Testing Laboratory
1190

FCC RADIO TEST REPORT

FCC ID	**:**	**UZ7ET65AW**
Equipment	**:**	**Rugged 2 in 1 Android Tablet**
Brand Name	**:**	**Zebra**
Model Name	**:**	**ET65AW**
Applicant	**:**	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Manufacturer	**:**	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Standard	**:**	**FCC 47 CFR Part 2, and 90(S)**

The product was received on Jul. 12, 2023 and testing was performed from Jul. 22, 2023 to Sep. 08, 2023. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FG371211G	01	Initial issue of report	Sep. 18, 2023

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046 §90.635	Conducted Output Power and Effective Radiated Power	Pass	-
3.3	-	Peak-to-Average Ratio	Reporting only	-
3.4	§2.1049 §90.209	Occupied Bandwidth and 26dB Bandwidth	Reporting only	-
3.5	§2.1051 §90.691	Emission masks – In-band emissions	Pass	-
3.6	§2.1051 §90.691	Emission masks – Out of band emissions	Pass	-
3.7	§2.1055 §90.213	Frequency Stability for Temperature & Voltage	Pass	-
3.8	§2.1053 §90.691	Field Strength of Spurious Radiation	Pass	42.16 dB under the limit at 3258.00 MHz

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”.

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Keven Cheng

Report Producer: Michelle Chen

1 General Description

1.1 Feature of Equipment Under Test

Product Feature	
Equipment	Rugged 2 in 1 Android Tablet
Brand Name	Zebra
Model Name	ET65AW
FCC ID	UZ7ET65AW
EUT supports Radios application	WCDMA/HSPA/LTE/5G NR/NFC/GNSS WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80/VHT160 WLAN 11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE
HW Version	DV2
SW Version	A13
MFD	21JUN23
DUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer.

Specification of Accessories				
Adapter	**Brand Name**	Zebra	**Part Number**	PWR-BGA15V45W-UC2-WW
Battery 1	**Brand Name**	Zebra	**Part Number**	BT-000471-0020
Battery 2	**Brand Name**	Zebra	**Part Number**	BT-000471-0820

Supported Unit Used in Test Configuration and System				
USB TYPE C to 3.5mm audio connector	**Brand Name**	Zebra	**Part Number**	ADP-USBC-35MM1-01
3.5mm Earphone	**Brand Name**	Zebra	**Part Number**	HDST-35MM-PTVP-01
USB TYPE C Earphone	**Brand Name**	Zebra	**Part Number**	HPST-USBC-PTT1-01
Headset Jumper	**Brand Name**	Zebra	**Part Number**	CBL-TC51-HDST35-01

1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx Frequency	816.5 ~ 821.5 MHz
Rx Frequency	861.5 ~ 866.5 MHz
Bandwidth	5MHz / 10MHz / 15MHz / 20MHz
Maximum Output Power to Antenna	24.09 dBm 24.14 dBm for Straddle Channel
Antenna Type	PIFA Antenna
Antenna Gain	Ant. 1: -0.60 dBi
Type of Modulation	PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM

Remark: The above EUT's information was declared by manufacturer. Please refer to Disclaimer in report summary.

1.3 Modification of EUT

No modifications made to the EUT during the testing.

1.4 Testing Site

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.** TH03-HY
Test Engineer	Hank Chen and Luffy Lin
Temperature (℃)	23.5~24.1
Relative Humidity (%)	48~52

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.** 03CH12-HY (TAF Code: 3786)
Test Engineer	Jesse Fan, Tim Lee and Wilson Wu
Temperature (℃)	20~25
Relative Humidity (%)	50~60
Remark	The Radiated Spurious Emission test item subcontracted to Sporton International Inc. Wensan Laboratory.

Note: The test site complies with ANSI C63.4 2014 requirement.
FCC Designation No.: TW1190 and TW3786

1.5 Applied Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC 47 CFR Part 2, 90
- ANSI / TIA-603-E
- ANSI C63.26-2015
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01
- FCC KDB 414788 D01 Radiated Test Site v01r01
- Interim Guidance for Equipment Authorization of Devices with Channel Bandwidths Combined Across Two Contiguous Service Rule Allocations OET/Lab/EACB, June 6, 2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

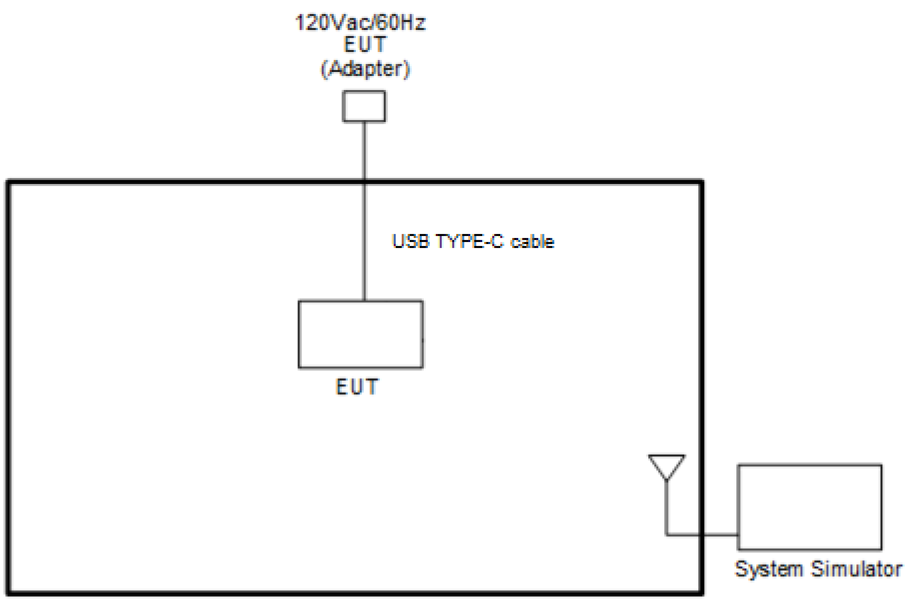
During all testing, EUT is in link mode with base station emulator at maximum power level.

For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.26 exploratory test procedures and only the worst case emissions were reported in this report.

Frequency range investigated for radiated emission is 30 MHz to 9000 MHz.

Conducted Test Cases	Band	Bandwidth (MHz)				Modulation					RB #			Test Channel		
		5	10	15	20	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	1	Half	Full	L	M	H
Max. Output Power	n26	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Peak-to-Average Ratio	n26		v		v	v	v	v	v	v			v		v	
26dB and 99% Bandwidth	n26	v	v	v	v	v	v	v	v	v			v		v	
Emission masks In-band emissions	n26	v	v			v	v	v	v	v	v		v	v	v	v
Emission masks – Out of band emissions	n26	v					v				v			v	v	v
Frequency Stability	n26		v		v	v							v		v	
E.R.P.	n26	v	v	v	v	v	v	v	v	v	Max. Power					
Radiated Spurious Emission	n26	Worst Case												v	v	v
Remark	1. The mark "**v** " means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. 5G NR n26 transmit frequency for part22 rule is 824MHz-849MHz, for part90 rule is 814MHz-824MHz. ERP over 15MHz bandwidth complies the ERP limit line of part22 rule, therefore ERP of the partial frequency spectrum which falls within part 22 also complies. 4. For radiated measurement, pre-scanned in two modes, DFT-s OFDM and CP OFDM. The worst cases (DFT-s OFDM) were recorded in this report. 5. All the radiated test cases were performed with Battery 1. 6. One representative bandwidth is selected to perform PAR and frequency stability.																

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8000A	N/A	N/A	Unshielded, 1.8 m

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between RF conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level will be exactly the RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

The following shows an offset computation example with RF cable loss 4.2 dB and a 10dB attenuator.

Example :

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

2.5 Frequency List of Low/Middle/High Channels

5G NR n26 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
10	Channel	-	163800	-
	Frequency	-	819	-
5	Channel	163300	163800	164300
	Frequency	816.5	819	821.5

5G NR n26 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**-**	**cross-rule channels**	**-**
20	Channel	-	164800	-
	Frequency	-	824	-
15	Channel	-	164800	-
	Frequency	-	824	-
10	Channel	-	164800	-
	Frequency	-	824	-
5	Channel	-	164800	-
	Frequency	-	824	-

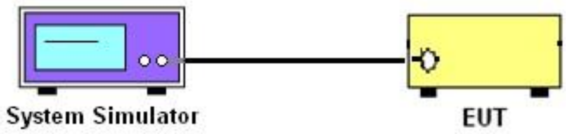
3 Conducted Test Items

3.1 Measuring Instruments

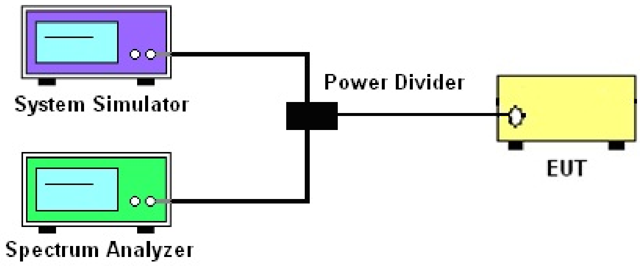
See list of measuring instruments of this test report.

3.1.1 Test Setup

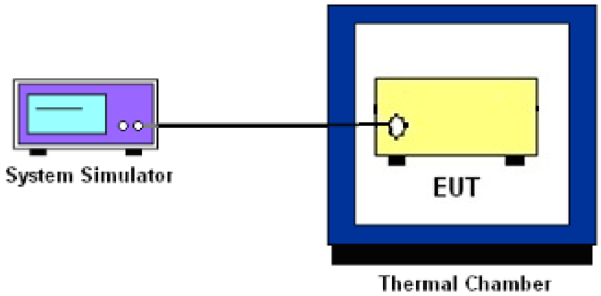
3.1.2 Conducted Output Power



3.1.3 Peak-to-Average Ratio, Occupied Bandwidth, Conducted Band-Edge, Emission Mask, Emissions Mask – Out Of Band Emissions, and Conducted Spurious Emission



3.1.4 Frequency Stability



3.1.5 Test Result of Conducted Test

Please refer to Appendix A.

3.2 Conducted Output Power Measurement and ERP Measurement

3.2.1 Description of the Conducted Output Power Measurement and ERP Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

The output power of mobile transmitters must not exceed 100 Watts for 5G NR n26.

According to KDB 412172 D01 Power Approach,

EIRP = $P_T + G_T – L_C$, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.2.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

3.3 Peak-to-Average Ratio

3.3.1 Description of the PAR Measurement

Reporting only

3.3.2 Test Procedures

1. The EUT was connected to spectrum and system simulator via a power divider.
2. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio.

3.4 99% Occupied Bandwidth and 26dB Bandwidth Measurement

3.4.1 Description of (Occupied) Bandwidth Limitations Measurement

The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The emission bandwidth is defined as the width of the signal between two points, located at the 2 sides of the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

3.4.2 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The 26dB and 99% occupied bandwidth (BW) of the middle channel for the highest RF power with full RB sizes were measured.

3.5 Emissions Mask Measurement

3.5.1 Description of Emissions Mask Measurement

Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of FCC Part 90.691.(a)

(a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log_{10}(f/6.1) decibels or 50 + 10 Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

3.5.2 Test Procedures

1. The EUT was connected to spectrum analyzer and base station via power divider.
2. The emissions mask of low and high channels for the highest RF powers were measured.
3. Set RBW and VBW 3 times of RBW to make the measurement with the spectrum analyzer's, and according to KDB 971168 D02 Misc Rev Approve License Devices v02r01 standards, set RBW = 300 Hz to make offsets less than 37.5 kHz from a channel edge , RBW = 100 kHz to make offsets greater than 37.5 kHz, that is allowed.
4. The test results were shown below plots with a correction offset factor including cable loss, insertion loss of power divider.

3.6 Emissions Mask – Out Of Band Emissions Measurement

3.6.1 Description of Conducted Emissions Out of band emissions measurement

The power of any emission FCC Part 90.691 (a)(2) on any frequency removed from the assigned frequency by out of the authorized bandwidth at least 43 + 10 log (P) dB. It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

3.6.2 Test Procedures

1. The EUT was connected to spectrum analyzer and system simulator via a power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. For testing below 1GHz, make the measurement with the spectrum analyzer's RBW = 100 kHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. For testing above 1GHz, make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

3.7 Frequency Stability Measurement

3.7.1 Description of Frequency Stability Measurement

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Procedures for Temperature Variation

1. The EUT was set up in the thermal chamber and connected with the base station.
2. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized for three hours. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

3.7.4 Test Procedures for Voltage Variation

1. The EUT was placed in a temperature chamber at 20±5° C and connected with the base station.
2. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

3.8 Field Strength of Spurious Radiation Measurement

3.8.1 Description of Field Strength of Spurious Radiated Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E. The power of any emission FCC Part 90.691 on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least 43 + 10 log (P) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

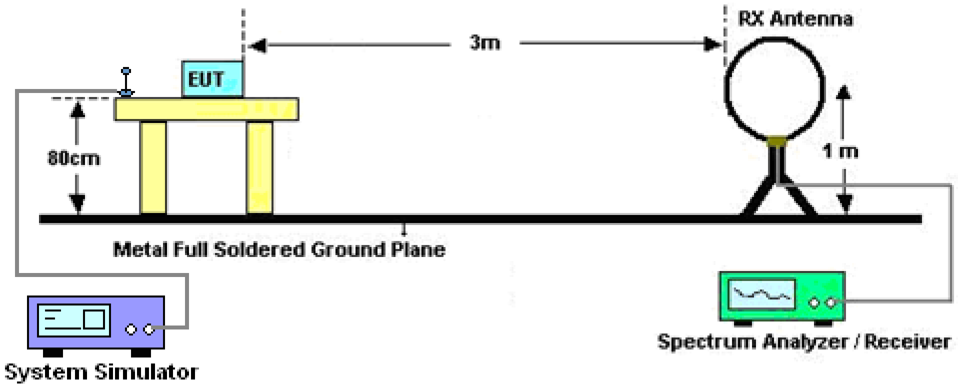
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43+10\log_{10}$(P[Watts]) dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

3.8.2 Test Procedures

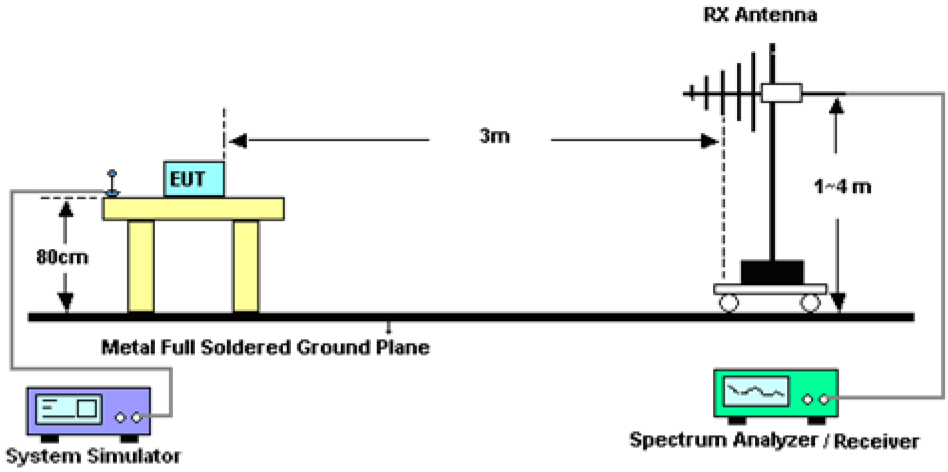
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. For testing below 1GHz, make the measurement with the spectrum analyzer's RBW = 100 kHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
6. For testing above 1GHz, make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
7. Measure the burst average result by setting trace = max hold or trace = average with duty cycle factor when margin is not enough.
8. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
9. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
10. Taking the record of output power at antenna port.
11. Repeat step 7 to step 8 for another polarization.
12. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
13. ERP (dBm) = EIRP - 2.15
14. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
15. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)

