FCC RADIO TEST REPORT

FCC ID	:	**UZ7WLMT0**
Equipment	:	**Touch Computer**
Brand Name	:	**Zebra**
Model Name	:	**WLMT0**
Applicant	:	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Manufacturer	:	**Zebra Technologies Corporation 1 Zebra Plaza, Holtsville, NY 11742**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Jan. 03, 2023 and testing was performed from Jan. 07, 2023 to Feb. 25, 2023. 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
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History of this test report

Report No.	Version	Description	Issue Date
FR2D2704C	01	Initial issue of report	Mar. 03, 2023
FR2D2704C	02	Revise Product Specification of Equipment Under Test	Mar. 13, 2023

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	Reporting only	-
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	1.28 dB under the limit at 2390.000 MHz
3.6	15.207	AC Conducted Emission	Pass	19.30 dB under the limit at 0.550 MHz
3.7	15.203	Antenna Requirement	Pass	-

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
   It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Uncertainty of Evaluation".

Comments and Explanations:

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

Reviewed by: Keven Cheng

Report Producer: Ming Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
Equipment	Touch Computer
Brand Name	Zebra
Model Name	WLMT0
FCC ID	UZ7WLMT0
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
Sample 1	Scanner(SE4710)
Sample 2	Scanner(SE5500)
HW Version	DV
SW Version	13-08-06.00-TG-UOO-PRD-ATH-04
FW Version	FUSION_QA_4_1.0.0.010_T
MFD	06FEB23
EUT Stage	Identical Prototype

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

Specification of Accessories				
Battery 1 **Standard Battery (3800mAh)**	**Brand Name**	Zebra	**Model Number**	BT-000473

Supported Unit Used in Test Configuration and System				
Battery 2 **Standard BLE Beacon Battery (3800mAh)**	**Brand Name**	Zebra	**Model Number**	BT-000473B
Battery 3 **Extended Battery (5200mAh)**	**Brand Name**	Zebra	**Model Number**	BT-000473E
Adapter 1 **Cigarette Lighter Adapter**	**Brand Name**	Zebra	**Part Number**	CHG-AUTO-USB1-01
Adapter 2 **USB Wall Charger**	**Brand Name**	Zebra	**Part Number**	PWR-WUA5V12W0US
Earphone 1 **3.5mm PTT Headset**	**Brand Name**	Zebra	**Part Number**	HDST-35MM-PTT1-01
Earphone 2 **USB-C Audio Headset**	**Brand Name**	Zebra	**Part Number**	HDST-USBC-PTT1-01
USB Cable **(Type C to Type A)**	**Brand Name**	Zebra	**Part Number**	CBL-TC5X-USBC2A-01
Type C-Audio Cable **(Type C to 3.5mm)**	**Brand Name**	Zebra	**Part Number**	ADP-USBC-35MM1-01

1.2 Product Specification of Equipment Under Test

Product Specification is subject to this standard	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum Output Power to Antenna	**MIMO <Ant. 0+1>** 802.11b : 23.71 dBm / 0.2350 W 802.11g : 22.67 dBm / 0.1849 W 802.11n HT20 : 22.72 dBm / 0.1871 W 802.11n HT40 : 21.66 dBm / 0.1466 W 802.11ac VHT20: 22.71 dBm / 0.1866 W 802.11ac VHT40: 21.66 dBm / 0.1466 W 802.11ax HE20: 22.77 dBm / 0.1892 W 802.11ax HE40: 21.86 dBm / 0.1535 W
99% Occupied Bandwidth	**MIMO <Ant. 0>** 802.11b : 13.69 MHz 802.11g : 17.33 MHz 802.11ax HE20 : 19.68 MHz 802.11ax HE40 : 38.16 MHz **MIMO <Ant. 1>** 802.11b : 13.69 MHz 802.11g : 17.23 MHz 802.11ax HE20 : 19.58 MHz 802.11ax HE40 : 38.06 MHz
Antenna Type / Gain	**<Ant. 0>:** Monopole Antenna with gain -1.10 dBi **<Ant. 1>:** IFA Antenna with gain -1.23 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. 0	Ant. 1
802.11 b/g/n/ac/ax MIMO	V	V
802.11 ax TXBF	V	V

Remark:

1. MIMO Ant. 0+1 Directional Gain is a calculated result from MIMO Ant. 0 and MIMO Ant. 1. The formula used in calculation is documented in section 1.2.1.
2. Power of MIMO Ant. 0 + Ant. 1 is a calculated result from sum of the power MIMO Ant. 0 and MIMO Ant. 1.
3. 802.11ax Support Tx Beamforming mode, and the manufacturer declares that Tx Beamforming power/EIRP is less than CDD mode 3dbm, so CDD mode cover Tx Beamforming mode.
4. The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.2.1 Antenna Directional Gain

<For CDD Mode>

Follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01F)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 0 (dBi)	Ant 1 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
2.4GHz	-1.10	-1.23	-1.10	1.85	0.00	0.00

Calculation example:

If a device has two antenna, G_{ANT1}= -1.10dBi; G_{ANT2}=-1.23dBi

Directional gain of power measurement = max(-1.10, -1.23) + 0 = -1.10 dBi

Directional gain of PSD derived from formula which is

10 x log { { [10^ (-1.10 dBi / 20) + 10^ (-1.23 dBi / 20)] ^ 2 } / 2 }

= 1.85 dBi

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

TXBF modes

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

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

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.

The EUT supports beamforming for 802.11ac modes.

The directional gain calculation is following F)2)e)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

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

	Ant0 (dBi)	Ant1 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
2.4GHz	-1.10	-1.23	1.85	1.85	0.00	0.00

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

PSD Limit Reduction = DG(PSD) – 6dBi, (min = 0)

1.3 Modification of EUT

No modifications made to the EUT during the testing.

1.4 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, 03CH16-HY

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

FCC designation No.: TW3786

1.5 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.
- 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 26/52/106/242/484-tone RU

The PSD of partial RU is reduced to be smaller than full RU according to TCB workshop interim guidance Oct. 2018.

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 242-tone RU is covered by 20MHz channel, 484-tone RU is covered by 40MHz channel

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

The power for 802.11n and 802.11ac mode is smaller than 802.11ax mode, so all other conducted and radiated test is covered by 802.11ax 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 HE20)	MCS0
802.11n HT40 (Covered by HE40)	MCS0
802.11ac VHT20 (Covered by HE20)	MCS0
802.11ac VHT40 (Covered by HE40)	MCS0
802.11ax HE20	MCS0
802.11ax HE40	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 Bluetooth Link + WLAN (2.4GHz) Link + Camera (Rear) + USB Cable (Charging with Adapter 2) + Battery 1 for Sample 1
Remark: For Radiated Test Cases, the tests were performed with Adapter 2.	

<Sample 1 with Battery 1>

Ch. #	2400-2483.5 MHz			
	802.11b	802.11g	802.11ax HE20	802.11ax HE40
Low	01	01	01	03
Middle	06	06	06	06
High	11	11	11	09

<Sample 1 with Battery 2>

Ch. #	2400-2483.5 MHz
	802.11ax HE20
Low	01
Middle	-
High	-

<Sample 1 with Battery 3>

Ch. #	2400-2483.5 MHz
	802.11ax HE20
Low	01
Middle	-
High	-

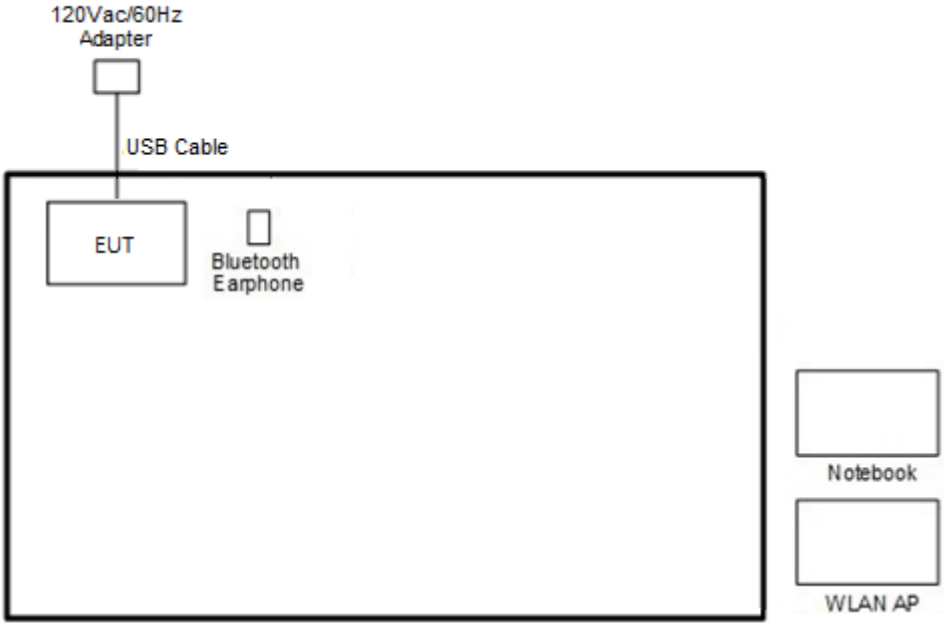
<Sample 2 with Battery 1>

Ch. #	2400-2483.5 MHz
	802.11ax HE20
Low	01
Middle	-
High	-

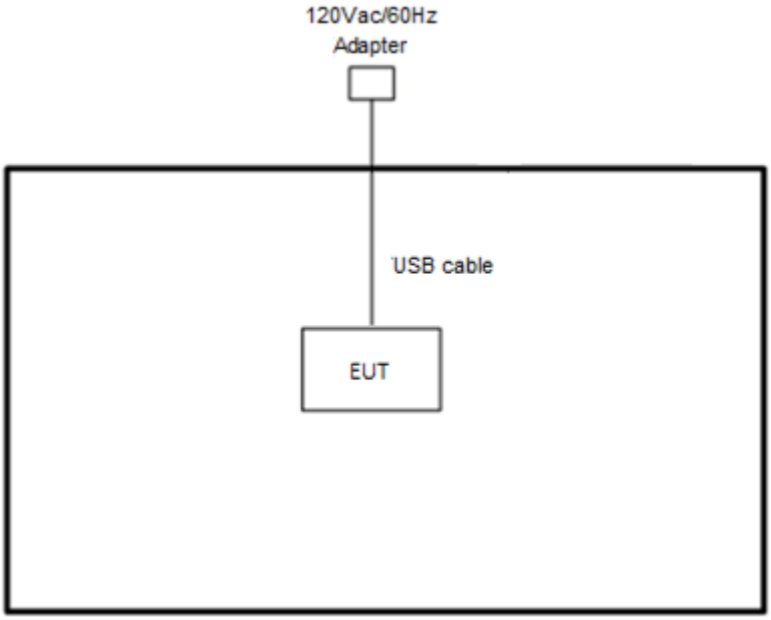
Remark: For radiation spurious emission, the modulation and the data rate picked for testing are determined by the Max. RF conducted power.

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.	WLAN AP	ASUS	RT-AC52	N/A	N/A	Unshielded, 1.8 m
2.	Notebook	DELL	P79G	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
3.	Bluetooth Earphone	Kinyo	BTE-3622	N/A	N/A	N/A

2.5 EUT Operation Test Setup

The RF test items, utility "QRCT Version 4.0.00206.0" 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.

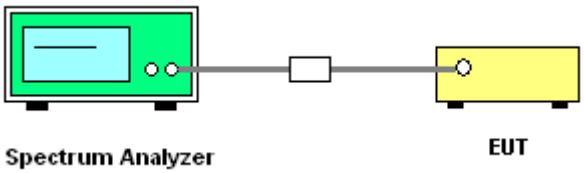
3.1.2 Measuring Instruments

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.

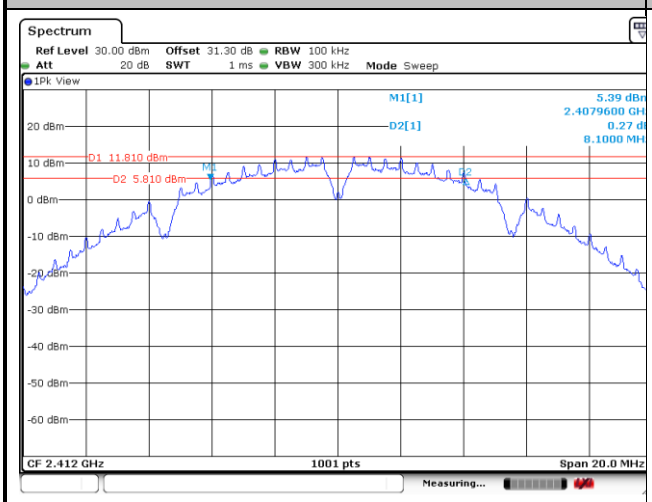
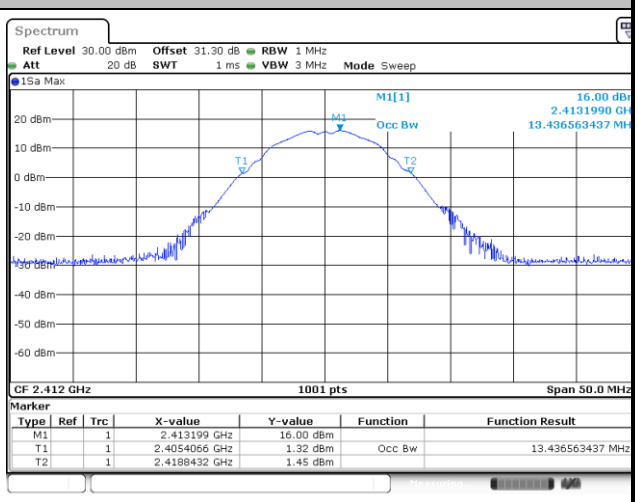
3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

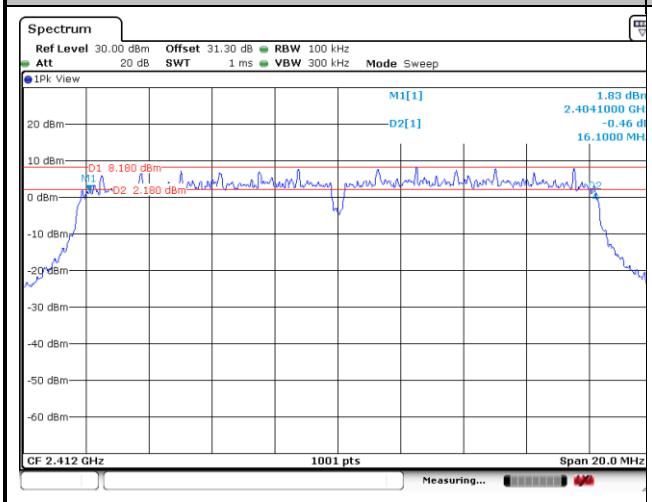
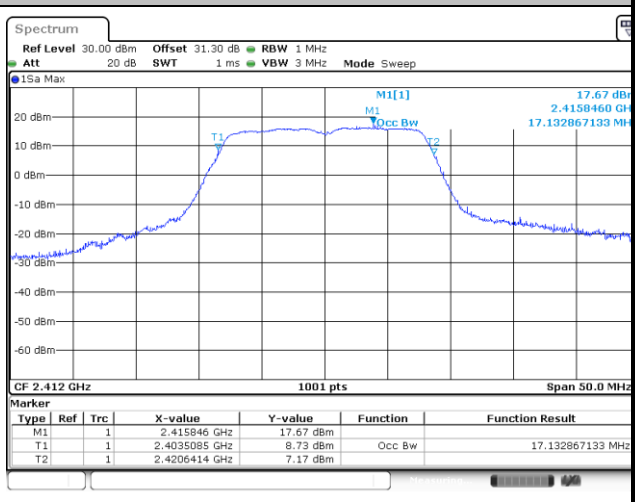
Please refer to Appendix A.

<802.11b>

6dB Bandwidth	99% Occupied Bandwidth
	

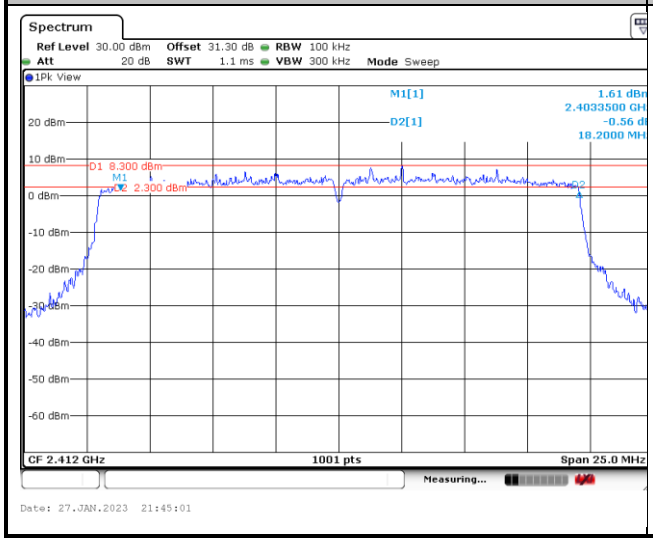
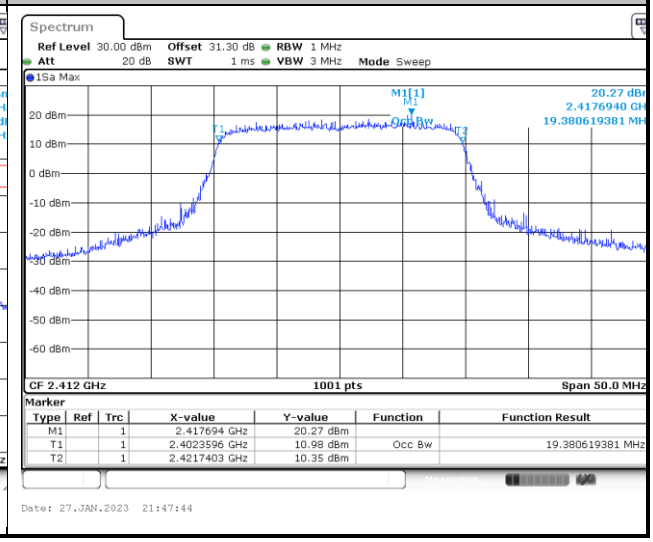
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11g>

6dB Bandwidth	99% Occupied Bandwidth
	

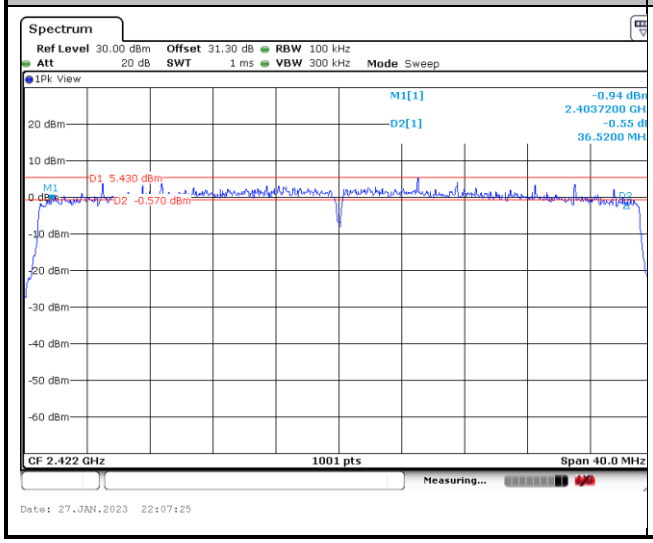
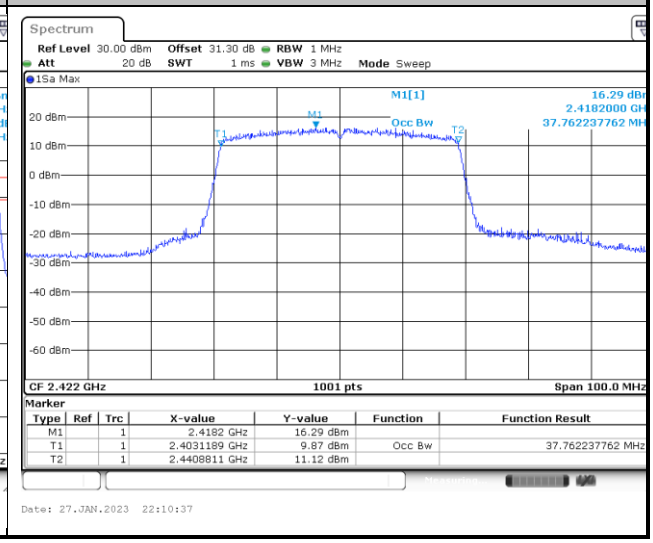
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

<802.11ax HE20>

6dB Bandwidth	99% Occupied Bandwidth
	

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

<802.11ax HE40>

6dB Bandwidth	99% Occupied Bandwidth
	

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

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.

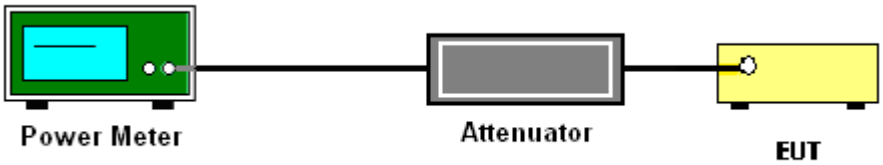
3.2.2 Measuring Instruments

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.

