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consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-9521/15-01-04-A

Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing laboratory

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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-12076-01-00

Applicant

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Manufacturer

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Test standard/s

47 CFR Part 27	Title 47 of the Code of Federal Regulations; Chapter I; Part 27 - Miscellaneous wireless communications services
RSS - 130 Issue 1	Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz
RSS - 139 Issue 3	Spectrum Management and Telecommunications Radio Standards Specification - Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz

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

Test Item

Kind of test item:	LTE SMT module (data only)
Model name:	PLS8-X
FCC ID:	QIPPLS8-X
IC:	7830A-PLS8X
Frequency:	LTE Band 4;13 and 17
Technology tested:	LTE
Antenna:	External antenna
Power supply:	3.8 V DC by external power supply
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:



Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:



p.o.
Tobias Wittenmeier
Testing Manager
Radio Communications & EMC

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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.

This test report replaces the test report with the number 1-9521/15-01-04 and dated 2015-06-24

2.2 Application details

Date of receipt of order:	2015-03-12
Date of receipt of test item:	2015-03-16
Start of test:	2015-03-17
End of test:	2015-08-04
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
RSS - 130 Issue 1	October 2013	Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz
RSS - 139 Issue 3	July 2015	Spectrum Management and Telecommunications Radio Standards Specification - Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz

3.1 Measurement guidance

Guidance	Version	Description
ANSI C63.4-2014	-/-	American national standard for methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz

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:		55 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	3.8 V DC by external power supply
	V_{max}	4.2 V
	V_{min}	3.3 V

5 Test item

Kind of test item	:	LTE SMT module (data only)
Type identification	:	PLS8-X
FCC ID	:	QIPPLS8-X
IC	:	7830A-PLS8X
PMN	:	Cinterion PLS8-X
HVIN	:	PLS8-X
FVIN	:	-/-
HMN	:	-/-
S/N serial number	:	No information available
HW hardware status	:	Rev. 2.3
SW software status	:	Rev. 02.502
Frequency band [MHz]	:	LTE Band 4;13 and 17
Type of radio transmission	:	OFDM
Use of frequency spectrum	:	
Type of modulation	:	QPSK, 16 – QAM
Antenna	:	External antenna
Power supply	:	3.8 V DC by external power supply
Temperature range	:	-30°C to +60°C

5.1 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-9521/15-01-01_AnnexA
1-9521/15-01-01_AnnexC

6 Test laboratories sub-contracted

None

7 Description of the test setup, test equipment and ancillaries used for tests

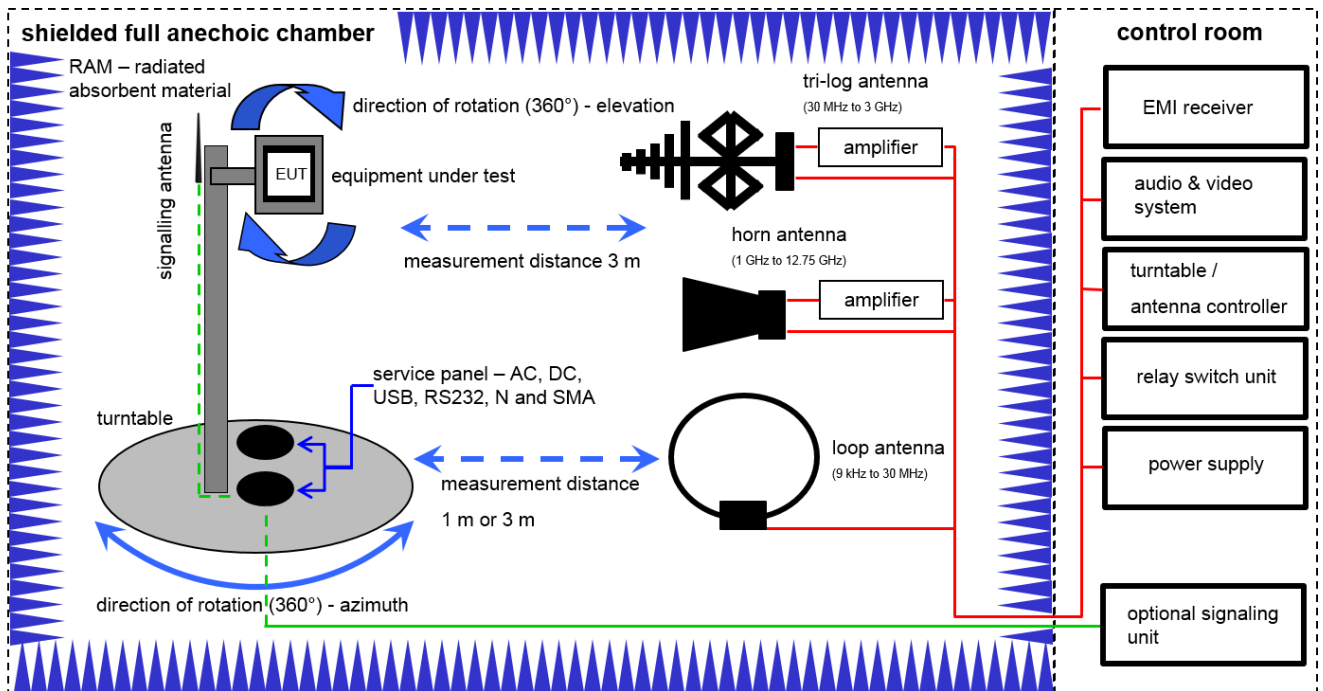
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, rf-generating and signalling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Radiated measurements chamber C



$$OP = AV + D - G + CA$$

(OP-output power; AV-analyzer value; D-distance; G-antenna gain+amplifier gain; CA-loss signal path)

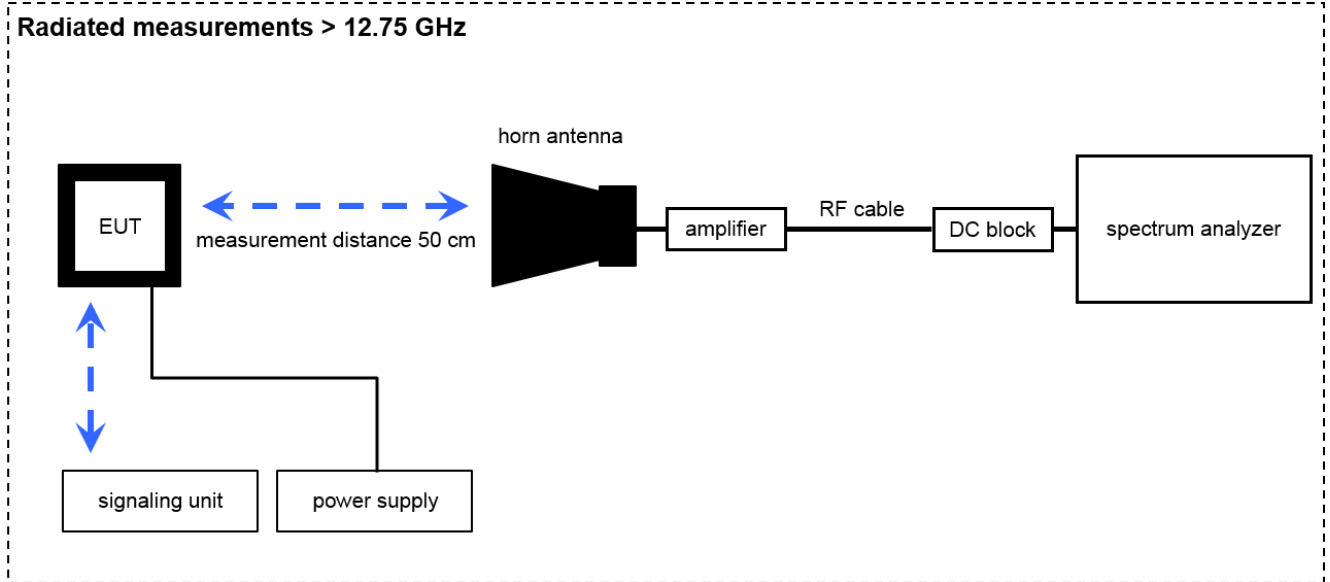
Example calculation:

$$OP \text{ [dBm]} = -11.0 \text{ [dBm]} + 47 \text{ [dB]} - 8 \text{ [dB]} + 5 \text{ [dB]} = 33 \text{ [dBm]} (2 \text{ W})$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2	A	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	08.05.2013	08.05.2015
3	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
4	A	Switch / Control Unit	3488A	HP	*	300000199	ne		
5	A	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
6	A	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
7	A	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
8	A	TRILOG Broadband Test-Antenna 30 MHz – 3 GHz	VULB9163	Schwarzbeck	371	300003854	vIKI!	29.10.2014	29.10.2017
9	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
10	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		
11	A	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	vIKI!	28.01.2015	28.01.2017

7.2 Radiated measurements > 12.75 GHz



$$OP = AV + D - G + CA$$

(OP-output power; AV-analyzer value; D-distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:

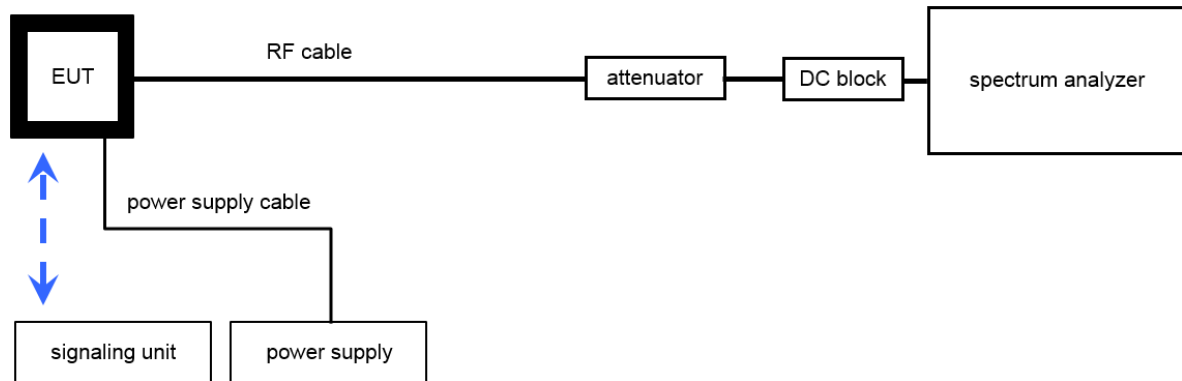
$$OP [dBm] = -41.0 [dBm] + 26 [dB] - 20 [dB] + 5 [dB] = -30 [dBm] \quad (1 \mu W)$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Std. Gain Horn Antenna 12.4 to 18.0 GHz	639	Narda	8402	300000786	ne		
2	A	Std. Gain Horn Antenna 18.0 to 26.5 GHz	638	Narda	8402	300000486	ne		
3	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
4	A	Amplifier 2-40 GHz	JS32-02004000-57-5P	MITEQ	1777200	300004541	ev		
5	A	RF-Cable	ST18/SMAm/SMAm/48	Huber & Suhner	Batch no. 600918	400001182	ev		
6	A	RF-Cable	ST18/SMAm/SMm/48	Huber & Suhner	Batch no. 127377	400001183	ev		
7	A	DC-Blocker 0.1-40 GHz	8141A	Inmet		400001185	ev		
8	A	Power Supply 0-20V; 0-5A	6632B	HP	US37478366	400000117	vIKI!	20.01.2015	20.01.2017
9	A	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	vIKI!	28.01.2015	28.01.2017

7.3 Conducted measurements

Conducted measurements normal conditions



$$OP = AV + CA$$

(OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:

$$OP \text{ [dBm]} = 6.0 \text{ [dBm]} + (11.7) \text{ [dB]} = 17.7 \text{ [dBm]} (58.88 \text{ mW})$$

Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A, B	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
2	A	Signal Analyzer 40 GHz	FSV40	R&S	101042	300004517	k	22.01.2015	22.01.2016
3	A, B	Power Supply 0-20V; 0-5A	6632B	HP	US37478366	400000117	vIKI!	20.01.2015	20.01.2017
4	A, B	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	vIKI!	28.01.2015	28.01.2017
5	B	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	Ve	26.09.2013	26.09.2015
6	A, B	RF-Cable	ST18/SMAm/SMAm/72	Huber & Suhner	Batch no. 699714	400001184	ev		
7	A	DC-Blocker 0.1-40 GHz	8141A	Inmet		400001185	ev		
8	A	Coax Attenuator 10 dB 2W 0-40 GHz	MCL BW-K10-2W44+	Mini Circuits		400001186	ev		

8 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
RF output power conducted	± 1 dB
RF output power radiated	± 3 dB
Frequency stability	± 20 Hz
Spurious emissions radiated below 30 MHz	± 3 dB
Spurious emissions radiated 30 MHz to 1 GHz	± 3 dB
Spurious emissions radiated 1 GHz to 12.75 GHz	± 3.7 dB
Spurious emissions radiated above 12.75 GHz	± 4.5 dB
Spurious emissions conducted	± 3 dB
Block edge compliance	± 3 dB
Occupied bandwidth	± RBW

9 Sequence of testing

9.1 Sequence of testing 9 kHz to 30 MHz

Setup

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.5 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with RMS (RMS / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

9.2 Sequence of testing 30 MHz to 1 GHz

Setup

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 10 or 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.
-

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions
-

Final measurement

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter.
- The final measurement will be done with RMS (RMS / see ANSI C 63.4) detector with an EMI receiver
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

9.3 Sequence of testing 1 GHz to 12.75 GHz

Setup

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter (see ANSI C 63.4) – see each test details
- The EUT was set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height is 1.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement

- The final measurement will be performed with minimum the six highest peaks according the requirements of the ANSI C63.4.
- According to the maximum found antenna polarization and turntable position of the premeasurement the software maximizes the peaks by rotating the turntable position (0° to 360°). This measurement is repeated for different EUT-table positions (0° to 150° in 30°-steps). This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and RMS (RMS / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

9.4 Sequence of testing above 12.75 GHz

Setup

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 0.5 meter
- The EUT was set into operation.

Premeasurement

- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and RMS (RMS / see ANSI C 63.4) detector
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

10 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC identifier	Description	verdict	date	Remark
RF-Testing	CFR Part 27 RSS-130, RSS 139	See table	2015-08-05	-/-

10.1 LTE – Band 4

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Frequency Stability	Extreme	Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Spurious Emissions Radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Spurious Emissions Conducted	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Block Edge Compliance	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Occupied Bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

10.2 LTE – Band 13

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Frequency Stability	Extreme	Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Spurious Emissions Radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Spurious Emissions Conducted	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Block Edge Compliance	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Occupied Bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

10.3 LTE – Band 17

Test Case	temperature conditions	power source voltages	C	NC	NA	NP	Remark
RF Output Power	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Frequency Stability	Extreme	Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Spurious Emissions Radiated	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Spurious Emissions Conducted	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Block Edge Compliance	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-
Occupied Bandwidth	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-/-

Note: C = Compliant; NC = Not compliant; NA = Not applicable; NP = Not performed

11 RF measurements**11.1 LTE technologies supported by EUT**Channel bandwidth

	Band 4	Band 13	Band 17
[MHz]			
1.4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
15	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11.2 Results LTE – Band 4

The EUT was set to transmit the maximum power.

11.2.1 RF output power

Description:

This paragraph contains average power, peak output power, PAPR and ERP measurements for the mobile station.

The plots in this test report represents only an example of the measurements. All plots of this chapter are available on request.

The red line in the measurements indicates the ideal Gaussian distribution for the measured amplitude range.

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:	Sample
AQT:	15.6 ms
Resolution bandwidth:	40 MHz
Used equipment:	see chapter 7.1 – A and chapter 7.2 – A
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
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:

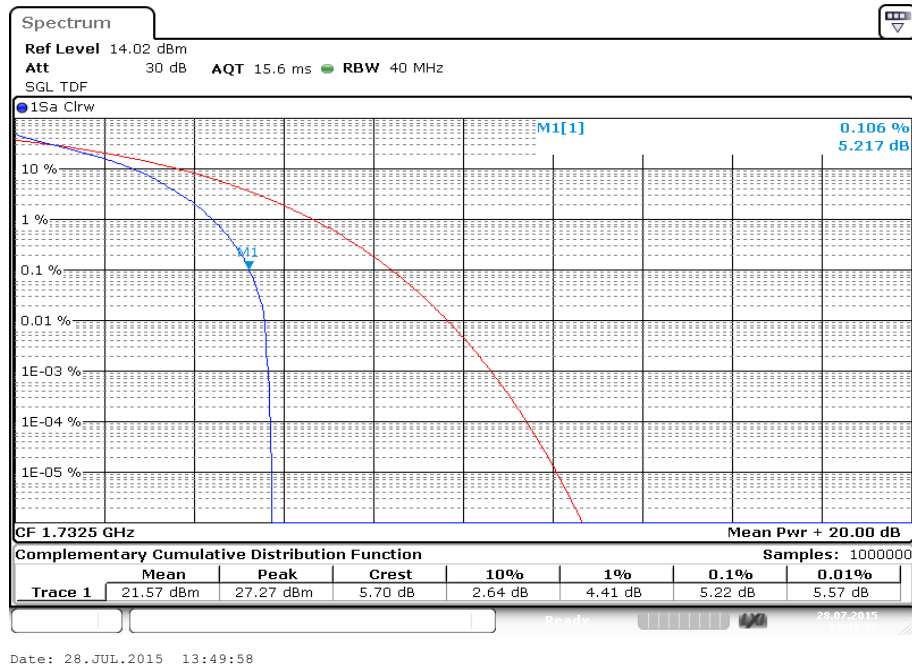
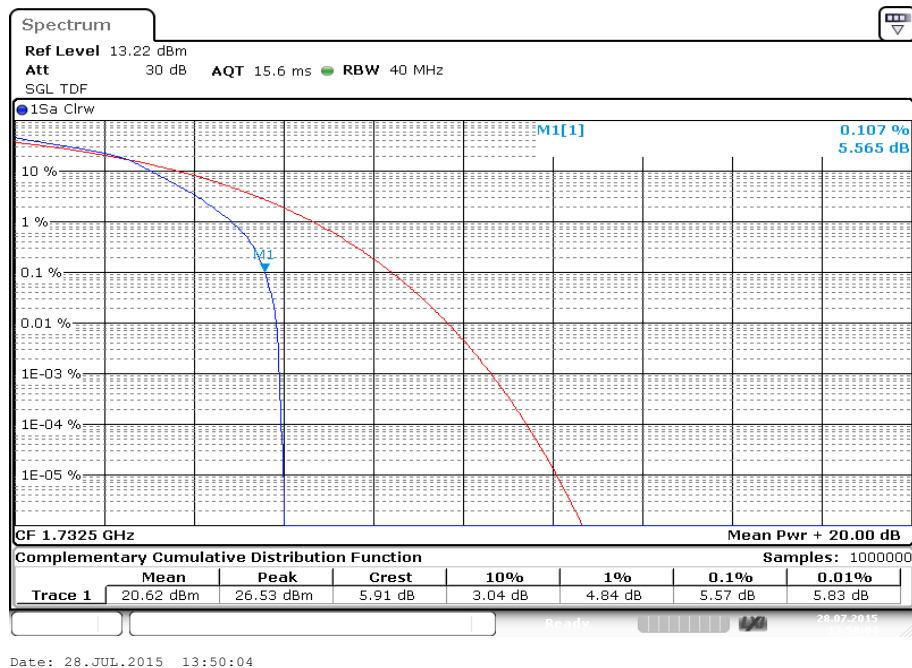
Output Power (conducted)								
Bandwidth (MHz)	Frequency (MHz)	Resource block allocation	Peak Output Power (dBm) QPSK	Average Output Power (dBm) QPSK	Peak to Average Ratio (dB) CCDF	Peak Output Power (dBm) 16-QAM	Average Output Power (dBm) 16-QAM	Peak to Average Ratio (dB) CCDF
1.4	1710.7	1 RB low	27.1	22.5	4.4	26.6	21.5	5.0
		1 RB high	27.2	22.4	4.6	26.7	21.5	5.0
		50% RB	27.3	22.4	4.5	26.6	21.5	5.0
		100% RB	27.1	21.5	5.3	26.6	20.5	5.7
	1732.5	1 RB low	27.3	22.4	4.8	27.3	21.2	5.8
		1 RB high	27.2	22.3	4.8	27.2	21.0	5.8
		50% RB	27.3	22.3	4.8	27.4	21.5	5.6
		100% RB	27.3	21.6	5.2	26.5	20.6	5.6
	1754.3	1 RB low	27.8	22.6	5.0	27.5	21.7	5.6
		1 RB high	27.7	22.5	5.0	27.4	21.5	5.7
		50% RB	27.9	22.4	5.0	27.5	21.5	5.7
		100% RB	27.8	21.5	5.6	27.3	20.7	6.2
3	1711.5	1 RB low	27.1	22.5	4.5	26.6	21.5	5.0
		1 RB high	27.3	22.6	4.6	26.9	21.5	5.2
		50% RB	27.2	21.6	5.2	26.6	20.4	5.8
		100% RB	27.3	21.4	5.2	26.7	20.5	5.7
	1732.5	1 RB low	27.4	22.8	4.4	27.3	21.4	5.6
		1 RB high	27.2	22.1	4.9	27.2	21.1	5.7
		50% RB	27.3	21.5	5.2	26.5	20.6	5.5
		100% RB	27.3	21.4	5.3	26.5	20.4	5.6
	1753.5	1 RB low	28.0	22.7	4.9	27.5	21.7	5.6
		1 RB high	27.8	22.5	5.0	27.3	21.4	5.8
		50% RB	27.8	21.7	5.6	27.4	20.7	6.2
		100% RB	27.8	21.6	5.5	27.5	20.6	6.3
5	1712.5	1 RB low	27.2	22.5	4.5	26.6	21.3	5.0
		1 RB high	27.6	22.6	4.7	27.1	21.5	5.4
		50% RB	26.7	21.5	4.9	26.8	20.6	5.8
		100% RB	27.5	21.5	5.2	26.9	20.4	5.9
	1732.5	1 RB low	27.6	23.0	4.3	27.5	22.0	5.4
		1 RB high	27.3	22.3	4.8	27.2	21.2	5.9
		50% RB	27.3	21.5	5.2	26.4	20.6	5.4
		100% RB	27.4	21.4	5.3	26.6	20.5	5.6
	1752.5	1 RB low	28.0	22.3	5.2	27.5	21.3	6.0
		1 RB high	27.9	22.6	5.0	27.3	21.5	5.7
		50% RB	27.8	21.6	5.5	27.3	20.5	6.3
		100% RB	27.5	21.7	5.3	27.5	20.6	6.1

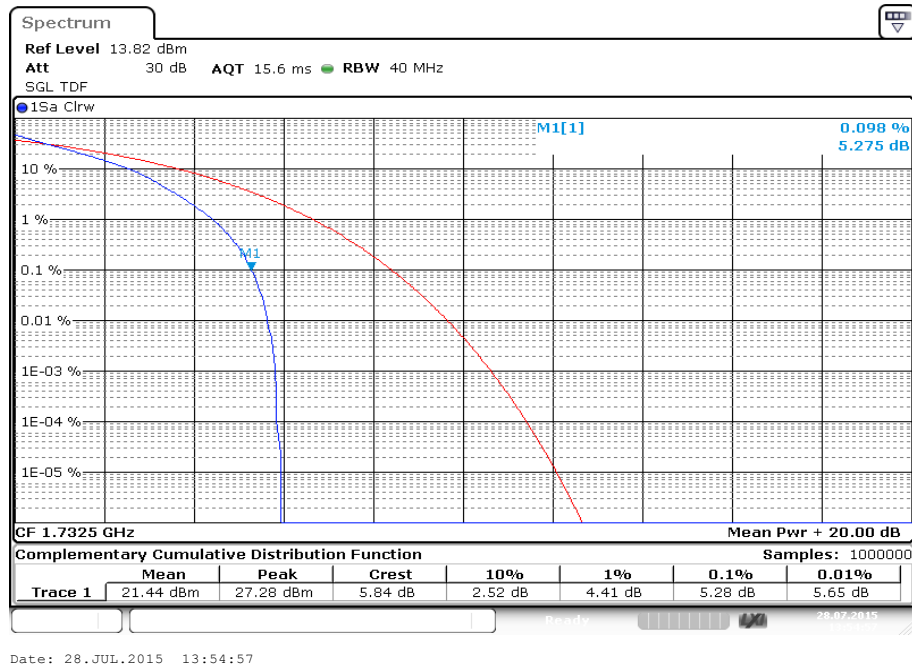
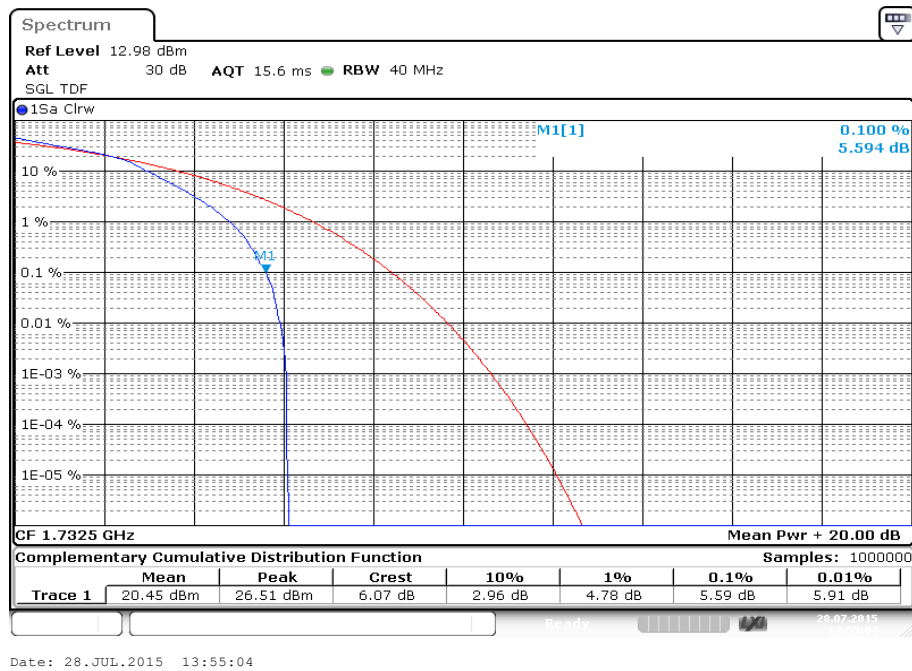
10	1715.0	1 RB low	27.1	22.4	4.6	26.8	21.3	5.2
		1 RB high	27.7	22.4	5.2	27.4	21.3	5.9
		50% RB	27.2	21.6	5.1	27.2	20.5	6.1
		100% RB	27.2	21.4	5.2	27.2	20.4	6.1
	1732.5	1 RB low	27.3	22.4	4.8	27.2	21.1	5.8
		1 RB high	27.7	23.0	4.5	27.3	21.8	5.3
		50% RB	27.4	21.6	5.2	26.5	20.5	5.6
		100% RB	27.5	21.5	5.2	26.6	20.5	5.6
	1750.0	1 RB low	28.0	22.5	5.1	27.5	21.4	5.8
		1 RB high	27.8	22.5	5.1	27.4	21.5	5.7
		50% RB	27.4	21.4	5.4	27.5	20.4	6.3
		100% RB	27.5	21.3	5.5	27.4	20.3	6.3
15	1717.5	1 RB low	26.9	22.1	4.6	26.6	21.1	5.3
		1 RB high	27.5	22.4	5.0	27.3	21.3	5.7
		50% RB	27.5	21.4	5.4	27.4	20.4	6.2
		100% RB	27.4	21.3	5.4	27.3	20.4	6.1
	1732.5	1 RB low	27.1	22.0	4.8	27.1	20.8	6.1
		1 RB high	27.1	22.2	4.6	27.2	21.0	6.0
		50% RB	27.5	21.5	5.2	26.6	20.5	5.6
		100% RB	27.3	21.4	5.4	26.7	20.5	5.6
	1747.5	1 RB low	27.4	21.9	5.1	26.9	20.9	5.7
		1 RB high	27.7	22.3	5.0	27.1	21.1	5.8
		50% RB	27.6	21.4	5.4	27.6	20.4	6.3
		100% RB	27.5	21.2	5.7	27.4	20.2	6.3
20	1720.0	1 RB low	26.8	21.9	4.7	26.6	21.0	5.4
		1 RB high	26.9	22.2	4.5	27.1	21.3	5.6
		50% RB	27.7	21.5	5.4	27.7	20.5	6.2
		100% RB	27.5	21.3	5.2	27.6	20.4	6.1
	1732.5	1 RB low	27.0	22.1	4.6	26.9	21.0	5.7
		1 RB high	27.0	21.8	4.8	26.9	20.9	5.8
		50% RB	27.4	21.5	5.2	26.5	20.6	5.5
		100% RB	27.5	21.3	5.3	26.7	20.4	5.6
	1745.0	1 RB low	27.0	22.3	4.5	26.6	21.2	5.2
		1 RB high	27.6	22.5	4.8	26.9	21.0	5.7
		50% RB	27.5	21.4	5.4	27.6	20.3	6.3
		100% RB	27.5	21.3	5.4	27.6	20.4	6.2

The output power is measured with configuration of maximum conducted output power.

