



FCC RF Test Report

APPLICANT : Technicolor Connected Home USA LLC
EQUIPMENT : DOCSIS 3.1 Residential Voice Gateway
BRAND NAME : Technicolor
MODEL NAME : CGA437TTCH4, CGA437TXXXXX (where X can be alphanumeric, -, or blank)
FCC ID : G95-CGA437T
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System
TEST DATE(S) : Nov. 08, 2022 ~ Dec. 05, 2022

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

APPENDIX C. RADIATED SPURIOUS EMISSION

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR201817A	Rev. 01	Initial issue of report	Dec. 23, 2022



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	-
3.5	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 0.28 dB at 2483.98 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 4.21 dB at 0.494 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

Technicolor Connected Home USA LLC
 4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092

1.2 Manufacturer

Technicolor Connected Home USA LLC
 4855 Peachtree Industrial Blvd. Suite 200 Norcross, Georgia 30092

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	DOCSIS 3.1 Residential Voice Gateway
Brand Name	Technicolor
Model Name	CGA437TTCH4, CGA437TXXXXX (where X can be alphanumeric, -, or blank)
FCC ID	G95-CGA437T
SN Code	Conducted: CGA437TTCH4Lab2B038 Radiated: CGA437TTCH4lab2C026 Conduction: CGA437TTCH4lab2B030
HW Version	1.0.0
SW Version	RG21.3-CGA437TTCH3-TCH_CORE-21.2P1_WLAN
EUT Stage	Identical Prototype

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

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Channel Frequency Range	2412 MHz ~ 2462 MHz
Maximum (Average) Output Power to antenna	<MIMO Ant.1+2+3+4> 802.11b : 29.94 dBm (0.9863 W) 802.11g : 29.93 dBm (0.9840 W) 802.11n HT20 : 29.60 dBm (0.9120 W) 802.11n HT40 : 27.37 dBm (0.5458 W) 802.11ac VHT20 : 29.66 dBm (0.9247 W) 802.11ac VHT40 : 27.13 dBm (0.5164 W) 802.11ax HE20 : 29.82 dBm (0.9594 W) 802.11ax HE40 : 27.40 dBm (0.5495 W)
99% Occupied Bandwidth	802.11b : 11.09MHz 802.11g : 18.63MHz 802.11ax HE20 : 19.93MHz 802.11ax HE40 : 38.16MHz
Antenna Type	Murphy Antenna
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: OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)				
Antenna Function Description		Ant. 1	Ant. 2	Ant. 3	Ant. 4
	802.11 b/g/n/ac/ax SISO	V	V	V	V
	802.11 b/g/n/ac/ax CDD 1S4T	V	V	V	V
	802.11 n/ac/ax Tx Beamforming 1S4T	V	V	V	V
	802.11 n/ac/ax SDM 4S4T	V	V	V	V

Note:

1. For SISO&MIMO mode, the whole testing has assessed only MIMO mode by referring to their higher conducted power.
2. For 802.11n/ac/ax 20/40MHz mode, the whole testing has assessed only 802.11ax HE20/HE40MHz mode by referring to the higher output power.
3. The device does not support partial RU tone for 802.11ax mode
4. The device supports 1S4T(CDD&TXBF) and 4S4T(SDM) mode; 1S4T: NSS=1, MIMO 4Tx; 4S4T: NSS=4, MIMO 4Tx.
5. Please refer to the antenna report for the maximum Single antenna gain and CDD (Cyclic Delay Diversity) directional gain and TXBF (Tx Beamforming) directional gain and SDM (Space Division Multiplexing) directional gain.

Frequency Band	Max Single Antenna gain (dBi)				CDD DG (dBi)		TXBF DG (dBi)		SDM DG (dBi)	
	ANT1	ANT2	ANT3	ANT4	For Power	For PSD	For Power	For PSD	For Power	For PSD
2.4GHz	4.35	5.11	4.10	3.53	5.11	7.58	7.58	7.58	1.87	1.87

1.5 Modification of EUT

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

1.6 Specification of Accessory

Specification of Accessory				
AC Adapter 1	Brand Name	HONOTO	Model Name	ADS-50FKI-12 12048EPCU-L
AC Adapter 2	Brand Name	HONOTO	Model Name	ADS-50FKI-12 12048EPG



1.7 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 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-KS 03CH05-KS TH01-KS	CN1257	314309

1.8 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH05-KS	AUDIX	E3	6.2009-8-24
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.9 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
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. 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, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y 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	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

2.2 Test Mode

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

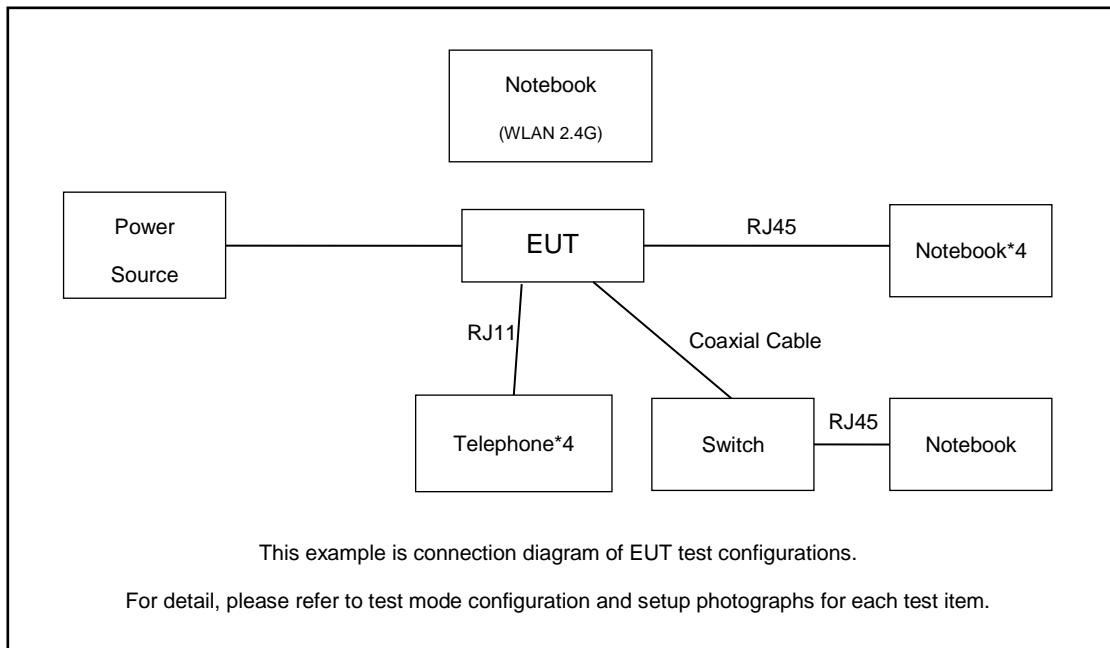
MIMO Antenna

Modulation	Data Rate
802.11b CDD 1S4T	1 Mbps
802.11g CDD 1S4T	6 Mbps / 24Mbps
802.11ax HE20 CDD 1S4T	MCS0 / MCS3 / MCS6
802.11ax HE40 CDD 1S4T	MCS0 / MCS3 / MCS6
802.11ax HE20 SDM 4S4T	MCS0 / MCS3 / MCS6
802.11ax HE40 SDM 4S4T	MCS0 / MCS3 / MCS6
802.11ax HE20 TX BF 1S4T	MCS0 / MCS3 / MCS6
802.11ax HE40 TX BF 1S4T	MCS0 / MCS3 / MCS6

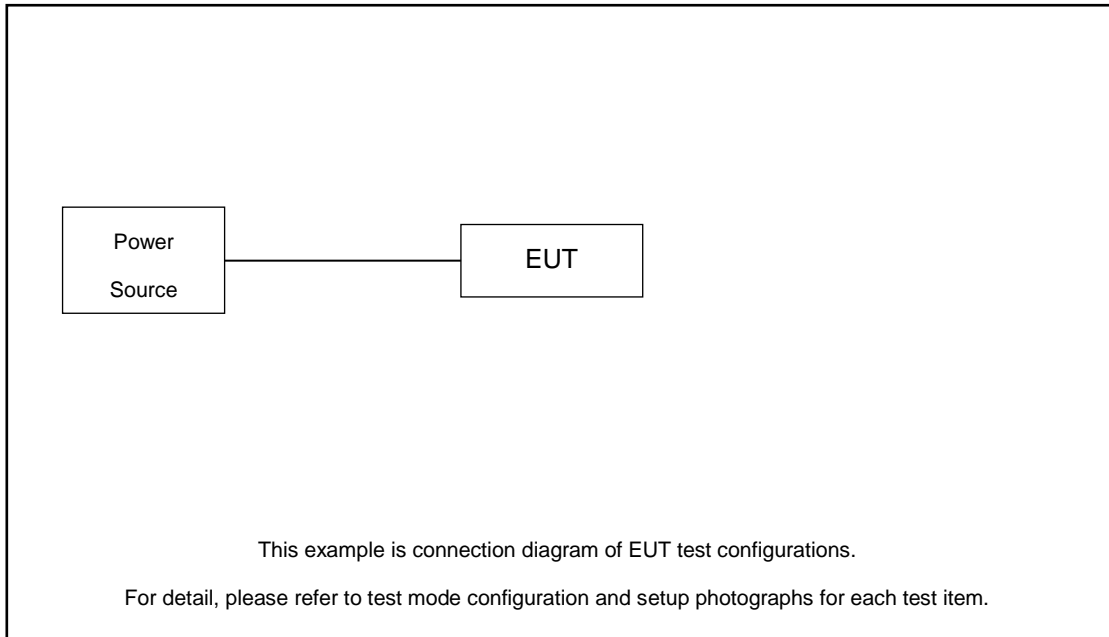
Test Cases	
AC Conducted Emission	Mode 1 :WLAN Link(2.4G) + Power from Adapter 1
Remark: For Radiated Test Cases, The tests were performance with Adapter 1.	

2.3 Connection Diagram of Test System

For 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.	Notebook*4	Lenovo	G480	QDS-BRCM1050I	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
2.	Notebook	Acer	N20C5	N/A	N/A	shielded cable DC O/P 1.8m , Unshielded AC I/P cable 1.8m
3.	Telephone*4	bubugao	HCD007(6082)TSD	N/A	N/A	N/A
4.	Switch	CISCO	NPE-G2	N/A	N/A	N/A
5.	RJ45 Cable	N/A	N/A	N/A	N/A	N/A
6.	RJ11 Cable	N/A	N/A	N/A	N/A	N/A
7.	U disk	N/A	N/A	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 Notebook 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 6.0 dB and 10dB attenuator.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 6.0 + 10 = 16.0 \text{ (dB)} \end{aligned}$$

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

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

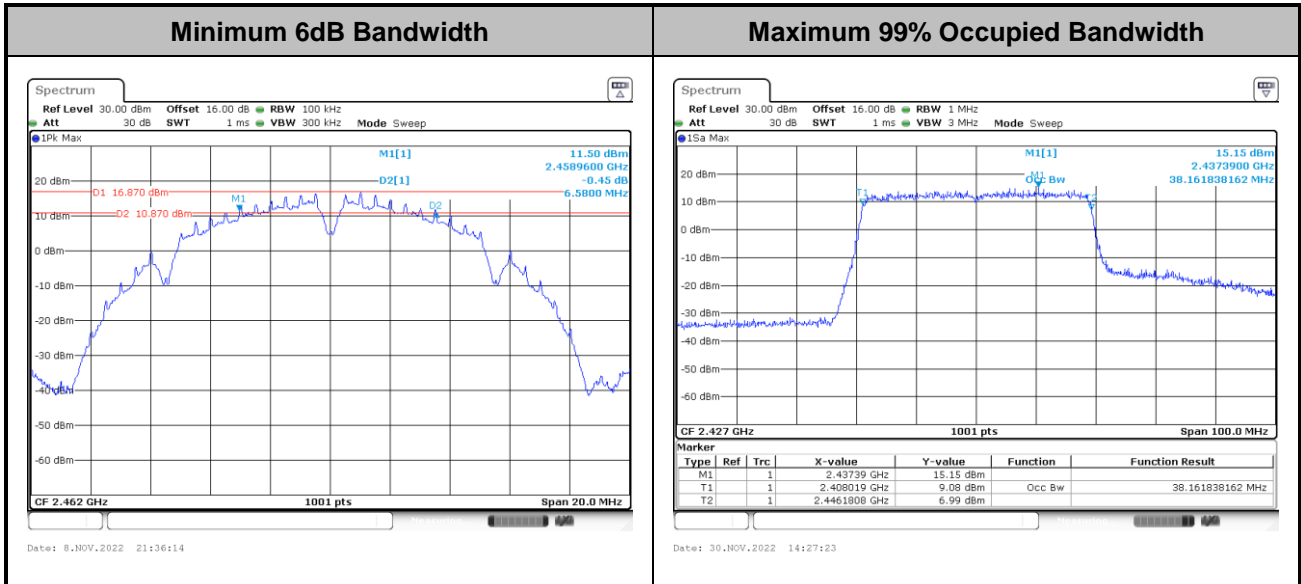




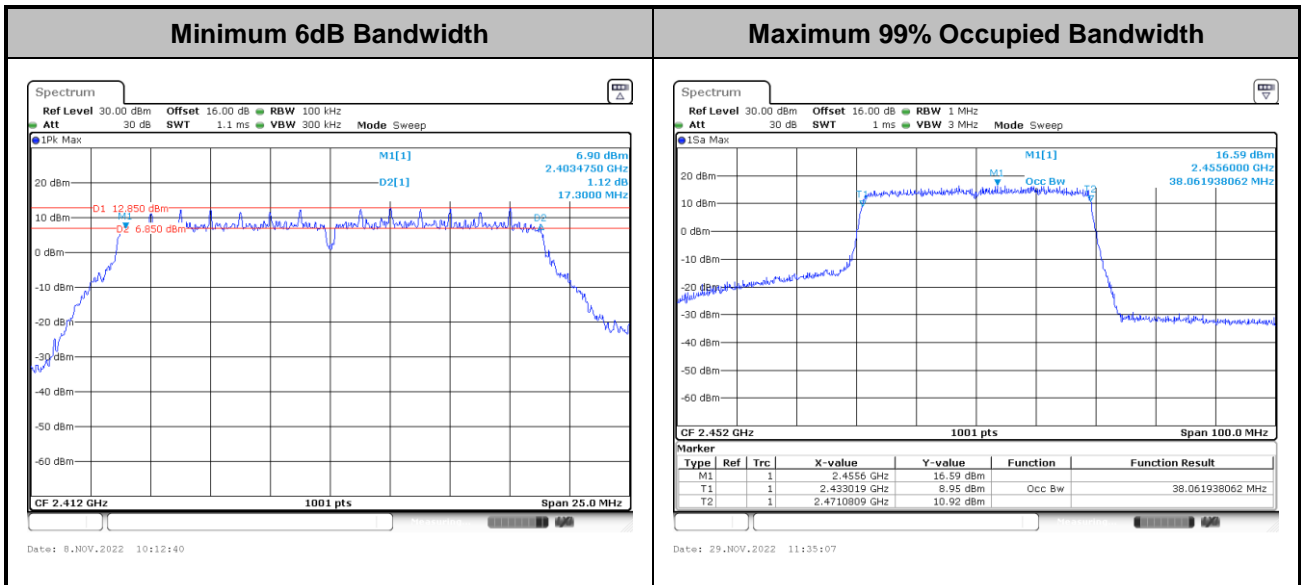
3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

<CDD 1S4T mode>

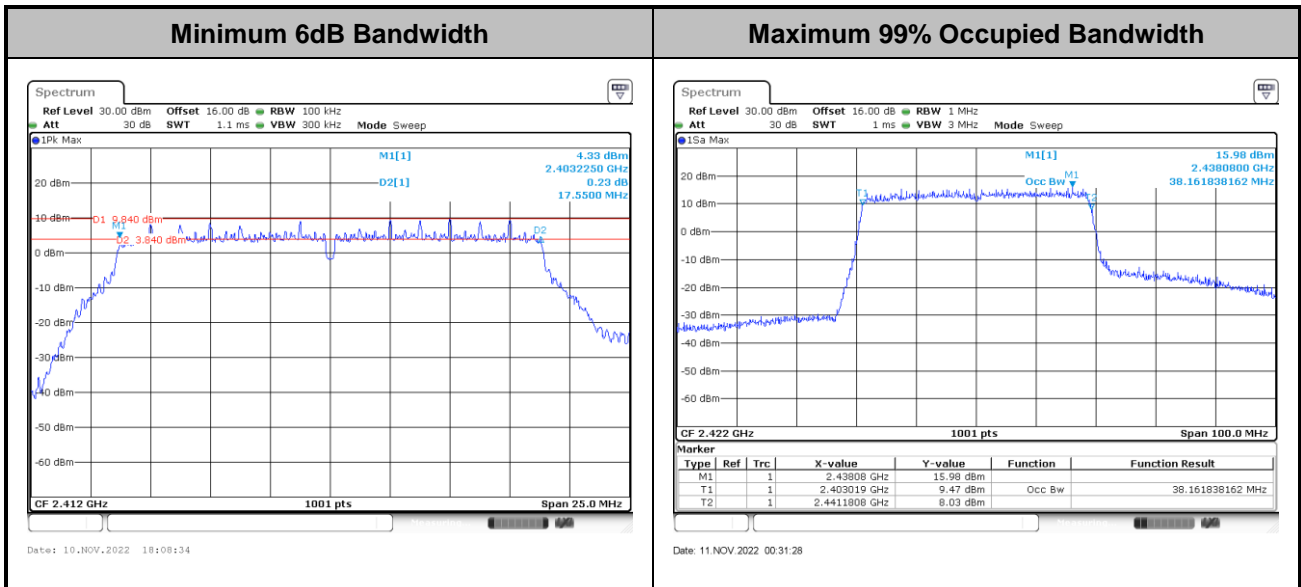


<SDM 4S4T mode>





<TX BF 1S4T mode>



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 output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the 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.

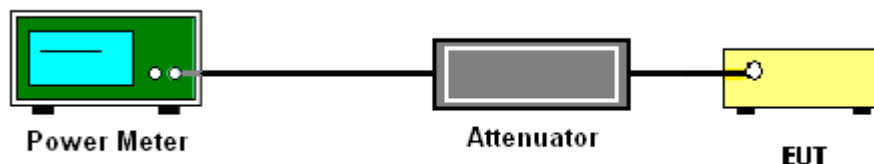
3.2.2 Measuring Instruments

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.
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 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

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.5 Method AVPSD.
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 = power averaging, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize.
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.

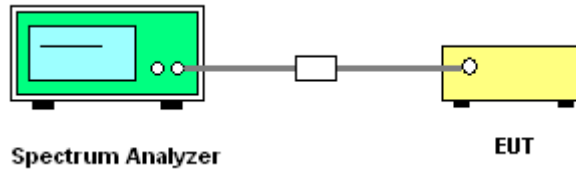
If measurements performed using method (2) plus $10 \log(N)$ exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

Method (1): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 4 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum. The summed spectrum value for each of the other frequency bins is computed in the same way.

