

A.3 Transmitter unwanted emissions at Band Edge

A.3.1 Reference

FCC CFR 47 Part 2, Clause 2.1051

FCC CFR 47 Part 27, Clause 27.53(l)

A.3.2 Method of measurement

The conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 dBm/MHz.

For MIMO mode configurations, the limit was adjusted with a correction of -18.06dB [10Log64] by using the Measure and Add 10Log(N) dB technique according to KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports. Then the limit was adjusted to -31.06dBm.

In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed and a RBW of 1MHz for measurements of emissions > 1MHz away from the band edges.

The limit was adjusted with -6.02dB [10Log(50/200)] to compensate for the reduced measurement bandwidth 50KHz for emission less than 1MHz away from the NR 20MHz band edges.

The limit was adjusted with -9.03dB [10Log(50/400)] to compensate for the reduced measurement bandwidth 50KHz for emission less than 1MHz away from the NR 40MHz and 2C 20MHz band edges.

The limit was adjusted with -12.04dB [10Log(50/800)] to compensate for the reduced measurement bandwidth 50KHz for emission less than 1MHz away from the NR 2C 40MHz band edges.

The limit was adjusted with -13.01dB [10Log(50/1000)] to compensate for the reduced measurement bandwidth 50KHz for emission less than 1MHz away from the NR 100MHz and 2C 100MHz band edges.

For MIMO mode, the limit was adjusted with -13.01dB [10Log(50/1000)] to compensate for the reduced measurement bandwidth 50KHz for emission more than 1MHz away from the band edges. The limit of -44.07dBm was used for emission more than 1MHz away from the 2C NR 20MHz band edges. Spectrum analyzer detector was set as RMS.

A.3.3 Measurement limit

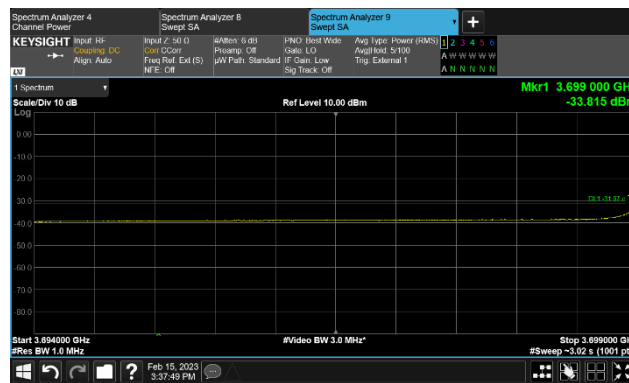
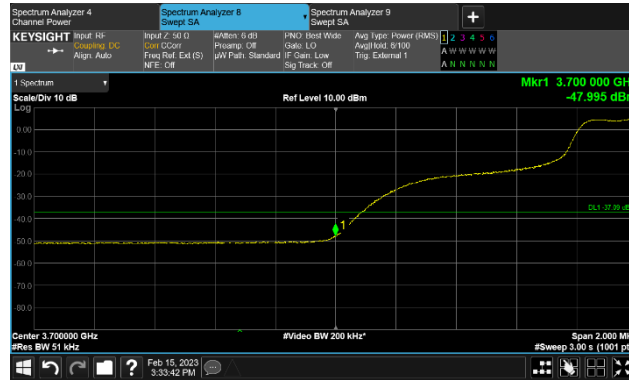
The conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 dBm/MHz.

A.3.4 Measurement result

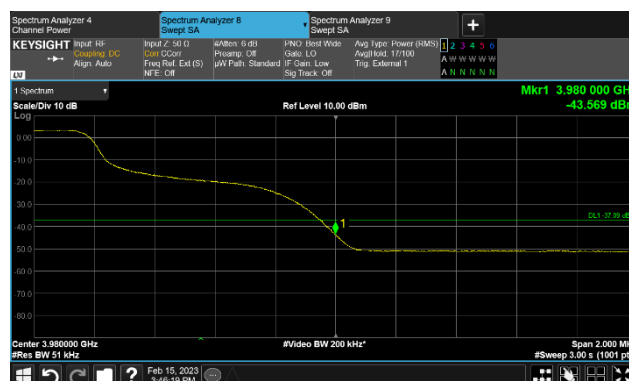
Configuration NR-MIMO-1C, 256QAM

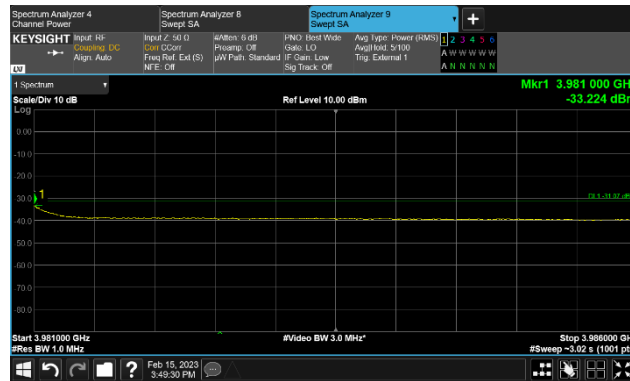
Band Edge Frequency	Channel Bandwidth	RBW	Limit(dBm)
Channel Position B 3700MHz	NR 20.0 MHz	50KHz/1MHz	-37.09/-31.06
Channel Position T 3980MHz	NR 20.0 MHz	50KHz/1MHz	-37.09/-31.06

Port 63, Channel Position B, 20.0 MHz



Port 63, Channel Position T, 20.0 MHz

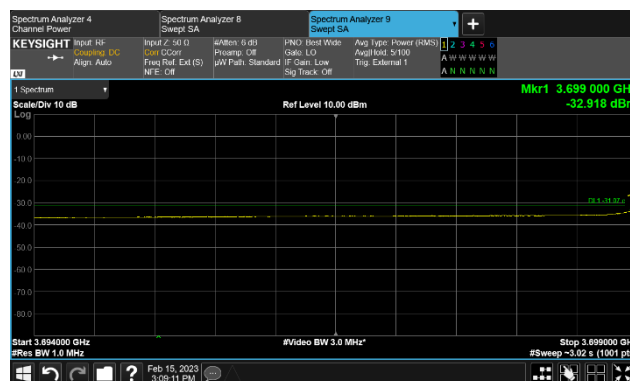
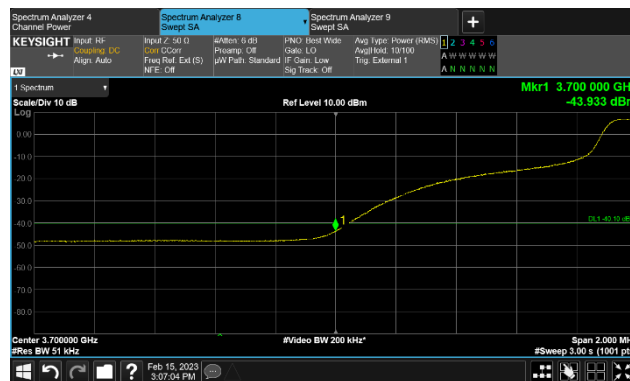




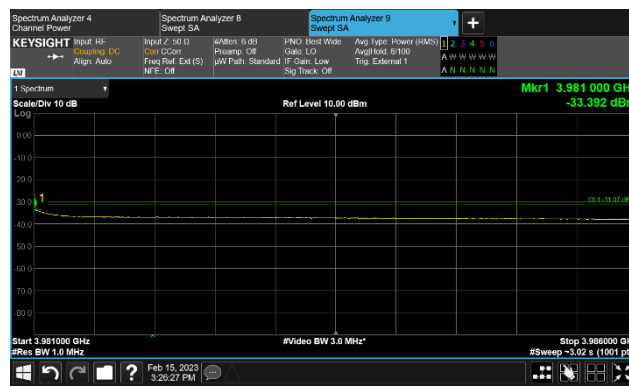
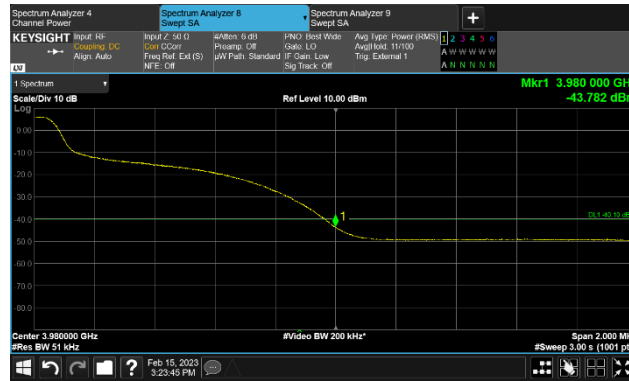
Configuration NR-MIMO-1C, 256QAM

Band Edge Frequency	Channel Bandwidth	RBW	Limit(dBm)
Channel Position B 3700MHz	NR 40.0 MHz	50KHz/1MHz	-40.10/-31.06
Channel Position T 3980MHz	NR 40.0 MHz	50KHz/1MHz	-40.10/-31.06

Port 63, Channel Position B, 40.0 MHz



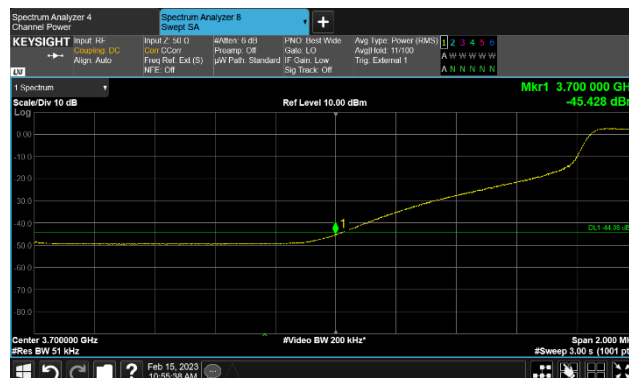
Port 63, Channel Position T, 40.0 MHz

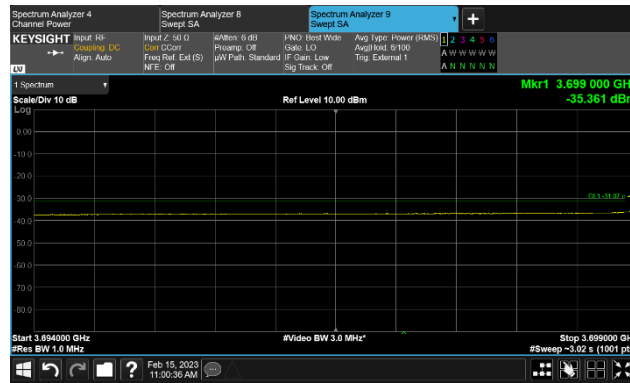


Configuration NR-MIMO-1C, 256QAM

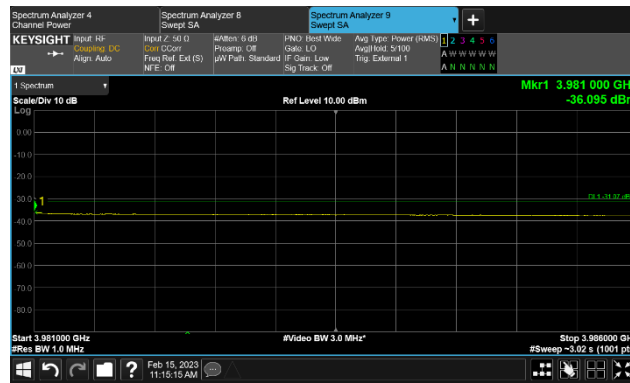
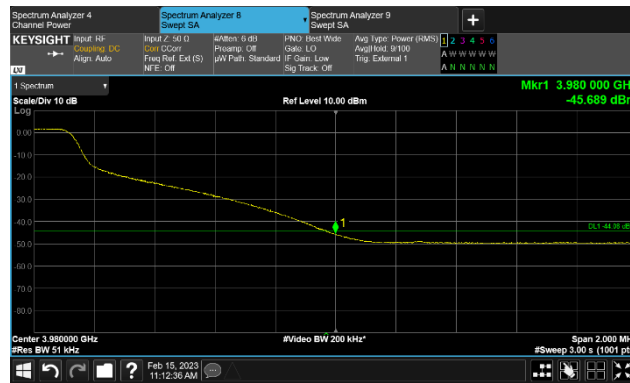
Band Edge Frequency	Channel Bandwidth	RBW	Limit(dBm)
Channel Position B 3700MHz	NR 100.0 MHz	50KHz/1MHz	-44.07/-31.06
Channel Position T 3980MHz	NR 100.0 MHz	50KHz/1MHz	-44.07/-31.06

