FCC RF Test Report

APPLICANT	:	**BTI Wireless**
EQUIPMENT	:	**5G NR Femtocell**
BRAND NAME	:	**BTI WIRELESS**
MODEL NAME	:	**nCELL-F2240**
FCC ID	:	**WBKF2240**
STANDARD	:	**47 CFR Part 2, 96**
CLASSIFICATION	:	**Citizens Band Category A and B Devices (CBD)**
EQUIPMENT TYPE	:	**CBSD (Category A)**
TEST DATE(S)	:	**Jun. 20, 2023 ~ Jul. 20, 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 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.

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

Table of Contents

History of this test report

Report No.	Version	Description	Issued Date
FG361223A	01	Initial issue of report	Aug. 09, 2023

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power	Reporting only	-
3.3	§96.41	Peak-to-Average Ratio	Pass	-
3.4	§96.41	Maximum E.I.R.P	Pass	-
		Maximum Power Spectral Density	Pass	-
3.5	§2.1049 §96.41	Occupied Bandwidth	Reporting only	-
3.6	§2.1051 §96.41	Conducted Band Edge Measurement	Pass	-
3.7	§2.1051 §96.41	Conducted Spurious Emission	Pass	
3.8	§2.1055	Frequency Stability for Temperature & Voltage	Pass	-
4.4	§2.1051 §96.41	Radiated Spurious Emission	Pass	Under limit 19.66 dB at 14322.000 MHz

Conformity Assessment Condition:

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

Disclaimer:

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

1 General Description

1.1 Applicant

BTI Wireless

11205 Knott Avenue – Suite A, Cypress, CA 90630 United States

1.2 Manufacturer

BTI Wireless

11205 Knott Avenue – Suite A, Cypress, CA 90630 United States

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	5G NR Femtocell
Brand Name	BTI WIRELESS
Model Name	nCELL-F2240
FCC ID	WBKF2240
Tx Frequency	5G NR n48: 3550 MHz ~ 3700 MHz
Rx Frequency	5G NR n48: 3550 MHz ~ 3700 MHz
SCS	30kHz
Bandwidth	40MHz / 60MHz / 80MHz / 90MHz 100MHz
Antenna Type	Integrated Antenna
Maximum Output Power to Antenna	<Ant.0+1>: n48 UL MIMO : 24.99 dBm
Antenna Gain	<Ant.0/1>: 5.0 dBi
Type of Modulation	CP-OFDM (64QAM / 256QAM)
HW Version	2
SW Version	5GNR_fa.tdd.fr1.2.3.0_475

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. 5G NR n48 supports UL MIMO mode only, and only supports CP-OFDM modulation in UL MIMO mode. The MIMO mode is completely uncorrelated, the directional gain is selected the maximum gain among Ant.0 & Ant.1.
3. 5G NR n48 support full RB only.
4. 5G NR n48 support SA mode only.
5. For all test items, an engineering test program (WINSCP TX Tool) was provided and enabled to make the EUT continuously transmit.

1.4 Maximum EIRP and Emission Designator

5G NR n48 UL MIMO		64QAM		256QAM	
BW (MHz)	Frequency Range (MHz)	Maximum EIRP(W)	Emission Designator (99%OBW)	Maximum EIRP(W)	Emission Designator (99%OBW)
40	**3570.00~3679.98**	0.8552	38M2W7D	0.8563	38M2W7D
60	**3580.02~3669.99**	0.8660	57M9W7D	0.9218	57M9W7D
80	**3590.01~3660.00**	0.8562	77M7W7D	0.9441	77M7W7D
90	**3595.02~3654.99**	0.8895	87M4W7D	0.8833	87M6W7D
100	**3600.00~3649.98**	0.9987	97M8W7D	0.9510	97M8W7D

1.5 Testing Site

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 FAX : +86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	03CH04-KS TH01-KS	CN1257	314309

1.6 Test Software

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

1.7 Applied Standards

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

- ANSI C63.26-2015
- 47 CFR Part 2, 96
- FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- FCC KDB 940660 D01 Part 96 CBRS v03
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

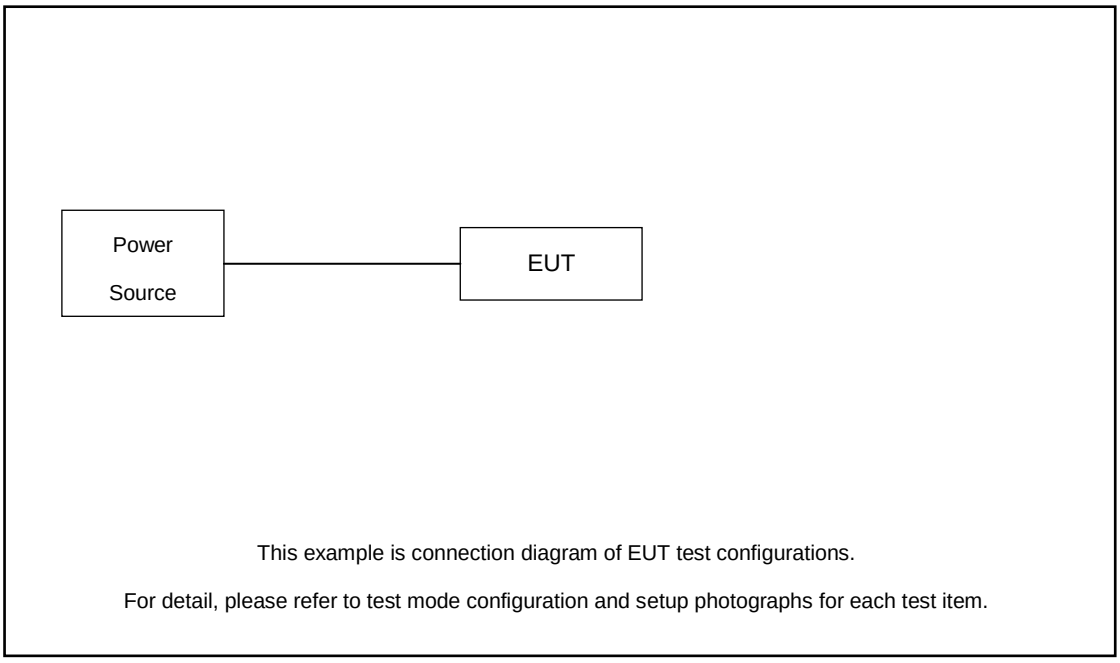
2.1 Test Mode

Antenna port conducted and radiated test items listed below 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.

Test Items	5G NR	Bandwidth (MHz)					Modulation					RB #			Test Channel		
		40	60	80	90	100	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	1	Half	Full	L	M	H
Max. Output Power & E.I.R.P	n48	v	v	v	v	v	-	-	-	v	v	-	-	v	v	v	v
Peak-to-Average Ratio	n48	-	-	-	-	v	-	-	-	v	v	-	-	v		v	
26dB and 99% Bandwidth	n48	v	v	v	v	v	-	-	-	v	v	-	-	v		v	
Conducted Band Edge	n48	v	v	v	v	v	-	-	-	v	v	-	-	v	v	v	v
Conducted Spurious Emission	n48	v	v	v	v	v	-	-	-	v	v	-	-	v	v	v	v
Power Spectral Density	n48	v	v	v	v	v	-	-	-	v	v	-	-	v	v	v	v
Frequency Stability	n48	-	-	-	-	v	-	-	-	v		-	-	v	v		v
Radiated Spurious Emission	n48		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



2.3 Support Unit used in test configuration

Item	Equipment	Trade Name	Model No.	FCC ID	Data Cable	Power Cord
1.	Power Supply	GWINSTEK	PSS-2002	N/A	N/A	Unshielded, 1.8 m

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between 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 3.41 dB and 10dB attenuator.

Example :

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

= 3.41 + 10 = 13.41 (dB)

2.5 Frequency List of Low/Middle/High Channels

5G NR n48 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
100	Channel	640000	641666	643332
	Frequency	3600	3624.99	3649.98
90	Channel	639668	641666	643666
	Frequency	3595.02	3624.99	3654.99
80	Channel	639334	641666	644000
	Frequency	3590.01	3624.99	3660
60	Channel	638668	641666	644666
	Frequency	3580.02	3624.99	3669.99
40	Channel	638000	641666	645332
	Frequency	3570	3624.99	3679.98

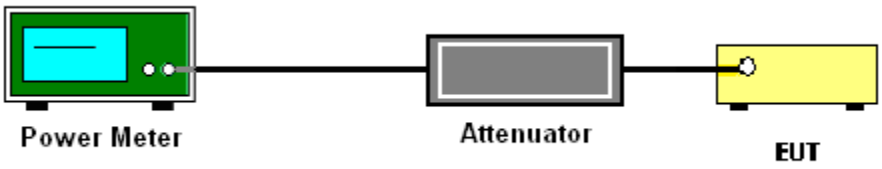
3 Conducted Test Items

3.1 Measuring Instruments

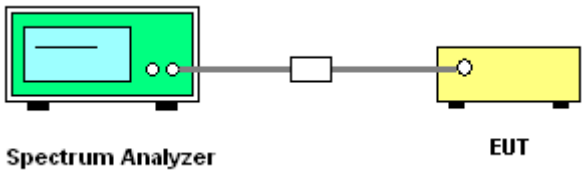
See list of measuring instruments of this test report.

3.1.1 Test Setup

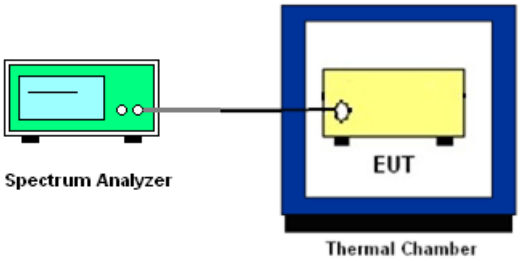
3.1.2 Conducted Output Power



3.1.3 PSD, Peak-to-Average Ratio, 26dB & 99% Occupied Bandwidth, Conducted Band-Edge and Conducted Spurious Emission



3.1.4 Frequency Stability



3.1.5 Test Result of Conducted Test

Please refer to Appendix A.

3.2 Conducted Output Power

3.2.1 Description of the Conducted Output Power 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.

3.2.2 Test Procedures

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

3.3 Peak-to-Average Ratio

3.3.1 Description of the PAR Measurement

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.

3.3.2 Test Procedures

1. The testing follows ANSI C63.26 Section 5.2.6 (PAPR).
2. The EUT was connected to spectrum.
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.

3.4 EIRP and PSD

3.4.1 Description of the EIRP Measurement

EIRP and PSD limits for CBRS equipment as below table:

Device		Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
☐	**End User Device**	23	n/a
Applied	**Category A CBSD**	30	20
☐	**Category B CBSD**	47	37

Remark: Maximum PSD values are radiated. Measurements can be done conducted and add antenna gain back in.

3.4.2 Test Procedures for EIRP

1. Measure the Maximum conducted power, the parameters were set to force the EUT transmitting at maximum output power level. Use the average power measurement function to measure total channel power of each channel bandwidth (per ANSI C63.26-2015 Section 5.2.1)

2. Determining ERP and/or EIRP from conducted RF output power measurements (Per ANSI C63.26-2015 Section 5.2.5.5)

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

3.4.3 Test Procedures for EIRP PSD

1. Set instrument center frequency to OBW center frequency.
2. Set span to at least 2 times the OBW.
3. Set the RBW to the specified reference bandwidth (often 1 MHz).
4. Set VBW ≥ 3 × RBW.
5. Detector = RMS (power averaging).
6. Ensure that the number of measurement points in the sweep ≥ 2 × span/RBW.
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).
10. Determine the EIRP by adding the effective antenna gain to the adjusted power level.
11. Add 10 log (1/duty cycle) to the measured power level to compute the average power during continuous transmission.

The testing follows ANSI C63.26-2015 Section 5.2.5.5

According to KDB 412172 D01 Power Approach,

EIRP = $P_T + G_T – L_C$, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

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

3.5 Occupied Bandwidth

3.5.1 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.

3.5.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.4.3 (26dB) and Section 5.4.4 (99OB)

1. The EUT was connected to spectrum analyzer.
2. 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.
3. 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.
4. Set the detection mode to peak, and the trace mode to max hold.
5. 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)
6. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
7. 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.
8. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

3.6 Conducted Band Edge

3.6.1 Description of Conducted Band Edge Measurement

Part 96.41 (e) (1) (i)

For CBSD the emission limits outside the fundamental are as follows:

Within 0 MHz to 10 MHz above and below the assigned channel ≤ −13 dBm/MHz

Greater than 10 MHz above and below the assigned channel ≤ −25 dBm/MHz

Part 96.41 (e) (2)

For CBSDs and End User Devices, the conducted power of emissions below 3540 MHz or above 3710 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz

3.6.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 6.1.

1. The EUT was connected to spectrum analyzer.
2. The band edges of low and high channels for the highest RF powers were measured.
3. Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
4. Beyond the 1 MHz band from the band edge, RBW=1MHz was used
5. Offset has included the duty factor and 10*log(N_{ANT}). Duty factor =10 log (1/x), where x is the measured duty cycle. 10 log(N_{ANT}) dB, where N_{ANT} is the number of outputs. (N=2)
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.7 Conducted Spurious Emission

3.7.1 Description of Conducted Spurious Emission Measurement

96.41 (e)(2)

The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed −40dBm/MHz.

3.7.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 6.1.

1. The EUT was connected to spectrum analyzer.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
6. For Ant.0 of MIMO Ant(0+1) and Ant.1 of MIMO Ant(0+1) in low/middle/high channel. Offset has included the duty factor and 10*log(N_{ANT}). Duty factor =10 log (1/x), where x is the measured duty cycle. 10 log(N_{ANT}) dB, where N_{ANT} is the number of outputs.(N=2)
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 −40dBm/MHz.

3.8 Frequency Stability

3.8.1 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

3.8.2 Test Procedures for Temperature Variation

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

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

3.8.3 Test Procedures for Voltage Variation

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

1. The EUT was placed in a temperature chamber at 25±5° C and connected with the system simulator.
2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

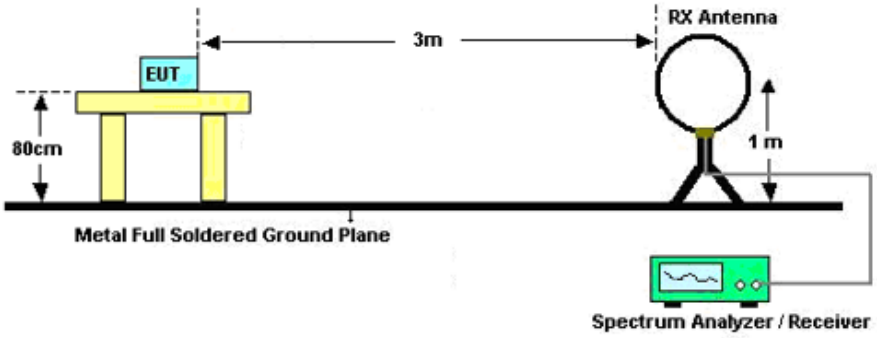
4 Radiated Test Items

4.1 Measuring Instruments

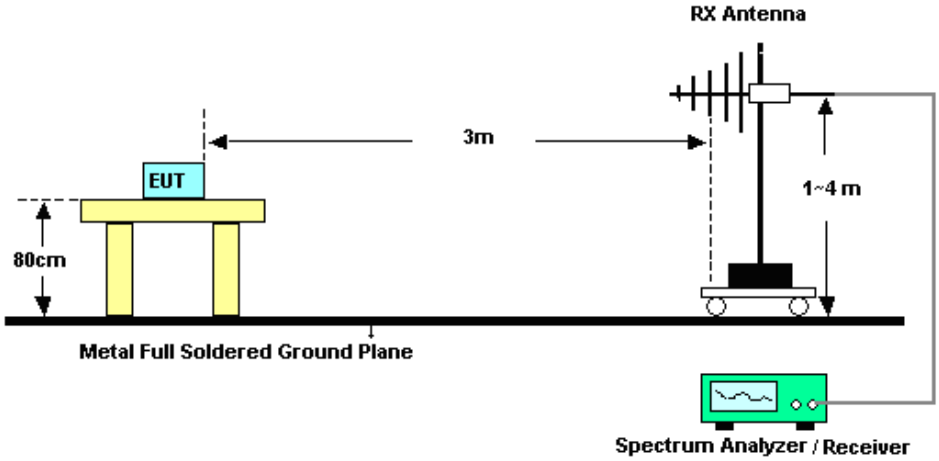
See list of measuring instruments of this test report.

4.2 Test Setup

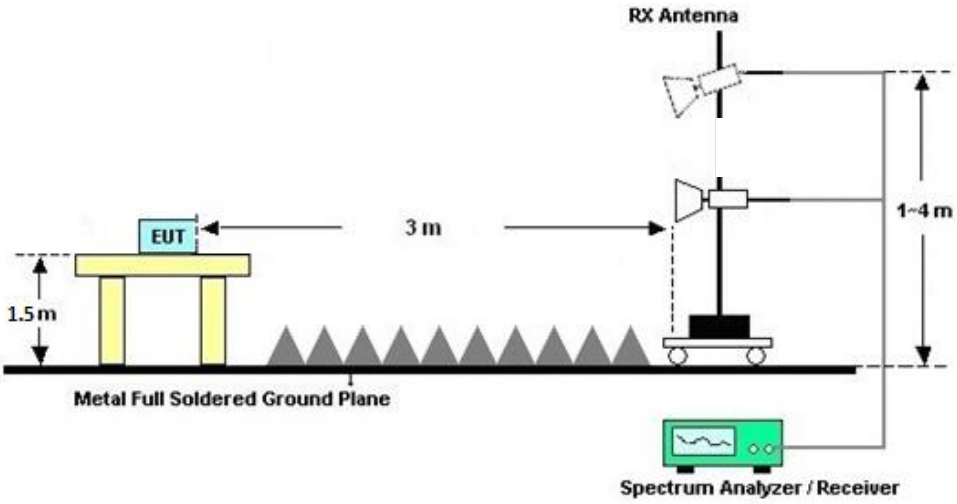
4.2.1 For radiated test below 30MHz



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 Measurement

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 -40dBm / MHz.

