



TEST REPORT

Report Number. : R13858717-E3V1

Applicant : TEXAS INSTRUMENTS
12500 TI BLVD.
DALLAS, TEXAS, 75243, USA

Model : AWR1843AOPEVM

EUT Description : MILLIMETERWAVE E-BAND RADAR SENSOR DEVELOPMENT BOARD

Test Standard : FCC 47 CFR PART 95 SUBPART M

Date Of Issue:
August 13, 2021

Prepared by:
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REVISION HISTORY

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	2021-08-13	Initial Release	Mike Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: TEXAS INSTRUMENTS
12500 TI BLVD.
DALLAS, TEXAS, 75243, USA

EUT DESCRIPTION: MILLIMETER WAVE E-BAND RADAR SENSOR DEVELOPMENT BOARD

MODEL: AWR1843AOPEVM

SERIAL NUMBERS: 0321106A102, 0321106A106

SAMPLE RECEIVE DATE: 2021-06-22

DATE TESTED: 2021-07-16 to 2021-07-19

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 95 SUBPART M	See Section 7

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document.

Approved & Released For
UL LLC By:



Michael Heckrotte
Principal Engineer
Consumer Technology Division
UL Verification Services

Tested By:



Mike Antola
Staff Engineer
Consumer Technology Division
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2
2. FCC CFR 47 Part 95M
4. ANSI C63.10-2020
5. ANSI C63.26-2015
6. KDB 653005 D01 76-81 GHz Radars v01r01
7. KDB 971168 D01 Power Meas. License Digital Systems v03r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., RTP, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

2800 Perimeter Park Dr.	12 Laboratory Dr.
☒ Chamber 1 - mmWave	☐ Chamber A RTP
☐ North Chamber	☐ Chamber C RTP
☒ South Chamber	

The above test sites and facilities are covered under FCC Test Firm Registration # 703469.

Chamber 1 is a fully anechoic chamber dedicated to make measurements to TRP limits from 18-40 GHz, and field strength, EIRP and TRP measurements at and above 40 GHz. The measurement antenna is nominally 1.5 m high in accordance with C63.10-2013, procedures developed by the C63 mmWave Joint Task Group for inclusion in the next editions of C63.10 and C63.26, and applicable FCC KDB documents. The absorber reflectivity fully supports chamber performance over this frequency range. The dimensions of the chamber are approximately 6.7 m L by 3.7 m W by 3.1 m H.

4. CALIBRATION AND UNCERTAINTY

4.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

4.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	U _{LAB}
Worst Case Radiated Disturbance, 30 to 1000 MHz	6.01 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.73 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.51 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.29 dB
Worst Case Radiated Disturbance >40000 MHz	2.89 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The AWR1843AOP is an Antenna-On-Package device capable of operation in the 76- to 81GHz band. This test report covers customer-requested testing of radiated spurious emissions above 154 GHz in all the EUT operating modes.

At the customer's request, additional radiated spurious emissions data has been included below 162 GHz. See informative Appendix I for details.

5.2. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was XDS Emulation Software, ver. 9.2.0.00002.

The EUT driver software installed in the support laptop during testing was XDS110 and FTDI.

The test utility software used during testing was MMWAVE-STUDIO, ver. 02.01.01.00.

Test script **AWR18xx_4GHz_Sweep.lua** was provided to initiate a 4GHz sweep from 77GHz to 81GHz.

Test script **AWR18xx_1300MHz_Sweep.lua** was provided to initiate a 1.3GHz sweep from 77.1GHz to 78.4GHz.

Test script **AWR18xx_76-77GHz_Sweep.lua** was provided to initiate a 1GHz sweep from 76GHz to 77GHz.

5.1. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes an Antenna-on-Package (AOP) antenna array . Refer to TI AWR1843AOP radar sensor datasheet for specifics on the antenna characteristics.

5.2. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

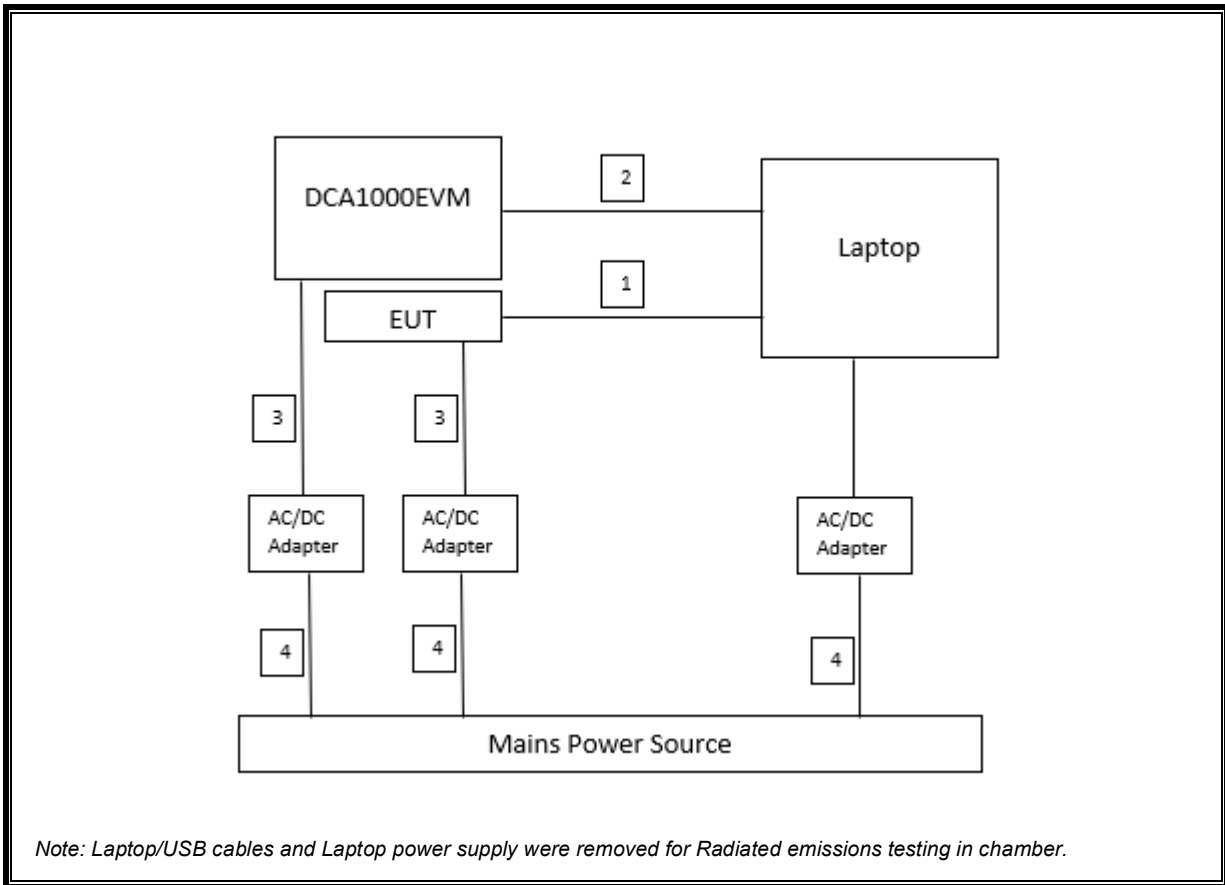
Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Data capture card	TI/Mistral	DCA1000EVM	0321DCA1000EVM0905	NA
5Vdc Wall Wart	Cui japan	EMSA050300-P5P-SZ	1222 S	NA
5Vdc Wall Wart	Cui japan	EMSA050300-P5P-SZ	1436 S	NA
Support laptop	Lenovo	20JVS08500	PF0ZV674	PD98260NG
Support laptop	Lenovo	20BU-S04K00	PC-0A2UQT	PD97265NGU

I/O CABLES

I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Ethernet	3	RJ45	Ethernet	> 3	NA
2	DC	4	Screw terminal	Stranded Wire	> 3	NA
3	BRR	2	4 pin data	BRR	> 3	NA

TEST SETUP

The EUT is connected to a laptop computer. Software within the computer is used to configure and exercise the EUT.

SETUP DIAGRAM FOR TESTS

FAR-FIELD DISTANCE AND MEASUREMENT DISTANCE

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable.

The measurement distance is in the far field per formula $2D^2/\lambda$ where D is the larger dimension of the antenna.

Frequency Range (GHz)	Wavelength (m)	Rx Antenna Diagonal dim. (m)	Far Field Distance (m)	Measurement Distance Used (m)
40-50	0.0060	0.069	1.61	3.00
50-75	0.0040	0.046	1.05	3.00
75-110	0.0027	0.031	0.70	3.00
110-170	0.0018	0.02	0.46	3.00
170-243	0.0012	0.013	0.31	0.50

Radiated spurious emissions limits above 40 GHz are based on a 3-meter measurement distance. As such, testing from 154-170GHz was performed at 3-meters. Above 170GHz, testing was performed at a 0.5-meter distance and the data was corrected, accordingly, to the 3-meter limit.

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst-case polarization/positioning.

6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment Used - mmWave Test Equipment (Morrisville – mmWave 1)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	40-50 GHz				
206209	Standard Gain Horn, 40-50GHz	Custom Microwave Inc.	HO22R	2020-07-27	See note *
205910	Low Noise Amplifier	Eravant	SBL-3335033040-2222-E1	2021-04-15	2022-04-15
207949	Band Pass Filter	Eravant	SWF-4510460-2F2F-B1	2021-05-26	2022-05-26
	50-75 GHz				
206202	Standard Gain Horn, 50-75GHz	Custom Microwave Inc.	HO15R	2020-07-27	See note *
206607	WR15 Downconverter	VDI	WR15.0SAX-F	2021-04-05	2022-04-05
205911	Low Noise Amplifier	Eravant	SBL-5037531850-1515-E1	2021-04-15	2022-04-15
	75-110 GHz				
206222	Standard Gain Horn, 75-110GHz	Custom Microwave Inc.	HO10R	2020-07-27	See note *
207249	WR10 Downconverter	VDI	WR10.0SAX-F	2021-04-19	2022-04-19
205913	Low Noise Amplifier	Eravant	SBL-7531142050-1010-E1	2021-04-15	2022-04-15
	110-170 GHz				
206242	Standard Gain Horn, 110-170GHz	Custom Microwave Inc.	HO6R	2020-07-27	See note *
206555	WR6.5 Downconverter	VDI	WR6.5SAX-F	2021-04-02	2022-04-02
205912	Low Noise Amplifier	Eravant	SBL-1141741860-0606-E1	2021-04-15	2022-04-15
	170-260 GHz				
206244	Standard Gain Horn, 170-260GHz	Custom Microwave Inc.	HO4R	2020-07-27	See note *
206556	WR6.5 Downconverter	VDI	WR4.3SAX-F	2021-04-02	2022-04-02
	Receiver & Software				
206459	Spectrum Analyzer	Rohde & Schwarz	FSW50	2021-03-15	2022-03-15
mmWave	mmWave Software	UL	V2021.4.30		
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2020-08-06	2021-08-06

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz				
AT0081	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-11-20	2020-11-20
	1-18 GHz				
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-05-26	2021-05-26
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2019-11-07	2020-11-07
	Gain-Loss Chains				
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-10	2021-07-10
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-06	2021-07-06
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-07-07	2021-07-07
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SA0020	Spectrum Analyzer	Agilent	E4446A	2021-05-25	2022-05-25
SOFTEMI	EMI Software	UL	Version 9.5 (27 May 2021)		
	Additional Equipment used				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

*- All horn antennas at and above the 33-50 GHz band are standard gain horns. In accordance with ANSI C63.10 clause 4.4.3 (a) Standard gain horns need not be periodically recalibrated, unless damage or deterioration is suspected or known to have occurred. If a standard gain horn is not periodically recalibrated, then its critical dimensions (see IEEE Std 1309-2005) shall be verified and documented on an annual basis.

UL measures the critical dimensions on an annual basis and checks for damage and deterioration before each test.

All equipment was within calibration at the time of test.

7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Bandwidth	N/A	Radiated	Not tested, see note
2.1046 95.3367	Equivalent Isotropic Radiated Power (EIRP)	+50 dBm (Average) +55dBm (Peak)	Radiated	Not tested, see note
2.1051 95.3379	Spurious Emissions < 40GHz	See Table 95.3379 (1)	Radiated	Not tested, see note
2.1051 95.3379	Spurious Emissions 40 – 154GHz	600 pW/cm ²	Radiated	Not tested, see note
2.1051 95.3379	Spurious Emissions 154 – 200GHz	600 pW/cm ²	Radiated	Compliant
2.1051 95.3379	Spurious Emissions > 200GHz	1000 pW/cm ²	Radiated	Compliant
2.1055 95.3379	Frequency Stability	See 95.3379 (b)	Radiated	Not tested, see note

NOTE: The scope of this customer-directed test program was to perform radiated spurious emissions testing above 154 GHz only. It is the responsibility of the manufacturer to ensure compliance with the other section of the relevant requirements.

8. APPLICABLE LIMITS AND TEST RESULTS

8.1. RADIATED SPURIOUS EMISSIONS

REQUIREMENT

FCC: §95.3379

LIMIT

95.3379 - (a)(1) Radiated emissions below 40 GHz shall not exceed the field strength as shown in the following emissions table

Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measurement Distance (meters)
0.009-0.490	2400/F (kHz)	48.5-13.8	300
0.490-1.705	24000/F (kHz)	49.0-23.0	30
1.705-30.0	30	29.5	30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

90.3379 - (a)(2) The power density of radiated emissions outside the 76-81 GHz band above 40.0 GHz shall not exceed the following, based on measurements employing an average detector with a 1 MHz RBW:

(i) For radiated emissions outside the 76-81 GHz band between 40 GHz and 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 600 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

(ii) For radiated emissions above 200 GHz from field disturbance sensors and radar systems operating in the 76-81 GHz band: 1000 pW/cm² at a distance of 3 meters from the exterior surface of the radiating structure.

(3) For field disturbance sensors and radar systems operating in the 76-81 GHz band, the spectrum shall be investigated up to 231.0 GHz.

NOTE: Testing was performed up to 243 GHz per the recommendation of KDB 653005.

The limits were converted to dBm EIRP as follows:

Meas. Distance (cm)	300	300
Pwr Density Limit (pW/cm ²)	600	1000
EIRP Limit (W)	0.0007	0.0011
EIRP Limit (dBm)	-1.7	0.5

TEST PROCEDURE

KDB 653005 D01 76-81 GHz v01r01 Section 4 (e)
ANSI C63.26-2015 Clause 5.5.4 and Annex C.5.2.

RSE was investigated from 154 GHz – 243 GHz while the EUT was operating in its 76-77 GHz sweep mode.

RSE was investigated from 162 GHz – 243 GHz while the EUT was operating in its 77-81 GHz & 77.1-78.4 GHz sweep modes.

Testing above 40 GHz:

All radiated spurious emissions were measured as EIRP to compare with the limits as defined above.

The average EIRP reported below is calculated per section 5.2.7 of ANSI C63.26-2015 which states: $EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m. The field strength E is calculated $E (dB\mu V/m) = \text{Spectrum Analyzer Level (dBm)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107$. All appropriate Antenna Factor and Cable Loss have been applied in the spectrum analyzer for each measurement.

RSEs above 40 GHz were measured at the appropriate far field distances listed on Section 5 on this report (FAR-FIELD DISTANCE AND MEASUREMENT DISTANCE). Then, the EIRP of RSE was calculated using the equations on ANSI C63.26-2015 Annex C.5.2, as described on Sections 8.2 and 8.3.

Emissions above 50 GHz were measured using a downconverter with spectrum analyzer, while an external LNA was used when applicable.

Worse-Case Configuration

All RSEs were measured for the configuration with the highest EIRP as representing the worst case. Preliminary radiated emissions tests on the low, middle and high channels indicated that the worst case radiated spurious emissions were on the channel with the highest power (low channel) and so only the test data for that channel is included in this report.

RESULTS

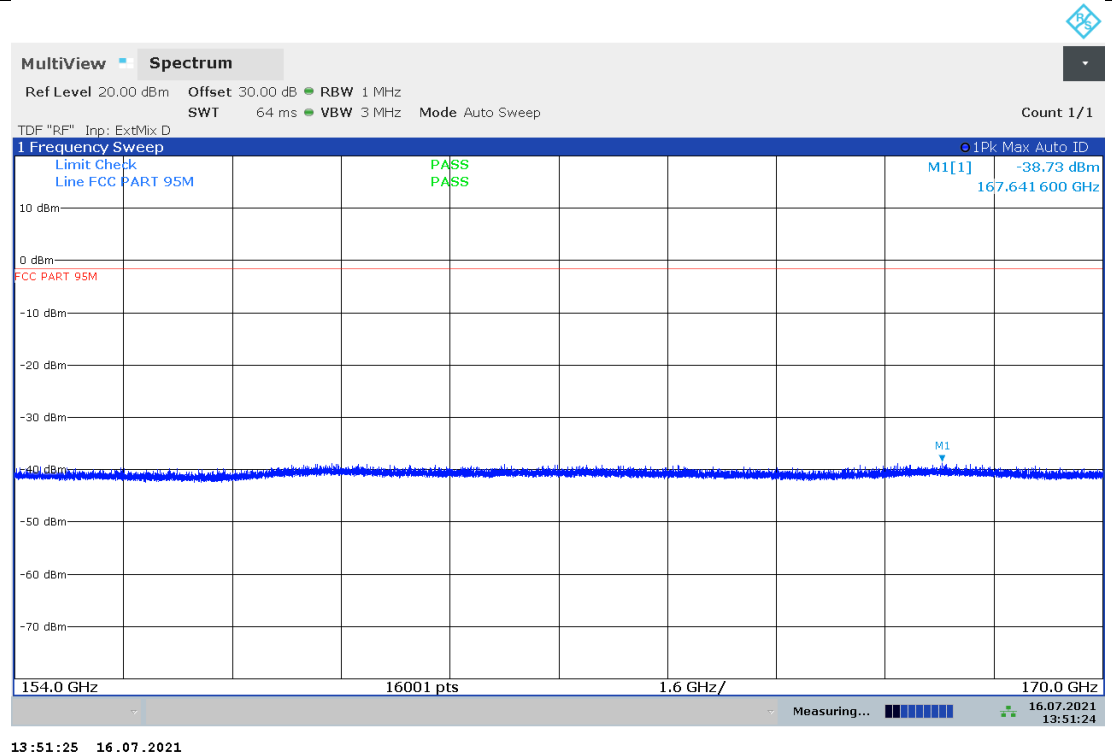
See the following pages.