Port 63, Channel Position B, 100.0 MHz





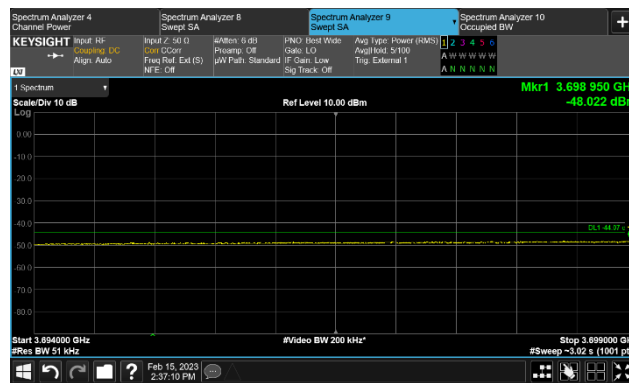
Port 63, Channel Position T, 100.0 MHz



Configuration NR-MIMO-2C, 256QAM

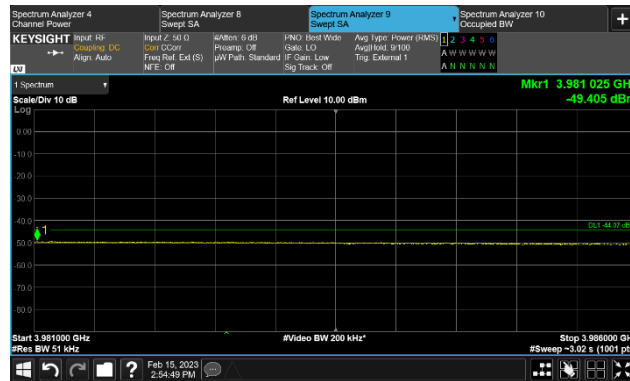
Band Edge Frequency	Channel Bandwidth	RBW	Limit(dBm)
Channel Position B 3700MHz	NR 20.0 MHz	50KHz/50KHz	-40.10/-44.07
Channel Position T 3980MHz	NR 20.0 MHz	50KHz/50KHz	-40.10/-44.07

Port 63, Channel Position B, 2C 20.0 MHz



Port 63, Channel Position T, 2C 20.0 MHz

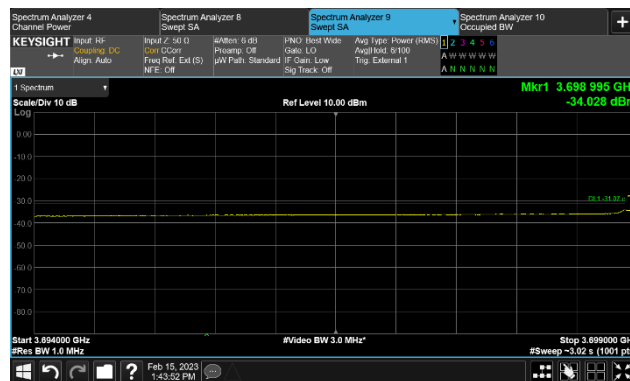
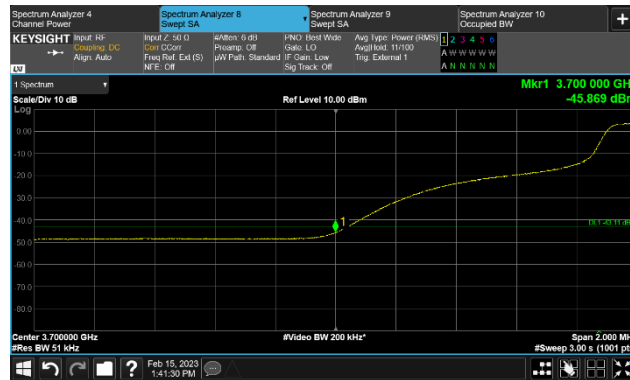




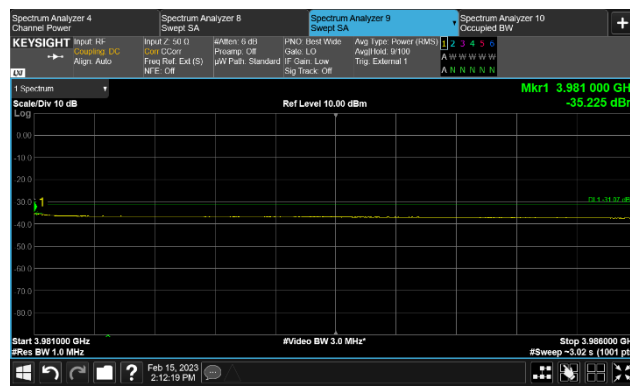
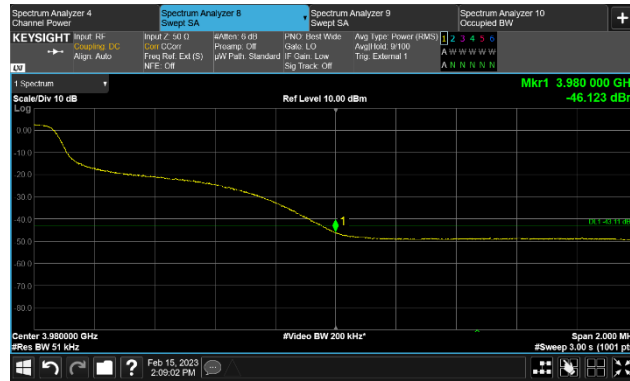
Configuration NR-MIMO-2C, 256QAM

Band Edge Frequency	Channel Bandwidth	RBW	Limit(dBm)
Channel Position B 3700MHz	NR 40.0 MHz	50KHz/1MHz	-43.11/-31.06
Channel Position T 3980MHz	NR 40.0 MHz	50KHz/1MHz	-43.11/-31.06

Port 63, Channel Position B, 2C 40.0 MHz



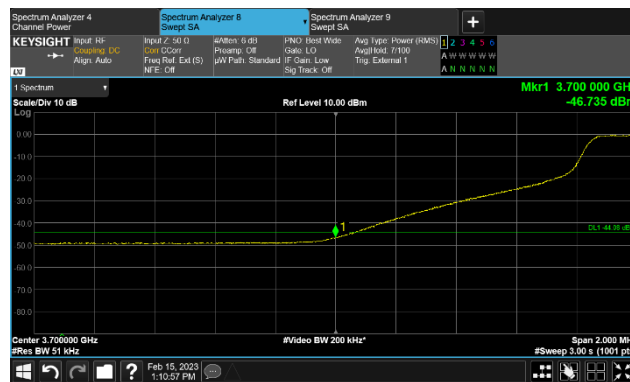
Port 63, Channel Position T, 2C 40.0 MHz

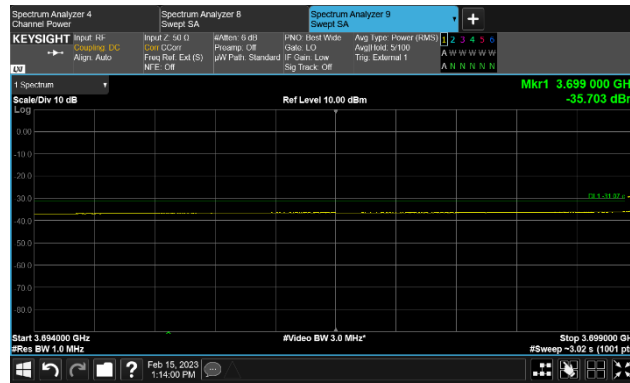


Configuration NR-MIMO-2C, 256QAM

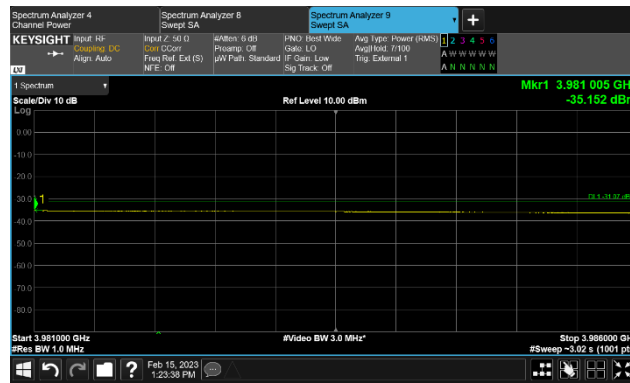
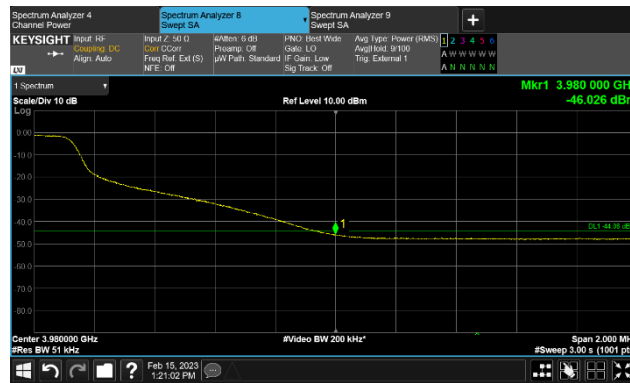
Band Edge Frequency	Channel Bandwidth	RBW	Limit(dBm)
Channel Position B 3700MHz	NR 100.0 MHz	50KHz/1MHz	-44.07/-31.06
Channel Position T 3980MHz	NR 100.0 MHz	50KHz/1MHz	-44.07/-31.06

Port 63, Channel Position B, 2C 100.0 MHz





Port 63, Channel Position T, 2C 100.0 MHz



A.4 Transmitter unwanted emissions - Conducted Spurious Emission

A.4.1 Reference

FCC CFR 47 Part 2, Clause 2.1051

FCC CFR 47 Part 27, Clause 27.53(l)

A.4.2 Method of measurement

In accordance with FCC rules, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 dBm/MHz.

