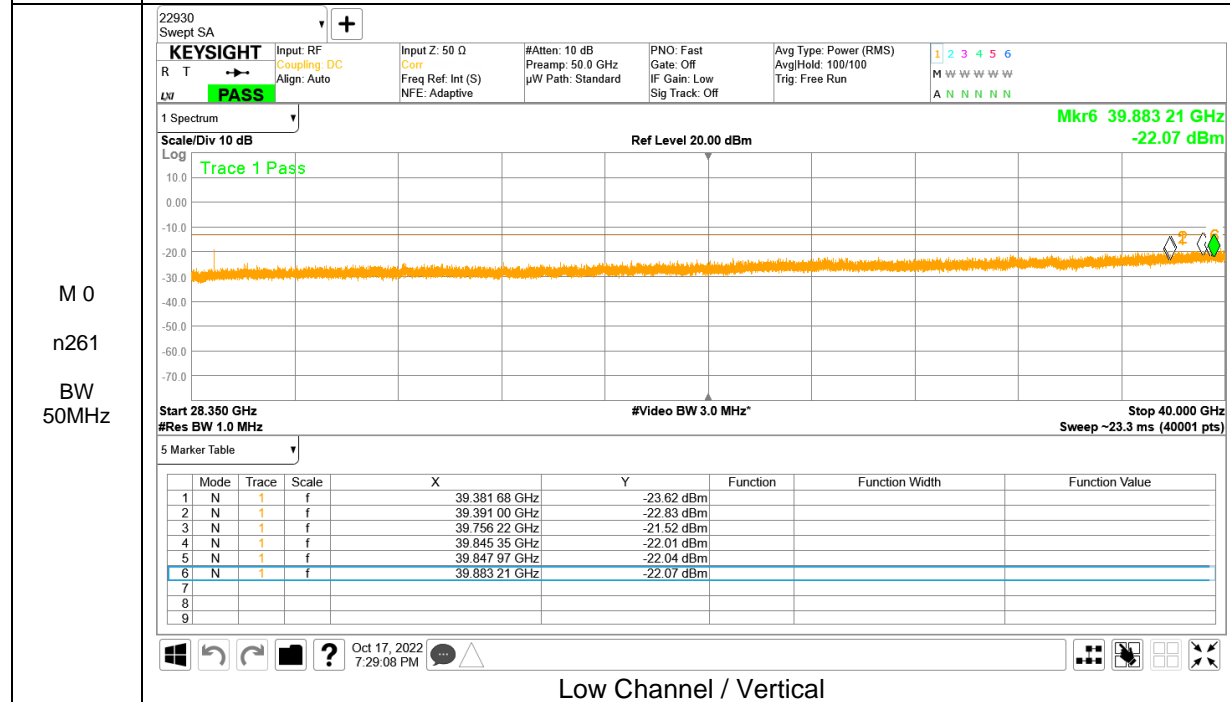
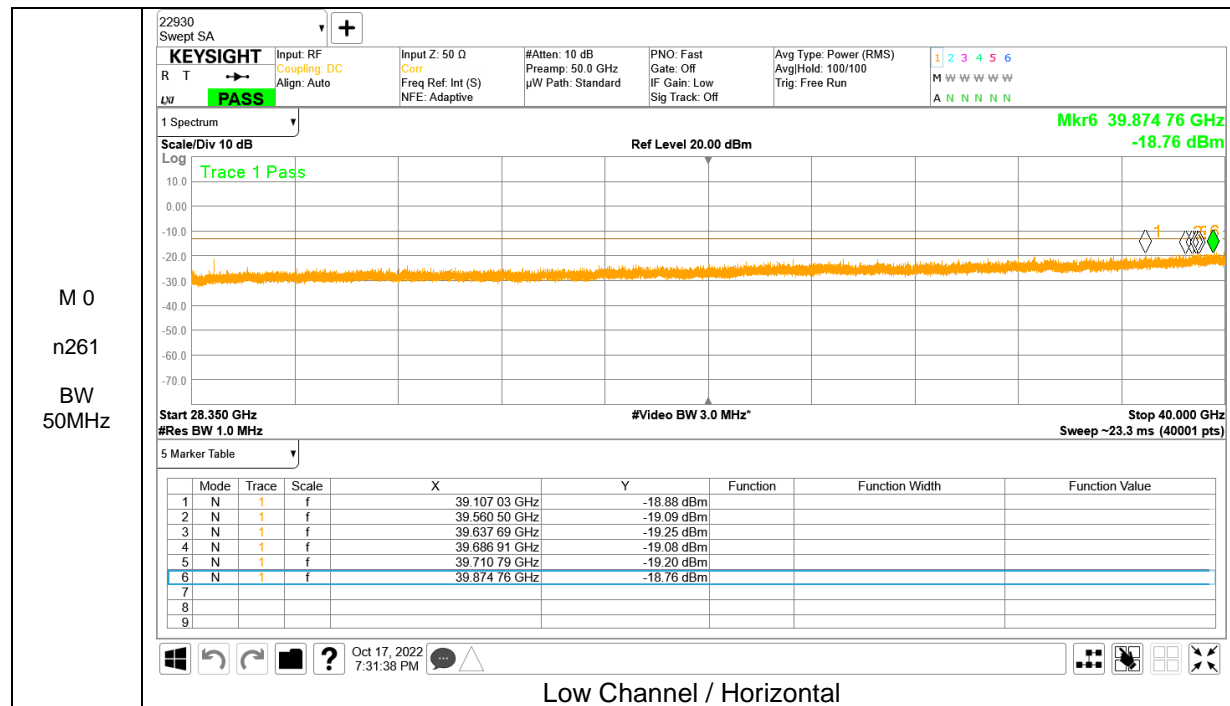




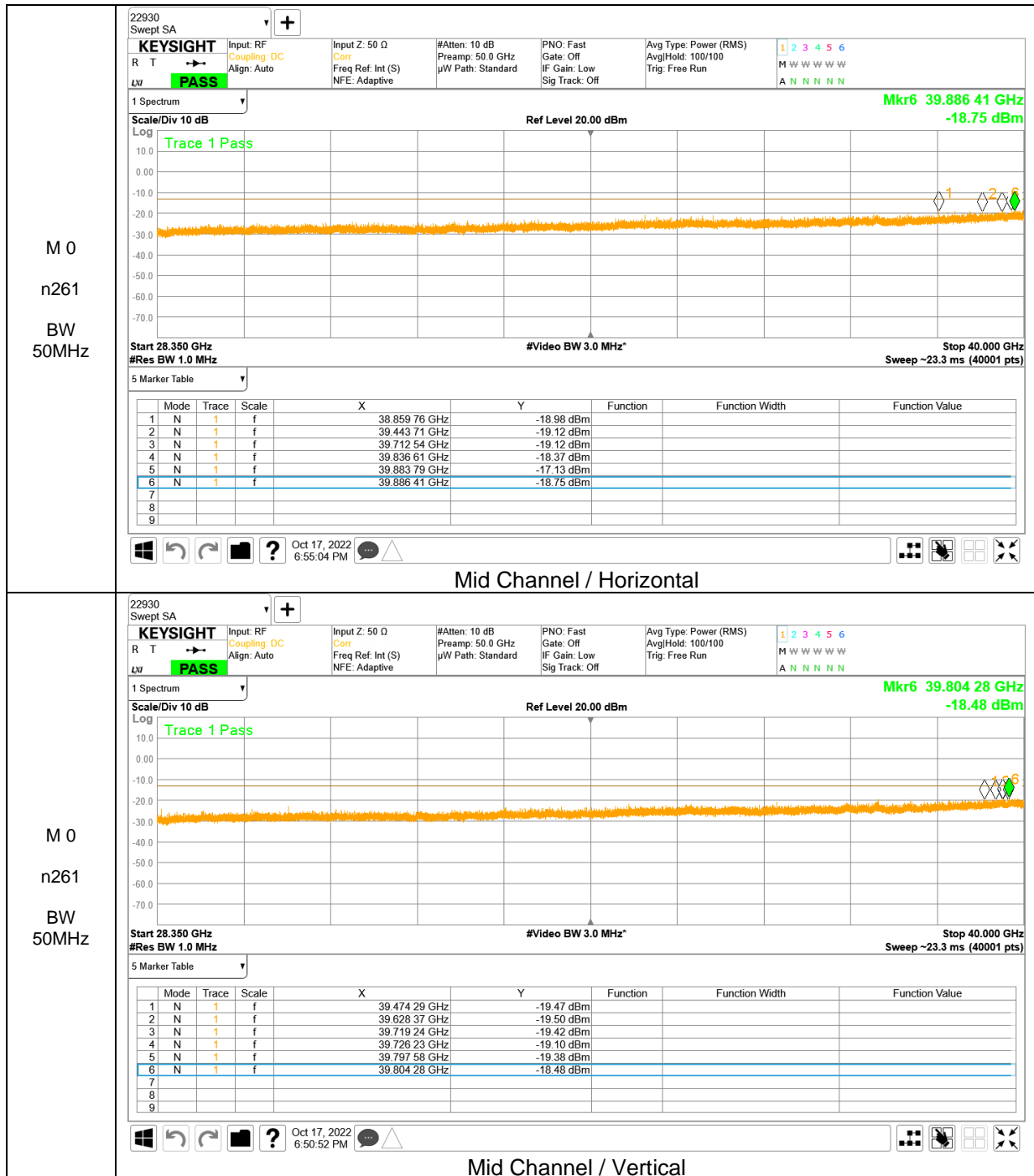
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

