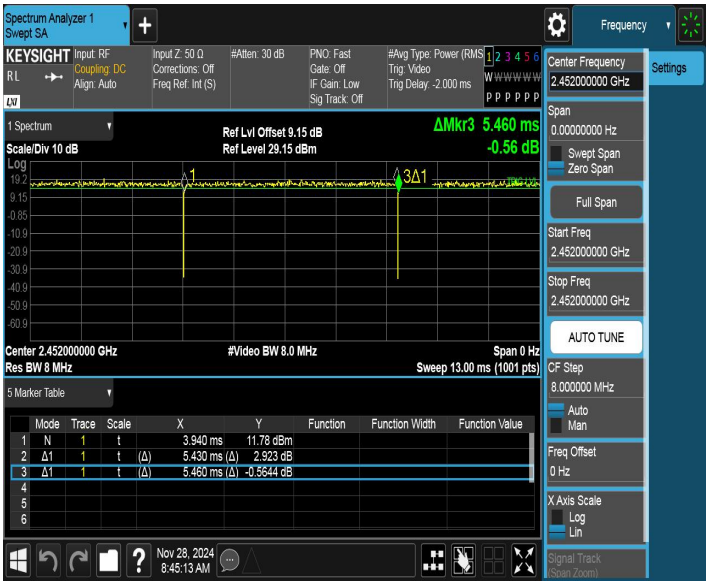
11AX40MIMO_Ant1_2452


2.6. Description of Test Software

The test utility software used during testing was “Putty.exe”, Power Parameter Value:

Test Mode	Ant 1	Ant 2	CDD/MIMO
802.11b	17	17	15
802.11g	17	17	14
802.11n-HT20	17	17	14
802.11n-HT40	17	17	14
802.11ax-HE20	17	17	14
802.11ax-HE40	17	17	14

2.7. Test Mode

The EUT not support partial RU’s and channel puncturing mode.

Test Mode
Mode 1: Transmit by 802.11b Antenna1
Mode 2: Transmit by 802.11g Antenna1
Mode 3: Transmit by 802.11n-HT20 Antenna1
Mode 4: Transmit by 802.11n-HT40 Antenna1
Mode 5: Transmit by 802.11ax-HE20 Antenna1
Mode 6: Transmit by 802.11ax-HE40 Antenna1
Mode 7: Transmit by 802.11b Antenna2
Mode 8: Transmit by 802.11g Antenna2

Mode 9: Transmit by 802.11n-HT20 Antenna2
Mode 10: Transmit by 802.11n-HT40 Antenna2
Mode 11: Transmit by 802.11ax-HE20 Antenna2
Mode 12: Transmit by 802.11ax-HE40 Antenna2
Mode 13: Transmit by 802.11b-CDD
Mode 14: Transmit by 802.11g-CDD
Mode 15: Transmit by 802.11n-HT20 MIMO
Mode 16: Transmit by 802.11n-HT40 MIMO
Mode 17: Transmit by 802.11ax-HE20 MIMO
Mode 18: Transmit by 802.11ax-HE40 MIMO

2.8. Test Configuration

The EUT was tested per the guidance of KDB 558074 D01 v05r02. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.9. EUT Photo

The EUT external photo, internal photo and test setup photo, please refer to the plots in the S20241118761701-A1/A2/A3.

2.10. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.11. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance provided in KDB 558074 D01 v05r02 were used in the measurement of the EUT.

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. The turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-25GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- Use a unique coupling to the intentional radiator.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	FWXGJC-2016-181	1 year	2025/03/07
Two-Line V-Network	R&S	ENV 216	FWXGJC-2016-182	1 year	2025/04/28
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2025/09/03

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Loop Antenna	Schwarzbeck	FMZB 1519B	FWXGJC-2018-015	1 year	2025/03/16
Bi-Log Antenna	R&S	HL562E	FWXGJC-2016-267-06	1 year	2025/07/26
Broadband Horn Antenna	R&S	HF907	FWXGJC-2016-267-07	1 year	2025/03/01
Broadband Horn Antenna	Schwarzbeck	BBHA9170	FWXGJC-2018-016	1 year	2025/07/26
EMI Receiver	R&S	ESR26	FWXGJC-2016-267-01	1 year	2025/07/26
Pre-Amplifier	R&S	SCU-18D	FWXGJC-2016-267-05	1 year	2025/07/23
Pre-Amplifier	R&S	EMC184055SE	FWXGJC-2018-018	1 year	2025/04/13
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-386	1 year	2025/09/03
Anechoic Chamber	Aimuke	EMCCT-3	FWXGJC-2016-270	3 year	2026/04/05

