



FCC RF Test Report

APPLICANT : Ring LLC
EQUIPMENT : Battery Doorbell Pro
BRAND NAME : ring
MODEL NAME : 5F79E9
FCC ID : 2AEUPBHARG091
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System
TEST DATE(S) : Apr. 14, 2023 ~ Sep. 05, 2023

We, Sporton International Inc. (Kunshan), 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 of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia



Approved by: Jason Jia

Sporton International Inc. (Kunshan)

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China**



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APPENDIX A. CONDUCTED TEST RESULTS

APPENDIX B. AC CONDUCTED EMISSION TEST RESULT

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APPENDIX D. DUTY CYCLE PLOTS



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR330811-01B	Rev. 01	Initial issue of report	Nov. 15, 2023



SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	≥ 0.5MHz	Pass	-
3.1	-	99% Bandwidth	-	Report Only	-
3.2	15.247(b)	Power Output Measurement	≤ 30dBm	Pass	-
3.3	15.247(e)	Power Spectral Density	≤ 8dBm/3kHz	Pass	-
3.4	15.247(d)	Conducted Band Edges	≤ 30dBc	Pass	-
		Conducted Spurious Emission		Pass	-
0	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 3.01 dB at 2483.77 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 20.90 dB at 0.15 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

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

Disclaimer:

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



1 General Description

1.1 Applicant

Ring LLC
12515 Cerise Ave, Hawthorne, CA 90250 USA

1.2 Product Feature of Equipment Under Test

Product Feature	
Equipment	Battery Doorbell Pro
Brand Name	ring
Model Name	5F79E9
FCC ID	2AEUPBHARG091
SN	Conducted: G9D2G90633150264 Conduction: G9D2G90431520124 Radiation: G9D2G90431460006 G9D2G90633050019
HW Version	DVT 4
SW Version	1.2.118
EUT Stage	Production Unit

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



1.3 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2472 MHz
Maximum (Average) Output Power to antenna	<Ant.1>: 802.11b : 18.32 dBm (0.0679 W) 802.11g : 18.34 dBm (0.0682 W) 802.11n HT20 : 18.24 dBm (0.0667 W) 802.11ax HE20 : 18.37 dBm (0.0687 W) <Ant.2>: 802.11b : 18.41 dBm (0.0693 W) 802.11g : 18.32 dBm (0.0679 W) 802.11n HT20 : 18.21 dBm (0.0662 W) 802.11ax HE20 : 18.36 dBm (0.0685 W)
99% Occupied Bandwidth	<Ant.1>: 802.11b : 14.24 MHz 802.11g : 18.38 MHz 802.11n HT20 : 19.23 MHz 802.11ax HE20 : 18.83 MHz <Ant.2>: 802.11b : 14.69 MHz 802.11g : 18.53 MHz 802.11n HT20 : 18.38 MHz 802.11ax HE20 : 19.13 MHz
Antenna Type / Gain	<Ant.1>: IFA Antenna with gain 1.9 dBi <Ant.2>: IFA Antenna with gain 2.2 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ax : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)

Note:

1. The WLAN Ant.1 & Ant.2 only support SISO mode, not support MIMO.
2. 802.11ax support full RU tone and partial RU tone, both full RU and partial RU-left (for low CH) and partial RU-right (for high CH) are tested for conducted Power/PSD, the full RU Power/PSD > partial RU, therefore the full RU perform full test and Partial RU verified Bandedge/Spurious.
3. The device does not support 802.11ax channel puncture mode.

1.4 Modification of EUT

No modifications are made to the EUT during all test items.



1.5 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-KS 03CH08-KS TH01-KS	CN1257	314309

1.6 Test Software

Item	Site	Manufacturer	Name	Version
1.	TH01-KS	SPORTON	FCC 15C-15E Test Tools Ver10.0_210607	10.0
2.	03CH08-KS	AUDIX	E3	6.2009-8-24
3.	CO01-KS	AUDIX	E3	6.2009-8-24

1.7 Applicable Standards

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

- ♦ 47 CFR Part 15 Subpart C §15.247
- ♦ FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ♦ ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.



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, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X/Z plane) were recorded 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	8	2447
	2	2417	9	2452
	3	2422	10	2457
	4	2427	11	2462
	5	2432	12	2467
	6	2437	13	2472
	7	2442	-	-



2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

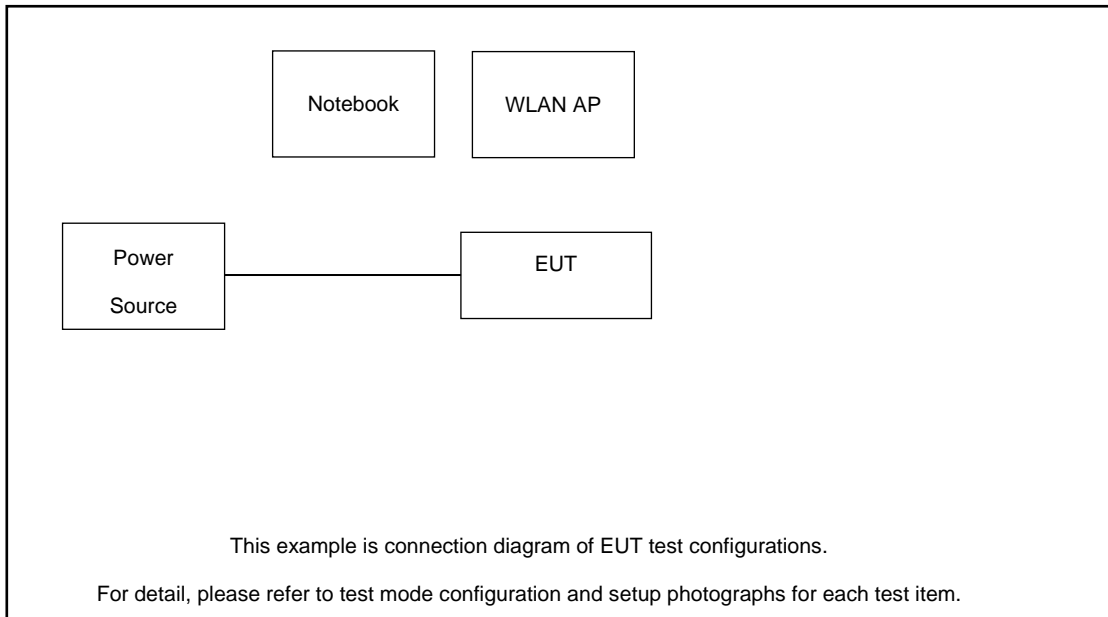
Single Antenna

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0
802.11ax HE20	MCS0

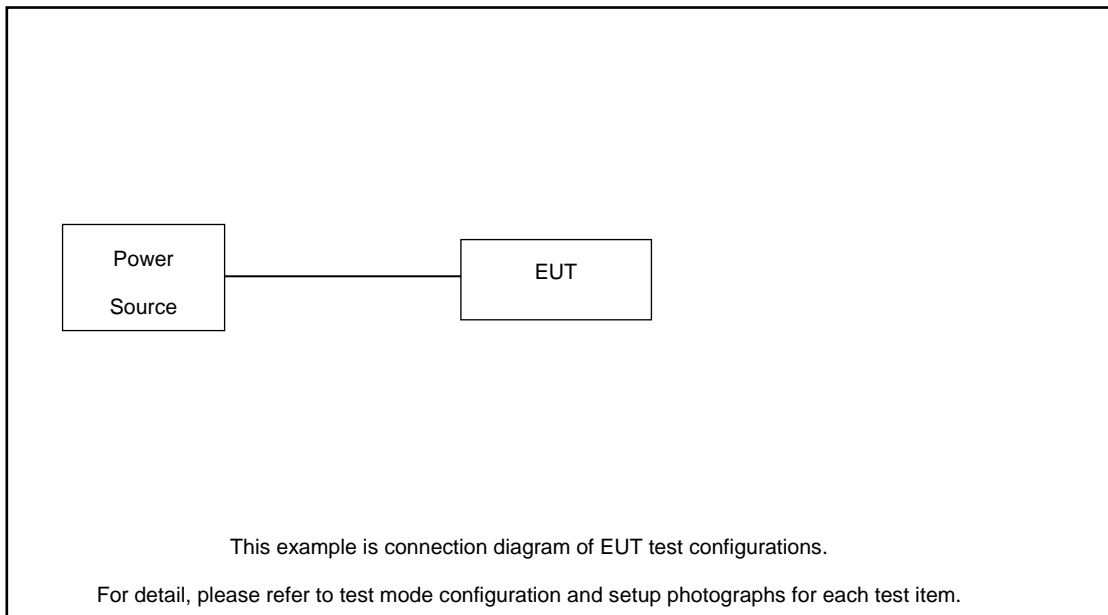
Test Cases	
AC Conducted Emission	Mode 1 :BT TX + WLAN Link(2.4G) + Adapter 1 + Battery 1
Remark:	
<ol style="list-style-type: none"> The AC Conduction and RSE are tested with accessories from the worst case of Part 15B report. For Radiated Test Cases, pretest with Plastic Faceplate and Metal Faceplate, use the worst Metal Faceplate to perform final test, and Plastic Faceplate modes were verified for the worse Metal Faceplate modes. 	

2.3 Connection Diagram of Test System

For AC Conducted Emission:



For Radiated Emission:





2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	LINKSYS	WRT 1900 ACS	N/A	N/A	Unshielded, 1.8m
2.	Notebook	Lenovo	V130-15IKB005	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
3.	AC/DC Adapter 1 (US)	DEE VAN ENTERPRISE CO., LTE	DSA-12PF16-24 FUS 240050	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

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 5.8 dB and 10dB attenuator.

$$\begin{aligned}
 \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\
 &= 5.8 + 10 = 15.8 \text{ (dB)}
 \end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB Bandwidth

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

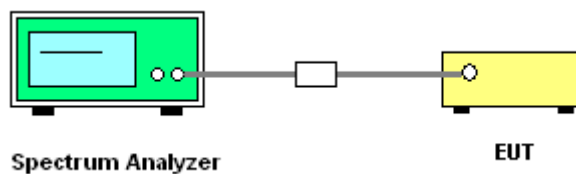
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.8
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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) = 1%~5% of OBW and set the Video bandwidth (VBW) = 3MHz.
6. Measure and record the results in the test report.

3.1.4 Test Setup

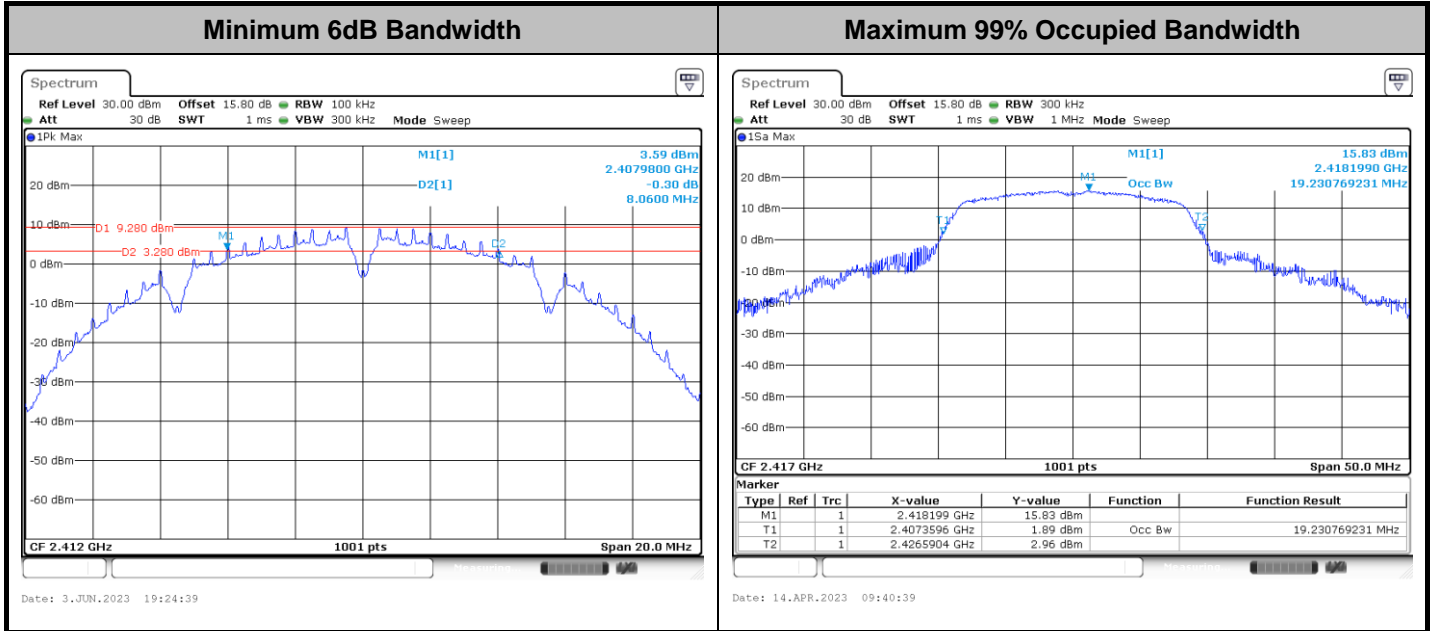




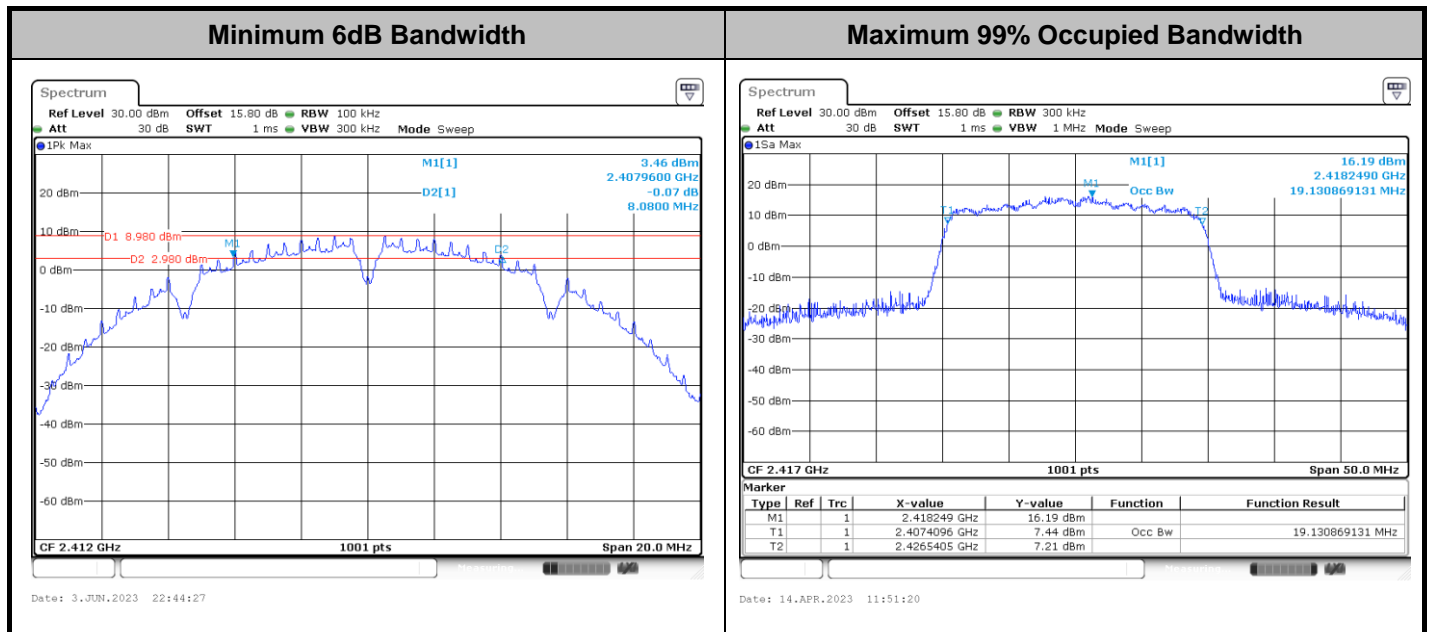
3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

For Ant.1:



For Ant.2:



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 2400-2483.5MHz, the limit for average output power is 30dBm.

If transmitting antenna with directional gain greater than 6dBi is used, the maximum 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 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

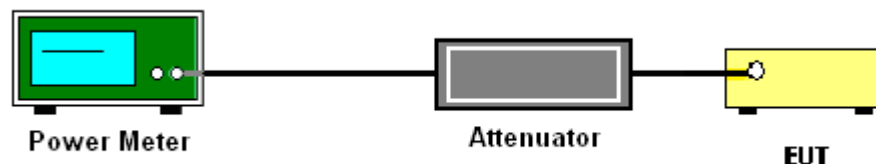
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of ANSI C63.10-2013 clause 11.9.2.3.1 Method AVGPM method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

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

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

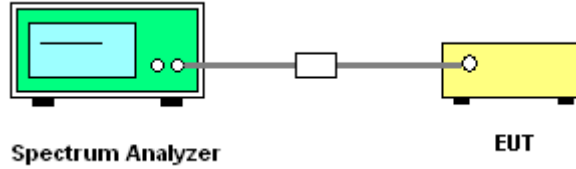
3.3.3 Test Procedures for 100KHz Peak PSD (reference level)

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 Method PKPSD.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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.

3.3.4 Test Procedures for 3KHz Average PSD

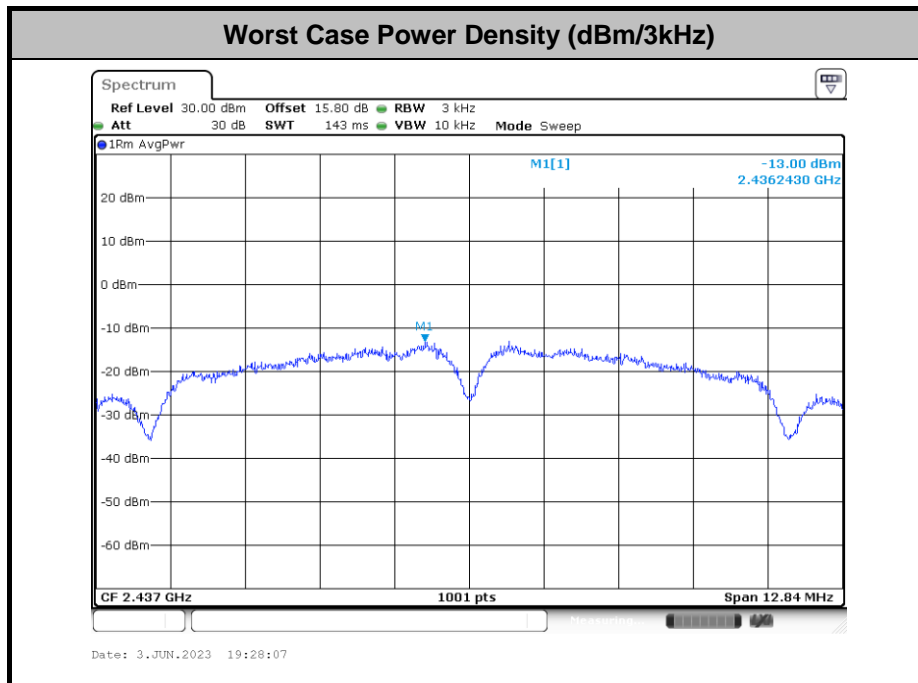
7. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.5 Method AVGPSD-2.
8. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
9. Set to the maximum power setting and enable the EUT transmit continuously.
10. 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 the OBW.
11. Detector = RMS, Sweep time = auto couple, Employ trace averaging (rms) mode over a minimum of 100 traces, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
12. Add $[10 \log (1 / D)]$, where D is the duty cycle, to the measured PSD to compute the average PSD during the actual transmission time.

3.3.5 Test Setup



3.3.6 Test Result of Power Spectral Density

Please refer to Appendix A.



Note: The Average PSD = Measured PSD + Duty Factor.