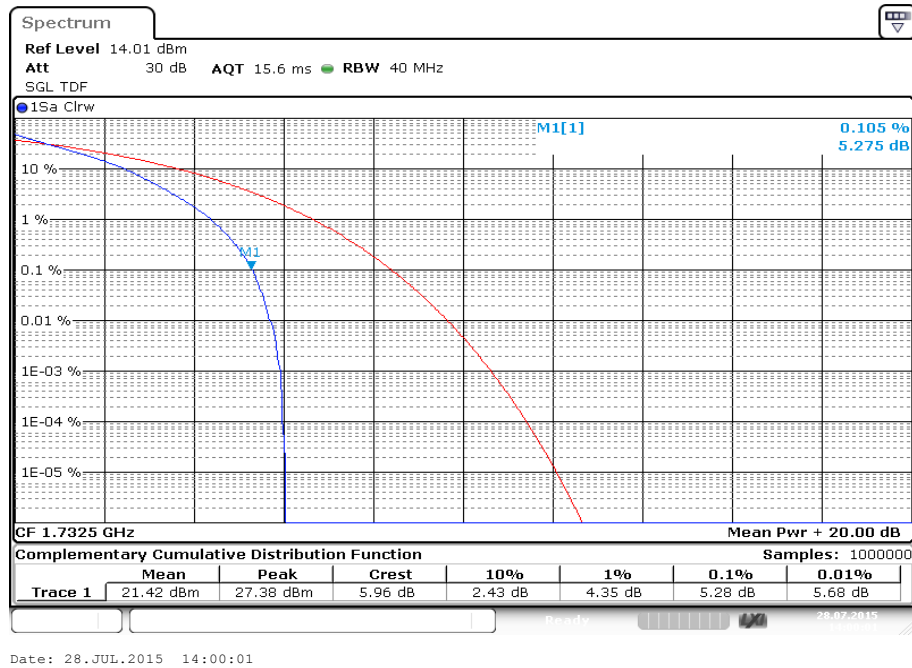
Output Power (radiated)			
Bandwidth (MHz)	Frequency (MHz)	Average Output Power (dBm) QPSK	Average Output Power (dBm) 16-QAM
1.4	1710.7	20.28	19.18
	1732.5	21.52	20.62
	1754.3	20.85	19.75
3	1711.5	20.28	19.38
	1732.5	21.42	20.32
	1753.5	20.85	19.85
5	1712.5	20.38	19.38
	1732.5	21.32	20.42
	1752.5	20.75	19.75
10	1715.0	20.08	19.08
	1732.5	21.42	20.52
	1750.0	20.45	19.45
15	1717.5	19.98	19.08
	1732.5	21.42	19.75
	1747.5	20.45	19.35
20	1720.0	20.08	19.18
	1732.5	20.08	20.32
	1745.0	20.65	19.35
Measurement uncertainty		± 3.0 dB	

Verdict: [compliant](#)

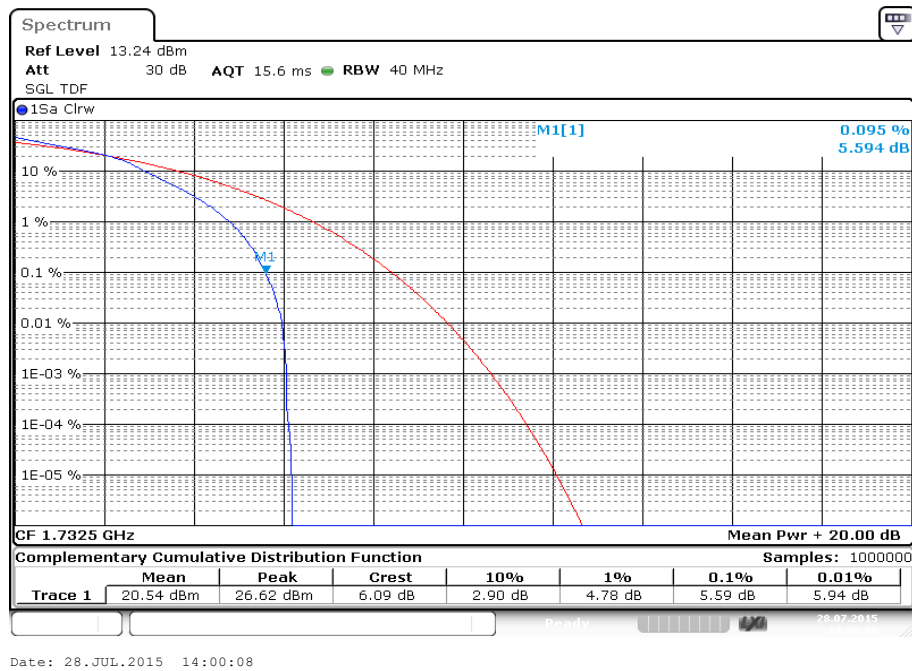
Plots:**Plot 1:** 1.4 MHz cell bandwidth, mid channel, 100% #RB, QPSK**Plot 2:** 1.4 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM

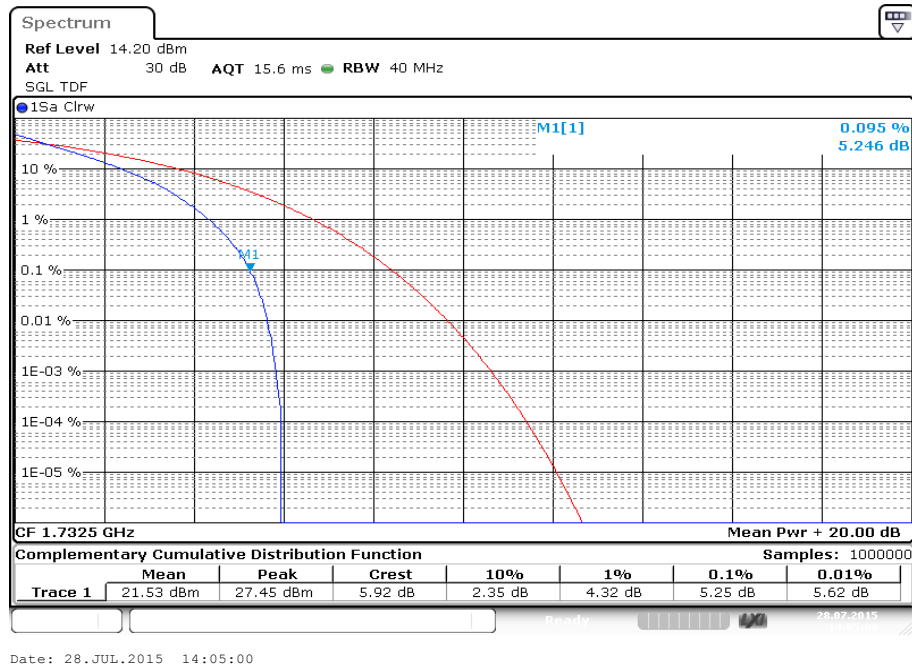
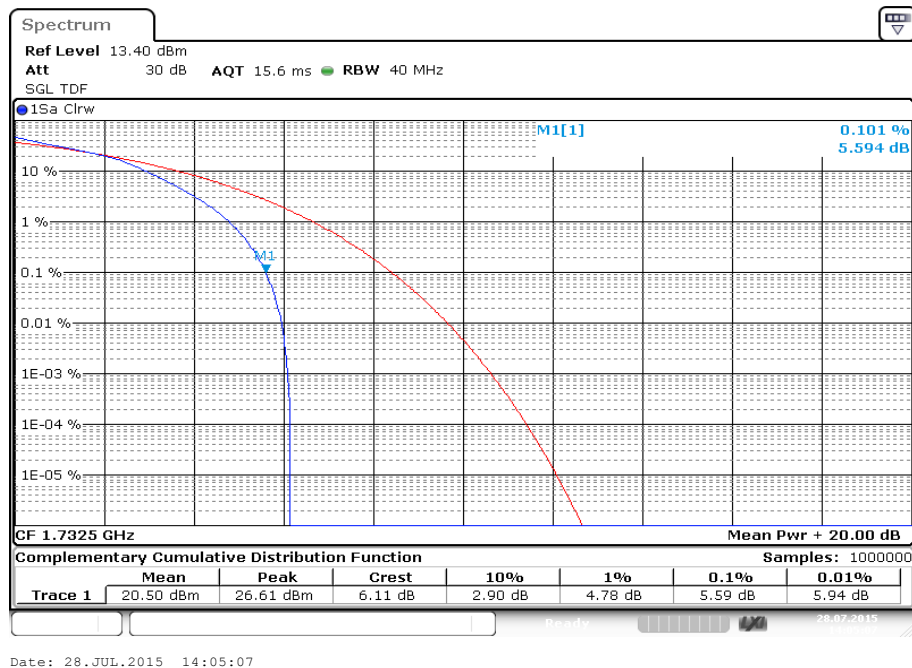
Plot 3: 3 MHz cell bandwidth, mid channel, 100% #RB, QPSK**Plot 4:** 3 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM

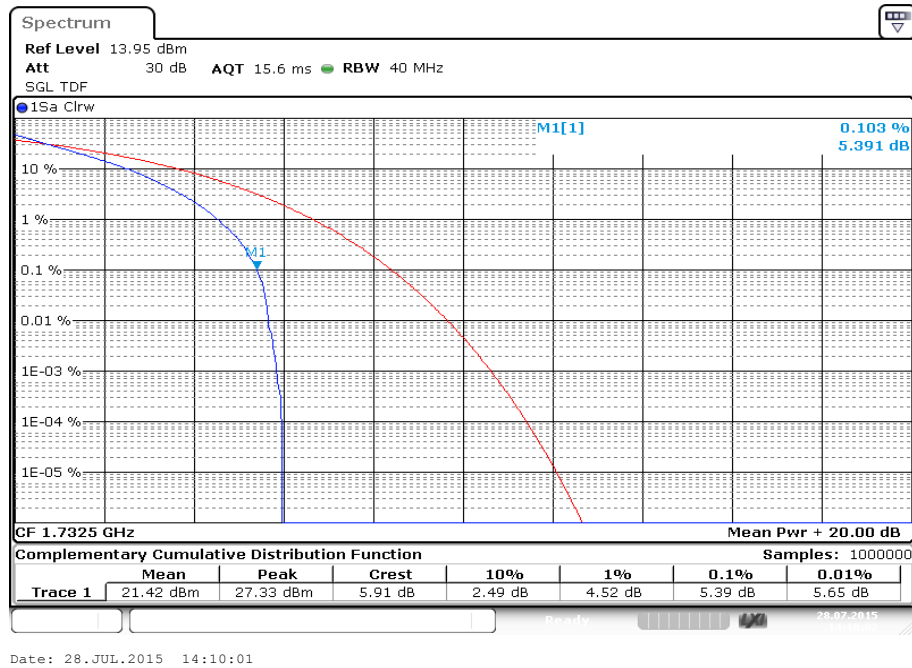
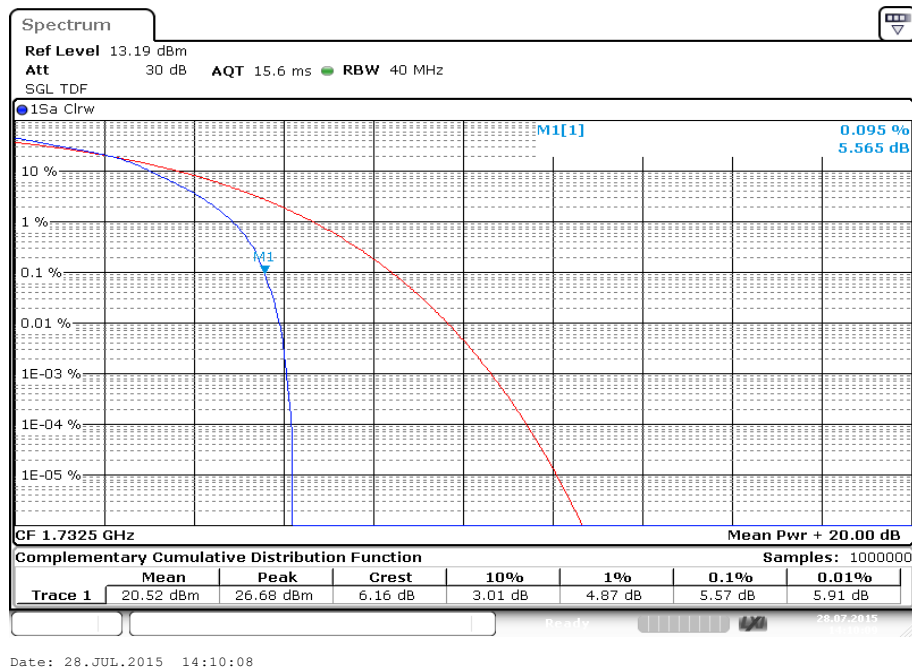
Plot 5: 5 MHz cell bandwidth, mid channel, 100% #RB, QPSK

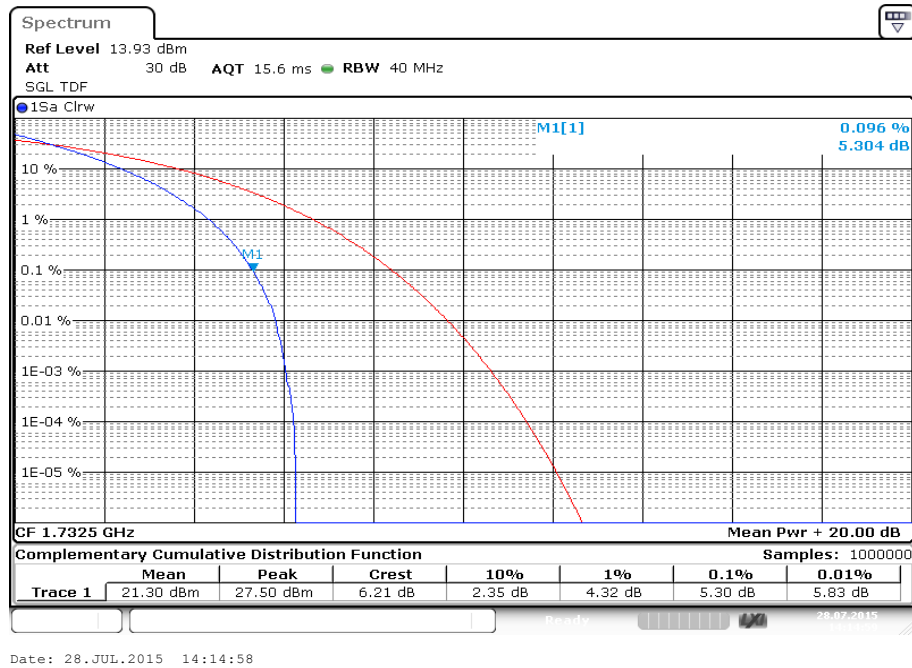
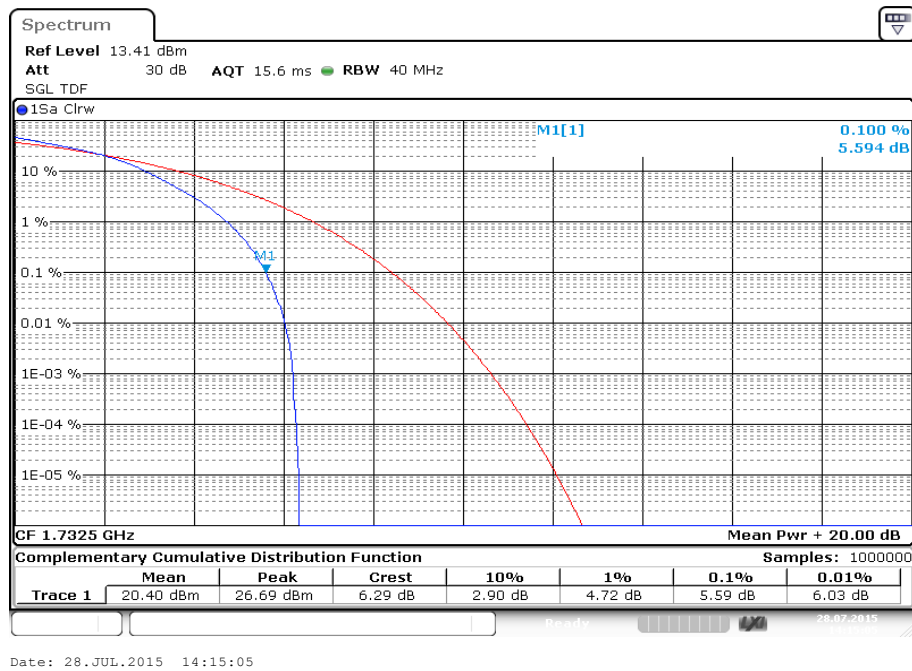


Plot 6: 5 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



Plot 7: 10 MHz cell bandwidth, mid channel, 100% #RB, QPSK**Plot 8:** 10 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM

Plot 9: 15 MHz cell bandwidth, mid channel, 100% #RB, QPSK**Plot 10:** 15 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM

Plot 11: 20 MHz cell bandwidth, mid channel, 100% #RB, QPSK**Plot 12:** 20 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM

11.2.2 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 connected to CMW. 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 a connection on 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} . 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 $\pm 0.5^{\circ}\text{C}$ during the measurement procedure.

Measurement:

Measurement parameters	
Detector:	Measured with CMW500
Sweep time:	
Resolution bandwidth:	
Video bandwidth:	
Span:	
Trace-Mode:	see chapter 7.2 – B
Used equipment:	
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
Frequency Stability	
< 2.5 ppm	

Results:**FREQ ERROR versus VOLTAGE**

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
13.8	8	0.00000046	0.0046
12.0	7	0.00000040	0.0040
10.2	8	0.00000046	0.0046

FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	7	0.00000040	0.0040
-20	10	0.00000058	0.0058
-10	9	0.00000052	0.0052
± 0	7	0.00000040	0.0040
10	8	0.00000046	0.0046
20	7	0.00000040	0.0040
30	7	0.00000040	0.0040
40	8	0.00000046	0.0046
50	6	0.00000035	0.0035
60	5	0.00000029	0.0029

Verdict: **compliant**

11.2.3 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 C63.4:2014 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 1754.3 MHz. Measurement made up to 26 GHz. The resolution bandwidth is set as outlined in Part 27.238. The spectrum was scanned with the mobile station transmitting at the middle carrier frequency of the LTE band IV.

Measurement:

Measurement parameters	
Detector:	Peak / RMS
Sweep time:	5 ms/MHz
Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Span:	different steps
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.1 - A & 7.2 - A
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
Spurious Emissions Radiated	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the center carrier frequencies of the LTE band 4 (1732.5 MHz). It was decided that measurements at this carrier frequency 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.

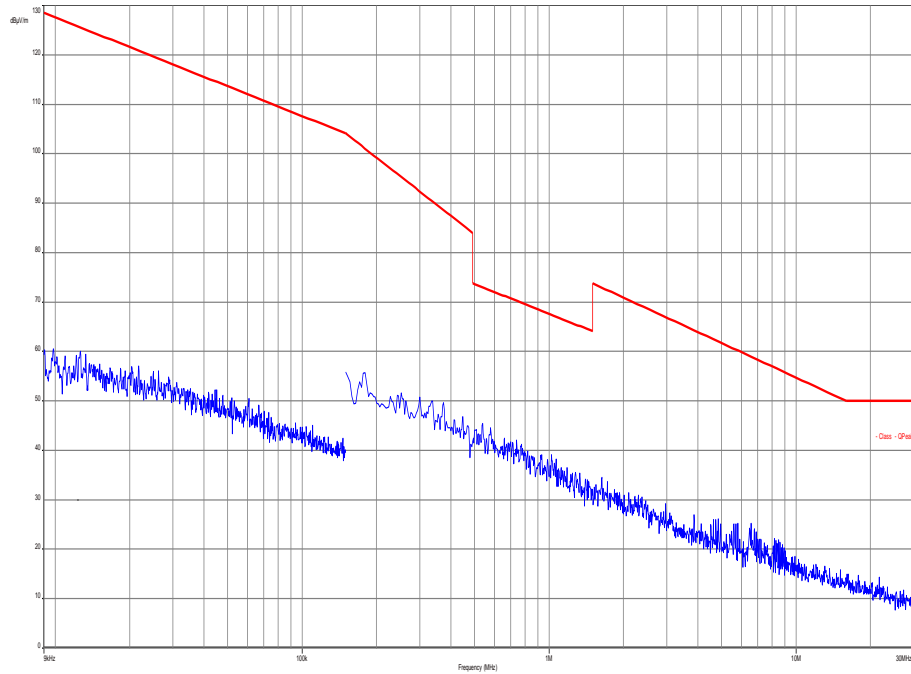
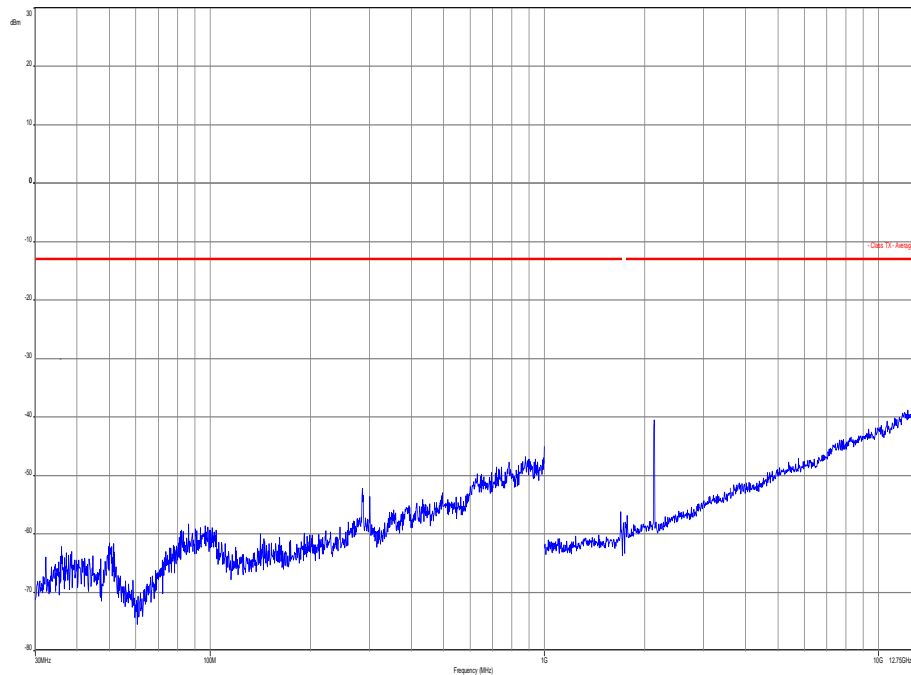
QPSK

Spurious Emission Level (dBm)	
Middle channel	
Spurious emissions	Level [dBm]
3465.0	-
5197.5	-
6930.0	-
8662.5	-
10395.0	-
12127.5	-
13860.0	-
15592.5	-
17325.0	-

16-QAM

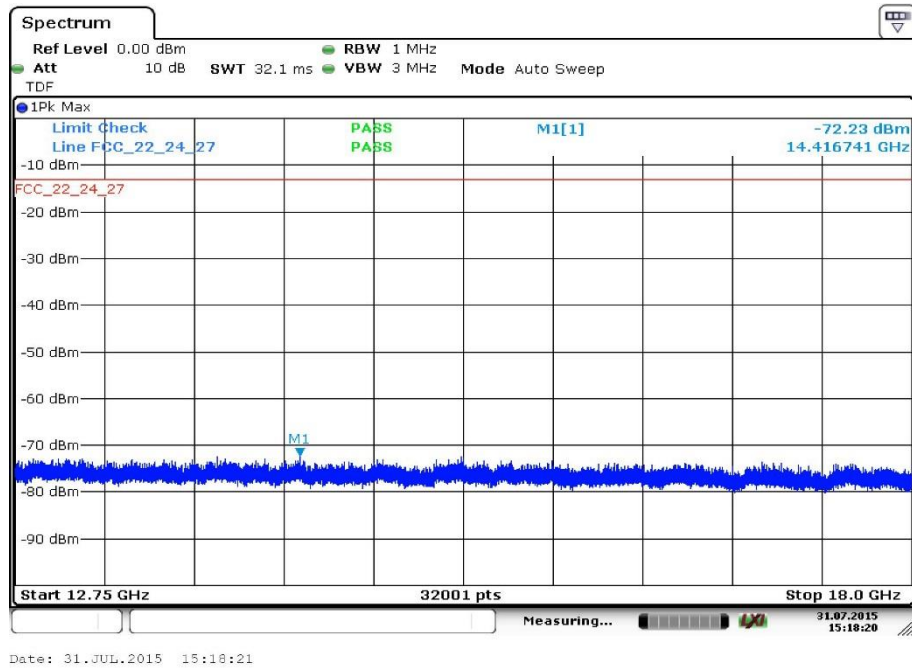
Spurious Emission Level (dBm)	
Middle channel	
Spurious emissions	Level [dBm]
3465.0	-
5197.5	-
6930.0	-
8662.5	-
10395.0	-
12127.5	-
13860.0	-
15592.5	-
17325.0	-

Verdict: [compliant](#)

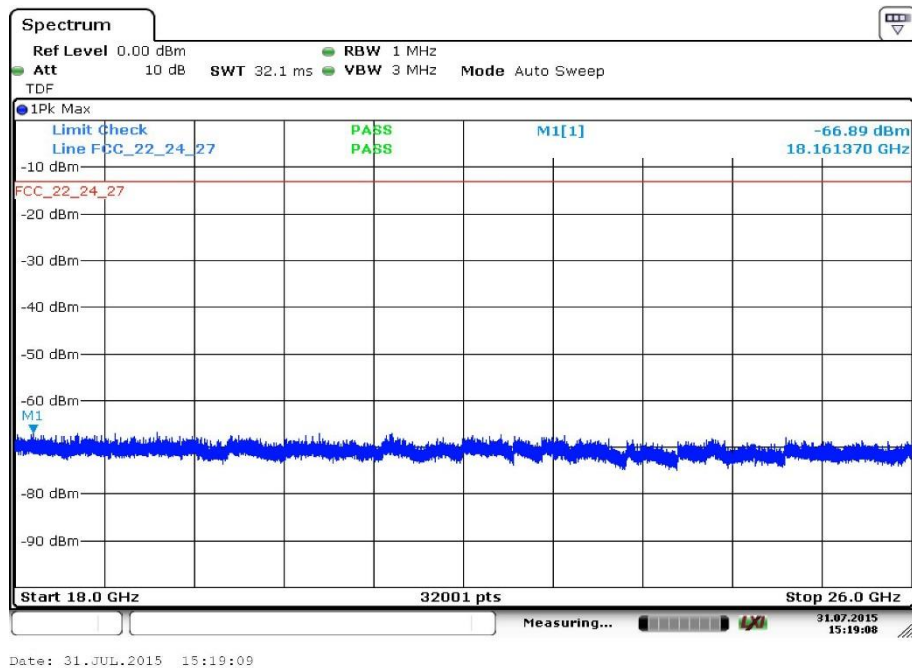
QPSK with 10 MHz channel bandwidth**Plot 1: Middle channel, up to 30 MHz****Plot 2: Middle channel, 30 MHz to 12.75 GHz**

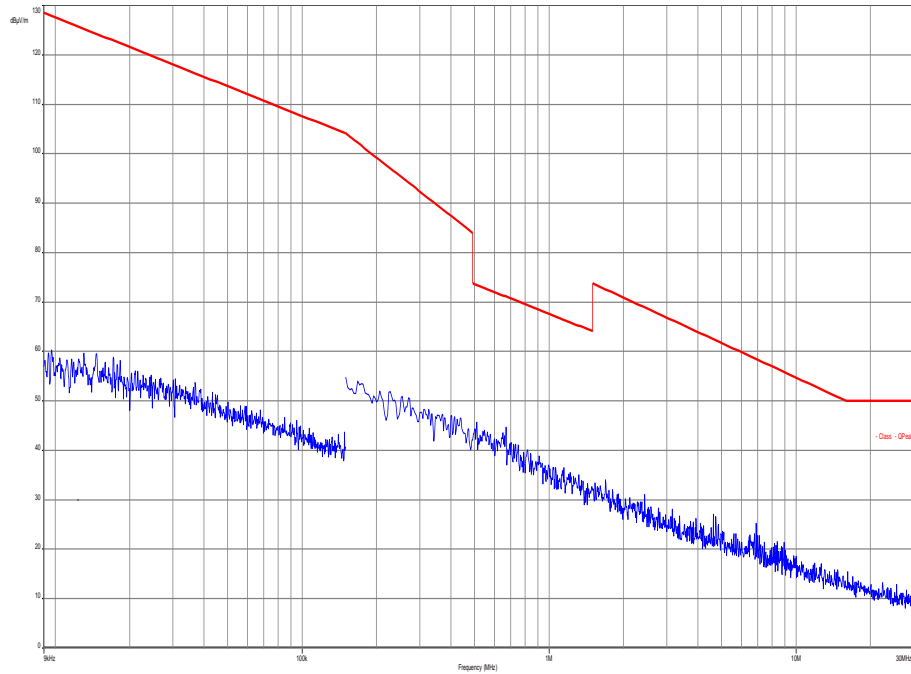
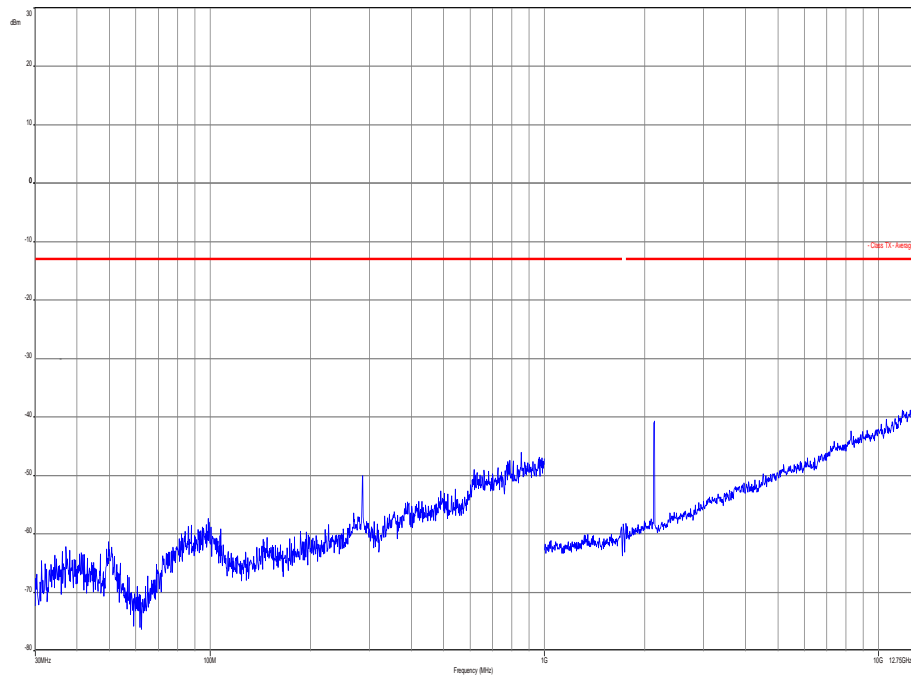
Carrier notched with 1.7 GHz rejection filter