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

4.4.2 Test Procedures

1. 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.
2. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
5. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
   Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
   EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
   ERP (dBm) = EIRP - 2.15
8. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
   The limit line is −40dBm/MHz

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	Jun. 27, 2023~ Jul. 20, 2023	Oct. 11, 2023	Conducted (TH01-KS)
Power divider	STI	STI08-0055	-	0.5~40GHz	NCR	Jun. 27, 2023~ Jul. 20, 2023	NCR	Conducted (TH01-KS)
Temperature &humidity chamber	Hongzhan	LP-150U	H20140114 40	-40~+150°C 20%~95%RH	Jul. 15, 2022	Jun. 27, 2023~ Jul. 20, 2023	Jul. 14, 2023	Conducted (TH01-KS)
Temperature &humidity chamber	Hongzhan	LP-150U	H20140114 40	-40~+150°C 20%~95%RH	Jul. 06, 2023		Jul. 05, 2024	Conducted (TH01-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY57471079	10Hz-44G,MAX 30dB	Oct. 12, 2022	Jun. 20, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Jun. 20, 2023	Oct. 15, 2023	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	Apr. 09, 2023	Jun. 20, 2023	Apr. 08, 2024	Radiation (03CH04-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1284	1GHz~18GHz	Oct. 16, 2022	Jun. 20, 2023	Oct. 15, 2023	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 08, 2023	Jun. 20, 2023	Jan. 07, 2024	Radiation (03CH04-KS)
Amplifier	SONOMA	310N	380827	9KHz-1GHz	Jul 11, 2022	Jun. 20, 2023	Jul 10, 2023	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2023	Jun. 20, 2023	Jan. 04, 2024	Radiation (03CH04-KS)
high gain Amplifier	EM	EM01G18GA	060840	1Ghz-18Ghz	Oct. 12, 2022	Jun. 20, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
Amplifier	Agilent	8449B	3008A02370	1Ghz-18Ghz	Oct. 12, 2022	Jun. 20, 2023	Oct. 11, 2023	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jun. 20, 2023	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jun. 20, 2023	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jun. 20, 2023	NCR	Radiation (03CH04-KS)

NCR: No Calibration Required

6 Measurement Uncertainty

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.46 dB
Conducted Emissions	±0.48 dB
Occupied Channel Bandwidth	±0.1 %
Conducted Power Spectral Density	±0.40 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.82 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.56 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.54 dB

---------- 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

5G NR n48 UL MIMO (Ant.0+1):

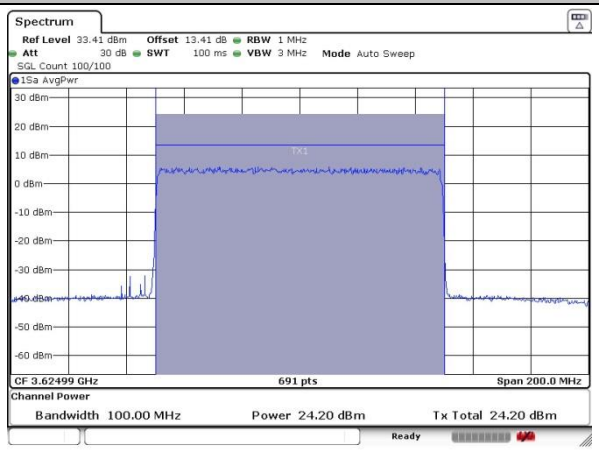
NR Band	SCS	BandWidth	Arfcn	Freq (MHz)	Modulation	RB	power setting	Conducted Power ANT0 (dBm)	Conducted Power ANT1 (dBm)	Conducted Power (dBm)	EIRP (dBm)	EIRP (W)
48	30	100M	640000	3600	CP-OFDM 64QAM	FULL RB	21	21.73	20.70	24.26	29.26	0.8425
48	30	100M	641666	3624.99	CP-OFDM 64QAM	FULL RB	22	22.37	21.56	24.99	29.99	0.9987
48	30	100M	643332	3649.98	CP-OFDM 64QAM	FULL RB	22	22.03	21.73	24.89	29.89	0.9756
48	30	100M	640000	3600	CP-OFDM 256QAM	FULL RB	21	20.67	20.96	23.83	28.83	0.7634
48	30	100M	641666	3624.99	CP-OFDM 256QAM	FULL RB	22	21.57	21.84	24.72	29.72	0.9370
48	30	100M	643332	3649.98	CP-OFDM 256QAM	FULL RB	22	21.65	21.89	24.78	29.78	0.9510
48	30	90M	639668	3595.02	CP-OFDM 64QAM	FULL RB	21	20.59	20.73	23.67	28.67	0.7364
48	30	90M	641666	3624.99	CP-OFDM 64QAM	FULL RB	22	21.39	21.57	24.49	29.49	0.8895
48	30	90M	643666	3654.99	CP-OFDM 64QAM	FULL RB	22	21.36	21.55	24.47	29.47	0.8844
48	30	90M	639668	3595.02	CP-OFDM 256QAM	FULL RB	21	20.29	20.58	23.45	28.45	0.6995
48	30	90M	641666	3624.99	CP-OFDM 256QAM	FULL RB	22	21.35	21.38	24.38	29.38	0.8660
48	30	90M	643666	3654.99	CP-OFDM 256QAM	FULL RB	22	21.38	21.52	24.46	29.46	0.8833
48	30	80M	639334	3590.01	CP-OFDM 64QAM	FULL RB	21	20.29	20.95	23.64	28.64	0.7316
48	30	80M	641666	3624.99	CP-OFDM 64QAM	FULL RB	22	21.26	21.37	24.33	29.33	0.8562
48	30	80M	644000	3660	CP-OFDM 64QAM	FULL RB	22	21.07	21.29	24.19	29.19	0.8302
48	30	80M	639334	3590.01	CP-OFDM 256QAM	FULL RB	21	20.62	20.68	23.66	28.66	0.7346
48	30	80M	641666	3624.99	CP-OFDM 256QAM	FULL RB	22	21.75	21.73	24.75	29.75	0.9441
48	30	80M	644000	3660	CP-OFDM 256QAM	FULL RB	22	21.09	21.26	24.19	29.19	0.8291
48	30	60M	638668	3580.02	CP-OFDM 64QAM	FULL RB	21	20.58	20.75	23.68	28.68	0.7372
48	30	60M	641666	3624.99	CP-OFDM 64QAM	FULL RB	22	21.38	21.35	24.38	29.38	0.8660
48	30	60M	644666	3669.99	CP-OFDM 64QAM	FULL RB	22	21.29	21.14	24.23	29.23	0.8367
48	30	60M	638668	3580.02	CP-OFDM 256QAM	FULL RB	21	20.55	20.29	23.43	28.43	0.6970
48	30	60M	641666	3624.99	CP-OFDM 256QAM	FULL RB	22	21.55	21.72	24.65	29.65	0.9218
48	30	60M	644666	3669.99	CP-OFDM 256QAM	FULL RB	22	21.29	21.16	24.24	29.24	0.8386
48	30	40M	638000	3570	CP-OFDM 64QAM	FULL RB	21	20.75	20.57	23.67	28.67	0.7364
48	30	40M	641666	3624.99	CP-OFDM 64QAM	FULL RB	22	21.29	21.23	24.27	29.27	0.8454
48	30	40M	645332	3679.98	CP-OFDM 64QAM	FULL RB	22	21.27	21.35	24.32	29.32	0.8552
48	30	40M	638000	3570	CP-OFDM 256QAM	FULL RB	21	20.61	20.72	23.68	28.68	0.7372
48	30	40M	641666	3624.99	CP-OFDM 256QAM	FULL RB	22	21.41	21.22	24.33	29.33	0.8563
48	30	40M	645332	3679.98	CP-OFDM 256QAM	FULL RB	22	21.21	21.27	24.25	29.25	0.8415

FR1 n48 CBSD

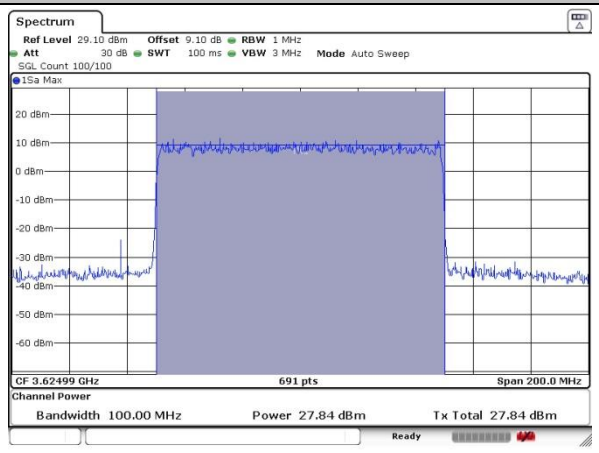
Peak-to-Average Ratio

Mode	FR1 PART96 N48 /100MHz / CP OFDM		
Mod.	100M		
RB Size	64QAM	64QAM	Limit: 13dB
ANT	ANT 0	ANT 1	Result
Middle CH	3.64	3.48	PASS
RB Size	256QAM	256QAM	Limit: 13dB
ANT	ANT 0	ANT 1	Result
Middle CH	3.78	3.75	PASS

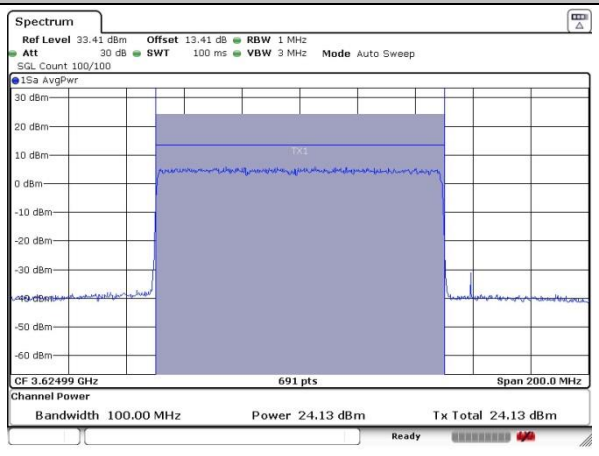
ANT0-64QAM-A



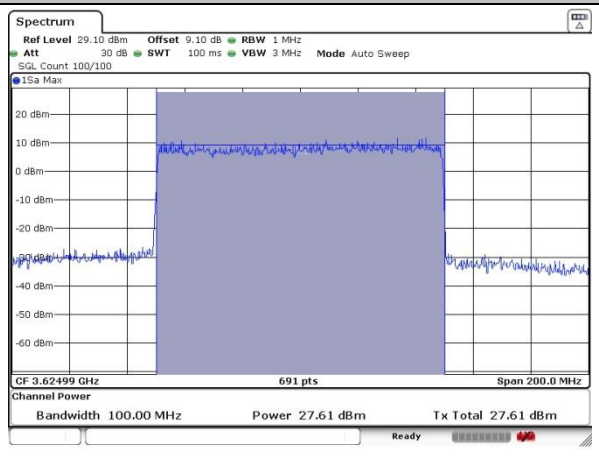
ANT0-64QAM-P

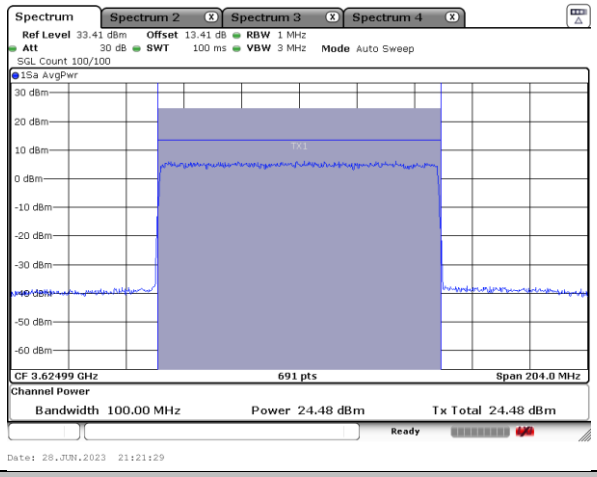
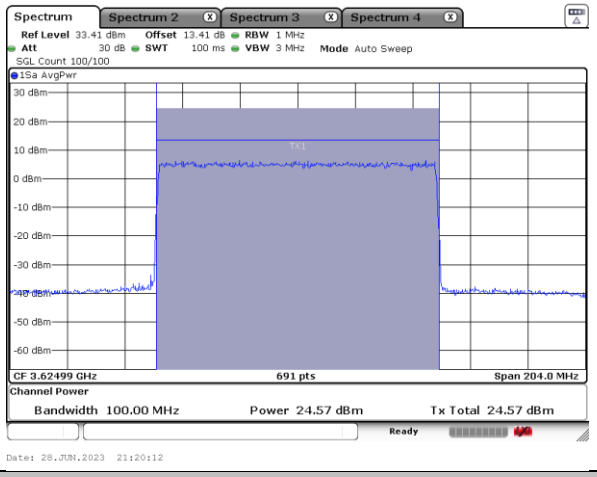
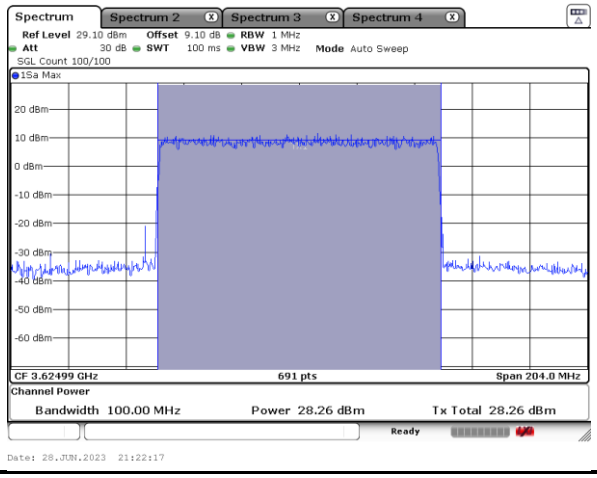
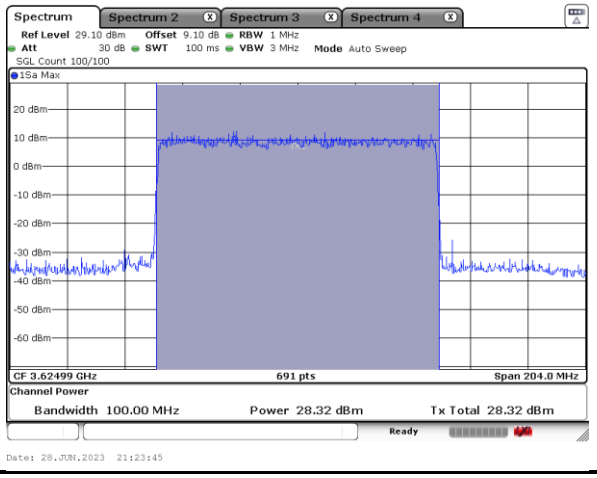


ANT1-64QAM-A



ANT1-64QAM-P

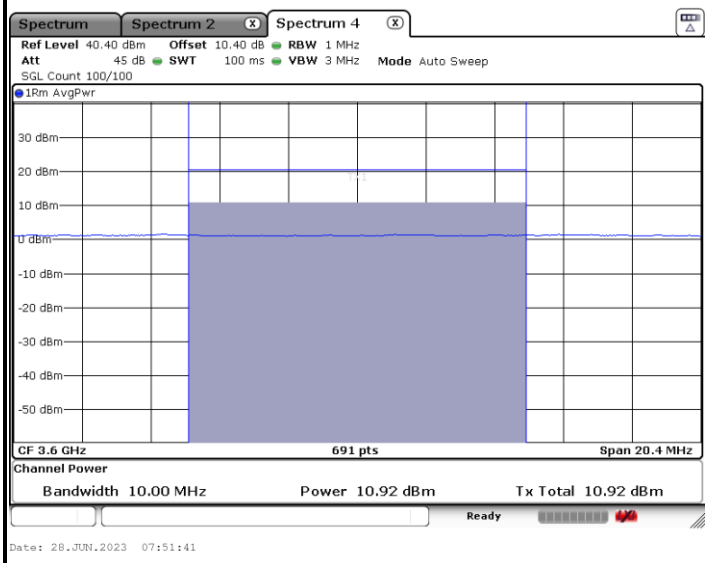
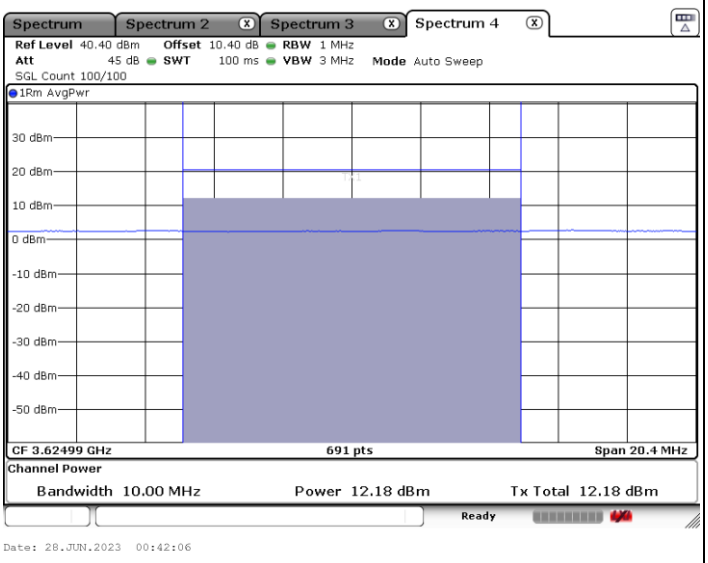
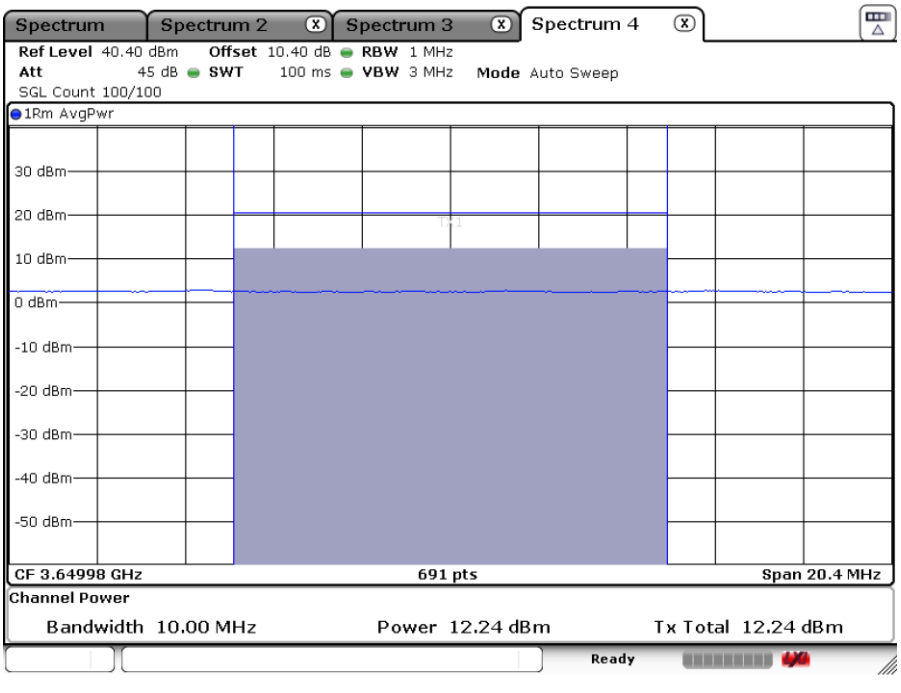


