FCC RF Test Report

APPLICANT	: Shenzhen Gongjin Electronics Co.,Ltd.
EQUIPMENT	: Nokia Smart Node
BRAND NAME	: Nokia
MODEL NAME	: Nokia Multi-Standard Smart Node N77(SN5I77)
FCC ID	: V4VSN5I77
STANDARD	: 47 CFR Part 2, 27 Subpart O (3700-3980MHz)
CLASSIFICATION	: Licensed Non-Broadcast Station Transmitter (TNB)
TEST DATE(S)	: Mar. 31, 2023 ~ Apr 12, 2023

We, Sporton International Inc. (KunShan), 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 Inc. (KunShan), the test report shall not be reproduced except in full.

Note:

1. The Nokia Multi Standard Smart Node N77 can work in SA mode (5G Only): n77 MIMO (Model: SN5I77; FCC ID: V4VSN5I77).

2. The Nokia Multi Standard Smart Node N77 can work in NSA mode (5G+4G), provided that smart node 4G (Model SN4IBN; FCC ID: V4V1SN4IBN) devices and 5G (Model : SN5I77; FCC ID: V4VSN5I77) devices need to be used together(n77 MIMO+ B2/B14/B66 MIMO).

Jason Jia

Approved by: Jason Jia

ACCREDITED Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FG331457	Rev. 01	Initial issue of report	Jul. 31, 2023

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.4	§2.1046	Conducted Output Power	Reporting Only	PASS	-
	§27.50(j)(2)	Equivalent Isotropic Radiated Power (5G NR n77)	EIRP < 1640Watt		
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 §27.53(l)(1)	Conducted Band Edge Measurement (5G NR n77)	< 43+10log10(P[Watts])	PASS	-
3.8	§2.1051 §27.53(l)(1)	Conducted Spurious Emission (5G NR n77)	< 43+10log10(P[Watts])	PASS	-
3.9	§27.54	Frequency Stability Temperature & Voltage	Within Authorized Band	PASS	-
4.4	§2.1053 §27.53(l)(2)	Radiated Spurious Emission (5G NR n77)	< $43+10\log_{10}$(P[Watts])	PASS	Under limit 36.70 dB at 7590.000 MHz

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Applicant

Shenzhen Gongjin Electronics Co.,Ltd.
No.2 Danzi North Road, Kengzi Street, Pingshan District, Shenzhen, Guangdong, 518122, P.R. China

1.2 Manufacturer

Nokia Solutions and Networks Oy
Karakaari 7, 02610 Espoo, Finland

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Nokia Smart Node
Brand Name	Nokia
Model Name	Nokia Multi-Standard Smart Node N77(SN5I77)
FCC ID	V4VSN5I77
HW Version	V0.2
SW Version	1.2.26.47.77
EUT Stage	Identical Prototype

Remark: There are two types of EUT, original is sample 1, variant is sample 2, the differences are DDR and Oscillator's supplier. According to the differences, we choose sample 1 to full test and the sample 2 is verified the worst RSE mode for the differences..

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency	5G NR n77: 3700 MHz ~ 3980 MHz
SCS	30kHz
Bandwidth	n77 (30kHz): 40 / 50 / 60 / 70 / 80 / 90 / 100MHz
Antenna Gain	**<Ant. 1>** 5G NR n77: 6.14 dBi **<Ant. 2>** 5G NR n77: 8.16 dBi
Type of Modulation	CP-OFDM: QPSK / 16QAM / 64QAM / 256QAM

Remark:

1. 5GNR Tx is non-signaling mode (Control tool "QRCT").
2. The base station only support 5GNR full RB.
3. For SISO & UL MIMO mode, the testing has assessed only UL MIMO mode by referring to the higher output power. The UL MIMO mode is completely uncorrelated, so the directional gain is selected the maximum gain among all antennas.
4. The device supported NSA combinations, only combination of LTE worst band (Nokia Smart Node (SN4IBN)) and 5G NR n77(sample 1) test data is shown in the report.

1.5 Modification of EUT

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

1.6 Maximum EIRP and Emission Designator

5G NR n77 UL MIMO for SCS 30kHz		QPSK		16QAM / 64QAM / 256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)
40	3720.00 ~ 3960.00	3.7717	38M0G7D	3.8774	38M1W7D
50	3725.01 ~ 3954.99	3.6649	47M7G7D	3.8997	47M9W7D
60	3730.02 ~ 3949.98	3.8244	57M9G7D	4.0978	58M0W7D
70	3735.00 ~ 3945.00	3.7805	67M6G7D	4.1123	67M6W7D
80	3740.01 ~ 3939.99	3.9091	78M0G7D	3.8732	78M2W7D
90	3745.02 ~ 3934.98	3.9770	87M6G7D	3.9542	87M9W7D
100	3750.00 ~ 3930.00	3.8507	97M5G7D	3.8729	98M1W7D

Note: All modulations have been tested, and only the worst test results of PSK & QAM are shown in the report.

1.7 Testing Location

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

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
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	Manufacturer	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24al

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, 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 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		
		10	15	20	40	50	60	70	80	90	100	PI/2 BPSK	QPSK	16QAM	64QAM	256 QAM	1	Partial	Full	L	M	H
Max. Output Power	n77	-	-	-	v	v	v	v	v	v	v	-	v	v	v	v	-	-	v	v	v	v
Peak-to-Average Ratio	n77	-	-	-							v	-	v				-	-	v	v	v	v
26dB and 99% Bandwidth	n77	-	-	-	v	v	v	v	v	v	v	-	v	v	v	v	-	-	v		v	
Conducted Band Edge	n77	-	-	-	v	v	v	v	v	v	v	-	v	v	v	v	-	-	v	v		v
Conducted Spurious Emission	n77	-	-	-	v	v	v	v	v	v	v	-	v	v	v	v	-	-	v	v	v	v
Frequency Stability	n77	-	-	-							v	-	v				-	-	v	v		v
E.I.R.P	n77	-	-	-	v	v	v	v	v	v	v	-	v	v	v	v	-	-	v	v	v	v
Radiated Spurious Emission	n77	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. Frequency Stability : Normal Voltage = 12V; Low Voltage =10V; High Voltage =14V.																					

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.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	Shielded cable DC O/P 1.8m, Unshielded AC I/P cable 1.8m
3.	Notebook	Lenovo	V130-15IKB005	N/A	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
4.	Nokia Smart Node (SN4IBN)	Nokia	SN4IBN	V4V1SN4IBN	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 + attenuator factor.

Following shows an offset computation example with cable loss 7.8 dB and 10dB attenuator.

Example :

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

= 7.8 + 10 = 17.8 (dB)

2.5 Frequency List of Low/Middle/High Channels

5G n77 (30kHz) Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
100	Channel	650000	656000	662000
	Frequency	3750	3840	3930
90	Channel	649668	656000	662332
	Frequency	3745.02	3840	3934.98
80	Channel	649334	656000	662666
	Frequency	3740.01	3840	3939.99
70	Channel	649000	656000	663000
	Frequency	3735	3840	3945
60	Channel	648668	656000	663332
	Frequency	3730.02	3840	3949.98
50	Channel	648334	656000	663666
	Frequency	3725.01	3840	3954.99
40	Channel	648000	656000	664000
	Frequency	3720	3840	3960

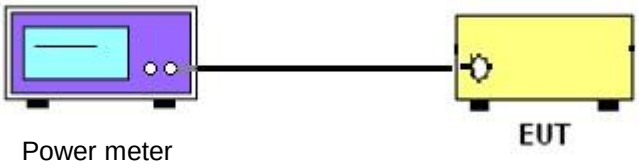
3 Conducted Test Items

3.1 Measuring Instruments

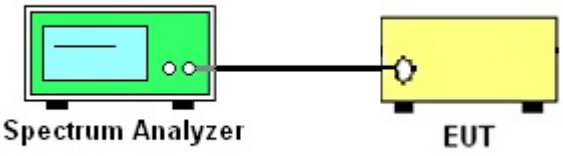
See list of measuring instruments of this test report.

3.2 Test Setup

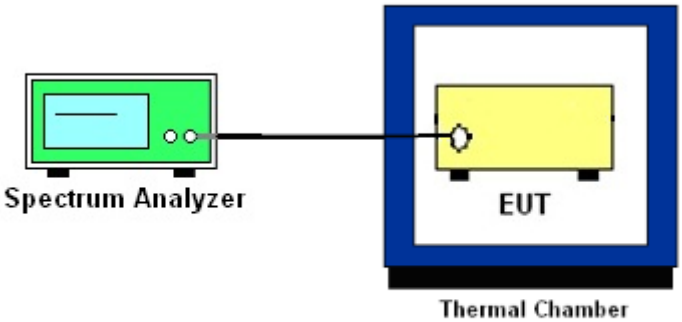
3.2.1 Conducted Output Power



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 EIRP

3.4.1 Description of the Conducted Output Power Measurement and 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 power of each fixed or base station transmitting in the 3700–3980 MHz band and situated in any geographic location is limited to an EIRP of 1640 Watts/MHz

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 5.2.6 (PAPR).
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set EUT in maximum power output.
4. Set the RBW = 1MHz, VBW = 3MHz, Detector = Peak, Trace mode = max hold, Set span ≥ 2 × OBW in spectrum analyzer.
5. Set the RBW = 1MHz, VBW = 3MHz, Detector = power averaging, Trace mode = max hold, Set span ≥ 2 × OBW in spectrum analyzer.
6. Add [10 log (1/duty cycle)] to the measured maximum power level to compute the average power during continuous transmission.
7. PAPR (dB) = P_{Pk} (dBm) − P_{Avg} (dBm)

   where

   PAPR peak-to-average power ratio, in dB

   P_{Pk} measured peak power level, in dBm

   P_{Avg} measured average power level, in dBm
8. 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

27.53(l)(1)

For base station operations in the 3700–3980 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz. Compliance with this paragraph is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz 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.

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 or a narrower RBW was used (generally limited to no less than 1% of the OBW) and the measured power was integrated over the full required measurement bandwidth.
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.

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.

3.9.4 Test Result

The EUT was operated at the lowest and highest channel, and the frequency at these points shall be recorded as FL and FH respectively. The test results shows that both FL and FH fall within the frequency range of the device design to determine frequency stability

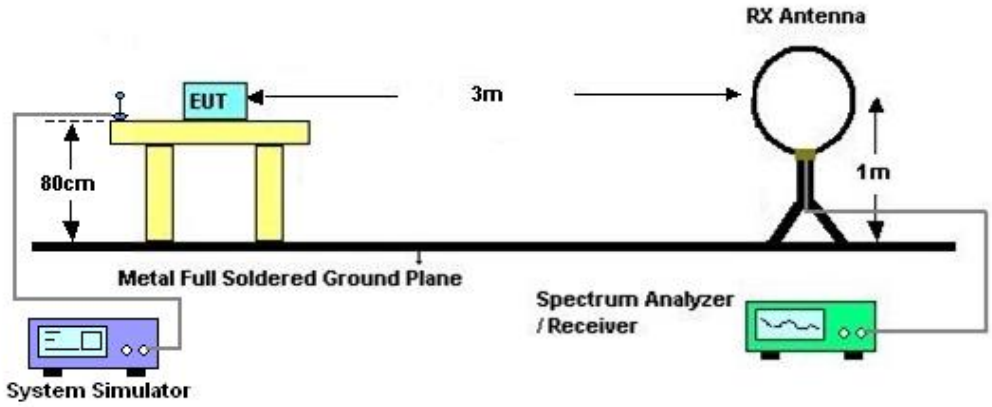
4 Radiated Test Items

4.1 Measuring Instruments

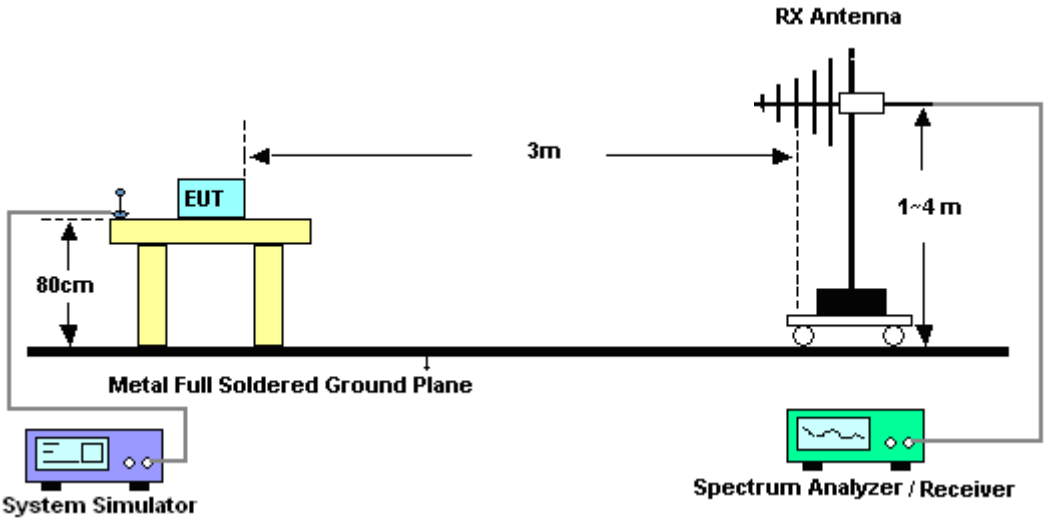
See list of measuring instruments of this test report.

4.2 Test Setup

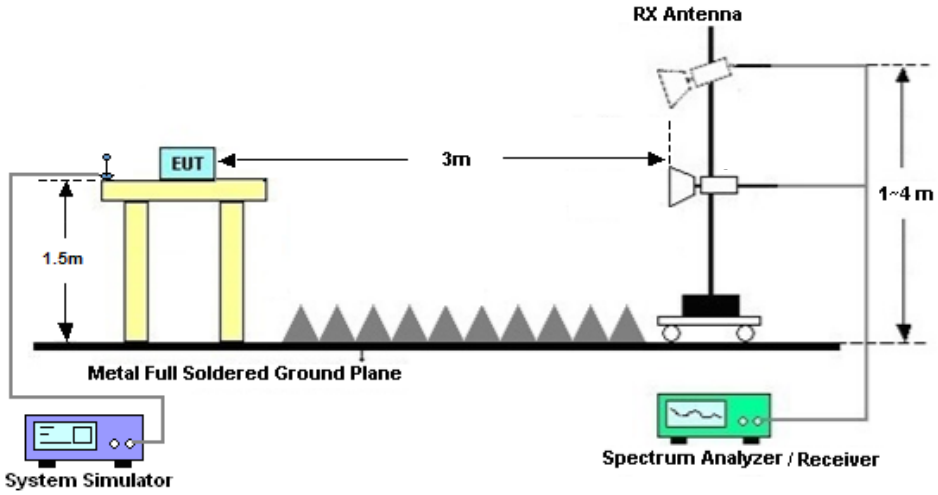
4.2.1 For radiated test below 30MHz



4.2.2 For radiated test from 30MHz to 1GHz



4.2.3 For radiated test above 1GHz



4.3 Test Result of Radiated Test

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

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	Oct. 12, 2022	Mar. 31, 2023~ Apr. 03, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2023	Mar. 31, 2023~ Apr. 03, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2023	Mar. 31, 2023~ Apr. 03, 2023	Jan. 04, 2024	Conducted (TH01-KS)
Temperature &humidity chamber	Hongzhan	LP-150U	H20140114 40	-40~+150°C 20%~95%RH	Jul. 15, 2022	Mar. 31, 2023~ Apr. 03, 2023	Jul. 14, 2023	Conducted (TH01-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY57471079	10Hz-44G,MAX 30dB	Oct. 12, 2022	Apr. 12, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	May 24, 2022	Apr. 12, 2023	May 23, 2023	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1284	1GHz~18GHz	Oct. 16, 2022	Apr. 12, 2023	Oct. 15, 2023	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 08, 2023	Apr. 12, 2023	Jan. 07, 2024	Radiation (03CH04-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	May 24, 2022	Apr. 12, 2023	May 23, 2023	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2023	Apr. 12, 2023	Jan. 04, 2024	Radiation (03CH04-KS)
high gain Amplifier	EM	EM01G18GA	060840	1Ghz-18Ghz	Oct. 12, 2022	Apr. 12, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
Amplifier	Agilent	8449B	3008A02370	1Ghz-18Ghz	Oct. 12, 2022	Apr. 12, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Apr. 12, 2023	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Apr. 12, 2023	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Apr. 12, 2023	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 Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.46 dB
Conducted Emissions	±0.48 dB
Occupied Channel Bandwidth	±0.1 %

