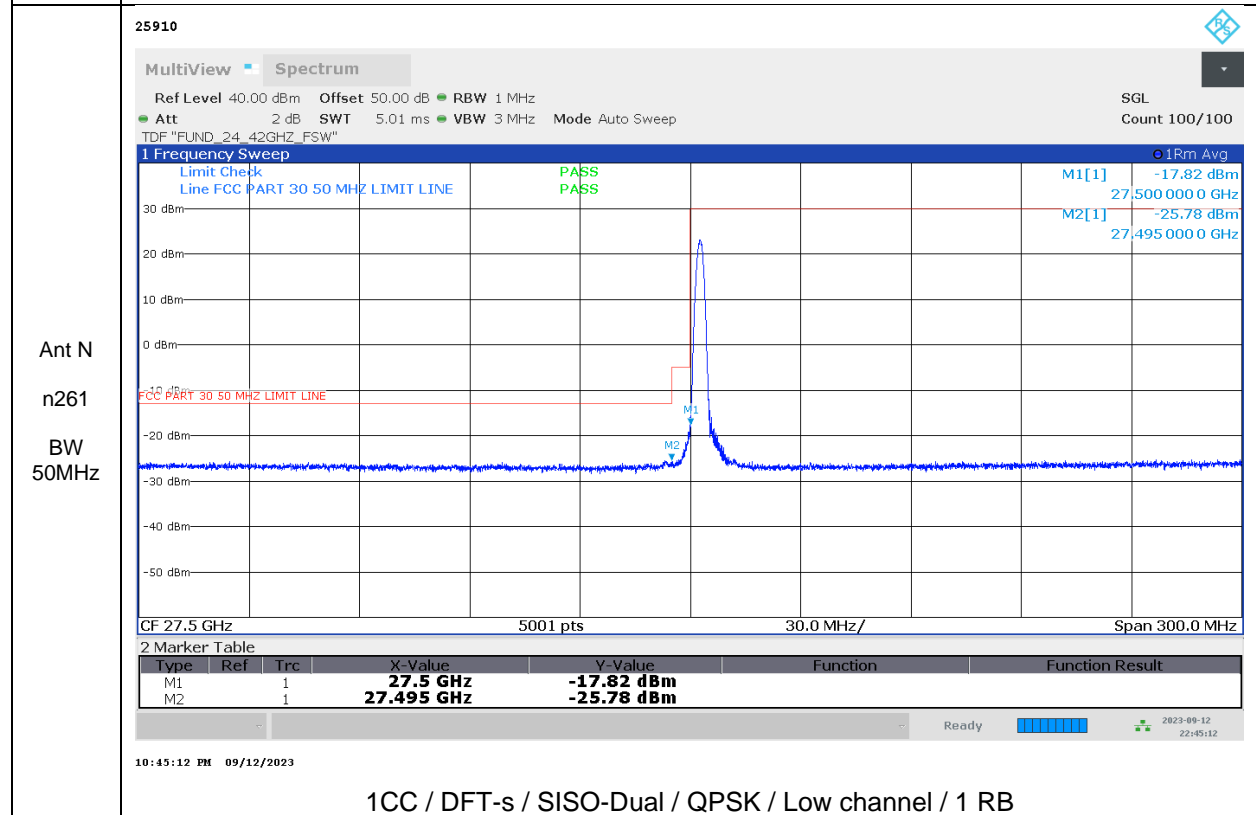
