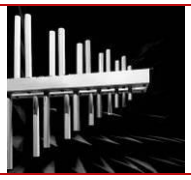
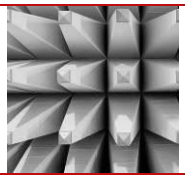

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CETECOM ICT Services
consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-6965/13-14-07

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

Testing laboratory

CETECOM ICT Services GmbH
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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 & EMC (RCE)

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	Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services

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

Test Item

Kind of test item:	**Tablet PC GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/V/VIII; LTE FDD2/3/4/7/13; CDMA 2K BC0/BC1; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS**
FCC ID:	**PY7TM-0042**
Frequency:	LTE FDD 4: 1710.7 MHz – 1754.3 MHz LTE FDD 7: 2502.5 MHz – 2567.5 MHz LTE FDD 13: 779.5 MHz – 784.5 MHz
Technology tested:	LTE FDD
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:

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Test performed:

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Andreas Luckenbill
Expert

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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.
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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:	2014-02-18
Date of receipt of test item:	2014-02-18
Start of test:	2014-02-18
End of test:	2014-03-14
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:		42 %	
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	**:**	**Tablet PC GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/II/V/VIII; LTE FDD2/3/4/7/13; CDMA 2K BC0/BC1; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS**
S/N serial number	**:**	**Rad. CB5126DPUB, CB5126DQ76** **Cond. CB5126DPK4, CB5126DPKF, CB5126DPK7, CB5126DPML**
HW hardware status	**:**	**AP1**
SW software status	**:**	**17.1.D.0.117**
Frequency band [MHz]	**:**	**LTE FDD 4: 1710.7 MHz – 1754.3 MHz** **LTE FDD 7: 2502.5 MHz – 2567.5 MHz** **LTE FDD 13: 779.5 MHz – 784.5 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: 1-6965/13-14-01_AnnexA
1-6965/13-14-01_AnnexB
1-6965/13-14-01_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	2014-03-18	-/-

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

8 RF measurements

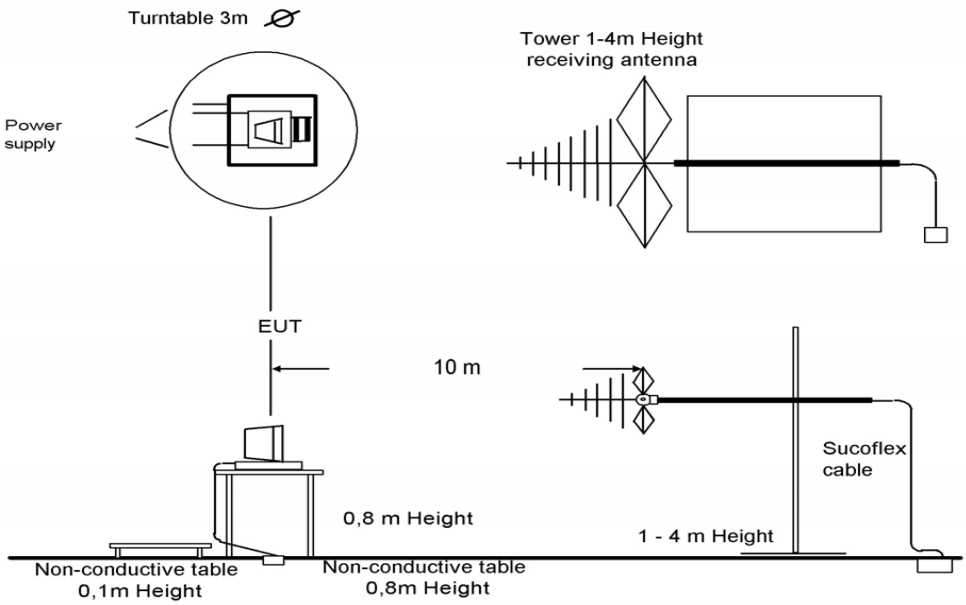
8.1 Description of test setup

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

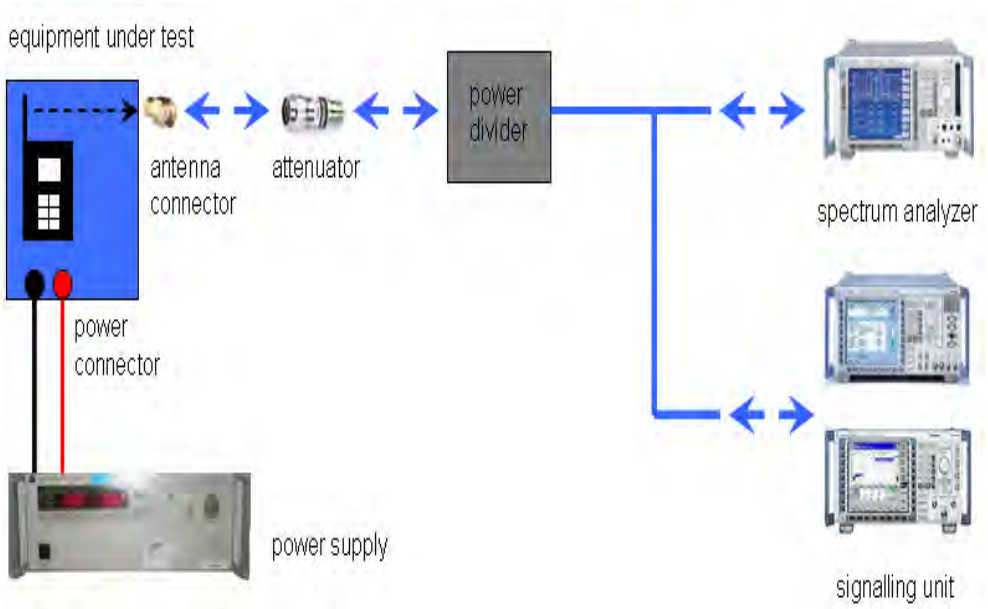


Picture 1: Diagram radiated measurements

Frequency being measured f	Measuring receiver bandwidth 6 dB	Spectrum analyser bandwidth 3dB
f < 150 kHz	200 Hz or	300 Hz
150 kHz ≤ f < 25 MHz	9 kHz or	10 kHz
25 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 < 150 kHz	200 Hz or	300 Hz
150 kHz ≤ f < 25 MHz	9 kHz or	10 kHz
25 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.		

8.2 LTE technologies supported by EUT

Channel bandwidth

	Band 4	Band 7	Band 13
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	22.5	4.9	21.8	5.5
		1 RB high	22.5	4.9	21.8	5.5
		50% RB mid	22.6	4.9	21.5	5.8
		100% RB	21.5	5.7	20.3	6.5
	1732.5	1 RB low	22.6	5.7	21.4	4.7
		1 RB high	22.6	5.7	21.5	4.8
		50% RB mid	22.5	5.6	21.7	4.8
		100% RB	21.5	6.1	20.7	5.6
	1754.3	1 RB low	22.6	4.8	21.6	6.0
		1 RB high	22.6	4.8	21.7	5.9
		50% RB mid	22.6	5.2	21.5	6.1
		100% RB	21.6	6.2	20.6	6.5
3	1711.5	1 RB low	22.6	5.5	21.7	4.9
		1 RB high	22.5	5.4	21.6	5.0
		50% RB mid	21.3	6.1	20.2	5.0
		100% RB	21.4	6.2	20.5	5.5
	1732.5	1 RB low	22.6	4.8	21.4	5.7
		1 RB high	22.6	4.8	21.4	5.7
		50% RB mid	21.6	4.8	20.6	5.5
		100% RB	21.5	5.8	20.5	6.6
	1753.5	1 RB low	22.7	6.2	21.3	5.1
		1 RB high	22.7	6.2	21.4	5.0
		50% RB mid	21.5	6.1	20.5	5.2
		100% RB	21.5	6.8	20.6	5.9
5	1712.5	1 RB low	22.6	4.8	21.5	5.6
		1 RB high	22.6	4.9	21.4	5.5
		50% RB mid	21.3	5.2	20.4	6.1
		100% RB	21.4	5.6	20.4	6.7
	1732.5	1 RB low	22.5	5.0	21.8	4.7
		1 RB high	22.6	5.0	21.9	4.7
		50% RB mid	21.5	5.9	20.6	5.0
		100% RB	21.5	6.4	20.5	5.6
	1752.5	1 RB low	22.6	5.0	21.3	6.0
		1 RB high	22.6	5.0	21.3	6.0
		50% RB mid	21.5	5.4	20.5	6.4
		100% RB	21.5	5.7	20.6	6.9

10	1715.0	1 RB low	22.6	5.5	21.7	4.8
		1 RB high	22.5	5.6	21.7	4.9
		50% RB mid	21.4	6.3	20.4	5.5
		100% RB	21.3	7.0	20.4	6.2
	1732.5	1 RB low	22.7	4.8	21.4	5.7
		1 RB high	22.6	4.7	21.4	5.7
		50% RB mid	21.5	5.0	20.7	5.9
		100% RB	21.6	5.4	20.5	6.2
	1750.0	1 RB low	22.6	5.6	21.2	4.9
		1 RB high	22.6	6.1	21.3	4.9
		50% RB mid	21.5	6.4	20.4	5.4
		100% RB	21.5	7.4	20.5	6.5
15	1717.5	1 RB low	22.6	4.8	21.7	5.5
		1 RB high	22.6	4.7	21.7	5.4
		50% RB mid	21.4	5.3	20.5	6.3
		100% RB	21.5	5.7	20.5	6.5
	1732.5	1 RB low	22.6	5.4	22.0	4.7
		1 RB high	22.5	5.3	21.9	4.7
		50% RB mid	21.5	6.1	20.5	5.1
		100% RB	21.6	6.6	20.6	5.8
	1747.5	1 RB low	22.5	4.8	21.2	5.8
		1 RB high	22.6	5.0	21.3	6.1
		50% RB mid	21.5	5.3	20.4	6.2
		100% RB	21.6	5.8	20.5	6.7
20	1720.0	1 RB low	22.5	5.5	21.6	5.1
		1 RB high	22.7	5.4	21.7	4.8
		50% RB mid	21.4	6.3	20.5	5.4
		100% RB	21.4	6.6	20.5	5.3
	1732.5	1 RB low	22.4	4.9	21.8	5.5
		1 RB high	22.4	4.8	21.6	5.5
		50% RB mid	21.5	5.2	20.6	6.0
		100% RB	21.5	6.0	20.5	6.7
	1745.0	1 RB low	22.5	5.2	21.7	4.7
		1 RB high	22.5	5.5	21.6	5.0
		50% RB mid	21.5	6.2	20.5	5.3
		100% RB	21.5	6.8	20.5	5.8
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	25.3	24.5
	1732.5	25.2	24.3
	1754.3	25.1	24.2
3	1711.5	25.3	24.4
	1732.5	25.2	24.0
	1753.5	25.2	23.9
5	1712.5	25.3	24.2
	1732.5	25.2	24.5
	1752.5	25.1	23.8
10	1715.0	25.3	24.4
	1732.5	25.3	24.0
	1750.0	25.1	23.8
15	1717.5	25.3	24.4
	1732.5	25.2	24.6
	1747.5	25.1	23.8
20	1720.0	25.4	24.4
	1732.5	25.0	24.4
	1745.0	25.0	24.2
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	-5	-0.00000029	-0.0029
3.4	11	0.00000063	0.0063
3.5	-1	-0.00000006	-0.0006
3.6	-12	-0.00000069	-0.0069
3.7	4	0.00000023	0.0023
3.8	-9	-0.00000052	-0.0052
3.9	6	0.00000035	0.0035
4.0	-7	-0.00000040	-0.0040
4.1	-8	-0.00000046	-0.0046
4.2	-10	-0.00000058	-0.0058
4.3	11	0.00000063	0.0063
4.4	6	0.00000035	0.0035

FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-6	-0.00000035	-0.0035
-20	-5	-0.00000029	-0.0029
-10	-10	-0.00000058	-0.0058
± 0	-2	-0.00000012	-0.0012
10	4	0.00000023	0.0023
20	11	0.00000063	0.0063
30	4	0.00000023	0.0023
40	-12	-0.00000069	-0.0069
50	-6	-0.00000035	-0.0035
60	-3	-0.00000017	-0.0017

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 30 MHz 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 1 GHz: 100 kHz Above 1 GHz: 1 MHz
Resolution bandwidth:	Below 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 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 with 10 MHz bandwidth and 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]
3430.0	-	3465.0	-	3500.0	-
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		

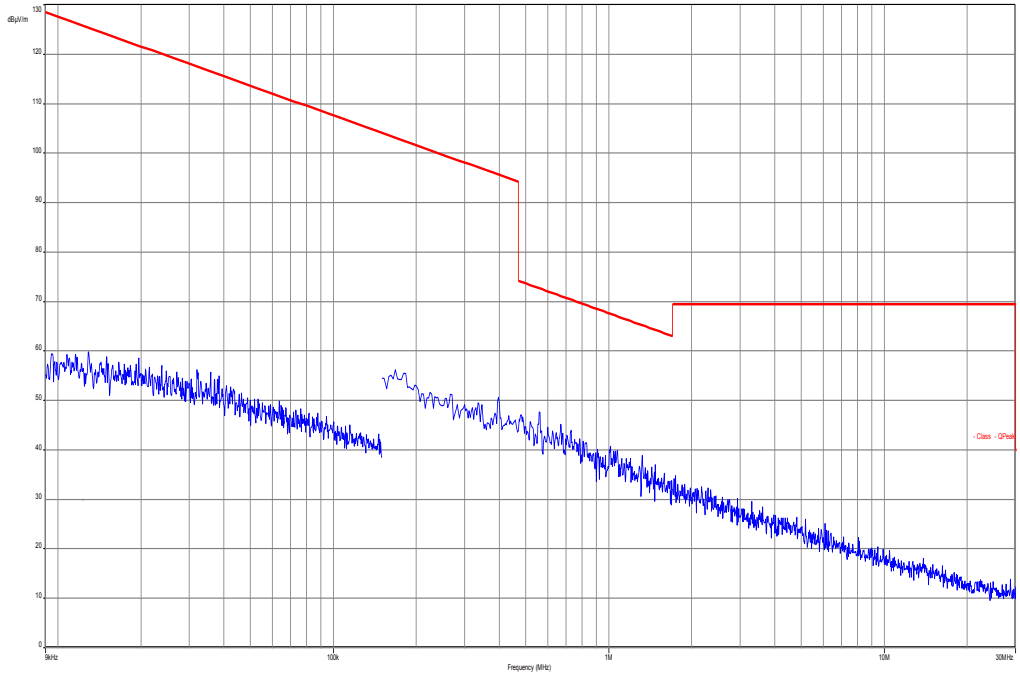
16-QAM

SPURIOUS EMISSION LEVEL (dBm)					
LOWEST CHANNEL		MIDDLE CHANNEL		HIGHEST CHANNEL	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3430.0	-	3465.0	-	3500.0	-
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		

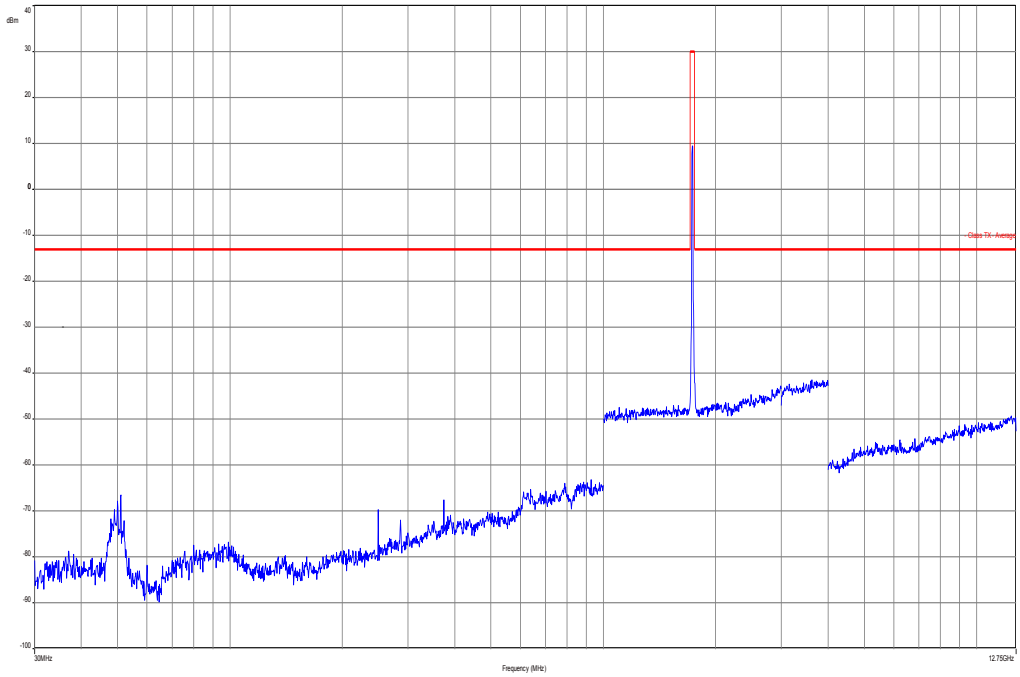
Result: **Passed**

QPSK with 10 MHz channel bandwidth

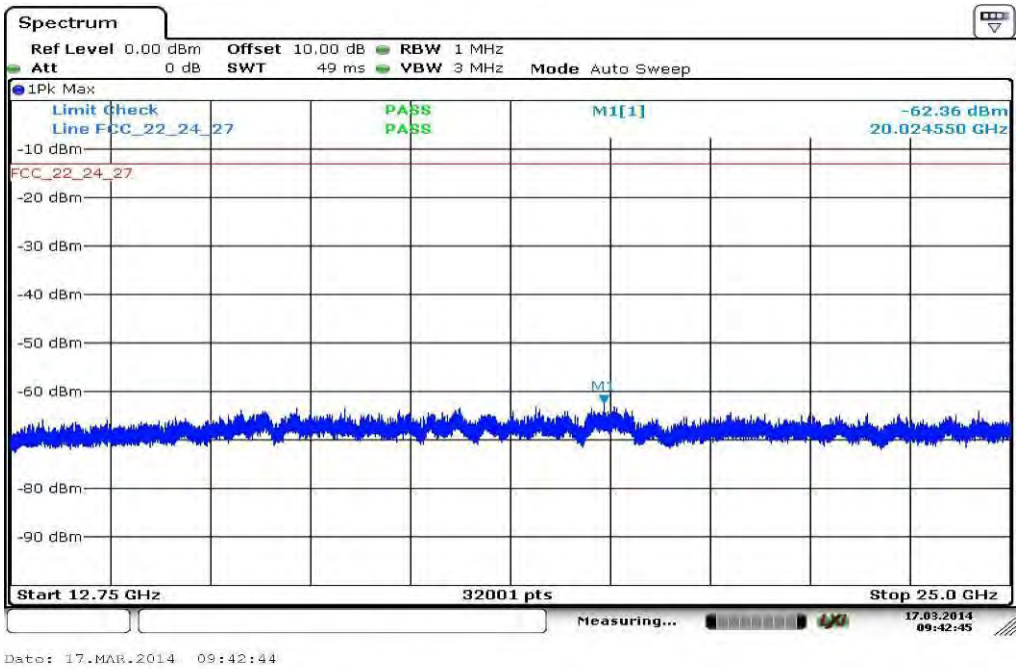
Plot 1: Middle channel, up to 30 MHz



Plot 2: Middle channel, 30 MHz to 12.75 GHz

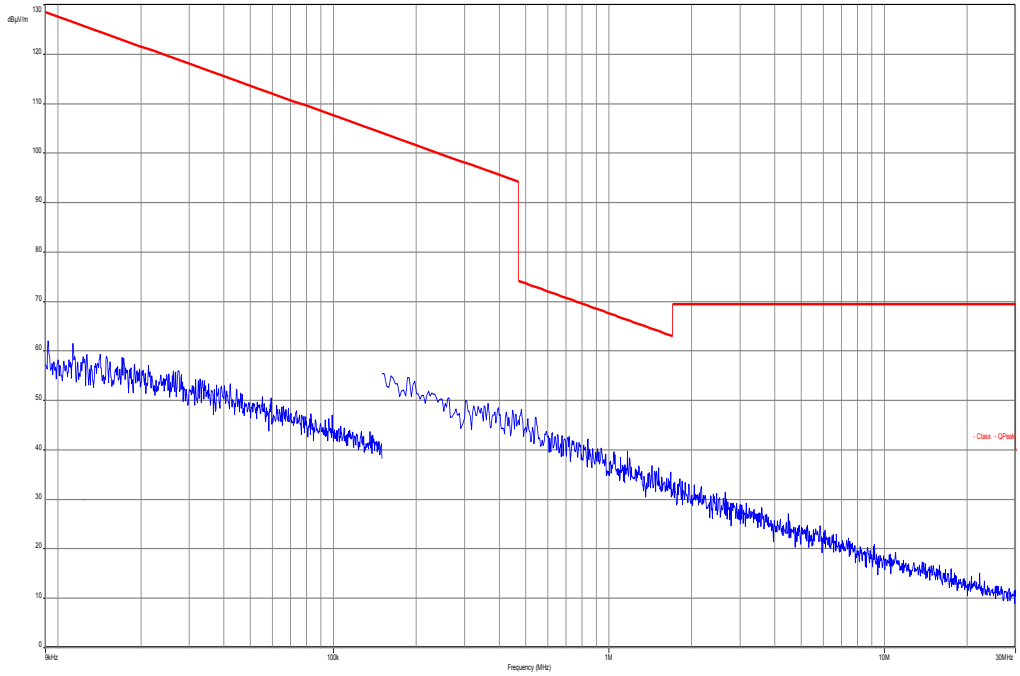


Plot 3: Middle channel, 12 GHz to 25 GHz

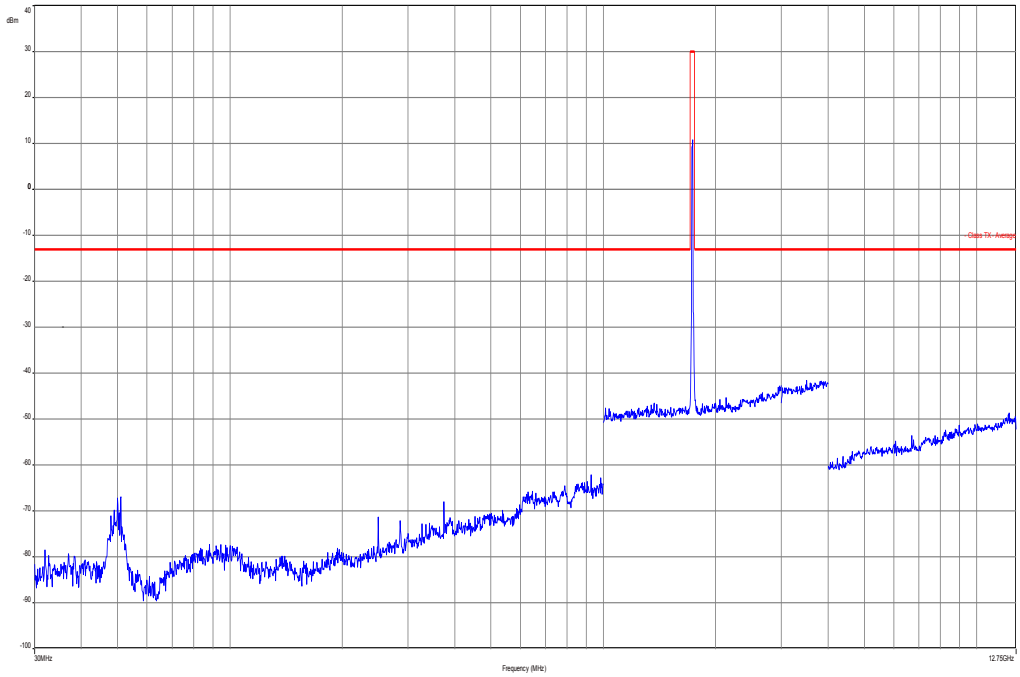


16-QAM with 10 MHz channel bandwidth

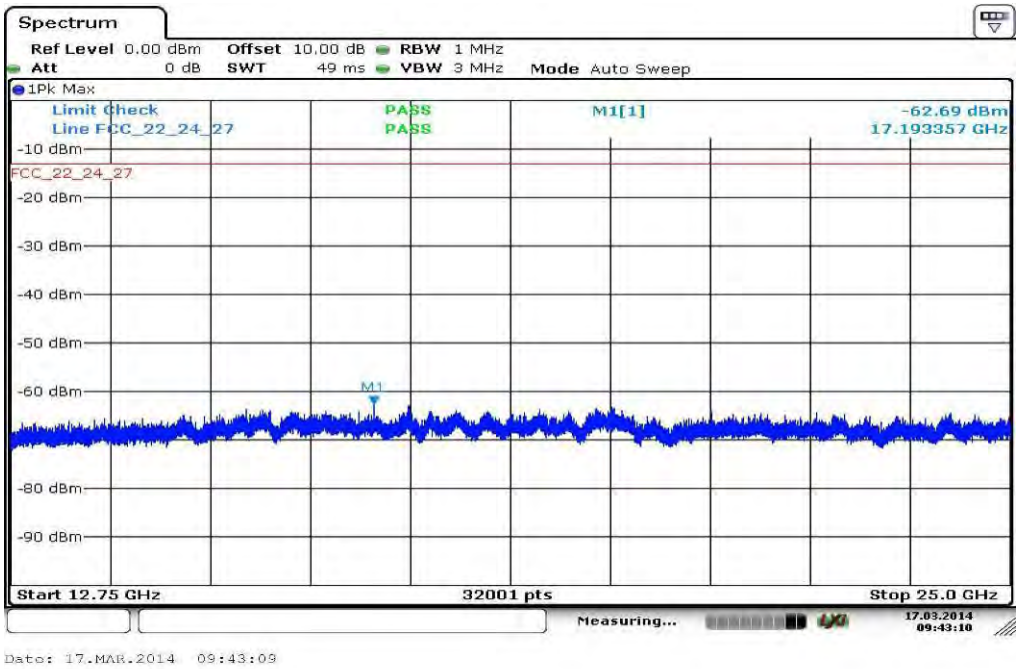
Plot 4: Middle channel, up to 30 MHz



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. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 17.6 GHz, data taken from 10 MHz to 26 GHz.
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	-	3465.0	-	3508.6	-
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	-	3465.0	-	3508.6	-
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	-	3465.0	-	3507.0	-
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	-	3465.0	-	3507.0	-
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	-	3465.0	-	3505.0	-
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	-	3465.0	-	3505.0	-
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	-	3465.0	-	3500.0	-
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	-	3465.0	-	3500.0	-
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	-	3465.0	-	3495.0	-
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	-	3465.0	-	3495.0	-
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	-	3465.0	-	3490.0	-
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		