Plot 3: Middle channel, 12.75 GHz to 18 GHz



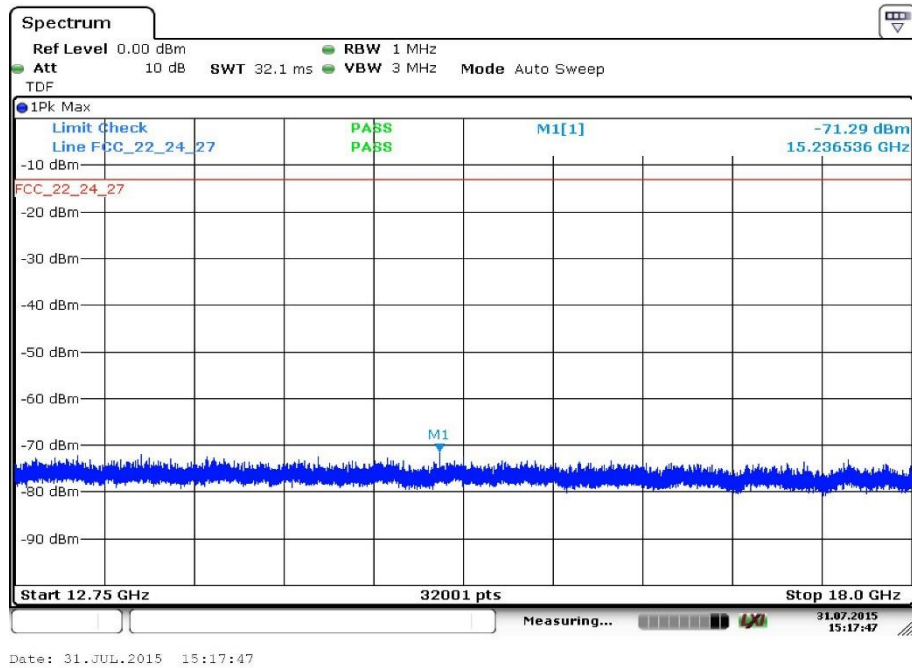
Plot 4: Middle channel, 18 GHz to 26 GHz



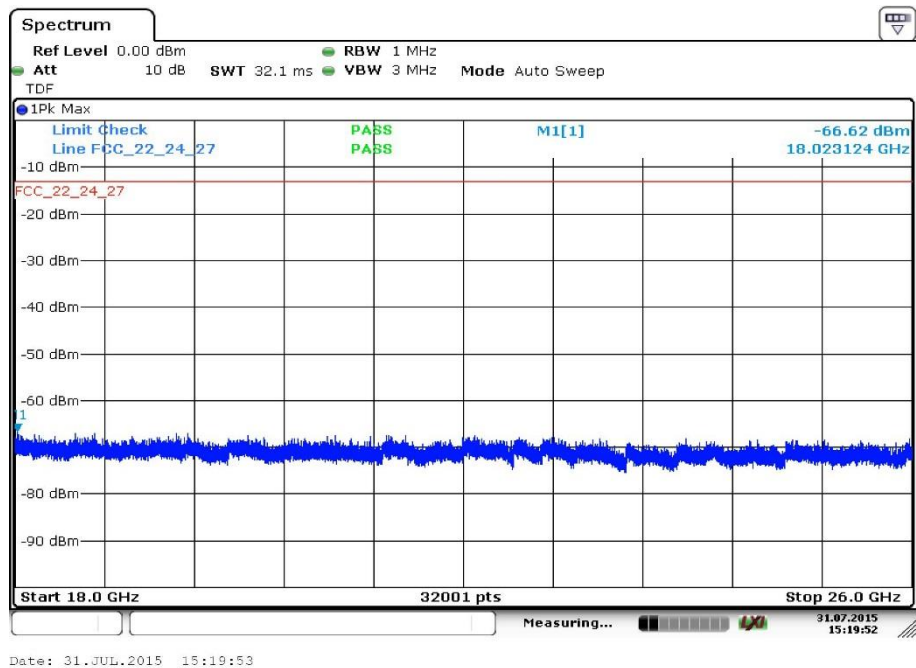
16-QAM with 10 MHz channel bandwidth**Plot 5: Middle channel, up to 30 MHz****Plot 6: Middle channel, 30 MHz to 12.75 GHz**

Carrier notched with 1.7 GHz rejection filter

Plot 7: Middle channel, 12 GHz to 25 GHz



Plot 8: Middle channel, 12 GHz to 25 GHz



11.2.4 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 / RMS
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement 3 MHz
Span:	10 MHz – 26 GHz
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.3
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
Spurious Emissions Conducted	
Attenuation $\geq 43 + 10\log(P)$ (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		

Verdict: **compliant**

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		

Verdict: **compliant**

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		

Verdict: **compliant**

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		

Verdict: **compliant**

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		

Verdict: **compliant**

Results: for 20 MHz channel bandwidth

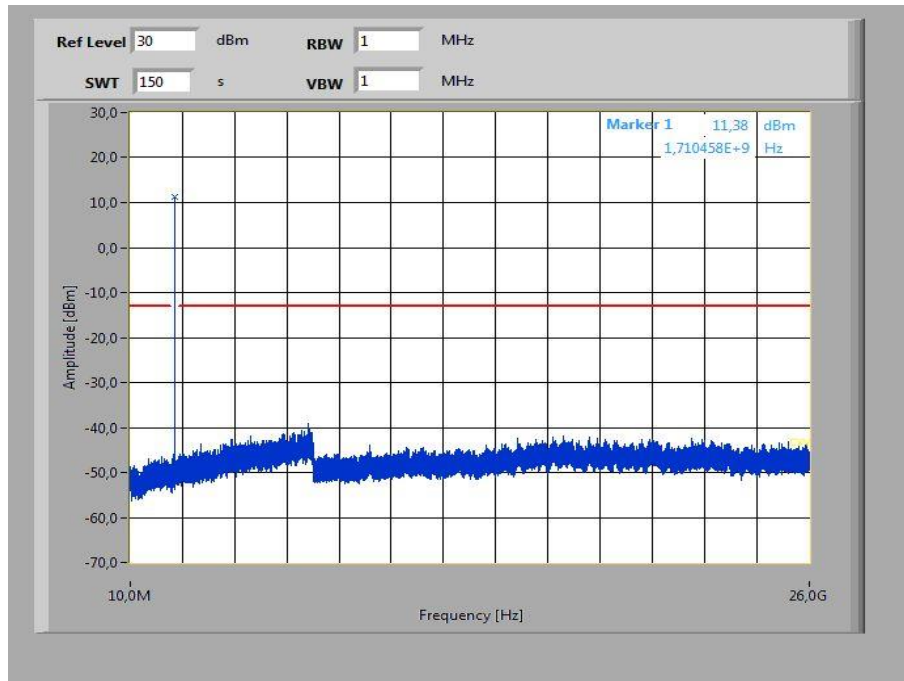
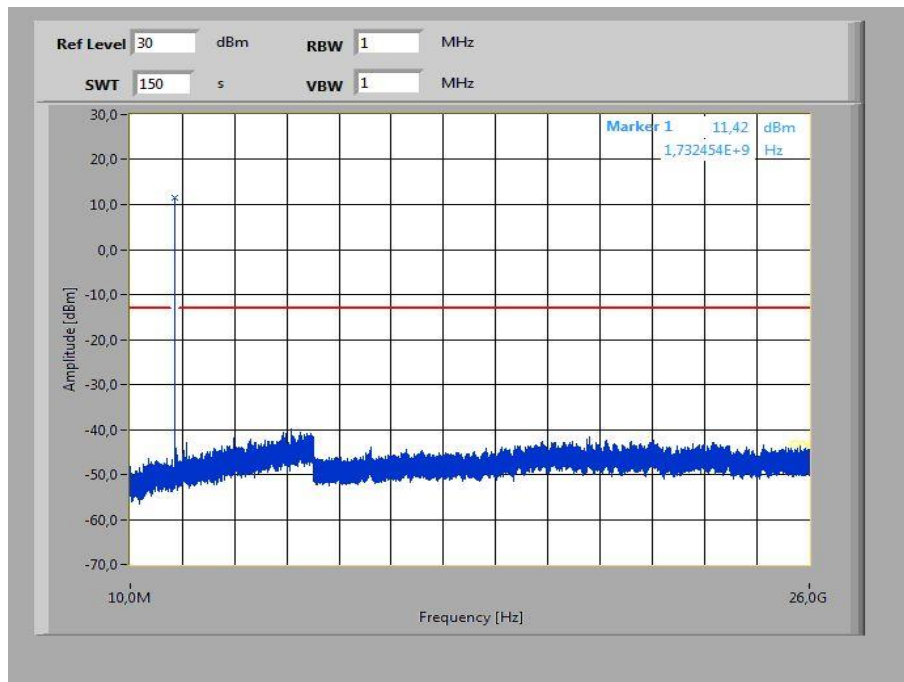
QPSK

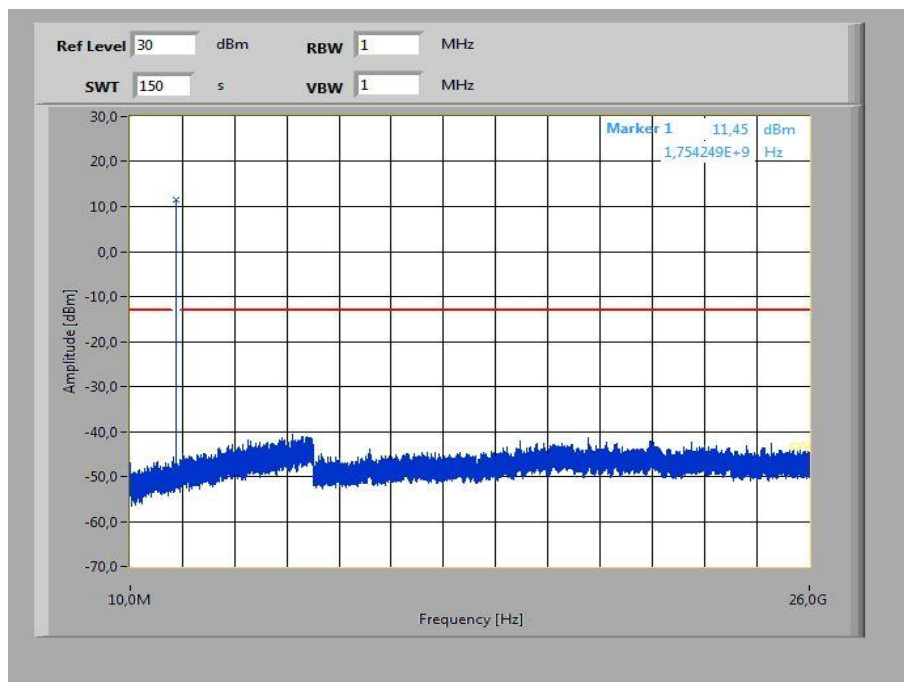
Spurious Emission Level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3440.0	-	3465.0	-	3490.0	-
5160.0	-	5197.5	-	5235.0	-
6880.0	-	6930.0	-	6980.0	-
8600.0	-	8662.5	-	8725.0	-
10320.0	-	10395.0	-	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		

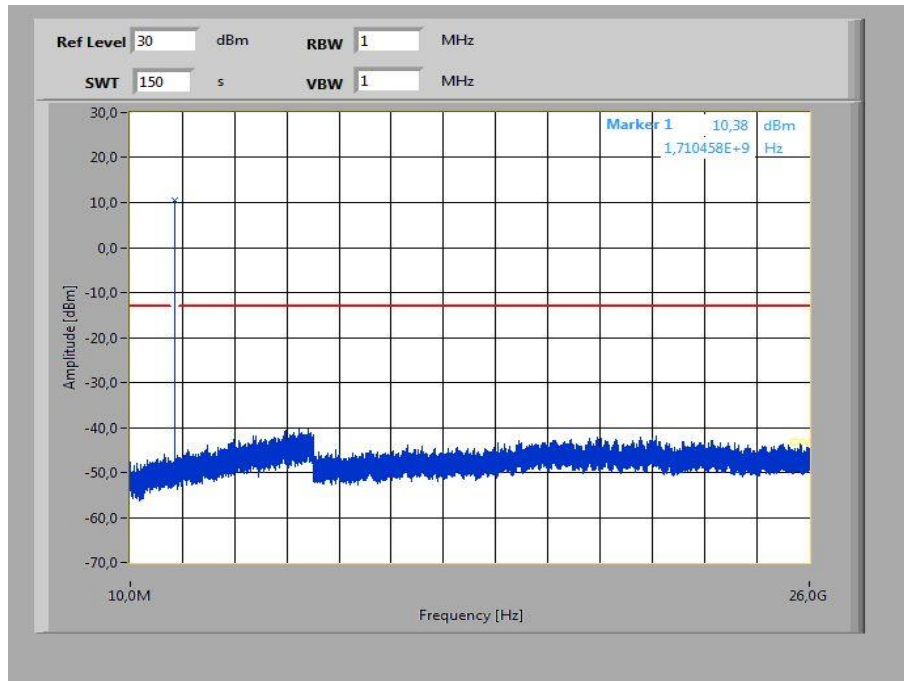
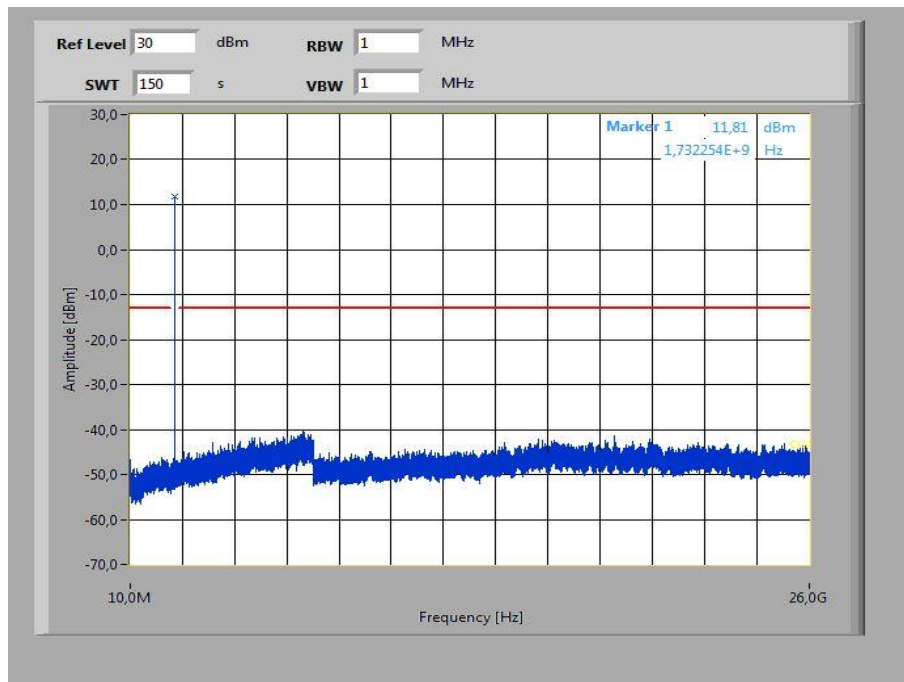
16-QAM

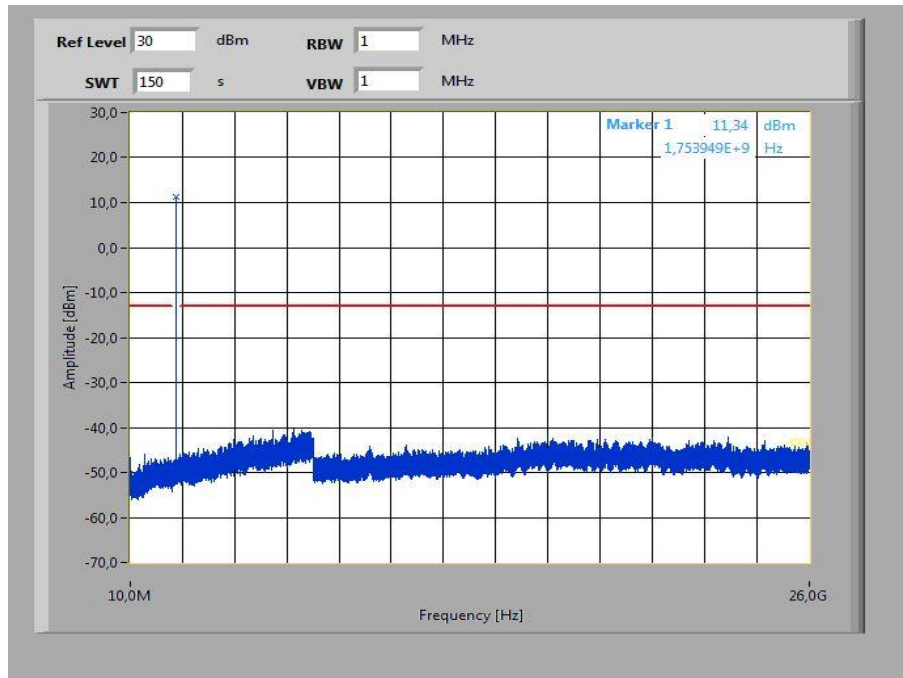
Spurious Emission Level (dBm)					
Lowest channel		Middle channel		Highest channel	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
3440.0	-	3465.0	-	3490.0	-
5160.0	-	5197.5	-	5235.0	-
6880.0	-	6930.0	-	6980.0	-
8600.0	-	8662.5	-	8725.0	-
10320.0	-	10395.0	-	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		

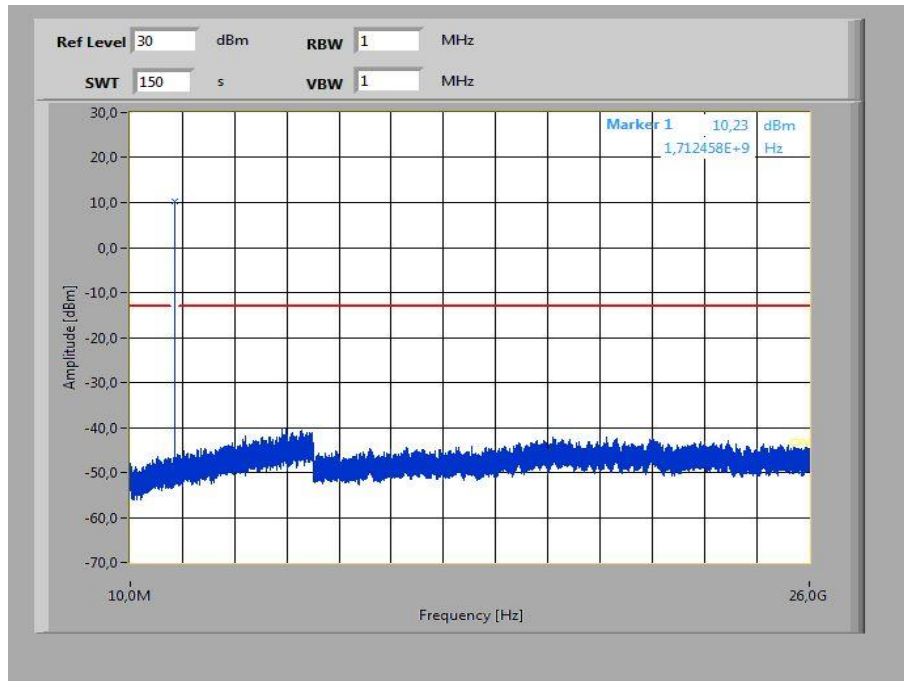
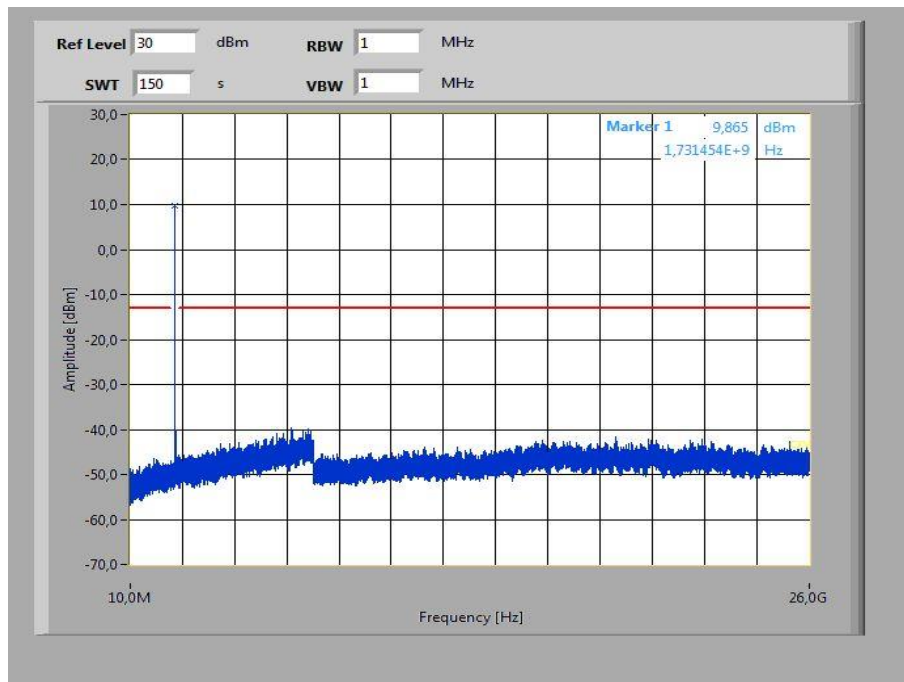
Verdict: **compliant**

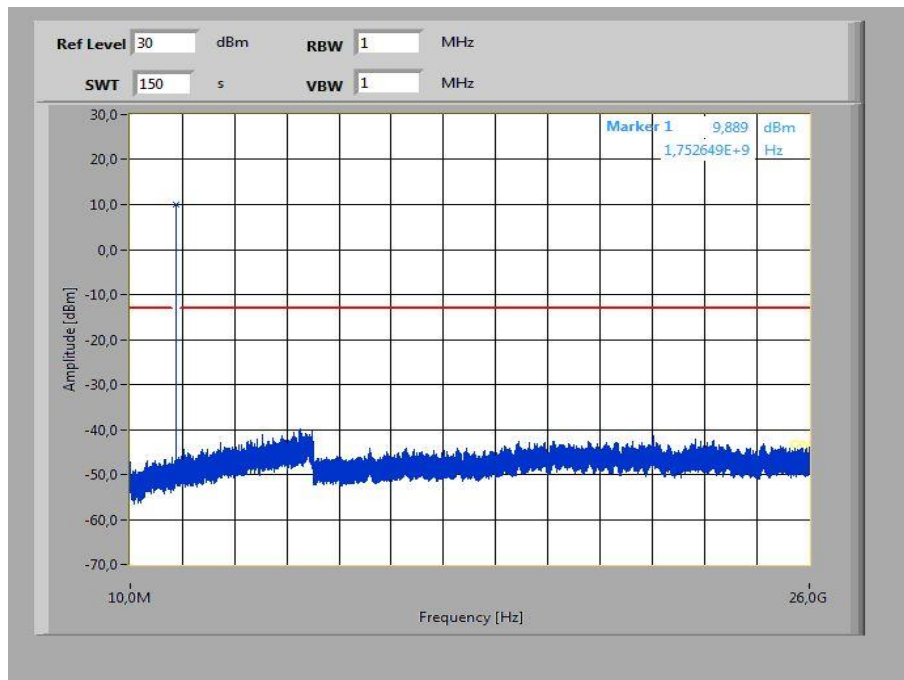
Plots for 1.4 MHz channel bandwidth, QPSK**Plot 1: Lowest channel, 10 MHz to 26 GHz****Plot 2: Middle channel, 10 MHz to 26 GHz**

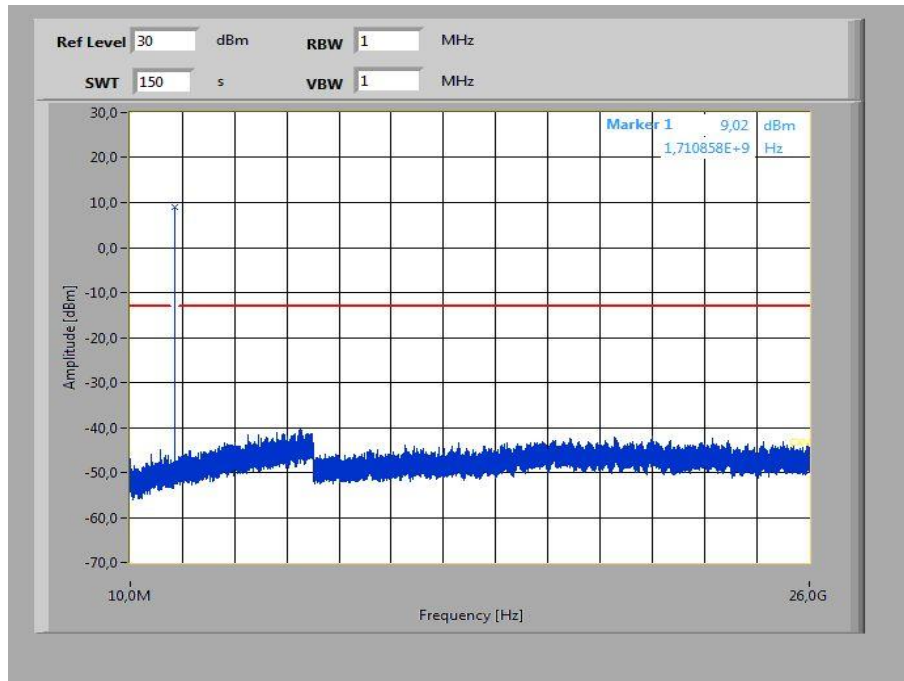
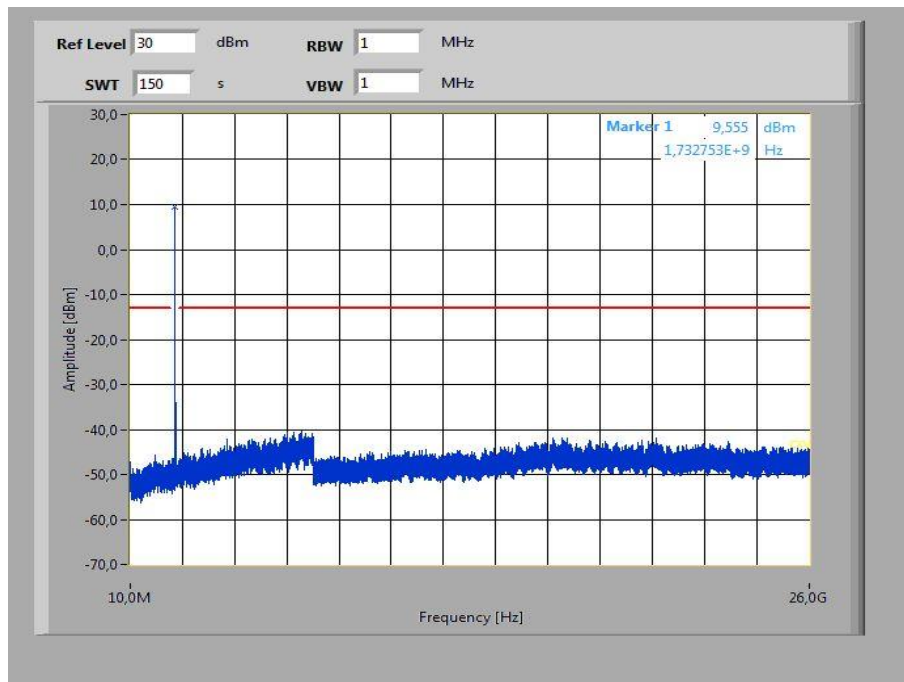
Plot 3: Highest channel, 10 MHz to 26 GHz

