
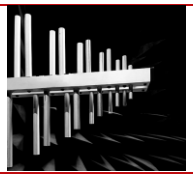
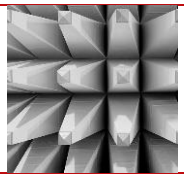

CETECOM™
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consulting - testing - certification

TEST REPORT

Test report no.: 1-9521/15-01-03-A

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
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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

Gemalto M2M GmbH
Siemensdamm 50
13629 Berlin / GERMANY
Phone: +49 30311028241
Fax: +49 30311028305
Contact: Thorsten Liebig
e-mail: Thorsten.liebig@gemalto.com
Phone: Office:+49 30311028241
Mobile: +491607074027

Manufacturer

Gemalto M2M GmbH
St.-Martin-Str. 60
81541 München / GERMANY

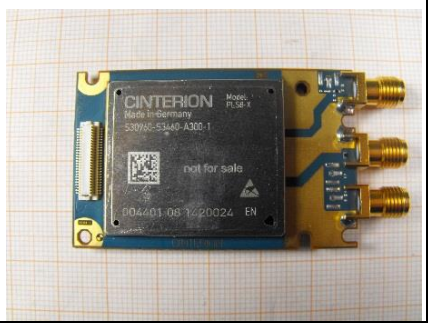
Test standard/s

47 CFR Part 24	Title 47 of the Code of Federal Regulations; Chapter I; Part 24 – Personal communications services
RSS – 133 Issue 6	Spectrum Management and Telecommunications Policy – Radio Standards Specifications, 2 GHz Personal Communication Services

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 2 FDD 1850 MHz to 1910 MHz
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:

cn=Andreas Luckenbill, o=CETECOM ICT Services GmbH, ou=LUC-111202, email=andreas.luckenbill@cetecom.com, c=DE
2015.08.04 09:54:22 +02'00'

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:

p.o.

cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-100826, email=marco.bertolino@cetecom.com, c=DE
2015.08.04 09:53:12 +02'00'

Tobias Wittenmeier
Testing Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

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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 1-9521/15-01-03 and dated 2015-06-23

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:	2015-07-31
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 24	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 24 – Personal communications services
RSS – 133 Issue 6	01.01.2013	Spectrum Management and Telecommunications Policy – Radio Standards Specifications, 2 GHz Personal Communication Services

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	:	LTE Band 2 FDD 1850 MHz to 1910 MHz
Type of radio transmission **Use of frequency spectrum**	: :	OFDM
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

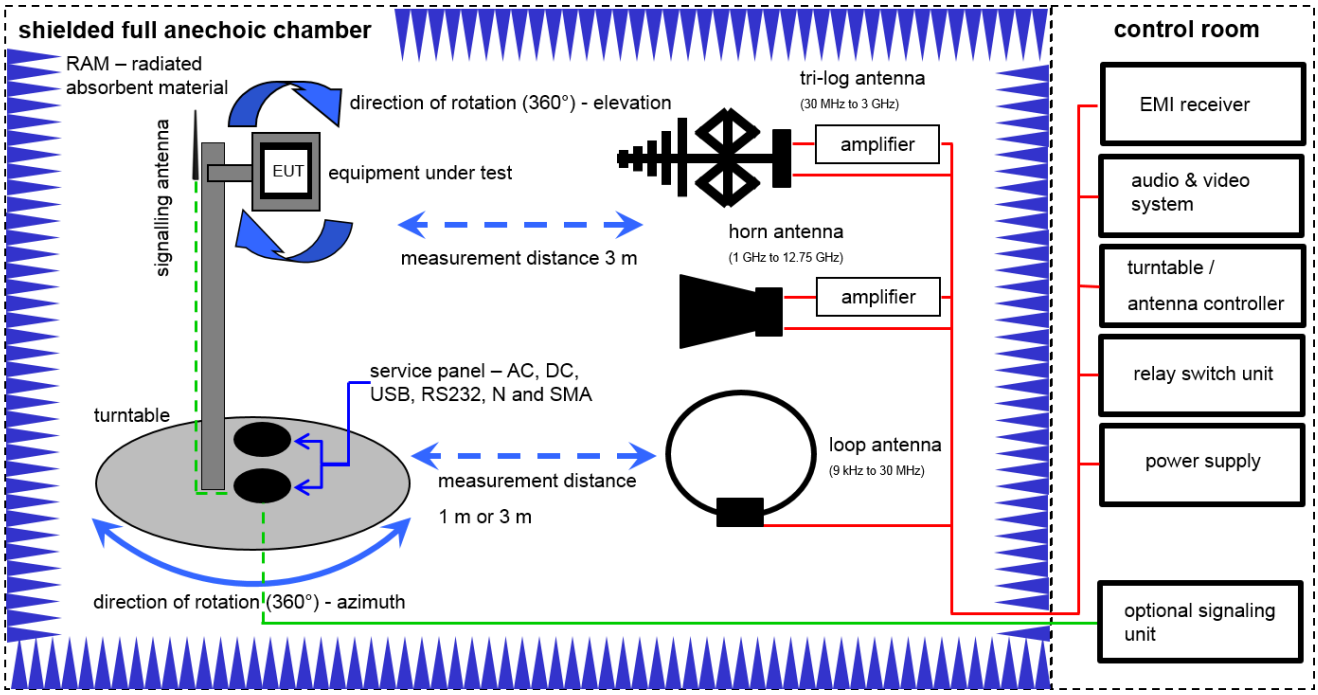
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements 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
vlkI!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Radiated measurements chamber C



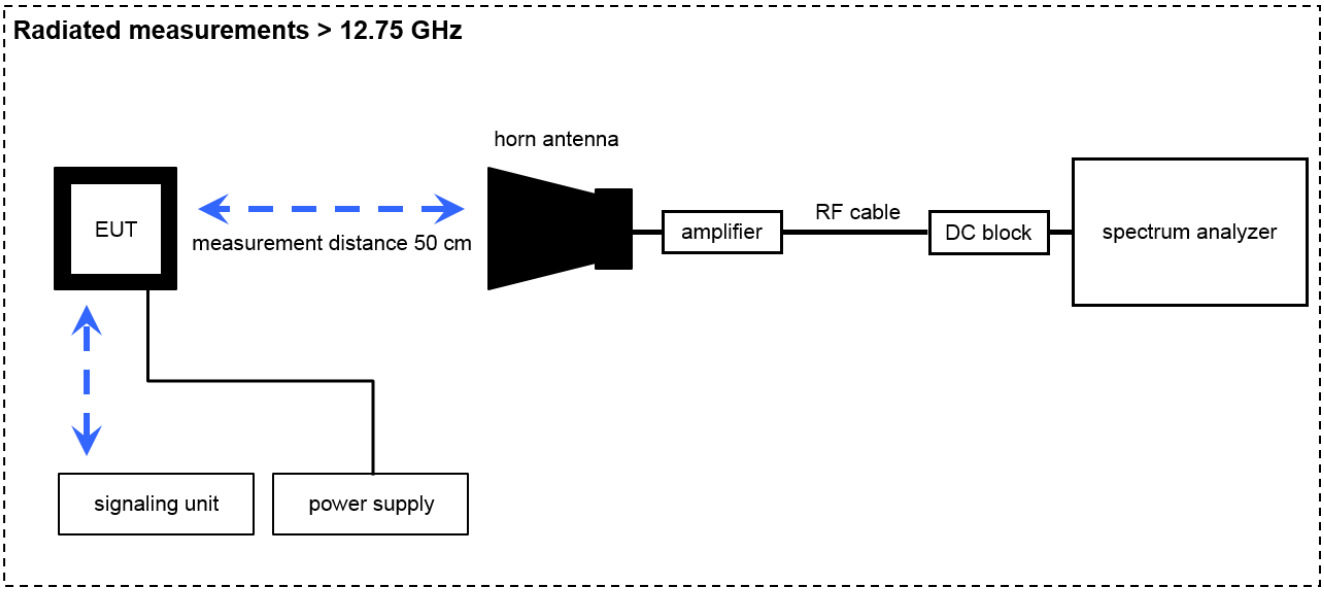
OP = AV + D - G + CA
(OP-output power; AV-analyzer value; D-distance; G-antenna gain+amplifier gain; CA-loss signal path)

Example calculation:
OP [dBm] = -11.0 [dBm] + 47 [dB] - 8 [dB] + 5 [dB] = 33 [dBm] (2 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	vlKl!	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	vlKl!	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	vlKl!	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)

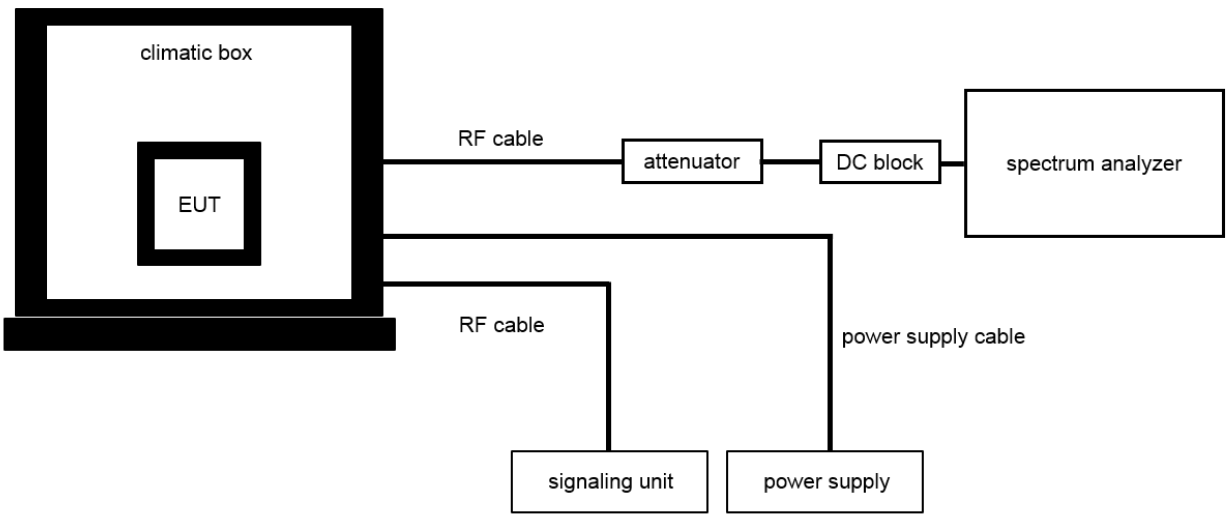
Example calculation:
OP [dBm] = -41.0 [dBm] + 26 [dB] - 20 [dB] + 5 [dB] = -30 [dBm] (1 µW)

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	vlKl!	20.01.2015	20.01.2017
9	A	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	vlKl!	28.01.2015	28.01.2017

7.3 Conducted measurements

Conducted measurements normal & extreme conditions



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

Example calculation:
OP [dBm] = 6.0 [dBm] + (11.7) [dB] = 17.7 [dBm] (58.88 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	vlKl!	20.01.2015	20.01.2017
4	A, B	Wideband Radio Communication Tester	CMW500	R&S	102375	300004187	vlKl!	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 descripted 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 axces (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 descripted 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 (± 45°) 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 descripted 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 descripted 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

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	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 24 RSS 133	See table	2015-08-04	-/-

10.1 LTE band II

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

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

11 RF measurements

11.1 Results LTE band II

The EUT was set to transmit the maximum power.

11.1.1 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
CFR Part 24.232 CFR Part 2.1046	RSS 133, Issue 5, Section 6.4
Nominal Peak Output Power	
+33.00 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	1850.7	1 RB low	26.9	22.1	4.6	26.9	21.1	5.6
		1 RB high	26.9	22.1	4.7	26.9	21.1	5.7
		50% RB	27.1	22.3	4.5	26.9	21.0	5.7
		100% RB	26.8	21.2	5.3	26.6	20.2	6.1
	1880.0	1 RB low	27.1	22.5	4.5	27.1	21.1	5.8
		1 RB high	27.0	22.3	4.6	27.0	21.0	5.7
		50% RB	27.1	22.4	4.6	27.2	21.5	5.5
		100% RB	27.0	21.4	5.3	26.8	20.4	6.0
	1909.3	1 RB low	26.4	22.0	4.3	26.4	21.0	5.3
		1 RB high	26.3	22.0	4.2	26.3	20.8	5.4
		50% RB	26.5	22.0	4.3	26.4	21.2	5.1
		100% RB	26.4	21.2	5.0	26.1	20.1	5.7
3	1851.5	1 RB low	26.9	22.0	4.7	27.0	21.4	5.4
		1 RB high	27.0	22.2	4.6	26.8	21.3	5.4
		50% RB	26.8	21.2	5.3	26.6	20.2	6.0
		100% RB	26.9	21.2	5.2	26.6	20.2	6.0
	1880.0	1 RB low	27.2	22.5	4.6	27.2	21.3	5.7
		1 RB high	26.9	22.3	4.5	26.8	21.0	5.6
		50% RB	27.0	21.4	5.2	26.8	20.4	6.0
		100% RB	27.1	21.4	5.2	26.9	20.4	6.0
	1908.5	1 RB low	26.5	22.1	4.2	26.5	21.2	5.1
		1 RB high	26.4	21.8	4.4	26.4	21.1	5.1
		50% RB	26.3	21.1	5.0	26.1	20.2	5.7
		100% RB	26.4	21.1	5.0	26.1	20.2	5.7
5	1852.5	1 RB low	26.9	21.9	4.7	26.7	21.1	5.4
		1 RB high	27.1	22.3	4.6	26.8	21.2	5.5
		50% RB	26.8	21.2	5.2	26.6	20.3	5.9
		100% RB	26.9	21.2	5.3	26.7	20.2	6.0
	1880.0	1 RB low	27.5	22.6	4.7	27.4	21.5	5.8
		1 RB high	27.0	22.4	4.4	27.0	21.3	5.5
		50% RB	27.1	21.4	5.2	26.8	20.4	5.9
		100% RB	27.2	21.4	5.3	27.0	20.4	5.9
	1907.5	1 RB low	26.7	22.3	4.2	26.5	21.3	5.0
		1 RB high	26.4	22.1	4.1	26.1	21.3	4.7
		50% RB	26.4	21.0	5.1	26.2	20.1	5.7
		100% RB	26.6	21.0	5.1	26.3	20.2	5.7

10	1855	1 RB low	27.4	21.7	5.4	27.3	21.1	6.0
		1 RB high	27.2	21.2	5.5	27.2	20.4	6.3
		50% RB	27.3	20.9	5.6	27.4	20.0	6.5
		100% RB	27.3	22.2	5.0	27.3	20.9	5.9
	1880	1 RB low	26.7	22.3	4.3	26.7	21.1	5.3
		1 RB high	27.1	21.4	5.2	26.9	20.4	6.0
		50% RB	27.2	21.3	5.3	26.9	20.3	6.0
		100% RB	27.1	22.1	4.7	26.8	21.0	5.6
	1905	1 RB low	26.4	22.1	4.1	26.1	21.1	4.8
		1 RB high	26.7	21.2	5.1	26.4	20.2	5.9
		50% RB	26.9	21.1	5.3	26.7	20.2	5.9
		100% RB	26.4	21.7	4.5	26.4	20.7	5.4
15	1857.5	1 RB low	27.4	22.1	5.2	27.5	21.3	6.0
		1 RB high	27.4	21.2	5.6	27.3	20.3	6.4
		50% RB	27.6	21.0	5.9	27.4	20.2	6.6
		100% RB	27.2	22.0	5.0	27.3	20.7	6.3
	1880.0	1 RB low	26.9	22.2	4.3	26.7	21.1	5.5
		1 RB high	27.2	21.3	5.3	26.9	20.3	6.0
		50% RB	27.1	21.2	5.5	27.0	20.1	6.1
		100% RB	26.9	21.8	4.8	26.6	20.4	6.0
	1902.5	1 RB low	26.2	21.9	4.0	25.8	20.8	4.9
		1 RB high	27.0	21.0	5.4	26.7	20.1	6.1
		50% RB	27.1	20.9	5.6	26.8	19.9	6.2
		100% RB	26.2	21.5	4.4	26.1	20.5	5.5
20	1860	1 RB low	27.4	22.2	5.0	27.5	21.1	6.2
		1 RB high	27.8	21.0	5.9	27.5	20.3	6.5
		50% RB	27.8	21.1	5.8	27.8	20.1	6.6
		100% RB	27.1	22.0	4.9	27.2	21.0	6.0
	1880	1 RB low	26.6	22.1	4.3	26.5	20.9	5.5
		1 RB high	27.2	21.2	5.3	26.8	20.3	6.0
		50% RB	27.3	21.1	5.4	27.0	20.2	6.0
		100% RB	26.5	21.7	4.6	26.2	20.3	5.7
	1900	1 RB low	26.0	21.7	4.0	25.7	20.6	4.9
		1 RB high	27.2	21.1	5.5	26.9	20.1	6.2
		50% RB	27.3	20.9	5.5	26.9	19.8	6.2
		100% RB	27.4	21.7	5.4	27.3	21.1	6.0

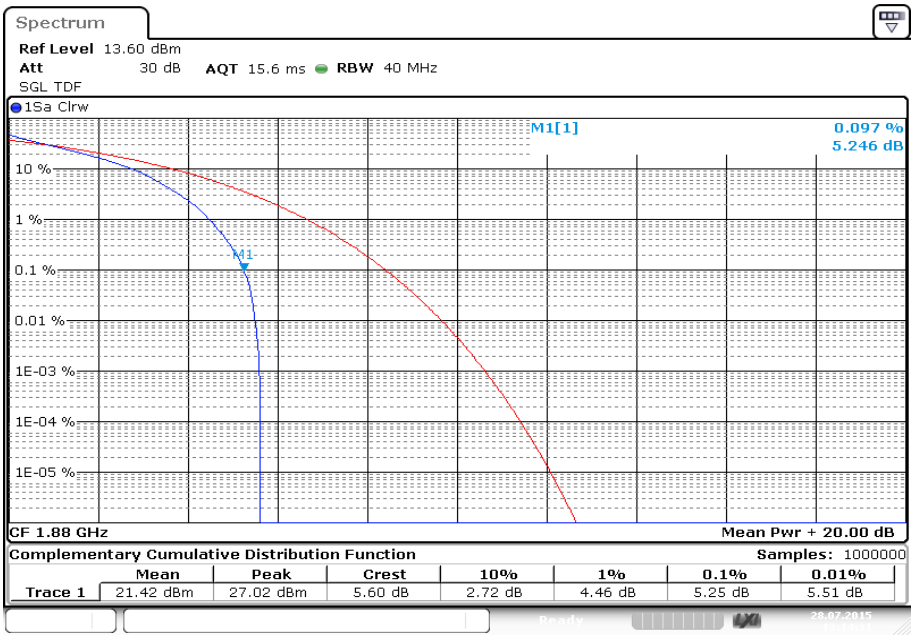
The values are meausured with configuration of highest conducted power.

Output Power (radiated)			
Bandwidth (MHz)	**Frequency (MHz)**	**Average Output Power (dBm) QPSK**	**Average Output Power (dBm) 16-QAM**
1.4	1850.7	21.00	19.80
	1880.0	21.89	20.89
	1909.3	21.37	20.27
3	1851.5	20.90	20.00
	1880.0	21.79	20.69
	1908.5	21.27	20.37
5	1852.5	20.90	19.90
	1880.0	21.79	20.79
	1907.5	21.27	20.37
10	1855.0	20.40	19.70
	1880.0	21.60	20.69
	1905.0	21.27	20.37
15	1857.5	20.60	19.90
	1880.0	21.49	20.49
	1902.5	21.07	20.17
20	1860.0	20.90	19.90
	1880.0	21.59	20.49
	1900.0	21.27	20.27

Verdict: **compliant**

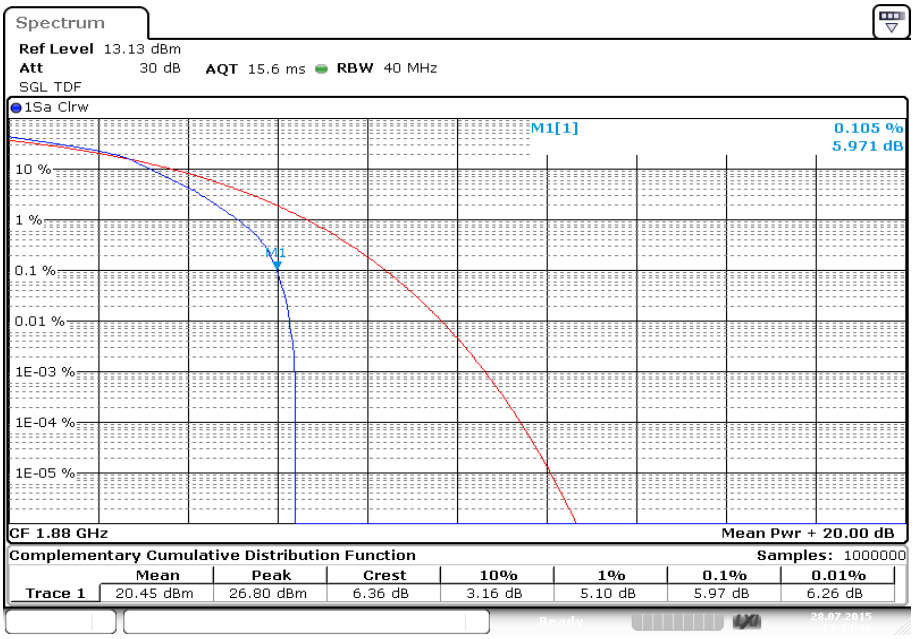
Plots:

Plot 1: 1.4 MHz cell bandwidth, mid channel, 100% #RB, QPSK



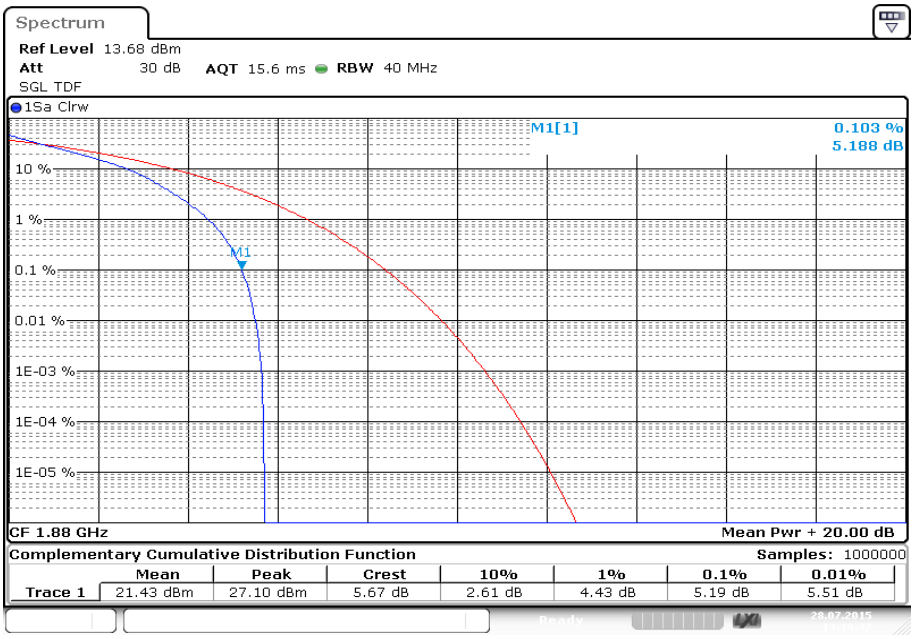
Date: 28.JUL.2015 13:14:31

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



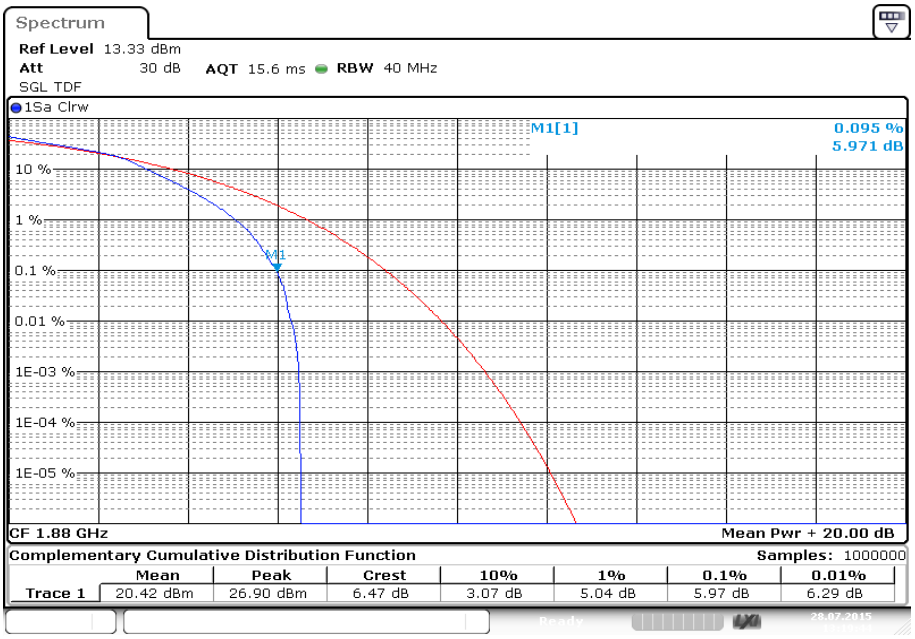
Date: 28.JUL.2015 13:14:38

Plot 3: 3 MHz cell bandwidth, mid channel, 100% #RB, QPSK



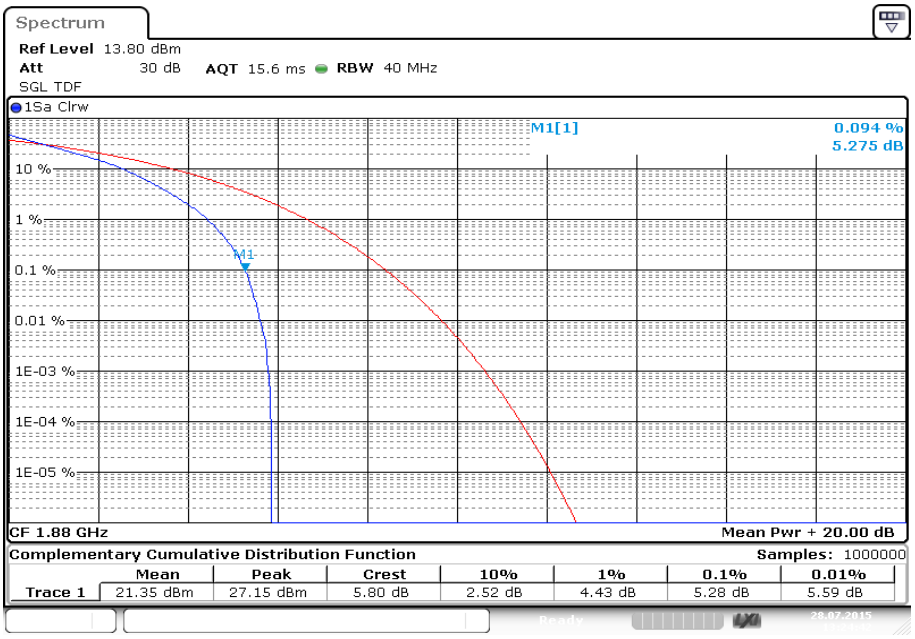
Date: 28.JUL.2015 13:19:37

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



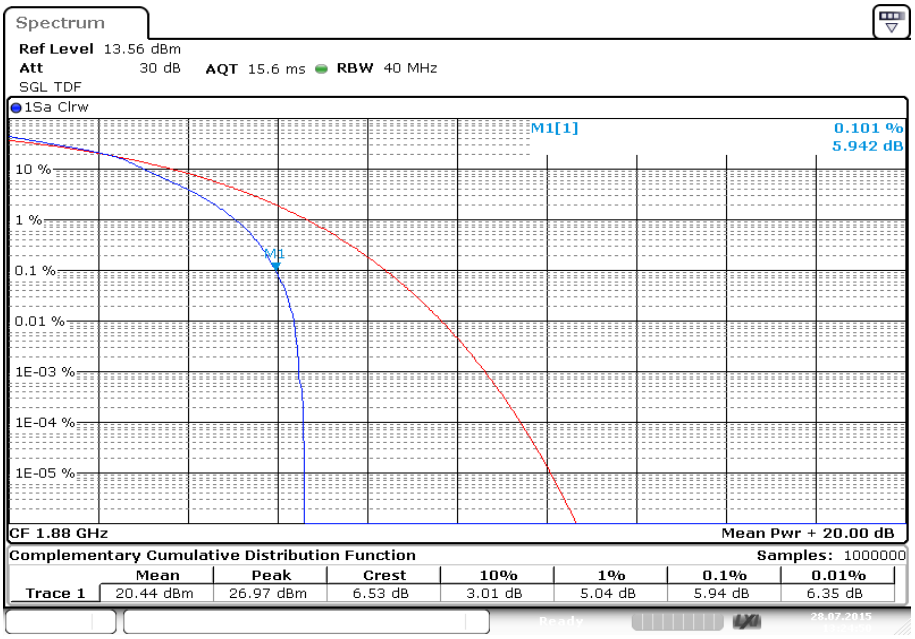
Date: 28.JUL.2015 13:19:44

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



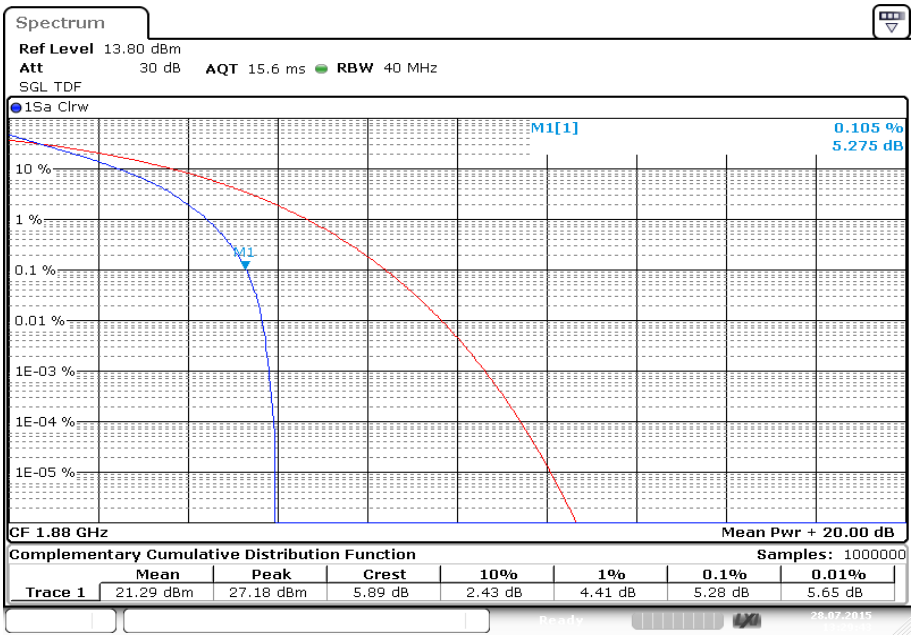
Date: 28.JUL.2015 13:24:42

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



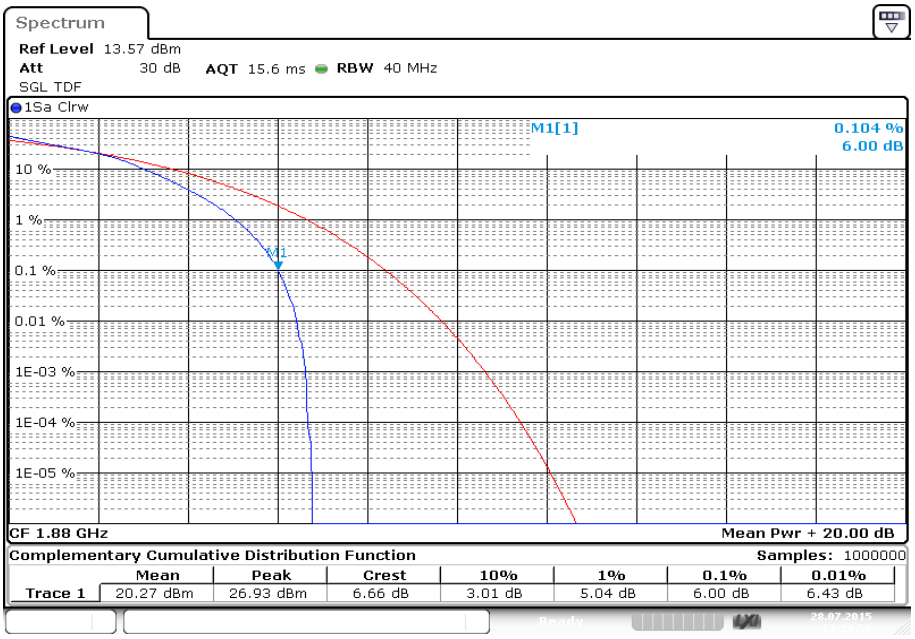
Date: 28.JUL.2015 13:24:49

Plot 7: 10 MHz cell bandwidth, mid channel, 100% #RB, QPSK



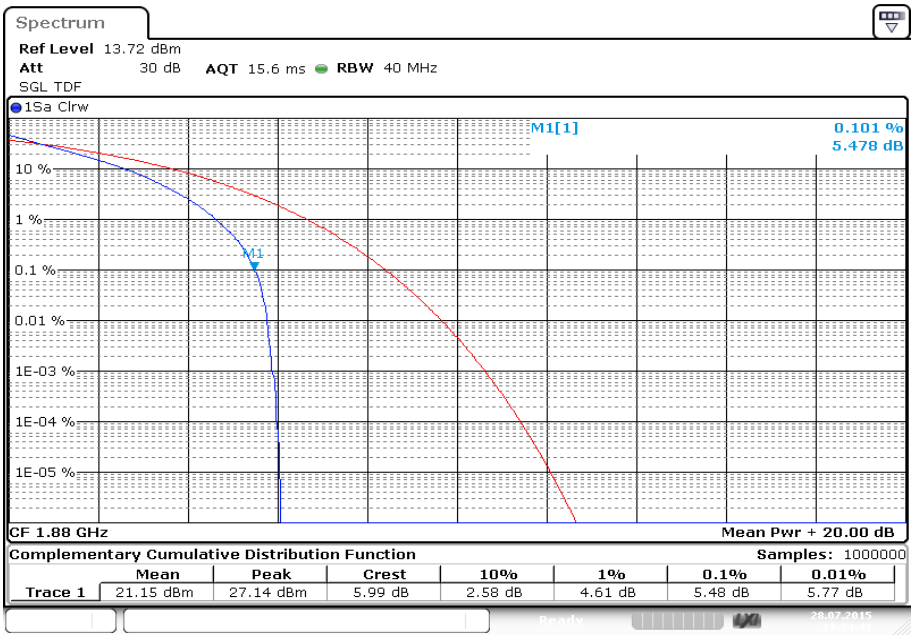
Date: 28.JUL.2015 13:29:43

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



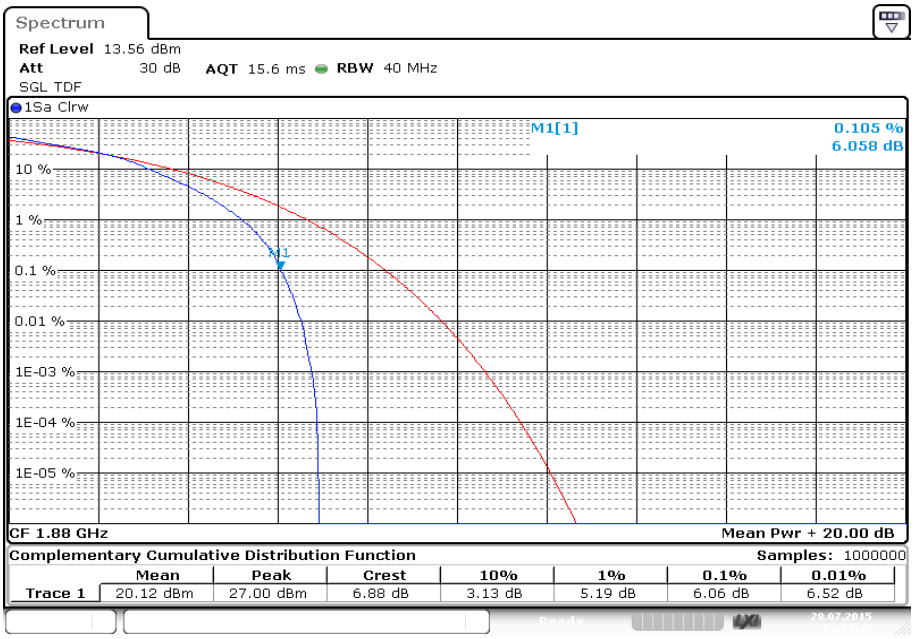
Date: 28.JUL.2015 13:29:50

Plot 9: 15 MHz cell bandwidth, mid channel, 100% #RB, QPSK



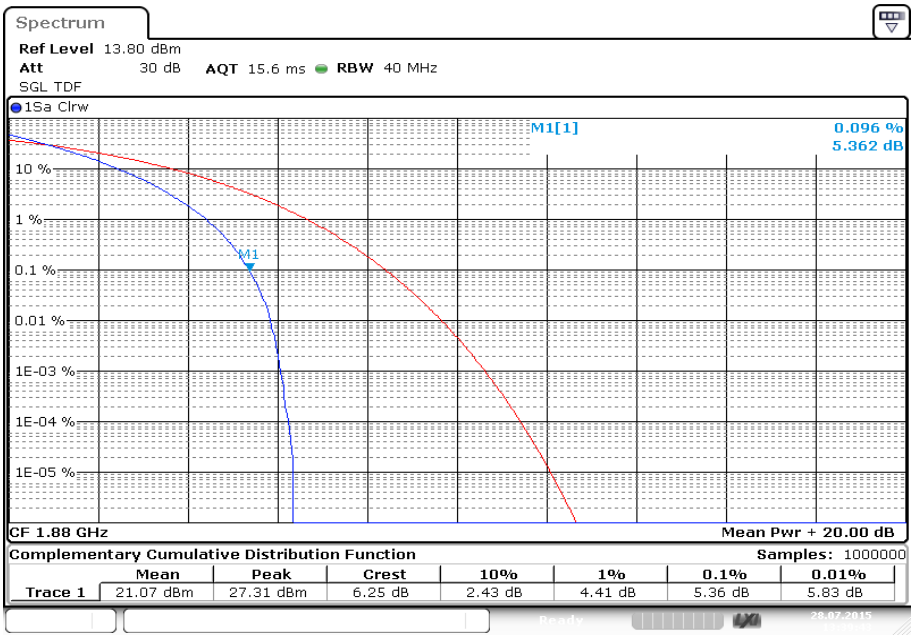
Date: 28.JUL.2015 13:34:41

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



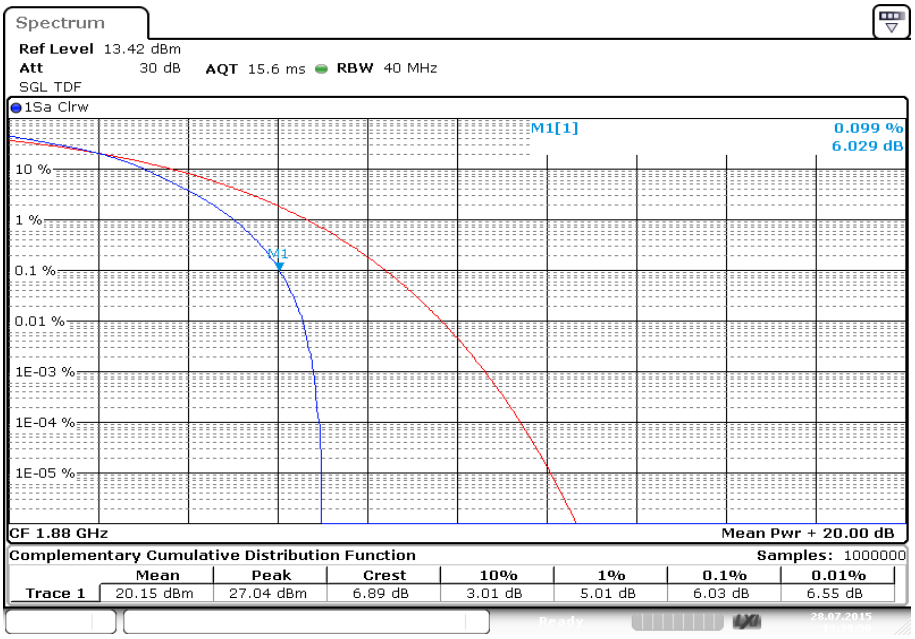
Date: 28.JUL.2015 13:34:48

Plot 11: 20 MHz cell bandwidth, mid channel, 100% #RB, QPSK



Date: 28.JUL.2015 13:39:43

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



Date: 28.JUL.2015 13:39:49

11.1.2 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 +/- 0.5°C during the measurement procedure.

Measurement:

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

Limits:

FCC	IC
CFR Part 24.235 CFR Part 2.1055	RSS 133
Frequency Stability	
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.	

Results:

AFC FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
13.8	-22	-0.0000030	-0.031
12.0	-17	-0.0000009	-0.009
10.2	-18	-0.0000010	-0.010

AFC FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-19	-0.0000011	-0.011
-20	-13	-0.0000007	-0.007
-10	-23	-0.0000012	-0.012
± 0	-21	-0.0000011	-0.011
10	-14	-0.0000007	-0.007
20	-17	-0.0000009	-0.009
30	-13	-0.0000007	-0.007
40	-17	-0.0000009	-0.009
50	-16	-0.0000009	-0.009
60	-22	-0.0000030	-0.031

Verdict: **compliant**

11.1.3 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 1909.3 MHz. Measurement made up to 26 GHz. The resolution bandwidth is set as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at the middle carrier frequency of the LTE band II.

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
CFR Part 24.238 CFR Part 2.1053	RSS 133
Spurious Emissions Radiated	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results:

Radiated emissions measurements were made only at the center carrier frequency of the LTE band II (1880 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 II 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. If spurious were detected, the lowest and highest channel were checked too. The found values are stated in the table below.

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

QPSK:

Spurious Emission Level (dBm)		
Harmonic	Middle channel Freq. (MHz)	Level [dBm]
2	3760.0	-
3	5640.0	-
4	7520.0	-
5	9400.0	-
6	11280.0	-
7	13160.0	-
8	15040.0	-
9	16920.0	-
10	18800.0	-

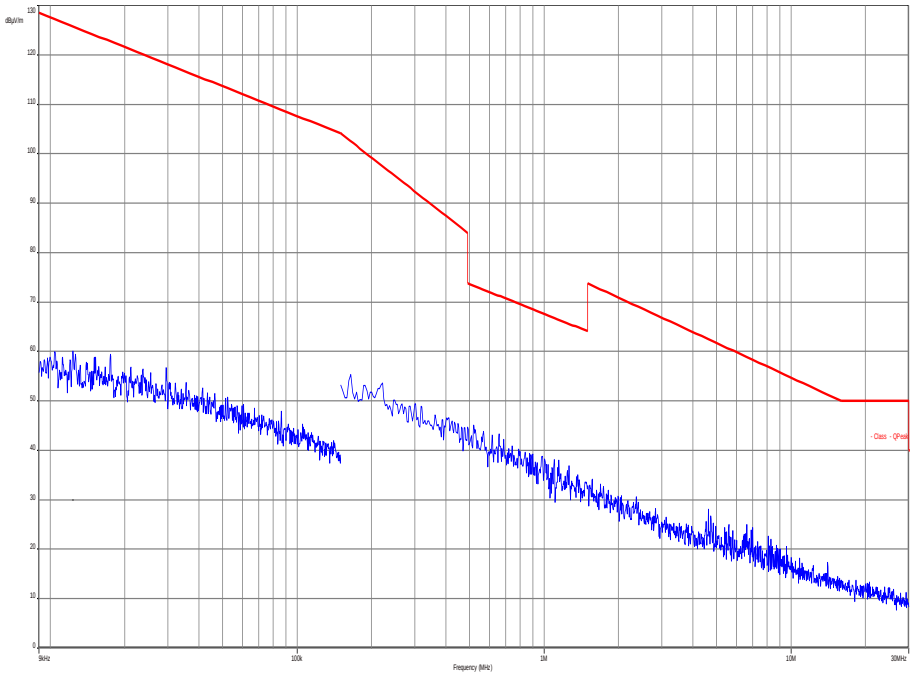
16-QAM:

Spurious Emission Level (dBm)		
Harmonic	Middle channel Freq. (MHz)	Level [dBm]
2	3760.0	-
3	5640.0	-
4	7520.0	-
5	9400.0	-
6	11280.0	-
7	13160.0	-
8	15040.0	-
9	16920.0	-
10	18800.0	-

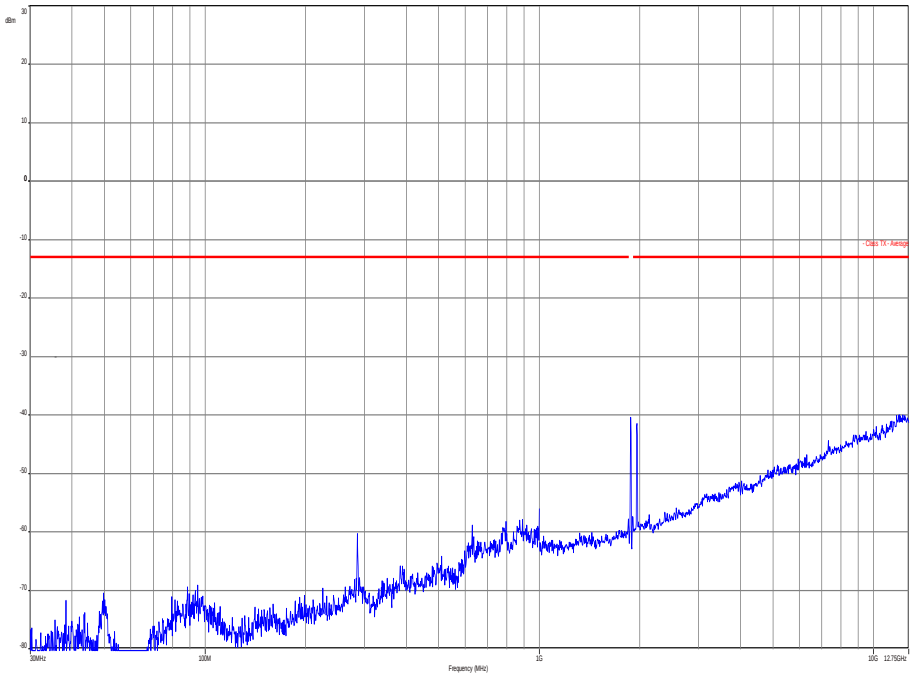
Verdict: compliant

QPSK with 10 MHz channel bandwidth

Plot 1: Channel 18900 (Traffic mode up to 30 MHz)

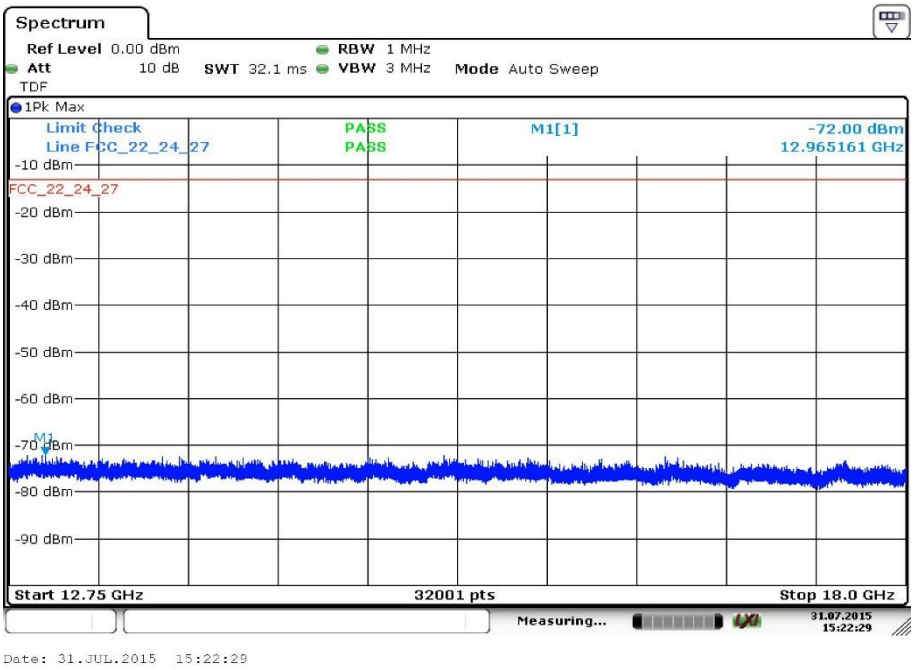


Plot 2: Channel 18900 (30 MHz – 12.75 GHz)

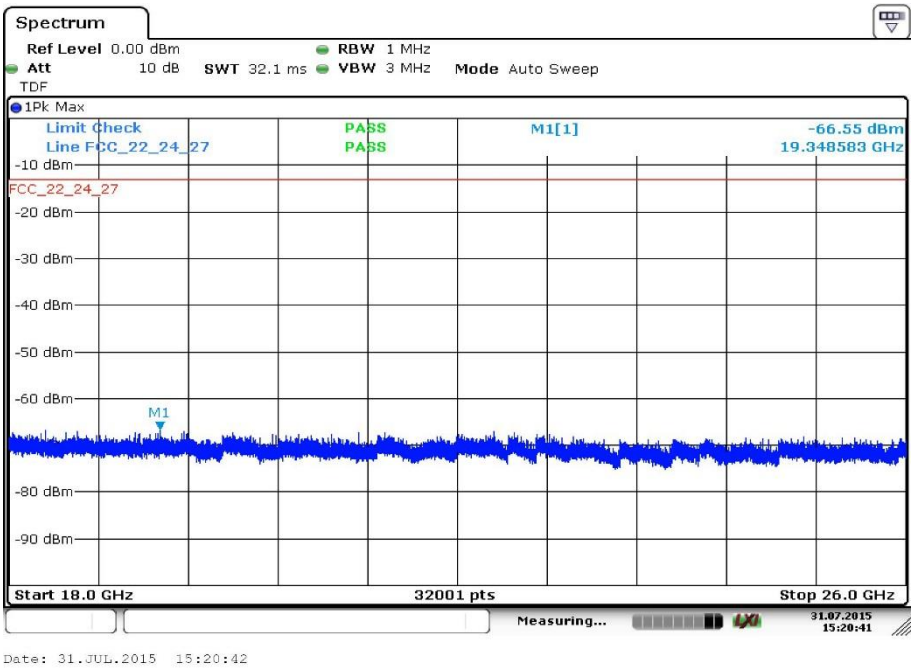


Carrier notched with 1.9 GHz rejection filter

Plot 3: Channel 18900 (12.75 GHz – 18 GHz)

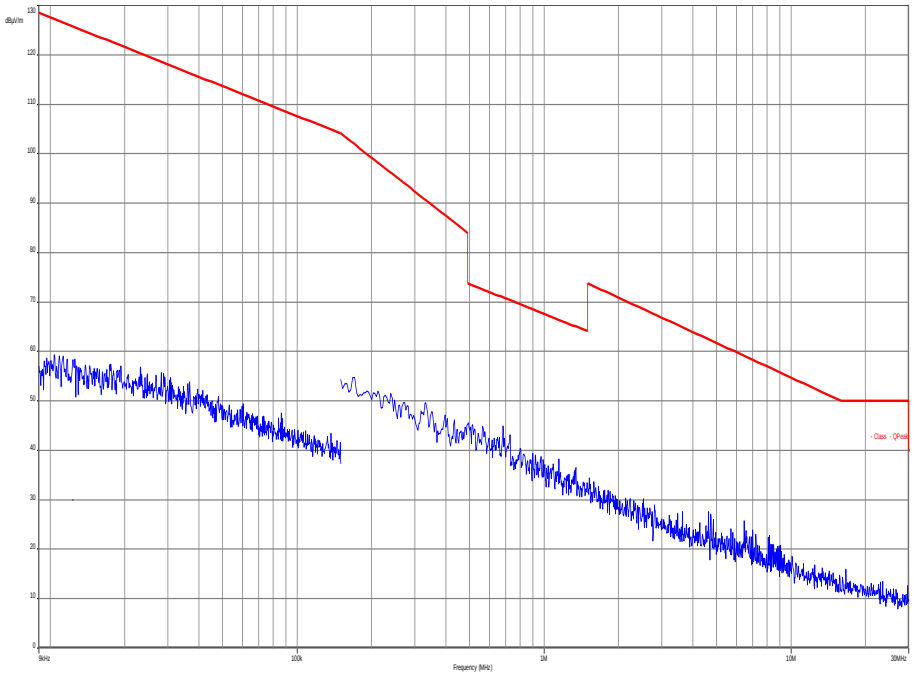


Plot 4: Channel 18900 (18 GHz – 26 GHz)

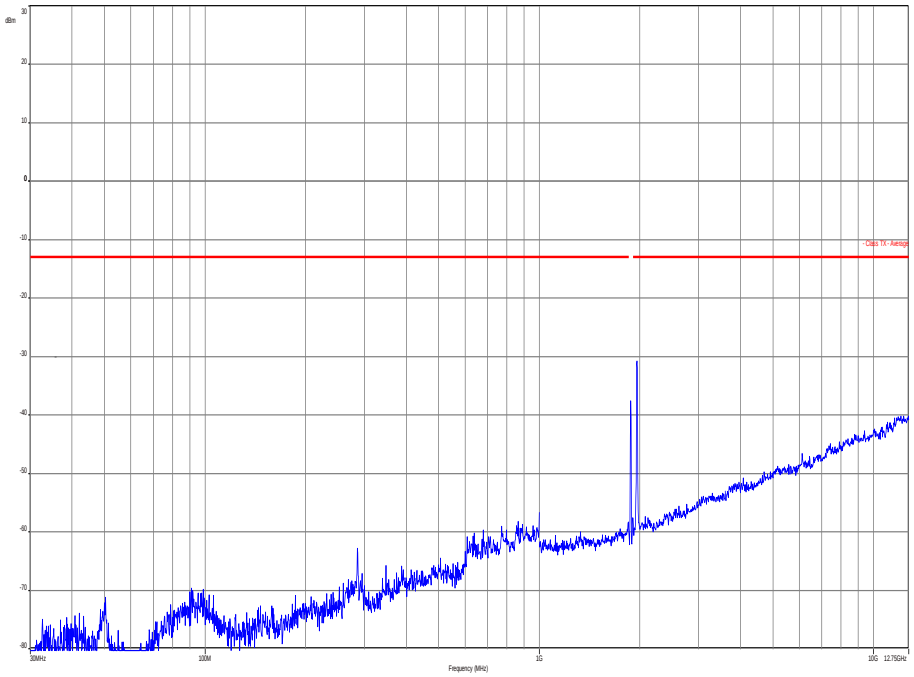


16-QAM with 10 MHz channel bandwidth

Plot 5: Channel 18900 (Traffic mode up to 30 MHz)

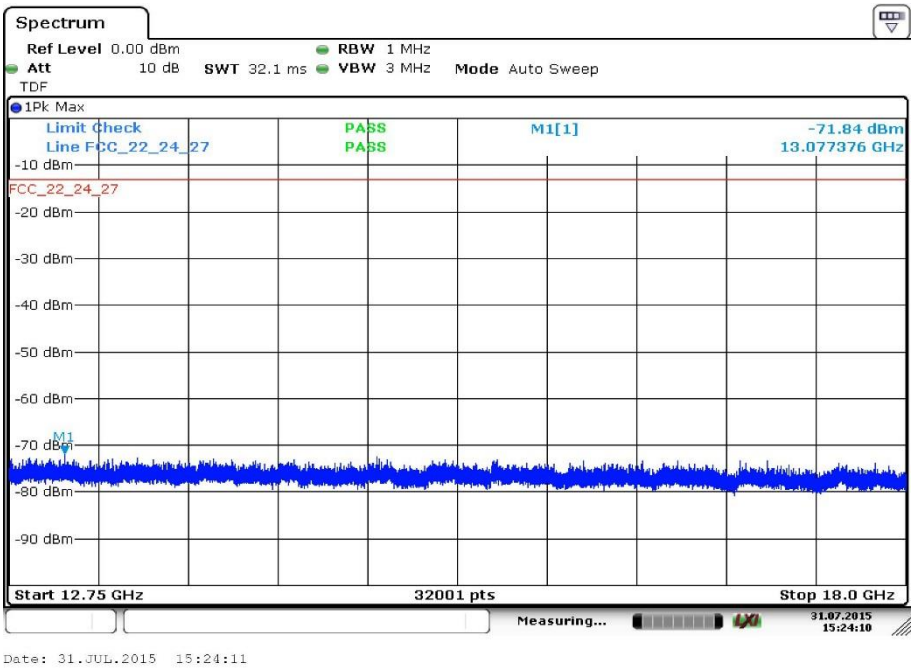


Plot 6: Channel 18900 (30 MHz – 12.75 GHz)

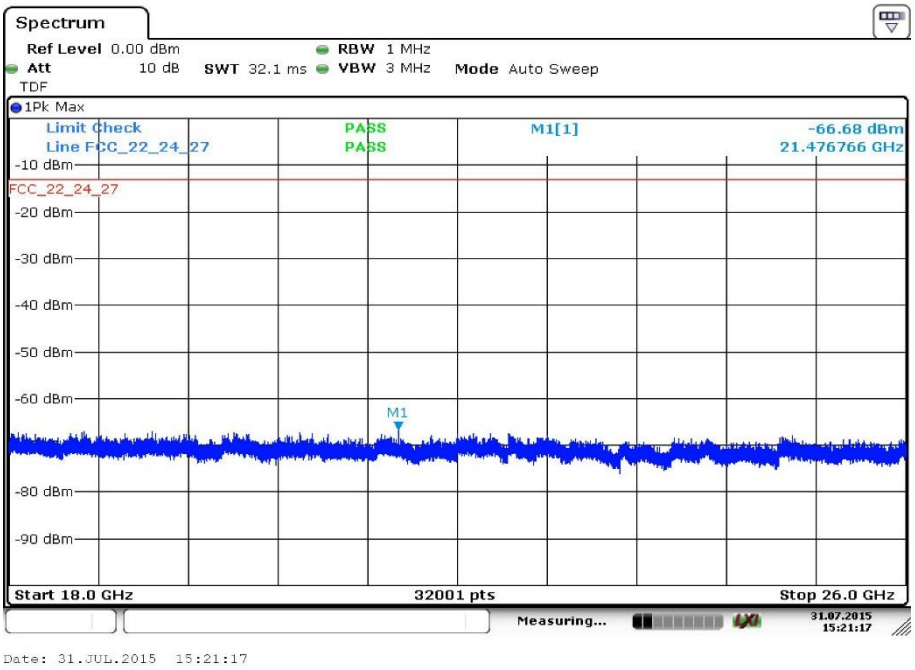


Carrier notched with 1.9 GHz rejection filter

Plot 7: Channel 18900 (12 GHz – 18 GHz)



Plot 8: Channel 18900 (18 GHz – 26 GHz)



11.1.4 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 19.1 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.

