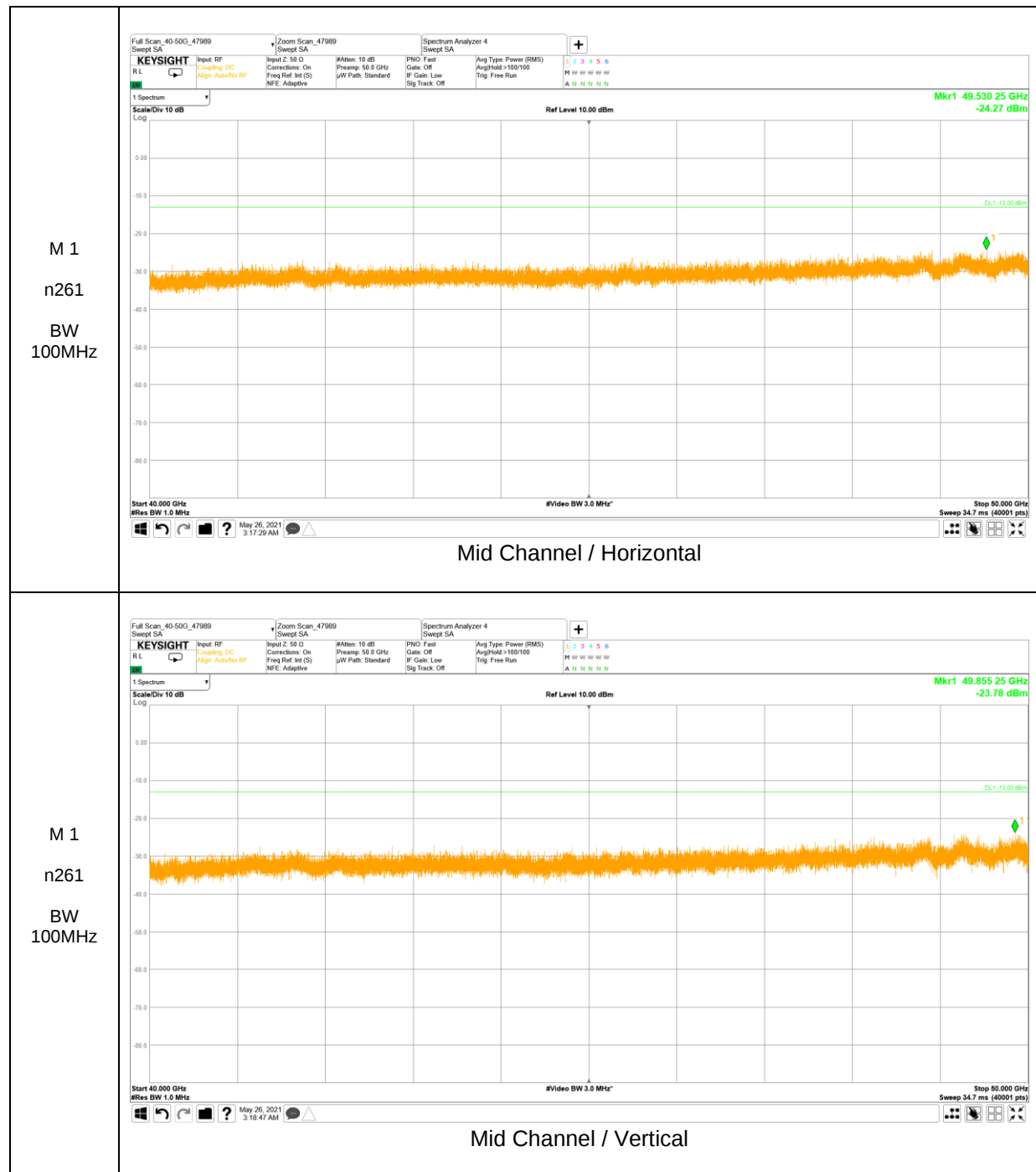
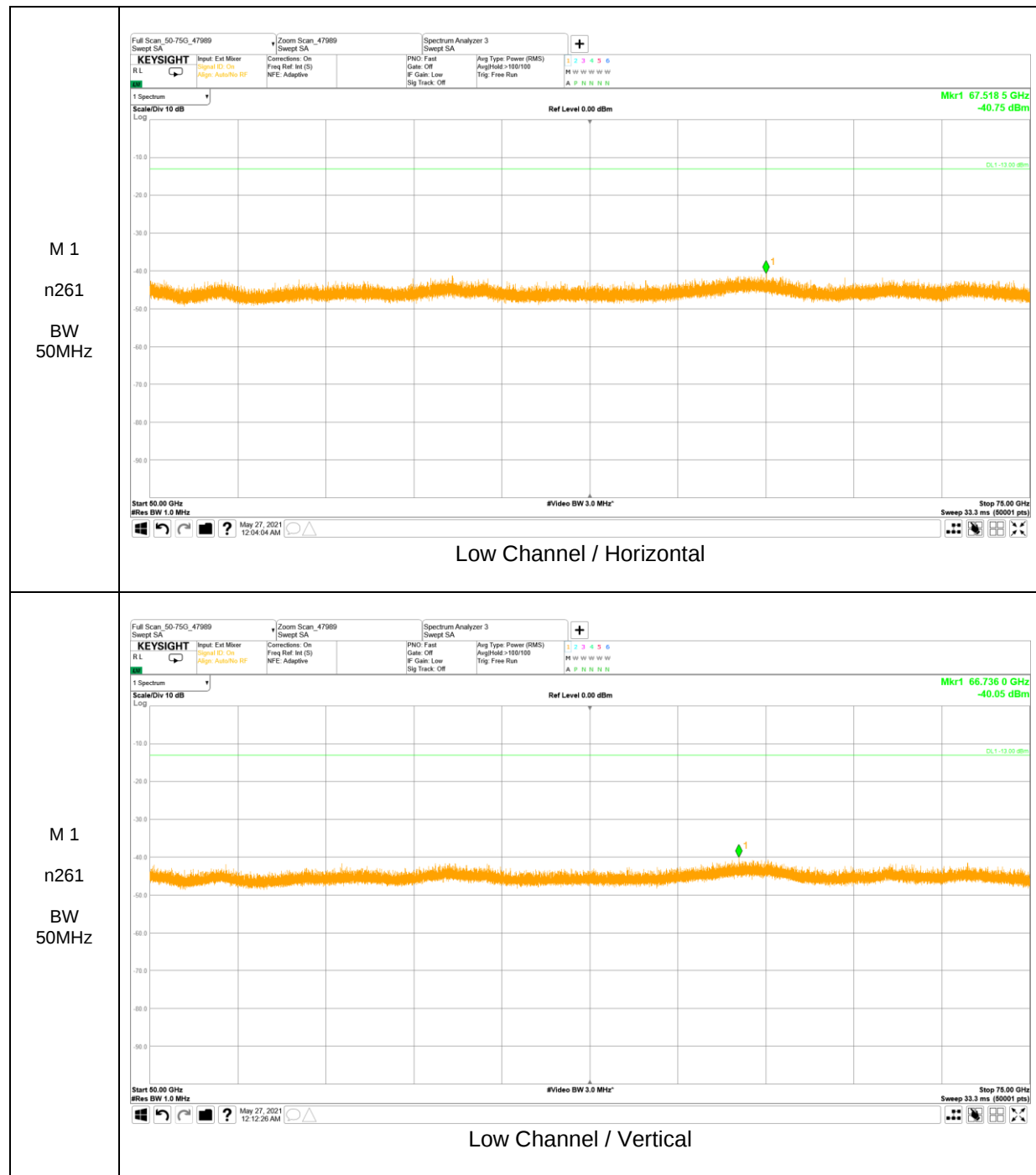


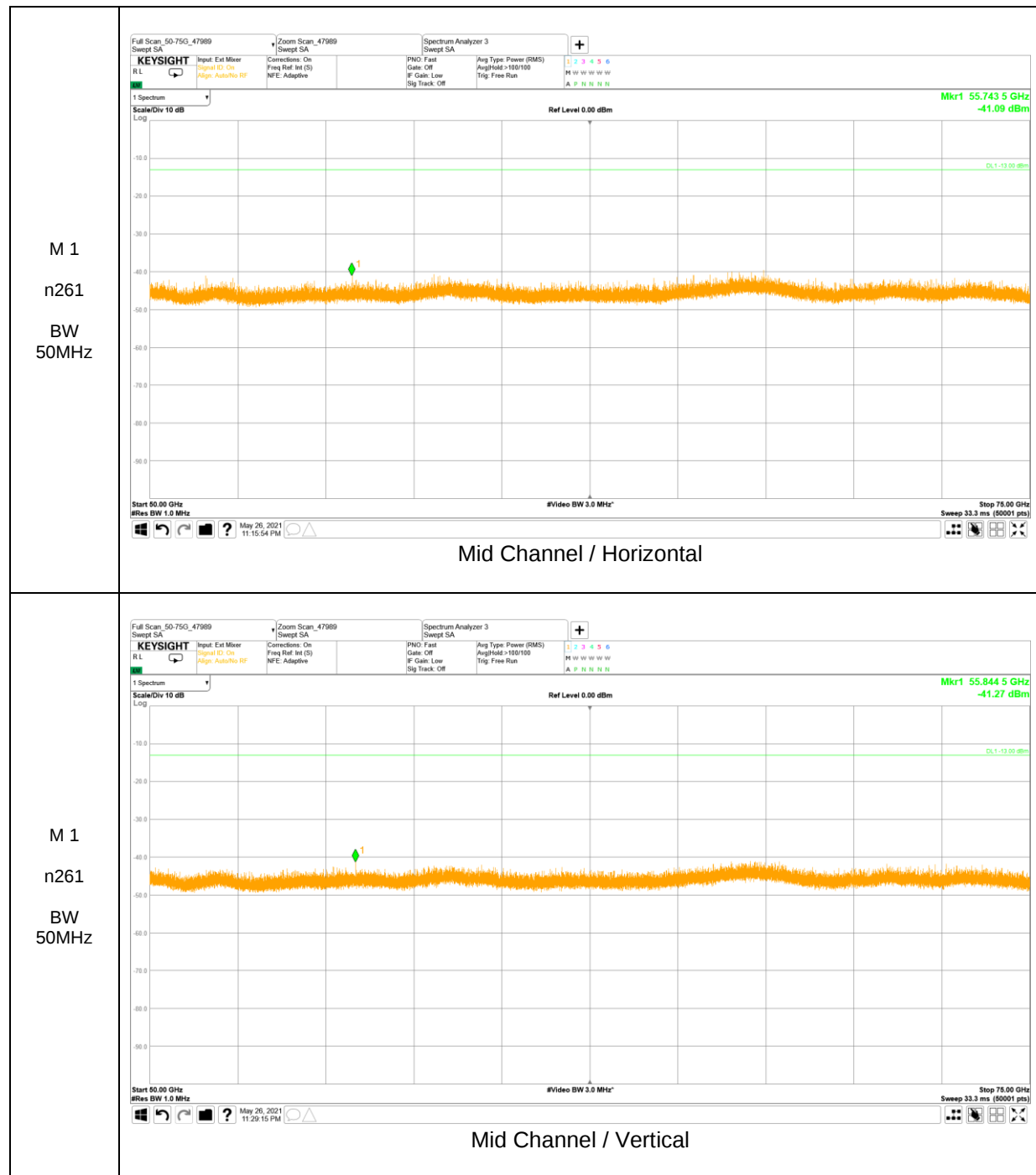


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

50 – 75 GHz Result

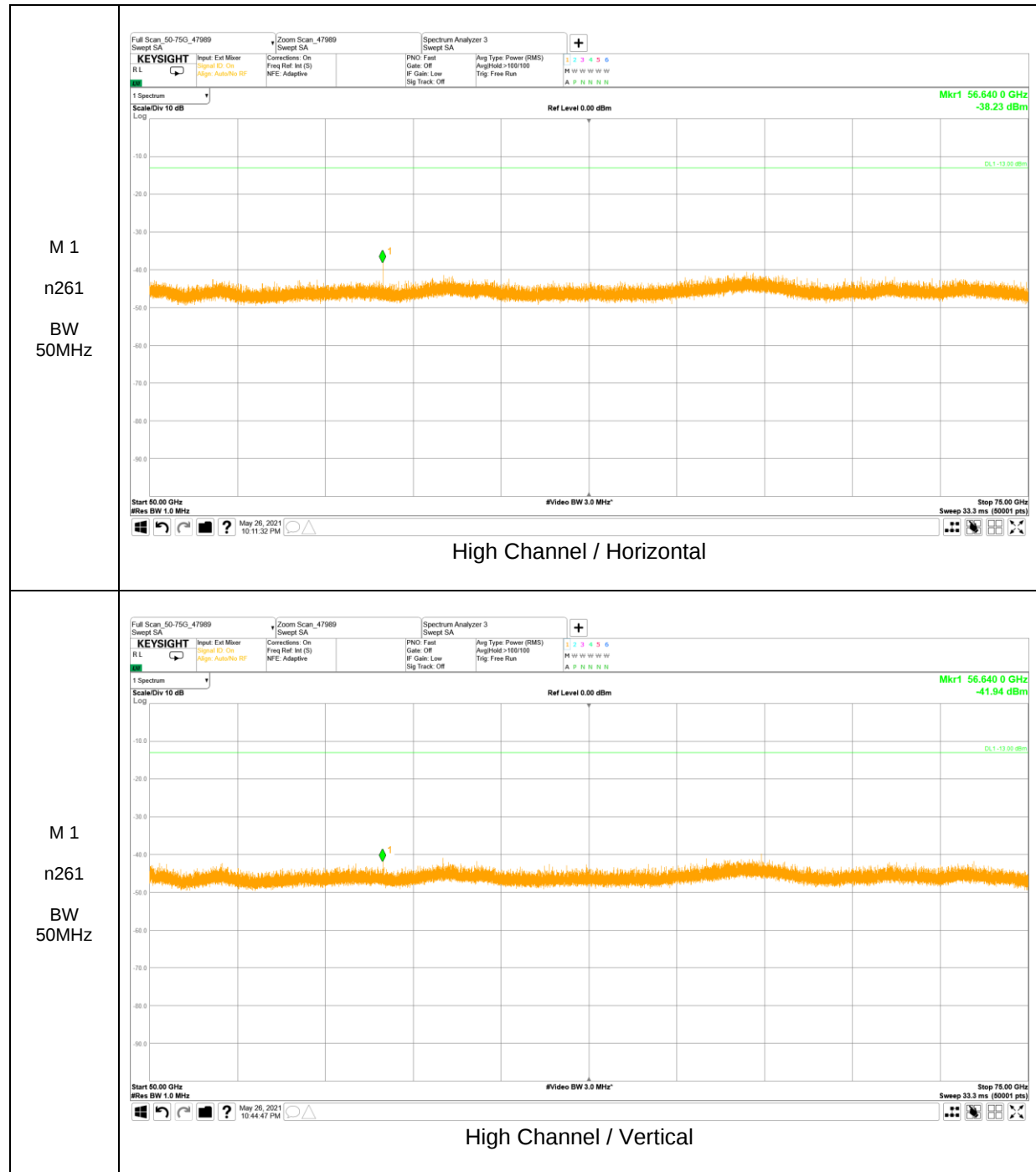


No emissions were detected above noise floor.



