FCC RF Test Report

APPLICANT	:	Xiaomi Communications Co., Ltd.
EQUIPMENT	:	Mobile Phone
BRAND NAME	:	Xiaomi
MODEL NAME	:	M2011K2G
FCC ID	:	2AFZZK2G
STANDARD	:	47 CFR Part 2, 22, 24, 27
CLASSIFICATION	:	PCS Licensed Transmitter Held to Ear (PCE)

The product was received on Oct. 23, 2020 and completely tested on Nov. 28, 2020. We, Sporton International (KunShan) Inc., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.26-2015 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (KunShan) Inc., the test report shall not be reproduced except in full.

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ACCREDITED
Cert #5145.02

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TABLE OF CONTENTS

REVISION HISTORY **3**

SUMMARY OF TEST RESULT **4**

1 GENERAL DESCRIPTION **5**

1.1 Applicant 5
1.2 Manufacturer 5
1.3 Product Feature of Equipment Under Test 5
1.4 Product Specification of Equipment Under Test 6
1.5 Modification of EUT 6
1.6 Maximum ERP/EIRP Power, Frequency Tolerance, and Emission Designator 6
1.7 Testing Location 8
1.8 Test Software 8
1.9 Applicable Standards 8

2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST **9**

2.1 Test Mode 9
2.2 Connection Diagram of Test System 10
2.3 Support Unit used in test configuration and system 10
2.4 Measurement Results Explanation Example 11
2.5 Frequency List of Low/Middle/High Channels 12

3 CONDUCTED TEST ITEMS **13**

3.1 Measuring Instruments 13
3.2 Test Setup 13
3.3 Test Result of Conducted Test 13
3.4 Conducted Output Power and ERP/EIRP 14
3.5 Peak-to-Average Ratio 15
3.6 Occupied Bandwidth 16
3.7 Conducted Band Edge 17
3.8 Conducted Spurious Emission 18
3.9 Frequency Stability 19

4 RADIATED TEST ITEMS **20**

4.1 Measuring Instruments 20
4.2 Test Setup 20
4.3 Test Result of Radiated Test 20
4.4 Radiated Spurious Emission 21

5 LIST OF MEASURING EQUIPMENT **22**

6 UNCERTAINTY OF EVALUATION **23**

APPENDIX A. TEST RESULTS OF CONDUCTED TEST

APPENDIX B. TEST RESULTS OF RADIATED TEST

APPENDIX C. TEST SETUP PHOTOGRAPHS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG0O2312D	Rev. 01	Initial issue of report	Dec. 17, 2020

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
	§22.913(a)(5)	Effective Radiated Power (5G NR n5)	ERP < 7 Watt		
	§27.50(h)(2)	Equivalent Isotropic Radiated Power (5G NR n7)	EIRP < 2Watt		
3.5	§27.50(j)(4)	Peak-to-Average Ratio	<13 dB	PASS	-
3.6	§2.1049	Occupied Bandwidth	Reporting Only	PASS	-
3.7	§2.1051 §22.917(a)	Conducted Band Edge Measurement (5G NR n5)	< 43+10log10(P[Watts])	PASS	-
	§27.53(m)(4)	Conducted Band Edge Measurement (5G NR n7)	§27.53(m)(4)		
3.8	§2.1051 §22.917(a)	Conducted Spurious Emission (5G NR n5)	< 43+10log10(P[Watts])	PASS	-
	§2.1051 §27.53(m)(4)	Conducted Spurious Emission (5G NR n7)	< $55+10\log_{10}$(P[Watts])		
3.9	§2.1055 §22.355	Frequency Stability Temperature & Voltage	< 2.5 ppm for Part 22	PASS	-
	§27.54		Within Authorized Band		
4.4	§2.1053 §22.917(a)	Radiated Spurious Emission (5G NR n5)	< $43+10\log_{10}$(P[Watts])	PASS	Under limit 31.60 dB at 10100.000 MHz
	§2.1053 §27.53(m)(4)	Radiated Spurious Emission (5G NR n7)	< $55+10\log_{10}$(P[Watts])		

1 General Description

1.1 Applicant

Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

1.2 Manufacturer

Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Phone
Brand Name	Xiaomi
Model Name	M2011K2G
FCC ID	2AFZZK2G
EUT supports Radios application	GSM/WCDMA/LTE/5GNR/NFC WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80/VHT160 WLAN 5GHz 802.11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE GNSS
IMEI Code	Conducted : 868285059998003 Radiation : 868285059998011
HW Version	P2
SW Version	MIUI12
EUT Stage	Identical Prototype

Remark:

1. Only 5G NR bands are tested in this report, all the other RF bands are tested in the other reports separately.
2. There are two types of EUT, the sample 1 is 6+128GB capacity and the sample 2 is 8+256GB capacity. According to the difference, we only choose sample 1 to perform full tests.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	5G NR n5: 826.5 MHz ~ 846.5 MHz 5G NR n7: 2502.5 MHz ~ 2567.5 MHz
Rx Frequency	5G NR n5: 871.5 MHz ~ 891.5 MHz 5G NR n7: 2622.5 MHz ~ 2687.5 MHz
Bandwidth	NSA: n5, n7: 5MHz / 10MHz / 15MHz / 20MHz SA: n7: 5MHz / 10MHz / 15MHz / 20MHz
Antenna Gain	5G NR n5:: -7.64 dBi 5G NR n7:: -1.61 dBi
Type of Modulation	CP-OFDM: QPSK / 16QAM / 64QAM / 256QAM DFT-s-OFDM: PI/2 BPSK / QPSK / 16QAM / 64QAM / 256QAM

Note:

1. For Ant1& Ant2 & Ant3 & Ant4, the whole testing has assessed Ant1/Ant2 by referring to the higher conducted power.
2. The Maximum ERP/EIRP is calculated from Max Output power and Max antenna gain, only the maximum ERP/EIRP is shown in the report.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Maximum ERP/EIRP Power, Frequency Tolerance, and Emission Designator

5G NR n5		PI/2 BPSK		QPSK	
BW (MHz)	**Frequency Range (MHz)**	**Emission Designator (99%OBW)**	**Maximum ERP(W)**	**Emission Designator (99%OBW)**	**Maximum ERP(W)**
5	826.5 ~ 846.5	4M50G7D	0.0250	4M51G7D	0.0248
10	829.0 ~ 844.0	9M09G7D	0.0246	9M09G7D	0.0249
15	831.5 ~ 841.5	13M5G7D	0.0248	13M5G7D	0.0253
20	834.0 ~ 839.0	18M3G7D	0.0248	18M4G7D	0.0254
Frequency Tolerance (ppm)		0.0018			
5G NR n5		**16QAM**		**64QAM**	
BW (MHz)	**Frequency Range (MHz)**	**Emission Designator (99%OBW)**	**Maximum ERP(W)**	**Emission Designator (99%OBW)**	**Maximum ERP(W)**
5	826.5 ~ 846.5	4M49W7D	0.0203	4M50W7D	0.0150
10	829.0 ~ 844.0	9M07W7D	0.0199	9M05W7D	0.0143

15	831.5 ~ 841.5	13M6W7D	0.0200	13M5W7D	0.0151
20	834.0 ~ 839.0	18M3W7D	0.0200	18M5W7D	0.0145
Frequency Tolerance (ppm)		-			

5G NR n5		**256QAM**	
BW (MHz)	**Frequency Range (MHz)**	**Emission Designator (99%OBW)**	**Maximum ERP(W)**
5	826.5 ~ 846.5	4M49W7D	0.0093
10	829.0 ~ 844.0	9M03W7D	0.0090
15	831.5 ~ 841.5	13M5W7D	0.0093
20	834.0 ~ 839.0	18M3W7D	0.0094
Frequency Tolerance (ppm)		-	

5G NR n7		**PI/2 BPSK**		**QPSK**	
BW (MHz)	**Frequency Range (MHz)**	**Emission Designator (99%OBW)**	**Maximum EIRP(W)**	**Emission Designator (99%OBW)**	**Maximum EIRP(W)**
5	2502.5 ~ 2567.5	4M52G7D	0.1560	4M49G7D	0.1545
10	2505.0 ~ 2565.0	9M07G7D	0.1603	9M05G7D	0.1614
15	2507.5 ~ 2562.5	13M5G7D	0.1671	13M5G7D	0.1663
20	2510.0 ~ 2560.0	18M4G7D	0.1694	18M4G7D	0.1698
Frequency Tolerance (ppm)		0.0018			
5G NR n7		**16QAM**		**64QAM**	
BW (MHz)	**Frequency Range (MHz)**	**Emission Designator (99%OBW)**	**Maximum EIRP(W)**	**Emission Designator (99%OBW)**	**Maximum EIRP(W)**
5	2502.5 ~ 2567.5	4M50W7D	0.1265	4M50W7D	0.0989
10	2505.0 ~ 2565.0	9M07W7D	0.1288	9M07W7D	0.0916
15	2507.5 ~ 2562.5	13M5W7D	0.1371	13M5W7D	0.1000
20	2510.0 ~ 2560.0	18M4W7D	0.1349	18M3W7D	0.1005
Frequency Tolerance (ppm)		-			

5G NR n7		**256QAM**	
BW (MHz)	**Frequency Range (MHz)**	**Emission Designator (99%OBW)**	**Maximum EIRP(W)**
5	2502.5 ~ 2567.5	4M52W7D	0.0564
10	2505.0 ~ 2565.0	9M03W7D	0.0592
15	2507.5 ~ 2562.5	13M5W7D	0.0627
20	2510.0 ~ 2560.0	18M4W7D	0.0662
Frequency Tolerance (ppm)		-	

1.7 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	03CH04-KS TH01-KS	CN1257	314309

1.8 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24a

1.9 Applicable Standards

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

- 47 CFR Part 2, 22, 24, 27
- ANSI C63.26-2015
- FCC KDB 971168 D01 Power Meas License Digital Systems v03r01
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items are performed according to KDB 971168 D01 Power Meas License Digital Systems v03r01 with maximum output power.

For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

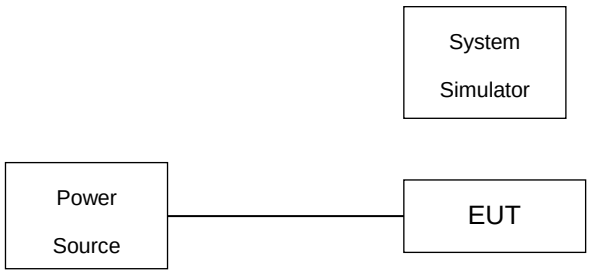
The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.

Orthogonal Planes of EUT	X Plane	Y Plane	Z Plane

Test Items	5G NR	Bandwidth (MHz)						Modulation					RB #		Test Channel		
		5	10	15	20	50-90	100	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	1	Full	L	M	H
Max. Output Power	n5	v	v	v	v	-	-	v	v	v	v	v	v	v	v	v	v
	n7	v	v	v	v	-	-	v	v	v	v	v	v	v	v	v	v
Peak-to-Average Ratio	n5				v	-	-	v	v	v	v	v		v	v	v	v
	n7				v	-	-	v	v	v	v	v		v	v	v	v
26dB and 99% Bandwidth	n5	v	v	v	v	-	-	v	v	v	v	v		v	v	v	v
	n7	v	v	v	v	-	-	v	v	v	v	v		v	v	v	v
Conducted Band Edge	n5	v	v	v	v	-	-	v	v	v	v	v	v	v	v		v
	n7	v	v	v	v	-	-	v	v	v	v	v	v	v	v		v
Conducted Spurious Emission	n5	v	v	v	v	-	-	v	v	v	v	v	v	v	v	v	v
	n7	v	v	v	v	-	-	v	v	v	v	v	v	v	v	v	v
Frequency Stability	n5				v	-	-		v					v		v	
	n7				v	-	-		v					v		v	
E.R.P / E.I.R.P	n5	v	v	v	v	-	-	v	v	v	v	v	v	v	v	v	v
	n7	v	v	v	v	-	-	v	v	v	v	v	v	v	v	v	v
Radiated Spurious Emission	n5	Worst Case														v	
	n7	Worst Case														v	
Note	1. The mark "**v** " means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test																

	under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 4. 5G NR supports SA and NSA mode (refer to the Operation Description), based on engineering evaluation, and according to the maximum power, only show the worst mode in the report. 5. For modulation of CP-OFDM and DFT-s-OFDM , the maximum power of CP-OFDM is lower than DFT-s-OFDM modulation, therefore, we chose higher power (DFT-s-OFDM modulation) to perform all tests and show in the report.

2.2 Connection Diagram of Test System



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

2.3 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	DC Power Supply	GW	GPS-3030D	N/A	N/A	Unshielded, 1.8 m
2.	LTE Base Station	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8 m
3.	NR Base Station	Anritsu	MT8000A	N/A	N/A	Unshielded, 1.8 m
4.	Fixture	INTEL	NGFF Card Carrier	N/A	N/A	N/A

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 EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 6 dB.

Example :

Offset(dB) = RF cable loss(dB).

= 6 (dB)

2.5 Frequency List of Low/Middle/High Channels

5G NR n5 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
20	Channel	166800	167300	167800
	Frequency	834	836.5	839
15	Channel	166300	167300	168300
	Frequency	831.5	836.5	841.5
10	Channel	165800	167300	168800
	Frequency	829	836.5	844
5	Channel	165300	167300	169300
	Frequency	826.5	836.5	846.5

5G NR n7 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
20	Channel	502000	507000	512000
	Frequency	2510	2535	2560
15	Channel	501500	507000	512500
	Frequency	2507.5	2535	2562.5
10	Channel	501000	507000	513000
	Frequency	2505	2535	2565
5	Channel	500500	507000	513500
	Frequency	2502.5	2535	2567.5

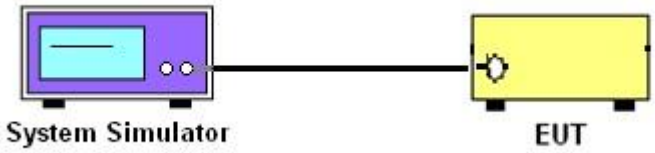
3 Conducted Test Items

3.1 Measuring Instruments

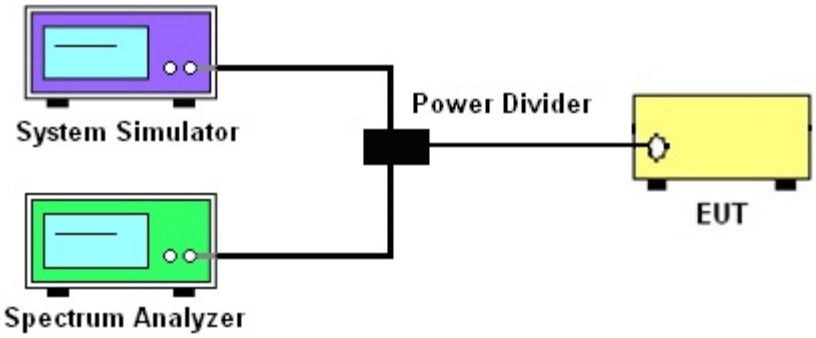
See list of measuring instruments of this test report.

3.2 Test Setup

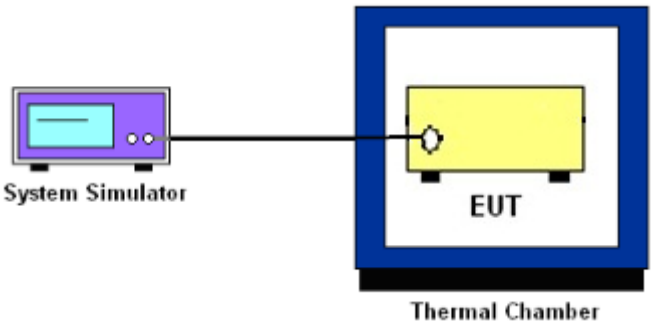
3.2.1 Conducted Output Power



3.2.2 Peak-to-Average Ratio, Occupied Bandwidth ,Conducted Band-Edge and Conducted Spurious Emission



3.2.3 Frequency Stability



3.3 Test Result of Conducted Test

Please refer to Appendix A.

3.4 Conducted Output Power and ERP/EIRP

3.4.1 Description of the Conducted Output Power Measurement and ERP/EIRP Measurement

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

The ERP of mobile transmitters must not exceed 7 Watts for 5G NR n5.

The EIRP of mobile transmitters must not exceed 2 Watts for 5G NR n7.

According to KDB 412172 D01 Power Approach,

EIRP = $P_T + G_T – L_C$, ERP = EIRP -2.15, 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

3.4.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2
2. The transmitter output port was connected to the system simulator.
3. Set EUT at maximum power through the system simulator.
4. Select lowest, middle, and highest channels for each band and different modulation.
5. Measure and record the power level from the system simulator.

3.5 Peak-to-Average Ratio

3.5.1 Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. 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.

3.5.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2.3.4 (CCDF).
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5. Record the deviation as Peak to Average Ratio.