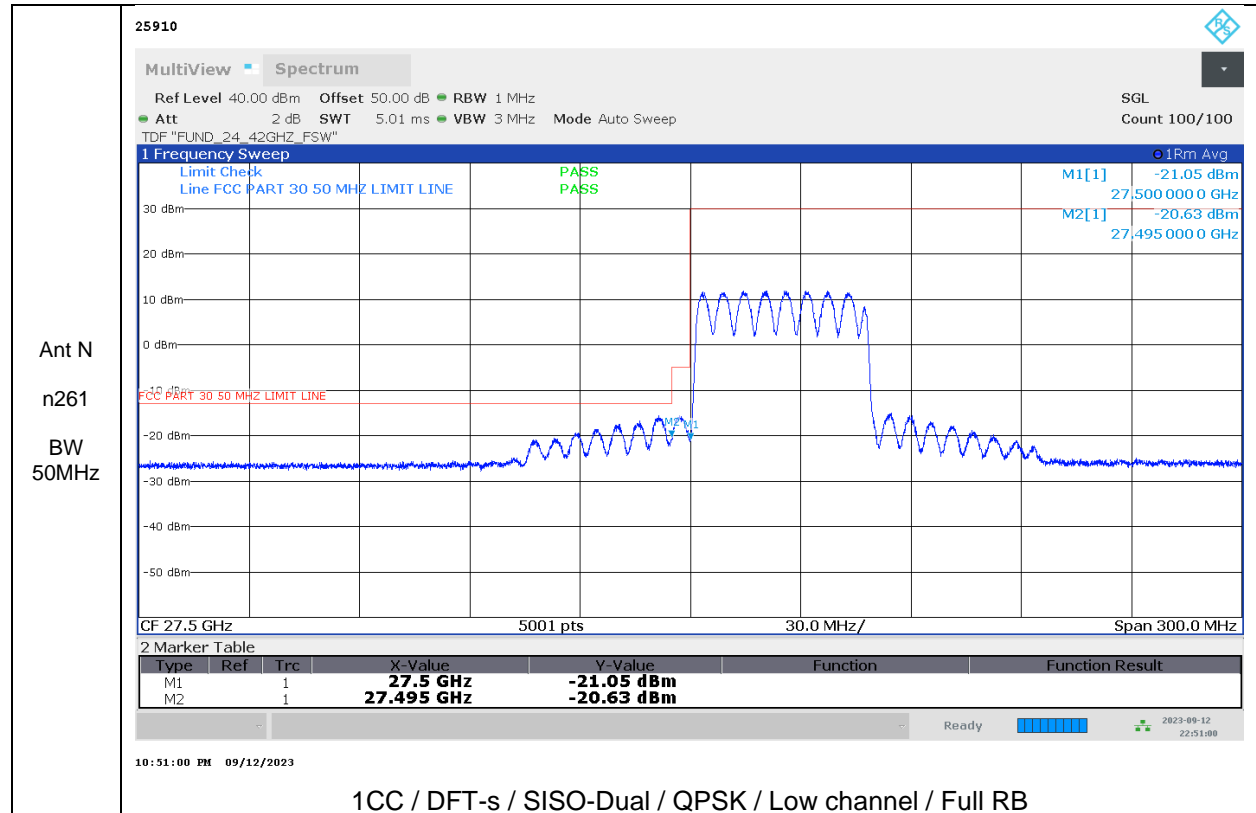
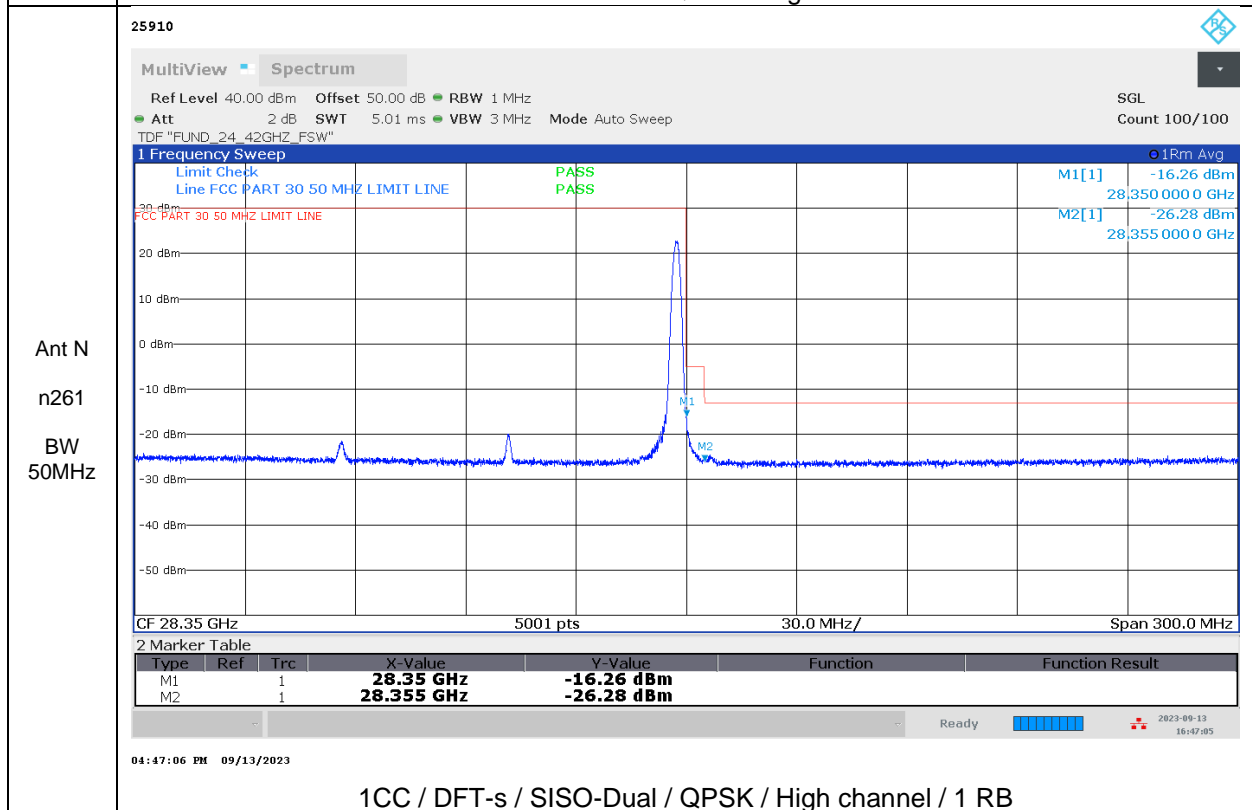