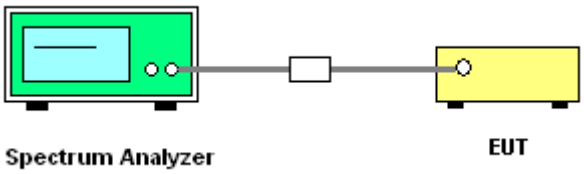
3.3.3 Test Procedures

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 .

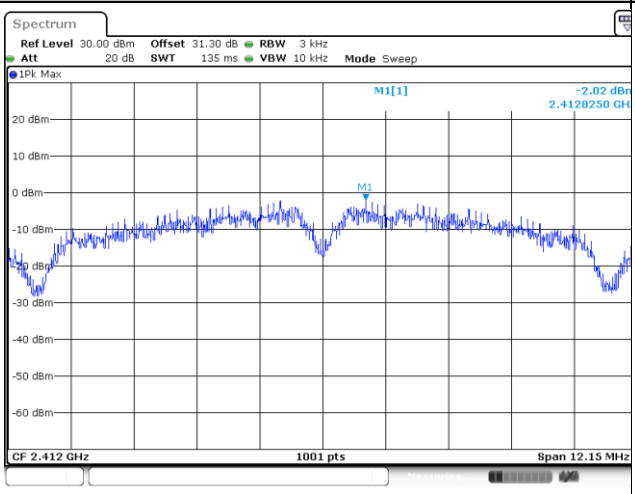
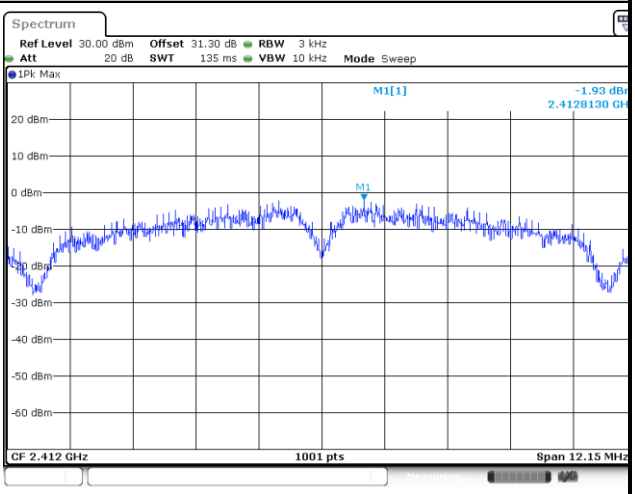
3.3.4 Test Setup



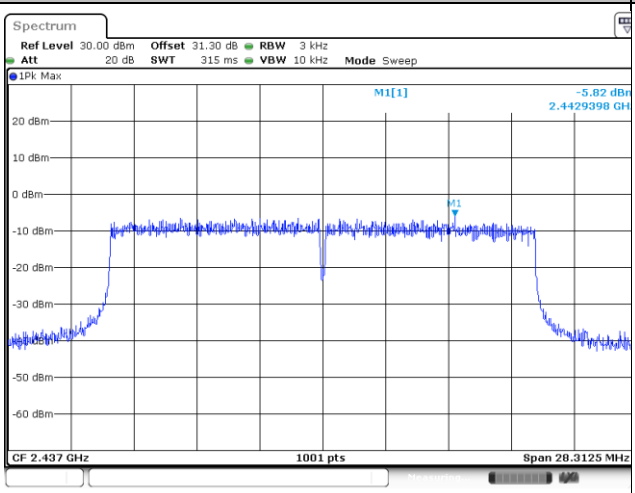
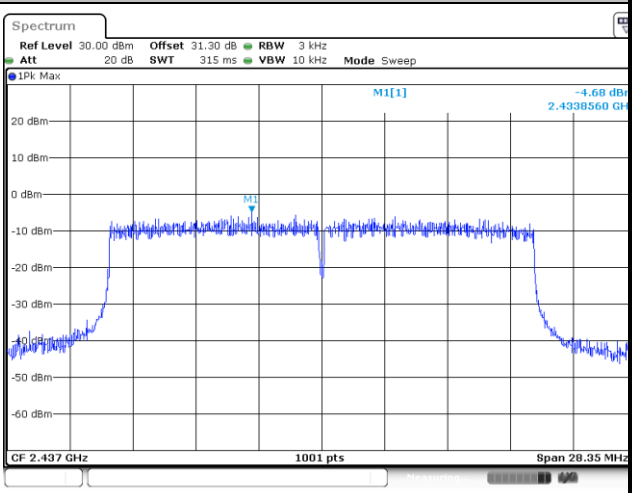
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

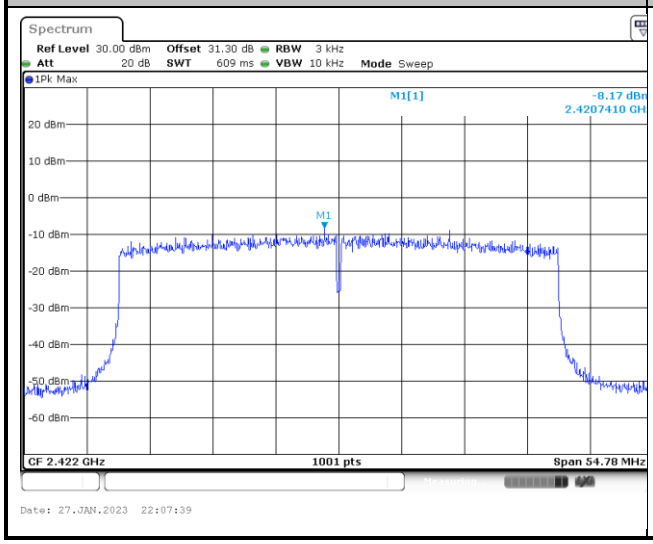
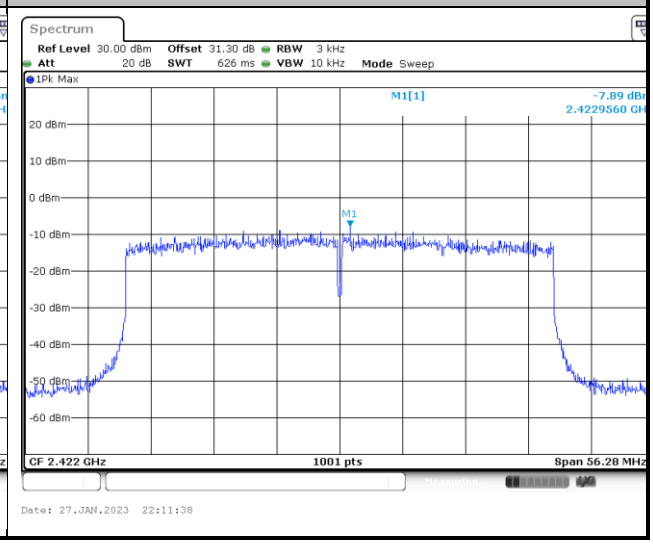
<802.11b>

Maximum Power Density Plot (dBm/3kHz)	
MIMO Ant. 0	MIMO Ant. 1
	

<802.11ax HE20>

Maximum Power Density Plot (dBm/3kHz)	
MIMO Ant. 0	MIMO Ant. 1
	

<802.11ax HE40>

Maximum Power Density Plot (dBm/3kHz)	
MIMO Ant. 0	MIMO Ant. 1
	

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.

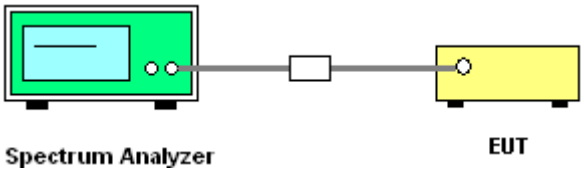
3.4.2 Measuring Instruments

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

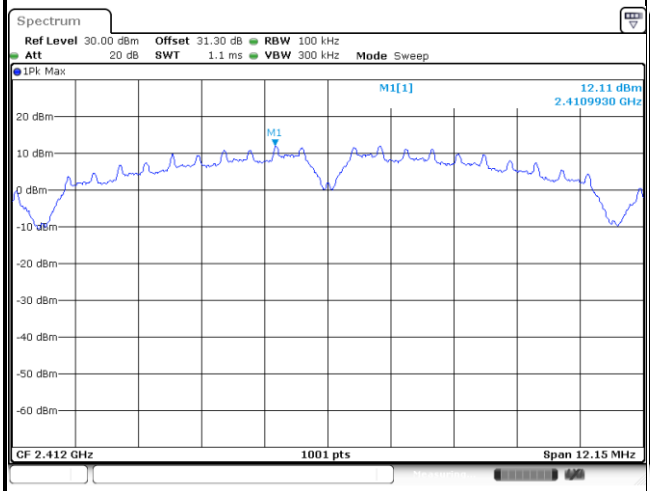


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

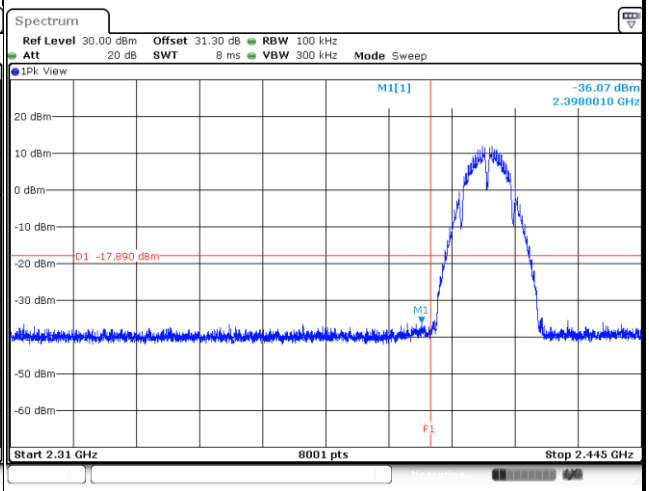
Number of TX = 2, Ant. 0 (Measured)

Test Mode :	802.11b	Test Channel :	01

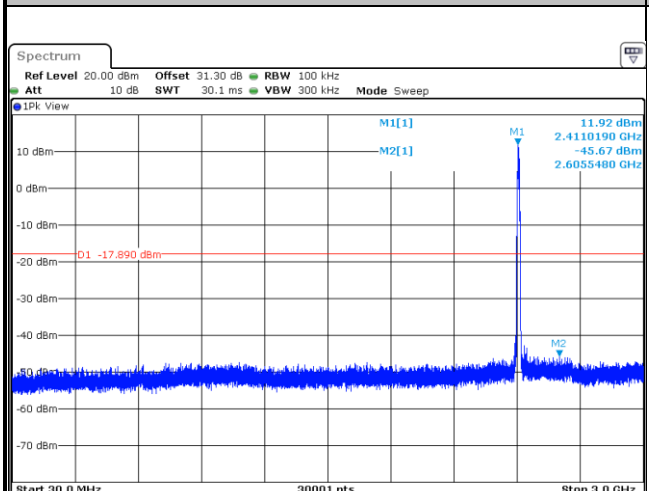
100kHz PSD reference Level



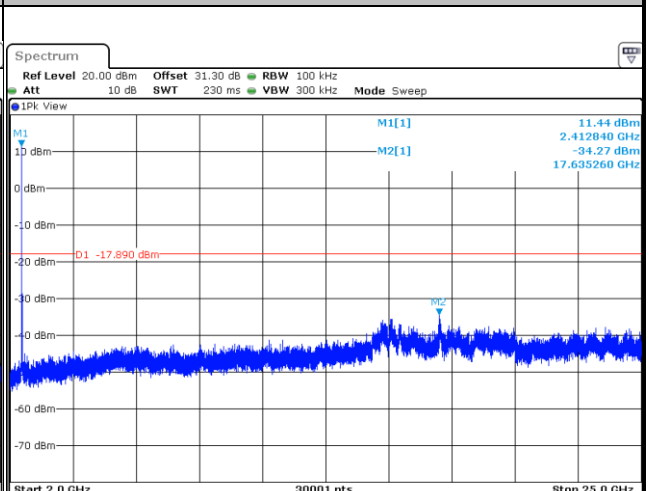
Channel Plot



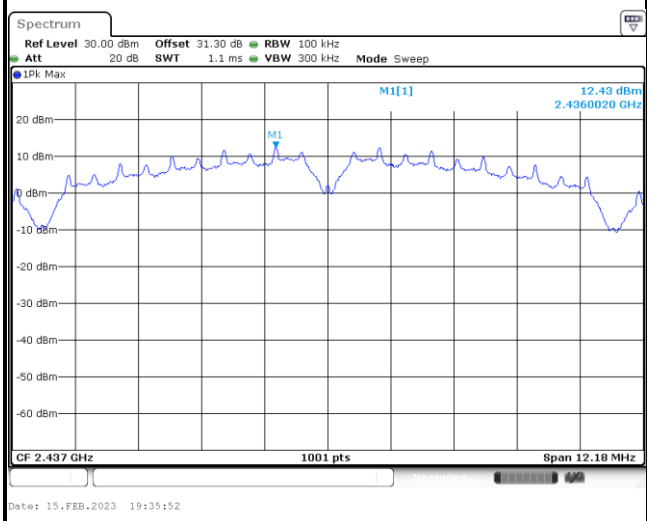
Spurious Emission 30MHz~3GHz

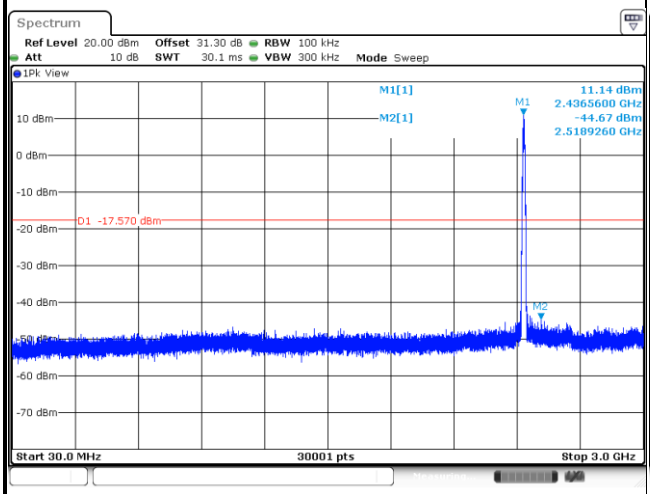
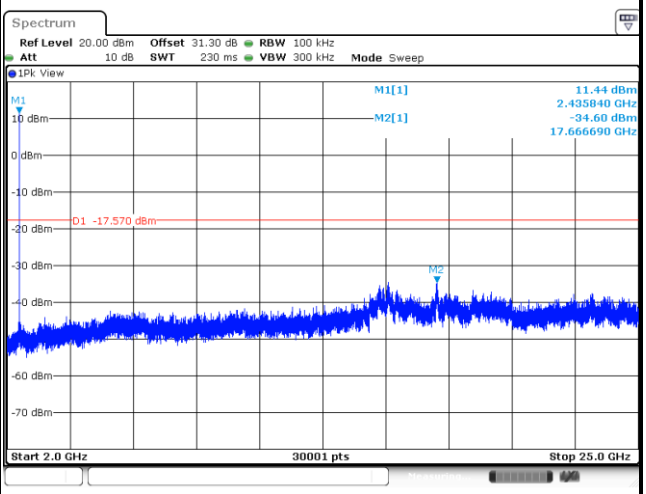


Spurious Emission 2GHz~25GHz

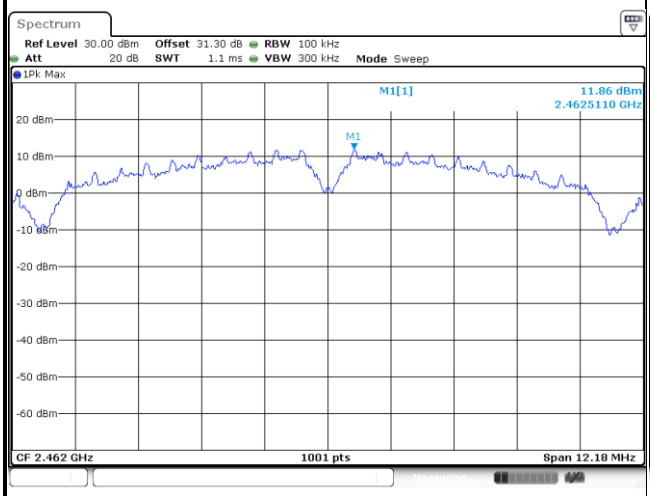
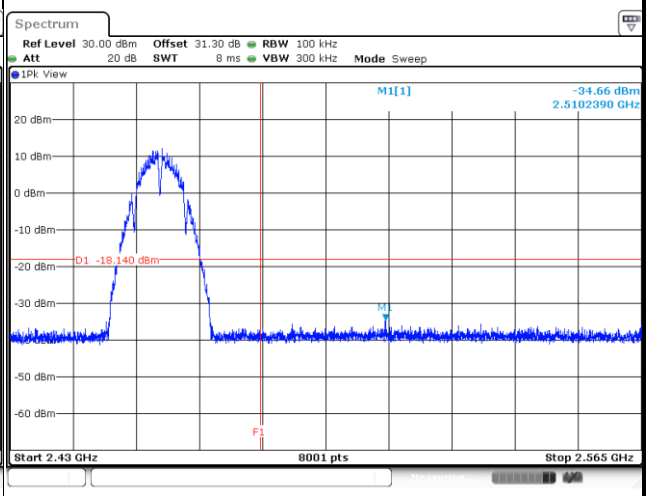
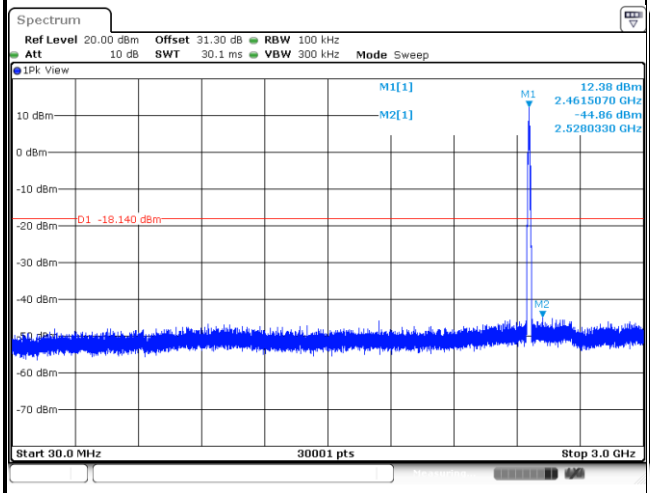
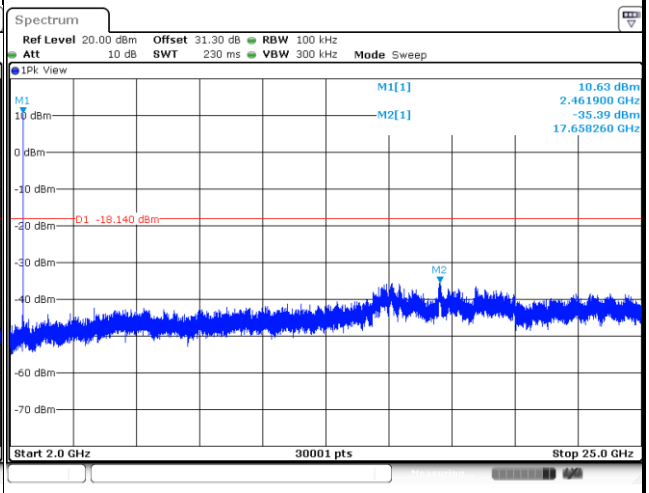


