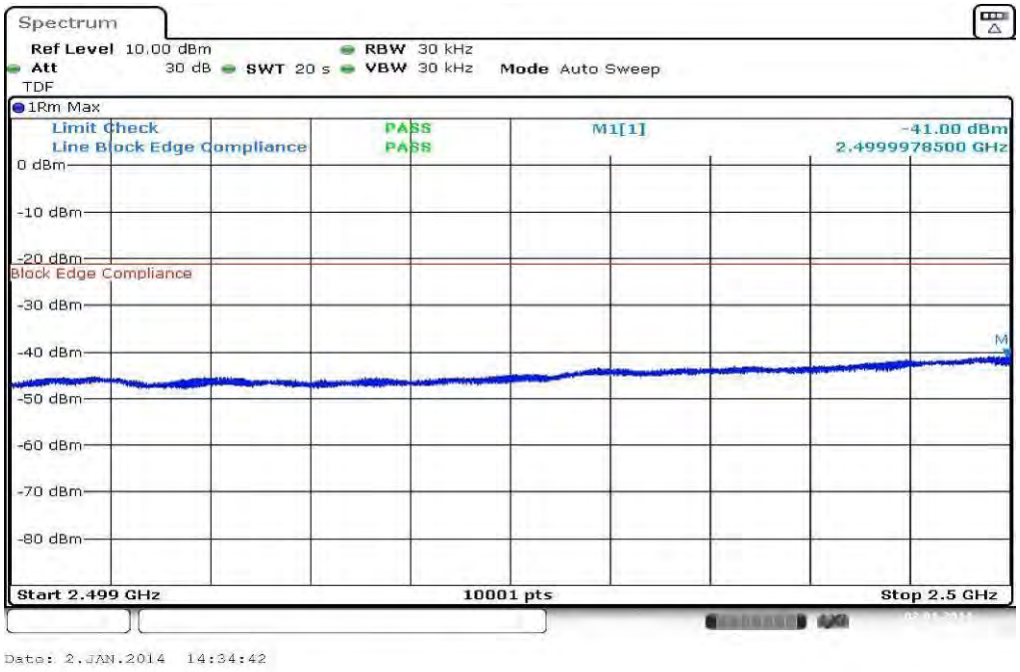


Plot 4: Highest channel, 16 – QAM modulation

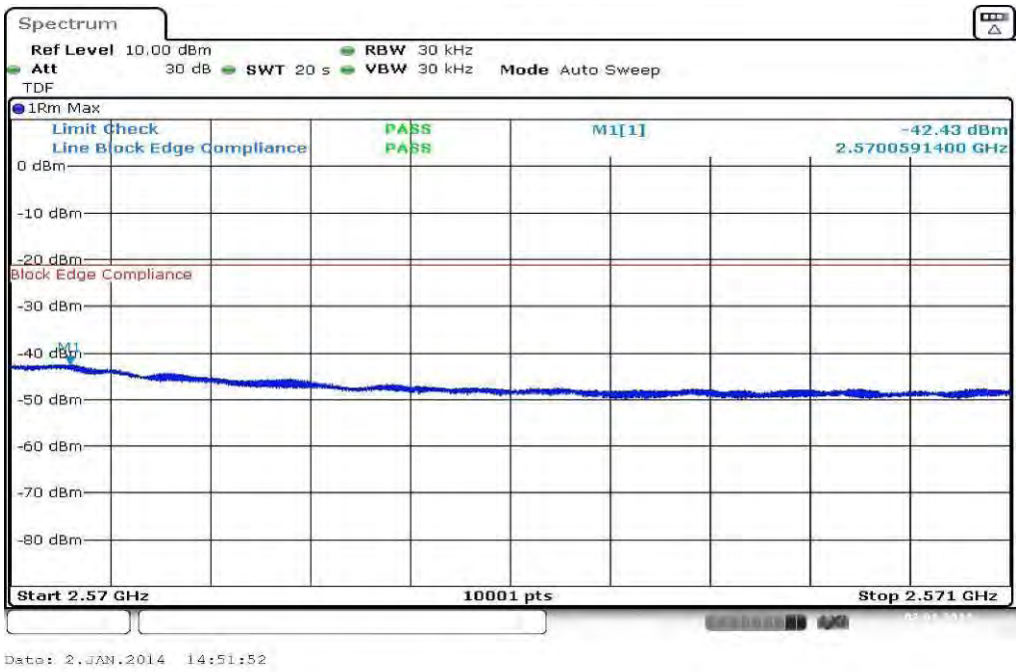


Results: **10 MHz channel bandwidth**

