

4. Occupied Bandwidth

4.1. Limit

CFR 47, Section FCC §2.1049 and IC RSS-Gen Issue 5 6.7.

4.2. Test Procedure

FCC

The test follows section 5.4.4 of ANSI C63.26-2015.

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (typically a span of $1.5 \times \text{OBW}$ is sufficient).
- b. The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be set $\geq 3 \times \text{RBW}$.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- d. Set the detection mode to peak, and the trace mode to max-hold.
- e. If the instrument does not have a 99 % OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5 % of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5 % of the total is reached and record that frequency as the upper OBW frequency. The 99 % power OBW can be determined by computing the difference these two frequencies.
- f. The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).

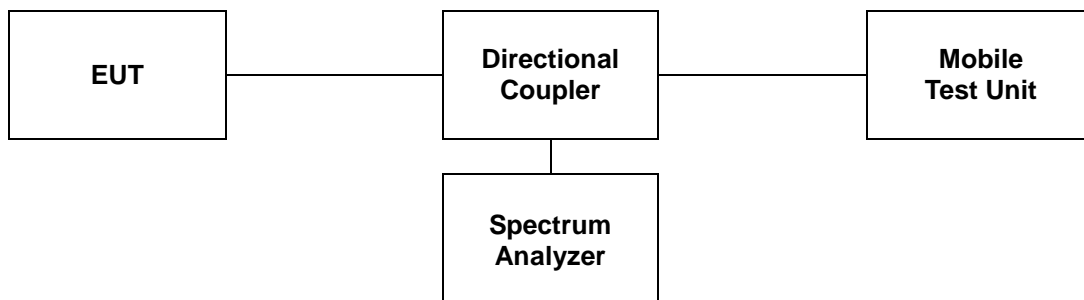
IC

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99 % emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99 % emission bandwidth).



4.3 Test Results

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

SIM 1

Band	SCS (kHz)	BW (MHz)	Frequency (MHz)	Occupied Bandwidth (MHz)				
				DFT-S-OFDM BPSK	DFT-S-OFDM QPSK	DFT-S-OFDM 16QAM	CP-OFDM QPSK	CP-OFDM 16QAM
25	15	5	1 882.5	4.486	4.486	4.486	4.515	4.501
		10		8.915	8.944	8.944	9.291	9.262
		15		13.502	13.589	13.502	14.197	14.110
		20		17.887	17.887	17.945	18.929	18.987
		25		22.938	22.938	22.938	23.878	23.806
		30		28.741	28.654	28.654	28.567	28.567
		40		38.437	38.669	38.669	38.553	38.553
41 (FCC)	30	20	2 593.0	17.887	17.945	17.945	18.234	18.292
		30		26.918	27.004	26.918	27.959	27.873
		40		35.890	35.890	35.774	37.974	38.090
		50		45.731	45.876	45.586	46.612	47.467
		60		58.177	58.177	58.177	58.177	58.003
		80		77.337	77.106	77.337	77.569	77.569
		90		86.744	87.004	87.004	87.265	87.265
		100		96.093	96.382	96.382	97.540	97.540
		41 (IC)		30	20	2 595.0	17.887	17.945
30	26.918		26.744		26.918		27.873	27.873
40	35.658		35.890		35.774		37.974	37.974
50	45.586		45.876		45.586		47.467	47.467
60	58.177		58.003		58.003		58.177	58.003
80	77.337		77.569		77.337		77.569	77.569
90	86.744		87.265		86.744		87.786	87.265
100	96.671		96.382		96.382		97.540	97.540
66	15		5		1 745.0		4.501	4.486
		10	8.915	8.973		8.944	9.291	9.262
		15	13.459	13.546		13.502	14.153	14.153
		20	17.887	17.829		17.887	18.929	18.987
		40	38.437	38.669		38.553	38.553	38.553
71	15	5	680.5	4.486	4.501	4.486	4.486	4.515
		10		8.915	8.944	8.944	9.291	9.262
		15		13.415	13.589	13.459	14.197	14.110
		20		17.829	17.887	17.887	18.929	18.929

ENDC

Band	SCS (kHz)	BW (MHz)	Frequency (MHz)	Occupied Bandwidth (MHz)				
				DFT-S-OFDM BPSK	DFT-S-OFDM QPSK	DFT-S-OFDM 16QAM	CP-OFDM QPSK	CP-OFDM 16QAM
13A-n2A	15	5	1 880.0	4.476	4.476	4.476	4.476	4.476
		10		8.951	8.931	8.951	9.311	9.271
		15		13.397	13.487	13.427	14.086	14.086
		20		17.822	17.822	17.862	18.901	18.941
Band	SCS (kHz)	BW (MHz)	Frequency (MHz)	Occupied Bandwidth (MHz)				
				DFT-S-OFDM BPSK	DFT-S-OFDM QPSK	DFT-S-OFDM 16QAM	CP-OFDM QPSK	CP-OFDM 16QAM
2A-n5A	15	5	836.5	4.476	4.476	4.476	4.476	4.476
		10		8.951	8.951	8.931	9.291	9.271
		15		13.427	13.487	13.427	14.116	14.086
		20		17.862	17.862	17.822	18.821	18.901

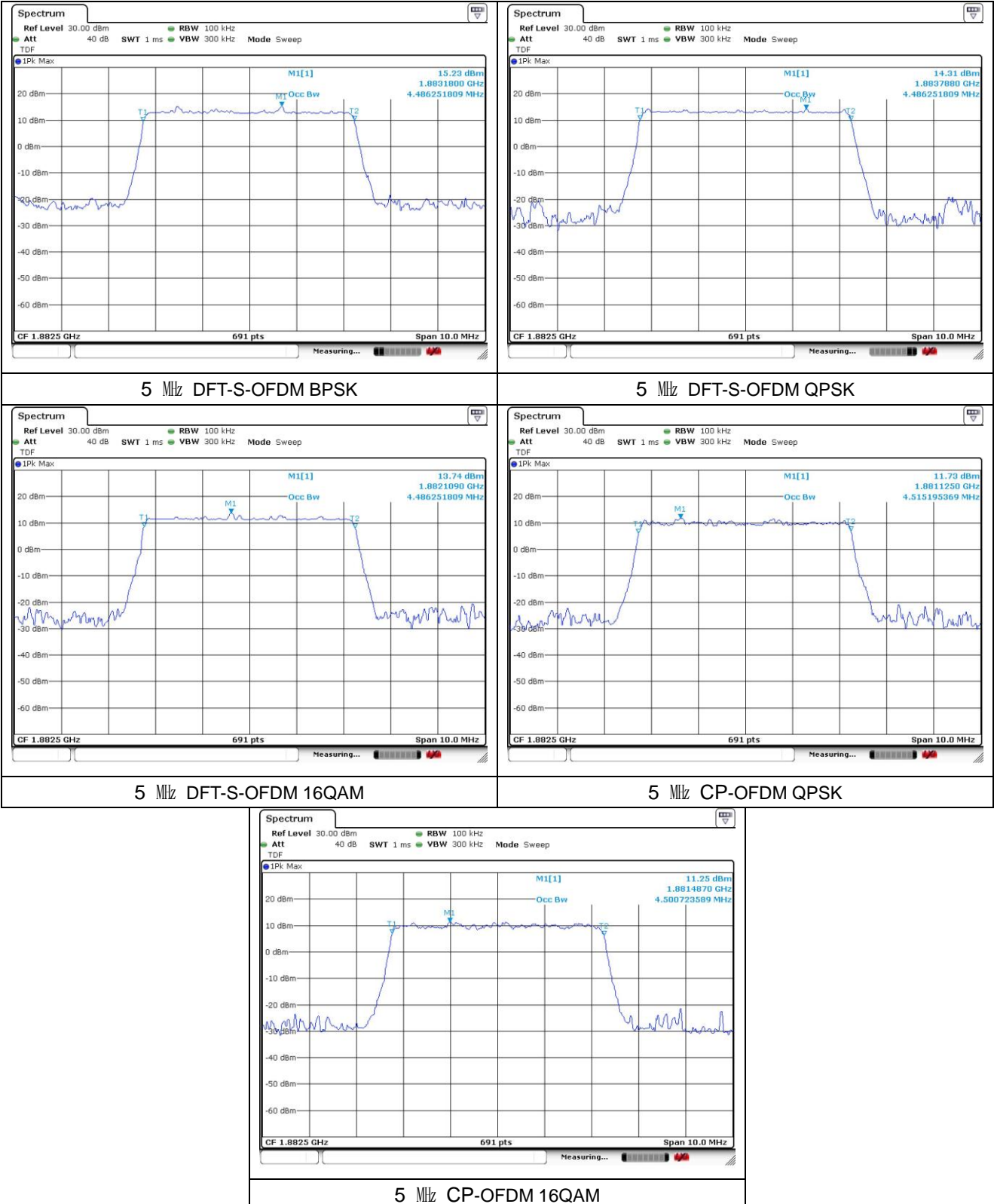
SIM 2

Band	SCS (kHz)	BW (MHz)	Frequency (MHz)	Occupied Bandwidth (MHz)				
				DFT-S-OFDM BPSK	DFT-S-OFDM QPSK	DFT-S-OFDM 16QAM	CP-OFDM QPSK	CP-OFDM 16QAM
25	15	5	1 882.5	4.486	4.472	4.486	4.501	4.501
		10		8.944	8.915	8.944	9.291	9.262
		15		13.502	13.589	13.502	14.197	14.153
		20		17.887	17.887	17.945	18.929	18.987
		25		22.865	23.010	22.938	23.878	23.806
		30		28.741	28.654	28.654	28.567	28.567
		40		38.437	38.669	38.669	38.553	38.669
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41 (FCC)	30	20	2 593.0	17.887	17.945	17.945	18.177	18.234
		30		26.918	26.918	26.918	27.873	27.873
		40		35.658	35.890	35.774	37.974	37.974
		50		45.731	45.876	45.586	47.467	47.467
		60		58.003	58.003	58.003	58.003	58.003
		80		77.337	77.106	77.106	77.800	77.569
		90		86.744	86.744	86.744	87.525	87.786
		100		96.671	96.382	96.093	97.540	97.540
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				DFT-S-OFDM BPSK	DFT-S-OFDM QPSK	DFT-S-OFDM 16QAM	CP-OFDM QPSK	CP-OFDM 16QAM
41 (IC)	30	20	2 595.0	17.887	17.945	17.945	18.292	18.234
		30		26.918	26.744	26.918	27.873	27.873
		40		35.658	35.890	35.774	37.858	37.974
		50		45.731	45.876	45.586	47.467	47.467
		60		58.177	58.177	58.003	58.003	58.003
		80		77.337	77.106	77.106	77.800	77.569
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		100		96.382	96.382	96.382	97.540	97.540
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66	15	5	1 745.0	4.486	4.486	4.486	4.515	4.501
		10		8.915	8.944	8.944	9.320	9.262
		15		13.459	13.589	13.502	14.197	14.110
		20		17.887	17.829	17.945	18.929	18.929
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Band	SCS (kHz)	BW (MHz)	Frequency (MHz)	Occupied Bandwidth (MHz)				
				DFT-S-OFDM BPSK	DFT-S-OFDM QPSK	DFT-S-OFDM 16QAM	CP-OFDM QPSK	CP-OFDM 16QAM
71	15	5	680.5	4.486	4.501	4.486	4.501	4.501
		10		8.944	8.973	8.944	9.291	9.291
		15		13.459	13.546	13.502	14.153	14.153
		20		17.829	17.887	17.887	18.929	18.929