Measurement:

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1 MHz
Video bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement 3 MHz
Span:	30 MHz – 26 GHz
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.3 - A
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
CFR Part 24.238 CFR Part 2.1051	RSS 133
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)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3701.4	-	2	3760.0	-	2	3818.6	-
3	5552.1	-	3	5640.0	-	3	5727.9	-
4	7402.8	-	4	7520.0	-	4	7637.2	-
5	9253.5	-	5	9400.0	-	5	9546.5	-
6	11104.2	-	6	11280.0	-	6	11455.8	-
7	12954.9	-	7	13160.0	-	7	13365.1	-
8	14805.6	-	8	15040.0	-	8	15274.4	-
9	16656.3	-	9	16920.0	-	9	17183.7	-
10	18507.0	-	10	18800.0	-	10	19093.0	-

16-QAM:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3701.4	-	2	3760.0	-	2	3818.6	-
3	5552.1	-	3	5640.0	-	3	5727.9	-
4	7402.8	-	4	7520.0	-	4	7637.2	-
5	9253.5	-	5	9400.0	-	5	9546.5	-
6	11104.2	-	6	11280.0	-	6	11455.8	-
7	12954.9	-	7	13160.0	-	7	13365.1	-
8	14805.6	-	8	15040.0	-	8	15274.4	-
9	16656.3	-	9	16920.0	-	9	17183.7	-
10	18507.0	-	10	18800.0	-	10	19093.0	-

Results: **for 3 MHz channel bandwidth**

QPSK:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3703.0	-	2	3760.0	-	2	3817.0	-
3	5554.5	-	3	5640.0	-	3	5725.5	-
4	7406.0	-	4	7520.0	-	4	7634.0	-
5	9257.5	-	5	9400.0	-	5	9542.5	-
6	11109.0	-	6	11280.0	-	6	11451.0	-
7	12960.5	-	7	13160.0	-	7	13359.5	-
8	14812.0	-	8	15040.0	-	8	15268.0	-
9	16663.5	-	9	16920.0	-	9	17176.5	-
10	18515.0	-	10	18800.0	-	10	19085.0	-

16-QAM:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3703.0	-	2	3760.0	-	2	3817.0	-
3	5554.5	-	3	5640.0	-	3	5725.5	-
4	7406.0	-	4	7520.0	-	4	7634.0	-
5	9257.5	-	5	9400.0	-	5	9542.5	-
6	11109.0	-	6	11280.0	-	6	11451.0	-
7	12960.5	-	7	13160.0	-	7	13359.5	-
8	14812.0	-	8	15040.0	-	8	15268.0	-
9	16663.5	-	9	16920.0	-	9	17176.5	-
10	18515.0	-	10	18800.0	-	10	19085.0	-

Results: **for 5 MHz channel bandwidth**

QPSK:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3705.0	-	2	3760.0	-	2	3815.0	-
3	5557.5	-	3	5640.0	-	3	5722.5	-
4	7410.0	-	4	7520.0	-	4	7630.0	-
5	9262.5	-	5	9400.0	-	5	9537.5	-
6	11115.0	-	6	11280.0	-	6	11445.0	-
7	12967.5	-	7	13160.0	-	7	13352.5	-
8	14820.0	-	8	15040.0	-	8	15260.0	-
9	16672.5	-	9	16920.0	-	9	17167.5	-
10	18525.0	-	10	18800.0	-	10	19075.0	-

16-QAM:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3705.0	-	2	3760.0	-	2	3815.0	-
3	5557.5	-	3	5640.0	-	3	5722.5	-
4	7410.0	-	4	7520.0	-	4	7630.0	-
5	9262.5	-	5	9400.0	-	5	9537.5	-
6	11115.0	-	6	11280.0	-	6	11445.0	-
7	12967.5	-	7	13160.0	-	7	13352.5	-
8	14820.0	-	8	15040.0	-	8	15260.0	-
9	16672.5	-	9	16920.0	-	9	17167.5	-
10	18525.0	-	10	18800.0	-	10	19075.0	-

Results: **for 10 MHz channel bandwidth**

QPSK:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3710.0	-	2	3760.0	-	2	3810.0	-
3	5565.0	-	3	5640.0	-	3	5715.0	-
4	7420.0	-	4	7520.0	-	4	7620.0	-
5	9275.0	-	5	9400.0	-	5	9525.0	-
6	11130.0	-	6	11280.0	-	6	11430.0	-
7	12985.0	-	7	13160.0	-	7	13335.0	-
8	14840.0	-	8	15040.0	-	8	15240.0	-
9	16695.0	-	9	16920.0	-	9	17145.0	-
10	18550.0	-	10	18800.0	-	10	19050.0	-

16-QAM:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3710.0	-	2	3760.0	-	2	3810.0	-
3	5565.0	-	3	5640.0	-	3	5715.0	-
4	7420.0	-	4	7520.0	-	4	7620.0	-
5	9275.0	-	5	9400.0	-	5	9525.0	-
6	11130.0	-	6	11280.0	-	6	11430.0	-
7	12985.0	-	7	13160.0	-	7	13335.0	-
8	14840.0	-	8	15040.0	-	8	15240.0	-
9	16695.0	-	9	16920.0	-	9	17145.0	-
10	18550.0	-	10	18800.0	-	10	19050.0	-

Results: **for 15 MHz channel bandwidth**

QPSK:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3715.0	-	2	3760.0	-	2	3805.0	-
3	5572.5	-	3	5640.0	-	3	5707.5	-
4	7430.0	-	4	7520.0	-	4	7610.0	-
5	9287.5	-	5	9400.0	-	5	9512.5	-
6	11145.0	-	6	11280.0	-	6	11415.0	-
7	13002.5	-	7	13160.0	-	7	13317.5	-
8	14860.0	-	8	15040.0	-	8	15220.0	-
9	16717.5	-	9	16920.0	-	9	17122.5	-
10	18575.0	-	10	18800.0	-	10	19025.0	-

16-QAM:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3715.0	-	2	3760.0	-	2	3805.0	-
3	5572.5	-	3	5640.0	-	3	5707.5	-
4	7430.0	-	4	7520.0	-	4	7610.0	-
5	9287.5	-	5	9400.0	-	5	9512.5	-
6	11145.0	-	6	11280.0	-	6	11415.0	-
7	13002.5	-	7	13160.0	-	7	13317.5	-
8	14860.0	-	8	15040.0	-	8	15220.0	-
9	16717.5	-	9	16920.0	-	9	17122.5	-
10	18575.0	-	10	18800.0	-	10	19025.0	-

Results: **for 20 MHz channel bandwidth**

QPSK:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3720.0	-	2	3760.0	-	2	3800.0	-
3	5580.0	-	3	5640.0	-	3	5700.0	-
4	7440.0	-	4	7520.0	-	4	7600.0	-
5	9300.0	-	5	9400.0	-	5	9500.0	-
6	11160.0	-	6	11280.0	-	6	11400.0	-
7	13020.0	-	7	13160.0	-	7	13300.0	-
8	14880.0	-	8	15040.0	-	8	15200.0	-
9	16740.0	-	9	16920.0	-	9	17100.0	-
10	18600.0	-	10	18800.0	-	10	19000.0	-

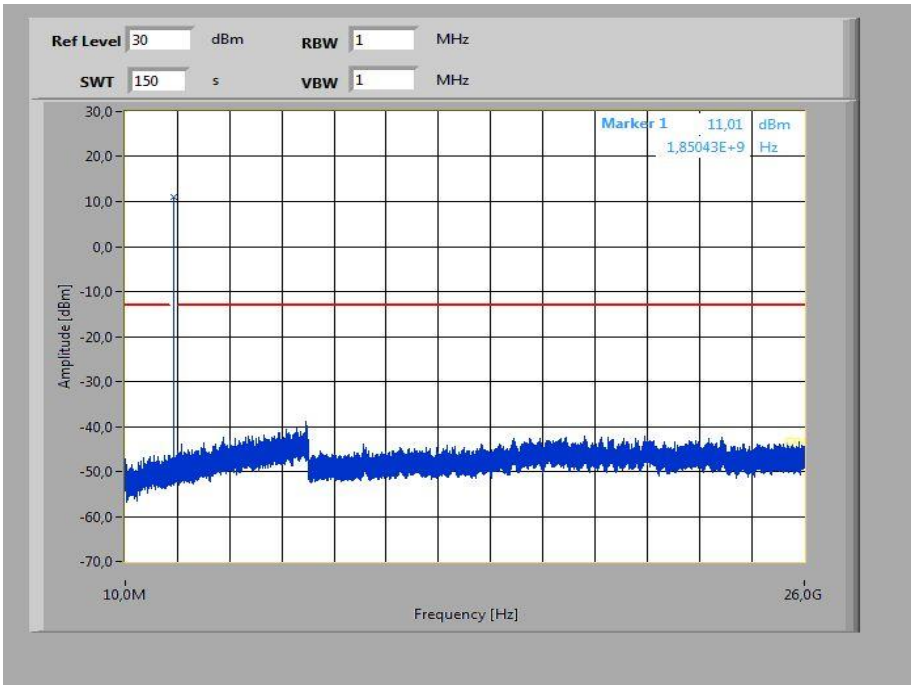
16-QAM:

Spurious Emission Level (dBm)								
Harmonic	Lowest channel Freq. (MHz)	Level [dBm]	Harmonic	Middle channel Freq. (MHz)	Level [dBm]	Harmonic	Highest channel Freq. (MHz)	Level [dBm]
2	3720.0	-	2	3760.0	-	2	3800.0	-
3	5580.0	-	3	5640.0	-	3	5700.0	-
4	7440.0	-	4	7520.0	-	4	7600.0	-
5	9300.0	-	5	9400.0	-	5	9500.0	-
6	11160.0	-	6	11280.0	-	6	11400.0	-
7	13020.0	-	7	13160.0	-	7	13300.0	-
8	14880.0	-	8	15040.0	-	8	15200.0	-
9	16740.0	-	9	16920.0	-	9	17100.0	-
10	18600.0	-	10	18800.0	-	10	19000.0	-

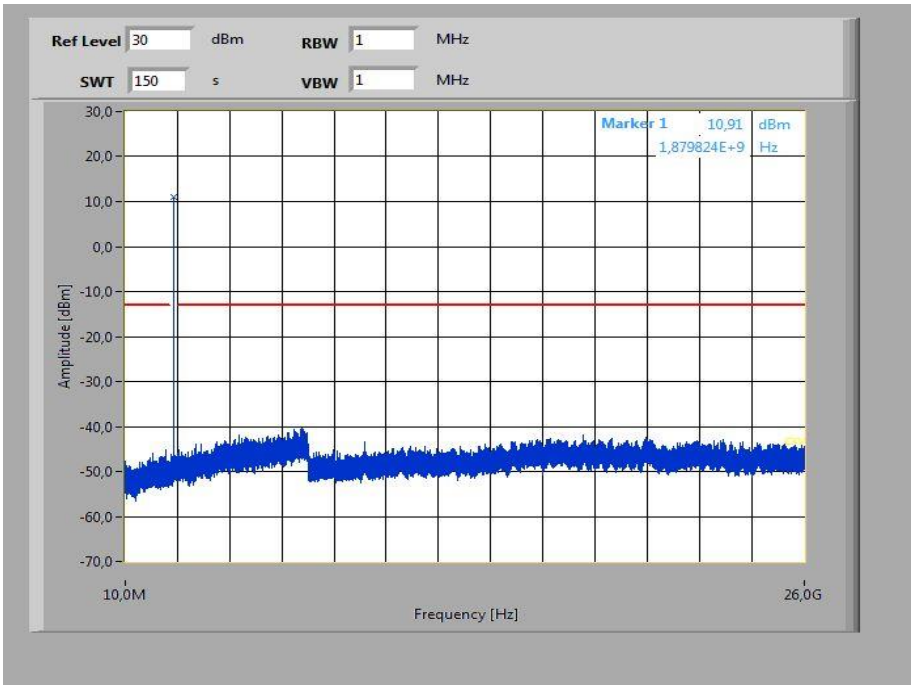
Verdict: **compliant**

Plots: QPSK with 1.4 MHz channel bandwidth

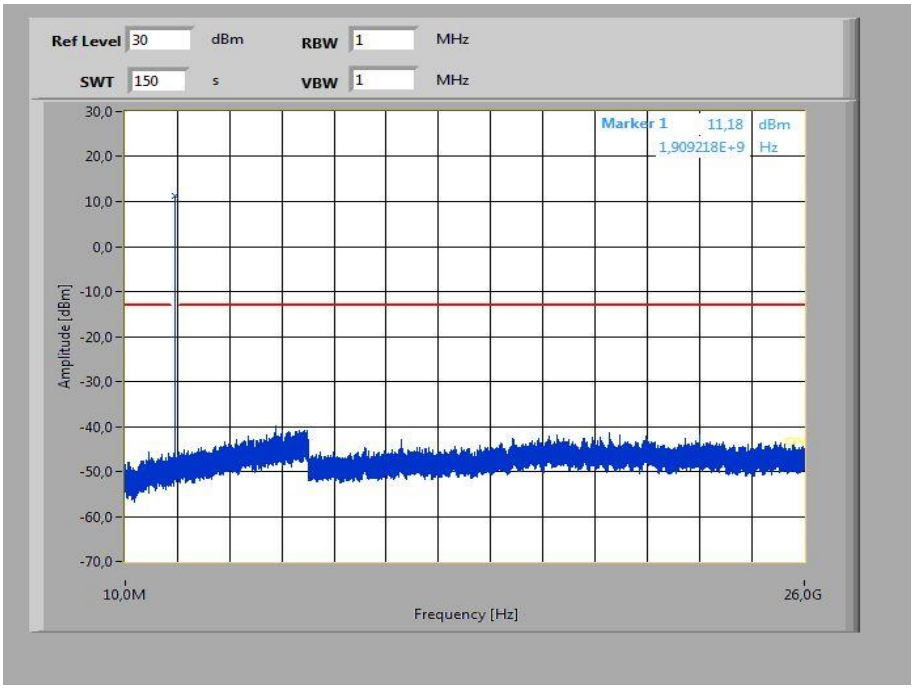
Plot 1: Lowest Channel (10 MHz – 26 GHz)



Plot 2: Middle Channel (10 MHz – 26 GHz)

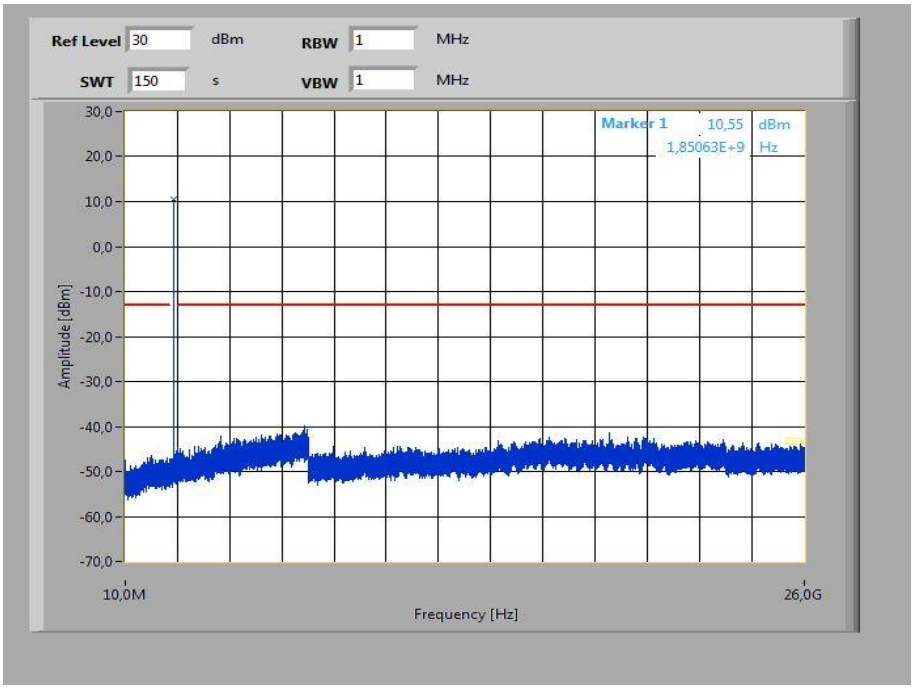


Plot 3: Highest Channel (10 MHz – 26 GHz)

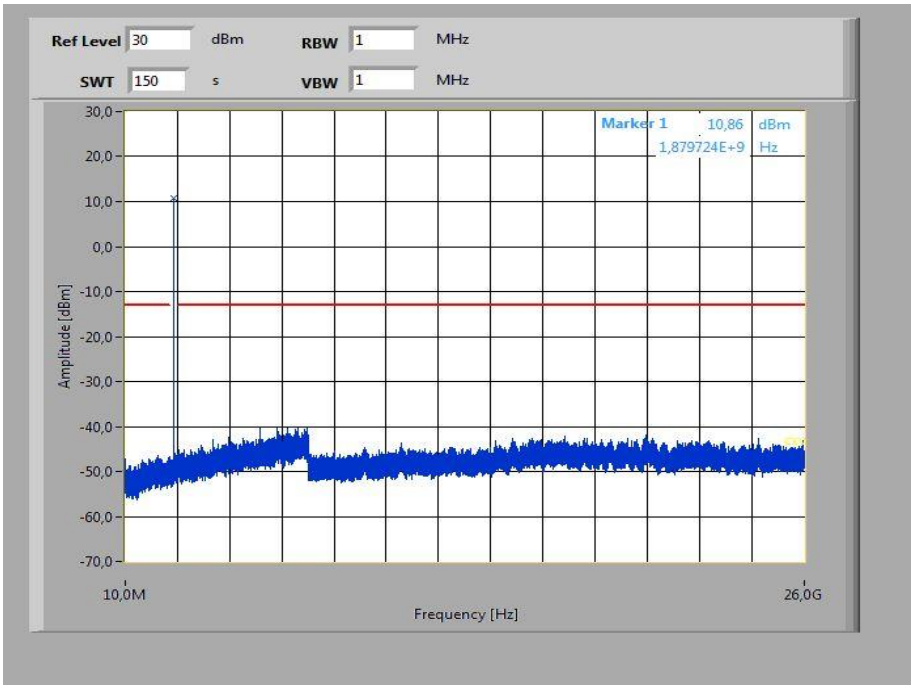


Plots: 16-QAM with 1.4 MHz channel bandwidth

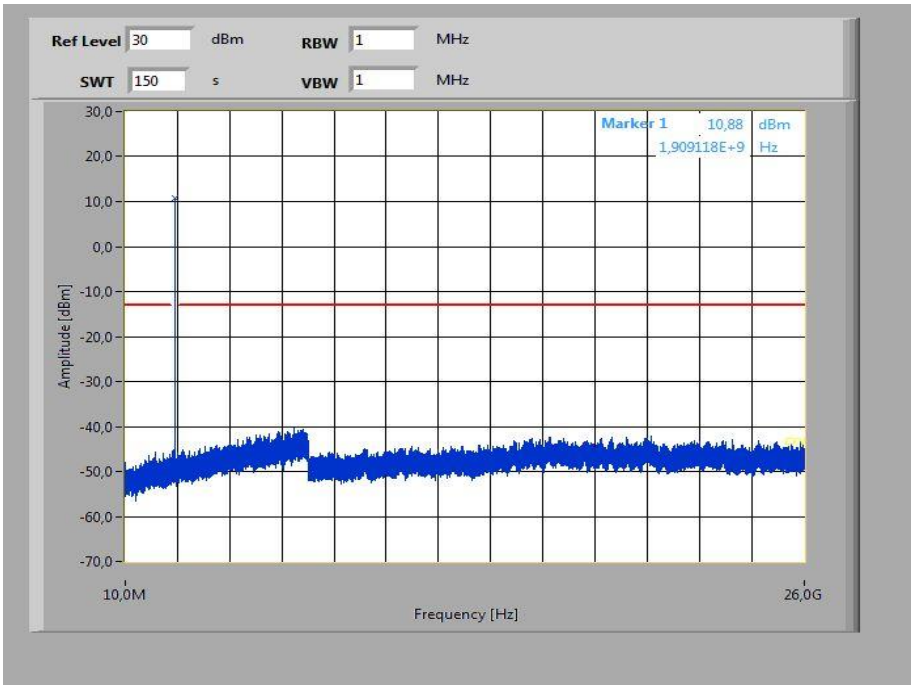
Plot 4: Lowest Channel (10 MHz – 26 GHz)



Plot 5: Middle Channel (10 MHz – 26 GHz)

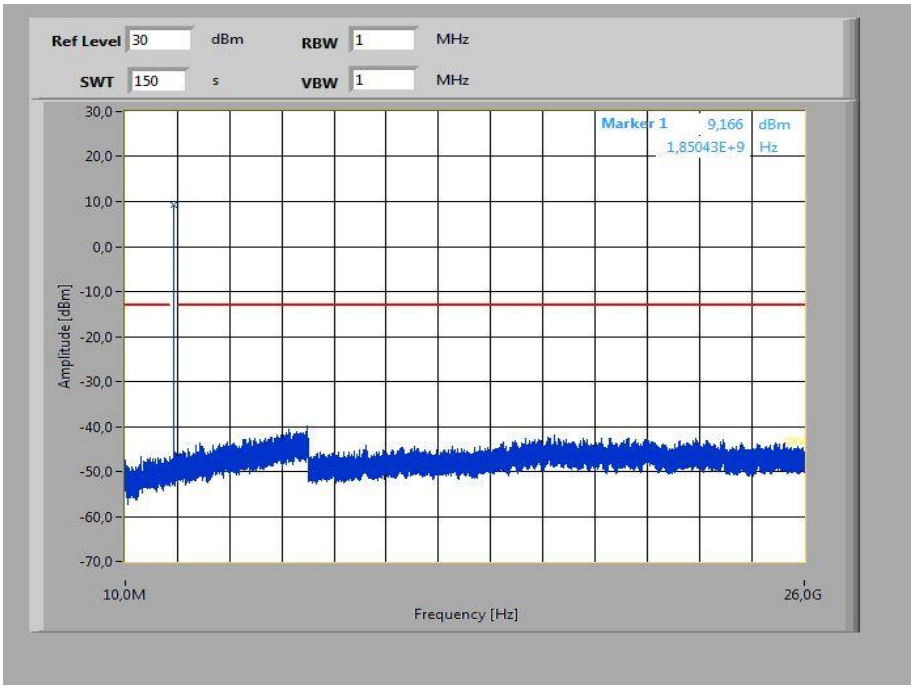


Plot 6: Highest Channel (10 MHz – 26 GHz)

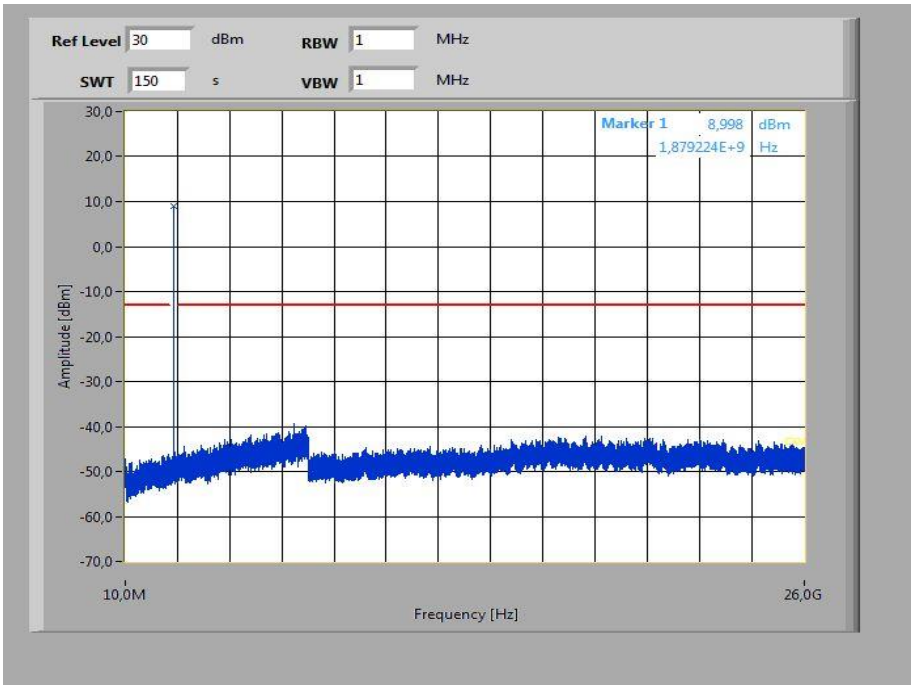


Plots: QPSK with 3 MHz channel bandwidth

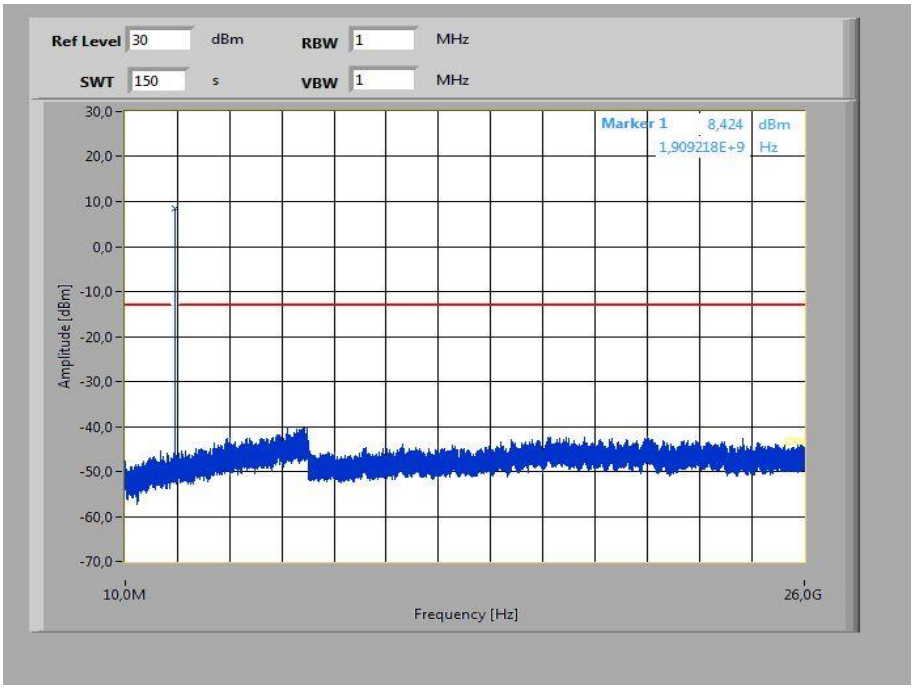
Plot 1: Lowest Channel (10 MHz – 26 GHz)



Plot 2: Middle Channel (10 MHz – 26 GHz)

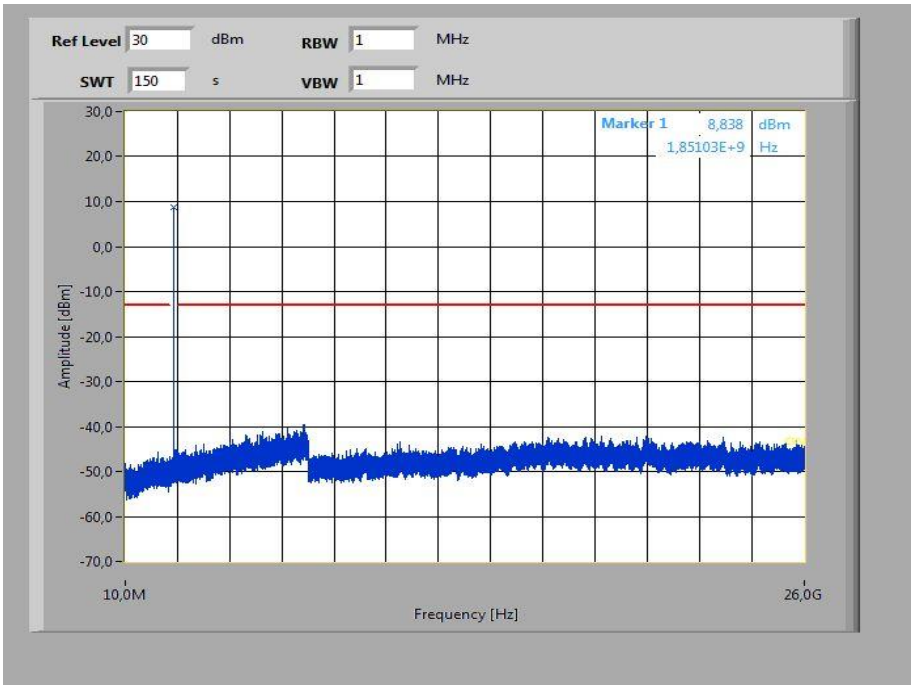


Plot 3: Highest Channel (10 MHz – 26 GHz)

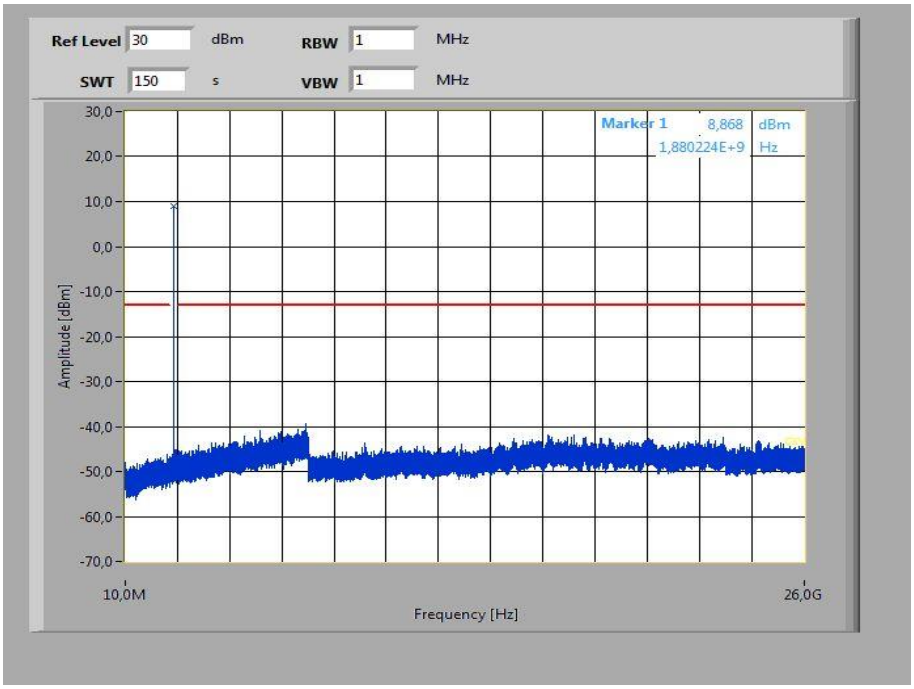


Plots: 16-QAM with 3 MHz channel bandwidth

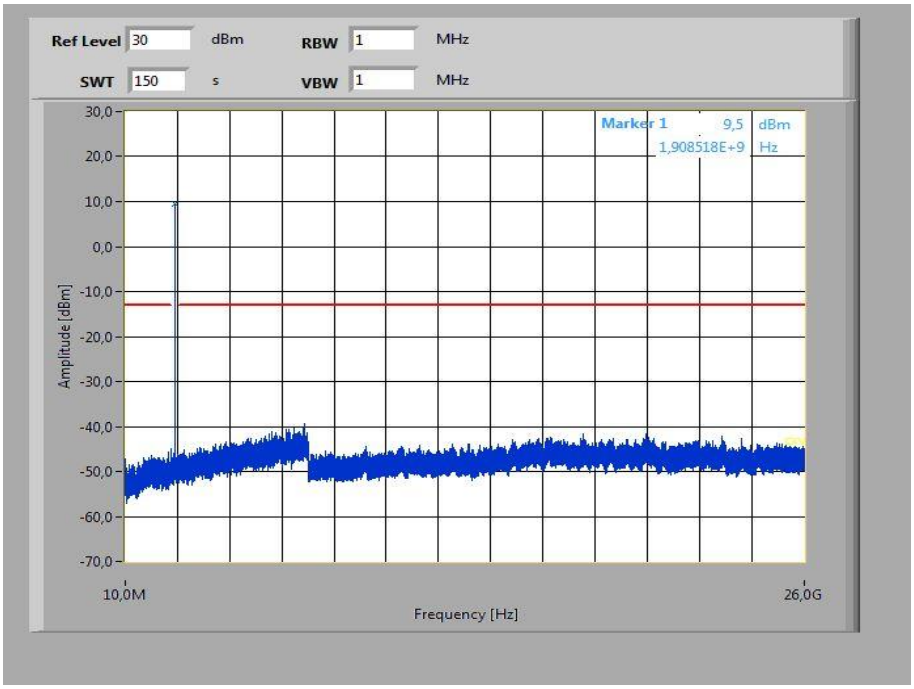
Plot 4: Lowest Channel (10 MHz – 26 GHz)