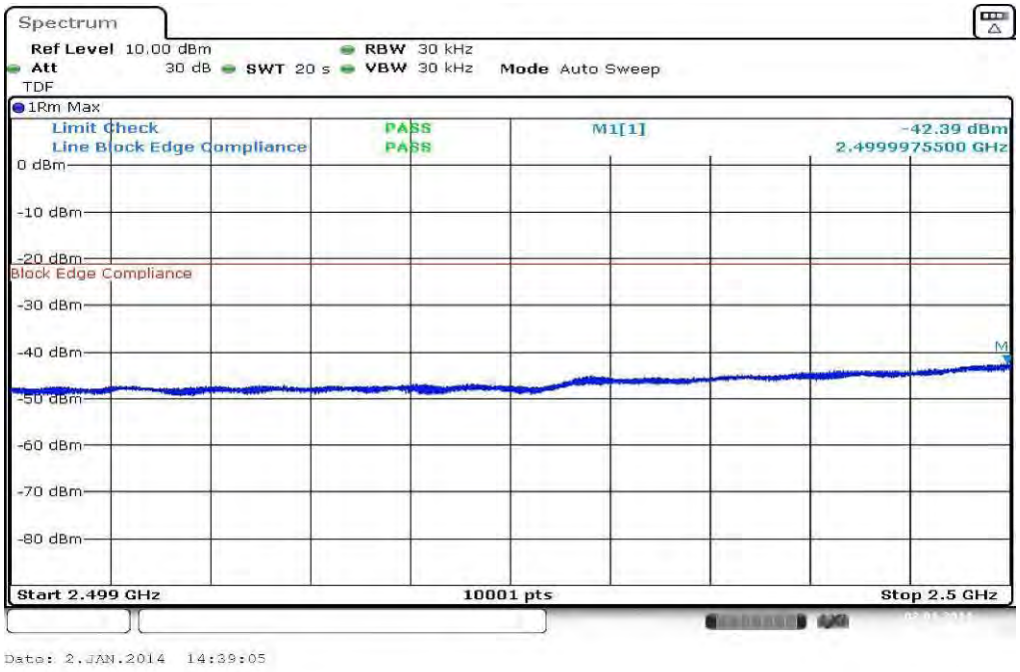
Plot 1: Lowest channel, QPSK modulation



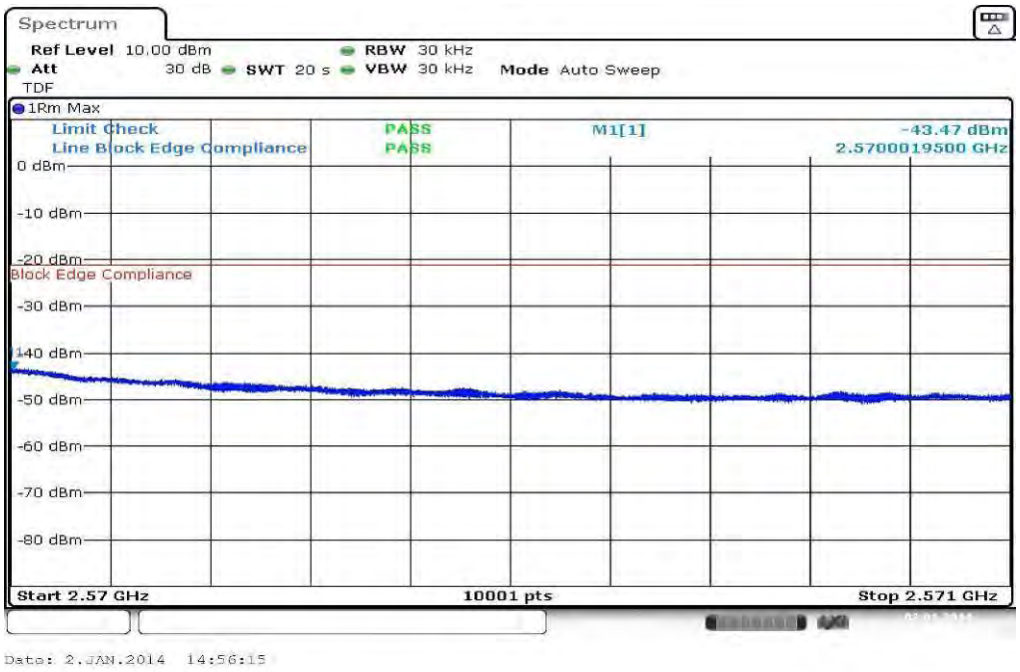
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