28.35 – 40 GHz Result

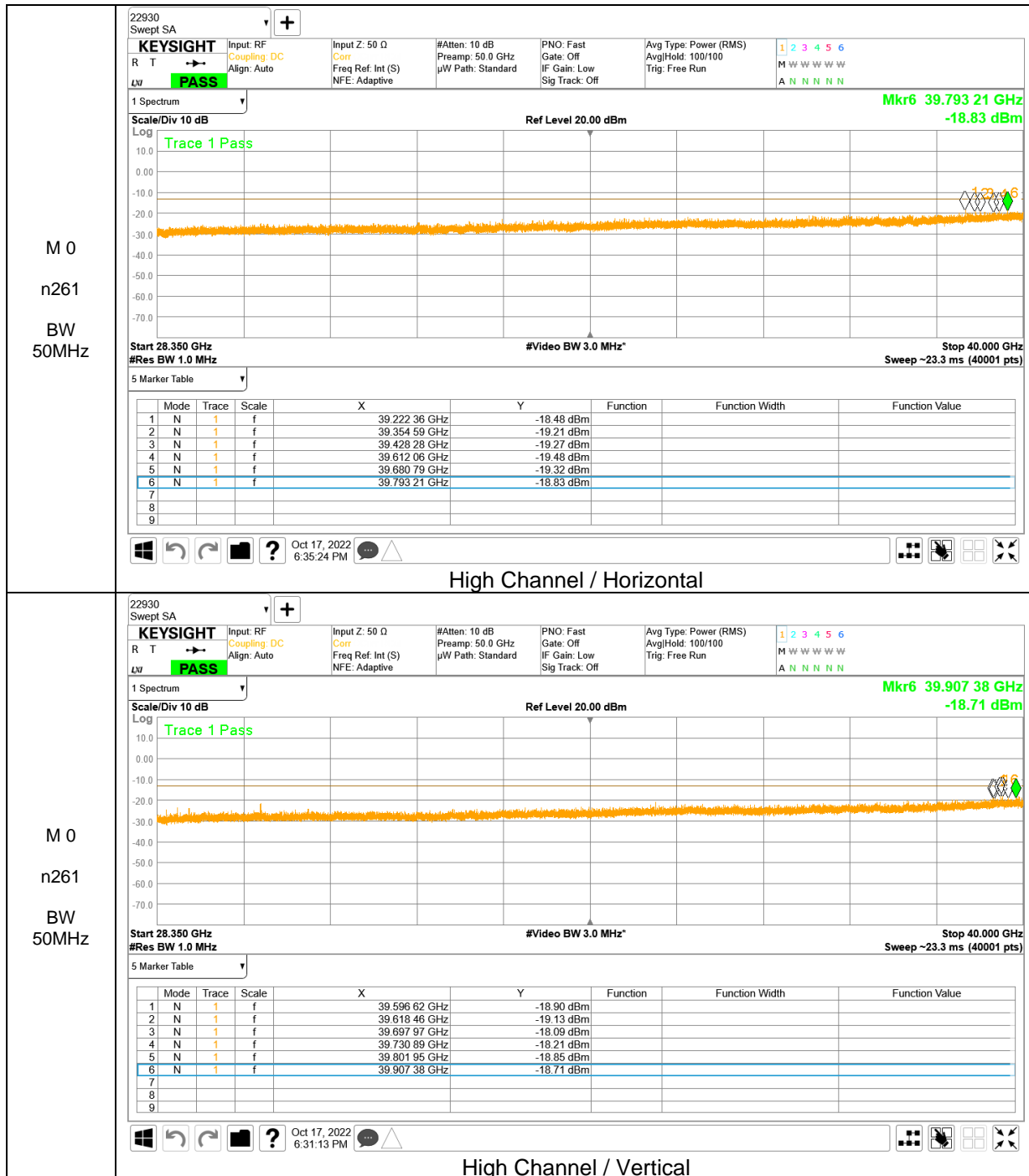


Final Measurement Data Table

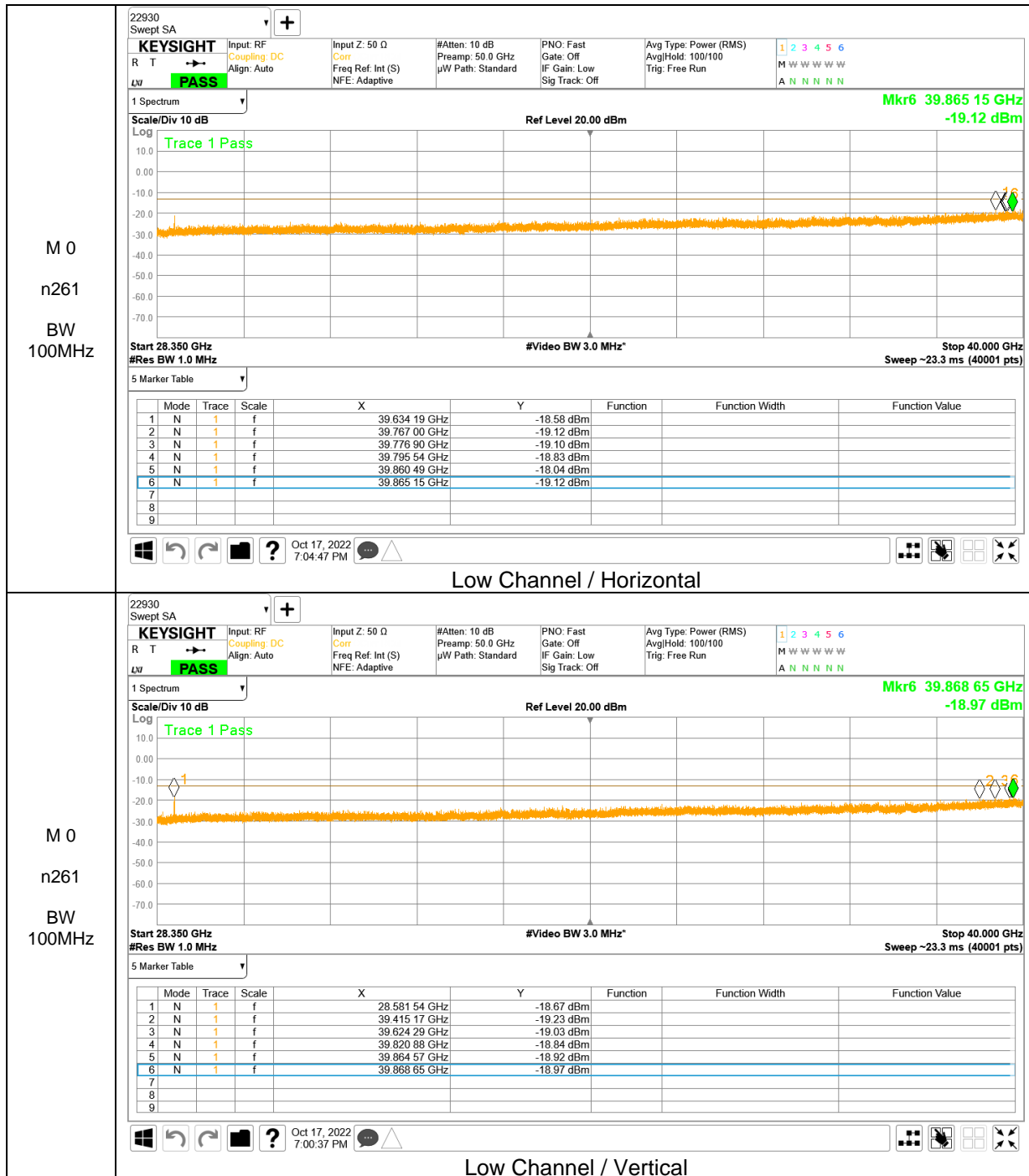
Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
28.61	50	SISO-Dual	QPSK	H	188.2	30.0	-26.90	-13	13.90
28.61	50	SISO-Dual	QPSK	V	199.0	30.0	-24.57	-13	11.57



No emissions were detected above noise floor.

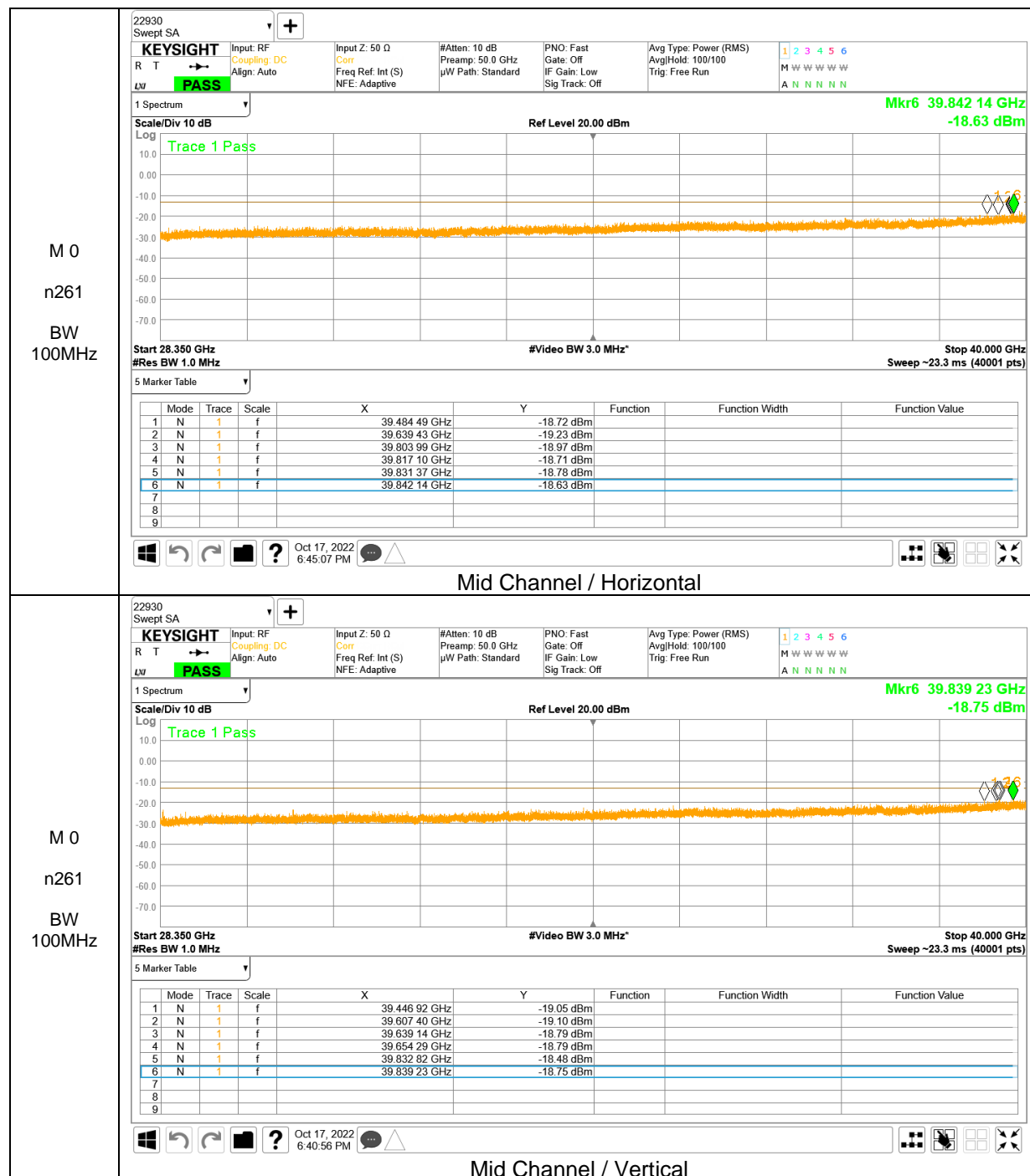


No emissions were detected above noise floor.



Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
29.77	100	SISO-Dual	QPSK	V	198.6	4.2	-26.95	-13	13.95



No emissions were detected above noise floor.



Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
28.58	100	SISO-Dual	QPSK	H	190.8	0.0	-25.97	-13	12.97
28.58	100	SISO-Dual	QPSK	V	199.5	0.0	-21.44	-13	8.44

40 – 50 GHz Result



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



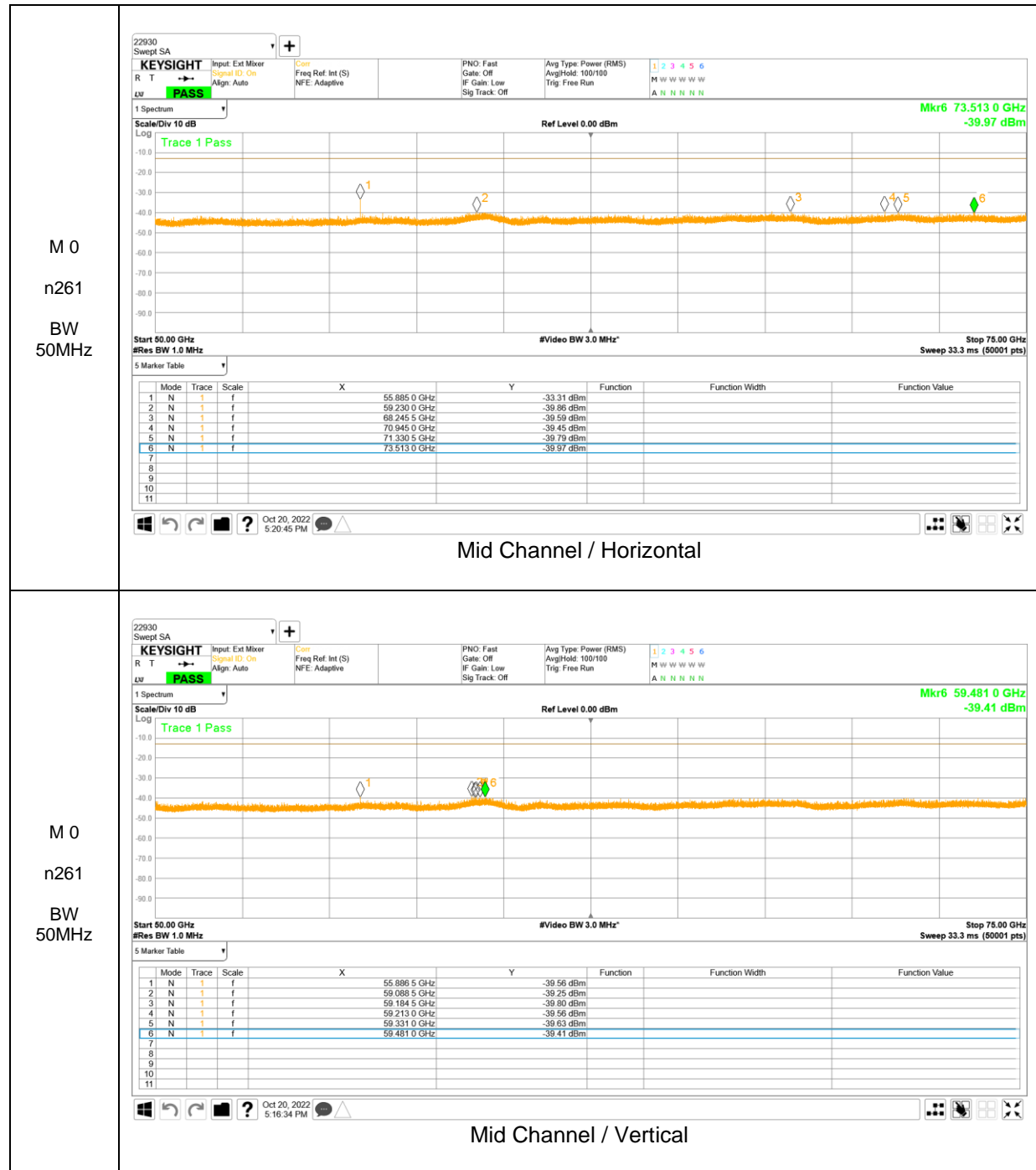
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

