11.3 Results LTE – Band 13

The EUT was set to transmit the maximum power.

11.3.1 RF output power

Description:

This paragraph contains average power, peak output power and EIRP 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
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**
5	779.5	1 RB low	26.7	21.5	4.8	26.6	20.3	5.9
		1 RB high	28.2	22.1	5.5	28.1	21.0	6.6
		50% RB	27.3	20.9	5.7	26.9	19.9	6.3
		100% RB	27.7	21.0	5.7	27.1	20.0	6.1
	782	1 RB low	27.8	22.1	5.3	27.5	21.0	6.3
		1 RB high	28.6	22.0	6.0	28.5	21.0	7.1
		50% RB	28.1	21.1	6.1	27.4	20.0	6.5
		100% RB	28.3	21.0	6.0	28.1	19.9	6.6
	784.5	1 RB low	28.4	22.0	5.7	28.3	21.0	6.9
		1 RB high	28.2	22.0	5.6	28.1	20.9	6.7
		50% RB	28.3	20.9	6.1	27.6	19.9	6.8
		100% RB	28.3	20.9	6.1	28.4	20.0	6.8
10	782.0	1 RB low	26.9	21.4	5.0	26.8	20.3	6.2
		1 RB high	28.2	21.9	5.7	28.2	20.8	6.9
		50% RB	28.3	21.0	5.9	28.0	19.9	6.7
		100% RB	28.1	20.7	5.9	27.6	19.7	6.4

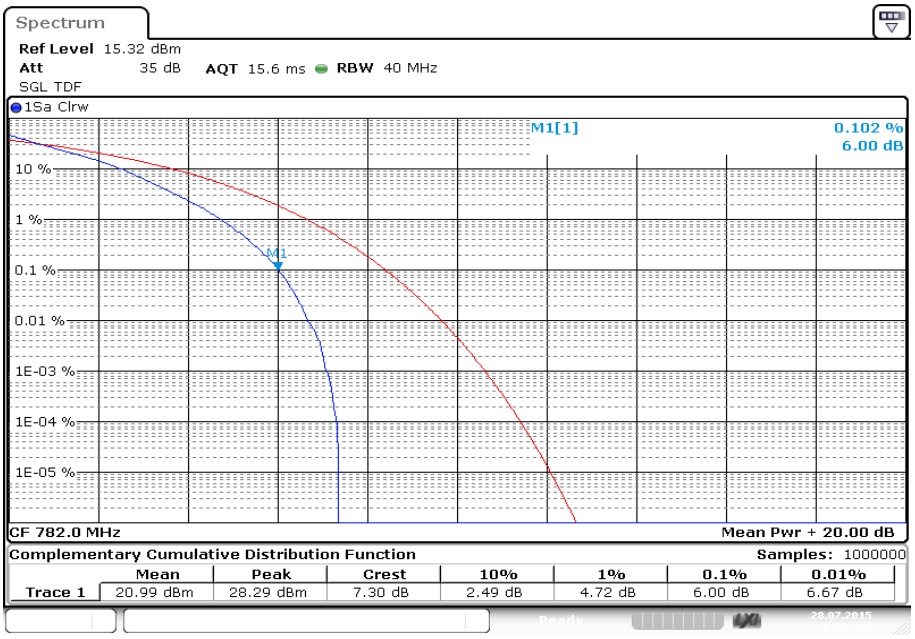
The output power is measured with configuration of maximum conducted output power.

Output Power (radiated)			
Bandwidth (MHz)	**Frequency (MHz)**	**Average Output Power (dBm) QPSK**	**Average Output Power (dBm) 16-QAM**
5	779.5	13.91	13.01
	782.0	13.99	12.79
	784.5	16.13	15.13
10	782.0	13.69	12.59

Verdict: compliant

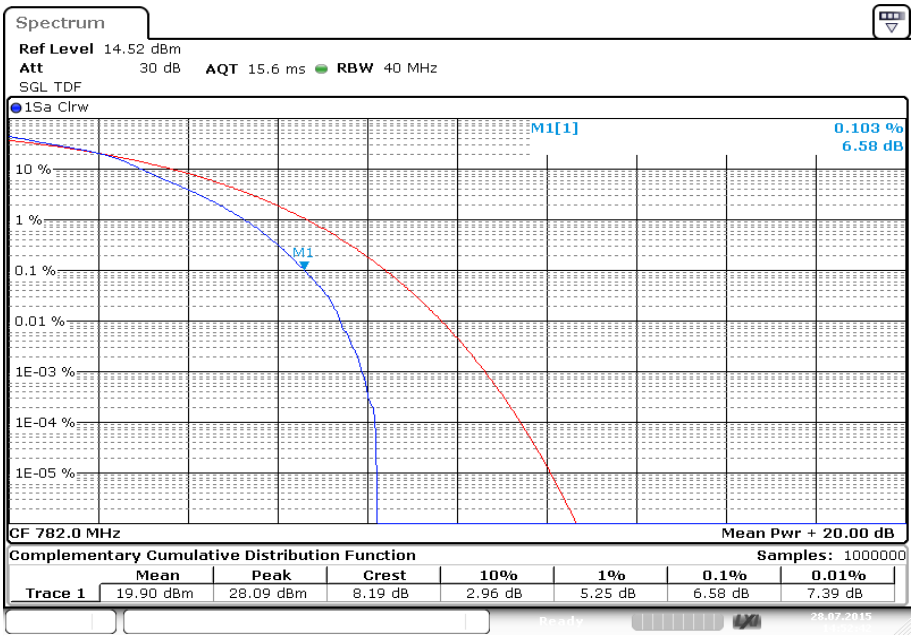
Plots:

Plot 1: 5 MHz cell bandwidth, mid channel, 100% #RB, QPSK



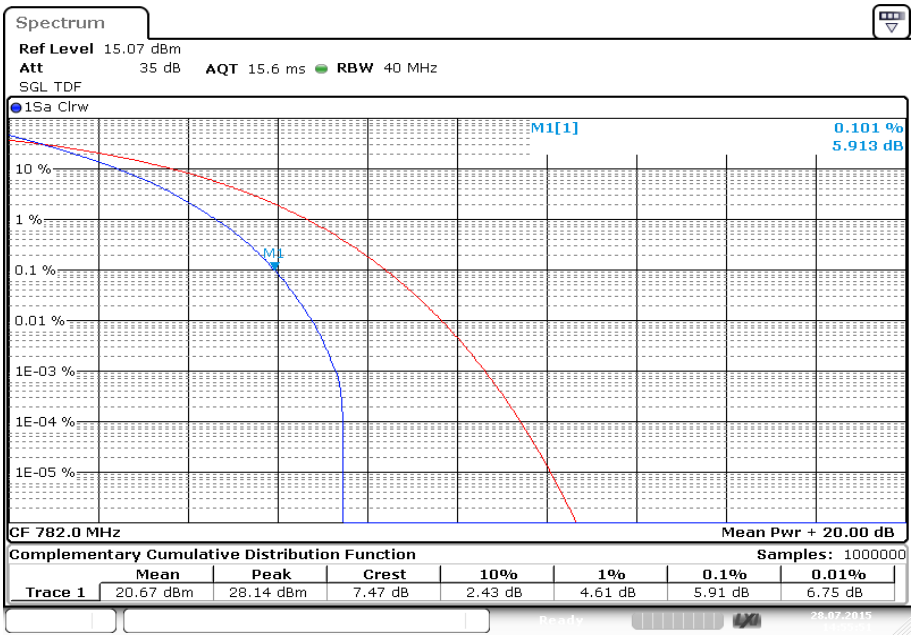
Date: 28.JUL.2015 14:52:36

Plot 2: 5 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



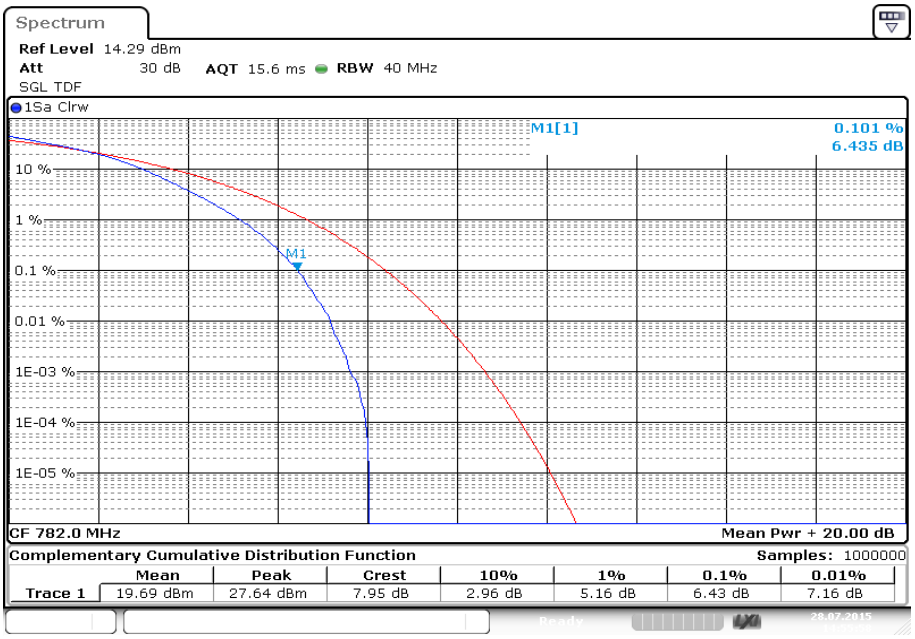
Date: 28.JUL.2015 14:52:42

Plot 3: 10 MHz cell bandwidth, mid channel, 100% #RB, QPSK



Date: 28.JUL.2015 14:55:51

Plot 4: 10 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



Date: 28.JUL.2015 14:55:58

11.3.2 Frequency stability

Description:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station 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
Frequency Stability	
< 2.5 ppm	

Results:

FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
13.8	-4	-0.00000051	-0.0051
12.0	-3	-0.00000038	-0.0038
10.2	-4	-0.00000051	-0.0051

FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	-4	-0.00000051	-0.0051
-20	-4	-0.00000051	-0.0051
-10	-4	-0.00000051	-0.0051
± 0	-4	-0.00000051	-0.0051
10	-4	-0.00000051	-0.0051
20	-3	-0.00000038	-0.0038
30	-3	-0.00000038	-0.0038
40	-3	-0.00000038	-0.0038
50	-4	-0.00000051	-0.0051
60	-3	-0.00000038	-0.0038

Additional measurements for RSS-130 (4.3 b)

f_L =777.398 MHz	f_H = 786.863 MHz
f_L – (max freq. error) = 777.398 MHz	f_H + (max freq. error) = 786.863 MHz

Verdict: compliant

11.3.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 784.5 MHz. Measured up to 12.75 GHz. The resolution bandwidth is set as outlined in Part 27.53. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE band 13.

Measurement:

Measurement parameters	
Detector:	Peak / RMS
Sweep time:	5 ms/MHz
Video bandwidth:	100 kHz
Resolution bandwidth:	300 kHz
Span:	different steps
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.1
Measurement uncertainty:	see chapter 8

Limits:

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

Results:

Radiated emissions measurements were made only at the center carrier frequencies of the LTE band 13 (782.0 MHz). It was decided that measurements at this carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band 13 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 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]
1564.0	-
2346.0	-
3128.0	-
3910.0	-
4692.0	-
5474.0	-
6256.0	-
7038.0	-
7820.0	-

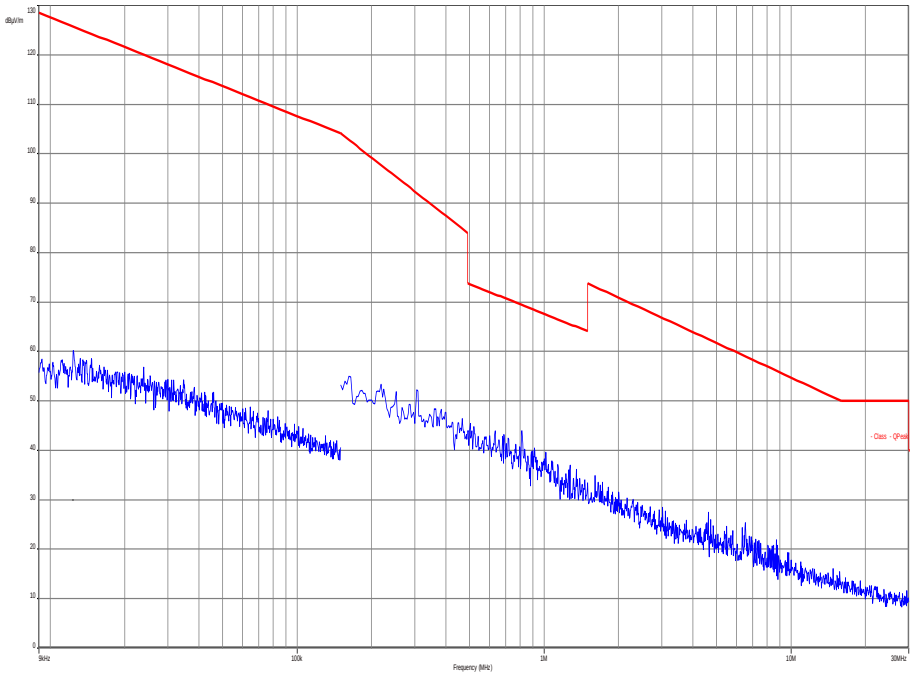
16-QAM

Spurious Emission Level (dBm)	
Middle channel	
Spurious emissions	Level [dBm]
1564.0	-
2346.0	-
3128.0	-
3910.0	-
4692.0	-
5474.0	-
6256.0	-
7038.0	-
7820.0	-

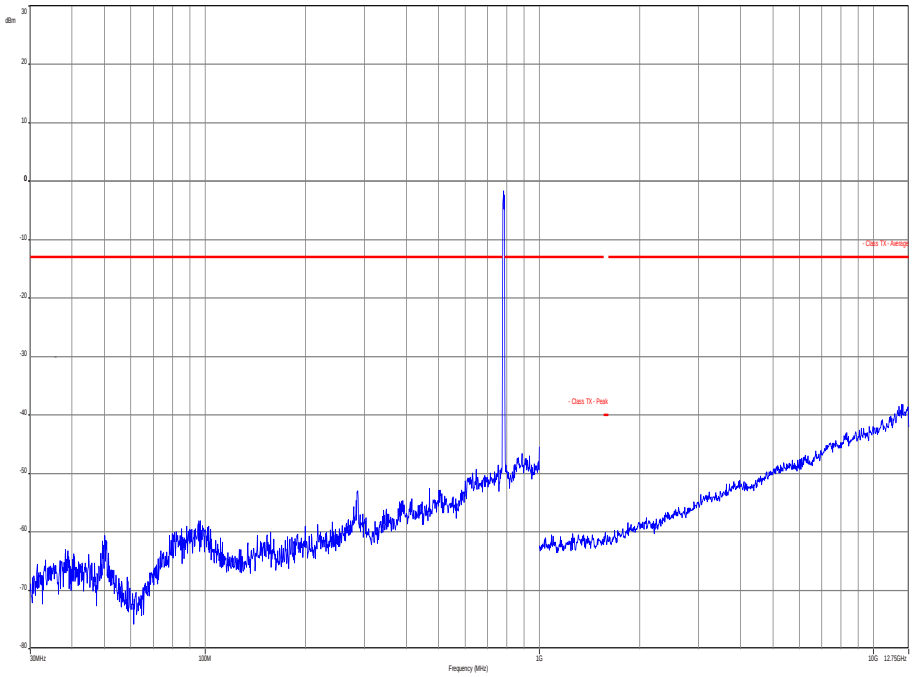
Verdict: compliant

QPSK with 10 MHz channel bandwidth

Plot 1: Middle channel, up to 30 MHz

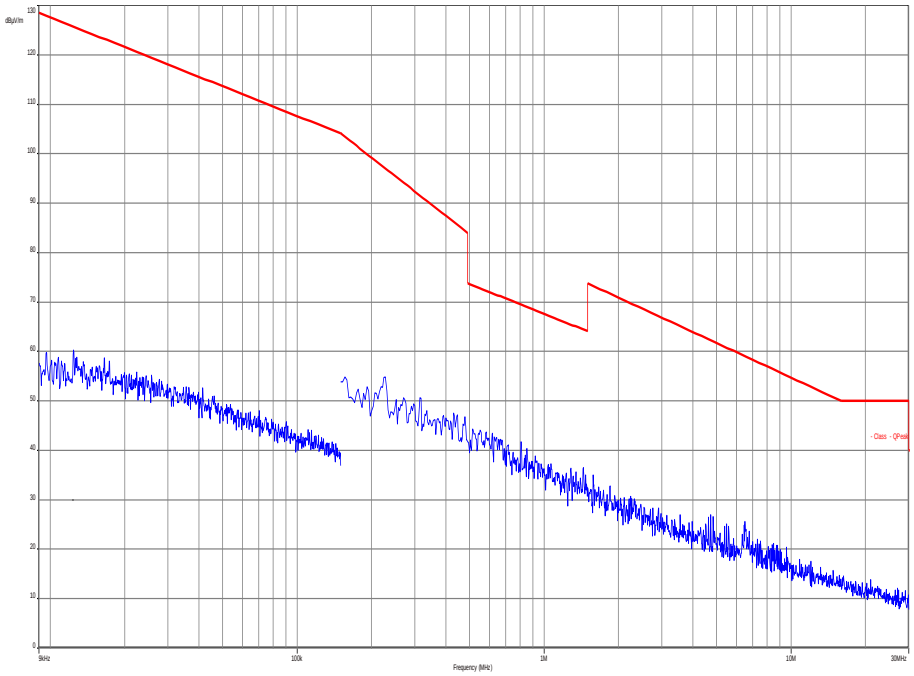


Plot 2: Middle channel, 30 MHz to 12.75 GHz

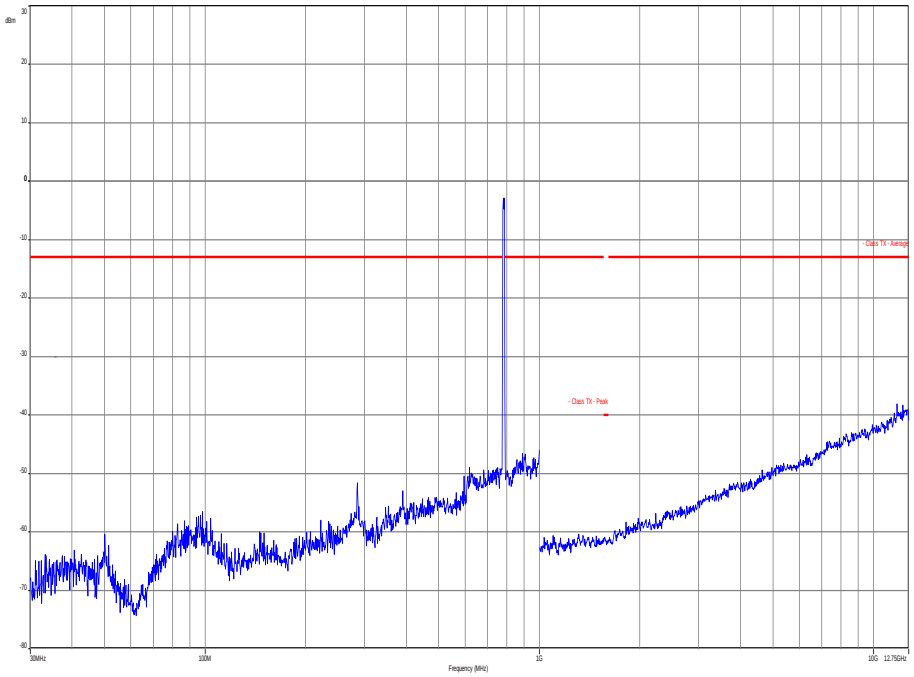


16-QAM with 10 MHz channel bandwidth

Plot 3: Middle channel, up to 30 MHz



Plot 4: Middle channel, 30 MHz to 12.75 GHz



11.3.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested 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 / RMS
Sweep time:	Auto
Resolution bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement 100 kHz
Video bandwidth:	Pre-measurement with 1 MHz On spurious detection re-measurement 300 kHz
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 ≥ 43 + 10log(P) (P, Power in Watts) In addition RSS-130 4.6.2 (a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least: (i) 76 + 10 $\log_{10}$ p (watts), dB, for base and fixed equipment, and (ii) 65 + 10 $\log_{10}$ p (watts), dB, for mobile and portable equipment.	
-13 dBm	