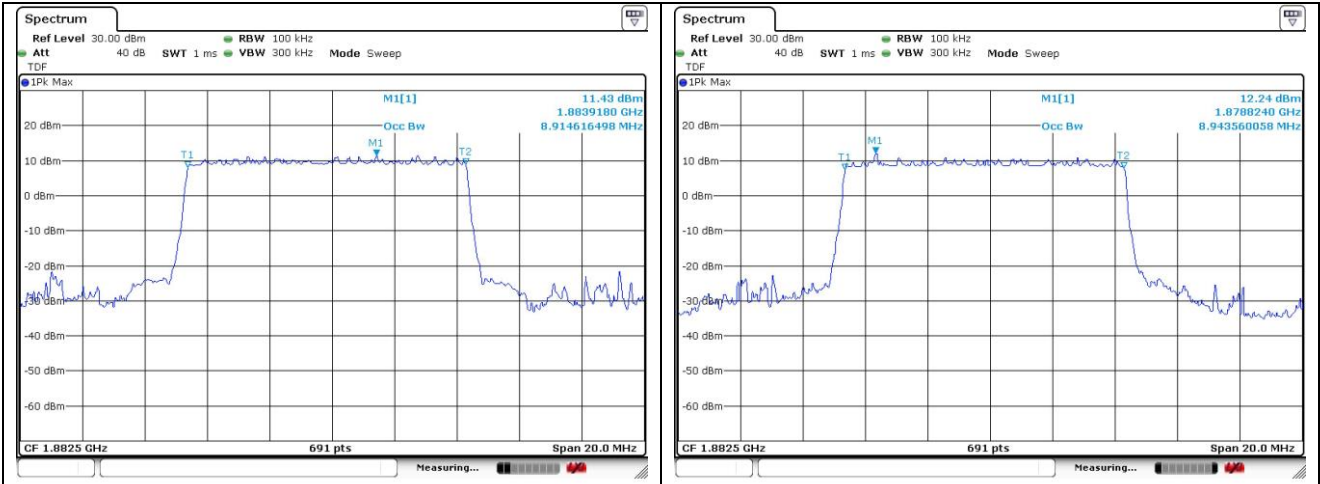
- Test plots

SIM 1

NR band 25

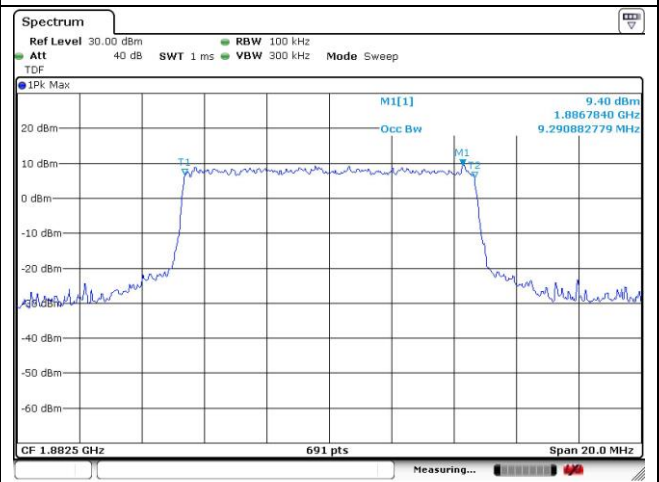
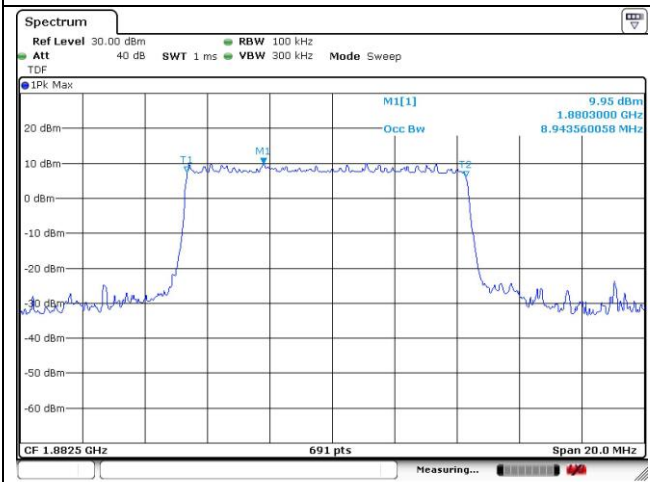


NR band 25



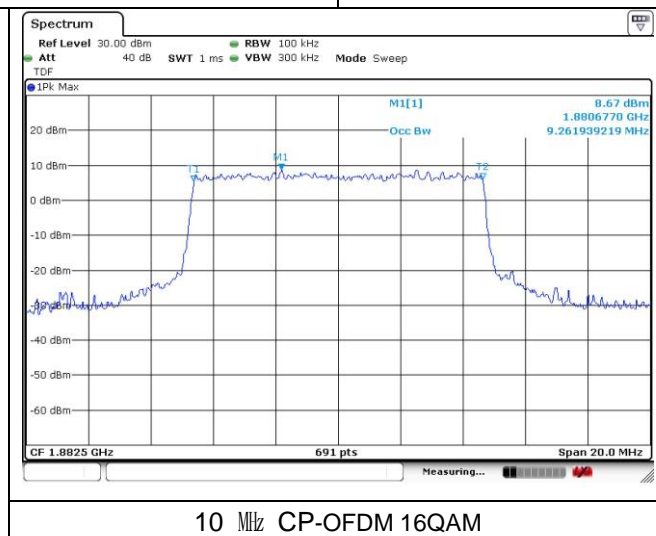
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10 MHz DFT-S-OFDM QPSK



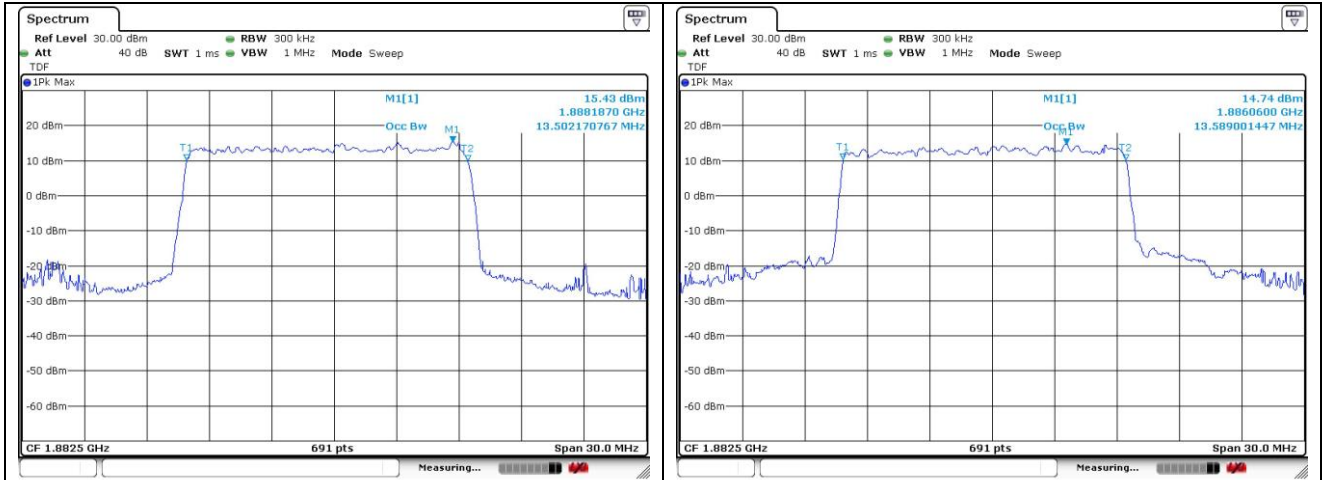
10 MHz DFT-S-OFDM 16QAM

10 MHz CP-OFDM QPSK



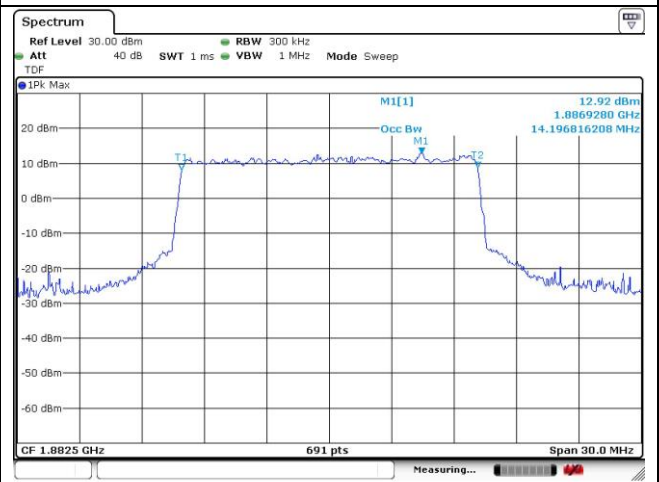
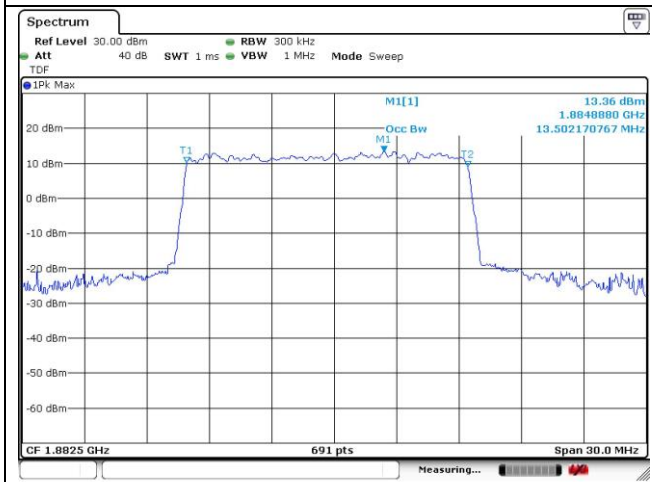
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NR band 25



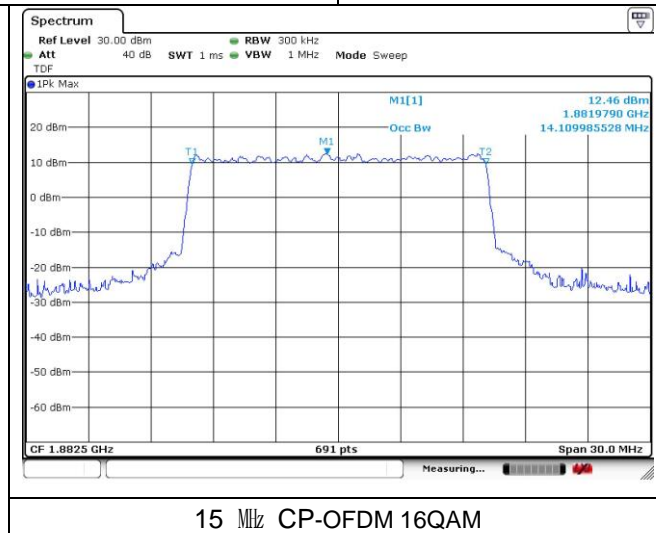
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15 MHz DFT-S-OFDM QPSK



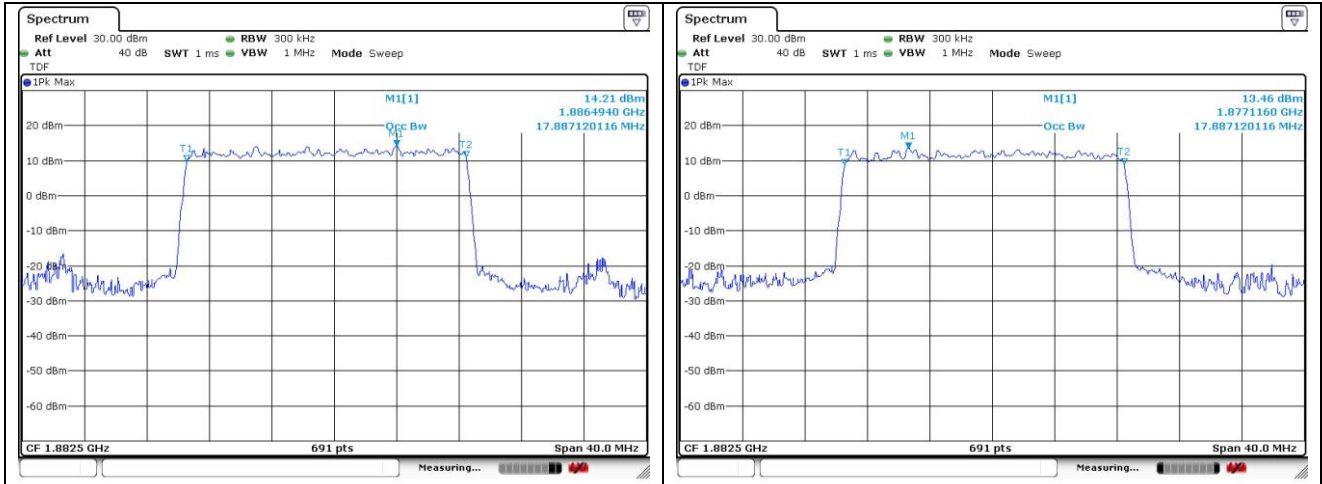
15 MHz DFT-S-OFDM 16QAM

15 MHz CP-OFDM QPSK



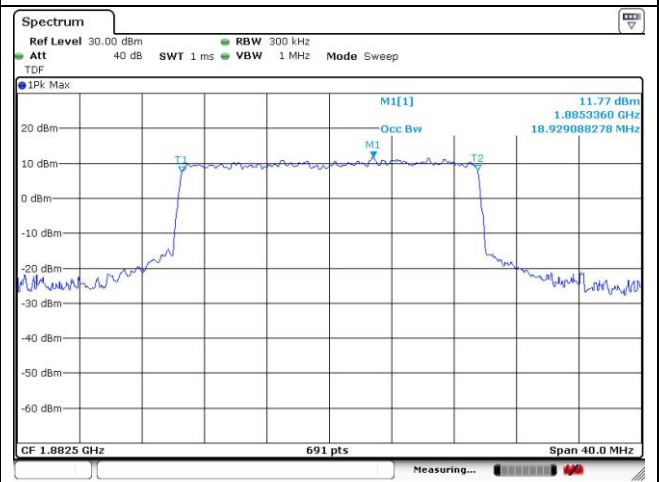
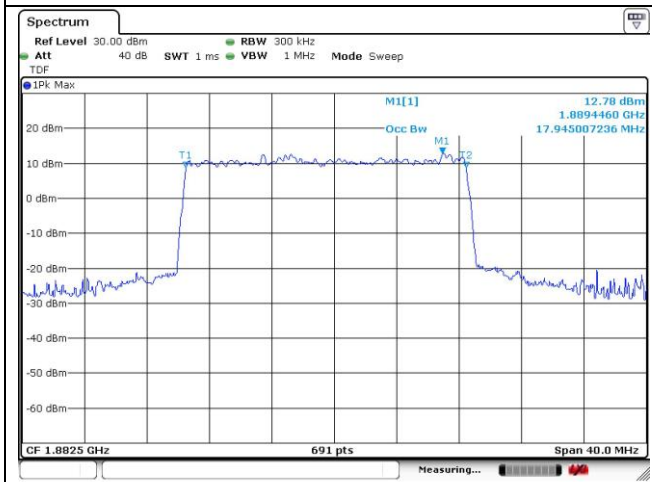
15 MHz CP-OFDM 16QAM