3.8.3 Test Setup

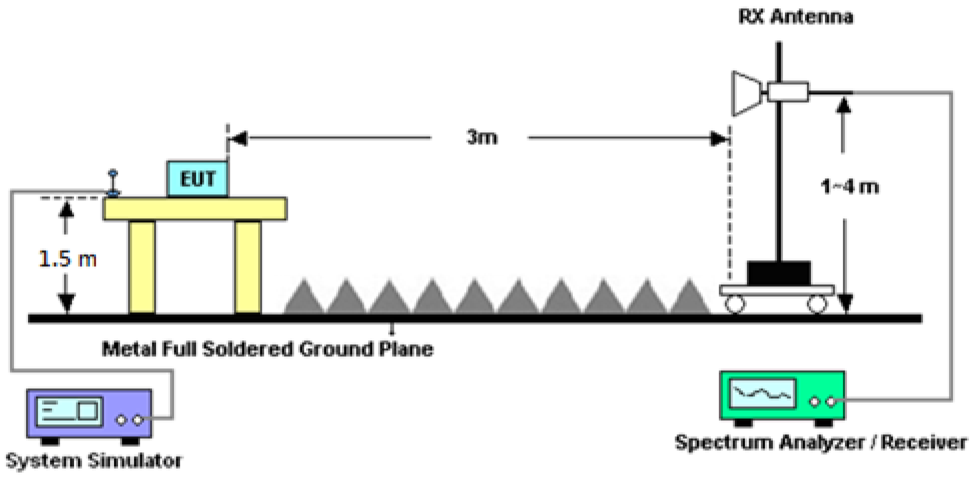
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.8.4 Test Result of Field Strength of Spurious Radiated

Please refer to Appendix B.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 28, 2023	Jul. 28, 2023~ Sep. 08, 2023	Mar. 27, 2024	Conducted (TH03-HY)
Radio Communication Test Station	Anritsu	MT8000A	6272337370	N/A	Oct. 28, 2022	Jul. 28, 2023~ Sep. 08, 2023	Oct. 27, 2023	Conducted (TH03-HY)
Base Station(Measure)	Anritsu	MT8821C	6262116725	LTE FDD/TDD LTE-3CC DLCA/2CC ULCA	Oct. 13, 2022	Jul. 28, 2023~ Sep. 08, 2023	Oct. 12, 2023	Conducted (TH03-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 20, 2022	Jul. 22, 2023~ Aug. 10, 2023	Sep. 19, 2023	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	37059 & 01	30MHz~1GHz	Nov. 10, 2022	Jul. 22, 2023~ Aug. 10, 2023	Nov. 09, 2023	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1328	1GHz~18GHz	Dec. 15, 2022	Jul. 22, 2023~ Aug. 10, 2023	Dec. 14, 2023	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02294	1GHz~18GHz	Jun. 30, 2023	Jul. 22, 2023~ Aug. 10, 2023	Jun. 29, 2024	Radiation (03CH12-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 03, 2022	Jul. 22, 2023~ Aug. 10, 2023	Oct. 02, 2023	Radiation (03CH12-HY)
Preamplifier	Agilent	8449B	3008A02375	1GHz~26.5GHz	May 23, 2023	Jul. 22, 2023~ Aug. 10, 2023	May 22, 2024	Radiation (03CH12-HY)
Preamplifier	E-INSTRUMENT TECH LTD.	ERA-100M-18G-56-01-A70	EC1900249	1GHz-18GHz	Dec. 21, 2022	Jul. 22, 2023~ Aug. 10, 2023	Dec. 20, 2023	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Jan. 10, 2023	Jul. 22, 2023~ Aug. 10, 2023	Jan. 09, 2024	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-1080-1200-15000-60SS	SN1	1.2GHz High Pass Filter	Mar. 14, 2023	Jul. 22, 2023~ Aug. 10, 2023	Mar. 13, 2024	Radiation (03CH12-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN2	3GHz High Pass Filter	Mar. 14, 2023	Jul. 22, 2023~ Aug. 10, 2023	Mar. 13, 2024	Radiation (03CH12-HY)
Filter	Wainwright	WHKX8-5872.5-6750-18000-40ST	SN2	6.75GHz High Pass Filter	Mar. 14, 2023	Jul. 22, 2023~ Aug. 10, 2023	Mar. 13, 2024	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	9kHz~30MHz	Mar. 07, 2023	Jul. 22, 2023~ Aug. 10, 2023	Mar. 06, 2024	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 20, 2022	Jul. 22, 2023~ Aug. 10, 2023	Dec. 19, 2023	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Dec. 20, 2022	Jul. 22, 2023~ Aug. 10, 2023	Dec. 19, 2023	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803953/2	30MHz~40GHz	Dec. 20, 2022	Jul. 22, 2023~ Aug. 10, 2023	Dec. 19, 2023	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Jul. 22, 2023~ Aug. 10, 2023	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Jul. 22, 2023~ Aug. 10, 2023	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-000989	N/A	N/A	Jul. 22, 2023~ Aug. 10, 2023	N/A	Radiation (03CH12-HY)
Signal Generator	Rohde & Schwarz	SMF100A	101107	100kHz~40GHz	Jan. 11, 2023	Jul. 22, 2023~ Aug. 10, 2023	Jan. 10, 2024	Radiation (03CH12-HY)

5 Measurement Uncertainty

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.07 dB**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.63 dB**

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power) and ERP

Part90s NR n26 Maximum Average Power [dBm] (GT - LC = -0.6 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP
5	1	1	PI/2 BPSK	23.96	24.03	23.98	21.34	0.1361
5	1	23		24.02	23.92	23.97		
5	12	6		24.04	24.01	24.04		
5	1	0		23.56	23.55	23.44		
5	1	24		23.49	23.57	23.51		
5	25	0		23.52	23.53	23.54		
5	1	1	QPSK	24.09	24.05	23.96		
5	1	23		24.01	23.99	24.03		
5	12	6		23.95	23.98	24.08		
5	1	0		22.94	22.98	22.99		
5	1	24		23.01	23.08	23.00		
5	25	0		23.05	23.00	23.07		
5	1	1	16-QAM	22.90	23.03	22.96	20.28	0.1067
5	1	1	64-QAM	21.59	21.63	21.57		
5	1	1	256-QAM	19.07	19.04	18.95		
Limit	ERP < 100W			Result			Pass	

Part90s NR n26 Maximum Average Power [dBm] (GT - LC = -0.6 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP
10	1	1	PI/2 BPSK	-	24.04	-	21.32	0.1355
10	1	50		-	23.95	-		
10	25	12		-	24.03	-		
10	1	0		-	23.57	-		
10	1	51		-	23.52	-		
10	50	0		-	23.52	-		
10	1	1	QPSK	-	24.07	-		
10	1	50		-	24.01	-		
10	25	12		-	24.04	-		
10	1	0		-	23.02	-		
10	1	51		-	23.07	-		
10	50	0		-	23.06	-		
10	1	1	16-QAM	-	22.92	-	20.17	0.1040
10	1	1	64-QAM	-	21.67	-		
10	1	1	256-QAM	-	19.04	-		
Limit	ERP < 100W			Result			Pass	

NR n26 Straddle Channel Maximum Average Power [dBm] (GT - LC = -0.6 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP
5	1	1	PI/2 BPSK	-	23.99	-	21.37	0.1371
5	1	23		-	24.08	-		
5	12	6		-	24.12	-		
5	1	0		-	23.50	-		
5	1	24		-	23.54	-		
5	25	0		-	23.59	-		
5	1	1	QPSK	-	24.03	-		
5	1	23		-	24.05	-		
5	12	6		-	24.10	-		
5	1	0		-	23.07	-		
5	1	24		-	23.04	-		
5	25	0		-	23.11	-		
5	1	1	16-QAM	-	23.02	-	20.27	0.1064
5	1	1	64-QAM	-	21.67	-		
5	1	1	256-QAM	-	18.94	-		
Limit	Reporting only			Result			N/A	

NR n26 Straddle Channel Maximum Average Power [dBm] (GT - LC = -0.6 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP
10	1	1	PI/2 BPSK	-	23.97	-	21.33	0.1358
10	1	50		-	24.08	-		
10	25	12		-	24.01	-		
10	1	0		-	23.52	-		
10	1	51		-	23.62	-		
10	50	0		-	23.54	-		
10	1	1	QPSK	-	24.00	-		
10	1	50		-	24.02	-		
10	25	12		-	23.97	-		
10	1	0		-	22.94	-		
10	1	51		-	23.18	-		
10	50	0		-	23.01	-		
10	1	1	16-QAM	-	22.92	-	20.17	0.1040
10	1	1	64-QAM	-	21.60	-		
10	1	1	256-QAM	-	19.09	-		
Limit	Reporting only			Result			N/A	

NR n26 Straddle Channel Maximum Average Power [dBm] (GT - LC = -0.6 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP
15	1	1	PI/2 BPSK	-	23.95	-	21.39	0.1377
15	1	77		-	24.02	-		
15	36	18		-	23.97	-		
15	1	0		-	23.45	-		
15	1	78		-	23.57	-		
15	75	0		-	23.53	-		
15	1	1	QPSK	-	23.90	-		
15	1	77		-	24.14	-		
15	36	18		-	24.01	-		
15	1	0		-	23.02	-		
15	1	78		-	23.17	-		
15	75	0		-	23.01	-		
15	1	1	16-QAM	-	22.89	-	20.14	0.1033
15	1	1	64-QAM	-	21.54	-		
15	1	1	256-QAM	-	19.03	-		
Limit	Reporting only			Result			N/A	

NR n26 Straddle Channel Maximum Average Power [dBm] (GT - LC = -0.6 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	ERP (dBm)	ERP
20	1	1	PI/2 BPSK	-	23.98	-	21.37	0.1371
20	1	104		-	24.12	-		
20	50	25		-	23.95	-		
20	1	0		-	23.46	-		
20	1	105		-	23.59	-		
20	100	0		-	23.64	-		
20	1	1	QPSK	-	23.90	-		
20	1	104		-	24.07	-		
20	50	25		-	23.96	-		
20	1	0		-	22.87	-		
20	1	105		-	23.05	-		
20	100	0		-	23.06	-		
20	1	1	16-QAM	-	22.85	-	20.10	0.1023
20	1	1	64-QAM	-	21.54	-		
20	1	1	256-QAM	-	18.86	-		
Limit	Reporting only			Result			N/A	

FR1 n26

Peak-to-Average Ratio

Mode	FR1 n26 / 10MHz / DFT-S OFDM				
Mod.	PI/2 BPSK	QPSK	16QAM	64QAM	Limit: 13dB
RB Size	Full RB	Full RB	Full RB	Full RB	Result
Middle CH	4.34	5.72	6.58	6.52	PASS
Mode	FR1 n26 / 10MHz / DFT-S OFDM				
Mod.	256QAM				Limit: 13dB
RB Size	Full RB				Result
Middle CH	6.64				PASS

<table>
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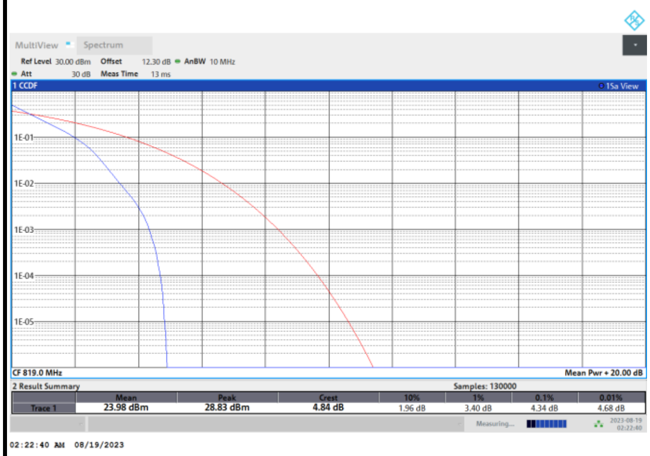
<tr><td>
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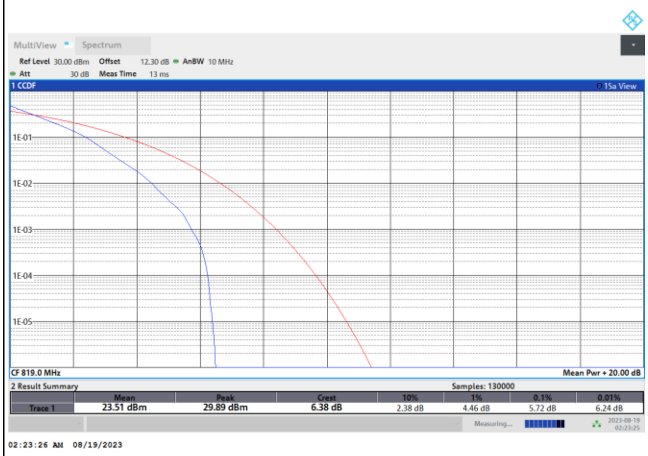
<td>
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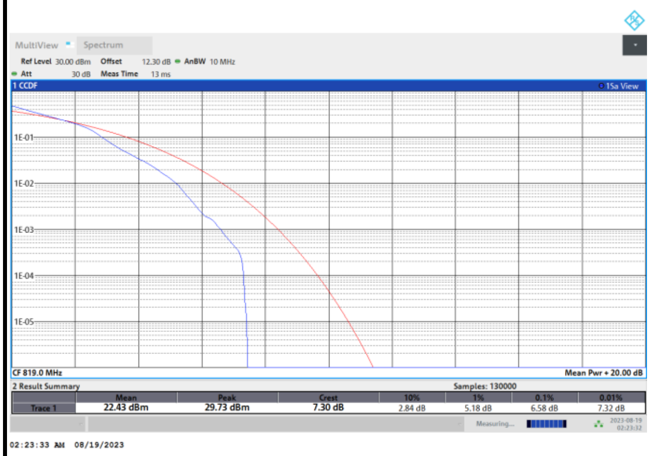
<tr><td>
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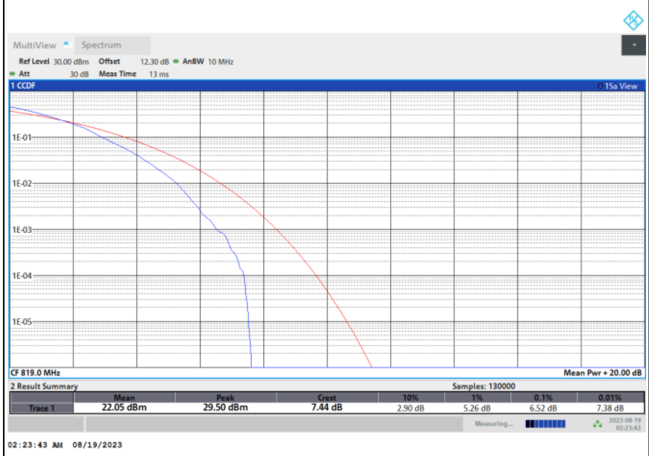
<td>
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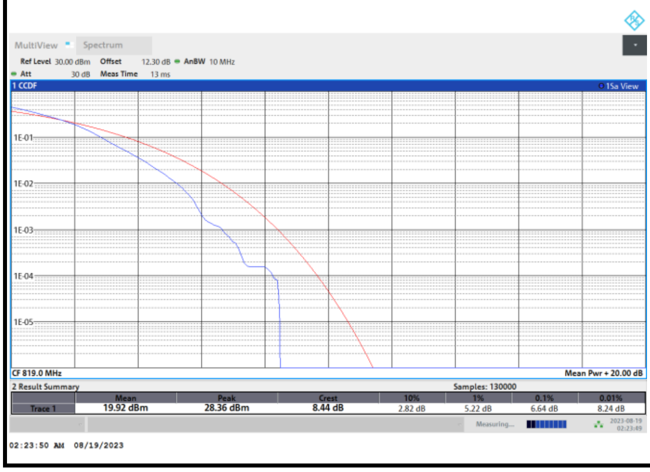
<tr><th>256QAM</th><th></th></tr>
<tr><td>
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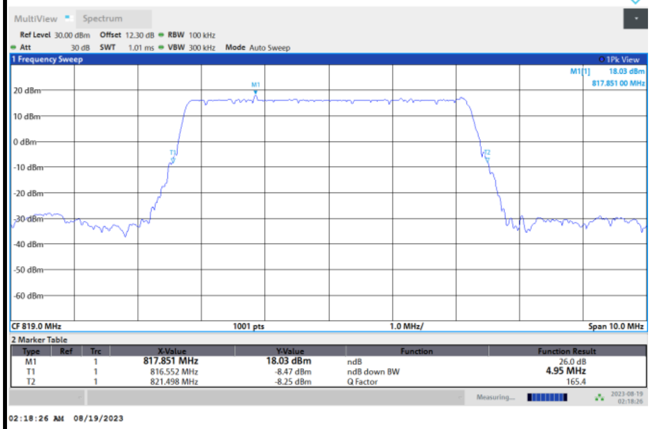
26dB Bandwidth

