REP018375C

Test Report

Product	**Wireless Module**
Name and address of the applicant	**Cisco Systems Norway AS** **Philip Pedersens vei 1** **1366 Lysaker, NORWAY**
Name and address of the manufacturer	**Cisco Systems, Inc.** **170 West Tasman Drive** **San Jose, CA 95134, USA**
Model	**LBEE5XV2EA**
Trademark	**CISCO**
Additional information	**Bluetooth LE, Bluetooth Classic, WiFi 6E**
Tested according to	**Parts of FCC Part 15.407** Unlicensed National Information Infrastructure Devices (U-NII) **Parts of Industry Canada RSS-248, Issue 2** Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	**PRJ0039024**
Tested in period	**2023-09-25 and 2023-10-03**
Issue date	**2024-01-19**
Name and address of the testing laboratory	Nemko Scandinavia AS Instituttveien 6 2007 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO0470 ISED No: 2040D-1 **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [Frode Sveinsen]	Approved by [Jan G Eriksen]

This report was originally distributed electronically with digital signatures. For more information, please contact Nemko Scandinavia AS.

Template version: C

Revision history

Revision	Date	Comment	Sign
A	2023-11-28	First Edition	FS
B	2023-12-08	Corrected some cal dates	FS
C	2024-01-19	Corrected frequency range and added clause with test frequencies	FS

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to ensure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is solely responsible for any modifications that could result in non-compliance with the relevant regulations.

This report shall not be reproduced except in full without the written approval of Nemko.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Group accepts no responsibility for damage suffered by any third party as a result of decisions made or actions based on this report.

Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither are opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence, that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in a separate clause in this report.

1 INFORMATION

1.1 Test Item

Name	**Cisco**
Model	**LBEE5XV2EA**
FCC ID	**LDKXV2EA2797**
ISED ID	**2461N-XV2EA2797**
Serial number	**/**
Hardware identity and/or version	**1.0**
Software identity and/or version	**1.1.1.1 1.1.2.1 1.1.1.2 1.1.2.2**
Frequency Ranges	**U-NII 5: 5955 – 6415 MHz**
Operating Modes	**802.11ax (20/40/80 MHz BW)**
Type of Modulation	**Digital (OFDM - Orthogonal frequency-division multiplexing)**
Antenna Connector	**Internal U-FL**
Number of Antennas	**2**
Antenna Diversity Supported	**Yes**
Smart Antennas Supported	**MIMO**
TPC Supported	**Not required when EIRP is below 500 mW**
Power Supply	**Powered from Host**
Antennas	**Antenna 1: Amphenol Model OCF605-15-000-R Antenna 2: Amphenol Model OCF606-15-000-R**

Description of Test Item

The tested EUT is a module with WiFi and Bluetooth.

This report covers only additional spurious emissions tests for certification for use in the 6 GHz frequency bands and for use with the specified antennas.

All radiated tests were performed with the module installed in host model TTC60-36.

This report cover only use of the module as Indoor Client Device.

Only U-NII Band 5 is used in the 6 GHz range, U-NII Bands 6, 7 and 8 are disabled.

1.2 Antenna Requirement

Is the antenna detachable?	☐ **Yes**	☒ **No**
If detachable, is the antenna connector non-standard?	☐ **Yes**	☐ **No**
Type of antenna connector: Internal U-FL		

1.3 Test Engineer

Frode Sveinsen

Jørn Gustavsen (Power Line Conducted)

1.4 Hosts Used During Testing

Name	**Cisco**
Model No.	**TTC60-35** **TTC60-36**
Serial number	**TTC60-35: WZS2731L008** **TTC60-36: WZS2731M00N**
Hardware identity and/or version	**DV1**
Software identity and/or version	**CE 11.9.0 / s01845-2.58.0.0**
Antenna Connector	**Internal U-FL**
Power Supply	**Mains (120V 60Hz AC)**
Rating	**TTC60-35: 100-240V_{AC} 50/60Hz 3.0-1.5A** **TTC60-36: 100-240V_{AC} 50/60Hz 4.0-2.0A**

1.5 Normal test conditions

Temperature:	**20 - 24 °C**
Relative humidity:	**20 - 50 %**
Normal test voltage:	**120 V 60 Hz**

The values are the limit registered during the test period.

1.6 EUT Operating Modes

Description of operating modes	Continuous TX, 6 GHz 802.11ax 20/40/80 MHz Mode
Worst Case Configuration	Radiated Emissions and Power Line Conducted Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

1.7 Test Frequencies

Channel BW	Lower Channel	Middle Channel	Upper Channel
20 MHz	**Ch01: 5955 MHz**	**Ch45: 6175 MHz**	**Ch93: 6415 MHz**
40 MHz	**Ch03: 5965 MHz**	**Ch43: 6165 MHz**	**Ch91: 6405 MHz**
80 MHz	**Ch07: 5985 MHz**	**Ch39: 6145 MHz**	**Ch87: 6385 MHz**

Default Power Levels were used for all tests.

1.8 Comments

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

MIMO measurements were performed with the EUT transmitting in MIMO mode on both antennas (P0 and P1). When measuring radiated the direction was locked and the maximum position was found.

Measurements in SISO mode was performed on P0 when measuring at the antenna connector, and on both antennas when measuring radiated.

2 TEST REPORT SUMMARY

2.1 General

The tests were performed to demonstrate compliance with FCC CFR 47 Part 15, paragraph 15.407 and ISED RSS-248 Issue 2.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Test were performed in accordance with the following standards and measurement descriptions:

Standard	Description
FCC Part 15E	**Unlicensed National Information Infrastructure Devices**
ISED RSS-248, Issue 2	**Radio Local Area Network (RLAN) Devices Operating in the 5925-7125 MHz Band**
FCC KDB 987594 D02	**6 GHz EMC Measurement**
FCC KDB 789033 D02	**General N-UNII Test Procedures New Rules**
FCC KDB 662911 D01	**Multiple Transmitter Output**
FCC KDB 412172 D01	**Determining EP and EIRP**
ANSI C63.4-2014	**Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz**
ANSI C63.10-2020	**Procedures for Compliance testing of Unlicensed Wireless Devices**
RSS-GEN, Issue 5	**General Requirements for Compliance of Radio Apparatus**

All radiated emissions tests were performed in a semi-anechoic chamber at measuring distance of 3m.

☐ **New Submission**	☒ **Production Unit**
☒ **Class II Permissive Change**	☐ **Pre-production Unit**
6XD Equipment Code	☐ **Family Listing**

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-248 Issue 2 RSS-GEN Issue 5 reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	**Complies**
Antenna Requirement	15.203	6.8 (RSS-GEN)	**Complies**
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	**Complies**
Maximum Conducted Output Power	15.407(a)	6.2	**Complies***
Power Spectral Density (PSD)	15.407(a)	6.2	**Complies***
Emission Bandwidth (EBW)	15.407(a)	6.2	**Complies***
Unwanted Emissions	15.407(b)	6.2	**Complies**
Contention Based Protocol	15.407(d)(6)	6.3	**Complies***
Radiated Emissions	15.205 15.209	7.3 (RSS-GEN) 8.9 (RSS-GEN)	**Complies**

***Covered by SGS Test report No. TERF2211002262ER**

3 TEST RESULTS

3.1 Radiated Emissions, 30 – 1000 MHz

FCC 15.205, 15.209, 15.407

ISED RSS-GEN, Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 12.7

Test Results: Complies

Measurement Data:

Detector: QuasiPeak (Pre-scan with Peak Detector)

