



TEST REPORT

Report Number. : R13824181-E1

Applicant : Waymo
100 Mayfield Ave.
Mountain View, CA 94043

Model : R6E

FCC ID : 2AZKT710-60000W

EUT Description : E-Band Automotive Radar Sensor

Test Standard : FCC 47 CFR PART 95 SUBPART M

Date Of Issue:
September 16, 2021

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REVISION HISTORY

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V1	2021-08-03	Initial Release	M. Antola
V2	2021-09-09	Updated Occupied Bandwidth and EIRP data; Removed Exposure section as this is now included in a separate report; Misc. editorial updates	M. Antola
V3	2021-09-16	Misc. editorial updates	M. Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Waymo
100 Mayfield Ave.
Mountain View, CA 94043

EUT DESCRIPTION: E-Band Automotive Radar Sensor

MODEL: R6E

SERIAL NUMBERS: DV-0001691

SAMPLE RECEIVE DATE: 2021-06-01

DATE TESTED: 2021-06-02 to 2021-09-09

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 95 SUBPART M	Compliant

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:

Tested By:



Michael Heckrotte
Principal Engineer
Consumer Technology Division
UL Verification Services

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.
<input checked="" type="checkbox"/> Chamber 1 - mmWave	<input type="checkbox"/> Chamber A RTP
<input type="checkbox"/> North Chamber	<input type="checkbox"/> Chamber C RTP
<input checked="" type="checkbox"/> 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, 9 kHz to 30 MHz	2.84 dB
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
Temperature	±0.57 %
Voltages	±0.57 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a radar sensor, operating in 76 - 81 GHz band, with a digital beam-forming scanning antenna. Four modes of each range for operation are available as shown.

Mode	Frequency (GHz)	Modulation Type
LRES W6	77.103 – 79.663	FMCW
LRES W4	77.103 – 79.663	FMCW
MRES	77.232 – 79.792	FMCW
HRES	77.411 – 79.731	FMCW

The EUT is powered by an external power supply with nominal voltage of 12 VDC.

5.2. SOFTWARE AND FIRMWARE

EUT Firmware versions: 382046355

The software used on the support laptop is WaymoRade6eTester.sh.

5.3. OUTPUT POWER

The highest LRES W6 Peak radiated output power is 37.52 dBm EIRP.

The highest LRES W6 Average radiated output power is 26.06 dBm EIRP.

The highest LRES W4 Peak radiated output power is 36.30 dBm EIRP.

The highest LRES W4 Average radiated output power is 25.73 dBm EIRP.

The highest MRES Peak radiated output power is 36.99 dBm EIRP.

The highest MRES Average radiated output power is 24.74 dBm EIRP.

The highest HRES Peak radiated output power is 38.15 dBm EIRP.

The highest HRES Average radiated output power is 25.80 dBm EIRP.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes an integral antenna with dimension of 29 mm x 2 mm x 1 mm. The antenna has a 15.1 dBi gain.

5.5. MODULATION FORMAT

Modulation is FMCW and parameters are as follows:

Mode	Approx. Chirp Width (MHz)	Waveform Up Chirp Sweep Time (us)	Waveform Down Chirp Sweep Time (us)
LRES W6	95	12	None
LRES W4	118	12	None
MRES	362	24	None
HRES	616	12	None

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
BRR (Interface Board)	Waymo	Brrswitch 2.4	650-00327-08 GORA01708900108	NA
Denkovi	Denkovi	LAN 5 channel relay module	DAE-PB-RO5-12V- DAenetIP4-BOX	NA
Meanwell PSU	Meanwell	RSP-500-12	EB83841151	NA
Network switch	Netgear	Prosafe plus 8-port gigabit switch GS108Ev3	3UH8895K022ED	NA
Wall wart for Network Switch	Netgear	AD2015F23	311831363107440RBD	NA
Laptop PS	HP	744481-002	F255081410012122	NA
Laptop	HP	Elitebook 840	CNU433B20Y	PD972 60H

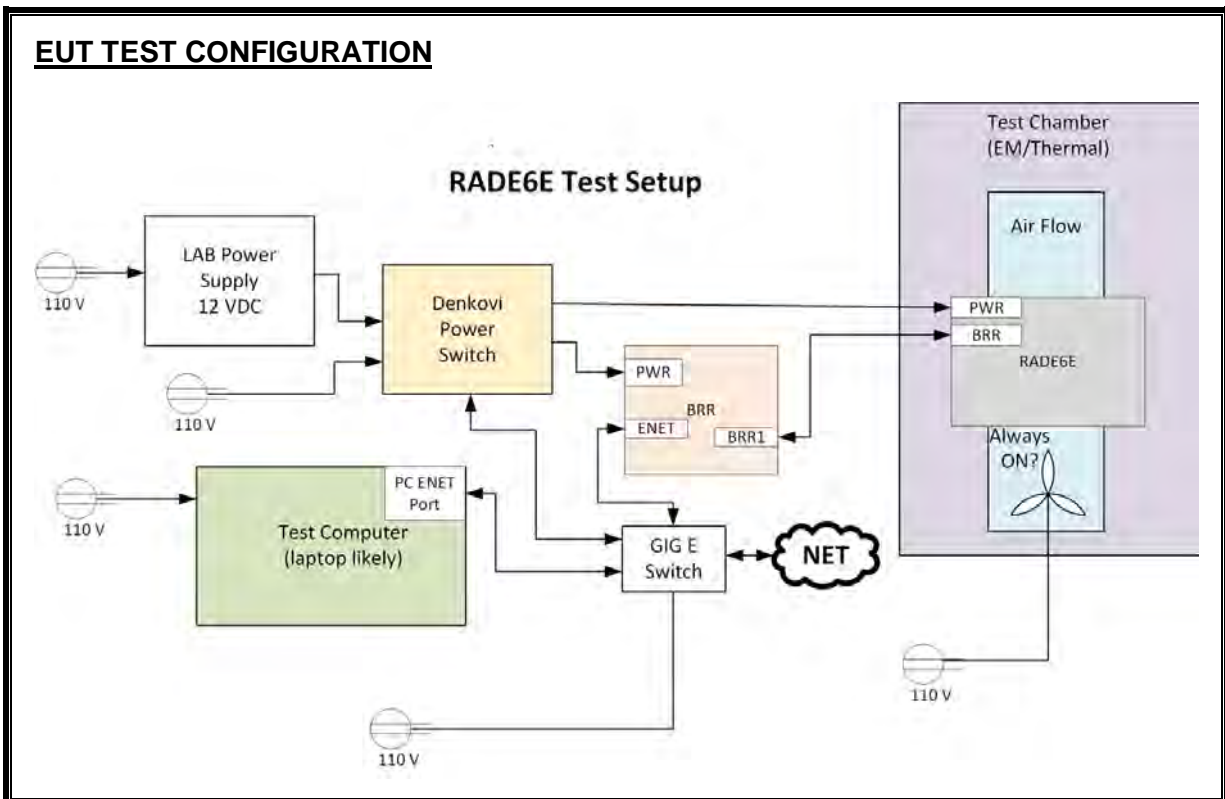
I/O CABLES

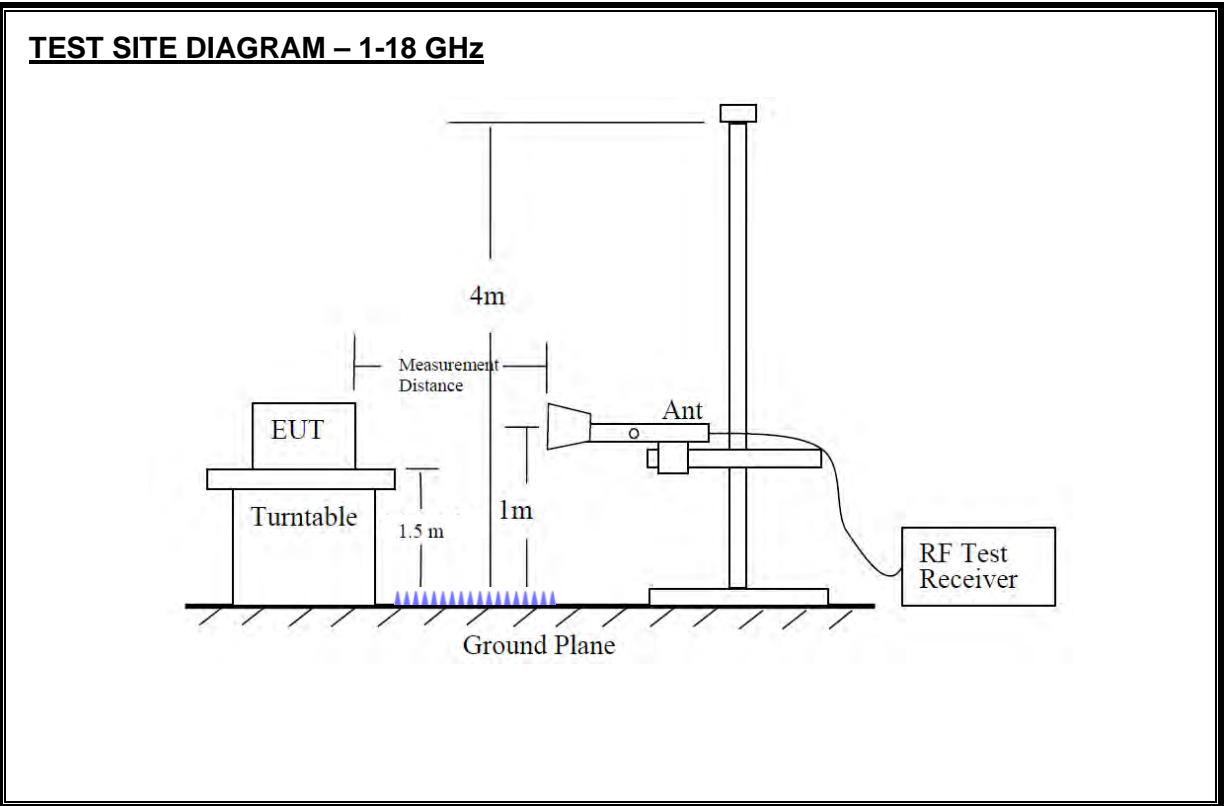
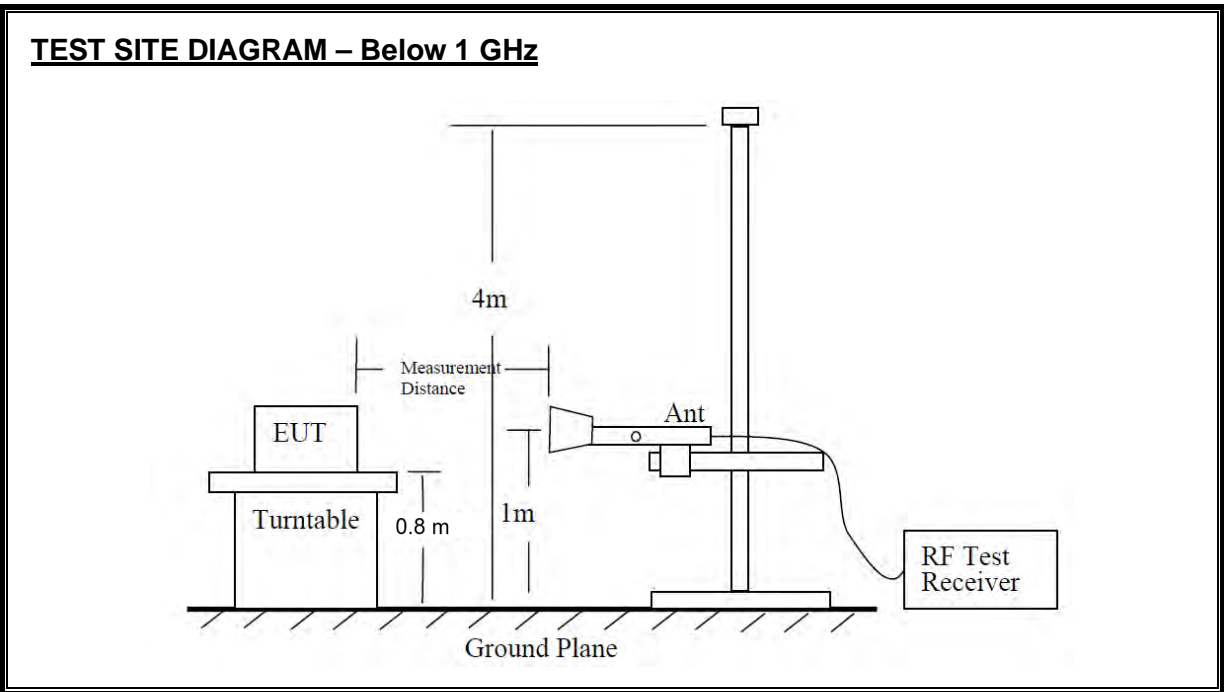
I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Ethernet	3	RJ45	Ethernet	> 3	NA
2	DC	4	Screw terminal	Stranded Wire	> 3	NA
3	BRR	2	4 pin data	BRR	> 3	NA

TEST SETUP

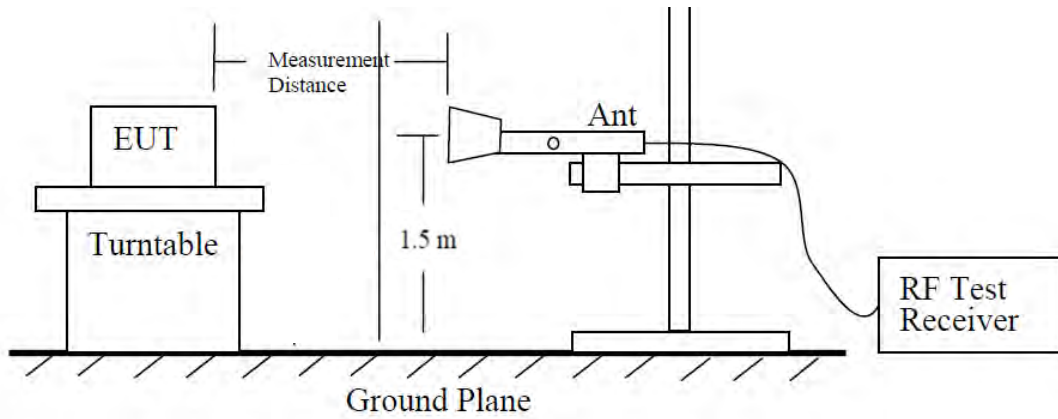
The EUT was connected to a laptop computer. All testing was performed using customer-provided software that was utilized to enable continuous Tx modulated operation.

SETUP DIAGRAM FOR TESTS

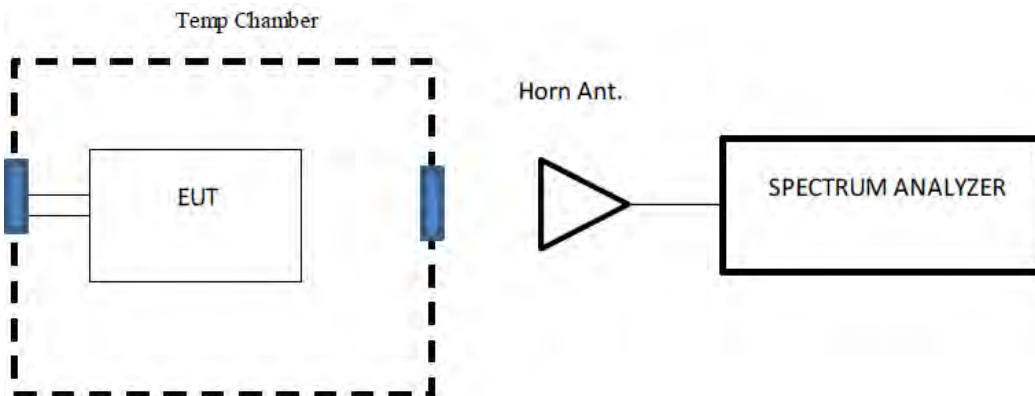




TEST SITE DIAGRAM – Above 18 GHz & mmWave



FREQUENCY STABILITY



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.

For fundamental / band edge emissions, the largest far-field distance of either the EUT antenna or measurement antenna shall be used. For above 18 GHz spurious emissions, the far-field distance will be based on the measured antenna. In this case, the measurement antenna has the largest far-field distance. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest EIRP reading on the receive spectrum analyzer.

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 40-170 GHz was performed at 3-meters. Above 170 GHz, testing was performed at a 0.5-meter distance and the data was corrected, accordingly, to the 3-meter limit.

In-band testing was performed at a 2-meter distance, which was still in the far-field based on the maximum EUT / measurement antenna dimension.

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst-case polarization/positioning. The worse-case orientation of the EUT was with the front fact facing the RX antenna, which was polarized vertically. Refer to test setup photos exhibit (report number R13824181-EP1) for details.

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/Brand	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		
SOFTEMI	EMI Software	UL	Version 9.5 (04 Mar 2021)		
	Additional Equipment used				
207161	Signal Generator	Rohde and Schwarz	SMA100B	2021-04-06	2022-04-06

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
208201	350 MHz High Definition Oscilloscope	Teledyne Lecroy	HDO6034A	2021-05-27	2022-05-27
s/n 05-01-401	200 MHz Low-Noise Voltage Amplifier	Femto	HVA-200M-40-B	NA	NA
206568	Isolator	Mi-Wave	115V/385	NA	NA
206569	Diode Detector	Mi-Wave	950V/385	NA	NA
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2020-08-06	2021-08-06

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	Conducted Room 1				
207726	Temp/Humid Chamber	Thermotron	SM-32-8200	2021-01-04	2022-01-04
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
206459	Spectrum Analyzer	Rohde & Schwarz	FSW50	2021-03-15	2022-03-15
207161	Signal Generator	Rohde & Schwarz	SMA100B	2021-04-06	2022-04-06
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
76022	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	NA	NA

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

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0075	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-10-27	2021-10-27
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2021-05-03	2022-05-03
	18-40 GHz				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2020-10-30	2021-10-30
AT0061	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2020-10-30	2021-10-30
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-10	2021-07-10
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
SA0025	Spectrum Analyzer	Agilent	N9030A	2021-04-01	2022-04-01
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 during 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	Compliant
2.1046 95.3367	Equivalent Isotropic Radiated Power (EIRP)	+50 dBm (Average) +55dBm (Peak)	Radiated	Compliant
2.1051 95.3379	Spurious Emissions < 40GHz	See Table 95.3379 (1)	Radiated	Compliant
2.1051 95.3379	Spurious Emissions 40 – 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	Compliant

8. APPLICABLE LIMITS AND TEST RESULTS

8.1. DUTY CYCLE

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The fundamental is measured using a Standard Gain Horn Antenna, Low Noise Amplifier and a Diode Detector connected to an Oscilloscope. Pulse widths, burst lengths, and periods are measured, then the duty cycle is calculated.

RESULTS

Duty cycle linear = on/off time

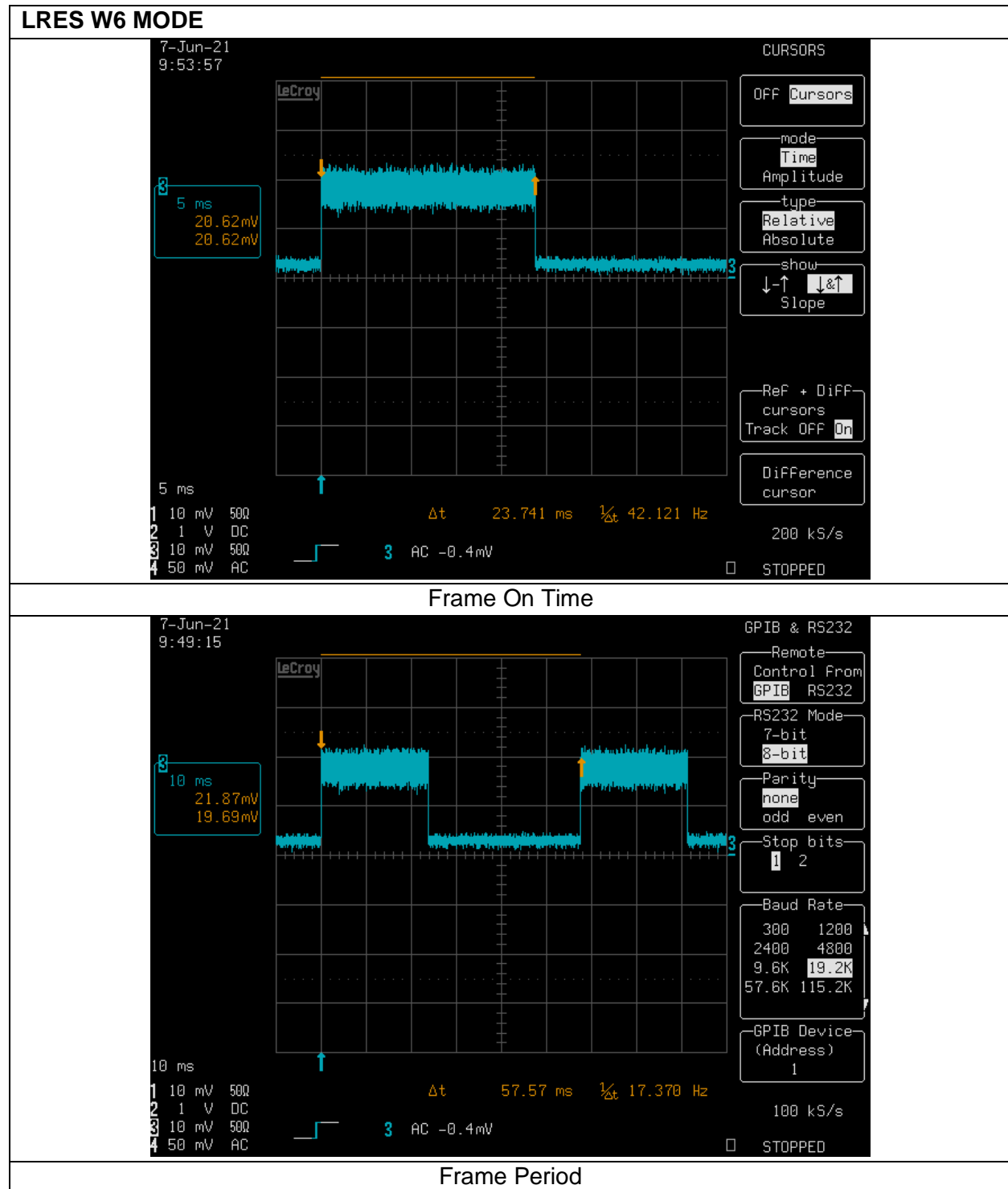
Duty cycle % = Duty cycle linear * 100

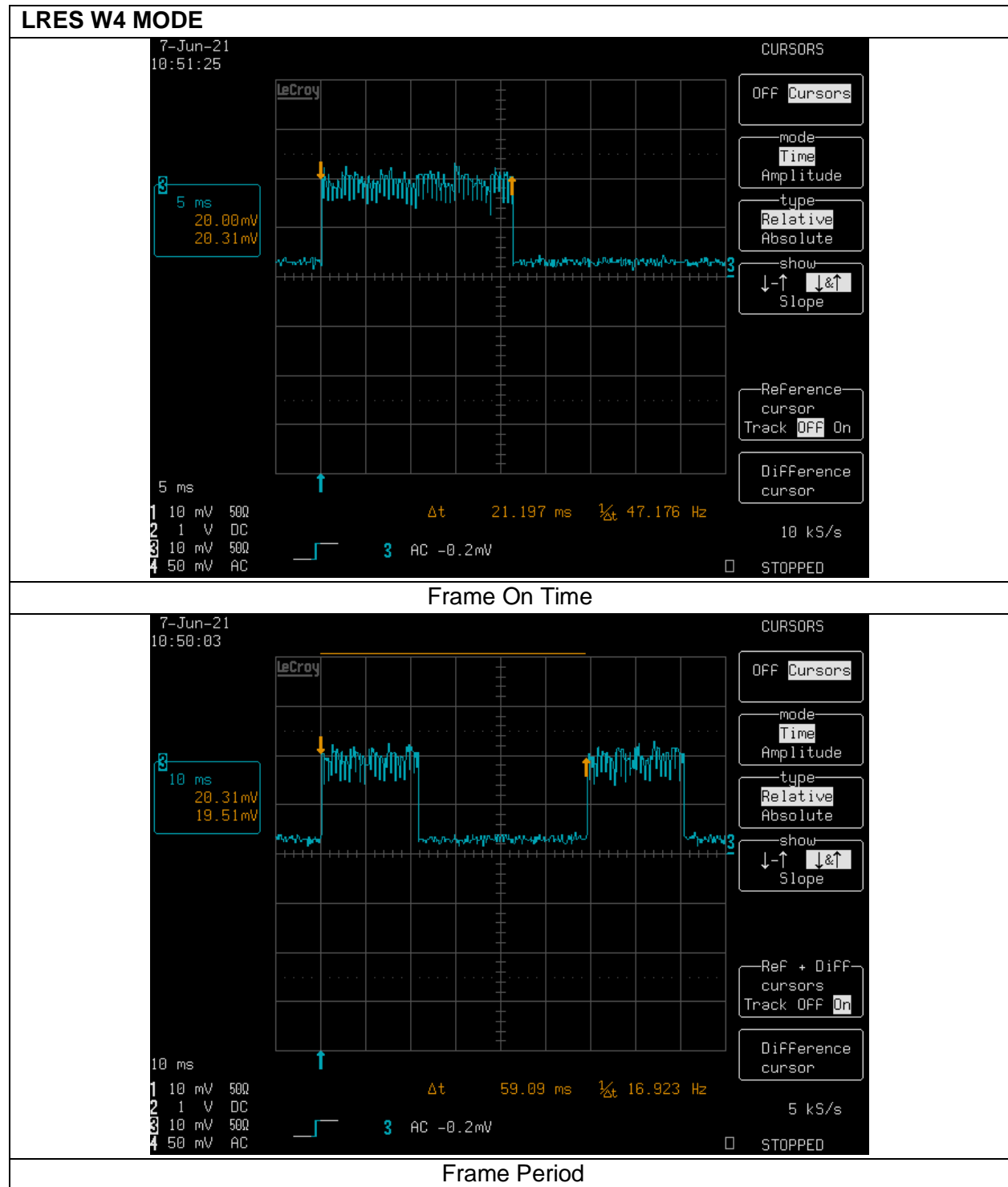
Mode	ON Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)
LRES W6	23.741	57.57	0.412	41%
LRES W4	21.197	59.09	0.359	36%
MRES	18.826	53.78	0.350	35%
HRES	21.061	56.4	0.373	37%

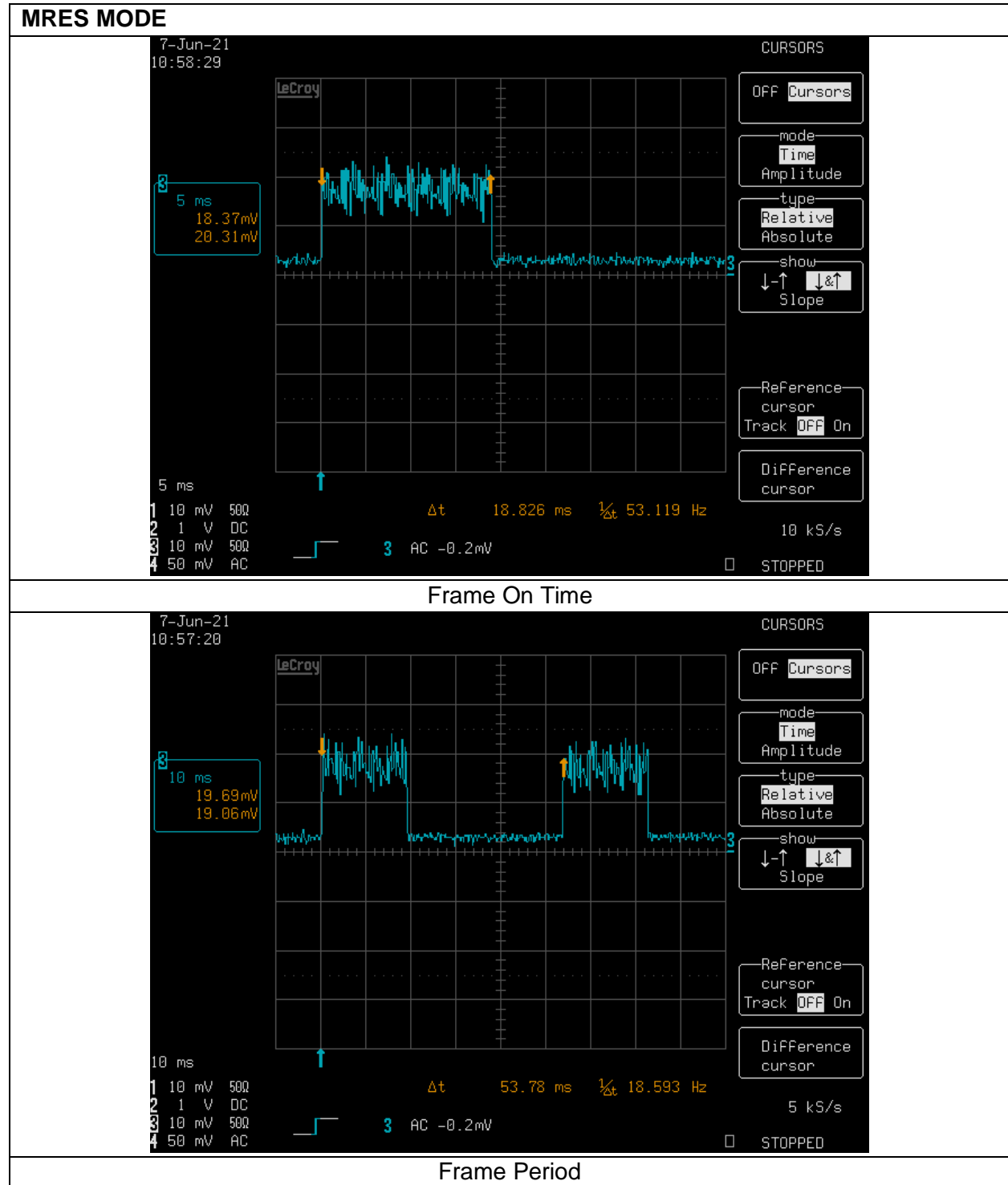
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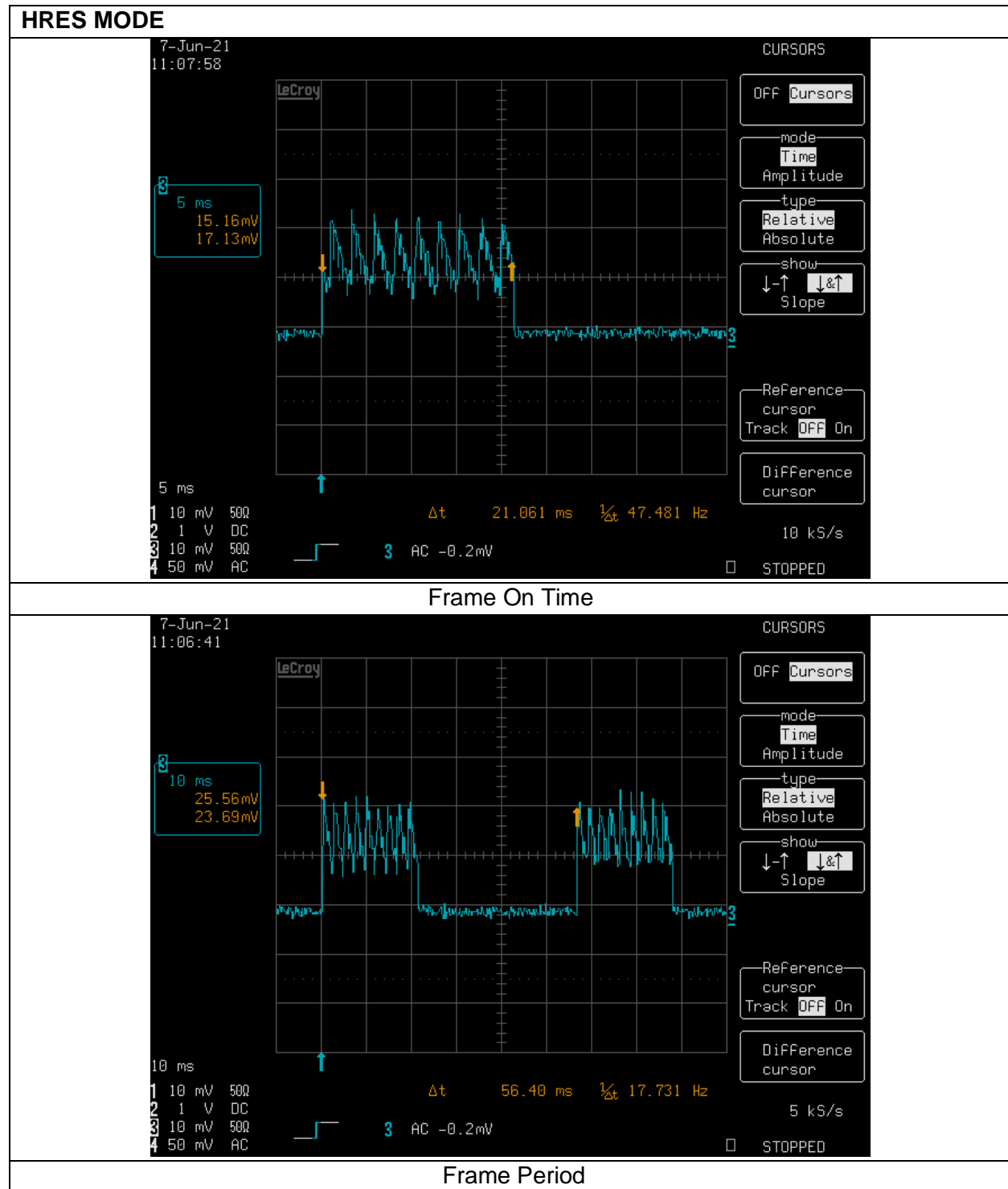
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Location: mmWave 1
Date: 2021-06-21

DUTY CYCLE









8.2. OCCUPIED BANDWIDTH

REQUIREMENT

FCC: §2.1049
FCC §95.3379 (b)

LIMIT

The radar device's occupied bandwidth (99% emission bandwidth) shall be contained in the 76-81GHz frequency band.

TEST PROCEDURES

99% bandwidth measurement function of the signal analyzer was used to measure 99% occupied.

- RBW = 1 – 5% of OBW
- VBW $\geq 3 \times$ RBW
- Span = Wide enough to capture all modulation products including the emission skirts
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- The trace was allowed to stabilize

ANSI C63.26-2015 Clause 5.4

All modes of operations were investigation and results are reported in this section.

RESULTS

See the following pages.