TESTED BY

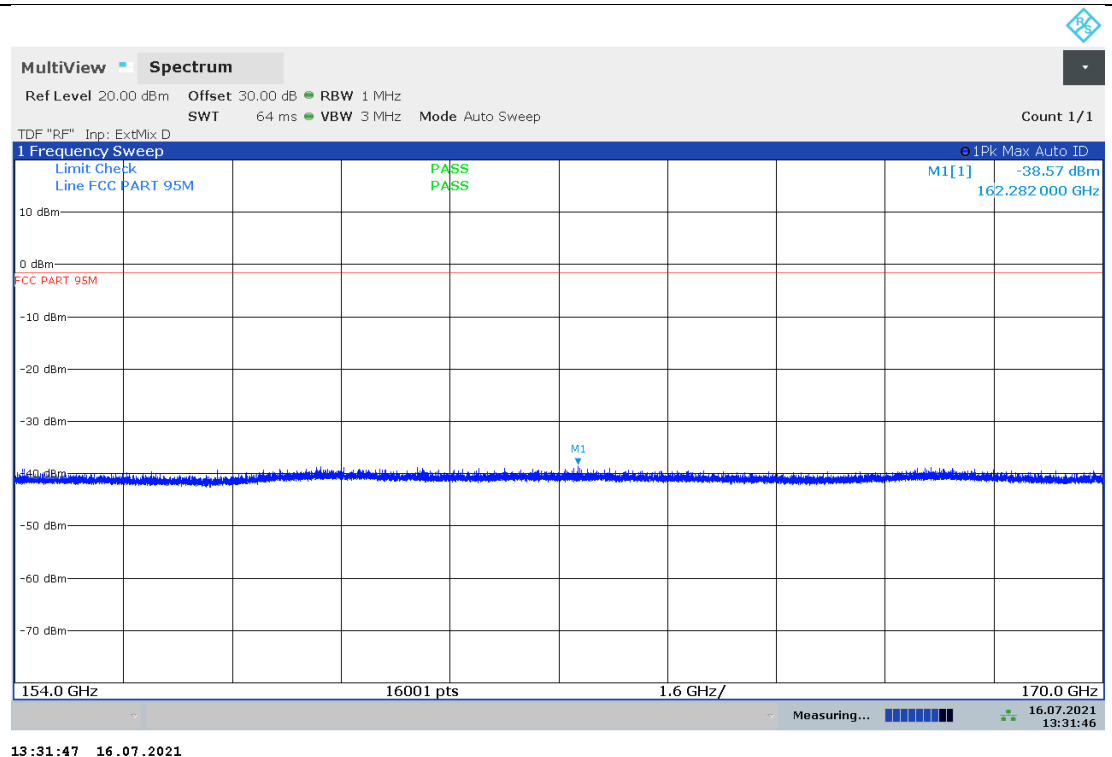
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Employee IDs: 23854

8.1.1. RADIATED SPURIOUS EMISSIONS 154-170 GHz

Horizontal

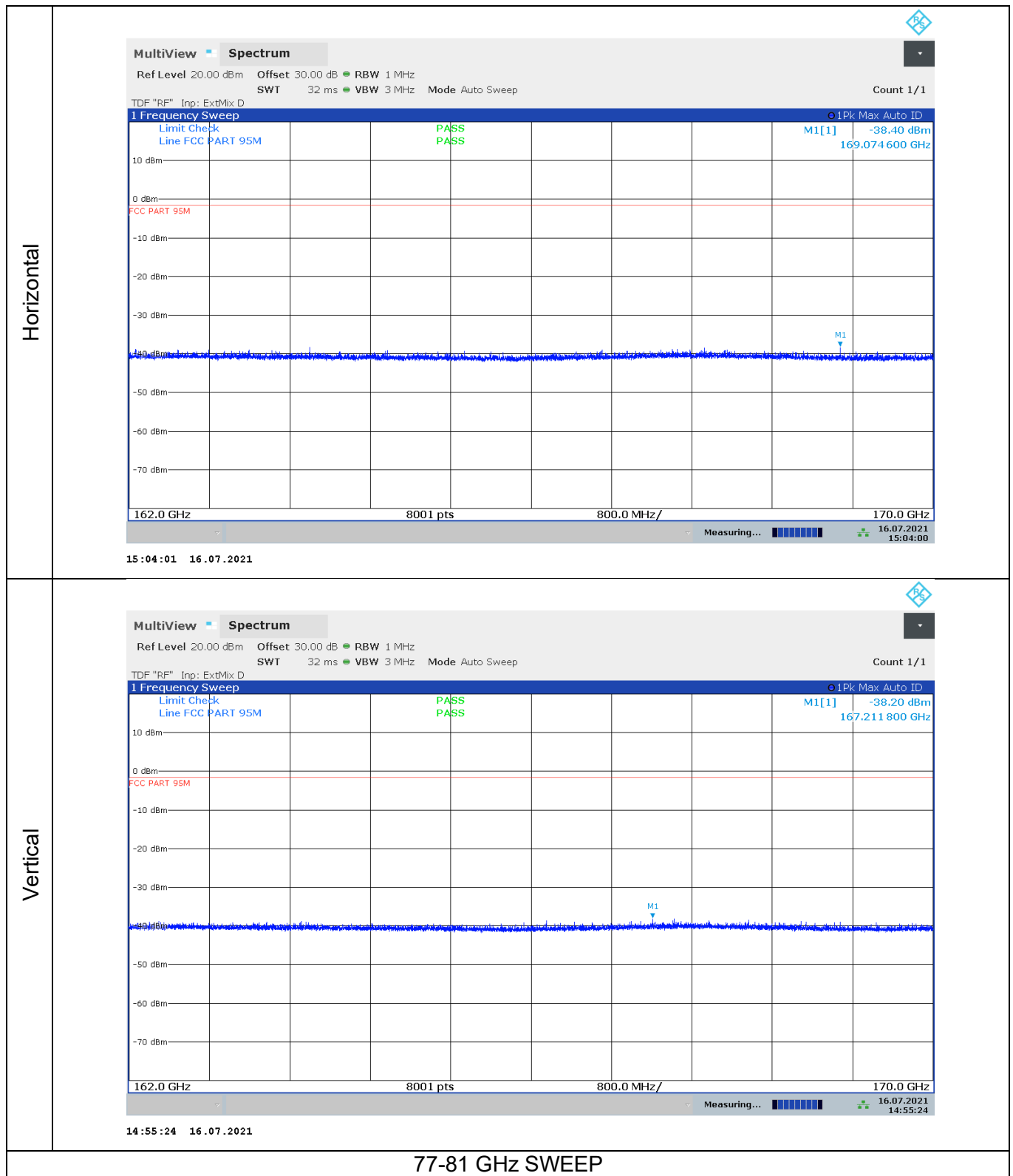


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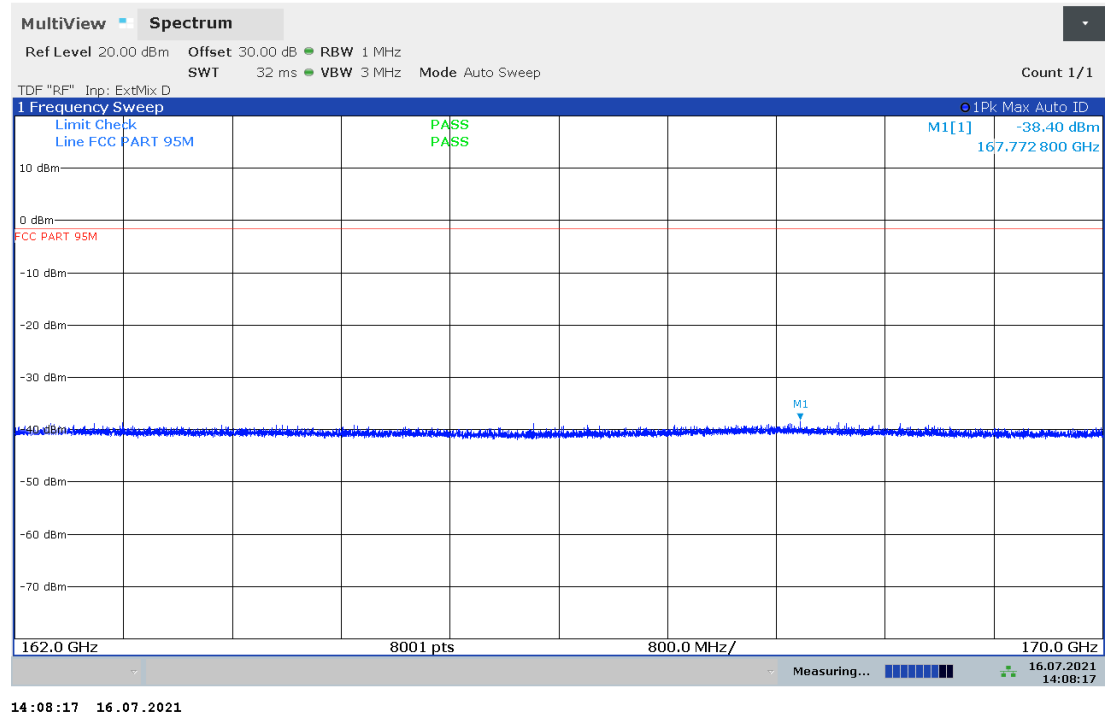


76-77 GHz SWEEP

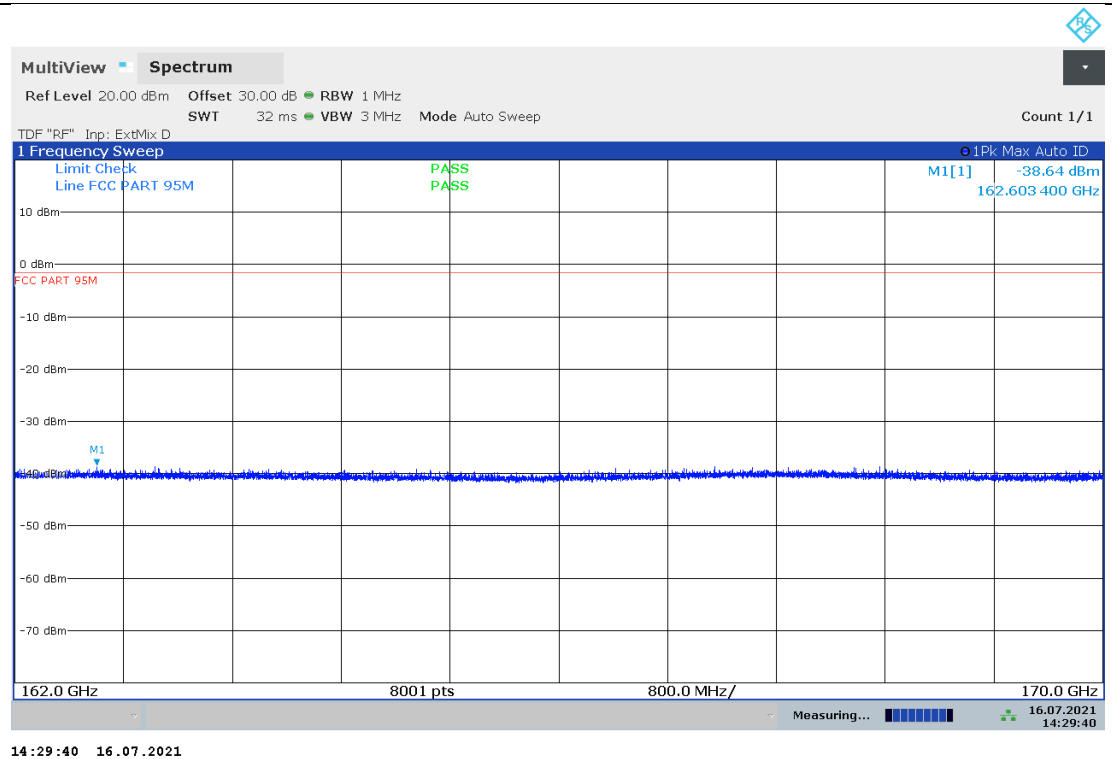
8.1.1. RADIATED SPURIOUS EMISSIONS 162-170 GHz



Horizontal

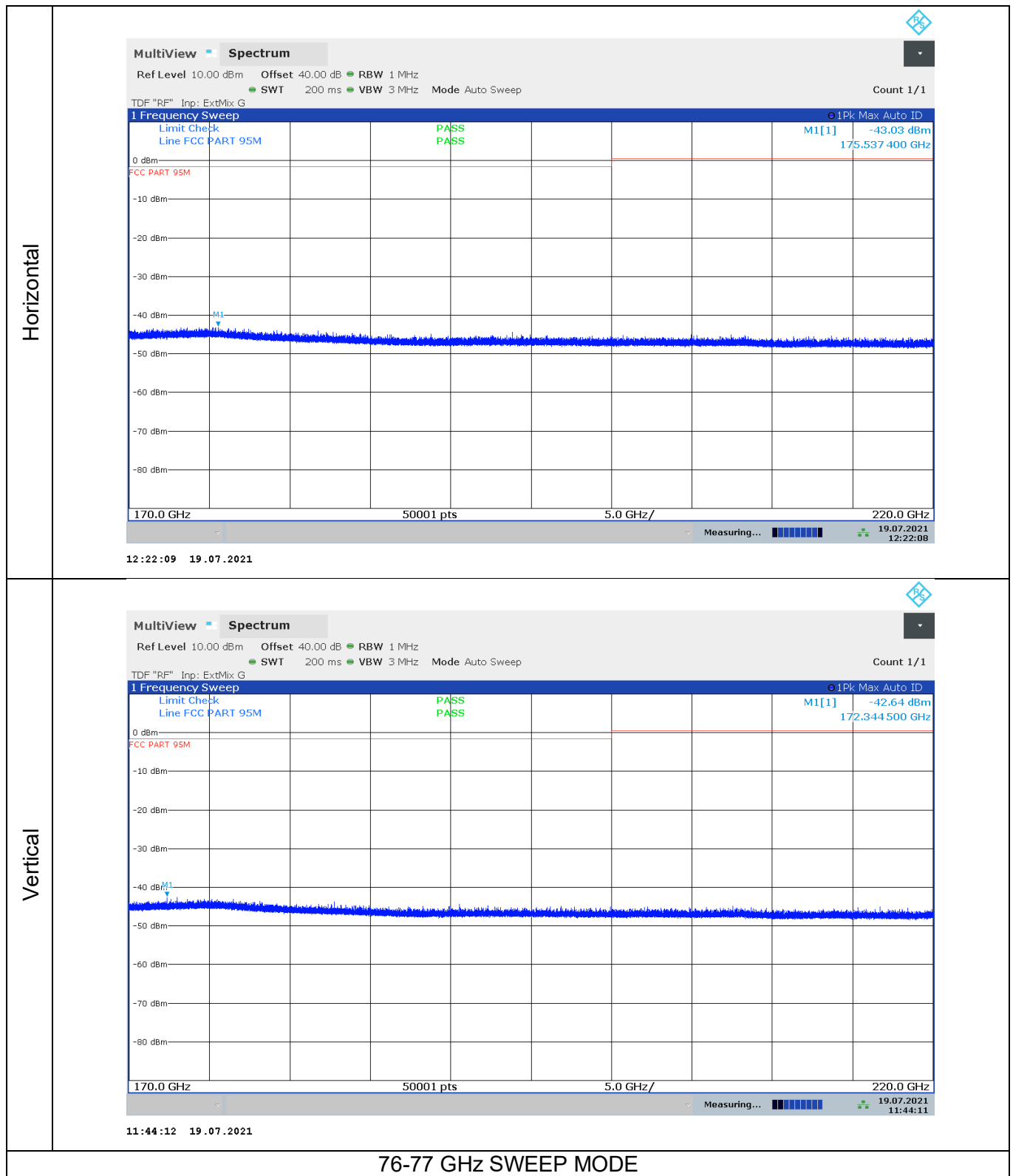


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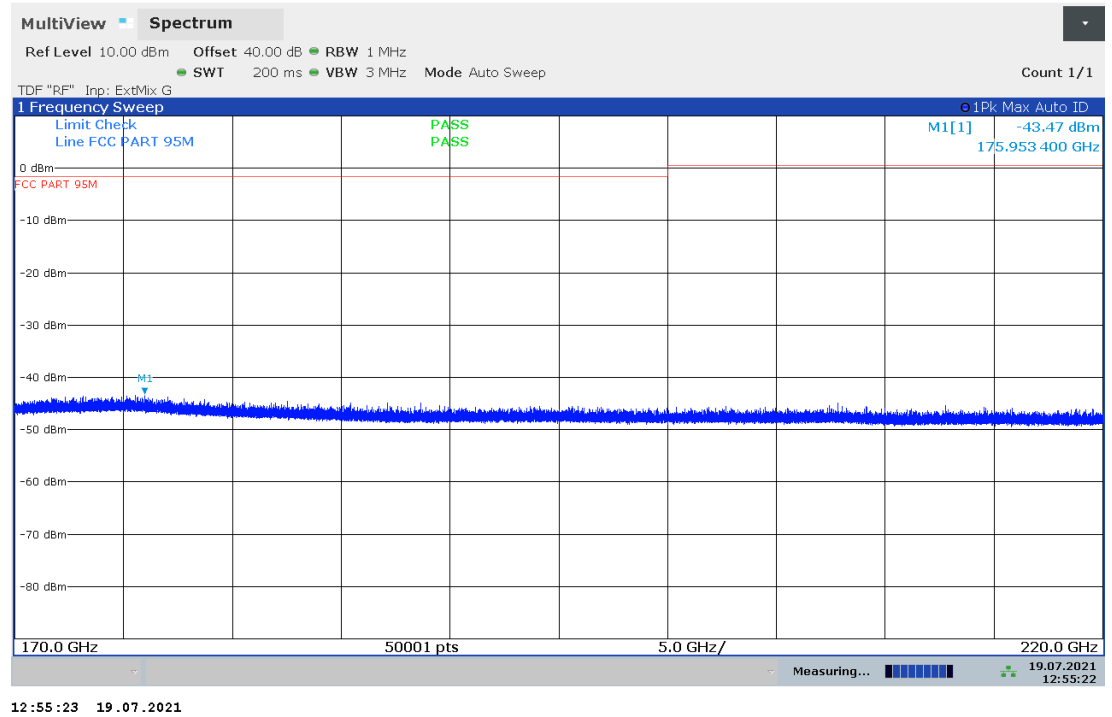


77.1-78.4 GHz SWEEP

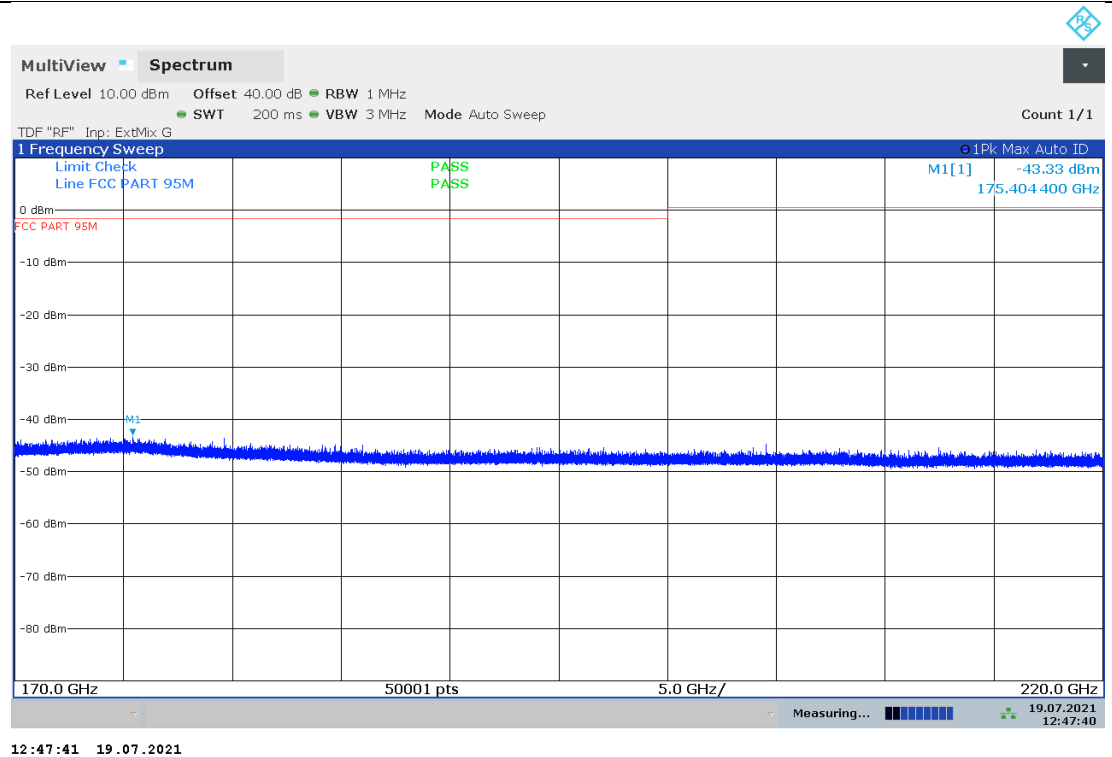
8.1.2. RADIATED SPURIOUS EMISSIONS 170-220 GHz



