FCC RF Test Report

APPLICANT	: TCL Communication Ltd
EQUIPMENT	: 5G NR/LTE/WCDMA/GSM Mobile Phone
BRAND NAME	: TCL
MODEL NAME	: T790S
FCC ID	: 2ACCJN042
STANDARD	: 47 CFR Part 2, 22(H), 24(E), 27(L)
CLASSIFICATION	: PCS Licensed Transmitter Held to Ear (PCE)

The product was received on May 19, 2020 and completely tested on Jul. 27, 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.

Jason Jia

Reviewed by: Jason Jia / Supervisor

James Huang

Approved by: James Huang / Manager

ACCREDITED Cert #5145.02

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People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG051926E	Rev. 01	Initial issue of report	Aug. 13, 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		
	§24.232(c) §27.50(h)(2)	Equivalent Isotropic Radiated Power (5G NR n2)	EIRP < 2Watt		
	§27.50(d)(4)	Equivalent Isotropic Radiated Power (5G NR n66)	EIRP < 1Watt		
3.5	§24.232(d)	Peak-to-Average Ratio	<13 dB	PASS	-
3.6	§2.1049	Occupied Bandwidth	Reporting Only	PASS	-
3.7	§2.1051 §22.917(a) §24.238(a) §27.53(h)	Conducted Band Edge Measurement (5G NR n2) (5G NR n5) (5G NR n66)	< 43+10log10(P[Watts])	PASS	-
3.8	§2.1051 §22.917(a) §24.238(a) §27.53(h)	Conducted Spurious Emission (5G NR n2) (5G NR n5) (5G NR n66)	< 43+10log10(P[Watts])	PASS	-
3.9	§2.1055 §22.355	Frequency Stability Temperature & Voltage	< 2.5 ppm for Part 22	PASS	-
	§2.1055 §24.235 §27.54		Within Authorized Band		
4.4	§2.1053 §22.917(a) §24.238(a) §27.53(h)	Radiated Spurious Emission (5G NR n2) (5G NR n5) (5G NR n66)	< 43+10$\log_{10}$(P[Watts])	PASS	Under limit 28.60 dB at 3486.500 MHz

1 General Description

1.1 Applicant

TCL Communication Ltd

5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong

1.2 Manufacturer

TCL Communication Ltd

5/F, Building 22E, 22 Science Park East Avenue, Hong Kong Science Park, Shatin, NT, Hong Kong

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	5G NR/LTE/WCDMA/GSM Mobile Phone
Brand Name	TCL
Model Name	T790S
FCC ID	2ACCJN042
EUT supports Radios application	GSM/WCDMA/LTE/5G NR/NFC/GNSS WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
IMEI Code	Conducted : 015749000012638 Radiation : 015749000013958
HW Version	03
SW Version	1B6GTWG0
EUT Stage	Identical Prototype

Remark:

1. Only 5G NR FR1 bands are tested in this report, all the other RF bands are tested in the other reports separately.
2. 5G NR supports NSA mode only. According to the maximum power between the NSA mode, we only show the combination of the maximum power among all EN-DC combinations in the report.
3. 5G NR supports CP-OFDM and DFT-s-OFDM modulation, DFT-s-OFDM power is higher than CP-OFDM, so only DFT-s-OFDM modulation is perform for all test

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	5G NR n2: 1852.5 MHz ~ 1907.5 MHz 5G NR n5: 826.5 MHz ~ 846.5 MHz 5G NR n66: 1712.5 MHz ~ 1777.5 MHz
Rx Frequency	5G NR n2: 1932.5 MHz ~ 1987.5 MHz 5G NR n5: 871.5 MHz ~ 891.5 MHz 5G NR n66: 2112.5 MHz~ 2197.5 MHz
Bandwidth	n2, n5, n66: 5MHz / 10MHz / 15MHz / 20MHz
SCS	15KHz
Antenna Gain	5G NR n2 : -1.40 dBi 5G NR n5 : -2.30 dBi 5G NR n66 : -1.90 dBi
Type of Modulation	CP-OFDM: QPSK / 16QAM / 64QAM / 256QAM DFT-s-OFDM: PI/2 BPSK / QPSK / 16QAM / 64QAM /256QAM

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 n2 (EN DC_66A-n2A)		PI/2 BPSK		QPSK	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1852.5 ~ 1907.5	4M54F9W	0.1581	4M49G7D	0.1574
10	1855.0 ~ 1905.0	8M91F9W	0.1581	8M97G7D	0.1585
15	1857.5 ~ 1902.5	13M5F9W	0.1611	13M5G7D	0.1589
20	1860.0 ~ 1900.0	18M5F9W	0.1589	18M5G7D	0.1567
Frequency Tolerance (ppm)		0.0020			

5G NR n2 (EN DC_66A-n2A)		16QAM		64QAM	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1852.5 ~ 1907.5	4M51W7D	0.1279	4M51W7D	0.0891
10	1855.0 ~ 1905.0	8M93W7D	0.1282	8M93W7D	0.0908
15	1857.5 ~ 1902.5	13M5W7D	0.1282	13M5W7D	0.0912
20	1860.0 ~ 1900.0	18M5W7D	0.1291	18M4W7D	0.0910
Frequency Tolerance (ppm)		-			

5G NR n2 (EN DC_66A-n2A)		256QAM	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1852.5 ~ 1907.5	4M52W7D	0.0569
10	1855.0 ~ 1905.0	8M93W7D	0.0564
15	1857.5 ~ 1902.5	13M5W7D	0.0571
20	1860.0 ~ 1900.0	18M4W7D	0.0573
Frequency Tolerance (ppm)		-	

5G NR n5 (EN DC_2A-n5A)		PI/2 BPSK		QPSK	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	826.5 ~ 846.5	4M50F9W	0.0942	4M49G7D	0.0951
10	829.0 ~ 844.0	9M11F9W	0.0935	9M07G7D	0.0916
15	831.5 ~ 841.5	13M5F9W	0.0933	13M5G7D	0.0931
20	834.0 ~ 839.0	18M3F9W	0.0929	18M3G7D	0.0931
Frequency Tolerance (ppm)		0.0036			

5G NR n5 (EN DC_2A-n5A)		16QAM		64QAM	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	826.5 ~ 846.5	4M49W7D	0.0764	4M48W7D	0.0543
10	829.0 ~ 844.0	9M07W7D	0.0736	9M03W7D	0.0535
15	831.5 ~ 841.5	13M5W7D	0.0743	13M5W7D	0.0537
20	834.0 ~ 839.0	18M5W7D	0.0741	18M3W7D	0.0560
Frequency Tolerance (ppm)		-			

5G NR n5 (EN DC_2A-n5A)		256QAM	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	826.5 ~ 846.5	4M48W7D	0.0339
10	829.0 ~ 844.0	9M07W7D	0.0339
15	831.5 ~ 841.5	13M5W7D	0.0345
20	834.0 ~ 839.0	18M4W7D	0.0338
Frequency Tolerance (ppm)		-	

5G NR n66 (EN DC_2A-n66A)		PI/2 BPSK		QPSK	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1712.5 ~ 1777.5	4M50F9W	0.1352	4M50G7D	0.1355
10	1715.0 ~ 1775.0	8M91F9W	0.1384	8M91G7D	0.1358
15	1717.5 ~ 1772.5	13M5F9W	0.1358	13M5G7D	0.1330
20	1720.0 ~ 1770.0	18M4F9W	0.1426	18M4G7D	0.1403
Frequency Tolerance (ppm)		0.0025			

5G NR n66 (EN DC_2A-n66A)		16QAM		64QAM	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1712.5 ~ 1777.5	4M50W7D	0.1117	4M51W7D	0.0785
10	1715.0 ~ 1775.0	8M93W7D	0.1107	8M95W7D	0.0771
15	1717.5 ~ 1772.5	13M5W7D	0.1067	13M5W7D	0.0780
20	1720.0 ~ 1770.0	18M4W7D	0.1127	18M4W7D	0.0811
Frequency Tolerance (ppm)		-			

5G NR n66 (EN DC_2A-n66A)		256QAM	
BW (MHz)	Frequency Range (MHz)	Emission Designator (99%OBW)	Maximum EIRP(W)
5	1712.5 ~ 1777.5	4M49W7D	0.0480
10	1715.0 ~ 1775.0	8M93W7D	0.0491
15	1717.5 ~ 1772.5	13M5W7D	0.0482
20	1720.0 ~ 1770.0	18M5W7D	0.0499
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.**
	TH01-KS	CN1257	314309

Sporton International (Shenzhen) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International (Shenzhen) Inc.		
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan Shenzhen, 518055 People's Republic of China TEL: +86-755-33202398		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	03CH01-SZ	CN1256	421272

1.8 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH01-SZ	AUDIX	E3	6.2009-8-24

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.

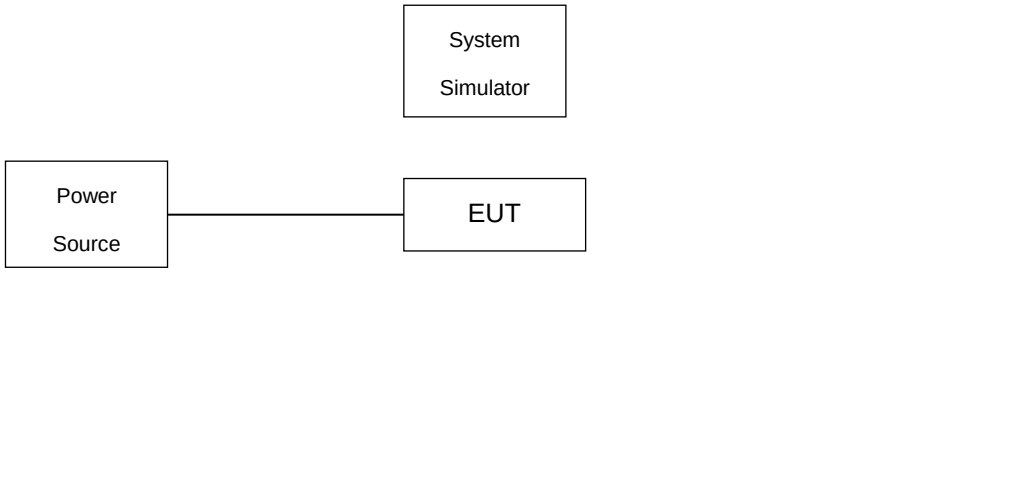
The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported.

	X Plane	Y Plane	Z Plane
Orthogonal Planes of EUT			

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	Half	Full	L	M	H
Max. Output Power	n2	v	v	v	v	-	-	v	v	v	v	v	v		v	v	v	v
	n5	v	v	v	v	-	-	v	v	v	v	v	v		v	v	v	v
	n66	v	v	v	v	-	-	v	v	v	v	v	v		v	v	v	v
Peak-to-Average Ratio	n2				v	-	-	v	v	v	v	v	v		v	v	v	v
	n5				v	-	-	v	v	v	v	v	v		v	v	v	v
	n66				v	-	-	v	v	v	v	v	v		v	v	v	v
26dB and 99% Bandwidth	n2	v	v	v	v	-	-	v	v	v	v	v			v	v	v	v
	n5	v	v	v	v	-	-	v	v	v	v	v			v	v	v	v
	n66	v	v	v	v	-	-	v	v	v	v	v			v	v	v	v

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	Half	Full	L	M	H
Conducted Band Edge	n2	v	v	v	v	-	-	v	v	v	v	v	v		v	v		v
	n5	v	v	v	v	-	-	v	v	v	v	v	v		v	v		v
	n66	v	v	v	v	-	-	v	v	v	v	v	v		v	v		v
Conducted Spurious Emission	n2	v	v	v	v	-	-	v	v	v	v	v	v			v	v	v
	n5	v	v	v	v	-	-	v	v	v	v	v	v			v	v	v
	n66	v	v	v	v	-	-	v	v	v	v	v	v			v	v	v
Frequency Stability	n2				v	-	-	v							v		v	
	n5				v	-	-	v							v		v	
	n66				v	-	-	v							v		v	
E.R.P / E.I.R.P	n2	v	v	v	v	-	-	v	v	v	v	v	v		v	v	v	v
	n5	v	v	v	v	-	-	v	v	v	v	v	v		v	v	v	v
	n66	v	v	v	v	-	-	v	v	v	v	v	v		v	v	v	v
Radiated Spurious Emission	n2	Worst Case															v	
	n5	Worst Case															v	
	n66	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.																	

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 and attenuator factor.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 5.4 dB.

Example :

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

= 5.4 (dB)

2.5 Frequency List of Low/Middle/High Channels

5G NR n2 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
20	Channel	372000	376000	380000
	Frequency	1860	1880	1900
15	Channel	371500	376000	380500
	Frequency	1857.5	1880	1902.5
10	Channel	371000	376000	381000
	Frequency	1855	1880	1905
5	Channel	370500	376000	381500
	Frequency	1852.5	1880	1907.5

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 n66 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
20	Channel	344000	349000	354000
	Frequency	1720	1745	1770
15	Channel	343500	349000	354500
	Frequency	1717.5	1745	1772.5
10	Channel	343000	349000	355000
	Frequency	1715	1745	1775
5	Channel	342500	349000	355500
	Frequency	1712.5	1745	1777.5

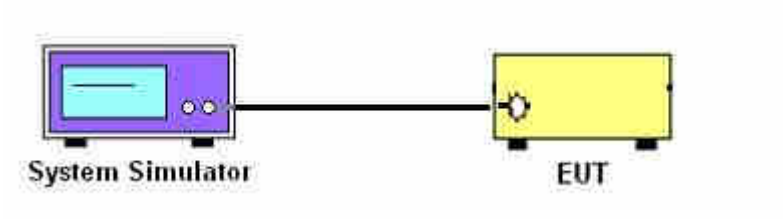
3 Conducted Test Items

3.1 Measuring Instruments

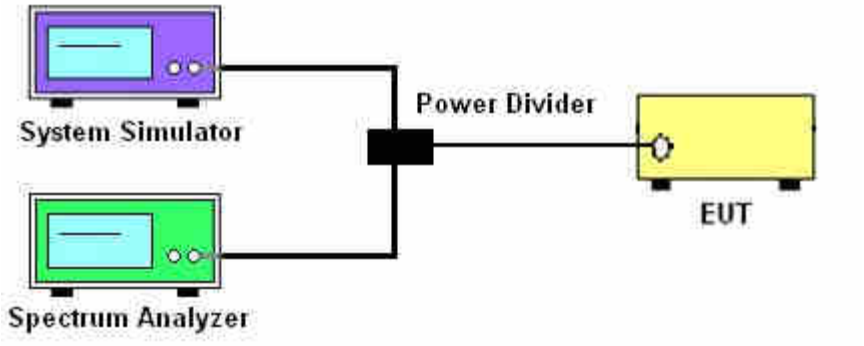
See list of measuring instruments of this test report.

3.2 Test Setup

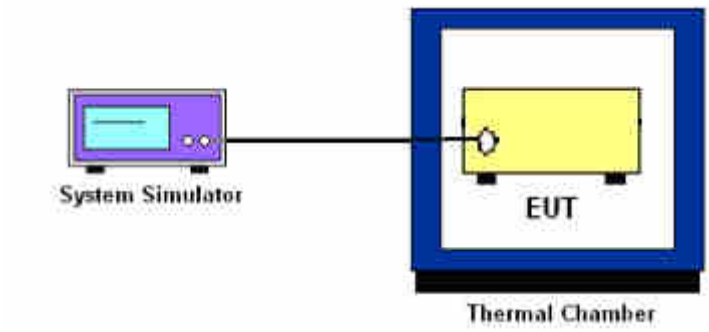
3.2.1 Conducted Output Power



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 n2.

The EIRP of mobile transmitters must not exceed 1 Watts for 5G NR n66.

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 + $10\log_{10}$(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.

24.238 (a)

For operations in the 1850-1910 and 1930-1990 MHz band, the FCC limit is 43 + $10\log_{10}$(P[Watts]) dB below the transmitter power P(Watts) in a 1MHz bandwidth. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

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.

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.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10^{th} 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.

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.

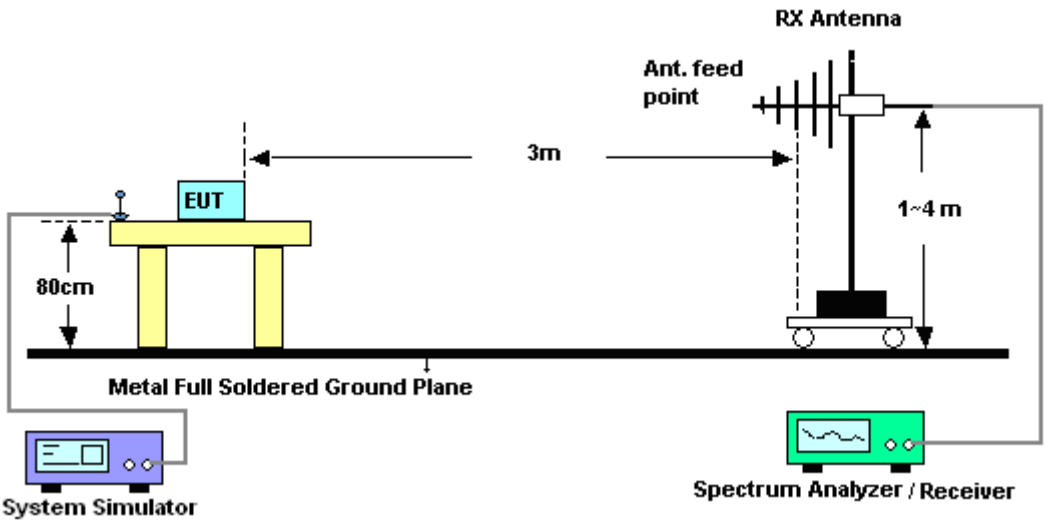
4 Radiated Test Items

4.1 Measuring Instruments

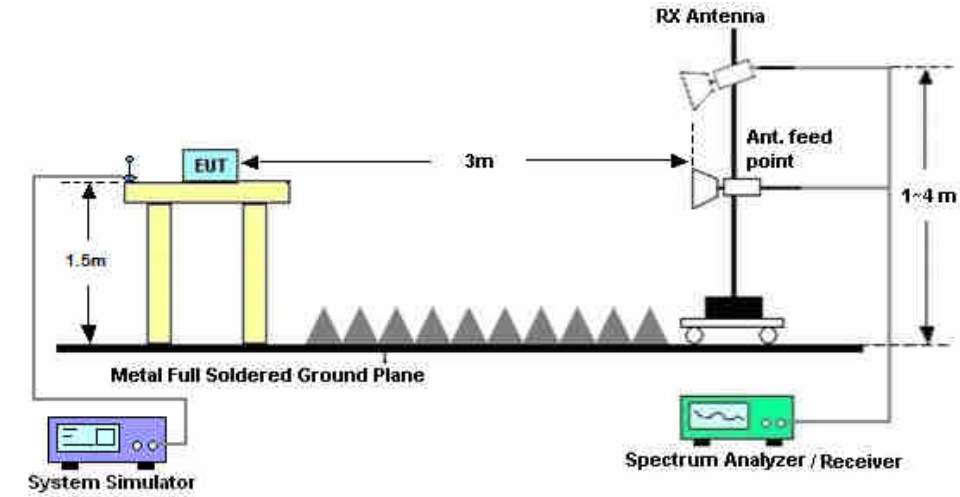
See list of measuring instruments of this test report.

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.

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.

