FCC RADIO TEST REPORT

FCC ID	:	**UZ7KC50E15**
Equipment	:	**KC50E15 Kiosk Computer**
Brand Name	:	**Zebra**
Model Name	:	**KC50E15**
Applicant	:	**Zebra Technologies Corporation** **3 Overlook Point, Lincolnshire, IL 60069 USA**
Manufacturer	:	**Zebra Technologies Corporation** **3 Overlook Point, Lincolnshire, IL 60069 USA**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on May 14, 2024 and testing was performed from May 14, 2024 to Aug. 30, 2024. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR470109C	01	Initial issue of report	Sep. 12, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(2)	6dB Bandwidth	Pass	-
3.1	2.1049	99% Occupied Bandwidth	Pass	-
3.2	15.247(b)	Power Output Measurement	Pass	-
3.3	15.247(e)	Power Spectral Density	Pass	-
3.4	15.247(d)	Conducted Band Edges	Pass	-
		Conducted Spurious Emission	Pass	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	1.58 dB under the limit at 2483.52 MHz
3.6	15.207	AC Conducted Emission	Pass	9.80 dB under the limit at 13.56 MHz
3.7	15.203	Antenna Requirement	Pass	-

Conformity Assessment Condition:

1. ECR inquiry for data referencing from UZ7KC50A15 has been approved by FCC. The ECR inquiry and the associated document are submitted in the confidential exhibit.
2. UZ7KC50E15 is different from FCC ID: UZ7KC50A15 (Reference model), in the following:
   - The only difference between UZ7KC50E15 and UZ7KC50A15 are the main board schematics, key components of BOM and NFC software and hardware.
3. All the test results are referenced from UZ7KC50A15 (Sporton Test Report FR450111C), and spot check results to justify data referencing is presented in the Appendix G.
4. 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.
5. 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.

Reviewed by: Yun Huang

Report Producer: Mila Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	KC50E15 Kiosk Computer
Brand Name	Zebra
Model Name	KC50E15
FCC ID	UZ7KC50E15
Supports Radios application	WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80/VHT160 WLAN 11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE

1.2 EUT Information (Referenced Model)

Product Feature	
Equipment	KC50A15 Kiosk Computer
Brand Name	Zebra
Model Name	KC50A15
FCC ID	UZ7KC50A15
EUT supports Radios application	NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80/VHT160 WLAN 11ax HE20/HE40/HE80/HE160 Bluetooth BR/EDR/LE
HW Version	REV:PT
SW Version	13-29-29.00-TG-U00-STD-ATH-04
OS Version	Android 13
MFD	11MAY24
EUT Stage	Identical Prototype

Remark: The EUT's information above is declared by manufacturer.

Specification of Accessories				
AC Adapter	**Brand Name**	ZEBRA	**Model Name**	PS000088A01
USB C-C Cable	**Brand Name**	ZEBRA	**Part Number**	CBL-EC5X-USBC3A-01
Stand	**Brand Name**	ZEBRA	**Part Number**	3PTY-SC-2000-CF2-01
Printer	**Brand Name**	ZEBRA	**Model Name**	ZD230t
2nd display	**Brand Name**	ZEBRA	**Model Name**	TD50-15F00
Edge scanner	**Brand Name**	ZEBRA	**Part Number**	ZFLX-SCNR-E00
Edge LED Light Bar	**Brand Name**	ZEBRA	**Part Number**	ZFLX-LTBAR-200
USB Cable	**Brand Name**	ZEBRA	**Part Number**	300283-002

1.3 Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx/Rx Frequency Range	2412 MHz ~ 2462 MHz
Maximum Output Power to Antenna	**MIMO <Ant. 1+2>** 802.11b : 26.47 dBm / 0.4436 W 802.11g : 25.41 dBm / 0.3475 W 802.11n HT20 : 24.77 dBm / 0.2999 W 802.11ac VHT20 : 24.87 dBm / 0.3069 W 802.11ax HE20 : 24.97 dBm / 0.3141 W
99% Occupied Bandwidth	**MIMO <Ant. 1>** 802.11b: 13.04 MHz 802.11g: 16.88 MHz 802.11ac VHT20 : 18.28 MHz 802.11ax HE20: 19.33 MHz **MIMO <Ant. 2>** 802.11b: 13.39 MHz 802.11g: 16.48 MHz 802.11ac VHT20 : 17.68 MHz 802.11ax HE20: 19.03 MHz
Antenna Type / Gain	**<Ant. 1>:** Coupling Antenna with gain 2.89 dBi **<Ant. 2>:** PIFA Antenna with gain 2.98 dBi
Type of Modulation	802.11b: DSSS (DBPSK / DQPSK / CCK) 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) 802.11ax: OFDMA (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)
Antenna Function Description	

	Ant. 1	Ant. 2
802.11ax MIMO	V	V

Remark:

1. MIMO Ant. 1+2 Directional Gain is a calculated result from MIMO Ant. 1 and MIMO Ant. 2. The formula used in calculation is documented in section 1.2.1.
2. Power of MIMO Ant. 1 + Ant. 2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.
3. The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

1.3.1 Antenna Directional Gain

Follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01 F)2)f)ii)

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows:

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$.

G_{ANT} is set equal to the gain of the antenna having the highest gain.

For PSD measurements, the directional gain calculation.

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k/20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

As minimum N_{SS}=1 is supported by EUT, the formula can be simplified as:

Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}]$ dBi

Where G1, G2….GN denote single antenna gain.

The directional gain "DG" is calculated as following table.

	Ant 1 (dBi)	Ant 2 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
2.4GHz	2.89	2.98	2.98	5.95	0.00	0.00

Calculation example:

If a device has two antenna, G_{ANT1}= 2.89dBi; G_{ANT2}=2.98dBi

Directional gain of power measurement = max(2.89, 2.98) + 0 = 2.98 dBi

Directional gain of PSD derived from formula which is

10 x log { { [10^ (2.89 dBi / 20) + 10^ (2.98 dBi / 20)] ^ 2 } / 2 }

= 5.95 dBi

Power and PSD limit reduction = Composite gain – 6dBi, (min = 0)

1.4 Modification of EUT

No modifications made to the EUT during the testing.

1.5 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	TH05-HY, CO07-HY, 03CH20-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW3786

1.6 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Test Mode

This device support 26/52/106/242-tone RU channel.

The PSD of partial RU is reduced to be smaller than full RU according to TCB workshop interim guidance Oct. 2022.

The 802.11ax mode is investigated among different tones, full resource units (RU), partial resource units. The partial RU has no higher power than full RU's, thus the full RU is chosen as main test configuration.

The SISO mode conducted power is covered by MIMO mode per chain, so only the MIMO mode is tested.

The power for 802.11n mode is smaller than 802.11ac mode, so all other conducted and radiated test is covered by 802.11ac mode.

The final test modes include the worst data rates for each modulation shown in the table below.

MIMO Antenna

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20 (Covered by VHT20)	MCS0
802.11ac VHT20	MCS0
802.11ax HE20	MCS0

Remark: The conducted power level of each chain in MIMO mode is equal or higher than SISO mode.

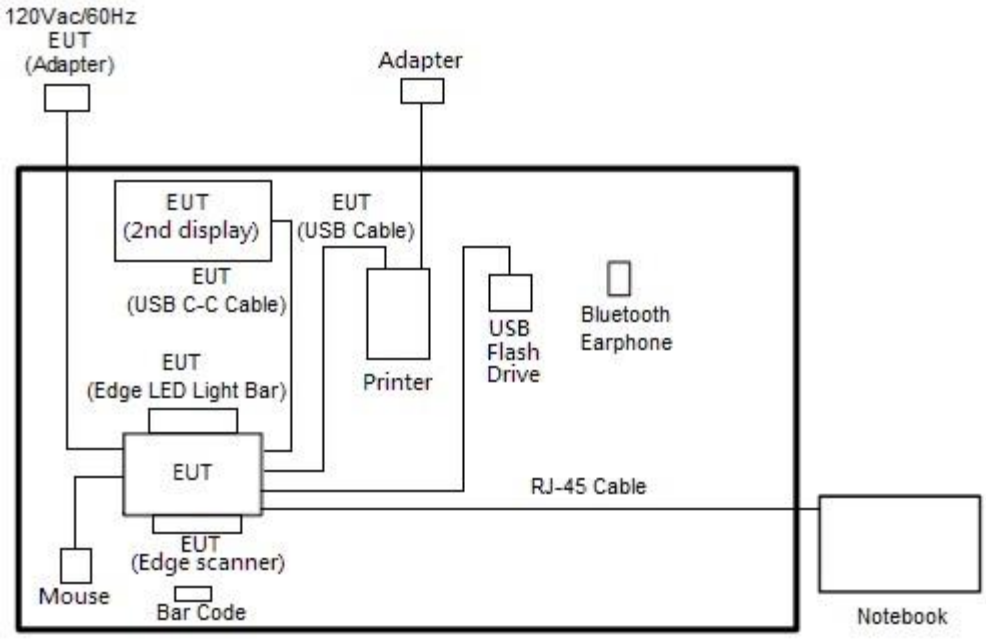
Test Cases	
AC Conducted Emission	Mode 1 : WLAN (2.4GHz) Link + Bluetooth Link + Scan Bar Code + USB C-C Cable Display with 2nd display + USB Cable with Printer + AC Adapter + LAN Link with Notebook + Edge USB-C with (Edge scanner + (Data Link with USB Flash Drive (USB to SD Card)) + Edge LED Light Bar + Mouse) + Stand
Remark: Data Link with USB Flash Drive means data application transferred mode between EUT and USB Flash Drive.	

Ch. #	2400-2483.5 MHz		
	802.11b	802.11g	802.11ax HE20
Low	01	01	03
Middle	06	06	06
High	11	11	09

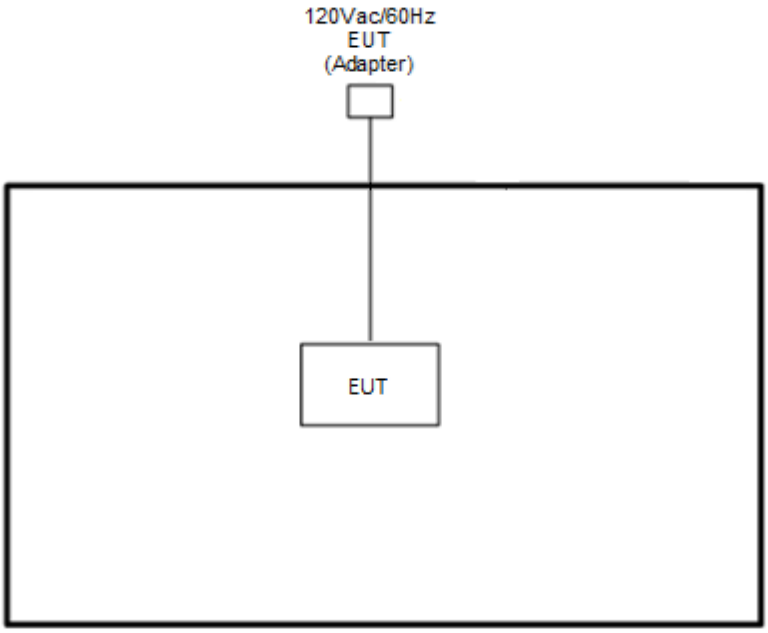
Remark: For radiation spurious emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<WLAN Tx Mode>



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Sony Ericsson	MW600	PY700A2029	N/A	N/A
2.	WLAN AP	ASUS	RT-AC52	MSQ-RTAC4A00	N/A	Unshielded, 1.8m
3.	Notebook	DELL	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Mouse	ACER	MOANUOA	FCC DoC	Shielded, 1.7m	N/A
5.	Bar Code	N/A	N/A	N/A	N/A	N/A
6.	USB Flash Drive	SanDisk	E4BDC	FCC DoC	N/A	N/A
7.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility “QRCT Version 4.0.211.0” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 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.

Example:
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 4.2 dB and 10 dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

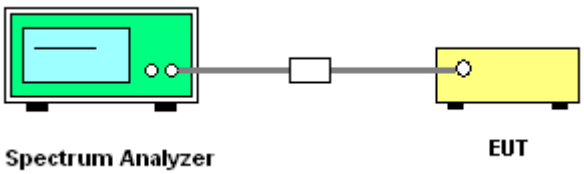
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) ≥ 3 * RBW.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna with directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

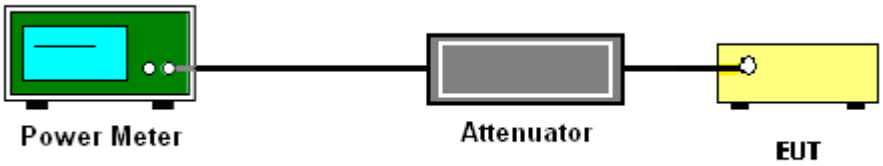
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

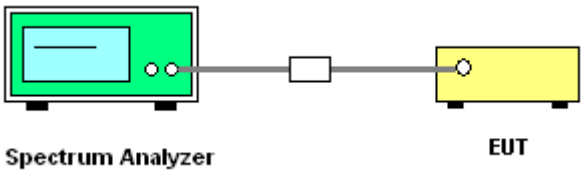
3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

   Method (c): Measure and add 10 log(N_{ANT}) dB.

   With this technique, spectrum measurements are performed at each output of the device, but rather than summing the spectra or the spectral peaks across the outputs, the quantity 10 log(N_{ANT}) dB is added to each spectrum value before comparing to the emission limit. The addition of 10 log(N_{ANT}) dB serves to apportion the emission limit among the N_{ANT} outputs so that each output is permitted to contribute no more than $1/N_{ANT}$ th of the PSD limit .

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

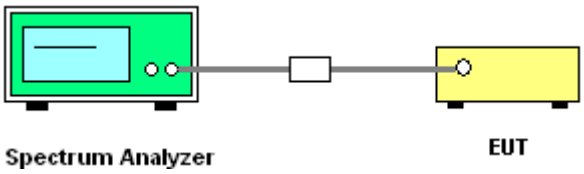
3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Please refer to Appendix A.

3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

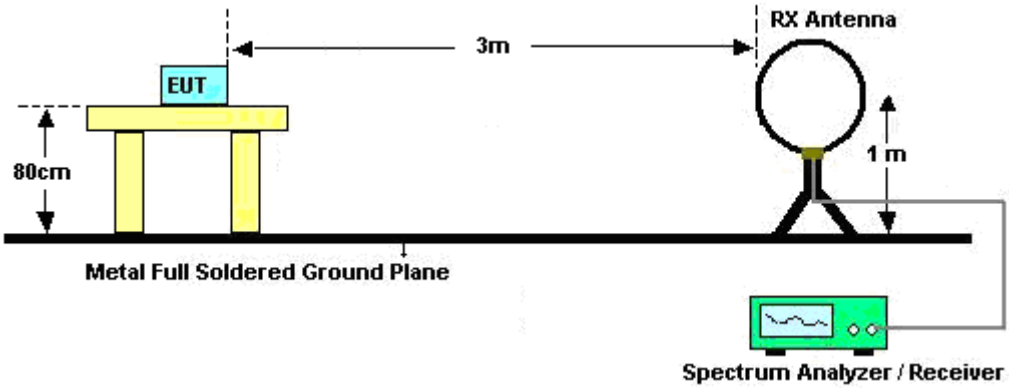
3.5.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-“.

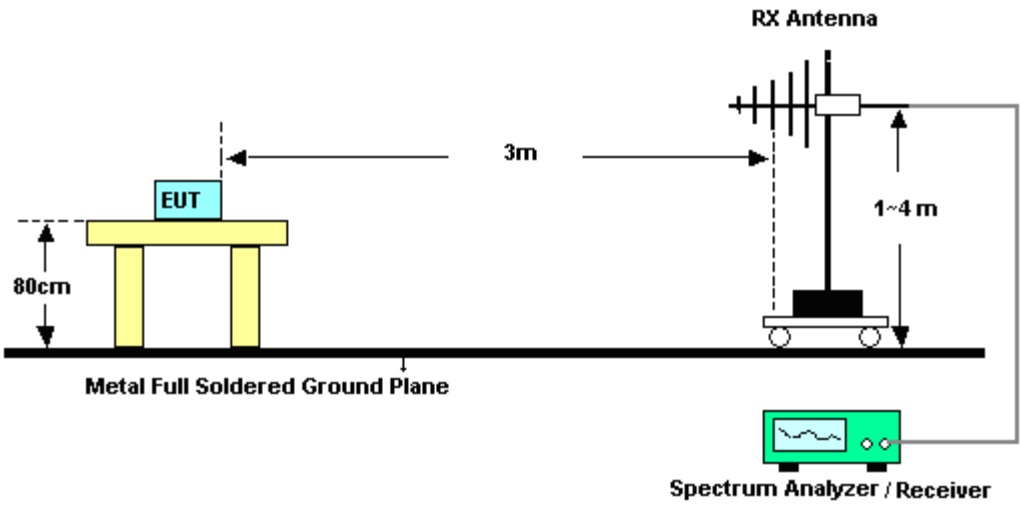
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".
8. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3 MHz for f ≥ 1 GHz for peak measurement.
   For average measurement:
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

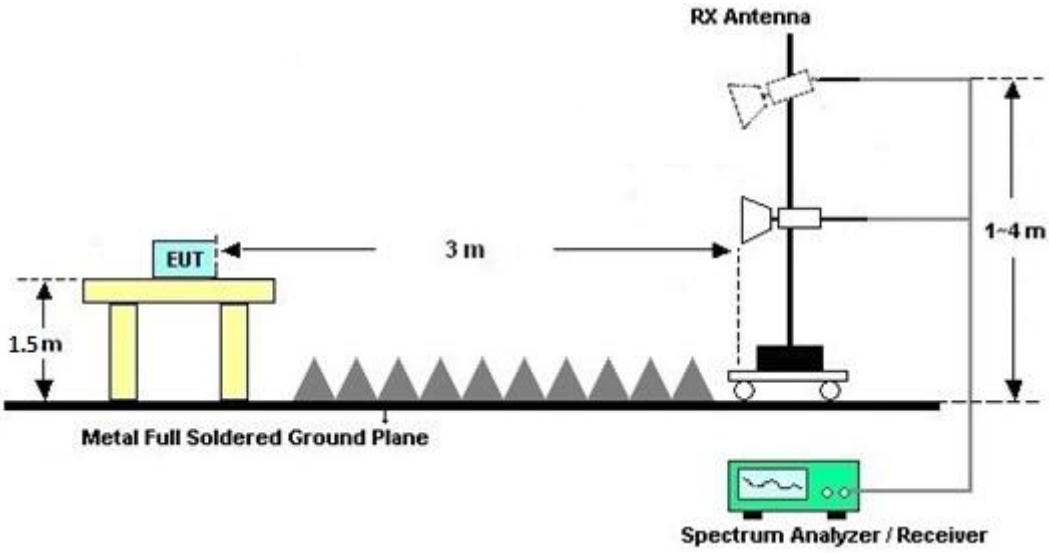
For radiated emissions below 30MHz



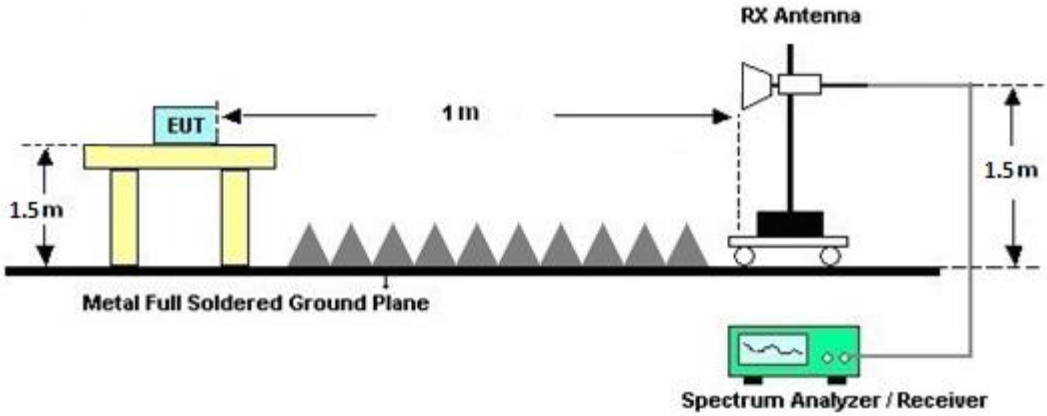
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

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

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.5.7 Duty Cycle

Please refer to Appendix E.