Method (2): Measure and add $10 \log(N)$ dB, where N is the number of outputs. (N=4)

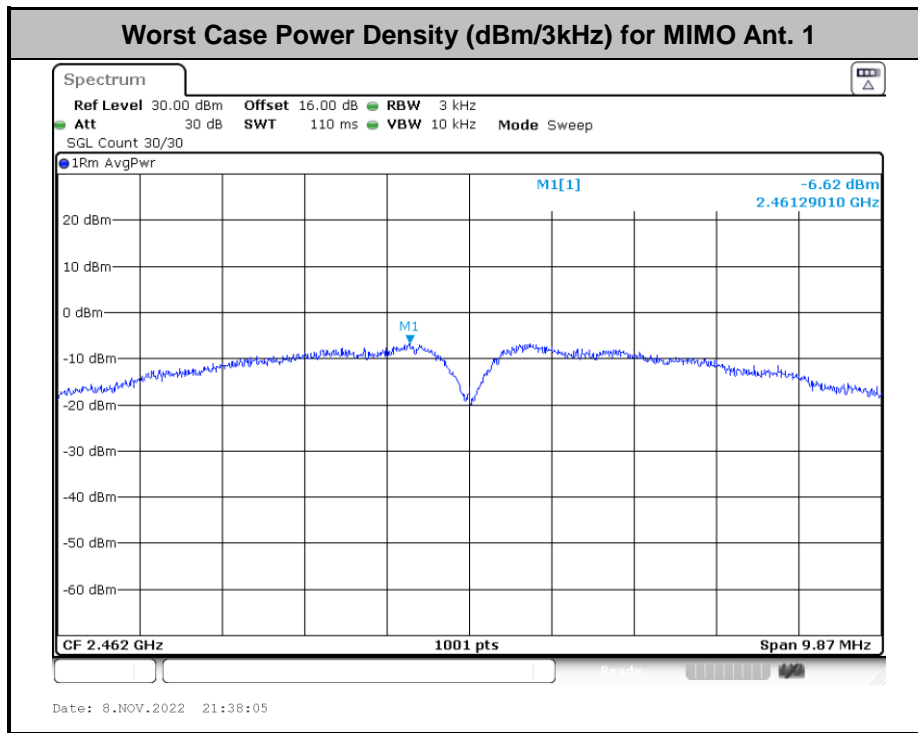
3.3.4 Test Setup

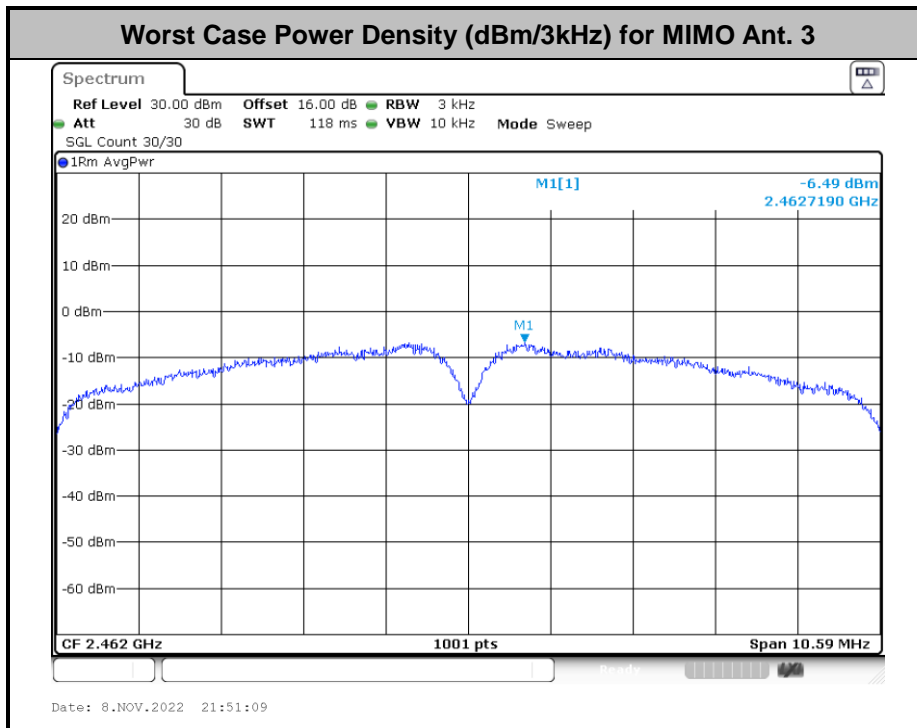
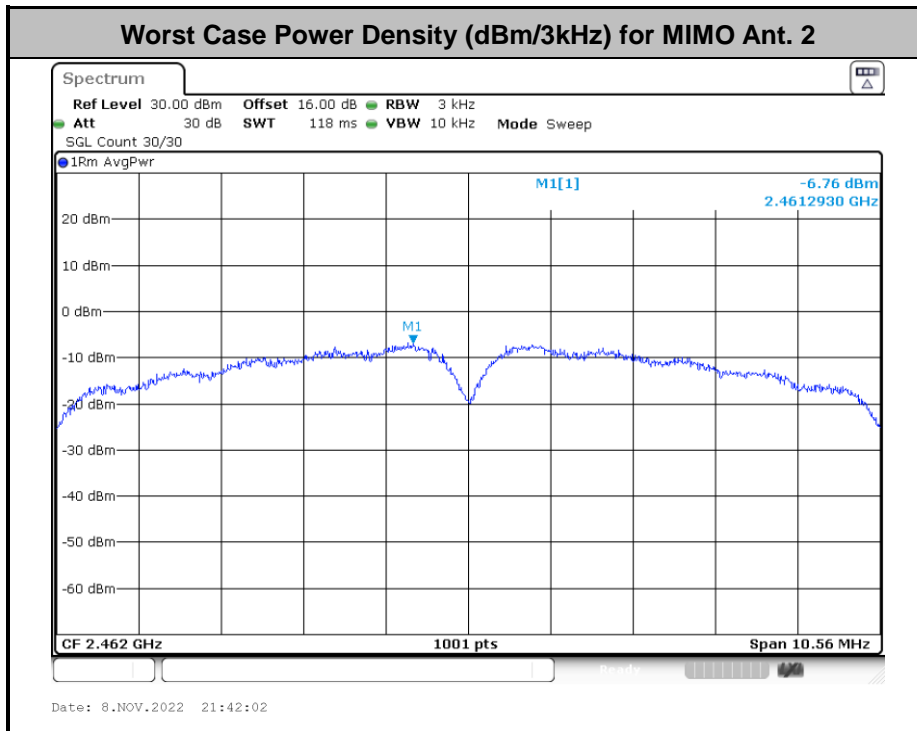


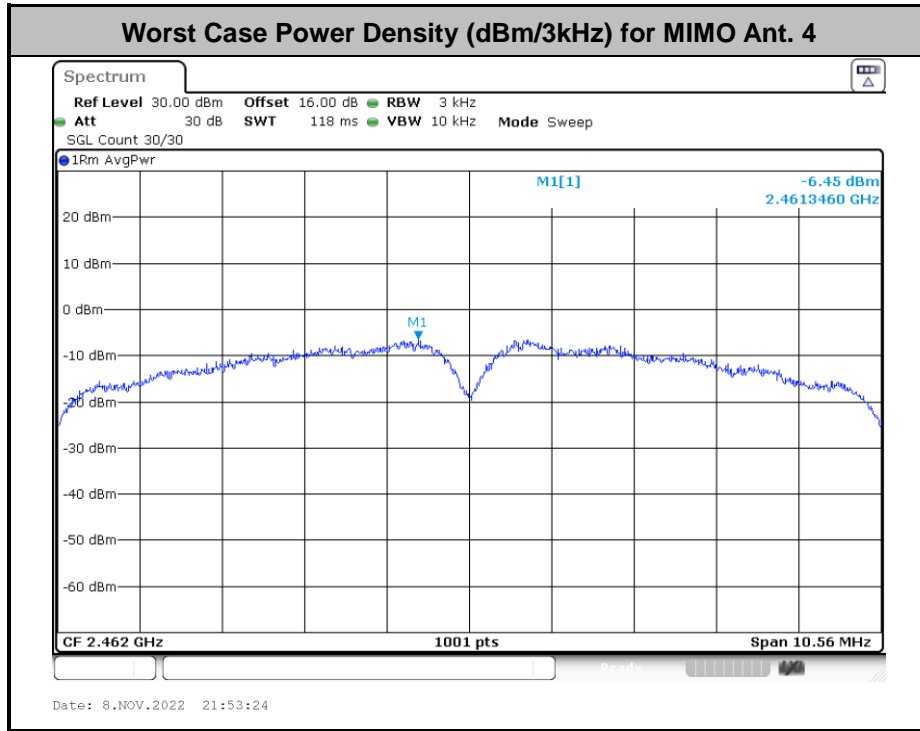
3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

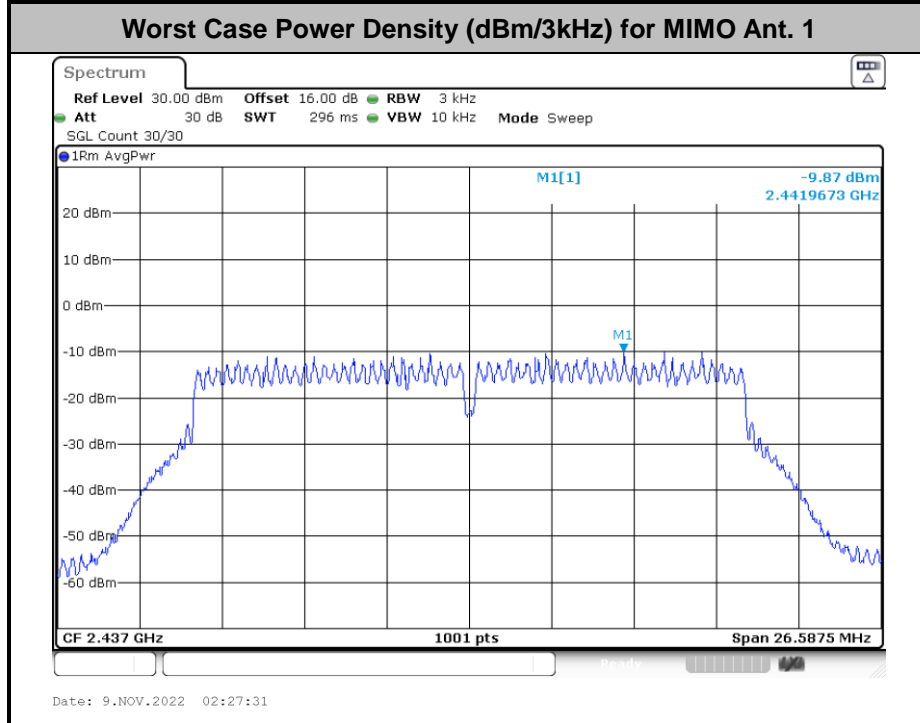
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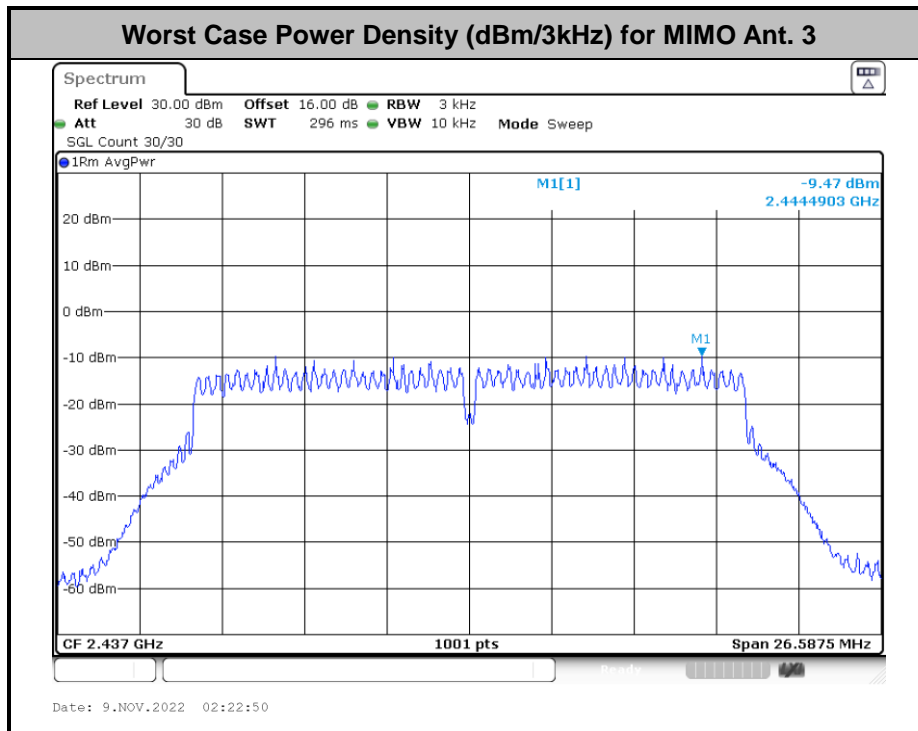
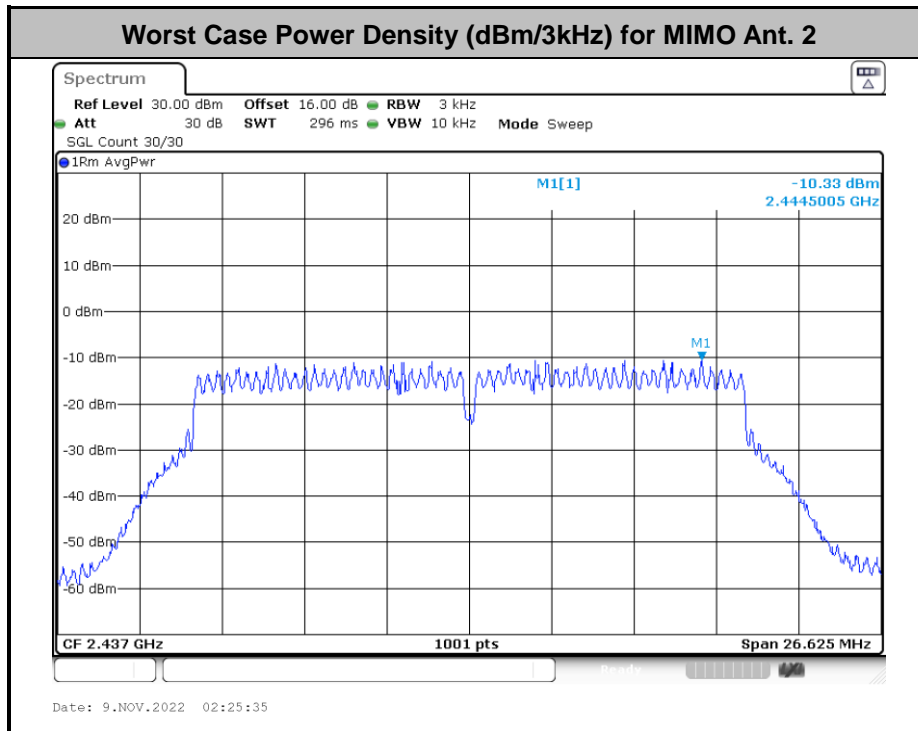


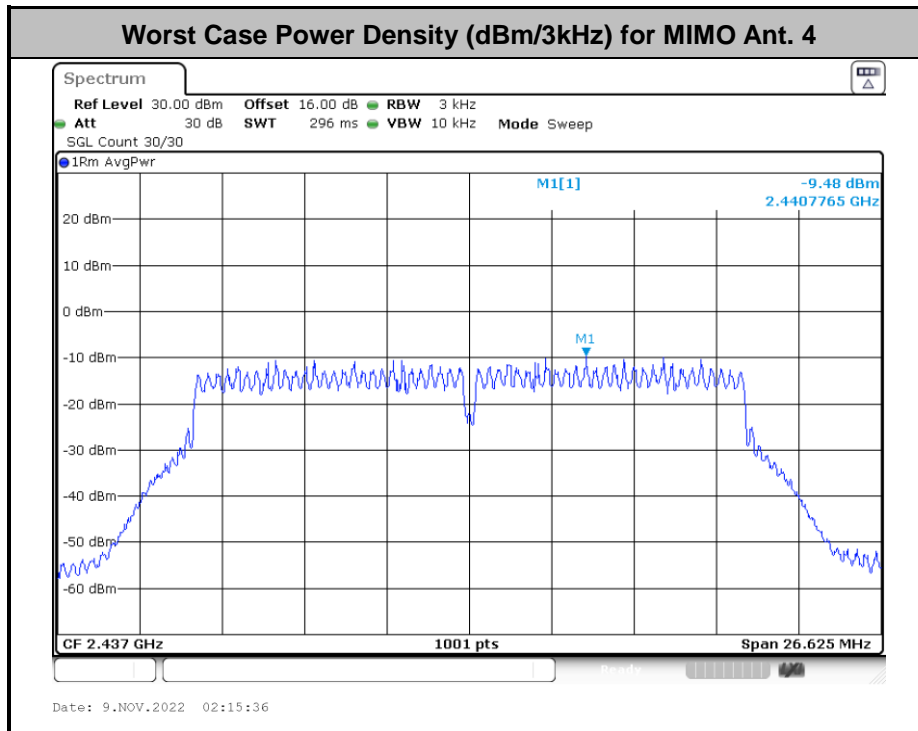




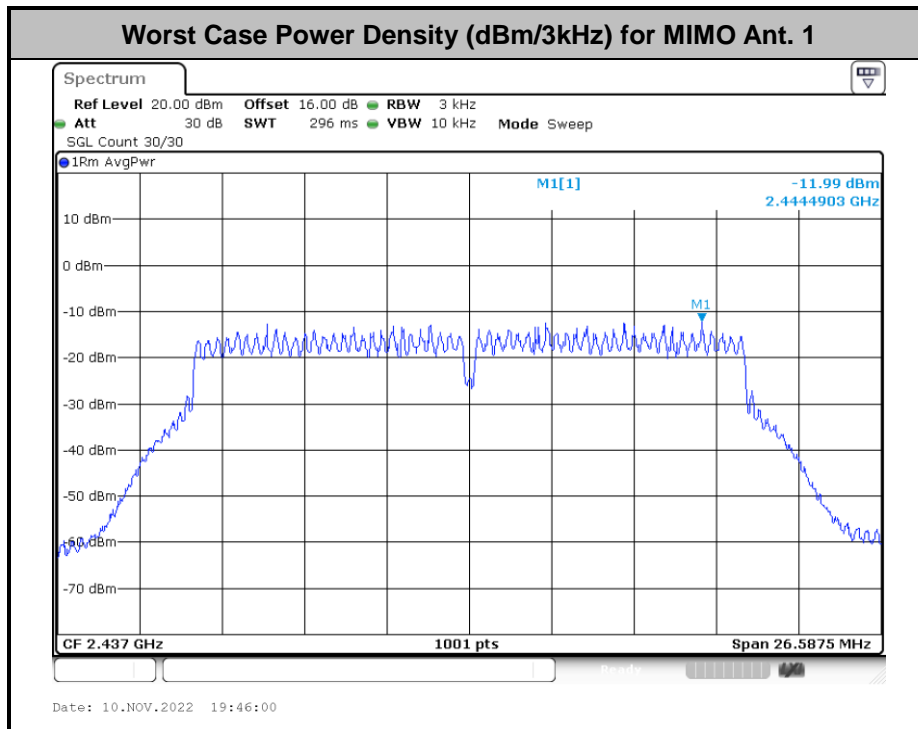
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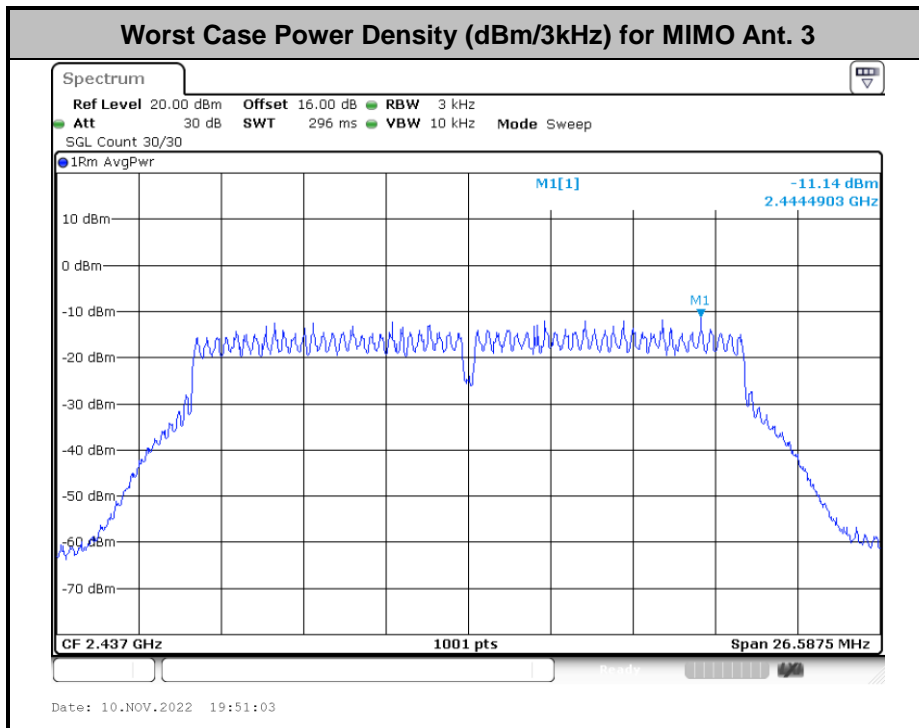
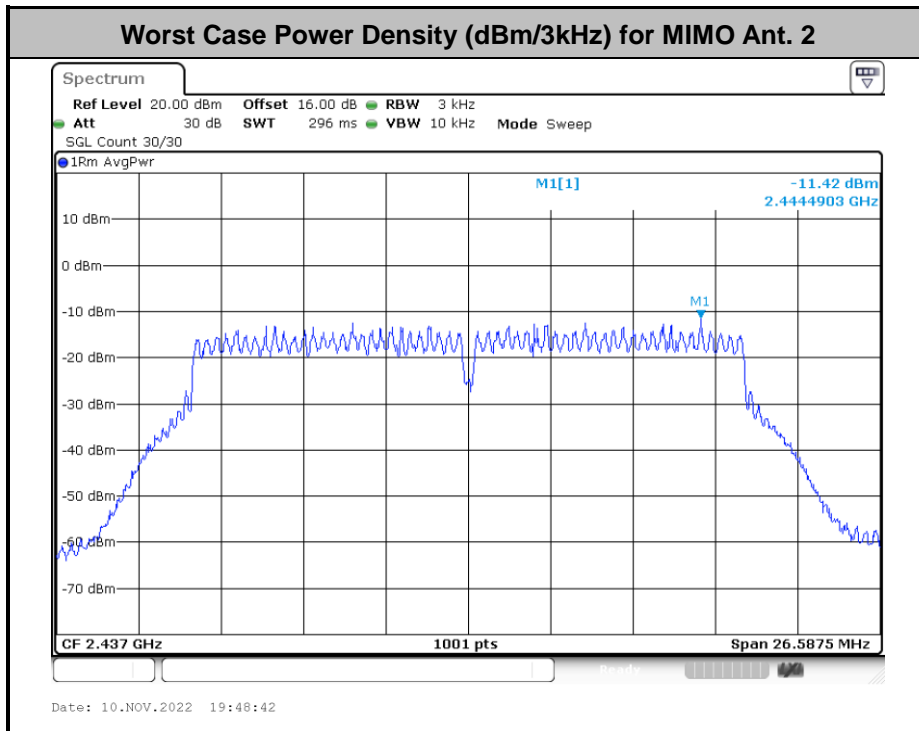