NR band 25



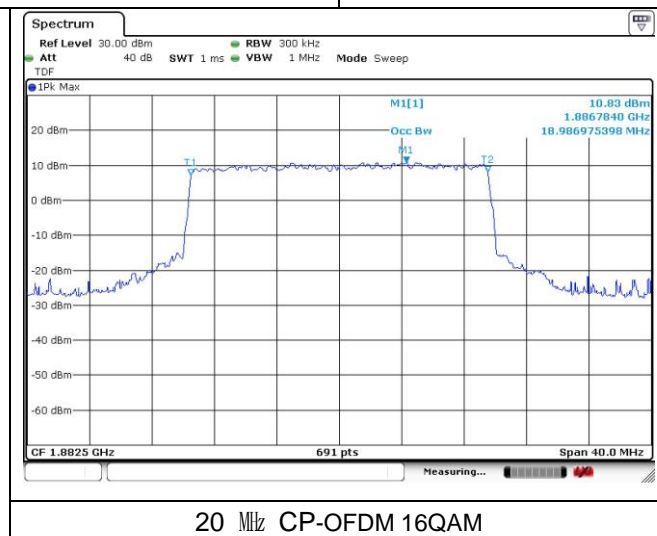
20 MHz DFT-S-OFDM BPSK

20 MHz DFT-S-OFDM QPSK



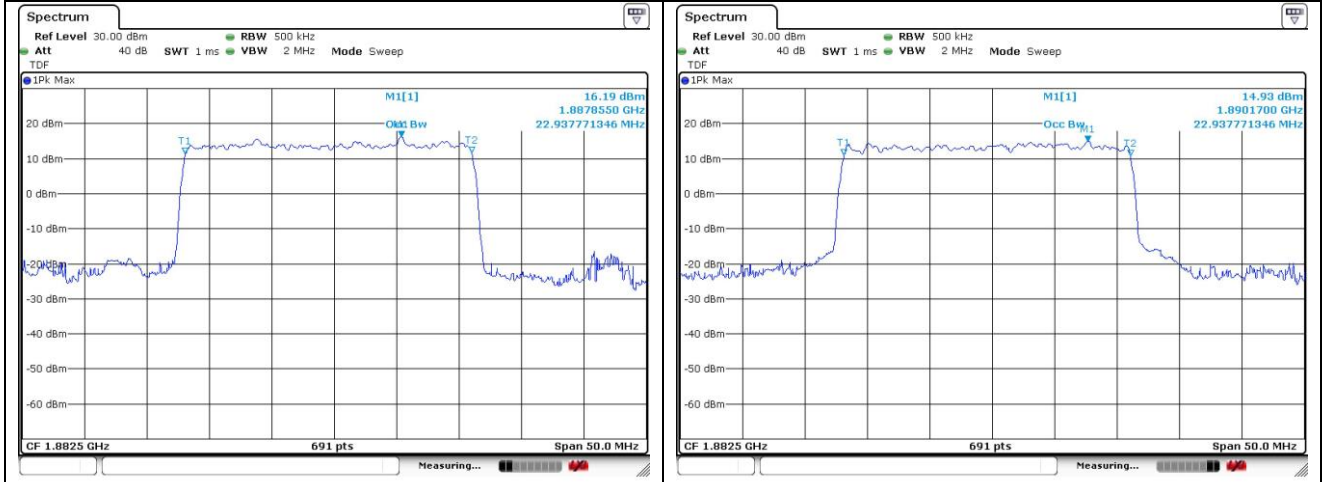
20 MHz DFT-S-OFDM 16QAM

20 MHz CP-OFDM QPSK



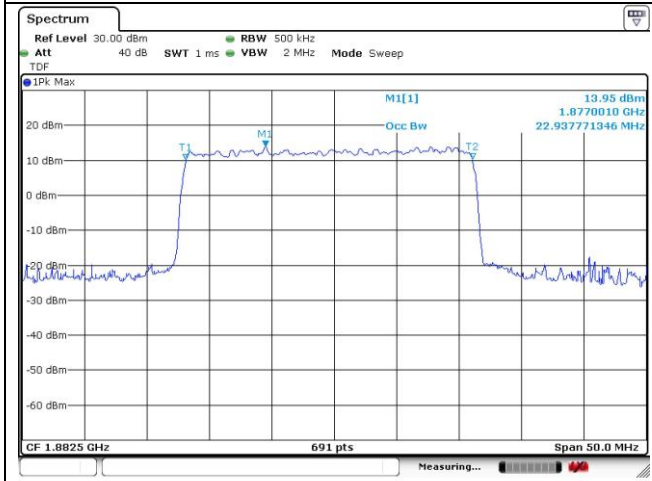
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NR band 25



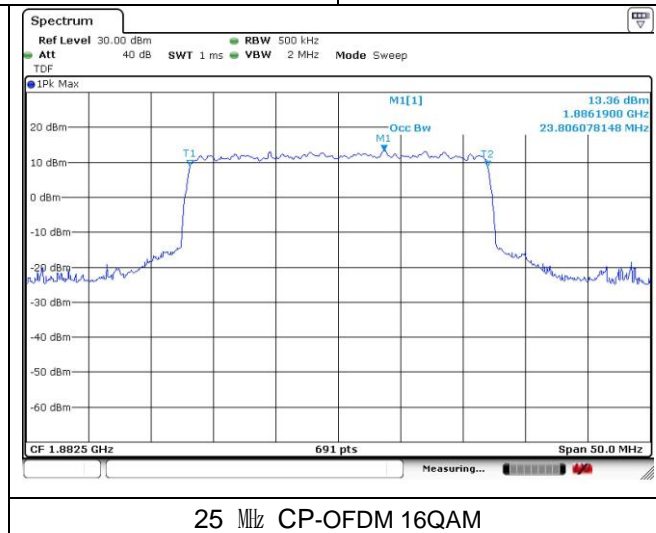
25 MHz DFT-S-OFDM BPSK

25 MHz DFT-S-OFDM QPSK



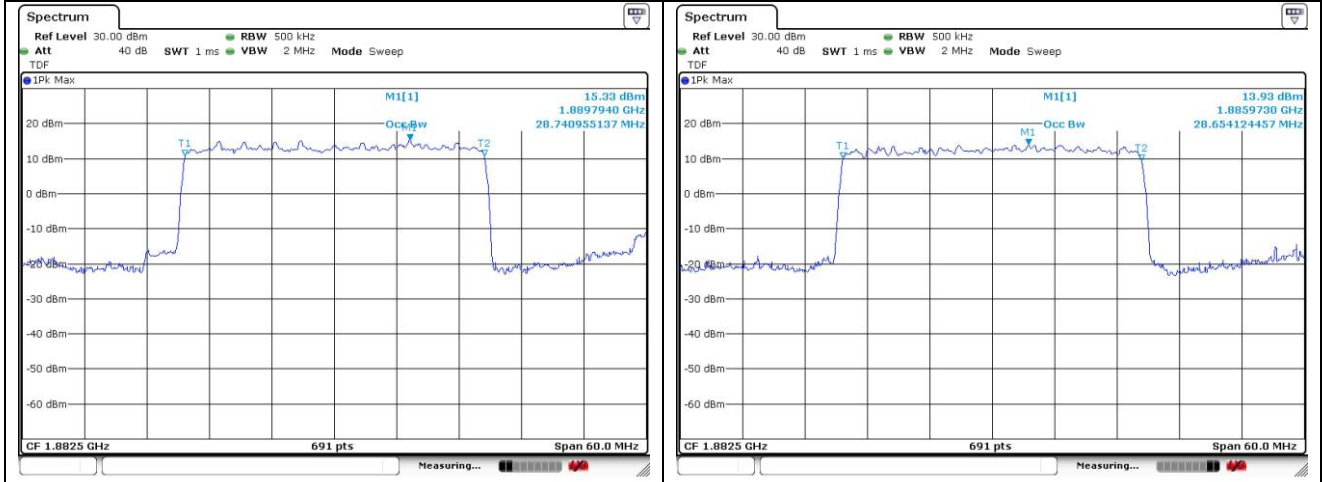
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25 MHz CP-OFDM QPSK



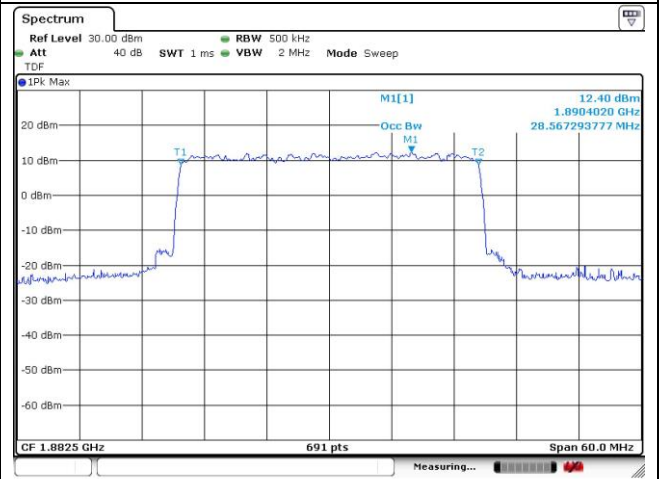
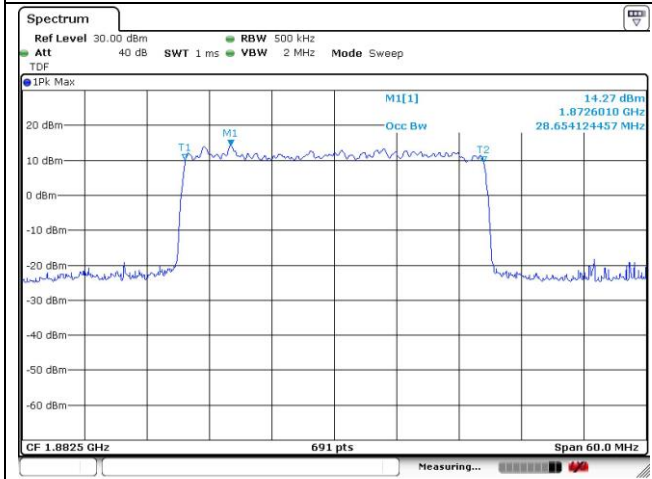
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NR band 25



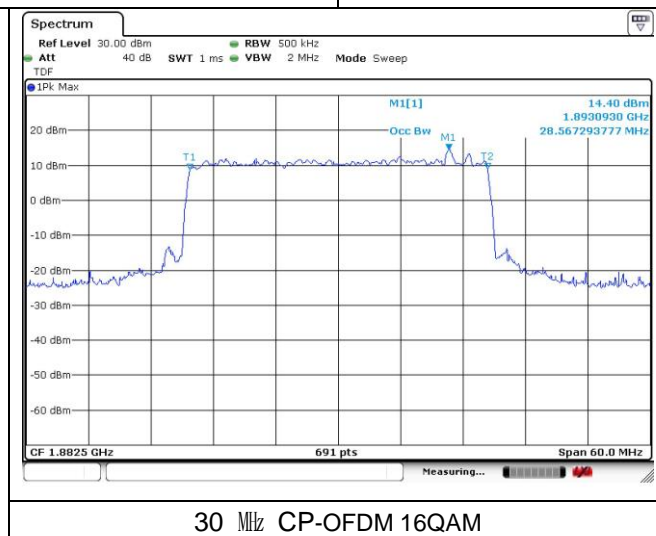
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30 MHz DFT-S-OFDM QPSK



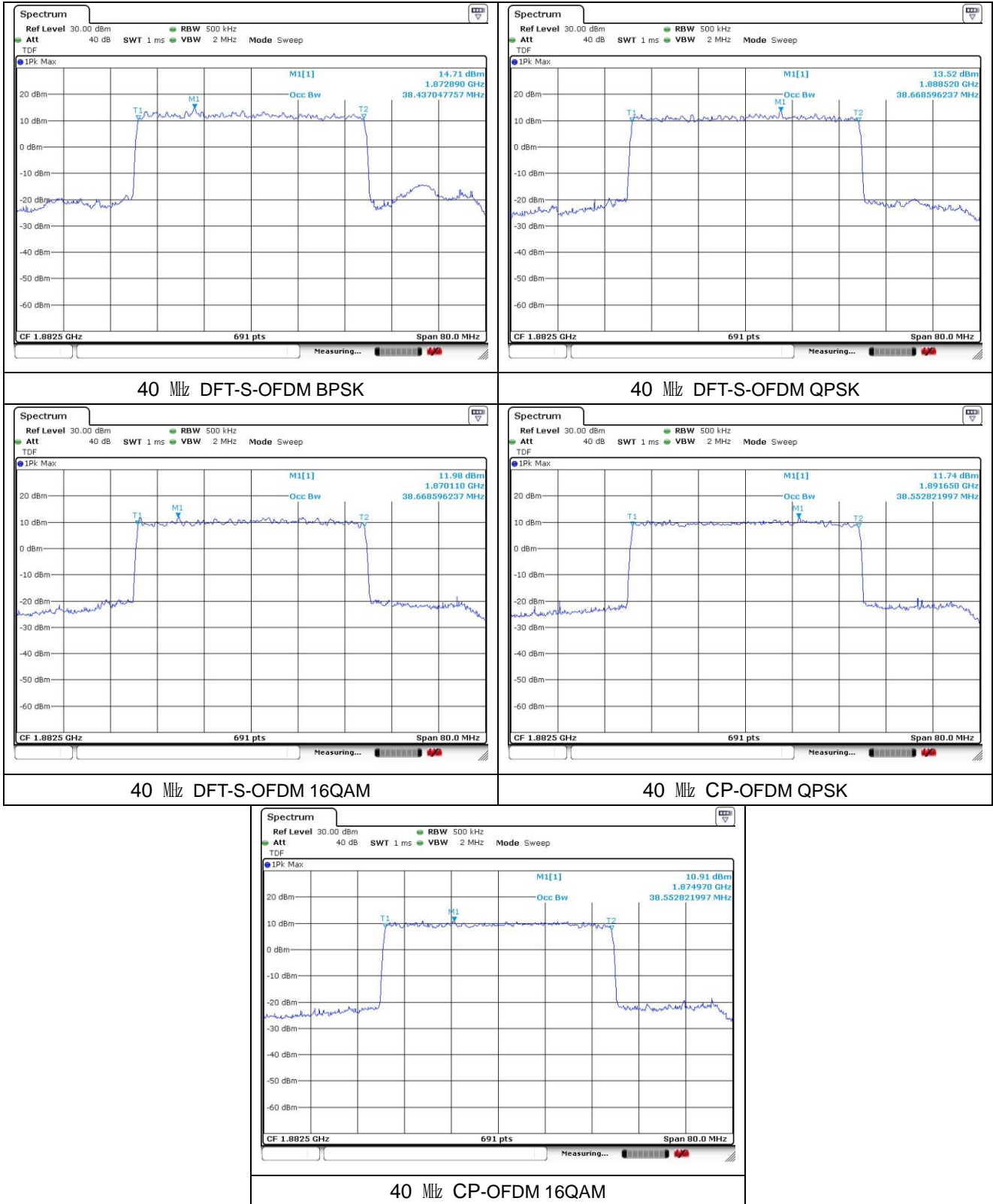
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30 MHz CP-OFDM QPSK