Measuring distance 3m

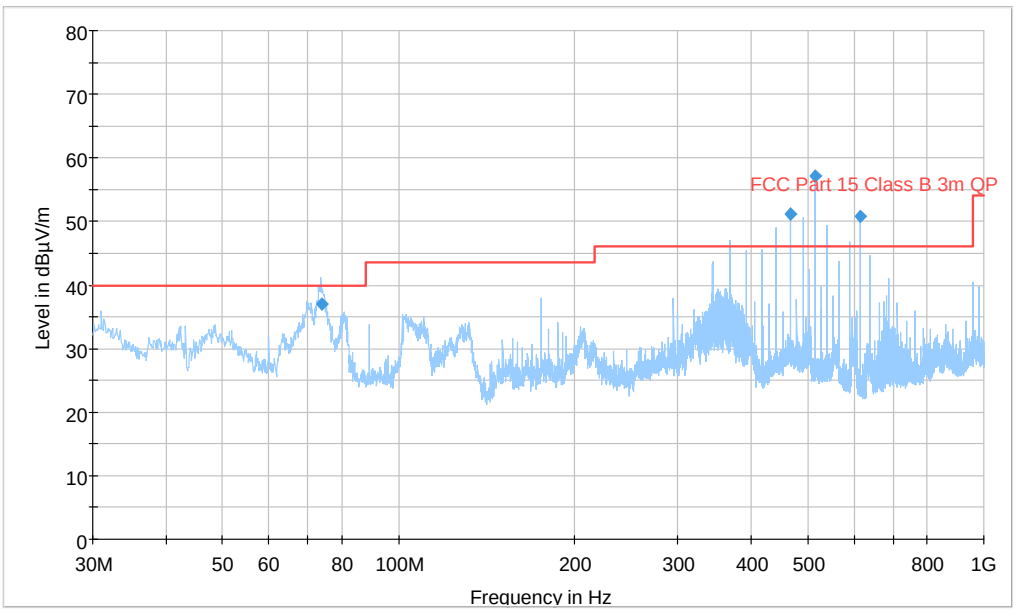
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
73.722486	37.05	40.00	2.95	15000.0	120.000	143.0	V	345.0	-17.7
466.935158*	51.20	46.00	-5.20	15000.0	120.000	125.0	V	322.0	-6.1
516.086386*	57.23	46.00	-11.23	15000.0	120.000	101.0	V	353.0	-5.1
614.388460*	50.82	46.00	-4.82	15000.0	120.000	275.0	V	149.0	-4.0

*These frequencies are not in a Restricted Band

This is a class A device; all emissions are below the Class A limit.
None of the emissions above are in a restricted band.
See attached plots.

Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 µV/m	40.0 dBµV/m
88 – 216 MHz	150 µV/m	43.5 dBµV/m
216 – 960 MHz	200 µV/m	46.0 dBµV/m
960 – 1000 MHz	500 µV/m	54.0 dBµV/m
	Limits above are with Quasi Peak Detector	



Radiated Emissions, 30-1000 MHz

3.2 Radiated Emissions, 1 – 40 GHz

FCC 15.205, 15.209, 15.407(b)

ISED RSS-248, Issue 2, Clause 4.6

ISED RSS-GEN, Issue 5, Clause 8.9

Measurement procedure: ANSI C63.10-2013 Clause 12.7

Test Results: Complies

Measurement Data:

Carrier freq. (MHz)	Measured Frequency (GHz)	Modulation	Measured Emission (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
			Peak	Average	Pk*	Av	Pk	Av
Any	5925	802.11ax	55.2	N/A	68.2	N/A	13.0	N/A
Any	7125	802.11ax	<50	N/A	68.2	N/A	>18	N/A
Any	7250	802.11ax	<50	<46	68.2	54	>18	>8
Any	1584	802.11ax	55.2	51.1	68.2	54	18.8	22.9
Any	2238	802.11ax	58.0	47.3	68.2	54	16.0	26.7
Any	4989	802.11ax	53.8	41.7	68.2	54	20.2	12.3
Any	2971*	802.11ax	65.5	N/A	68.2	N/A	2.7	N/A
Any	5941*	802.11ax	65.1	N/A	68.2	N/A	3.1	N/A
Any	Any	802.11ax	<58	<46	68.2	54	>10	>8

*Not in a Restricted Band

Peak Limit is -27 dBm for all out-of-band emissions, this is converted to 68.2 dBµV/m @3m by using the formula from KDB 412172.

Measuring distance 3m up to 18 GHz, 1m above 18 GHz.

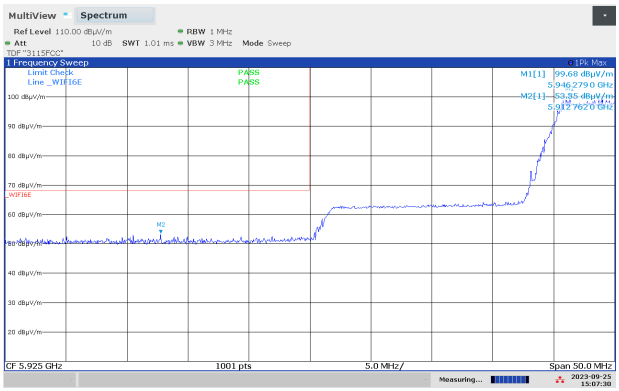
A High-Pass Filter (6.5 GHz) was used for out-of band measurements from 7 to 13 GHz, except Band Edge.

Antenna factor, amplifier gain and cable loss are included in Spectrum Analyzer “Transducer factor”.

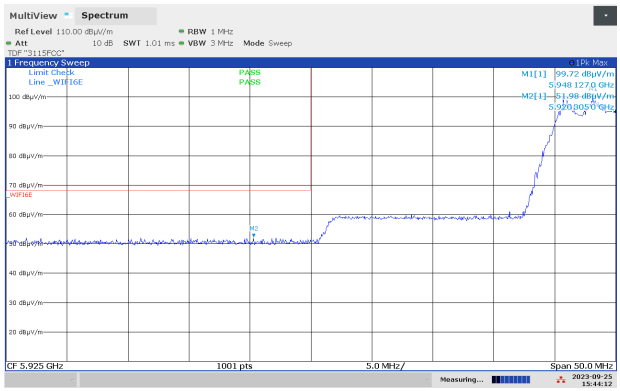
See attached plots.

Requirements/Limit

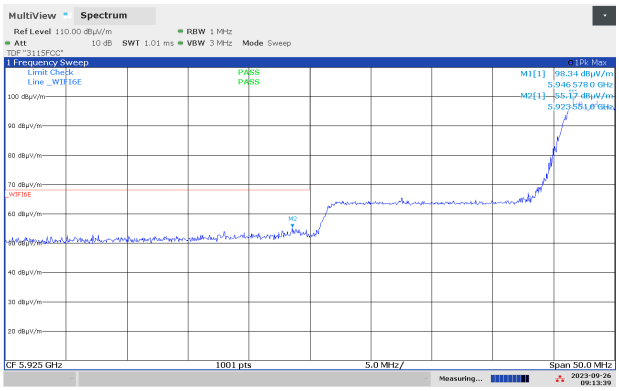
FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector (dBµV/m)	Peak Detector (dBµV/m)
1 – 40 GHz	54.0	74.0



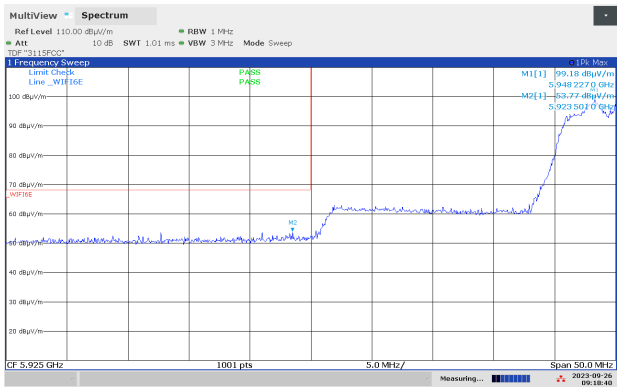
Band Edge, 5925 MHz, Ch01, 802.11ax HT20 SISO, Pk, Max



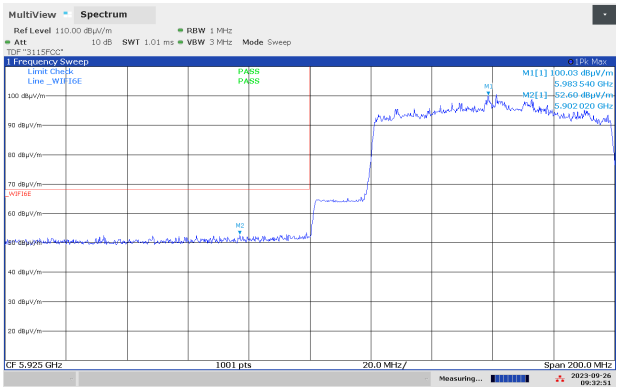
Band Edge, 5925 MHz, Ch01, 802.11ax HT20 MIMO, Pk, Max