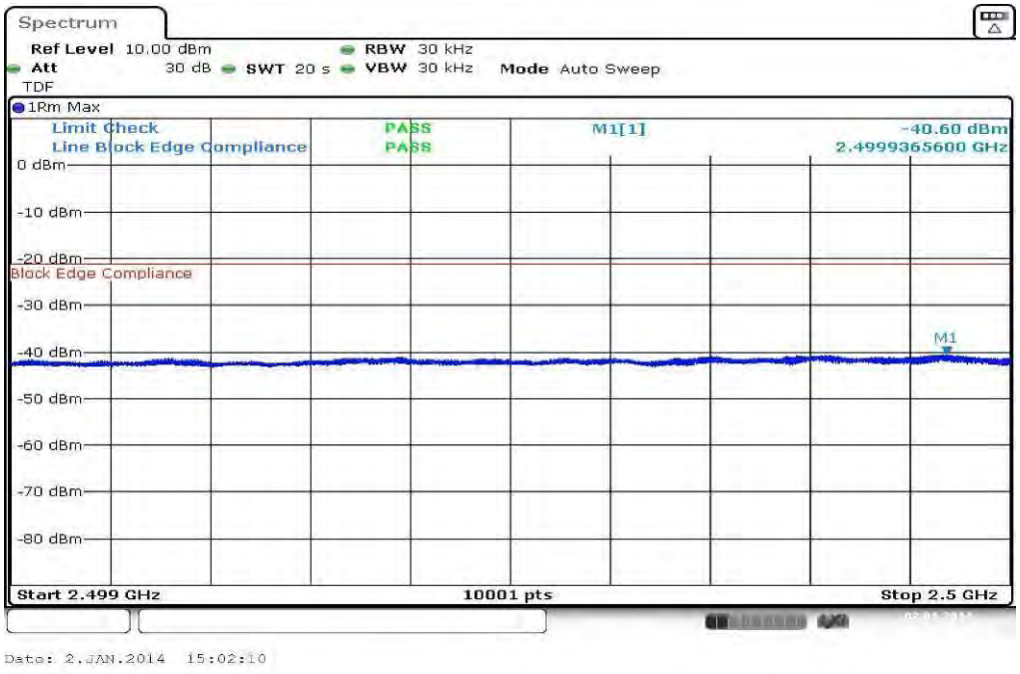


Plot 4: Highest channel, 16 – QAM modulation

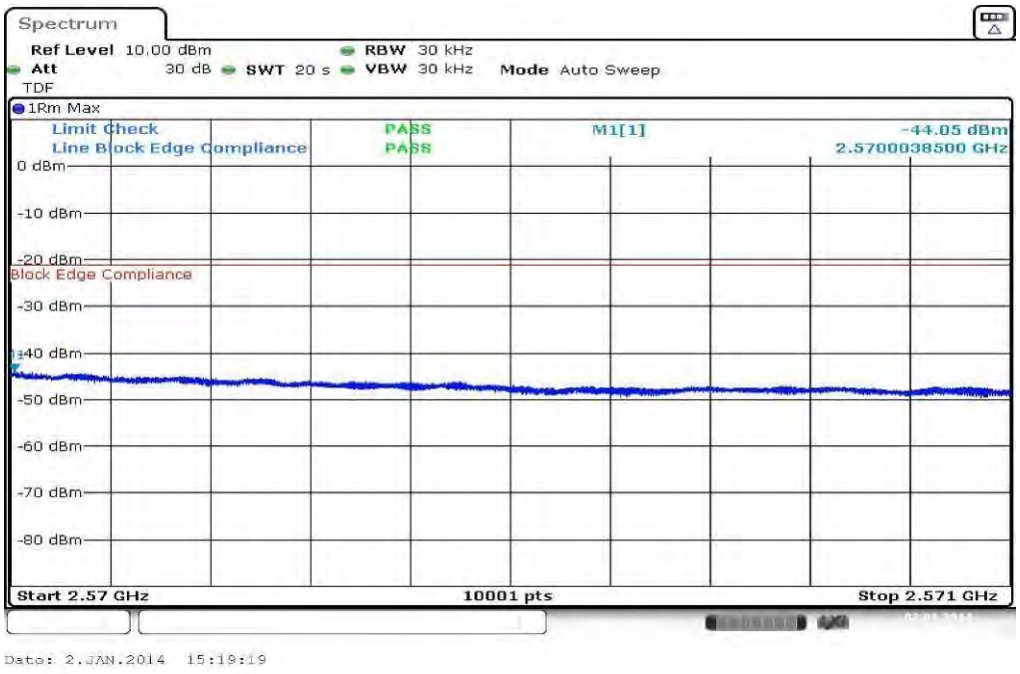


Results: **15 MHz channel bandwidth**