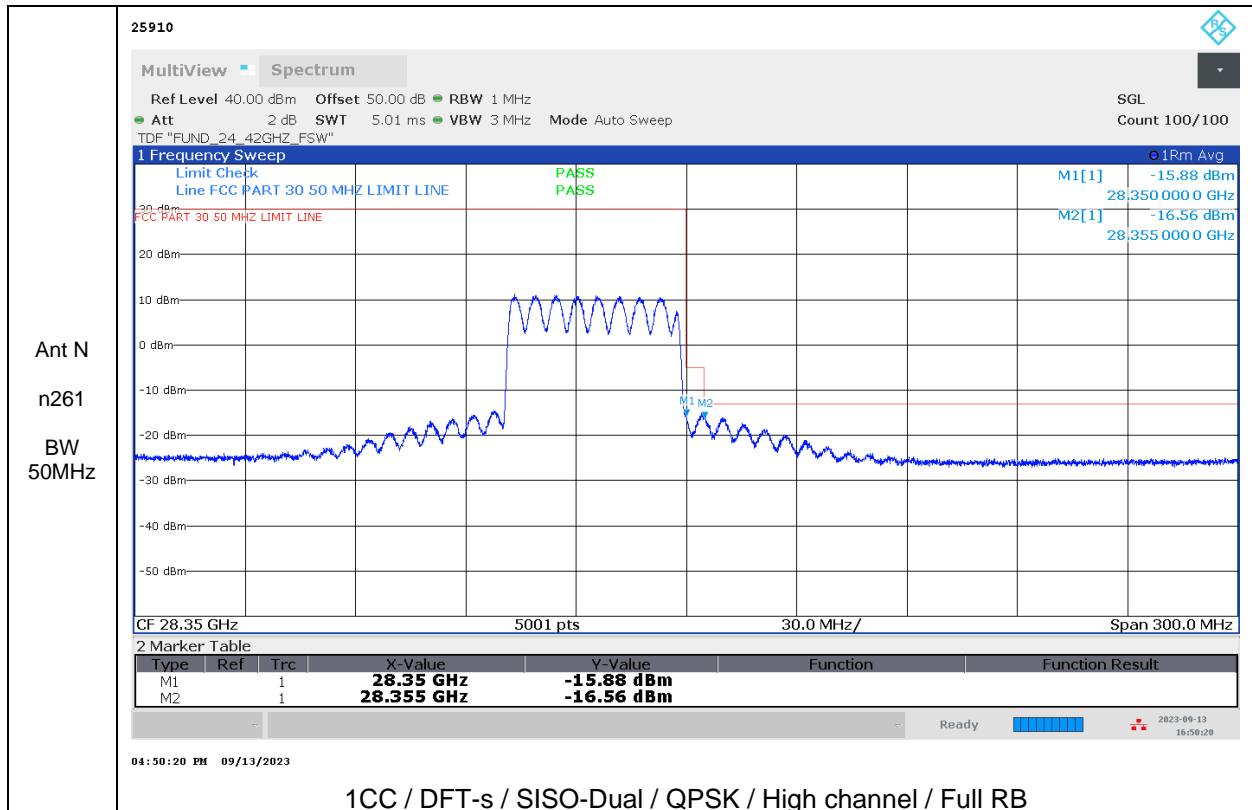