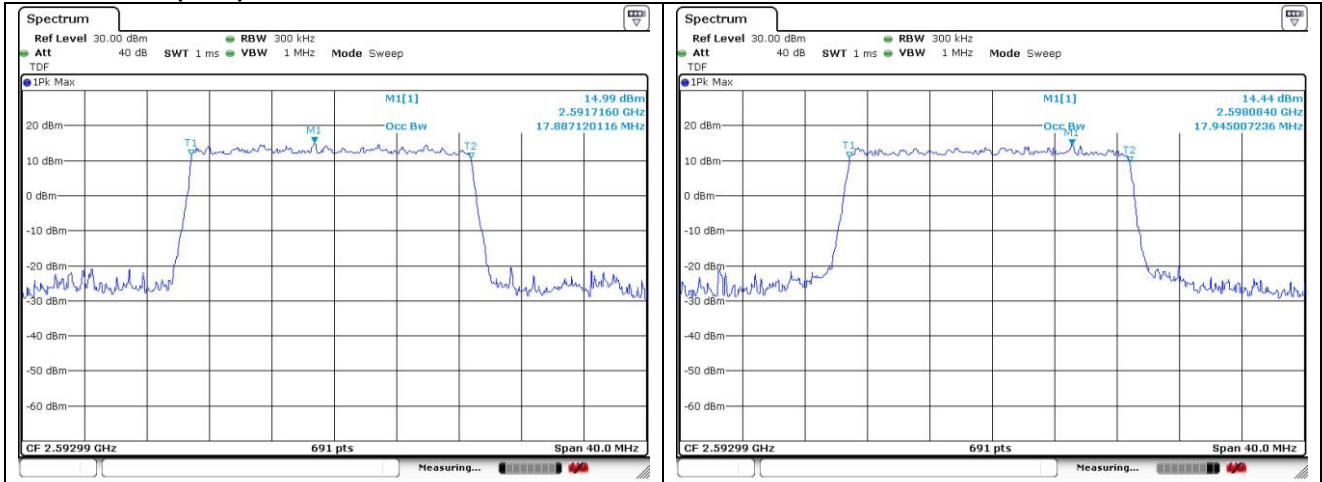


30 MHz CP-OFDM 16QAM

NR band 25

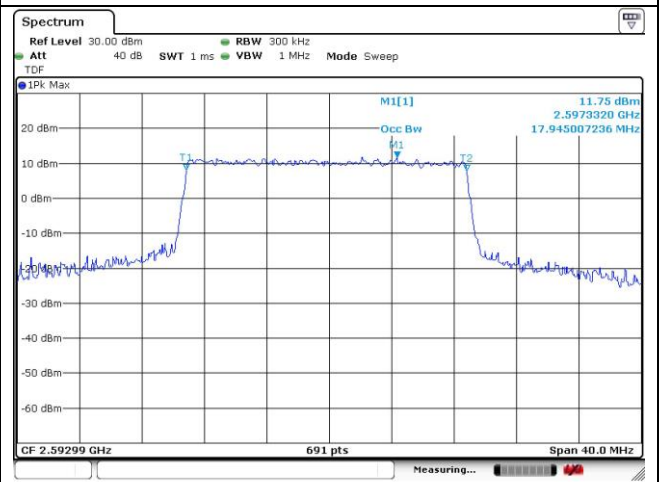
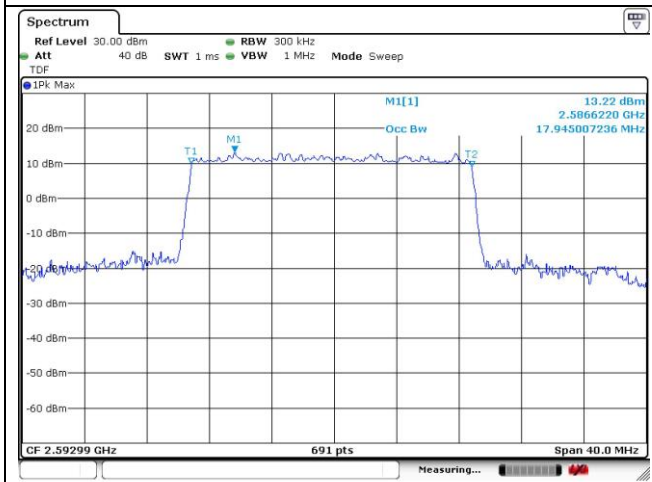


NR band 41 (FCC)



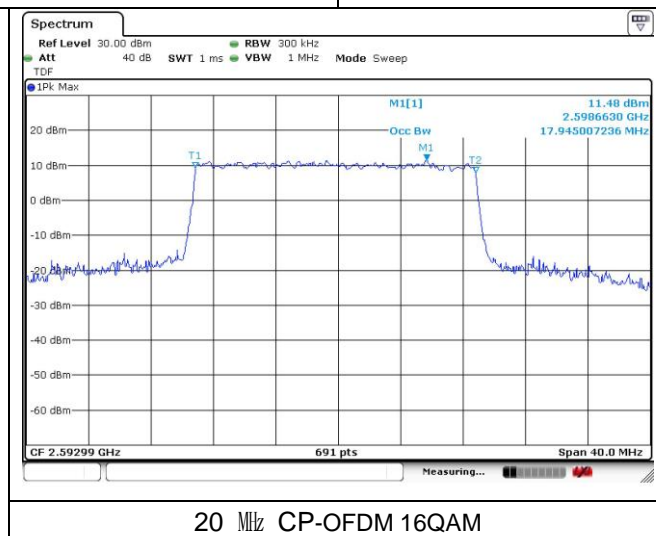
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20 MHz DFT-S-OFDM QPSK



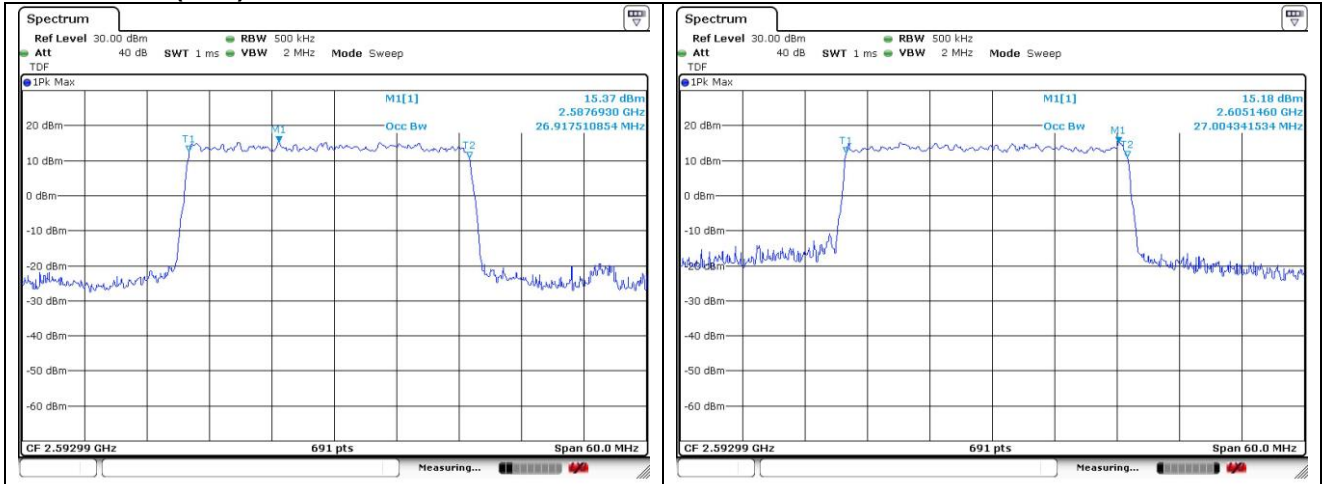
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20 MHz CP-OFDM QPSK



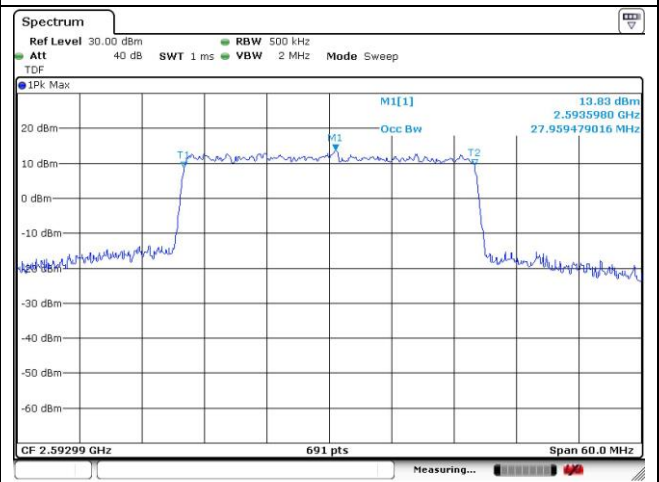
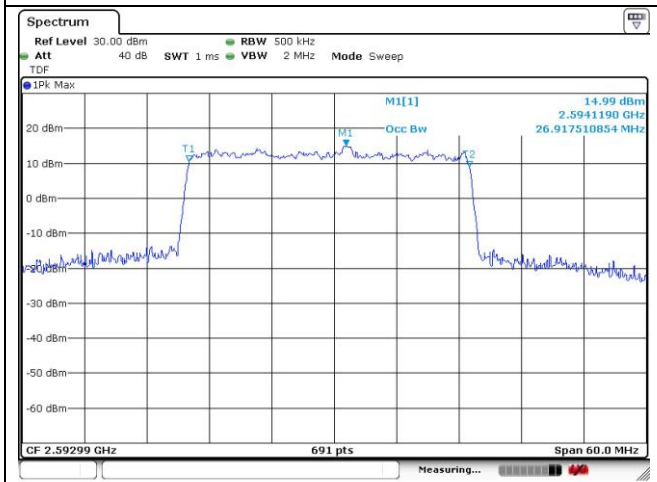
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NR band 41 (FCC)



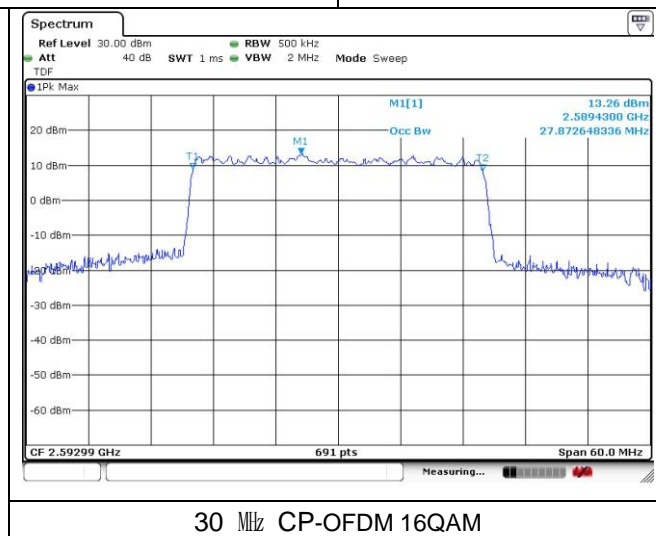
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30 MHz DFT-S-OFDM QPSK