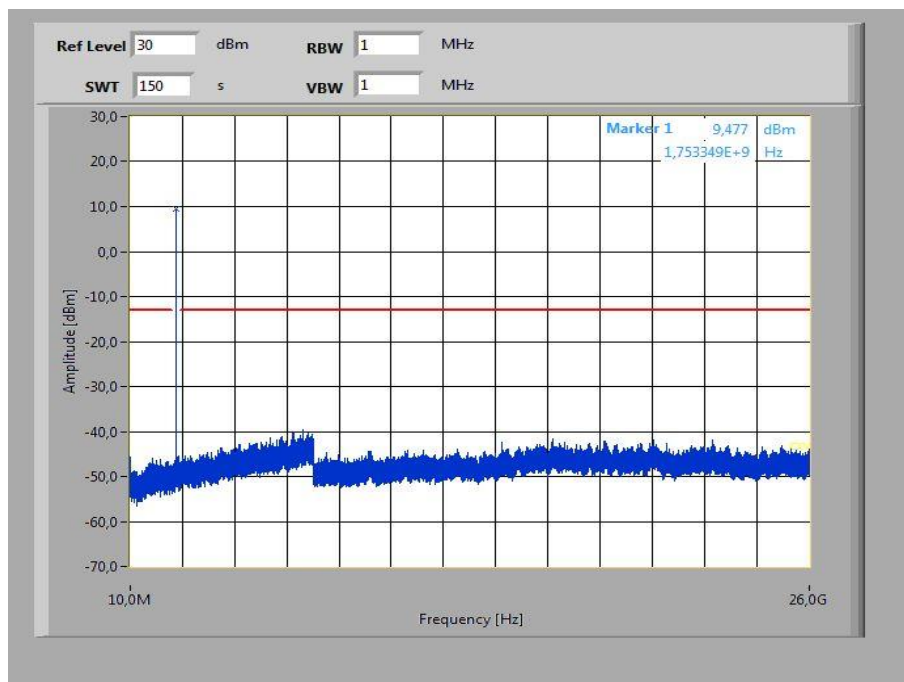
Plots for 1.4 MHz channel bandwidth, 16-QAM**Plot 4: Lowest channel, 10 MHz to 26 GHz****Plot 5: Middle channel, 10 MHz to 26 GHz**

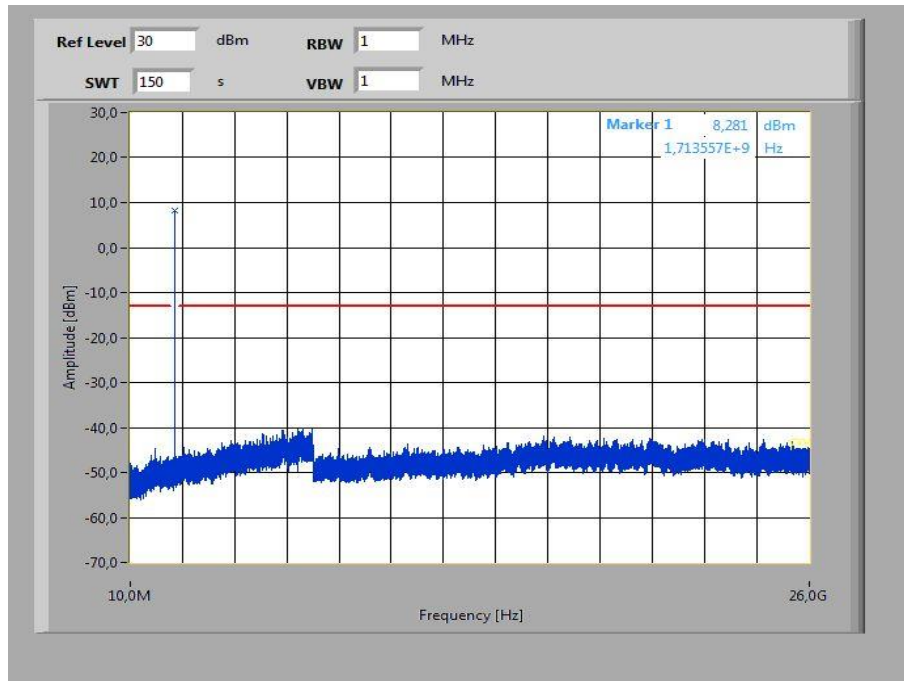
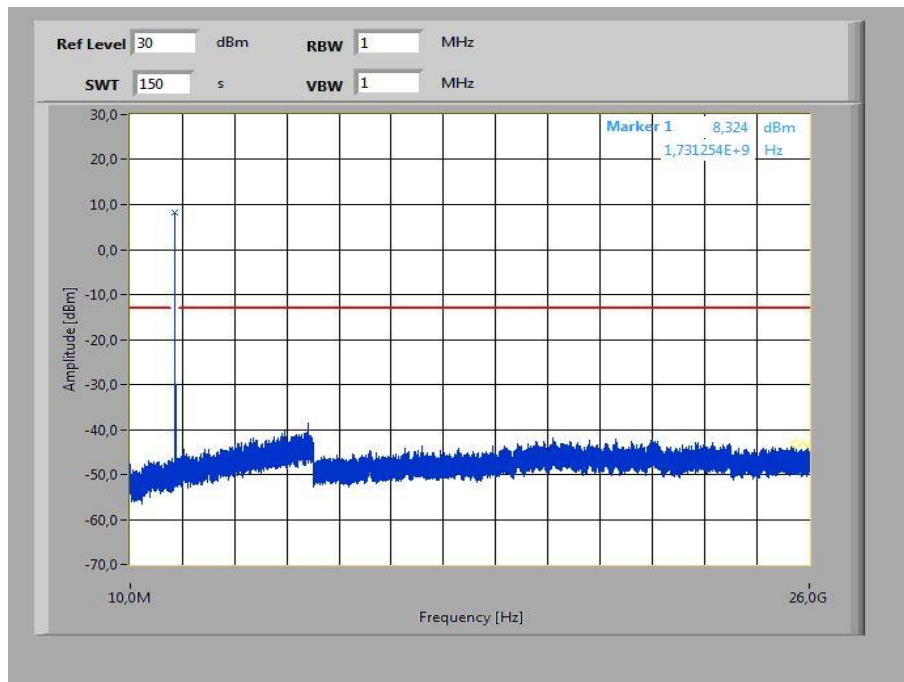
Plot 6: Highest channel, 10 MHz to 26 GHz

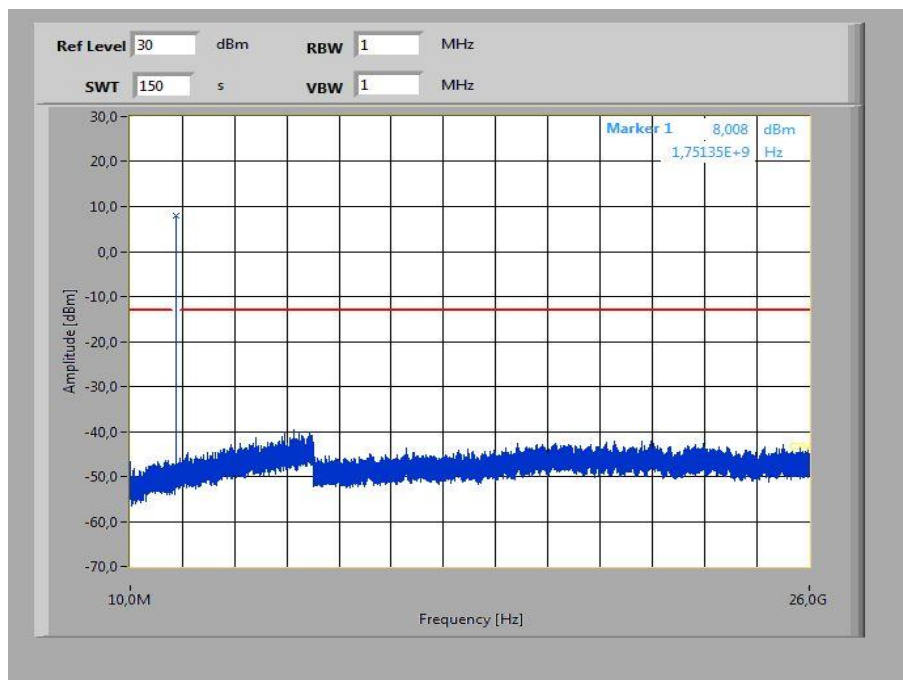
Plots for 3 MHz channel bandwidth, QPSK**Plot 1: Lowest channel, 10 MHz to 26 GHz****Plot 2: Middle channel, 10 MHz to 26 GHz**

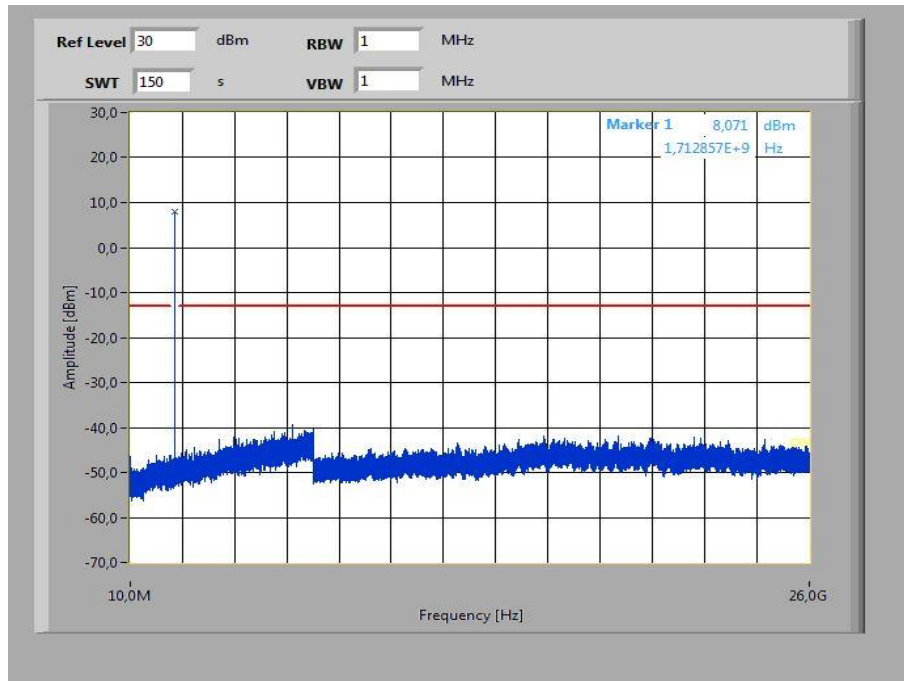
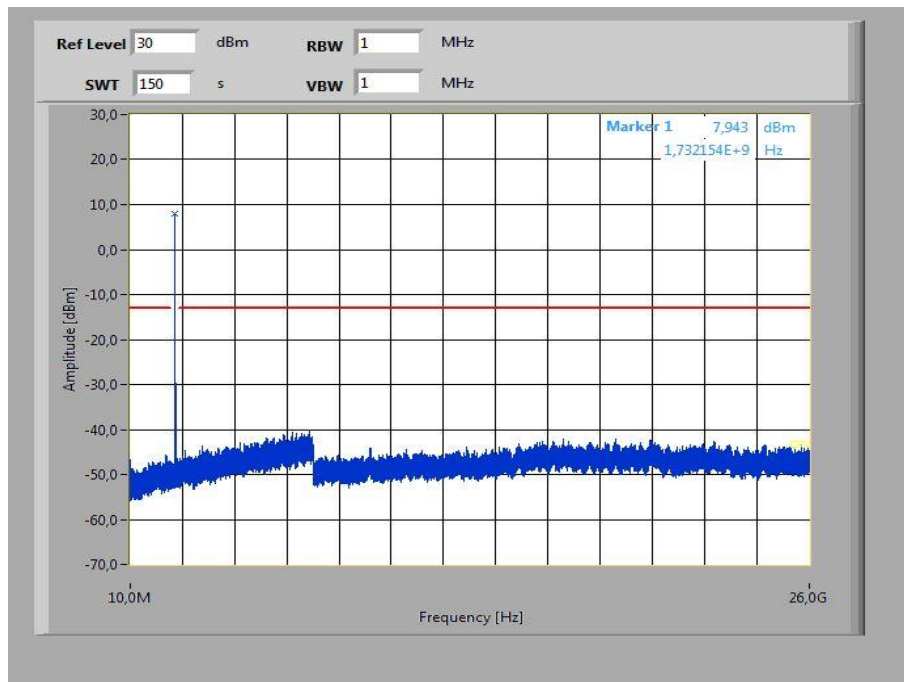
Plot 3: Highest channel, 10 MHz to 26 GHz

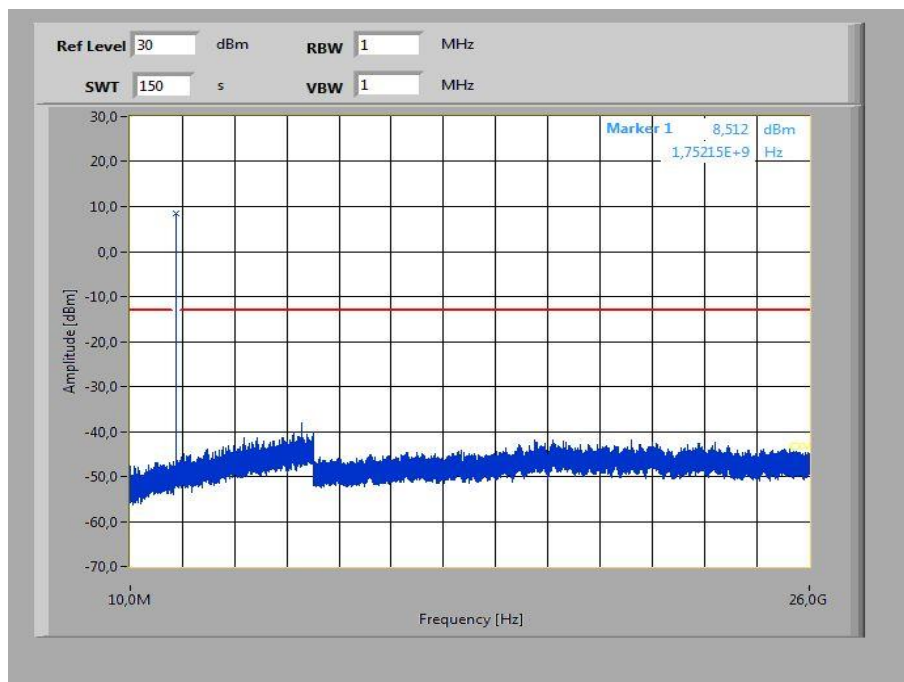
Plots for 3 MHz channel bandwidth, 16-QAM**Plot 4: Lowest channel, 10 MHz to 26 GHz****Plot 5: Middle channel, 10 MHz to 26 GHz**

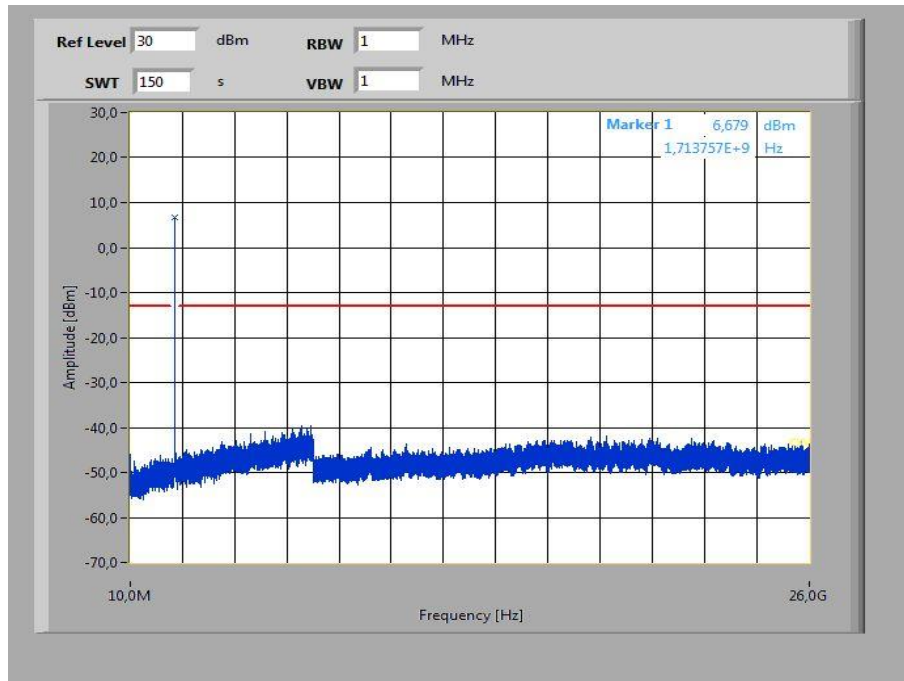
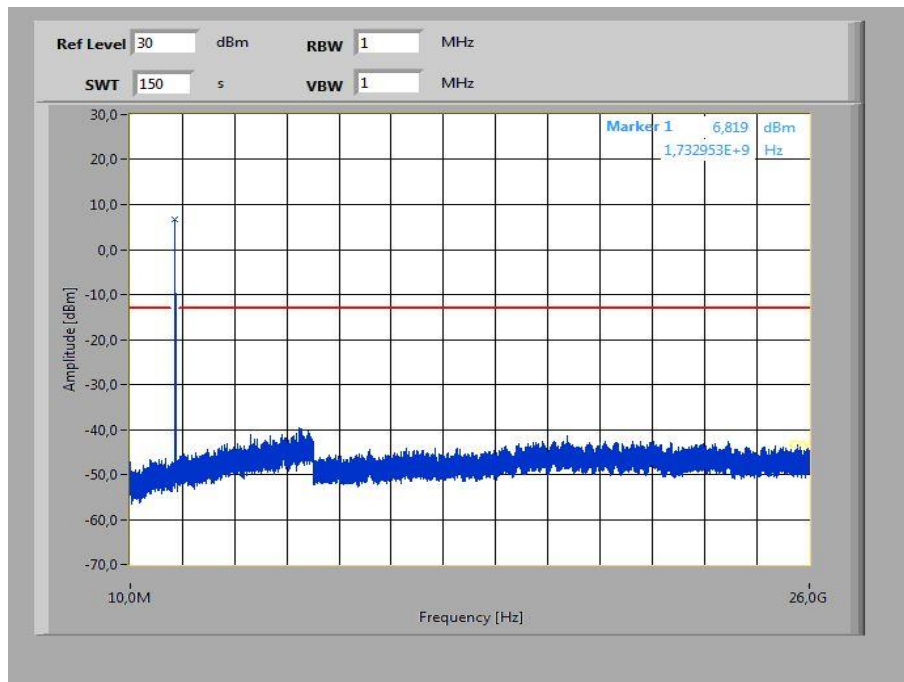
Plot 6: Highest channel, 10 MHz to 26 GHz

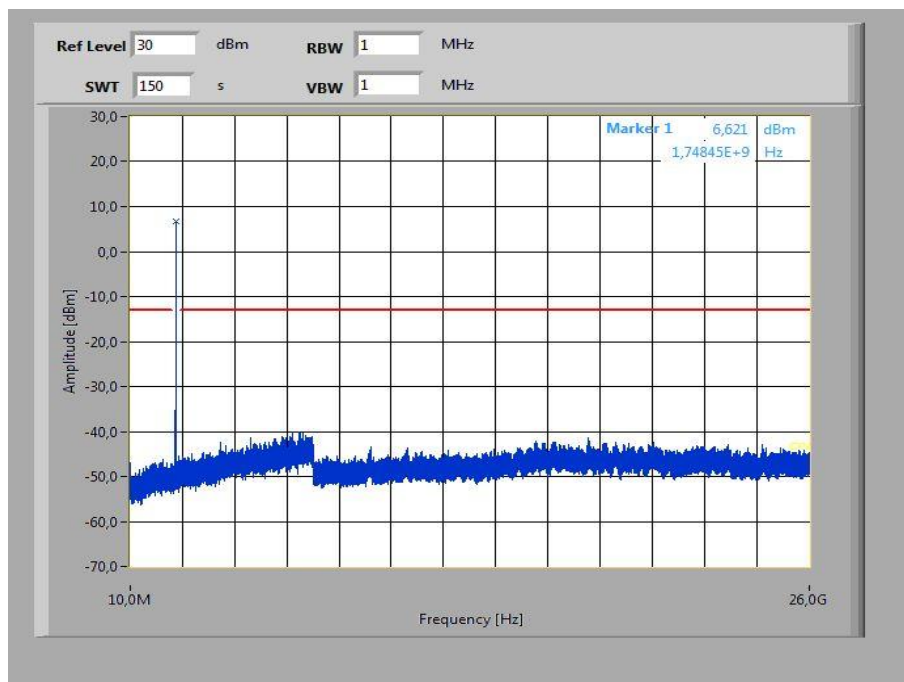
Plots for 5 MHz channel bandwidth, QPSK**Plot 1: Lowest channel, 10 MHz to 26 GHz****Plot 2: Middle channel, 10 MHz to 26 GHz**

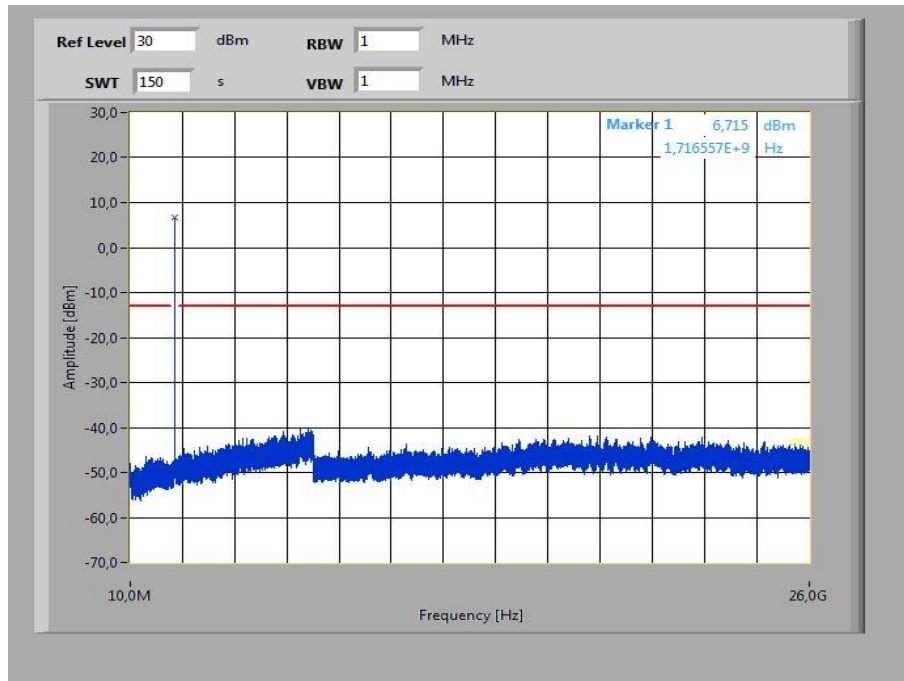
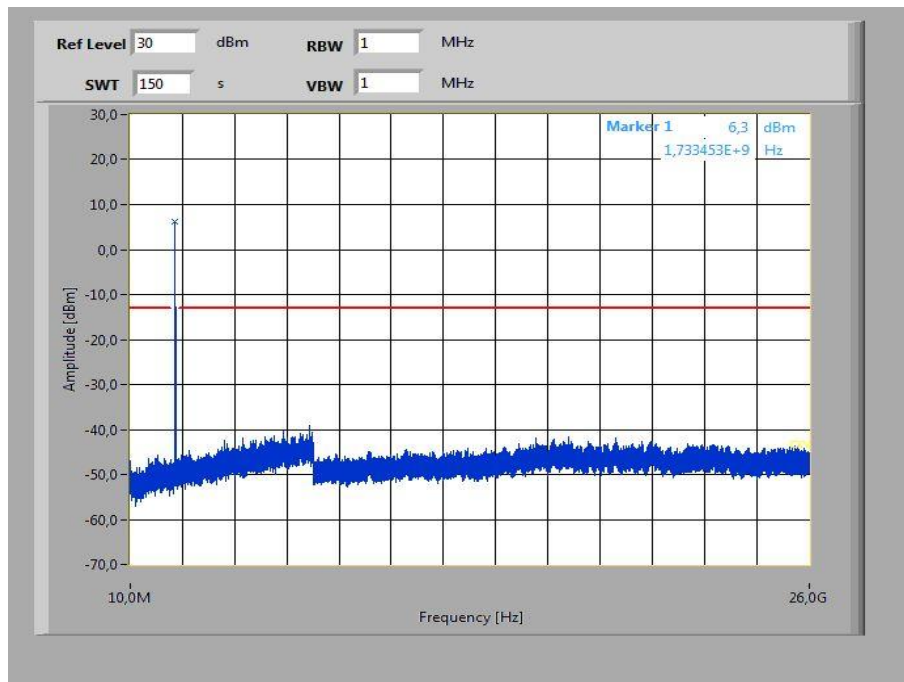
Plot 3: Highest channel, 10 MHz to 26 GHz

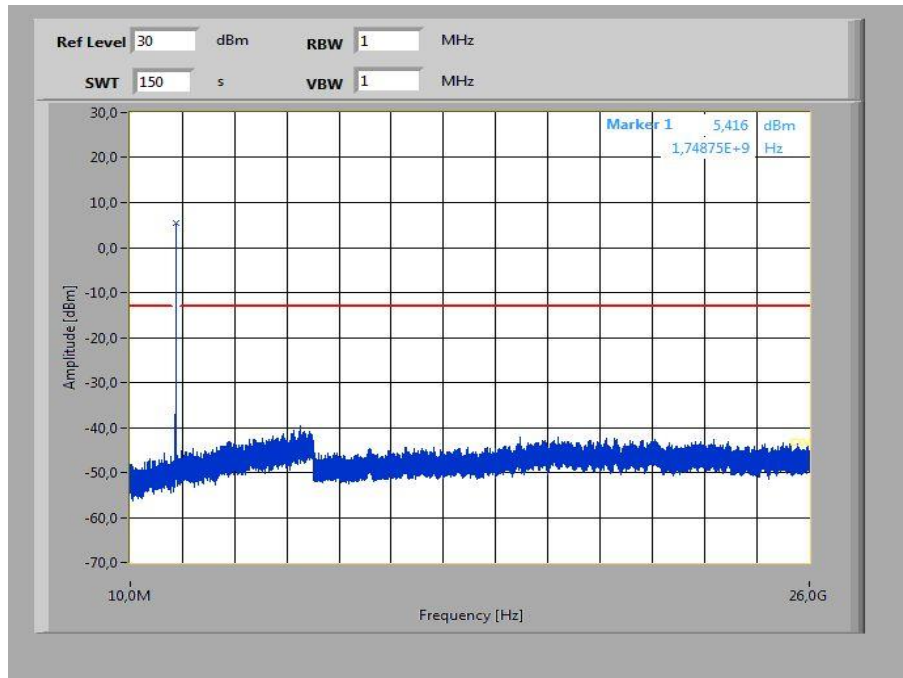
Plots for 5 MHz channel bandwidth, 16-QAM**Plot 4: Lowest channel, 10 MHz to 26 GHz****Plot 5: Middle channel, 10 MHz to 26 GHz**

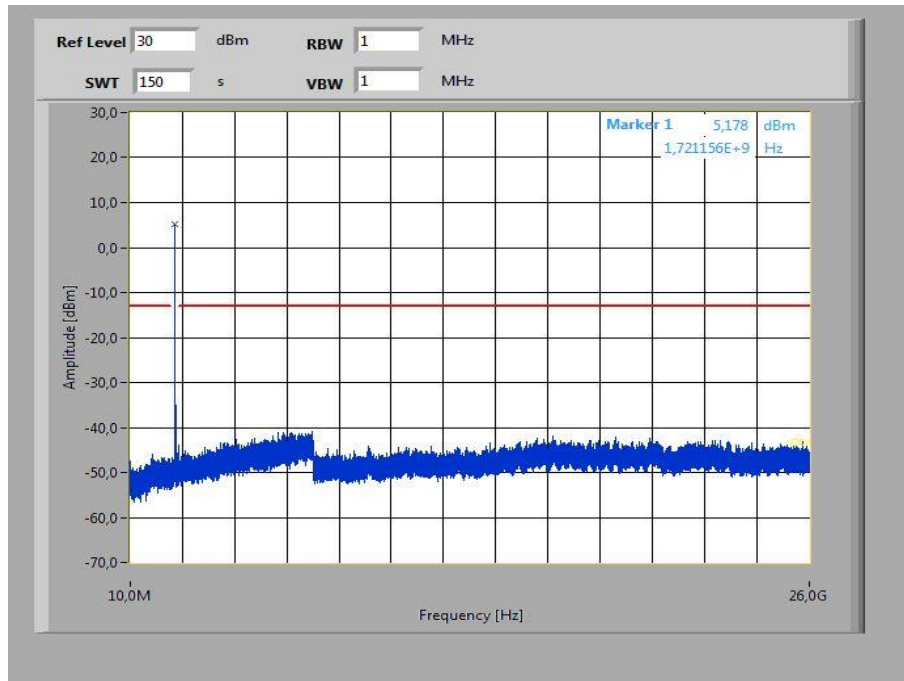
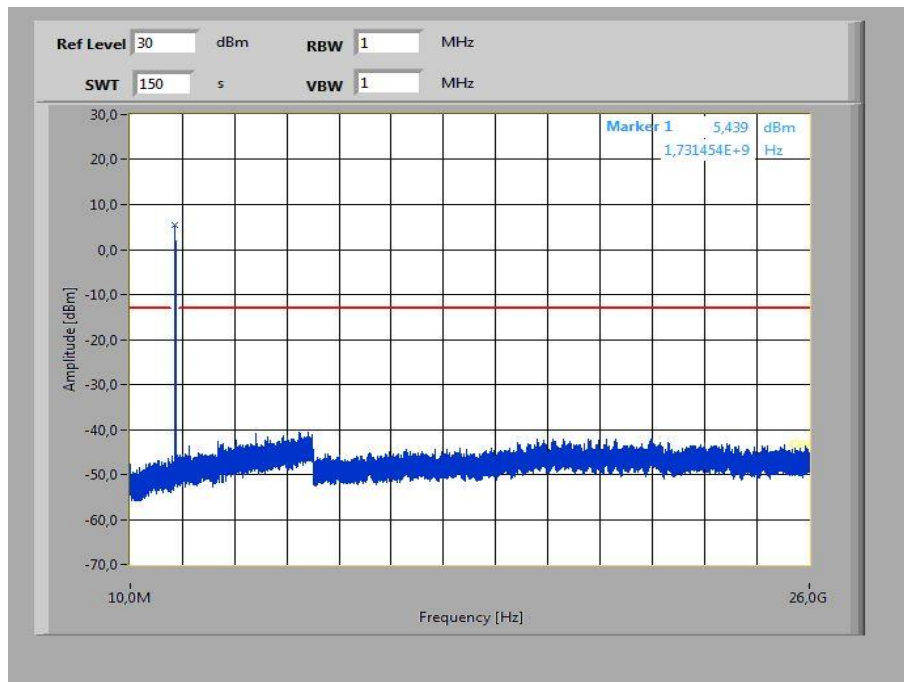
Plot 6: Highest channel, 10 MHz to 26 GHz