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

---------- THE END ----------

Appendix A. Test Results of Conducted Test

Test Engineer :	Simle Wang	Temperature :	22~23℃
		Relative Humidity :	40~42%

Conducted Output Power(Average power) and EIRP

UL MIMO < Ant 1+2>:

BW	Modulation	Channel	Frequency MHz	Power	Gain	EIRP (W)
40M	QPSK	648000	3720	27.44	8.16	3.6315
	QPSK	656000	3840	27.36	8.16	3.5609
	QPSK	664000	3960	27.61	8.16	3.7717
50M	QPSK	648334	3725.01	27.22	8.16	3.4480
	QPSK	656000	3840	27.34	8.16	3.5495
	QPSK	663666	3954.99	27.48	8.16	3.6649
60M	QPSK	648668	3730.02	27.67	8.16	3.8244
	QPSK	656000	3840	27.58	8.16	3.7459
	QPSK	663332	3949.98	27.50	8.16	3.6816
70M	QPSK	649000	3735	27.62	8.16	3.7805
	QPSK	656000	3840	27.53	8.16	3.7052
	QPSK	663000	3945	27.52	8.16	3.6985
80M	QPSK	649334	3740.01	27.76	8.16	3.9091
	QPSK	656000	3840	27.70	8.16	3.8517
	QPSK	662666	3939.99	27.68	8.16	3.8376
90M	QPSK	649668	3745.02	27.79	8.16	3.9361
	QPSK	656000	3840	27.84	8.16	3.9770
	QPSK	662332	3934.98	27.56	8.16	3.7292
100M	QPSK	650000	3750	27.50	8.16	3.6773
	QPSK	656000	3840	27.70	8.16	3.8507
	QPSK	662000	3930	27.56	8.16	3.7328
40M	16QAM	648000	3720	27.28	8.16	3.4997
	16QAM	656000	3840	27.10	8.16	3.3578
	16QAM	664000	3960	27.05	8.16	3.3194
50M	16QAM	648334	3725.01	27.28	8.16	3.5000
	16QAM	656000	3840	27.29	8.16	3.5039
	16QAM	663666	3954.99	27.48	8.16	3.6647
60M	16QAM	648668	3730.02	27.29	8.16	3.5080
	16QAM	656000	3840	27.14	8.16	3.3900
	16QAM	663332	3949.98	27.35	8.16	3.5531
70M	16QAM	649000	3735	27.33	8.16	3.5364

	16QAM	656000	3840	27.35	8.16	3.5533
	16QAM	663000	3945	27.29	8.16	3.5087
80M	16QAM	649334	3740.01	27.21	8.16	3.4441
	16QAM	656000	3840	27.07	8.16	3.3346
	16QAM	662666	3939.99	27.13	8.16	3.3813
90M	16QAM	649668	3745.02	27.55	8.16	3.7274
	16QAM	656000	3840	27.81	8.16	3.9542
	16QAM	662332	3934.98	27.80	8.16	3.9469
100M	16QAM	650000	3750	27.28	8.16	3.4974
	16QAM	656000	3840	27.29	8.16	3.5093
	16QAM	662000	3930	27.38	8.16	3.5776
40M	64QAM	648000	3720	26.92	8.16	3.2194
	64QAM	656000	3840	27.03	8.16	3.3060
	64QAM	664000	3960	27.42	8.16	3.6101
50M	64QAM	648334	3725.01	27.72	8.16	3.8766
	64QAM	656000	3840	27.62	8.16	3.7859
	64QAM	663666	3954.99	27.75	8.16	3.8997
60M	64QAM	648668	3730.02	27.53	8.16	3.7031
	64QAM	656000	3840	27.59	8.16	3.7545
	64QAM	663332	3949.98	27.70	8.16	3.8507
70M	64QAM	649000	3735	27.60	8.16	3.7634
	64QAM	656000	3840	27.57	8.16	3.7373
	64QAM	663000	3945	27.69	8.16	3.8463
80M	64QAM	649334	3740.01	27.69	8.16	3.8464
	64QAM	656000	3840	27.65	8.16	3.8076
	64QAM	662666	3939.99	27.17	8.16	3.4158
90M	64QAM	649668	3745.02	27.76	8.16	3.9042
	64QAM	656000	3840	27.69	8.16	3.8472
	64QAM	662332	3934.98	27.77	8.16	3.9136
100M	64QAM	650000	3750	27.72	8.16	3.8729
	64QAM	656000	3840	27.63	8.16	3.7935
	64QAM	662000	3930	27.40	8.16	3.5953
40M	256QAM	648000	3720	27.70	8.16	3.8552
	256QAM	656000	3840	27.73	8.16	3.8774
	256QAM	664000	3960	27.71	8.16	3.8598
50M	256QAM	648334	3725.01	27.35	8.16	3.5584
	256QAM	656000	3840	27.71	8.16	3.8652
	256QAM	663666	3954.99	27.67	8.16	3.8287
60M	256QAM	648668	3730.02	27.88	8.16	4.0138
	256QAM	656000	3840	27.82	8.16	3.9639
	256QAM	663332	3949.98	27.97	8.16	4.0978

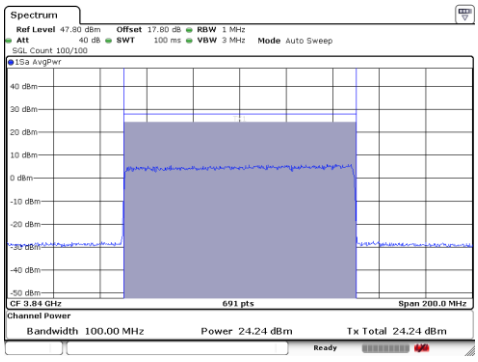
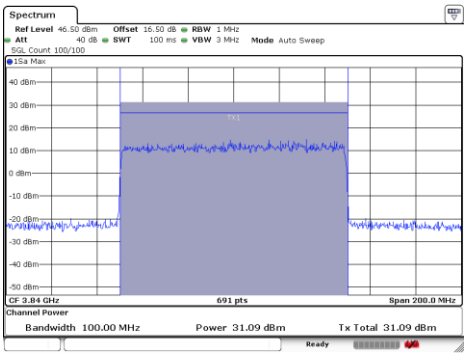
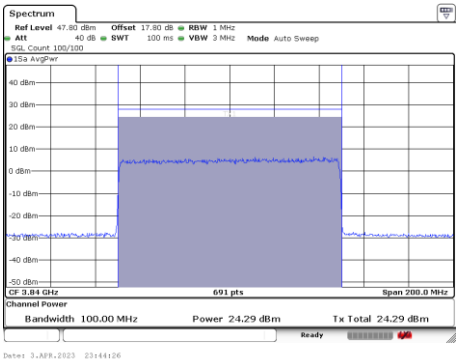
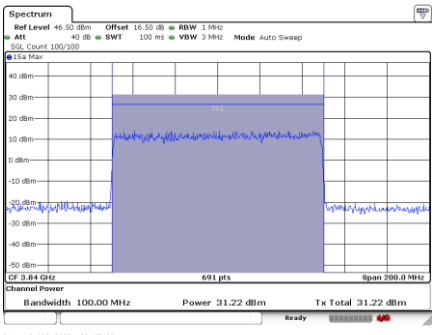
70M	256QAM	649000	3735	27.62	8.16	3.7805
	256QAM	656000	3840	27.75	8.16	3.8952
	256QAM	663000	3945	27.98	8.16	4.1123
80M	256QAM	649334	3740.01	27.63	8.16	3.7935
	256QAM	656000	3840	27.72	8.16	3.8732
	256QAM	662666	3939.99	27.39	8.16	3.5877
90M	256QAM	649668	3745.02	27.63	8.16	3.7893
	256QAM	656000	3840	27.71	8.16	3.8597
	256QAM	662332	3934.98	27.63	8.16	3.7936
100M	256QAM	650000	3750	27.71	8.16	3.8595
	256QAM	656000	3840	27.68	8.16	3.8373
	256QAM	662000	3930	27.66	8.16	3.8197

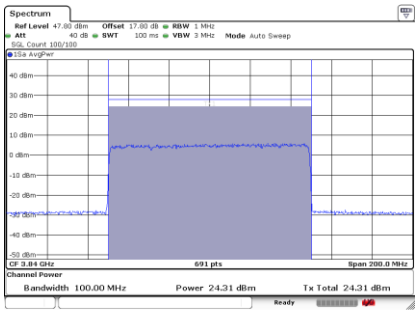
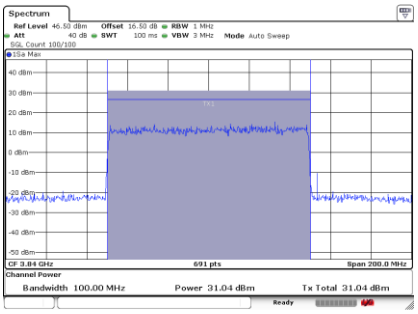
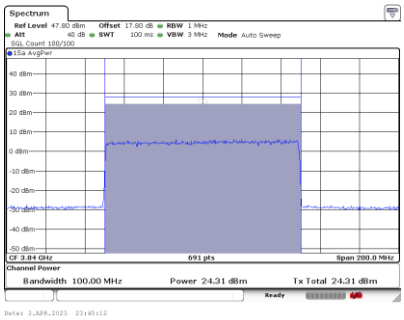
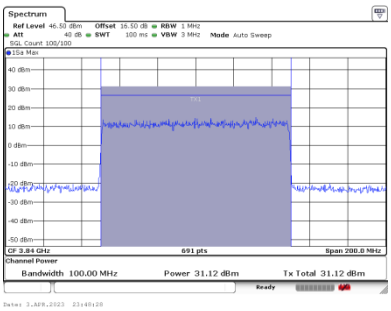
R1 n77

Peak-to-Average Ratio

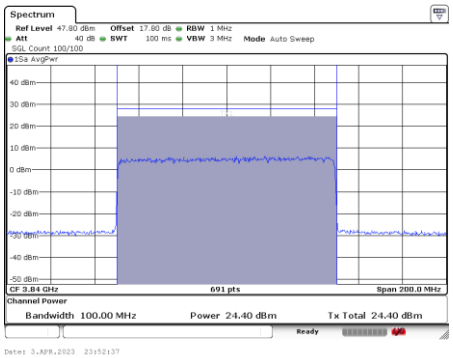
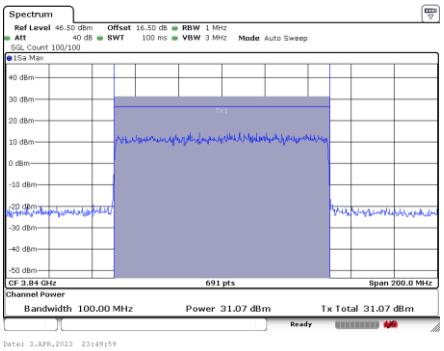
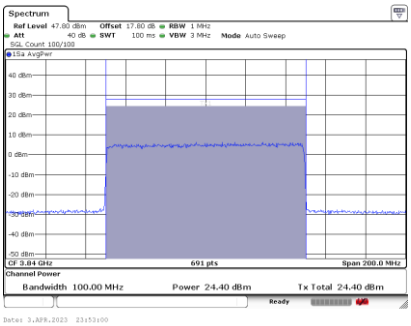
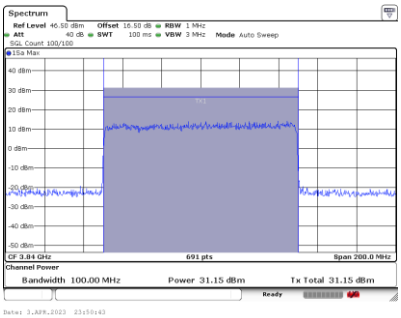
Mode	FR1 n77 / 100MHz / OFDM				
Mod.	100M ANT1				Limit: 13dB
RB Size	QPSK	16QAM	64QAM	256QAM	Result
Middle CH	6.85	6.93	6.73	6.81	PASS
Mod.	100M ANT2				Limit: 13dB
RB Size	QPSK	16QAM	64QAM	256QAM	Result
Middle CH	6.67	6.75	6.76	6.68	PASS

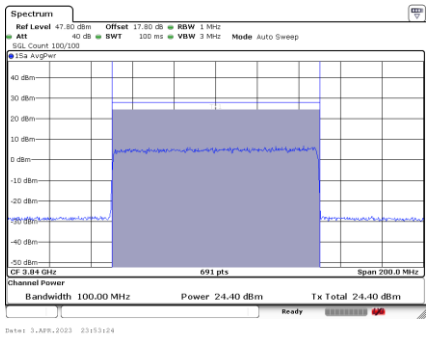
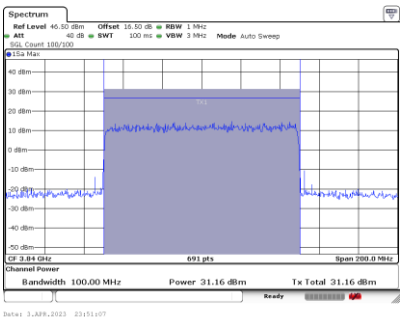
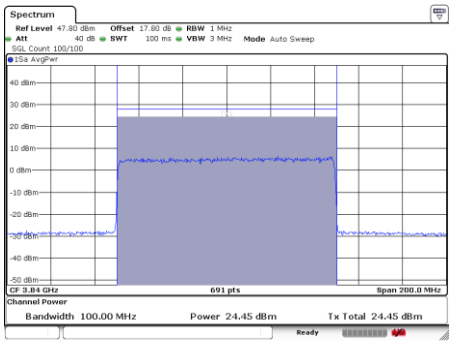
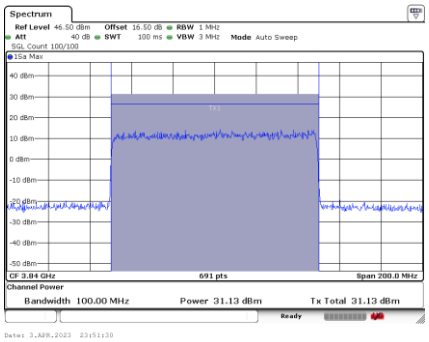
100M-ANT1

QPSK-A	QPSK-P
	
16QAM-A	**16QAM-P**
	

64QAM-A	64QAM-P
	
256QAM-A	**256QAM-P**
	

100M-ANT2

QPSK-A	QPSK-P
	
16QAM-A	**16QAM-P**
	

64QAM-A	64QAM-P
	
256QAM-A	**256QAM-P**
	

26DB Bandwidth

Mode	FR1 n77 : 26dB BW(MHz) / CP			
ANT.	Ant1			
BW	40MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	40.28	40.44	40.68	40.68

ANT.	Ant2			
BW	40MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	40.28	40.36	40.28	40.44

Mode	FR1 n77 : 26dB BW(MHz) / CP			
ANT.	Ant1			
BW	50MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	49.95	49.85	49.95	49.75

ANT.	Ant2			
BW	50MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	49.95	49.95	49.95	49.85

Mode	FR1 n77 : 26dB BW(MHz) / CP			
ANT.	Ant1			
BW	60MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	60.66	60.42	60.78	60.30

ANT.	Ant2			
BW	60MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	60.54	60.42	60.66	60.42

Mode	FR1 n77 : 26dB BW(MHz) / CP			
ANT.	Ant1			
BW	70MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	70.35	70.35	70.35	70.35

ANT.	Ant2			
BW	70MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	70.35	70.35	70.21	70.35

Mode	FR1 n77 : 26dB BW(MHz) / CP			
ANT.	Ant1			
BW	80MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	82.32	82.00	82.16	82.32

ANT.	Ant2			
BW	80MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	82.48	82.16	82.32	82.48

Mode	FR1 n77 : 26dB BW(MHz) / CP			
ANT.	Ant1			
BW	90MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	92.07	92.43	92.07	92.25

ANT.	Ant2			
BW	90MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	92.43	92.61	92.43	92.25