3.6 Occupied Bandwidth

3.6.1 Description of Occupied Bandwidth Measurement

The 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 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

3.6.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.4
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
4. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
5. Set the detection mode to peak, and the trace mode to max hold.
6. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.
   (this is the reference value)
7. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
8. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “–X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
9. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

3.7 Conducted Band Edge

3.7.1 Description of Conducted Band Edge Measurement

22.917(a)

For operations in the 824 – 849 MHz band, the FCC limit is 43 + 10log$_{10}$(P[Watts]) dB below the transmitter power P(Watts) in a 100kHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

27.53(m)(4)

For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

3.7.2 Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured.
4. Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
5. Beyond the 1 MHz band from the band edge, RBW=1MHz was used.
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. Checked that all the results comply with the emission limit line.

   Example:

   The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

   = P(W)- [43 + 10log(P)] (dB)

   = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB) = -13dBm.
9. For 5G NR n7, the other 40 dB, and 55 dB have additionally applied same calculation above.

3.8 Conducted Spurious Emission

3.8.1 Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

For 5G NR n7:

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 55 + 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.

3.8.2 Test Procedures

1. The testing follows ANSI C63.26 section 5.7
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. 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.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
7. Set spectrum analyzer with RMS detector.
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
10. The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [43 + 10log(P)] (dB)
    = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
    = -13dBm.
11. For 5G NR n7
    The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [55+ 10log(P)] (dB)
    = [30+ 10log(P)] (dBm) - [55+ 10log(P)] (dB)
    = -25dBm.

3.9 Frequency Stability

3.9.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

3.9.2 Test Procedures for Temperature Variation

1. The testing follows ANSI C63.26 section 5.6.4
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. 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.

3.9.3 Test Procedures for Voltage Variation

1. The testing follows ANSI C63.26 section 5.6.5
2. The EUT was placed in a temperature chamber at 20±5°C and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
4. For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.
5. The variation in frequency was measured for the worst case.

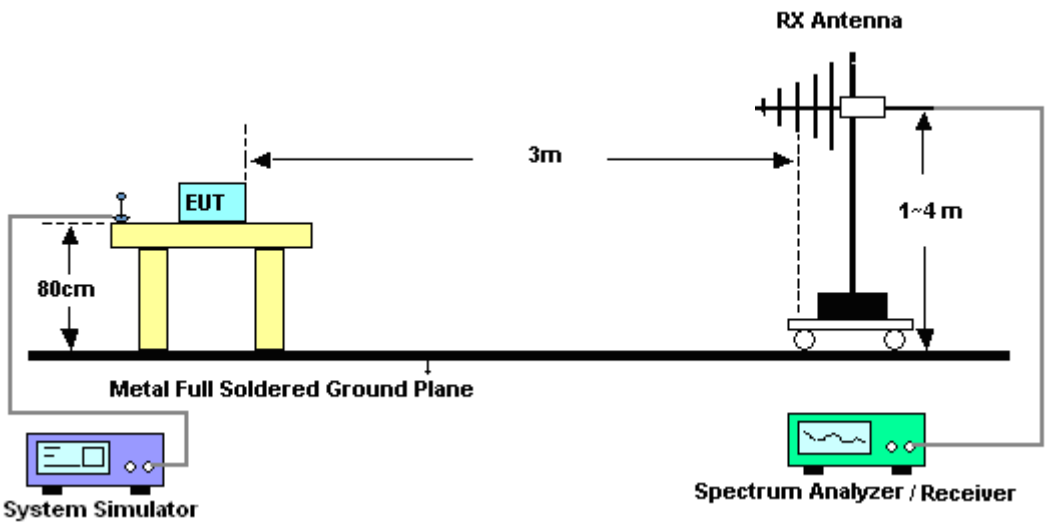
4 Radiated Test Items

4.1 Measuring Instruments

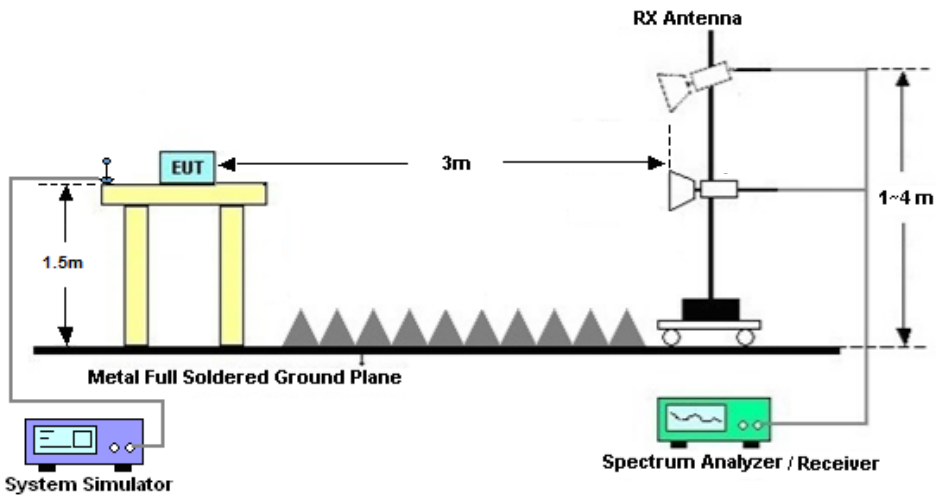
See list of measuring instruments of this test report.

4.2 Test Setup

4.2.1 For radiated test from 30MHz to 1GHz



4.2.2 For radiated test above 1GHz



4.3 Test Result of Radiated Test

Please refer to Appendix B.

4.4 Radiated Spurious Emission

4.4.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI C63.26. 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 (P) dB.

For 5G NR n7

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 55 + 10 log (P) dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.5
2. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
6. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
7. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
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. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
11. ERP (dBm) = EIRP - 2.15
12. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
    The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [43 + 10log(P)] (dB)
    = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
    = -13dBm.
13. For 5G NR n7:
    The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)

5 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Nov. 02, 2020	Nov. 15, 2020~ Nov. 16, 2020	Nov. 01, 2021	Conducted (TH01-KS)
Thermal Chamber	Ten Billion	TTC-B3S	TBN-960502	-40~+150°C	Oct. 27, 2020	Nov. 15, 2020~ Nov. 16, 2020	Oct. 26, 2021	Conducted (TH01-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz-44G,MAX 30dB	Apr. 15, 2020	Nov. 28, 2020	Apr. 14, 2021	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	Jan. 03, 2020	Nov. 28, 2020	Jan. 02, 2021	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1356	1GHz~18GHz	Apr. 20, 2020	Nov. 28, 2020	Apr. 19, 2021	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 09, 2020	Nov. 28, 2020	Nov. 08, 2021	Radiation (03CH04-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	Jan. 03, 2020	Nov. 28, 2020	Jan. 02, 2021	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40G GA	060728	18~40GHz	Jan. 08, 2020	Nov. 28, 2020	Jan. 07, 2021	Radiation (03CH04-KS)
high gain Amplifier	MITEQ	AMF-7D-00 101800-30-1 0P	2025788	1Ghz-18Ghz	Jan. 03, 2020	Nov. 28, 2020	Jan. 02, 2021	Radiation (03CH04-KS)
Amplifier	Keysight	83017A	MY57280106	500MHz~26.5GHz	Oct. 14, 2020	Nov. 28, 2020	Oct. 13, 2021	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Nov. 28, 2020	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Nov. 28, 2020	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Nov. 28, 2020	NCR	Radiation (03CH04-KS)

NCR: No Calibration Required

6 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26-2015. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.3dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.8dB**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.8dB**

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power and EIRP)

5G NR n5

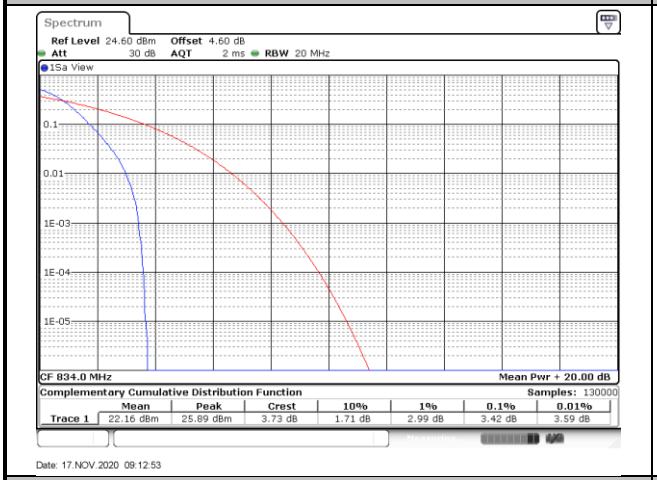
Peak-to-Average Ratio

Mode	FR1 n5 / 20MHz / DFT-S OFDM					
Mod.	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	Limit: 13dB
RB Size	Full RB	Full RB	Full RB	Full RB	Full RB	Result
Lowest CH	3.42	4.70	5.80	6.09	6.46	PASS
Middle CH	3.28	4.70	5.68	6.09	6.46	
Highest CH	3.59	4.72	5.83	6.09	6.49	
Mode	FR1 n5 / 20MHz / DFT-S OFDM					
Mod.	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	Limit: 13dB
RB Size	1 RB0	1 RB0	1 RB0	1 RB0	1 RB0	Result
Lowest CH	3.77	4.78	5.62	5.91	5.65	PASS
Middle CH	3.86	4.93	5.65	6.12	6.61	
Highest CH	3.71	4.90	5.65	6.17	7.07	