Results: for 5 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
1559.0	-	1564.0	-	1569.0	-
2338.5	-	2346.0	-	2353.5	-
3118.0	-	3128.0	-	3138.0	-
3897.5	-	3910.0	-	3922.5	-
4677.0	-	4692.0	-	4707.0	-
5456.5	-	5474.0	-	5491.5	-
6236.0	-	6256.0	-	6276.0	-
7015.5	-	7038.0	-	7060.5	-
7795.0	-	7820.0	-	7845.0	-
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]
1559.0	-	1564.0	-	1569.0	-
2338.5	-	2346.0	-	2353.5	-
3118.0	-	3128.0	-	3138.0	-
3897.5	-	3910.0	-	3922.5	-
4677.0	-	4692.0	-	4707.0	-
5456.5	-	5474.0	-	5491.5	-
6236.0	-	6256.0	-	6276.0	-
7015.5	-	7038.0	-	7060.5	-
7795.0	-	7820.0	-	7845.0	-
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]
1564.0	-	1564.0	-	1564.0	-
2346.0	-	2346.0	-	2346.0	-
3128.0	-	3128.0	-	3128.0	-
3910.0	-	3910.0	-	3910.0	-
4692.0	-	4692.0	-	4692.0	-
5474.0	-	5474.0	-	5474.0	-
6256.0	-	6256.0	-	6256.0	-
7038.0	-	7038.0	-	7038.0	-
7820.0	-	7820.0	-	7820.0	-
Measurement uncertainty			± 3dB		

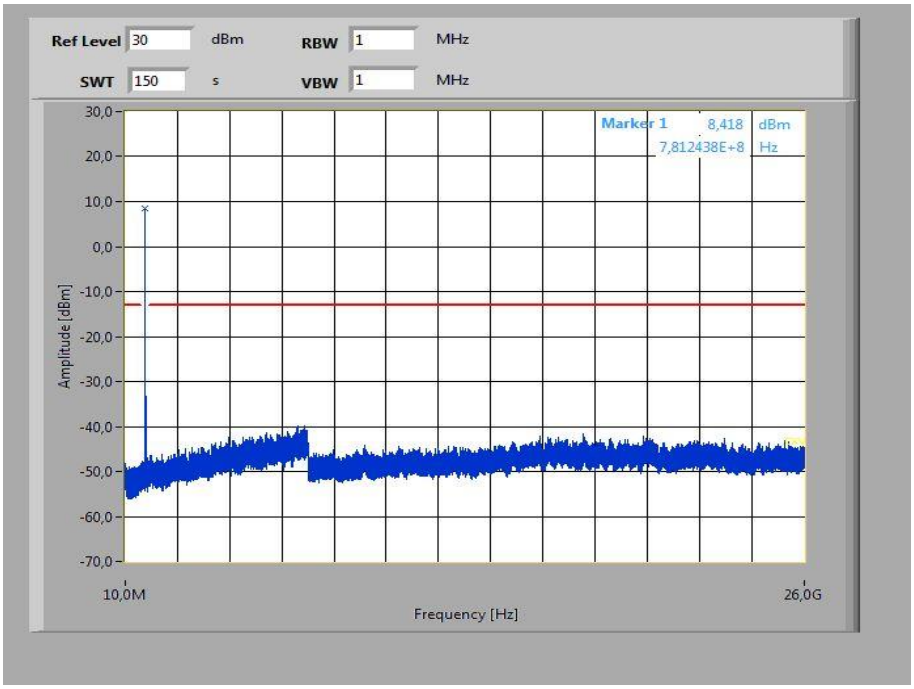
16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
1564.0	-	1564.0	-	1564.0	-
2346.0	-	2346.0	-	2346.0	-
3128.0	-	3128.0	-	3128.0	-
3910.0	-	3910.0	-	3910.0	-
4692.0	-	4692.0	-	4692.0	-
5474.0	-	5474.0	-	5474.0	-
6256.0	-	6256.0	-	6256.0	-
7038.0	-	7038.0	-	7038.0	-
7820.0	-	7820.0	-	7820.0	-
Measurement uncertainty			± 3dB		

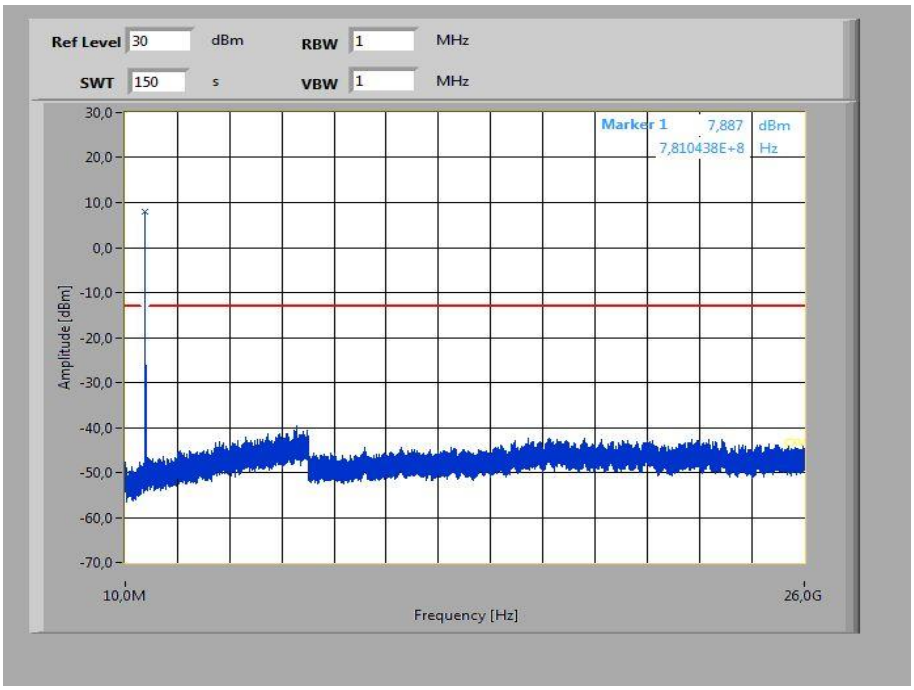
Verdict: compliant

Plots for 5 MHz channel bandwidth, QPSK

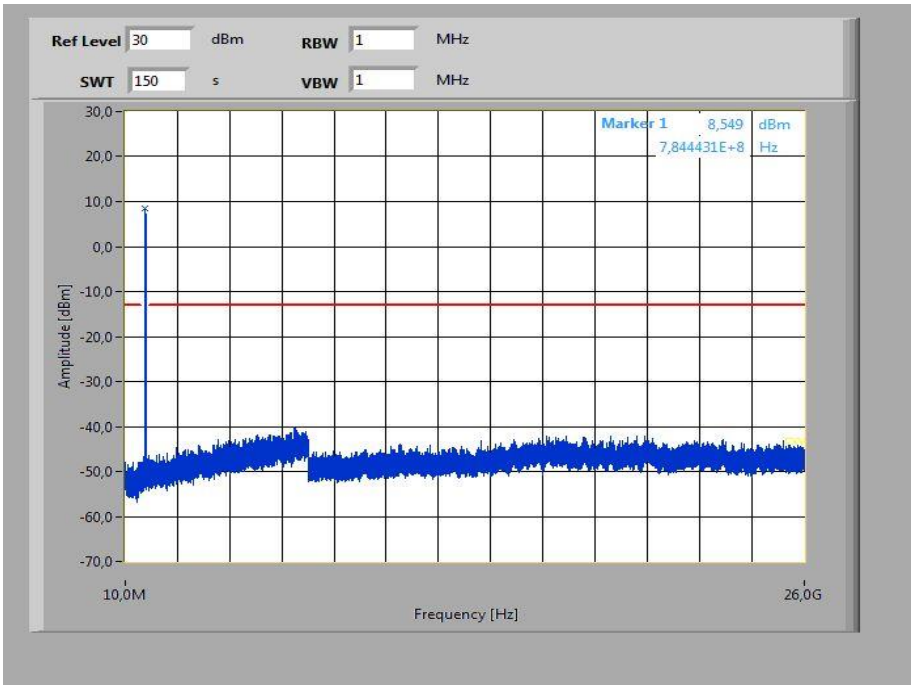
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

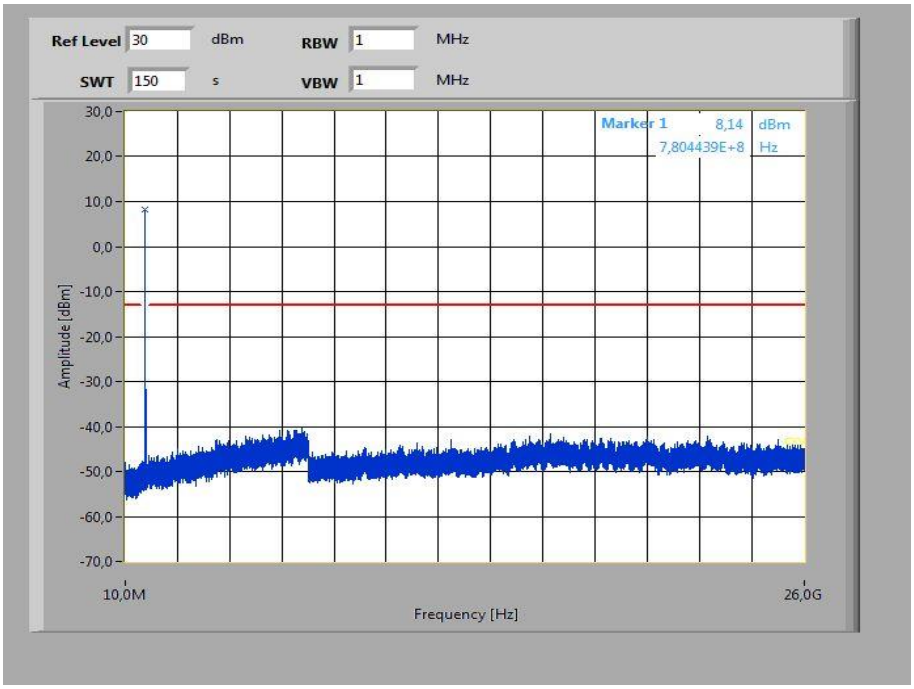


Plot 3: Highest channel, 10 MHz to 26 GHz

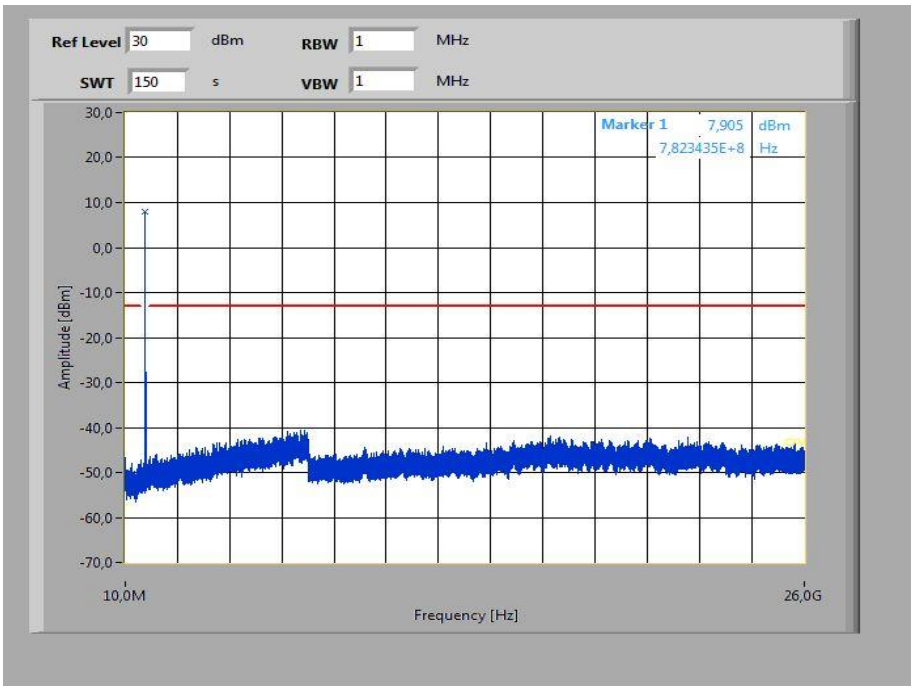


Plots for 5 MHz channel bandwidth, 16-QAM

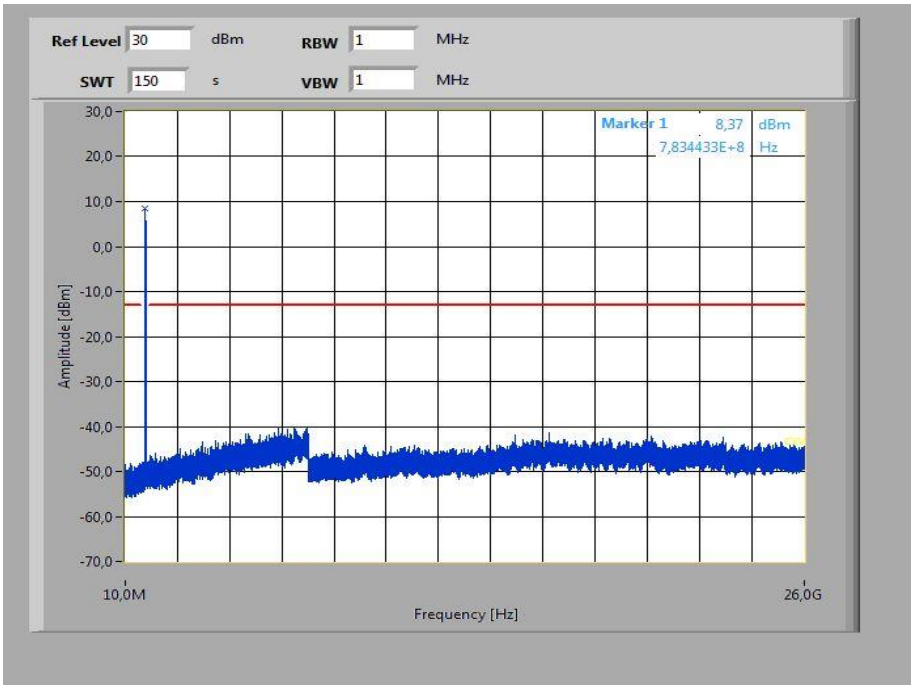
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz

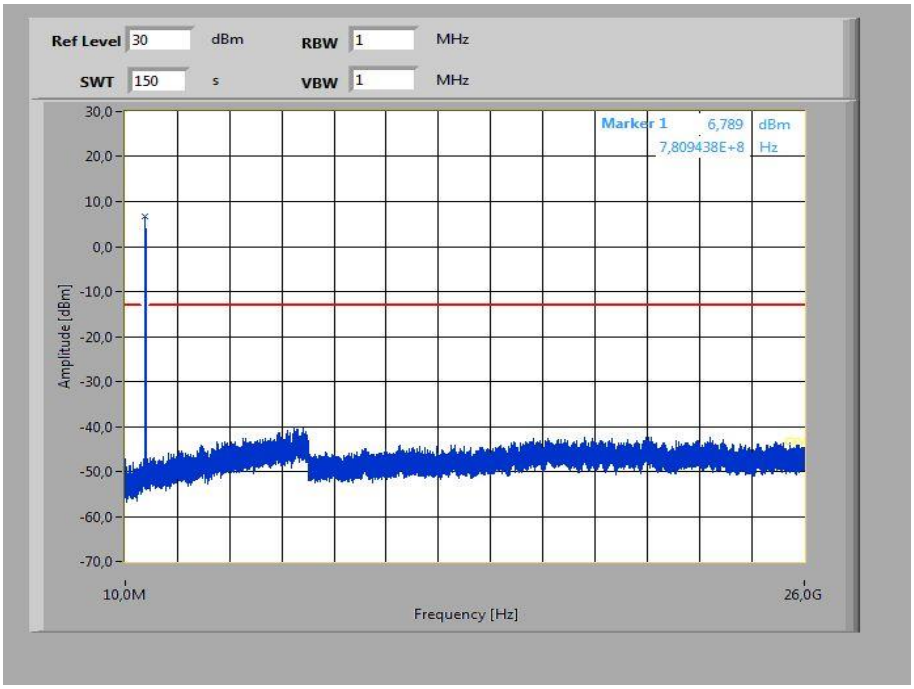


Plot 6: Highest channel, 10 MHz to 26 GHz

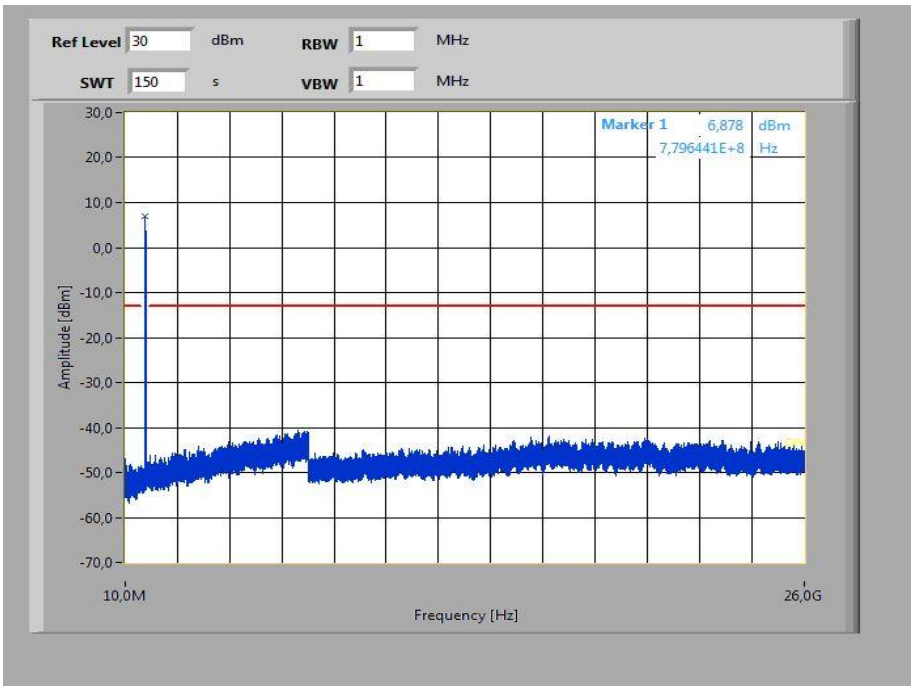


Plots for 10 MHz channel bandwidth, QPSK

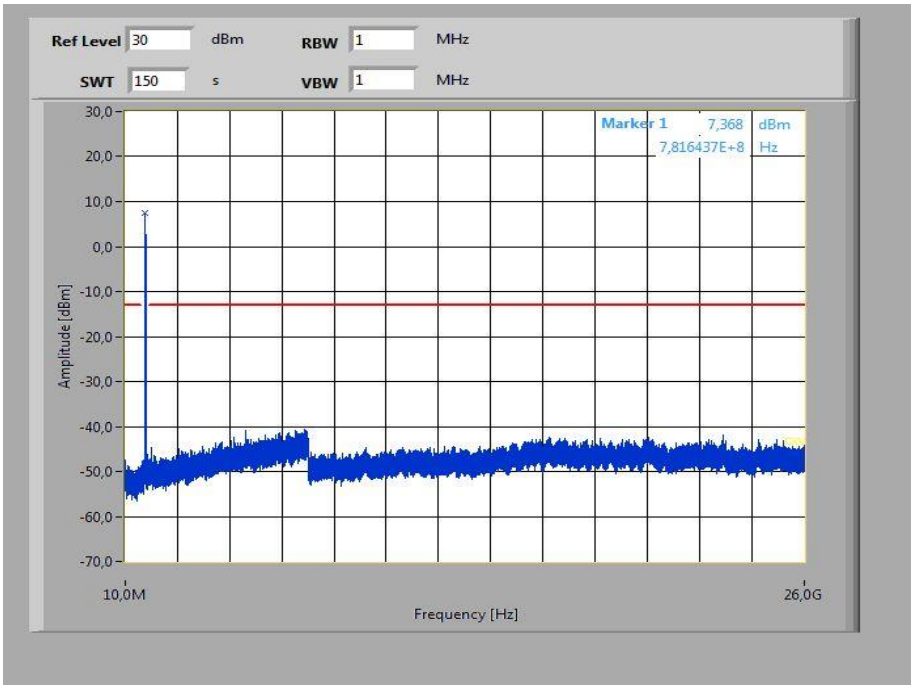
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