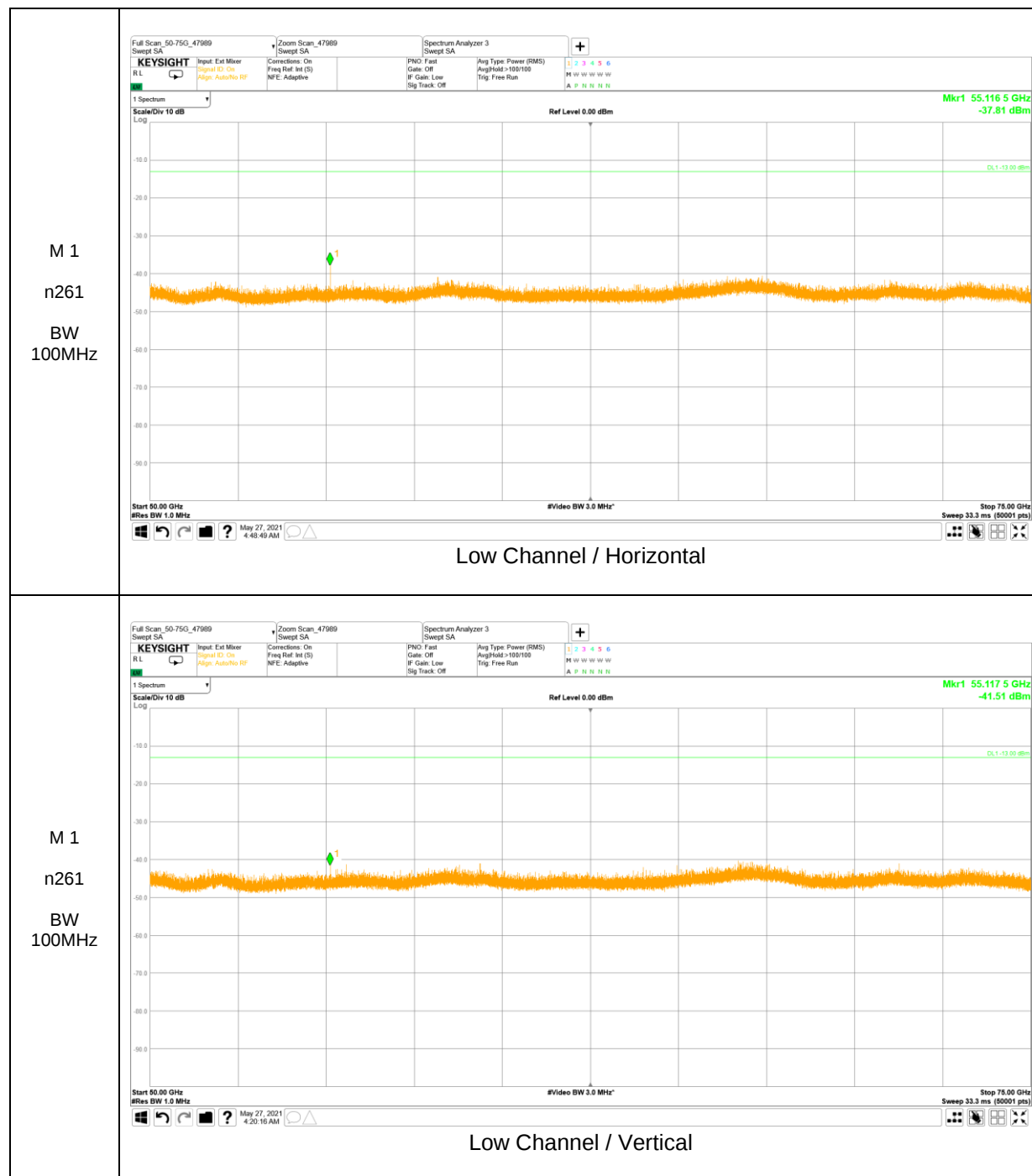
Final Measurement Data Table

Frequency [MHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55844.96	50	SISO-Dual	QPSK	H	123.0	38.4	-48.37	-13	35.37
55845.18	50	SISO-Dual	QPSK	V	107.5	59.2	-47.12	-13	34.12



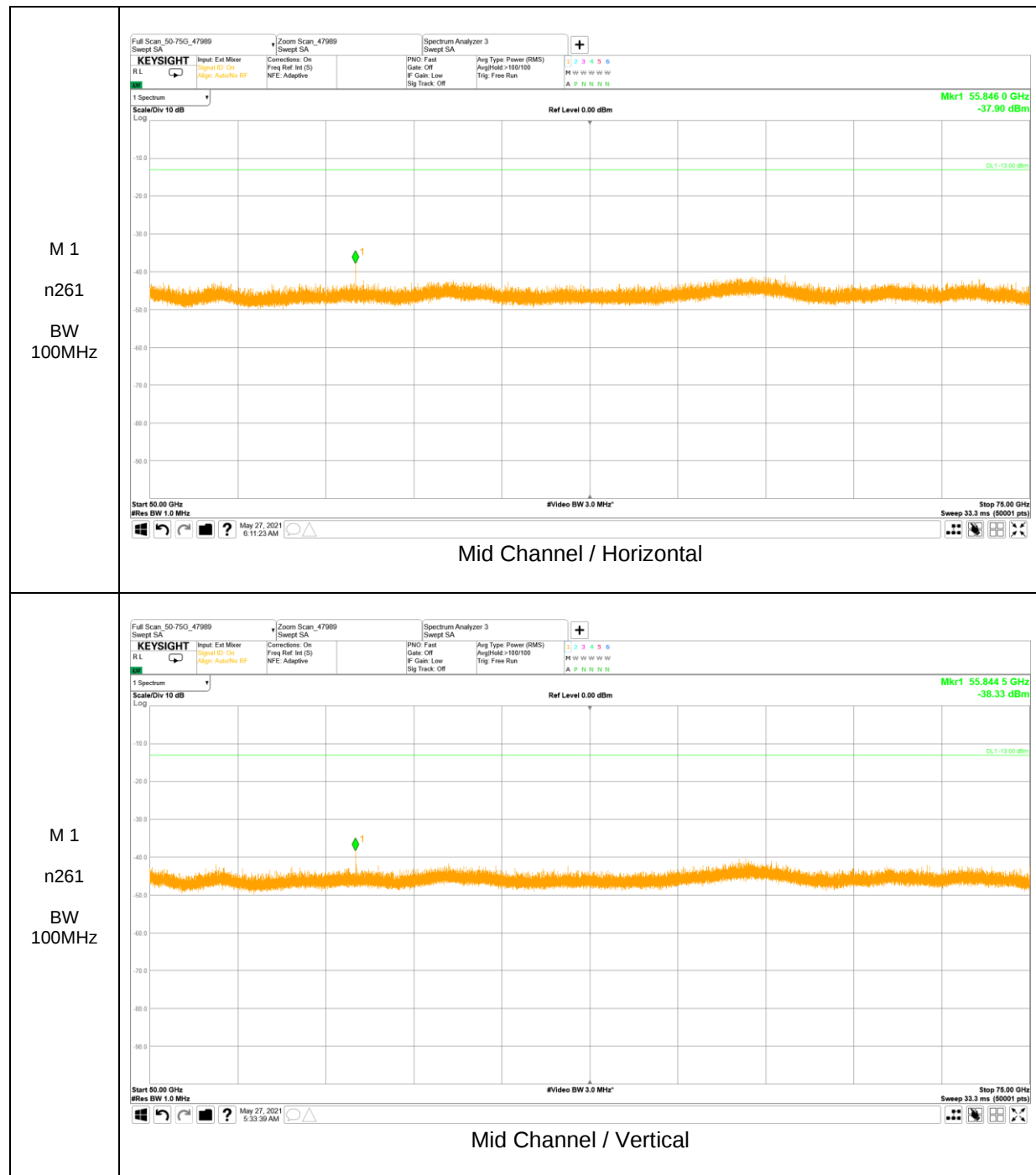
Final Measurement Data Table

Frequency [MHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
56640.17	50	SISO-Dual	QPSK	H	108.9	21.7	-42.88	-13	29.88
56640.16	50	SISO-Dual	QPSK	V	142.9	75.9	-46.97	-13	33.97



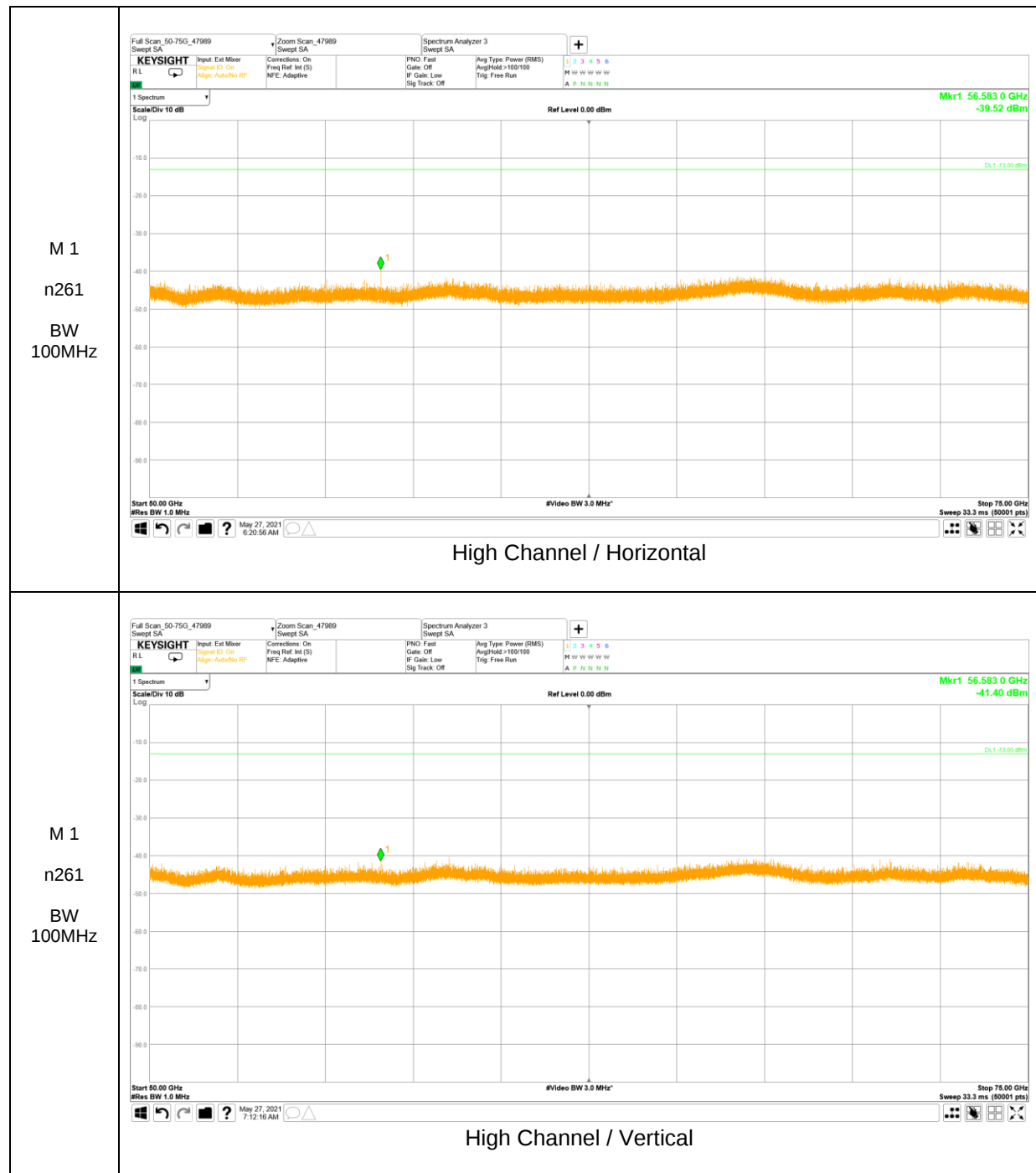
Final Measurement Data Table

Frequency [MHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55116.62	100	SISO-Dual	QPSK	H	115.0	49.4	-43.06	-13	30.06
55116.65	100	SISO-Dual	QPSK	V	118.7	81.1	-47.29	-13	34.29



Final Measurement Data Table

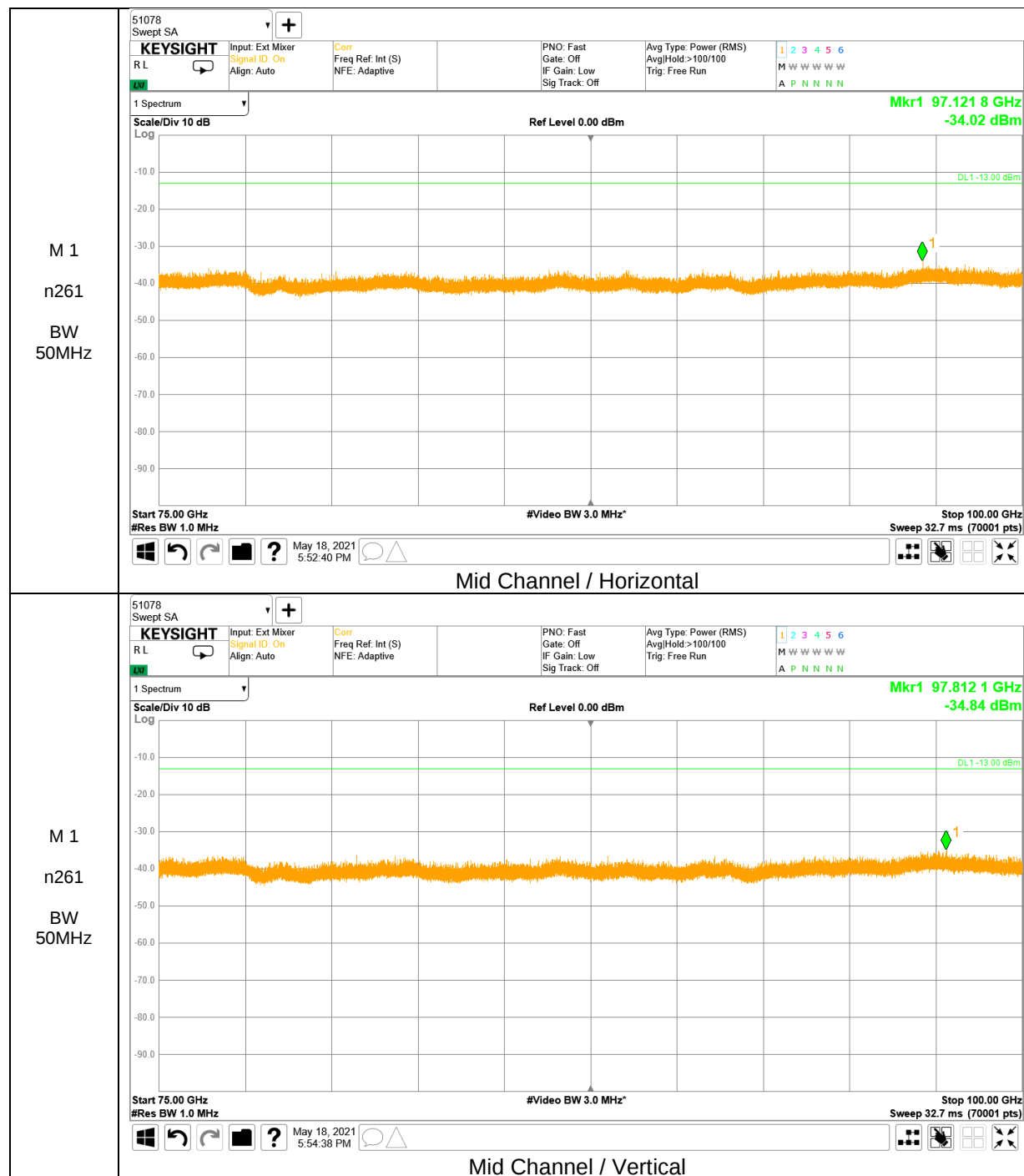
Frequency [MHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55845.35	100	SISO-Dual	QPSK	H	125.5	310.0	-43.63	-13	30.63
55845.47	100	SISO-Dual	QPSK	V	106.5	76.1	-43.62	-13	30.62



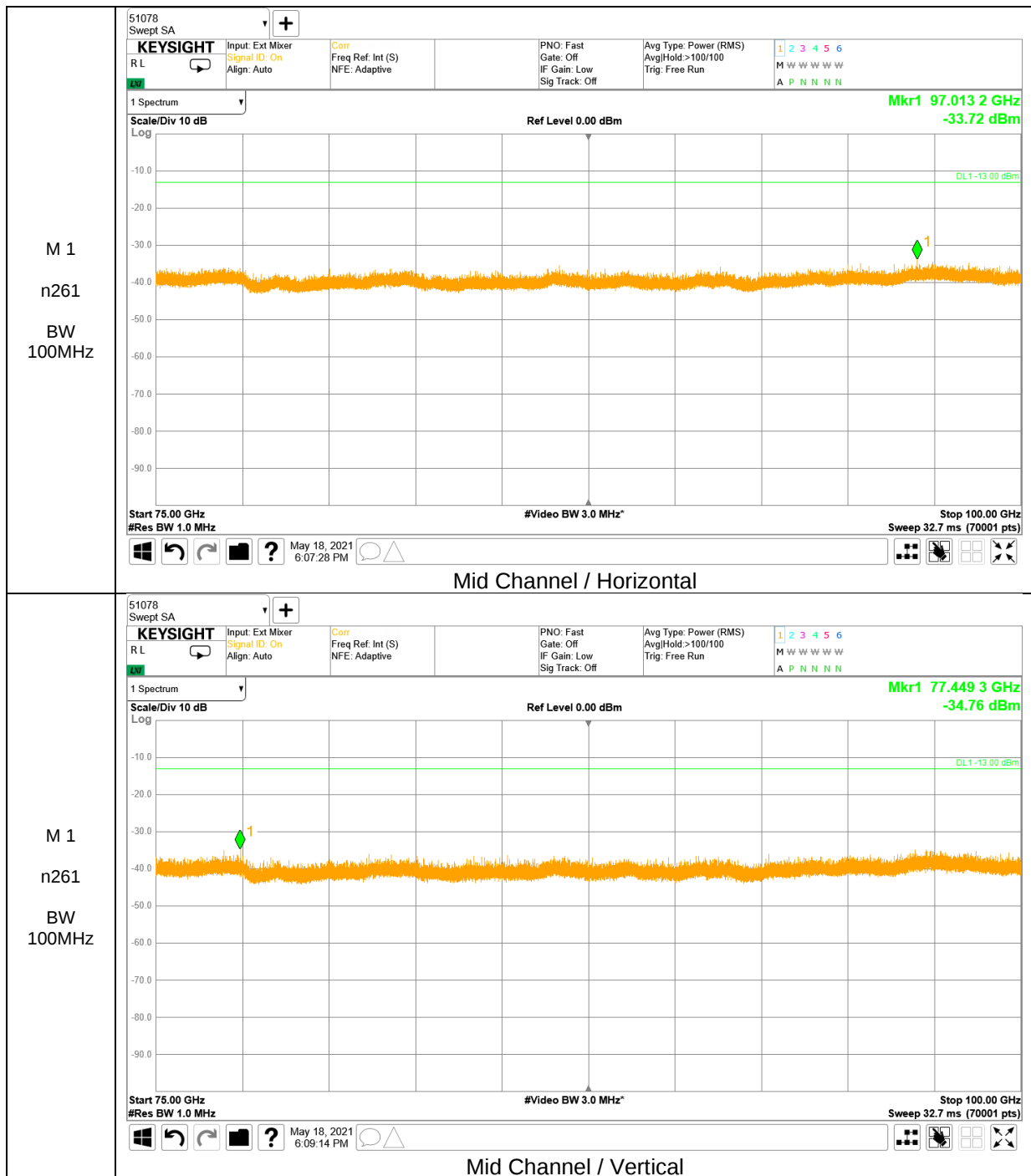
Final Measurement Data Table

Frequency [MHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
56582.73	100	SISO-Dual	QPSK	H	117.5	56.7	-44.25	-13	31.25
56582.74	100	SISO-Dual	QPSK	V	110.0	15.8	-46.63	-13	33.63