Horizontal

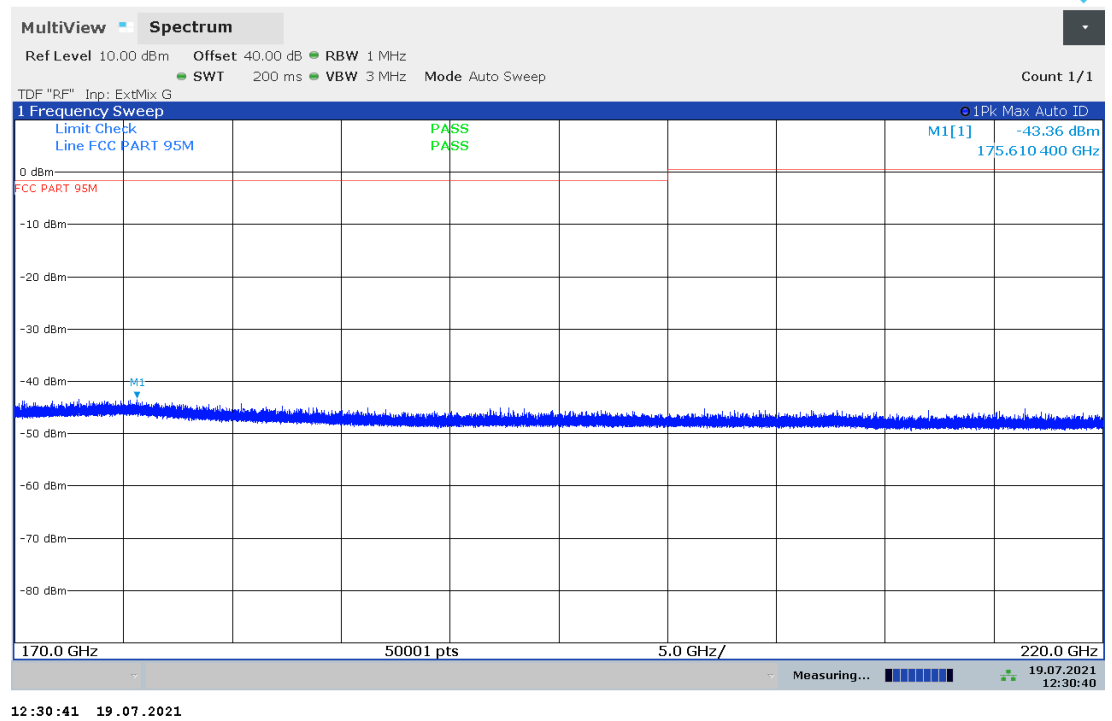


Vertical

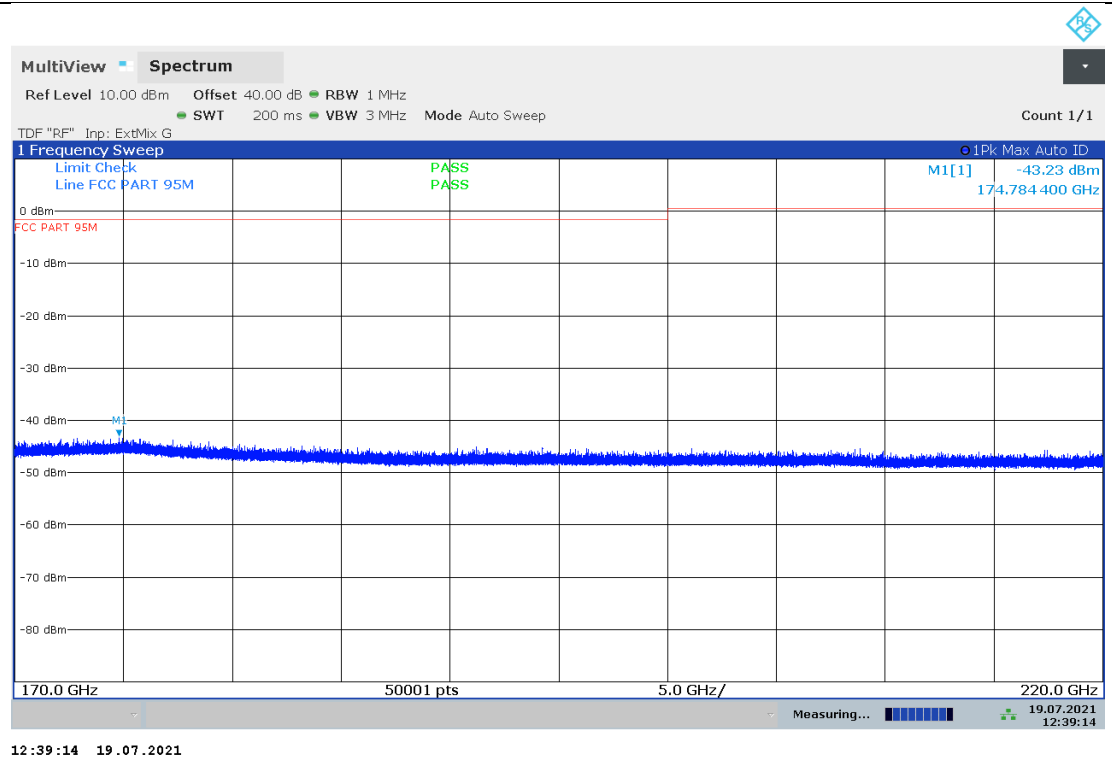


77-81 GHz SWEEP MODE

Horizontal



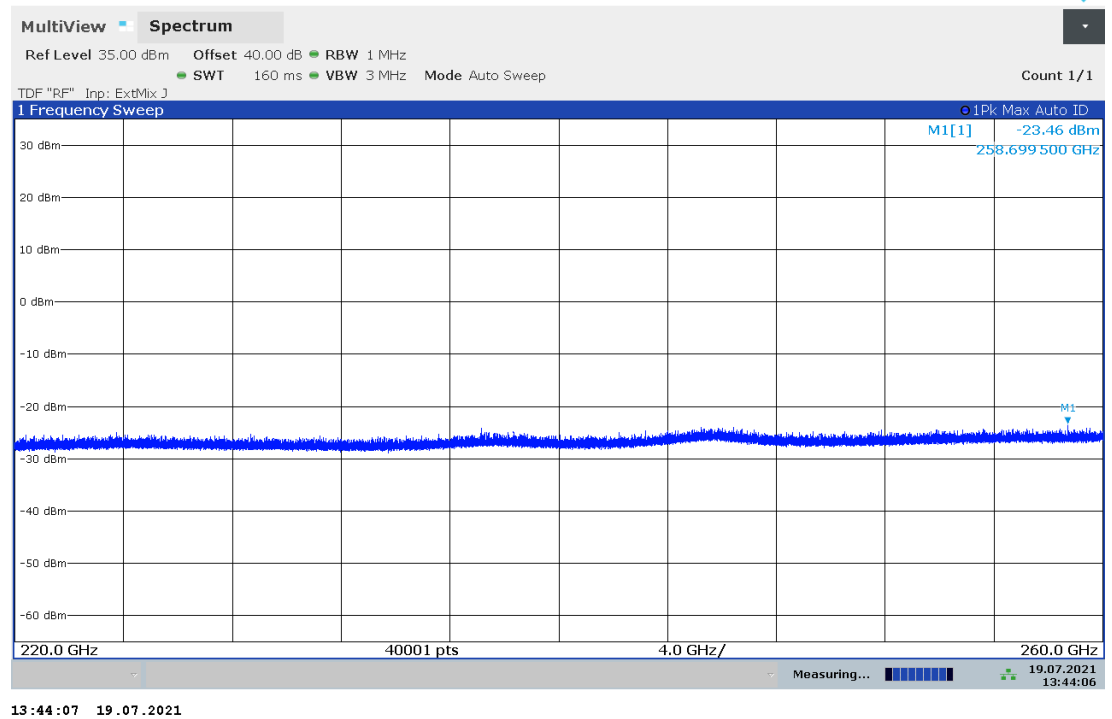
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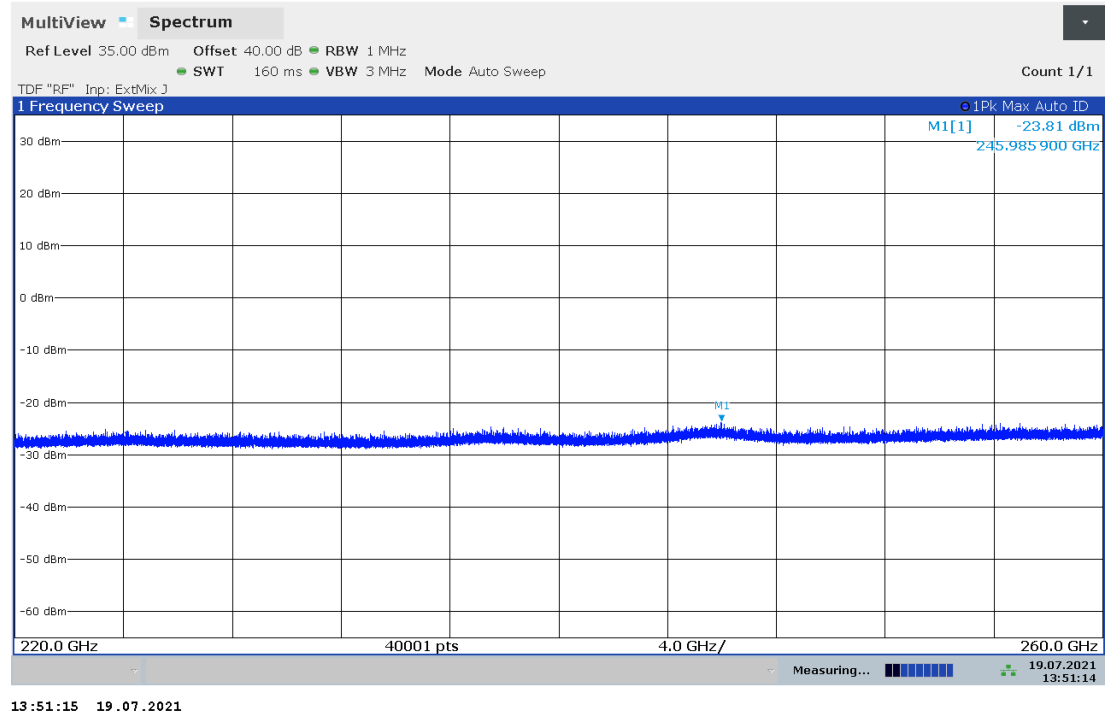
77.1-78.4 GHz SWEEP