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 30 dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

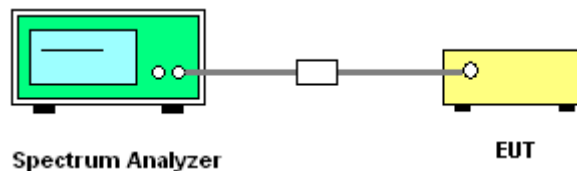
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 11.11
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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



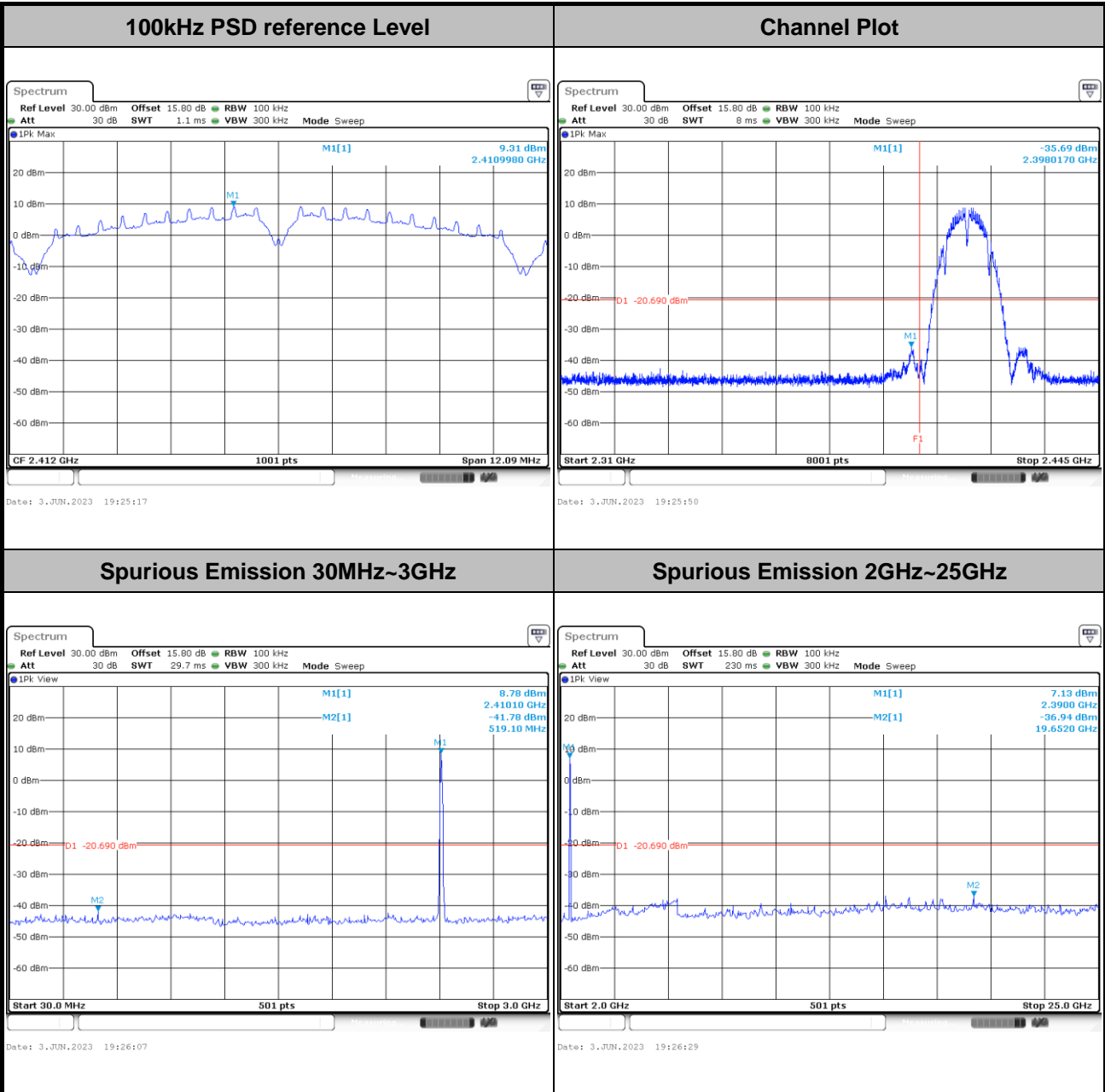


3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer : Jiang Jun	Temperature :	21~25°C
	Relative Humidity :	51~54%

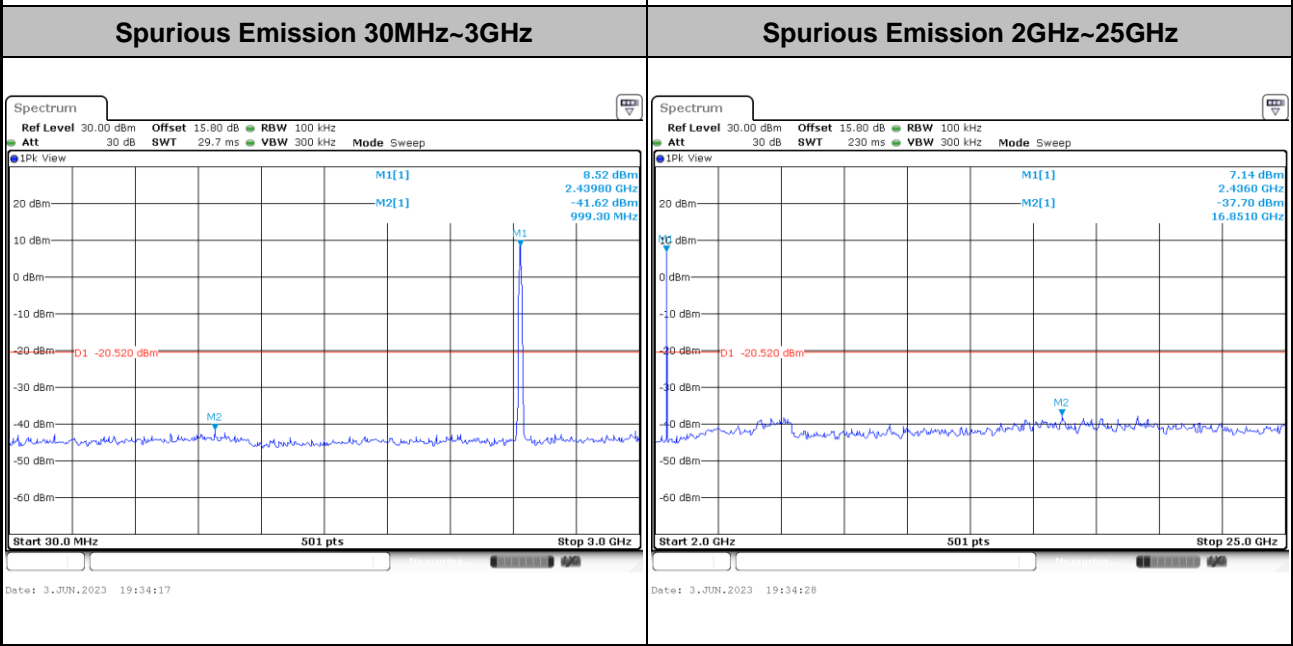
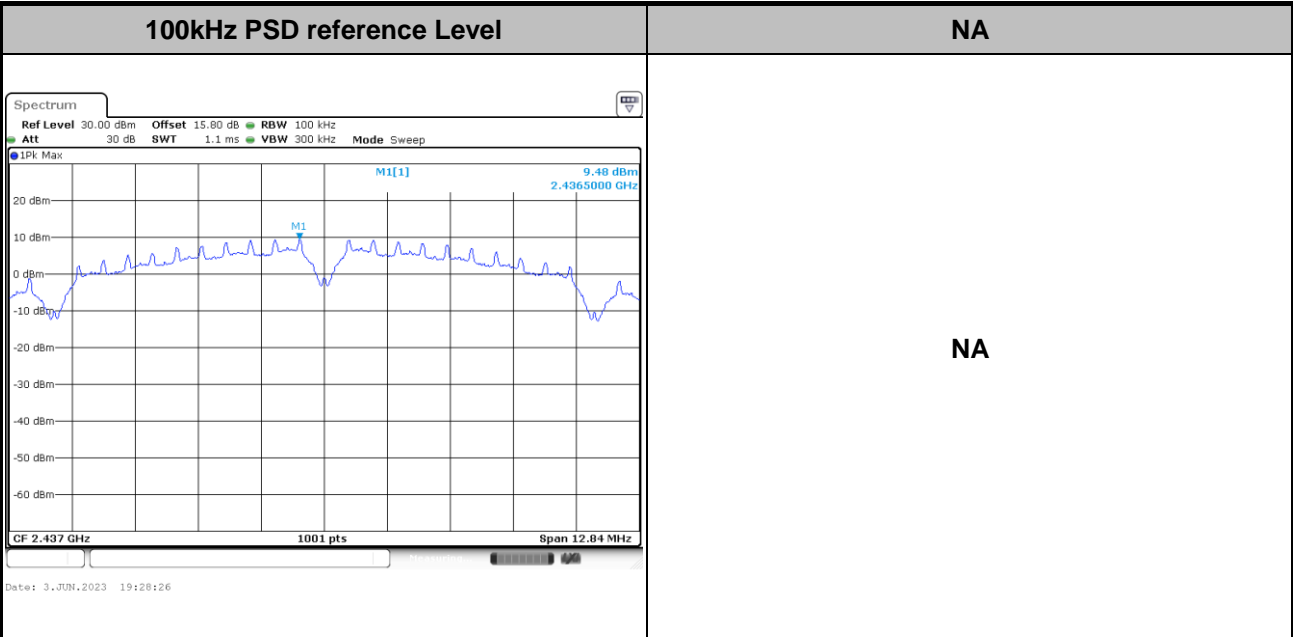
Number of TX = 1, Ant. 1 (Measured)

Test Mode :	802.11b	Test Channel :	01
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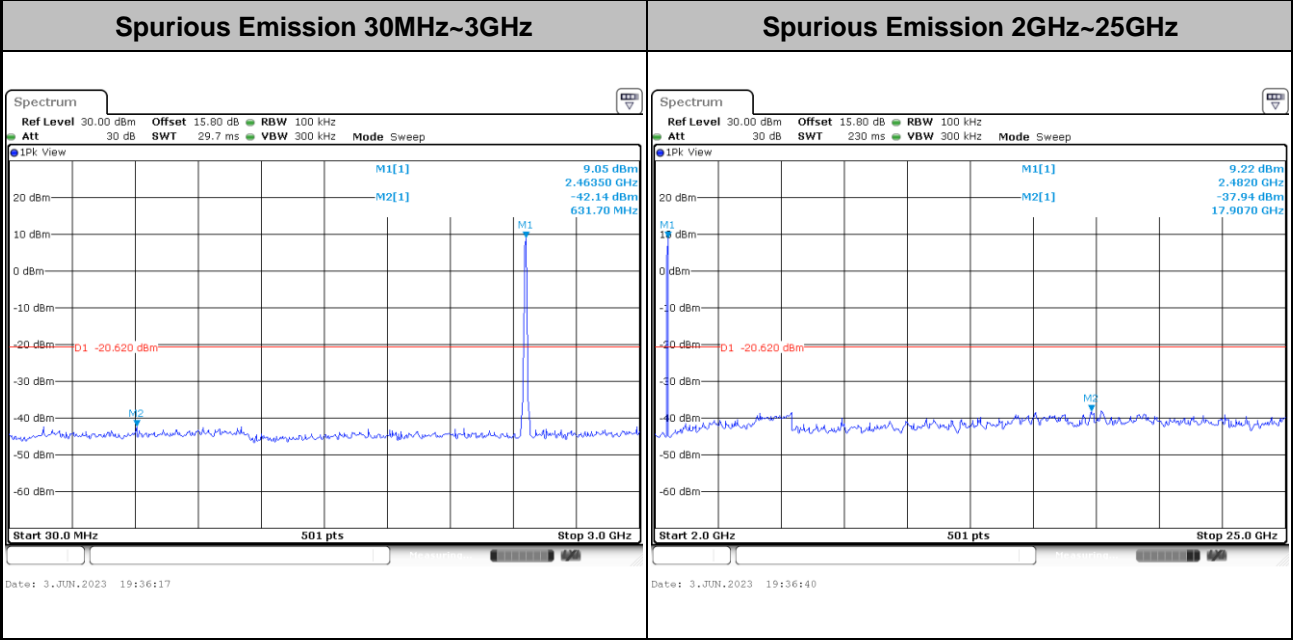
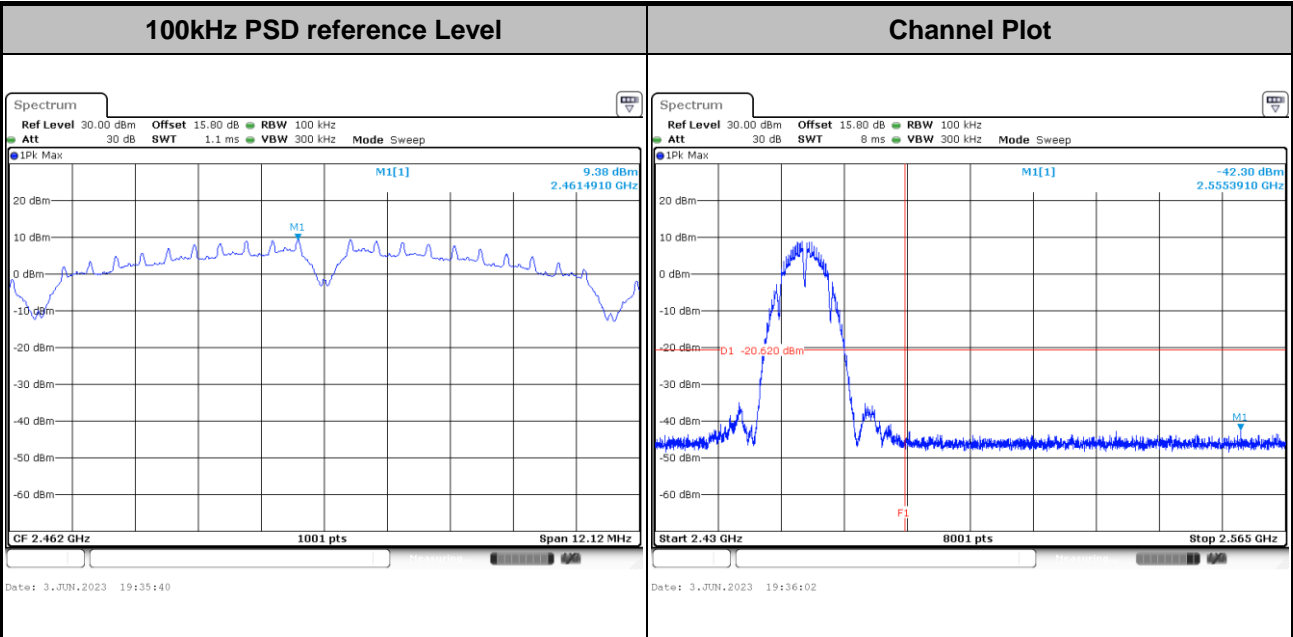


Test Mode :	802.11b	Test Channel :	06
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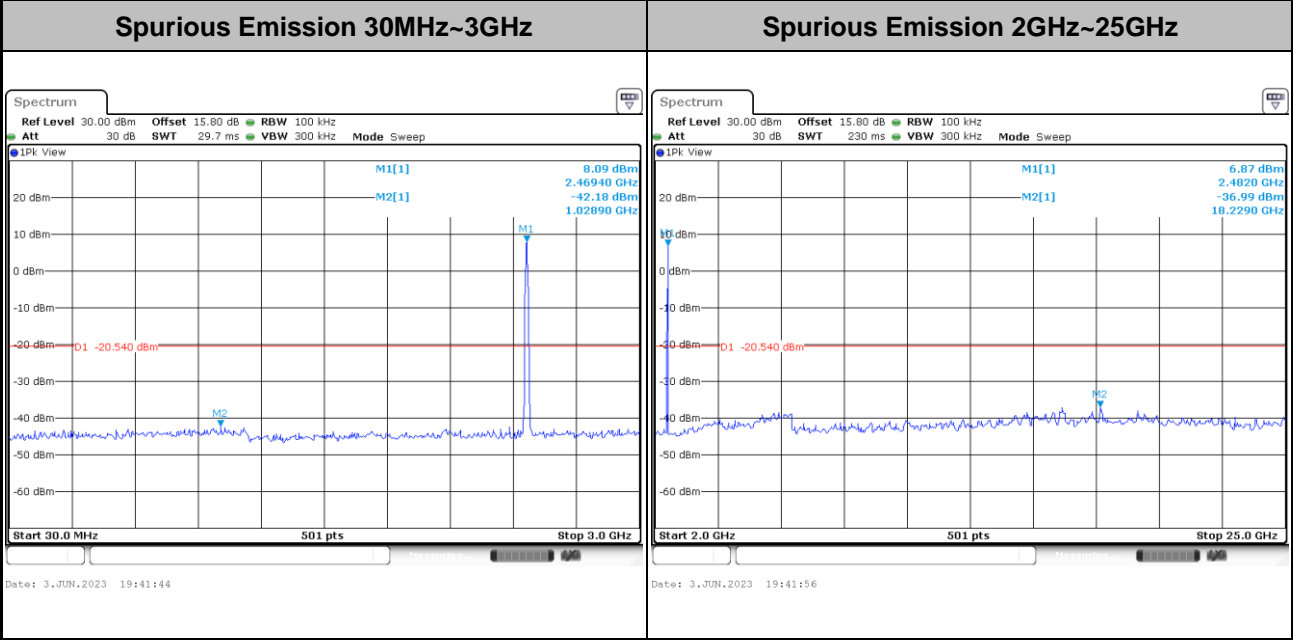
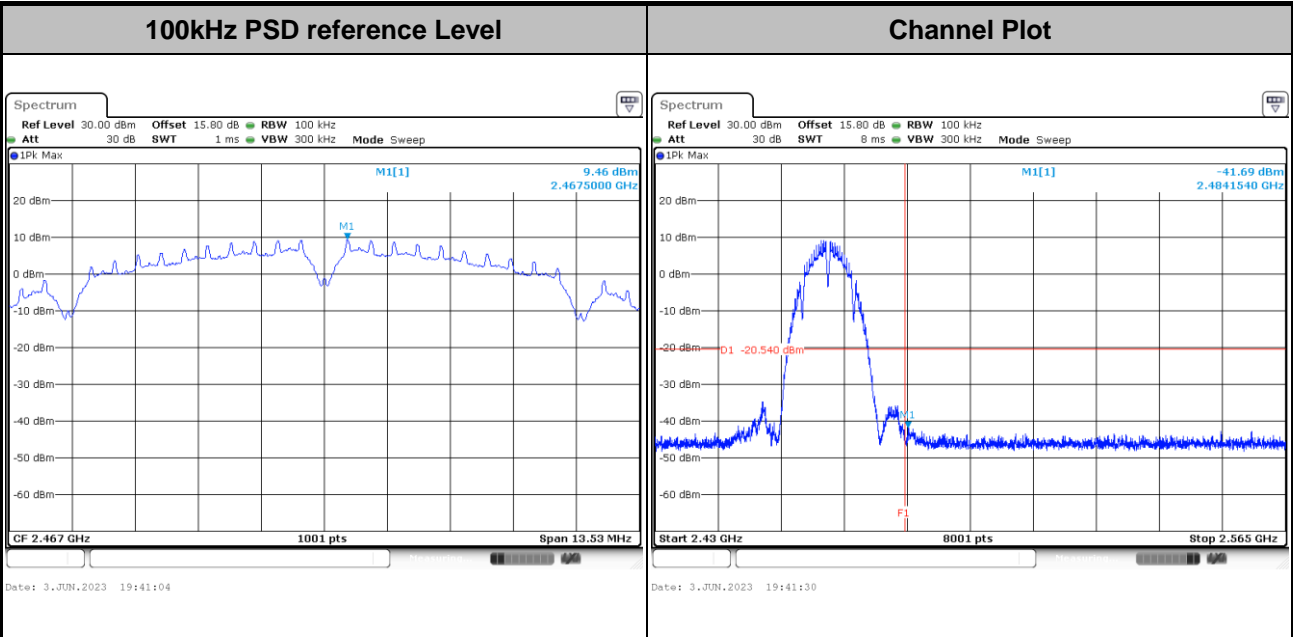


Test Mode : 802.11b Test Channel : 11



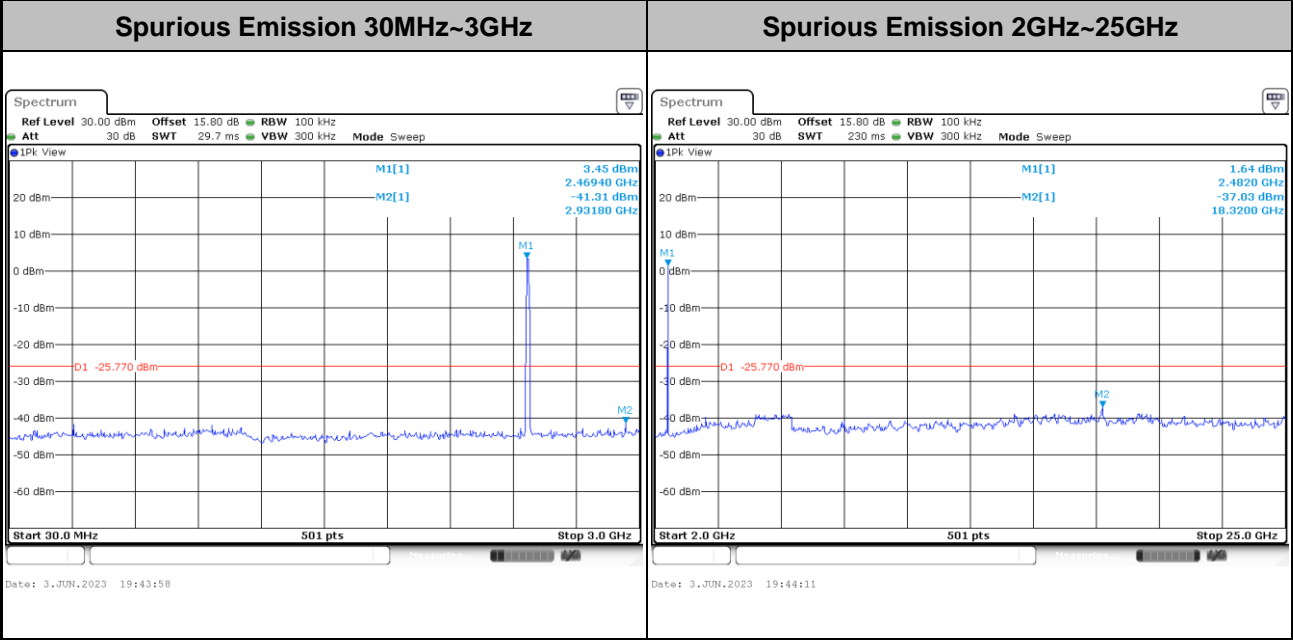
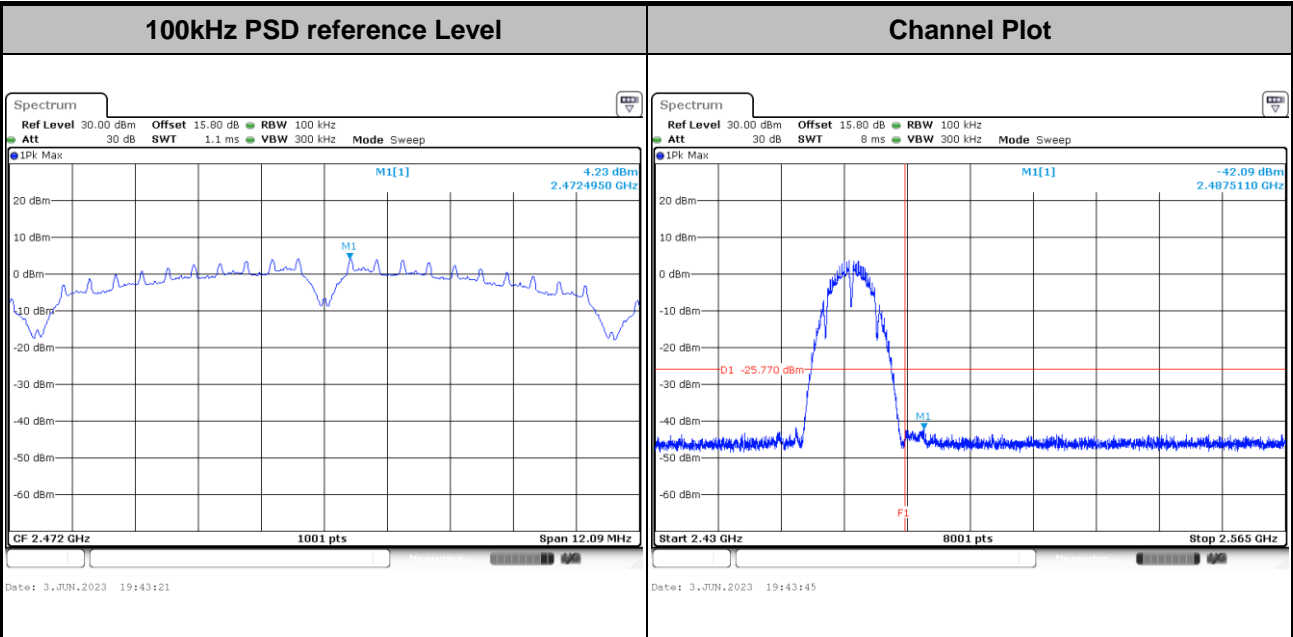