Mode	FR1 n26 : 26dB BW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz					
Mod.	PI/2 BPSK		PI/2 BPSK					
Middle CH	4.95		9.41					

Mode	FR1 n26 : 26dB BW(MHz) / CP OFDM							
BW	5MHz		10MHz					
Mod.	QPSK	16QAM	QPSK	16QAM				
Middle CH	5.01	4.95	9.75	9.79				
Mod.	64QAM	256QAM	64QAM	256QAM				
Middle CH	4.89	5.01	9.93	9.91				

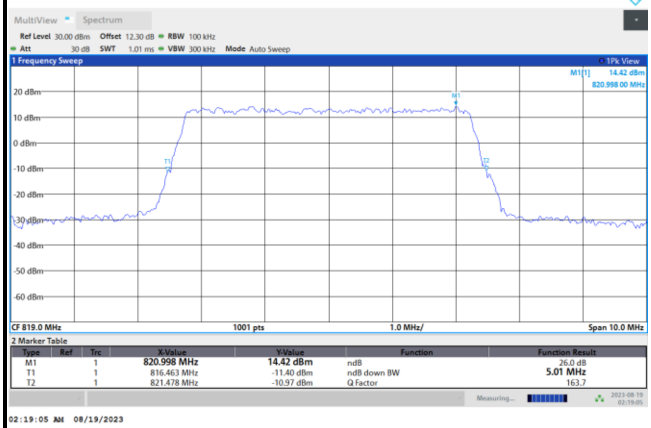
FR1 n26 / 5MHz / DFT-S OFDM / Middle Channel / Full RB

PI/2 BPSK

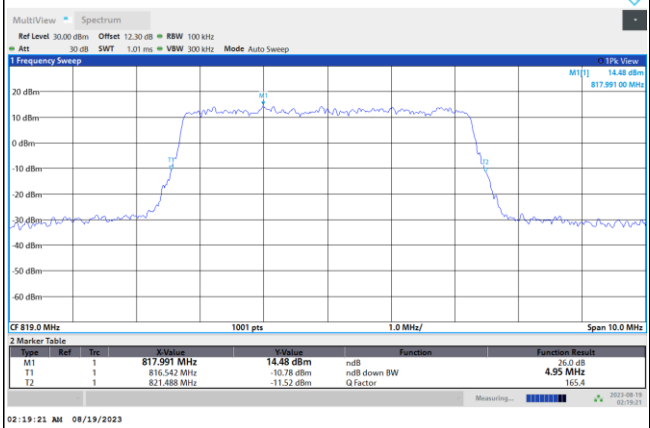


FR1 n26 / 5MHz / CP OFDM / Middle Channel / Full RB

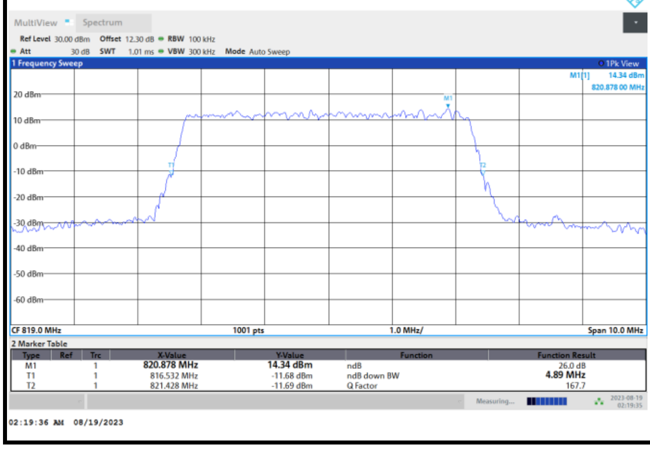
QPSK



16QAM



64QAM



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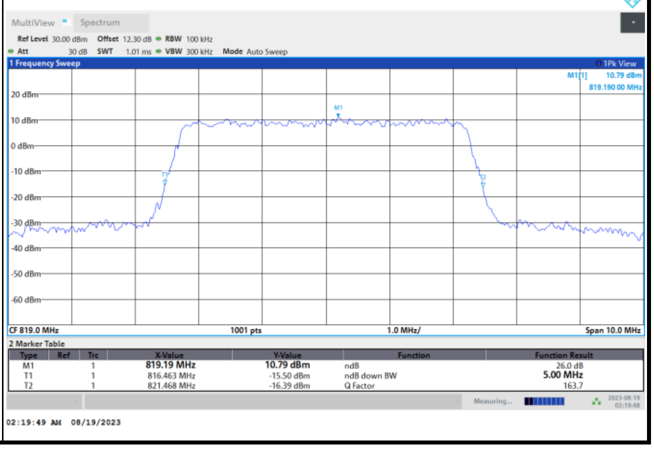
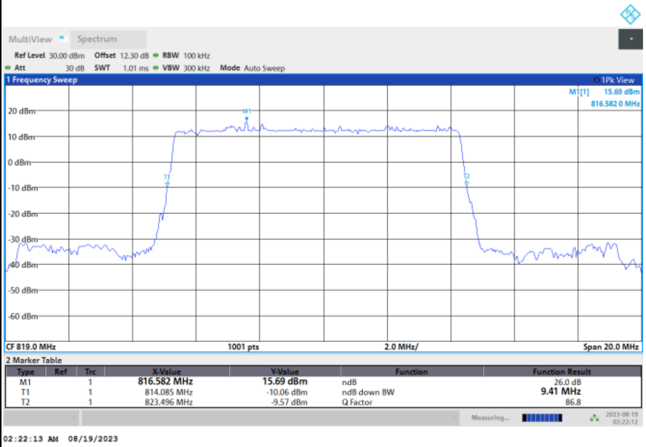


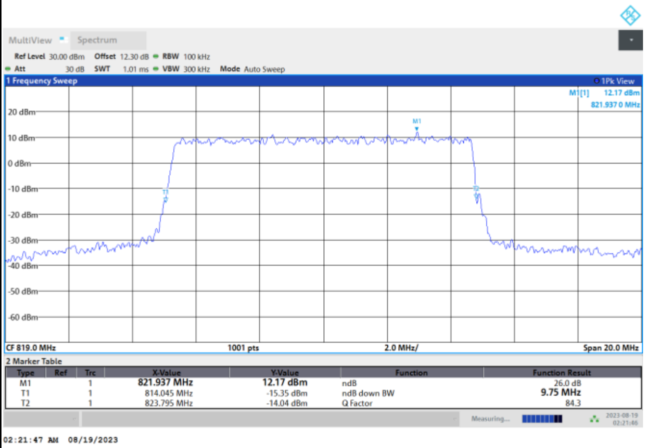
FR1 n26 / 10MHz / DFT-S OFDM / Middle Channel / Full RB

PI/2 BPSK



FR1 n26 / 10MHz / CP OFDM / Middle Channel / Full RB

QPSK



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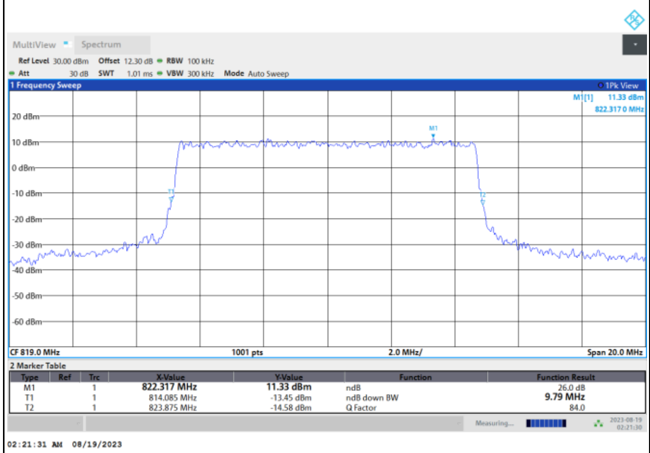

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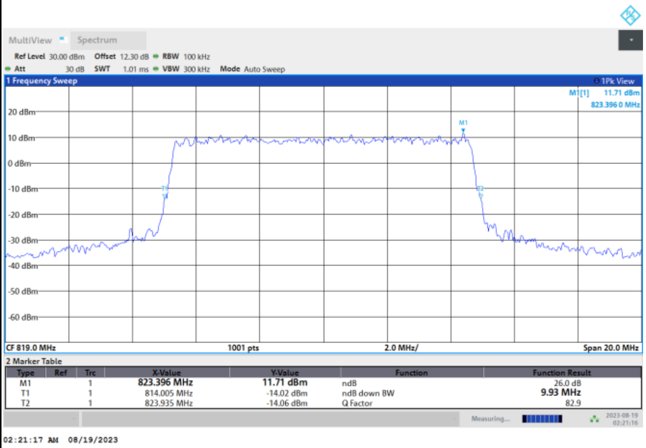

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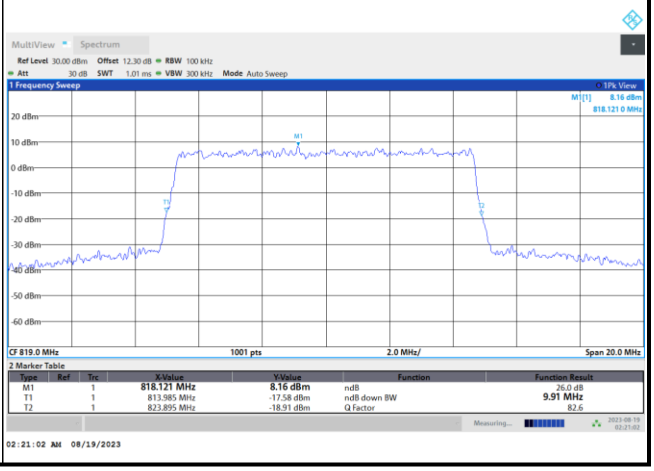


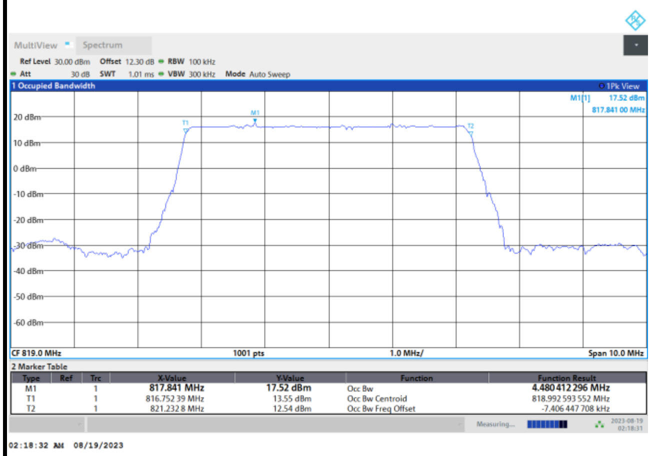
Occupied Bandwidth

Mode	FR1 n26 : 99%OBW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz					
Mod.	PI/2 BPSK		PI/2 BPSK					
Middle CH	4.48		8.88					

Mode	FR1 n26 : 99%OBW (MHz) / CP OFDM							
BW	5MHz		10MHz					
Mod.	QPSK	16QAM	QPSK	16QAM				
Middle CH	4.49	4.48	9.28	9.28				
Mod.	64QAM	256QAM	64QAM	256QAM				
Middle CH	4.48	4.48	9.26	9.28				

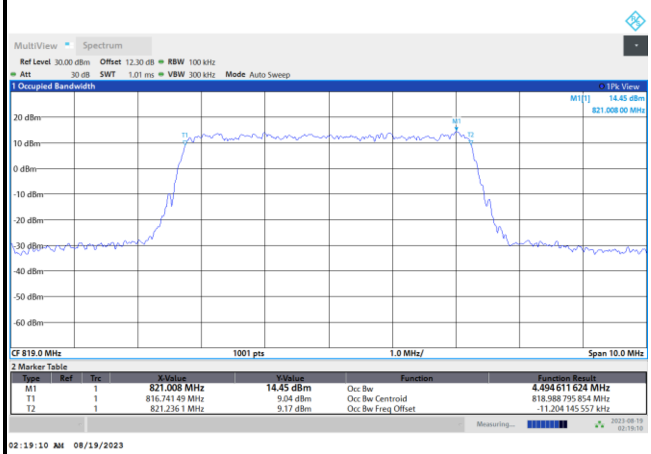
FR1 n26 / 5MHz / DFT-S OFDM / Middle Channel / Full RB