ANT0-256QAM-A	ANT0-256QAM-P
	
ANT1-256QAM-A	**ANT1-256QAM-P**
	

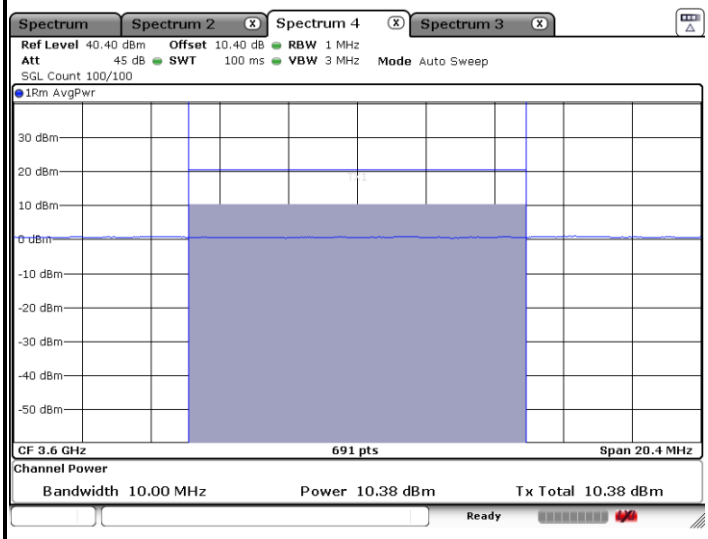
Channel Power (EIRP) /100M

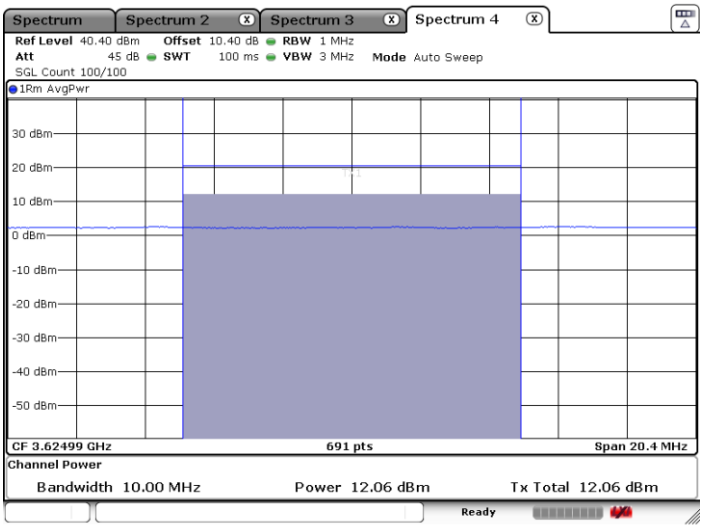
Conducted channel power (dBm/10MHz)			
64QAM	L	M	H
Ant0	10.92	12.18	12.24
Ant1	10.38	12.06	12.14
Ant0+Ant1	13.67	15.13	15.20
EIRP channel power (dBm/10MHz)			
64QAM	L	M	H
Ant0+Ant1	18.67	20.13	20.20
Limit	30dBm /10MHz		
Result	Pass		

Conducted channel power (dBm/10MHz)			
256QAM	L	M	H
Ant0	10.73	11.67	11.59
Ant1	10.88	11.87	11.70
Ant0+Ant1	13.82	14.78	14.66
EIRP channel power (dBm/10MHz)			
256QAM	L	M	H
Ant0+Ant1	18.82	19.78	19.66
Limit	30dBm /10MHz		
Result	Pass		

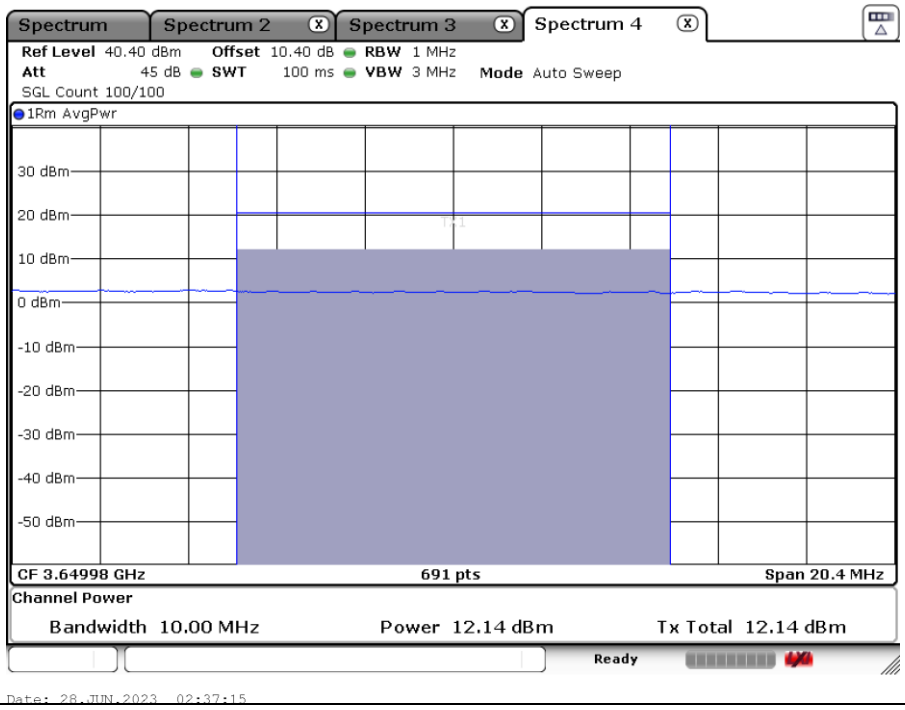
FR1 Part 96 n48 / 100MHz	
ANT0 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

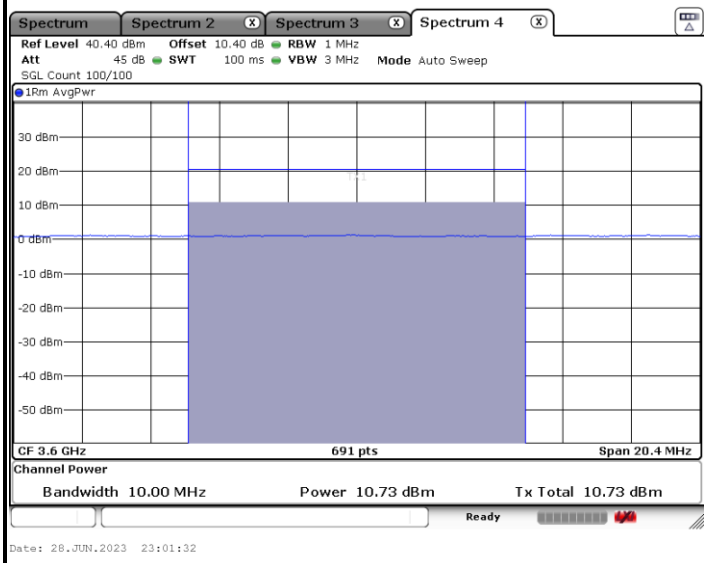
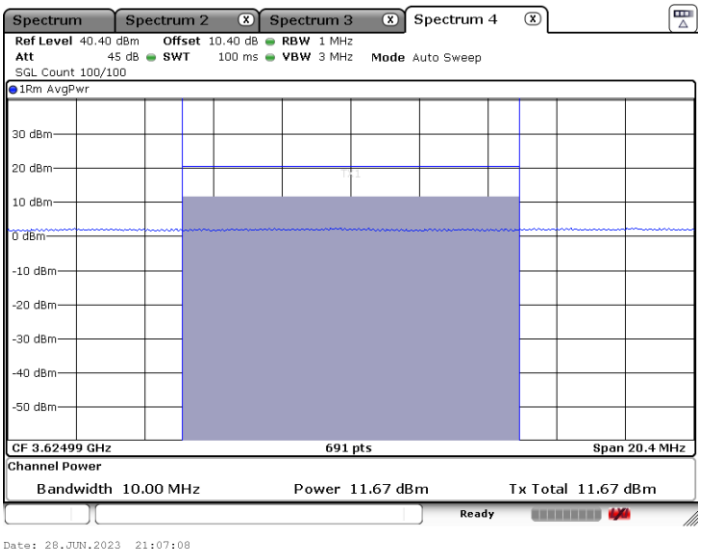
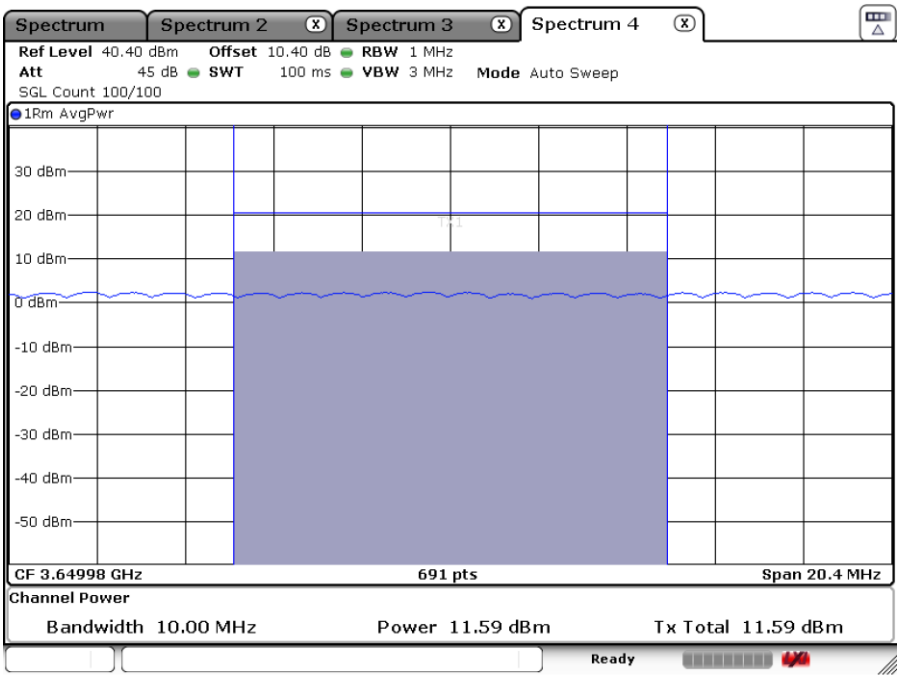
FR1 Part 96 n48 / 100MHz	
ANT1 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB

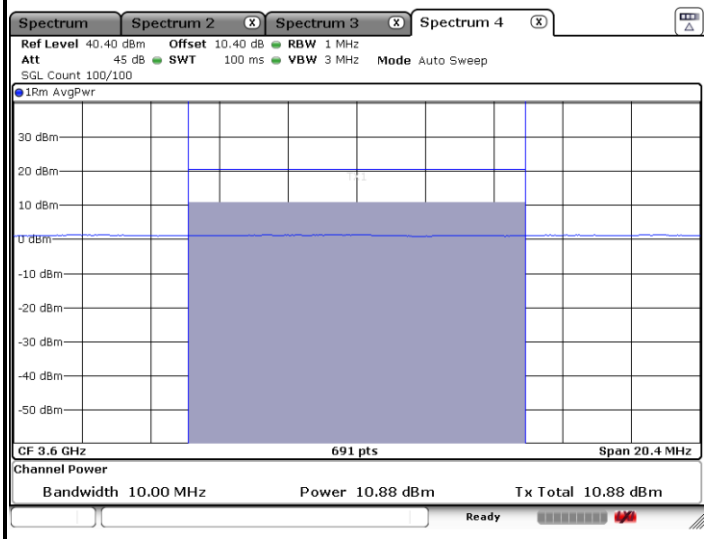
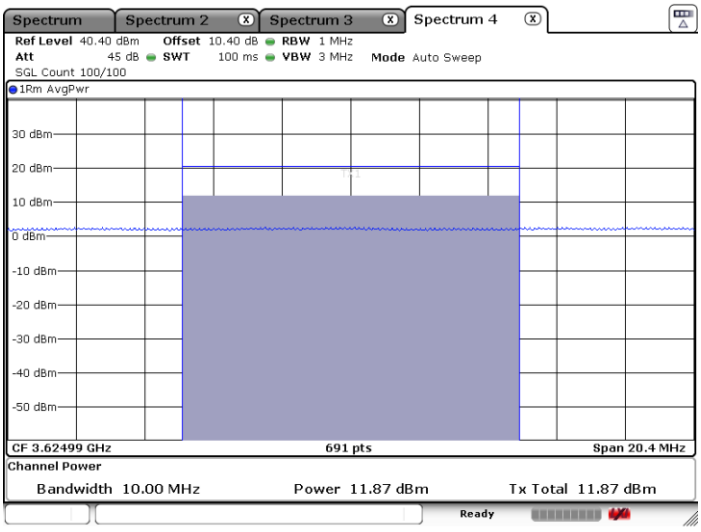
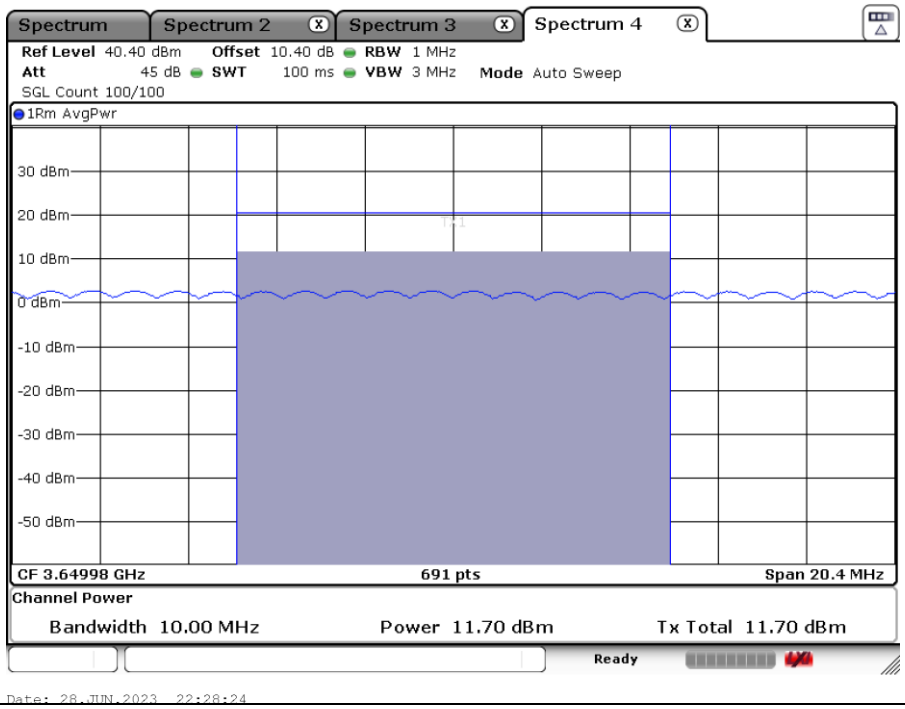




Highest Channel / FullRB



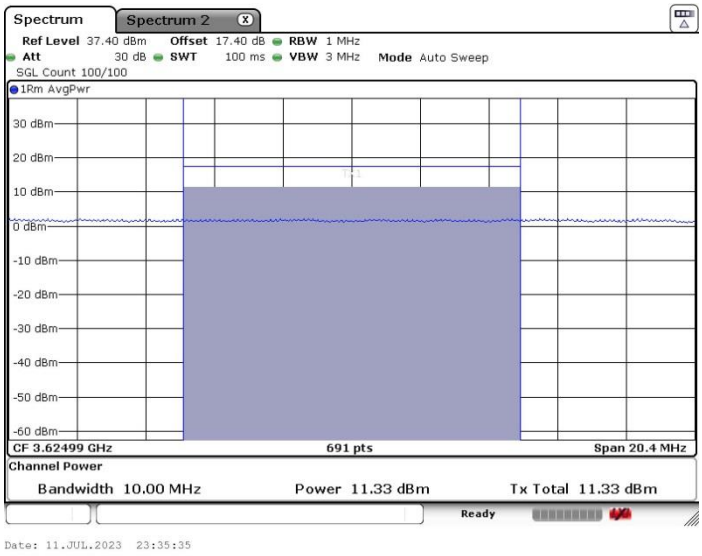
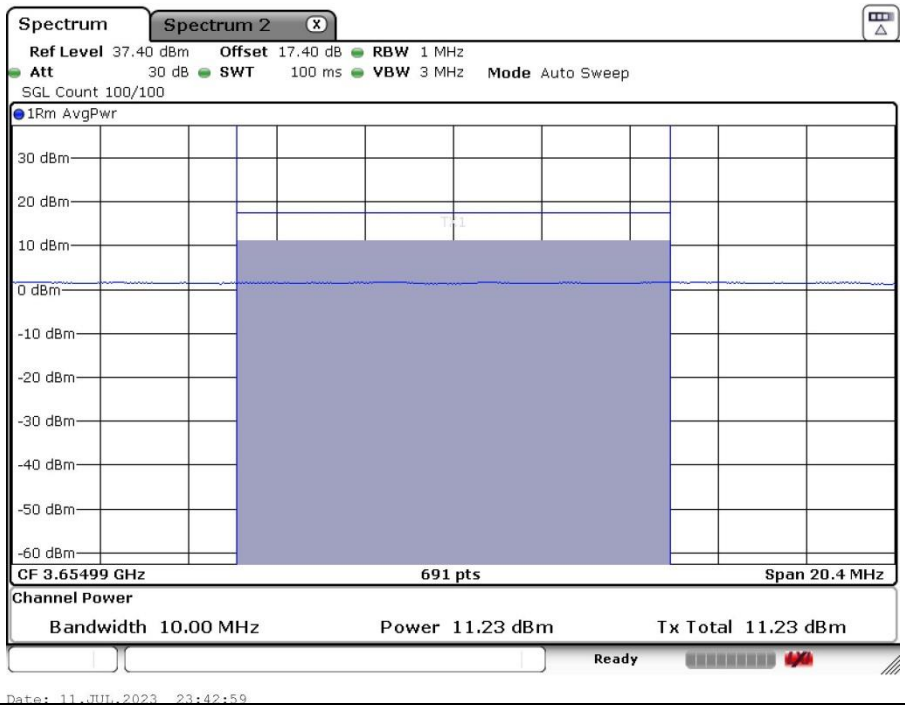
FR1 Part 96 n48 / 100MHz	
ANT0 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

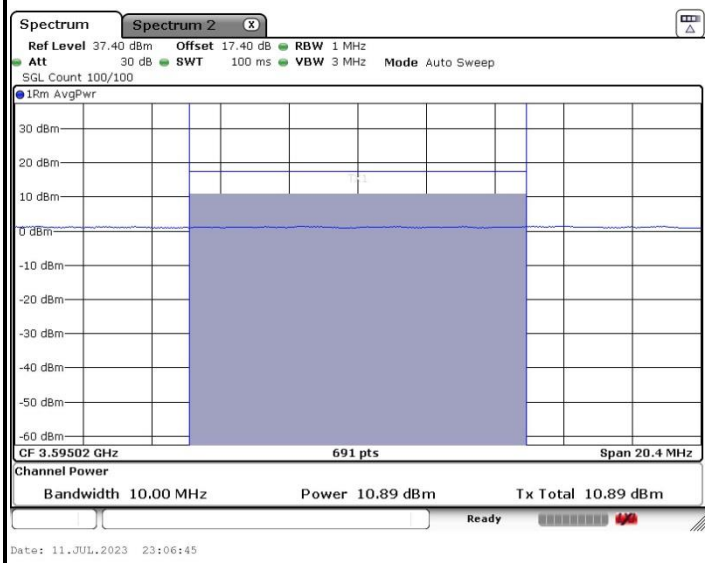
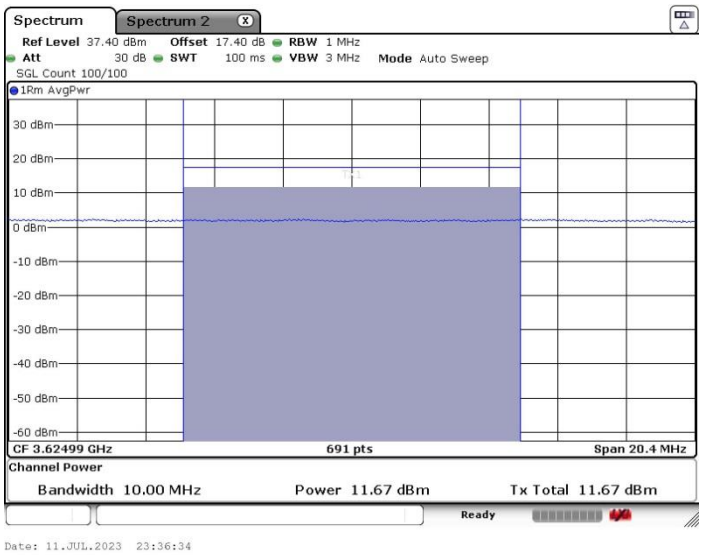
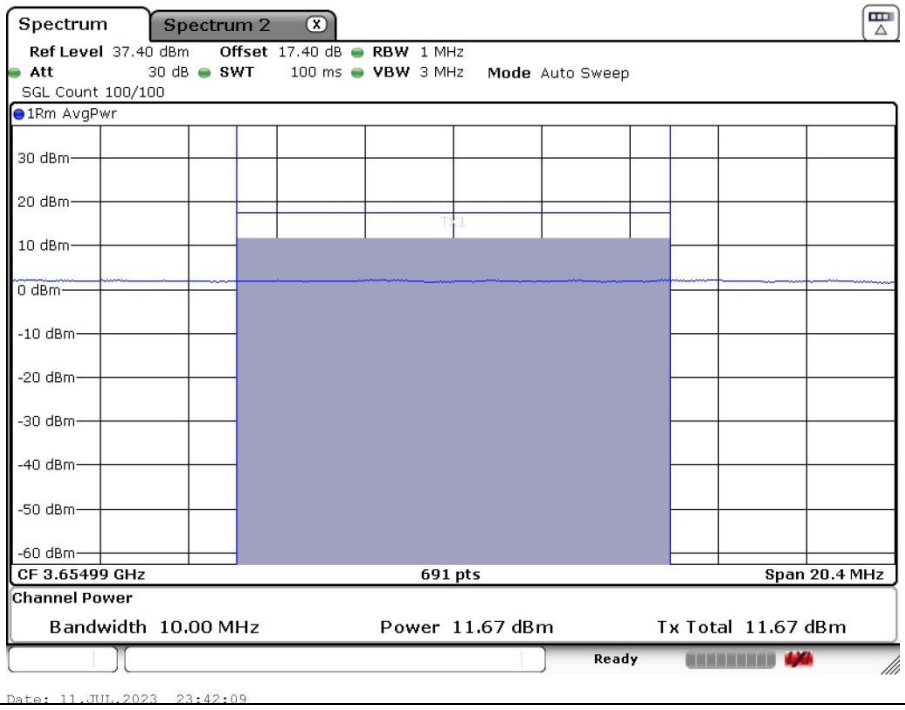
FR1 Part 96 n48 / 100MHz	
ANT1 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