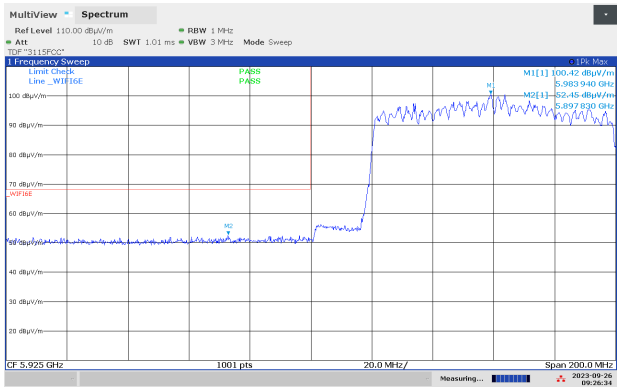
Band Edge, 5925 MHz, Ch03, 802.11ax HT40 SISO, Pk, Max



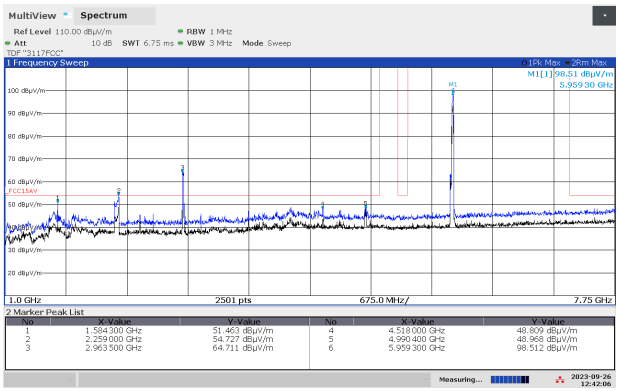
Band Edge, 5925 MHz, Ch03, 802.11ax HT40 MIMO, Pk, Max



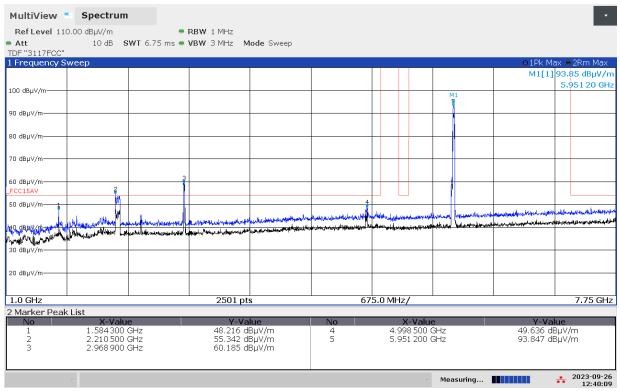
Band Edge, 5925 MHz, Ch07, 802.11ax HT80 SISO, Pk, Max



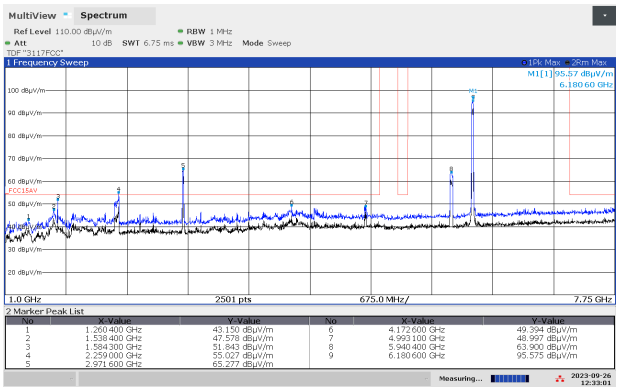
Band Edge, 5925 MHz, Ch07, 802.11ax HT80 MIMO, Pk, Max



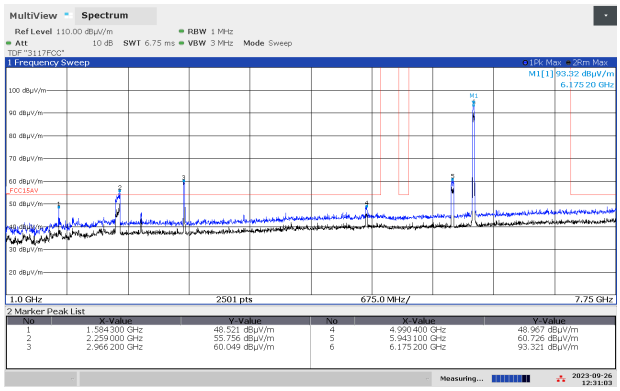
Radiated Emissions 1-7.75 GHz, Ch45, 802.11ax HT20 MIMO, HP



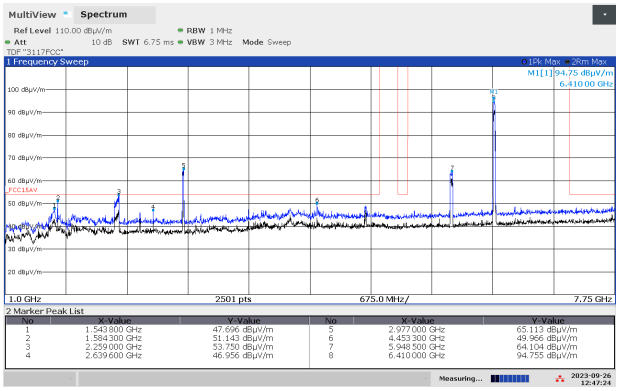
VP



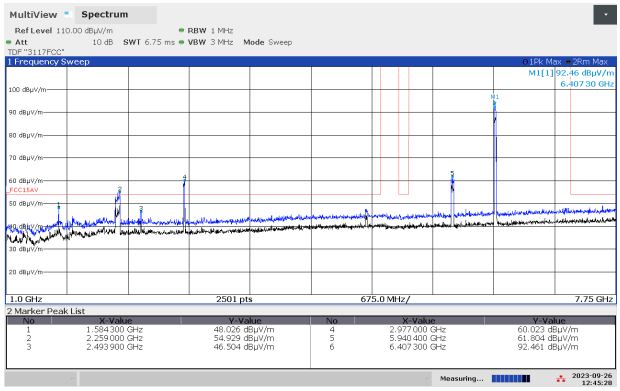
Radiated Emissions 1-7.75 GHz, Ch45, 802.11ax HT20 MIMO, HP



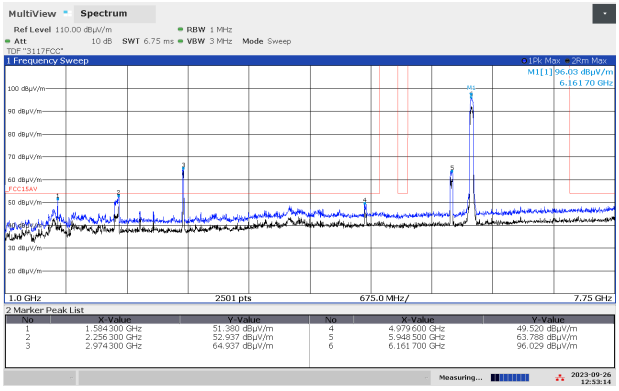
VP



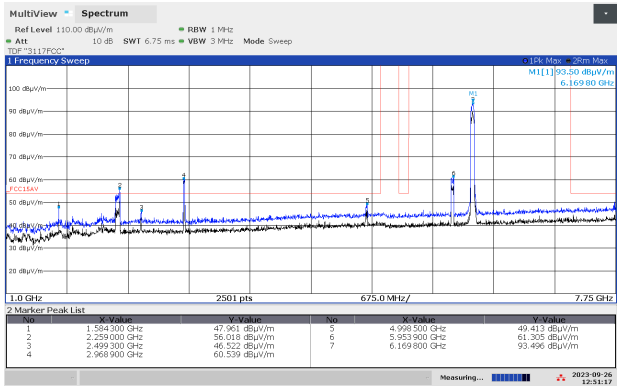
Radiated Emissions 1-7.75 GHz, Ch93, 802.11ax HT20 MIMO, HP