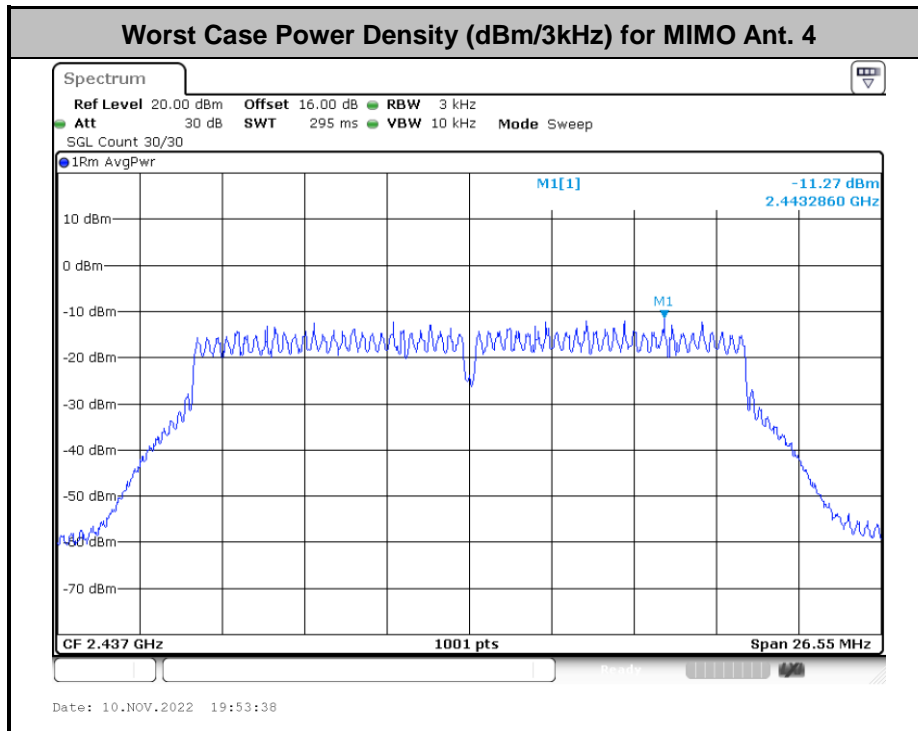




<TX BF 1S4T mode>







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 30dB 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 11.13
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





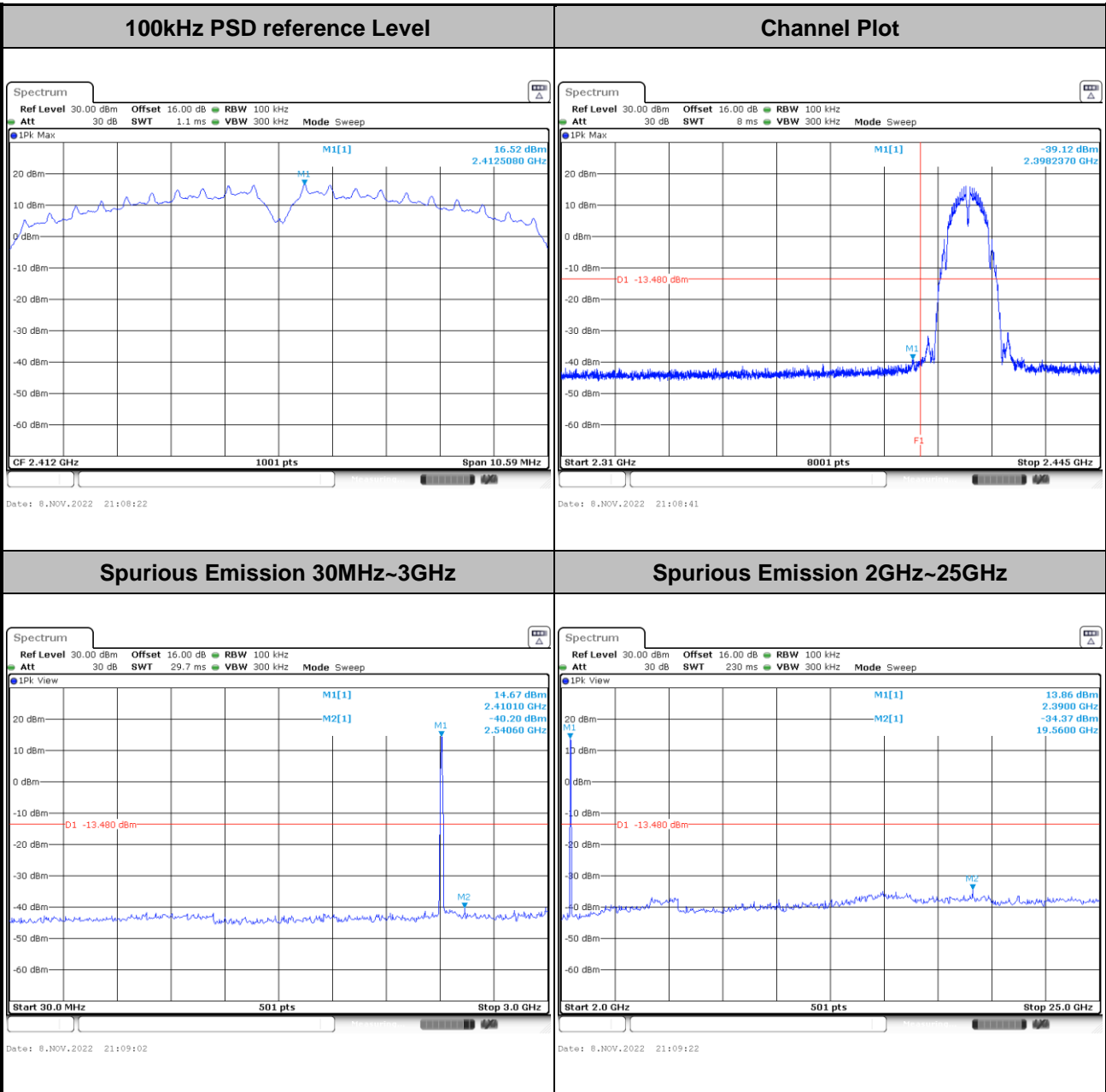
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer : Jacob Zhang	Temperature : 21~25°C
	Relative Humidity : 51~54%

<CDD 1S4T>

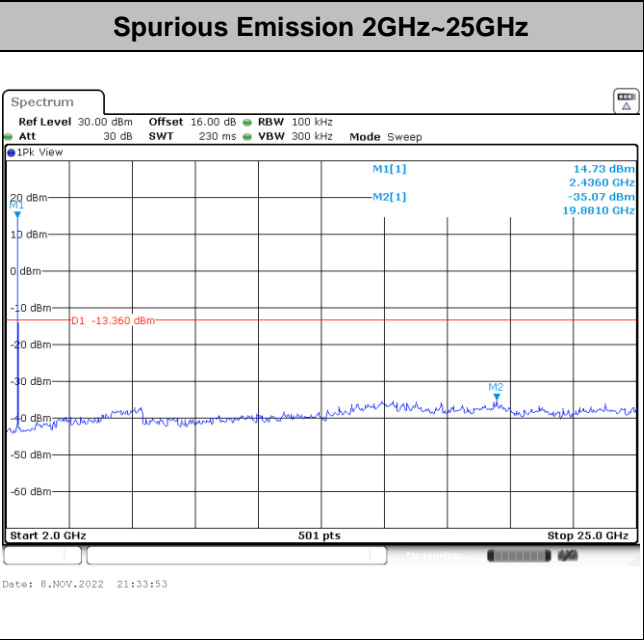
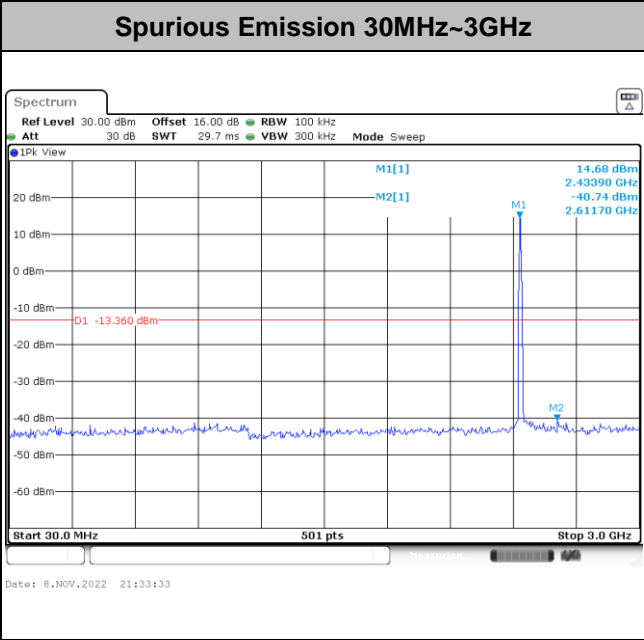
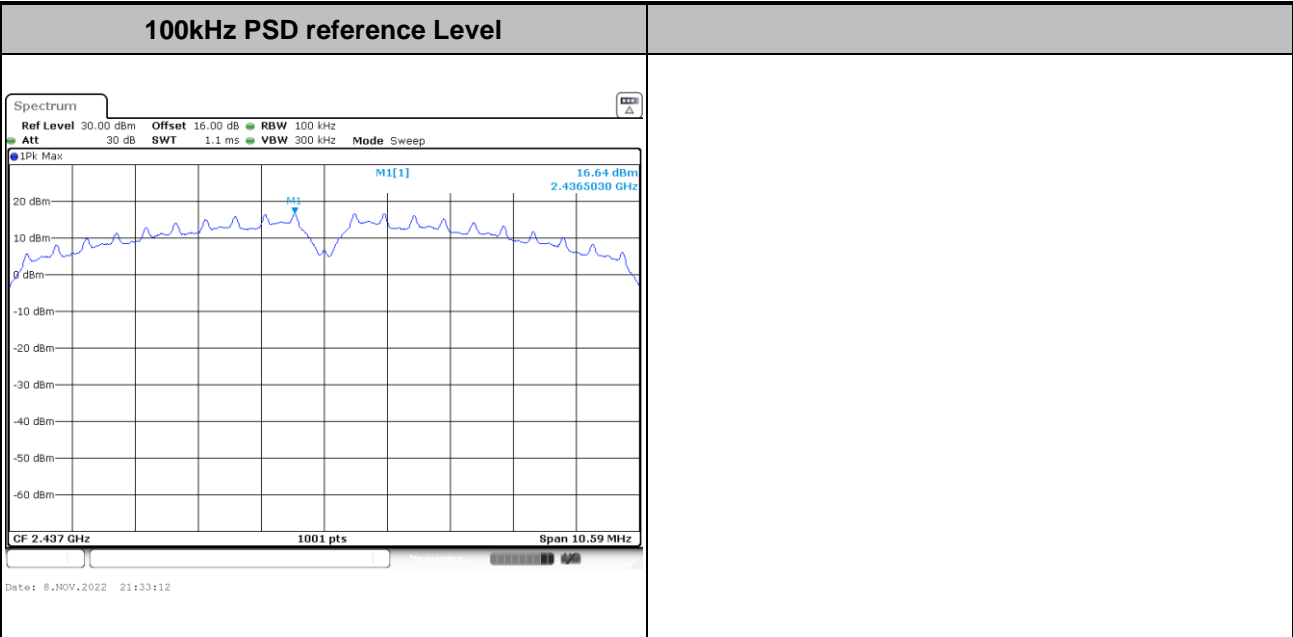
Number of TX = 4, Ant. 1 (Measured)

Test Mode : 802.11b-1Mbps	Test Channel : 01
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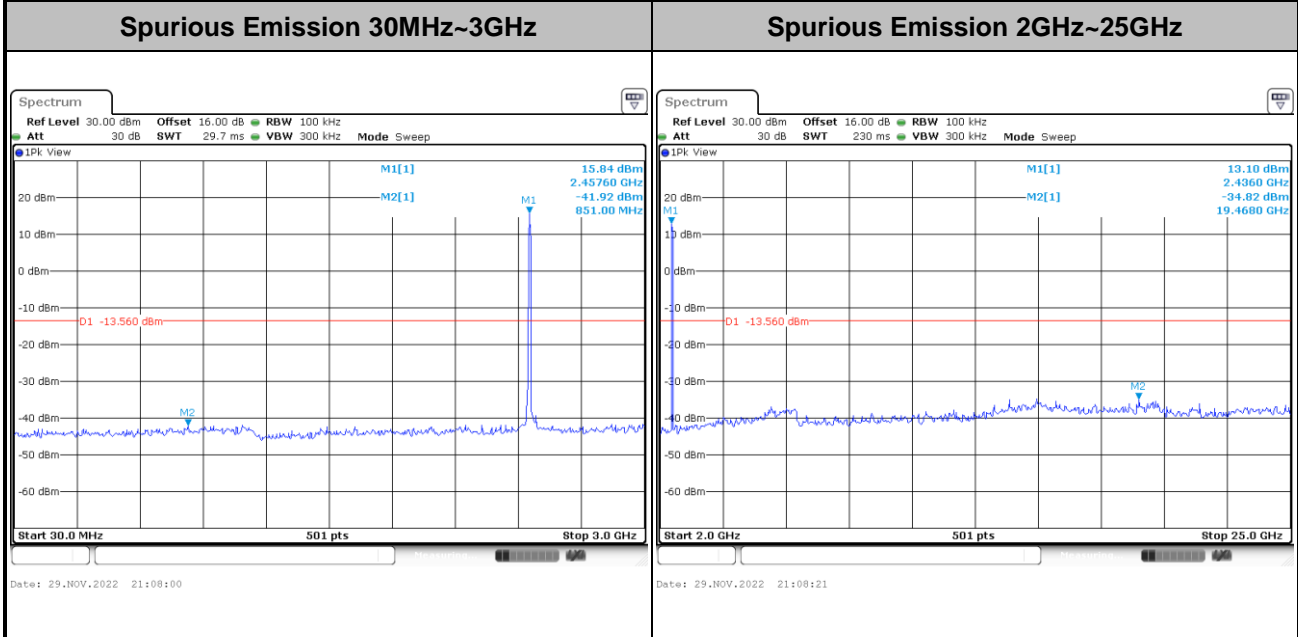
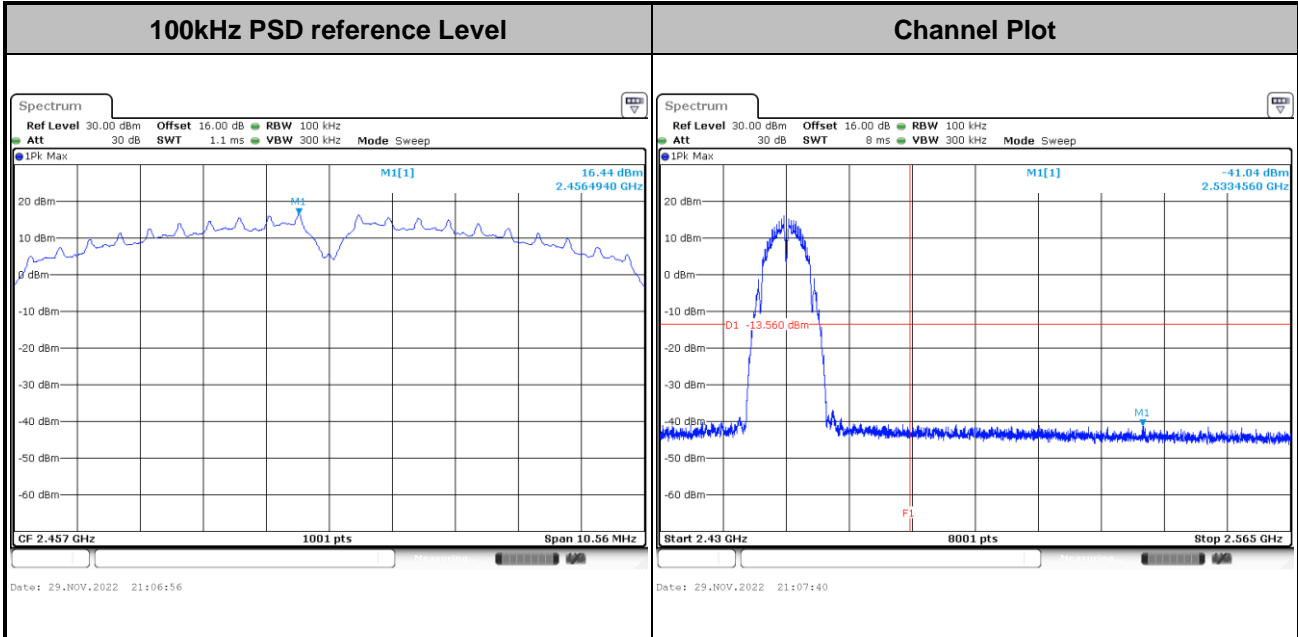


Test Mode :	802.11b-1Mbps	Test Channel :	06
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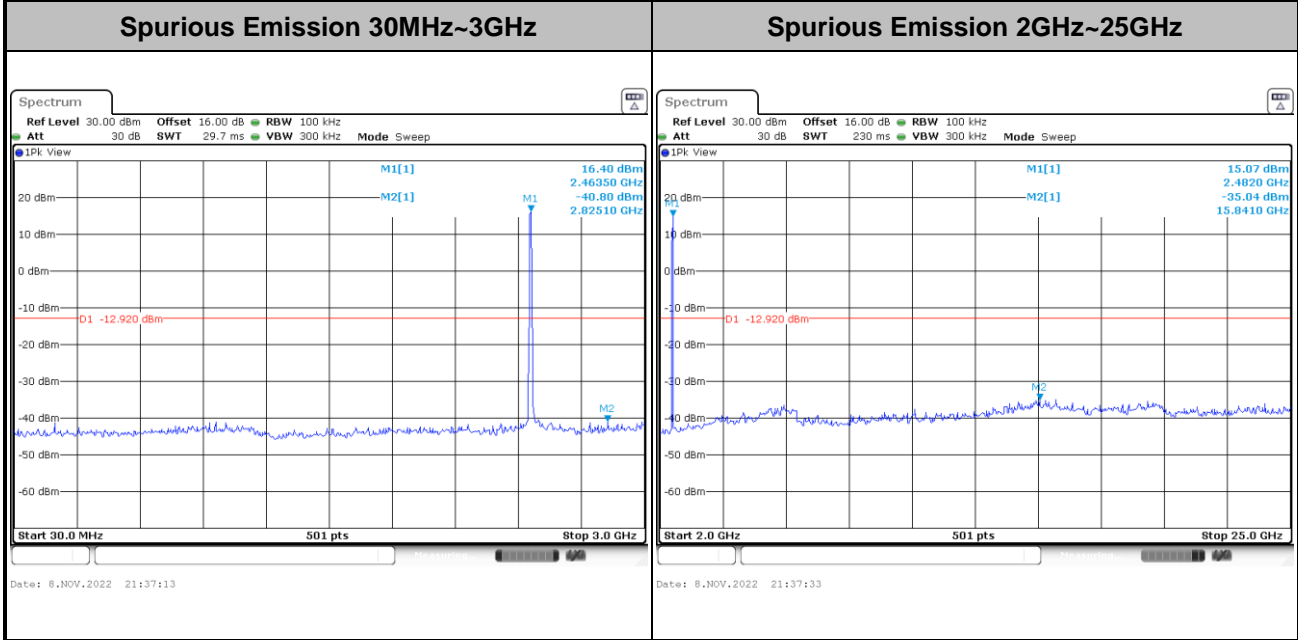
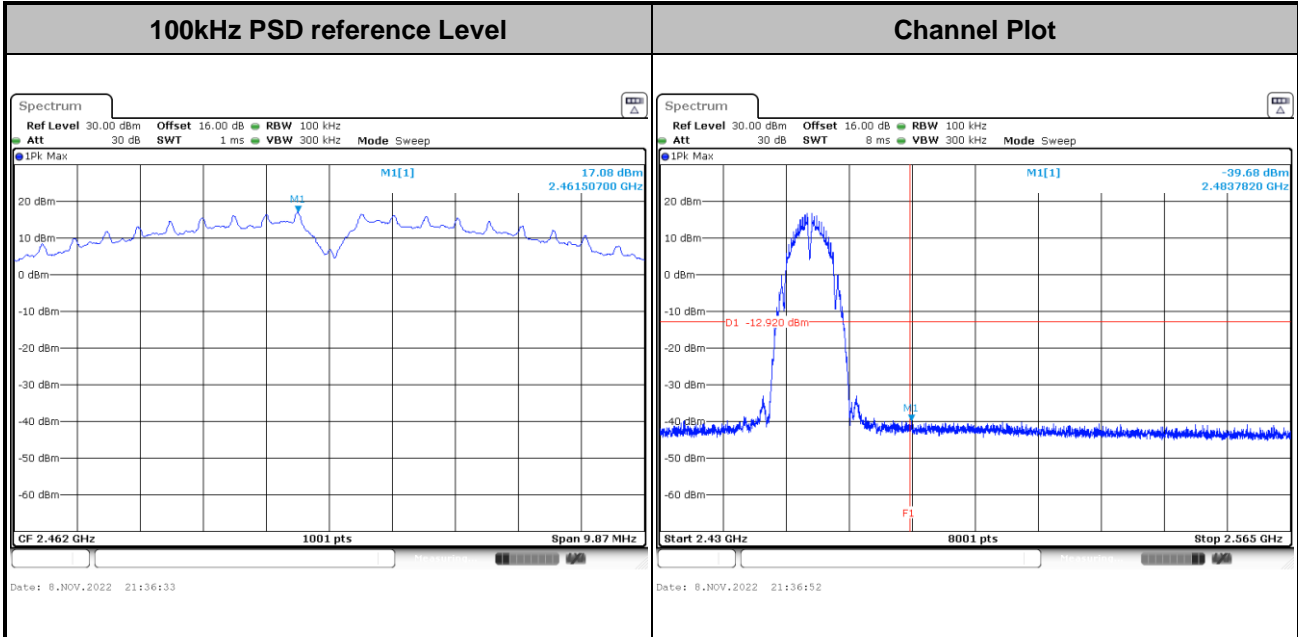