3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

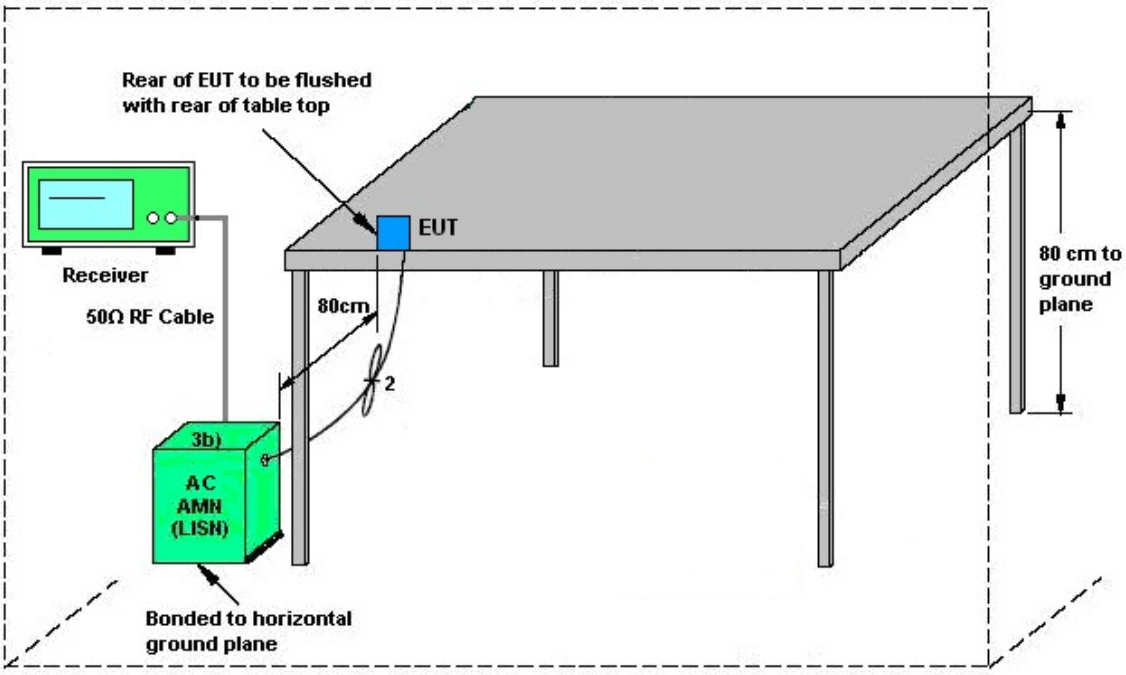
3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

3.6.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.7 Antenna Requirements

3.7.1 Standard Applicable

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 rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Jun. 26, 2024	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jun. 26, 2024	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Oct. 20, 2023	Jun. 26, 2024	Oct. 19, 2024	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 14, 2024	Jun. 26, 2024	Mar. 13, 2025	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Mar. 10, 2024	Jun. 26, 2024	Mar. 09, 2025	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Mar. 07, 2024	Jun. 26, 2024	Mar. 06, 2025	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Sep. 20, 2023	Jun. 26, 2024	Sep. 19, 2024	Conduction (CO07-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 07, 2023	May 14, 2024~ Jun. 28, 2024	Nov. 06, 2024	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	15I00041SNO 10 (NO:248)	10MHz~6GHz	Jan. 10, 2024	May 14, 2024~ Jun. 28, 2024	Jan. 09, 2025	Conducted (TH05-HY)
Switch Control Mainframe	Burgeon	ETF-058	EC1300485 (BOX4)	N/A	Apr. 08, 2024	May 14, 2024~ Jun. 28, 2024	Apr. 07, 2025	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101566	10Hz~40GHz	Aug. 23, 2023	May 14, 2024~ Jun. 28, 2024	Aug. 22, 2024	Conducted (TH05-HY)
Software	Sporton	BTWIFI_Final_version_240411	N/A	Conducted Other Test Item	N/A	May 14, 2024~ Jun. 28, 2024	N/A	Conducted (TH05-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	N/A	Oct. 06, 2023	May 14, 2024~ Jul. 10, 2024	Oct. 05, 2024	Radiation (03CH20-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 12, 2023	May 14, 2024~ Jul. 10, 2024	Sep. 11, 2024	Radiation (03CH20-HY)
Preamplifier	EMEC	EM18G40G	060871	18GHz~40GHz	Aug. 30, 2023	May 14, 2024~ Jul. 10, 2024	Aug. 29, 2024	Radiation (03CH20-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	May 14, 2024~ Jul. 10, 2024	N/A	Radiation (03CH20-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	May 14, 2024~ Jul. 10, 2024	N/A	Radiation (03CH20-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	May 14, 2024~ Jul. 10, 2024	N/A	Radiation (03CH20-HY)
Signal Analyzer	Keysight	N9010B	MY60240520	N/A	Dec. 12, 2023	May 14, 2024~ Jul. 10, 2024	Dec. 11, 2024	Radiation (03CH20-HY)
Bilog Antenna	TESEQ	CBL 6111D&00802N 1D01N-06	55606 & 08	30MHz~1GHz	Oct. 20, 2023	May 14, 2024~ Jul. 10, 2024	Oct. 19, 2024	Radiation (03CH20-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	02360	1GHz-18GHz	Oct. 30, 2023	May 14, 2024~ Jul. 10, 2024	Oct. 29, 2024	Radiation (03CH20-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	00993	18GHz-40GHz	Nov. 24, 2023	May 14, 2024~ Jul. 10, 2024	Nov. 23, 2024	Radiation (03CH20-HY)
Preamplifier	COM-POWER	PAM-103	18020201	1MHz-1000MHz	Jan. 01, 2024	May 14, 2024~ Jul. 10, 2024	Dec. 31, 2024	Radiation (03CH20-HY)
Amplifier	EMCI	EMC118A45SE	980792	N/A	Nov. 13, 2023	May 14, 2024~ Jul. 10, 2024	Nov. 12, 2024	Radiation (03CH20-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519229/2,804015/2,804027/2	N/A	Jan. 17, 2024	May 14, 2024~ Jul. 10, 2024	Jan. 16, 2025	Radiation (03CH20-HY)
Hygrometer	TECPEL	DTM-303A	TP211382	N/A	Mar. 27, 2024	May 14, 2024~ Jul. 10, 2024	Mar. 26, 2025	Radiation (03CH20-HY)
Software	Audix	N/A	RK-002156	N/A	N/A	May 14, 2024~ Jul. 10, 2024	N/A	Radiation (03CH20-HY)

5 Measurement Uncertainty

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.44 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.4 dB

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.5 dB

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.6 dB

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.4 dB

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Sylvia Li	Temperature:	21~25	°C
Test Date:	2024/5/14~2024/06/28	Relative Humidity:	51~54	%

Report Number : FR470109C

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band MIMO										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
					Ant1	Ant2	Ant1	Ant2		
11b	1Mbps	2	1	2412	13.04	13.04	8.08	8.07	0.50	Pass
11b	1Mbps	2	6	2437	13.04	13.14	8.09	8.07	0.50	Pass
11b	1Mbps	2	11	2462	12.89	13.39	8.05	8.06	0.50	Pass
11g	6Mbps	2	1	2412	16.43	16.38	16.31	16.31	0.50	Pass
11g	6Mbps	2	6	2437	16.88	16.48	16.05	16.30	0.50	Pass
11g	6Mbps	2	11	2462	16.38	16.43	16.31	16.33	0.50	Pass
VHT20	MCS0	2	1	2412	17.58	17.53	17.53	16.93	0.50	Pass
VHT20	MCS0	2	6	2437	18.28	17.68	17.53	17.30	0.50	Pass
VHT20	MCS0	2	11	2462	17.53	17.63	17.28	17.57	0.50	Pass

TEST RESULTS DATA
Average Output Power

2.4GHz Band MIMO																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
					Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	2	1	2412	23.60	23.20	26.41	30.00		2.98		29.39		36.00		Pass
11b	1Mbps	2	6	2437	23.60	23.30	26.46	30.00		2.98		29.44		36.00		Pass
11b	1Mbps	2	11	2462	23.70	23.20	26.47	30.00		2.98		29.45		36.00		Pass
11g	6Mbps	2	1	2412	19.70	19.70	22.71	30.00		2.98		25.69		36.00		Pass
11g	6Mbps	2	6	2437	22.20	22.60	25.41	30.00		2.98		28.39		36.00		Pass
11g	6Mbps	2	11	2462	20.30	20.20	23.26	30.00		2.98		26.24		36.00		Pass
HT20	MCS0	2	1	2412	18.40	18.40	21.41	30.00		2.98		24.39		36.00		Pass
HT20	MCS0	2	6	2437	21.50	22.00	24.77	30.00		2.98		27.75		36.00		Pass
HT20	MCS0	2	11	2462	17.60	18.00	20.81	30.00		2.98		23.79		36.00		Pass
VHT20	MCS0	2	1	2412	18.50	18.50	21.51	30.00		2.98		24.49		36.00		Pass
VHT20	MCS0	2	6	2437	21.60	22.10	24.87	30.00		2.98		27.85		36.00		Pass
VHT20	MCS0	2	11	2462	17.70	18.10	20.91	30.00		2.98		23.89		36.00		Pass

Note: Measured power (dBm) has offset with cable loss.

Report Number : FR470109C

TEST RESULTS DATA
Peak Power Spectral Density

2.4GHz Band MIMO													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
					Ant1	Ant2	Worse + 3.01	Ant1	Ant2	Ant1	Ant2	
11b	1Mbps	2	1	2412	0.62	-0.04	3.63	5.95		8.00		Pass
11b	1Mbps	2	6	2437	1.79	1.31	4.80	5.95		8.00		Pass
11b	1Mbps	2	11	2462	0.47	-0.08	3.48	5.95		8.00		Pass
11g	6Mbps	2	1	2412	-7.34	-7.58	-4.33	5.95		8.00		Pass
11g	6Mbps	2	6	2437	-4.22	-3.62	-0.61	5.95		8.00		Pass
11g	6Mbps	2	11	2462	-6.09	-6.63	-3.08	5.95		8.00		Pass
VHT20	MCS0	2	1	2412	-7.66	-7.56	-4.55	5.95		8.00		Pass
VHT20	MCS0	2	6	2437	-3.82	-3.30	-0.29	5.95		8.00		Pass
VHT20	MCS0	2	11	2462	-8.40	-8.01	-5.00	5.95		8.00		Pass

Measured power density (dBm) has offset with cable loss.

TEST RESULTS DATA
6dB and 99% Occupied Bandwidth

2.4GHz Band MIMO											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	99% Occupied BW (MHz)		6dB BW (MHz)		6dB BW Limit (MHz)	Pass/Fail
						Ant1	Ant2	Ant1	Ant2		
HE20	MCS0	2	1	2412	Full	18.93	18.88	18.81	18.57	0.50	Pass
HE20	MCS0	2	6	2437	Full	19.33	19.03	18.74	18.88	0.50	Pass
HE20	MCS0	2	11	2462	Full	18.93	18.93	18.63	18.87	0.50	Pass

TEST RESULTS DATA
Average Output Power

2.4GHz Band MIMO																	
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Average Conducted Power (dBm)			Conducted Power Limit (dBm)		DG (dBi)		EIRP Power (dBm)		EIRP Power Limit (dBm)		Pass /Fail
						Ant1	Ant2	SUM	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	Ant1	Ant2	
HE20	MCS0	2	1	2412	Full	18.60	18.60	21.61	30.00		2.98		24.59		36.00		Pass
HE20	MCS0	2	1	2412	26/0	10.00	9.60	12.81	30.00		2.98		15.79		36.00		Pass
HE20	MCS0	2	1	2412	52/37	13.00	12.60	15.81	30.00		2.98		18.79		36.00		Pass
HE20	MCS0	2	1	2412	106/53	15.50	15.20	18.36	30.00		2.98		21.34		36.00		Pass
HE20	MCS0	2	6	2437	Full	21.70	22.20	24.97	30.00		2.98		27.95		36.00		Pass
HE20	MCS0	2	6	2437	26/4	13.20	12.80	16.01	30.00		2.98		18.99		36.00		Pass
HE20	MCS0	2	6	2437	52/38	14.30	15.30	17.84	30.00		2.98		20.82		36.00		Pass
HE20	MCS0	2	6	2437	106/53	17.50	18.20	20.87	30.00		2.98		23.85		36.00		Pass
HE20	MCS0	2	11	2462	Full	17.80	18.20	21.01	30.00		2.98		23.99		36.00		Pass
HE20	MCS0	2	11	2462	26/8	9.30	9.70	12.51	30.00		2.98		15.49		36.00		Pass
HE20	MCS0	2	11	2462	52/40	11.60	12.10	14.87	30.00		2.98		17.85		36.00		Pass
HE20	MCS0	2	11	2462	106/54	14.20	14.40	17.31	30.00		2.98		20.29		36.00		Pass

Note: Measured power (dBm) has offset with cable loss.

TEST RESULTS DATA
Peak Power Spectral Density

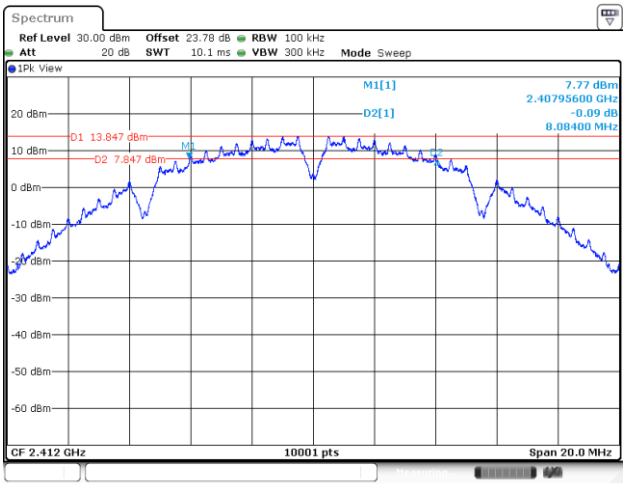
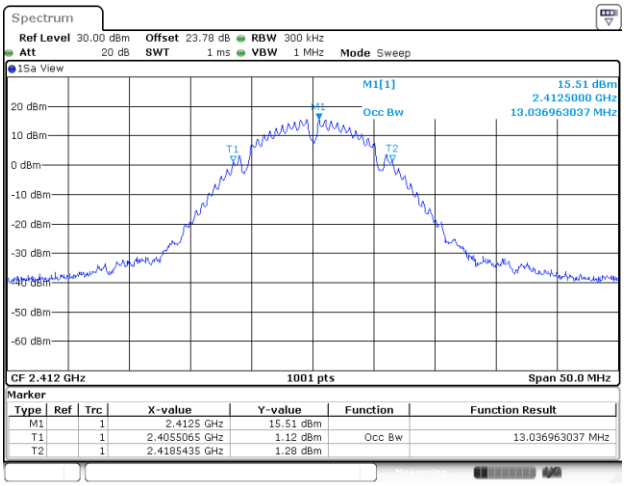
2.4GHz Band MIMO														
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	RU Config.	Peak PSD (dBm/3kHz)			DG (dBi)		Peak PSD Limit (dBm/3kHz)		Pass/Fail
						Ant1	Ant2	Worse + 3.01	Ant1	Ant2	Ant1	Ant2	
HE20	MCS0	2	1	2412	Full	-7.25	-7.36	-4.24	5.95		8.00		Pass
HE20	MCS0	2	1	2412	26/0	-7.72	-7.62	-4.61	5.95		8.00		Pass
HE20	MCS0	2	1	2412	52/37	-7.62	-7.91	-4.61	5.95		8.00		Pass
HE20	MCS0	2	1	2412	106/53	-7.77	-7.99	-4.76	5.95		8.00		Pass
HE20	MCS0	2	6	2437	Full	-4.12	-4.05	-1.04	5.95		8.00		Pass
HE20	MCS0	2	6	2437	26/4	-4.49	-4.73	-1.48	5.95		8.00		Pass
HE20	MCS0	2	6	2437	52/38	-5.23	-4.18	-1.17	5.95		8.00		Pass
HE20	MCS0	2	6	2437	106/53	-5.10	-4.33	-1.32	5.95		8.00		Pass
HE20	MCS0	2	11	2462	Full	-8.25	-7.95	-4.94	5.95		8.00		Pass
HE20	MCS0	2	11	2462	26/8	-8.65	-8.26	-5.25	5.95		8.00		Pass
HE20	MCS0	2	11	2462	52/40	-8.88	-8.30	-5.29	5.95		8.00		Pass
HE20	MCS0	2	11	2462	106/54	-8.60	-8.36	-5.35	5.95		8.00		Pass

Measured power density (dBm) has offset with cable loss.

6dB and 99% Occupied Bandwidth

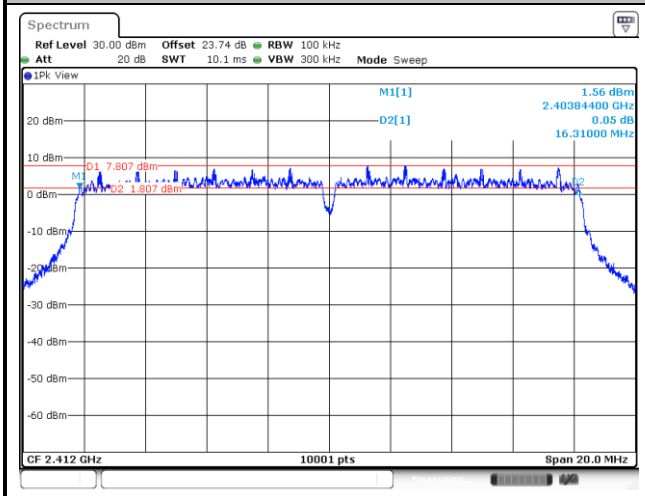
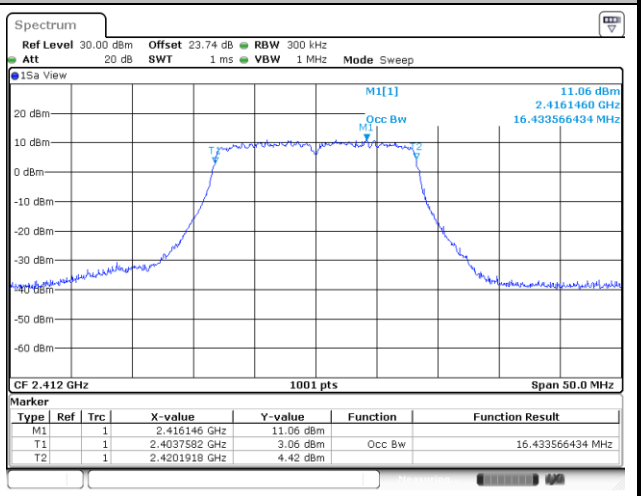
MIMO<Ant. 1+2>

<802.11b>

6dB Bandwidth	99% Occupied Bandwidth
	

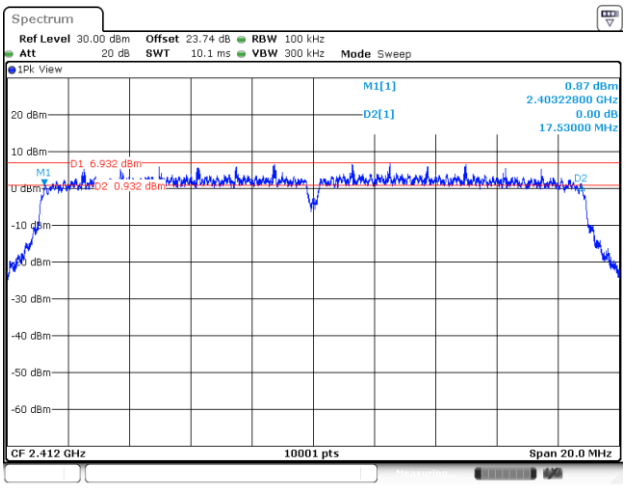
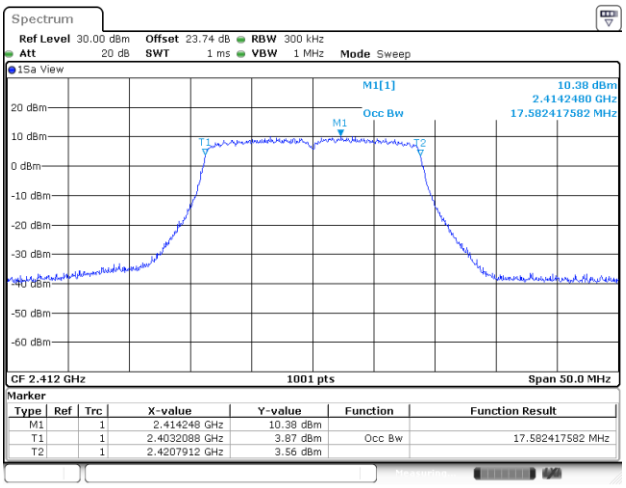
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11g>

6dB Bandwidth	99% Occupied Bandwidth
	

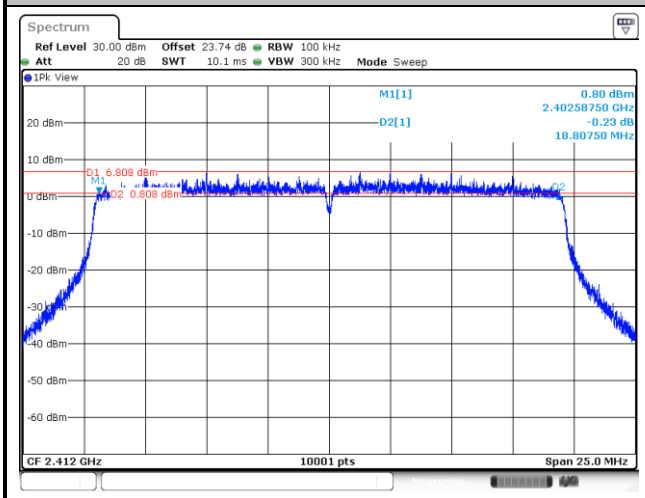
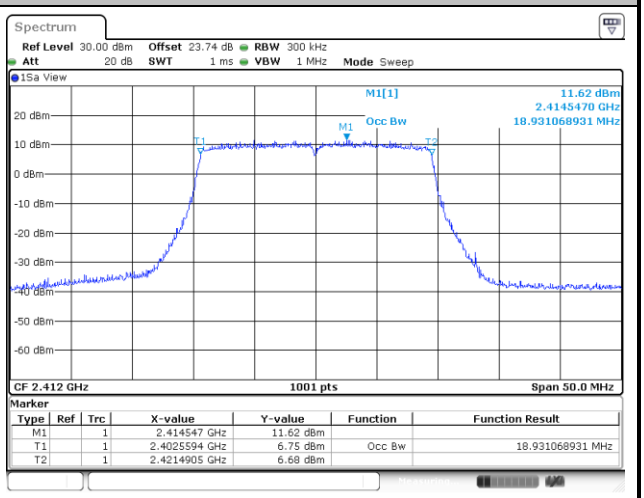
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11ac VHT20>

