

5. Peak-Average Ratio

5.1. Limit

FCC

- §22.913(d) Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

- §24.232(d), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. 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.

- §27.50(d)(5), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. 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.

IC

- RSS-130 Issue 2

4.6.1, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1 % of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

- RSS-132 Issue 3

5.4, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1 % of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

- RSS-133 Issue 6

6.4, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1 % of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

- RSS-139 Issue 3

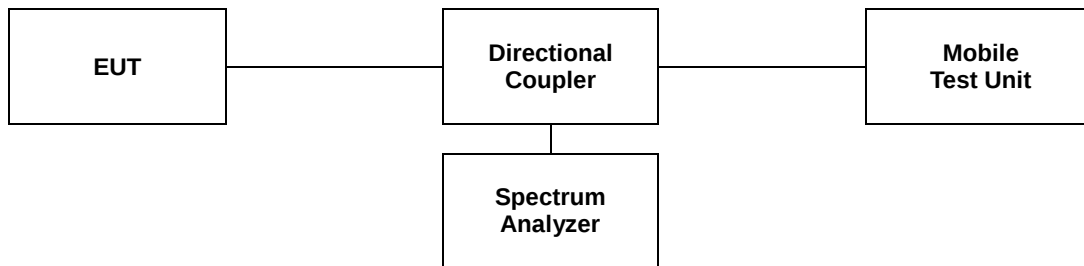
6.5, the peak to average power ratio (PAPR) of the equipment shall not exceed 13 dB for more than 0.1 % of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

5.2. Test Procedure

The test follows section 5.2.3.4 of ANSI C63.26-2015.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

- a. Set resolution/measurement bandwidth $\geq$ OBW or specified reference bandwidth.
- b. Set the number of counts to a value that stabilizes the measured CCDF curve.
- c. Set the measurement interval as follows:
 - 1) For continuous transmissions, set to greater of $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ or 1 ms.
 - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
 - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
- d. Record the maximum PAPR level associated with a probability of 0.1 %.
- e. The peak power level is calculated from the sum of the PAPR value from step d) to the measured average power.



5.3 Test Results

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

SIM 1

Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
25	15	5	256QAM	1 852.5	6.72	8.43
				1 882.5	6.67	8.46
				1 912.5	6.67	8.46
		10	256QAM	1 855.0	6.52	8.78
				1 882.5	6.58	8.75
				1 910.0	6.49	8.67
		15	256QAM	1 857.5	6.64	8.52
				1 882.5	6.64	8.52
				1 907.5	6.52	8.49
		20	256QAM	1 860.0	6.38	8.72
				1 882.5	6.46	8.67
				1 905.0	6.46	8.61
		25	256QAM	1 882.5	6.55	8.78
		30	256QAM	1 882.5	6.64	8.61
		40	256QAM	1 882.5	6.35	8.58
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
41 (FCC)	30	20	256QAM	2 506.02	6.67	8.67
				2 592.99	6.70	8.67
				2 679.99	6.72	8.72
		30	256QAM	2 511.00	6.75	8.70
				2 592.99	6.78	8.72
				2 674.98	6.75	8.75
		40	256QAM	2 516.01	6.64	8.61
				2 592.99	6.58	8.70
				2 670.00	6.58	8.70
		50	256QAM	2 521.02	6.58	8.49
				2 592.99	6.52	8.58
				2 664.99	6.52	8.49
		60	256QAM	2 526.00	6.96	8.84
				2 592.99	6.90	8.72
				2 659.98	6.93	8.81
		80	256QAM	2 536.02	7.16	8.55
				2 592.99	7.13	8.58
				2 649.99	7.30	8.67
		90	256QAM	2 541.00	7.42	8.55
				2 592.99	7.39	8.58
				2 644.98	7.48	8.61
		100	256QAM	2 546.01	7.42	8.35
				2 592.99	7.45	8.38
				2 640.00	7.45	8.41

Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
41 (IC)	30	20	256QAM	2 510.01	6.61	8.64
				2 595.00	6.67	8.64
				2 679.99	6.72	8.72
		30	256QAM	2 515.02	6.70	8.78
				2 595.00	6.75	8.61
				2 674.98	6.75	8.75
		40	256QAM	2 520.00	6.58	8.67
				2 595.00	6.61	8.67
				2 670.00	6.58	8.70
		50	256QAM	2 525.01	6.58	8.58
				2 595.00	6.49	8.49
				2 664.99	6.52	8.49
		60	256QAM	2 530.02	6.96	8.93
				2 595.00	6.90	8.84
				2 659.98	6.93	8.81
		80	256QAM	2 540.01	7.25	8.64
				2 595.00	7.13	8.64
				2 649.99	7.30	8.67
		90	256QAM	2 545.02	7.45	8.52
				2 595.00	7.39	8.55
				2 644.98	7.48	8.61
		100	256QAM	2 550.00	7.45	8.43
				2 595.00	7.45	8.43
				2 640.00	7.45	8.41
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
66	15	5	256QAM	1 712.5	6.52	8.29
				1 745.0	6.52	8.64
				1 777.5	6.43	8.26
		10	256QAM	1 715.0	6.46	8.64
				1 745.0	6.43	8.70
				1 775.0	6.38	8.75
		15	256QAM	1 717.5	6.55	8.43
				1 745.0	6.58	8.55
				1 772.5	6.61	8.41
		20	256QAM	1 720.0	6.46	8.64
				1 745.0	6.49	8.58
				1 770.0	6.41	8.64
		40	256QAM	1 745.0	6.23	8.29
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
71	15	5	256QAM	665.5	6.64	8.55
				680.5	6.61	8.09
				695.5	6.75	8.61
		10	256QAM	668.0	6.49	8.75
				680.5	6.55	8.84
				693.0	6.64	9.01
		15	256QAM	670.5	6.09	8.46
				680.5	5.91	8.55
				690.5	6.26	8.58
		20	256QAM	673.0	6.52	8.43
				680.5	6.32	8.32
				688.0	6.52	8.49

ENDC

Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
13A-n2A	15	5	256QAM	1 852.5	6.67	8.81
				1 880.0	6.72	8.90
				1 907.5	6.75	8.72
		10	256QAM	1 855.0	6.43	8.49
				1 880.0	6.49	8.72
				1 905.0	6.46	8.84
		15	256QAM	1 857.5	6.55	8.49
				1 880.0	6.61	8.55
				1 902.5	6.67	8.41
		20	256QAM	1 860.0	6.32	8.64
				1 880.0	6.43	8.55
				1 900.0	6.43	8.72
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
2A-n5A	15	5	256QAM	826.5	5.86	8.29
				836.5	6.26	8.17
				846.5	6.12	8.17
		10	256QAM	829.0	6.29	8.70
				836.5	6.20	8.67
				844.0	6.00	8.81
		15	256QAM	831.5	6.52	8.41
				836.5	6.64	8.64
				841.5	6.55	8.58
		20	256QAM	834.0	6.41	8.52
				836.5	6.52	8.78
				839.0	6.58	8.55

SIM 2

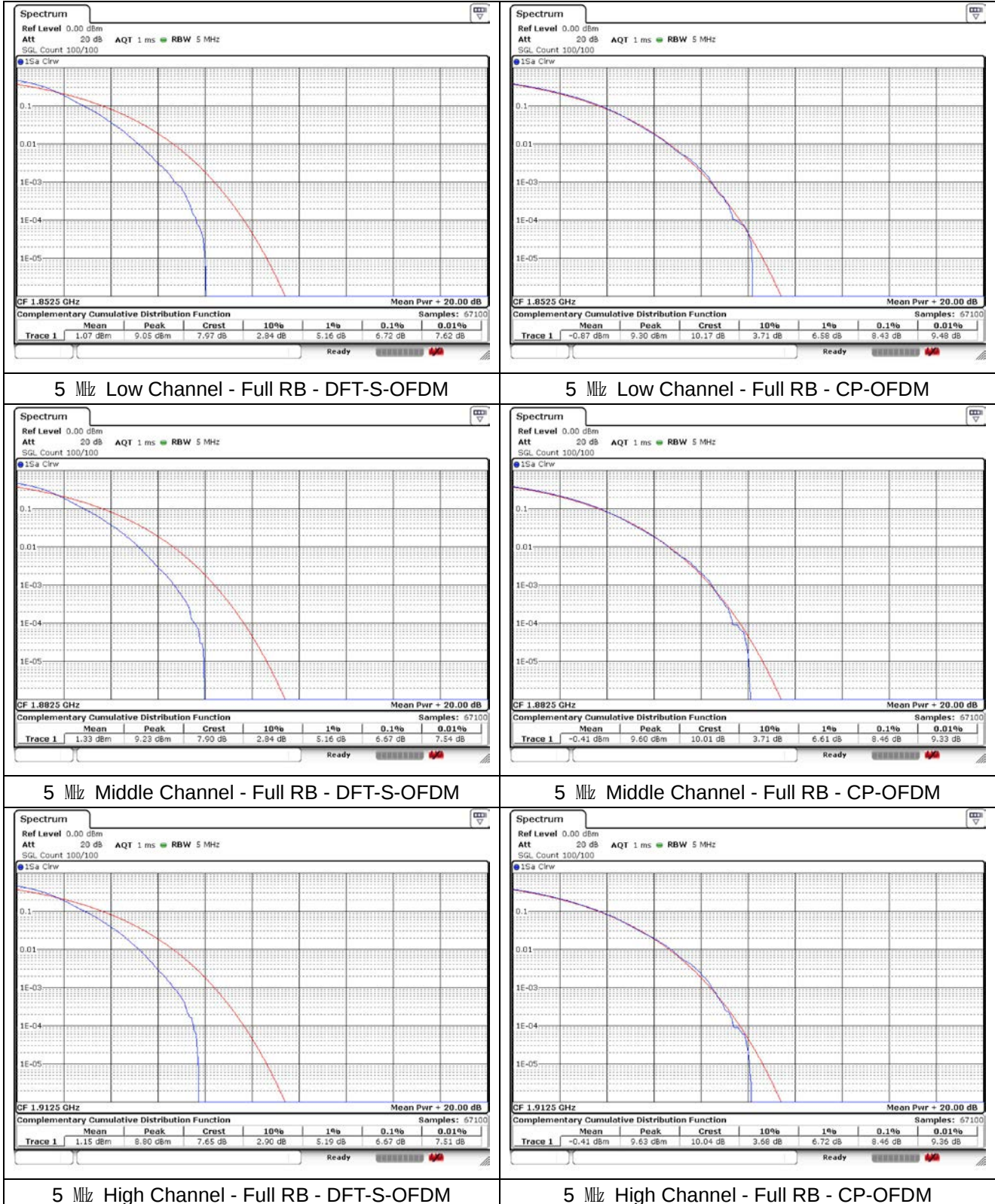
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
25	15	5	256QAM	1 852.5	6.58	8.41
				1 882.5	6.61	8.41
				1 912.5	6.52	8.52
		10	256QAM	1 855.0	6.41	8.61
				1 882.5	6.49	8.67
				1 910.0	6.38	8.93
		15	256QAM	1 857.5	6.58	8.49
				1 882.5	6.52	8.70
				1 907.5	6.58	8.43
		20	256QAM	1 860.0	6.35	8.49
				1 882.5	6.41	8.70
				1 905.0	6.52	8.64
		25	256QAM	1 882.5	6.52	8.78
		30	256QAM	1 882.5	6.70	8.55
		40	256QAM	1 882.5	6.23	8.55
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
41 (FCC)	30	20	256QAM	2 506.02	6.55	8.49
				2 592.99	6.55	8.55
				2 679.99	6.58	8.72
		30	256QAM	2 511.00	6.67	8.61
				2 592.99	6.72	8.55
				2 674.98	6.72	8.58
		40	256QAM	2 516.01	6.55	8.61
				2 592.99	6.52	8.61
				2 670.00	6.58	8.67
		50	256QAM	2 521.02	6.46	8.52
				2 592.99	6.46	8.41
				2 664.99	6.46	8.43
		60	256QAM	2 526.00	6.93	8.84
				2 592.99	6.90	8.75
				2 659.98	6.90	8.78
		80	256QAM	2 536.02	7.19	8.64
				2 592.99	7.16	8.61
				2 649.99	7.28	8.58
		90	256QAM	2 541.00	7.42	8.49
				2 592.99	7.39	8.58
				2 644.98	7.48	8.55
		100	256QAM	2 546.01	7.45	8.43
				2 592.99	7.45	8.41
				2 640.00	7.51	8.46

Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
41 (IC)	30	20	256QAM	2 510.01	6.61	8.64
				2 595.00	6.64	8.43
				2 679.99	6.58	8.72
		30	256QAM	2 515.02	6.64	8.58
				2 595.00	6.70	8.70
				2 674.98	6.72	8.58
		40	256QAM	2 520.00	6.55	8.64
				2 595.00	6.58	8.61
				2 670.00	6.58	8.67
		50	256QAM	2 525.01	6.49	8.52
				2 595.00	6.46	8.64
				2 664.99	6.46	8.43
		60	256QAM	2 530.02	6.93	8.84
				2 595.00	6.90	8.72
				2 659.98	6.90	8.78
		80	256QAM	2 540.01	7.19	8.67
				2 595.00	7.16	8.58
				2 649.99	7.28	8.58
		90	256QAM	2 545.02	7.45	8.43
				2 595.00	7.42	8.58
				2 644.98	7.48	8.55
		100	256QAM	2 550.00	7.45	8.38
				2 595.00	7.45	8.46
				2 640.00	7.51	8.46
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
66	15	5	256QAM	1 712.5	6.61	8.35
				1 745.0	6.58	8.35
				1 777.5	6.55	8.32
		10	256QAM	1 715.0	6.46	8.78
				1 745.0	6.46	8.70
				1 775.0	6.41	8.67
		15	256QAM	1 717.5	6.61	8.55
				1 745.0	6.55	8.46
				1 772.5	6.67	8.49
		20	256QAM	1 720.0	6.41	8.64
				1 745.0	6.38	8.61
				1 770.0	6.46	8.58
		40	256QAM	1 745.0	6.20	8.32
Band	SCS (kHz)	BW (MHz)	Mode	Frequency (MHz)	PAR (dB)	
					DFT-S-OFDM	CP-OFDM
71	15	5	256QAM	665.5	6.38	8.17
				680.5	6.43	8.29
				695.5	6.38	8.17
		10	256QAM	668.0	6.32	8.64
				680.5	6.38	8.75
				693.0	6.29	8.49
		15	256QAM	670.5	6.52	8.29
				680.5	6.55	8.35
				690.5	6.55	8.32
		20	256QAM	673.0	6.32	8.52
				680.5	6.41	8.43
				688.0	6.38	8.43