Test Mode :	802.11b-1Mbps	Test Channel :	10
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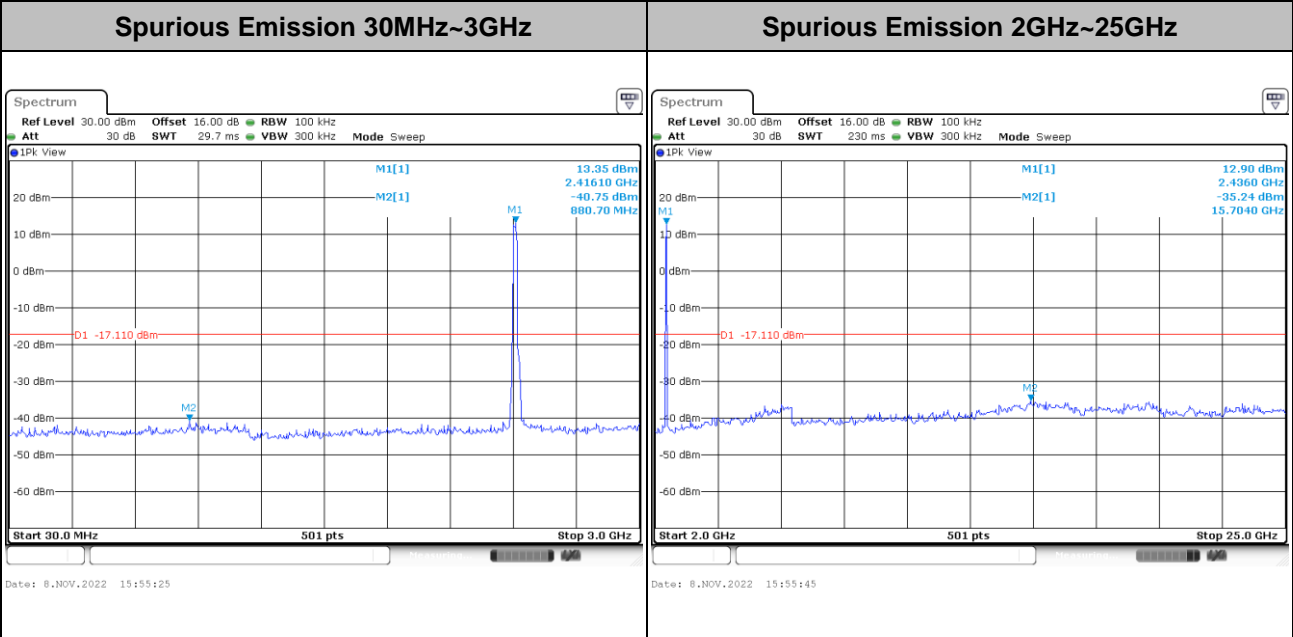
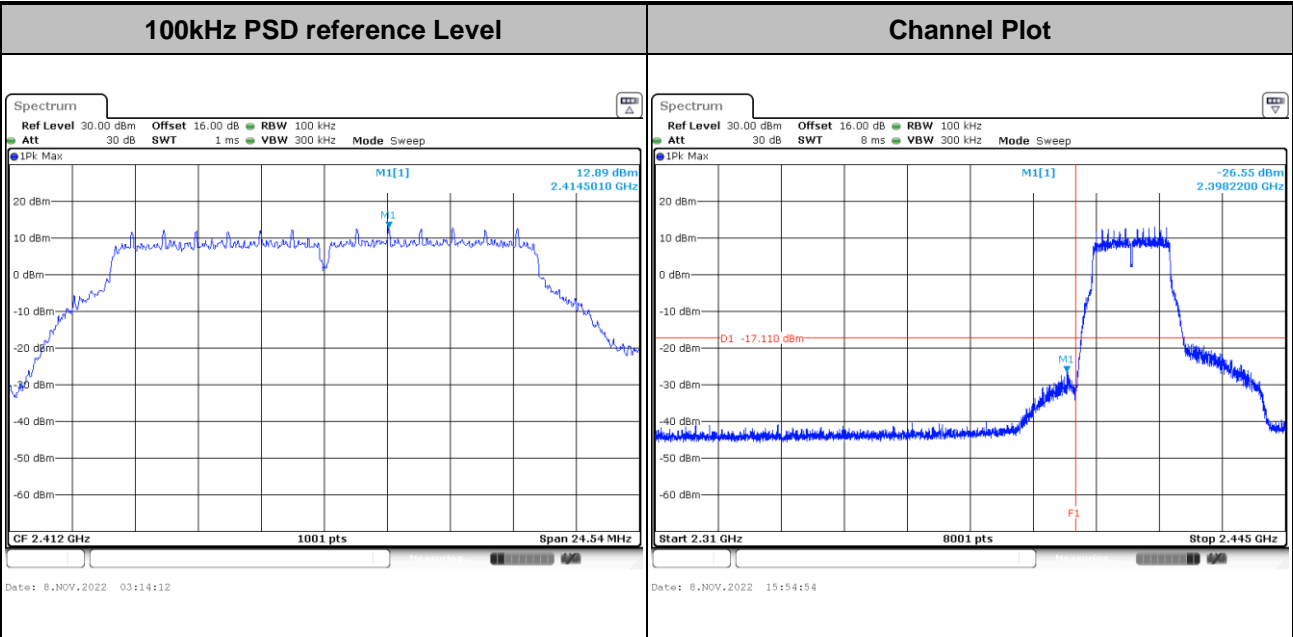


Test Mode :	802.11b-1Mbps	Test Channel :	11
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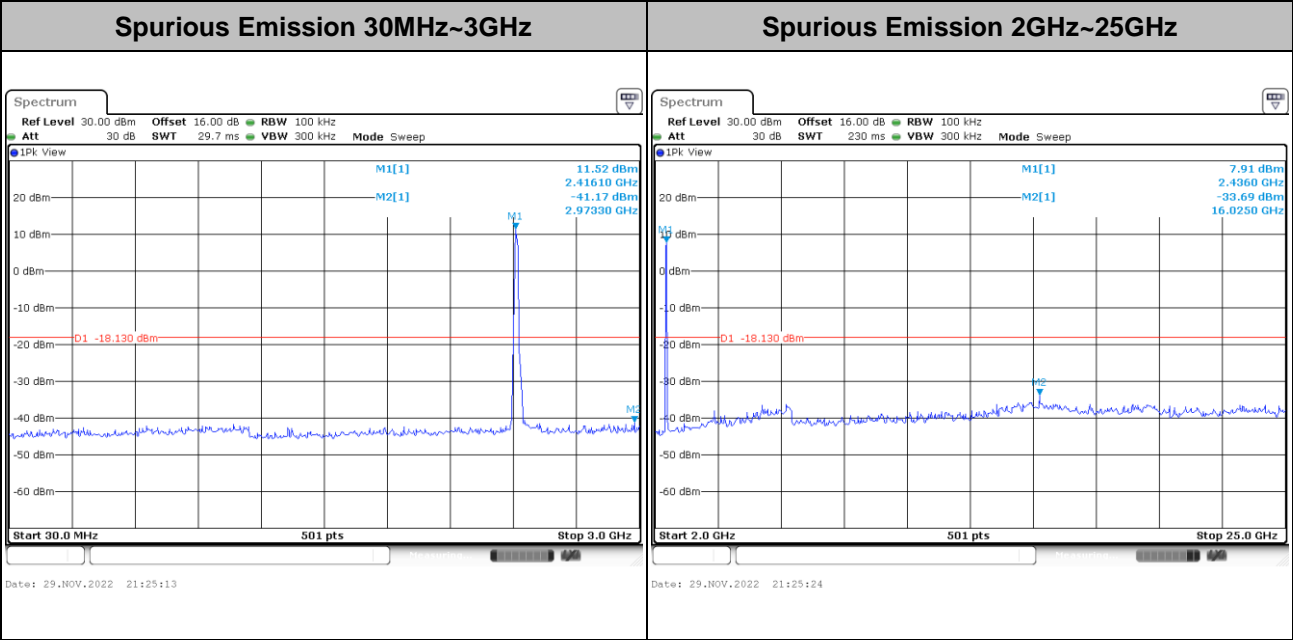
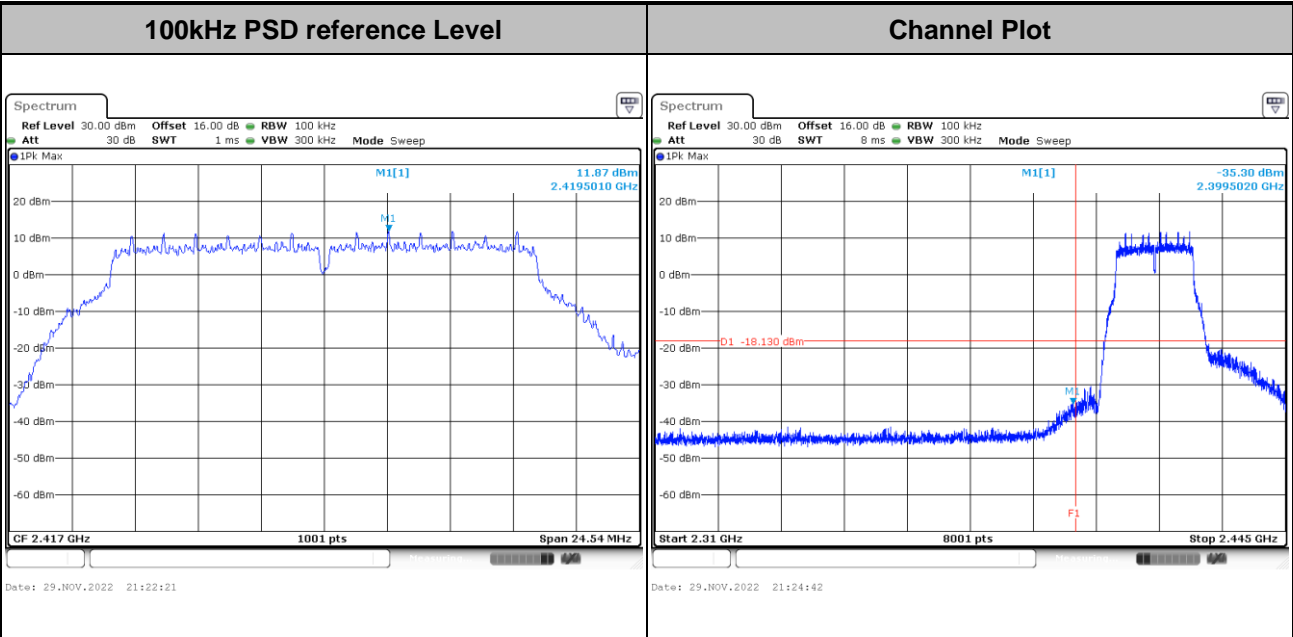


Test Mode : 802.11g-6Mbps Test Channel : 01



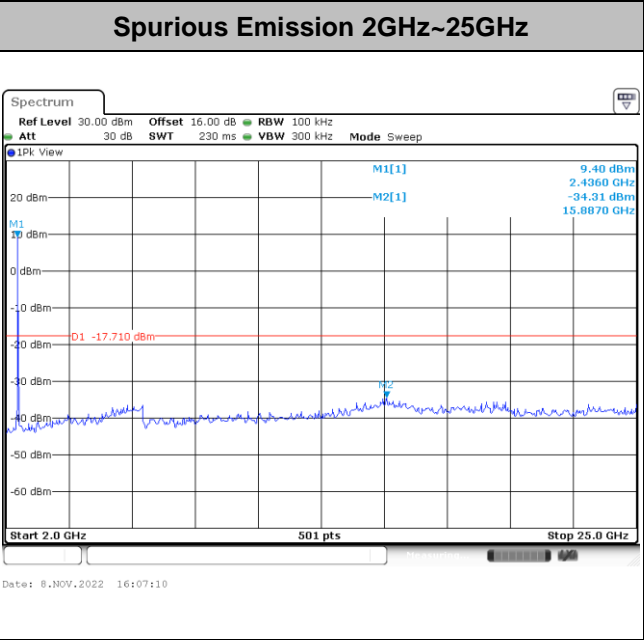
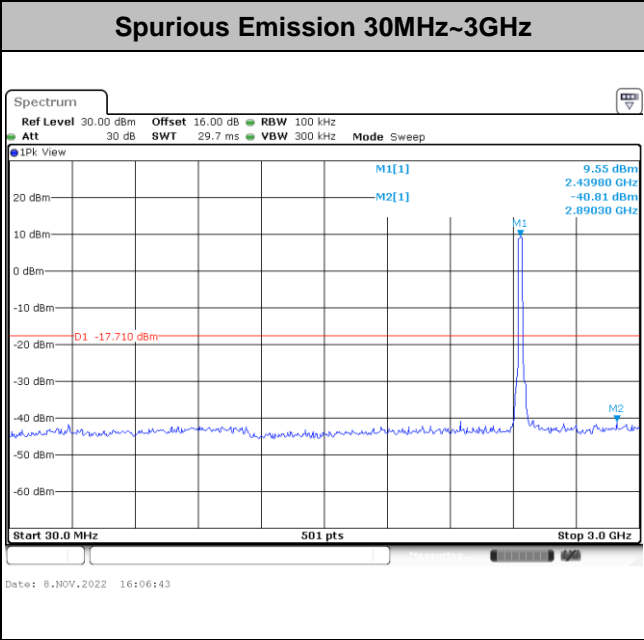
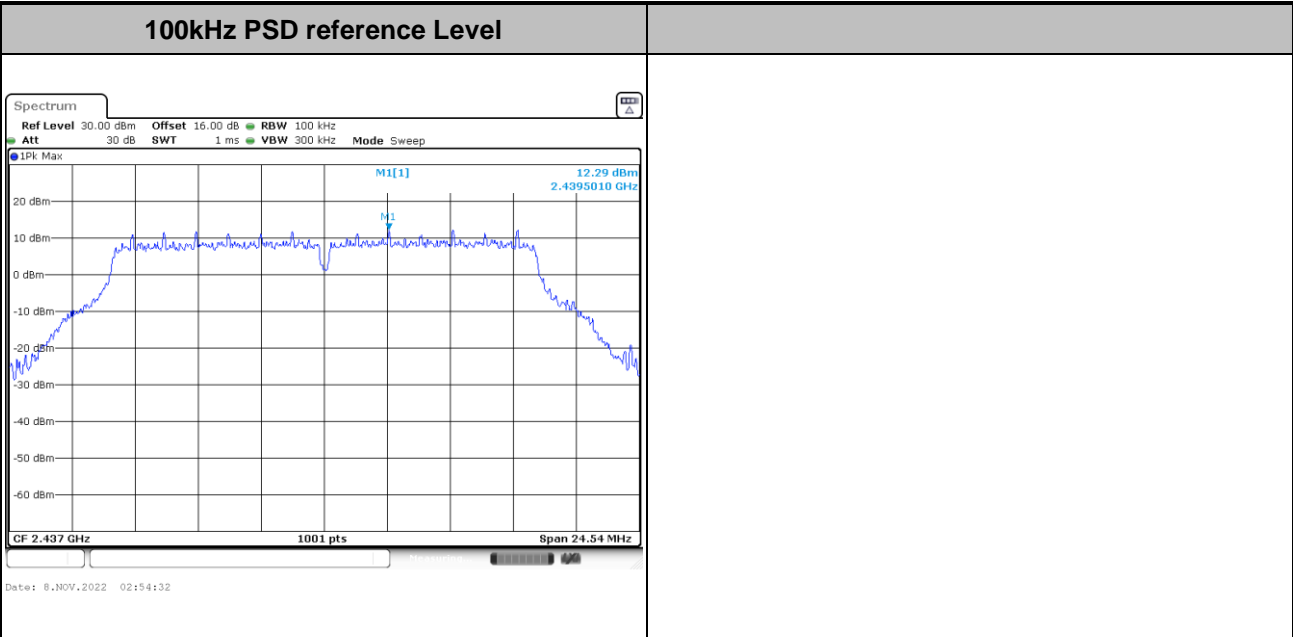


Test Mode : 802.11g-6Mbps Test Channel : 02



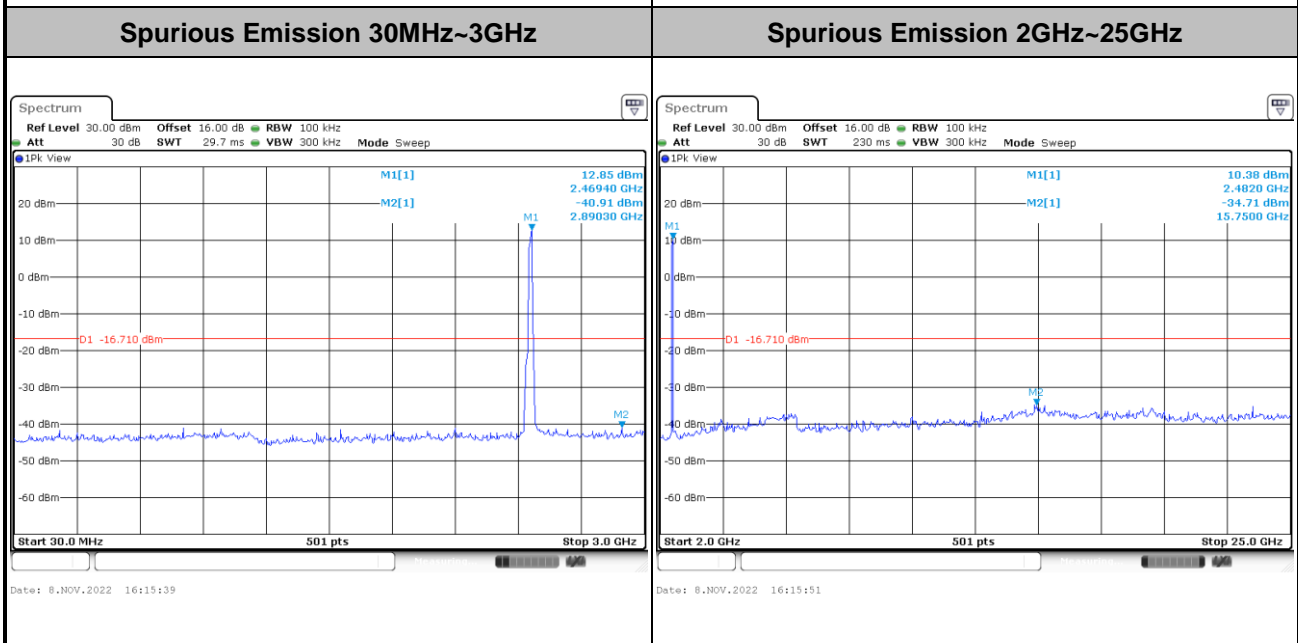
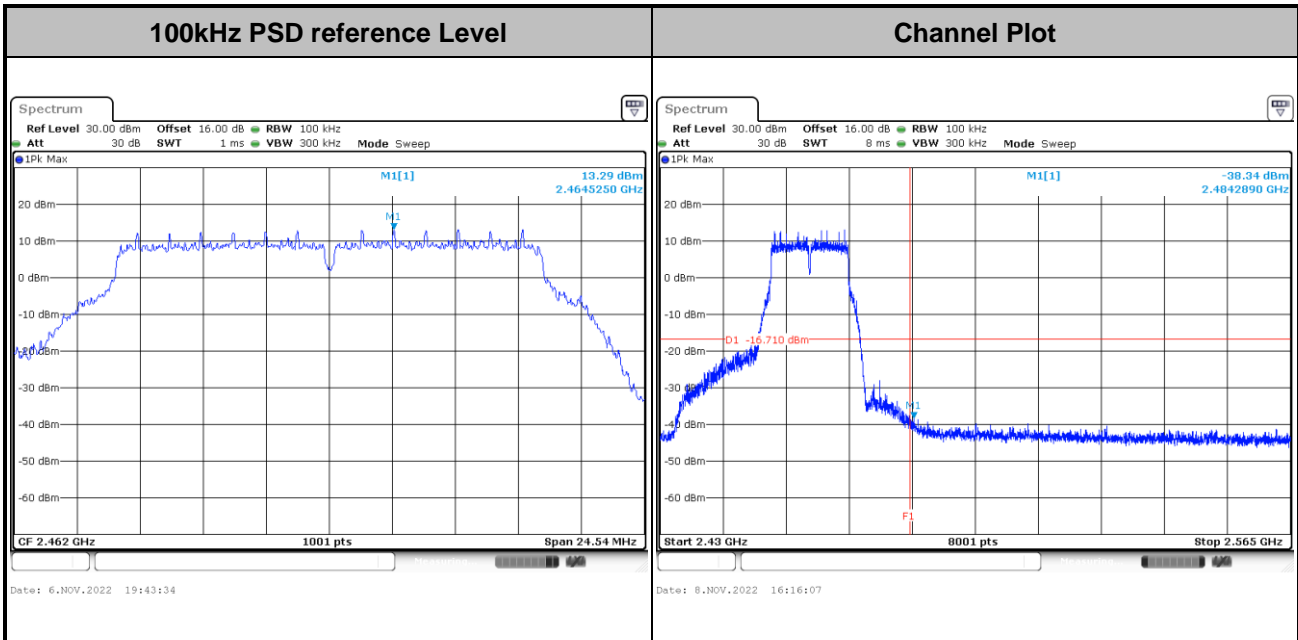