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, 2019	Jun. 28, 2020~ Jul. 07, 2020	Nov. 01, 2020	Conducted (TH01-KS)
Thermal Chamber	Ten Billion	TTC-B3S	TBN-960502	-40~+150°C	Oct. 28, 2019	Jun. 28, 2020~ Jul. 07, 2020	Oct. 27, 2020	Conducted (TH01-KS)
EMI Test Receiver&SA	Agilent	N9038A	MY52260185	20Hz~26.5GHz	Jul. 21, 2020	Jul. 27, 2020	Jul. 20, 2021	Radiation (03CH01-SZ)
HF Amplifier	KEYSIGHT	83017A	MY53270104	0.5GHz~26.5Ghz	Dec. 27, 2019	Jul. 27, 2020	Dec. 26, 2020	Radiation (03CH01-SZ
Bilog Antenna	TeseQ	CBL6112D	35407	30MHz-2GHz	Jul. 15, 2020	Jul. 27, 2020	Jul. 14, 2021	Radiation (03CH01-SZ)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00119436	1GHz~18GHz	Jul. 25, 2020	Jul. 27, 2020	Jul. 24, 2021	Radiation (03CH01-SZ)
SHF-EHF Horn	com-power	AH-840	101071	18Ghz-40GHz	Apr. 17, 2020	Jul. 27, 2020	Apr. 16, 2021	Radiation (03CH01-SZ)
LF Amplifier	Burgeon	BPA-530	102209	0.01~3000Mhz	Apr. 17, 2020	Jul. 27, 2020	Apr. 16, 2021	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	AMF-7D-00 101800-30-1 0P-R	1943528	1GHz~18GHz	Oct. 18, 2019	Jul. 27, 2020	Oct. 17, 2020	Radiation (03CH01-SZ)
HF Amplifier	MITEQ	TTA1840-35 -HG	1871923	18GHz~40GHz	Jul. 21, 2020	Jul. 27, 2020	Jul. 20, 2021	Radiation (03CH01-SZ)
AC Power Source	Chroma	61601	616010001985	N/A	NCR	Jul. 27, 2020	NCR	Radiation (03CH01-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Jul. 27, 2020	NCR	Radiation (03CH01-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Jul. 27, 2020	NCR	Radiation (03CH01-SZ)

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))	**2.48dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.53dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.02dB**

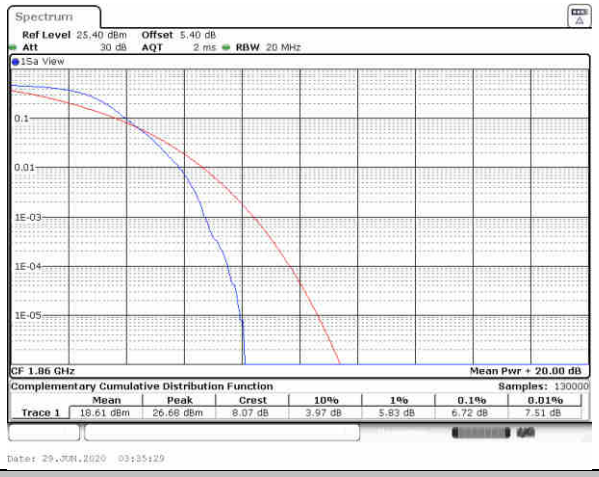
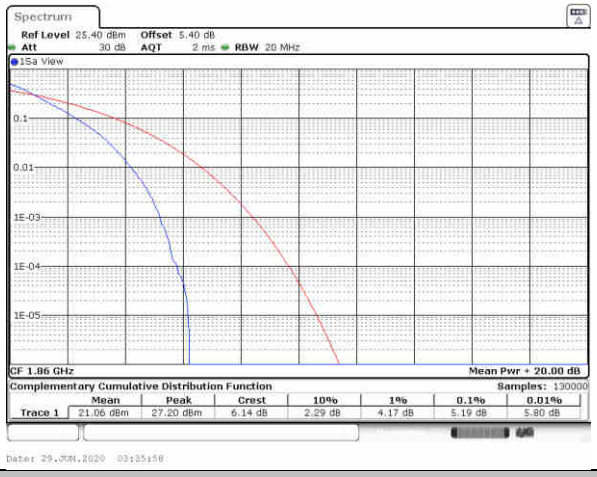
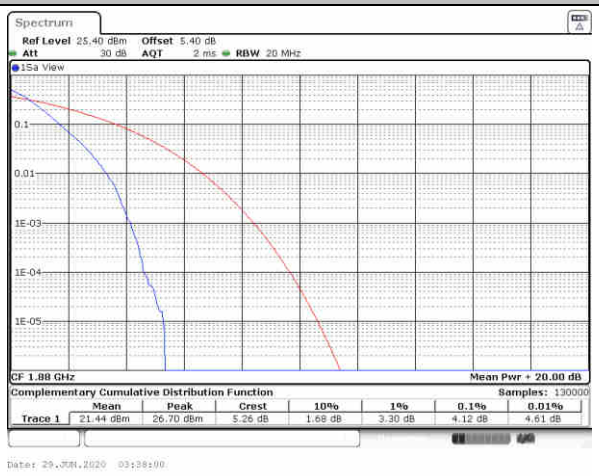
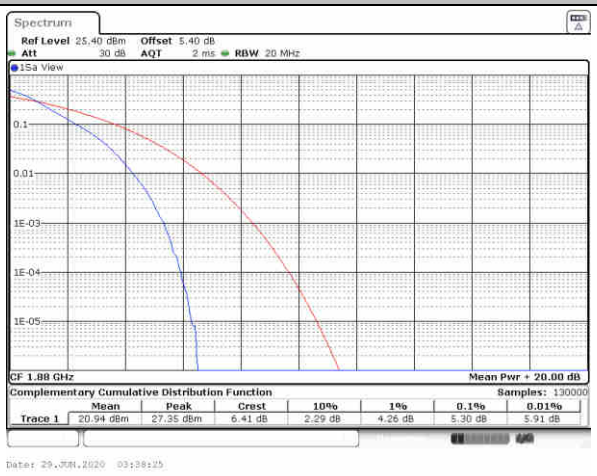
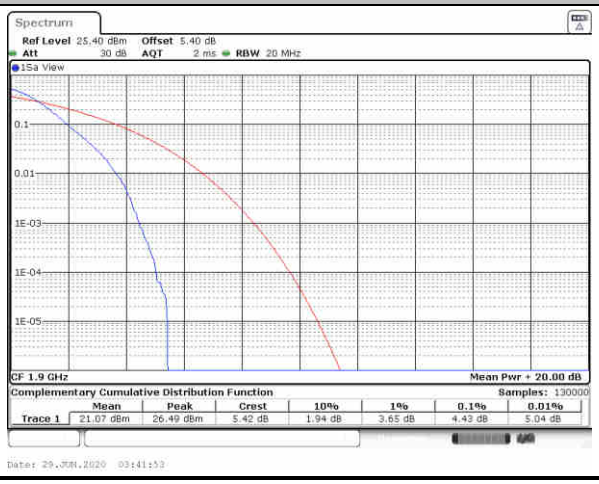
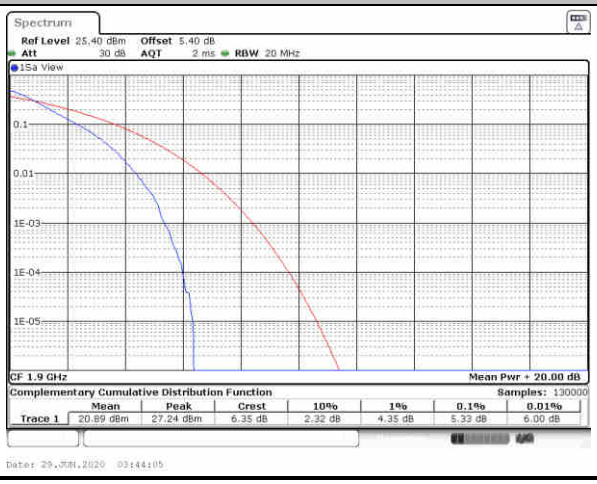
Appendix A. Test Results of Conducted Test

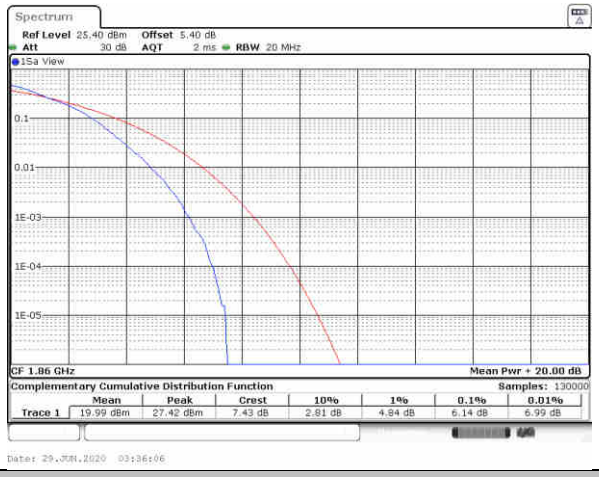
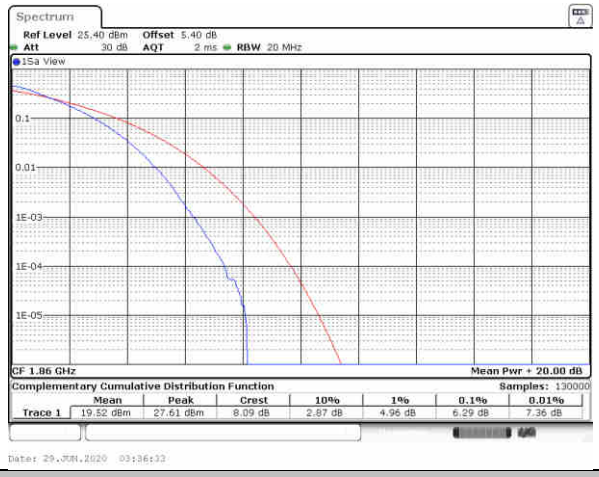
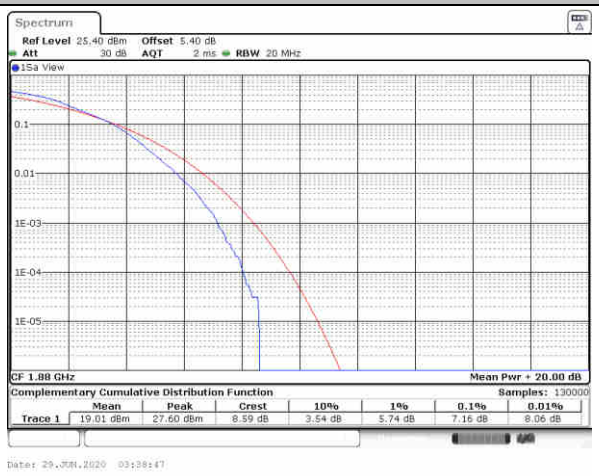
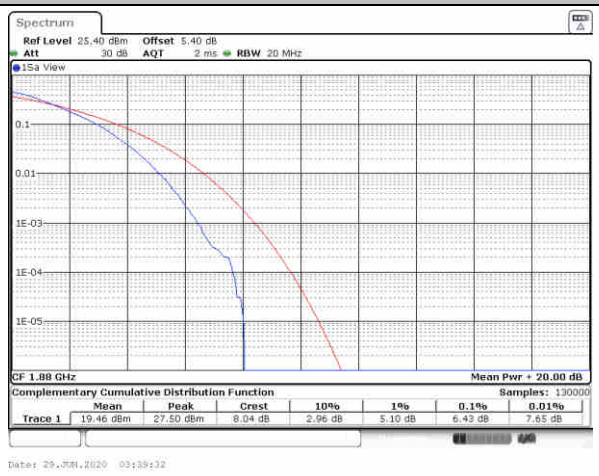
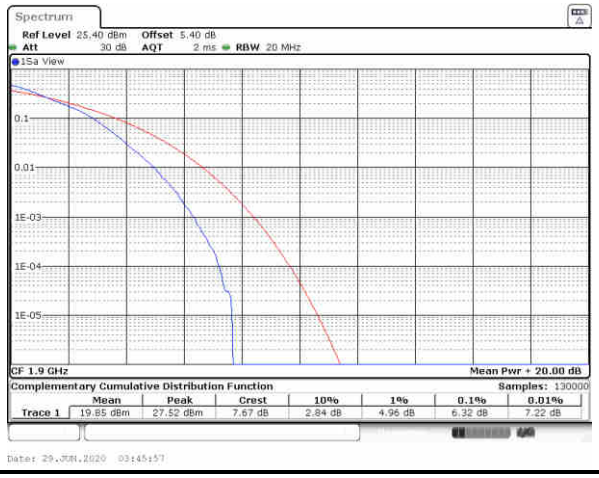
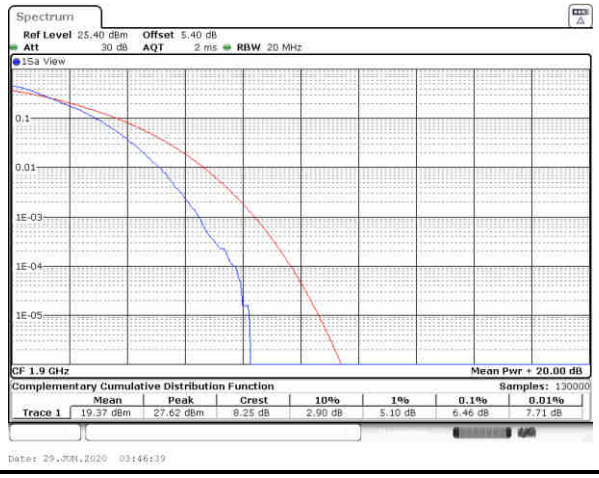
Conducted Output Power(Average power and EIRP)

5G NR n2

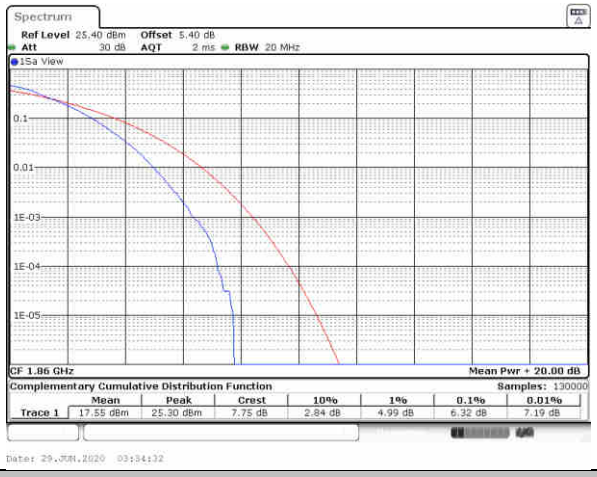
Peak-to-Average Ratio

Mode	FR1 n2 / 20MHz / DFT-S OFDM				
Mod.	PI/2 BPSK	QPSK	16QAM	64QAM	Limit: 13dB
RB Size	Full RB	Full RB	Full RB	Full RB	Result
Lowest CH	6.72	5.19	6.14	6.29	PASS
Middle CH	4.12	5.30	7.16	6.43	
Highest CH	4.43	5.33	6.32	6.46	
Mode	FR1 n2 / 20MHz / DFT-S OFDM				
Mod.	256QAM				Limit: 13dB
RB Size	Full RB				Result
Lowest CH	6.32				PASS
Middle CH	6.75				
Highest CH	6.52				
Mode	FR1 n2 / 20MHz / DFT-S OFDM				
Mod.	PI/2 BPSK	QPSK	16QAM	64QAM	Limit: 13dB
RB Size	1 RB0	1 RB0	1 RB0	1 RB0	Result
Lowest CH	4.61	6.09	6.41	8.78	PASS
Middle CH	4.87	5.88	6.23	6.06	
Highest CH	4.46	5.91	6.26	5.77	
Mode	FR1 n2 / 20MHz / DFT-S OFDM				
Mod.	256QAM				Limit: 13dB
RB Size	1 RB0				Result
Lowest CH	6.35				PASS
Middle CH	6.06				
Highest CH	6.06				

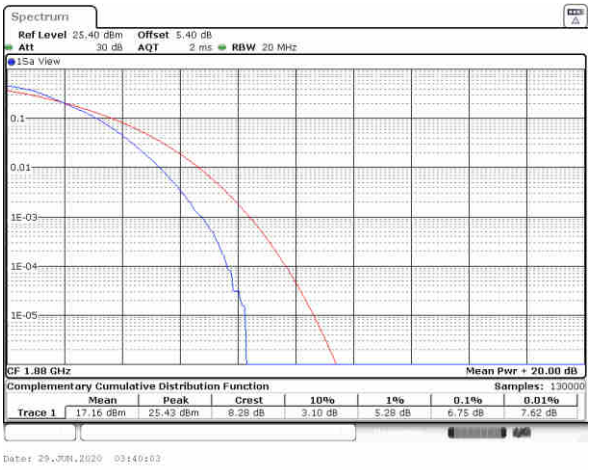
FR1 n2 / 20MHz / DFT-S OFDM	
PI/2 BPSK	**QPSK**
Lowest Channel / Full RB	**Lowest Channel / Full RB**
	
Middle Channel / Full RB	**Middle Channel / Full RB**
	
Highest Channel / Full RB	**Highest Channel / Full RB**
	

FR1 n2 / 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**
	

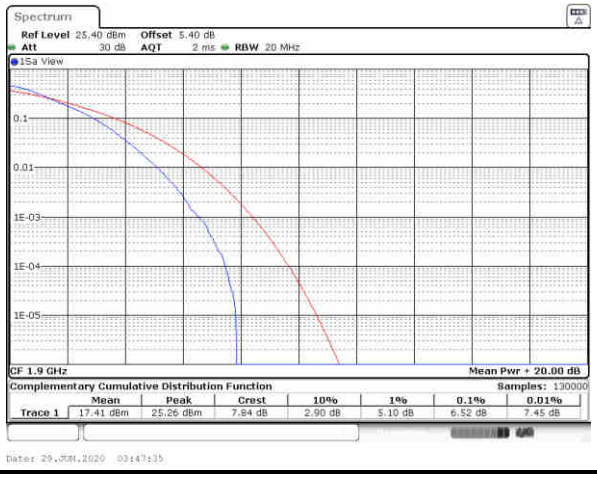
FR1 n2 / 20MHz / DFT-S OFDM
256QAM
Lowest Channel / Full RB

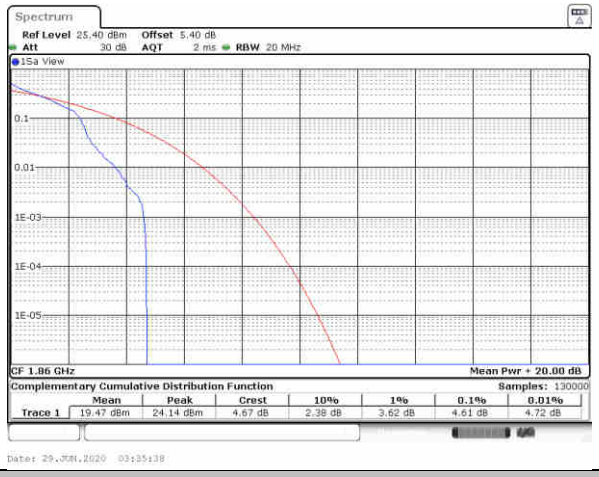
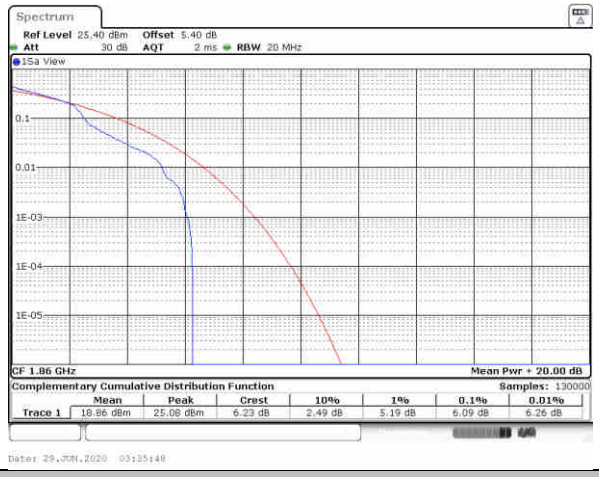
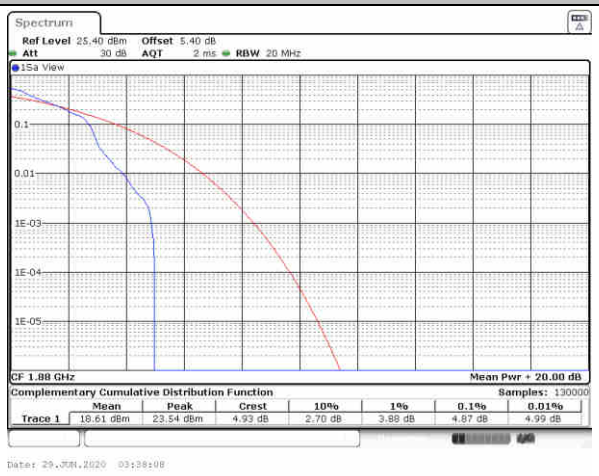
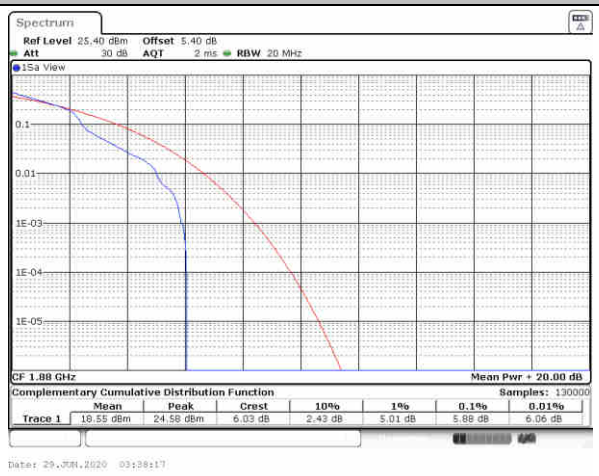
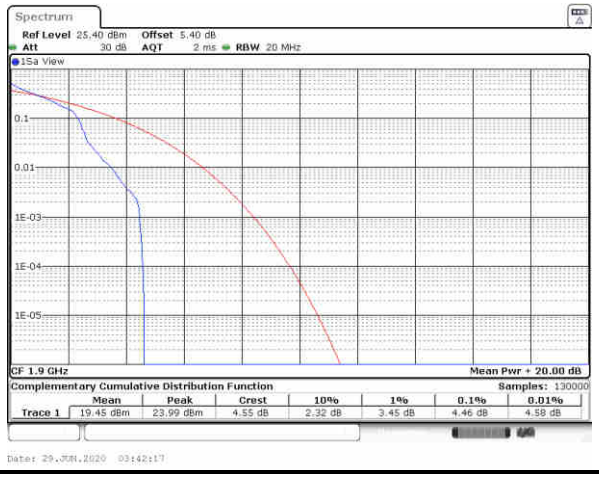
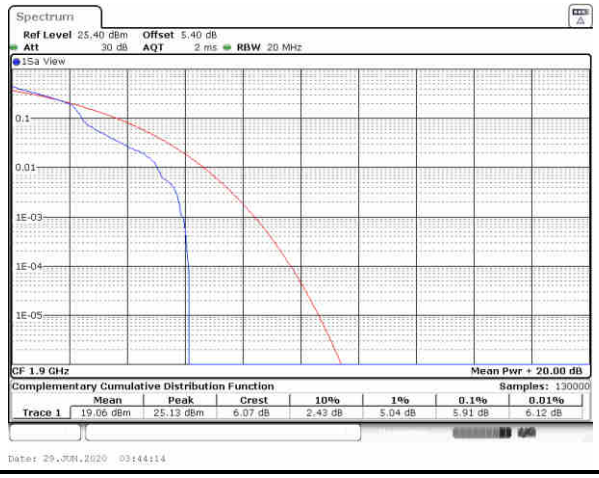