75 – 100 GHz Result



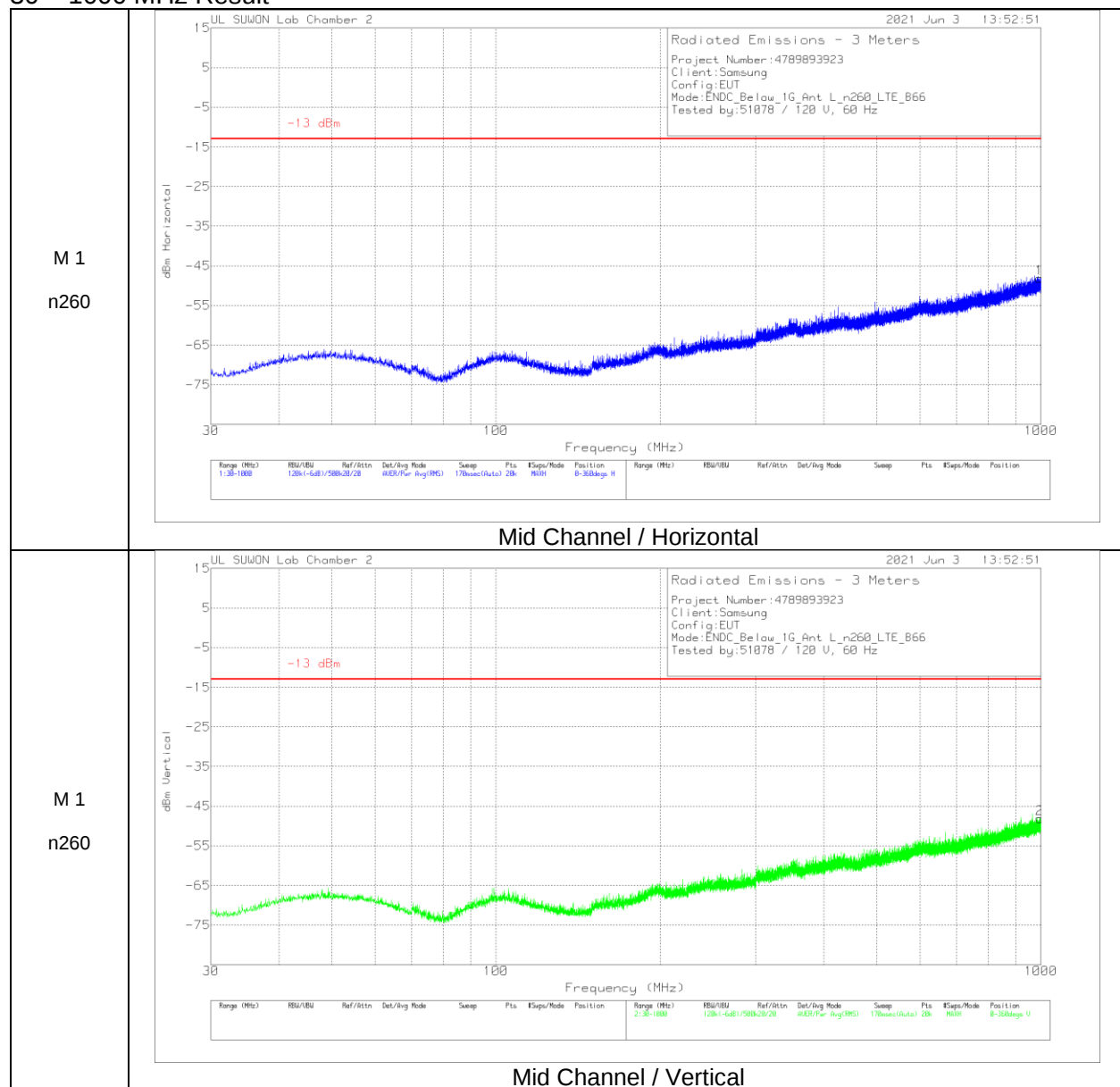
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

Module 1 / n260

30 – 1000 MHz Result



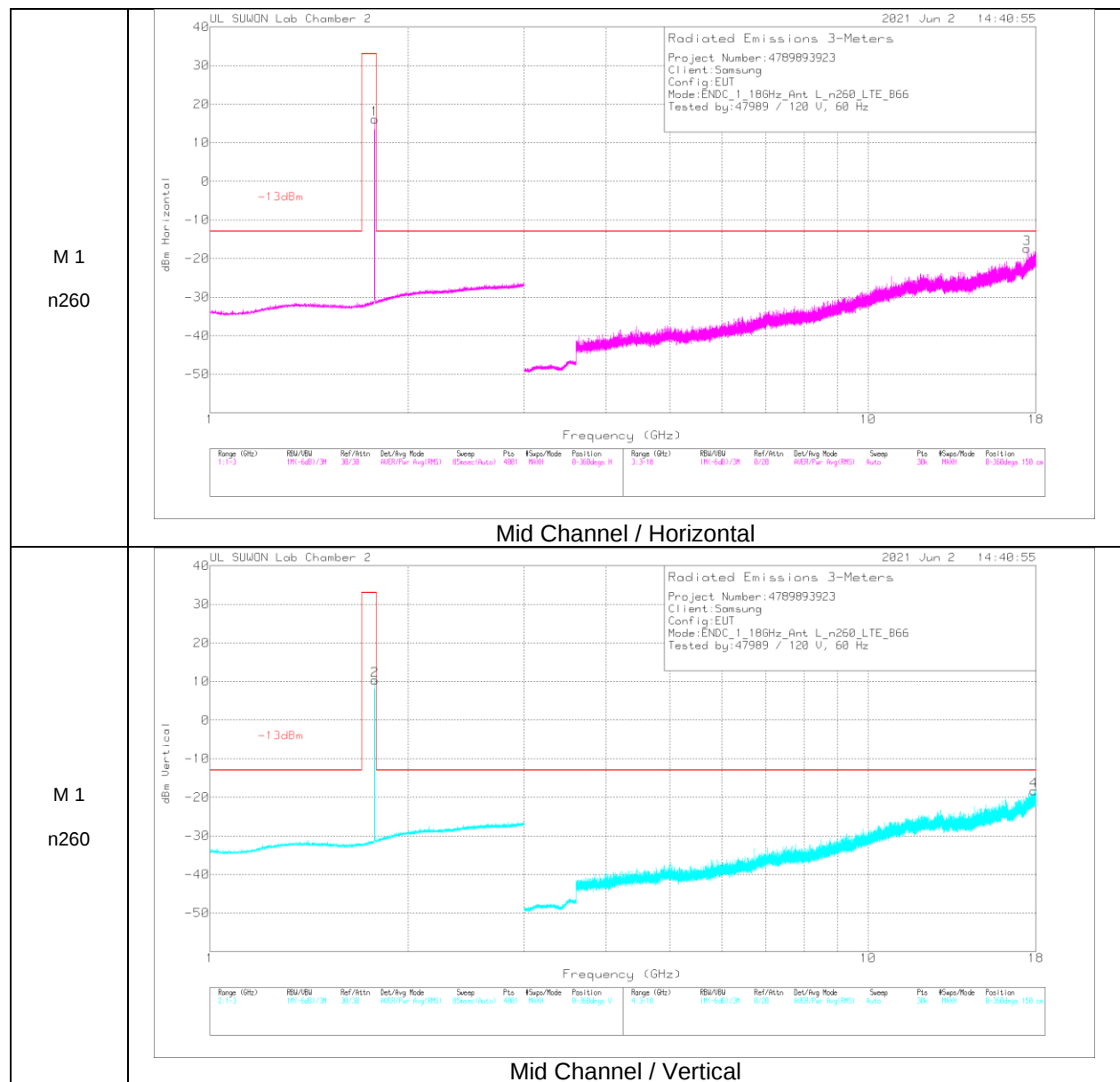
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBm)	Det	VULB9163_749	Below 1G[dB]	Conversion Factor[dB]	Corrected Reading dBm	-13 dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	993.8493	-61.21	RMS	28.4	-27.1	11.8	-48.11	-	-	0-360	400	H
2	994.8677	-61.21	RMS	28.4	-27.1	11.8	-48.11	-	-	0-360	300	V

RMS - RMS detection

No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

1 – 18 GHz Result



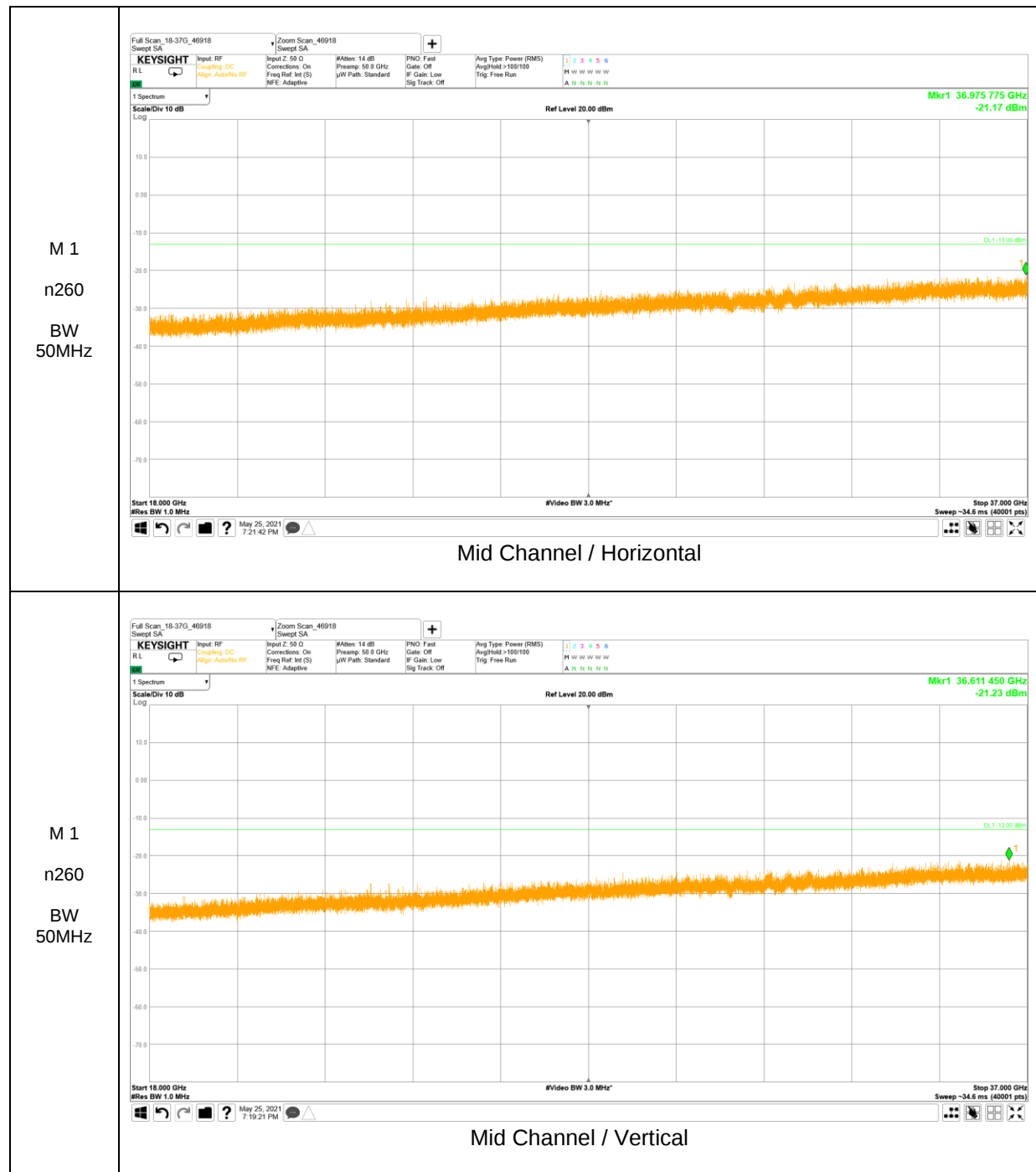
Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBm)	Det	3117_00168724	10dB ATT[dB]	Conversion Factor[dB]	Corrected Reading dBm	-13dBm	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
**1	1.7795	-3.77	RMS	29.6	-21.5	11.8	16.13	33	-16.87	0-360	150	H
**2	1.779	-9.57	RMS	29.6	-21.5	11.8	10.33	33	-22.67	0-360	150	V
3	17.46151	-61.02	RMS	41.1	-9.3	11.8	-17.42	-13	-4.42	0-360	150	H
4	17.88049	-63.44	RMS	41.7	-8.4	11.8	-18.34	-13	-5.34	0-360	150	V

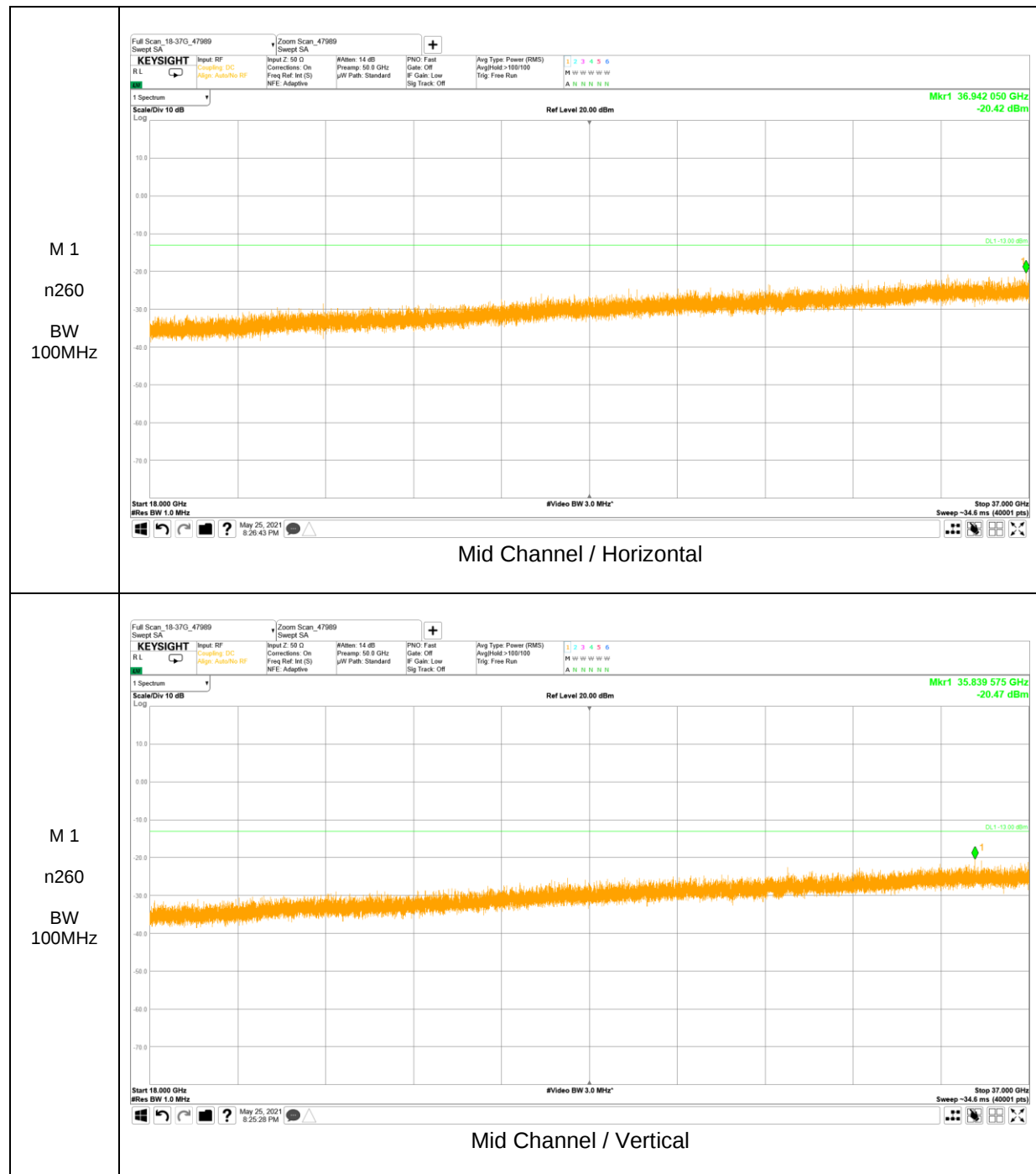
RMS - RMS detection

**** Marker 1 and 2 were the fundamental signal of LTE Band 66 that was used as a representative anchor band for EN-DC investigations.**
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