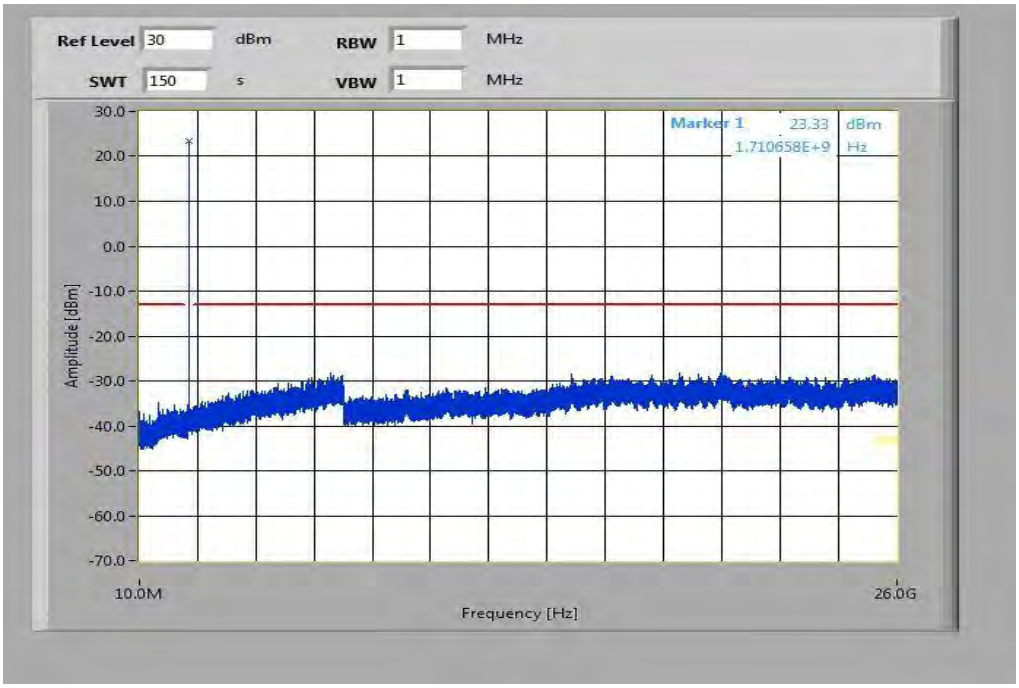
16-QAM

SPURIOUS EMISSION LEVEL (dBm)					
LOWEST CHANNEL		MIDDLE CHANNEL		HIGHEST CHANNEL	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3440.0	-	3465.0	-	3490.0	-
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		

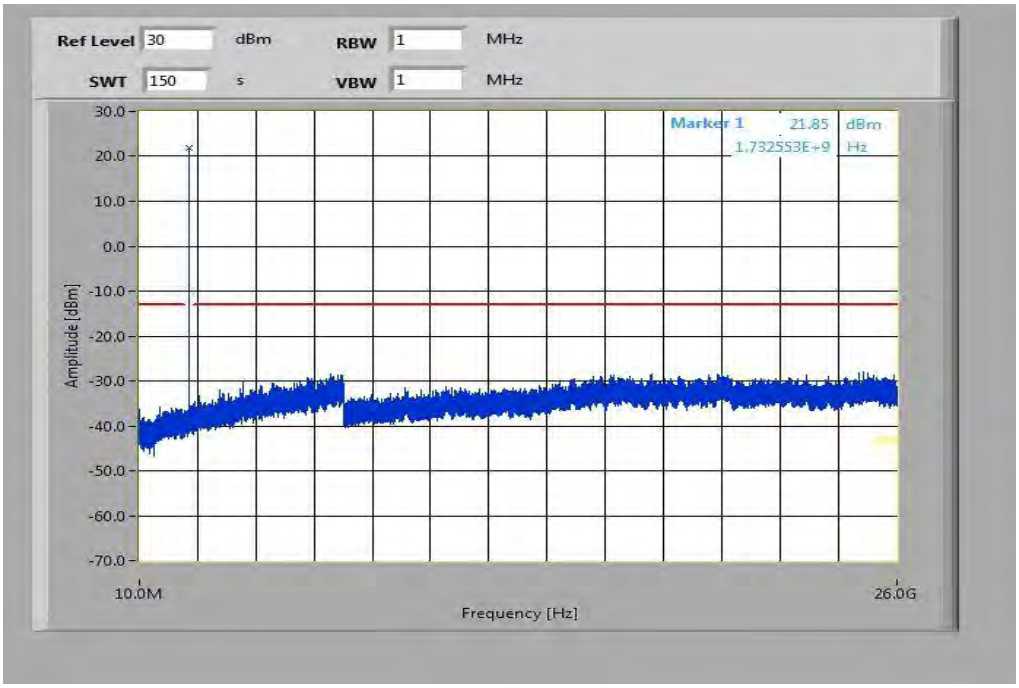
Result: Passed

Plots for 1.4 MHz channel bandwidth, QPSK

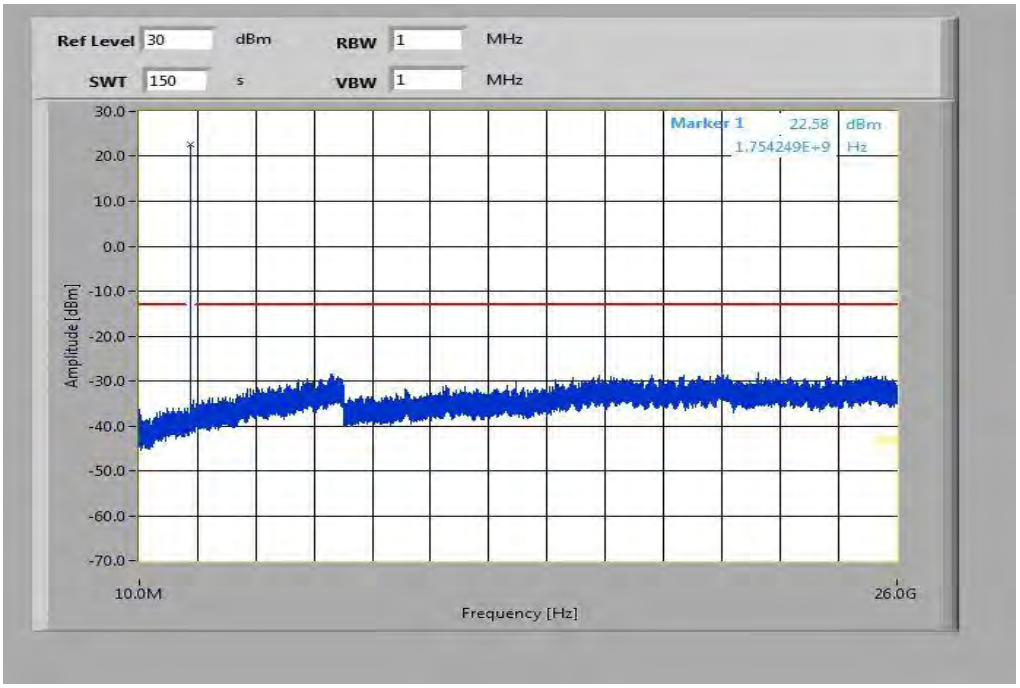
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

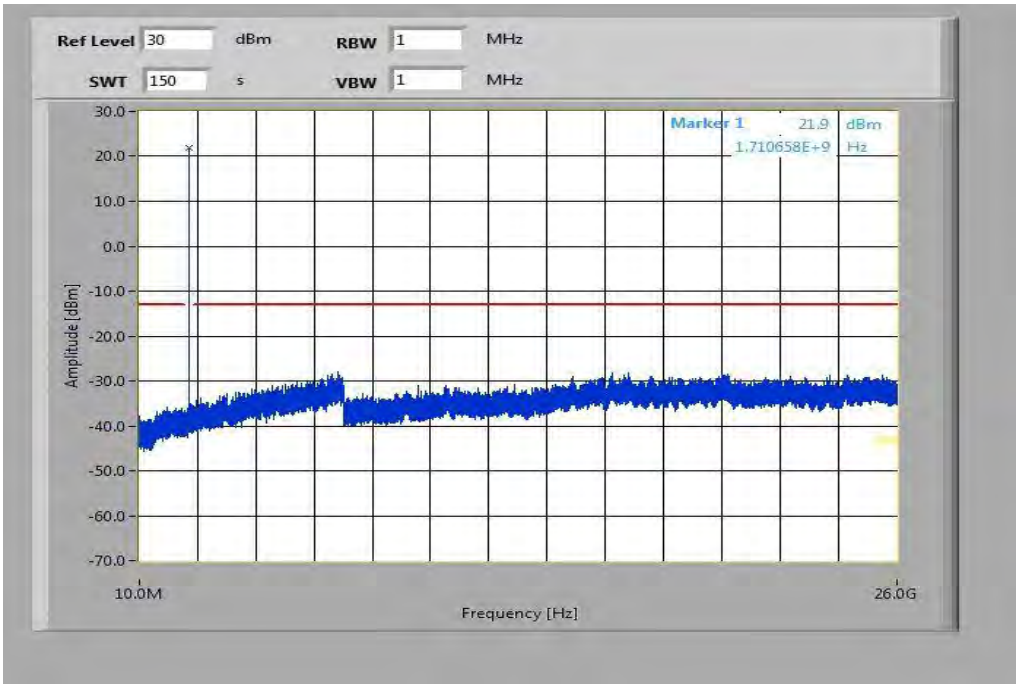


Plot 3: Highest channel, 10 MHz to 26 GHz

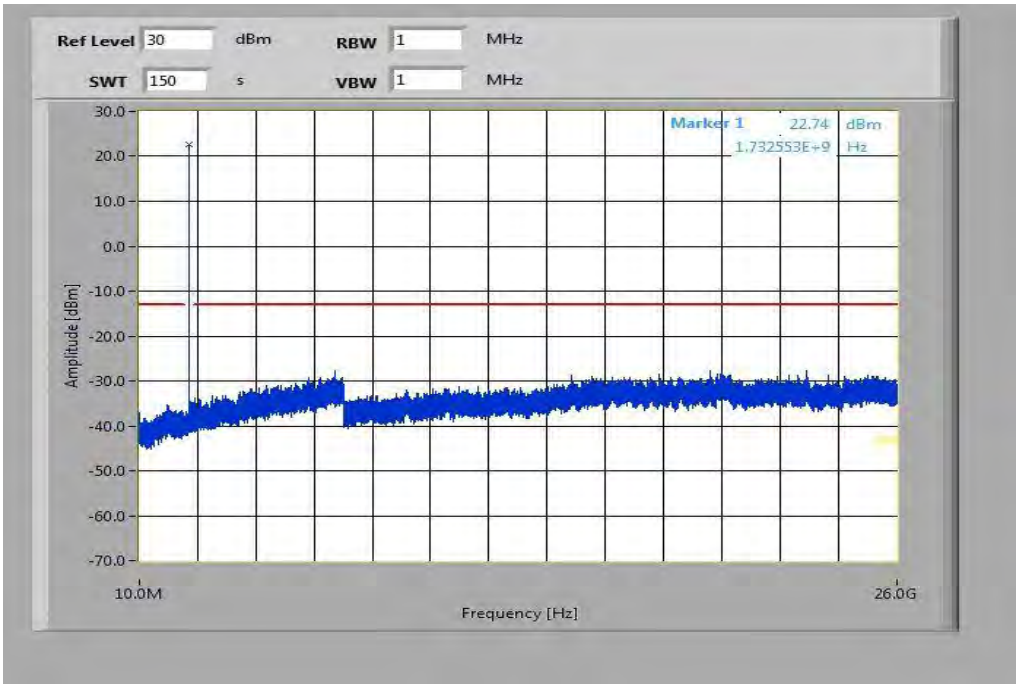


Plots for 1.4 MHz channel bandwidth, 16-QAM

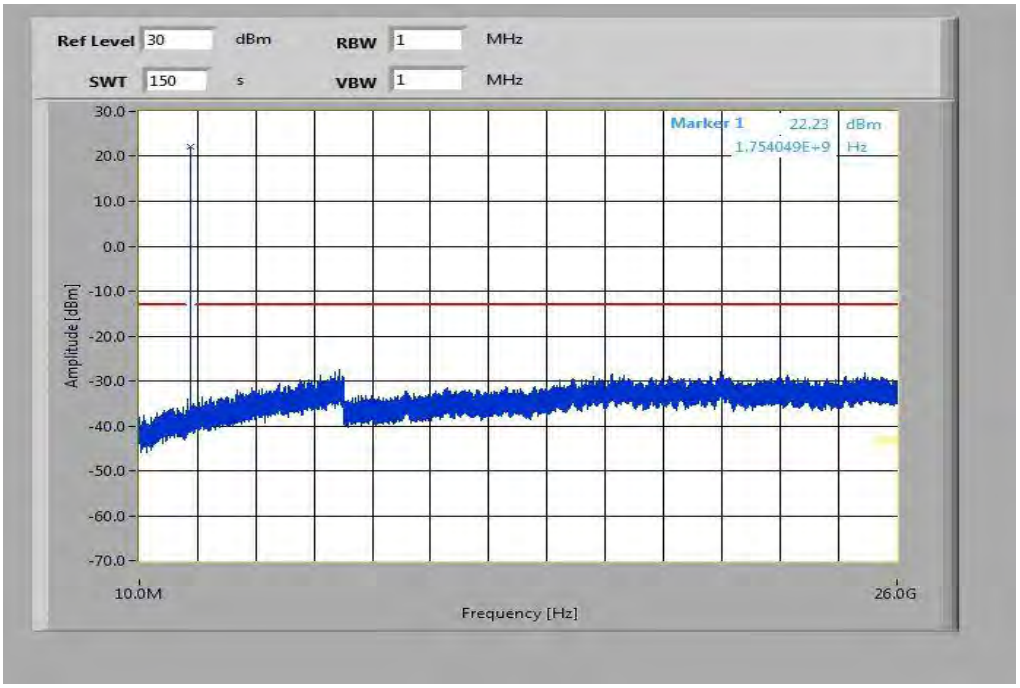
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz

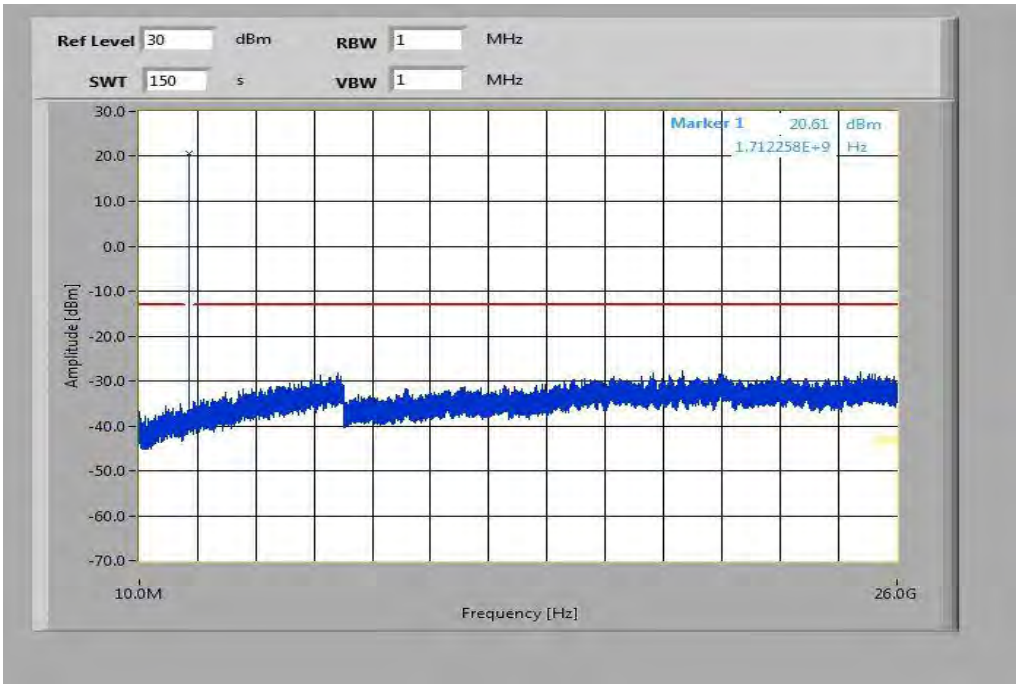


Plot 6: Highest channel, 10 MHz to 26 GHz

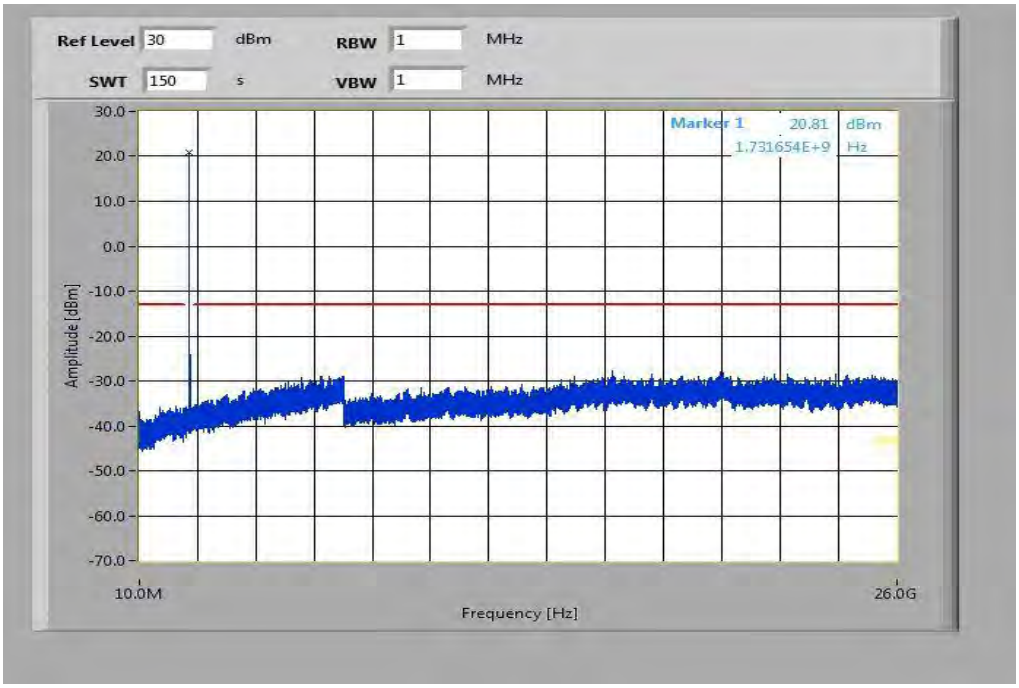


Plots for 3 MHz channel bandwidth, QPSK

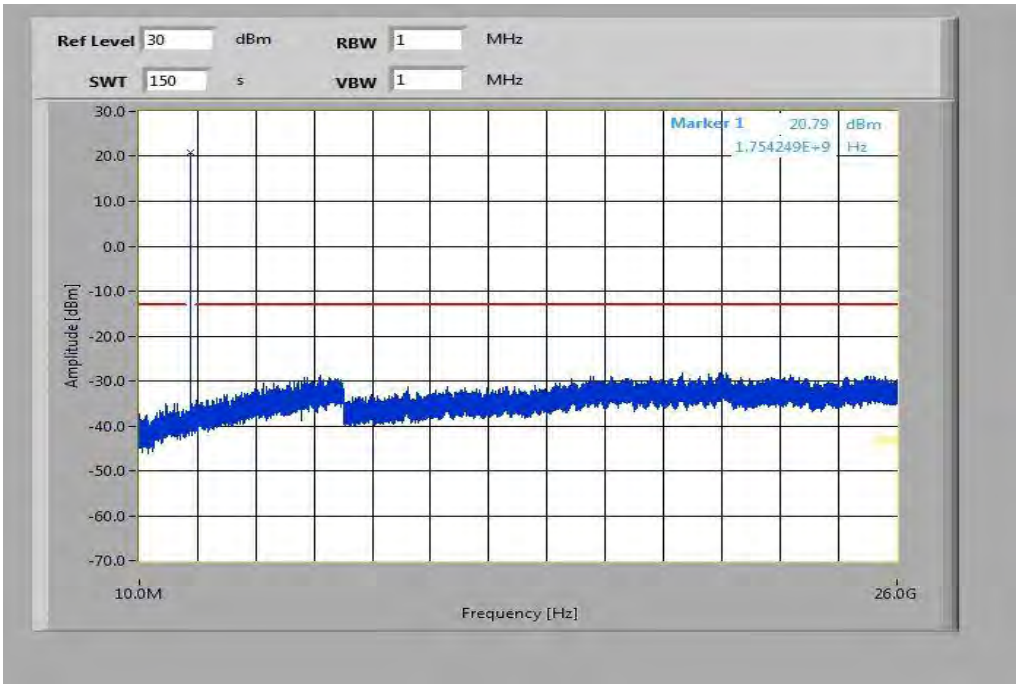
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

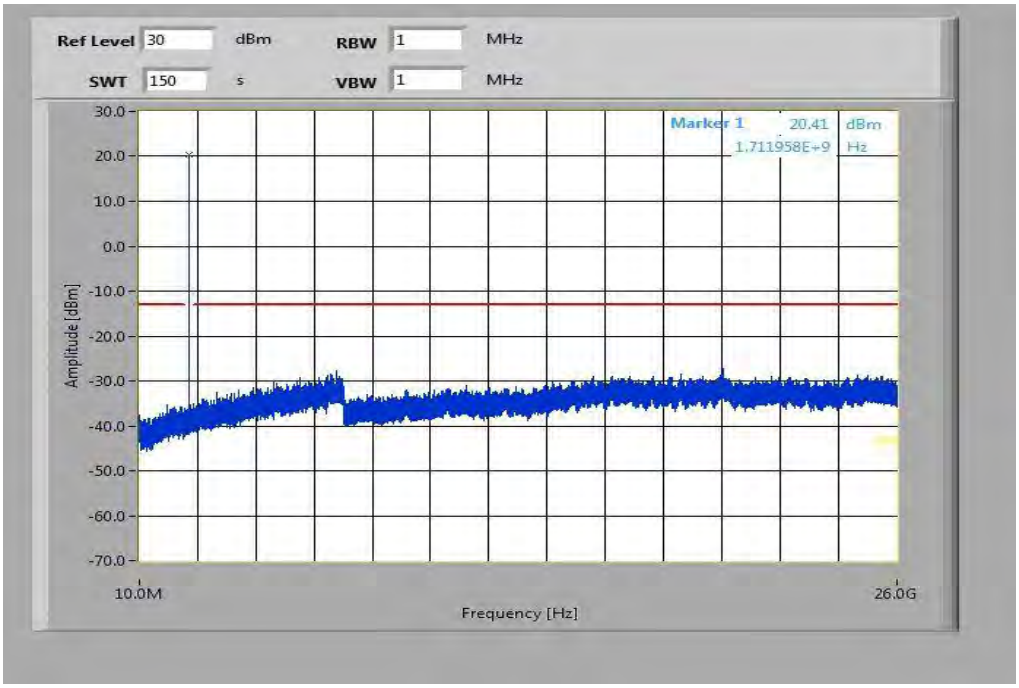


Plot 3: Highest channel, 10 MHz to 26 GHz

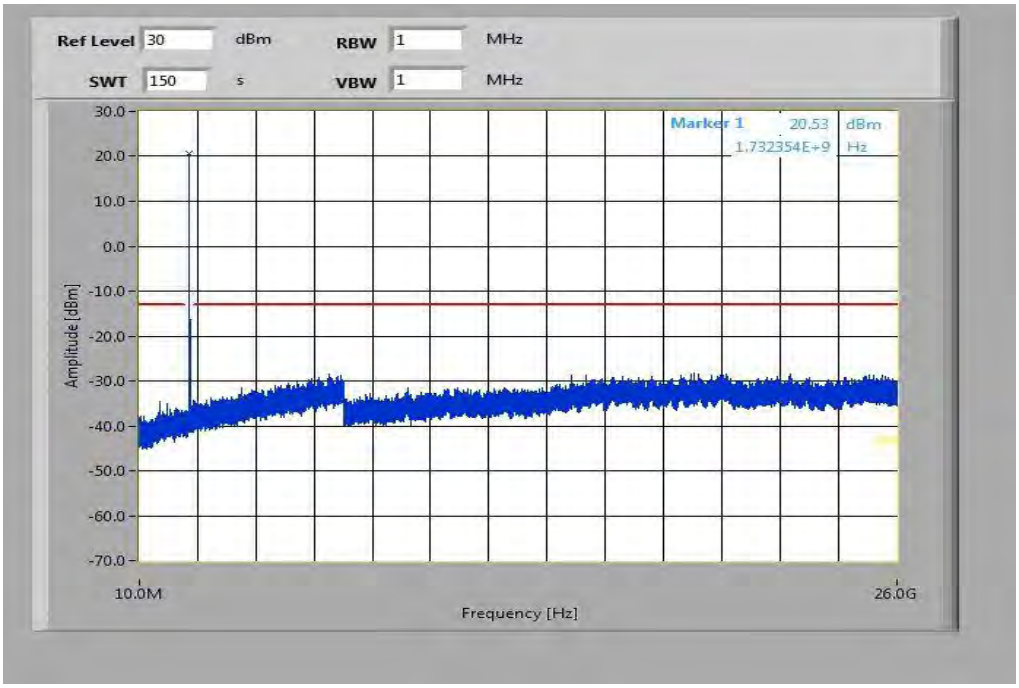


Plots for 3 MHz channel bandwidth, 16-QAM

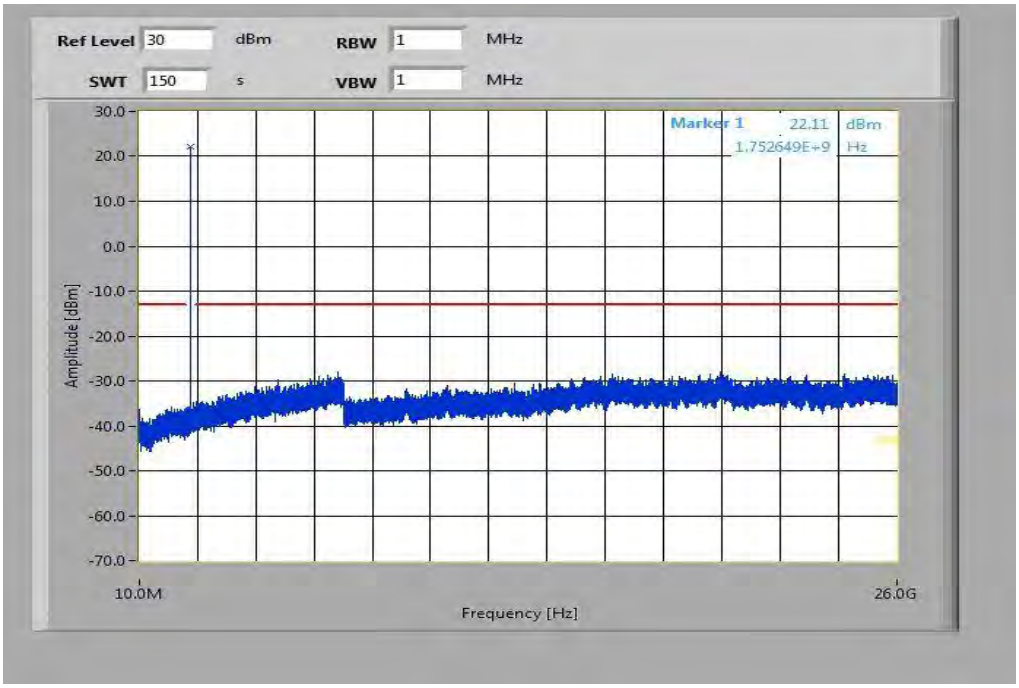
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz

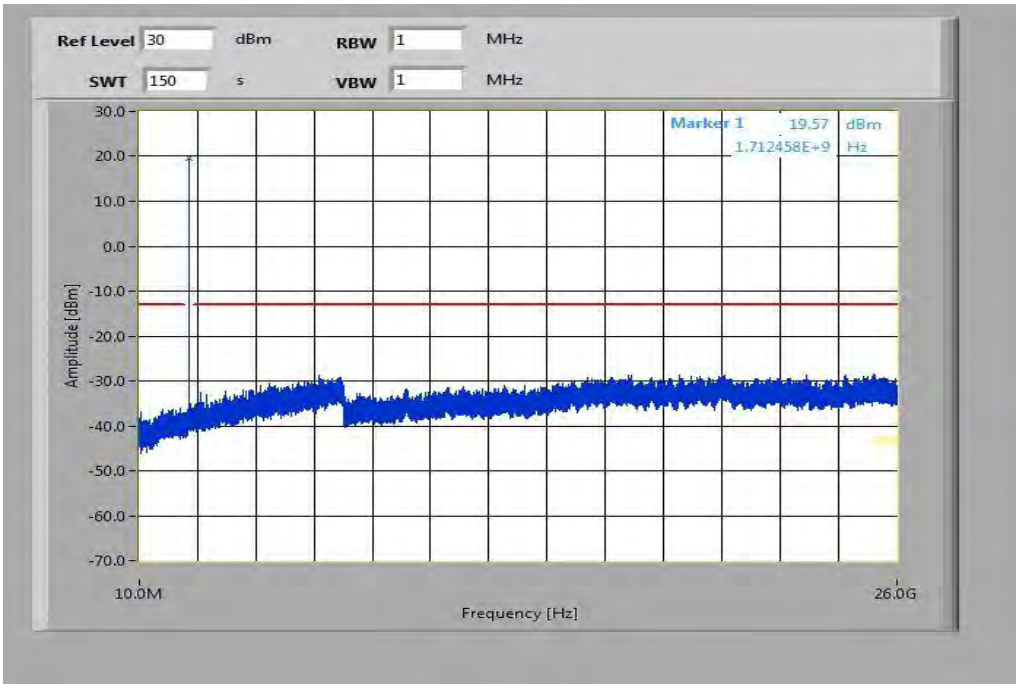


Plot 6: Highest channel, 10 MHz to 26 GHz

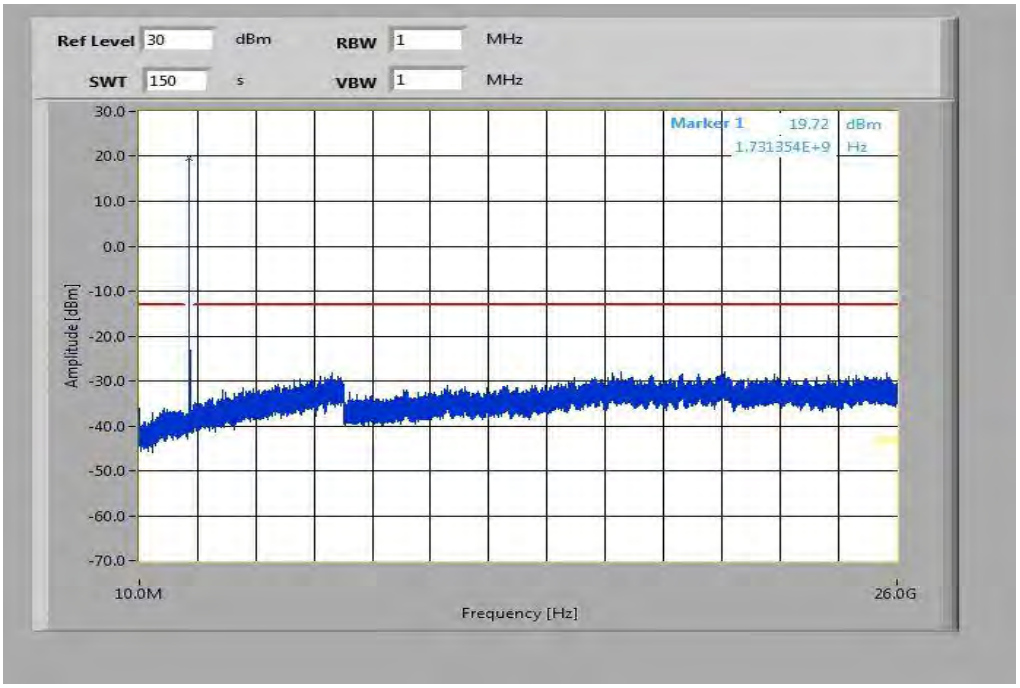


Plots for 5 MHz channel bandwidth, QPSK

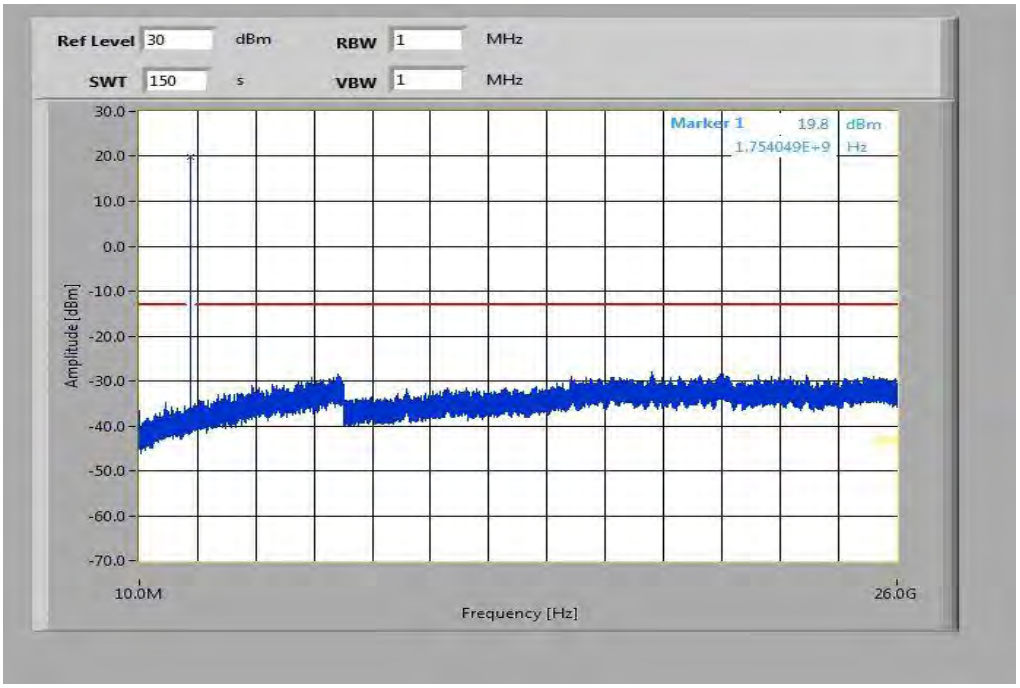
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

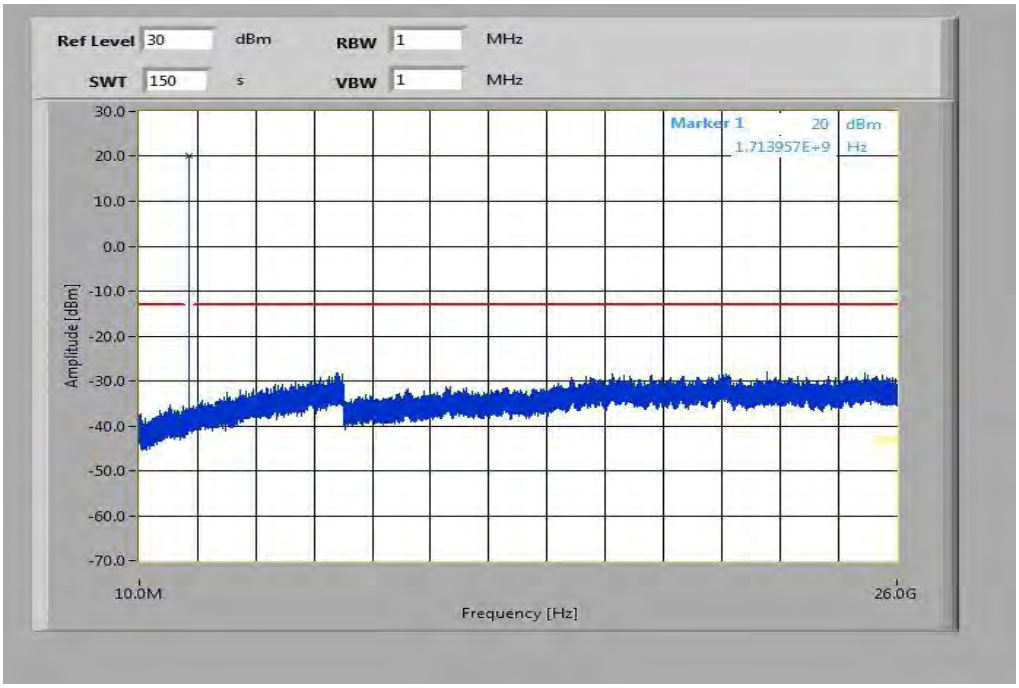


Plot 3: Highest channel, 10 MHz to 26 GHz

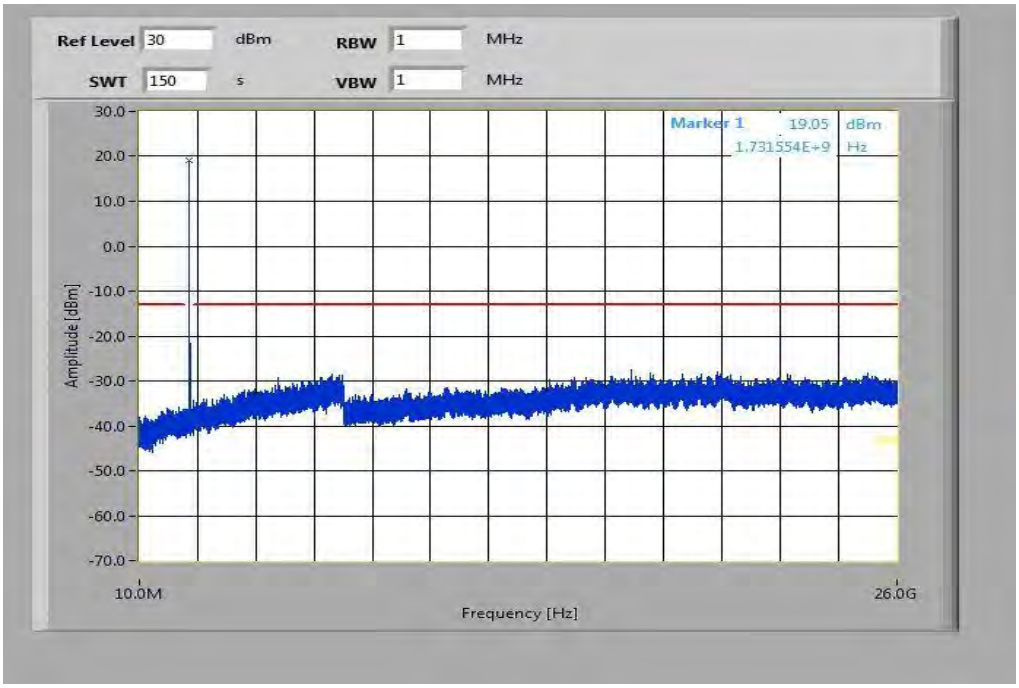


Plots for 5 MHz channel bandwidth, 16-QAM

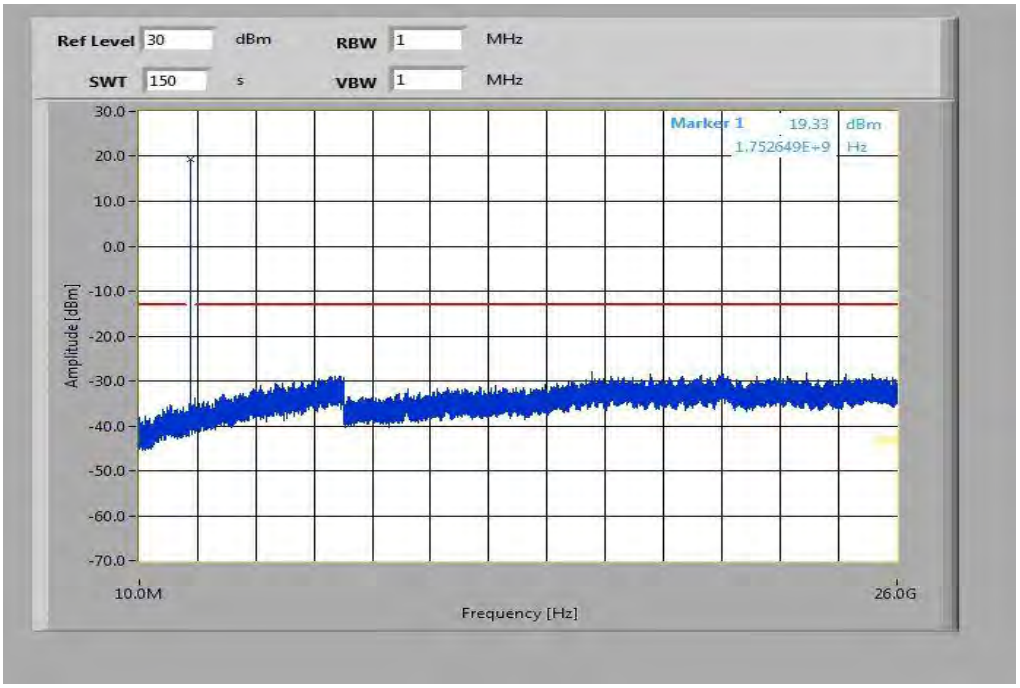
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz

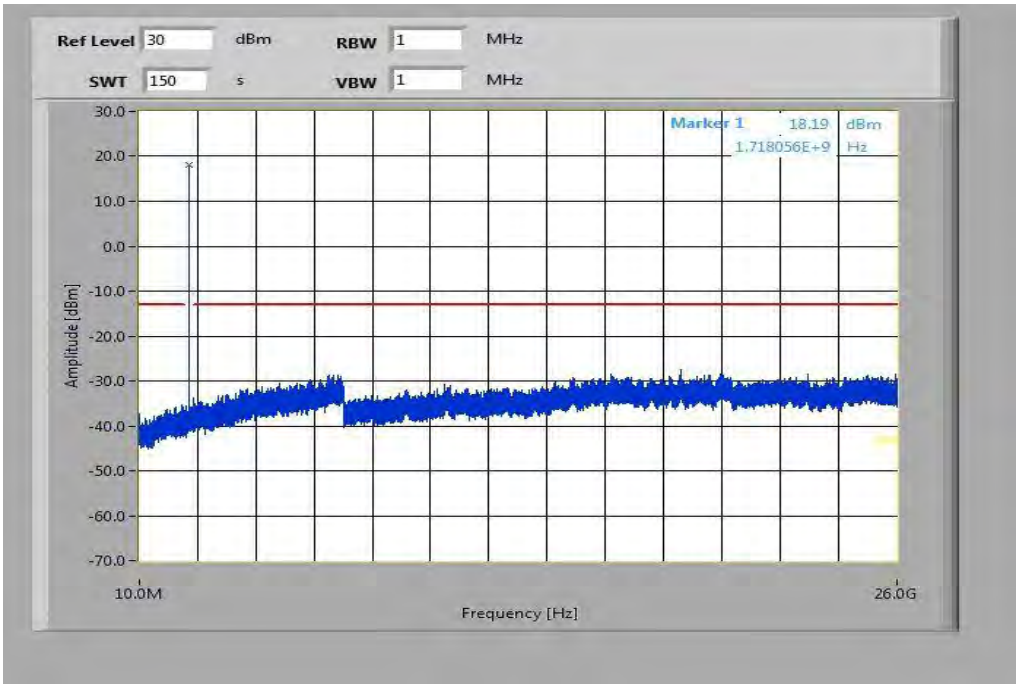


Plot 6: Highest channel, 10 MHz to 26 GHz

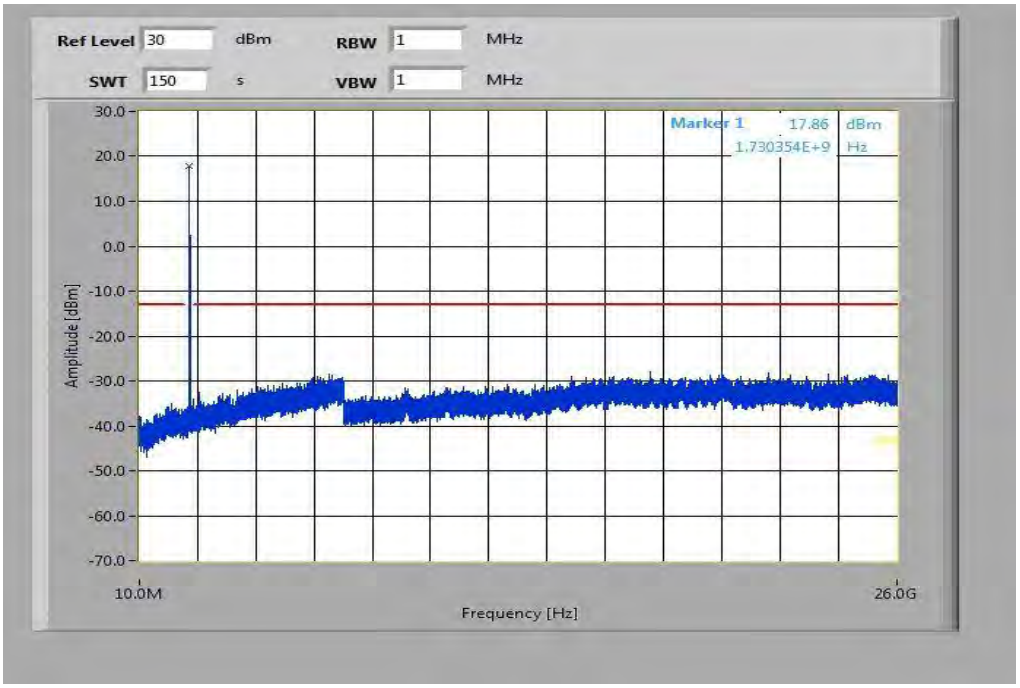


Plots for 10 MHz channel bandwidth, QPSK

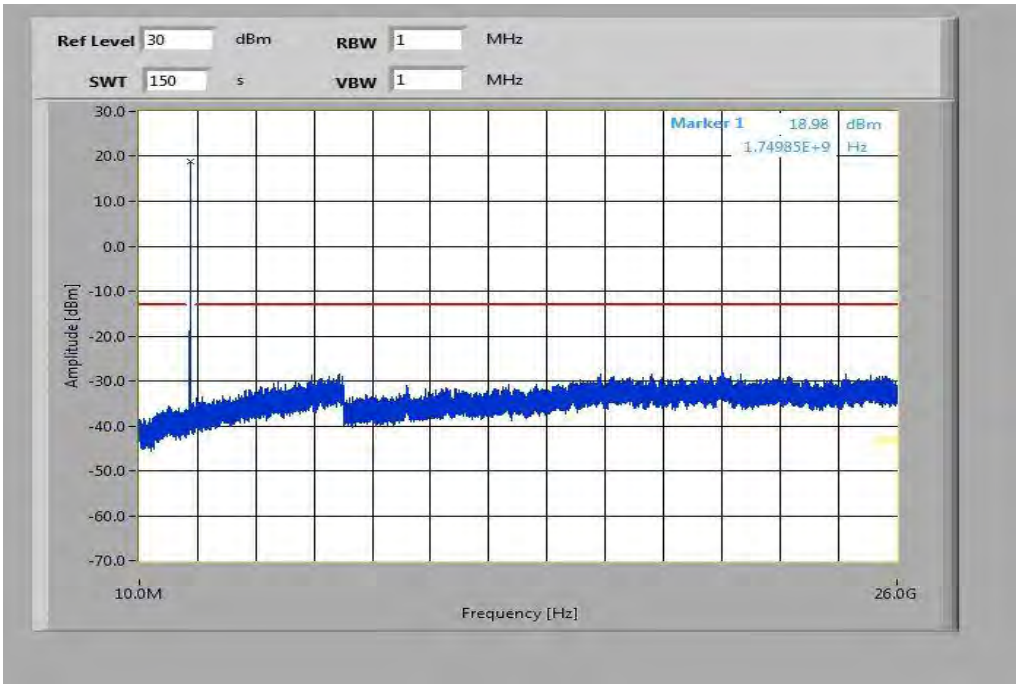
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