For MIMO mode configurations, the limit was adjusted with a correction of -18.06dB [10Log64] by using the Measure and Add 10Log(N) dB technique according to FCC KDB 662911 D01 Multiple Transmitter Output accounting for simultaneous transmission from antenna ports. Then the limit was adjusted to -31.06dBm.

The spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using an attenuator and the frequency spectrum investigated from 3kHz to 40GHz. The resolution bandwidth of 1MHz was employed. The spectrum analyzer detector was set to RMS.

A.4.3 Measurement limit

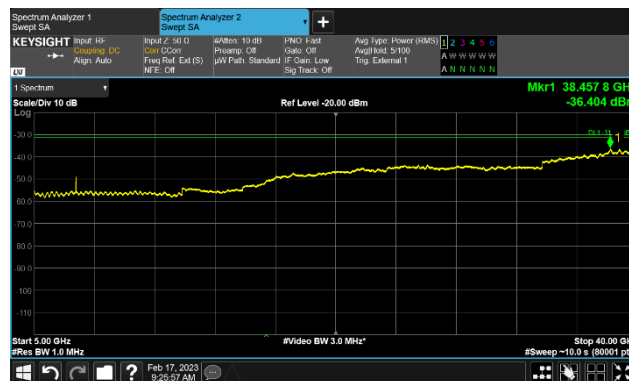
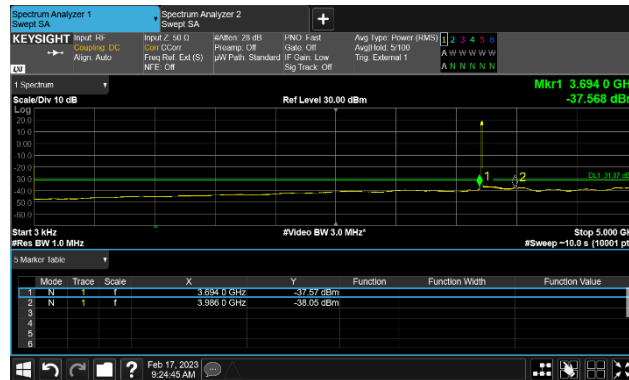
The conducted power of any emission outside the licensee's authorized bandwidth shall not exceed -13 dBm/MHz.

A.4.4 Measurement results

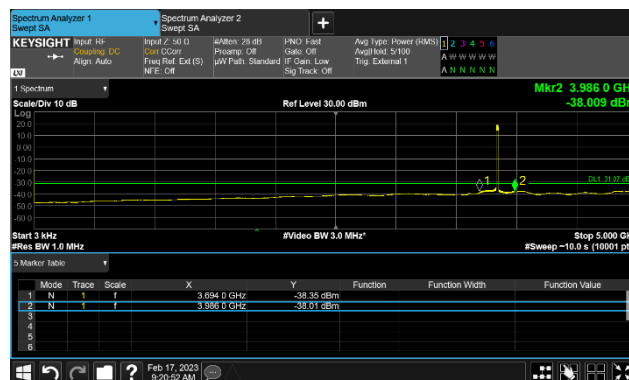
Configuration NR-MIMO-1C, 256QAM

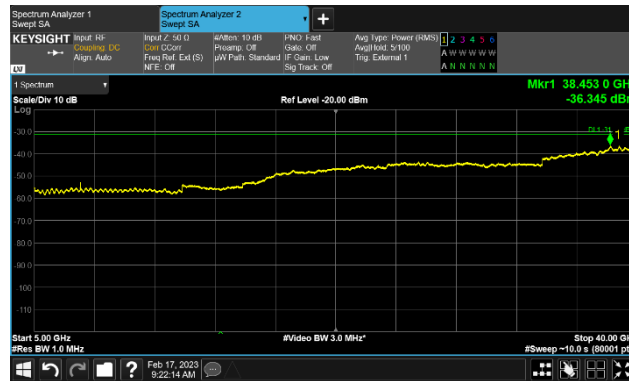
Channel Bandwidth	RBW (MHz)	Limit (dBm)
20.0 MHz	1.0	-31.06

Port 63, Channel Position B

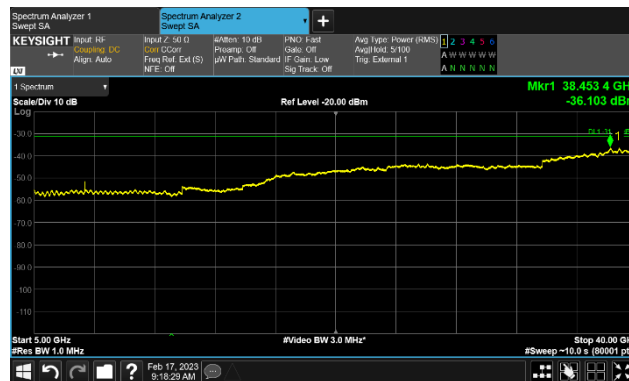
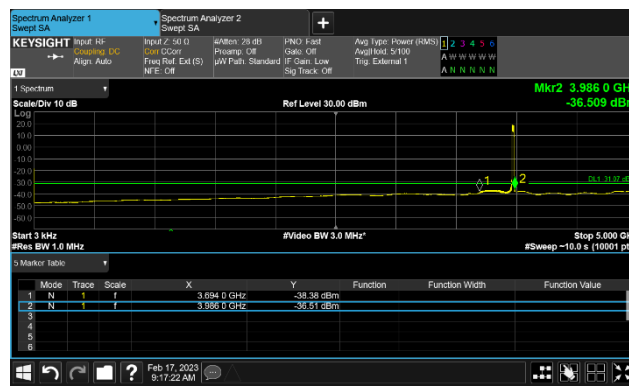


Port 63, Channel Position M





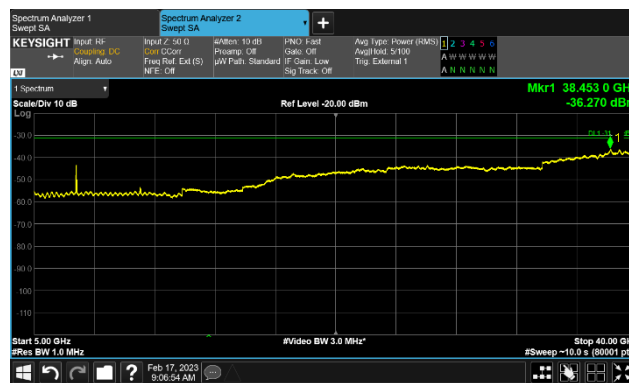
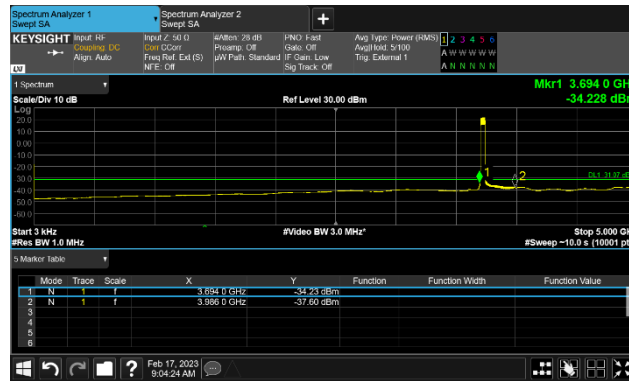
Port 63, Channel Position T



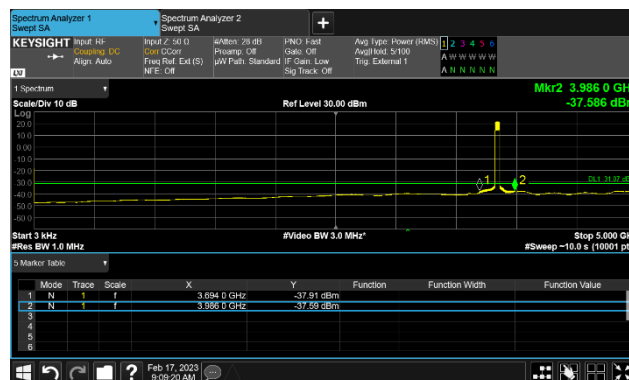
Configuration NR-MIMO-1C, 256QAM

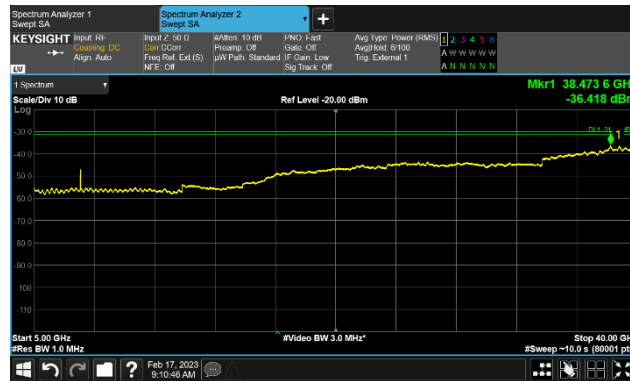
Channel Bandwidth	RBW (MHz)	Limit (dBm)
40.0 MHz	1.0	-31.06

Port 63, Channel Position B

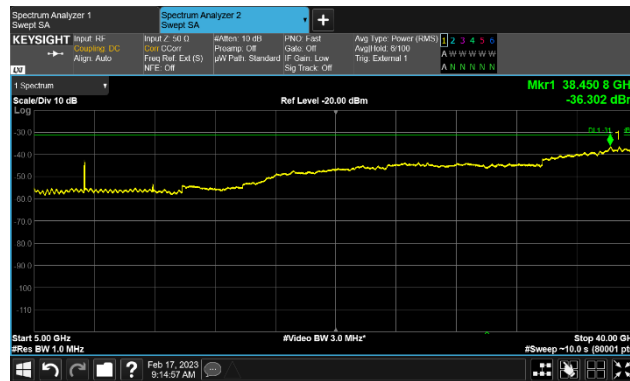
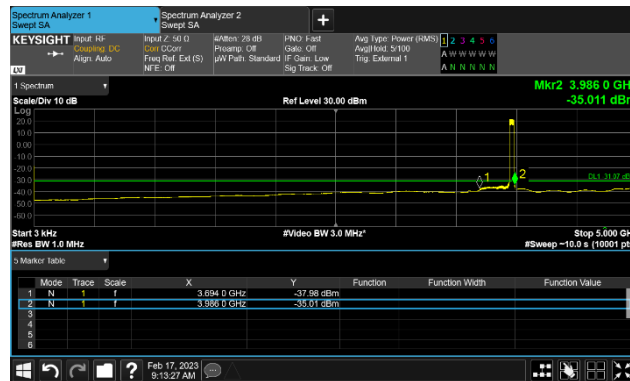