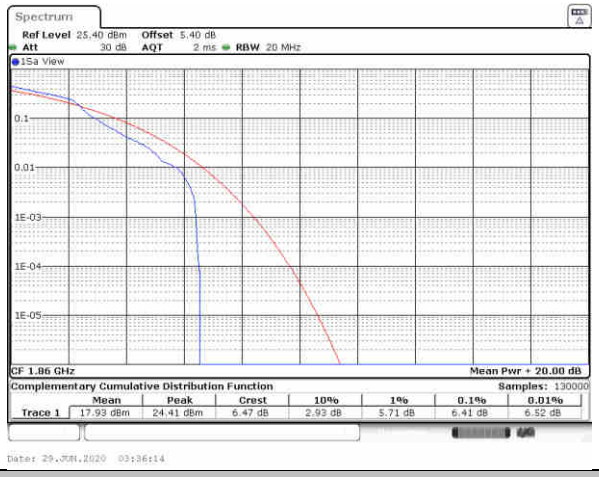
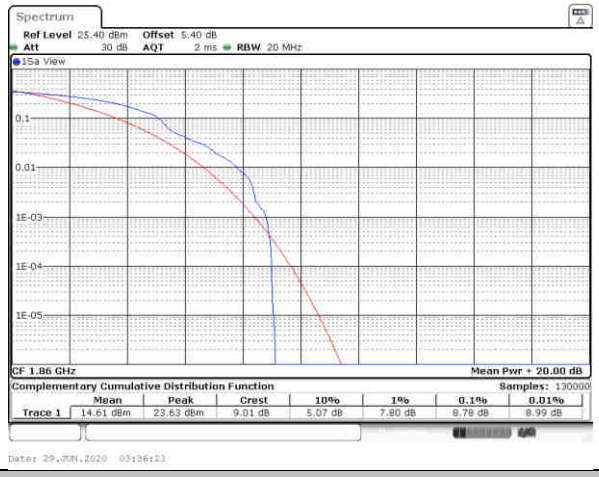
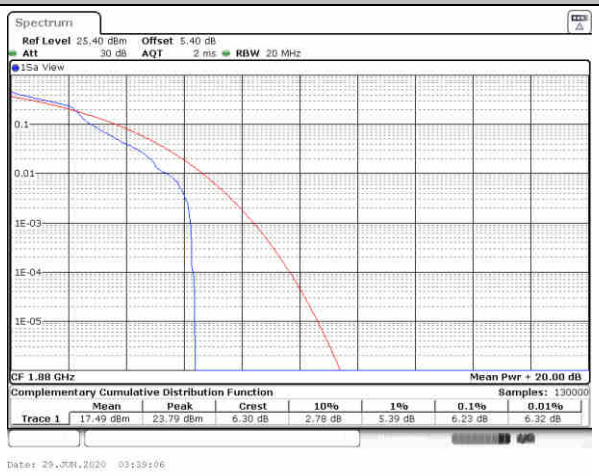
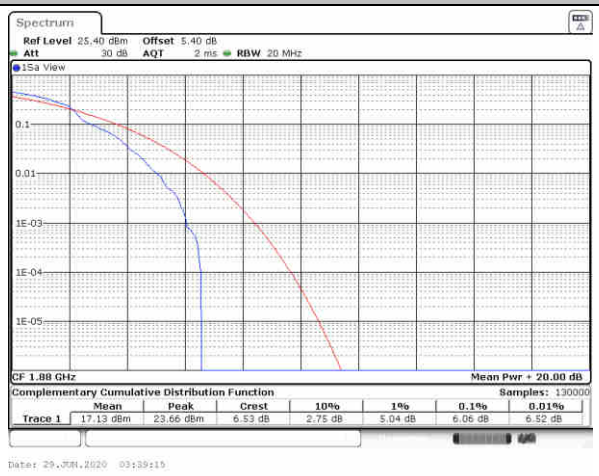
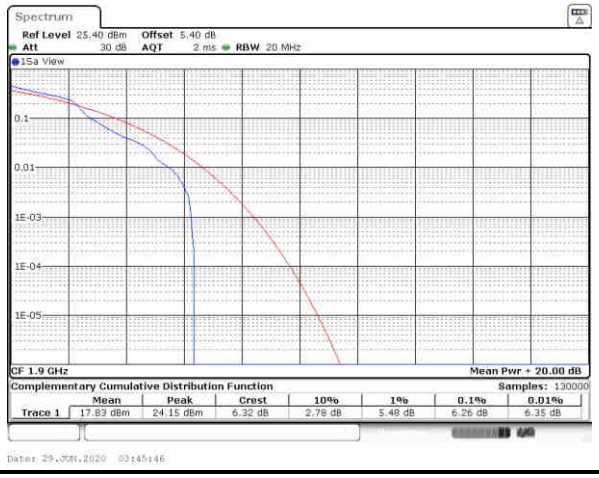
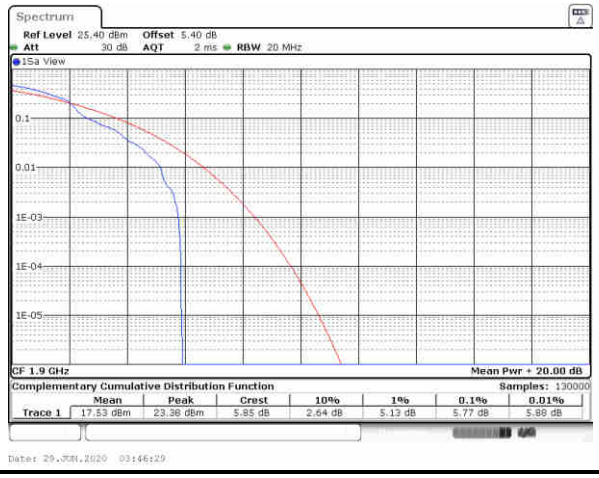
Middle Channel / Full RB



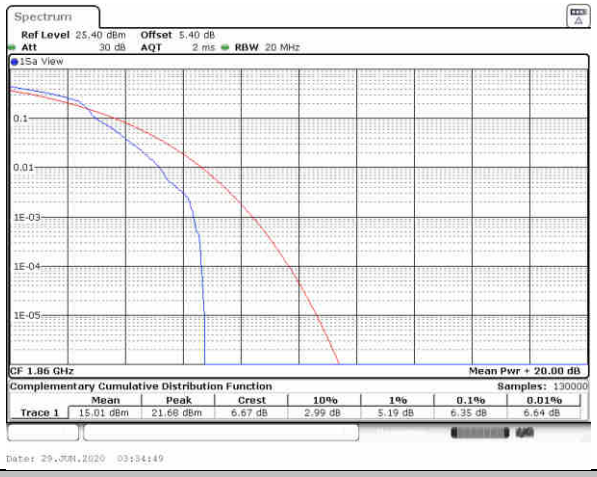
Highest Channel / Full RB



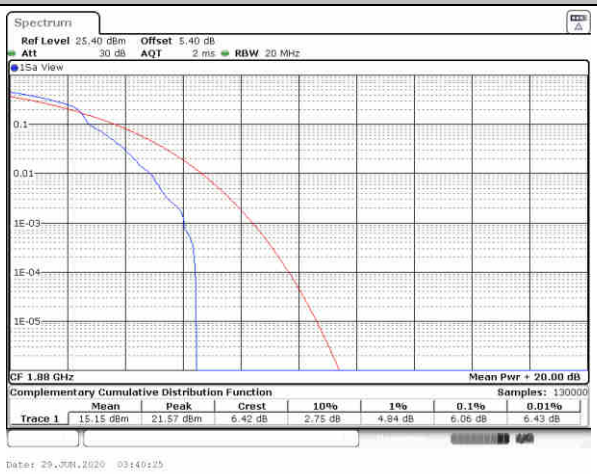
FR1 n2 / 20MHz / DFT-S OFDM	
PI/2 BPSK	**QPSK**
Lowest Channel / 1RB0	**Lowest Channel / 1RB0**
	
Middle Channel / 1RB0	**Middle Channel / 1RB0**
	
Highest Channel / 1RB0	**Highest Channel / 1RB0**
	

FR1 n2 / 20MHz / DFT-S OFDM	
16QAM	**64QAM**
Lowest Channel / 1RB0	**Lowest Channel / 1RB0**
	
Middle Channel / 1RB0	**Middle Channel / 1RB0**
	
Highest Channel / 1RB0	**Highest Channel / 1RB0**
	

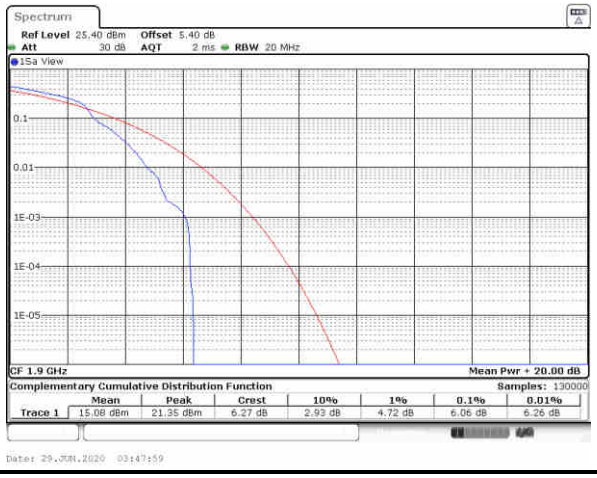
FR1 n2 / 20MHz / DFT-S OFDM
256QAM
Lowest Channel / 1RB0



Middle Channel / 1RB0



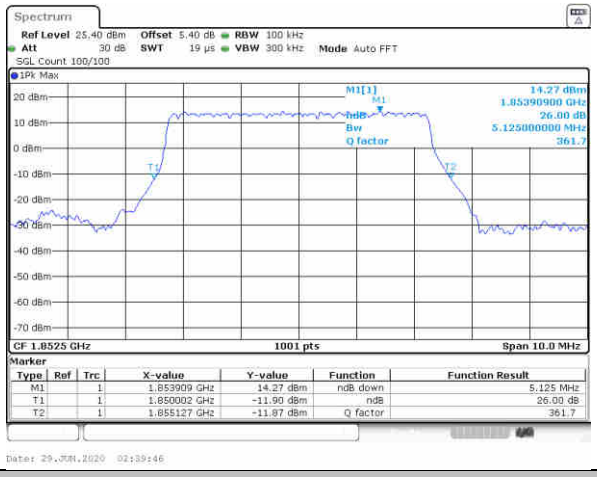
Highest Channel / 1RB0



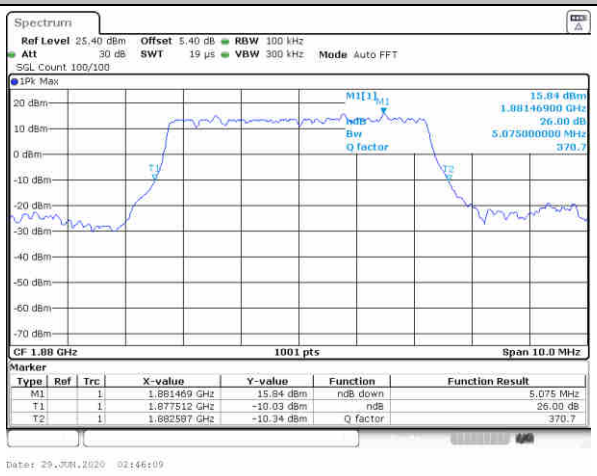
26dB Bandwidth

Mode	FR1 n2 : 26dB BW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	PI/2 BPSK		PI/2 BPSK		PI/2 BPSK		PI/2 BPSK	
Lowest CH	5.12		9.61		14.48		20.18	
Middle CH	5.08		9.53		14.30		20.10	
Highest CH	5.09		9.59		14.39		20.26	
Mode	FR1 n2 : 26dB BW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	5.08	5.04	9.59	9.67	14.33	14.15	20.22	20.26
Middle CH	5.14	5.01	9.41	9.65	14.27	14.54	20.14	20.18
Highest CH	5.17	4.92	9.47	9.53	14.48	14.30	20.14	20.22
Mode	FR1 n2 : 26dB BW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Lowest CH	5.04	5.17	9.59	9.35	14.45	14.24	20.06	20.22
Middle CH	4.92	4.92	9.69	9.43	14.39	14.33	20.18	20.22
Highest CH	5.00	4.96	9.65	9.63	14.24	14.21	20.14	20.22

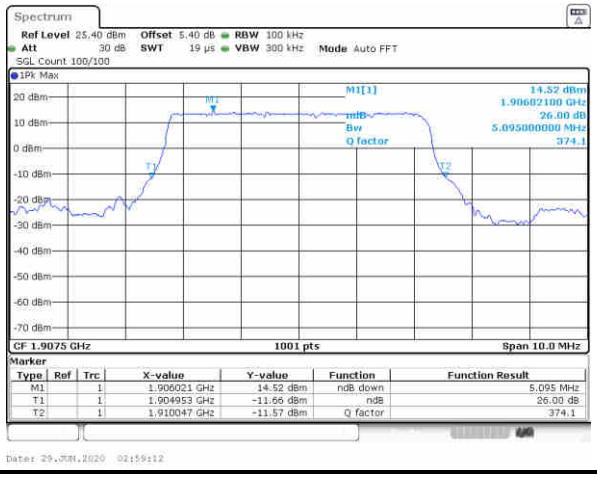
FR1 n2 / 5MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

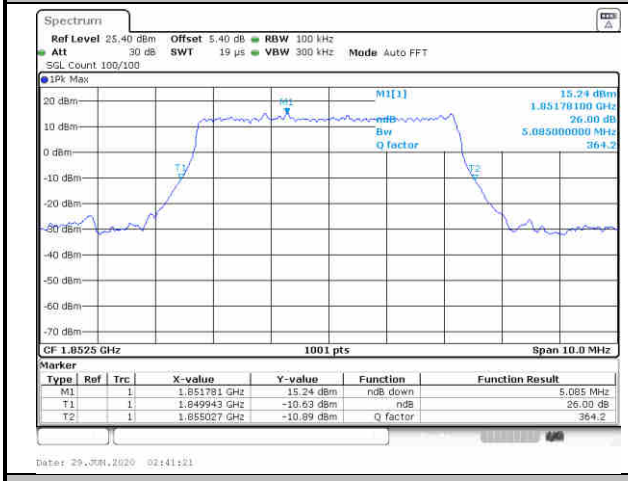
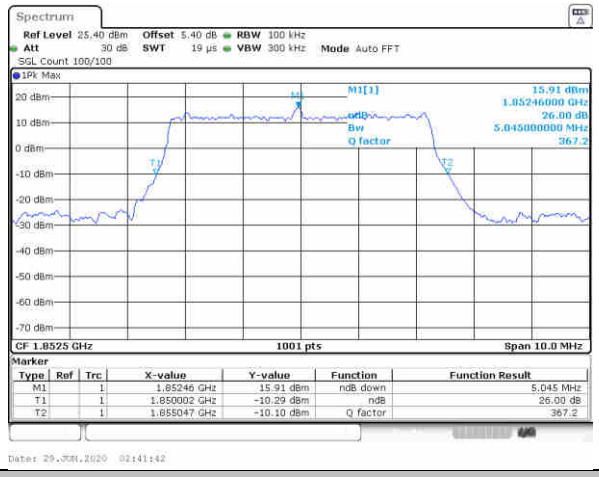
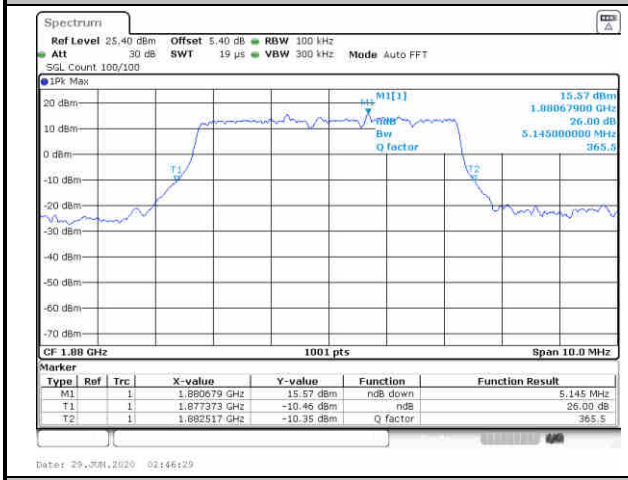
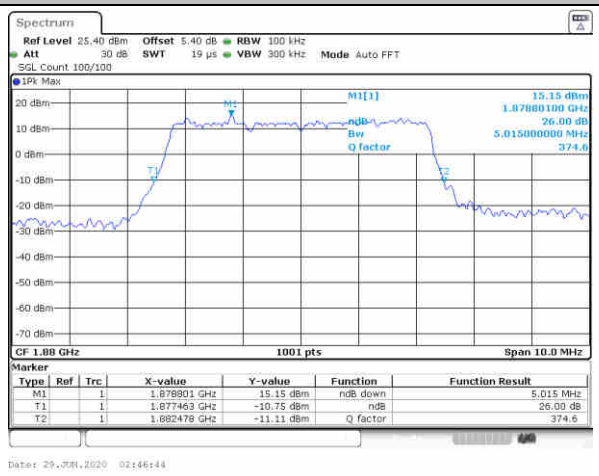
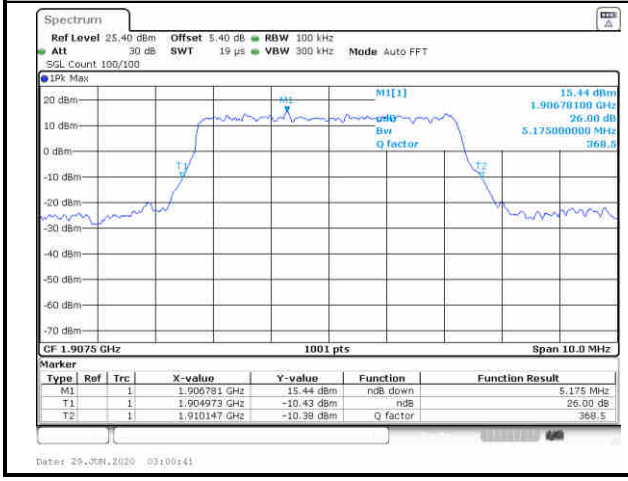
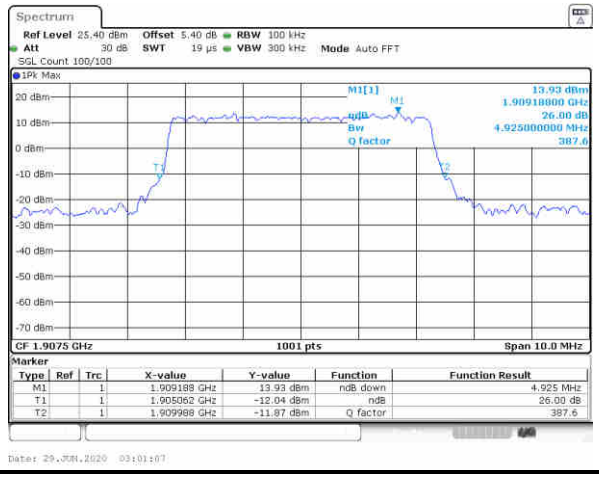


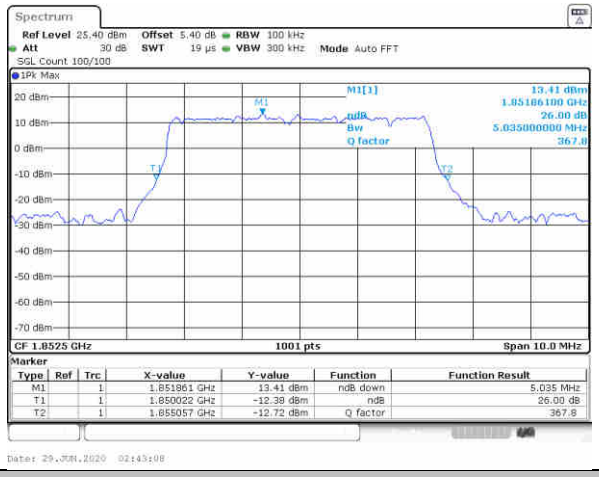
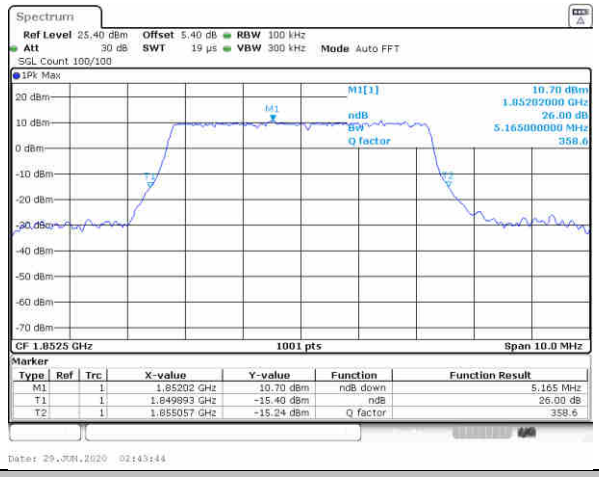
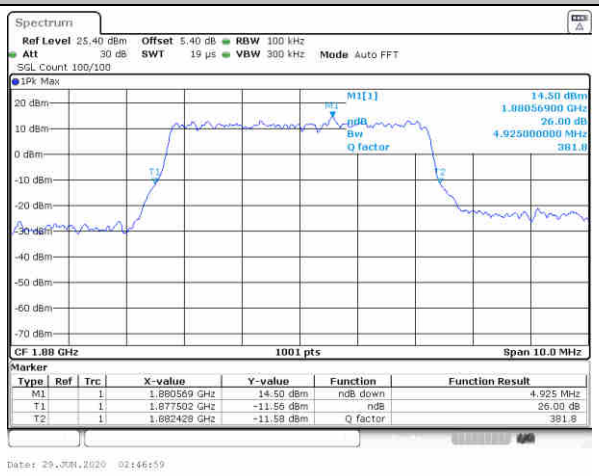
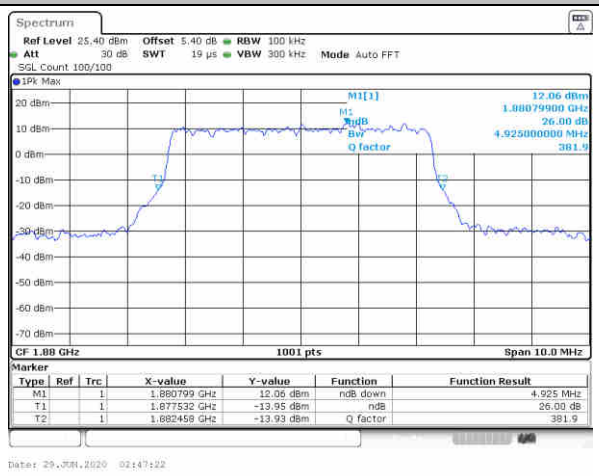
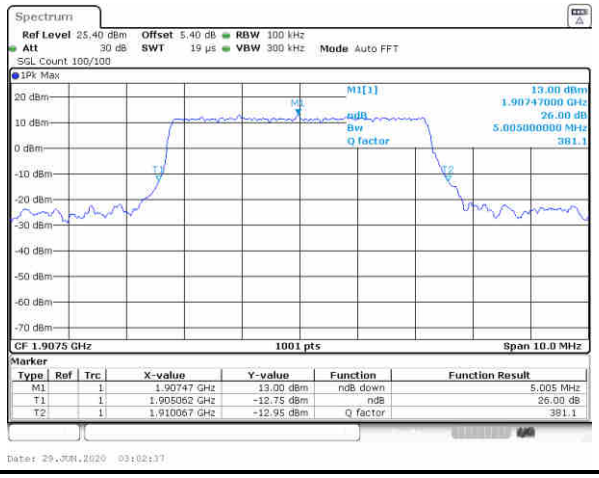
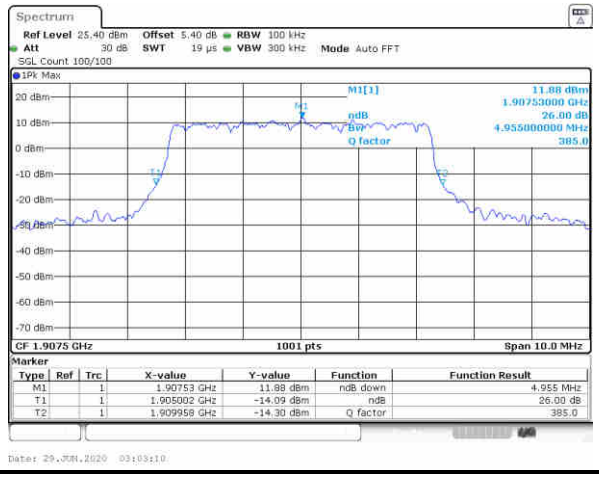
Middle Channel