PI/2 BPSK

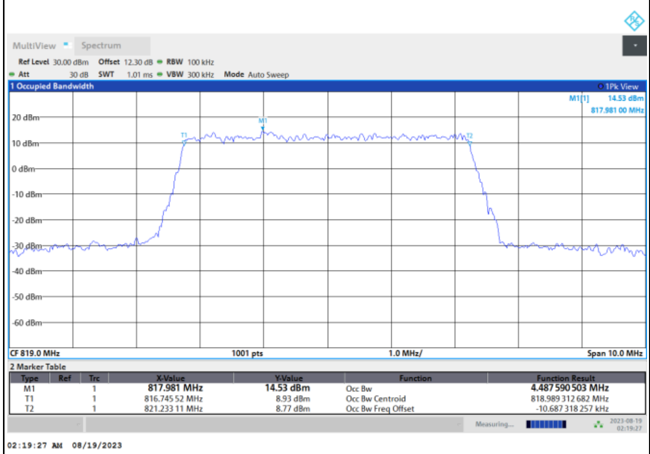


FR1 n26 / 5MHz / CP OFDM / Middle Channel / Full RB

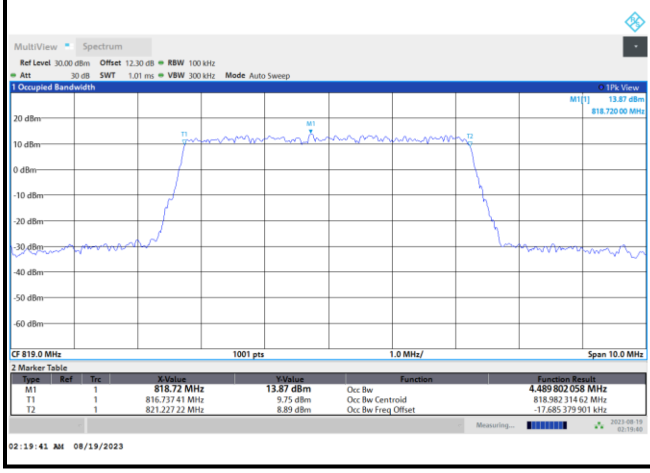
QPSK



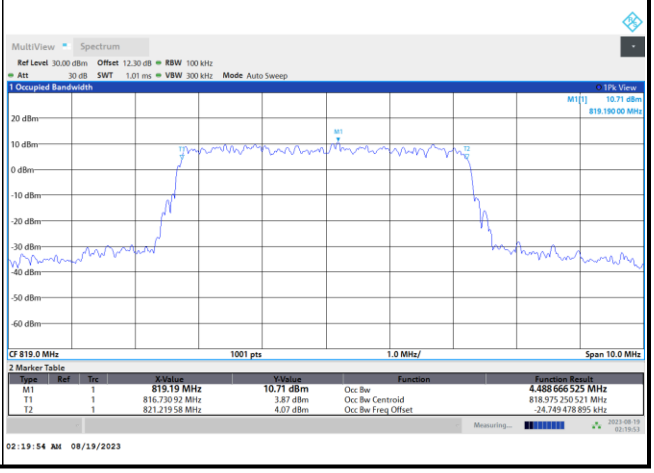
16QAM

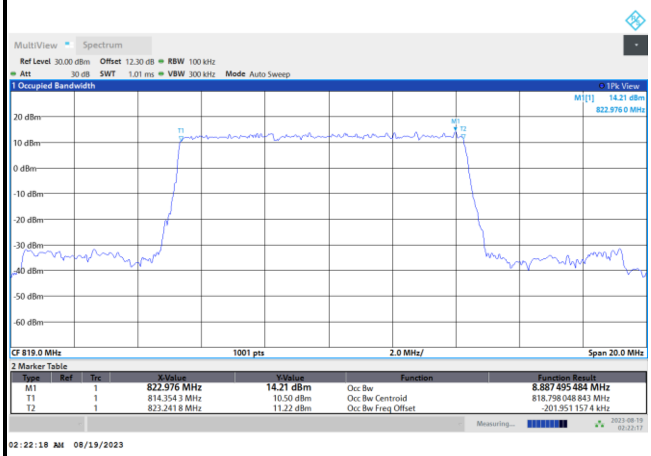


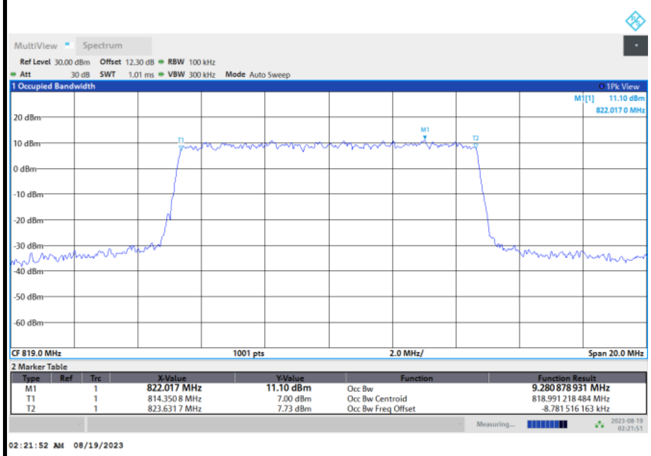
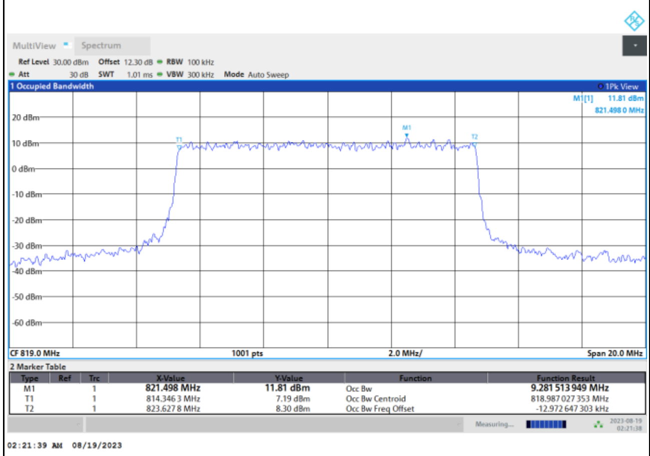
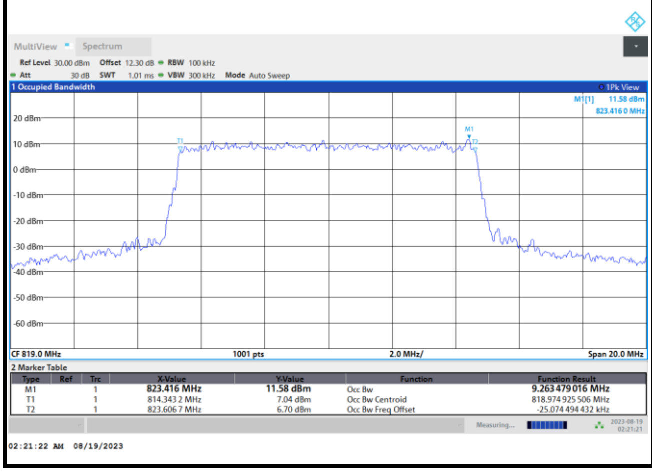
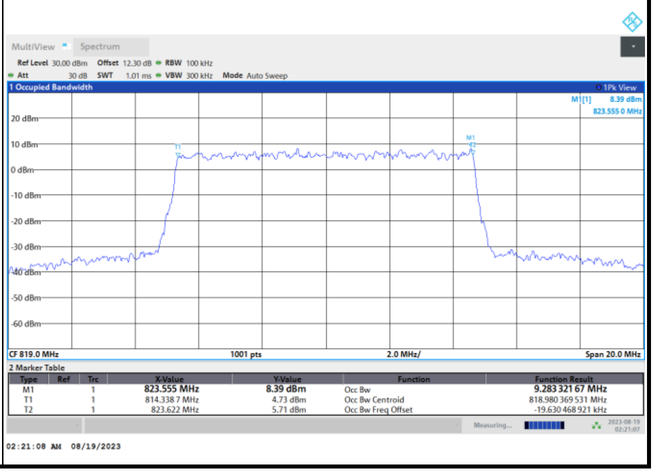
64QAM



256QAM



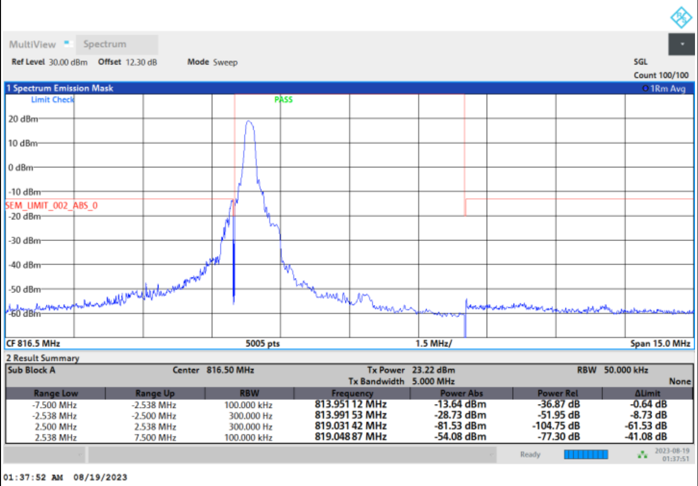
FR1 n26 / 10MHz / DFT-S OFDM / Middle Channel / Full RB	
PI/2 BPSK	
	

FR1 n26 / 10MHz / CP OFDM / Middle Channel / Full RB	
QPSK	16QAM
	
64QAM	256QAM
	

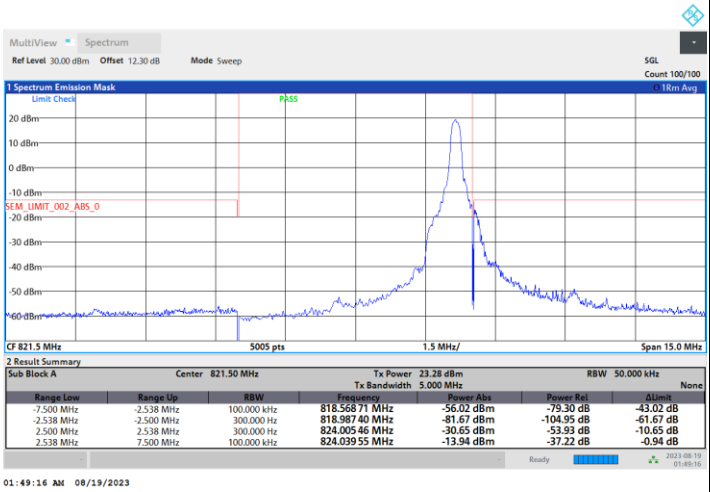
Emission masks – In-band emissions

FR1 n26 / 5MHz / DFT-S OFDM / PI/2 BPSK

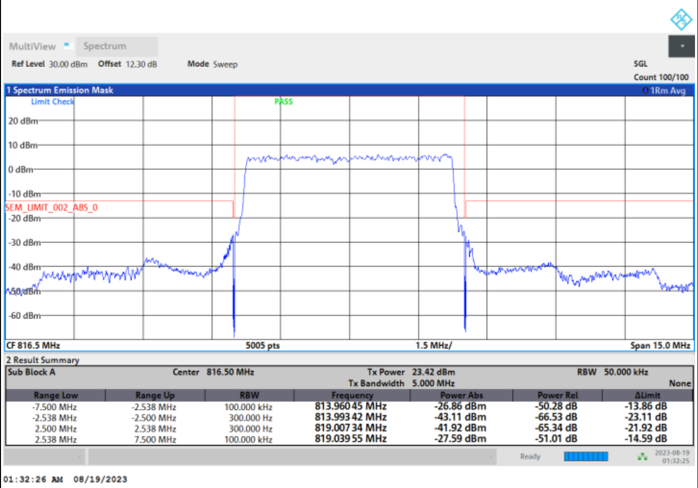
Lowest MASK / 1RB0



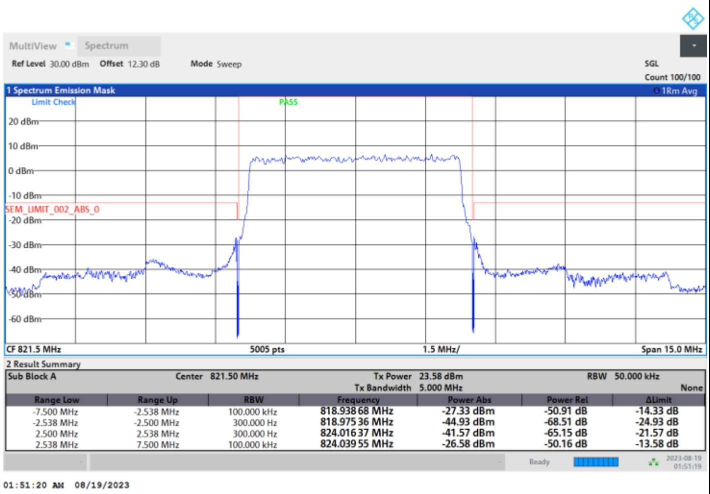
Highest MASK / 1RBmax



Lowest MASK / Full RB

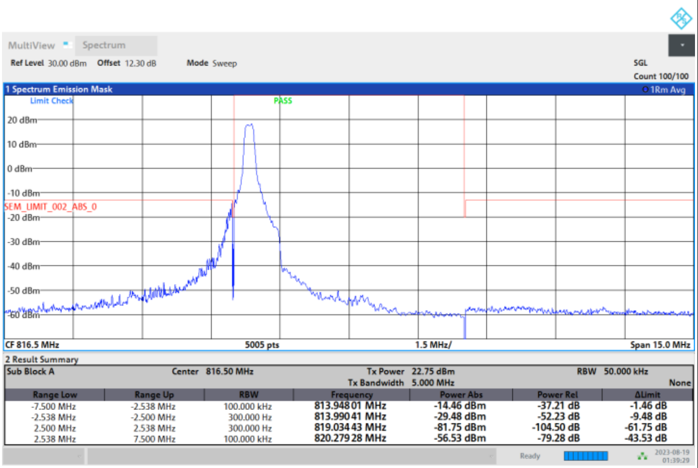


Highest MASK / Full RB



FR1 n26 / 5MHz / DFT-S OFDM / QPSK

Lowest MASK / 1RB0



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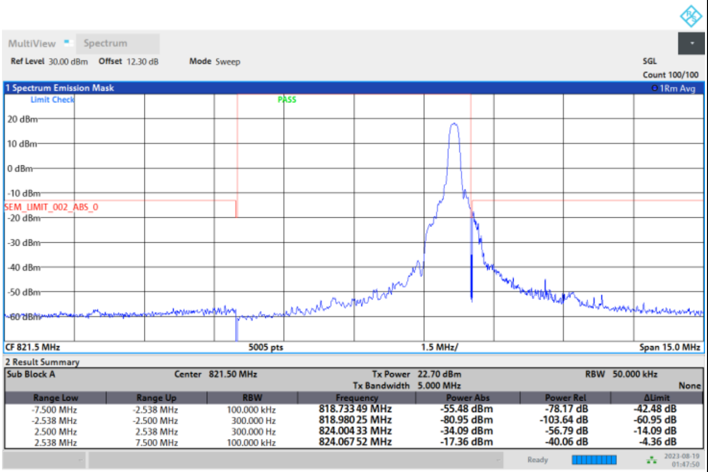
Highest MASK / 1RBmax



