



FCC RF Test Report

APPLICANT : OnePlus Technology (Shenzhen) Co., Ltd.
EQUIPMENT : Tablet
BRAND NAME : ONEPLUS
MODEL NAME : OPD2408
FCC ID : 2ABZ2-OPD2408
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DTS) Digital Transmission System
TEST DATE(S) : Sep. 14, 2024 ~ Sep. 27, 2024

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

Jason Jia

Approved by: Jason Jia



Sporton International Inc. (ShenZhen)

1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055

People's Republic of China



TABLE OF CONTENTS

REVISION HISTORY.....	3
SUMMARY OF TEST RESULT	4
1 GENERAL DESCRIPTION	5
1.1 Applicant	5
1.2 Manufacturer	5
1.3 Product Feature of Equipment Under Test.....	5
1.4 Product Specification of Equipment Under Test.....	6
1.5 Modification of EUT	6
1.6 Testing Location	7
1.7 Test Software.....	7
1.8 Applicable Standards.....	8
2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST	9
2.1 Carrier Frequency and Channel	9
2.2 Test Mode.....	10
2.3 Connection Diagram of Test System.....	11
2.4 Support Unit used in test configuration and system	11
2.5 EUT Operation Test Setup	12
2.6 Measurement Results Explanation Example.....	12
3 TEST RESULT	13
3.1 6dB and 99% Bandwidth Measurement	13
3.2 Output Power Measurement.....	15
3.3 Power Spectral Density Measurement	16
3.4 Conducted Band Edges and Spurious Emission Measurement	18
3.5 Radiated Band Edges and Spurious Emission Measurement	55
3.6 AC Conducted Emission Measurement.....	59
3.7 Antenna Requirements.....	61
4 LIST OF MEASURING EQUIPMENT	62
5 MEASUREMENT UNCERTAINTY	63
APPENDIX A. CONDUCTED TEST RESULTS	
APPENDIX B. AC CONDUCTED EMISSION TEST RESULT	
APPENDIX C. RADIATED SPURIOUS EMISSION	
APPENDIX D. DUTY CYCLE PLOTS	
APPENDIX E. SETUP PHOTOGRAPHS	



REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR480201C	Rev. 01	Initial issue of report	Nov. 07, 2024

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.1	-	99% Bandwidth	-	Report Only	-
3.2	15.247(b)	Power Output Measurement	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
3.4	15.247(d)	Conducted Band Edges	$\leq 30\text{dBc}$	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 5.02 dB at 2483.510 MHz
3.6	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 10.97 dB at 0.260 MHz
3.7	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

Conformity Assessment Condition:

- 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/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
- 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

OnePlus Technology (Shenzhen) Co., Ltd.

18C02, 18C03, 18C04, and 18C05, Shum Yip Terra Building, Binhe Avenue North, Futian District, Shenzhen, Guangdong, P.R. China

1.2 Manufacturer

LONGCHEER ELECTRONICS (HUIZHOU) CO., Ltd.

No.28, Hechang Six Road(West), Zhongkai High Technology Zone, 516006 Huizhou, Guangdong, P. R. China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Tablet
Brand Name	ONEPLUS
Model Name	OPD2408
FCC ID	2ABZ2-OPD2408
SN Code	Conducted: L621521000011E8D000F Conduction: L621521000011E8D00EN Radiation: L621521000011E8D00EQ
HW Version	OPD2408_11
SW Version	OPD2408_15.0.0.61
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 (AV) Output Power to antenna	<SISO Ant 0> 802.11b : 16.70 dBm (0.0468 W) 802.11g : 16.90 dBm (0.0490 W) <SISO Ant 1> 802.11b : 16.90 dBm (0.0490 W) 802.11g : 17.00 dBm (0.0501 W) <MIMO Ant 0+1> 802.11ac VHT20 : 20.11 dBm (0.1026 W) 802.11ac VHT40 : 19.96 dBm (0.0991 W) 802.11ax HE20 : 20.26 dBm (0.1062 W) 802.11ax HE40 : 20.21 dBm (0.1050 W)
99% Occupied Bandwidth	<SISO Ant 0> 802.11b : 12.73MHz 802.11g : 17.08MHz <SISO Ant 1> 802.11b : 12.85MHz 802.11g : 17.11MHz <MIMO Ant 0+1> 802.11ac VHT20 : 18.60MHz 802.11ac VHT40 : 37.38MHz 802.11ax HE20 : 19.03MHz 802.11ax HE40 : 38.01MHz
Antenna Type / Gain	<Ant 0>Cavity Antenna type with gain -1.4 dBi <Ant 1>Cavity Antenna type with gain -1.5 dBi
Type of Modulation	802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11g/n/ac : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ax : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM / 1024QAM)

Note:

- 802.11b/g support SISO mode only.
- 802.11n/ac/ax support SISO & CDD MIMO mode. The whole testing has assessed only MIMO mode by referring to the higher normal output power.
- For 802.11n/11ac mode, the whole testing have assessed only 802.11ac by referring to the higher output power.
- 802.11ax support OFDMA full RU tone and partial RU tone, both full RU and partial RU-left (for low CH) and partial RU-right (for high CH) test output power, the full RU power/PSD > partial RU, therefore the full RU perform full, and partial RU verify bandedge/spurious.

1.5 Modification of EUT

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



1.6 Testing Location

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-SZ TH01-SZ	CN1256	421272

Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City, Guangdong Province 518103 People's Republic of China TEL: +86-755-86066985		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH04-SZ	CN1256	421272

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH04-SZ	AUDIX	E3	6.2009-8-24
2.	CO01-SZ	AUDIX	E3	6.120613b



1.8 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.

SISO Antenna

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps

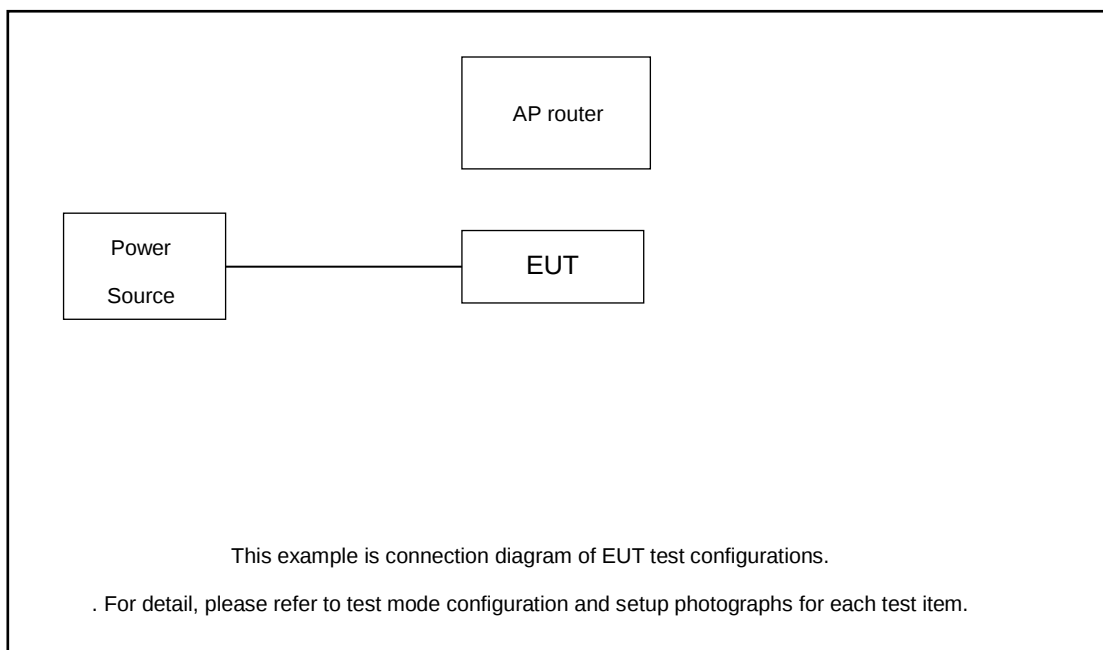
MIMO Antenna

Modulation	Data Rate
802.11n HT20 (Covered by VHT20)	MCS0
802.11n HT40 (Covered by VHT40)	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ax HE20	MCS0
802.11ax HE40	MCS0

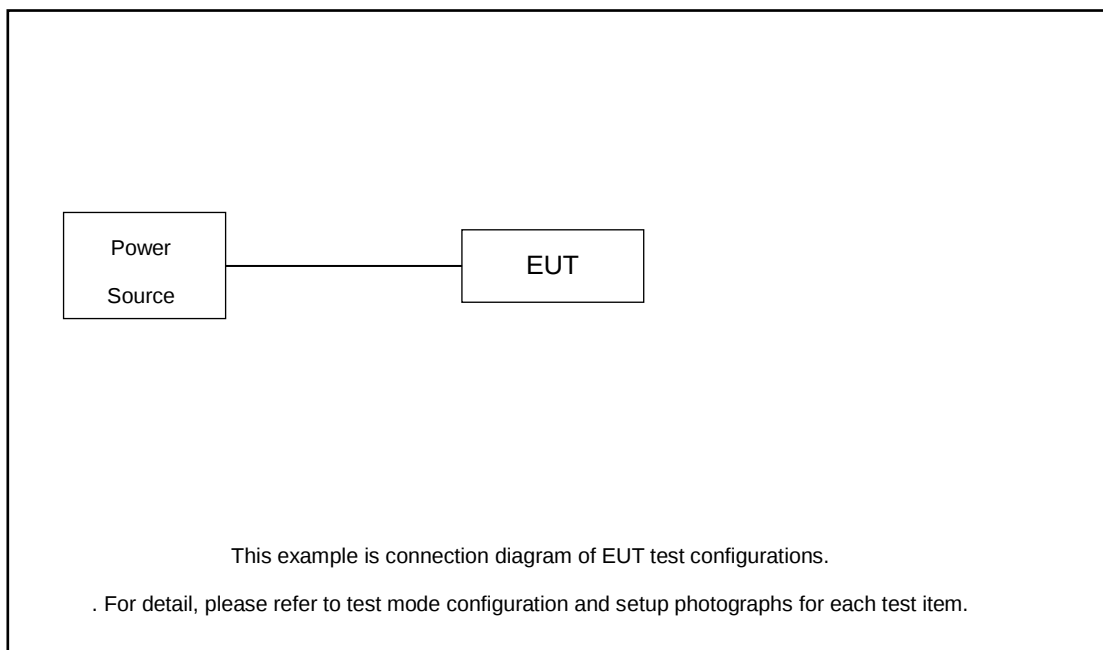
Test Cases	
AC Conducted Emission	Mode 1 :WLAN Link(2.4G) + USB Cable 1(Charging from Adapter1) + Battery
Remark: For Radiated Test Cases, the tests were performed with Adapter1 and USB Cable1.	

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	Dlink	DIR-820L	KA21R820LA1	N/A	Unshielded,1.8m



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 1.3 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.3 + 10 = 11.3 \text{ (dB)}\end{aligned}$$

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) $\geq 3 \times \text{RBW}$. 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) approximately three times the RBW.
6. Measure and record the results in the test report.

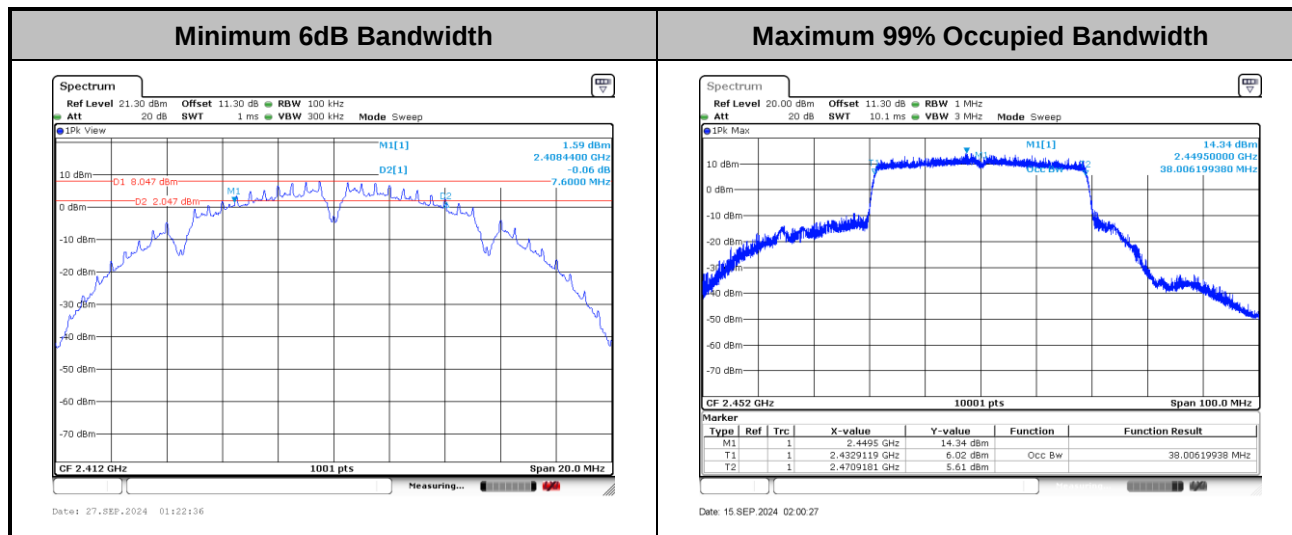
3.1.4 Test Setup





3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.



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.

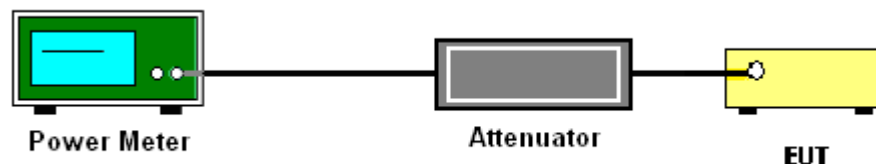
3.2.2 Measuring Instruments

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 11.9.1.3 PKPM1 Peak power meter or 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.

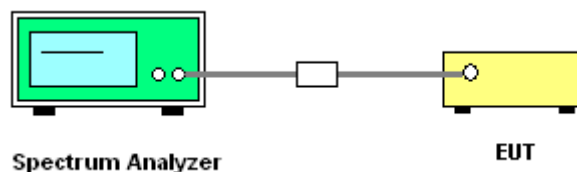
3.3.3 Test Procedures

1. The testing follows Measurement Procedure of ANSI C63.10-2013 clause 11.10.2 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.
7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01:

Method (c): Measure and add $10 \log(N_{\text{ANT}})$ dB, where N_{ANT} is the number of outputs.

The measurement on each individual output were performed with the same span and number on each individual output. The quantity $10 \log(N_{\text{ANT}})$ dB is added to each spectrum value before comparing to the emission limit.

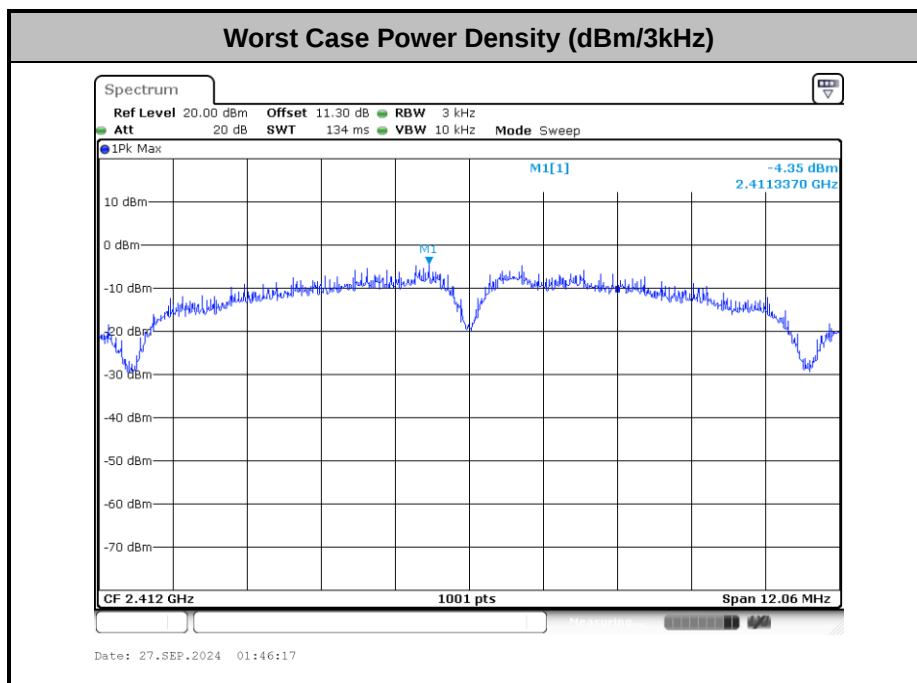
3.3.4 Test Setup





3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

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

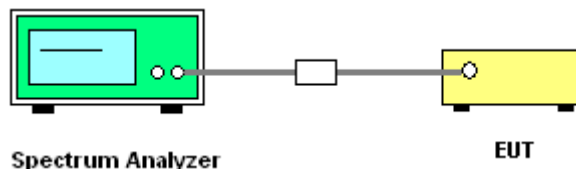
3.4.2 Measuring Instruments

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 11.11
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