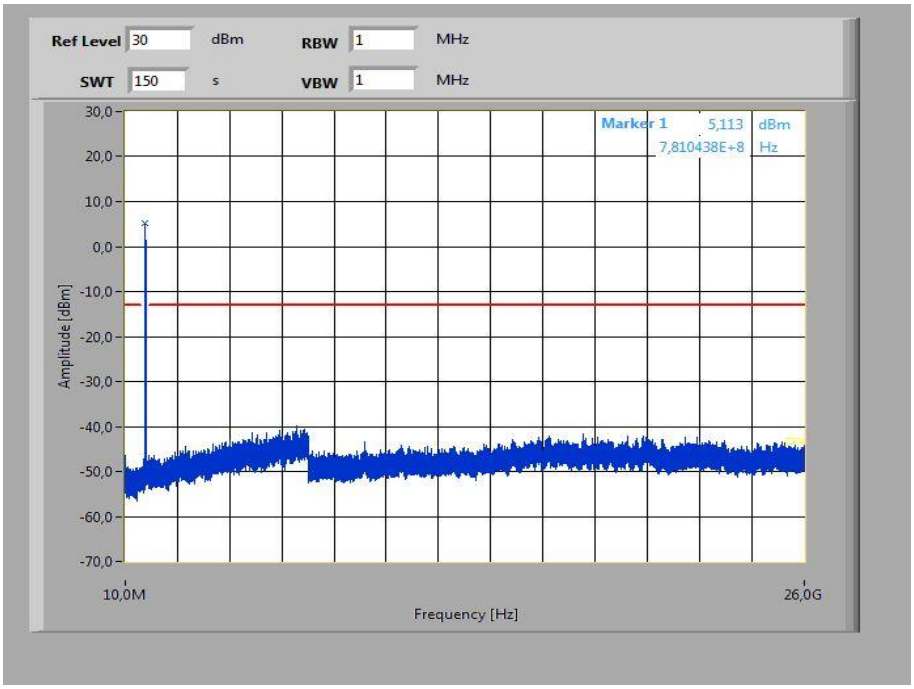


Plot 3: Highest channel, 10 MHz to 26 GHz

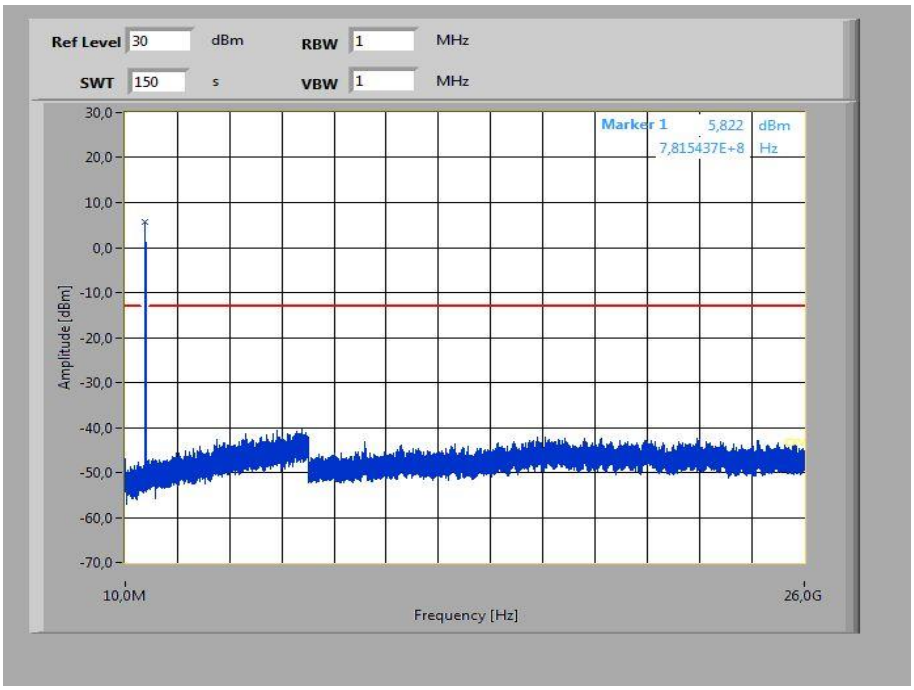


Plots for 10 MHz channel bandwidth, 16-QAM

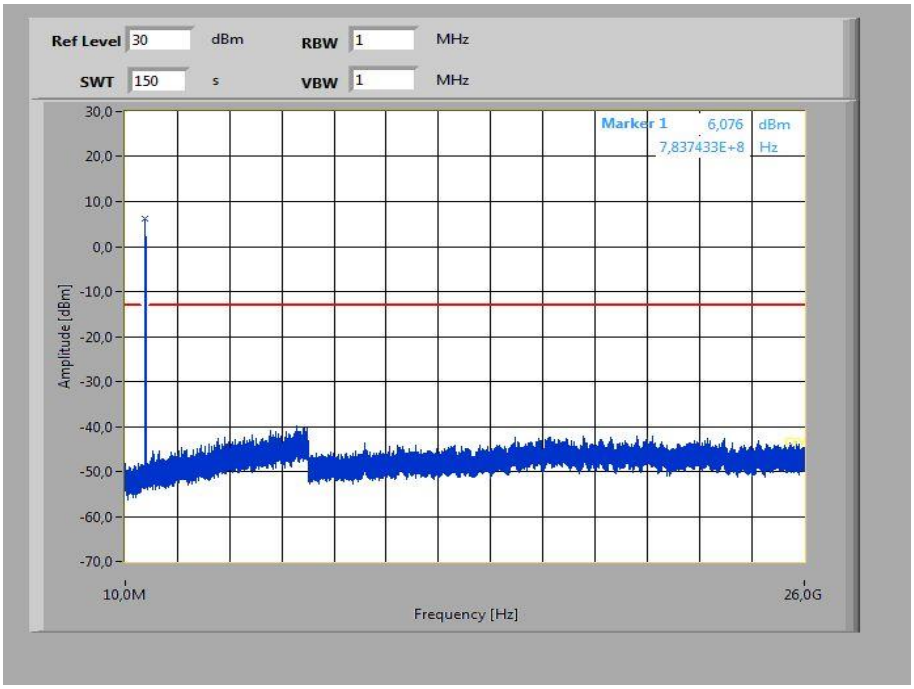
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz



Plot 6: Highest channel, 10 MHz to 26 GHz



11.3.5 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:	100 kHz
Video bandwidth:	300 kHz
Span:	5 MHz
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.3 - A
Measurement uncertainty:	see chapter 8

Limits:

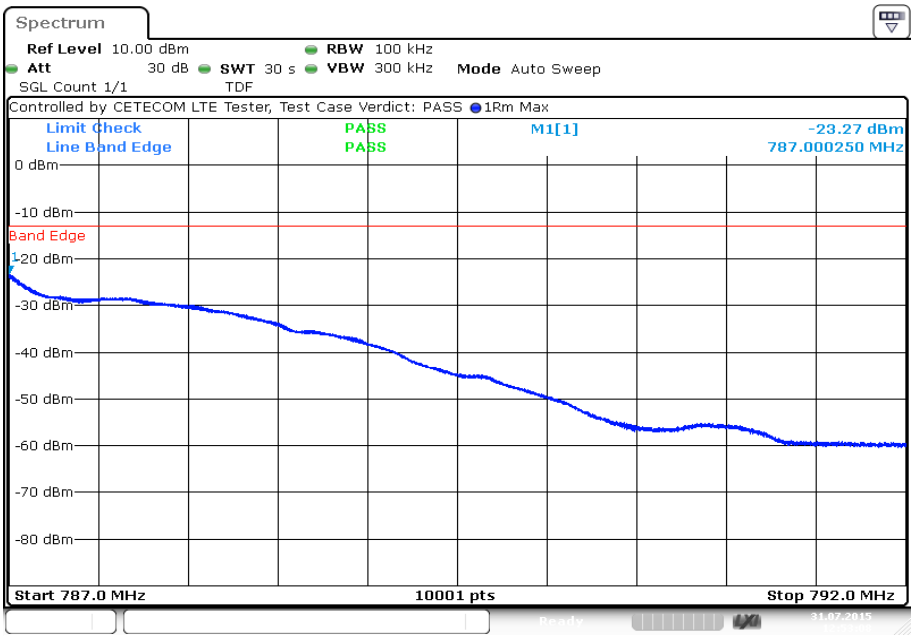
FCC	IC
Block Edge Compliance	
Attenuation ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results: **5 MHz channel bandwidth**

Plot 1: Lowest channel, QPSK modulation

Date: 31.JUL.2015 12:51:44

Plot 2: Highest channel, QPSK modulation

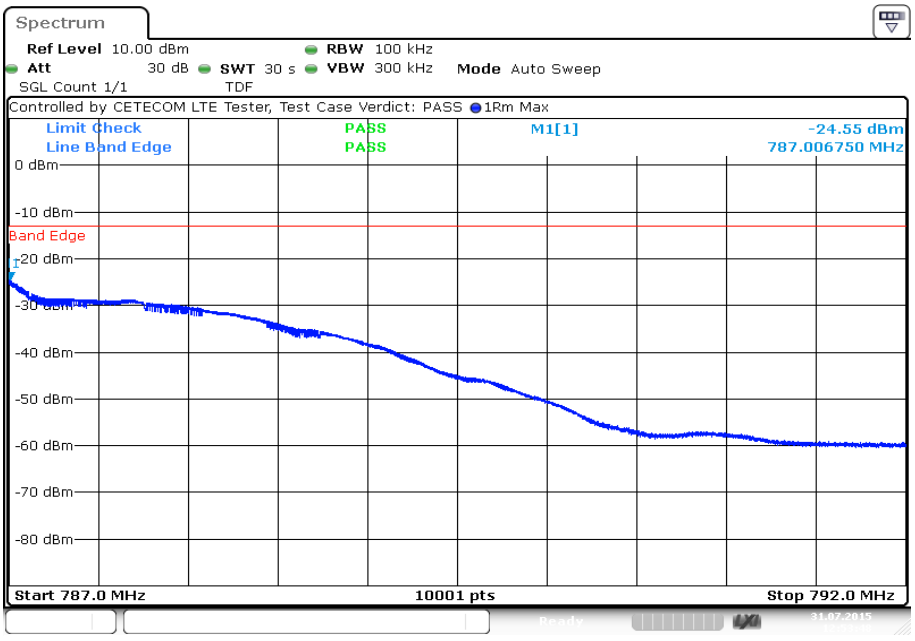


Date: 31.JUL.2015 12:53:08

Plot 3: Lowest channel, 16 – QAM modulation

Date: 31.JUL.2015 12:52:21

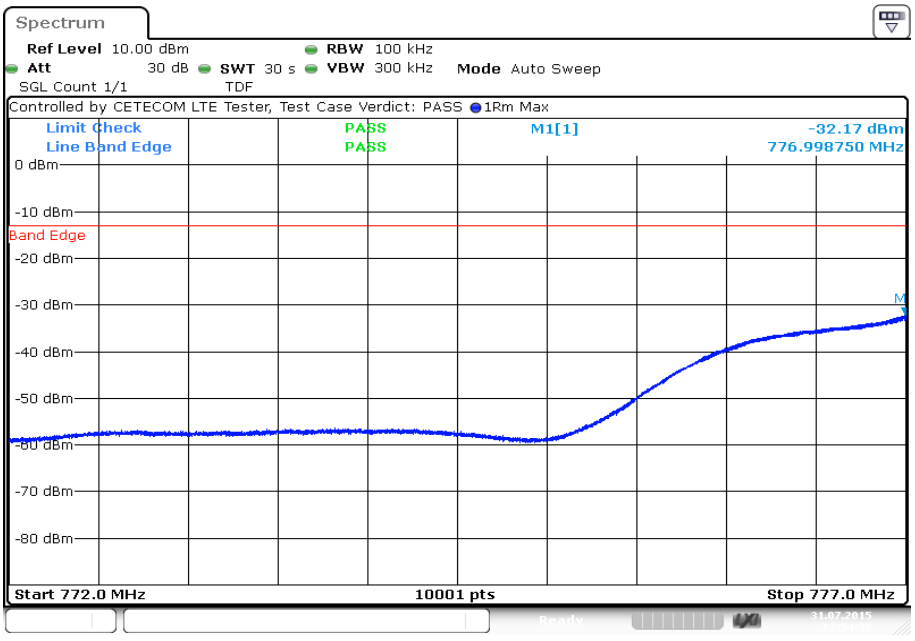
Plot 4: Highest channel, 16 – QAM modulation



Date: 31.JUL.2015 12:53:49

Results: **10 MHz channel bandwidth**

Plot 1: Lowest channel, QPSK modulation

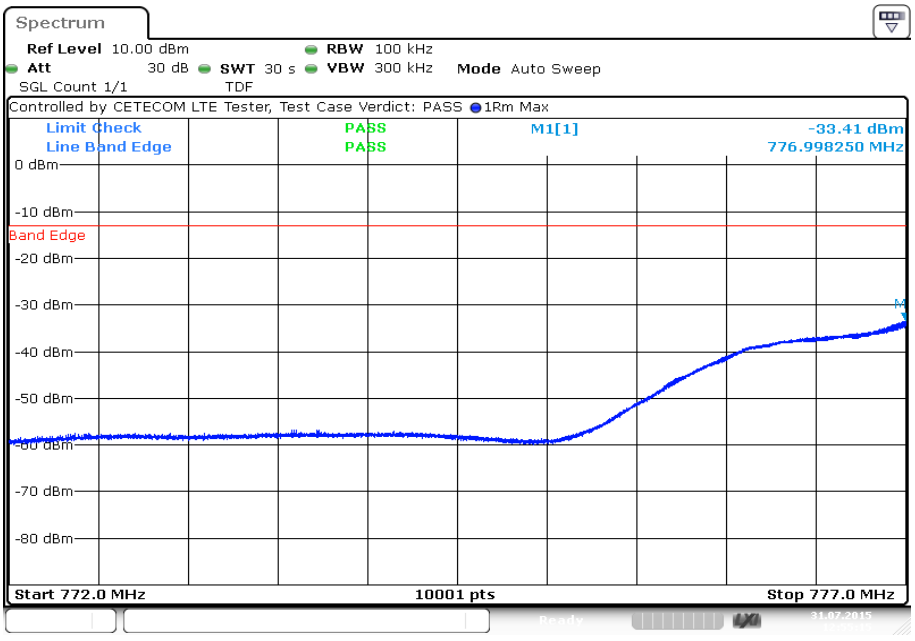


Date: 31.JUL.2015 12:54:39

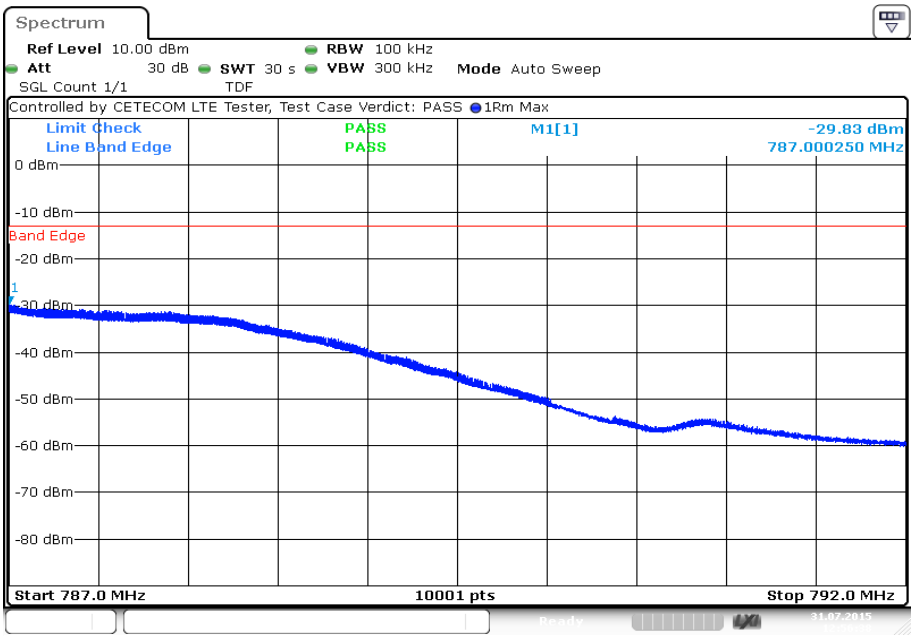
Plot 2: Highest channel, QPSK modulation

Date: 31.JUL.2015 12:56:01

Plot 3: Lowest channel, 16 – QAM modulation



Plot 4: Highest channel, 16 – QAM modulation



Verdict: compliant

11.3.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE band 17 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:	≥ 3xRBW
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:

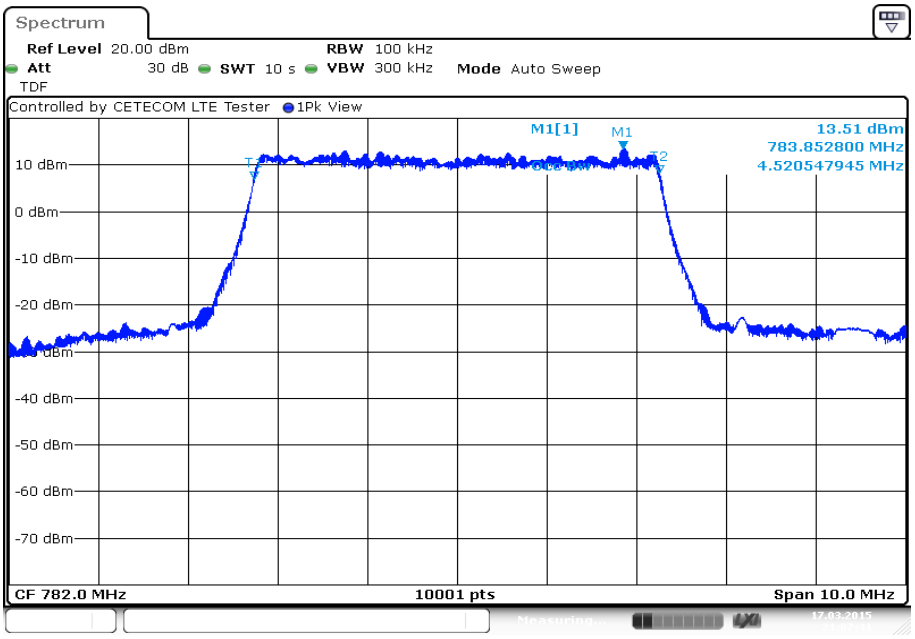
Occupied Bandwidth - QPSK		
Bandwidth [MHz]	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
5	4521	5096
10	9051	10259
Measurement uncertainty	± 100 kHz	

Occupied Bandwidth – 16-QAM		
Bandwidth [MHz]	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
5	4510	5050
10	9045	10183
Measurement uncertainty	± 100 kHz	

Verdict: **compliant**

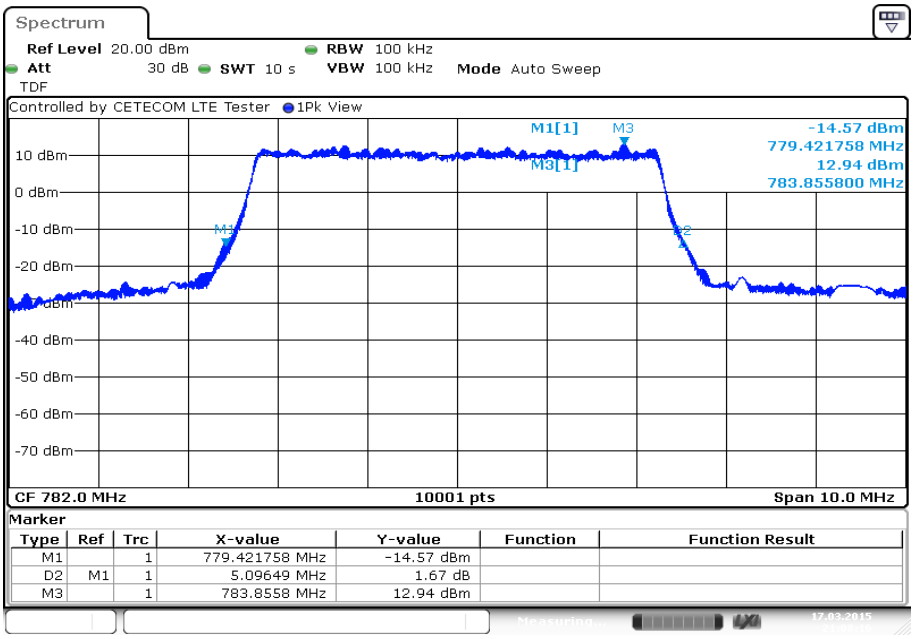
Plots: QPSK

Plot 1: 5 MHz, 99% OBW



Date: 17.MAR.2015 21:07:42

Plot 2: 5 MHz, -26 dBc OBW

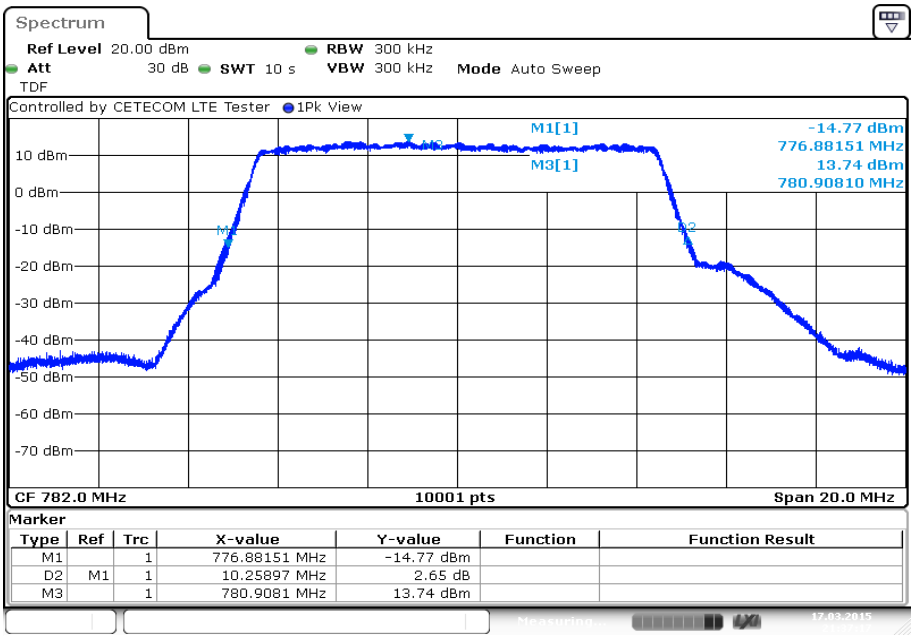


Date: 17.MAR.2015 21:08:16

Plot 3: 10 MHz, 99% OBW

Date: 17.MAR.2015 21:36:43

Plot 4: 10 MHz, -26 dBc OBW



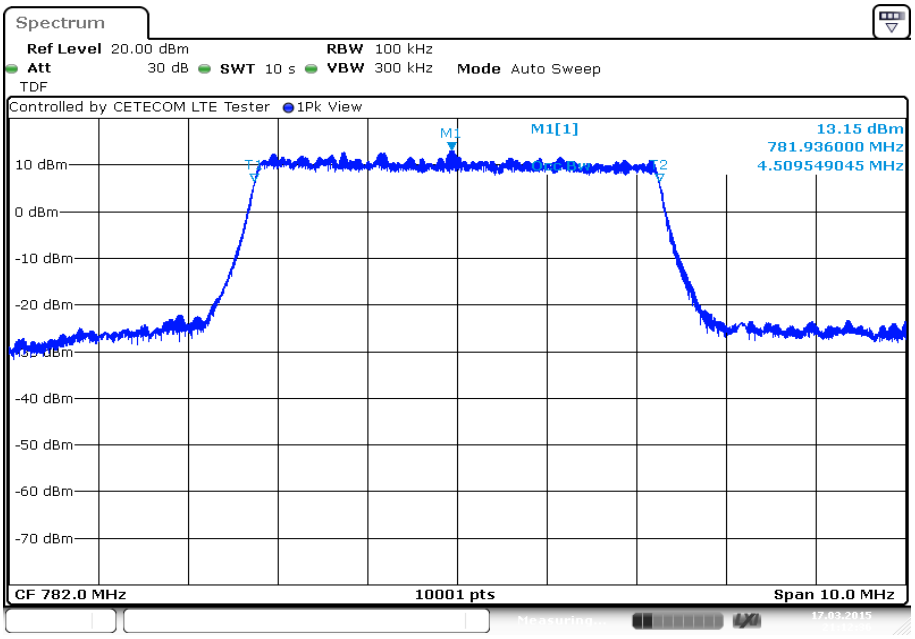
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	776.88151 MHz	-14.77 dBm		
D2	M1	1	10.25897 MHz	2.65 dB		
M3		1	780.9081 MHz	13.74 dBm		

Date: 17.MAR.2015 21:37:17

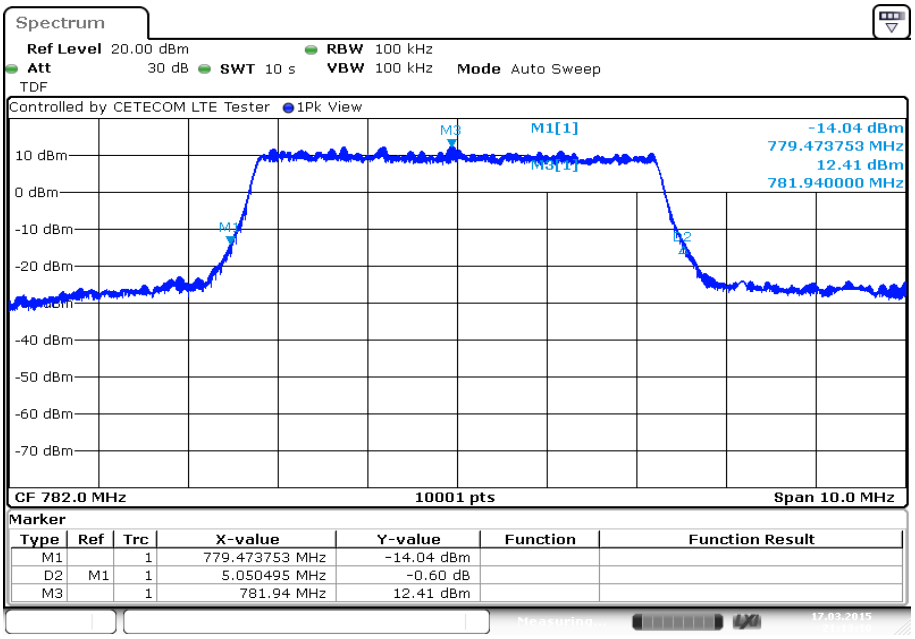
Plots: 16-QAM

Plot 1: 5 MHz, 99% OBW



Date: 17.MAR.2015 21:12:36

Plot 2: 5 MHz, -26 dBc OBW

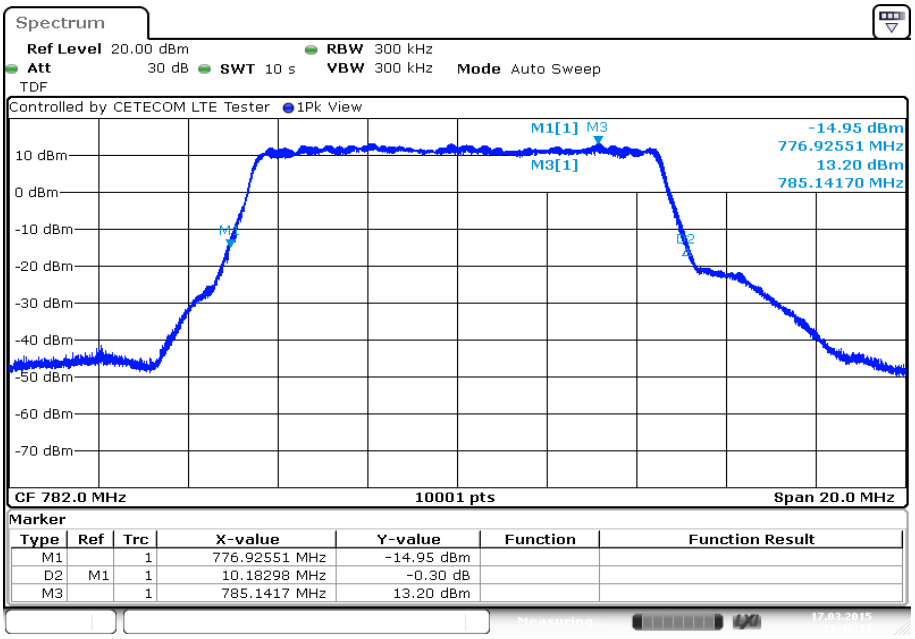


Date: 17.MAR.2015 21:13:11

Plot 3: 10 MHz, 99% OBW

Date: 17.MAR.2015 21:41:37

Plot 4: 10 MHz, -26 dBc OBW



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	776.92551 MHz	-14.95 dBm		
D2	M1	1	10.18298 MHz	-0.30 dB		
M3		1	785.1417 MHz	13.20 dBm		

Date: 17.MAR.2015 21:42:12

11.4 Results LTE – Band 17

The EUT was set to transmit the maximum power.

11.4.1 RF output power

Description:

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

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
34.77 dBm	37 dBm
Nominal Peak Output Power	
In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.	

Results:

Output Power (conducted)								
Bandwidth (MHz)	**Frequency (MHz)**	**Resource block allocation**	**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**
5	706.5	1 RB low	27.3	21.9	5.0	27.2	20.7	6.1
		1 RB high	27.6	22.0	5.1	27.5	20.8	6.2
		50% RB	27.0	20.8	5.5	27.1	19.7	6.4
		100% RB	27.3	20.8	5.6	27.3	19.8	6.4
	710.0	1 RB low	27.7	22.0	5.4	27.5	20.8	6.4
		1 RB high	28.1	21.9	5.6	27.8	20.8	6.7
		50% RB	27.4	20.7	5.8	27.2	19.7	6.4
		100% RB	27.6	20.7	5.7	27.6	19.8	6.5
	713.5	1 RB low	27.8	21.8	5.4	27.7	20.7	6.6
		1 RB high	26.8	21.5	4.9	26.8	20.5	6.0
		50% RB	27.4	20.6	5.7	27.2	19.5	6.6
		100% RB	27.4	20.7	5.7	27.4	19.7	6.4
10	709.0	1 RB low	27.0	21.5	5.2	27.2	20.4	6.2
		1 RB high	27.3	21.5	5.4	27.6	20.5	6.5
		50% RB	27.3	20.6	5.7	27.4	19.5	6.5
		100% RB	27.4	20.5	5.6	27.4	19.5	6.4
	710.0	1 RB low	27.0	21.3	5.4	26.7	20.0	6.2
		1 RB high	27.1	21.6	5.2	26.9	20.3	6.1
		50% RB	27.4	20.7	5.7	27.3	19.6	6.6
		100% RB	27.4	20.5	5.7	27.4	19.5	6.4
	711.0	1 RB low	27.3	21.5	5.3	27.3	20.5	6.4
		1 RB high	26.9	21.4	5.0	26.8	20.3	6.1
		50% RB	27.7	20.7	5.7	27.5	19.6	6.6
		100% RB	27.4	20.4	5.7	27.3	19.5	6.4

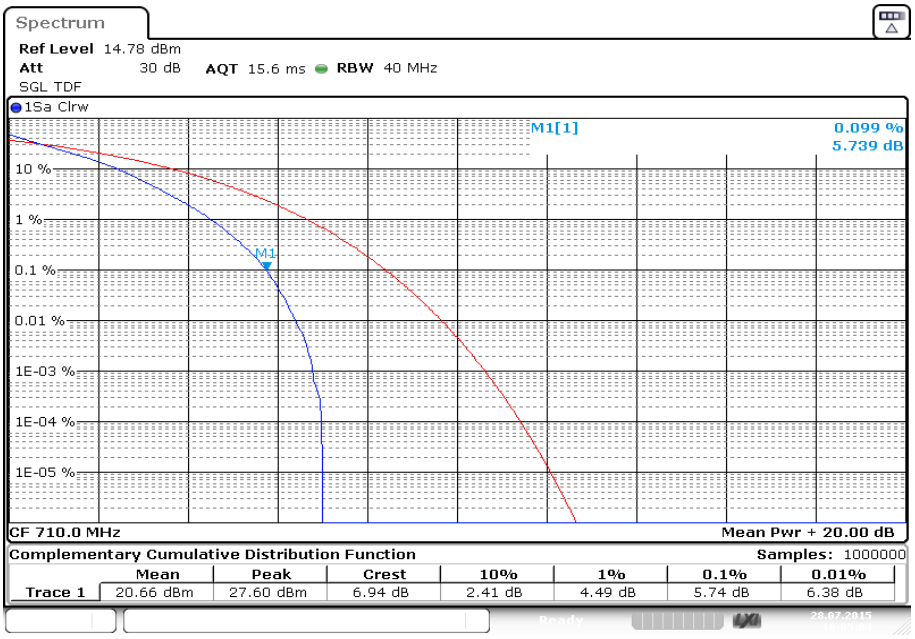
The output power is measured with configuration of maximum conducted output power.

Output Power (radiated)			
Bandwidth (MHz)	**Frequency (MHz)**	**Average Output Power (dBm) QPSK**	**Average Output Power (dBm) 16-QAM**
5	706.5	9.17	8.27
	710.0	7.00	5.96
	713.5	8.58	7.58
10	709.0	9.07	7.97
	710.0	6.86	5.96
	711.0	8.28	7.38

Verdict: compliant

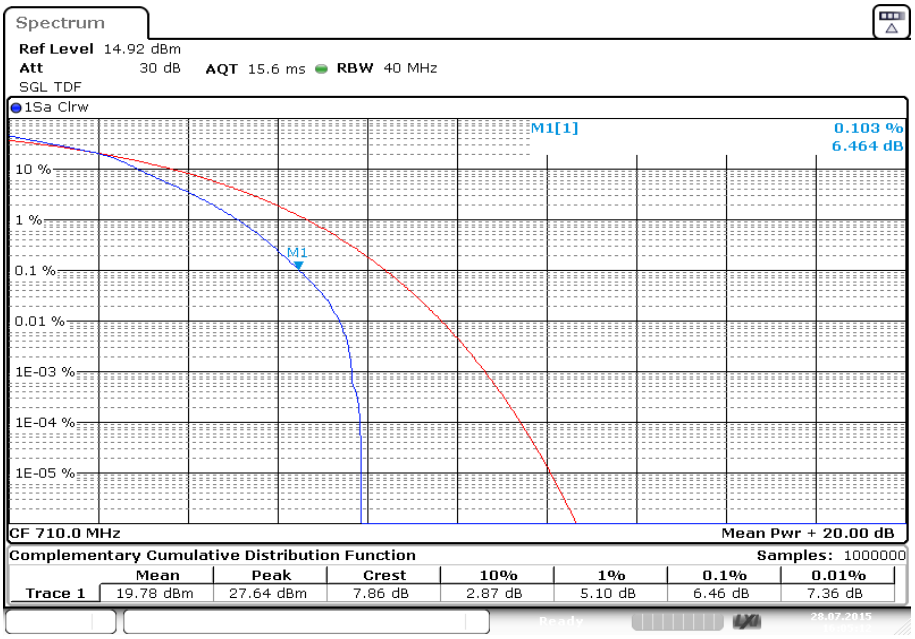
Plots:

Plot 1: 5 MHz cell bandwidth, mid channel, 100% #RB, QPSK



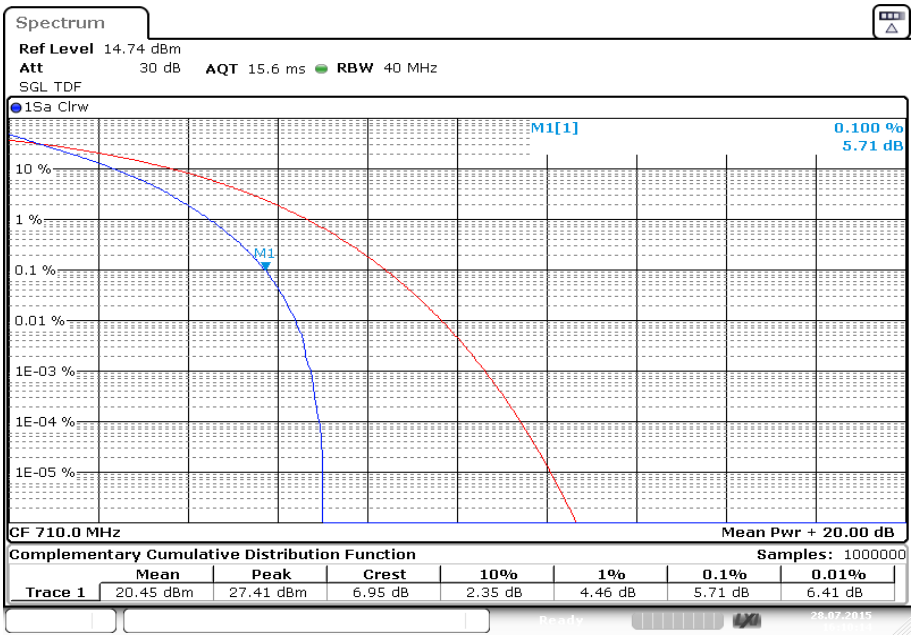
Date: 28.JUL.2015 16:05:04

Plot 2: 5 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



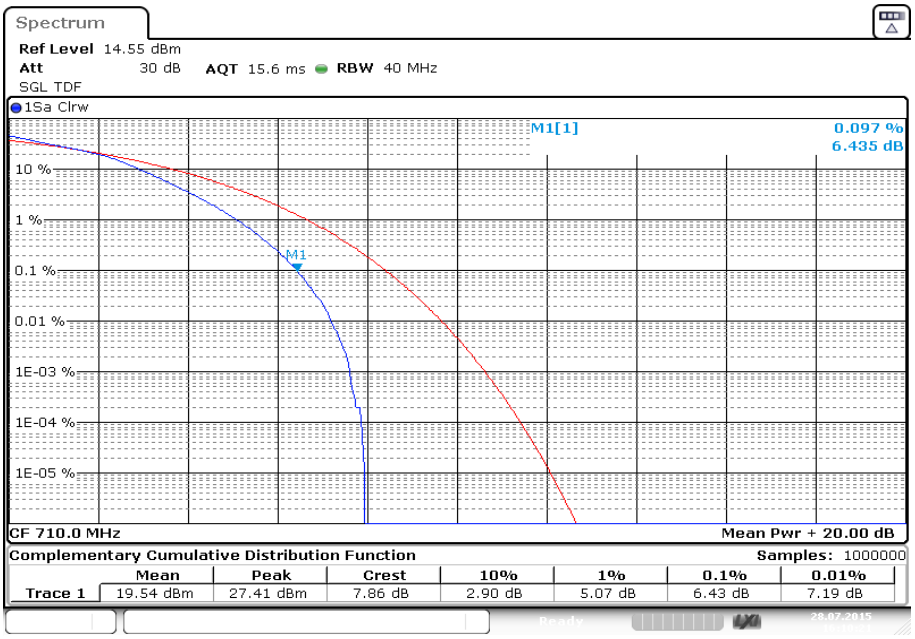
Date: 28.JUL.2015 16:05:12

Plot 3: 10 MHz cell bandwidth, mid channel, 100% #RB, QPSK



Date: 28.JUL.2015 16:10:14

Plot 4: 10 MHz cell bandwidth, mid channel, 100% #RB, 16-QAM



Date: 28.JUL.2015 16:10:21

11.4.2 Frequency stability

Description:

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the mobile station 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
Frequency Stability	
< 2.5 ppm	

Results:

FREQ ERROR versus VOLTAGE

Voltage (V)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
13.8	-3	-0.00000042	-0.0042
12.0	-5	-0.00000070	-0.0070
10.2	-3	-0.00000042	-0.0042

FREQ ERROR versus TEMPERATURE

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)	Frequency Error (ppm)
-30	2	0.00000028	0.0028
-20	3	0.00000042	0.0042
-10	5	0.00000070	0.0070
± 0	-3	-0.00000042	-0.0042
10	-2	-0.00000028	-0.0028
20	-5	-0.00000070	-0.0070
30	-3	-0.00000042	-0.0042
40	-4	-0.00000056	-0.0056
50	-2	-0.00000028	-0.0028
60	-3	-0.00000042	-0.0042

Additional measurements for RSS-130 (4.3 b)

f_L = 703.203 MHz	f_H = 715.816 MHz
f_L – (max freq. error) = 703.203 MHz	f_H + (max freq. error) = 715.816 MHz

Verdict: compliant

11.4.3 Spurious emissions radiated

Description:

The following steps outline the procedure used to measure the radiated emissions from the mobile station. The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3 and a 10 meter site. The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 746 MHz. Measurement is made up to 12.75 GHz. The resolution bandwidth is set as outlined in Part 27.53. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE band 17.

Measurement:

Measurement parameters	
Detector:	Peak / RMS
Sweep time:	5 ms/MHz
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	Different steps
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.1
Measurement uncertainty	see chapter 8

Limits:

FCC	IC
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 17 (710.0 MHz). It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE band 17 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]
1420.0	-
2130.0	-
2840.0	-
3550.0	-
4260.0	-
4970.0	-
5680.0	-
6390.0	-
7100.0	-

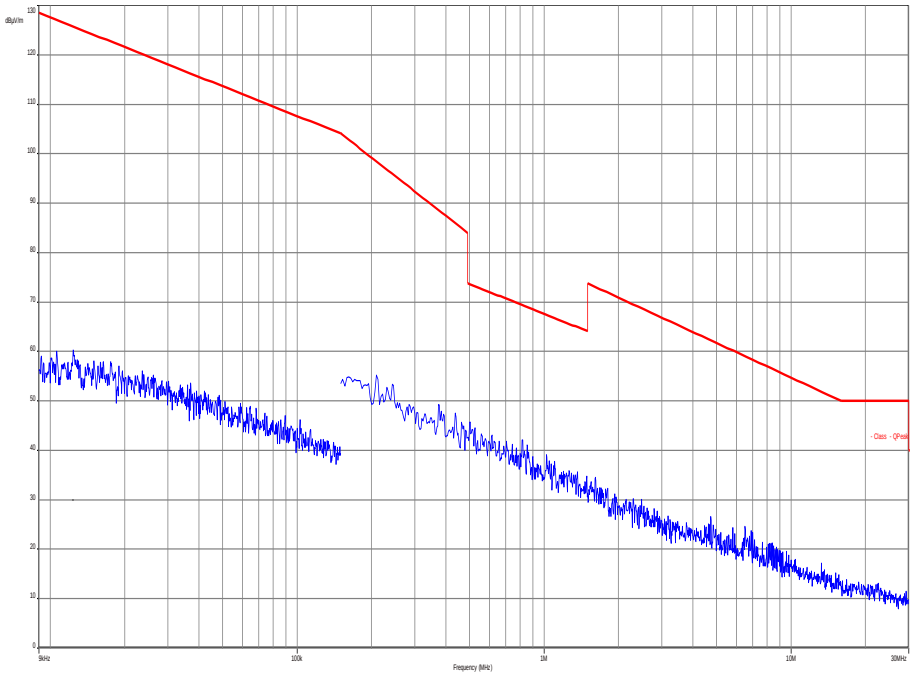
16-QAM

Spurious Emission Level (dBm)	
Middle channel	
Spurious emissions	Level [dBm]
1420.0	-
2130.0	-
2840.0	-
3550.0	-
4260.0	-
4970.0	-
5680.0	-
6390.0	-
7100.0	-

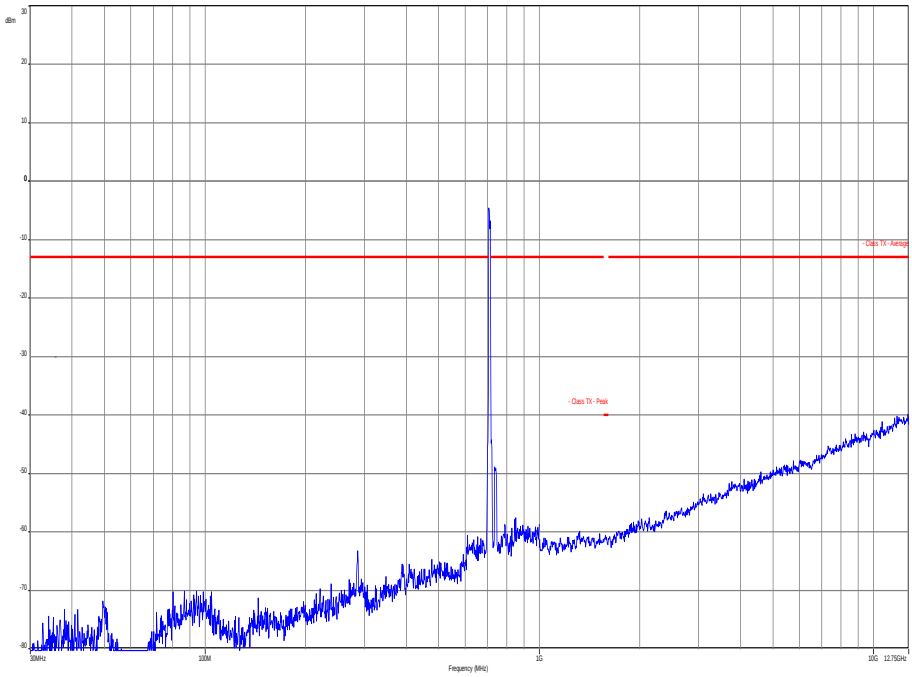
Verdict: compliant

QPSK with 10 MHz channel bandwidth

Plot 1: Middle channel, up to 30 MHz

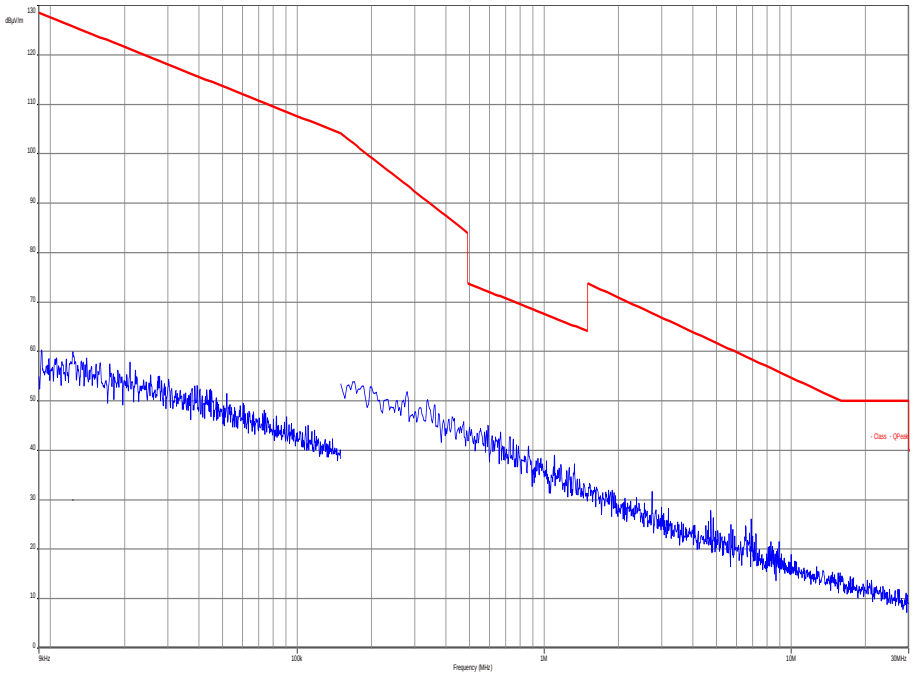


Plot 2: Middle channel, 30 MHz to 12.75 GHz

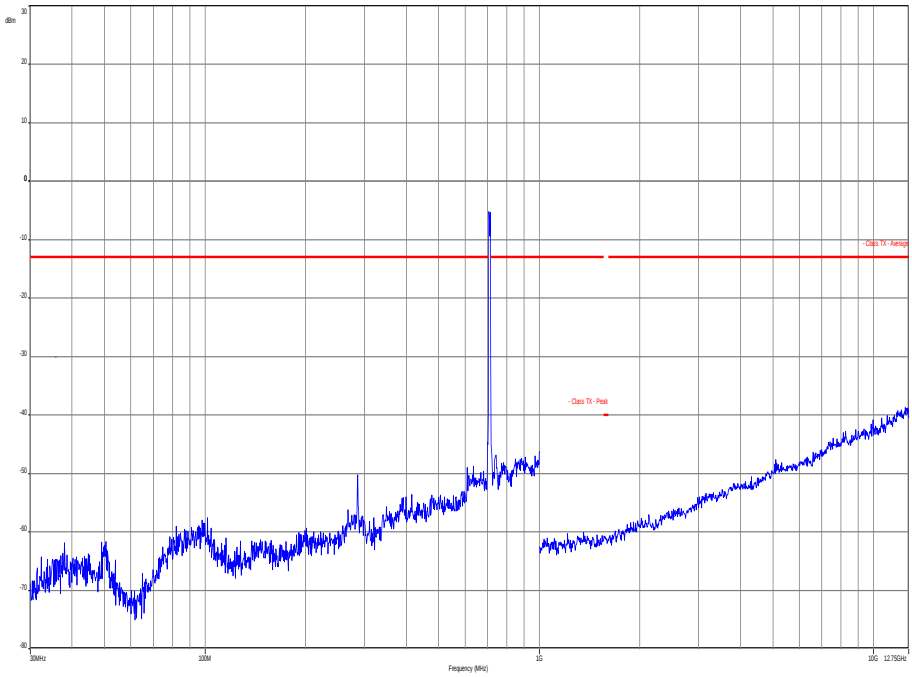


16-QAM with 10 MHz channel bandwidth

Plot 3: Middle channel, up to 30 MHz



Plot 4: Middle channel, 30 MHz to 12.75 GHz



11.4.4 Spurious emissions conducted

Description:

The following steps outline the procedure used to measure the conducted emissions from the mobile station.
1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 7460 MHz, 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:	Premeasurement 1 MHz Final measurement in case of spurious 100 kHz
Video bandwidth:	Premeasurement 1 MHz Final measurement in case of spurious 300 kHz
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 ≥ 43 + 10log(P) (P, Power in Watts)	
-13 dBm	

Results: for 5 MHz channel bandwidth

QPSK

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
1413.0	-	1420.0	-	1427.0	-
2119.5	-	2130.0	-	2140.5	-
2826.0	-	2840.0	-	2854.0	-
3532.5	-	3550.0	-	3567.5	-
4239.0	-	4260.0	-	4281.0	-
4945.5	-	4970.0	-	4994.5	-
5652.0	-	5680.0	-	5708.0	-
6358.5	-	6390.0	-	6421.5	-
7065.0	-	7100.0	-	7135.0	-
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]
1413.0	-	1420.0	-	1427.0	-
2119.5	-	2130.0	-	2140.5	-
2826.0	-	2840.0	-	2854.0	-
3532.5	-	3550.0	-	3567.5	-
4239.0	-	4260.0	-	4281.0	-
4945.5	-	4970.0	-	4994.5	-
5652.0	-	5680.0	-	5708.0	-
6358.5	-	6390.0	-	6421.5	-
7065.0	-	7100.0	-	7135.0	-
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]
1418.0	-	1420.0	-	1422.0	-
2127.0	-	2130.0	-	2133.0	-
2836.0	-	2840.0	-	2844.0	-
3545.0	-	3550.0	-	3555.0	-
4254.0	-	4260.0	-	4266.0	-
4963.0	-	4970.0	-	4977.0	-
5672.0	-	5680.0	-	5688.0	-
6381.0	-	6390.0	-	6399.0	-
7090.0	-	7100.0	-	7110.0	-
Measurement uncertainty			± 3dB		

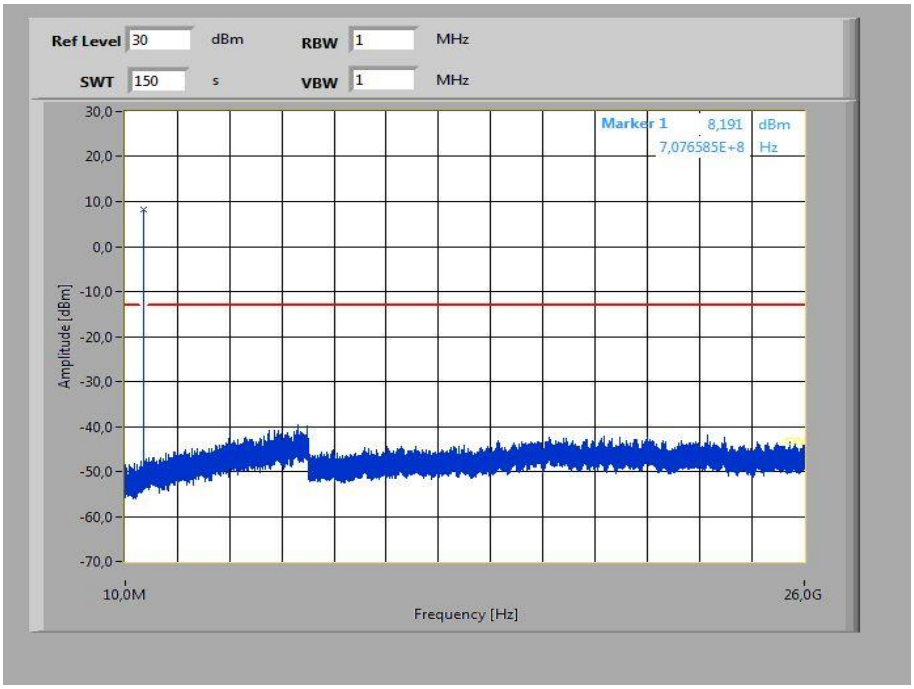
16-QAM

Spurious Emission Level (dBm)					
Lowest channel		**Middle channel**		**Highest channel**	
Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]	Spurious emissions	Level [dBm]
1418.0	-	1420.0	-	1422.0	-
2127.0	-	2130.0	-	2133.0	-
2836.0	-	2840.0	-	2844.0	-
3545.0	-	3550.0	-	3555.0	-
4254.0	-	4260.0	-	4266.0	-
4963.0	-	4970.0	-	4977.0	-
5672.0	-	5680.0	-	5688.0	-
6381.0	-	6390.0	-	6399.0	-
7090.0	-	7100.0	-	7110.0	-
Measurement uncertainty			± 3dB		