Test Mode :	802.11g-6Mbps	Test Channel :	06
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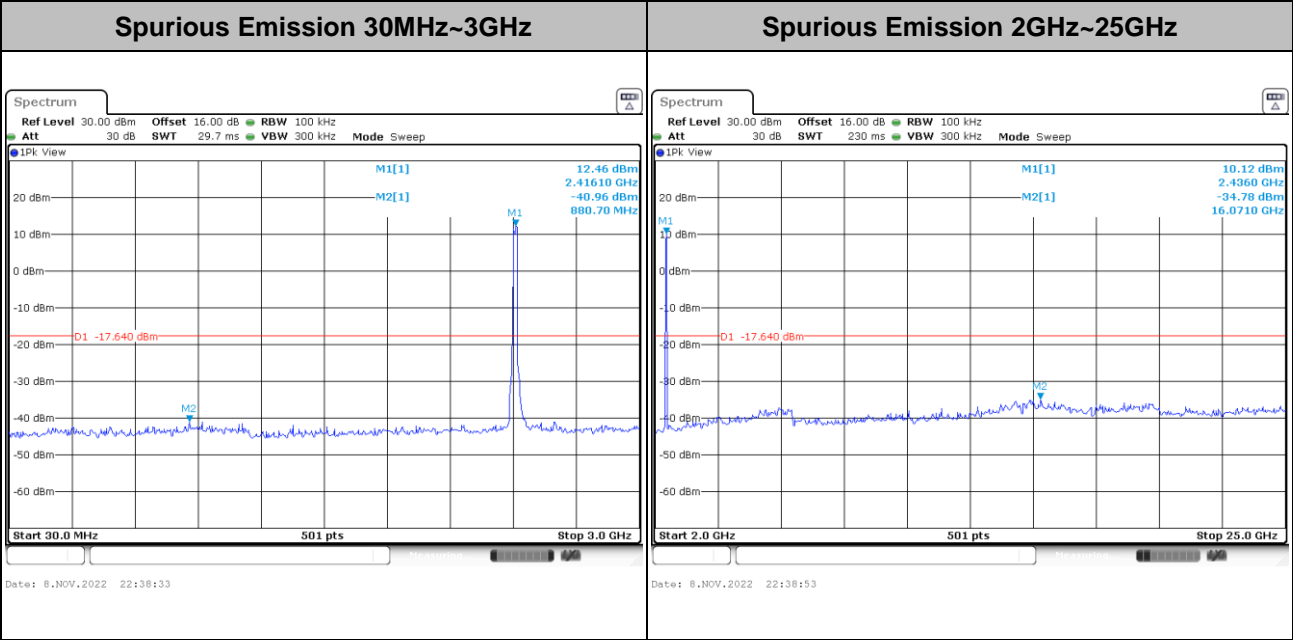
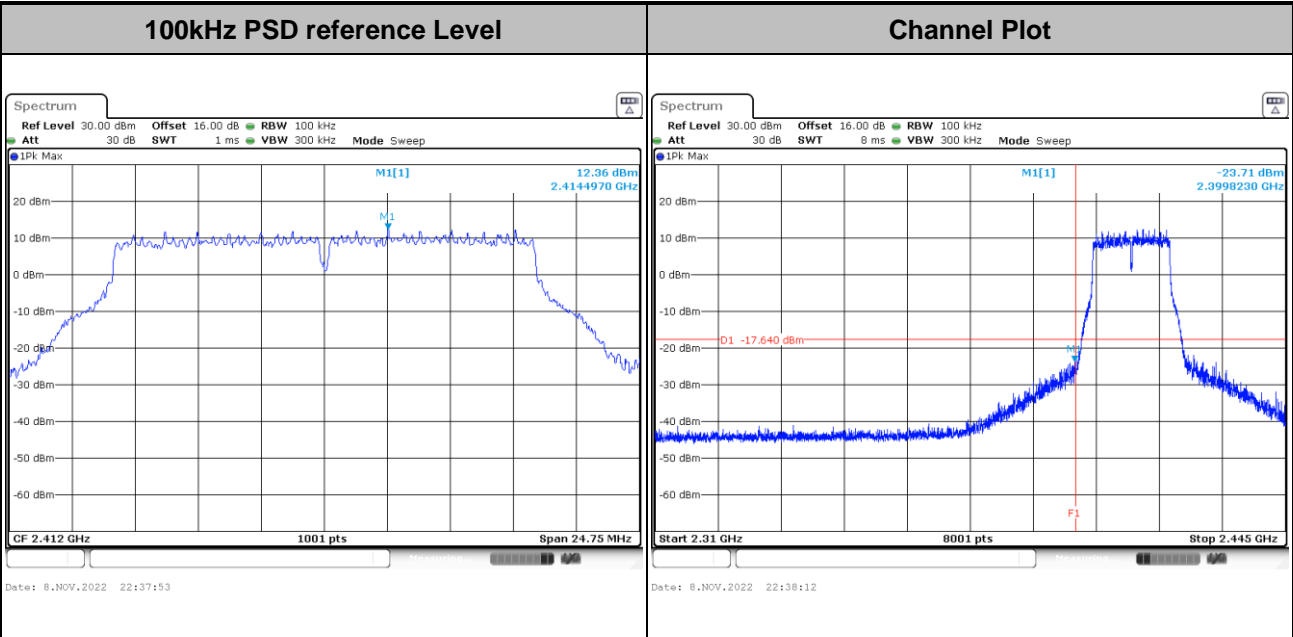


Test Mode :	802.11g-6Mbps	Test Channel :	11
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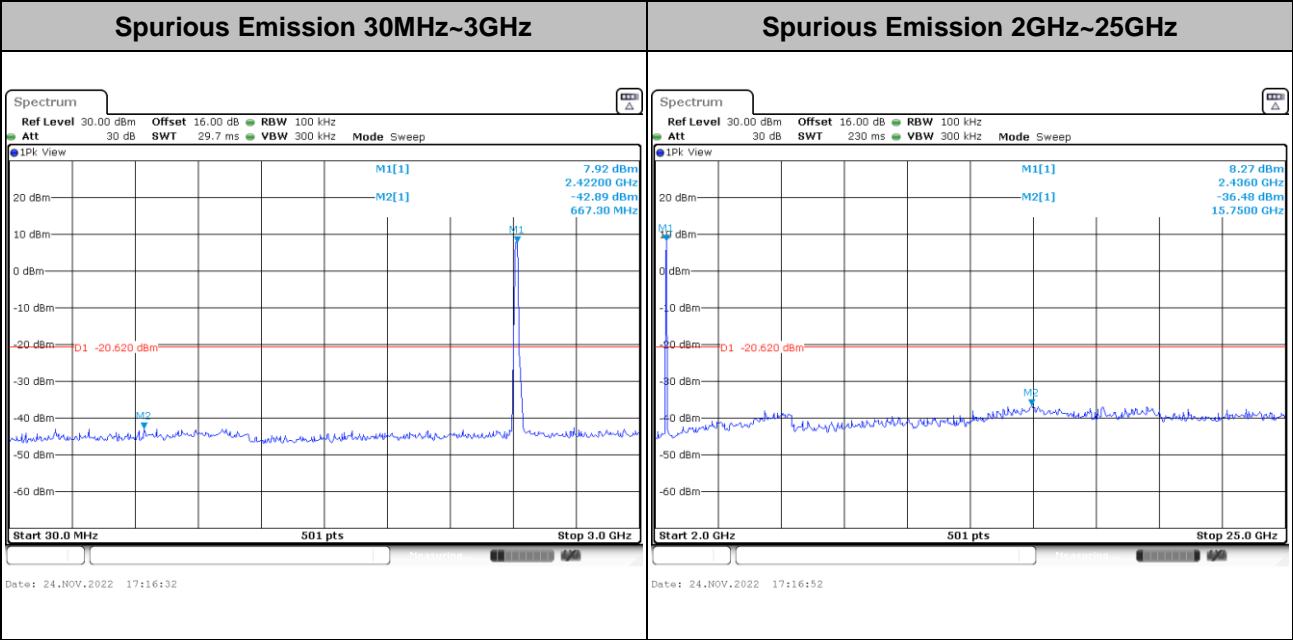
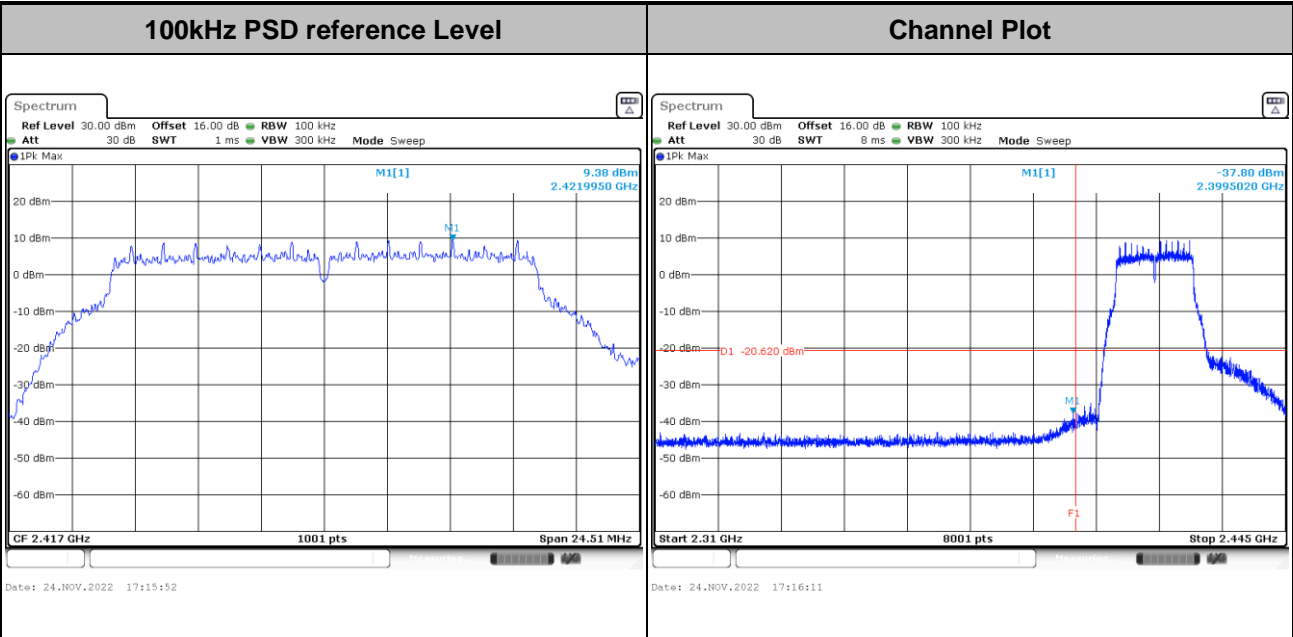


Test Mode : 802.11g-24Mbps Test Channel : 01



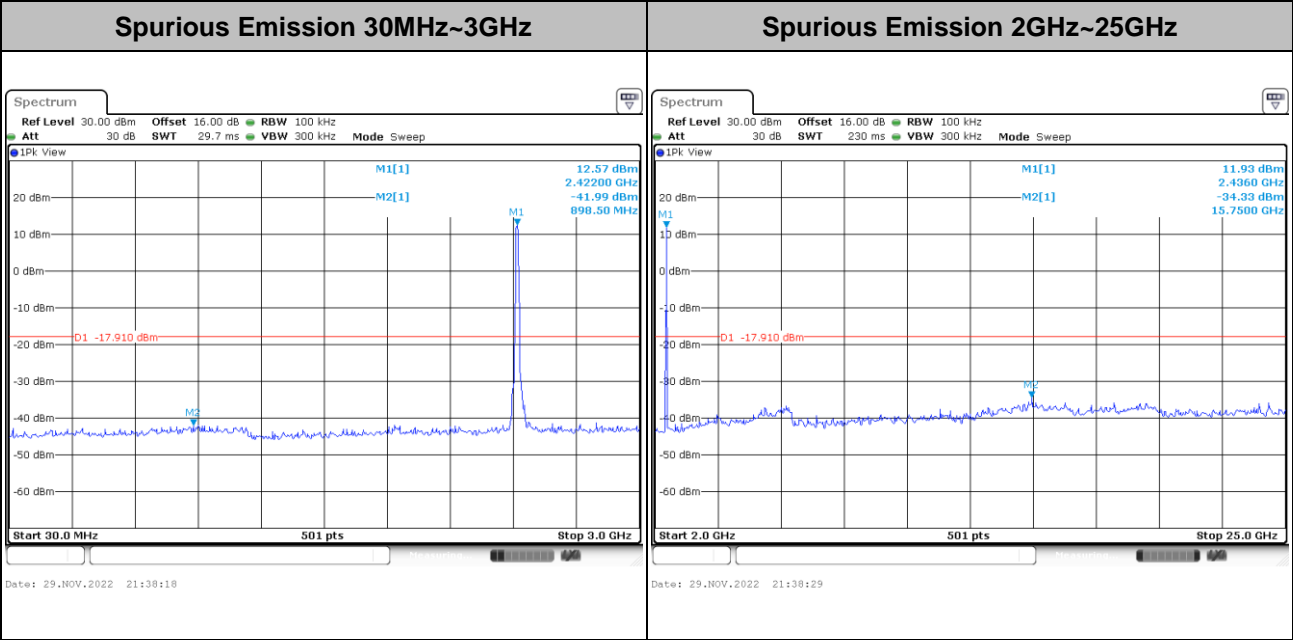
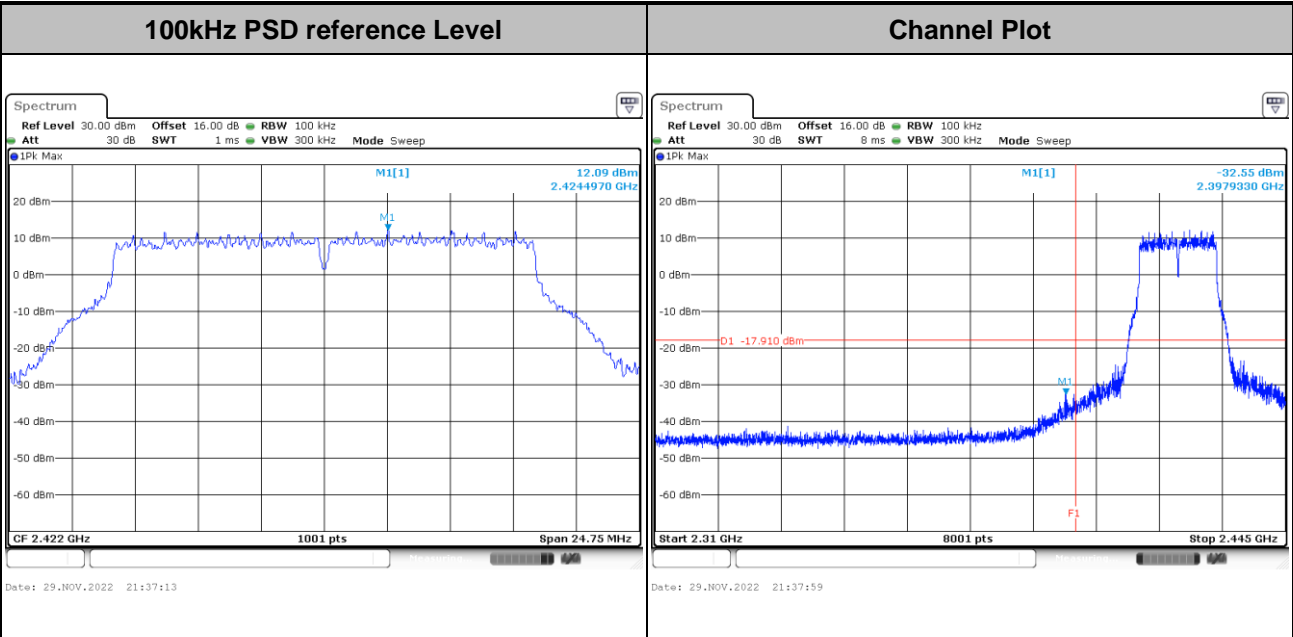


Test Mode : 802.11g-24Mbps Test Channel : 02





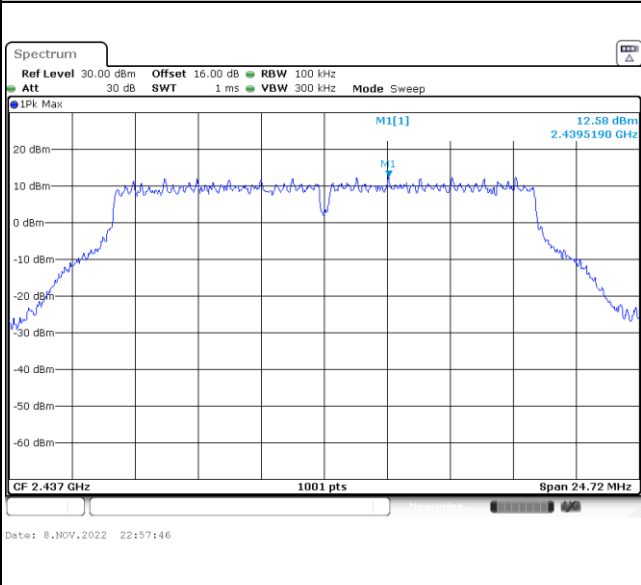
Test Mode : 802.11g-24Mbps Test Channel : 03