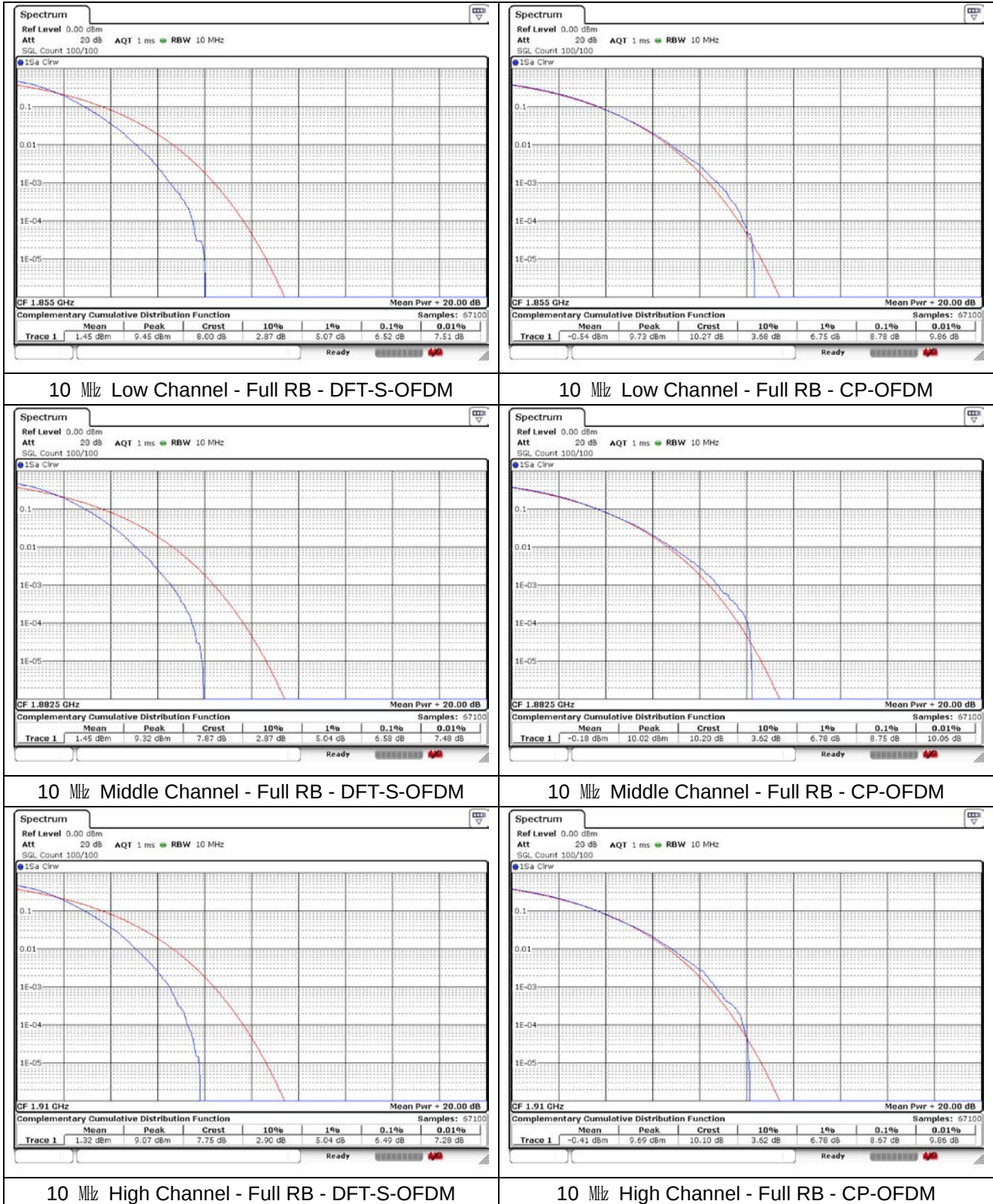
- Test plots

SIM 1

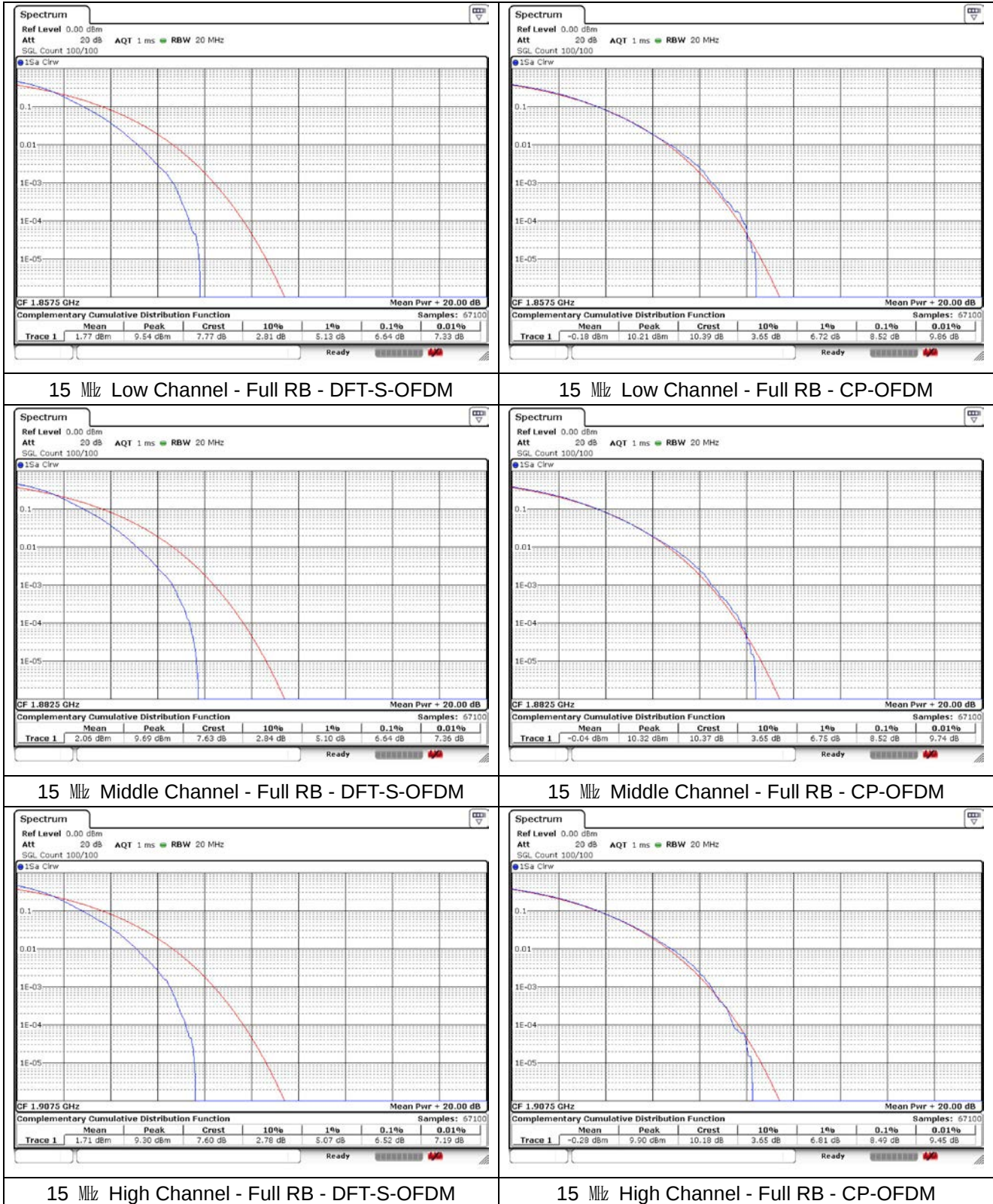
NR band 25



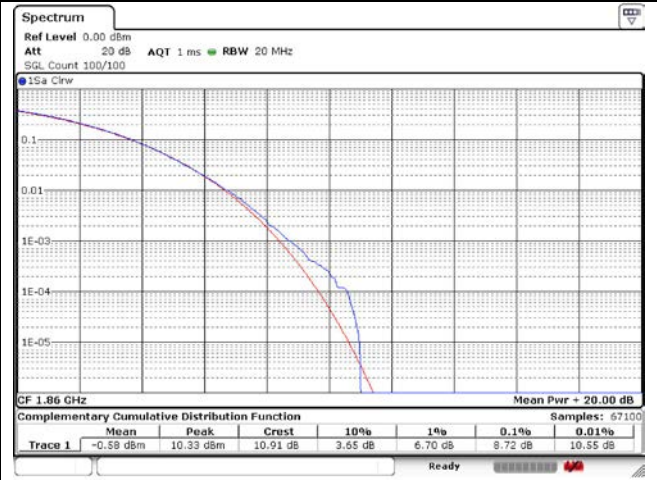
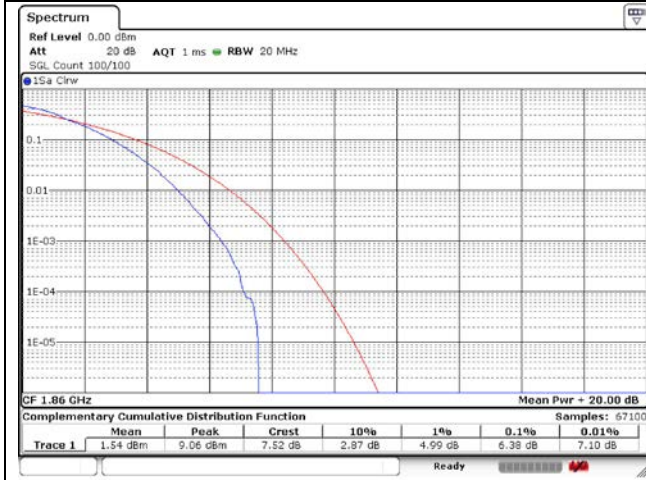
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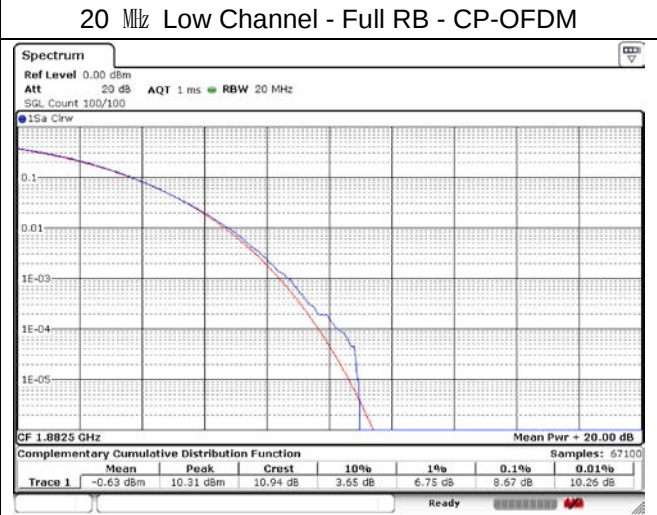
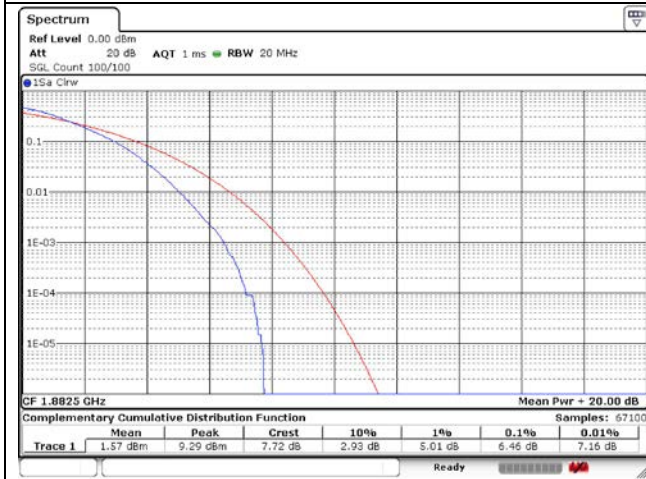
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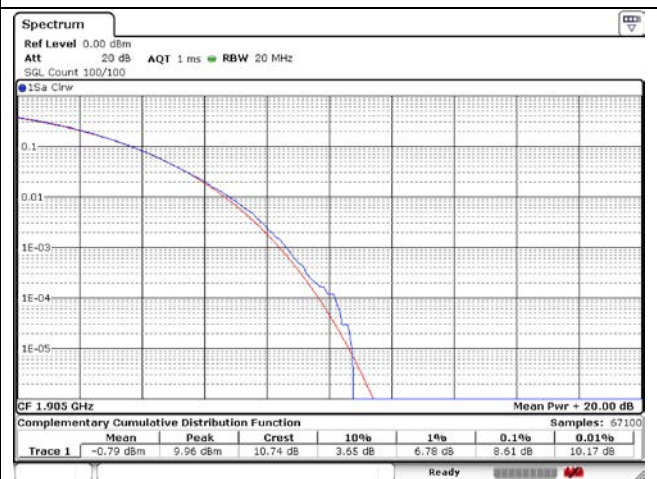
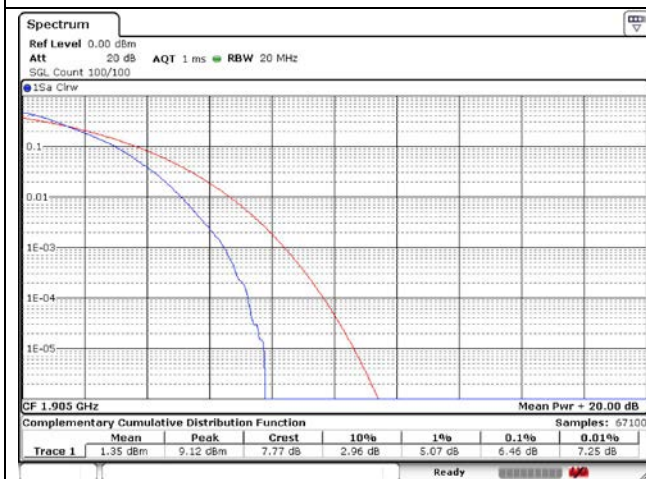
NR band 25



20 MHz Low Channel - Full RB - DFT-S-OFDM

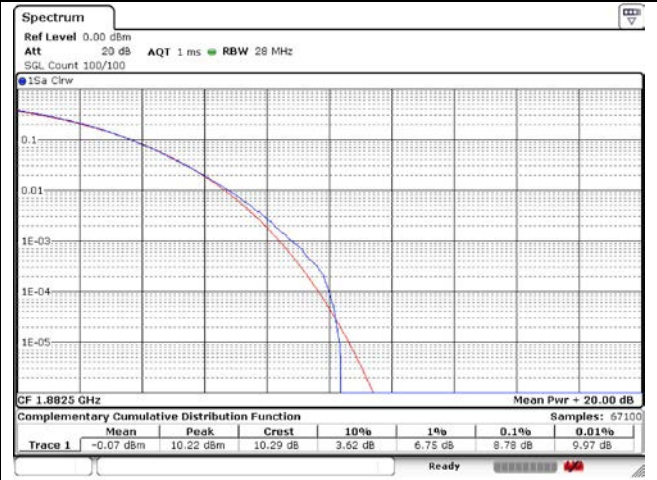
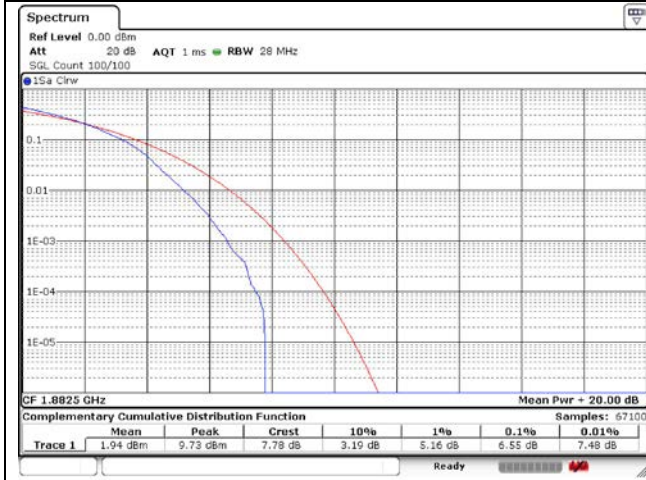
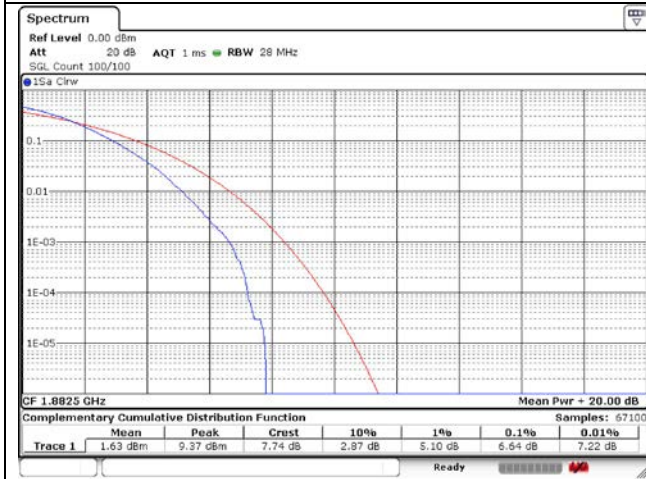
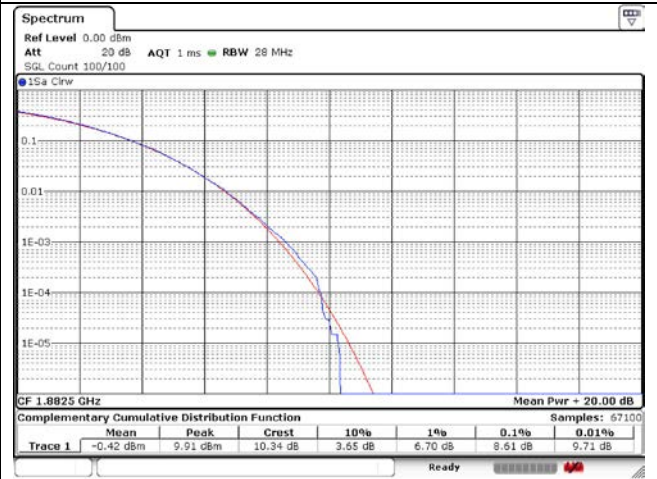
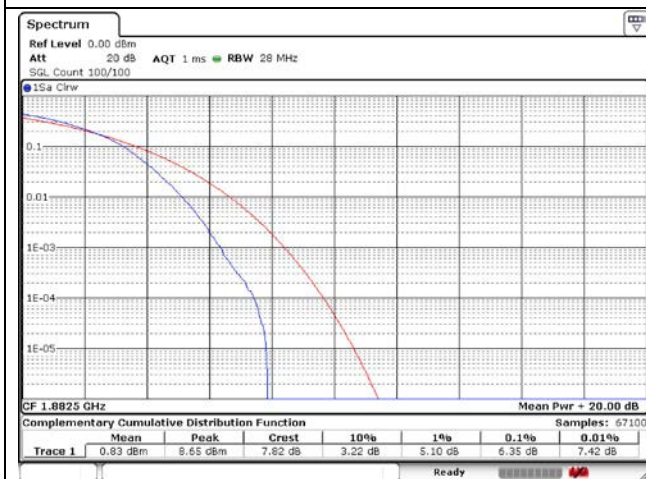
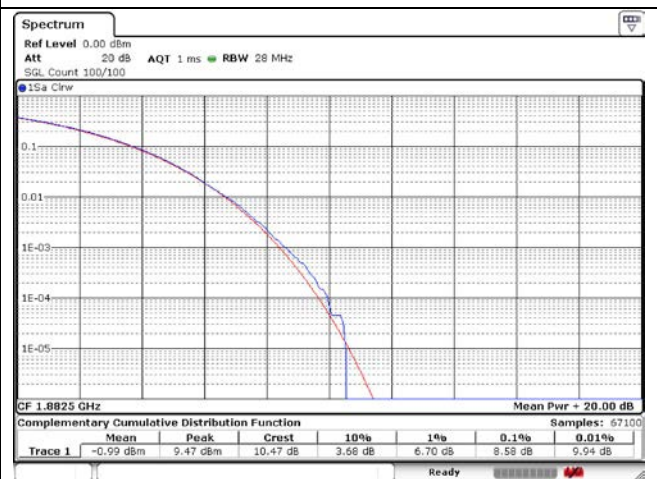