Port 63, Channel Position M





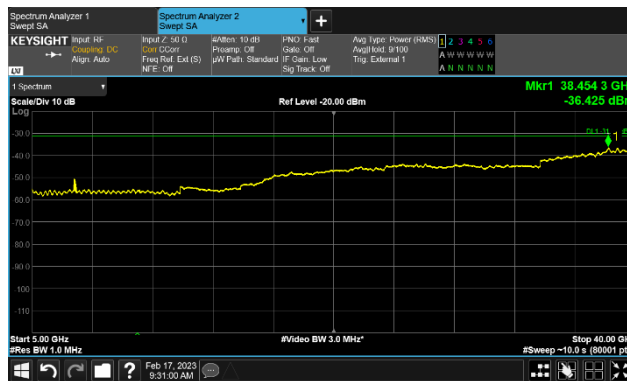
Port 63, Channel Position T



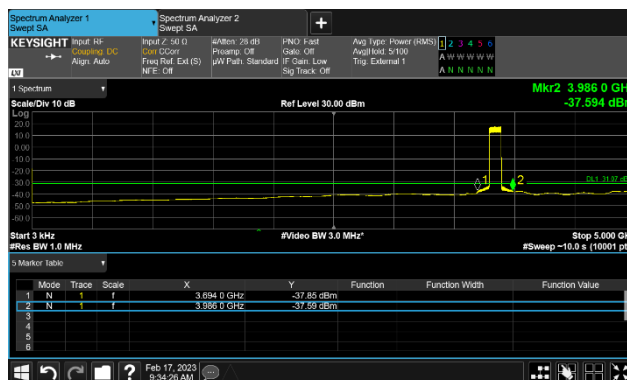
Configuration NR-MIMO-1C, 256QAM

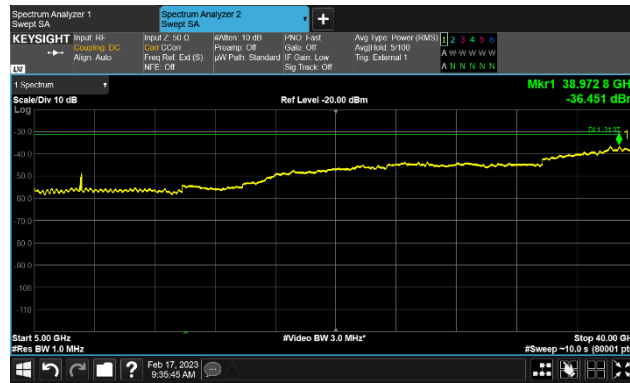
Channel Bandwidth	RBW (MHz)	Limit (dBm)
100.0 MHz	1.0	-31.06

Port 63, Channel Position B

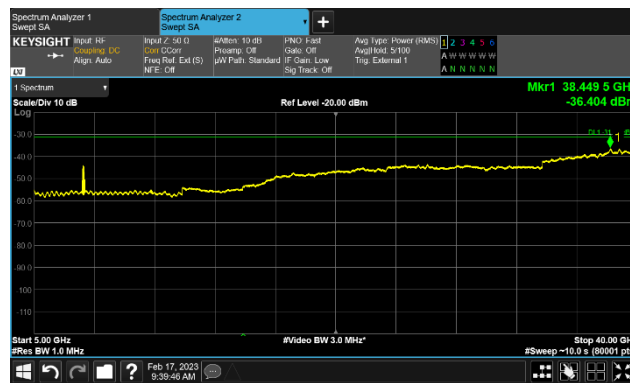
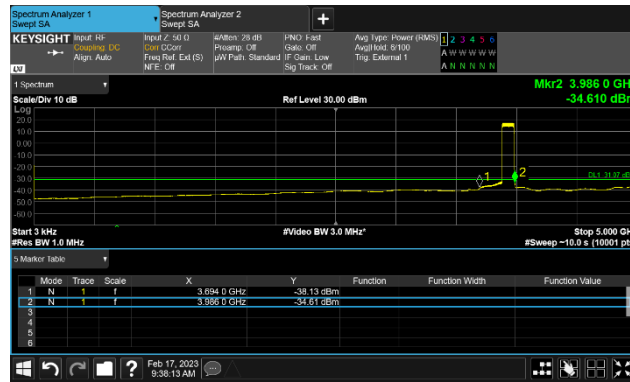


Port 63, Channel Position M





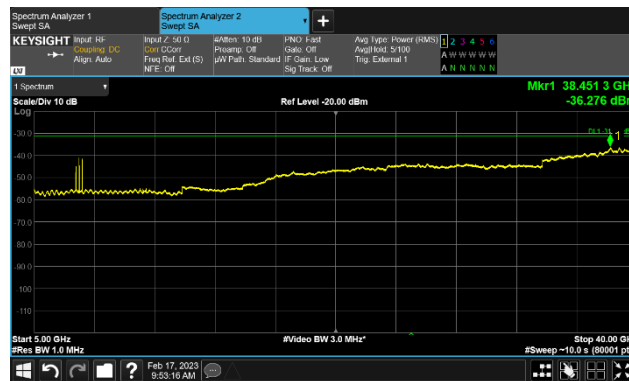
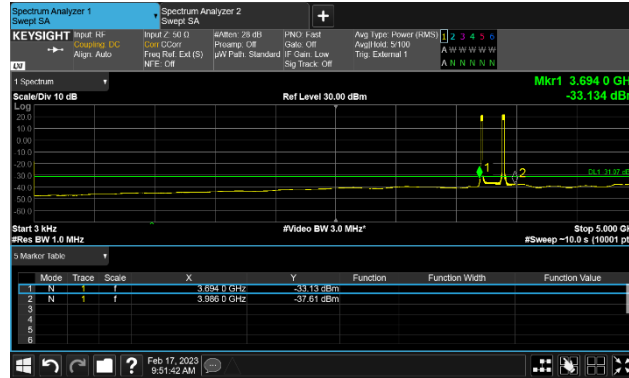
Port 63, Channel Position T



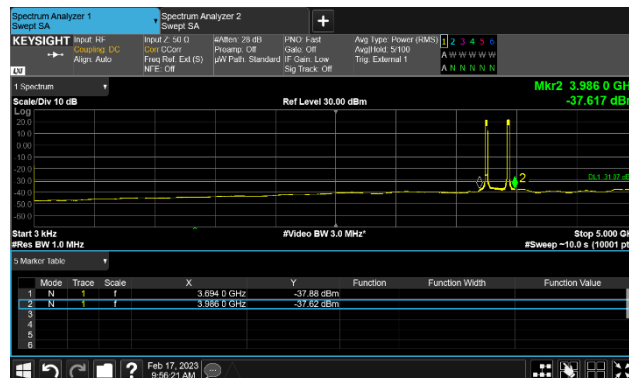
Configuration NR-MIMO-2C, 256QAM

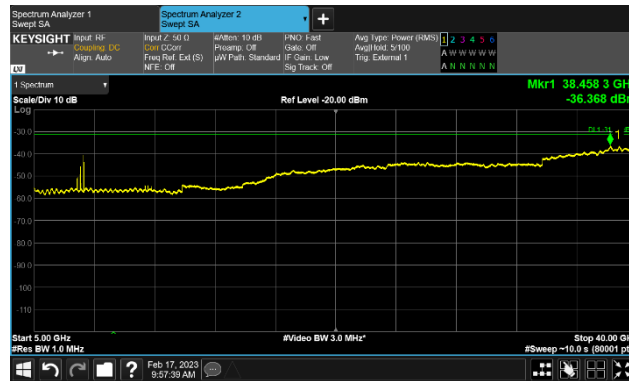
Channel Bandwidth	RBW (MHz)	Limit (dBm)
20.0 MHz	1.0	-31.06

Port 63, Channel Position B

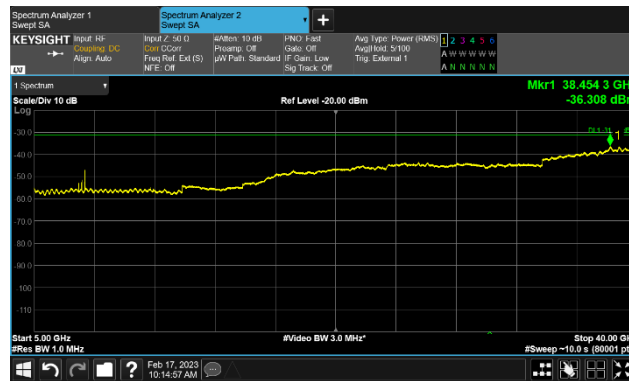
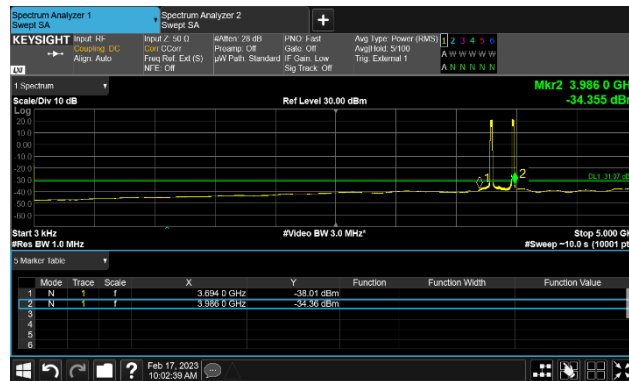


Port 63, Channel Position M





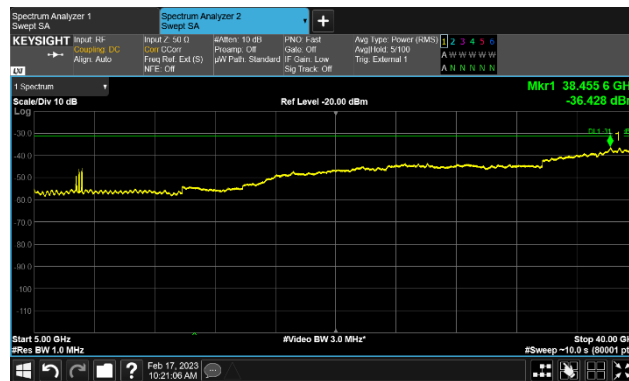
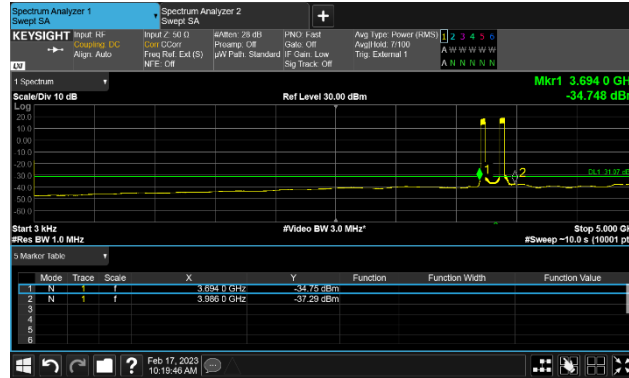
Port 63, Channel Position T