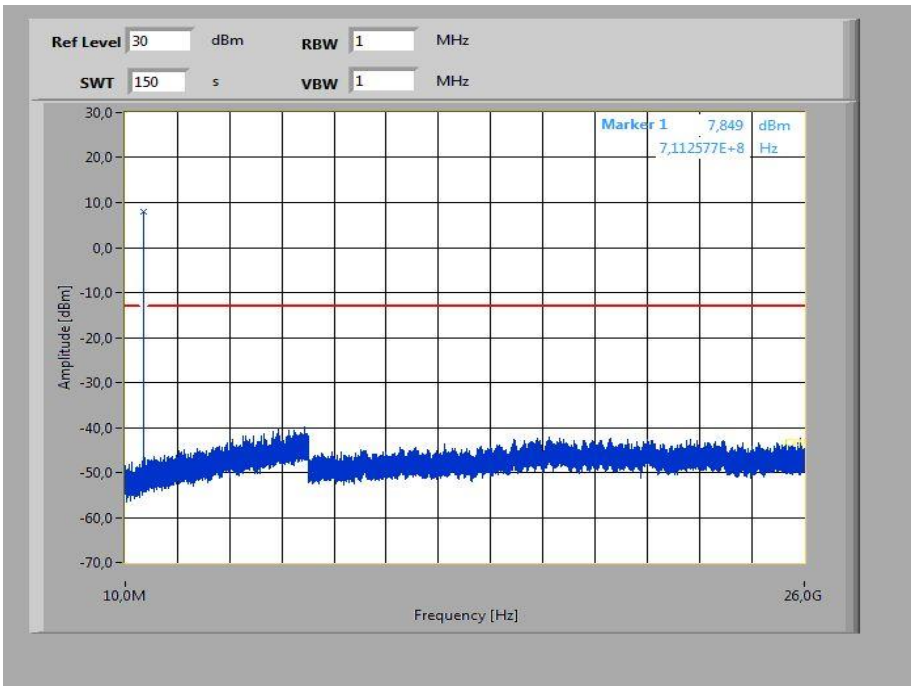
Verdict: compliant

Plots for 5 MHz channel bandwidth, QPSK

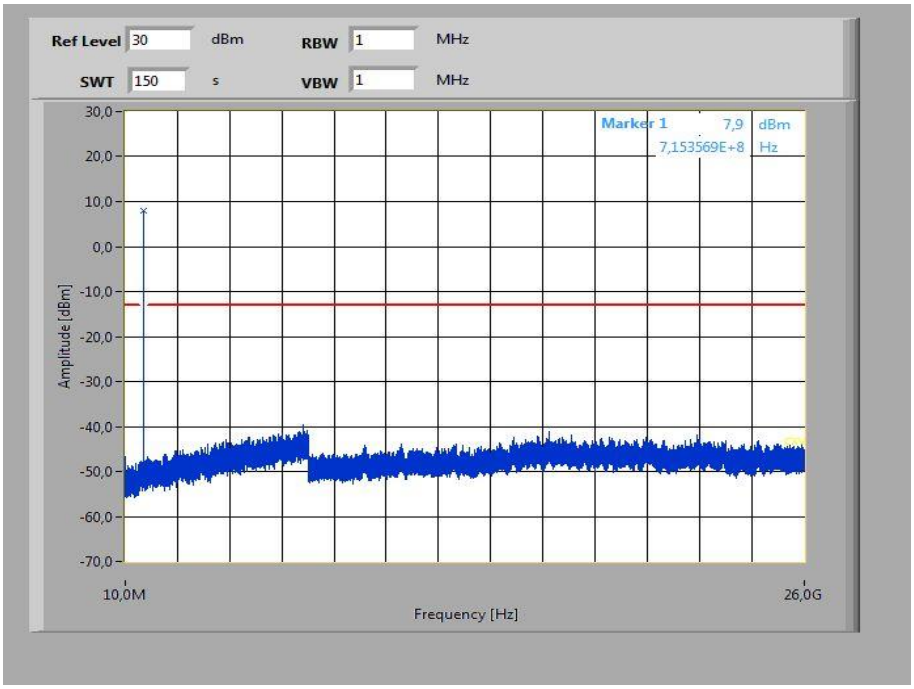
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

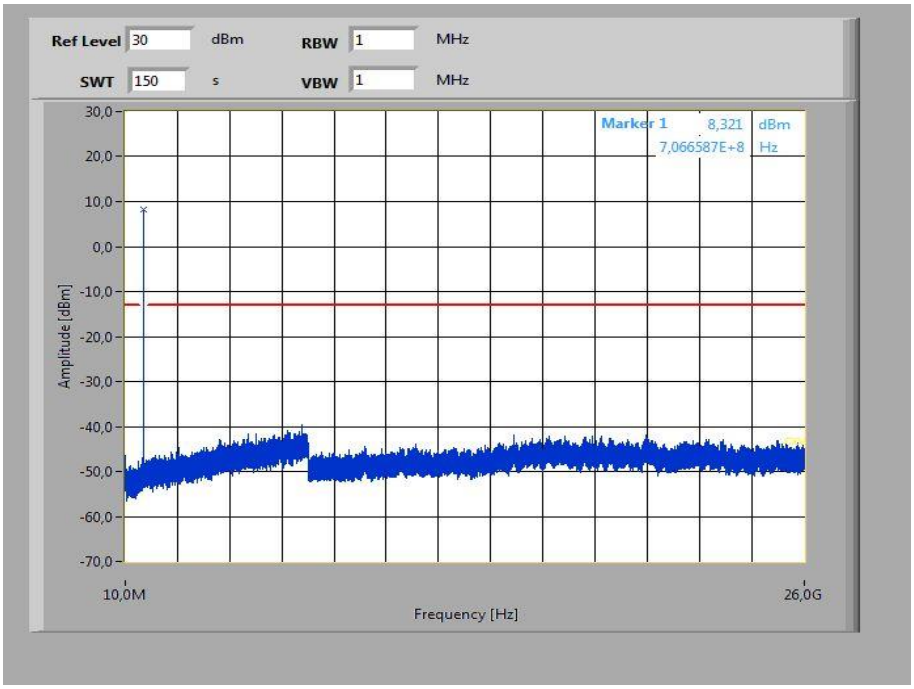


Plot 3: Highest channel, 10 MHz to 26 GHz

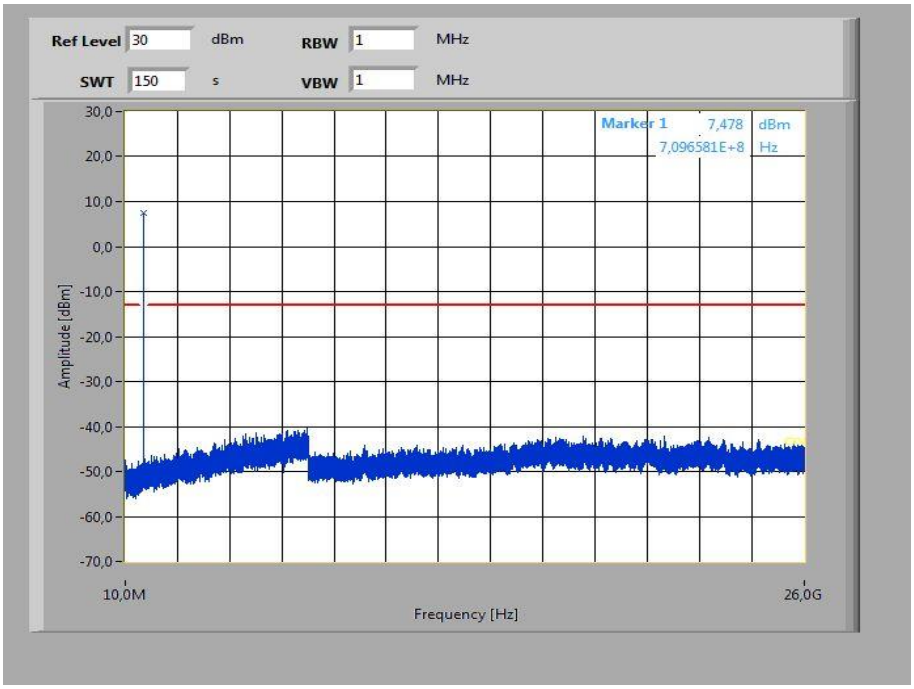


Plots for 5 MHz channel bandwidth, 16-QAM

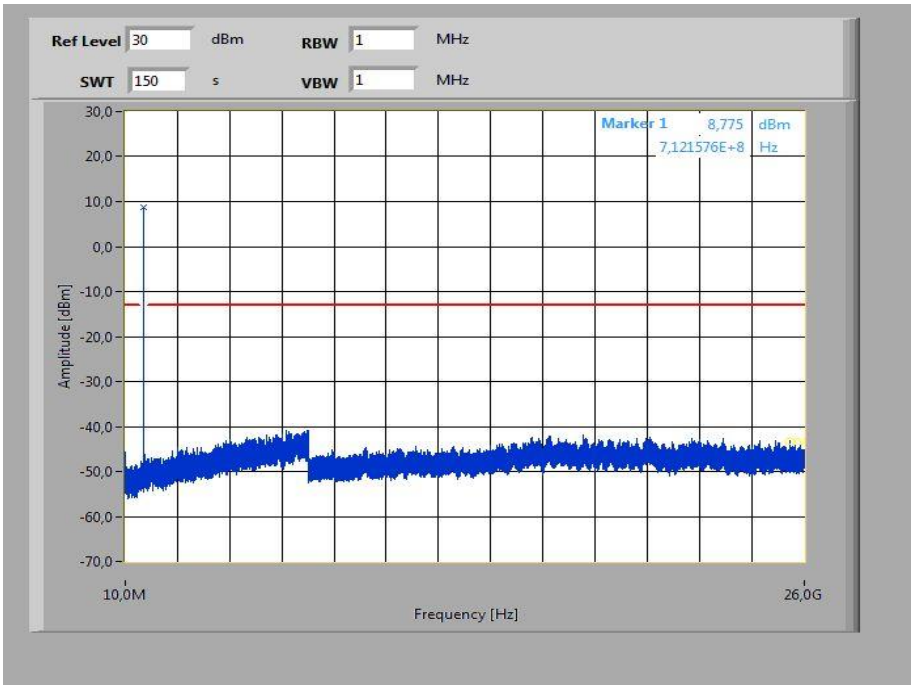
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz

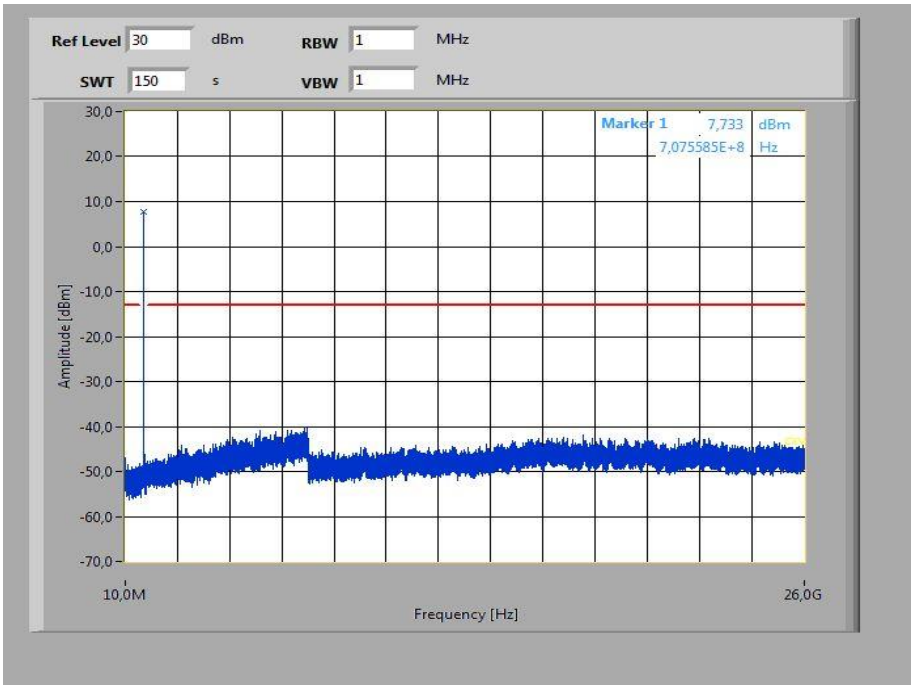


Plot 6: Highest channel, 10 MHz to 26 GHz

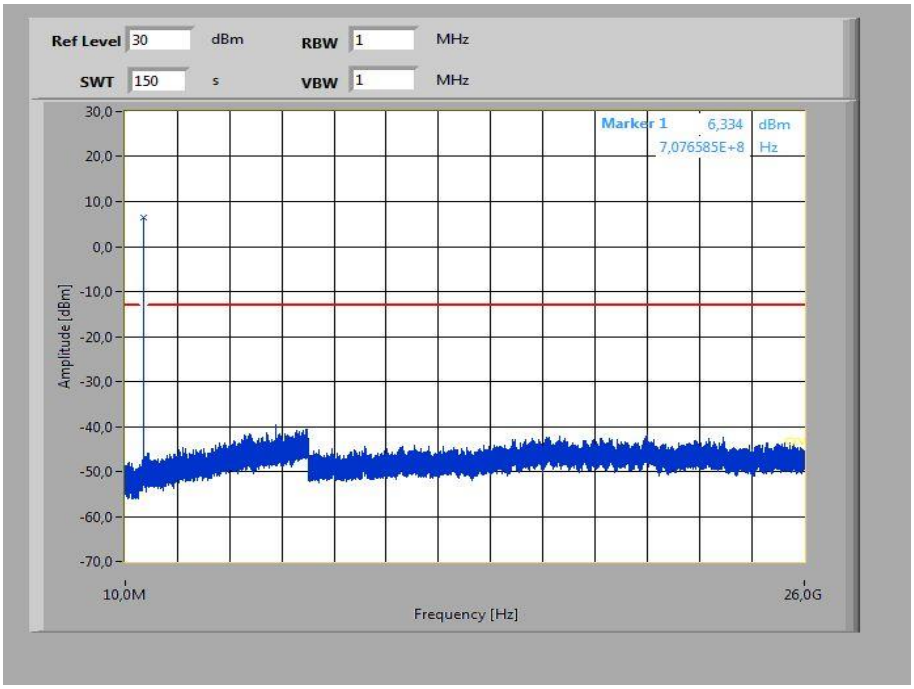


Plots for 10 MHz channel bandwidth, QPSK

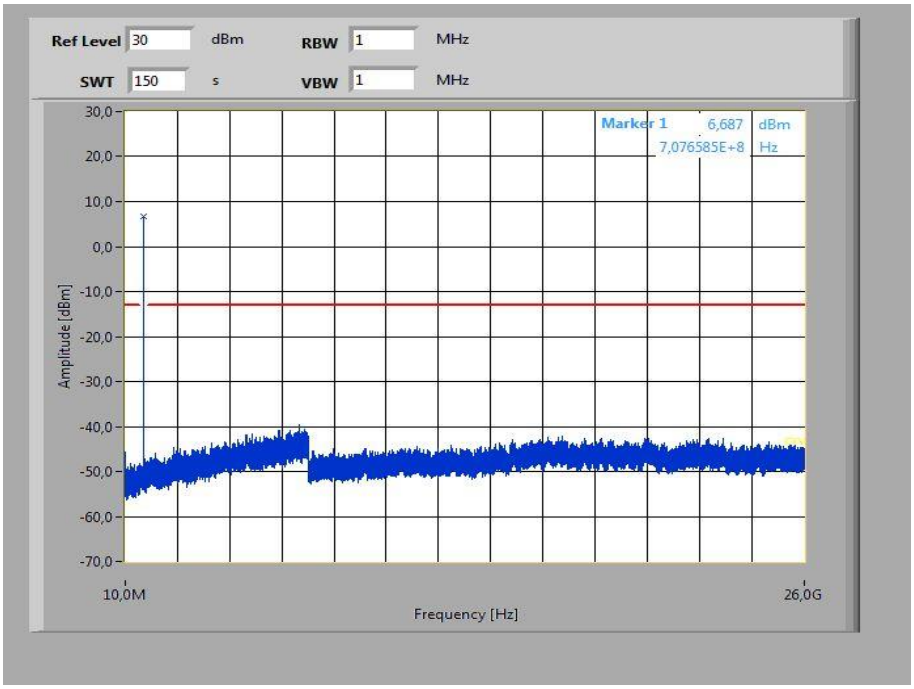
Plot 1: Lowest channel, 10 MHz to 26 GHz



Plot 2: Middle channel, 10 MHz to 26 GHz

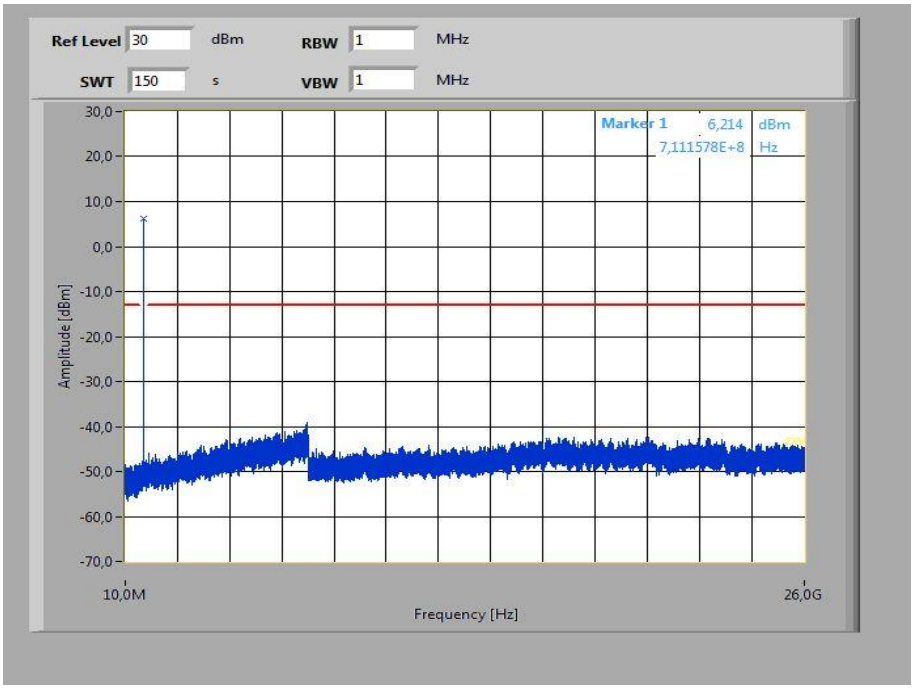


Plot 3: Highest channel, 10 MHz to 26 GHz

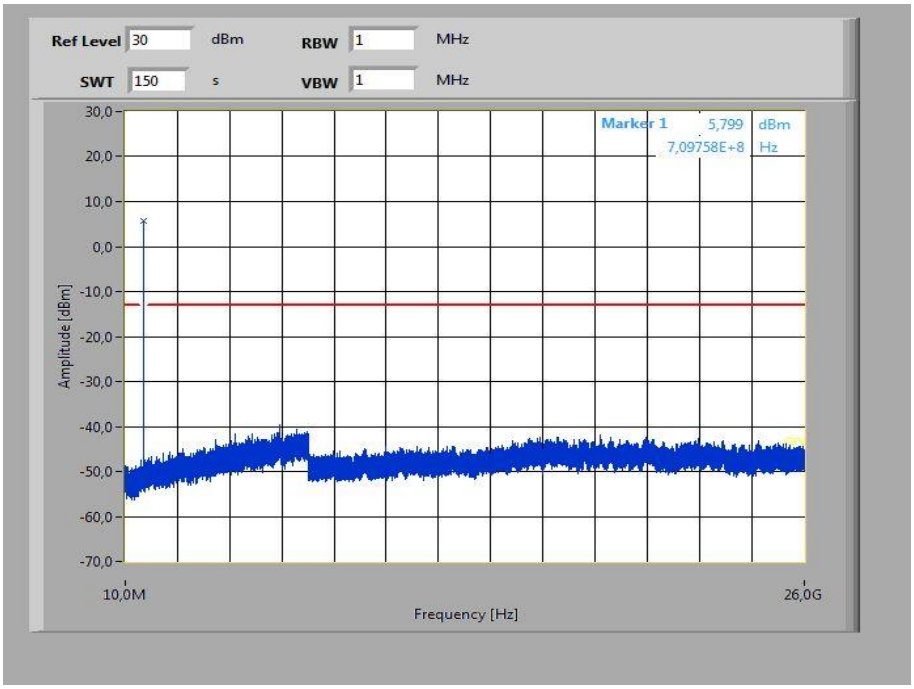


Plots for 10 MHz channel bandwidth, 16-QAM

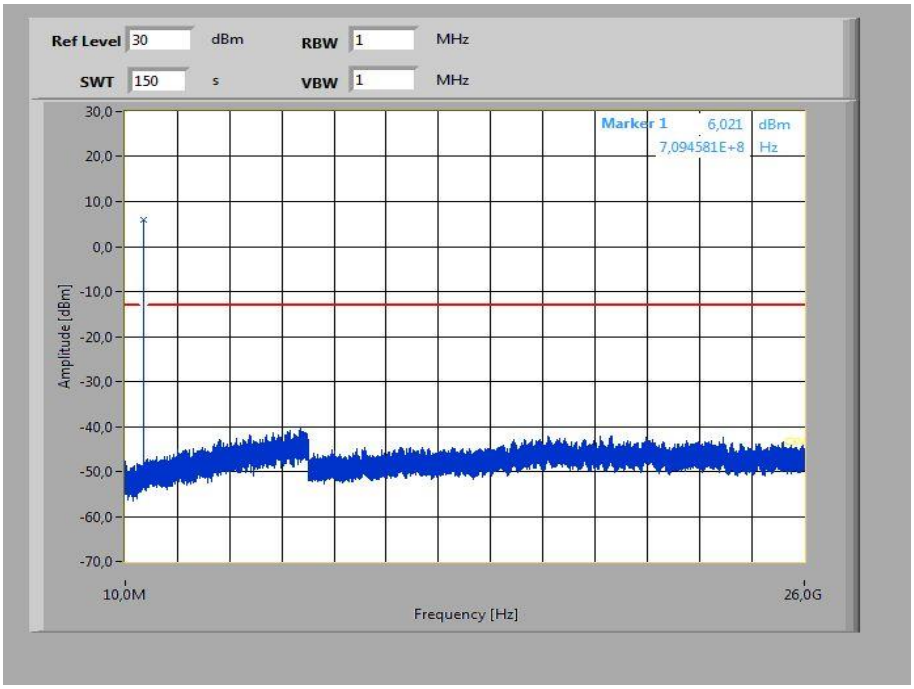
Plot 4: Lowest channel, 10 MHz to 26 GHz