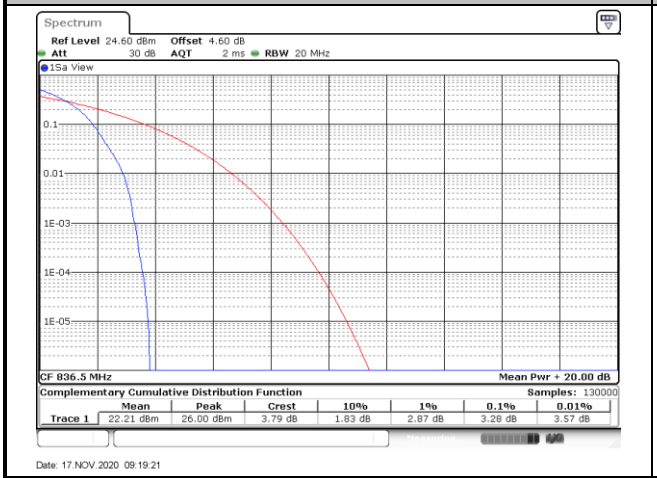
FR1 n5 / 20MHz / DFT-S OFDM

PI/2 BPSK

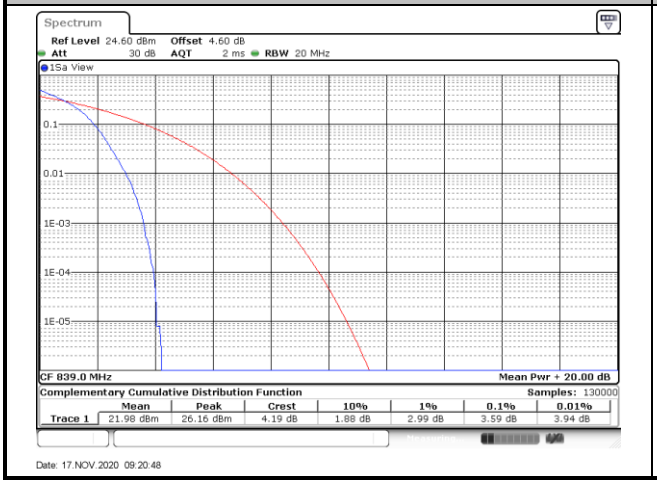
Lowest Channel / Full RB



Middle Channel / Full RB

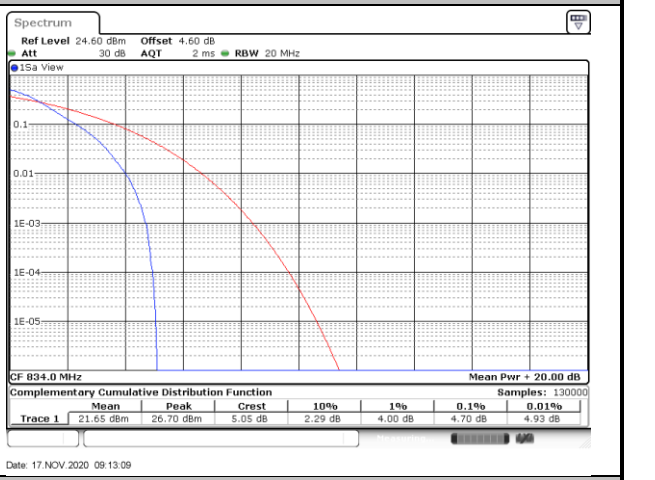


Highest Channel / Full RB

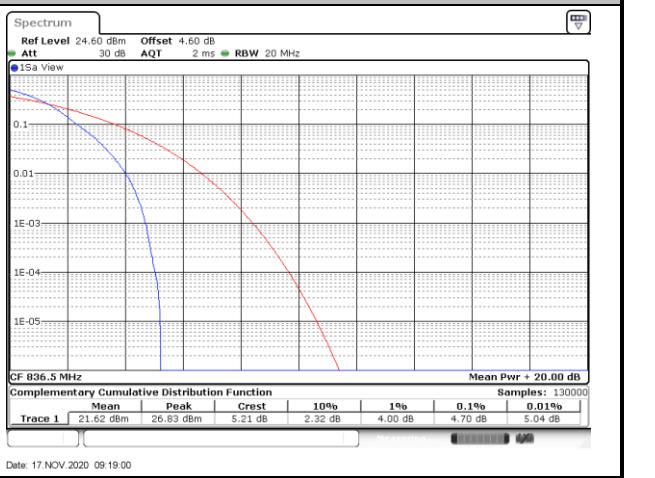


QPSK

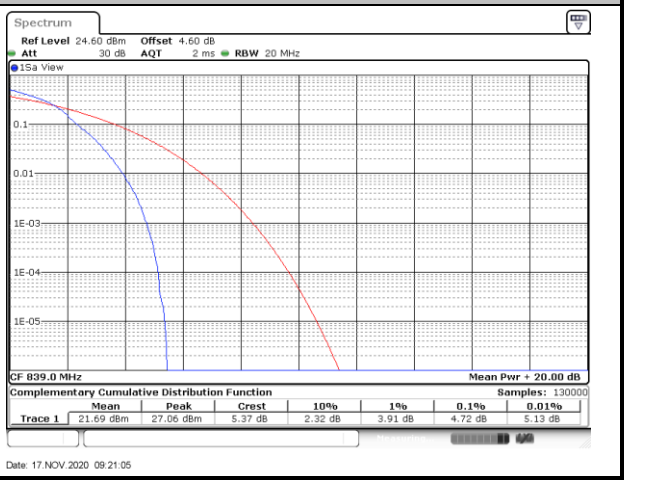
Lowest Channel / Full RB

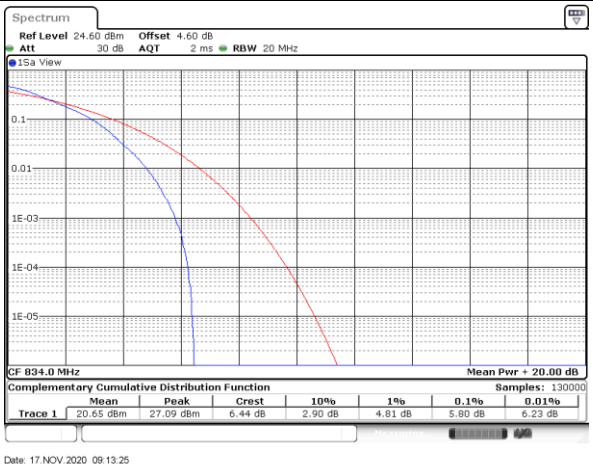
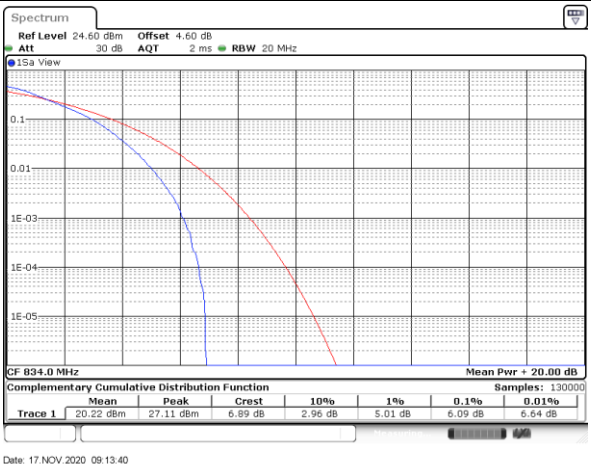
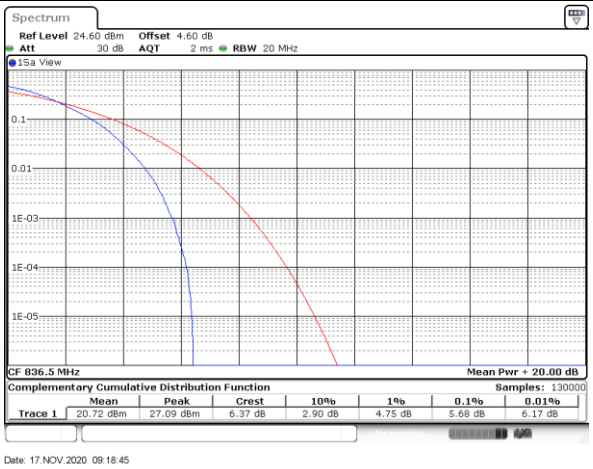
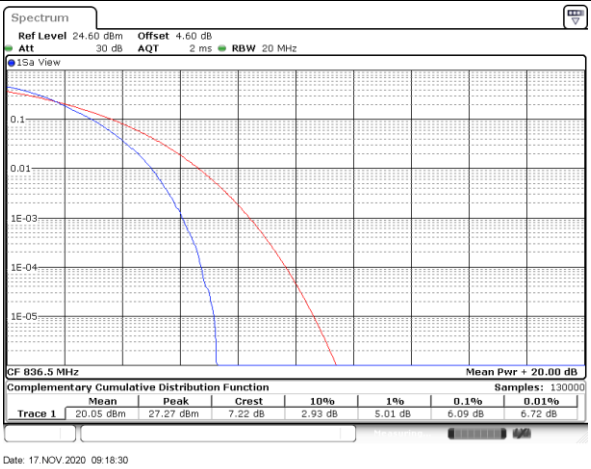
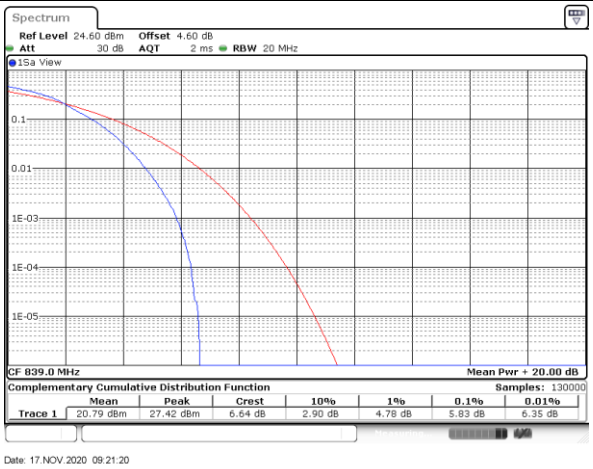
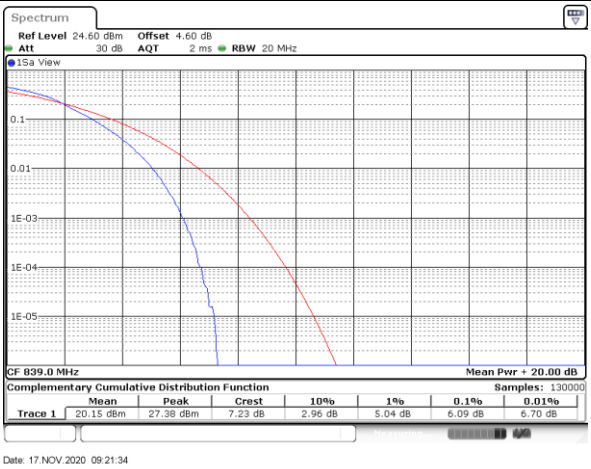


Middle Channel / Full RB

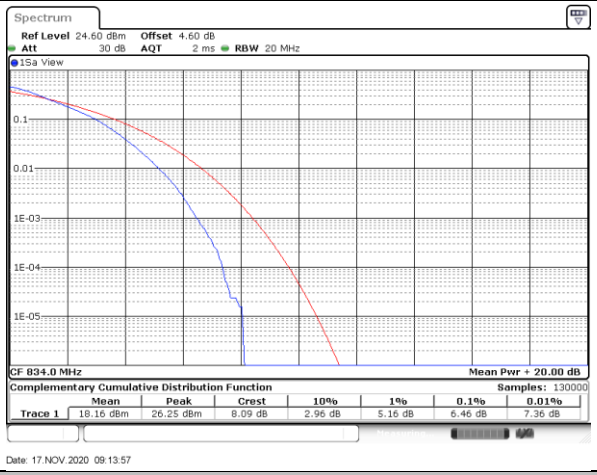


Highest Channel / Full RB

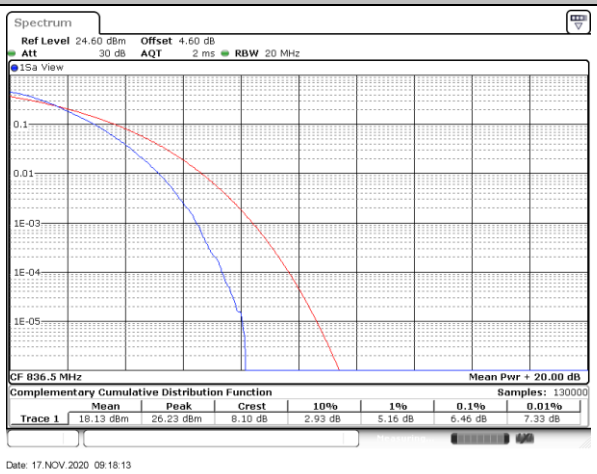


FR1 n5 / 20MHz / DFT-S OFDM	
16QAM	**64QAM**
Lowest Channel / Full RB	**Lowest Channel / Full RB**
	
Middle Channel / Full RB	**Middle Channel / Full RB**
	
Highest Channel / Full RB	**Highest Channel / Full RB**
	

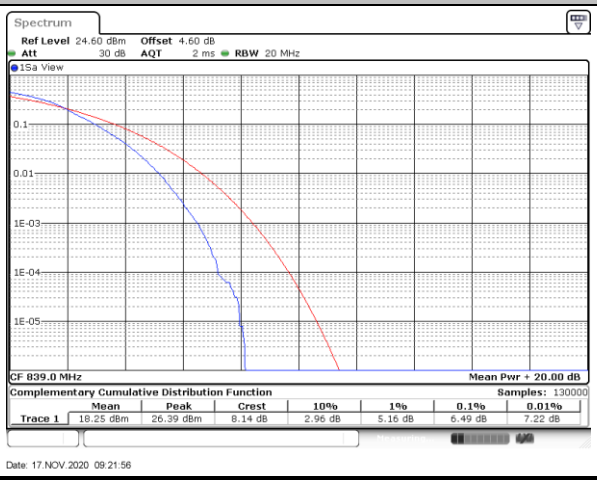
FR1 n5 / 20MHz / DFT-S OFDM
256QAM
Lowest Channel / Full RB

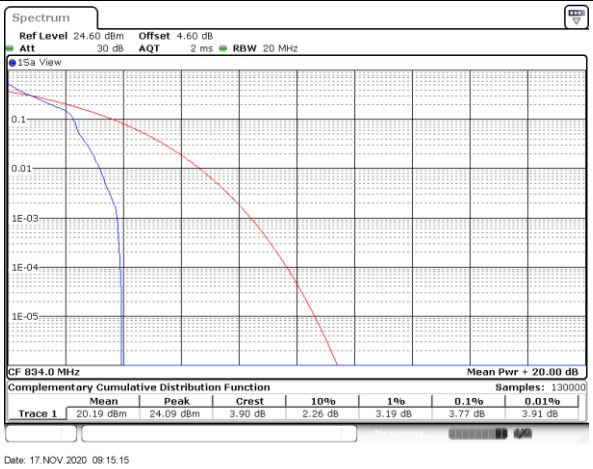
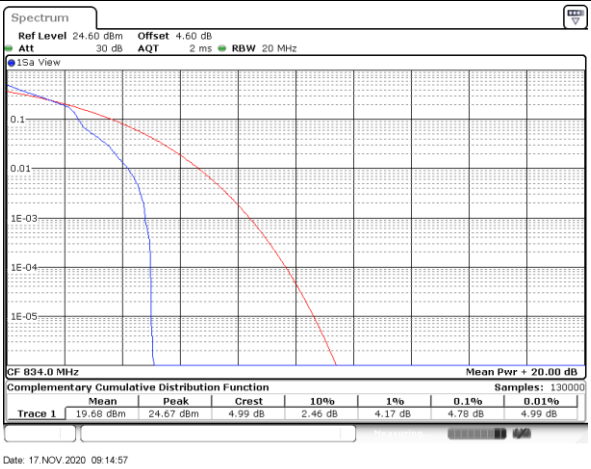
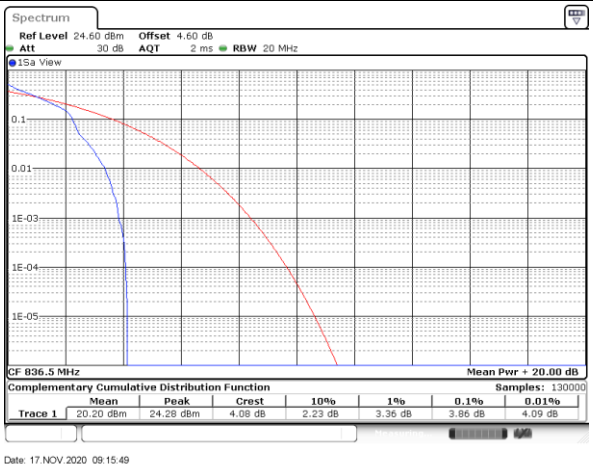
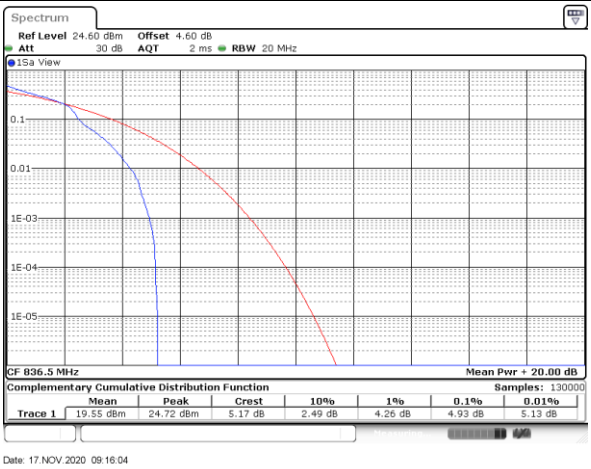
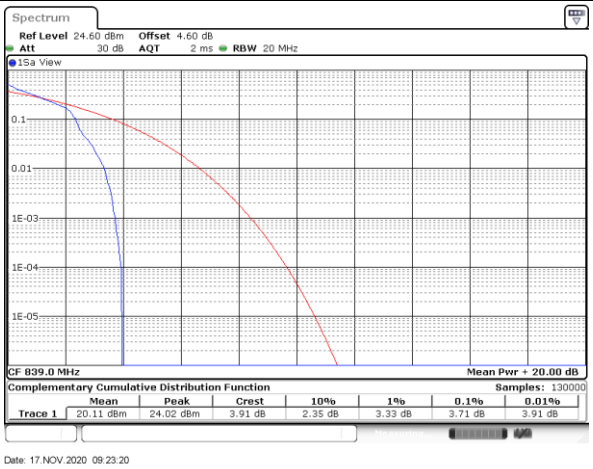
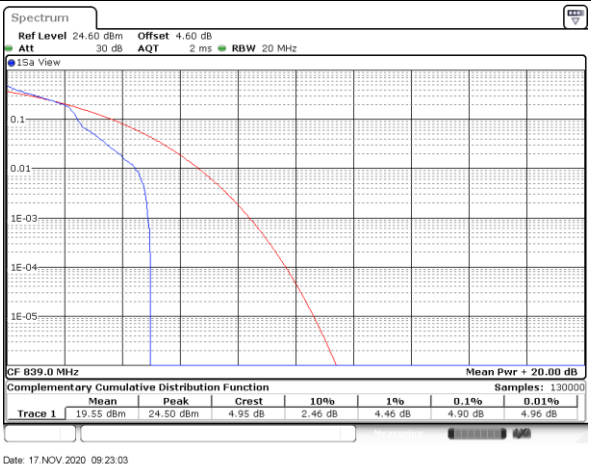


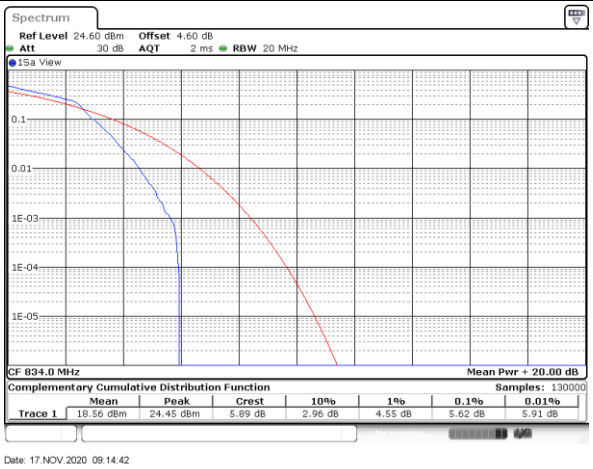
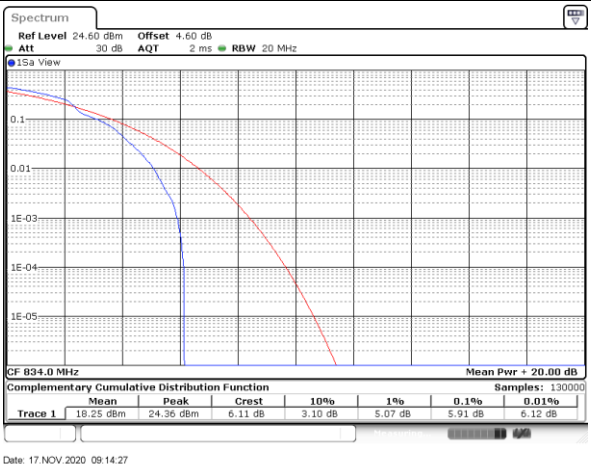
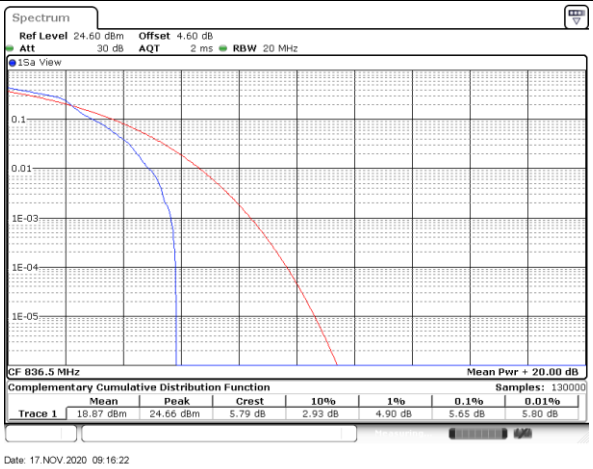
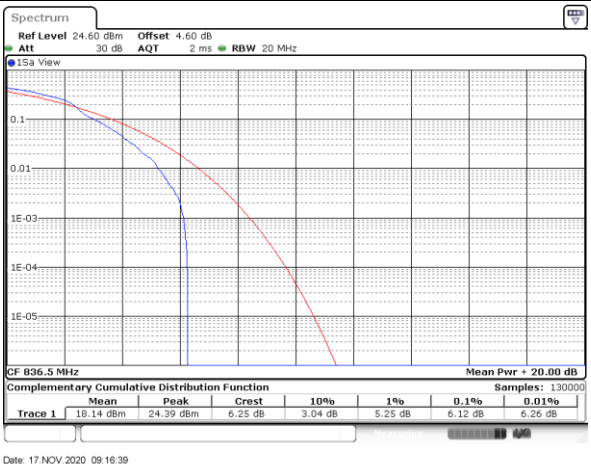
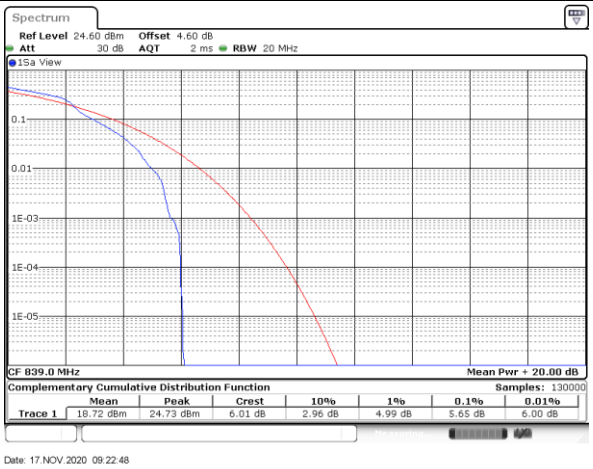
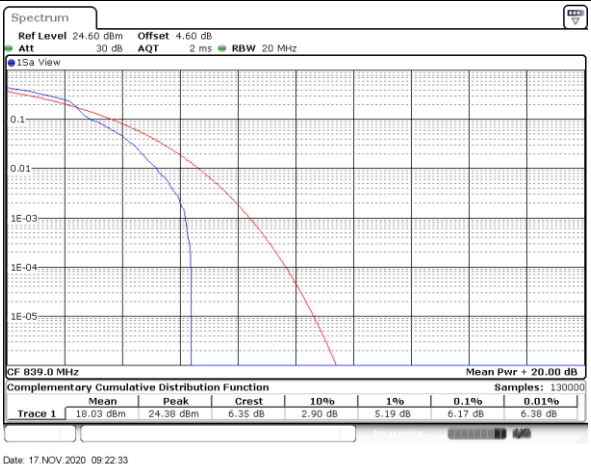
Middle Channel / Full RB