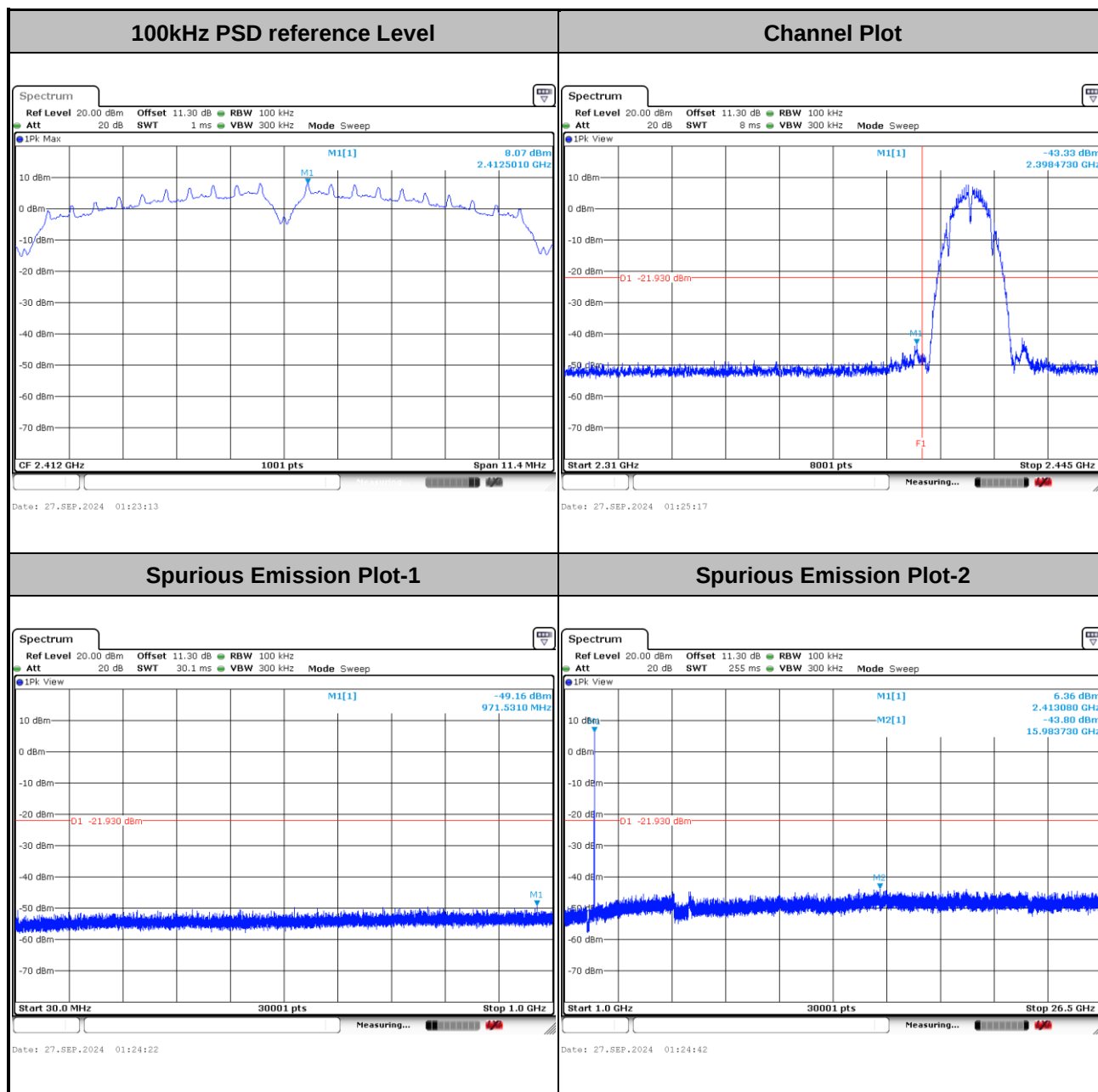


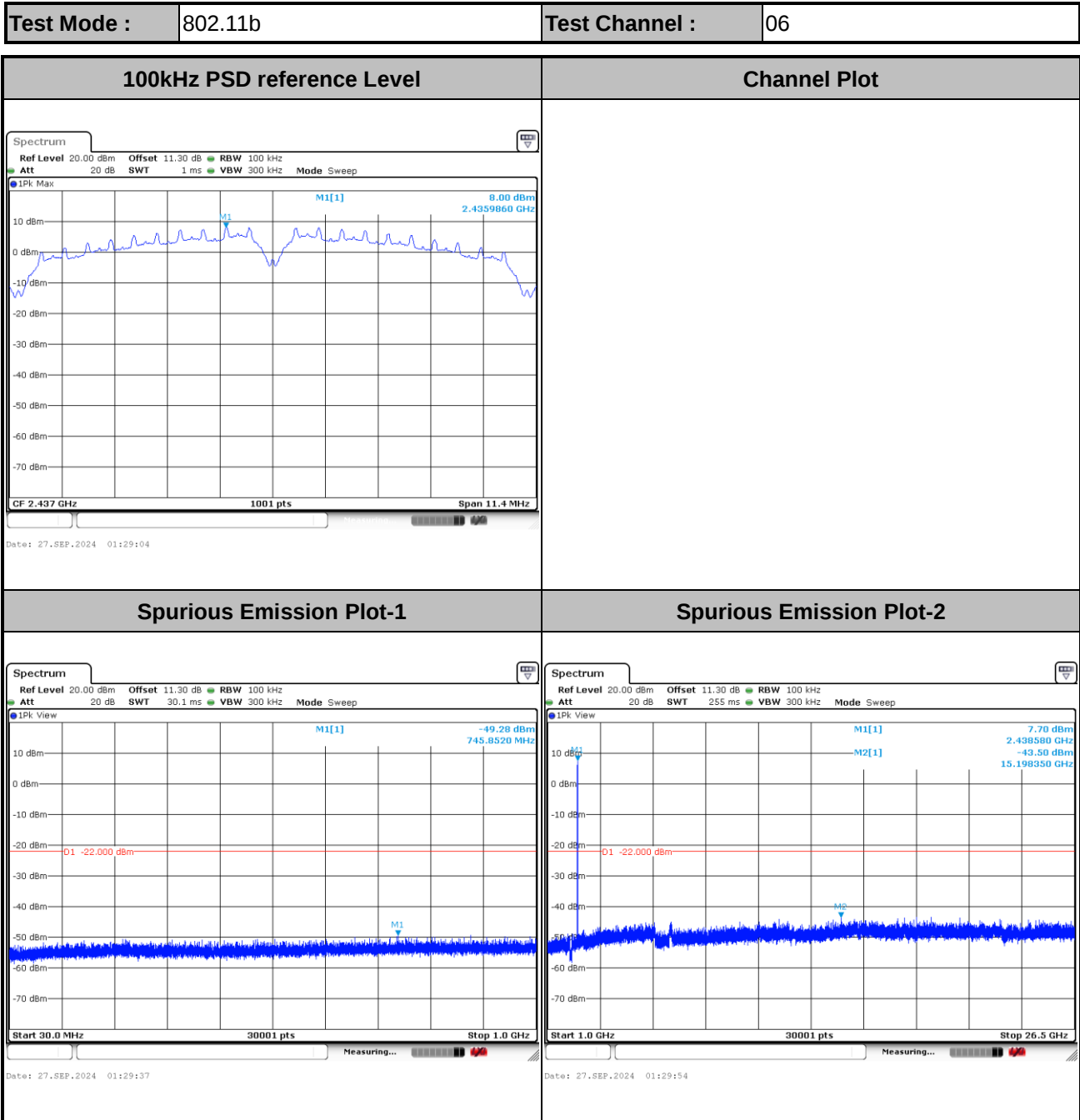
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Test Engineer :	He Qingsheng	Temperature :	21~25°C
		Relative Humidity :	51~54%

Number of TX = 1, Ant. 0 (Measured)

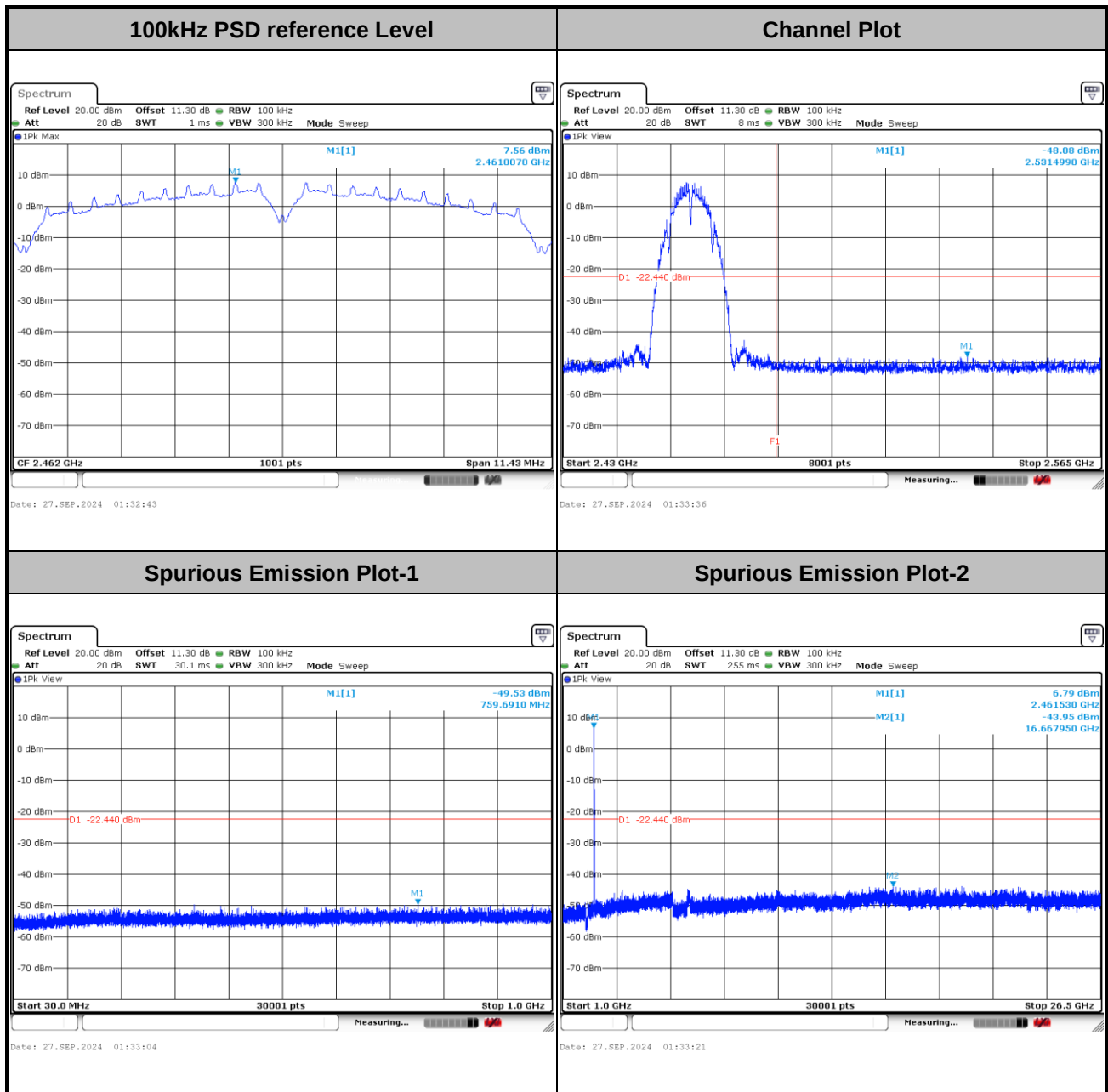
Test Mode :	802.11b	Test Channel :	01
-------------	---------	----------------	----







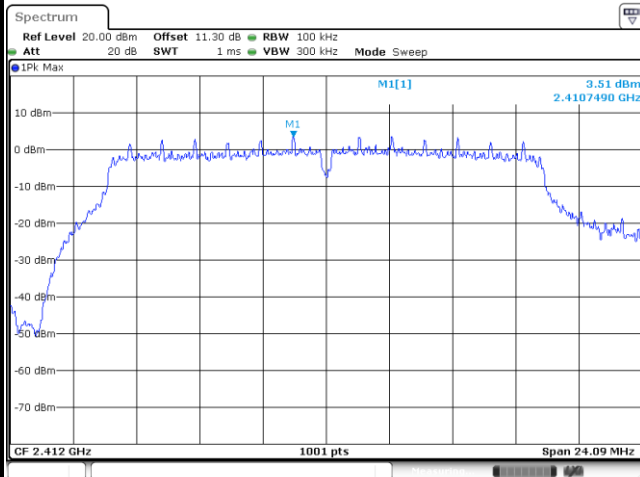
Test Mode :	802.11b	Test Channel :	11
-------------	---------	----------------	----





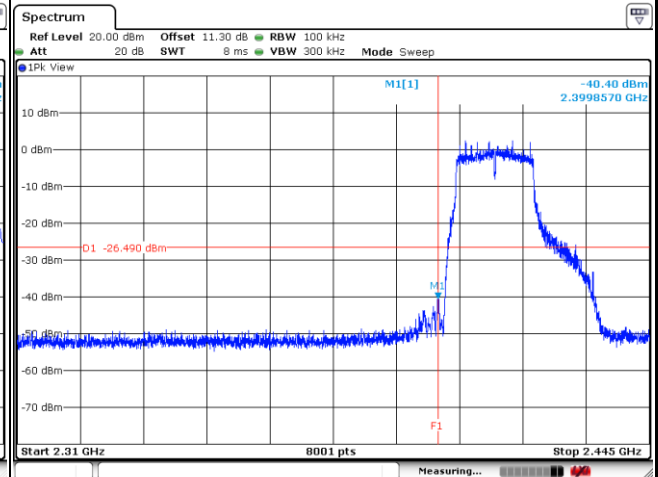
Test Mode :	802.11g	Test Channel :	01
-------------	---------	----------------	----