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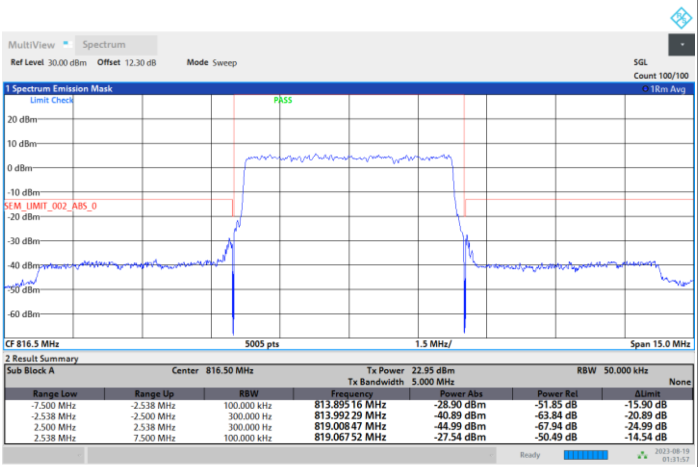
Lowest MASK / Full RB



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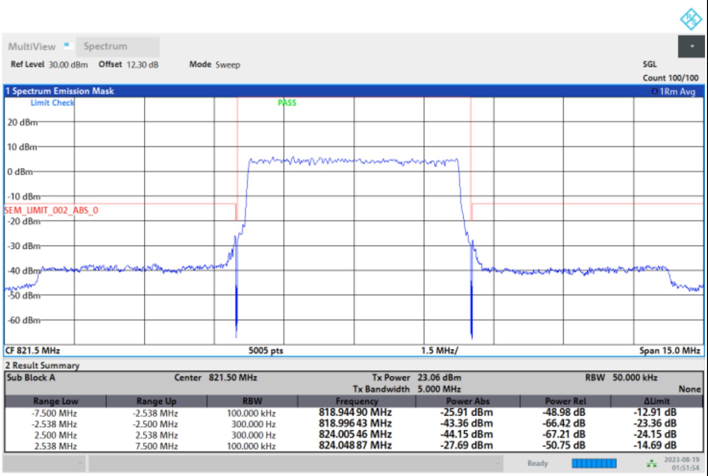

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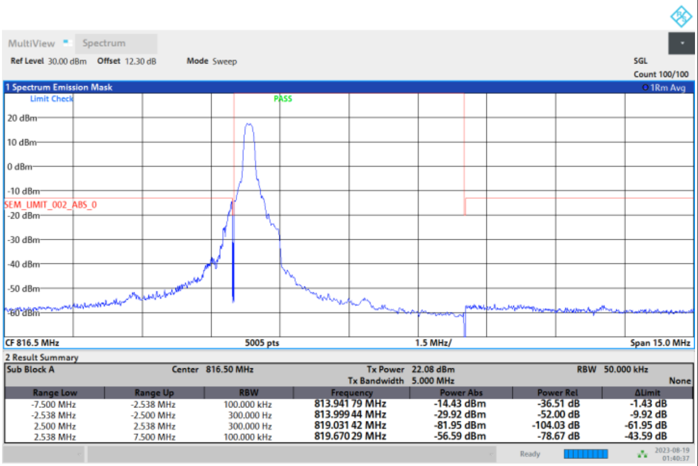
FR1 n26 / 5MHz / DFT-S OFDM / 16QAM	
Lowest MASK / 1RB0	Highest MASK / 1RBmax



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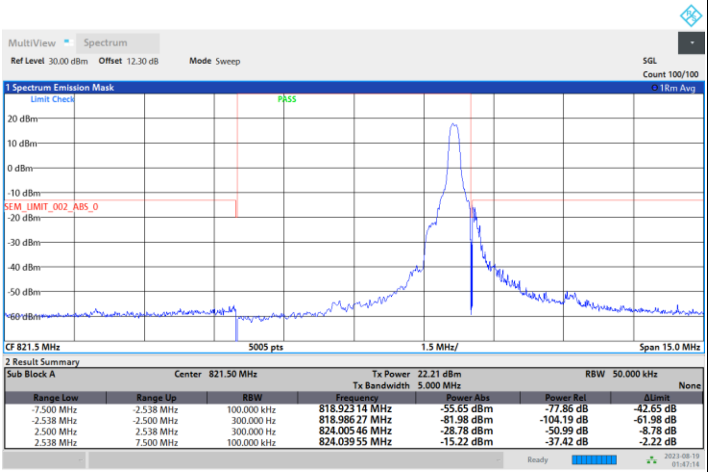

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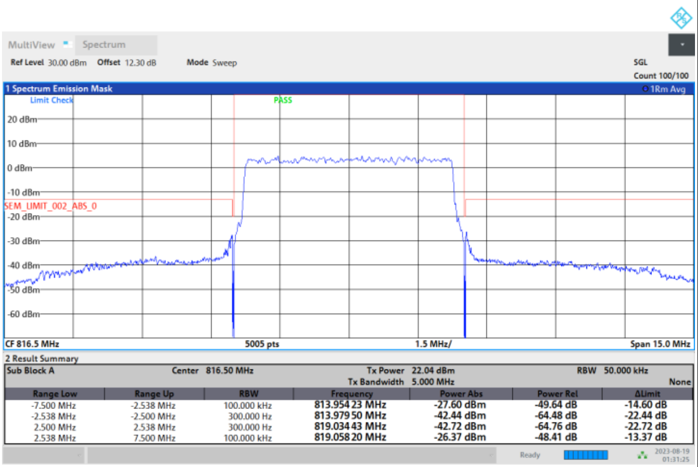
Lowest MASK / Full RB	Highest MASK / Full RB



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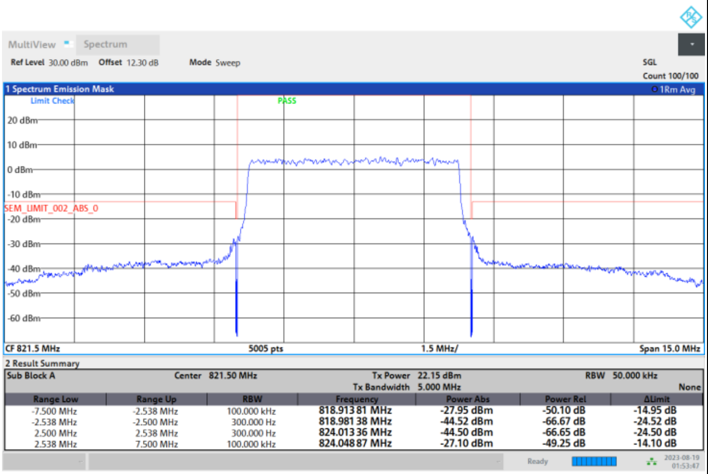

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FR1 n26 / 5MHz / DFT-S OFDM / 64QAM

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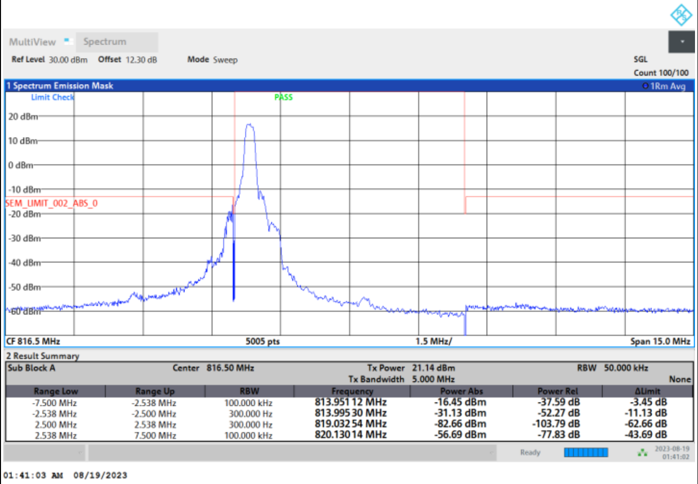
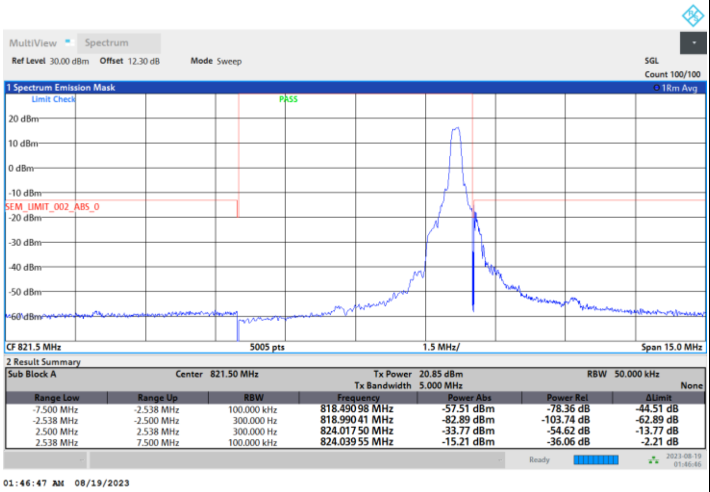


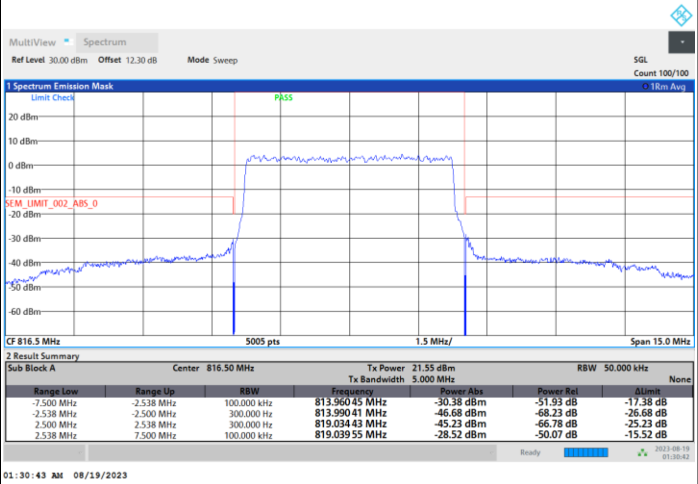
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-7.500 MHz	-2.538 MHz	100.000 kHz	813.951 12 MHz	-16.45 dBm	-37.59 dB	-3.45 dB
-2.538 MHz	-2.500 MHz	300.000 Hz	813.995 30 MHz	-31.13 dBm	-52.27 dB	-11.13 dB
2.500 MHz	2.538 MHz	300.000 Hz	819.032 54 MHz	-82.66 dBm	-103.79 dB	-62.66 dB
2.538 MHz	7.500 MHz	100.000 kHz	820.130 14 MHz	-56.69 dBm	-77.83 dB	-43.69 dB

Highest MASK / 1RBmax



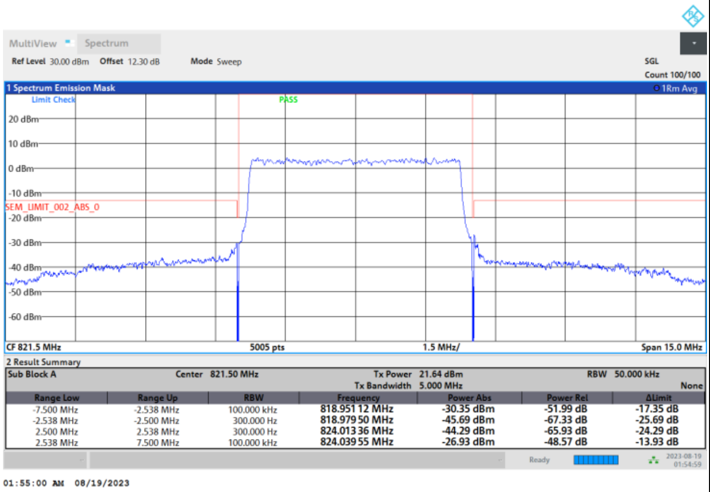
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-7.500 MHz	-2.538 MHz	100.000 kHz	818.490 98 MHz	-57.51 dBm	-78.36 dB	-44.51 dB
-2.538 MHz	-2.500 MHz	300.000 Hz	818.990 41 MHz	-82.89 dBm	-103.74 dB	-62.89 dB
2.500 MHz	2.538 MHz	300.000 Hz	824.017 50 MHz	-33.77 dBm	-54.62 dB	-13.77 dB
2.538 MHz	7.500 MHz	100.000 kHz	824.039 55 MHz	-15.21 dBm	-36.06 dB	-2.21 dB

Lowest MASK / Full RB

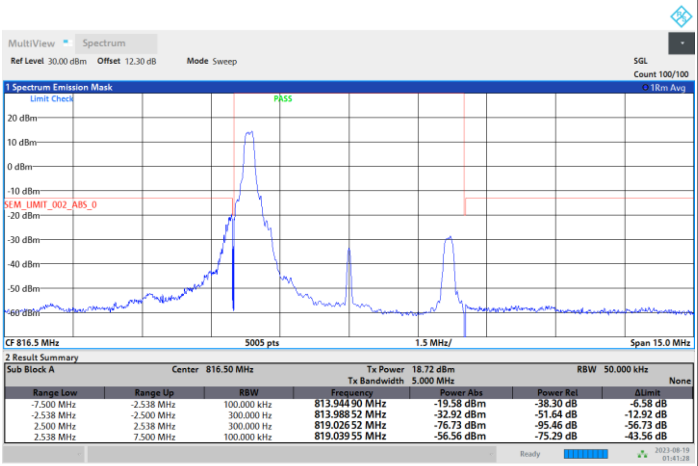
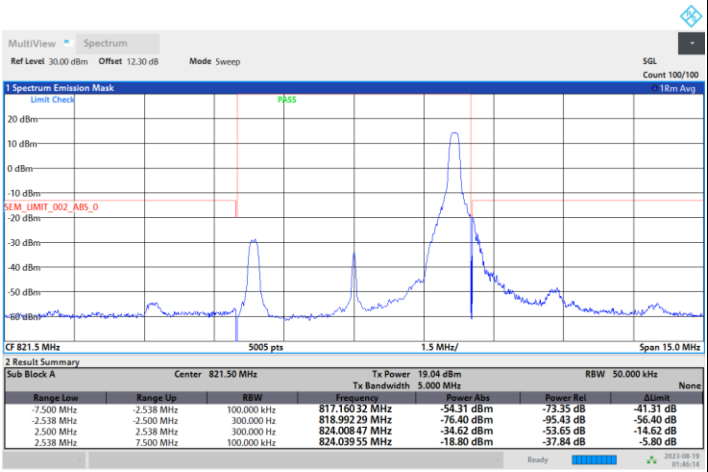
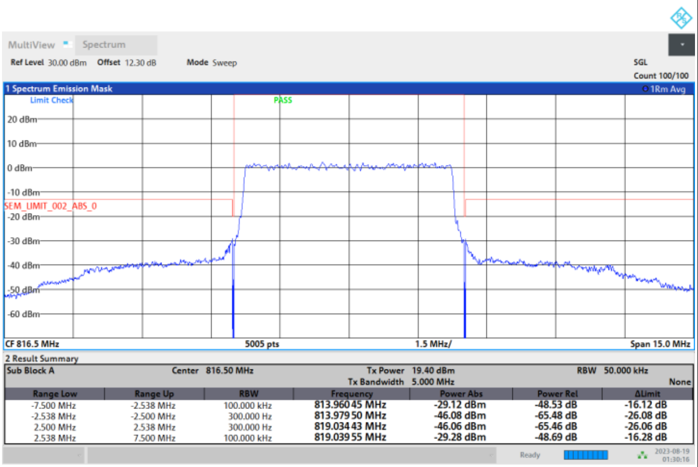
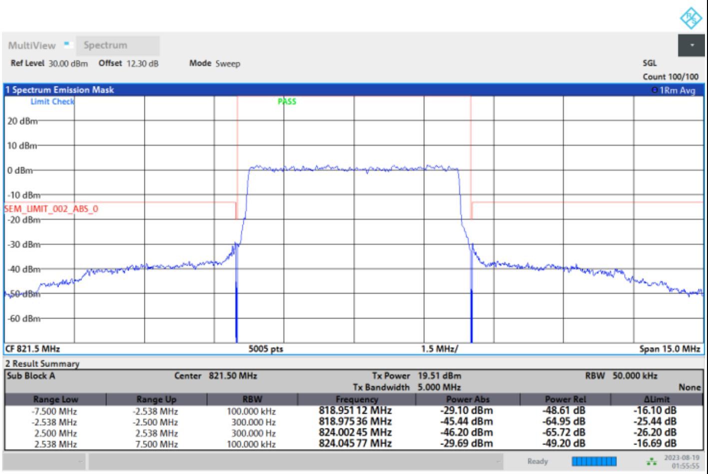