50 – 75 GHz Result



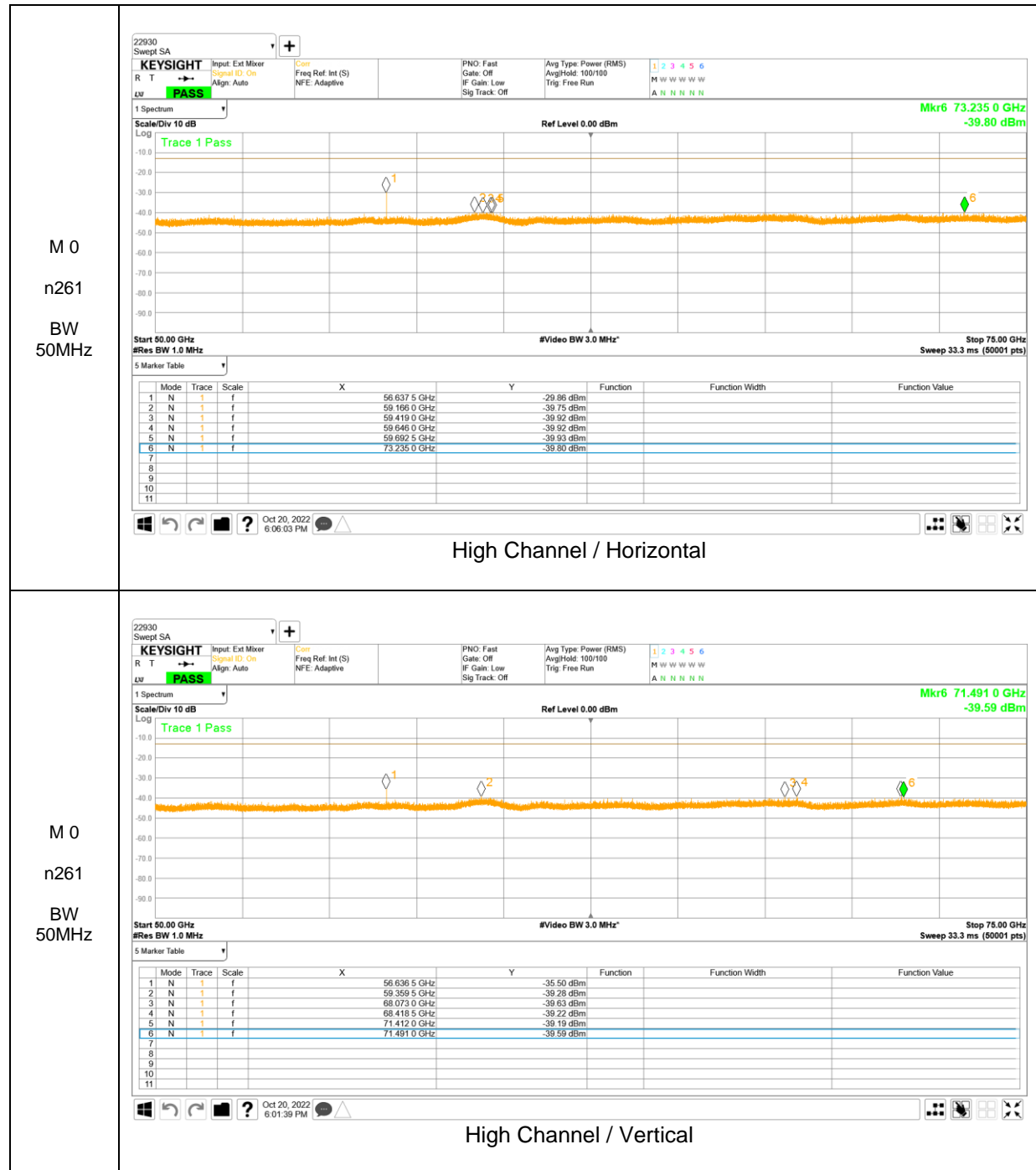
Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
56.64	50	SISO-Dual	QPSK	H	143.8	22.5	-34.02	-13	21.02
56.64	50	SISO-Dual	QPSK	V	119.1	127.2	-38.20	-13	25.20



Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55.07	50	SISO-Dual	QPSK	H	133.1	3.0	-43.67	-13	30.67
55.07	50	SISO-Dual	QPSK	V	208.1	2.6	-42.68	-13	29.68



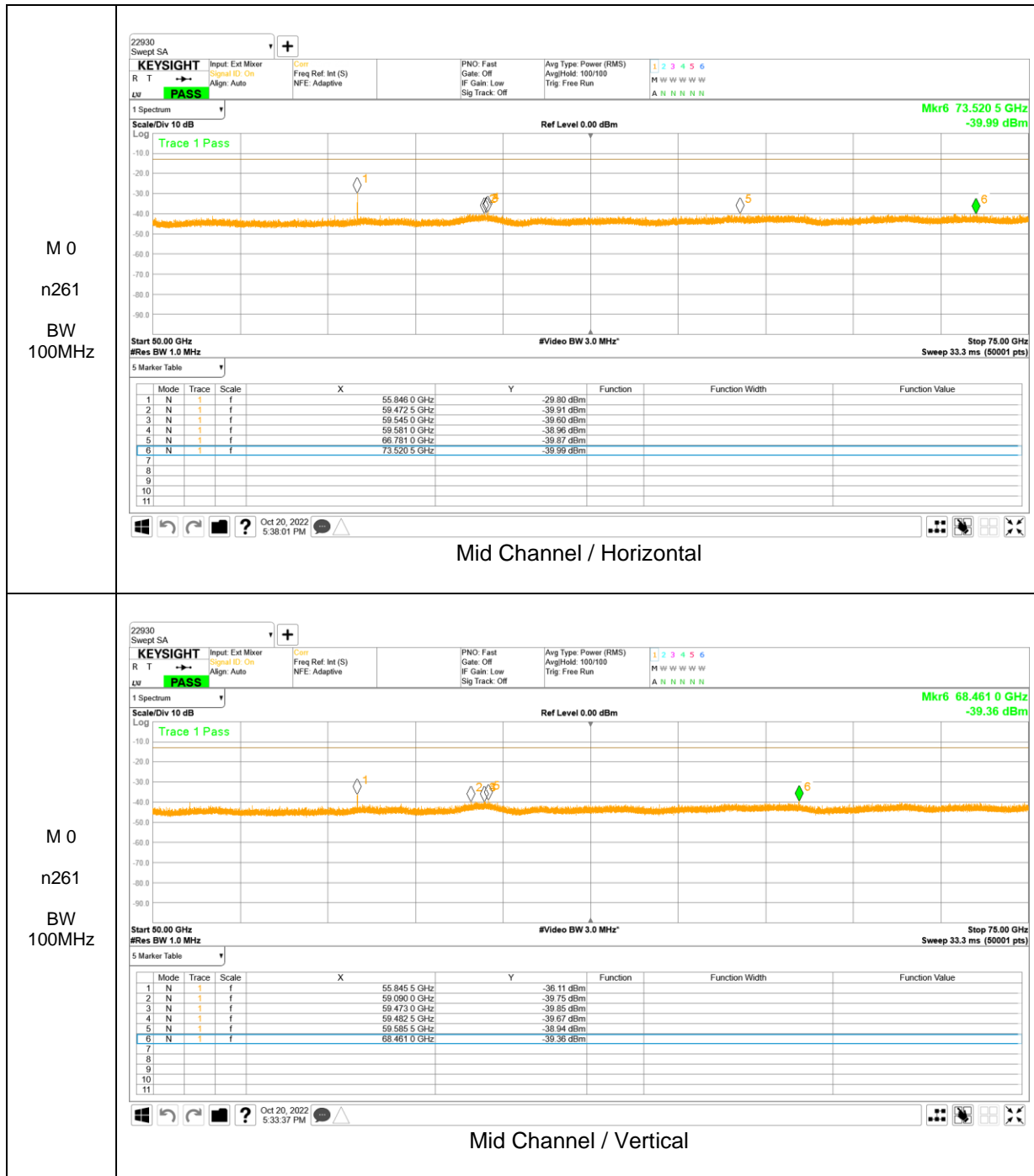
Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55.89	50	SISO-Dual	QPSK	H	123.8	45.0	-39.34	-13	26.34
55.89	50	SISO-Dual	QPSK	V	201.4	6.8	-43.92	-13	30.92



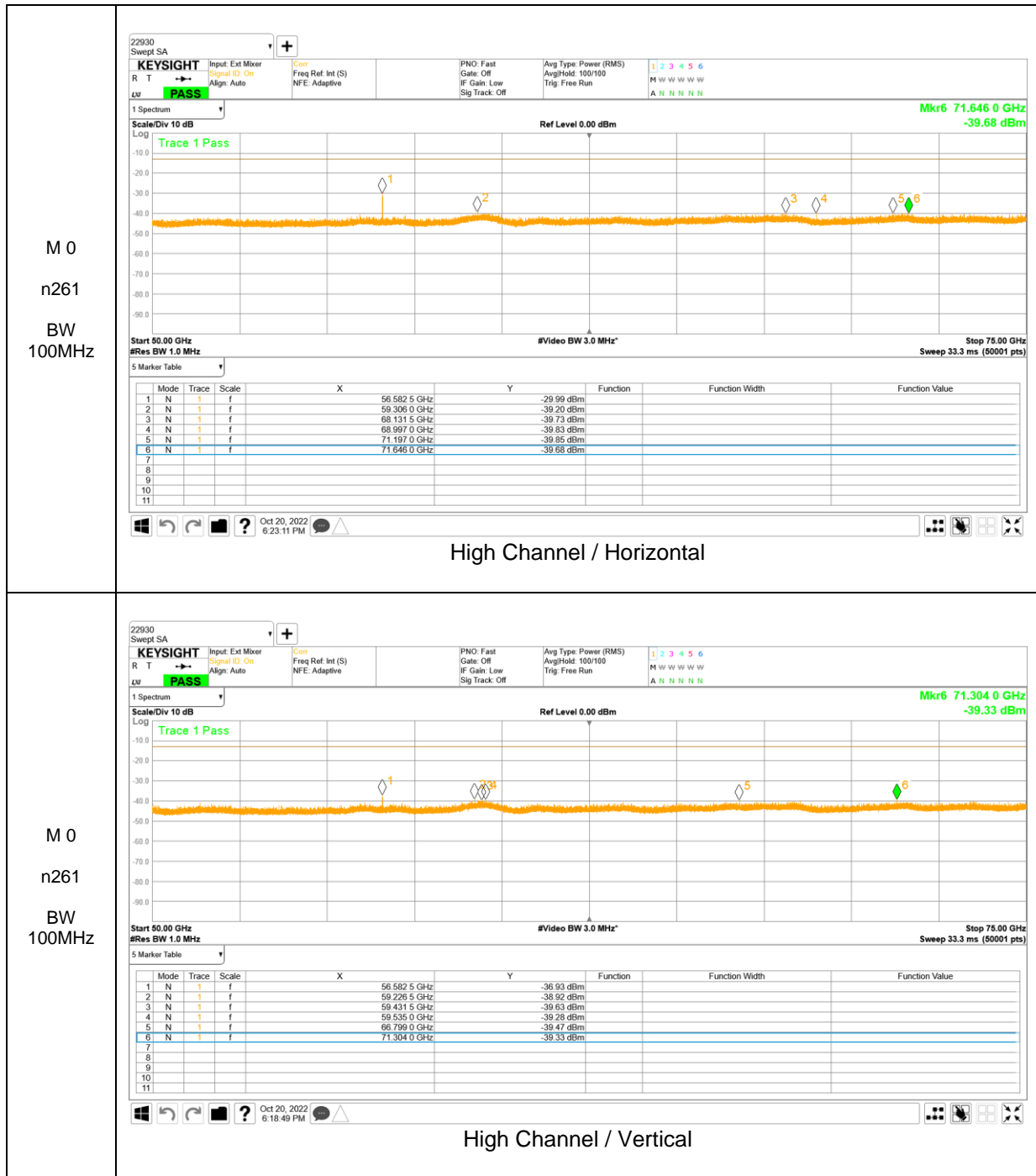
Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55.89	100	SISO-Dual	QPSK	H	143.4	38.2	-33.59	-13	20.59
55.89	100	SISO-Dual	QPSK	V	189.2	20.3	-41.65	-13	28.65