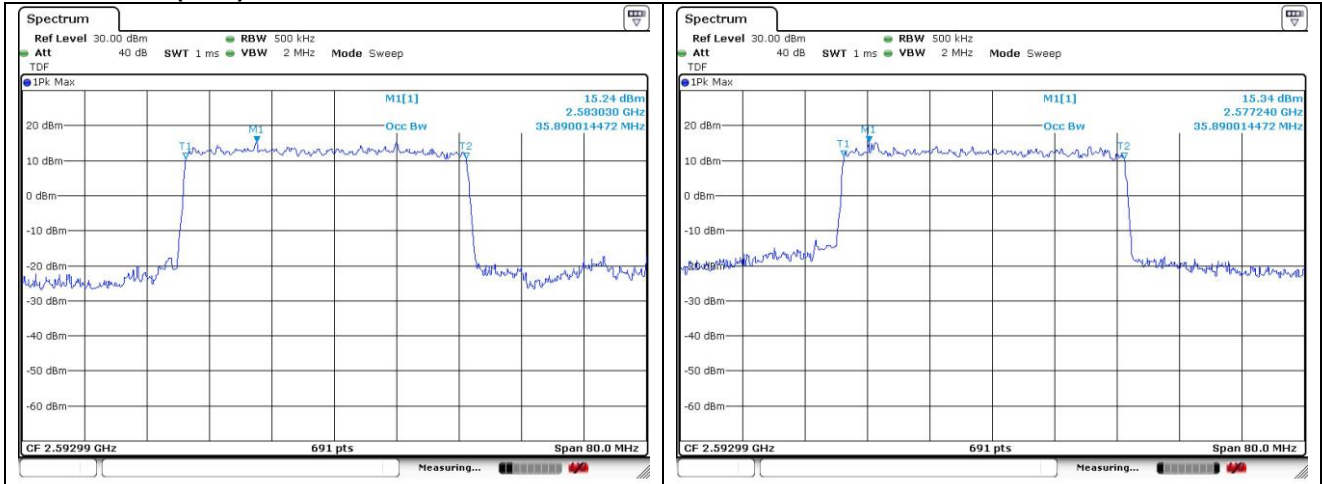
30 MHz DFT-S-OFDM 16QAM

30 MHz CP-OFDM QPSK



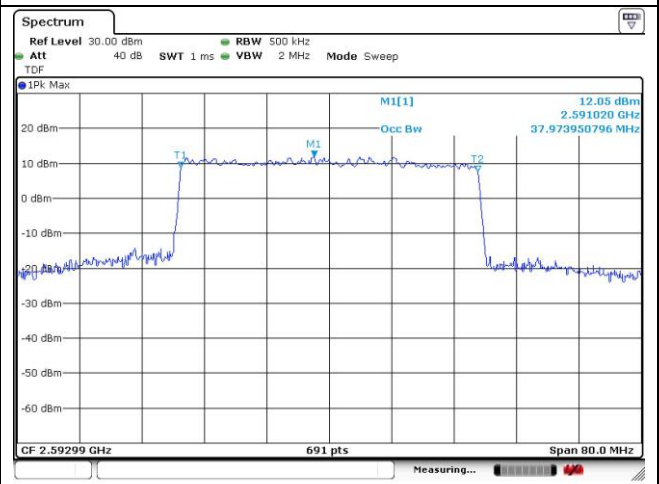
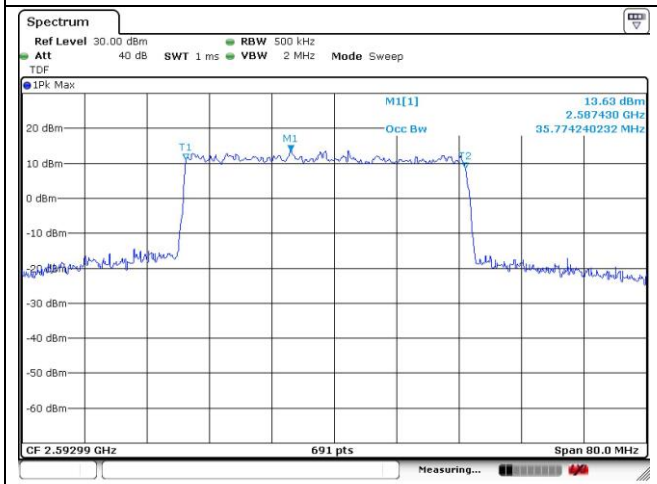
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NR band 41 (FCC)



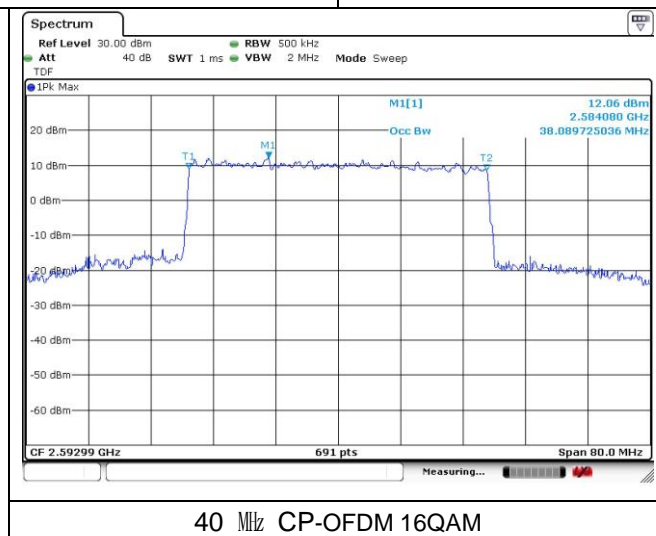
40 MHz DFT-S-OFDM BPSK

40 MHz DFT-S-OFDM QPSK



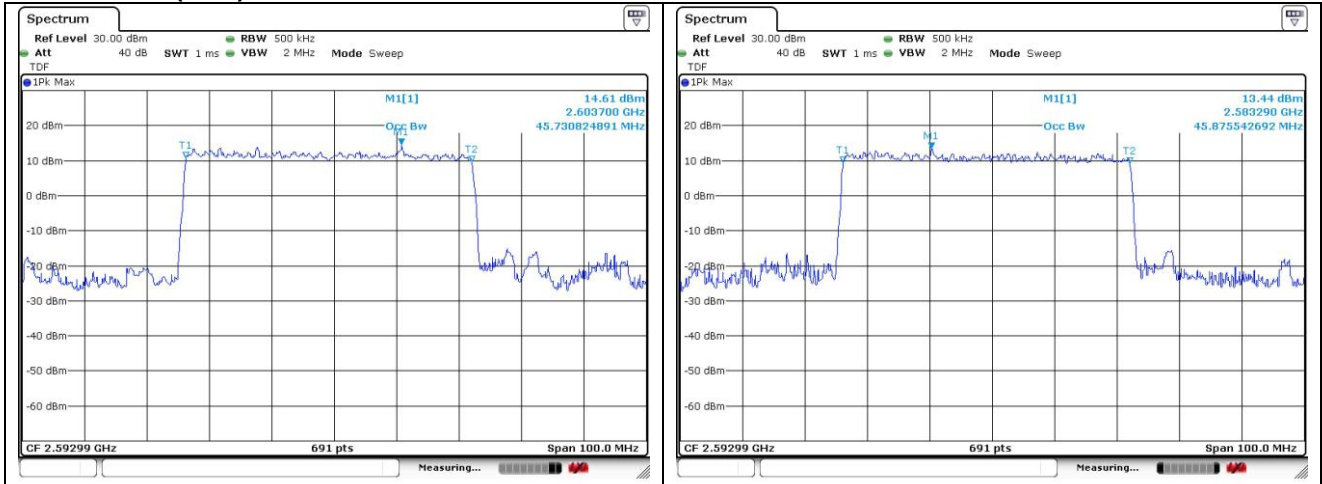
40 MHz DFT-S-OFDM 16QAM

40 MHz CP-OFDM QPSK



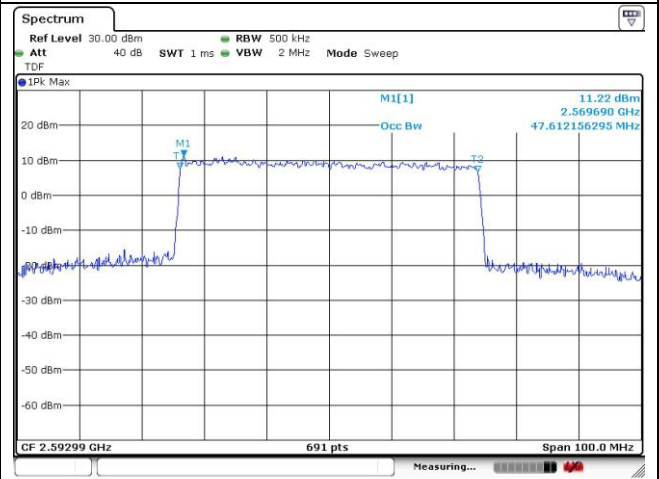
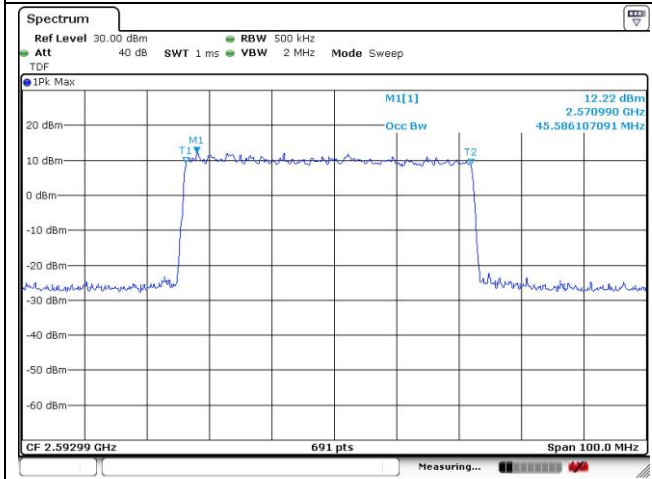
40 MHz CP-OFDM 16QAM

NR band 41 (FCC)



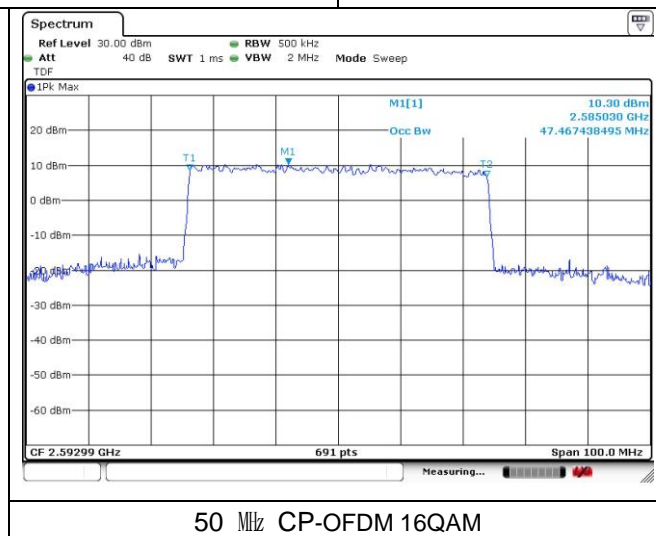
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50 MHz DFT-S-OFDM QPSK