Test Mode : 802.11b Test Channel : 12



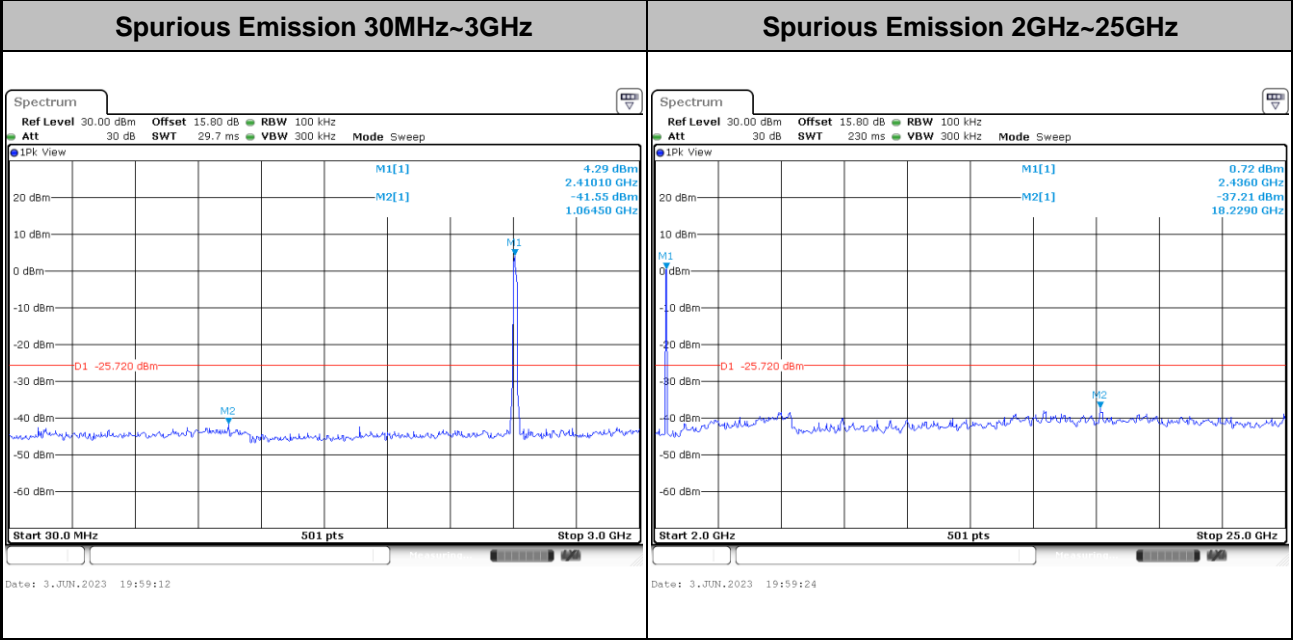
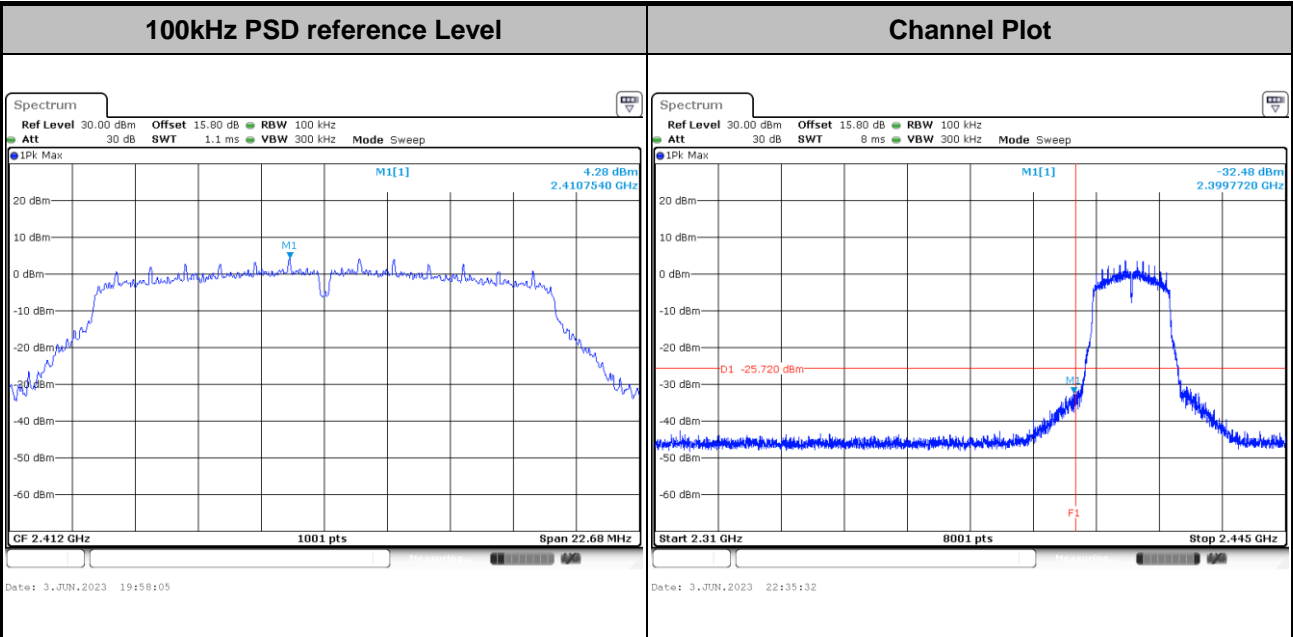


Test Mode : 802.11b Test Channel : 13



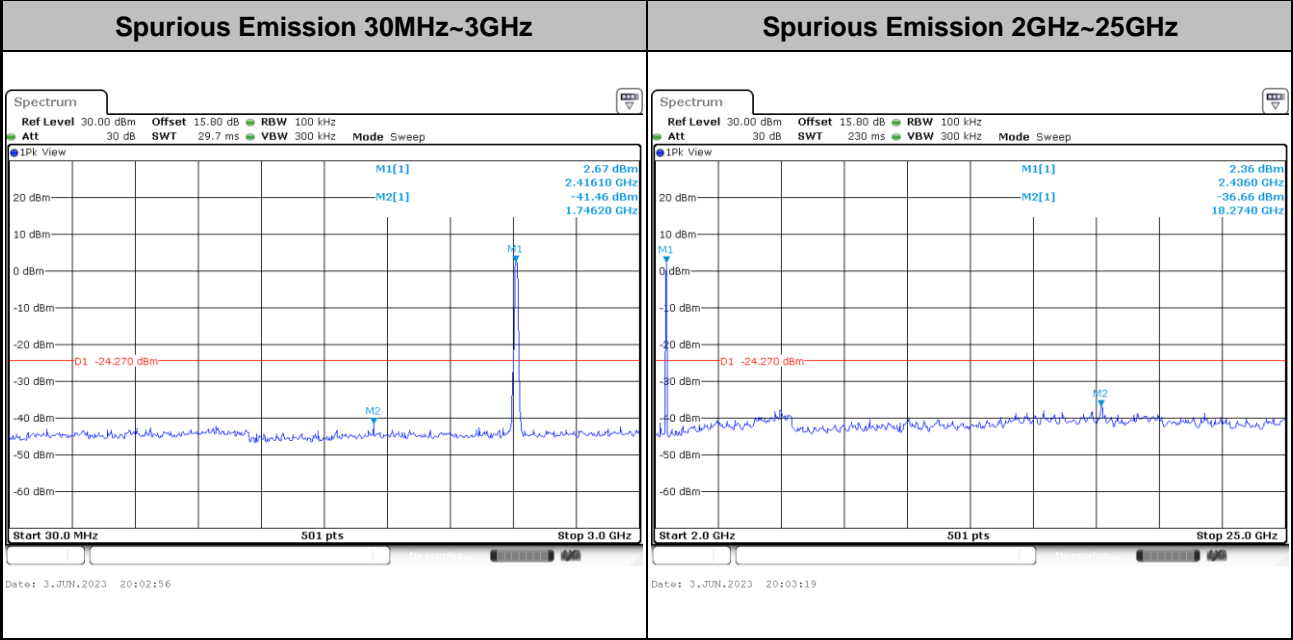
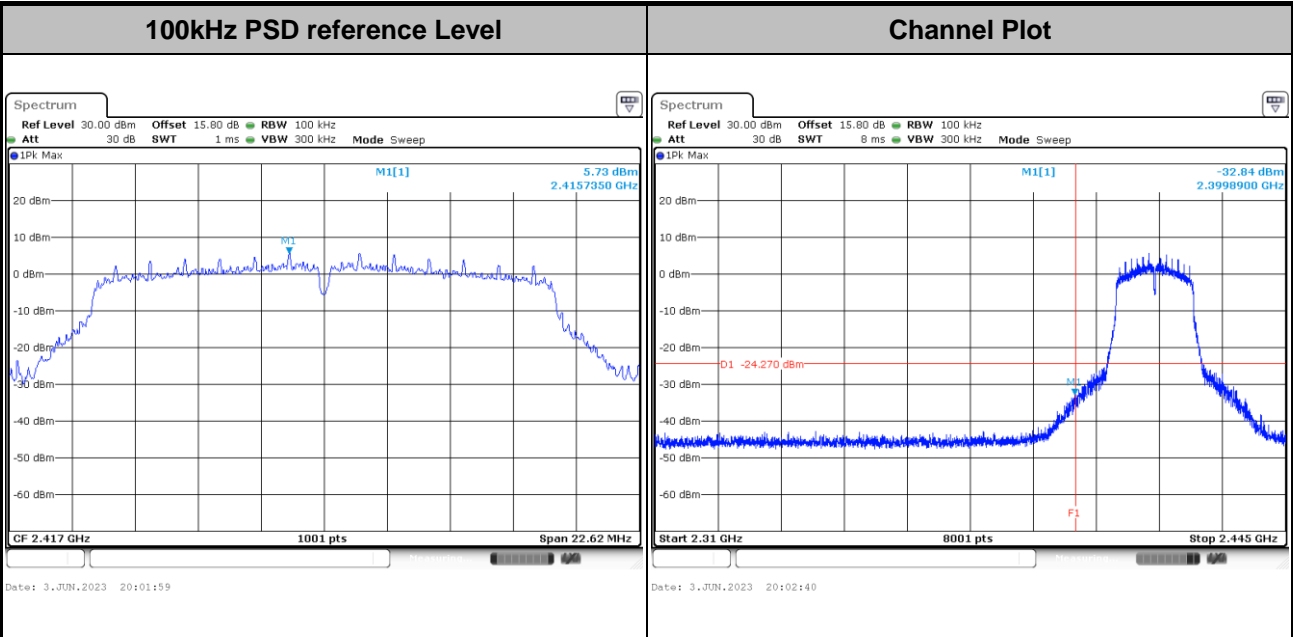


Test Mode : 802.11g Test Channel : 01



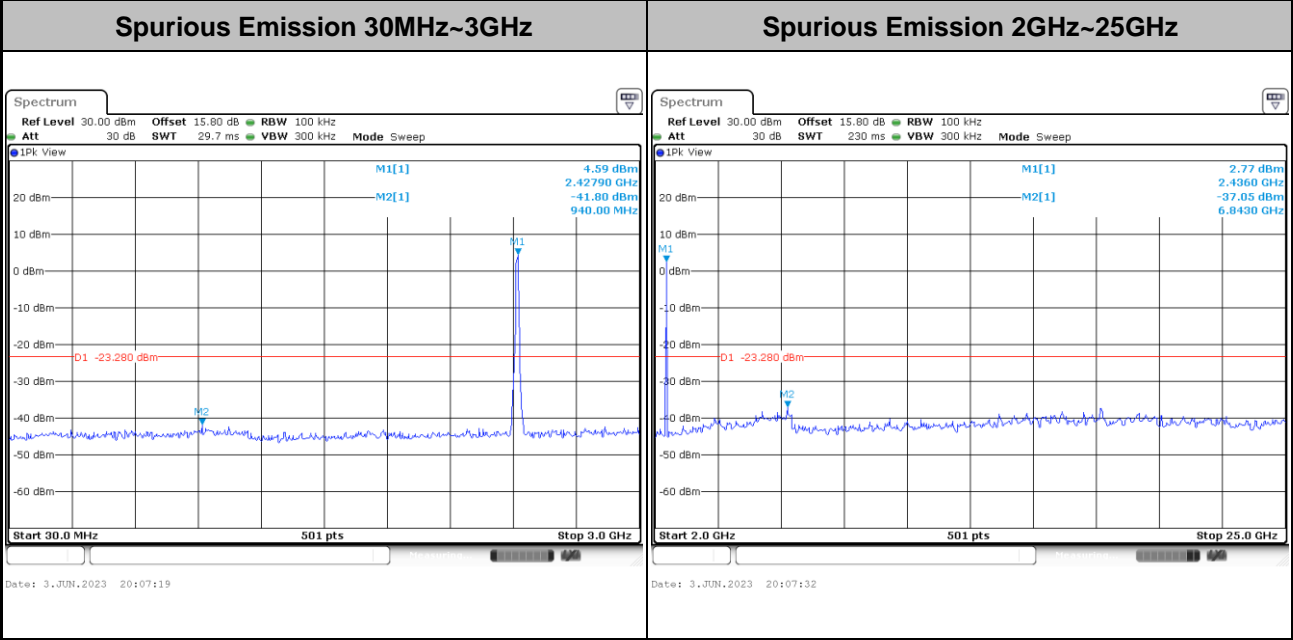
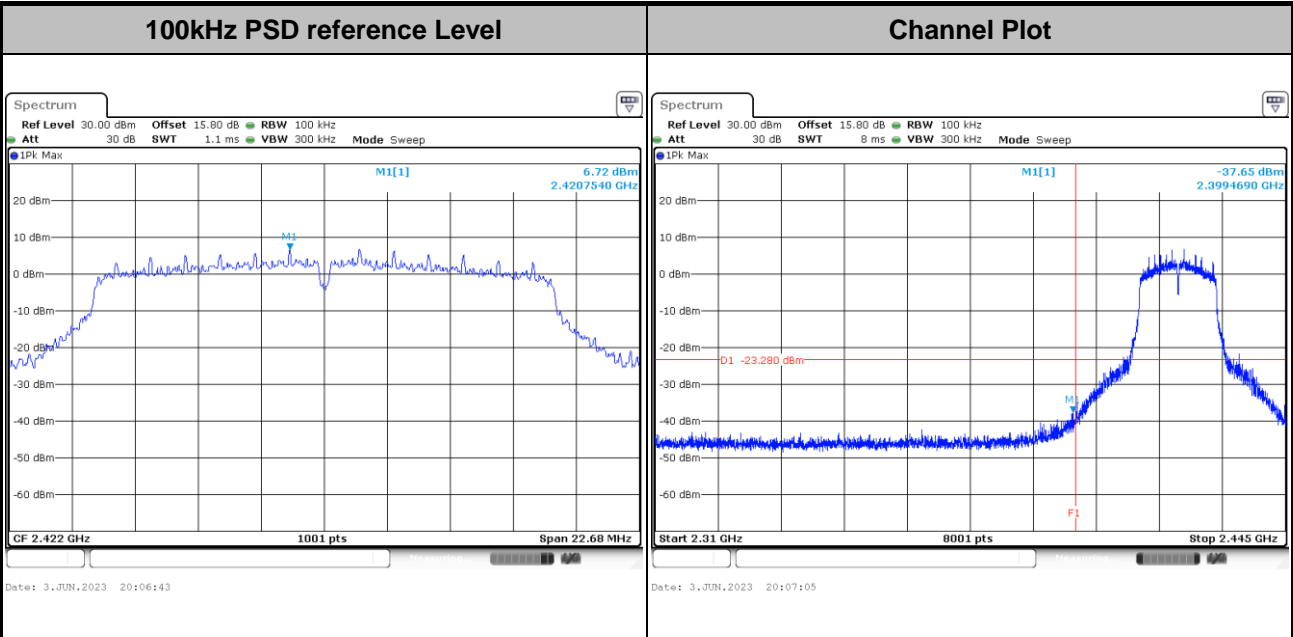


Test Mode : 802.11g Test Channel : 02



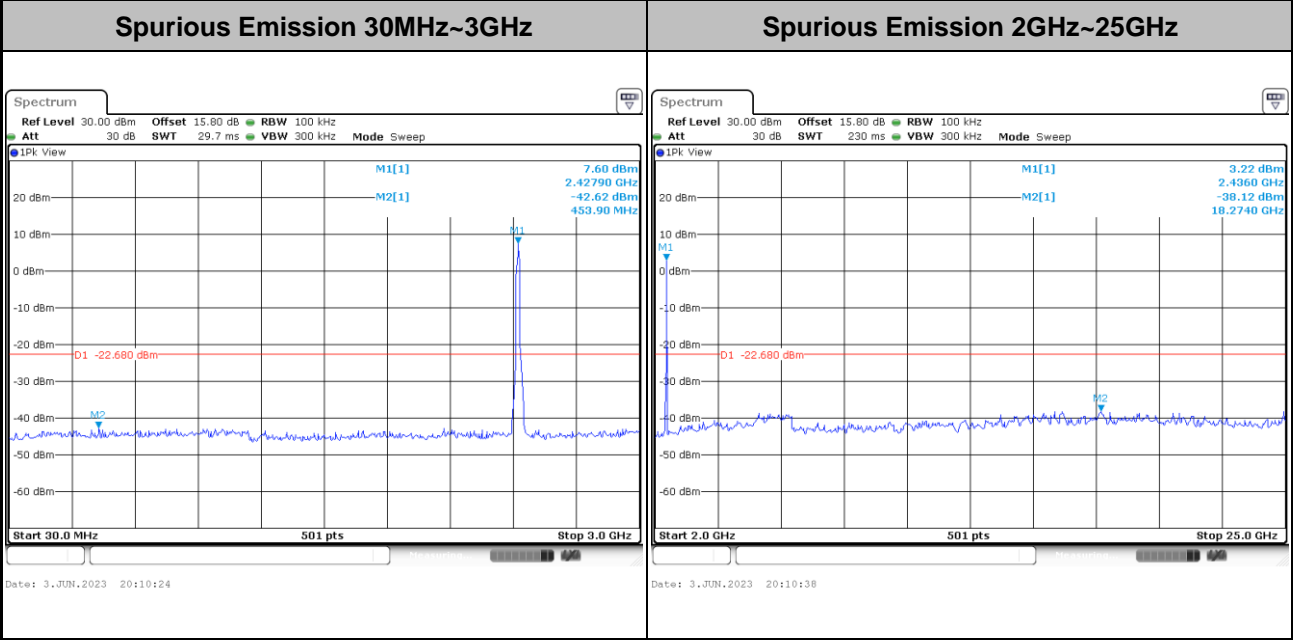
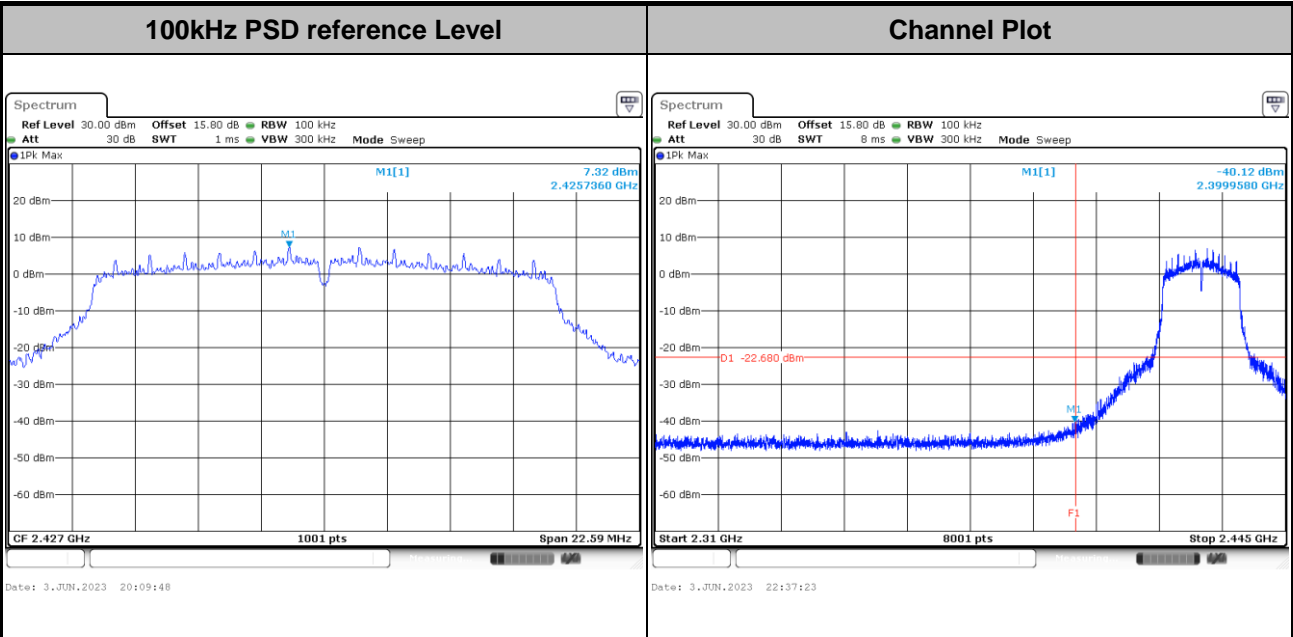