Final Measurement Data Table

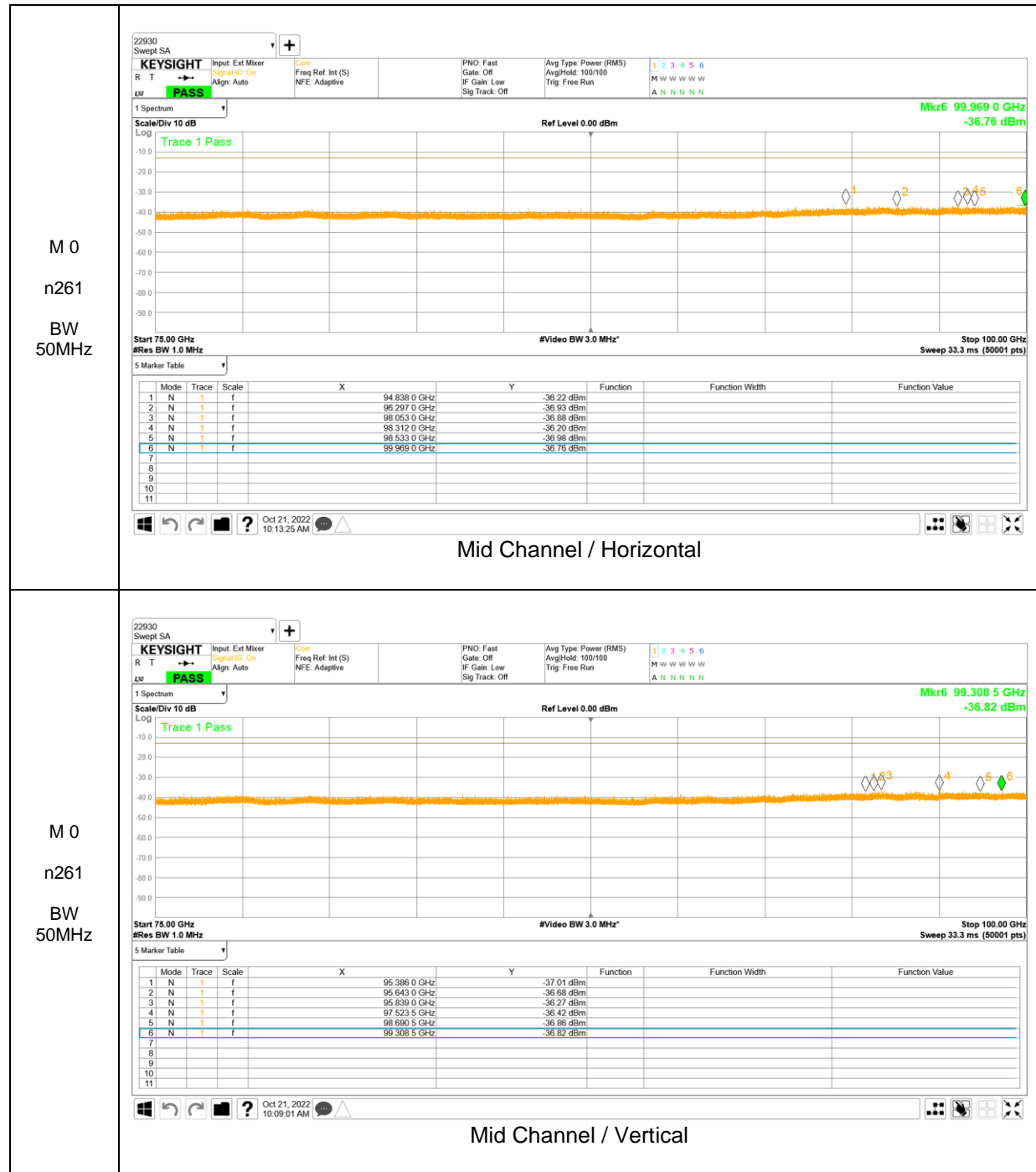
Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55.12	100	SISO-Dual	QPSK	H	132.6	22.7	-43.74	-13	30.74
55.12	100	SISO-Dual	QPSK	V	218.3	27.5	-41.36	-13	28.36



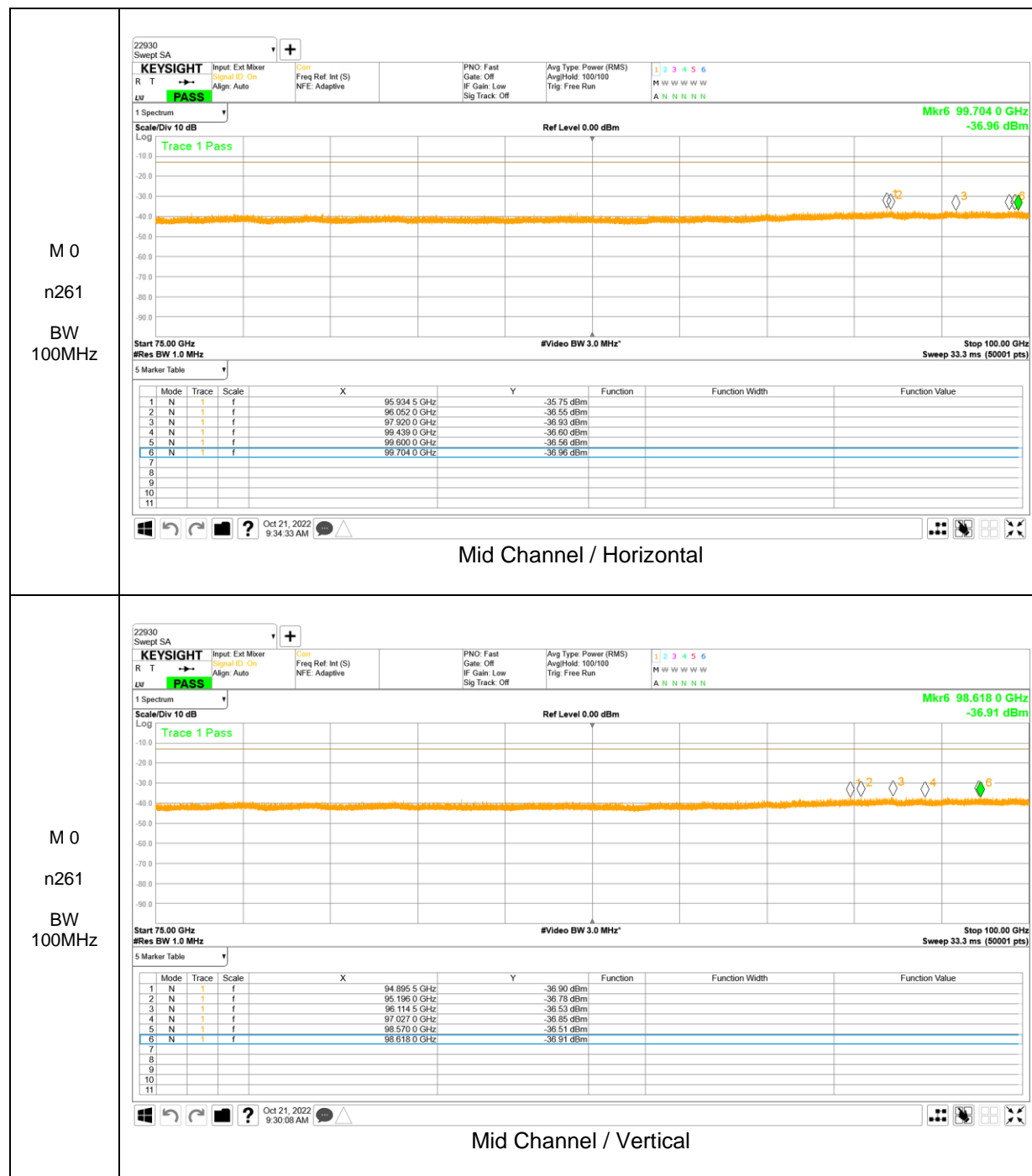
Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
55.85	100	SISO-Dual	QPSK	H	124.1	35.7	-35.11	-13	22.11
55.85	100	SISO-Dual	QPSK	V	150.1	51.5	-41.22	-13	28.22