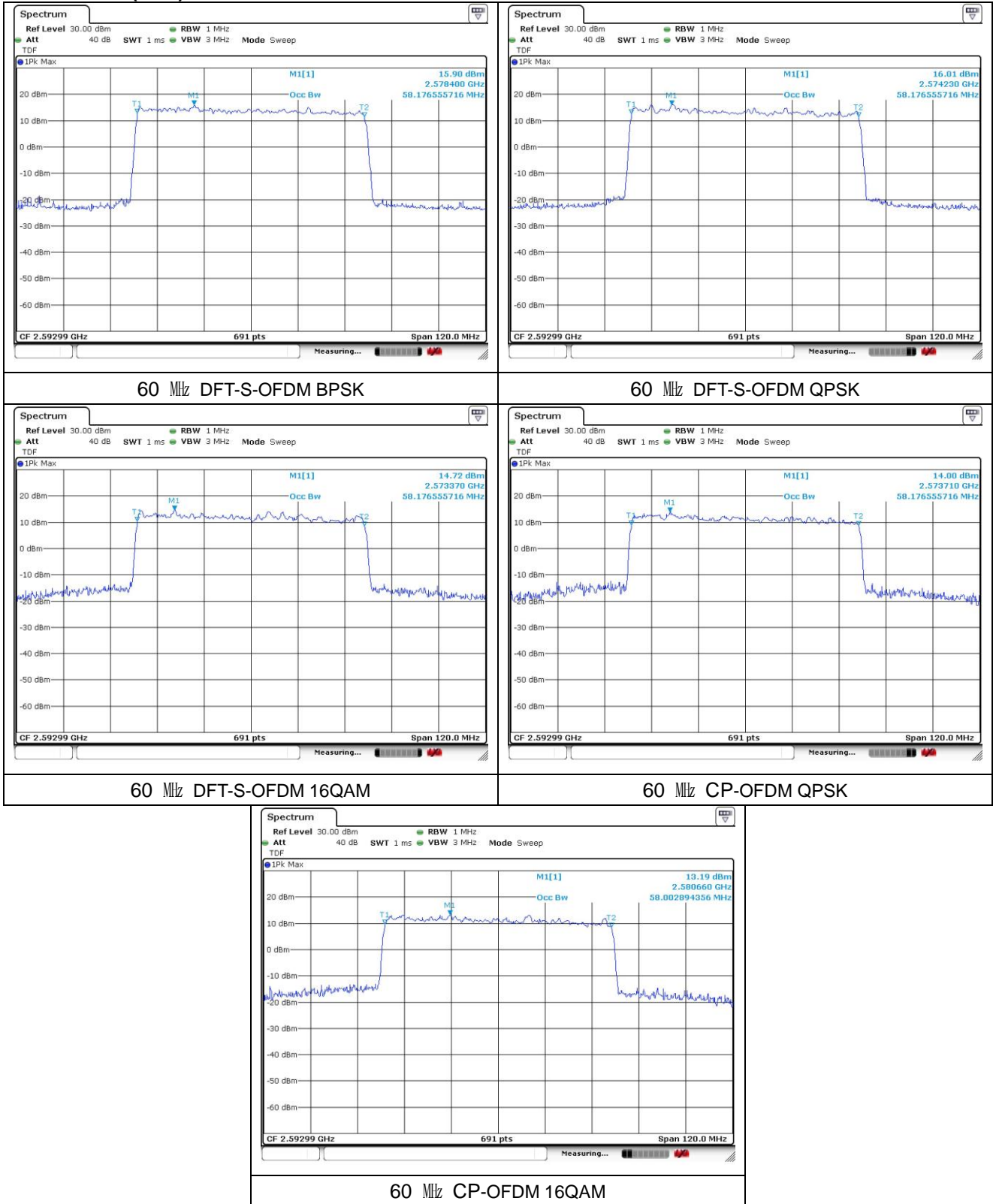
50 MHz DFT-S-OFDM 16QAM

50 MHz CP-OFDM QPSK

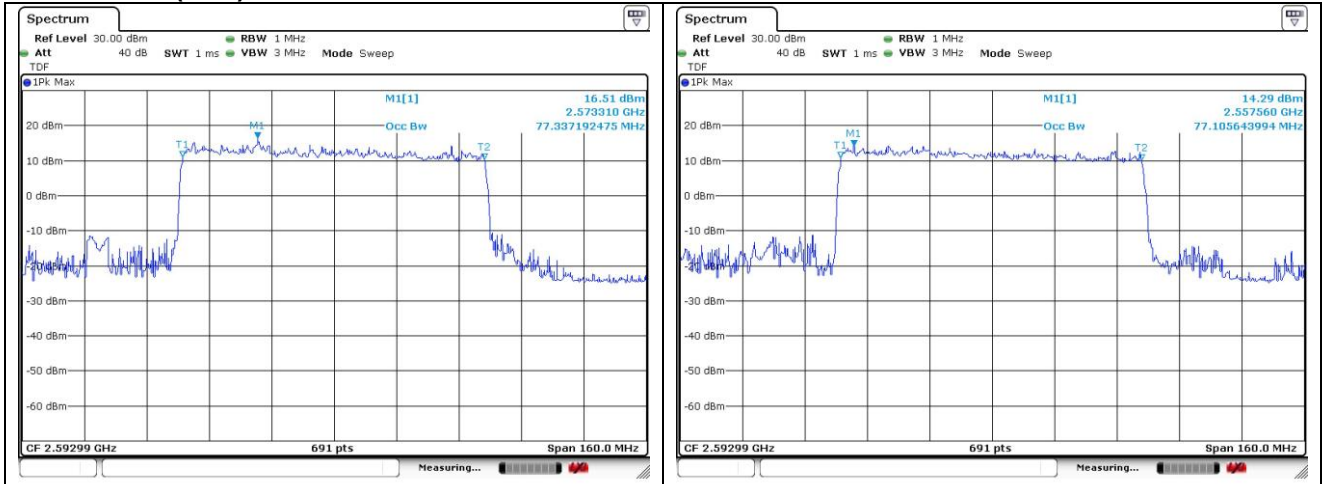


50 MHz CP-OFDM 16QAM

NR band 41 (FCC)

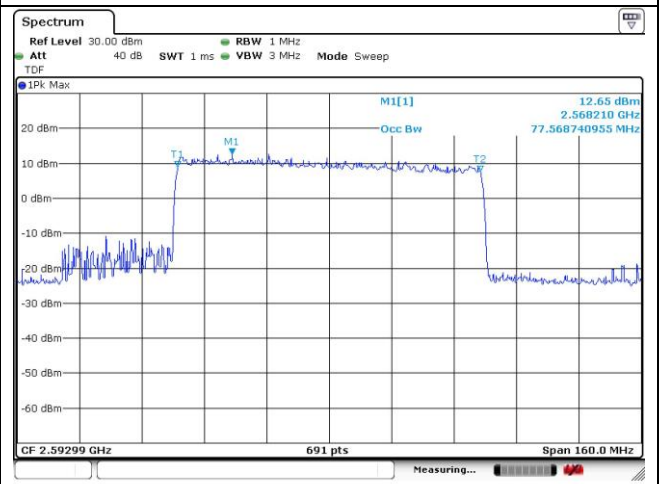
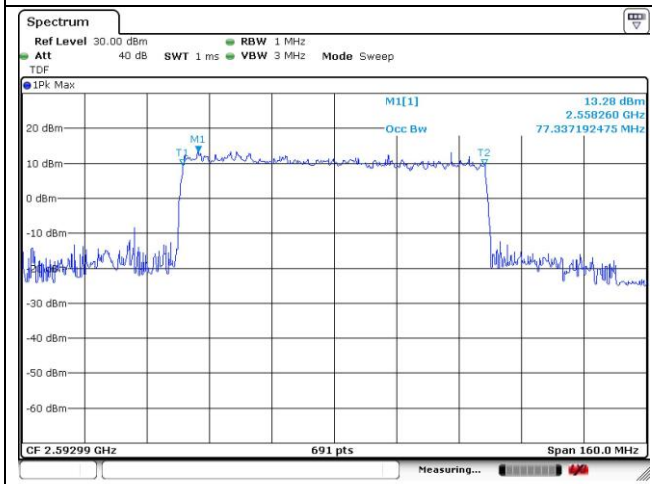


NR band 41 (FCC)



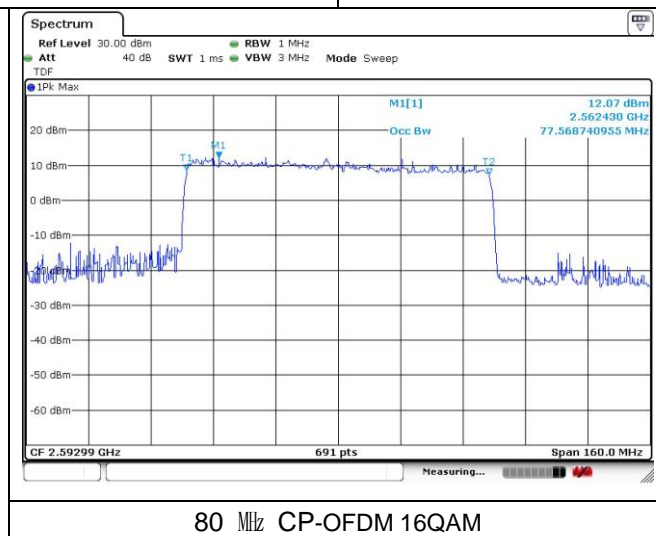
80 MHz DFT-S-OFDM BPSK

80 MHz DFT-S-OFDM QPSK



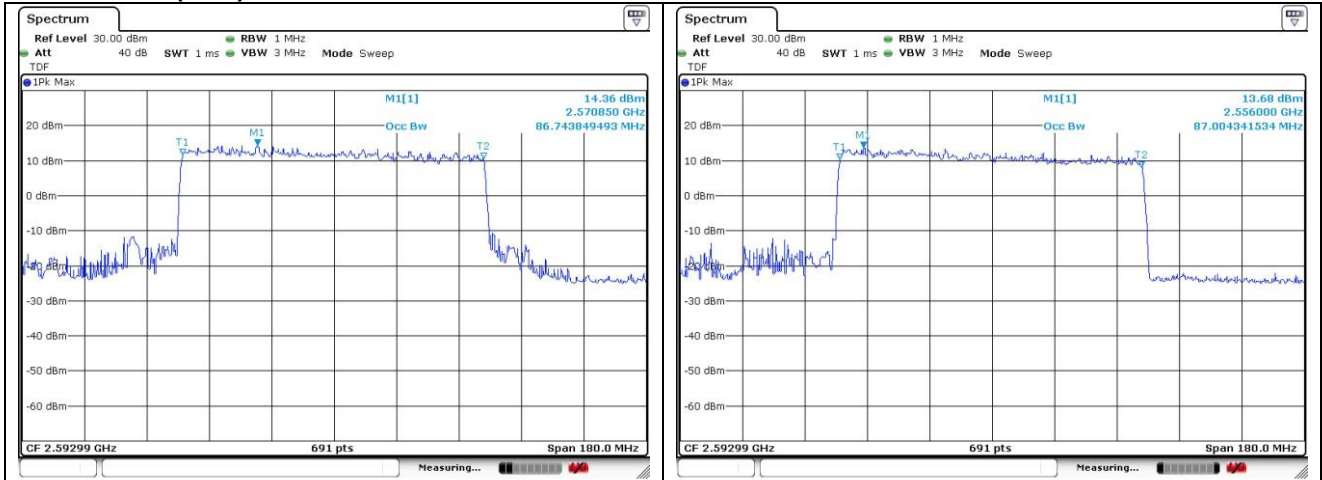
80 MHz DFT-S-OFDM 16QAM

80 MHz CP-OFDM QPSK



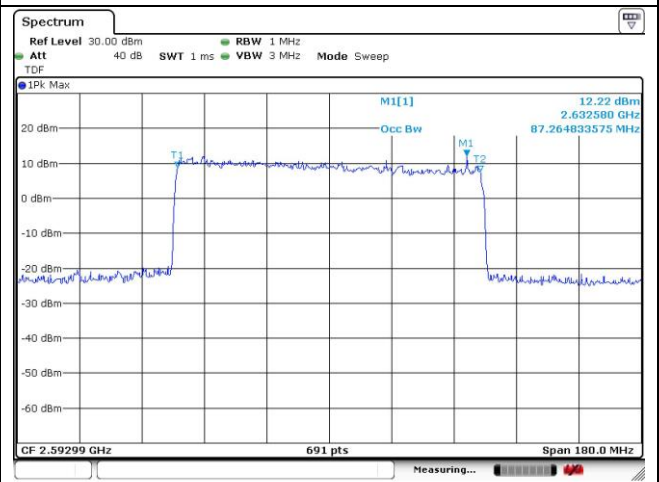
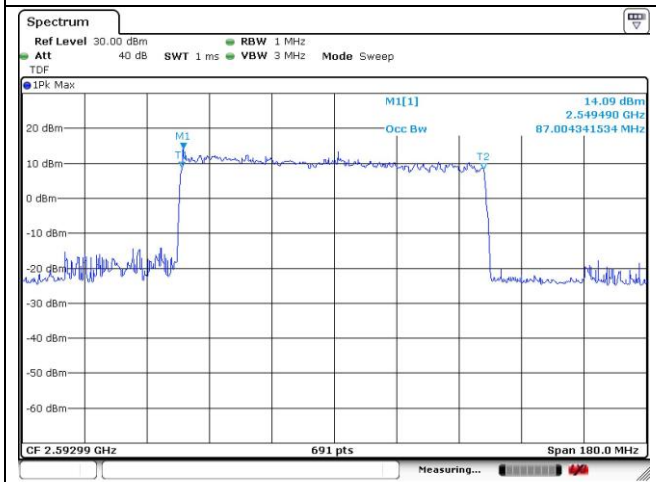
80 MHz CP-OFDM 16QAM

NR band 41 (FCC)