Plot 5: Middle Channel (10 MHz – 26 GHz)

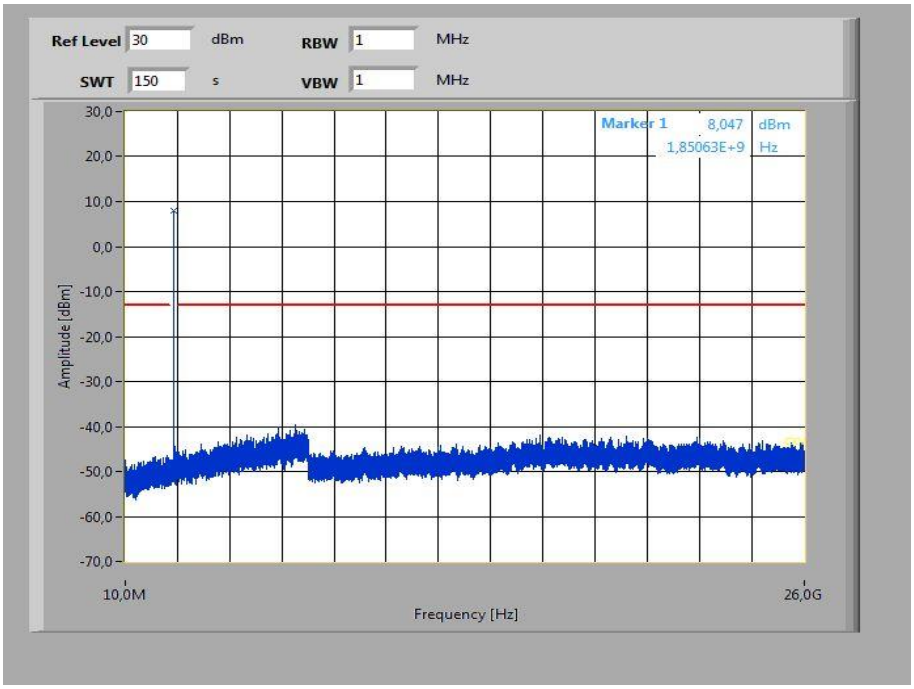


Plot 6: Highest Channel (10 MHz – 26 GHz)

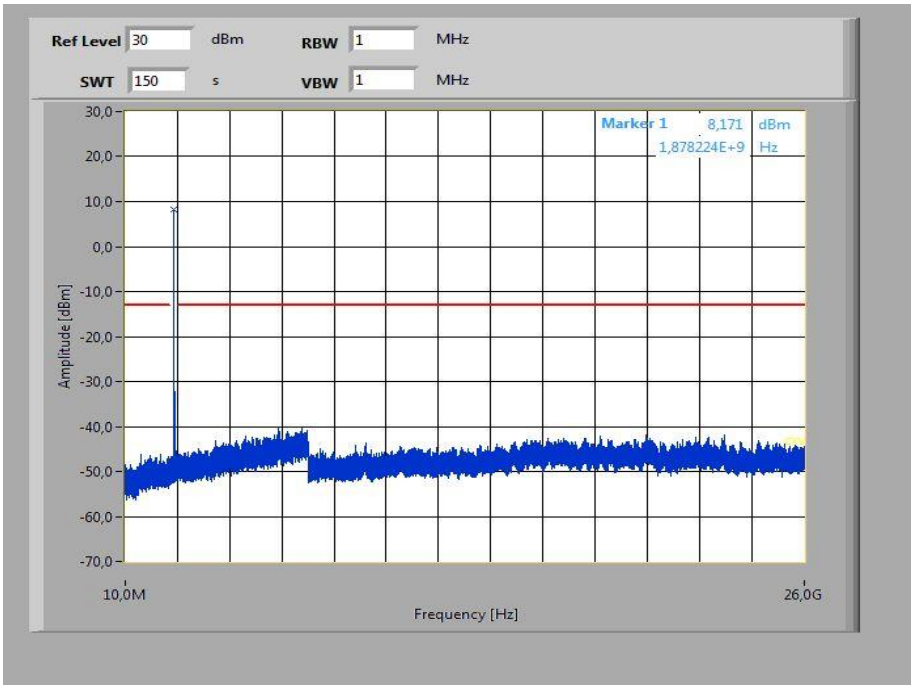


Plots: QPSK with 5 MHz channel bandwidth

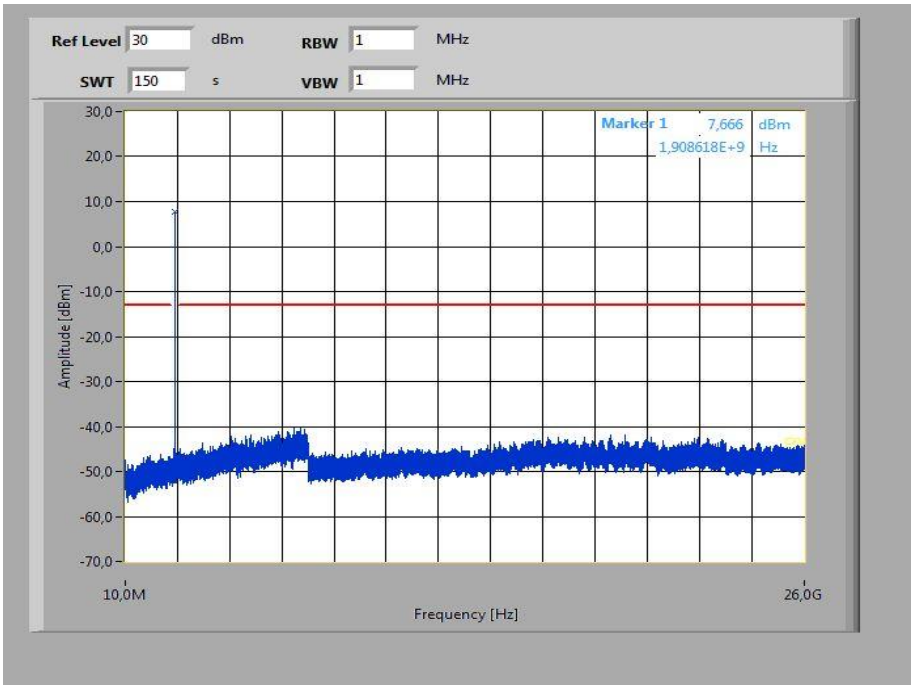
Plot 1: Lowest Channel (10 MHz – 26 GHz)



Plot 2: Middle Channel (10 MHz – 26 GHz)

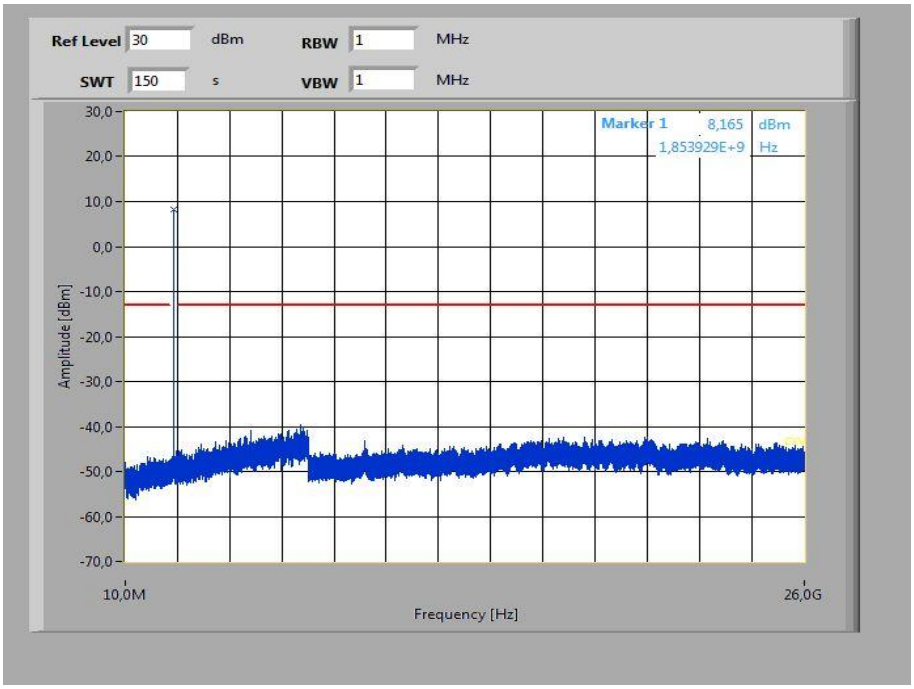


Plot 3: Highest Channel (10 MHz – 26 GHz)

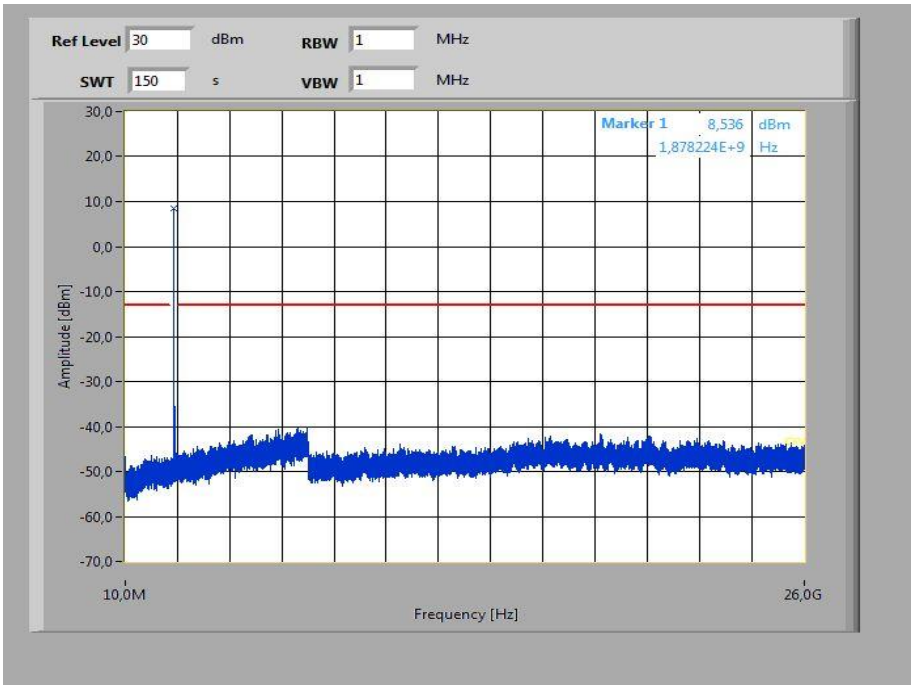


Plots: 16-QAM with 5 MHz channel bandwidth

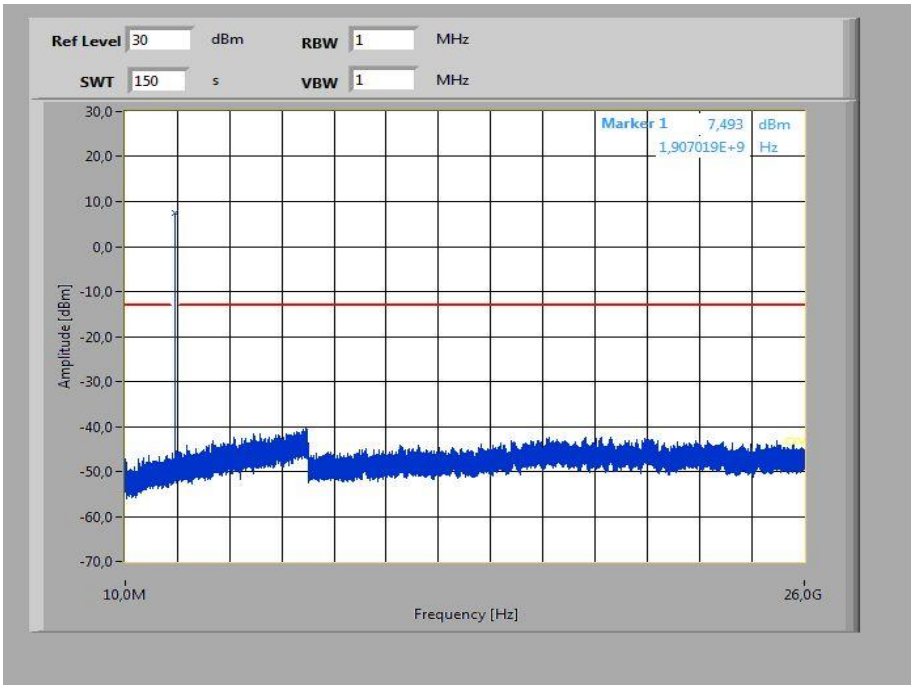
Plot 4: Lowest Channel (10 MHz – 26 GHz)



Plot 5: Middle Channel (10 MHz – 26 GHz)

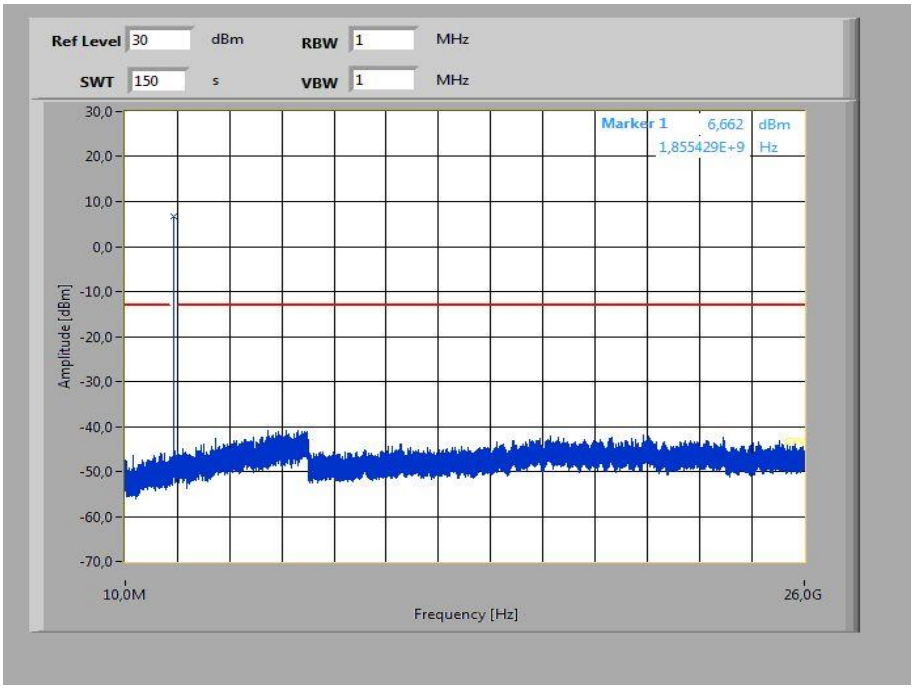


Plot 6: Highest Channel (10 MHz – 26 GHz)

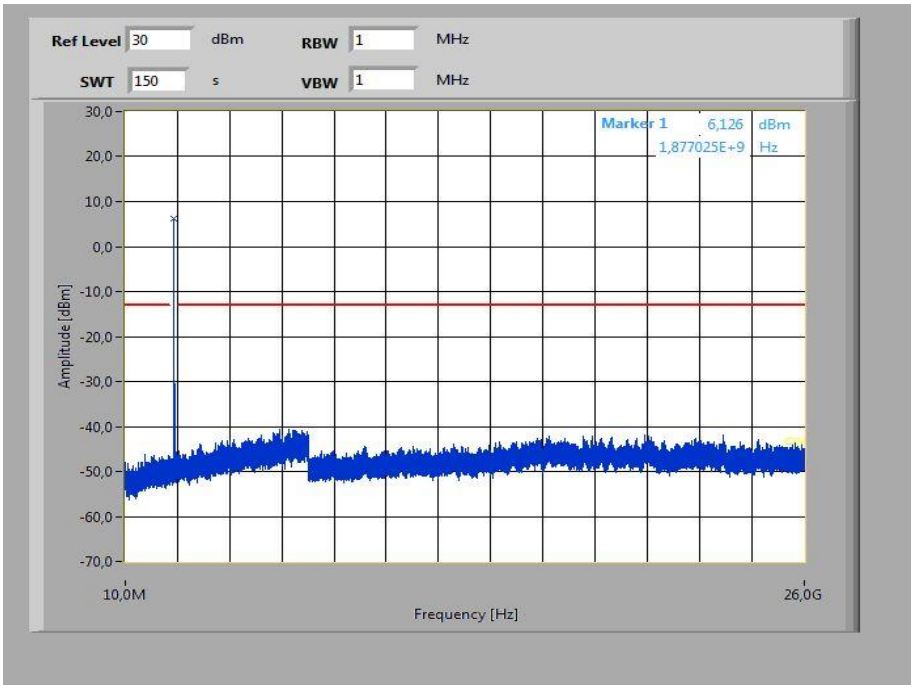


Plots: QPSK with 10 MHz channel bandwidth

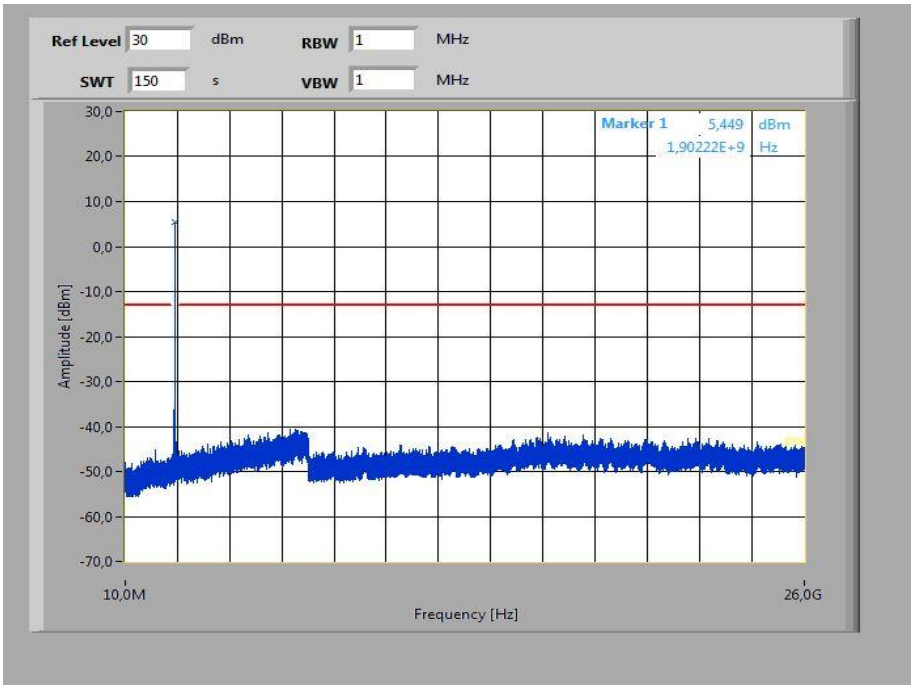
Plot 1: Lowest Channel (10 MHz – 26 GHz)



Plot 2: Middle Channel (10 MHz – 26 GHz)

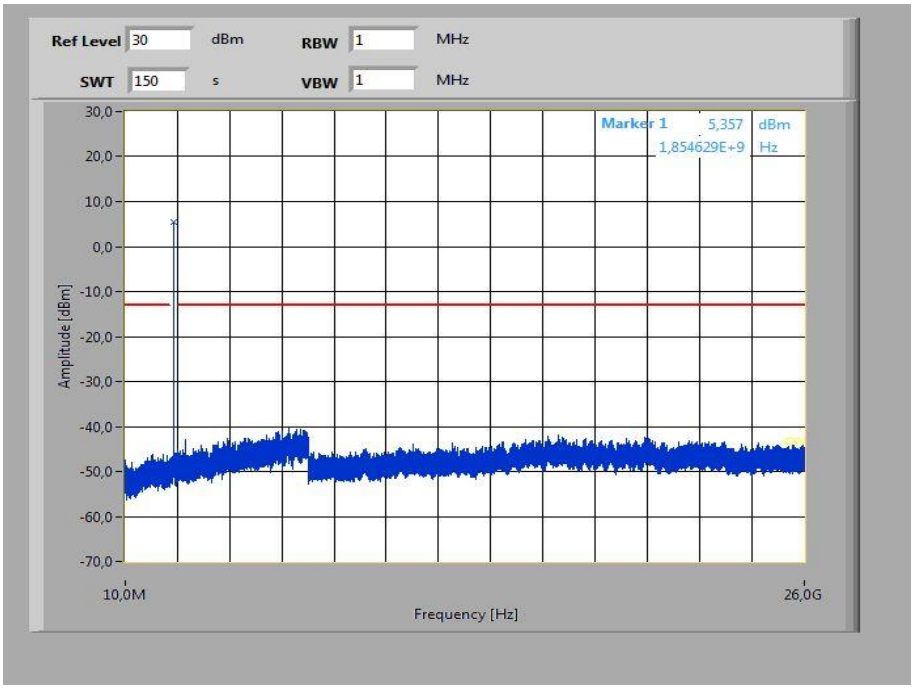


Plot 3: Highest Channel (10 MHz – 26 GHz)

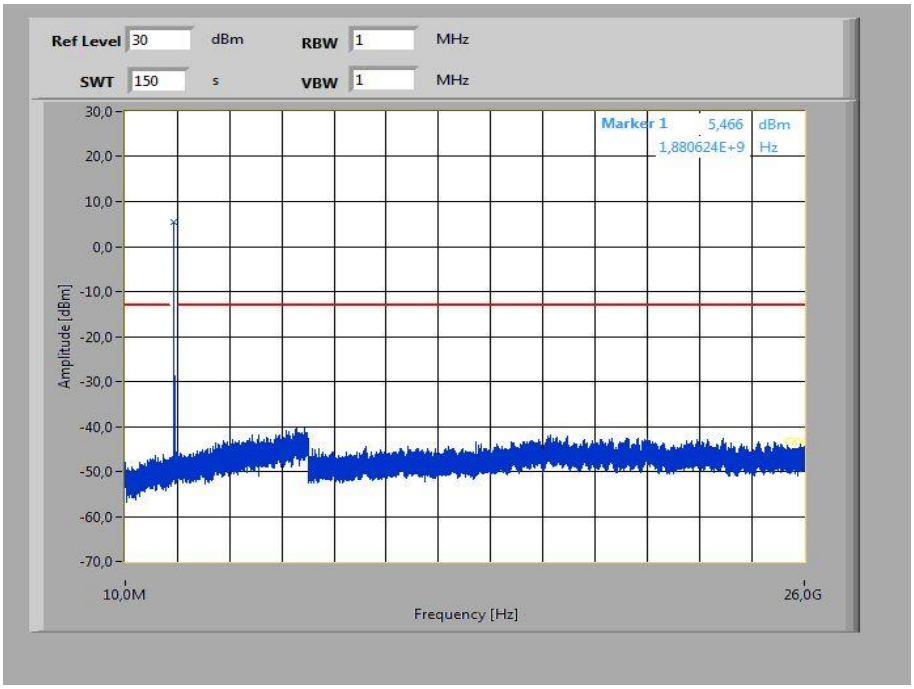


Plots: 16-QAM with 10 MHz channel bandwidth

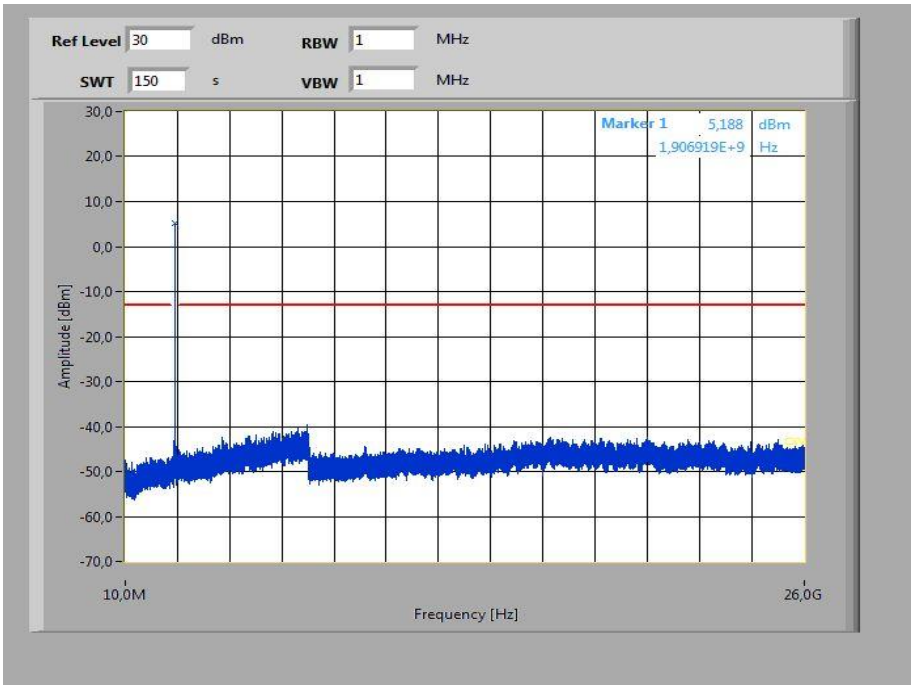
Plot 4: Lowest Channel (10 MHz – 26 GHz)



Plot 5: Middle Channel (10 MHz – 26 GHz)

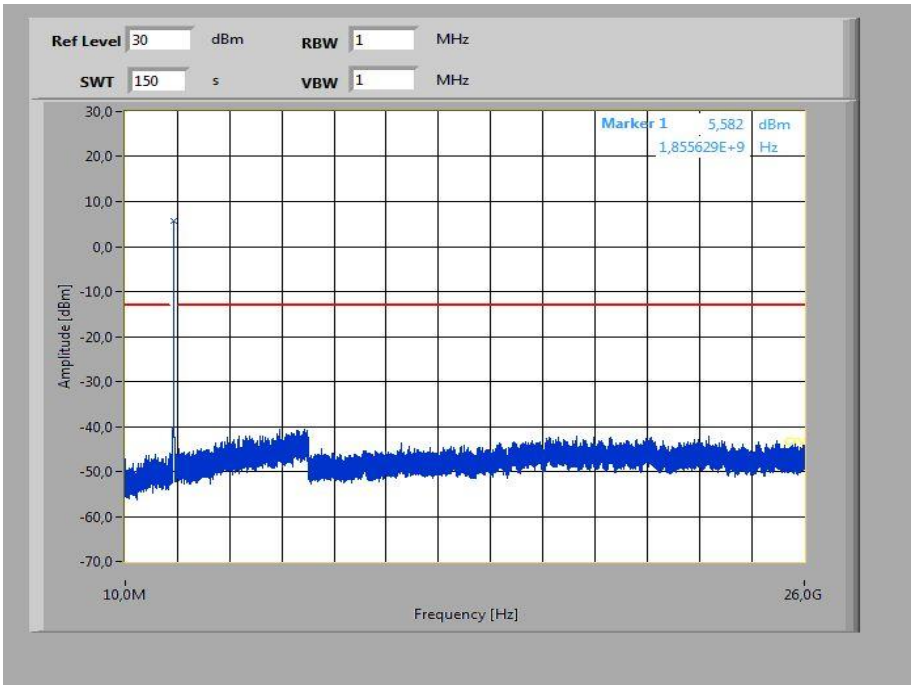


Plot 6: Highest Channel (10 MHz – 26 GHz)

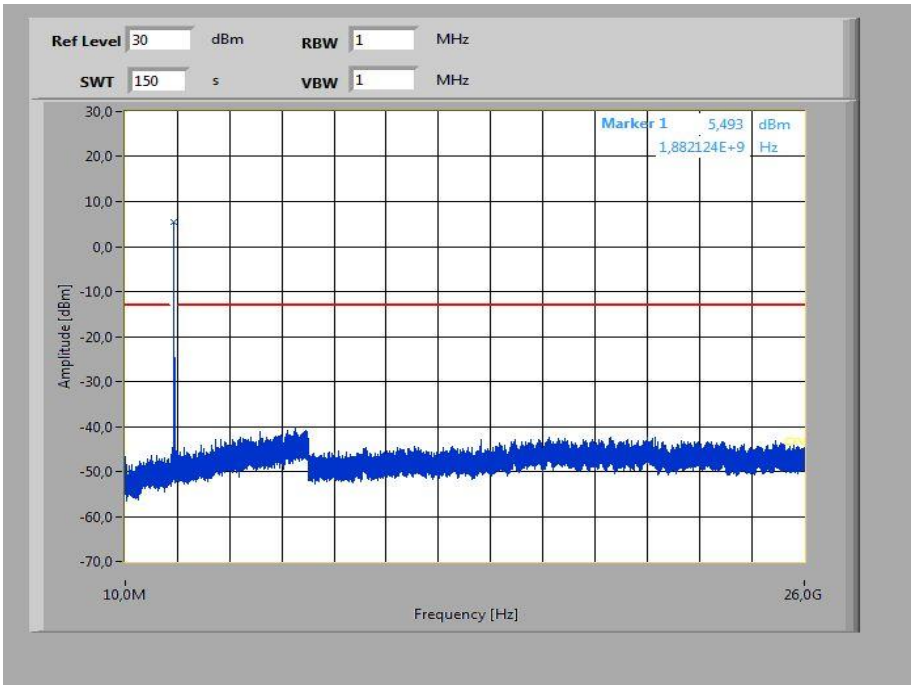


Plots: QPSK with 15 MHz channel bandwidth

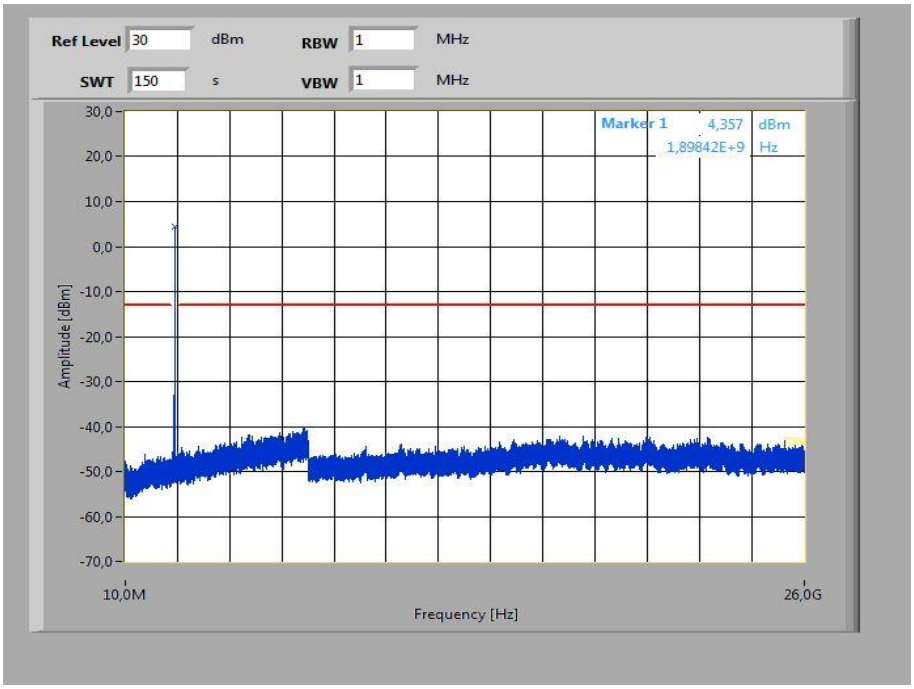
Plot 1: Lowest Channel (10 MHz – 26 GHz)