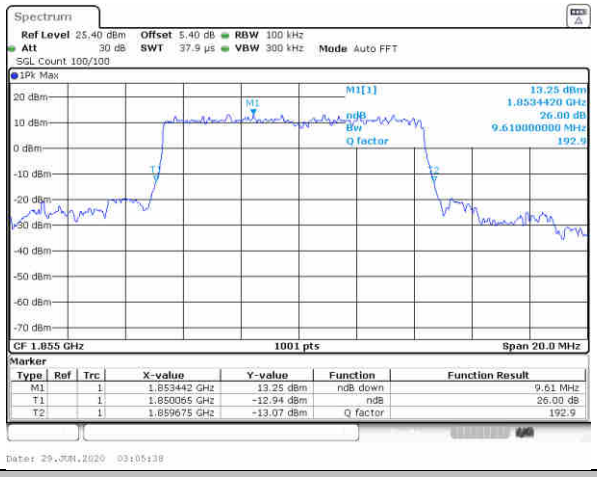
Highest Channel



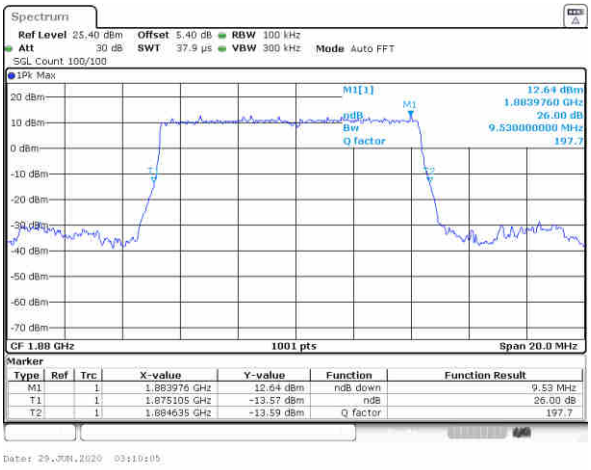
FR1 n2 / 5MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 5MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

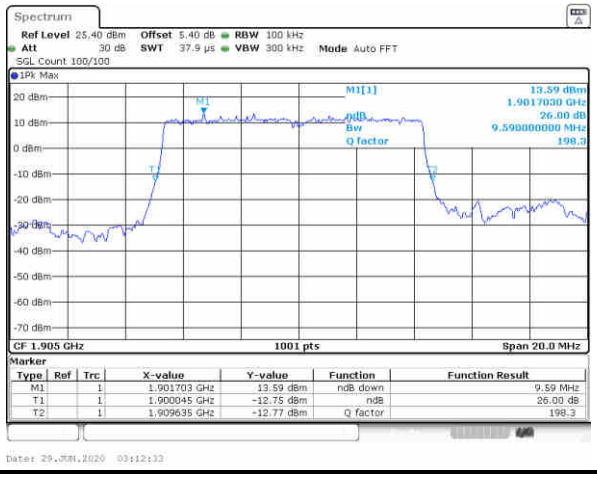
FR1 n2 / 10MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

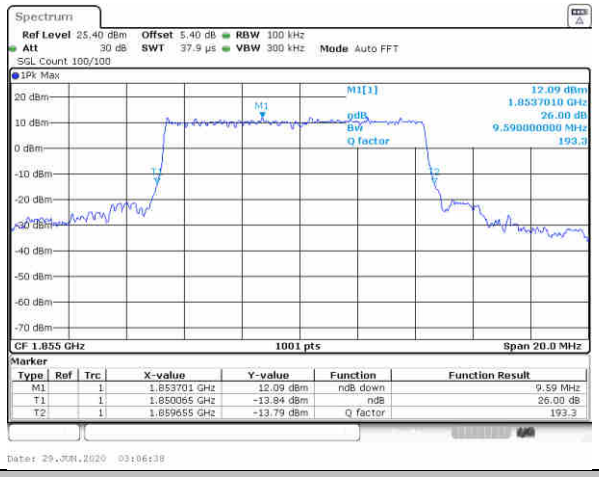
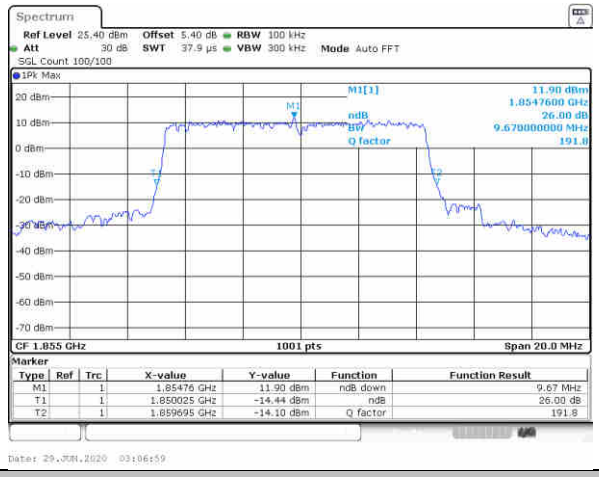
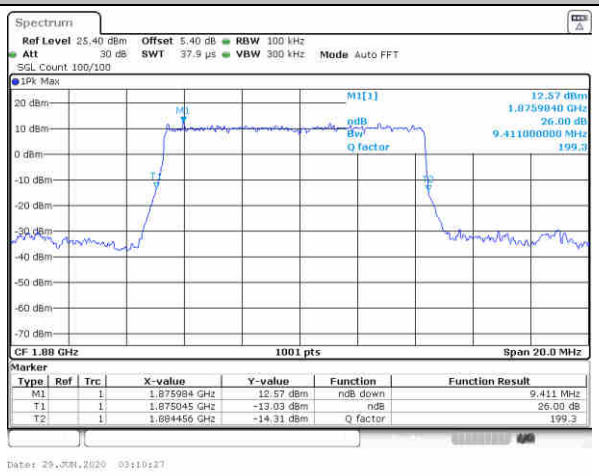
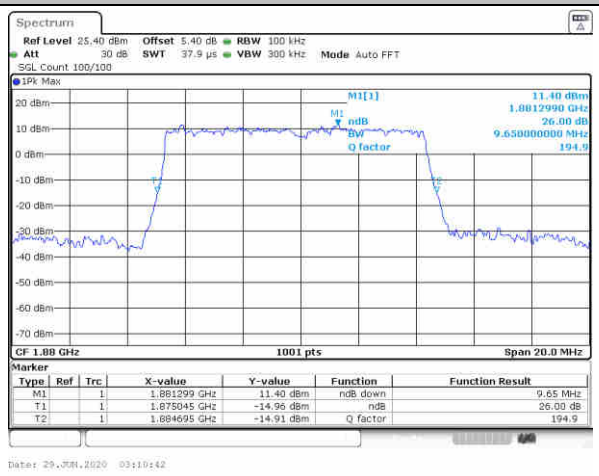
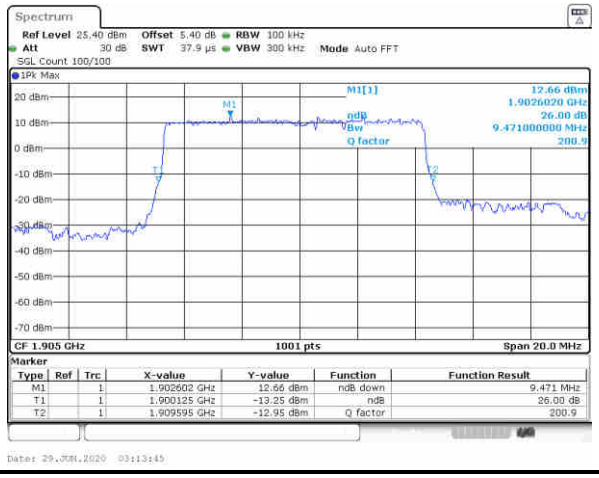
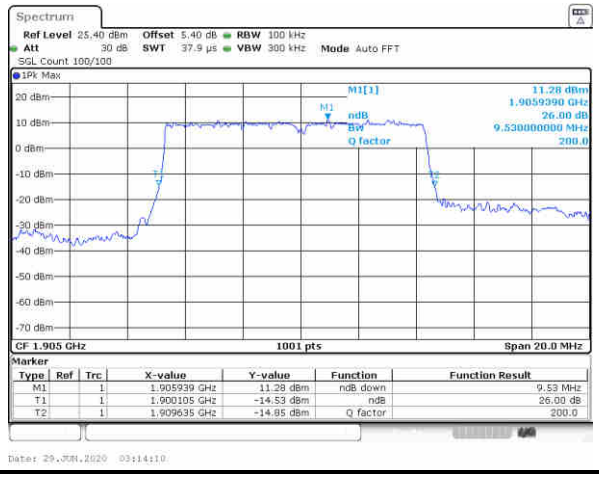


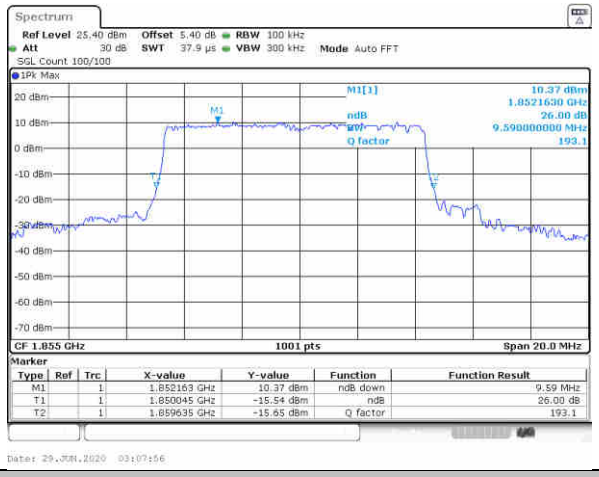
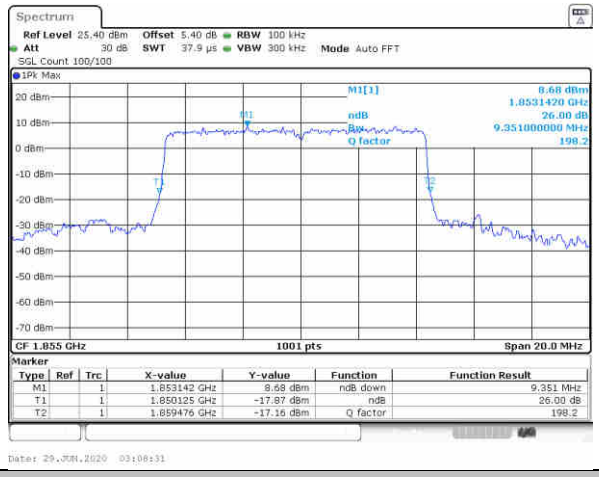
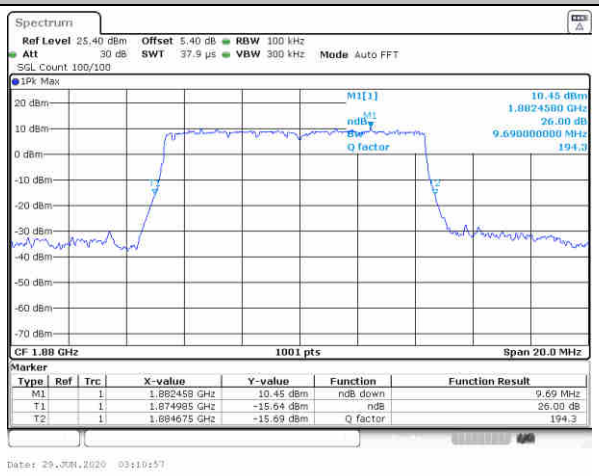
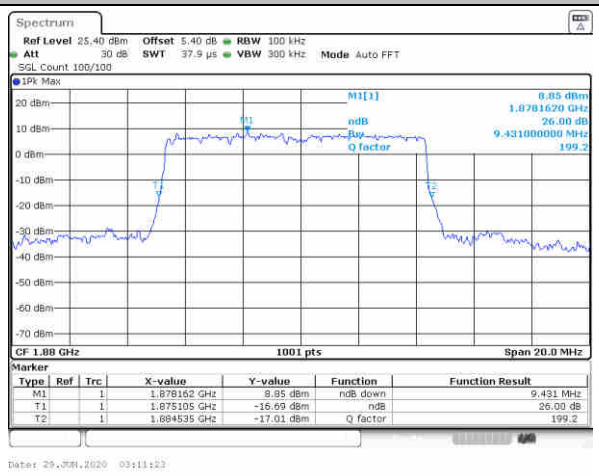
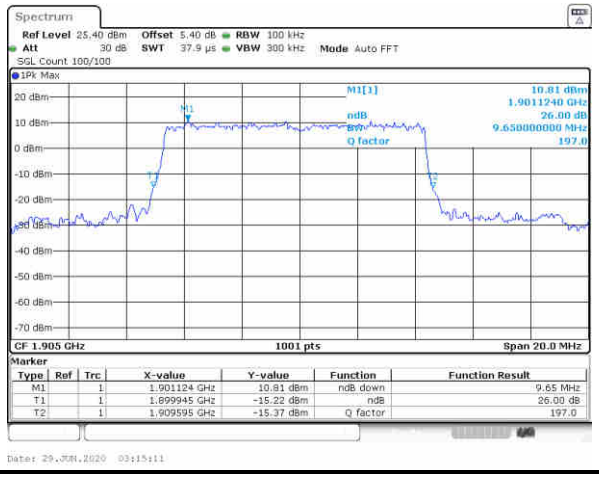
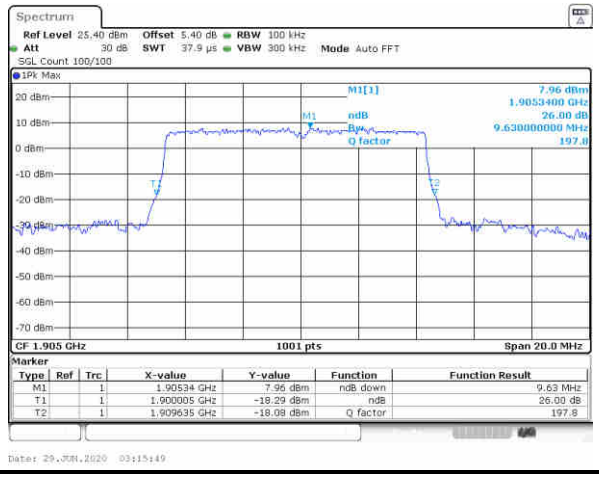
Middle Channel



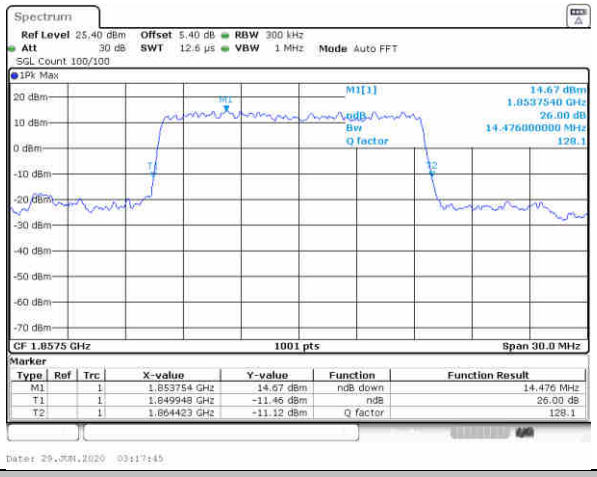
Highest Channel



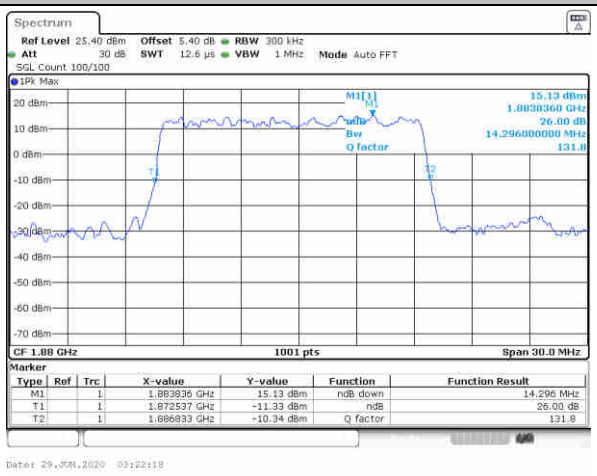
FR1 n2 / 10MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 10MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

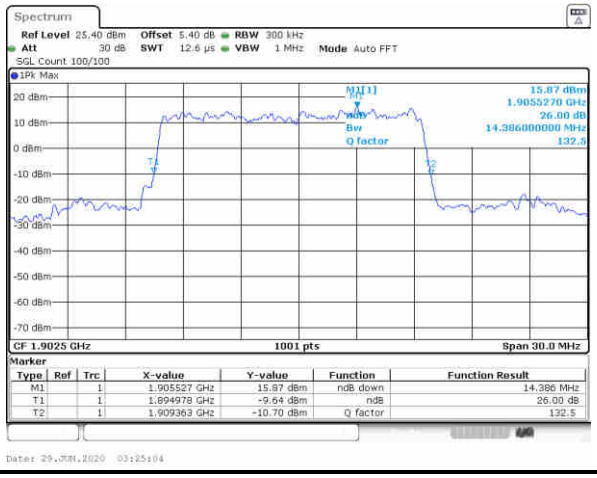
FR1 n2 / 15MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