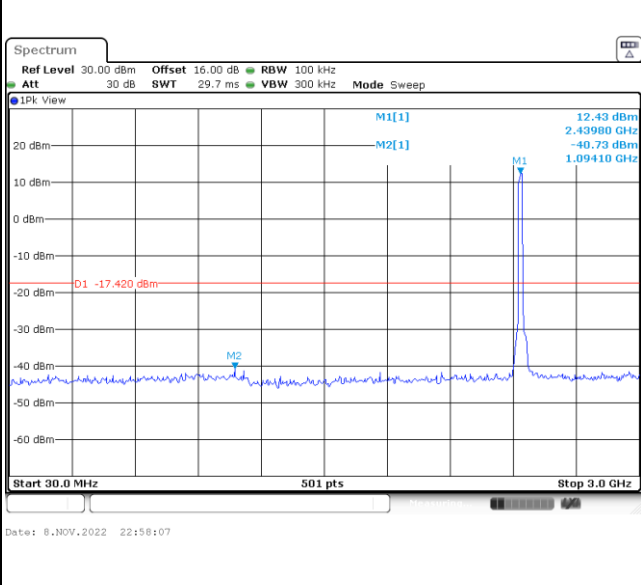


Test Mode :	802.11g-24Mbps	Test Channel :	06
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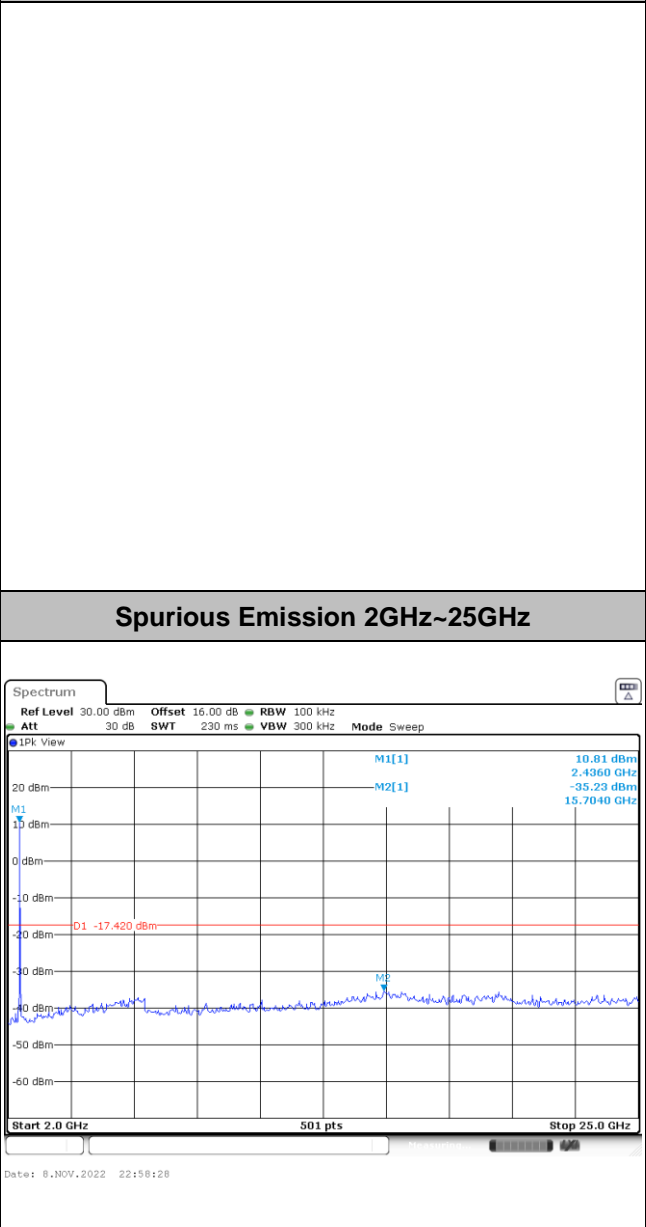
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

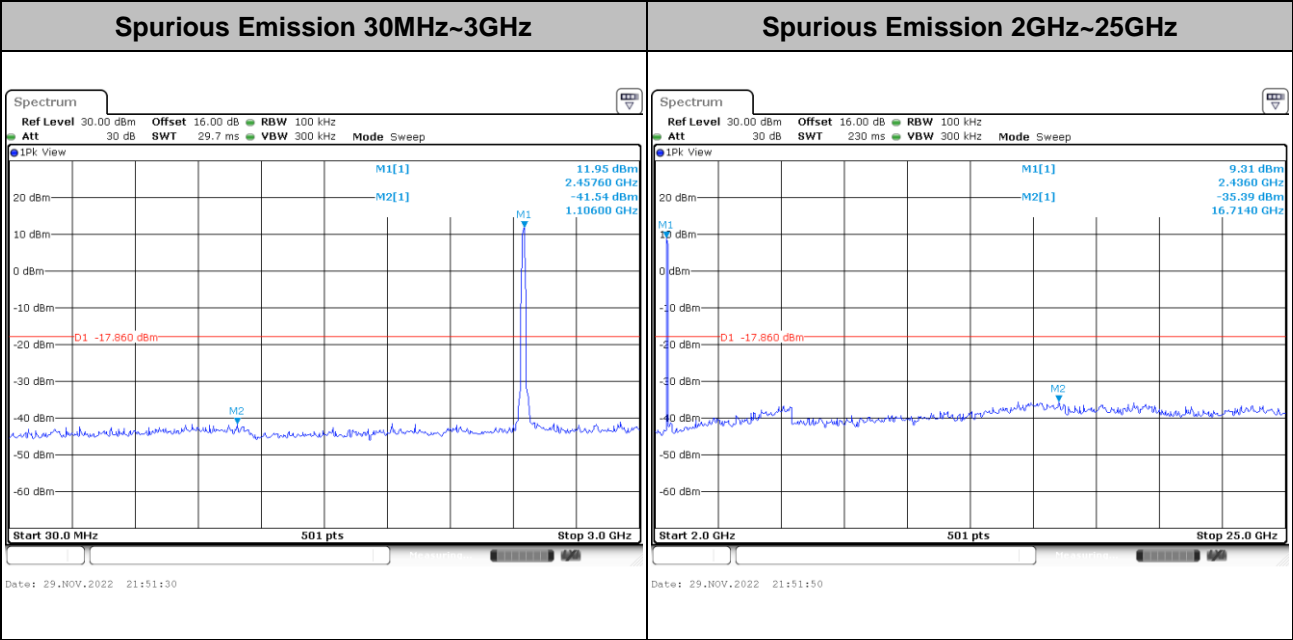
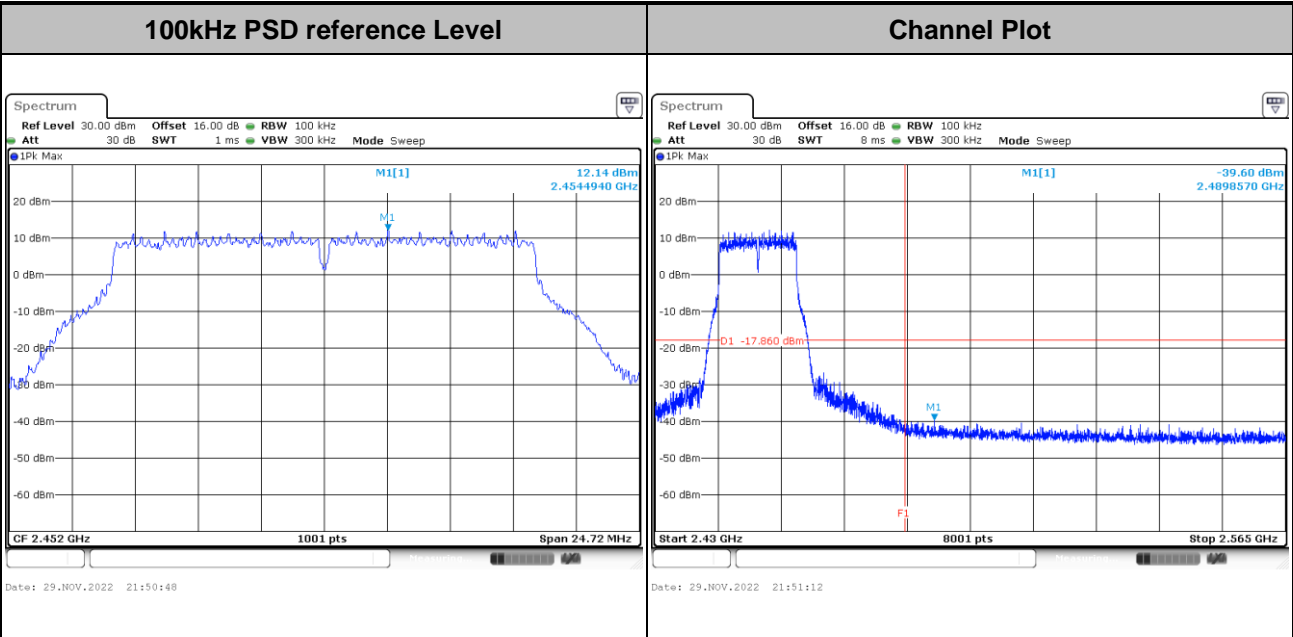


Spurious Emission 2GHz~25GHz



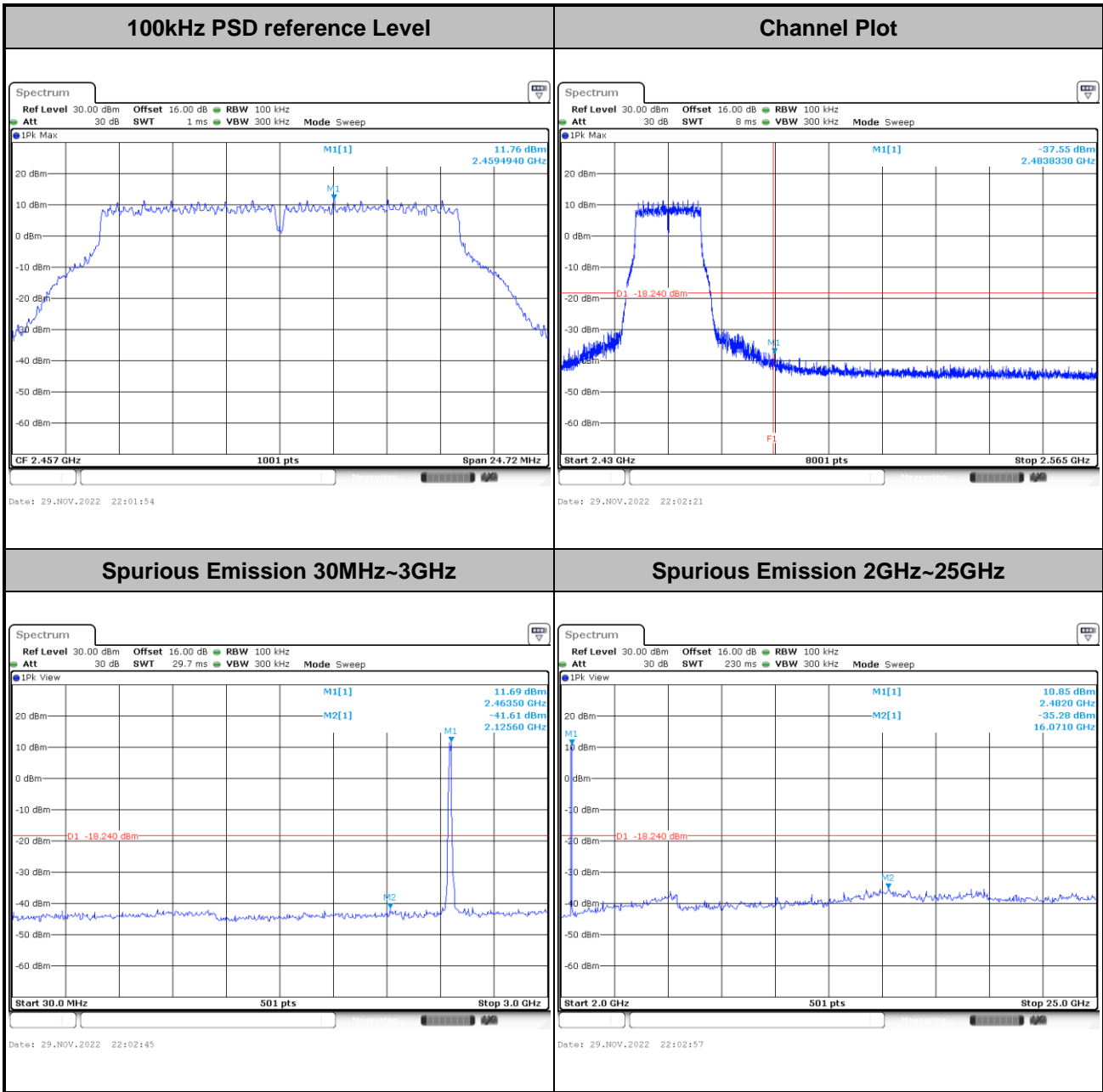


Test Mode : 802.11g-24Mbps Test Channel : 09



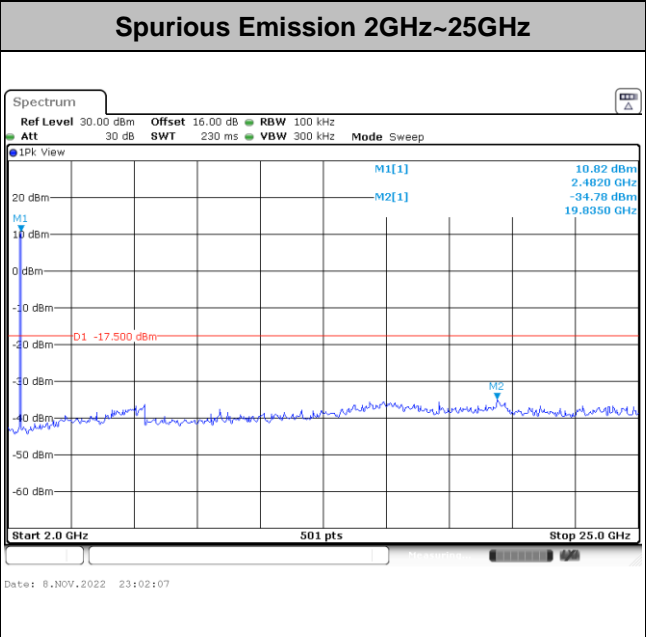
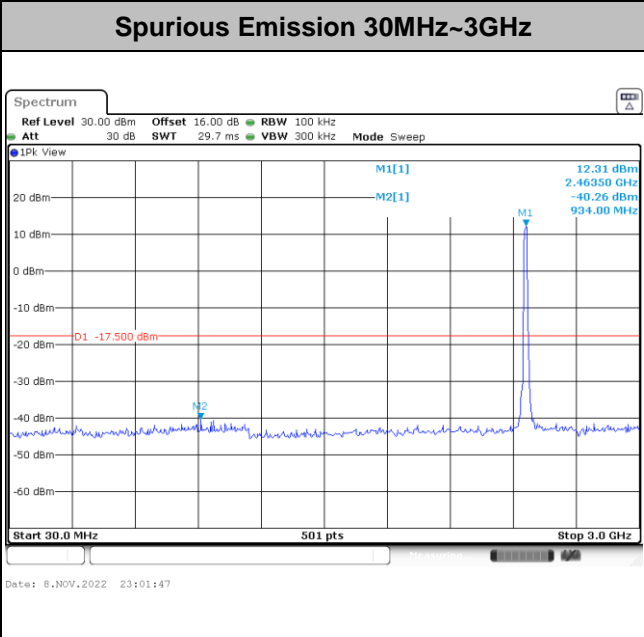
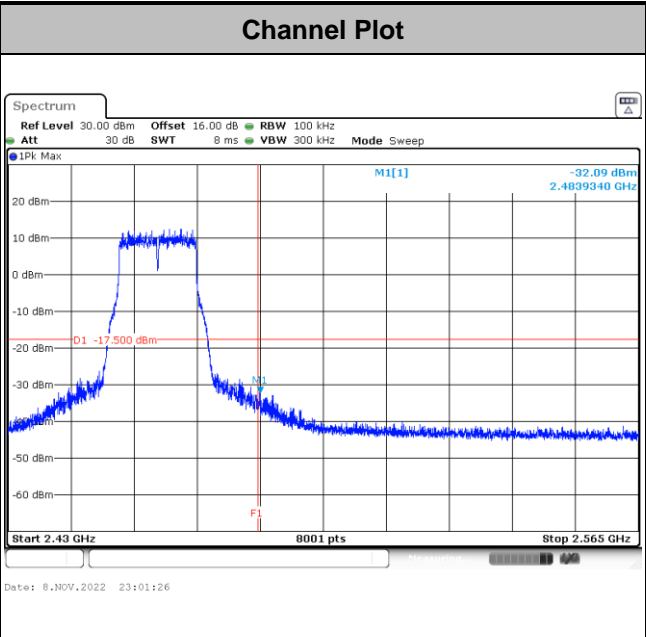
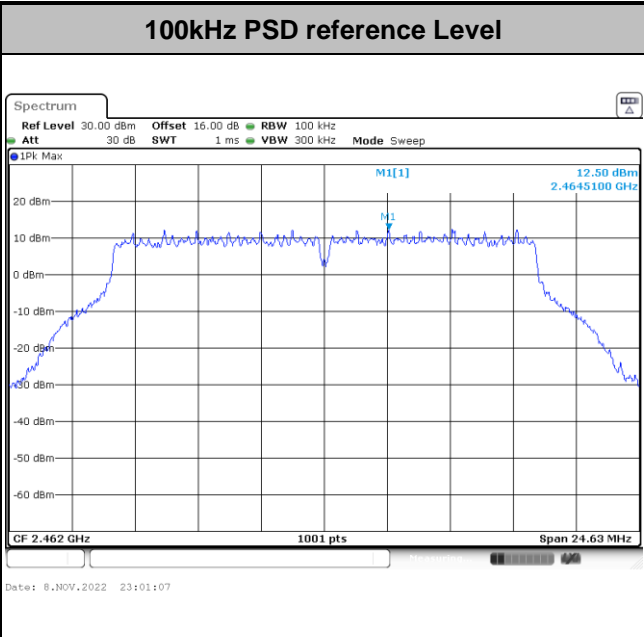


Test Mode :	802.11g-24Mbps	Test Channel :	10
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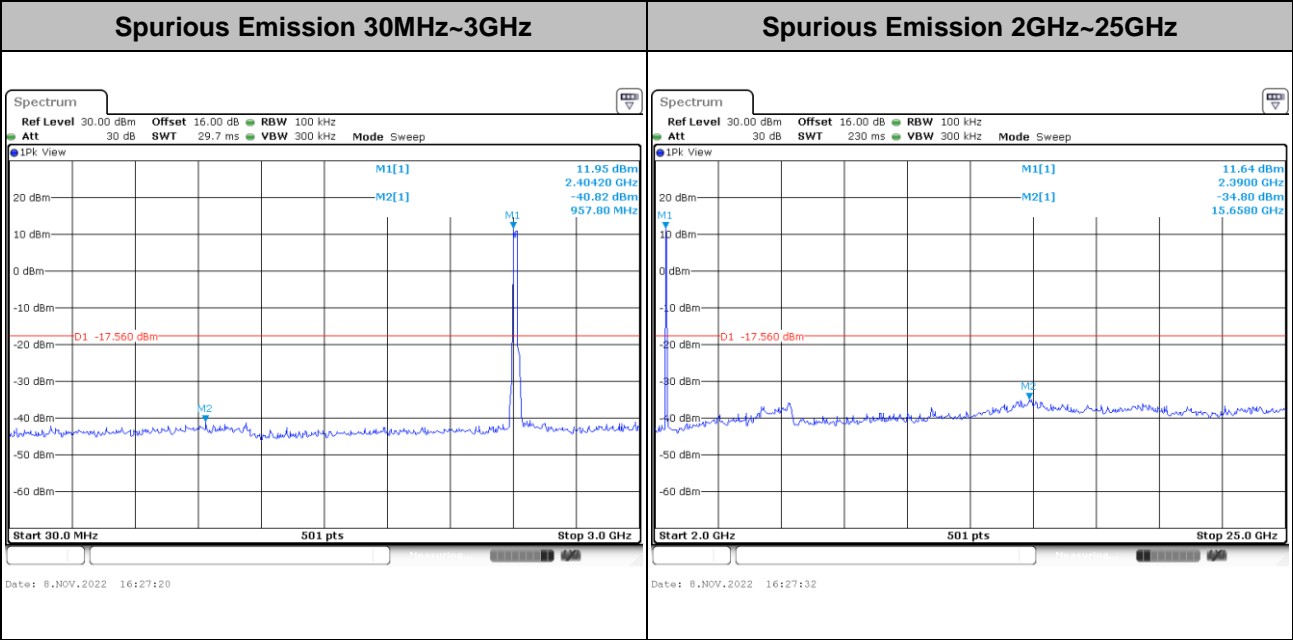
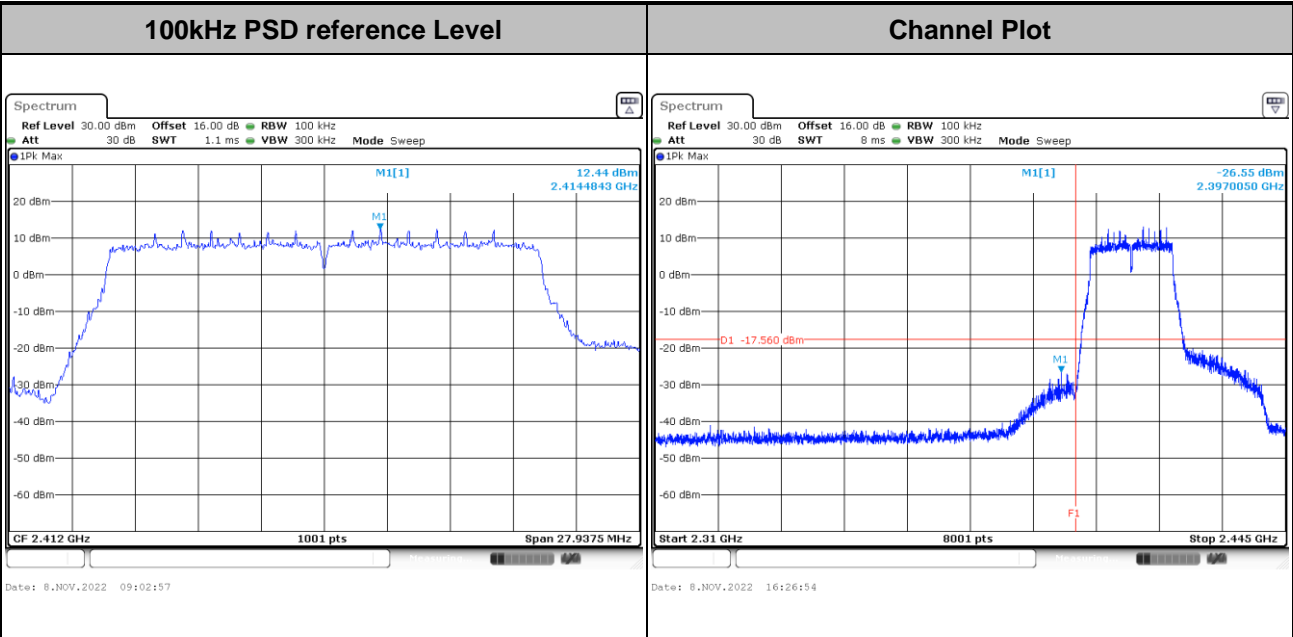