Highest Channel / Full RB



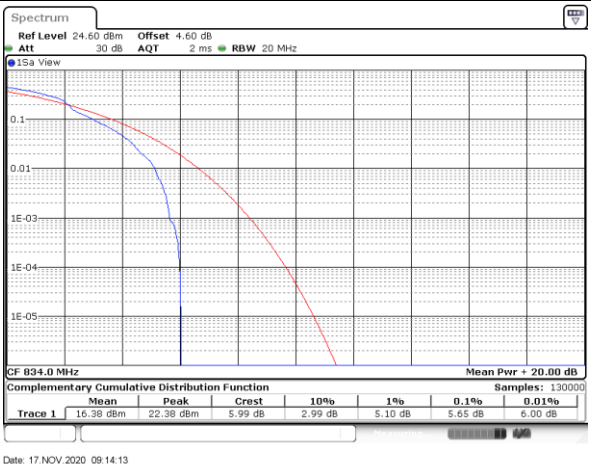
FR1 n5 / 20MHz / DFT-S OFDM	
PI/2 BPSK	**QPSK**
Lowest Channel / 1RB0	**Lowest Channel / 1RB0**
	
Middle Channel / 1RB0	**Middle Channel / 1RB0**
	
Highest Channel / 1RB0	**Highest Channel / 1RB0**
	

FR1 n5 / 20MHz / DFT-S OFDM	
16QAM	**64QAM**
Lowest Channel / 1RB0	**Lowest Channel / 1RB0**
	
Middle Channel / 1RB0	**Middle Channel / 1RB0**
	
Highest Channel / 1RB0	**Highest Channel / 1RB0**
	

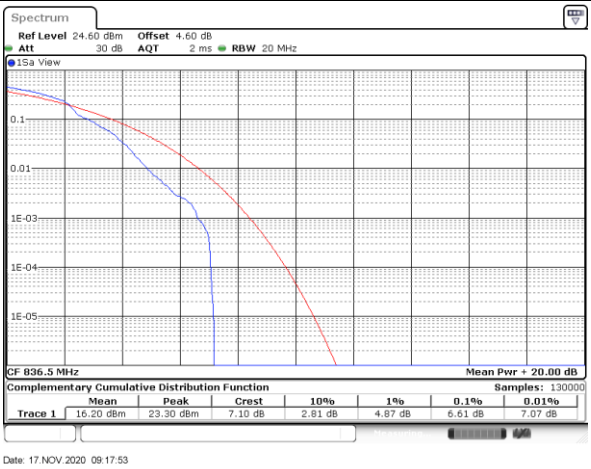
FR1 n5 / 20MHz / DFT-S OFDM

256QAM

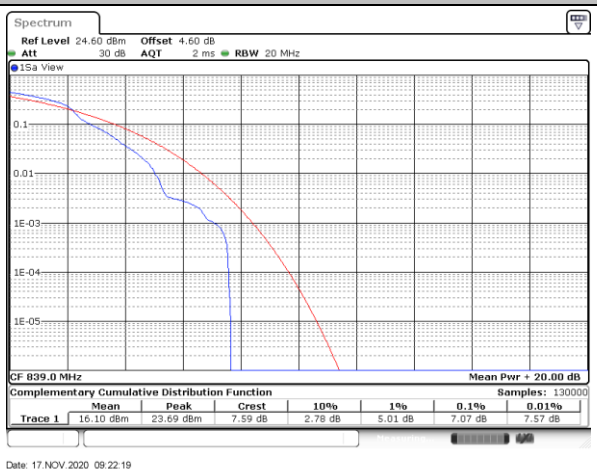
Lowest Channel / 1RB0



Middle Channel / 1RB0



Highest Channel / 1RB0



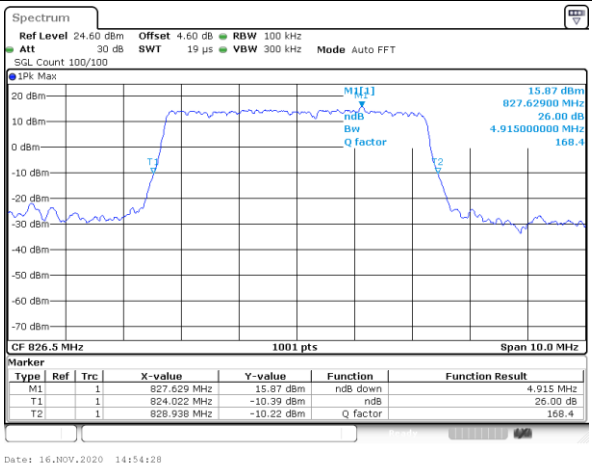
26dB Bandwidth

Mode	FR1 n5 : 26dB BW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	PI / BPSK		PI / BPSK		PI / BPSK		PI / BPSK	
Lowest CH	4.92		9.77		14.27		20.22	
Middle CH	4.88		9.71		14.21		20.06	
Highest CH	4.96		9.77		14.18		19.94	
Mode	FR1 n5 : 26dB BW(MHz) / CP OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	5.08	5.00	9.77	9.77	14.30	14.27	20.14	20.14
Middle CH	4.97	4.93	9.65	9.77	14.21	14.21	20.10	20.10
Highest CH	4.99	5.03	9.71	9.69	14.30	14.27	20.10	20.10
Mode	FR1 n5 : 26dB BW(MHz) / CP OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Lowest CH	4.97	4.86	9.75	9.77	14.30	14.36	20.14	20.26
Middle CH	4.92	4.97	9.73	9.73	14.27	14.24	20.14	20.18
Highest CH	5.00	4.96	9.77	9.73	14.24	14.12	20.14	20.14