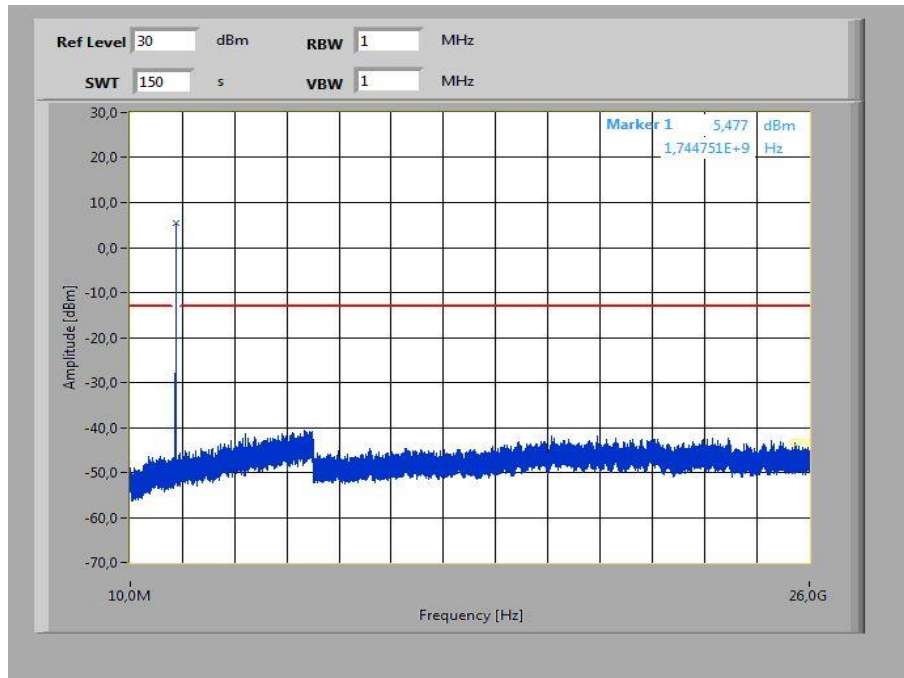
Plots for 10 MHz channel bandwidth, QPSK**Plot 1: Lowest channel, 10 MHz to 26 GHz****Plot 2: Middle channel, 10 MHz to 26 GHz**

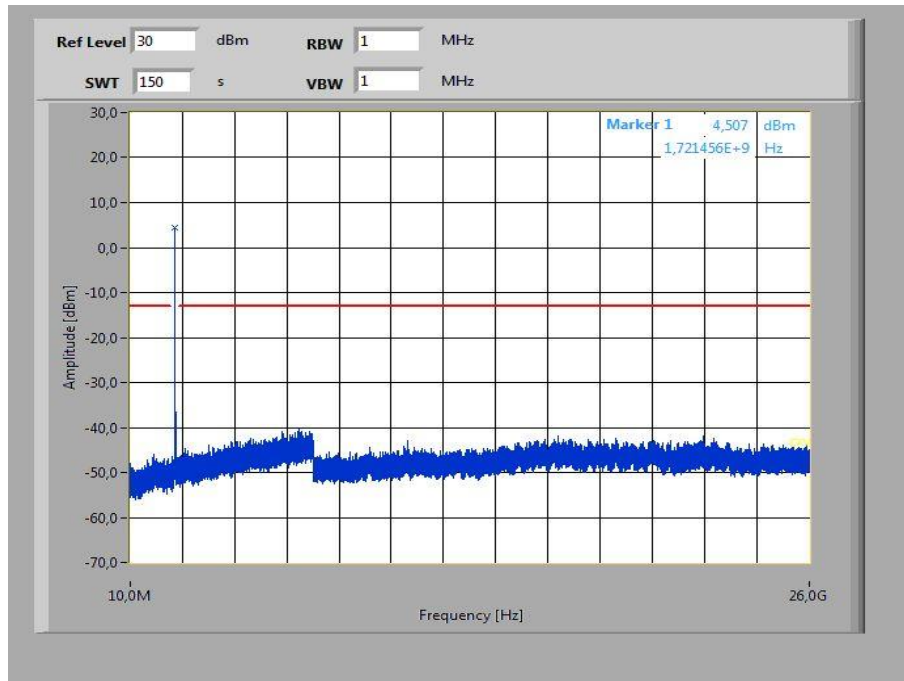
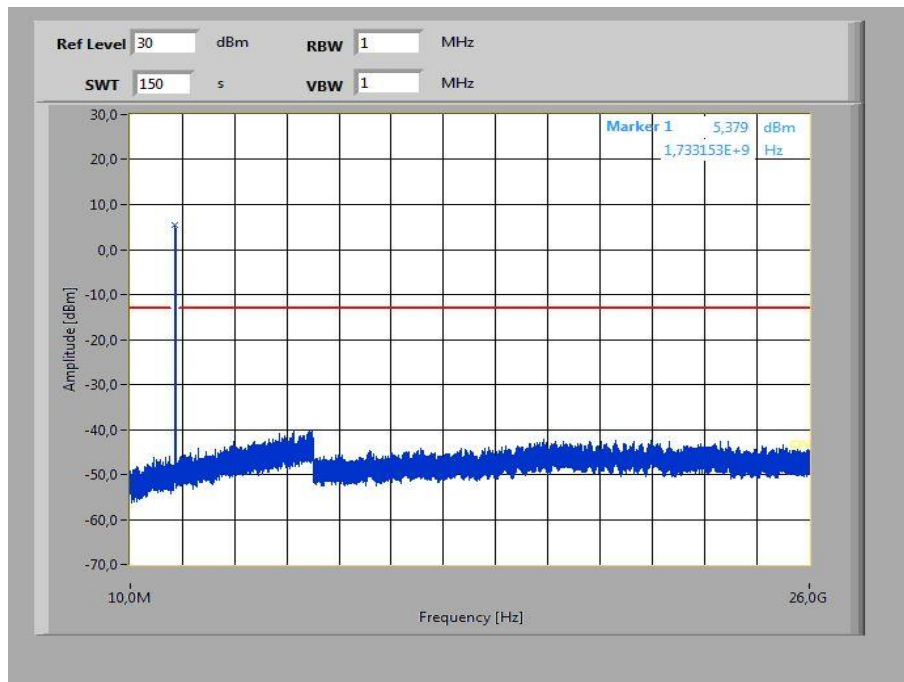
Plot 3: Highest channel, 10 MHz to 26 GHz

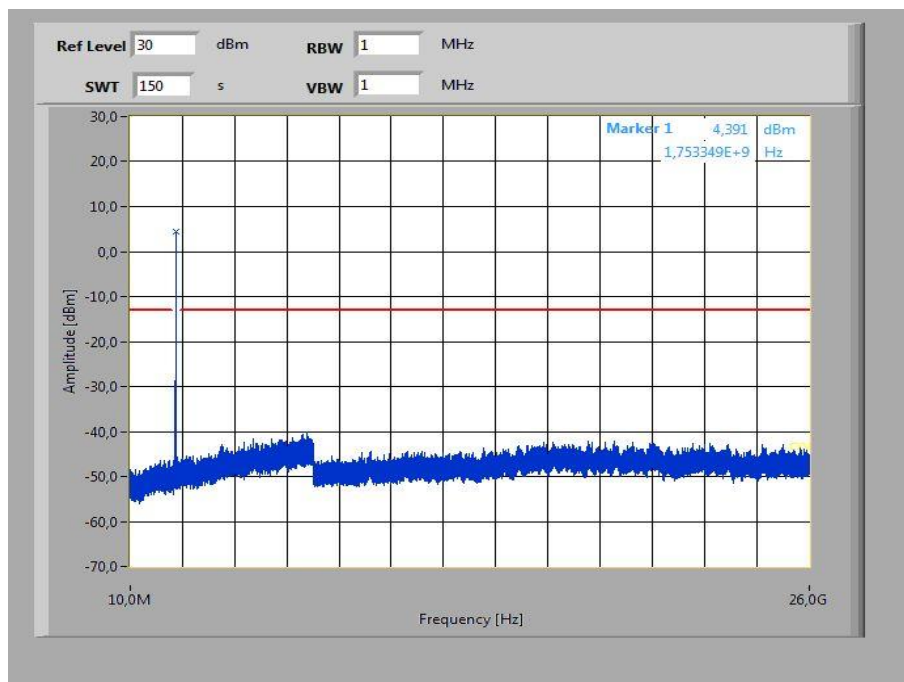
Plots for 10 MHz channel bandwidth, 16-QAM**Plot 4: Lowest channel, 10 MHz to 26 GHz****Plot 5: Middle channel, 10 MHz to 26 GHz**

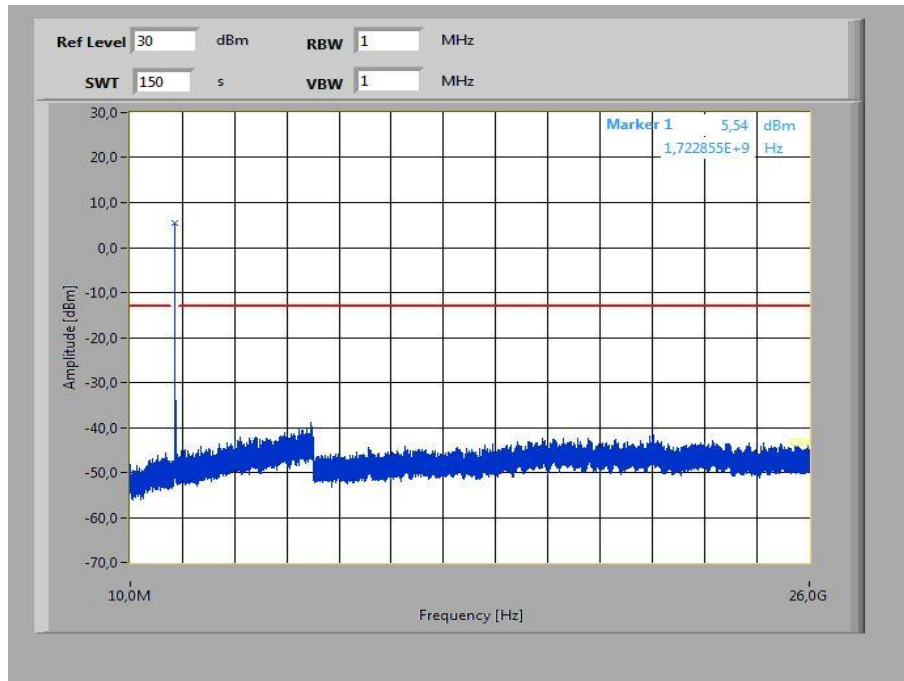
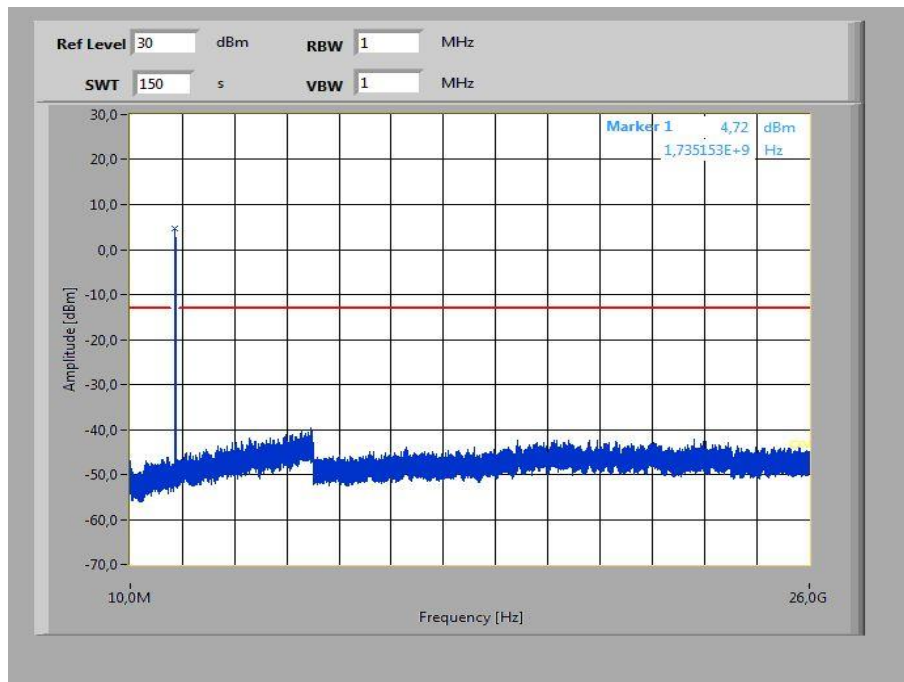
Plot 6: Highest channel, 10 MHz to 26 GHz

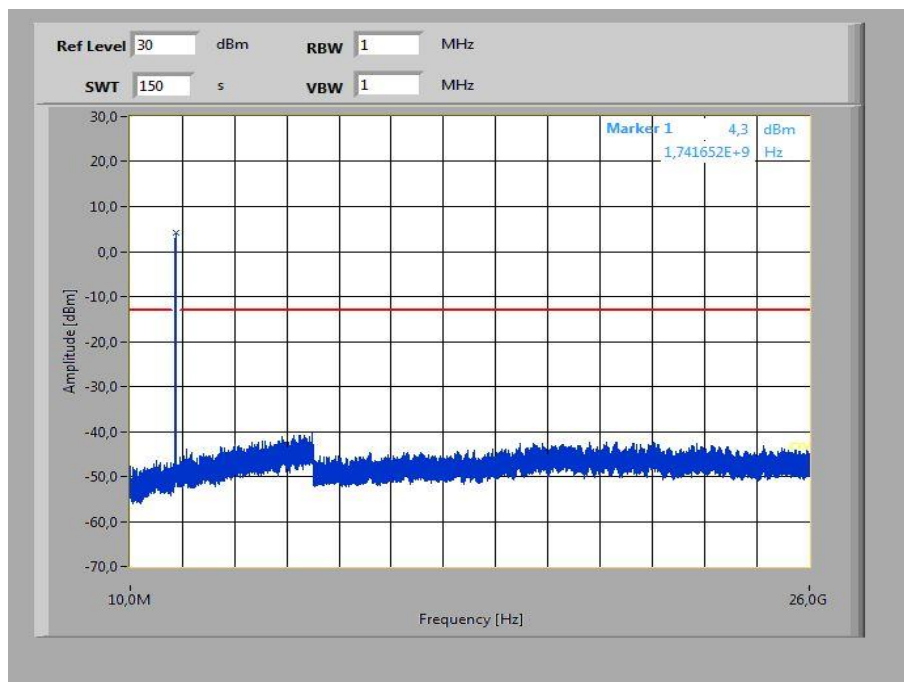
Plots for 15 MHz channel bandwidth, QPSK**Plot 1: Lowest channel, 10 MHz to 26 GHz****Plot 2: Middle channel, 10 MHz to 26 GHz**

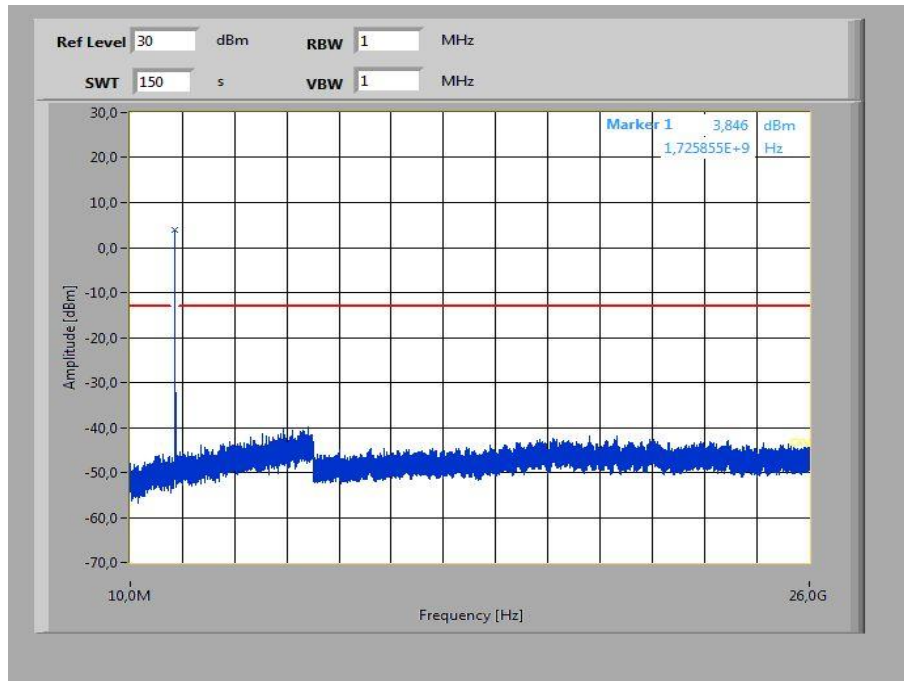
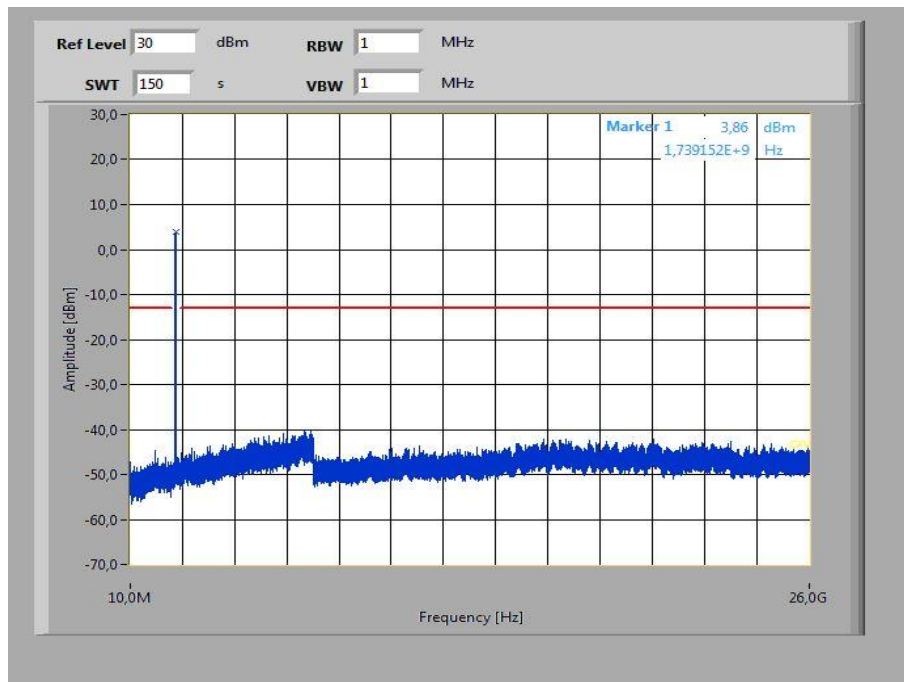
Plot 3: Highest channel, 10 MHz to 26 GHz

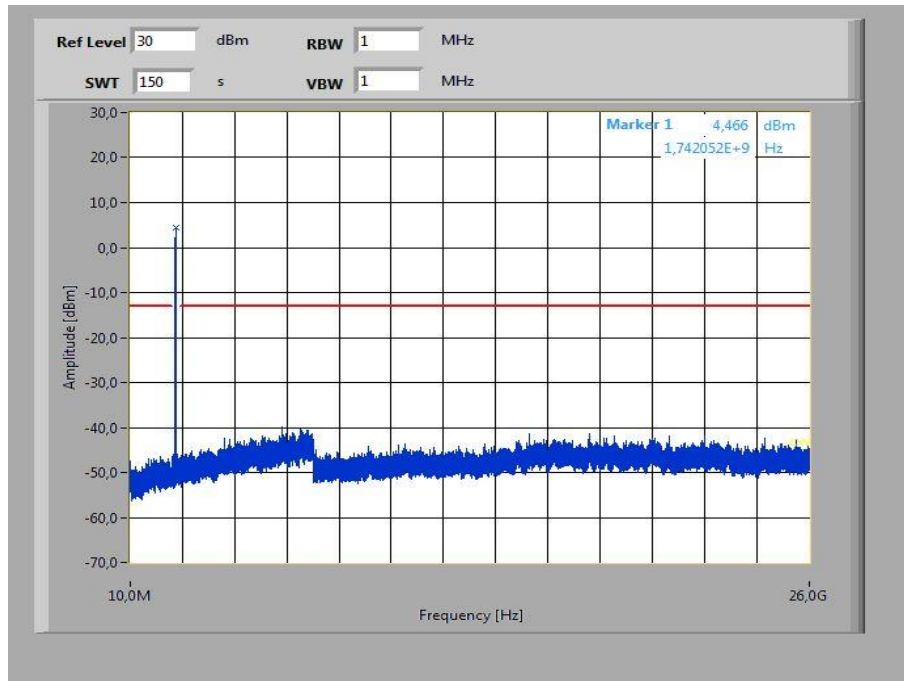
Plots for 15 MHz channel bandwidth, 16-QAM**Plot 4: Lowest channel, 10 MHz to 26 GHz****Plot 5: Middle channel, 10 MHz to 26 GHz**

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

11.2.5 Block edge compliance

Description:

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

For the measurement all available channel bandwidths were used.

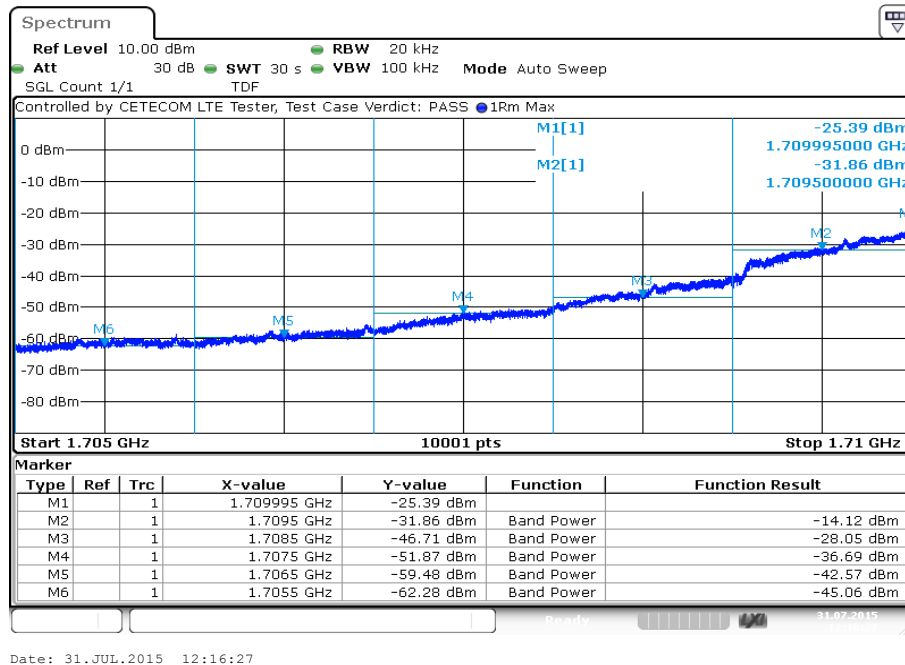
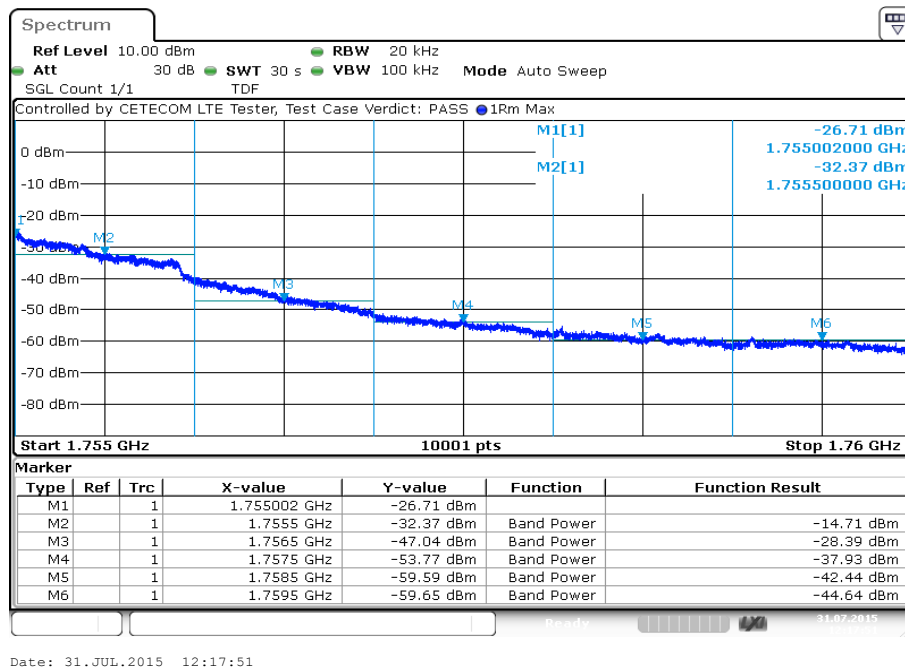
Measurement:

Measurement parameters	
Detector:	RMS
Sweep time:	30 s
Resolution bandwidth:	1% - 5% of the OBW
Video bandwidth:	$\geq 3 \times \text{RBW}$
Span:	5 MHz
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.3 - A
Measurement uncertainty:	see chapter 8

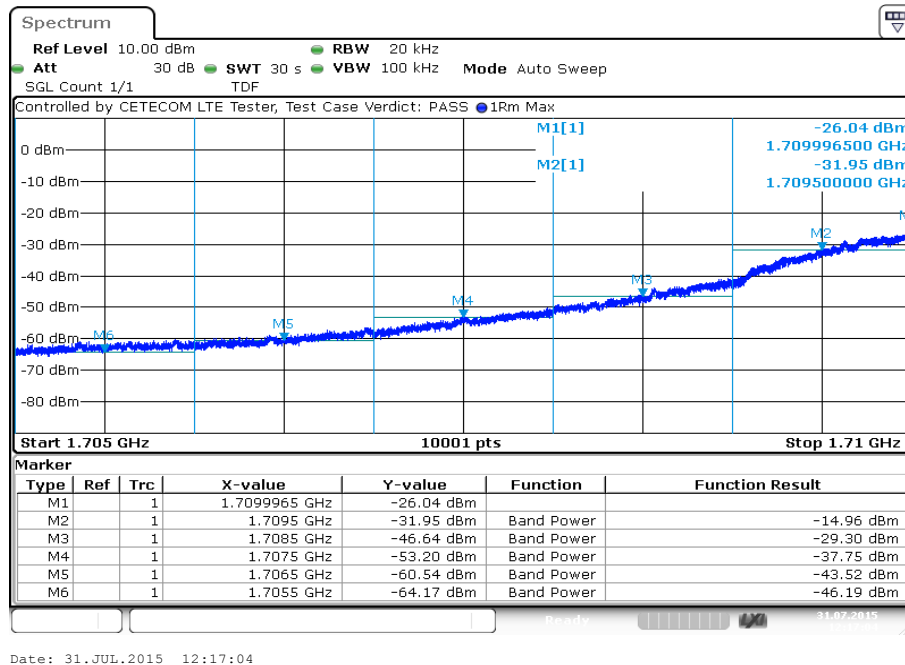
Plot shows the band edge. M1 shows the value with the 1% OBW filter. The table below the plot shows the channel power values over 1 MHz.