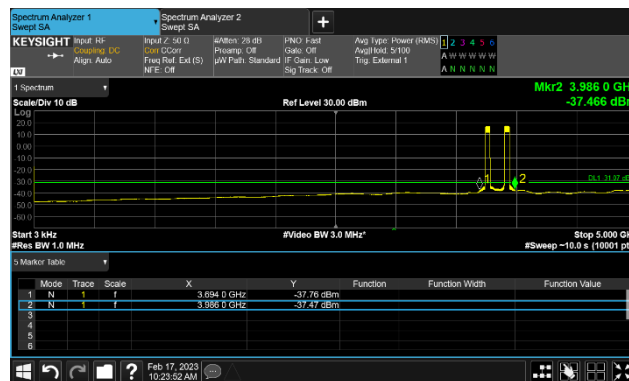
Configuration NR-MIMO-2C, 256QAM

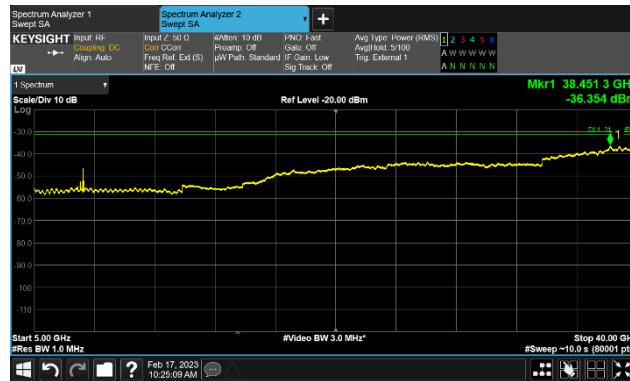
Channel Bandwidth	RBW (MHz)	Limit (dBm)
40.0 MHz	1.0	-31.06

Port 63, Channel Position B

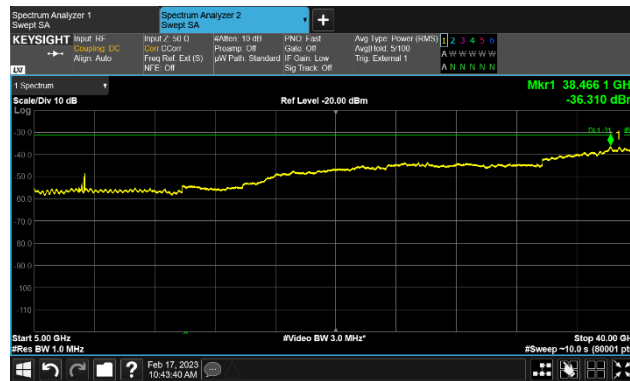
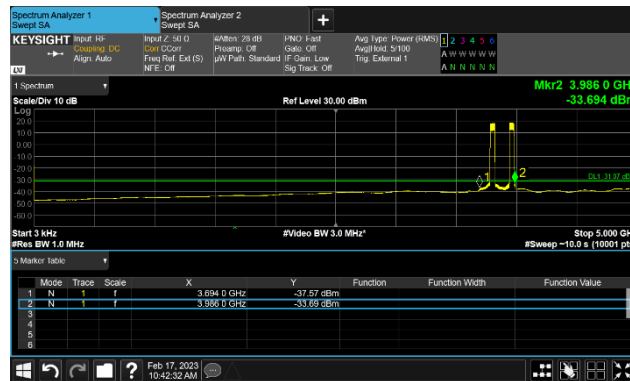


Port 63, Channel Position M





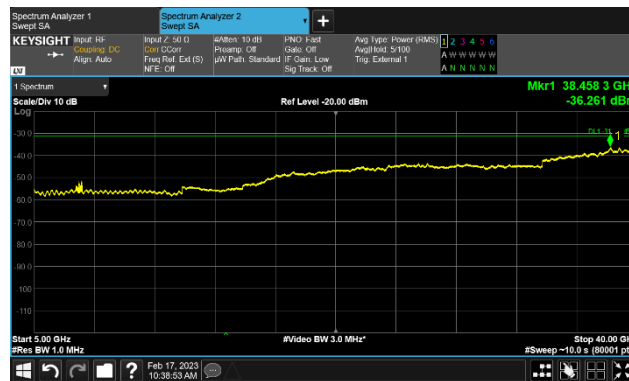
Port 63, Channel Position T



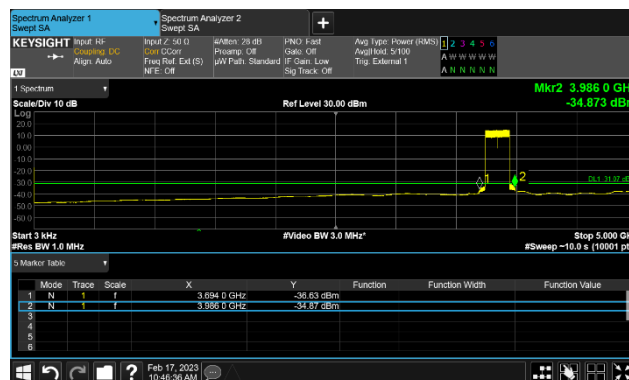
Configuration NR-MIMO-2C, 256QAM

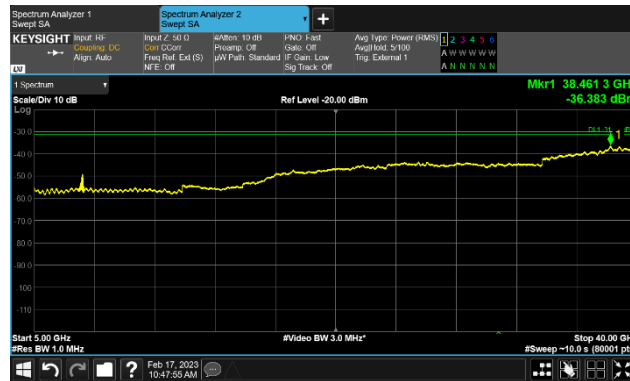
Channel Bandwidth	RBW (MHz)	Limit (dBm)
100.0 MHz	1.0	-31.06

Port 63, Channel Position B

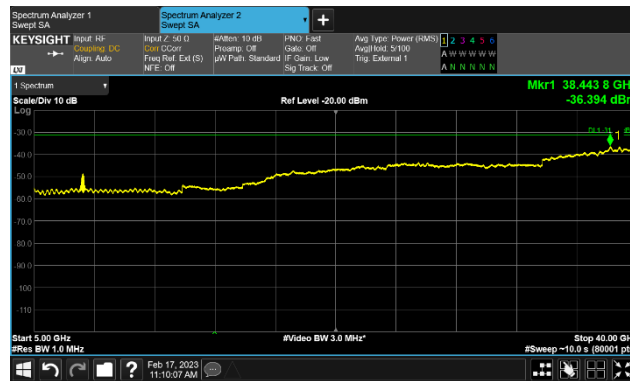
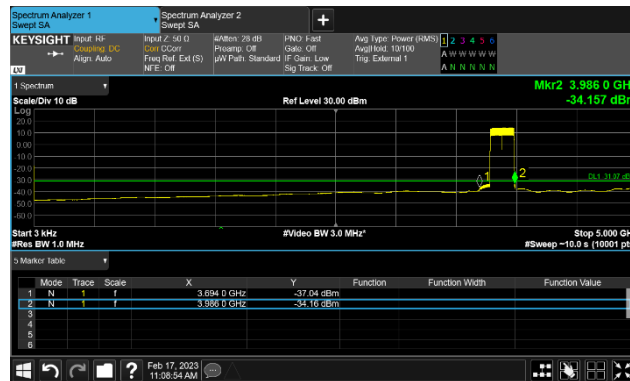


Port 63, Channel Position M





Port 63, Channel Position T



A.5 Radiated Spurious Emission

A.5.1 Reference

FCC CFR 47 Part 2, Clause 2.1046

FCC CFR 47 Part 27, Clause 27.53(l)

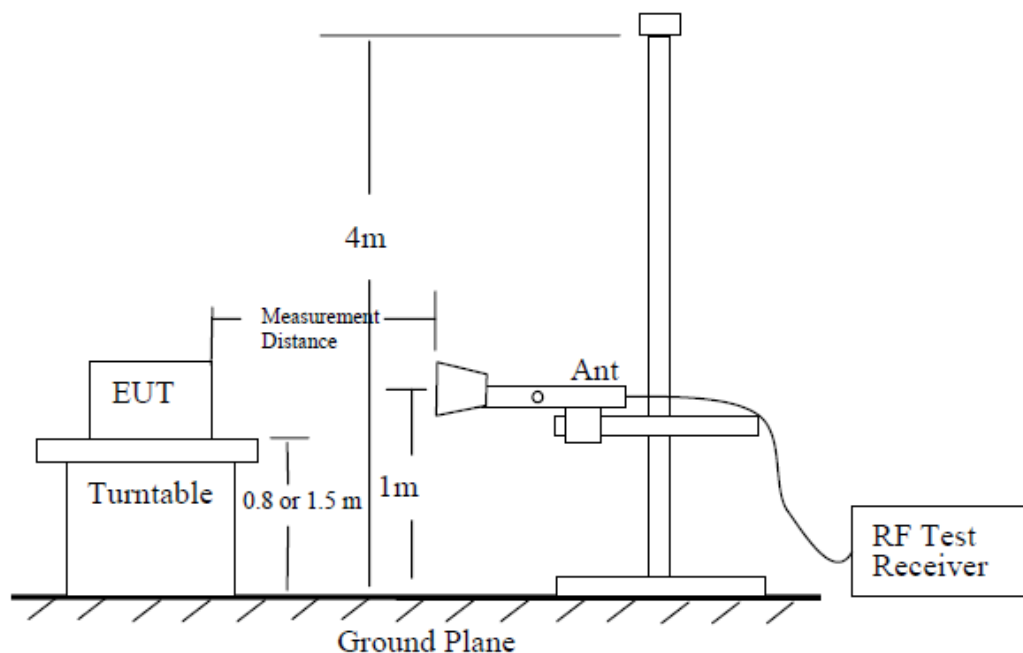
A.2.1 Measurement Method

The measurements procedures in C63.26 are used.

The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment.

The procedure of radiated spurious emissions is as follows:

Using the test configuration as follow, measure the radiated emissions directly from the EUT and convert the measured field strength or received power to ERP or EIRP, as required, for comparison to the applicable limits.



The emission characteristics of the EUT can be identified from the pre-scan measurement information.

Exploratory radiated measurements (pre-scans) may be performed to determine the general EUT radiated emissions characteristics and, when necessary, the EUT-to-measurement antenna orientation that produces the maximum emission amplitude. Pre-scans shall only be used to determine the emission frequencies (i.e., not amplitude levels). The information garnered from a pre-scan can then be used to perform final compliance measurements using either the substitution or direct field strength method.