Plot 5: Middle channel, 10 MHz to 26 GHz



Plot 6: Highest channel, 10 MHz to 26 GHz



11.4.5 Block edge compliance

Description:

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

Measurement:

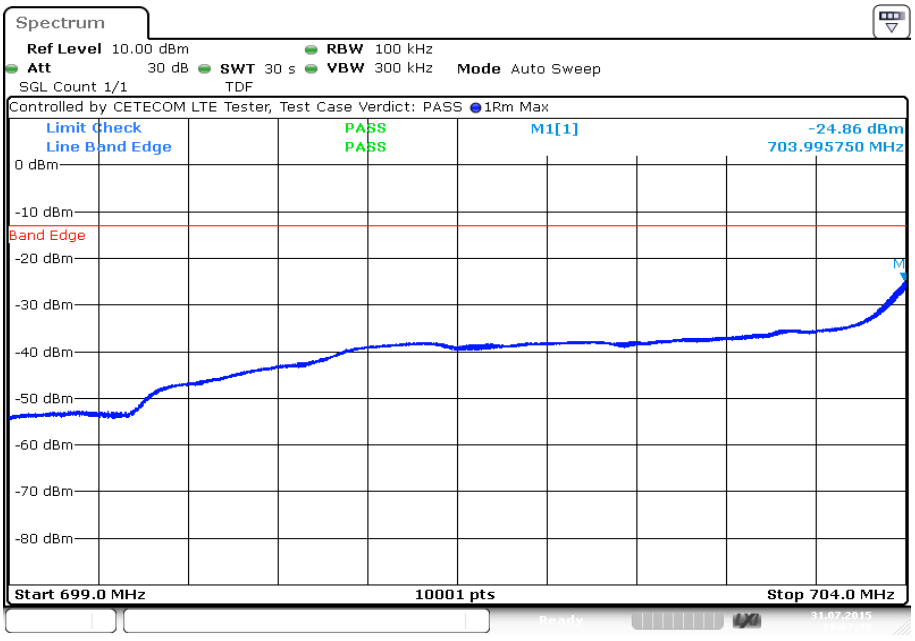
Measurement parameters	
Detector:	RMS
Sweep time:	30 s
Resolution bandwidth:	100 kHz
Video bandwidth:	≥ 3xRBW
Span:	5 MHz
Trace-Mode:	Max Hold
Used equipment:	see chapter 7.3 - A
Measurement uncertainty:	see chapter 8

Limits:

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

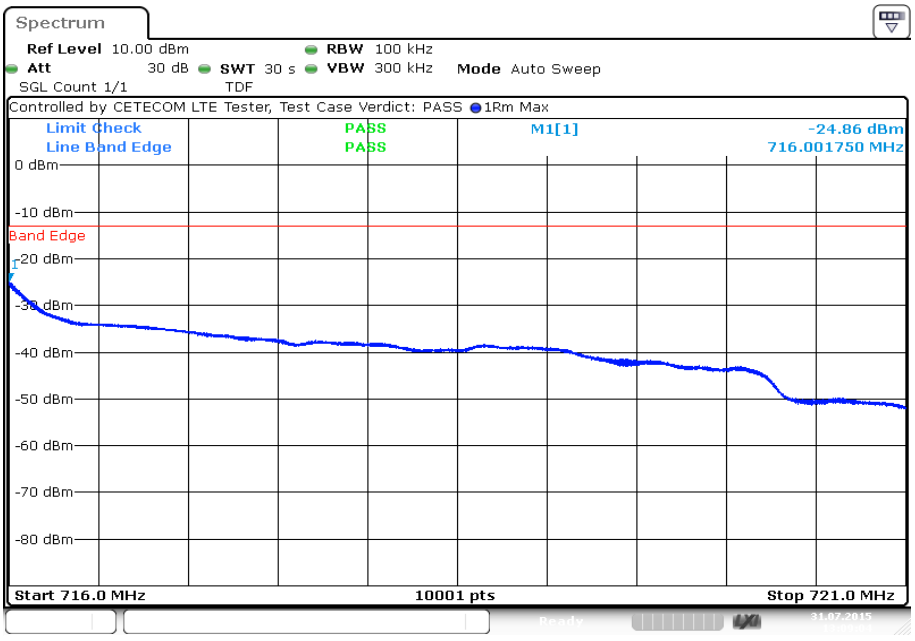
Results: **5 MHz channel bandwidth**

Plot 1: Lowest channel, QPSK modulation



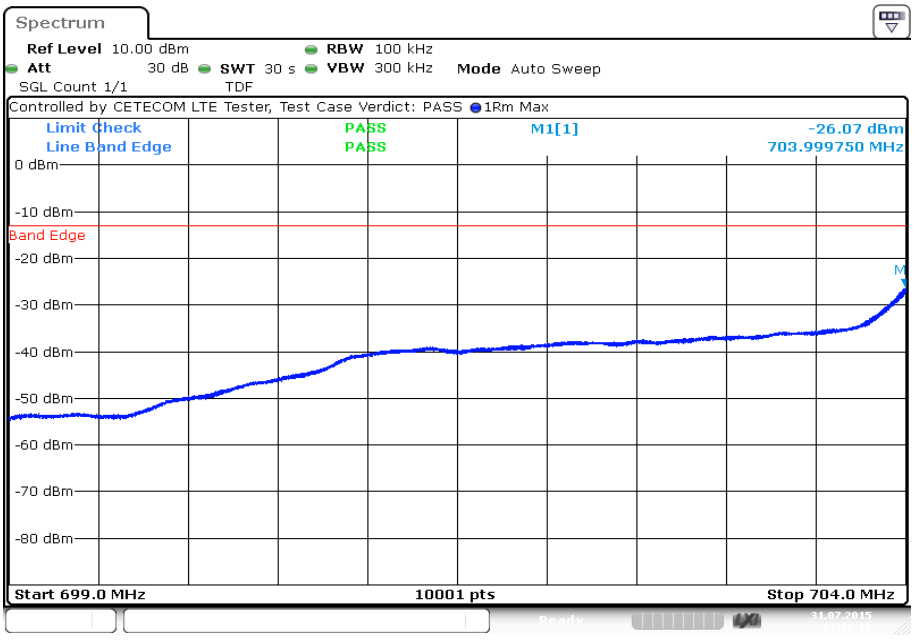
Date: 31.JUL.2015 13:07:39

Plot 2: Highest channel, QPSK modulation

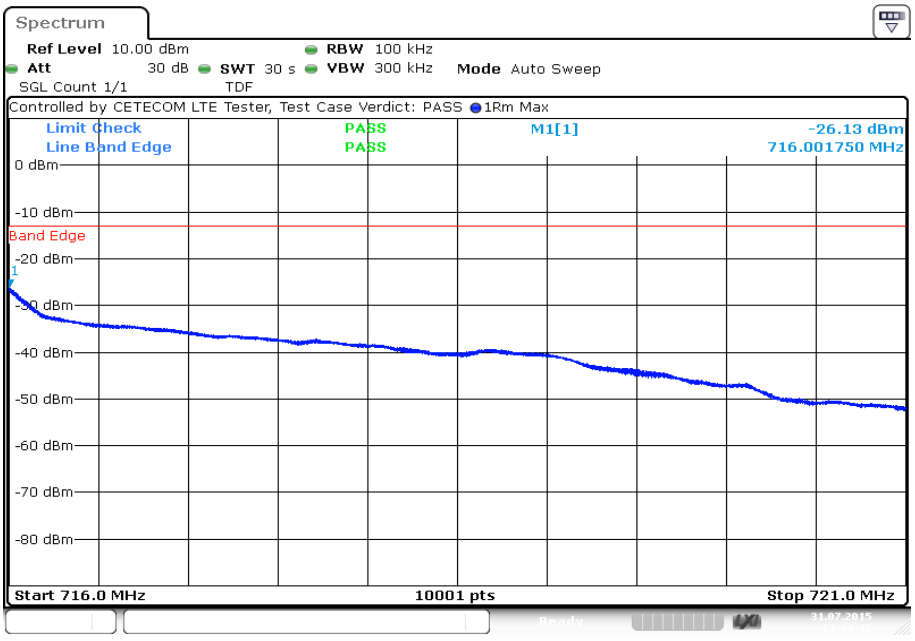


Date: 31.JUL.2015 13:09:04

Plot 3: Lowest channel, 16 – QAM modulation

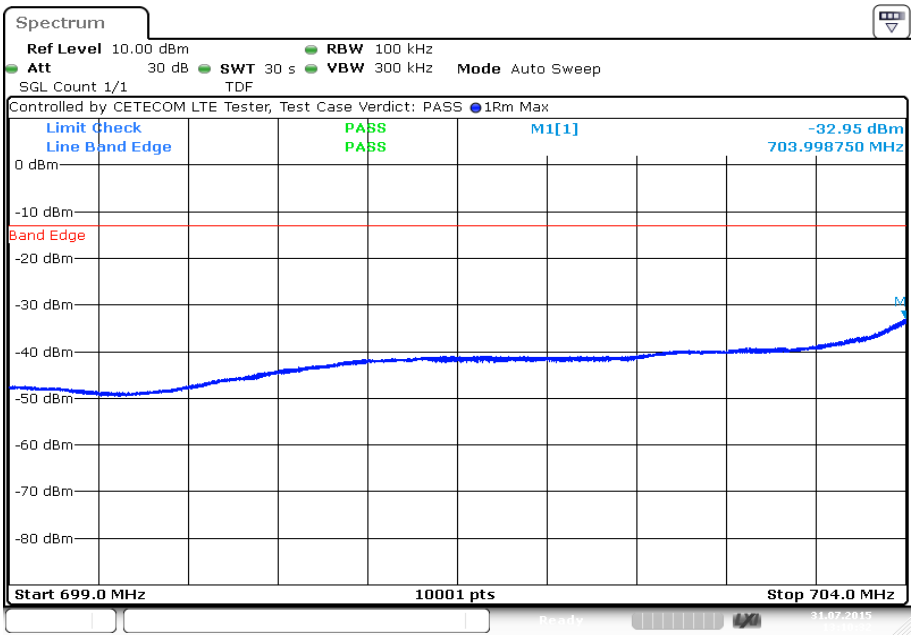


Plot 4: Highest channel, 16 – QAM modulation



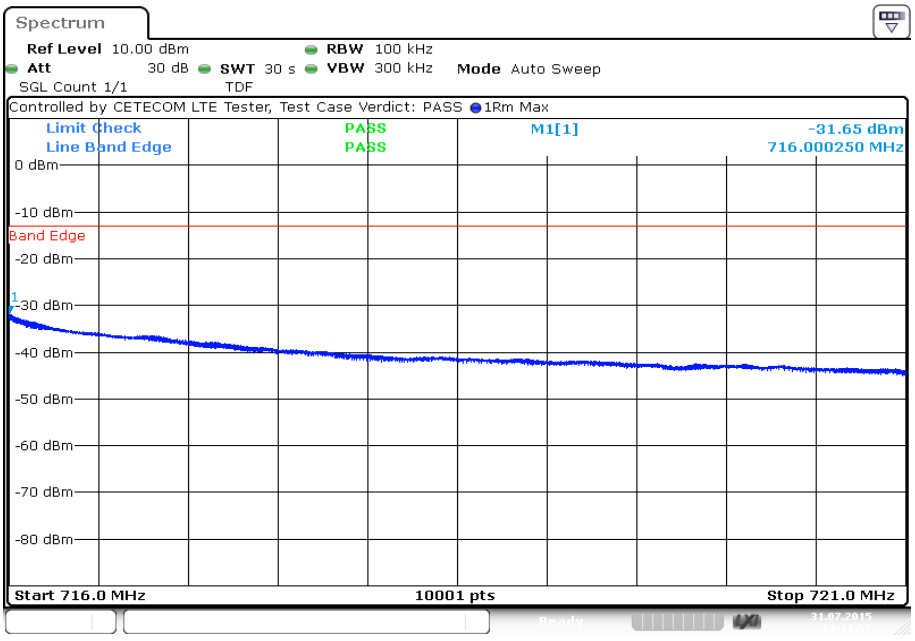
Results: **10 MHz channel bandwidth**

Plot 1: Lowest channel, QPSK modulation



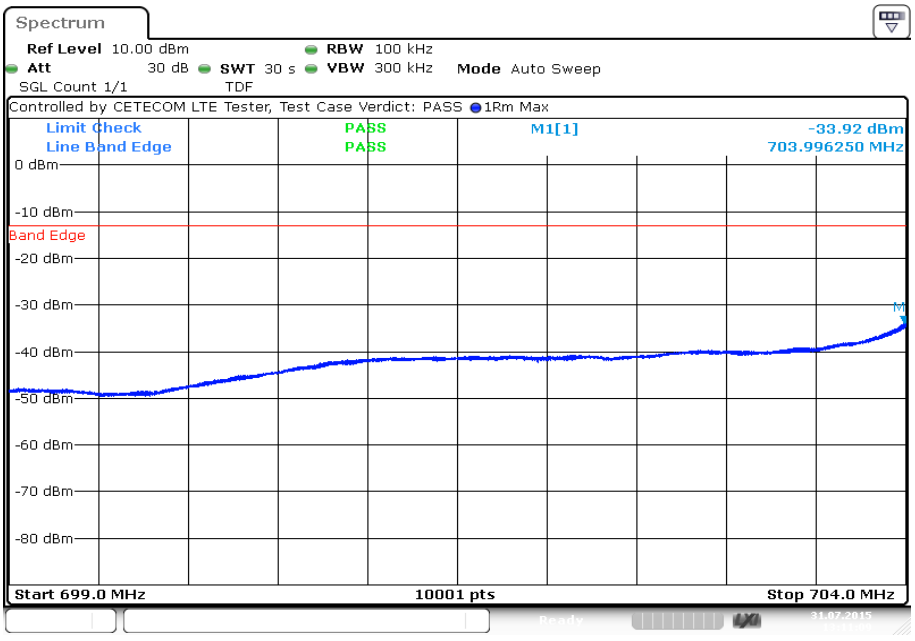
Date: 31.JUL.2015 13:10:32

Plot 2: Highest channel, QPSK modulation

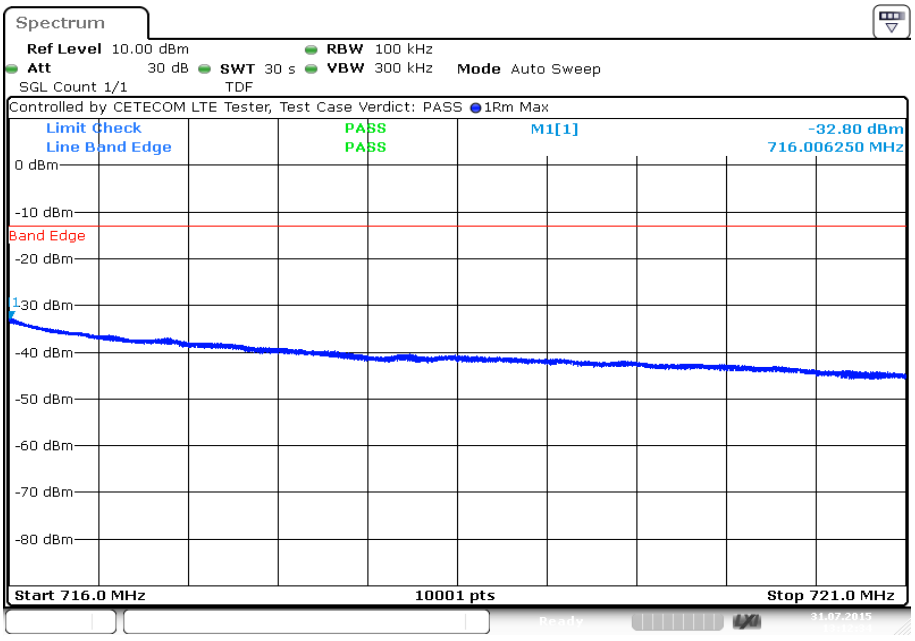


Date: 31.JUL.2015 13:11:57

Plot 3: Lowest channel, 16 – QAM modulation



Plot 4: Highest channel, 16 – QAM modulation



Verdict: compliant

11.4.6 Occupied bandwidth

Description:

Measurement of the occupied bandwidth of the transmitted signal.