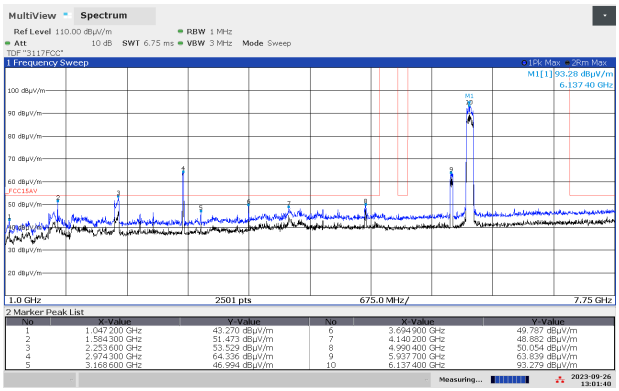
VP



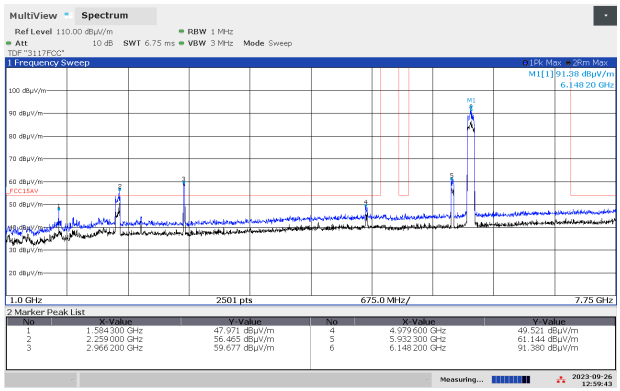
Radiated Emissions 1-7.75 GHz, Ch43, 802.11ax HT40 MIMO, HP



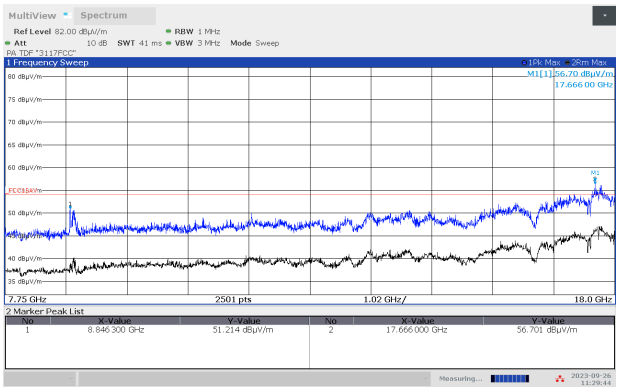
VP



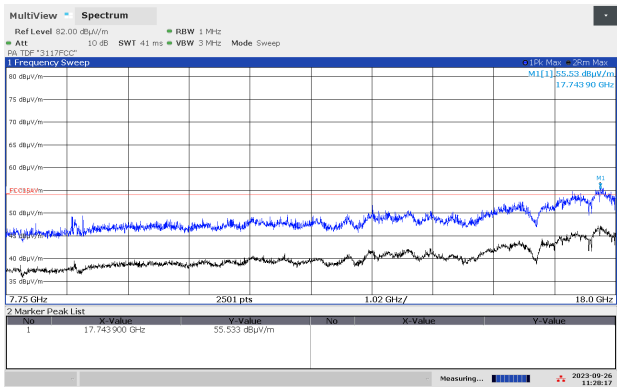
Radiated Emissions 1-7.75 GHz, Ch39, 802.11ax HT80 MIMO, HP



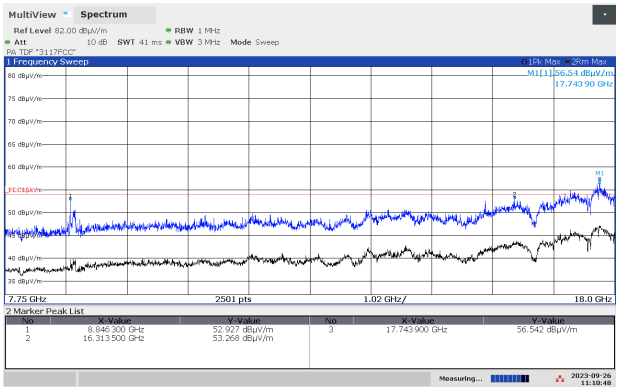
VP



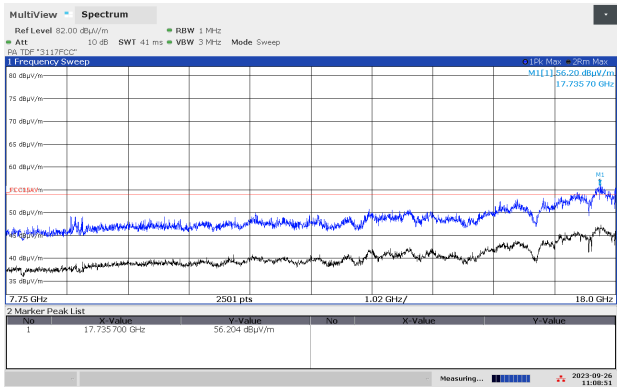
Radiated Emissions 7.75-18 GHz, Ch01, 802.11ax HT20 Ant0, HP



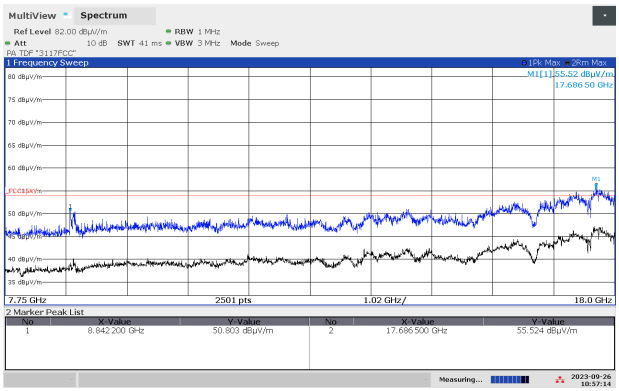
VP



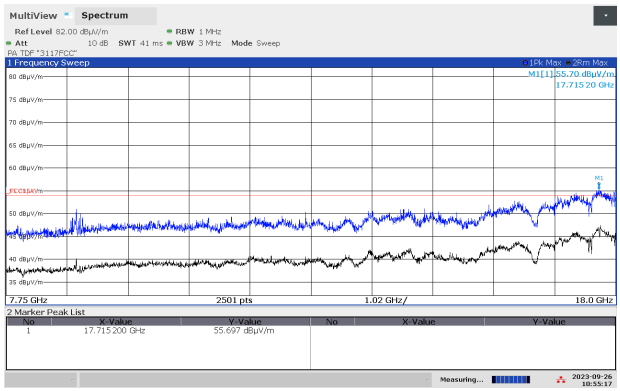
Radiated Emissions 7.75-18 GHz, Ch01, 802.11ax HT20 Ant1, HP



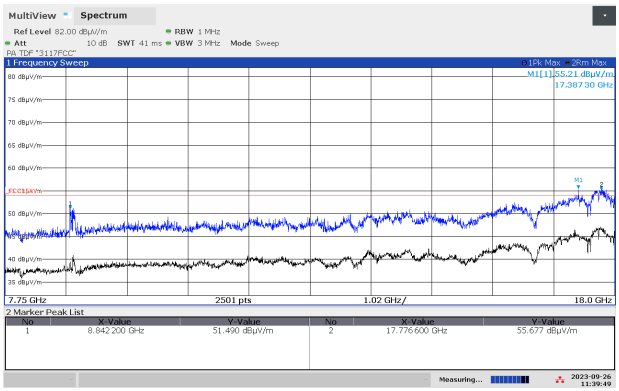
VP



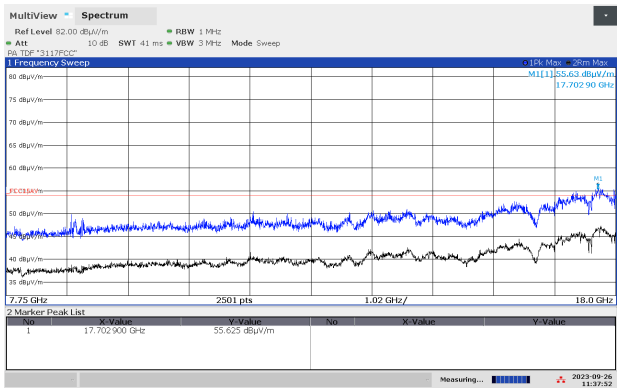
Radiated Emissions 7.75-18 GHz, Ch01, 802.11ax HT20 MIMO, HP