Test Mode : 802.11g-24Mbps Test Channel : 11



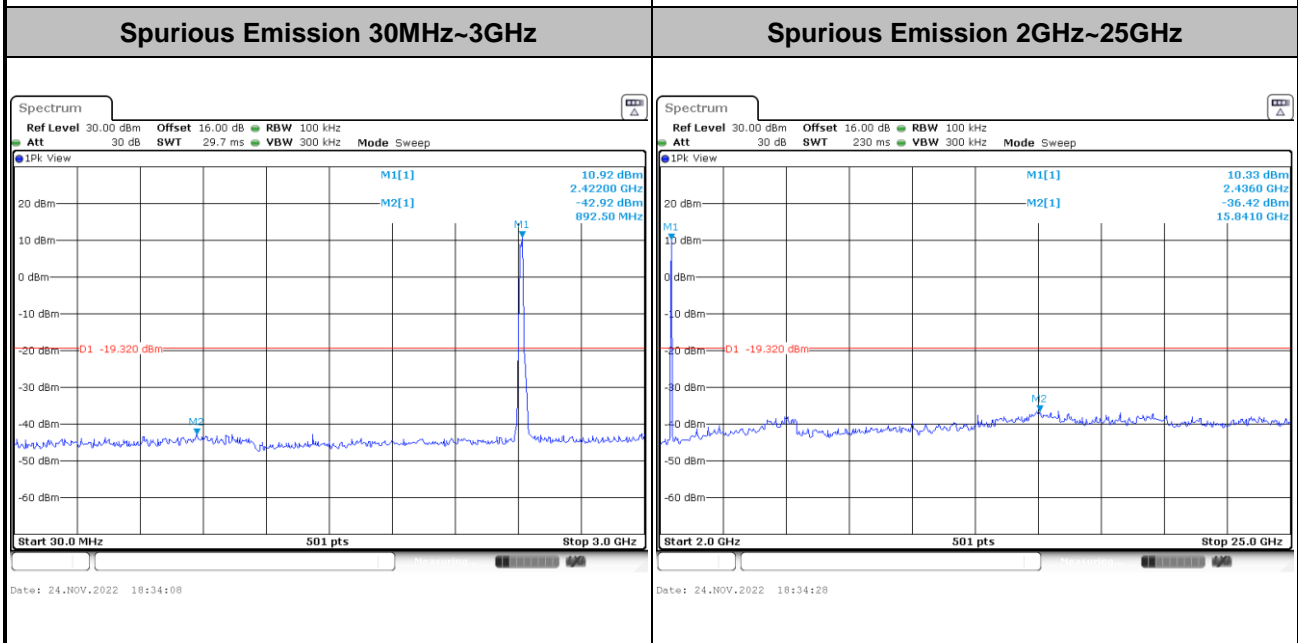
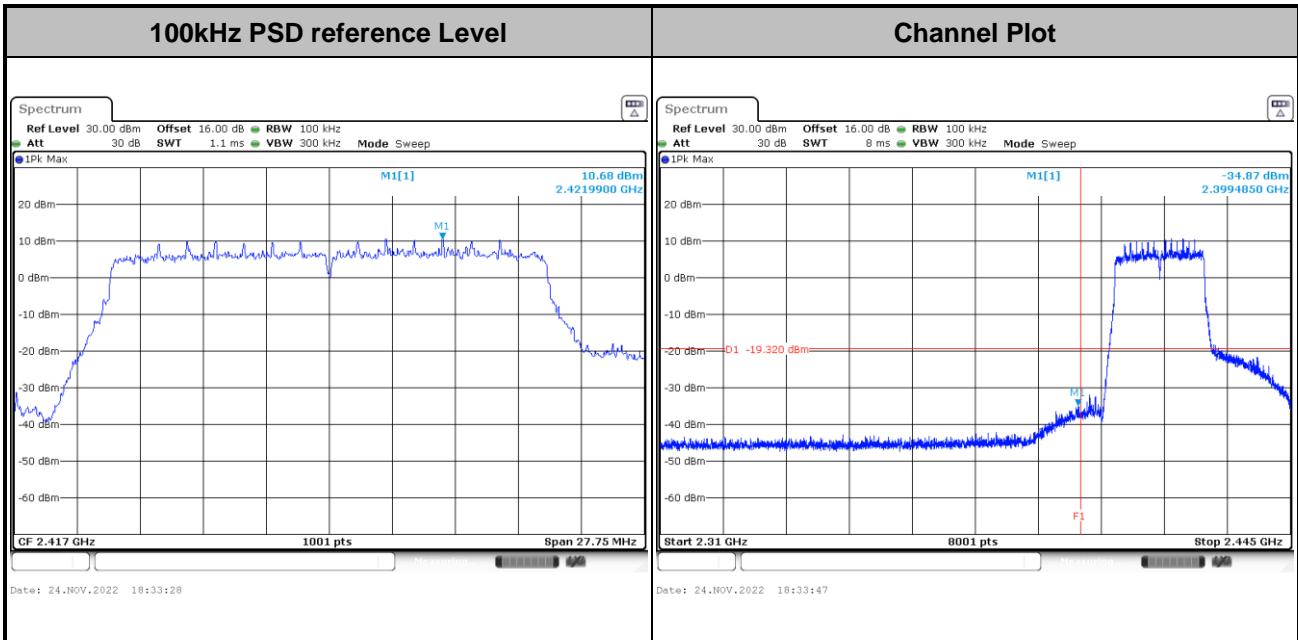


Test Mode :	802.11ax HE20-MCS0	Test Channel :	01
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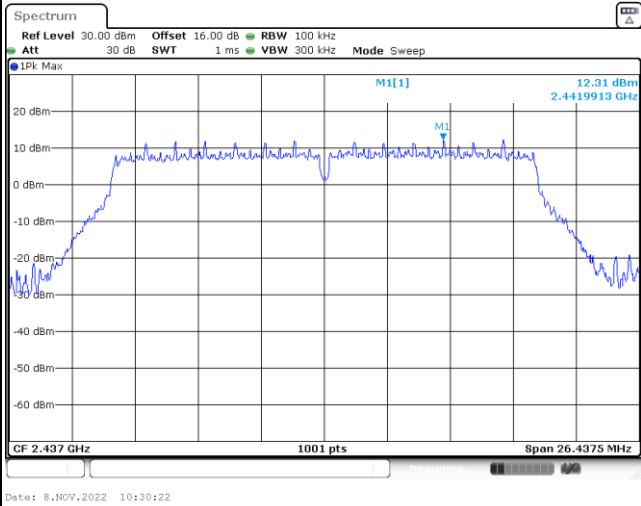
Test Mode :	802.11ax HE20-MCS0	Test Channel :	02
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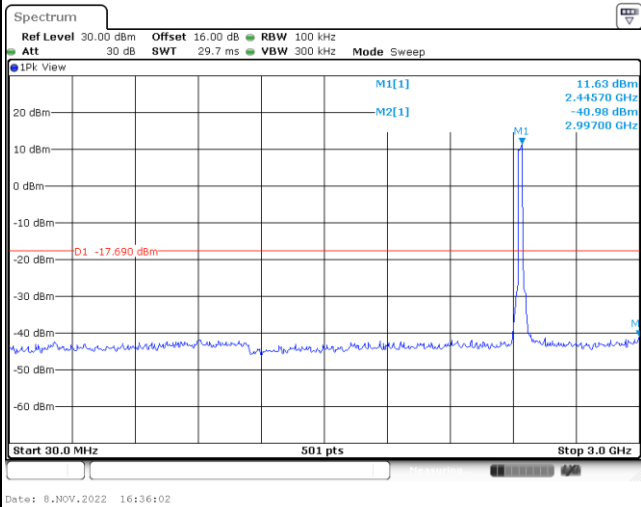


Test Mode :	802.11ax HE20-MCS0	Test Channel :	06
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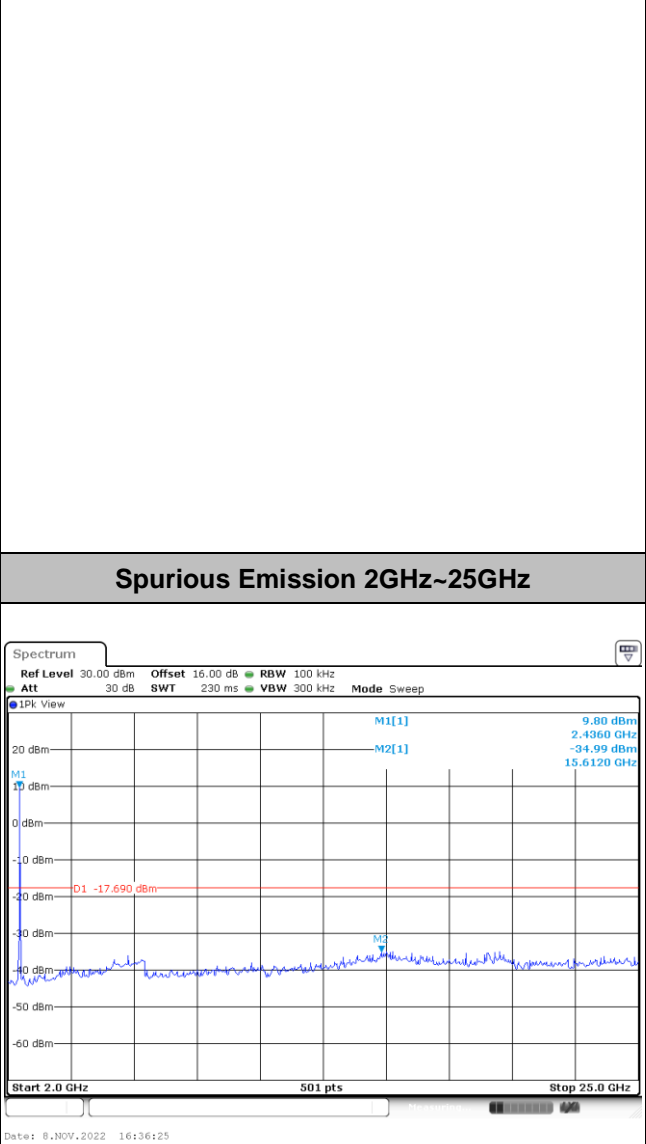
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz

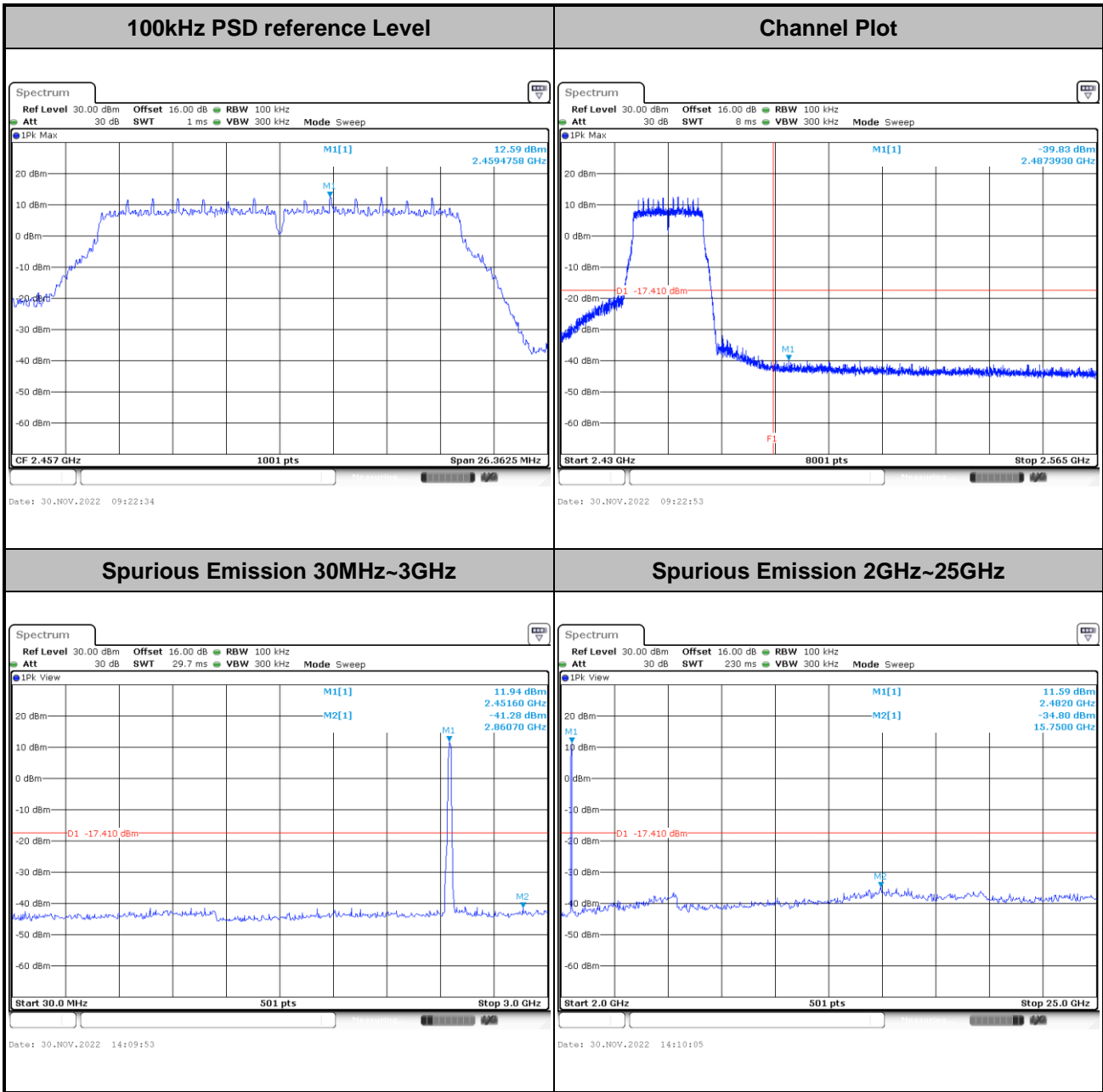


Spurious Emission 2GHz~25GHz



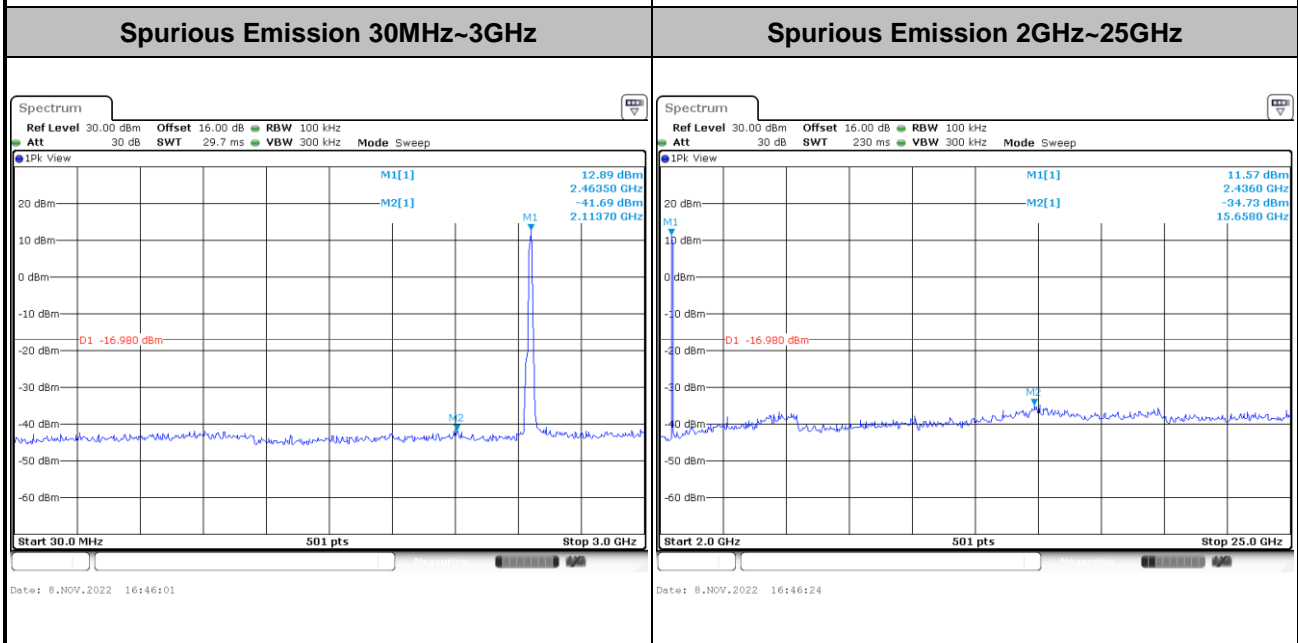
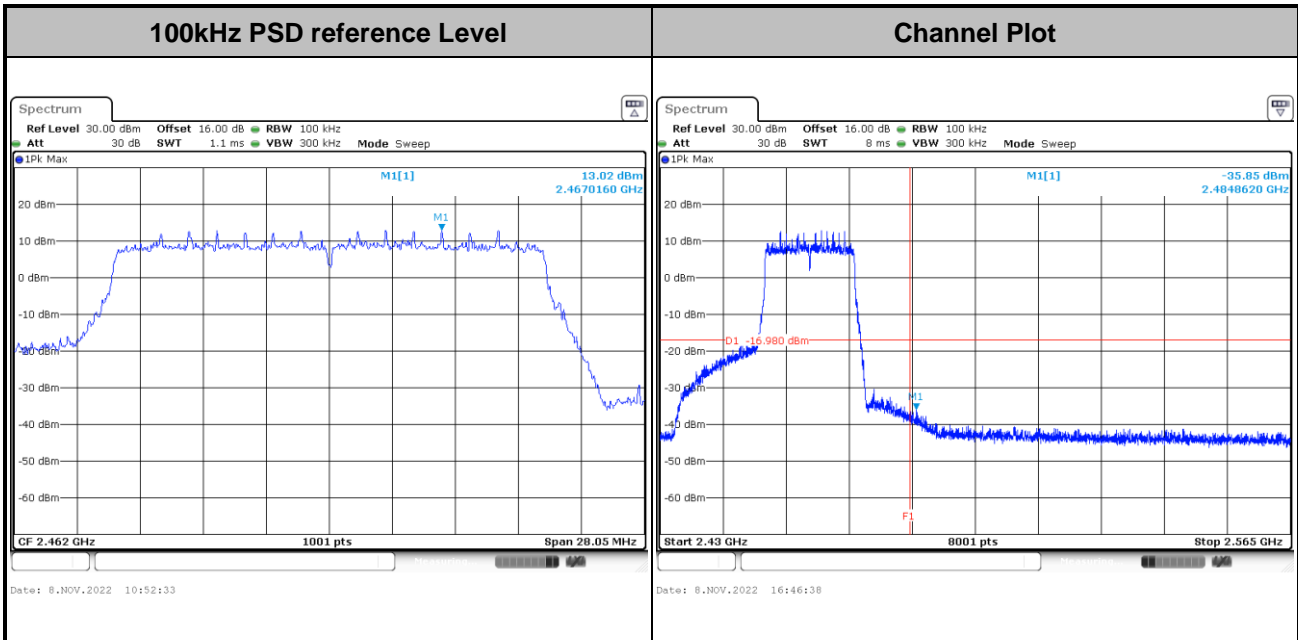