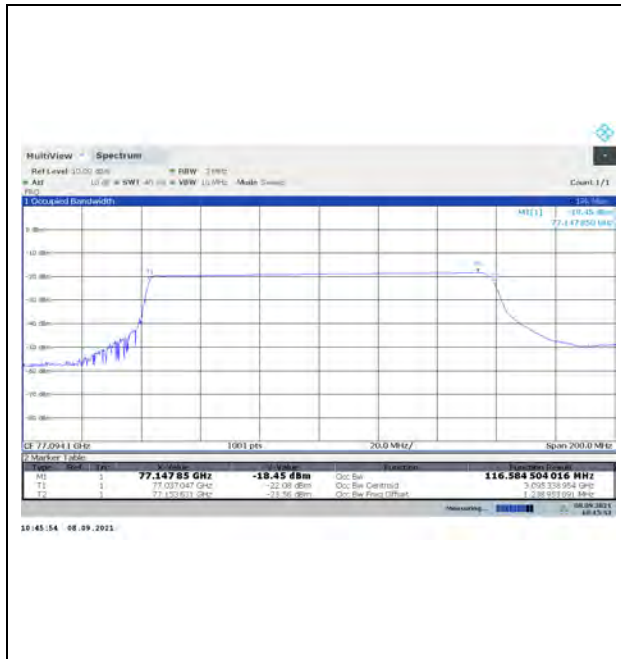
TESTED BY

Employee ID: 25674/11322
Location: mmWave 1
Date: 2021-09-08

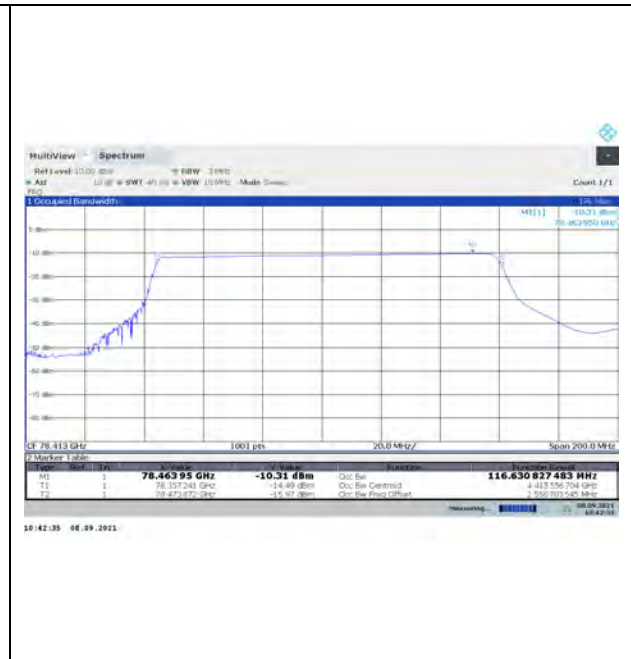
OCCUPIED BANDWIDTH

Mode	Center Freq. (GHz)	99% BW (MHz)	FL Min Limit (GHz)	Meas. FL (GHz)	Pass or Fail	Meas. FH (GHz)	FH Max Limit (GHz)	Pass or Fail
LRES W6	77.094	116.585	76	77.0370	Pass	77.1536	81	Pass
LRES W6	78.413	116.631	76	78.3572	Pass	78.4739	81	Pass
LRES W6	79.733	116.405	76	79.6769	Pass	79.7933	81	Pass
LRES W4	77.088	153.826	76	77.0107	Pass	77.1646	81	Pass
LRES W4	78.413	152.532	76	78.3318	Pass	78.4843	81	Pass
LRES W4	79.728	152.512	76	79.6518	Pass	79.8043	81	Pass
MRES	77.195	426.644	76	76.9906	Pass	77.4173	81	Pass
MRES	78.482	424.38	76	78.2699	Pass	78.6943	81	Pass
MRES	79.762	425.466	76	79.5482	Pass	79.9736	81	Pass
HRES	77.327	769.041	76	76.9522	Pass	77.7212	81	Pass
HRES	78.452	774.394	76	78.0643	Pass	78.8387	81	Pass
HRES	79.659	774.552	76	79.2636	Pass	80.0382	81	Pass

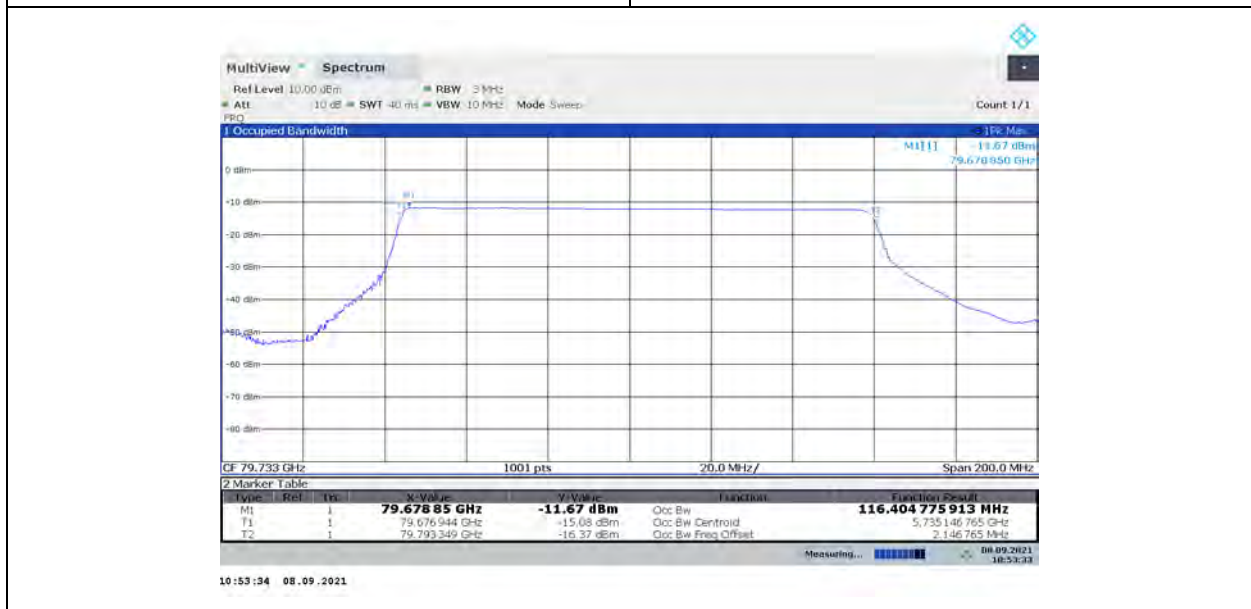
LRES W6 MODE



Low Channel

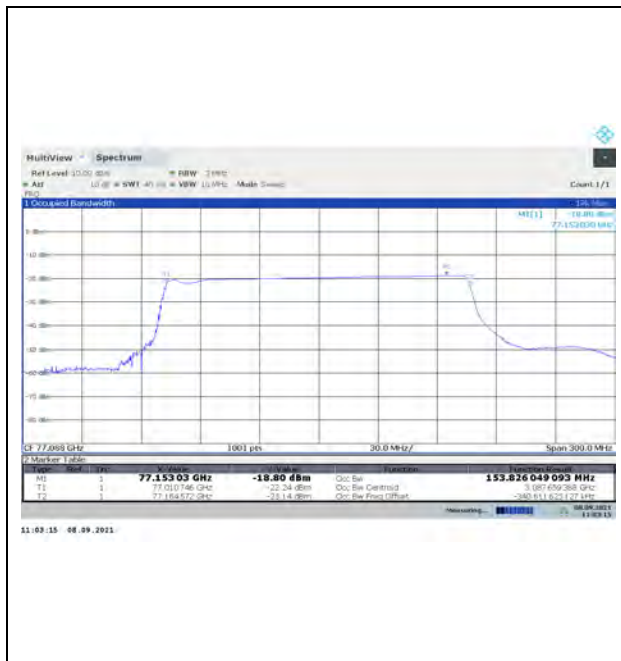


Mid Channel

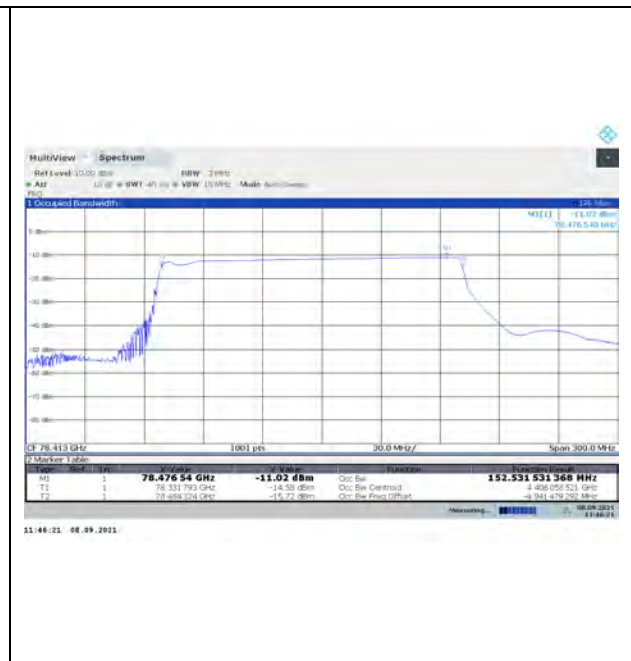


High Channel

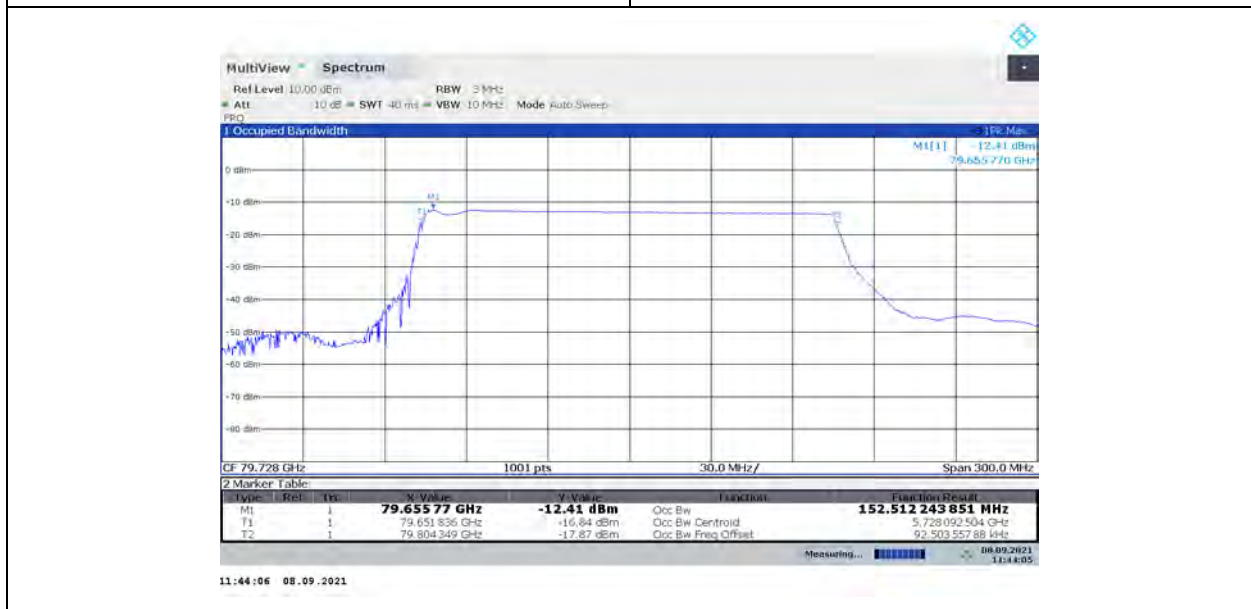
LRES W4 MODE



Low Channel

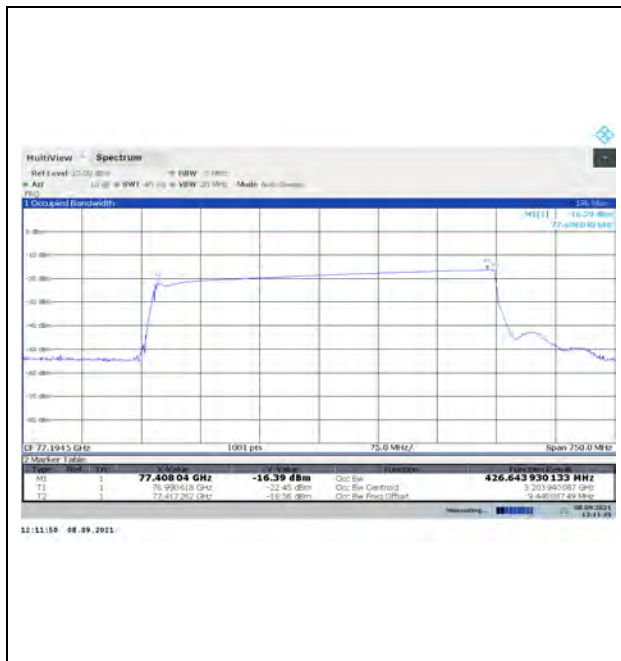


Mid Channel



High Channel

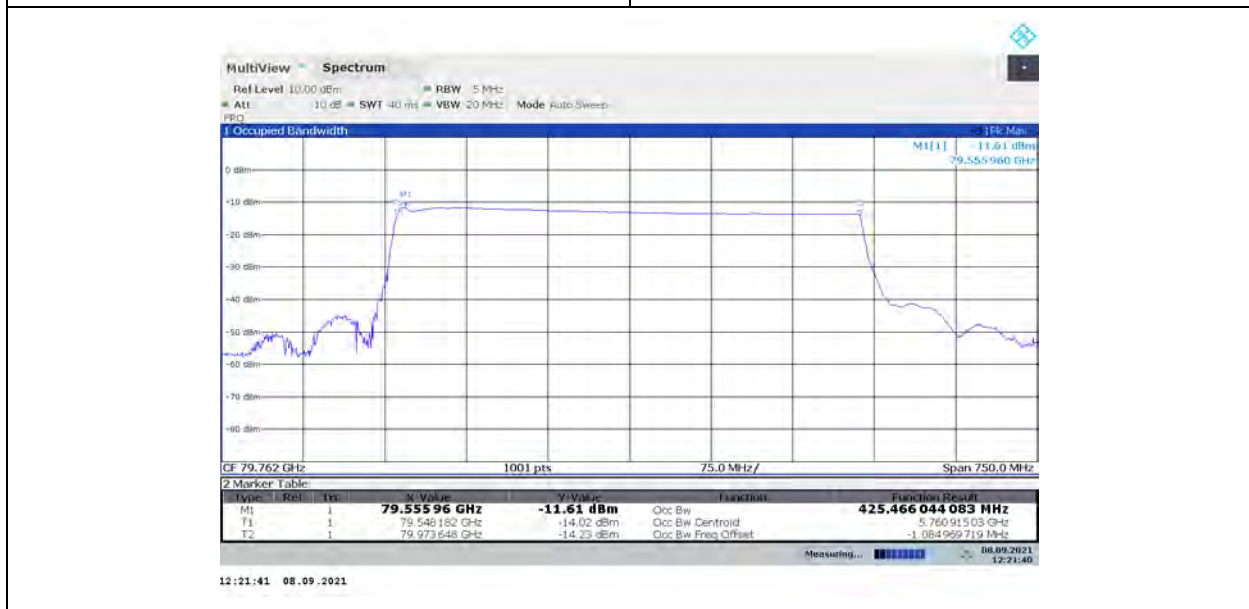
MRES MODE



Low Channel



Mid Channel



High Channel

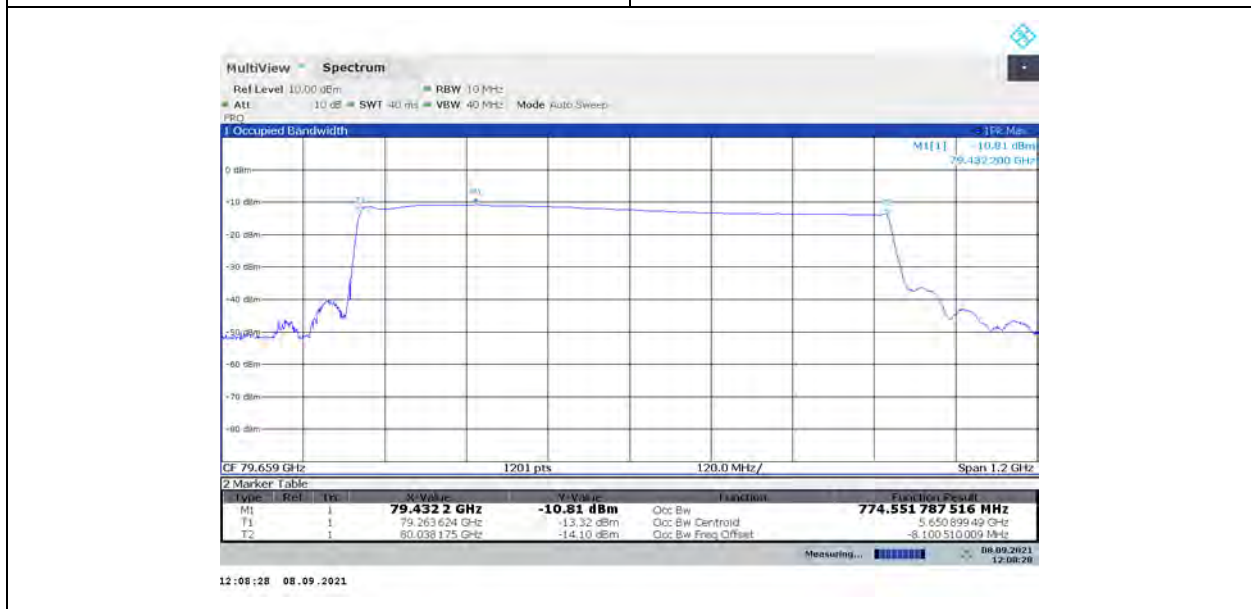
HRES MODE



Low Channel



Mid Channel



High Channel

8.3. PEAK AND AVERAGE RADIATED POWER

REQUIREMENT

FCC: §2.1046, §95.3367 (a) (b)

LIMIT

FCC §95.3367 - The fundamental radiated emission limits within the 76-81 GHz band are expressed in terms of Equivalent Isotropically Radiated Power (EIRP) and are as follows:

(a) The maximum power (EIRP) within the 76-81 GHz band shall not exceed 50 dBm based on measurements employing a power averaging detector with a 1 MHz Resolution Bandwidth (RBW).

(b) The maximum peak power (EIRP) within the 76-81 GHz band shall not exceed 55 dBm based on measurements employing a peak detector with a 1 MHz RBW.

TEST PROCEDURES

Peak Power

Radiated power measurements are performed with the signal analyzer's set to spectrum analyzer mode.

- RBW = 1 MHz
- VBW \geq 3 x RBW
- Span = 2x to 3x the OBW
- Number of measurement points in sweep $>$ 2 x span / RBW
- Sweep time = 2 x (Signal Period) x (Span / RBW)
- Detector = Peak
- Trace mode = Max Hold
- Set reference level as required
- Set marker on the signal peak after trace has stabilized

Worse-case Signal Period of all modes is 59.09ms, thus sweep times are:

Signal Period (ms): 59.09

Mode	SPAN (MHz)	RBW (MHz)	Swp Time (ms)	Swp Time (s)	Actual Swp Time Used (s)
LRS W6	300	1	35454	35.5	120
LRES W4	300	1	35454	35.5	120
MRES	1000	1	118180	118.2	200
HRES	1500	1	177270	177.3	200

Average Power

Radiated power measurements are performed using the signal analyzer’s “channel power” measurement capability for signals with continuous operation.

- RBW = 1 – 5% of the OBW, not to exceed 1 MHz
- VBW ≥ 3 x RBW
- Span = 2x to 3x the OBW
- Number of measurement points in sweep > 2 x span / RBW
- Sweep time = 5 x (Signal Period) x (Span / RBW)
- Detector = RMS
- Power shall be integrated over the OBW

Worse-case Signal Period of all modes is 59.09ms, thus sweep times are:

Signal Period (ms): 59.09

Mode	SPAN (MHz)	RBW (MHz)	Swp Time (ms)	Swp Time (s)	Actual Swp Time Used (s)
LRS W6	300	1	88635	88.6	300
LRES W4	300	1	88635	88.6	300
MRES	1000	1	295450	295.5	300
HRES	1500	1	443175	443.2	500

KDB 653005 D01 76-81 GHz Radars v01r01 Section 4 a) b) c)
 ANSI C63.26-2015 Clause 5.2, Clause 5.5, Clause 6.4, and Annex C.5.2
 ANSI C63.10-2020 Clause 9, Annex C, Annex L

Measurements are made at a distance greater than or equal to the far field boundary distance. The measured power level is converted to EIRP based on the following:

$$EIRP = P_R + L_P$$

where,

- P_R is the adjusted received power, after corrections
- L_P is the basic free space propagation path loss

EIRP was calculated using the equations of ANSI C63.26-2015 Annex C.5.2. The total correction factors from 76-81 GHz range of horn antenna gain, cable loss, etc. were calculated using equation C.8. Then, EIRP was calculated using equation C.9 with Path Loss (L_P) @ 2m, 77 GHz.

Sample calculation of EIRP:

$$\begin{aligned} \text{Total Correction Factor} &= \text{Cable Loss (dB)} - \text{Horn Ant Gain (dBi)} + \text{Ext. Atten. (dB)} - \text{Ext. Amp. (dB)} \\ &= 4 - 23 + 0 - 0 = -19 \text{ dB} \end{aligned}$$

$$\begin{aligned} P_R &= P_{\text{meas}} \text{ (dBm)} + \text{Total Correction Factor} \\ &= -30 + (-19) = -49 \text{ dBm} \end{aligned}$$

$$\begin{aligned} L_P &= 20\log(F) + 20\log(d) - 27.5 \\ &= 20\log(77000) + 20\log(2) - 27.5 = 76 \text{ dB} \end{aligned}$$

$$\begin{aligned} \text{EIRP} &= P_R \text{ (dBm)} + L_P \text{ (dB)} \\ &= -49 + 76 = 27 \text{ dBm} \end{aligned}$$

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst-case polarization/positioning. Additionally, the EUT was rotated along its horizontal and vertical axis. The worse-case orientation of the EUT was with the front fact facing the RX antenna, which was polarized vertically. Refer to test setup photos exhibit (report number R13824181-EP1) for details.

FAR FIELD BOUNDARY CALCULATIONS

The far-field boundary is given as:

$$R_{\text{far field}} = (2 * L^2) / \lambda$$

where,

L = Largest Antenna Dimension, including the reflector, in meters
 λ = wavelength in meters

The largest dimension of the integral TX array antenna is 29 mm, which is smaller than the maximum dimension of the measurement antenna (31 mm). As such, 31 mm is the dimension that is used in determining the far-field boundary.

Frequency (GHz)	L (m)	Lambda (m)	R (Far Field) (m)
79.792	0.0310	0.0038	0.51

Radiated power measurements are performed at a 2-meter test distance.

FMCW CORRECTION FACTOR FOR PEAK DETECTION

Keysight Technologies Application Note 5952-1039 “Spectrum and Signal Analysis Pulsed RF” provides the derivation of the FMCW Desensitization Factor for Gaussian-shaped Resolution Bandwidth Filters in Appendix B “IF Amplifier Response and Distortion”.

Equation B-10 is excerpted:

$$\alpha = \frac{1}{\sqrt[4]{1 + \left(\frac{2\ln(2)}{\pi}\right)^2 \left(\frac{F_s}{T_s B^2}\right)^2}} \quad (B-10)$$

Where

- α is the reduction in amplitude
- F_s= FMCW Chirp Bandwidth
- T_s = FMCW Chirp Time
- B= 3 dB IF Bandwidth = RBW

FMCW Correction Factor for Peak Detection

Mode	Start Freq (GHz)	Stop Freq (GHz)	Center Freq (GHz)	FMCW Width (MHz)	Ramp Time (us)	RBW (MHz)	Amplitude Loss (lin)	Correction Factor (dB)
LRES W6	77.103	79.663	78.383	115	12	1	0.480	6.38
LRES W4	77.103	79.663	78.383	149	12	1	0.424	7.46
MRES	77.232	79.792	78.512	429	24	1	0.355	9.00
HRES	77.411	79.731	78.571	780	12	1	0.187	14.58

RESULTS

See the following pages.

TESTED BY

Employee ID: 25674/11322
 Location: mmWave 1
 Date: 2021-09-08, 2021-09-09

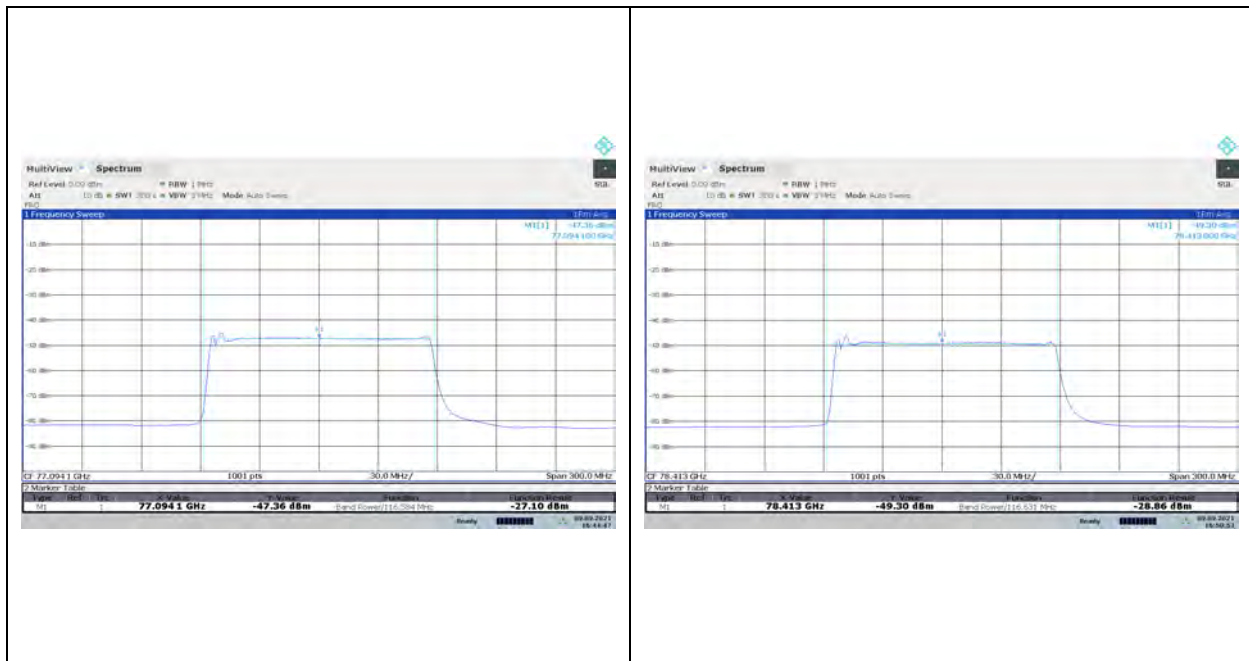
Average EIRP Power 1 MHz RBW / 3 MHz VBW

Mode	Channel	Frequency (GHz)	Meas. Distance (m)	RBW (MHz)	Measured Power (dBm)	Total Corr Factor (dB)	Free Path Loss (dB)	Average Power (dBm EIRP)	Average Limit (dBm EIRP)	Limit Margin (dB)
LRES W6	Low	77.094	2	1	-27.1	-23.1	76.26	26.06	50.00	-23.94
LRES W6	Mid	78.413	2	1	-28.86	-22.2	76.41	25.35	50.00	-24.65
LRES W6	High	79.733	2	1	-30.61	-21.1	76.55	24.84	50.00	-25.16
LRES W4	Low	77.08	2	1	-27.43	-23.1	76.26	25.73	50.00	-24.27
LRES W4	Mid	78.413	2	1	-29.22	-22.2	76.41	24.99	50.00	-25.01
LRES W4	High	79.728	2	1	-31.06	-21.1	76.55	24.39	50.00	-25.61
MRES	Low	77.195	2	1	-28.53	-23	76.27	24.74	50.00	-25.26
MRES	Mid	78.482	2	1	-30.6	-22.4	76.42	23.42	50.00	-26.58
MRES	High	79.762	2	1	-32.85	-21.1	76.56	22.61	50.00	-27.39
HRES	Low	77.327	2	1	-27.99	-22.5	76.29	25.80	50.00	-24.20
HRES	Mid	78.452	2	1	-29.32	-22.4	76.41	24.69	50.00	-25.31
HRES	High	79.659	2	1	-30.91	-21.1	76.55	24.54	50.00	-25.46

Total Corr Factor (dB) = Cable Loss - Rx Antenna Gain - Premp Gain + Mixer Loss + Waveguide Loss

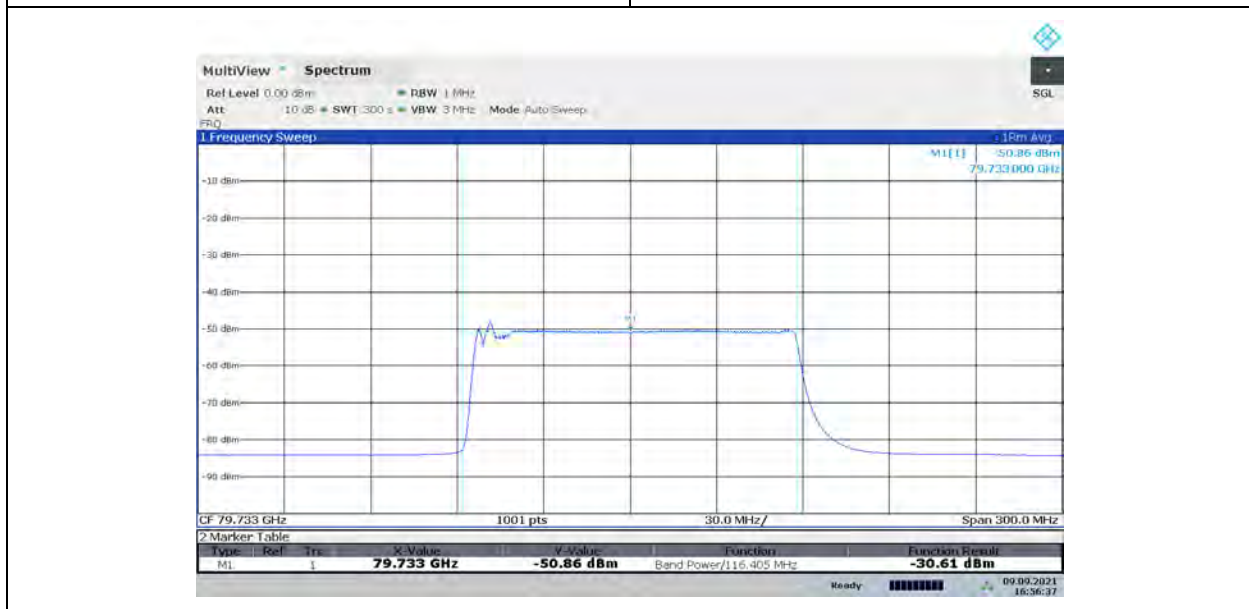
Average Power (dBm EIRP) = Measured Power + Total Corr Factor + Free Space Loss