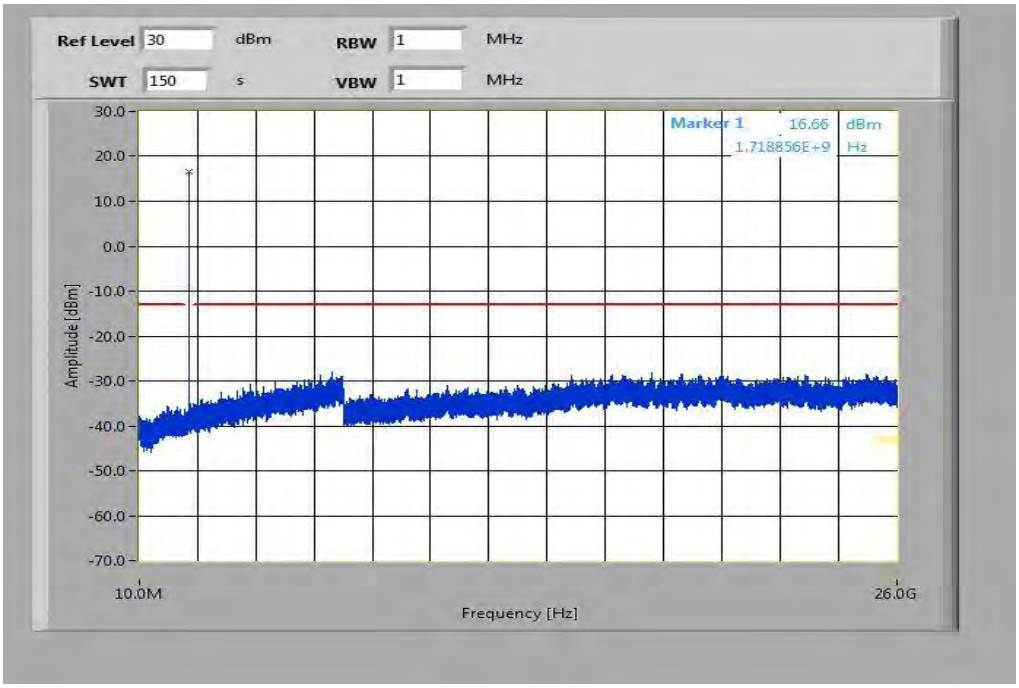


Plot 3: Highest channel, 10 MHz to 26 GHz

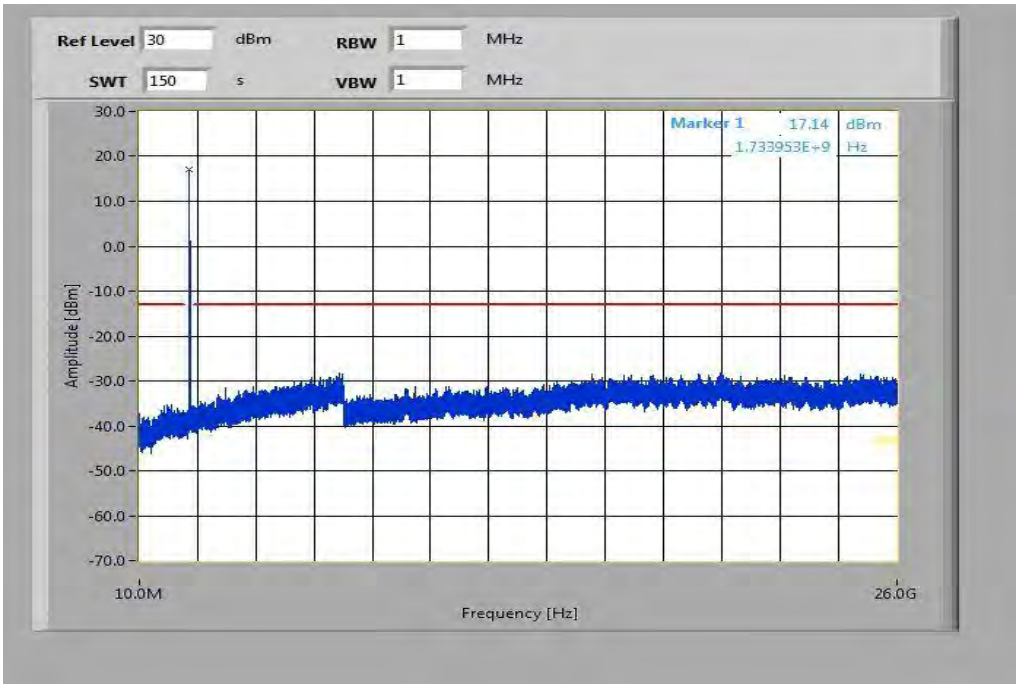


Plots for 10 MHz channel bandwidth, 16-QAM

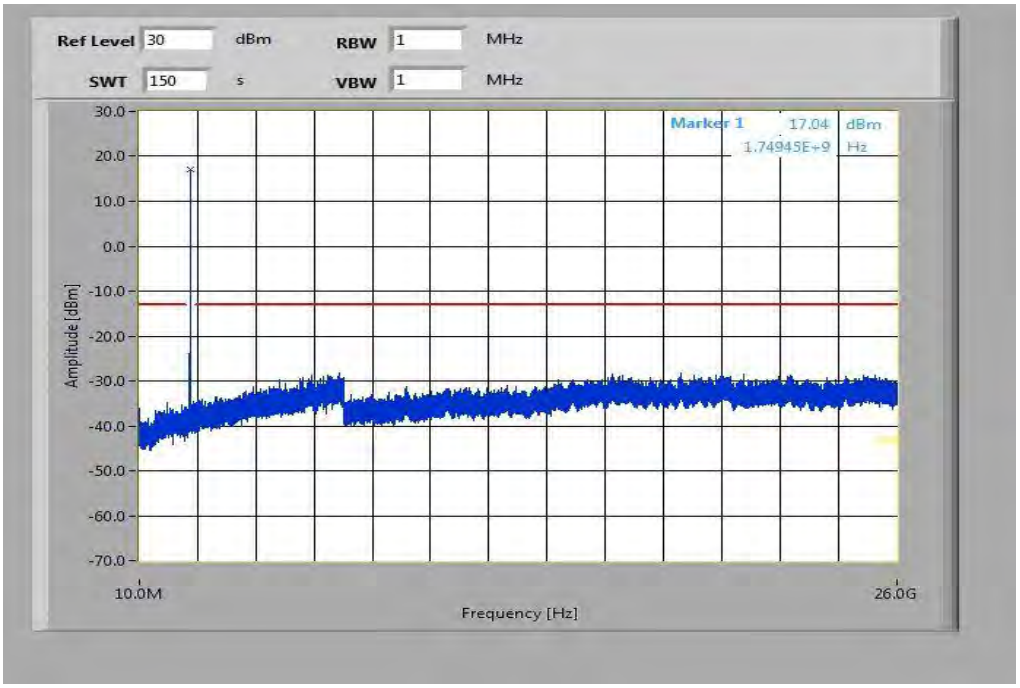
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz

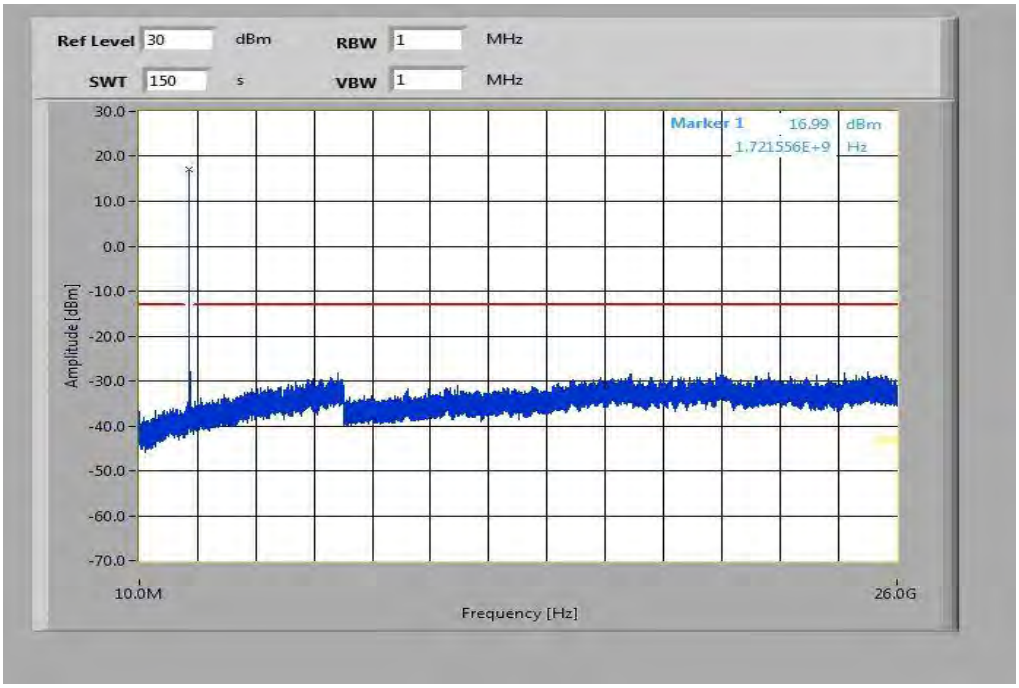


Plot 6: Highest channel, 10 MHz to 26 GHz

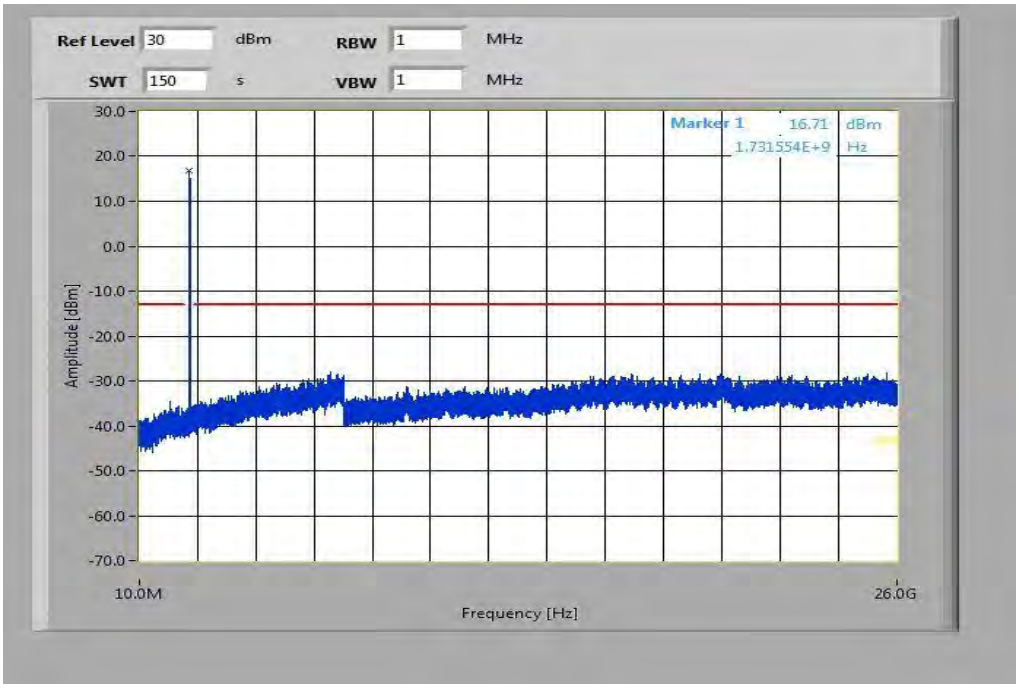


Plots for 15 MHz channel bandwidth, QPSK

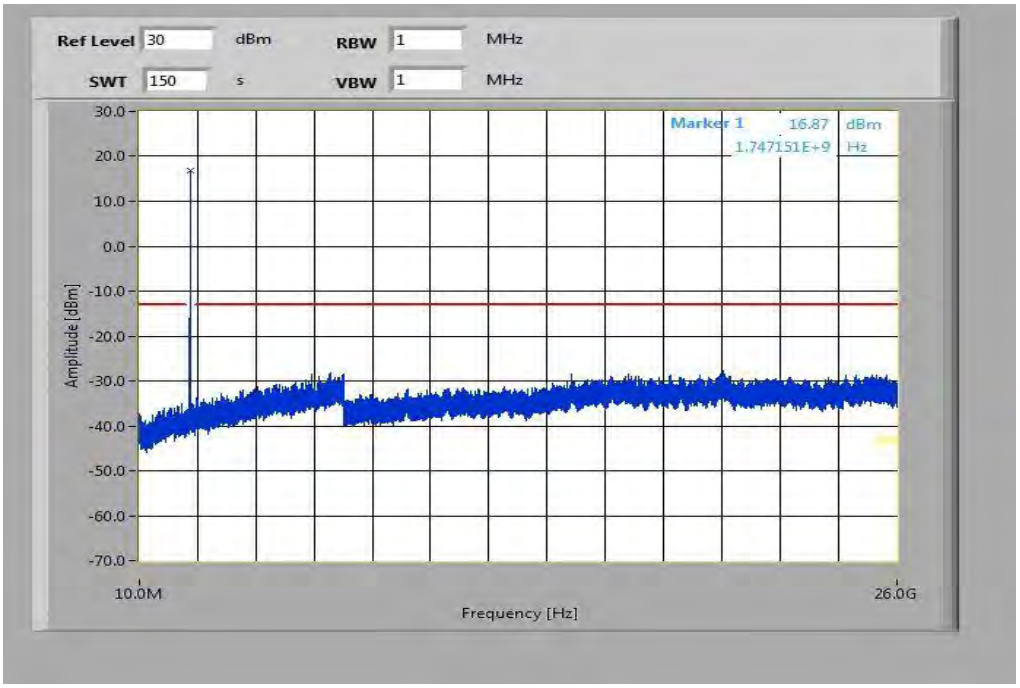
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

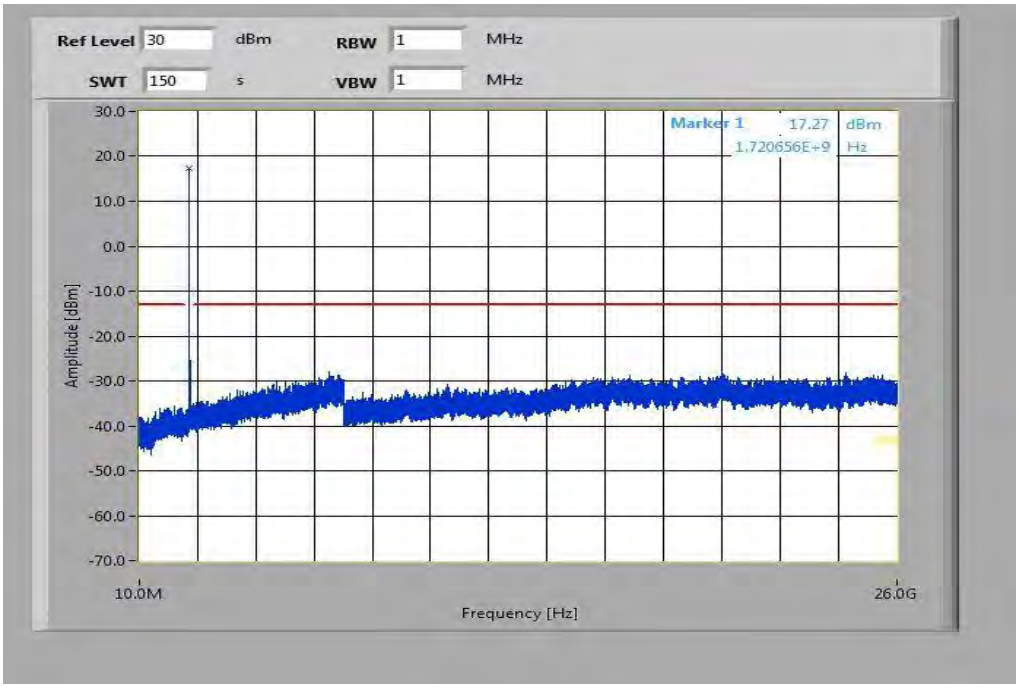


Plot 3: Highest channel, 10 MHz to 26 GHz

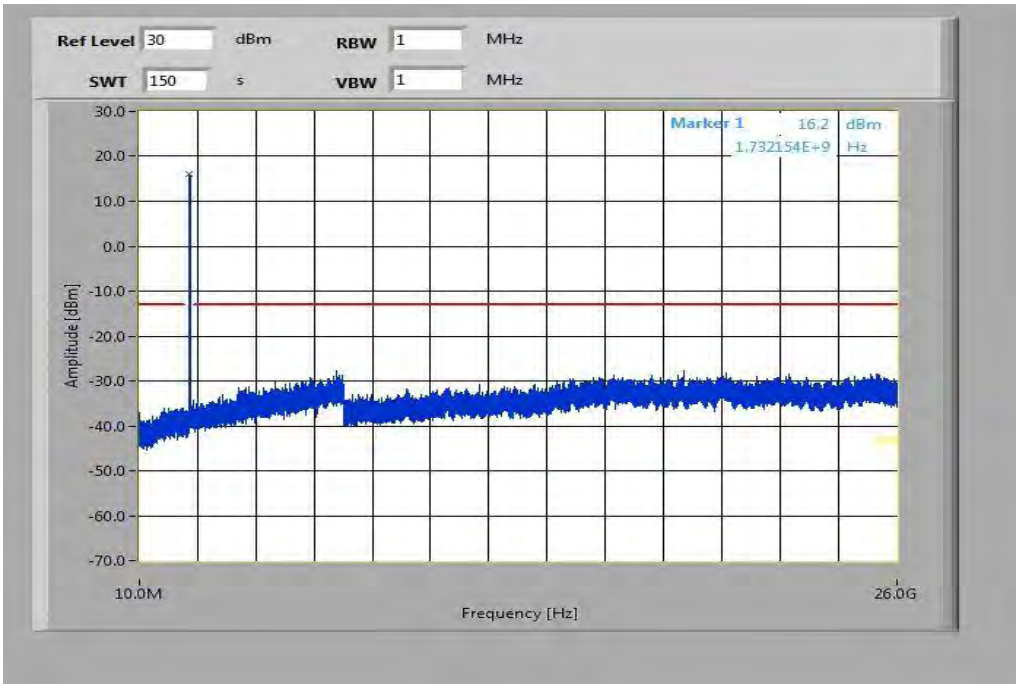


Plots for 15 MHz channel bandwidth, 16-QAM

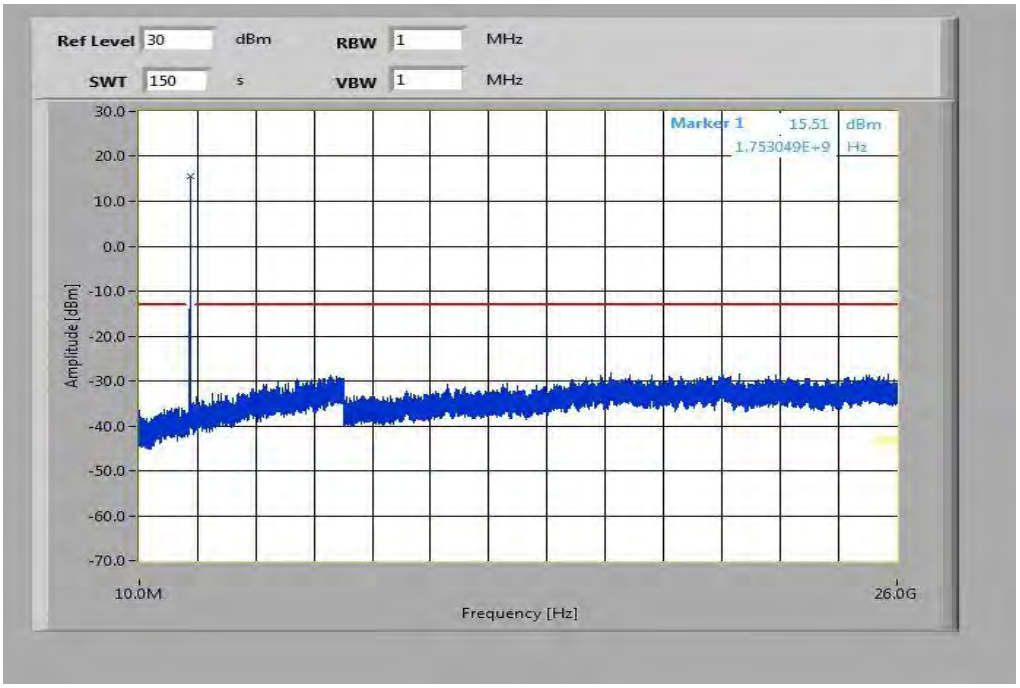
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz

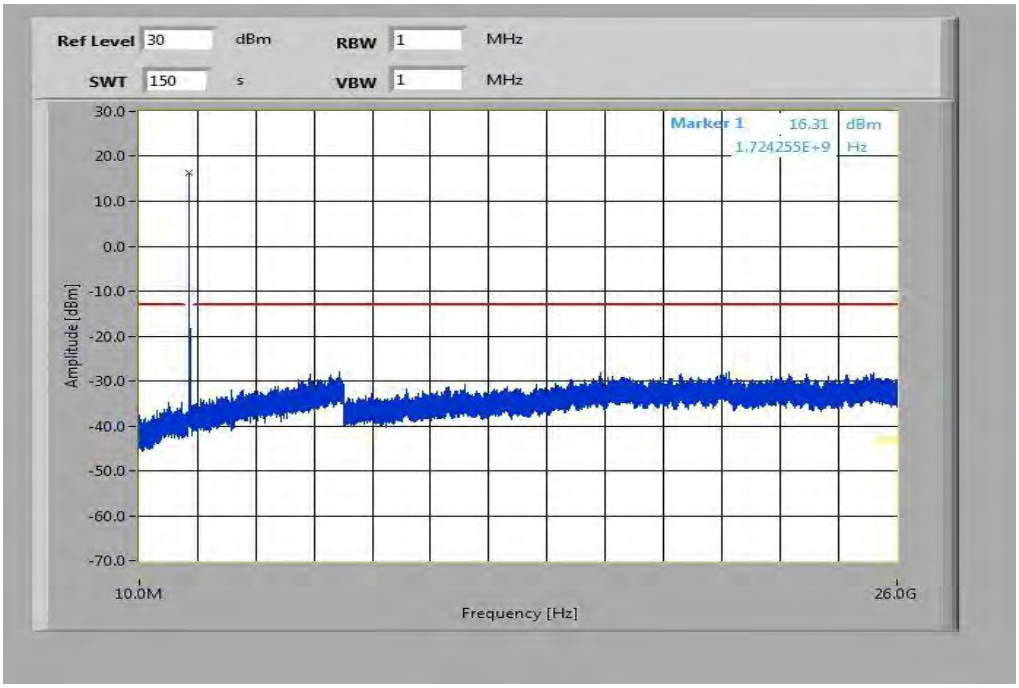


Plot 6: Highest channel, 10 MHz to 26 GHz

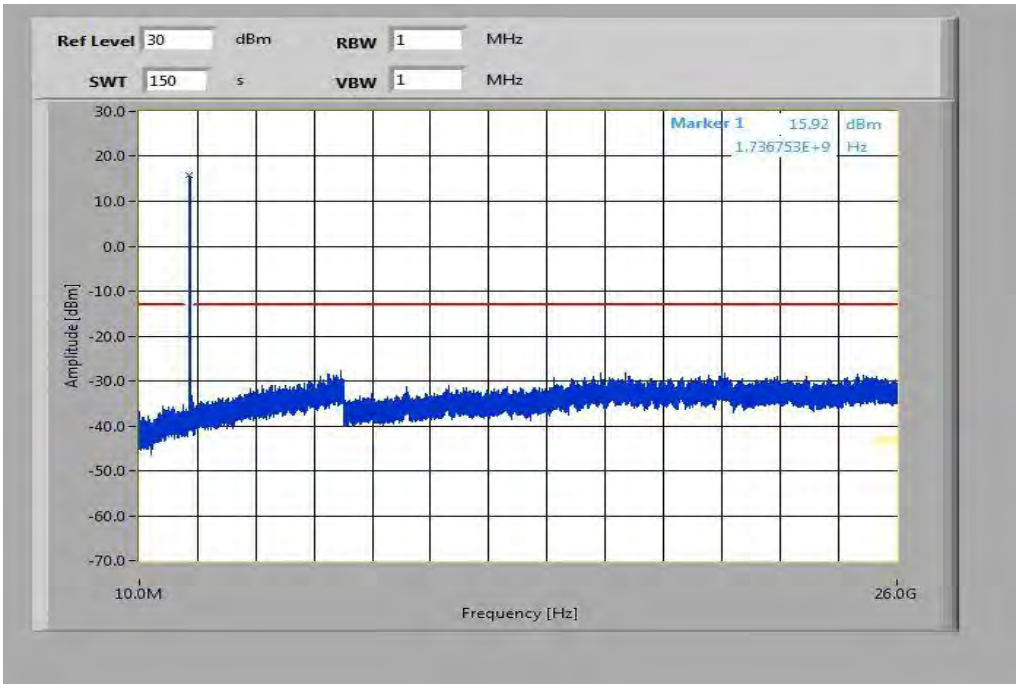


Plots for 20 MHz channel bandwidth, QPSK

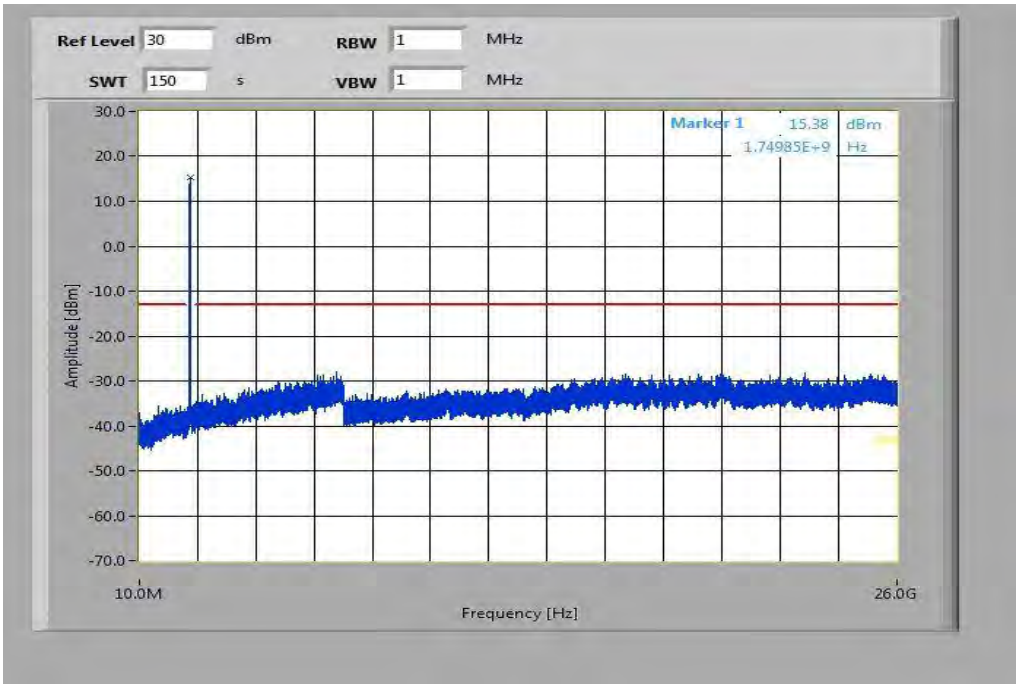
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