8.1.3. RADIATED SPURIOUS EMISSIONS 220-243 GHz

Horizontal

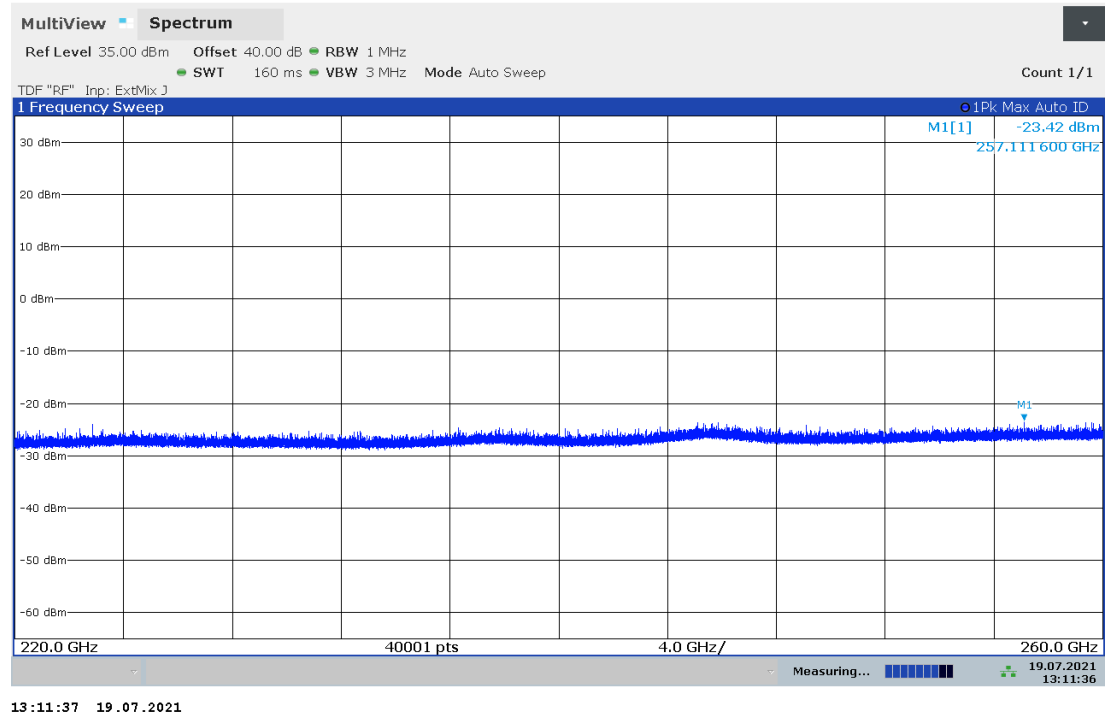


Vertical

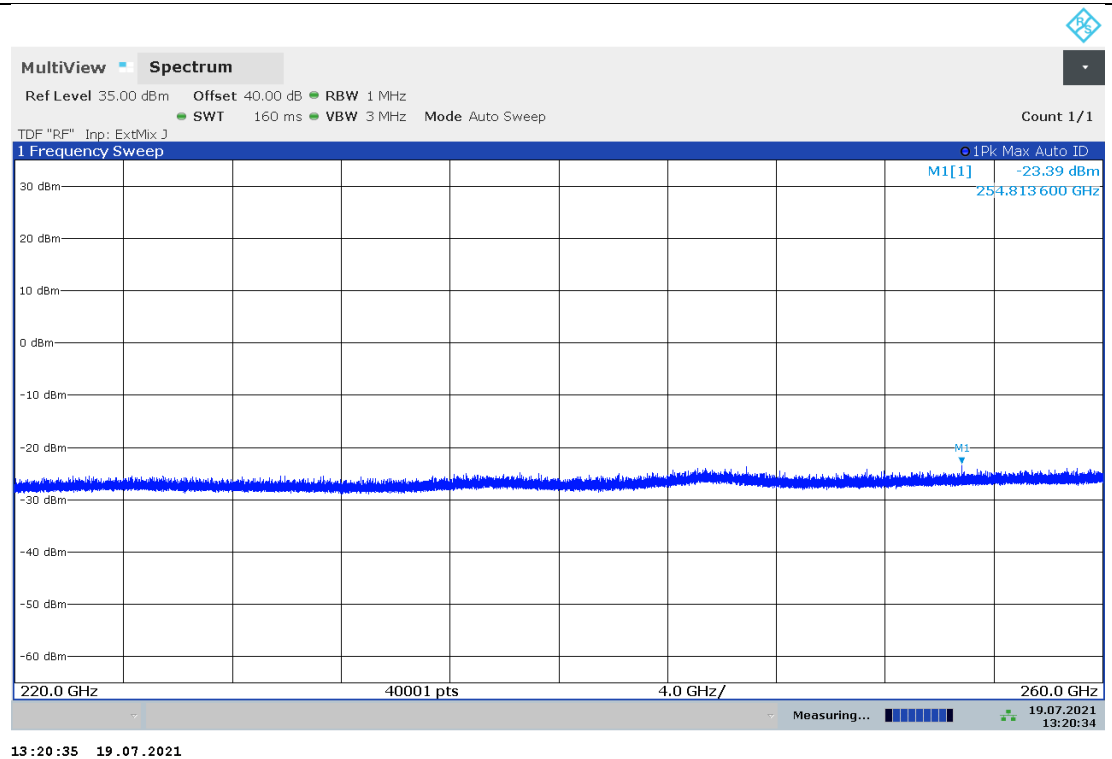


76-77 GHz SWEEP MODE

Horizontal

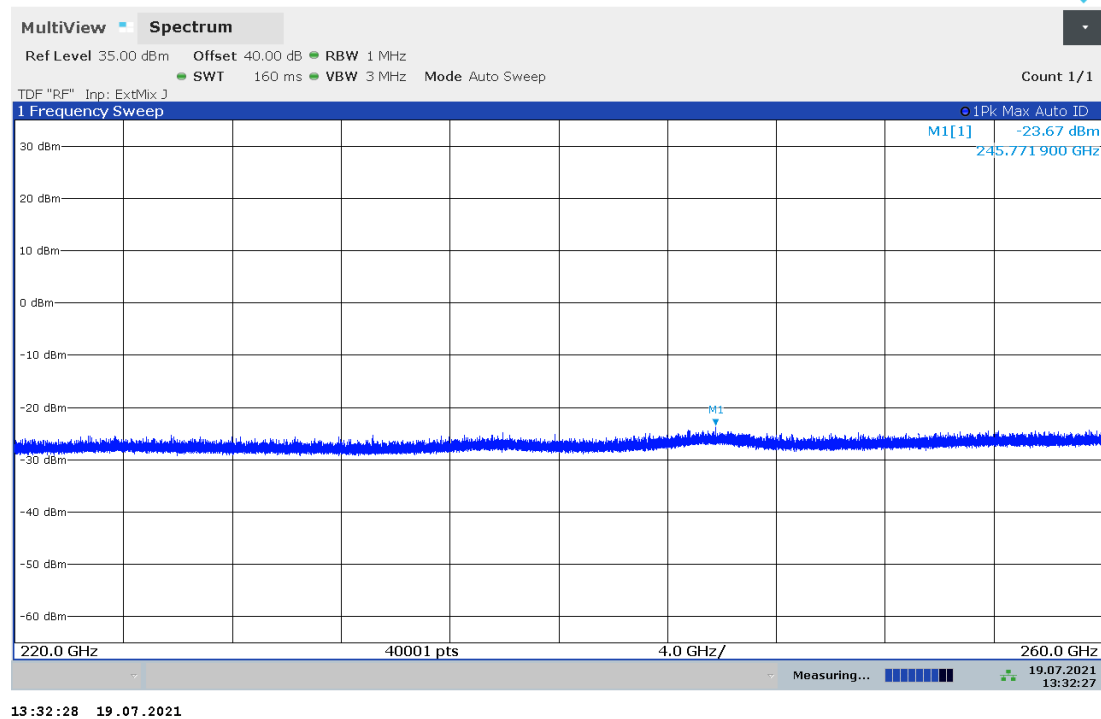


Vertical

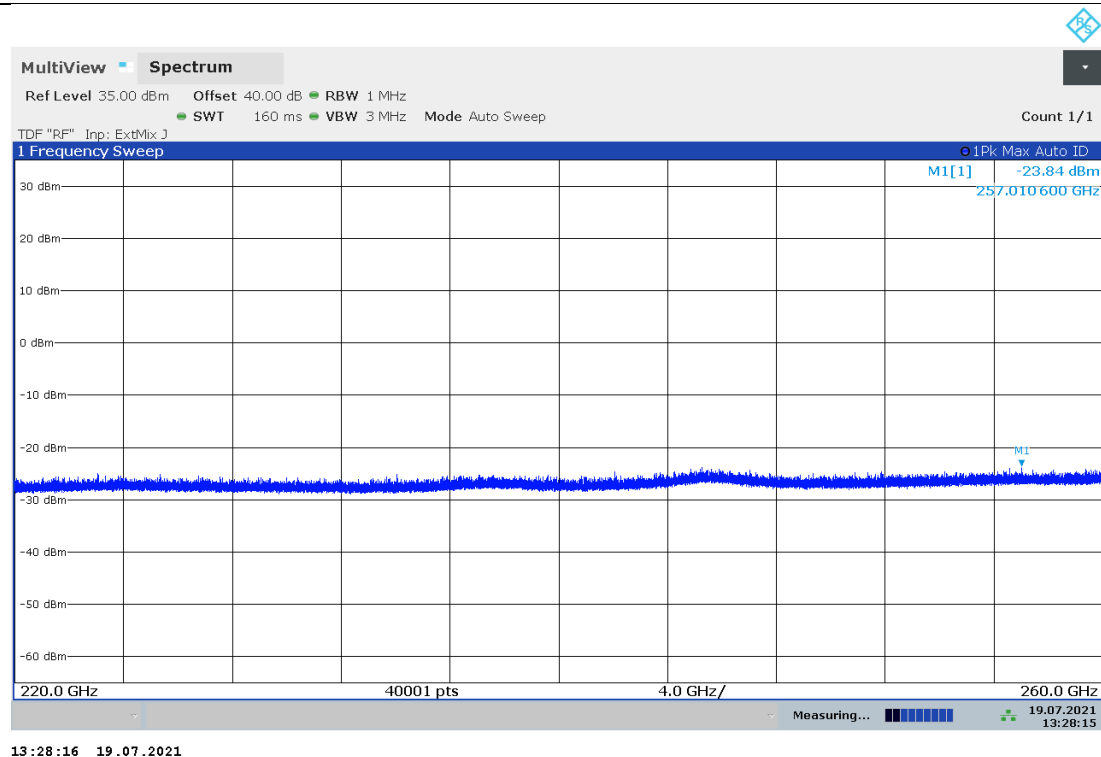


77-81 GHz SWEEP MODE

Horizontal

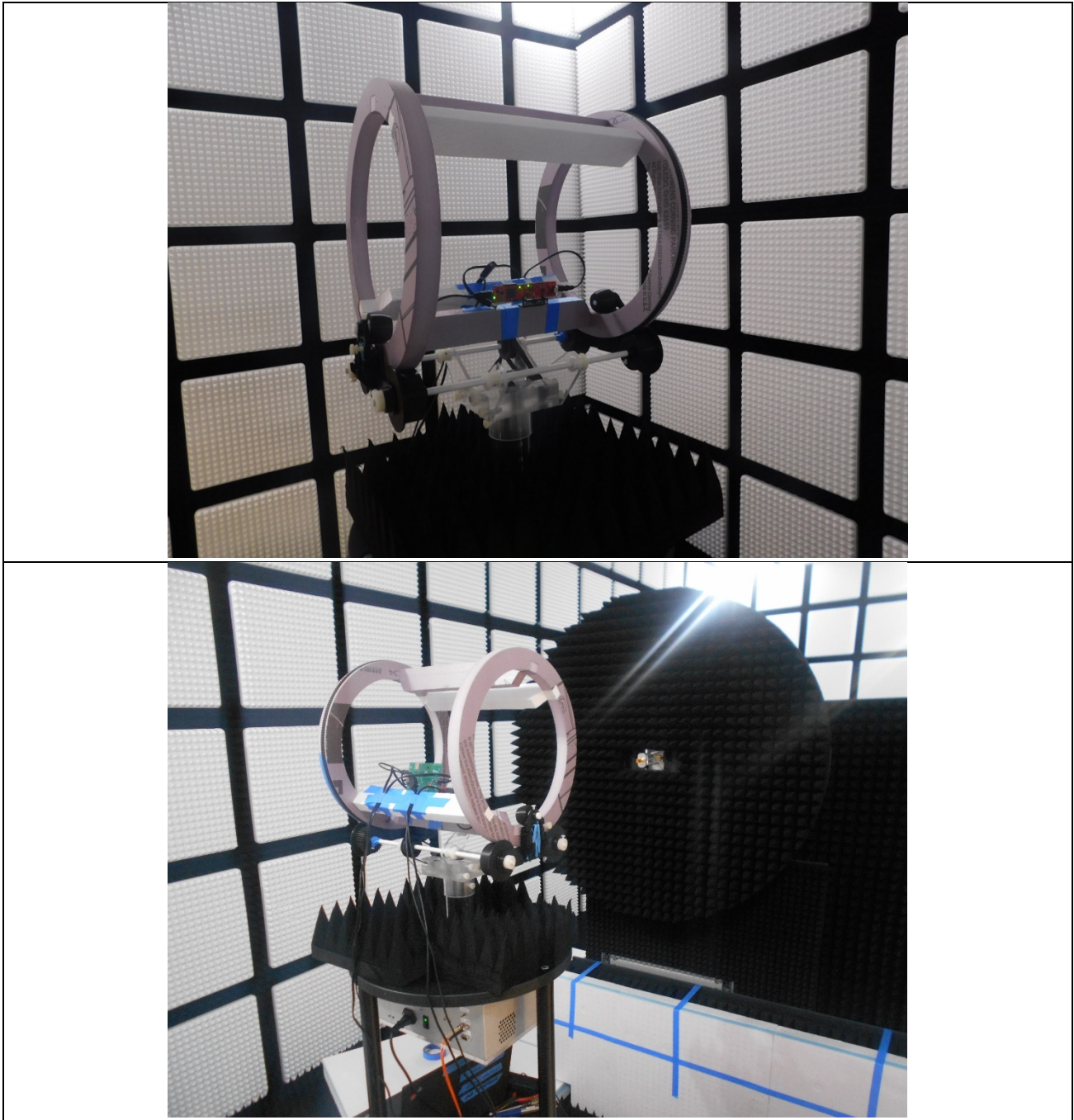


Vertical



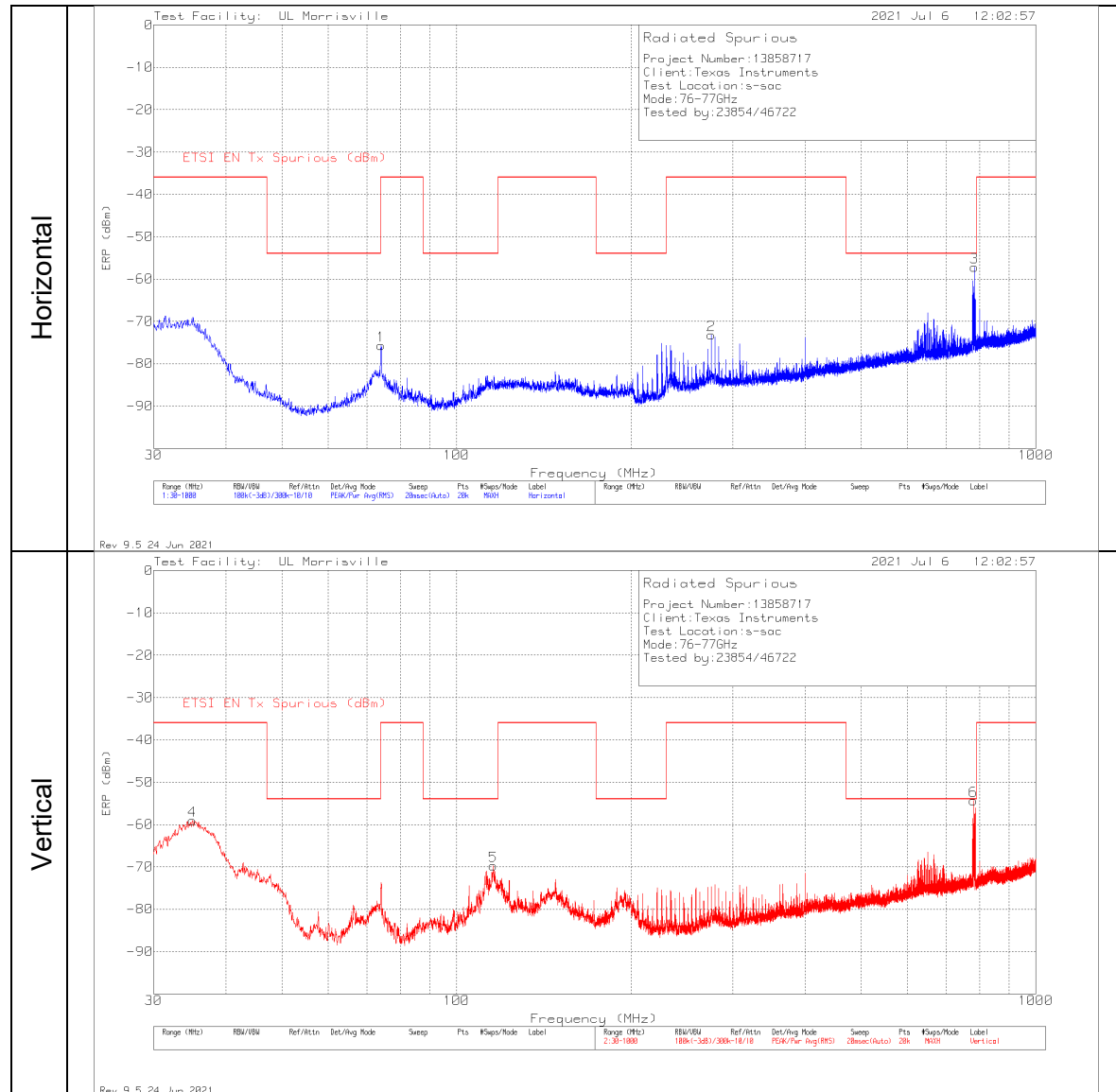
77.1-78.4 GHz SWEEP MODE

9. SETUP PHOTOS



APPENDIX I

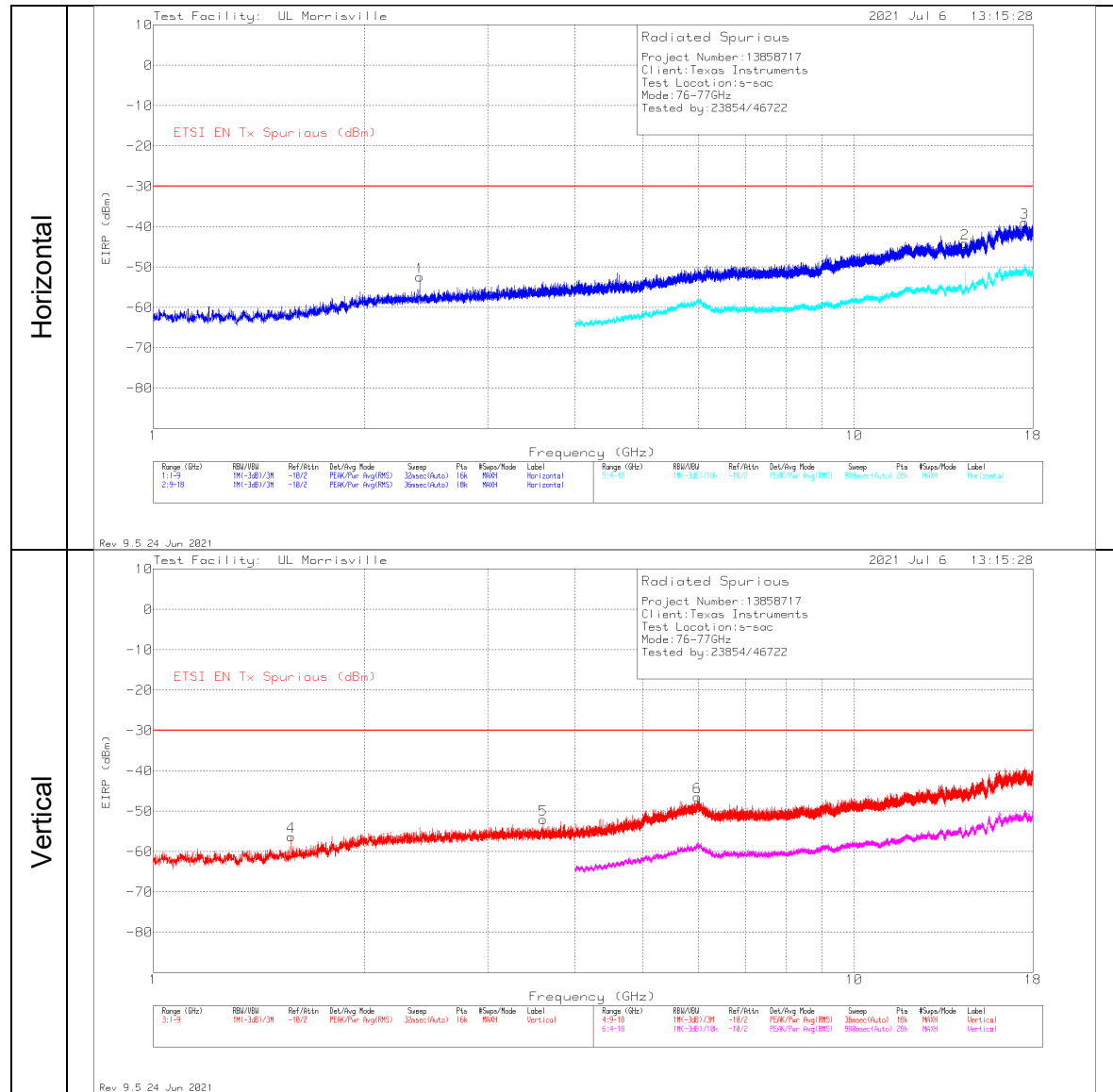
RSE Below 154GHz, 1 MHz Sweep Mode

RADIATED SPURIOUS EMISSIONS BELOW 1 GHz

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	PL (dB)	Corrected Reading ERP (dBm)	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	34.9955	-58.54	Pk	-5	-59.04	-36	-23.04	0-360	101	V
1	74.135	-67.4	PK	-8.3	-75.7	-36	-39.7	0-360	399	H
5	115.651	-69.68	Pk	-1	-69.78	-54	-15.78	0-360	101	V
2	275.313	-70.47	Pk	-2.7	-73.17	-36	-37.17	0-360	100	H
6	780.2465	-87.86	Qp	8.9	-78.96	-54	-24.96	131	102	V
3	782.9148	-87.91	Qp	6.2	-81.71	-54	-27.71	131	319	H

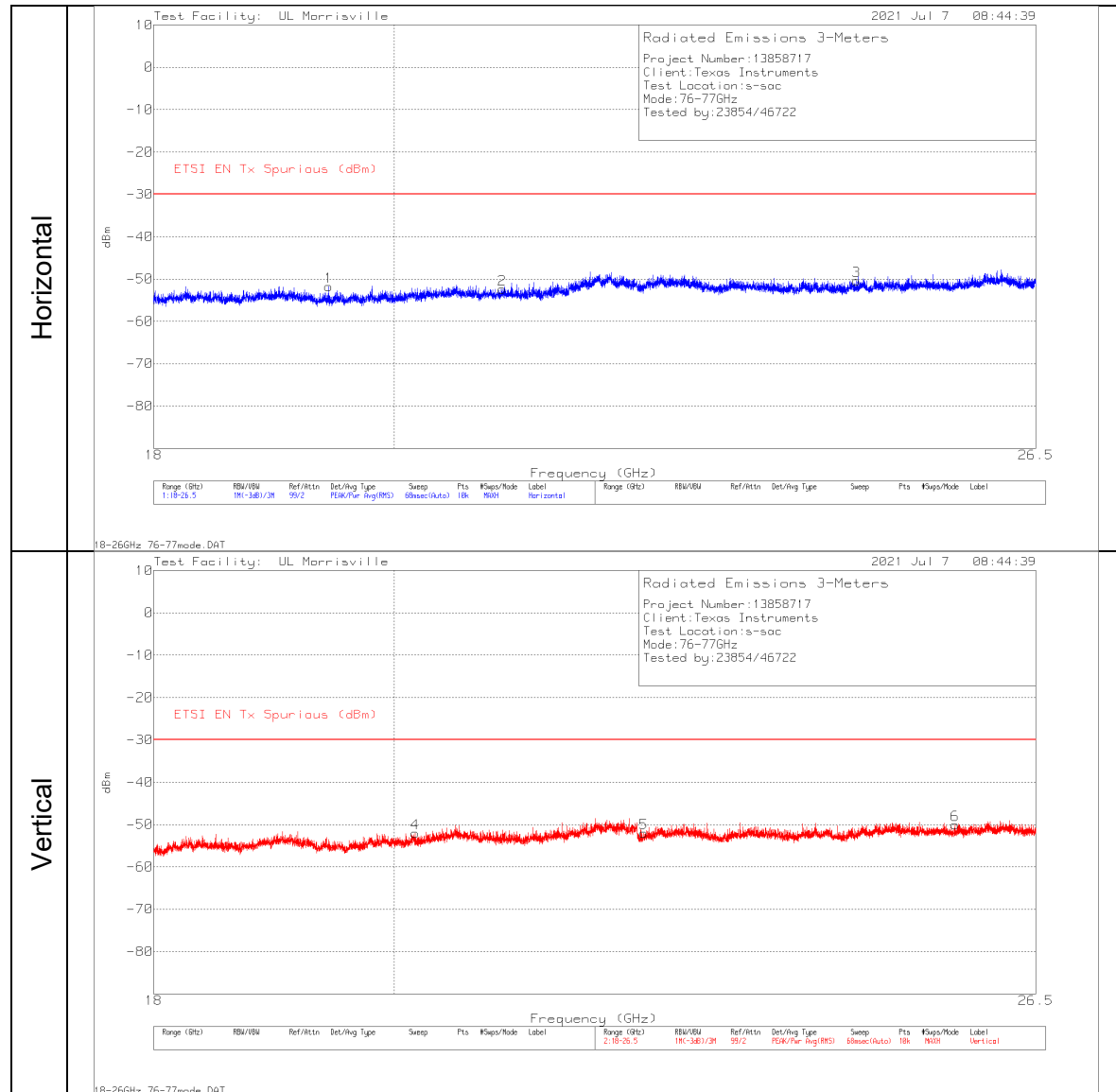
Pk - Peak detector

Qp - Quasi-Peak detector

RADIATED SPURIOUS EMISSIONS 1 – 18 GHz

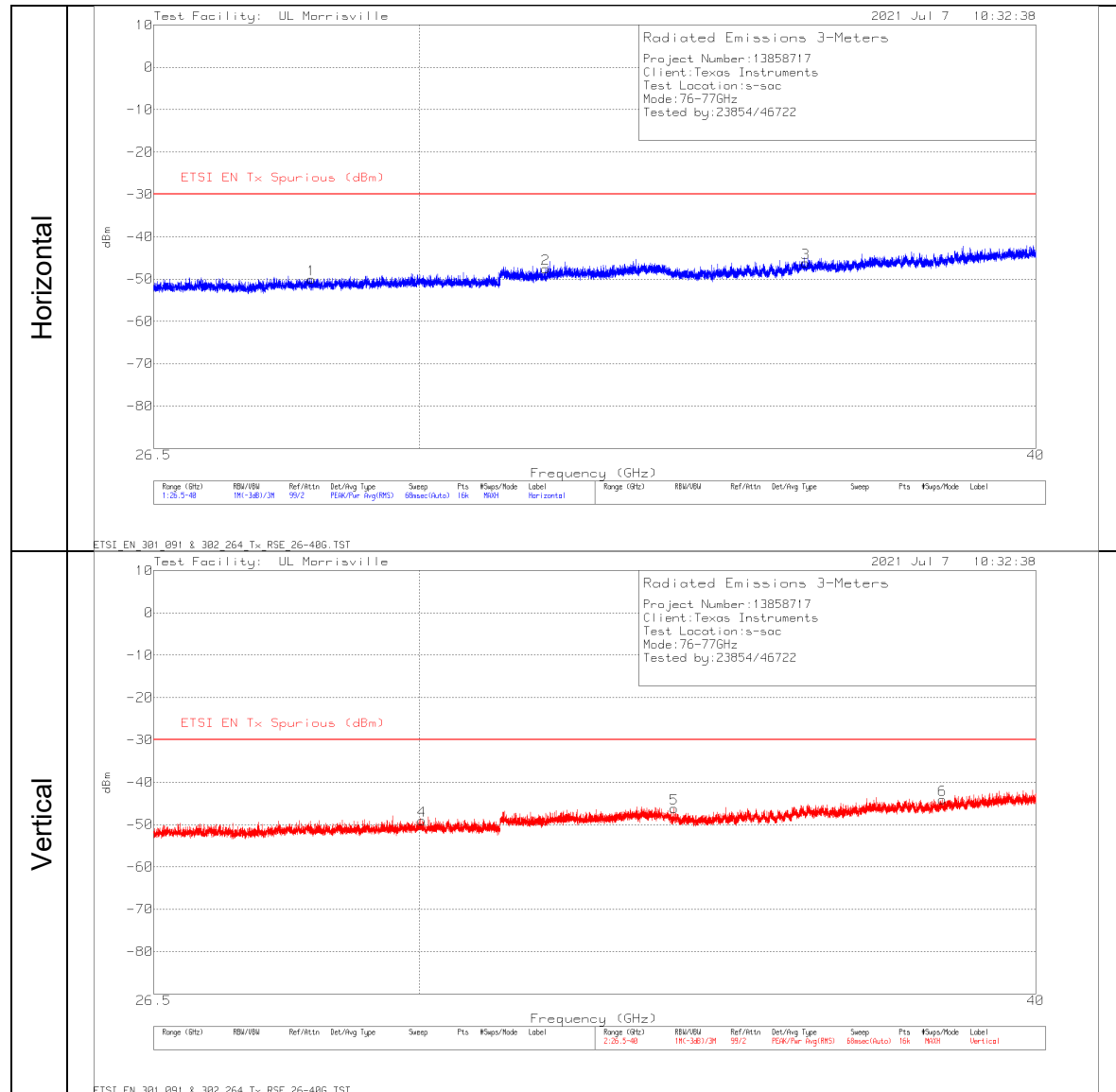
Marker	Frequency (GHz)	Meter Reading (dBm)	Det	PL (dB)	Filter (dB)	Corrected Reading EIRP (dBm)	ETSI EN Tx Spurious (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.39959	-61.31	Pk	8.9	-	-52.41	-30	-22.41	0-360	150	H
4	1.57304	-61.35	Pk	4.9	.2	-56.25	-30	-26.25	0-360	150	V
5	3.60016	-63.97	Pk	11.6	.4	-51.97	-30	-21.97	0-360	150	V
6	5.97781	-66.4	Pk	16.7	3.3	-46.4	-30	-16.4	0-360	199	V
2	14.4008	-70.98	Pk	26.1	.8	-44.08	-30	-14.08	0-360	200	H
3	17.51148	-69.7	Pk	30.2	.6	-38.9	-30	-8.9	0-360	150	H

Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 18 – 26.5 GHz

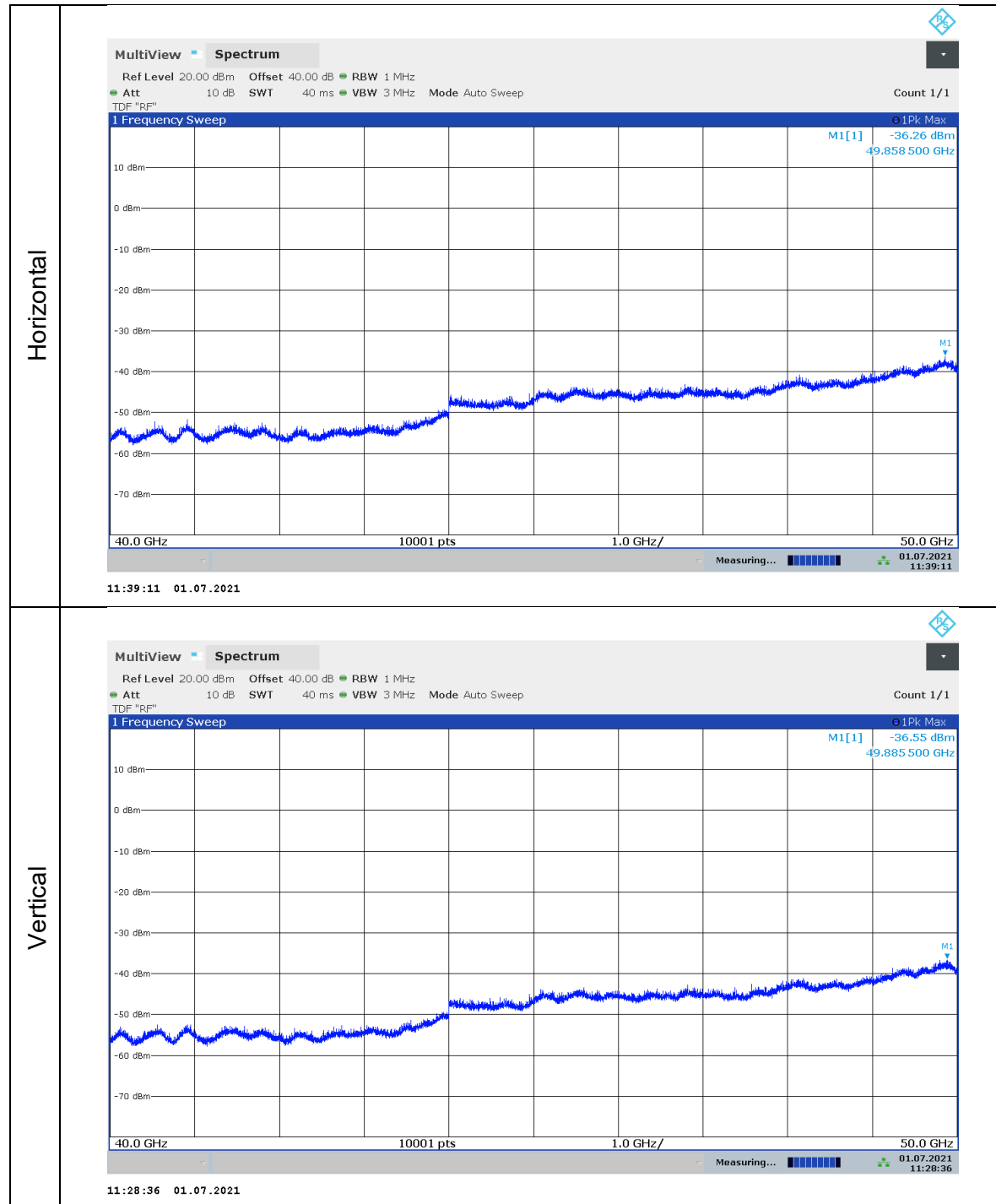
Marker	Frequency (GHz)	Meter Reading (dBUV)	Det	AT006 3 AF (dB/m)	Amp/Cbl (dB)	Conversion to dBm (dB)	Corrected Reading dBm	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	19.43466	49.17	Pk	33.4	-39.2	-95.2	-51.83	-30	-21.83	0-360	199	H
4	20.18853	48.2	Pk	33.8	-38.8	-95.2	-52	-30	-22	0-360	150	V
2	20.97385	47.86	Pk	34.2	-39.3	-95.2	-52.44	-30	-22.44	0-360	149	H
5	22.31672	46.1	Pk	36.5	-39.5	-95.2	-52.1	-30	-22.1	0-360	200	V
3	24.4959	48.16	Pk	35	-38.4	-95.2	-50.44	-30	-20.44	0-360	100	H
6	25.57784	47.68	Pk	35.2	-37.7	-95.2	-50.02	-30	-20.02	0-360	100	V