For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, the EUT shall be placed on a RF-transparent table or support at a nominal height of 80 cm above the reference ground plane. Radiated measurements shall be made with the measurement

antenna positioned in both horizontal and vertical polarization. The measurement antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level (i.e., field strength or received power). When orienting the measurement antenna in vertical polarization, the minimum height of the lowest element of the antenna shall clear the site reference ground plane by at least 25 cm.

The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.

For radiated measurements performed at frequencies above 1 GHz, the EUT shall be placed on an RF transparent table or support at a nominal height of 1.5 m above the ground plane. When maximizing the emissions from the EUT for measurement, the EUT and its transmitting antenna(s) shall be rotated through 360°. For each mode of operation to be tested, the frequency spectrum (based on findings from exploratory measurements) shall be monitored. Final measurements shall be performed for the worst case combination(s) of variable technical parameters that result in the maximum measured emission amplitude, record the frequency and amplitude of the highest fundamental emission (if applicable), and the frequency and amplitude data for the six highest-amplitude spurious emissions.

The measurements in the frequency range 30 to 1000MHz was performed with a RBW of 100kHz. The measurements in the frequency range 1 to 40GHz was performed with a RBW of 1MHz. Emissions identified within the range 30MHz to 40GHz were then formally measured using a peak detector as the worst case.

A.5.3 Measurement limit

The limits for outside a licensee's frequency band(s) of operation the power of the spurious emissions have been calculated, as shown below using the following formula:

$$\text{Field Strength of Carrier} - (43 + 10 \log (P) \text{ dB}) \text{ dB}$$

Where:

Field Strength is measured in dB μ V/m

P is measured Transmitter Power in Watts

The field strength of the carrier has been calculated assuming that the power is to be fed to a half-wave tuned dipoles as per 2.1053 (a).

$$E_{(v/m)} = (30 \times G_i \times P_o)^{0.5} / d$$

Where

G_i is the antenna gain of ideal half-wave dipoles,

P_o is the power out of the transceiver in W,

d is the measurement distance in meter.

Therefore at 3m measurement distance the field strength using the lowest transceiver output power would be:

$$E_{(v/m)} = (30 \times 1.64 \times 16.56)^{0.5} / 3 = 9.51 \text{V/m} = 139.57 \text{ dB}\mu\text{V/m}$$

As Clause 27.53(l)(1) For operations in the 3700-3980 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(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(43 + 10 log(P) dB):

$$43 + 10\log(16.56) = 55.19 \text{ dB}$$

Therefore the limit at 3m measurement distance is:

$$139.57 - 55.19 = 83.81 \text{ dB}\mu\text{V/m}$$

These limits have been used to determine Pass or Fail for the harmonics measured and detailed in the following results.

A.5.4 Measurement results

These results are the worst case.

Configuration NR-MIMO-1C, 16QAM, 80.0M

Channel Position	Channel Frequencies(MHz)
Channel Position B	3740.01
Channel Position M	3840.00
Channel Position T	3940.02

Channel Position B

No emissions were detected within 20dB of the limit.

Channel Position M

No emissions were detected within 20dB of the limit.

Channel Position T

No emissions were detected within 20dB of the limit.

Configuration NR-MIMO-2C, 16QAM, 100.0M

Channel Position	Channel Frequencies(MHz)
Channel Position B	3750+3849.99
Channel Position M	3790.02+3890.01
Channel Position T	3830.01+3930

Channel Position B

No emissions were detected within 20dB of the limit.

Channel Position M

No emissions were detected within 20dB of the limit.

Channel Position T

No emissions were detected within 20dB of the limit.

Configuration NR-MIMO-4C, 16QAM, 20.0M

Channel Position	Channel Frequencies(MHz)
Channel Position B	3710.01+3730.02+3870+3890.01
Channel Position M	3750.01+3770.01+3909.99+3930
Channel Position T	3790.02+3810.03+3950.01+3970.0

Channel Position B

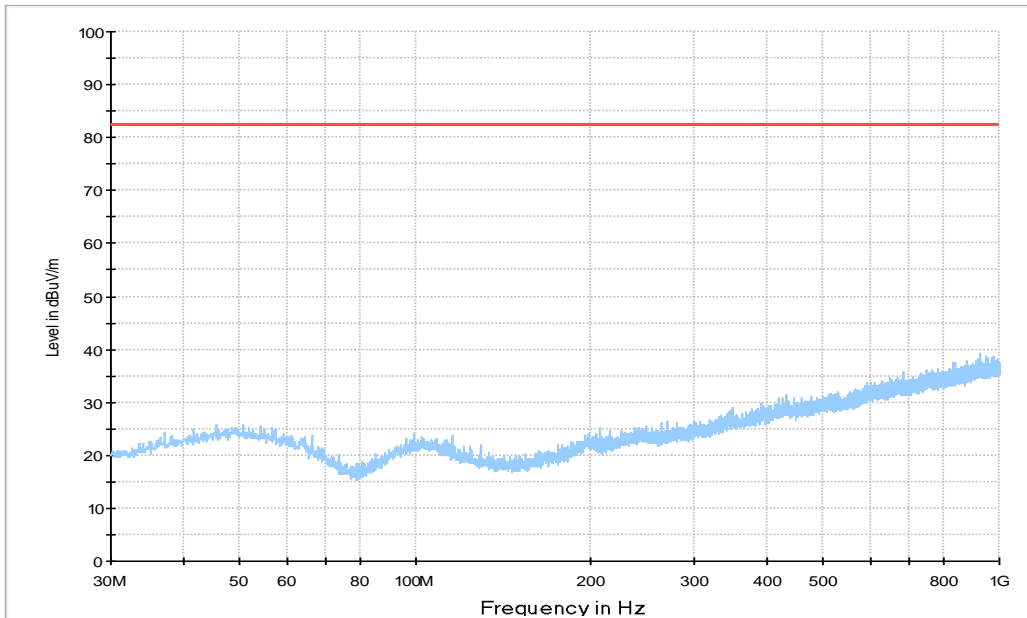
No emissions were detected within 20dB of the limit.

Channel Position M

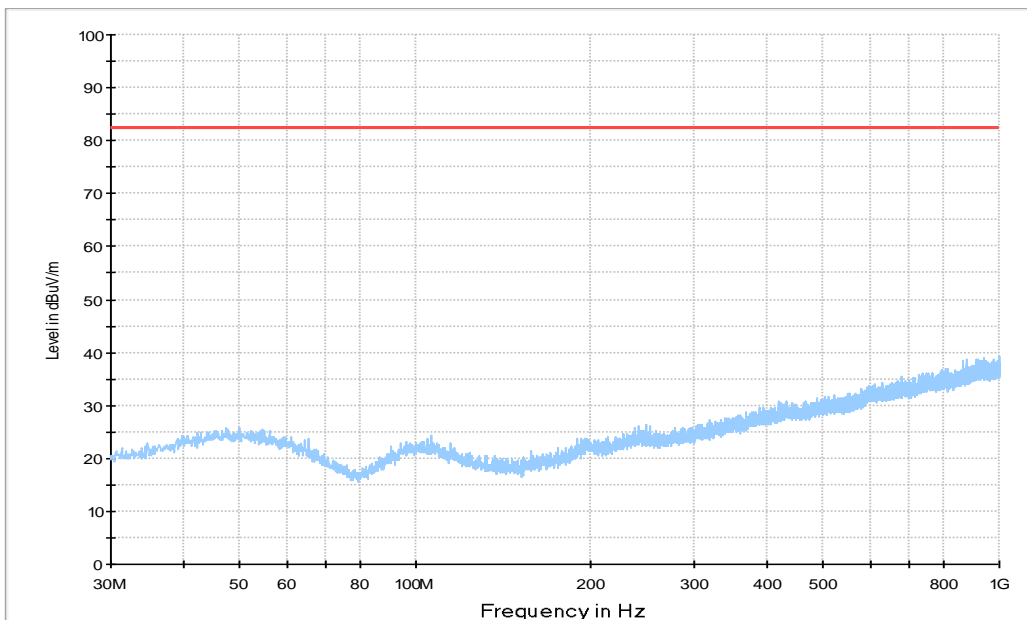
No emissions were detected within 20dB of the limit.

Channel Position T

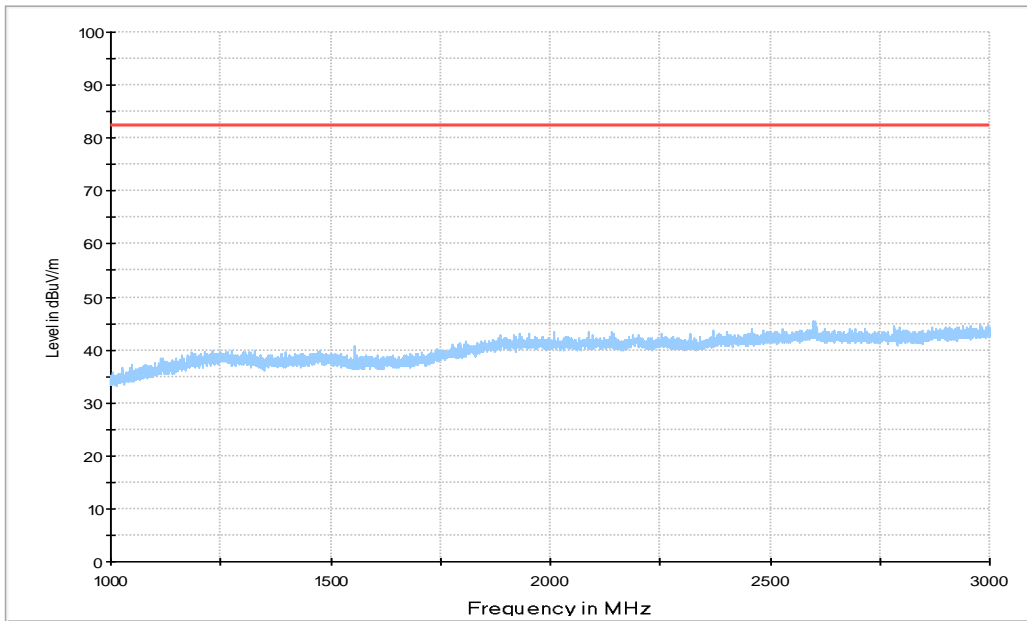
No emissions were detected within 20dB of the limit.