Test Mode : 802.11g Test Channel : 03



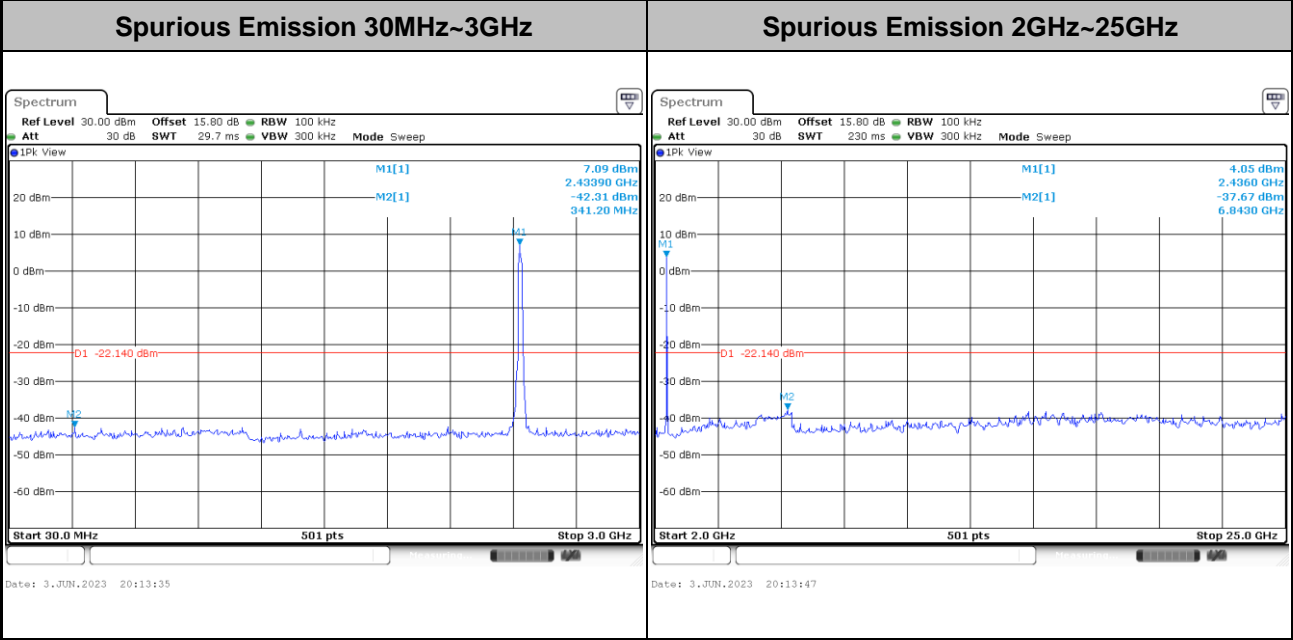
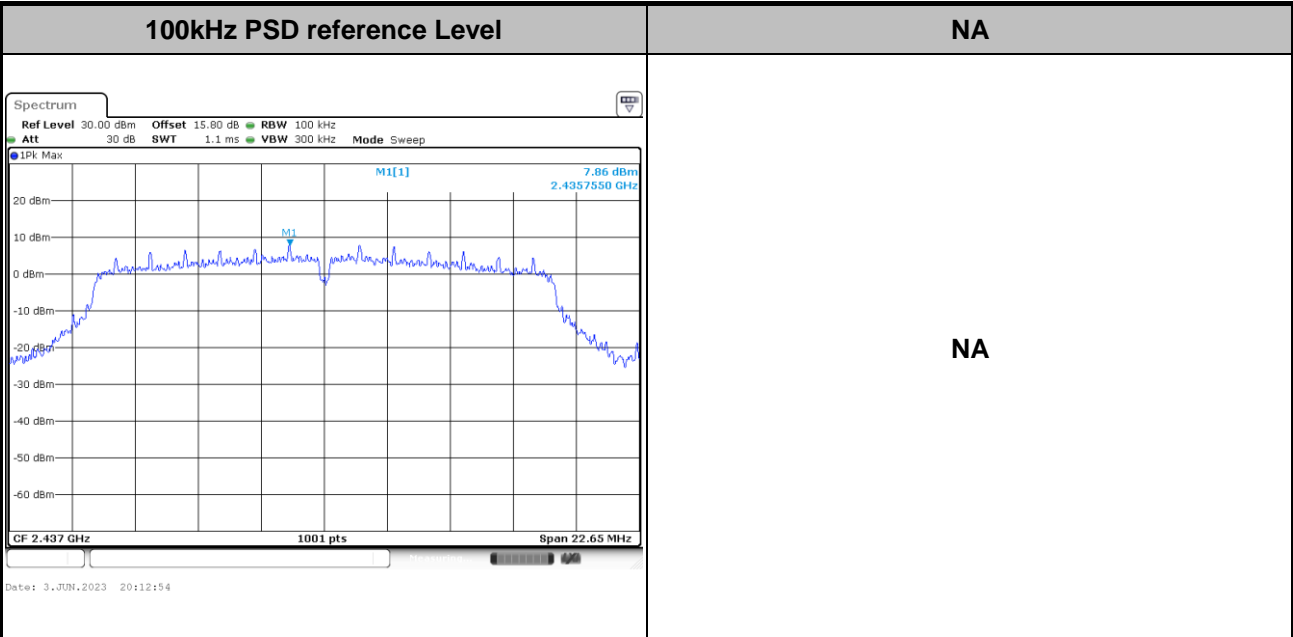


Test Mode : 802.11g Test Channel : 04



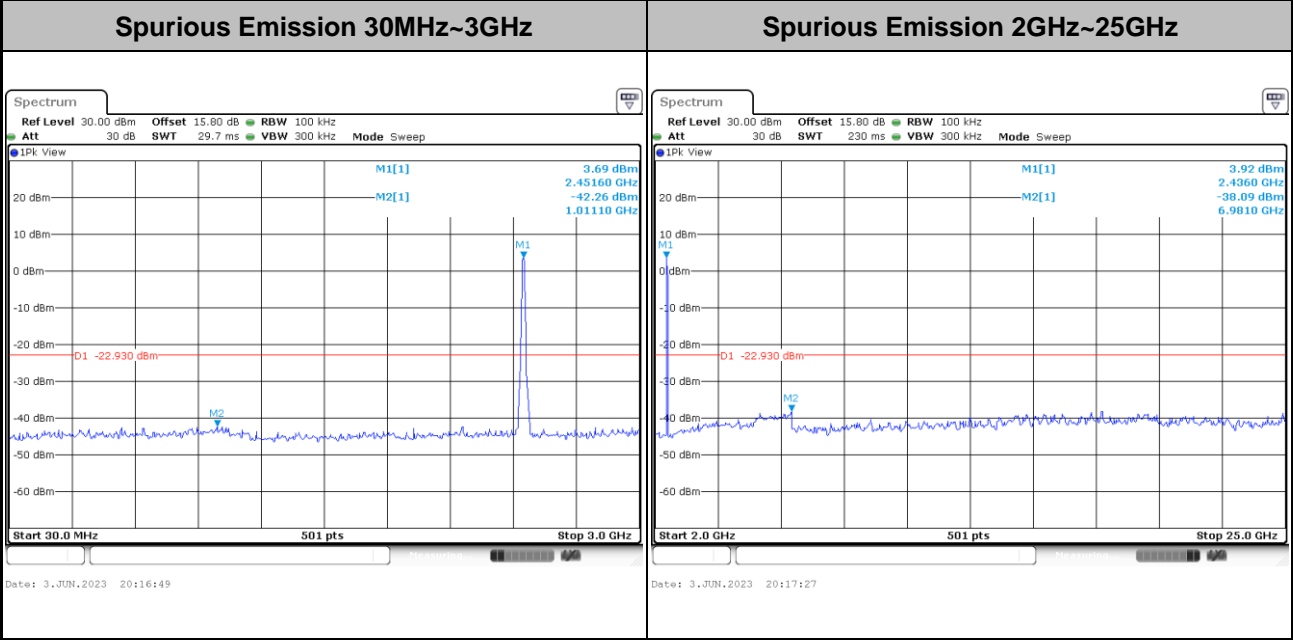
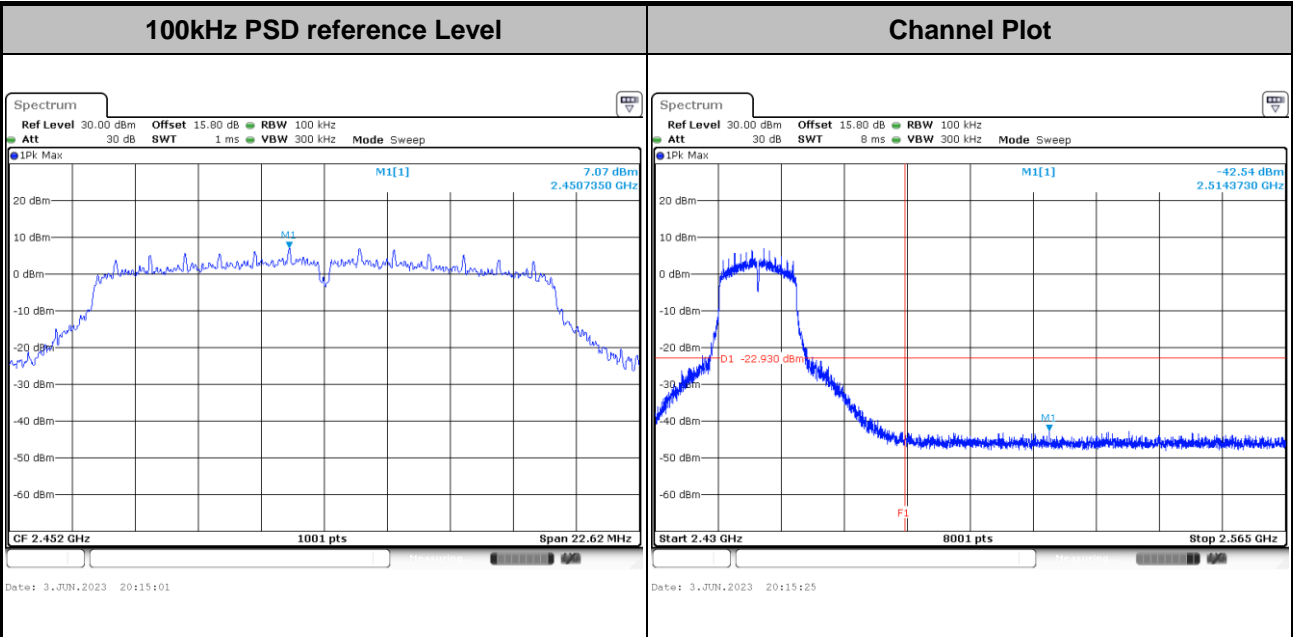


Test Mode :	802.11g	Test Channel :	06
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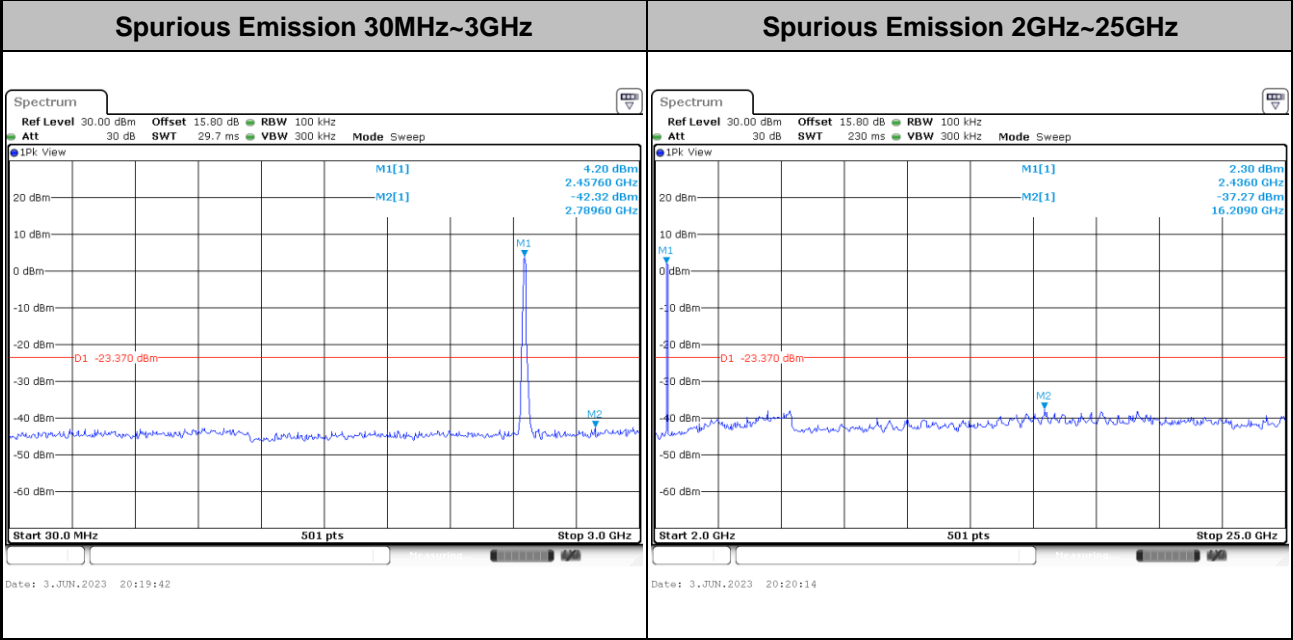
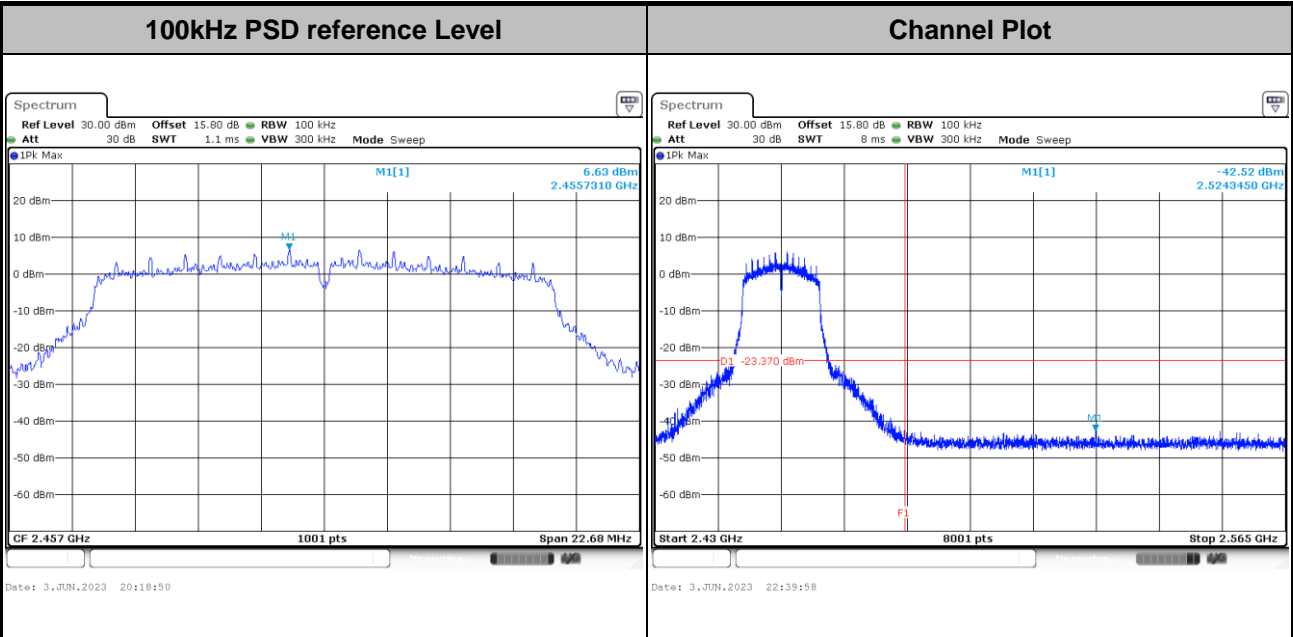


Test Mode : 802.11g Test Channel : 09



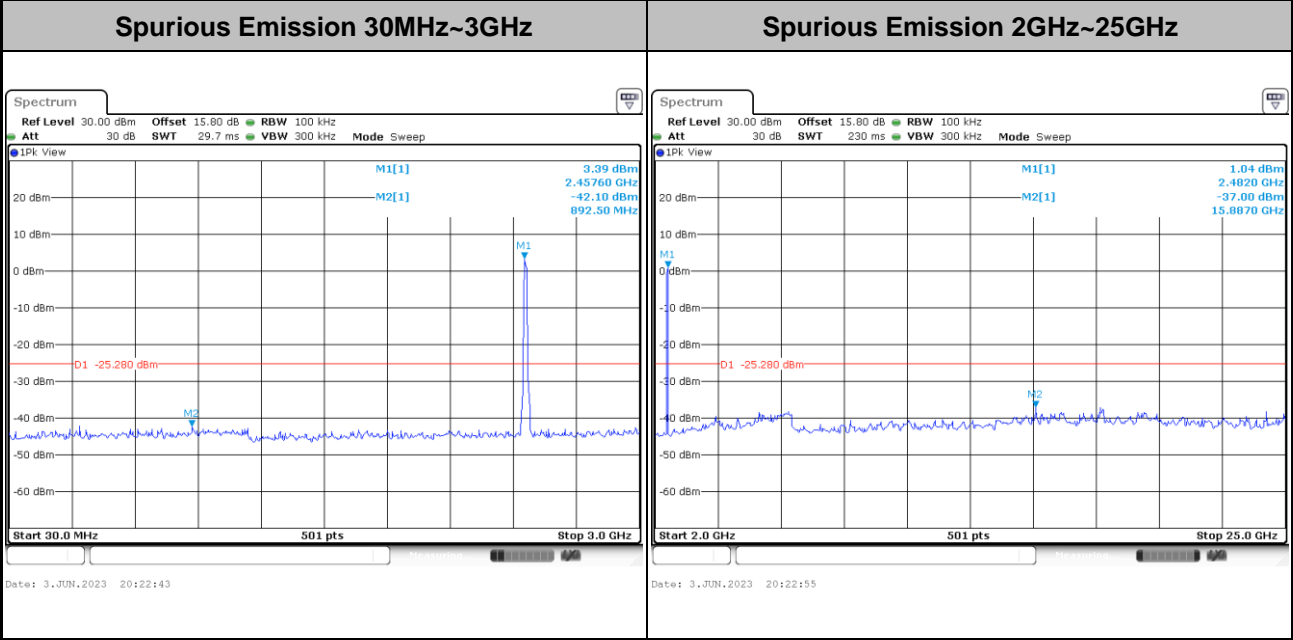
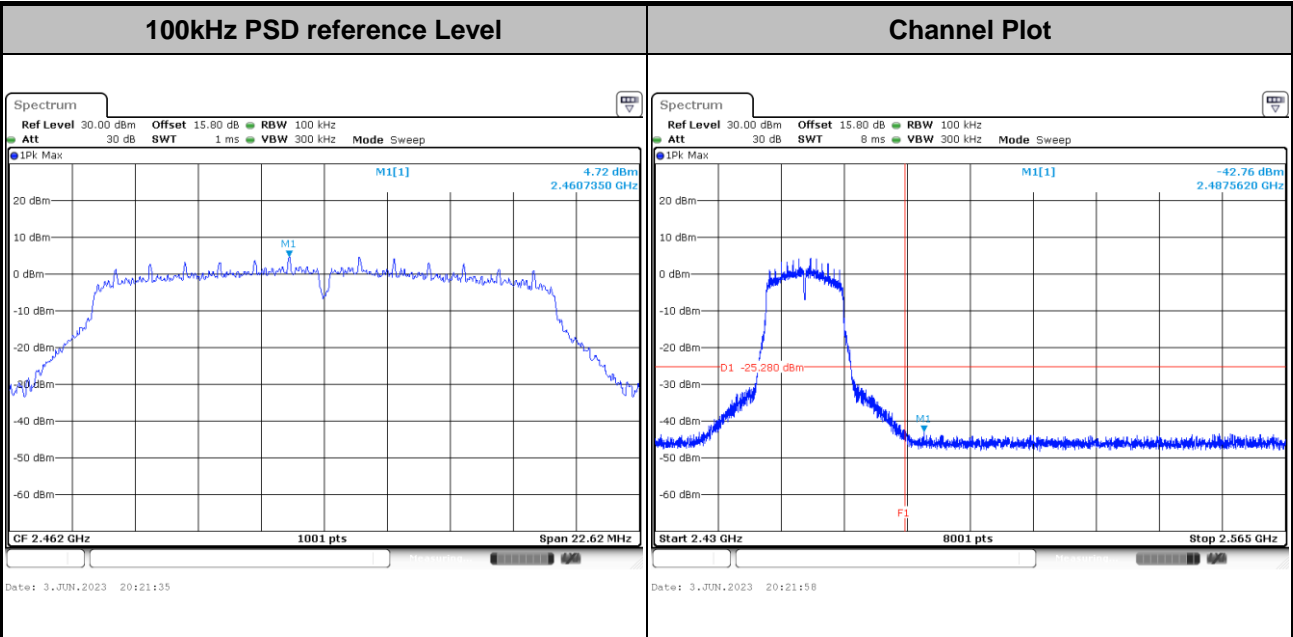