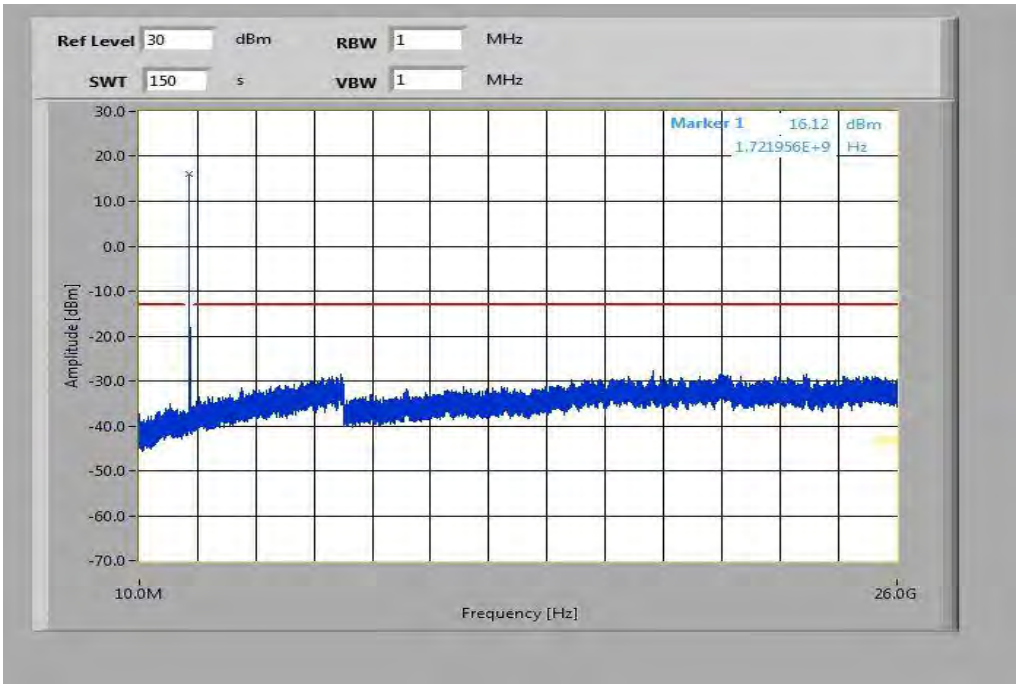


Plot 3: Highest channel, 10 MHz to 26 GHz

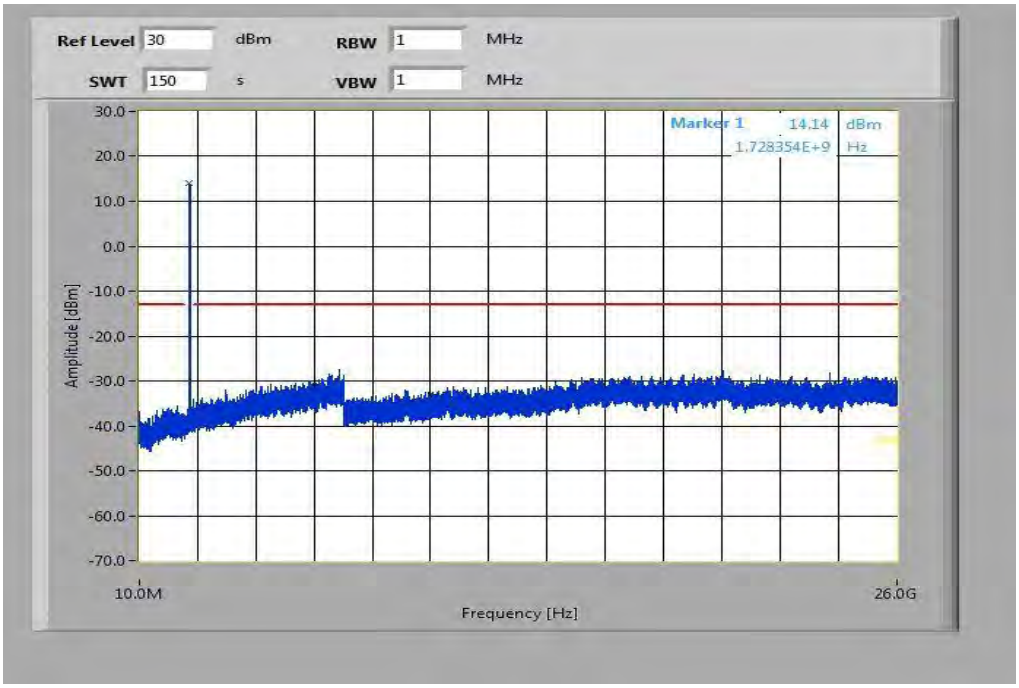


Plots for 20 MHz channel bandwidth, 16-QAM

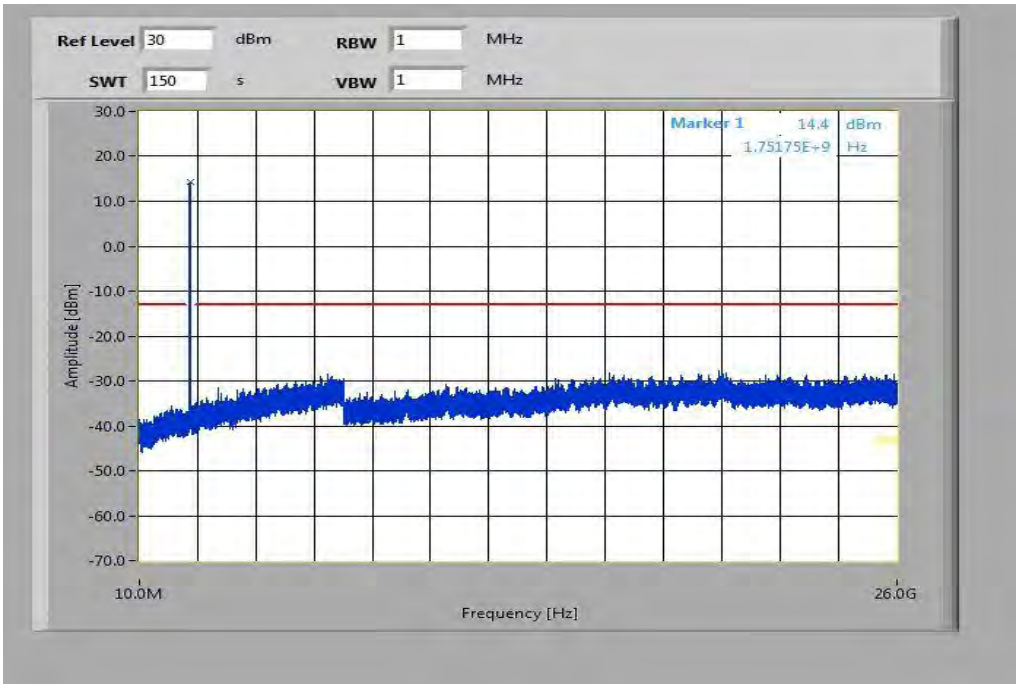
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz



Plot 6: Highest channel, 10 MHz to 26 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:

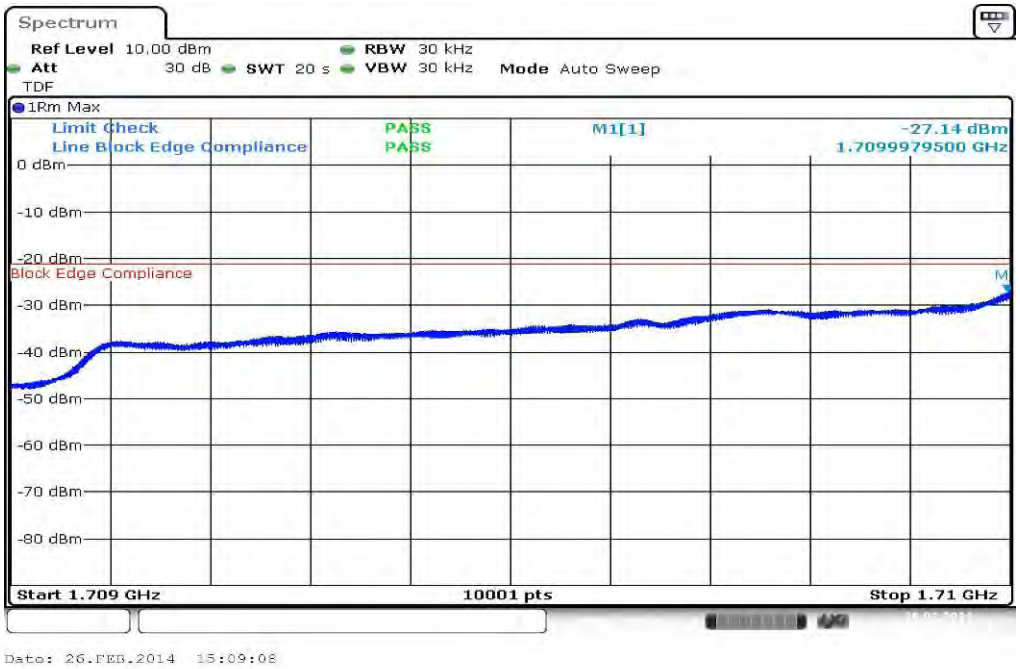
Measurement parameters	
Detector:	RMS
Sweep time:	20 sec.
Video bandwidth:	30 kHz
Resolution bandwidth:	30 kHz
Span:	1 MHz
Trace-Mode:	Max Hold

Limits:

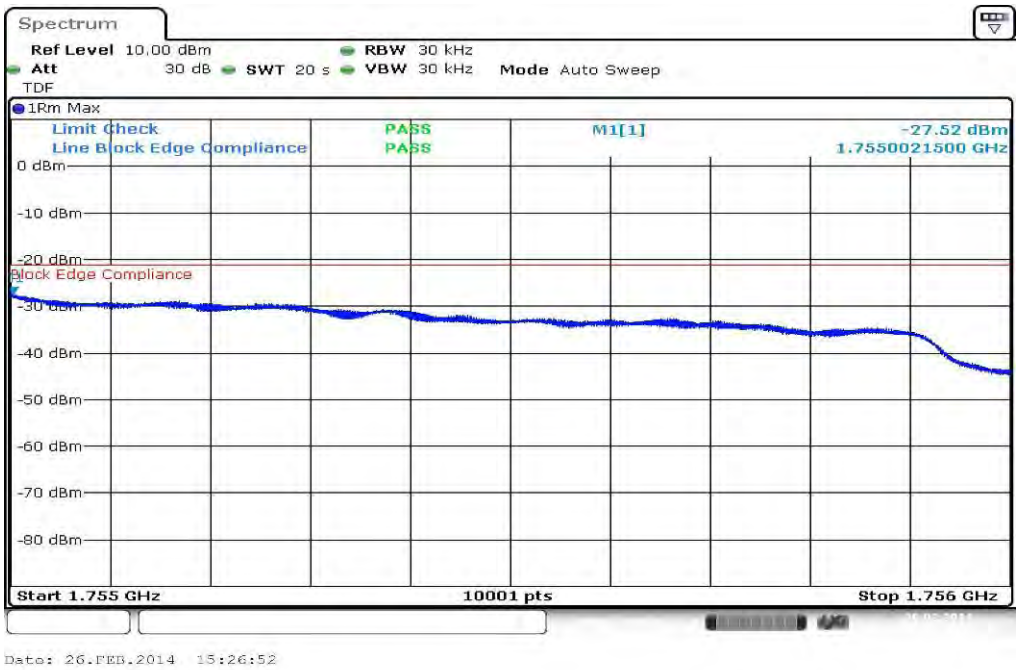
FCC
Block Edge Compliance
Part 27.53 specifies that “the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.” However, in publication number 890810, The FCC Office of Engineering and 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/50kHz) = -8.239]. When this adjustment is applied to the limit, the limit becomes -21.24.
-21.24 dBm

Results: **1.4 MHz channel bandwidth**

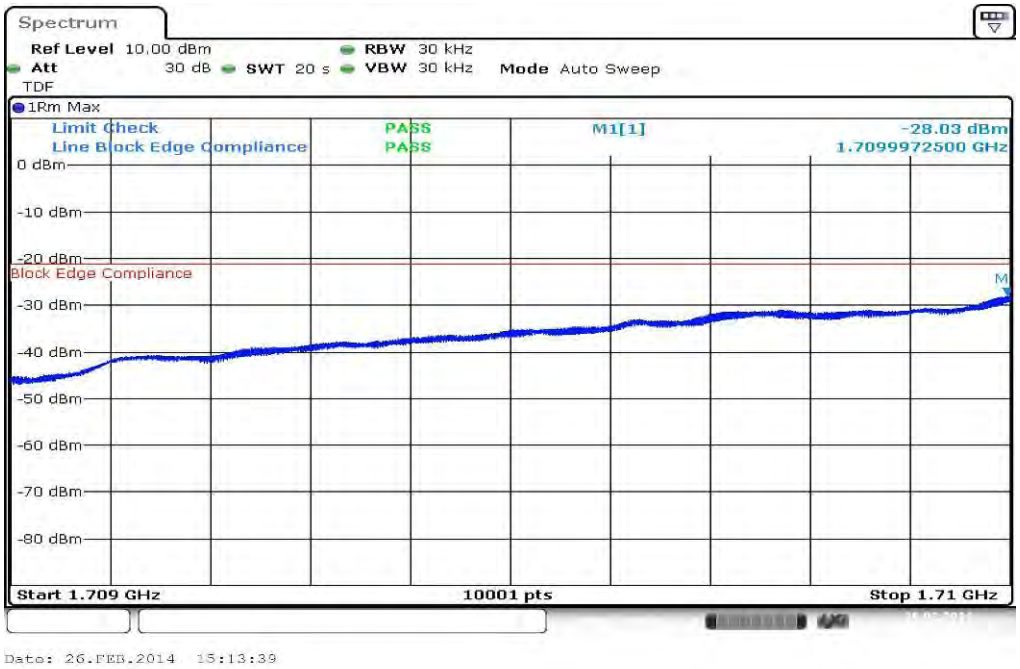
Plot 1: Lowest channel, QPSK modulation



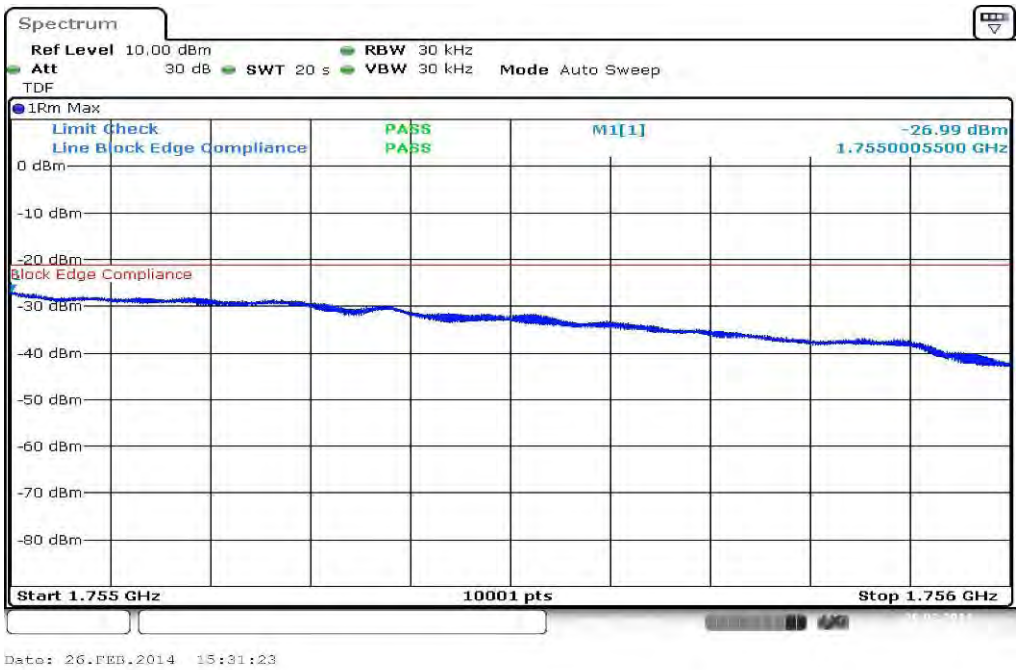
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

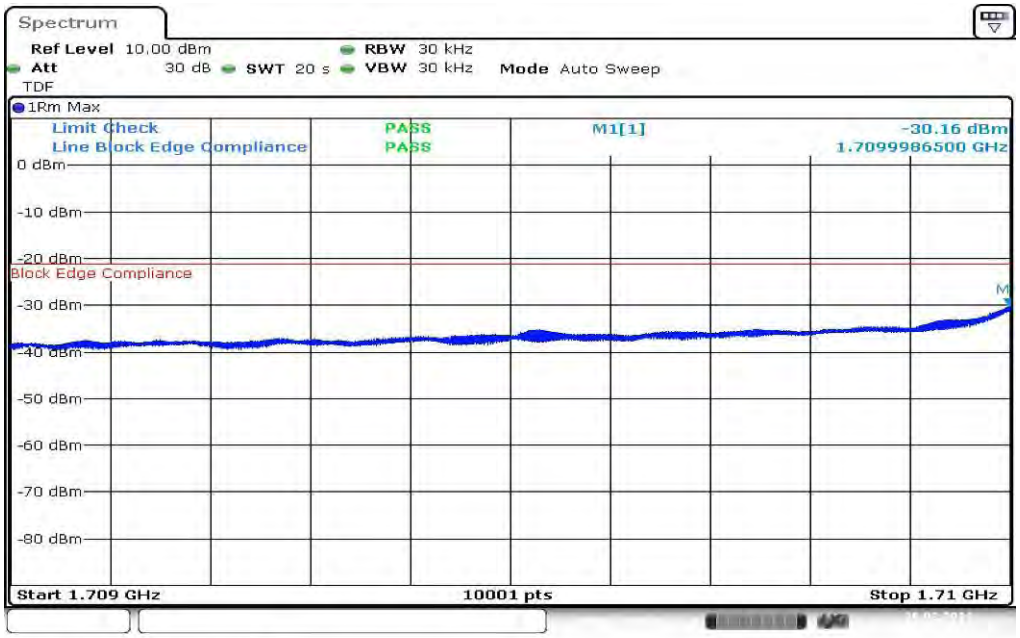


Plot 4: Highest channel, 16 – QAM modulation

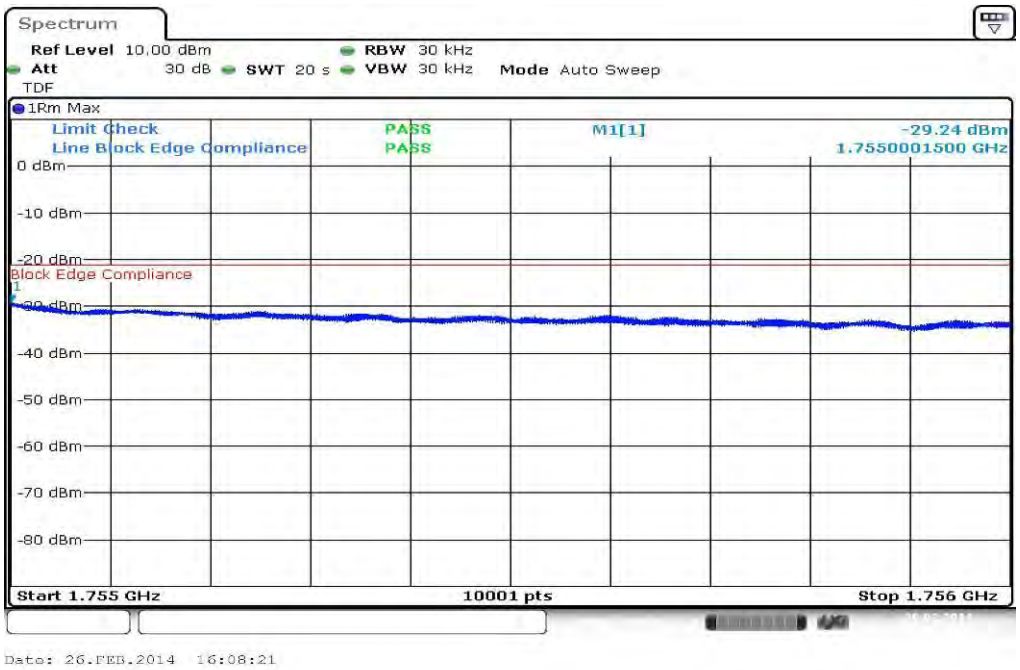


Results: **3 MHz channel bandwidth**

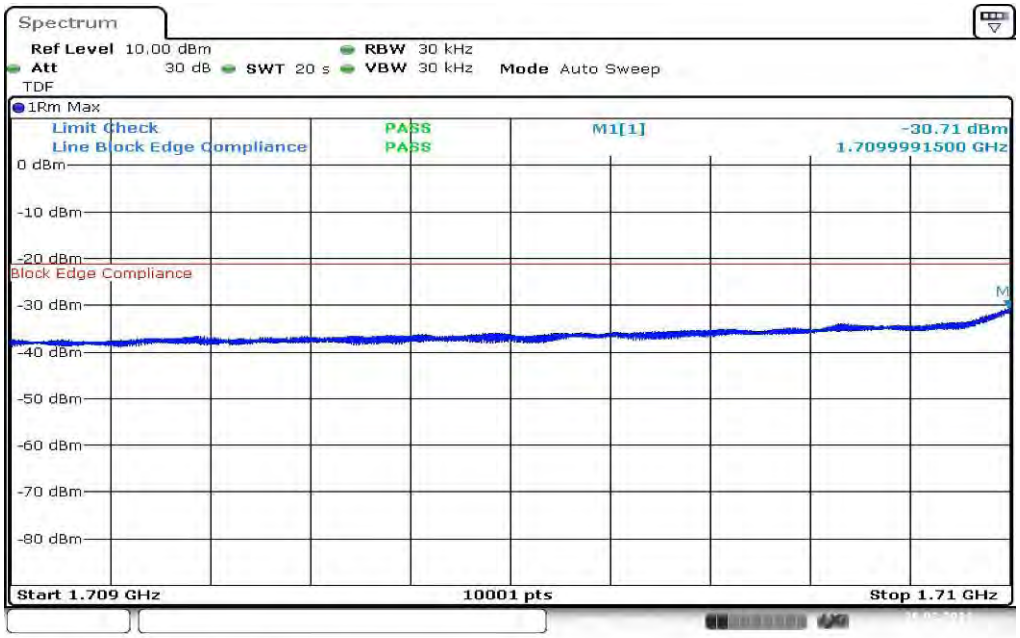
Plot 1: Lowest channel, QPSK modulation



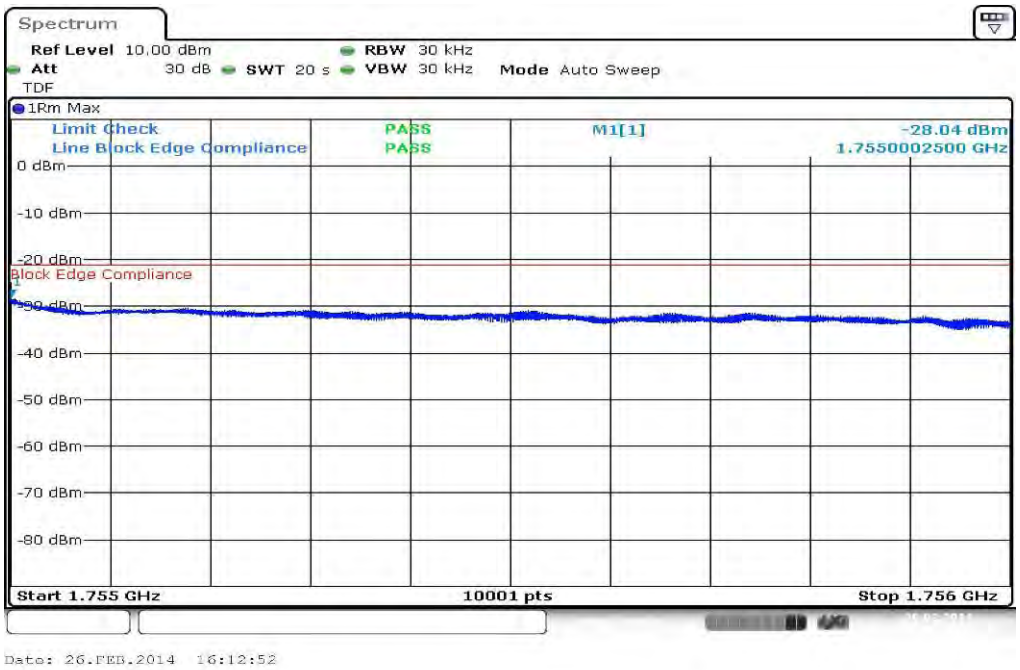
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