Limits:

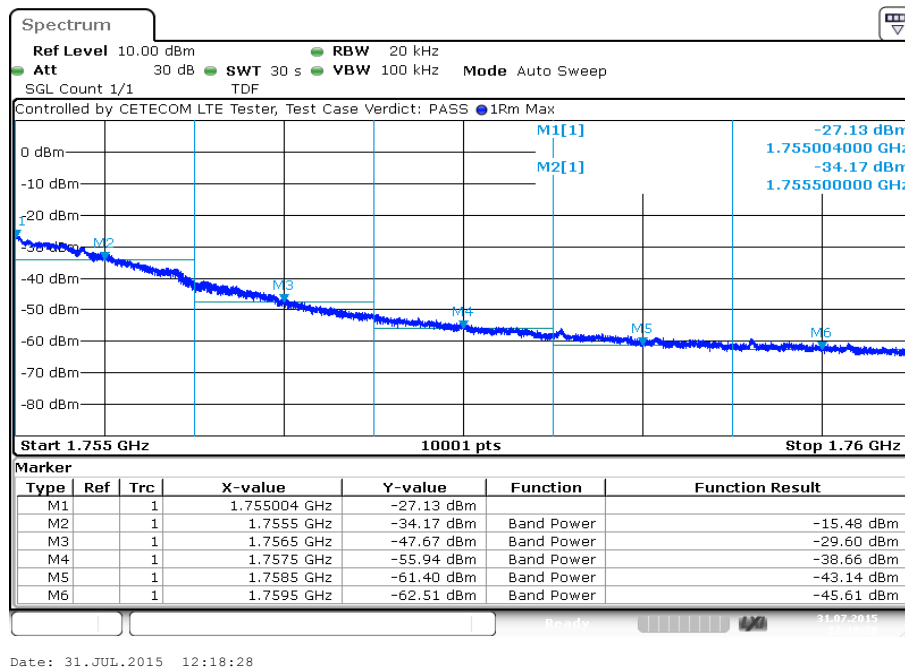
FCC	IC
Block Edge Compliance	
Attenuation $\geq 43 + 10\log(P)$ (P, Power in Watts)	
-13 dBm	

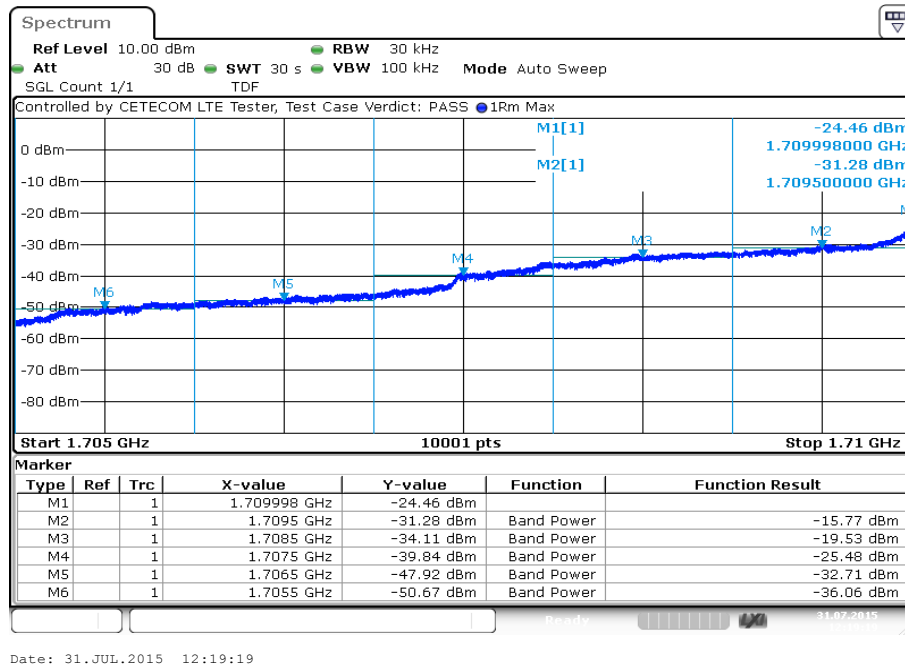
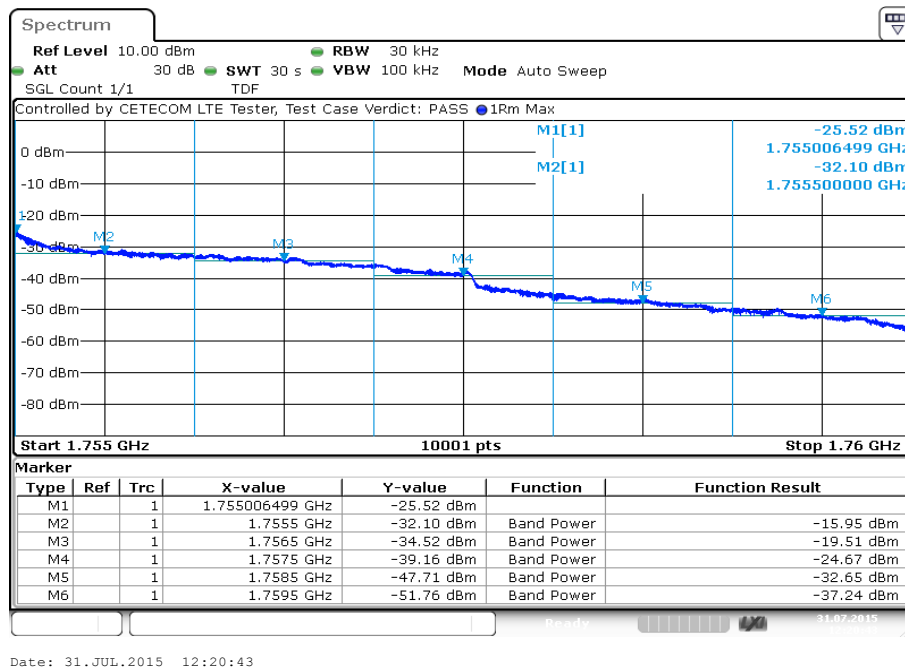
Results: 1.4 MHz channel bandwidth**Plot 1: Lowest channel, QPSK modulation****Plot 2: Highest channel, QPSK modulation**

Plot 3: Lowest channel, 16 – QAM modulation

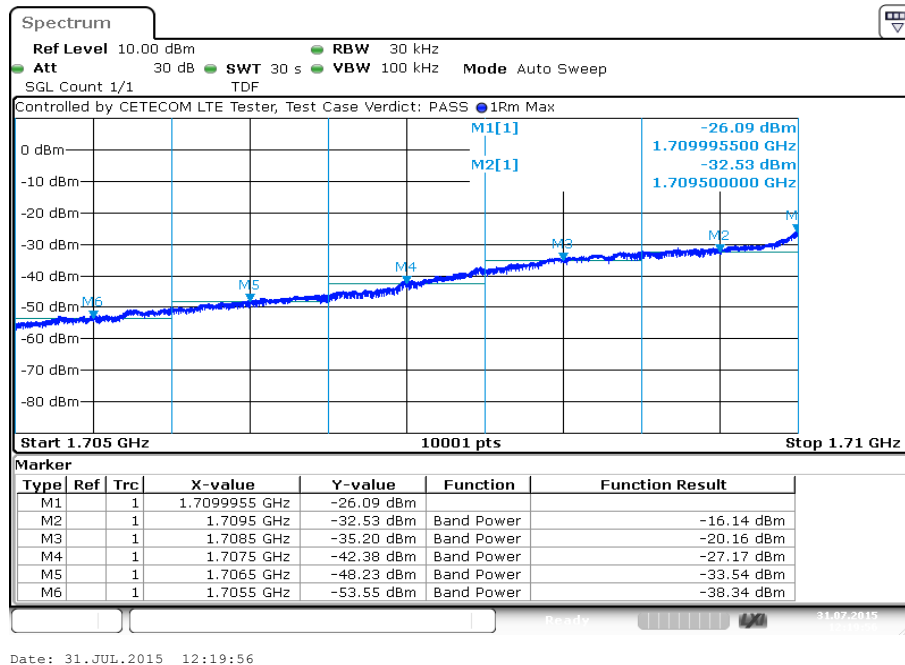


Plot 4: Highest channel, 16 – QAM modulation

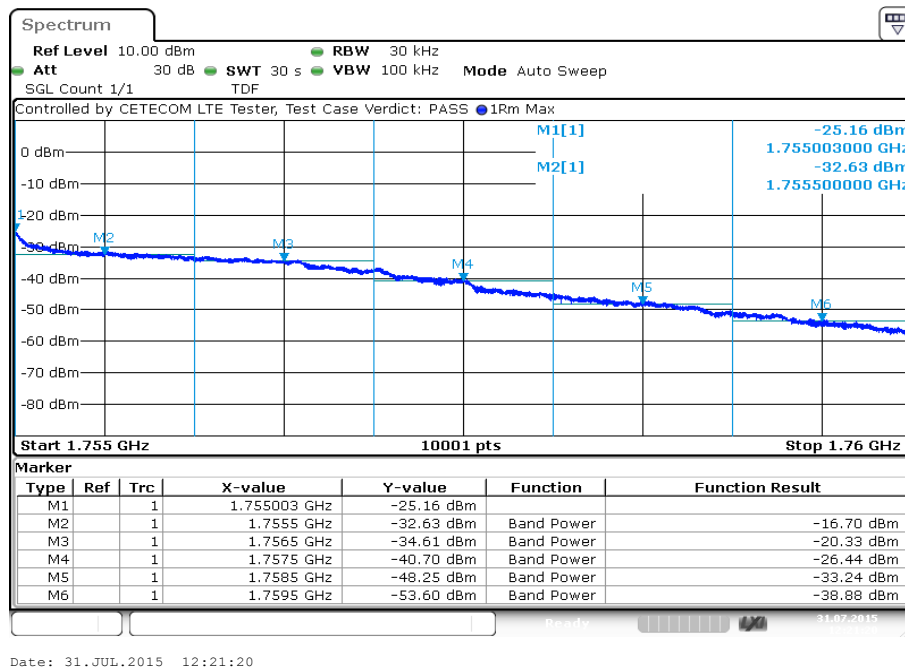


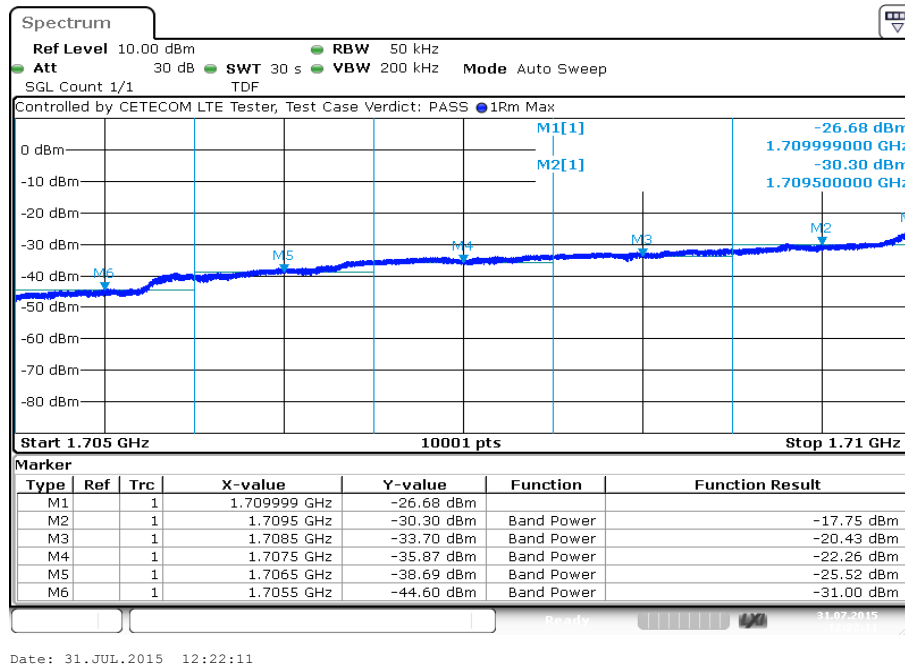
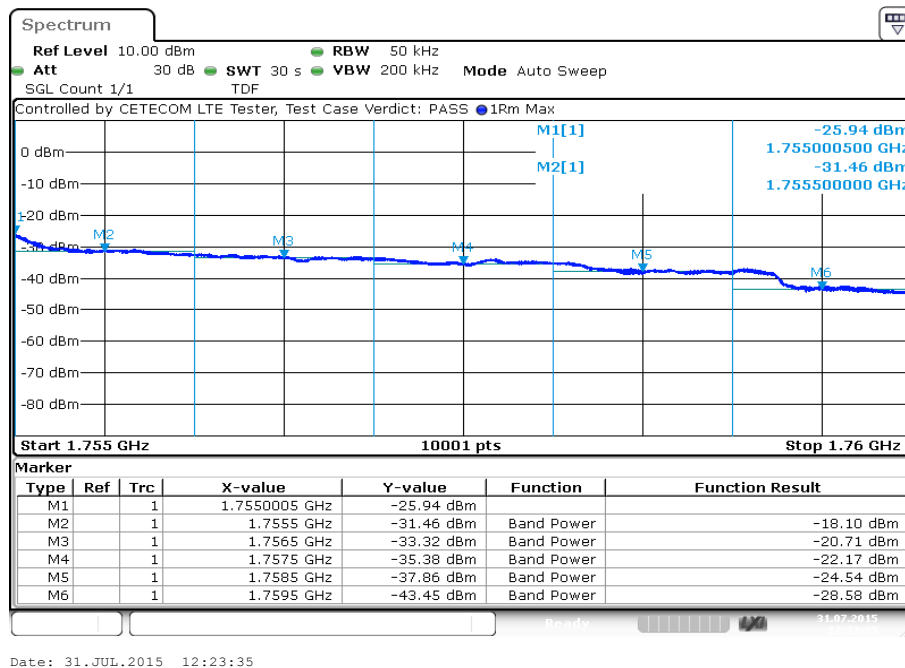
Results: 3 MHz channel bandwidth**Plot 1: Lowest channel, QPSK modulation****Plot 2: Highest channel, QPSK modulation**

Plot 3: Lowest channel, 16 – QAM modulation

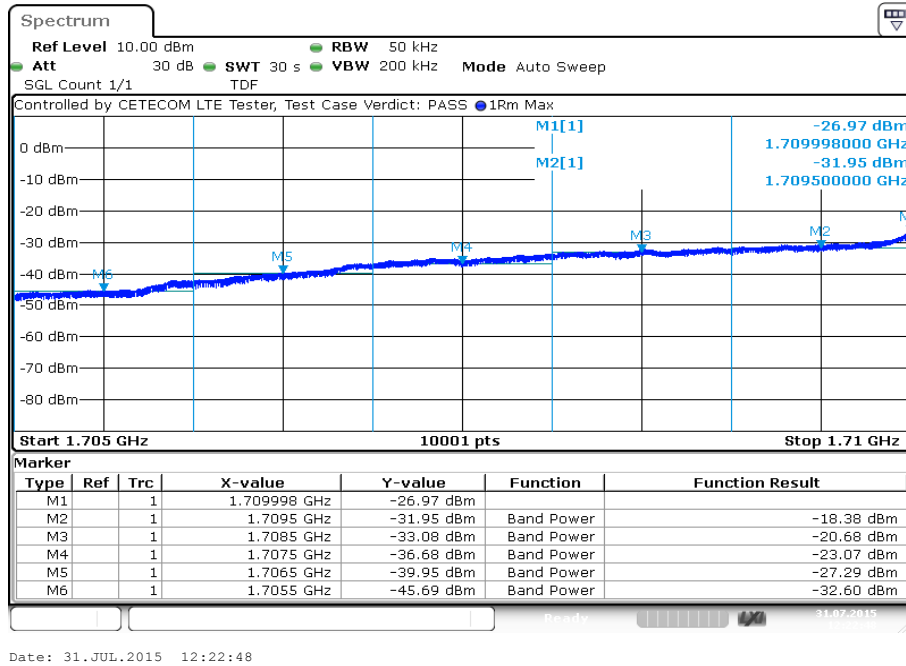


Plot 4: Highest channel, 16 – QAM modulation

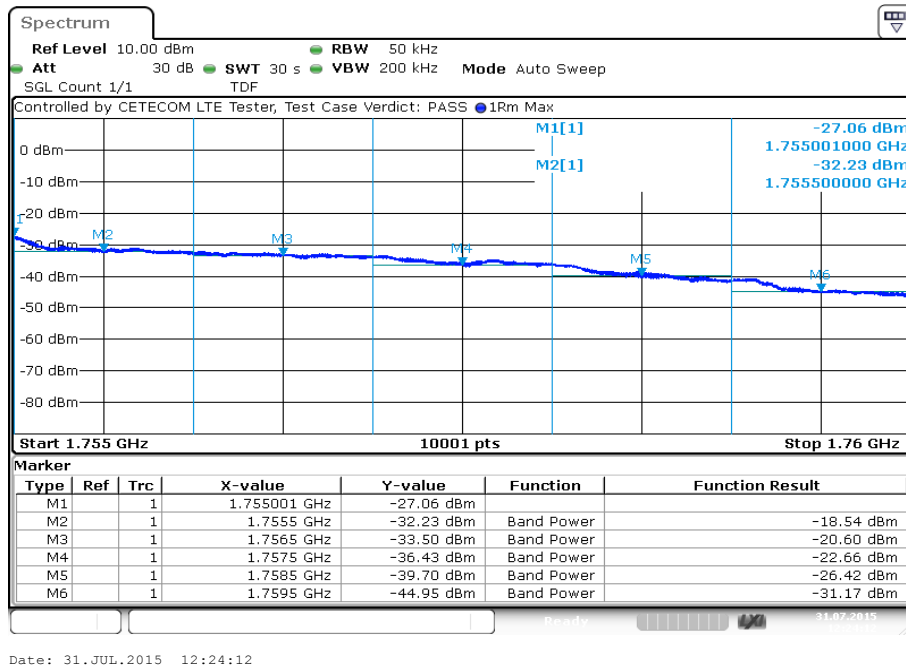


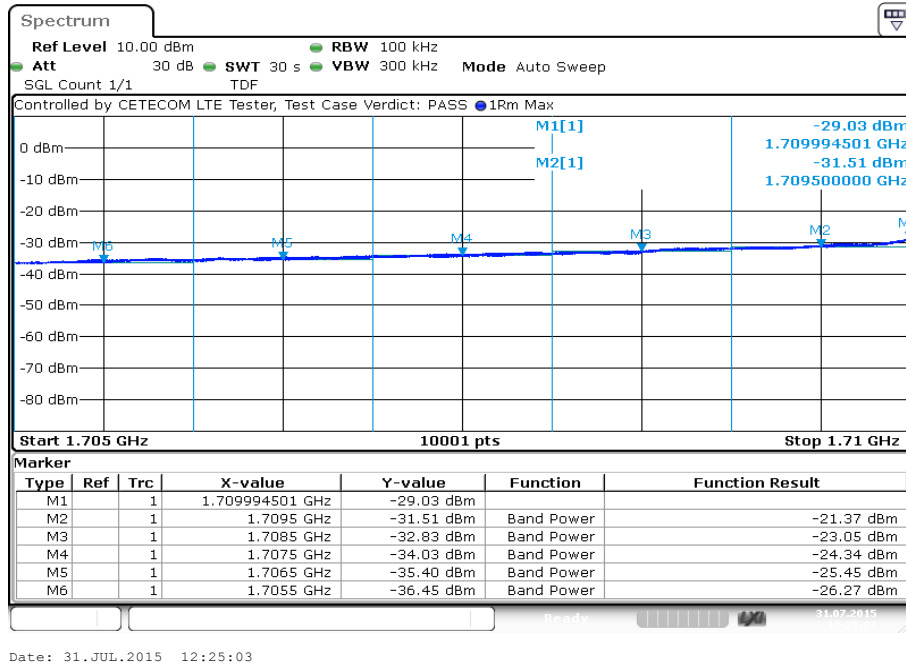
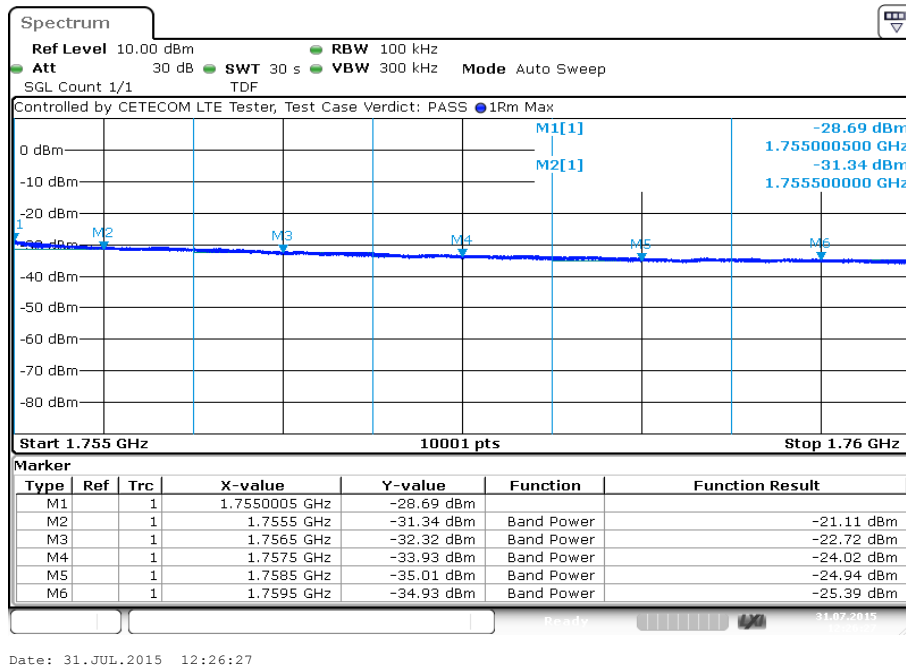
Results: 5 MHz channel bandwidth**Plot 1: Lowest channel, QPSK modulation****Plot 2: Highest channel, QPSK modulation**

Plot 3: Lowest channel, 16 – QAM modulation

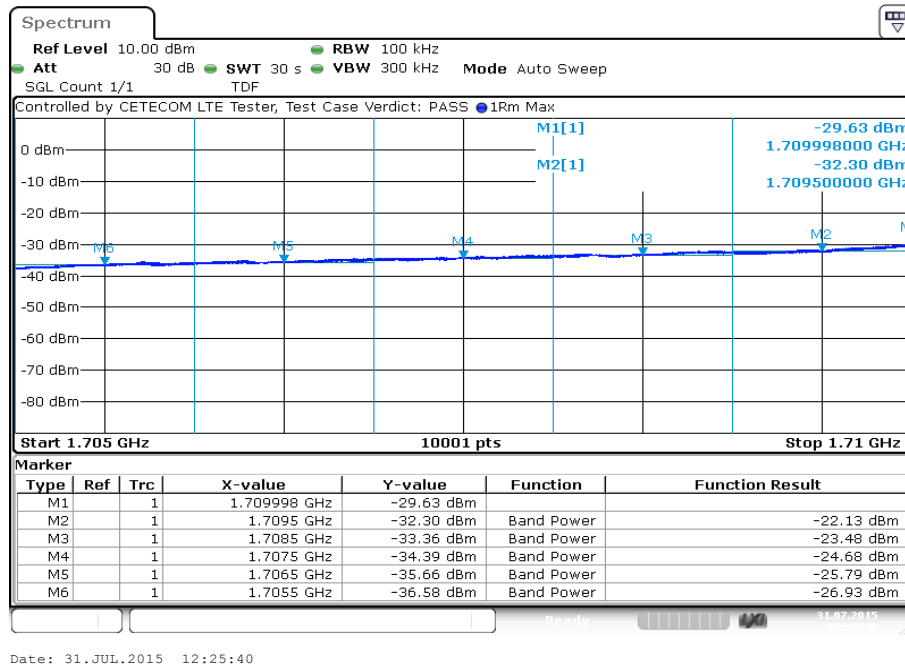


Plot 4: Highest channel, 16 – QAM modulation

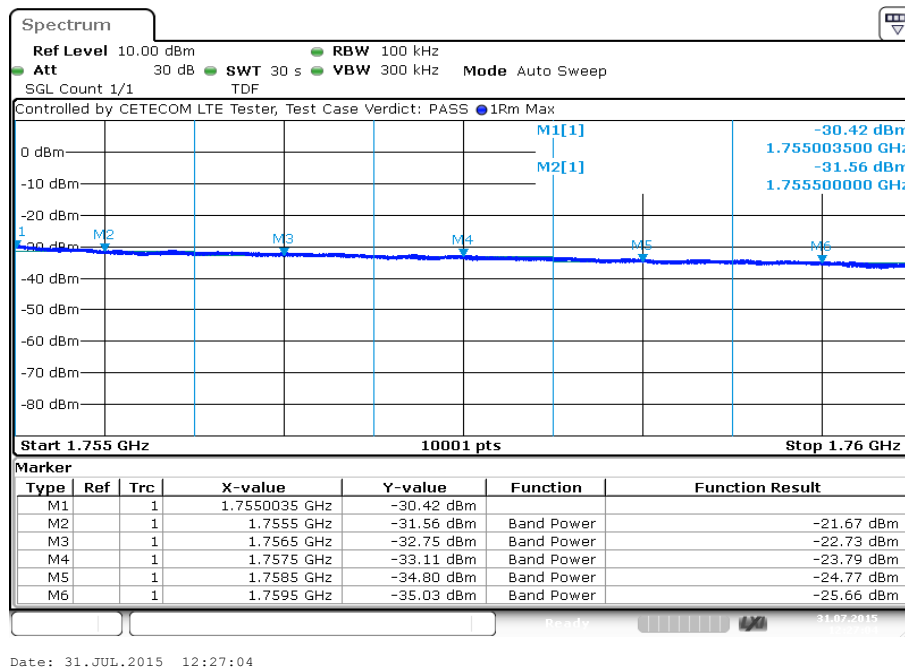


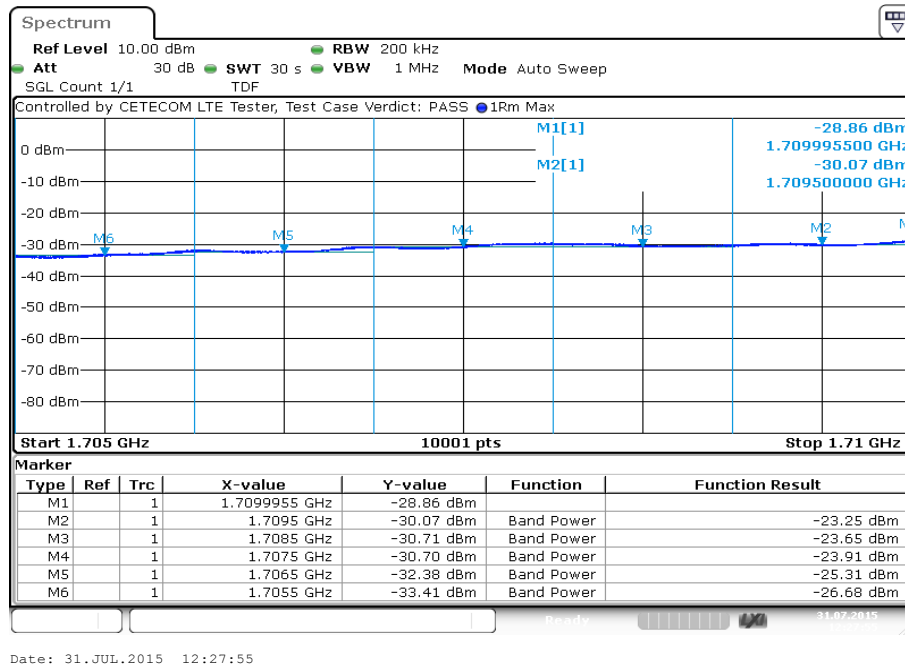
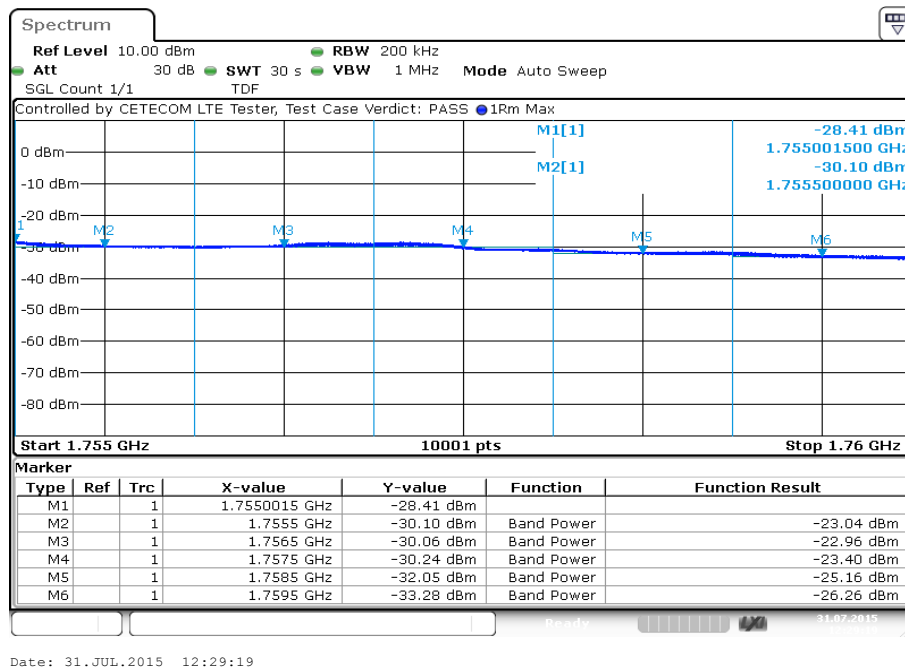
Results: 10 MHz channel bandwidth**Plot 1: Lowest channel, QPSK modulation****Plot 2: Highest channel, QPSK modulation**