Test Mode :	802.11b	Test Channel :	06

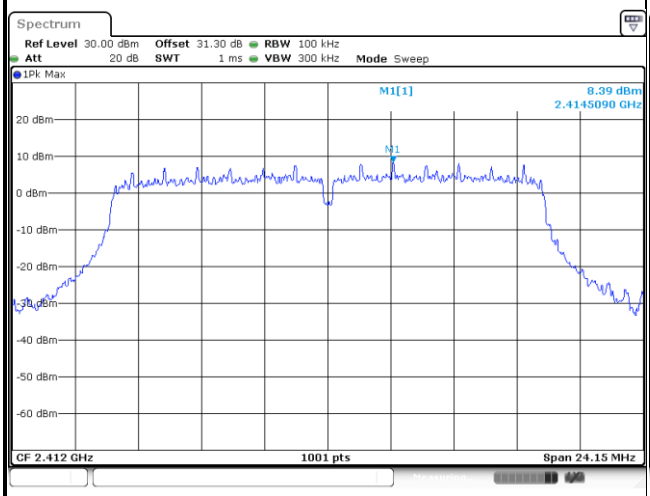
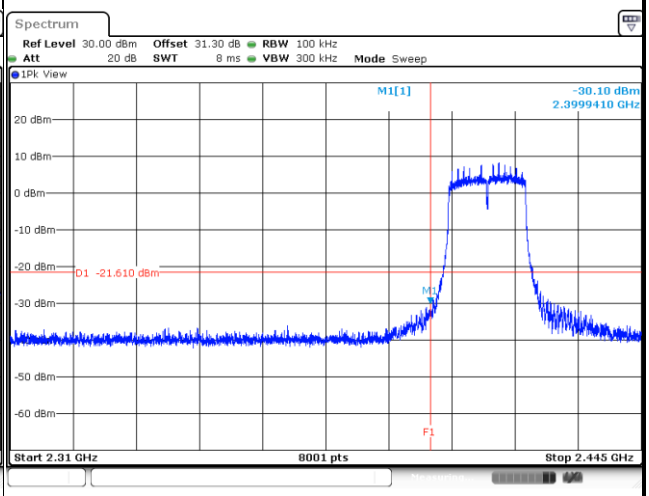
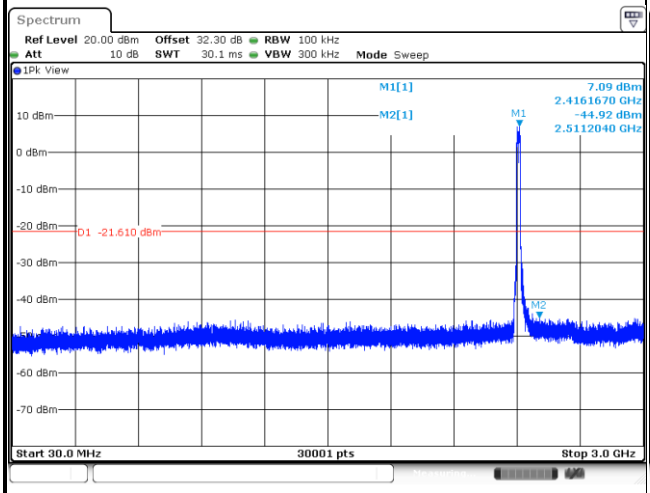
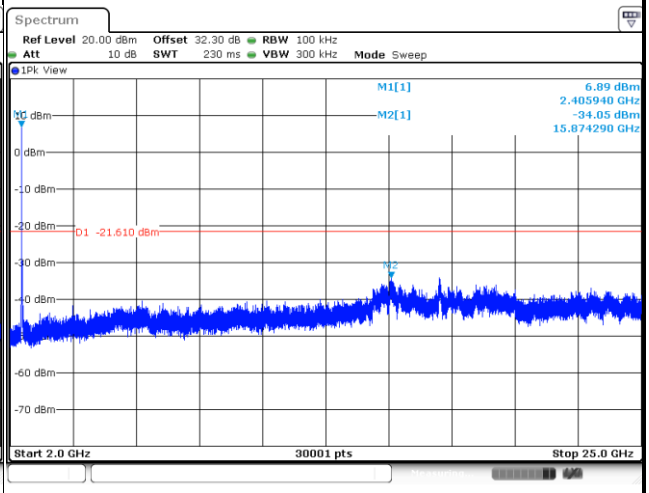
100kHz PSD reference Level	Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

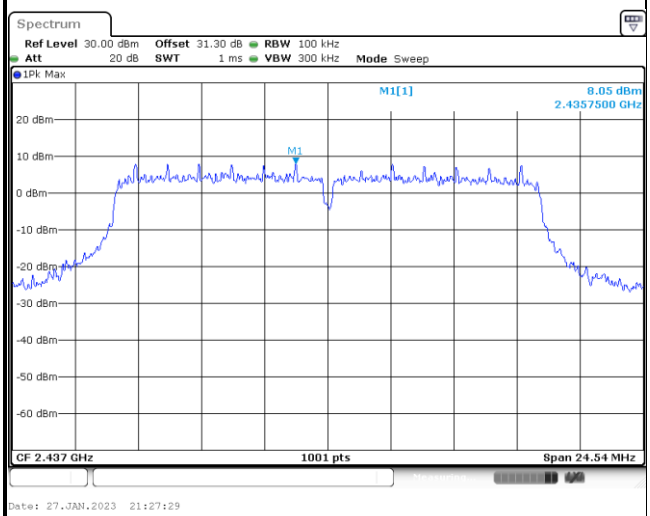
Test Mode :	802.11b	Test Channel :	11

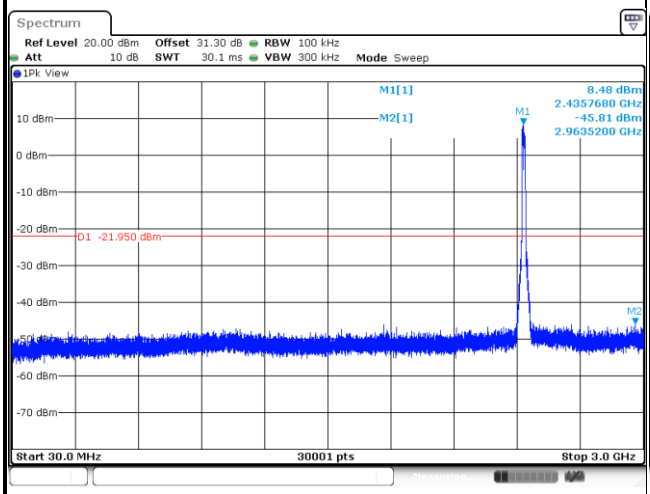
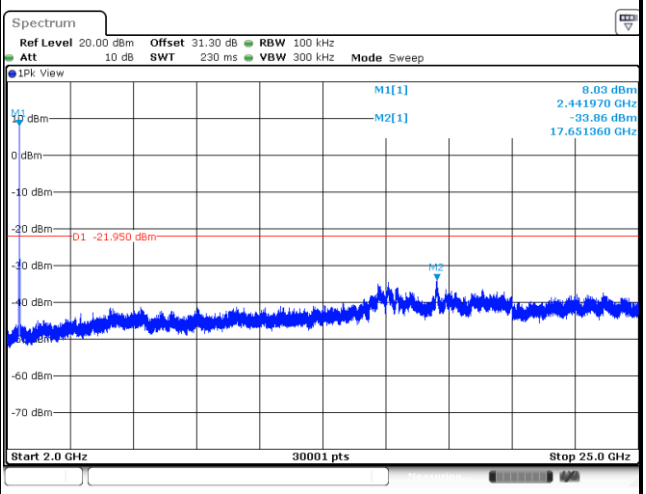
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	01

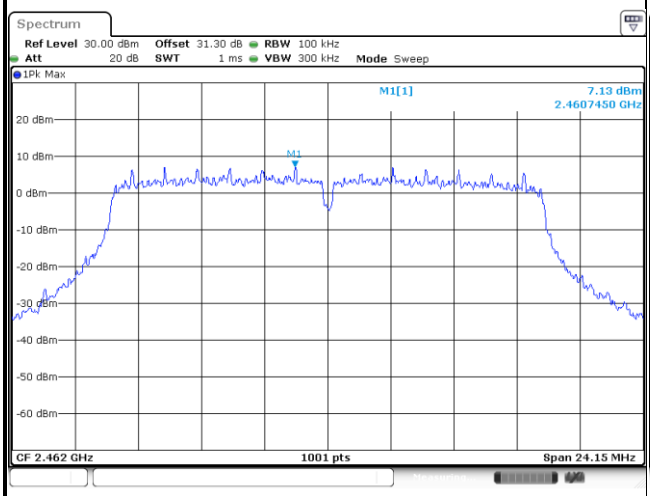
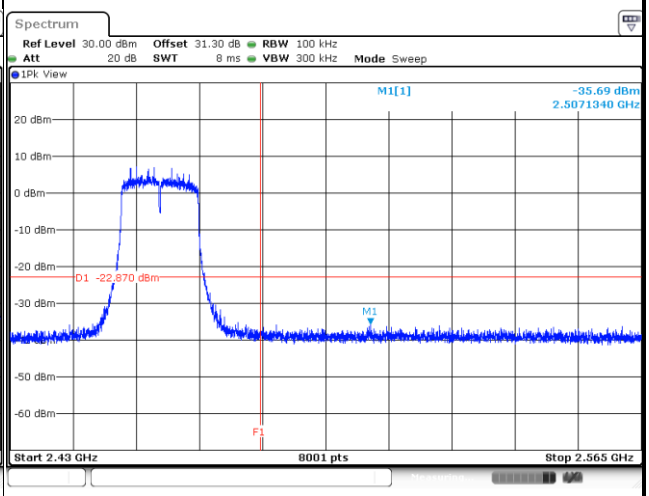
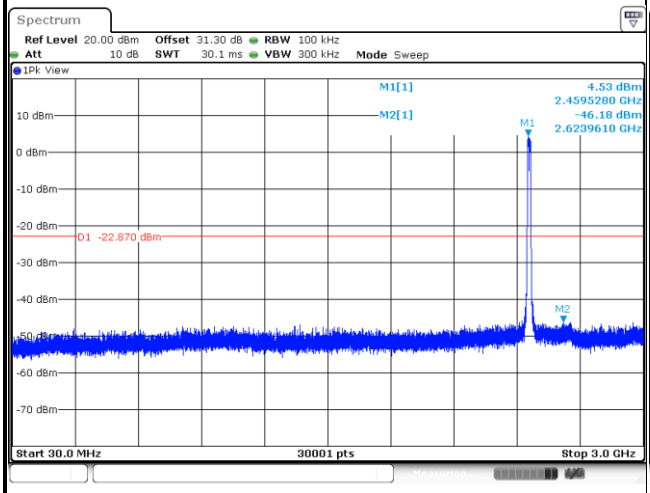
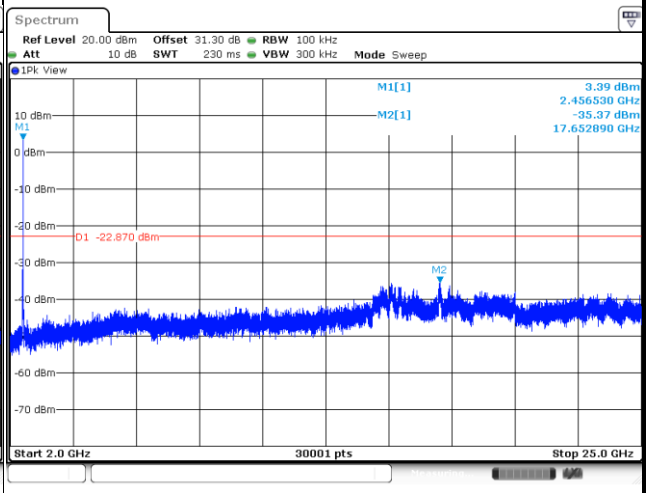
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	06

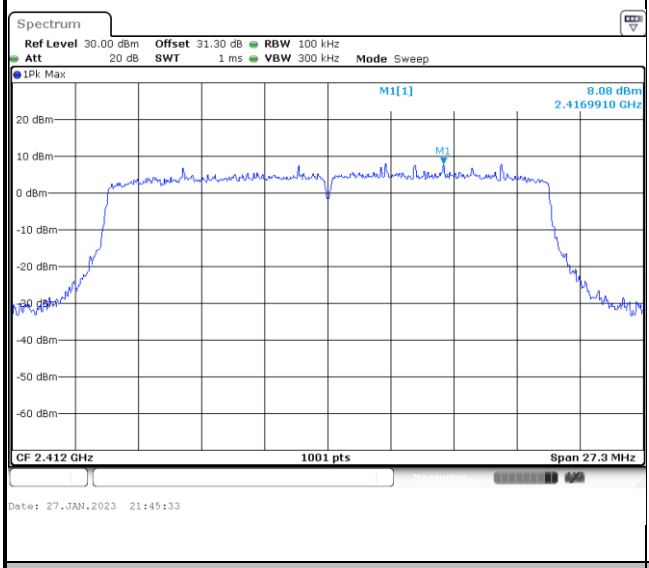
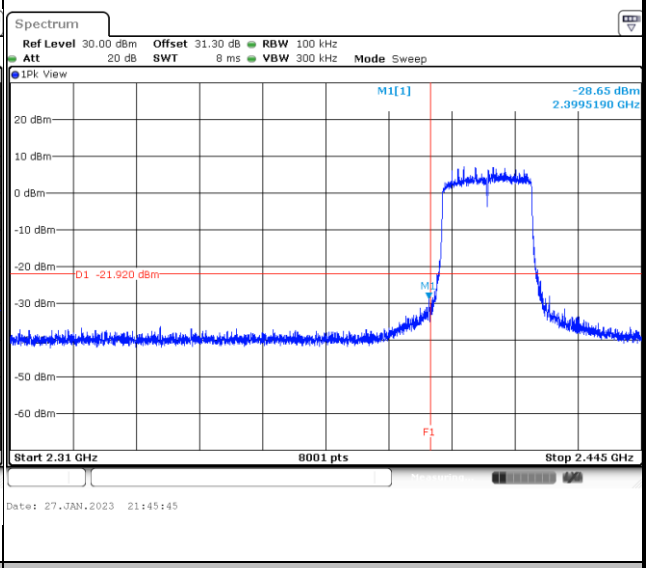
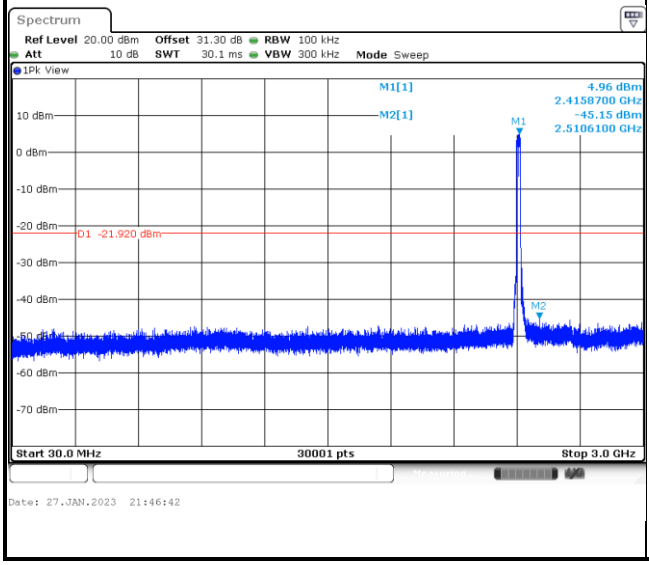
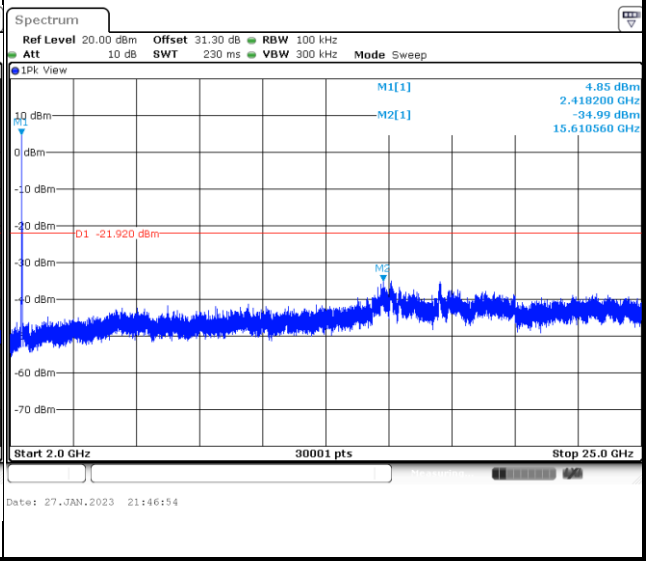
100kHz PSD reference Level	Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

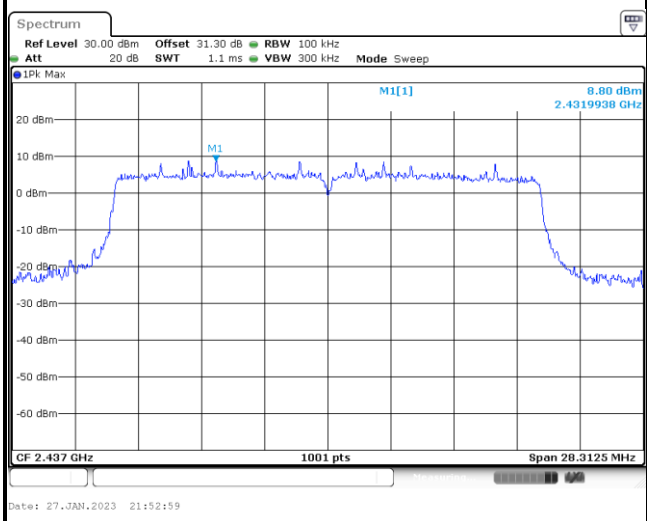
Test Mode :	802.11g	Test Channel :	11

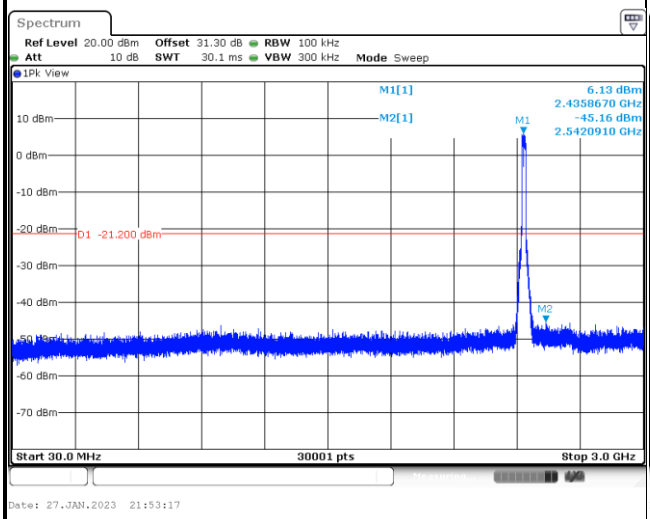
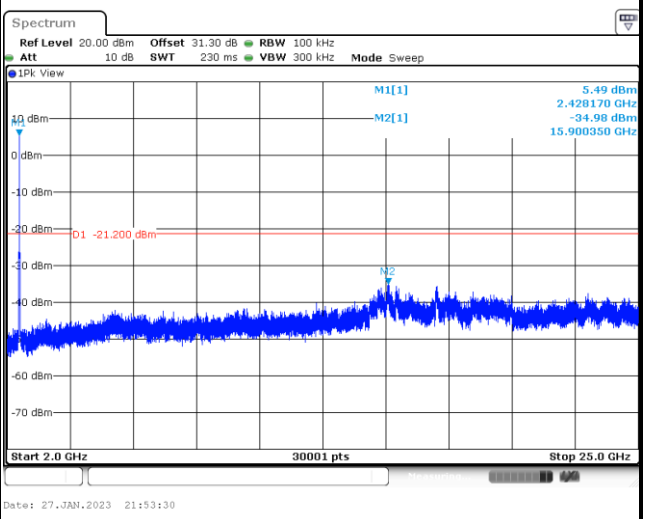
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	01

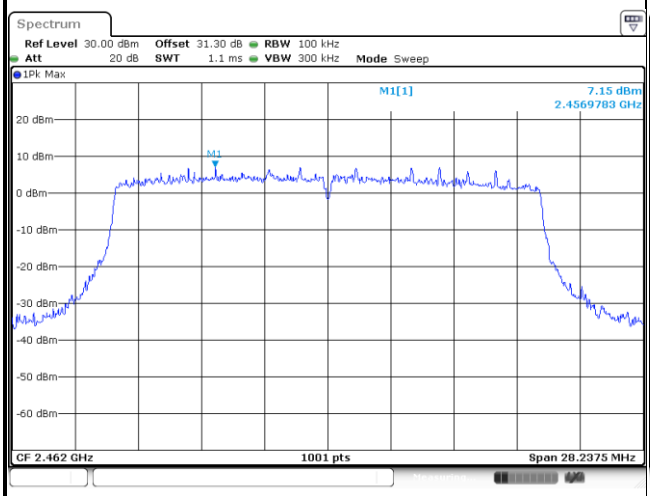
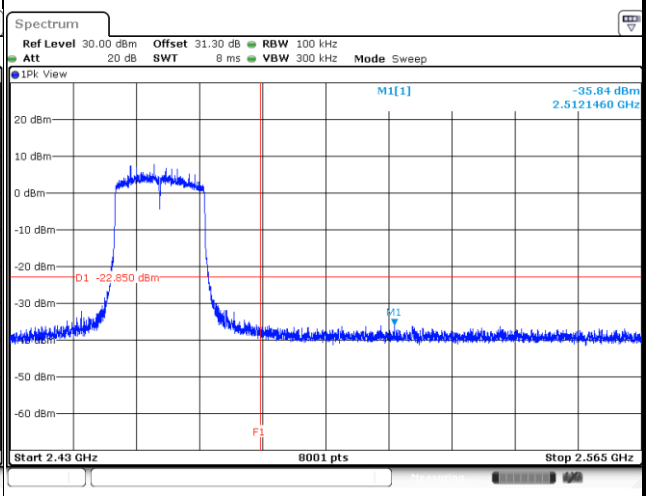
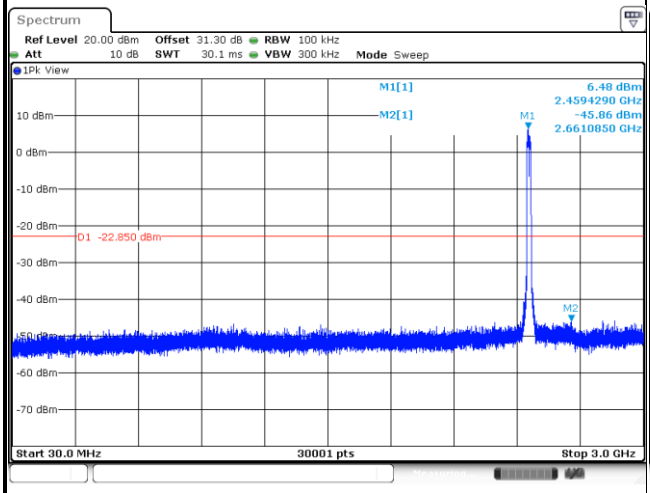
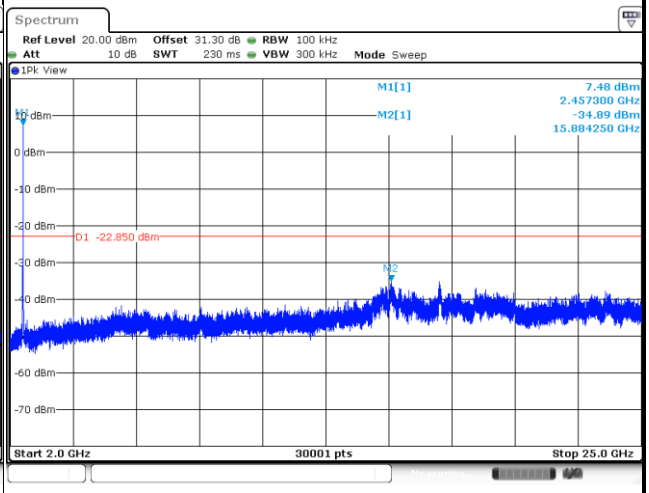
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	06