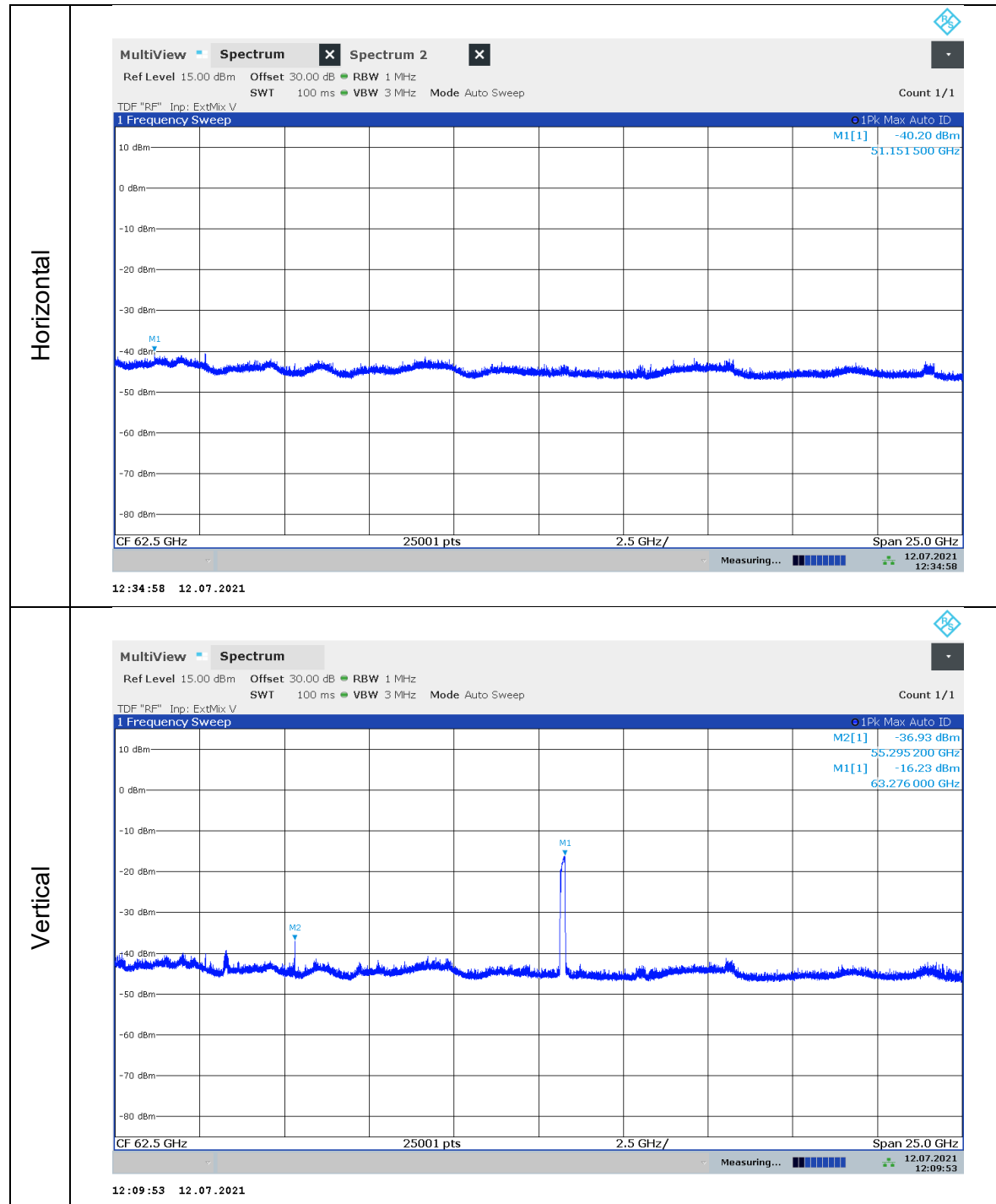
Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 26.5 – 40 GHz

Marker	Frequency (GHz)	Meter Reading (dBUV)	Det	AT006 1 AF (dB/m)	Amp/Cbl (dB)	Conversion to dBm (dB)	Corrected Reading dBm	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarit y
1	28.52656	45.19	Pk	36.2	-36.3	-95.2	-50.11	-30	-20.11	0-360	150	H
4	30.03509	44.89	Pk	36.7	-35.4	-95.2	-49.01	-30	-19.01	0-360	200	V
2	31.82204	46.54	Pk	36.8	-35.7	-95.2	-47.56	-30	-17.56	0-360	199	H
5	33.78701	48.09	Pk	37.1	-36.2	-95.2	-46.21	-30	-16.21	0-360	150	V
3	35.92663	48.81	Pk	38.2	-38	-95.2	-46.19	-30	-16.19	0-360	100	H
6	38.2932	50.33	Pk	38.3	-37.5	-95.2	-44.07	-30	-14.07	0-360	150	V

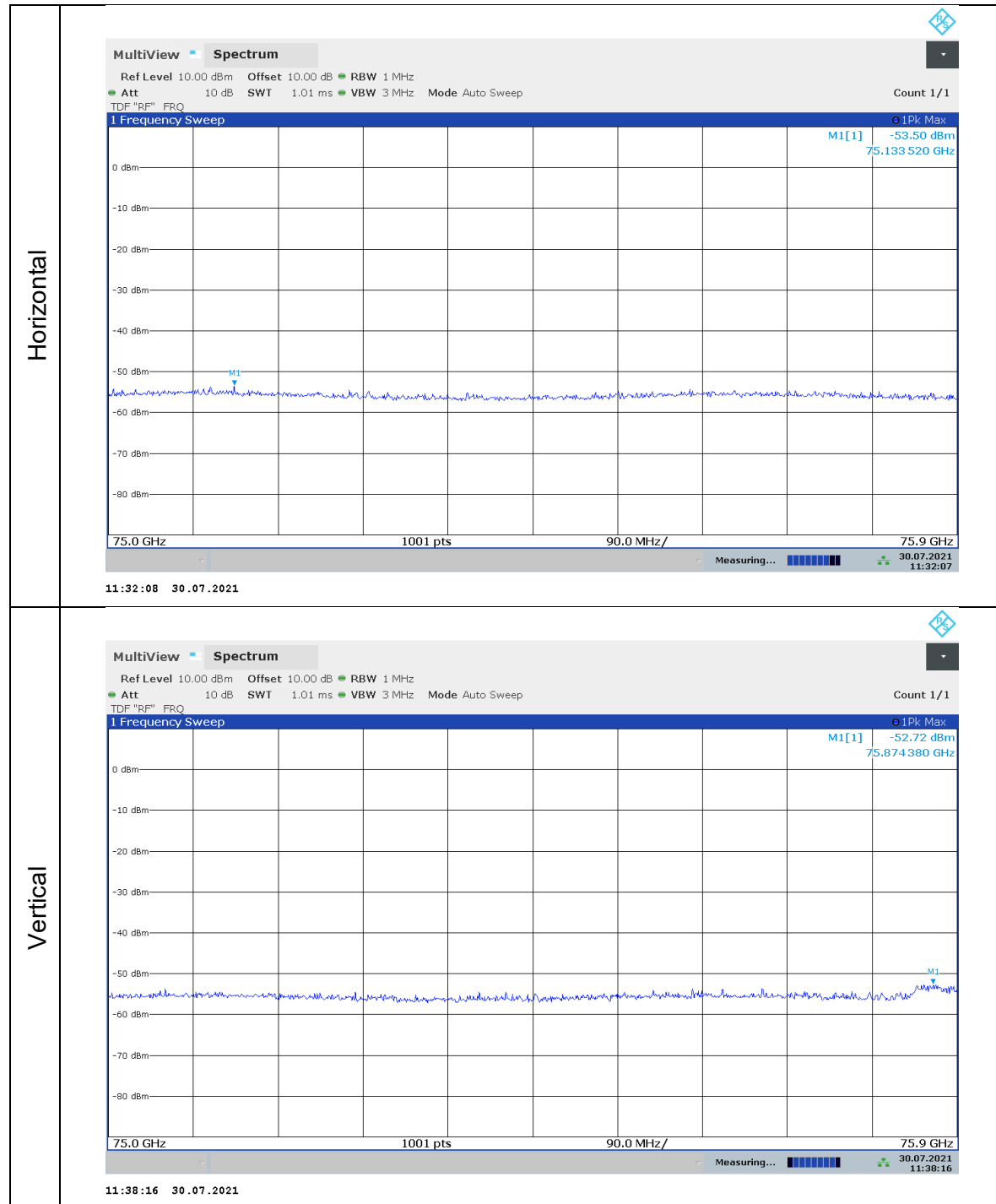
Pk - Peak detector

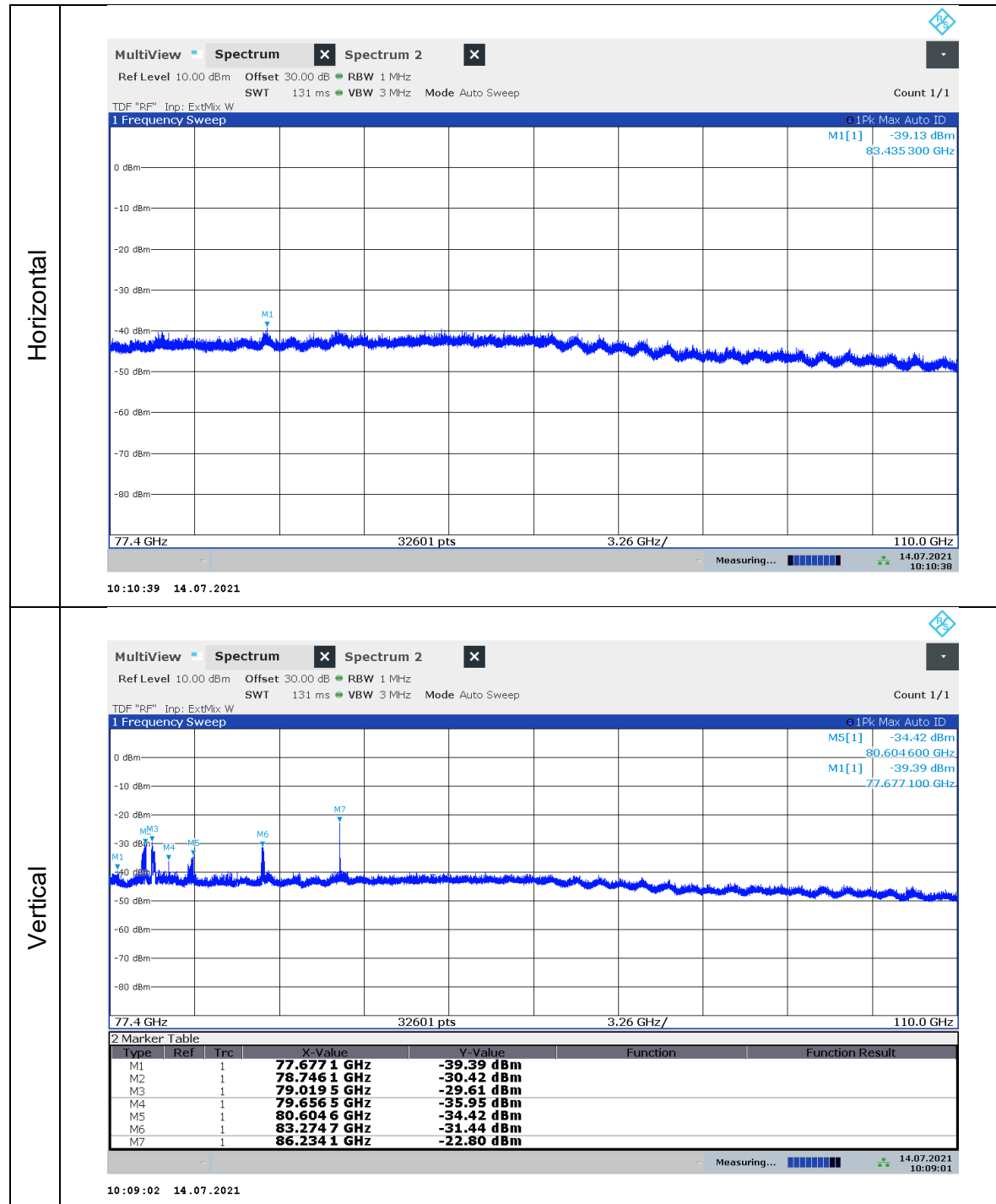
RADIATED SPURIOUS EMISSIONS 40 – 50 GHz

RADIATED SPURIOUS EMISSIONS 50 – 75 GHz

Frequency (GHz)	Detector	Polarity	Avg Pwr (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
63.280	RMS	Vert	-37.05	-30	-7.05

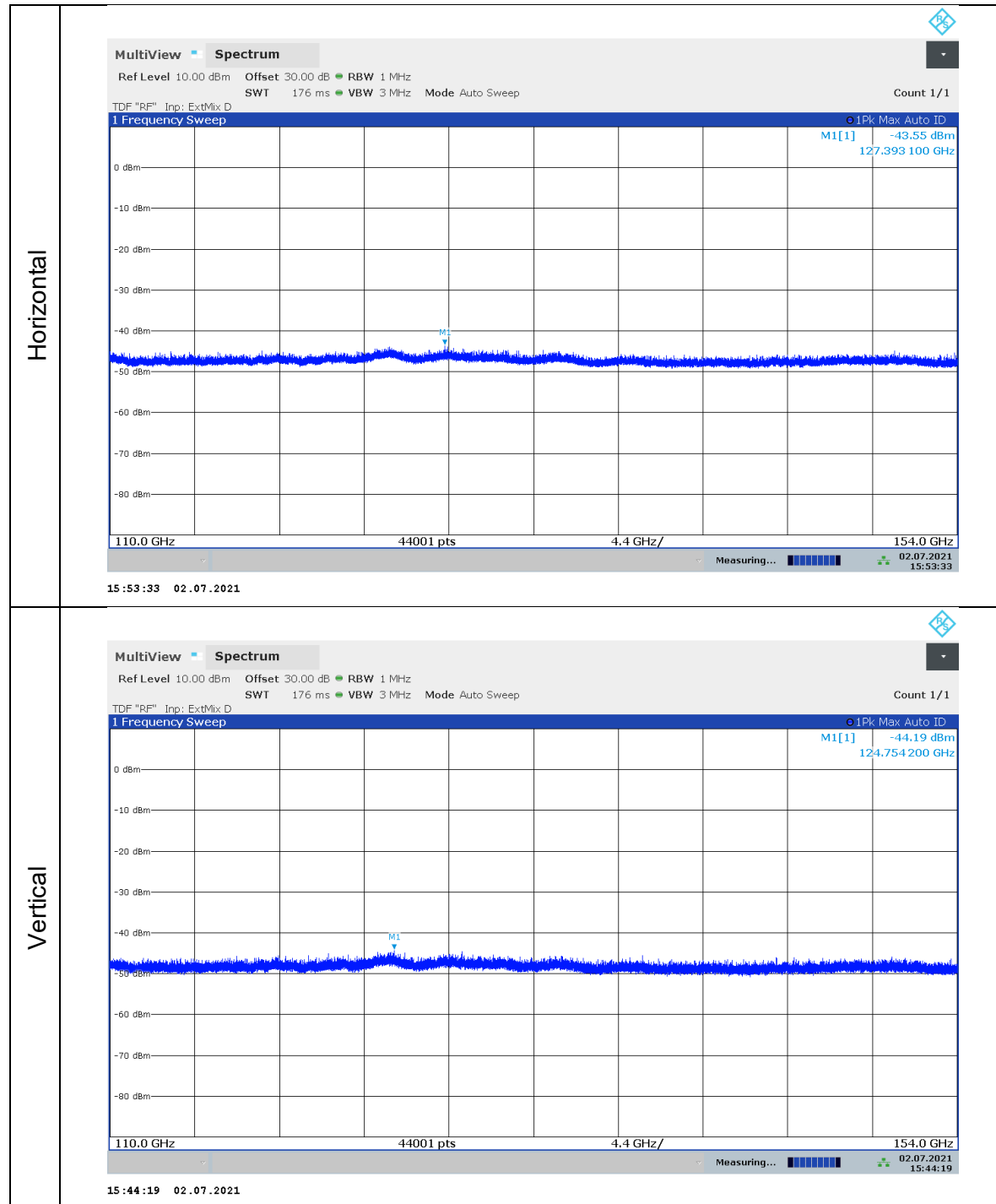
NOTE: Observed vertically polarized emissions are believed to be due to image frequencies of the fundamental, however the average levels comply with the limits of the standard.

RADIATED SPURIOUS EMISSIONS 75 – 75.9 GHz

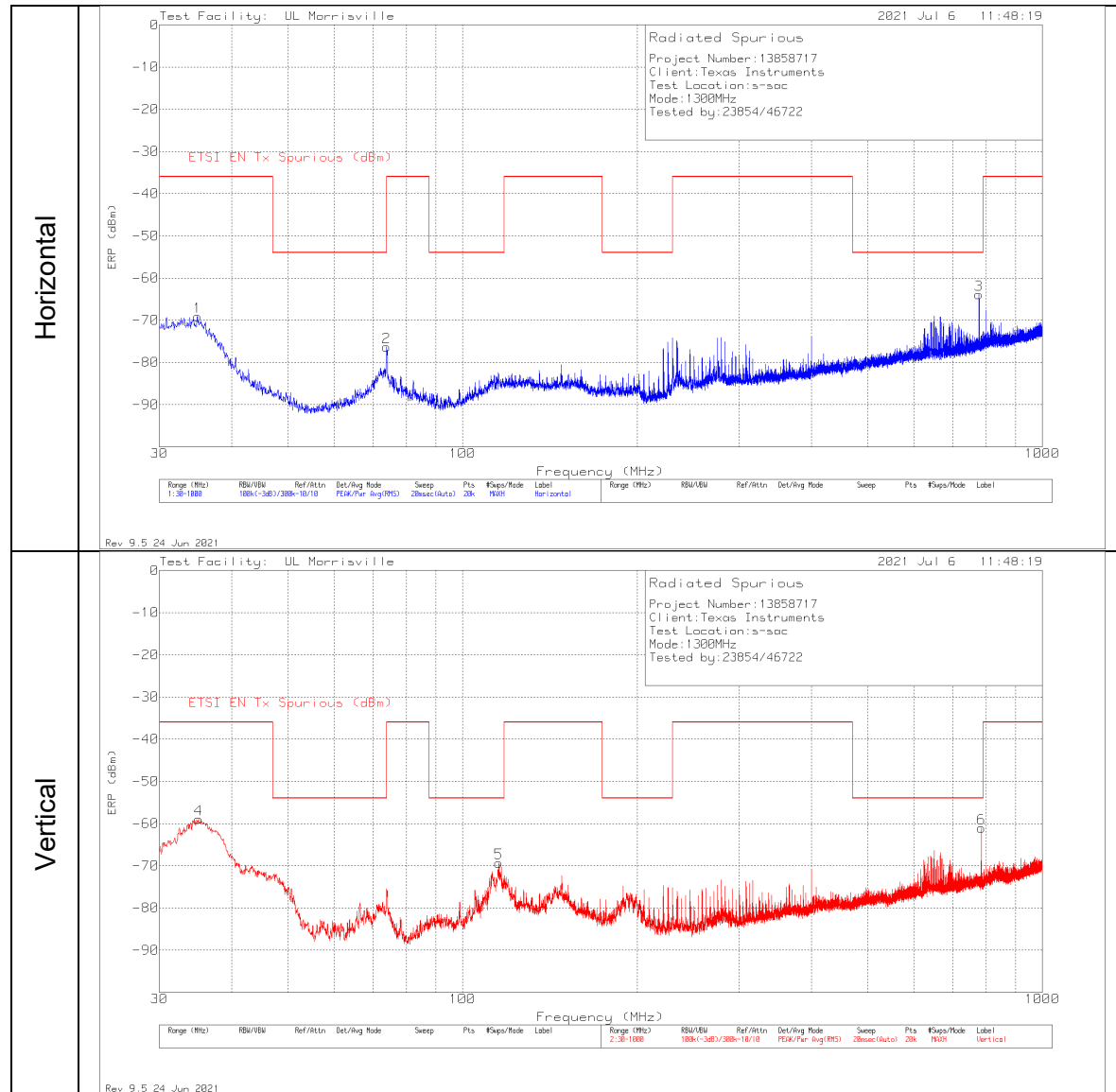
RADIATED SPURIOUS EMISSIONS 77.4 – 110 GHz

Frequency (GHz)	Detector	Polarity	Avg Pwr (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
77.676	RMS	Vert	-53.41	-30	-23.41
78.762	RMS	Vert	-52.01	-30	-22.01
79.015	RMS	Vert	-52.11	-30	-22.11
79.648	RMS	Vert	-51.20	-30	-21.20
80.611	RMS	Vert	-54.06	-30	-24.06
83.254	RMS	Vert	-53.33	-30	-23.33
86.235	RMS	Vert	-44.98	-30	-14.98

NOTE: Observed vertically polarized emissions are believed to be due to image frequencies of the fundamental, however the average levels comply with the limits of the standard.