Test Mode : 802.11g Test Channel : 10



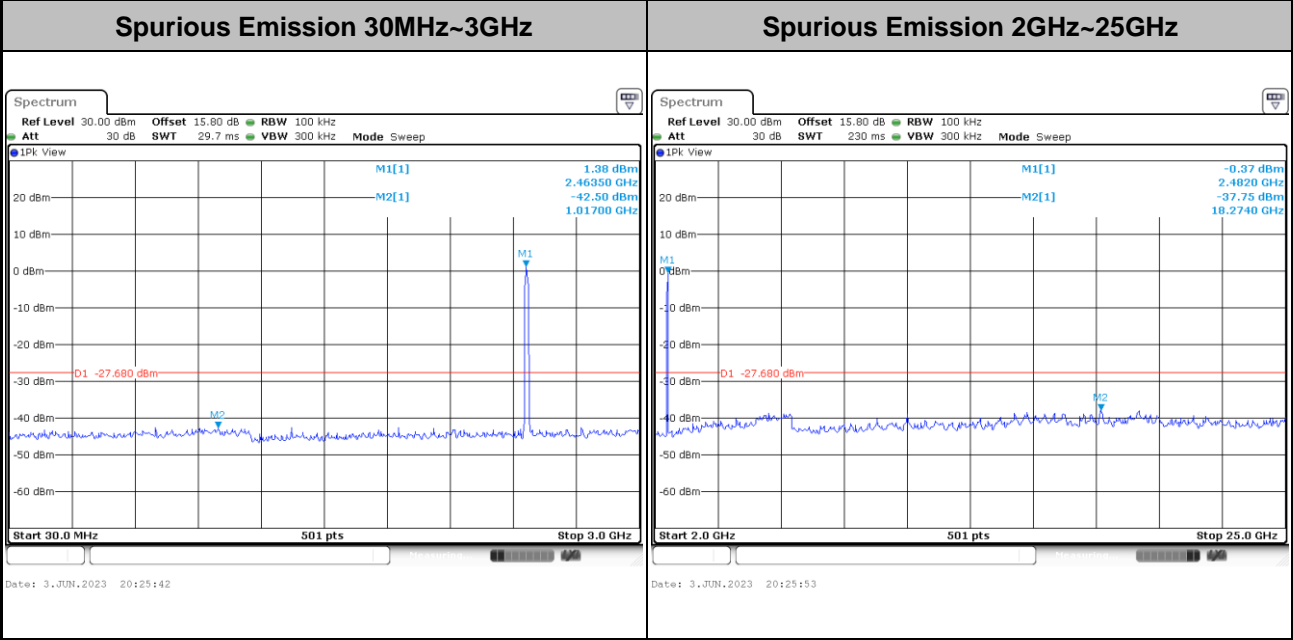
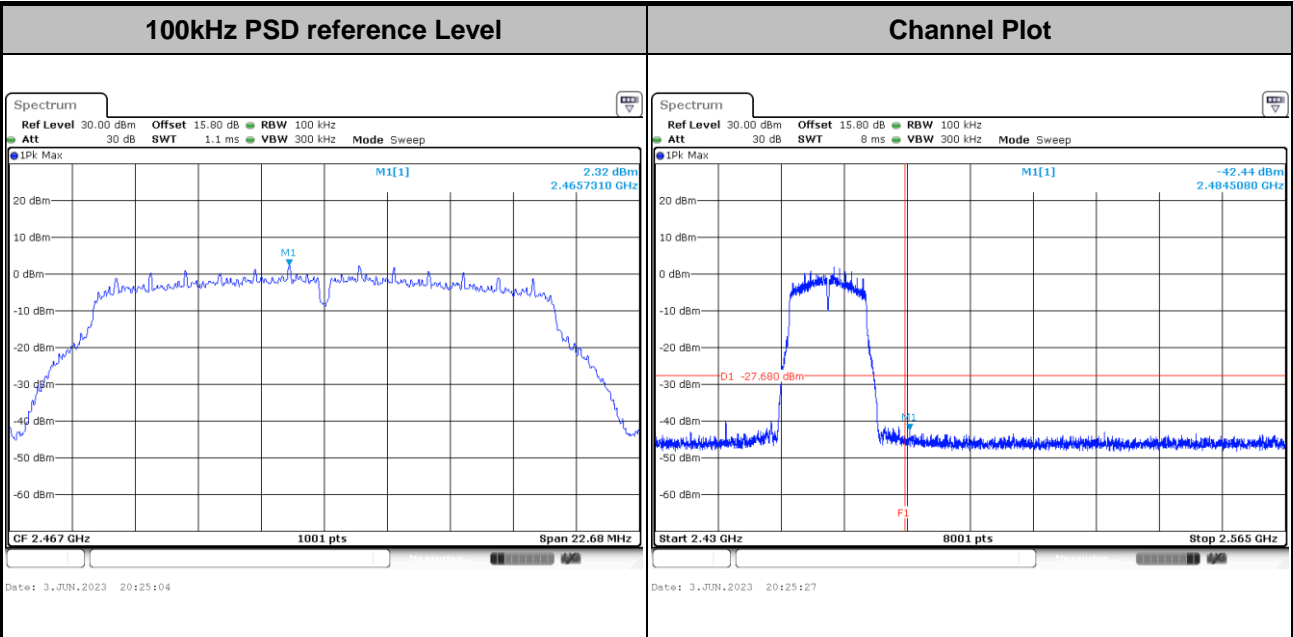


Test Mode : 802.11g Test Channel : 11



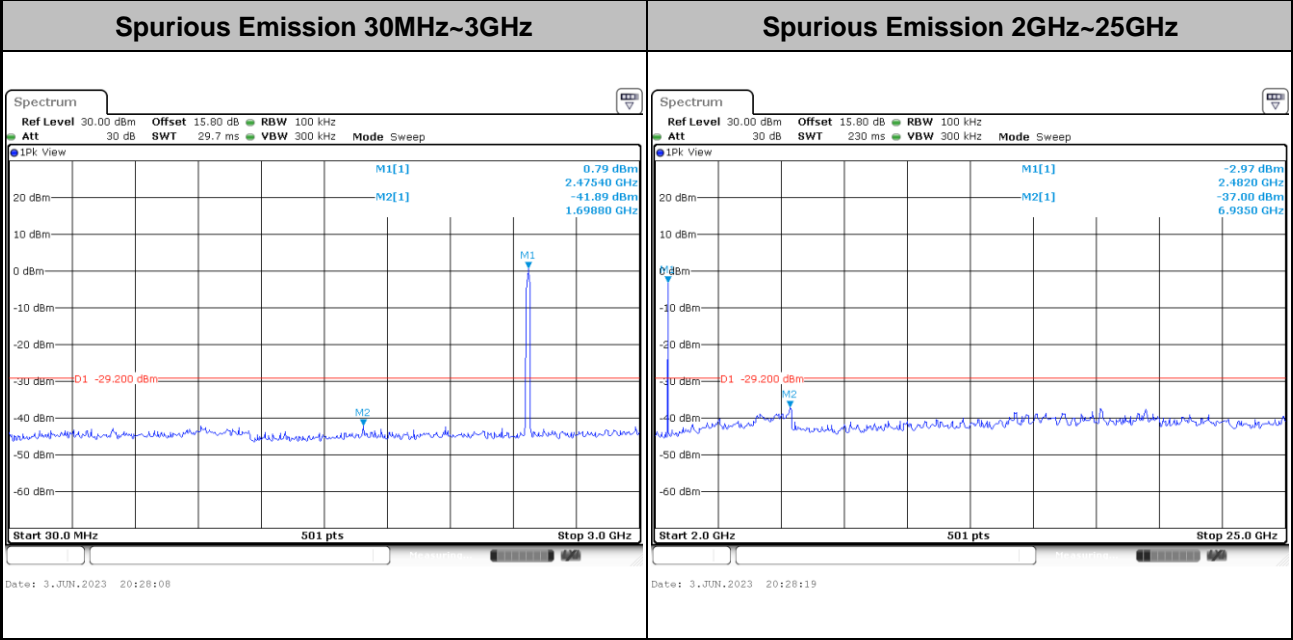
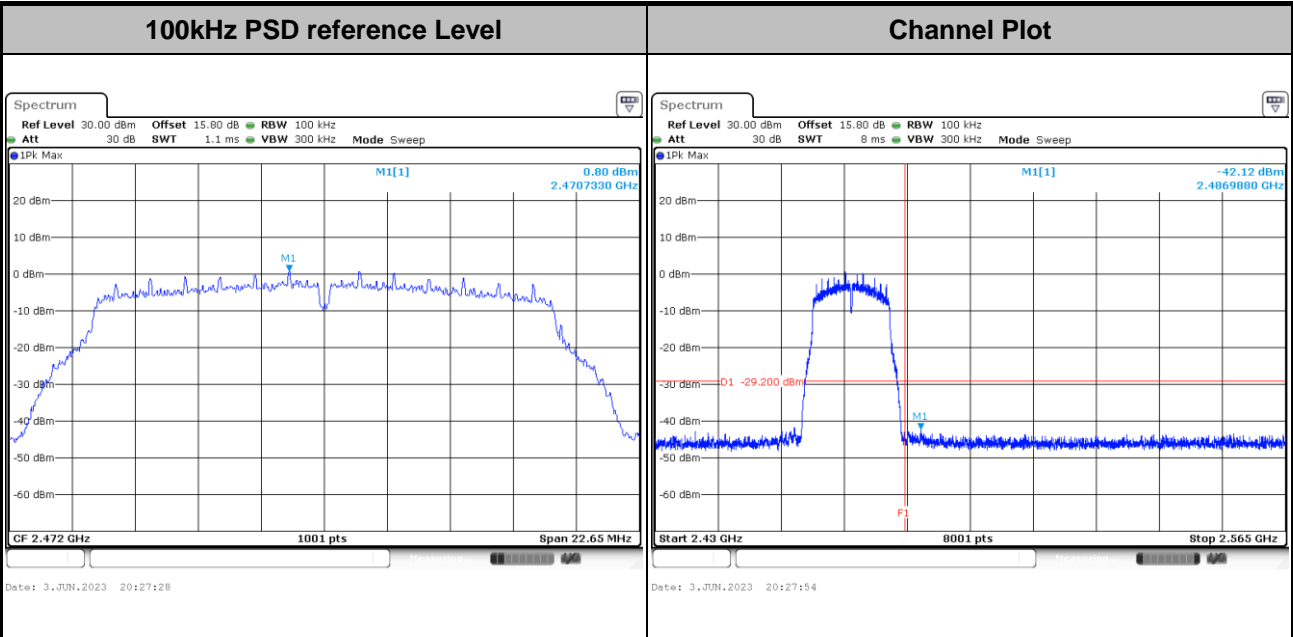


Test Mode : 802.11g Test Channel : 12



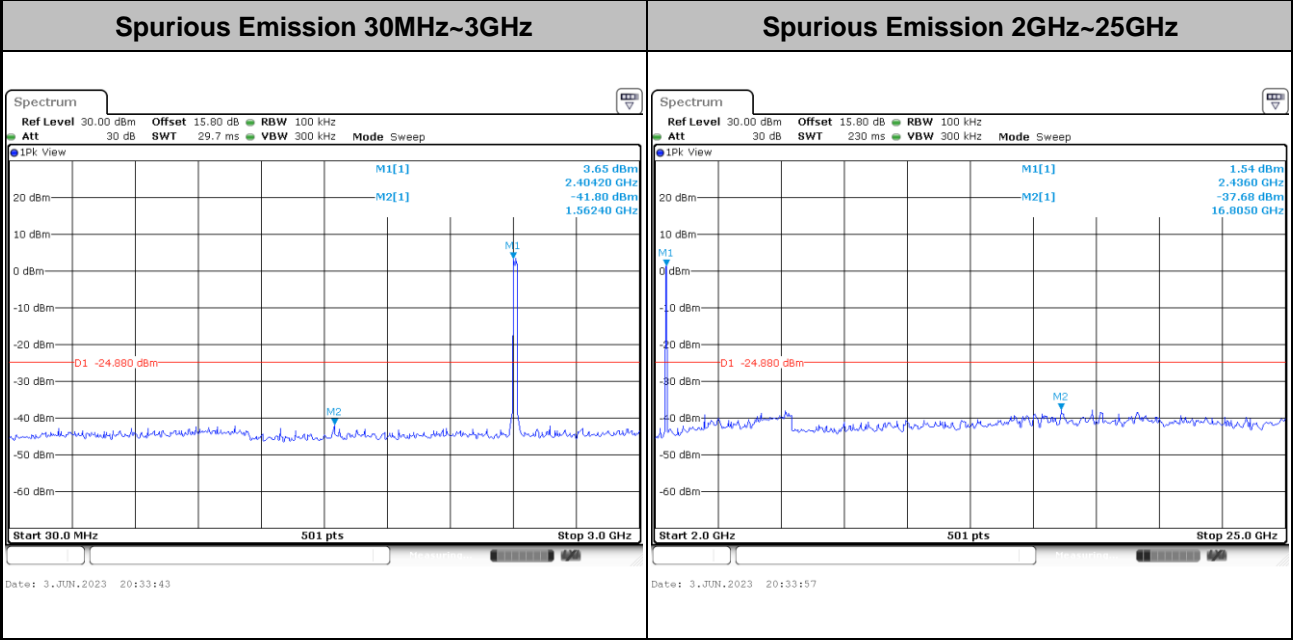
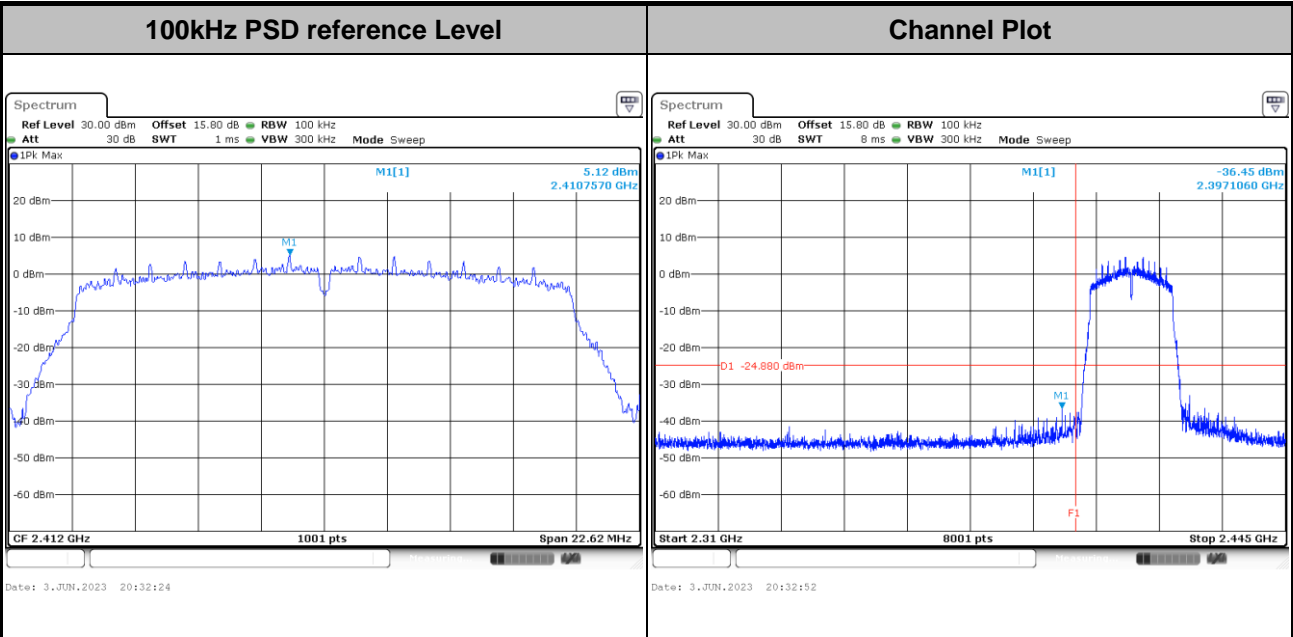


Test Mode : 802.11g Test Channel : 13



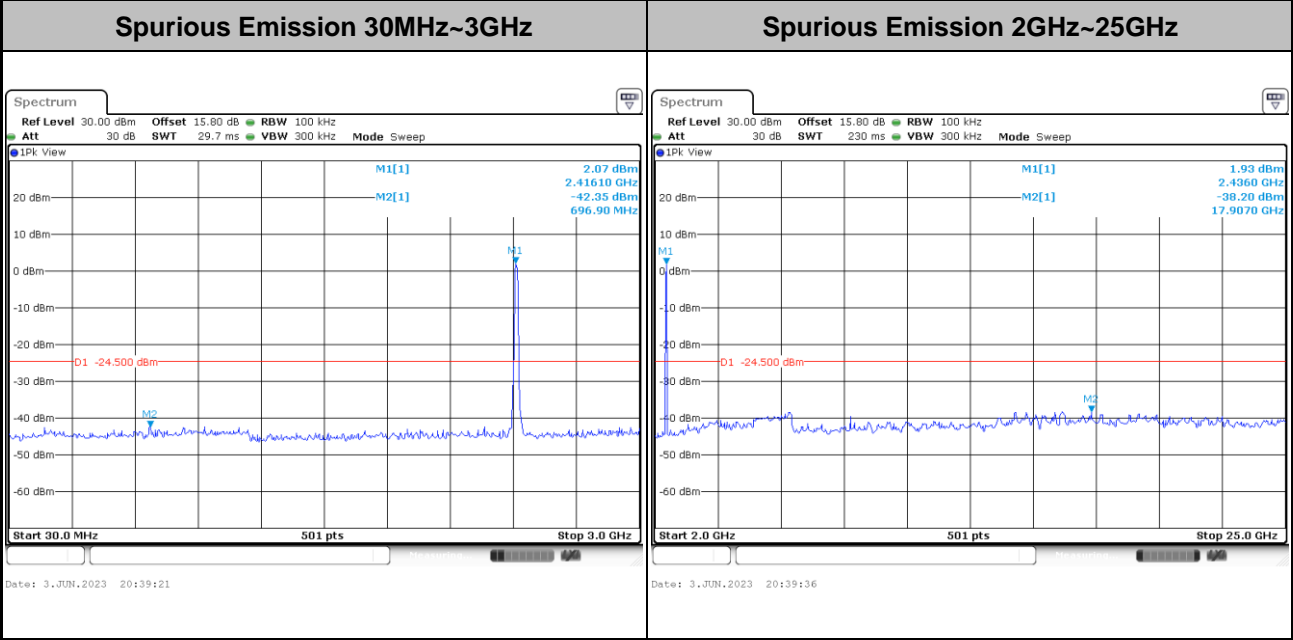
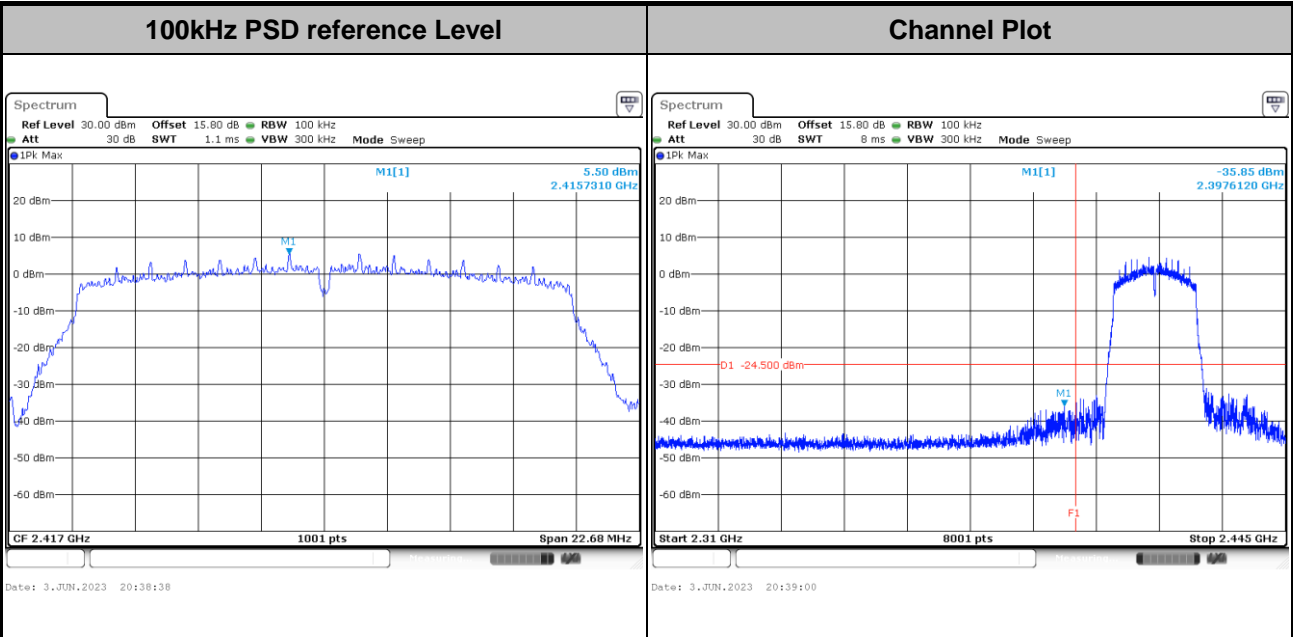