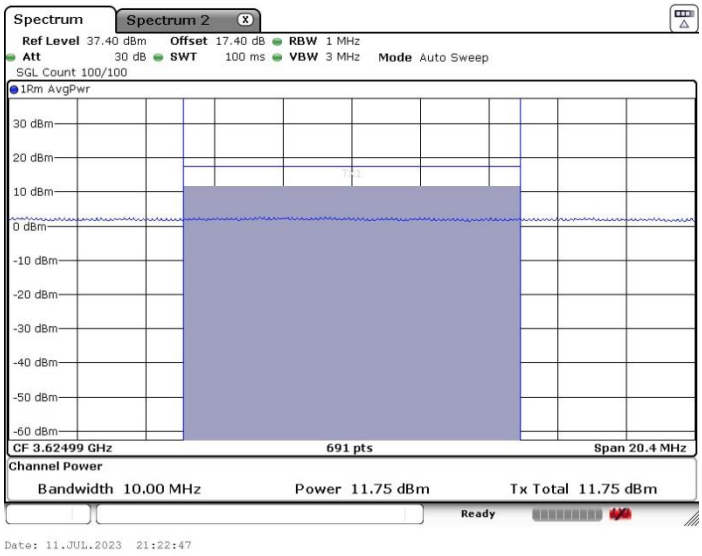
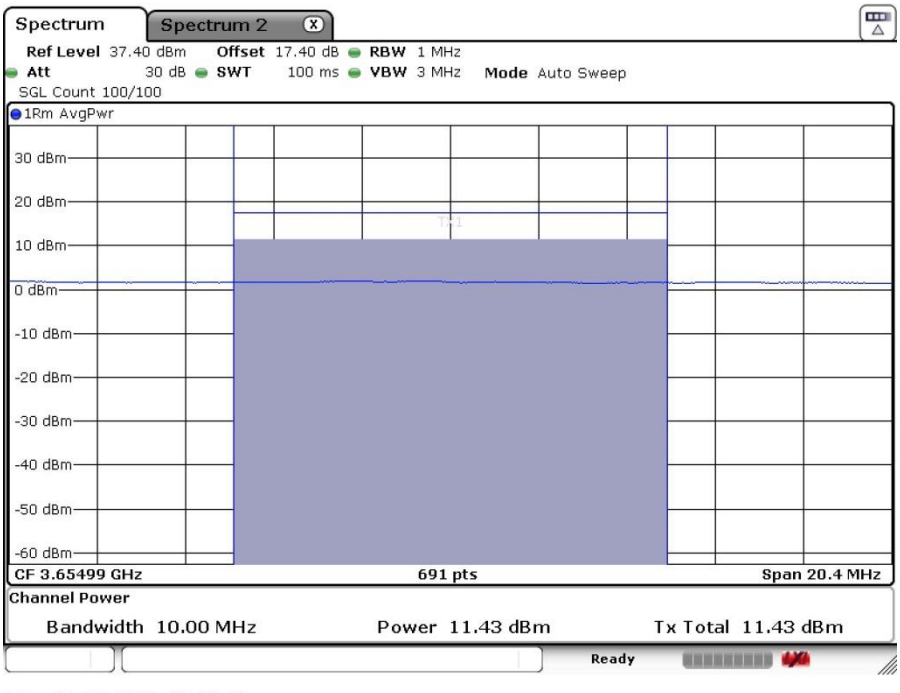
Channel Power (EIRP) /90M

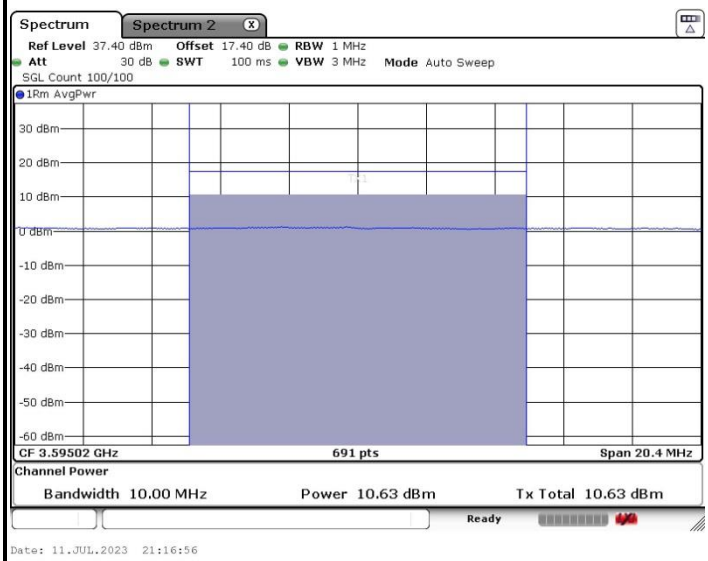
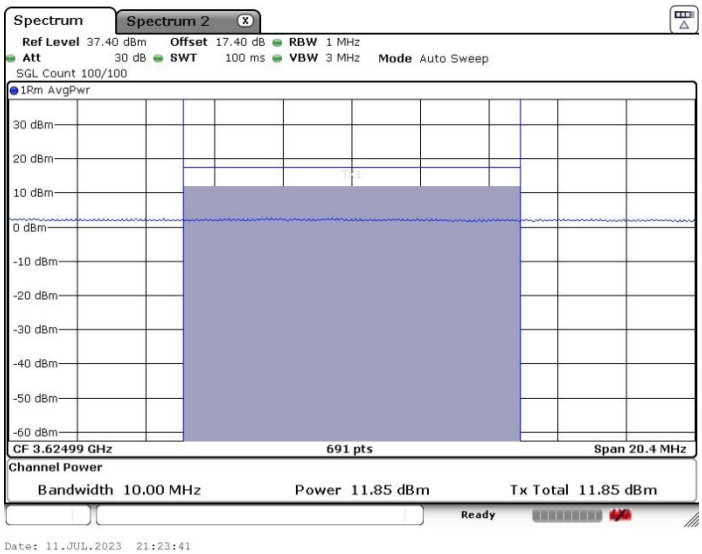
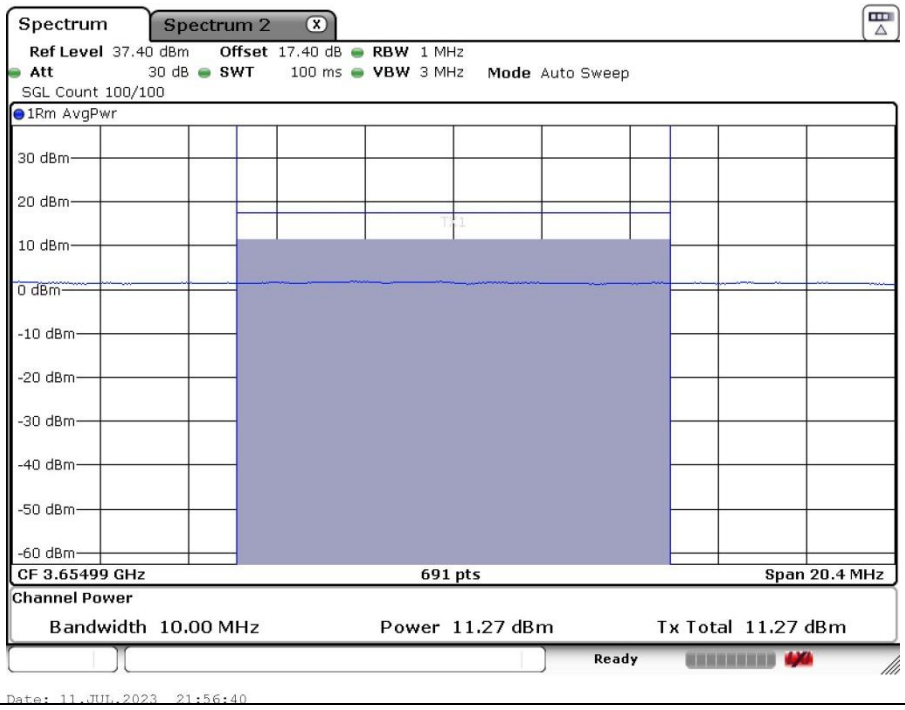
Conducted channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0	10.63	11.33	11.23
Ant1	10.89	11.67	11.67
Ant0+Ant1	13.77	14.51	14.47
EIRP channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0+Ant1	18.77	19.51	19.47
Limit	30dBm /10MHz		
Result	Pass		

Conducted channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0	10.66	11.75	11.43
Ant1	10.63	11.85	11.27
Ant0+Ant1	13.66	14.81	14.36
EIRP channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0+Ant1	18.66	19.81	19.36
Limit	30dBm /10MHz		
Result	Pass		

FR1 Part 96 n48 / 90MHz	
ANT0 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

FR1 Part 96 n48 / 90MHz	
ANT1 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

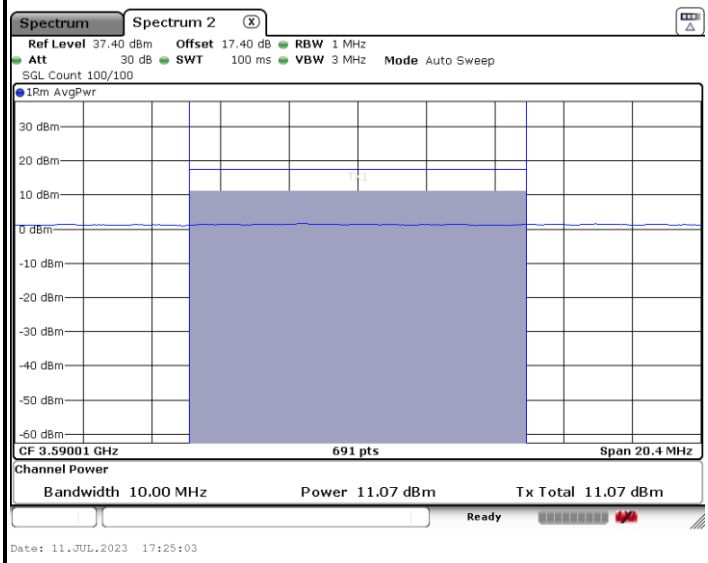
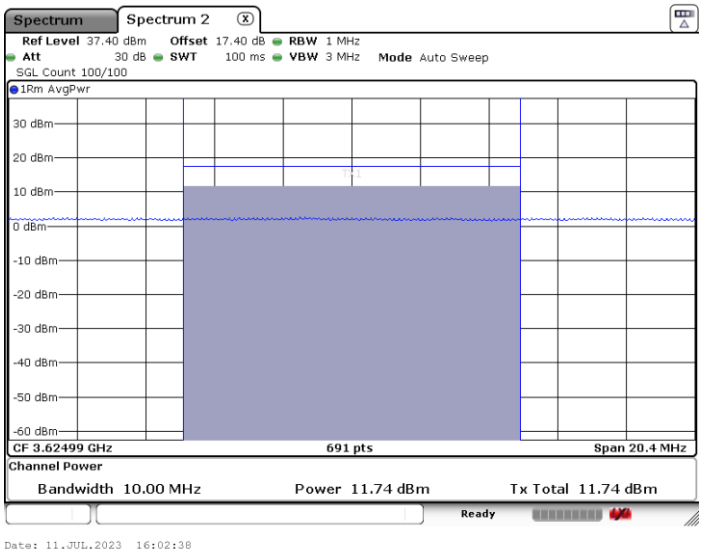
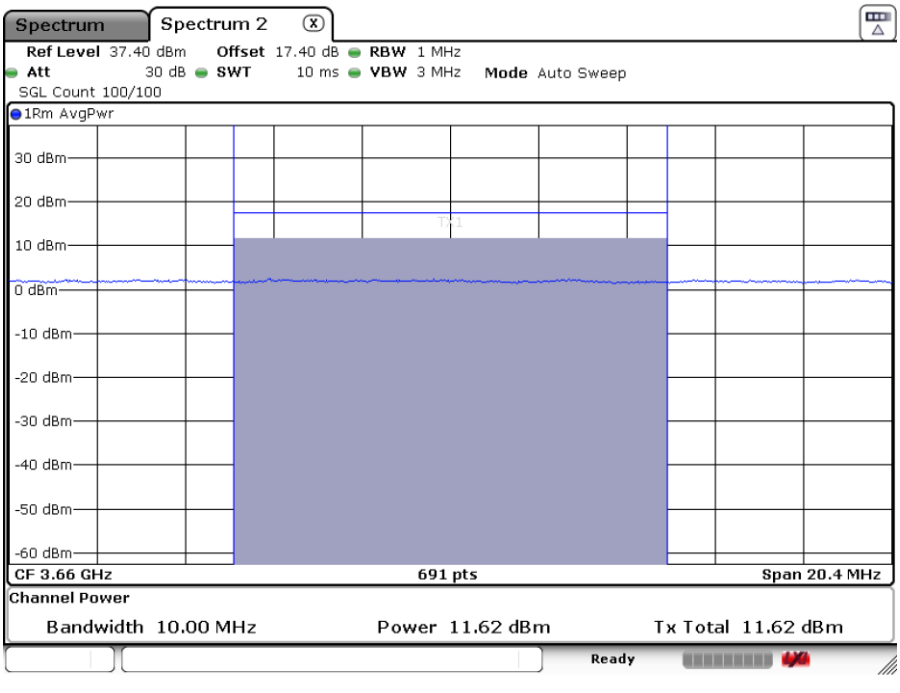
FR1 Part 96 n48 / 90MHz	
ANT0 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

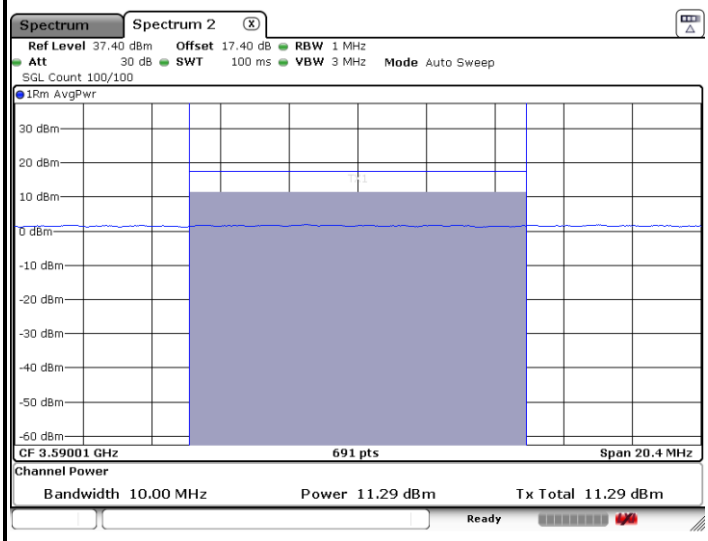
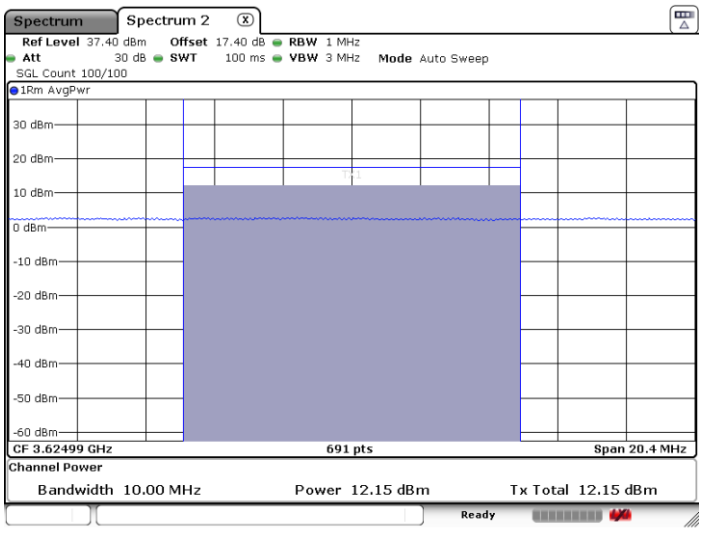
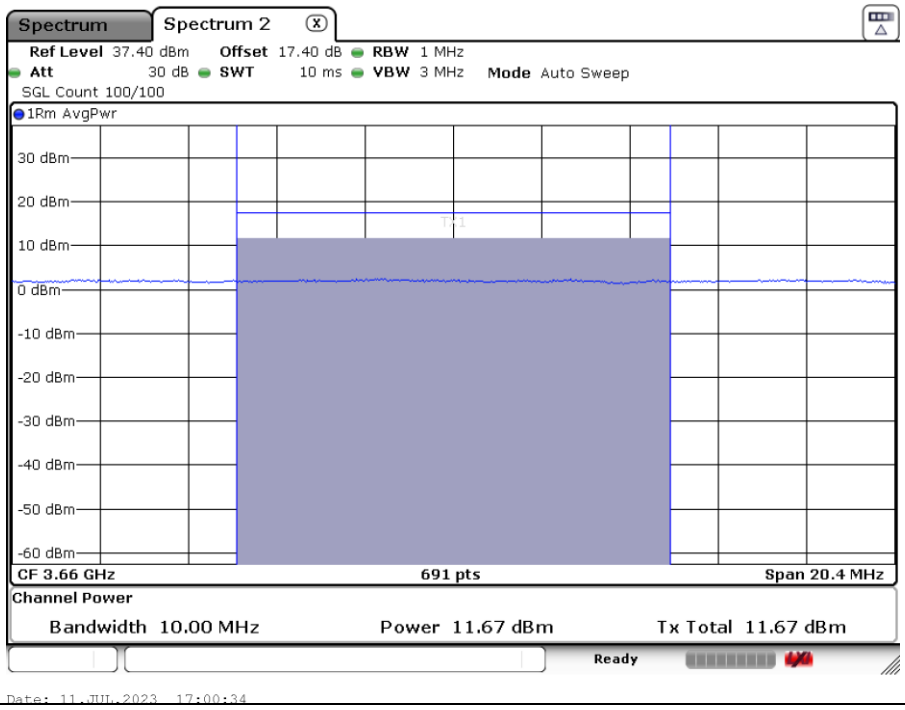
FR1 Part 96 n48 / 90MHz	
ANT1 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