Mode	FR1 n77 : 26dB BW(MHz) / CP			
ANT.	Ant1			
BW	100MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	102.7	102.7	102.5	102.7

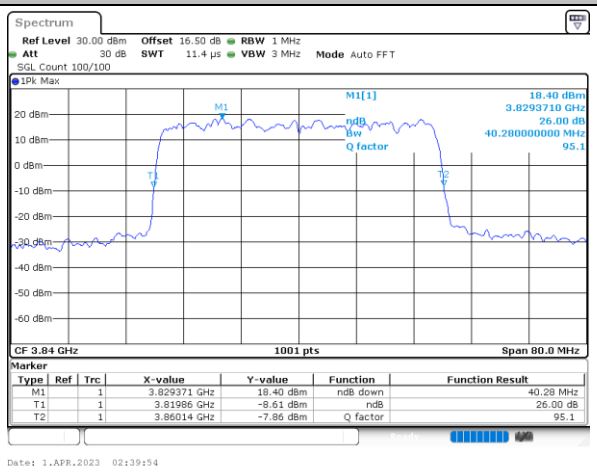
ANT.	Ant2			
BW	100MHz			
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	102.3	102.3	102.7	102.7

40M-ANT1

FR1 n77 / 40MHz / CP

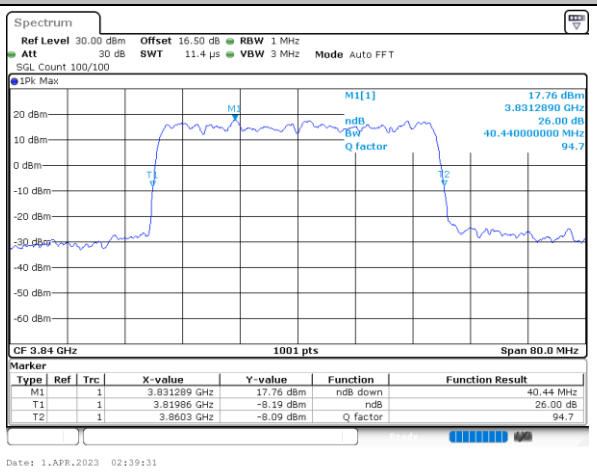
QPSK

Middle Channel



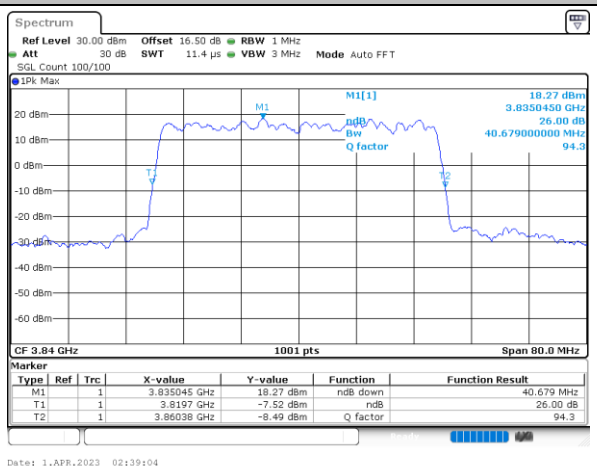
16QAM

Middle Channel



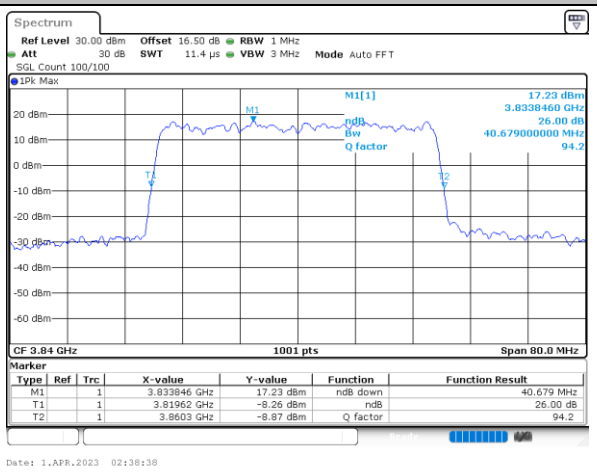
64QAM

Middle Channel



256QAM

Middle Channel

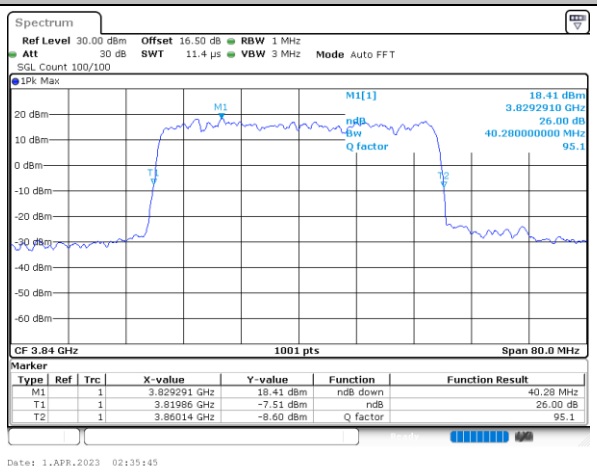


40M-ANT2

FR1 n77 / 40MHz / CP

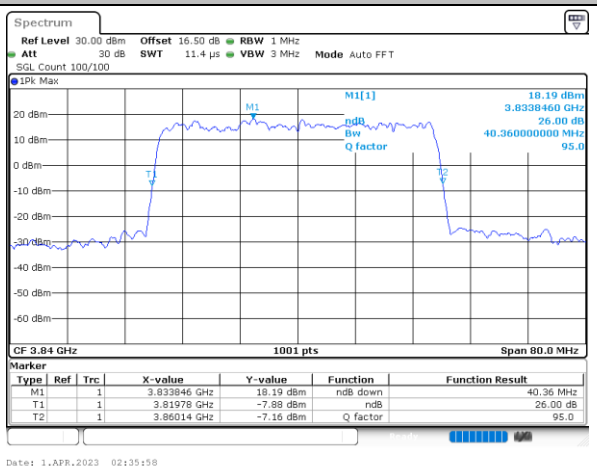
QPSK

Middle Channel



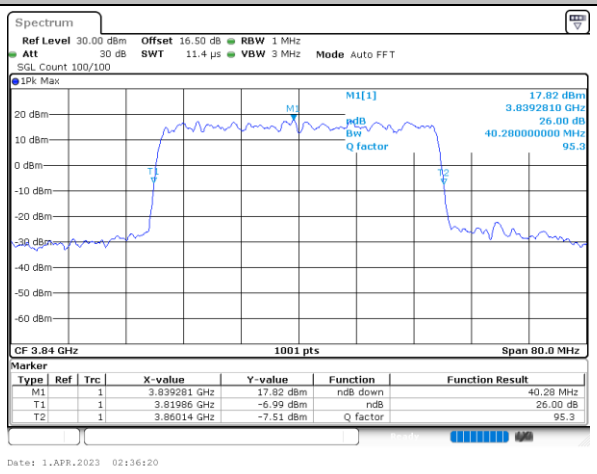
16QAM

Middle Channel



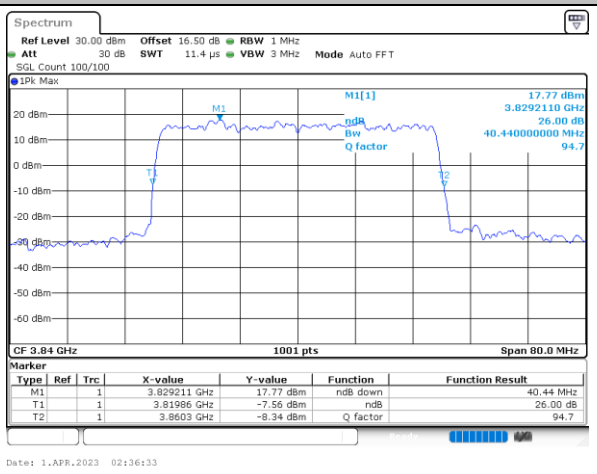
64QAM

Middle Channel



256QAM

Middle Channel

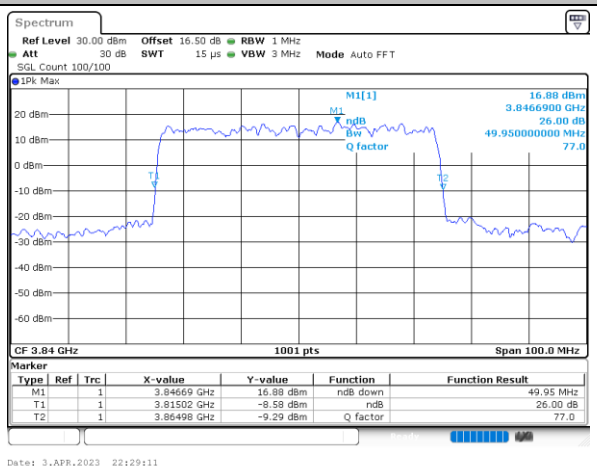


50M-ANT1

FR1 n77 / 50MHz / CP

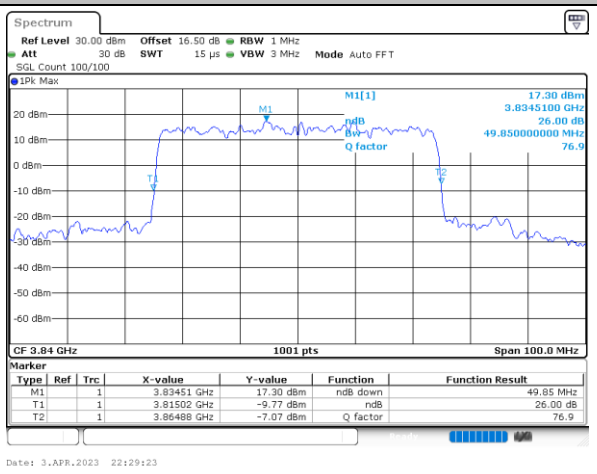
QPSK

Middle Channel



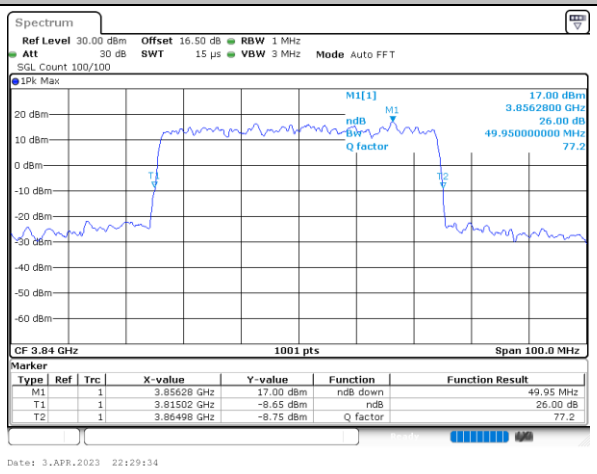
16QAM

Middle Channel



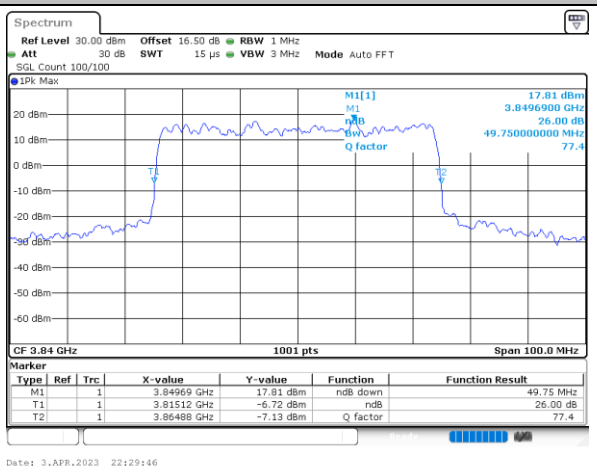
64QAM

Middle Channel



256QAM

Middle Channel

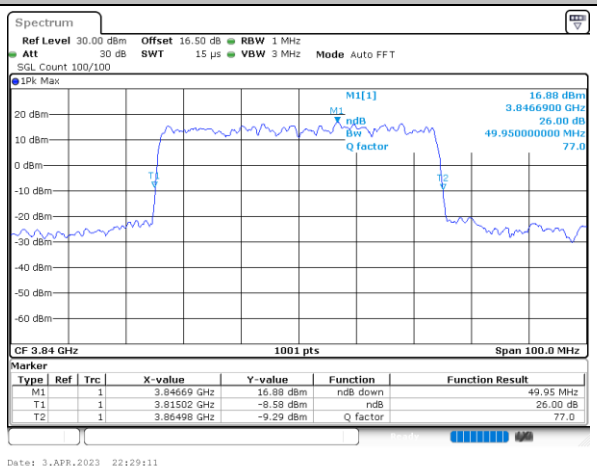


50M-ANT2

FR1 n77 / 50MHz / CP

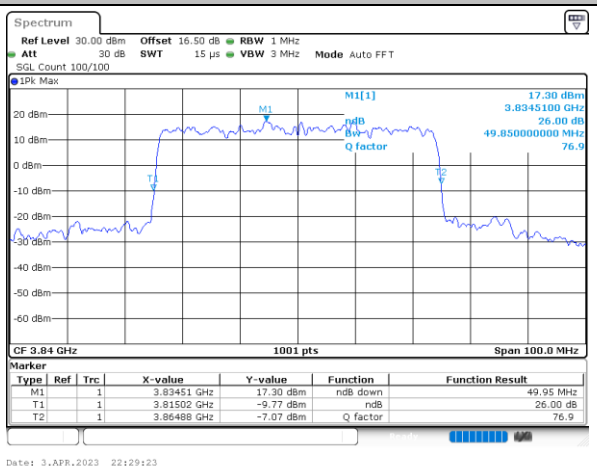
QPSK

Middle Channel



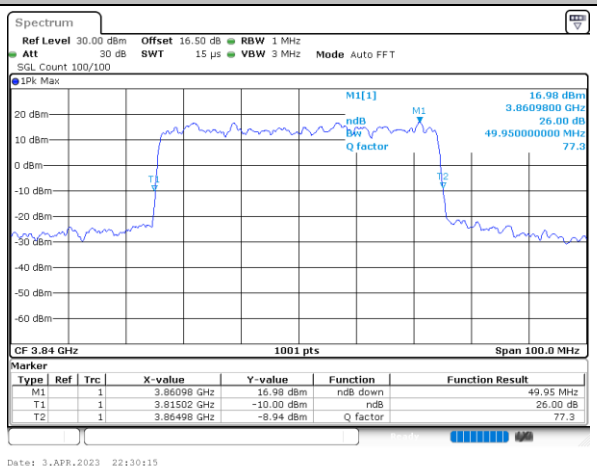
16QAM

Middle Channel



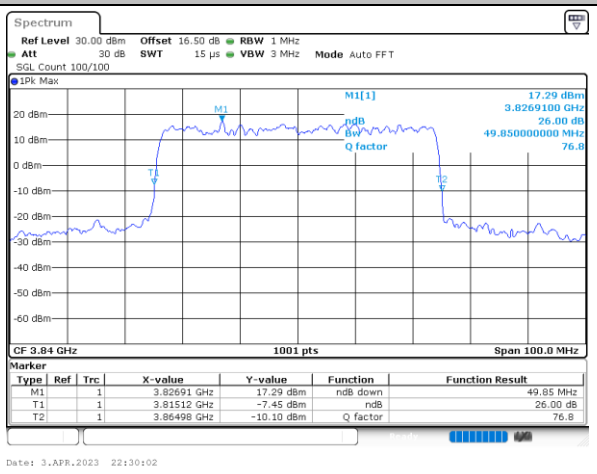
64QAM

Middle Channel



256QAM

Middle Channel

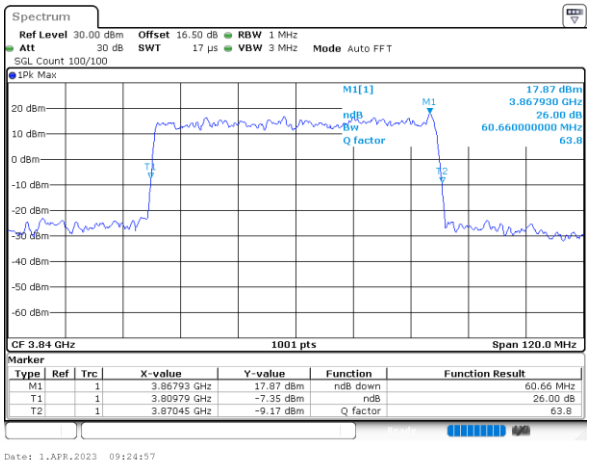


60M-ANT1

FR1 n77 / 60MHz / CP

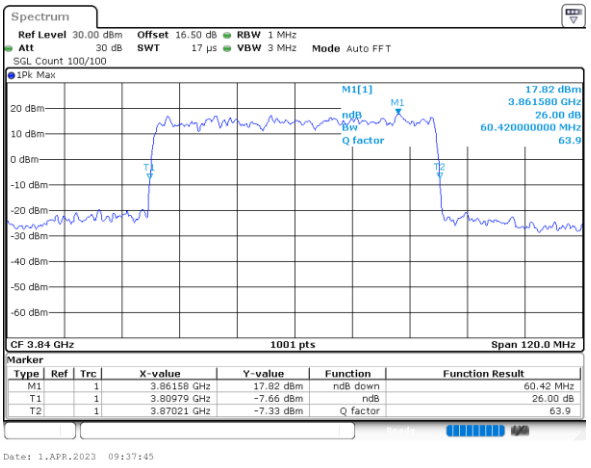
QPSK

Middle Channel



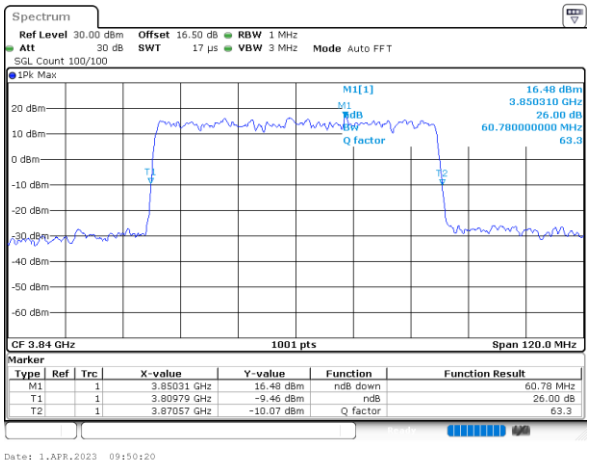
16QAM

Middle Channel