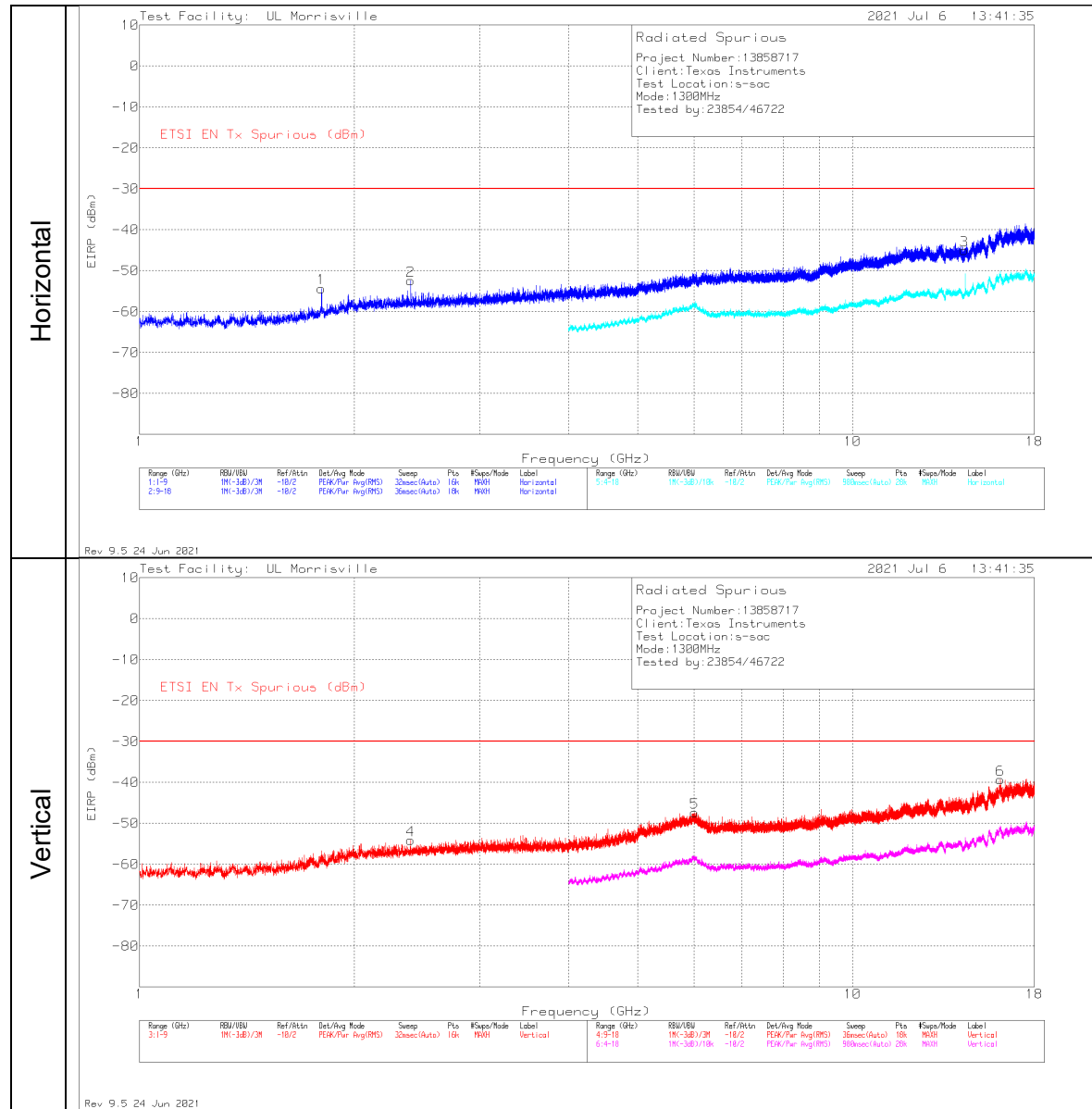
RADIATED SPURIOUS EMISSIONS 110 – 154 GHz

RSE Below 162GHz, 1300 MHz Sweep Mode

RADIATED SPURIOUS EMISSIONS BELOW 1 GHz

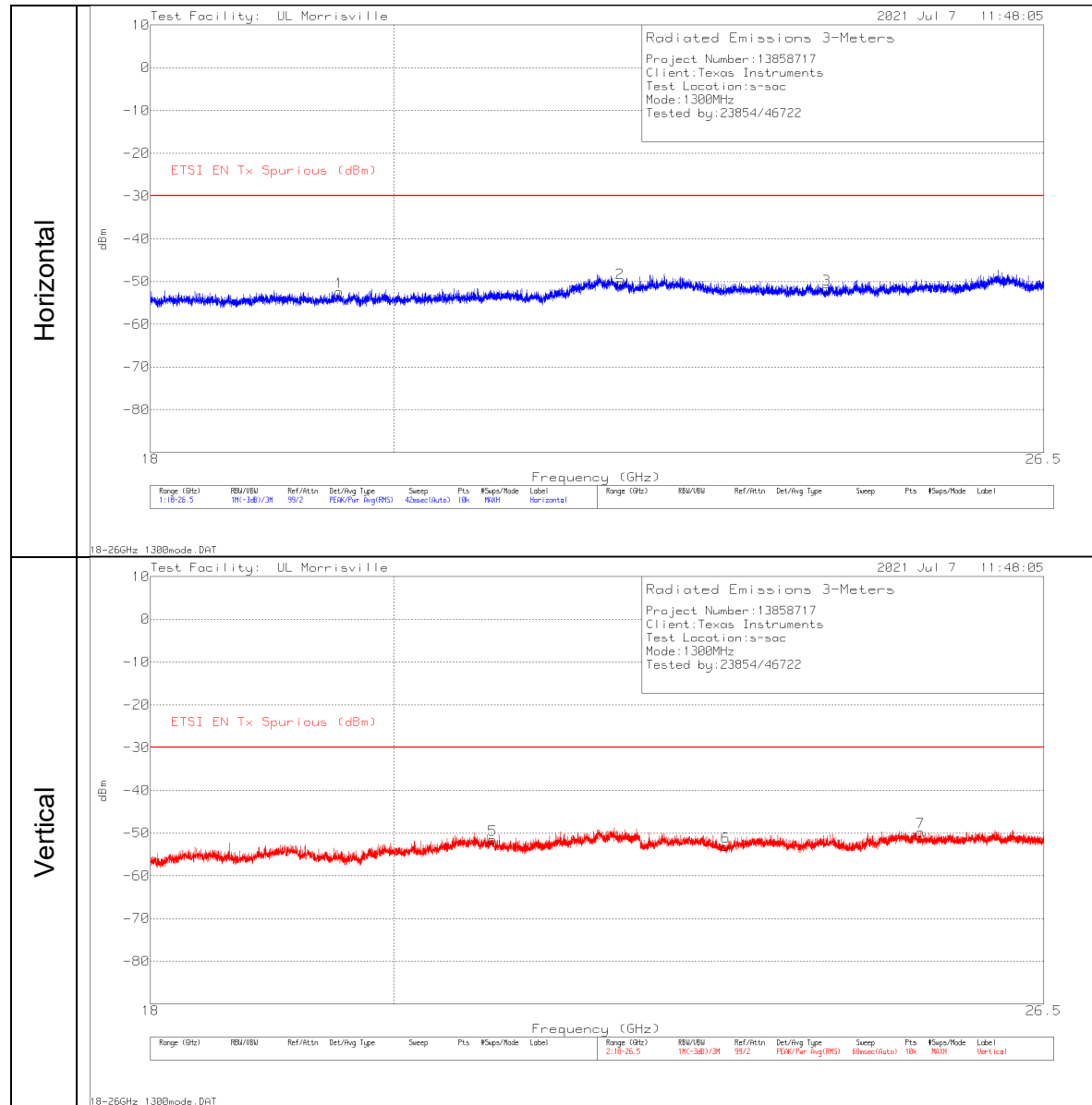
Marker	Frequency (MHz)	Meter Reading (dBm)	Det	PL (dB)	Corrected Reading ERP (dBm)	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	34.8985	-72.07	Pk	3	-69.07	-36	-33.07	0-360	299	H
4	35.044	-58.39	Pk	-5	-58.89	-36	-22.89	0-360	101	V
2	73.941	-68.06	Pk	-8.3	-76.36	-54	-22.36	0-360	199	H
5	115.554	-69.21	Pk	-1	-69.31	-54	-15.31	0-360	101	V
3	777.87	-70.1	Pk	6.2	-63.9	-54	-9.9	0-360	199	H
6	785.1935	-69.71	Pk	8.7	-61.01	-54	-7.01	0-360	101	V

Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 1 – 18 GHz

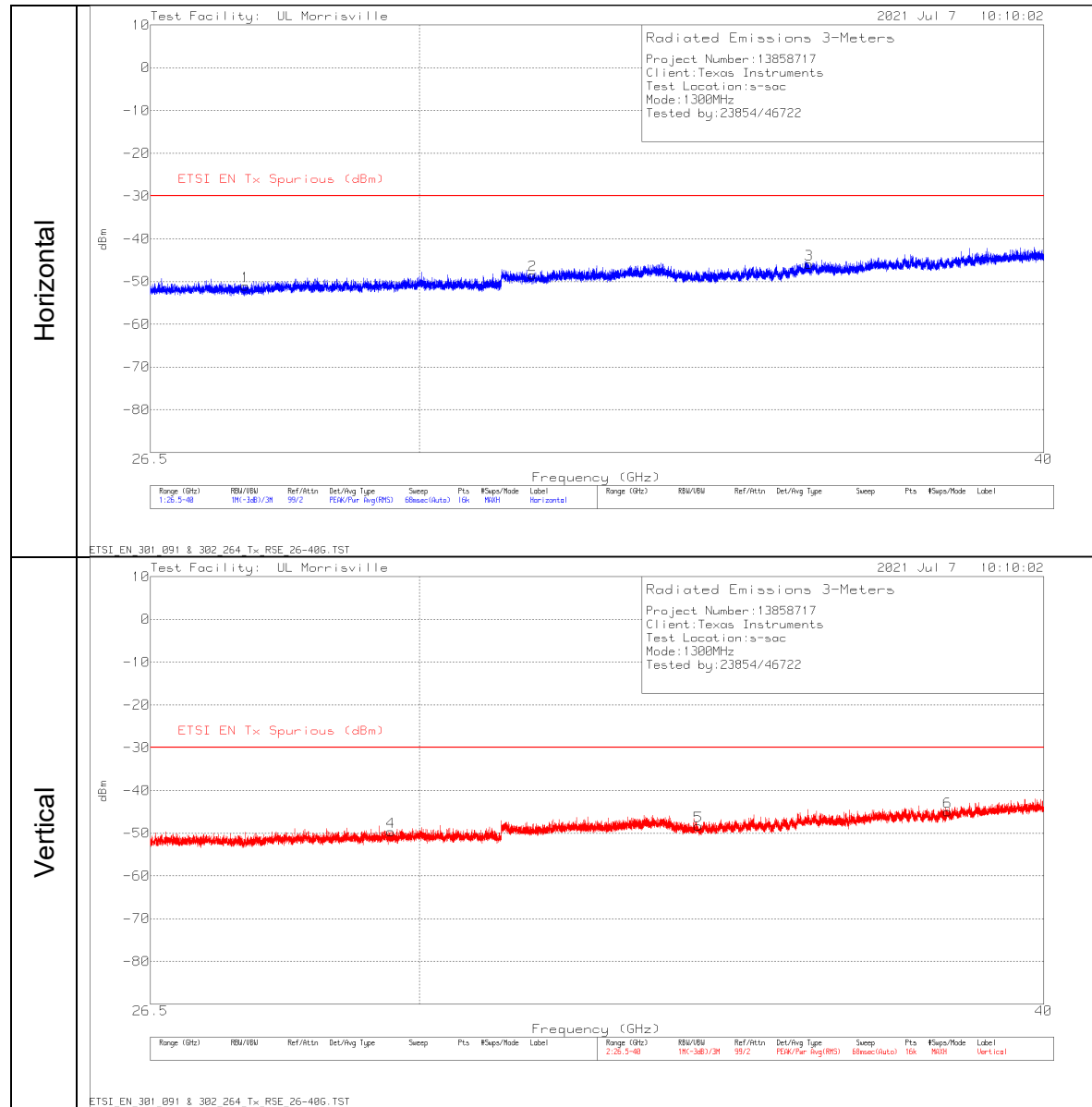
Marker	Frequency (GHz)	Meter Reading (dBm)	Det	PL (dB)	Filter (dB)	Corrected Reading EIRP (dBm)	ETSI EN Tx Spurious (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	2.40009	-64.02	Pk	9.5	.4	-54.12	-30	-24.12	0-360	200	V
5	6.00981	-67.41	Pk	16.8	3.3	-47.31	-30	-17.31	0-360	200	V
3	14.3538	-71.86	Pk	26	.8	-45.06	-30	-15.06	0-360	200	H
6	16.1259	-68.56	Pk	28.5	.7	-39.36	-30	-9.36	0-360	150	V
1	1.80005	-60.6	Pk	6.3	0	-54.3	-30	-24.3	0-360	200	H
2	2.39959	-61.31	Pk	8.9	0	-52.41	-30	-22.41	0-360	150	H

Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 18 – 26.5 GHz

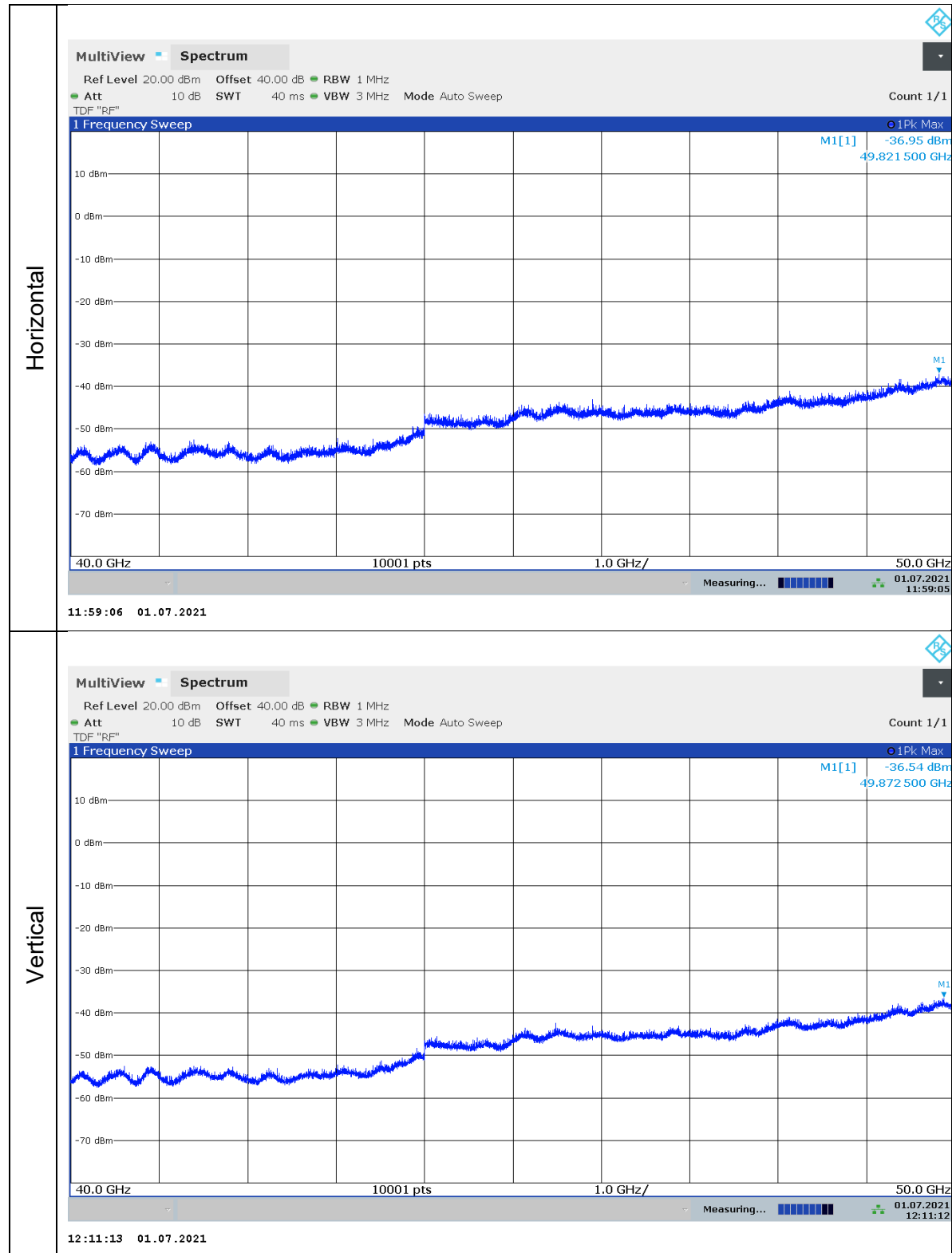
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT006 3 AF (dB/m)	Amp/Cbl (dB)	Conversion to dBm (dB)	Corrected Reading dBm	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarization
1	19.5341	48.22	Pk	33.5	-38.9	-95.2	-52.38	-30	-22.38	0-360	150	H
5	20.87696	48.75	Pk	34.1	-39.2	-95.2	-51.55	-30	-21.55	0-360	150	V
2	22.05919	47.32	Pk	36.9	-39.3	-95.2	-50.28	-30	-20.28	0-360	200	H
6	23.09354	46.17	Pk	35	-39.1	-95.2	-53.13	-30	-23.13	0-360	200	V
3	24.12449	47.08	Pk	34.8	-38.5	-95.2	-51.82	-30	-21.82	0-360	150	H
7	25.12399	48.05	Pk	35.3	-38	-95.2	-49.85	-30	-19.85	0-360	200	V

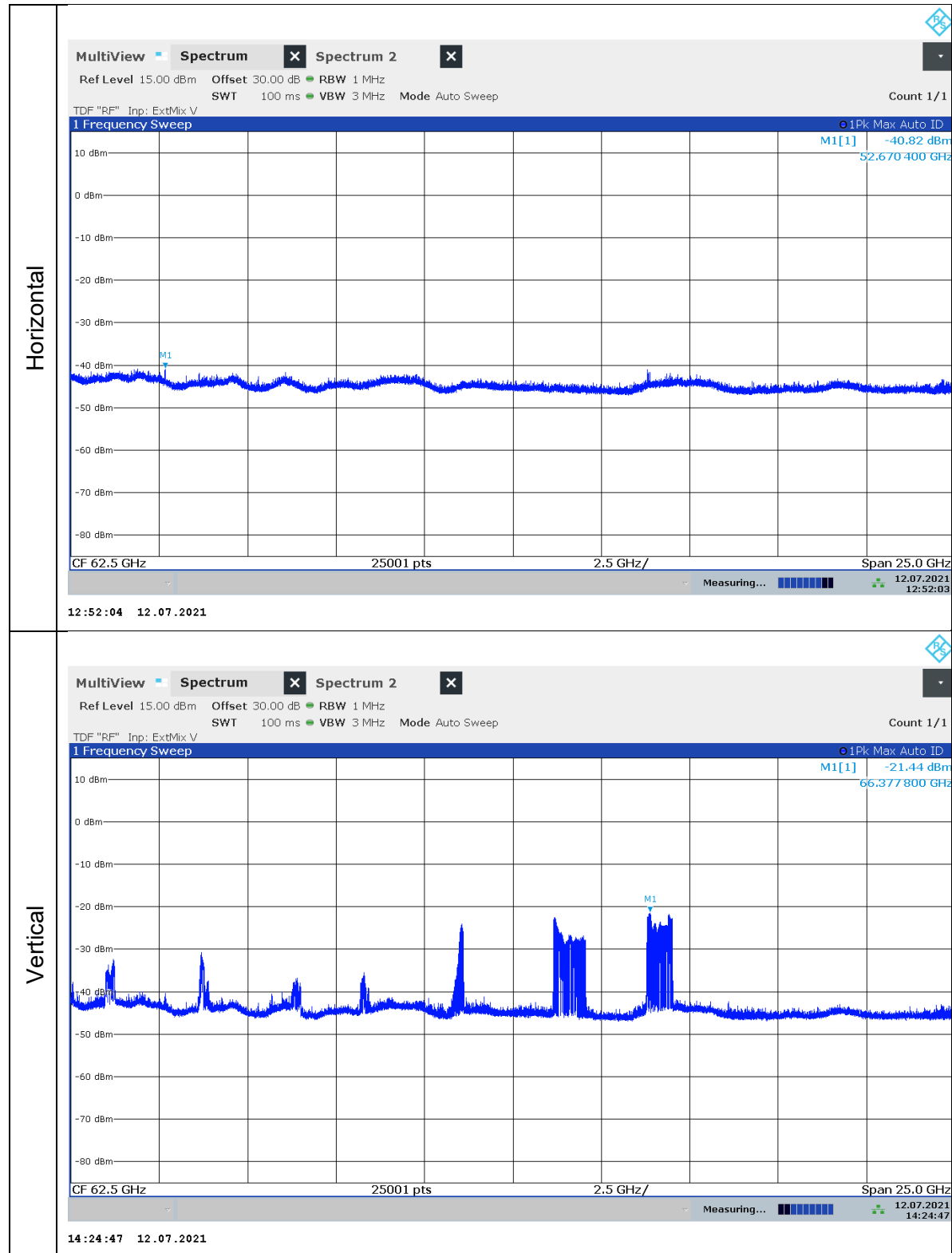
Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 26.5 – 40 GHz

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 AF (dB/m)	Amp/Cbl (dB)	Conversion to dBm (dB)	Corrected Reading dBm	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	27.68371	45.16	Pk	35.7	-36.7	-95.2	-51.04	-30	-21.04	0-360	100	H
4	29.60734	44.78	Pk	36.2	-35.5	-95.2	-49.72	-30	-19.72	0-360	149	V
2	31.60268	45.14	Pk	36.9	-35.3	-95.2	-48.46	-30	-18.46	0-360	199	H
5	34.11437	46.89	Pk	37.2	-37.2	-95.2	-48.31	-30	-18.31	0-360	199	V
3	35.903	48.89	Pk	38.2	-37.9	-95.2	-46.01	-30	-16.01	0-360	150	H
6	38.26367	49.27	Pk	38.3	-37.3	-95.2	-44.93	-30	-14.93	0-360	100	V