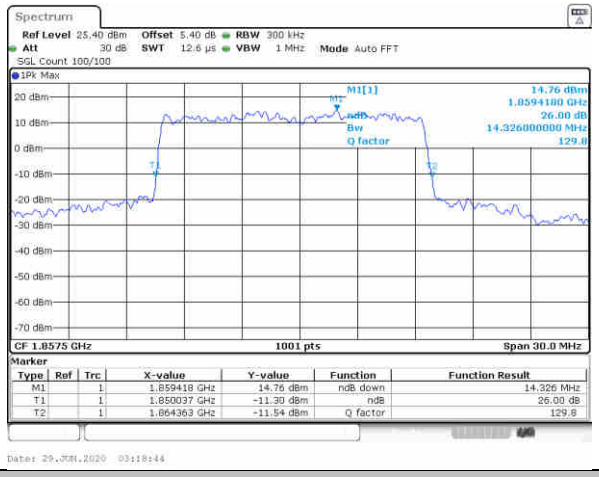
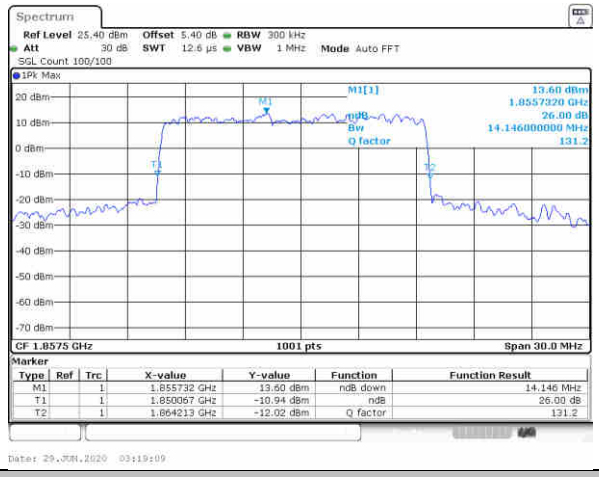
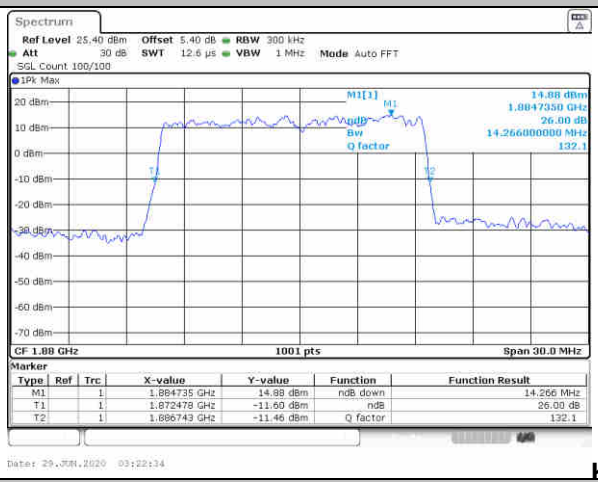
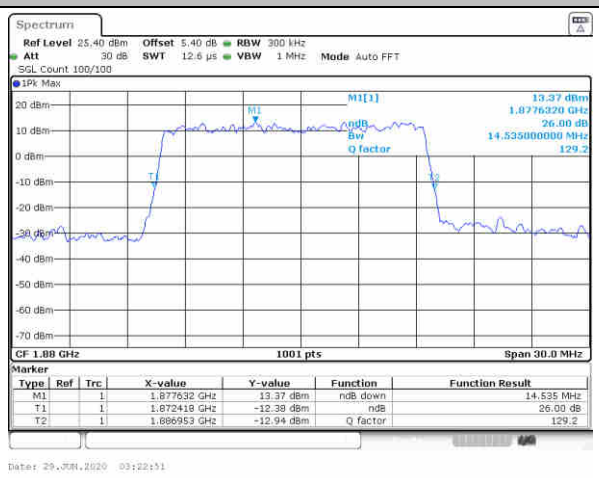
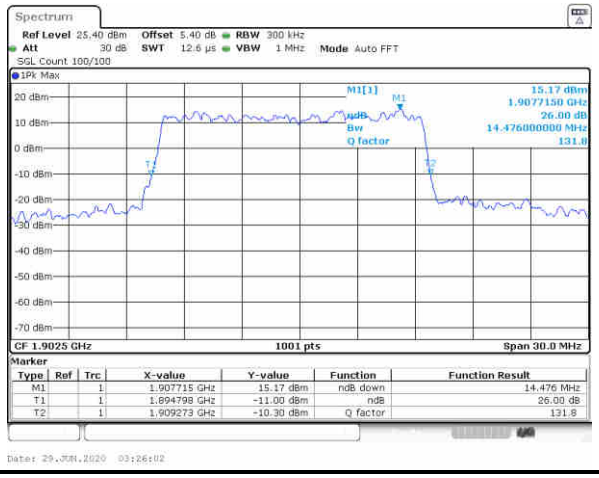
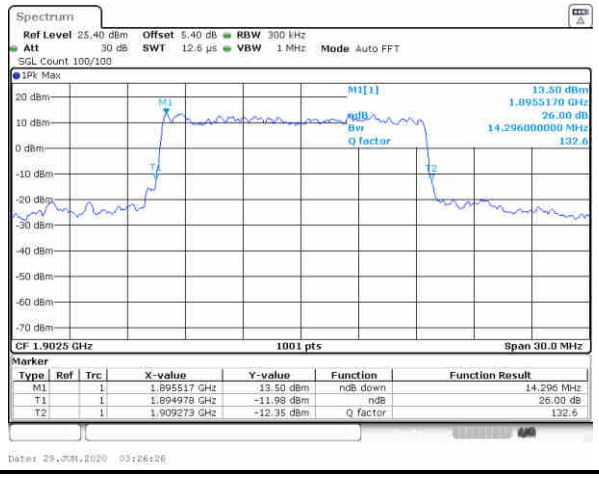


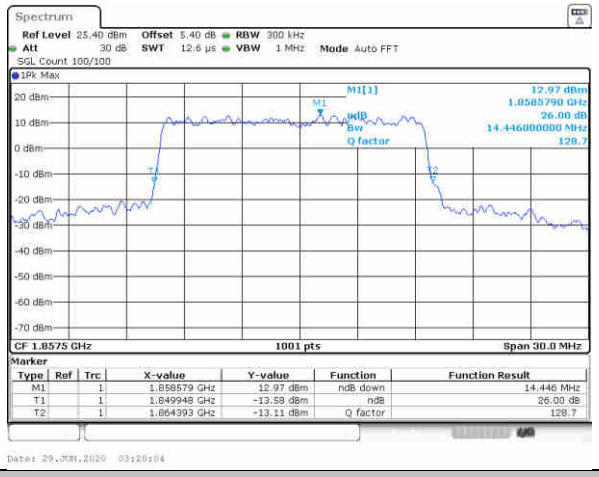
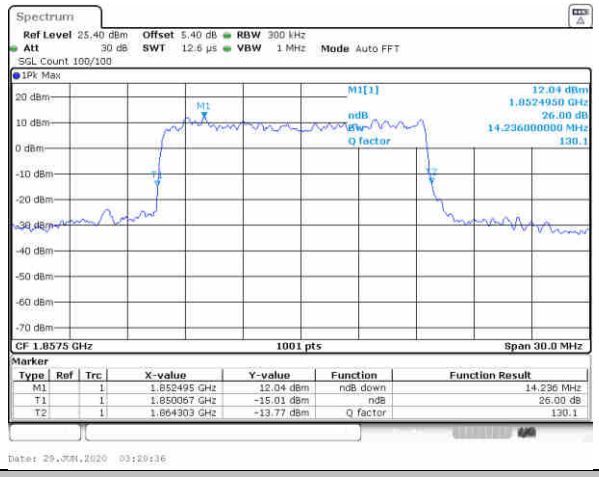
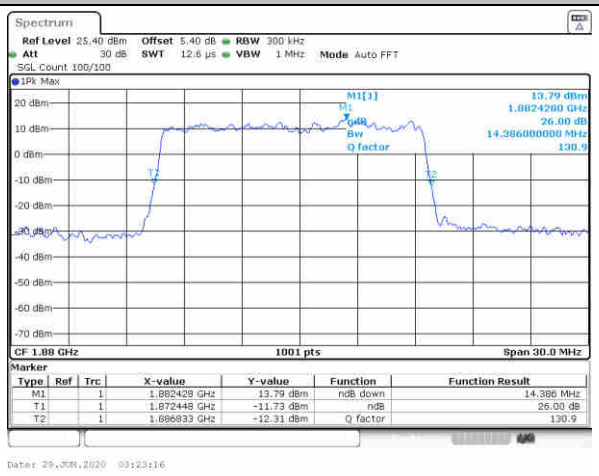
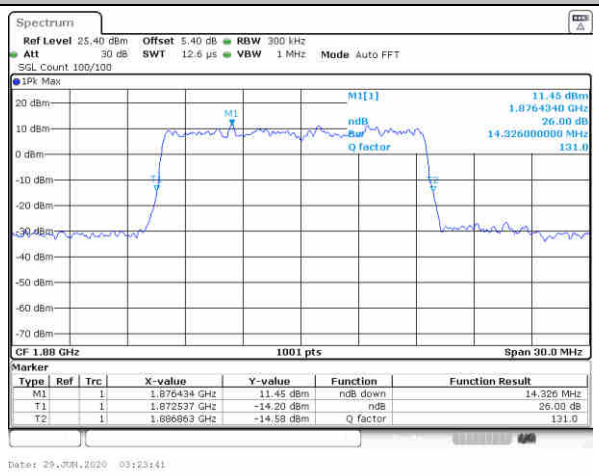
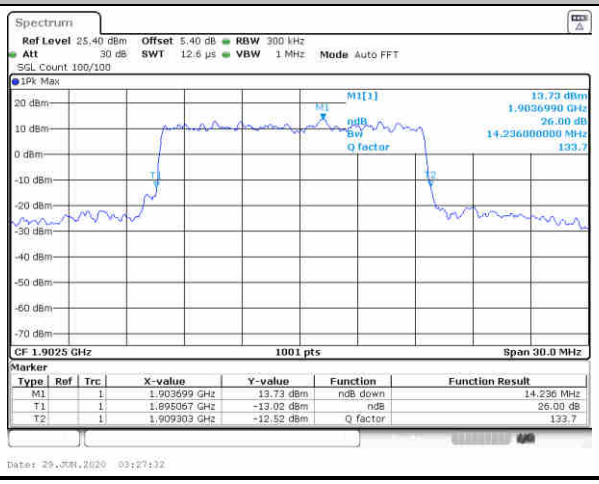
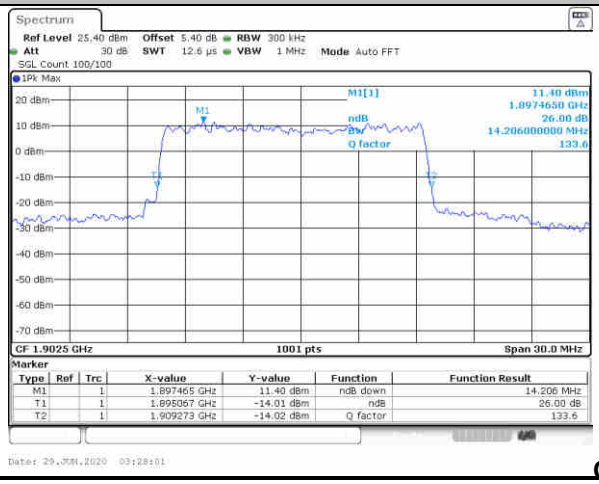
Middle Channel



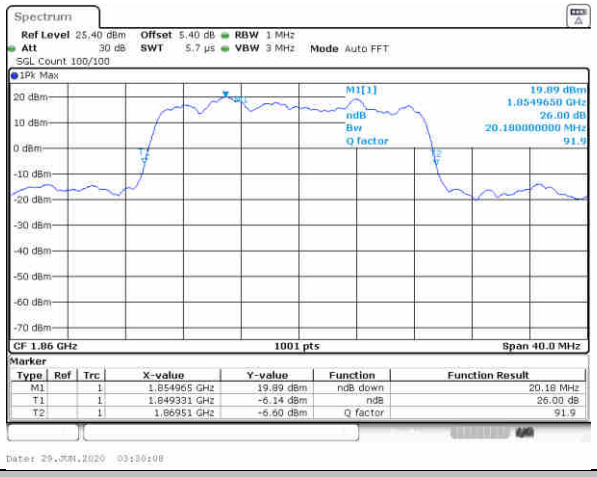
Highest Channel



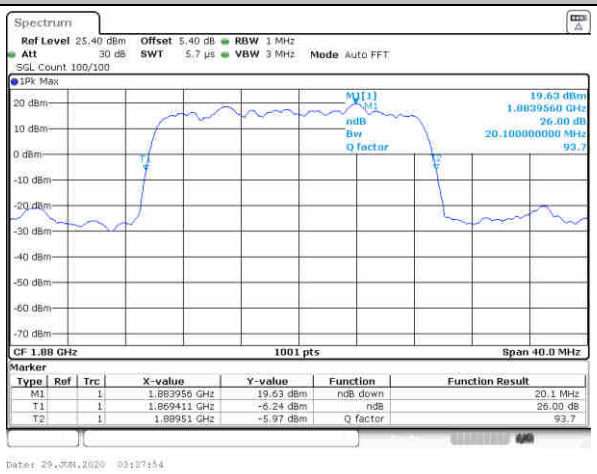
FR1 n2 / 15MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 15MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

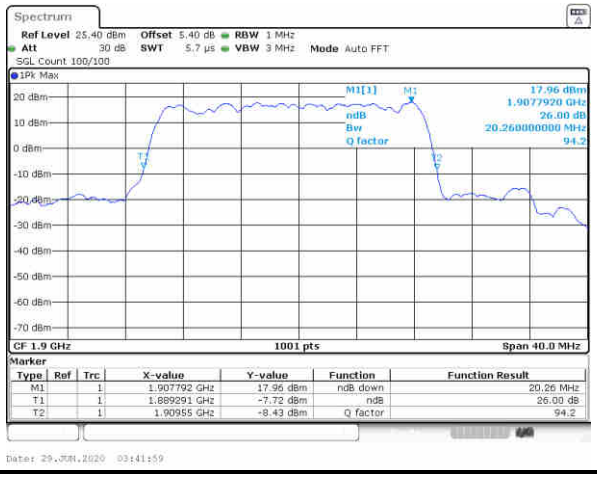
FR1 n2 / 20MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

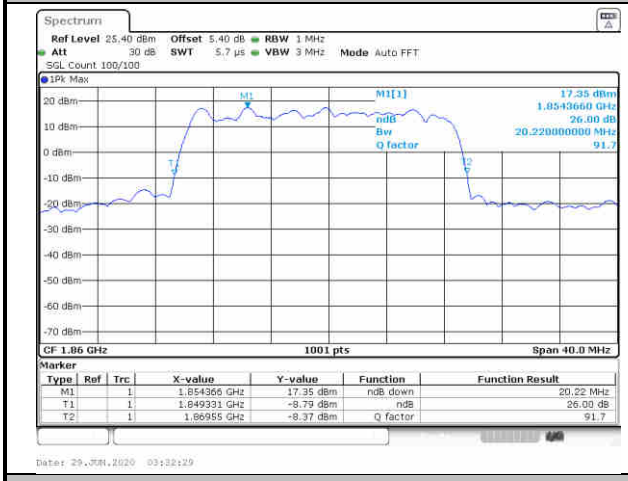
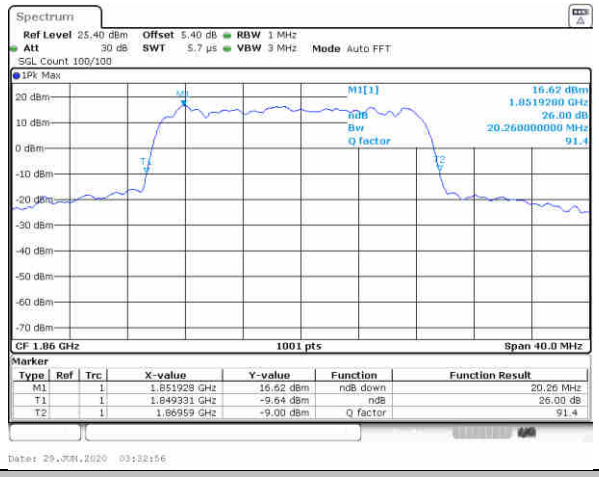
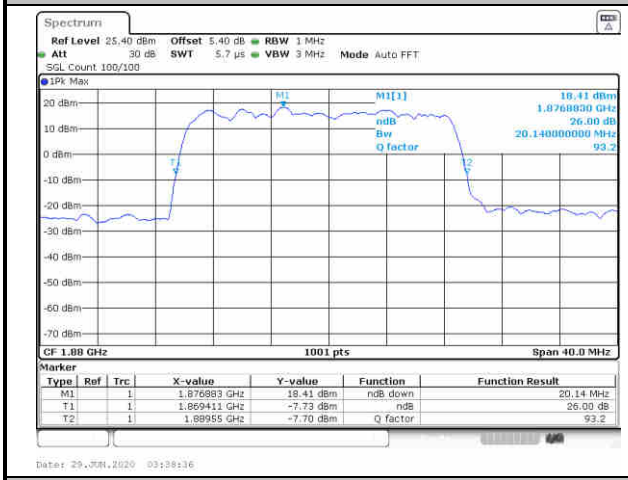
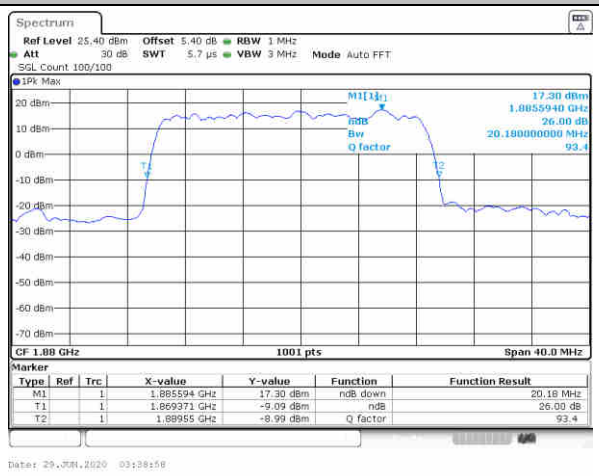
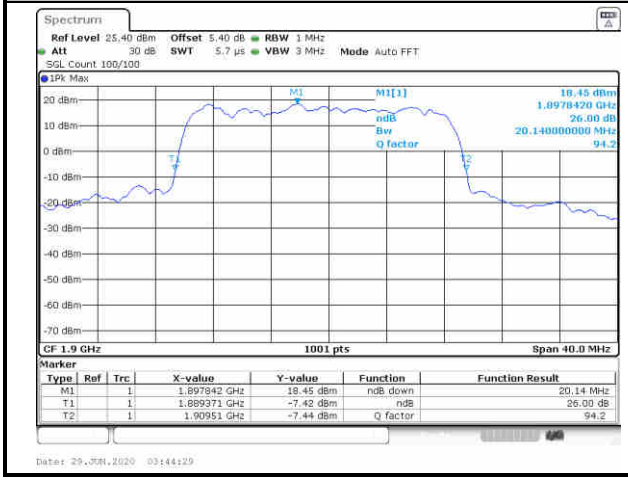
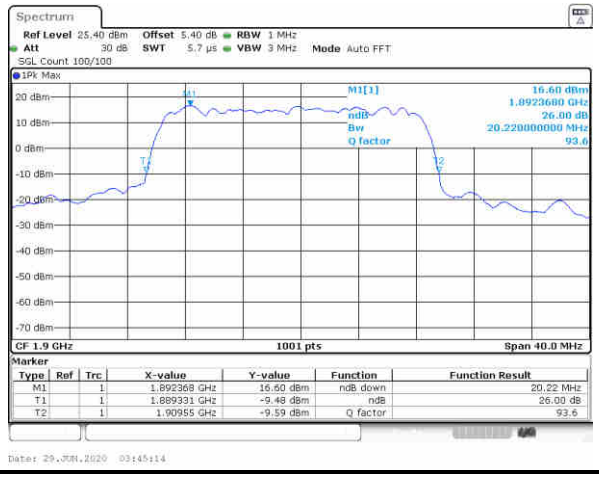


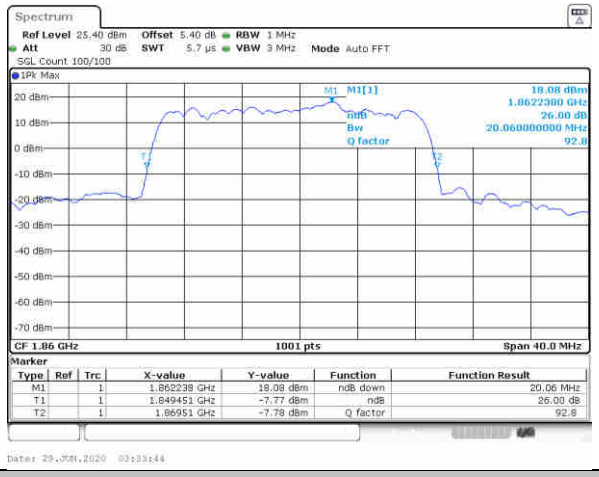
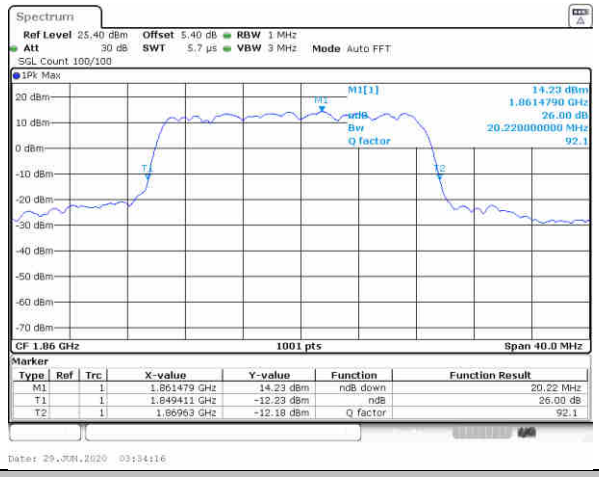
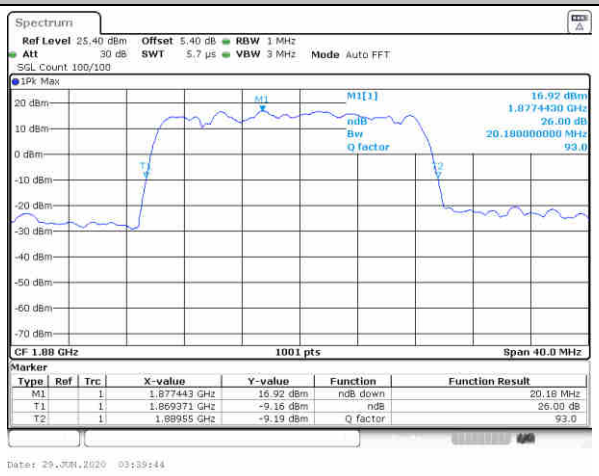
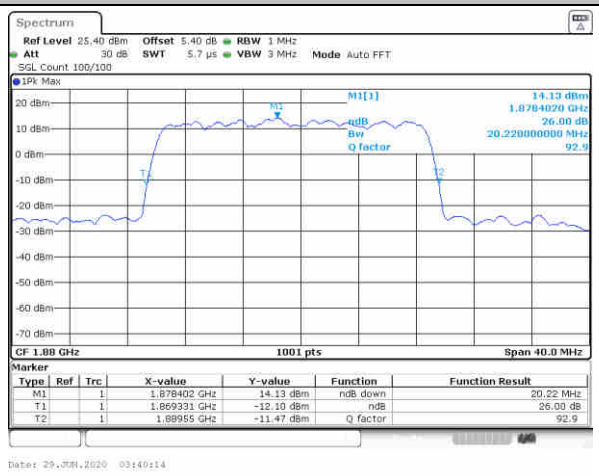
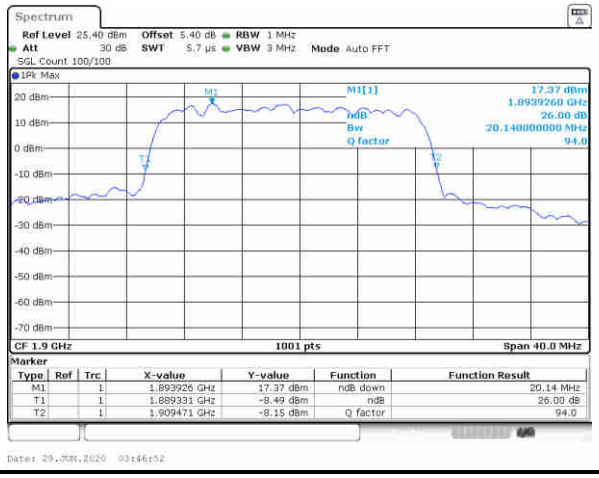
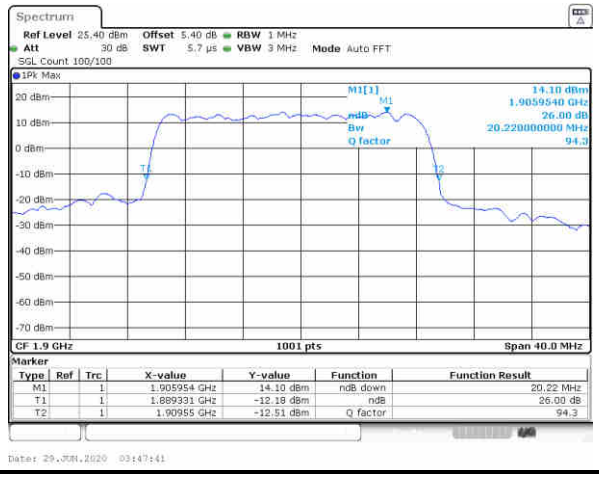
Middle Channel