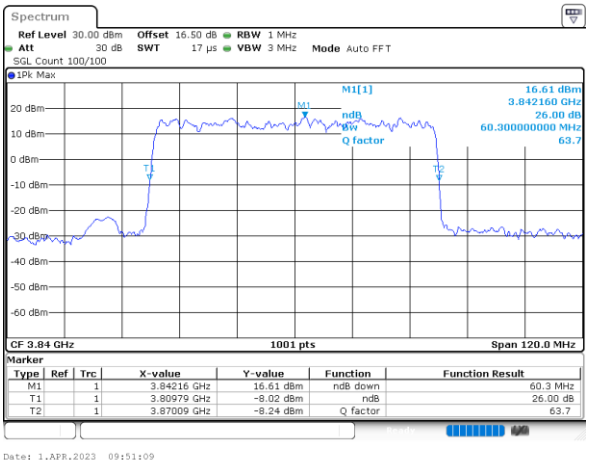
64QAM

Middle Channel



256QAM

Middle Channel

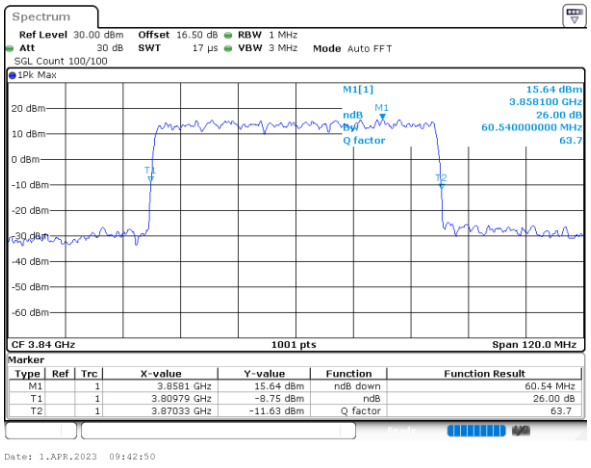


60M-ANT2

FR1 n77 / 60MHz / CP

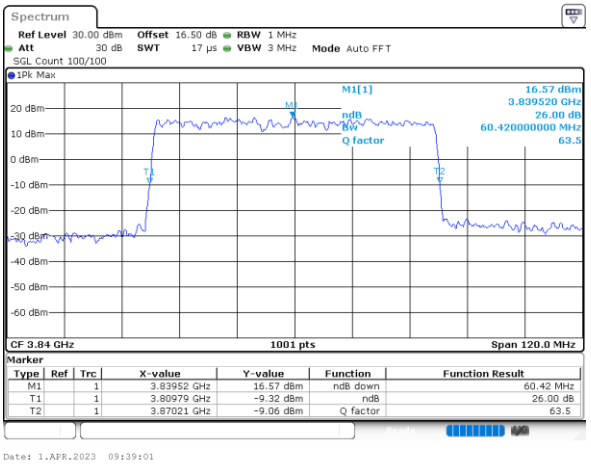
QPSK

Middle Channel



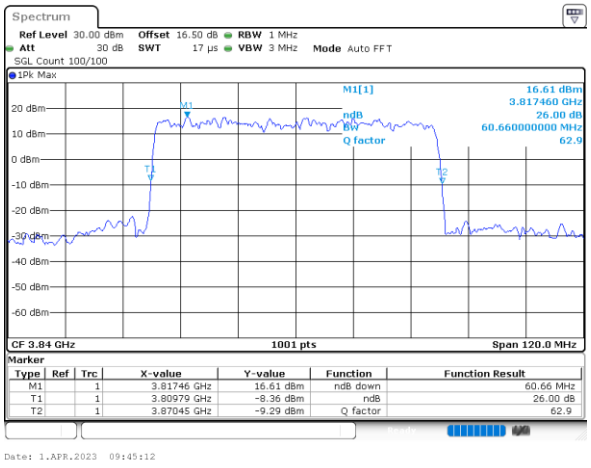
16QAM

Middle Channel



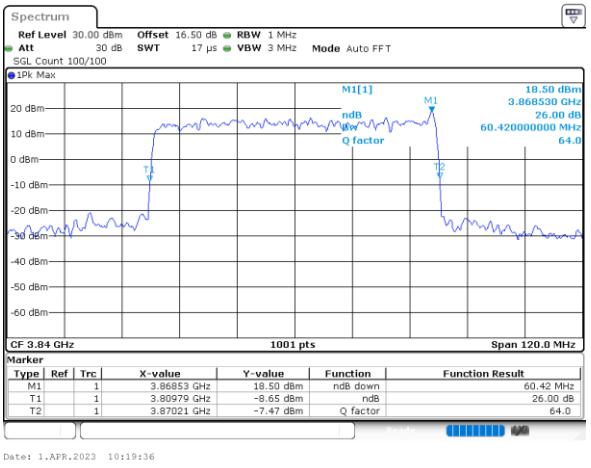
64QAM

Middle Channel



256QAM

Middle Channel

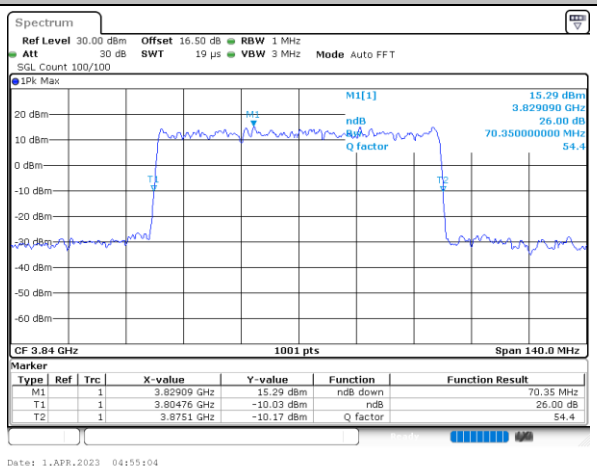


70M-ANT1

FR1 n77 / 70MHz / CP

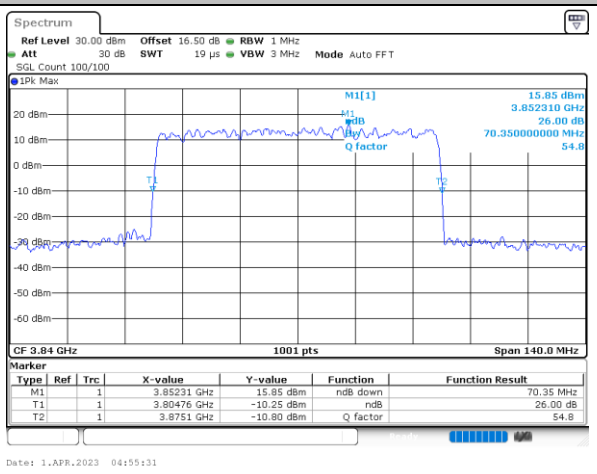
QPSK

Middle Channel



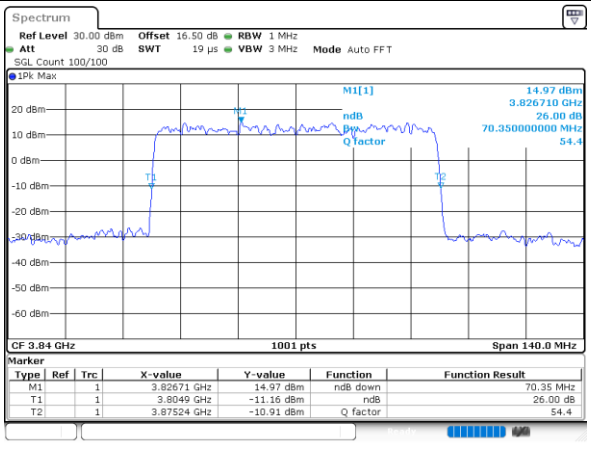
16QAM

Middle Channel



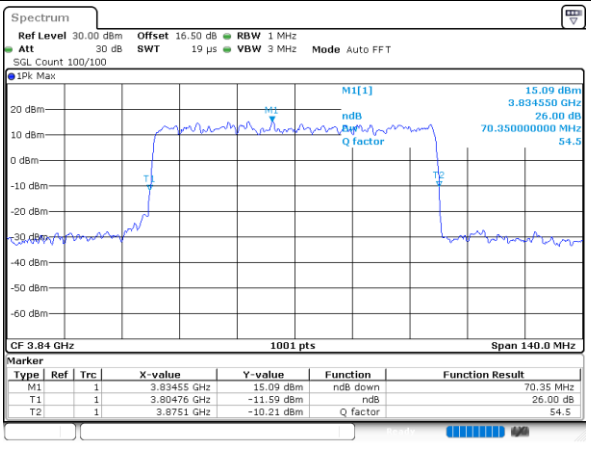
64QAM

Middle Channel



256QAM

Middle Channel

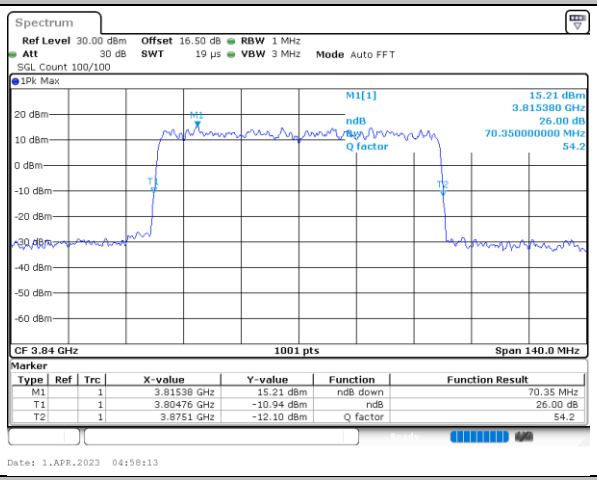


70M-ANT2

FR1 n77 / 70MHz / CP

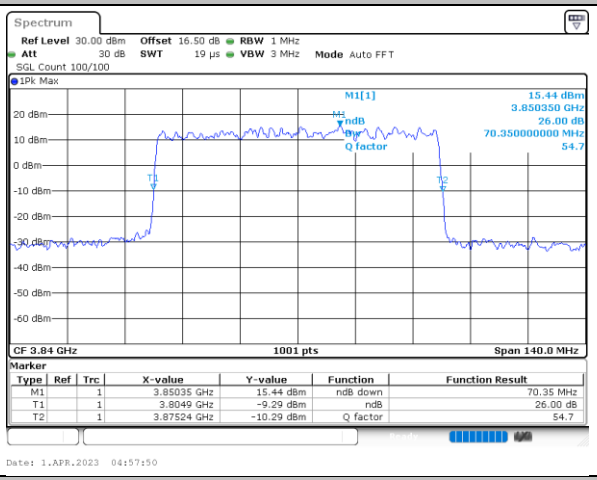
QPSK

Middle Channel



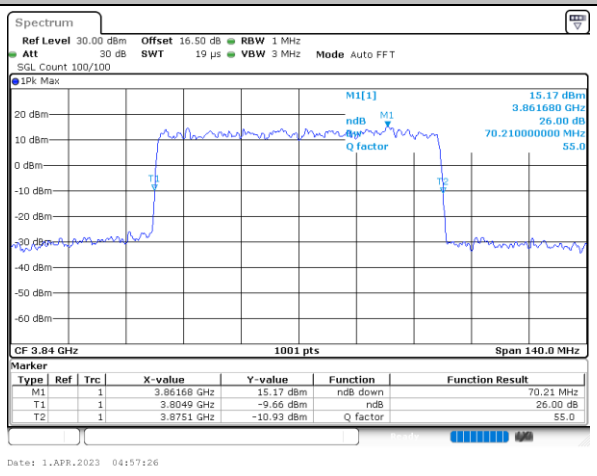
16QAM

Middle Channel



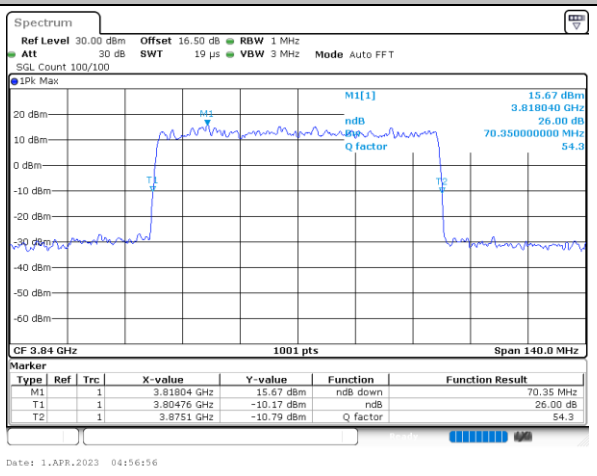
64QAM

Middle Channel



256QAM

Middle Channel

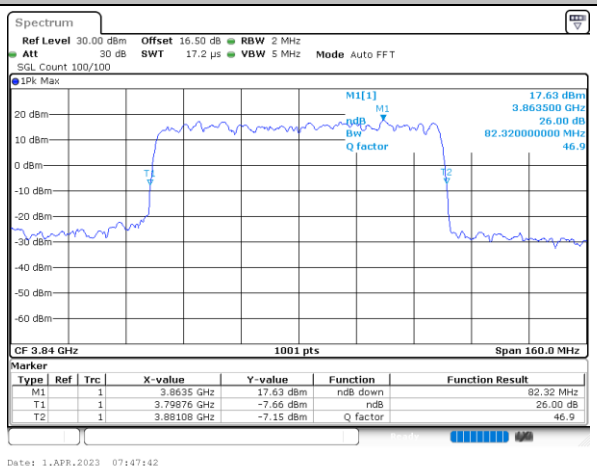


80M-ANT1

FR1 n77 / 80MHz / CP

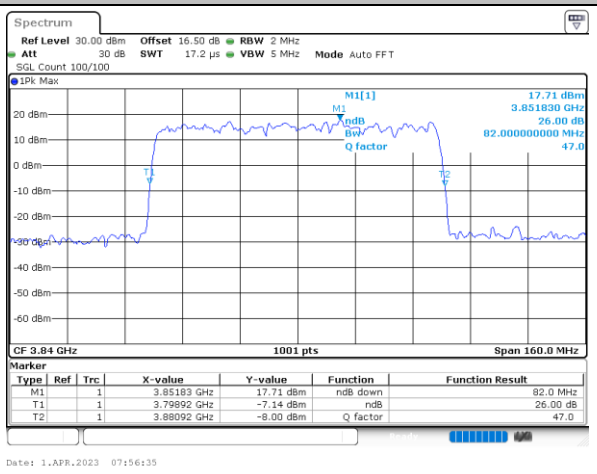
QPSK

Middle Channel



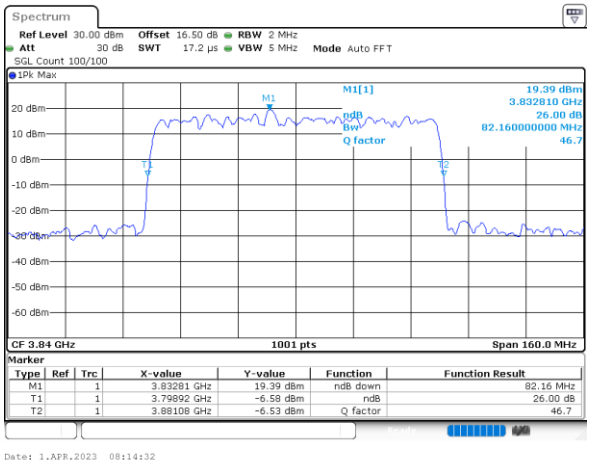
16QAM

Middle Channel



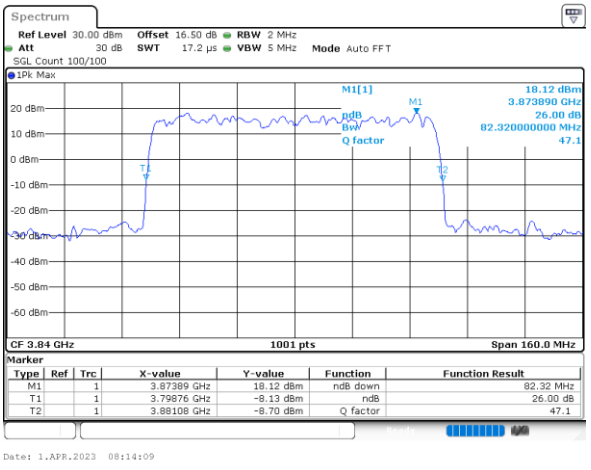
64QAM

Middle Channel



256QAM

Middle Channel

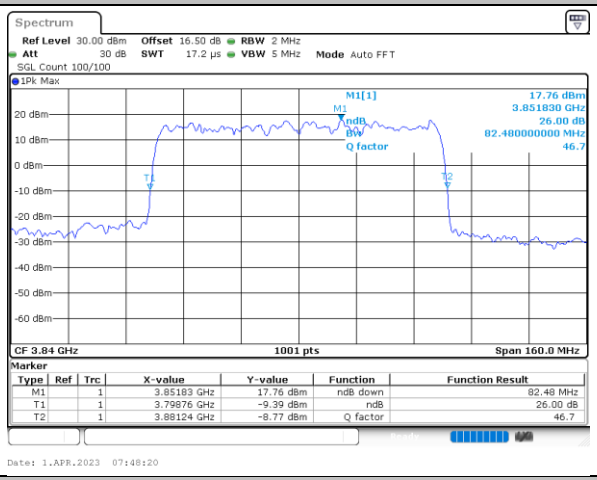


80M-ANT2

FR1 n77 / 80MHz / CP

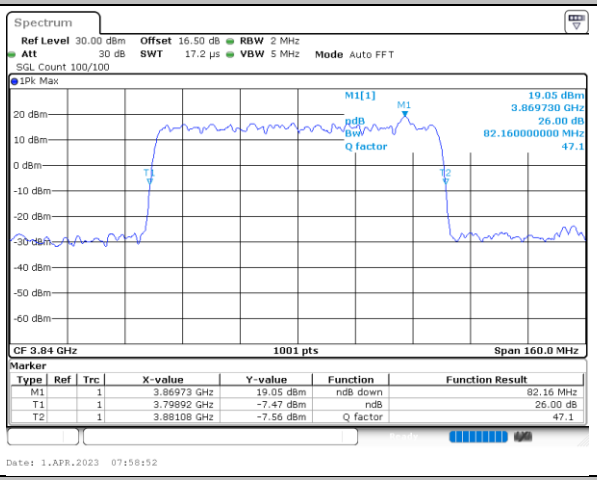
QPSK

Middle Channel



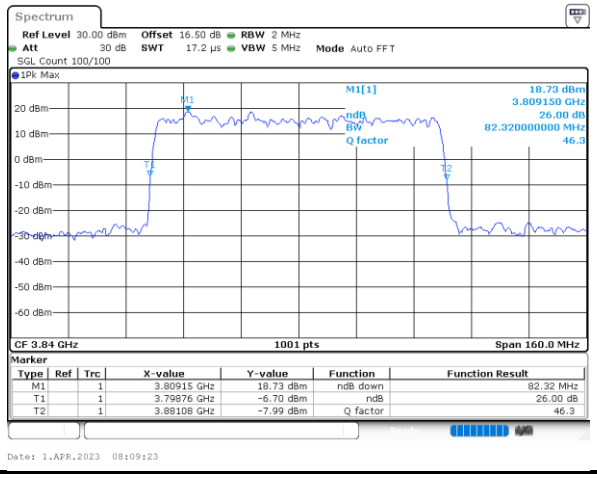
16QAM

Middle Channel



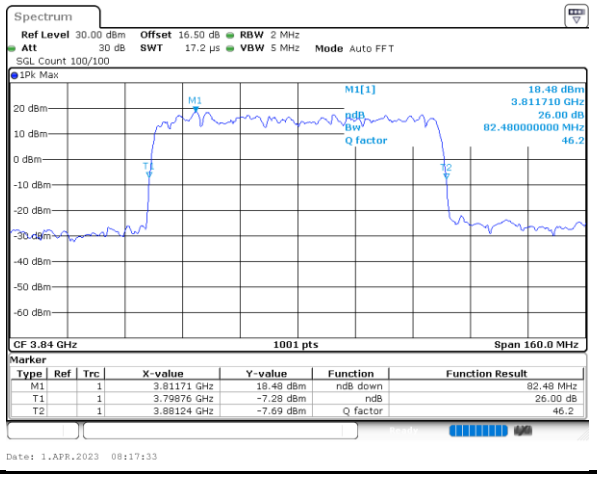
64QAM

Middle Channel



256QAM

Middle Channel

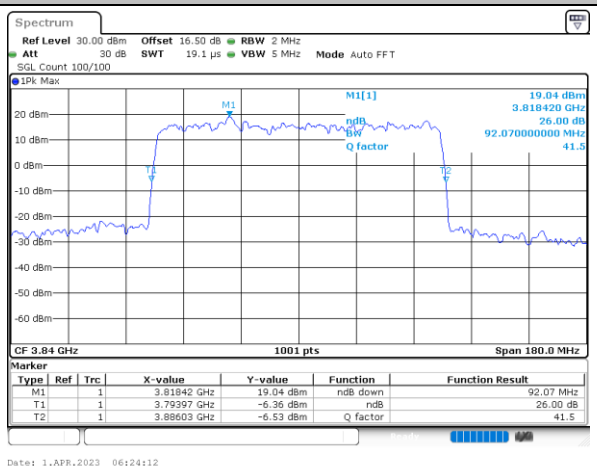


90M-ANT1

FR1 n77 / 90MHz / CP