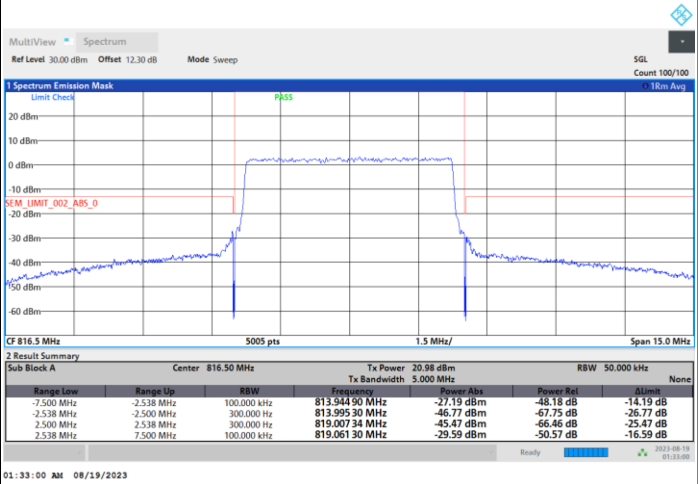
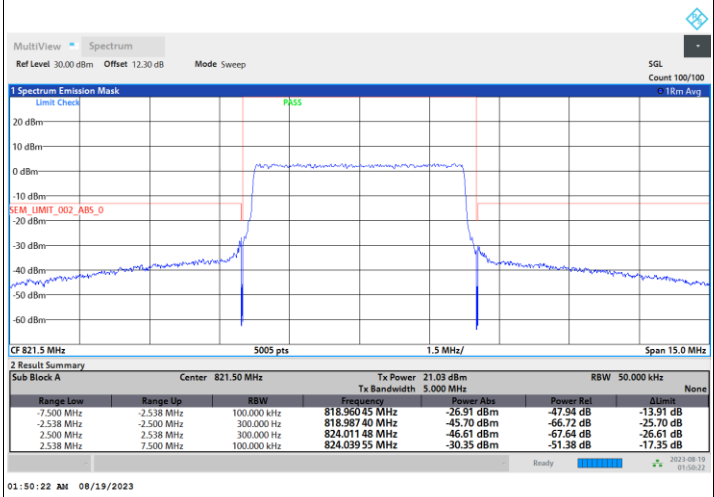
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-7.500 MHz	-2.538 MHz	100.000 kHz	813.960 45 MHz	-30.38 dBm	-51.93 dB	-17.38 dB
-2.538 MHz	-2.500 MHz	300.000 Hz	813.990 41 MHz	-46.68 dBm	-68.23 dB	-26.68 dB
2.500 MHz	2.538 MHz	300.000 Hz	819.034 43 MHz	-45.23 dBm	-66.78 dB	-25.23 dB
2.538 MHz	7.500 MHz	100.000 kHz	819.039 55 MHz	-28.52 dBm	-50.07 dB	-15.52 dB

Highest MASK / Full RB



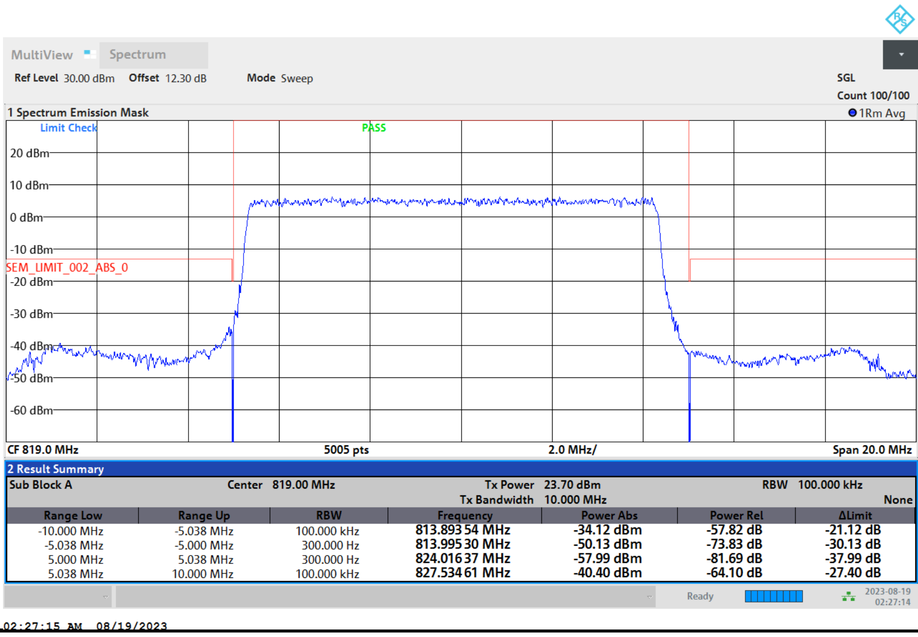
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-7.500 MHz	-2.538 MHz	100.000 kHz	818.951 12 MHz	-30.35 dBm	-51.99 dB	-17.35 dB
-2.538 MHz	-2.500 MHz	300.000 Hz	818.979 50 MHz	-45.69 dBm	-67.33 dB	-25.69 dB
2.500 MHz	2.538 MHz	300.000 Hz	824.013 36 MHz	-44.29 dBm	-65.93 dB	-24.29 dB
2.538 MHz	7.500 MHz	100.000 kHz	824.039 55 MHz	-26.93 dBm	-48.57 dB	-13.93 dB

FR1 n26 / 5MHz / DFT-S OFDM / 256QAM	
Lowest MASK / 1RB0	**Highest MASK / 1RBmax**
 01:41:28 AM 08/19/2023	 01:46:14 AM 08/19/2023
Lowest MASK / Full RB	**Highest MASK / Full RB**
 01:30:17 AM 08/19/2023	 01:55:55 AM 08/19/2023

FR1 n26 / 5MHz / CP OFDM / QPSK / Full RB	
Lowest MASK	**Highest MASK**
	

FR1 n26 / 10MHz / DFT-s-OFDM / PI/2 BPSK

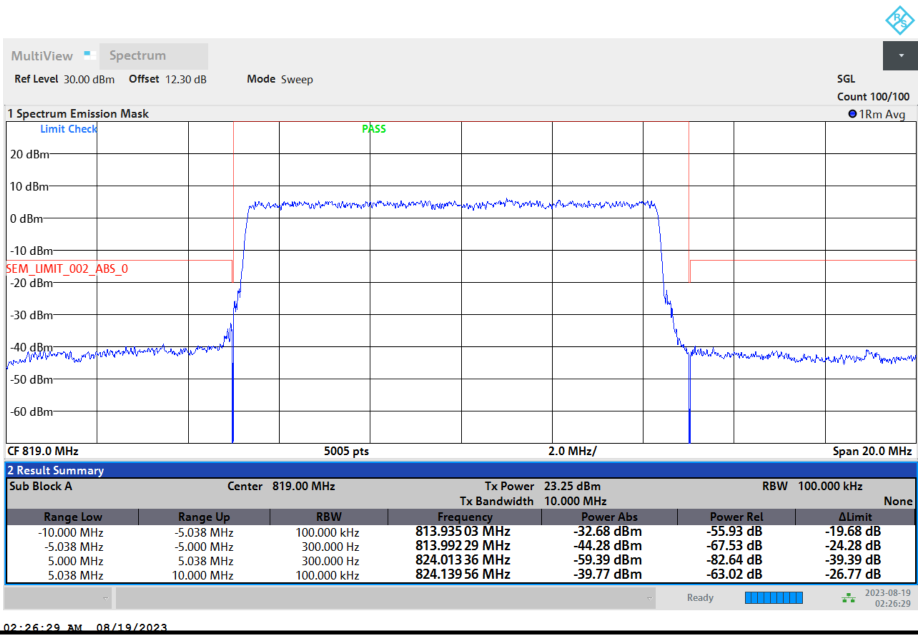
Middle MASK / Full RB



Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-10.000 MHz	-5.038 MHz	100.000 kHz	813.893 54 MHz	-34.12 dBm	-57.82 dB	-21.12 dB
-5.038 MHz	-5.000 MHz	300.000 Hz	813.995 30 MHz	-50.13 dBm	-73.83 dB	-30.13 dB
5.000 MHz	5.038 MHz	300.000 Hz	824.016 37 MHz	-57.99 dBm	-81.69 dB	-37.99 dB
5.038 MHz	10.000 MHz	100.000 kHz	827.534 61 MHz	-40.40 dBm	-64.10 dB	-27.40 dB

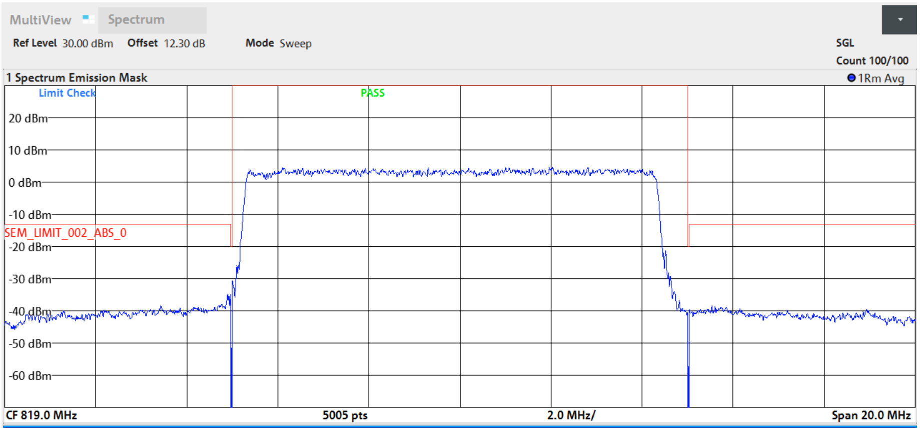
FR1 n26 / 10MHz / DFT-s-OFDM / QPSK

Lowest MASK / Full RB



Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-10.000 MHz	-5.038 MHz	100.000 kHz	813.935 03 MHz	-32.68 dBm	-55.93 dB	-19.68 dB
-5.038 MHz	-5.000 MHz	300.000 Hz	813.992 29 MHz	-44.28 dBm	-67.53 dB	-24.28 dB
5.000 MHz	5.038 MHz	300.000 Hz	824.013 36 MHz	-59.39 dBm	-82.64 dB	-39.39 dB
5.038 MHz	10.000 MHz	100.000 kHz	824.139 56 MHz	-39.77 dBm	-63.02 dB	-26.77 dB

FR1 n26 / 10MHz / DFT-s-OFDM / 16QAM
Middle MASK / Full RB



2 Result Summary

Sub Block A — Center 819.00 MHz — Tx Power 22.10 dBm — Tx Bandwidth 10.000 MHz — RBW 100.000 kHz — None

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-10.000 MHz	-5.038 MHz	100.000 kHz	813.959 93 MHz	-34.82 dBm	-56.93 dB	-21.82 dB
-5.038 MHz	-5.000 MHz	300.000 Hz	813.993 42 MHz	-49.56 dBm	-71.66 dB	-29.56 dB
5.000 MHz	5.038 MHz	300.000 Hz	824.001 32 MHz	-55.83 dBm	-77.93 dB	-35.83 dB
5.038 MHz	10.000 MHz	100.000 kHz	824.537 52 MHz	-38.46 dBm	-60.56 dB	-25.46 dB

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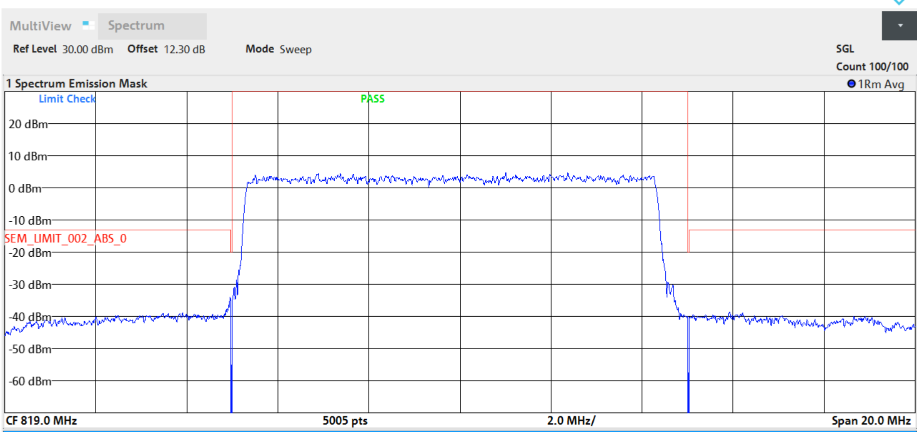
FR1 n26 / 10MHz / DFT-s-OFDM / 64QAM
Middle MASK / Full RB



2 Result Summary

Sub Block A — Center 819.00 MHz — Tx Power 21.78 dBm — Tx Bandwidth 10.000 MHz — RBW 100.000 kHz — None

Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ΔLimit
-10.000 MHz	-5.038 MHz	100.000 kHz	813.947 48 MHz	-33.93 dBm	-55.70 dB	-20.93 dB
-5.038 MHz	-5.000 MHz	300.000 Hz	813.989 28 MHz	-52.68 dBm	-74.46 dB	-32.68 dB
5.000 MHz	5.038 MHz	300.000 Hz	824.024 27 MHz	-57.54 dBm	-79.32 dB	-37.54 dB
5.038 MHz	10.000 MHz	100.000 kHz	824.927 18 MHz	-38.58 dBm	-60.36 dB	-25.58 dB

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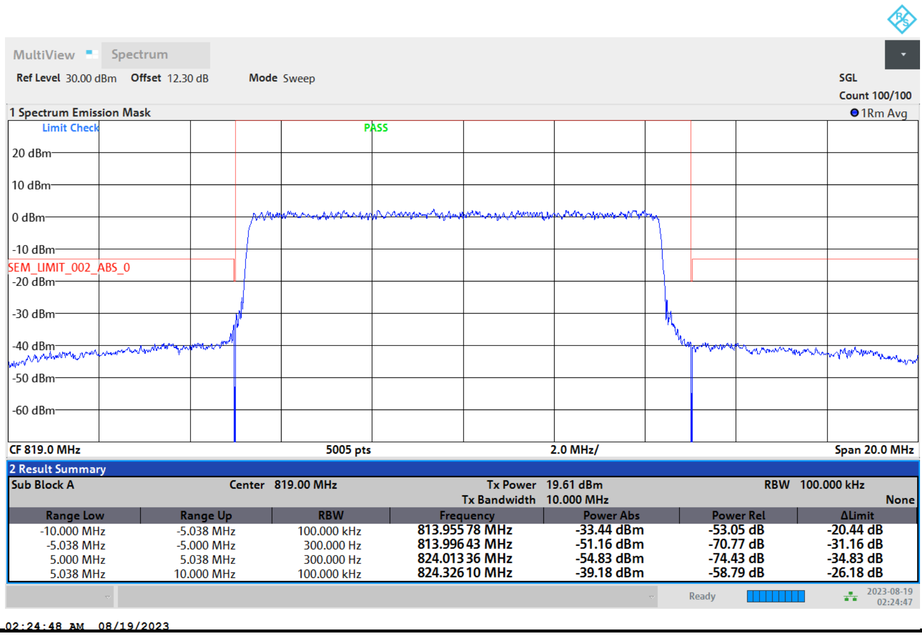
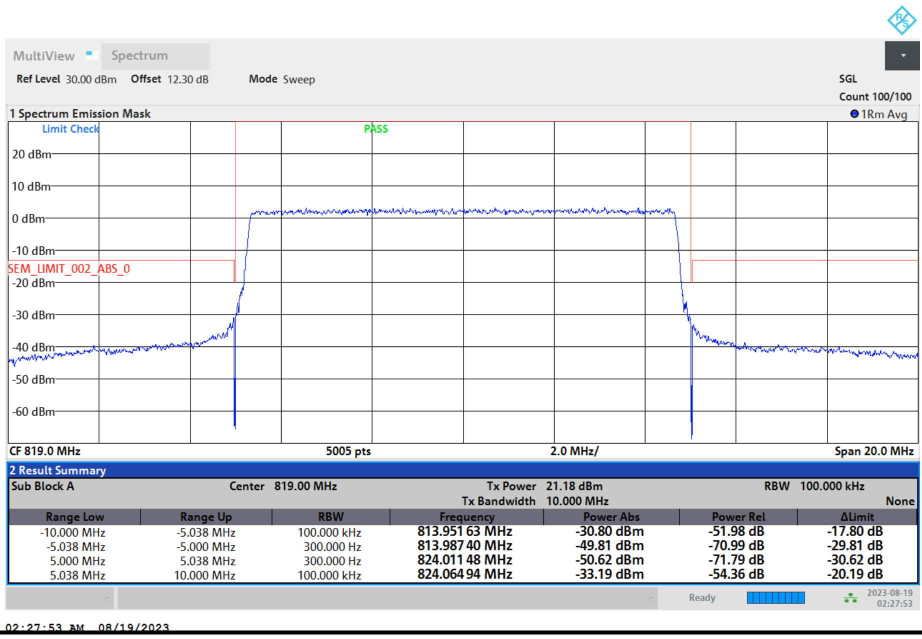
FR1 n26 / 10MHz / DFT-s-OFDM / 256QAM
Middle MASK / Full RB



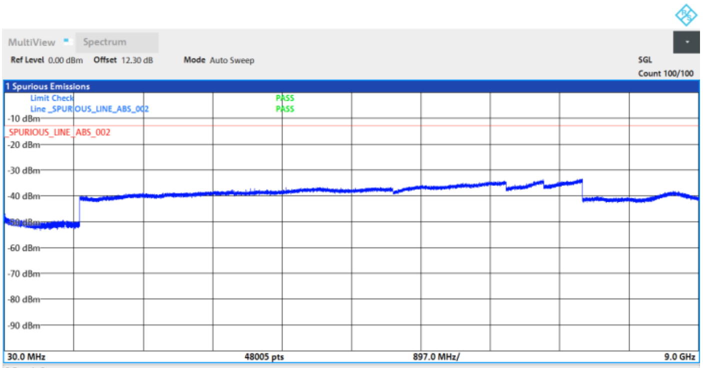
FR1 n26 / 10MHz / CP OFDM / QPSK / Full RB
Middle MASK



Emission masks – Out of band emissions

FR1 n26 / 5MHz / DFT-S OFDM / QPSK / 1RB1

Lowest Channel



2 Result Summary

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	809.000 MHz	100.000 kHz	34.132 80 MHz	-46.90 dBm	-33.90 dB
829.000 MHz	1.000 GHz	100.000 kHz	835.645 96 MHz	-49.68 dBm	-36.68 dB
1.000 GHz	3.000 GHz	1.000 MHz	2.974 88 GHz	-37.61 dBm	-24.61 dB
3.000 GHz	7.000 GHz	1.000 MHz	6.988 20 GHz	-33.63 dBm	-20.63 dB
7.000 GHz	9.000 GHz	1.000 MHz	7.494 56 GHz	-33.48 dBm	-20.48 dB

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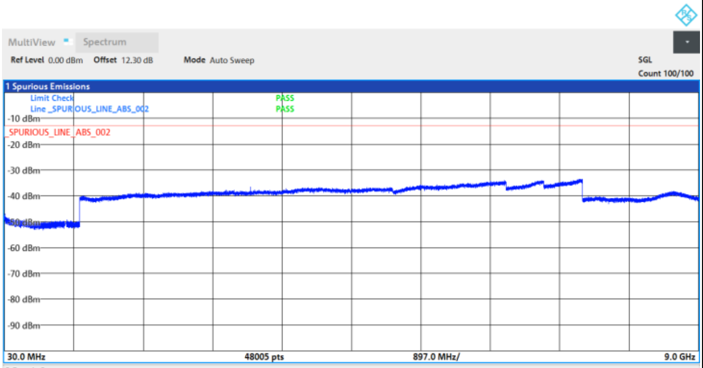
Middle Channel



2 Result Summary

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	809.000 MHz	100.000 kHz	34.479 00 MHz	-46.87 dBm	-33.87 dB
829.000 MHz	1.000 GHz	100.000 kHz	839.150 59 MHz	-49.33 dBm	-36.33 dB
1.000 GHz	3.000 GHz	1.000 MHz	2.998 63 GHz	-37.85 dBm	-24.85 dB
3.000 GHz	7.000 GHz	1.000 MHz	6.491 85 GHz	-34.04 dBm	-21.04 dB
7.000 GHz	9.000 GHz	1.000 MHz	7.463 57 GHz	-33.55 dBm	-20.55 dB

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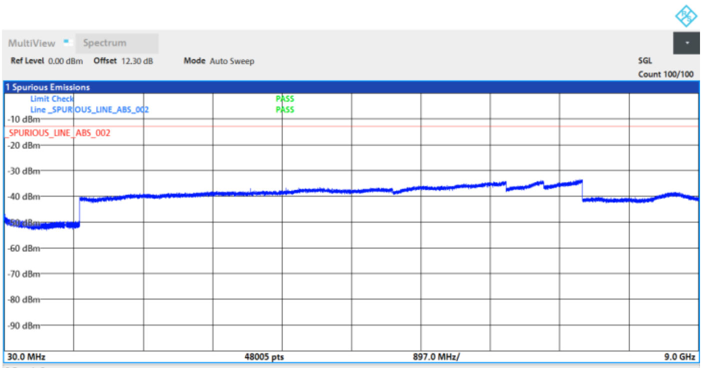
Highest Channel



2 Result Summary

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	809.000 MHz	100.000 kHz	35.517 61 MHz	-46.97 dBm	-33.97 dB
829.000 MHz	1.000 GHz	100.000 kHz	848.467 76 MHz	-49.63 dBm	-36.63 dB
1.000 GHz	3.000 GHz	1.000 MHz	2.781 40 GHz	-38.16 dBm	-25.16 dB
3.000 GHz	7.000 GHz	1.000 MHz	6.961 00 GHz	-33.75 dBm	-20.75 dB
7.000 GHz	9.000 GHz	1.000 MHz	7.463 32 GHz	-33.47 dBm	-20.47 dB

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Frequency Stability

Test Conditions		FR1 n26 (BPSK) / Middle Channel	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	2.5 ppm
		Deviation (ppm)	Result
50	Normal Voltage	0.0017	PASS
40	Normal Voltage	0.0141	
30	Normal Voltage	0.0162	
20(Ref.)	Normal Voltage	0.0000	
10	Normal Voltage	0.0097	
0	Normal Voltage	0.0100	
-10	Normal Voltage	0.0001	
-20	Normal Voltage	0.0031	
-30	Normal Voltage	0.0088	
20	Maximum Voltage	0.0006	
20	Normal Voltage	0.0127	
20	Battery End Point	0.0086	

Note: Normal Voltage = 4.05 V.；Battery End Point (BEP) = 3.85 V.；Maximum Voltage = 4.35 V.

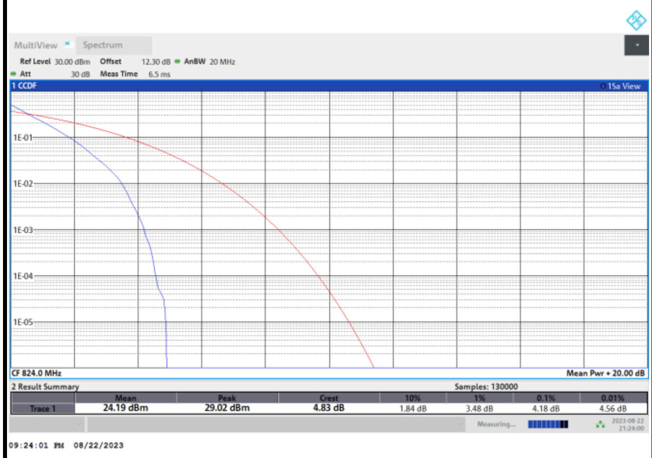
FR1 n26 Straddle Channel

Peak-to-Average Ratio

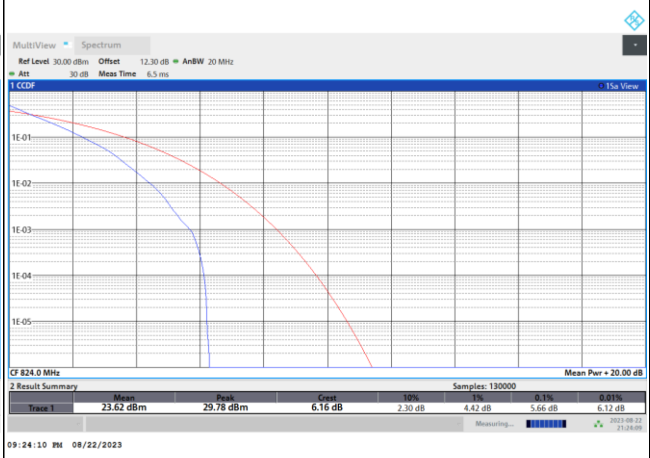
Mode	FR1 n26 / 20MHz / DFT-S OFDM				
Mod.	PI/2 BPSK	QPSK	16QAM	64QAM	Limit: 13dB
RB Size	Full RB	Full RB	Full RB	Full RB	Result
824 MHz	4.18	5.66	6.46	6.64	PASS
Mode	FR1 n26 / 20MHz / DFT-S OFDM				
Mod.	256QAM				Limit: 13dB
RB Size	Full RB				Result
824 MHz	6.58				PASS

FR1 n26 / 20MHz / DFT-S OFDM /824 MHz/ Full RB

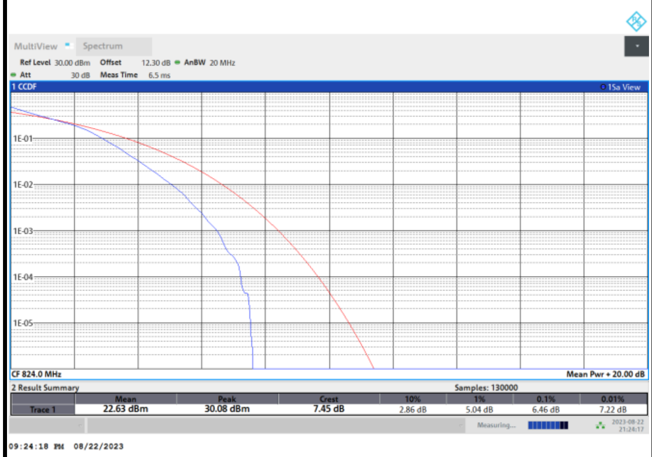
PI/2 BPSK



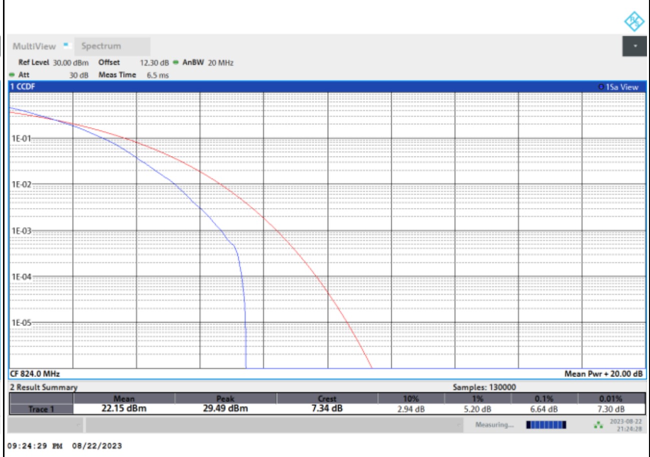
QPSK



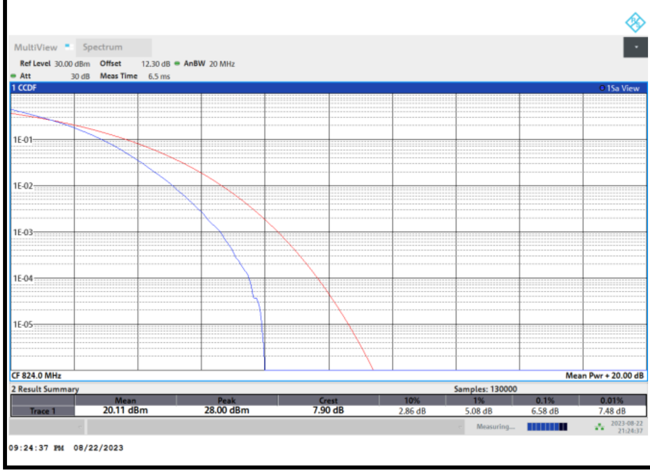
16QAM



64QAM



256QAM



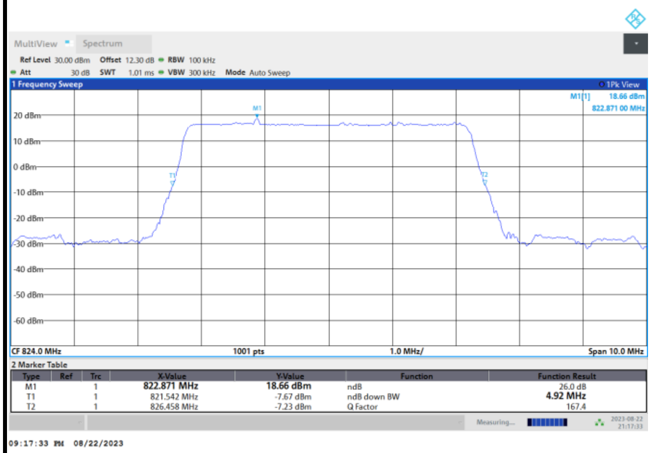
26dB Bandwidth

Mode	FR1 n26 : 26dB BW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	PI/2 BPSK		PI/2 BPSK		PI/2 BPSK		PI/2 BPSK	
Middle CH	4.92		9.47		14.30		18.78	
BW	25MHz		30MHz					
Mod.	PI/2 BPSK		PI/2 BPSK					
Middle CH	-		-					