Plot 2: Middle Channel (10 MHz – 26 GHz)

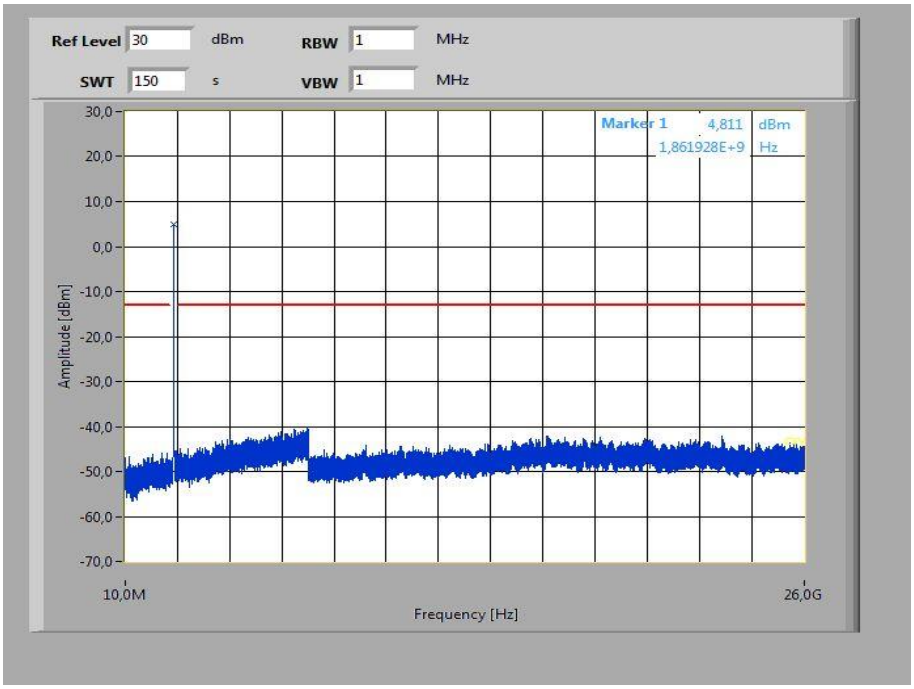


Plot 3: Highest Channel (10 MHz – 26 GHz)

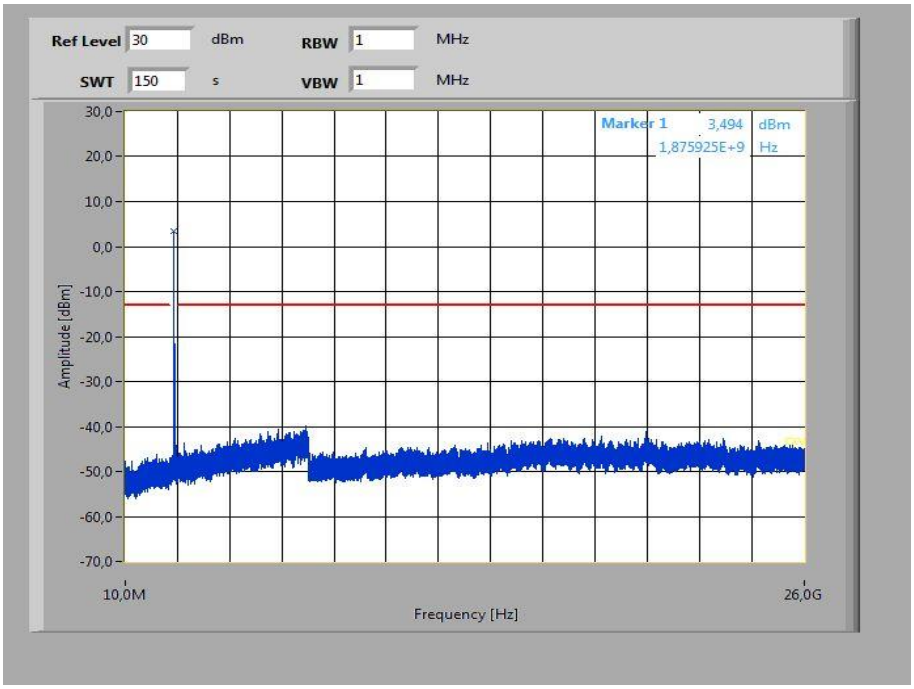


Plots: 16-QAM with 15 MHz channel bandwidth

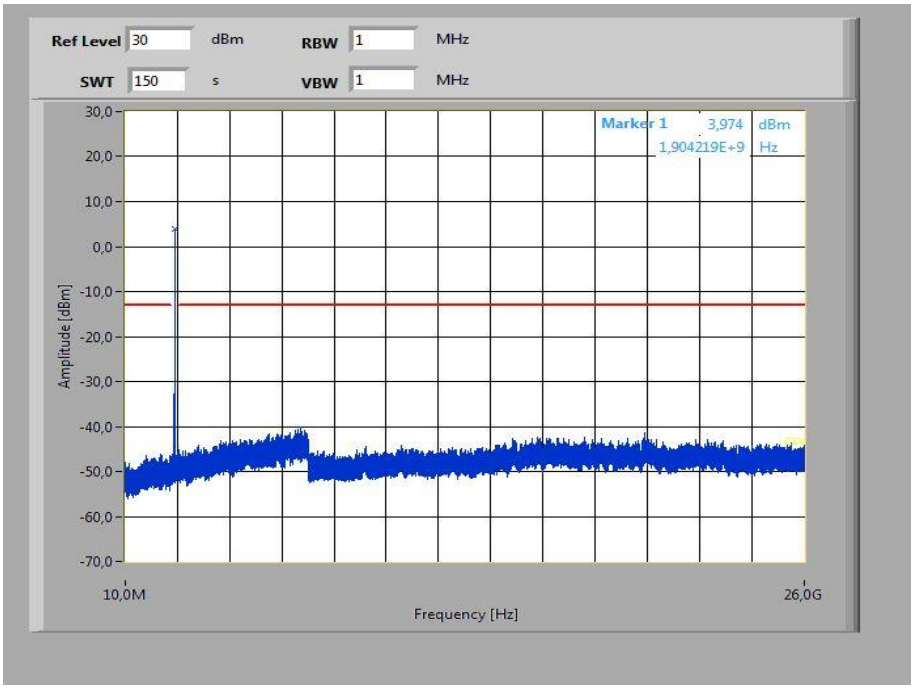
Plot 4: Lowest Channel (10 MHz – 26 GHz)



Plot 5: Middle Channel (10 MHz – 26 GHz)

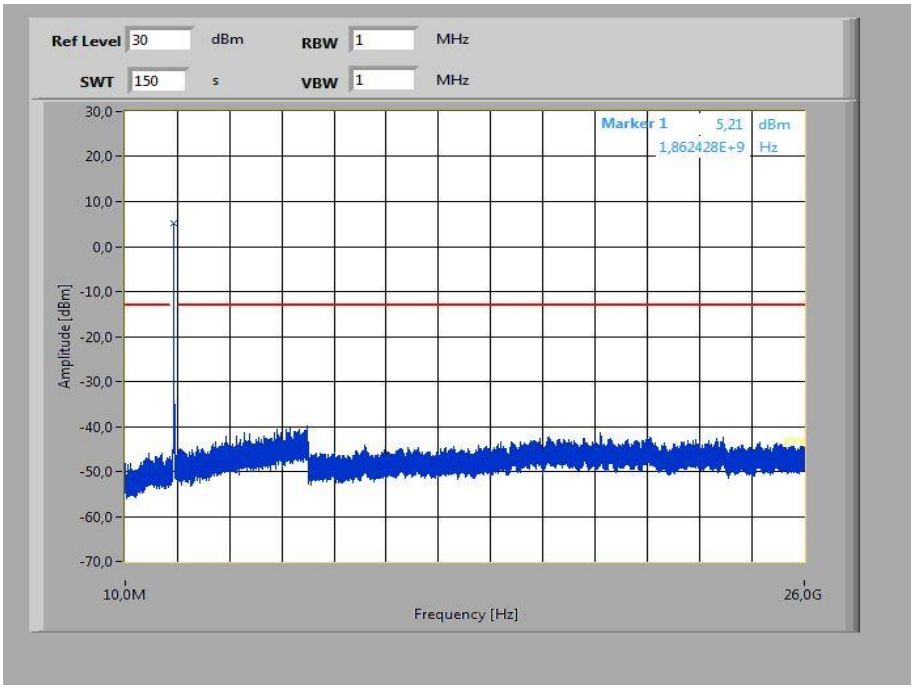


Plot 6: Highest Channel (10 MHz – 26 GHz)

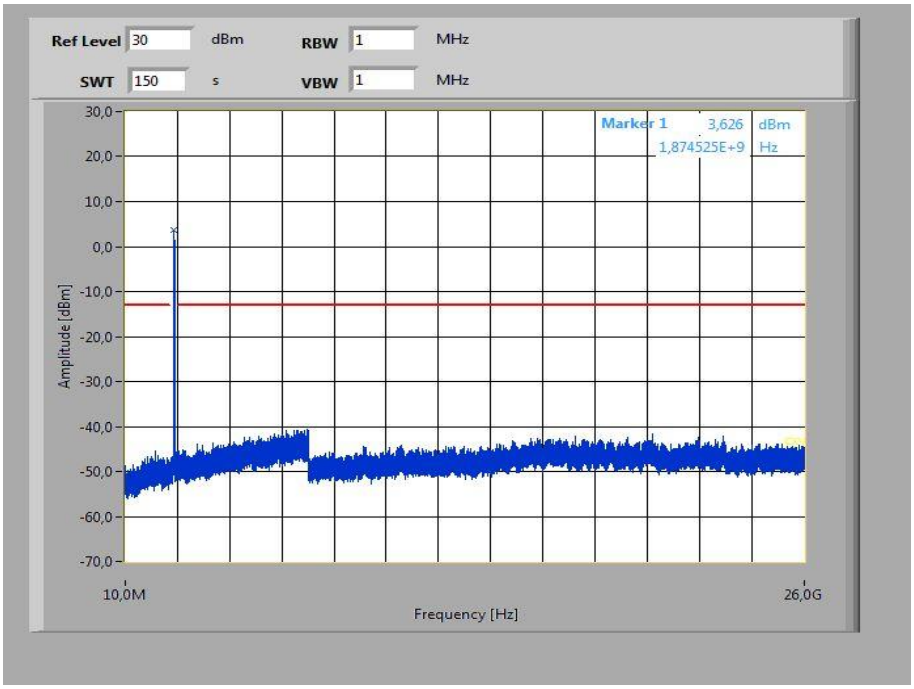


Plots: QPSK with 20 MHz channel bandwidth

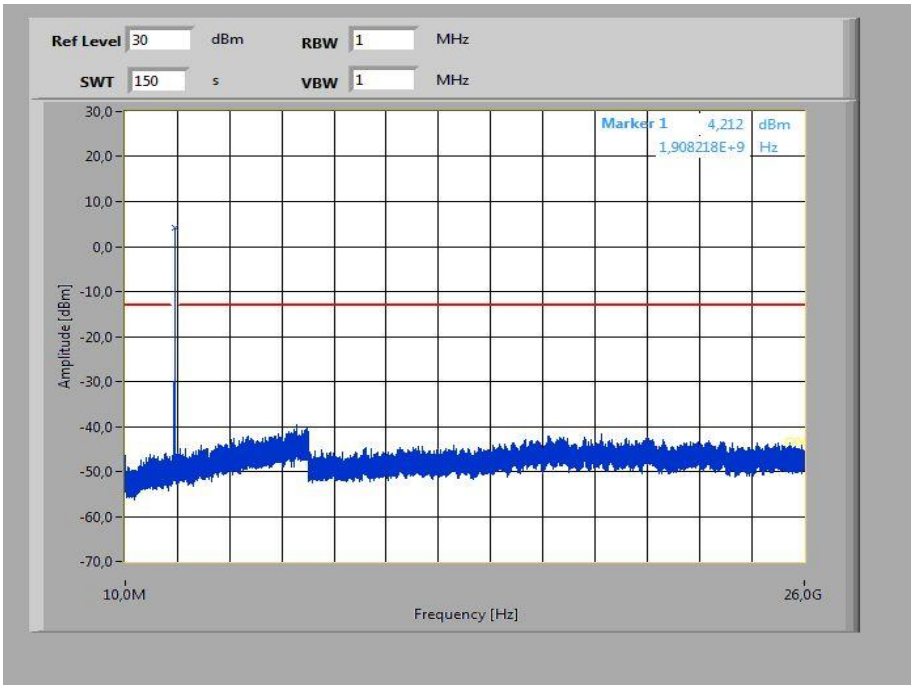
Plot 1: Lowest Channel (10 MHz – 26 GHz)



Plot 2: Middle Channel (10 MHz – 26 GHz)

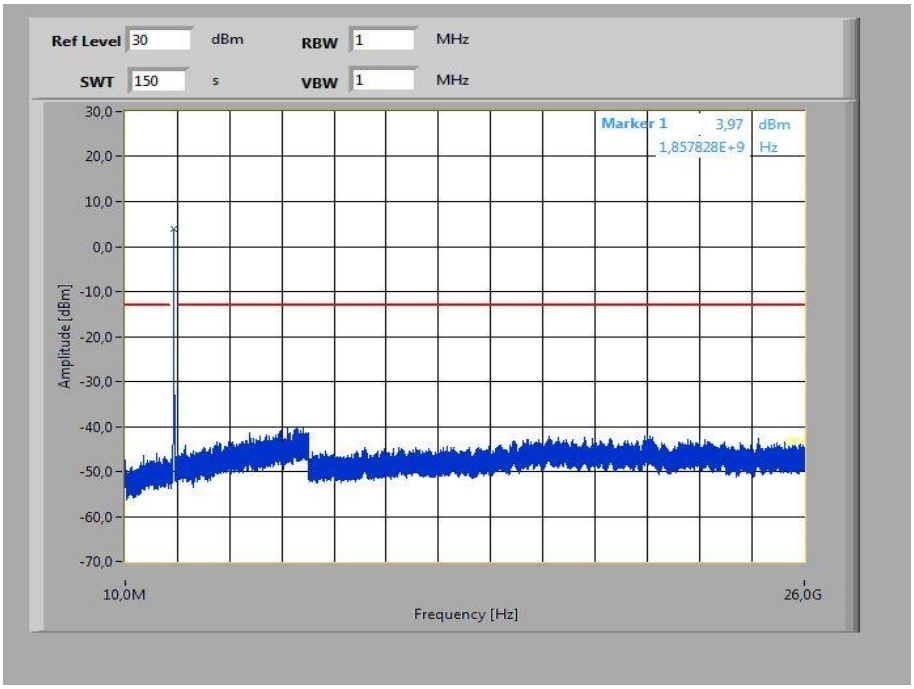


Plot 3: Highest Channel (10 MHz – 26 GHz)

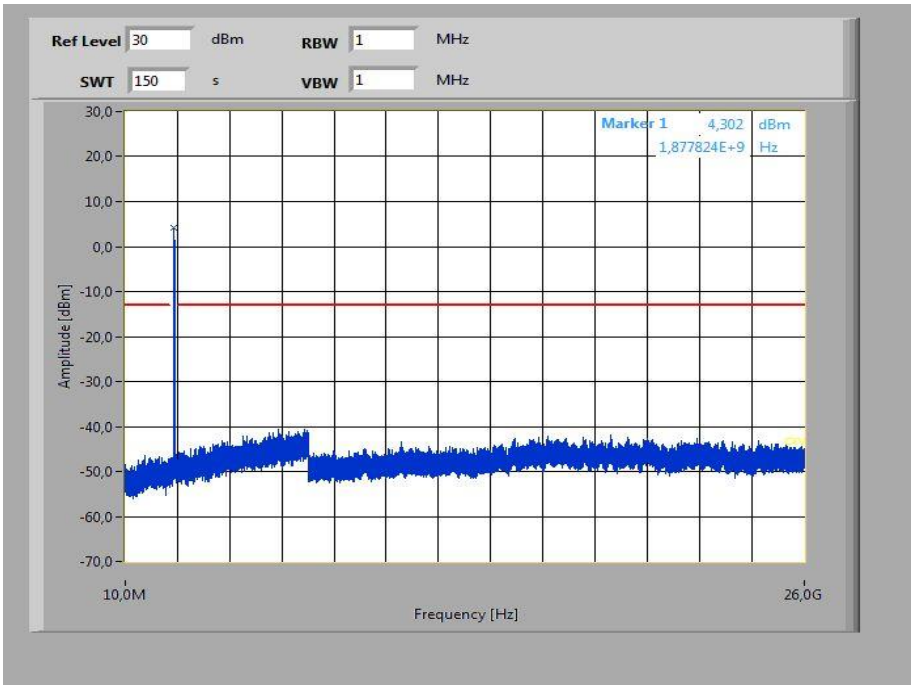


Plots: 16-QAM with 20 MHz channel bandwidth

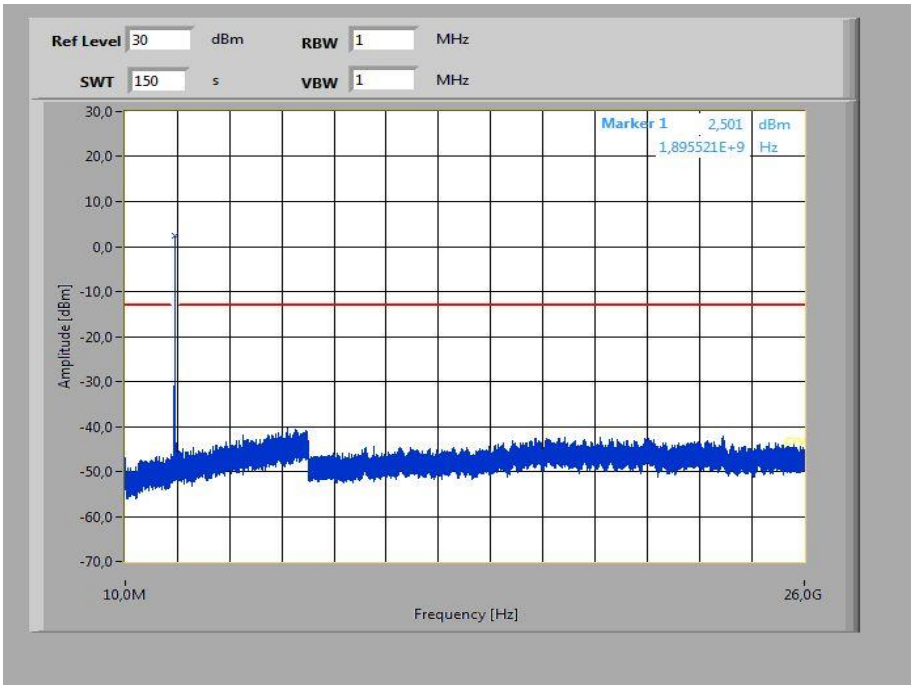
Plot 4: Lowest Channel (10 MHz – 26 GHz)



Plot 5: Middle Channel (10 MHz – 26 GHz)



Plot 6: Highest Channel (10 MHz – 26 GHz)



11.1.5 Block edge compliance

Description:

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

Measurement:

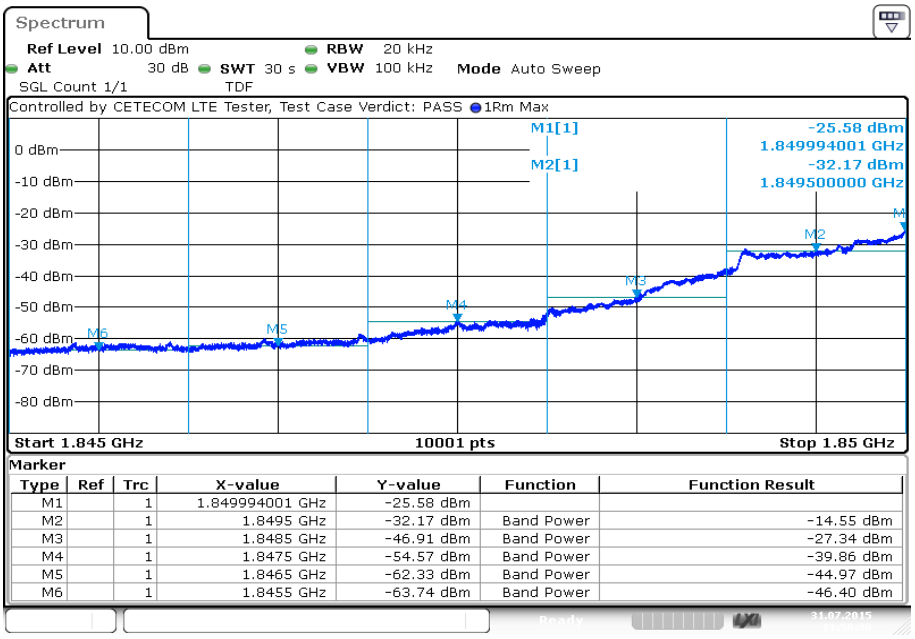
Measurement parameters	
Detector:	RMS
Sweep time:	30 s
Resolution bandwidth:	1% - 5% of the OBW
Video bandwidth:	≥ 3xRBW
Span:	5 MHz
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.3 - A
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
CFR Part 24.238 CFR Part 2.1051	RSS 133
Block Edge Compliance	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results: **1.4 MHz channel bandwidth**

Plot 1: Lowest channel – QPSK

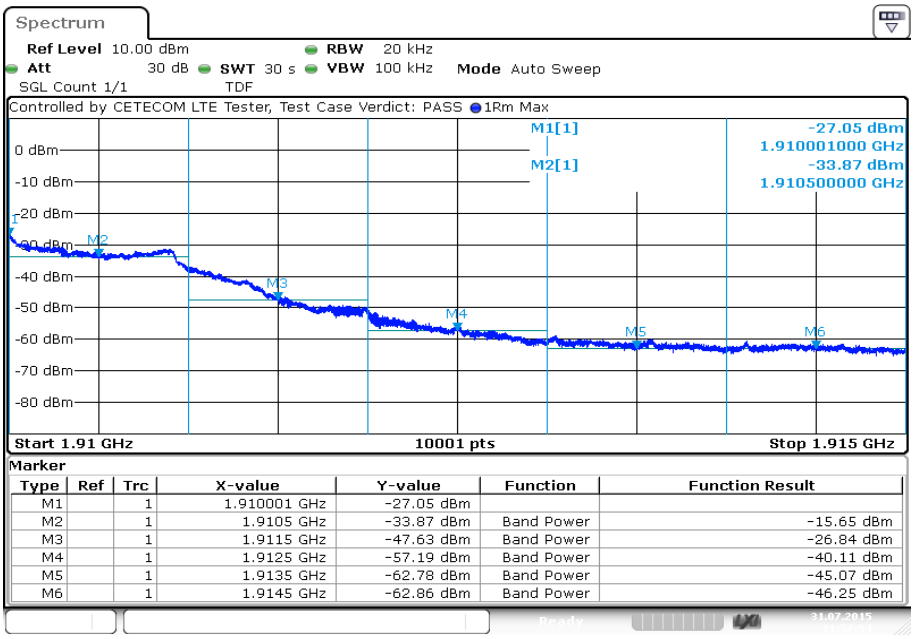


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.849994001 GHz	-25.58 dBm		
M2		1	1.8495 GHz	-32.17 dBm	Band Power	-14.55 dBm
M3		1	1.8485 GHz	-46.91 dBm	Band Power	-27.34 dBm
M4		1	1.8475 GHz	-54.57 dBm	Band Power	-39.86 dBm
M5		1	1.8465 GHz	-62.33 dBm	Band Power	-44.97 dBm
M6		1	1.8455 GHz	-63.74 dBm	Band Power	-46.40 dBm

Date: 31.JUL.2015 11:56:30

Plot 2: Highest channel – QPSK

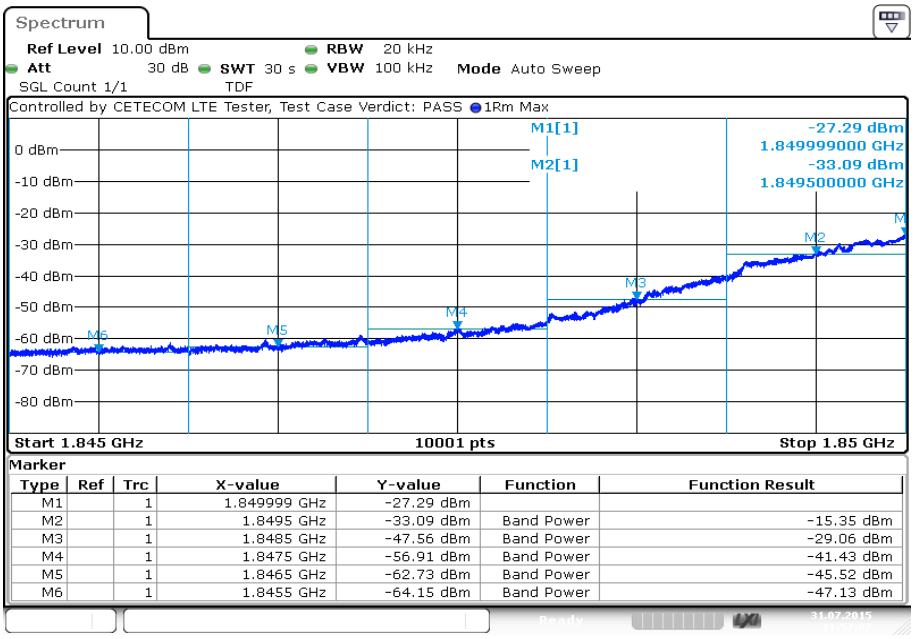


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.910001 GHz	-27.05 dBm		
M2		1	1.9105 GHz	-33.87 dBm	Band Power	-15.65 dBm
M3		1	1.9115 GHz	-47.63 dBm	Band Power	-26.84 dBm
M4		1	1.9125 GHz	-57.19 dBm	Band Power	-40.11 dBm
M5		1	1.9135 GHz	-62.78 dBm	Band Power	-45.07 dBm
M6		1	1.9145 GHz	-62.86 dBm	Band Power	-46.25 dBm

Date: 31.JUL.2015 11:57:54

Plot 3: Lowest channel – 16-QAM

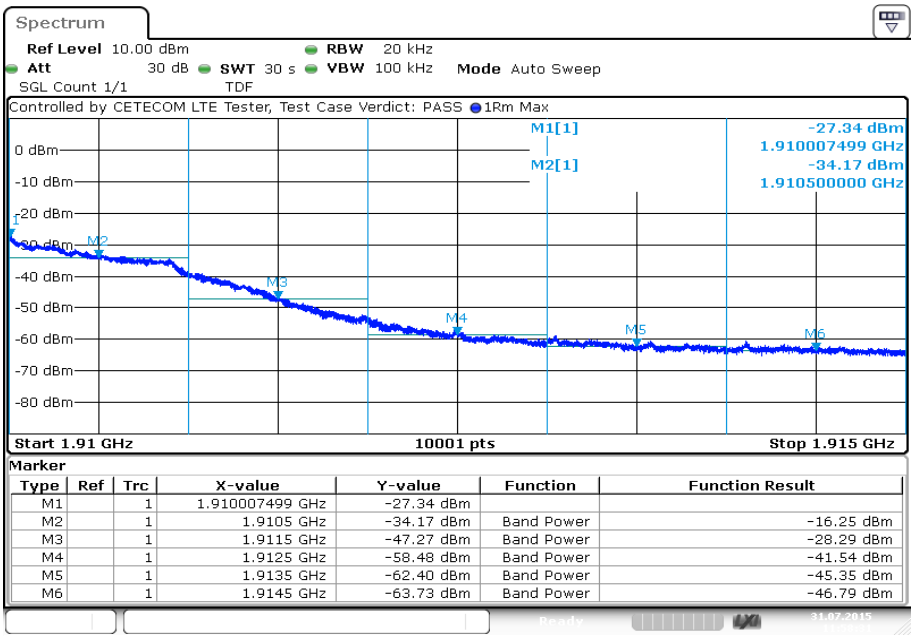


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.849999 GHz	-27.29 dBm		
M2		1	1.8495 GHz	-33.09 dBm	Band Power	-15.35 dBm
M3		1	1.8485 GHz	-47.56 dBm	Band Power	-29.06 dBm
M4		1	1.8475 GHz	-56.91 dBm	Band Power	-41.43 dBm
M5		1	1.8465 GHz	-62.73 dBm	Band Power	-45.52 dBm
M6		1	1.8455 GHz	-64.15 dBm	Band Power	-47.13 dBm