AVERAGE EIRP - LRES W6 MODE



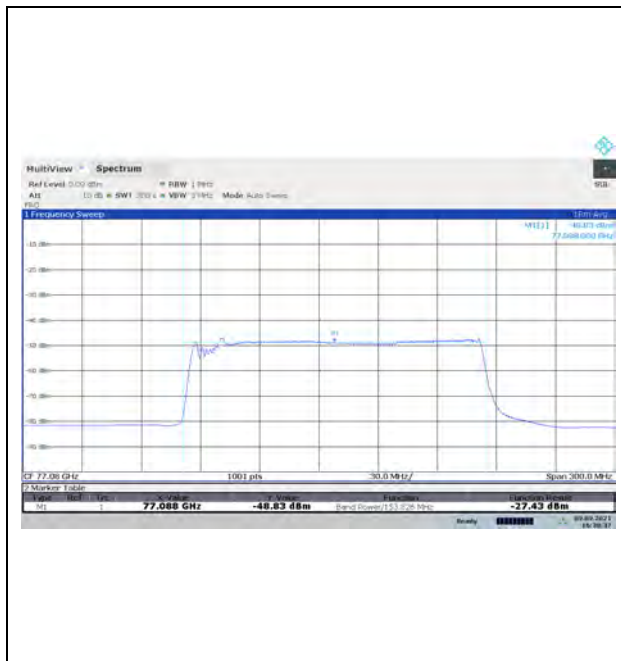
Low Channel

Mid Channel

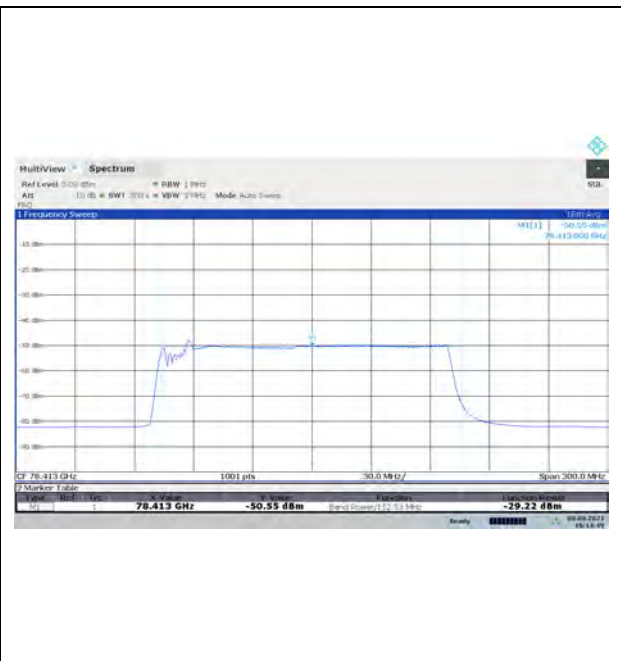


High Channel

AVERAGE EIRP - LRES W4 MODE



Low Channel

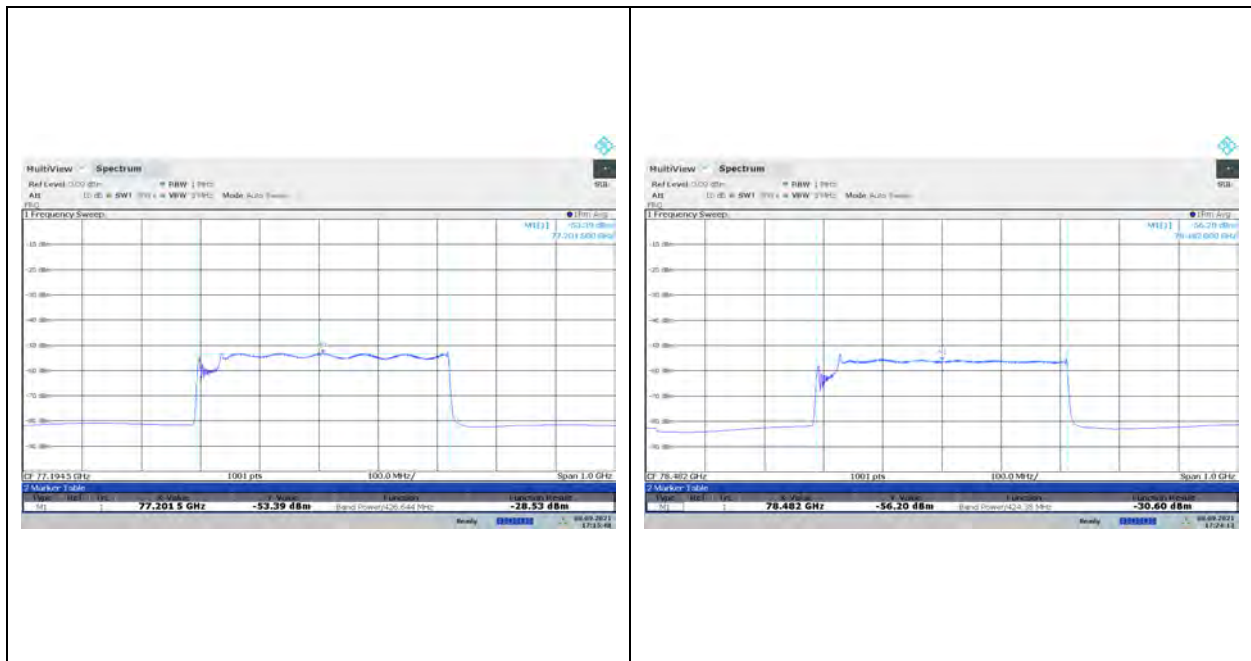


Mid Channel



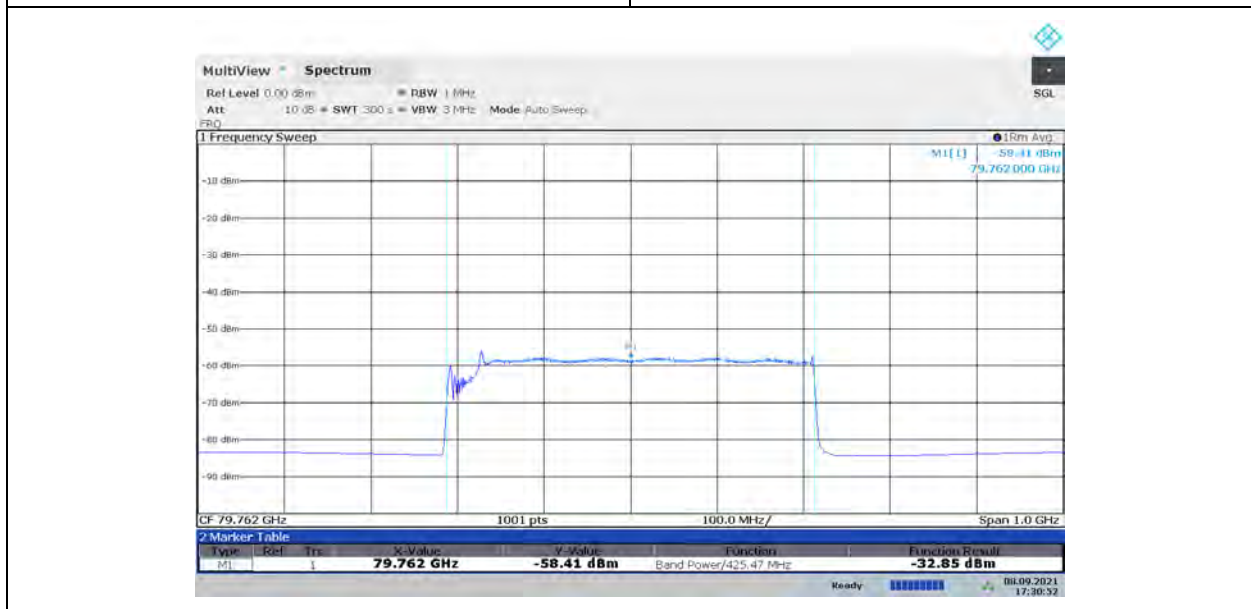
High Channel

AVERAGE EIRP - MRES MODE



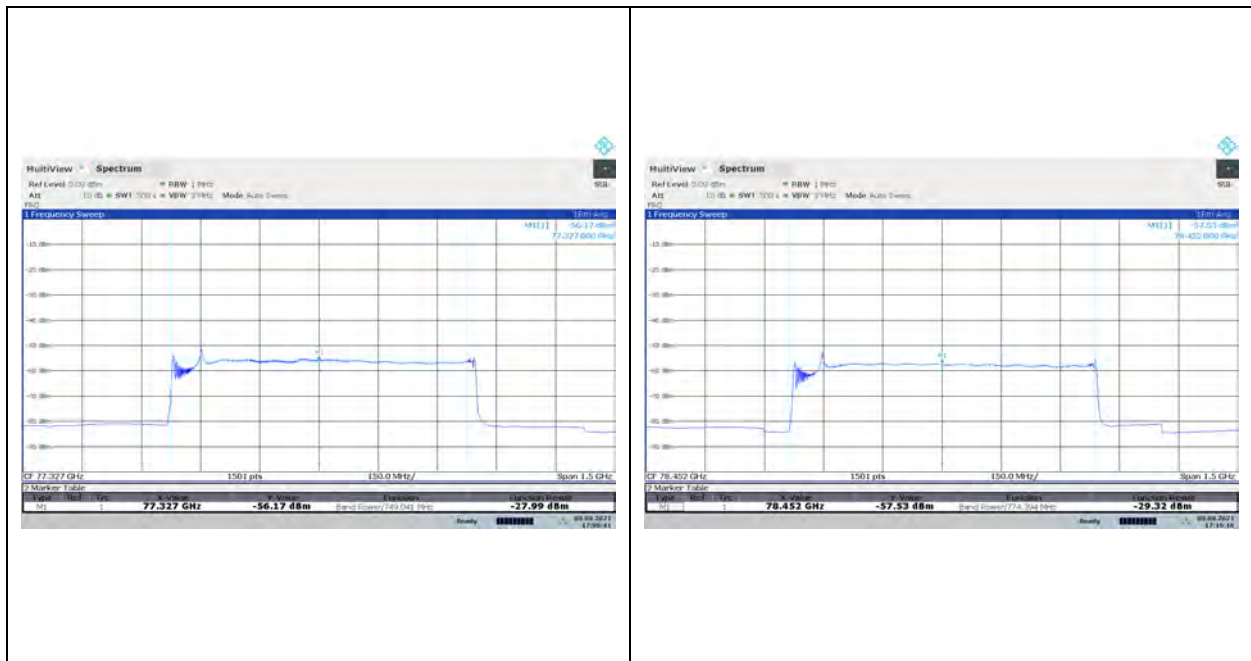
Low Channel

Mid Channel



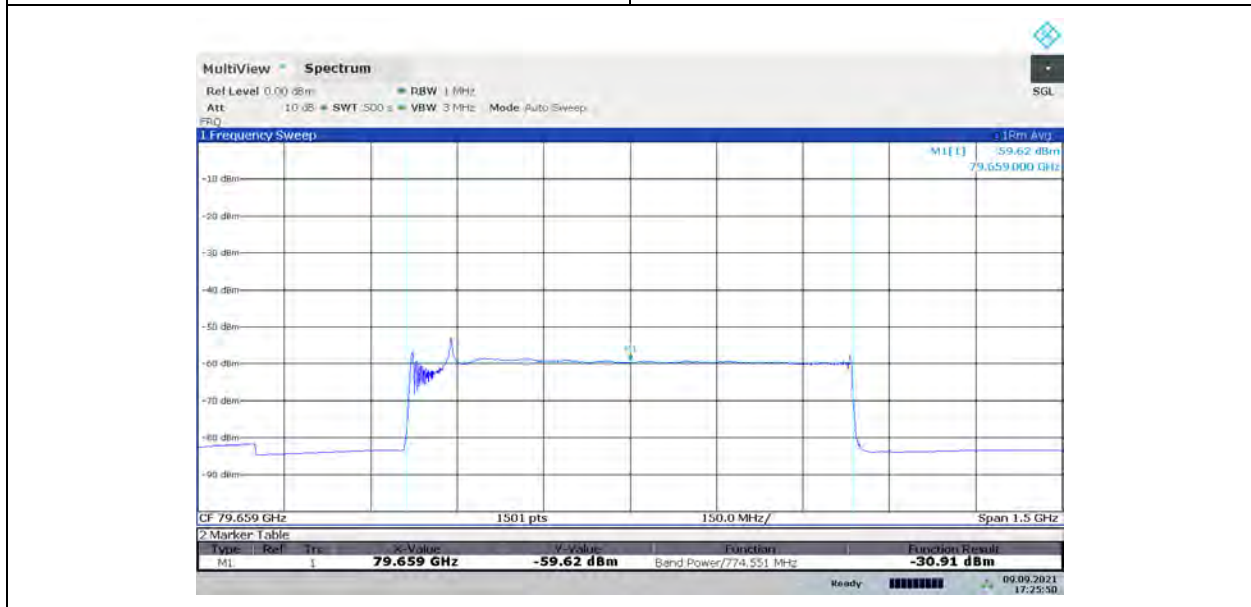
High Channel

AVERAGE EIRP - HRES MODE



Low Channel

Mid Channel



High Channel

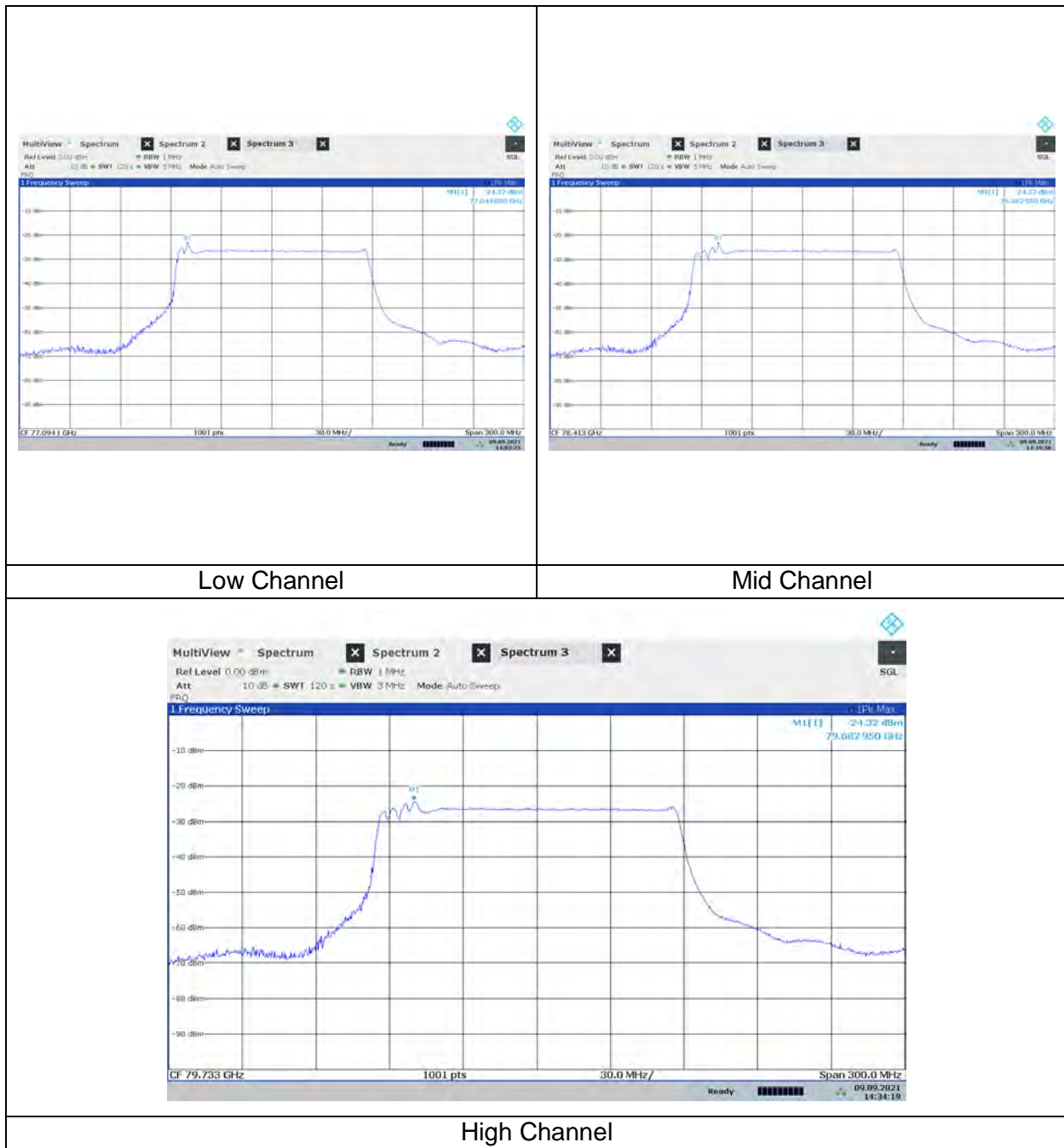
Peak EIRP Power 1 MHz RBW / 3 MHz VBW

Mode	Channel	Frequency (GHz)	Meas. Distance (m)	RBW (MHz)	Measured Power (dBm)	Total Corr Factor (dB)	Free Space Path Loss (dB)	Normalized Sweep Rate Correction (dB)	Peak Power (dBm EIRP)	Peak Limit (dBm EIRP)	Limit Margin (dB)
LRES W6	Low	77.094	2	1	-24.32	-23.1	76.26	6.38	35.22	55.00	-19.78
LRES W6	Mid	78.413	2	1	-24.32	-22.2	76.41	6.38	36.27	55.00	-18.73
LRES W6	High	79.733	2	1	-24.32	-21.1	76.55	6.38	37.52	55.00	-17.48
LRES W4	Low	77.088	2	1	-24.32	-23.1	76.26	7.46	36.30	55.00	-18.70
LRES W4	Mid	78.413	2	1	-27.15	-22.2	76.41	7.46	34.52	55.00	-20.48
LRES W4	High	79.728	2	1	-28.77	-21.1	76.55	7.46	34.14	55.00	-20.86
MRES	Low	77.195	2	1	-27.47	-23	76.27	9.01	34.81	55.00	-20.19
MRES	Mid	78.482	2	1	-27.47	-22.4	76.42	9.01	35.55	55.00	-19.45
MRES	High	79.762	2	1	-27.47	-21.1	76.56	9.01	36.99	55.00	-18.01
HRES	Low	77.327	2	1	-30.22	-22.5	76.29	14.58	38.15	55.00	-16.85
HRES	Mid	78.452	2	1	-32.43	-22.4	76.41	14.58	36.16	55.00	-18.84
HRES	High	79.659	2	1	-32.23	-21.1	76.55	14.58	37.80	55.00	-17.20

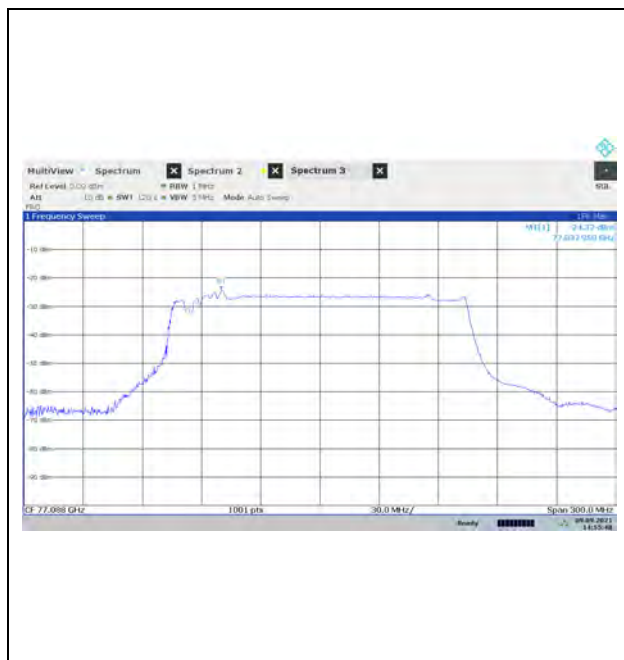
Total Corr Factor (dB) = Cable Loss - Rx Antenna Gain - Premp Gain + Mixer Loss + Waveguide Loss

Peak Power (dBm EIRP) = Measured Power + Total Corr Factor + Free Space Loss + Normalized Sweep Rate Correction

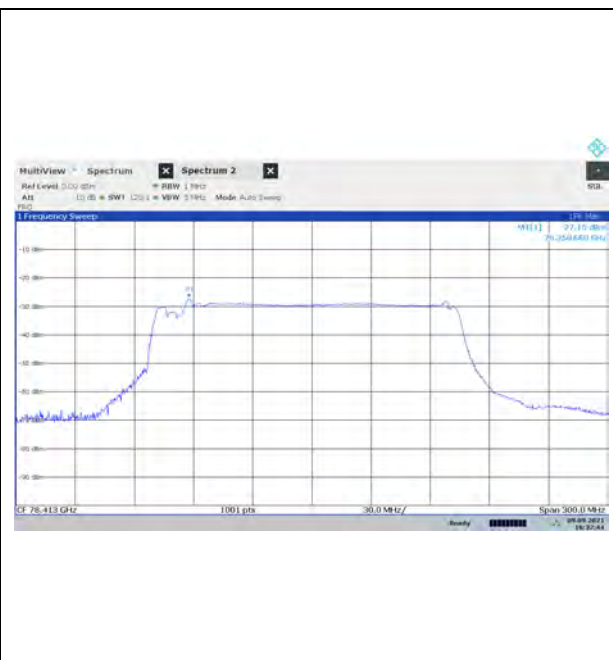
PEAK EIRP - LRES W6 MODE



PEAK EIRP - LRES W4 MODE



Low Channel



Mid Channel

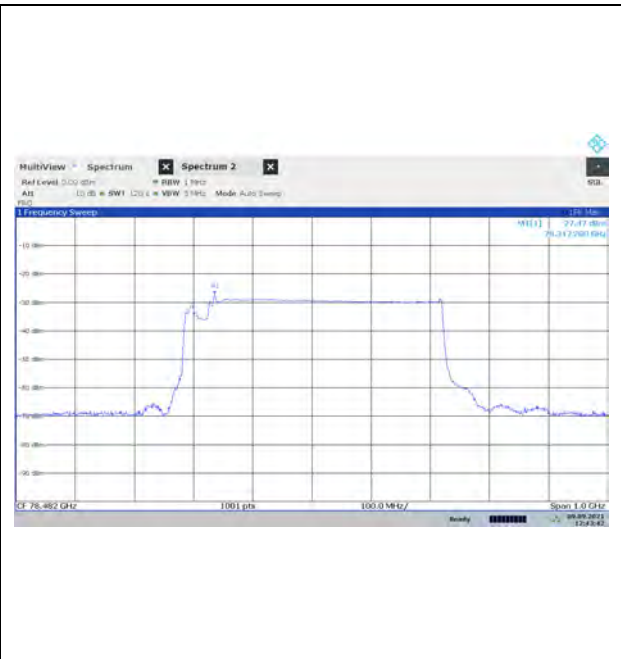


High Channel

PEAK EIRP - MRES MODE



Low Channel



Mid Channel

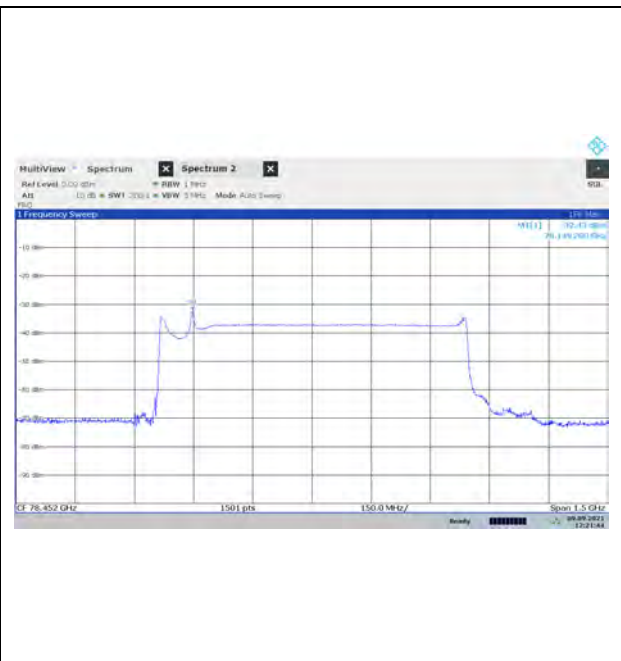


High Channel

PEAK EIRP - HRES MODE



Low Channel



Mid Channel



High Channel

8.4. 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 above 40 GHz were converted to dBm EIRP as follows:

Limit Distance (cm)	300	300
Power Density Limit (pW/cm ²)	600	1000
EIRP Limit (W)	0.00068	0.00113
EIRP Limit (dBm)	-1.7	0.5

$$\text{EIRP (mW)} = S * 4 * \text{Pi} * D^2$$

$$\text{EIRP (dBm)} = 10 * \log [\text{EIRP (mW)} * 1000]$$

Where, S = Power density in mW/cm²
 D = Separation distance in cm

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 9 kHz – 243 GHz for FCC.

Testing below 40 GHz:

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1 GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.26 and set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements; as applicable for linear voltage averaging measurements.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

3D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel).

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

OFS and chamber correlation testing had been performed and chamber measured test result is the worst-case test result.

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.

RSEs from 40 – 50 GHz were measured using a spectrum analyzer or EMI receiver with an internal preamplifier when applicable. 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

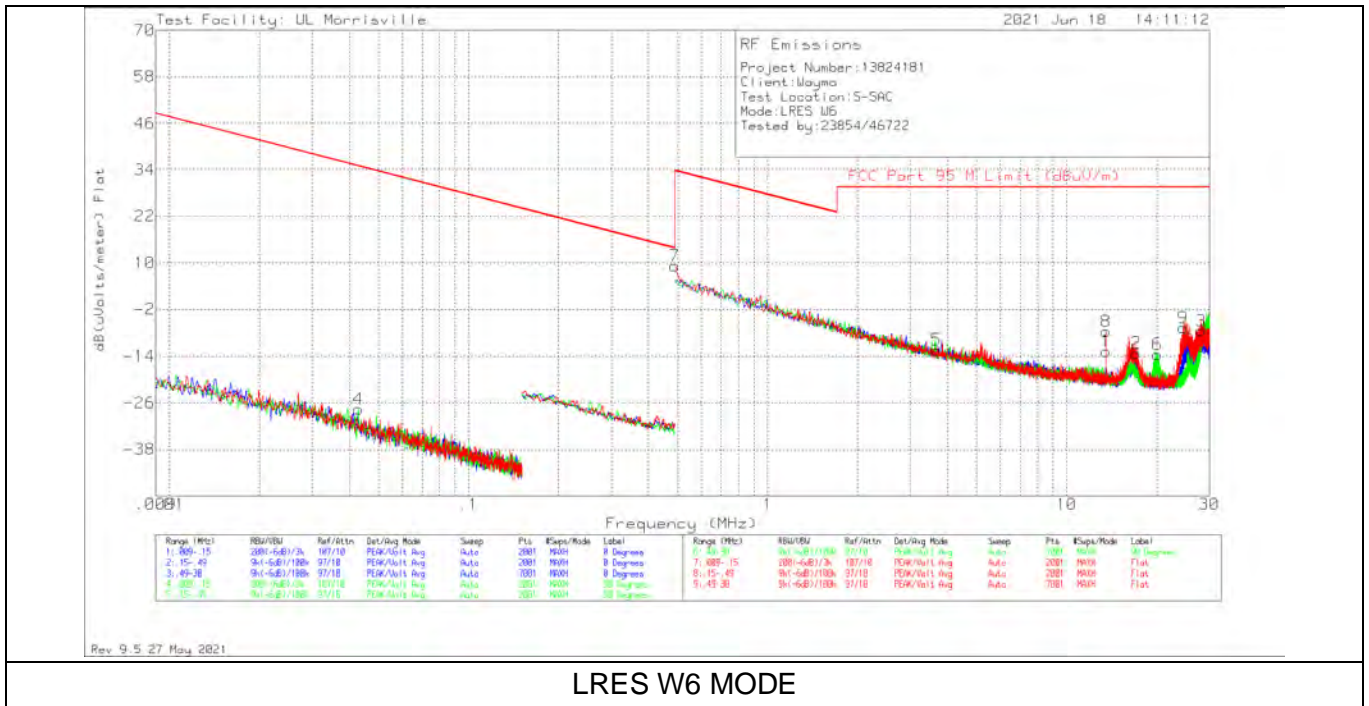
See the following pages.

TESTED BY

Below 40 GHz Test Site: South Chamber
Employee IDs: 23854, 11322
Date: 2021-06-14 to 2021-07-13

Above 40 GHz Test Site: Chamber 1 - mmWave
Employee IDs: 23854
Date: 2021-06-09 to 2021-06-24

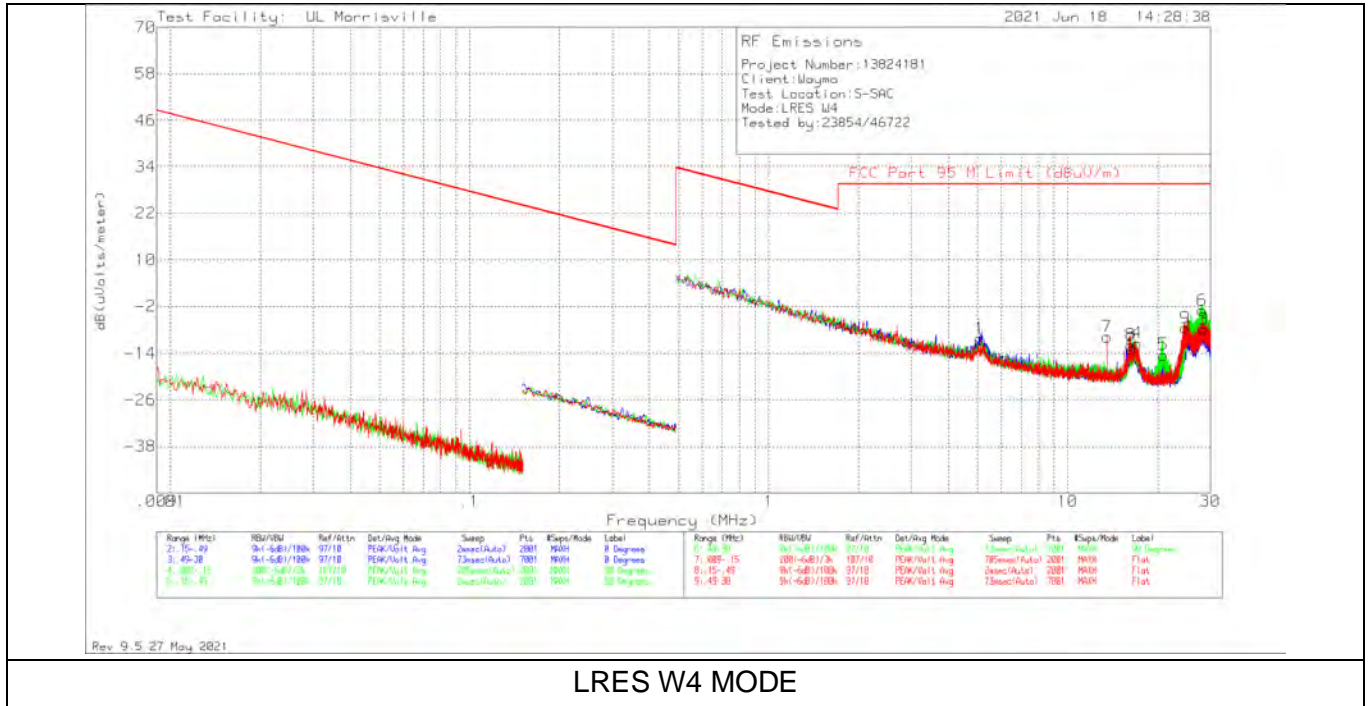
8.4.1. RADIATED EMISSIONS 9 kHz - 30 MHz



LRES W6 MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC Part 95 M Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
4	.0428	40.25	Pk	12.1	.1	-80	-27.55	34.98	-62.53	0-360	390	90 degs
7	.49357	30.6	Qp	10.8	.1	-40	1.5	33.74	-32.24	21	100	Flat
5	3.66043	16.02	Pk	11.2	.4	-40	-12.38	29.54	-41.92	0-360	390	90 degs
1	13.5596	16.17	Pk	10.4	.7	-40	-12.73	29.54	-42.27	0-360	390	0 degs
8	13.5596	21.19	Pk	10.4	.7	-40	-7.71	29.54	-37.25	0-360	390	Flat
2	17.04623	15.81	Pk	10.2	.8	-40	-13.19	29.54	-42.73	0-360	390	0 degs
6	20.09018	15.59	Pk	10	.9	-40	-13.51	29.54	-43.05	0-360	390	90 degs
9	24.47482	23.09	Pk	9.2	1	-40	-6.71	29.54	-36.25	0-360	390	Flat
3	28.1301	22.88	Pk	8.4	1.1	-40	-7.62	29.54	-37.16	0-360	390	0 degs

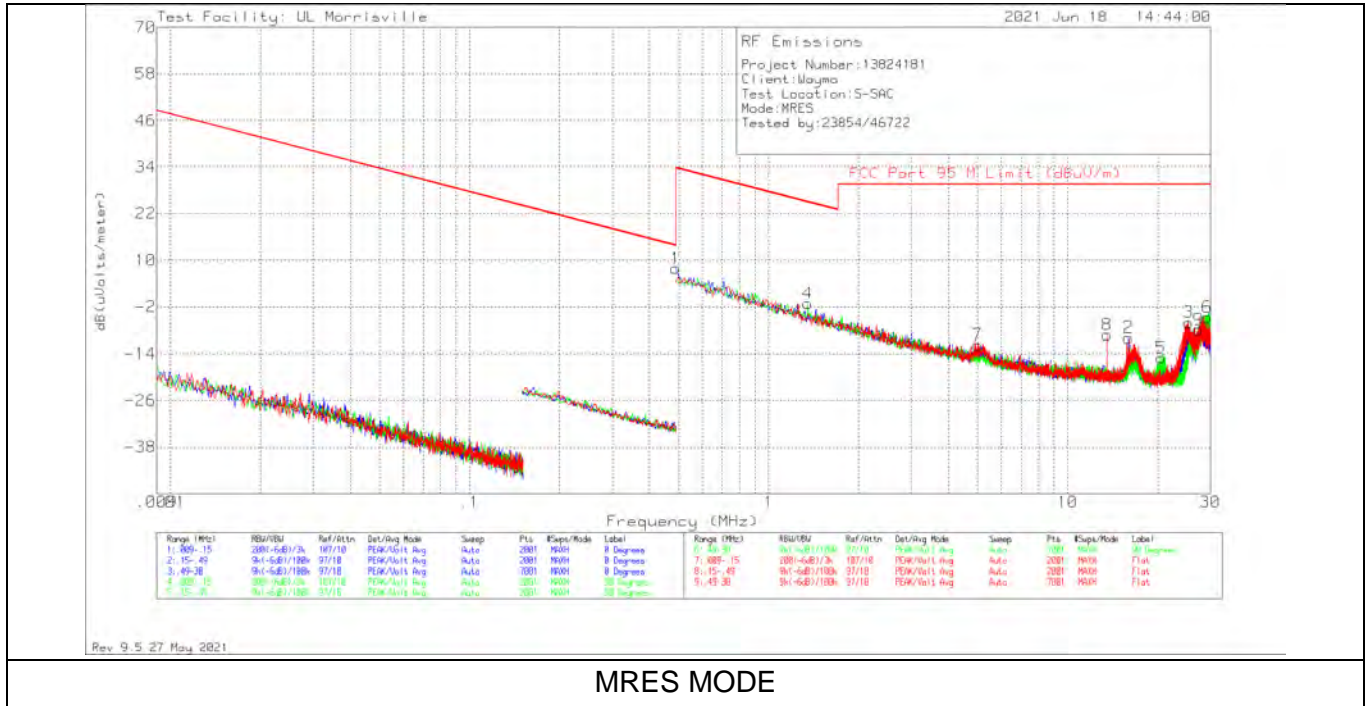
Pk - Peak detector



LRES W4 MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC Part 95 M Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	5.09387	18.27	Pk	11	.4	-40	-10.33	29.54	-39.87	0-360	390	0 degs
7	13.5596	19.09	Pk	10.4	.7	-40	-9.81	29.54	-39.35	0-360	390	Flat
8	16.26206	16.98	Pk	10.3	.8	-40	-11.92	29.54	-41.46	0-360	390	Flat
2	16.34638	16.03	Pk	10.3	.8	-40	-12.87	29.54	-42.41	0-360	390	0 degs
4	17.05045	17.63	Pk	10.2	.8	-40	-11.37	29.54	-40.91	0-360	390	90 degs
5	20.87436	14.88	Pk	9.8	.9	-40	-14.42	29.54	-43.96	0-360	390	90 degs
9	24.74886	22.3	Pk	9.2	1	-40	-7.5	29.54	-37.04	0-360	390	Flat
6	28.16804	27.48	Pk	8.3	1.1	-40	-3.12	29.54	-32.66	0-360	390	90 degs
3	28.45894	22.69	Pk	8.3	1.1	-40	-7.91	29.54	-37.45	0-360	390	0 degs

Pk - Peak detector



MRES MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC Part 95 M Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	.49308	30.5	Qp	10.8	.1	-40	1.4	33.75	-32.35	299	100	0 degs
4	1.35217	27.7	Pk	11	.2	-40	-1.1	24.98	-26.08	0-360	390	90 degs
7	4.9969	16.91	Pk	11	.4	-40	-11.69	29.54	-41.23	0-360	390	Flat
8	13.5596	19.76	Pk	10.4	.7	-40	-9.14	29.54	-38.68	0-360	390	Flat
2	15.9838	18.99	Pk	10.3	.8	-40	-9.91	29.54	-39.45	0-360	390	0 degs
5	20.48649	14.14	Pk	9.9	.9	-40	-15.06	29.54	-44.6	0-360	390	90 degs
3	25.36862	23.97	Pk	9	1	-40	-6.03	29.54	-35.57	0-360	390	0 degs
9	27.38808	22.58	Pk	8.5	1	-40	-7.92	29.54	-37.46	0-360	390	Flat
6	29.2895	26.2	Pk	8	1.1	-40	-4.7	29.54	-34.24	0-360	390	90 degs

Pk - Peak detector

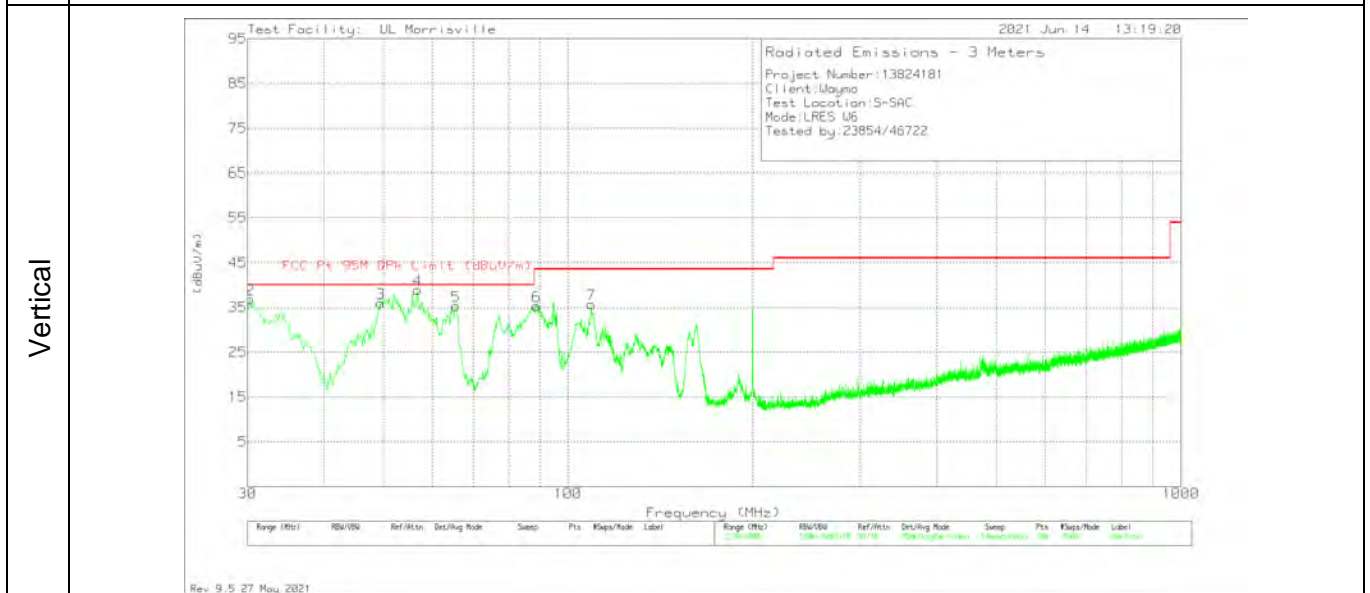
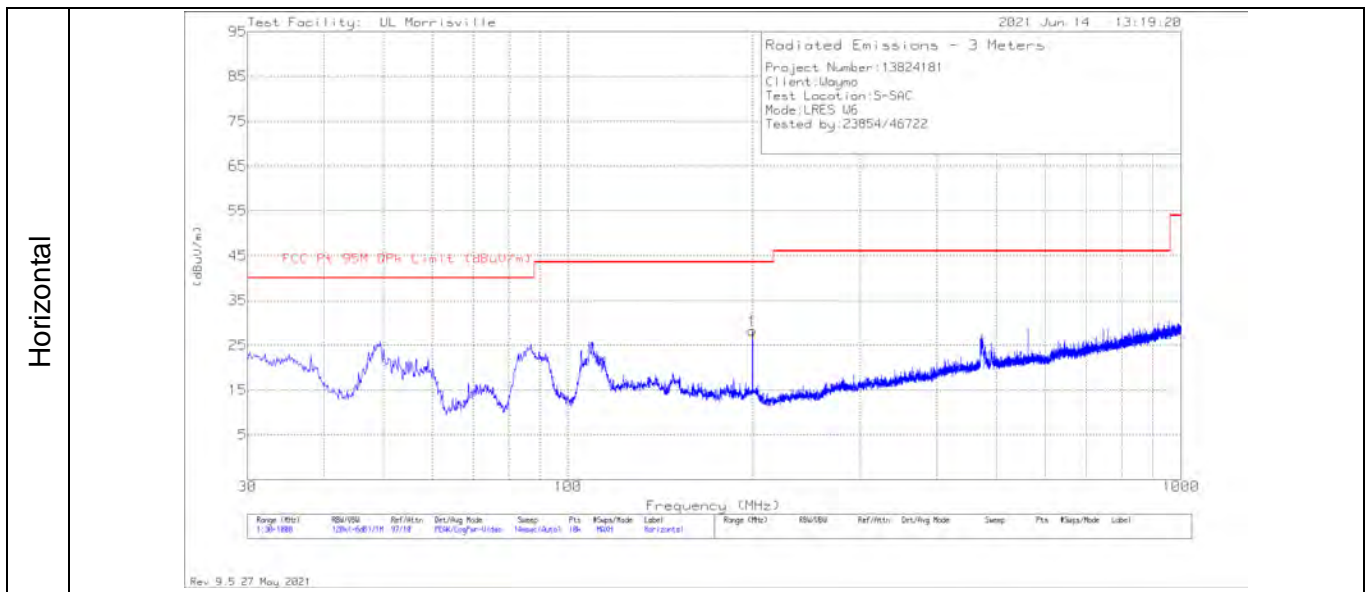


HRES MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC Part 95 M Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
4	5.08544	14.1	Pk	11	.4	-40	-14.5	29.54	-44.04	0-360	390	90 degs
7	5.11917	16.79	Pk	11	.4	-40	-11.81	29.54	-41.35	0-360	390	Flat
1	7.36208	14.66	Pk	10.7	.5	-40	-14.14	29.54	-43.68	0-360	390	0 degs
8	13.5596	18.7	Pk	10.4	.7	-40	-10.2	29.54	-39.74	0-360	390	Flat
5	16.34216	19.11	Pk	10.3	.8	-40	-9.79	29.54	-39.33	0-360	390	90 degs
2	16.48129	13.11	Pk	10.3	.8	-40	-15.79	29.54	-45.33	0-360	390	0 degs
6	20.71415	16.54	Pk	9.9	.9	-40	-12.66	29.54	-42.2	0-360	390	90 degs
3	25.87454	18.8	Pk	8.8	1	-40	-11.4	29.54	-40.94	0-360	390	0 degs
9	27.88135	23.31	Pk	8.4	1.1	-40	-7.19	29.54	-36.73	0-360	390	Flat

Pk - Peak detector

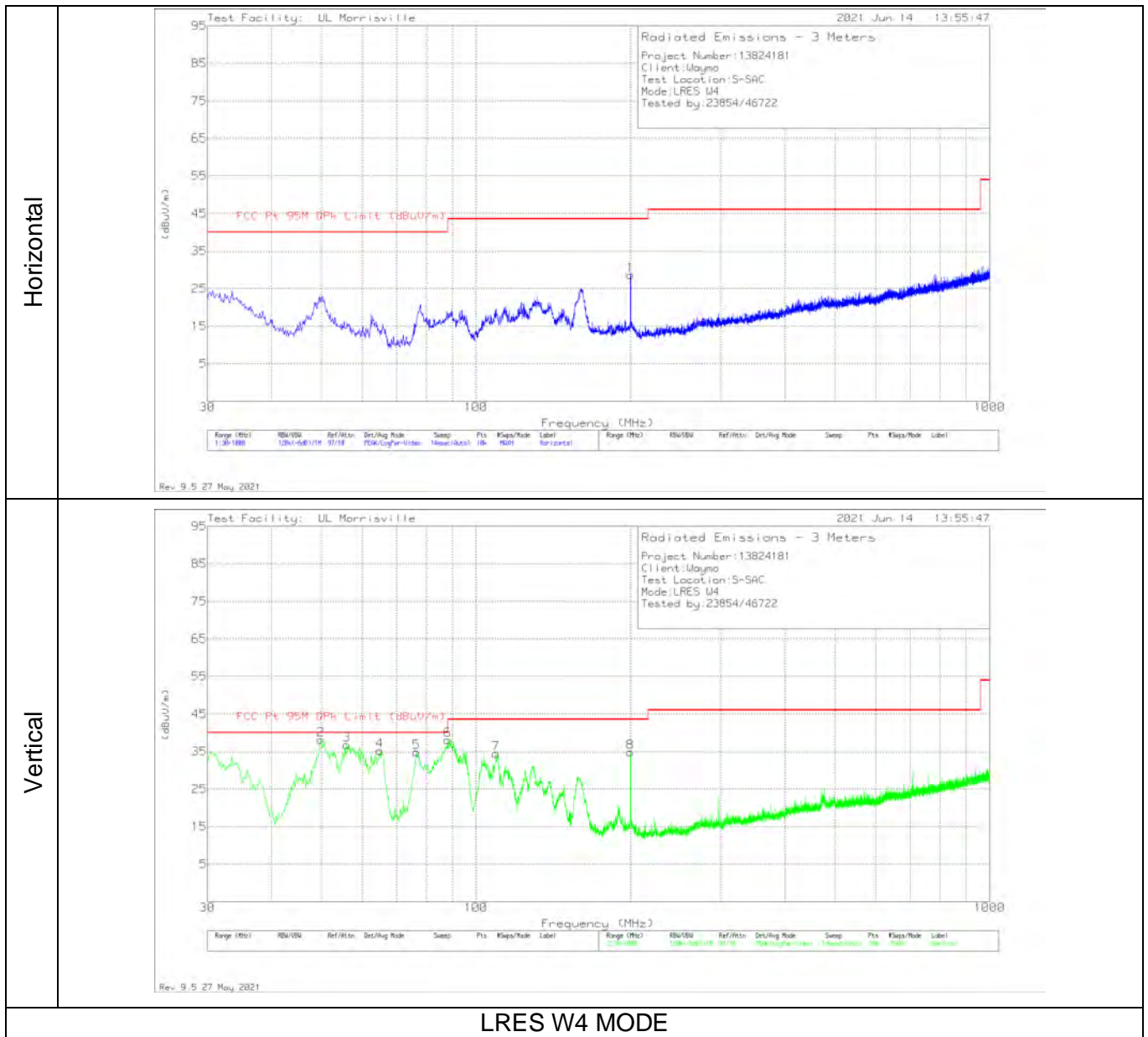
8.4.2. RADIATED EMISSIONS 30 MHz - 1 GHz



LRES W6 MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	30.1961	35.86	Qp	26.8	-31.5	31.16	40	-8.84	74	103	V
3	49.6912	50.46	Qp	14.3	-31.2	33.56	40	-6.44	326	103	V
4	57.0891	50.22	Qp	13.5	-31.1	32.62	40	-7.38	50	102	V
5	65.743	49.5	Qp	14.2	-31	32.7	40	-7.3	351	107	V
6	88.8109	43.15	Qp	14	-30.7	26.45	43.52	-17.07	4	116	V
7	109.3419	41.08	Qp	18.7	-30.5	29.28	43.52	-14.24	161	108	V
1	199.9915	31.37	Qp	18.9	-29.6	20.67	43.52	-22.85	88	174	H