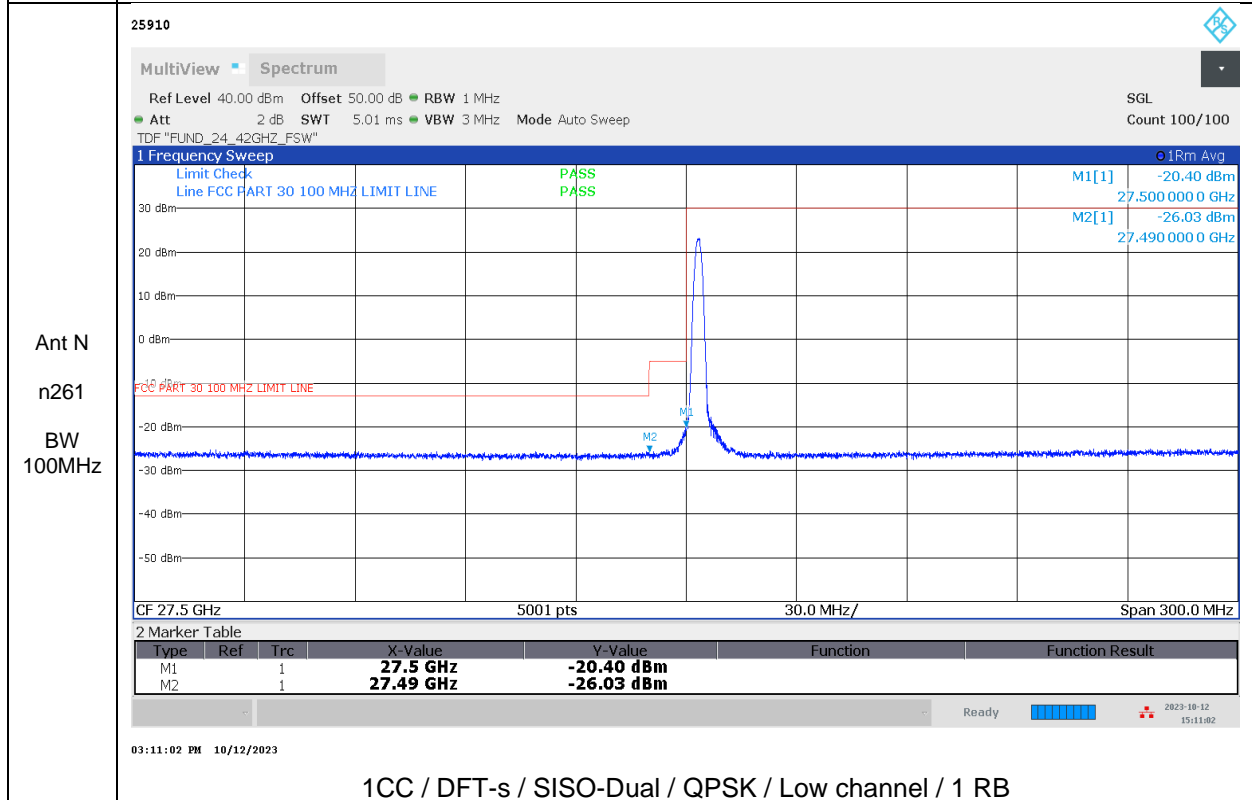
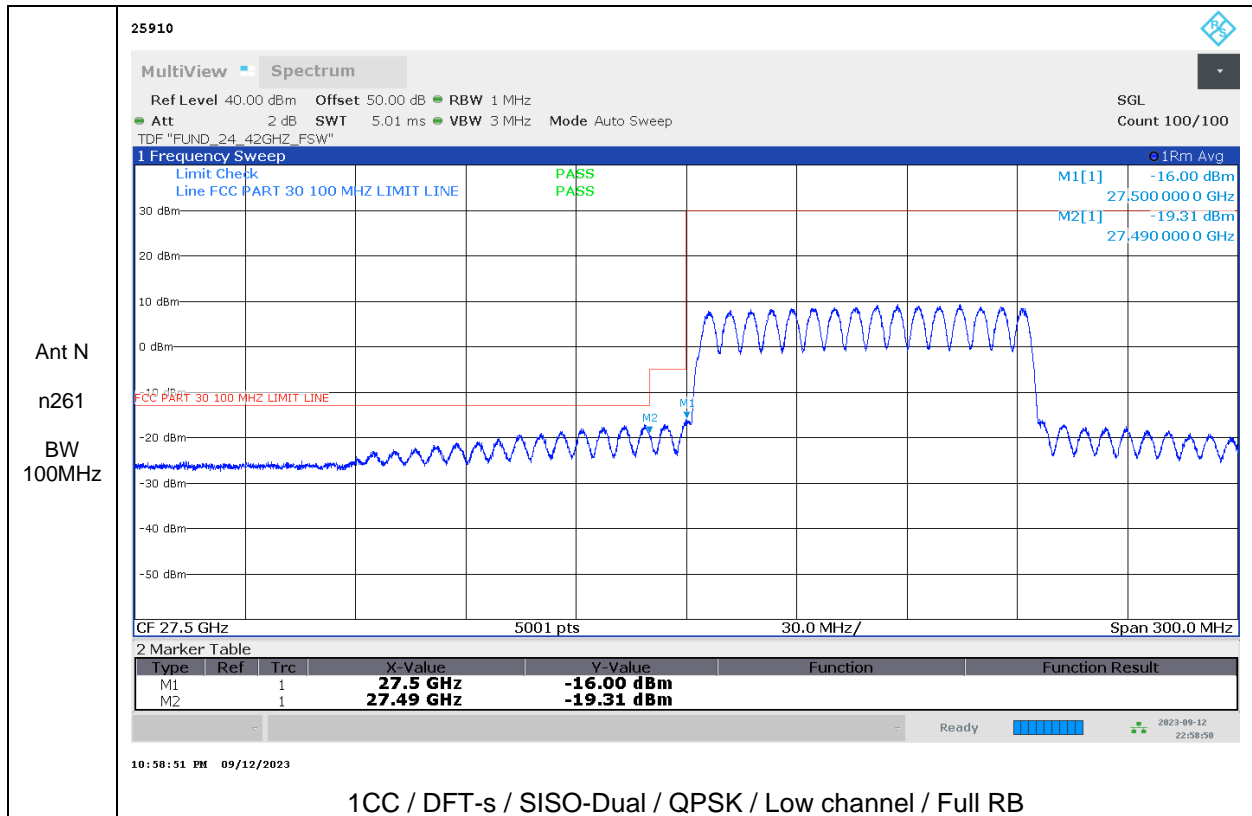