75 – 100 GHz Result

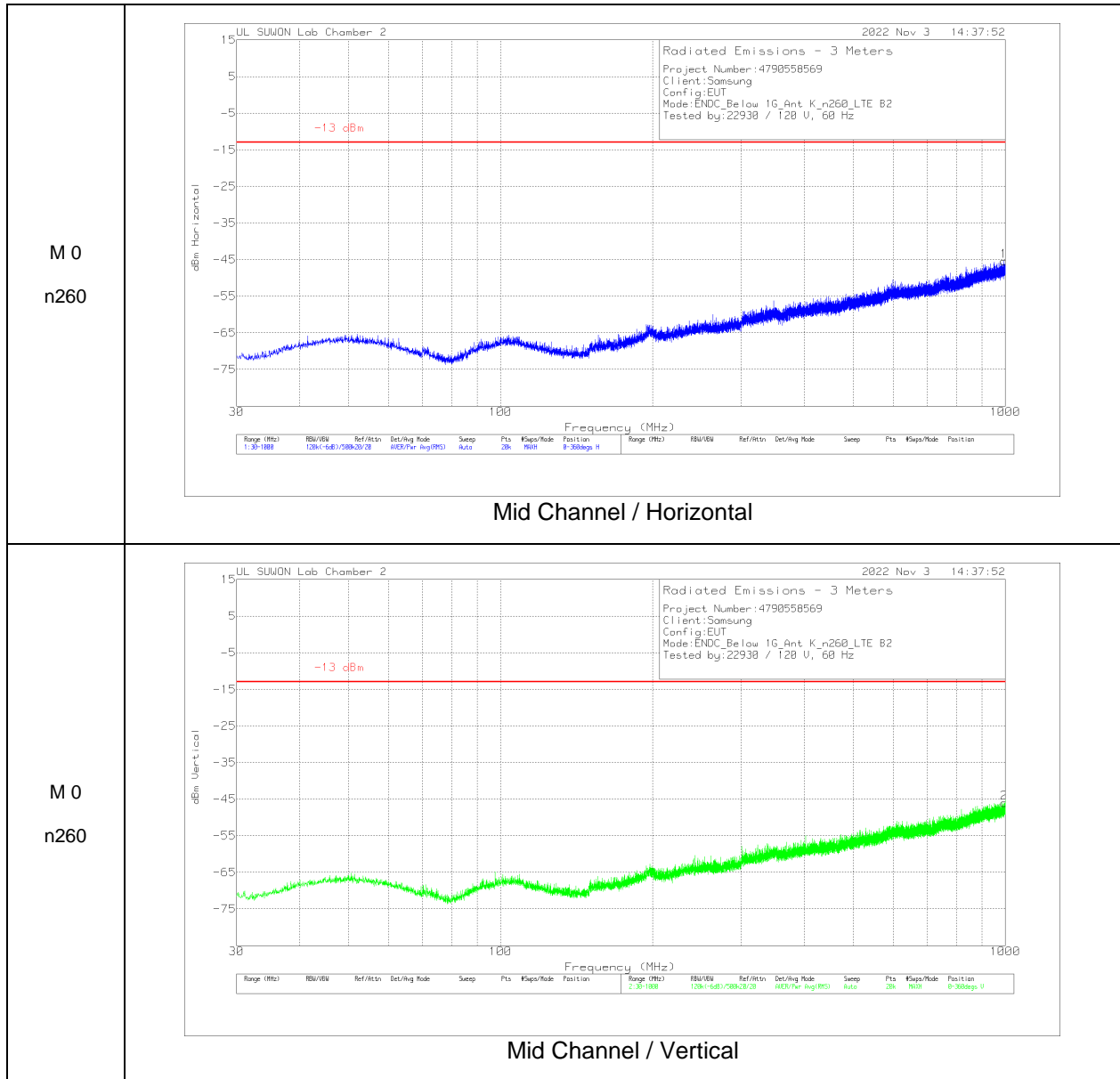


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



Module 0 / n260

30 – 1000 MHz Result



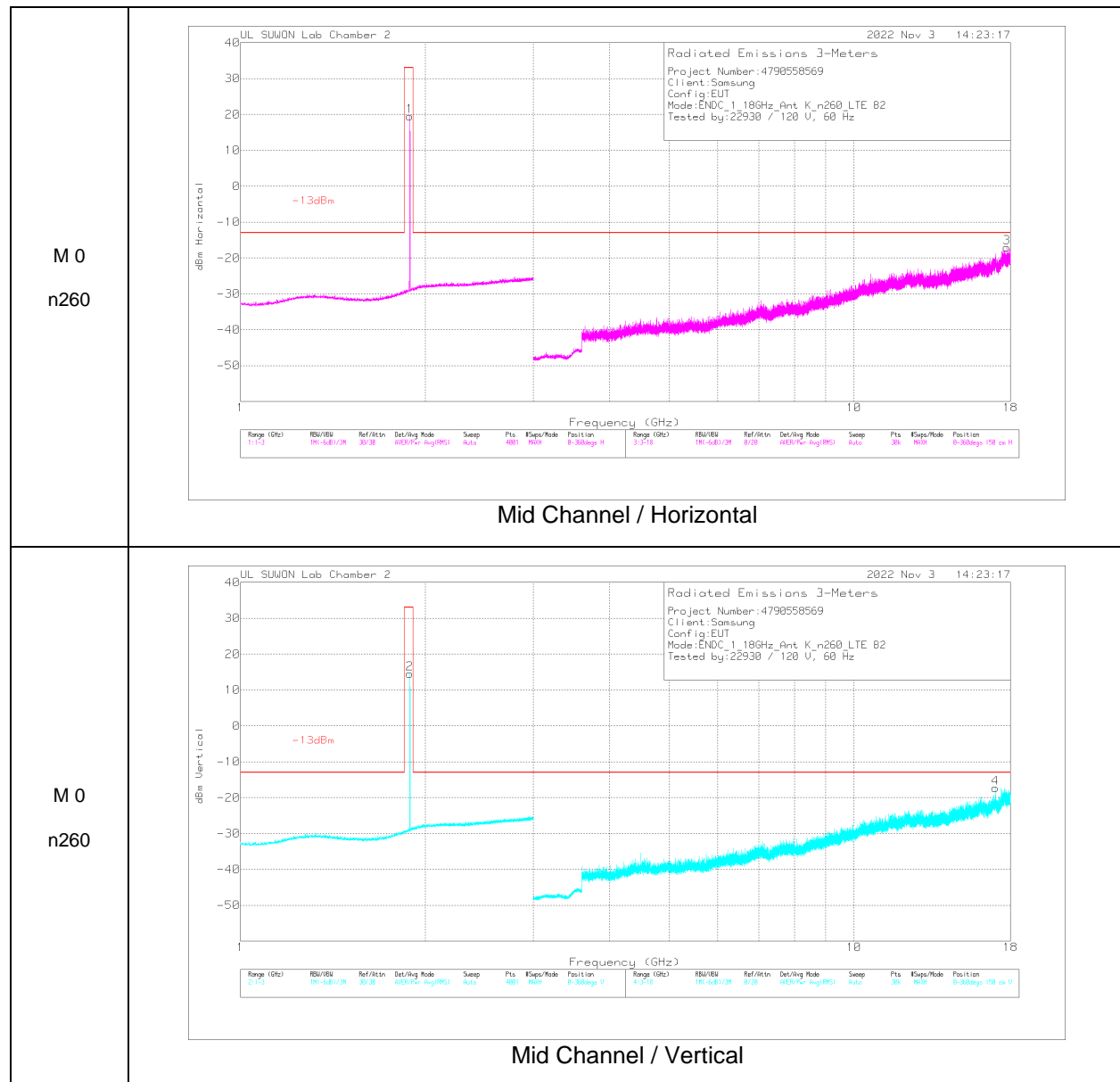
Trace Markers

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	994.3827	-60.45	RMS	27.8	-24.6	11.8	-45.45	-13	-32.45	0-360	200	H
2	995.1587	-61.02	RMS	27.8	-24.6	11.8	-46.02	-13	-33.02	0-360	100	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	1.889	-2.67	RMS	30.6	-20.2	11.8	19.53	33	-13.47	0-360	150	H
2	1.889	-7.6	RMS	30.6	-20.2	11.8	14.6	33	-18.4	0-360	150	V
3	17.7445	-62.74	RMS	41.7	-7.8	11.8	-17.04	-13	-4.04	0-360	150	H
4	17.01052	-62.33	RMS	41.2	-8	11.8	-17.33	-13	-4.33	0-360	150	V

RMS - RMS detection

** Marker 1 and 2 were the fundamental signal of LTE Band 2 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.

40.1 – 50 GHz Result



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



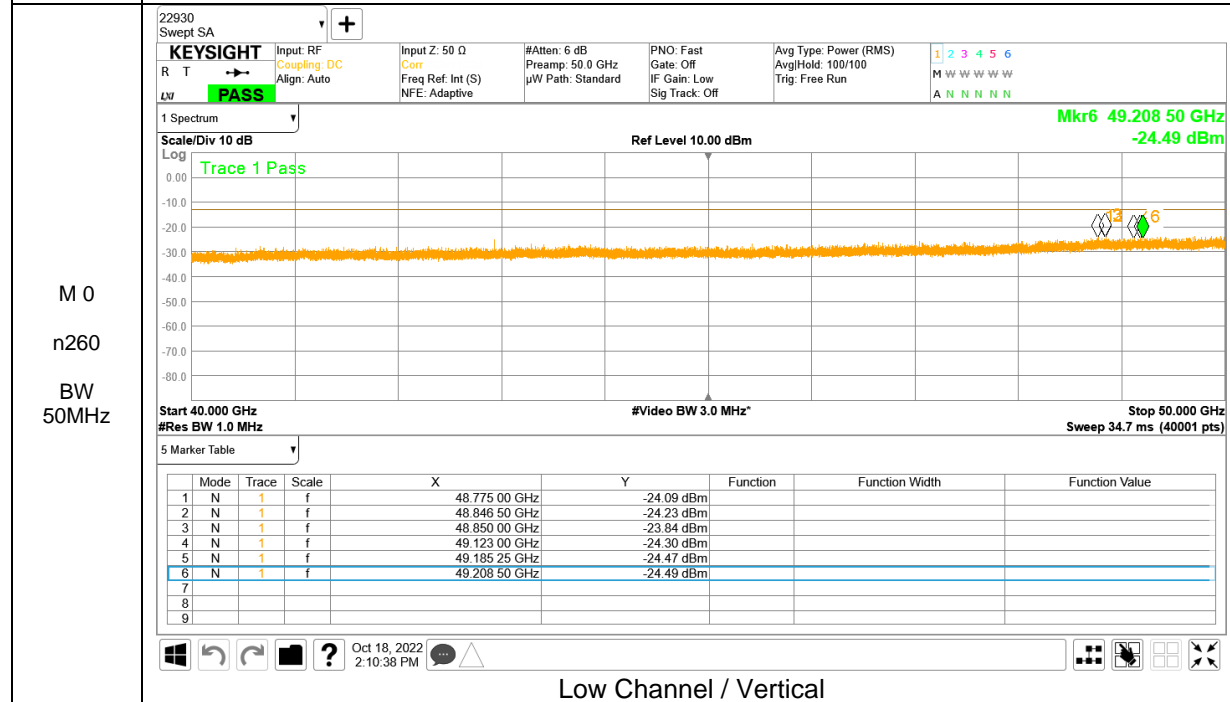
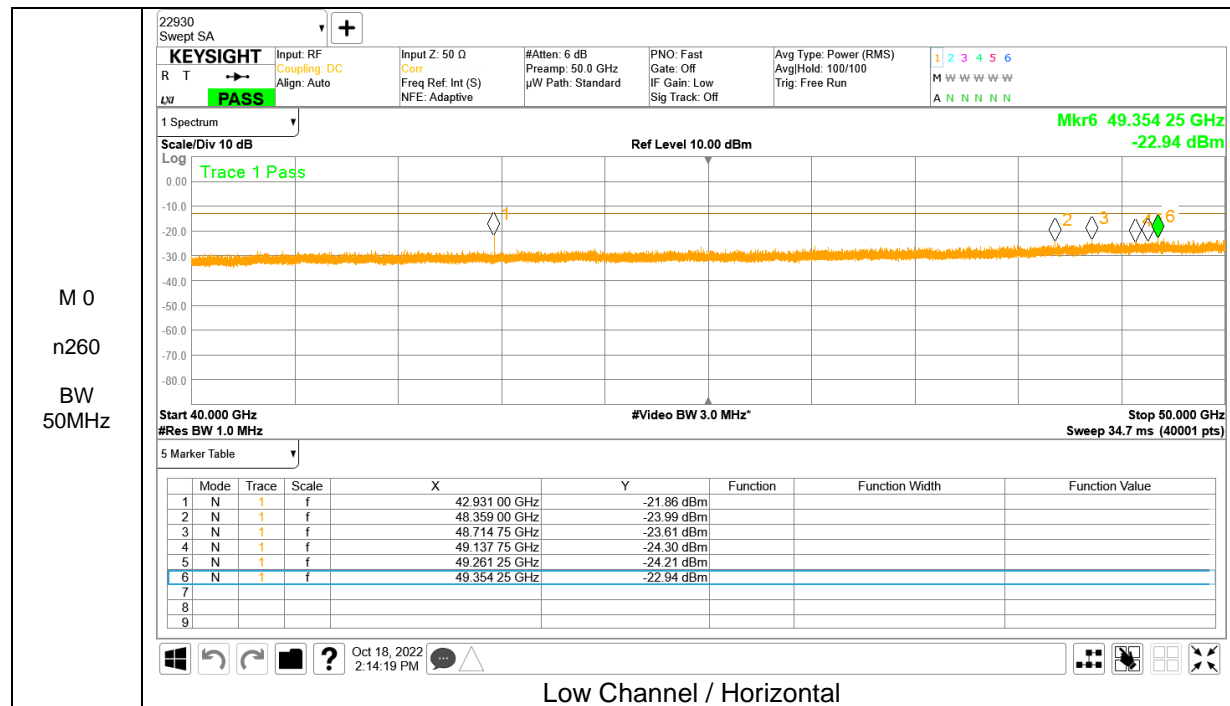
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
40.14	50	SISO-Dual	QPSK	H	206.0	15.4	-27.12	-13	14.12
40.14	50	SISO-Dual	QPSK	V	194.5	15.0	-41.14	-13	28.14
40.54	50	SISO-Dual	QPSK	V	201.5	15.0	-32.48	-13	19.48
40.54	50	SISO-Dual	QPSK	H	201.3	15.0	-29.07	-13	16.07

50 – 75 GHz Result



Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
42.93	100	SISO-Dual	QPSK	H	177.2	15.0	-24.89	-13	11.89
42.93	100	SISO-Dual	QPSK	V	229.5	15.0	-35.69	-13	22.69