Mode	FR1 n26 : 26dB BW(MHz) / CP OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Middle CH	5.00	4.97	9.87	9.83	15.05	14.99	19.98	19.90
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Middle CH	4.95	5.00	9.89	9.93	15.11	15.02	19.86	19.94
BW	25MHz		30MHz					
Mod.	QPSK	16QAM	QPSK	16QAM				
Middle CH	-	-	-	-				
Mod.	64QAM	256QAM	64QAM	256QAM				
Middle CH	-	-	-	-				

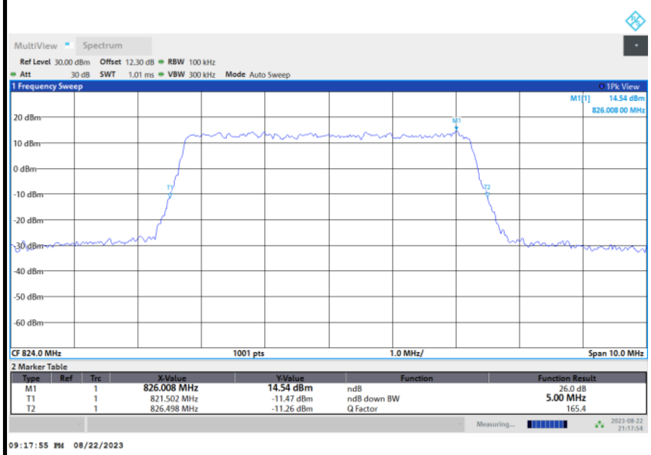
FR1 n26 / 5MHz / DFT-S OFDM /824 MHz/ Full RB

PI/2 BPSK

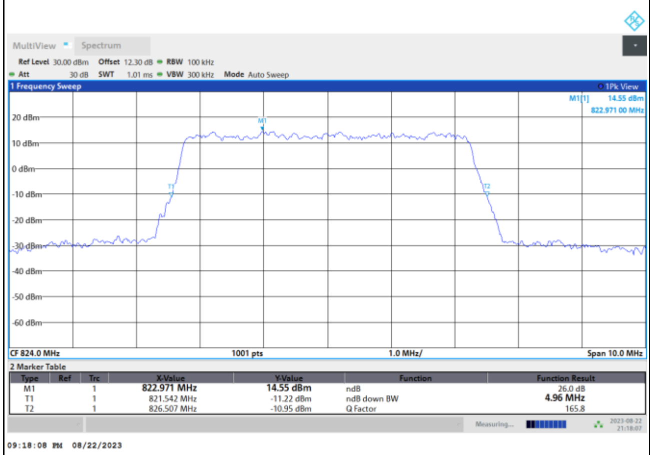


FR1 n26 / 5MHz / CP OFDM /824 MHz/ Full RB

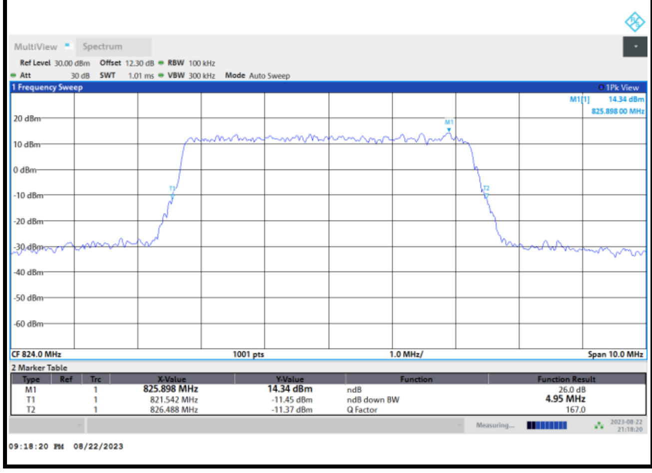
QPSK



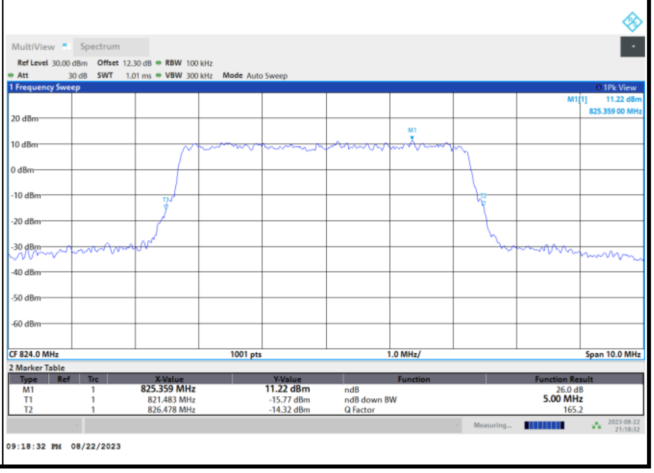
16QAM

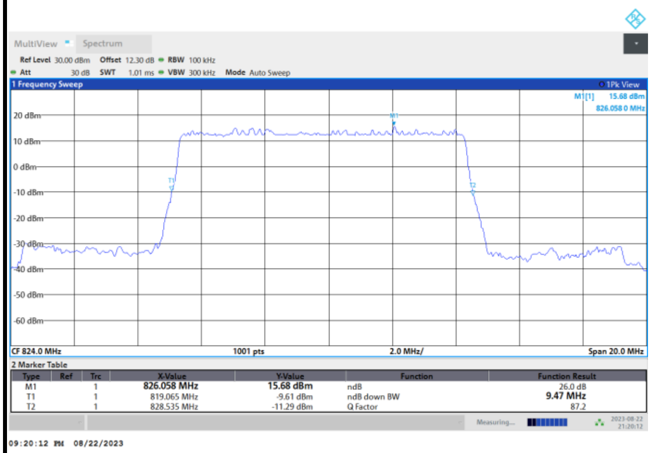


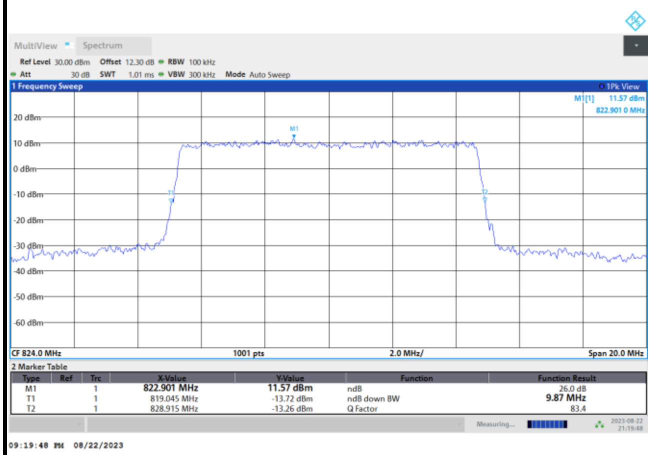
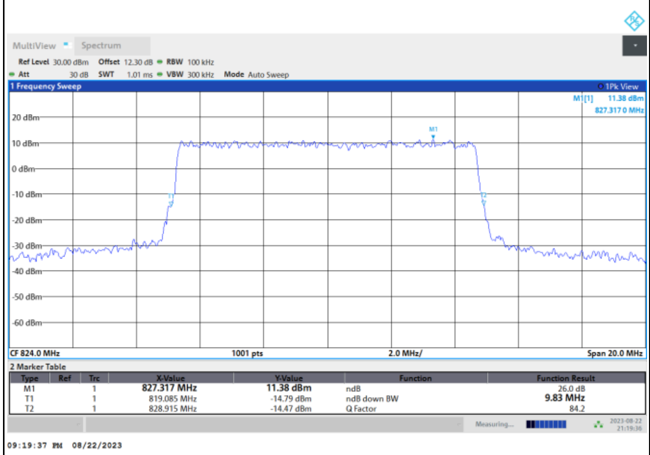
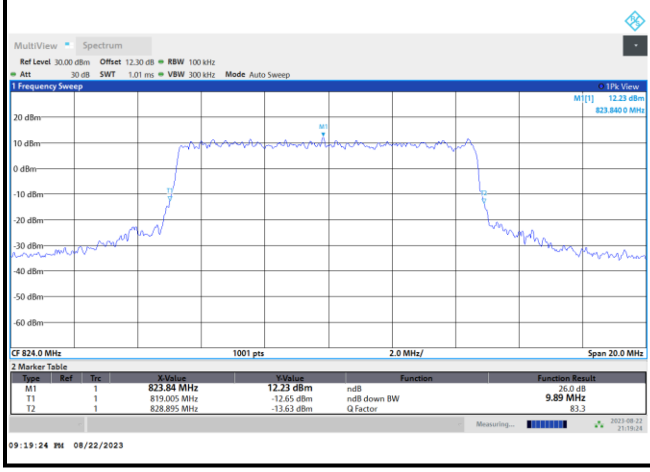
64QAM



256QAM

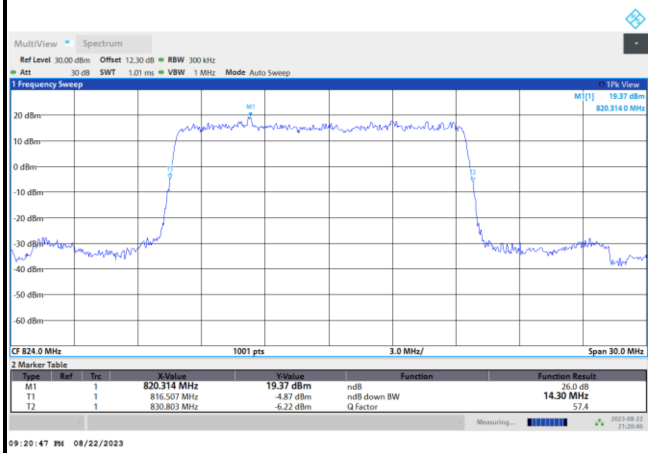


FR1 n26 / 10MHz / DFT-S OFDM /824 MHz/ Full RB	
PI/2 BPSK	
	

FR1 n26 / 10MHz / CP OFDM /824 MHz/ Full RB	
QPSK	16QAM
	
64QAM	256QAM
	

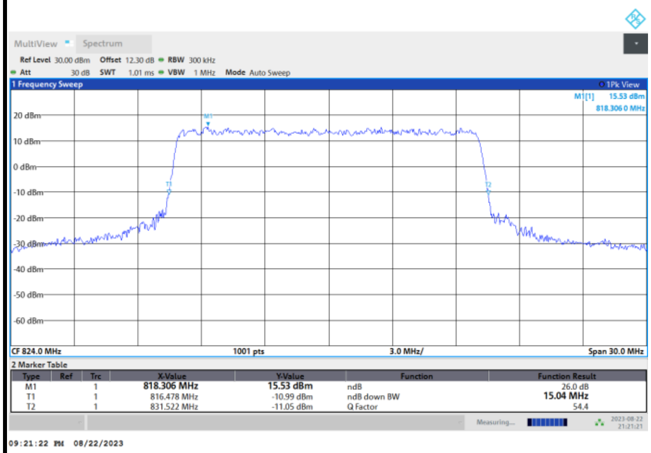
FR1 n26 / 15MHz / DFT-S OFDM /824 MHz/ Full RB

PI/2 BPSK

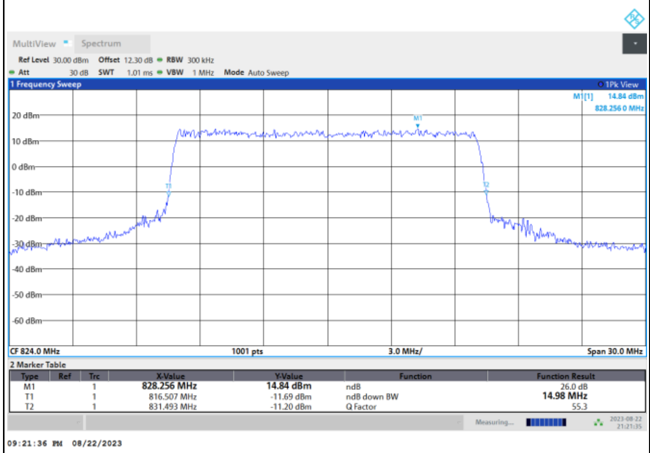


FR1 n26 / 15MHz / CP OFDM /824 MHz/ Full RB

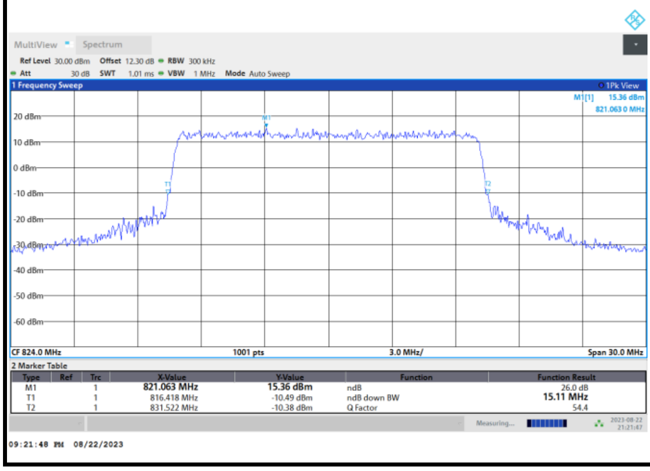
QPSK



16QAM



64QAM



256QAM