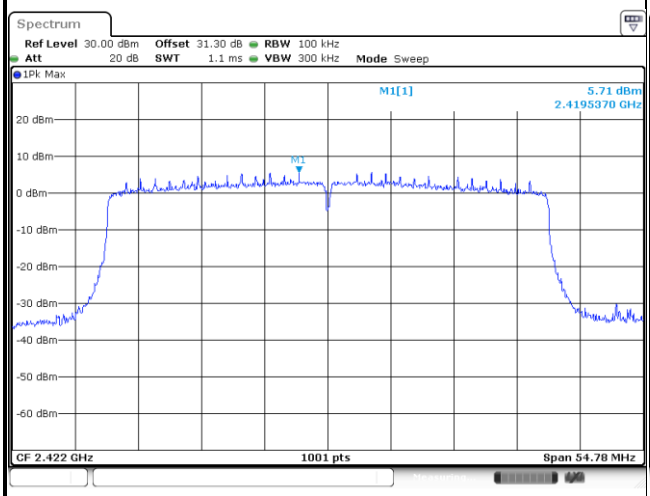
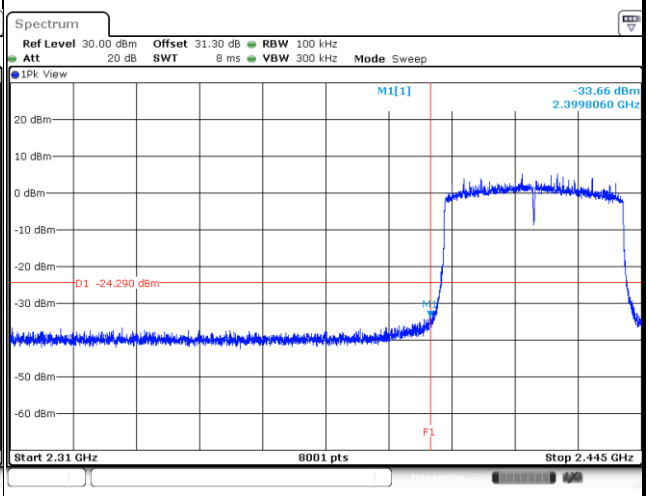
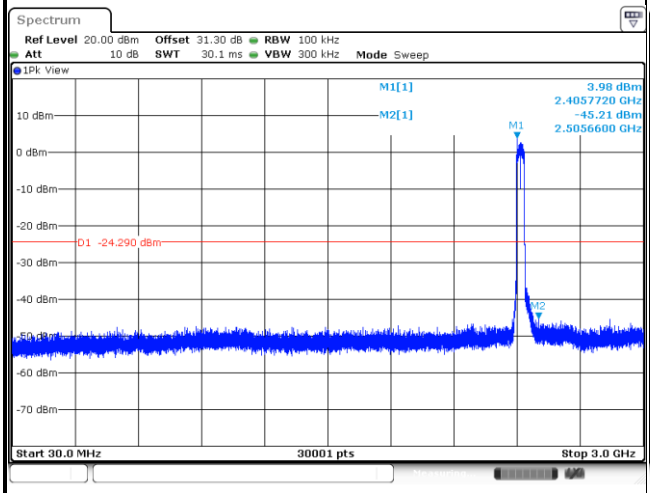
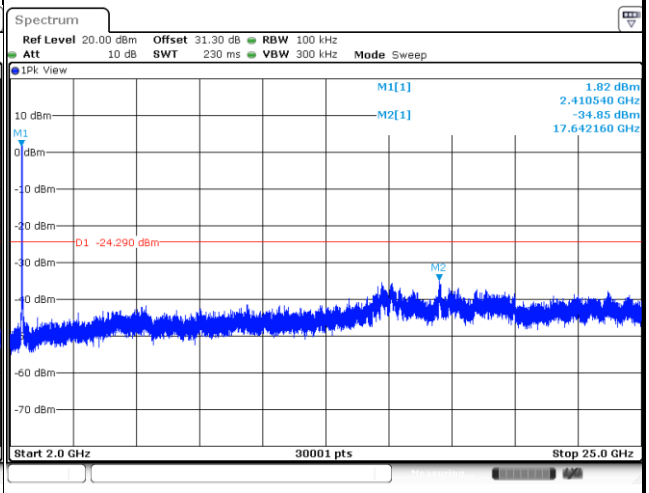
100kHz PSD reference Level	Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

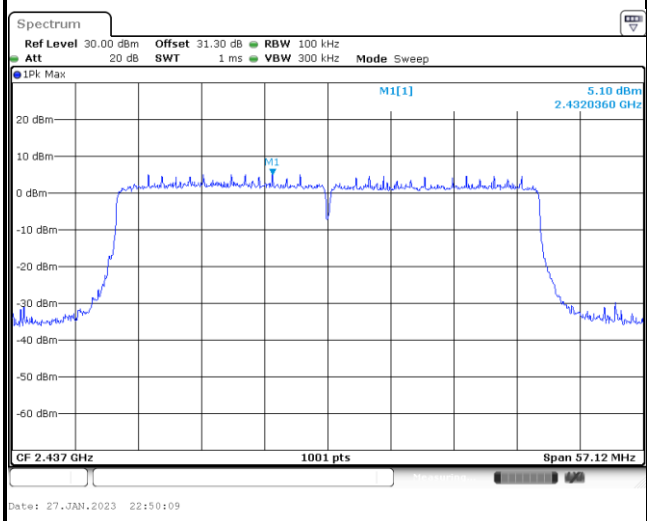
Test Mode :	802.11ax HE20	Test Channel :	11

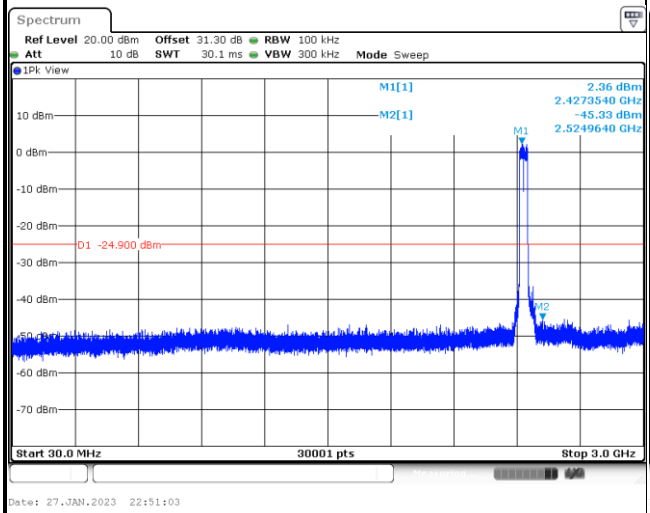
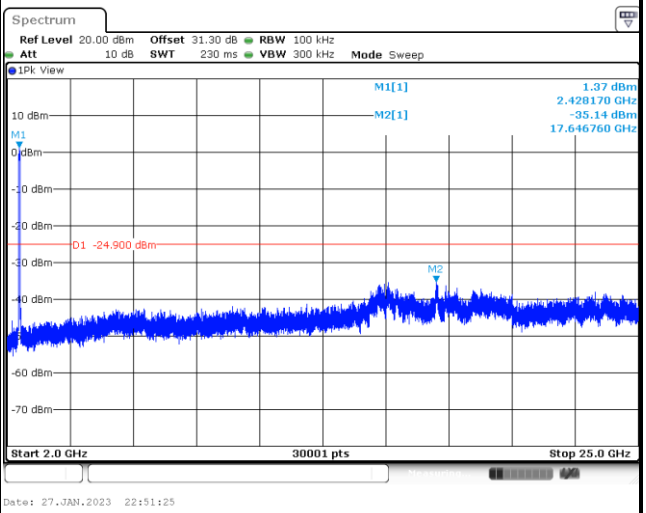
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	03

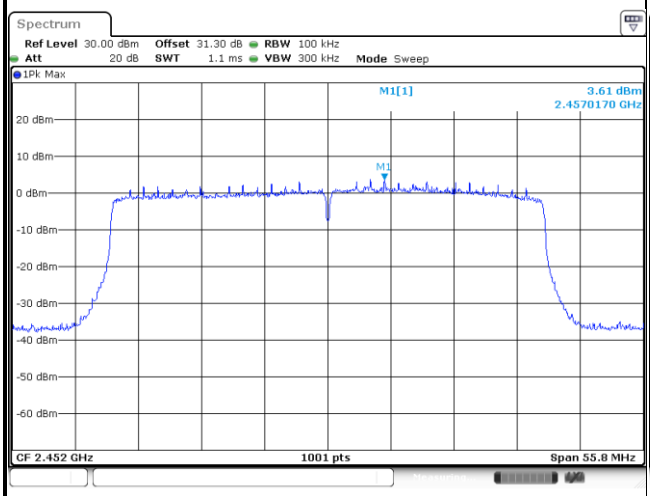
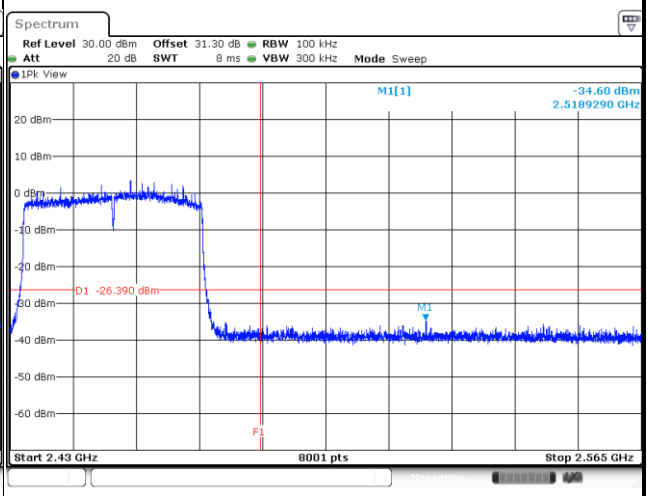
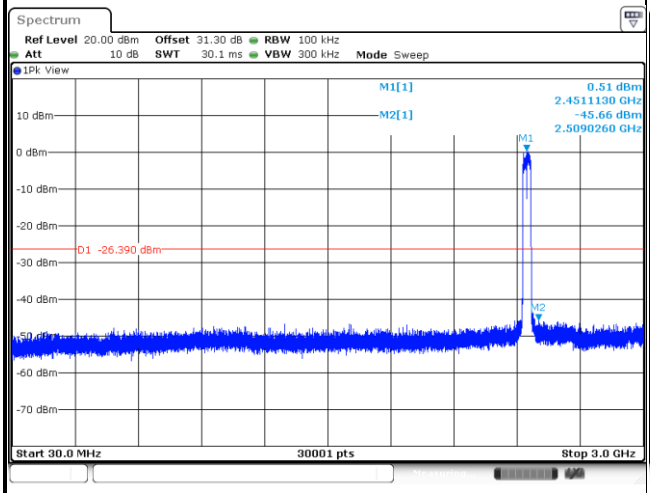
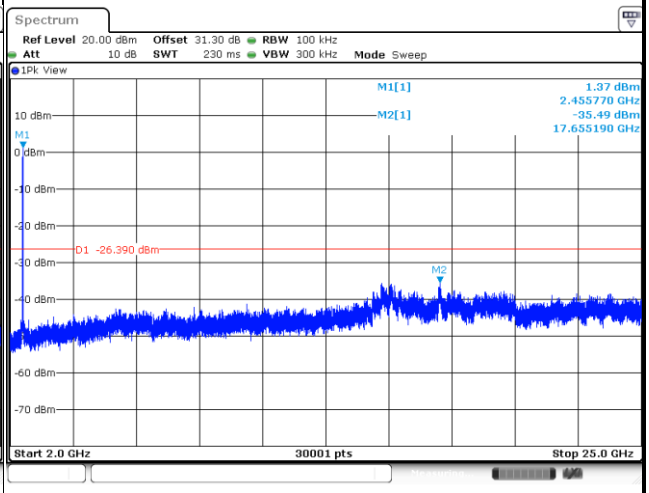
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	06

100kHz PSD reference Level	Channel Plot
	

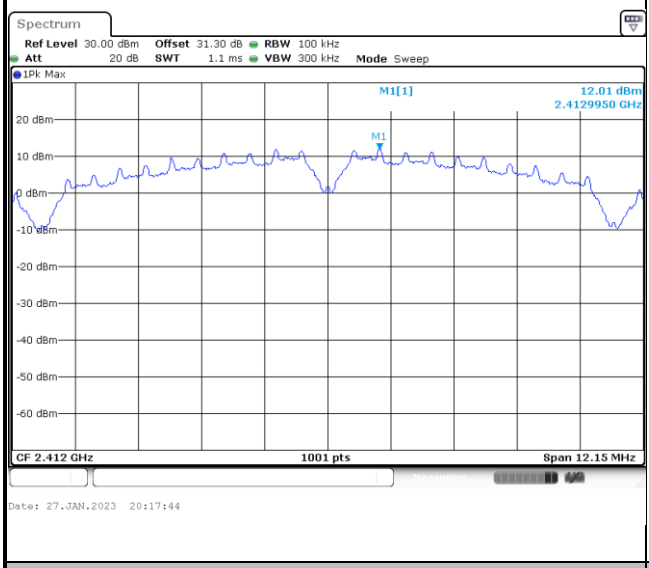
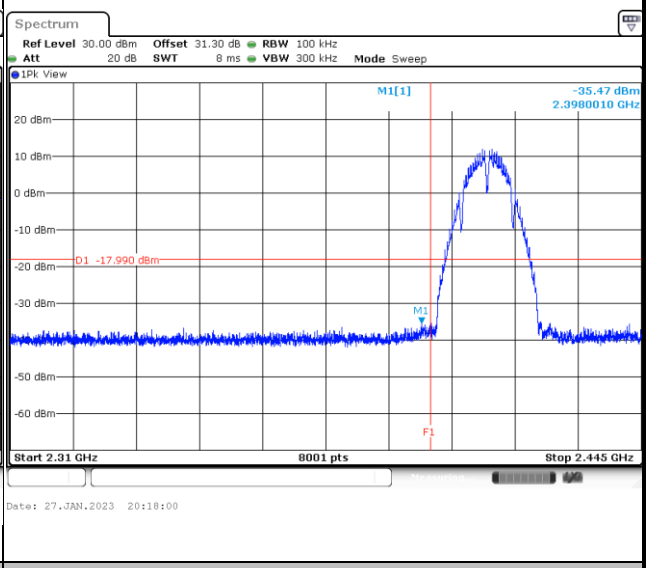
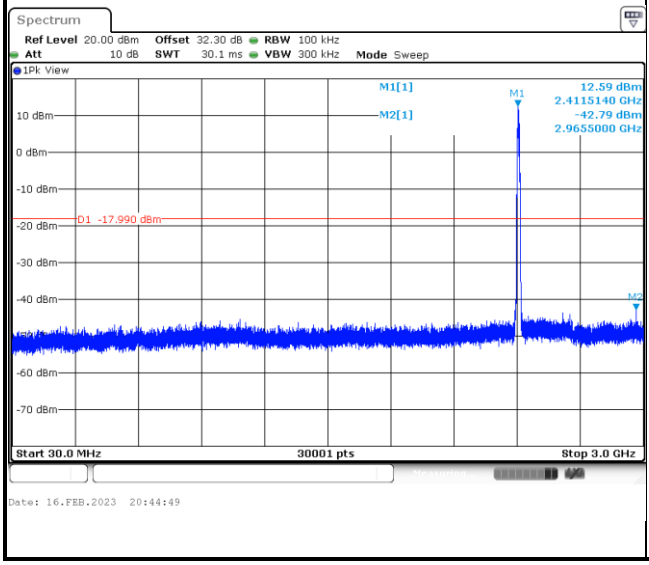
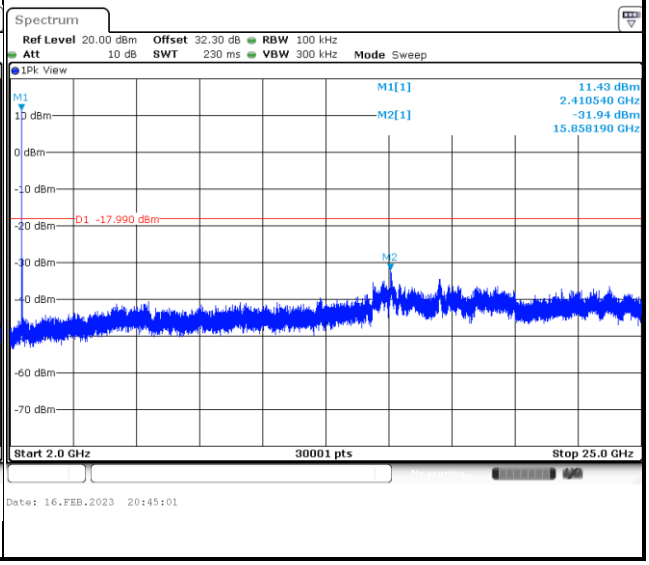
Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11ax HE40	Test Channel :	09

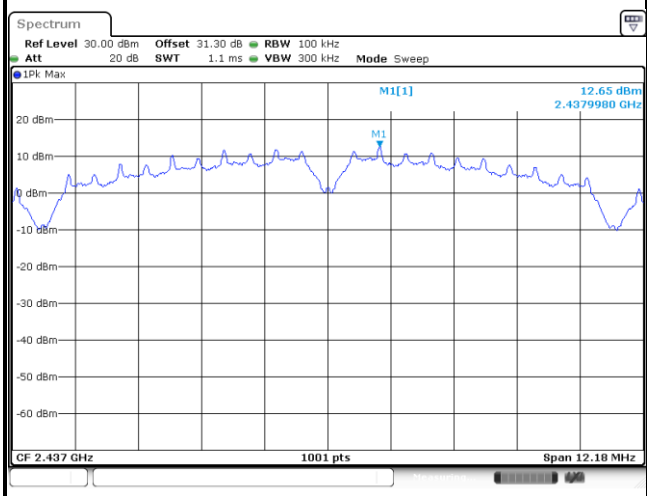
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

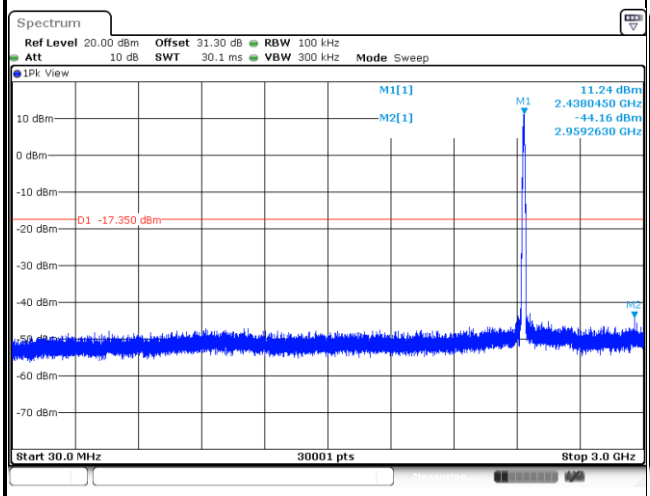
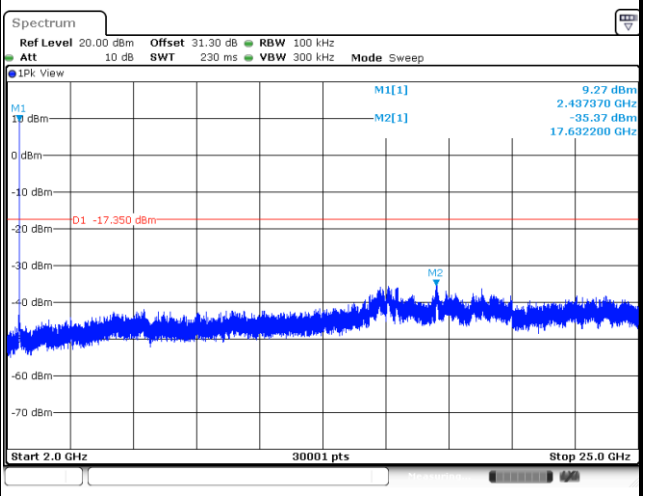
Number of TX = 2, Ant. 1 (Measured)