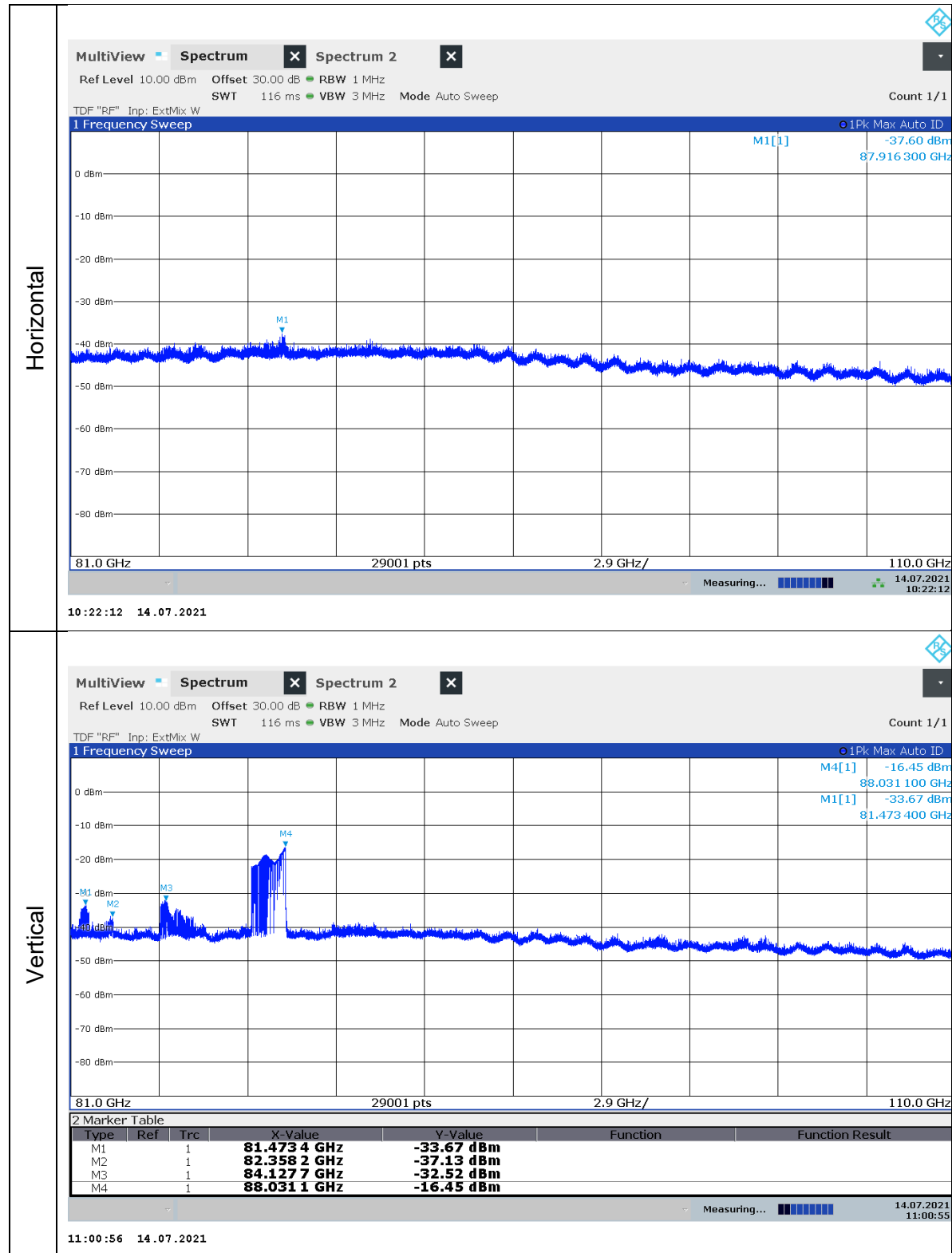
Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 40 – 50 GHz

RADIATED SPURIOUS EMISSIONS 50 – 75 GHz

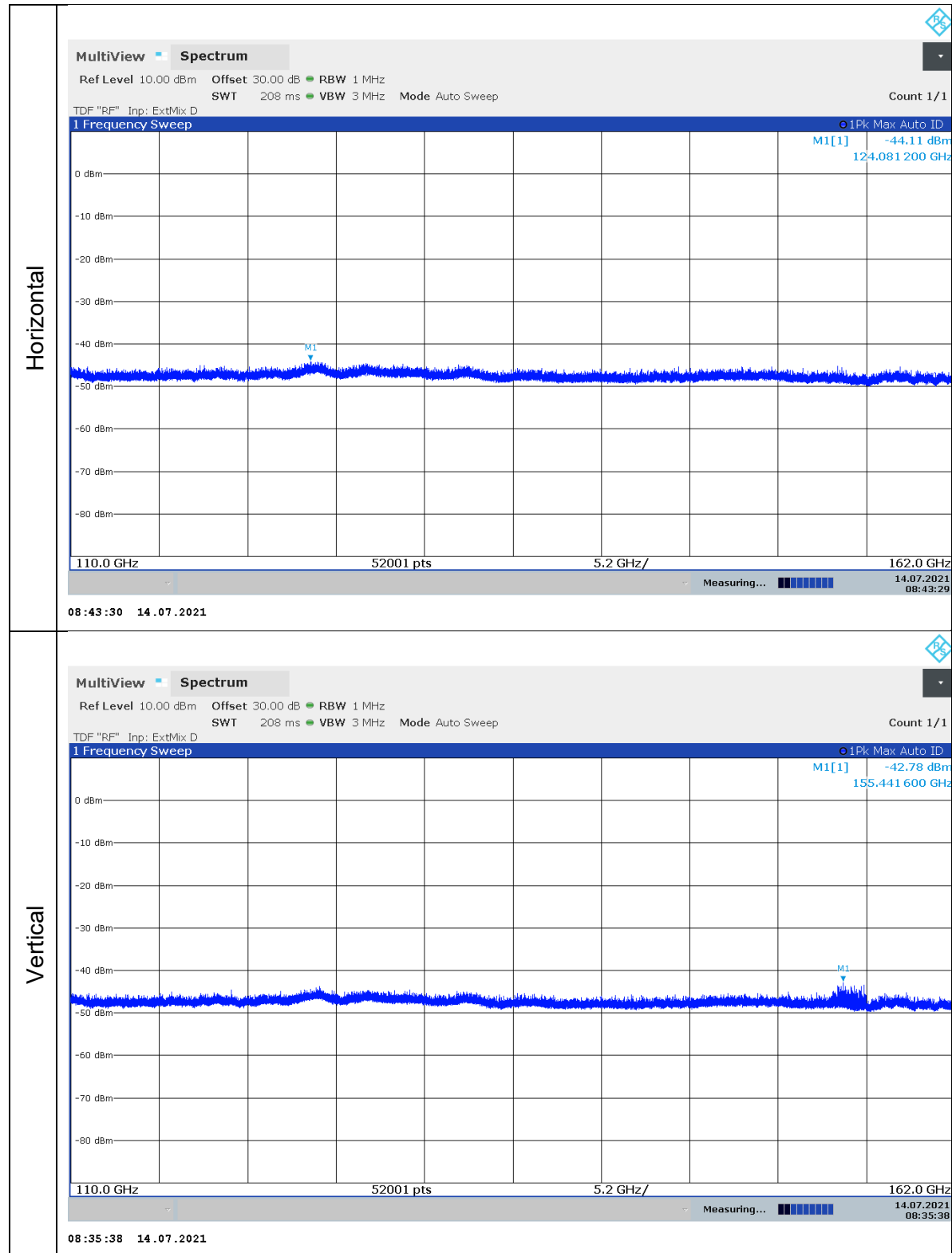
Frequency (GHz)	Detector	Polarity	Avg Pwr (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
66.379	RMS	Vert	-41.00	-30	-11.00
63.679	RMS	Vert	-44.66	-30	-14.66
61.048	RMS	Vert	-46.44	-30	-16.44
53.691	RMS	Vert	-51.85	-30	-21.85
51.206	RMS	Vert	-50.99	-30	-20.99

NOTE: Observed vertically polarized emissions are believed to be due to image frequencies of the fundamental, however the average levels comply with the limits of the standard.

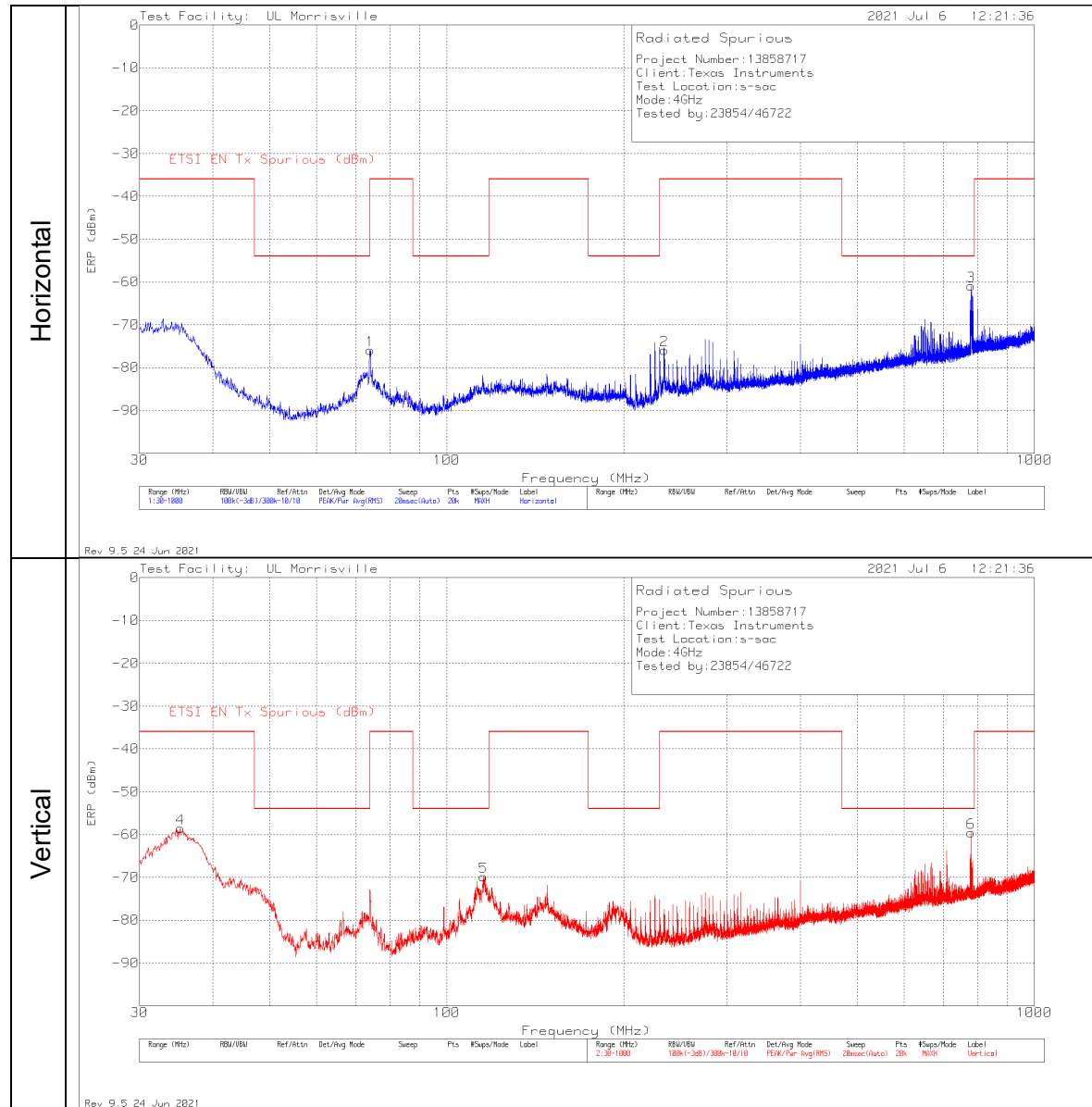
RADIATED SPURIOUS EMISSIONS 81 – 110 GHz

Frequency (GHz)	Detector	Polarity	Avg Pwr (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
81.513	RMS	Vert	-53.73	-30	-23.73
82.386	RMS	Vert	-54.83	-30	-24.83
84.475	RMS	Vert	-54.34	-30	-24.34
88.033	RMS	Vert	-45.00	-30	-15.00

NOTE: Observed vertically polarized emissions are believed to be due to image frequencies of the fundamental, however the average levels comply with the limits of the standard.

RADIATED SPURIOUS EMISSIONS 110 – 162 GHz

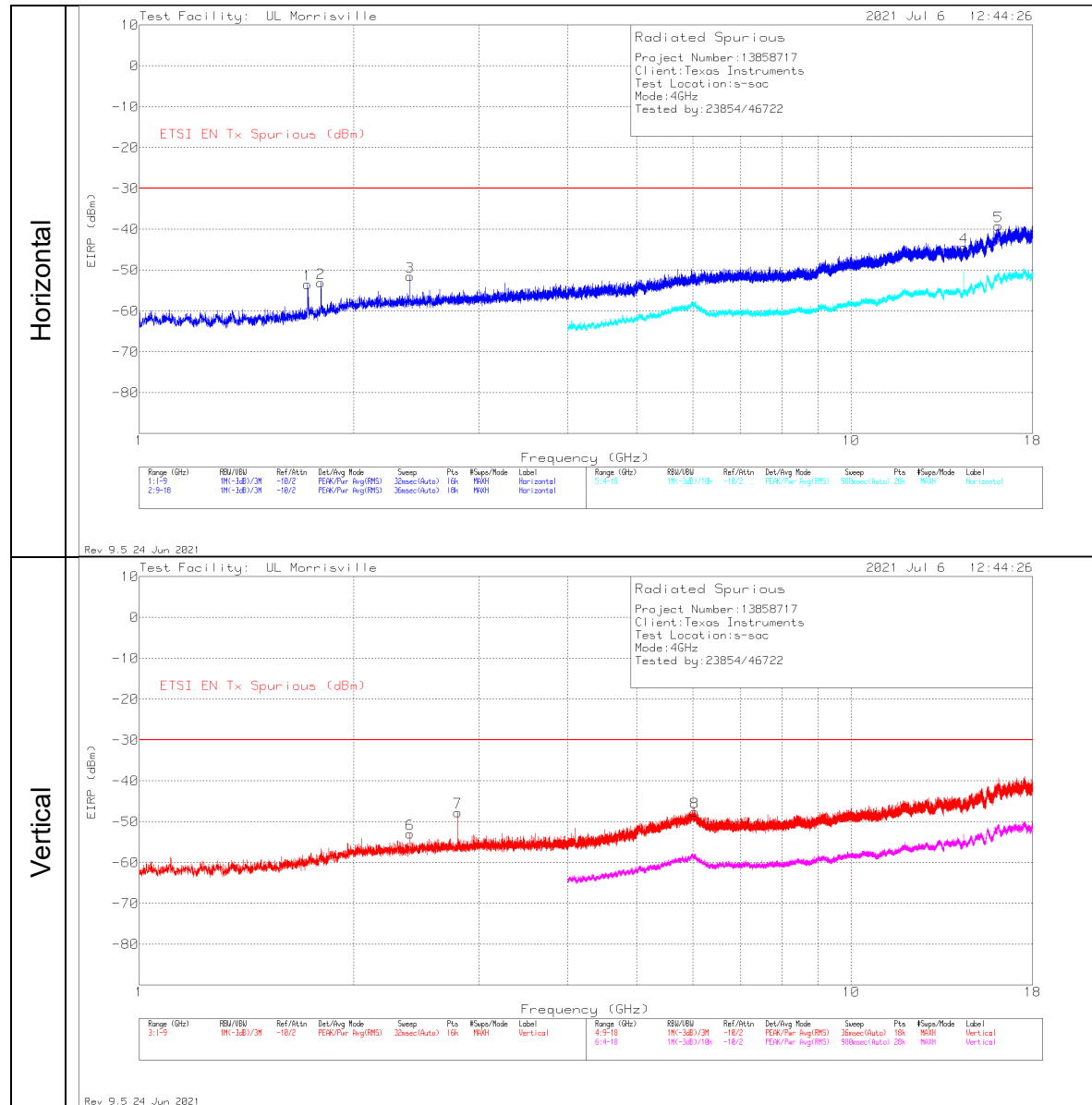
RSE Below 162GHz, 4 GHz Sweep Mode

RADIATED SPURIOUS EMISSIONS BELOW 1 GHz

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	PL (dB)	Corrected Reading ERP (dBm)	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	35.1895	-58.02	Pk	-6	-58.62	-36	-22.62	0-360	101	V
1	74.135	-67.68	Pk	-8.3	-75.98	-36	-39.98	0-360	299	H
5	115.36	-69.7	Pk	-2	-69.9	-54	-15.9	0-360	101	V
2	234.282	-70.69	Pk	-5.3	-75.99	-36	-39.99	0-360	99	H
6	780.1272	-82.6	Qp	8.9	-73.7	-54	-19.7	101	106	V
3	780.489	-67.2	Pk	6.3	-60.9	-54	-6.9	0-360	299	H