100kHz PSD reference Level



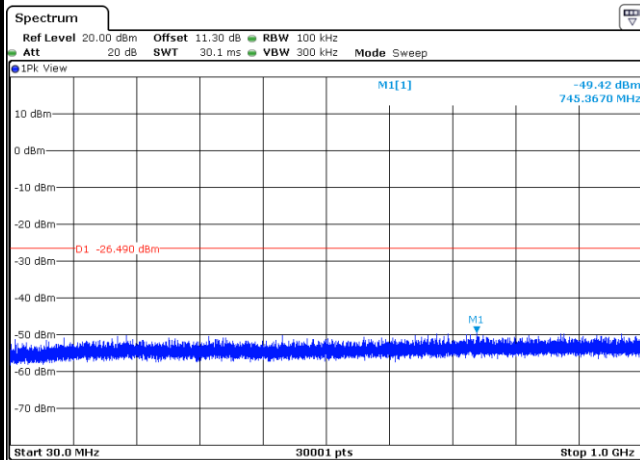
Date: 27.SEP.2024 02:19:43

Channel Plot



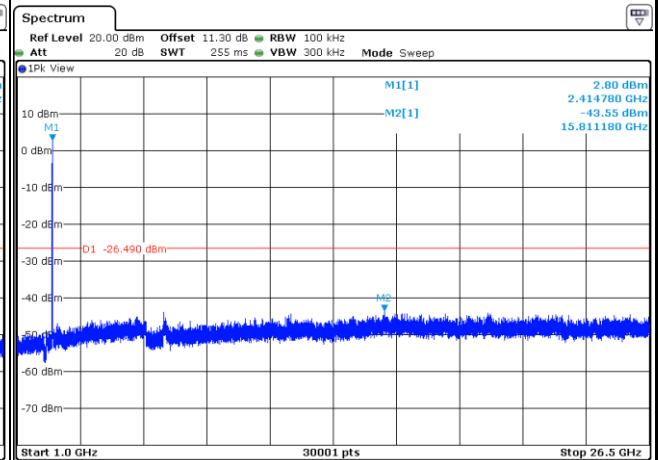
Date: 27.SEP.2024 02:20:33

Spurious Emission Plot-1



Date: 27.SEP.2024 02:20:04

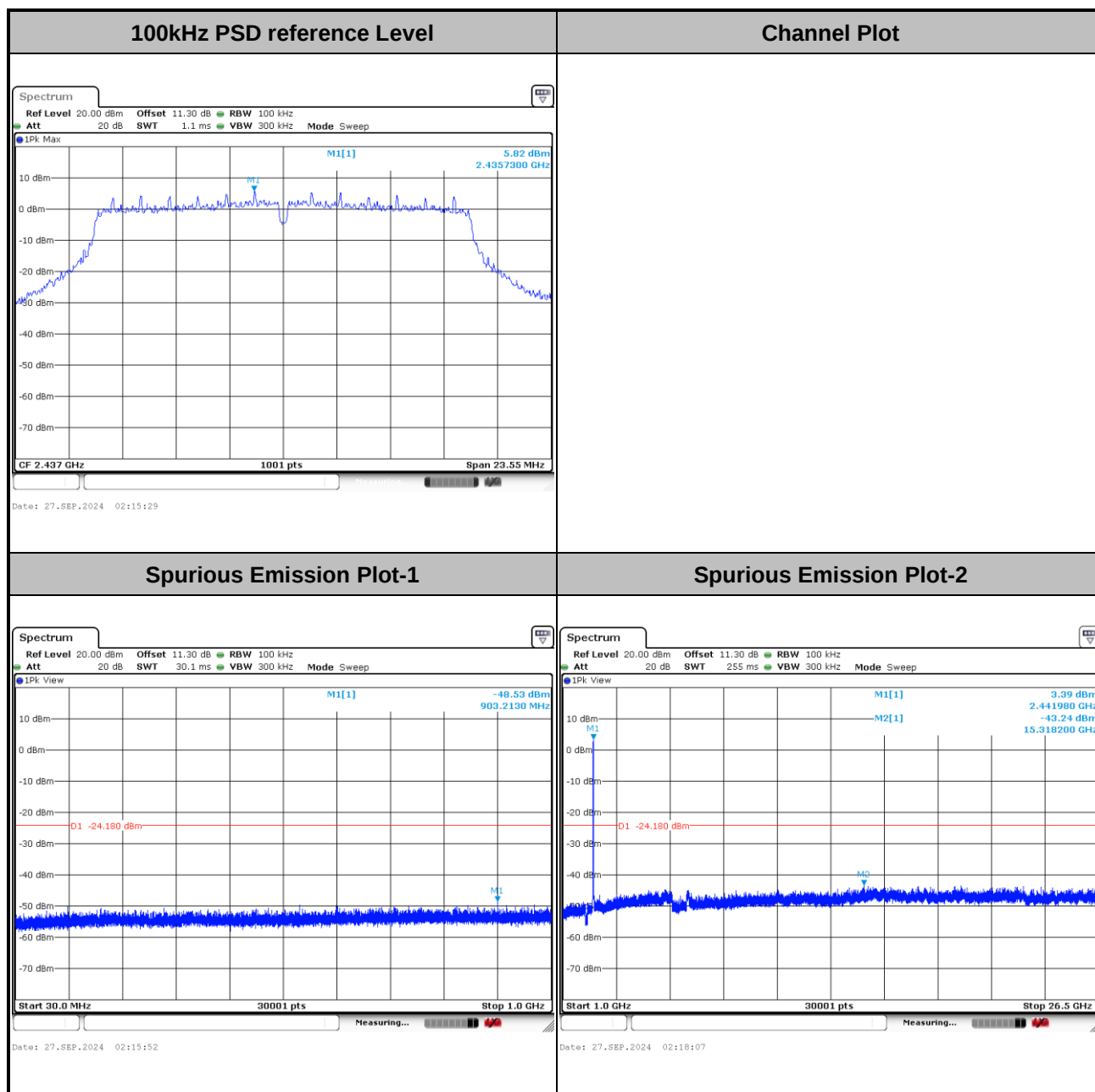
Spurious Emission Plot-2



Date: 27.SEP.2024 02:20:21

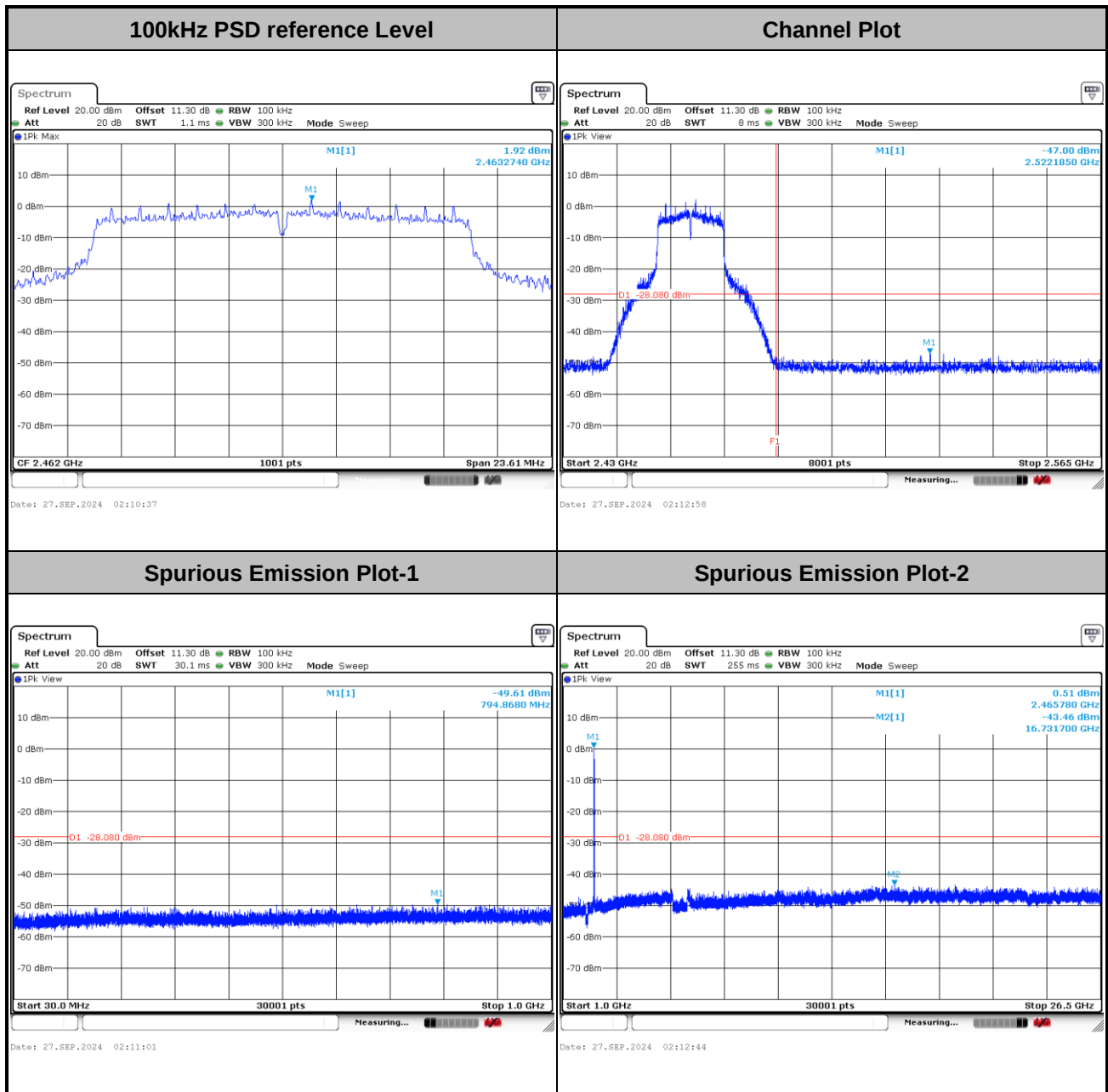


Test Mode :	802.11g	Test Channel :	06
-------------	---------	----------------	----



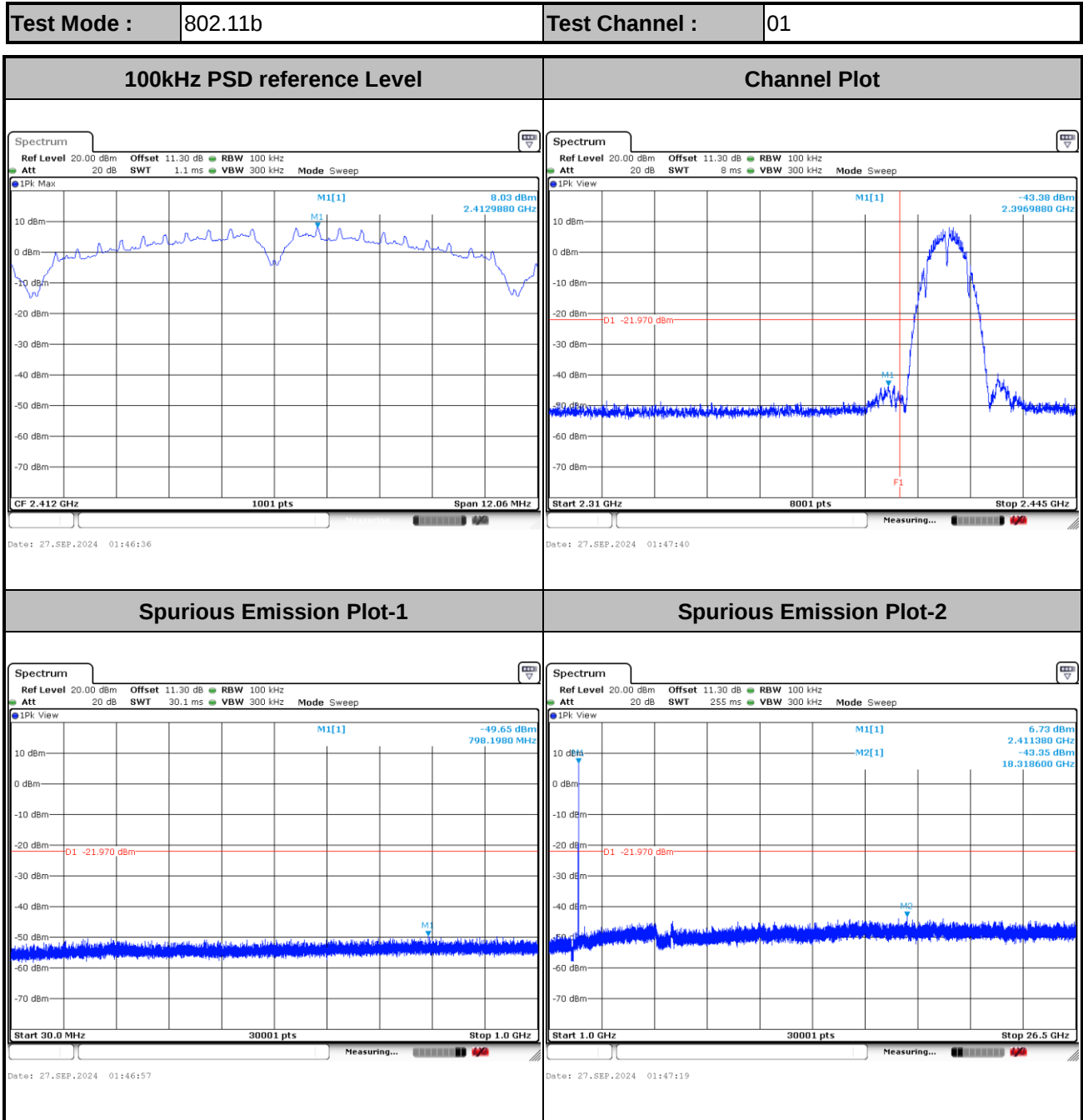


Test Mode :	802.11g	Test Channel :	11
-------------	---------	----------------	----





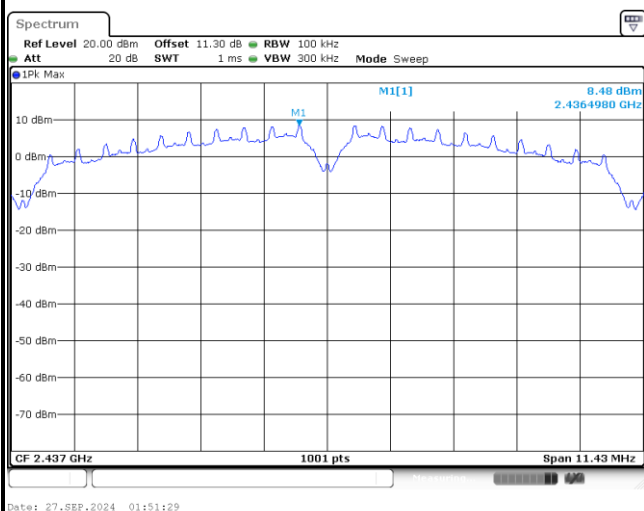
Number of TX = 1, Ant. 1 (Measured)





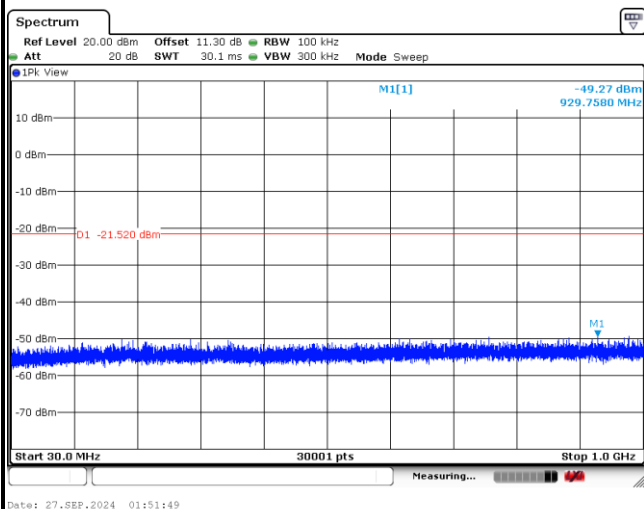
Test Mode :	802.11b	Test Channel :	06
-------------	---------	----------------	----