6dB Bandwidth	99% Occupied Bandwidth
	

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

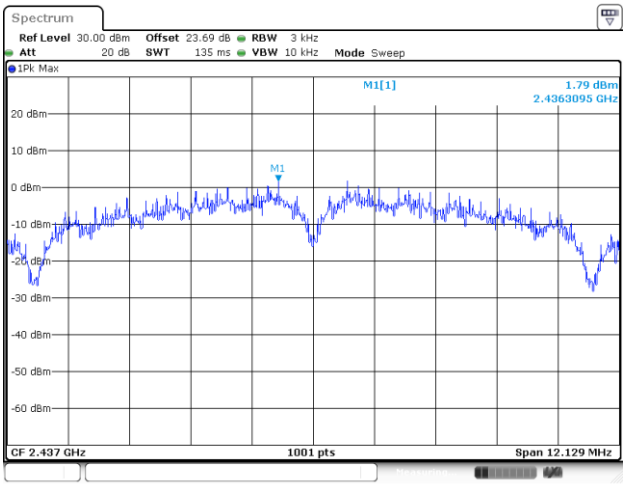
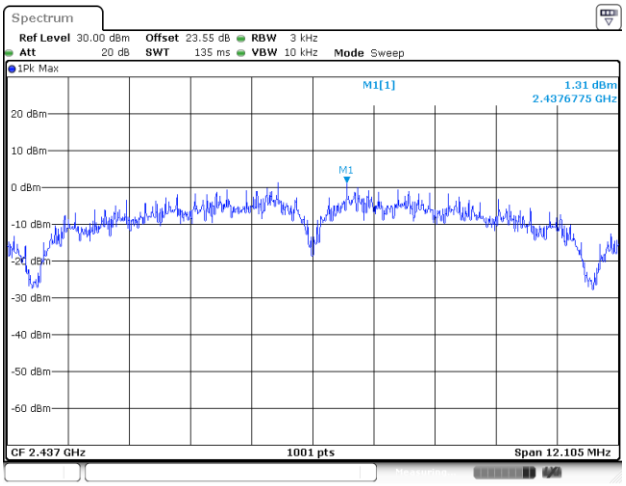
<802.11ax HE20>

6dB Bandwidth	99% Occupied Bandwidth
	

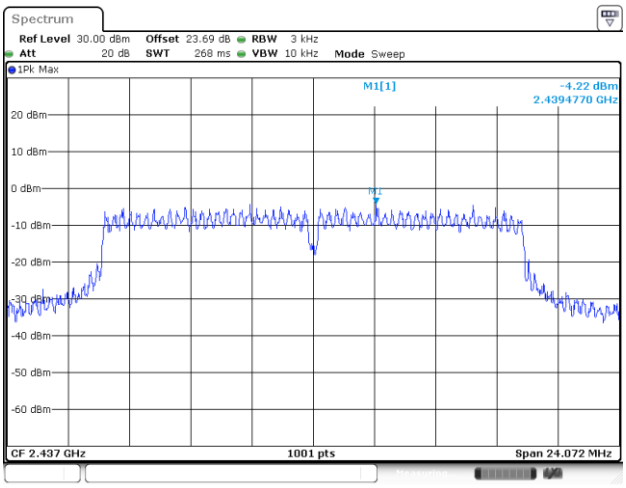
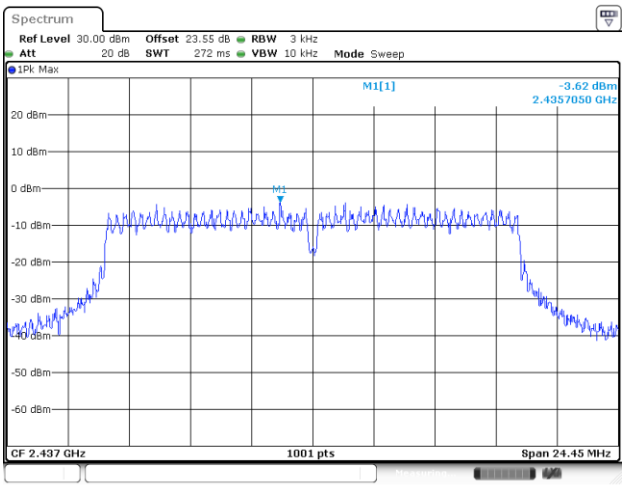
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

Power Spectral Density(dBm/3kHz)

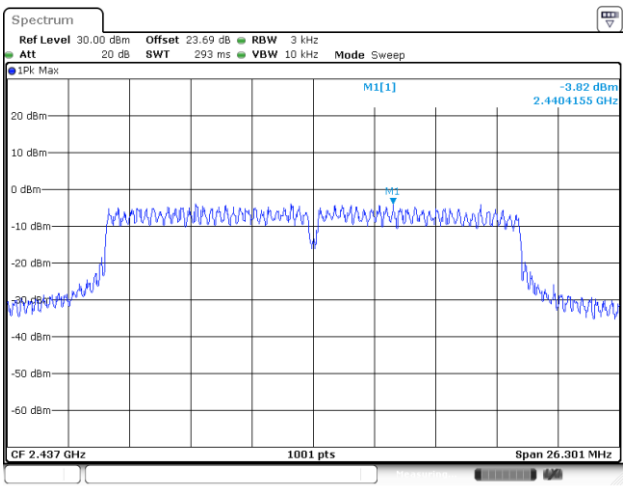
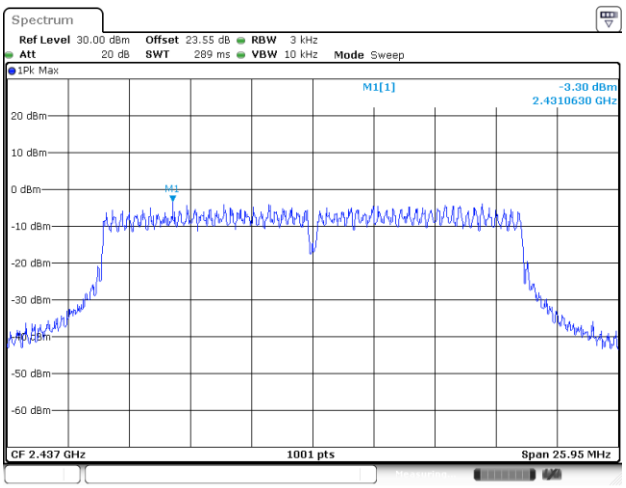
<802.11b>

Maximum Power Density Plot (dBm/3kHz)	
MIMO Ant 1	MIMO Ant 2
	

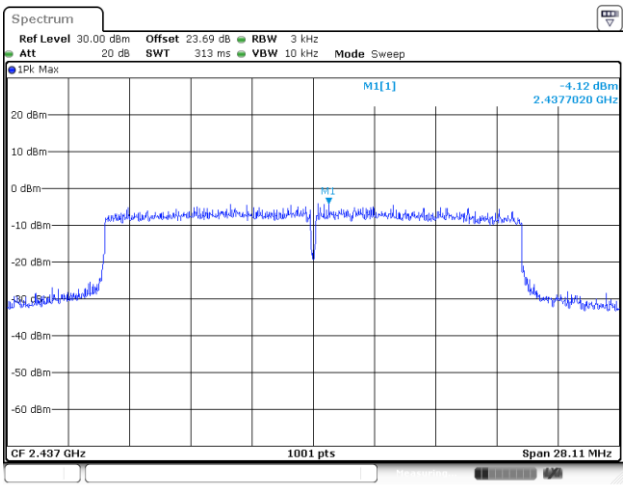
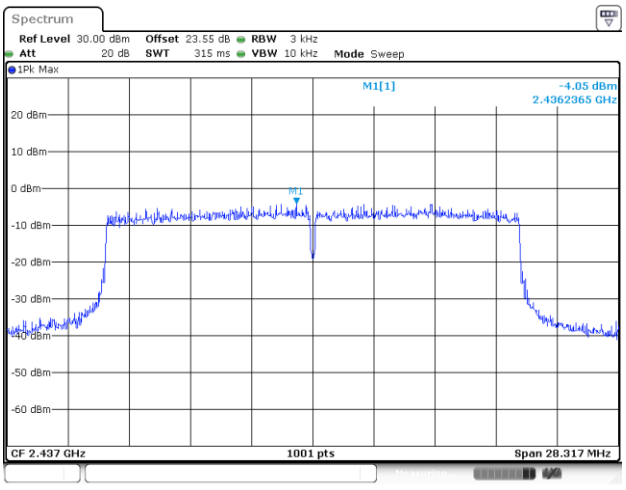
<802.11g>

Maximum Power Density Plot (dBm/3kHz)	
MIMO Ant 1	MIMO Ant 2
	

<802.11ac VHT20>

Maximum Power Density Plot (dBm/3kHz)	
MIMO Ant 1	MIMO Ant 2
	

<802.11ax HE20>

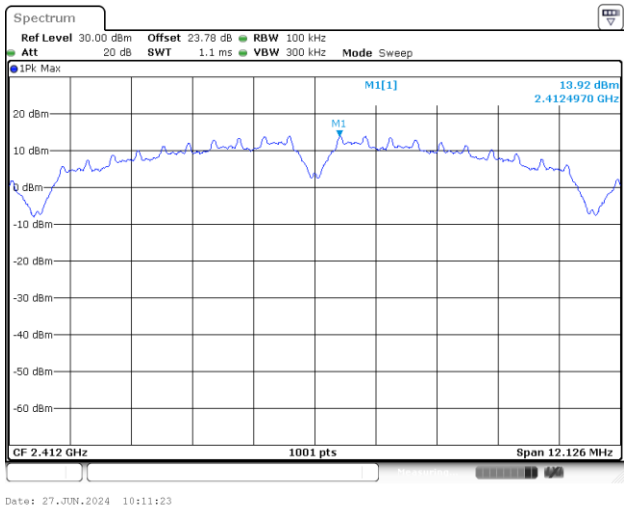
Maximum Power Density Plot (dBm/3kHz)	
MIMO Ant 1	MIMO Ant 2
	

Band Edges and Spurious Emission

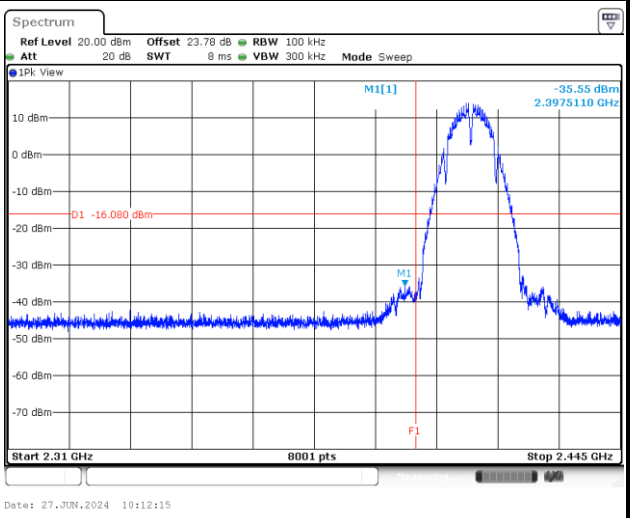
Number of TX = 2, Ant. 1 (Measured)

Test Mode :	802.11b	Test Channel :	01

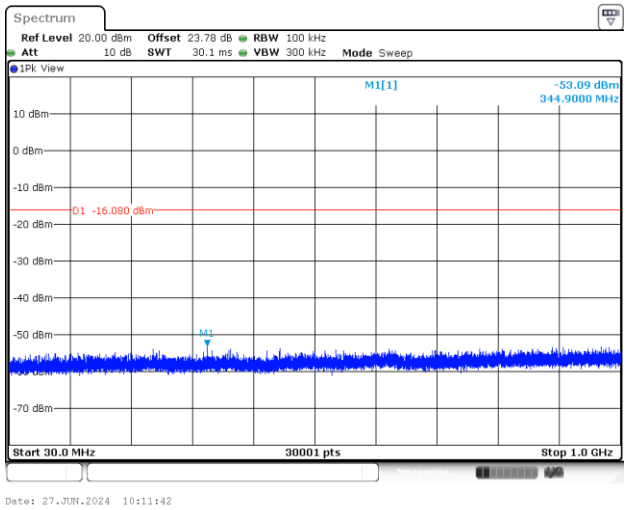
100kHz PSD reference Level



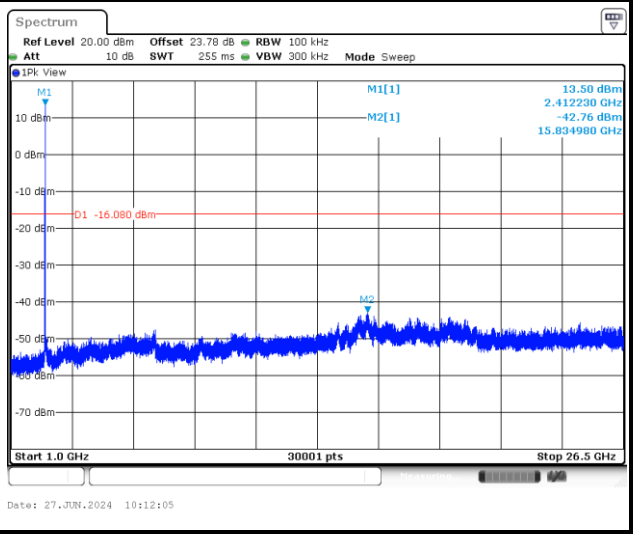
Low Channel Plot



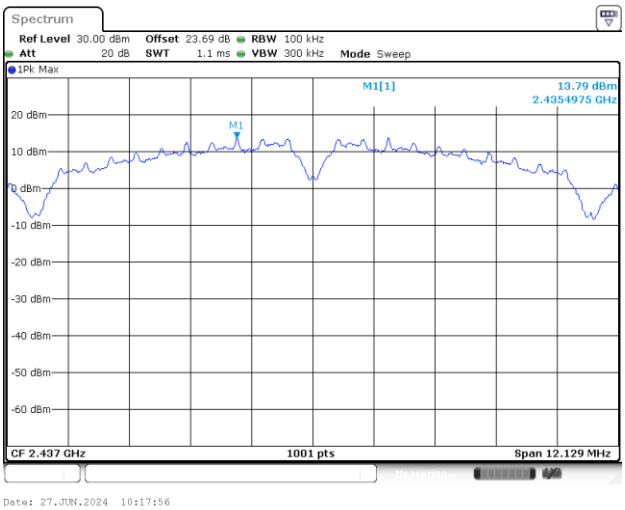
Spurious Emission 30MHz~1GHz

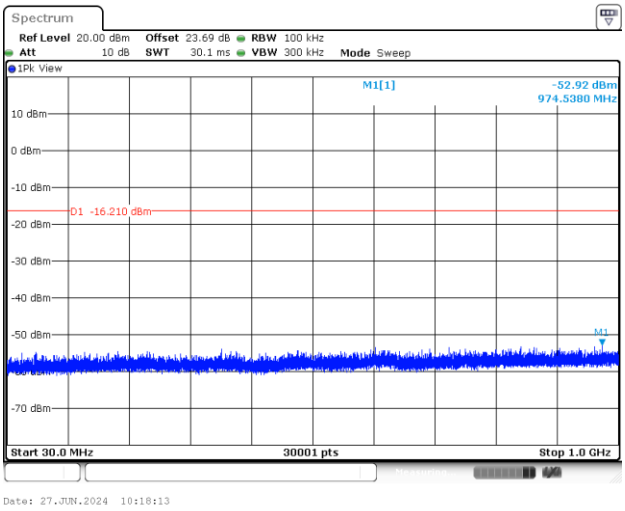
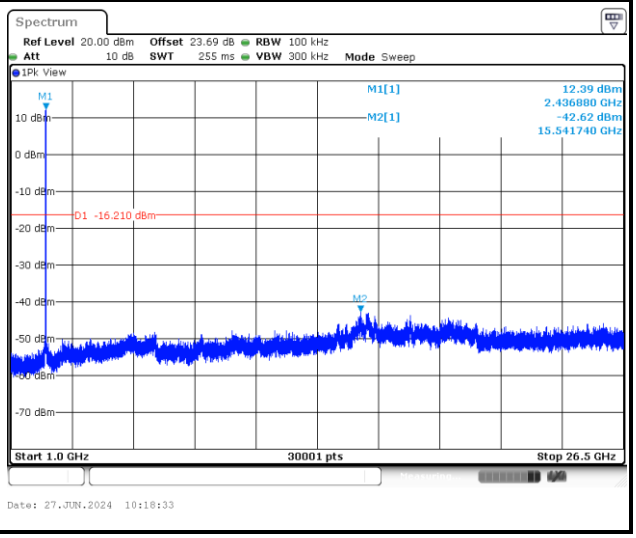


Spurious Emission 1GHz~26.5GHz

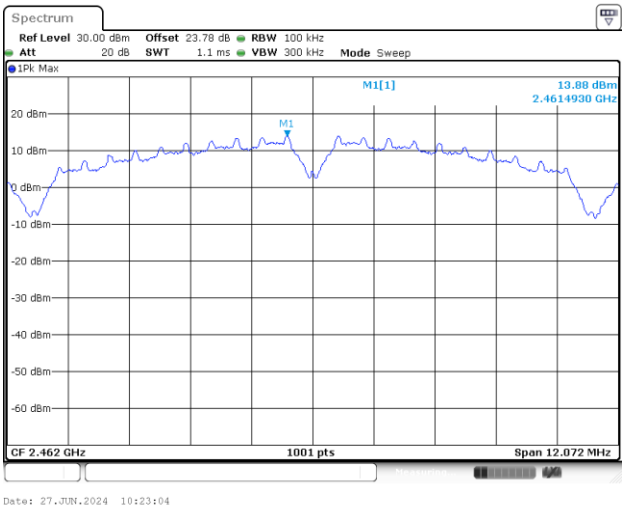
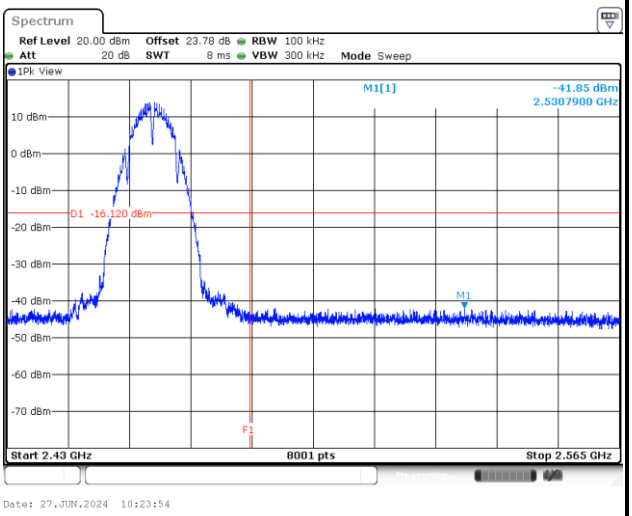
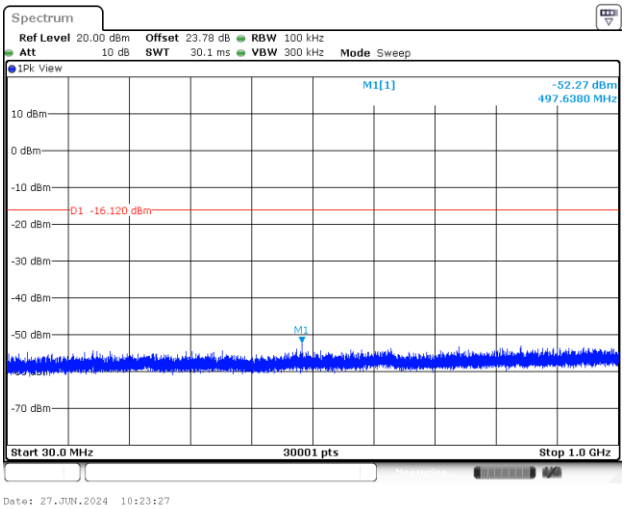
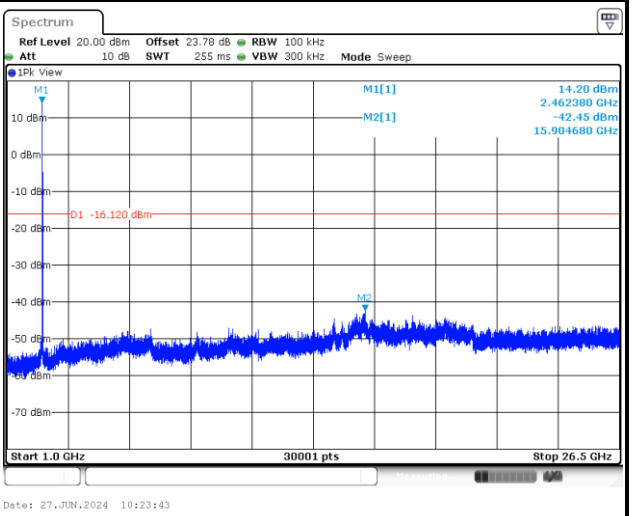