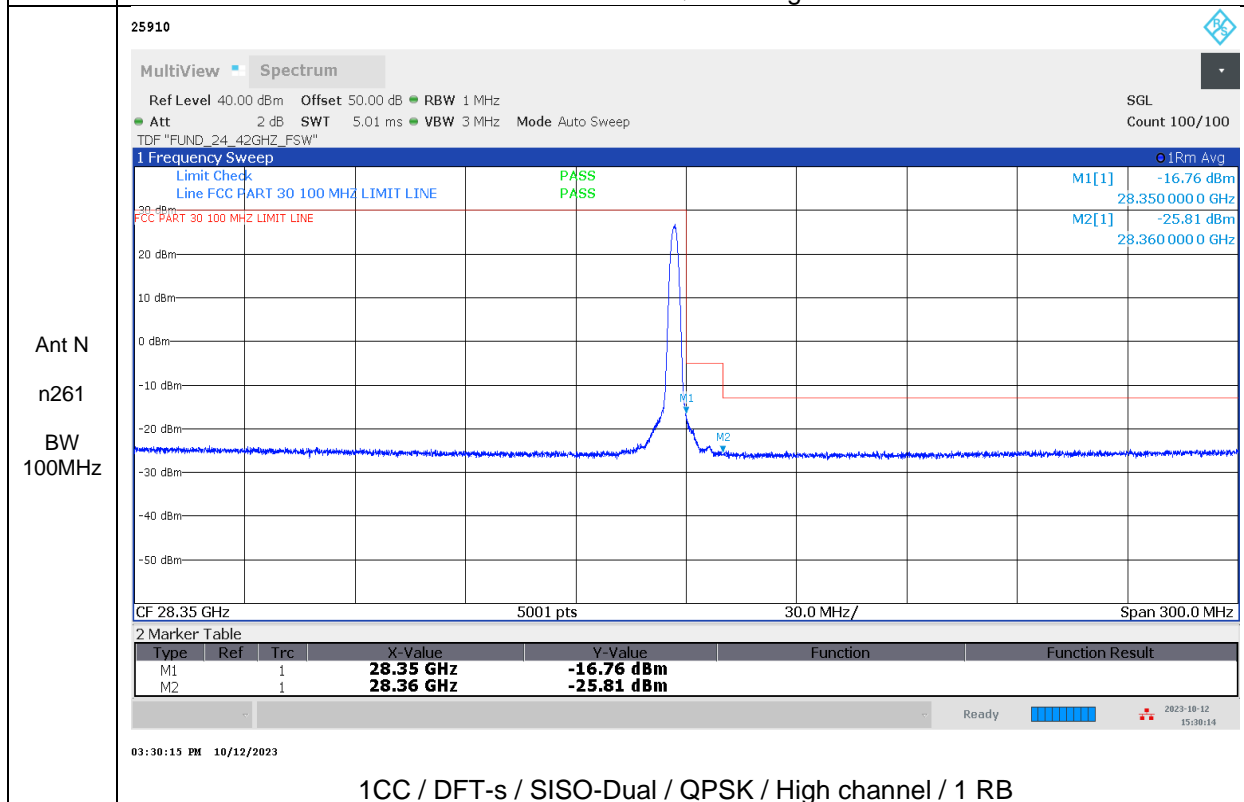