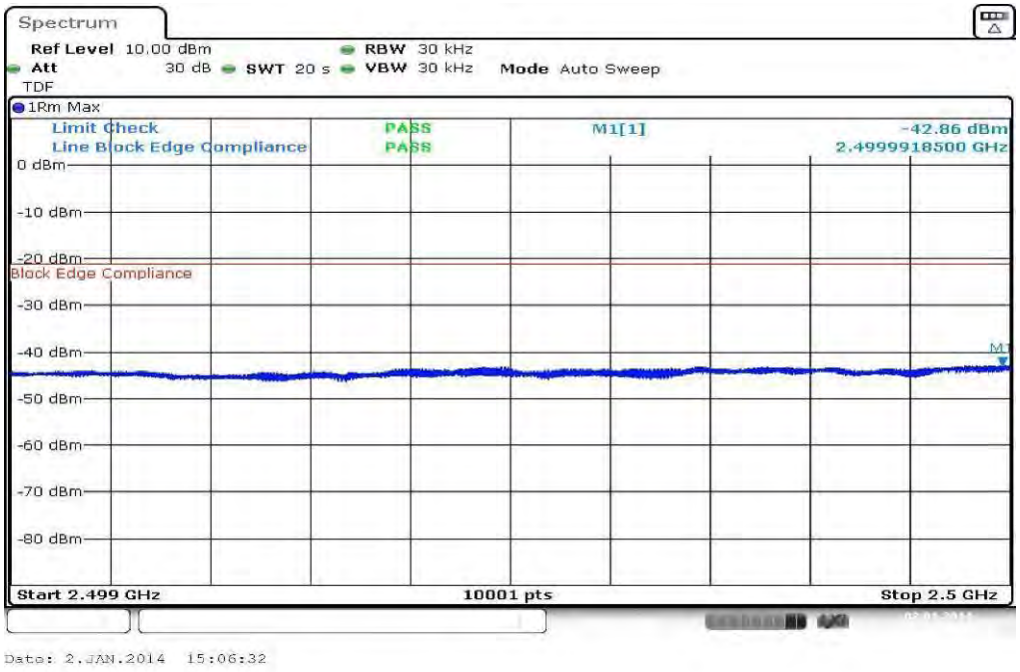
Plot 1: Lowest channel, QPSK modulation



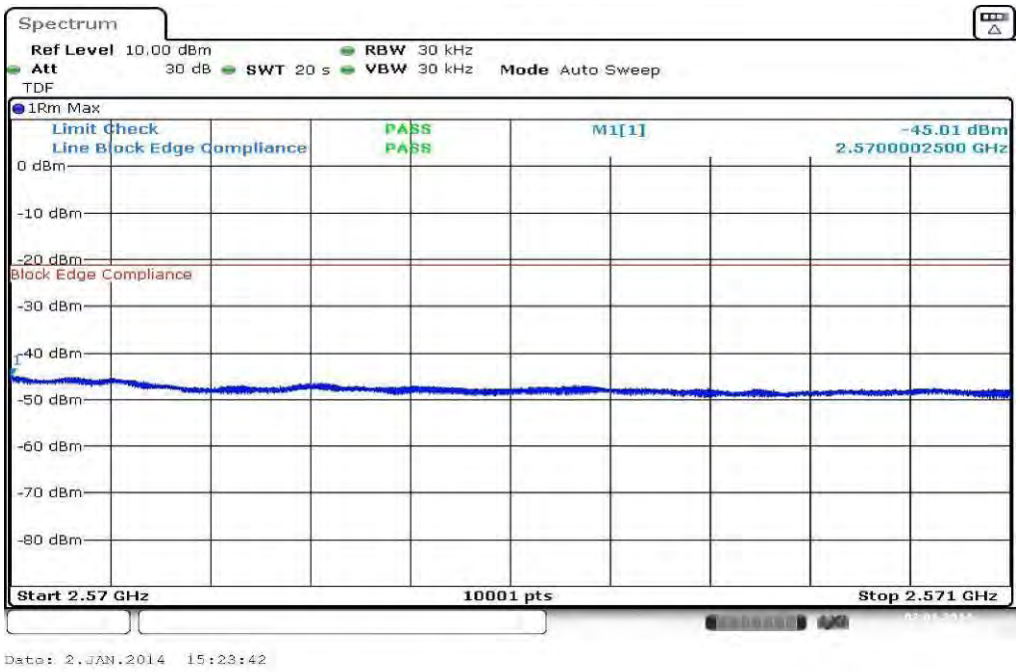
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