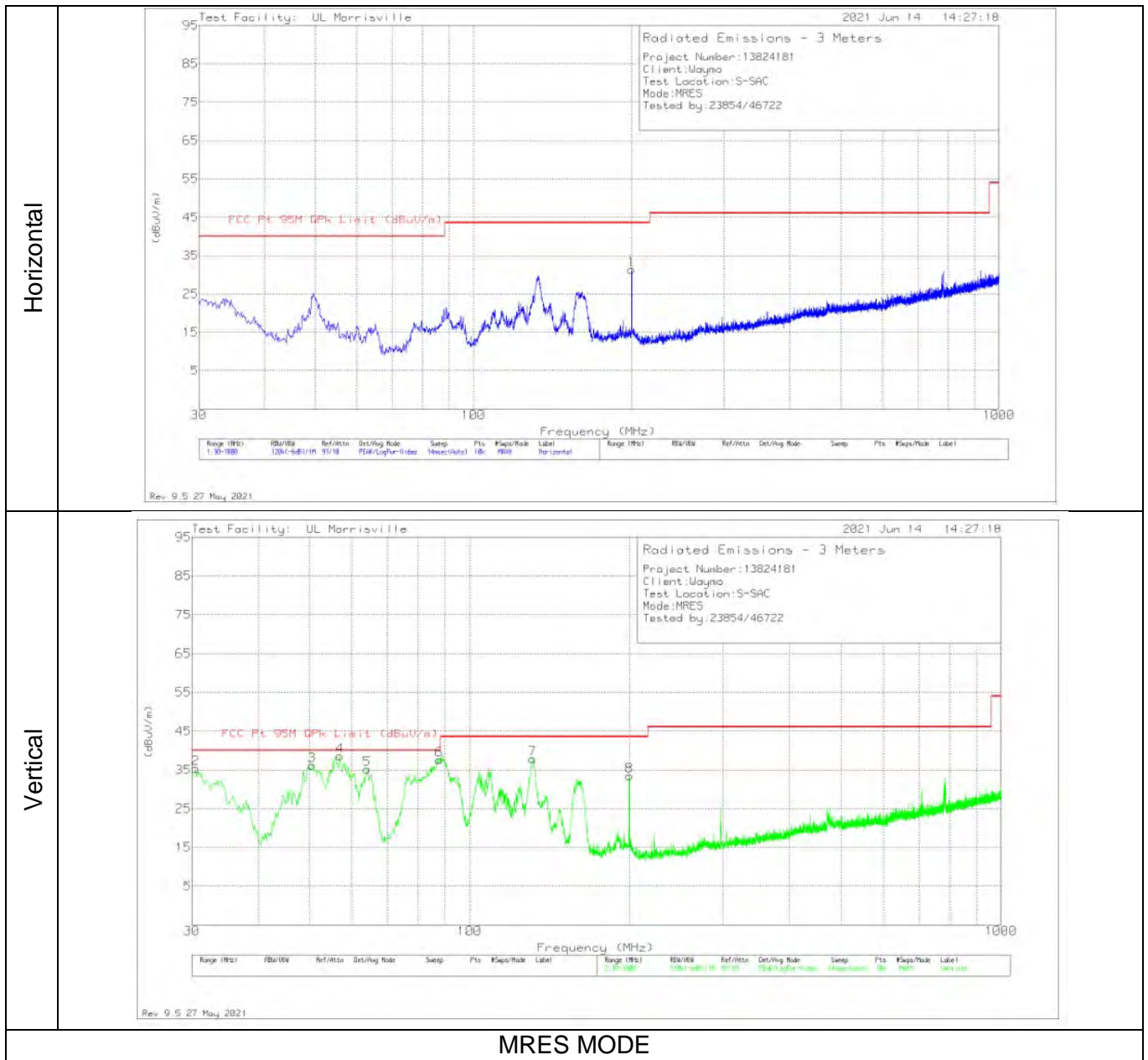
Qp - Quasi-Peak detector



LRES W4 MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	49.8524	50.73	Qp	14.2	-31.2	33.73	40	-6.27	337	102	V
3	56.2704	48.78	Qp	13.5	-31.1	31.18	40	-8.82	49	101	V
4	64.8214	48.44	Qp	14.1	-31.1	31.44	40	-8.56	360	125	V
5	76.5044	45.52	Qp	14.1	-30.9	28.72	40	-11.28	334	119	V
6	88.3365	44.57	Qp	13.9	-30.7	27.77	43.52	-15.75	11	107	V
7	109.489	44.02	Qp	18.7	-30.5	32.22	43.52	-11.3	190	104	V
1	199.9958	39.27	Qp	18.9	-29.6	28.57	43.52	-14.95	28	161	H
8	199.9968	32.2	Qp	18.9	-29.6	21.5	43.52	-22.02	221	246	V

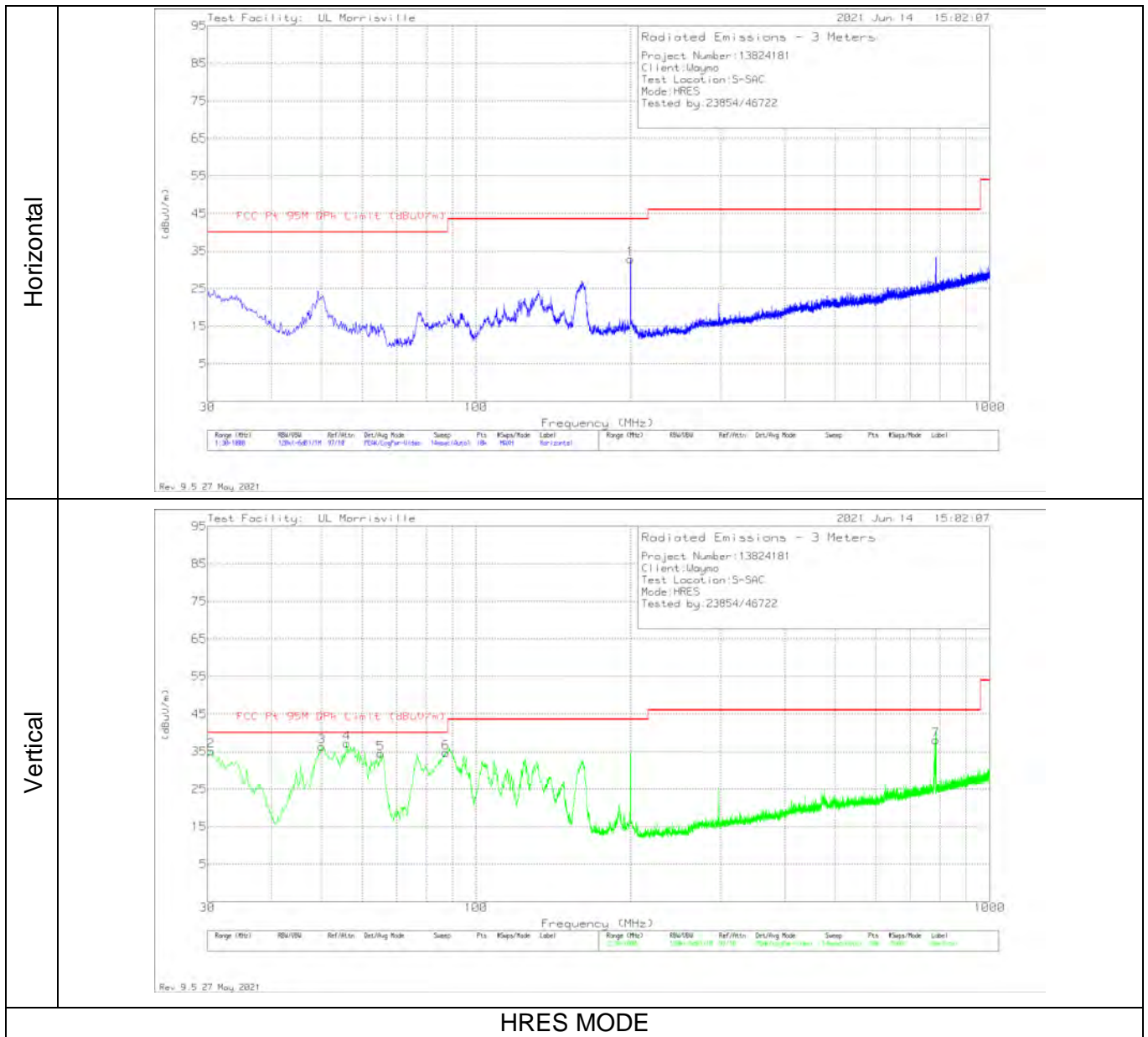
Qp - Quasi-Peak detector



MRES MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	30.6586	35.13	Qp	26.6	-31.5	30.23	40	-9.77	164	107	V
3	50.2637	50.13	Qp	14.1	-31.2	33.03	40	-6.97	325	107	V
4	56.7411	50.75	Qp	13.5	-31.1	33.15	40	-6.85	46	103	V
5	64.1124	45.93	Qp	14	-31.1	28.83	40	-11.17	43	104	V
6	87.5932	51.38	Qp	13.8	-30.7	34.48	40	-5.52	360	104	V
7	131.7205	31.14	Qp	19.8	-30.2	20.74	43.52	-22.78	106	106	V
1	199.9848	32.63	Qp	18.9	-29.6	21.93	43.52	-21.59	225	153	H
8	199.9905	39.14	Qp	18.9	-29.6	28.44	43.52	-15.08	181	107	V

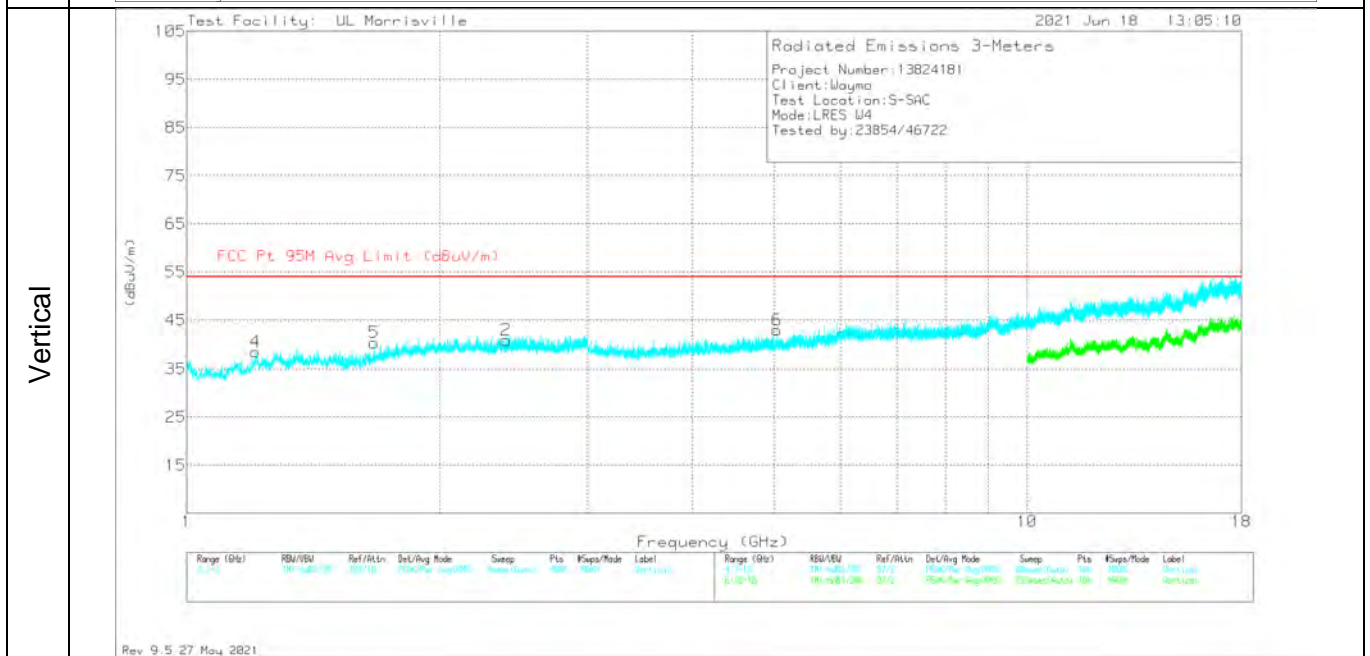
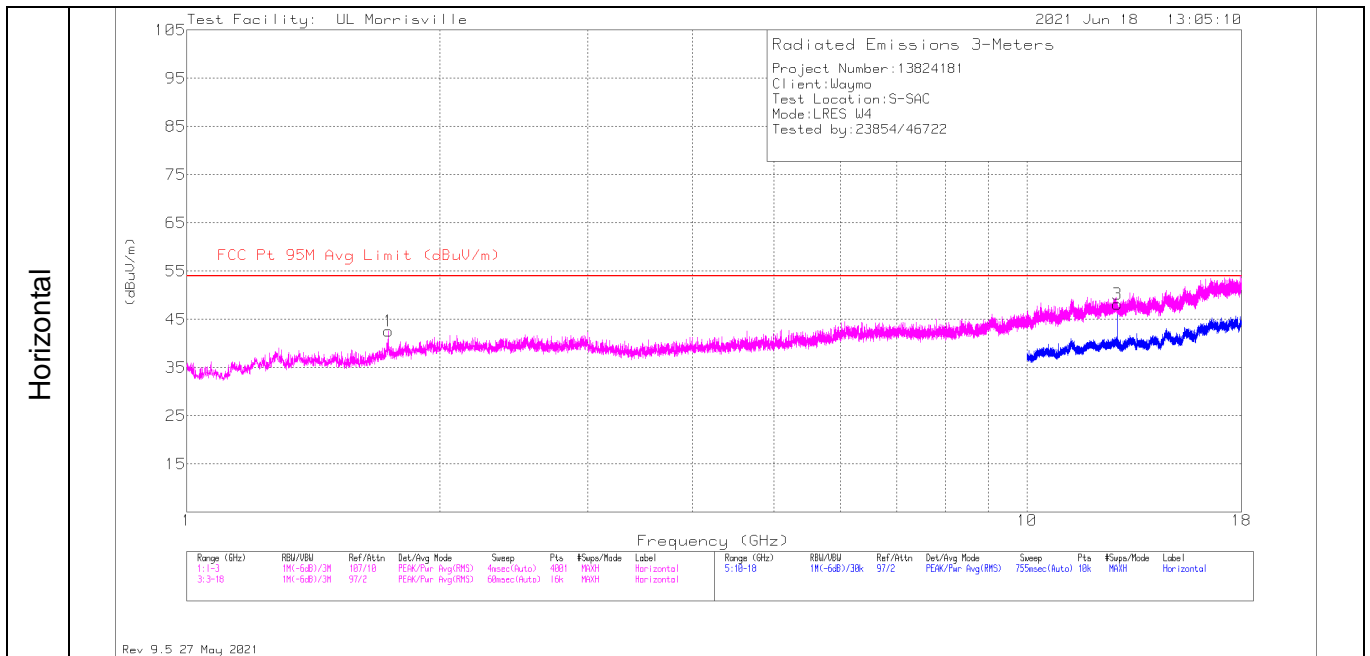
Qp - Quasi-Peak detector



HRES MODE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	30.6677	35.9	Qp	26.6	-31.5	31	40	-9	37	104	V
3	50.1178	50.66	Qp	14.2	-31.2	33.66	40	-6.34	332	101	V
4	56.1351	49.45	Qp	13.5	-31.1	31.85	40	-8.15	93	112	V
5	65.4533	46.9	Qp	14.1	-31	30	40	-10	336	105	V
6	87.5198	42.06	Qp	13.8	-30.7	25.16	40	-14.84	11	105	V
1	199.9968	37.4	Qp	18.9	-29.6	26.7	43.52	-16.82	220	136	H
7	785.2655	19.1	Qp	27.3	-26.6	19.8	46.02	-26.22	132	360	V

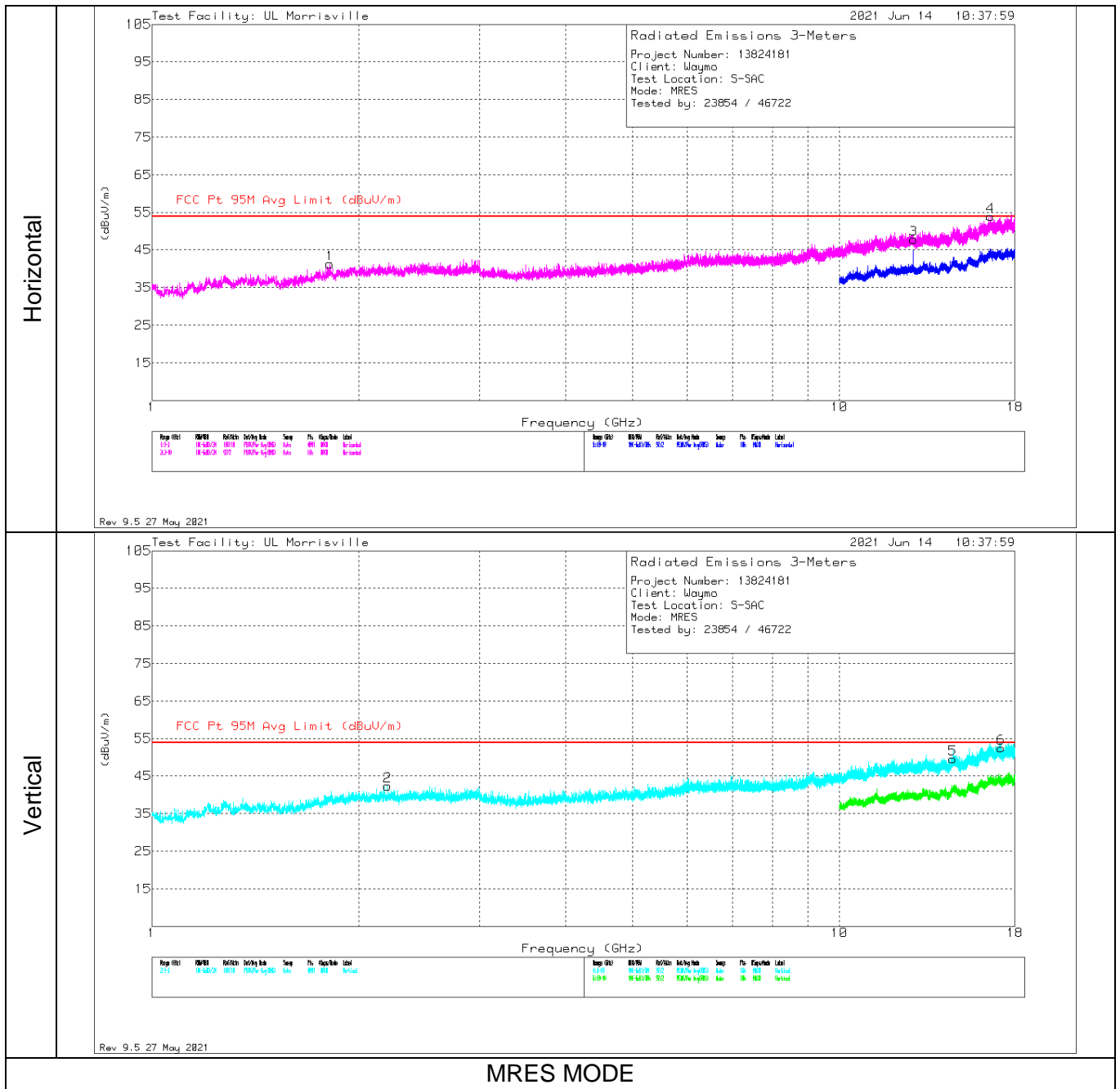
Qp - Quasi-Peak detector



LRES W4 MODE

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.7375	35.06	Pk	29.7	-22.2	42.56	54	-11.44	0-360	199	H
4	1.2085	33.03	Pk	29.1	-23.6	38.53	54	-15.47	0-360	101	V
5	1.671	33.83	Pk	28.7	-22.2	40.33	54	-13.67	0-360	199	V
6	5.04375	39.98	Pk	34.3	-31.3	42.98	54	-11.02	0-360	101	V
2	2.3985	32.61	Pk	32.3	-24	40.91	54	-13.09	0-360	199	V
3	12.79962	27.34	Av	39.1	-24.9	41.54	54	-12.46	318	110	H

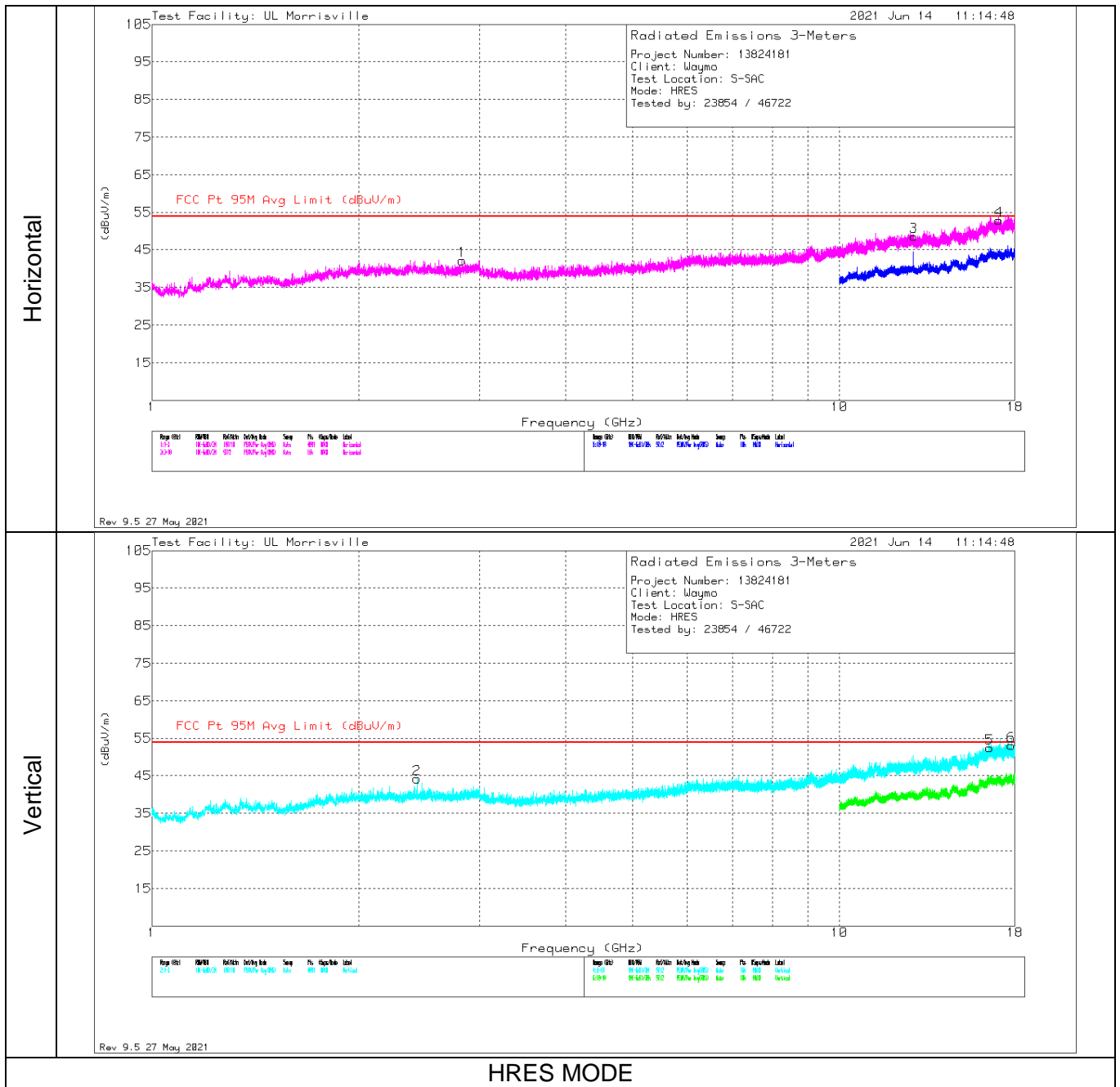
Pk – Peak Detector
 Av - Average detection



MRES MODE

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	2.20332	16.23	Av	31.9	-23.3	24.83	54	-29.17	55	191	V
1	1.81598	16.04	Av	30.6	-22.3	24.34	54	-29.66	229	212	H
3	12.81836	21.85	Av	39.1	-25	35.95	54	-18.05	353	232	H
5	14.60545	21.27	Av	39.8	-23.1	37.97	54	-16.03	133	119	V
4	16.58368	21.25	Av	41.7	-22.9	40.05	54	-13.95	360	347	H
6	17.17406	22.58	Av	41.4	-23.1	40.88	54	-13.12	133	198	V

Av - Average detection

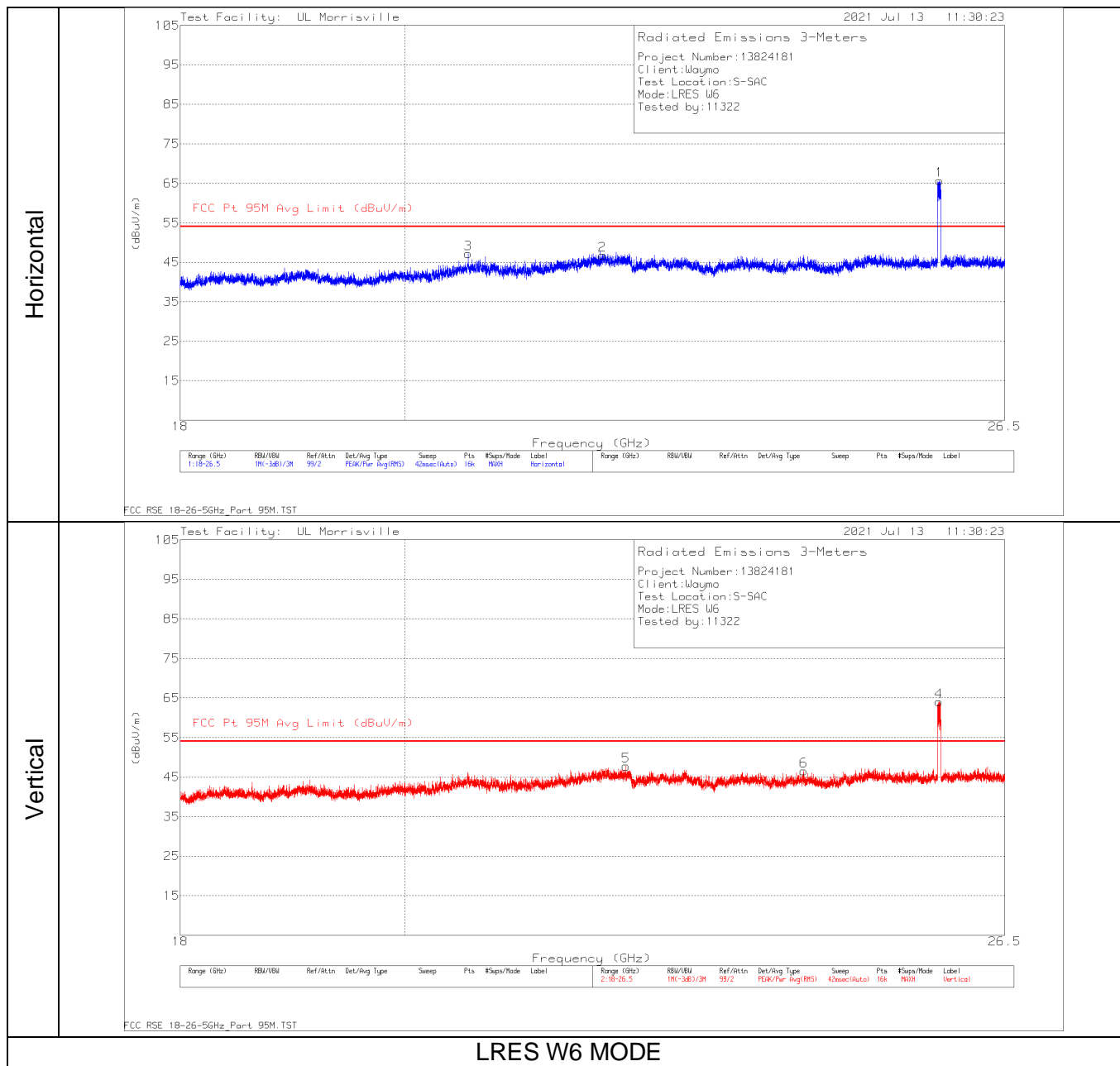


HRES MODE

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	2.8237	19.38	Av	32.7	-25.9	26.18	54	-27.82	117	134	H
6	17.77707	21.23	Av	41.6	-22.2	40.63	54	-13.37	287	259	V
2	2.43191	17.32	Av	32.2	-24.2	25.32	54	-28.68	307	190	V
3	12.82876	21.87	Av	39	-24.9	35.97	54	-18.03	215	260	H
5	16.52656	21.31	Av	41.6	-23.1	39.81	54	-14.19	109	218	V
4	17.05236	22.73	Av	41.5	-23.6	40.63	54	-13.37	253	178	H

Av - Average detection

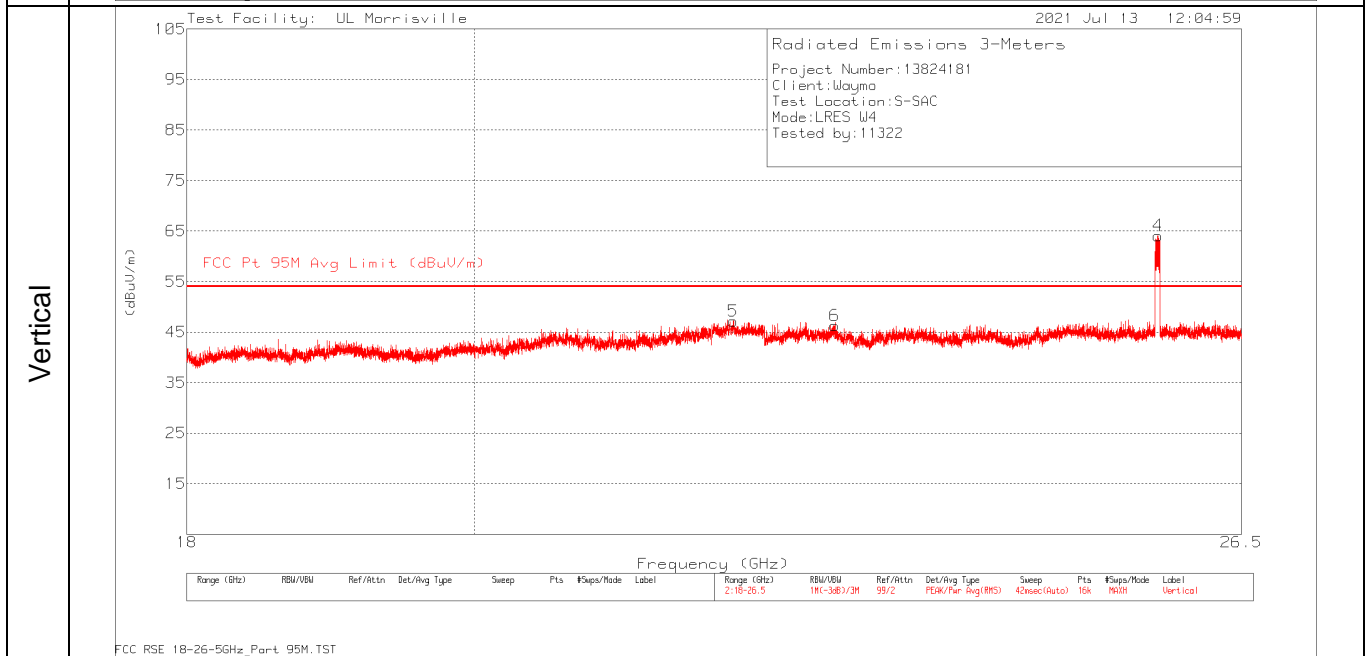
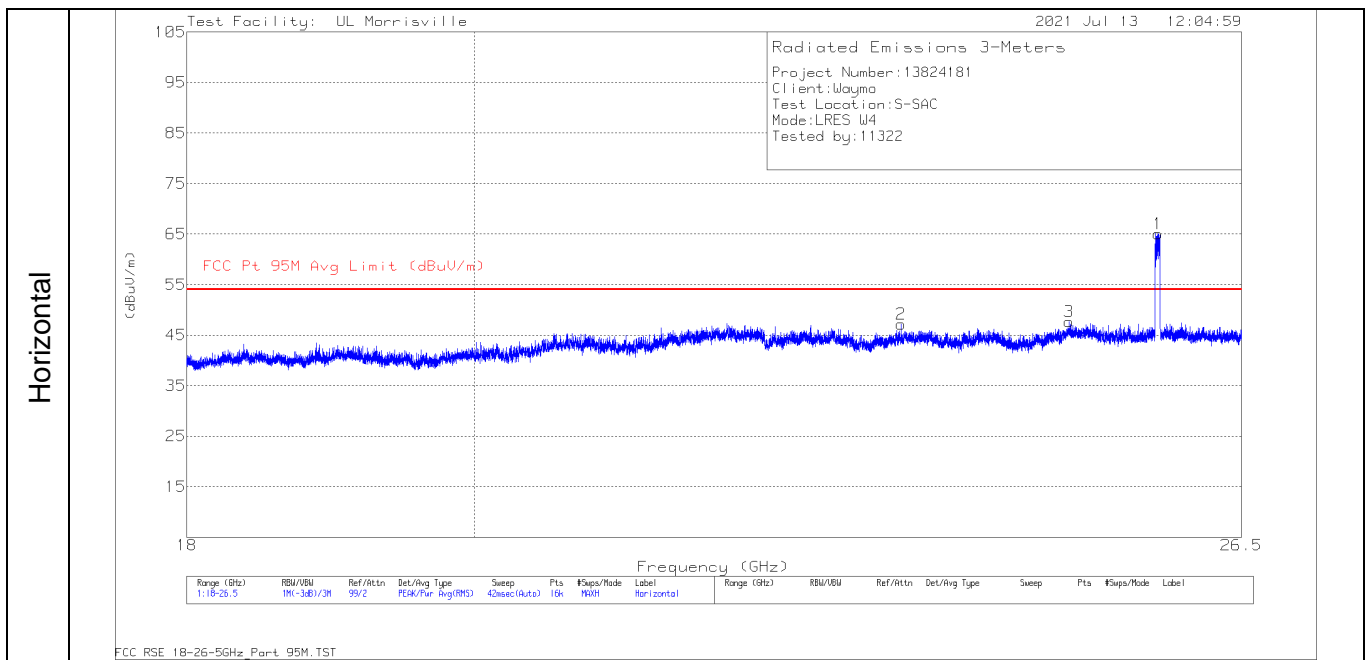
8.4.4. RADIATED EMISSIONS 18-26.5 GHz



LRES W6 MODE

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	20.60509	51.23	Pk	33.9	-38	47.13	54	-6.87	0-360	201	H
2	21.94482	47.36	Pk	37	-37.6	46.76	54	-7.24	0-360	150	H
5	22.1844	49.24	Pk	36.7	-38.2	47.74	54	-6.26	0-360	250	V
6	24.11885	48.67	Pk	34.8	-36.9	46.57	54	-7.43	0-360	250	V
4	25.681	48.62	RMS	35.2	-36.8	47.02	54	-6.98	14	102	V
1	25.68	45.66	RMS	35.2	-36.6	44.26	54	-9.74	325	295	H

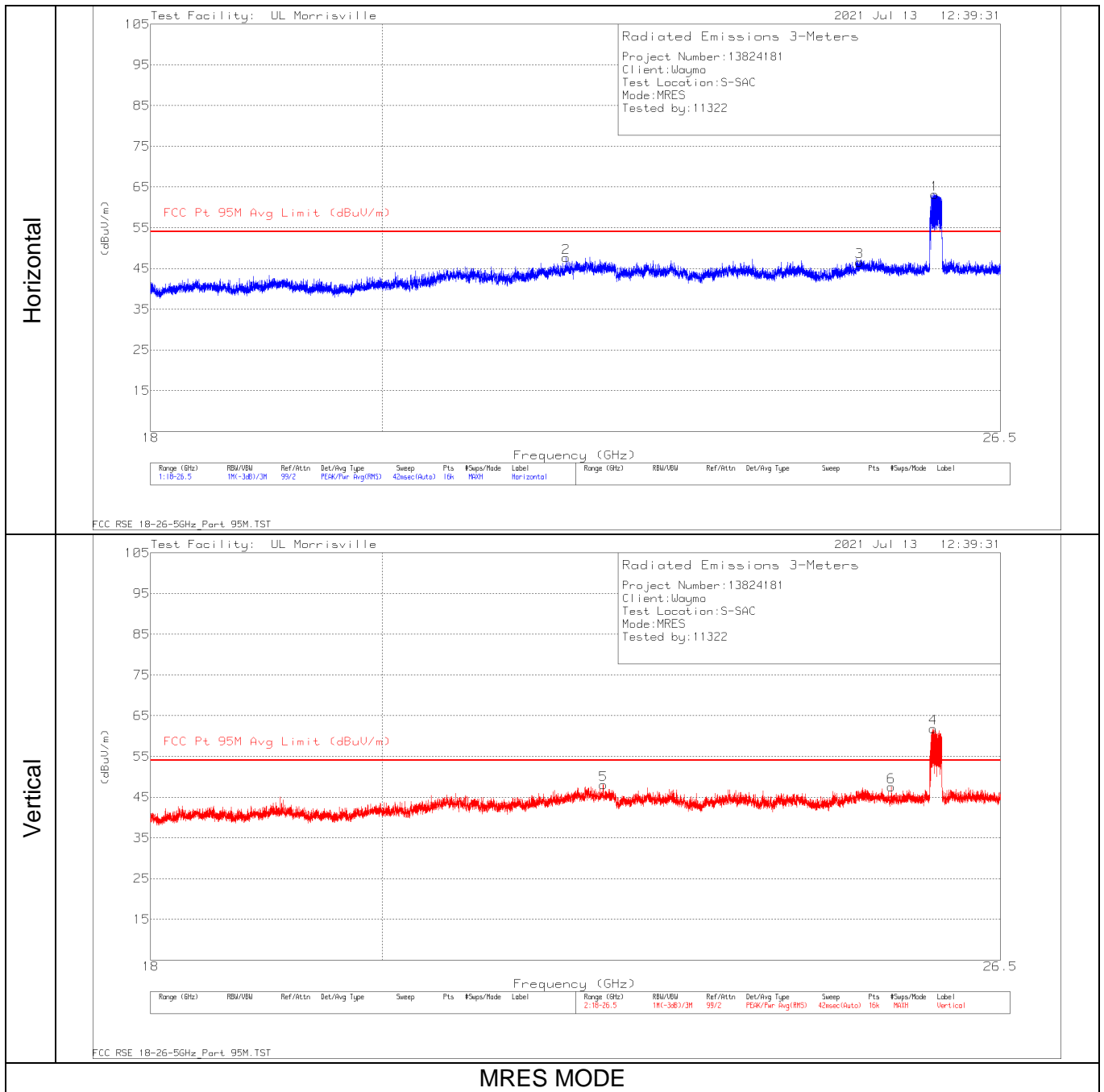
Pk – Peak Detector
 RMS - RMS detection



LRES W4 MODE

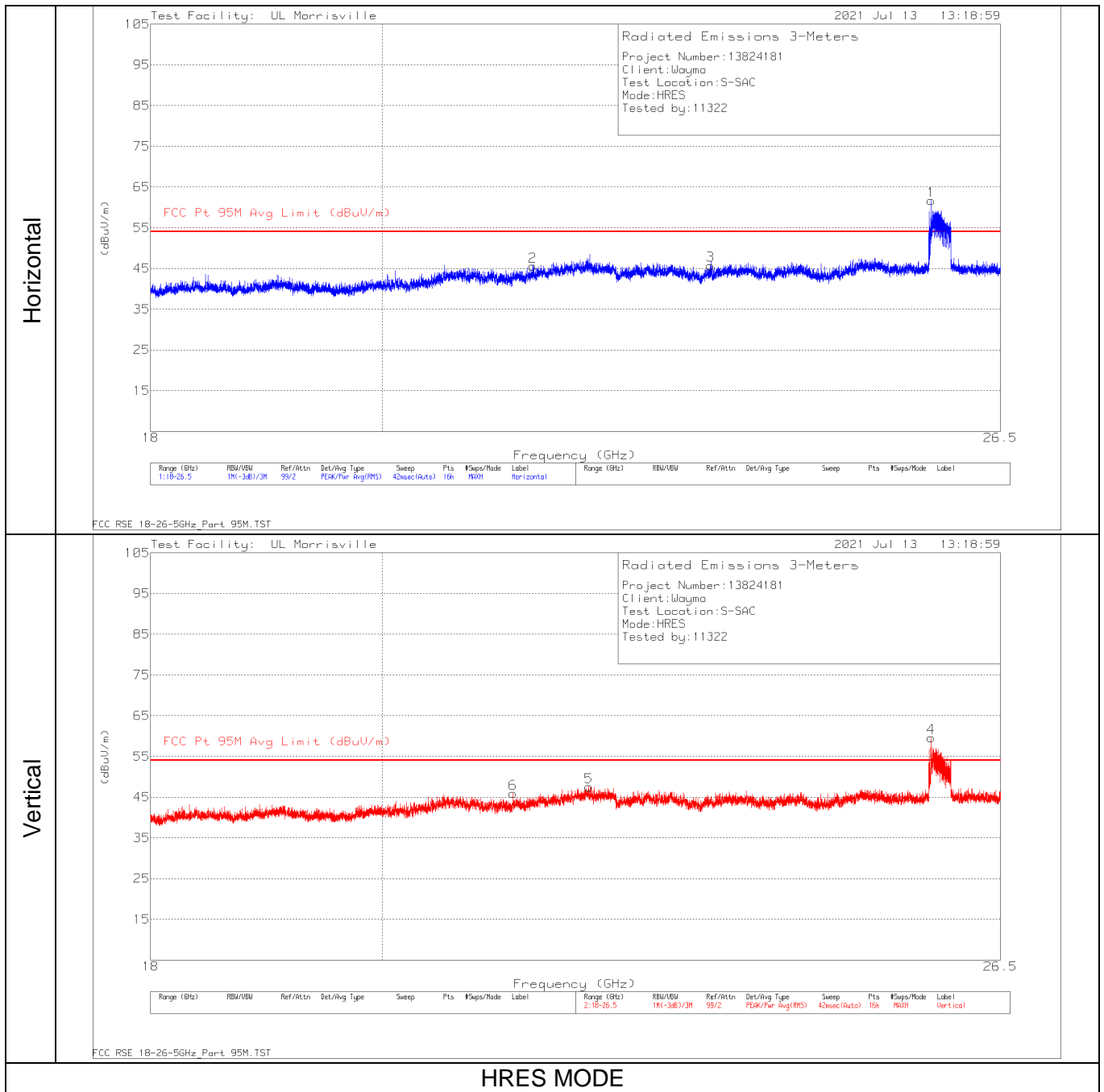
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	21.99265	47.97	Pk	37.1	-37.9	47.17	54	-6.83	0-360	250	V
6	22.82603	48.29	Pk	35.5	-37.5	46.29	54	-7.71	0-360	250	V
2	23.3892	49.67	Pk	34.9	-37.4	47.17	54	-6.83	0-360	300	H
3	24.8782	49.12	Pk	35.1	-36.6	47.62	54	-6.38	0-360	101	H
4	25.719	46.3	RMS	35.2	-36.4	45.1	54	-8.9	6	166	V
1	25.719	48.97	RMS	35.2	-36.4	47.77	54	-6.23	15	168	H