Highest Channel



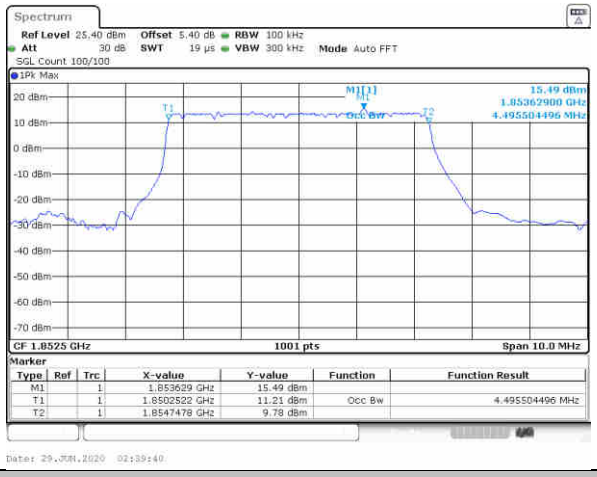
FR1 n2 / 20MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 20MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

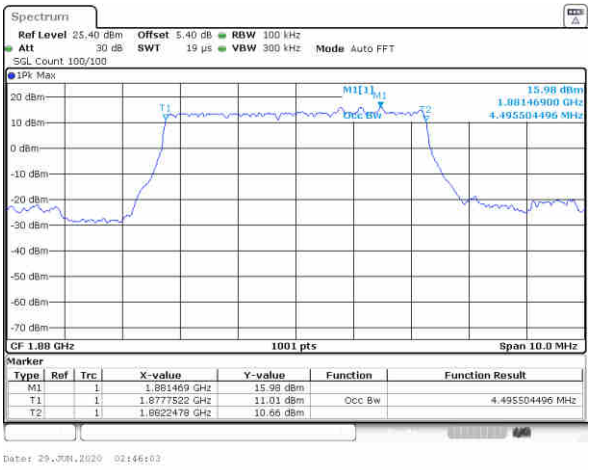
Occupied Bandwidth

Mode	FR1 n2 : 99%OBW(MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	PI/2 BPSK		PI/2 BPSK		PI/2 BPSK		PI/2 BPSK	
Lowest CH	4.50		8.91		13.43		18.22	
Middle CH	4.50		8.91		13.52		18.46	
Highest CH	4.54		8.89		13.49		18.42	
Mode	FR1 n2 : 99%OBW (MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	16QAM
Lowest CH	4.48	4.51	8.89	8.91	13.52	13.52	18.26	18.34
Middle CH	4.48	4.50	8.97	8.93	13.52	13.52	18.38	18.34
Highest CH	4.49	4.50	8.89	8.91	13.52	13.52	18.46	18.46
Mode	FR1 n2 : 99%OBW (MHz) / DFT-S OFDM							
BW	5MHz		10MHz		15MHz		20MHz	
Mod.	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM	64QAM	256QAM
Lowest CH	4.48	4.49	8.91	8.91	13.52	13.49	18.38	18.38
Middle CH	4.49	4.52	8.87	8.89	13.49	13.49	18.42	18.26
Highest CH	4.51	4.48	8.93	8.93	13.46	13.52	18.30	18.34

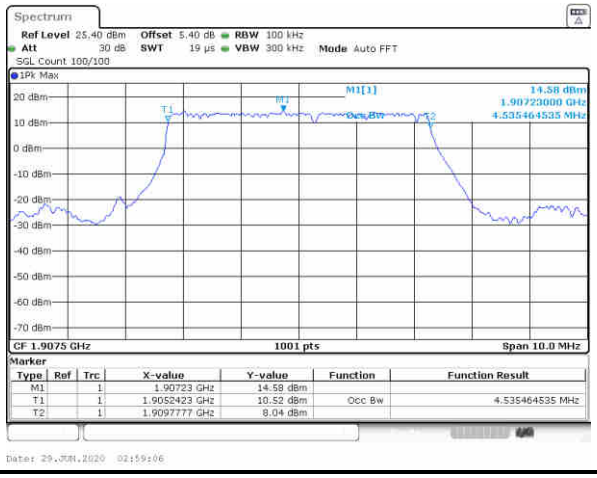
FR1 n2 / 5MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

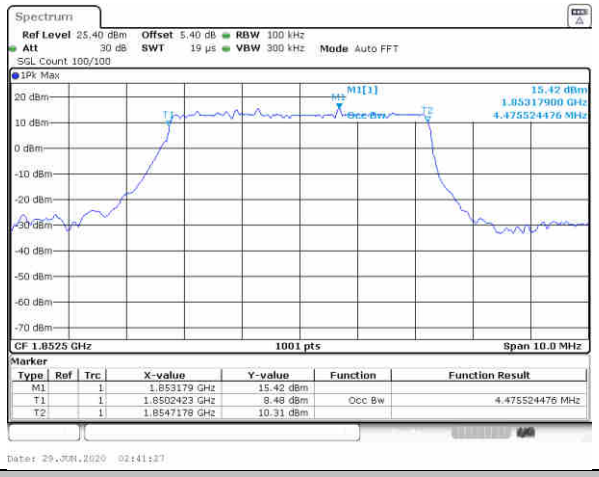
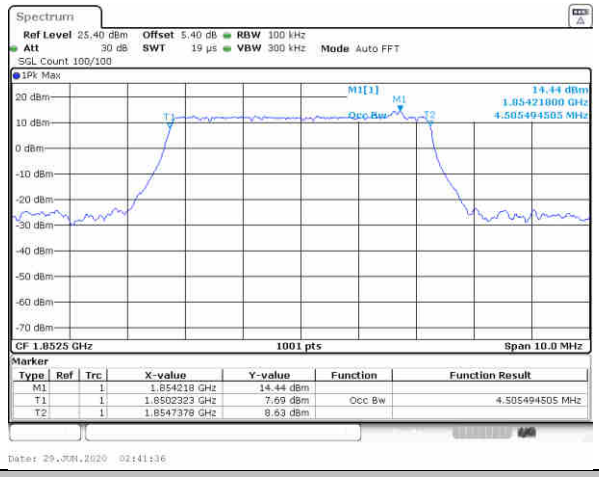
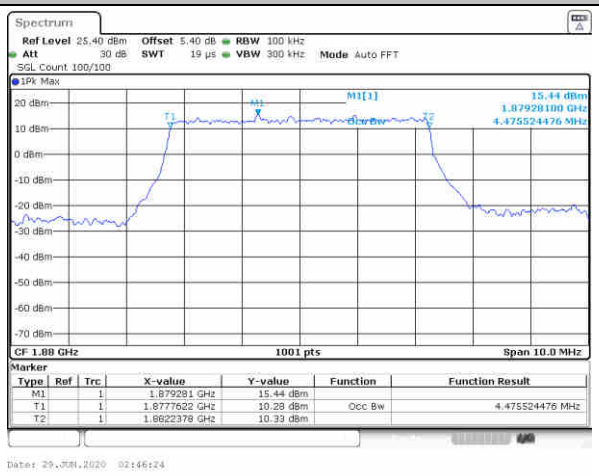
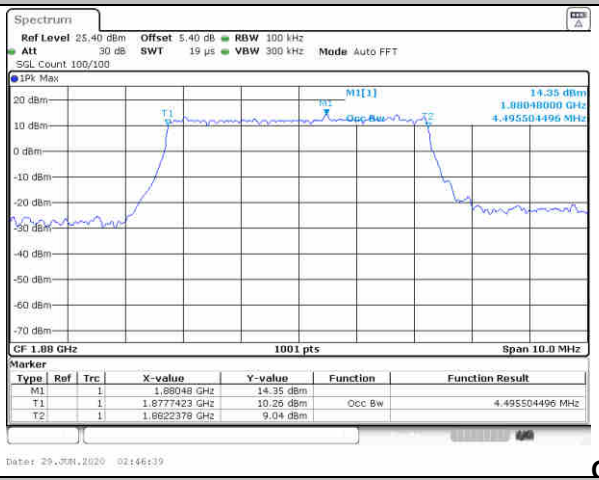
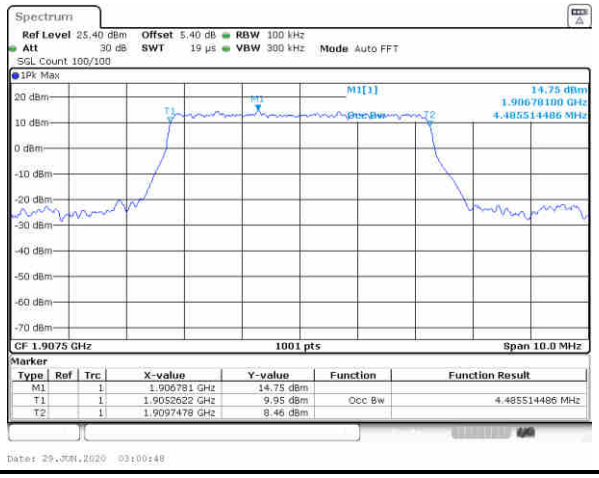
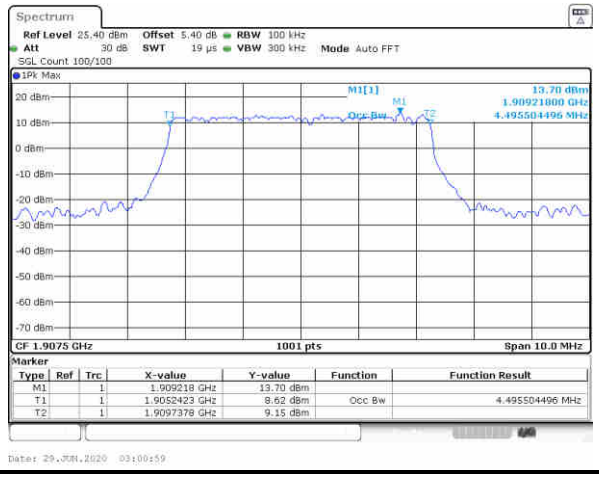


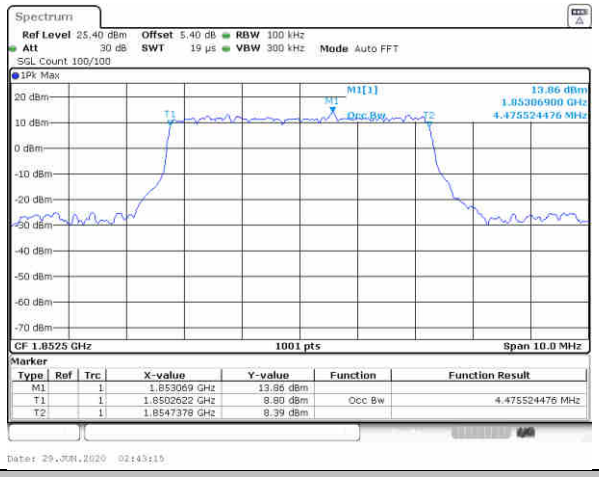
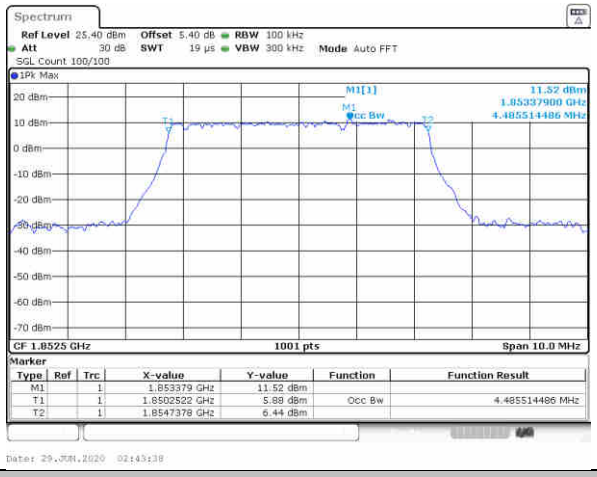
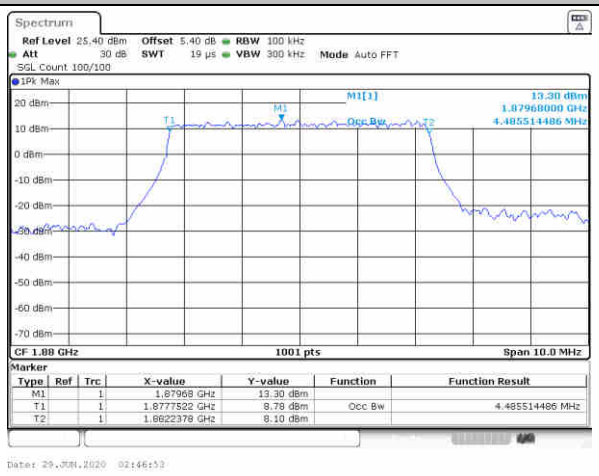
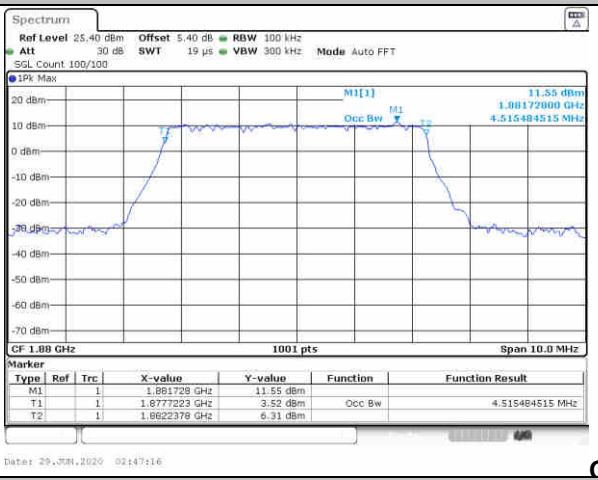
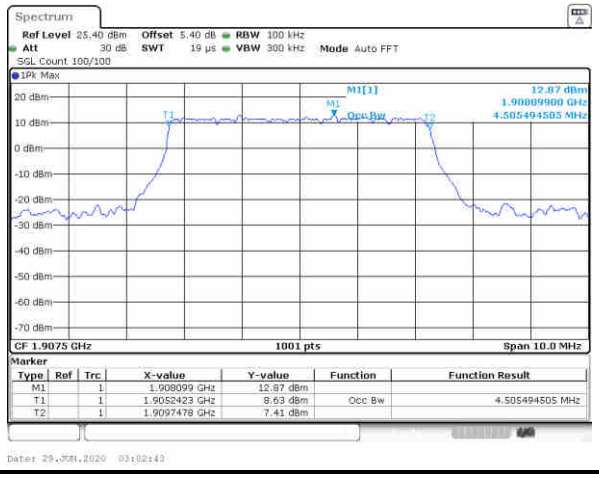
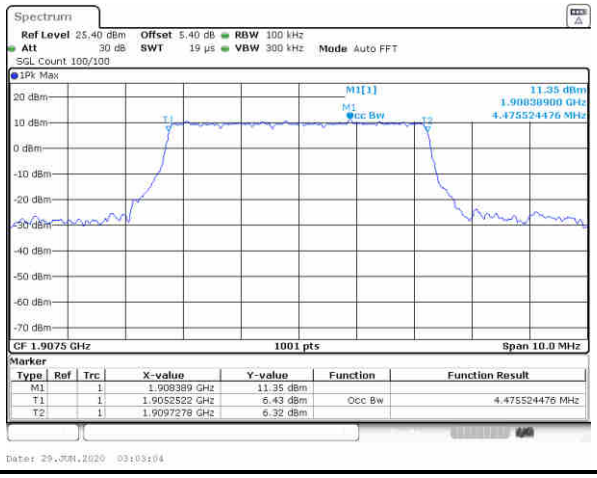
Middle Channel



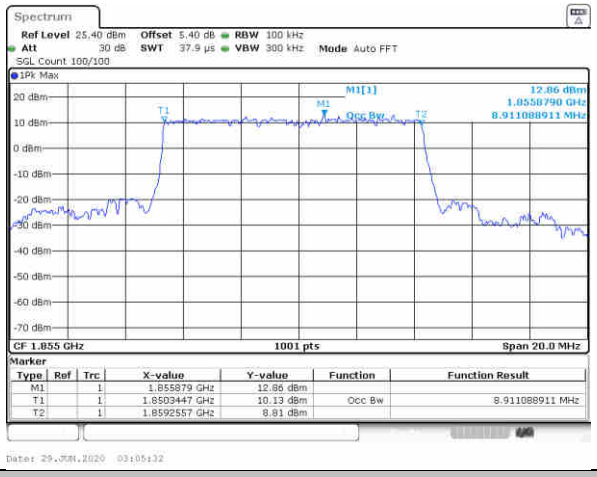
Highest Channel



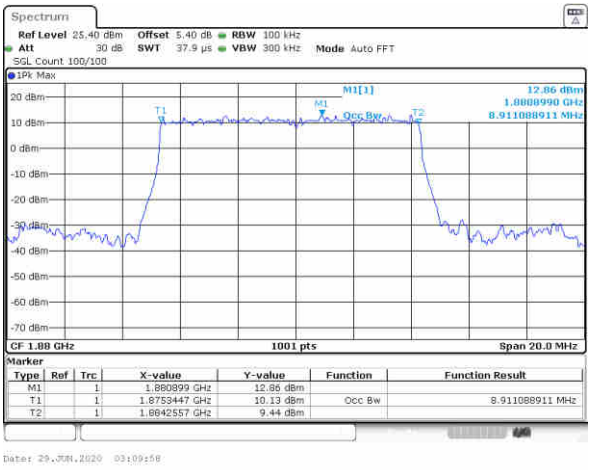
FR1 n2 / 5MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 5MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

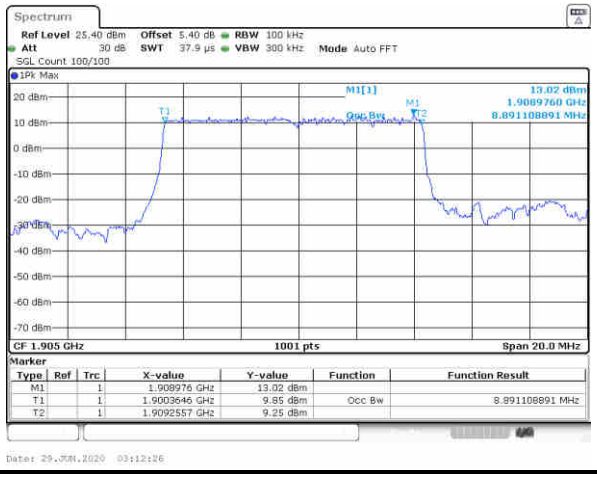
FR1 n2 / 10MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