18 – 37 GHz Result

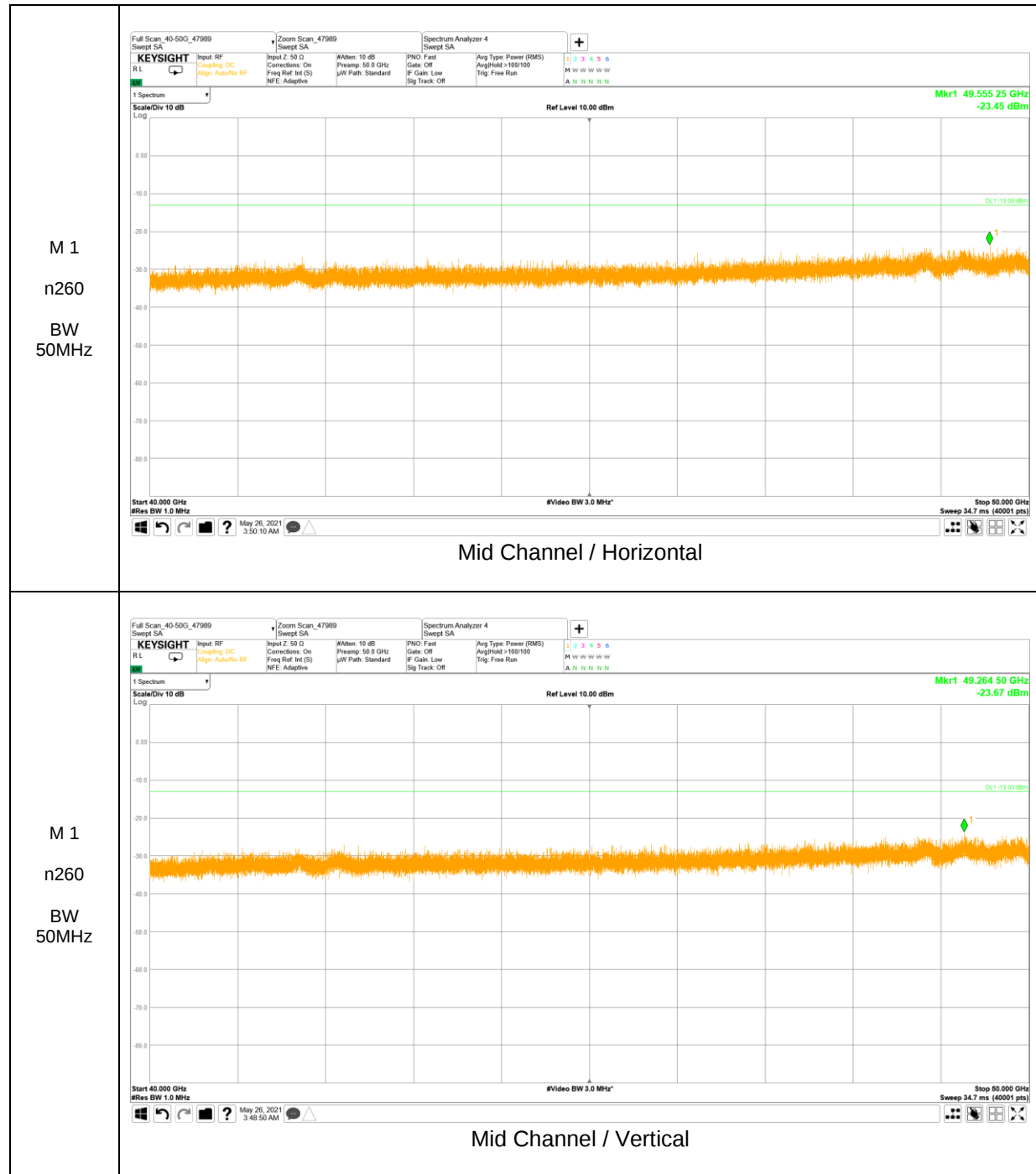


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

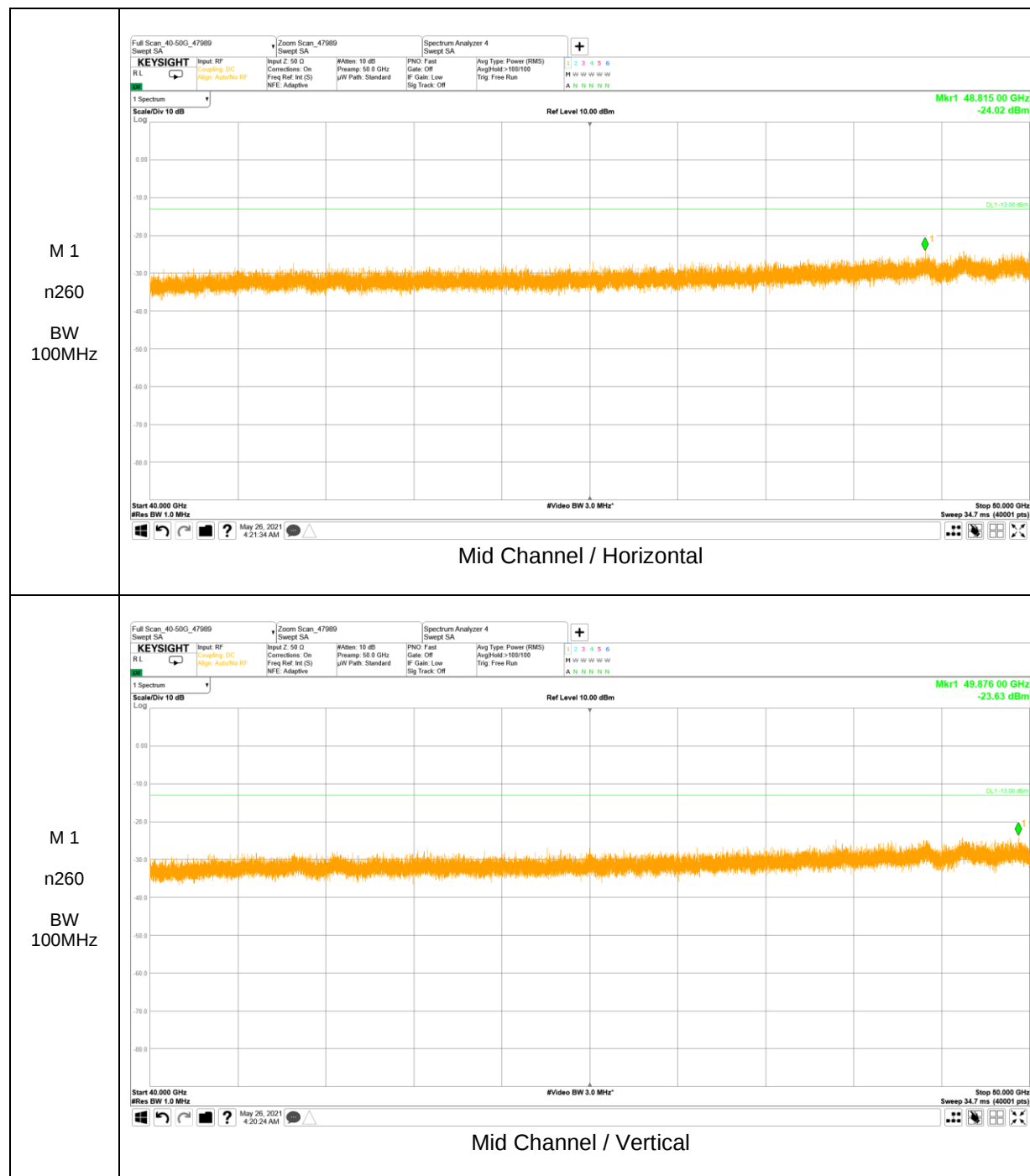


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

40 – 50 GHz Result

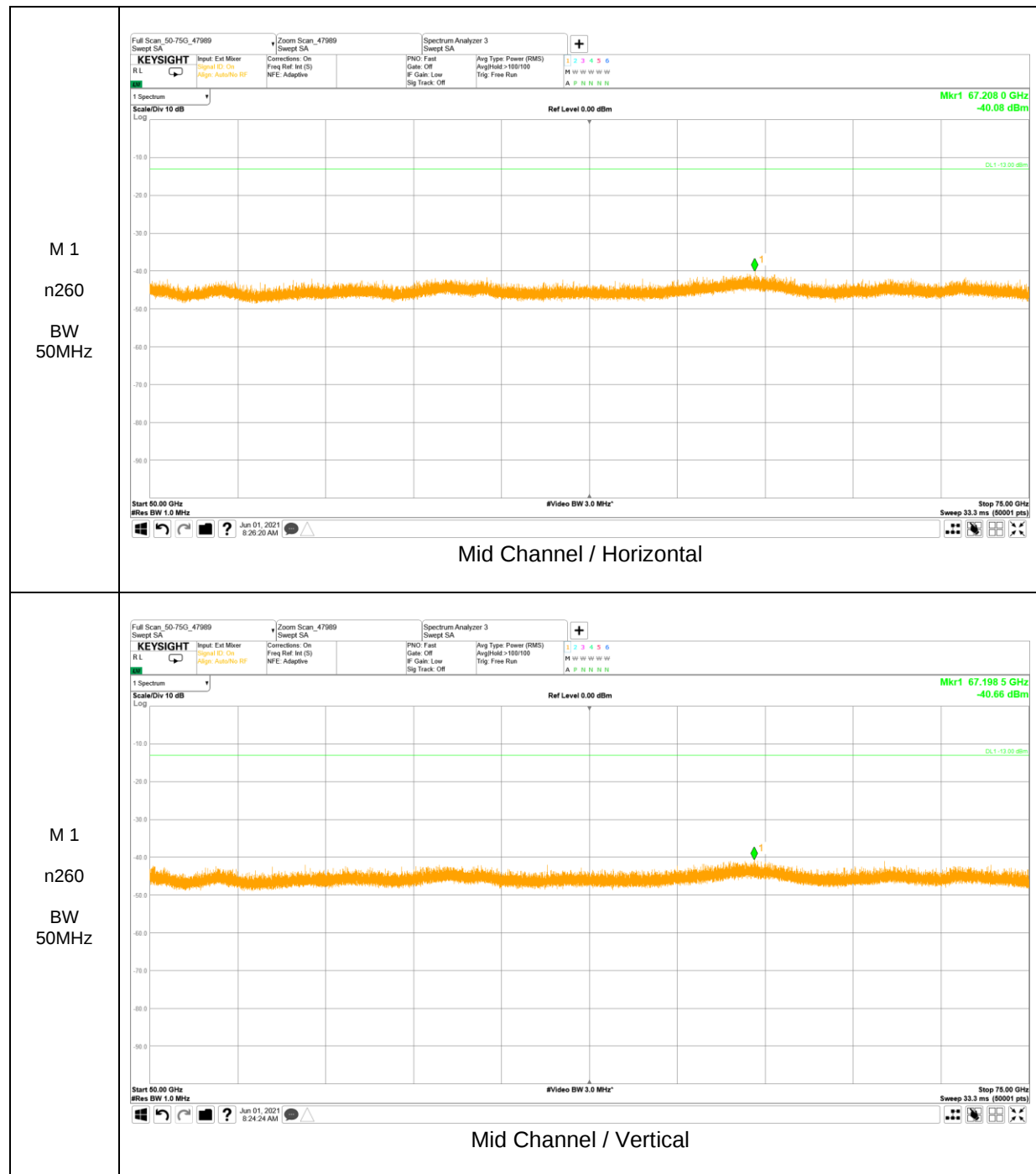


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

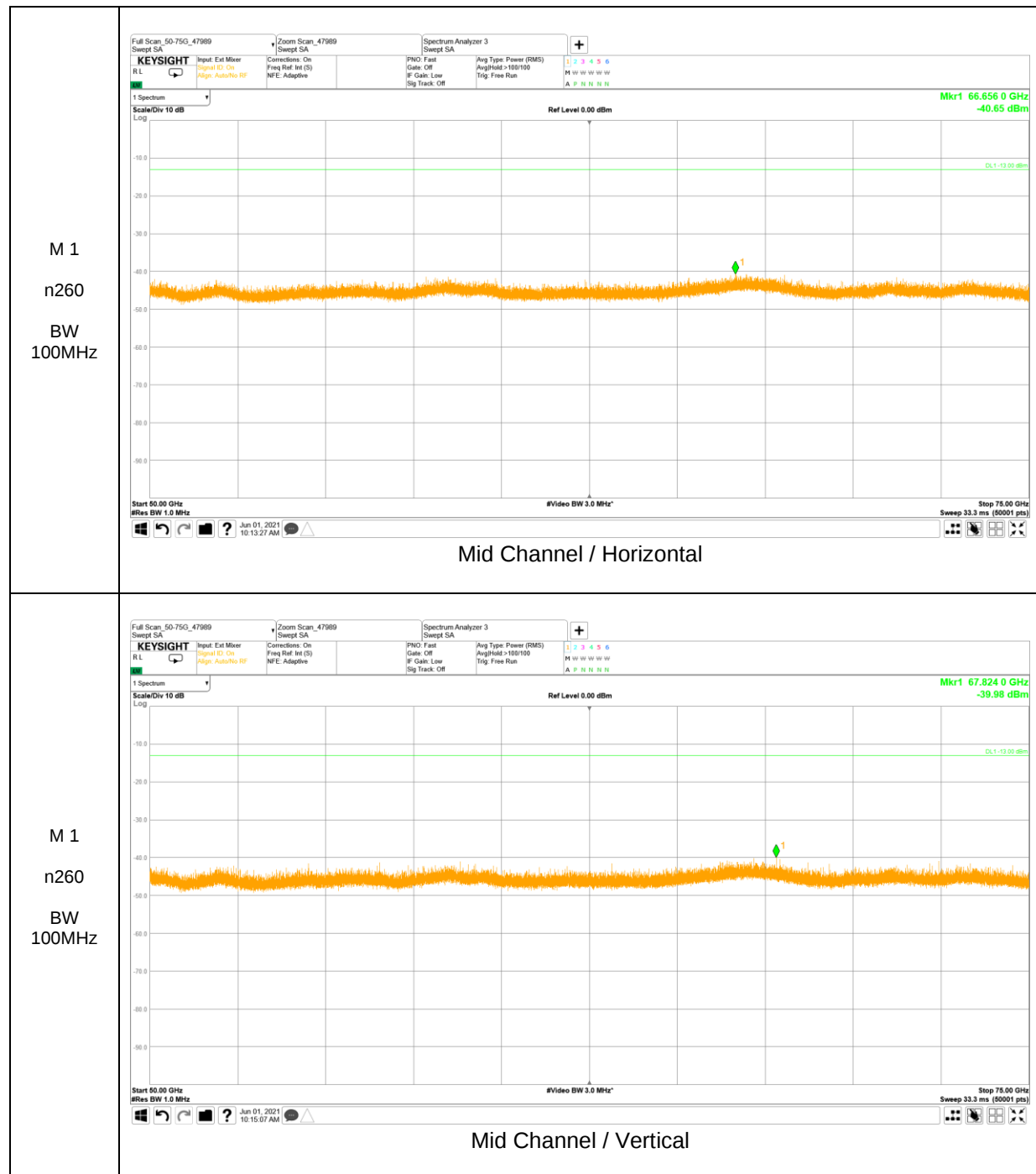


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

50 – 75 GHz Result

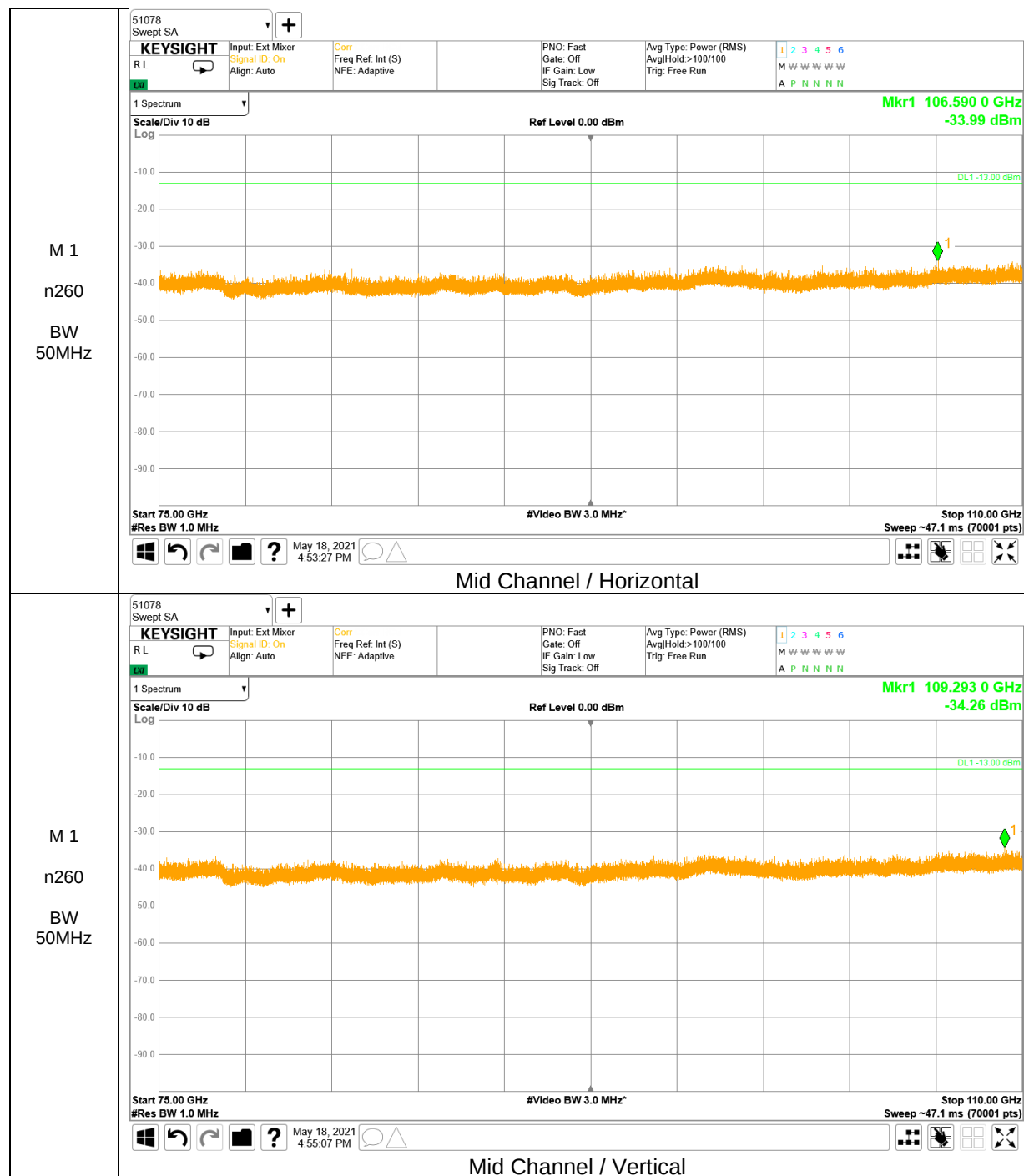


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

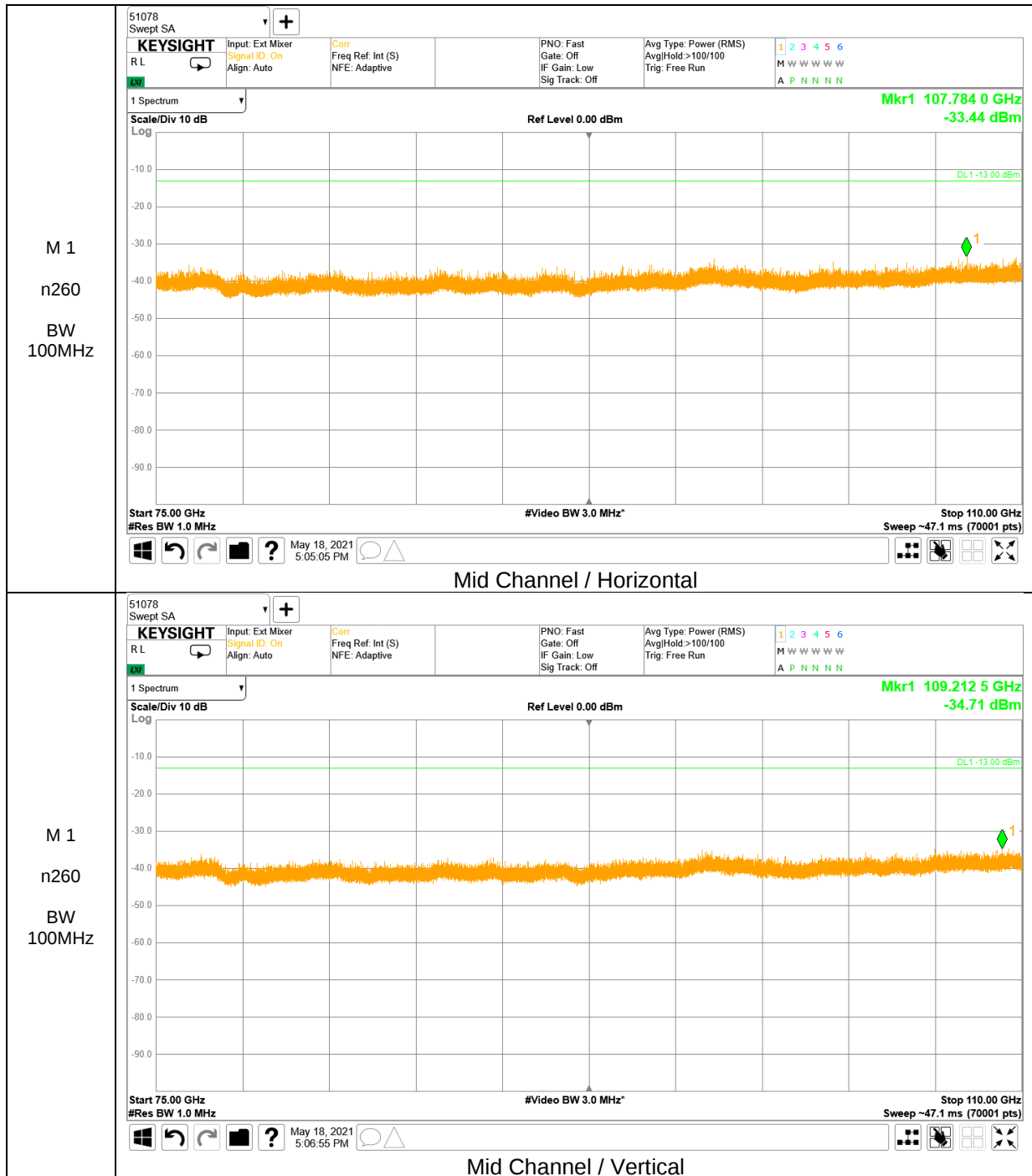


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

75 – 110 GHz Result



No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

110 – 140 GHz Result

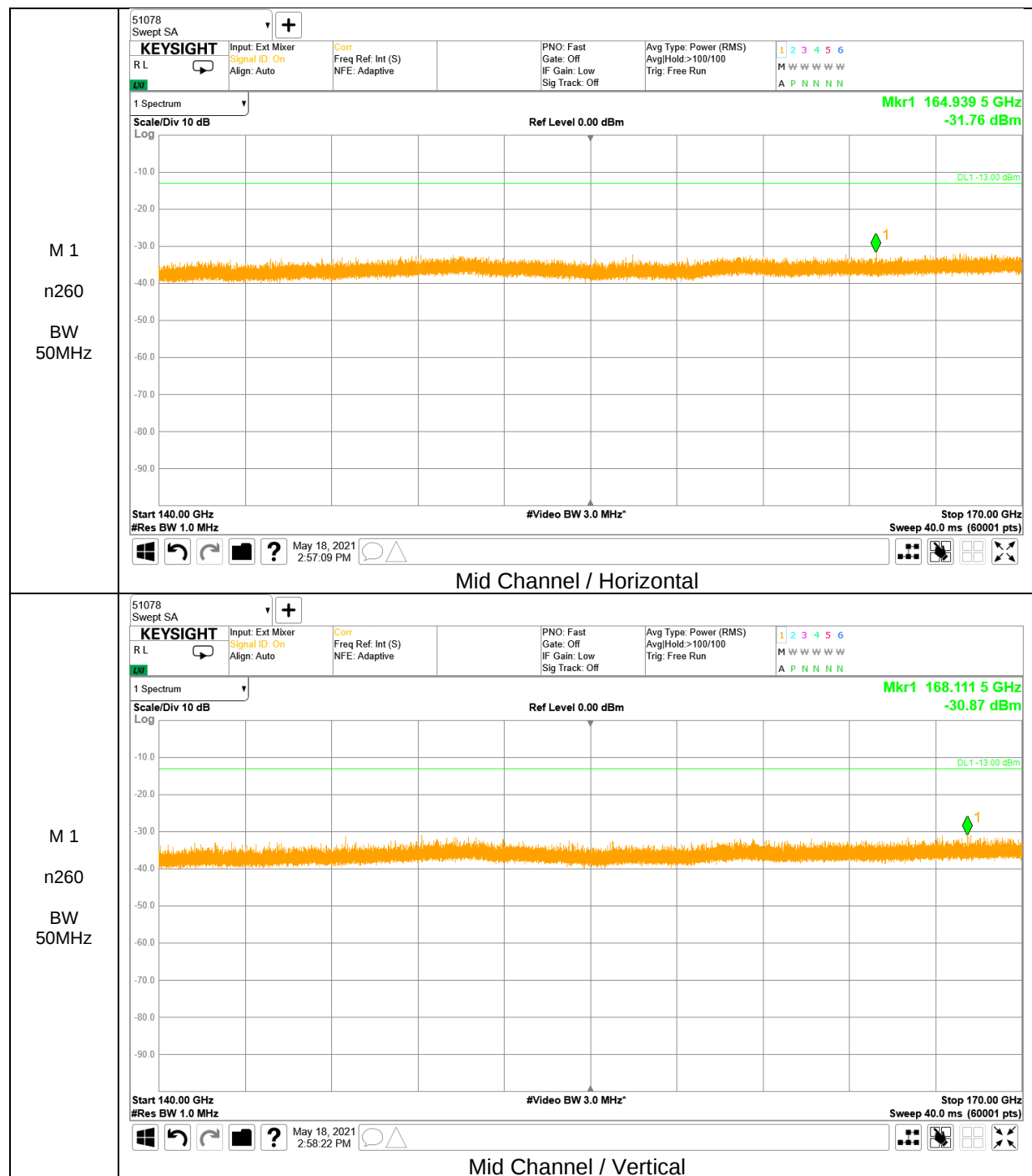


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

140 – 170 GHz Result

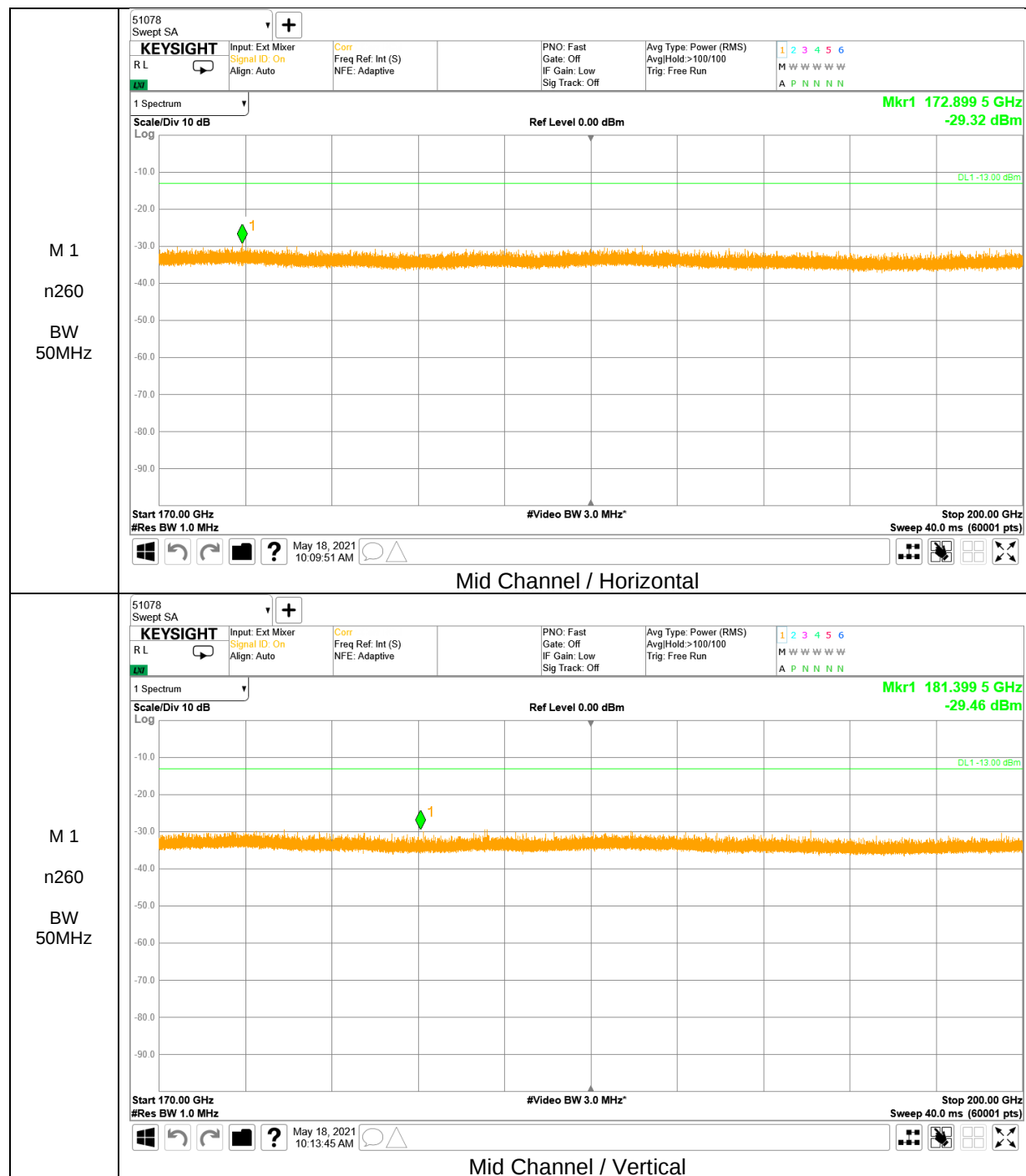


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

170 – 200 GHz Result



No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

8.5. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055

LIMITS

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST PROCEDURE

Test procedures for temperature variation

- Position the EUT in temperature/humidity chamber with power off.
- Set chamber temperature to -30°C and stabilize the EUT for at least 30 minutes.
- Record maximum change in frequency within one minute after powering the EUT.
- Increase chamber temperature at 10°C intervals from -30°C to 50°C. Record maximum change in frequency at each temperature.
- A period of at least 30 minutes is provided to allow stabilization of the equipment at each temperature level.

Test procedures for voltage variation

- Position the EUT in temperature/humidity chamber with power off.
- Set chamber temperature to 20°C.
- Record maximum frequency change within one minute after powering the EUT.
- The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

(KDB 842590 D01 Upper Microwave Flexible Use Service v01r02 Section 4.5)
(ANSI C63.26-2015 Section 5.6)

NOTE :

The Deviation column in the table below is the amount of deviation measured from the center frequency of the authorized bands of operation.

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

See the following pages.