Pk – Peak Detector
 RMS - RMS detection



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	21.7472	49.72	Pk	36.1	-38.2	47.62	54	-6.38	0-360	150	H
5	22.11801	49.11	Pk	36.7	-37.8	48.01	54	-5.99	0-360	199	V
3	24.85323	48.42	Pk	35.1	-36.9	46.62	54	-7.38	0-360	300	H
6	25.21567	48.88	Pk	35.3	-36.6	47.58	54	-6.42	0-360	199	V
4	25.676	42.37	RMS	35.2	-36.3	41.27	54	-12.73	17	105	V
1	25.676	44.2	RMS	35.2	-36.3	43.1	54	-10.9	5	166	H

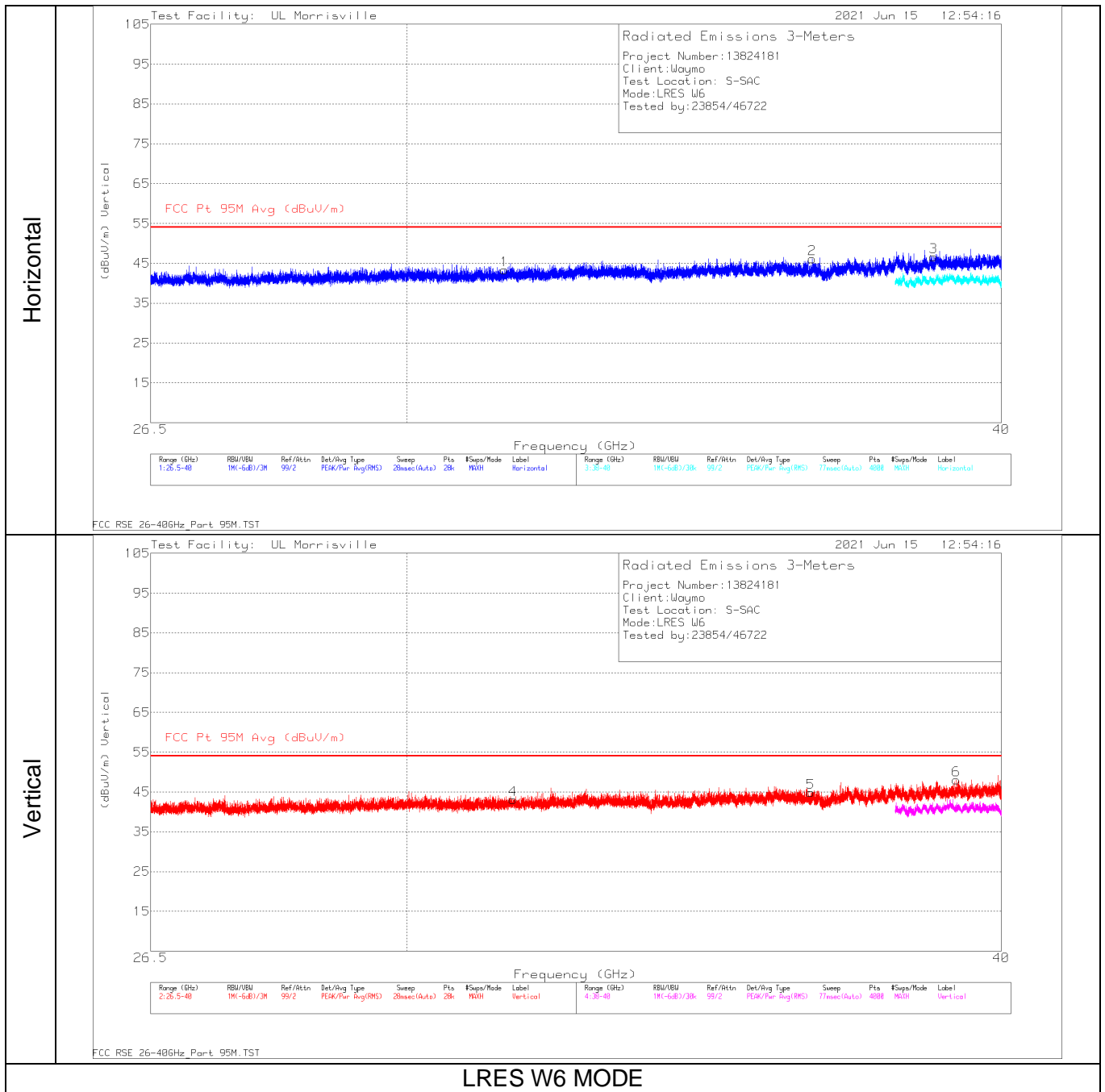
Pk – Peak Detector
 RMS - RMS detection



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6	21.2278	48.86	Pk	34.4	-37.3	45.96	54	-8.04	0-360	200	V
2	21.41891	48.9	Pk	34.7	-38	45.6	54	-8.4	0-360	250	H
5	21.97566	48.98	Pk	37.1	-38.5	47.58	54	-6.42	0-360	299	V
3	23.22293	48.55	Pk	34.9	-37.7	45.75	54	-8.25	0-360	149	H
4	25.675	43.13	RMS	35.2	-36.3	42.03	54	-11.97	20	104	V
1	25.675	46.09	RMS	35.2	-36.3	44.99	54	-9.01	9	171	H

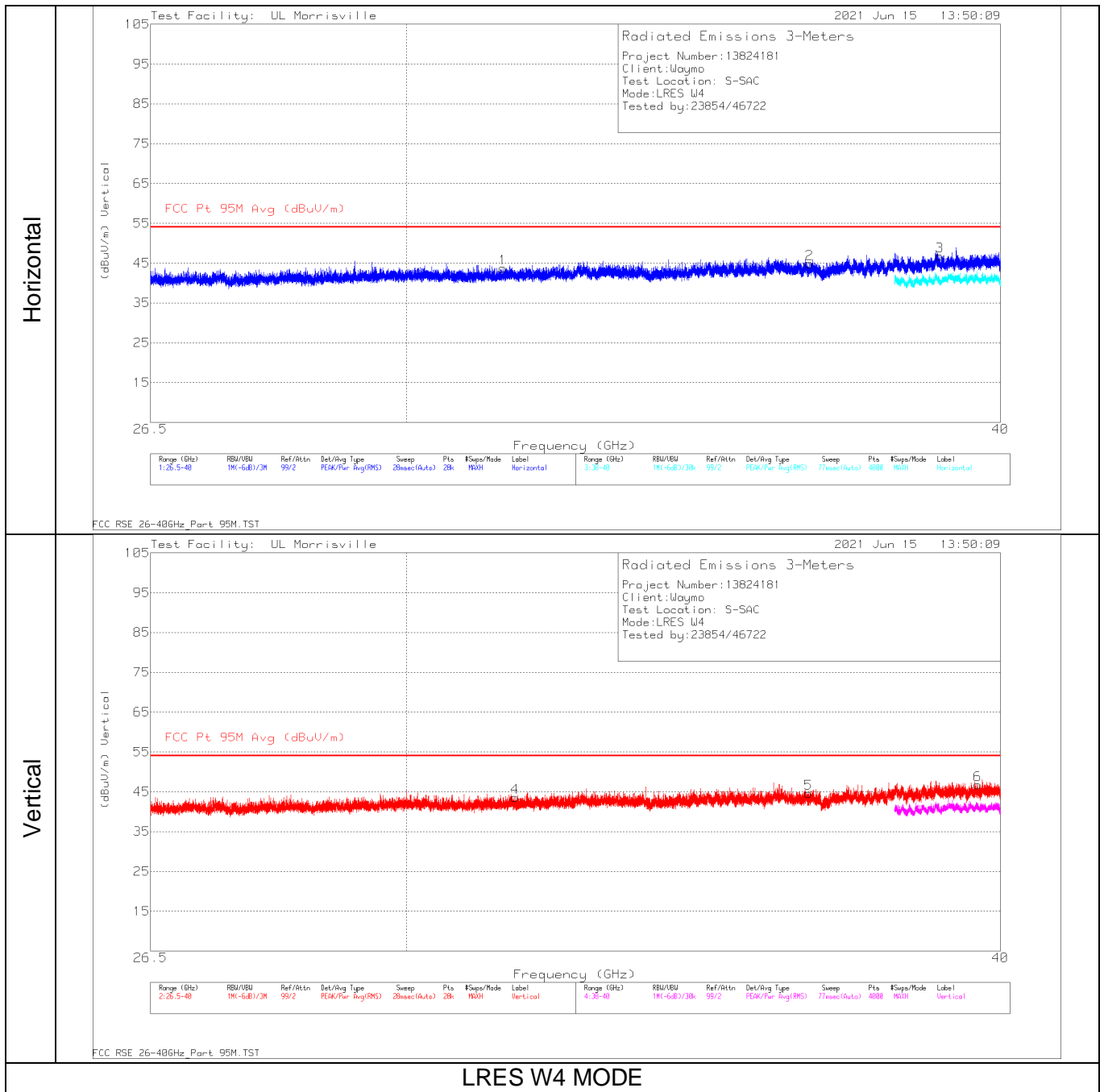
Pk – Peak Detector
 RMS - RMS detection

8.4.5. RADIATED EMISSIONS 26.5-40 GHz



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0061 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.44974	30.25	Av	36.9	-35.5	31.65	54	-22.35	1	202	H
2	36.49765	33.52	Av	37.9	-38.4	33.02	54	-20.98	249	305	H
3	38.71021	32.58	Av	38.6	-37.5	33.68	54	-20.32	83	379	H
4	31.57402	30.54	Av	36.9	-35.5	31.94	54	-22.06	313	228	V
5	36.47833	33.2	Av	38	-38.4	32.8	54	-21.2	118	112	V
6	39.13677	32.67	Av	38.7	-37	34.37	54	-19.63	278	175	V

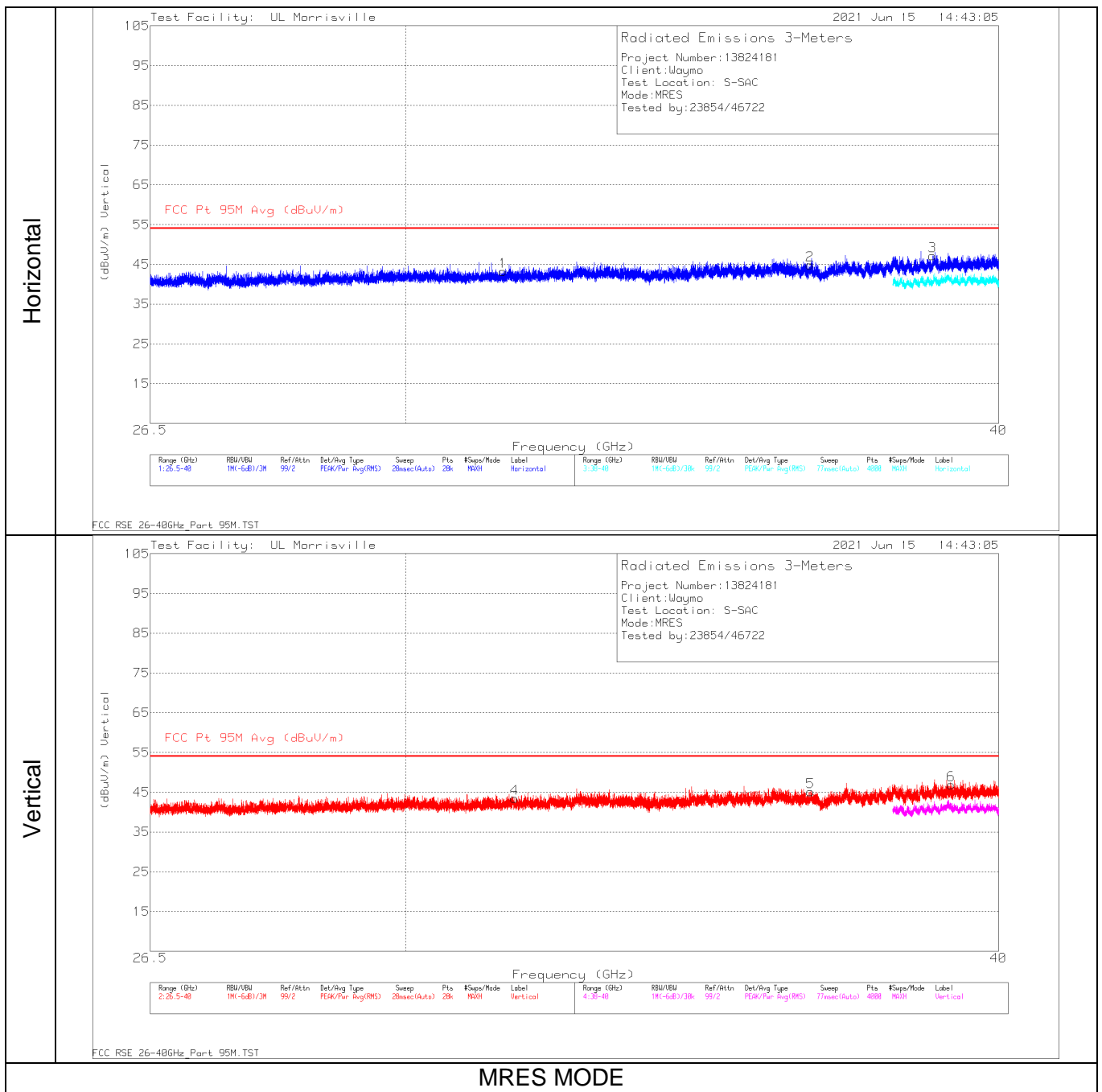
Av - Average detection



LRES W4 MODE

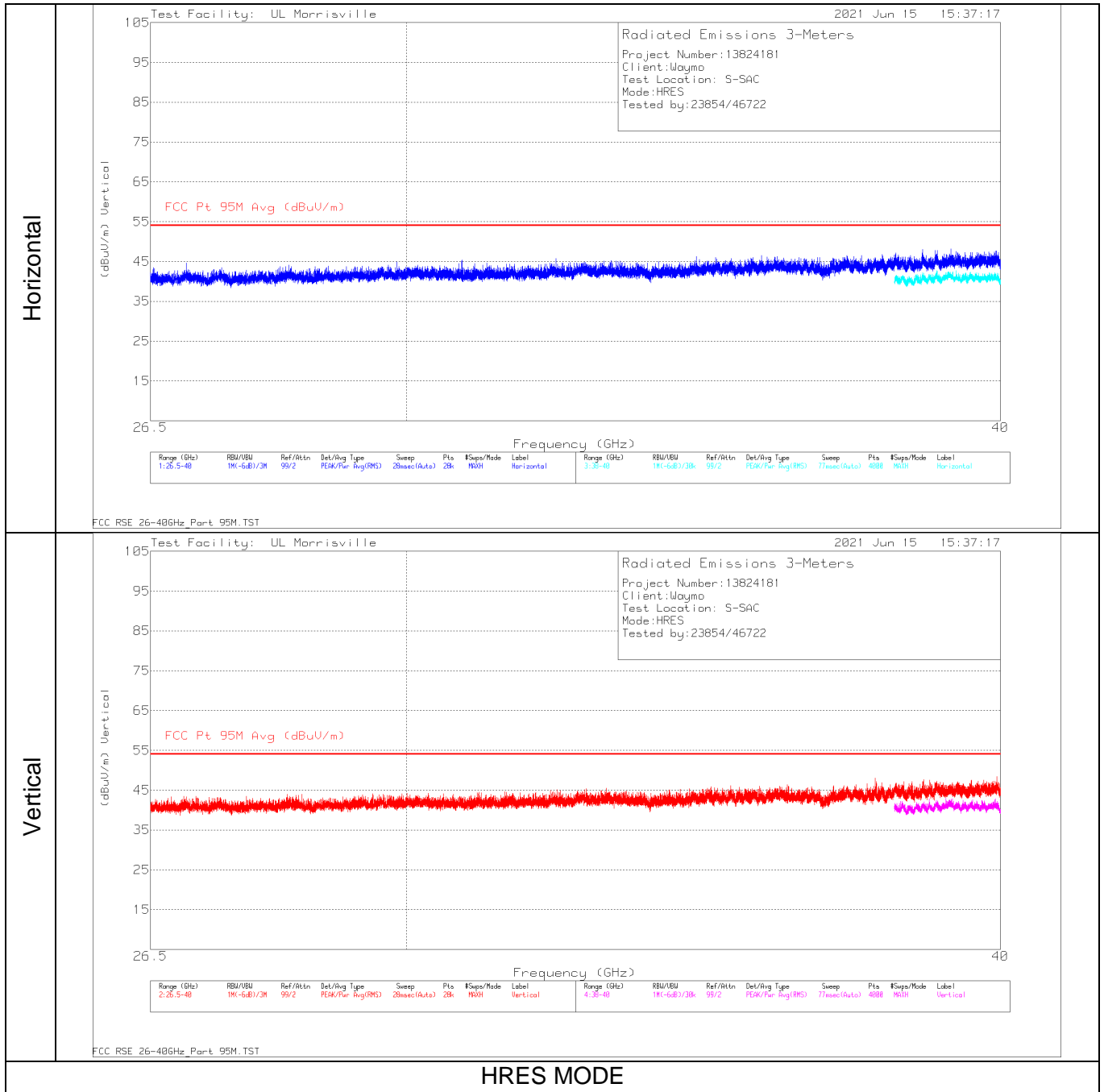
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0061 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.43652	30.37	Av	36.9	-35.5	31.77	54	-22.23	13	121	H
2	36.46724	33.12	Av	38	-38.4	32.72	54	-21.28	100	146	H
3	38.83935	32.82	Av	38.7	-37.2	34.32	54	-19.68	192	225	H
4	31.61937	30.12	Av	36.9	-35.3	31.72	54	-22.28	264	259	V
5	36.45392	32.96	Av	38	-38.5	32.46	54	-21.54	145	194	V
6	39.55749	32.9	Av	38.6	-36.8	34.7	54	-19.3	343	171	V

Av - Average detection



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0061 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	31.44706	30.19	Av	36.9	-35.5	31.59	54	-22.41	48	359	H
2	36.50052	33.64	Av	37.9	-38.4	33.14	54	-20.86	348	364	H
3	38.7409	32.83	Av	38.7	-37.6	33.93	54	-20.07	15	391	H
4	31.62878	30.06	Av	36.9	-35.4	31.56	54	-22.44	28	126	V
6	39.08916	32.38	Av	38.7	-36.9	34.18	54	-19.82	342	193	V
5	36.51321	33.78	Av	38	-38.2	33.58	54	-20.42	344	234	V

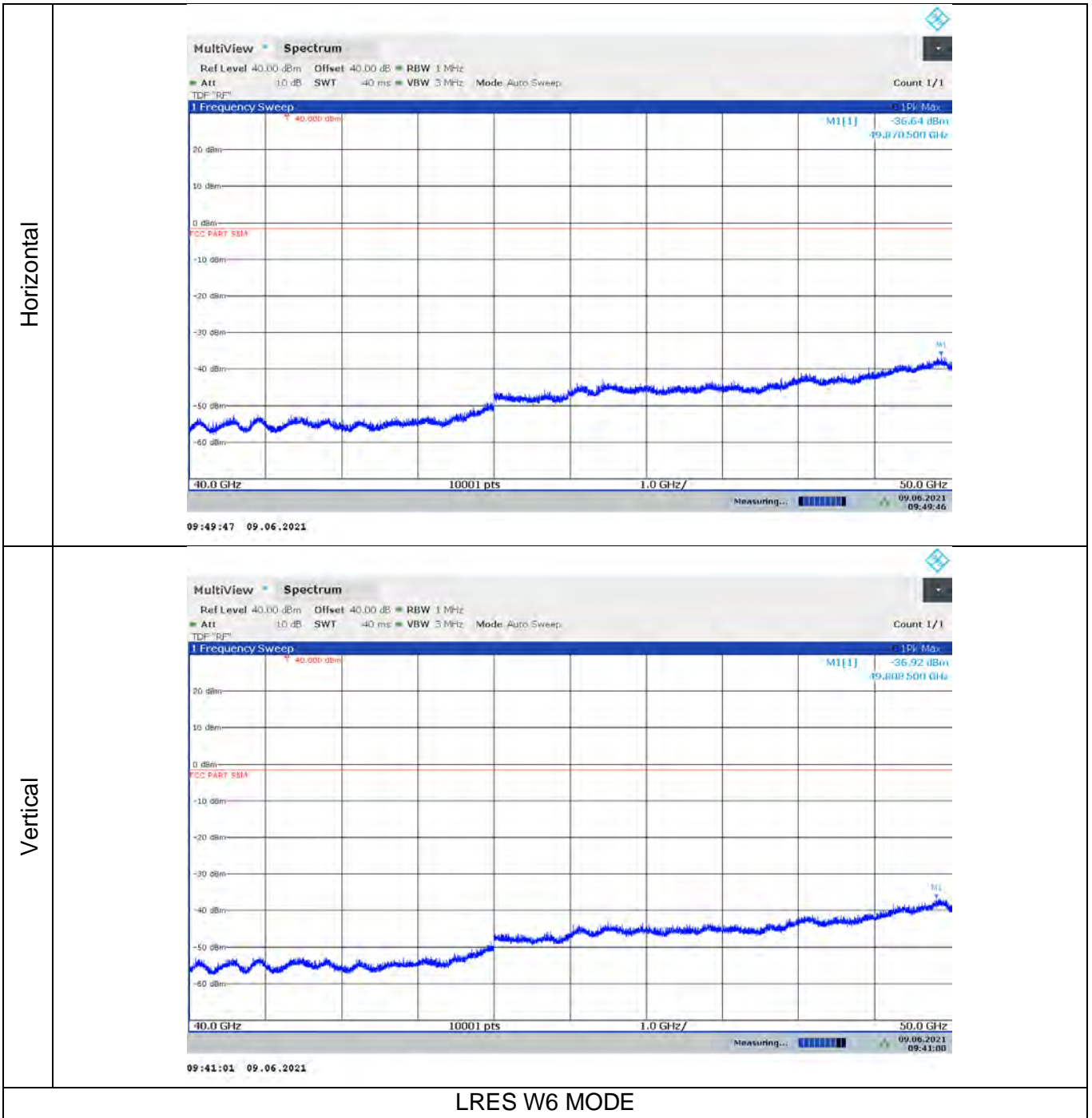
Av - Average detection



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0061 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	FCC Pt 95M Avg Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	29.8621	43.88	Pk	36.5	-35.5	44.88	54	-9.12	0-360	199	H
2	30.8134	44.25	Pk	36.5	-35.4	45.35	54	-8.65	0-360	299	H
3	34.52266	45.92	Pk	37.6	-37.2	46.32	54	-7.68	0-360	101	H
4	35.10222	45.98	Pk	37.7	-37.5	46.18	54	-7.82	0-360	150	V
5	36.07666	46.25	Pk	38	-37.9	46.35	54	-7.65	0-360	101	V
6	37.64224	47.25	Pk	38.3	-37.6	47.95	54	-6.05	0-360	150	V

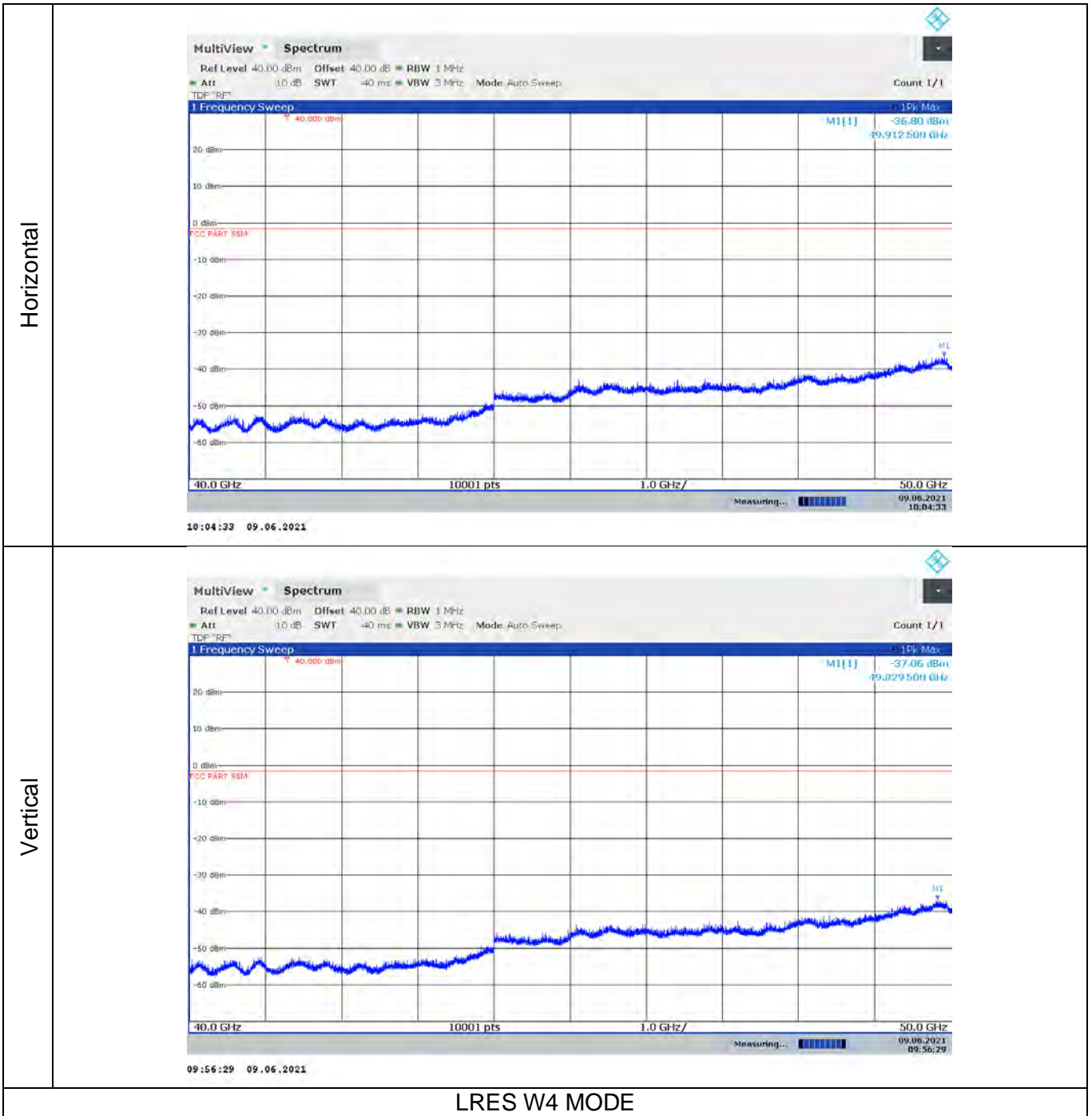
Pk - Peak detector

8.4.6. RADIATED EMISSIONS 40-50 GHz



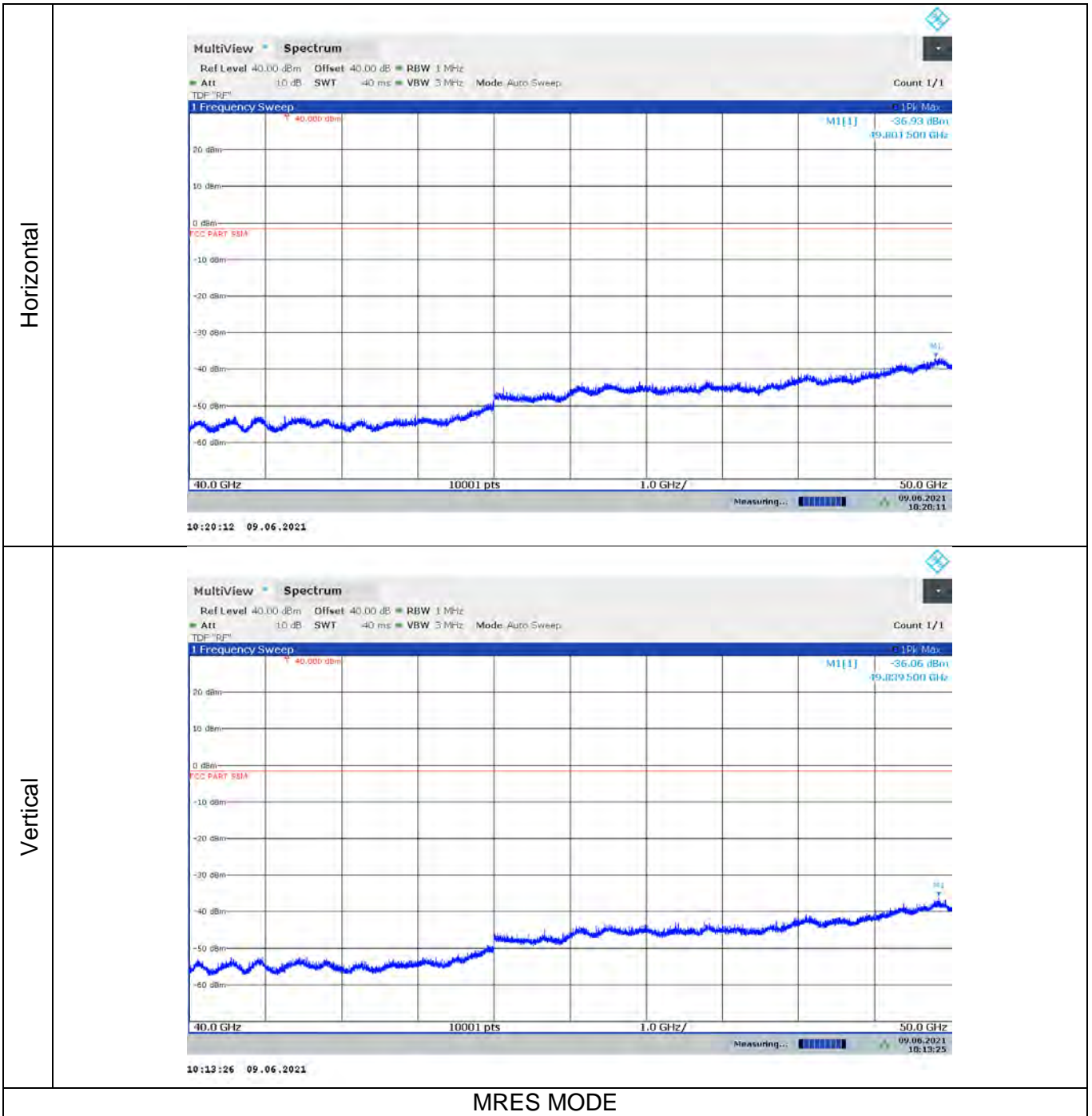
LRES W6 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
49.871	Peak	Horiz	-36.64	-1.7	-34.94
49.809	Peak	Vert	-36.92	-1.7	-35.22



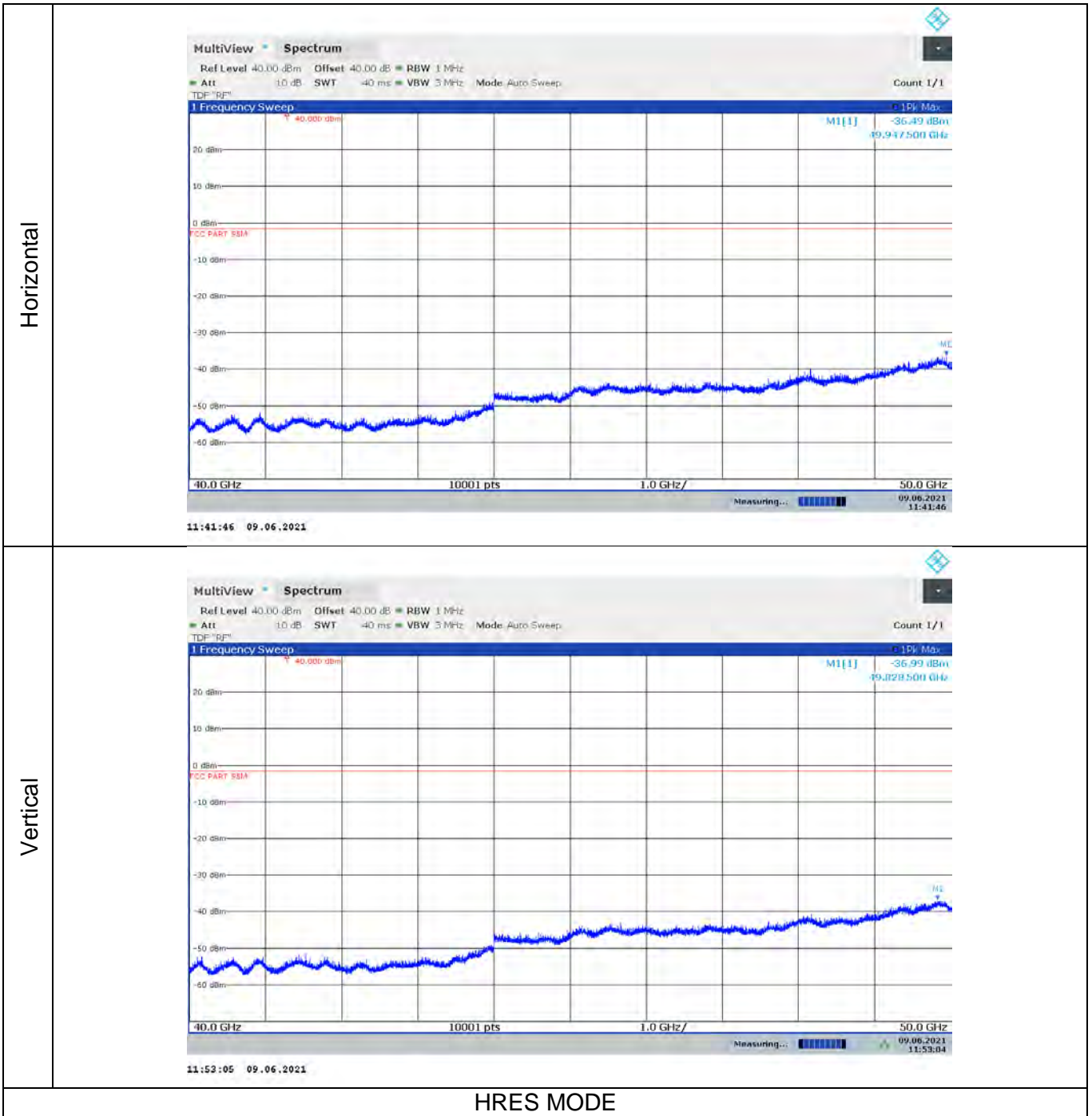
LRES W4 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
49.913	Peak	Horiz	-36.80	-1.7	-35.10
49.830	Peak	Vert	-37.06	-1.7	-35.36