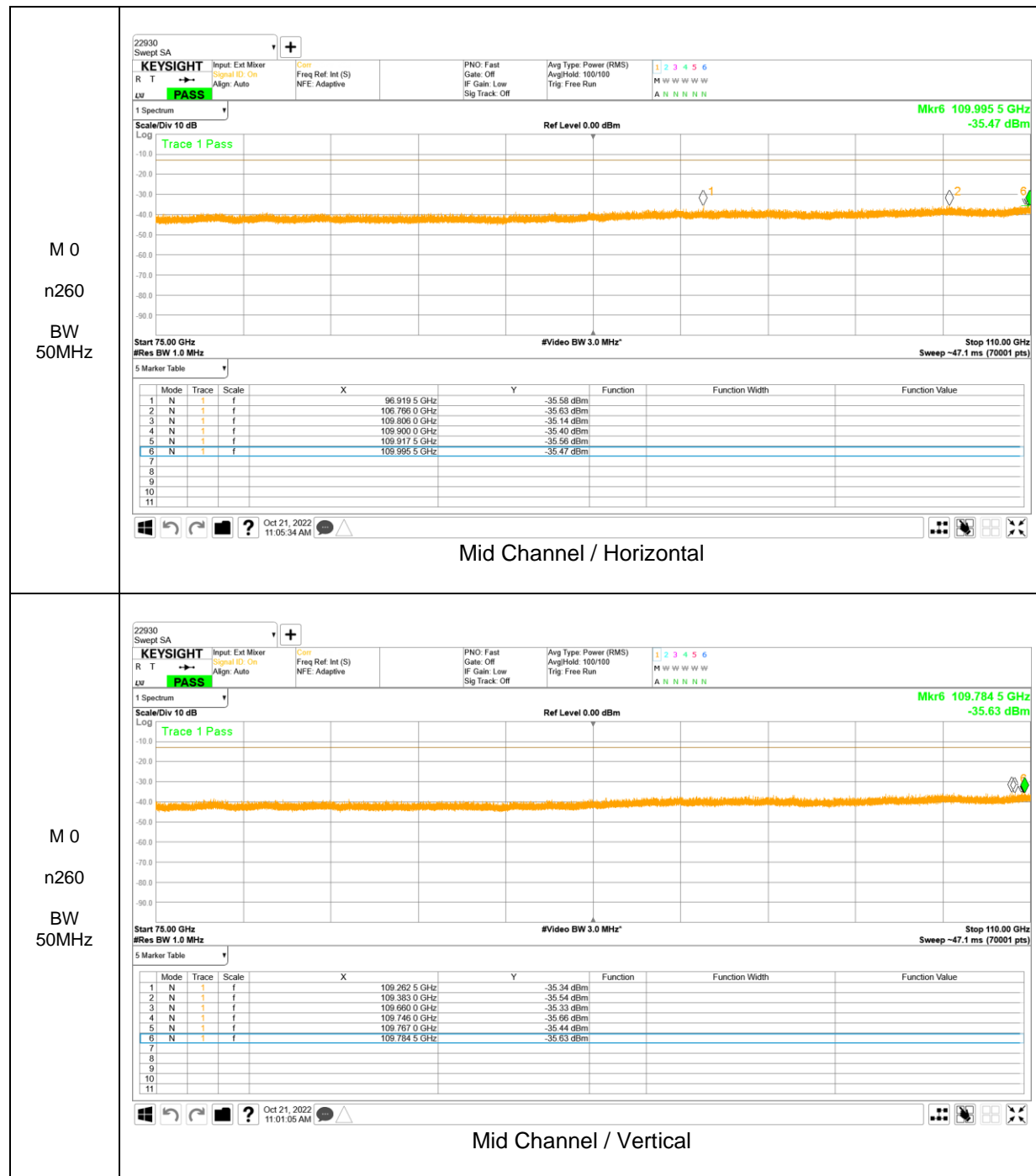


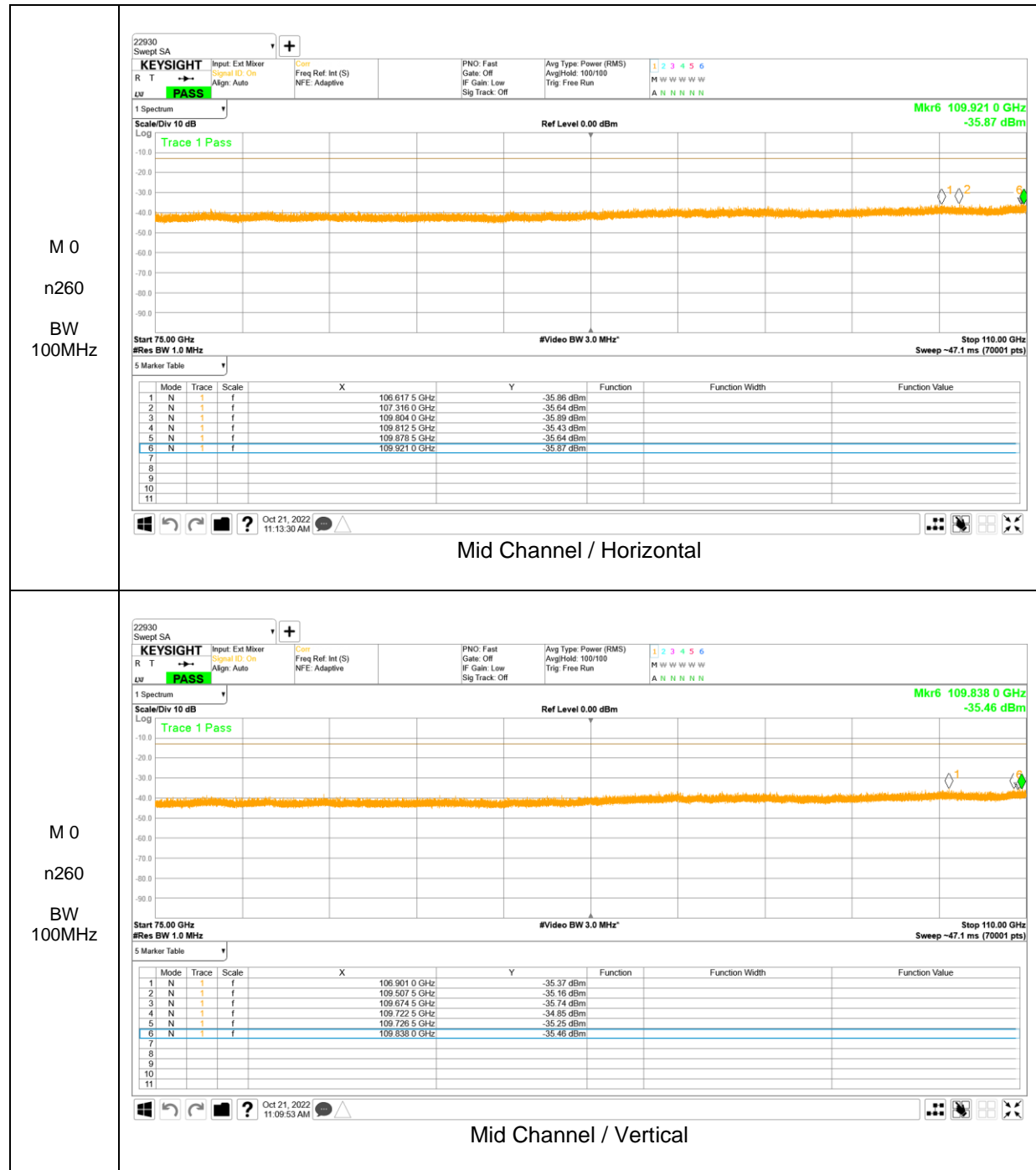
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



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

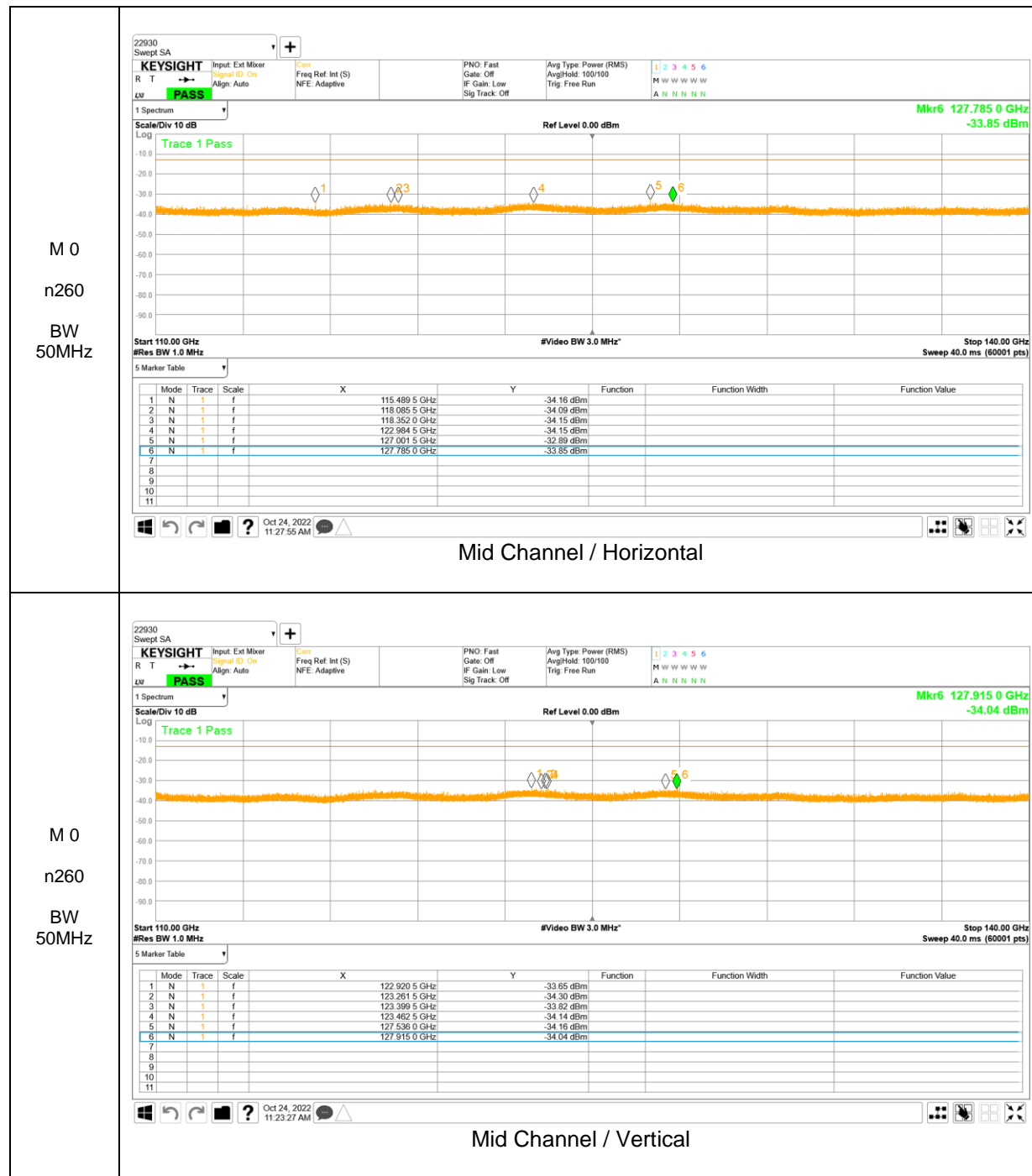
75 – 110 GHz Result



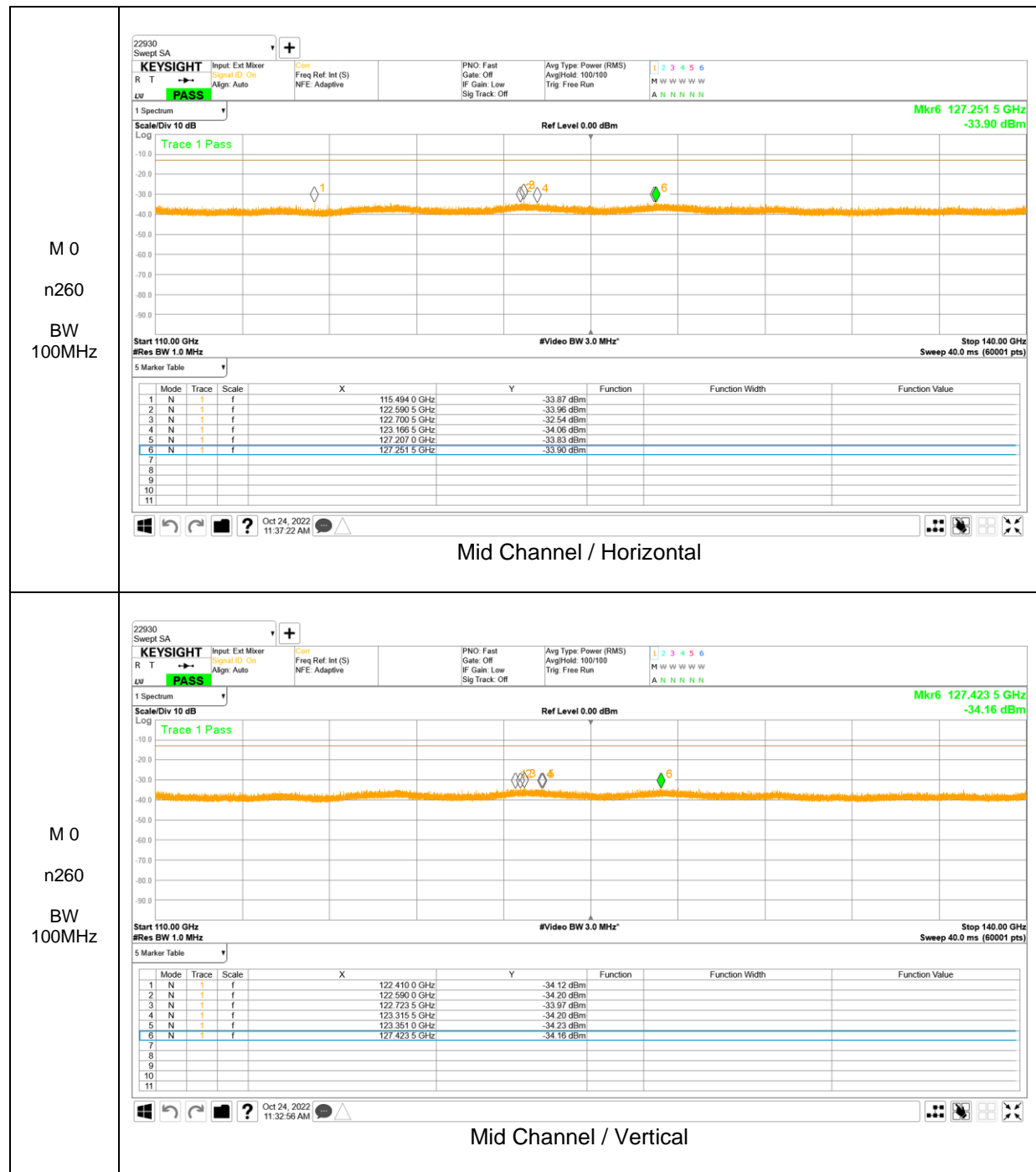


No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.