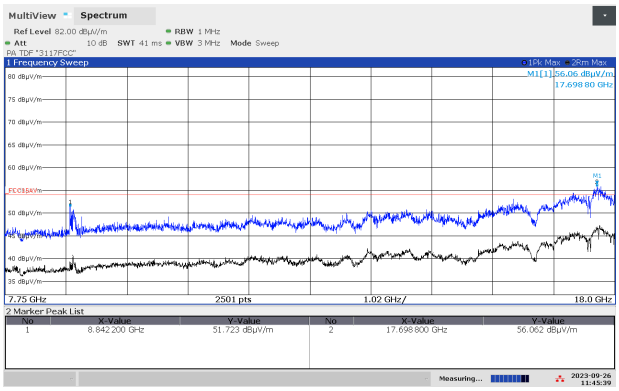
VP



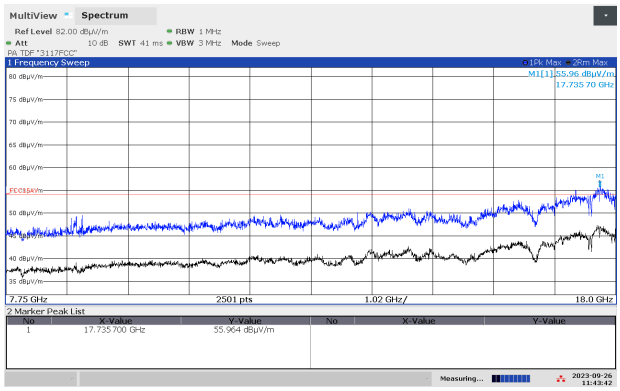
Radiated Emissions 7.75-18 GHz, Ch93, 802.11ax HT20 Ant0, HP



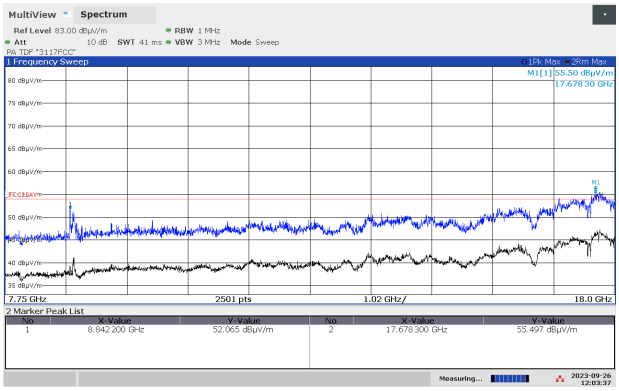
VP



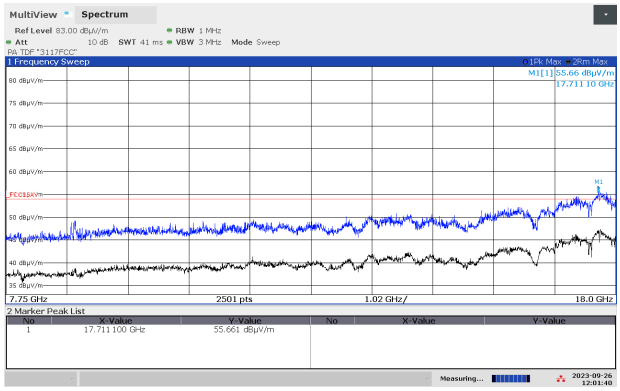
Radiated Emissions 7.75-18 GHz, Ch93, 802.11ax HT20 Ant1, HP



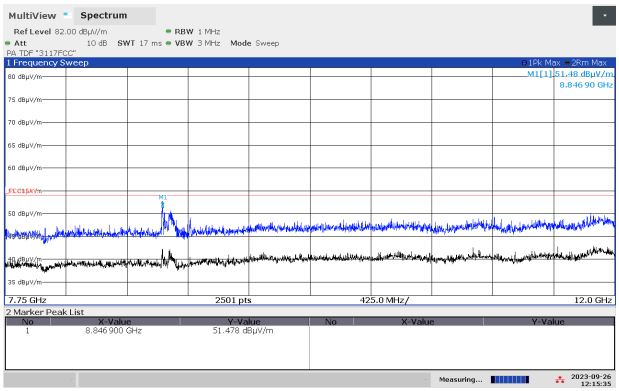
VP



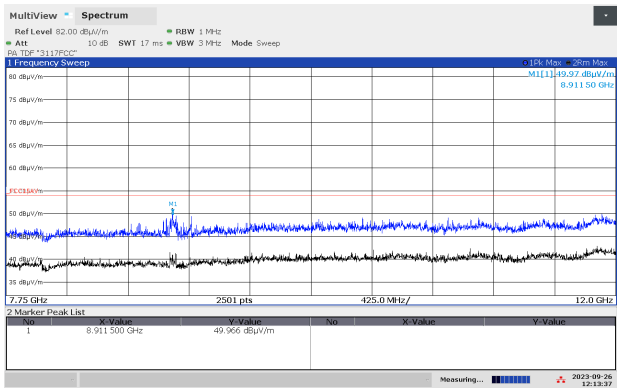
Radiated Emissions 7.75-18 GHz, Ch93, 802.11ax HT20 MIMO, HP