100kHz PSD reference Level

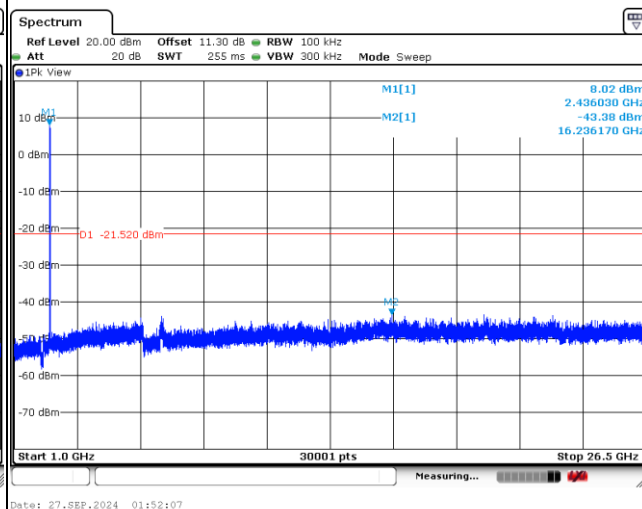


Channel Plot

Spurious Emission Plot-1

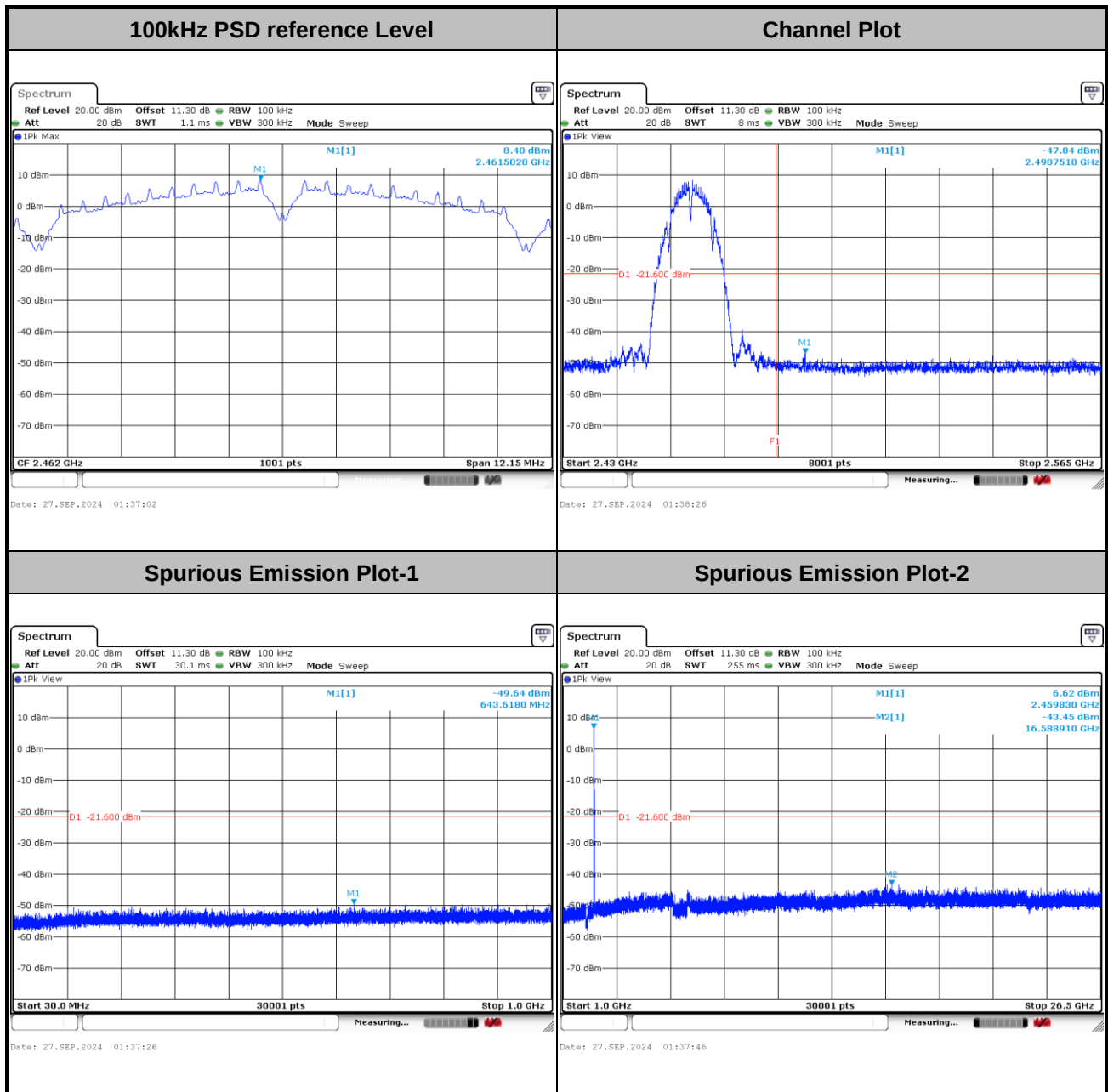


Spurious Emission Plot-2



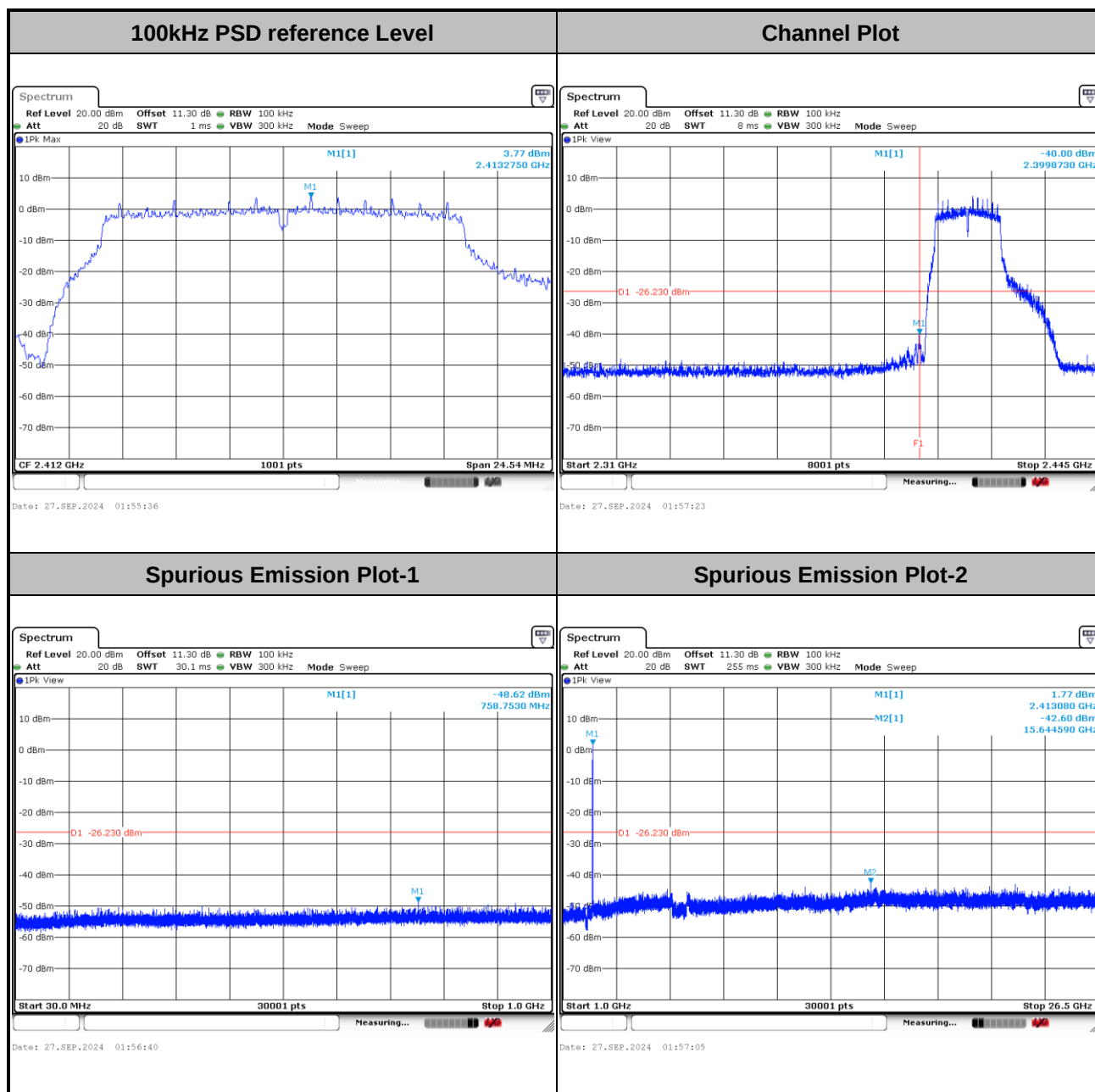


Test Mode :	802.11b	Test Channel :	11
-------------	---------	----------------	----



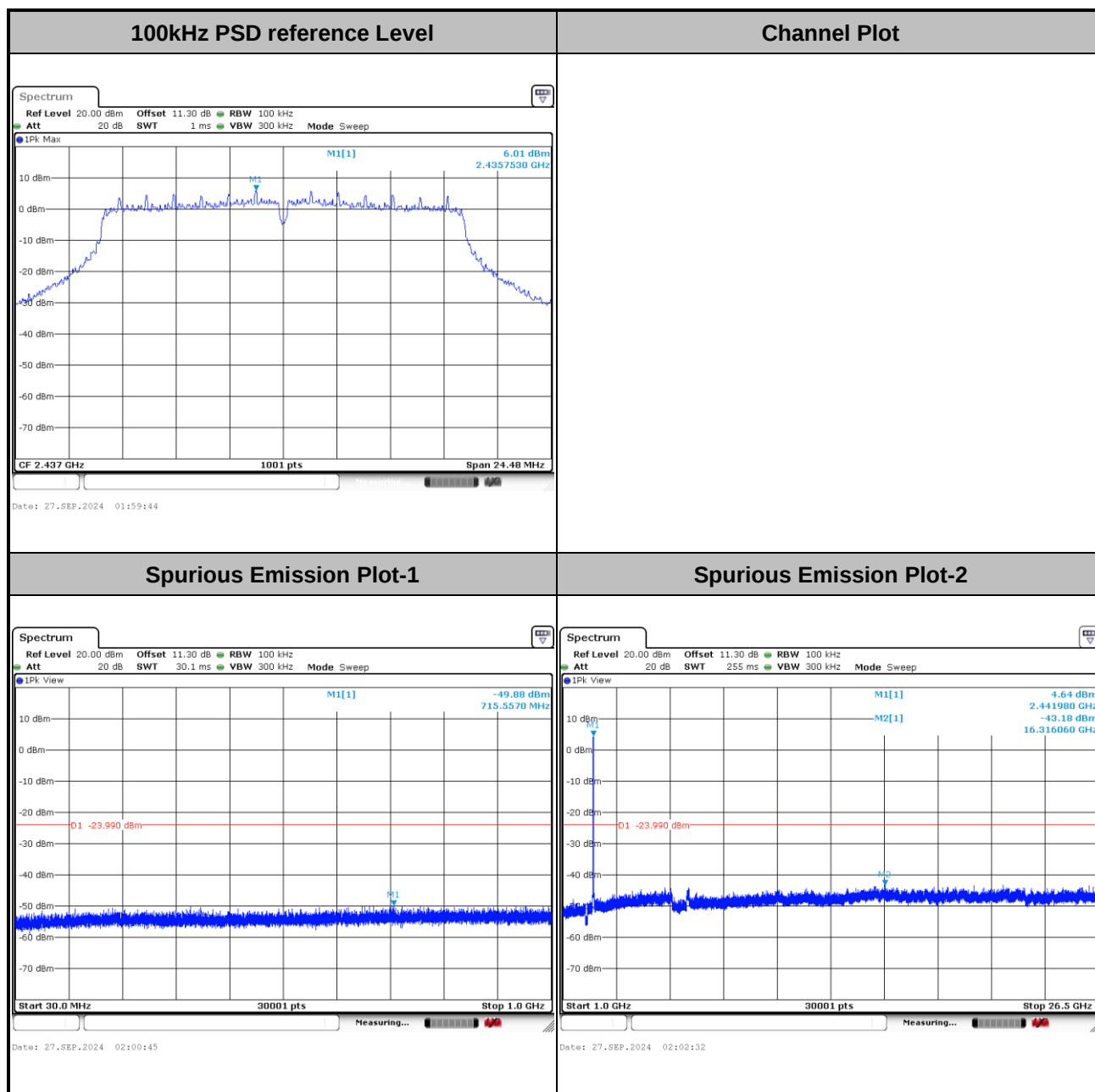


Test Mode :	802.11g	Test Channel :	01
-------------	---------	----------------	----



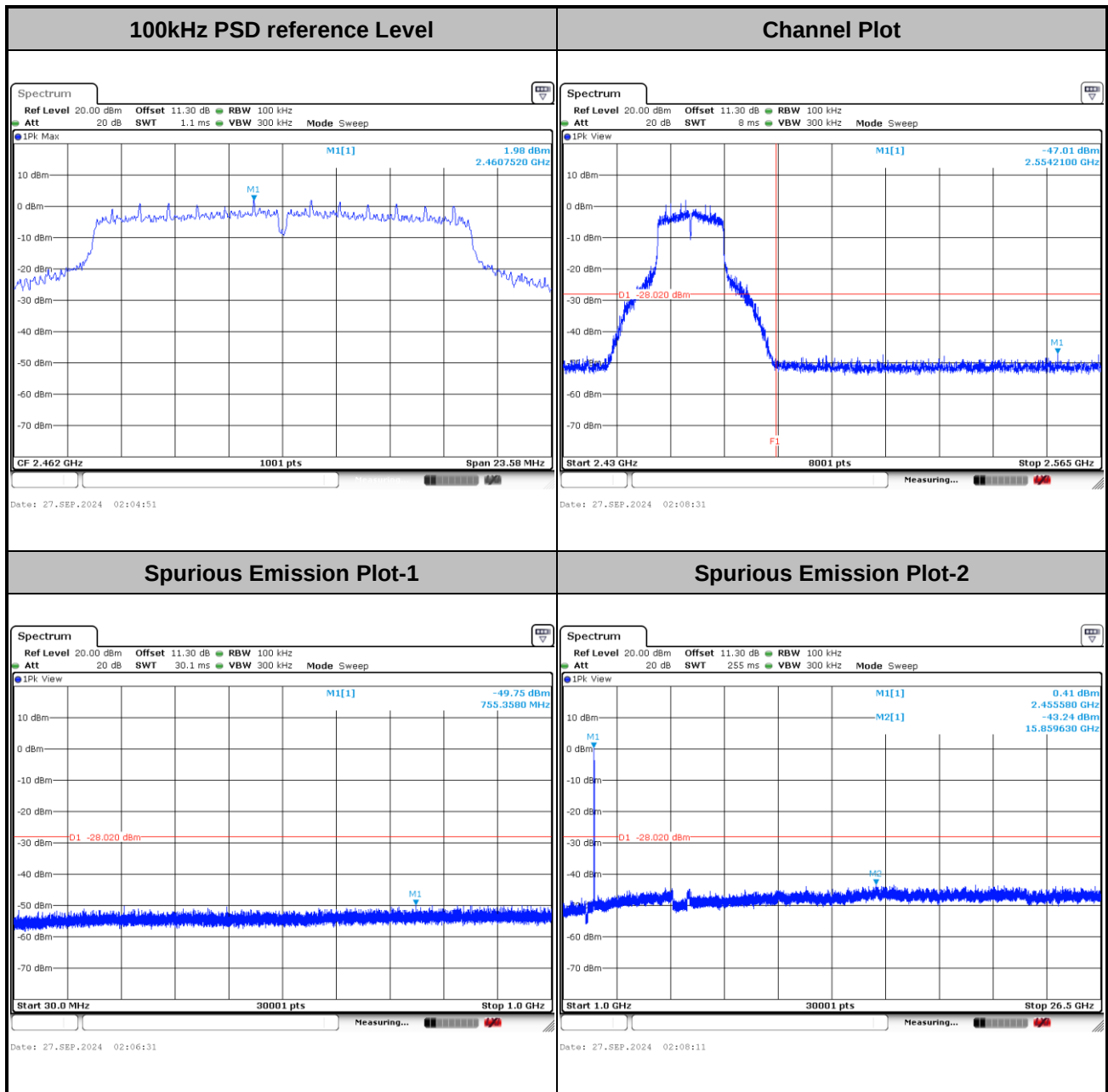


Test Mode :	802.11g	Test Channel :	06
-------------	---------	----------------	----





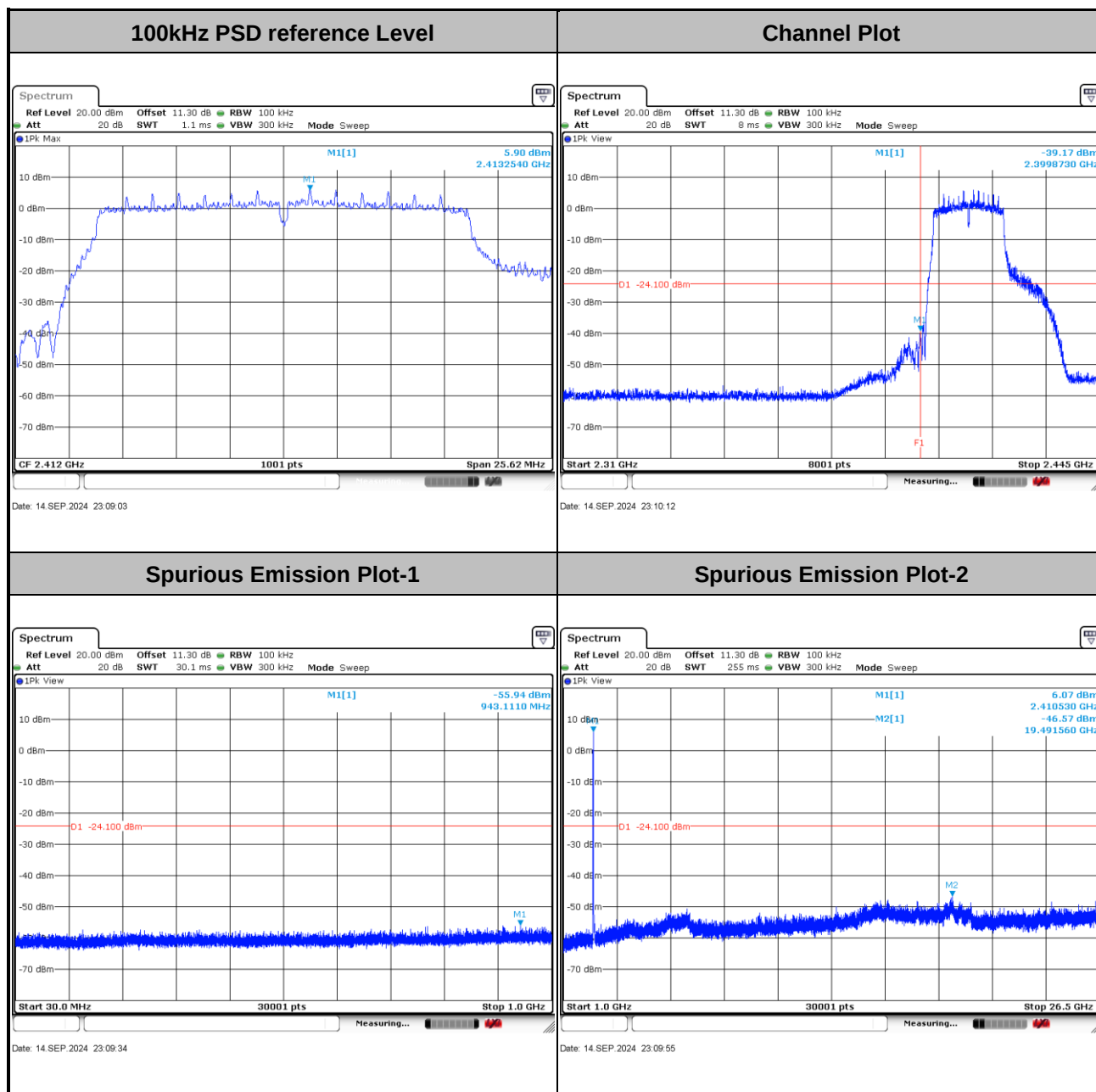
Test Mode :	802.11g	Test Channel :	11
-------------	---------	----------------	----





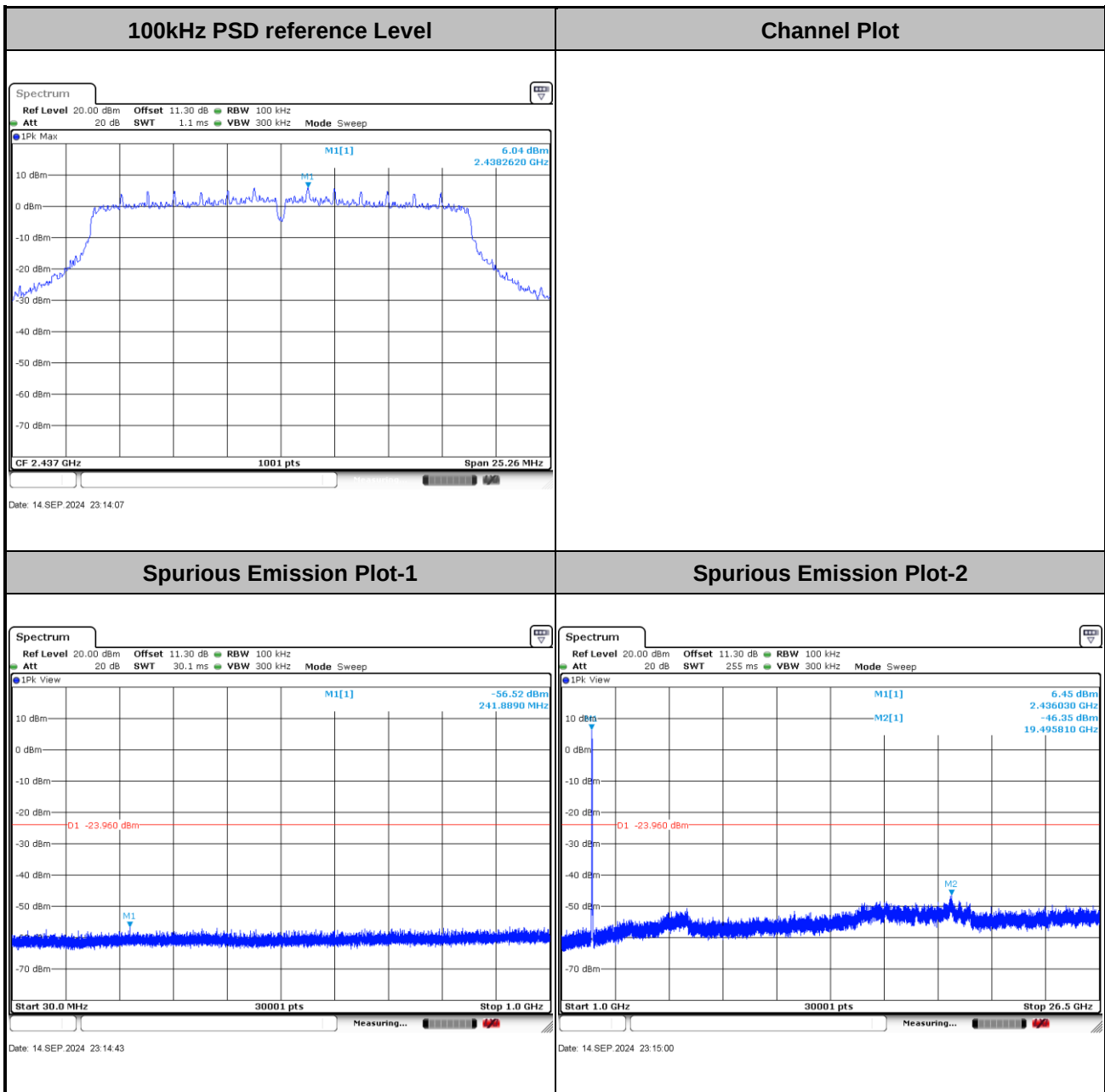
Number of TX = 2, Ant. 0 (Measured)