Date: 31.JUL.2015 11:57:07

Plot 4: Highest channel – 16-QAM



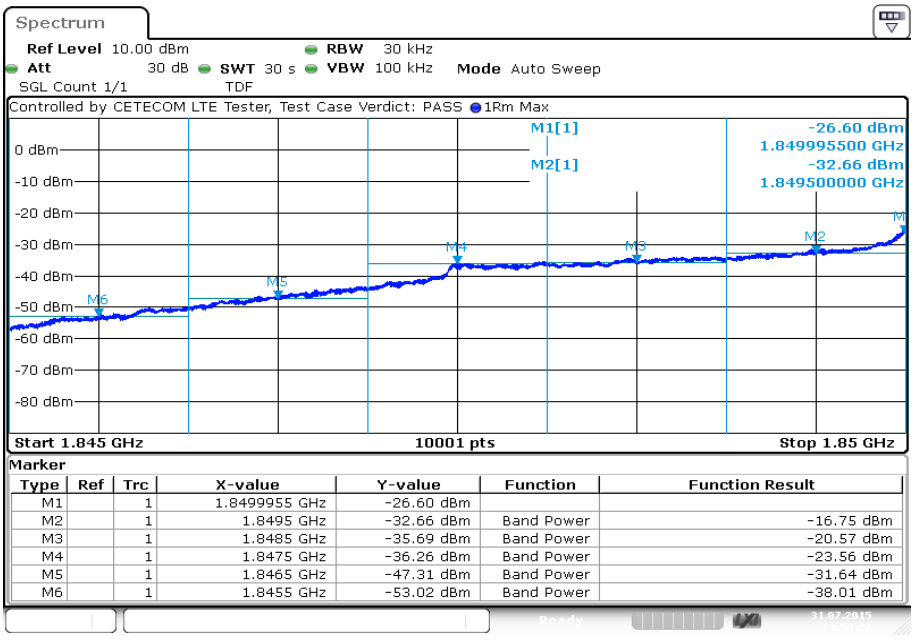
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.910007499 GHz	-27.34 dBm		
M2		1	1.9105 GHz	-34.17 dBm	Band Power	-16.25 dBm
M3		1	1.9115 GHz	-47.27 dBm	Band Power	-28.29 dBm
M4		1	1.9125 GHz	-58.48 dBm	Band Power	-41.54 dBm
M5		1	1.9135 GHz	-62.40 dBm	Band Power	-45.35 dBm
M6		1	1.9145 GHz	-63.73 dBm	Band Power	-46.79 dBm