Test Mode :	802.11b	Test Channel :	06

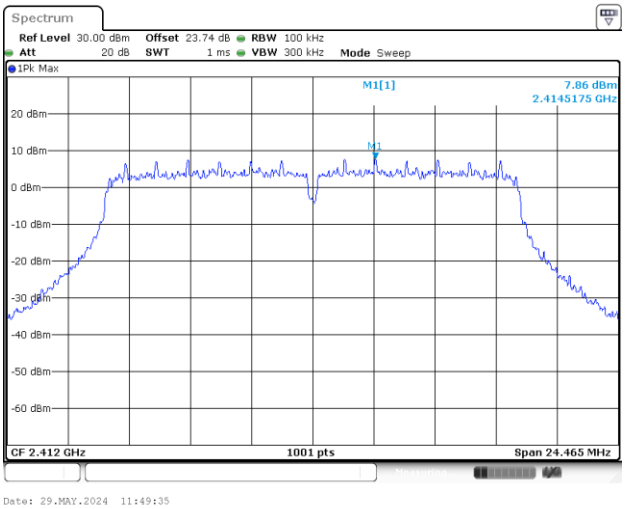
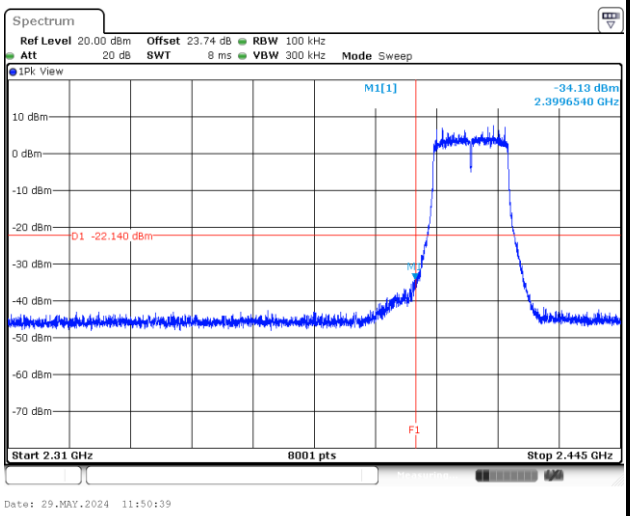
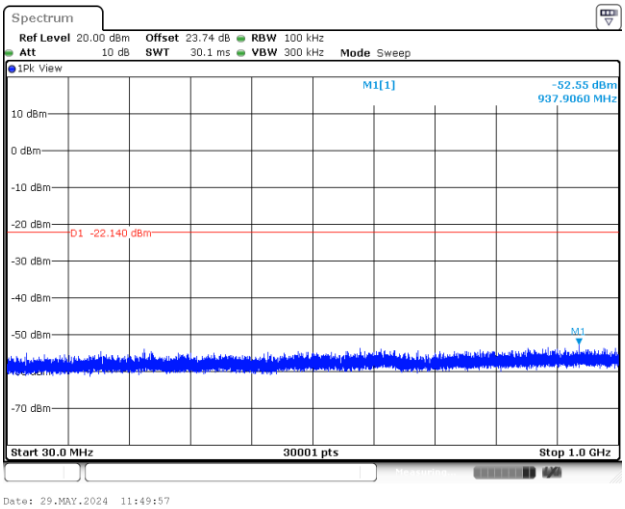
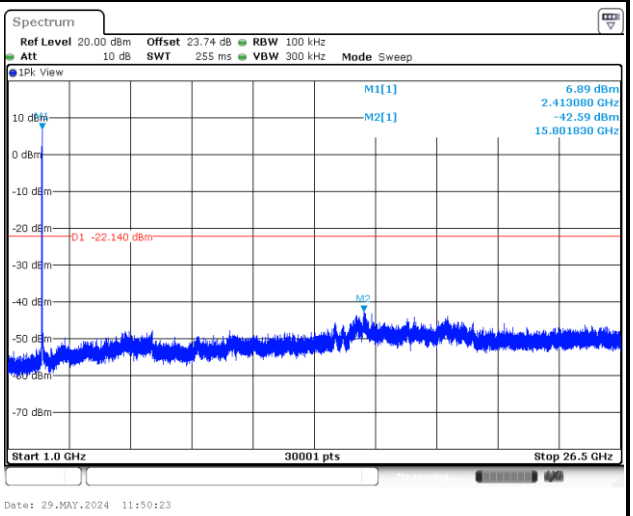
100kHz PSD reference Level	Middle Channel Plot
	

Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

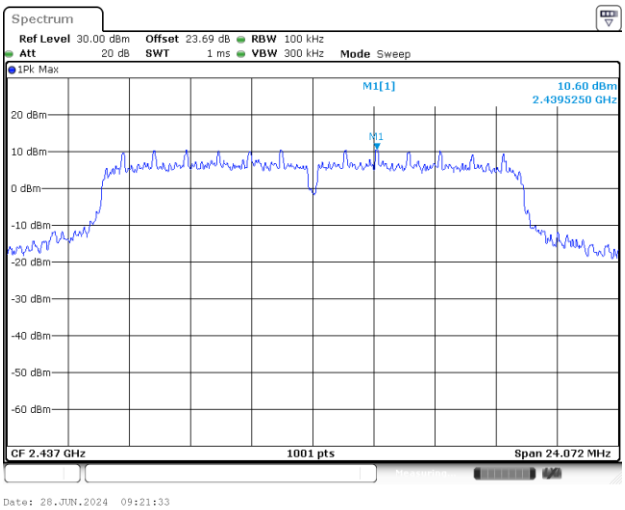
Test Mode :	802.11b	Test Channel :	11

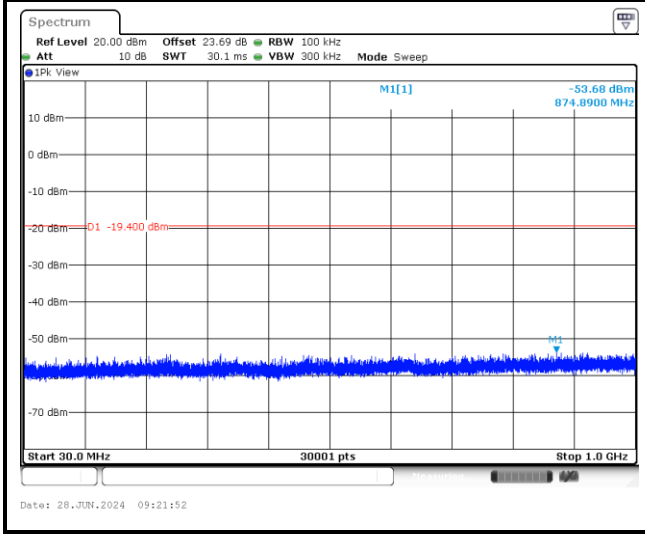
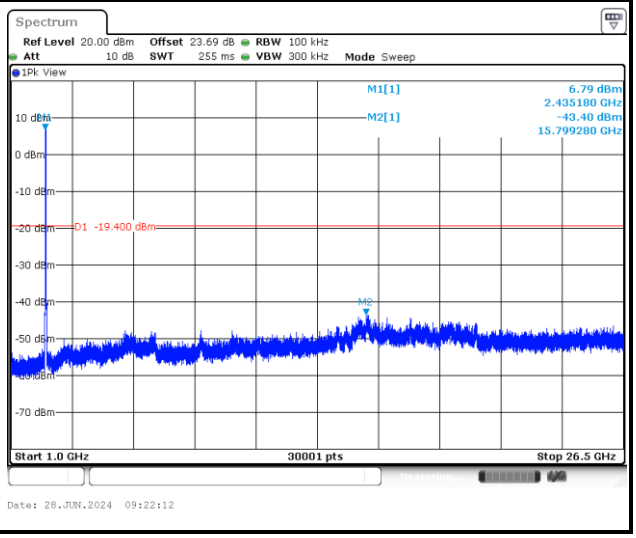
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11g	Test Channel :	01

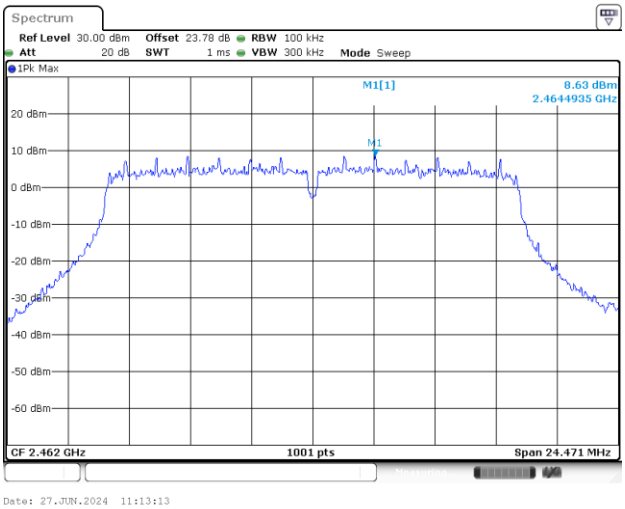
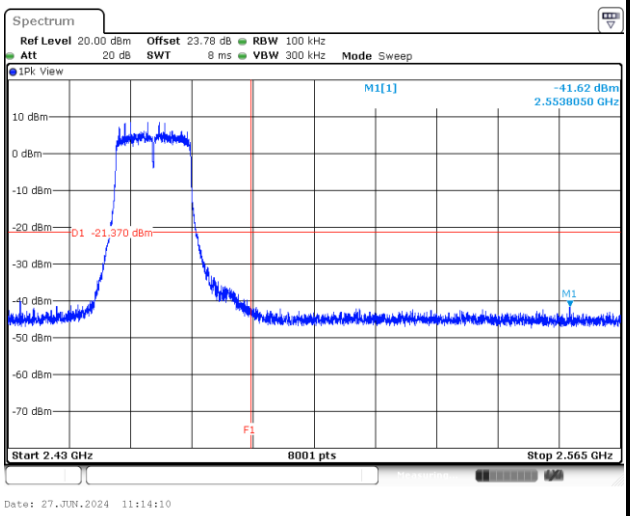
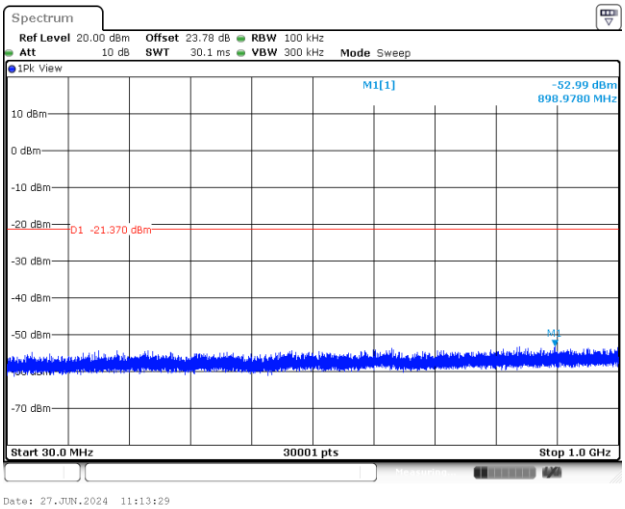
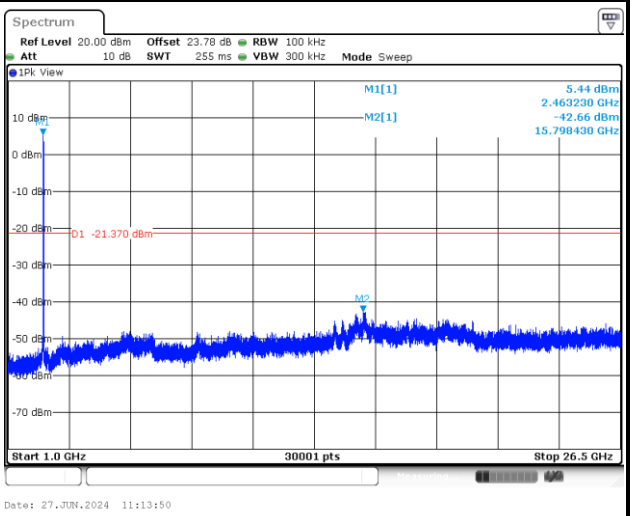
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11g	Test Channel :	06

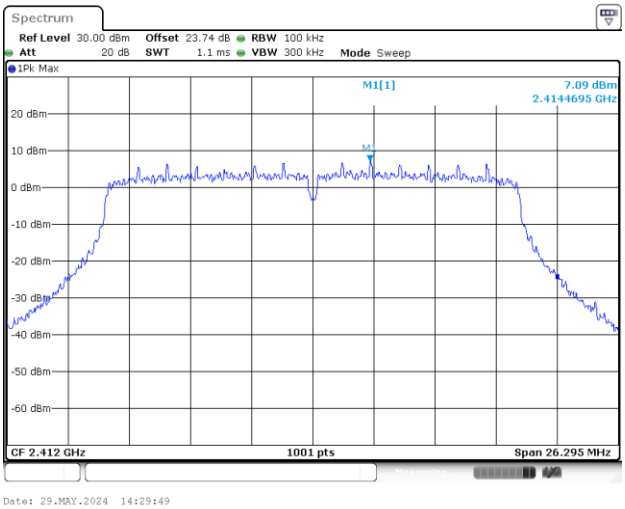
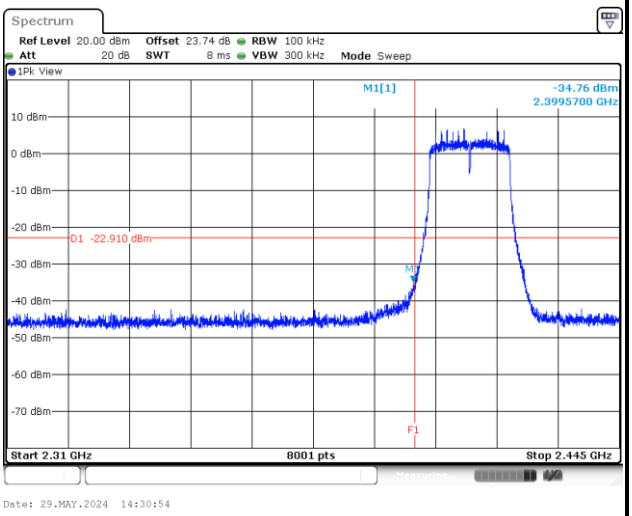
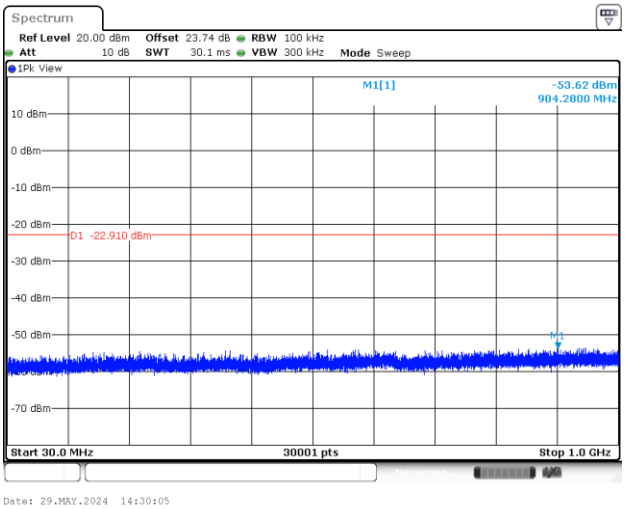
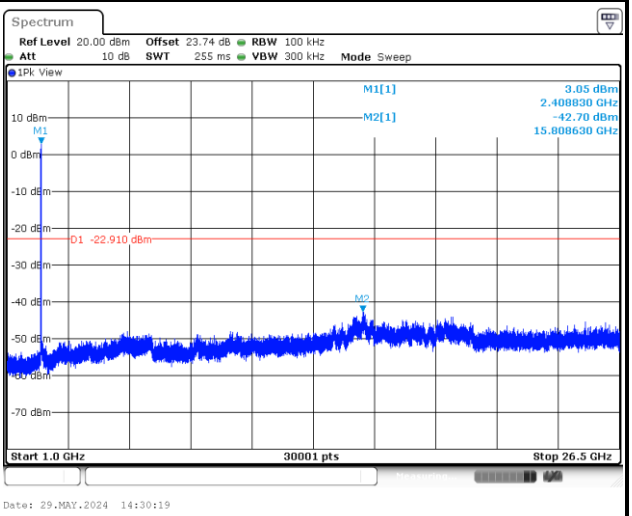
100kHz PSD reference Level	Middle Channel Plot
	

Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

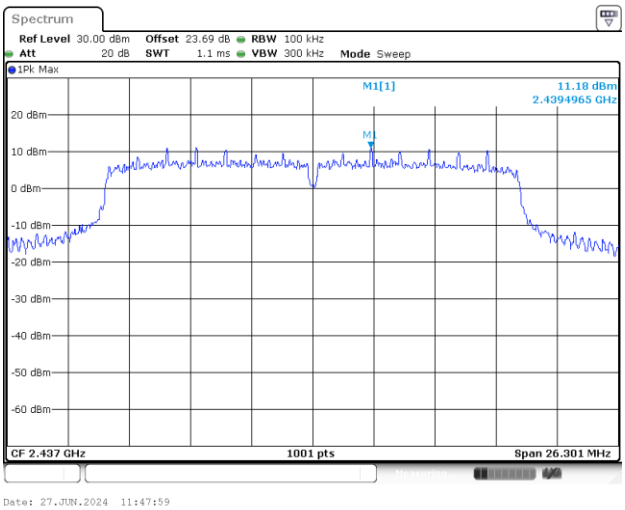
Test Mode :	802.11g	Test Channel :	11

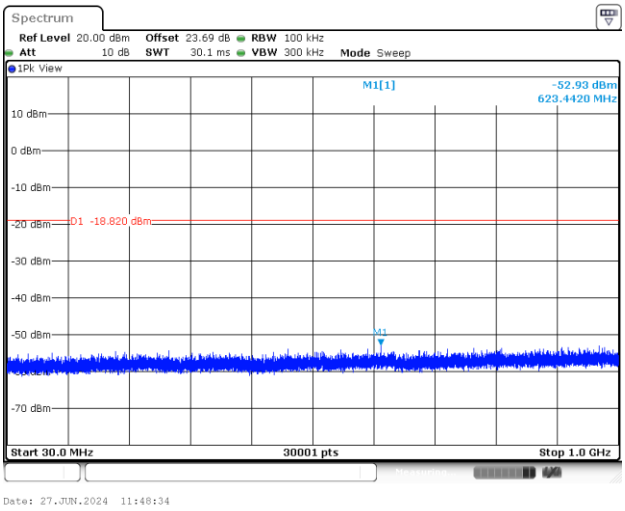
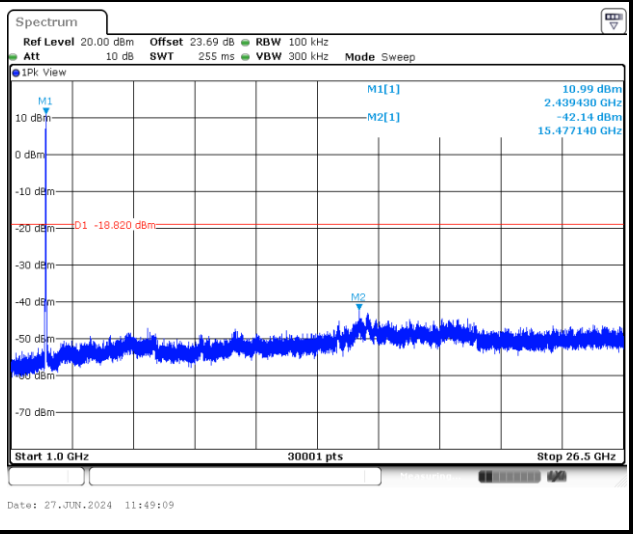
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ac VHT20	Test Channel :	01

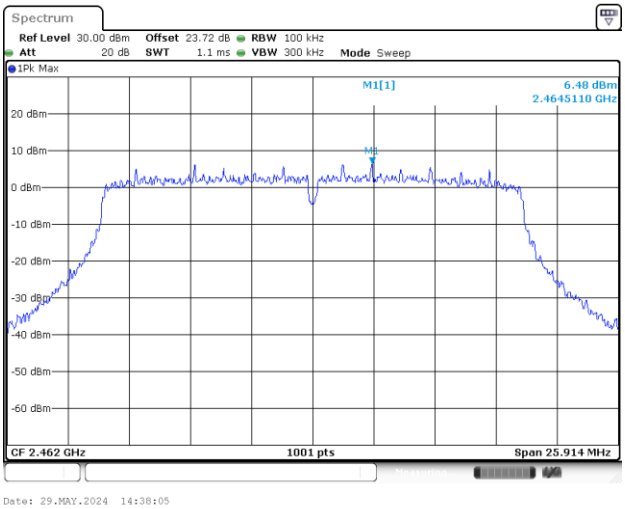
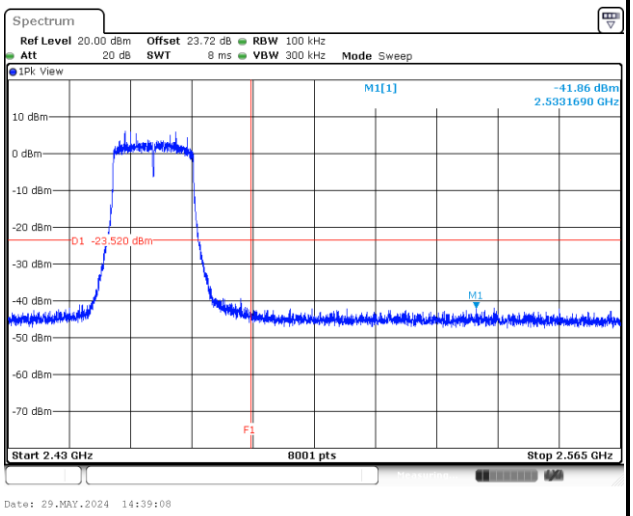
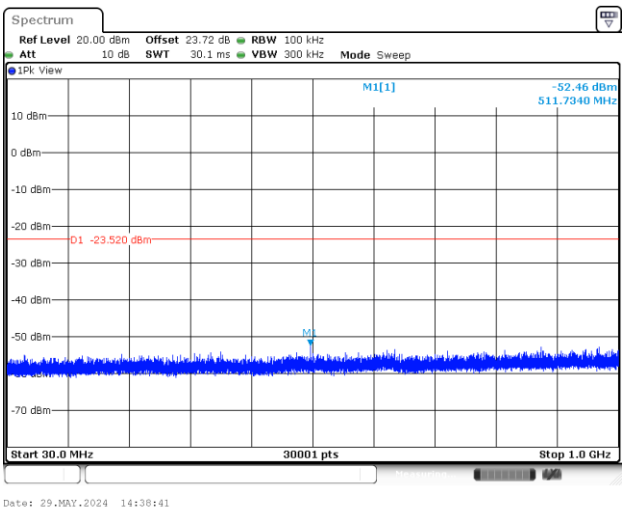
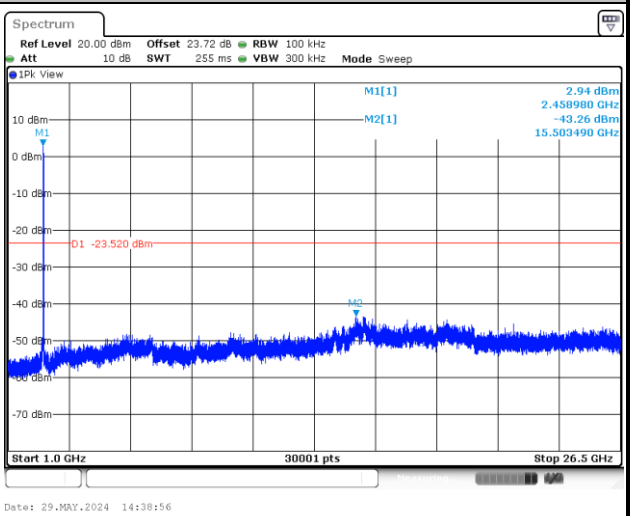
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ac VHT20	Test Channel :	06