Test Mode :	802.11ac VHT20	Test Channel :	01
-------------	----------------	----------------	----





Test Mode :	802.11ac VHT20	Test Channel :	06
-------------	----------------	----------------	----

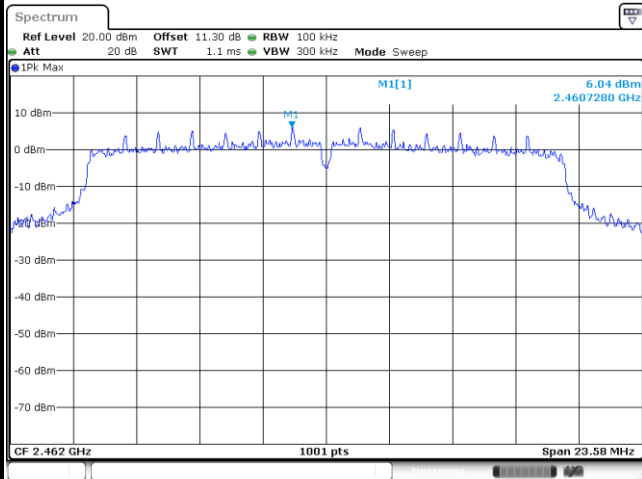




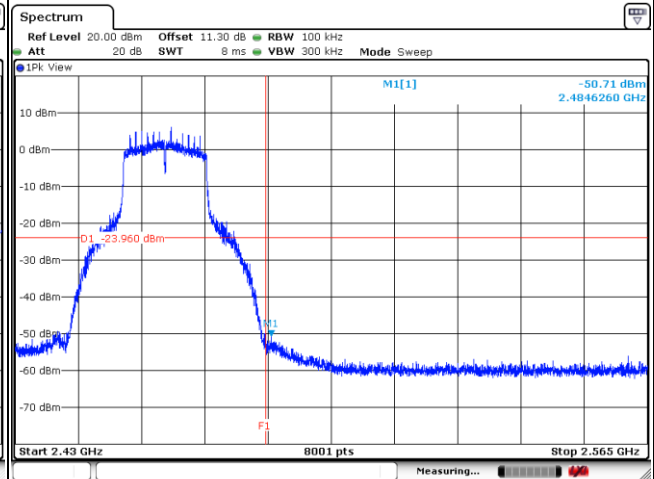
Test Mode : 802.11ac VHT20

Test Channel : 11

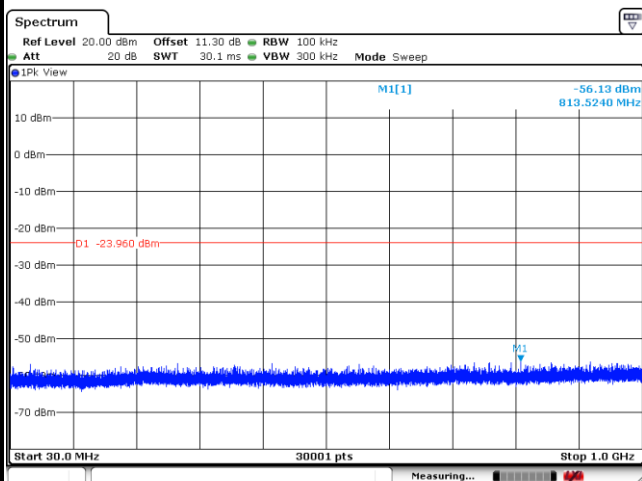
100kHz PSD reference Level



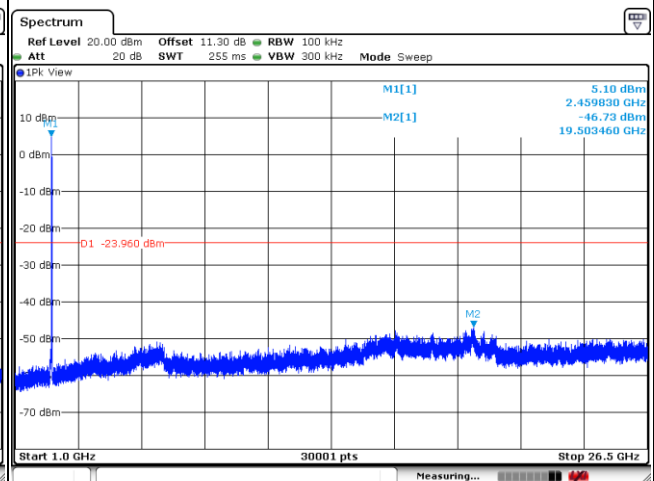
Channel Plot

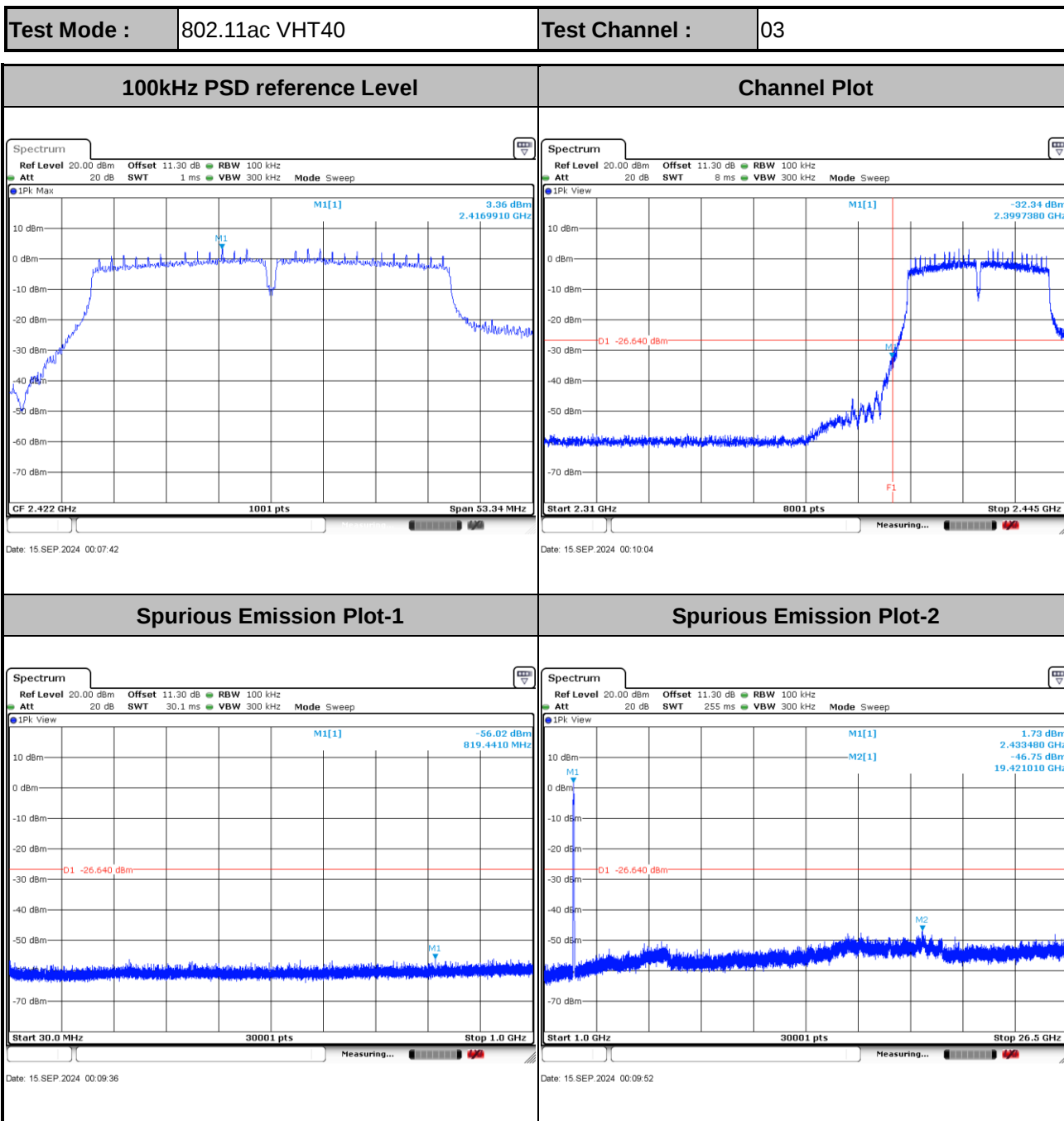


Spurious Emission Plot-1



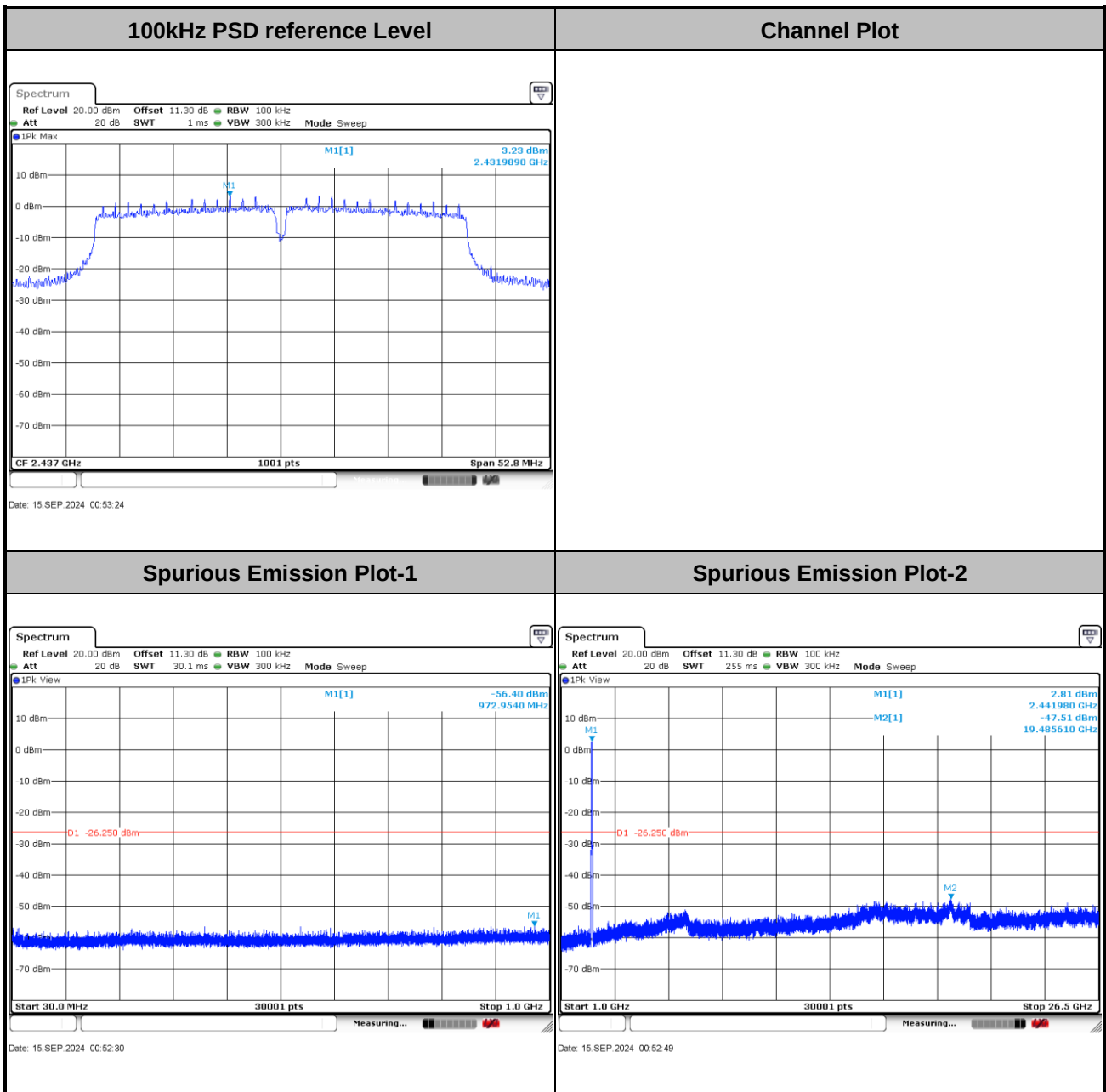
Spurious Emission Plot-2







Test Mode :	802.11ac VHT40	Test Channel :	06
-------------	----------------	----------------	----