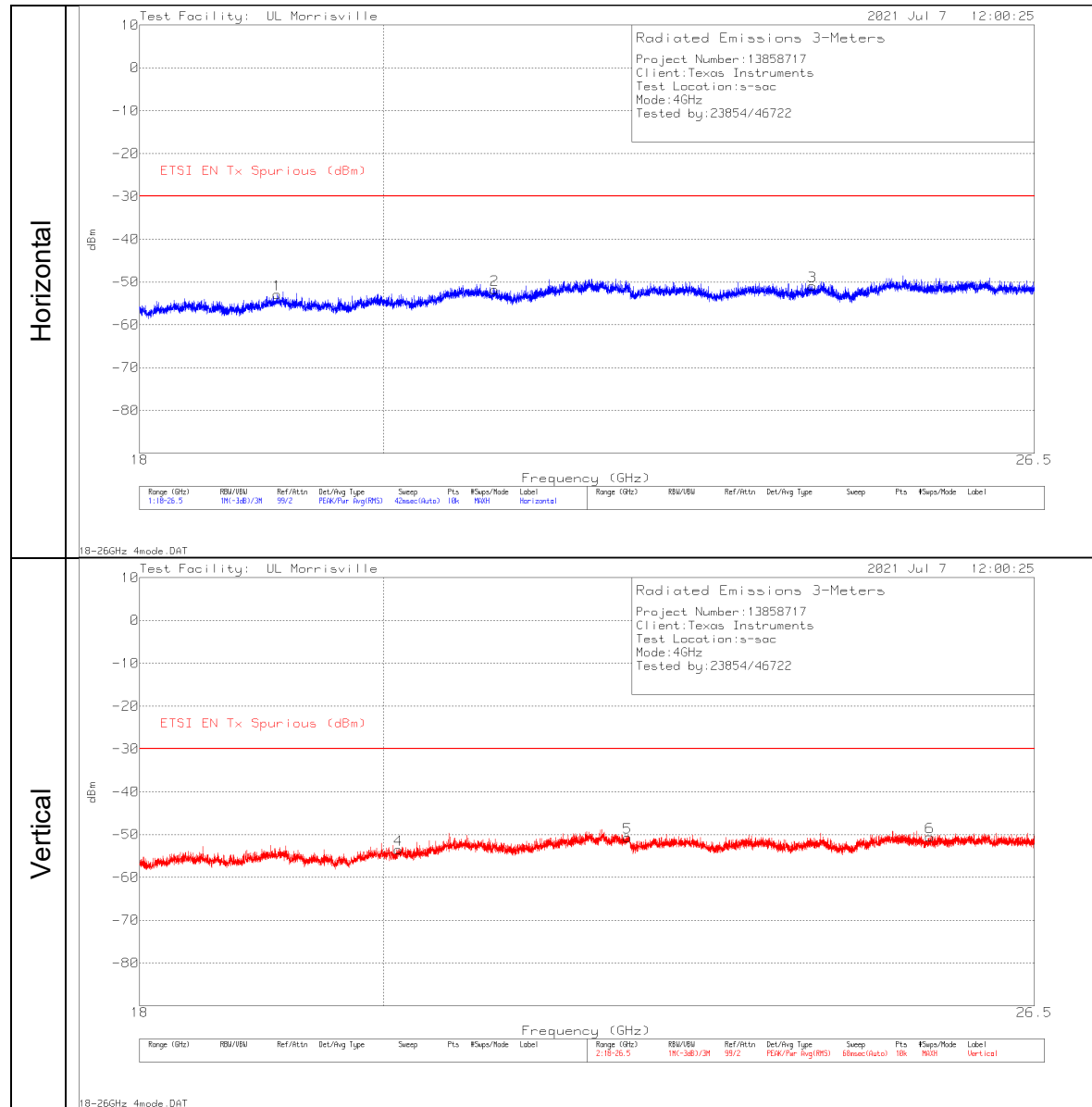
Pk - Peak detector

Qp - Quasi-Peak detector

RADIATED SPURIOUS EMISSIONS 1 – 18 GHz

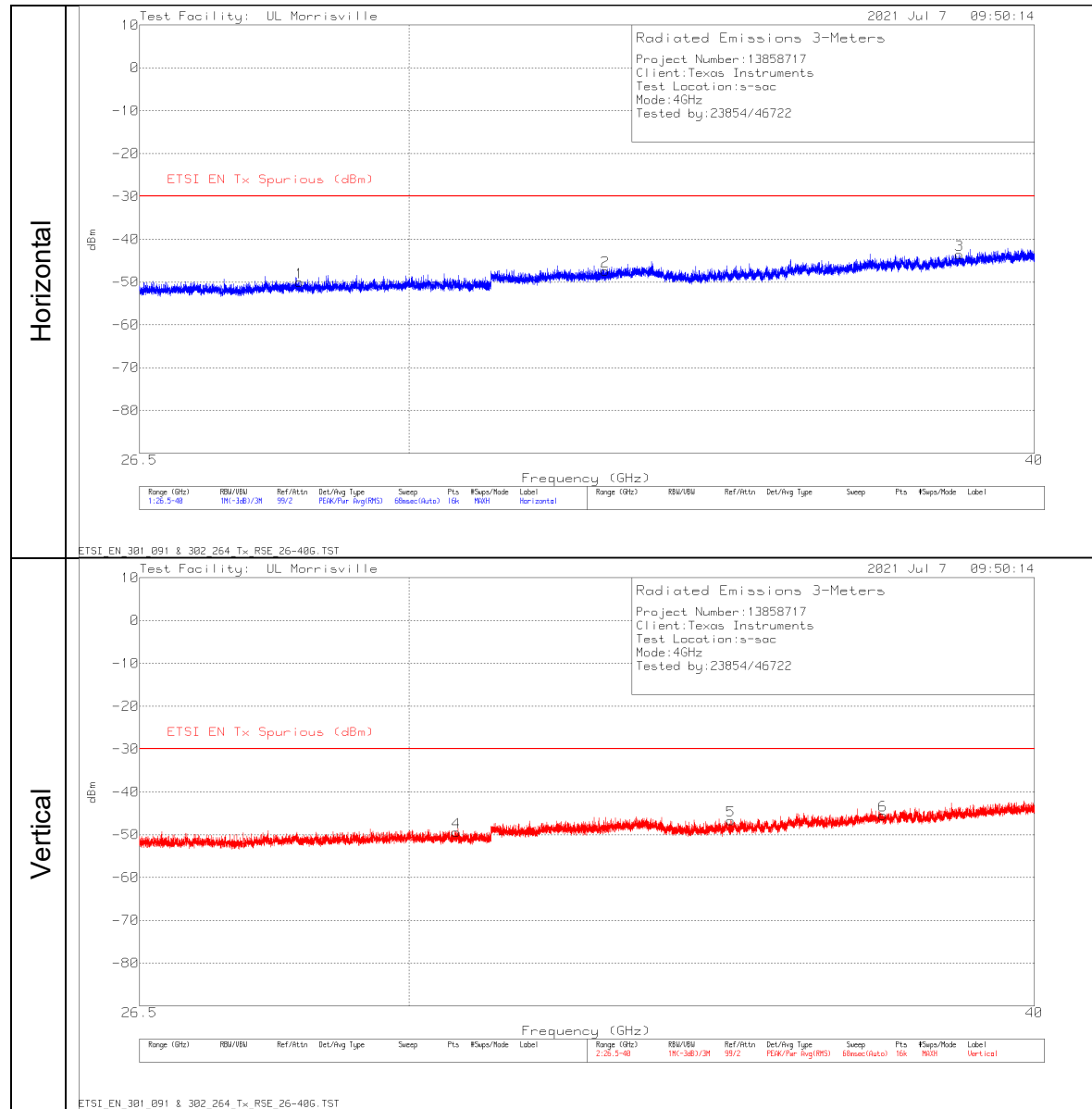
Marker	Frequency (GHz)	Meter Reading (dBm)	Det	PL (dB)	Filter (dB)	Corrected Reading EIRP (dBm)	ETSI EN Tx Spurious (dBm)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	2.40009	-62.85	Pk	9.5	.4	-52.95	-30	-22.95	0-360	150	V
7	2.80011	-58.38	Pk	10.3	.4	-47.68	-30	-17.68	0-360	150	V
8	6.03231	-67.84	Pk	16.9	3.3	-47.64	-30	-17.64	0-360	150	V
4	14.4243	-71.33	Pk	26.1	.8	-44.43	-30	-14.43	0-360	150	H
5	16.1114	-68.67	Pk	28.8	.7	-39.17	-30	-9.17	0-360	200	H
1	1.72354	-59.09	Pk	5.6	0	-53.49	-30	-23.49	0-360	200	H
2	1.79955	-59.4	Pk	6.3	0	-53.1	-30	-23.1	0-360	200	H
3	2.40009	-60.38	Pk	8.9	0	-51.48	-30	-21.48	0-360	150	H

Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 18 – 26.5 GHz

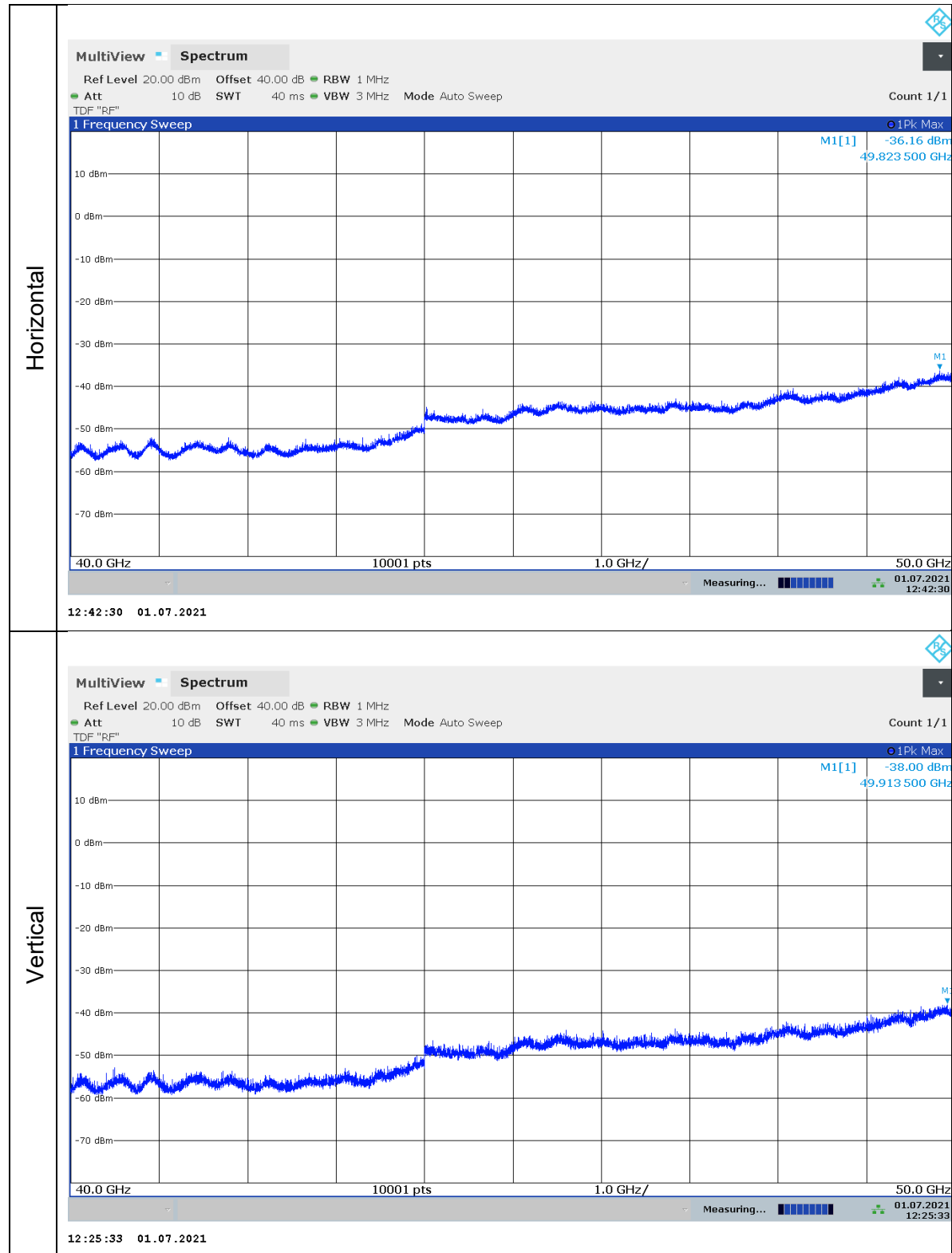
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 AF (dB/m)	Amp/Cbl (dB)	Conversion to dBm (dB)	Corrected Reading dBm	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)
1	19.10404	47.88	Pk	33.5	-39.1	-95.2	-52.92	-30	-22.92	0-360	200
4	20.12904	47.22	Pk	33.6	-39.1	-95.2	-53.48	-30	-23.48	0-360	100
2	20.9883	48.33	Pk	34.3	-39.2	-95.2	-51.77	-30	-21.77	0-360	200
5	22.22833	46.87	Pk	36.6	-38.9	-95.2	-50.63	-30	-20.63	0-360	100
3	24.07519	47.97	Pk	34.8	-38.5	-95.2	-50.93	-30	-20.93	0-360	200
6	25.32967	47.1	Pk	35.3	-37.8	-95.2	-50.6	-30	-20.6	0-360	100

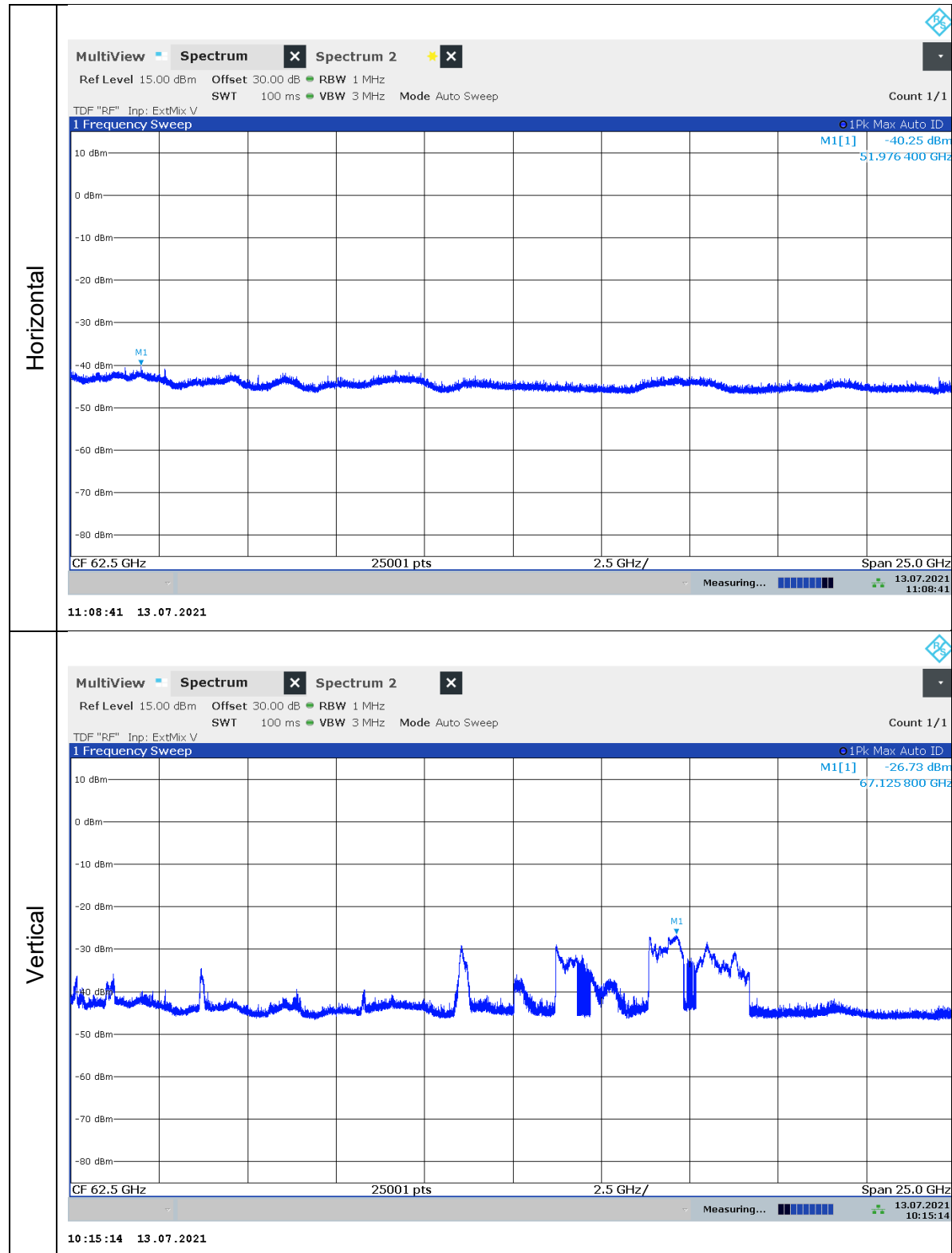
Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 26.5 – 40 GHz

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 AF (dB/m)	Amp/Cbl (dB)	Conversion to dBm (dB)	Corrected Reading dBm	ETSI EN Tx Spurious (dBm)	Margin (dB)	Azimuth (Degs)	Height (cm)
1	28.5215	45.13	Pk	36.3	-36.3	-95.2	-50.07	-30	-20.07	0-360	100
4	30.6569	44.5	Pk	36.6	-35.3	-95.2	-49.4	-30	-19.4	0-360	199
2	32.83026	46.71	Pk	37.2	-36.1	-95.2	-47.39	-30	-17.39	0-360	150
5	34.78426	48.44	Pk	37.4	-37.3	-95.2	-46.66	-30	-16.66	0-360	100
6	37.30523	49.38	Pk	38.3	-38	-95.2	-45.52	-30	-15.52	0-360	100
3	38.64417	50.05	Pk	38.7	-37.2	-95.2	-43.65	-30	-13.65	0-360	150

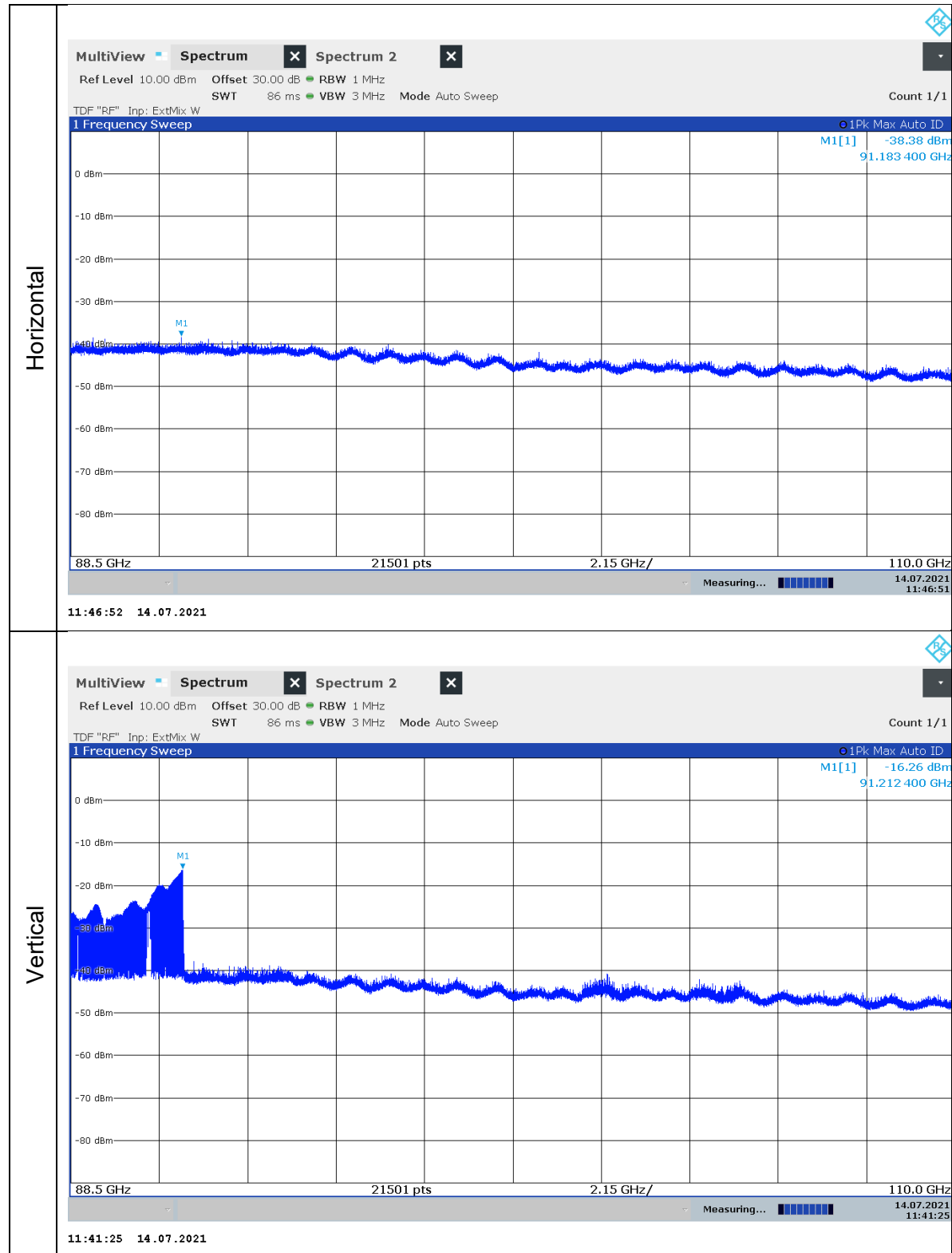
Pk - Peak detector

RADIATED SPURIOUS EMISSIONS 40 – 50 GHz

RADIATED SPURIOUS EMISSIONS 50 – 75 GHz

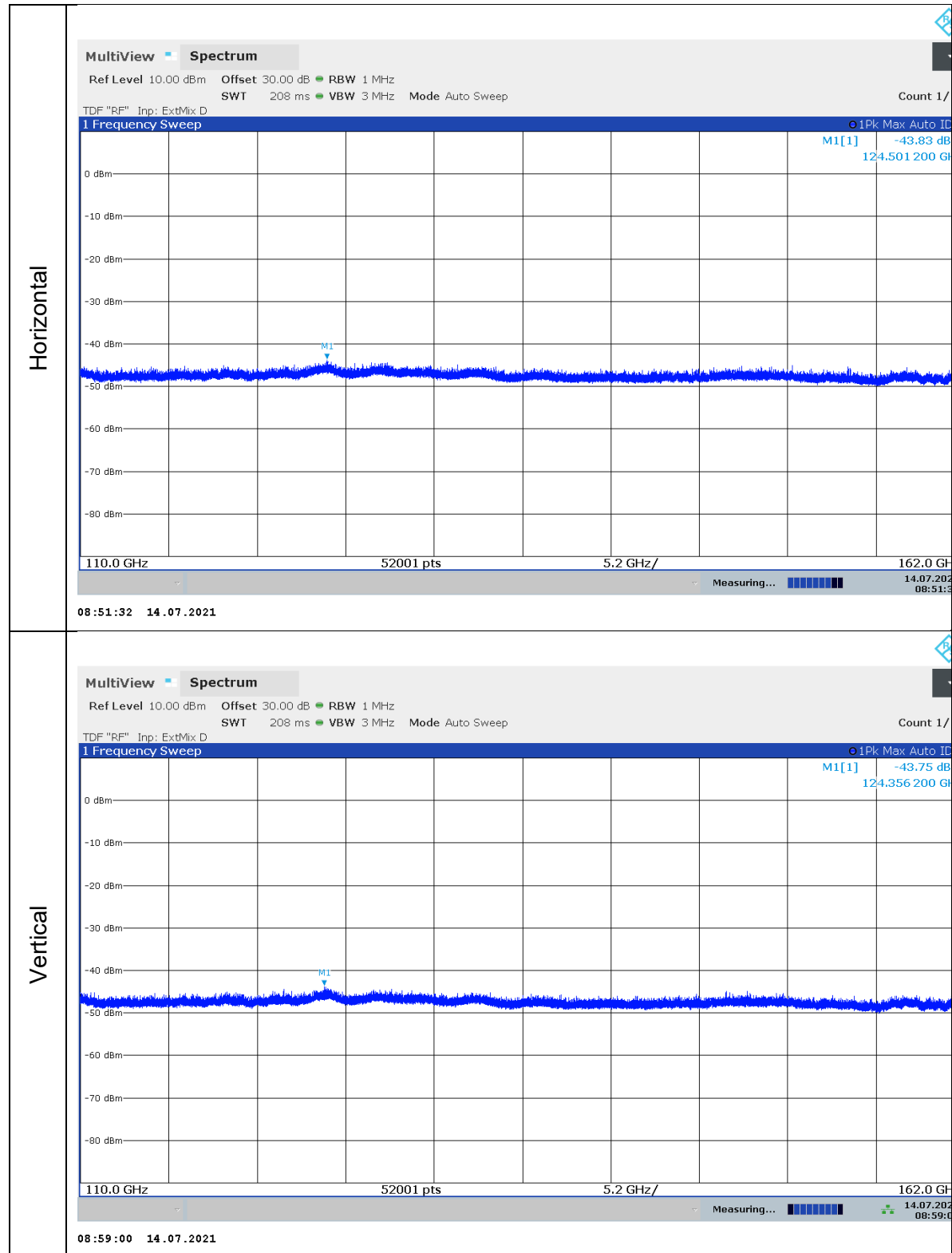
Frequency (GHz)	Detector	Polarity	Avg Pwr (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
66.902	RMS	Vert	-44.51	-30	-14.51
63.717	RMS	Vert	-48.44	-30	-18.44
61.051	RMS	Vert	-49.71	-30	-19.71
53.861	RMS	Vert	-53.57	-30	-23.57
51.185	RMS	Vert	-52.20	-30	-22.20

NOTE: Observed vertically polarized emissions are believed to be due to image frequencies of the fundamental, however the average levels comply with the limits of the standard.

RADIATED SPURIOUS EMISSIONS 88.5 – 110 GHz

Frequency (GHz)	Detector	Polarity	Avg Pwr (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
91.216	RMS	Vert	-43.50	-30	-13.50

NOTE: Observed vertically polarized emissions are believed to be due to image frequencies of the fundamental, however the average levels comply with the limits of the standard.

RADIATED SPURIOUS EMISSIONS 110 – 162 GHz**END OF REPORT**