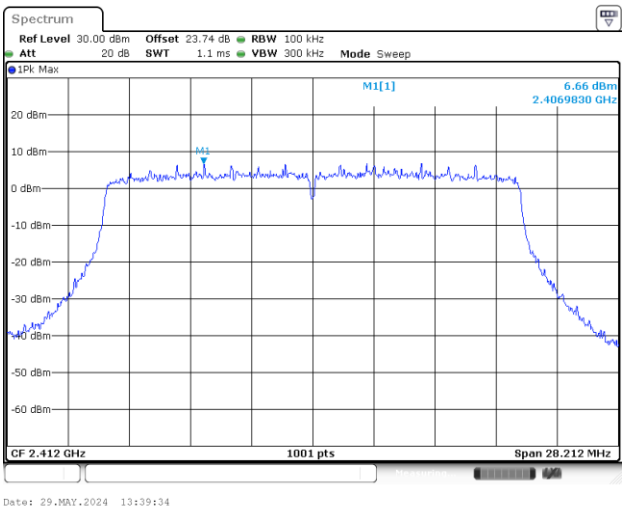
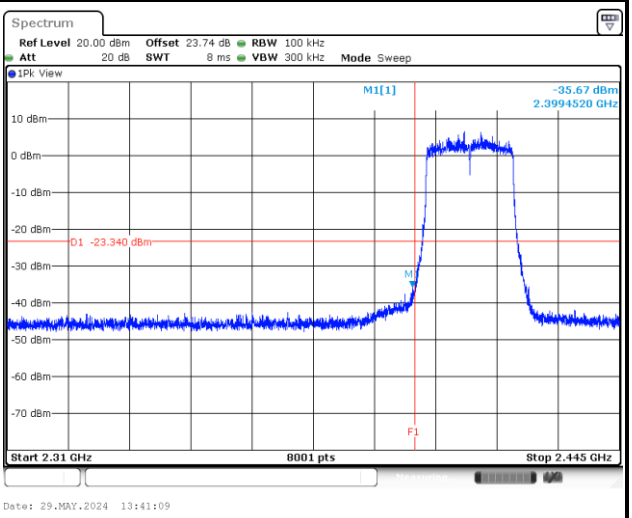
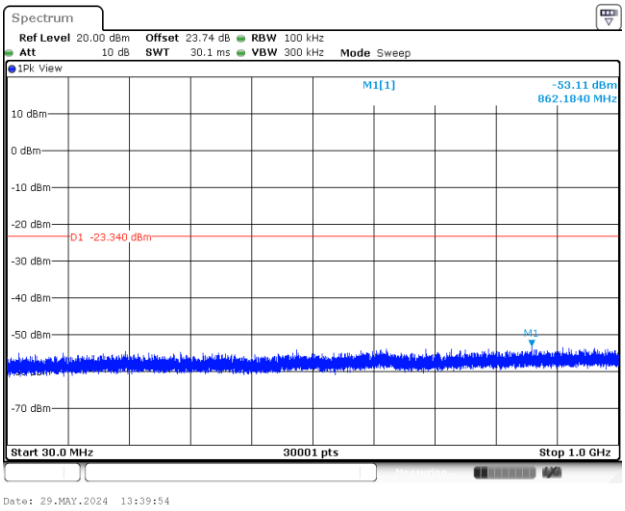
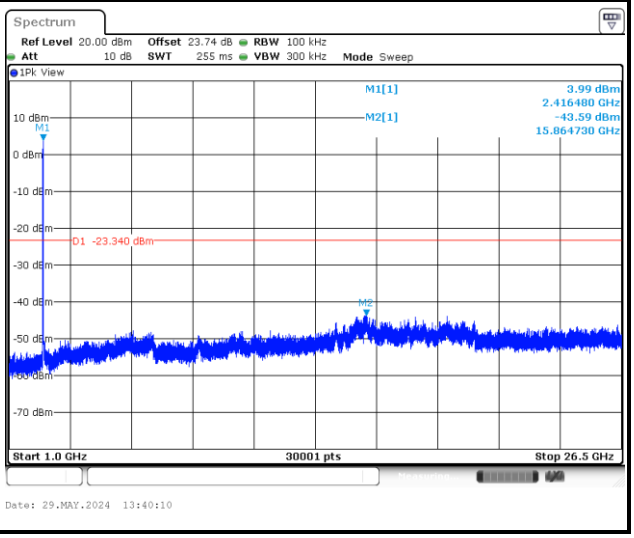
100kHz PSD reference Level	Middle Channel Plot
	

Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

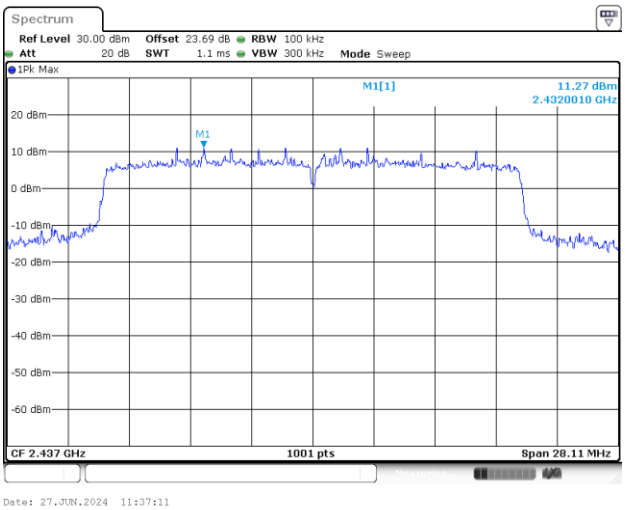
Test Mode :	802.11ac VHT20	Test Channel :	11

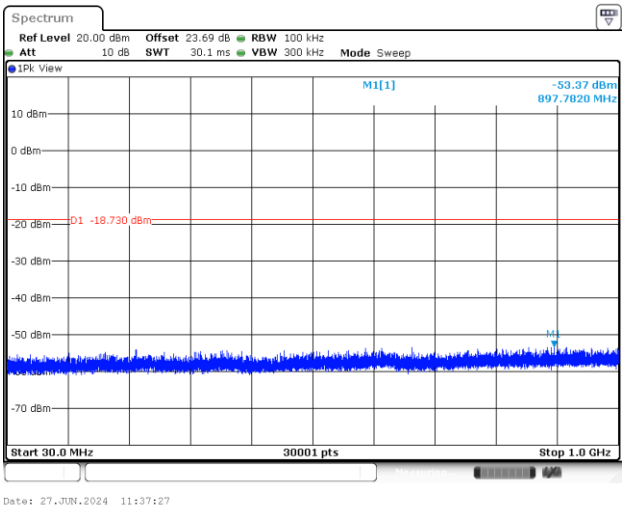
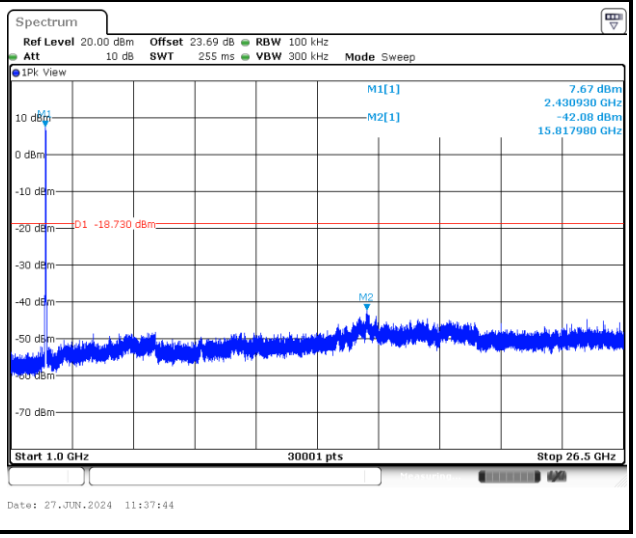
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ax HE20_Full RU	Test Channel :	01

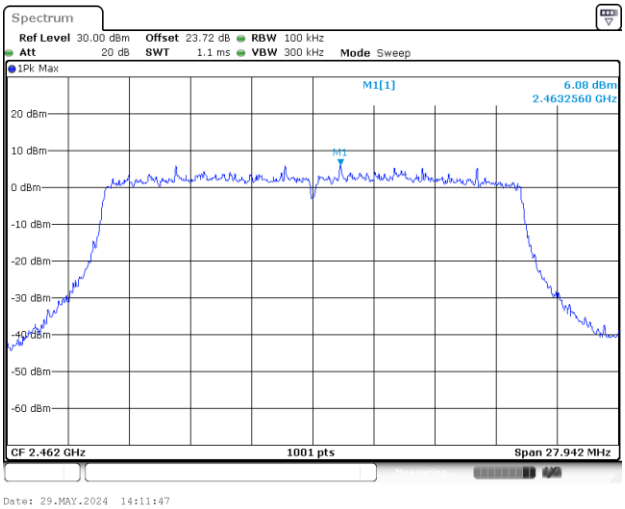
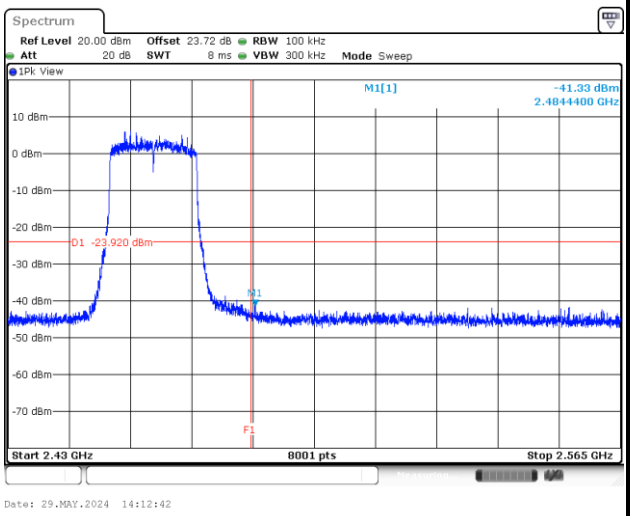
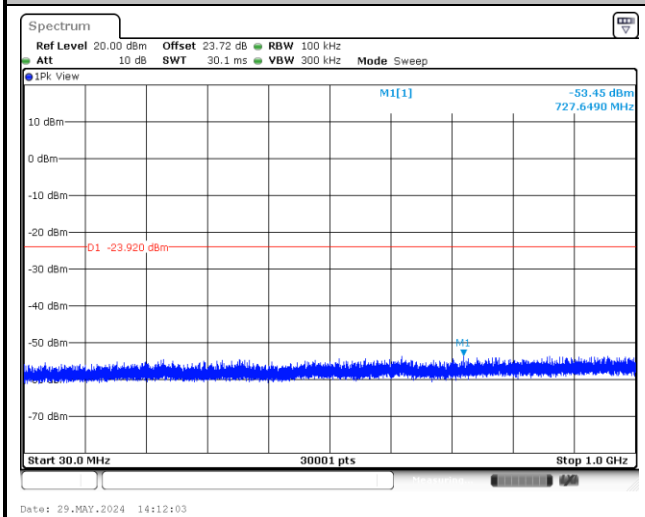
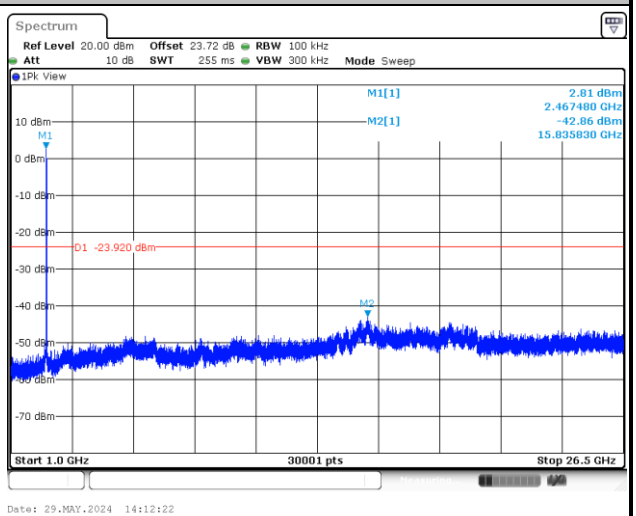
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ax HE20_Full RU	Test Channel :	06

100kHz PSD reference Level	Middle Channel Plot
	

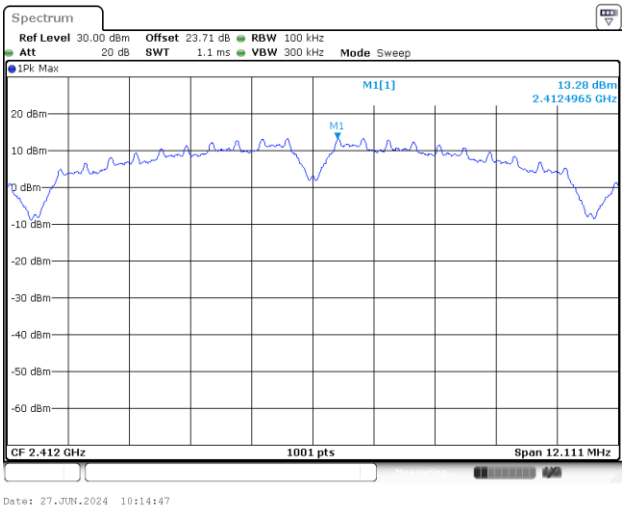
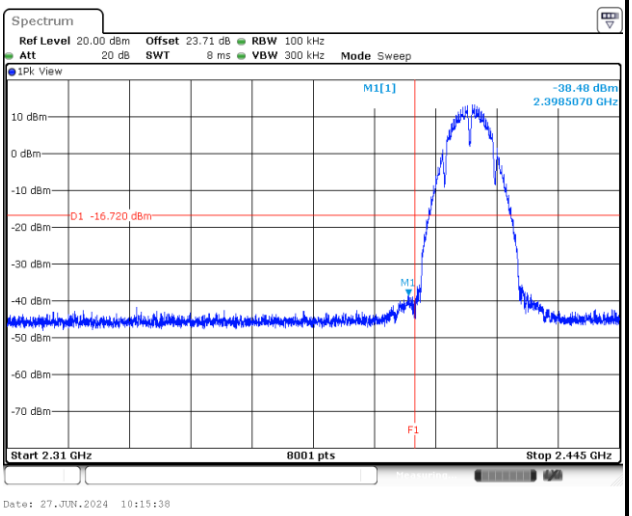
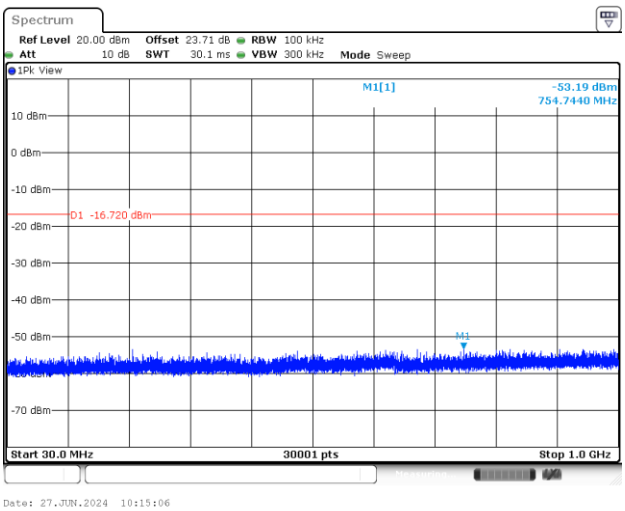
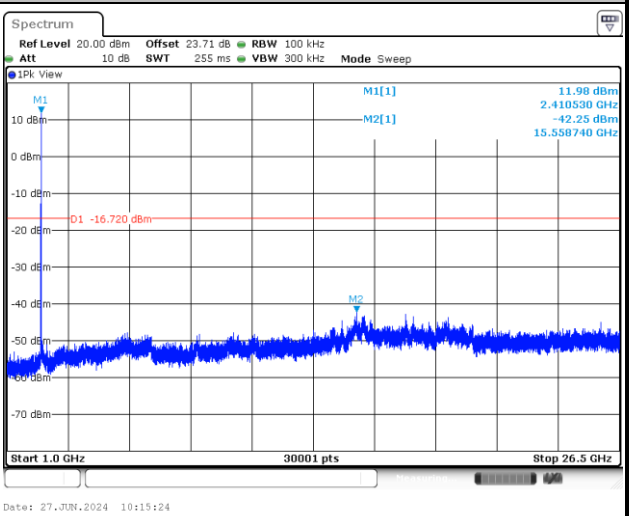
Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

Test Mode :	802.11ax HE20_Full RU	Test Channel :	11

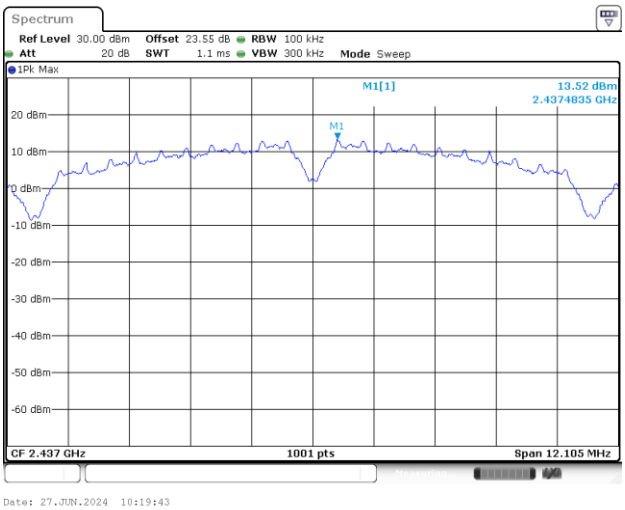
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

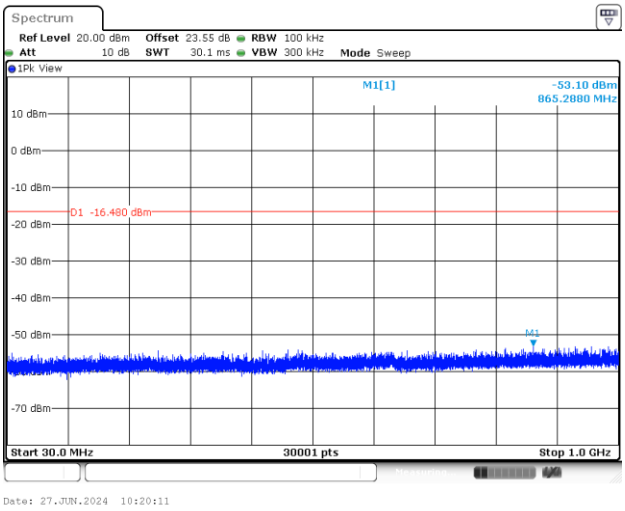
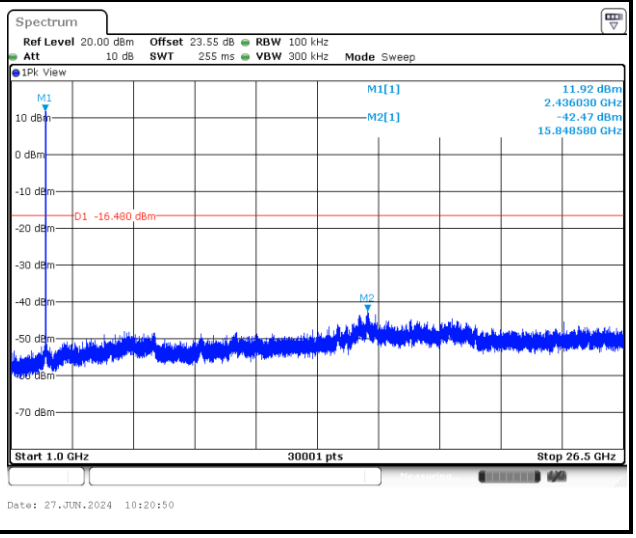
Number of TX = 2, Ant. 2 (Measured)