Measurement:

Similar to conducted emissions, occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE band 17. The table below lists the measured 99% power 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:	≥ 3xRBW
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:

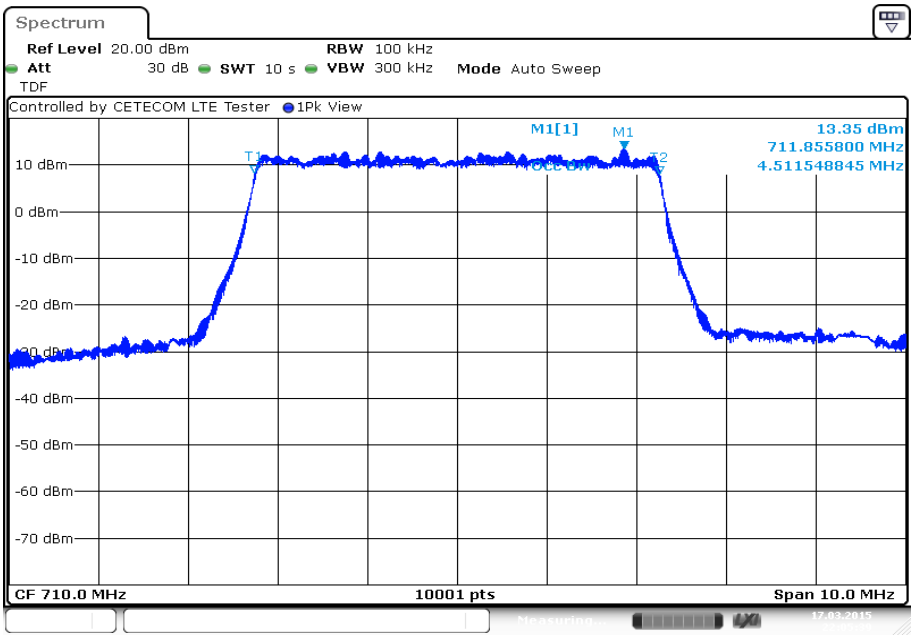
Occupied Bandwidth - QPSK		
Bandwidth [MHz]	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
5	4512	5046
10	9063	10217
Measurement uncertainty	± 100 kHz	

Occupied Bandwidth – 16-QAM		
Bandwidth [MHz]	**99% OBW (kHz)**	**-26 dBc BW (kHz)**
5	4503	5036
10	9057	10095
Measurement uncertainty	± 100 kHz	

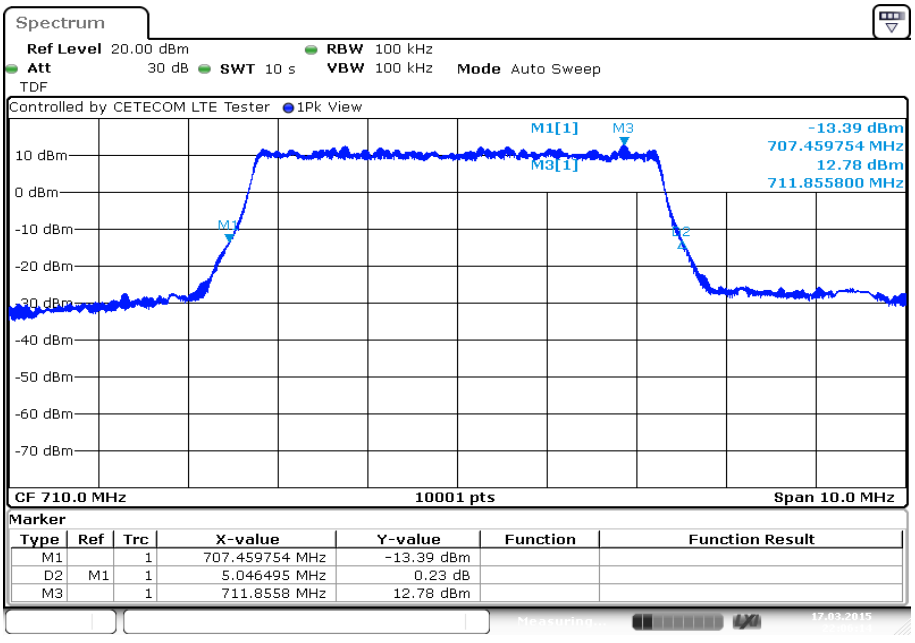
Verdict: **compliant**

Plots: QPSK

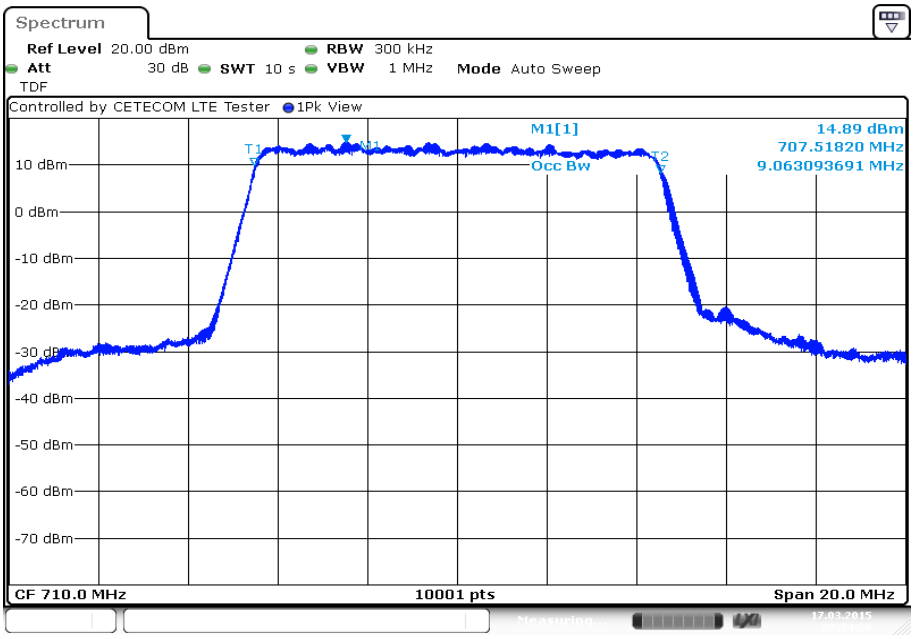
Plot 1: 5 MHz, 99% OBW



Plot 2: 5 MHz, -26 dBc OBW

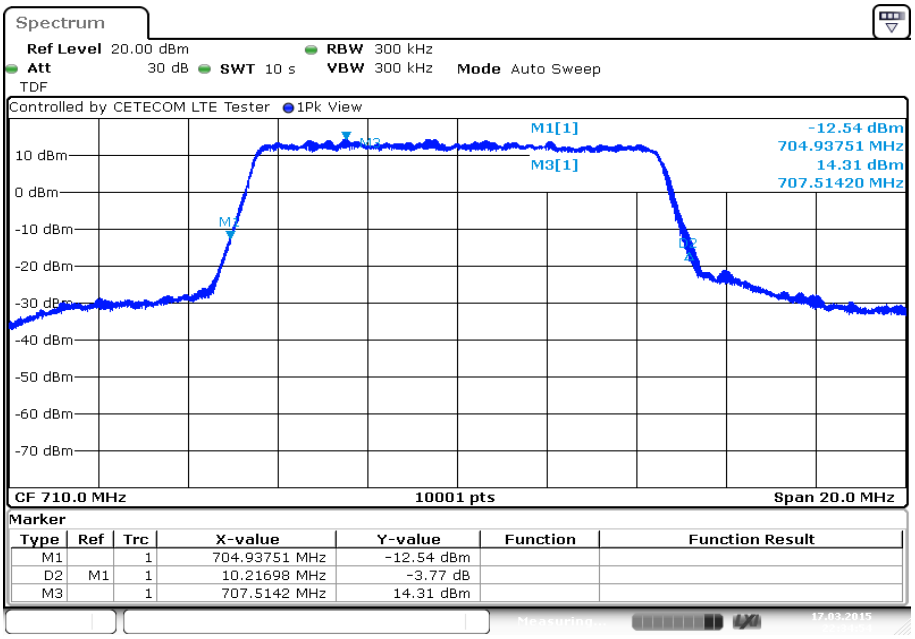


Plot 3: 10 MHz, 99% OBW



Date: 17.MAR.2015 22:34:20

Plot 4: 10 MHz, -26 dBc OBW



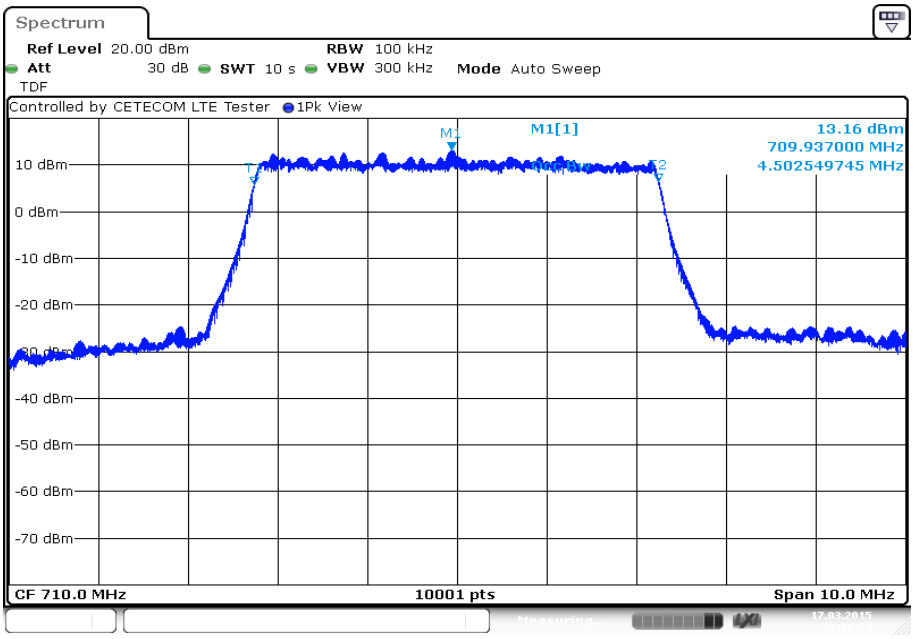
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	704.93751 MHz	-12.54 dBm		
D2	M1	1	10.21698 MHz	-3.77 dB		
M3		1	707.5142 MHz	14.31 dBm		

Date: 17.MAR.2015 22:34:55

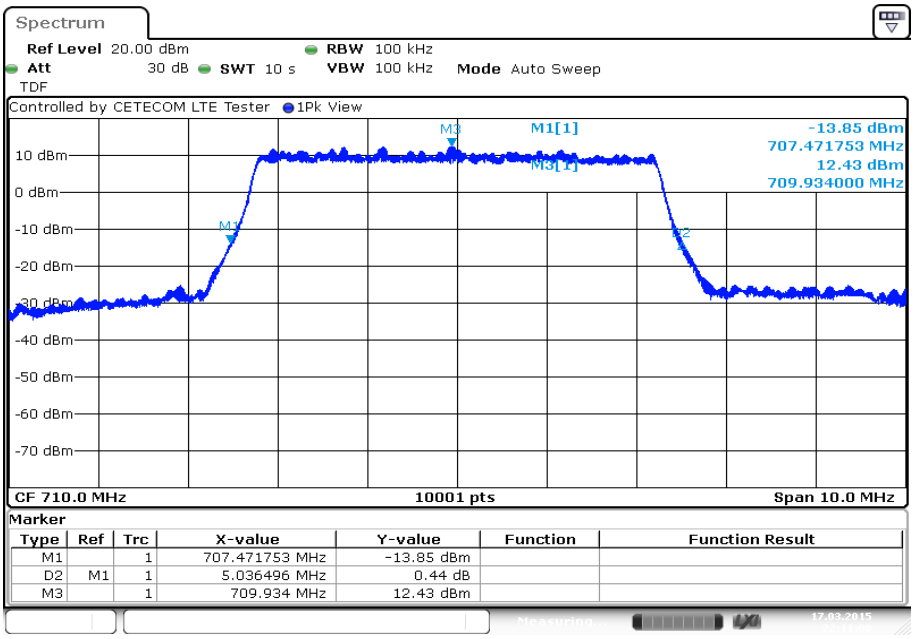
Plots: 16-QAM

Plot 1: 5 MHz, 99% OBW



Date: 17.MAR.2015 22:10:34

Plot 2: 5 MHz, -26 dBc OBW

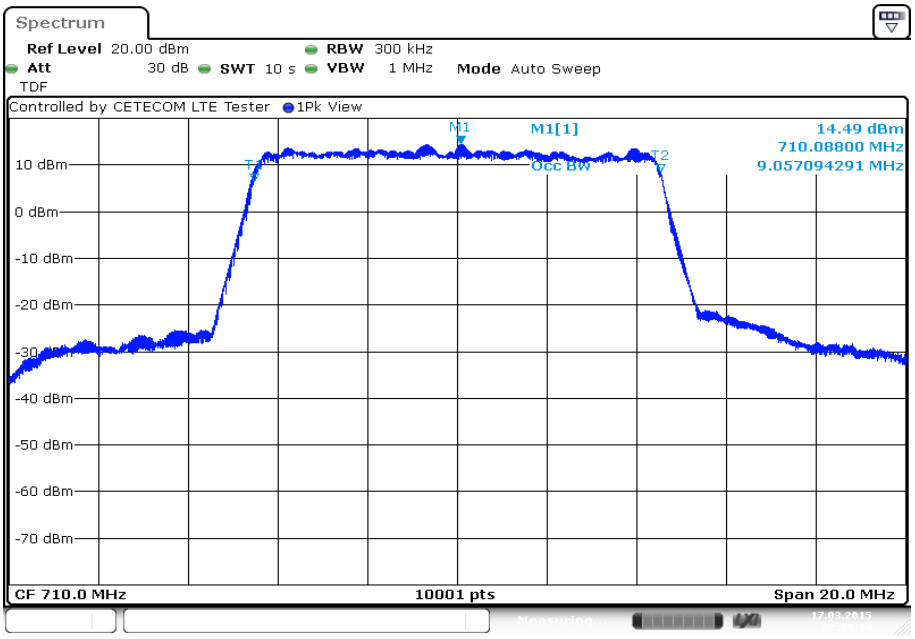


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	707.471753 MHz	-13.85 dBm		
D2	M1	1	5.036496 MHz	0.44 dB		
M3		1	709.934 MHz	12.43 dBm		

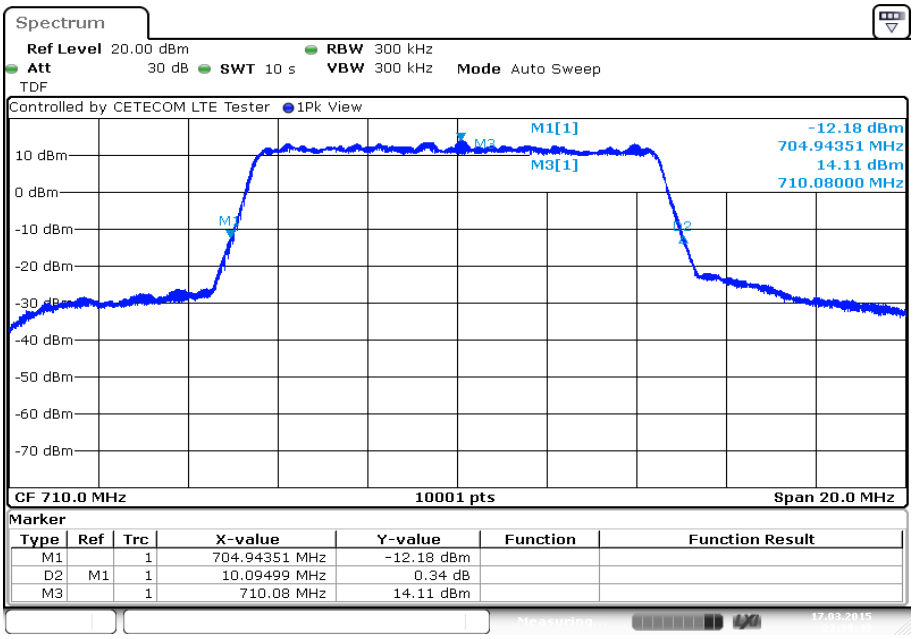
Date: 17.MAR.2015 22:11:09

Plot 3: 10 MHz, 99% OBW



Date: 17.MAR.2015 22:39:15

Plot 4: 10 MHz, -26 dBc OBW



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	704.94351 MHz	-12.18 dBm		
D2	M1	1	10.09499 MHz	0.34 dB		
M3		1	710.08 MHz	14.11 dBm		

Date: 17.MAR.2015 22:39:50

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	2015-06-24
A	Editorial changes	2015-08-05

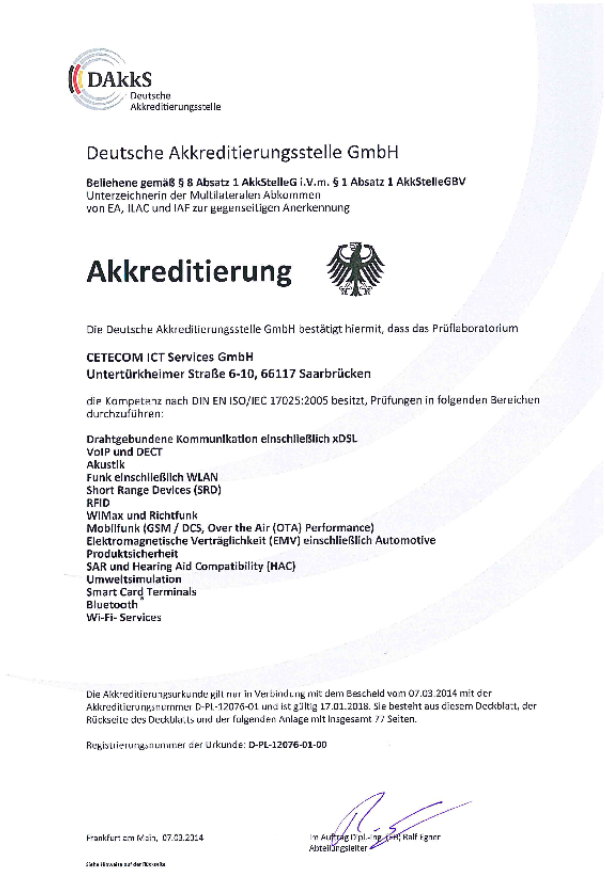
Annex B Further information

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

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. **§ 1 Absatz 1 AkkStelleGBV**
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

Akkreditierung

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

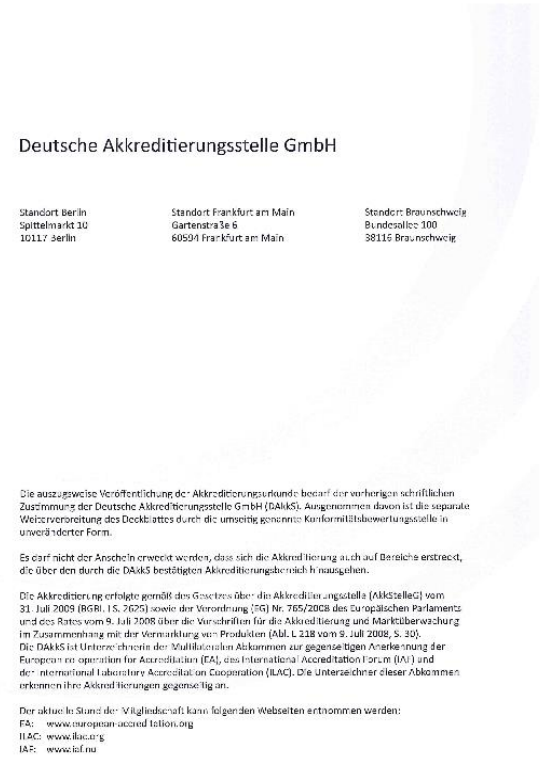
Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

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



Deutsche Akkreditierungsstelle GmbH

Standort Berlin
Spittelmarkt 10
10117 Berlin

Standort Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Standort Braunschweig
Bundesallee 100
38116 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen Zustimmung der Deutsche Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt, die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).
Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Note:

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

http://www.cetecom.com/eu/de/cetecom-group/europa/deutschland-saarbruecken/akkreditierungen.html