20 MHz Middle Channel - Full RB - DFT-S-OFDM



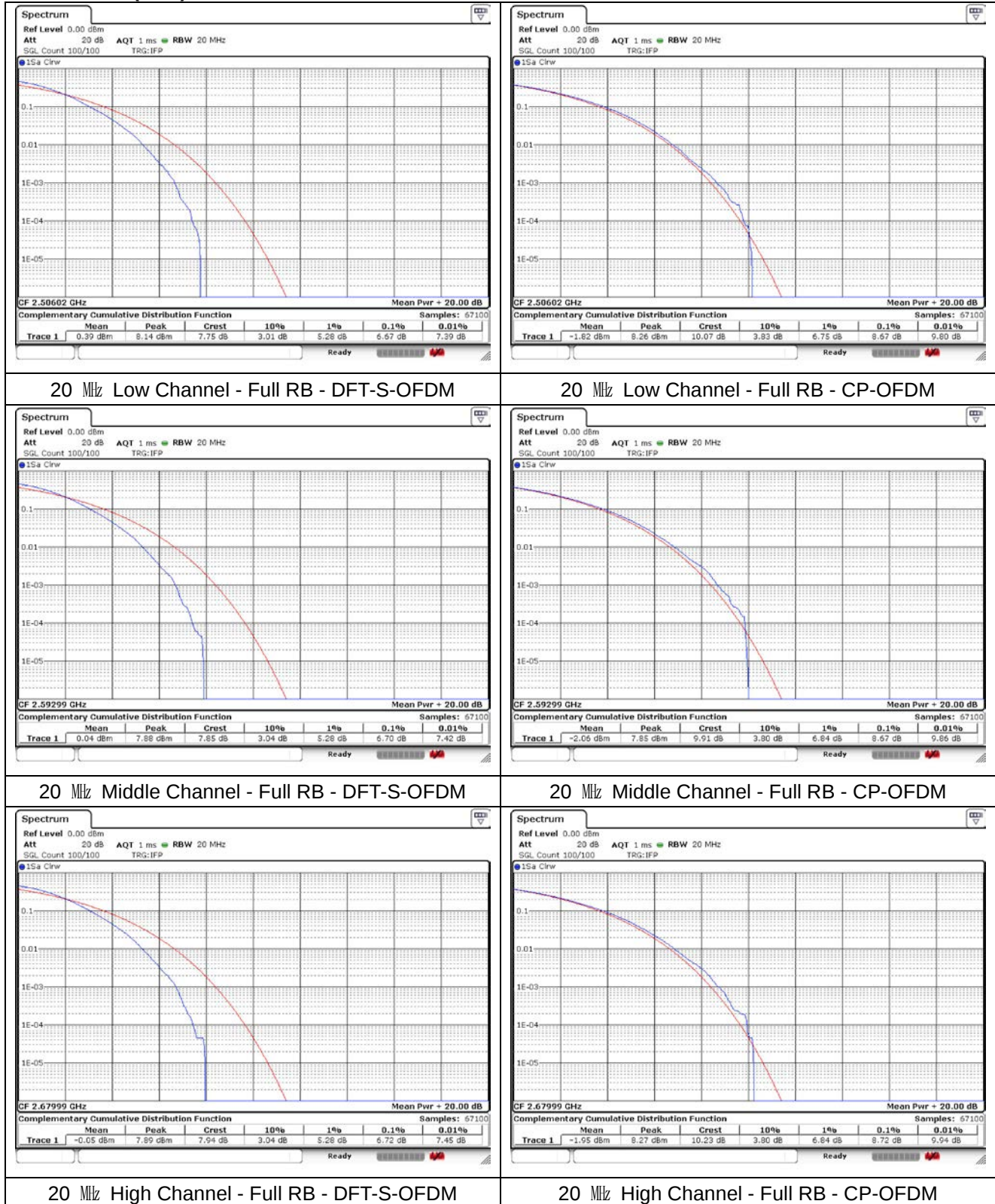
20 MHz High Channel - Full RB - DFT-S-OFDM

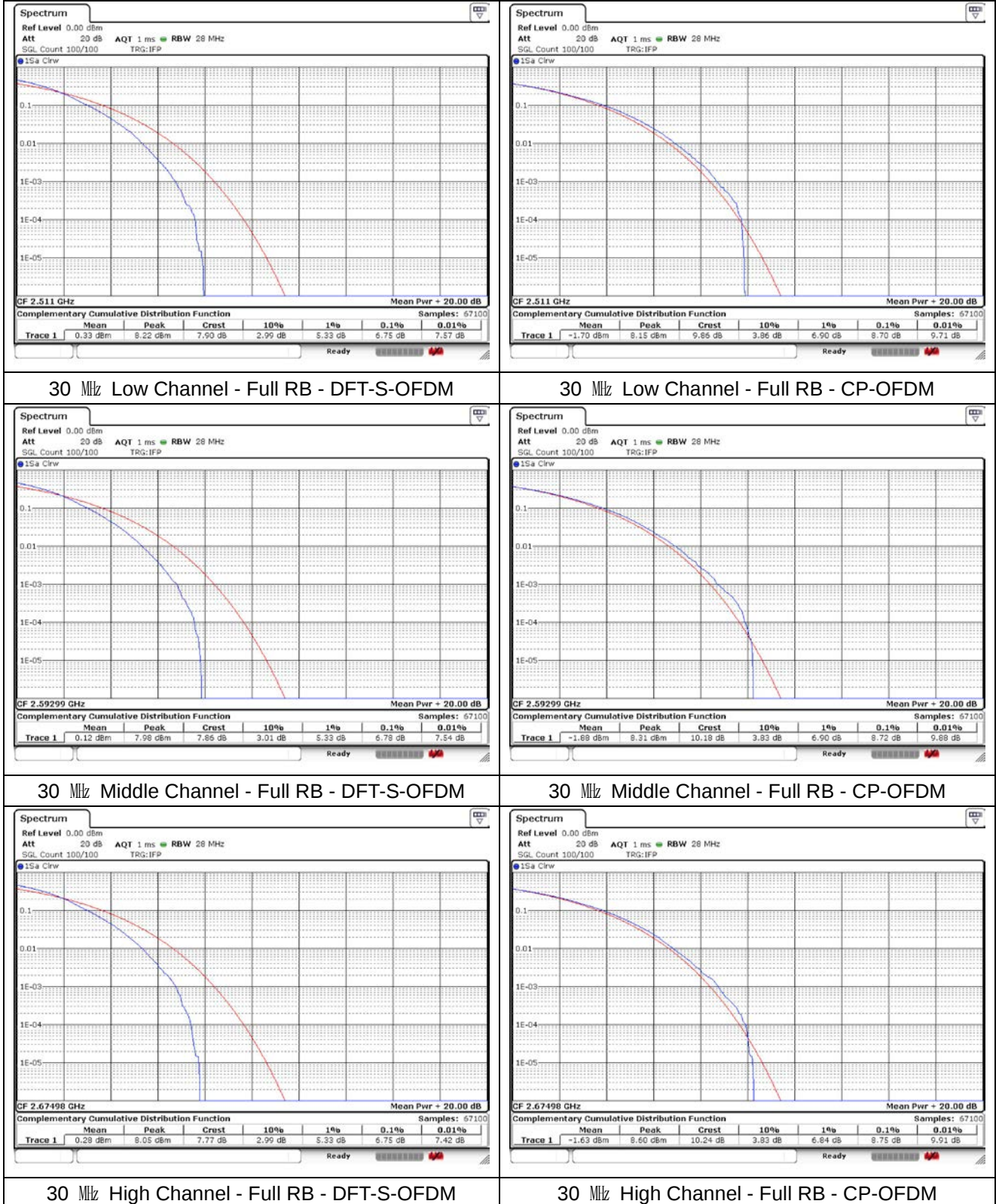
20 MHz High Channel - Full RB - CP-OFDM

NR band 25

25 MHz Middle Channel - Full RB - DFT-S-OFDM

25 MHz Middle Channel - Full RB - CP-OFDM

30 MHz Middle Channel - Full RB - DFT-S-OFDM

30 MHz Middle Channel - Full RB - CP-OFDM

40 MHz Middle Channel - Full RB - DFT-S-OFDM

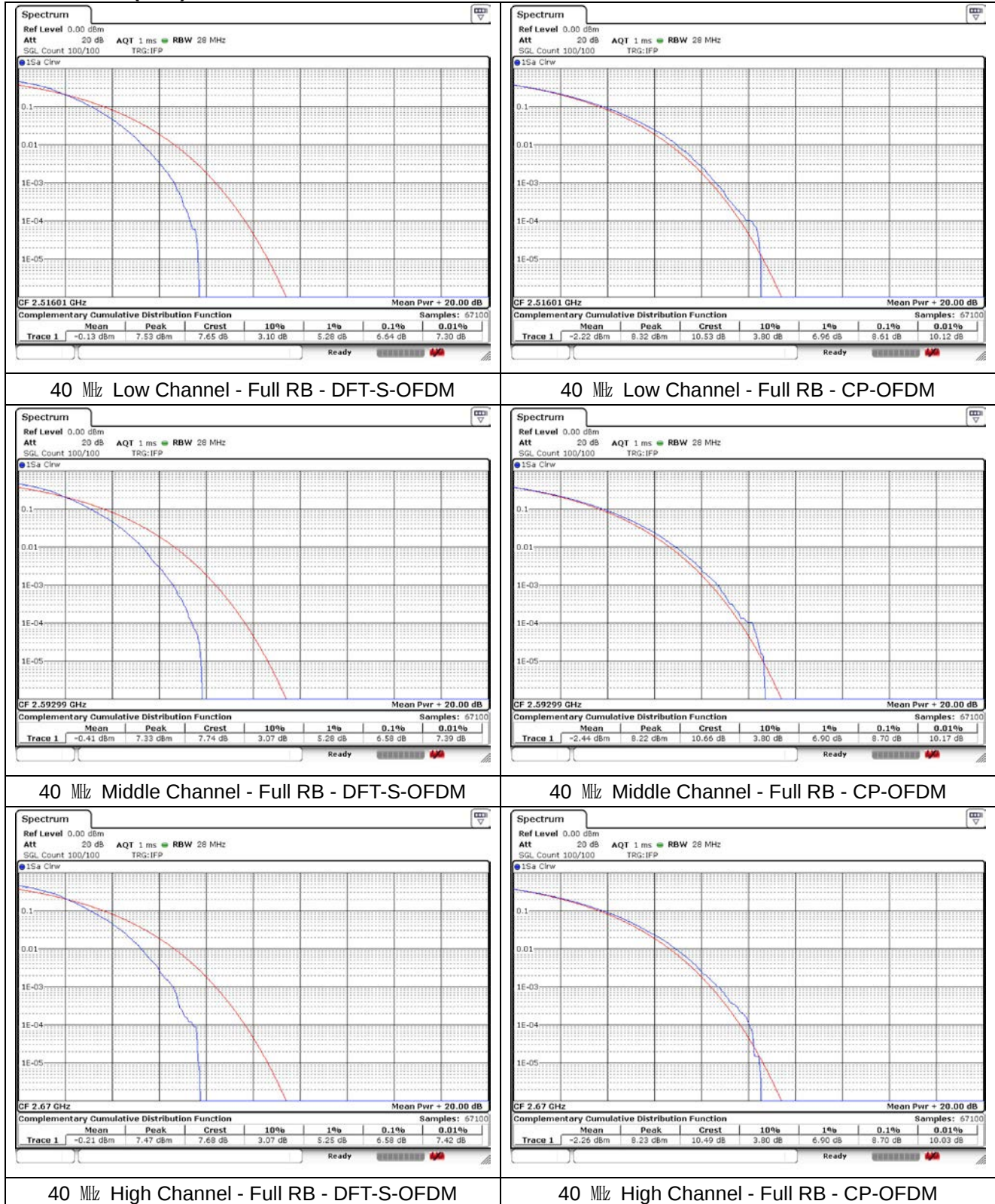
40 MHz Middle Channel - Full RB - CP-OFDM