Test Mode :	802.11b	Test Channel :	01

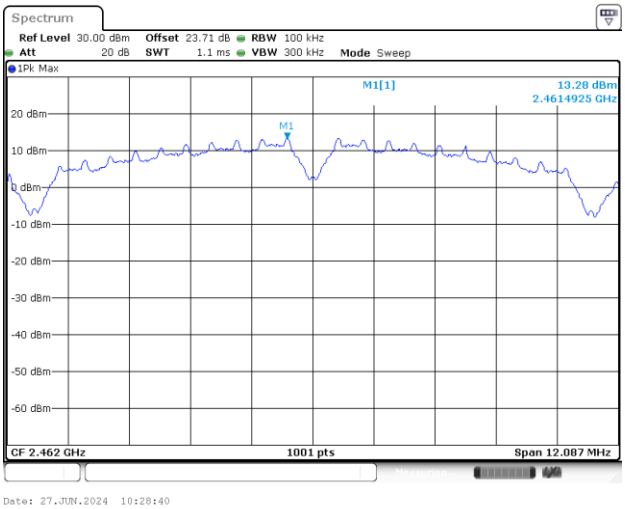
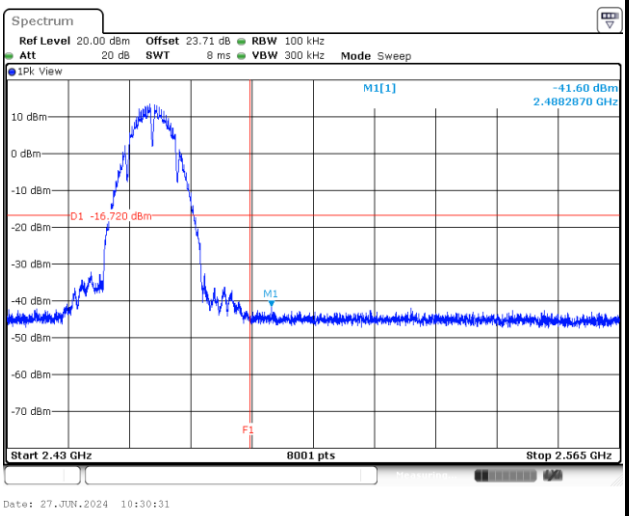
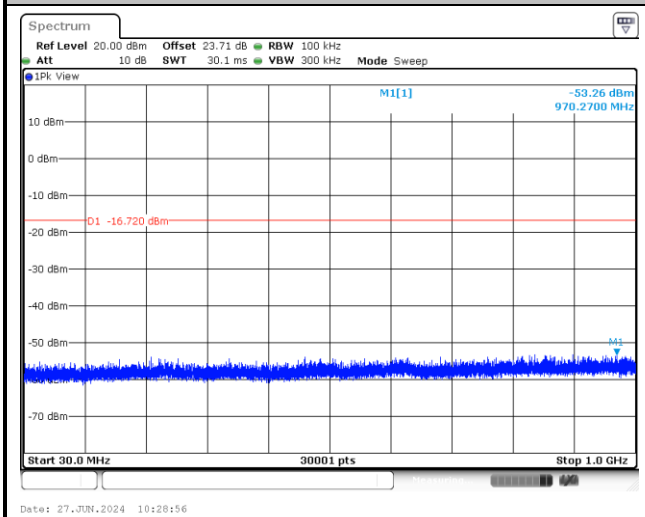
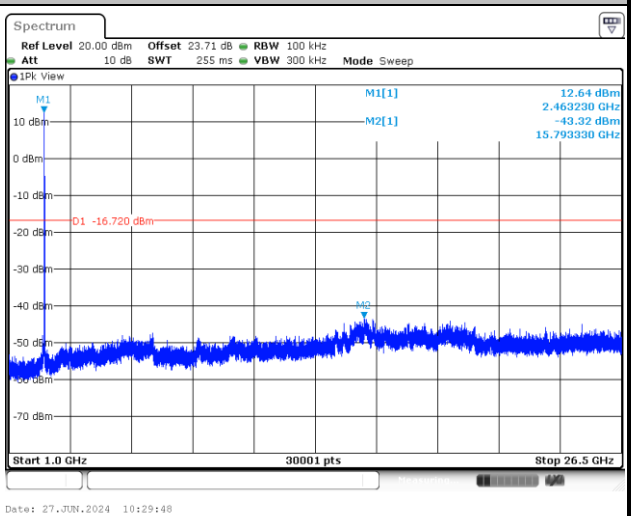
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11b	Test Channel :	06

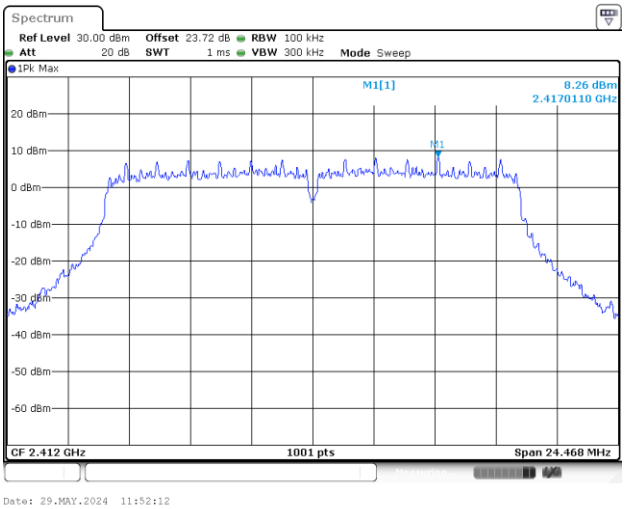
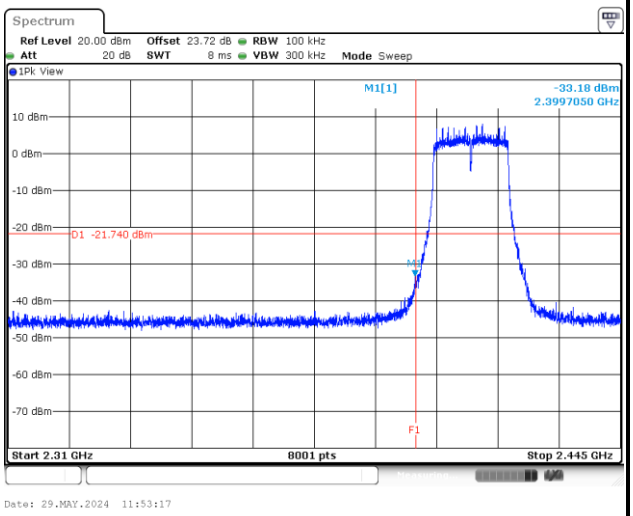
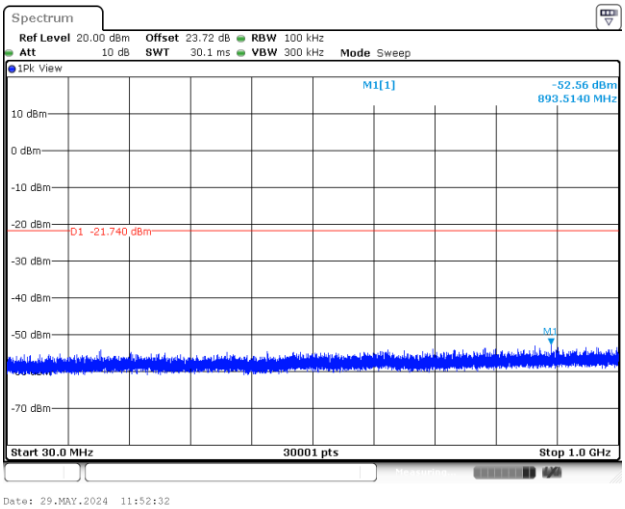
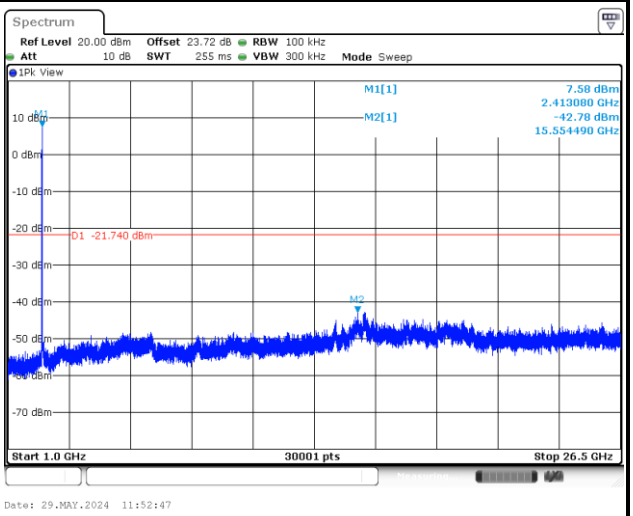
100kHz PSD reference Level	Middle Channel Plot
	

Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

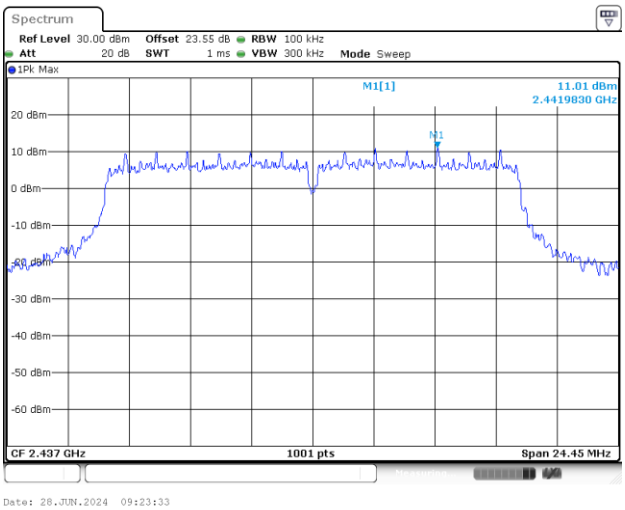
Test Mode :	802.11b	Test Channel :	11

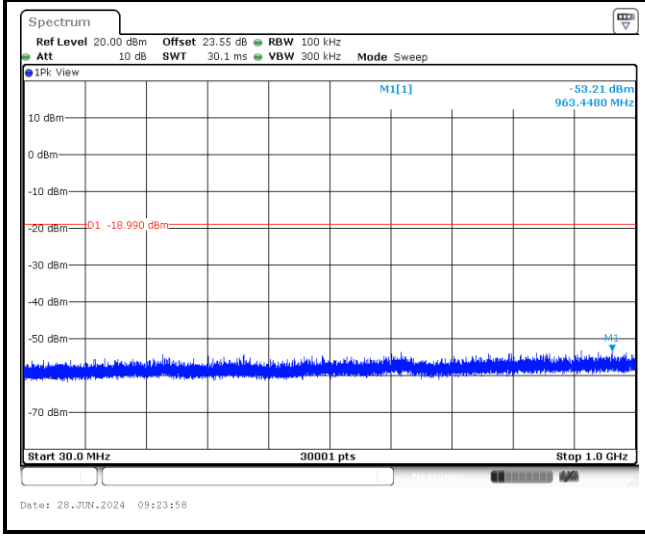
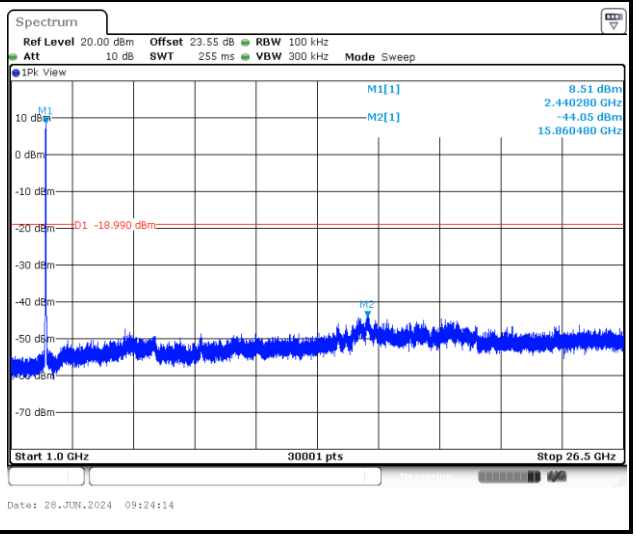
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11g	Test Channel :	01

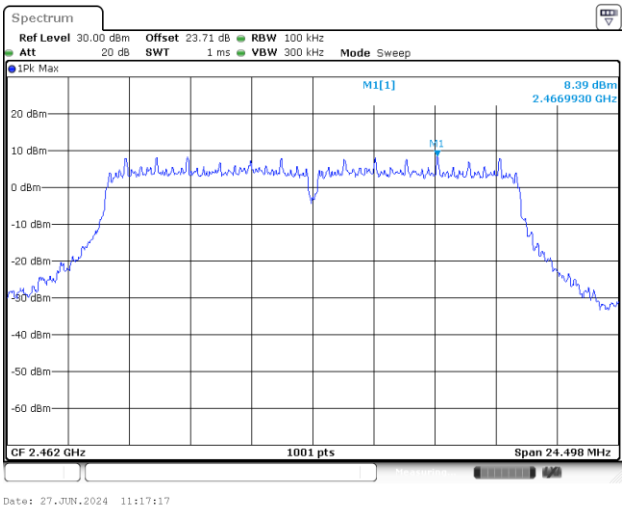
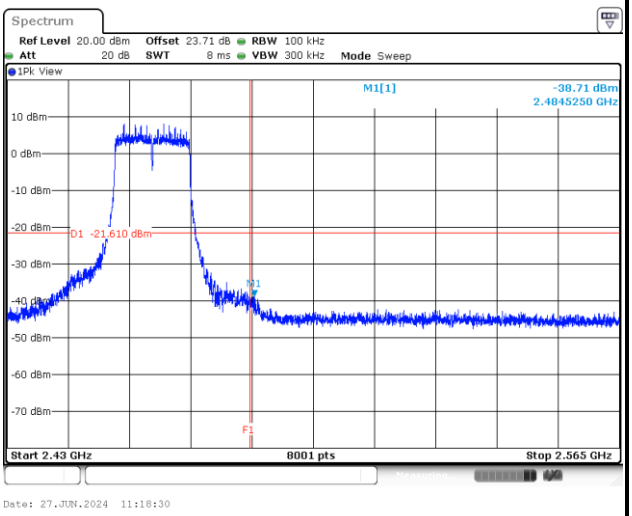
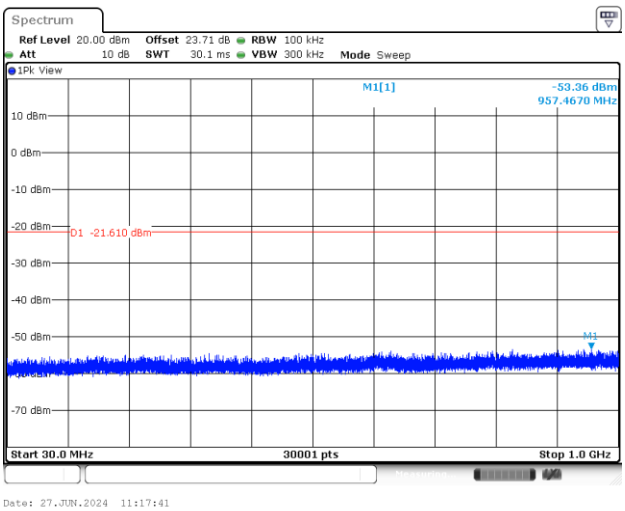
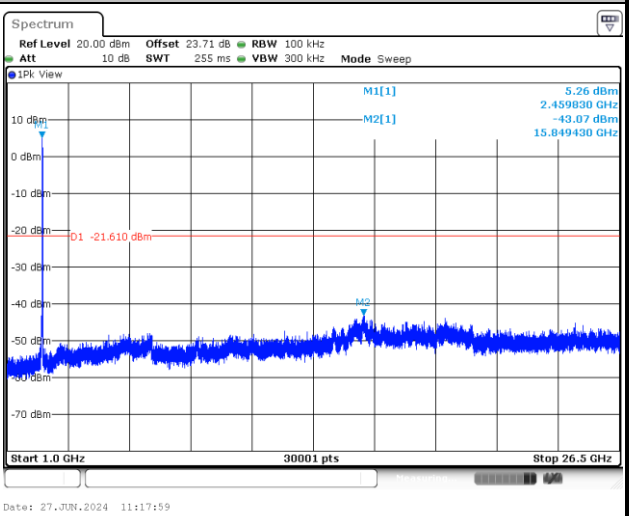
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11g	Test Channel :	06

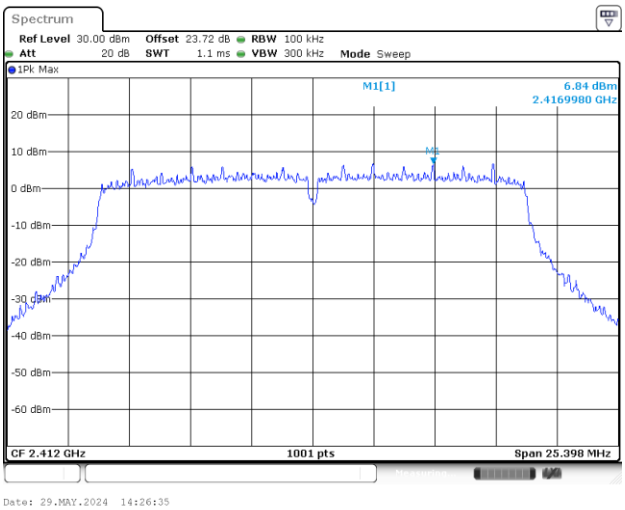
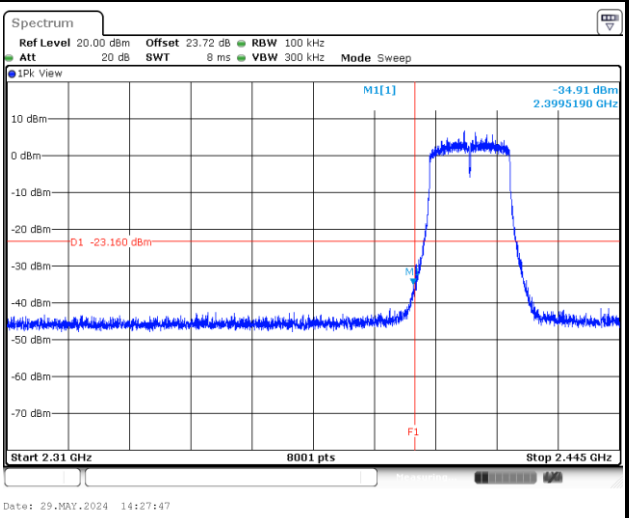
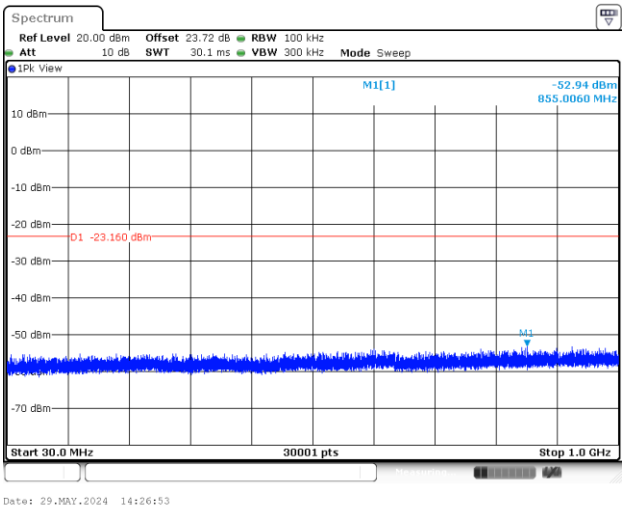
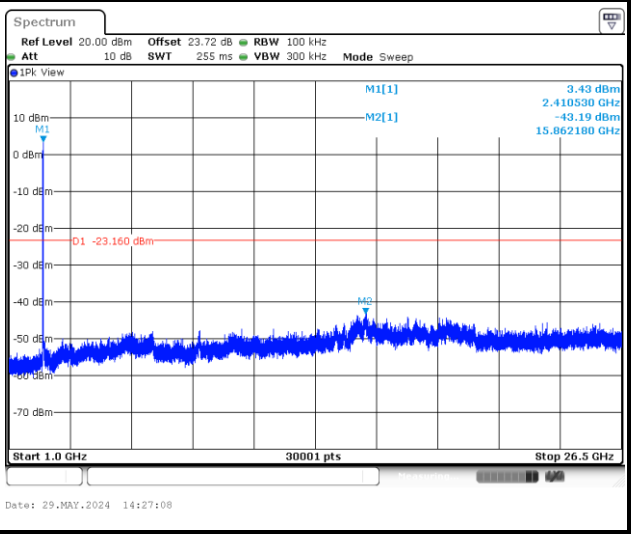
100kHz PSD reference Level	Middle Channel Plot
	

Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

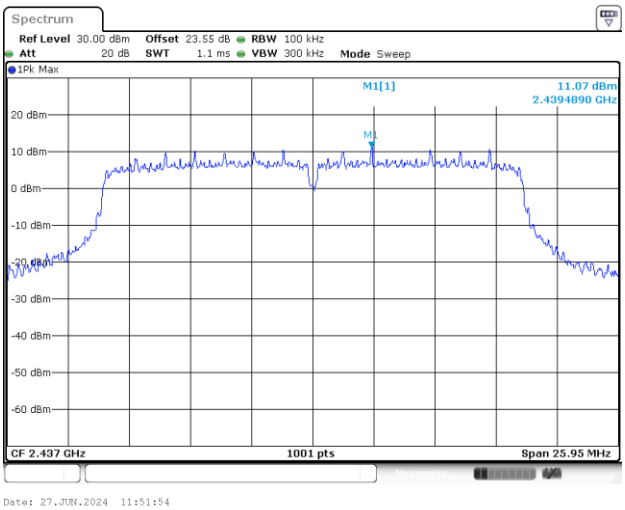
Test Mode :	802.11g	Test Channel :	11

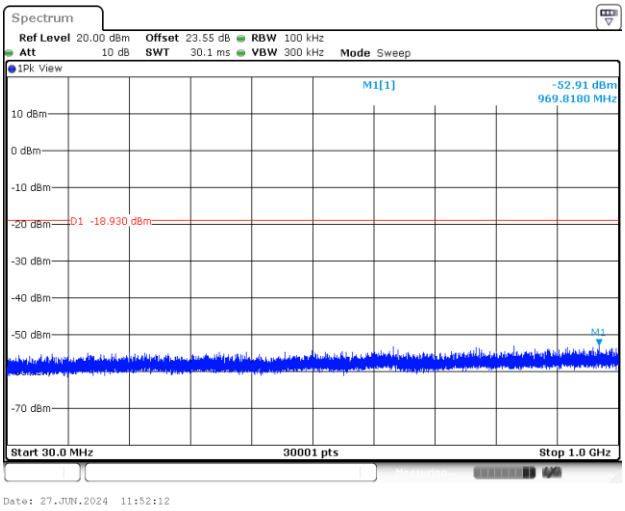
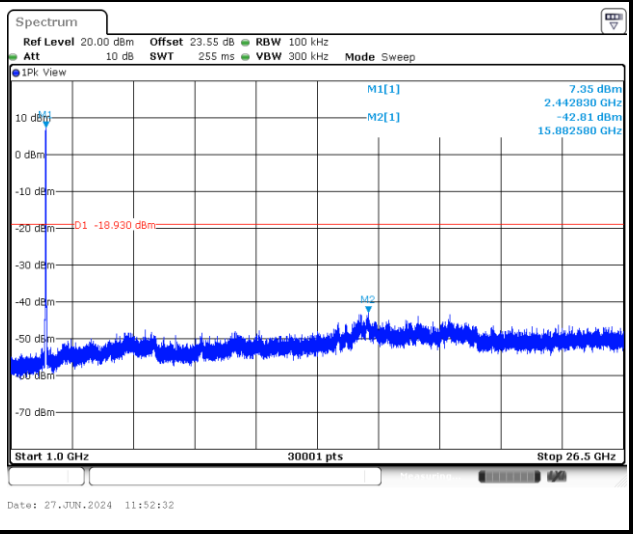
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ac VHT20	Test Channel :	01