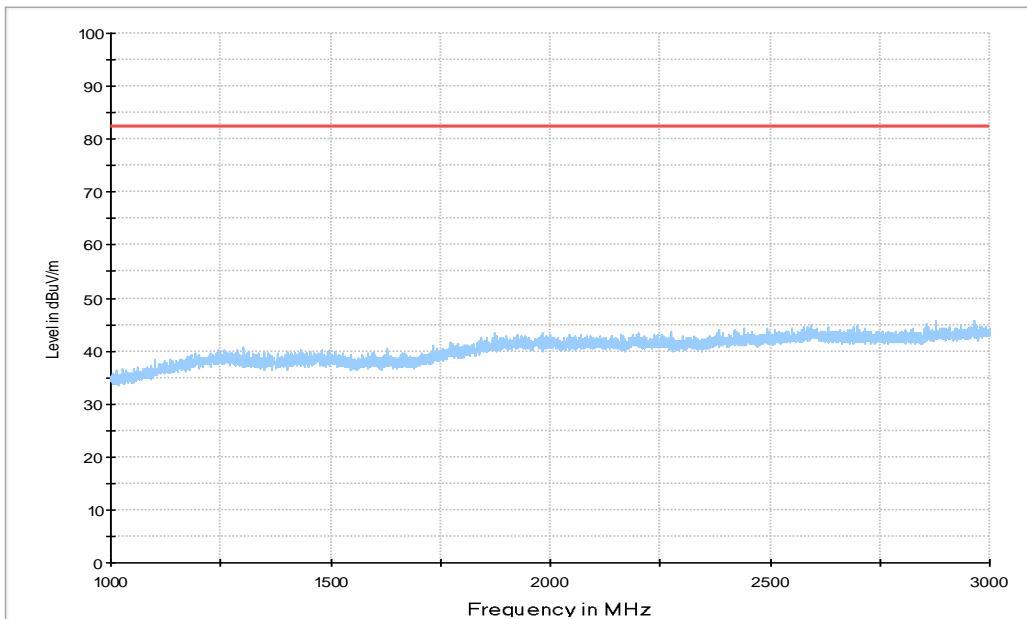
Configuration NR-MIMO-4C; 16QAM; 20MHz, Vertical, 30MHz-1GHz



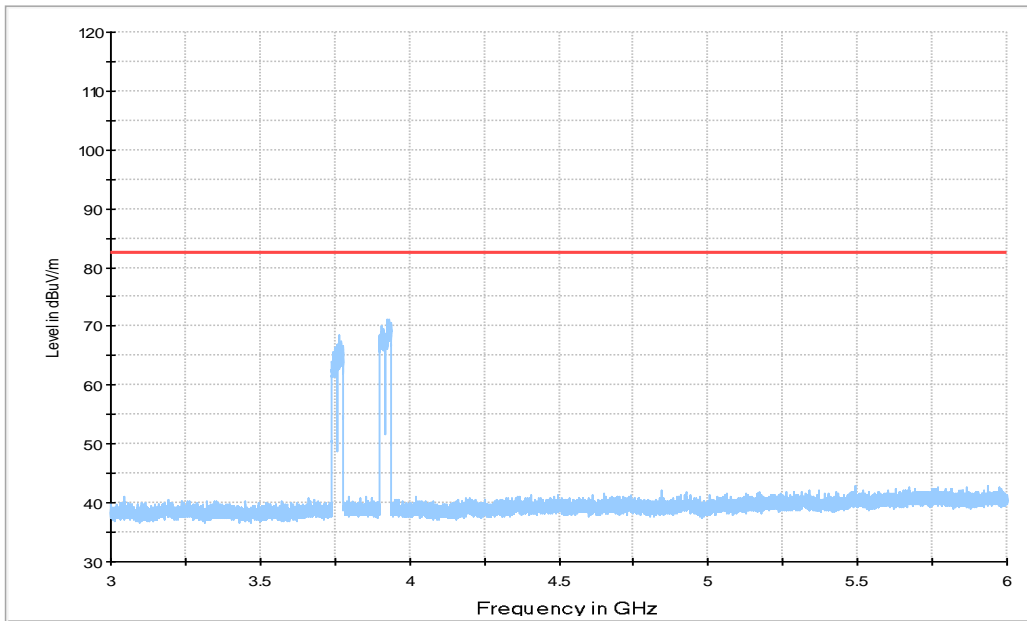
Configuration NR-MIMO-4C; 16QAM; 20MHz, Horizontal, 30MHz-1GHz



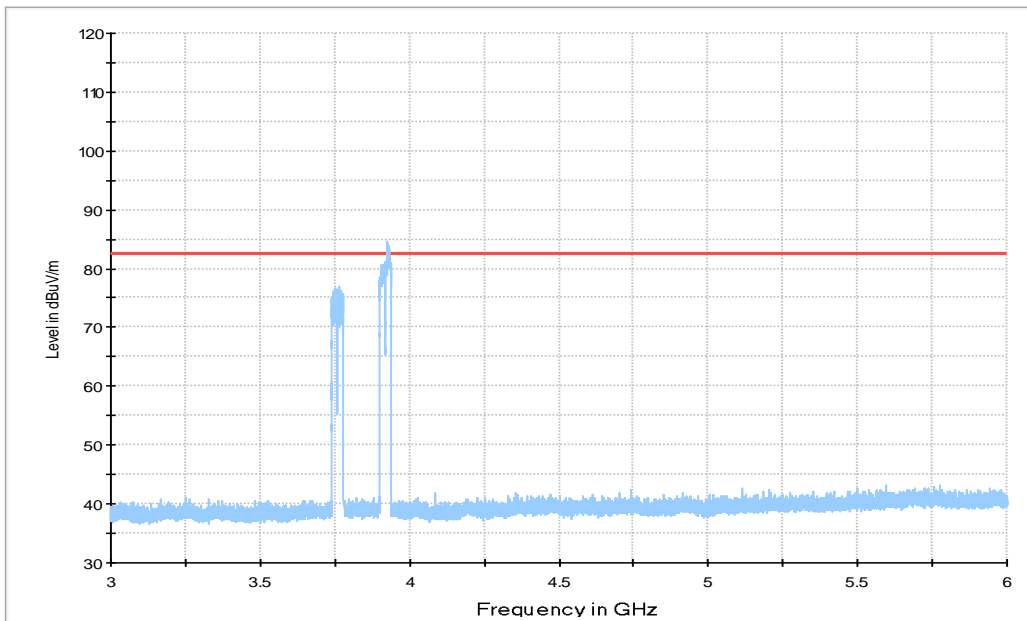
Configuration NR-MIMO-4C; 16QAM; 20MHz, Vertical, 1GHz-3GHz



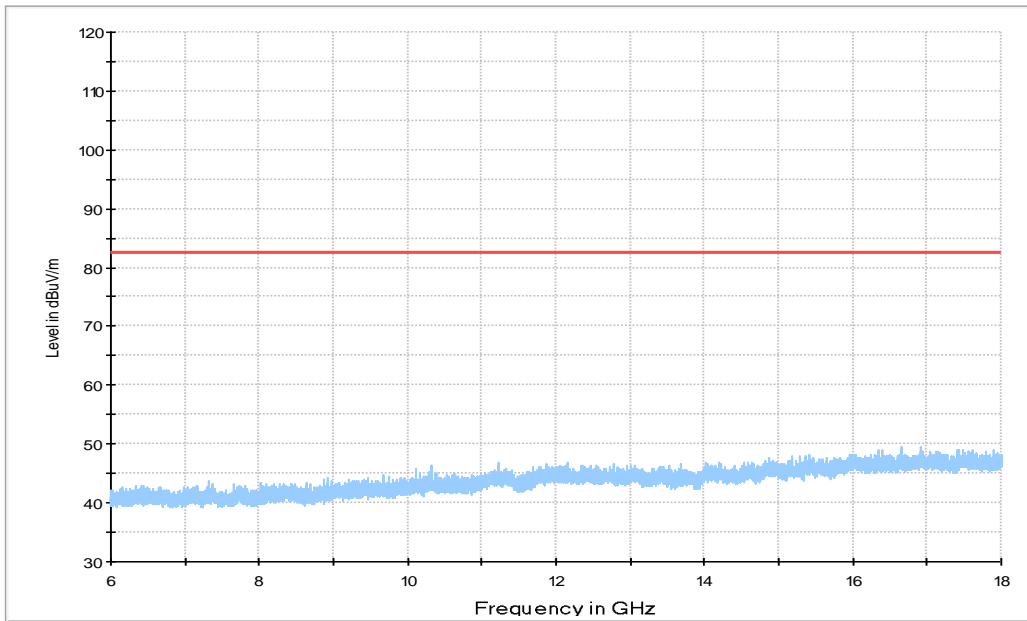
Configuration NR-MIMO-4C; 16QAM; 20MHz, Horizontal, 1GHz-3GHz



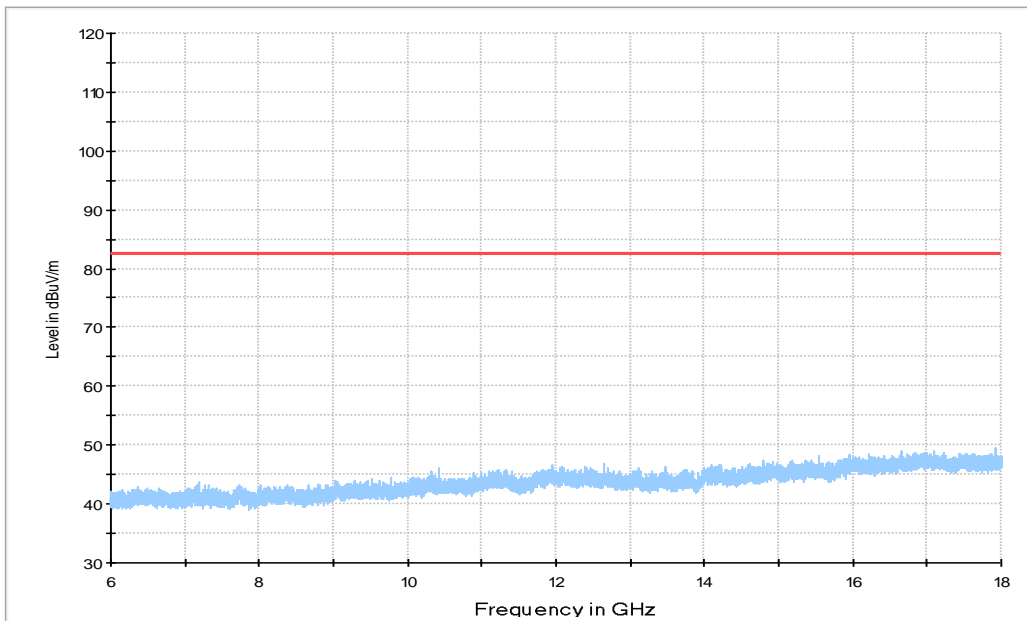
Configuration NR-MIMO-4C; 16QAM; 20MHz, Vertical, 3GHz-6GHz