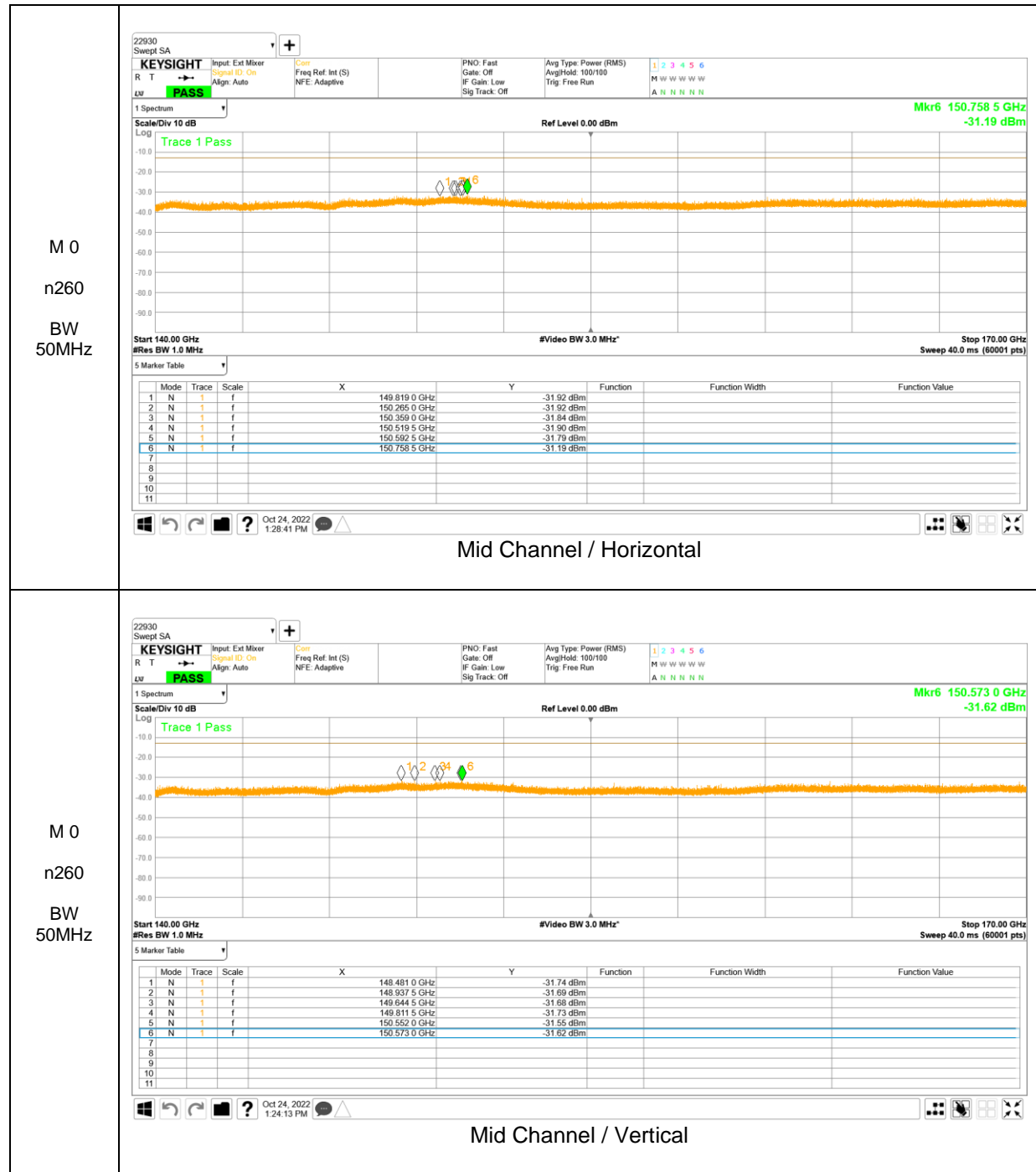
110 – 140 GHz Result



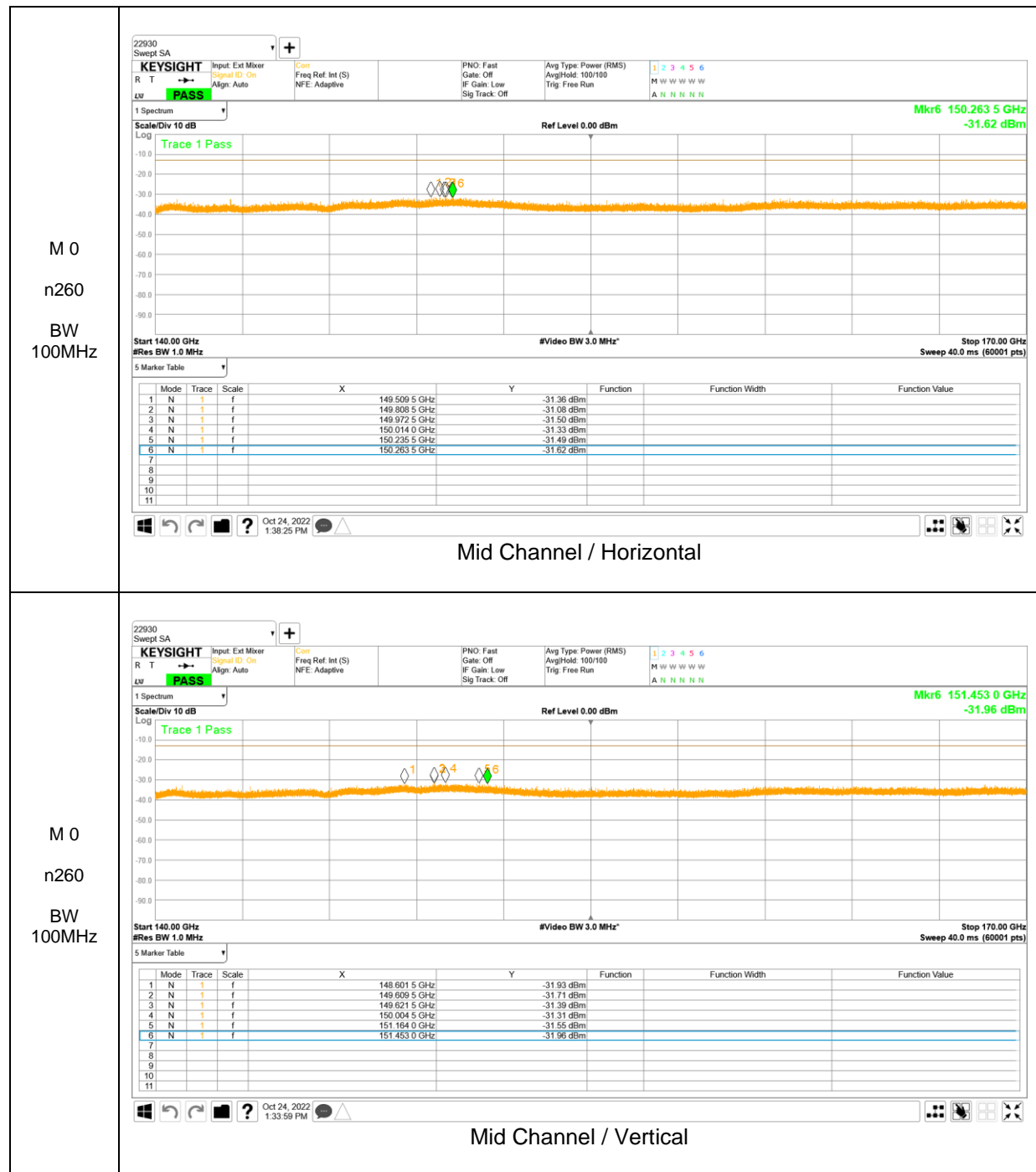
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



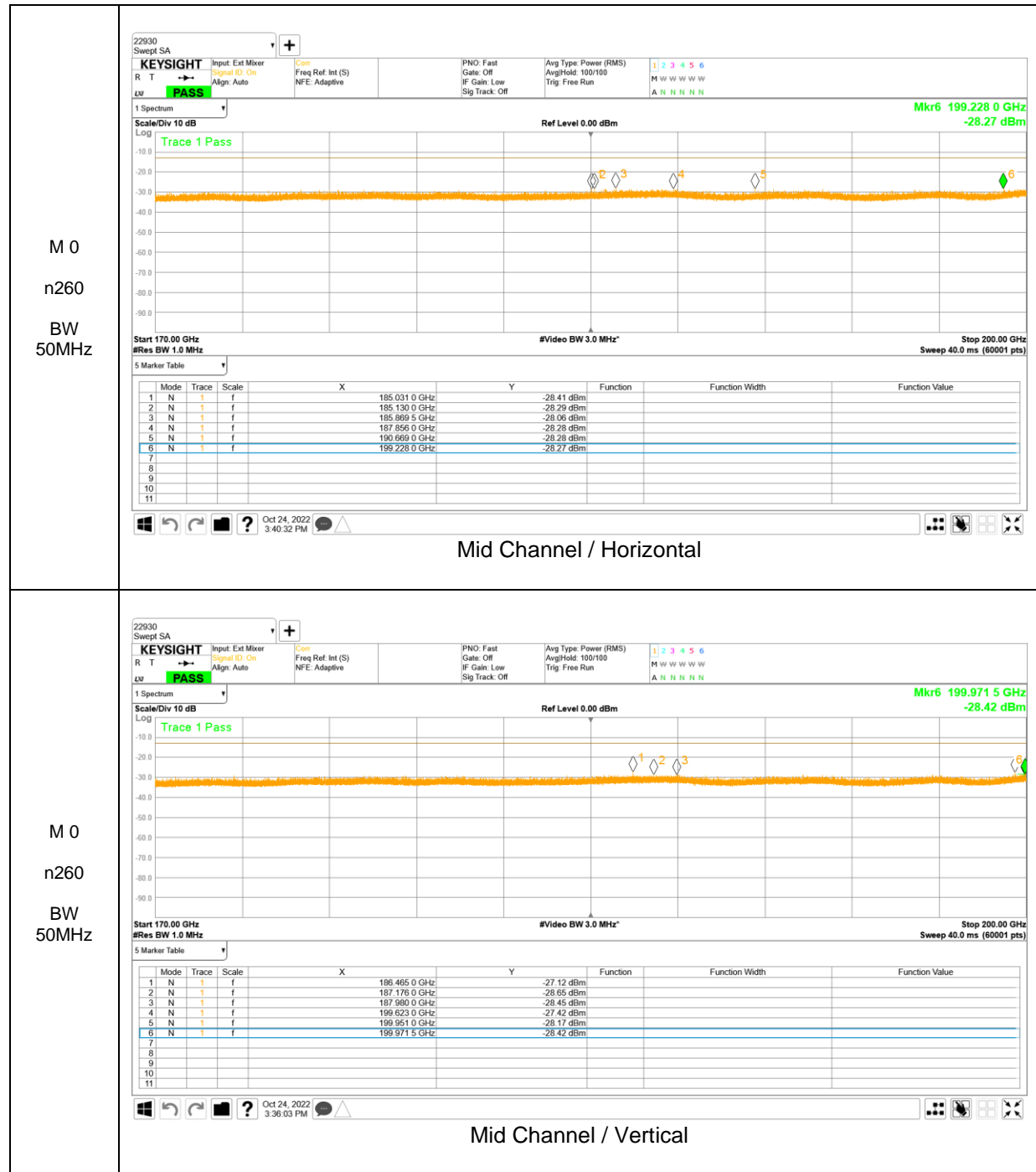
140 – 170 GHz Result



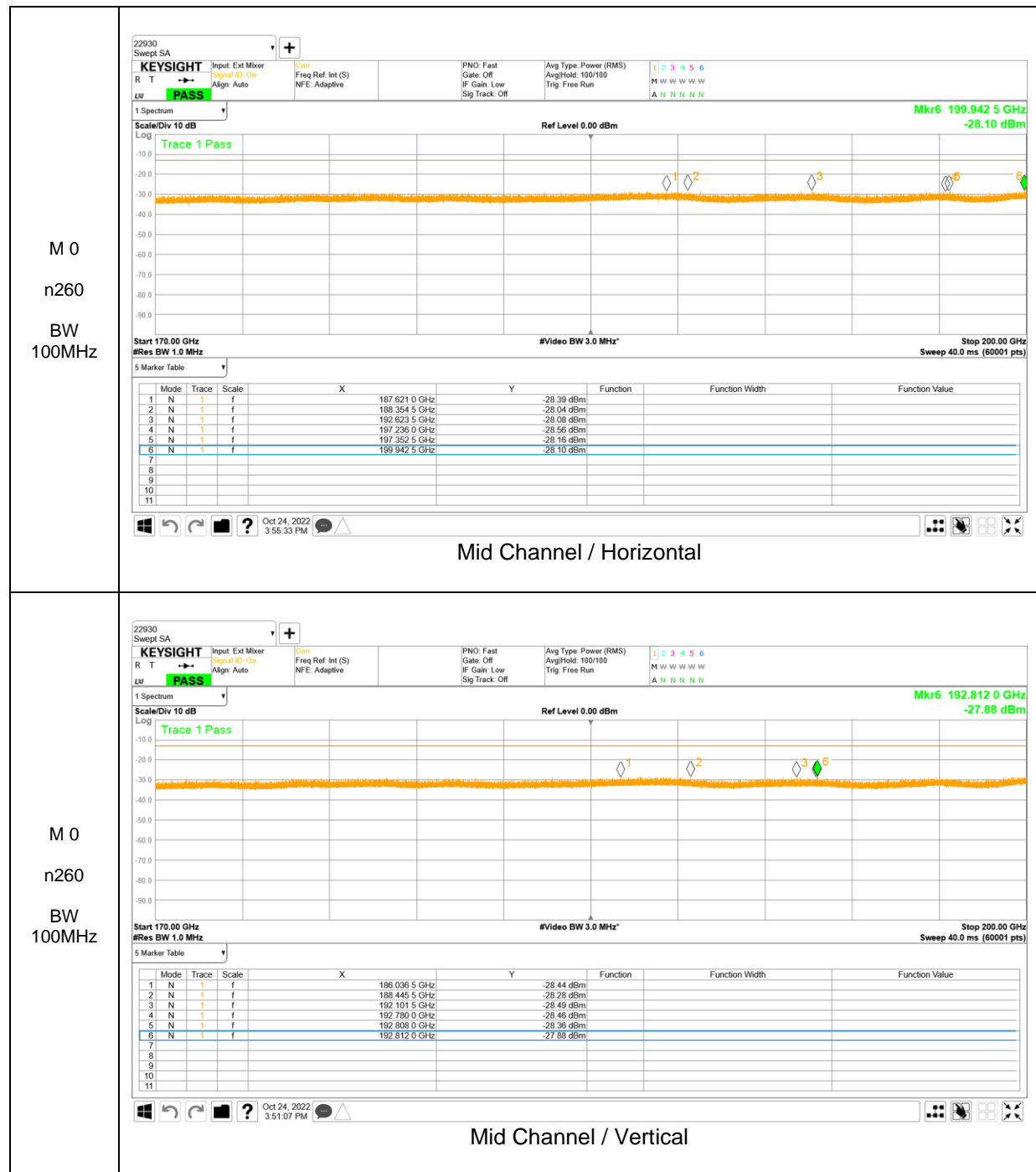
No emissions were detected above noise floor this antenna and band. Thus reported mid channel data.