Test Mode :	802.11b	Test Channel :	01

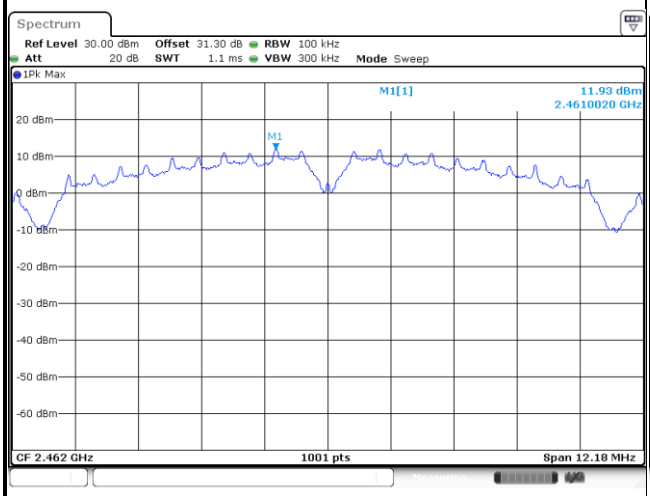
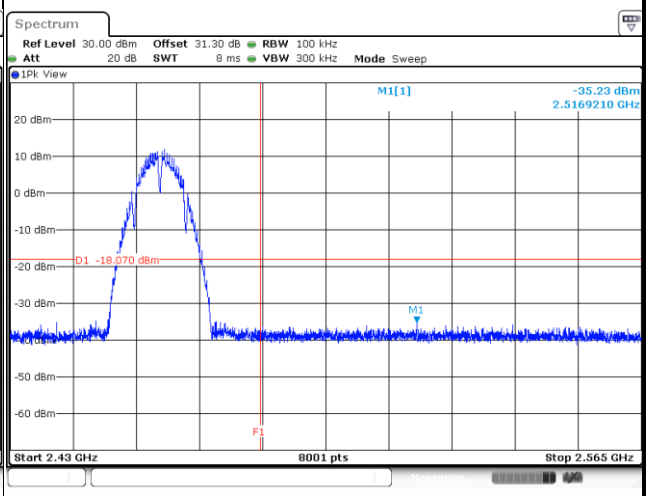
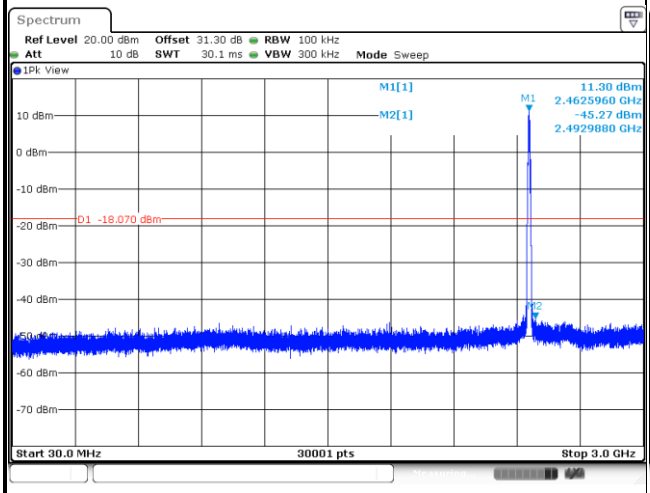
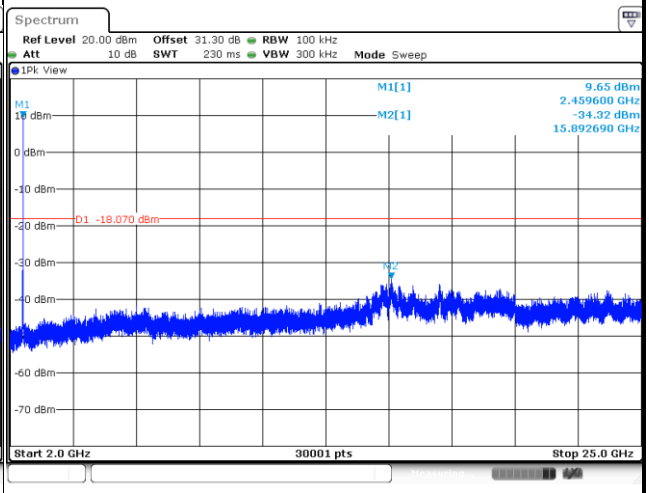
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11b	Test Channel :	06

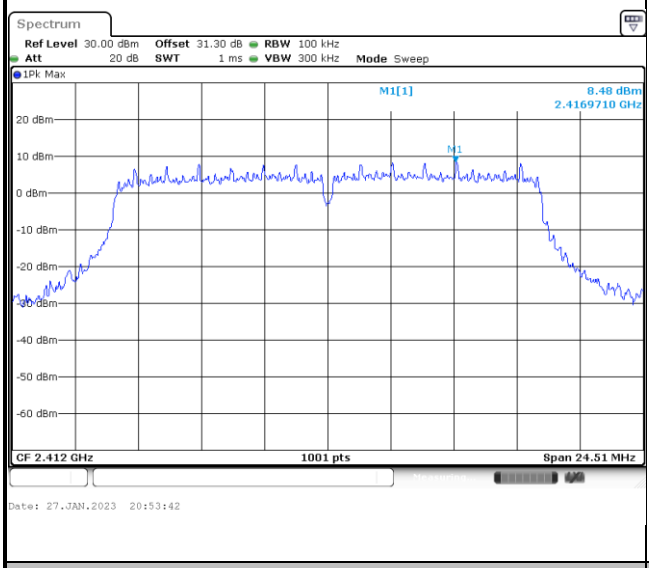
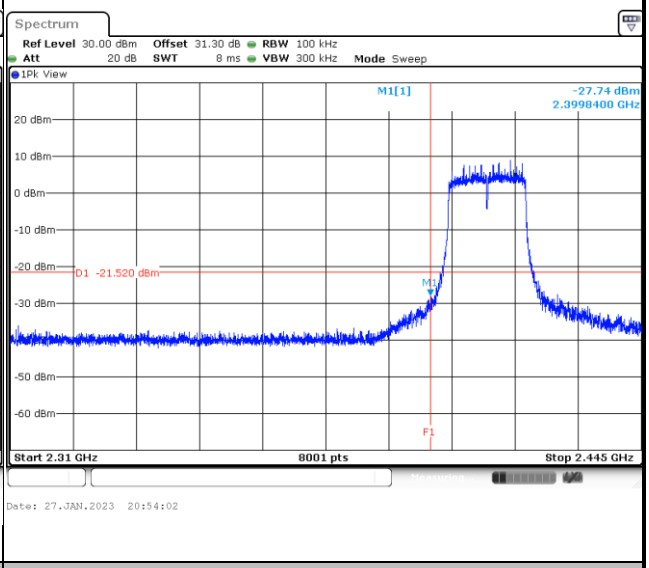
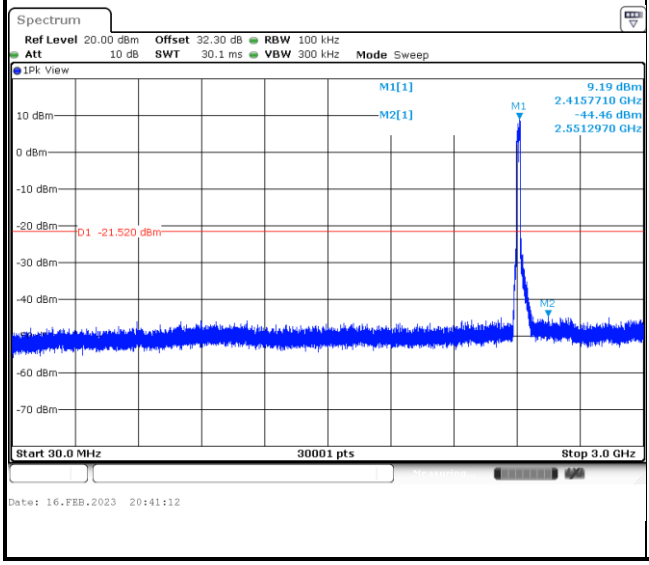
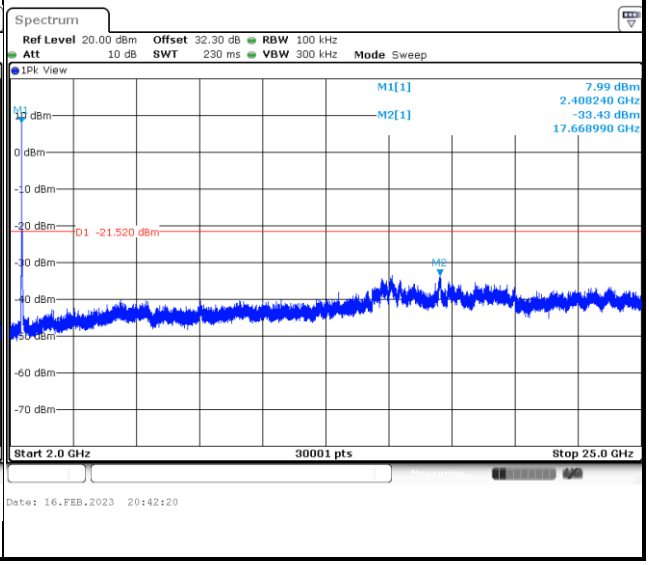
100kHz PSD reference Level	Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

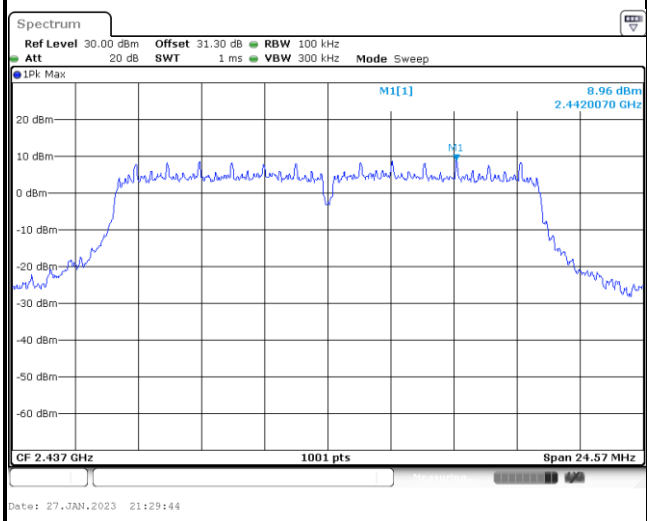
Test Mode :	802.11b	Test Channel :	11

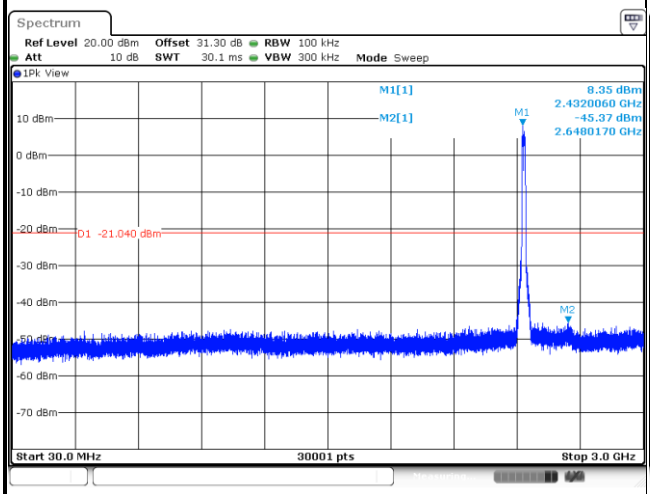
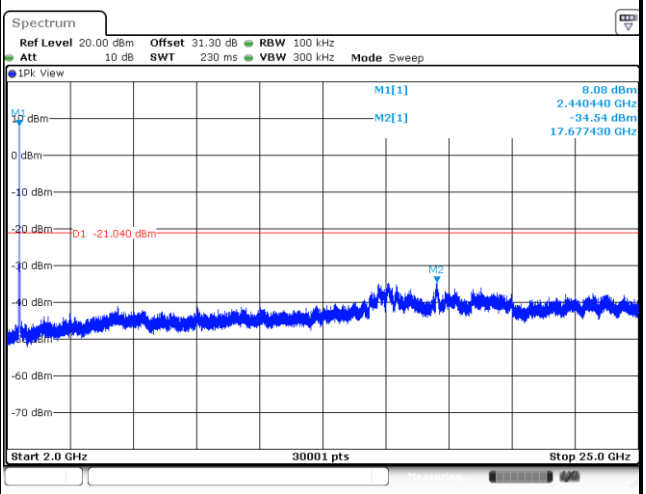
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	01

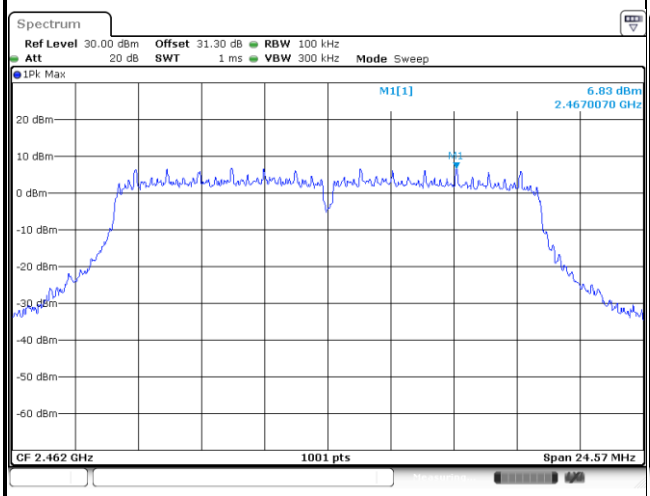
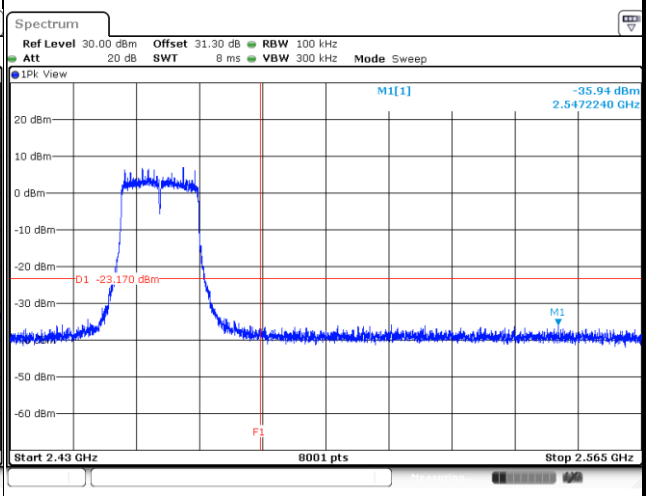
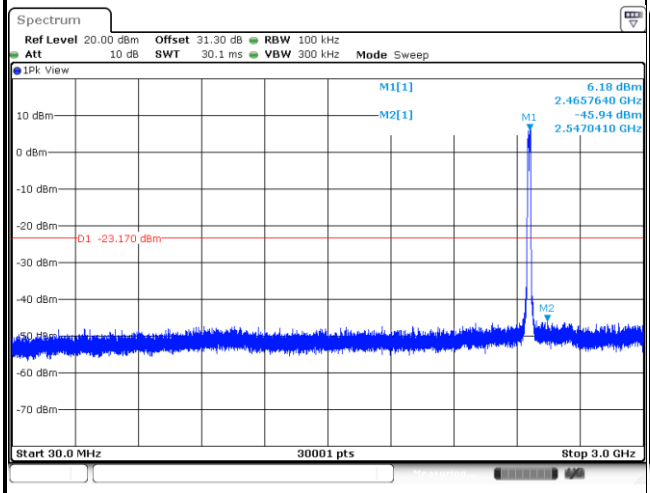
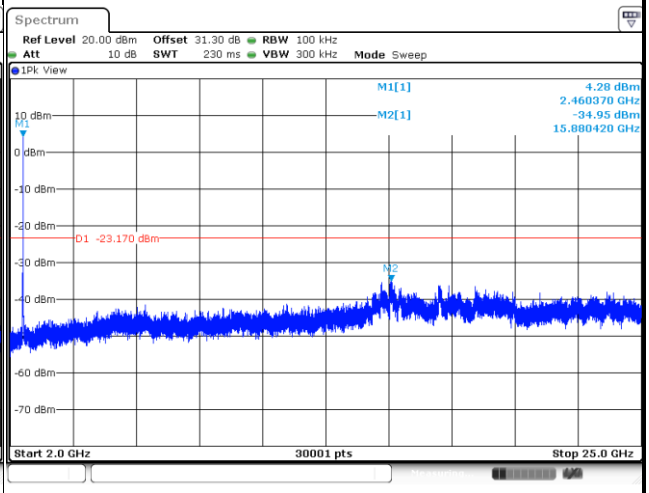
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11g	Test Channel :	06

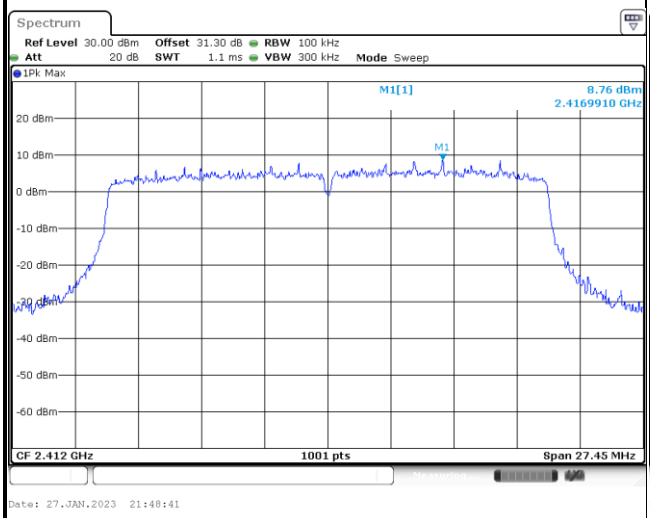
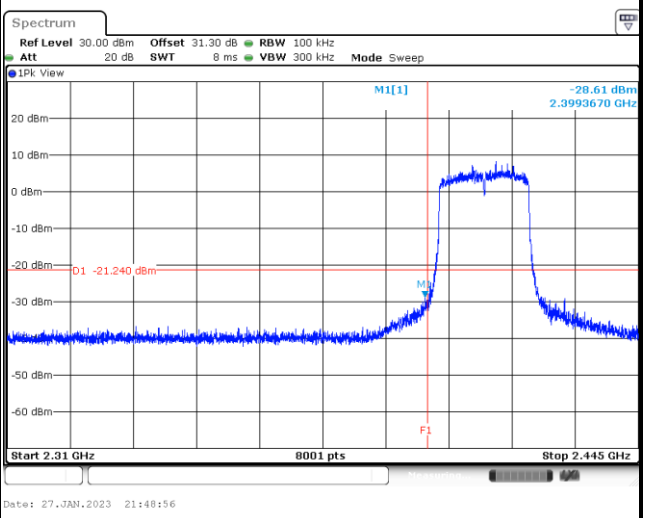
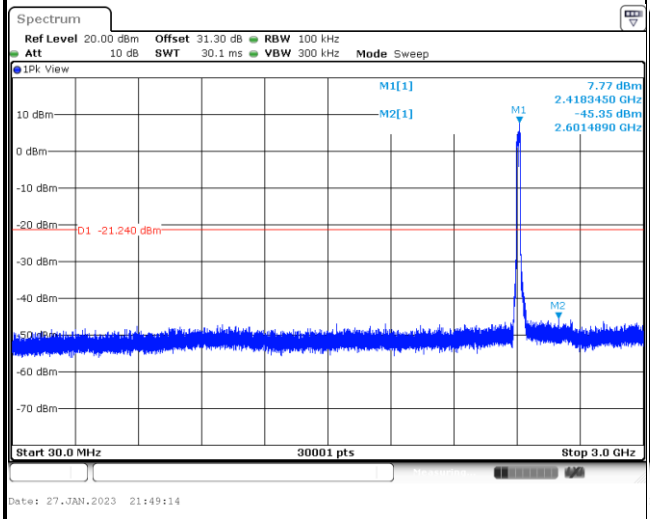
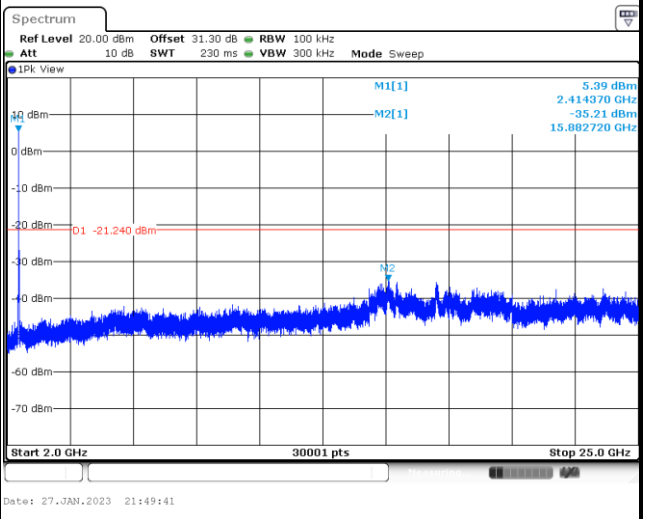
100kHz PSD reference Level	Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