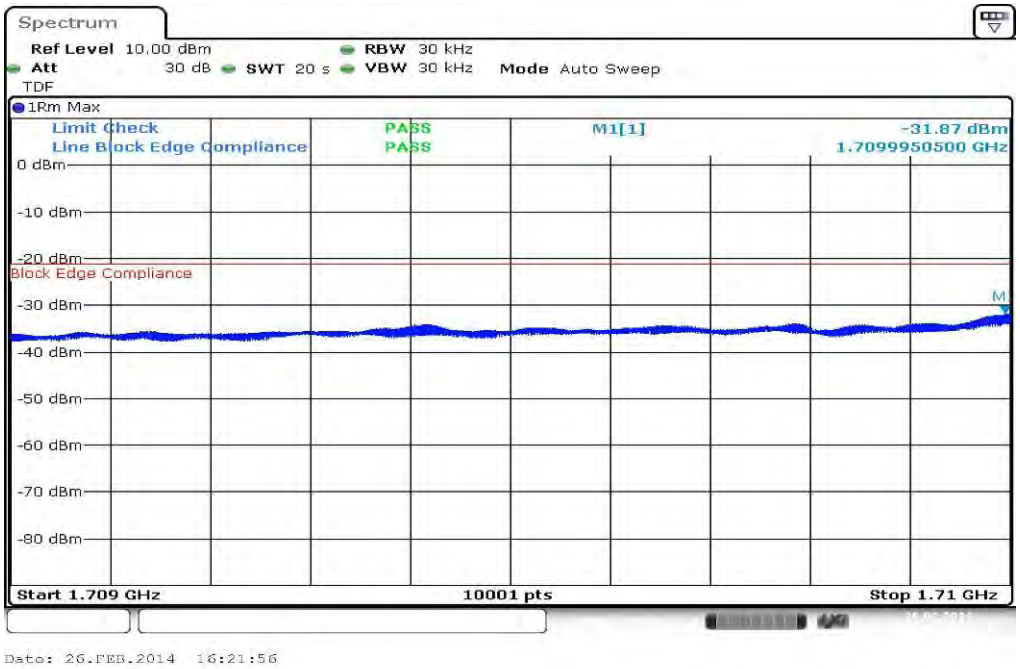


Plot 4: Highest channel, 16 – QAM modulation

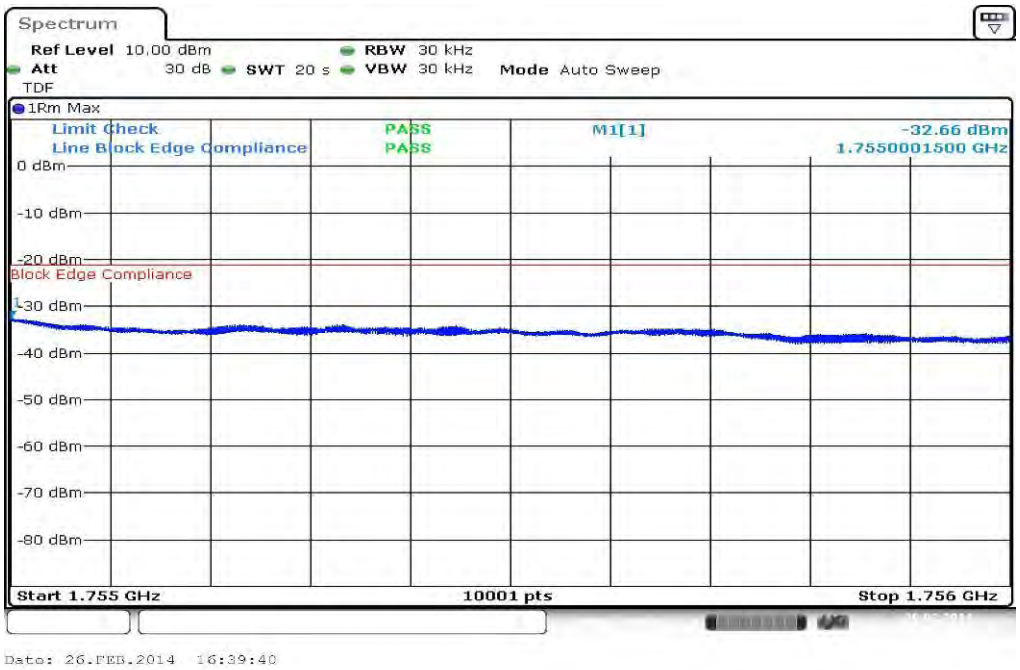


Results: **5 MHz channel bandwidth**

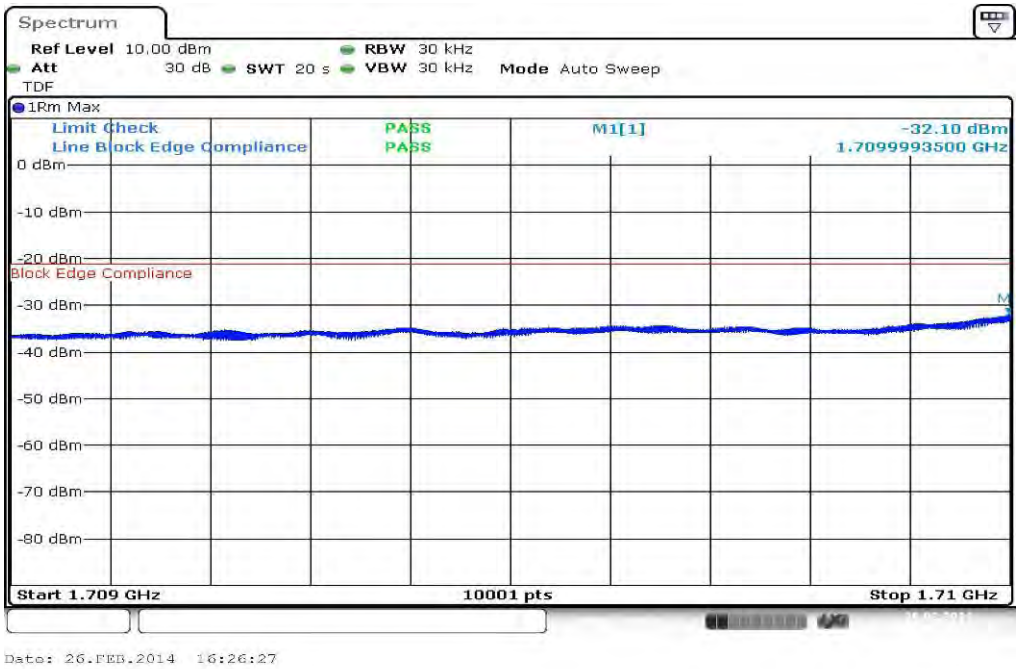
Plot 1: Lowest channel, QPSK modulation



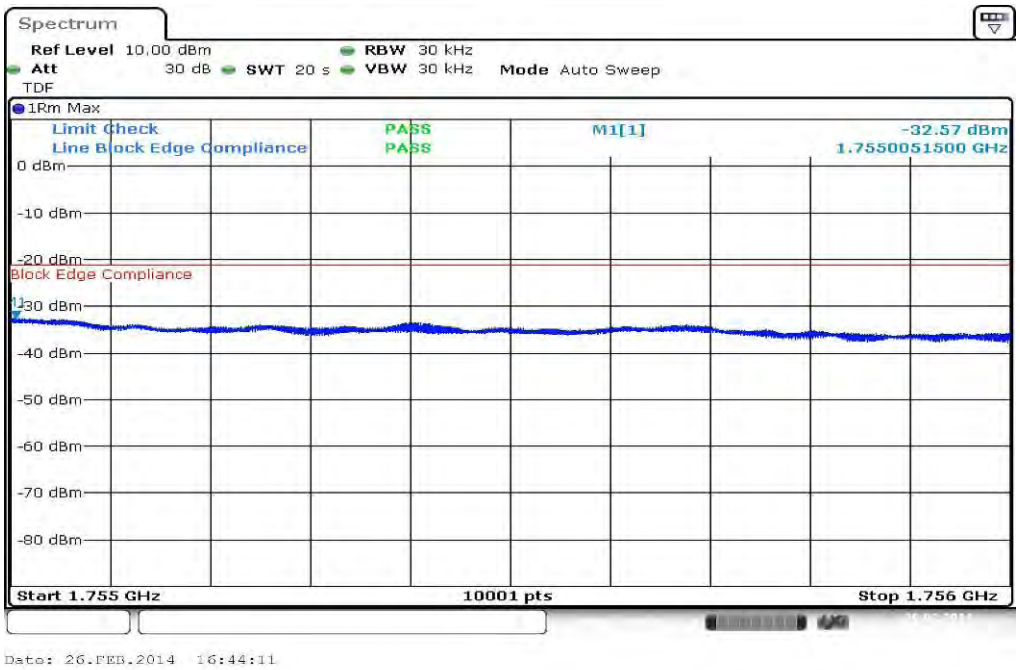
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

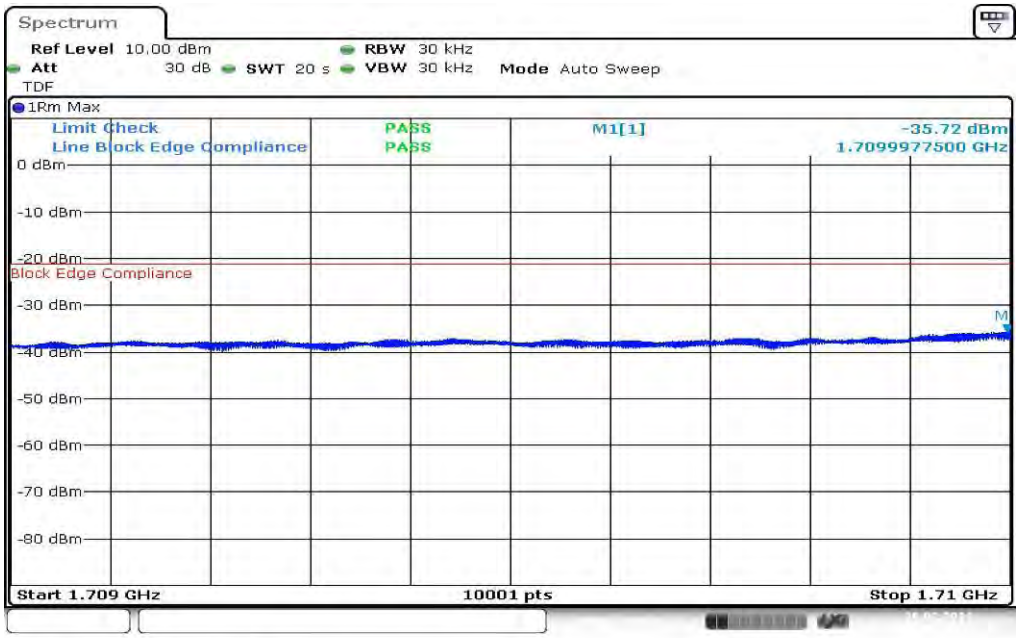


Plot 4: Highest channel, 16 – QAM modulation

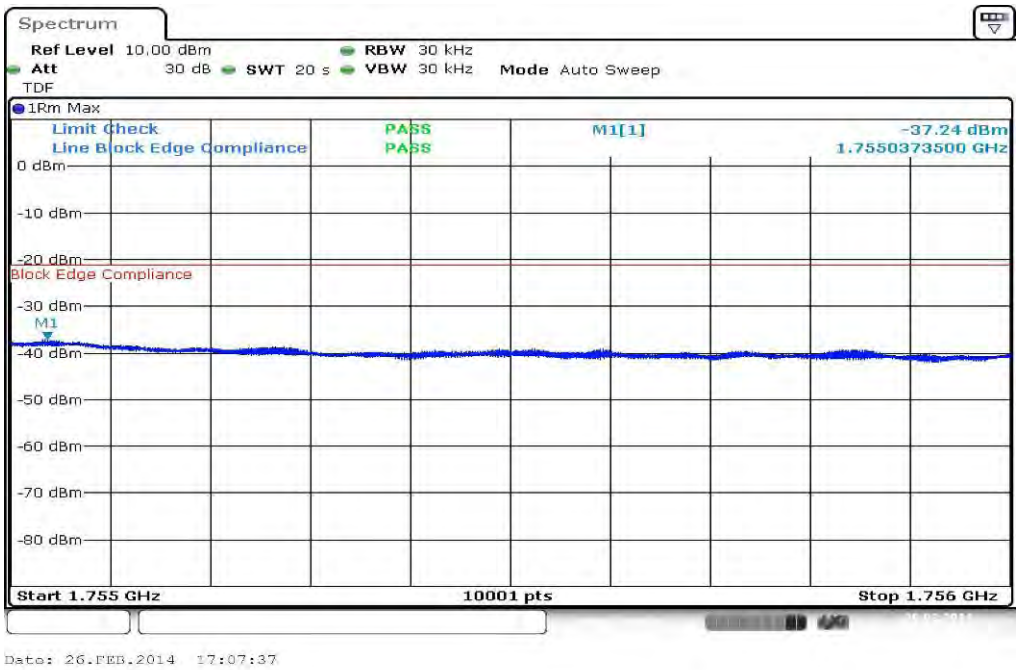


Results: **10 MHz channel bandwidth**

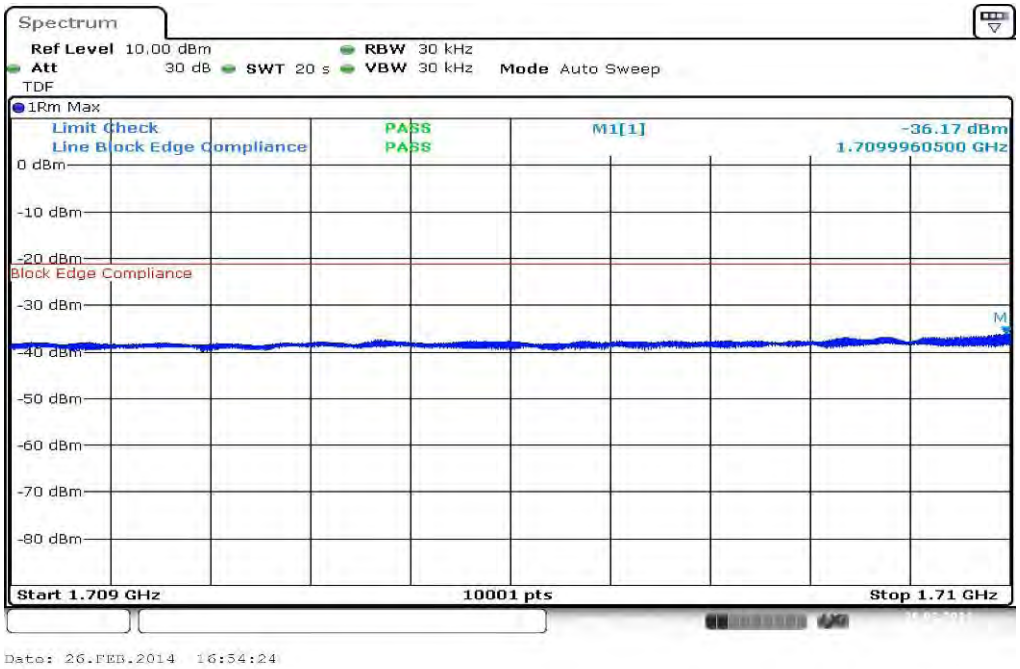
Plot 1: Lowest channel, QPSK modulation



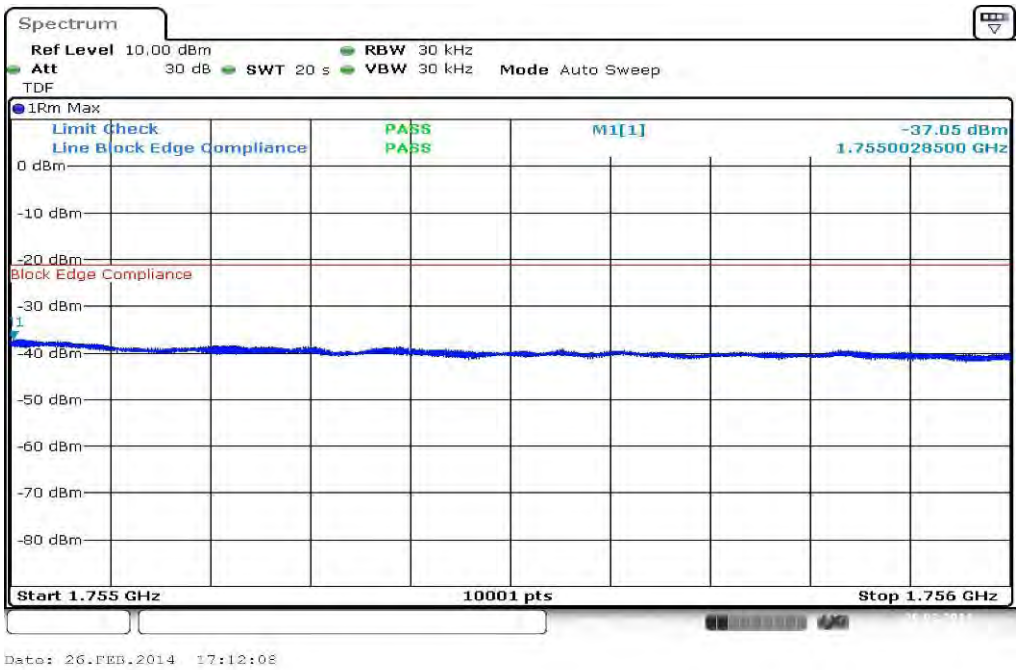
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

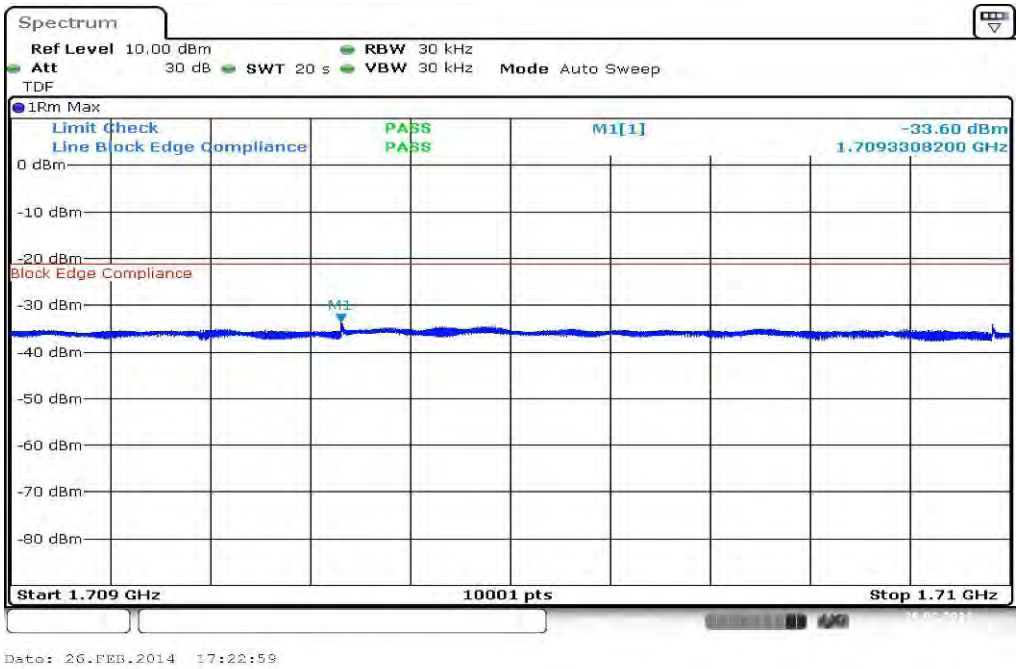


Plot 4: Highest channel, 16 – QAM modulation

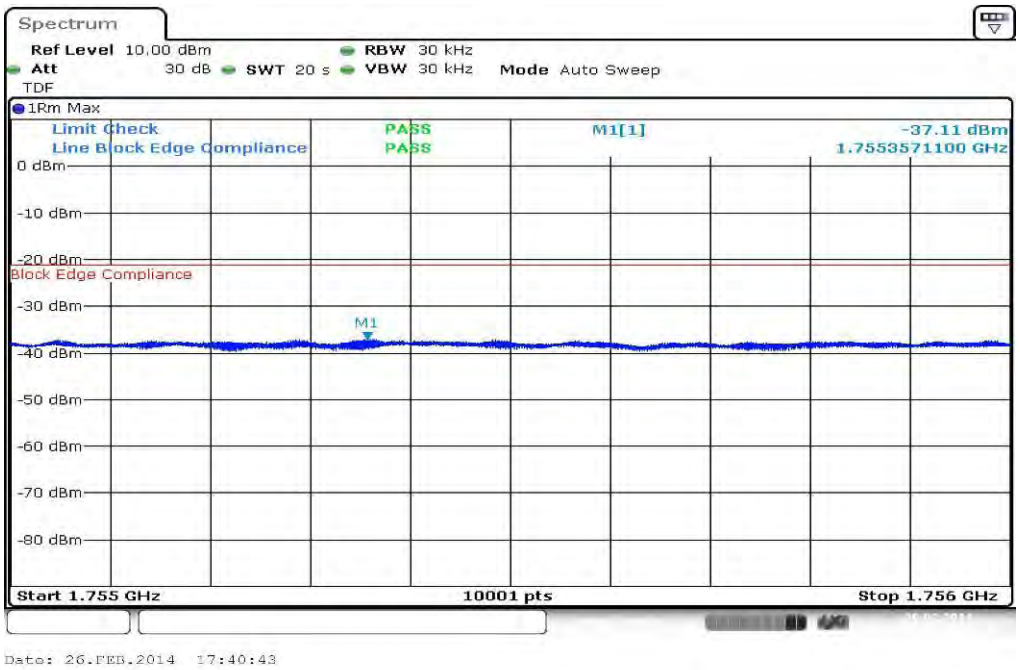


Results: **15 MHz channel bandwidth**

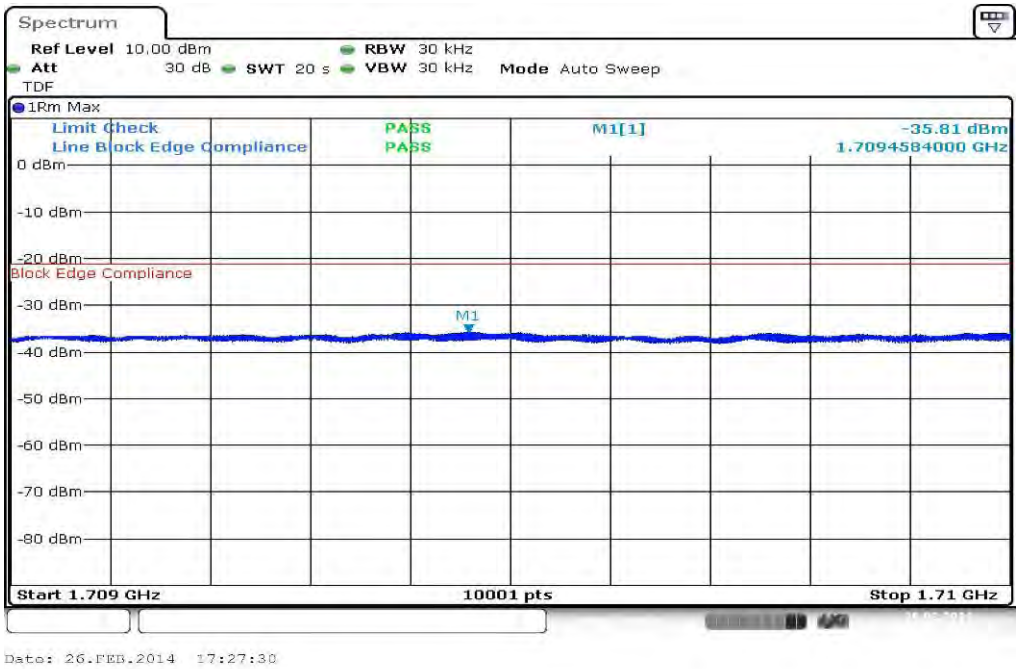
Plot 1: Lowest channel, QPSK modulation



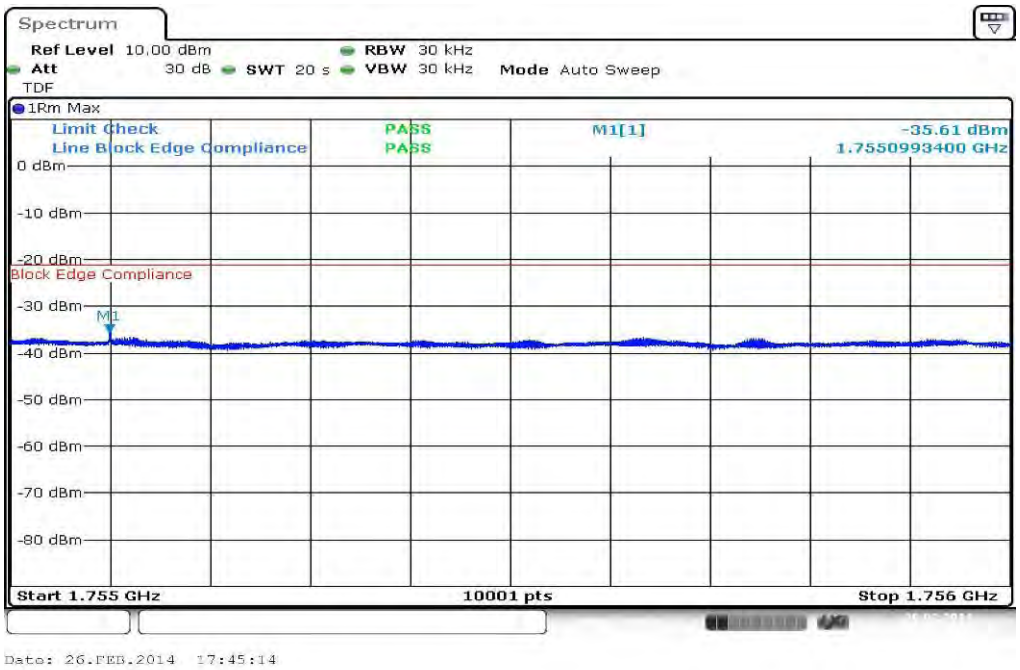
Plot 2: Highest channel, QPSK modulation