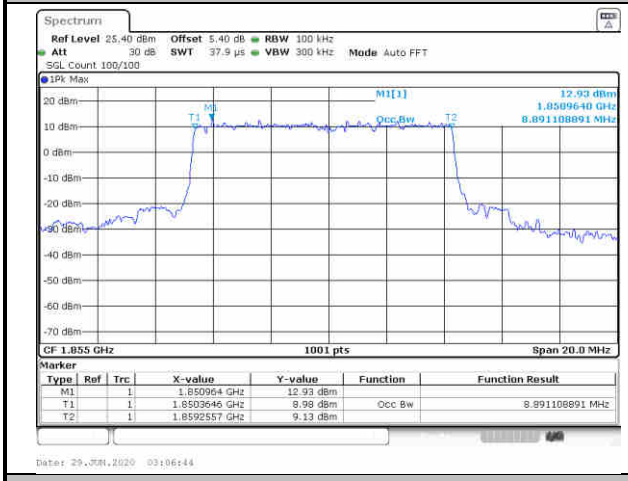
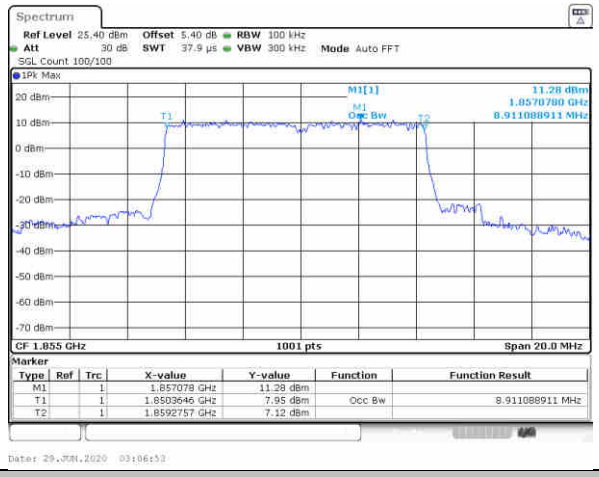
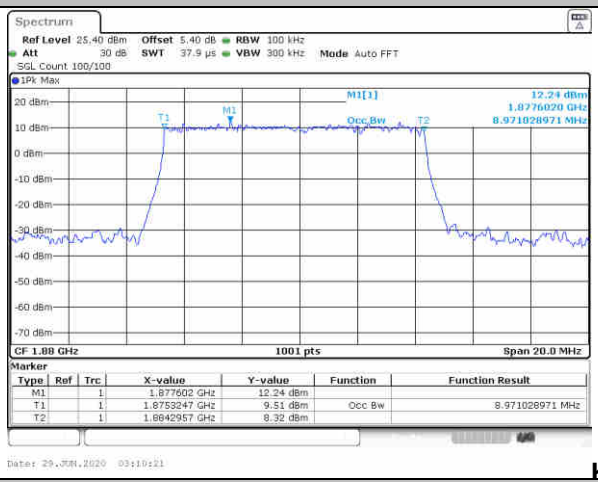
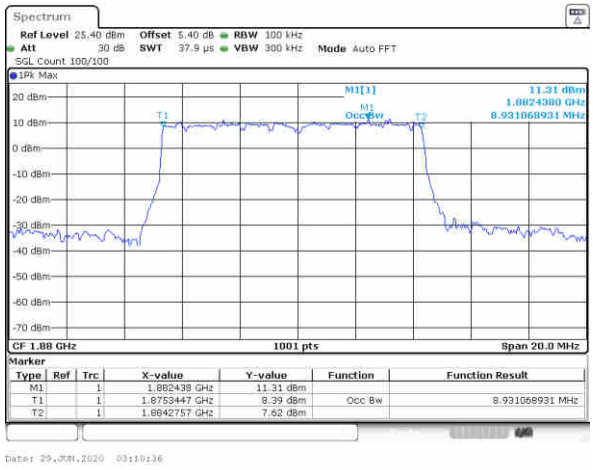
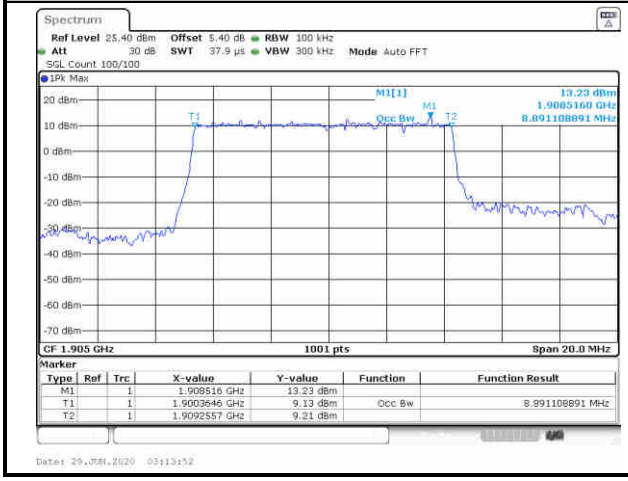
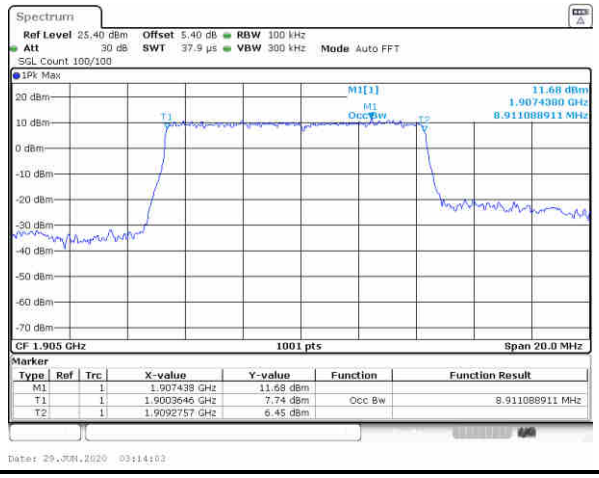


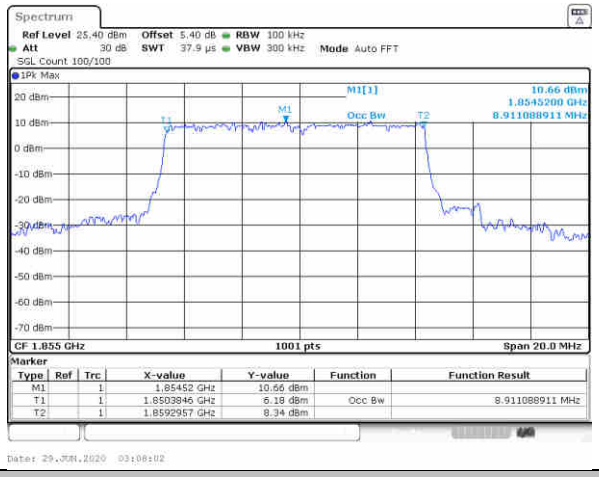
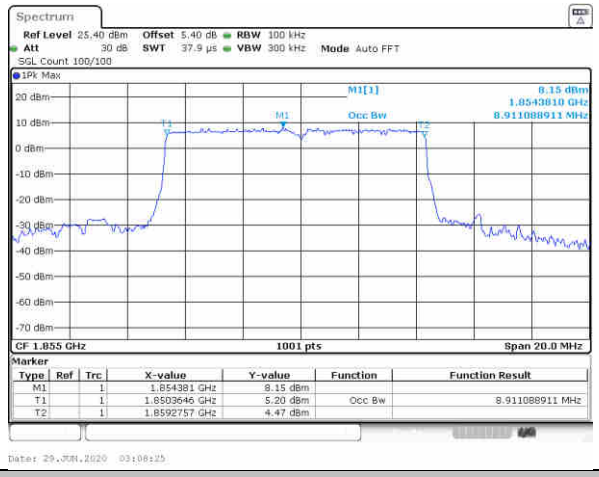
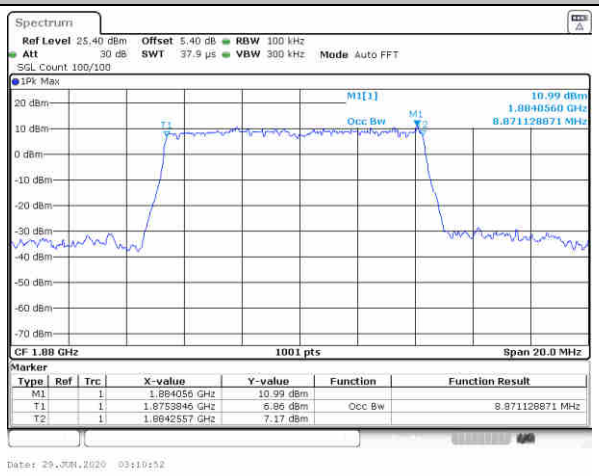
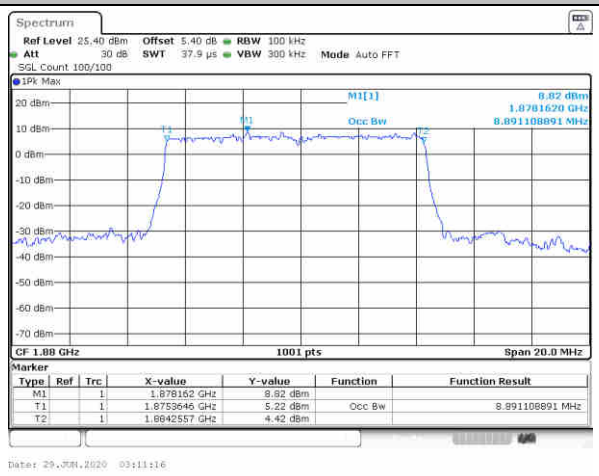
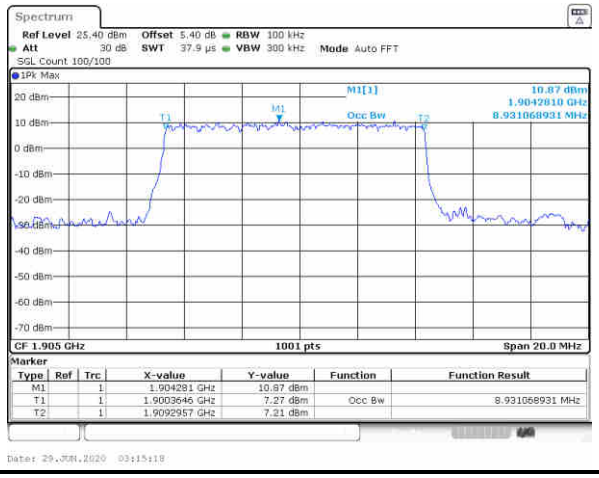
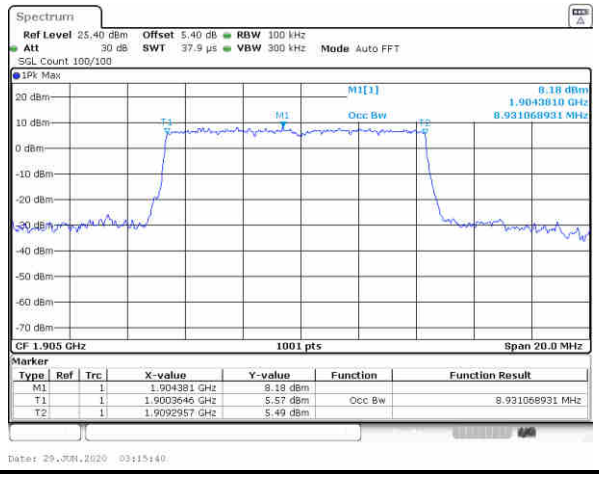
Middle Channel



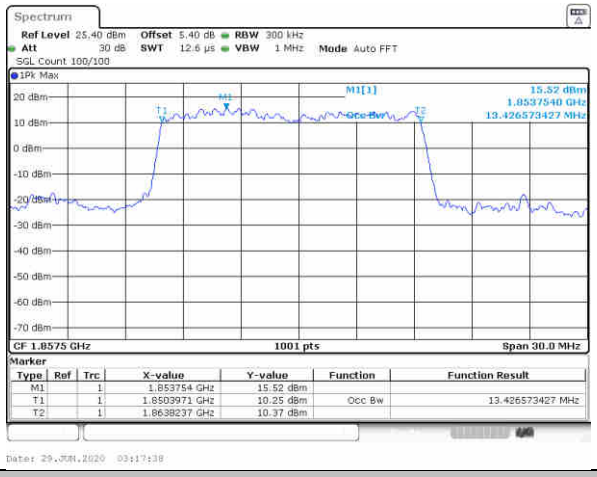
Highest Channel



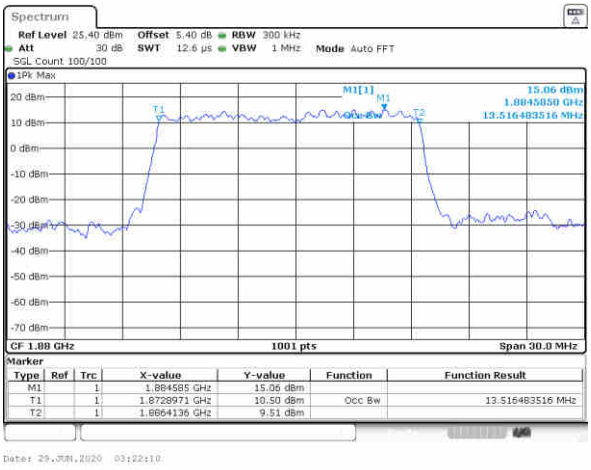
FR1 n2 / 10MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 10MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

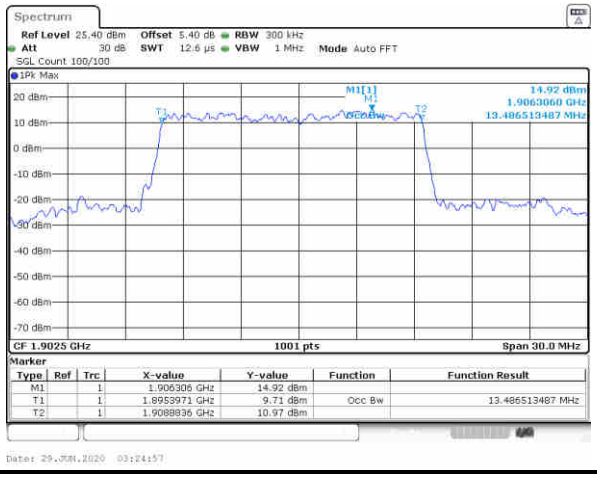
FR1 n2 / 15MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

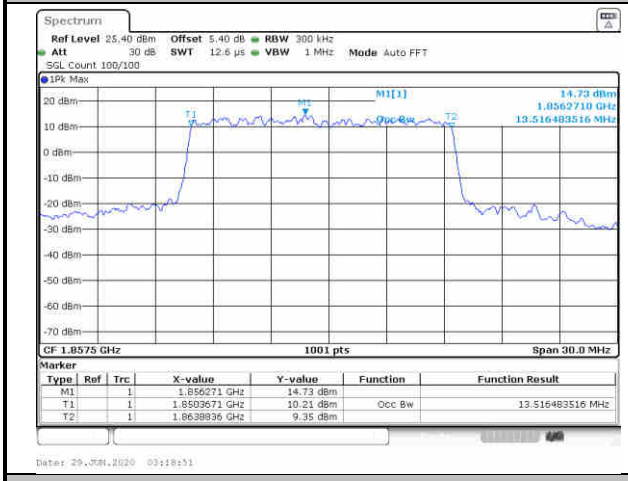
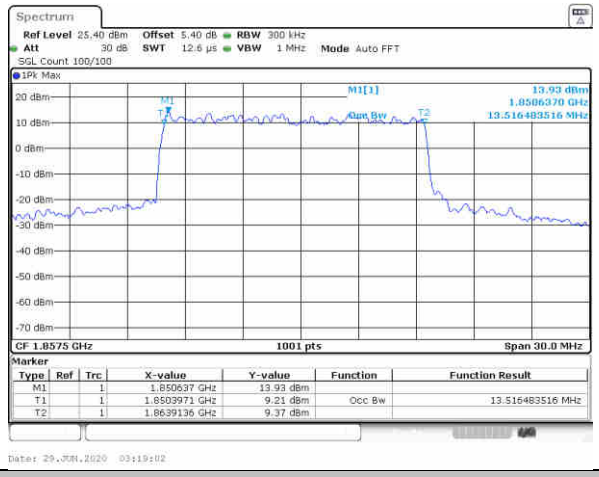
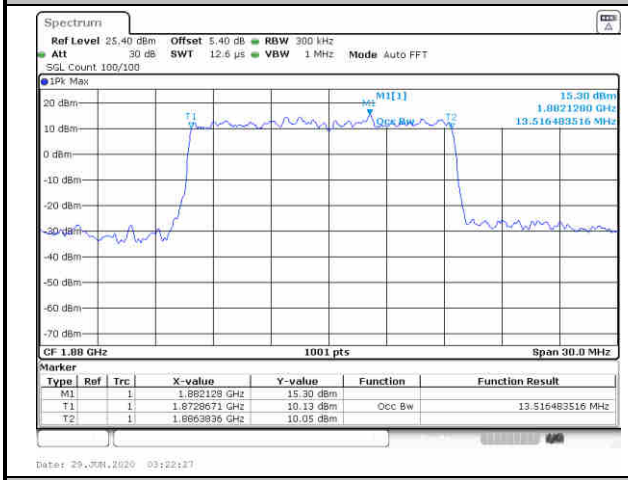
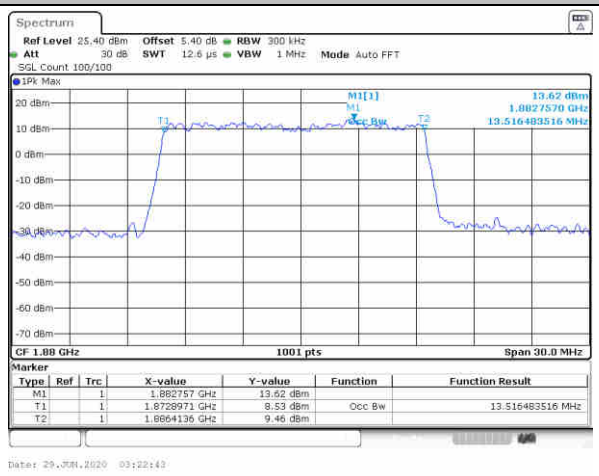
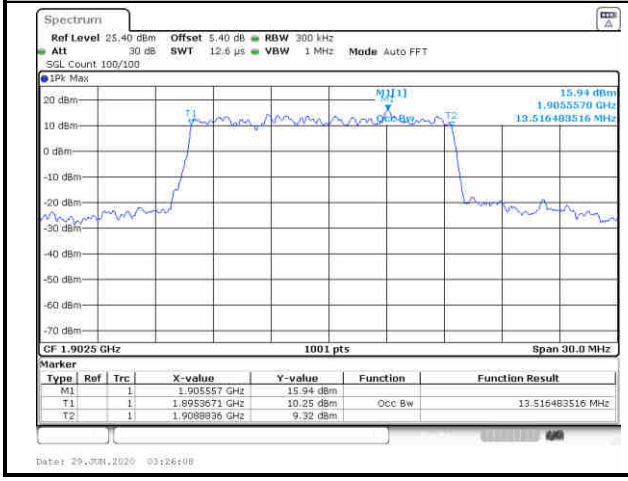
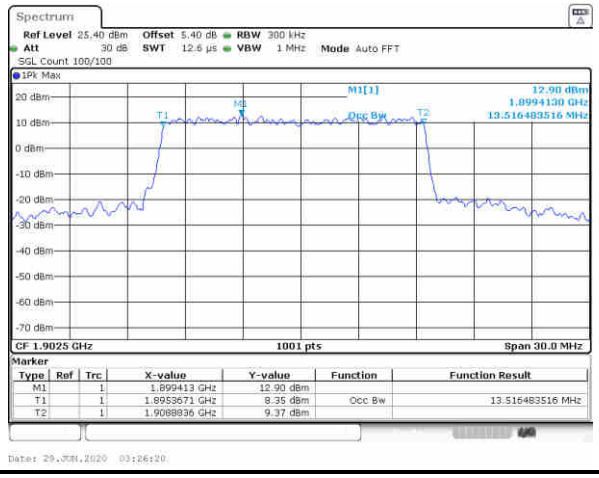


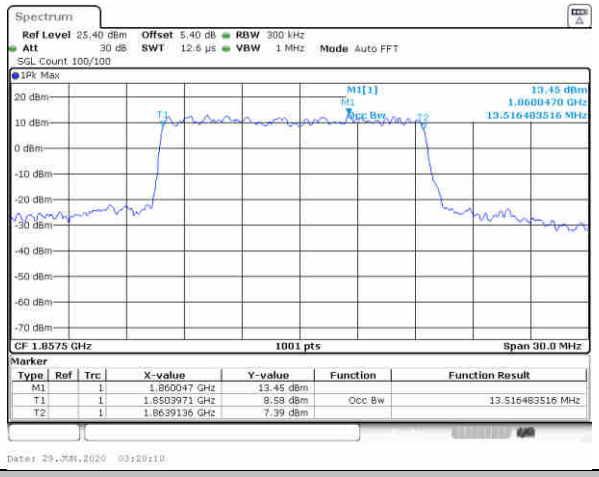
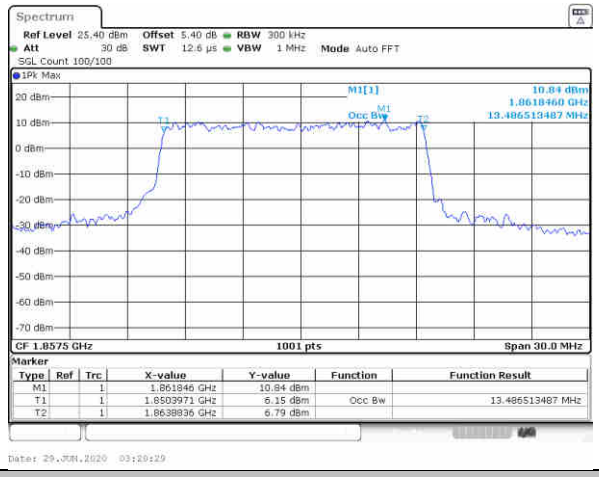
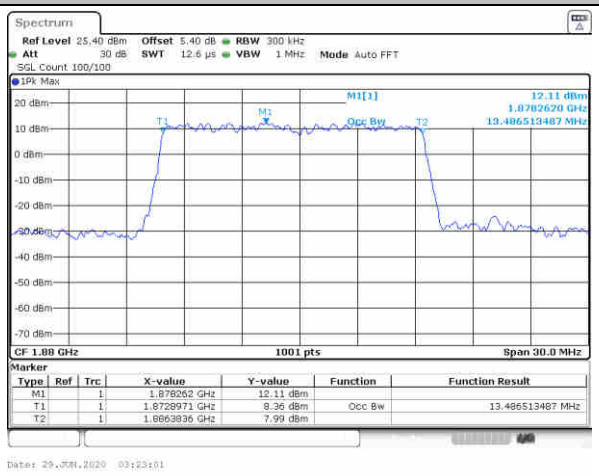
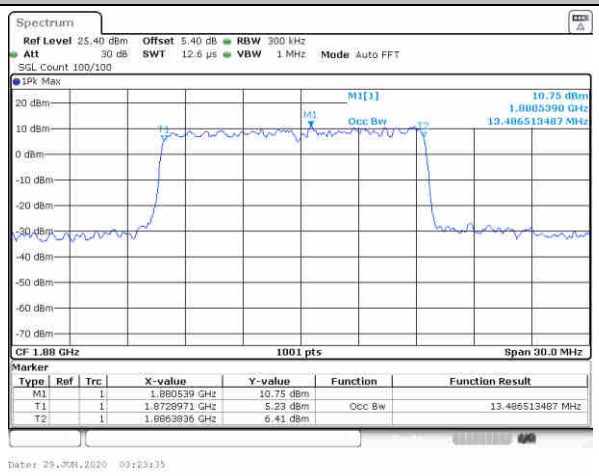
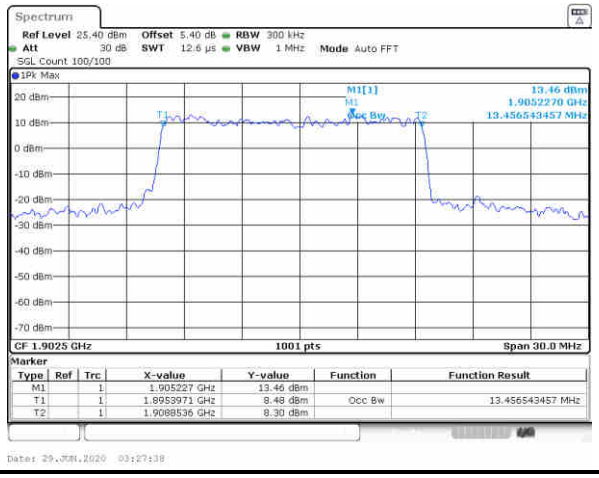
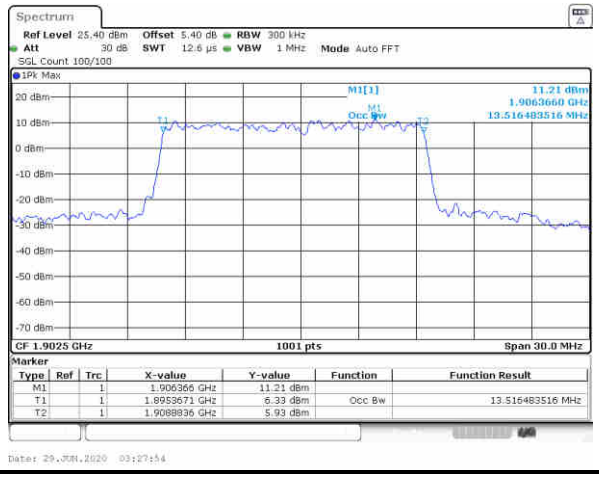
Middle Channel