Test Mode : 802.11n HT20 Test Channel : 01



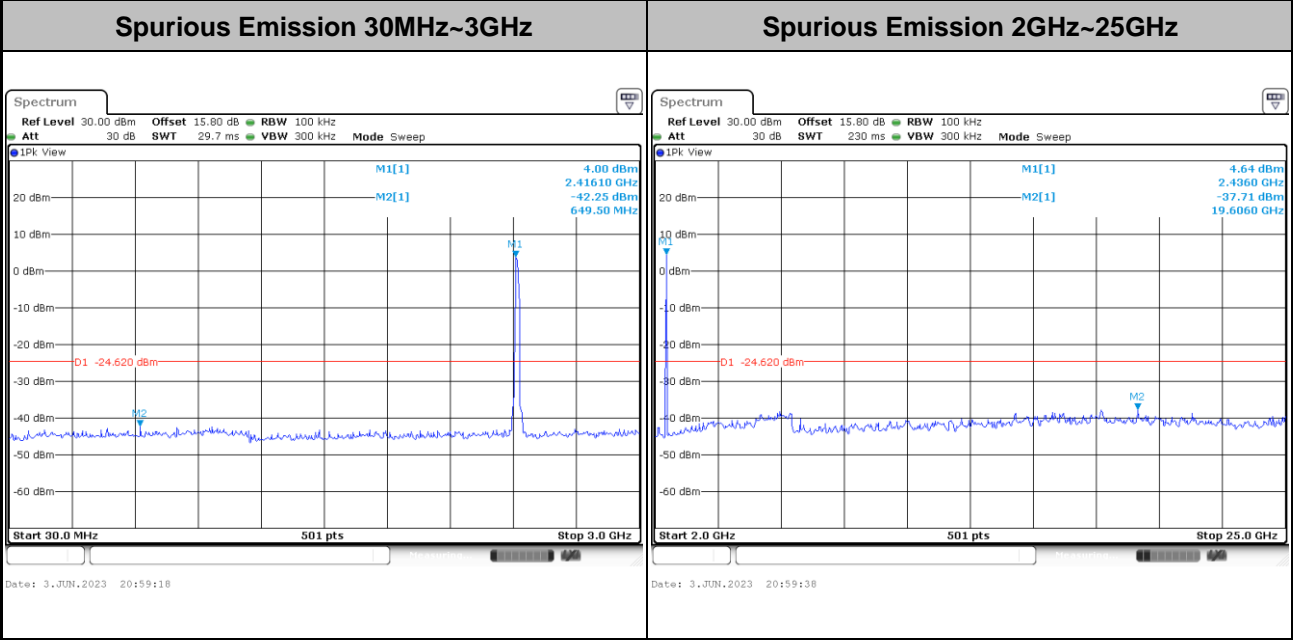
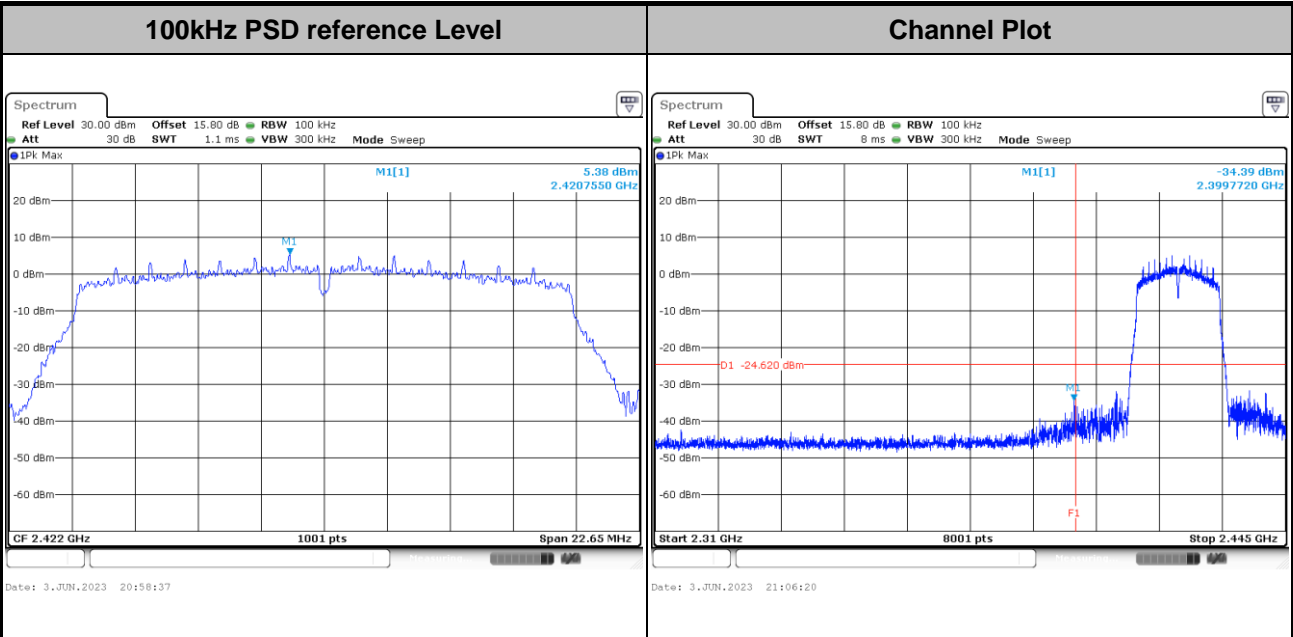


Test Mode : 802.11n HT20 Test Channel : 02



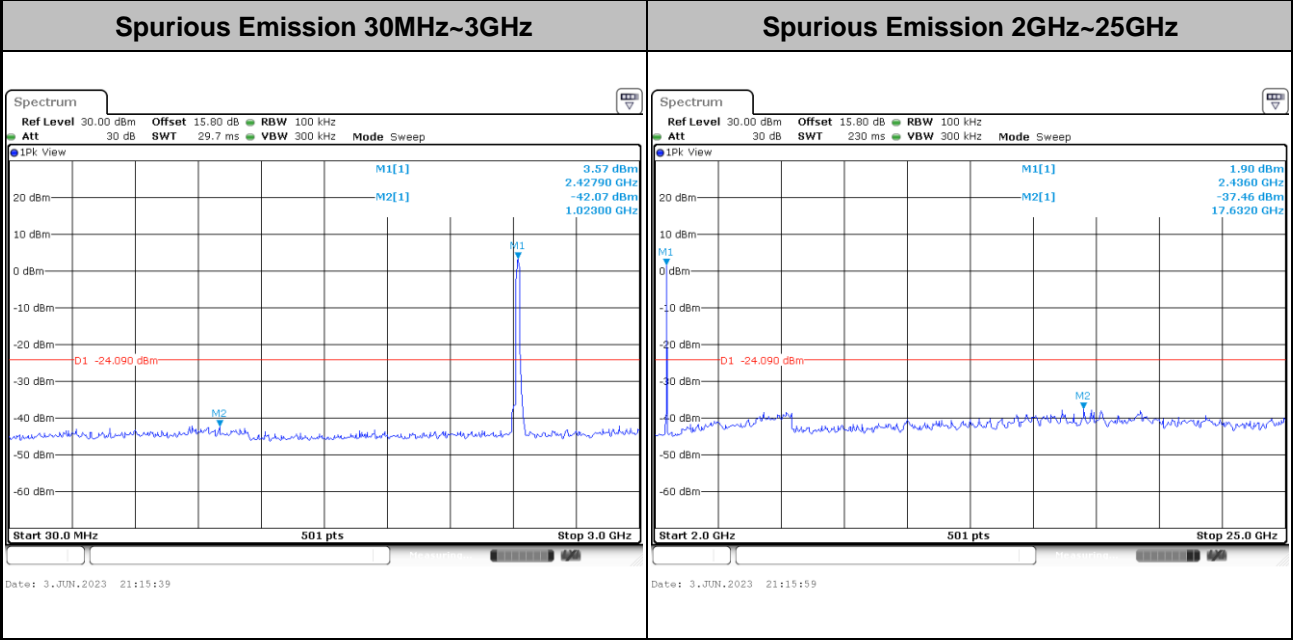
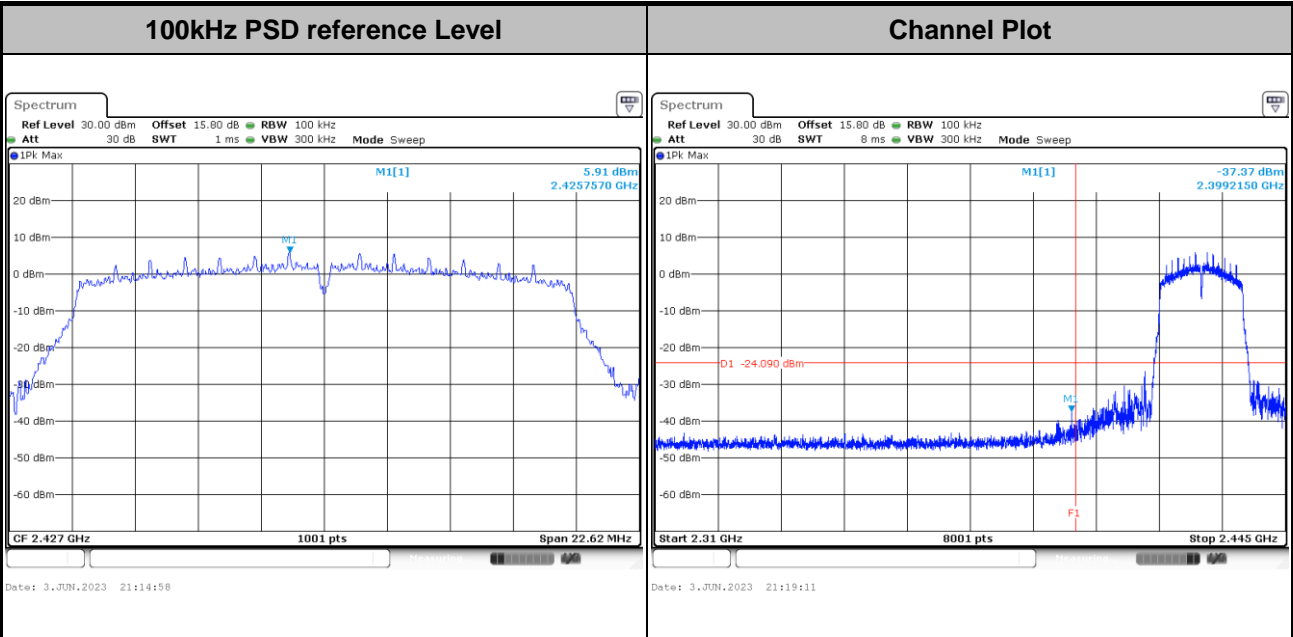


Test Mode : 802.11n HT20 Test Channel : 03



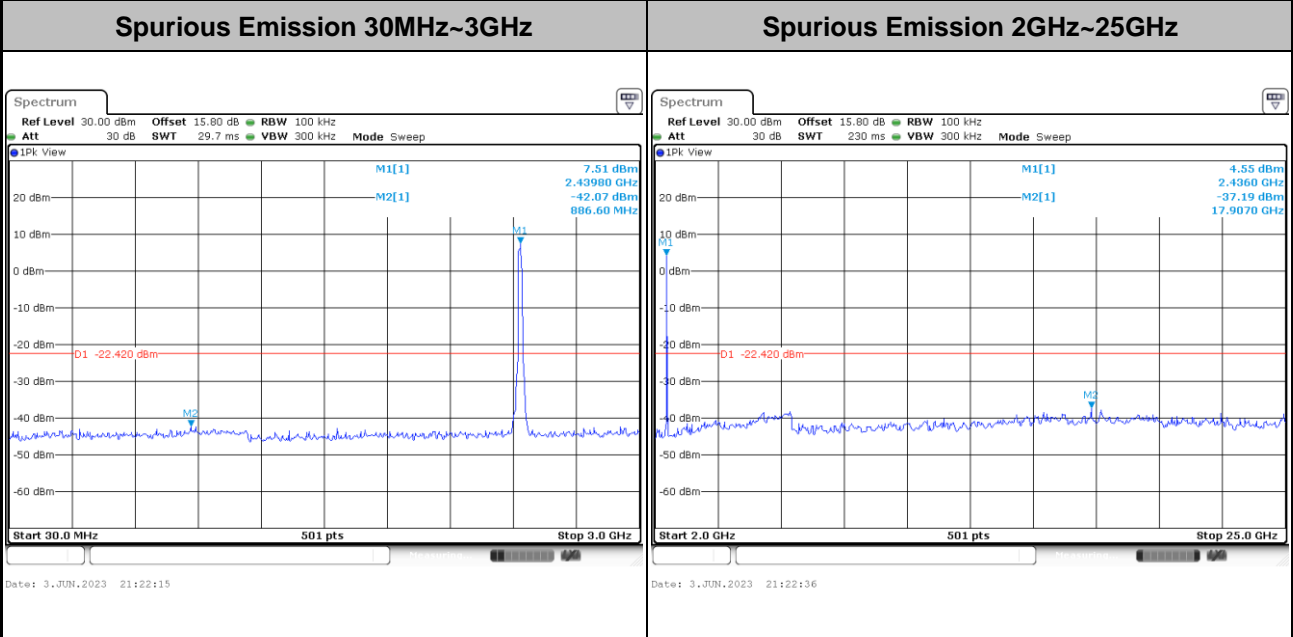
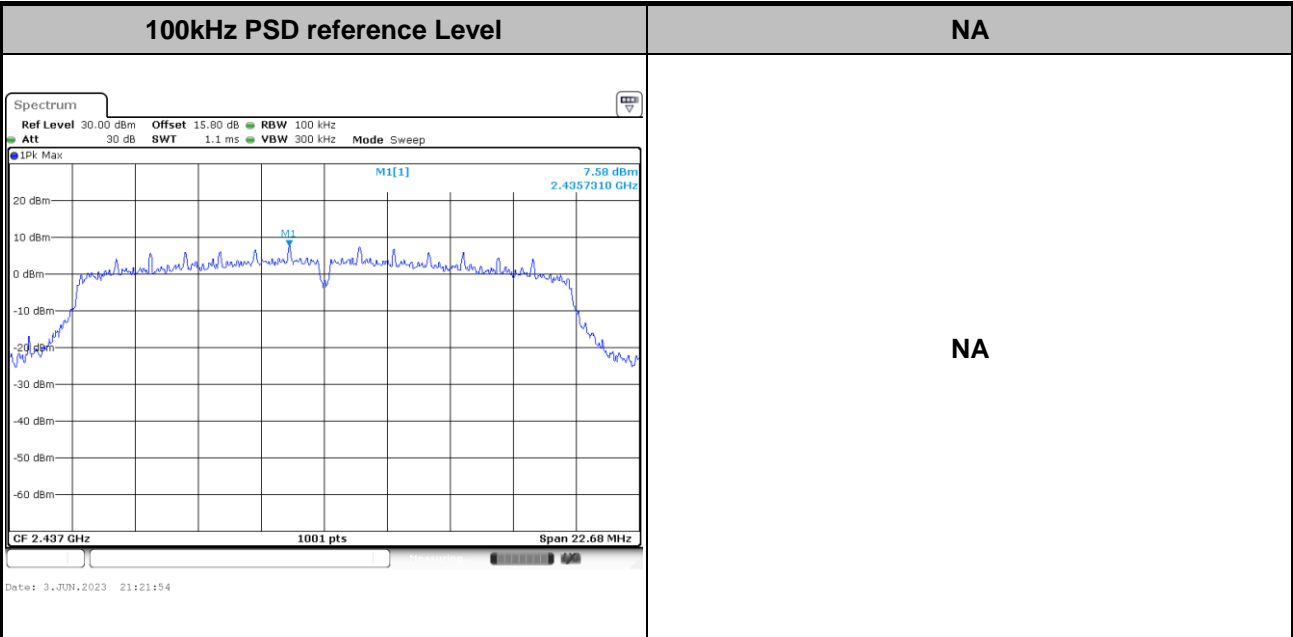


Test Mode :	802.11n HT20	Test Channel :	04
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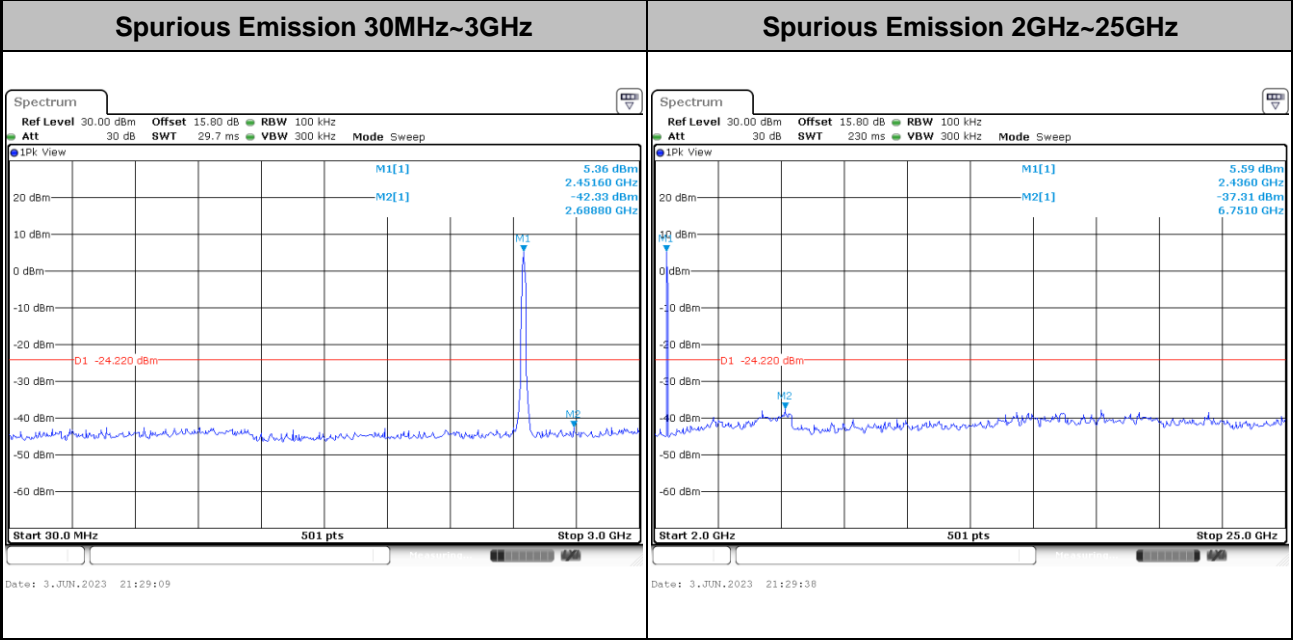
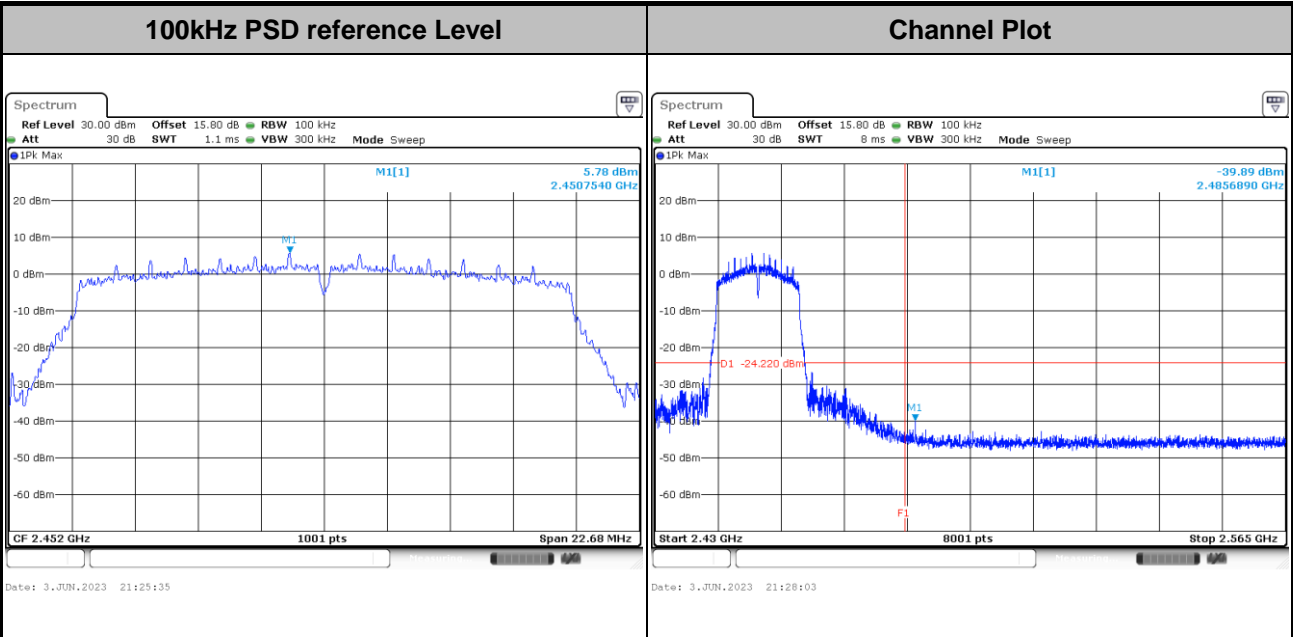