8.5.1. FREQUENCY STABILITY RESULTS

Module 0, Band n261

Limit (MHz)		27500			28350		
Condition		F low @ End of OBW	Delta (kHz)	Deviation (%)	F high @ End of OBW	Delta (kHz)	Deviation (%)
Temperature	Voltage	(MHz)			(MHz)		
Normal (20°C) (Ref)	Normal	27509.8400	67.978	0.000243	28344.5200	83.296	0.000298
Extreme (50°C)		27509.8403	270.610	0.000969	28344.5202	162.130	0.000581
Extreme (40°C)		27509.8402	200.160	0.000717	28344.5203	335.000	0.001200
Extreme (30°C)		27509.8400	5.483	0.000020	28344.5201	88.013	0.000315
Extreme (10°C)		27509.8403	308.220	0.001104	28344.5201	52.991	0.000190
Extreme (0°C)		27509.8407	690.570	0.002473	28344.5203	274.430	0.000983
Extreme (-10°C)		27509.8407	664.160	0.002378	28344.5203	263.640	0.000944
Extreme (-20°C)		27509.8401	114.690	0.000411	28344.5204	350.560	0.001255
Extreme (-30°C)		27509.8402	170.190	0.000609	28344.5201	109.680	0.000393
Normal (20°C)	15%	27509.8403	198.880	0.000712	28344.5201	137.750	0.000493
	-15%	27509.8402	219.050	0.000784	28344.5201	73.553	0.000263
	End Point	27509.8400	209.100	0.000749	28344.5202	132.500	0.000474

Module 0, Band n260

Limit (MHz)		37000			40000		
Condition		F low @ End of OBW	Delta (kHz)	Deviation (%)	F high @ End of OBW	Delta (kHz)	Deviation (%)
Temperature	Voltage	(MHz)			(MHz)		
Normal (20°C) (Ref)	Normal	37002.3200	364.610	0.000947	39991.2400	118.040	0.000307
Extreme (50°C)		37002.3203	279.320	0.000726	39991.2401	145.980	0.000379
Extreme (40°C)		37002.3206	642.600	0.001669	39991.2406	607.850	0.001579
Extreme (30°C)		37002.3207	678.590	0.001763	39991.2400	33.258	0.000086
Extreme (10°C)		37002.3201	76.140	0.000198	39991.2402	192.460	0.000500
Extreme (0°C)		37002.3201	115.800	0.000301	39991.2403	304.960	0.000792
Extreme (-10°C)		37002.3203	311.070	0.000808	39991.2409	928.160	0.002411
Extreme (-20°C)		37002.3202	180.760	0.000470	39991.2406	573.120	0.001489
Extreme (-30°C)		37002.3202	208.330	0.000541	39991.2402	186.720	0.000485
Normal (20°C)	15%	37002.3203	236.600	0.000615	39991.2401	144.690	0.000376
	-15%	37002.3206	211.900	0.000550	39991.2401	138.630	0.000360
	End Point	37002.3207	200.340	0.000520	39991.2402	138.570	0.000360

Module 1, Band n261

Limit (MHz)		27500			28350		
Condition		F low @ End of OBW	Delta (kHz)	Deviation (%)	F high @ End of OBW	Delta (kHz)	Deviation (%)
Temperature	Voltage	(MHz)			(MHz)		
Normal (20°C) (Ref)	Normal	27509.8400	64.272	0.000230	28344.5200	36.770	0.000132
Extreme (50°C)		27509.8403	345.220	0.001236	28344.5203	317.510	0.001137
Extreme (40°C)		27509.8402	205.420	0.000736	28344.5203	299.190	0.001071
Extreme (30°C)		27509.8402	216.030	0.000774	28344.5201	110.180	0.000395
Extreme (10°C)		27509.8401	57.963	0.000208	28344.5201	87.575	0.000314
Extreme (0°C)		27509.8404	441.880	0.001582	28344.5205	476.000	0.001705
Extreme (-10°C)		27509.8403	335.880	0.001203	28344.5202	167.960	0.000601
Extreme (-20°C)		27509.8400	34.752	0.000124	28344.5201	116.790	0.000418
Extreme (-30°C)		27509.8402	187.280	0.000671	28344.5203	272.430	0.000976
Normal (20°C)	15%	27509.8403	131.850	0.000472	28344.5202	200.700	0.000719
	-15%	27509.8402	114.650	0.000411	28344.5202	228.550	0.000818
	End Point	27509.8402	113.780	0.000407	28344.5201	229.620	0.000822

Module 1, Band n260

Limit (MHz)		37000			40000		
Condition		F low @ End of OBW	Delta (kHz)	Deviation (%)	F high @ End of OBW	Delta (kHz)	Deviation (%)
Temperature	Voltage	(MHz)			(MHz)		
Normal (20°C) (Ref)	Normal	37002.3200	105.420	0.000274	39991.2400	1.604	0.000004
Extreme (50°C)		37002.3202	223.280	0.000580	39991.2401	123.570	0.000321
Extreme (40°C)		37002.3202	152.690	0.000397	39991.2403	272.830	0.000709
Extreme (30°C)		37002.3201	81.986	0.000213	39991.2403	264.420	0.000687
Extreme (10°C)		37002.3202	228.210	0.000593	39991.2402	151.080	0.000392
Extreme (0°C)		37002.3203	257.260	0.000668	39991.2401	107.740	0.000280
Extreme (-10°C)		37002.3201	89.774	0.000233	39991.2404	353.210	0.000917
Extreme (-20°C)		37002.3206	584.730	0.001519	39991.2400	21.018	0.000055
Extreme (-30°C)		37002.3202	248.980	0.000647	39991.2401	135.260	0.000351
Normal (20°C)	15%	37002.3202	254.120	0.000660	39991.2401	107.610	0.000280
	-15%	37002.3202	204.000	0.000530	39991.2401	110.550	0.000287
	End Point	37002.3201	202.987	0.000527	39991.2402	109.650	0.000285

Appendix A

1. Accreditation Scope

A transmitter operating at 40 GHz requires spurious emissions to be investigated up to 200 GHz. In this case, the test laboratory scope should reflect that it has capability to measure up to 200 GHz.

UL Korea, Ltd. test sites and facilities are covered under FCC test Firm Registrations #KR0161.

The scope of accreditation can be viewed at

https://apps.fcc.gov/oetcf/eas/reports/ViewTestFirmAccredScopes.cfm?calledFromFrame=N&RequestTimeout=500®num_specified=N&test_firm_id=7730.

2. VDI Mixer Certificate Report

2.1. Model : N9029AV15, S/N : SAX486

열람용

This certificate may not be reproduced other than in full except with permission of the issuing laboratory.

CALIBRATION CERTIFICATE

7F, SEOICHEON-RO 578BEON-GIL, MAJANG-MYEON, ICHEON-SI, GYEONGGI-DO, KOREA 17383
TEL. 82-31-645-6900, FAX. 82-31-645-6969



KOREA LABORATORY ACCREDITATION SCHEME
CALIBRATION NO. K202141

page : 1 of 4

- Certificate No : IC-2021-26368-R1 [Amendment to Report, Certificate No 'IC-2021-26368']
- Calibration No : C-2021-031910

1. Client

- Name : UL Korea, Ltd.
- Address : Suwon Test Site: UL Korea, Ltd. Suwon Laboratory 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea

2. Calibration Subject ◇ Registration No : 376588

- Description : SA EXTENSION MODULE
- Manufacturer and Model Name : VDI / SAX WR15
- Serial Number : SAX486

3. Date of Calibration : 2021.03.29 The due date of next Calibration : 2022.03.29

4. Environment

- Temperature : (22.9 ± 0.2) °C - Humidity : (47 ± 3) % R.H.
- Location : Permanent Calibration Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea)

5. Traceability

Calibration method and/or brief description

This certifies that the equipment has been calibrated using applicable HCT procedure(HCT-CS-125-40641), in compliance with ISO/IEC 17025. Measurement are traceable to the International System of Unit (SI) via national metrology institutes.

List of used standards/specifications

Description	Manufacturer and Model Name	Serial Number	The due date of next Calibration	Calibration laboratory
EXG ANALOG SIGNAL GENERATOR	KEYSIGHT N5173B	MY53270544	2021/06/23	HCT CO., LTD.
	AGILENT E4419B			
EPM SERIES POWER METER	KEYSIGHT V8486A	GB42420565	2021/11/02	HCT CO., LTD.
POWER SENSOR	OML S12MS-A	MY56330017	2022/01/25	Keysight Technologies
WR-12 MULTIPLIER SOURCE MODULE	OML S19MS-A	160419-1	2021/09/09	HCT CO., LTD.
WR-19 MULTIPLIER SOURCE MODULE		160516-1	2021/09/09	HCT CO., LTD.

6. Calibration result : Refer to attachment

7. Measurement uncertainty : Refer to attachment
(Confidence level about 95 %, k = 2)

affirmation

Measurements performed by
Name : **Meenji Park**

Approved by

Title : Technical Cal. Manager
Name : **Seungchan Lee**

The above calibration certificate is the accredited calibration items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

2021. 03. 31

Accredited by KOLAS, Republic of KOREA **HCT Co., Ltd.**



(NOTE) If any significant instability or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

F-02P-02-014 (Rev.00)

■ Asset Number: SUW-E0173



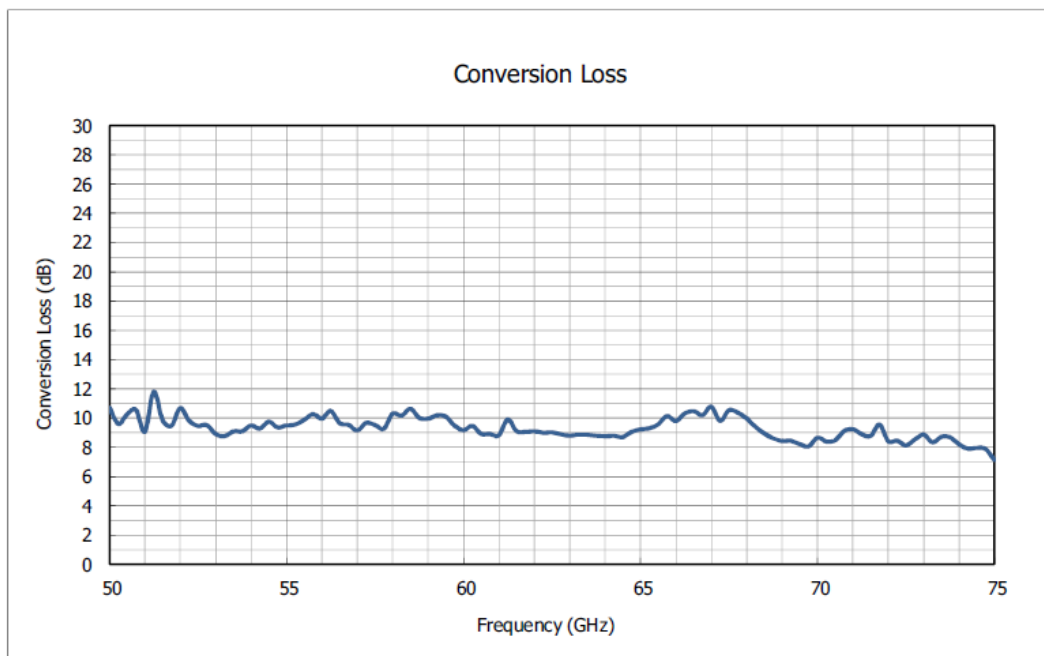
Calibration Results

Certificate No : IC-2021-26368-R1

Calibration No : C-2021-031910

page : 2 of 4

1. Conversion Loss Graph



Note 1) This is the result of measuring the requested equipment and Keysight N9040B (SN US57212313) together.

F-02P-02-014 (Rev.00)



Calibration Results

Certificate No : IC-2021-26368-R1

Calibration No : C-2021-031910

page : 3 of 4

2. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
50.0	10.73	0.89	57.5	9.52	0.82
50.3	9.59	0.89	57.8	9.27	0.82
50.5	10.26	0.89	58.0	10.31	0.82
50.8	10.56	0.89	58.3	10.16	0.82
51.0	9.07	0.89	58.5	10.63	0.82
51.3	11.80	0.89	58.8	10.01	0.82
51.5	9.86	0.89	59.0	9.95	0.82
51.8	9.47	0.89	59.3	10.18	0.82
52.0	10.68	0.89	59.5	10.09	0.82
52.3	9.81	0.89	59.8	9.48	0.82
52.5	9.47	0.89	60.0	9.17	0.82
52.8	9.52	0.89	60.3	9.47	0.82
53.0	8.90	0.89	60.5	8.91	0.82
53.3	8.76	0.89	60.8	8.91	0.82
53.5	9.09	0.89	61.0	8.82	0.82
53.8	9.10	0.89	61.3	9.89	0.82
54.0	9.49	0.89	61.5	9.11	0.82
54.3	9.28	0.89	61.8	9.05	0.82
54.5	9.75	0.89	62.0	9.10	0.82
54.8	9.36	0.89	62.3	8.99	0.82
55.0	9.49	0.89	62.5	9.02	0.82
55.3	9.55	0.89	62.8	8.88	0.82
55.5	9.88	0.89	63.0	8.80	0.82
55.8	10.27	0.89	63.3	8.86	0.82
56.0	9.97	0.89	63.5	8.85	0.82
56.3	10.48	0.82	63.8	8.78	0.82
56.5	9.65	0.82	64.0	8.75	0.82
56.8	9.53	0.82	64.3	8.78	0.82
57.0	9.15	0.82	64.5	8.70	0.82
57.3	9.67	0.82	64.8	9.05	0.82

F-02P-02-014 (Rev.00)



Calibration Results

Certificate No : IC-2021-26368-R1

Calibration No : C-2021-031910

page : 4 of 4

2. Conversion Loss Data (cont.)

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
65.0	9.22	0.82	70.3	8.39	0.82
65.3	9.31	0.82	70.5	8.48	0.82
65.5	9.57	0.82	70.8	9.11	0.82
65.8	10.14	0.82	71.0	9.23	0.82
66.0	9.79	0.82	71.3	8.89	0.82
66.3	10.31	0.82	71.5	8.77	0.82
66.5	10.47	0.82	71.8	9.56	0.82
66.8	10.20	0.82	72.0	8.41	0.82
67.0	10.78	0.82	72.3	8.45	0.82
67.3	9.81	0.82	72.5	8.12	0.82
67.5	10.53	0.82	72.8	8.53	0.82
67.8	10.37	0.82	73.0	8.87	0.82
68.0	9.97	0.82	73.3	8.34	0.82
68.3	9.38	0.82	73.5	8.71	0.82
68.5	8.93	0.82	73.8	8.68	0.82
68.8	8.61	0.82	74.0	8.19	0.82
69.0	8.43	0.82	74.3	7.90	0.82
69.3	8.44	0.82	74.5	7.96	0.82
69.5	8.21	0.82	74.8	7.88	0.82
69.8	8.06	0.82	75.0	7.11	0.82
70.0	8.66	0.82	-	-	-

END.

F-02P-02-014 (Rev.00)

2.2. Model : N9029AV10, S/N : SAX388



CALIBRATION CERTIFICATE

74, SEOICHEON-RO 578BEON-GIL, MAJANG-MYEON,
ICHEON-SI, GYEONGGIDO, KOREA 17383
TEL : 82-31-645-6900, FAX : 82-31-645-6969



- Certificate No : IC-2021-03540-R1 [Amendment to Report, Certificate No 'IC-2021-03540']
- Calibration No : C-2021-005009

page : 1 of 4

1. Client

- Name : UL Korea, Ltd.
- Address : Suwon Test Site: UL Korea, Ltd. Suwon Laboratory 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea

2. Calibration Subject

◇ Registration No : 376593

- Description : SA EXTENSION MODULE
- Manufacturer and Model Name : VDI / SAX WR10
- Serial Number : SAX388

3. Date of Calibration

: 2021.01.19 The due date of next Calibration : 2022.01.19

4. Environment

- Temperature : (22.6 ± 0.1) °C - Humidity : (46 ± 1) % R.H.
- Location : Permanent Calibration Lab
(Address: 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea)

5. Traceability

Calibration method and/or brief description

This certifies that the equipment has been calibrated using applicable HCT procedure(HCT-CS-125-40641), in compliance with ISO/IEC 17025. Measurement are traceable to the International System of Unit (SI) via national metrology institutes.

List of used standards/specifications

Description	Manufacturer and Model Name	Serial Number	The due date of next Calibration	Calibration laboratory
EXG ANALOG SIGNAL GENERATOR	KEYSIGHT N5173B	MY53270544	2021/06/23	HCT CO., LTD.
EPM SERIES POWER METER	AGILENT E4419B	GB42420565	2021/11/02	HCT CO., LTD.
POWER SENSOR	KEYSIGHT W8486A	MY44420260	2021/04/17	Keysight Technologies
WR-12 MULTIPLIER SOURCE MODULE	OML S12MS-A	160419-1	2021/09/09	HCT CO., LTD.
WR-08 MULTIPLIER SOURCE MODULE	OML S08MS-A	164019-1	2021/09/09	HCT CO., LTD.

6. Calibration result

: Refer to attachment

7. Measurement uncertainty

: Refer to attachment

(Confidence level about 95 %, k = 2)

affirmation	Measurements performed by		Approved by	
	Name : Meenji Park		Title : Technical Cal. Manager Name : Seungchan Lee	

The above calibration certificate is the accredited calibration items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

2021. 03. 31

Accredited by KOLAS, Republic of KOREA

HCT Co., Ltd.