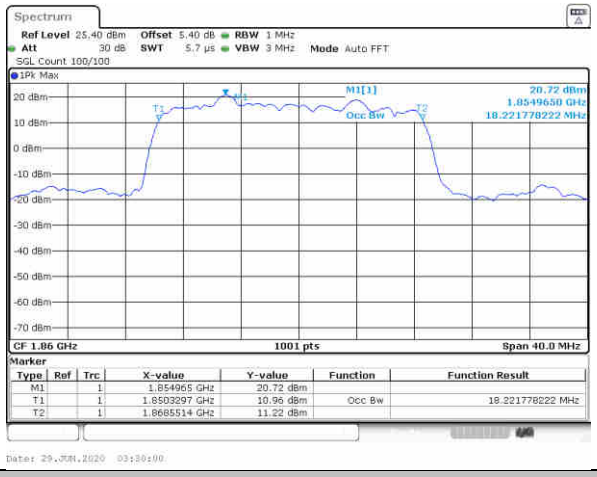
Highest Channel



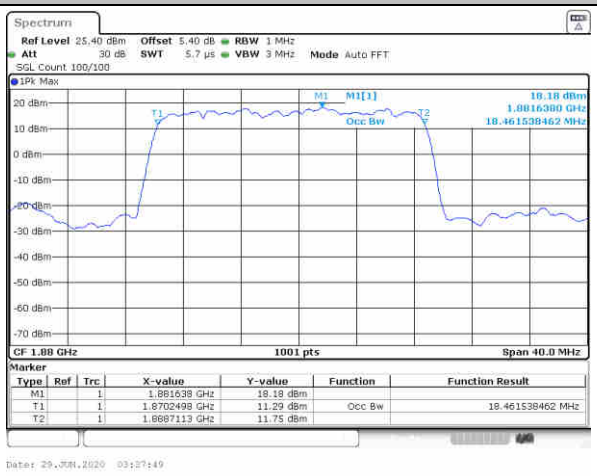
FR1 n2 / 15MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 15MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

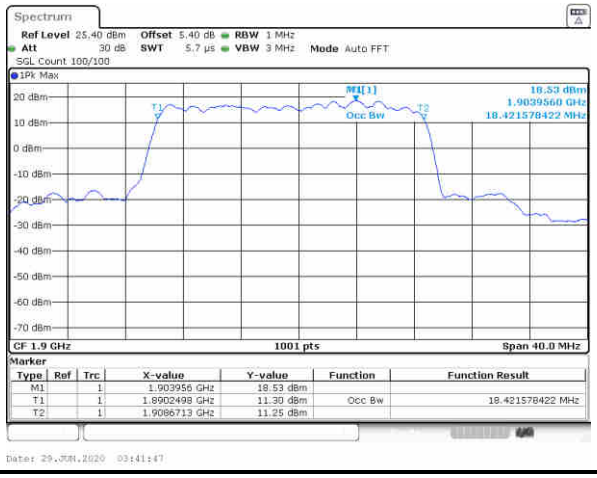
FR1 n2 / 20MHz / DFT-S OFDM
PI/2 BPSK
Lowest Channel

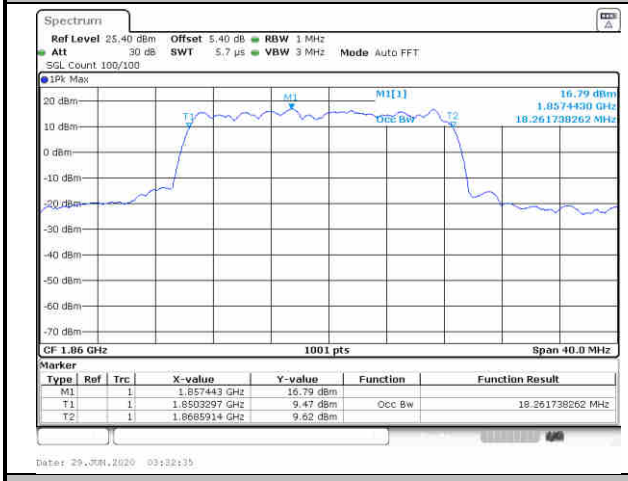
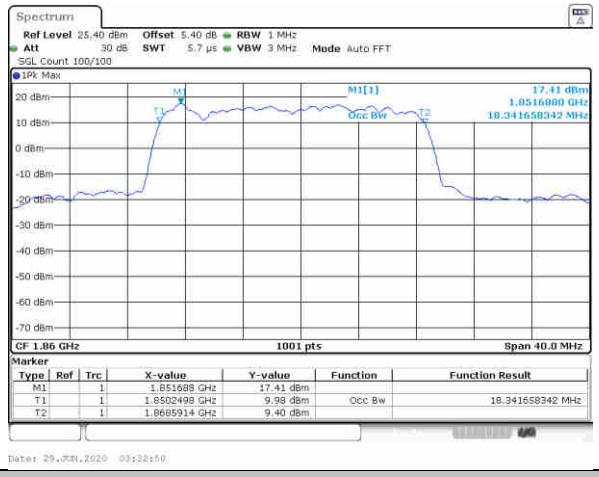
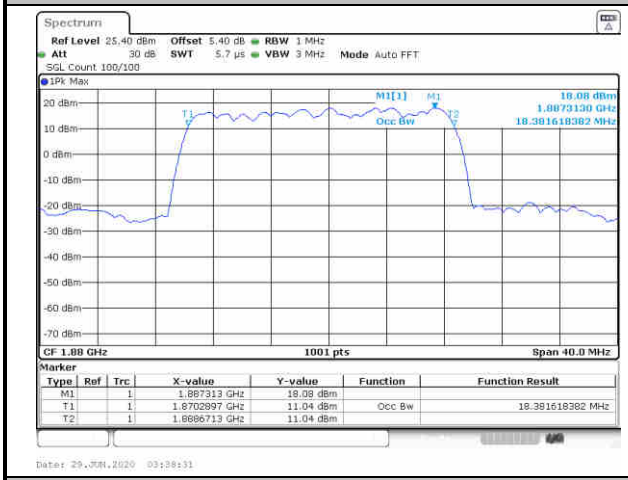
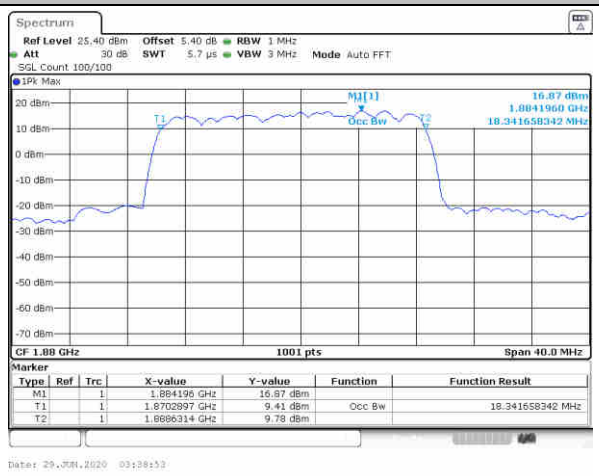
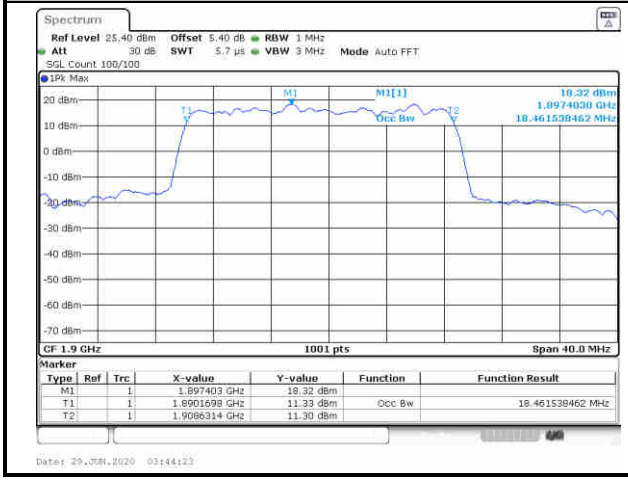
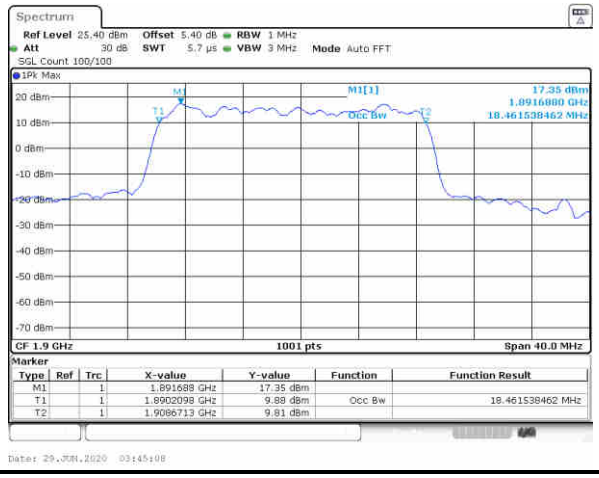


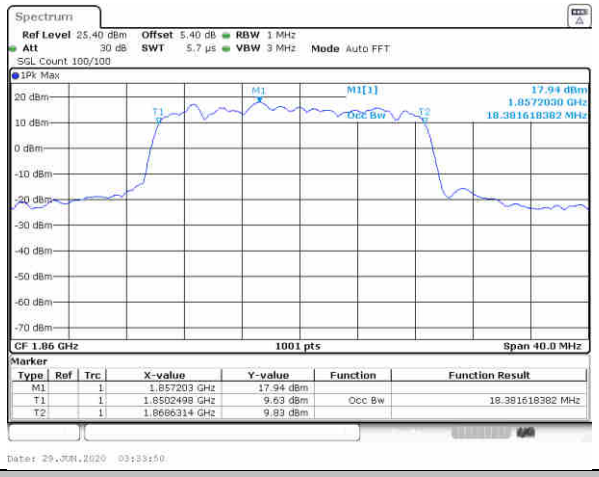
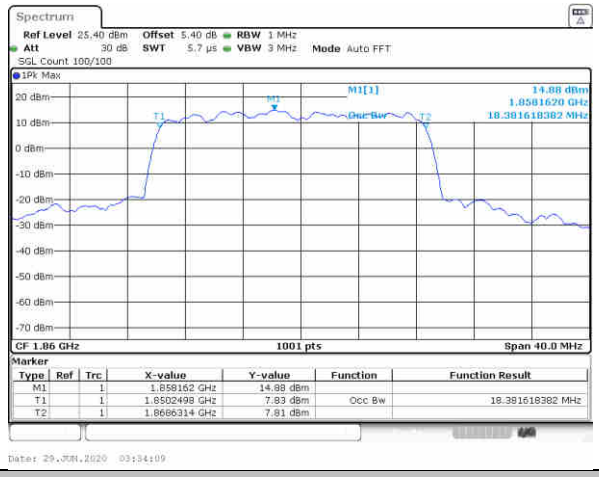
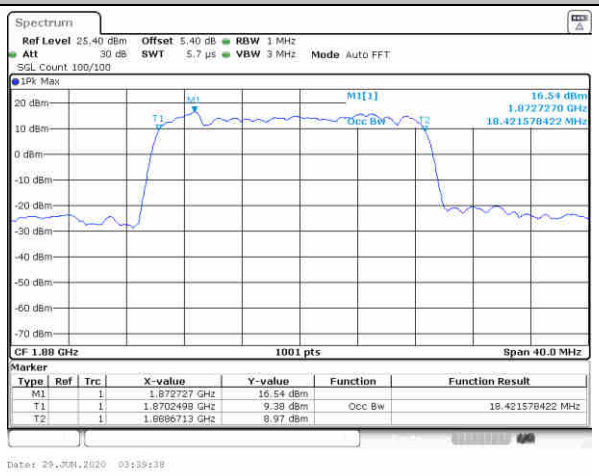
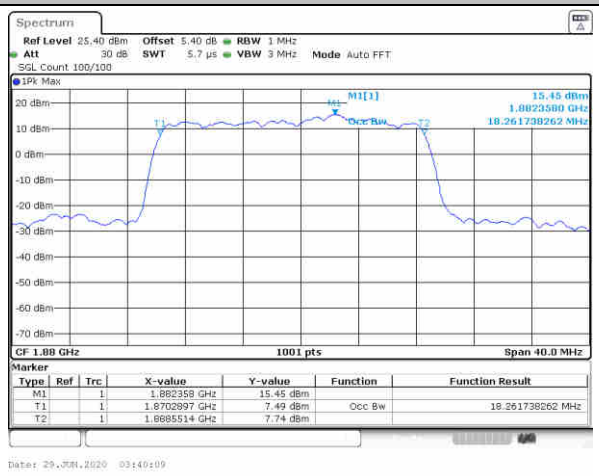
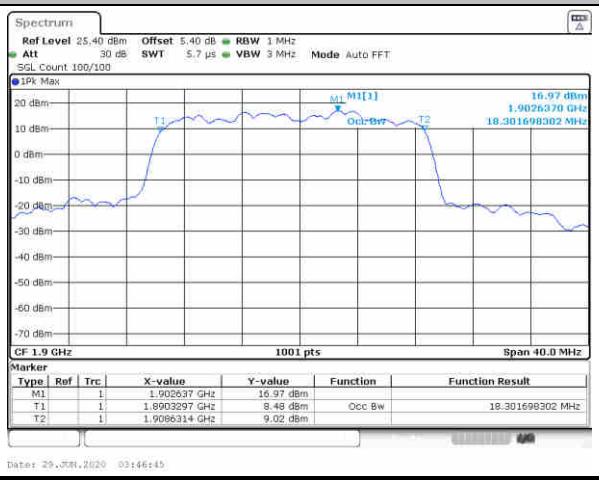
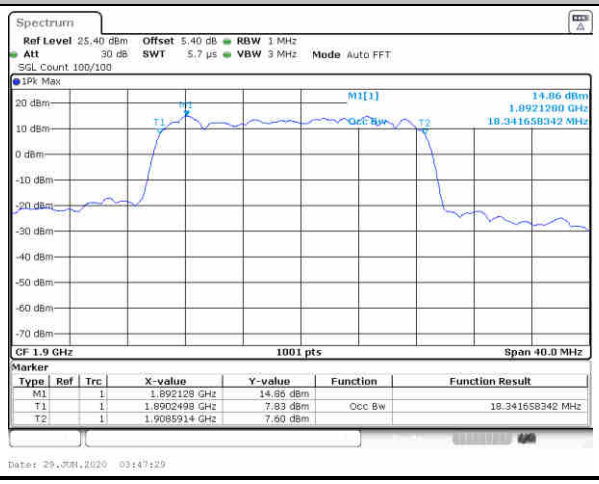
Middle Channel



Highest Channel



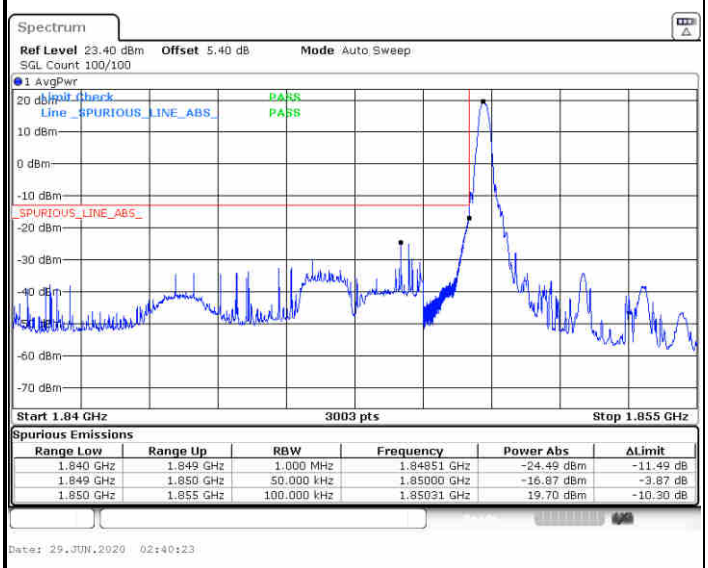
FR1 n2 / 20MHz / DFT-S OFDM	
QPSK	**16QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

FR1 n2 / 20MHz / DFT-S OFDM	
64QAM	**256QAM**
Lowest Channel	**Lowest Channel**
	
Middle Channel	**Middle Channel**
	
Highest Channel	**Highest Channel**
	

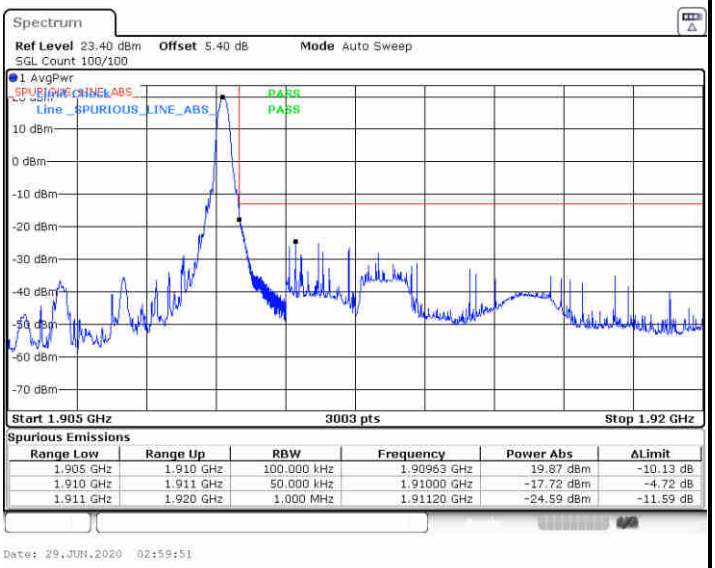
Conducted Band Edge

FR1 n2 / 5MHz / DFT-S OFDM / PI/2 BPSK

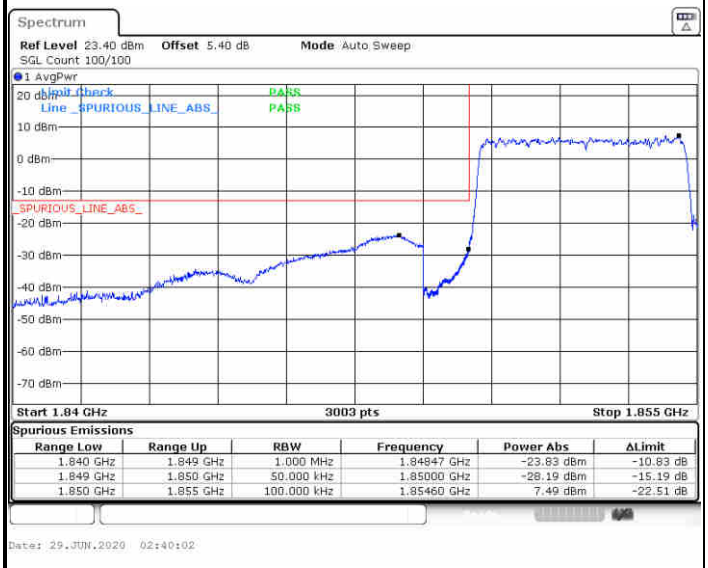
Lowest Band Edge / 1RB0



Highest Band Edge / 1RBMAX



Lowest Band Edge / Full RB



Highest Band Edge / Full RB