MRES MODE

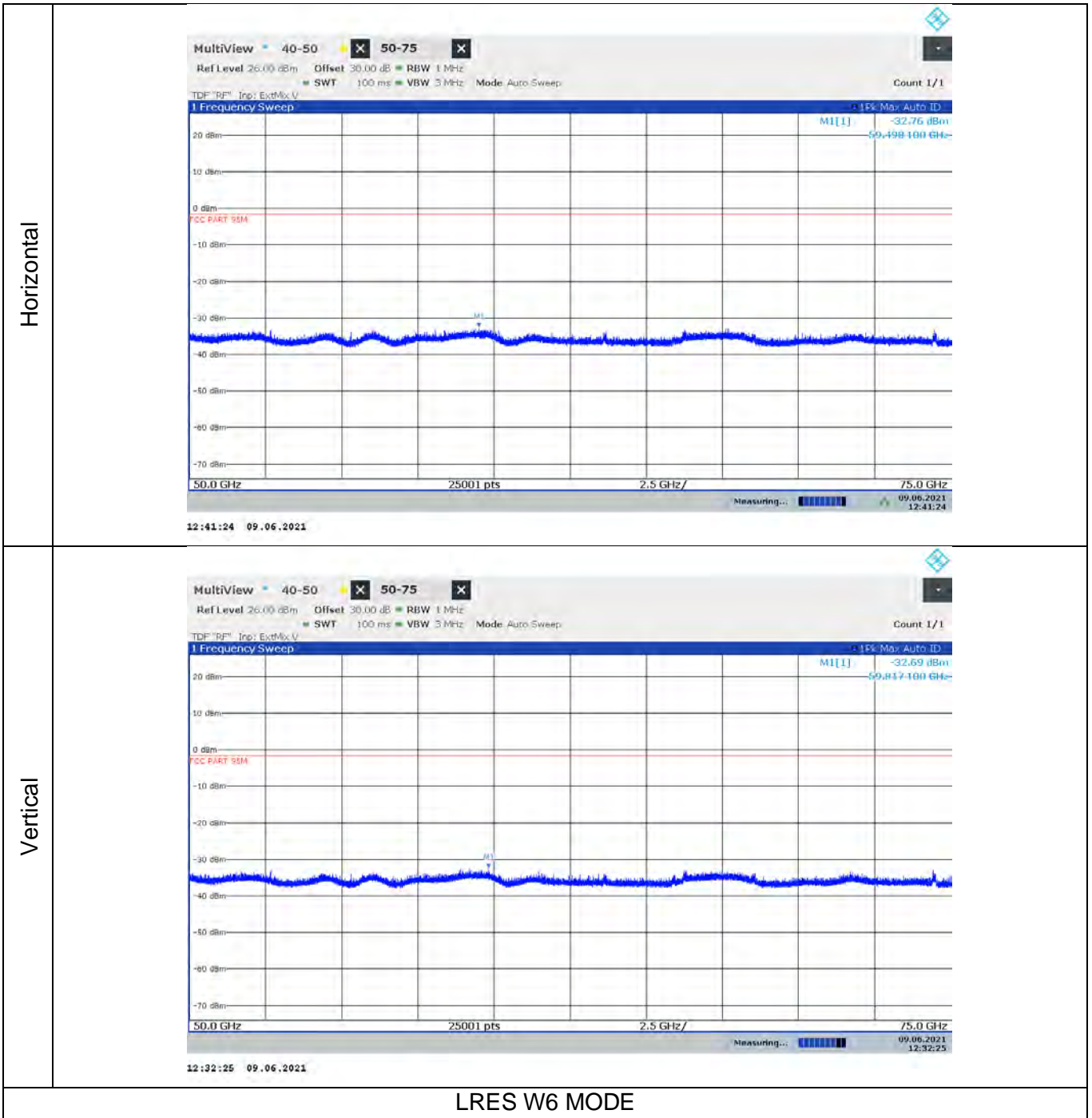
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
49.802	Peak	Horiz	-36.93	-1.7	-35.23
49.830	Peak	Vert	-36.06	-1.7	-34.36



HRES MODE

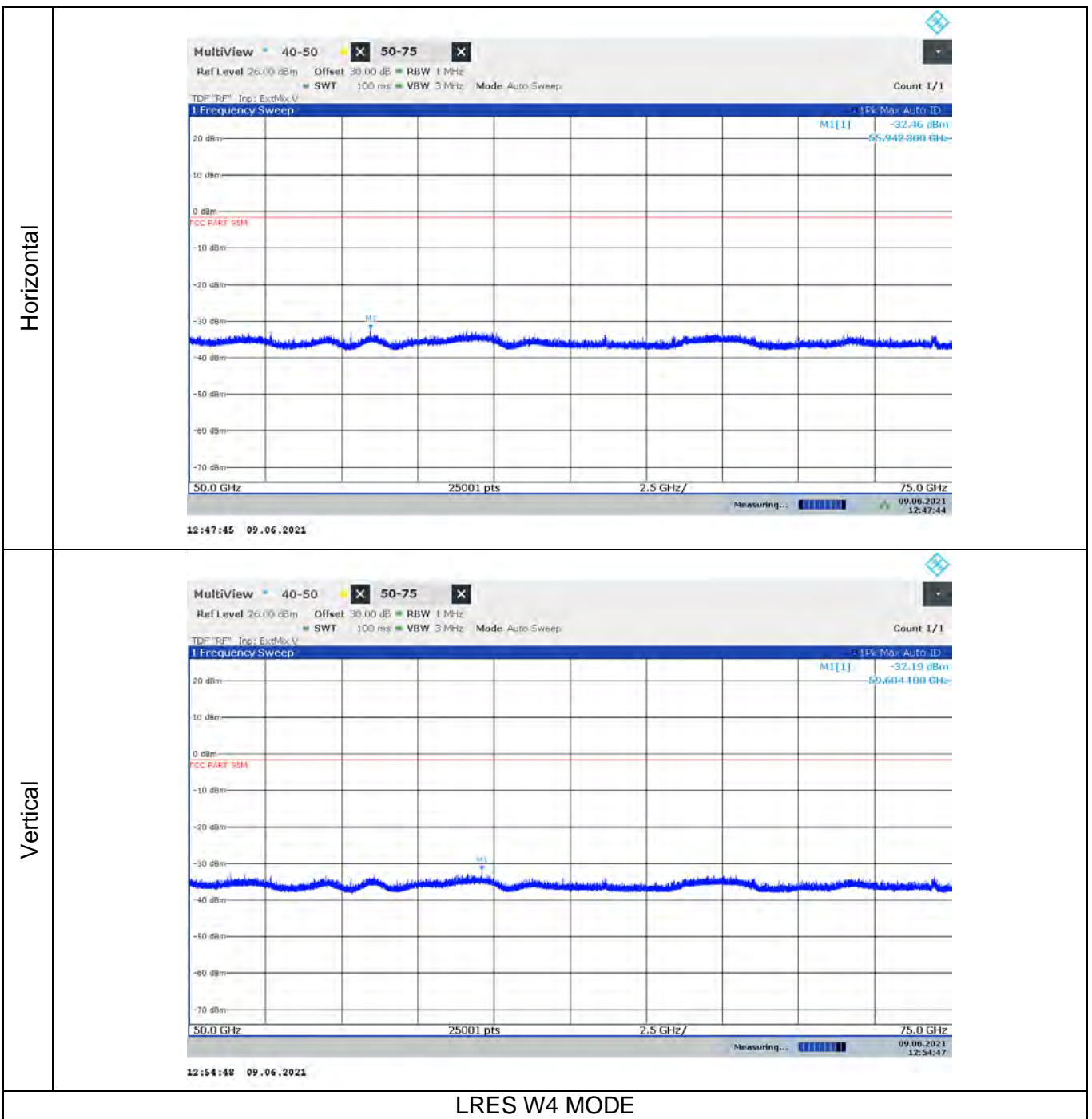
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
49.948	Peak	Horiz	-36.49	-1.7	-34.79
49.829	Peak	Vert	-36.99	-1.7	-35.29

8.4.7. RADIATED EMISSIONS 50-75 GHz



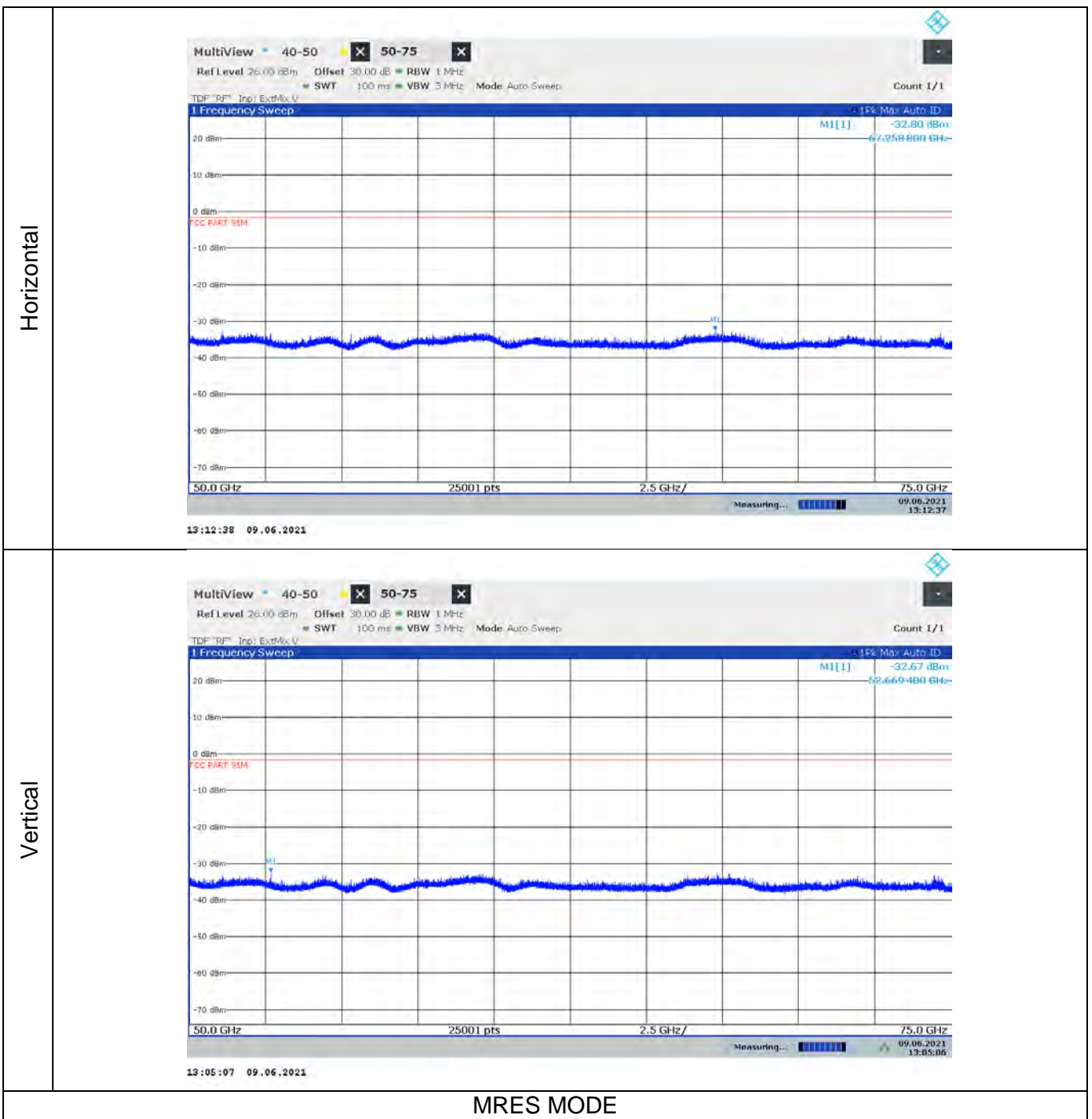
LRES W6 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
59.498	Peak	Horiz	-32.76	-1.7	-31.06
59.817	Peak	Vert	-32.69	-1.7	-30.99



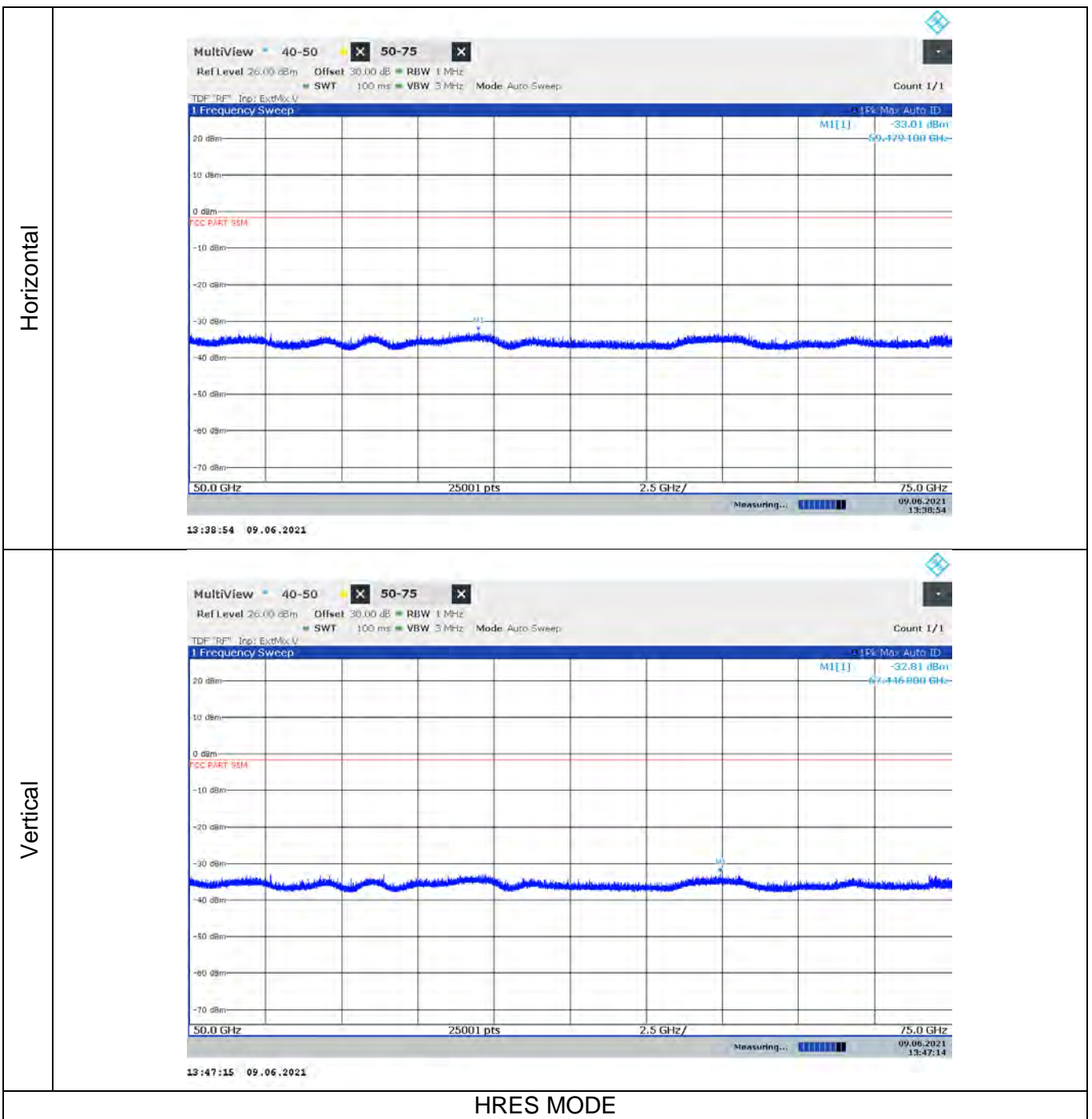
LRES W4 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
55.942	Peak	Horiz	-32.46	-1.7	-30.76
59.604	Peak	Vert	-32.19	-1.7	-30.49



MRES MODE

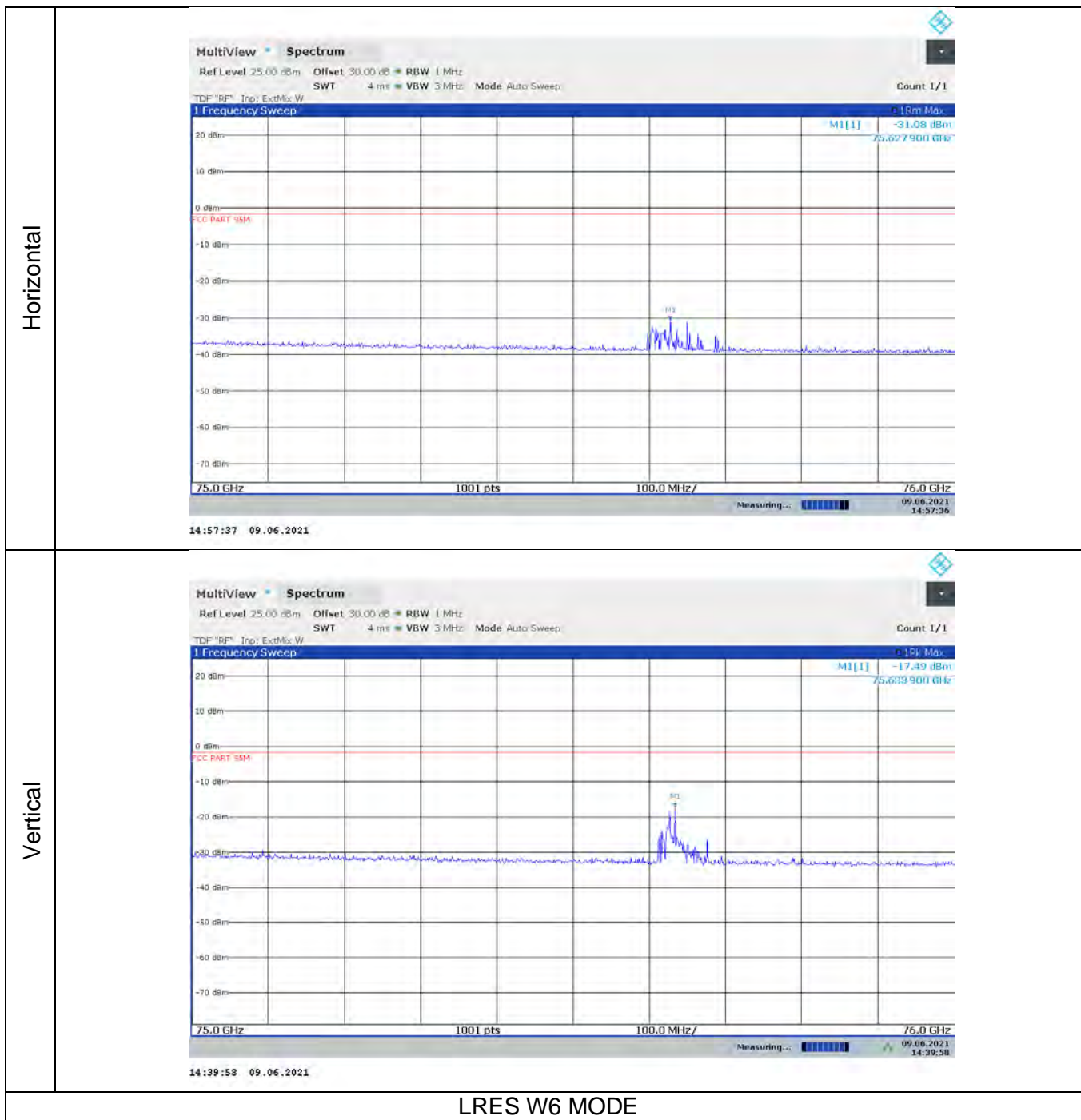
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
67.259	Peak	Horiz	-32.80	-1.7	-31.10
52.669	Peak	Vert	-32.67	-1.7	-30.97



HRES MODE

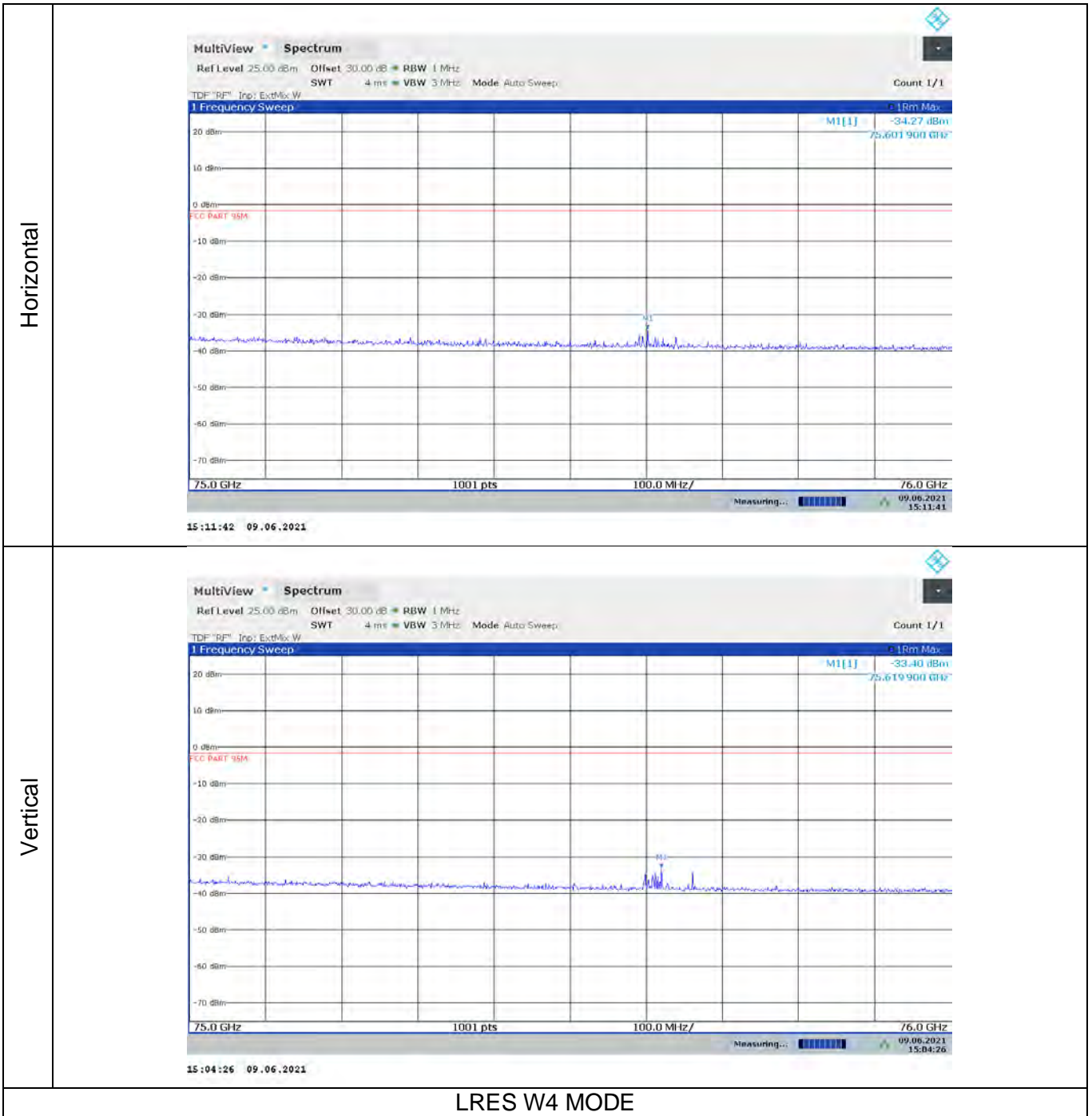
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
59.479	Peak	Horiz	-33.01	-1.7	-31.31
67.447	Peak	Vert	-32.81	-1.7	-31.11

8.4.8. RADIATED EMISSIONS 75-76 GHz



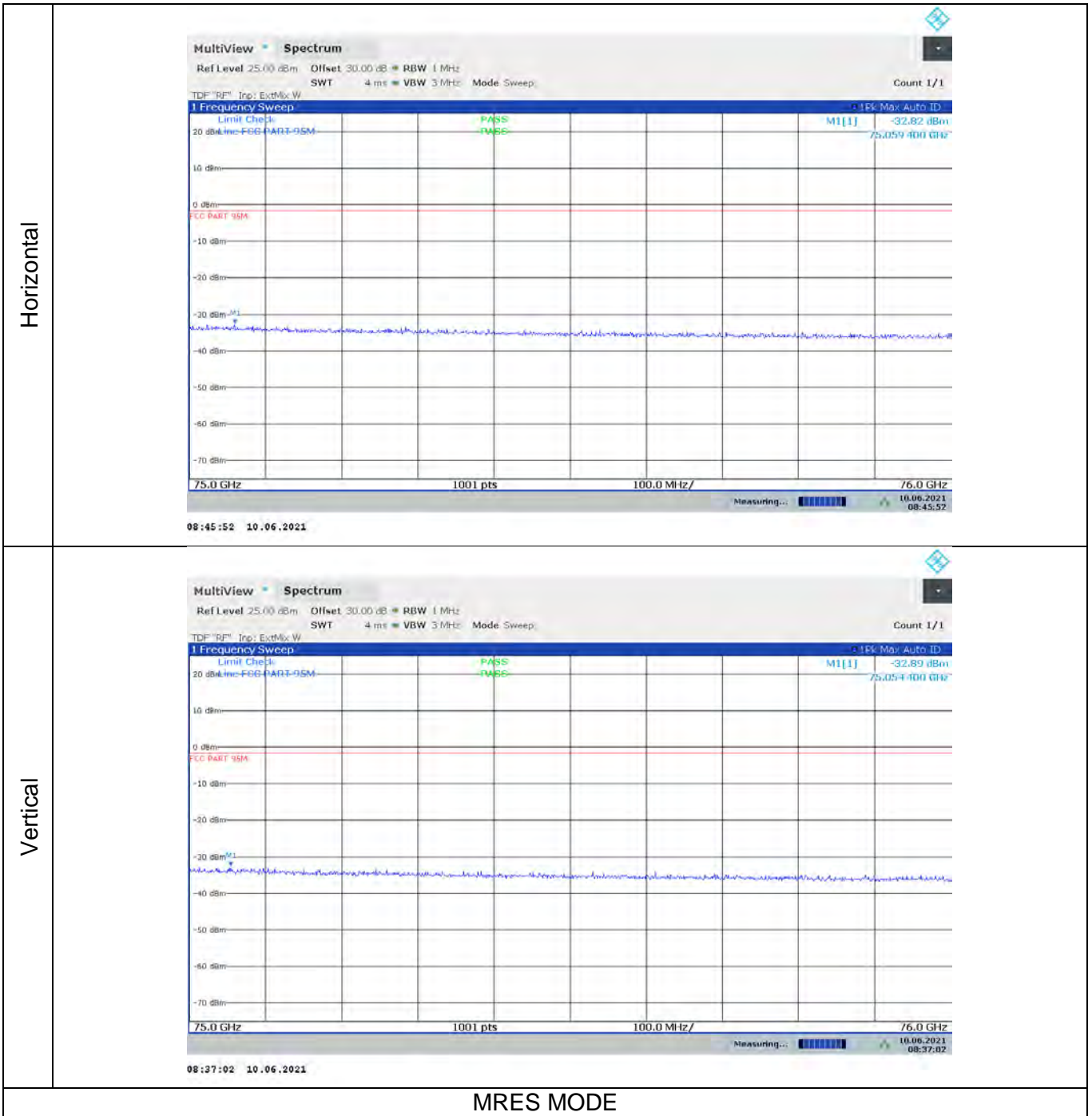
LRES W6 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
75.628	RMS	Horiz	-31.08	-1.7	-29.38
75.634	Peak	Vert	-17.49	-1.7	-15.79



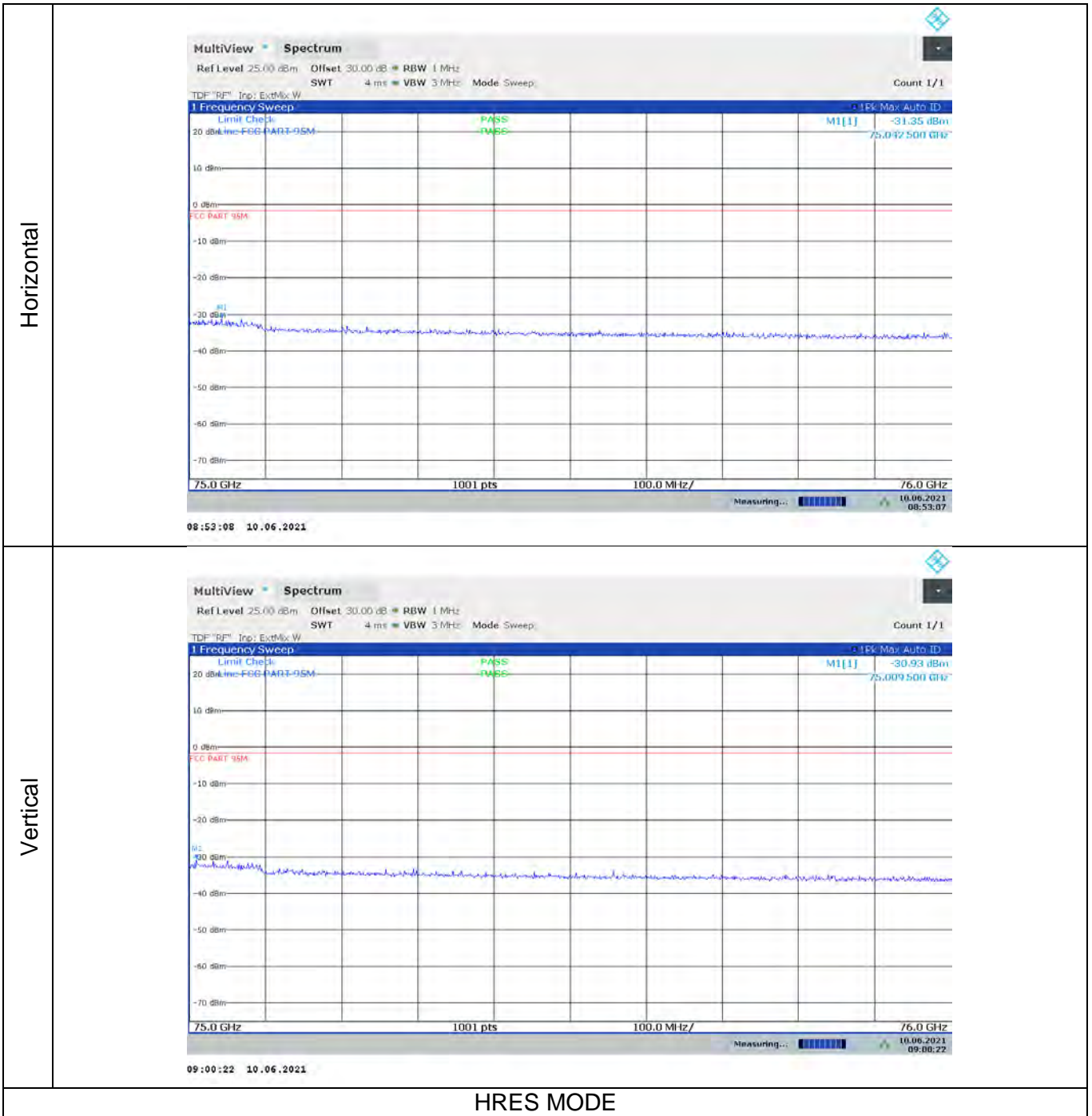
LRES W4 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
75.602	Peak	Horiz	-34.27	-1.7	-32.57
75.620	Peak	Vert	-33.40	-1.7	-31.70



MRES MODE

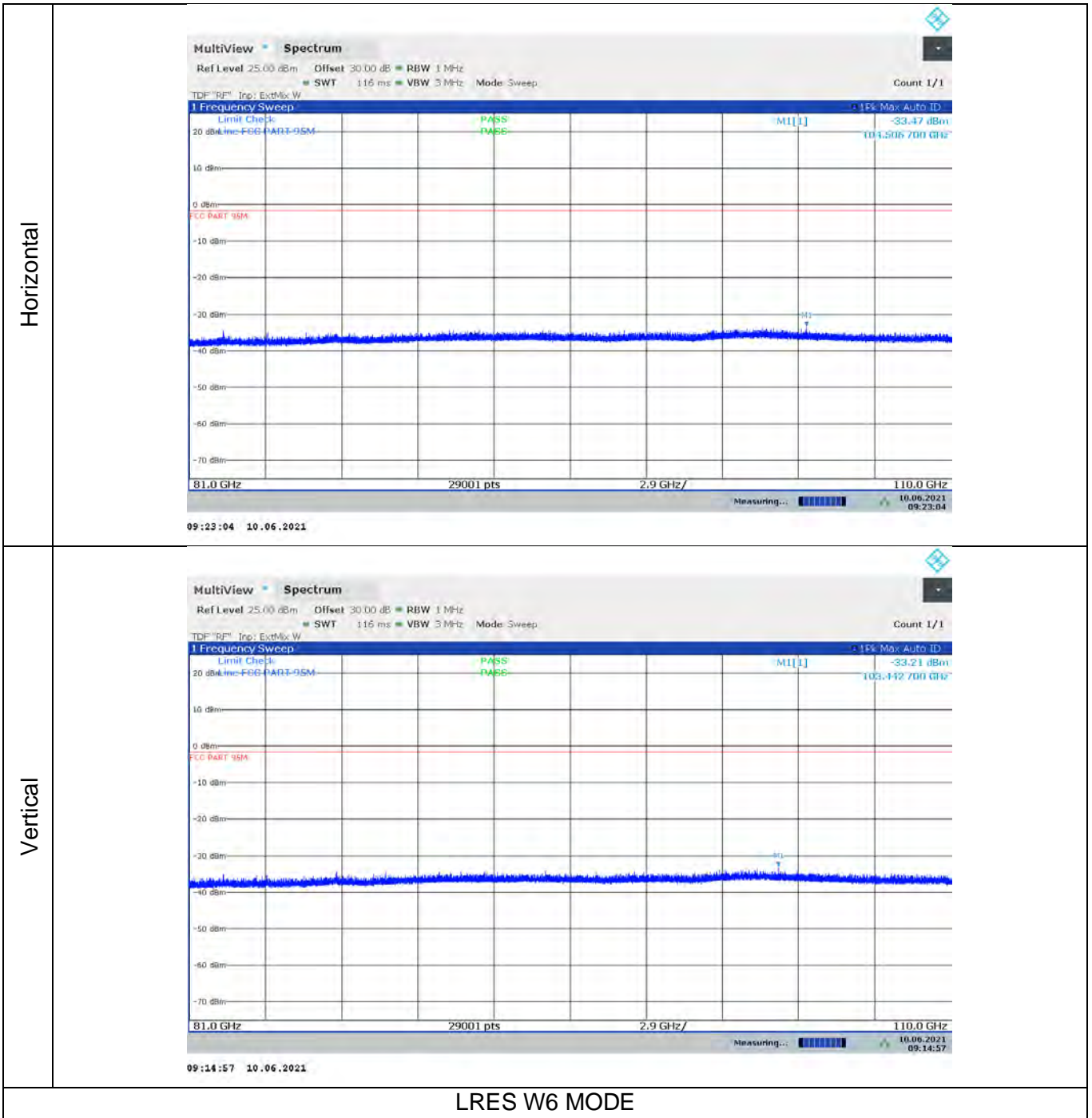
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
75.059	Peak	Horiz	-32.82	-1.7	-31.12
75.054	Peak	Vert	-32.89	-1.7	-31.19



HRES MODE

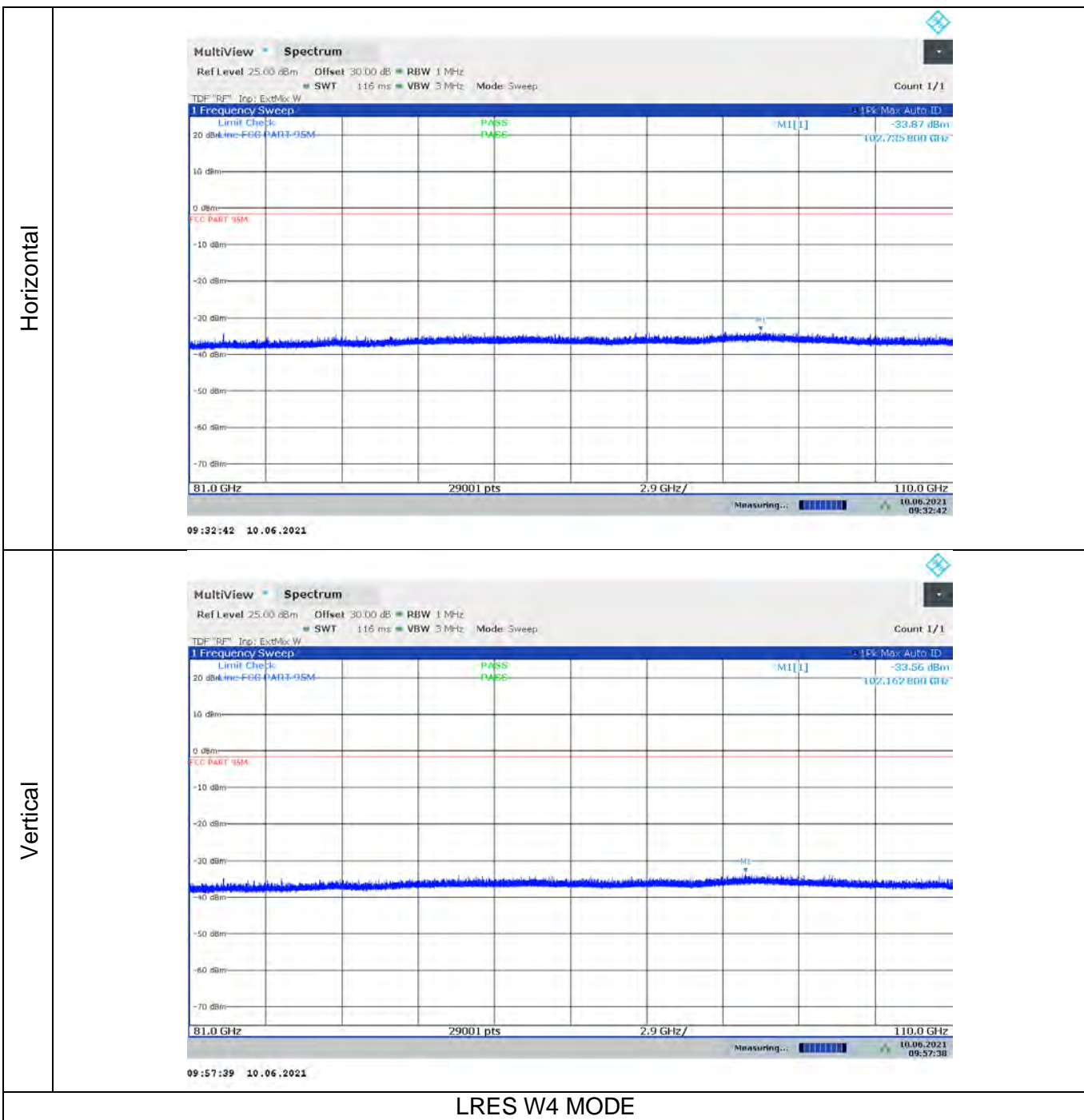
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
75.043	Peak	Horiz	-31.35	-1.7	-29.65
75.010	Peak	Vert	-30.93	-1.7	-29.23