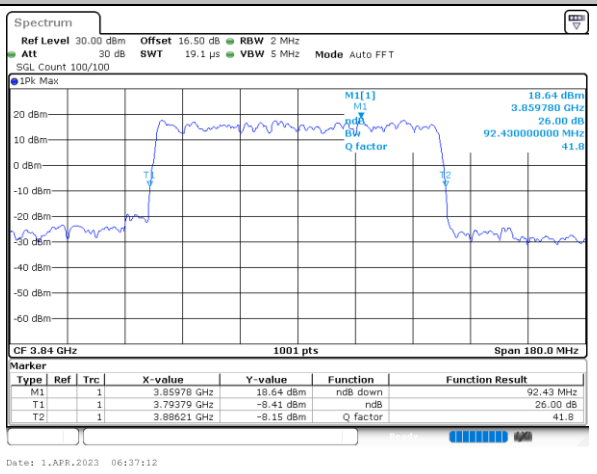
QPSK

Middle Channel



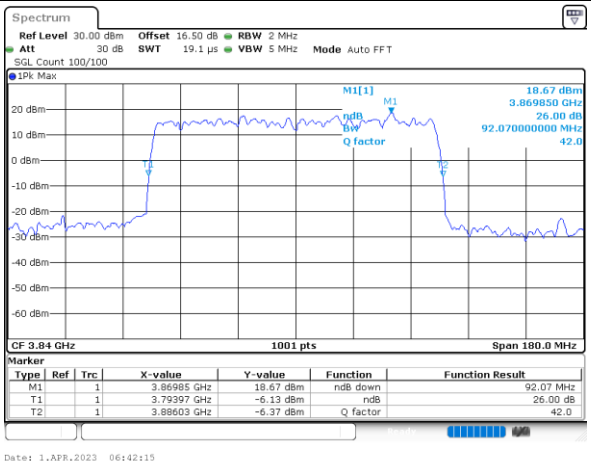
16QAM

Middle Channel



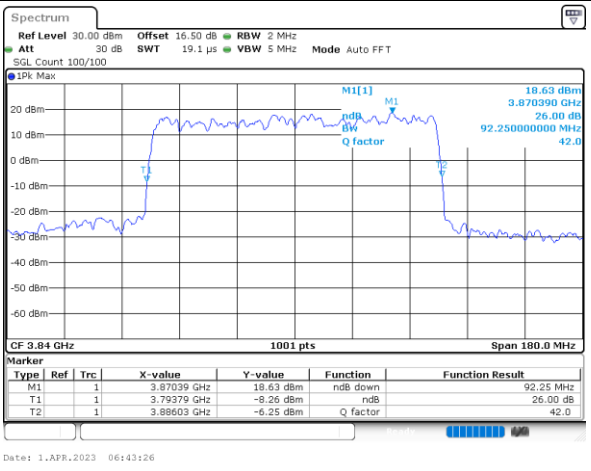
64QAM

Middle Channel



256QAM

Middle Channel

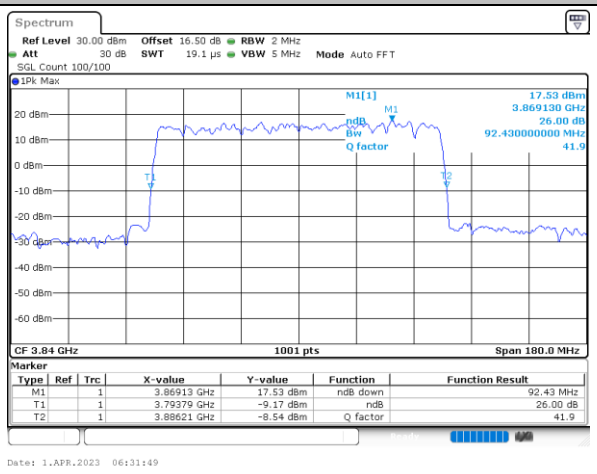


90M-ANT2

FR1 n77 / 90MHz / CP

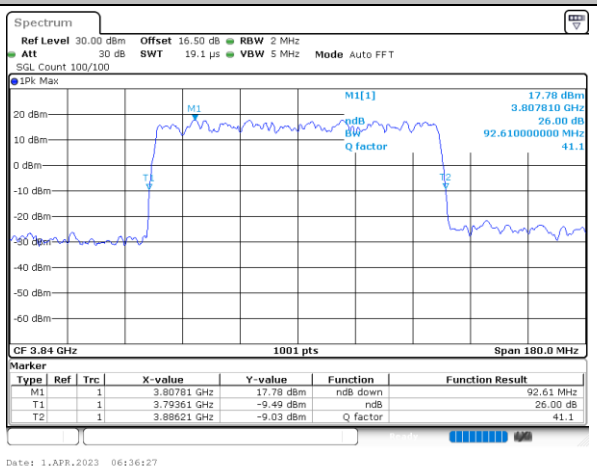
QPSK

Middle Channel



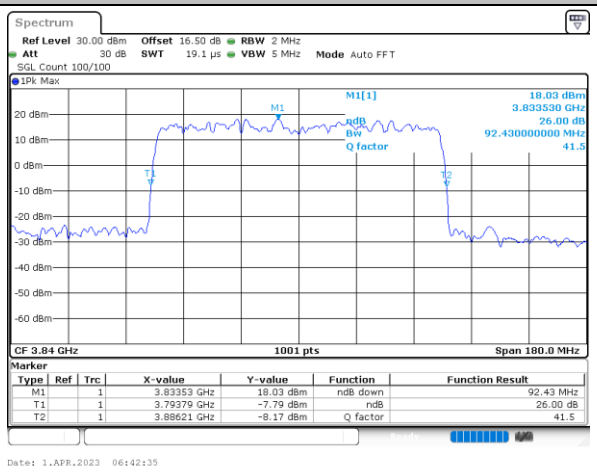
16QAM

Middle Channel



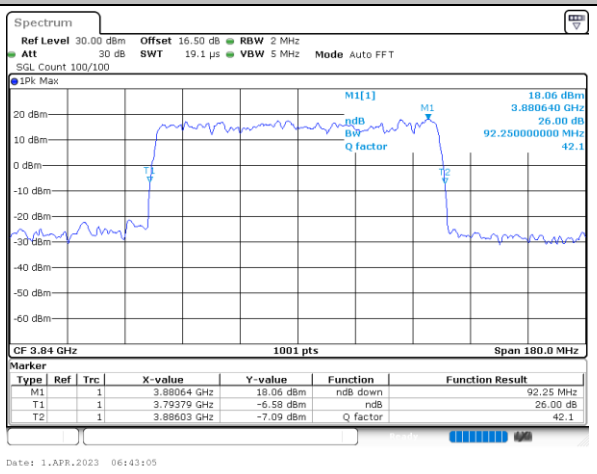
64QAM

Middle Channel



256QAM

Middle Channel

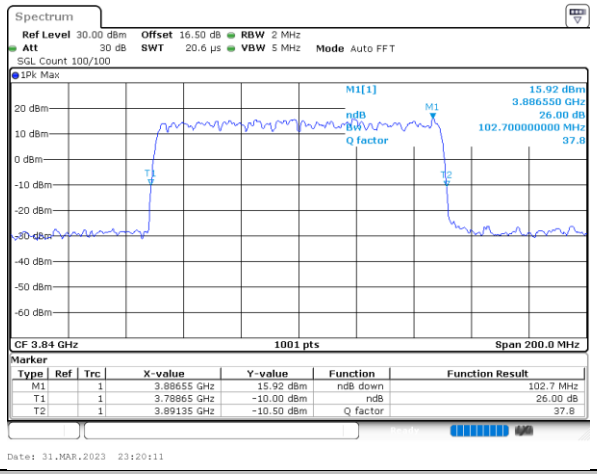


100M-ANT1

FR1 n77 / 100MHz / CP

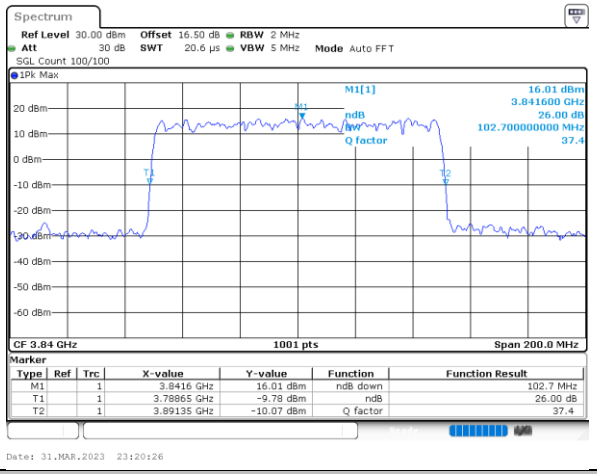
QPSK

Middle Channel



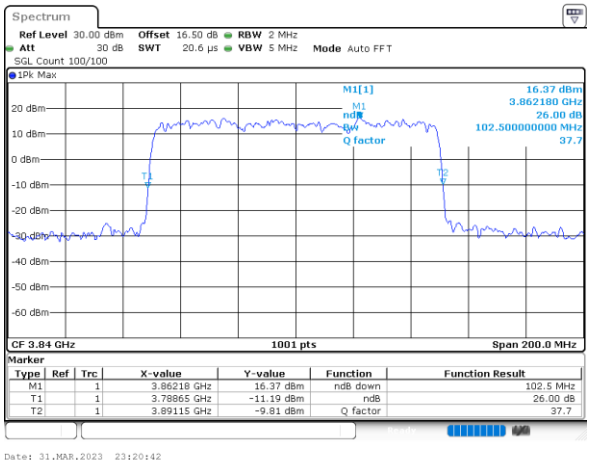
16QAM

Middle Channel



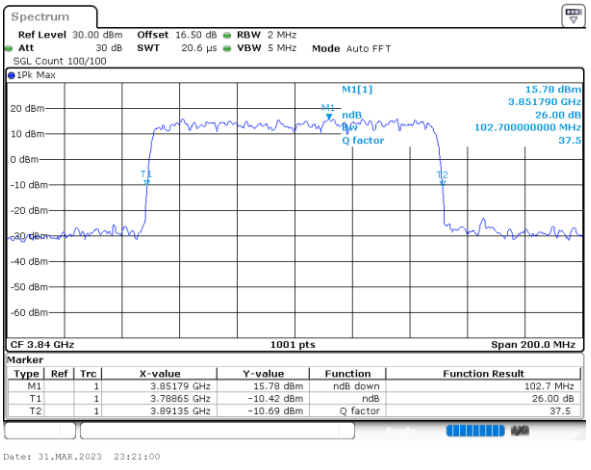
64QAM

Middle Channel



256QAM

Middle Channel

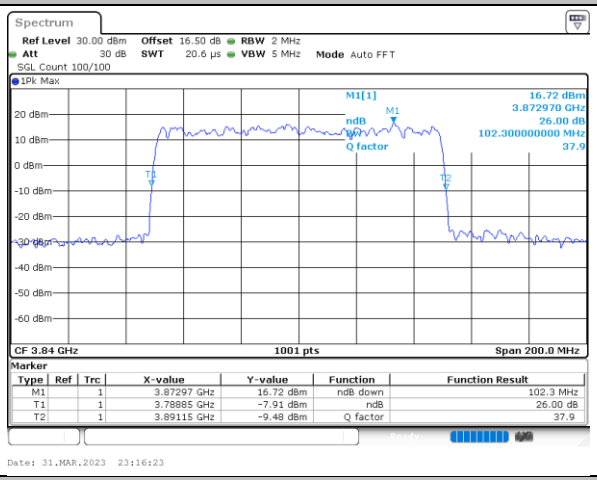


100M-ANT2

FR1 n77 / 100MHz / CP

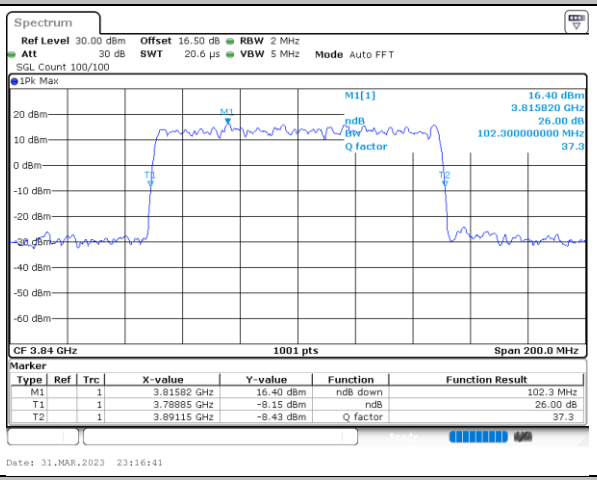
QPSK

Middle Channel



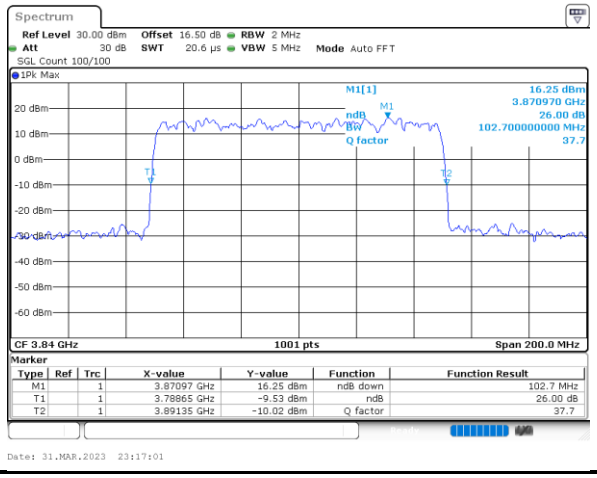
16QAM

Middle Channel



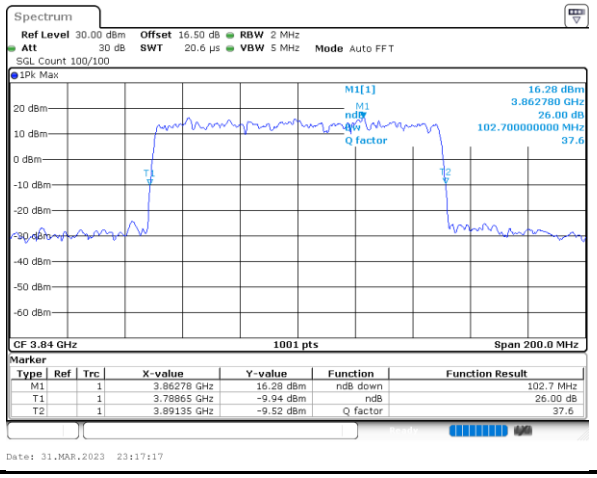
64QAM

Middle Channel



256QAM

Middle Channel

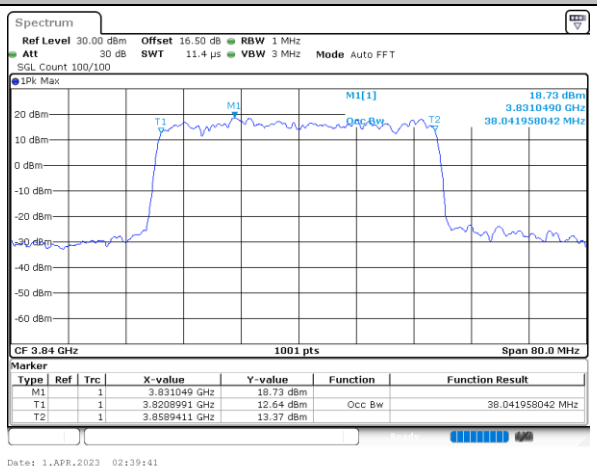
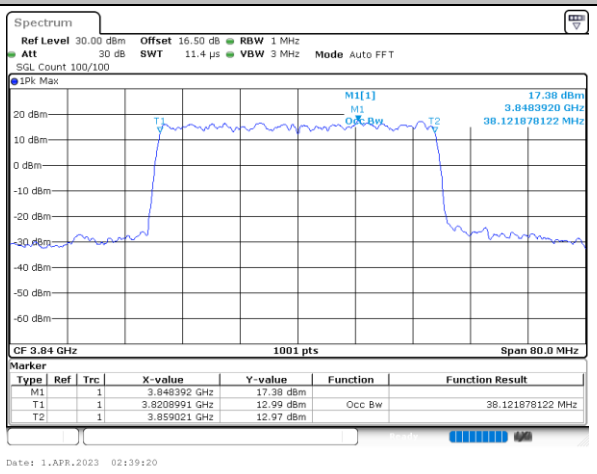
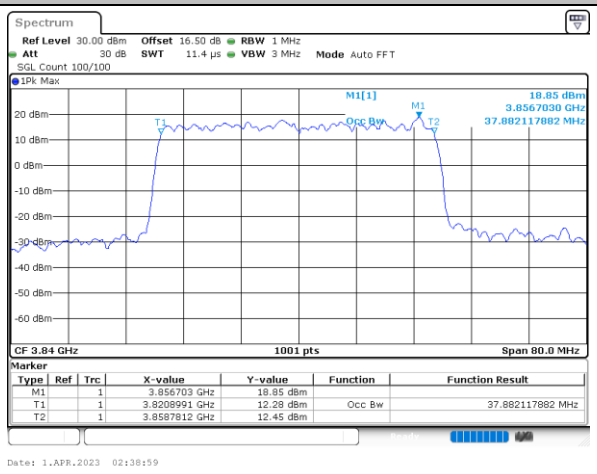
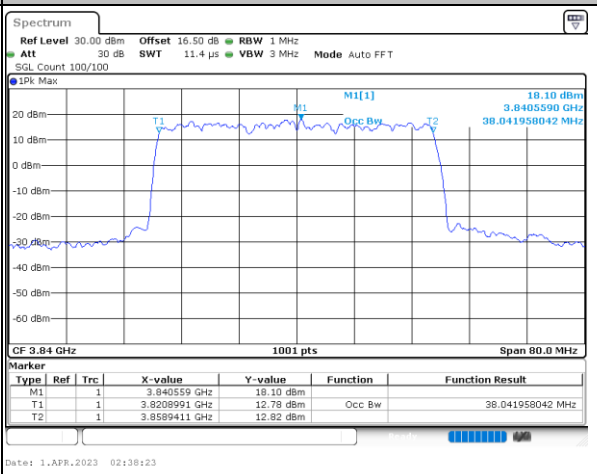


Occupied Bandwidth

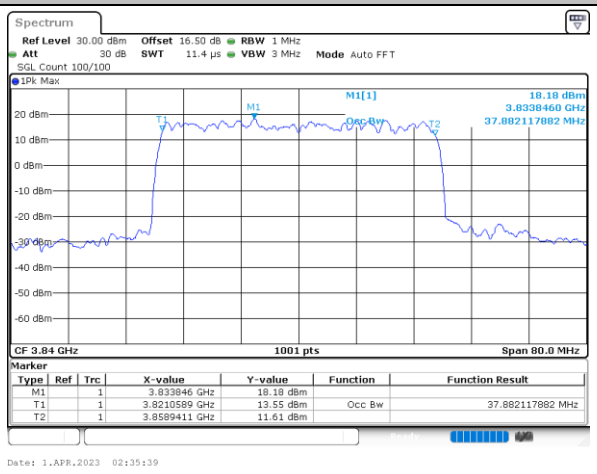
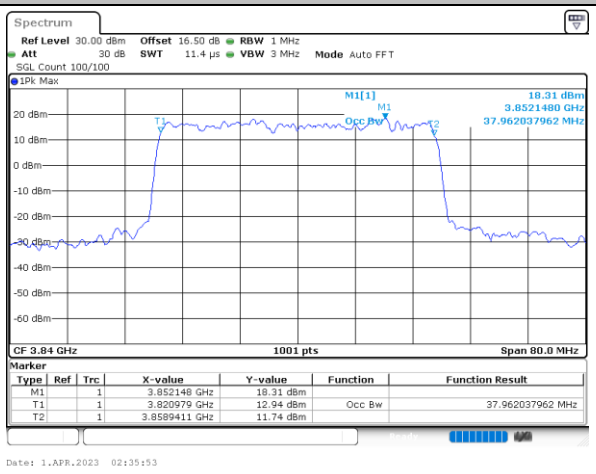
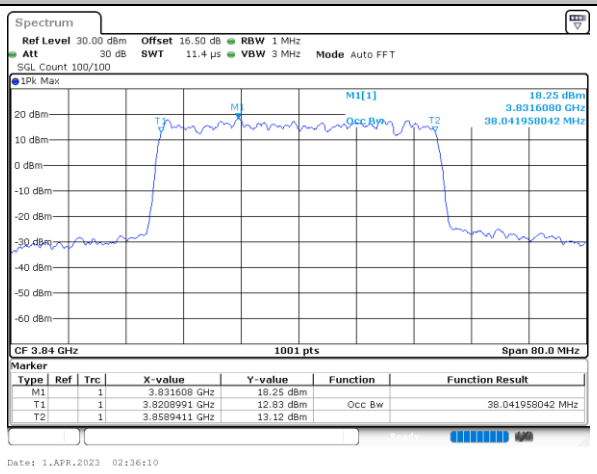
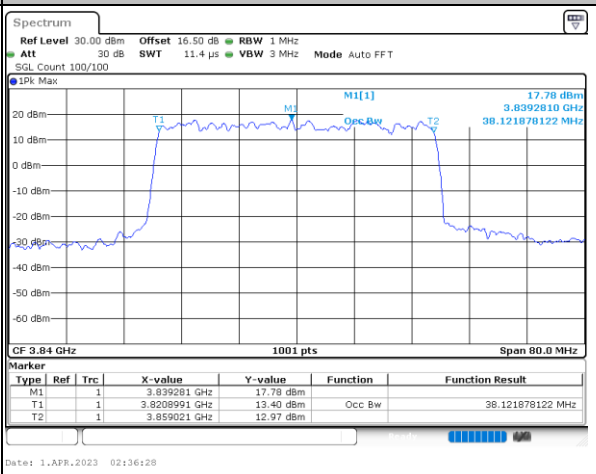
Mode	FR1 n77 : OB / CP			
ANT.	Ant1			
BW	40MHz	40MHz	40MHz	40MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	38.04	38.12	37.88	38.04
ANT.	Ant2			