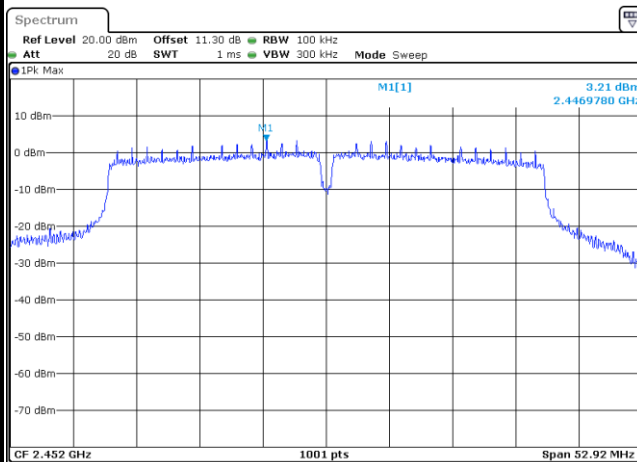




Test Mode : 802.11ac VHT40

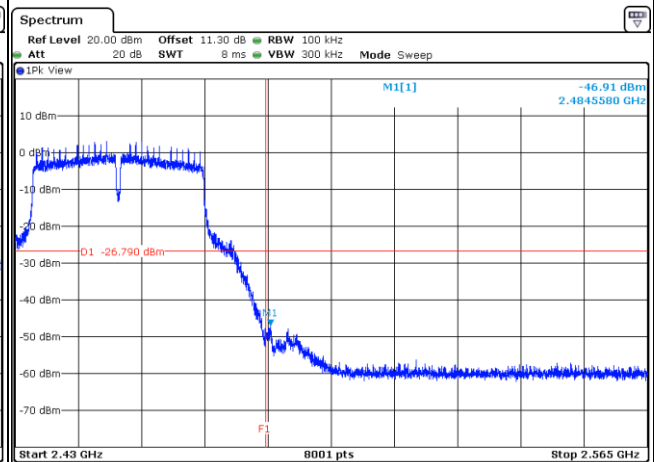
Test Channel : 09

100kHz PSD reference Level



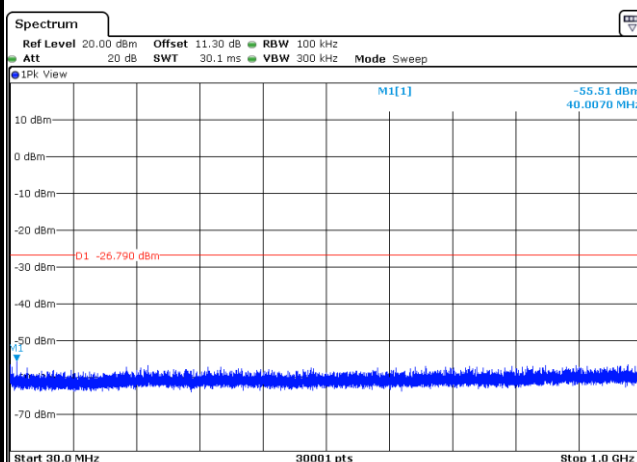
Date: 15 SEP 2024 00:56:12

Channel Plot



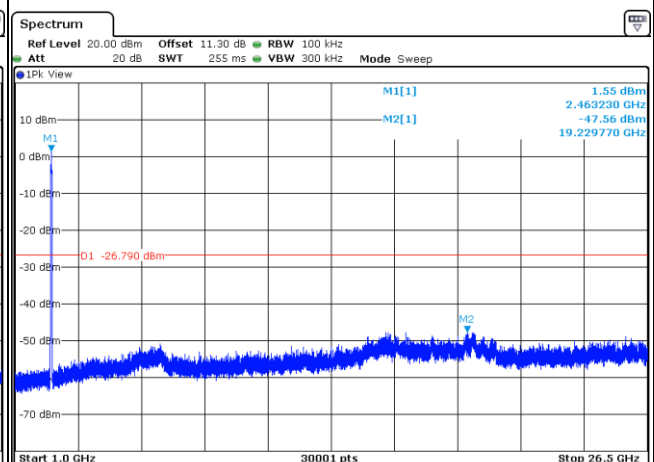
Date: 15 SEP 2024 00:57:54

Spurious Emission Plot-1

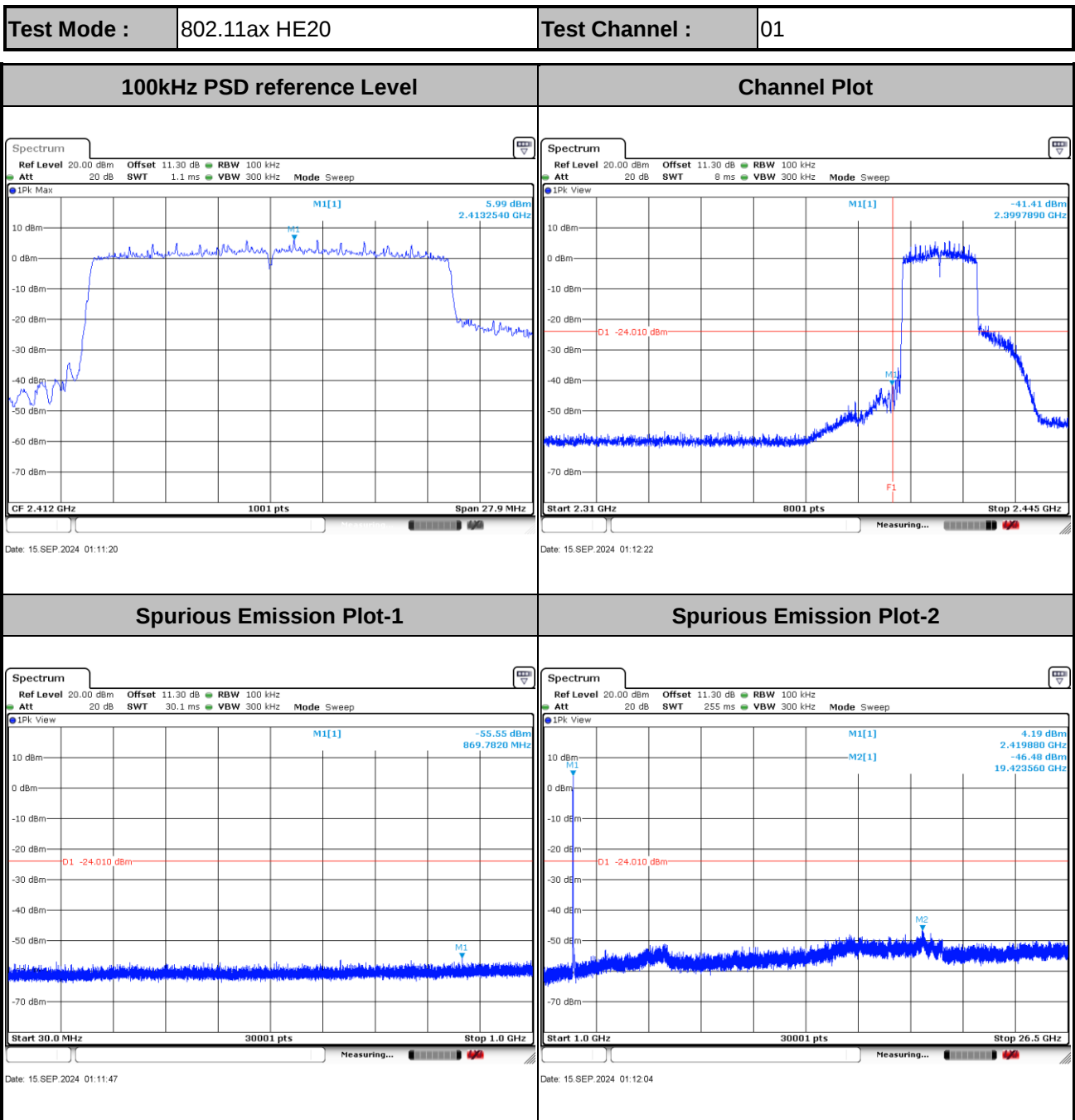


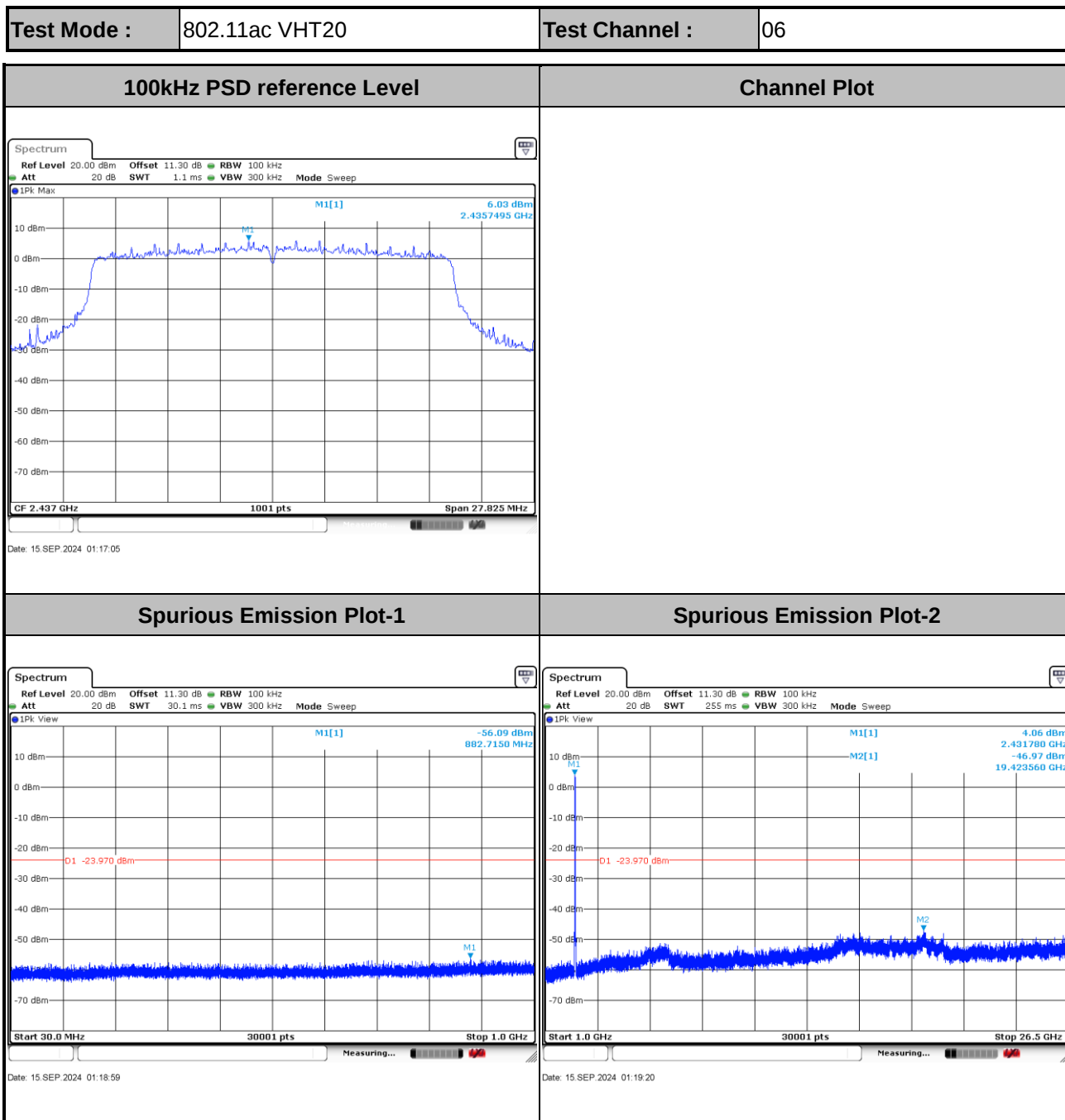
Date: 15 SEP 2024 00:57:10

Spurious Emission Plot-2



Date: 15 SEP 2024 00:57:33



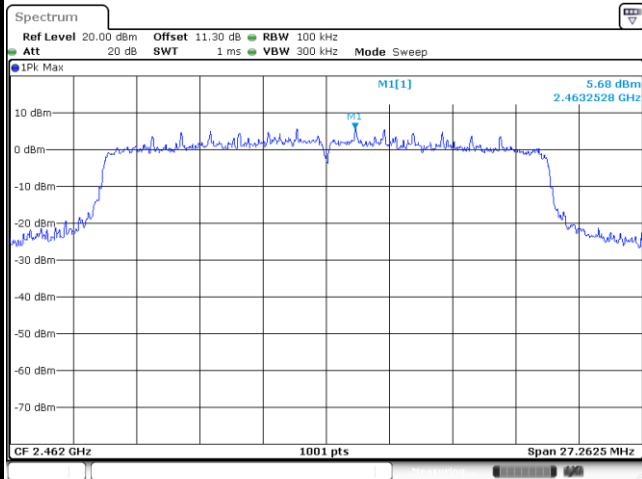




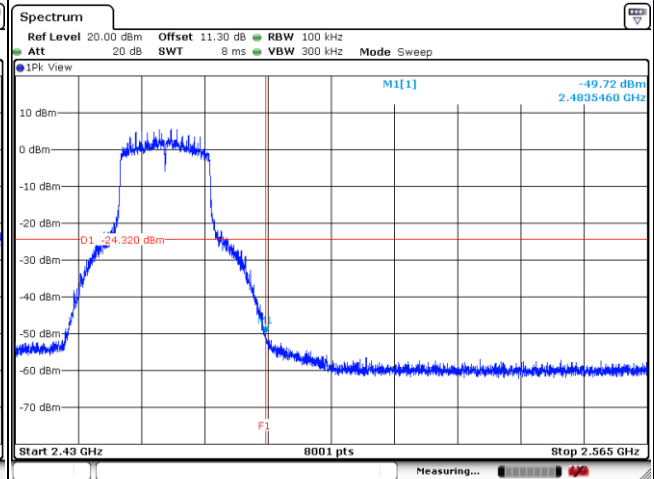
Test Mode : 802.11ac VHT20

Test Channel : 11

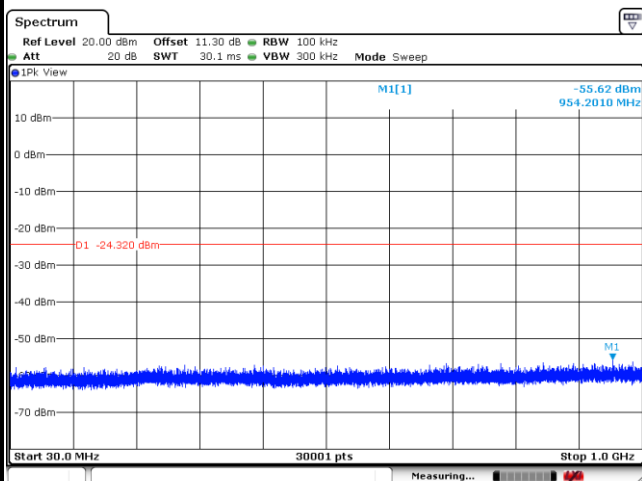
100kHz PSD reference Level



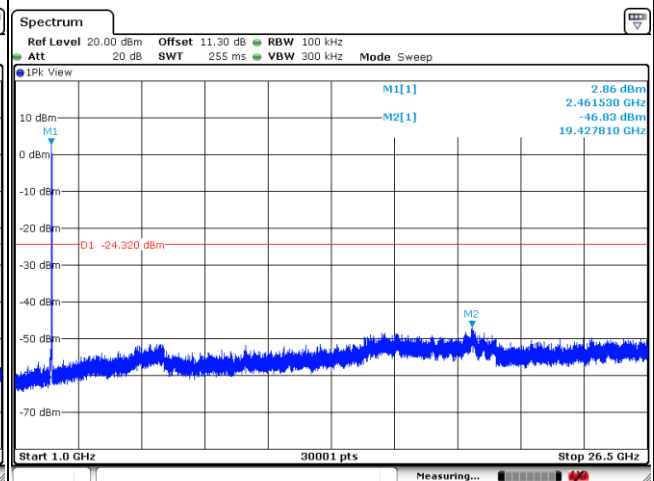
Channel Plot



Spurious Emission Plot-1



Spurious Emission Plot-2

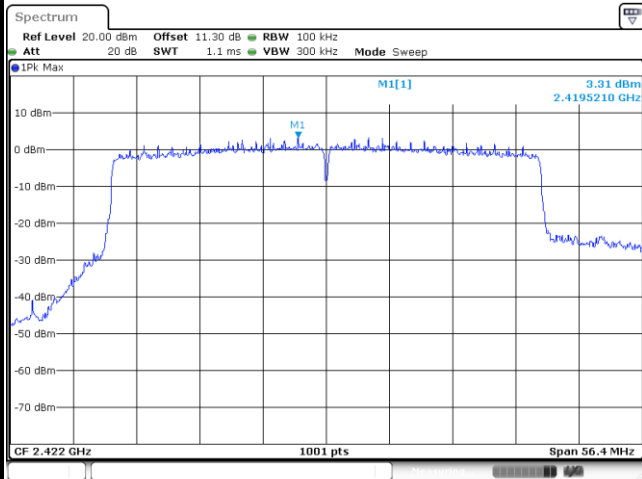