8.4.9. RADIATED EMISSIONS 81-110 GHz



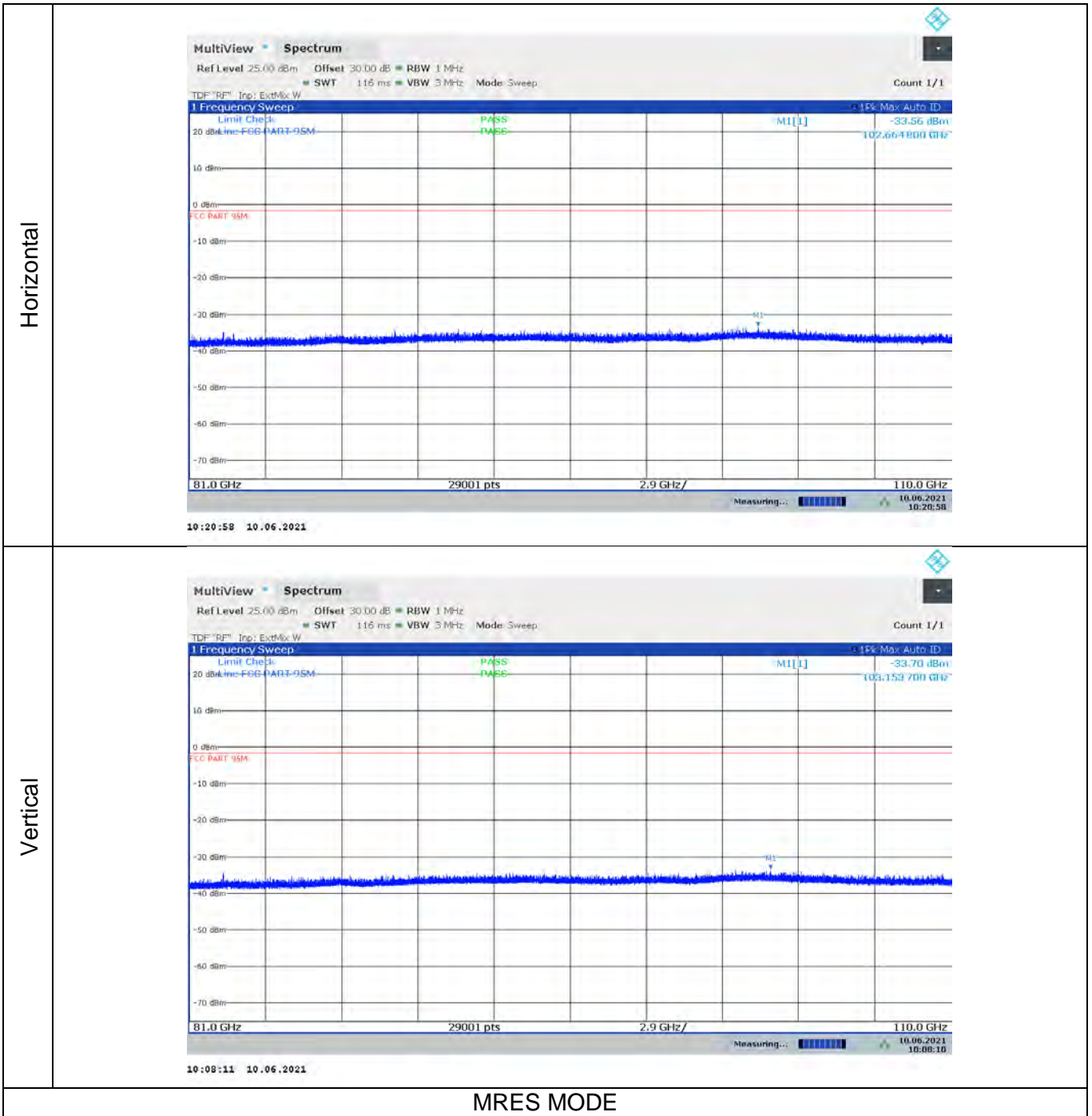
LRES W6 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
104.507	Peak	Horiz	-33.47	-1.7	-31.77
103.442	Peak	Vert	-33.21	-1.7	-31.51



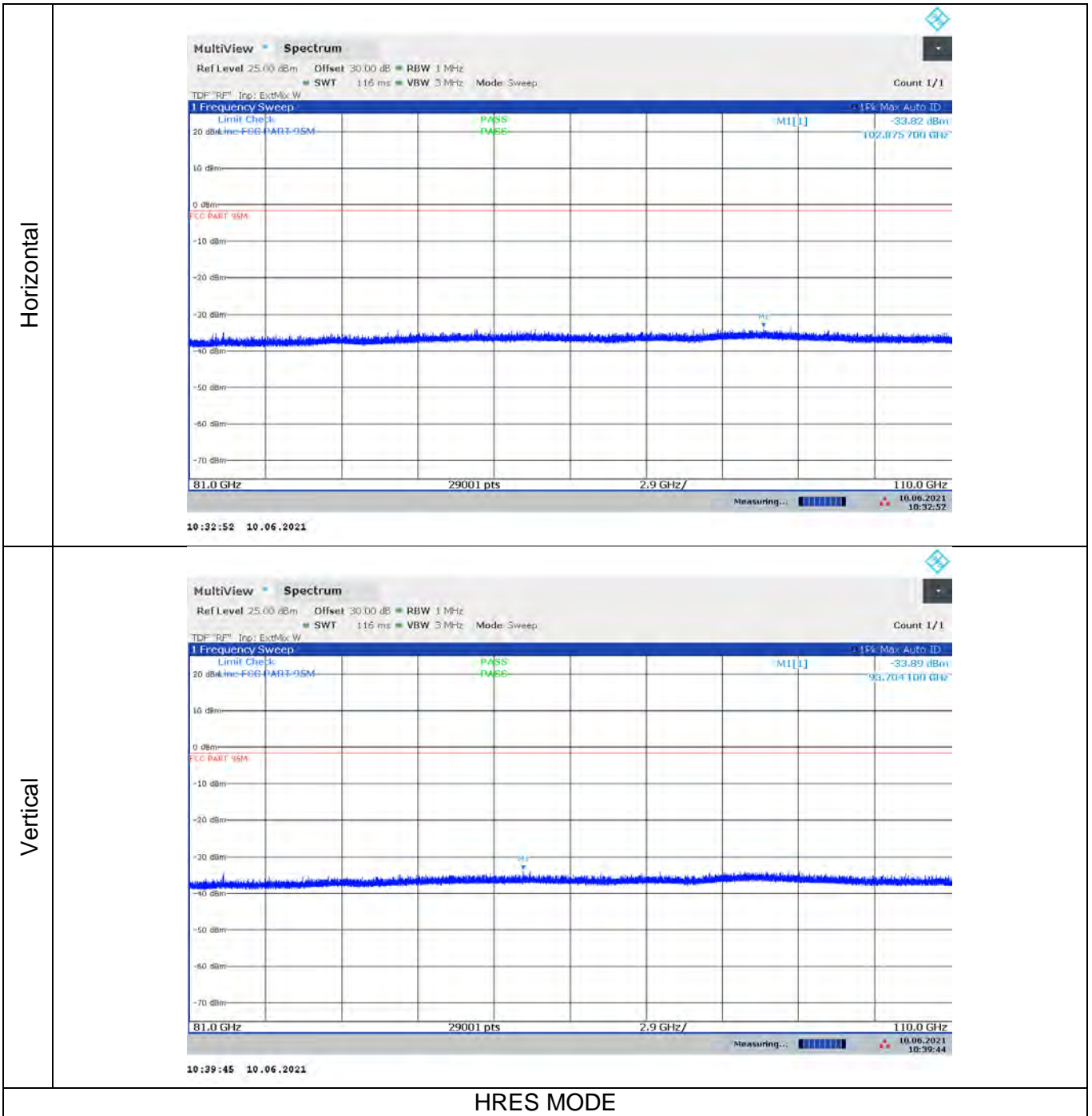
LRES W4 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
102.736	Peak	Horiz	-33.87	-1.7	-32.17
102.163	Peak	Vert	-33.56	-1.7	-31.86



MRES MODE

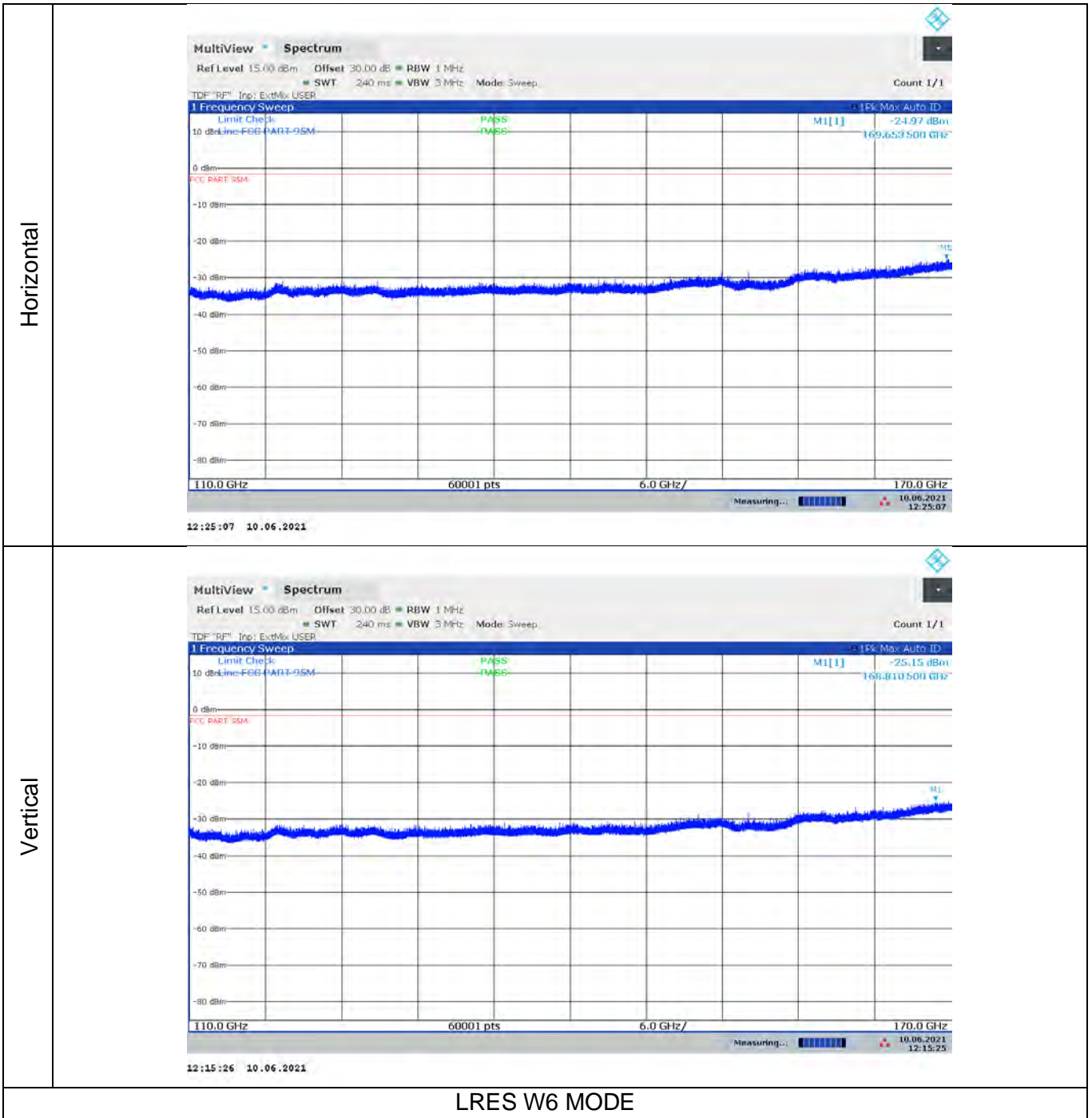
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
102.665	Peak	Horiz	-33.56	-1.7	-31.86
103.154	Peak	Vert	-33.70	-1.7	-32.00



HRES MODE

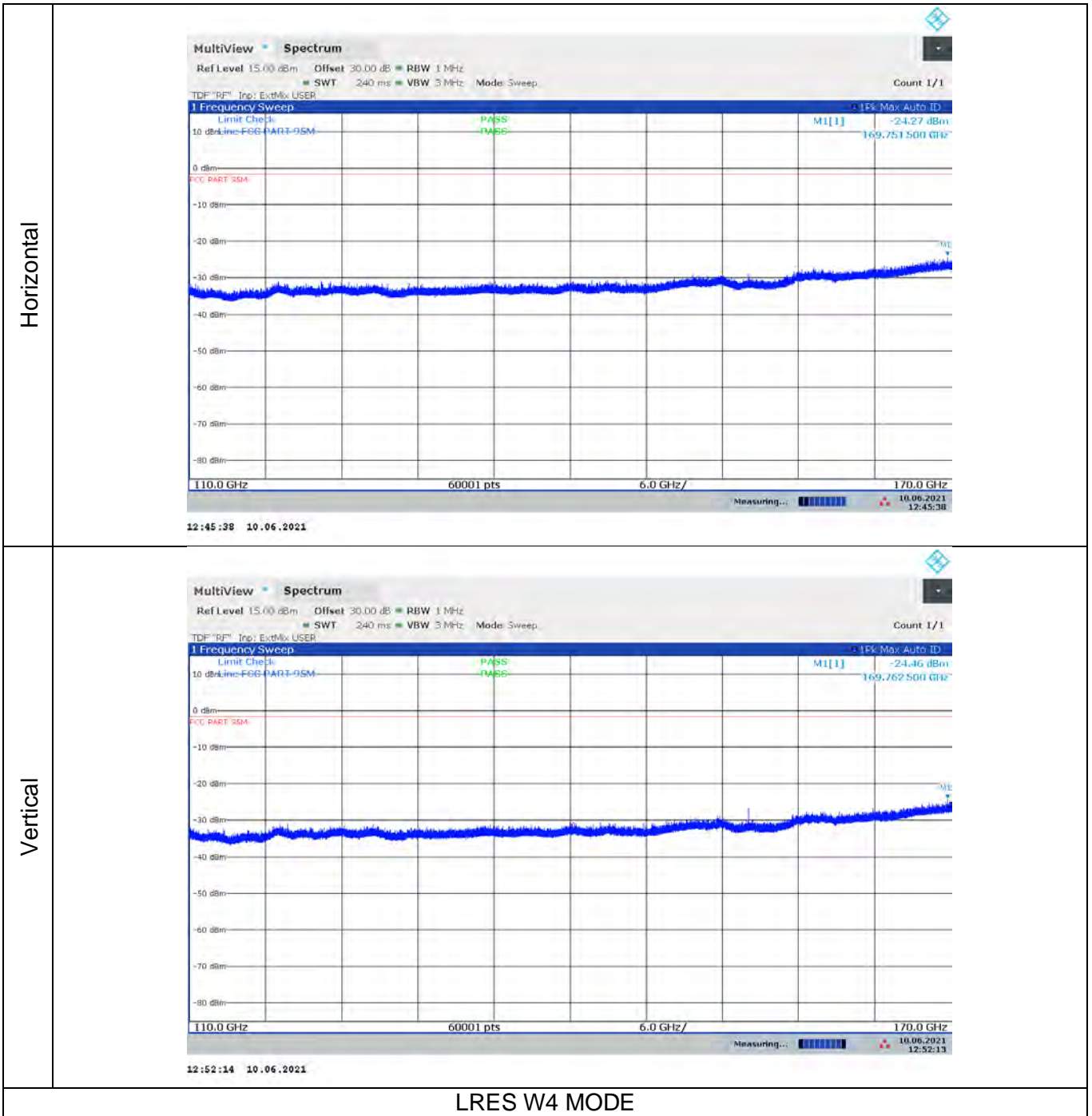
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
102.876	Peak	Horiz	-33.82	-1.7	-32.12
93.704	Peak	Vert	-33.89	-1.7	-32.19

8.4.10. RADIATED EMISSIONS 110-170 GHz



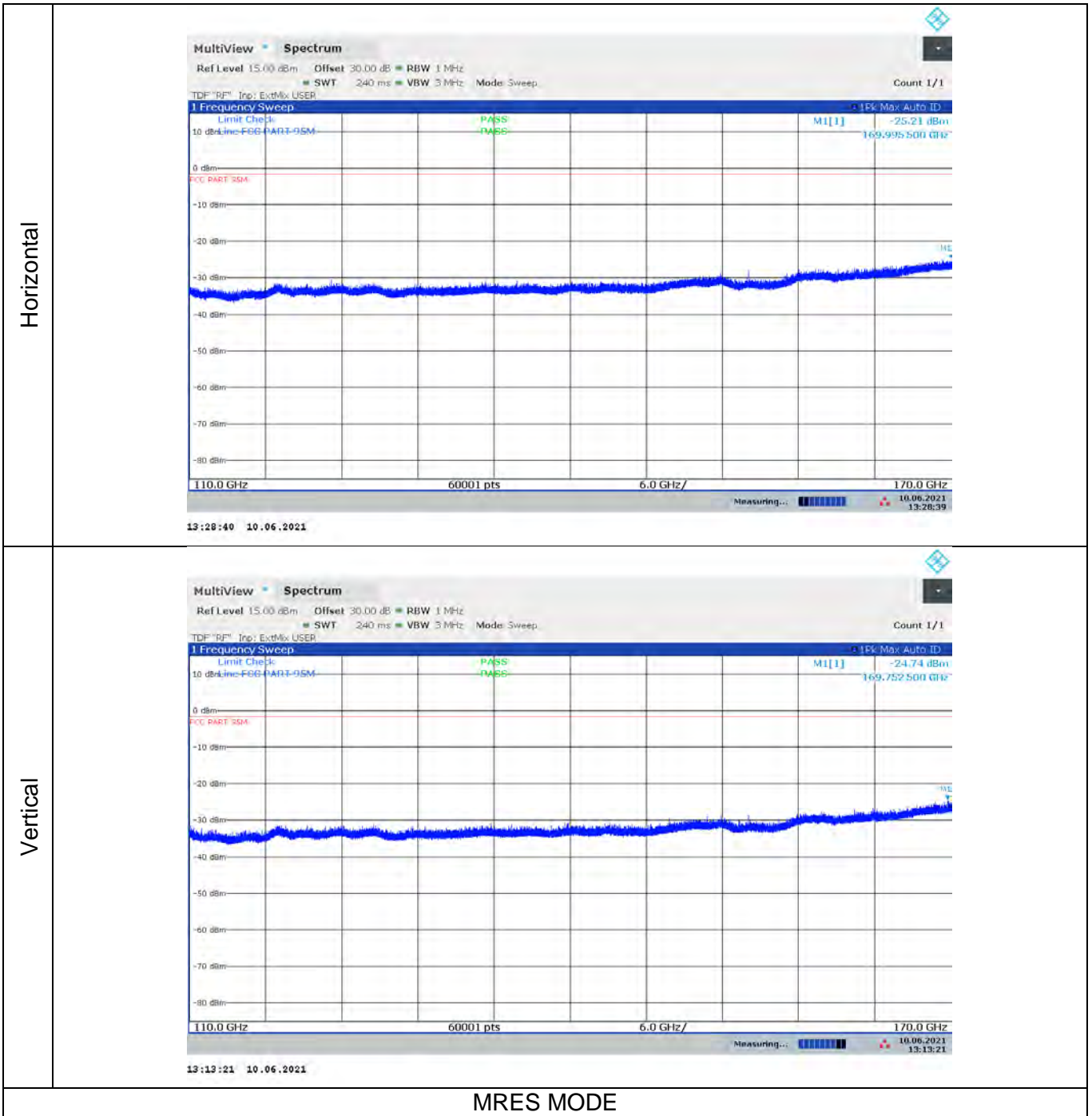
LRES W6 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
169.653	Peak	Horiz	-24.97	-1.7	-23.27
168.811	Peak	Vert	-25.15	-1.7	-23.45



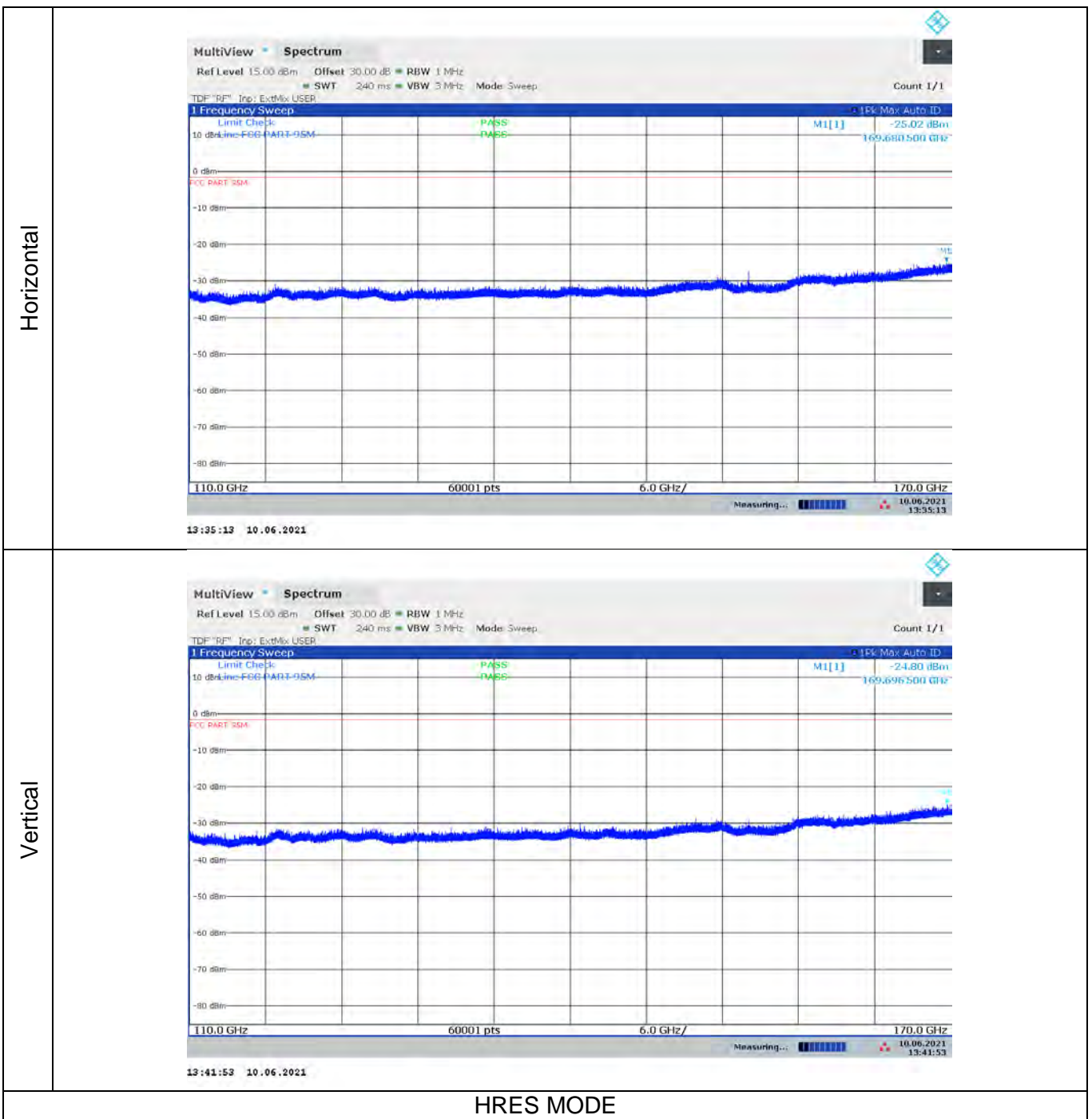
LRES W4 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
169.752	Peak	Horiz	-24.27	-1.7	-22.57
169.763	Peak	Vert	-24.46	-1.7	-22.76



MRES MODE

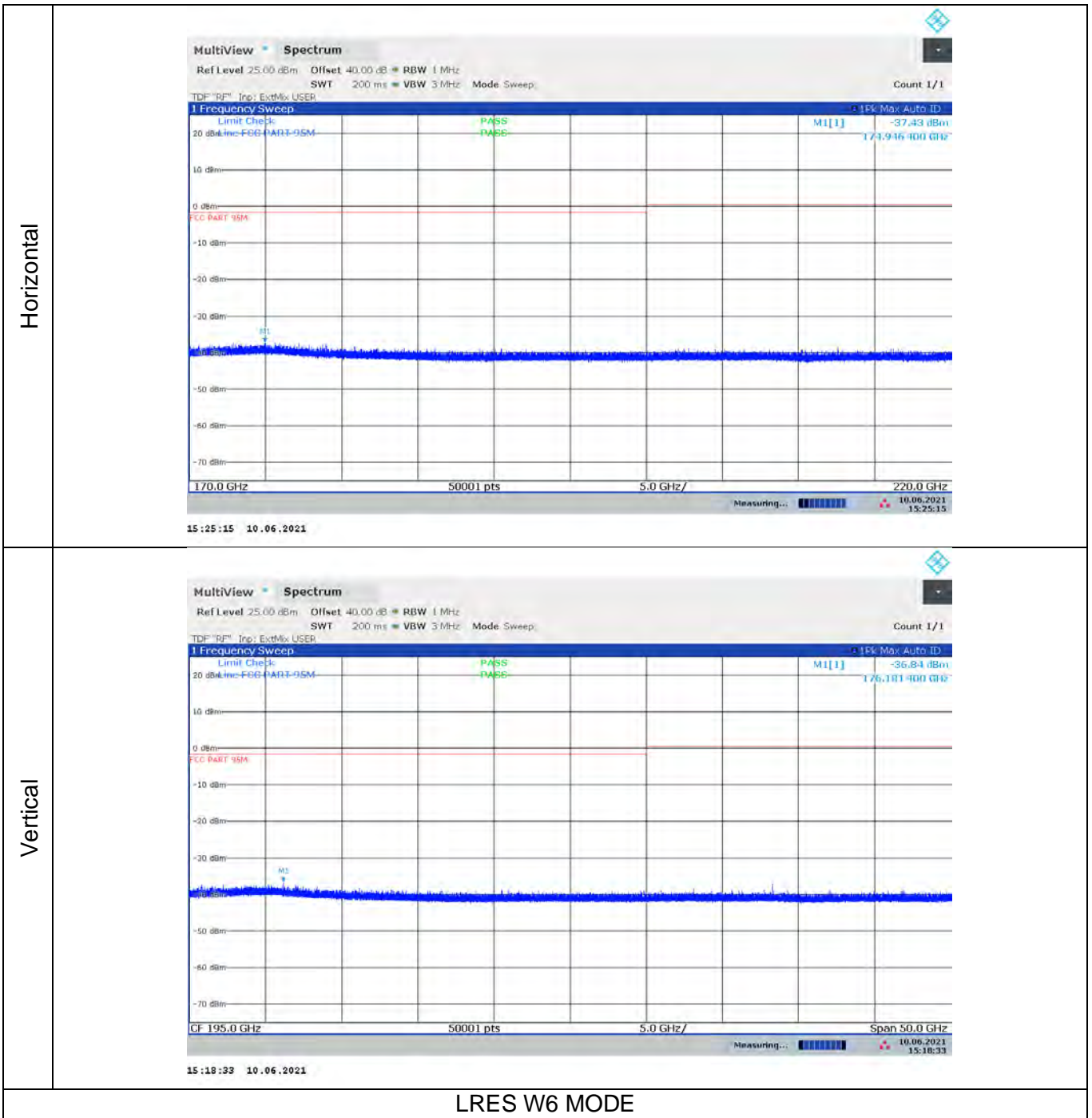
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
169.996	Peak	Horiz	-25.21	-1.7	-23.51
169.753	Peak	Vert	-24.74	-1.7	-23.04



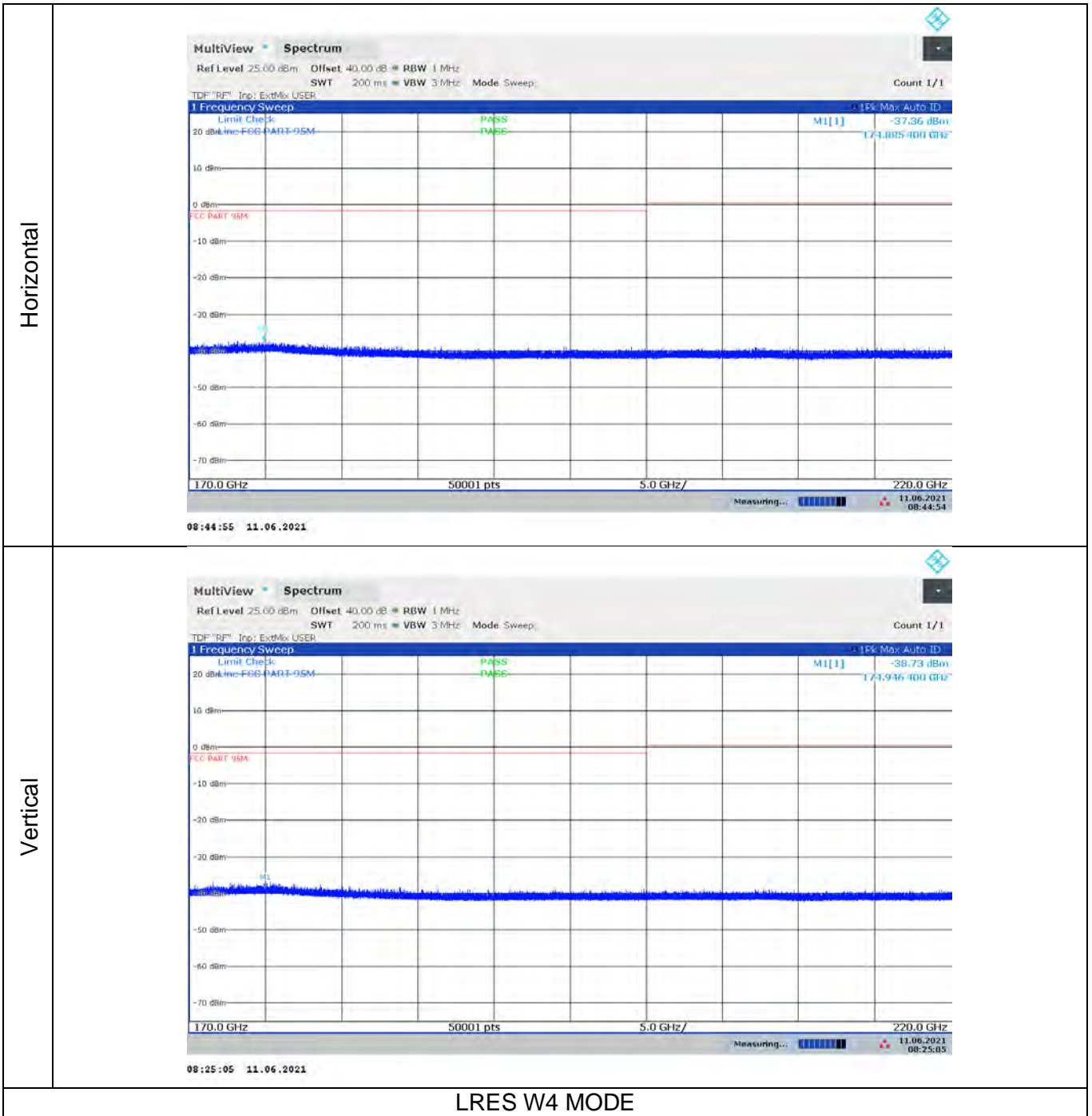
HRES MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
169.681	Peak	Horiz	-25.02	-1.7	-23.32
169.697	Peak	Vert	-24.80	-1.7	-23.10

8.4.11. RADIATED EMISSIONS 170-220 GHz

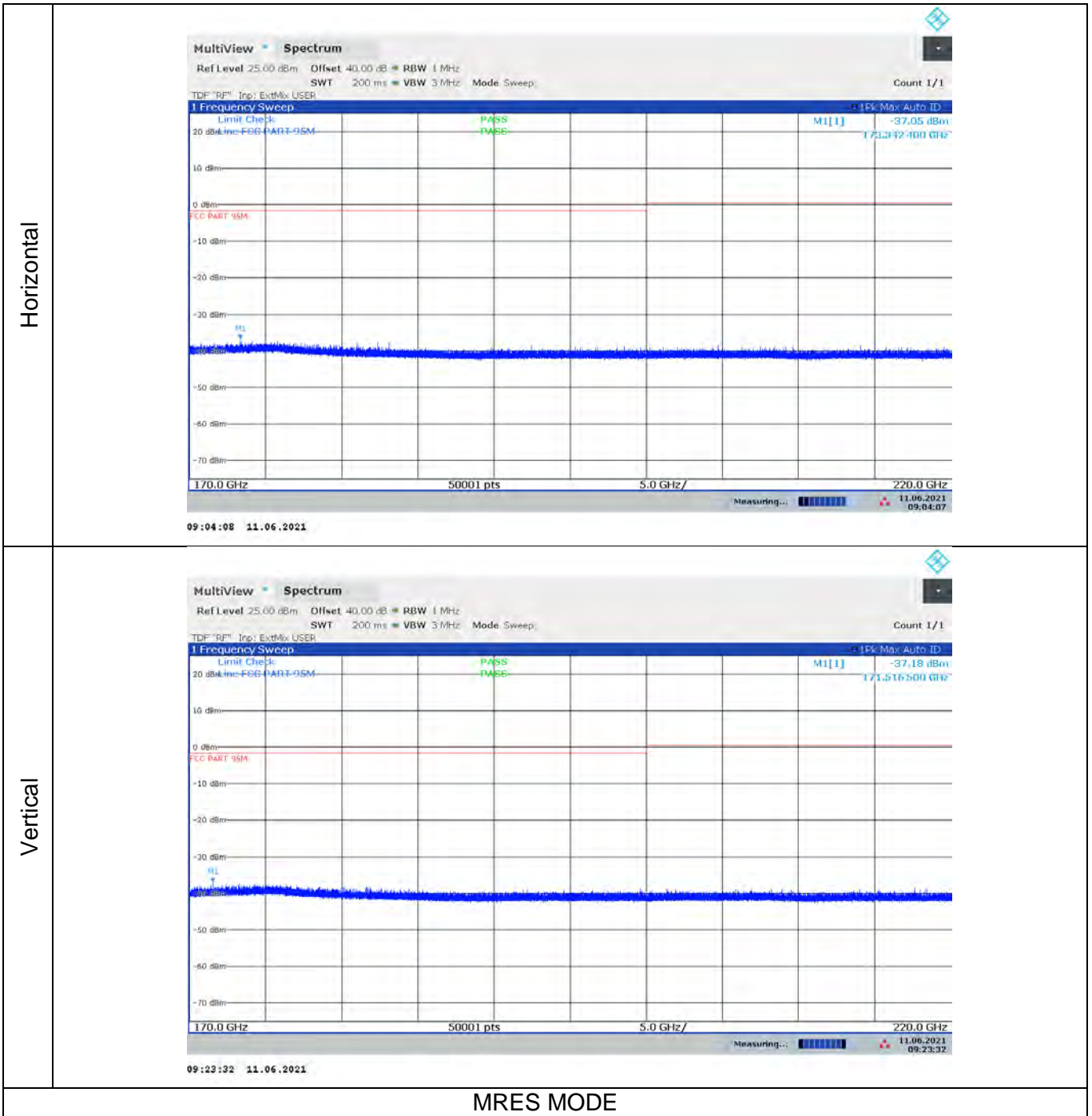


Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
174.946	Peak	Horiz	-37.43	-1.7	-35.73
176.181	Peak	Vert	-36.84	-1.7	-35.14



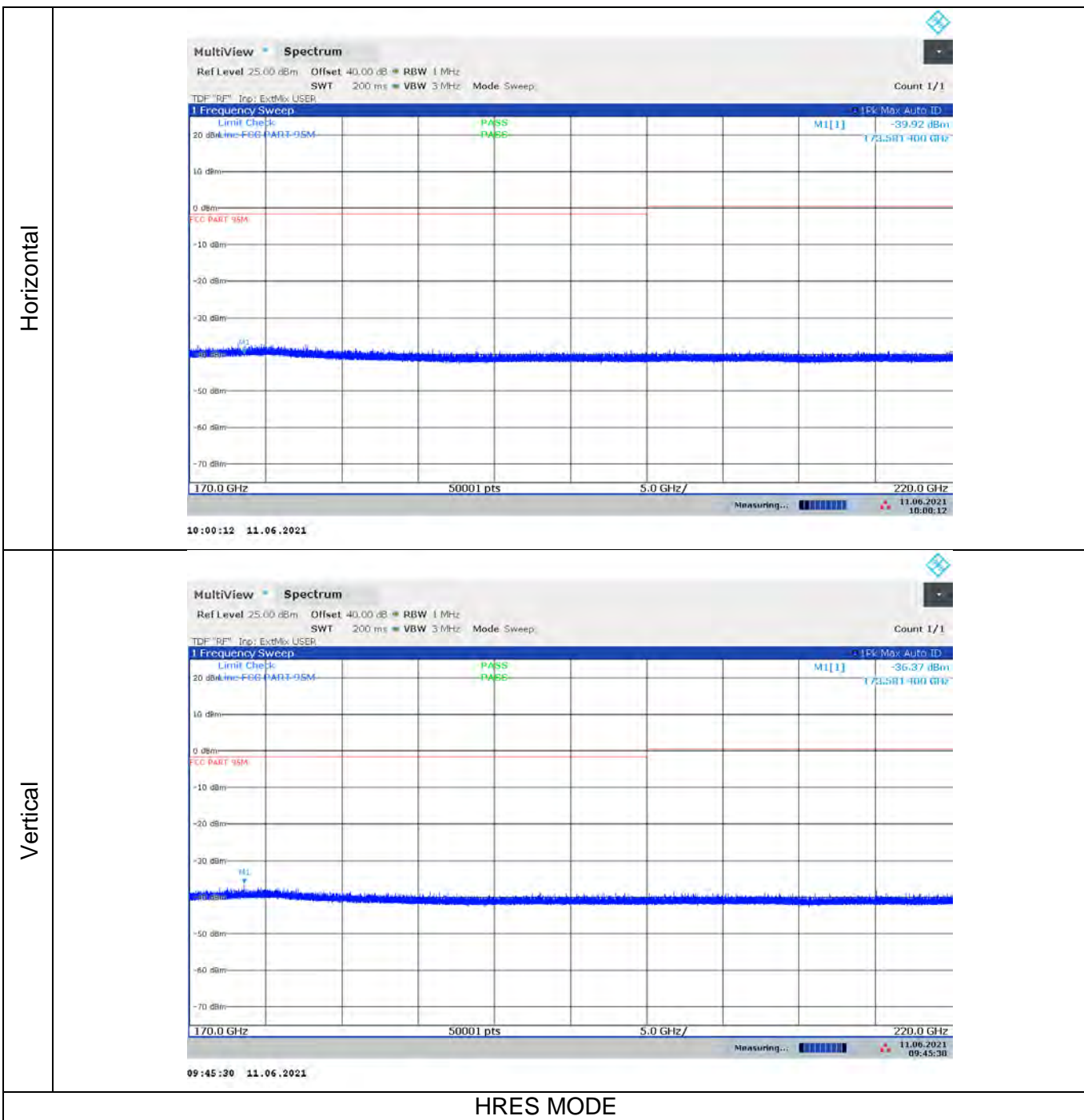
LRES W4 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
174.885	Peak	Horiz	-37.36	-1.7	-35.66
174.946	Peak	Vert	-38.73	-1.7	-37.03