NR band 41 (FCC)

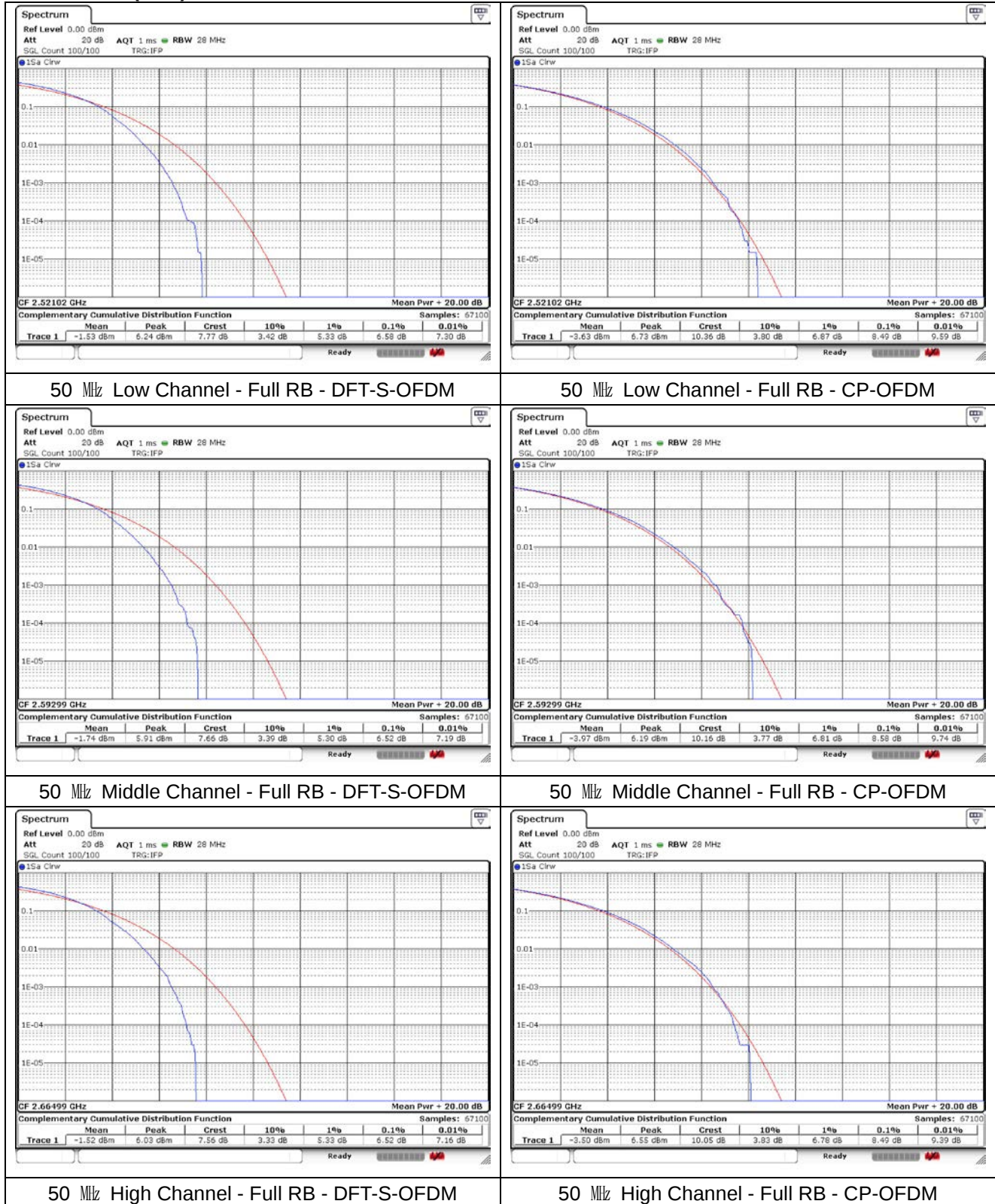


NR band 41 (FCC)


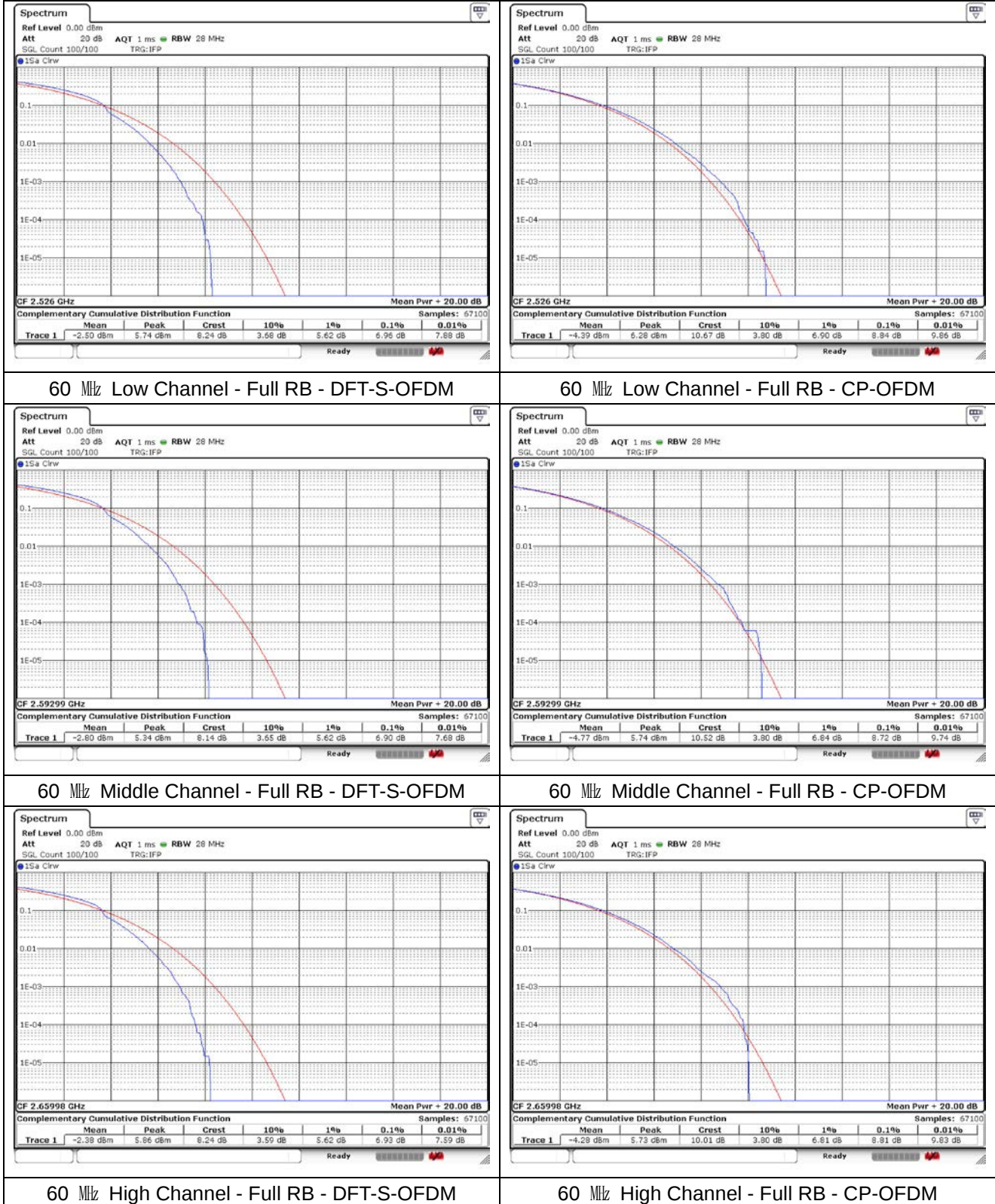
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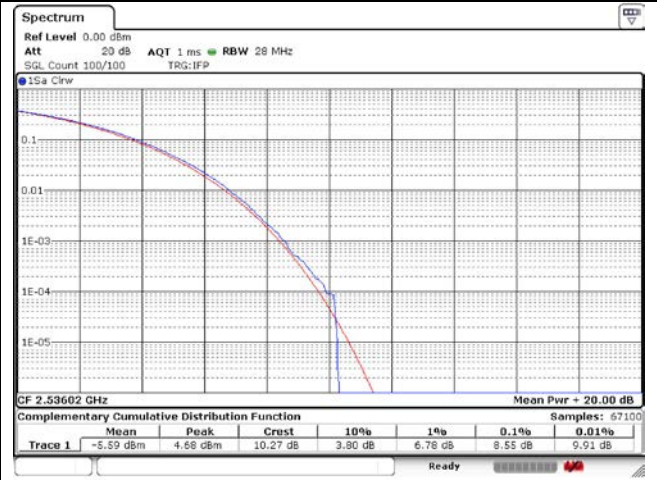
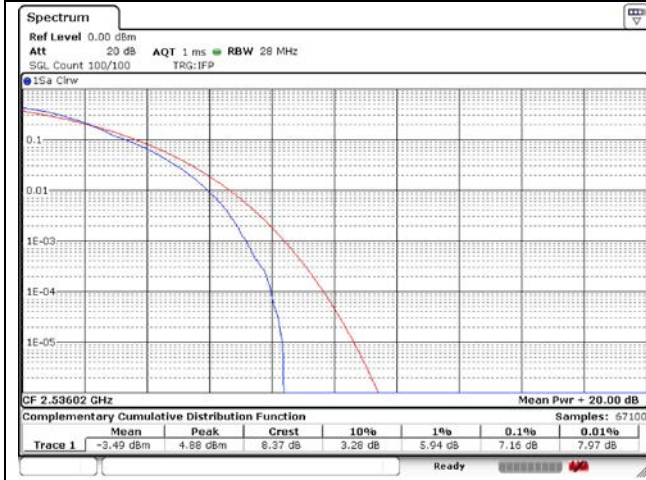
NR band 41 (FCC)



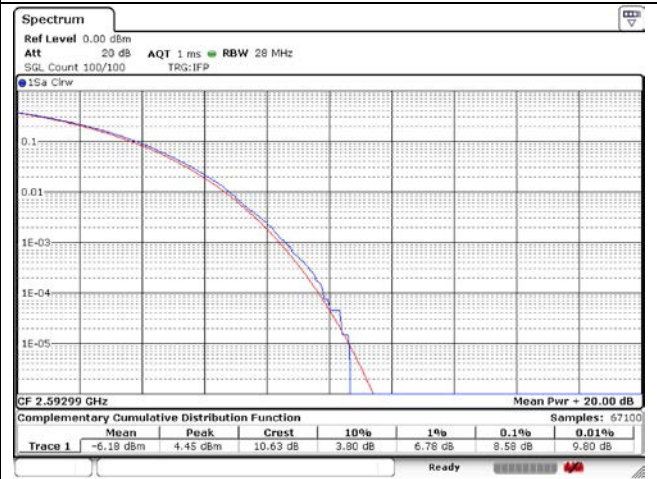
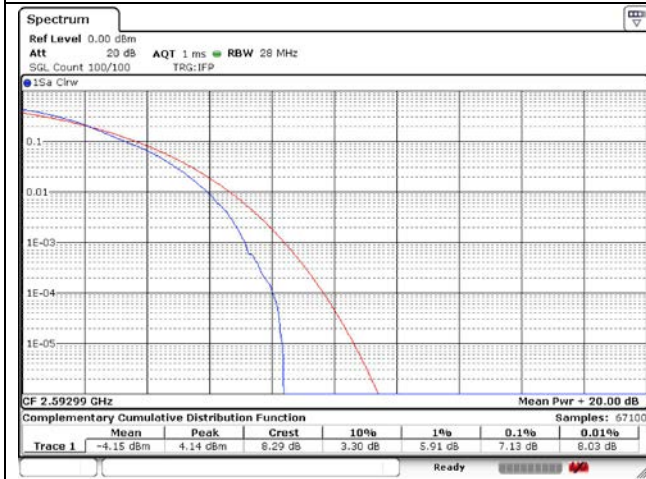
NR band 41 (FCC)