Test Mode : 802.11ax HE40

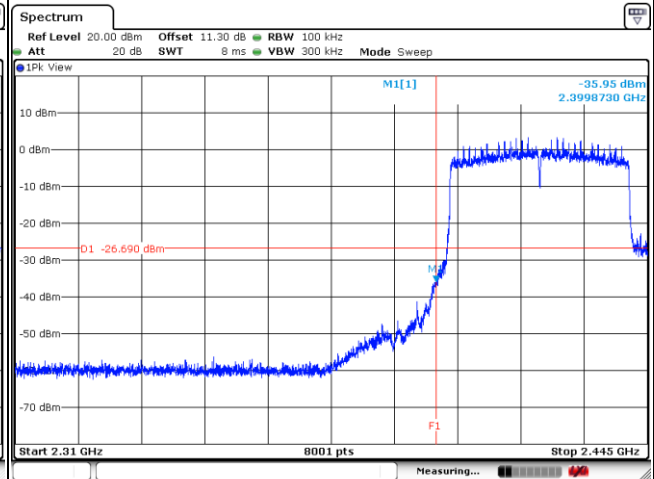
Test Channel : 03

100kHz PSD reference Level



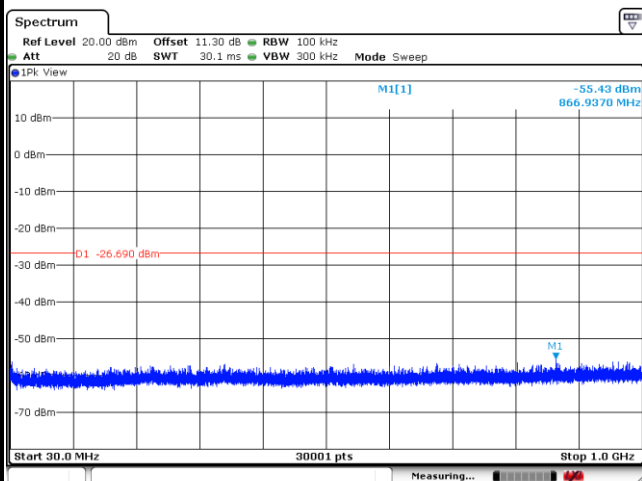
Date: 15 SEP 2024 01:35:32

Channel Plot



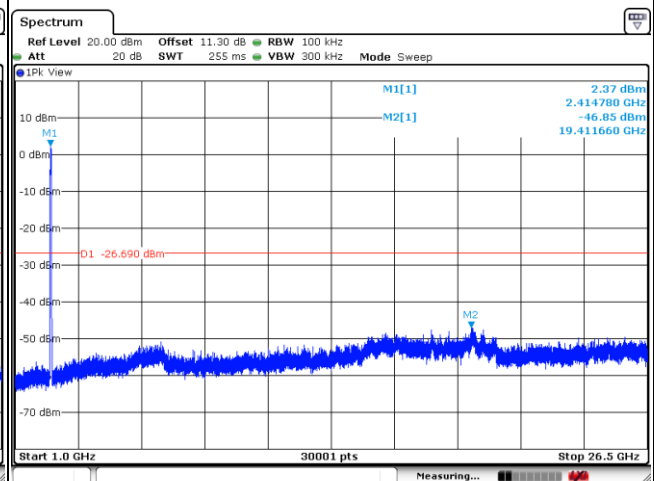
Date: 15 SEP 2024 01:36:44

Spurious Emission Plot-1

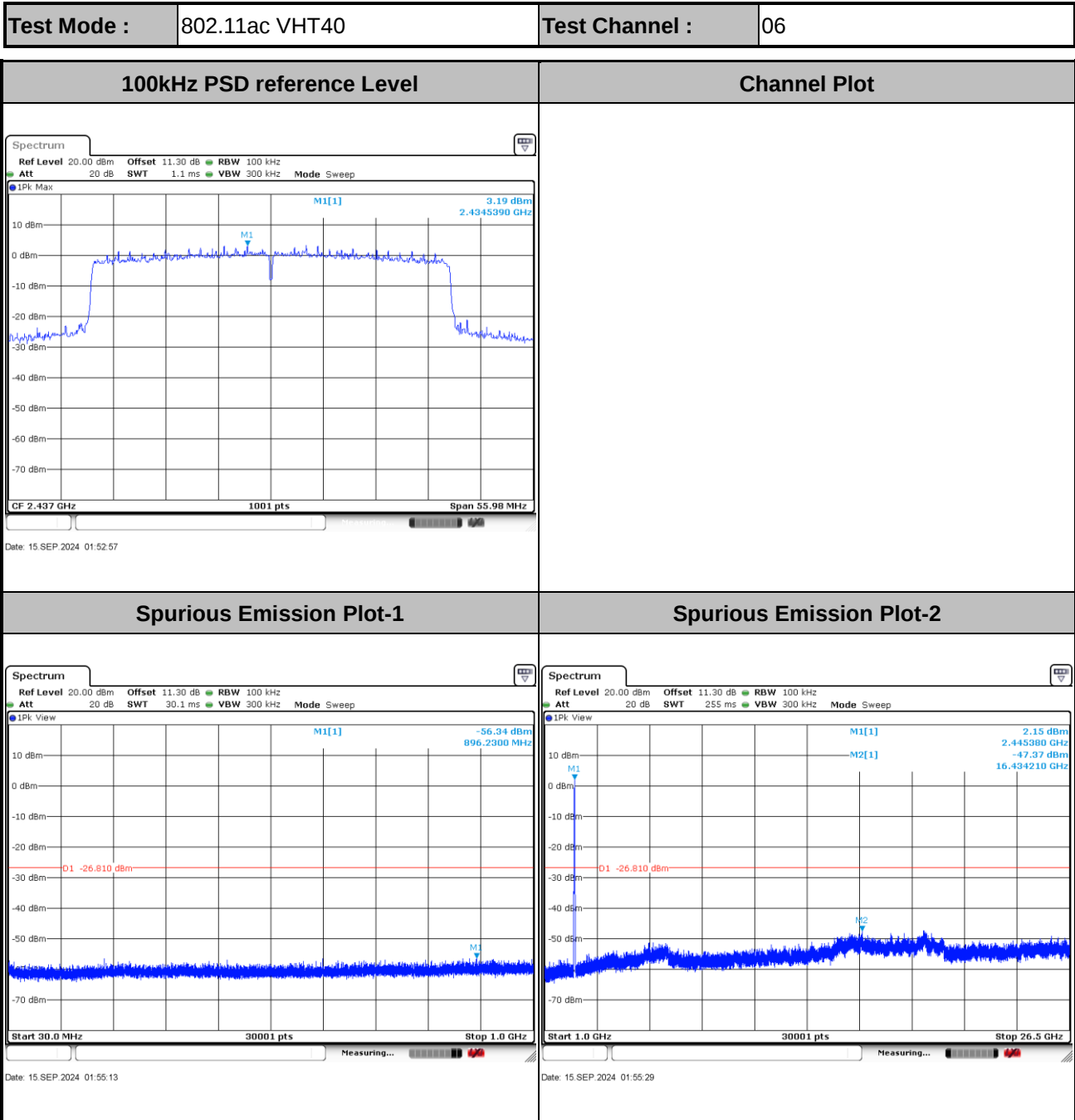


Date: 15 SEP 2024 01:36:09

Spurious Emission Plot-2

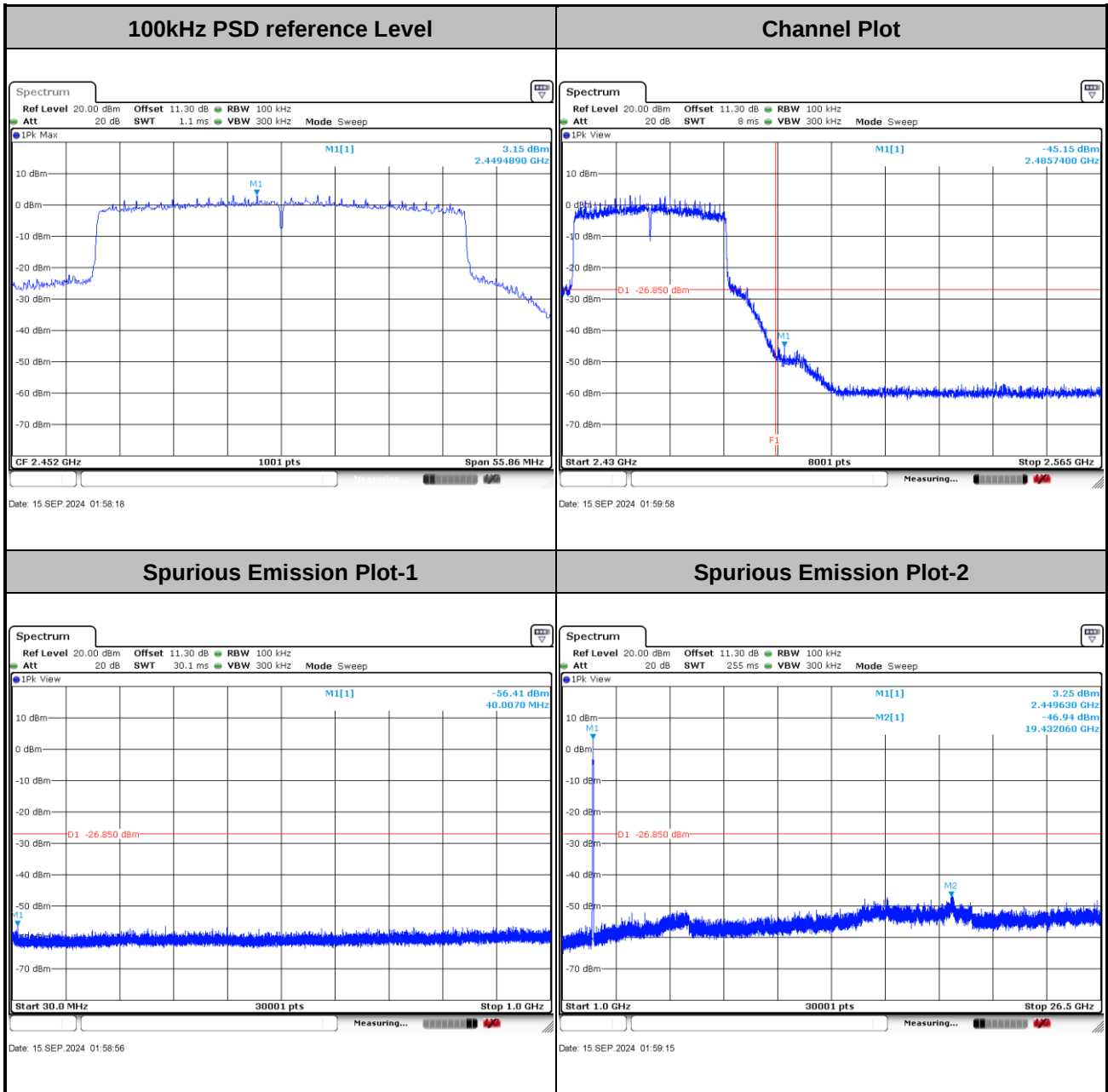


Date: 15 SEP 2024 01:36:27





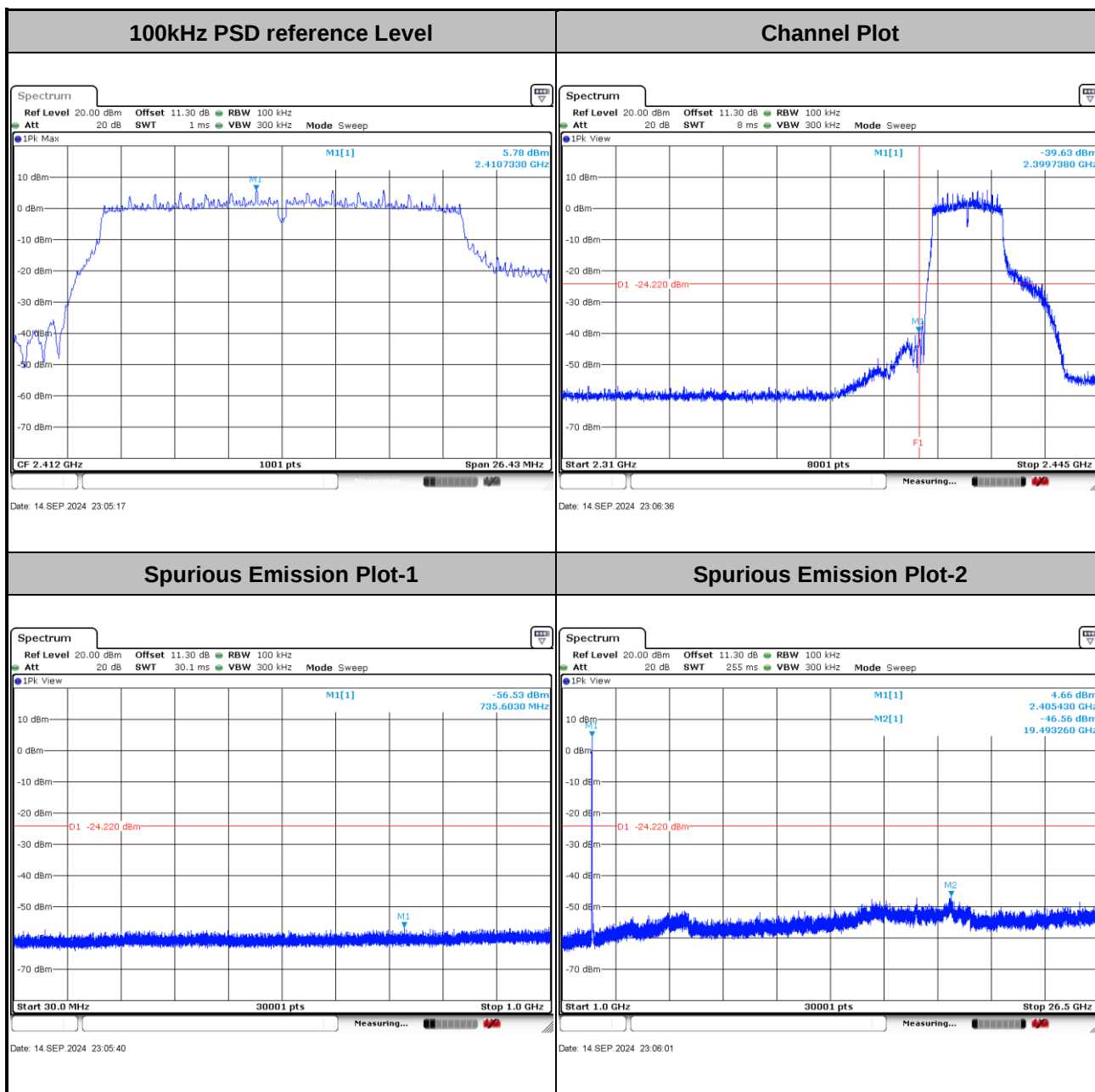
Test Mode :	802.11ac VHT40	Test Channel :	09
-------------	----------------	----------------	----





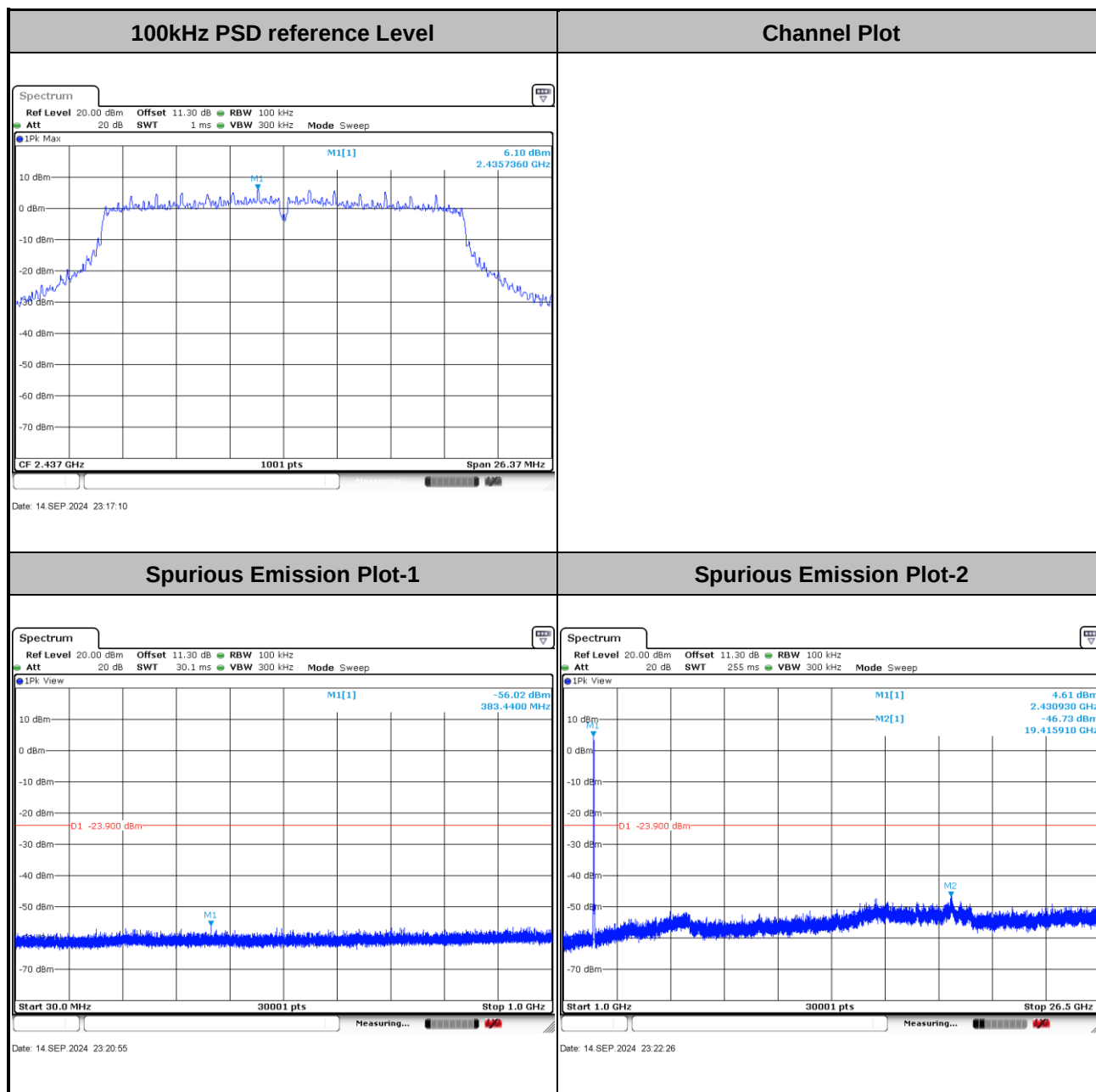
Number of TX = 2, Ant. 1 (Measured)

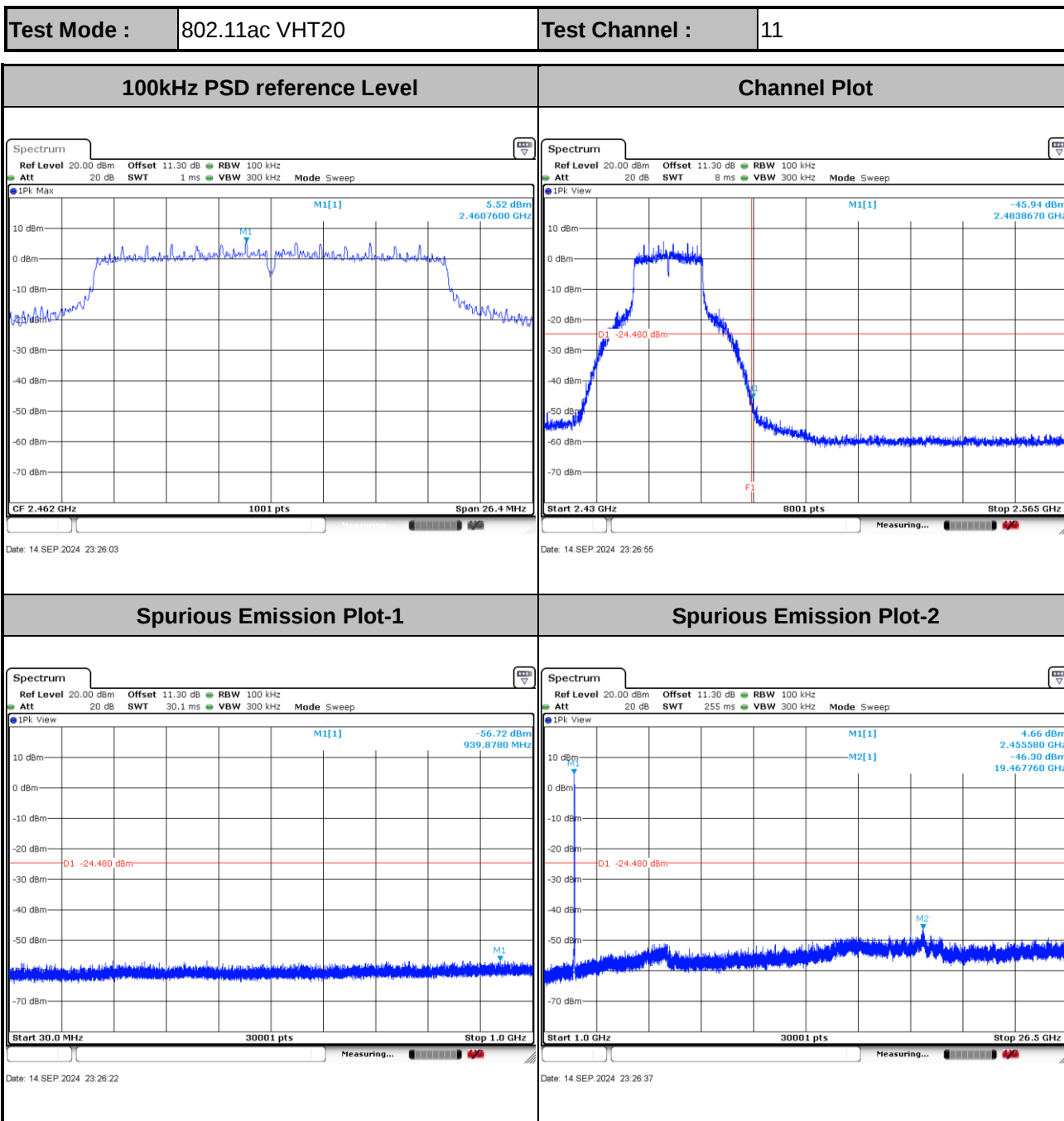
Test Mode :	802.11ac VHT20	Test Channel :	01
-------------	----------------	----------------	----