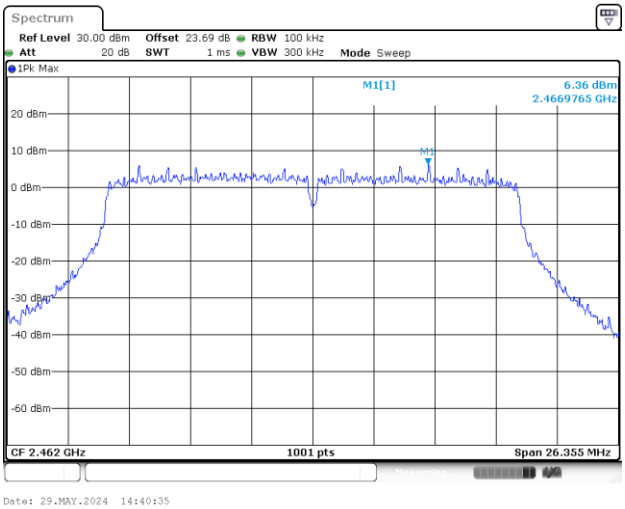
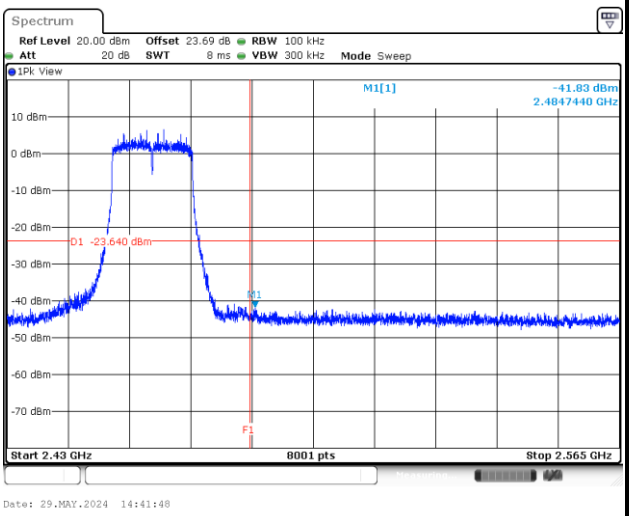
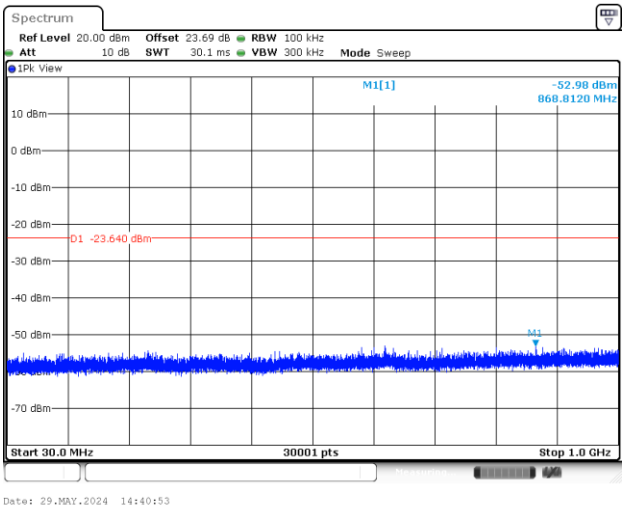
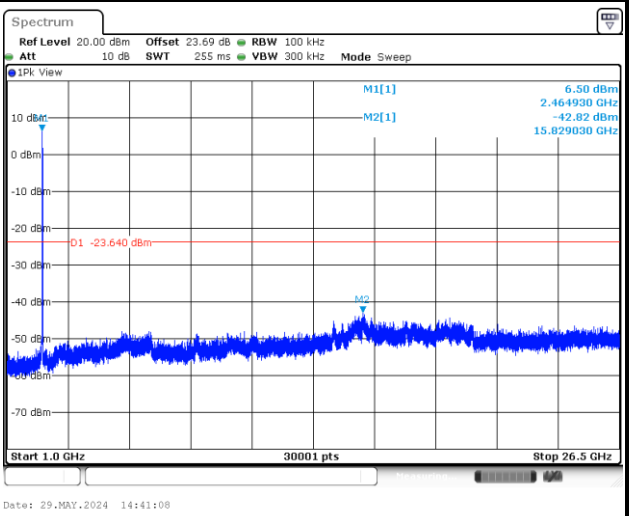
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ac VHT20	Test Channel :	06

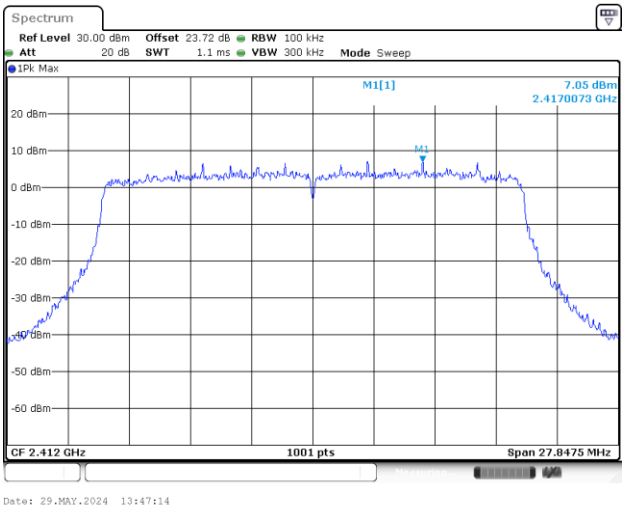
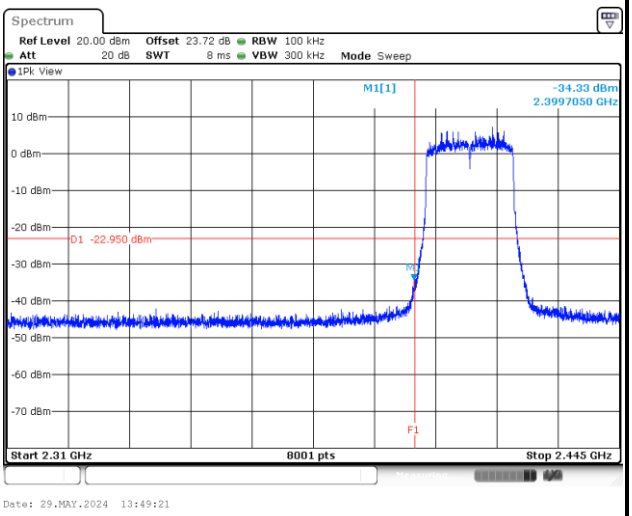
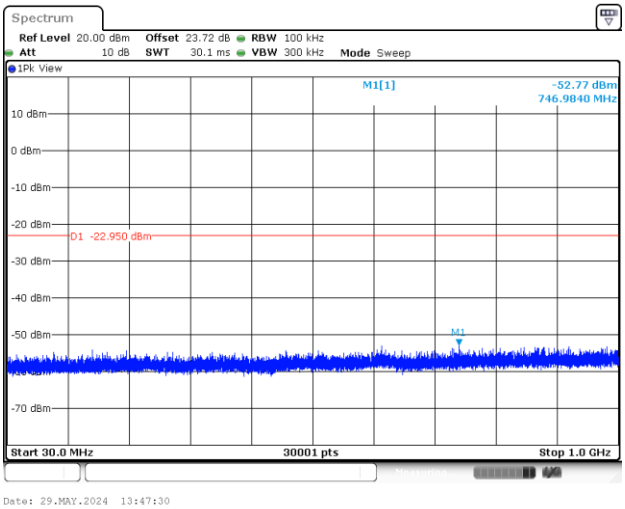
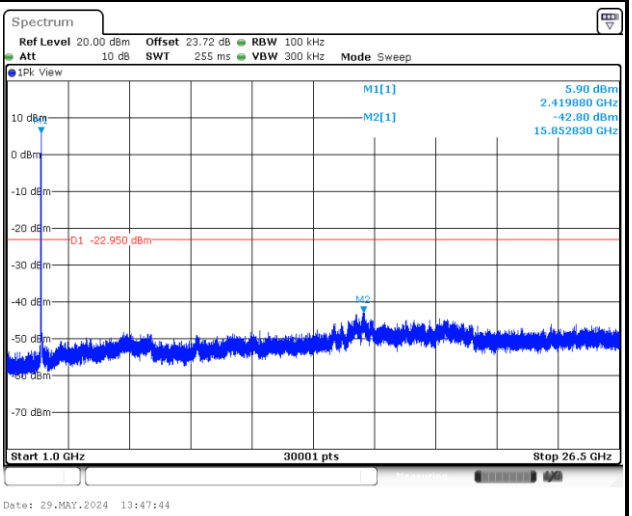
100kHz PSD reference Level	Middle Channel Plot
	

Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

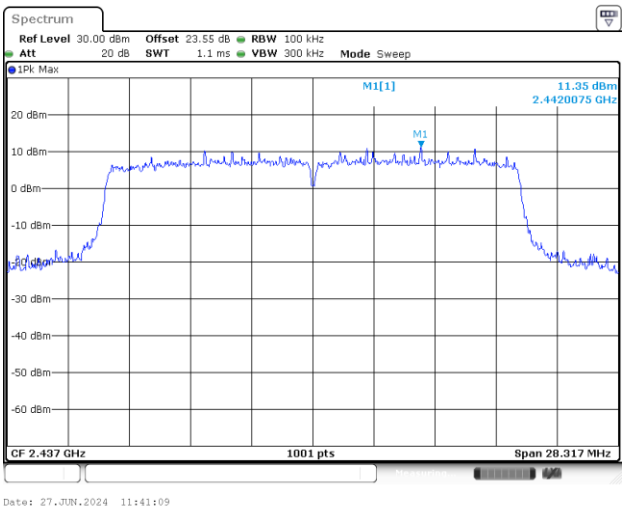
Test Mode :	802.11ac VHT20	Test Channel :	11

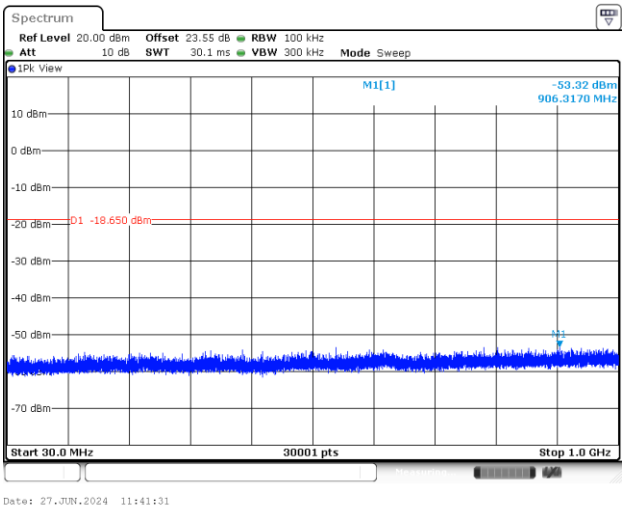
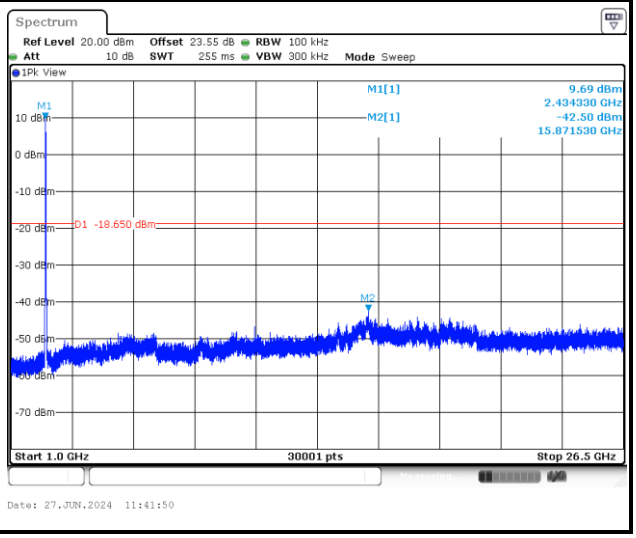
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ax HE20_Full RU	Test Channel :	01

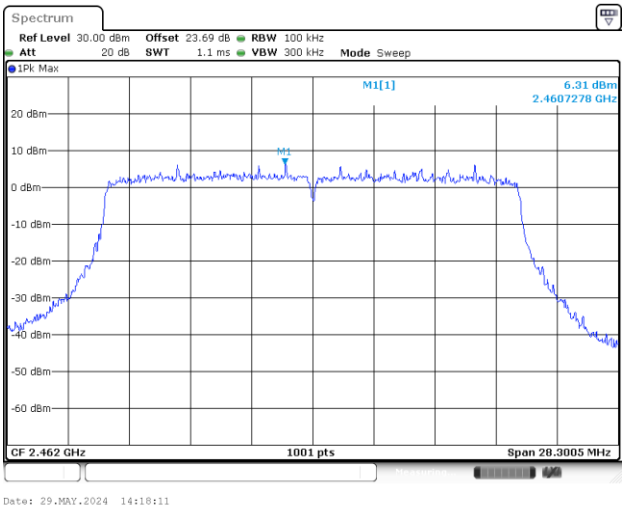
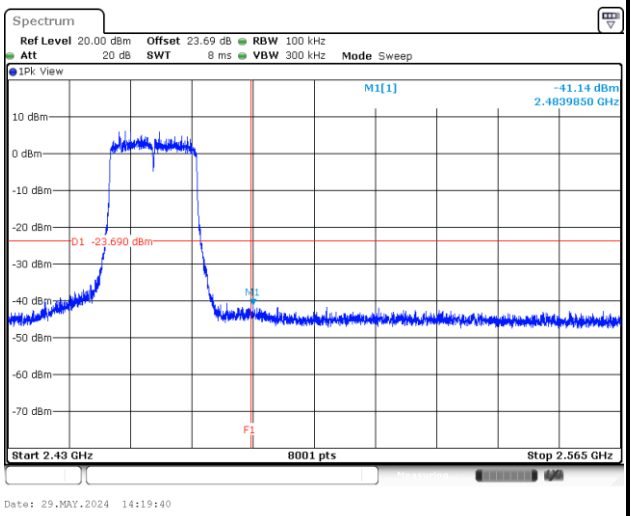
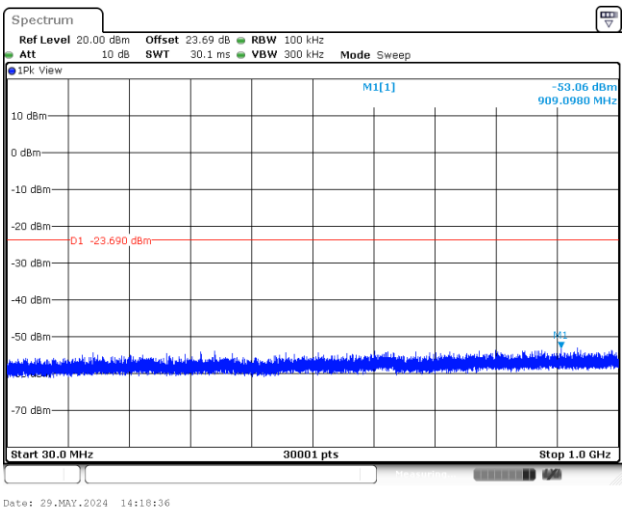
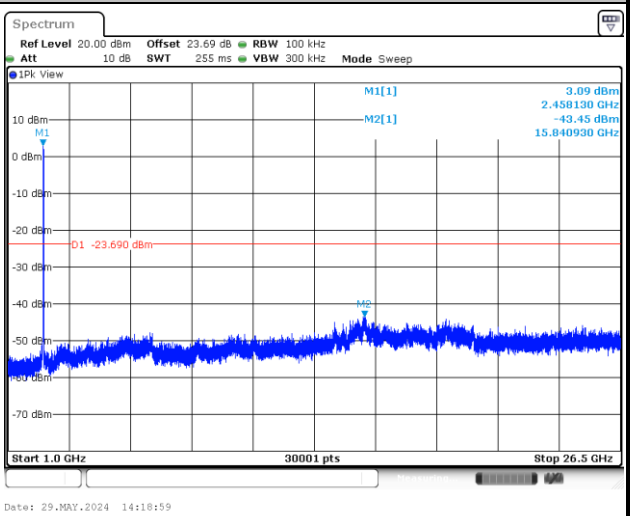
100kHz PSD reference Level	Low Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Test Mode :	802.11ax HE20_Full RU	Test Channel :	06

100kHz PSD reference Level	Middle Channel Plot
	

Spurious Emission 30MHz~1GHz	Spurious Emission 1GHz~26.5GHz
	

Test Mode :	802.11ax HE20_Full RU	Test Channel :	11

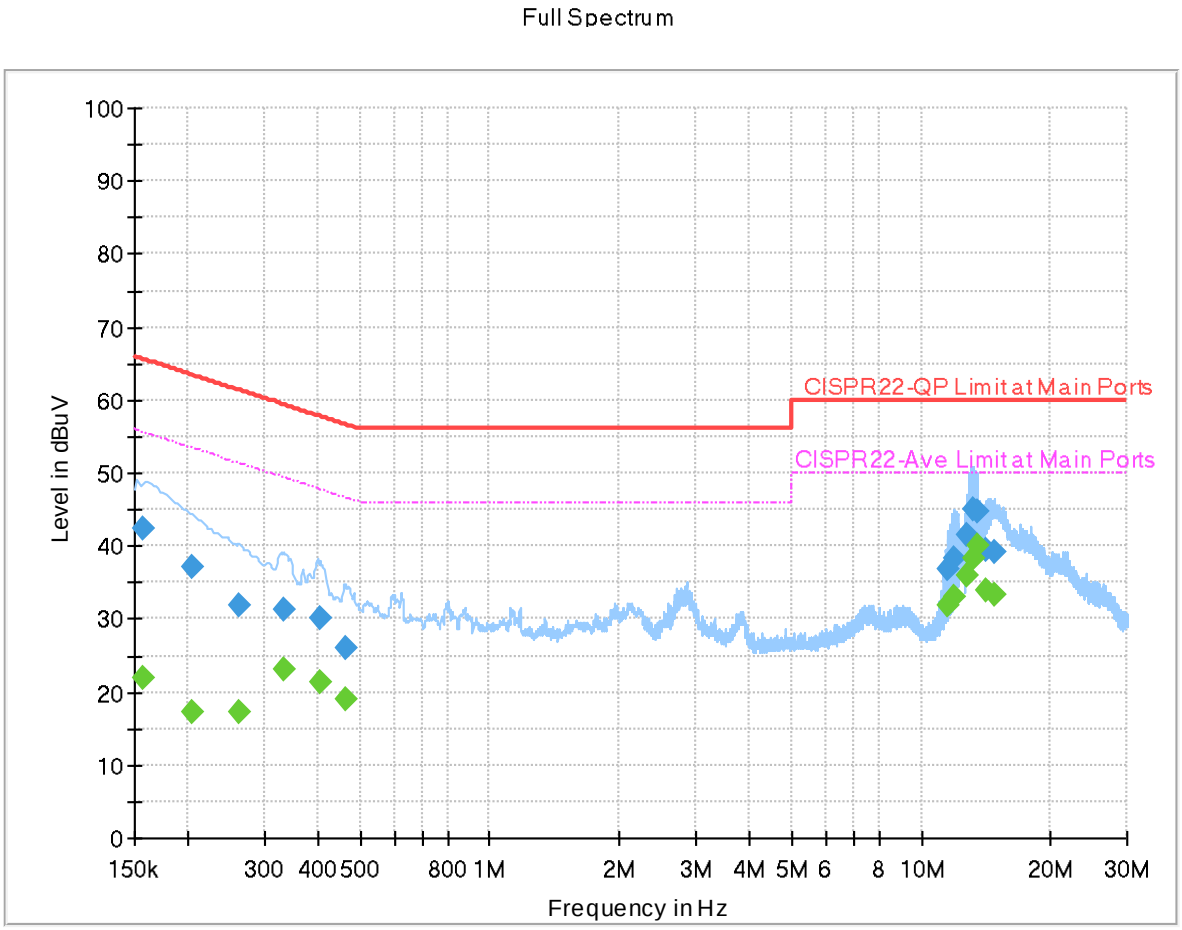
100kHz PSD reference Level	High Channel Plot
	
Spurious Emission 30MHz~1GHz	**Spurious Emission 1GHz~26.5GHz**
	

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Louis Chung	**Temperature :**	22.3~24.7℃
		Relative Humidity :	40.4~48.9%