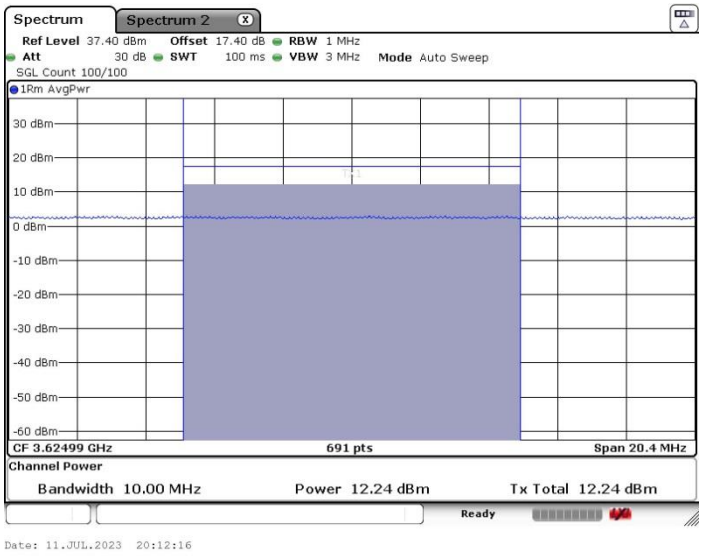
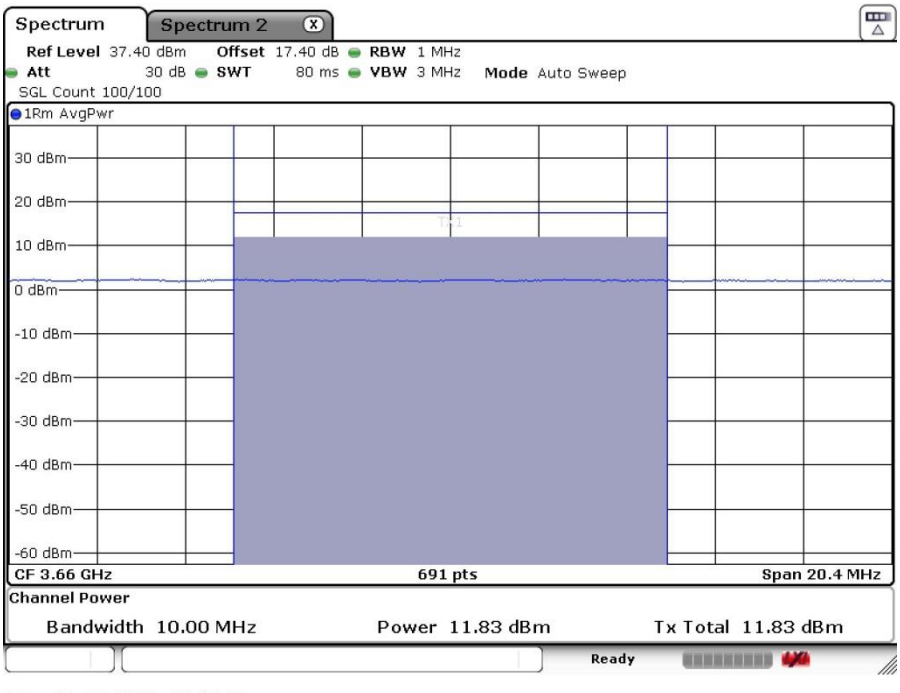
Channel Power (EIRP) /80M

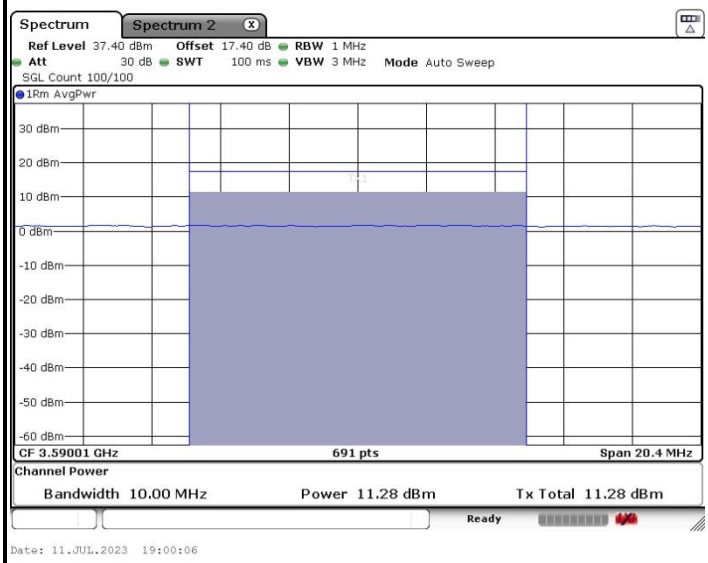
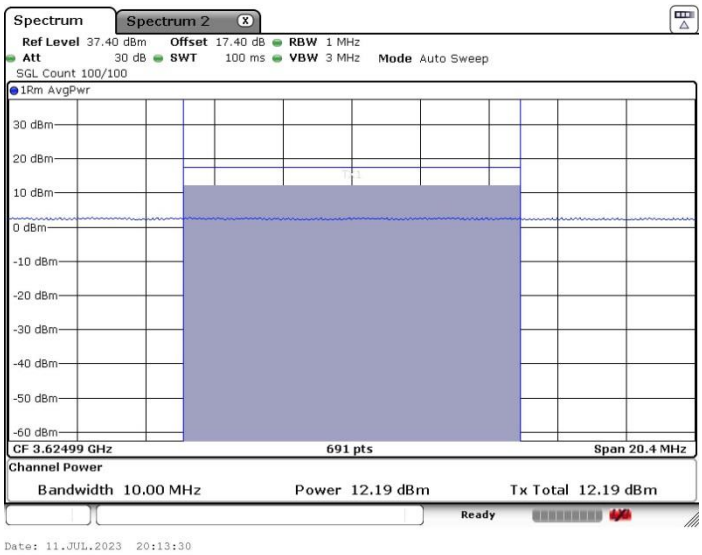
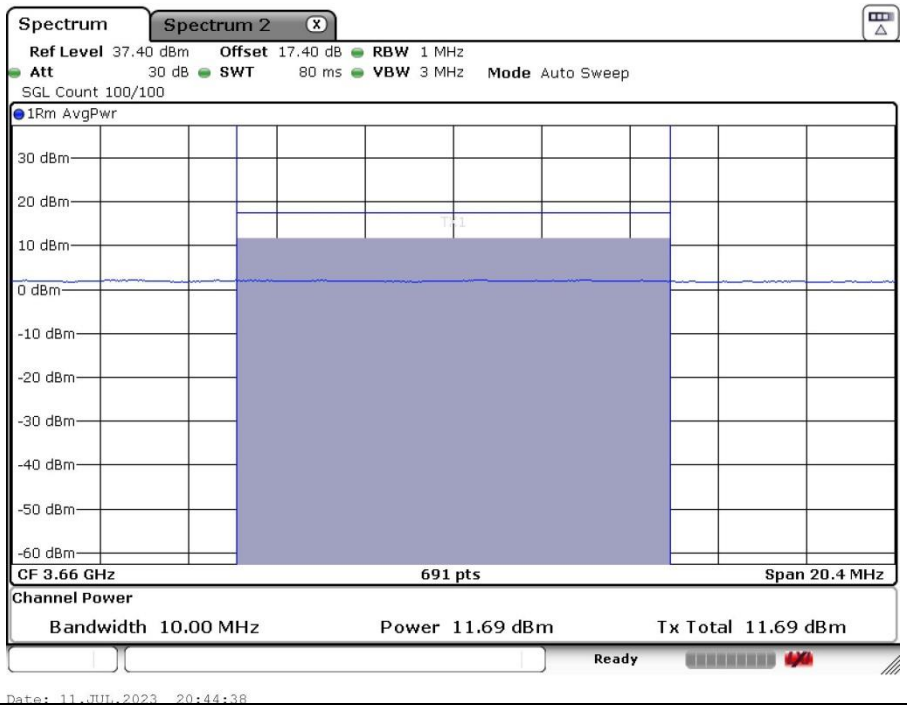
Conducted channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0	11.07	11.74	11.62
Ant1	11.29	12.15	11.67
Ant0+Ant1	14.19	14.96	14.66
EIRP channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0+Ant1	19.19	19.96	19.66
Limit	30dBm /10MHz		
Result	Pass		

Conducted channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0	11.07	12.24	11.83
Ant1	11.28	12.19	11.69
Ant0+Ant1	14.19	15.23	14.77
EIRP channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0+Ant1	19.19	20.23	19.77
Limit	30dBm /10MHz		
Result	Pass		

FR1 Part 96 n48 / 80MHz	
ANT0 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

FR1 Part 96 n48 / 80MHz	
ANT1 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

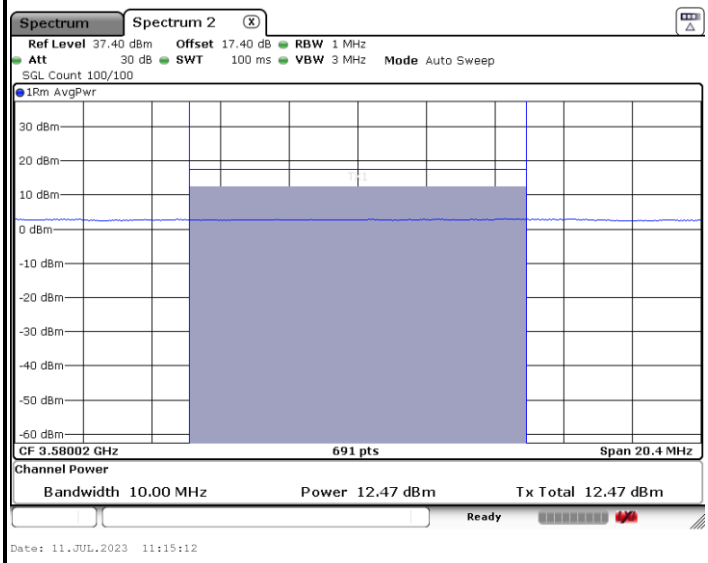
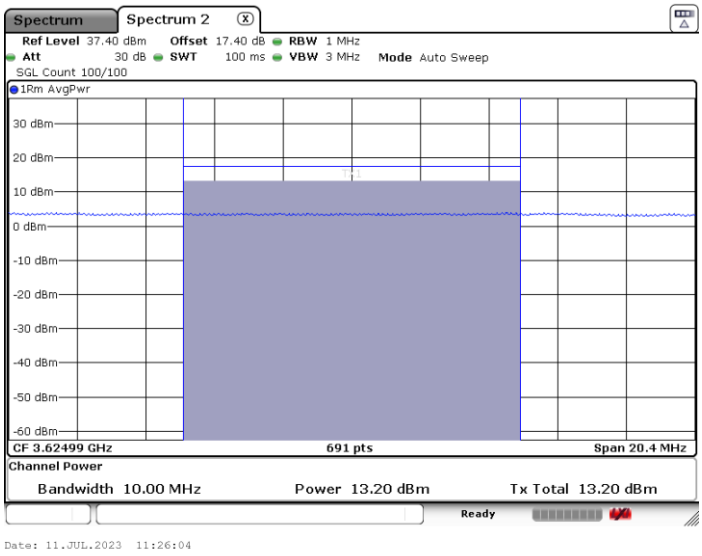
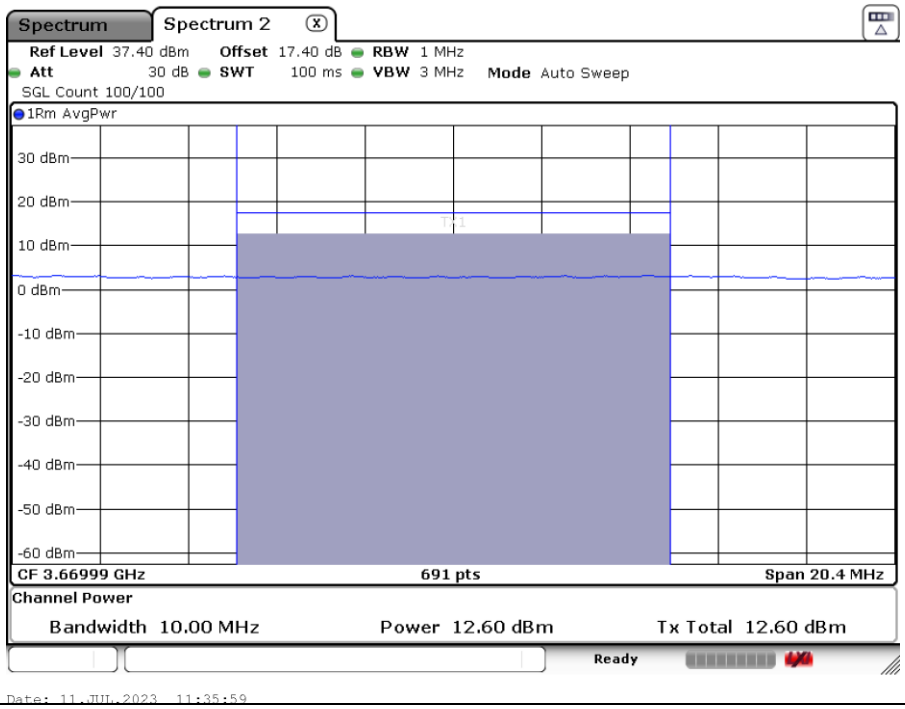
FR1 Part 96 n48 / 80MHz	
ANT0 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

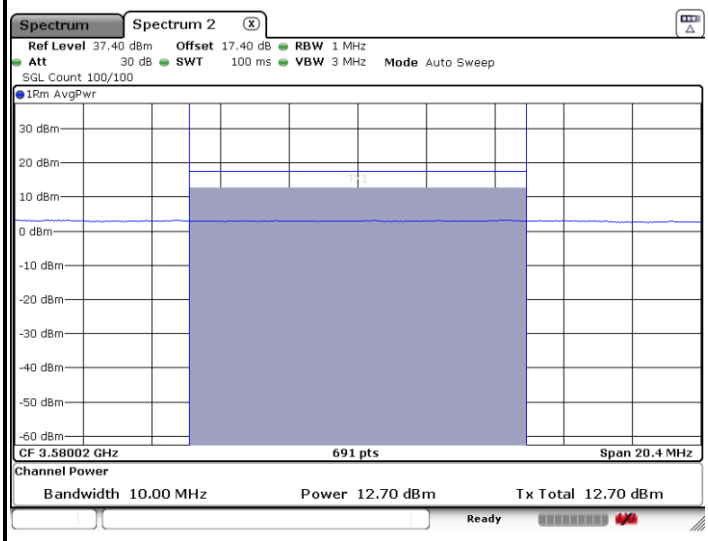
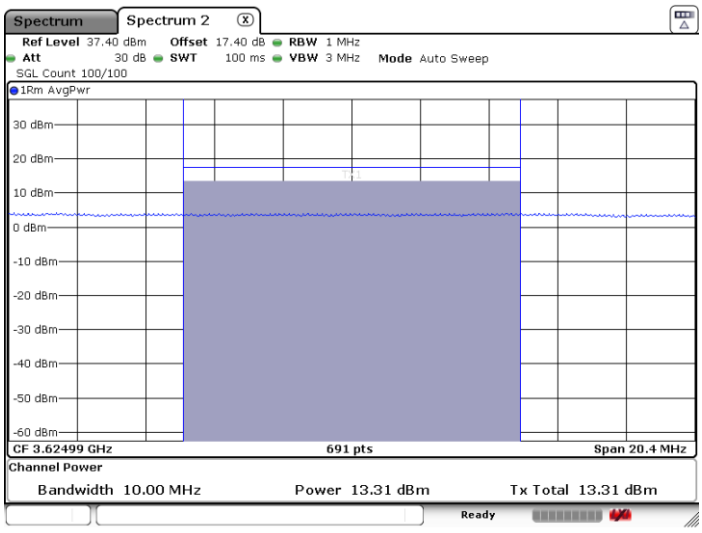
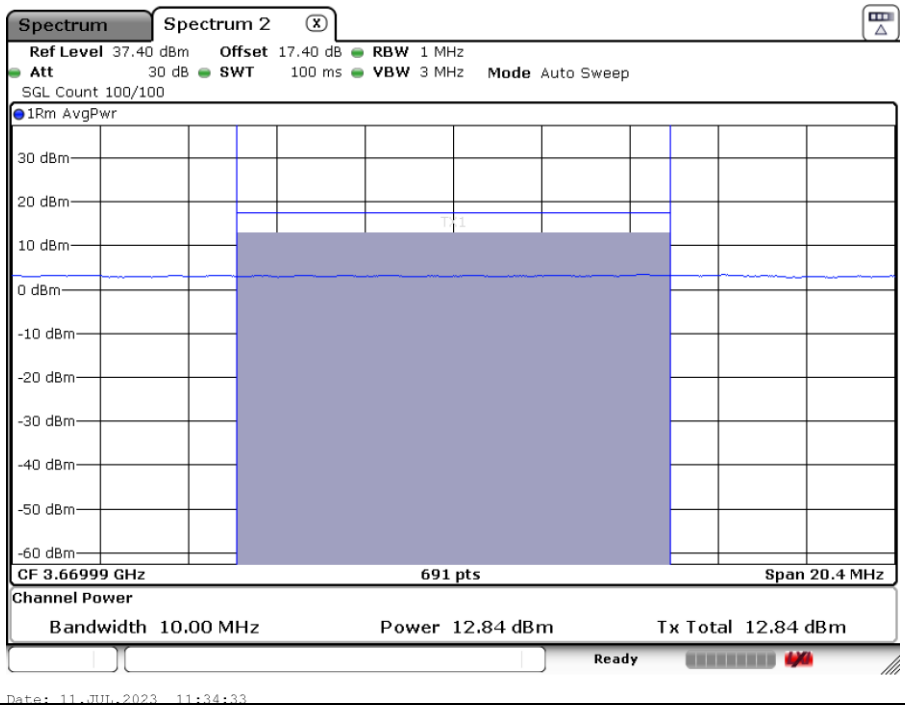
FR1 Part 96 n48 / 80MHz	
ANT1 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