(NOTE) If any significant instability or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

F-02P-02-014 (Rev.00)

■ Asset Number: SUW-E0175

Calibration Results

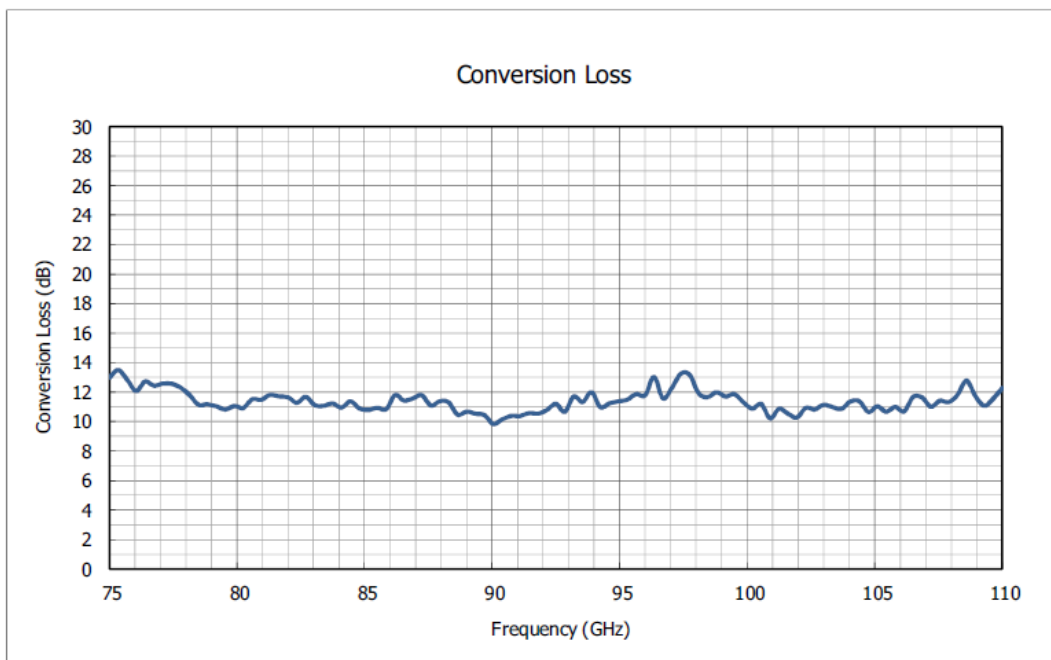


Certificate No : IC-2021-03540-R1

Calibration No : C-2021-005009

page : 2 of 4

1. Conversion Loss Graph



Note 1) This is the result of measuring the requested equipment and Keysight N9040B (SN MY60080268) together.

F-02P-02-014 (Rev.00)



Calibration Results

Certificate No : IC-2021-03540-R1

Calibration No : C-2021-005009

page : 3 of 4

2. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
75.0	12.96	0.89	85.5	10.93	0.82
75.4	13.50	0.89	85.9	10.84	0.82
75.7	12.84	0.89	86.2	11.80	0.82
76.1	12.07	0.89	86.6	11.42	0.82
76.4	12.72	0.89	86.9	11.57	0.82
76.8	12.43	0.89	87.3	11.78	0.82
77.1	12.58	0.89	87.6	11.08	0.82
77.5	12.56	0.89	88.0	11.37	0.82
77.8	12.29	0.89	88.3	11.30	0.82
78.2	11.79	0.89	88.7	10.47	0.82
78.5	11.14	0.89	89.0	10.67	0.82
78.9	11.17	0.89	89.4	10.54	0.82
79.2	11.02	0.89	89.7	10.44	0.82
79.6	10.82	0.89	90.1	9.84	0.82
79.9	11.05	0.89	90.4	10.15	0.82
80.3	10.92	0.89	90.8	10.38	0.82
80.6	11.51	0.89	91.1	10.38	0.82
81.0	11.48	0.89	91.5	10.58	0.82
81.3	11.81	0.89	91.8	10.54	0.82
81.7	11.70	0.89	92.2	10.78	0.82
82.0	11.65	0.89	92.5	11.21	0.82
82.4	11.27	0.89	92.9	10.67	0.82
82.7	11.68	0.89	93.2	11.70	0.82
83.1	11.12	0.89	93.6	11.33	0.82
83.4	11.07	0.89	93.9	11.99	0.82
83.8	11.23	0.82	94.3	10.97	0.82
84.1	10.94	0.82	94.6	11.24	0.82
84.5	11.37	0.82	95.0	11.37	0.82
84.8	10.89	0.82	95.3	11.48	0.82
85.2	10.79	0.82	95.7	11.86	0.82

F-02P-02-014 (Rev.00)



Calibration Results

Certificate No : IC-2021-03540-R1

Calibration No : C-2021-005009

page : 4 of 4

2. Conversion Loss Data (cont.)

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
96.0	11.78	0.82	103.4	10.98	0.82
96.4	13.03	0.82	103.7	10.86	0.82
96.7	11.57	0.82	104.1	11.37	0.82
97.1	12.29	0.82	104.4	11.37	0.82
97.4	13.25	0.82	104.8	10.65	0.82
97.8	13.16	0.82	105.1	11.03	0.82
98.1	11.91	0.82	105.5	10.67	0.82
98.5	11.66	0.82	105.8	11.00	0.82
98.8	11.99	0.82	106.2	10.69	0.82
99.2	11.69	0.82	106.5	11.66	0.82
99.5	11.86	0.82	106.9	11.65	0.82
99.9	11.32	0.82	107.2	11.01	0.82
100.2	10.88	0.82	107.6	11.41	0.82
100.6	11.19	0.82	107.9	11.32	0.82
100.9	10.22	0.82	108.3	11.83	0.82
101.3	10.87	0.82	108.6	12.77	0.82
101.6	10.53	0.82	109.0	11.70	0.82
102.0	10.27	0.82	109.3	11.06	0.82
102.3	10.93	0.82	109.7	11.57	0.82
102.7	10.82	0.82	110.0	12.28	0.82
103.0	11.14	0.82	-	-	-

END.

F-02P-02-014 (Rev.00)

2.3. Model : N9029AV06, S/N : SAX483



Measurement Report

74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, Korea 17383
Tel : 82-31-645-6900, www.hct.co.kr

보고서번호(Report No) : IC-2021-03526-R1 [Amendment to Report, Certificate No 'IC-2021-03526-R1']
측정번호(Measurement No) : C-2021-004992

1. 의뢰자 (Client)
 - 기관명 (Name) : UL Korea, Ltd.
 - 주소 (Address) : Suwon Test Site: UL Korea, Ltd. Suwon Laboratory 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea
2. 대상품목 (Measurement Item) ◇ HCT 등록번호 : 376587
 - 기기명 (Description) : SA EXTENSION MODULE
 - 제작회사 및 형식 (Manufacturer and Model Name) : VDI / SAX WR6.5
 - 기기번호 (Serial Number) : SAX483
3. 측정일자 (Measurement date) : 2021.01.20
4. 측정환경 (Environment)
 - 온도(Temperature) : (22.3 ± 0.3) °C
 - 습도(Humidity) : (45 ± 3) % R.H.

5. 측정방법 (Measurement method used)

This certifies that the equipment has been calibrated using applicable HCT procedure(HCT-CS-125-40641), in compliance with ISO/IEC 17025. Measurement are traceable to the International System of Unit (SI) via national metrology institutes.

측정에 사용한 표준장비 명세 (List of used standards/specifications)

기기명 (Description)	제작회사 및 형식 (Manufacturer and Model Name)	기기번호 (Serial Number)	차기교정예정일자 (The due date of next Calibration)	교정기관 (Calibration laboratory)
EXG ANALOG SIGNAL GENERATOR	KEYSIGHT N5173B	MY53270544	2021/06/23	HCT CO., LTD.
ERICKSON POWER METER	VDI PM5	394V	측정	HCT CO., LTD.
WR-05 MULTIPLIER SOURCE MODULE	OML S05MS-A	160419-1	측정	HCT CO., LTD.
WR-08 MULTIPLIER SOURCE MODULE	OML S08MS-A	160419-1	측정	HCT CO., LTD.

6. 측정결과 (Measurement result) : 측정결과 참조 (Refer to attachment)

(이) 측정결과는 의뢰자가 제시한 시료 및 시료명에만 한정됩니다.

The measurement results shown in this report refer only to the sample(s) measured unless otherwise stated.

확 인 (Affirmation)	작성자 (Tested by)		승인자 (Approved by)	
	성명 (Name) : Meenji Park		직위 (Title) : 기술책임자(Technical Manager) 성명 (Name) : Seungchan Lee	

이 성적서는 ILAC MRA 서명 기관인 KOLAS(Korea Laboratory Accreditation Scheme)와 A2LA (American Laboratory for Laboratory Accreditation)의 인정과 무관합니다. This calibration certificate is Not an accredited report by KOLAS(Korea Laboratory Accreditation Scheme) and A2LA(American Association for Laboratory Accreditation), a ILAC MRA signatory.

2021. 03. 31



(주)에이치시티 대표이사
President, HCT Co., Ltd.



(참) 측정결과는 측정기의 정밀정확도에 영향을 미치는 요소(과부하, 온도, 습도 등)의 급격한 변화가 발생한 경우에는 무효가 됩니다. If any significant instability or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

F-02P-02-010 (Rev.01)

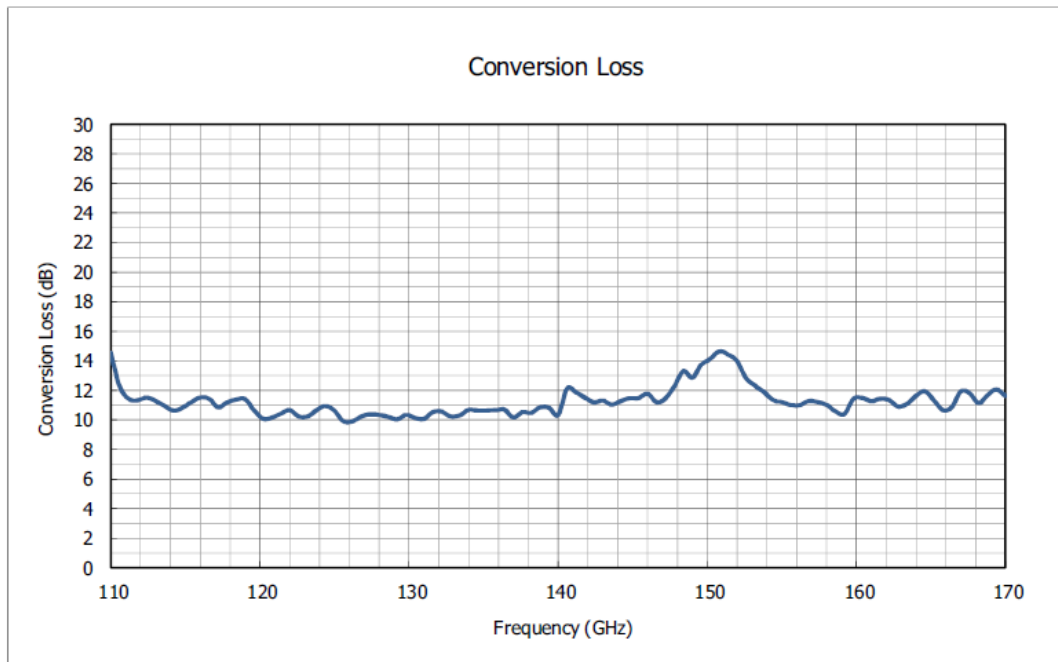
■ Asset Number: SUW-E0176

Measurement Results

Certificate No : IC-2021-03526-R1
Measurement No : C-2021-004992

페이지(page) : 2 of 4

1. Conversion Loss Graph



Note 1) This is the result of measuring the requested equipment and Keysight N9040B (SN MY60080268) together.

Note 2)

- In the absence of power standards above 110 GHz, power measurements above 110 GHz are to confirm operation functionality and traceable only to HCT.

F-02P-02-010 (Rev.01)

Measurement Results

Certificate No : IC-2021-03526-R1
Measurement No : C-2021-004992

페이지(page) : 3 of 4

2. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
110.0	14.5	0.82	128.0	10.3	0.82
110.6	12.3	0.82	128.6	10.2	0.82
111.2	11.4	0.82	129.2	10.0	0.82
111.8	11.3	0.82	129.8	10.3	0.82
112.4	11.5	0.82	130.4	10.1	0.82
113.0	11.3	0.82	131.0	10.1	0.82
113.6	10.9	0.82	131.6	10.5	0.82
114.2	10.6	0.82	132.2	10.6	0.82
114.8	10.8	0.82	132.8	10.2	0.82
115.4	11.2	0.82	133.4	10.3	0.82
116.0	11.5	0.82	134.0	10.7	0.82
116.6	11.4	0.82	134.6	10.6	0.82
117.2	10.8	0.82	135.2	10.6	0.82
117.8	11.2	0.82	135.8	10.7	0.82
118.4	11.4	0.82	136.4	10.7	0.82
119.0	11.4	0.82	137.0	10.2	0.82
119.6	10.7	0.82	137.6	10.5	0.82
120.2	10.1	0.82	138.2	10.5	0.82
120.8	10.2	0.82	138.8	10.9	0.82
121.4	10.4	0.82	139.4	10.8	0.82
122.0	10.7	0.82	140.0	10.3	0.82
122.6	10.2	0.82	140.6	12.1	0.82
123.2	10.2	0.82	141.2	11.9	0.82
123.8	10.7	0.82	141.8	11.5	0.82
124.4	10.9	0.82	142.4	11.2	0.82
125.0	10.6	0.82	143.0	11.3	0.82
125.6	9.9	0.82	143.6	11.0	0.82
126.2	9.9	0.82	144.2	11.3	0.82
126.8	10.2	0.82	144.8	11.5	0.82
127.4	10.4	0.82	145.4	11.5	0.82

F-02P-02-010 (Rev.01)

Measurement Results

Certificate No : IC-2021-03526-R1
Measurement No : C-2021-004992

페이지(page) : 4 of 4

2. Conversion Loss Data (cont.)

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
146.0	11.8	0.82	158.6	10.6	0.82
146.6	11.2	0.82	159.2	10.4	0.82
147.2	11.5	0.82	159.8	11.4	0.82
147.8	12.3	0.82	160.4	11.5	0.82
148.4	13.3	0.82	161.0	11.3	0.82
149.0	12.9	0.82	161.6	11.4	0.82
149.6	13.7	0.82	162.2	11.3	0.82
150.2	14.1	0.82	162.8	10.9	0.82
150.8	14.6	0.82	163.4	11.1	0.82
151.4	14.4	0.82	164.0	11.6	0.82
152.0	14.0	0.82	164.6	11.9	0.82
152.6	12.8	0.82	165.2	11.3	0.82
153.2	12.3	0.82	165.8	10.7	0.82
153.8	11.9	0.82	166.4	10.9	0.82
154.4	11.4	0.82	167.0	11.9	0.82
155.0	11.2	0.82	167.6	11.8	0.82
155.6	11.0	0.82	168.2	11.1	0.82
156.2	11.0	0.82	168.8	11.7	0.82
156.8	11.3	0.82	169.4	12.1	0.82
157.4	11.2	0.82	170.0	11.6	0.82
158.0	11.0	0.82	-	-	-

END.

F-02P-02-010 (Rev.01)

2.4. Model : N9029AV04, S/N : SAX487



Measurement Report

74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, Korea 17383
Tel : 82-31-645-6900, www.hct.co.kr

보고서번호(Report No) : IC-2021-03523-R2 [Amendment to Report, Certificate No 'IC-2021-03523'] (page) : 1 of 4
측정번호(Measurement No) : C-2021-004989

1. 의뢰자 (Client)

- 기관명 (Name) : UL Korea, Ltd.
- 주소 (Address) : Suwon Test Site: UL Korea, Ltd. Suwon Laboratory 218 Maeyong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea

2. 대상품목 (Measurement Item)

◇ HCT 등록번호 : 376591

- 기기명 (Description) : SA EXTENSION MODULE
- 제작회사 및 형식 (Manufacturer and Model Name) : VDI / SAX WR4.3
- 기기번호 (Serial Number) : SAX487

3. 측정일자 (Measurement date) : 2021.01.20

4. 측정환경 (Environment)

- 온도(Temperature) : (22.4 ± 0.2) °C - 습도(Humidity) : (45 ± 2) % R.H.

5. 측정방법 (Measurement method used)

This certifies that the equipment has been calibrated using applicable HCT procedure(HCT-CS-125-40641), in compliance with ISO/IEC 17025. Measurement are traceable to the International System of Unit (SI) via national metrology institutes.

측정에 사용한 표준장비 명세 (List of used standards/specifications)

기기명 (Description)	제작회사 및 형식 (Manufacturer and Model Name)	기기번호 (Serial Number)	차기교정예정일자 (The due date of next Calibration)	교정기관 (Calibration laboratory)
EXG ANALOG SIGNAL GENERATOR	KEYSIGHT N5173B	MY53270544	2021/06/23	HCT CO., LTD.
ERICKSON POWER METER	VDI PMS	394V	측정	HCT CO., LTD.
WR-03 MULTIPLIER SOURCE MODULE	OML S03MS-A	160419-1	측정	HCT CO., LTD.
WR-05 MULTIPLIER SOURCE MODULE	OML S05MS-A	160419-1	측정	HCT CO., LTD.