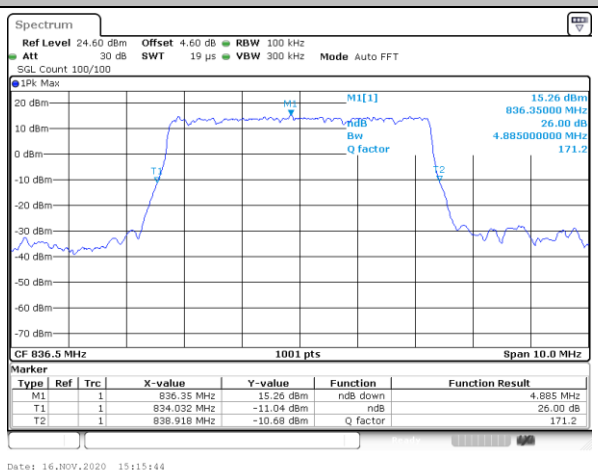
FR1 n5 / 5MHz / DFT-S OFDM

PI / BPSK

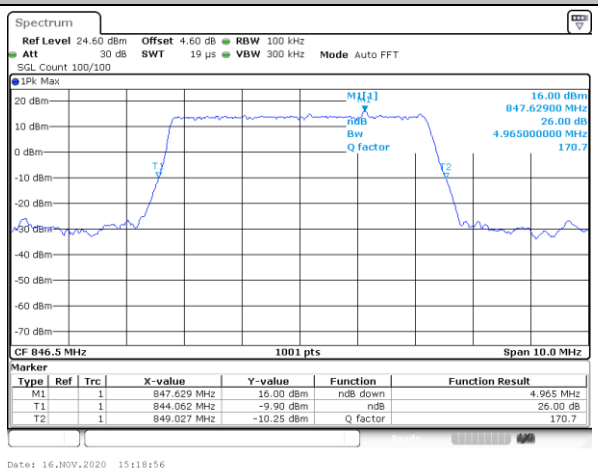
Lowest Channel



Middle Channel



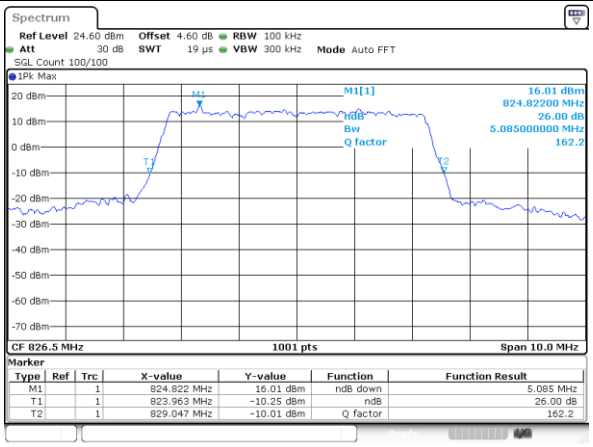
Highest Channel



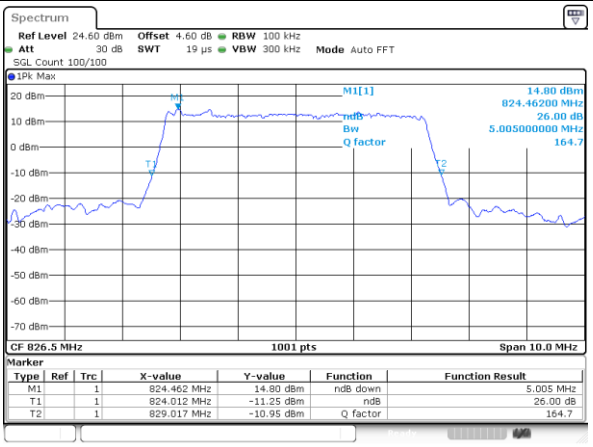
FR1 n5 / 5MHz / CP OFDM

QPSK

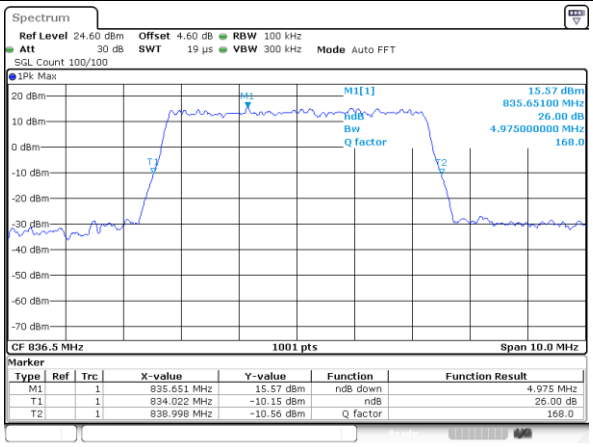
Lowest Channel



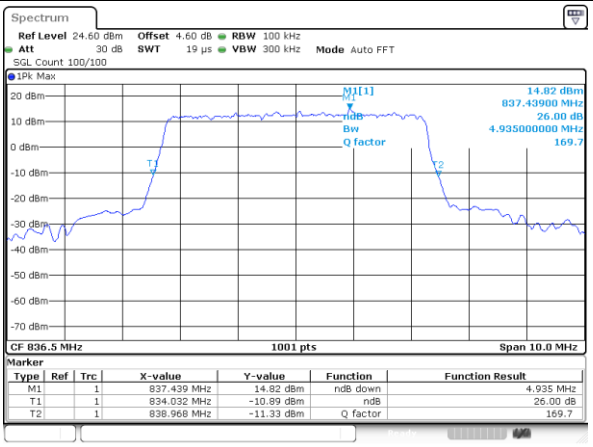
Lowest Channel



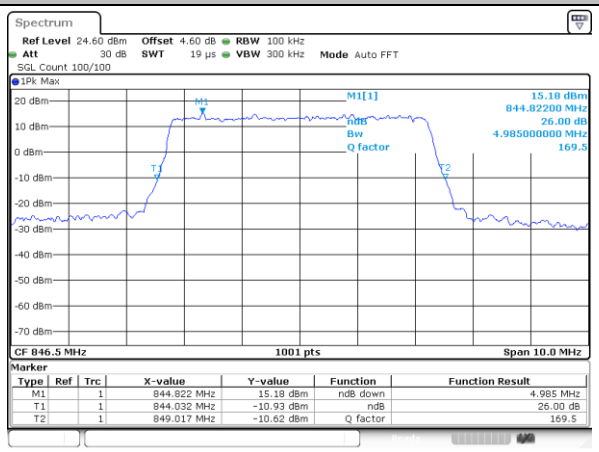
Middle Channel



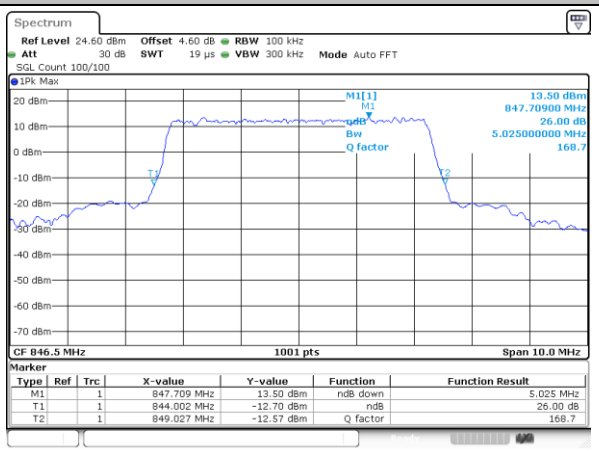
Middle Channel



Highest Channel



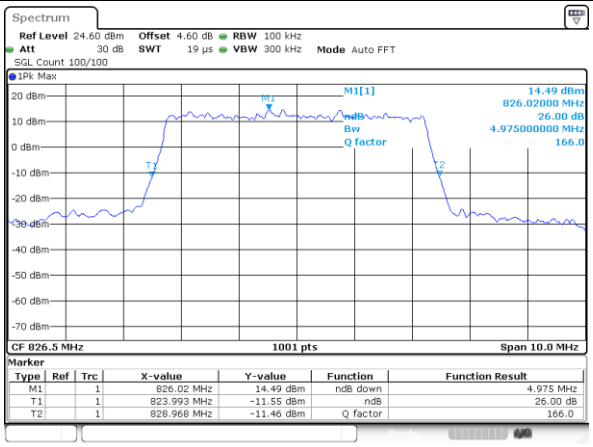
Highest Channel



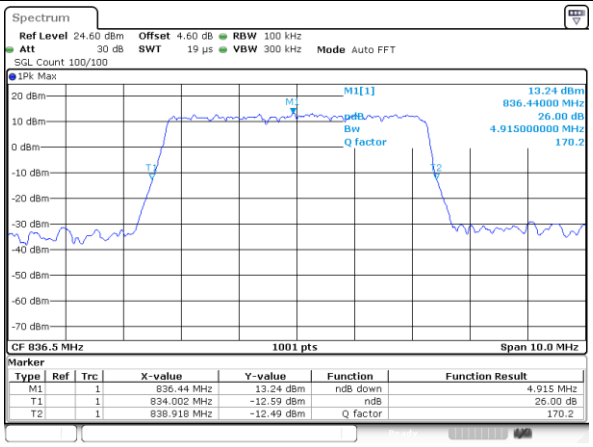
FR1 n5 / 5MHz / CP OFDM

64QAM

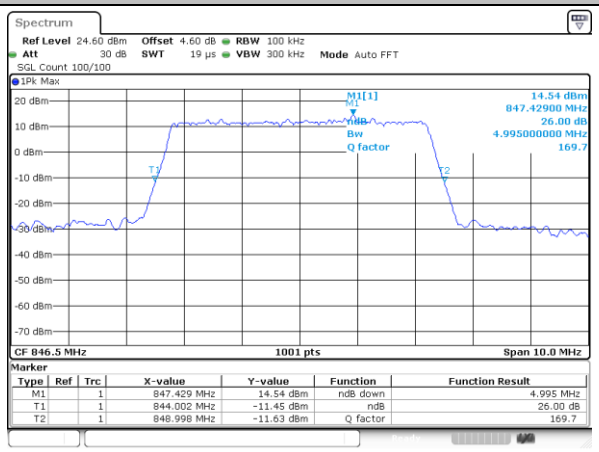
Lowest Channel



Middle Channel

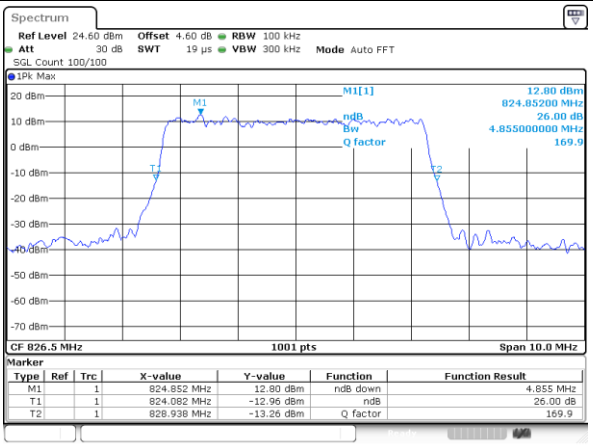


Highest Channel

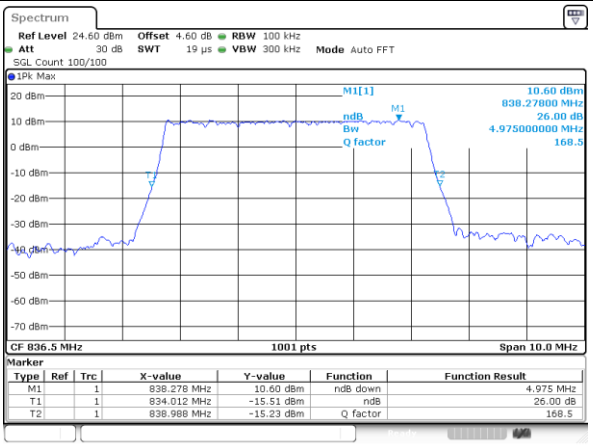


256QAM

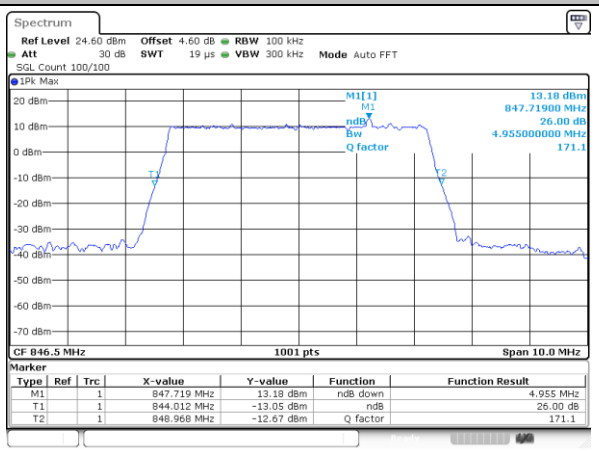
Lowest Channel



Middle Channel



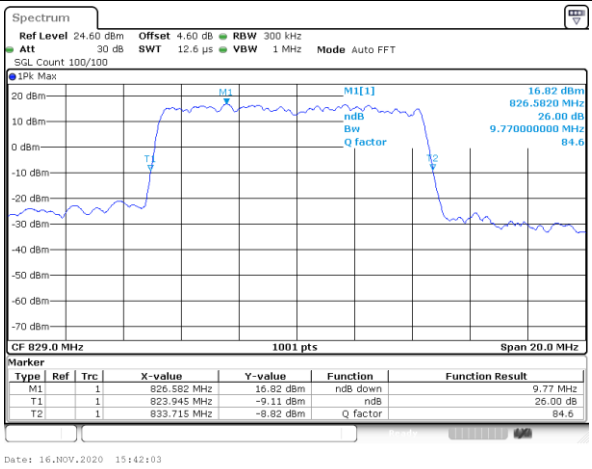
Highest Channel



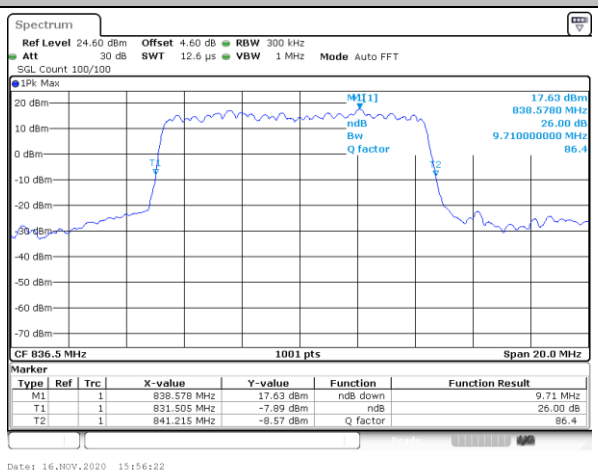
FR1 n5 / 10MHz / DFT-S OFDM

PI / BPSK

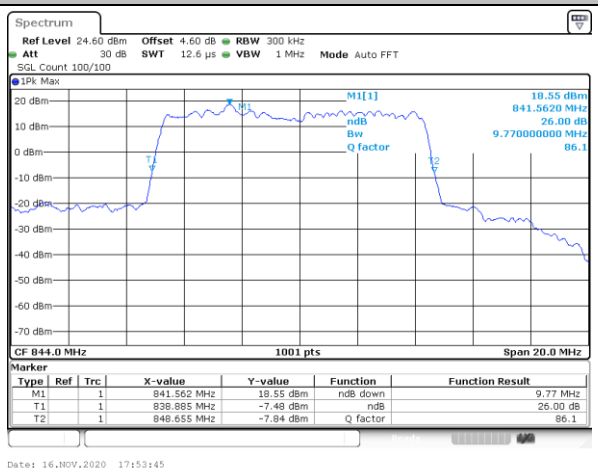
Lowest Channel



Middle Channel



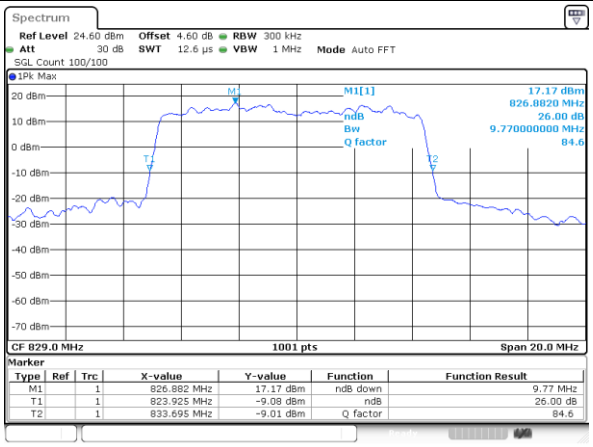
Highest Channel



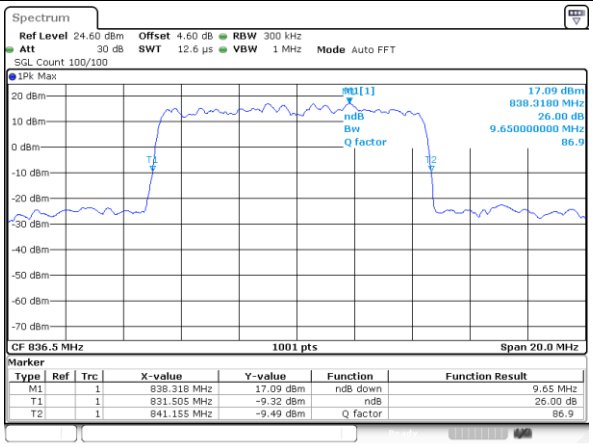
FR1 n5 / 10MHz / CP OFDM

QPSK

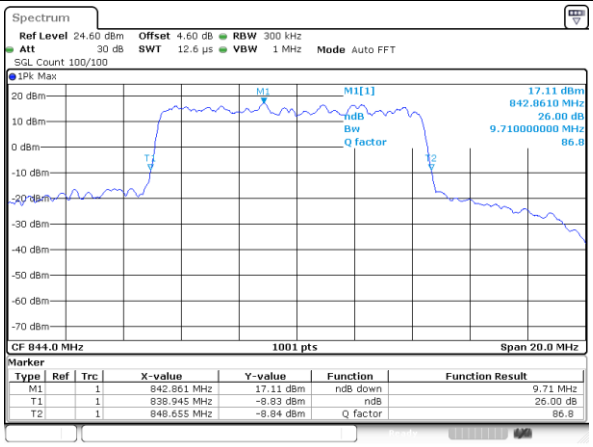
Lowest Channel



Middle Channel

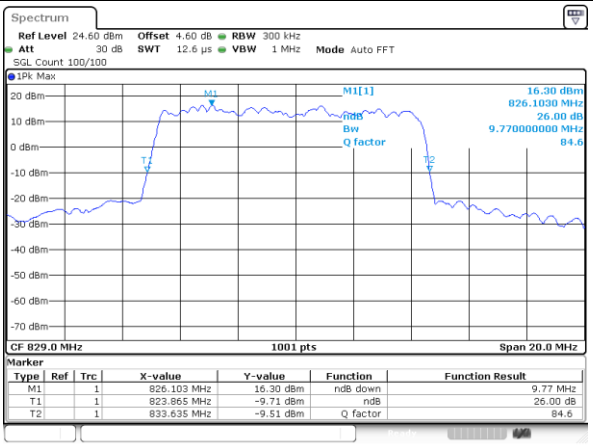


Highest Channel

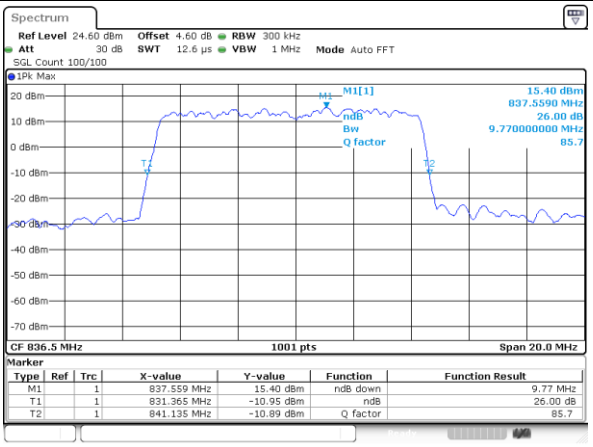


16QAM

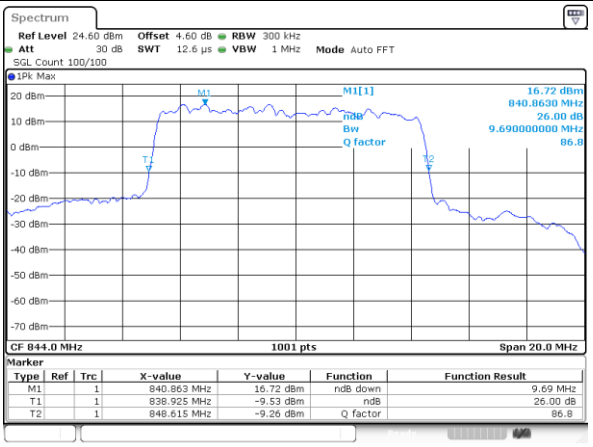
Lowest Channel



Middle Channel



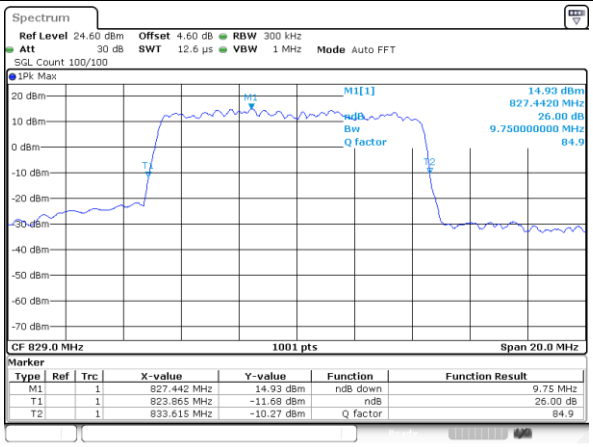