EUT Information

Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line



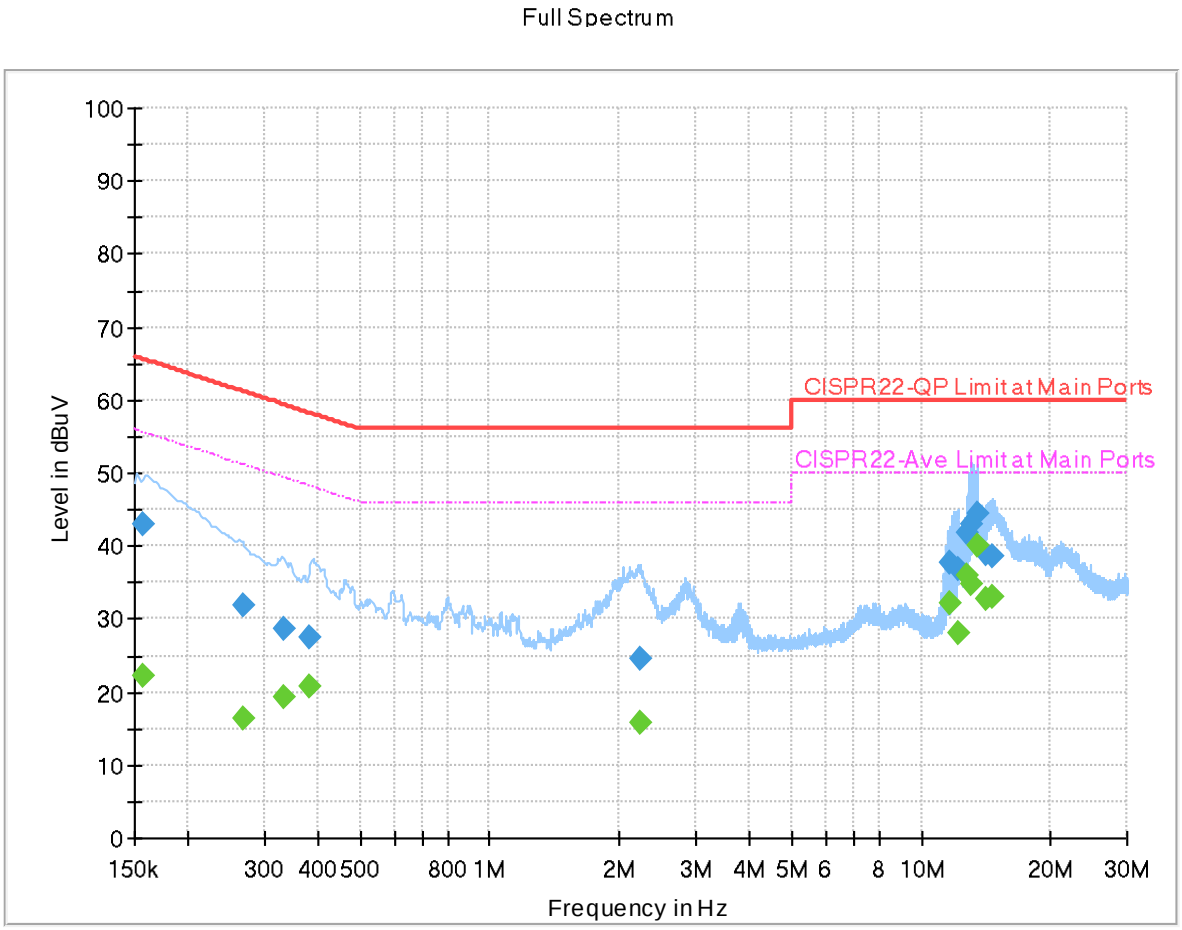
Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	---	21.94	55.63	33.69	L1	OFF	19.9
0.156750	42.26	---	65.63	23.37	L1	OFF	19.9
0.204000	---	17.35	53.45	36.10	L1	OFF	19.9
0.204000	36.99	---	63.45	26.46	L1	OFF	19.9
0.261240	---	17.30	51.39	34.09	L1	OFF	19.9
0.261240	31.87	---	61.39	29.52	L1	OFF	19.9
0.332160	---	23.23	49.40	26.17	L1	OFF	19.9
0.332160	31.28	---	59.40	28.12	L1	OFF	19.9
0.403530	---	21.35	47.78	26.43	L1	OFF	19.9
0.403530	30.07	---	57.78	27.71	L1	OFF	19.9
0.465000	---	18.98	46.60	27.62	L1	OFF	19.9
0.465000	26.05	---	56.60	30.55	L1	OFF	19.9
11.559750	---	31.89	50.00	18.11	L1	OFF	20.1
11.559750	36.81	---	60.00	23.19	L1	OFF	20.1
11.930010	---	33.02	50.00	16.98	L1	OFF	20.1
11.930010	38.27	---	60.00	21.73	L1	OFF	20.1
12.757380	---	36.00	50.00	14.00	L1	OFF	20.1
12.757380	41.65	---	60.00	18.35	L1	OFF	20.1
13.144290	---	38.20	50.00	11.80	L1	OFF	20.1

13.144290	45.06	---	60.00	14.94	L1	OFF	20.1
13.559910	---	40.20	50.00	9.80	L1	OFF	20.1
13.559910	44.76	---	60.00	15.24	L1	OFF	20.1
14.148600	---	33.99	50.00	16.01	L1	OFF	20.1
14.148600	39.44	---	60.00	20.56	L1	OFF	20.1
14.739000	---	33.34	50.00	16.66	L1	OFF	20.1
14.739000	39.24	---	60.00	20.76	L1	OFF	20.1

EUT Information

Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	---	22.12	55.63	33.51	N	OFF	19.9
0.156750	42.96	---	65.63	22.67	N	OFF	19.9
0.267900	---	16.39	51.18	34.79	N	OFF	19.9
0.267900	31.93	---	61.18	29.25	N	OFF	19.9
0.332430	---	19.40	49.39	29.99	N	OFF	19.9
0.332430	28.56	---	59.39	30.83	N	OFF	19.9
0.384000	---	20.78	48.19	27.41	N	OFF	19.9
0.384000	27.60	---	58.19	30.59	N	OFF	19.9
2.229000	---	15.66	46.00	30.34	N	OFF	20.0
2.229000	24.62	---	56.00	31.38	N	OFF	20.0
11.656860	---	32.26	50.00	17.74	N	OFF	20.1
11.656860	37.75	---	60.00	22.25	N	OFF	20.1
12.130080	---	28.14	50.00	21.86	N	OFF	20.1
12.130080	36.81	---	60.00	23.19	N	OFF	20.1
12.753780	---	35.94	50.00	14.06	N	OFF	20.1
12.753780	41.70	---	60.00	18.30	N	OFF	20.1
13.058250	---	34.74	50.00	15.26	N	OFF	20.1
13.058250	43.11	---	60.00	16.89	N	OFF	20.1
13.560360	---	40.08	50.00	9.92	N	OFF	20.1

13.560360	**44.50**	**---**	**60.00**	**15.50**	**N**	**OFF**	**20.1**
14.150130	**---**	**32.87**	**50.00**	**17.13**	**N**	**OFF**	**20.1**
14.150130	**38.88**	**---**	**60.00**	**21.12**	**N**	**OFF**	**20.1**
14.632440	**---**	**32.93**	**50.00**	**17.07**	**N**	**OFF**	**20.1**
14.632440	**38.63**	**---**	**60.00**	**21.37**	**N**	**OFF**	**20.1**

Appendix C. Radiated Spurious Emission

Test Engineer :	John Chuang, David Dai, and Sam Chou	Temperature :	19.7~23.5°C
		Relative Humidity :	64.9~70.8%

MOMO<Ant. 1+2>

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2389.905	55.69	-18.31	74	45.95	27.26	18.72	36.24	134	64	P	H
		2390	46.03	-7.97	54	36.29	27.26	18.72	36.24	134	64	A	H
	*	2412	119.37	-	-	109.51	27.35	18.76	36.25	134	64	P	H
	*	2412	115.41	-	-	105.55	27.35	18.76	36.25	134	64	A	H
		2486.448	56.23	-17.77	74	45.96	27.65	18.9	36.28	200	313	P	H
		2486.8	49.27	-4.73	54	39	27.65	18.9	36.28	200	313	A	H
		2389.59	53.99	-20.01	74	44.25	27.26	18.72	36.24	309	92	P	V
		2390	44.13	-9.87	54	34.39	27.26	18.72	36.24	309	92	A	V
	*	2412	115.36	-	-	105.5	27.35	18.76	36.25	309	92	P	V
	*	2412	112.19	-	-	102.33	27.35	18.76	36.25	309	92	A	V
		2485.392	57.34	-16.66	74	47.08	27.64	18.9	36.28	209	24	P	V
		2486.8	50.15	-3.85	54	39.88	27.65	18.9	36.28	209	24	A	V
802.11b CH 06 2437MHz		2389.84	52.42	-21.58	74	42.68	27.26	18.72	36.24	109	71	P	H
		2390	43.1	-10.9	54	33.36	27.26	18.72	36.24	109	71	A	H
	*	2437	118.69	-	-	108.69	27.45	18.81	36.26	109	71	P	H
	*	2437	115.1	-	-	105.1	27.45	18.81	36.26	109	71	A	H
		2483.92	52.42	-21.58	74	42.15	27.64	18.9	36.27	109	71	P	H
		2483.92	42.01	-11.99	54	31.74	27.64	18.9	36.27	109	71	A	H
		2389.68	51.73	-22.27	74	41.99	27.26	18.72	36.24	223	33	P	V
		2390	41.56	-12.44	54	31.82	27.26	18.72	36.24	223	33	A	V
	*	2437	115.97	-	-	105.97	27.45	18.81	36.26	223	33	P	V
	*	2437	112.82	-	-	102.82	27.45	18.81	36.26	223	33	A	V
		2484.88	53.42	-20.58	74	43.15	27.64	18.9	36.27	223	33	P	V
		2483.68	42.38	-11.62	54	32.13	27.63	18.89	36.27	223	33	A	V

802.11b CH 11 2462MHz		2386.456	57.73	-16.27	74	48.01	27.25	18.71	36.24	112	54	P	H
		2386.152	51.53	-2.47	54	41.82	27.24	18.71	36.24	112	54	A	H
	*	2462	118.86	-	-	108.73	27.55	18.85	36.27	107	51	P	H
	*	2462	115.3	-	-	105.17	27.55	18.85	36.27	107	51	A	H
		2485.04	55.41	-18.59	74	45.14	27.64	18.9	36.27	107	51	P	H
		2483.52	46.12	-7.88	54	35.87	27.63	18.89	36.27	107	51	A	H
		2388.128	55.83	-18.17	74	46.1	27.25	18.72	36.24	220	39	P	V
		2386.912	49.41	-4.59	54	39.68	27.25	18.72	36.24	220	39	A	V
	*	2462	115.43	-	-	105.3	27.55	18.85	36.27	205	29	P	V
	*	2462	112.45	-	-	102.32	27.55	18.85	36.27	205	29	A	V
		2484.24	54.97	-19.03	74	44.7	27.64	18.9	36.27	205	29	P	V
		2483.52	45.43	-8.57	54	35.18	27.63	18.89	36.27	205	29	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 01 2412MHz		4824	47.7	-26.3	74	39.57	32.4	13.25	37.52	143	3	P	H
		4824	41.27	-12.73	54	33.14	32.4	13.25	37.52	143	3	A	H
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		4824	46.7	-27.3	74	38.57	32.4	13.25	37.52	300	37	P	V
		4824	41.01	-12.99	54	32.88	32.4	13.25	37.52	300	37	A	V
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WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 06 2437MHz		4874	49.45	-24.55	74	41.28	32.5	13.23	37.56	300	49	P	H
		4874	44.08	-9.92	54	35.91	32.5	13.23	37.56	300	49	A	H
		7311	48.44	-25.56	74	34.35	36.9	15.8	38.61	400	36	P	H
		7311	38.78	-15.22	54	24.69	36.9	15.8	38.61	400	36	A	H
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		4874	48.58	-25.42	74	40.41	32.5	13.23	37.56	243	18	P	V
		4874	43.72	-10.28	54	35.55	32.5	13.23	37.56	243	18	A	V
		7311	50.57	-23.43	74	36.48	36.9	15.8	38.61	200	7	P	V
		7311	39.33	-14.67	54	25.24	36.9	15.8	38.61	200	7	A	V
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WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11b CH 11 2462MHz		4924	49.33	-24.67	74	40.97	32.74	13.22	37.6	299	19	P	H
		4924	44.42	-9.58	54	36.06	32.74	13.22	37.6	299	19	A	H
		7386	48.04	-25.96	74	34.18	36.68	15.85	38.67	300	37	P	H
		7386	37.87	-16.13	54	24.01	36.68	15.85	38.67	300	37	A	H
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		4924	48.05	-25.95	74	39.69	32.74	13.22	37.6	150	341	P	V
		4924	42.92	-11.08	54	34.56	32.74	13.22	37.6	150	341	A	V
		7386	47.72	-26.28	74	33.86	36.68	15.85	38.67	400	215	P	V
		7386	37.81	-16.19	54	23.95	36.68	15.85	38.67	400	215	A	V
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Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 01 2412MHz		2390	61.32	-12.68	74	51.58	27.26	18.72	36.24	127	67	P	H
		2390	48.53	-5.47	54	38.79	27.26	18.72	36.24	127	67	A	H
	*	2412	117.62	-	-	107.76	27.35	18.76	36.25	127	67	P	H
	*	2412	110.11	-	-	100.25	27.35	18.76	36.25	127	67	A	H
		2484.16	56.11	-17.89	74	45.84	27.64	18.9	36.27	100	15	P	H
		2483.632	46.43	-7.57	54	36.18	27.63	18.89	36.27	100	15	A	H
		2389.905	57.62	-16.38	74	47.88	27.26	18.72	36.24	292	95	P	V
		2390	44.56	-9.44	54	34.82	27.26	18.72	36.24	292	95	A	V
	*	2412	114.49	-	-	104.63	27.35	18.76	36.25	292	95	P	V
	*	2412	106.77	-	-	96.91	27.35	18.76	36.25	292	95	A	V
		2484.336	55.24	-18.76	74	44.97	27.64	18.9	36.27	202	29	P	V
		2484.776	45.9	-8.1	54	35.63	27.64	18.9	36.27	202	29	A	V
802.11g CH 06 2437MHz		2389.84	54.06	-19.94	74	44.32	27.26	18.72	36.24	100	54	P	H
		2390	43.63	-10.37	54	33.89	27.26	18.72	36.24	100	54	A	H
	*	2437	119.79	-	-	109.79	27.45	18.81	36.26	100	54	P	H
	*	2437	112.04	-	-	102.04	27.45	18.81	36.26	100	54	A	H
		2485.76	55.1	-18.9	74	44.84	27.64	18.9	36.28	100	54	P	H
		2483.52	42.76	-11.24	54	32.51	27.63	18.89	36.27	100	54	A	H
		2390	53.71	-20.29	74	43.97	27.26	18.72	36.24	191	318	P	V
		2390	42.01	-11.99	54	32.27	27.26	18.72	36.24	191	318	A	V
	*	2437	117.47	-	-	107.47	27.45	18.81	36.26	191	318	P	V
	*	2437	109.95	-	-	99.95	27.45	18.81	36.26	191	318	A	V
		2485.12	55.91	-18.09	74	45.64	27.64	18.9	36.27	191	318	P	V
		2483.52	44.2	-9.8	54	33.95	27.63	18.89	36.27	191	318	A	V

802.11g CH 11 2462MHz		2389.952	57.3	-16.7	74	47.56	27.26	18.72	36.24	112	53	P	H
		2389.952	47.63	-6.37	54	37.89	27.26	18.72	36.24	112	53	A	H
	*	2462	115.82	-	-	105.69	27.55	18.85	36.27	114	49	P	H
	*	2462	108.22	-	-	98.09	27.55	18.85	36.27	114	49	A	H
		2483.52	64.79	-9.21	74	54.54	27.63	18.89	36.27	114	49	P	H
		2483.52	51.41	-2.59	54	41.16	27.63	18.89	36.27	114	49	P	H
		2389.496	54.74	-19.26	74	45	27.26	18.72	36.24	308	91	P	V
		2388.736	44.96	-9.04	54	35.23	27.25	18.72	36.24	308	91	A	V
	*	2462	115.83	-	-	105.7	27.55	18.85	36.27	283	311	P	V
	*	2462	108.18	-	-	98.05	27.55	18.85	36.27	283	311	A	V
		2483.56	65.3	-8.7	74	55.05	27.63	18.89	36.27	283	311	P	V
		2483.52	51.45	-2.55	54	41.2	27.63	18.89	36.27	283	311	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11g (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		4824	45	-29	74	36.87	32.4	13.25	37.52	-	-	P	H
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802.11g CH 01 2412MHz		4824	44.17	-29.83	74	36.04	32.4	13.25	37.52	-	-	P	V
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WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		4874	44.8	-29.2	74	36.63	32.5	13.23	37.56	-	-	P	H
		7311	49.82	-24.18	74	35.73	36.9	15.8	38.61	-	-	P	H
		7311	39.43	-14.57	54	25.34	36.9	15.8	38.61	-	-	A	H
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802.11g CH 06 2437MHz													H
		4874	44.55	-29.45	74	36.38	32.5	13.23	37.56	-	-	P	V
		7311	48.91	-25.09	74	34.82	36.9	15.8	38.61	-	-	P	V
		7311	39.41	-14.59	54	25.32	36.9	15.8	38.61	-	-	A	V
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WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11g CH 11 2462MHz		4924	45.11	-28.89	74	36.75	32.74	13.22	37.6	-	-	P	H
		7386	47.77	-26.23	74	33.91	36.68	15.85	38.67	-	-	P	H
													H
													H
													H
													H
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													H
													H
		4924	45	-29	74	36.64	32.74	13.22	37.6	-	-	P	V
		7386	47.66	-26.34	74	33.8	36.68	15.85	38.67	-	-	P	V
													V
													V
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Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.												

2.4GHz 2400~2483.5MHz

WIFI 802.11ax HE20 Full (Band Edge @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ax HE20 Full CH 01 2412MHz		2389.275	64.84	-9.16	74	55.1	27.26	18.72	36.24	109	303	P	H
		2389.905	52.17	-1.83	54	42.43	27.26	18.72	36.24	109	303	A	H
	*	2412	113.35	-	-	103.49	27.35	18.76	36.25	109	303	P	H
	*	2412	103.14	-	-	93.28	27.35	18.76	36.25	109	303	A	H
		2484.248	55.38	-18.62	74	45.11	27.64	18.9	36.27	230	240	P	H
		2483.632	44.92	-9.08	54	34.67	27.63	18.89	36.27	230	240	A	H
		2390	62.87	-11.13	74	53.13	27.26	18.72	36.24	139	51	P	V
		2390	49.85	-4.15	54	40.11	27.26	18.72	36.24	139	51	A	V
	*	2412	113.39	-	-	103.53	27.35	18.76	36.25	139	51	P	V
	*	2412	104.08	-	-	94.22	27.35	18.76	36.25	139	51	A	V
		2485.216	56.11	-17.89	74	45.84	27.64	18.9	36.27	190	313	P	V
		2483.544	45	-9	54	34.75	27.63	18.89	36.27	190	313	A	V
802.11ax HE20 Full CH 06 2437MHz		2390	58.99	-15.01	74	49.25	27.26	18.72	36.24	113	51	P	H
		2390	45.3	-8.7	54	35.56	27.26	18.72	36.24	113	51	A	H
	*	2437	121.07	-	-	111.07	27.45	18.81	36.26	113	51	P	H
	*	2437	112.82	-	-	102.82	27.45	18.81	36.26	113	51	A	H
		2485.52	59.01	-14.99	74	48.75	27.64	18.9	36.28	113	51	P	H
		2484.4	45.1	-8.9	54	34.83	27.64	18.9	36.27	113	51	A	H
		2389.84	54.67	-19.33	74	44.93	27.26	18.72	36.24	199	316	P	V
		2390	42.62	-11.38	54	32.88	27.26	18.72	36.24	199	316	A	V
	*	2437	119.05	-	-	109.05	27.45	18.81	36.26	199	316	P	V
	*	2437	109.26	-	-	99.26	27.45	18.81	36.26	199	316	A	V
		2483.6	59.35	-14.65	74	49.1	27.63	18.89	36.27	199	316	P	V
		2483.52	45.24	-8.76	54	34.99	27.63	18.89	36.27	199	316	A	V

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ax HE20 Full CH 11 2462MHz		2387.52	55.51	-18.49	74	45.78	27.25	18.72	36.24	100	54	P	H
		2386.76	43.66	-10.34	54	33.94	27.25	18.71	36.24	100	54	A	H
	*	2462	113.97	-	-	103.84	27.55	18.85	36.27	200	132	P	H
	*	2462	104.73	-	-	94.6	27.55	18.85	36.27	200	132	A	H
		2483.68	67.23	-6.77	74	56.98	27.63	18.89	36.27	200	132	P	H
		2483.52	52.16	-1.84	54	41.91	27.63	18.89	36.27	200	132	A	H
		2389.8	55.06	-18.94	74	45.32	27.26	18.72	36.24	207	324	P	V
		2389.952	44.19	-9.81	54	34.45	27.26	18.72	36.24	207	324	A	V
	*	2462	115.62	-	-	105.49	27.55	18.85	36.27	400	106	P	V
	*	2462	106.77	-	-	96.64	27.55	18.85	36.27	400	106	A	V
		2483.52	65.78	-8.22	74	55.53	27.63	18.89	36.27	400	106	P	V
		2483.52	52.42	-1.58	54	42.17	27.63	18.89	36.27	400	106	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

2.4GHz 2400~2483.5MHz

WIFI 802.11 ax HE20 Full (Harmonic @ 3m)

WIFI Ant. 1+2	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		4824	43.94	-30.06	74	35.81	32.4	13.25	37.52	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
802.11ax													H
HE20 Full													H
CH 01		4824	44.94	-29.06	74	36.81	32.4	13.25	37.52	-	-	P	V
2412MHz													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V