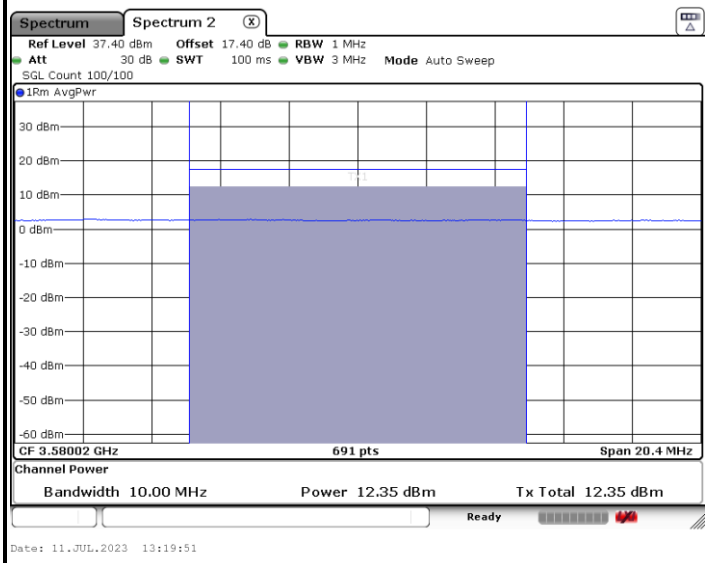
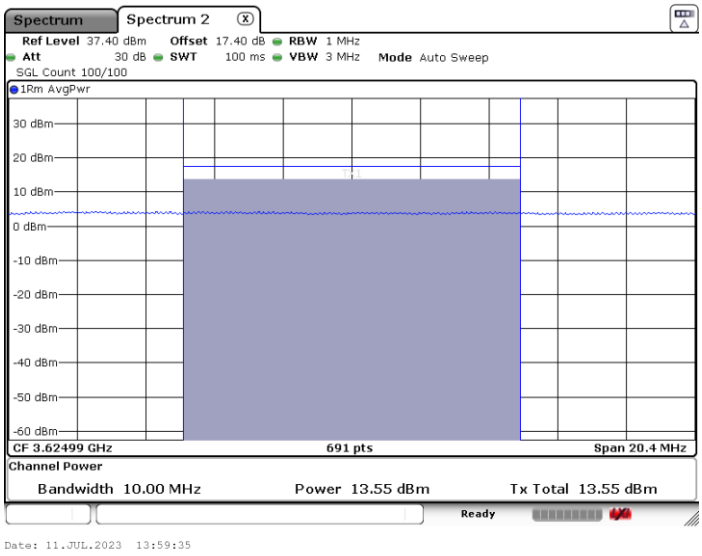
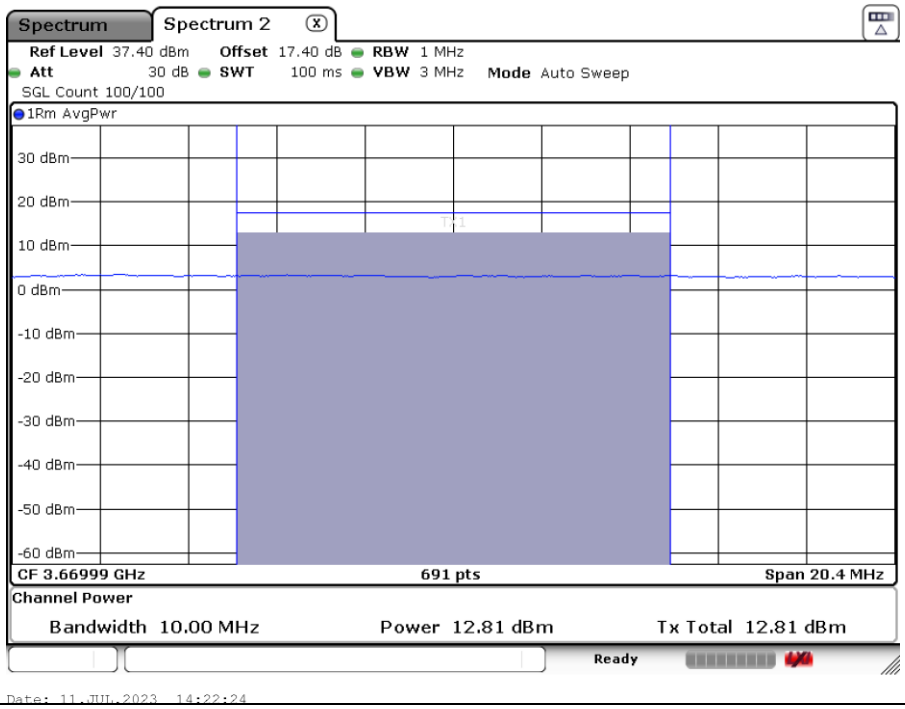
Channel Power (EIRP) /60M

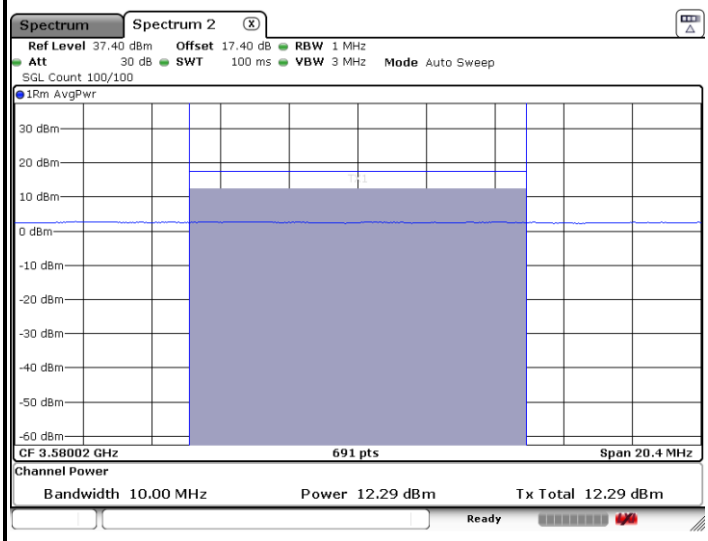
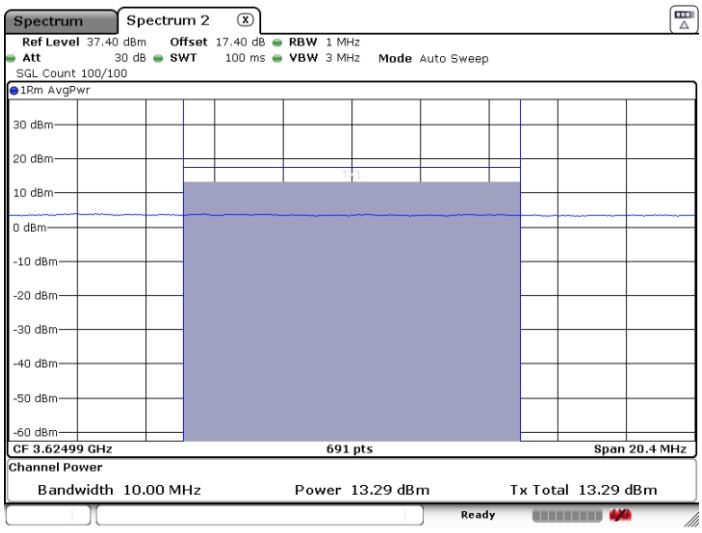
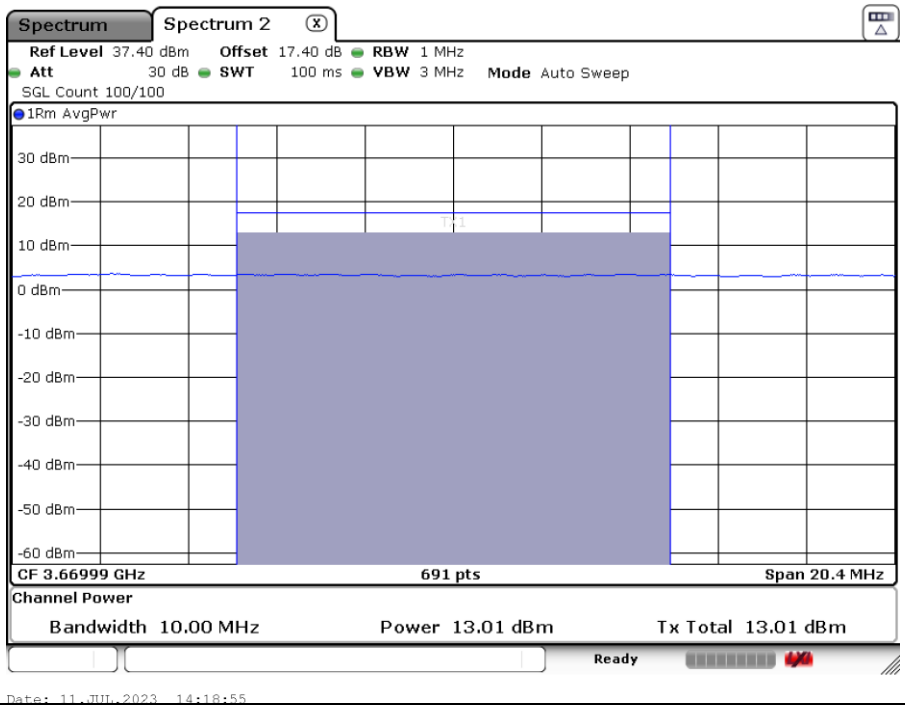
Conducted channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0	12.47	13.2	12.6
Ant1	12.7	13.31	12.84
Ant0+Ant1	15.60	16.27	15.73
EIRP channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0+Ant1	20.60	21.27	20.73
Limit	30dBm /10MHz		
Result	Pass		

Conducted channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0	12.35	13.55	12.81
Ant1	12.29	13.29	13.01
Ant0+Ant1	15.33	16.43	15.92
EIRP channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0+Ant1	20.33	21.43	20.92
Limit	30dBm /10MHz		
Result	Pass		

FR1 Part 96 n48 / 60MHz	
ANT0 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

FR1 Part 96 n48 / 60MHz	
ANT1 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

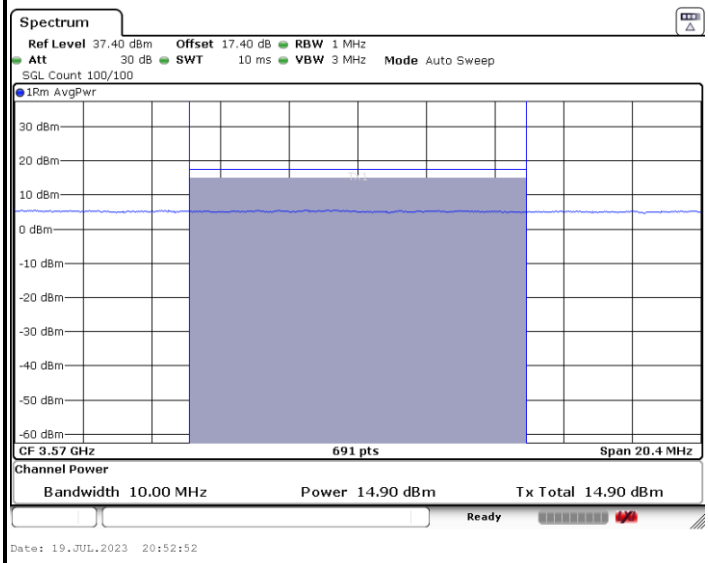
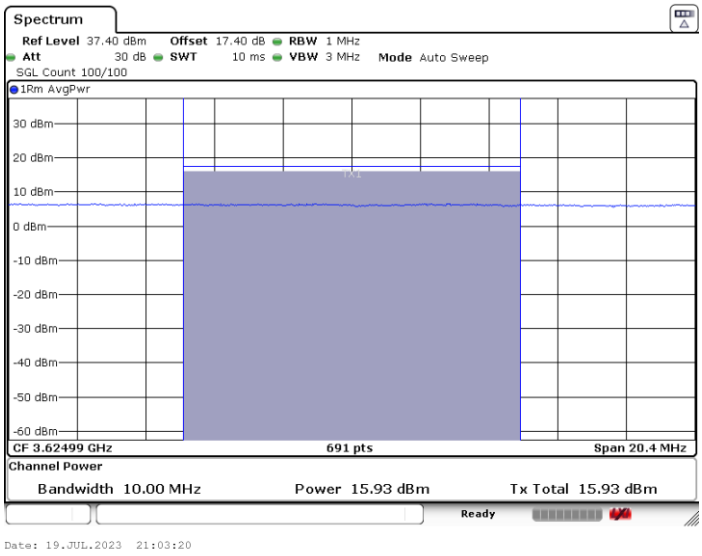
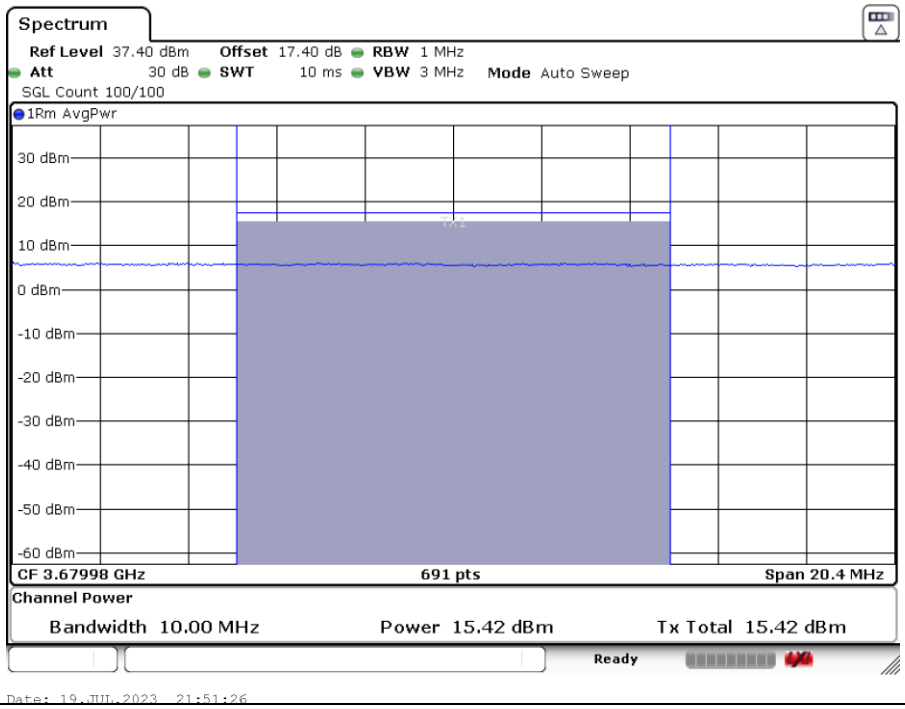
FR1 Part 96 n48 / 60MHz	
ANT0 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

FR1 Part 96 n48 / 60MHz	
ANT1 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

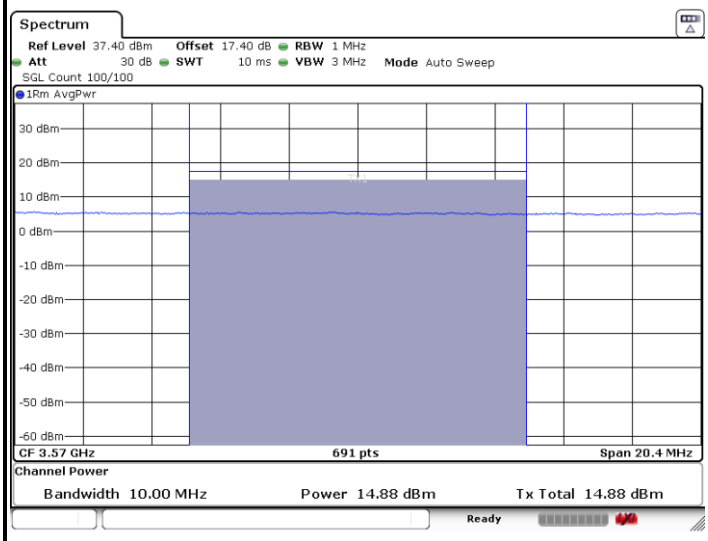
Channel Power (EIRP) /40M

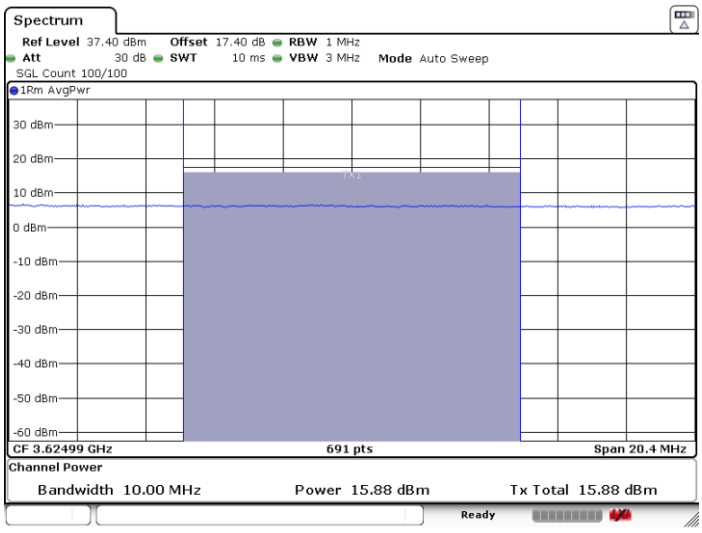
Conducted channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0	14.9	15.93	15.42
Ant1	14.88	15.88	15.33
Ant0+Ant1	17.90	18.92	18.39
EIRP channel power(dBm/10MHz)			
64QAM	L	M	H
Ant0+Ant1	22.9	23.92	23.39
Limit	30dBm /10MHz		
Result	Pass		

Conducted channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0	14.98	15.12	14.77
Ant1	14.58	14.97	14.74
Ant0+Ant1	17.79	18.06	17.77
EIRP channel power(dBm/10MHz)			
256QAM	L	M	H
Ant0+Ant1	22.79	23.06	22.77
Limit	30dBm /10MHz		
Result	Pass		

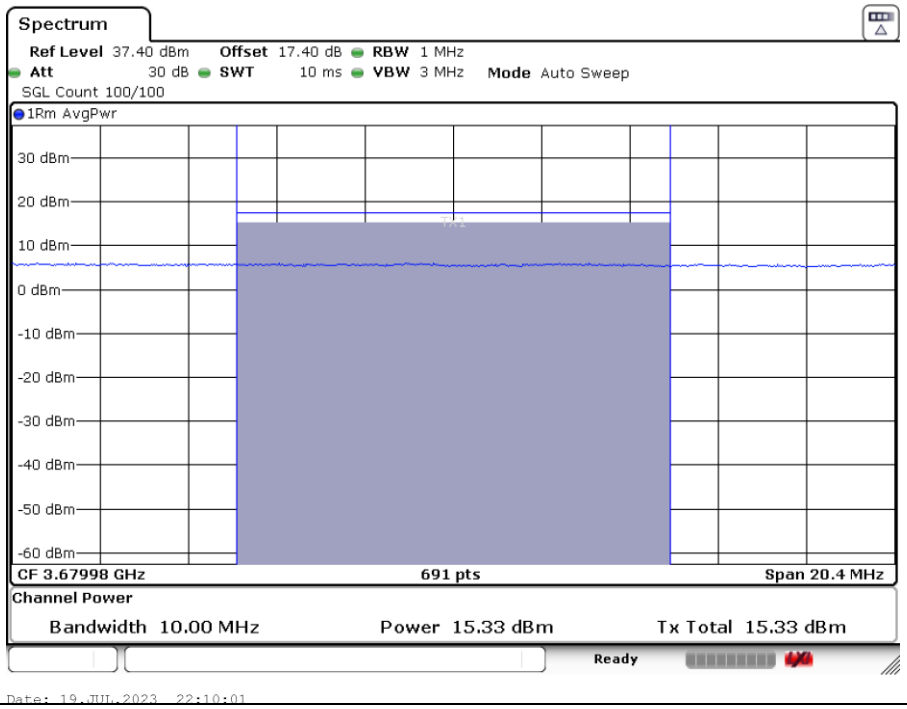
FR1 Part 96 n48 / 40MHz	
ANT0 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