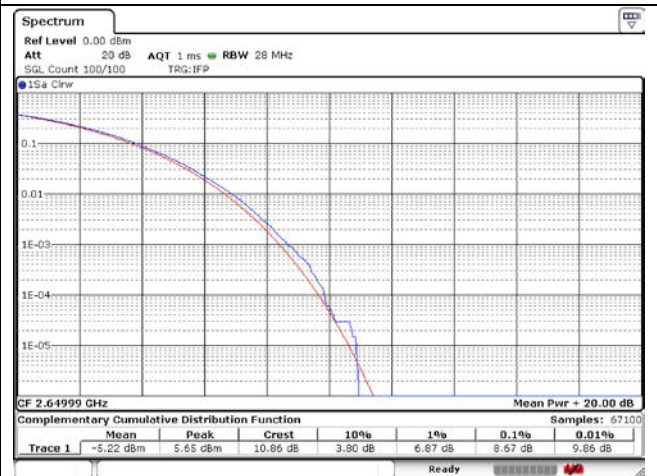
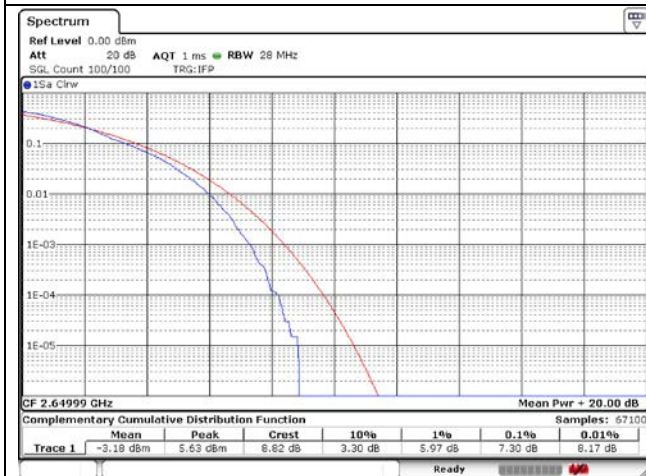
NR band 41 (FCC)



80 MHz Low Channel - Full RB - DFT-S-OFDM

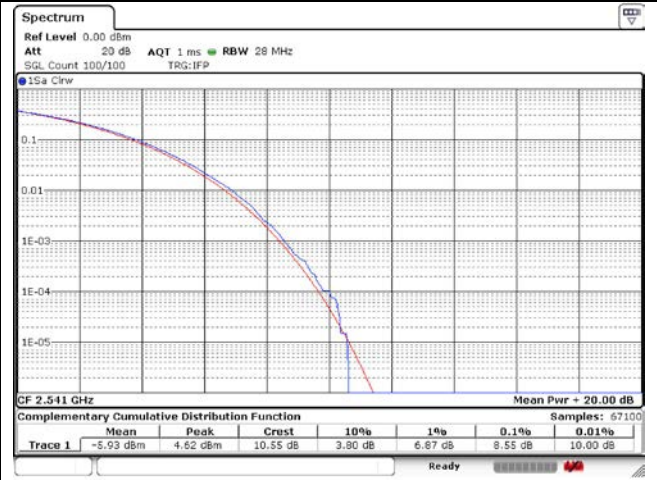
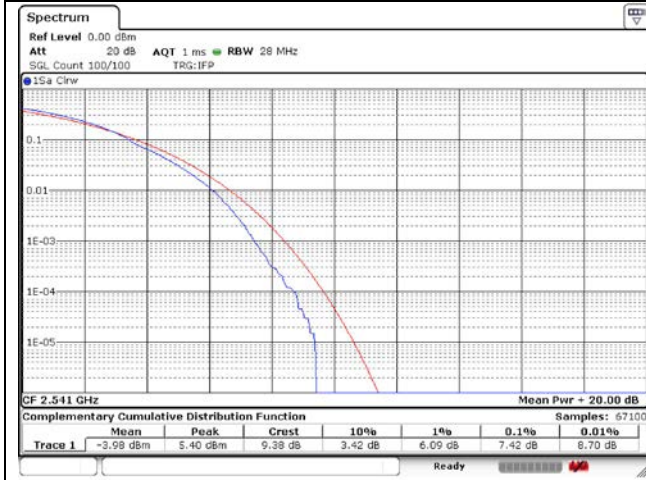
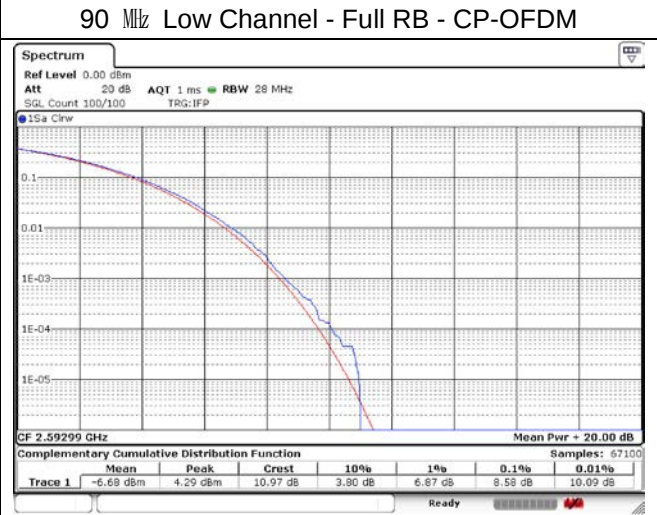
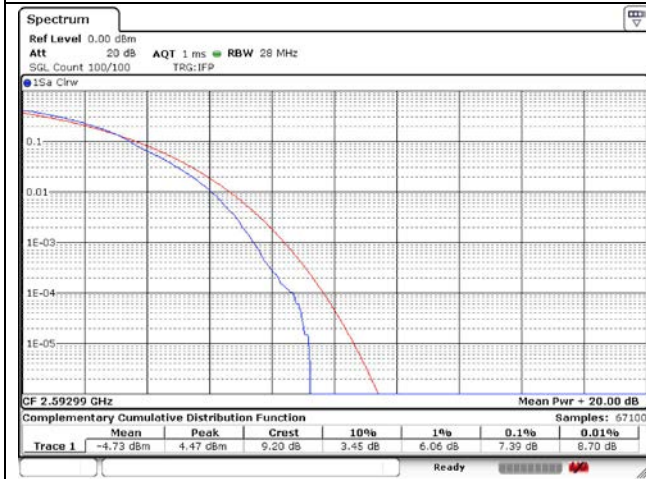
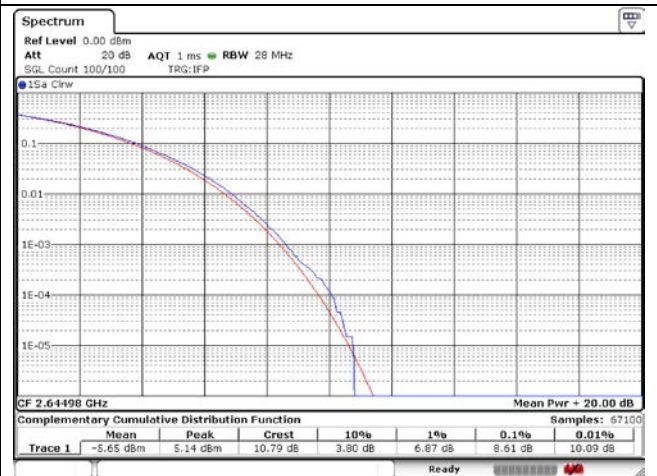
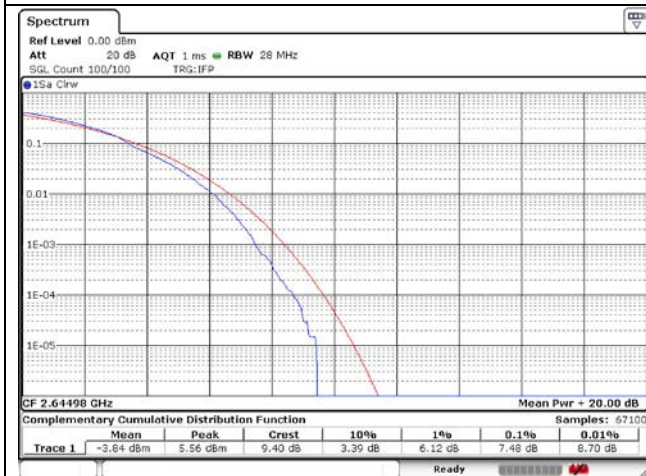


80 MHz Middle Channel - Full RB - DFT-S-OFDM

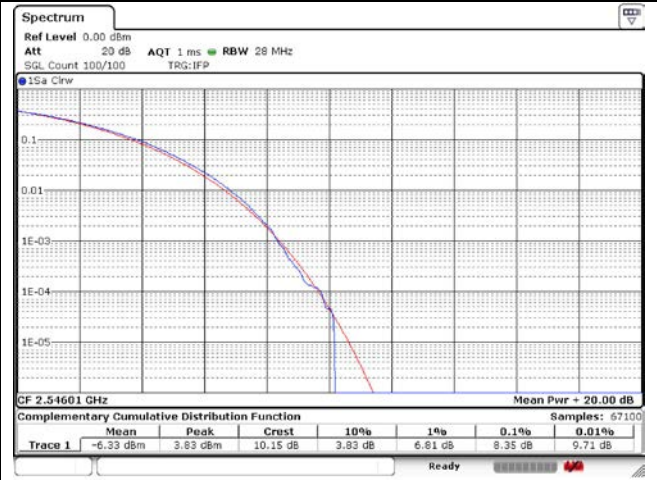
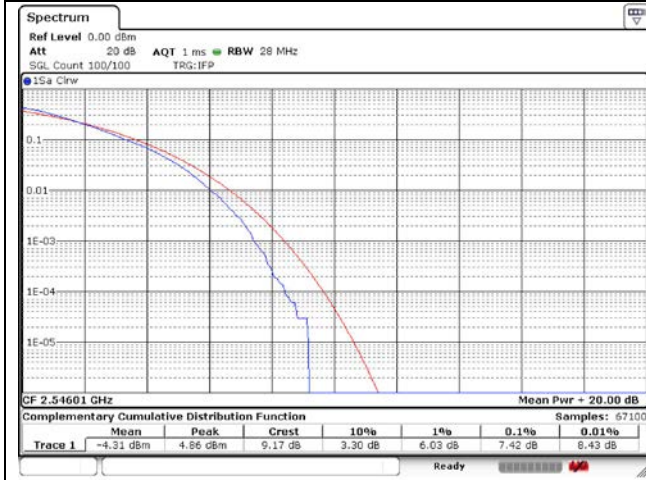