BW	40MHz	40MHz	40MHz	40MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	37.88	37.96	38.04	38.12
Mode	FR1 n77 : OB / CP			
ANT.	Ant1			
BW	50MHz	50MHz	50MHz	50MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	47.35	47.45	47.45	47.55
ANT.	Ant2			
BW	50MHz	50MHz	50MHz	50MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	47.65	47.55	47.45	47.85
Mode	FR1 n77 : OB / CP			
ANT.	Ant1			
BW	60MHz	60MHz	60MHz	60MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	57.90	57.66	58.02	57.66
ANT.	Ant2			
BW	60MHz	60MHz	60MHz	60MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	57.90	57.90	58.02	57.90
Mode	FR1 n77 : OB / CP			
ANT.	Ant1			
BW	70MHz	70MHz	70MHz	70MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	67.27	67.13	67.41	67.55
ANT.	Ant2			
BW	70MHz	70MHz	70MHz	70MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	67.55	67.41	67.41	67.41

Mode	FR1 n77 : OB / CP			
ANT.	Ant1			
BW	80MHz	80MHz	80MHz	80MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	78.00	77.52	78.00	78.16
ANT.	Ant2			
BW	80MHz	80MHz	80MHz	80MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	78.00	78.16	77.68	78.00
Mode	FR1 n77 : OB / CP			
ANT.	Ant1			
BW	90MHz	90MHz	90MHz	90MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	87.39	87.75	87.39	87.75
ANT.	Ant2			
BW	90MHz	90MHz	90MHz	90MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	87.57	87.75	87.75	87.93
Mode	FR1 n77 : OB / CP			
ANT.	Ant1			
BW	100MHz	100MHz	100MHz	100MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	97.50	98.10	97.70	98.10
ANT.	Ant2			
BW	100MHz	100MHz	100MHz	100MHz
Mod.	QPSK	16QAM	64QAM	256QAM
Middle CH	97.50	97.90	97.50	97.50