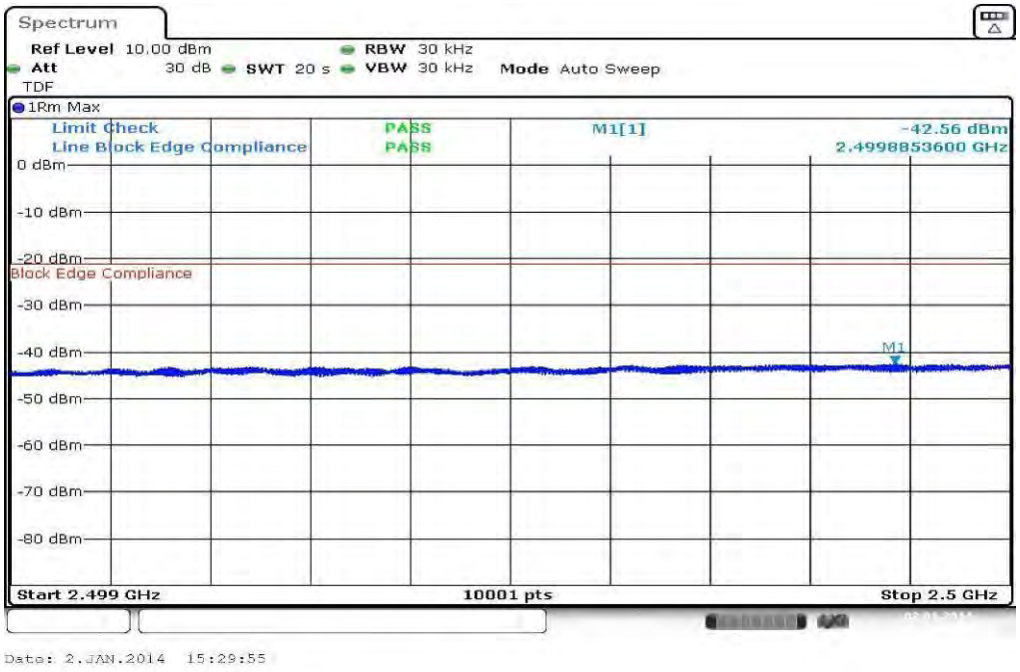


Plot 4: Highest channel, 16 – QAM modulation

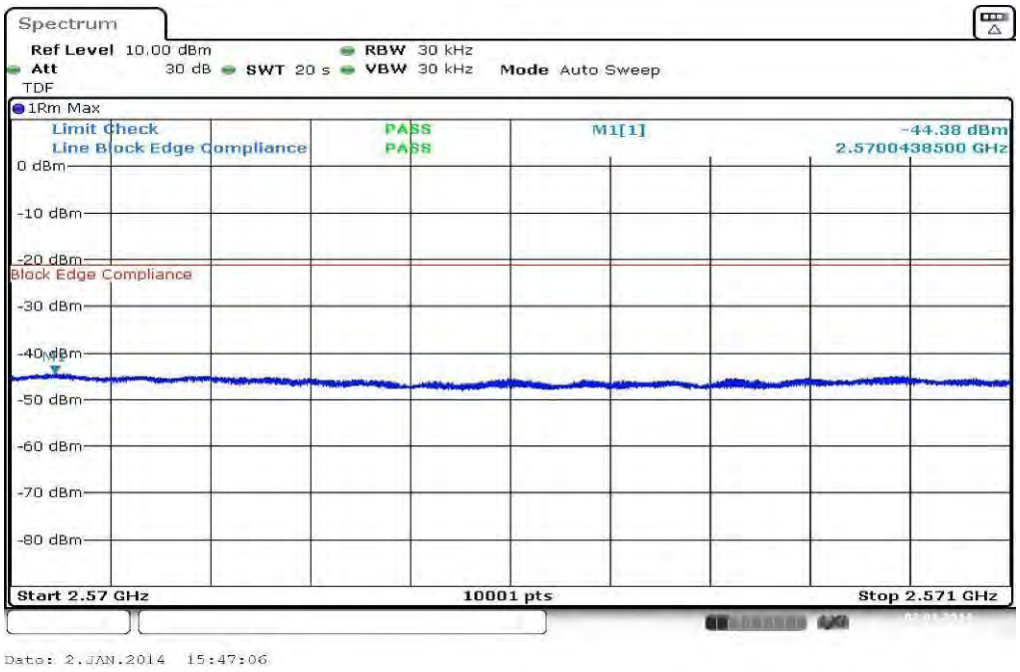


Results: **20 MHz channel bandwidth**

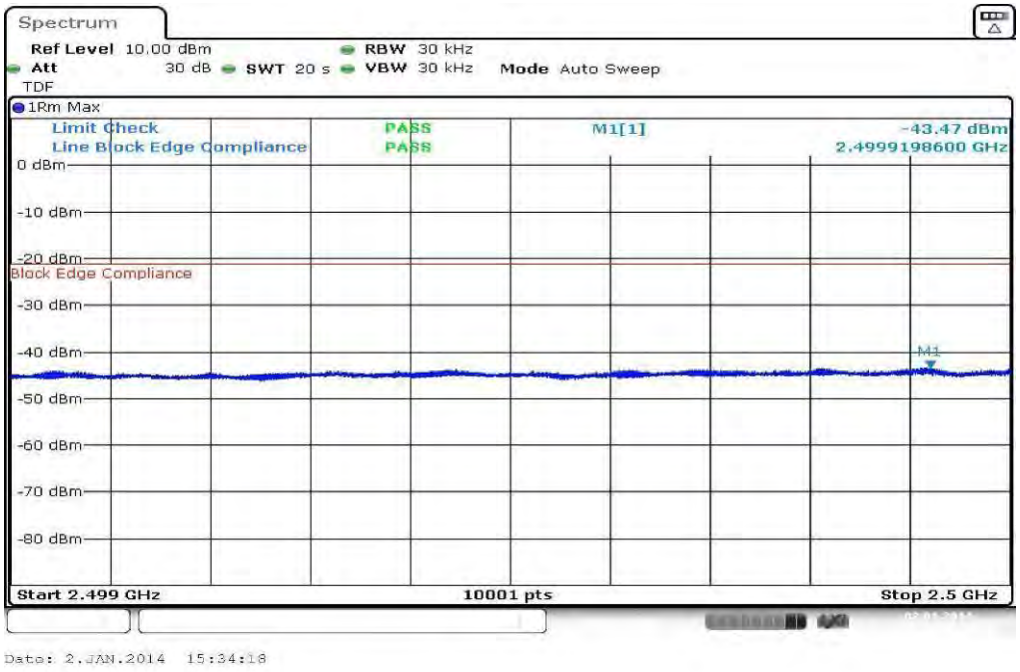
Plot 1: Lowest channel, QPSK modulation



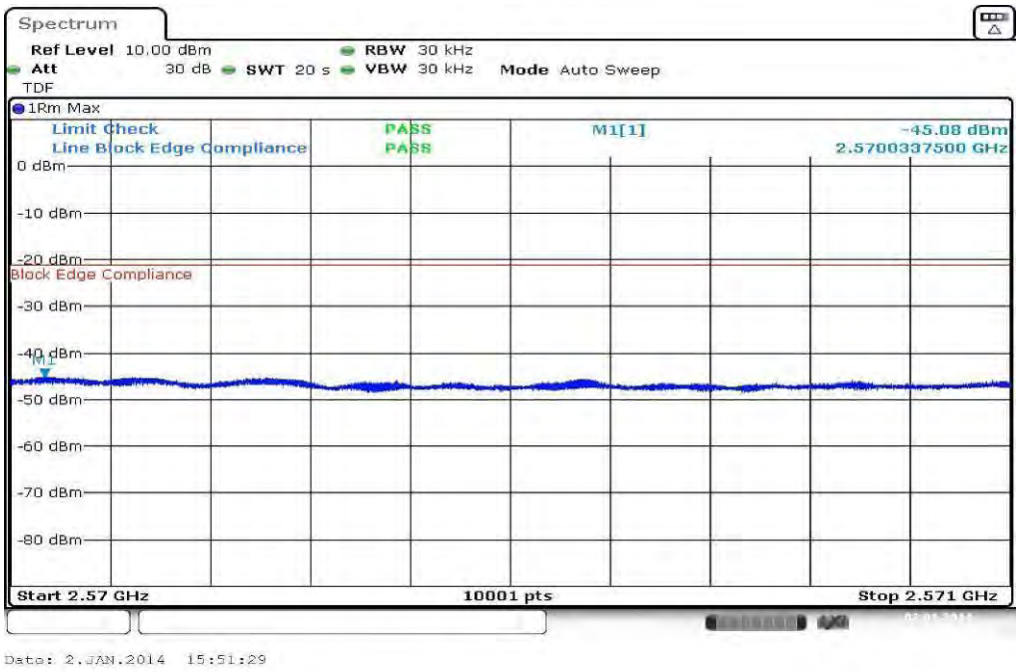
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation



Plot 4: Highest channel, 16 – QAM modulation



Result: **Passed**

8.4.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE band 7. The table below lists the measured 99% power and 26 dB occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Part 27.53 requires a measurement bandwidth of at least 1% of the occupied bandwidth.

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Video bandwidth:	Depends on Channel Bandwidth
Resolution bandwidth:	Depends on Channel Bandwidth
Span:	Depends on Channel Bandwidth
Trace-Mode:	Max Hold

Limits:

FCC	-/-
Occupied Bandwidth	
Spectrum must fall completely in the specified band	

Results:

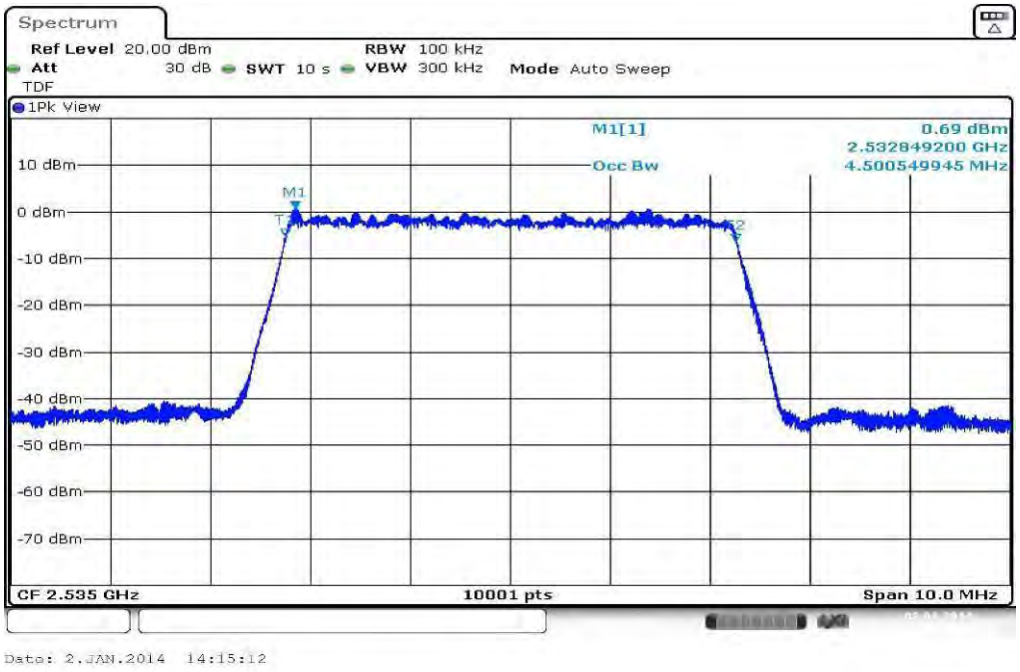
Occupied Bandwidth - QPSK		
Bandwidth [MHz]	**99% OBW (kHz)**	**26 dB bandwidth (kHz)**
5	4501	4990
10	9067	10149
15	13439	14693
20	17962	19702
Measurement uncertainty	± 100 kHz to ± 500 kHz depending on channel bandwidth	

Occupied Bandwidth – 16-QAM		
Bandwidth [MHz]	**99% OBW (kHz)**	**26 dB bandwidth (kHz)**
5	4518	5024
10	9069	10037
15	13439	14657
20	17966	19678
Measurement uncertainty	± 100 kHz to ± 500 kHz depending on channel bandwidth	