80 MHz High Channel - Full RB - DFT-S-OFDM

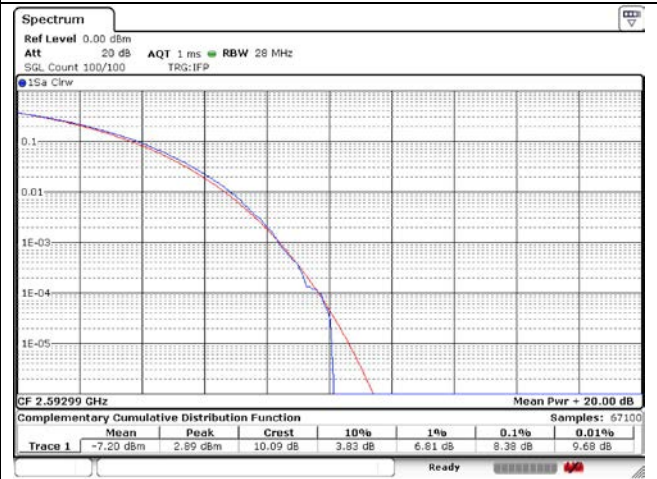
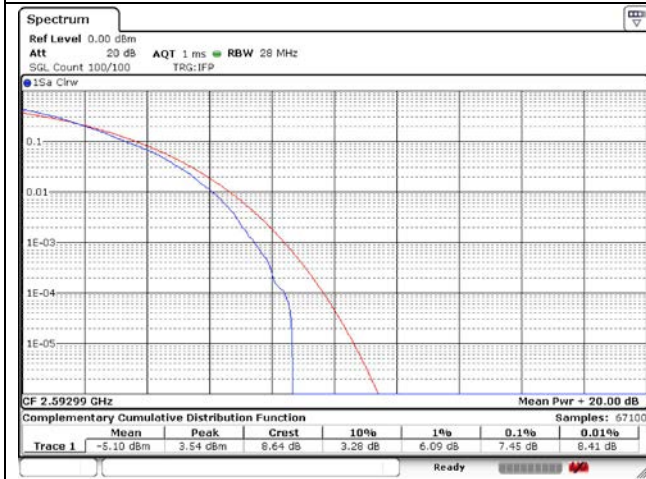
80 MHz High Channel - Full RB - CP-OFDM

NR band 41 (FCC)

90 MHz Low Channel - Full RB - DFT-S-OFDM

90 MHz Middle Channel - Full RB - DFT-S-OFDM

90 MHz High Channel - Full RB - DFT-S-OFDM
90 MHz High Channel - Full RB - CP-OFDM

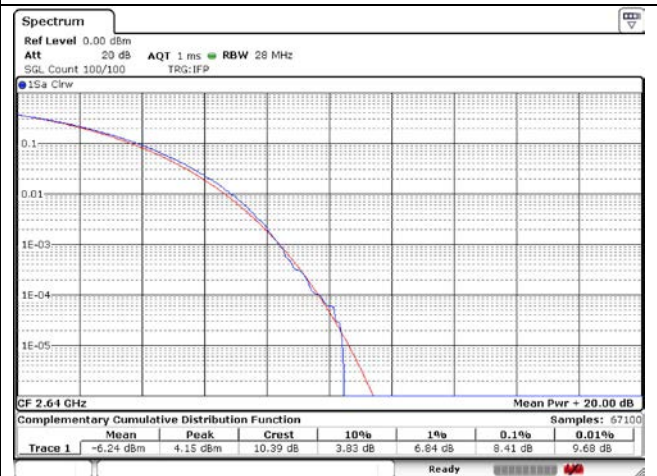
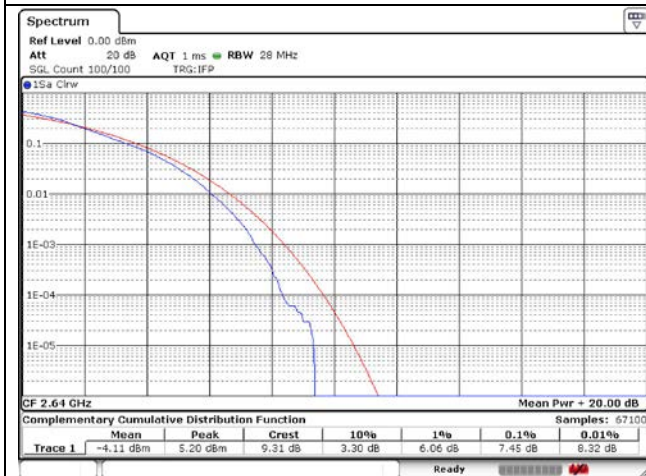
NR band 41 (FCC)



100 MHz Low Channel - Full RB - DFT-S-OFDM



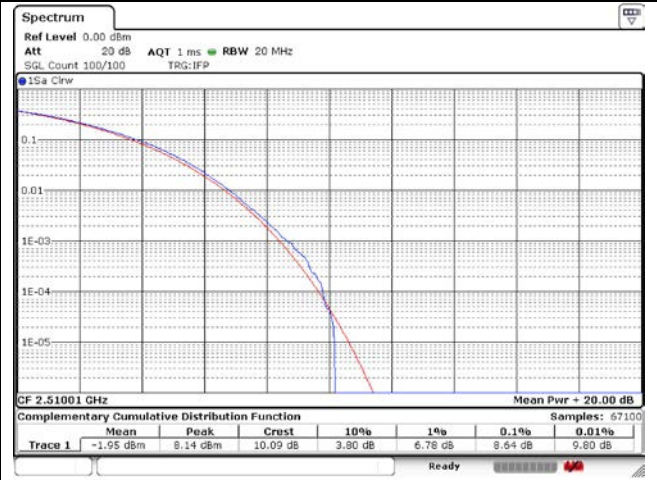
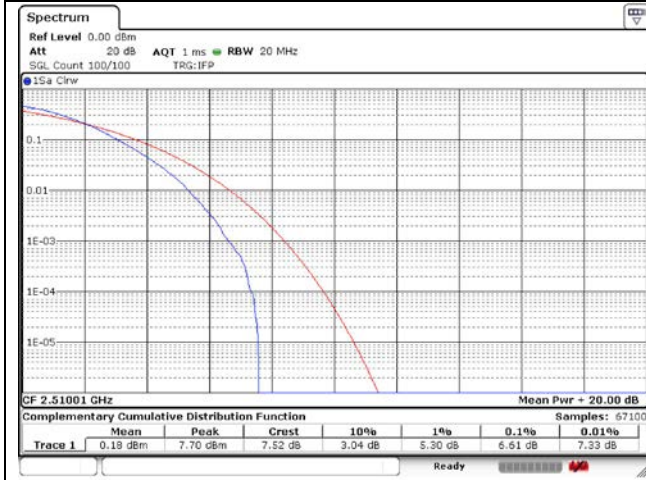
100 MHz Middle Channel - Full RB - DFT-S-OFDM



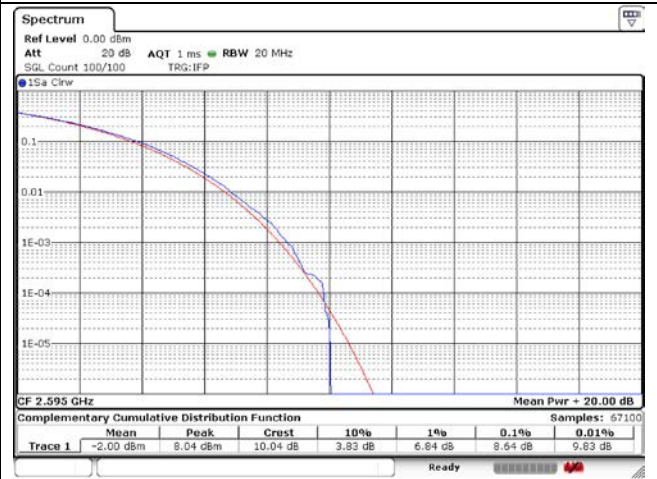
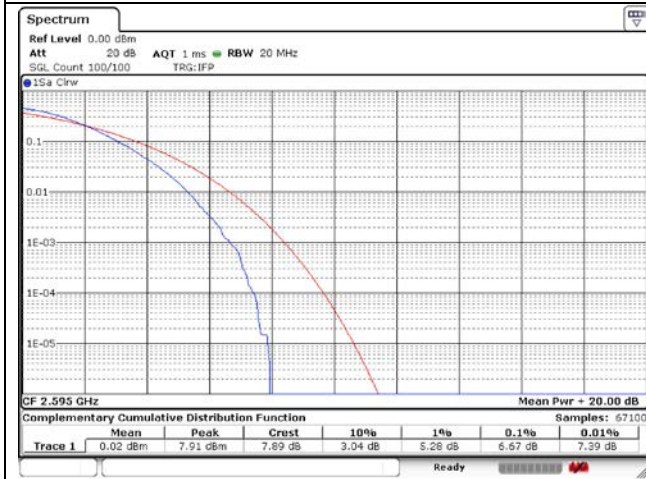
100 MHz High Channel - Full RB - DFT-S-OFDM

100 MHz High Channel - Full RB - CP-OFDM

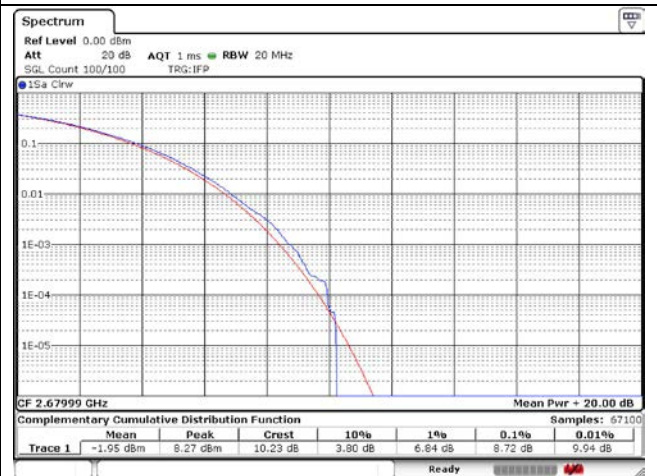
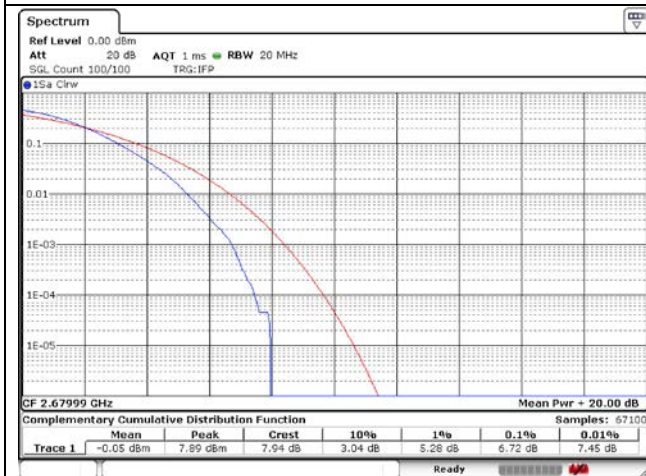
NR band 41 (IC)