Highest Channel



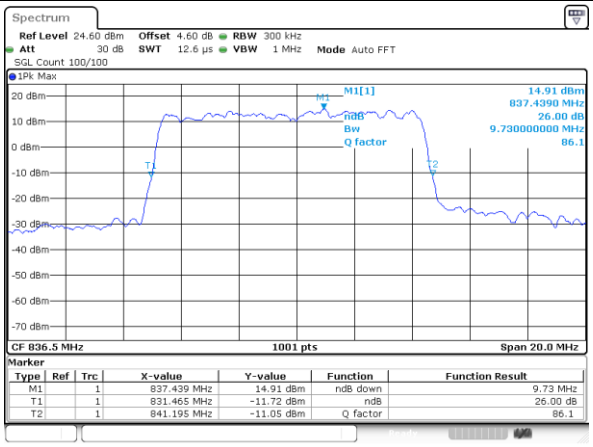
FR1 n5 / 10MHz / CP OFDM

64QAM

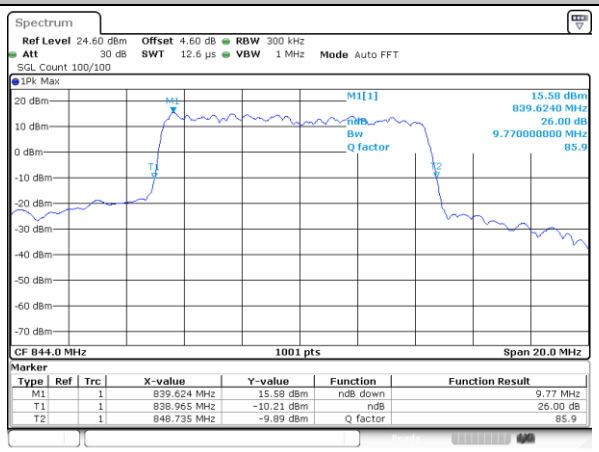
Lowest Channel



Middle Channel

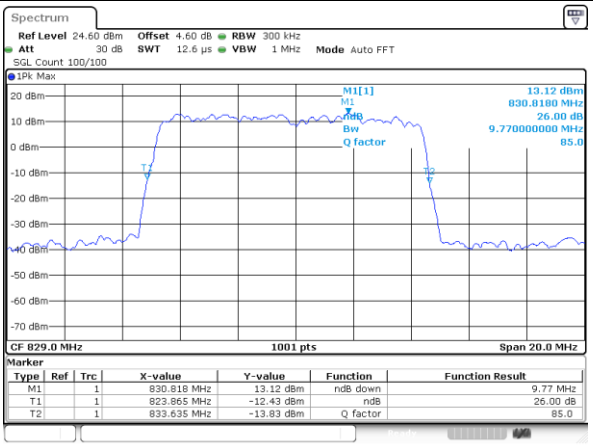


Highest Channel

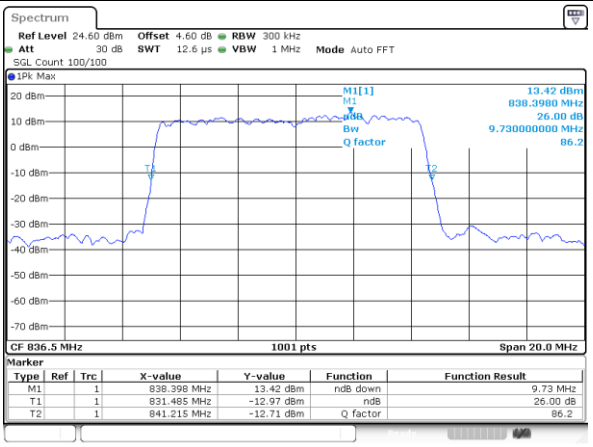


256QAM

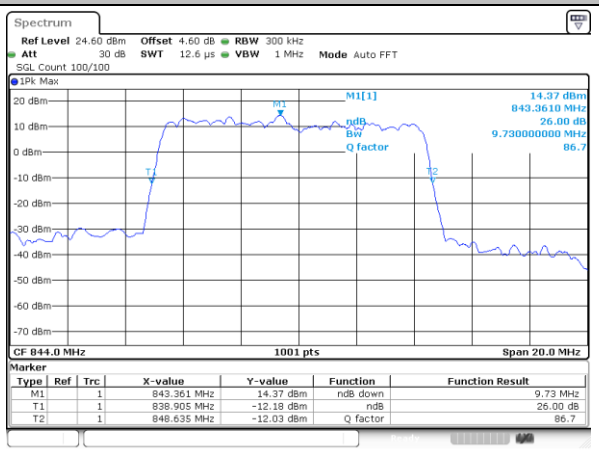
Lowest Channel



Middle Channel



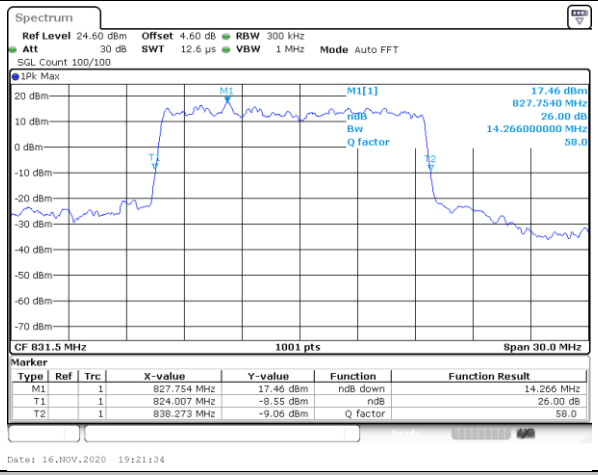
Highest Channel



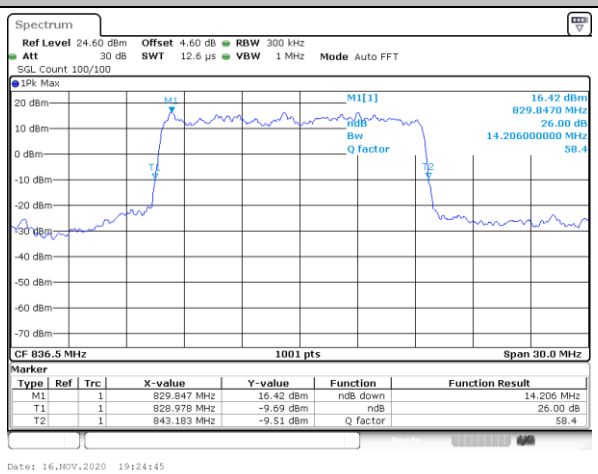
FR1 n5 / 15MHz / DFT-S OFDM

PI / BPSK

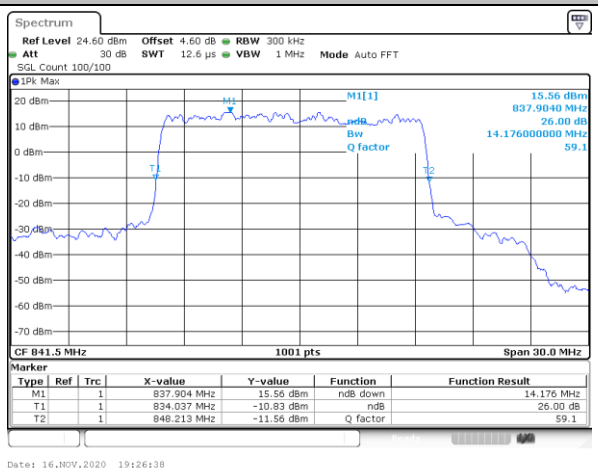
Lowest Channel



Middle Channel



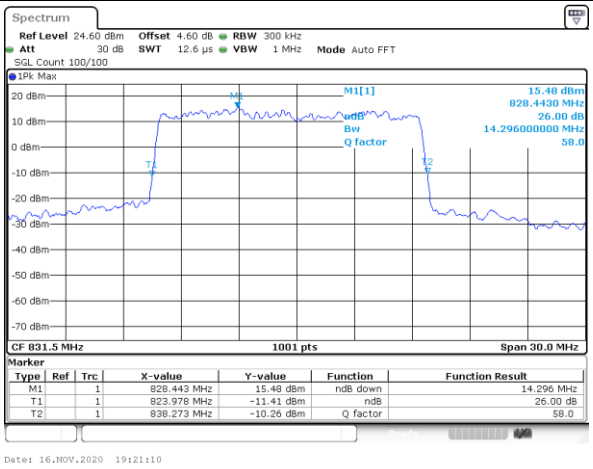
Highest Channel



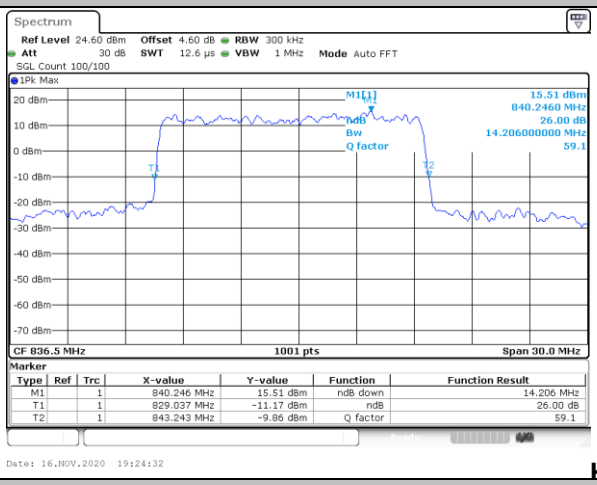
FR1 n5 / 15MHz / CP OFDM

QPSK

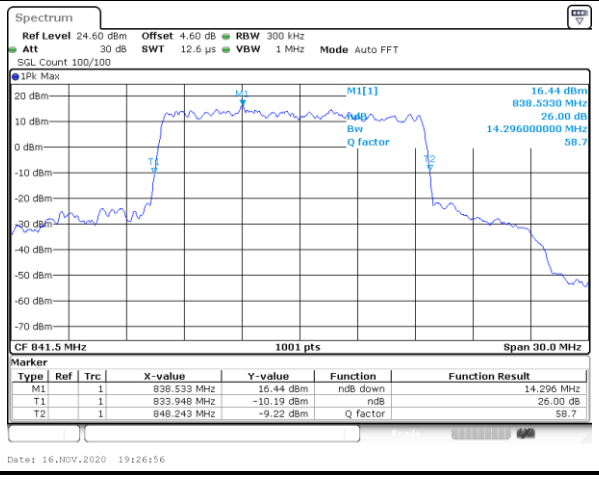
Lowest Channel



Middle Channel

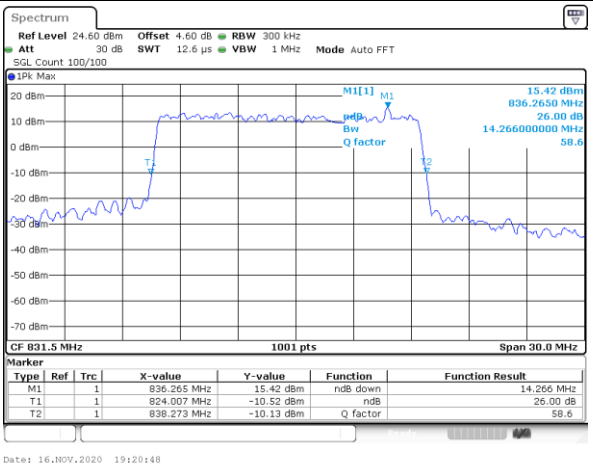


Highest Channel

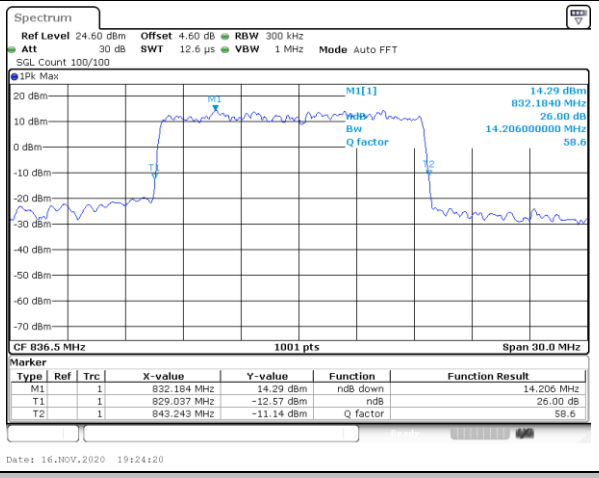


16QAM

Lowest Channel

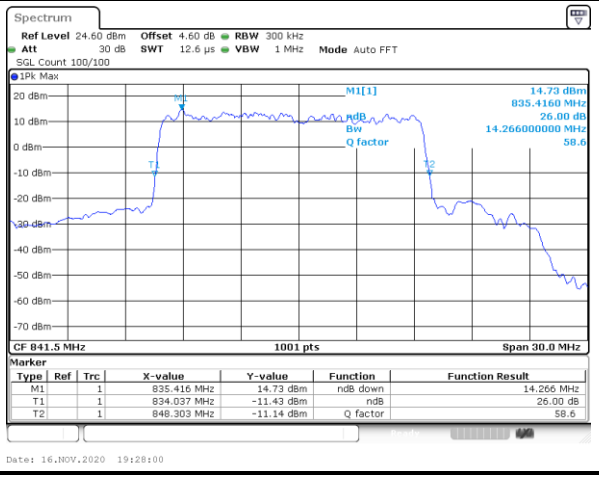


Middle Channel



K

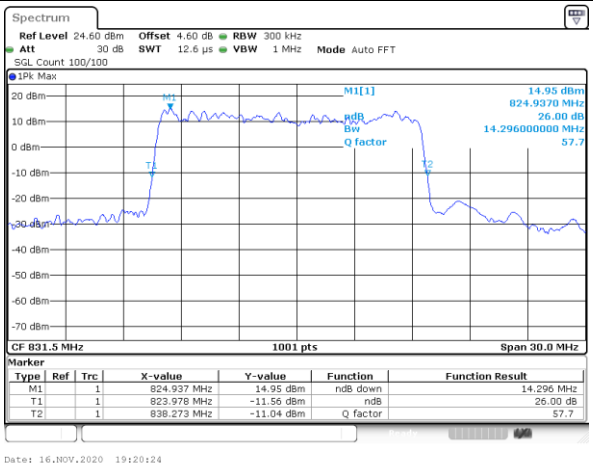
Highest Channel



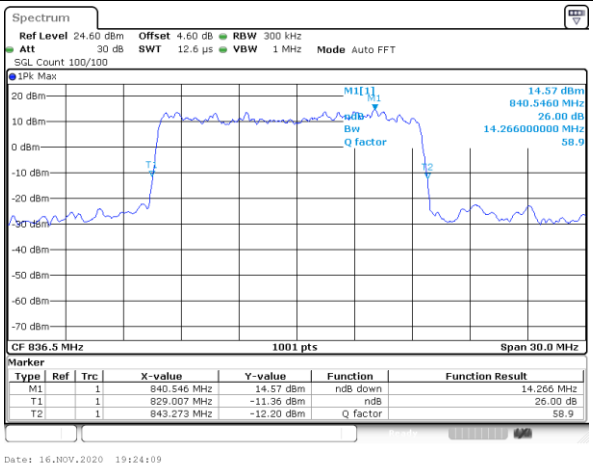
FR1 n5 / 15MHz / CP OFDM

64QAM

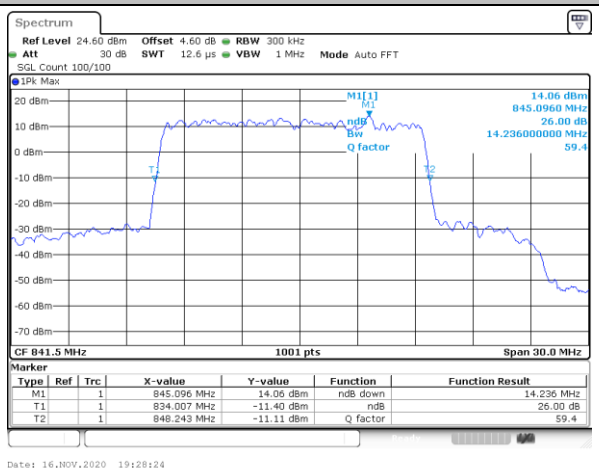
Lowest Channel



Middle Channel

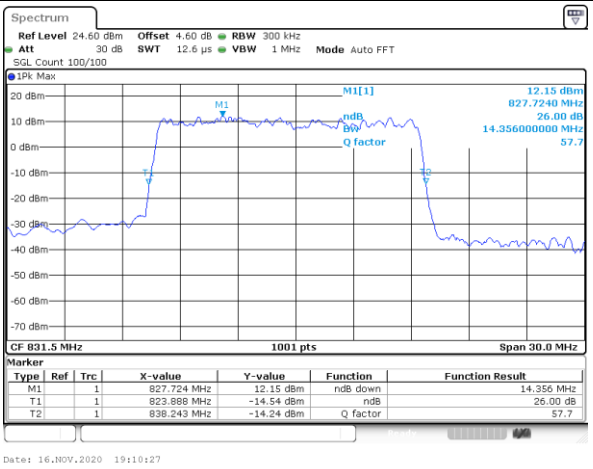


Highest Channel

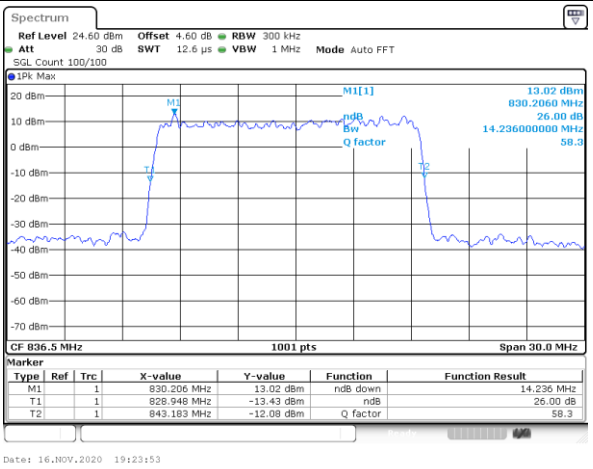


256QAM

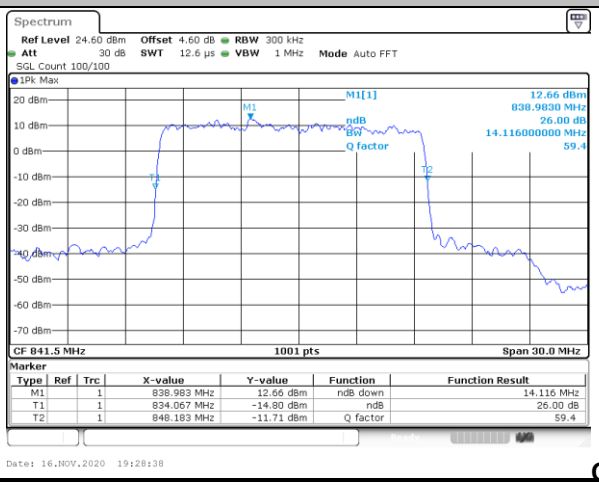
Lowest Channel



Middle Channel



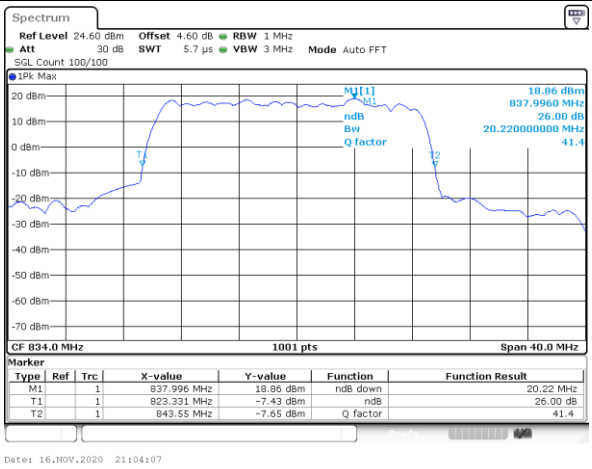
Highest Channel



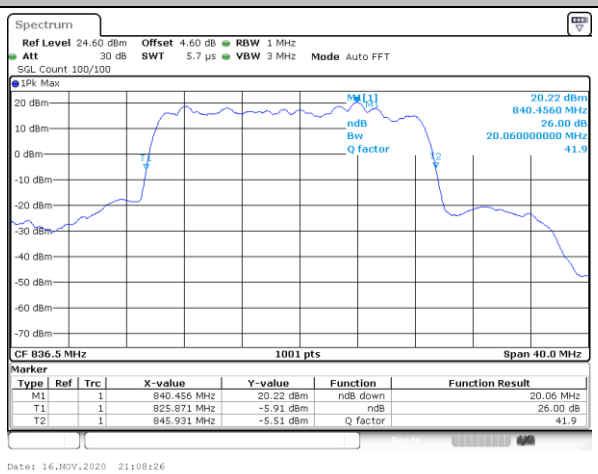
FR1 n5 / 20MHz / DFT-S OFDM

PI / BPSK

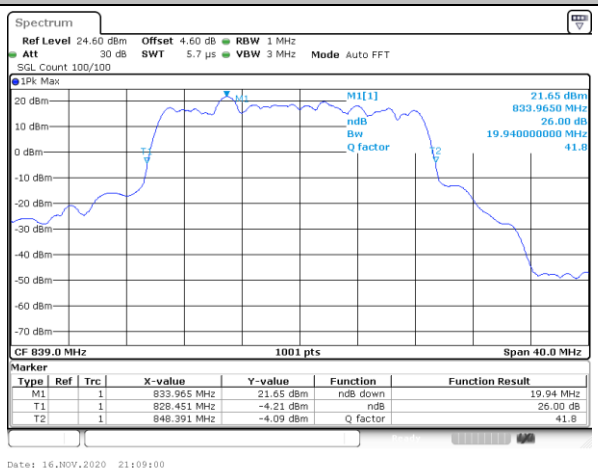
Lowest Channel



Middle Channel