Plot 3: Lowest channel, 16 – QAM modulation

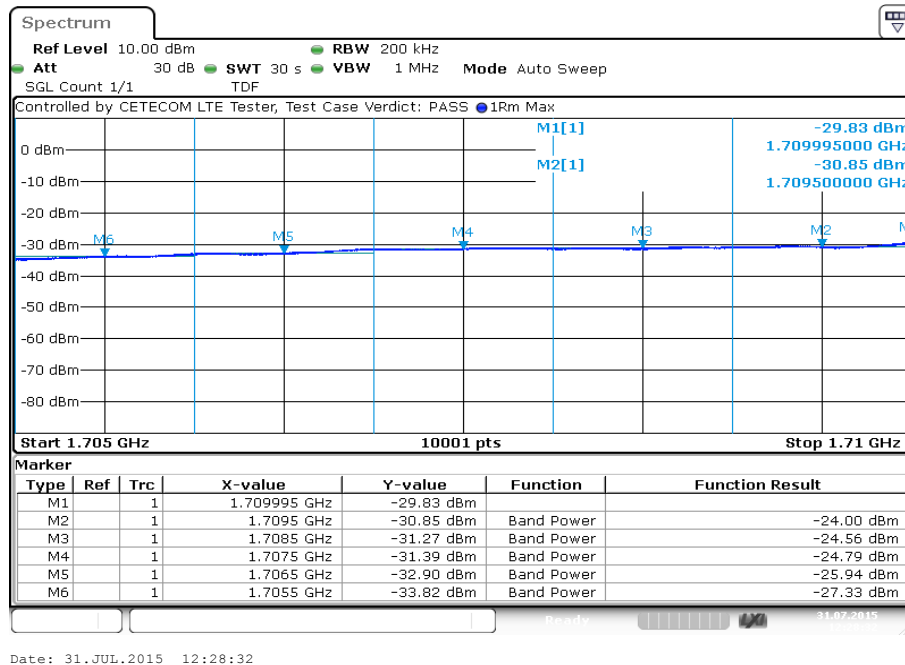


Plot 4: Highest channel, 16 – QAM modulation

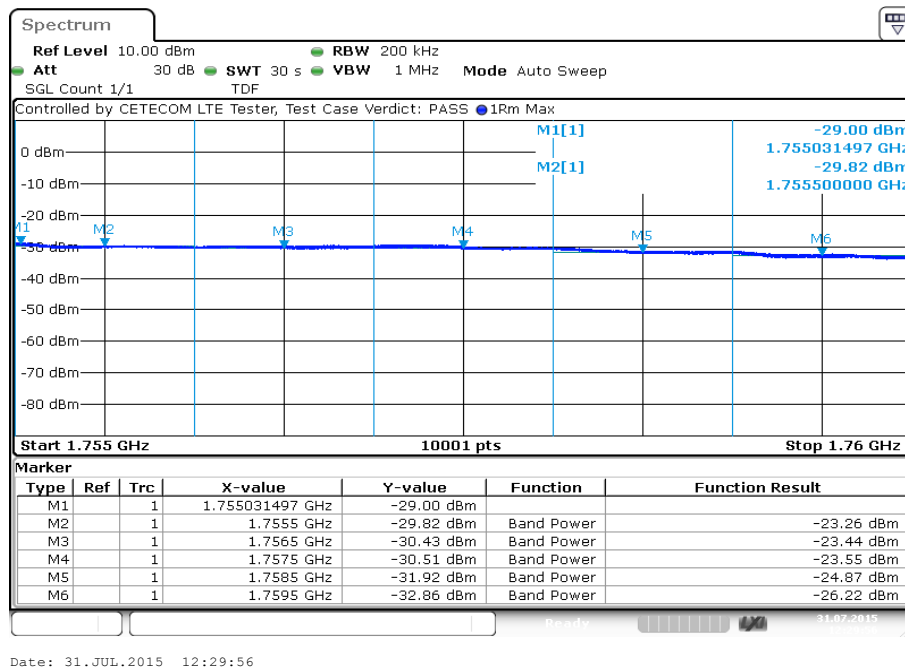


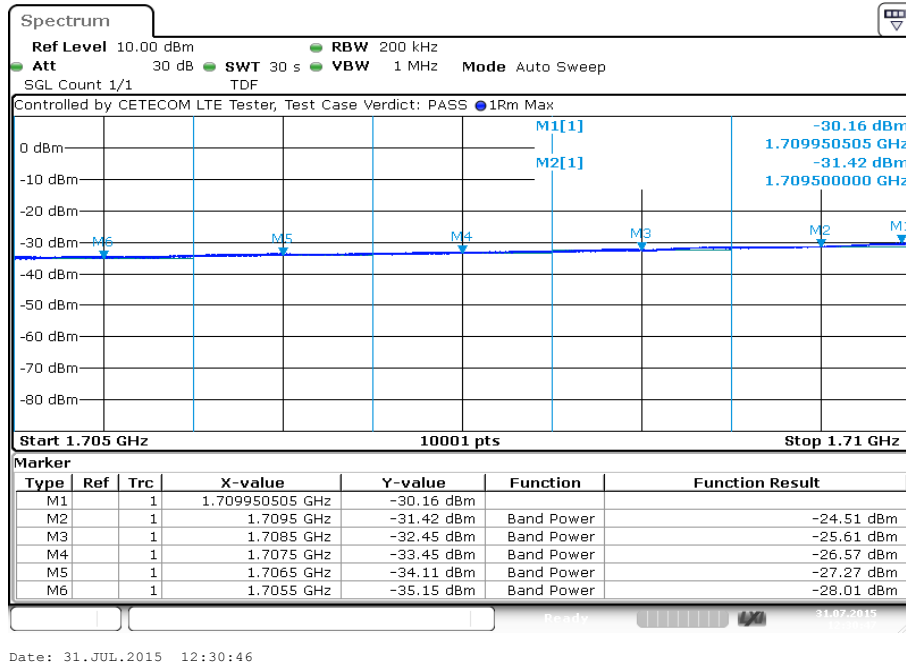
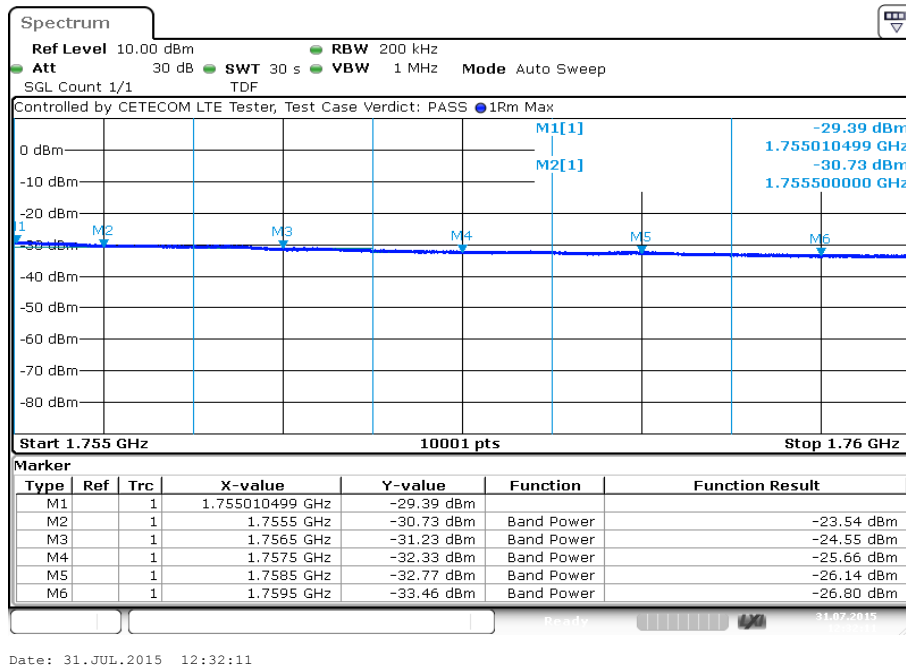
Results: 15 MHz channel bandwidth**Plot 1: Lowest channel, QPSK modulation****Plot 2: Highest channel, QPSK modulation**

Plot 3: Lowest channel, 16 – QAM modulation

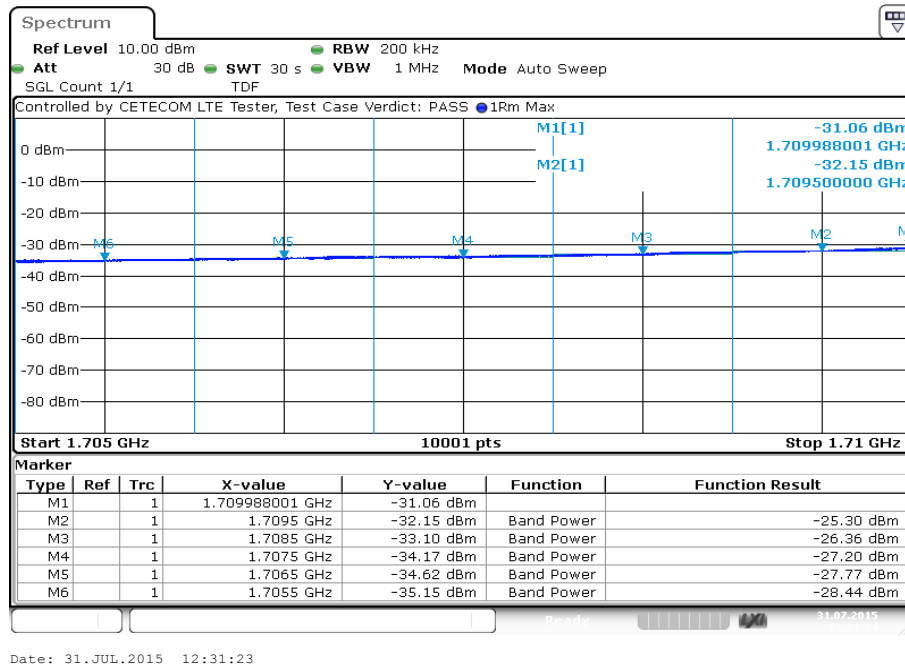


Plot 4: Highest channel, 16 – QAM modulation

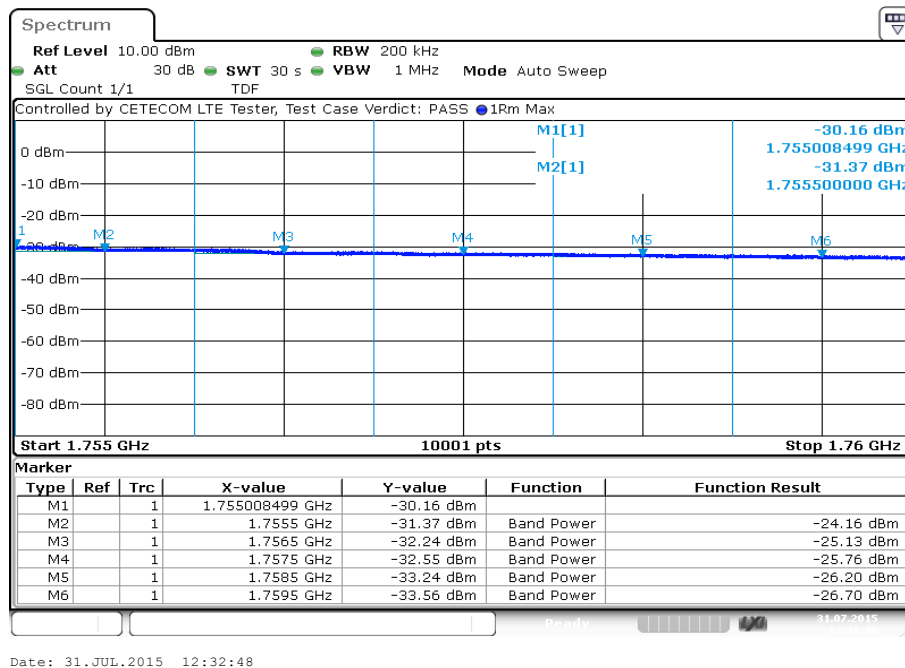


Results: 20 MHz channel bandwidth**Plot 1: Lowest channel, QPSK modulation****Plot 2: Highest channel, QPSK modulation**

Plot 3: Lowest channel, 16 – QAM modulation



Plot 4: Highest channel, 16 – QAM modulation

**Verdict:** compliant

11.2.6 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
Resolution bandwidth:	1% - 5% of the OBW
Video bandwidth:	$\geq 3 \times \text{RBW}$
Span:	2 x nominal BW
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.2
Measurement uncertainty:	see chapter 8

Limits:

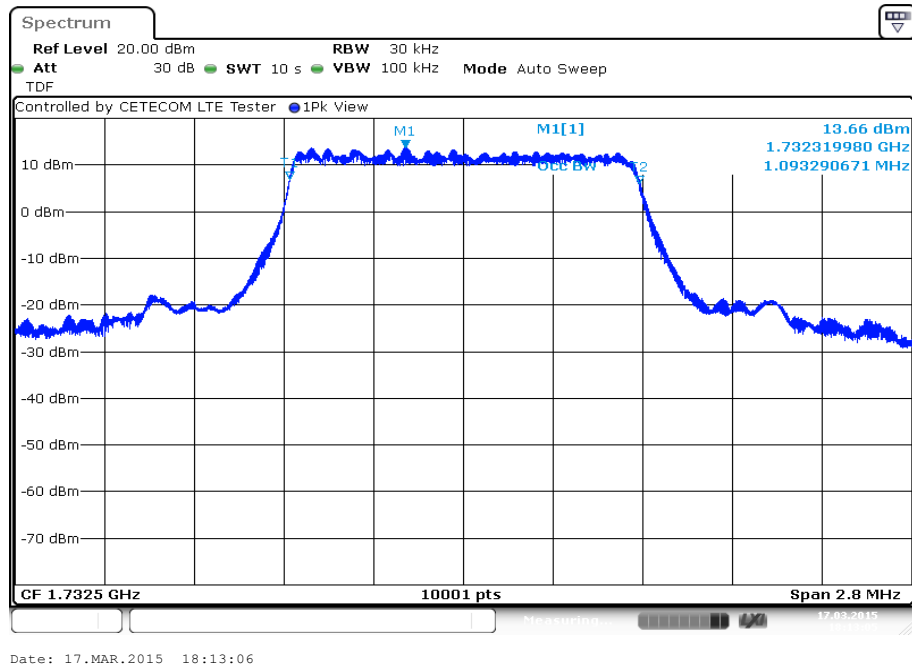
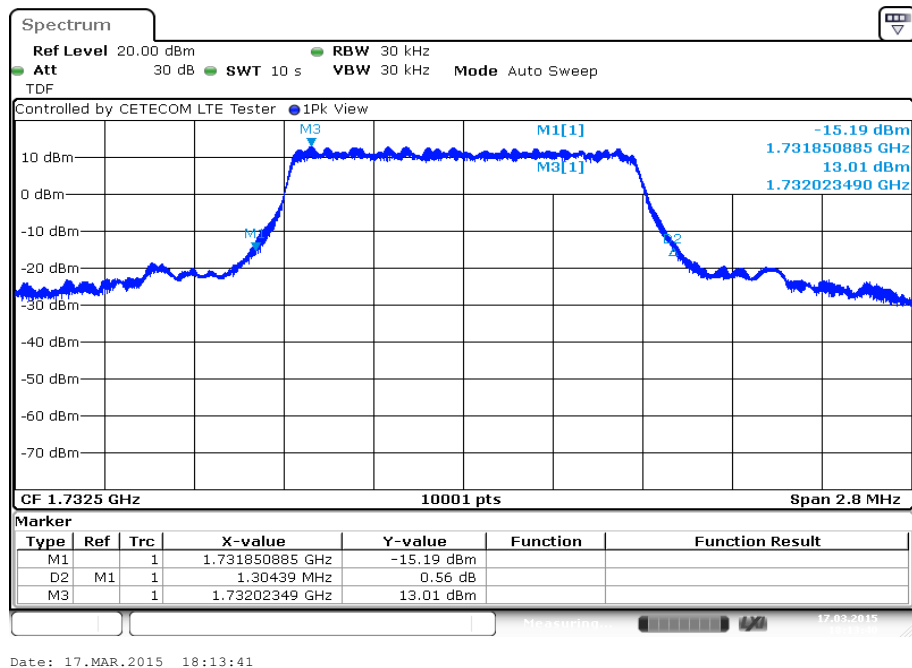
FCC	IC
Occupied Bandwidth	
Spectrum must fall completely in the specified band	

Results:

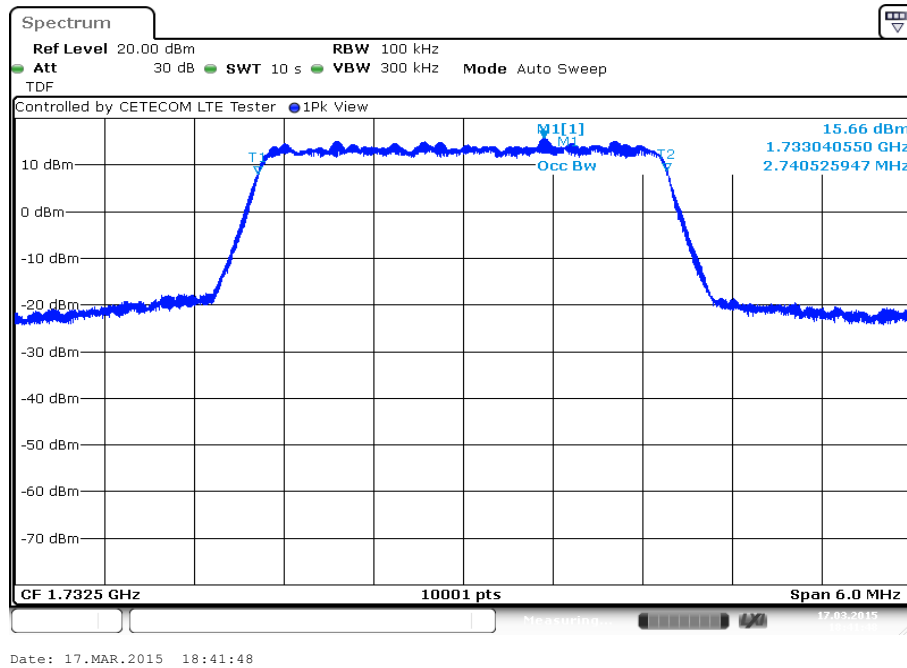
Occupied Bandwidth - QPSK		
Bandwidth [MHz]	99% OBW (kHz)	-26 dBc BW (kHz)
1.4	1093	1304
3	2741	3129
5	4512	5106
10	9057	10195
15	13424	14897
20	17938	19870
Measurement uncertainty	± 100 kHz	

Occupied Bandwidth – 16-QAM		
Bandwidth [MHz]	99% OBW (kHz)	-26 dBc BW (kHz)
1.4	1100	1318
3	2739	3150
5	4500	5034
10	9057	10087
15	13427	14909
20	17946	19966
Measurement uncertainty	± 100 kHz	