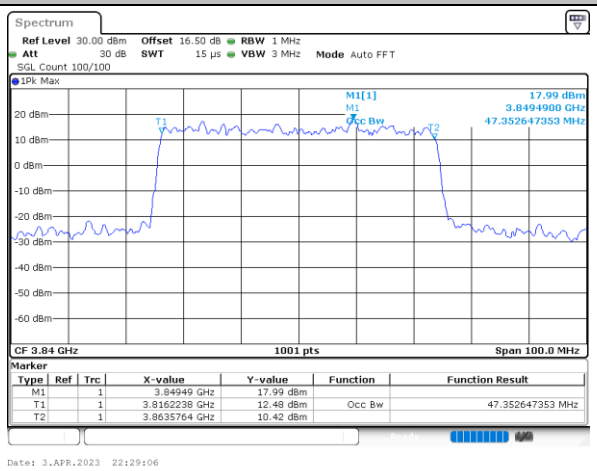
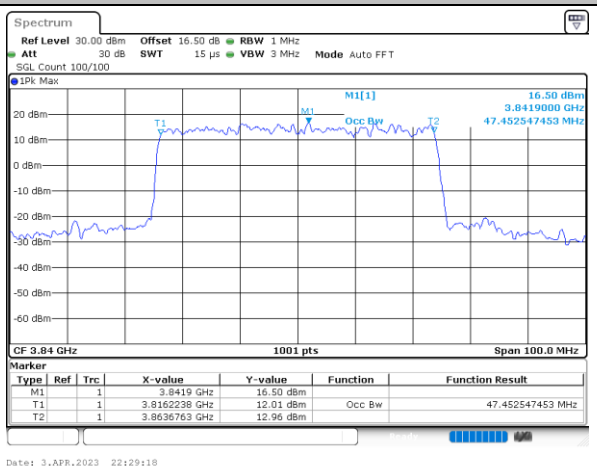
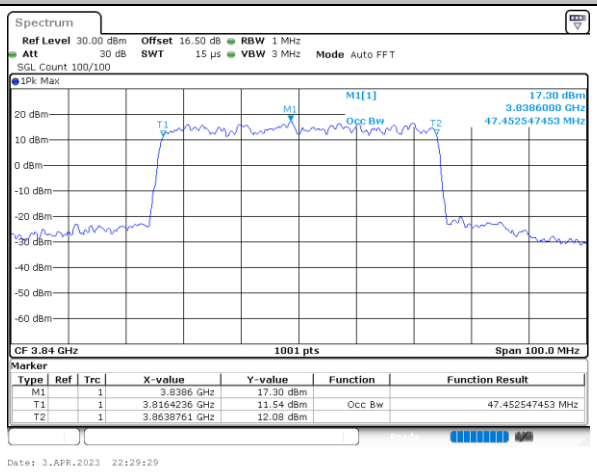
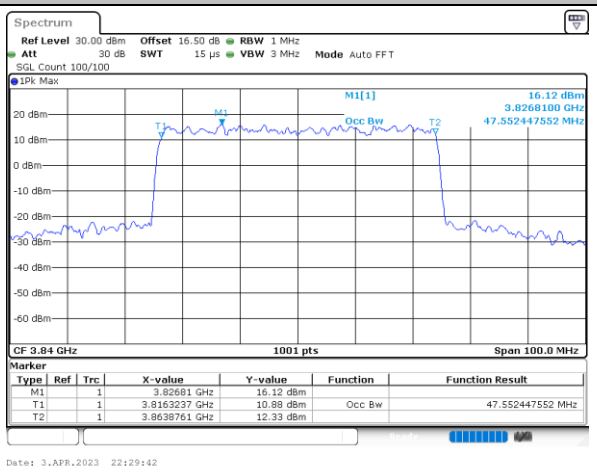
40M-ANT1

FR1 n77 / 40MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

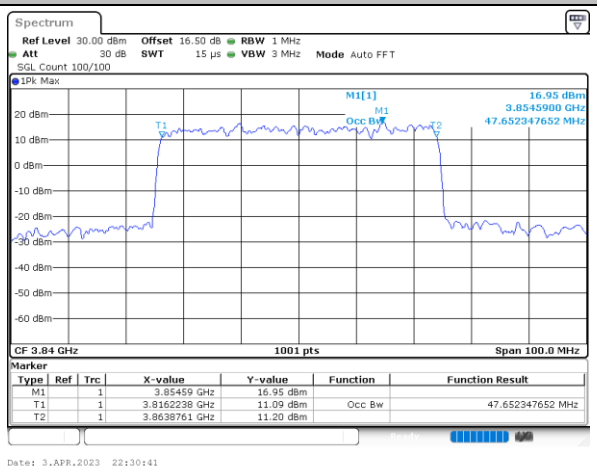
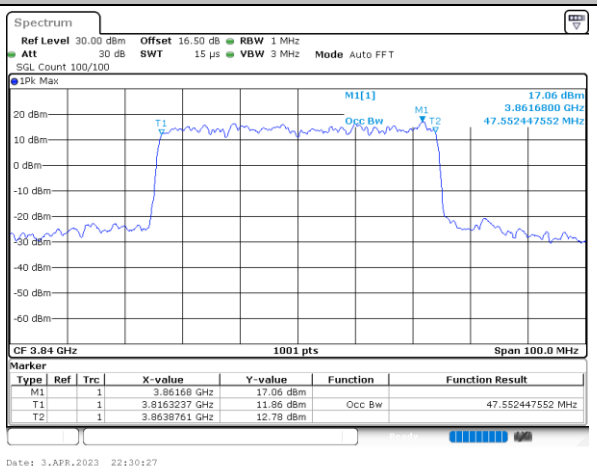
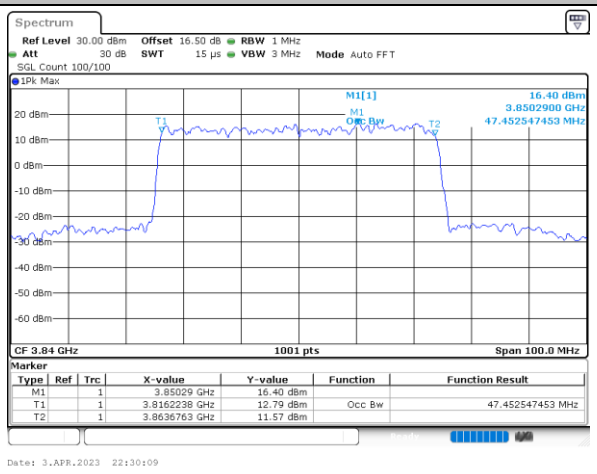
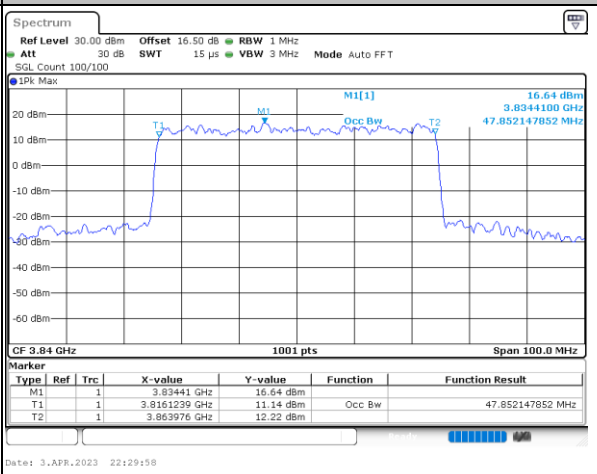
40M-ANT2

FR1 n77 / 40MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

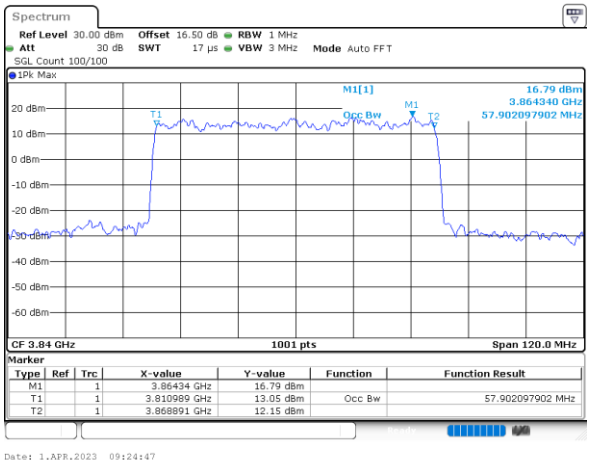
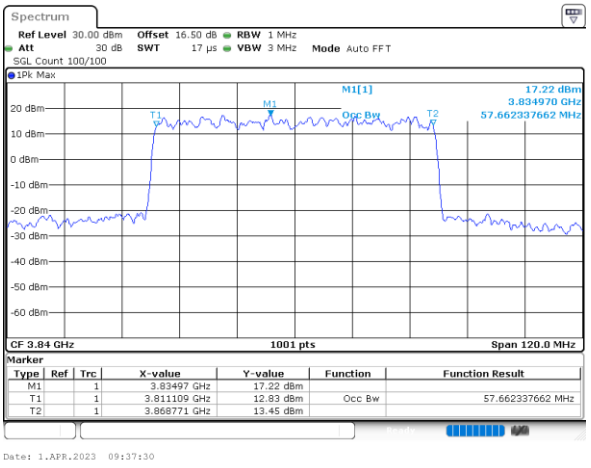
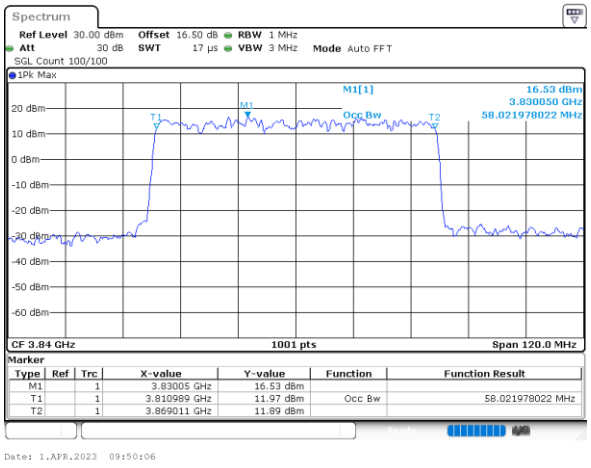
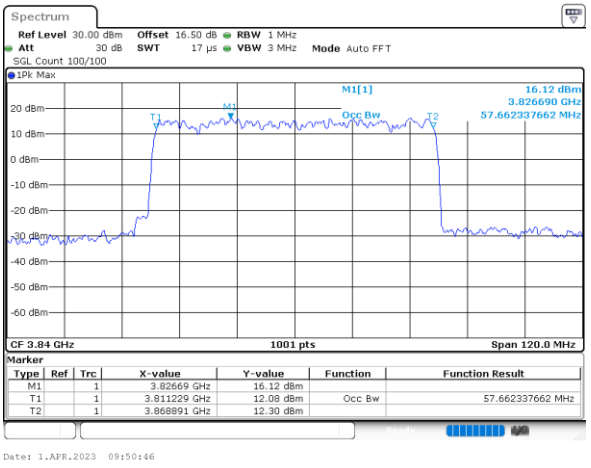
50M-ANT1

FR1 n77 / 50MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

50M-ANT2

FR1 n77 / 50MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

60M-ANT1

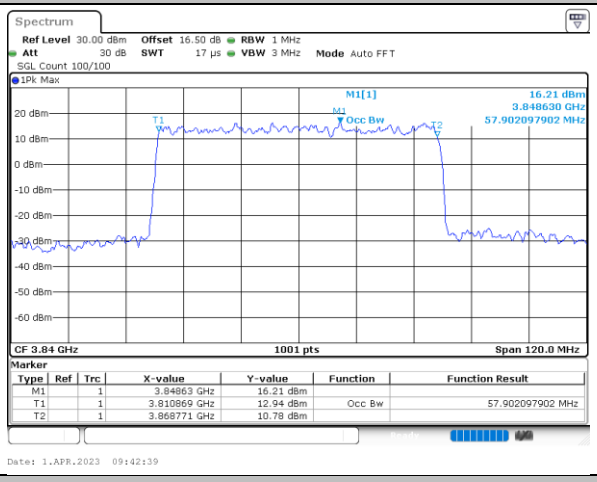
FR1 n77 / 60MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

60M-ANT2

FR1 n77 / 60MHz / CP

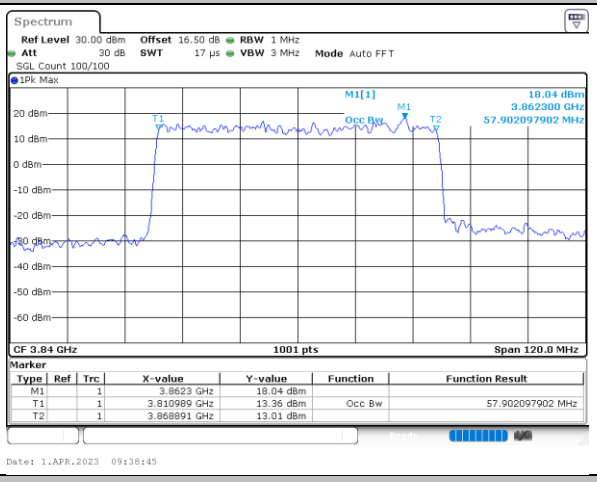
QPSK

Middle Channel



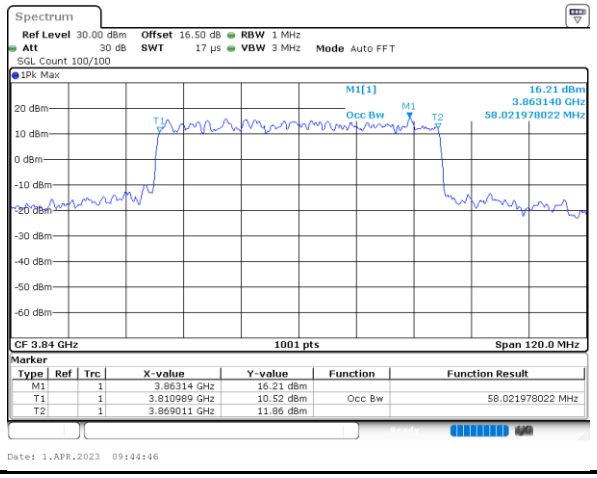
16QAM

Middle Channel



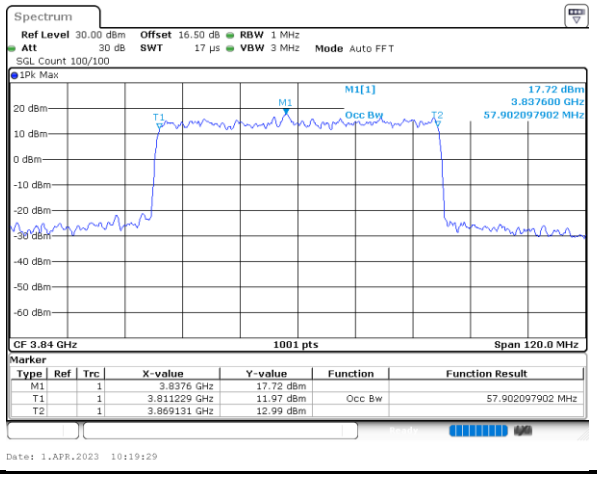
64QAM

Middle Channel

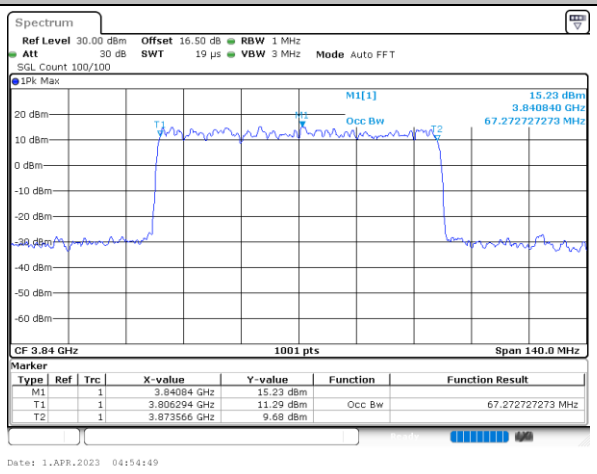
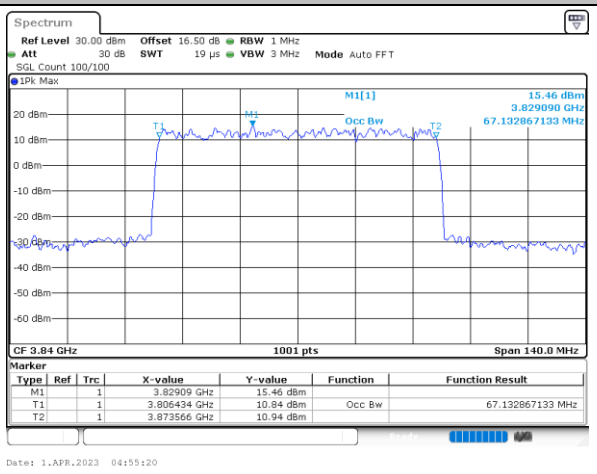
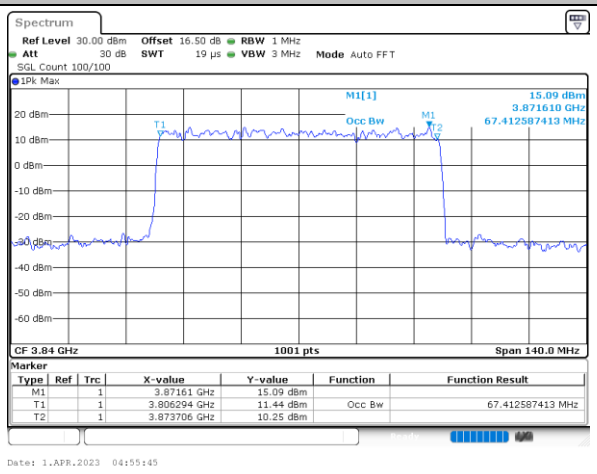
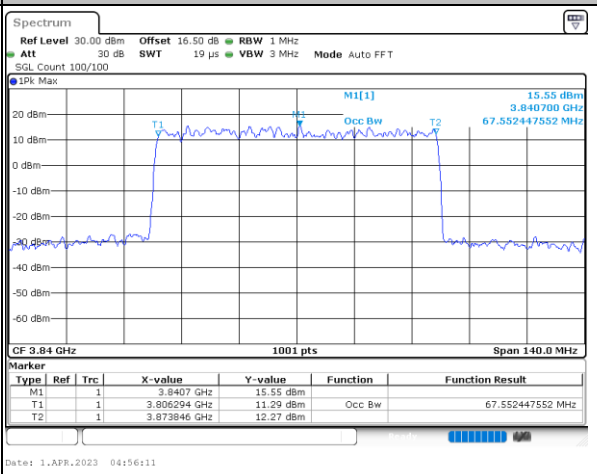