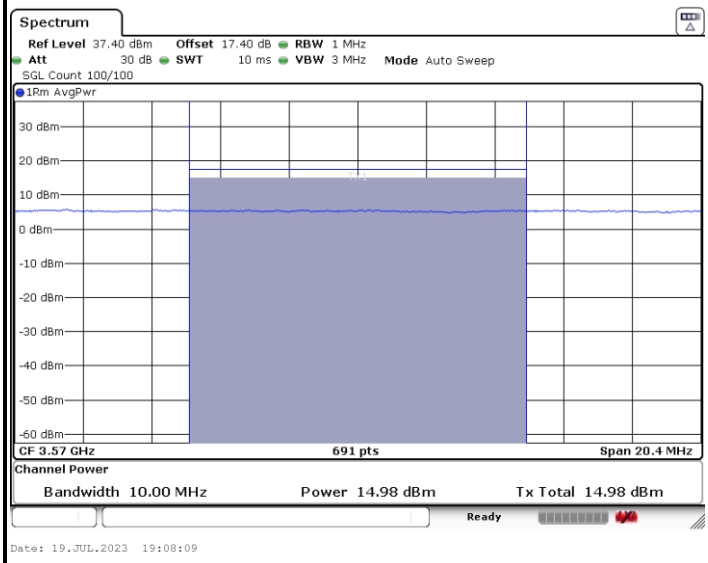
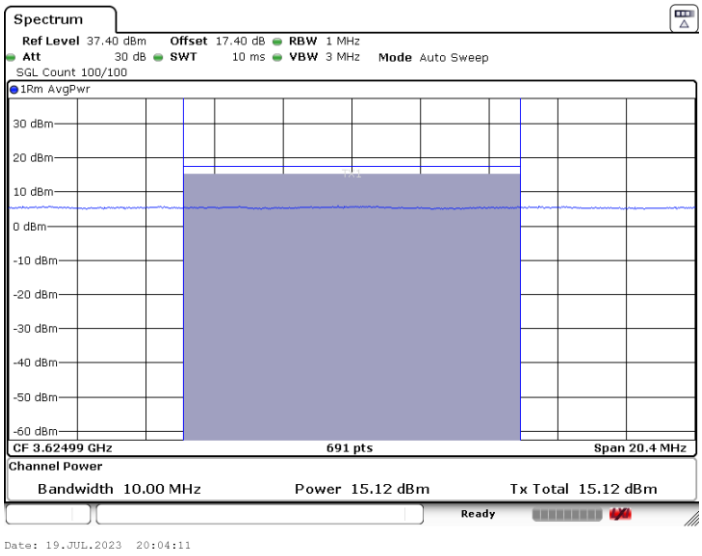
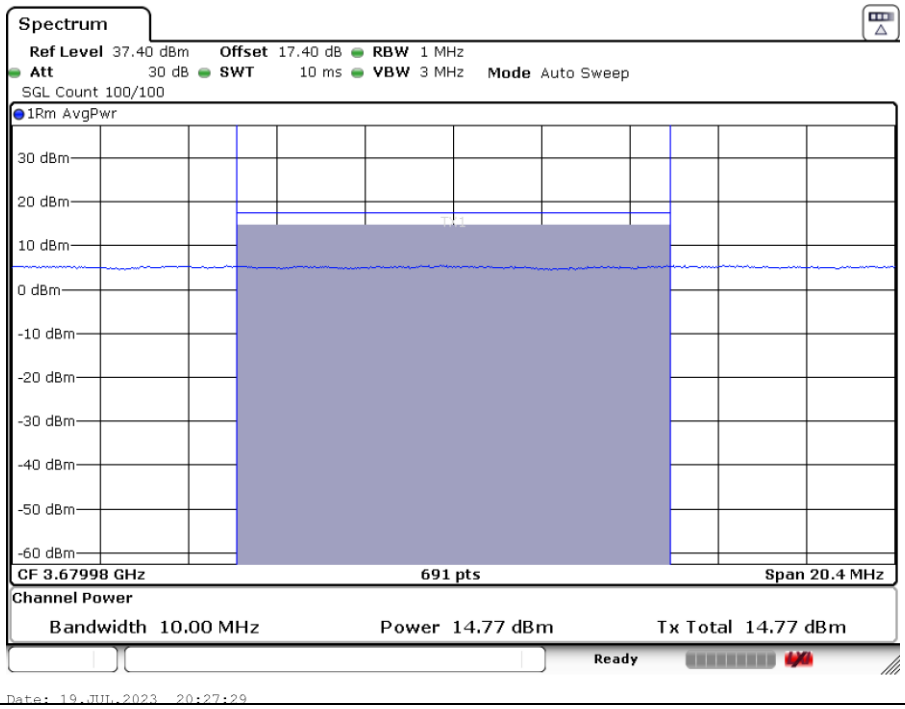
FR1 Part 96 n48 / 40MHz	
ANT1 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB

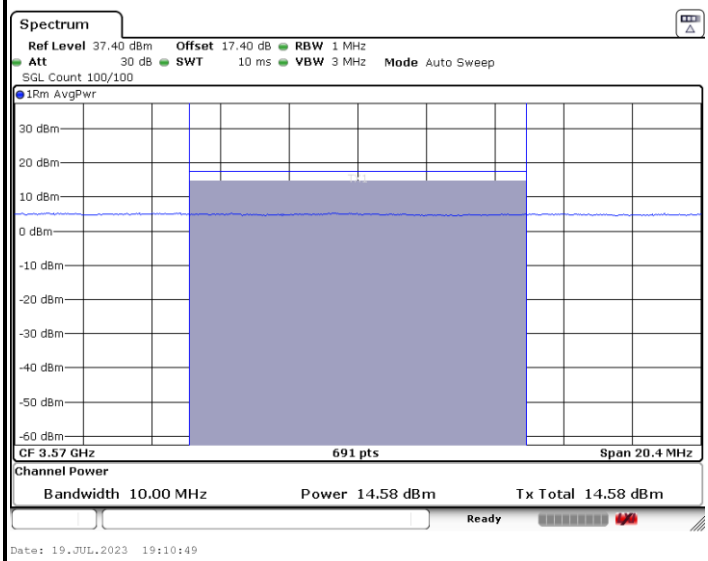
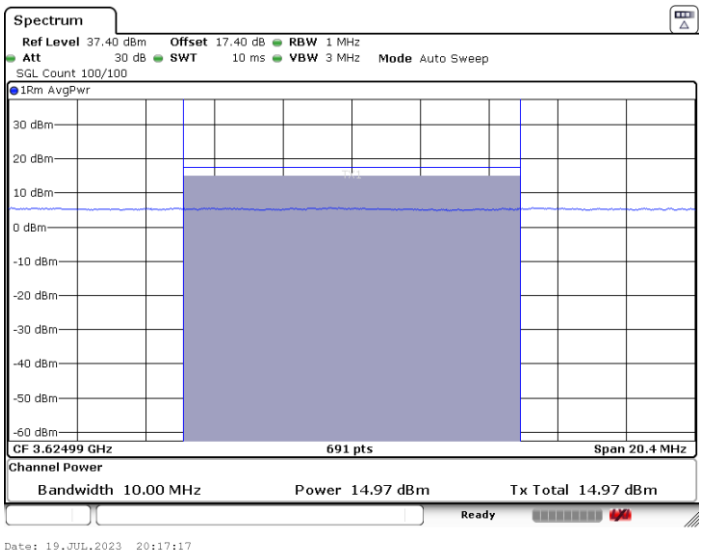
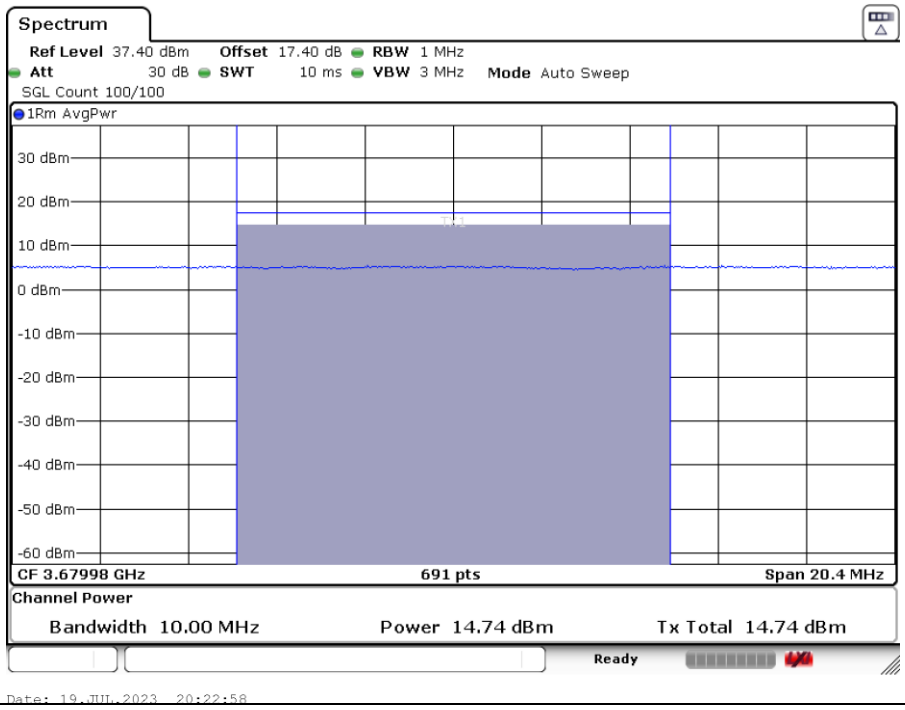




Highest Channel / FullRB



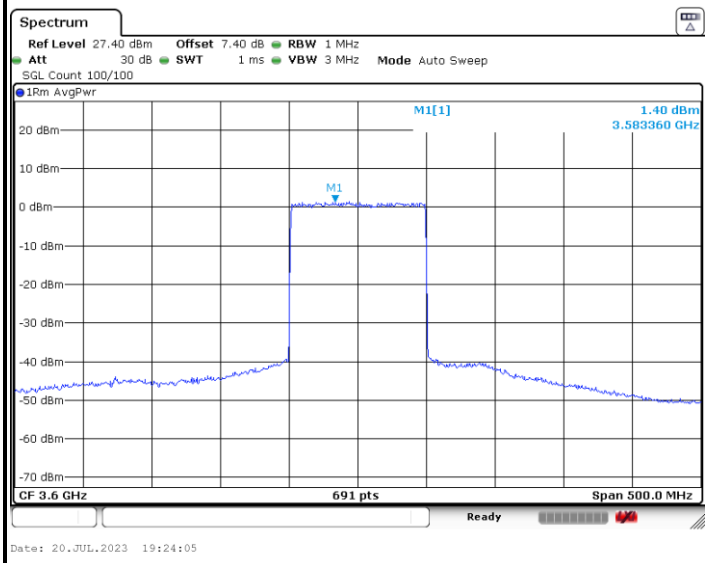
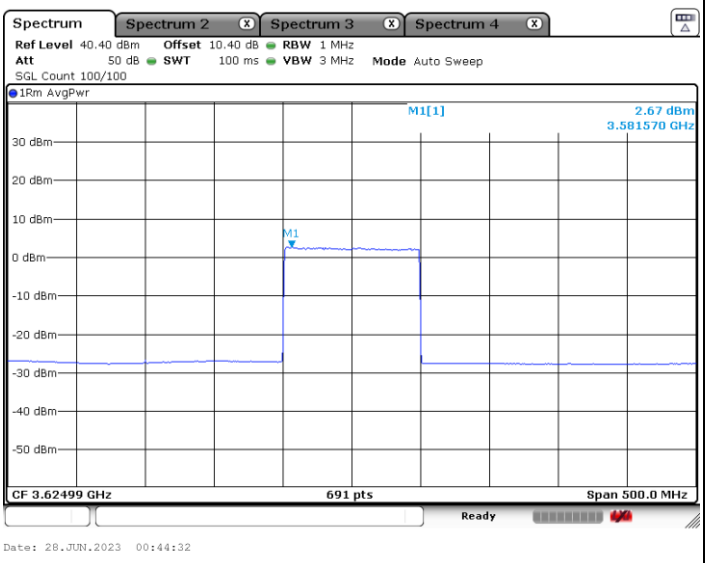
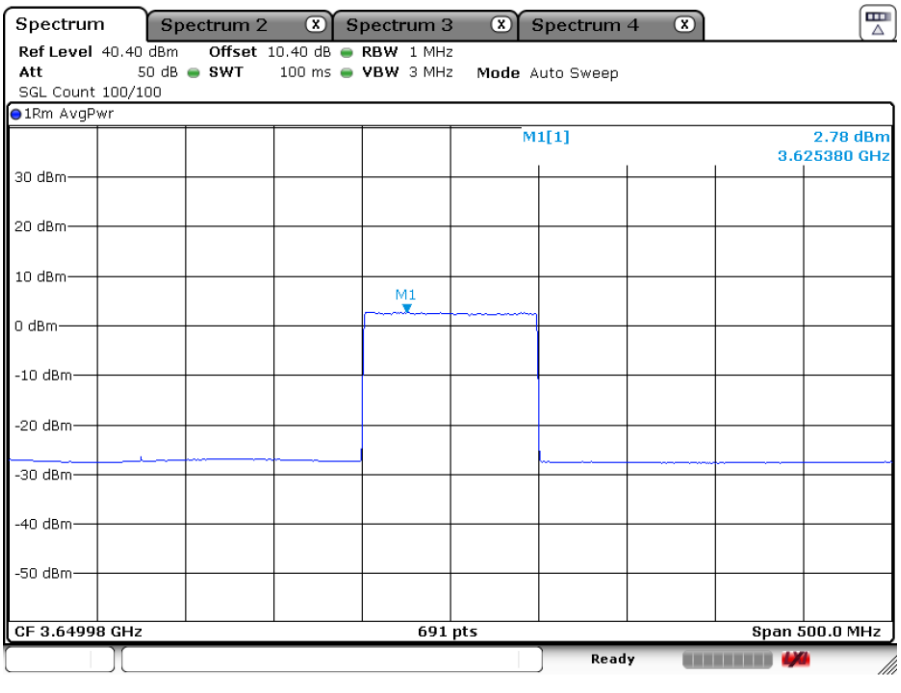
FR1 Part 96 n48 / 40MHz	
ANT0 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

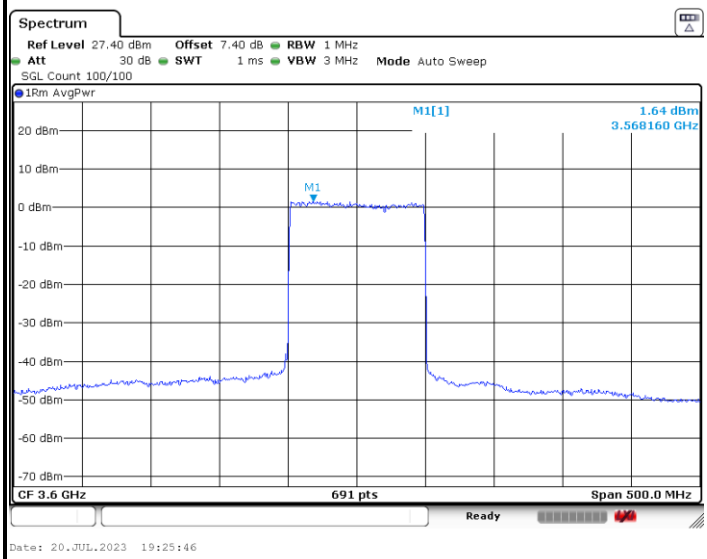
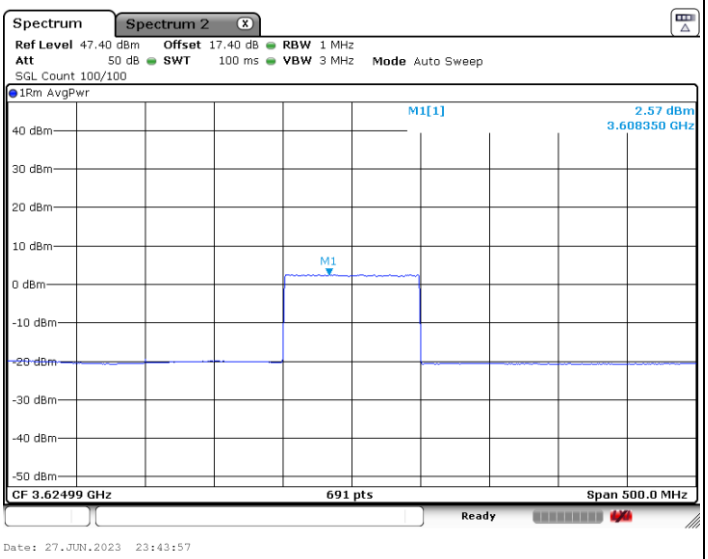
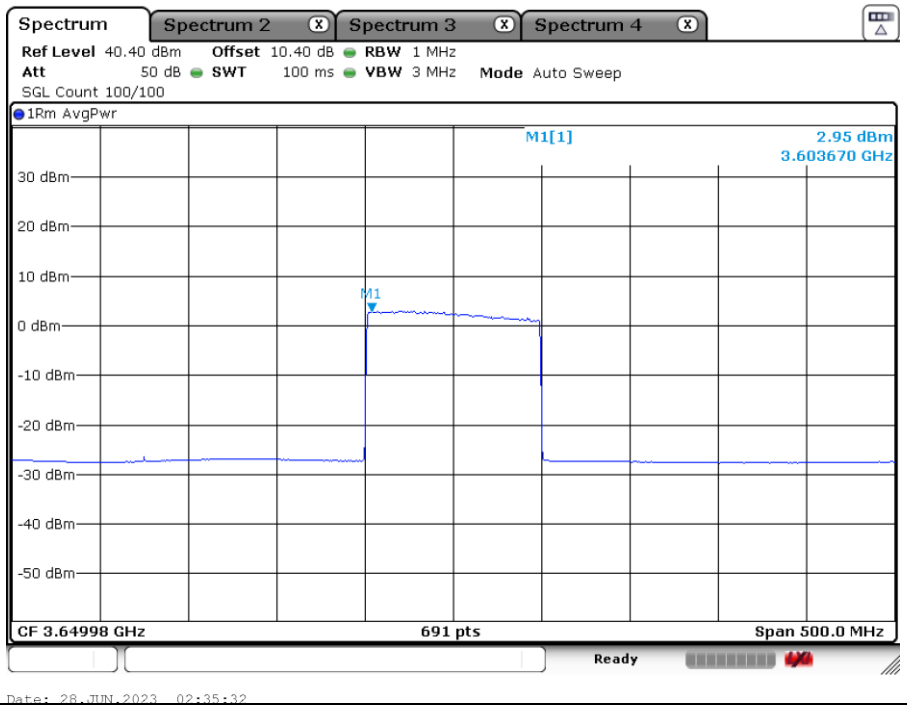
FR1 Part 96 n48 / 40MHz	
ANT1 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