Date: 31.JUL.2015 11:58:31

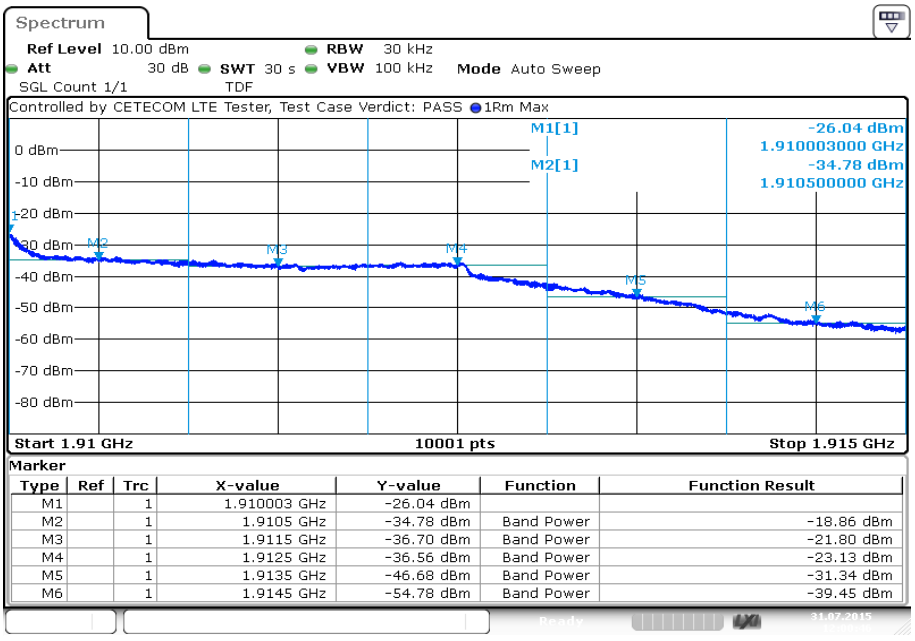
Results: **3 MHz channel bandwidth**

Plot 1: Lowest channel – QPSK



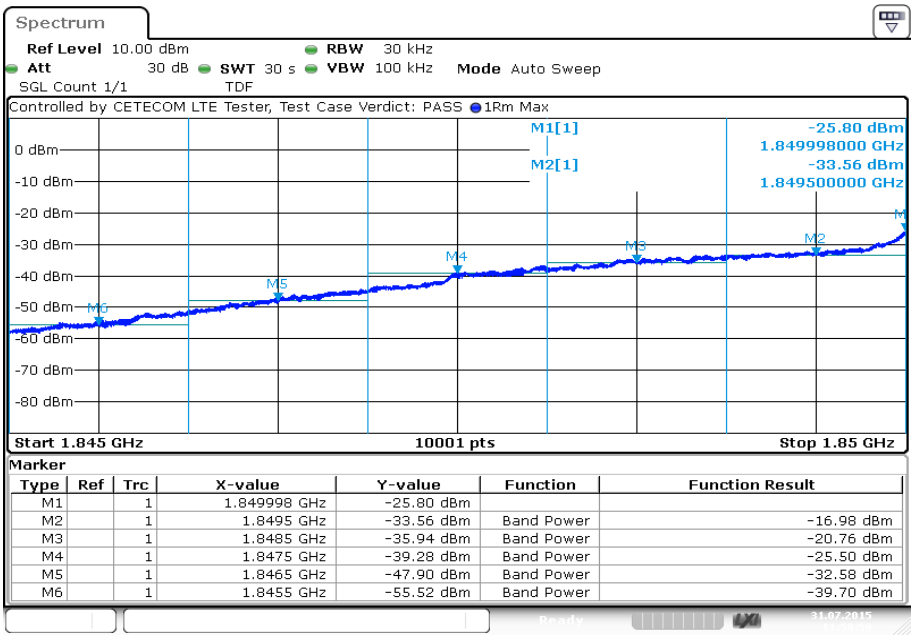
Date: 31.JUL.2015 11:59:22

Plot 2: Highest channel – QPSK



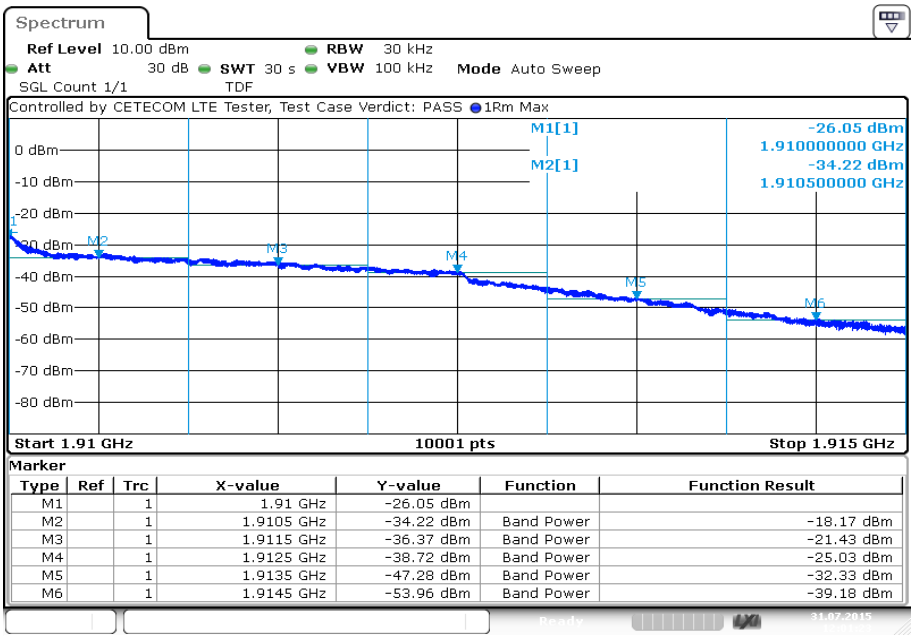
Date: 31.JUL.2015 12:00:46

Plot 3: Lowest channel – 16-QAM



Date: 31.JUL.2015 11:59:59

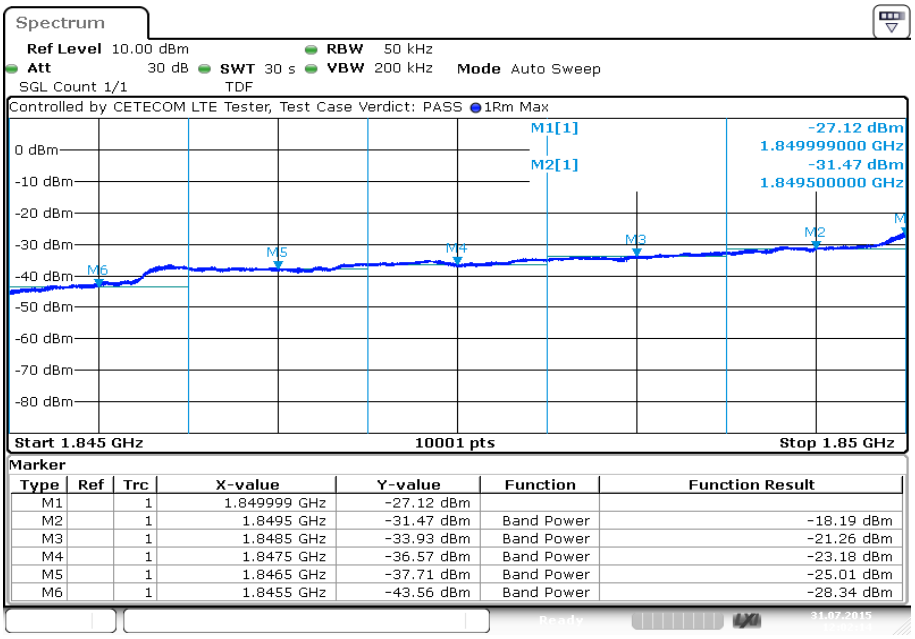
Plot 4: Highest channel – 16-QAM



Date: 31.JUL.2015 12:01:23

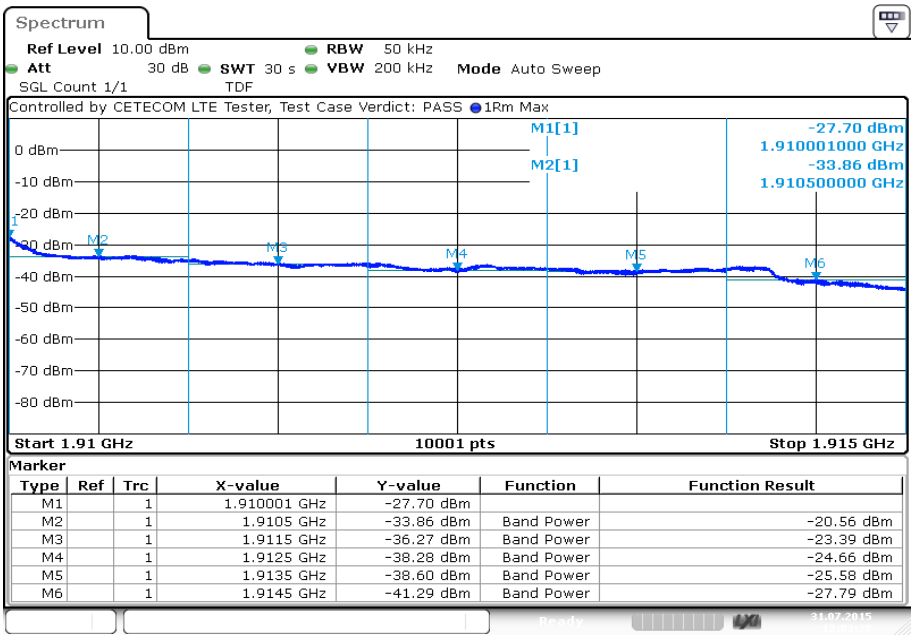
Results: **5 MHz channel bandwidth**

Plot 1: Lowest channel – QPSK



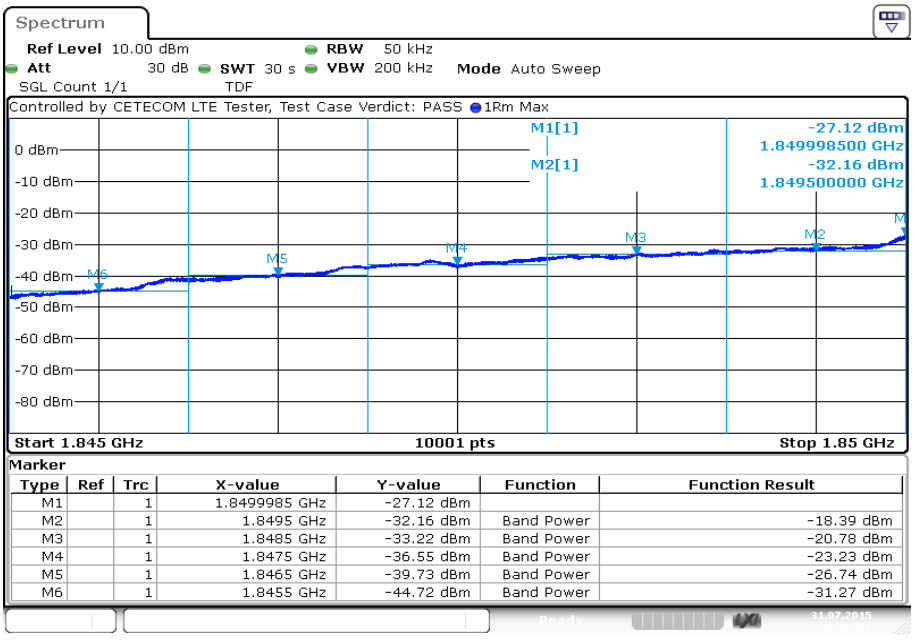
Date: 31.JUL.2015 12:02:14

Plot 2: Highest channel – QPSK



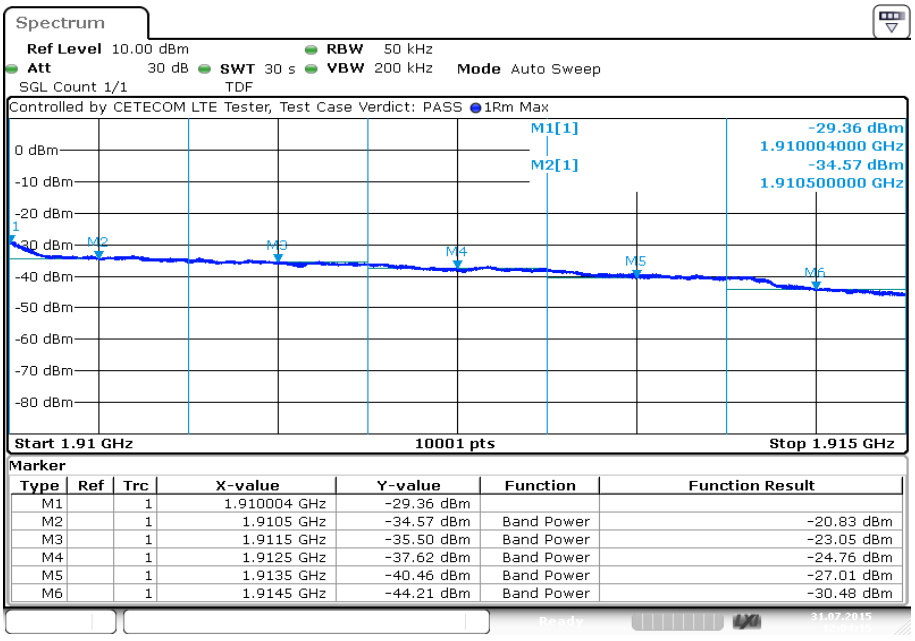
Date: 31.JUL.2015 12:03:38

Plot 3: Lowest channel – 16-QAM



Date: 31.JUL.2015 12:02:51

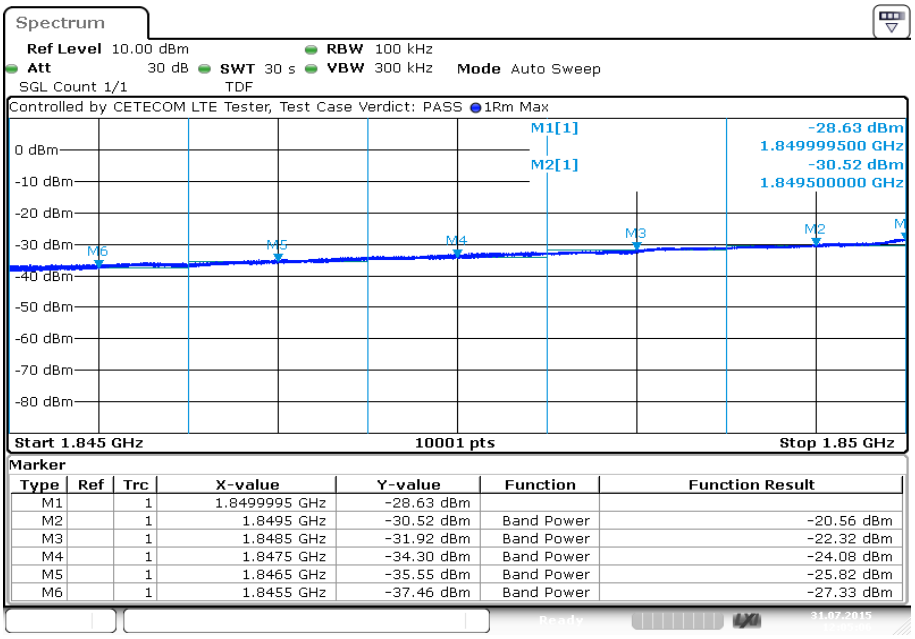
Plot 4: Highest channel – 16-QAM



Date: 31.JUL.2015 12:04:15

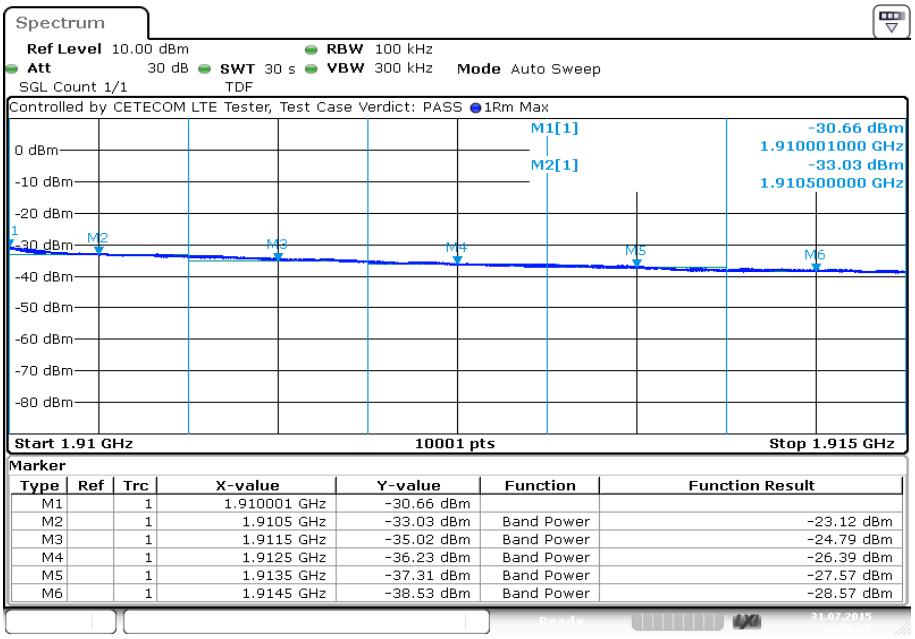
Results: **10 MHz channel bandwidth**

Plot 1: Lowest channel – QPSK



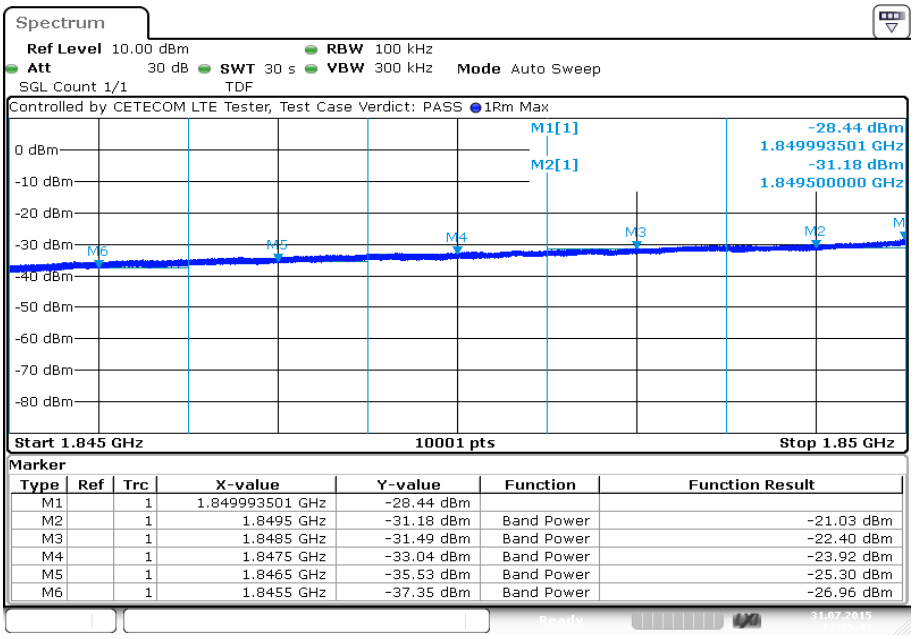
Date: 31.JUL.2015 12:05:06

Plot 2: Highest channel – QPSK



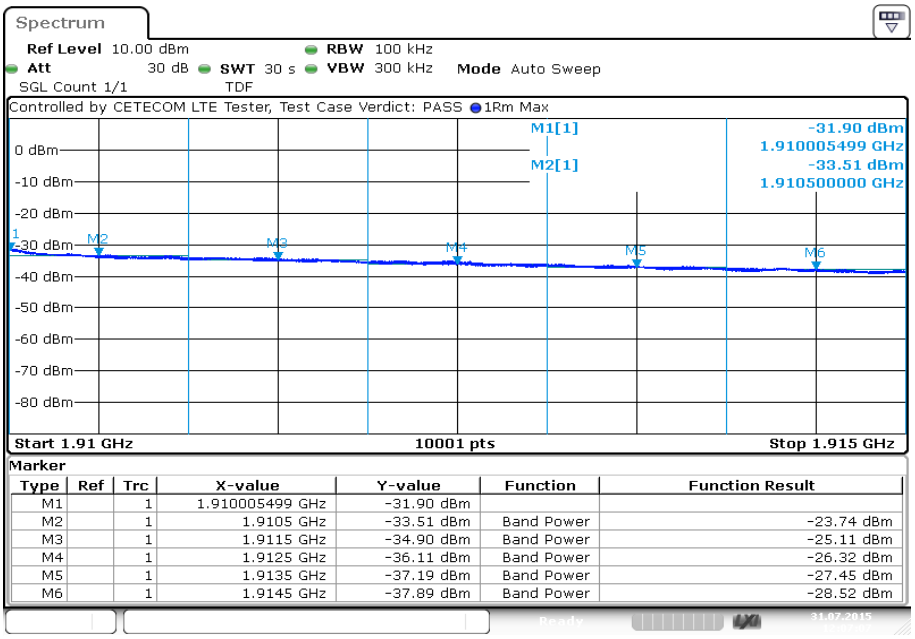
Date: 31.JUL.2015 12:06:30

Plot 3: Lowest channel – 16-QAM



Date: 31.JUL.2015 12:05:43

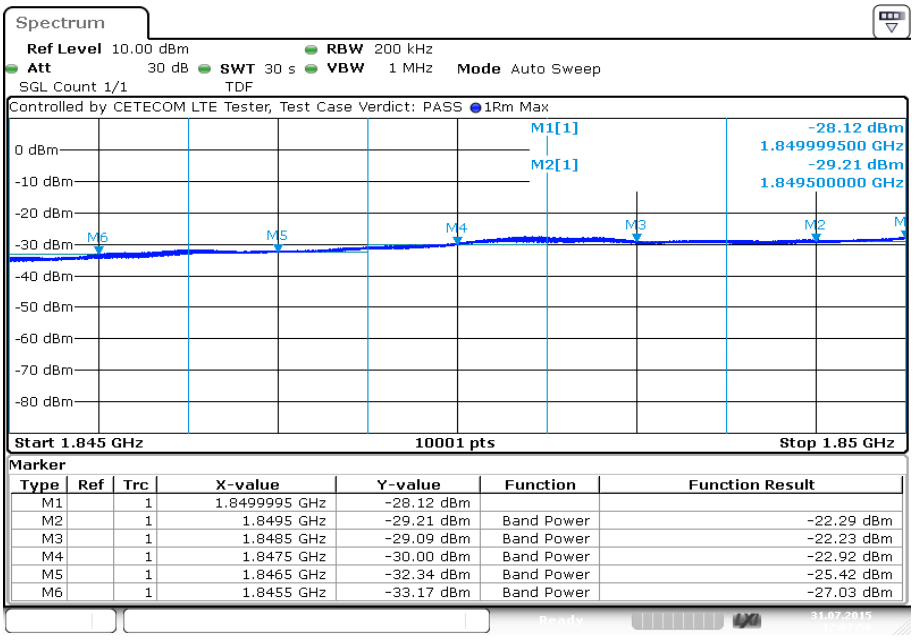
Plot 4: Highest channel – 16-QAM



Date: 31.JUL.2015 12:07:07

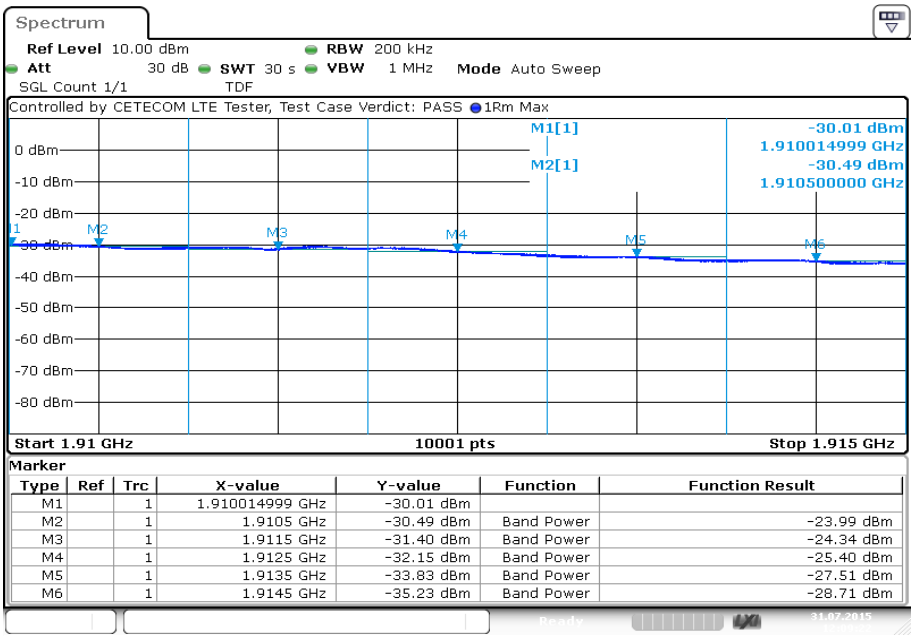
Results: **15 MHz channel bandwidth**

Plot 1: Lowest channel – QPSK



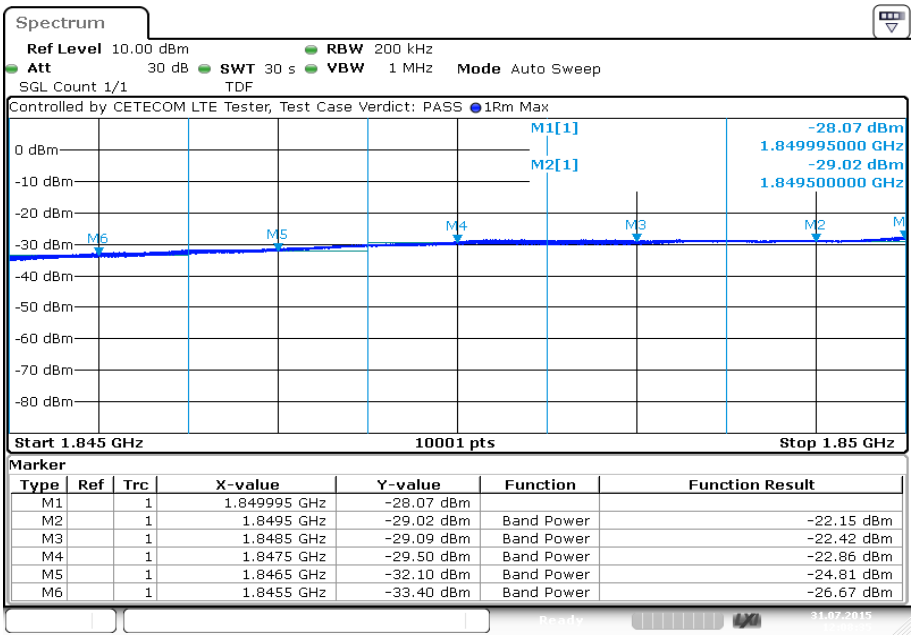
Date: 31.JUL.2015 12:07:58

Plot 2: Highest channel – QPSK



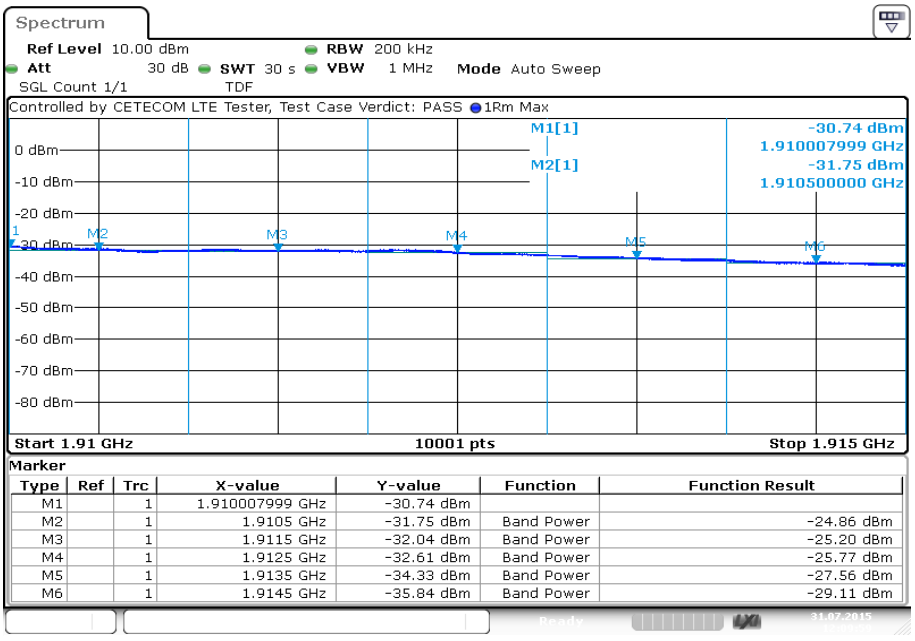
Date: 31.JUL.2015 12:09:22

Plot 3: Lowest channel – 16-QAM



Date: 31.JUL.2015 12:08:35

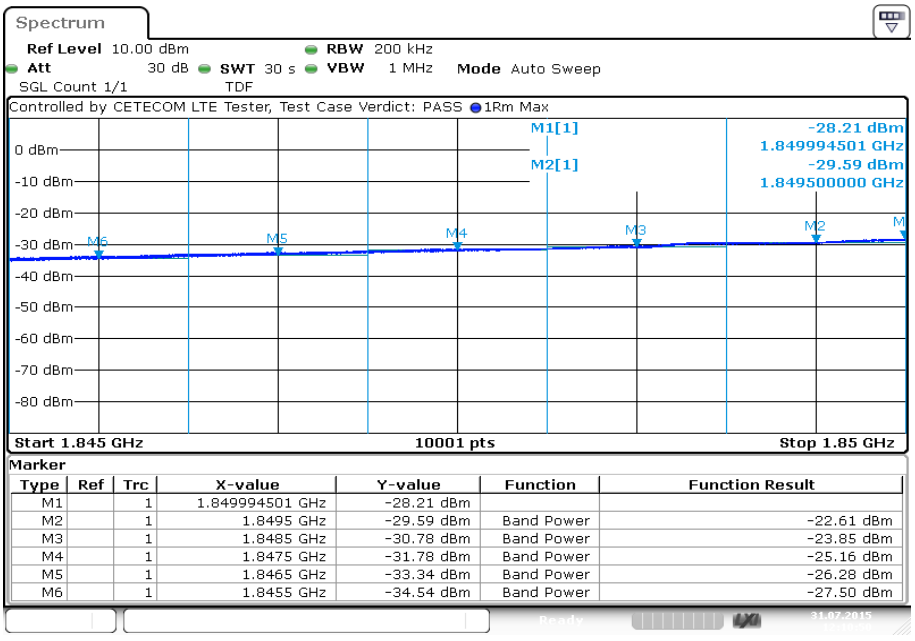
Plot 4: Highest channel – 16-QAM



Date: 31.JUL.2015 12:09:59

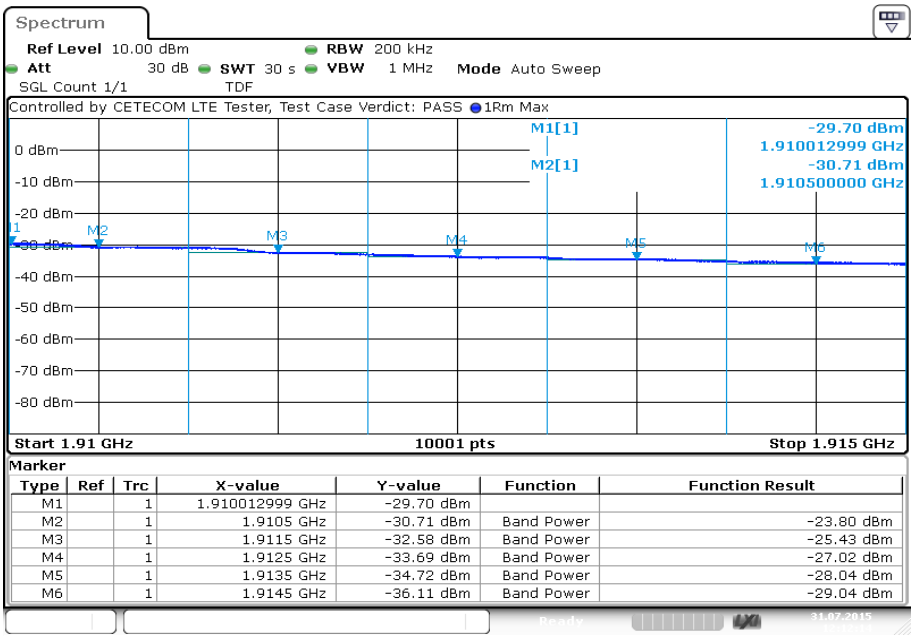
Results: **20 MHz channel bandwidth**

Plot 1: Lowest channel – QPSK



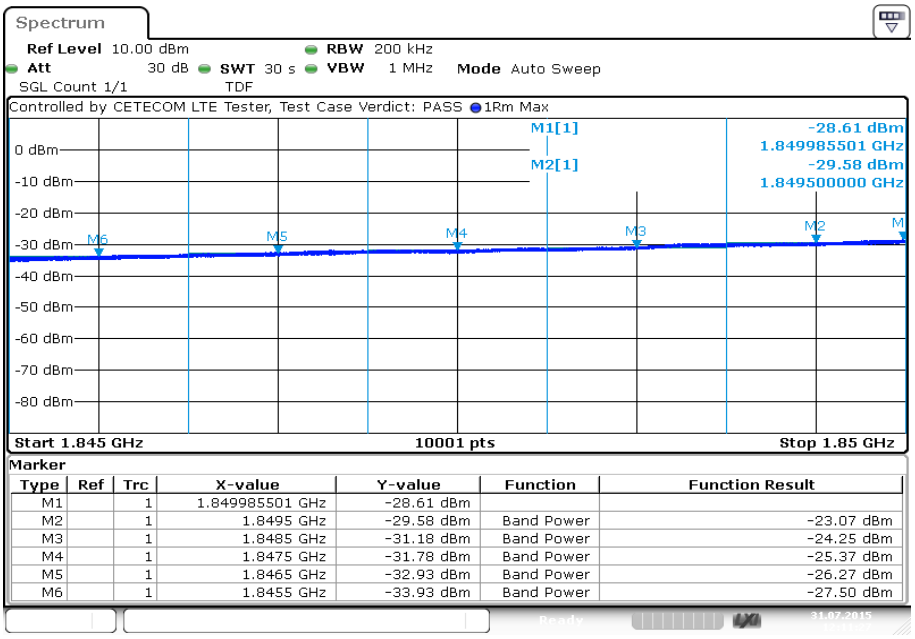
Date: 31.JUL.2015 12:10:50

Plot 2: Highest channel – QPSK



Date: 31.JUL.2015 12:12:14

Plot 3: Lowest channel – 16-QAM

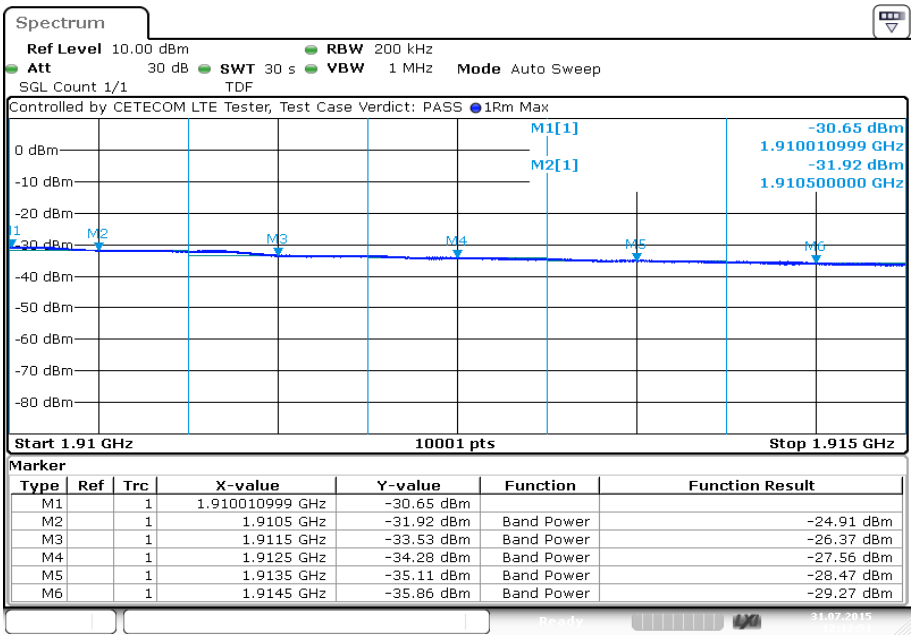


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.849985501 GHz	-28.61 dBm		
M2		1	1.8495 GHz	-29.58 dBm	Band Power	-23.07 dBm
M3		1	1.8485 GHz	-31.18 dBm	Band Power	-24.25 dBm
M4		1	1.8475 GHz	-31.78 dBm	Band Power	-25.37 dBm
M5		1	1.8465 GHz	-32.93 dBm	Band Power	-26.27 dBm
M6		1	1.8455 GHz	-33.93 dBm	Band Power	-27.50 dBm

Date: 31.JUL.2015 12:11:27

Plot 4: Highest channel – 16-QAM



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.910010999 GHz	-30.65 dBm		
M2		1	1.9105 GHz	-31.92 dBm	Band Power	-24.91 dBm
M3		1	1.9115 GHz	-33.53 dBm	Band Power	-26.37 dBm
M4		1	1.9125 GHz	-34.28 dBm	Band Power	-27.56 dBm
M5		1	1.9135 GHz	-35.11 dBm	Band Power	-28.47 dBm
M6		1	1.9145 GHz	-35.86 dBm	Band Power	-29.27 dBm

Date: 31.JUL.2015 12:12:51

Verdict: compliant

11.1.6 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 extreme and mid frequencies of the LTE band II frequency band. The table below lists the measured 99% power and -26dBc occupied bandwidths. Spectrum analyzer plots are included on the following pages.

Measurement parameters	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1% - 5% of the OBW
Video bandwidth:	≥ 3xRBW
Span:	2 x nominal BW
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.2
Measurement uncertainty:	see chapter 8

Limits:

FCC	IC
CFR Part 24.238 CFR Part 2.1049	RSS 133
Occupied Bandwidth	
Spectrum must fall completely in the specified band	

Results:

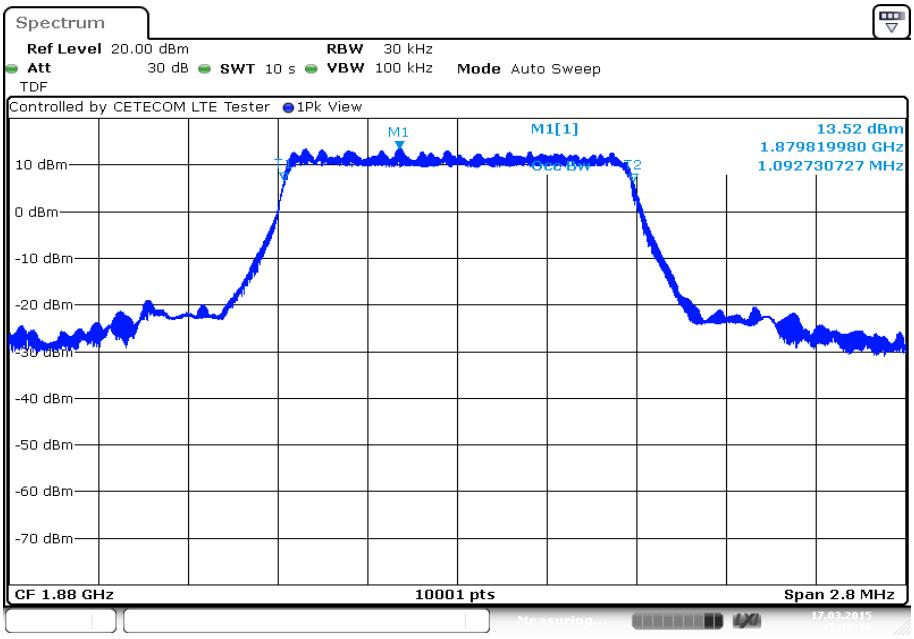
Occupied Bandwidth – QPSK		
Bandwidth (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1.4	1093	1306
3.0	2739	3114
5.0	4533	5130
10.0	9053	10169
15.0	13427	14852
20.0	17902	19754

Occupied Bandwidth – 16-QAM		
Bandwidth (MHz)	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
1.4	1098	1315
3.0	2736	3132
5.0	4510	5156
10.0	9047	10067
15.0	13433	14934
20.0	17902	19890

Verdict: **compliant**

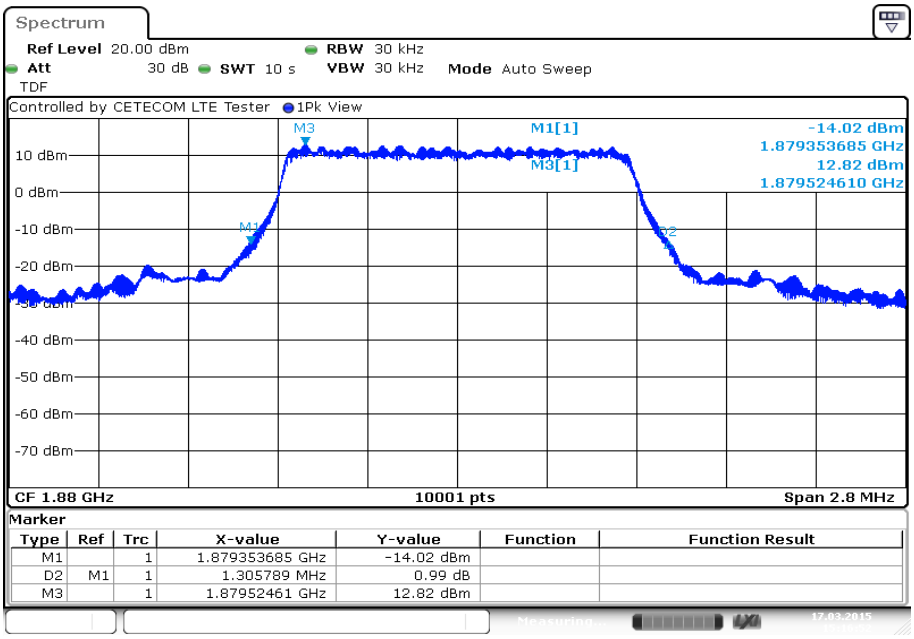
Plots: QPSK

Plot 1: 1.4 MHz (99% - OBW)



Date: 17.MAR.2015 15:16:18

Plot 2: 1.4 MHz (-26 dBc BW)

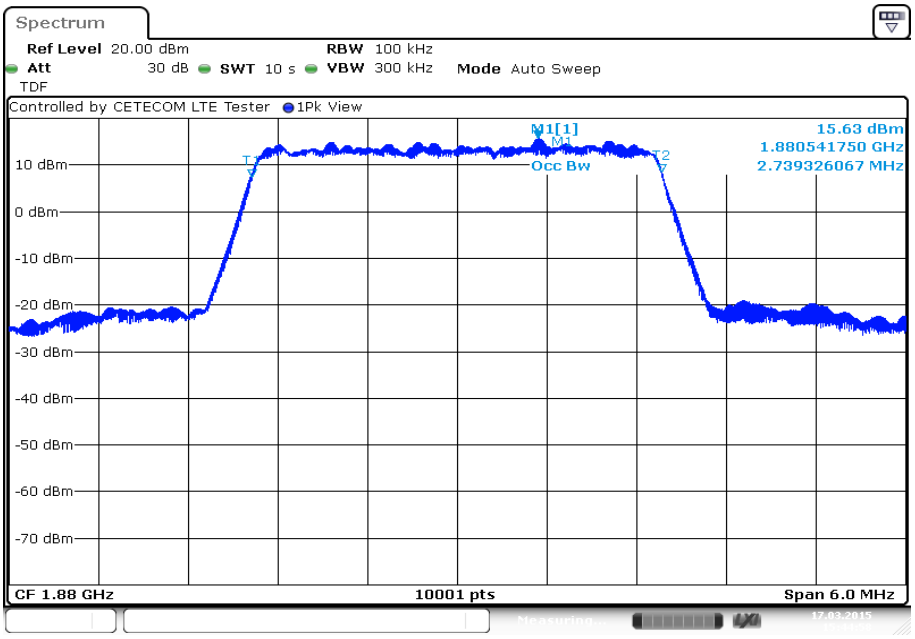


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.879353685 GHz	-14.02 dBm		
D2	M1	1	1.305789 MHz	0.99 dB		
M3		1	1.87952461 GHz	12.82 dBm		

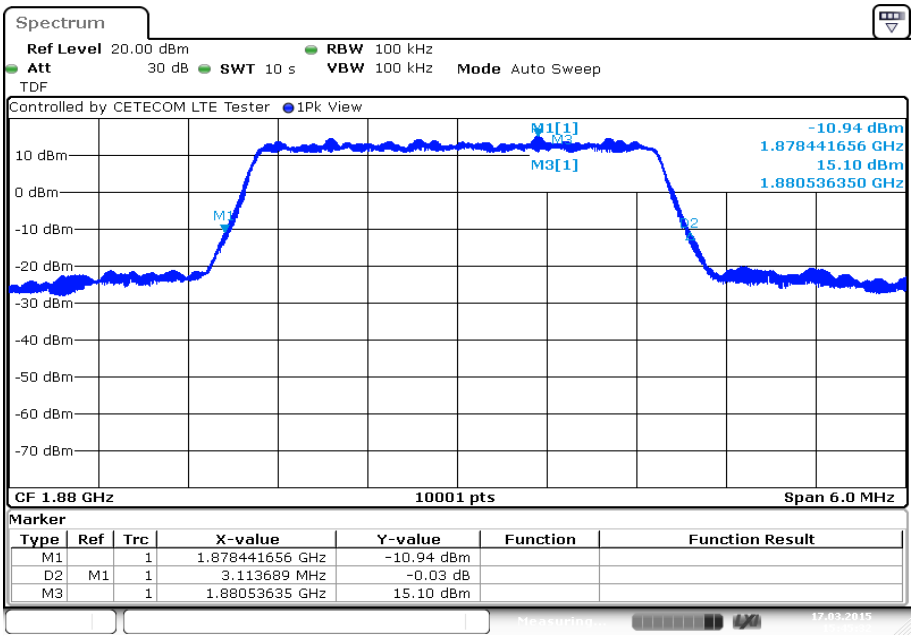
Date: 17.MAR.2015 15:16:53

Plot 3: 3 MHz (99% - OBW)



Date: 17.MAR.2015 15:44:58

Plot 4: 3 MHz (-26 dBc BW)

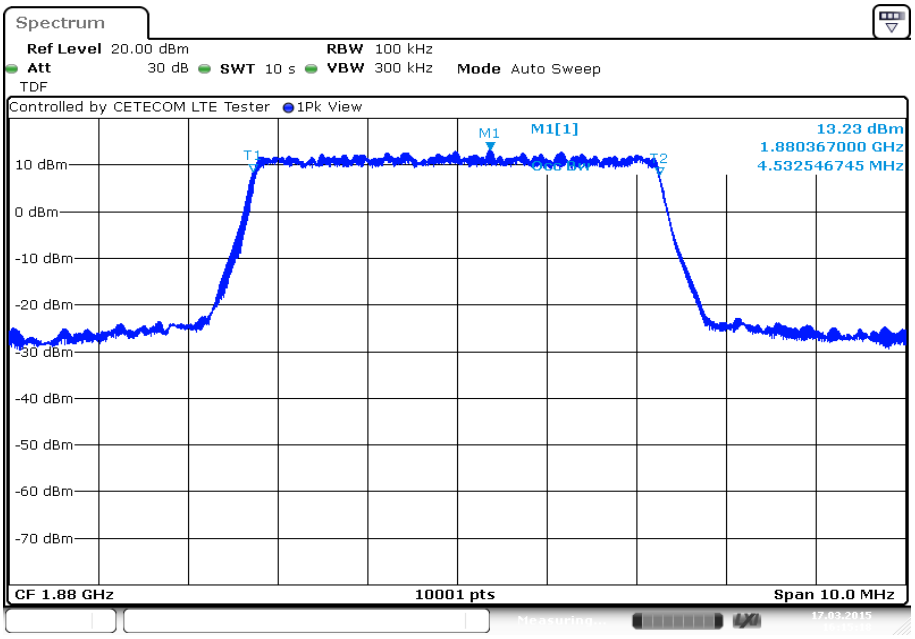


Marker

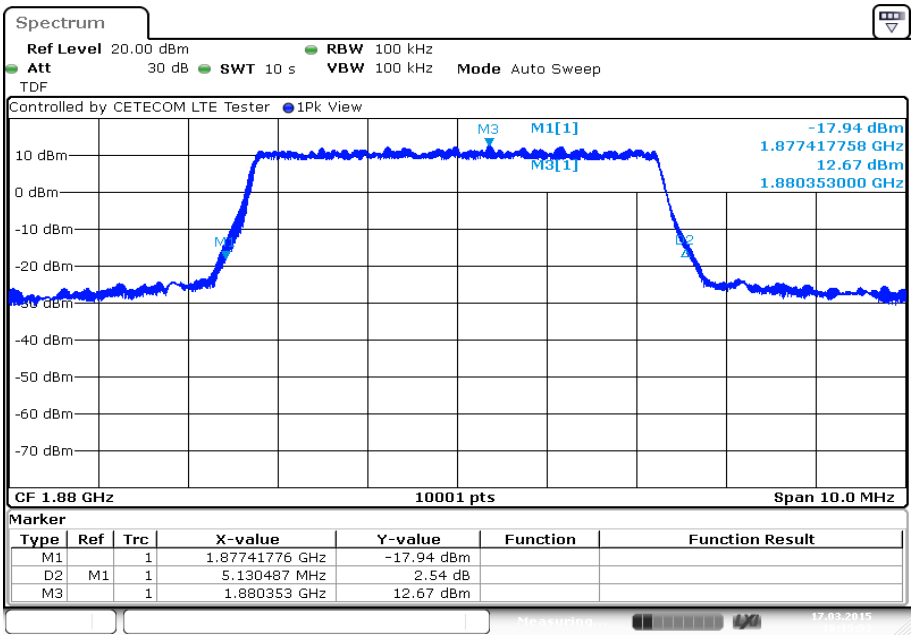
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.878441656 GHz	-10.94 dBm		
D2	M1	1	3.113689 MHz	-0.03 dB		
M3		1	1.88053635 GHz	15.10 dBm		

Date: 17.MAR.2015 15:45:33

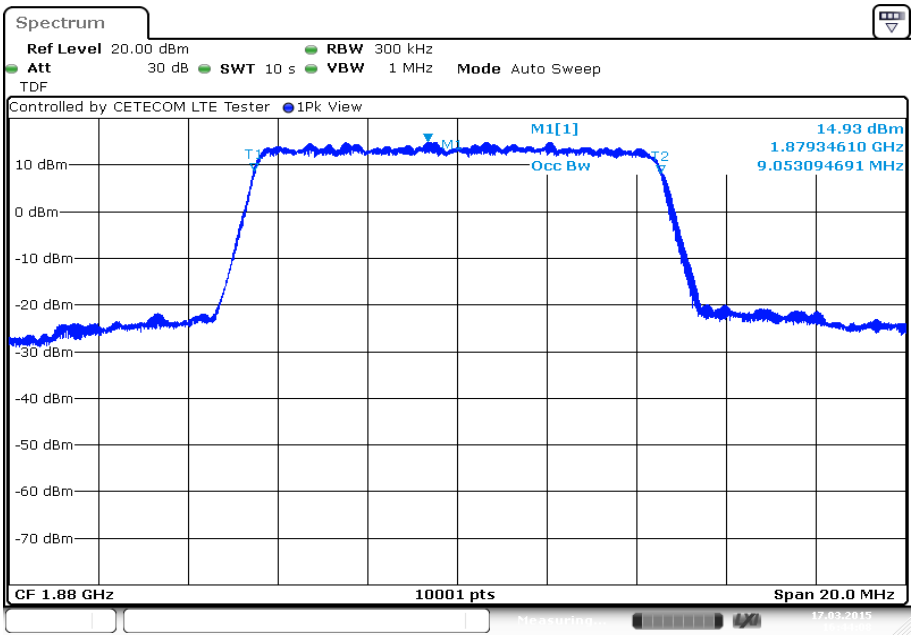
Plot 5: 5 MHz (99% - OBW)



Plot 6: 5 MHz (-26 dBc BW)

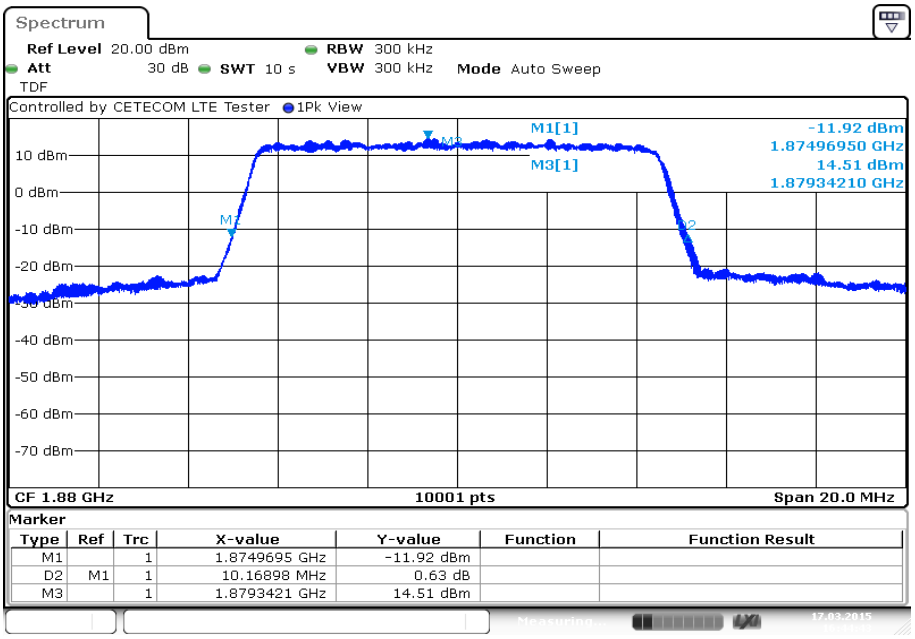


Plot 7: 10 MHz (99% - OBW)



Date: 17.MAR.2015 16:44:09

Plot 8: 10 MHz (-26 dBc BW)

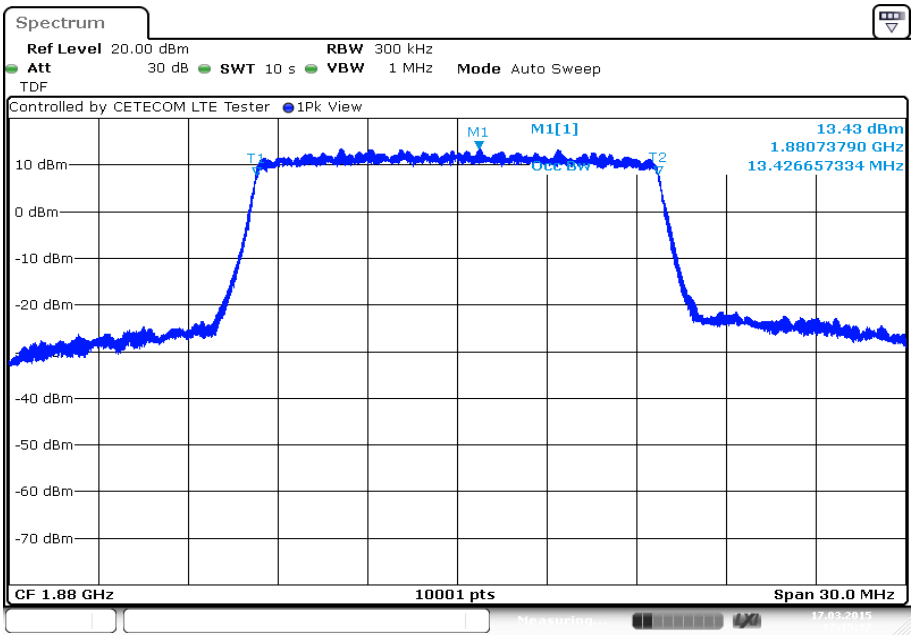


Marker

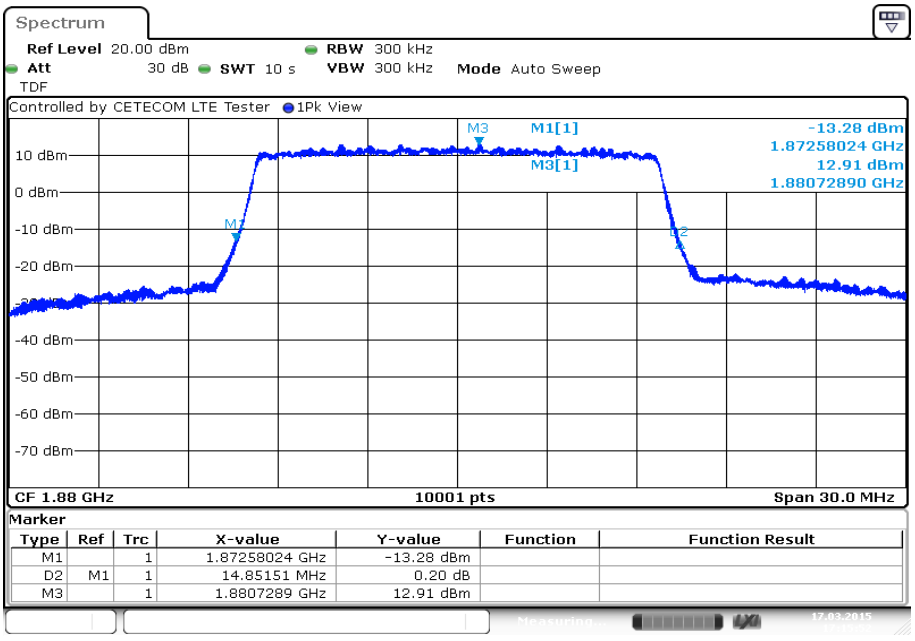
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.8749695 GHz	-11.92 dBm		
D2	M1	1	10.16898 MHz	0.63 dB		
M3		1	1.8793421 GHz	14.51 dBm		

Date: 17.MAR.2015 16:44:44

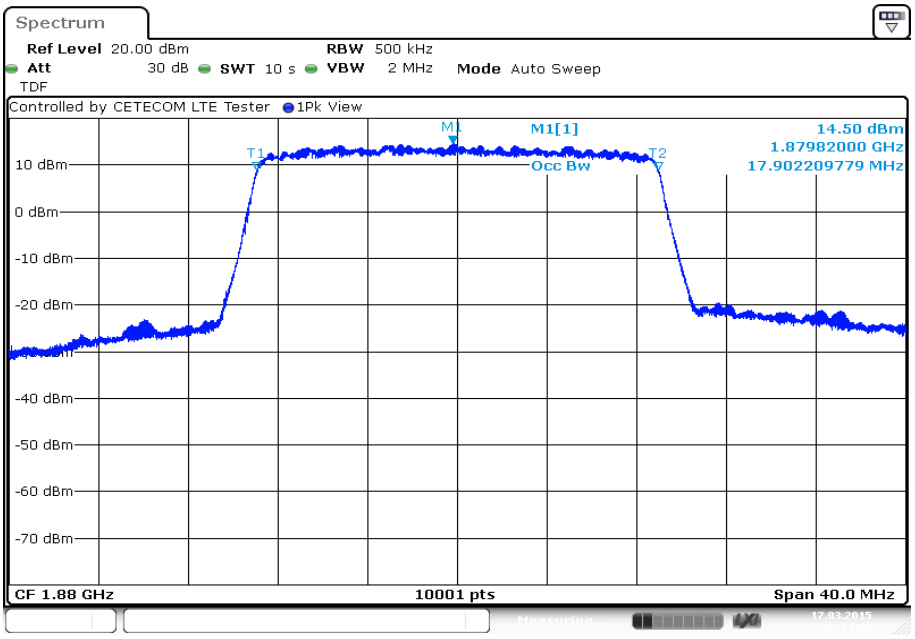
Plot 9: 15 MHz (99% - OBW)