256QAM

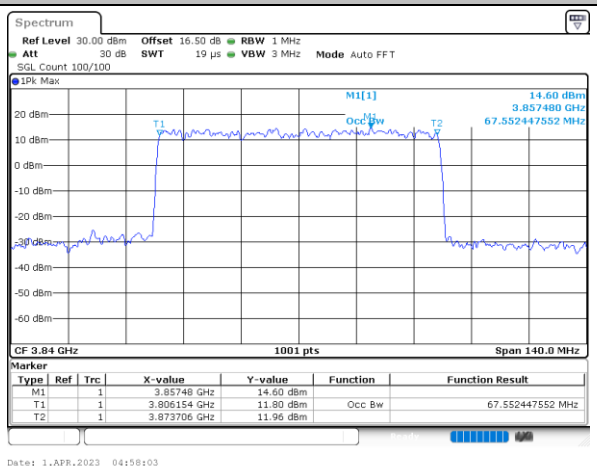
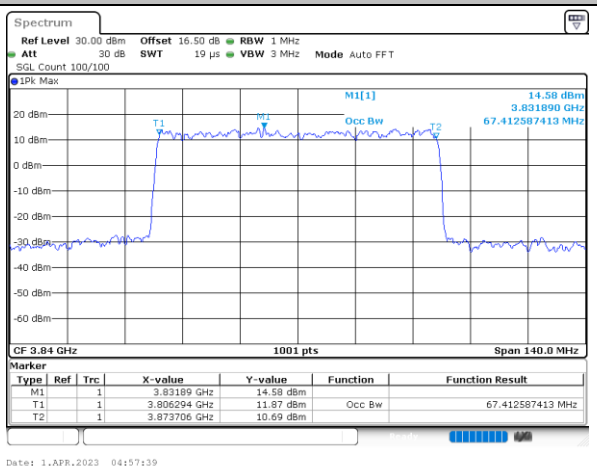
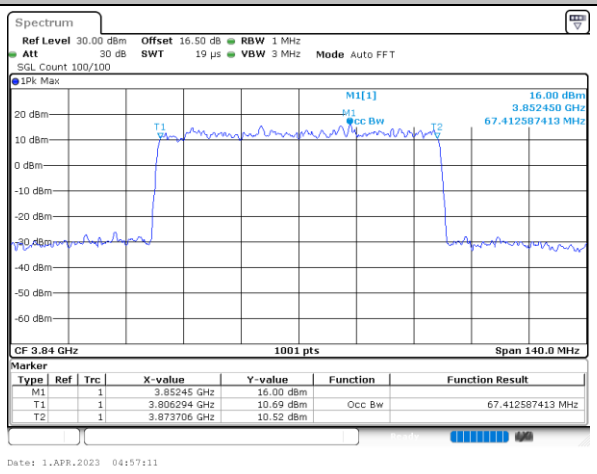
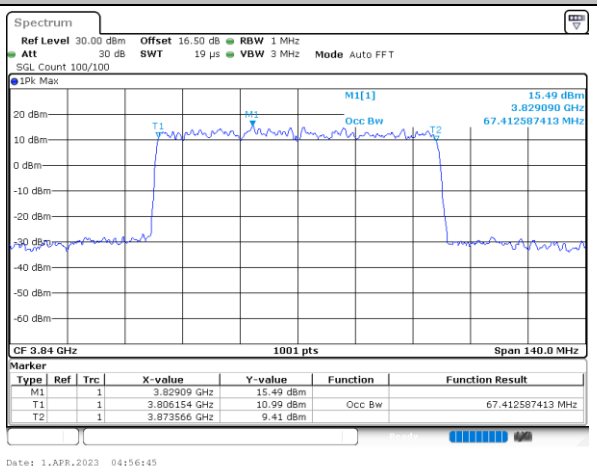
Middle Channel



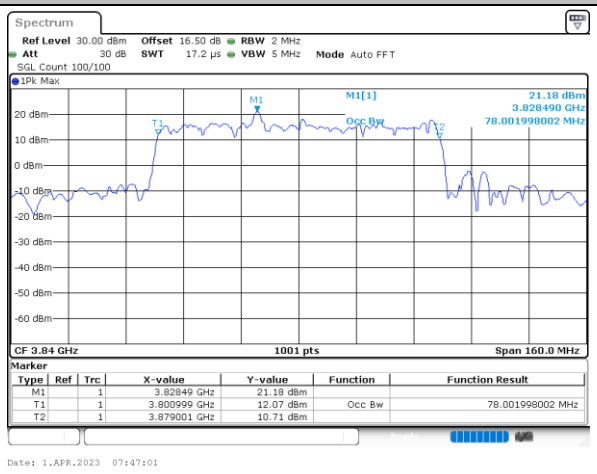
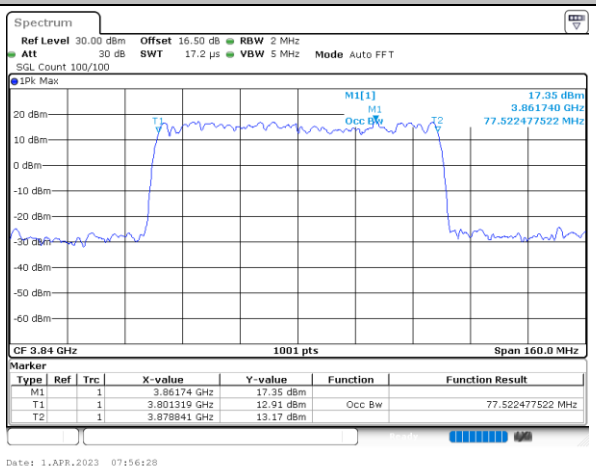
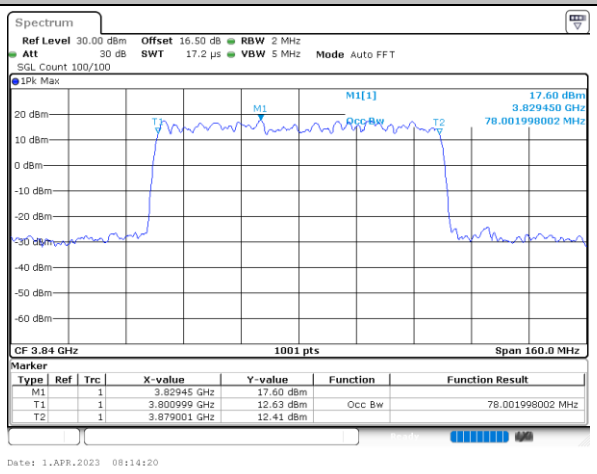
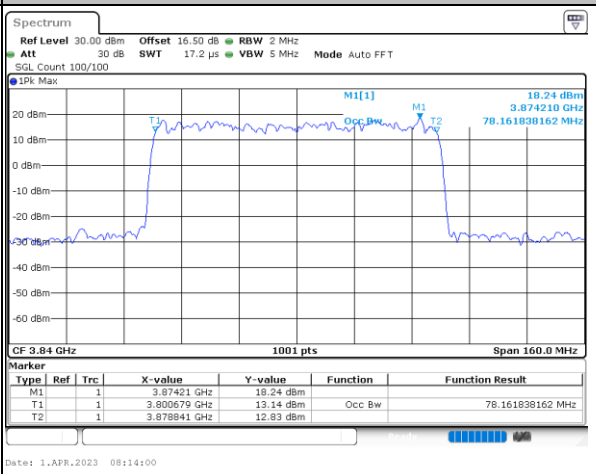
70M-ANT1

FR1 n77 / 70MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

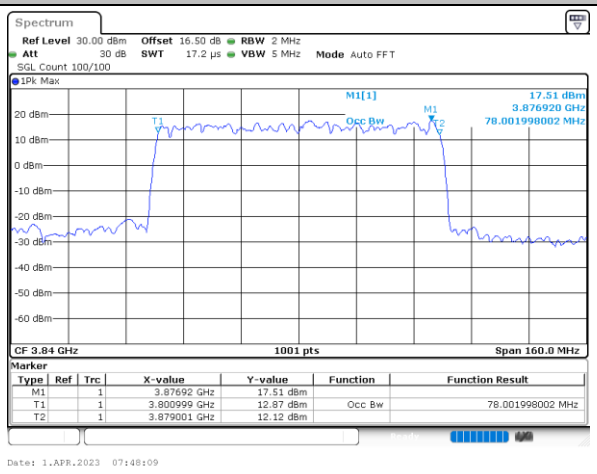
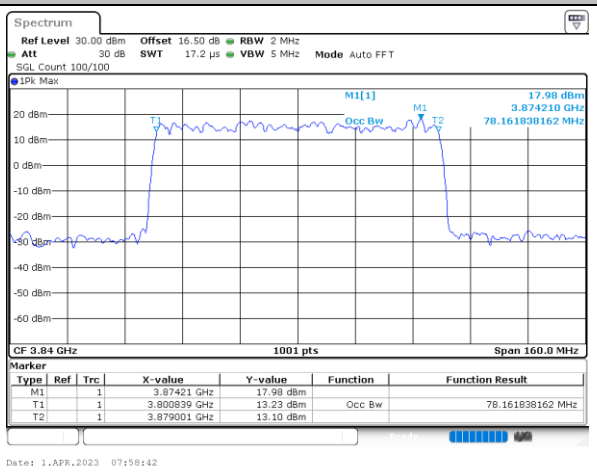
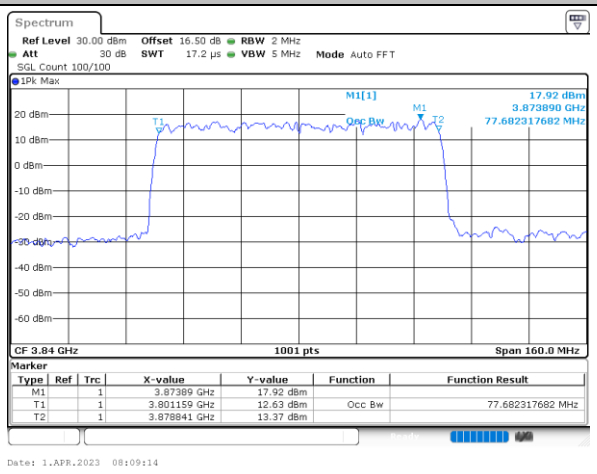
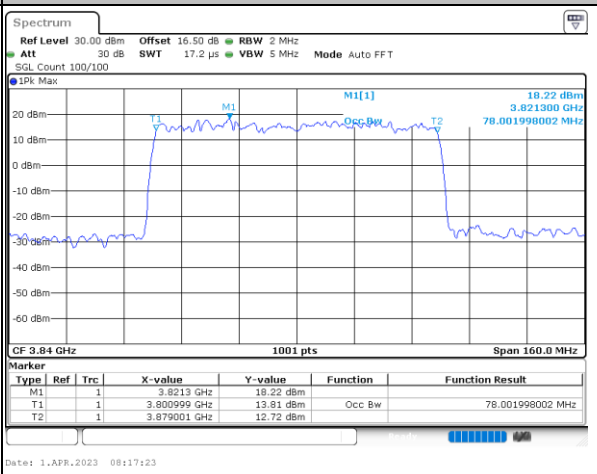
70M-ANT2

FR1 n77 / 70MHz / CP	
QPSK	**16QAM**
Middle Channe	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

80M-ANT1

FR1 n77 / 80MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

80M-ANT2

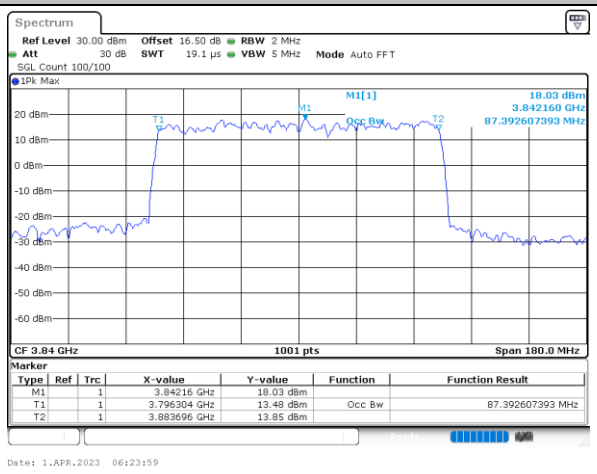
FR1 n77 / 80MHz / CP	
QPSK	**16QAM**
Middle Channel	**Middle Channel**
	
64QAM	**256QAM**
Middle Channel	**Middle Channel**
	

90M-ANT1

FR1 n77 / 90MHz / CP

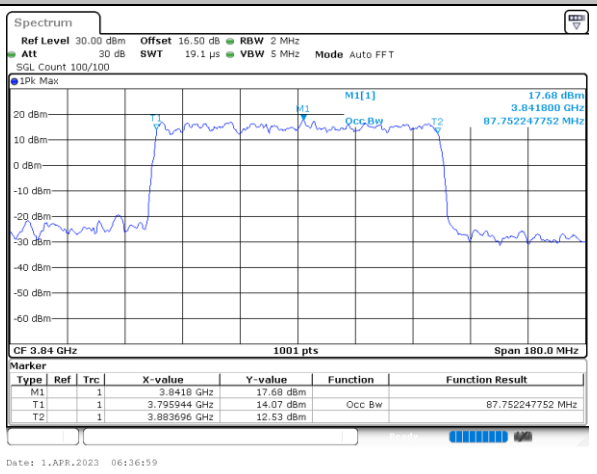
QPSK

Middle Channel



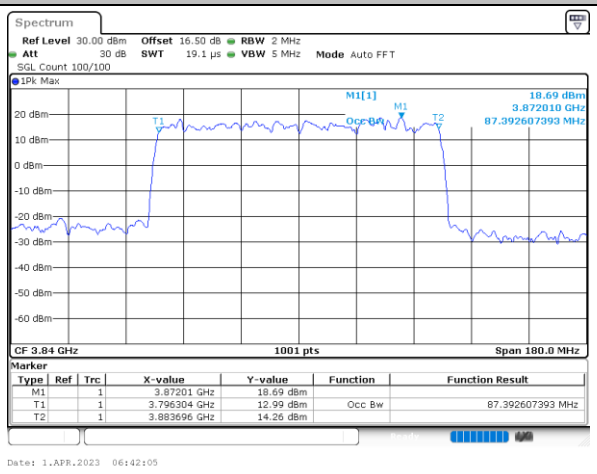
16QAM

Middle Channel



64QAM

Middle Channel



256QAM

Middle Channel