6. 측정결과 (Measurement result)

: 측정결과 참조 (Refer to attachment)

(주) 이 측정결과는 의뢰자가 제시한 시료 및 시료명에만 한정됩니다.

The measurement results shown in this report refer only to the sample(s) measured unless otherwise stated.

확 인 (Affirmation)	작성자 (Tested by) 성명 (Name) : Meenji Park	승인자 (Approved by) 직위 (Title) : 기술책임자 (Technical Manager) 성명 (Name) : Seungchan Lee

이 성적서는 ILAC MRA 서명 기관인 KOLAS(Korea Laboratory Accreditation Scheme)와 A2LA (American Laboratory for Laboratory Accreditation)의 인정과 무관합니다. This calibration certificate is Not an accredited report by KOLAS(Korea Laboratory Accreditation Scheme) and A2LA(American Association for Laboratory Accreditation), a ILAC MRA signatory.

2021. 03. 31



(주)에이치시티 대표이사
President, HCT Co., Ltd.



(주) 측정결과는 측정기의 정밀정확도에 영향을 미치는 요소(과부하, 온도, 습도 등)의 급격한 변화가 발생한 경우에는 무효가 됩니다. If any significant instability or other adverse factor(overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.

F-02P-02-010 (Rev.01)

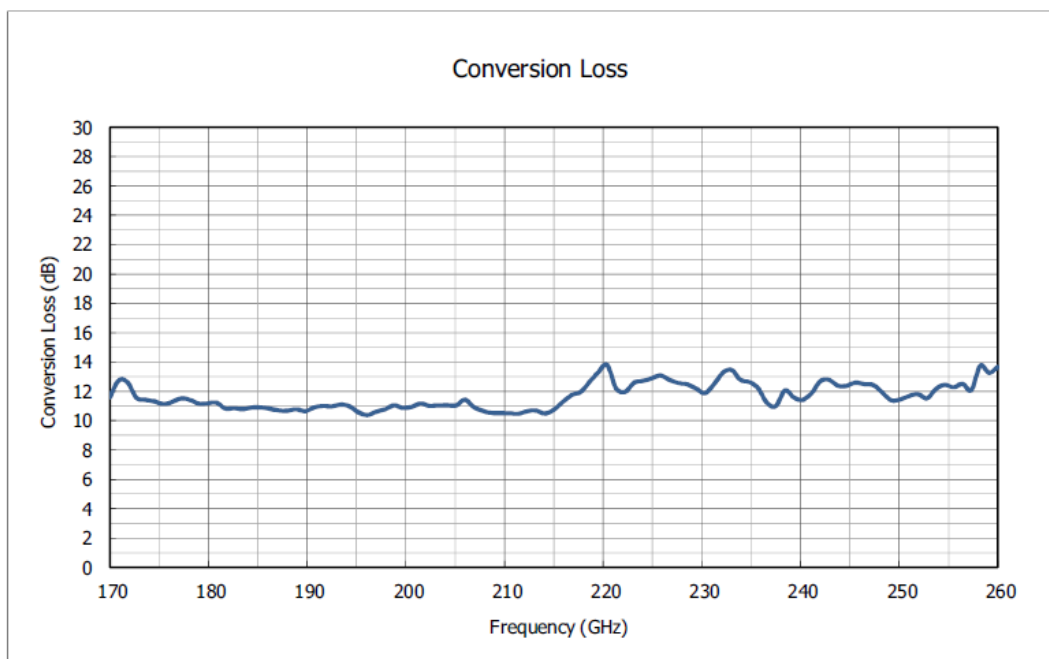
Asset Number: SUW-E0177

Measurement Results

Certificate No : IC-2021-03523-R2
Measurement No : C-2021-004989

페이지(page) : 2 of 4

1. Conversion Loss Graph



Note 1) This is the result of measuring the requested equipment and Keysight N9040B (SN MY60080268) together.

Note 2)

- In the absence of power standards above 110 GHz, power measurements above 110 GHz are to confirm operation functionality and traceable only to HCT.

F-02P-02-010 (Rev.01)

Measurement Results

Certificate No : IC-2021-03523-R2
Measurement No : C-2021-004989

페이지(page) : 3 of 4

2. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
170.0	11.56	0.98	197.0	10.61	0.98
170.9	12.74	0.98	197.9	10.78	0.98
171.8	12.62	0.98	198.8	11.05	0.98
172.7	11.57	0.98	199.7	10.87	0.98
173.6	11.42	0.98	200.6	10.95	0.98
174.5	11.32	0.98	201.5	11.17	0.98
175.4	11.13	0.98	202.4	11.01	0.98
176.3	11.27	0.98	203.3	11.05	0.98
177.2	11.52	0.98	204.2	11.06	0.98
178.1	11.42	0.98	205.1	11.04	0.98
179.0	11.16	0.98	206.0	11.43	0.98
179.9	11.18	0.98	206.9	10.92	0.98
180.8	11.23	0.98	207.8	10.67	0.98
181.7	10.83	0.98	208.7	10.52	0.98
182.6	10.84	0.98	209.6	10.52	0.98
183.5	10.79	0.98	210.5	10.51	0.98
184.4	10.90	0.98	211.4	10.47	0.98
185.3	10.91	0.98	212.3	10.65	0.98
186.2	10.82	0.98	213.2	10.69	0.98
187.1	10.70	0.98	214.1	10.49	0.98
188.0	10.69	0.98	215.0	10.76	0.98
188.9	10.78	0.98	215.9	11.27	0.98
189.8	10.65	0.98	216.8	11.75	0.98
190.7	10.90	0.98	217.7	11.95	0.98
191.6	11.00	0.98	218.6	12.62	0.98
192.5	10.98	0.98	219.5	13.30	0.98
193.4	11.09	0.98	220.4	13.80	0.98
194.3	10.97	0.98	221.3	12.21	0.98
195.2	10.57	0.98	222.2	11.95	0.98
196.1	10.39	0.98	223.1	12.58	0.98

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Measurement Results

Certificate No : IC-2021-03523-R2
Measurement No : C-2021-004989

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2. Conversion Loss Data (cont.)

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
224.0	12.71	0.98	242.9	12.78	0.98
224.9	12.89	0.98	243.8	12.38	0.98
225.8	13.08	0.98	244.7	12.39	0.98
226.7	12.78	0.98	245.6	12.60	0.98
227.6	12.56	0.98	246.5	12.48	0.98
228.5	12.48	0.98	247.4	12.42	0.98
229.4	12.19	0.98	248.3	11.90	0.98
230.3	11.88	0.98	249.2	11.39	0.98
231.2	12.46	0.98	250.1	11.45	0.98
232.1	13.25	0.98	251.0	11.68	0.98
233.0	13.46	0.98	251.9	11.80	0.98
233.9	12.79	0.98	252.8	11.53	0.98
234.8	12.63	0.98	253.7	12.15	0.98
235.7	12.22	0.98	254.6	12.45	0.98
236.6	11.20	0.98	255.5	12.27	0.98
237.5	11.00	0.98	256.4	12.51	0.98
238.4	12.05	0.98	257.3	12.09	0.98
239.3	11.59	0.98	258.2	13.75	0.98
240.2	11.42	0.98	259.1	13.27	0.98
241.1	11.86	0.98	260.0	13.67	0.98
242.0	12.69	0.98	-	-	-

END.

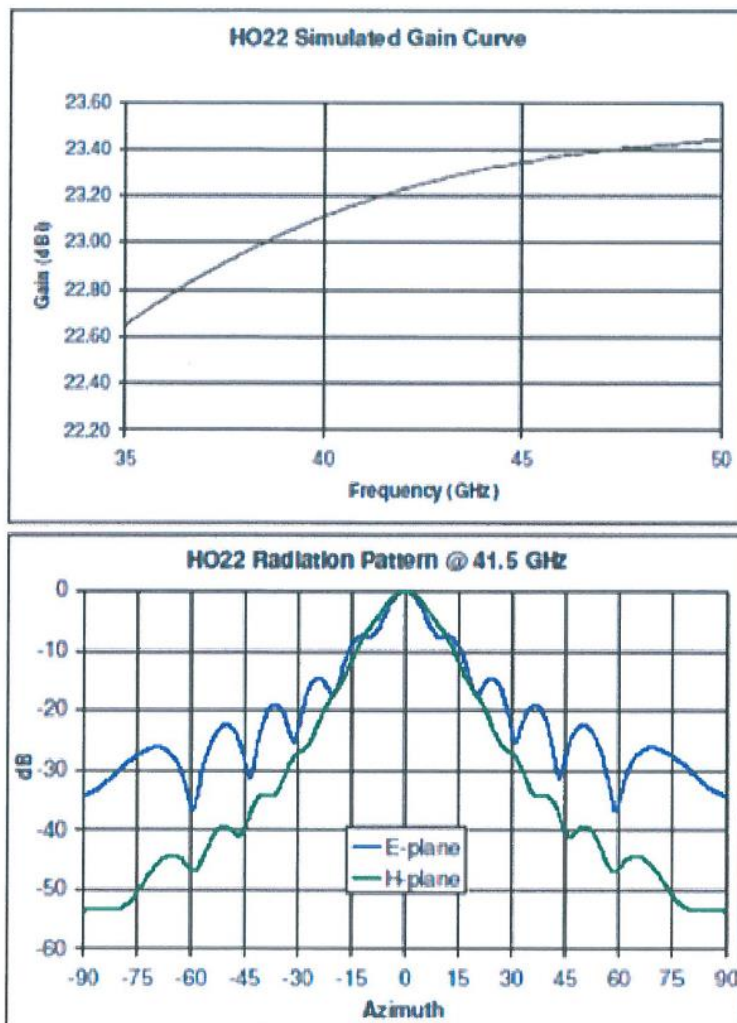
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3. CMI Horn Antenna gain

3.1. HO22R (33 GHz – 50 GHz)



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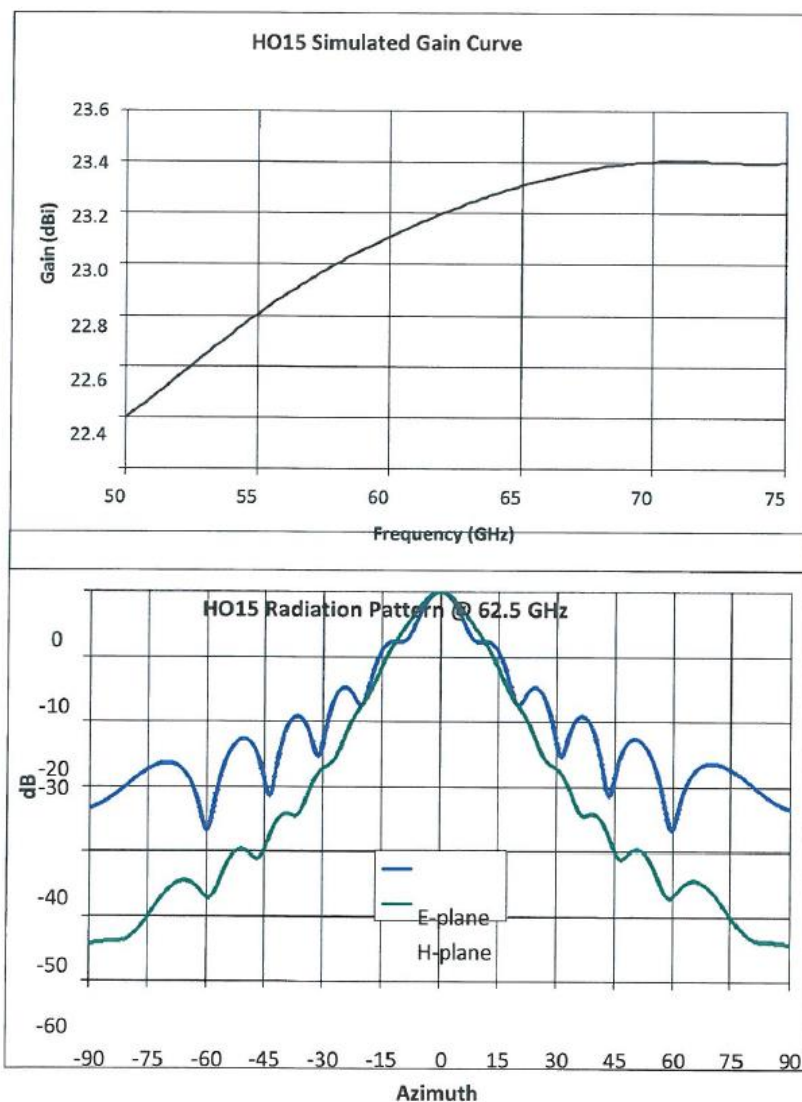
Model	HO22R
Frequency(GHz)	Gain(dBi)
33.00	22.40
33.85	22.50
34.70	22.60
35.55	22.70
36.40	22.80
37.25	22.90
38.10	23.00
38.95	23.05
39.80	23.10
40.65	23.15
41.50	23.20
42.35	23.25
43.20	23.27
44.05	23.30
44.90	23.35
45.75	23.37
46.60	23.39
47.45	23.41
48.30	23.42
49.15	23.43
50.00	23.44

3.1. HO15R (50 GHz – 75 GHz)



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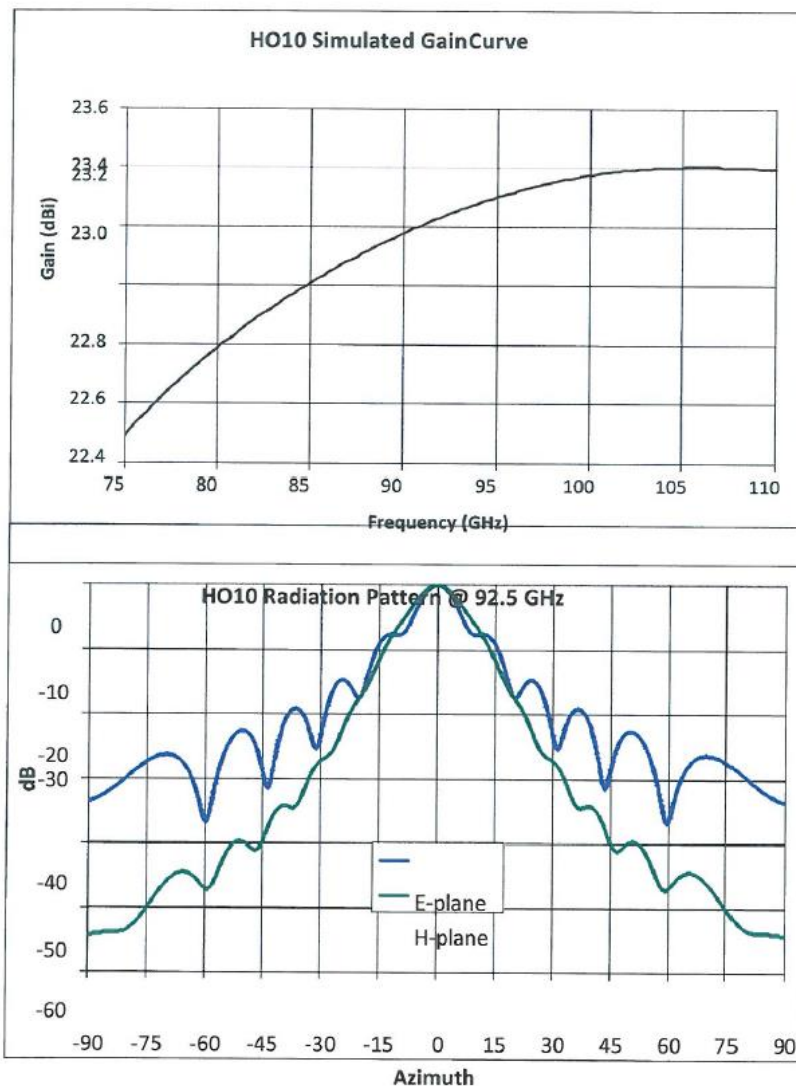
Model	HO15R
Frequency(GHz)	Gain(dBi)
50.00	22.4
51.25	22.5
52.50	22.6
53.75	22.7
55.00	22.8
56.25	22.9
57.50	23.0
58.75	23.0
60.00	23.1
61.25	23.2
62.50	23.2
63.75	23.3
65.00	23.3
66.25	23.3
67.50	23.4
68.75	23.4
70.00	23.4
71.25	23.4
72.50	23.4
73.75	23.4
75.00	23.4

3.2. HO10R (75 GHz – 110 GHz)



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Model	HO10R
Frequency(GHz)	Gain(dBi)
75.00	22.5
76.75	22.6
78.50	22.7
80.25	22.8
82.00	22.9
83.75	23.0
85.50	23.0
87.25	23.1
89.00	23.1
90.75	23.2
92.50	23.3
94.25	23.3
96.00	23.3
97.75	23.3
99.50	23.4
101.25	23.4
103.00	23.4
104.75	23.4
106.50	23.4
108.25	23.4
110.00	23.4

3.3. HO06R (110 GHz – 170 GHz)



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