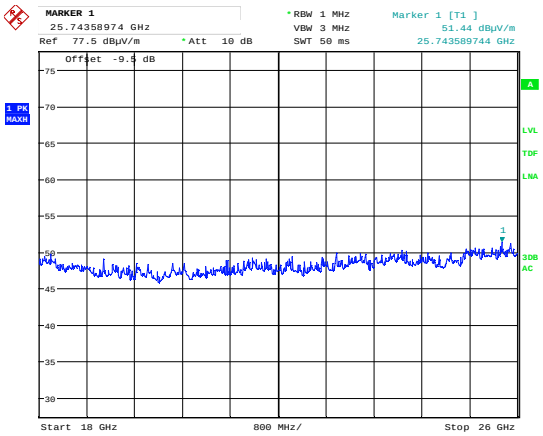
VP



Radiated Emissions 7.75-12 GHz, Ch45, 802.11ax HT20 MIMO, HP

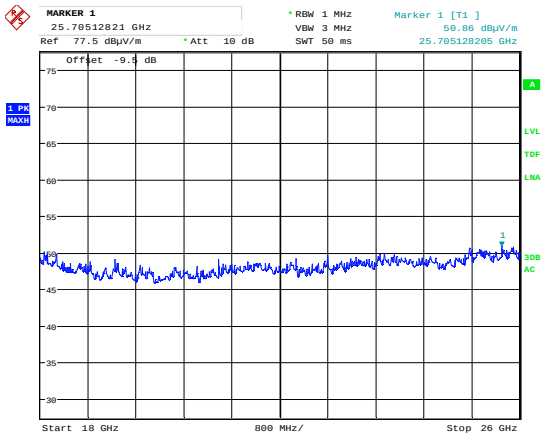


VP



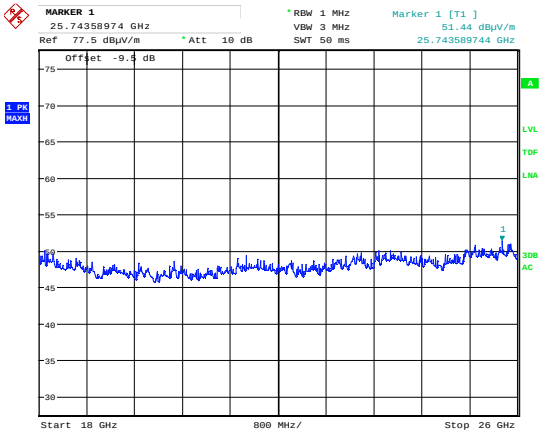
Date: 2.OCT.2023 16:31:10

Radiated Emissions 18-26 GHz, Ch01, 802.11ax HT20 MIMO, HP



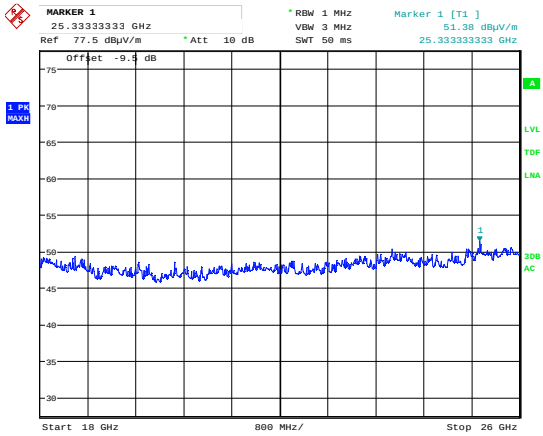
Date: 2.OCT.2023 16:33:23

VP



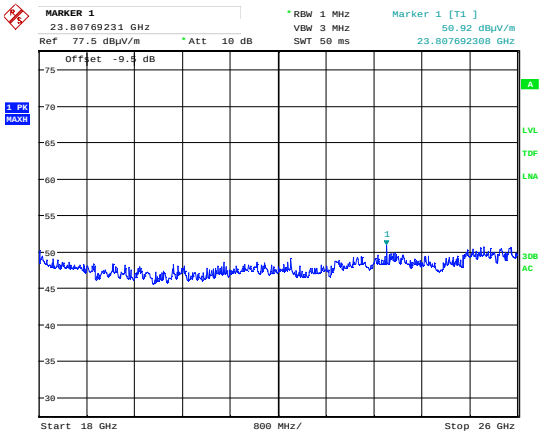
Date: 2.OCT.2023 16:20:48

Radiated Emissions 18-26 GHz, Ch45, 802.11ax HT20 Ant0, HP



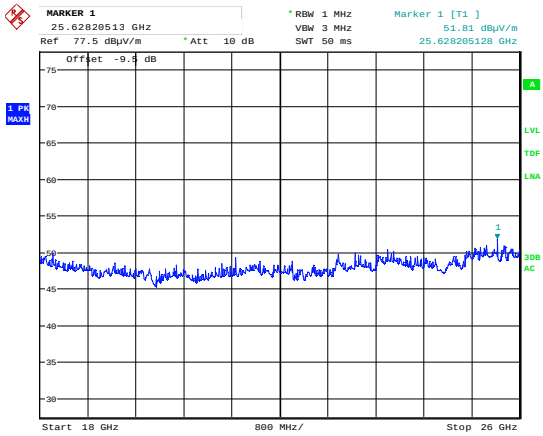
Date: 2.OCT.2023 16:23:17

VP



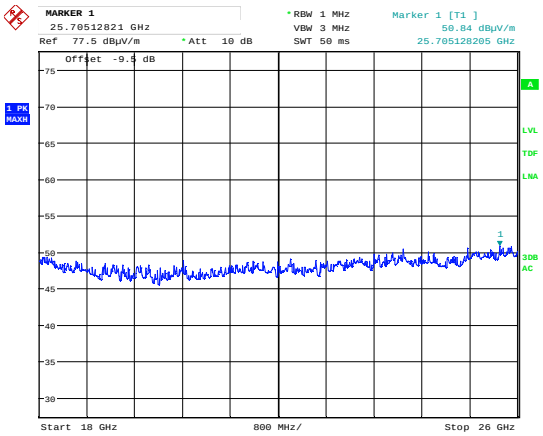
Date: 2.OCT.2023 16:18:41

Radiated Emissions 18-26 GHz, Ch45, 802.11ax HT20 Ant1, HP



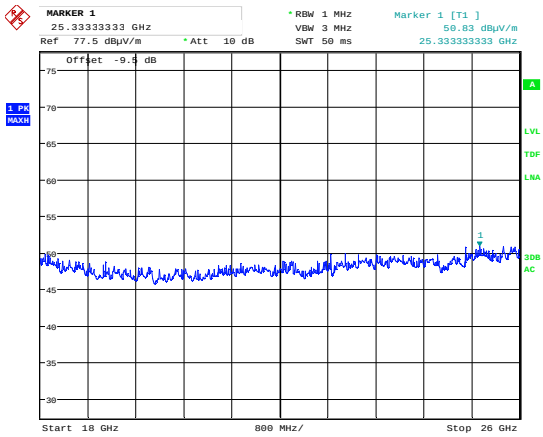
Date: 2.OCT.2023 16:16:30

VP



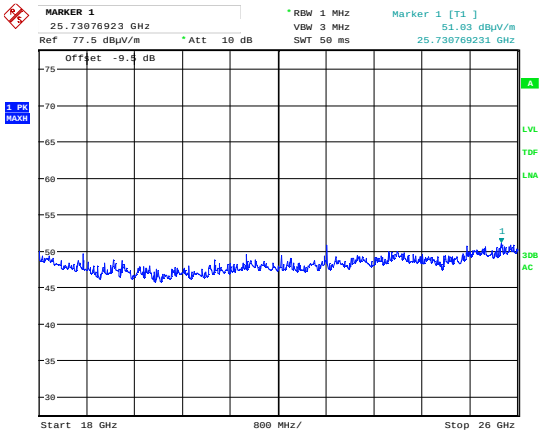
Date: 2.OCT.2023 16:28:20

Radiated Emissions 18-26 GHz, Ch45, 802.11ax HT20 MIMO, HP



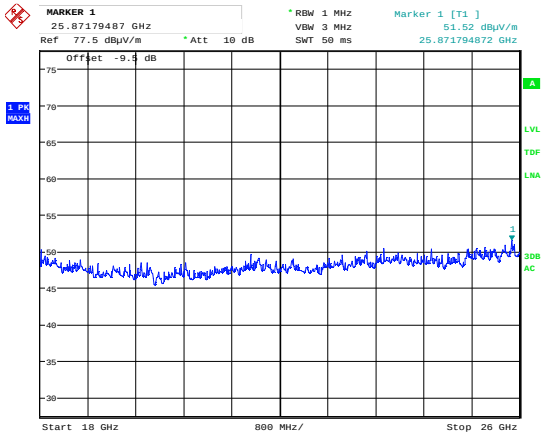
Date: 2.OCT.2023 16:26:05

VP



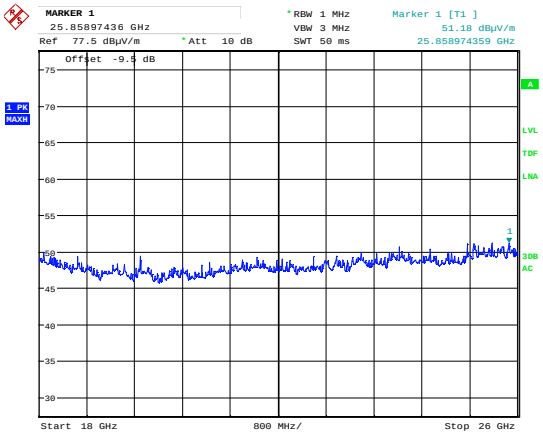
Date: 2.OCT.2023 16:41:03

Radiated Emissions 18-26 GHz, Ch43, 802.11ax HT40 MIMO, HP



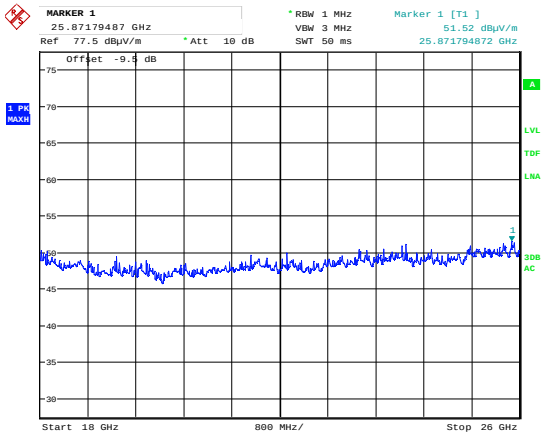
Date: 2.OCT.2023 16:43:16

VP



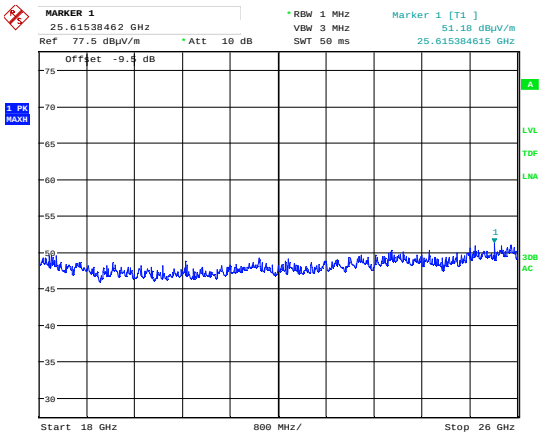
Date: 2.OCT.2023 16:48:32

Radiated Emissions 18-26 GHz, Ch39, 802.11ax HT80 MIMO, HP



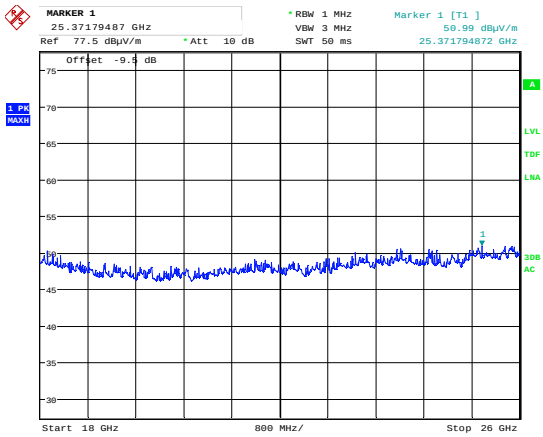
Date: 2.OCT.2023 16:46:04

VP



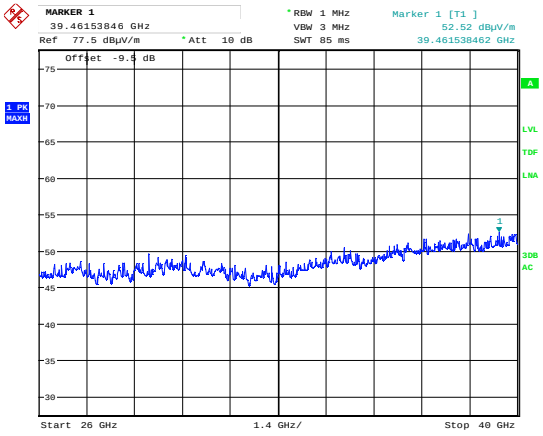
Date: 2.OCT.2023 16:38:26

Radiated Emissions 18-26 GHz, Ch93, 802.11ax HT20 MIMO, HP



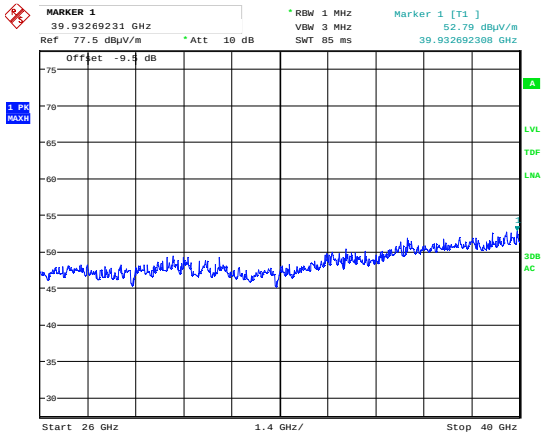