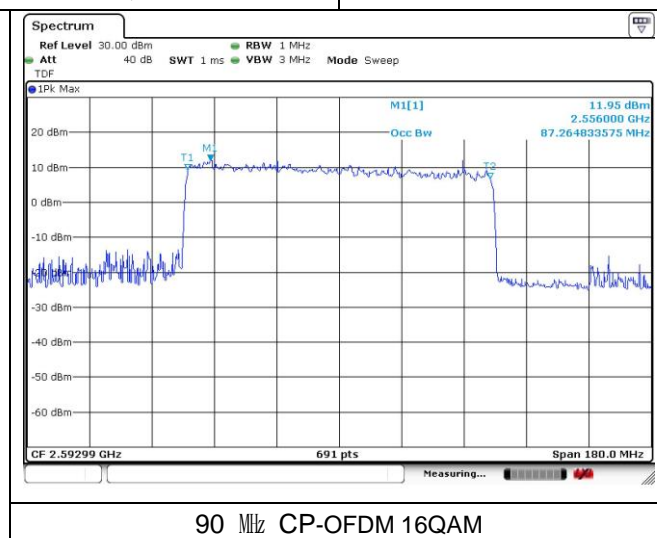
90 MHz DFT-S-OFDM BPSK

90 MHz DFT-S-OFDM QPSK



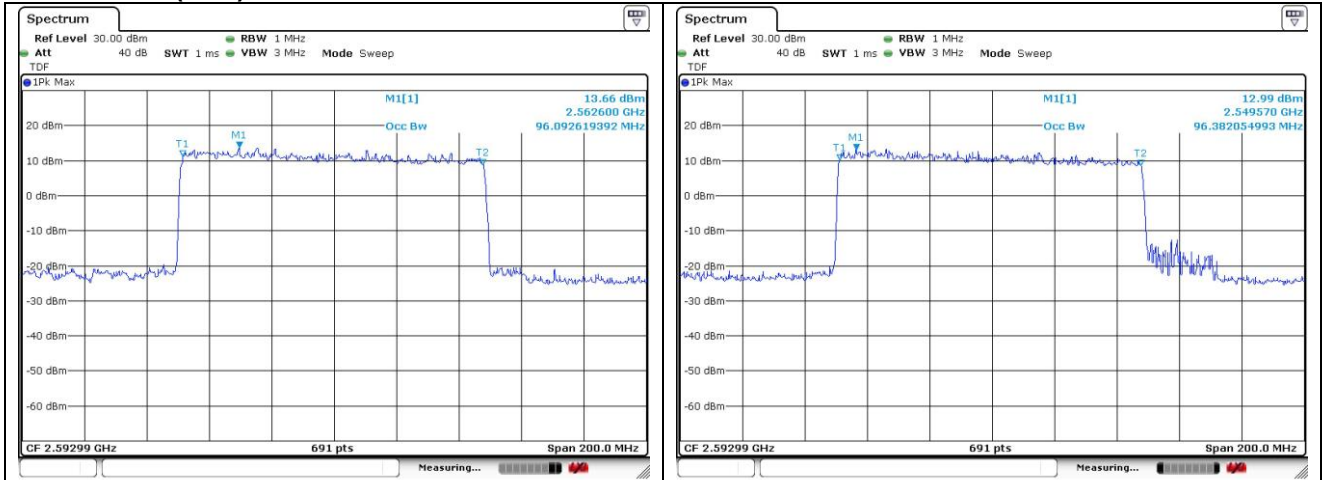
90 MHz DFT-S-OFDM 16QAM

90 MHz CP-OFDM QPSK



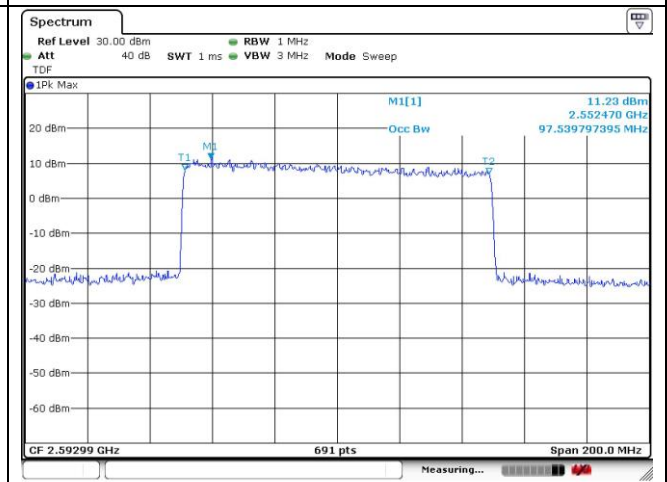
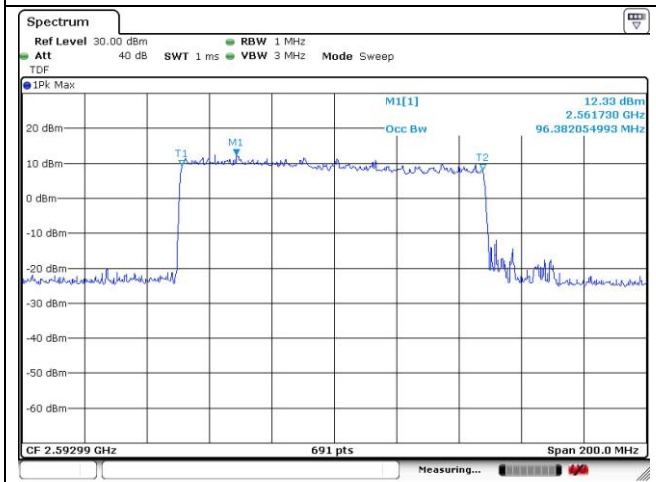
90 MHz CP-OFDM 16QAM

NR band 41 (FCC)



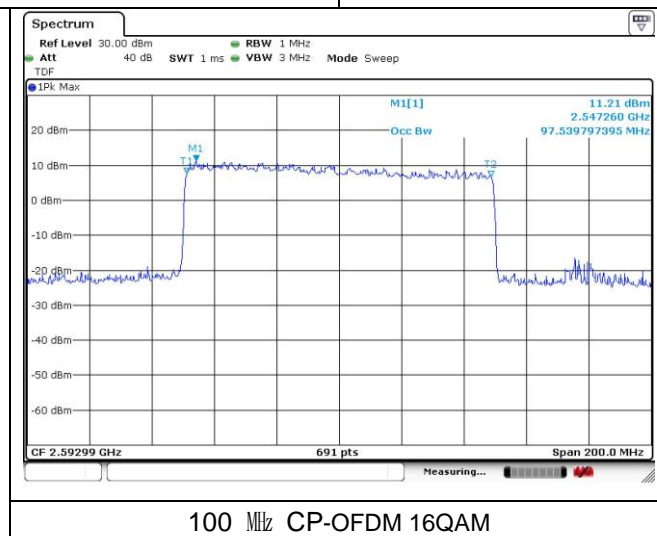
100 MHz DFT-S-OFDM BPSK

100 MHz DFT-S-OFDM QPSK



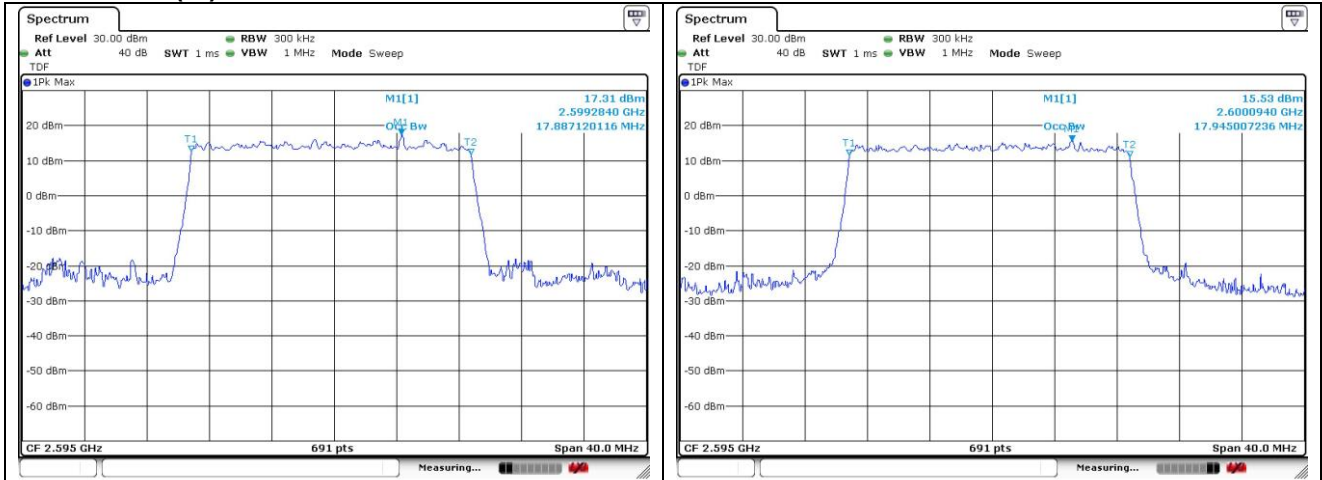
100 MHz DFT-S-OFDM 16QAM

100 MHz CP-OFDM QPSK



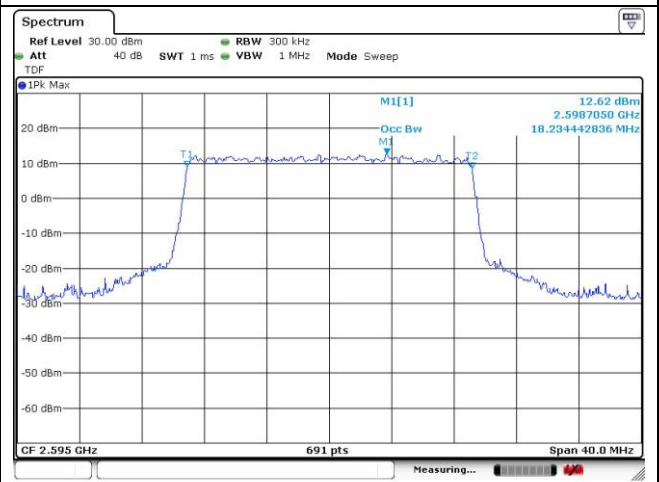
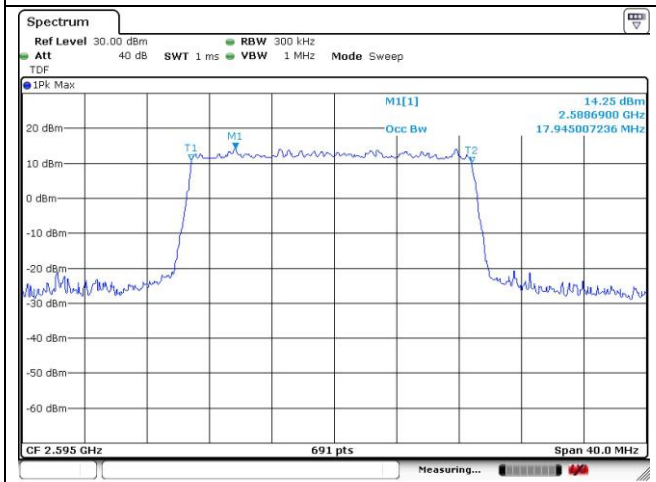
100 MHz CP-OFDM 16QAM

NR band 41 (IC)



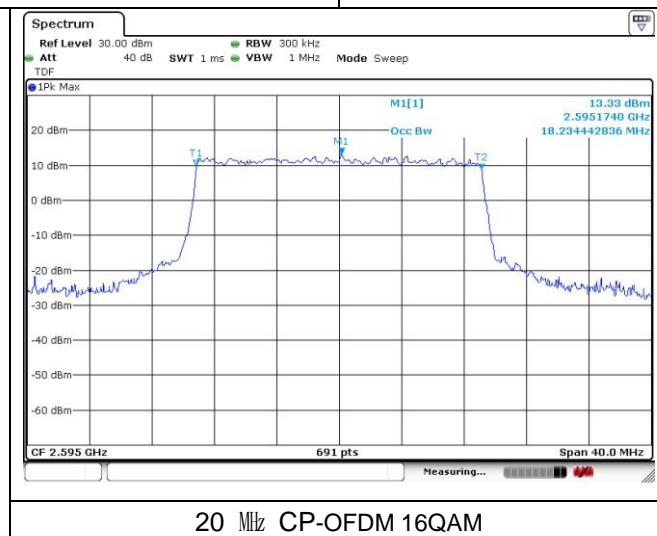
20 MHz DFT-S-OFDM BPSK

20 MHz DFT-S-OFDM QPSK



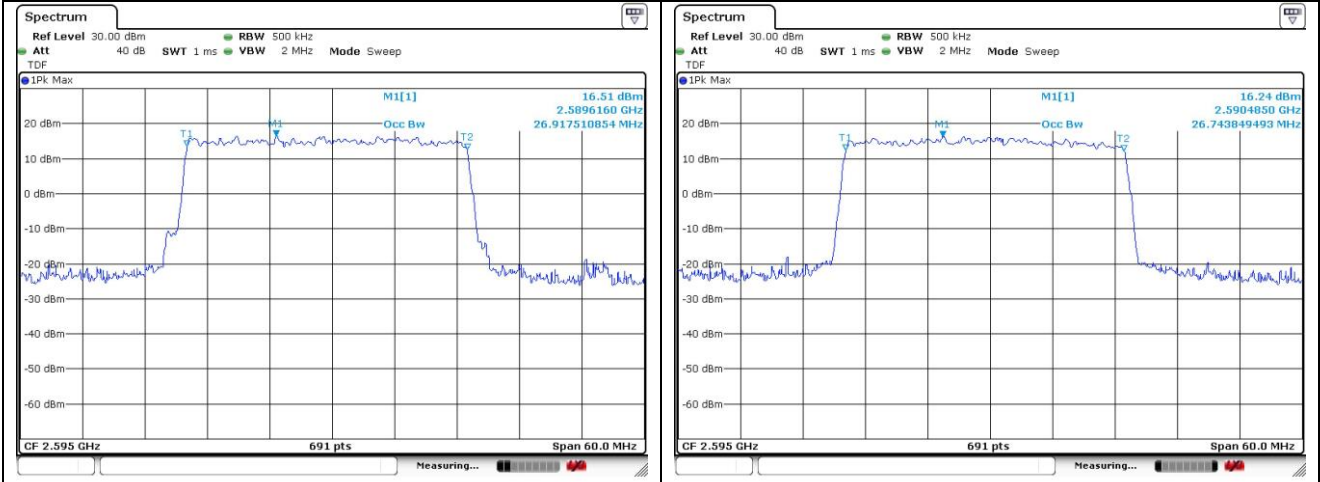
20 MHz DFT-S-OFDM 16QAM

20 MHz CP-OFDM QPSK



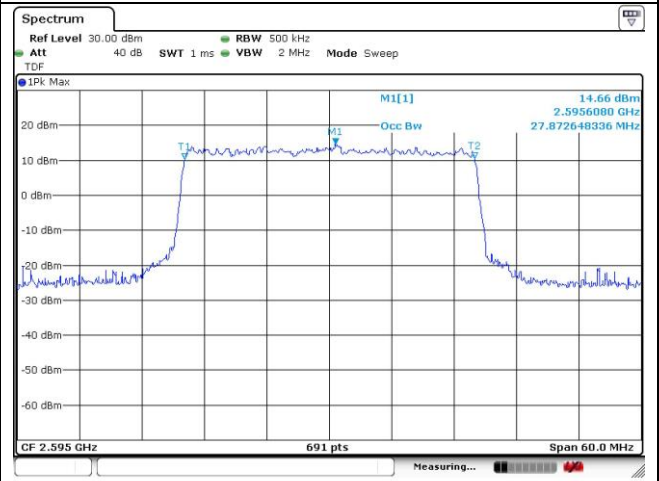
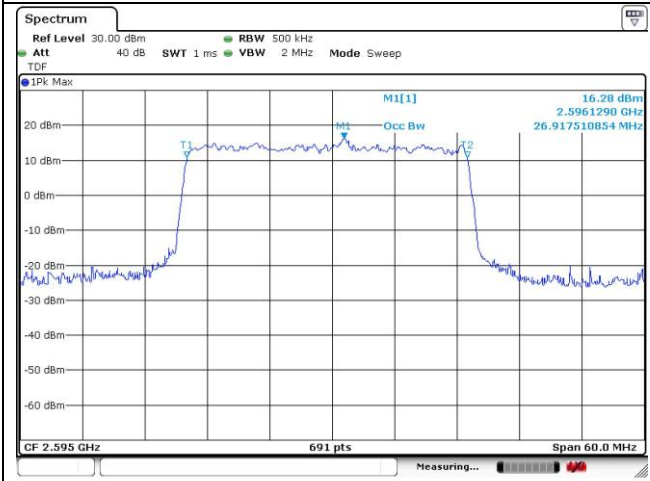
20 MHz CP-OFDM 16QAM