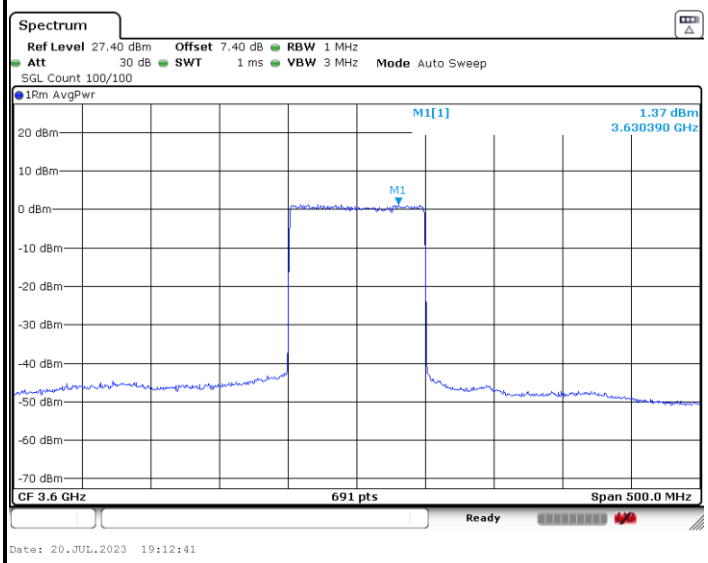
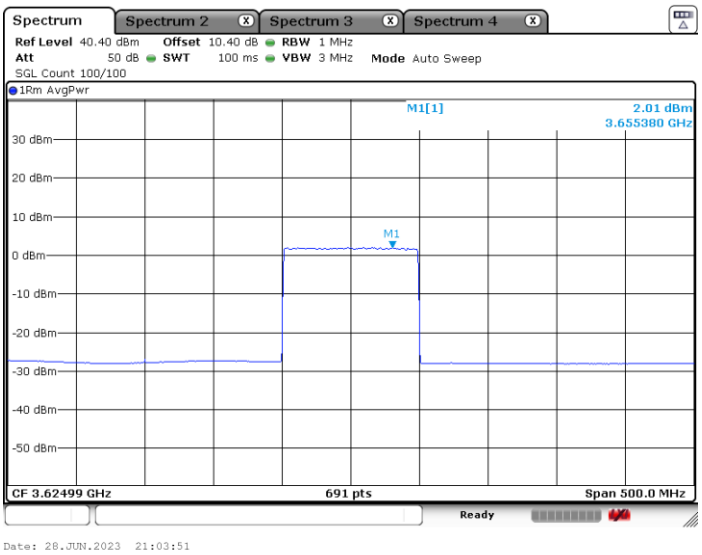
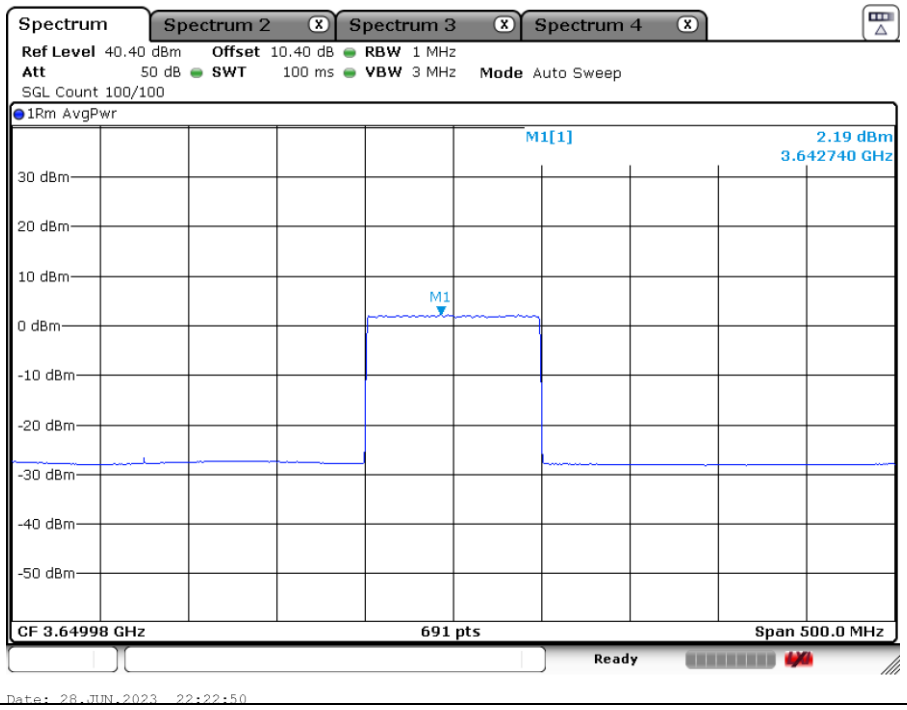
EIRP PSD / 100M

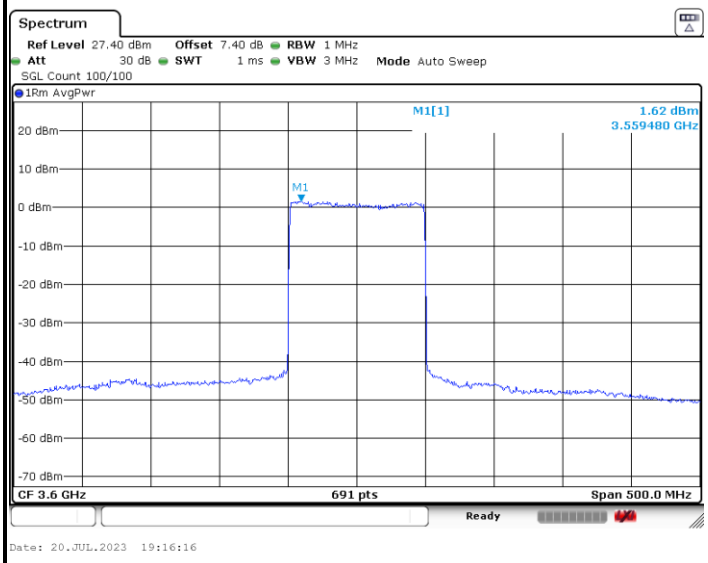
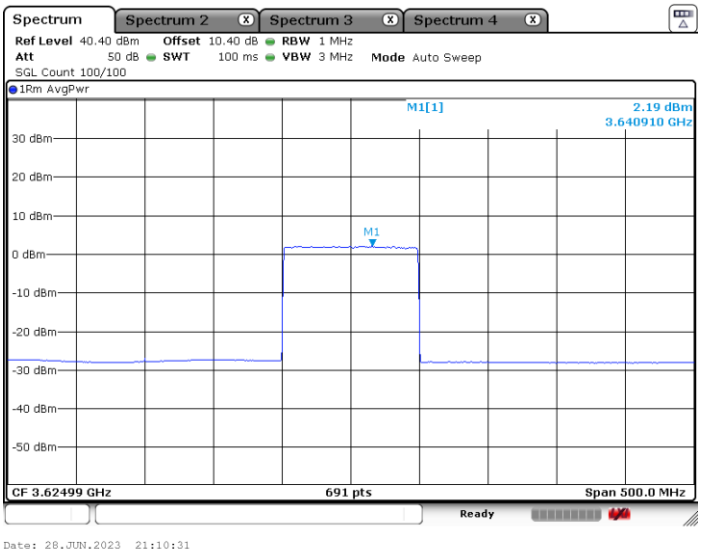
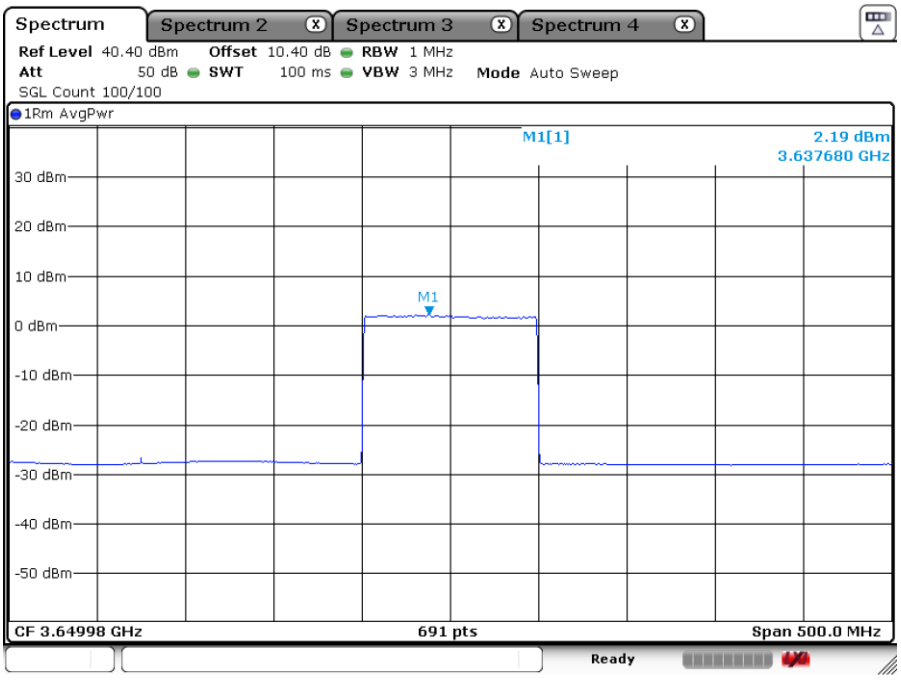
Conducted PSD(dBm/MHz)			
64QAM	L	M	H
Ant0	1.40	2.67	2.78
Ant1	1.64	2.57	2.95
Ant0+Ant1	4.53	5.63	5.88
EIRP PSD (dBm/MHz)			
64QAM	L	M	H
Ant0+Ant1	9.53	10.63	10.88
Limit	20dBm / MHz		
Result	Pass		

Conducted PSD(dBm/MHz)			
256QAM	L	M	H
Ant0	1.37	2.01	2.19
Ant1	1.62	2.19	2.19
Ant0+Ant1	4.51	5.11	5.20
EIRP PSD (dBm/MHz)			
256QAM	L	M	H
Ant0+Ant1	9.51	10.11	10.20
Limit	20dBm / MHz		
Result	Pass		

FR1 Part 96 n48 / 100MHz	
ANT0 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

FR1 Part 96 n48 / 100MHz	
ANT1 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

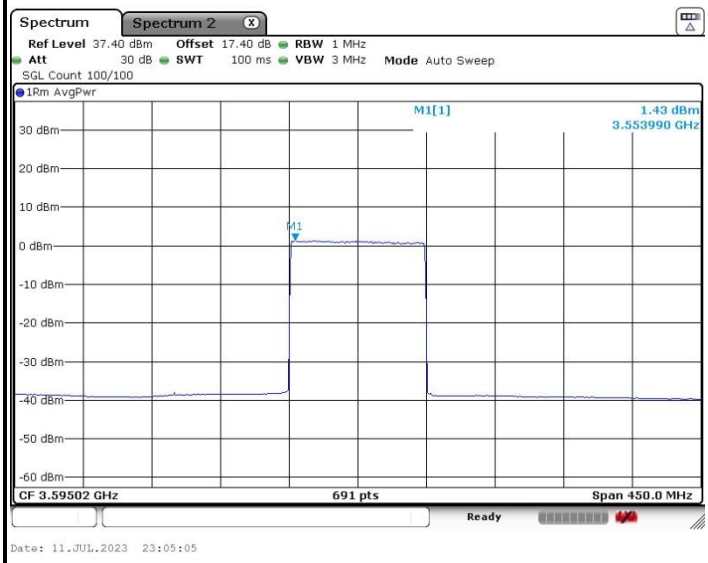
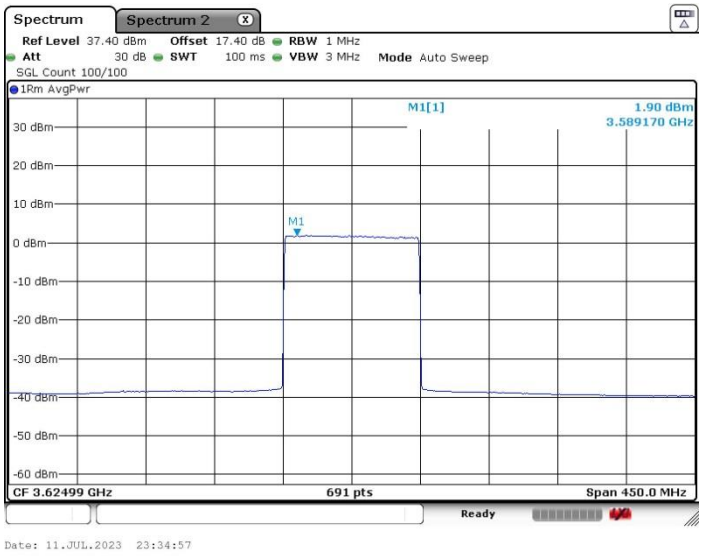
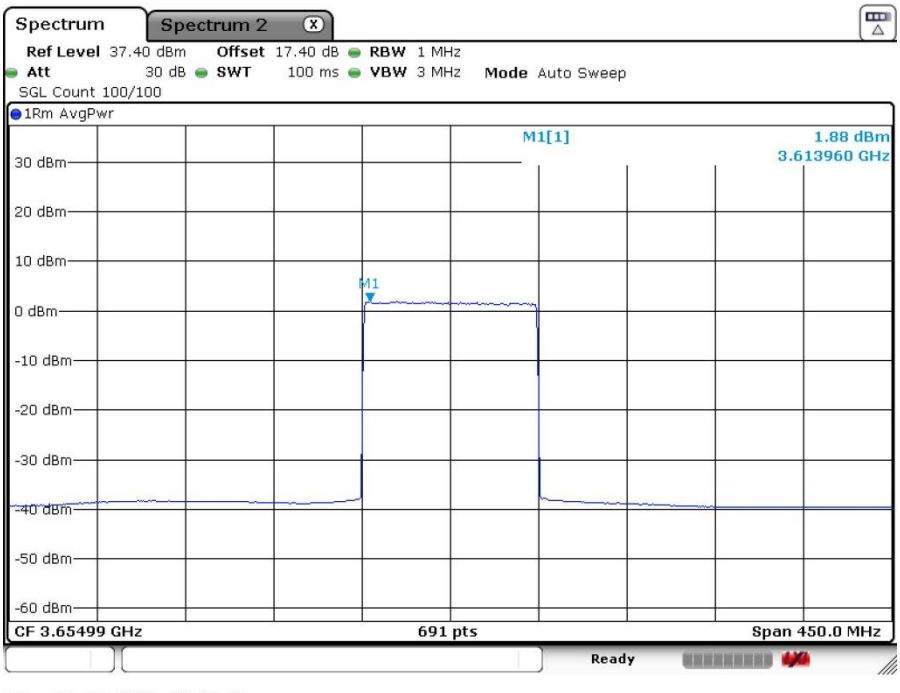
FR1 Part 96 n48 / 100MHz	
ANT0 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

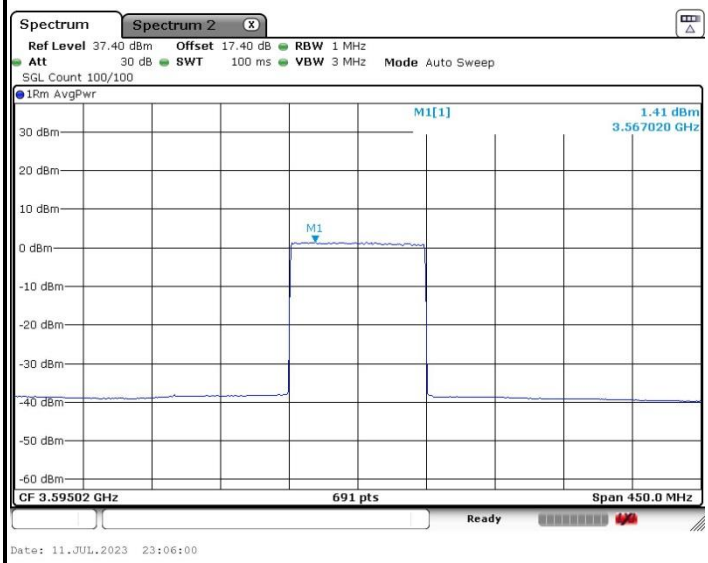
FR1 Part 96 n48 / 100MHz	
ANT1 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

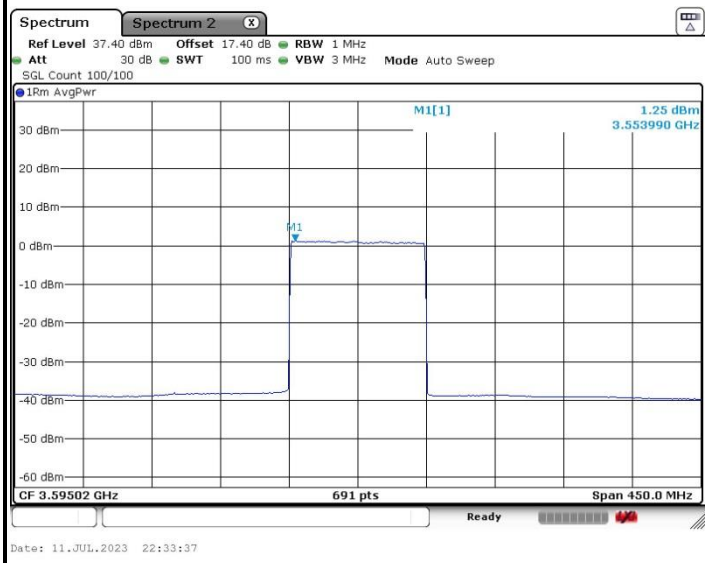
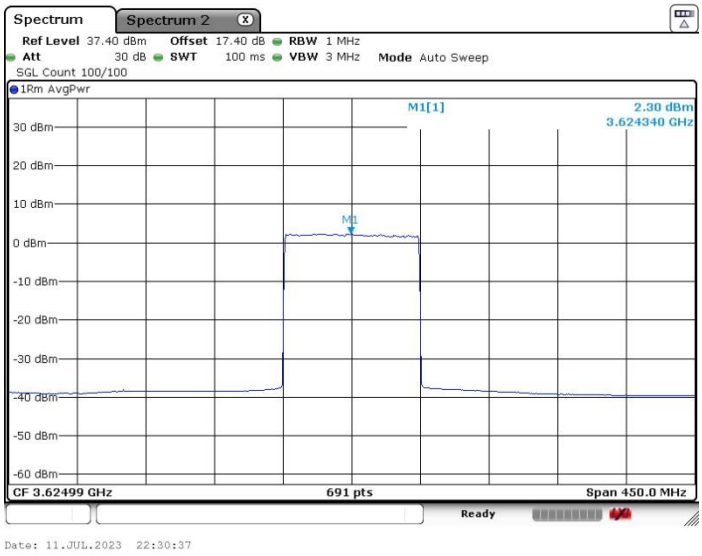
EIRP PSD / 90M

Conducted PSD(dBm/MHz)			
64QAM	L	M	H
Ant0	1.43	1.9	1.88
Ant1	1.41	2.29	1.93
Ant0+Ant1	4.43	5.11	4.92
EIRP PSD (dBm/MHz)			
64QAM	L	M	H
Ant0+Ant1	9.43	10.11	9.92
Limit	20dBm / MHz		
Result	Pass		

Conducted PSD(dBm/MHz)			
256QAM	L	M	H
Ant0	1.25	2.3	2.17
Ant1	1.56	2.25	1.96
Ant0+Ant1	4.42	5.29	5.08
EIRP PSD (dBm/MHz)			
256QAM	L	M	H
Ant0+Ant1	9.42	10.29	10.08
Limit	20dBm / MHz		
Result	Pass		

FR1 Part 96 n48 / 90MHz	
ANT0 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

FR1 Part 96 n48 / 90MHz	
ANT1 64QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB	
	

FR1 Part 96 n48 / 90MHz	
ANT0 256QAM	
Lowest Channel / FullRB	Middle Channel / FullRB
	
Highest Channel / FullRB