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Keysight	N9010B	FWXGJC-2018-010	1 year	2025/03/02
RF Control Unit	Toncend	JS0806-2	FWXGJC-2018-013	1 year	2025/05/19
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2025/09/03

Test Software	Manufacturer	Version	Asset No.	Function
EMI Test Software	tonscend	V3.3.10	/	/
JS32	tonscend	V2.5.2.4	/	/

Auxiliary Equipment

Instrument	Manufacturer	Type No.	Asset No.	Function
Filter	Tonscend	ZBSF6	07247867	/
Filter	Tonscend	ZHPF6	07233297	/
Attenuator	Tonscend	10dB	/	/
RF Cable	Tonscend	T-1	/	/

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.68dB
Radiated Emission Measurement (Below 1GHz)
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 4.01dB
Radiated Emission Measurement (1-18GHz)
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 4.97dB
Radiated Emission Measurement (Above 18-40GHz)
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 5.32dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 30MHz-1GHz: 1.00 dB 1GHz-12.75GHz: 1.30 dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.60dB
Power Spectrum Density
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.80dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.20MHz
Frequency Stability
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.1×10^{-6}MHz

7. TEST RESULT

7.1. Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 7.2
15.247(b)(3)	Output Power	≤ 30dBm		Pass	Section 7.3
15.247(e)	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 7.4
15.247(d)	Band Edge	≥ 30dBc		Pass	Section 7.5
15.247(d)	Out-of-Band Emissions	≥ 30dBc		Pass	Section 7.6
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS GEN [8.9])	Radiated	Pass	Section 7.7
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits (RSS GEN [8.8])	Line Conducted	Not Applicable	Section 7.8

Notes:

1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

7.2. 6dB Bandwidth Measurement

7.2.1. Test Limit

The minimum permissible 6dB bandwidth is 500 kHz.

7.2.2. Test Procedure used

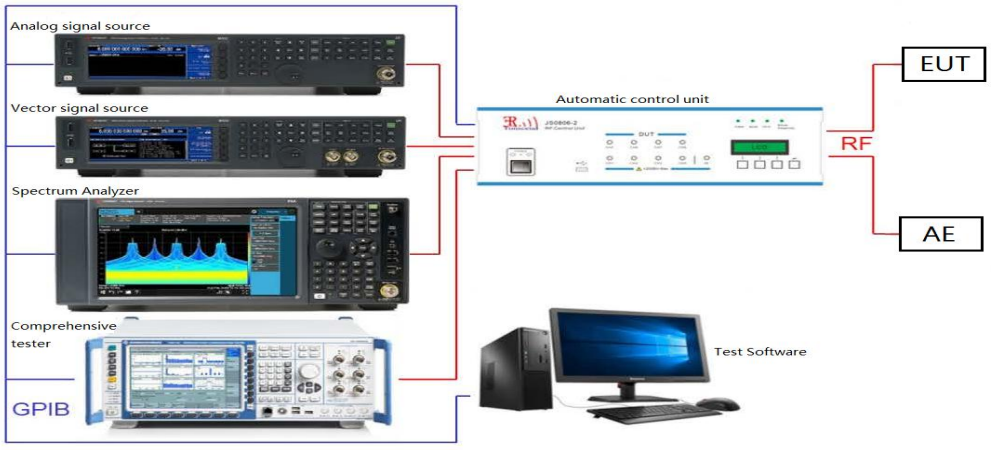
ANSI C63.10-2013 Section 11.8.2 Option 1

KDB 558074 D01 v05r02 – Section 8.2

7.2.3. Test Setting

1. Set RBW = 100 kHz
2. VBW ≥ 3 × RBW
3. Detector = peak
4. Trace mode = max hold
5. Sweep = auto couple
6. Allow the trace was allowed to stabilize
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.2.4. Test Setup



7.2.5. Test Result

All the test mode and antenna port were tested, the test results showed as below is the worst case for all test mode and antenna port:

Test Mode	Antenna	Frequency [MHz]	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit [MHz]	99%BW	Verdict
11B	Ant1	2412	7.560	2408.440	2416.000	0.5	12.927	PASS
	Ant1	2437	8.040	2433.000	2441.040	0.5	12.950	PASS
	Ant1	2462	7.120	2458.440	2465.560	0.5	12.971	PASS
11G	Ant1	2412	15.080	2404.480	2419.560	0.5	16.253	PASS
	Ant1	2437	15.040	2429.480	2444.520	0.5	16.246	PASS
	Ant1	2462	13.840	2455.680	2469.520	0.5	16.245	PASS
11N20SISO	Ant1	2412	12.280	2407.280	2419.560	0.5	17.405	PASS
	Ant1	2437	14.960	2429.520	2444.480	0.5	17.405	PASS
	Ant1	2462	15.320	2454.200	2469.520	0.5	17.404	PASS
11N40SISO	Ant1	2422	34.960	2404.560	2439.520	0.5	35.669	PASS
	Ant1	2437	28.800	2421.960	2450.760	0.5	35.566	PASS
	Ant1	2452	30.000	2436.960	2466.960	0.5	35.601	PASS
11AX20SISO	Ant1	2412	12.920	2404.560	2417.480	0.5	18.706	PASS
	Ant1	2437	11.320	2431.960	2443.280	0.5	18.680	PASS
	Ant1	2462	15.480	2454.080	2469.560	0.5	18.680	PASS
11AX40SISO	Ant1	2422	30.400	2405.760	2436.160	0.5	37.261	PASS
	Ant1	2437	31.280	2421.960	2453.240	0.5	37.342	PASS
	Ant1	2452	32.560	2435.680	2468.240	0.5	37.236	PASS
11B-CDD	Ant1	2412	7.120	2408.440	2415.560	0.5	13.071	PASS
	Ant1	2437	7.560	2433.440	2441.000	0.5	13.040	PASS
	Ant1	2462	7.560	2458.440	2466.000	0.5	13.012	PASS
11G-CDD	Ant1	2412	14.960	2404.520	2419.480	0.5	16.216	PASS
	Ant1	2437	15.000	2429.520	2444.520	0.5	16.236	PASS
	Ant1	2462	15.040	2454.520	2469.560	0.5	16.256	PASS
11N20MIMO	Ant1	2412	13.760	2404.520	2418.280	0.5	17.392	PASS
	Ant1	2437	11.280	2430.720	2442.000	0.5	17.368	PASS
	Ant1	2462	15.080	2454.480	2469.560	0.5	17.398	PASS
11N40MIMO	Ant1	2422	32.560	2404.480	2437.040	0.5	35.678	PASS
	Ant1	2437	20.160	2425.640	2445.800	0.5	35.587	PASS
	Ant1	2452	30.080	2436.960	2467.040	0.5	35.576	PASS

11AX20MIMO	Ant1	2412	11.320	2406.960	2418.280	0.5	18.730	PASS
	Ant1	2437	8.840	2431.960	2440.800	0.5	18.705	PASS
	Ant1	2462	13.840	2454.480	2468.320	0.5	18.693	PASS
11AX40MIMO	Ant1	2422	32.160	2404.480	2436.640	0.5	37.332	PASS
	Ant1	2437	32.400	2419.560	2451.960	0.5	37.290	PASS
	Ant1	2452	29.200	2436.560	2465.760	0.5	37.211	PASS

Test Graphs of 6dB Bandwidth

11B_Ant1_2412


11B_Ant1_2437


11B_Ant1_2462

11G_Ant1_2412

11G_Ant1_2437

11G_Ant1_2462

11N20SISO_Ant1_2412


11N20SISO_Ant1_2437


11N20SISO_Ant1_2462


11N40SISO_Ant1_2422


11N40SISO_Ant1_2437


11N40SISO_Ant1_2452


11AX20SISO_Ant1_2412

11AX20SISO_Ant1_2437

11AX20SISO_Ant1_2462

11AX40SISO_Ant1_2422

11AX40SISO_Ant1_2437


11AX40SISO_Ant1_2452


11B-CDD_Ant1_2412

11B-CDD_Ant1_2437

11B-CDD_Ant1_2462

11G-CDD_Ant1_2412

11G-CDD_Ant1_2437

11G-CDD_Ant1_2462

11N20MIMO_Ant1_2412


11N20MIMO_Ant1_2437


11N20MIMO_Ant1_2462


11N40MIMO_Ant1_2422


11N40MIMO_Ant1_2437


11N40MIMO_Ant1_2452