MRES MODE

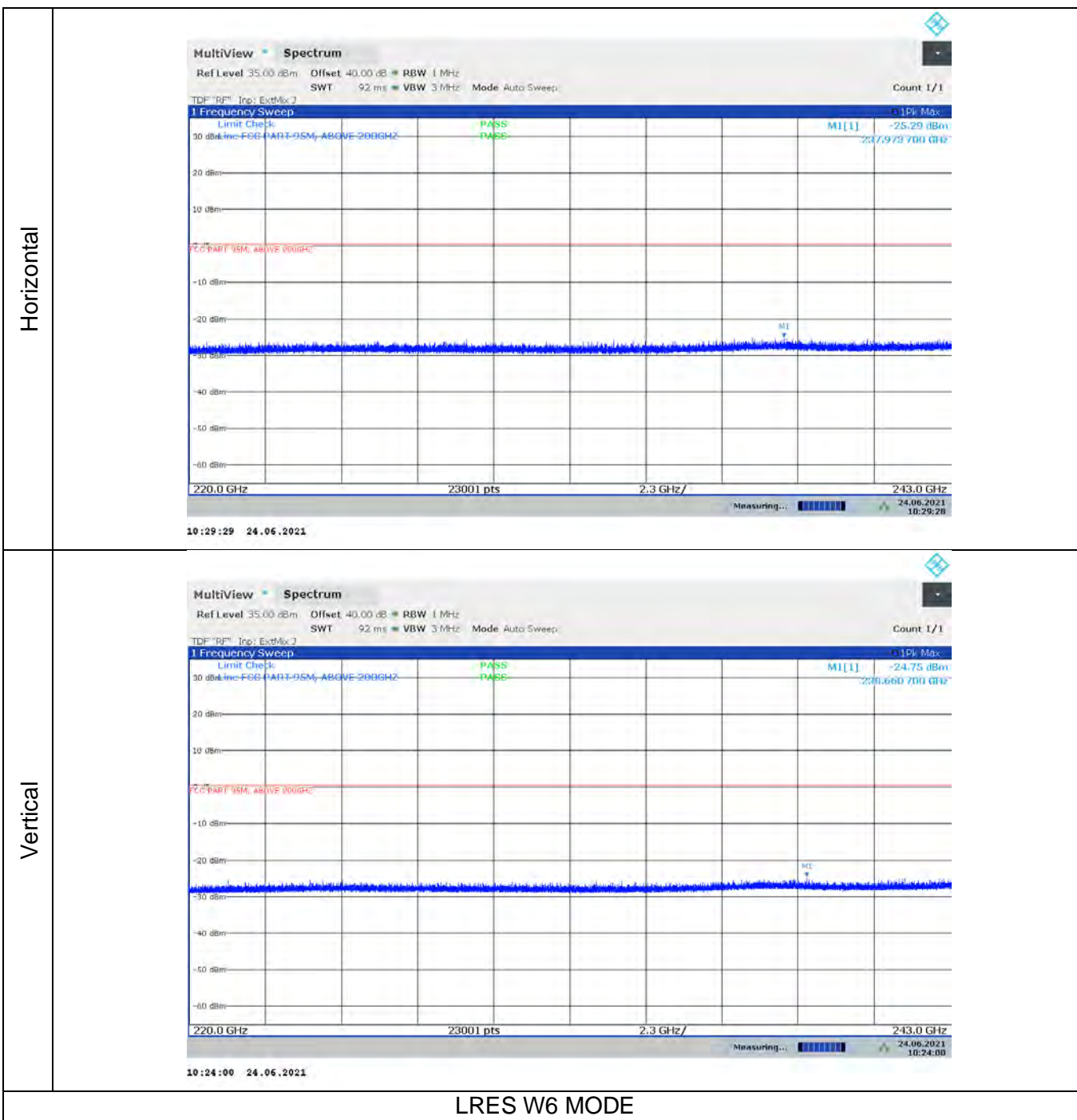
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
173.342	Peak	Horiz	-37.05	-1.7	-35.35
171.517	Peak	Vert	-37.18	-1.7	-35.48



HRES MODE

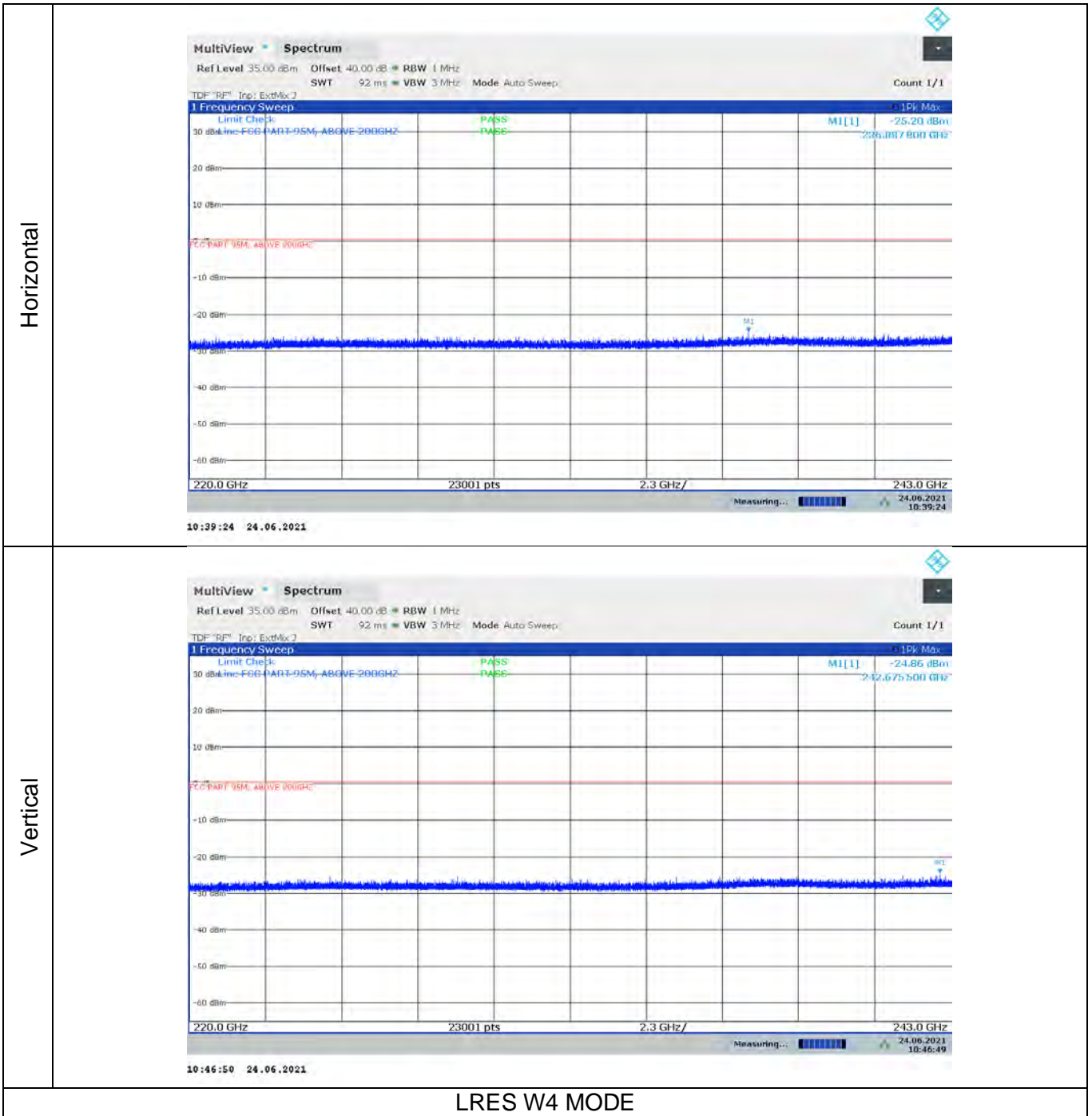
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
173.581	Peak	Horiz	-39.92	-1.7	-38.22
173.581	Peak	Vert	-36.37	-1.7	-34.67

8.4.12. RADIATED EMISSIONS 220-243 GHz



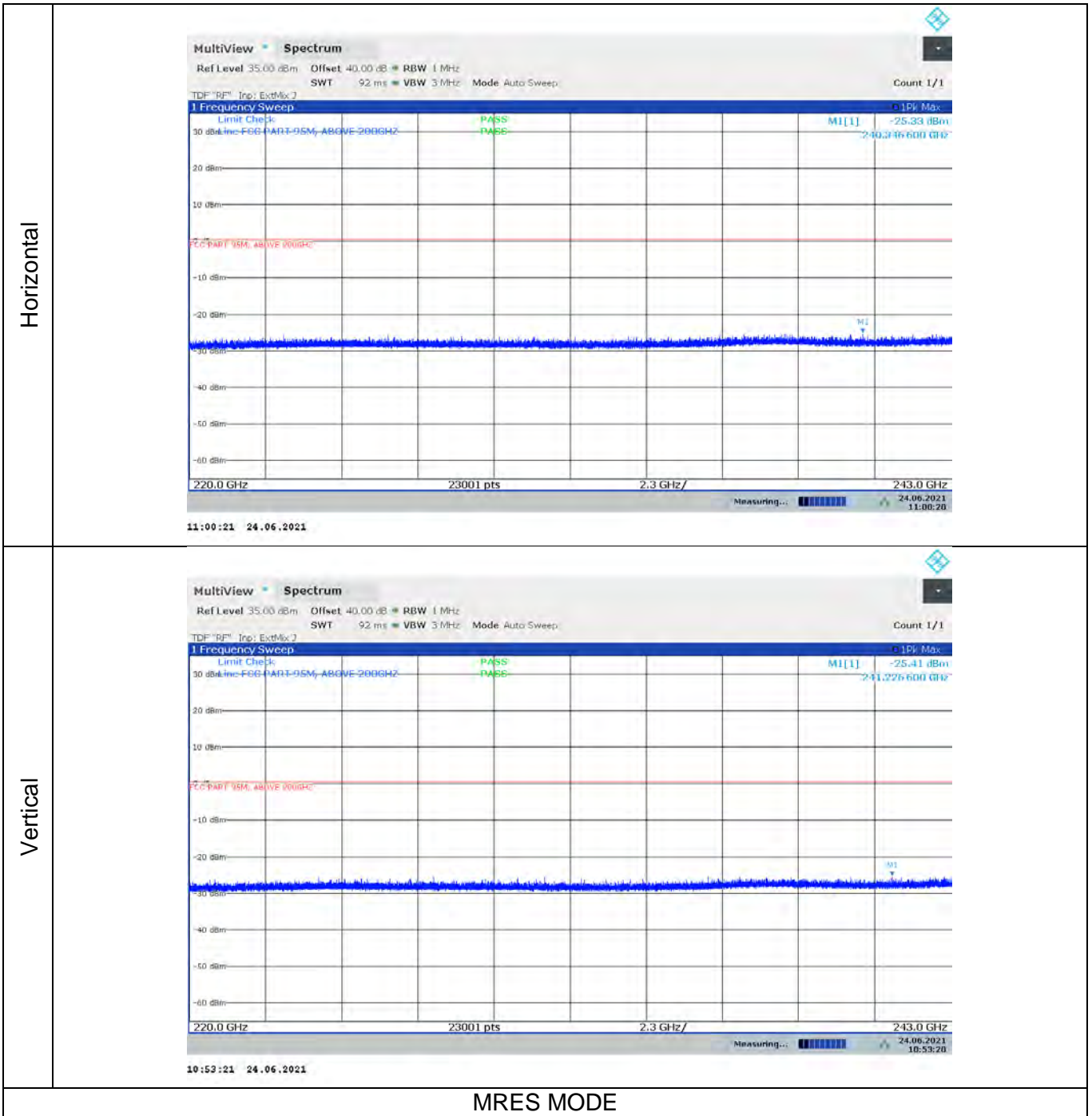
LRES W6 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
237.974	Peak	Horiz	-25.29	0.5	-25.79
238.661	Peak	Vert	-24.75	0.5	-25.25



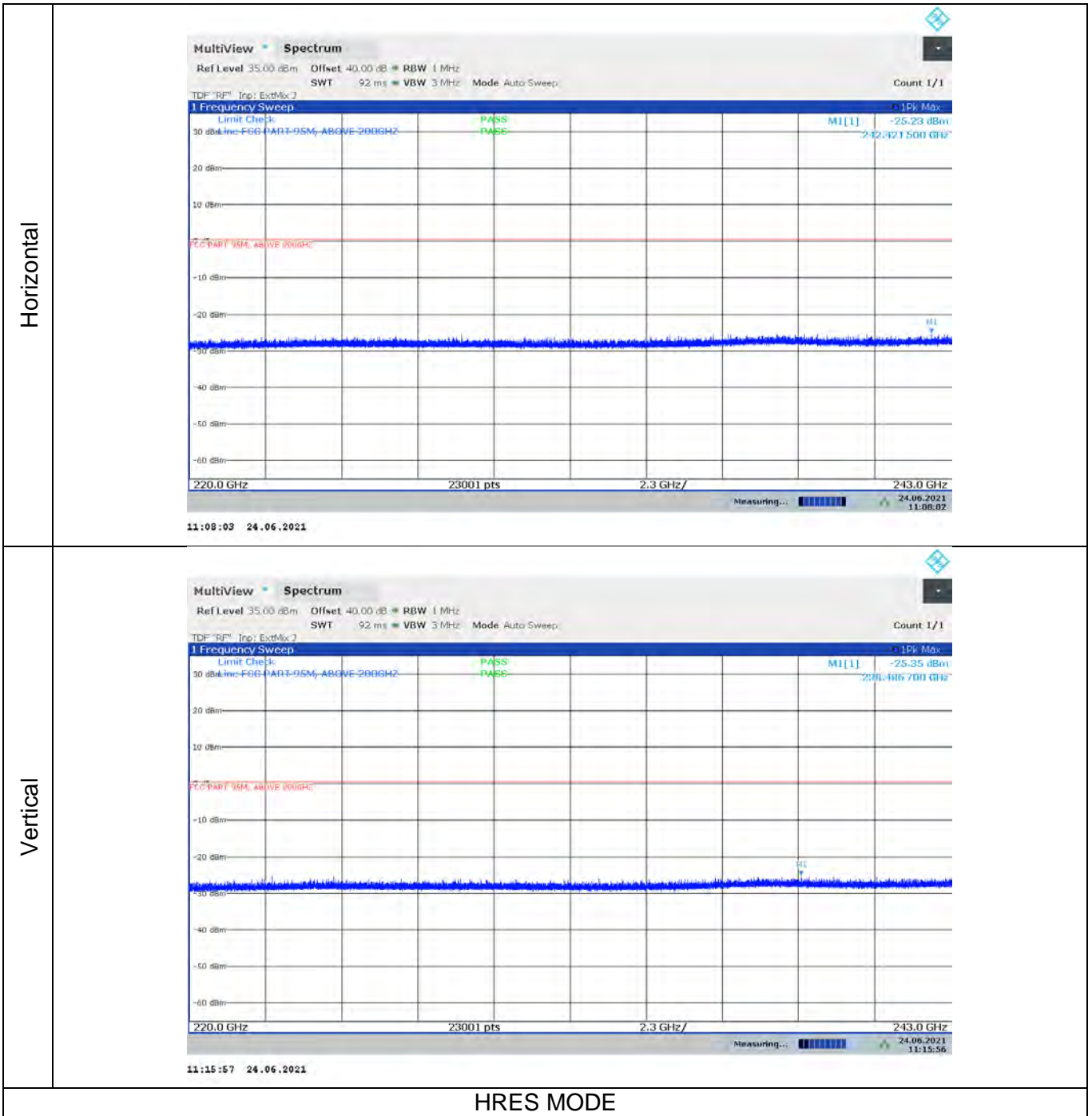
LRES W4 MODE

Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
236.888	Peak	Horiz	-25.20	0.5	-25.70
242.676	Peak	Vert	-24.86	0.5	-25.36



MRES MODE

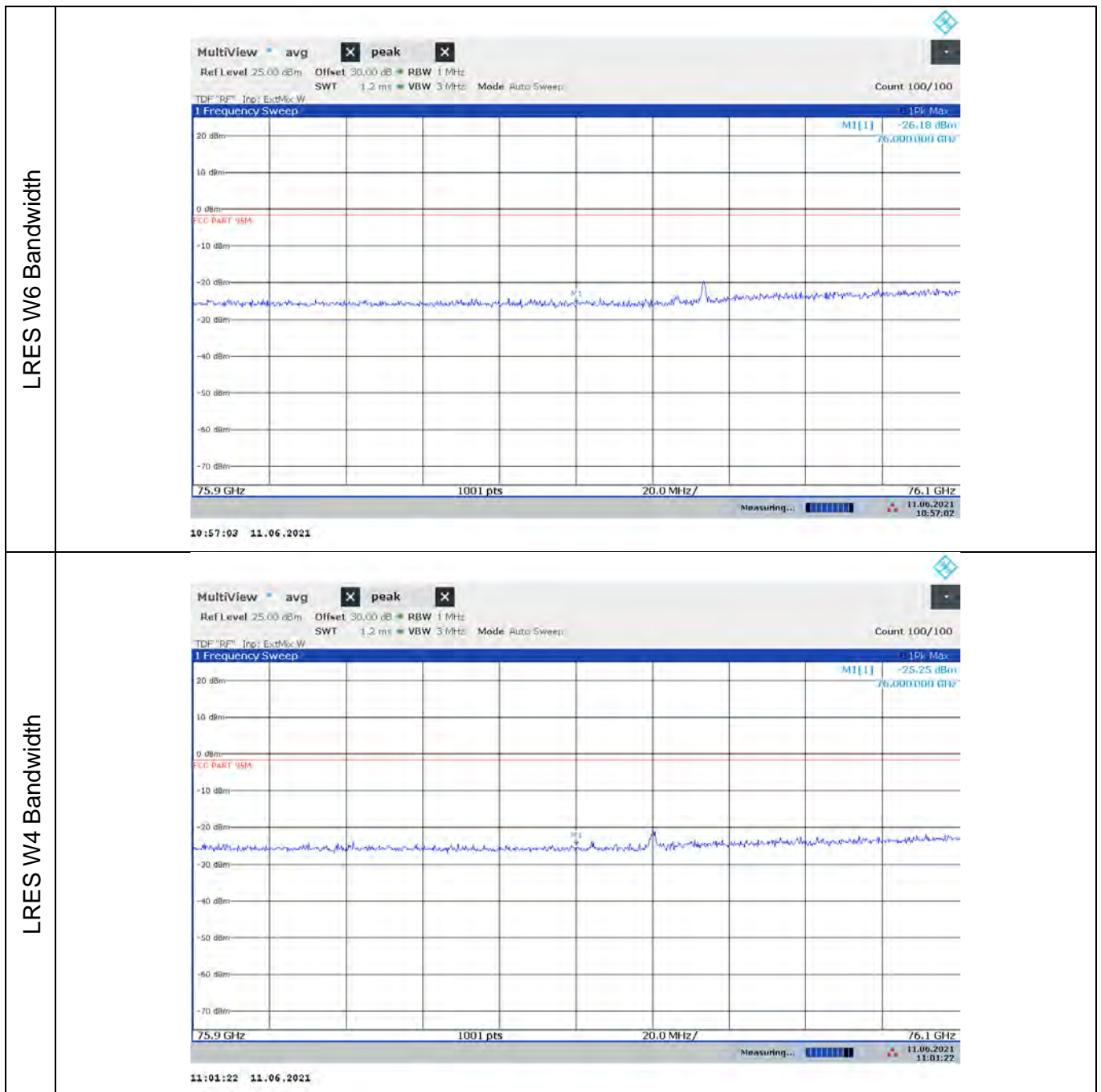
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
240.347	Peak	Horiz	-25.33	0.5	-25.83
241.227	Peak	Vert	-25.41	0.5	-25.91



HRES MODE

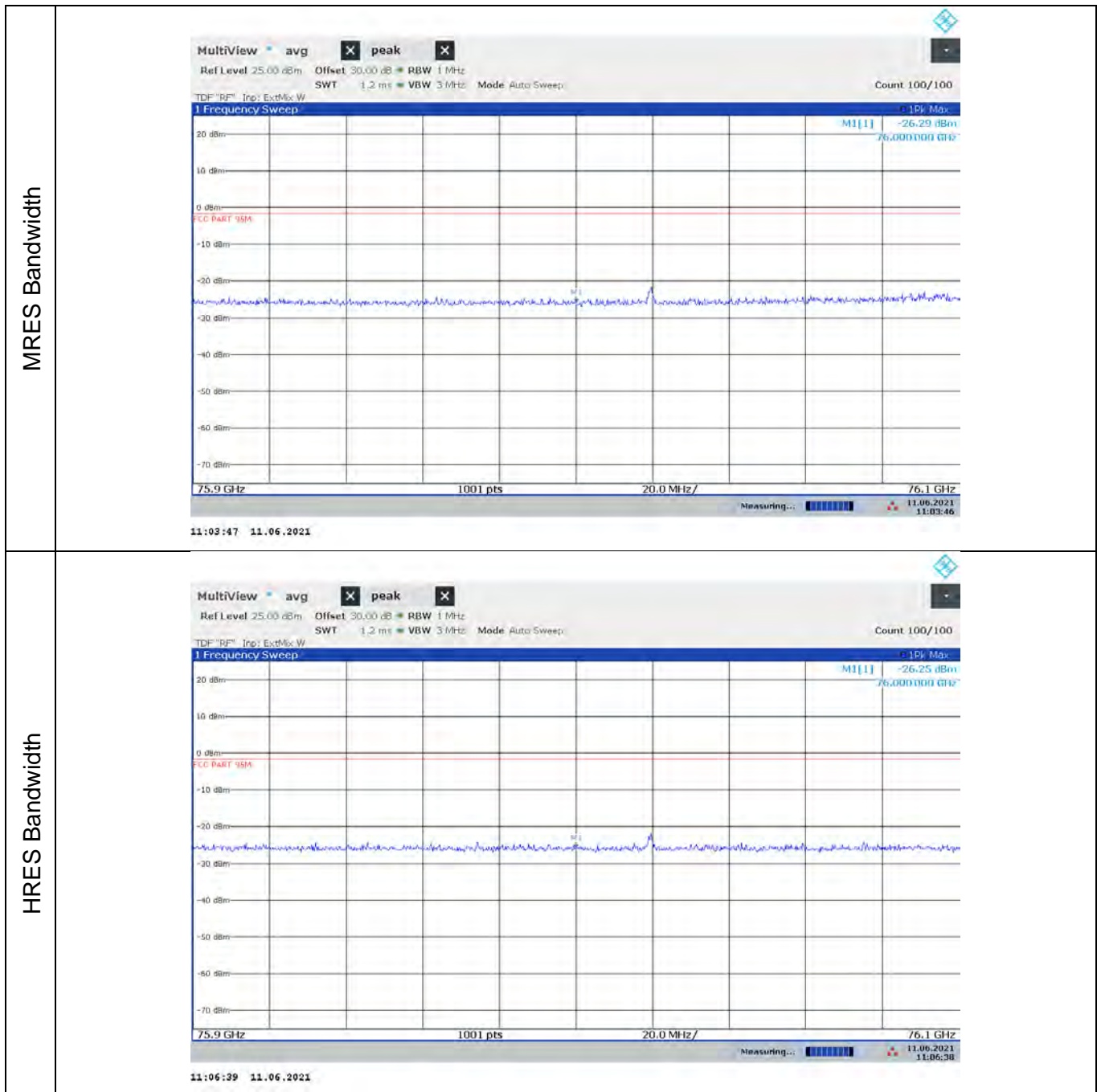
Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
242.422	Peak	Horiz	-25.23	0.5	-25.73
238.487	Peak	Vert	-25.35	0.5	-25.85

8.4.13. LOW BANDEDGE



Note: Only worse case of horizontal / vertical measurement reported.

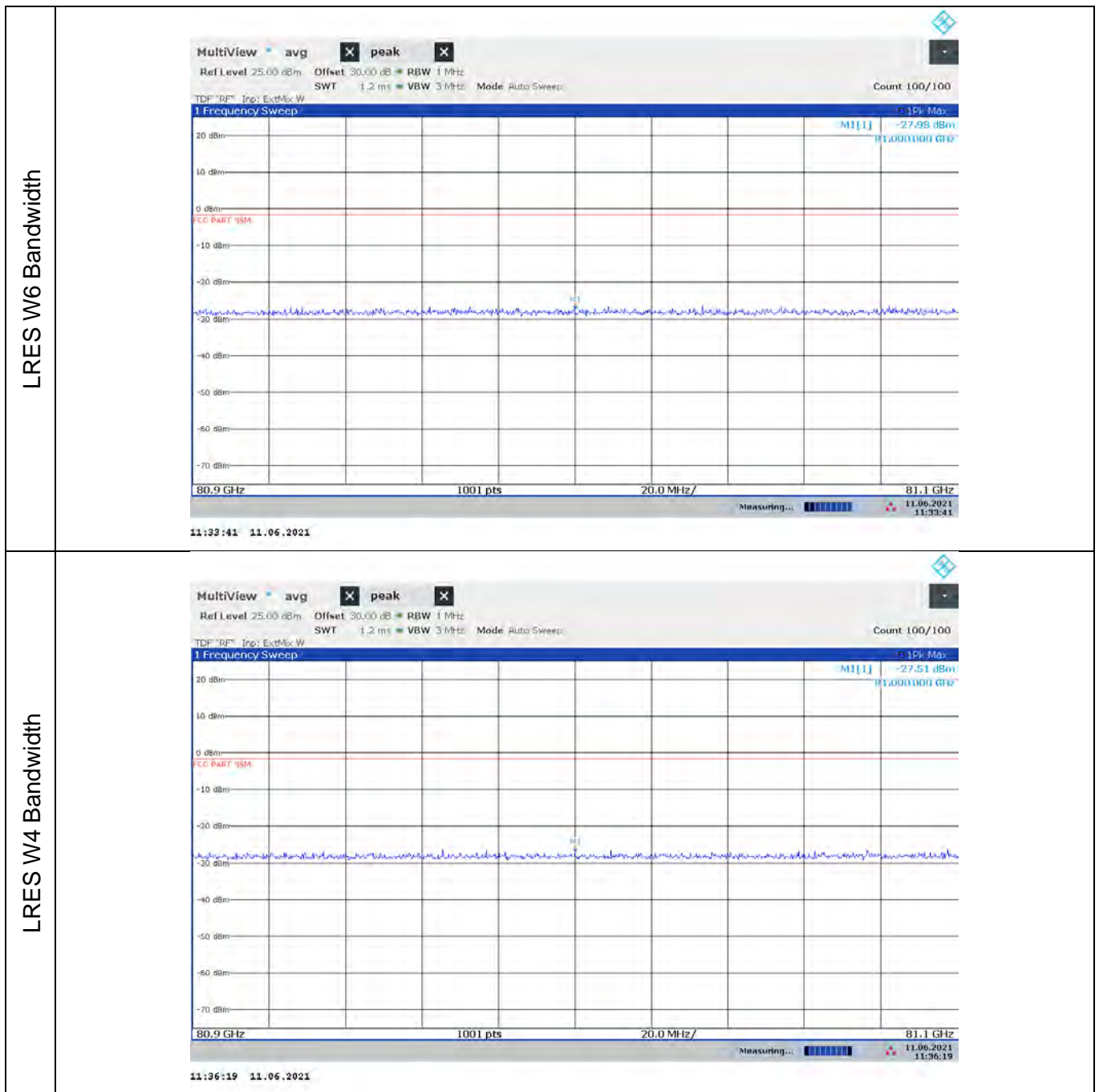
Mode	Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
LRES W6	76.000	Peak	Vert	-26.18	-1.7	-24.48
LRES W4	76.000	Peak	Vert	-25.25	-1.7	-23.55



Note: Only worse case of horizontal / vertical measurement reported.

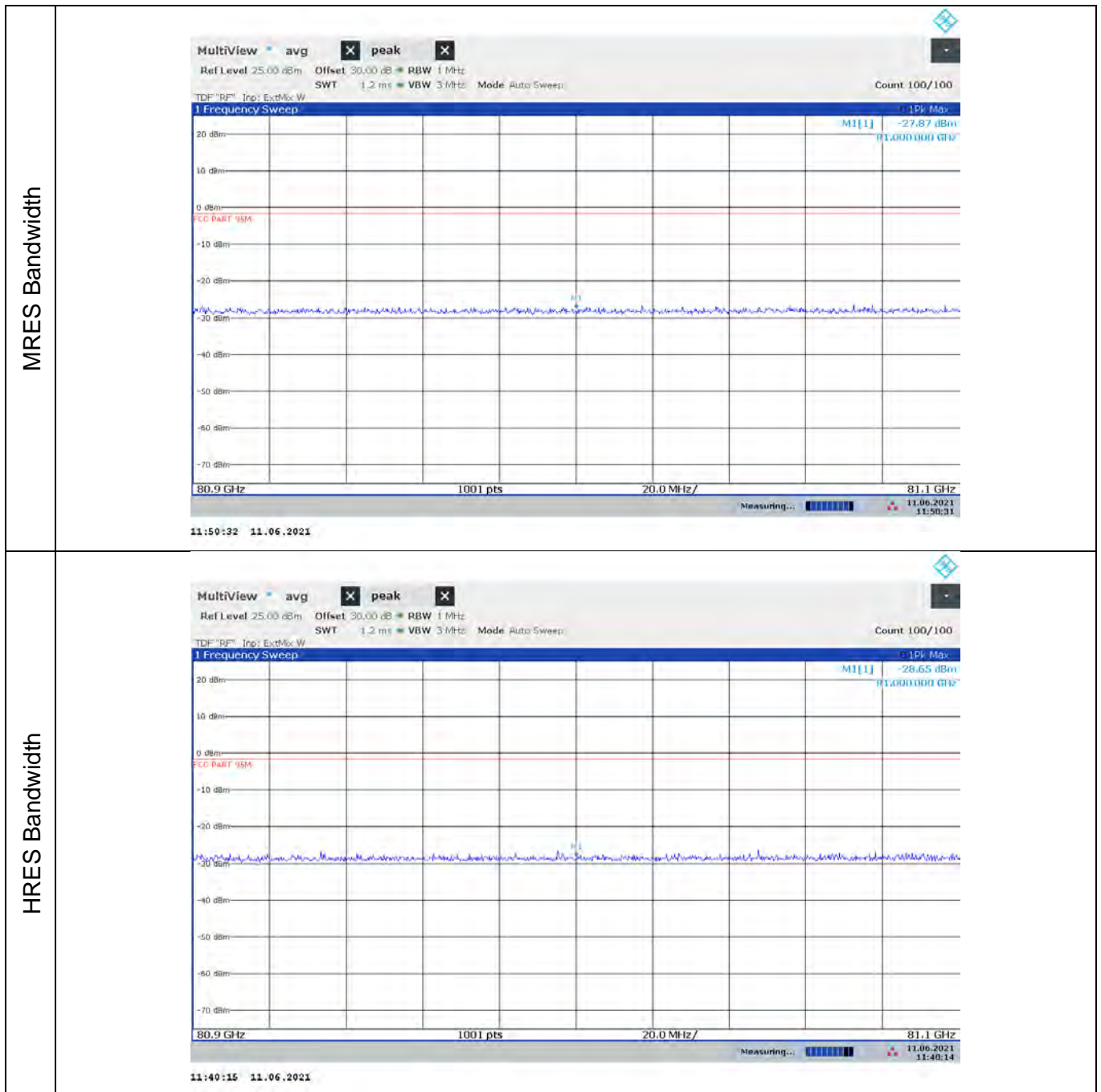
Mode	Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
MRES	76.000	Peak	Vert	-26.29	-1.7	-24.59
HRES	76.000	Peak	Vert	-26.25	-1.7	-24.55

8.4.14. HIGH BANDEDGE



Note: Only worse case of horizontal / vertical measurement reported.

Mode	Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
LRES W6	81.000	Peak	Vert	-27.98	-1.7	-26.28
LRES W4	81.000	Peak	Vert	-27.51	-1.7	-25.81



Note: Only worse case of horizontal / vertical measurement reported.

Mode	Frequency (GHz)	Detector	Polarity	Peak (dBm EIRP)	Limit (dBm EIRP)	Margin (dB)
MRES	81.000	Peak	Horiz	-27.87	-1.7	-26.17
HRES	81.000	Peak	Vert	-28.65	-1.7	-26.95

8.5. FREQUENCY STABILITY

REQUIREMENT

FCC: §2.1055

FCC §95.3379 (b) – F (low) > 76.0 GHz ; F (high) < 81 GHz

Fundamental emissions must be contained within the frequency bands specified in this section during all conditions of operation. Equipment is presumed to operate over the temperature range -20 to +50 degrees Celsius with an input voltage variation of 85% to 115% of rated input voltage, unless justification is presented to demonstrate otherwise.

TEST PROCEDURES

ANSI C63.26-2015 Section 5.6

The 99% occupied bandwidth was measured using the occupied bandwidth function of the spectrum analyzer. The lower side of the low channel was compared to the lower limit (76 GHz) and the higher side of the high channel was compared to the higher limit (81 GHz).

RESULTS

See the following page.

Plots only reported for the mode which utilized the widest bandwidth (HRES). Additionally, plots only reported at the extreme & nominal conditions. Numerical results for the remaining modes/environmental conditions are provided in the following tables.

TESTED BY

Employee ID: 23854

Location: mmWave 1

Date: 2021-06-16, 2021-06-17

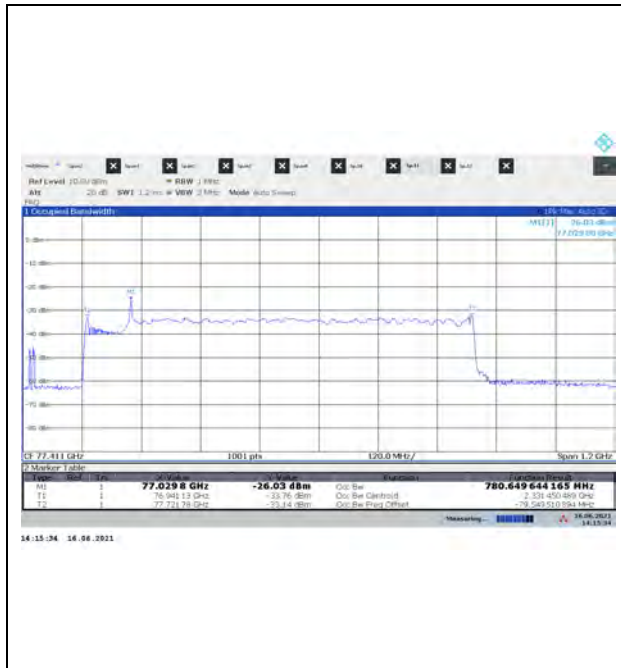
RESULTS

Mode : LRES W6					
Power Supply (VDC)	Environment Temp (°C)	Frequency F _L (MHz)	Delta (MHz)	Frequency F _H (MHz)	Delta (MHz)
13.80	50	77.0357	0.0009	79.7911	0.0004
12.00	50	77.0358	0.0008	79.7913	0.0002
10.20	50	77.0356	0.0009	79.7911	0.0004
12.00	40	77.0362	0.0003	79.7915	0.0000
12.00	30	77.0365	0.0001	79.7910	0.0005
13.80	20	77.0360	0.0005	79.7910	0.0005
12.00	20	77.0365	Reference	79.7915	Reference
10.20	20	77.0363	0.0002	79.7915	0.0000
12.00	10	77.0368	-0.0002	79.7917	-0.0002
12.00	0	77.0367	-0.0002	79.7914	0.0001
12.00	-10	77.0366	0.0000	79.7912	0.0004
13.80	-20	77.0365	0.0000	79.7913	0.0002
12.00	-20	77.0366	-0.0001	79.7913	0.0003
10.2	-20	77.0365	0.0000	79.7913	0.0002

Mode : LRES W4					
Power Supply (VDC)	Environment Temp (°C)	Frequency F _L (MHz)	Delta (MHz)	Frequency F _H (MHz)	Delta (MHz)
13.80	50	77.0127	0.0009	79.8025	0.0003
12.00	50	77.0129	0.0007	79.8024	0.0004
10.20	50	77.0129	0.0007	79.8024	0.0004
12.00	40	77.0129	0.0006	79.8030	-0.0002
12.00	30	77.0136	0.0000	79.8026	0.0002
13.80	20	77.0014	0.0122	79.8027	0.0001
12.00	20	77.0136	Reference	79.8028	Reference
10.20	20	77.0137	-0.0002	79.8028	0.0000
12.00	10	77.0139	-0.0003	79.8029	-0.0001
12.00	0	77.0132	0.0004	79.8029	-0.0001
12.00	-10	77.0135	0.0000	79.8028	0.0000
13.80	-20	77.0132	0.0003	79.8029	-0.0001
12.00	-20	77.0133	0.0003	79.8027	0.0001
10.2	-20	77.0134	0.0001	79.8028	-0.0001

Mode : MRES					
Power Supply (VDC)	Environment Temp (°C)	Frequency F _L (MHz)	Delta (MHz)	Frequency F _H (MHz)	Delta (MHz)
13.80	50	76.9883	-0.0036	79.9716	0.0015
12.00	50	76.9865	-0.0018	79.9719	0.0011
10.20	50	76.9880	-0.0032	79.9718	0.0013
12.00	40	76.9838	0.0010	79.9703	0.0027
12.00	30	76.9842	0.0005	79.9728	0.0002
13.80	20	76.9854	-0.0007	79.9729	0.0001
12.00	20	76.9847	Reference	79.9731	Reference
10.20	20	76.9848	0.0000	79.9733	-0.0002
12.00	10	76.9858	-0.0011	79.9728	0.0002
12.00	0	76.9859	-0.0011	79.9725	0.0006
12.00	-10	76.9857	-0.0009	79.9729	0.0002
13.80	-20	76.9860	-0.0013	79.9727	0.0004
12.00	-20	76.9853	-0.0006	79.9731	0.0000
10.2	-20	76.9864	-0.0016	79.9727	0.0004

Mode: HRES					
Power Supply (VDC)	Environment Temp (°C)	Frequency F _L (MHz)	Delta (MHz)	Frequency F _H (MHz)	Delta (MHz)
13.80	50	76.9370	0.0041	80.0459	-0.0047
12.00	50	76.9397	0.0015	80.0446	-0.0034
10.20	50	76.9384	0.0027	80.0448	-0.0036
12.00	40	76.9413	-0.0002	80.0428	-0.0016
12.00	30	76.9393	0.0018	80.0414	-0.0002
13.80	20	76.9395	0.0016	80.0391	0.0021
12.00	20	76.9411	Reference	80.0412	Reference
10.20	20	76.9400	0.0011	80.0403	0.0009
12.00	10	76.9388	0.0023	80.0400	0.0012
12.00	0	76.9401	0.0011	80.0384	0.0028
12.00	-10	76.9394	0.0017	80.0415	-0.0004
13.80	-20	76.9388	0.0023	80.0414	-0.0003
12.00	-20	76.9391	0.0020	80.0420	-0.0008
10.2	-20	76.9386	0.0025	80.0411	0.0001



HRES: Nom T / Nom V – Low Channel



HRES: Nom T / Nom V – High Channel



HRES: Low T / Nom V – Low Channel



HRES: Low T / Nom V – High Channel



HRES: High T / Nom V – Low Channel



HRES: High T / Nom V – High Channel



HRES: Low T / Low V – Low Channel



HRES: Low T / Low V – High Channel



HRES: Low T / High V – Low Channel



HRES: Low T / High V – High Channel



HRES: High T / Low V – Low Channel



HRES: High T / Low V – High Channel



HRES: High T / High V – Low Channel



HRES: High T / High V – High Channel

9. SETUP PHOTOS

Please refer to report R13824181-EP1 for setup photos.

END OF REPORT