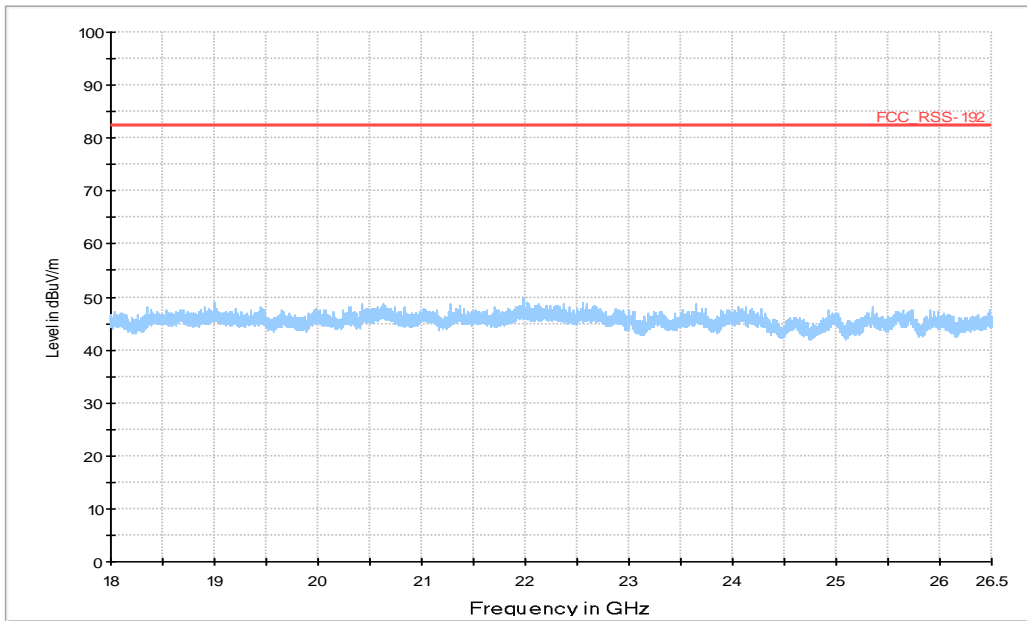
Configuration NR-MIMO-4C; 16QAM; 20MHz, Horizontal, 3GHz-6GHz



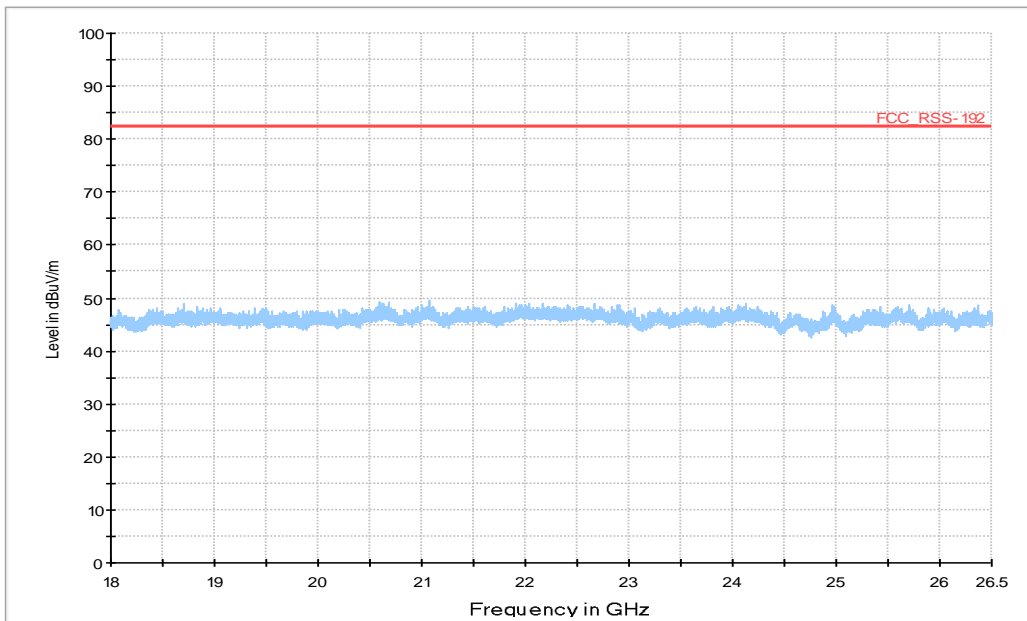
Configuration NR-MIMO-4C; 16QAM; 20MHz, Vertical, 6GHz-18GHz



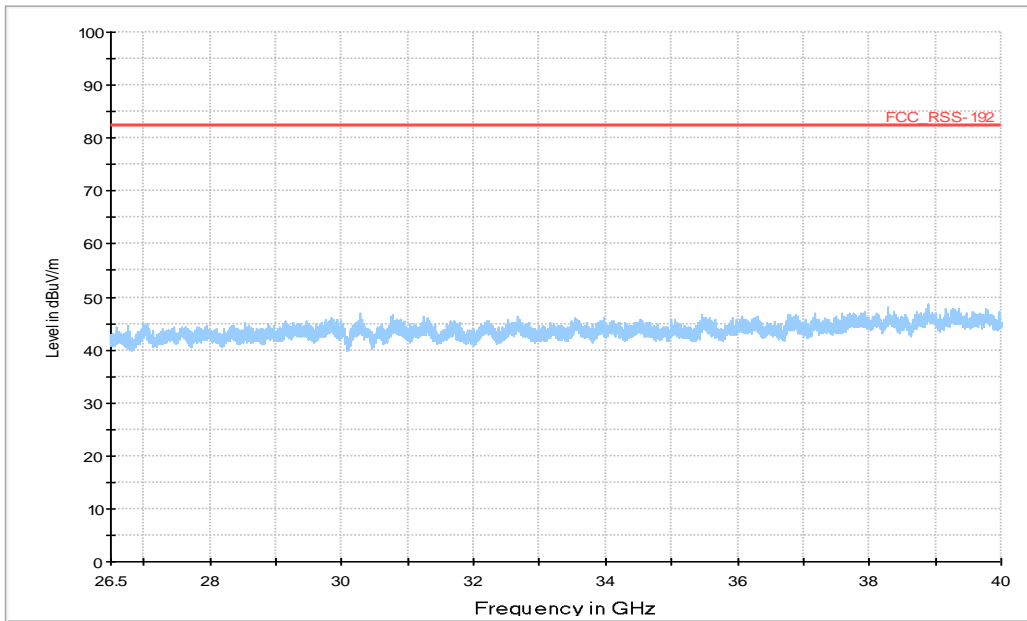
Configuration NR-MIMO-4C; 16QAM; 20MHz, Horizontal, 6GHz-18GHz



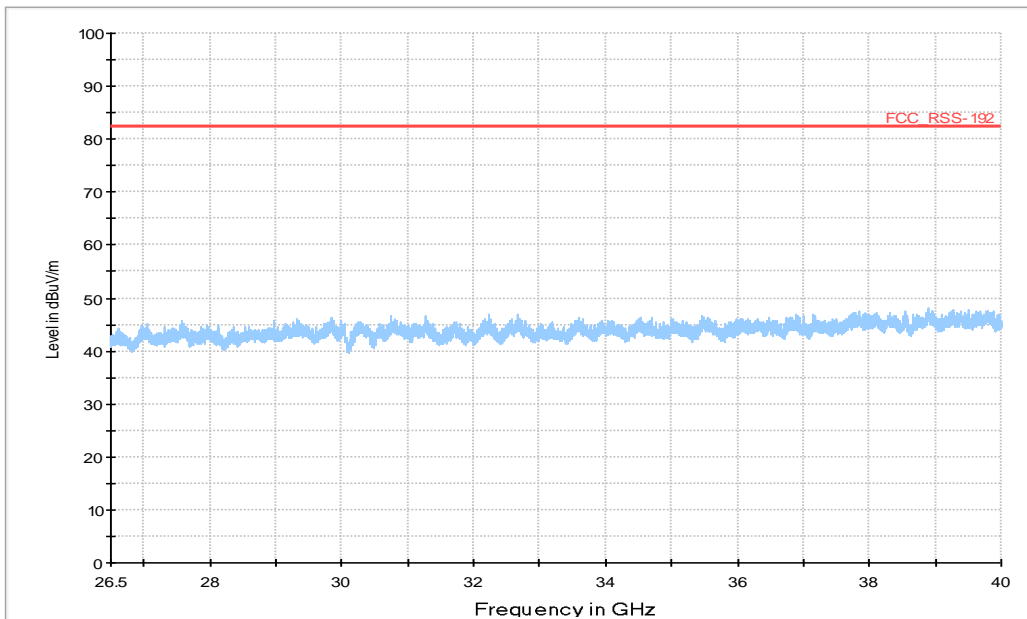
Configuration NR-MIMO-4C; 16QAM; 20MHz, Vertical, 18GHz-26.5GHz



Configuration NR-MIMO-4C; 16QAM; 20MHz, Horizontal, 18GHz-26.5GHz



Configuration NR-MIMO-4C; 16QAM; 20MHz, Vertical, 26.5GHz-40GHz



Configuration NR-MIMO-4C; 16QAM; 20MHz, Horizontal, 26.5GHz-40GHz

A.6 Frequency Stability

A.6.1 Reference

FCC CFR 47 Part 2, Clause 2.1055

FCC CFR 47 Part 27, Clause 27.54

A.6.2 Method of measurement

Temperature Variation

The EUT was tested over the temperature range -30°C to +50°C in 10°C steps with -48 VDC Power Supply. At each temperature step, the Base Station was configured to transmit a [RAT]* at maximum power on the middle channel of the operating band. After achieving thermal balance, the averages of 200 transmission bursts were measured and the result recorded.

Voltage Variation

The EUT was tested at the supplied voltages varied from 85 to 115 percent of the nominal value of -48 VDC. At +20°C, the Base Station was configured to transmit a [RAT]* at maximum power on the middle channel of the operating band. The average of 200 transmission bursts was measured and the result recorded.

[RAT]*:

NR-256QAM modulation

A.6.3 Measurement limit

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

A.6.4 Measurement results

Configuration NR-MIMO-1C, 256QAM

Maximum Output Power 30.97dBm per port for NR 20MHz, 36.99dBm per port for NR100MHz

Frequency Error – Temperature Variation

Supply Voltage DC(V)	Temperature	Frequency Stability (Hz) Channel position M	
		Bandwidth 20MHz	Bandwidth 100MHz
-48	-30	-1.84	4.64
	-20	2.58	-3.49
	-10	2.72	-2.68
	0	-1.95	3.31
	10	-2.23	-2.09
	20	5.77	-7.10
	30	-4.67	4.79
	40	7.56	-5.52
	50	-4.69	-2.56

Frequency Error – Voltage Variation

Supply Voltage DC(V)	Temperature(°C)	Frequency Stability (Hz) Channel position M	
		Bandwidth 20MHz	Bandwidth 100MHz
-40.8	20	-9.87	6.09
-55.2	20	-2.35	-5.12

ANNEX B: Accreditation Certificate

<p>United States Department of Commerce National Institute of Standards and Technology</p> <p>NVLAP </p> <hr/> <p>Certificate of Accreditation to ISO/IEC 17025:2017</p> <hr/>	
<p>NVLAP LAB CODE: 600118-0</p>	
<p>Telecommunication Technology Labs, CAICT Beijing China</p>	
<p><i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i></p>	
<p>Electromagnetic Compatibility & Telecommunications</p>	
<p><i>This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).</i></p>	
<hr/> <p>2022-10-01 through 2023-09-30 <i>Effective Dates</i></p>	 <hr/> <p><i>[Signature]</i> For the National Voluntary Laboratory Accreditation Program</p>

END OF REPORT