Plot 3: Lowest channel, 16 – QAM modulation

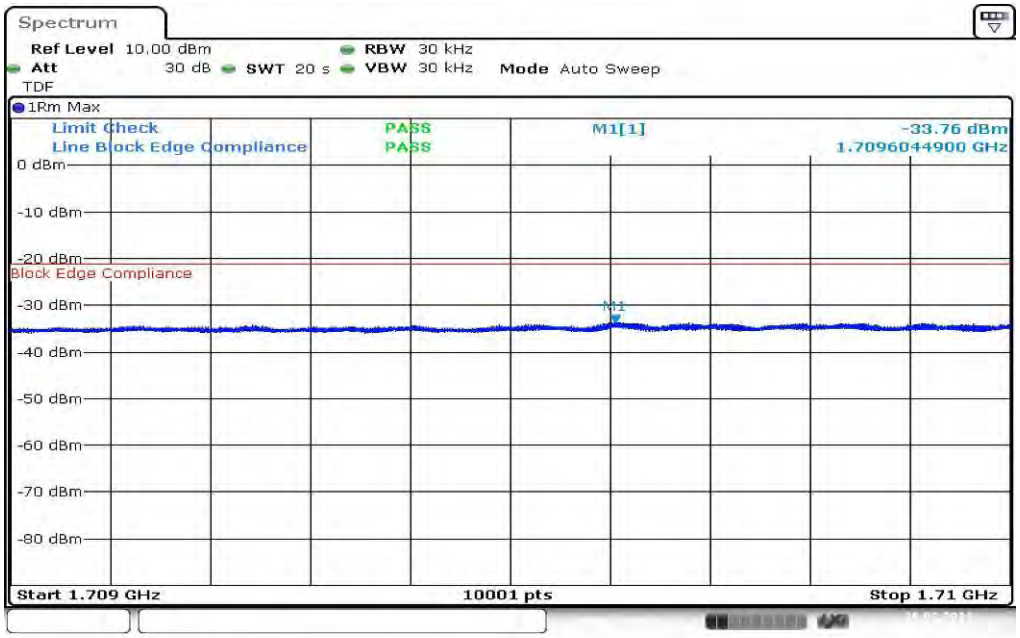


Plot 4: Highest channel, 16 – QAM modulation

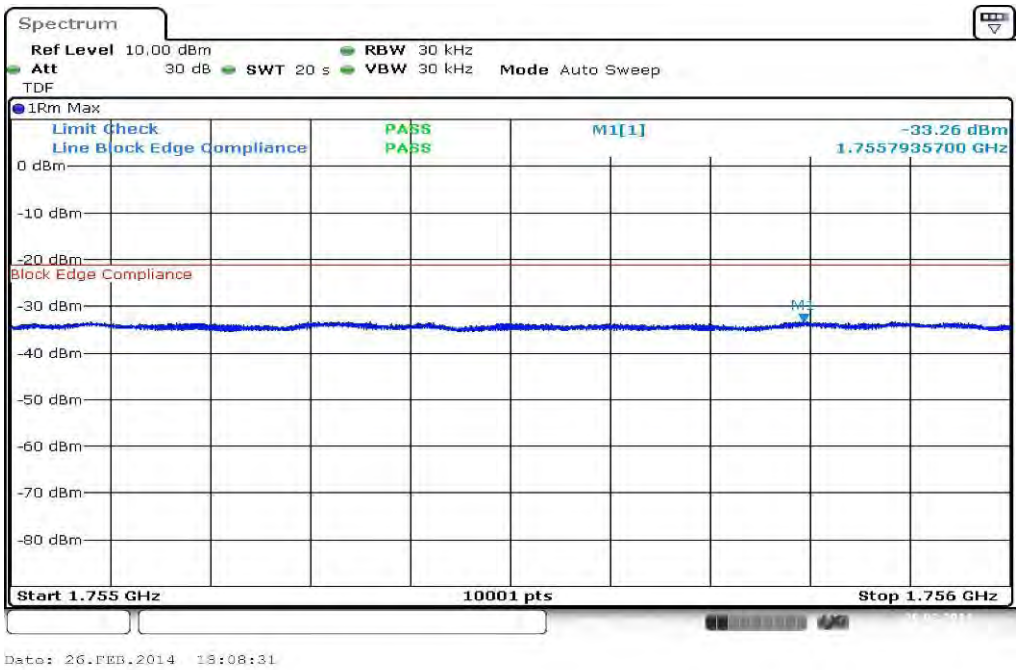


Results: **20 MHz channel bandwidth**

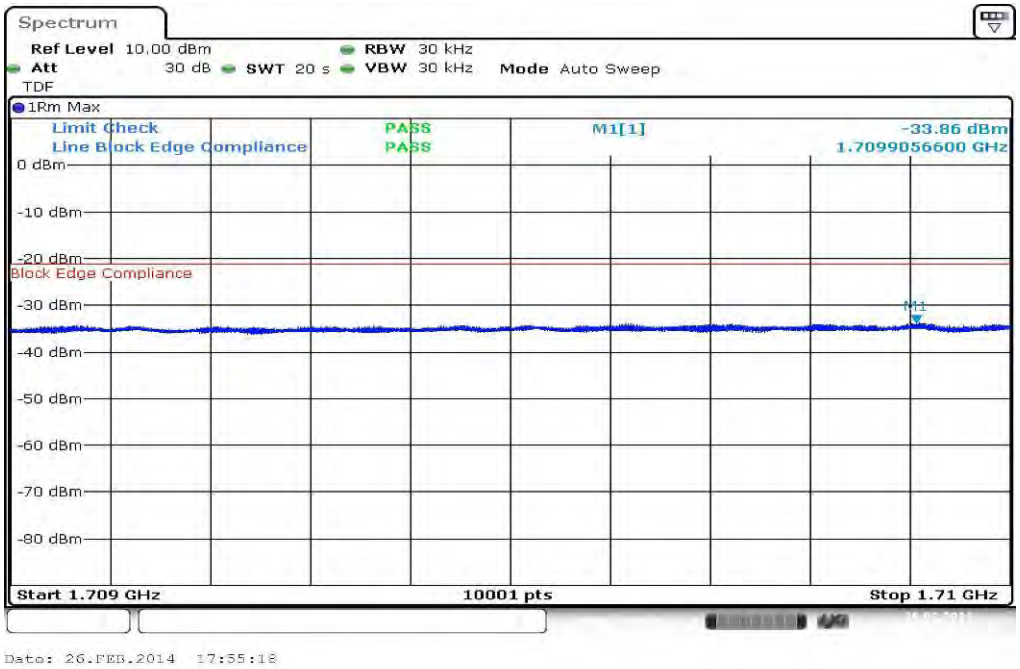
Plot 1: Lowest channel, QPSK modulation



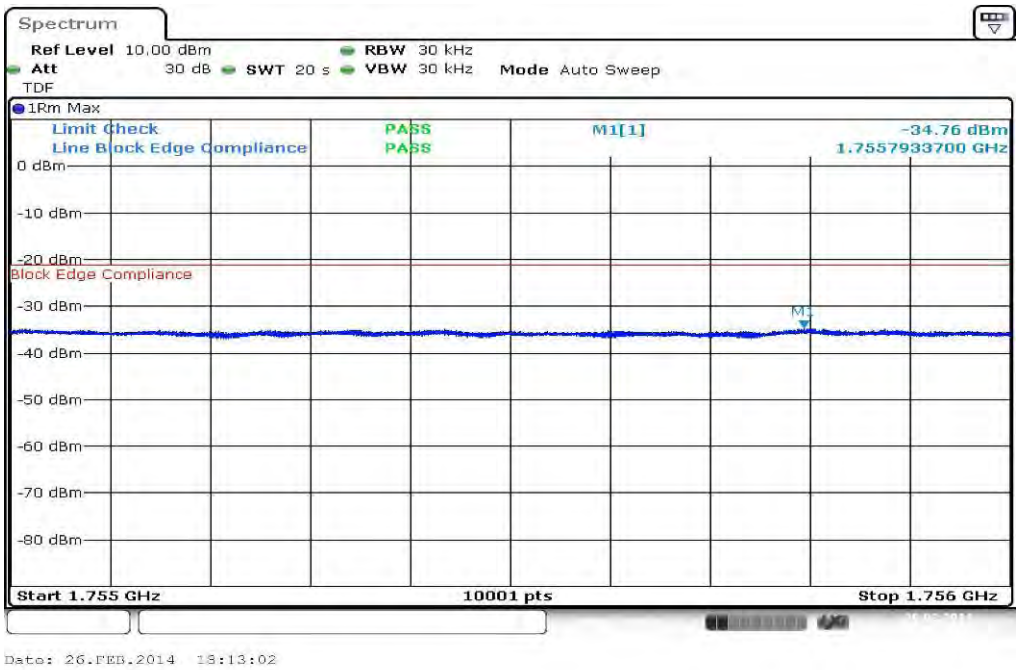
Plot 2: Highest channel, QPSK modulation



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 -26dBc 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:

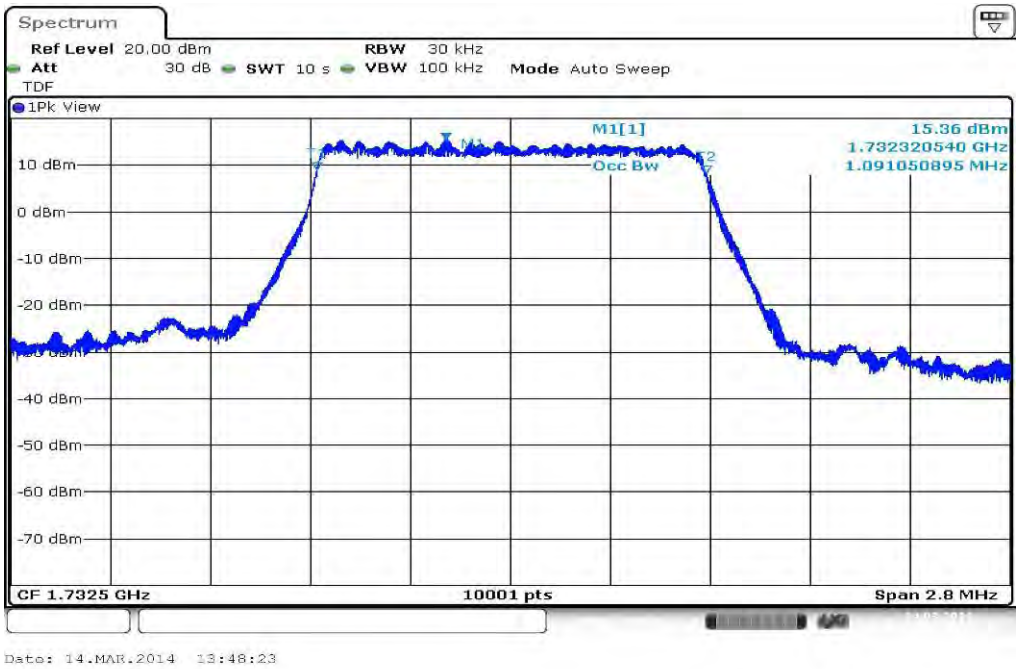
Occupied Bandwidth - QPSK		
Bandwidth [MHz]	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1.4	1091	1292
3	2733	3051
5	4502	4982
10	9065	10183
15	13442	14678
20	17934	19638
Measurement uncertainty	± 30 kHz to ± 500 kHz depending on channel bandwidth	

Occupied Bandwidth – 16-QAM		
Bandwidth [MHz]	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1.4	1096	1299
3	2726	3054
5	4519	5019
10	9061	10069
15	13430	14705
20	17930	19622
Measurement uncertainty	± 30 kHz to ± 500 kHz depending on channel bandwidth	

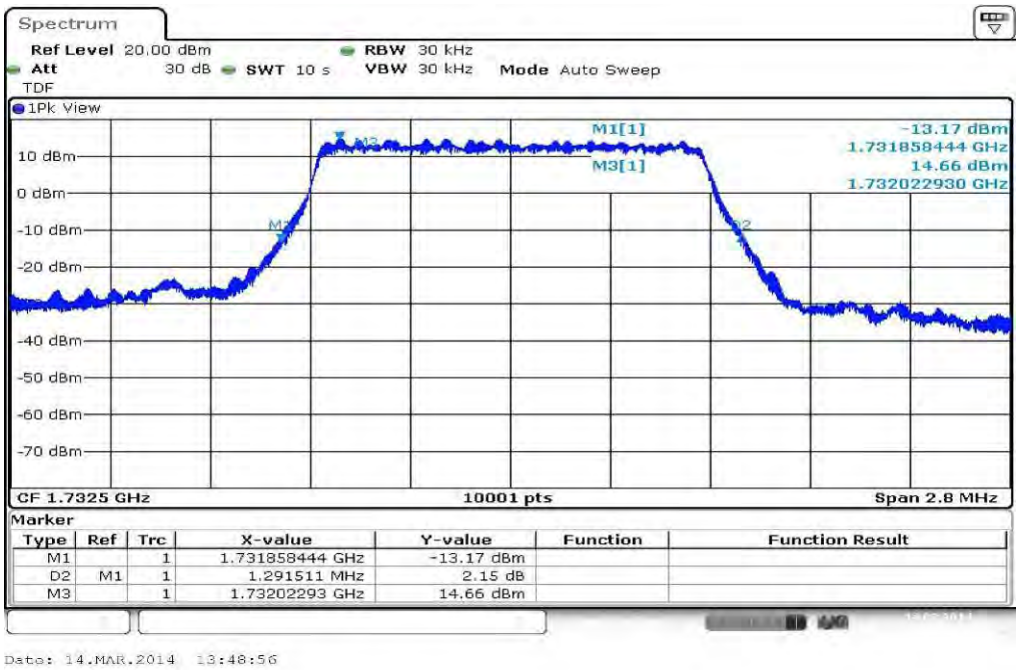
Result: **Passed**

Plots: QPSK

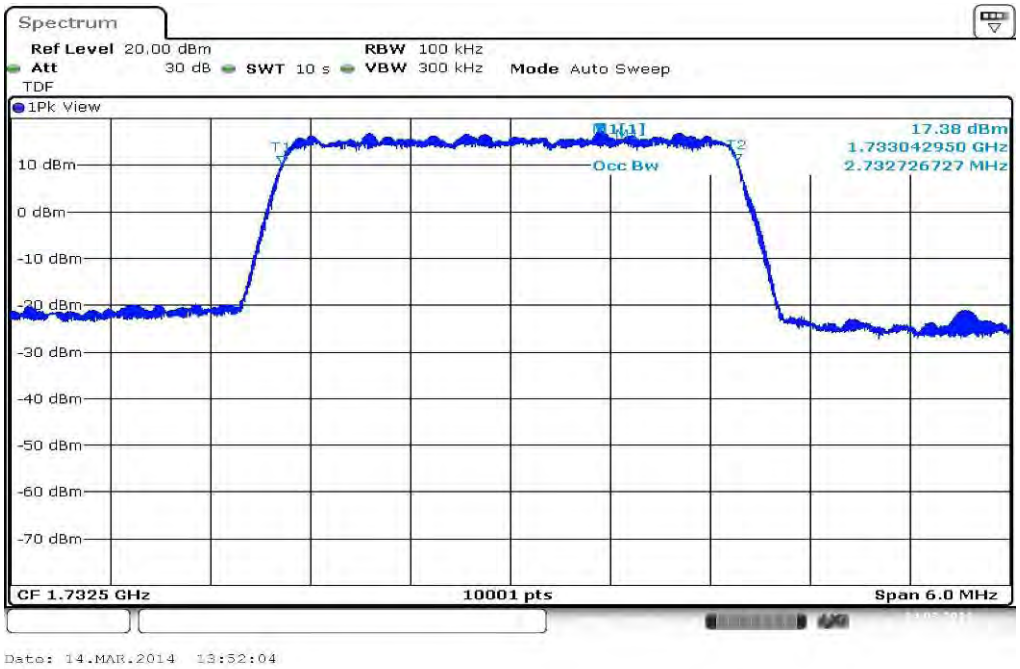
Plot 1: 1.4 MHz, 99% OBW



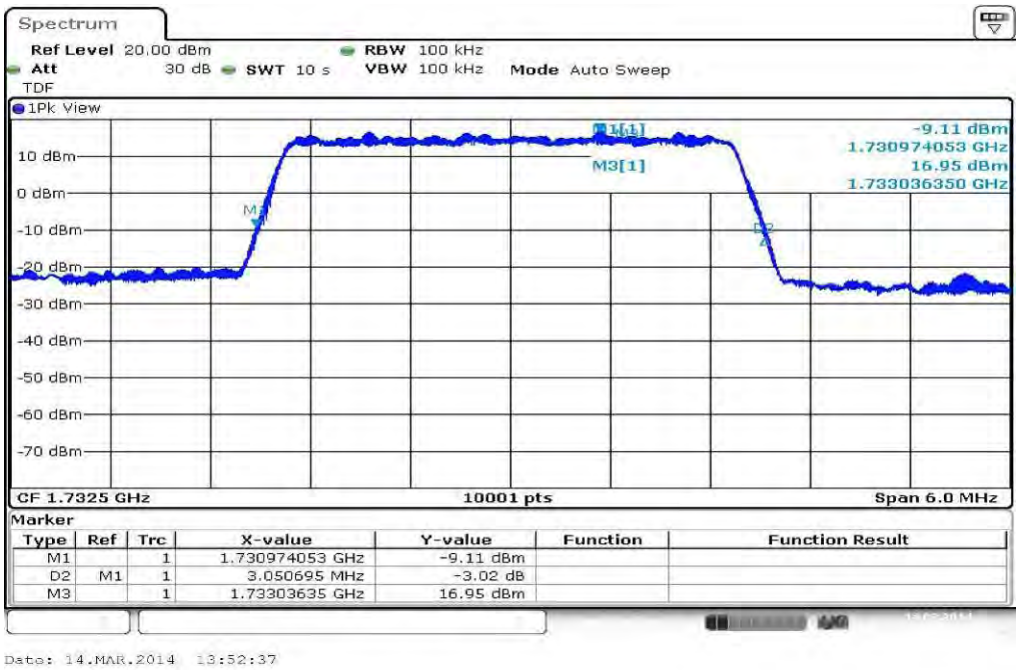
Plot 2: 1.4 MHz, -26 dBc OBW



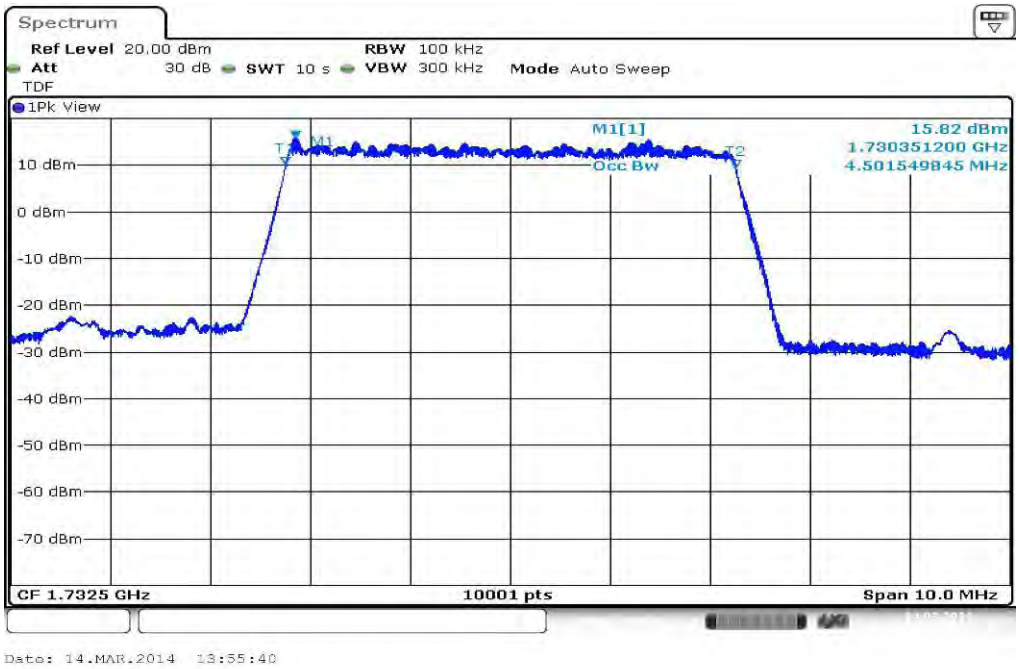
Plot 3: 3 MHz, 99% OBW



Plot 4: 3 MHz, -26 dBc OBW

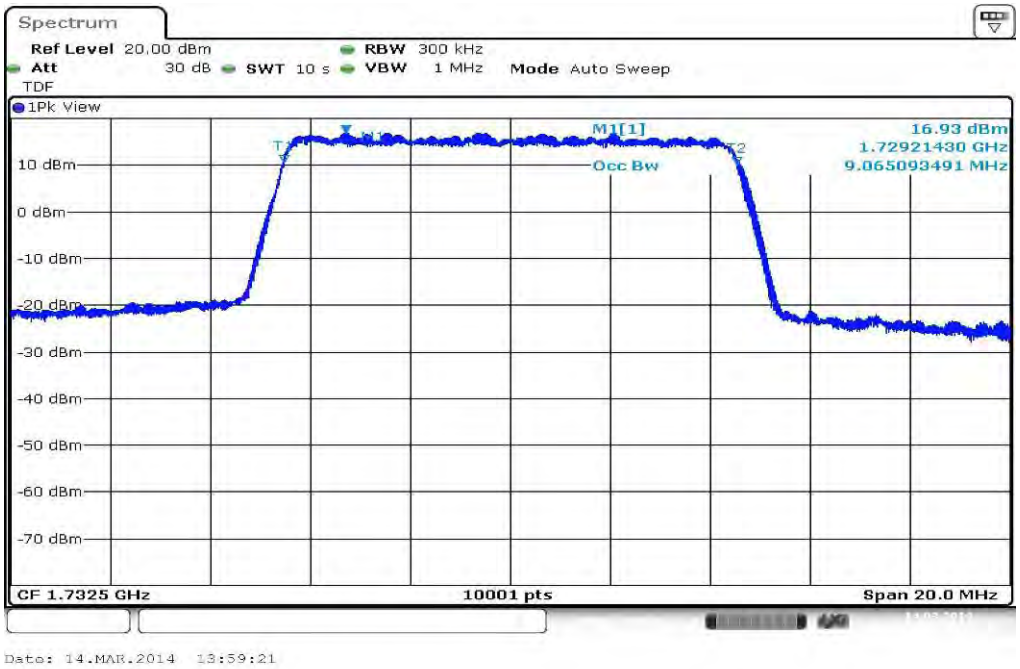


Plot 5: 5 MHz, 99% OBW

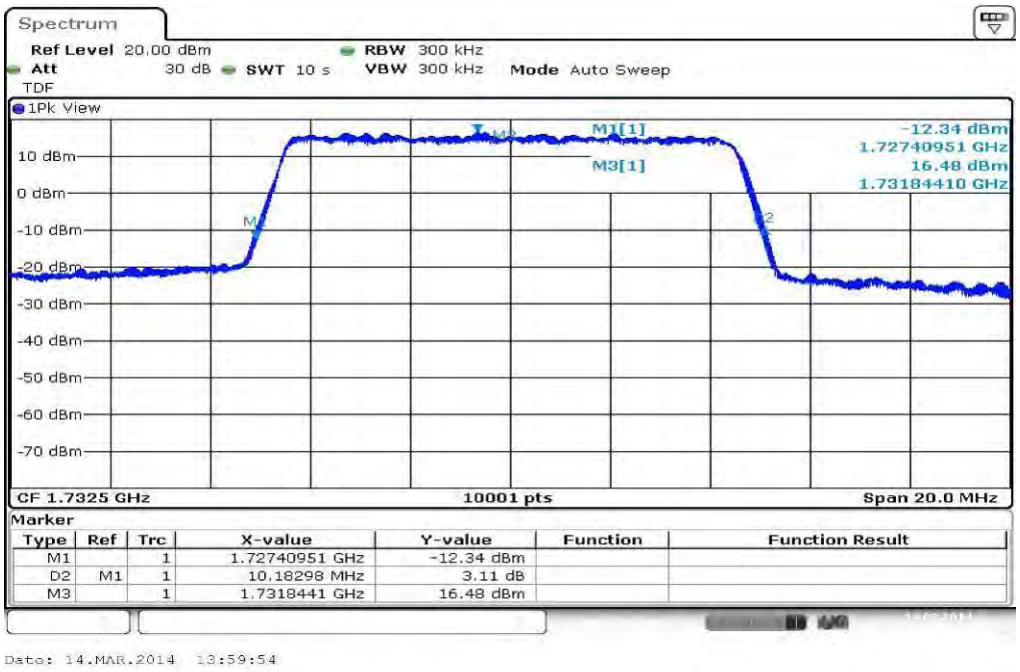


Plot 6: 5 MHz, -26 dBc OBW

Plot 7: 10 MHz, 99% OBW



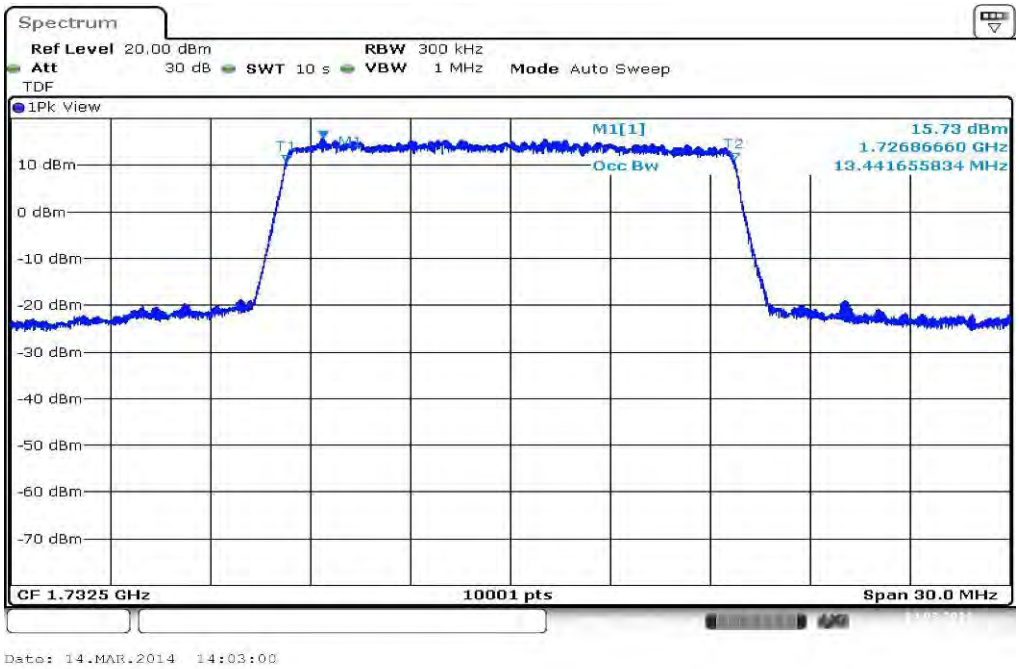
Plot 8: 10 MHz, -26 dBc OBW



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.72740951 GHz	-12.34 dBm		
D2	M1	1	10.18298 MHz	3.11 dB		
M3		1	1.7318441 GHz	16.48 dBm		