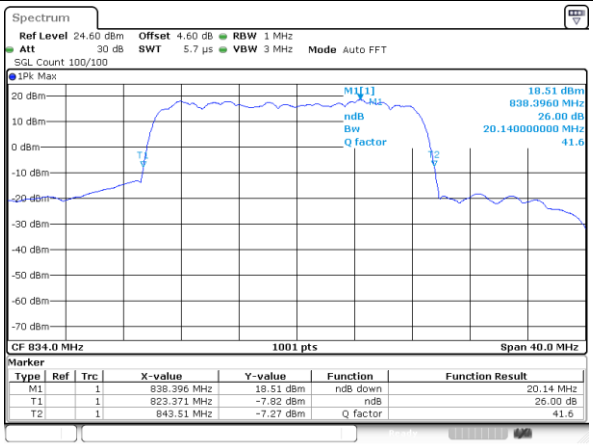
Highest Channel



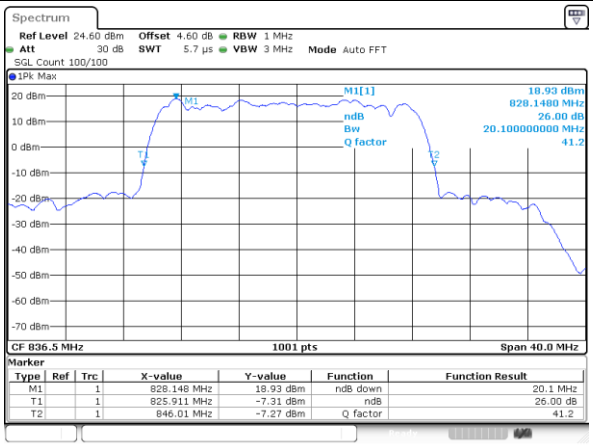
FR1 n5 / 20MHz / CP OFDM

QPSK

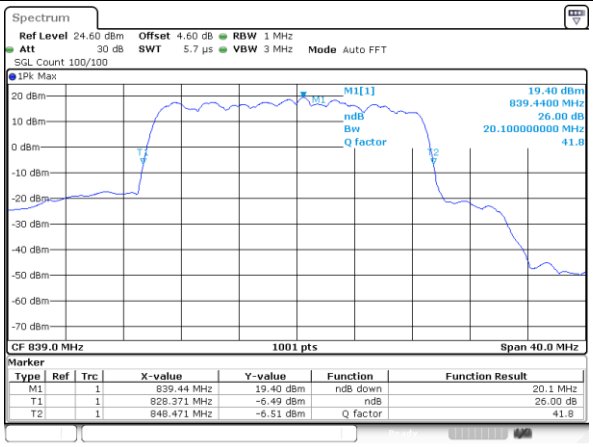
Lowest Channel



Middle Channel

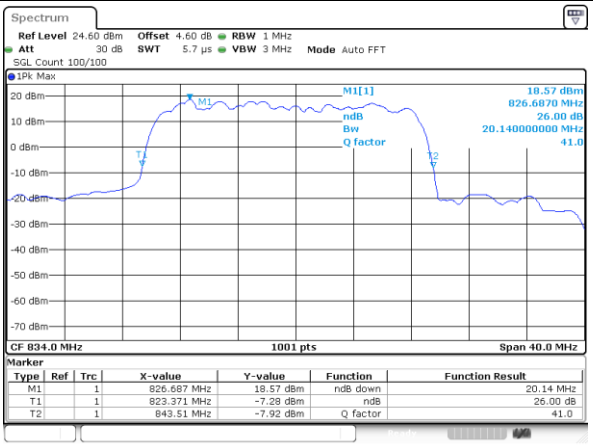


Highest Channel

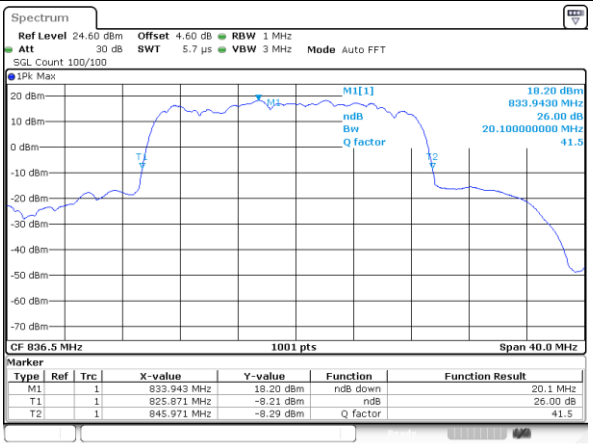


16QAM

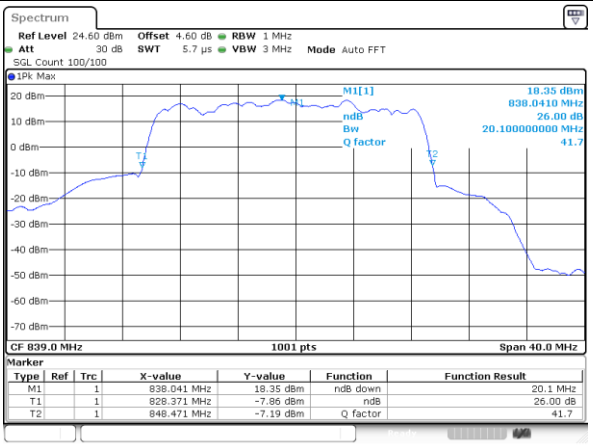
Lowest Channel



Middle Channel



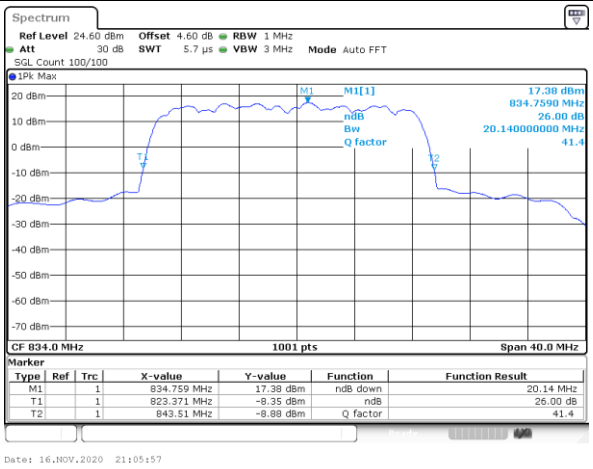
Highest Channel



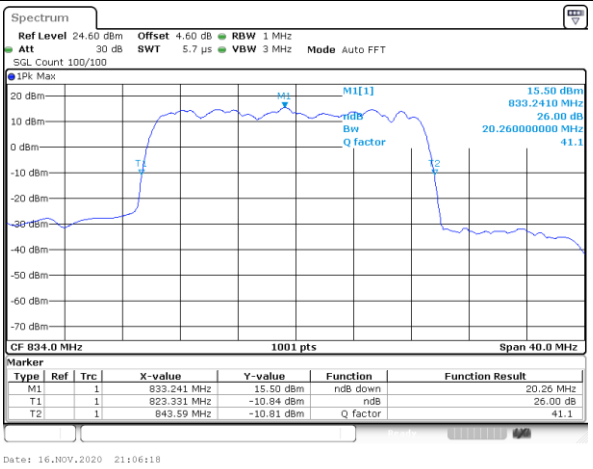
FR1 n5 / 20MHz / CP OFDM

64QAM

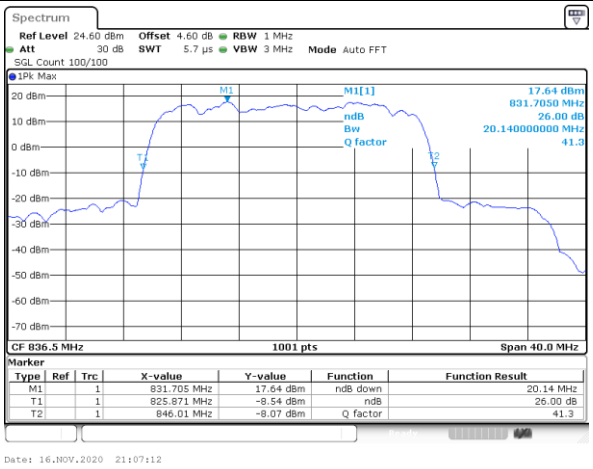
Lowest Channel



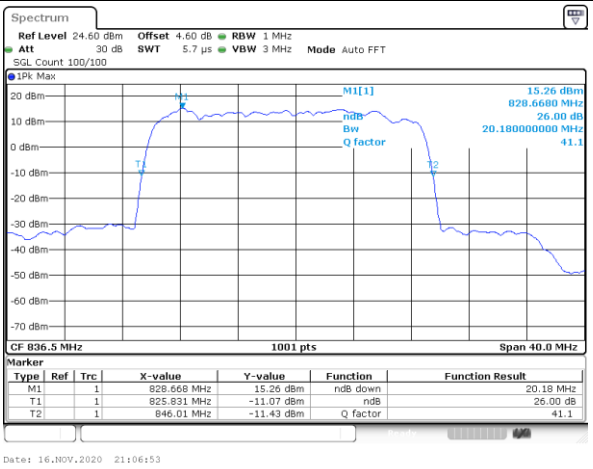
Lowest Channel



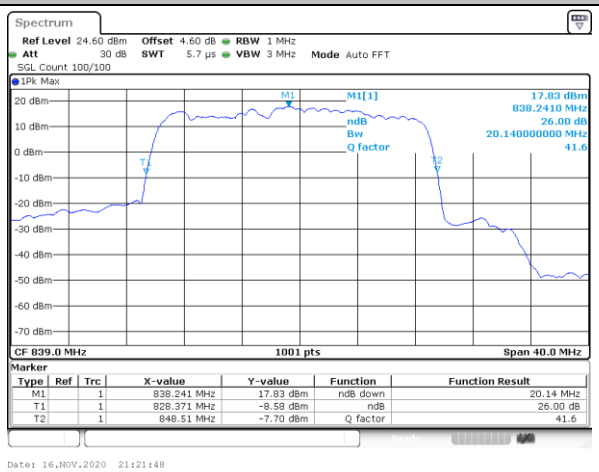
Middle Channel



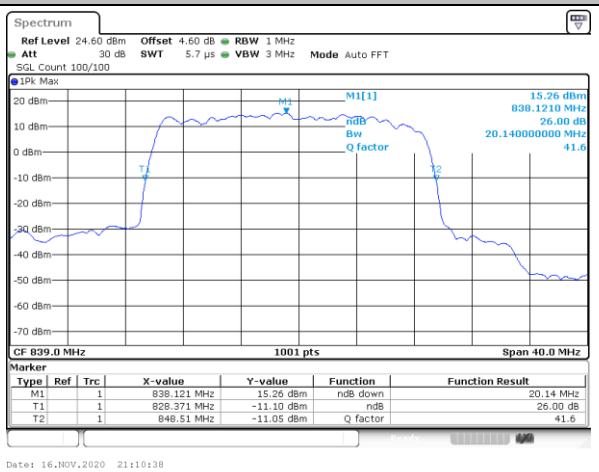
Middle Channel



Highest Channel



Highest Channel



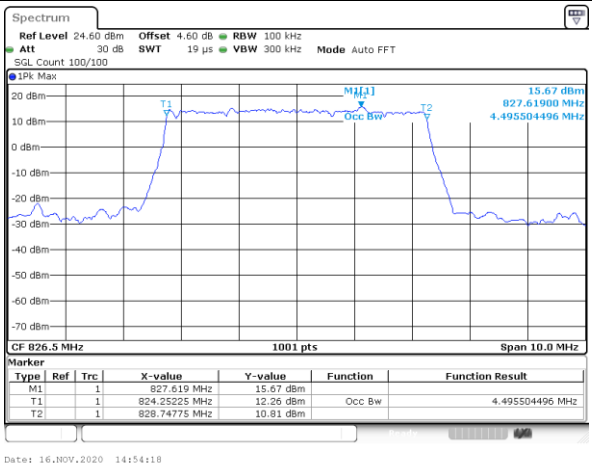
Occupied Bandwidth

Mode	FR1 n5 : 99%OBW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	PI / BPSK		PI / BPSK		PI / BPSK		PI / BPSK	
Lowest CH	4.50		8.99		13.52		18.26	
Middle CH	4.49		9.01		13.49		18.18	
Highest CH	4.48		9.09		13.46		18.30	
Mode	FR1 n5 : 99%OBW (MHz) / CP OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	4.51	4.49	9.05	9.05	13.52	13.55	18.26	18.30
Middle CH	4.48	4.48	9.07	9.01	13.49	13.43	18.42	18.30
Highest CH	4.48	4.47	9.09	9.07	13.43	13.43	18.22	18.26
Mode	FR1 n5 : 99%OBW (MHz) / CP OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Lowest CH	4.50	4.49	9.01	9.03	13.46	13.49	18.34	18.18
Middle CH	4.46	4.49	9.05	9.03	13.43	13.49	18.46	18.34
Highest CH	4.48	4.47	9.03	9.03	13.43	13.49	18.18	18.30