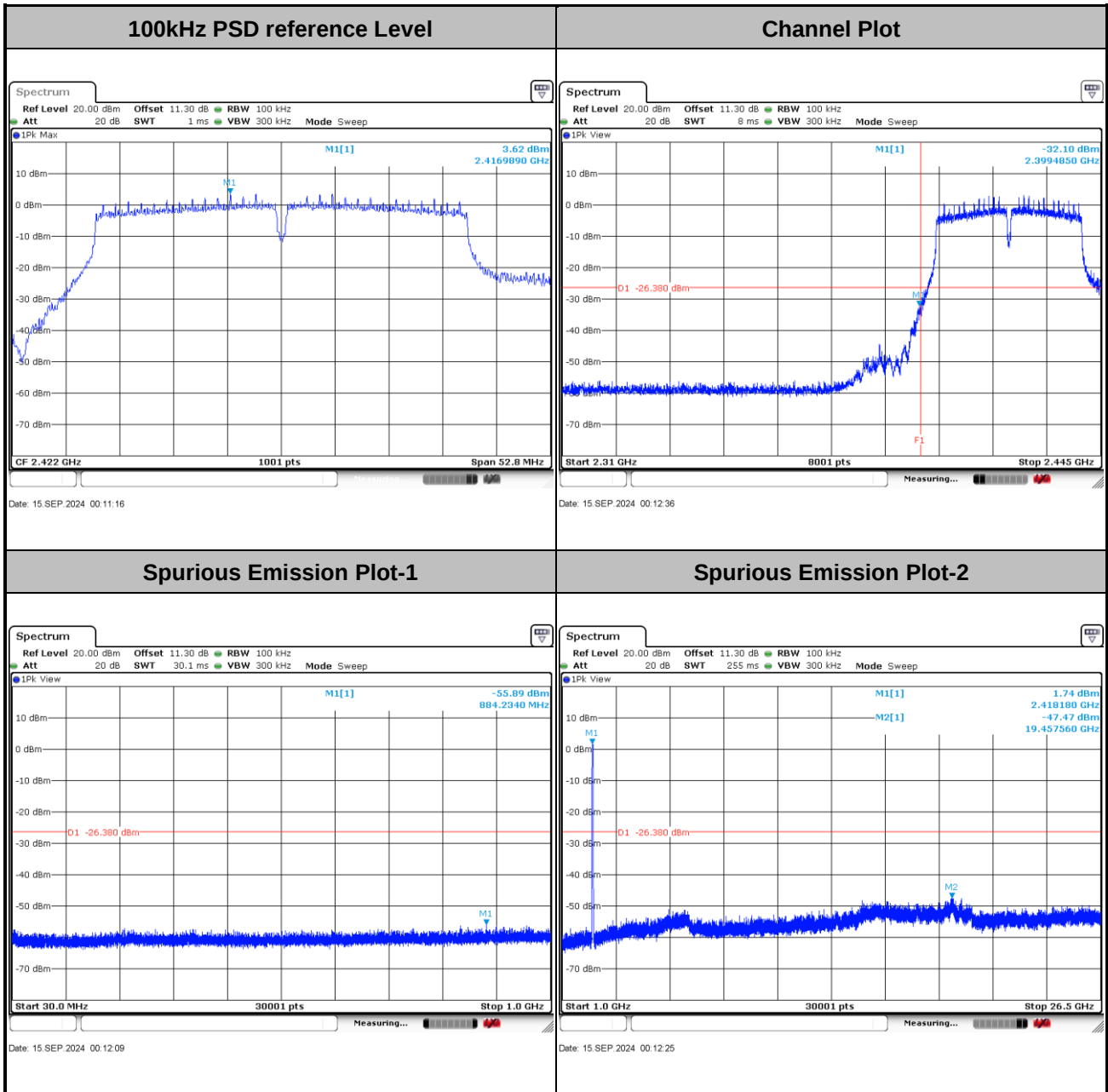
Test Mode :	802.11ac VHT20	Test Channel :	06
-------------	----------------	----------------	----



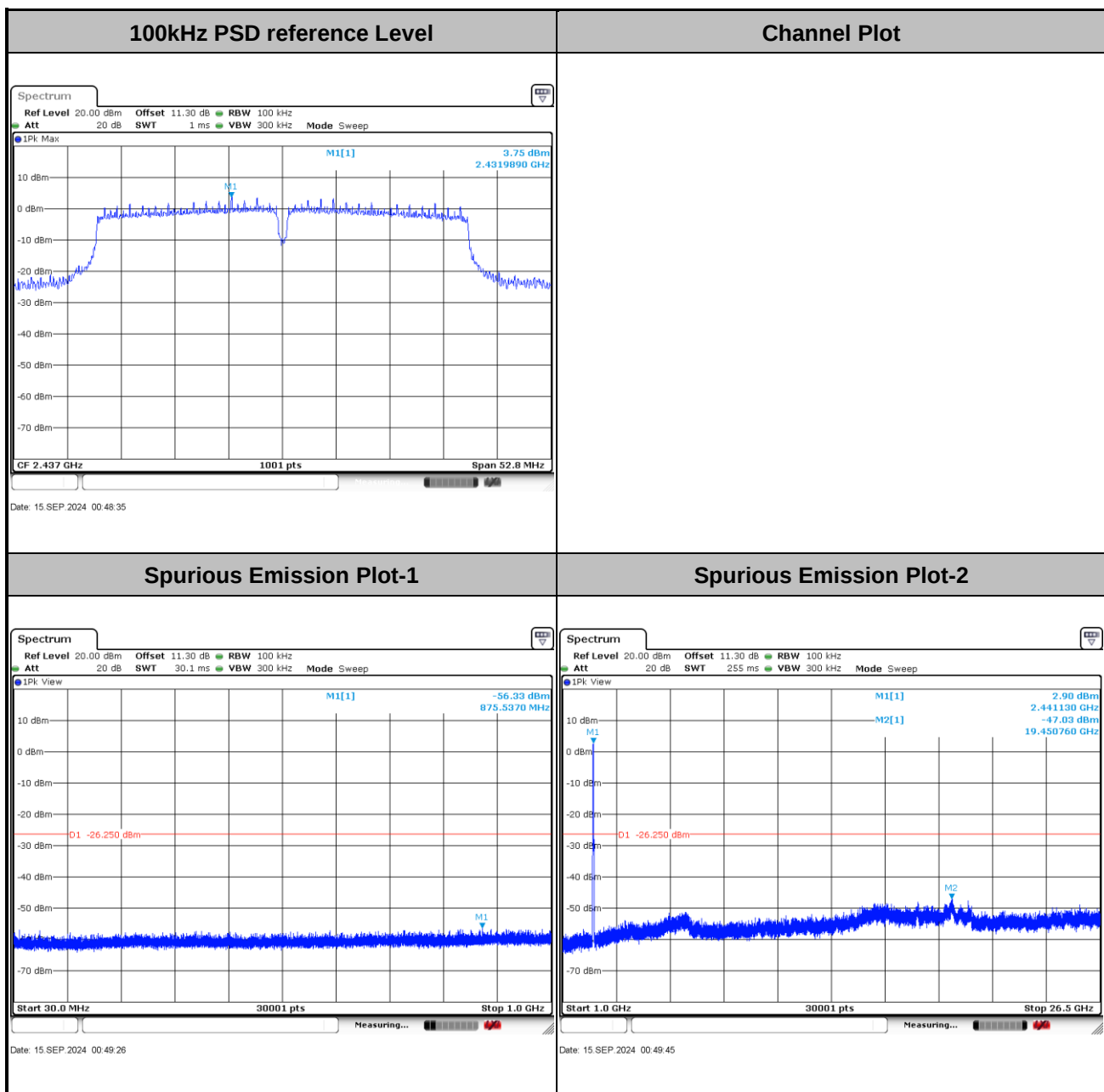


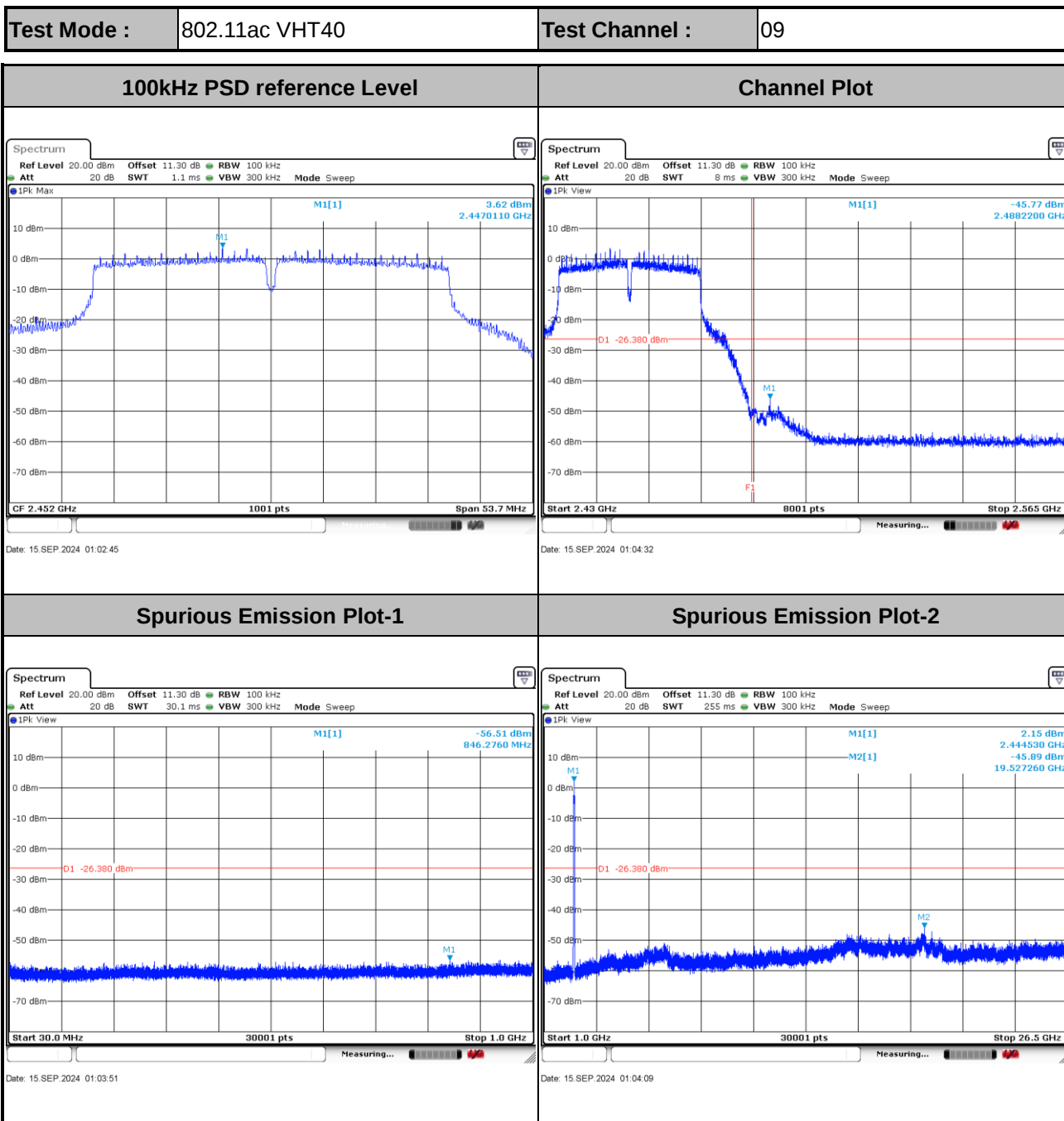


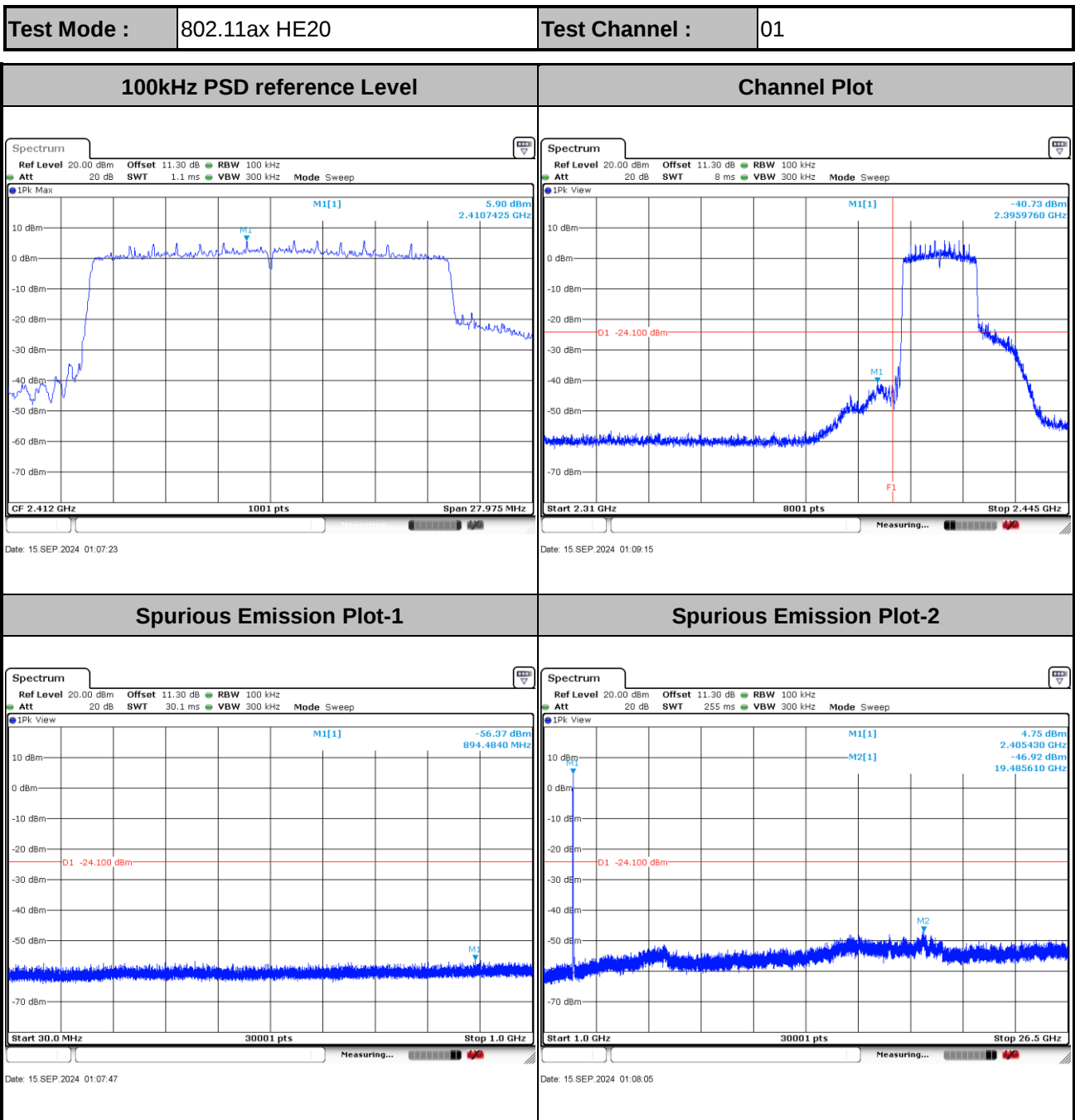
Test Mode :	802.11ac VHT40	Test Channel :	03
-------------	----------------	----------------	----



Test Mode :	802.11ac VHT40	Test Channel :	06
--------------------	----------------	-----------------------	----









Test Mode :	802.11ac VHT20	Test Channel :	06
-------------	----------------	----------------	----