NR band 41 (IC)



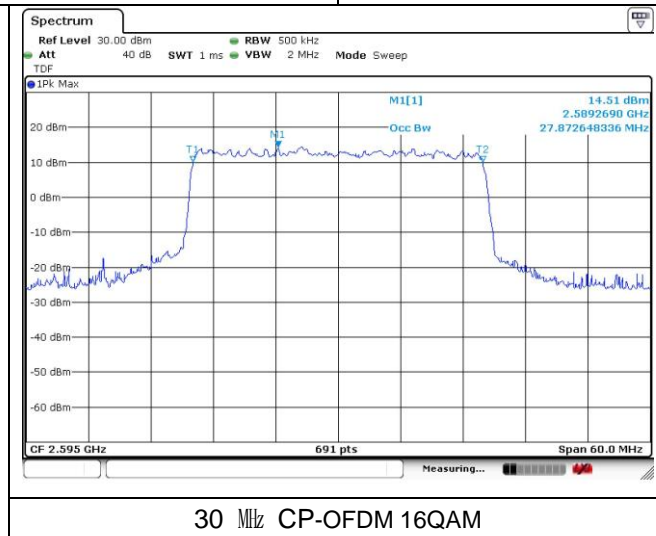
30 MHz DFT-S-OFDM BPSK

30 MHz DFT-S-OFDM QPSK



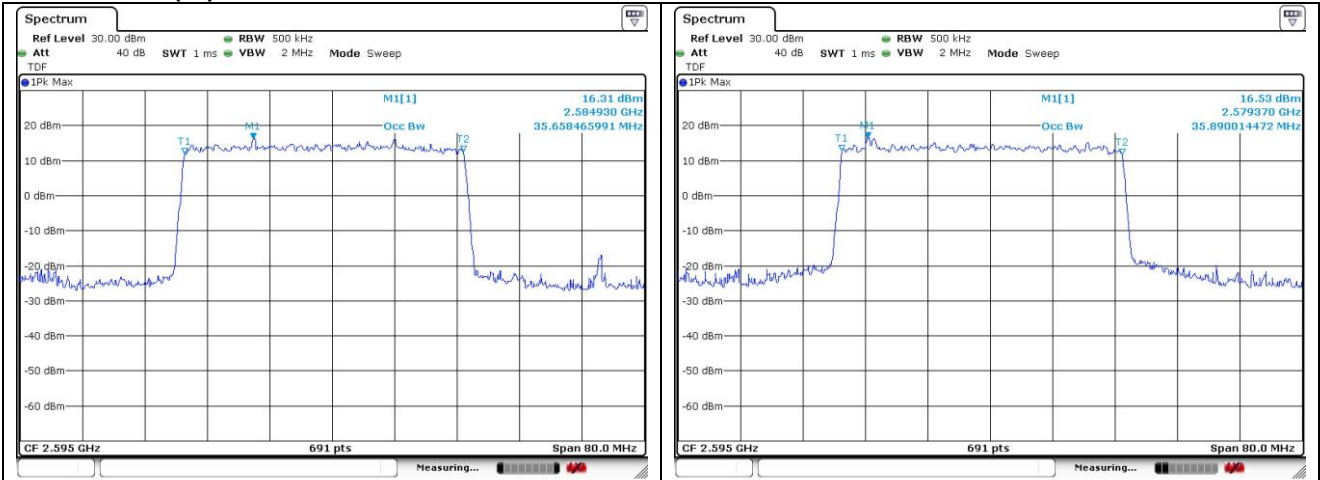
30 MHz DFT-S-OFDM 16QAM

30 MHz CP-OFDM QPSK



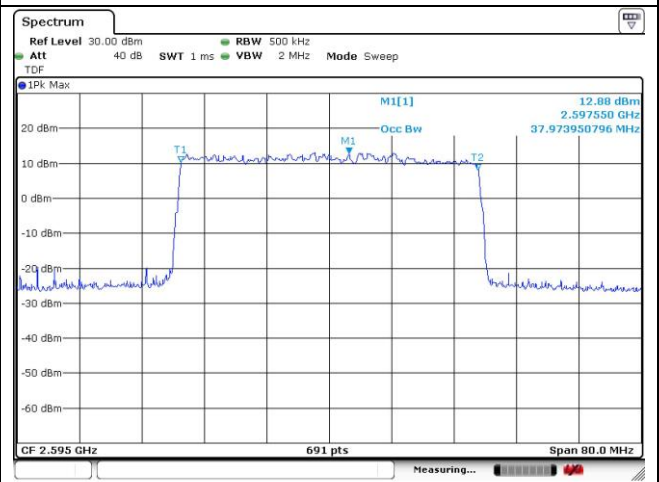
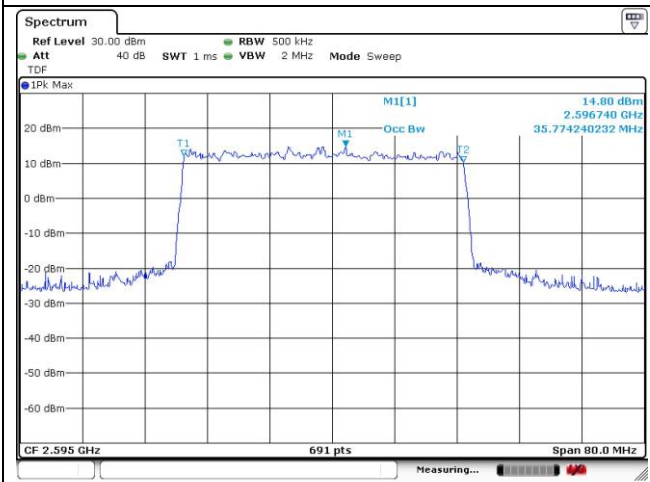
30 MHz CP-OFDM 16QAM

NR band 41 (IC)



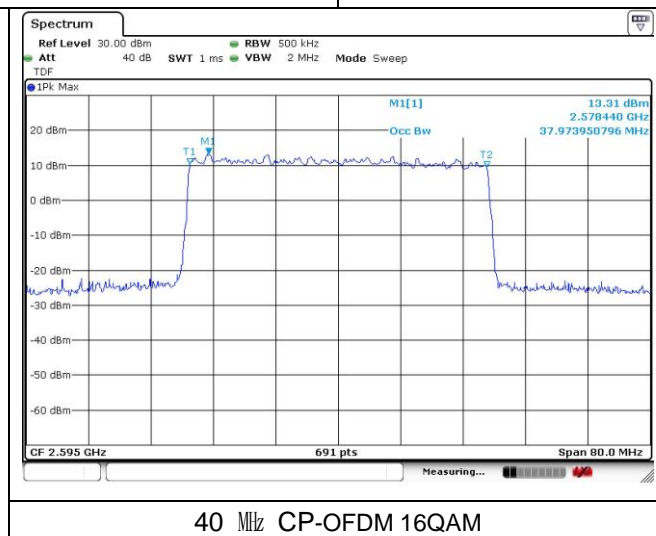
40 MHz DFT-S-OFDM BPSK

40 MHz DFT-S-OFDM QPSK



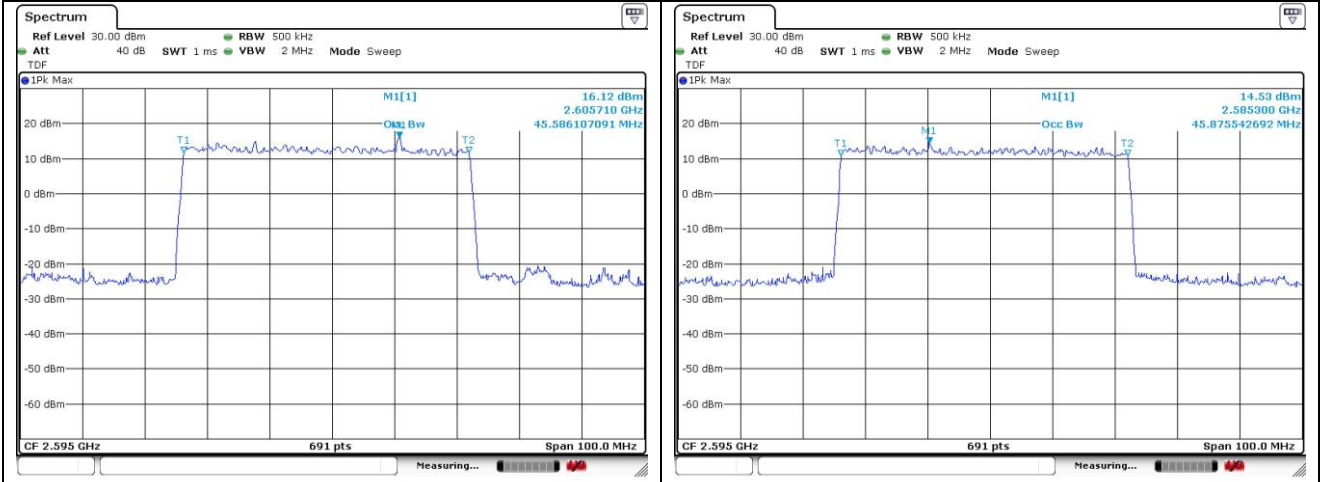
40 MHz DFT-S-OFDM 16QAM

40 MHz CP-OFDM QPSK



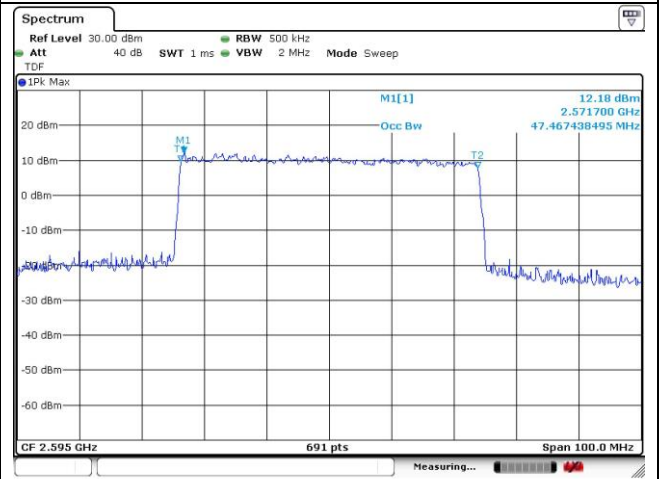
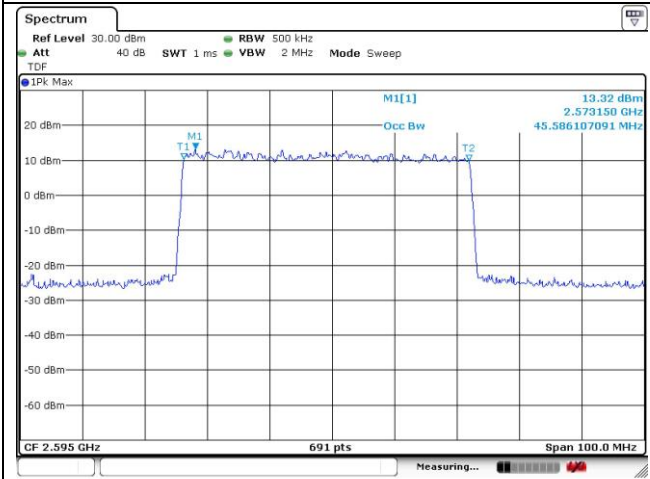
40 MHz CP-OFDM 16QAM

NR band 41 (IC)



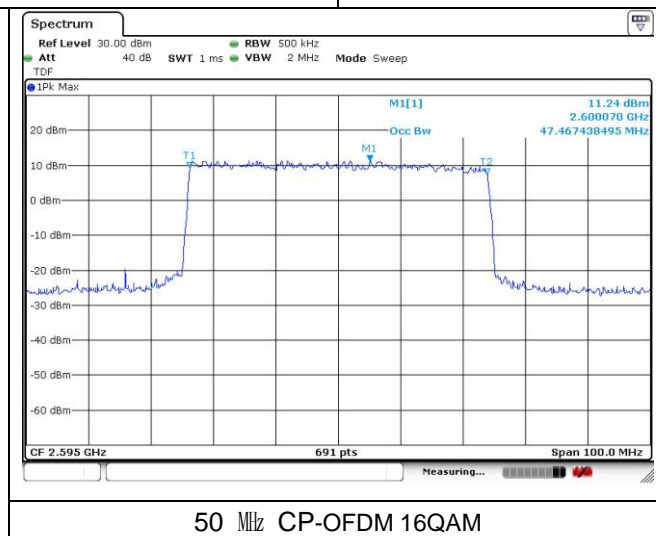
50 MHz DFT-S-OFDM BPSK

50 MHz DFT-S-OFDM QPSK



50 MHz DFT-S-OFDM 16QAM

50 MHz CP-OFDM QPSK



50 MHz CP-OFDM 16QAM

NR band 41 (IC)