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

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

Test procedures for voltage variation

- a) Position the EUT in temperature/humidity chamber with power off.
- b) Set chamber temperature to 20°C.
- c) Record maximum frequency change within one minute after powering the EUT.
- d) 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	257.050	0.000921	28344.5200	258.000	0.000924
Extreme (50°C)		27509.8402	203.800	0.000730	28344.5201	129.190	0.000463
Extreme (40°C)		27509.8403	329.090	0.001178	28344.5201	122.290	0.000438
Extreme (30°C)		27509.8404	361.080	0.001293	28344.5200	38.933	0.000139
Extreme (10°C)		27509.8403	342.230	0.001226	28344.5203	267.510	0.000958
Extreme (0°C)		27509.8400	35.003	0.000125	28344.5202	154.210	0.000552
Extreme (-10°C)		27509.8401	62.473	0.000224	28344.5201	124.460	0.000446
Extreme (-20°C)		27509.8401	77.875	0.000279	28344.5201	95.211	0.000341
Extreme (-30°C)		27509.8403	261.300	0.000936	28344.5201	55.733	0.000200
Normal (20°C)		15%	27509.8402	196.630	0.000704	28344.5201	148.060
	-15%	27509.8403	213.040	0.000763	28344.5202	236.690	0.000848
	End Point	27509.8404	212.258	0.000760	28344.5202	185.542	0.000664

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	230.020	0.000597	39991.2400	211.670	0.000550
Extreme (50°C)		37002.3201	62.230	0.000162	39991.2401	62.736	0.000163
Extreme (40°C)		37002.3201	60.190	0.000156	39991.2401	56.627	0.000147
Extreme (30°C)		37002.3204	375.130	0.000974	39991.2401	149.980	0.000390
Extreme (10°C)		37002.3202	216.660	0.000563	39991.2403	267.880	0.000696
Extreme (0°C)		37002.3202	234.930	0.000610	39991.2403	309.220	0.000803
Extreme (-10°C)		37002.3203	265.730	0.000690	39991.2403	266.110	0.000691
Extreme (-20°C)		37002.3203	318.530	0.000827	39991.2404	350.570	0.000911
Extreme (-30°C)		37002.3203	338.600	0.000879	39991.2403	308.320	0.000801
Normal (20°C)		15%	37002.3201	492.510	0.001279	39991.2402	211.670
	-15%	37002.3201	251.620	0.000654	39991.2402	179.870	0.000467
	End Point	37002.3204	300.240	0.000780	39991.2403	184.250	0.000479

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 : SAX693



교정 성적서 CALIBRATION CERTIFICATE

경기도 이천시 마장면 서이천로 578번길 74
 TEL : 031-645-6900, FAX : 031-645-6969



성적서발급번호(Certificate No) : IC-2022-002597

교정번호(Calibration No) : C-2022-003548

페이지(page) : 1 of 4

1. 의뢰자 (Client)
 - 기관명 (Name) : 유엘코리아(주)
 - 주소 (Address) : 경기도 수원시 영통구 매영로 218
2. 측정기 (Calibration Subject)
 - ◇ 등록번호 : 409611
 - 기기명 (Description) : SA EXTENSION MODULE
 - 제작회사 및 형식 (Manufacturer and Model Name) : VDI / SAX WR15
 - 기기번호 (Serial Number) : SAX693
3. 교정일자 (Date of Calibration) : 2022.01.18 차기교정예정일자 : 2023.01.18
 (The due date of next Calibration)
4. 교정환경 (Environment)
 - 온도(Temperature) : (23.6 ± 0.3) °C - 습도(Humidity) : (51 ± 3) % R.H.
 - 교정장소 (Location) : 고정표준실(Permanent Calibration Lab)
 (주소: 경기도 이천시 마장면 서이천로 578번길 74)
5. 측정 표준의 소급성 (Traceability) ◇Field code : 40641(RF SPECTRUM ANALYZER)
 교정방법 및 소급성 서술 (Calibration method and/or brief description)
 상기 기기는 고주파 스펙트럼 분석기의 교정절차(HCT-CS-125-40641)에 따라 국가측정표준기관으로부터 측정의 소급성이 확
 보된 아래의 표준장비를 이용하여 교정 되었음.

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

기기명 (Description)	제작회사 / 형식 (Manufacturer and Model Name)	기기번호 (Serial Number)	차기교정예정일자 (The due date of next Calibration)	교정기관 (Calibration laboratory)
EXG ANALOG SIGNAL GENERATOR	KEYSIGHT/N5173B	MY61252589	2022/10/15	(주)에이치시티
EPM-P SERIES POWER METER	AGILENT/E4417A	GB41291582	2022/06/04	(주)에이치시티
POWER SENSOR	KEYSIGHT/V8486A	MY56330017	2022/12/07	Keysight Technologies
WR-12 MULTIPLIER SOURCE MODULE	OML/S12MS-A	160419-1	2022/09/07	(주)에이치시티
WR-19 MULTIPLIER SOURCE MODULE	OML/S19MS-A	160516-1	2022/09/07	(주)에이치시티

6. 교정결과 (Calibration result) : 교정결과 참조 (Refer to attachment)
7. 측정불확도 (Measurement uncertainty) : 교정결과 참조 (Refer to attachment)
 신뢰수준 약 95 %, k = 2 (Confidence level about 95 %, k = 2)

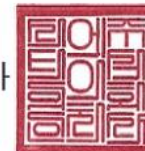
확 인 (affirmation)	작성자 (Measurements performed by)	승인자 (Approved by)
	성명 (Name) 고형재 (인명)	직위 (Title) 기술책임자(Technical Cal. Manager) 김광철 성명 (Name) 김 광 철 (서명)

위 성적서는 국제시험기관인정협력체(International Laboratory Accreditation Cooperation) 상호인정협정(Mutual Recognition Arrangement)에 서명한 한국인정기구(KOLAS)로부터 공인 받은 분야의 교정결과입니다.

2022. 01. 18

한국인정기구 인정
 Accredited by KOLAS, Republic of KOREA

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



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F-02P-02-008 (Rev.02)

■고객사 관리번호: SUW-E0250

교 정 결 과

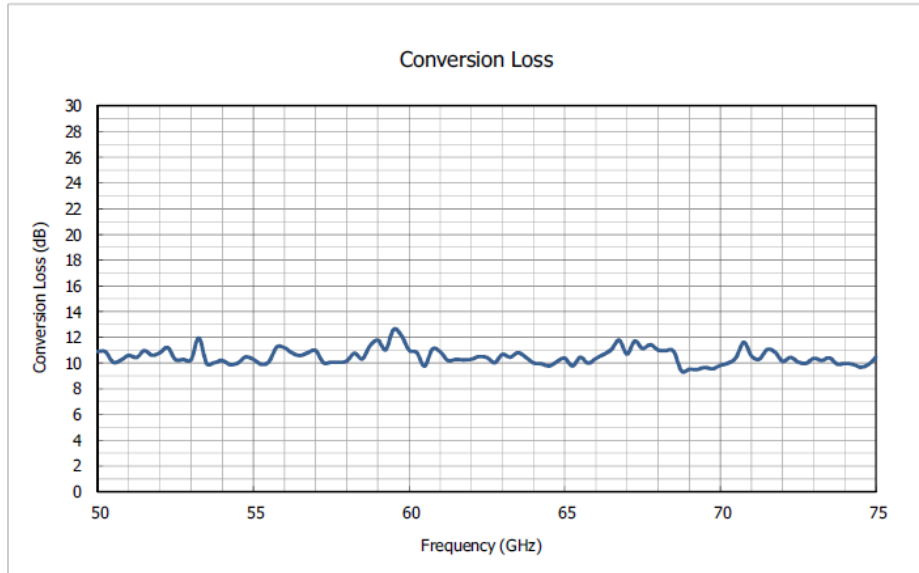
CALIBRATION RESULT



성적서발급번호(Certificate No) : IC-2022-002597
교 정 번 호(Calibration No) : C-2022-003548

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1. Conversion Loss Graph



Note 1) Measurement Condition :

RF = -30 dBm, Harmonic Order = 12, L.O. Level = 10 dBm, IF = 322.5 MHz, Bias Value = 0.00 mA

Note 2) This is the result of measuring the requested equipment and Keysight N9040B (SN MY60080268) together.

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교 정 결 과

CALIBRATION RESULT



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2. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)	Frequency (GHz)	Conversion Loss (dB)	Measurement Uncertainty (dB)
50.0	10.90	0.82	57.5	10.07	0.82
50.3	10.88	0.82	57.8	10.06	0.82
50.5	10.06	0.82	58.0	10.15	0.82
50.8	10.24	0.82	58.3	10.76	0.82
51.0	10.60	0.82	58.5	10.32	0.82
51.3	10.44	0.82	58.8	11.35	0.82
51.5	10.96	0.82	59.0	11.78	0.82
51.8	10.61	0.82	59.3	11.03	0.82
52.0	10.80	0.82	59.5	12.61	0.82
52.3	11.21	0.82	59.8	12.17	0.82
52.5	10.27	0.82	60.0	11.00	0.82
52.8	10.28	0.82	60.3	10.82	0.82
53.0	10.25	0.82	60.5	9.75	0.82
53.3	11.95	0.82	60.8	11.09	0.82
53.5	9.97	0.82	61.0	10.88	0.82
53.8	10.03	0.82	61.3	10.20	0.82
54.0	10.19	0.82	61.5	10.28	0.82
54.3	9.88	0.82	61.8	10.25	0.82
54.5	9.99	0.82	62.0	10.29	0.82
54.8	10.47	0.82	62.3	10.50	0.82
55.0	10.29	0.82	62.5	10.44	0.82
55.3	9.91	0.82	62.8	10.03	0.82
55.5	10.10	0.82	63.0	10.67	0.82
55.8	11.24	0.82	63.3	10.45	0.82
56.0	11.19	0.82	63.5	10.81	0.82
56.3	10.78	0.82	63.8	10.46	0.82
56.5	10.59	0.82	64.0	10.01	0.82
56.8	10.80	0.82	64.3	9.94	0.82
57.0	10.98	0.82	64.5	9.78	0.82
57.3	10.03	0.82	64.8	10.11	0.82
65.0	10.38	0.82	70.3	9.99	0.82
65.3	9.78	0.82	70.5	10.42	0.82
65.5	10.45	0.82	70.8	11.62	0.82
65.8	9.99	0.82	71.0	10.55	0.82
66.0	10.35	0.82	71.3	10.30	0.82
66.3	10.67	0.82	71.5	11.05	0.82
66.5	11.06	0.82	71.8	10.86	0.82

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교 정 결 과

CALIBRATION RESULT



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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)
66.8	11.79	0.82	72.0	10.13	0.82
67.0	10.69	0.82	72.3	10.44	0.82
67.3	11.71	0.82	72.5	10.07	0.82
67.5	11.13	0.82	72.8	9.98	0.82
67.8	11.43	0.82	73.0	10.37	0.82
68.0	11.00	0.82	73.3	10.20	0.82
68.3	10.97	0.82	73.5	10.41	0.82
68.5	10.92	0.82	73.8	9.91	0.82
68.8	9.38	0.82	74.0	9.97	0.82
69.0	9.52	0.82	74.3	9.90	0.82
69.3	9.50	0.82	74.5	9.67	0.82
69.5	9.66	0.82	74.8	9.87	0.82
69.8	9.55	0.82	75.0	10.45	0.82
70.0	9.82	0.82	-	-	-

END.

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