Test Mode :	802.11n HT20	Test Channel :	06
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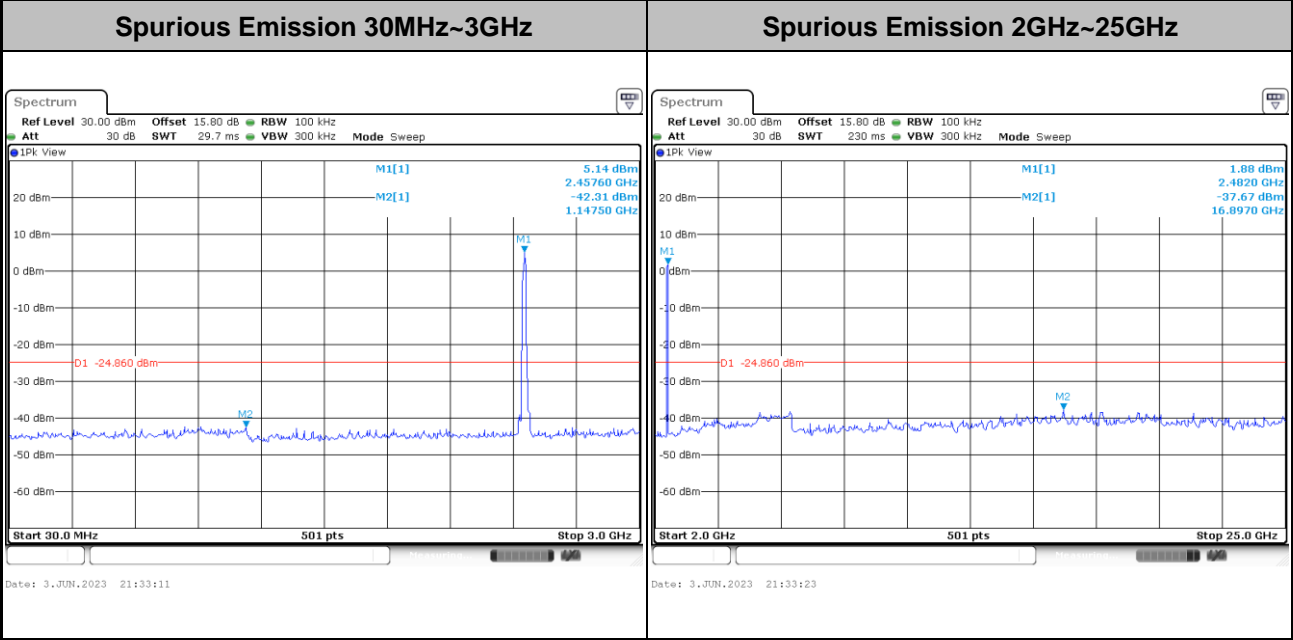
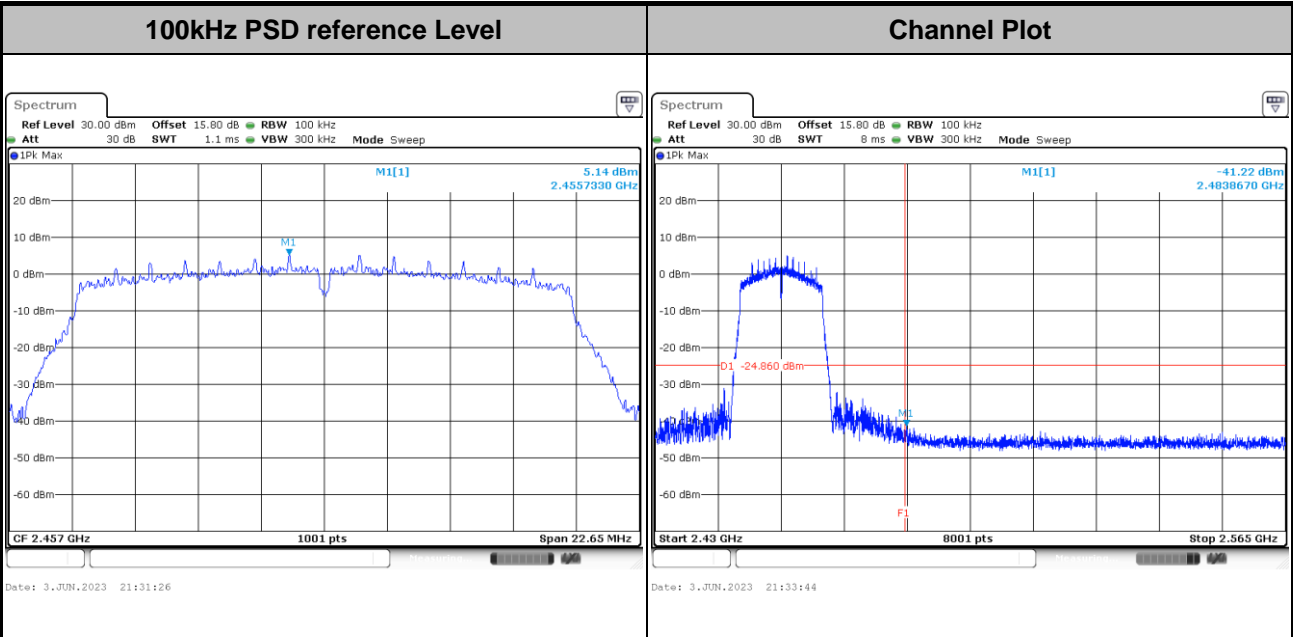


Test Mode : 802.11n HT20 Test Channel : 09



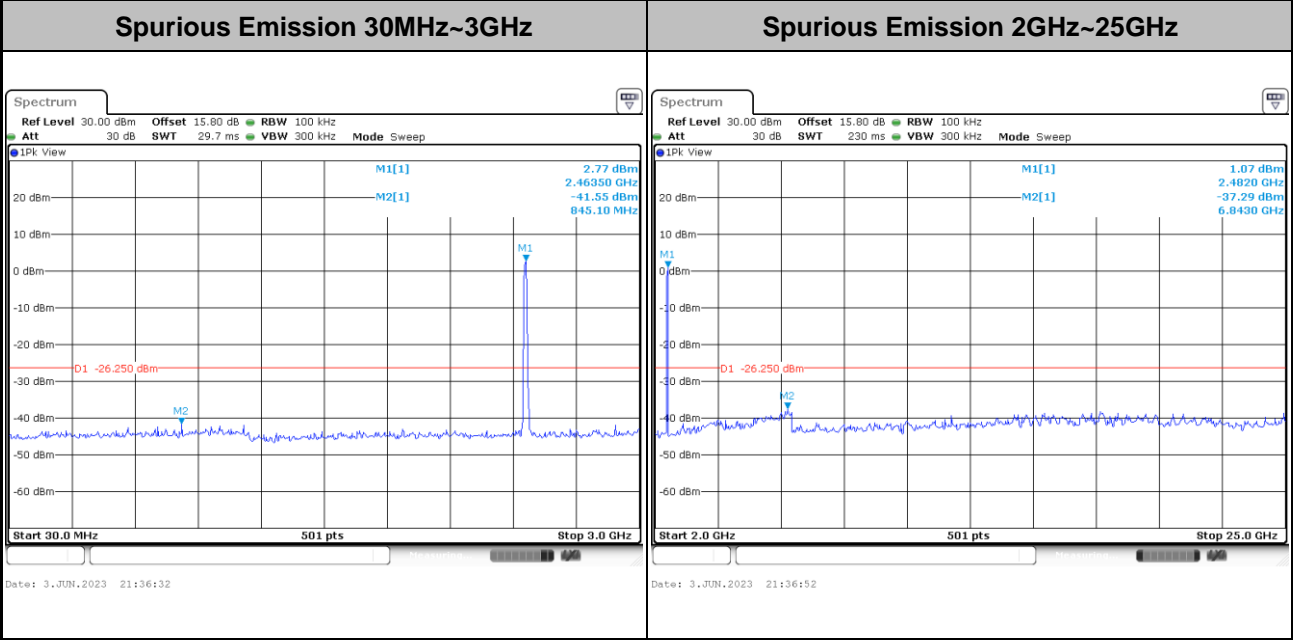
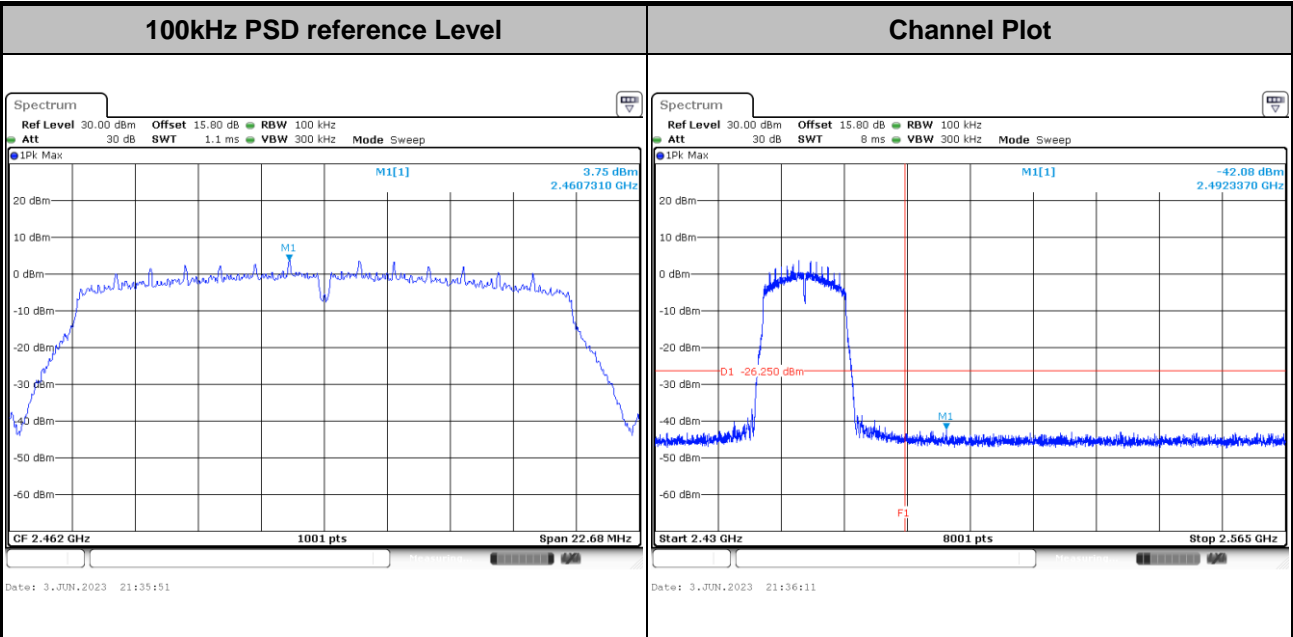


Test Mode : 802.11n HT20 Test Channel : 10



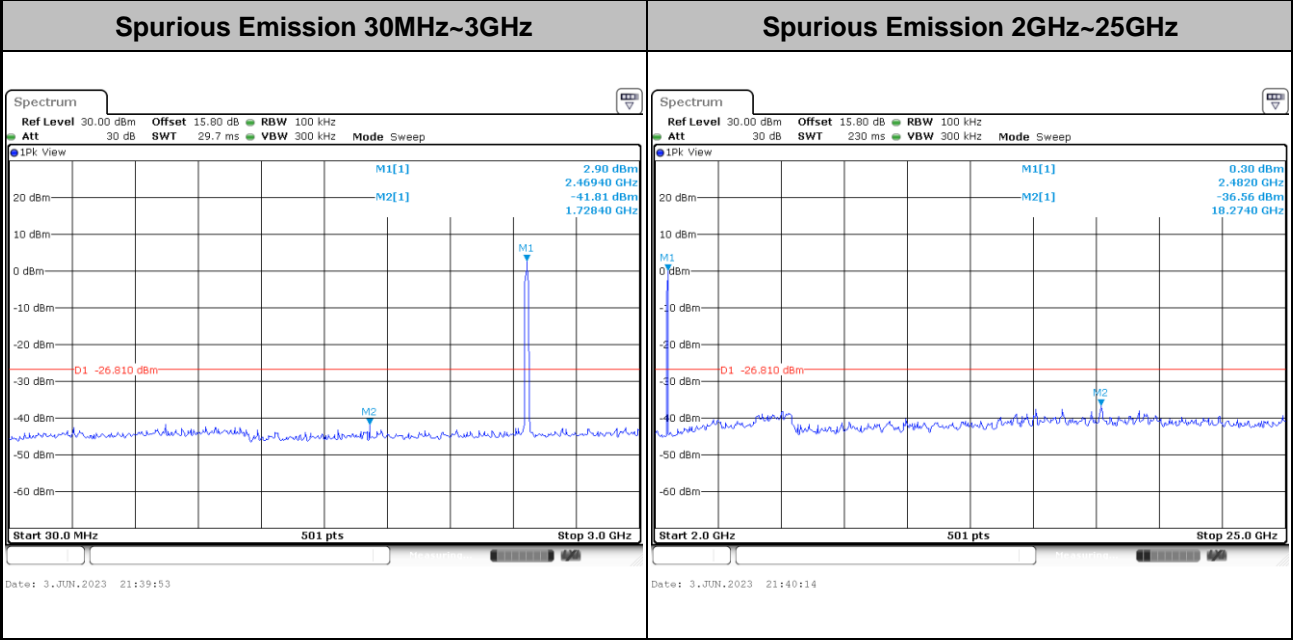
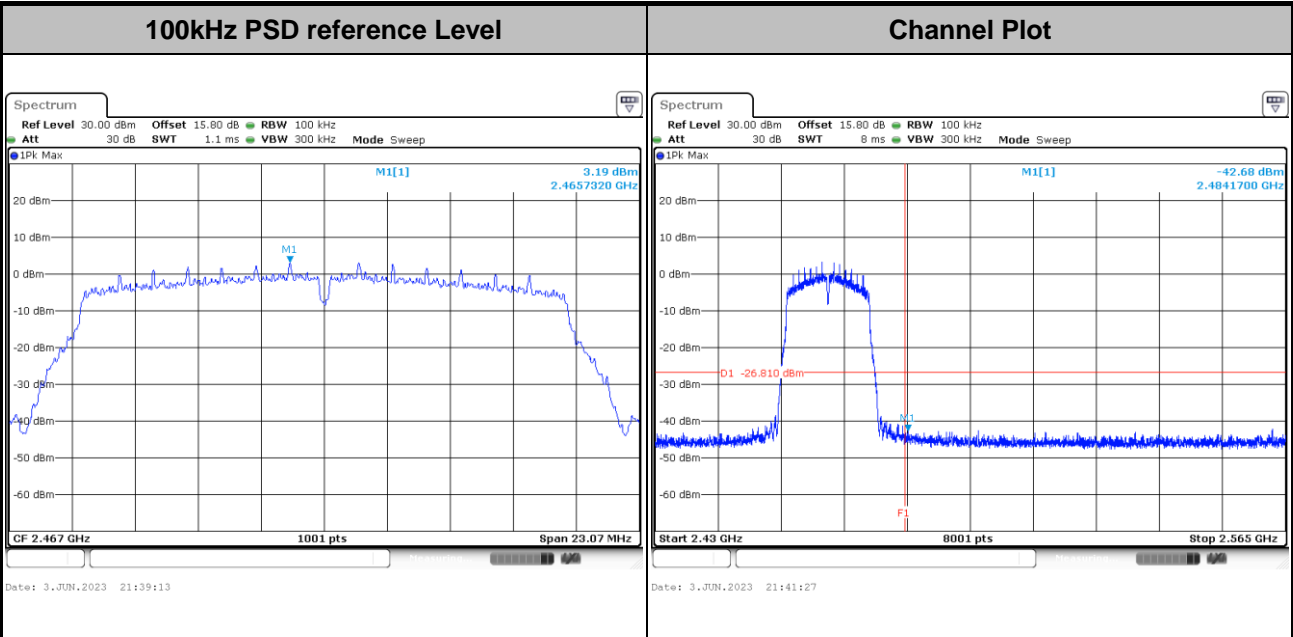


Test Mode :	802.11n HT20	Test Channel :	11
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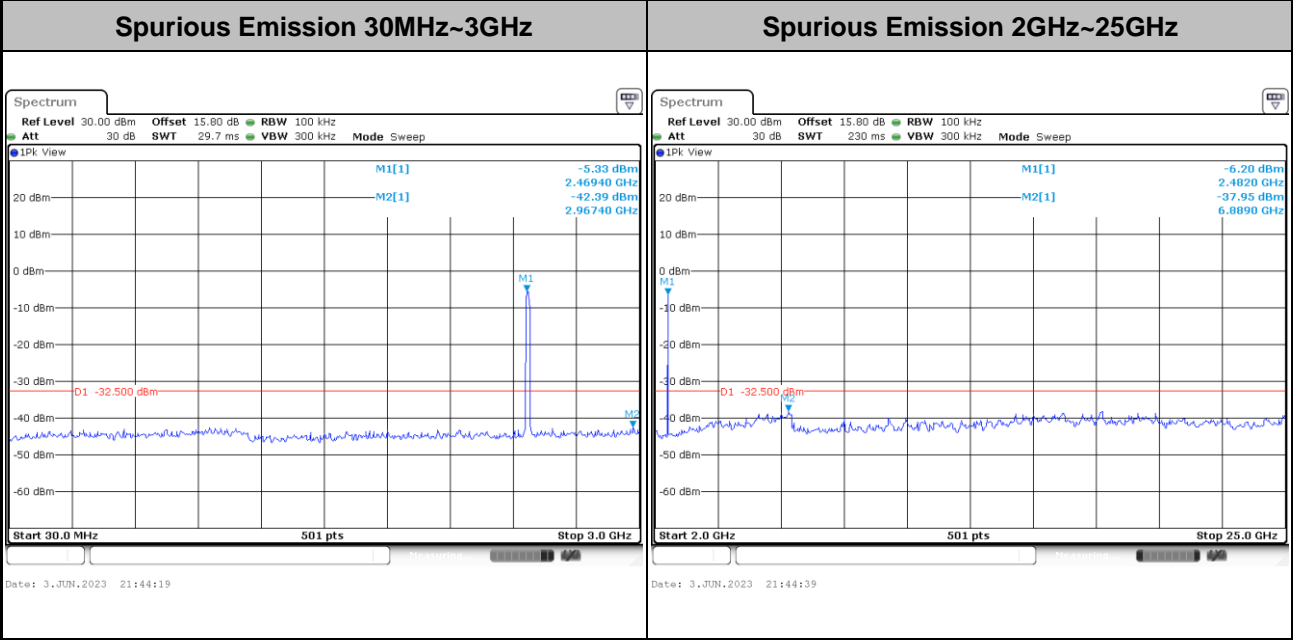
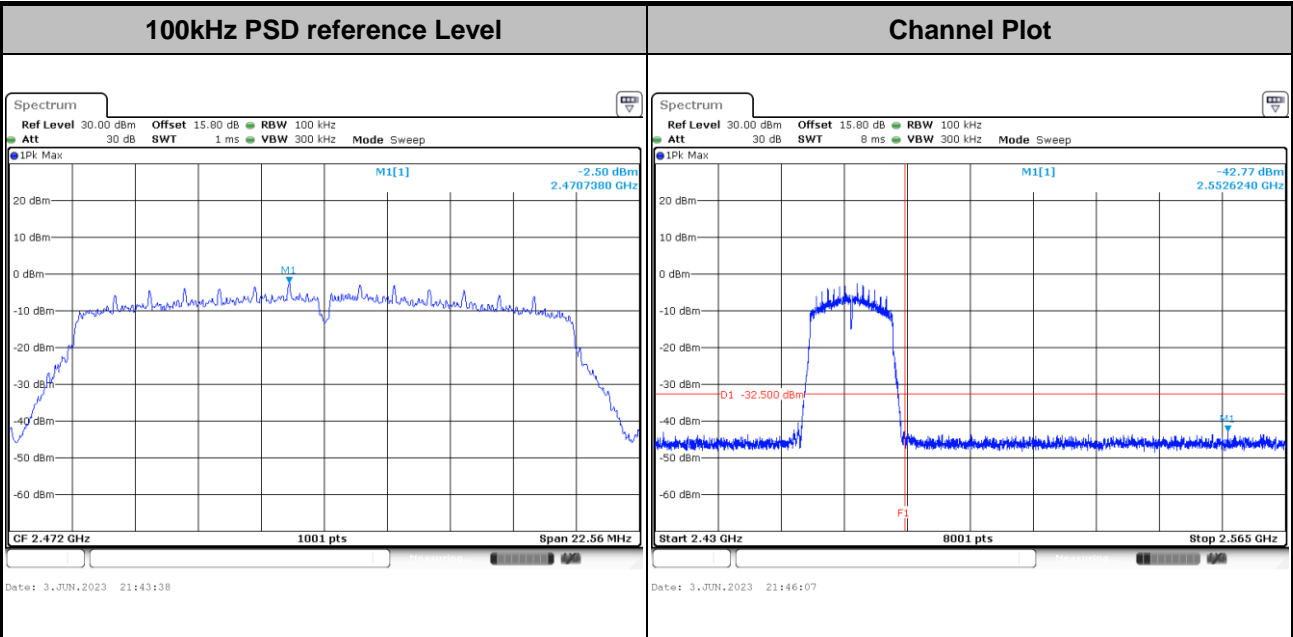