Plot 9: 15 MHz, 99% OBW

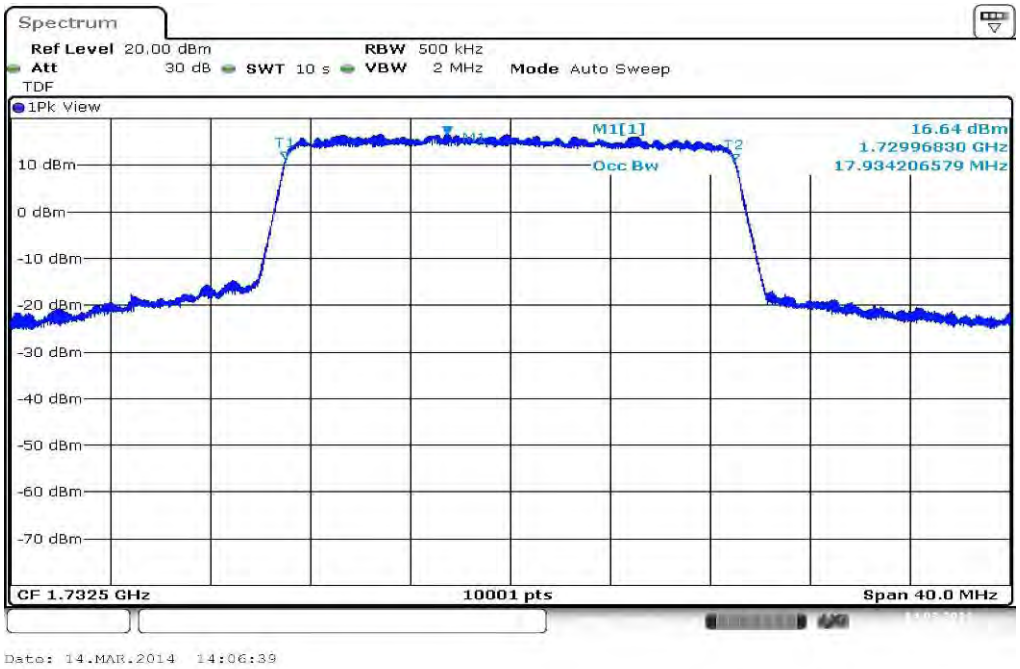


Plot 10: 15 MHz, -26 dBc OBW

Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.72514024 GHz	-11.14 dBm		
D2	M1	1	14.67753 MHz	0.62 dB		
M3		1	1.7268636 GHz	15.30 dBm		

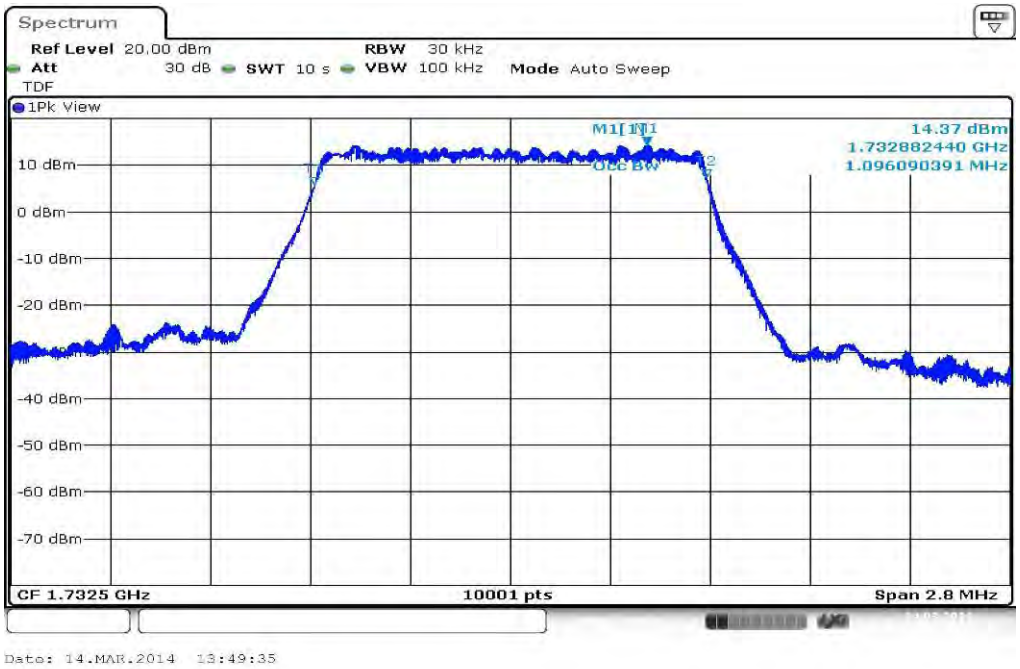
Plot 11: 20 MHz, 99% OBW



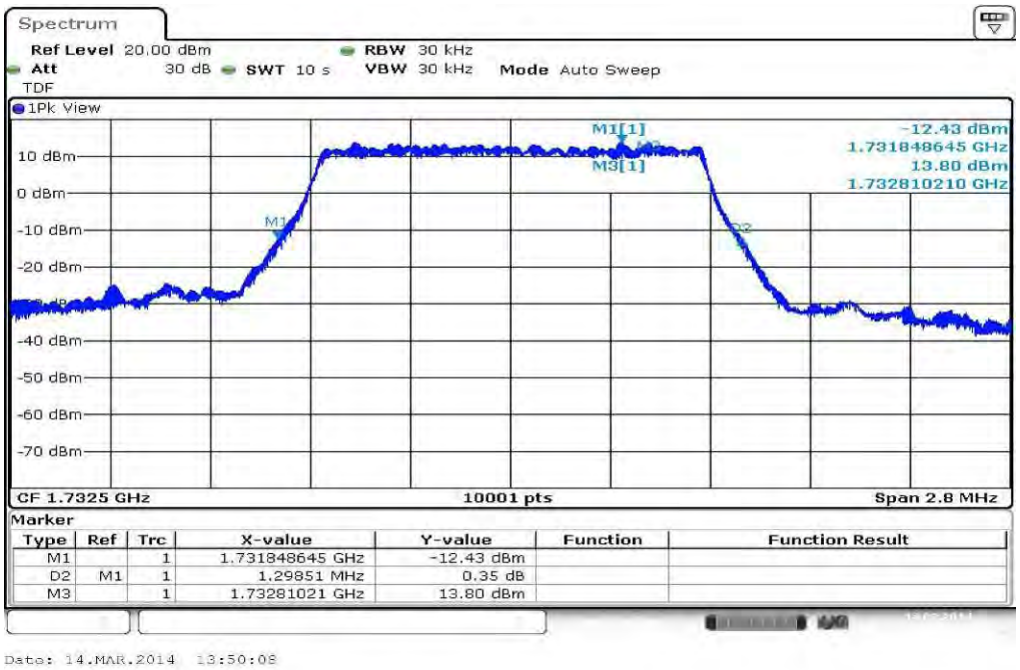
Plot 12: 20 MHz, -26 dBc OBW

Plots: 16-QAM

Plot 1: 1.4 MHz, 99% OBW

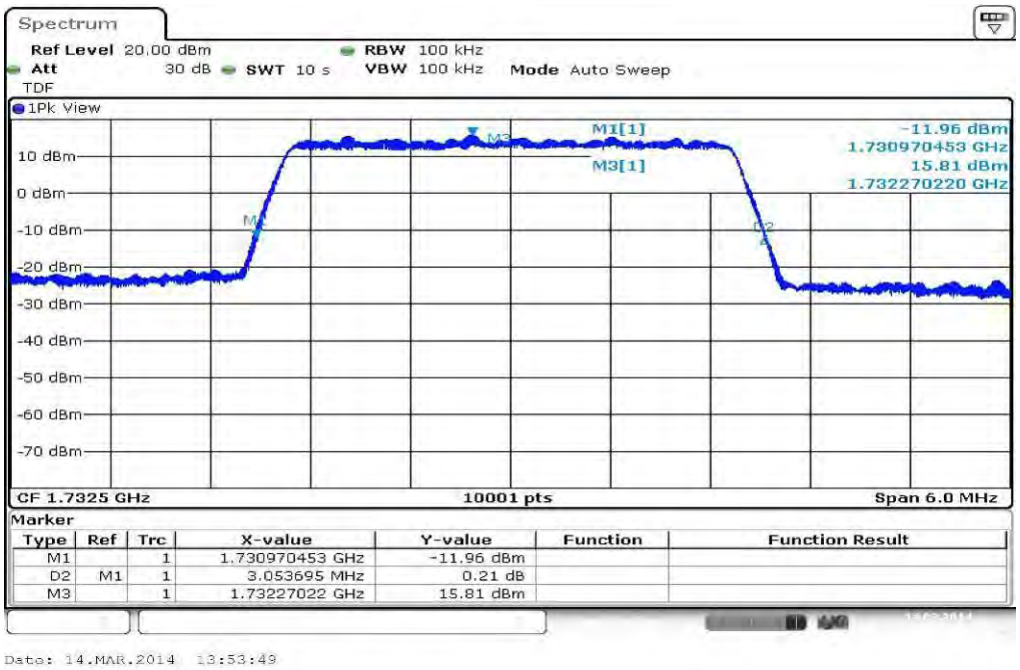


Plot 2: 1.4 MHz, -26 dBc OBW

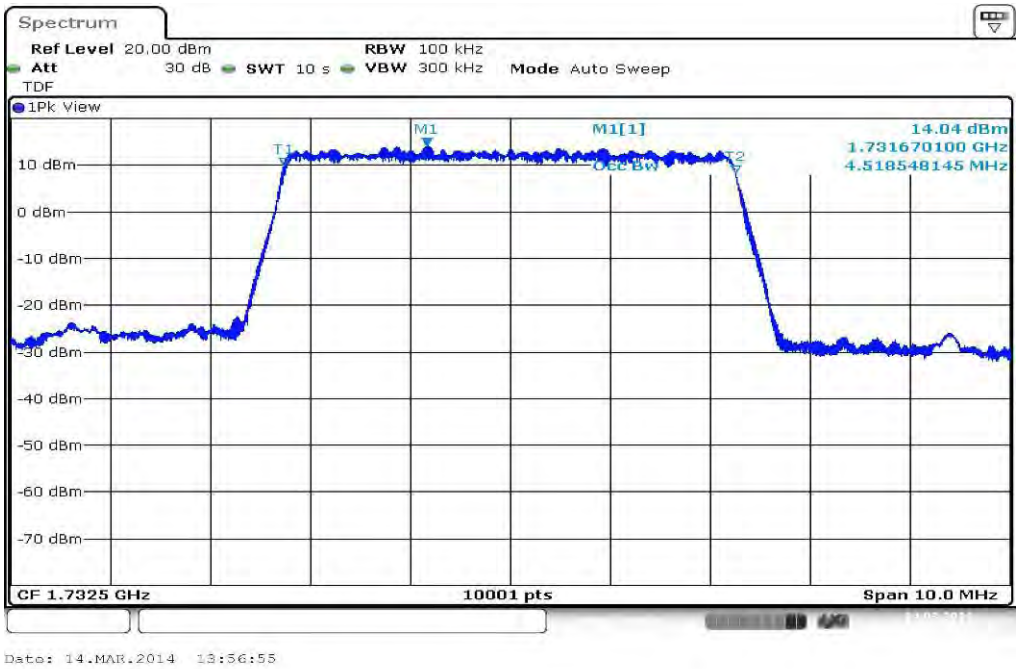


Plot 3: 3 MHz, 99% OBW

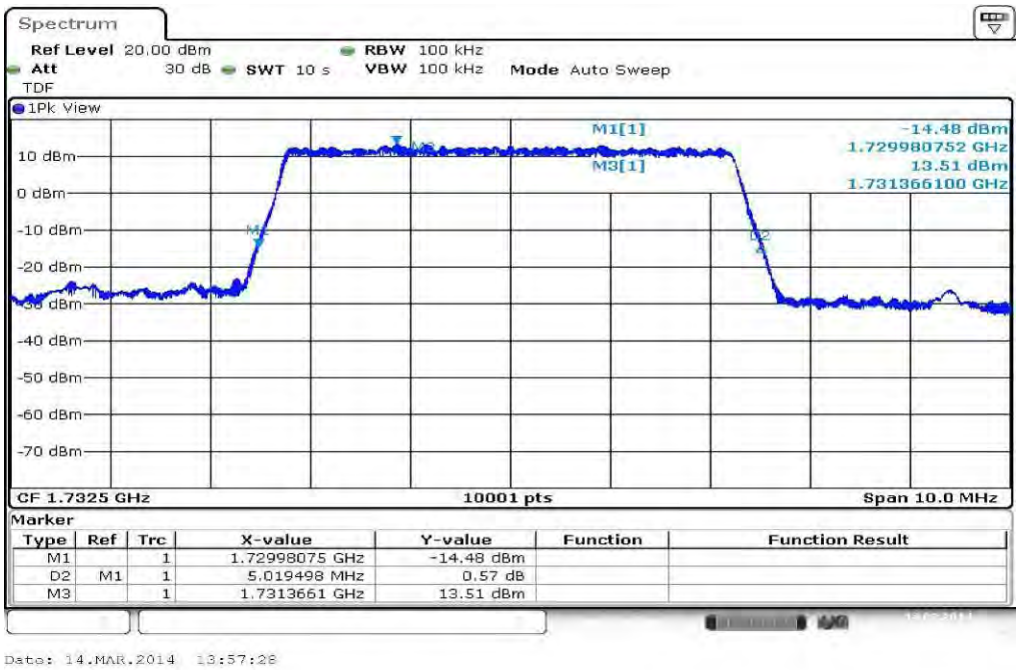
Plot 4: 3 MHz, -26 dBc OBW



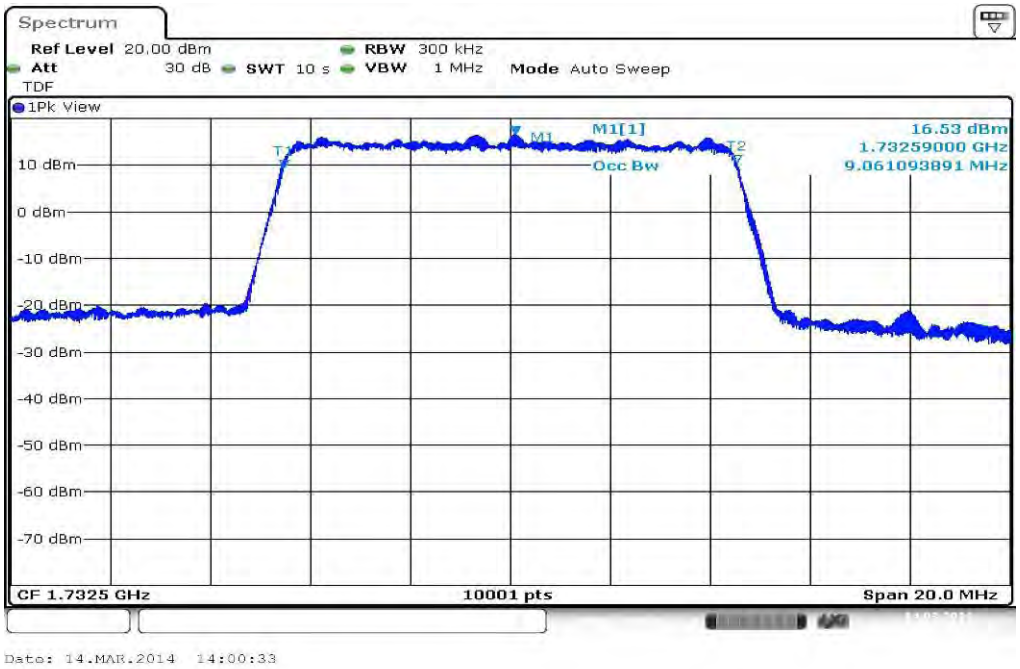
Plot 5: 5 MHz, 99% OBW



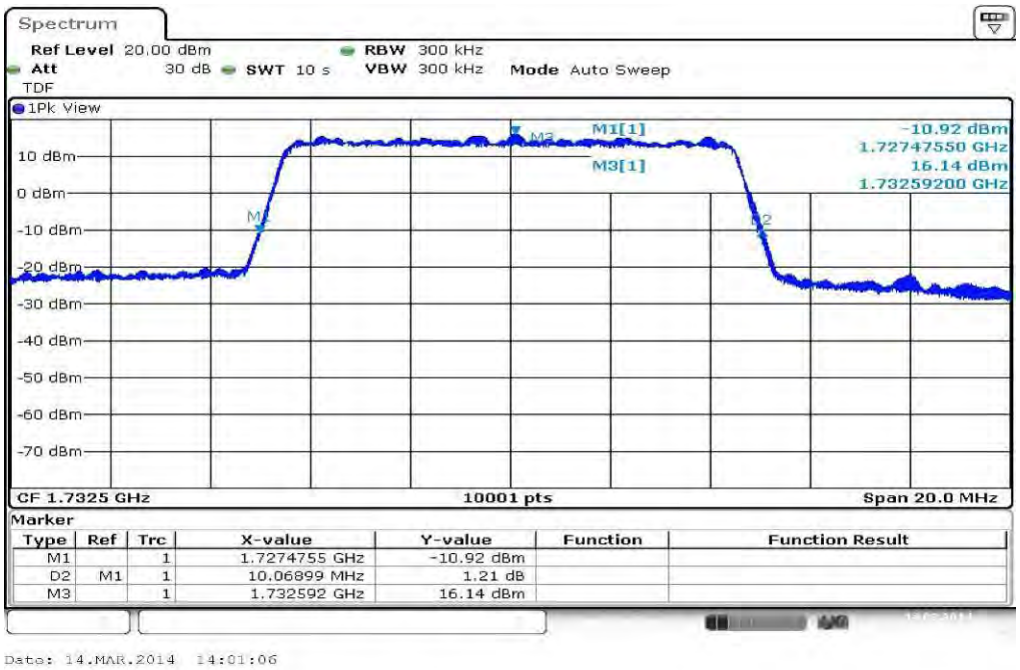
Plot 6: 5 MHz, -26 dBc OBW



Plot 7: 10 MHz, 99% OBW



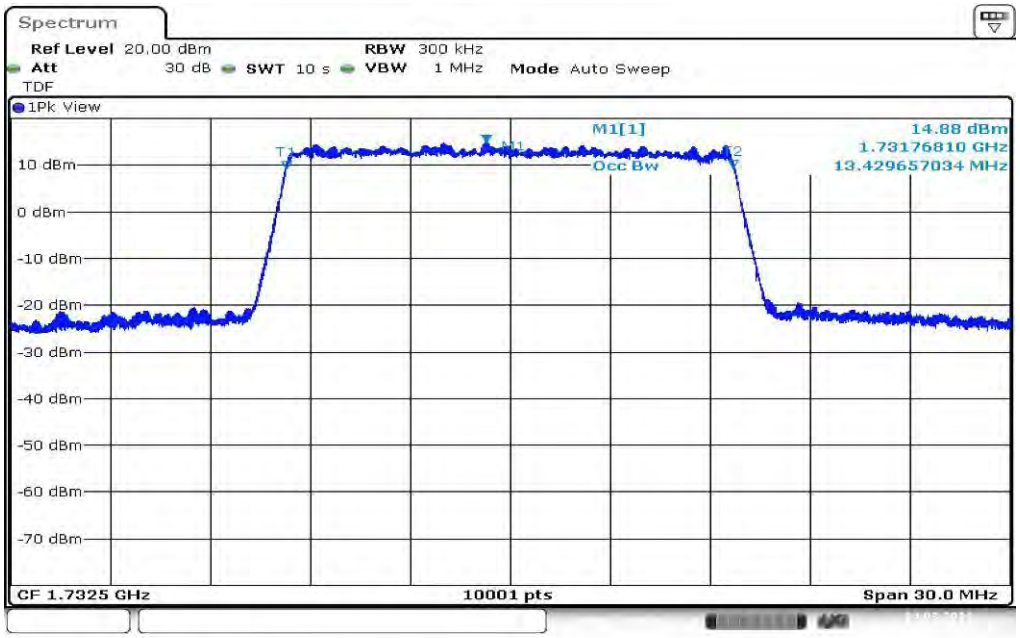
Plot 8: 10 MHz, -26 dBc OBW



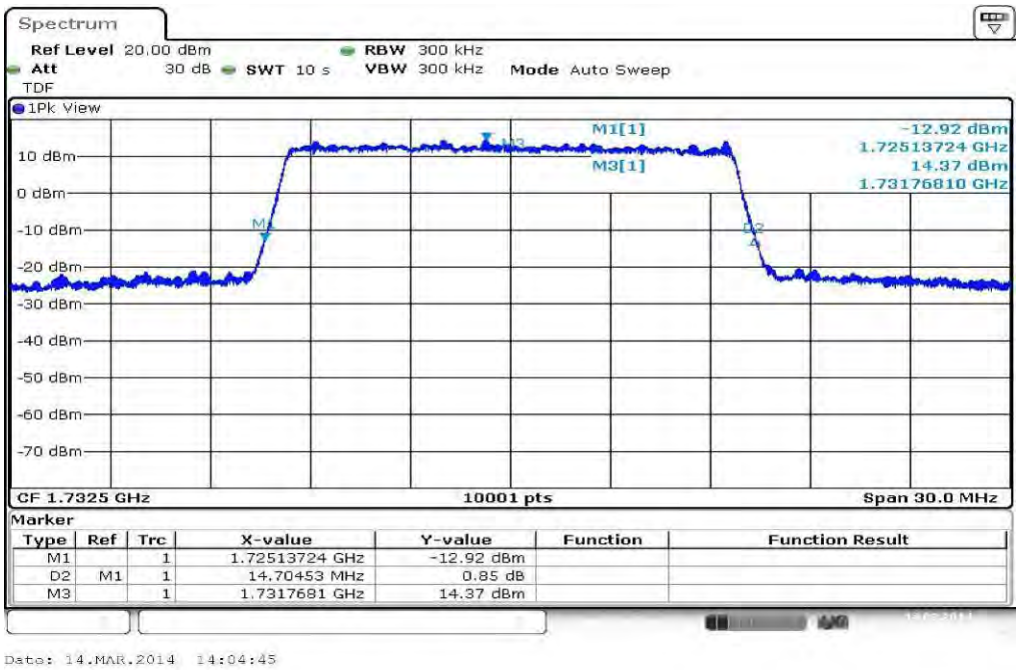
Marker

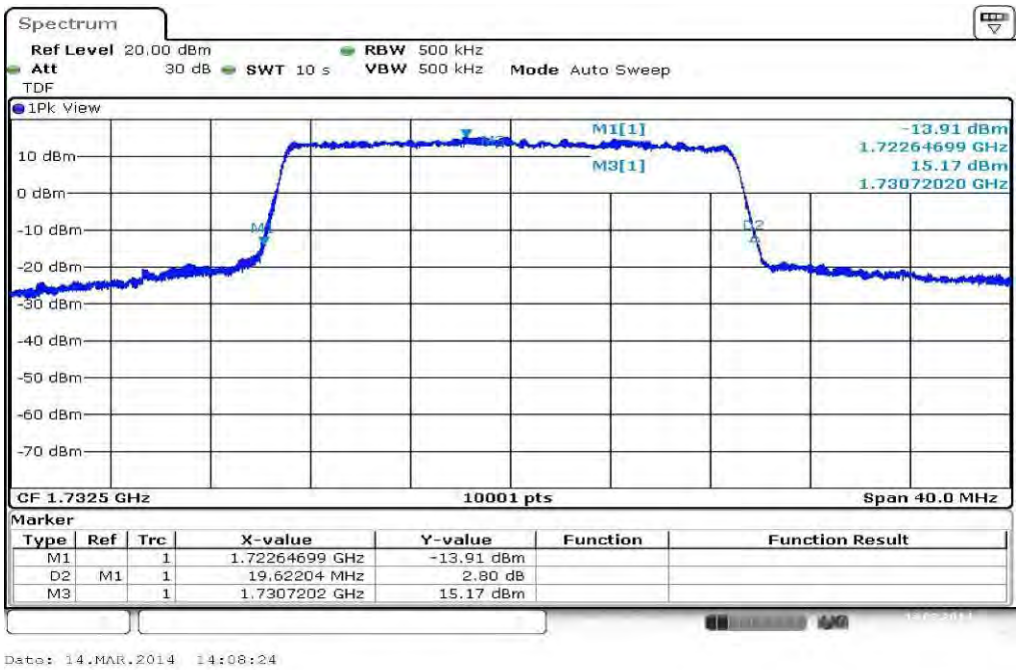
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.7274755 GHz	-10.92 dBm		
D2	M1	1	10.06899 MHz	1.21 dB		
M3		1	1.732592 GHz	16.14 dBm		

Plot 9: 15 MHz, 99% OBW



Plot 10: 15 MHz, -26 dBc OBW



Plot 11: 20 MHz, 99% OBW

Plot 12: 20 MHz, -26 dBc OBW