20 MHz Low Channel - Full RB - DFT-S-OFDM



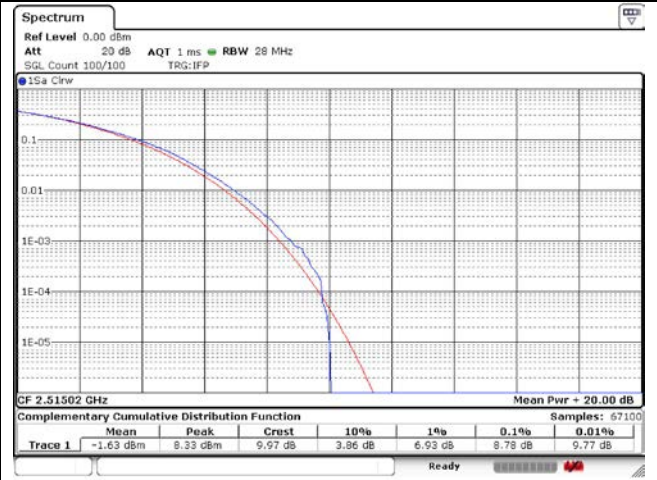
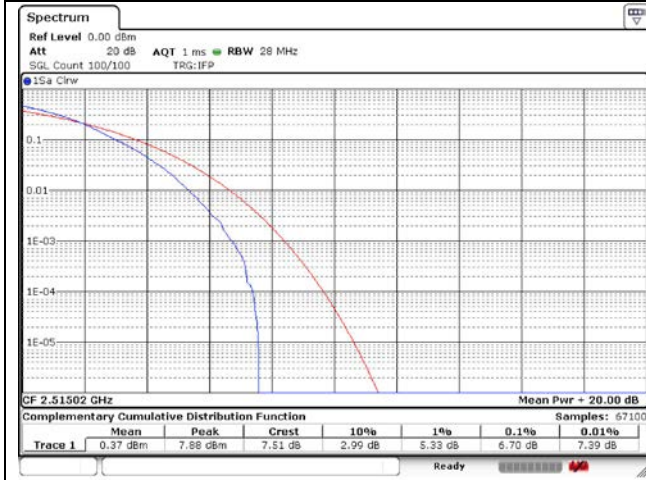
20 MHz Middle Channel - Full RB - DFT-S-OFDM



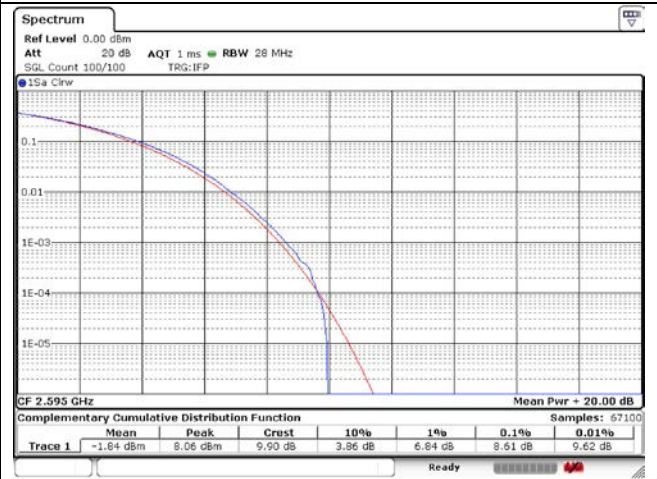
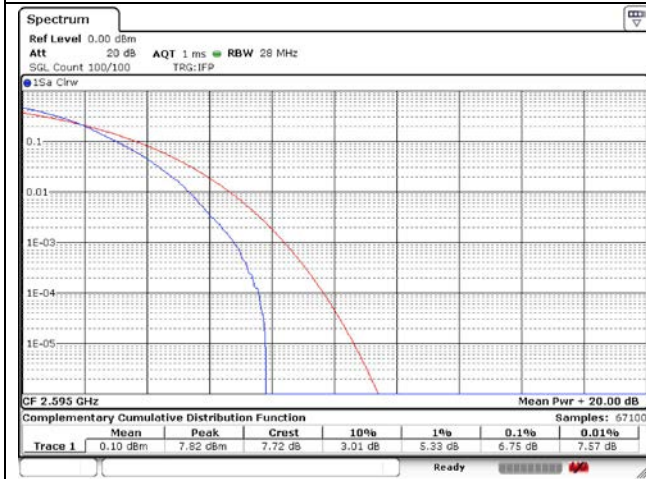
20 MHz High Channel - Full RB - DFT-S-OFDM

20 MHz High Channel - Full RB - CP-OFDM

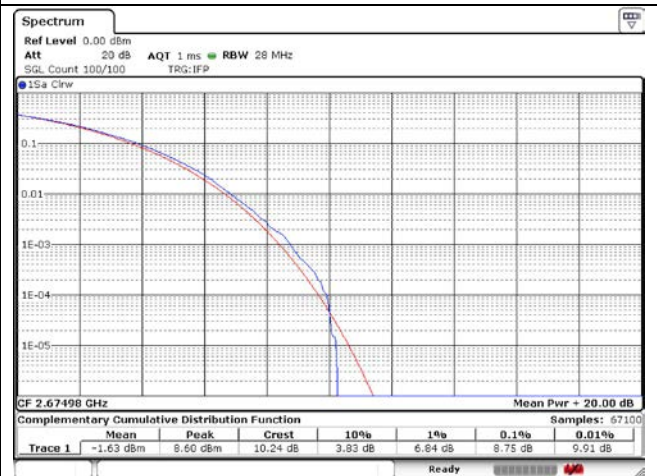
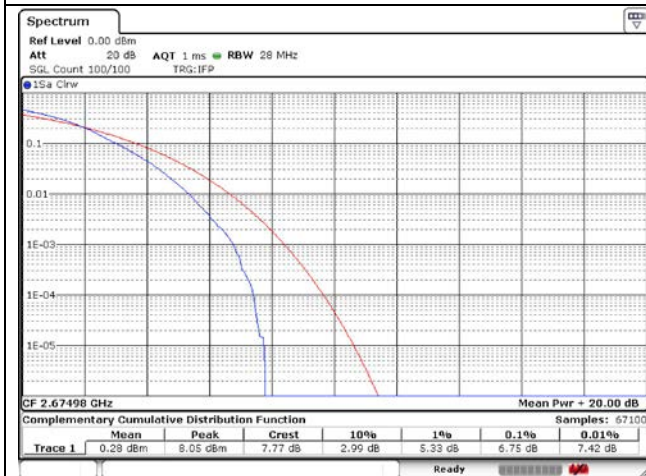
NR band 41 (IC)



30 MHz Low Channel - Full RB - DFT-S-OFDM



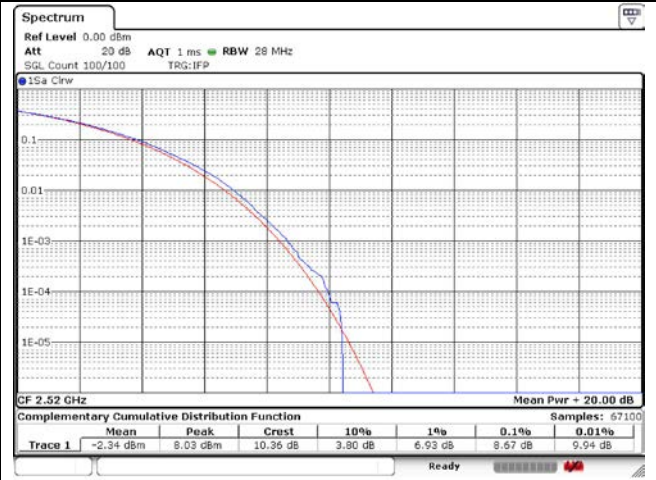
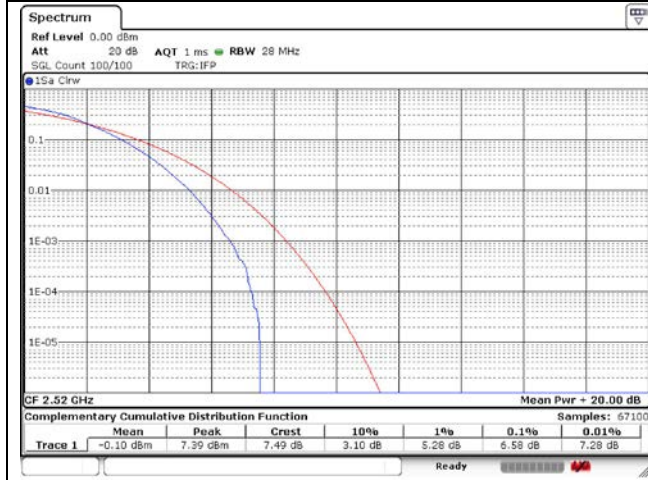
30 MHz Middle Channel - Full RB - DFT-S-OFDM



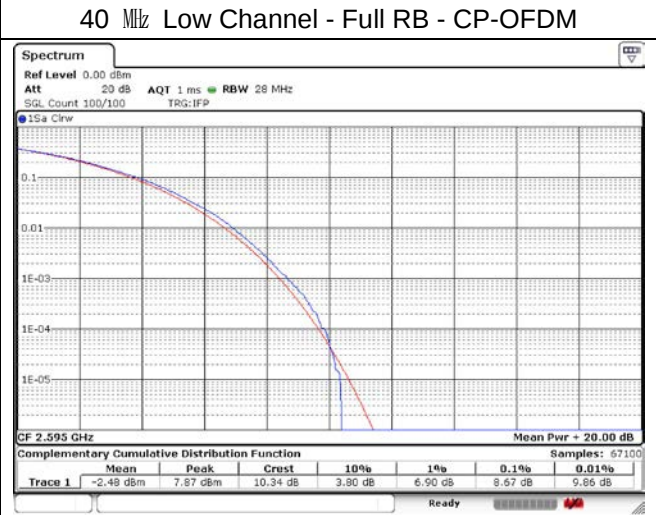
30 MHz High Channel - Full RB - DFT-S-OFDM

30 MHz High Channel - Full RB - CP-OFDM

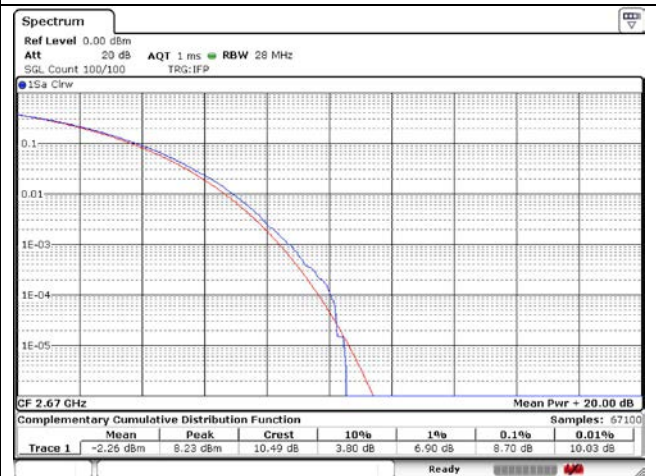
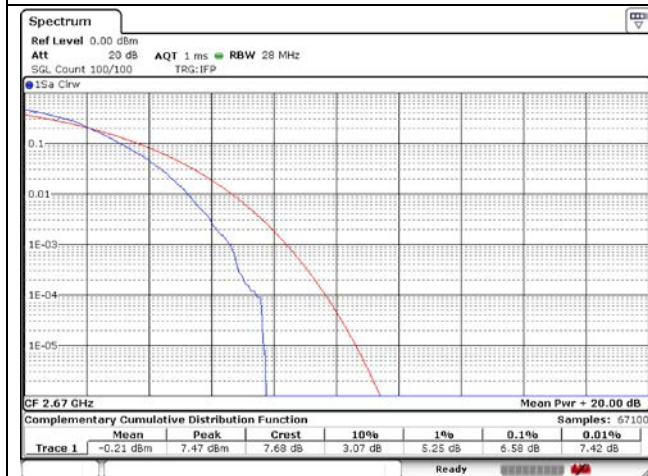
NR band 41 (IC)



40 MHz Low Channel - Full RB - DFT-S-OFDM



40 MHz Middle Channel - Full RB - DFT-S-OFDM



40 MHz High Channel - Full RB - DFT-S-OFDM

40 MHz High Channel - Full RB - CP-OFDM