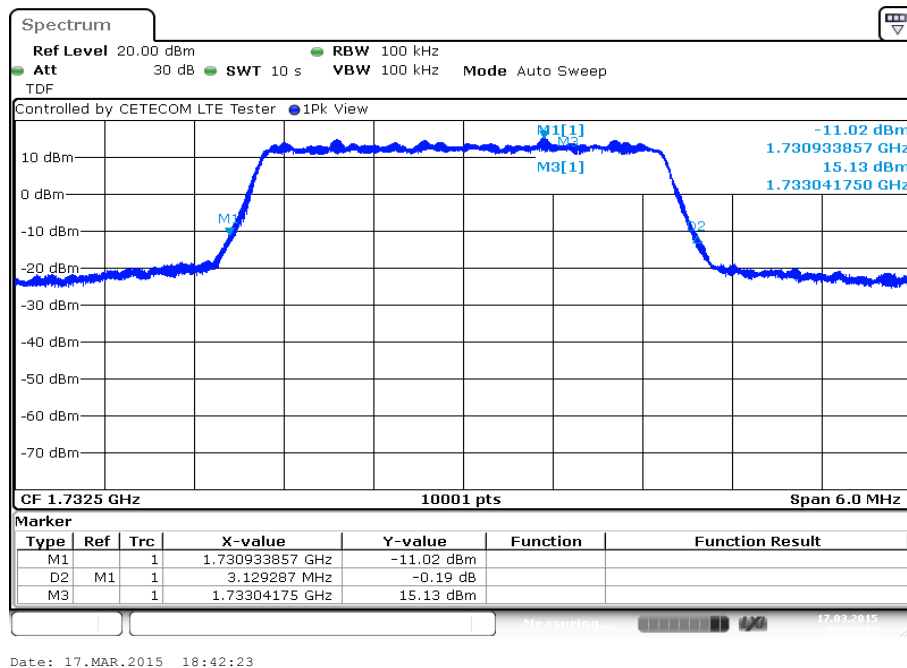
Verdict: **compliant**

Plots: QPSK**Plot 1: 1.4 MHz, 99% OBW****Plot 2: 1.4 MHz, -26 dBc OBW**

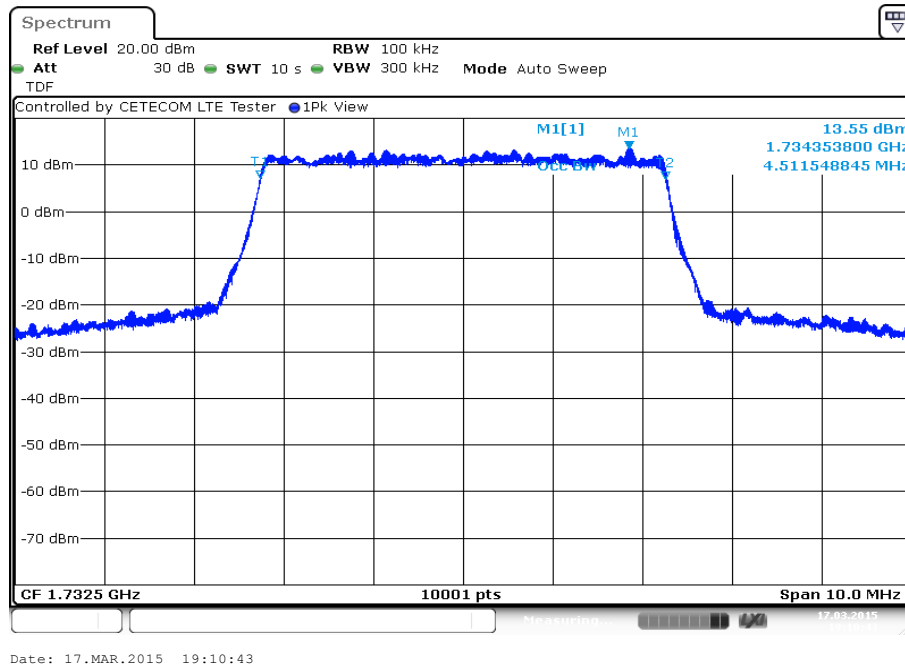
Plot 3: 3 MHz, 99% OBW



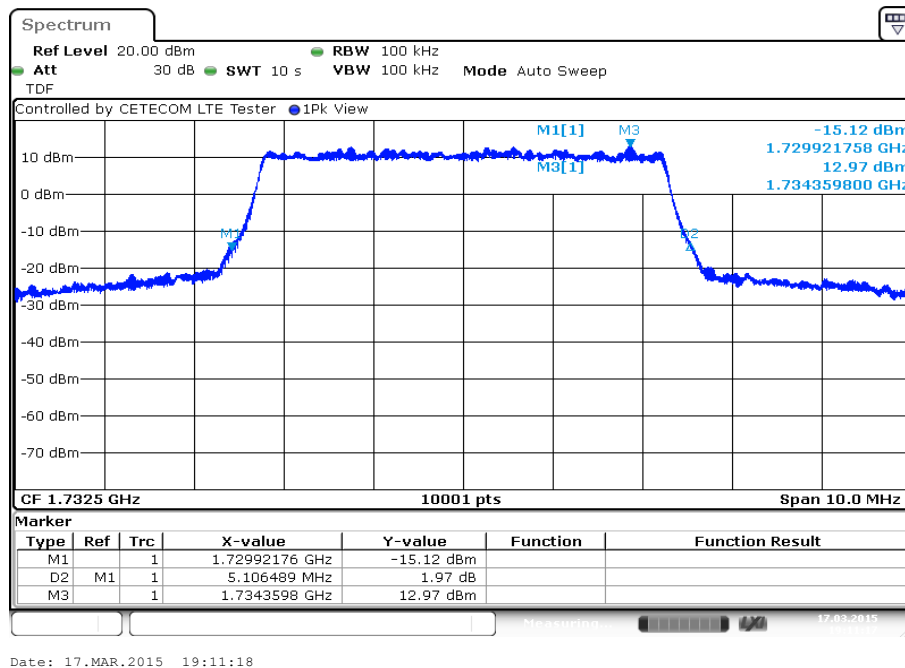
Plot 4: 3 MHz, -26 dBc OBW



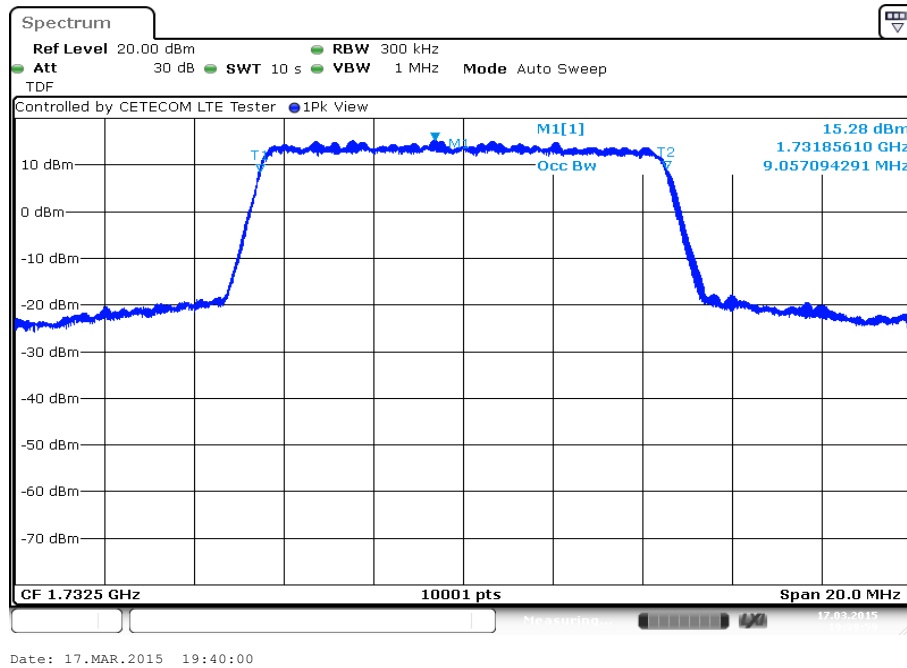
Plot 5: 5 MHz, 99% OBW



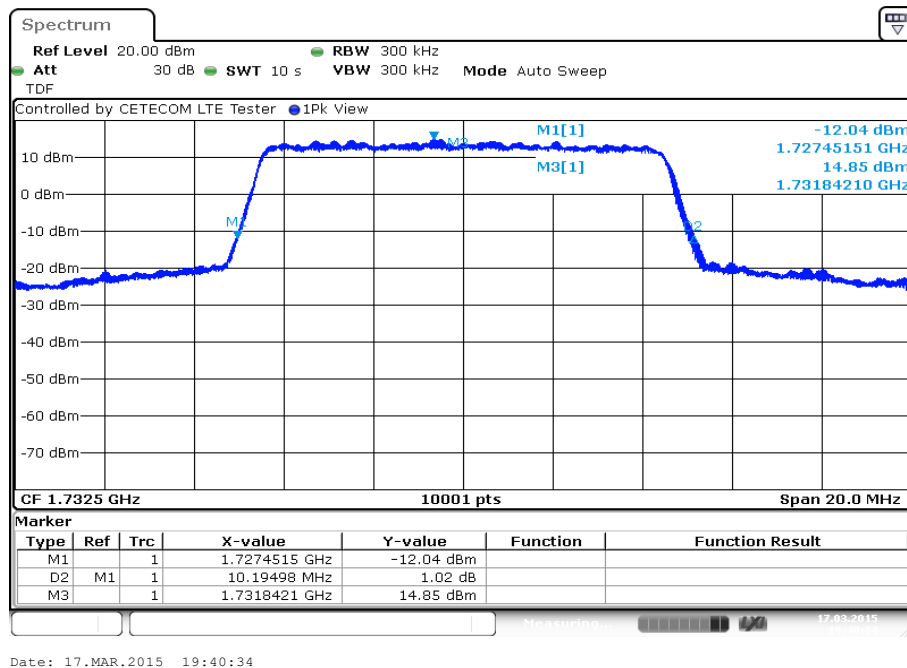
Plot 6: 5 MHz, -26 dBc OBW



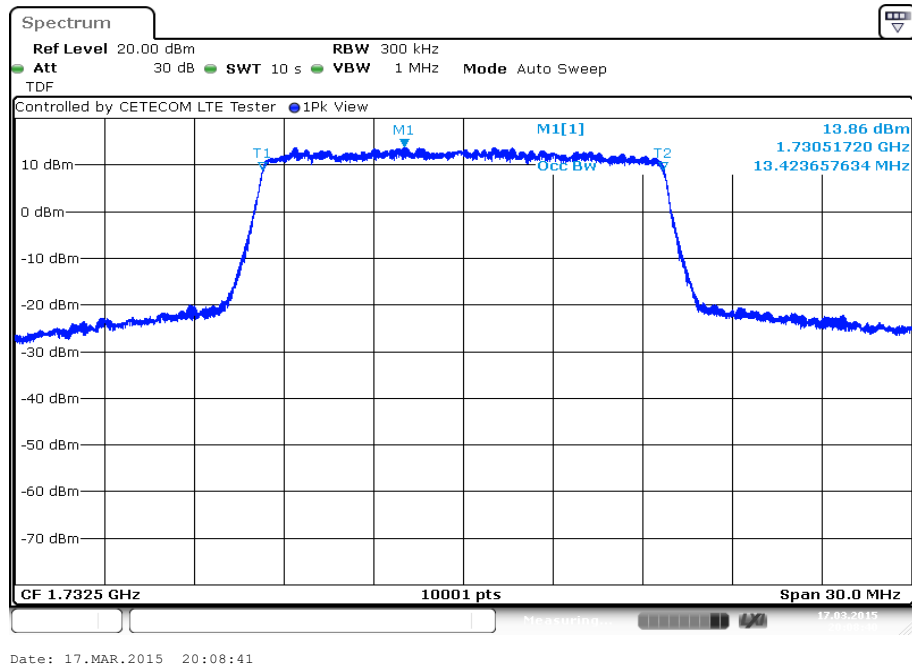
Plot 7: 10 MHz, 99% OBW



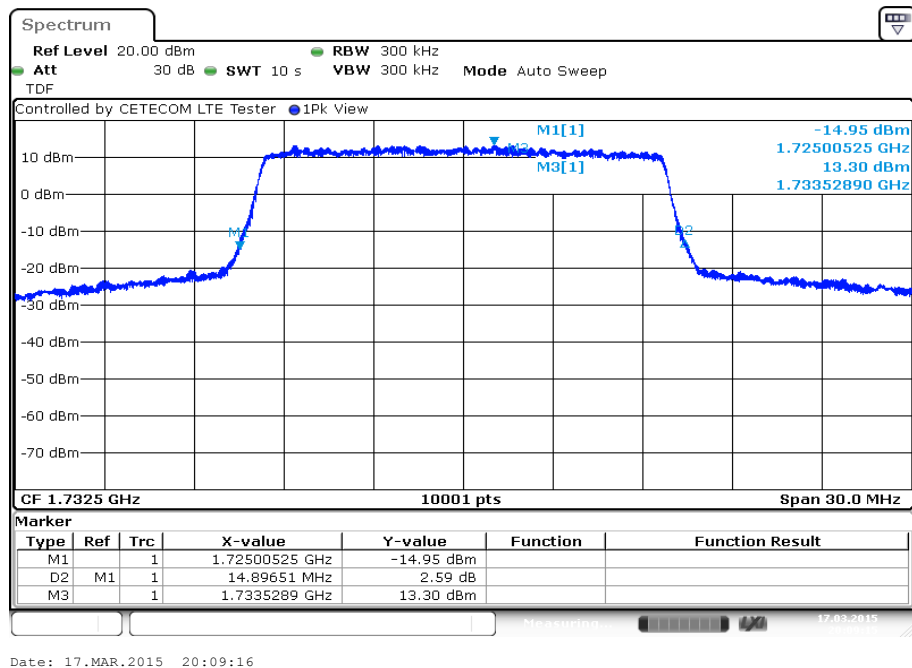
Plot 8: 10 MHz, -26 dBc OBW



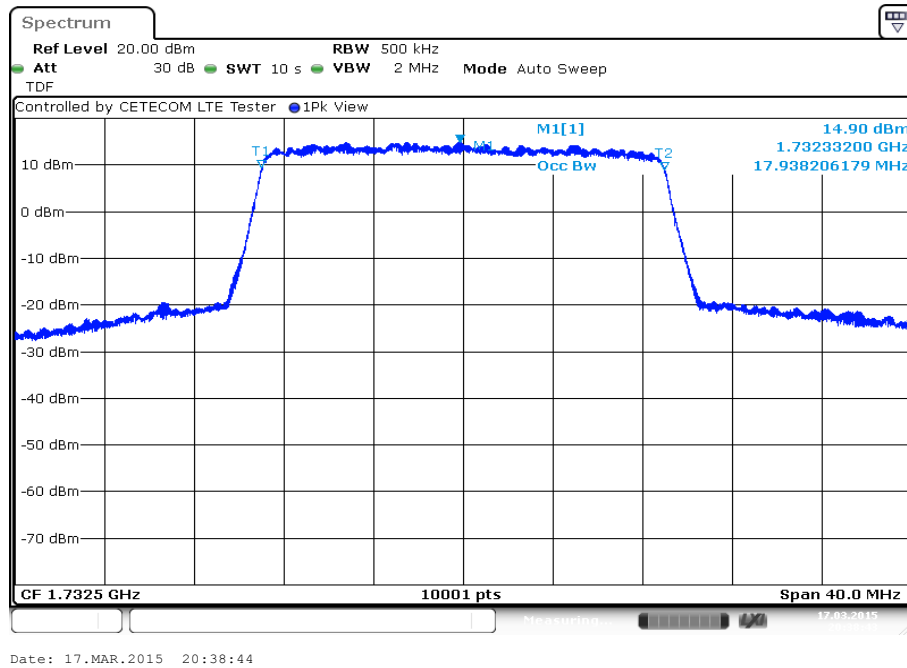
Plot 9: 15 MHz, 99% OBW



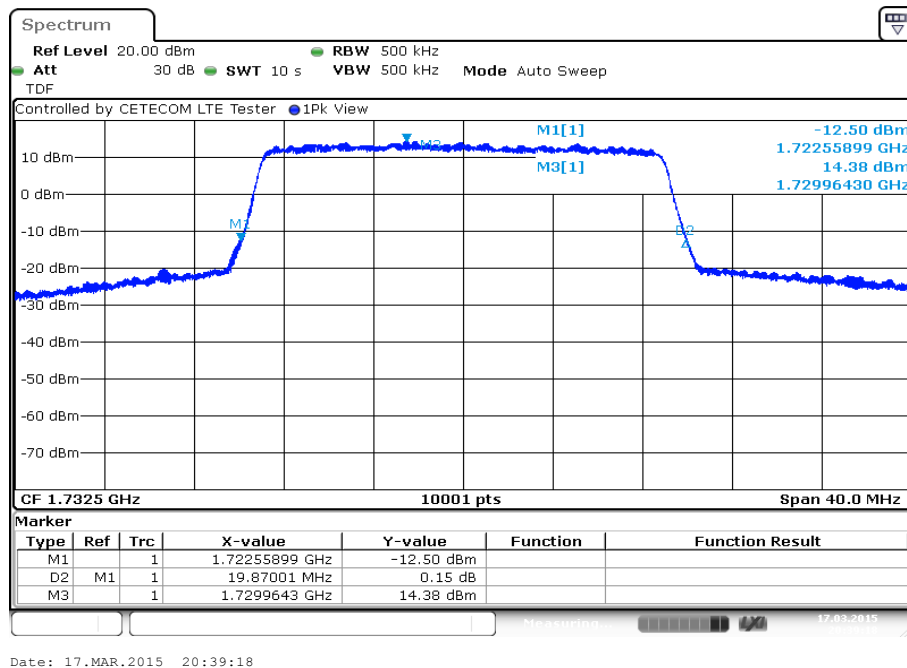
Plot 10: 15 MHz, -26 dBc OBW

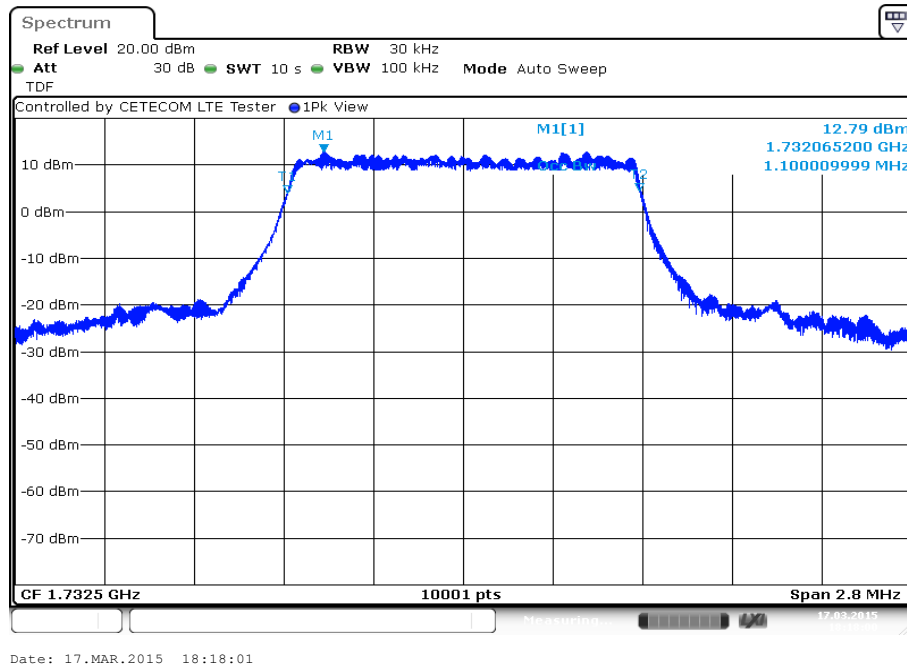
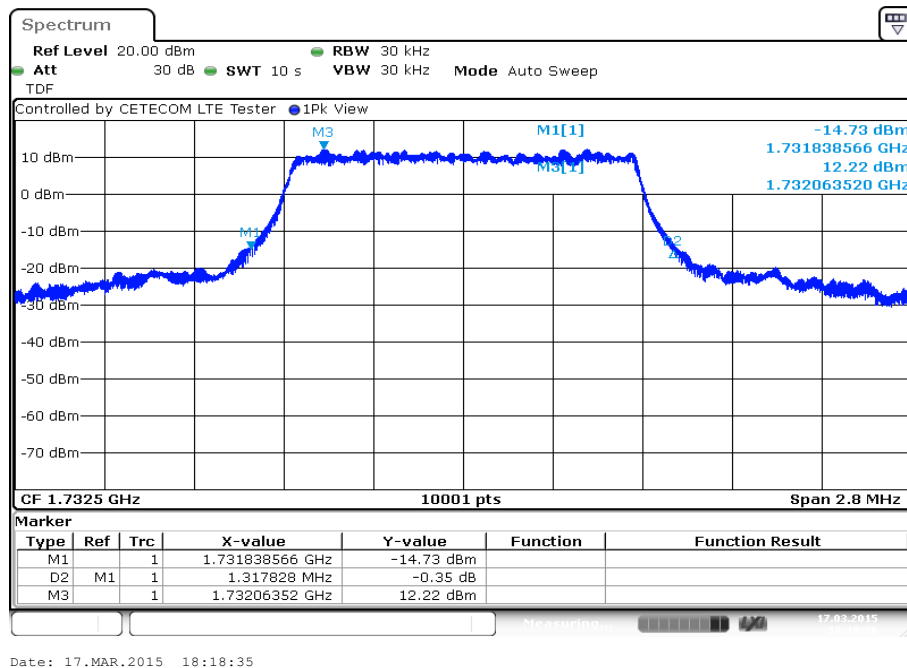


Plot 11: 20 MHz, 99% OBW

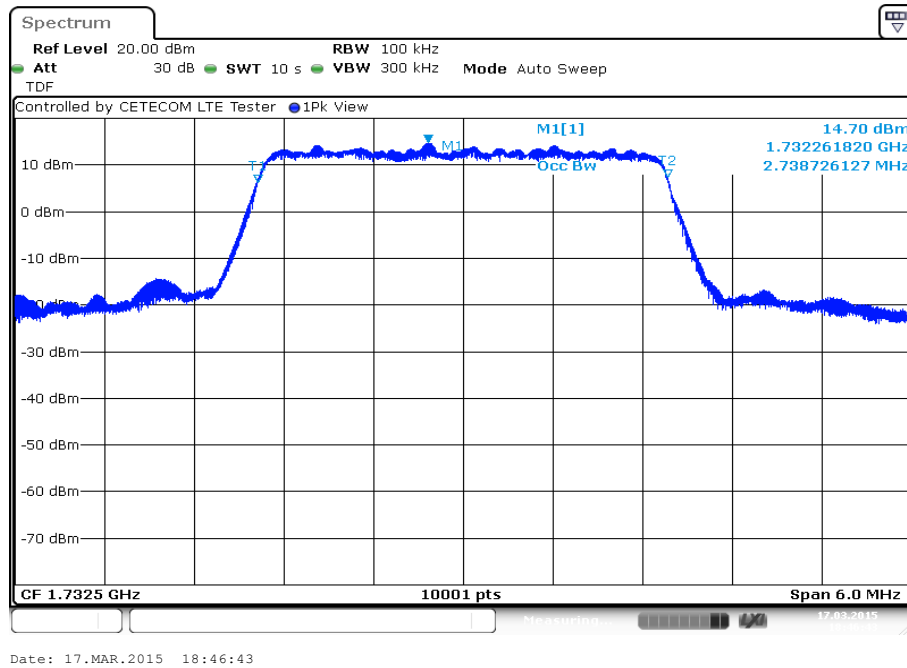


Plot 12: 20 MHz, -26 dBc OBW

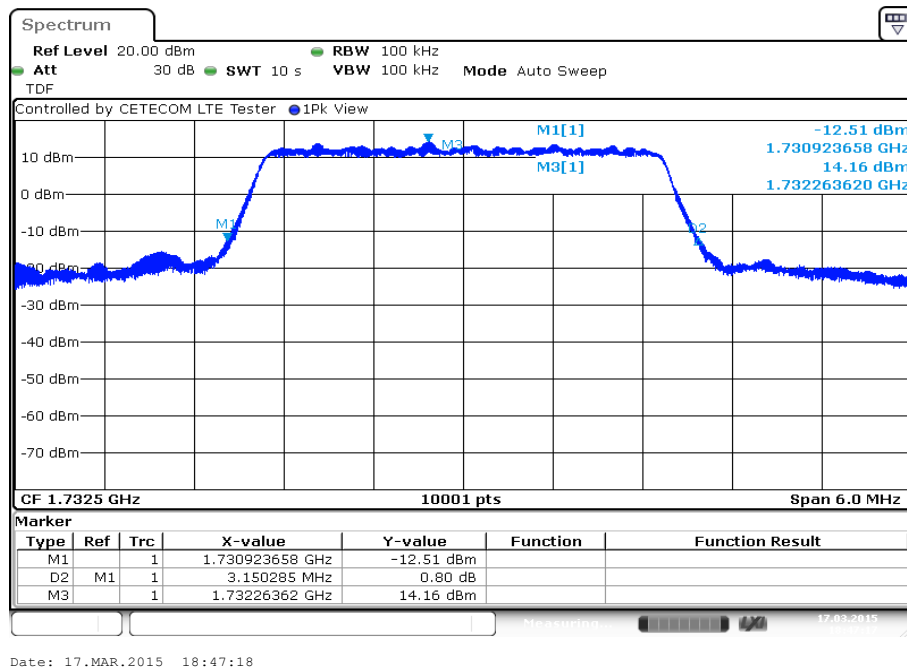


Plots: 16-QAM**Plot 1: 1.4 MHz, 99% OBW****Plot 2: 1.4 MHz, -26 dBc OBW**

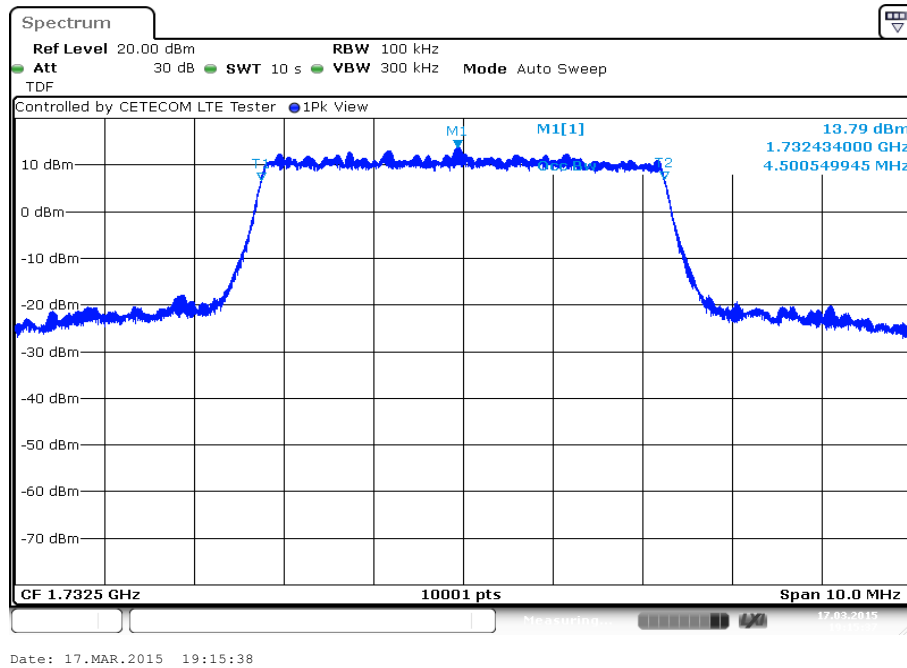
Plot 3: 3 MHz, 99% OBW



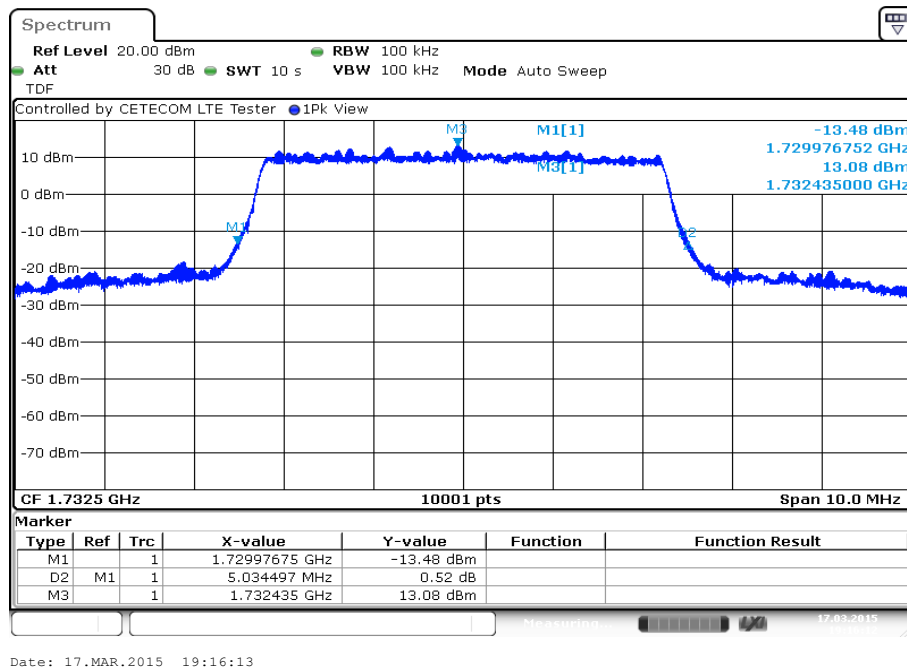
Plot 4: 3 MHz, -26 dBc OBW



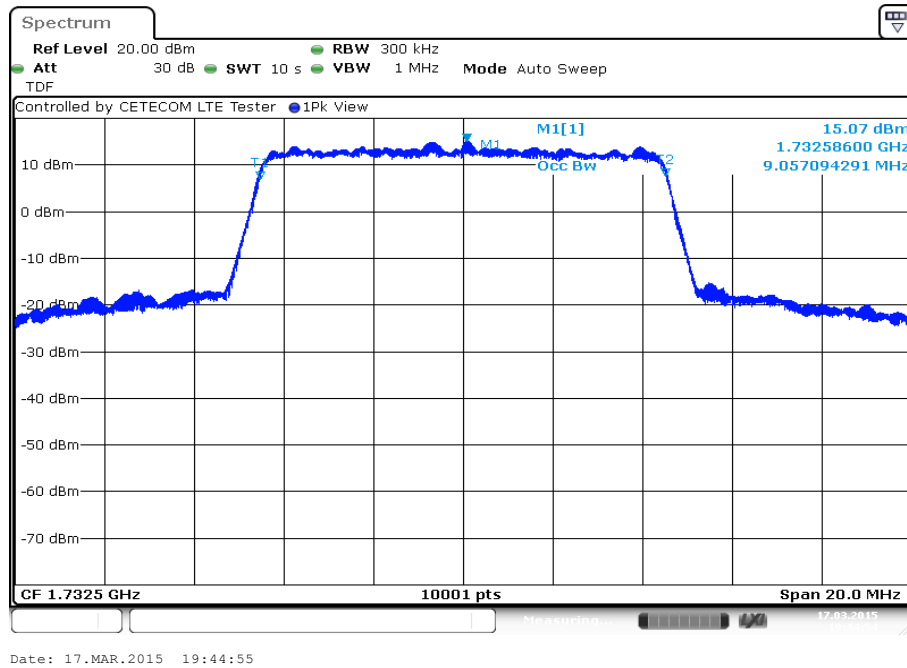
Plot 5: 5 MHz, 99% OBW



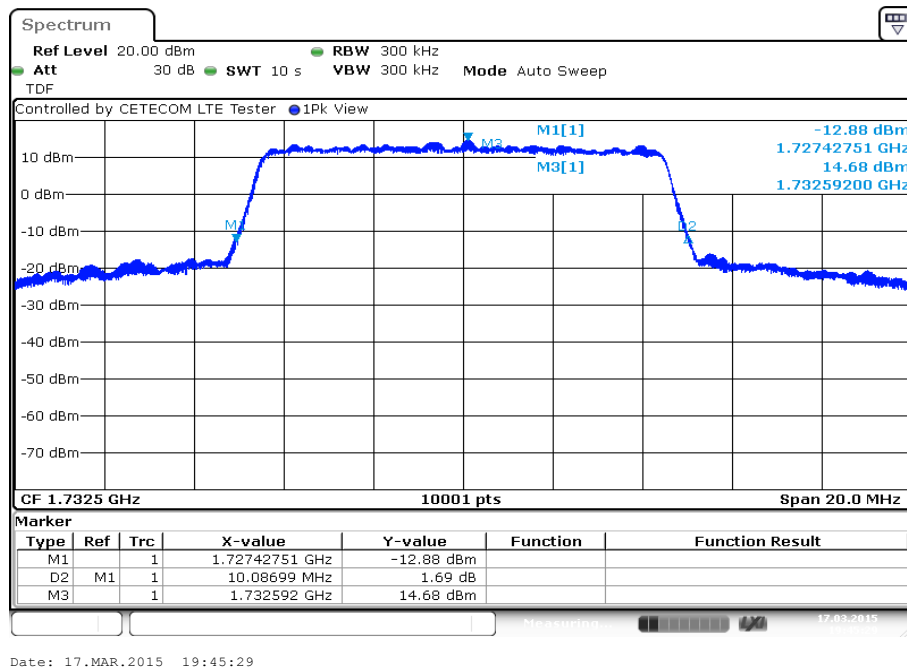
Plot 6: 5 MHz, -26 dBc OBW



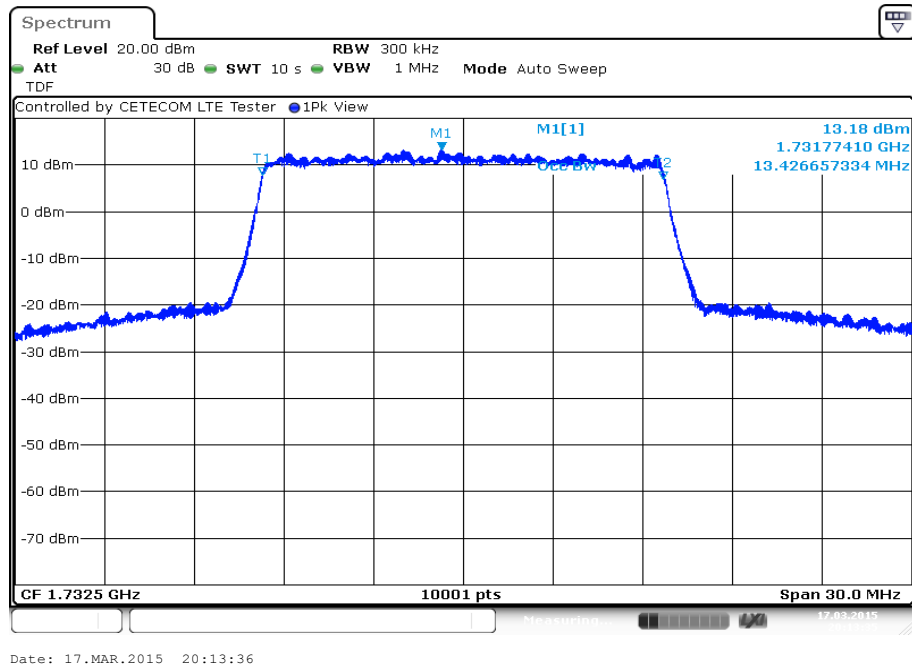
Plot 7: 10 MHz, 99% OBW



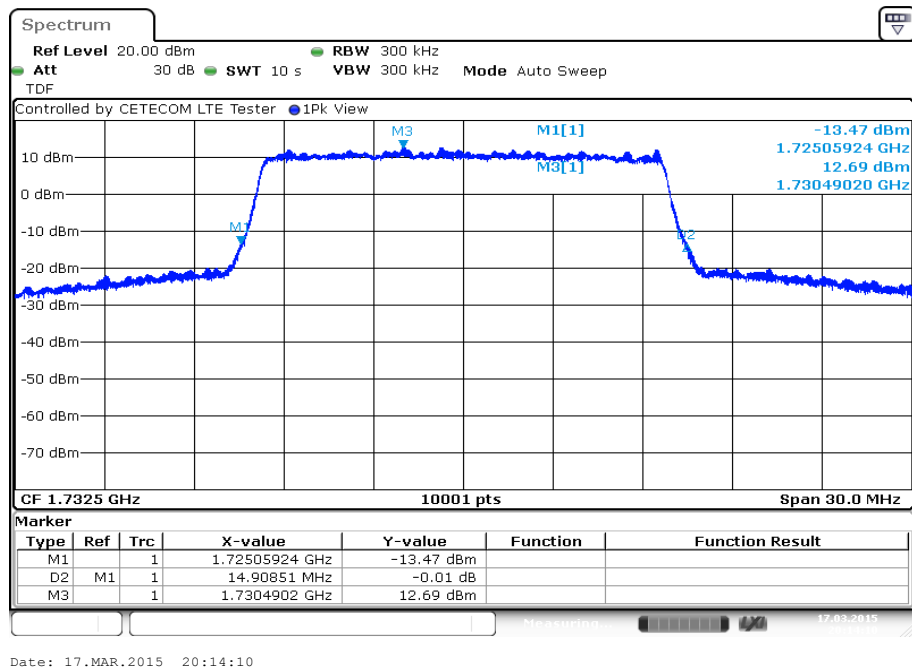
Plot 8: 10 MHz, -26 dBc OBW



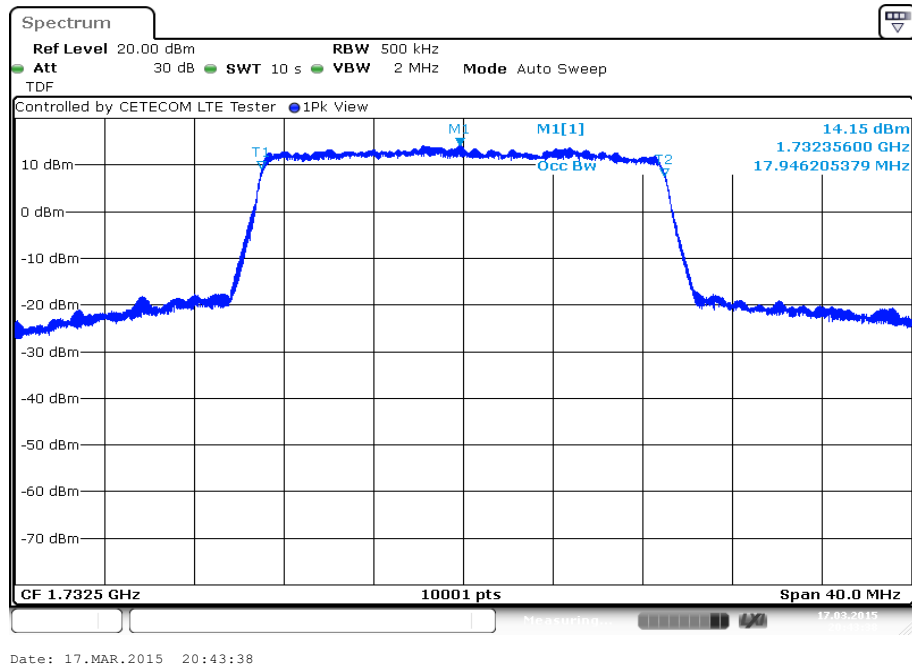
Plot 9: 15 MHz, 99% OBW



Plot 10: 15 MHz, -26 dBc OBW



Plot 11: 20 MHz, 99% OBW



Plot 12: 20 MHz, -26 dBc OBW