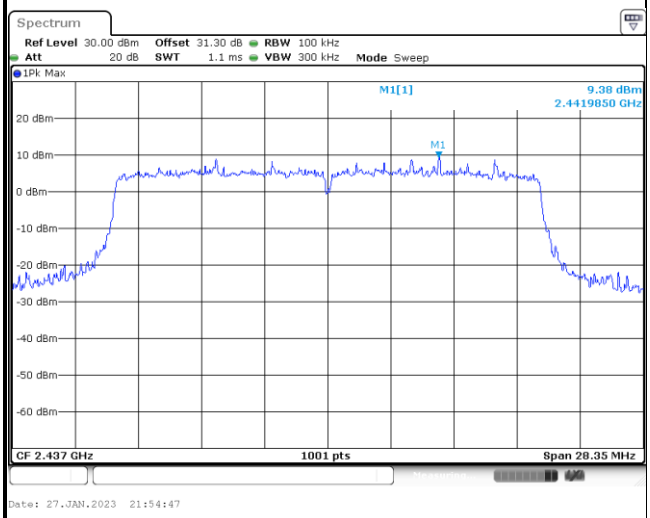
Test Mode :	802.11g	Test Channel :	11

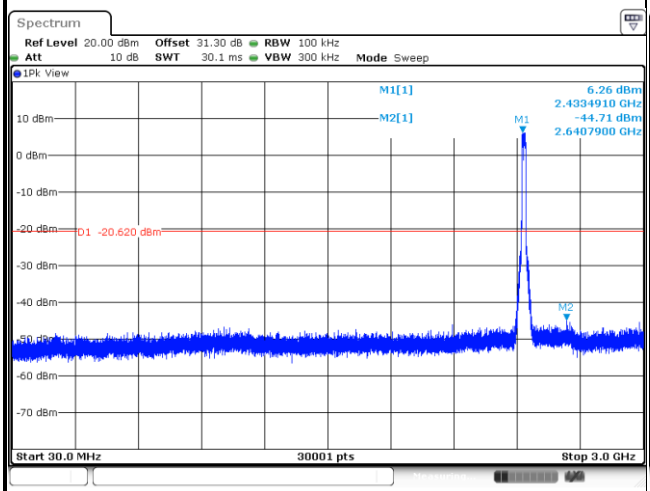
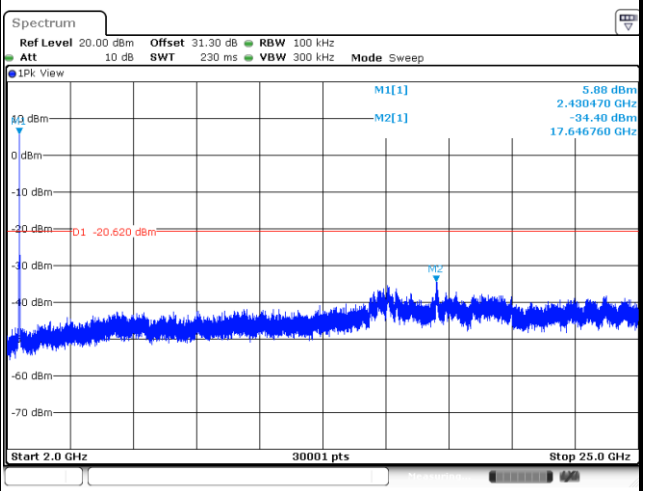
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	01

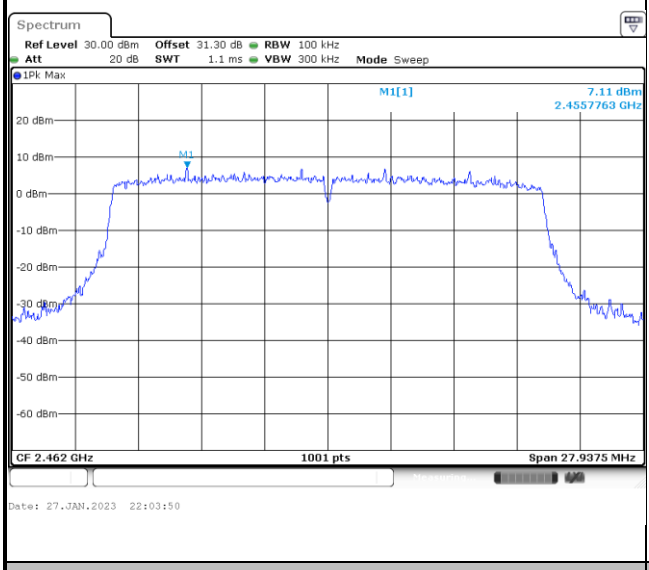
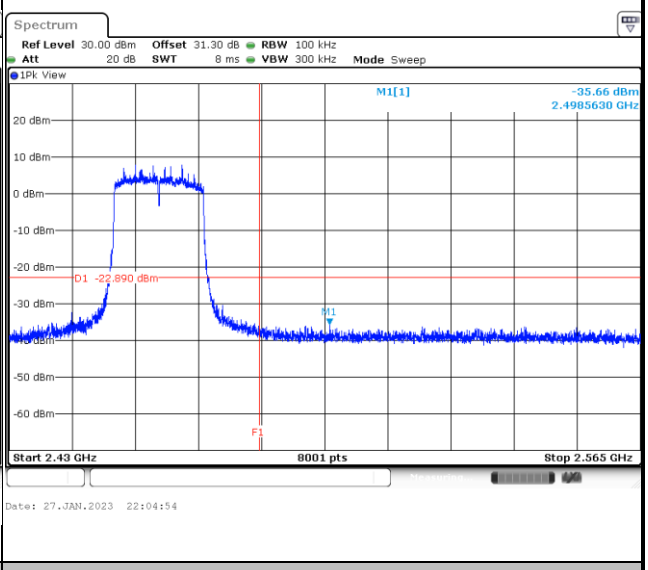
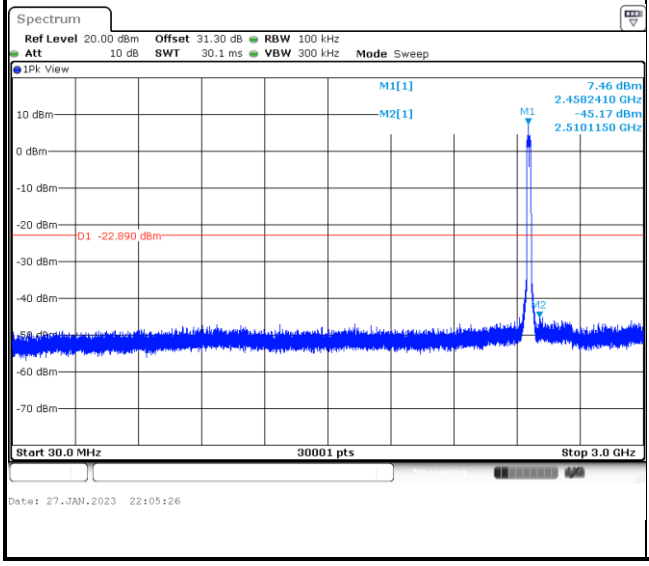
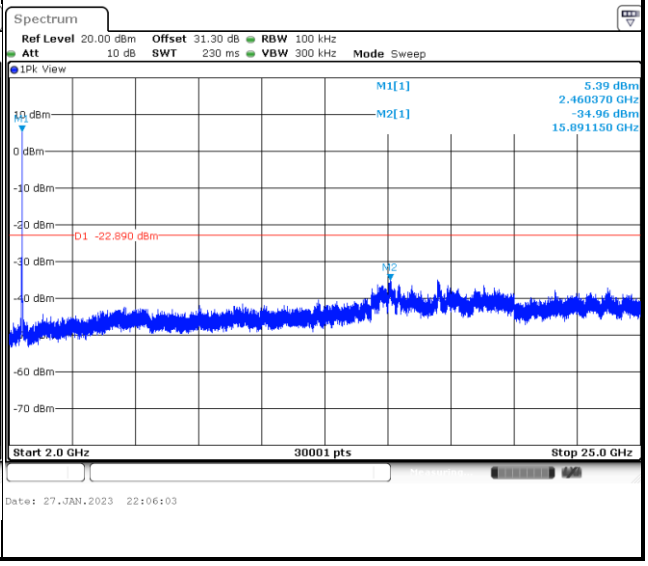
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE20	Test Channel :	06

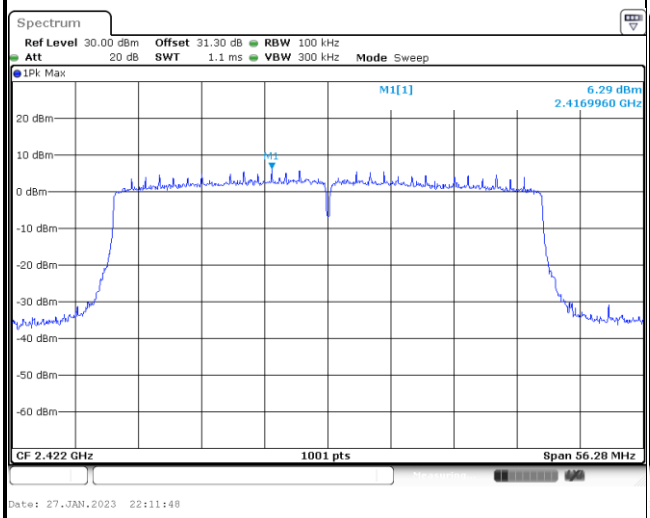
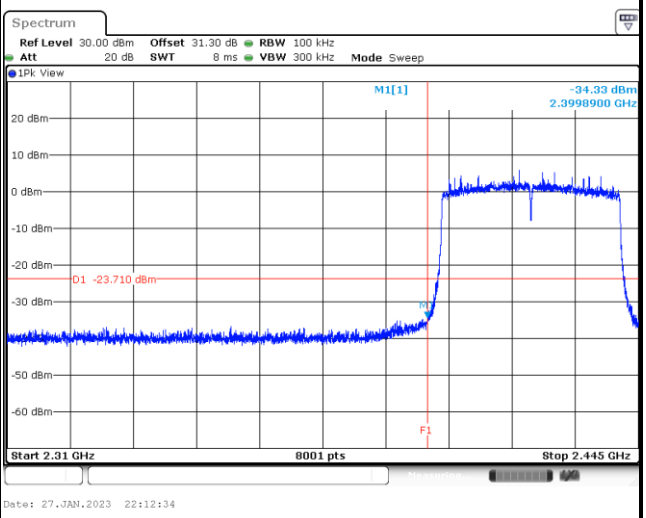
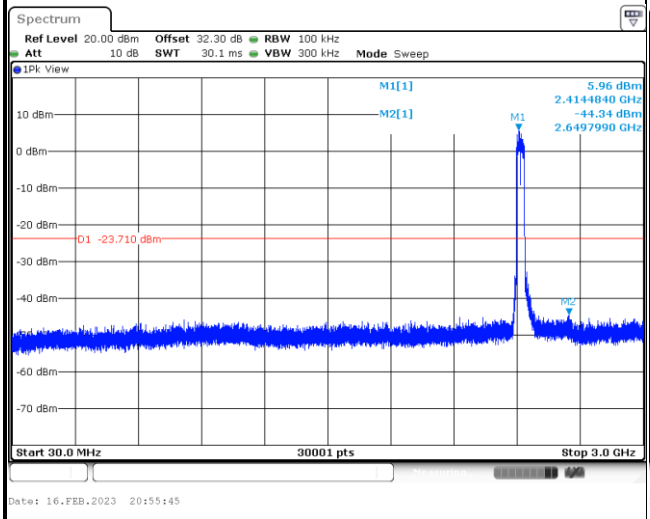
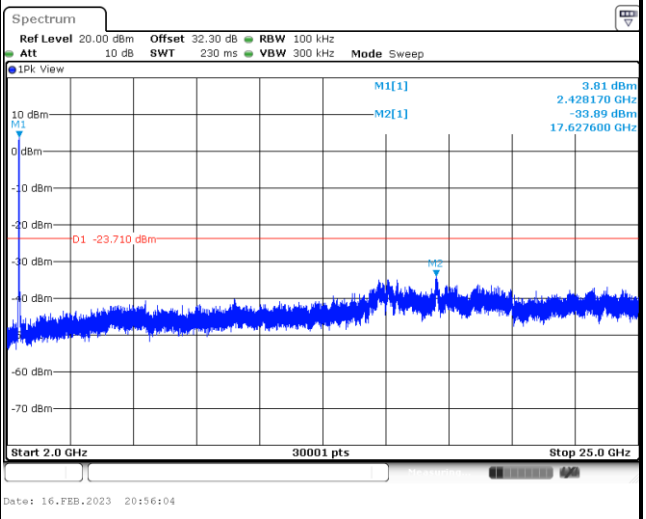
100kHz PSD reference Level	Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

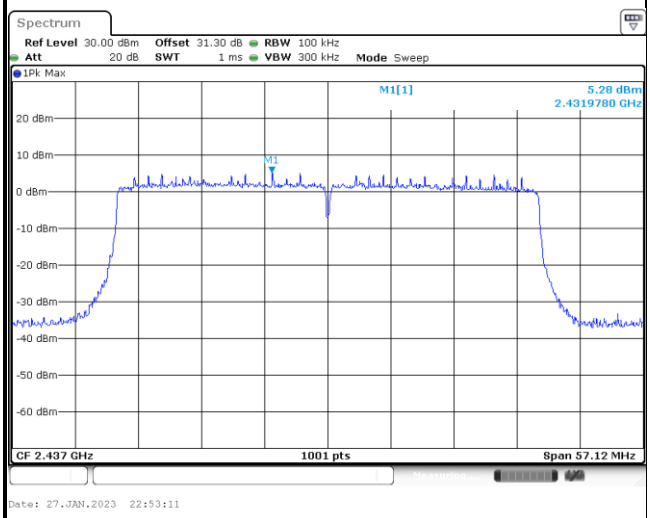
Test Mode :	802.11ax HE20	Test Channel :	11

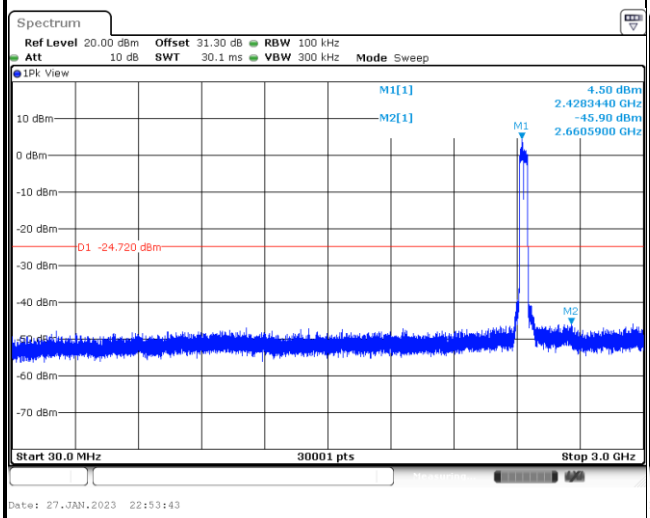
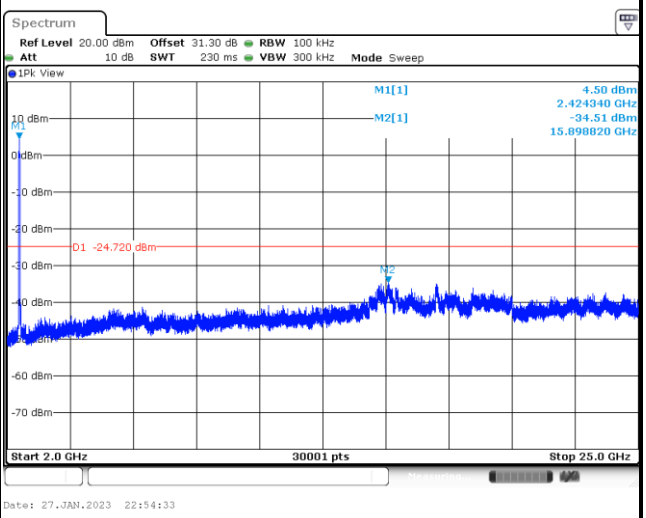
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	03

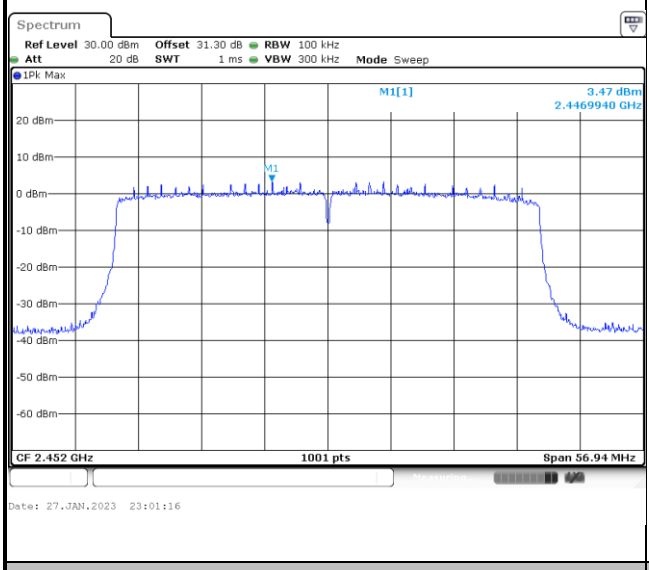
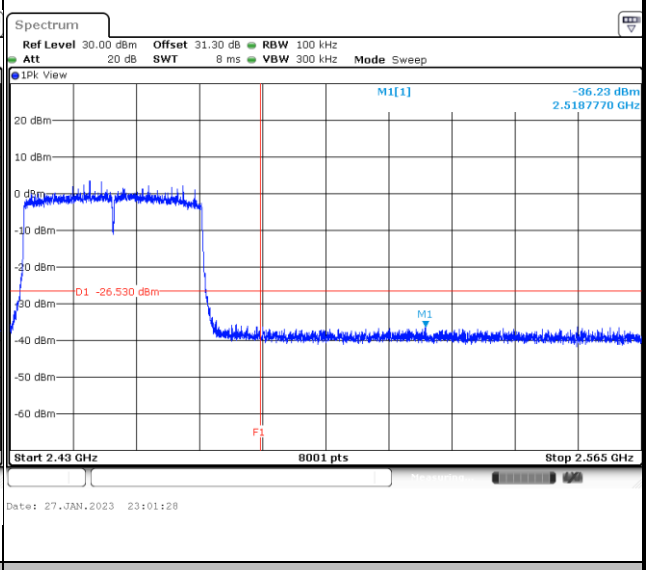
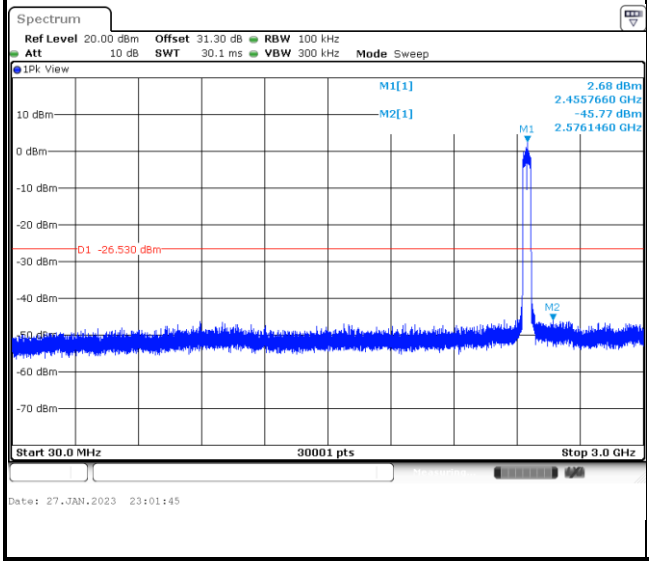
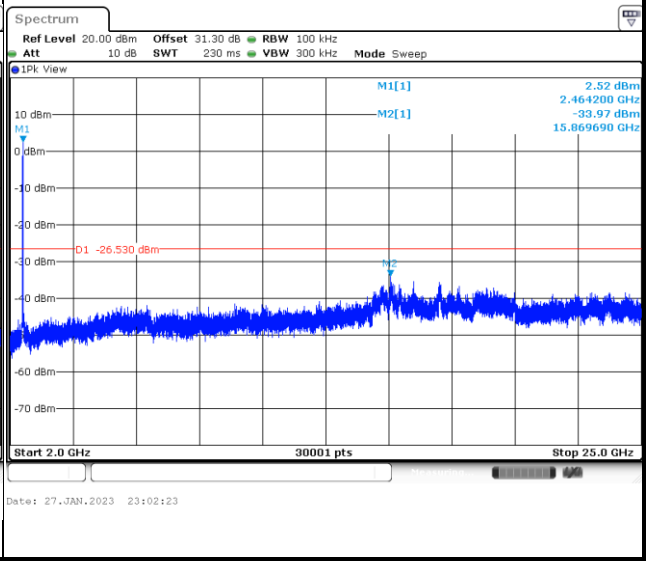
100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

Test Mode :	802.11ax HE40	Test Channel :	06

100kHz PSD reference Level	Channel Plot
	

Spurious Emission 30MHz~3GHz	Spurious Emission 2GHz~25GHz
	

Test Mode :	802.11ax HE40	Test Channel :	09

100kHz PSD reference Level	Channel Plot
	
Spurious Emission 30MHz~3GHz	**Spurious Emission 2GHz~25GHz**
	

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.