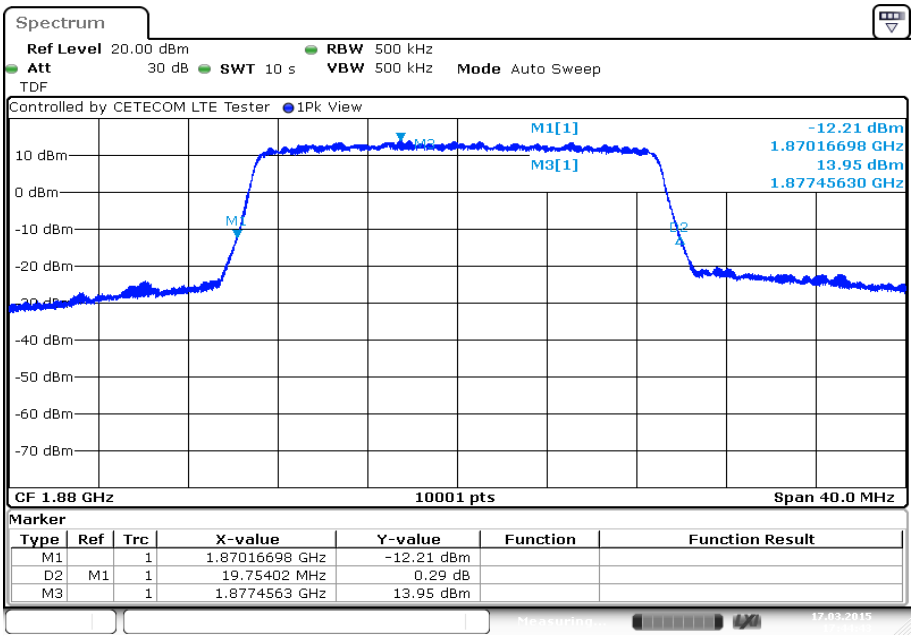
Plot 10: 15 MHz (-26 dBc BW)



Plot 11: 20 MHz (99% - OBW)

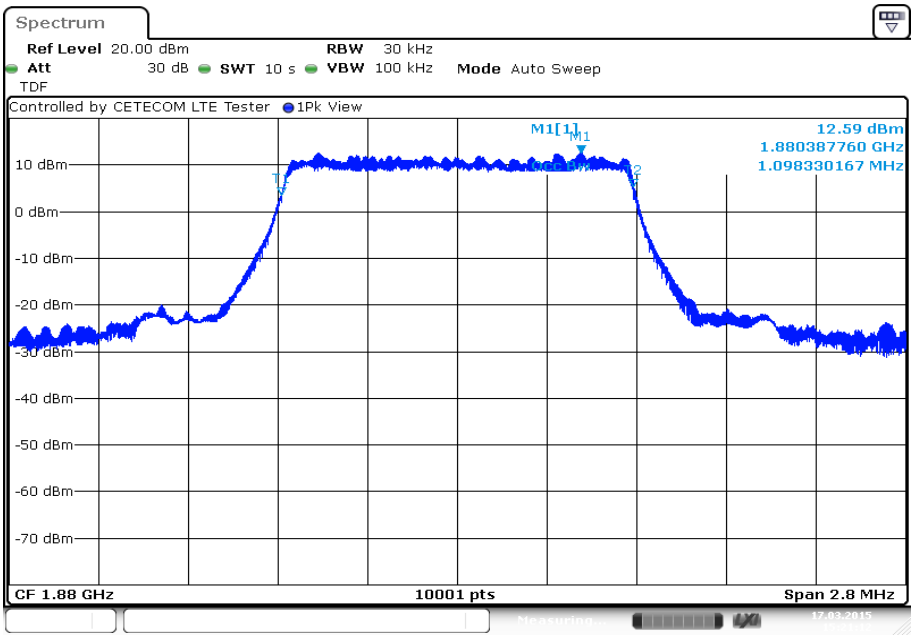


Plot 12: 20 MHz (-26 dBc BW)



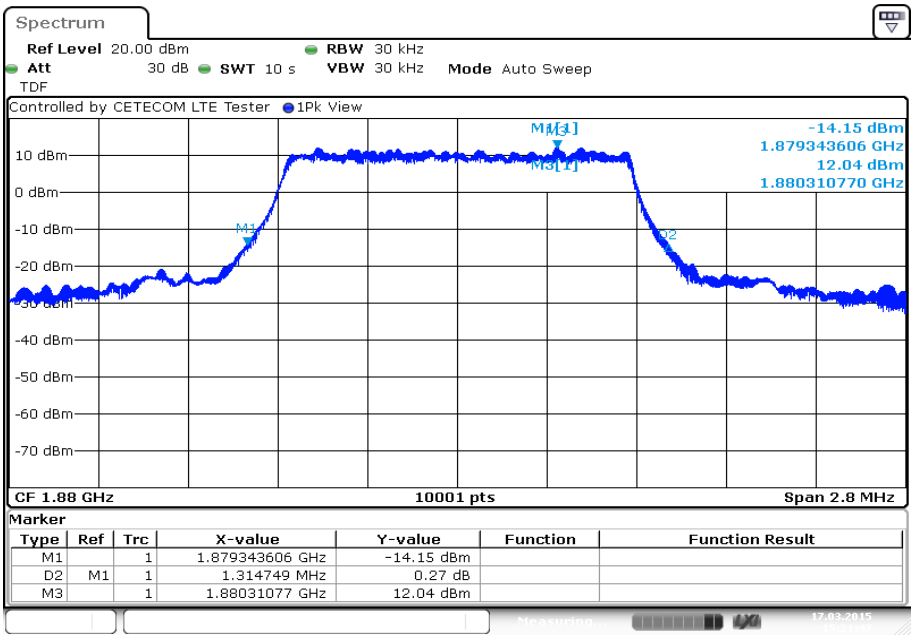
Plots: 16-QAM

Plot 1: 1.4 MHz (99% - OBW)



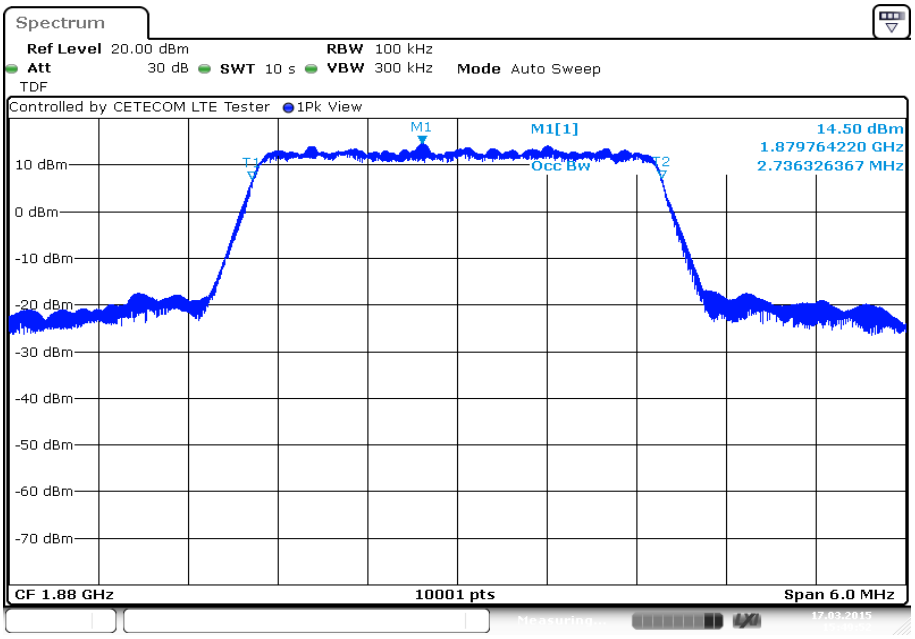
Date: 17.MAR.2015 15:21:13

Plot 2: 1.4 MHz (-26 dBc BW)



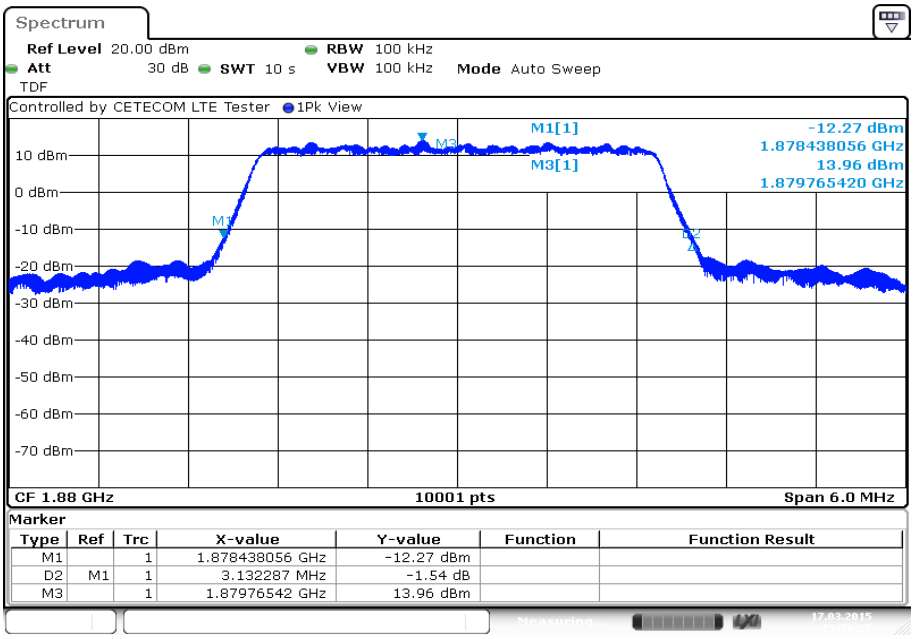
Date: 17.MAR.2015 15:21:48

Plot 3: 3 MHz (99% - OBW)



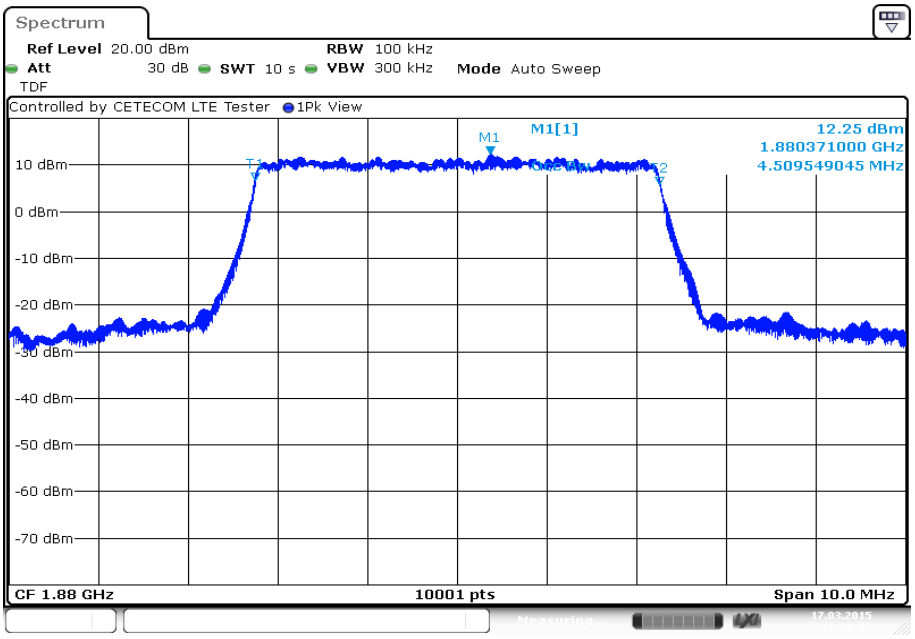
Date: 17.MAR.2015 15:49:53

Plot 4: 3 MHz (-26 dBc BW)



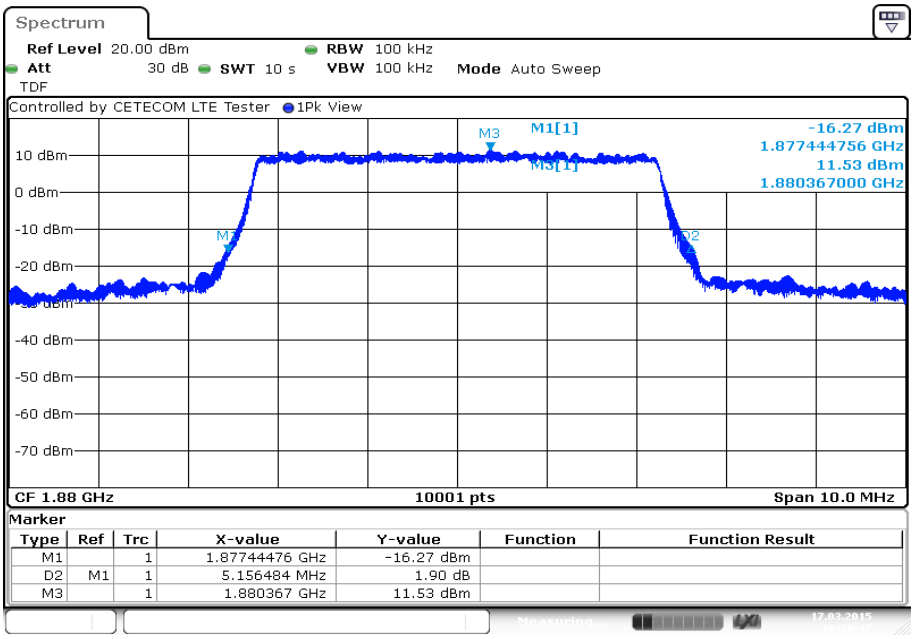
Date: 17.MAR.2015 15:50:28

Plot 5: 5 MHz (99% - OBW)



Date: 17.MAR.2015 16:20:13

Plot 6: 5 MHz (-26 dBc BW)

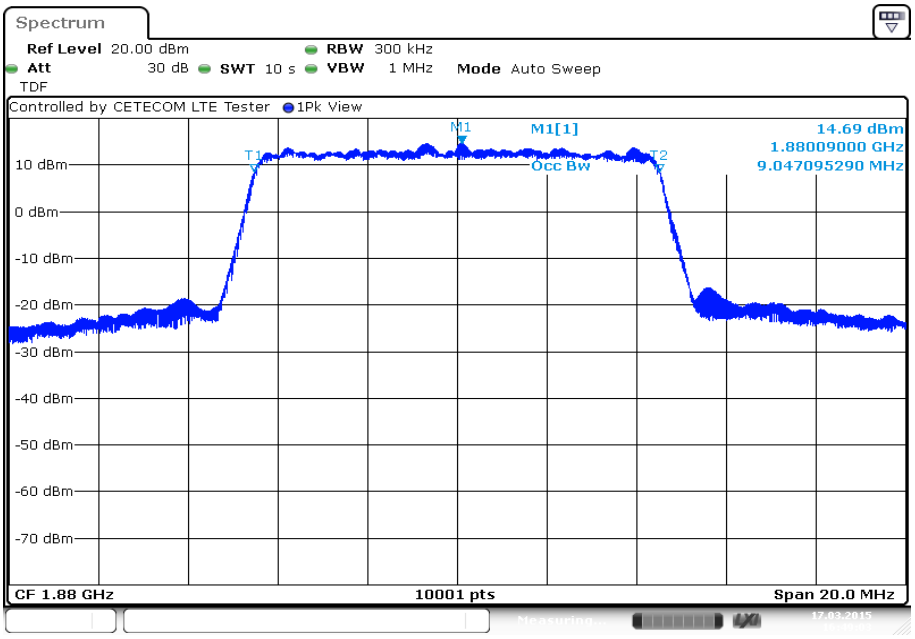


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.87744476 GHz	-16.27 dBm		
D2	M1	1	5.156484 MHz	1.90 dB		
M3		1	1.880367 GHz	11.53 dBm		

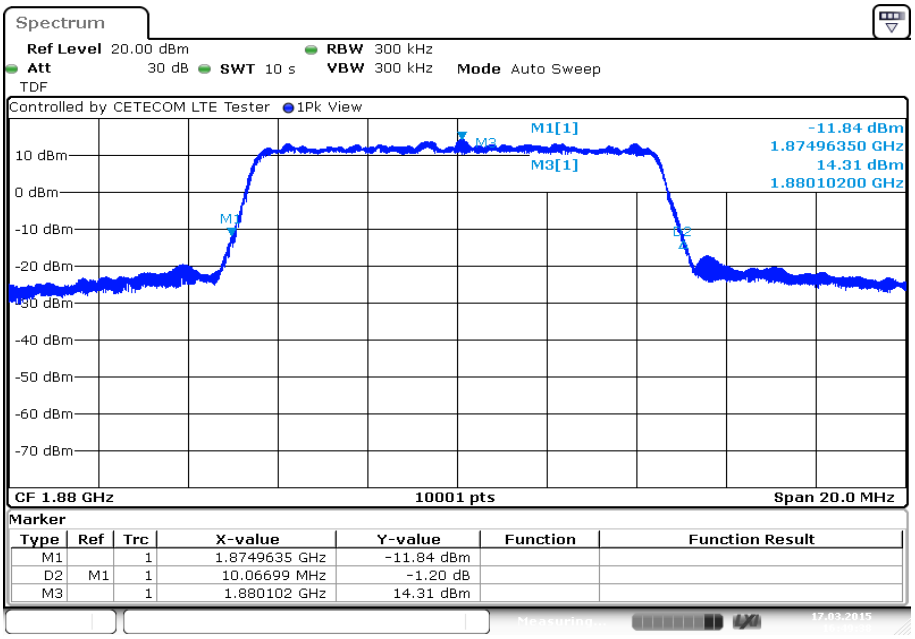
Date: 17.MAR.2015 16:20:48

Plot 7: 10 MHz (99% - OBW)



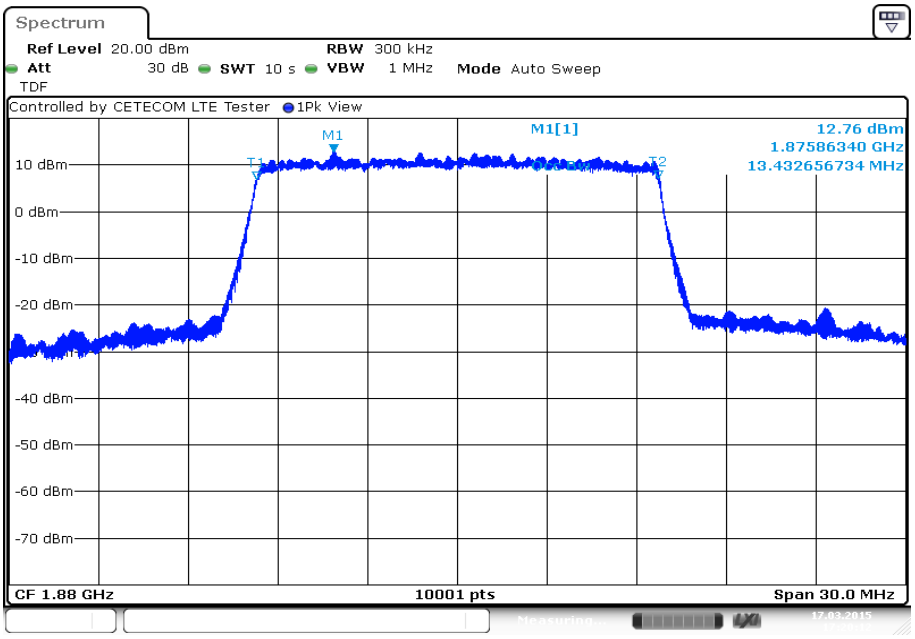
Date: 17.MAR.2015 16:49:04

Plot 8: 10 MHz (-26 dBc BW)



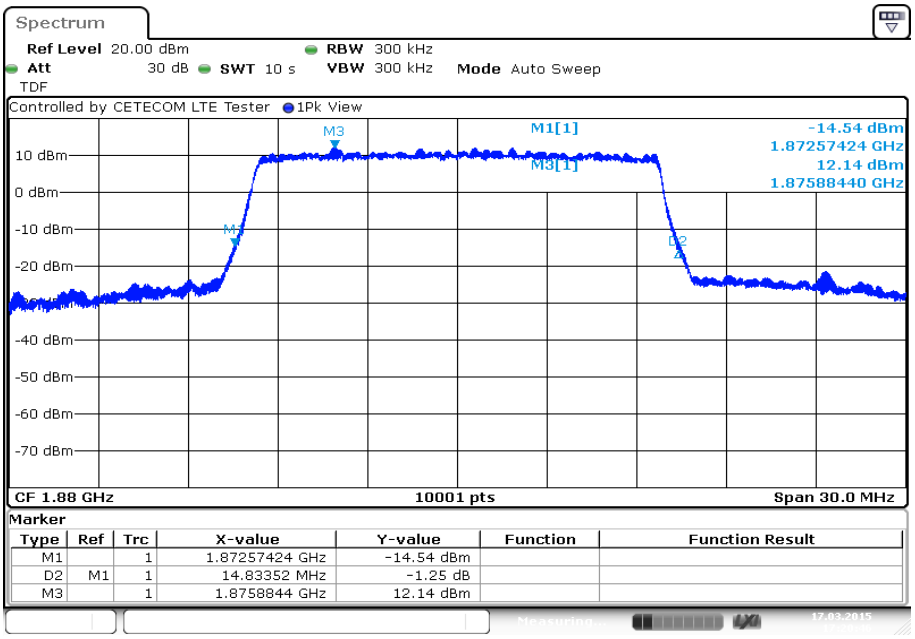
Date: 17.MAR.2015 16:49:39

Plot 9: 15 MHz (99% - OBW)



Date: 17.MAR.2015 17:20:13

Plot 10: 15 MHz (-26 dBc BW)

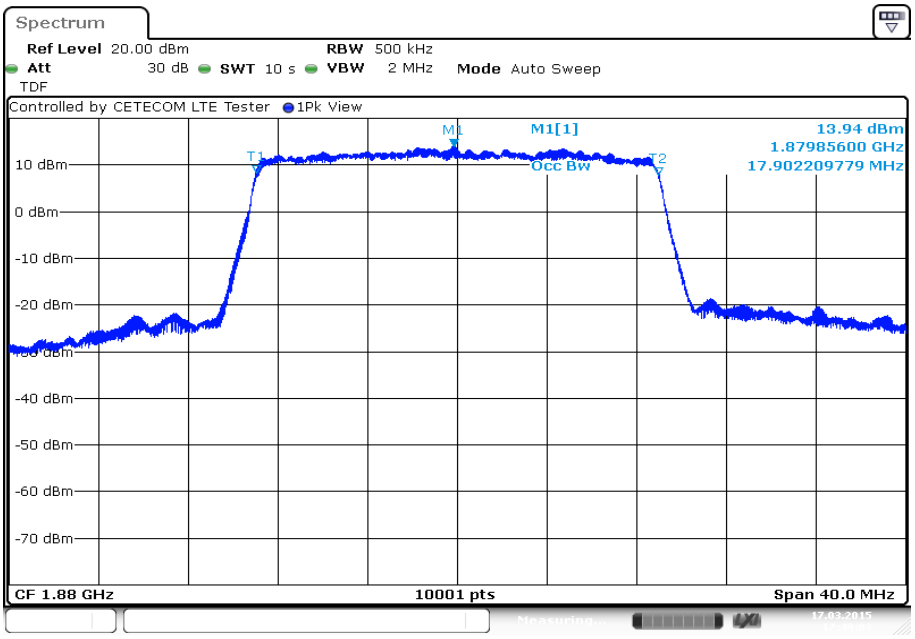


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.87257424 GHz	-14.54 dBm		
D2	M1	1	14.83352 MHz	-1.25 dB		
M3		1	1.8758844 GHz	12.14 dBm		

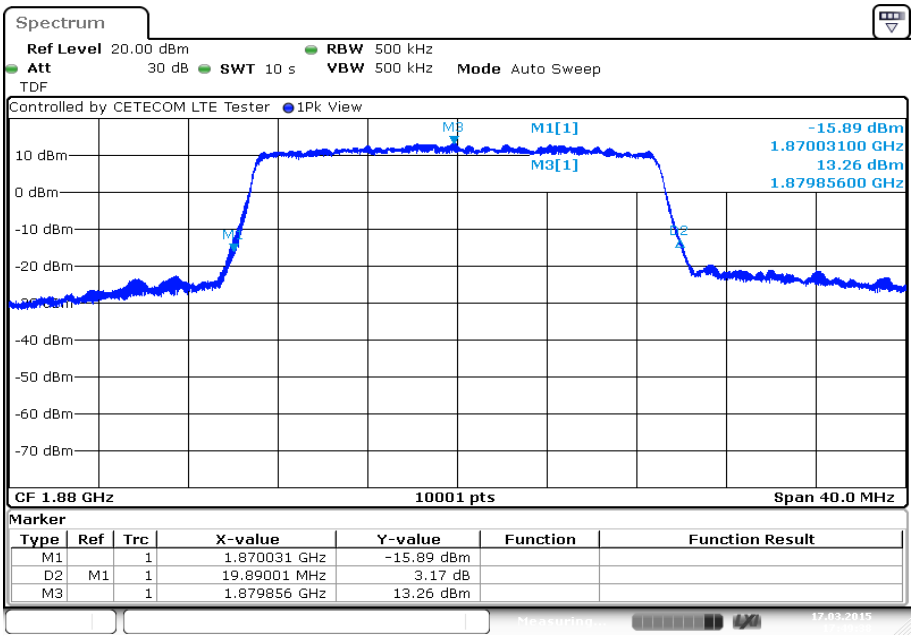
Date: 17.MAR.2015 17:20:47

Plot 11: 20 MHz (99% - OBW)



Date: 17.MAR.2015 17:49:04

Plot 12: 20 MHz (-26 dBc BW)



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	1.870031 GHz	-15.89 dBm		
D2	M1	1	19.89001 MHz	3.17 dB		
M3		1	1.879856 GHz	13.26 dBm		

Date: 17.MAR.2015 17:49:39

12 Observations

No observations except those reported with the single test cases have been made.

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2015-06-23
A	Editorial changes	2015-08-04

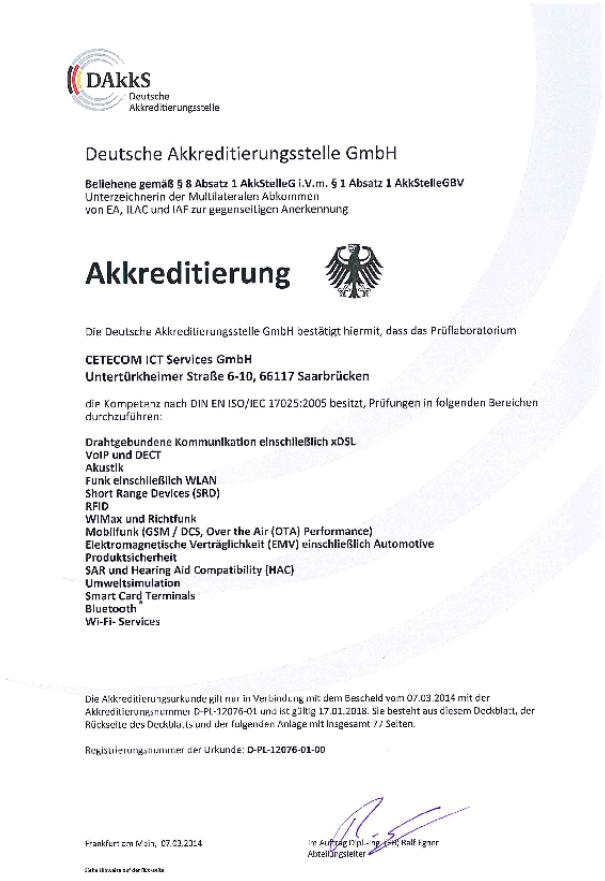
Annex B Further information

Glossary

AVG - Average
DUT - Device under test
EMC - Electromagnetic Compatibility
EN - European Standard
EUT - Equipment under test
ETSI - European Telecommunications Standard Institute
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory number
N/A - Not applicable
PP - Positive peak
QP - Quasi peak
S/N - Serial number
SW - Software

Annex C Accreditation Certificate

Front side of certificate



DAkkS
Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

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Unterzeichnerin der Multilateralen Abkommen
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Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

Drahtgebundene Kommunikation einschließlich xDSL
VoIP und DECT
Akustik
Funk einschließlich WLAN
Short Range Devices (SRD)
RFID
WiMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation
Smart Card Terminals
Bluetooth®
Wi-Fi- Services

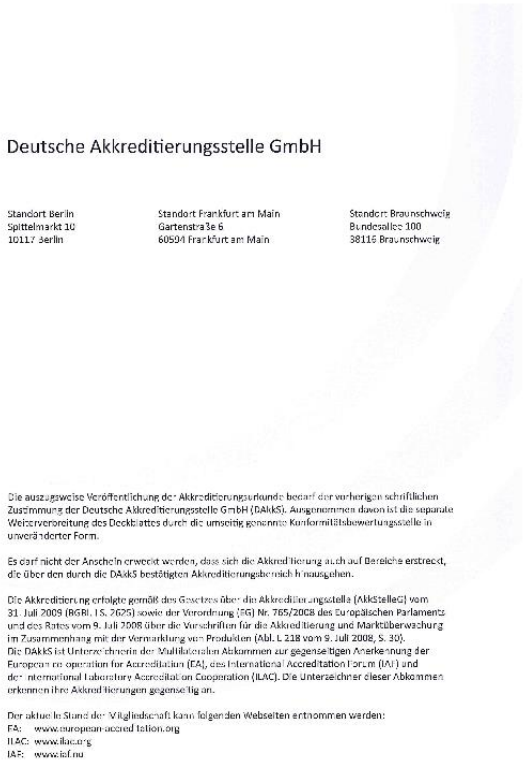
Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

Registrierungsnummer der Urkunde: **D-PL-12076-01-00**

Frankfurt am Main, 07.03.2014

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

Back side of certificate



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Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

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