Test Mode :	802.11ax HE20-MCS0	Test Channel :	10
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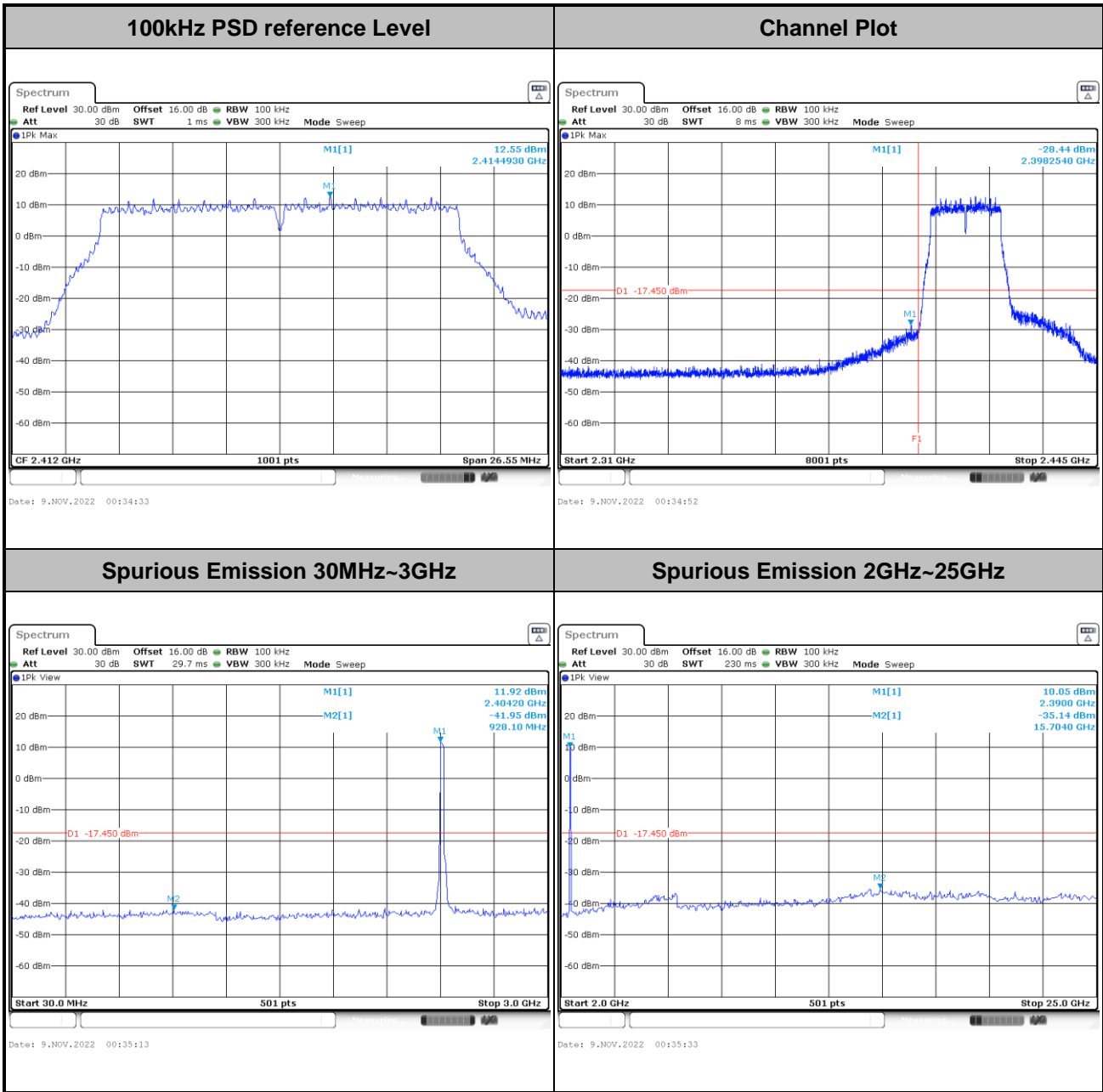


Test Mode :	802.11ax HE20-MCS0	Test Channel :	11
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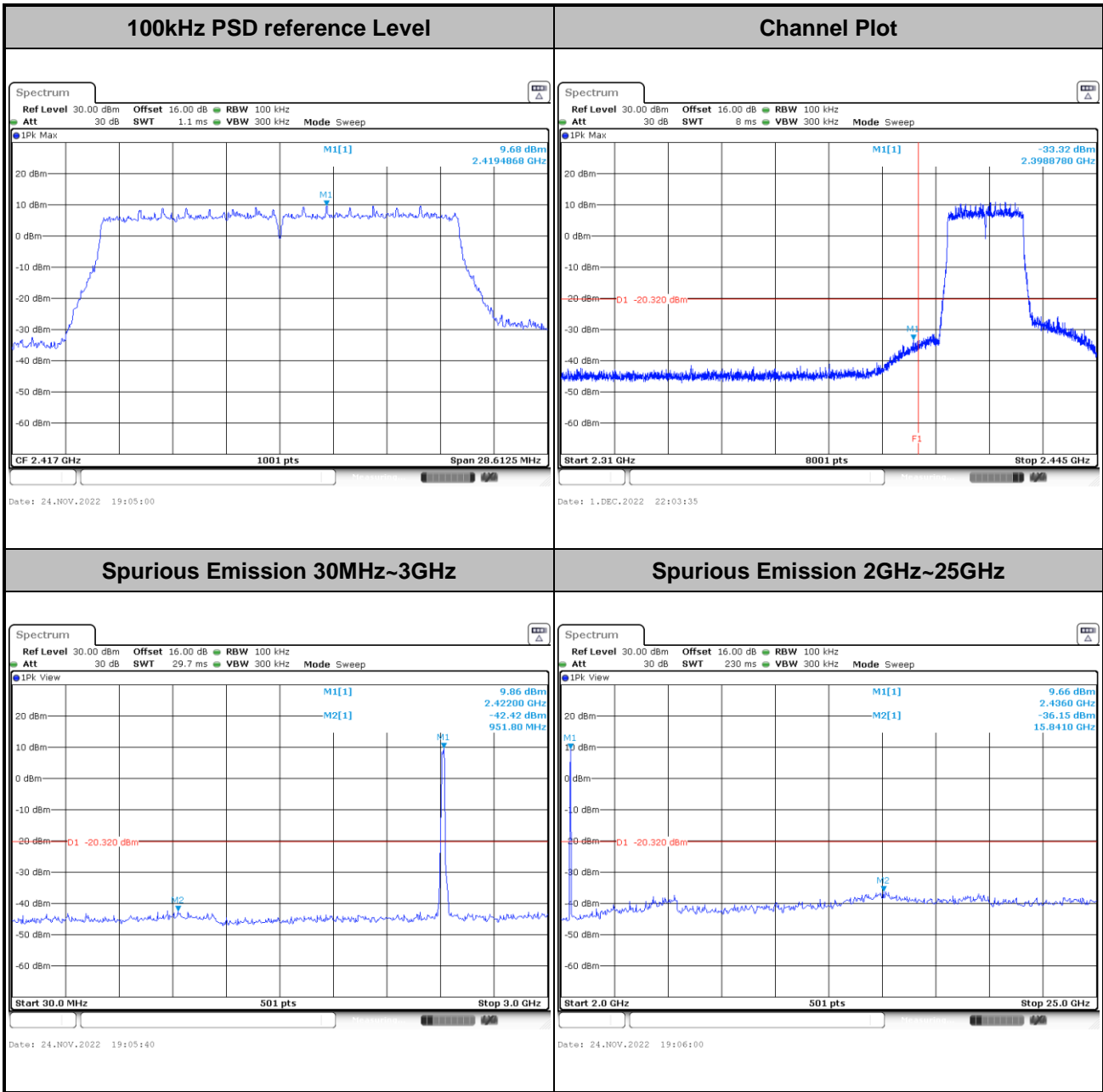


Test Mode :	802.11ax HE20-MCS3	Test Channel :	01
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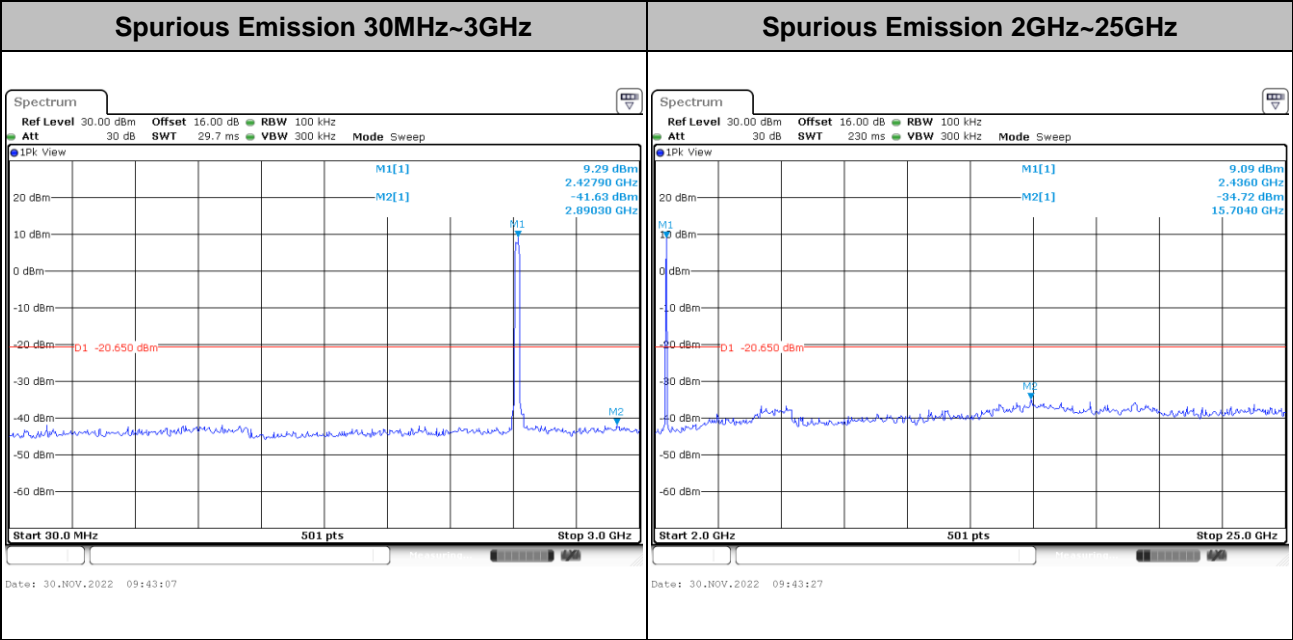
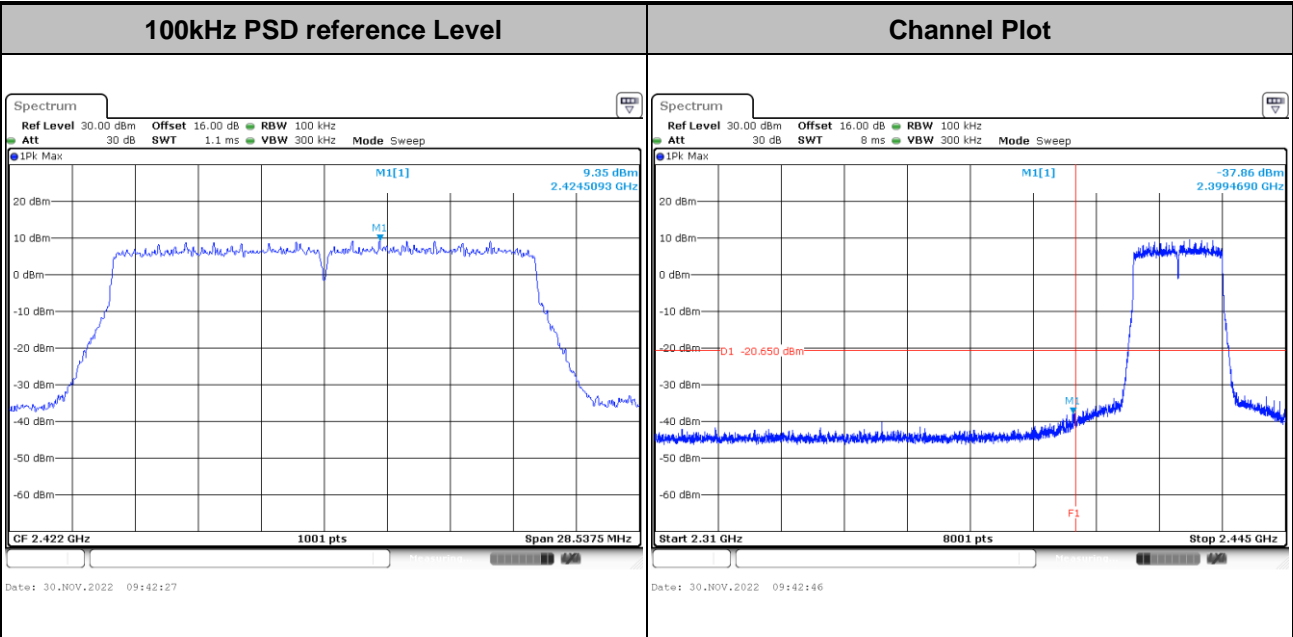


Test Mode :	802.11ax HE20-MCS3	Test Channel :	02
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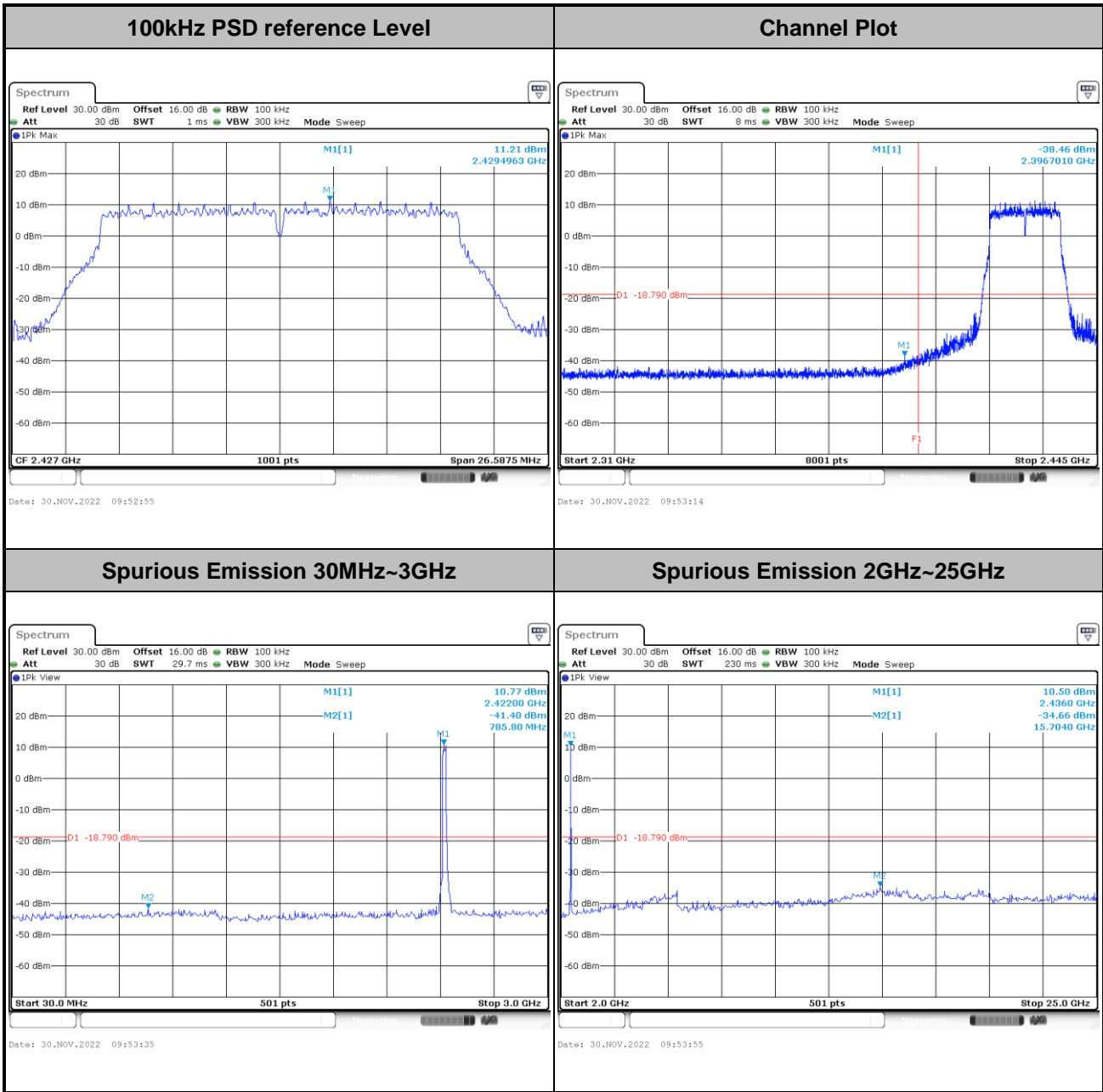


Test Mode :	802.11ax HE20-MCS3	Test Channel :	03
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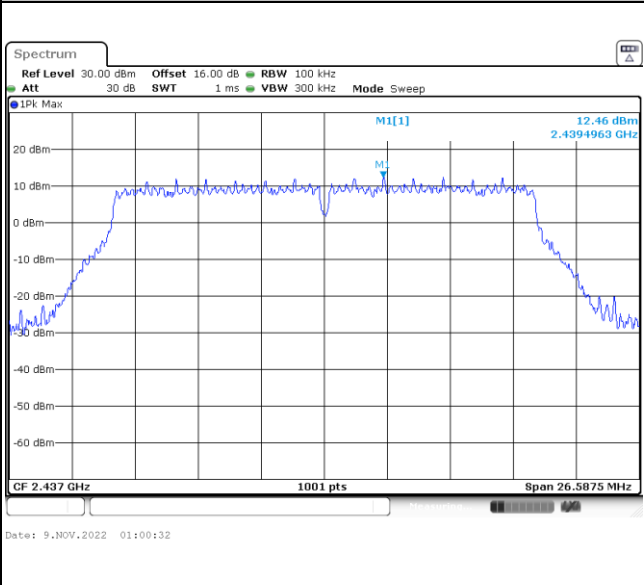
Test Mode :	802.11ax HE20-MCS3	Test Channel :	04
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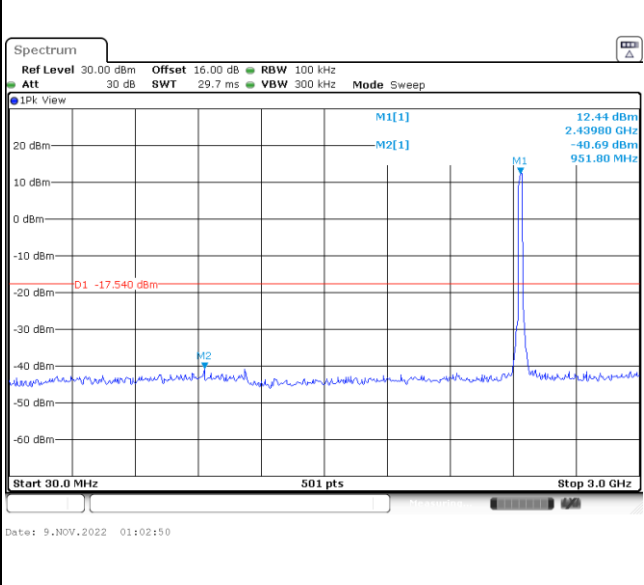


Test Mode :	802.11ax HE20-MCS3	Test Channel :	06
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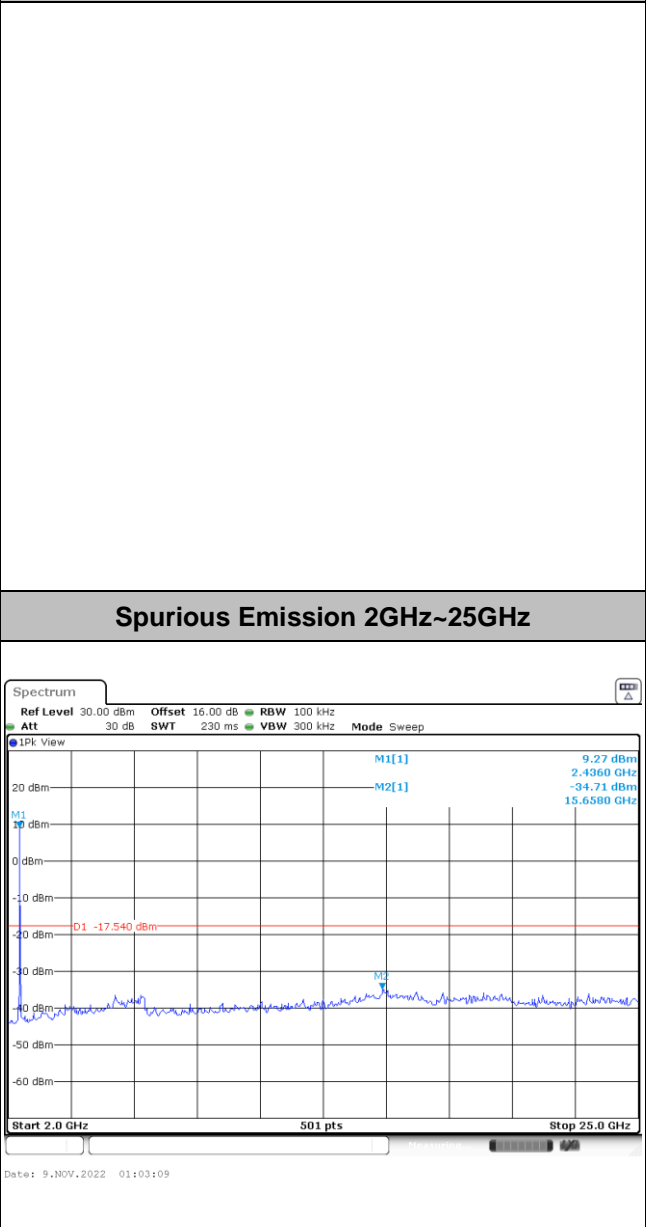
100kHz PSD reference Level



Spurious Emission 30MHz~3GHz



Spurious Emission 2GHz~25GHz





Test Mode : 802.11ax HE20-MCS3 Test Channel : 08