Result: **Passed**

Plots: QPSK

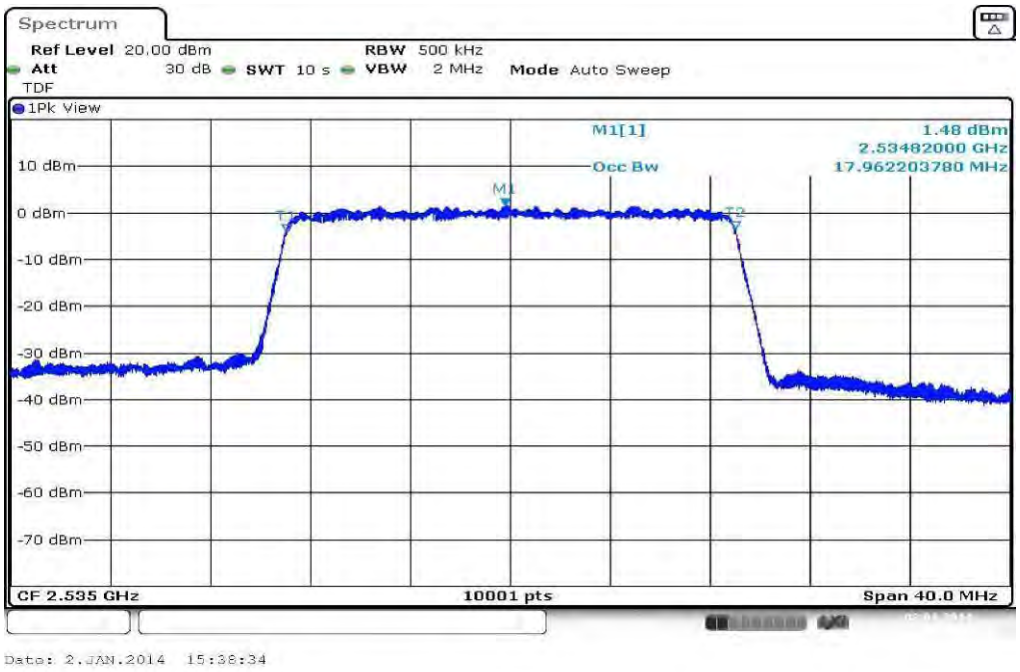
Plot 1: 5 MHz, 99% OBW



Plot 2: 10 MHz, 99% OBW

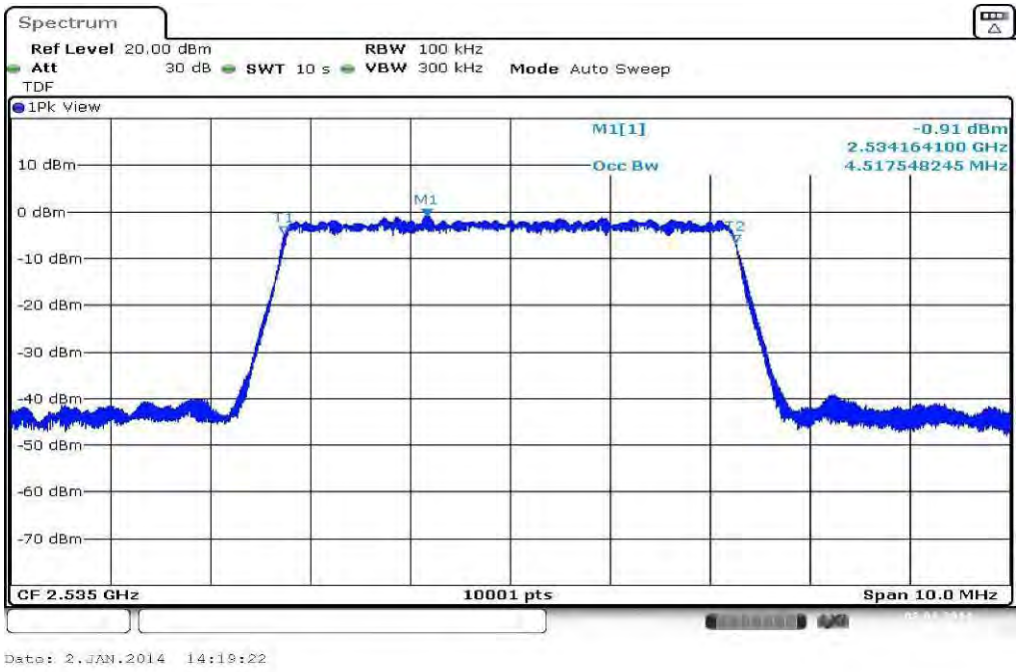
Plot 3: 15 MHz, 99% OBW

Plot 4: 20 MHz, 99% OBW

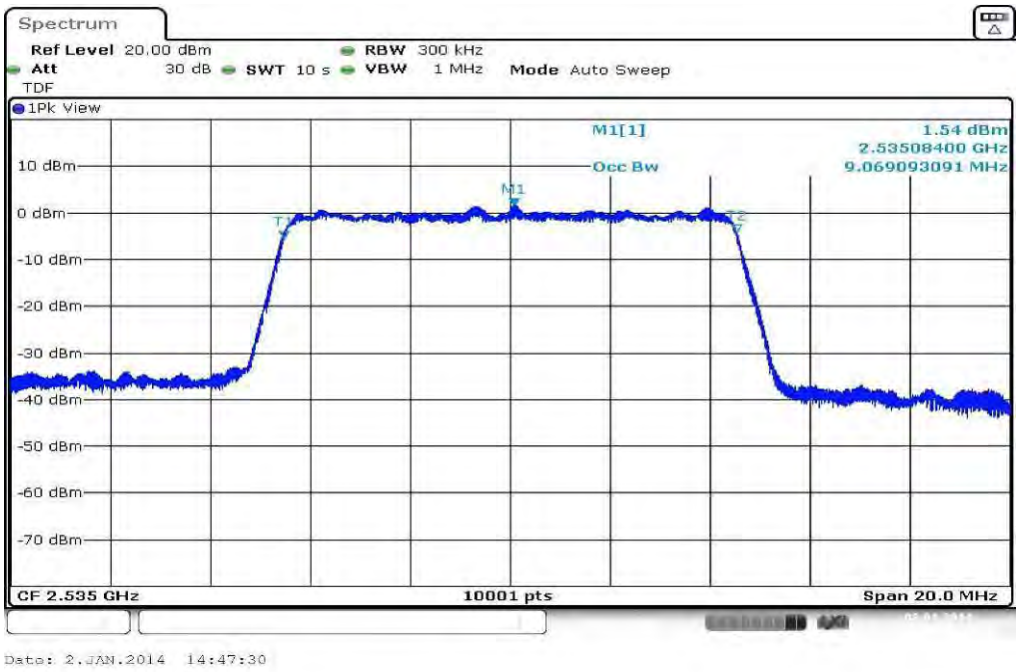


Plots: 16-QAM

Plot 1: 5 MHz, 99% OBW



Plot 2: 10 MHz, 99% OBW



Plot 3: 15 MHz, 99% OBW

Plot 4: 20 MHz, 99% OBW