Date: 2.OCT.2023 16:36:10

VP



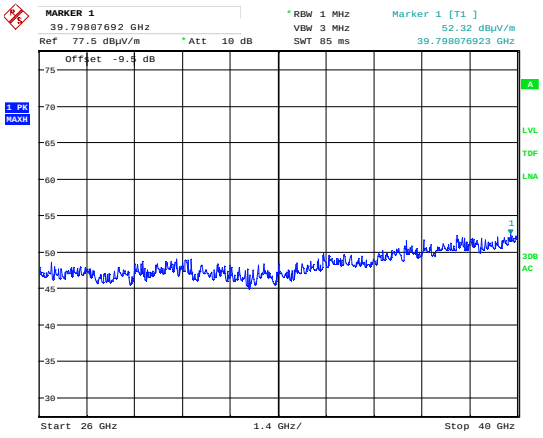
Date: 2.OCT.2023 15:47:46

Radiated Emissions 26-40 GHz, Ch01, 802.11ax HT20 MIMO, HP



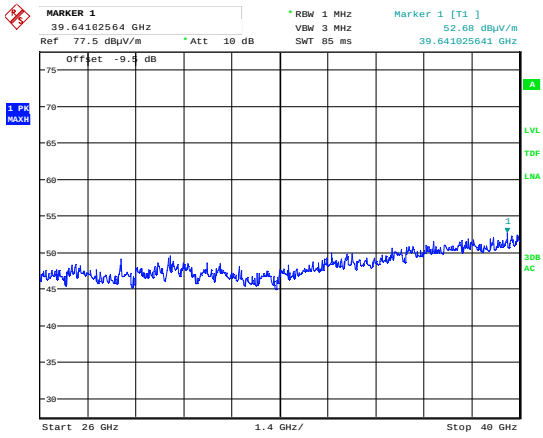
Date: 2.OCT.2023 15:45:10

VP



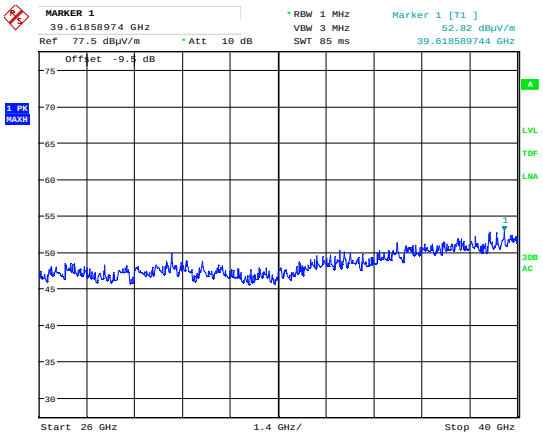
Date: 2.OCT.2023 16:02:08

Radiated Emissions 26-40 GHz, Ch45, 802.11ax HT20 Ant0, HP



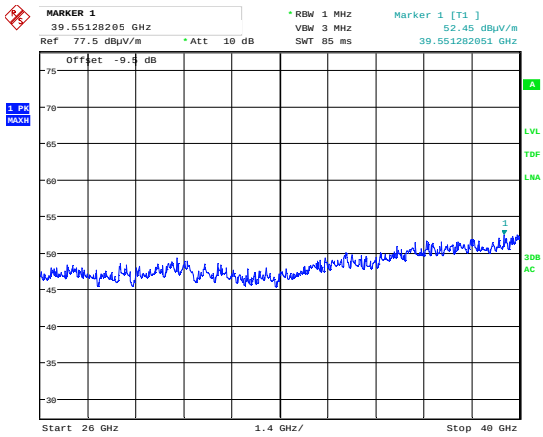
Date: 2.OCT.2023 16:04:17

VP



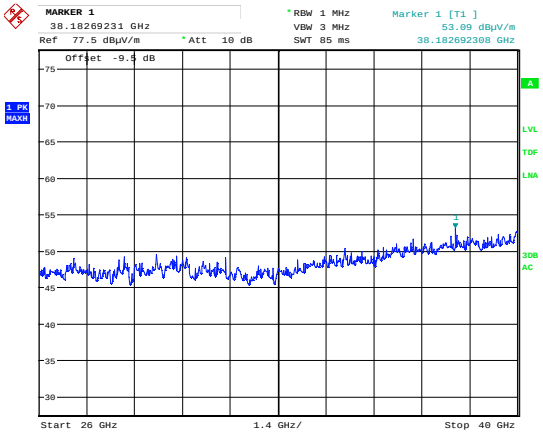
Date: 2.OCT.2023 16:09:29

Radiated Emissions 26-40 GHz, Ch45, 802.11ax HT20 Ant1, HP



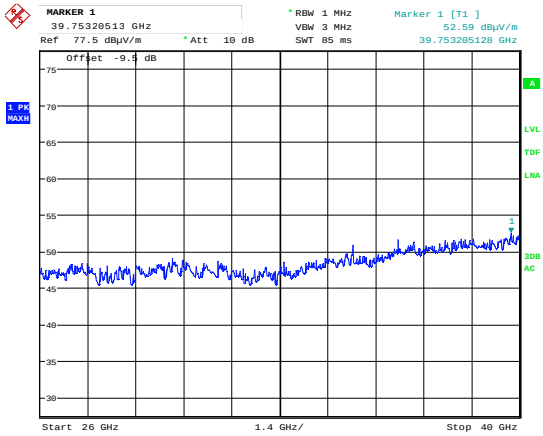
Date: 2.OCT.2023 16:06:43

VP



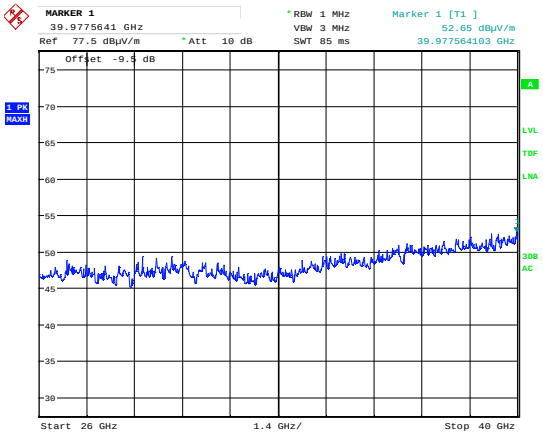
Date: 2.OCT.2023 15:50:29

Radiated Emissions 26-40 GHz, Ch45, 802.11ax HT20 MIMO, HP



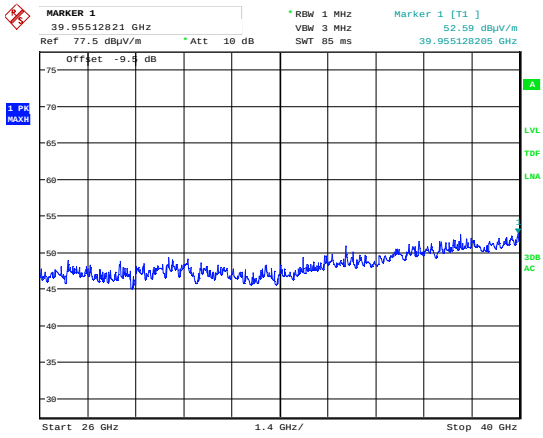
Date: 2.OCT.2023 15:53:12

VP



Date: 2.OCT.2023 15:57:55

Radiated Emissions 26-40 GHz, Ch93, 802.11ax HT20 MIMO, HP



Date: 2.OCT.2023 15:55:47

VP

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		**Uncertainty**
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	**< 3.6 GHz**	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	**< 1 GHz**	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	**Frequency**	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2023-01	2024-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2023-01	2024-01
3	L01G18G1	LowPass Filter (1 GHz)	Microwave Circuits	LR 1768	COU	
4	H7G718G1	HighPass Filter (7.75 GHz)	Microwave Circuits	LR 1773	COU	