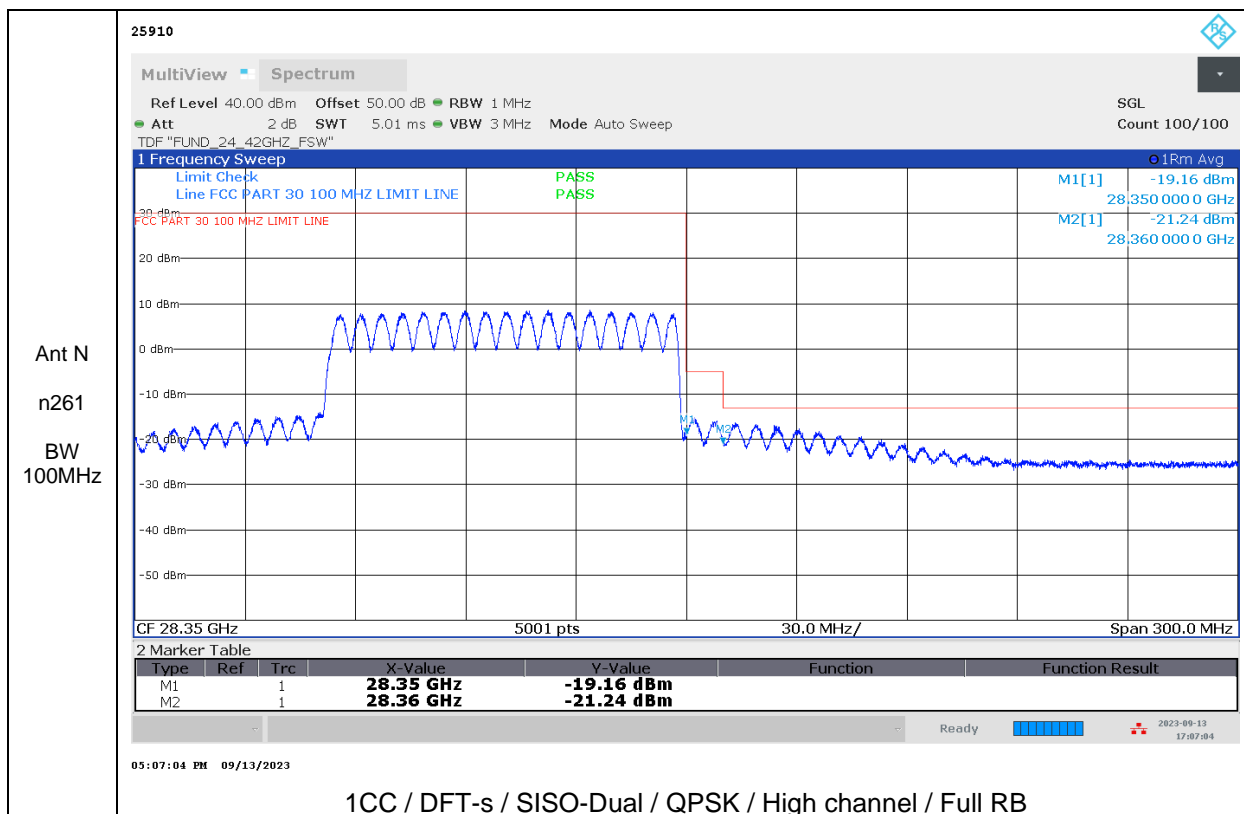


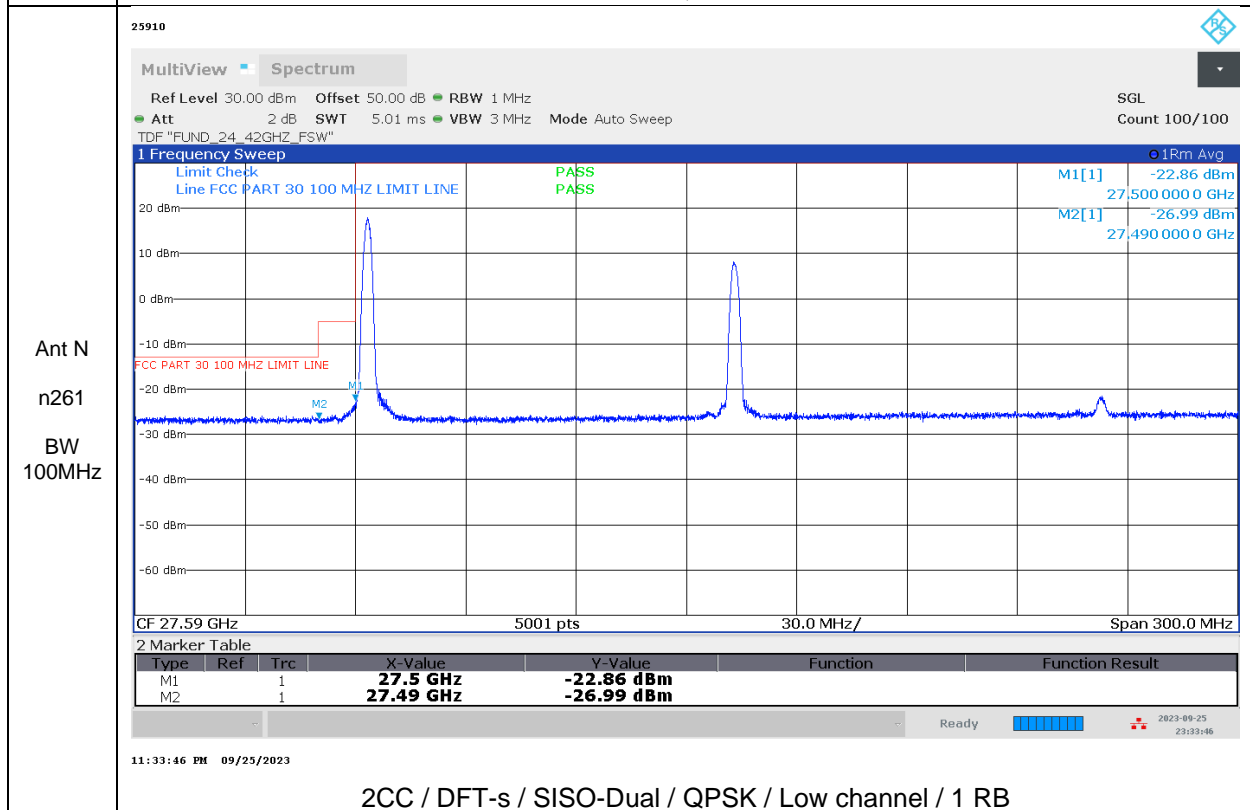