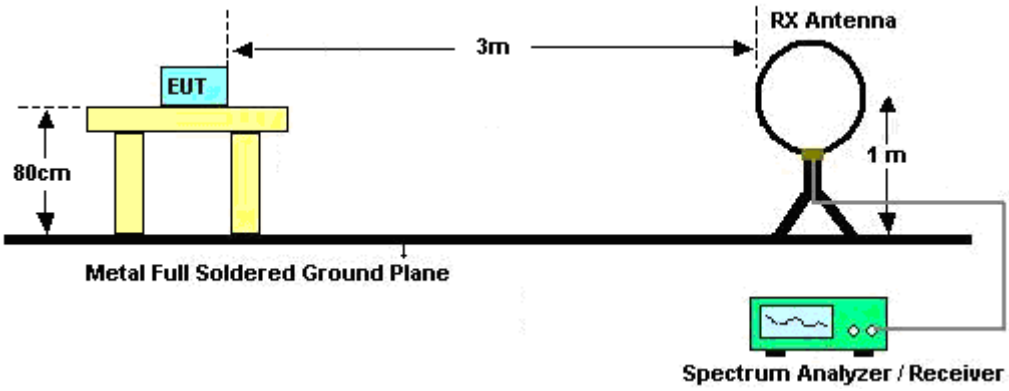
3.5.3 Test Procedures

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 “-“.

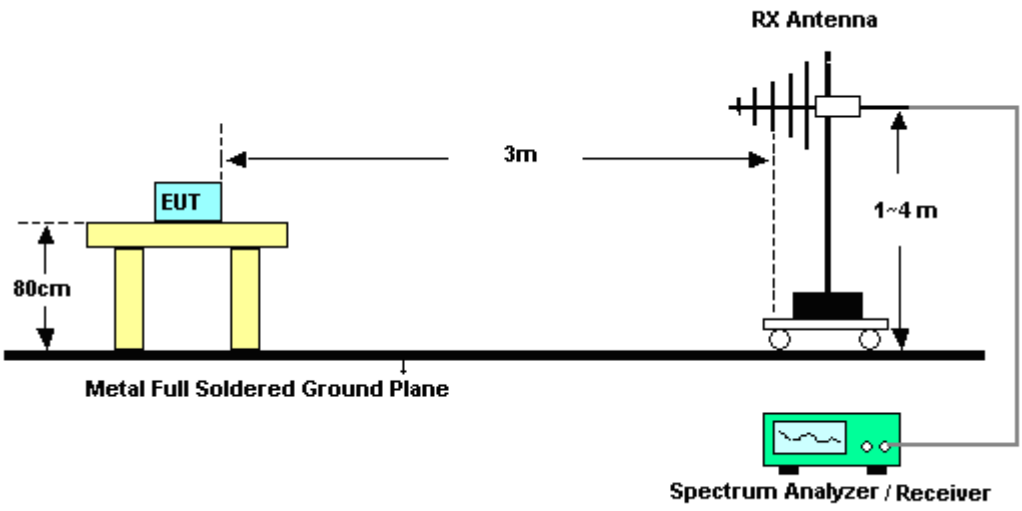
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with 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

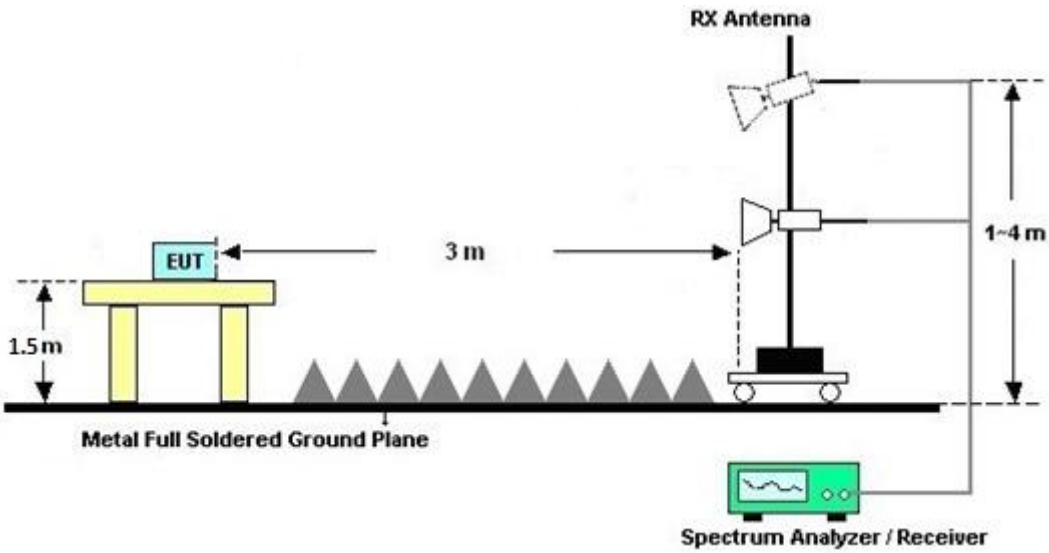
For radiated emissions below 30MHz



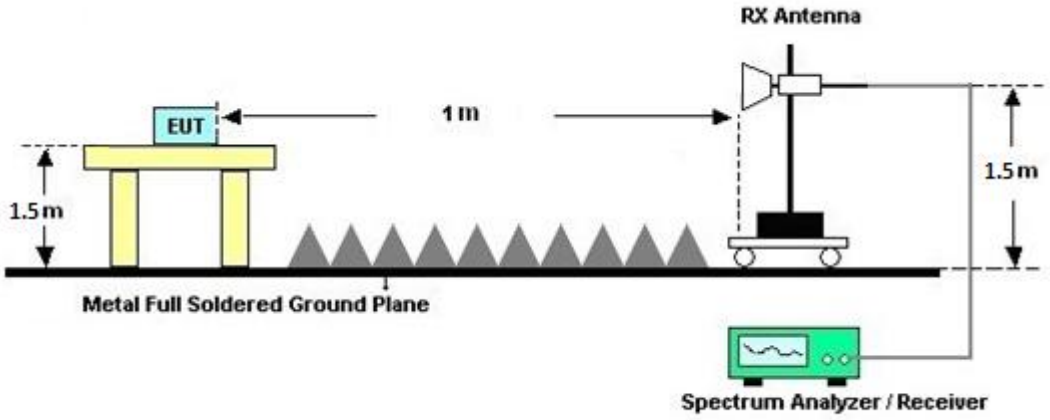
For radiated emissions from 30MHz to 1GHz



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.

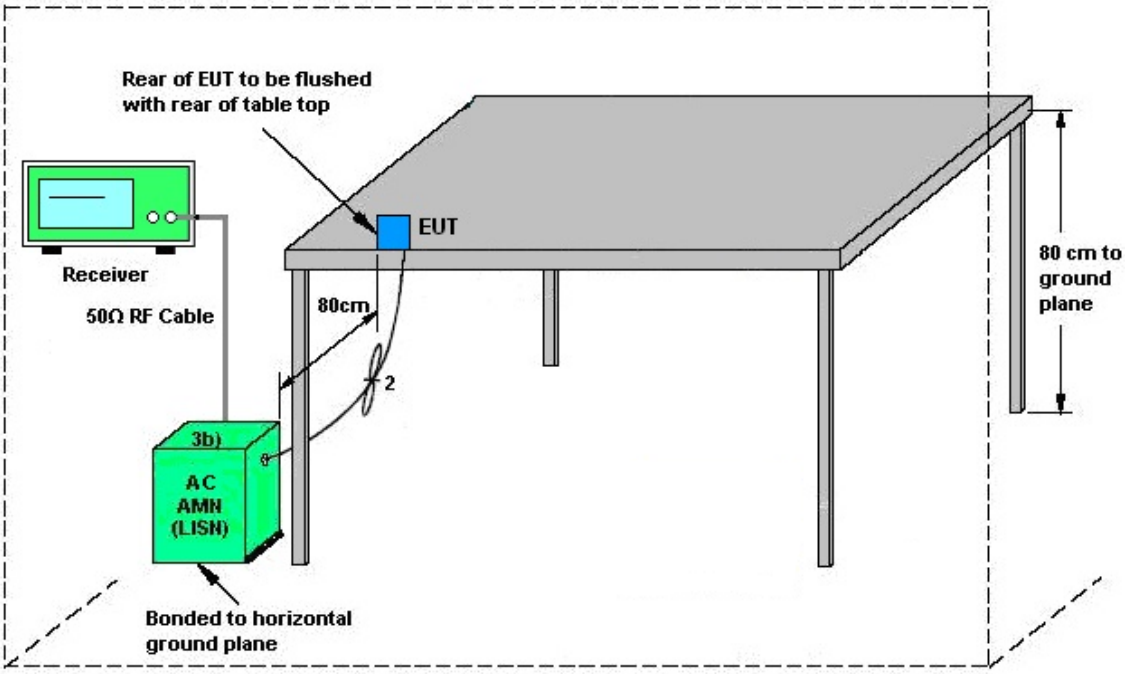
3.6.2 Measuring Instruments

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
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 17, 2022	Jan. 07, 2023~ Feb. 17, 2023	Nov. 16, 2023	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	16I00054SNO12 (NO:113)	10MHz~6GHz	Dec. 13, 2022	Jan. 07, 2023~ Feb. 17, 2023	Dec. 12, 2023	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101905	10Hz - 40GHz(amp)	Aug. 03, 2022	Jan. 07, 2023~ Feb. 17, 2023	Aug. 02, 2023	Conducted (TH05-HY)
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Feb. 14, 2023	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Feb. 14, 2023	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Nov. 01, 2022	Feb. 14, 2023	Oct. 31, 2023	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 16, 2022	Feb. 14, 2023	Mar. 15, 2023	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Feb. 16, 2022	Feb. 14, 2023	Feb. 15, 2023	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Mar. 04, 2022	Feb. 14, 2023	Mar. 03, 2023	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI7	100724	9kHz~7GHz	Feb. 24, 2022	Feb. 14, 2023	Feb. 23, 2023	Conduction (CO07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 20, 2022	Jan. 22, 2023~ Feb. 25, 2023	Sep. 19, 2023	Radiation (03CH16-HY)
Preamplifier	EMEC	EM18G40G	060715	18GHz~40GHz	Dec. 07, 2022	Jan. 22, 2023~ Feb. 25, 2023	Dec. 06, 2023	Radiation (03CH16-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170	00993	18GHz-40GHz	Nov. 24, 2022	Jan. 22, 2023~ Feb. 25, 2023	Nov. 23, 2023	Radiation (03CH16-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1522	1GHz~18GHz	Mar. 10, 2022	Jan. 22, 2023~ Feb. 25, 2023	Mar. 09, 2023	Radiation (03CH16-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00802N1D01N-06	47020 & 06	30MHz~1GHz	Oct. 08, 2022	Jan. 22, 2023~ Feb. 25, 2023	Oct. 07, 2023	Radiation (03CH16-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY57290111	3Hz~26.5GHz	Dec. 15, 2022	Jan. 22, 2023~ Feb. 25, 2023	Dec. 14, 2023	Radiation (03CH16-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200485	10Hz~44GHz	Mar. 07, 2022	Jan. 22, 2023~ Feb. 25, 2023	Mar. 06, 2023	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	805935/4	N/A	Aug. 09, 2022	Jan. 22, 2023~ Feb. 25, 2023	Aug. 08, 2023	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	802434/4	N/A	Aug. 09, 2022	Jan. 22, 2023~ Feb. 25, 2023	Aug. 08, 2023	Radiation (03CH16-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	EC-A5-300-5757	N/A	Aug. 09, 2022	Jan. 22, 2023~ Feb. 25, 2023	Aug. 08, 2023	Radiation (03CH16-HY)
Amplifier	SONOMA	310N	371607	9kHz~1GHz	Jul. 04, 2022	Jan. 22, 2023~ Feb. 25, 2023	Jul. 03, 2023	Radiation (03CH16-HY)
Preamplifier	EMEC	EM1G18G	060812	1GHz~18GHz	Dec. 26, 2022	Jan. 22, 2023~ Feb. 25, 2023	Dec. 25, 2023	Radiation (03CH16-HY)
Preamplifier	Keysight	83017A	MY53270264	1GHz~26.5GHz	Dec. 09, 2022	Jan. 22, 2023~ Feb. 25, 2023	Dec. 08, 2023	Radiation (03CH16-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Jan. 22, 2023~ Feb. 25, 2023	N/A	Radiation (03CH16-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jan. 22, 2023~ Feb. 25, 2023	N/A	Radiation (03CH16-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jan. 22, 2023~ Feb. 25, 2023	N/A	Radiation (03CH16-HY)
Software	Audix	E3 6.2009-8-24	RK-001136	N/A	N/A	Jan. 22, 2023~ Feb. 25, 2023	N/A	Radiation (03CH16-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	3.46 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	6.5 dB

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

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

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

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

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.6 dB

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Hank Hsu	Temperature:	21~25	°C
Test Date:	2023/1/7~2023/2/17	Relative Humidity:	51~54	%

Report Number : FR2D2704C

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
					Ant0	Ant1	Ant0	Ant1		
11b	5.5Mbps	2	1	2412	13.44	13.59	8.10	8.10	0.50	Pass
11b	5.5Mbps	2	6	2437	13.59	13.64	8.12	8.12	0.50	Pass
11b	5.5Mbps	2	11	2462	13.69	13.69	8.12	8.12	0.50	Pass
11g	6Mbps	2	1	2412	17.13	17.18	16.10	16.34	0.50	Pass
11g	6Mbps	2	6	2437	17.33	17.23	16.36	16.38	0.50	Pass
11g	6Mbps	2	11	2462	16.98	17.08	16.10	16.38	0.50	Pass

Report Number : FR2D2704C

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
					Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
11b	5.5Mbps	2	1	2412	20.70	20.70	23.71	30.00		-1.10		22.61		36.00		Pass
11b	5.5Mbps	2	6	2437	20.60	20.60	23.61	30.00		-1.10		22.51		36.00		Pass
11b	5.5Mbps	2	11	2462	20.60	20.60	23.61	30.00		-1.10		22.51		36.00		Pass
11g	6Mbps	2	1	2412	19.30	19.70	22.51	30.00		-1.10		21.41		36.00		Pass
11g	6Mbps	2	6	2437	19.40	19.90	22.67	30.00		-1.10		21.57		36.00		Pass
11g	6Mbps	2	11	2462	18.50	18.40	21.46	30.00		-1.10		20.36		36.00		Pass
HT20	MCS0	2	1	2412	19.10	19.60	22.37	30.00		-1.10		21.27		36.00		Pass
HT20	MCS0	2	6	2437	19.40	20.00	22.72	30.00		-1.10		21.62		36.00		Pass
HT20	MCS0	2	11	2462	18.80	18.80	21.81	30.00		-1.10		20.71		36.00		Pass
HT40	MCS0	2	3	2422	18.40	18.80	21.61	30.00		-1.10		20.51		36.00		Pass
HT40	MCS0	2	6	2437	18.60	18.70	21.66	30.00		-1.10		20.56		36.00		Pass
HT40	MCS0	2	9	2452	16.60	17.00	19.81	30.00		-1.10		18.71		36.00		Pass
VHT20	MCS0	2	1	2412	19.10	19.50	22.31	30.00		-1.10		21.21		36.00		Pass
VHT20	MCS0	2	6	2437	19.50	19.90	22.71	30.00		-1.10		21.61		36.00		Pass
VHT20	MCS0	2	11	2462	18.70	18.80	21.76	30.00		-1.10		20.66		36.00		Pass
VHT40	MCS0	2	3	2422	18.30	18.80	21.57	30.00		-1.10		20.47		36.00		Pass
VHT40	MCS0	2	6	2437	18.60	18.70	21.66	30.00		-1.10		20.56		36.00		Pass
VHT40	MCS0	2	9	2452	16.60	16.90	19.76	30.00		-1.10		18.66		36.00		Pass

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

Report Number : FR2D2704C

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
					Ant0	Ant1	Worse + 3.01	Ant0	Ant1	Ant0	Ant1	
11b	5.5Mbps	2	1	2412	-2.02	-1.93	1.08	1.85		8.00		Pass
11b	5.5Mbps	2	6	2437	-2.90	-2.83	0.18	1.85		8.00		Pass
11b	5.5Mbps	2	11	2462	-2.12	-2.51	0.89	1.85		8.00		Pass
11g	6Mbps	2	1	2412	-6.97	-6.98	-3.96	1.85		8.00		Pass
11g	6Mbps	2	6	2437	-5.86	-5.40	-2.39	1.85		8.00		Pass
11g	6Mbps	2	11	2462	-7.02	-7.04	-4.01	1.85		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
						Ant0	Ant1	Ant0	Ant1		
HE20	MCS0	2	1	2412	Full	19.38	19.43	18.20	18.30	0.50	Pass
HE20	MCS0	2	6	2437	Full	19.68	19.58	18.88	18.90	0.50	Pass
HE20	MCS0	2	11	2462	Full	19.38	19.38	18.83	18.63	0.50	Pass
HE40	MCS0	2	3	2422	Full	37.76	37.96	36.52	37.52	0.50	Pass
HE40	MCS0	2	6	2437	Full	38.16	38.06	38.08	38.08	0.50	Pass
HE40	MCS0	2	9	2452	Full	37.86	37.86	37.20	37.96	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
						Ant0	Ant1	SUM	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	Ant0	Ant1	
HE20	MCS0	2	1	2412	Full	19.20	19.60	22.41	30.00		-1.10		21.31		36.00		Pass
HE20	MCS0	2	1	2412	26/0	10.80	10.90	13.86	30.00		-1.10		12.76		36.00		Pass
HE20	MCS0	2	1	2412	52/37	13.50	13.80	16.66	30.00		-1.10		15.56		36.00		Pass
HE20	MCS0	2	1	2412	106/53	16.50	16.80	19.66	30.00		-1.10		18.56		36.00		Pass
HE20	MCS0	2	6	2437	Full	19.50	20.00	22.77	30.00		-1.10		21.67		36.00		Pass
HE20	MCS0	2	6	2437	26/4	11.80	11.60	14.71	30.00		-1.10		13.61		36.00		Pass
HE20	MCS0	2	6	2437	52/38	14.30	14.20	17.26	30.00		-1.10		16.16		36.00		Pass
HE20	MCS0	2	6	2437	106/53	17.80	17.80	20.81	30.00		-1.10		19.71		36.00		Pass
HE20	MCS0	2	11	2462	Full	18.80	18.90	21.86	30.00		-1.10		20.76		36.00		Pass
HE20	MCS0	2	11	2462	26/8	9.70	10.50	13.13	30.00		-1.10		12.03		36.00		Pass
HE20	MCS0	2	11	2462	52/40	13.50	13.90	16.71	30.00		-1.10		15.61		36.00		Pass
HE20	MCS0	2	11	2462	106/54	16.10	16.30	19.21	30.00		-1.10		18.11		36.00		Pass
HE40	MCS0	2	3	2422	Full	18.70	19.00	21.86	30.00		-1.10		20.76		36.00		Pass
HE40	MCS0	2	3	2422	242/61	16.90	17.30	20.11	30.00		-1.10		19.01		36.00		Pass
HE40	MCS0	2	6	2437	Full	18.70	18.70	21.71	30.00		-1.10		20.61		36.00		Pass
HE40	MCS0	2	6	2437	242/61	17.10	16.90	20.01	30.00		-1.10		18.91		36.00		Pass
HE40	MCS0	2	9	2452	Full	16.70	17.00	19.86	30.00		-1.10		18.76		36.00		Pass
HE40	MCS0	2	9	2452	242/62	14.60	14.60	17.61	30.00		-1.10		16.51		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
						Ant0	Ant1	Worse + 3.01	Ant0	Ant1	Ant0	Ant1	
HE20	MCS0	2	1	2412	Full	-6.51	-5.50	-2.49	1.85		8.00		Pass
HE20	MCS0	2	1	2412	26/0	-5.82	-6.48	-2.81	1.85		8.00		Pass
HE20	MCS0	2	1	2412	52/37	-6.21	-5.88	-2.87	1.85		8.00		Pass
HE20	MCS0	2	1	2412	106/53	-5.69	-5.63	-2.62	1.85		8.00		Pass
HE20	MCS0	2	6	2437	Full	-5.82	-4.68	-1.67	1.85		8.00		Pass
HE20	MCS0	2	6	2437	26/4	-4.84	-4.99	-1.83	1.85		8.00		Pass
HE20	MCS0	2	6	2437	52/38	-5.36	-5.03	-2.02	1.85		8.00		Pass
HE20	MCS0	2	6	2437	106/53	-4.83	-5.12	-1.82	1.85		8.00		Pass
HE20	MCS0	2	11	2462	Full	-7.22	-5.76	-2.75	1.85		8.00		Pass
HE20	MCS0	2	11	2462	26/8	-6.79	-6.10	-3.09	1.85		8.00		Pass
HE20	MCS0	2	11	2462	52/40	-6.25	-5.91	-2.90	1.85		8.00		Pass
HE20	MCS0	2	11	2462	106/54	-6.05	-5.90	-2.89	1.85		8.00		Pass
HE40	MCS0	2	3	2422	Full	-8.17	-7.89	-4.88	1.85		8.00		Pass
HE40	MCS0	2	3	2422	242/61	-8.50	-8.03	-5.02	1.85		8.00		Pass
HE40	MCS0	2	6	2437	Full	-9.45	-8.24	-5.23	1.85		8.00		Pass
HE40	MCS0	2	6	2437	242/61	-8.30	-8.78	-5.29	1.85		8.00		Pass
HE40	MCS0	2	9	2452	Full	-11.33	-11.73	-8.32	1.85		8.00		Pass
HE40	MCS0	2	9	2452	242/62	-11.60	-11.47	-8.46	1.85		8.00		Pass