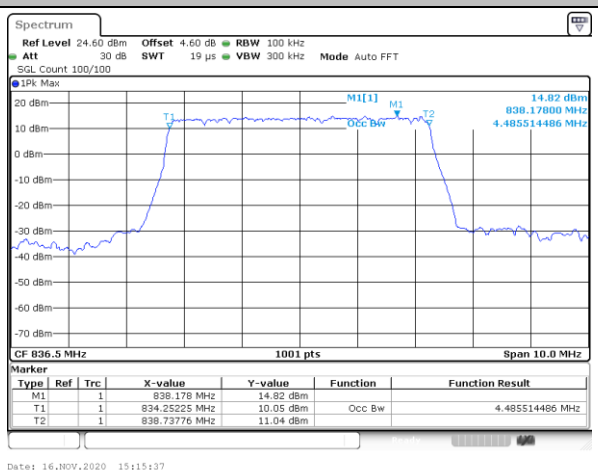
FR1 n5 / 5MHz / DFT-S OFDM

PI / BPSK

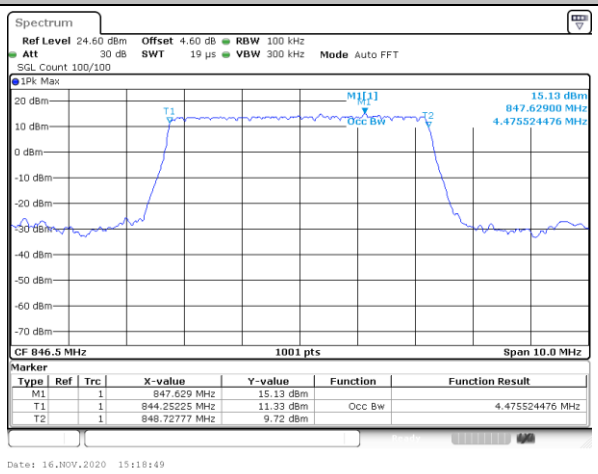
Lowest Channel



Middle Channel



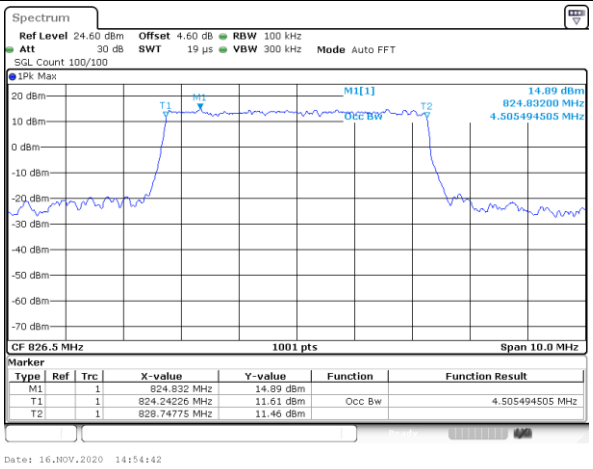
Highest Channel



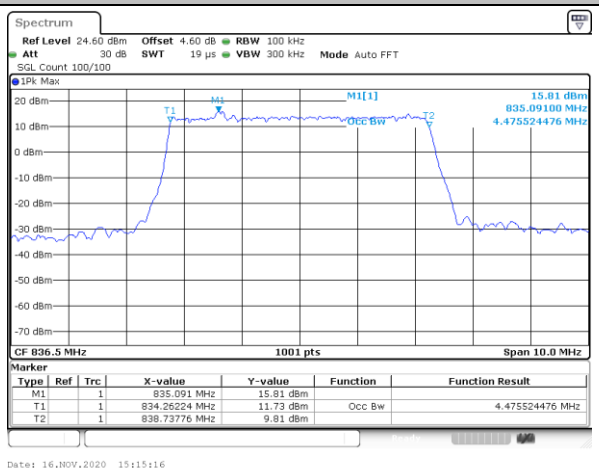
FR1 n5 / 5MHz / CP OFDM

QPSK

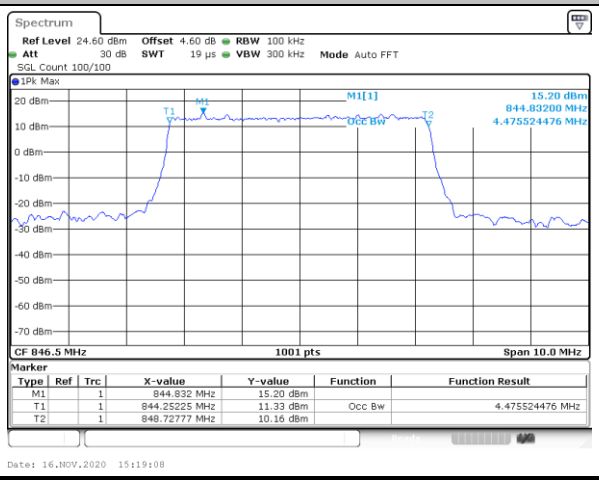
Lowest Channel



Middle Channel

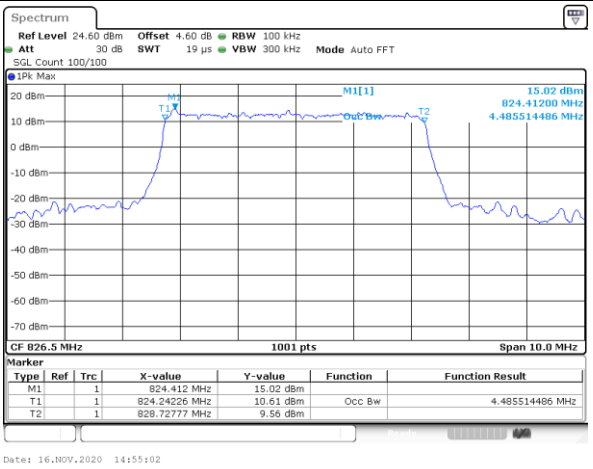


Highest Channel

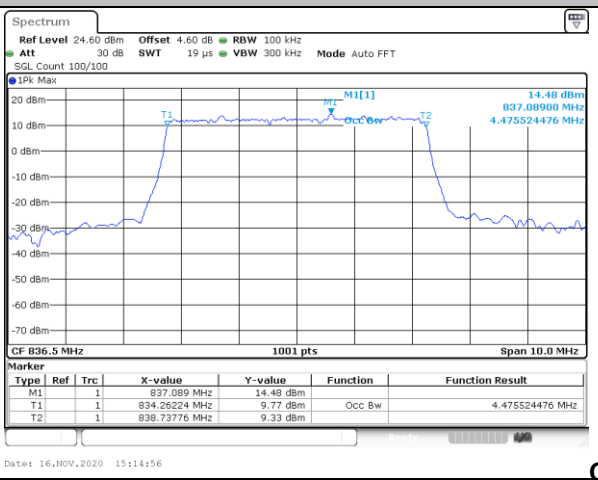


16QAM

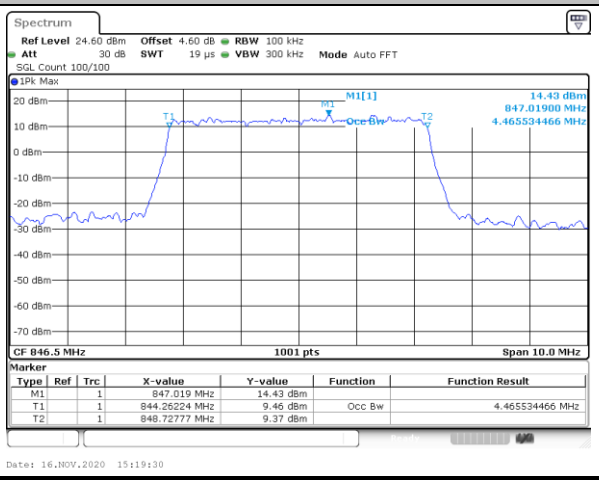
Lowest Channel



Middle Channel



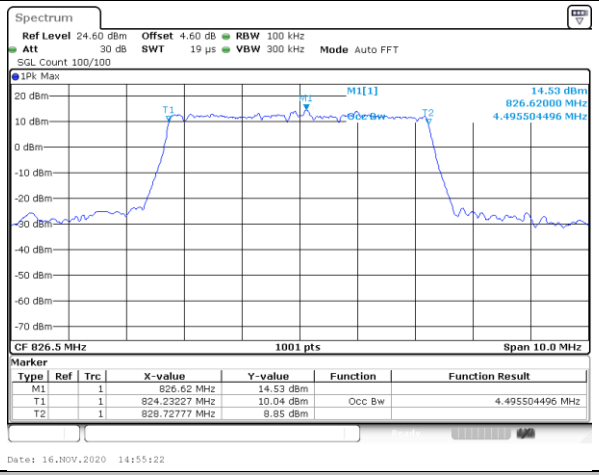
Highest Channel



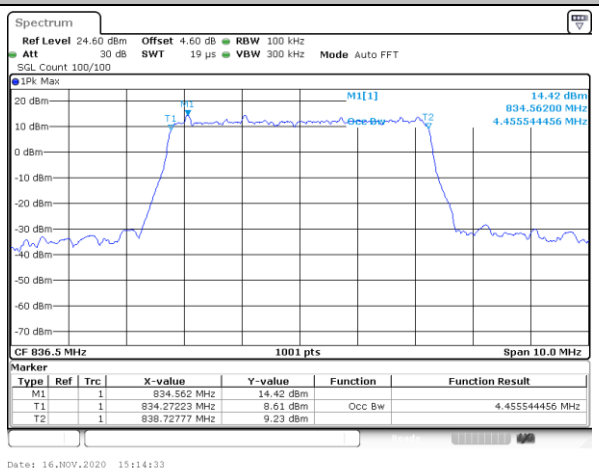
FR1 n5 / 5MHz / CP OFDM

64QAM

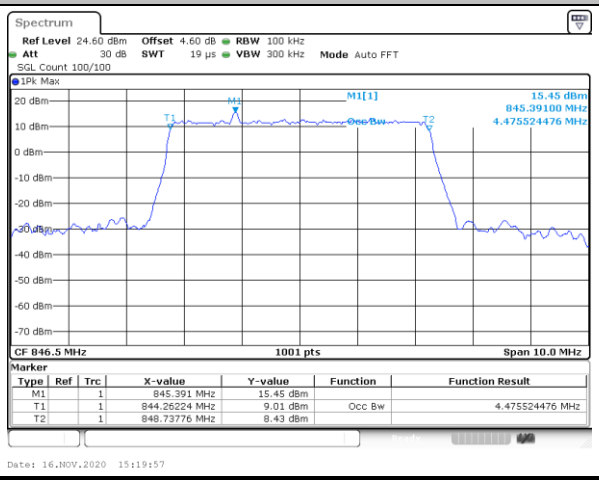
Lowest Channel



Middle Channel

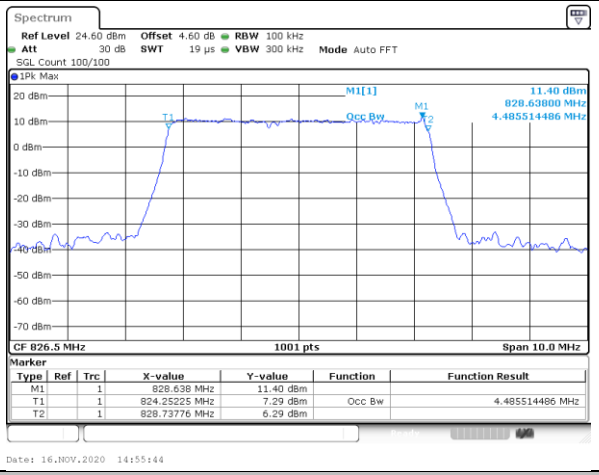


Highest Channel

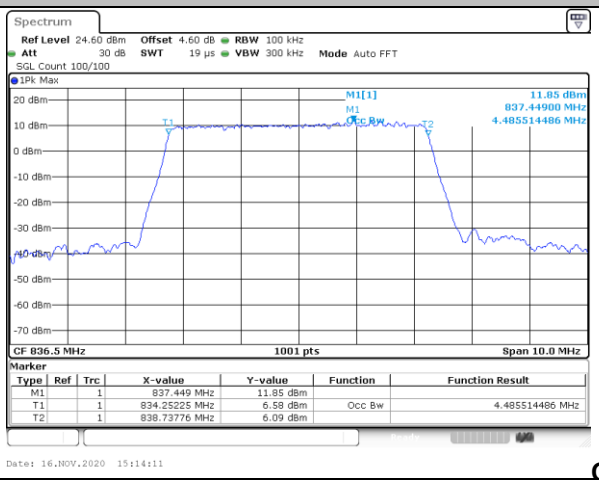


256QAM

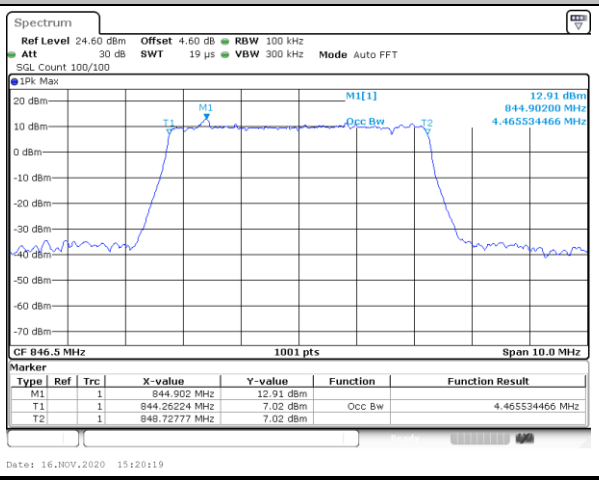
Lowest Channel



Middle Channel



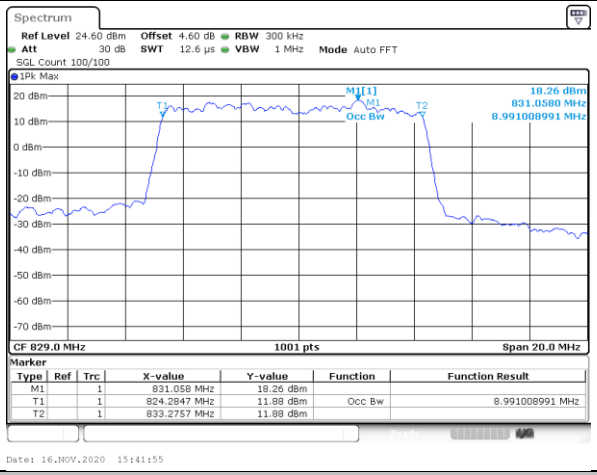
Highest Channel



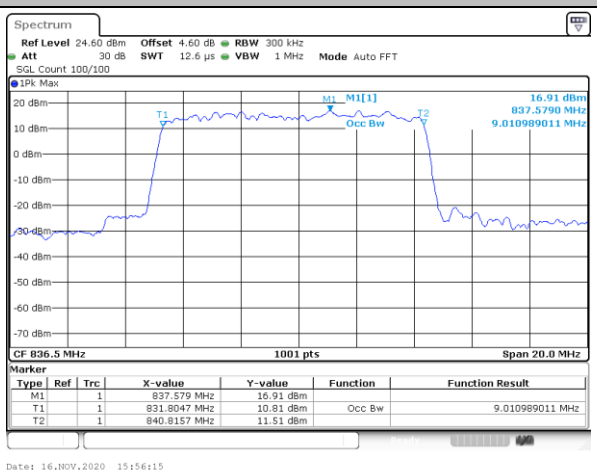
FR1 n5 / 10MHz / DFT-S OFDM

PI / BPSK

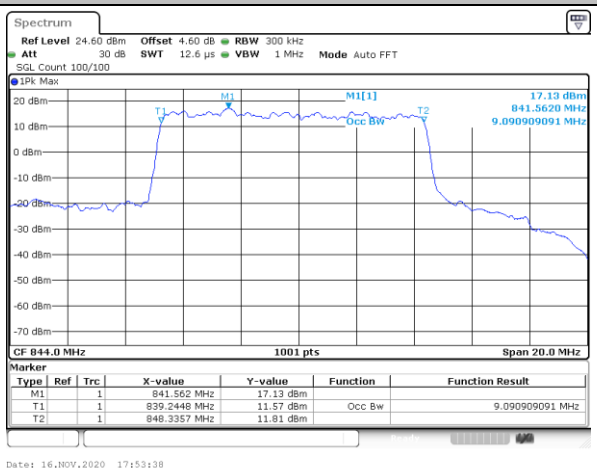
Lowest Channel



Middle Channel



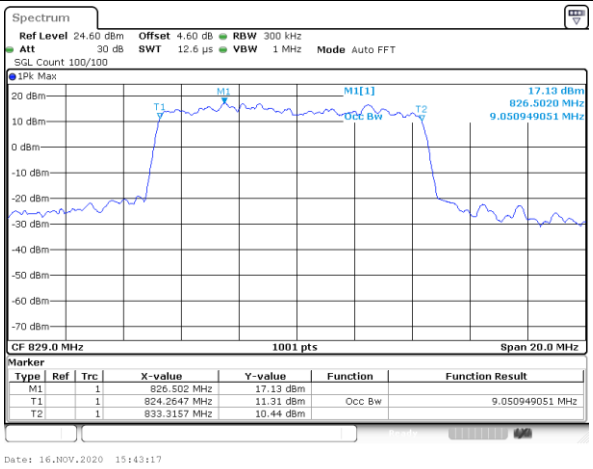
Highest Channel



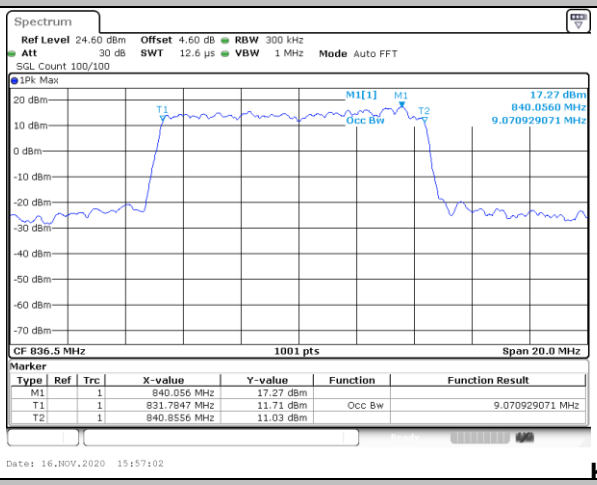
FR1 n5 / 10MHz / CP OFDM

QPSK

Lowest Channel

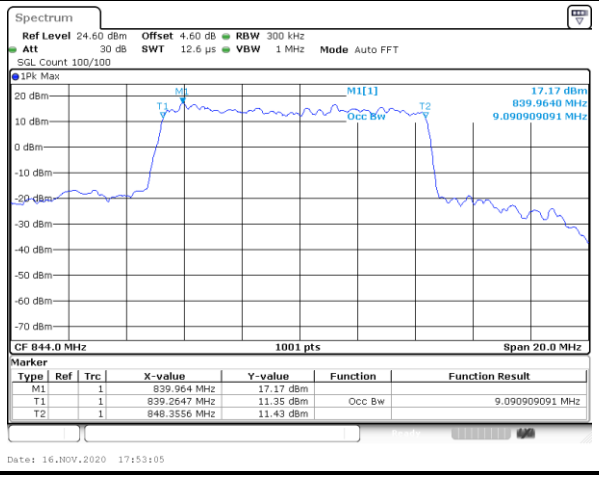


Middle Channel



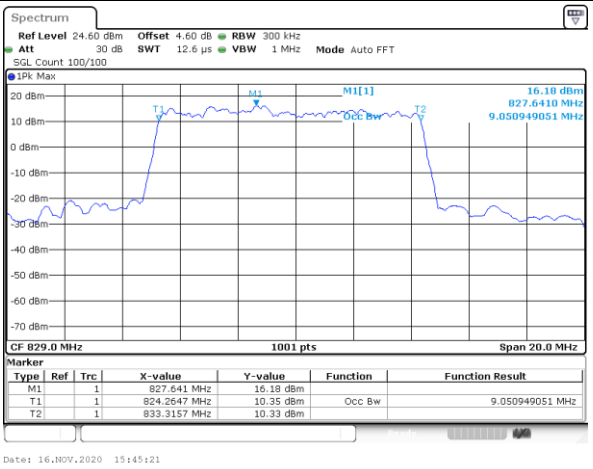
K

Highest Channel

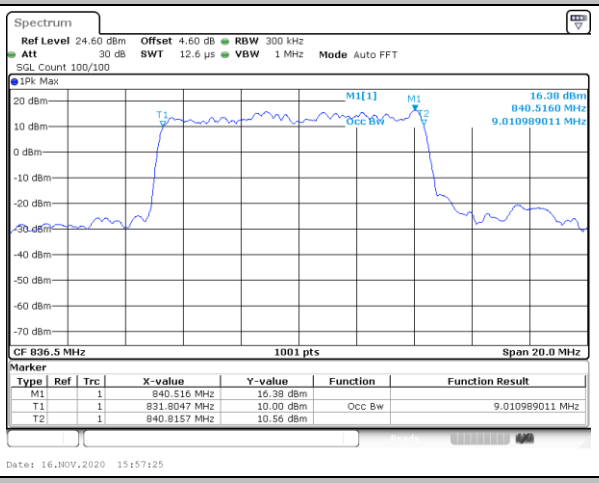
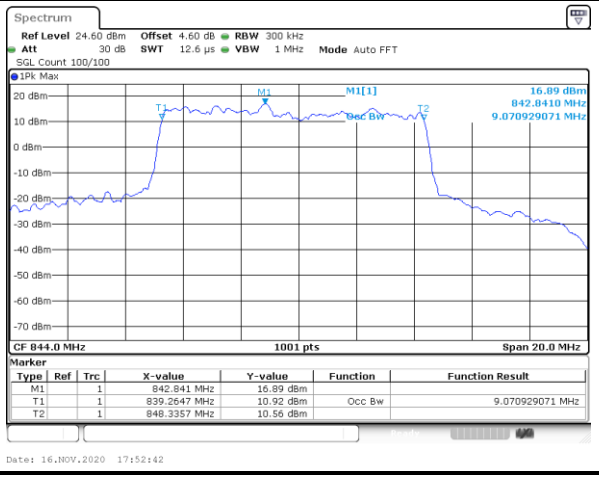


16QAM

Lowest Channel



Middle Channel



Highest Channel