Test Mode :	802.11n HT20	Test Channel :	12
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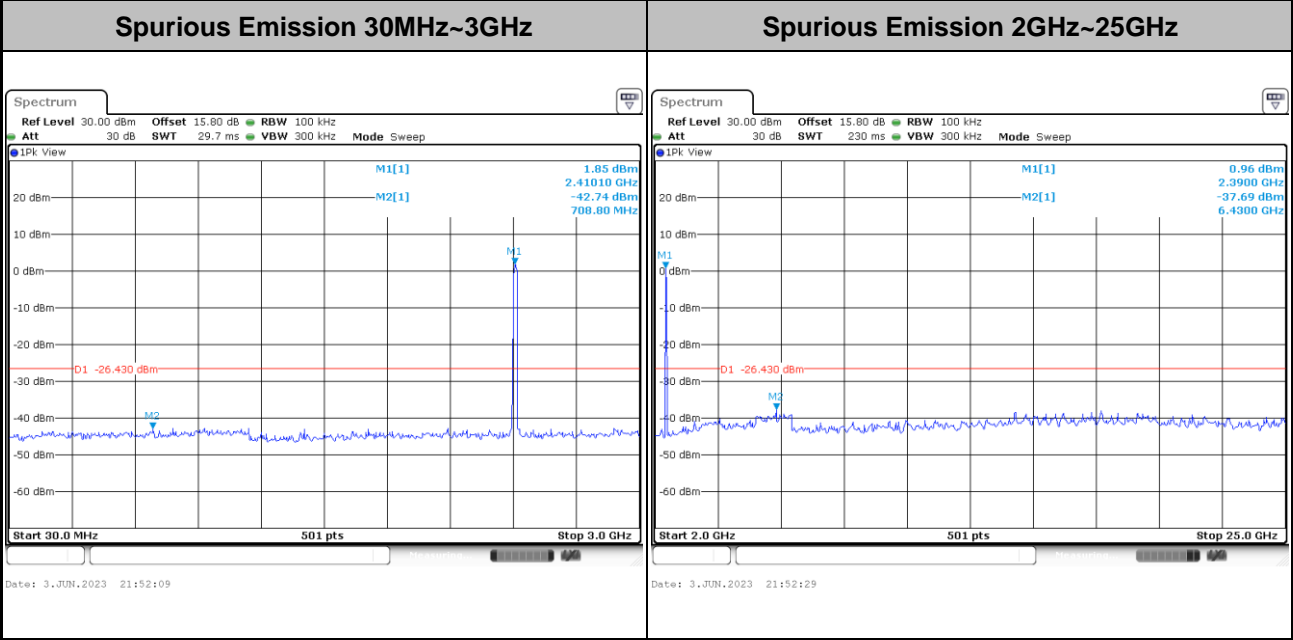
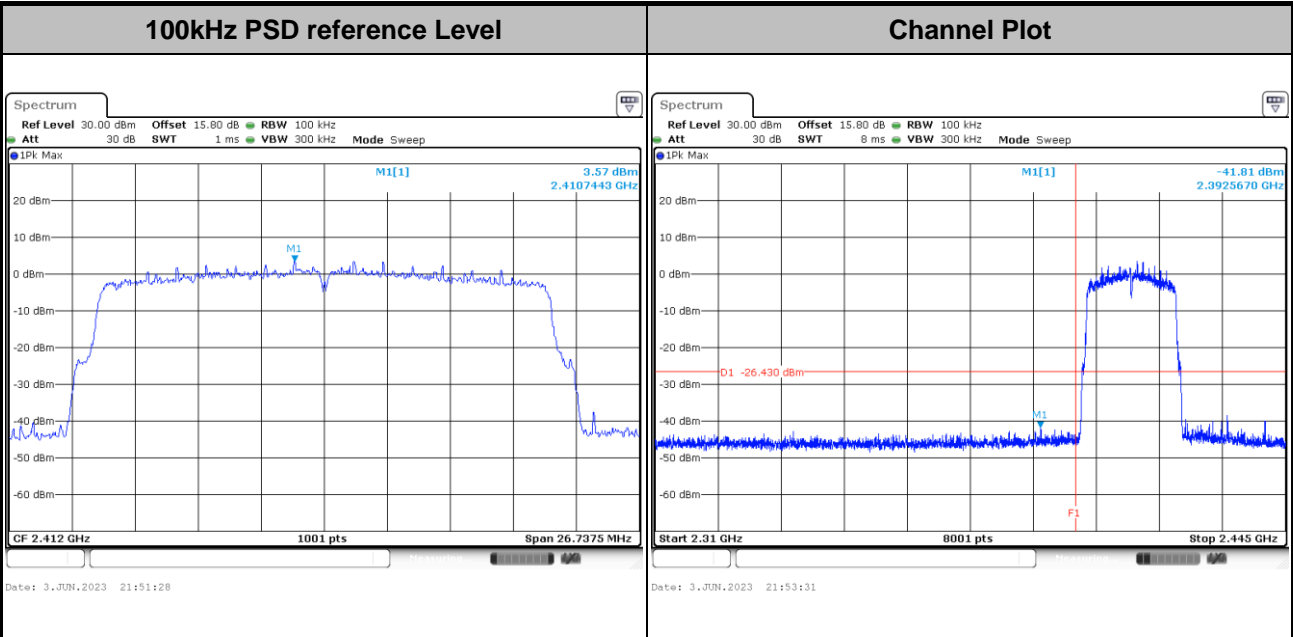


Test Mode : 802.11n HT20 Test Channel : 13



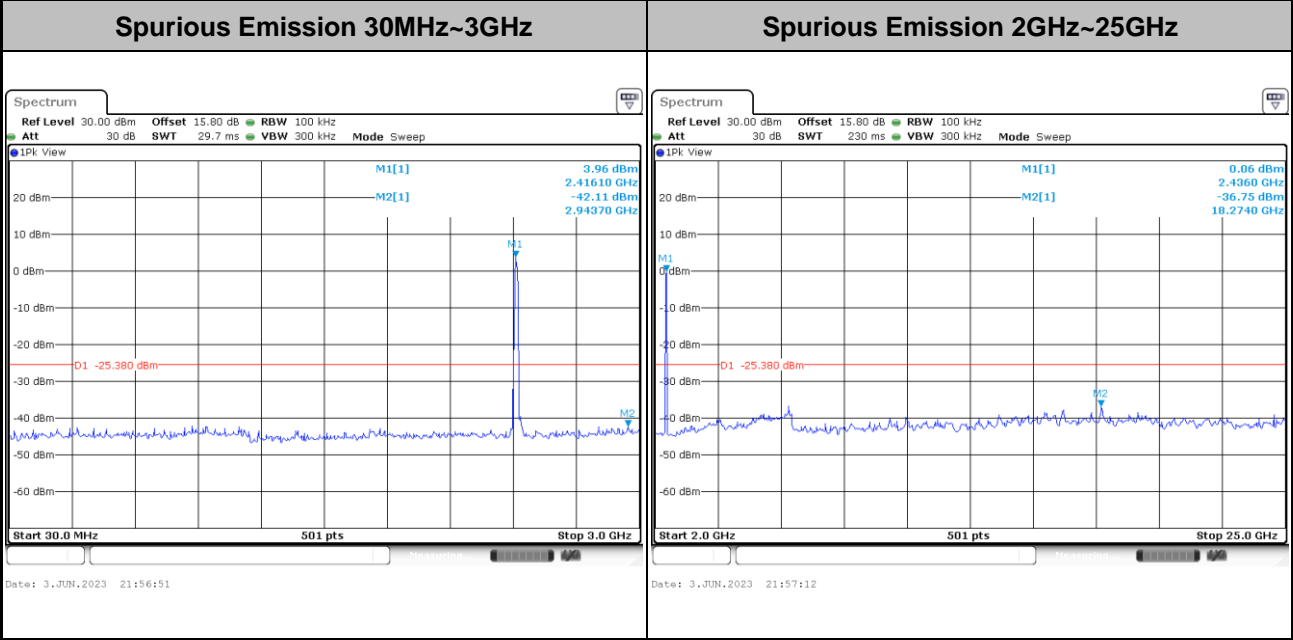
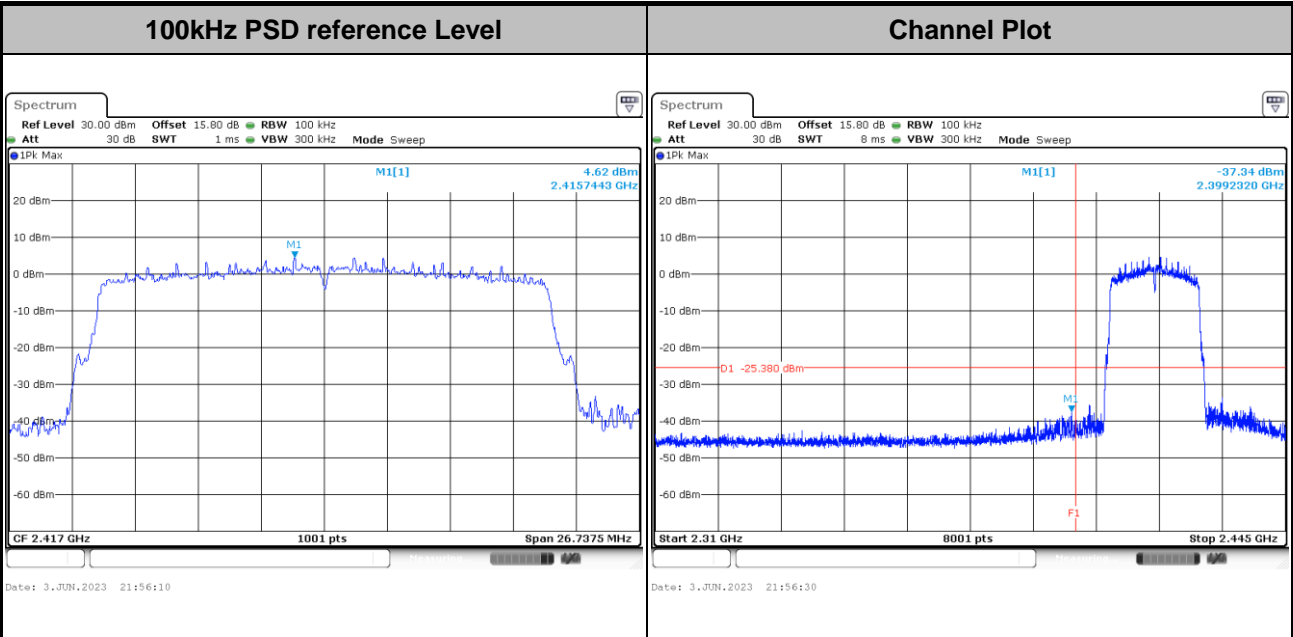


Test Mode : 802.11ax HE20 Test Channel : 01



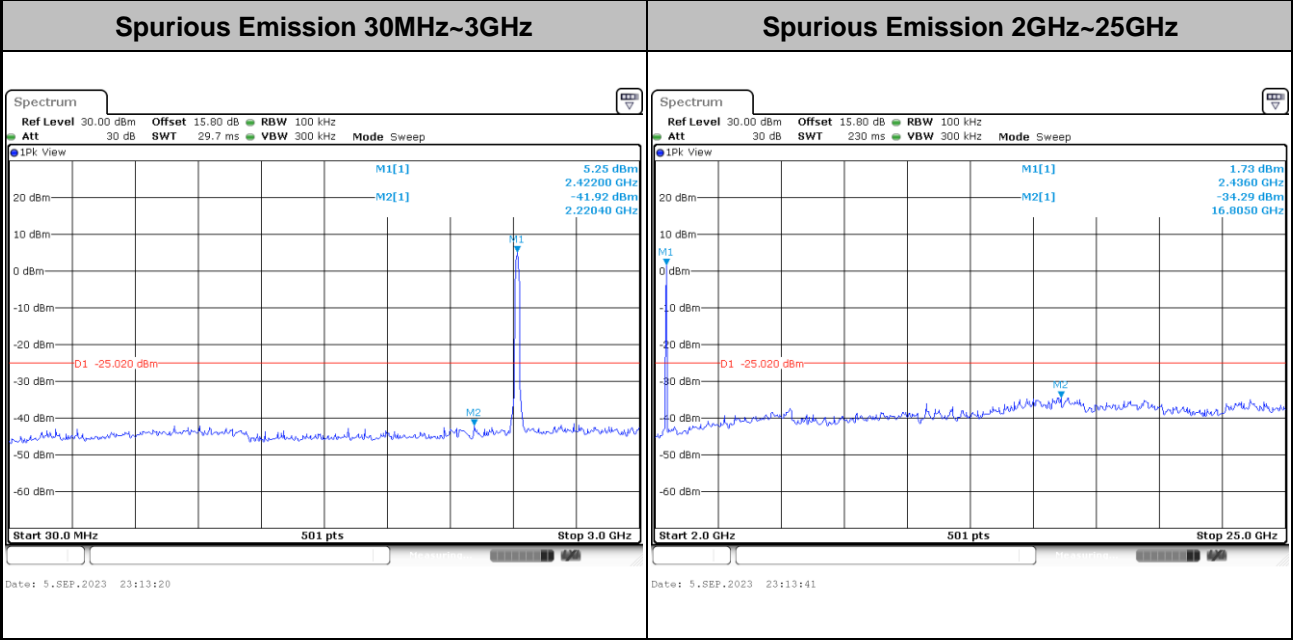
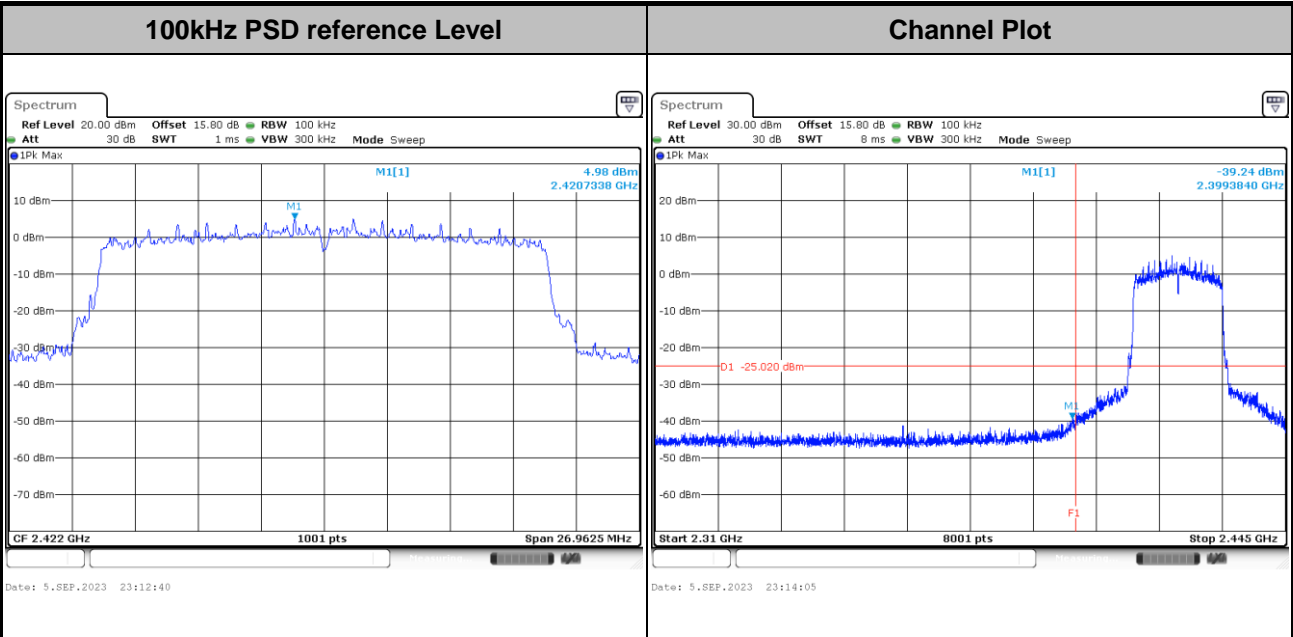


Test Mode : 802.11ax HE20 Test Channel : 02



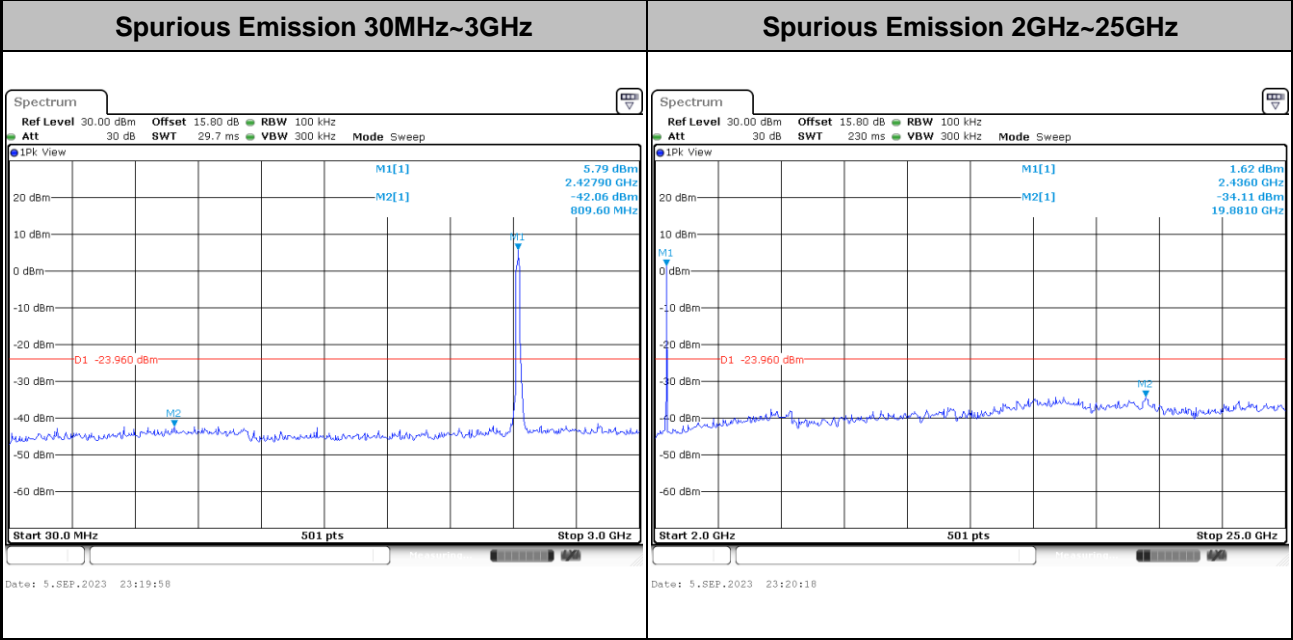
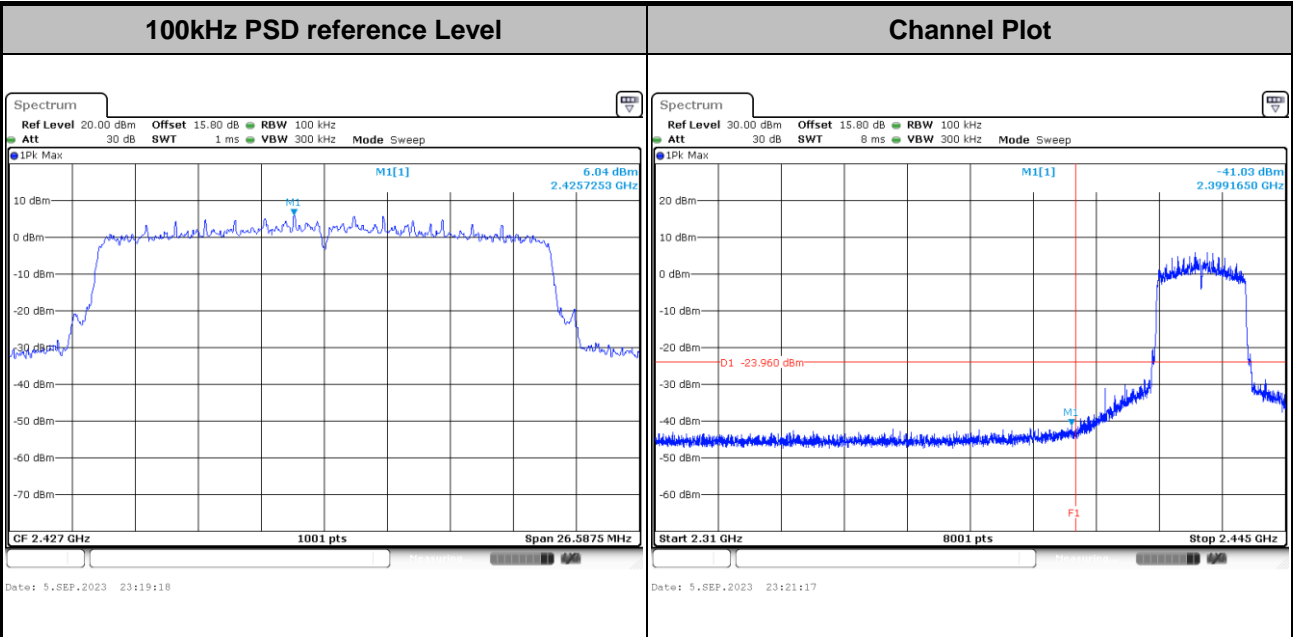


Test Mode : 802.11ax HE20 Test Channel : 03





Test Mode : 802.11ax HE20 Test Channel : 04





Test Mode :	802.11ax HE20	Test Channel :	06
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