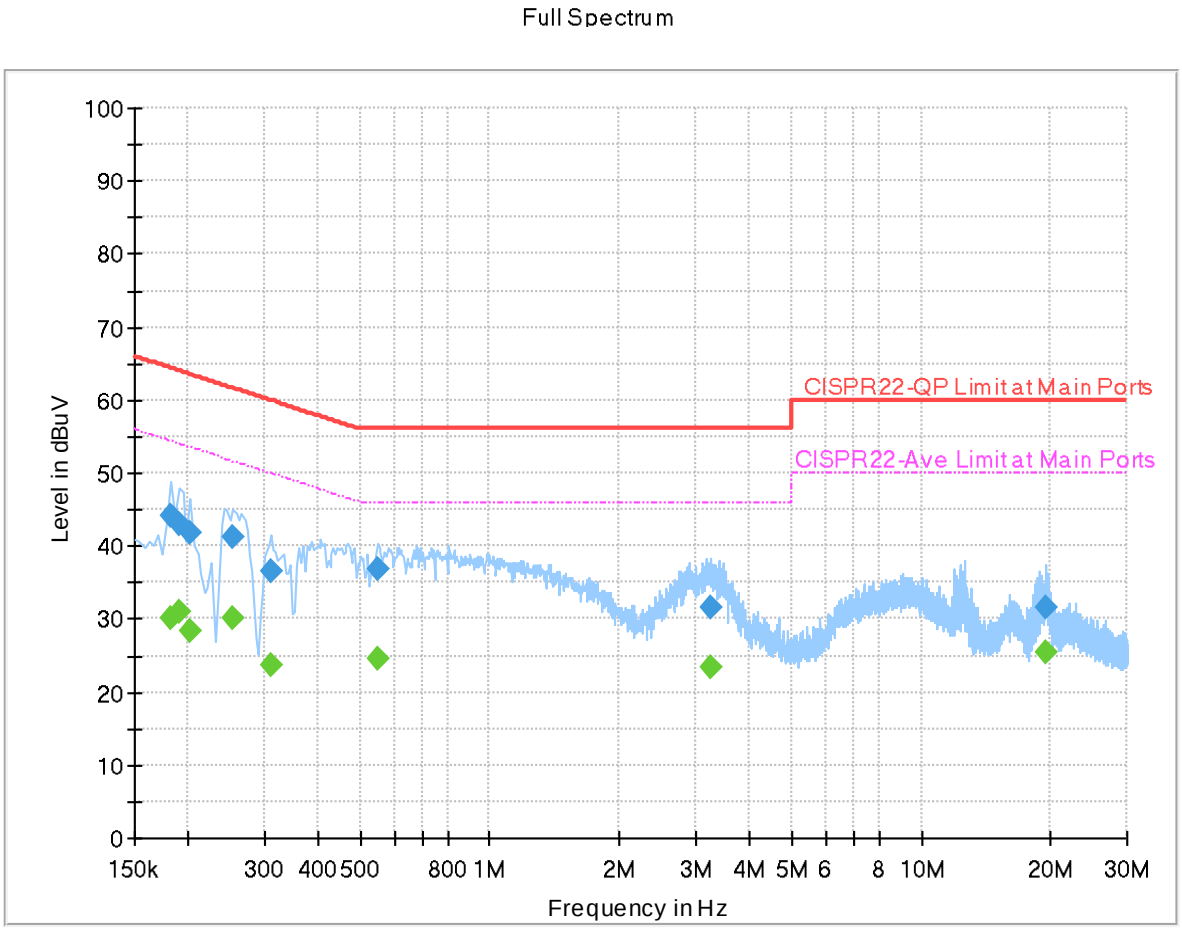
Measured power density (dBm) has offset with cable loss.

Appendix B. AC Conducted Emission Test Results

Test Engineer :	Louis Chung	Temperature :	20.2~23.4℃
		Relative Humidity :	55.6~71.3%

EUT Information

Report NO :	2D2704
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line

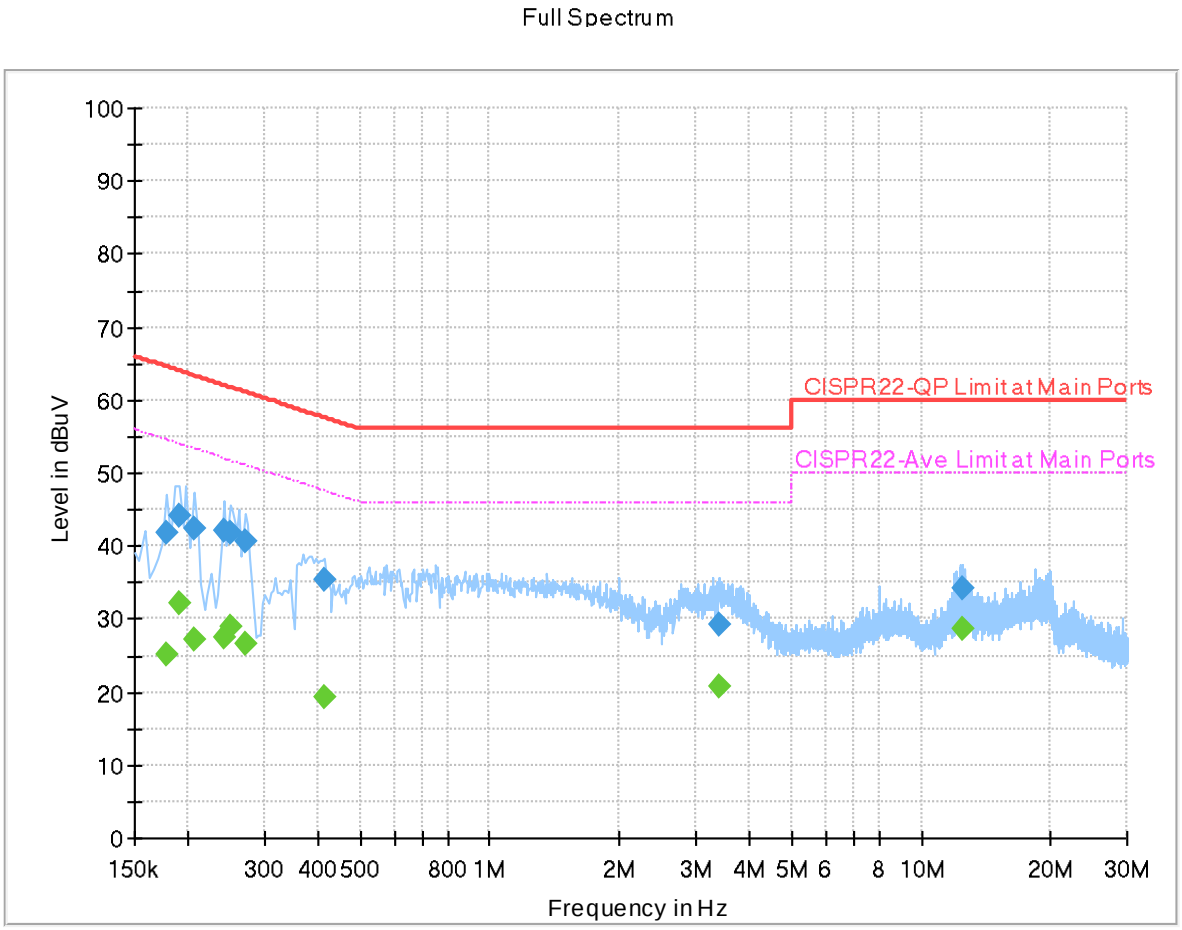


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.182000	---	30.05	54.39	24.34	L1	OFF	20.0
0.182000	44.15	---	64.39	20.24	L1	OFF	20.0
0.190000	---	30.93	54.04	23.11	L1	OFF	20.0
0.190000	43.06	---	64.04	20.98	L1	OFF	20.0
0.202000	---	28.31	53.53	25.22	L1	OFF	20.0
0.202000	41.71	---	63.53	21.82	L1	OFF	20.0
0.254000	---	30.25	51.63	21.38	L1	OFF	20.0
0.254000	41.34	---	61.63	20.29	L1	OFF	20.0
0.310000	---	23.80	49.97	26.17	L1	OFF	20.0
0.310000	36.47	---	59.97	23.50	L1	OFF	20.0
0.550000	---	24.65	46.00	21.35	L1	OFF	20.0
0.550000	36.70	---	56.00	19.30	L1	OFF	20.0
3.258000	---	23.31	46.00	22.69	L1	OFF	20.0
3.258000	31.47	---	56.00	24.53	L1	OFF	20.0
19.354000	---	25.58	50.00	24.42	L1	OFF	20.2
19.354000	31.53	---	60.00	28.47	L1	OFF	20.2

EUT Information

Report NO :	2D2704
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)
0.178000	41.95	---	64.58	22.63	N	OFF	20.0
0.178000	---	25.17	54.58	29.41	N	OFF	20.0
0.190000	44.19	---	64.04	19.85	N	OFF	20.0
0.190000	---	32.18	54.04	21.86	N	OFF	20.0
0.206000	42.37	---	63.37	21.00	N	OFF	20.0
0.206000	---	27.20	53.37	26.17	N	OFF	20.0
0.242000	42.08	---	62.03	19.95	N	OFF	20.0
0.242000	---	27.48	52.03	24.55	N	OFF	20.0
0.250000	41.85	---	61.76	19.91	N	OFF	20.0
0.250000	---	28.95	51.76	22.81	N	OFF	20.0
0.270000	40.78	---	61.12	20.34	N	OFF	20.0
0.270000	---	26.54	51.12	24.58	N	OFF	20.0
0.414000	35.48	---	57.57	22.09	N	OFF	20.0
0.414000	---	19.22	47.57	28.35	N	OFF	20.0
3.398000	29.17	---	56.00	26.83	N	OFF	20.1
3.398000	---	20.72	46.00	25.28	N	OFF	20.1
12.486000	34.10	---	60.00	25.90	N	OFF	20.2
12.486000	---	28.77	50.00	21.23	N	OFF	20.2

Appendix C. Radiated Spurious Emission

Test Engineer :	Andy Yang, Karl Hou and Gary Guo	**Temperature :**	18~23°C
		Relative Humidity :	50~65%

<Sample 1 with Battery 1>

2.4GHz 2400~2483.5MHz

WIFI 802.11b (Band Edge @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant. 0+1		(MHz)	(dBμV/m)	Limit (dB)	Line (dBμV/m)	Level (dBμV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg. (P/A)	(H/V)
802.11b CH 01 2412MHz		2390	54.69	-19.31	74	40.44	27.36	17.36	30.47	116	38	P	H
		2390	43	-11	54	28.75	27.36	17.36	30.47	116	38	A	H
	*	2412	116.46	-	-	102.05	27.47	17.4	30.46	116	38	P	H
	*	2412	113.23	-	-	98.82	27.47	17.4	30.46	116	38	A	H
													H
													H
		2385.915	54.09	-19.91	74	39.87	27.34	17.35	30.47	370	169	P	V
		2389.905	42.7	-11.3	54	28.45	27.36	17.36	30.47	370	169	A	V
	*	2412	114.29	-	-	99.88	27.47	17.4	30.46	370	169	P	V
	*	2412	111.08	-	-	96.67	27.47	17.4	30.46	370	169	A	V
													V
													V
802.11b CH 06 2437MHz		2388.96	54.46	-19.54	74	40.21	27.36	17.28	30.48	131	72	P	H
		2389.24	42.67	-11.33	54	28.42	27.36	17.36	30.47	131	72	A	H
	*	2437	116.02	-	-	101.41	27.62	17.44	30.45	131	72	P	H
	*	2437	112.89	-	-	98.28	27.62	17.44	30.45	131	72	A	H
		2486.07	55.26	-18.74	74	40.34	27.84	17.51	30.44	131	72	P	H
		2485.65	45.79	-8.21	54	30.87	27.84	17.51	30.43	131	72	A	H
		2356.9	53.83	-20.17	74	39.79	27.23	17.35	30.47	100	346	P	V
		2389.94	42.48	-11.52	54	28.23	27.36	17.36	30.47	100	346	A	V
	*	2437	113.06	-	-	98.45	27.62	17.44	30.45	100	346	P	V
	*	2437	109.85	-	-	95.24	27.62	17.44	30.45	100	346	A	V
		2489.29	55.33	-18.67	74	40.39	27.86	17.51	30.43	100	346	P	V
		2485.51	44.45	-9.55	54	29.53	27.84	17.51	30.43	100	346	A	V

802.11b CH 11 2462MHz	*	2462	115.96	-	-	101.18	27.75	17.47	30.44	141	68	P	H
	*	2462	112.87	-	-	98.09	27.75	17.47	30.44	141	68	A	H
		2485.6	56.62	-17.38	74	41.7	27.84	17.51	30.43	141	68	P	H
		2485.08	45.09	-8.91	54	30.17	27.84	17.51	30.43	141	68	A	H
													H
													H
	*	2462	108.87	-	-	94.09	27.75	17.47	30.44	100	117	P	V
	*	2462	105.67	-	-	90.89	27.75	17.47	30.44	100	117	A	V
		2486.84	56.24	-17.76	74	41.31	27.85	17.51	30.43	100	117	P	V
		2487.44	46.39	-7.61	54	31.46	27.85	17.51	30.43	100	117	A	V
													V
													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. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (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	52.74	-21.26	74	75.62	32.44	11.32	66.64	100	331	P	H
		4824	50.61	-3.39	54	73.49	32.44	11.32	66.64	100	331	A	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		4824	51.41	-22.59	74	74.29	32.44	11.32	66.64	100	90	P	V
		4824	48.9	-5.1	54	71.78	32.44	11.32	66.64	100	90	A	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V

WIFI Ant. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (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	54.12	-19.88	74	76.66	32.7	11.35	66.59	304	329	P	H
		4874	51.9	-2.1	54	74.44	32.7	11.35	66.59	304	329	A	H
		7311	55.42	-18.58	74	71.12	37.13	13.5	66.33	227	301	P	H
		7311	51.05	-2.95	54	66.75	37.13	13.5	66.33	227	301	A	H
													H
													H
													H
													H
													H
													H
													H
													H
		4874	52.31	-21.69	74	74.85	32.7	11.35	66.59	100	86	P	V
		4874	49.43	-4.57	54	71.97	32.7	11.35	66.59	100	86	A	V
		7311	57.72	-16.28	74	73.42	37.13	13.5	66.33	400	337	P	V
		7311	50.65	-3.35	54	66.35	37.13	13.5	66.33	400	337	A	V
													V
													V
													V
													V
													V
													V
													V
													V

WIFI Ant. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (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	53.07	-20.93	74	75.29	32.94	11.38	66.54	287	332	P	H
		4924	50.73	-3.27	54	72.95	32.94	11.38	66.54	287	332	A	H
		7386	50.11	-23.89	74	66.32	36.76	13.39	66.36	300	359	P	H
		7386	45.38	-8.62	54	61.59	36.76	13.39	66.36	300	359	A	H
													H
													H
													H
													H
													H
													H
													H
													H
		4924	51.9	-22.1	74	74.12	32.94	11.38	66.54	100	85	P	V
		4924	48.21	-5.79	54	70.43	32.94	11.38	66.54	100	85	A	V
		7386	50.27	-23.73	74	66.48	36.76	13.39	66.36	100	10	P	V
		7386	44.25	-9.75	54	60.46	36.76	13.39	66.36	100	10	A	V
													V
													V
													V
													V
													V
													V
													V
													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 (Band Edge @ 3m)

WIFI Ant. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (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	64.25	-9.75	74	50	27.36	17.36	30.47	279	67	P	H
		2390	50.75	-3.25	54	36.5	27.36	17.36	30.47	279	67	A	H
	*	2412	114.01	-	-	99.6	27.47	17.4	30.46	279	67	P	H
	*	2412	106.74	-	-	92.33	27.47	17.4	30.46	279	67	A	H
													H
													H
		2390	66.02	-7.98	74	51.77	27.36	17.36	30.47	100	58	P	V
		2390	52.42	-1.58	54	38.17	27.36	17.36	30.47	100	58	A	V
	*	2412	116.12	-	-	101.71	27.47	17.4	30.46	100	58	P	V
	*	2412	108.16	-	-	93.75	27.47	17.4	30.46	100	58	A	V
													V
													V
802.11g CH 06 2437MHz		2372.58	55.4	-18.6	74	41.26	27.29	17.32	30.47	300	62	P	H
		2389.94	42.92	-11.08	54	28.67	27.36	17.36	30.47	300	62	A	H
	*	2437	116.51	-	-	101.9	27.62	17.44	30.45	300	62	P	H
	*	2437	109	-	-	94.39	27.62	17.44	30.45	300	62	A	H
		2485.44	55.34	-18.66	74	40.42	27.84	17.51	30.43	300	62	P	H
		2484.6	44.54	-9.46	54	29.62	27.84	17.51	30.43	300	62	A	H
		2378.18	53.47	-20.53	74	39.3	27.31	17.33	30.47	103	117	P	V
		2389.8	43.08	-10.92	54	28.83	27.36	17.36	30.47	103	117	A	V
	*	2437	118.01	-	-	103.4	27.62	17.44	30.45	103	117	P	V
	*	2437	110.38	-	-	95.77	27.62	17.44	30.45	103	117	A	V
		2485.16	56.04	-17.96	74	41.12	27.84	17.51	30.43	103	117	P	V
		2484.74	45.48	-8.52	54	30.56	27.84	17.51	30.43	103	117	A	V

802.11g CH 11 2462MHz	*	2462	115.01	-	-	100.23	27.75	17.47	30.44	297	65	P	H
	*	2462	107.57	-	-	92.79	27.75	17.47	30.44	297	65	A	H
		2486.2	62.41	-11.59	74	47.49	27.84	17.51	30.43	297	65	P	H
		2485.68	48.96	-5.04	54	34.04	27.84	17.51	30.43	297	65	A	H
													H
													H
	*	2462	116.08	-	-	101.3	27.75	17.47	30.44	100	86	P	V
	*	2462	108.72	-	-	93.94	27.75	17.47	30.44	100	86	A	V
		2484.84	63.77	-10.23	74	48.85	27.84	17.51	30.43	100	86	P	V
		2485.12	51.22	-2.78	54	36.3	27.84	17.51	30.43	100	86	A	V
													V
													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. 0+1	Note	Frequency (MHz)	Level (dBµV/m)	Over Limit (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		4824	50.96	-23.04	74	73.84	32.44	11.32	66.64	304	327	P	H
		4824	39.81	-14.19	54	62.69	32.44	11.32	66.64	304	327	A	H
													H
													H
													H
													H
													H
													H
													H
													H
													H
													H
		4824	48.46	-25.54	74	71.34	32.44	11.32	66.64	100	86	P	V
		4824	37.81	-16.19	54	60.69	32.44	11.32	66.64	100	86	A	V
													V
													V
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													V
													V

WIFI Ant. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (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 06 2437MHz		4874	51.69	-22.31	74	74.23	32.7	11.35	66.59	291	330	P	H
		4874	41.28	-12.72	54	63.82	32.7	11.35	66.59	291	330	A	H
		7311	54.41	-19.59	74	70.11	37.13	13.5	66.33	230	300	P	H
		7311	42.54	-11.46	54	58.24	37.13	13.5	66.33	230	300	A	H
													H
													H
													H
													H
													H
													H
													H
													H
		4874	48.62	-25.38	74	71.16	32.7	11.35	66.59	106	98	P	V
		4874	38.84	-15.16	54	61.38	32.7	11.35	66.59	106	98	A	V
		7311	51.33	-22.67	74	67.03	37.13	13.5	66.33	100	12	P	V
		7311	40.21	-13.79	54	55.91	37.13	13.5	66.33	100	12	A	V
													V
													V
													V
													V
													V
													V
													V
													V

WIFI Ant. 0+1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (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	46.01	-27.99	74	68.23	32.94	11.38	66.54	314	335	P	H
		4924	36.05	-17.95	54	58.27	32.94	11.38	66.54	314	335	A	H
		7386	53.63	-20.37	74	69.84	36.76	13.39	66.36	228	299	P	H
		7386	41.22	-12.78	54	57.43	36.76	13.39	66.36	228	299	A	H
													H
													H
													H
													H
													H
													H
													H
													H
		4924	46.4	-27.6	74	68.62	32.94	11.38	66.54	100	103	P	V
		4924	36.36	-17.64	54	58.58	32.94	11.38	66.54	100	103	A	V
		7386	46.13	-27.87	74	62.34	36.76	13.39	66.36	100	96	P	V
		7386	35.43	-18.57	54	51.64	36.76	13.39	66.36	100	96	A	V
													V
													V
													V
													V
													V
													V
													V
													V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												