5	JB3	BiLog Antenna	Sunol	N 4525	2023-03	2026-03
6	310	Preamplifier	Sonoma Inst.	LR 1686	2023-08	2024-08
7	8449A	Pre-amplifier	Hewlett Packard	LR 1322	2023-08	2024-08
8	3115	Horn Antenna	EMCO	LR 1226	2022-11	2027-11
9	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2023-08	2024-08
10	Model 638	Antenna Horn	Narda	LR 1480	N/A	
11	Model V637	Horn Antenna	Narda	LR 099	N/A	
12	JS4-20004000	Preamplifier	Miteq	LR 1591	2023-09 2023-12	2024-09 2025-12
13	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2021-12	2023-12
14	ESCI3	Measuring Receiver	Rohde & Schwarz	N-4259	2023-11	2025-11
15	Model 87 V	Multimeter	Fluke	LR 1600	2022-03	2024-03
16	6812B	AC Power Source	Agilent	LR 1515	2022-11	2024-11
17	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
18	SF102/1000MM	RF Cable	Suhner	SN 50113/2	COU	
19	SF102/2000MM	RF Cable	Suhner	SN 500100/2	COU	

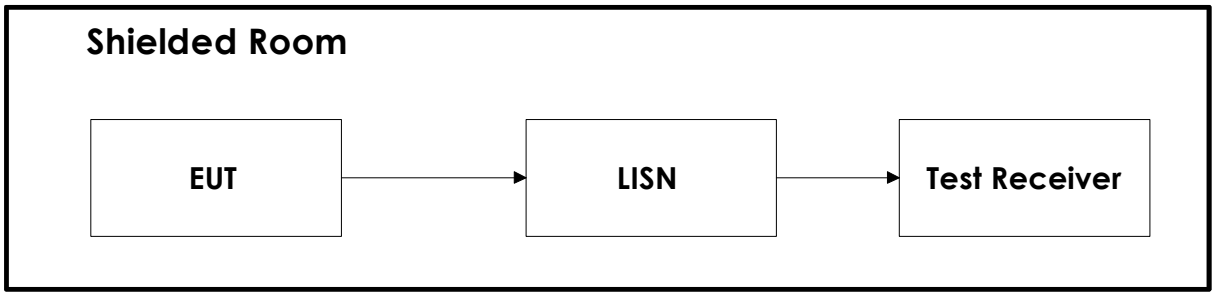
Note: COU – calibrate on use; N/A – Not Applicable

The software listed below has been used for one or more tests.

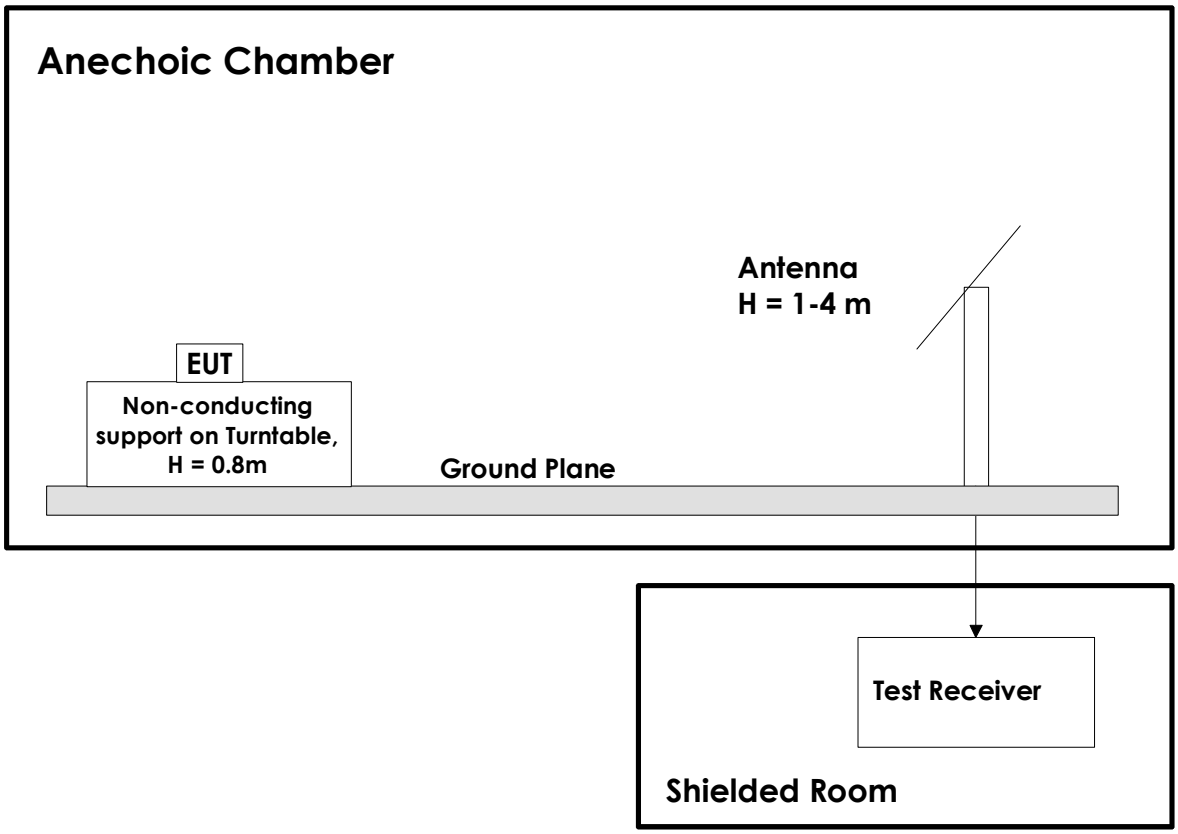
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko AS	RSPlot	1.0.8.0	Screen capture from R&S Spectrum Analyzers

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission



6.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. Measuring distance is 3m for all frequencies.

Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna.

All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers.

A pre-amplifier is used for all measurements, and High-Pass filter is used for all harmonics.