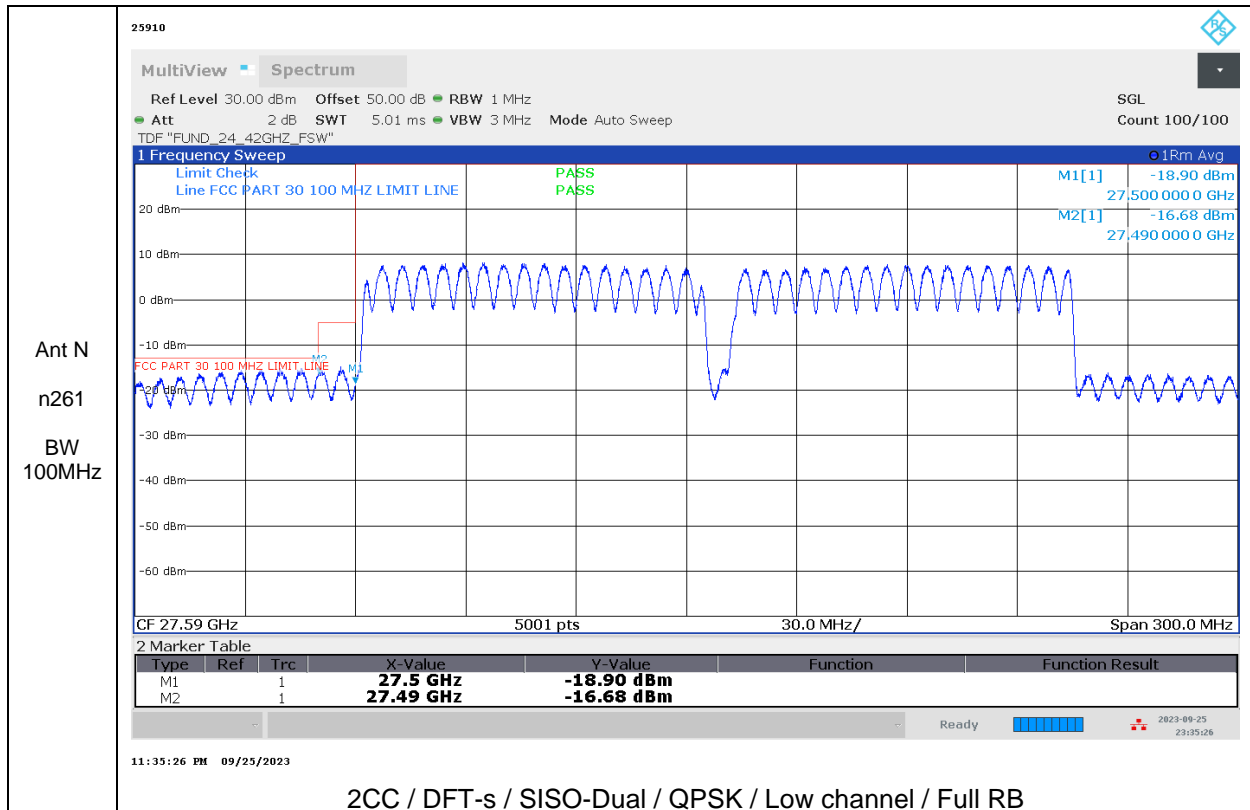
Antenna 2 / Ant N / Band n261

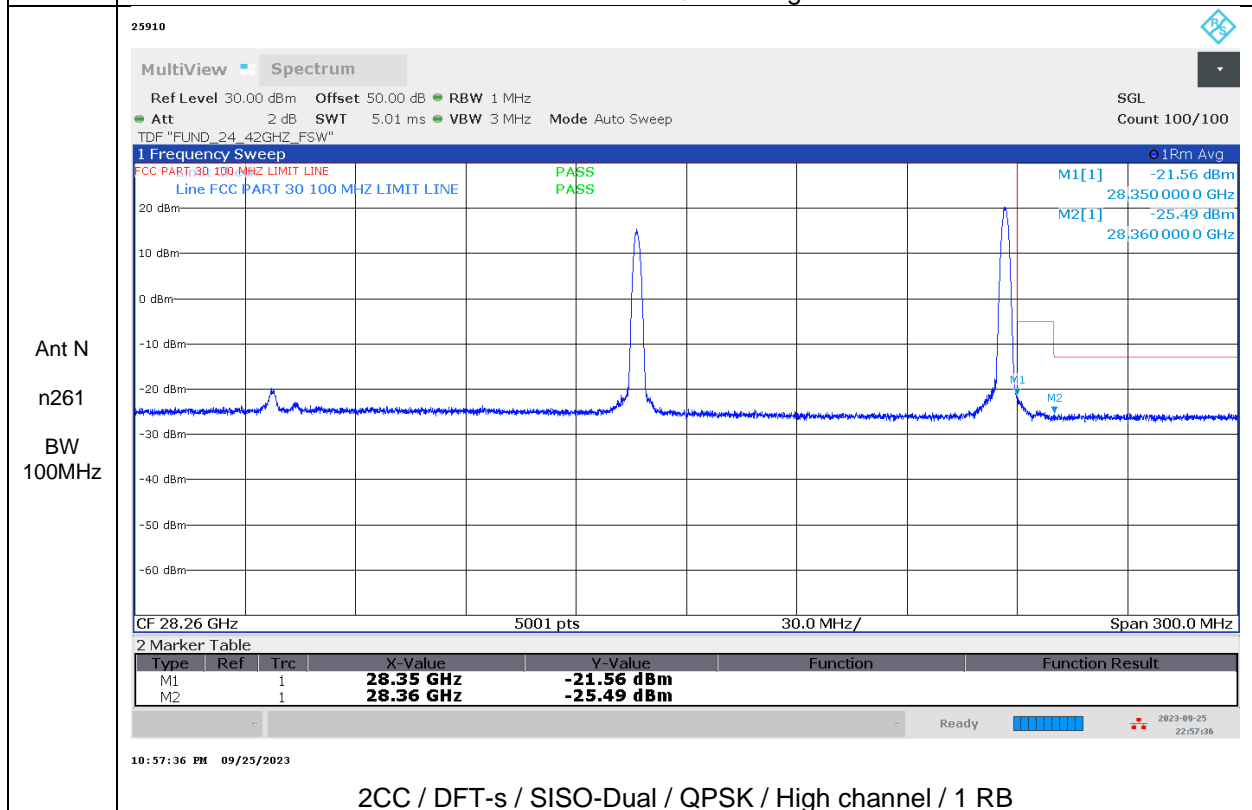
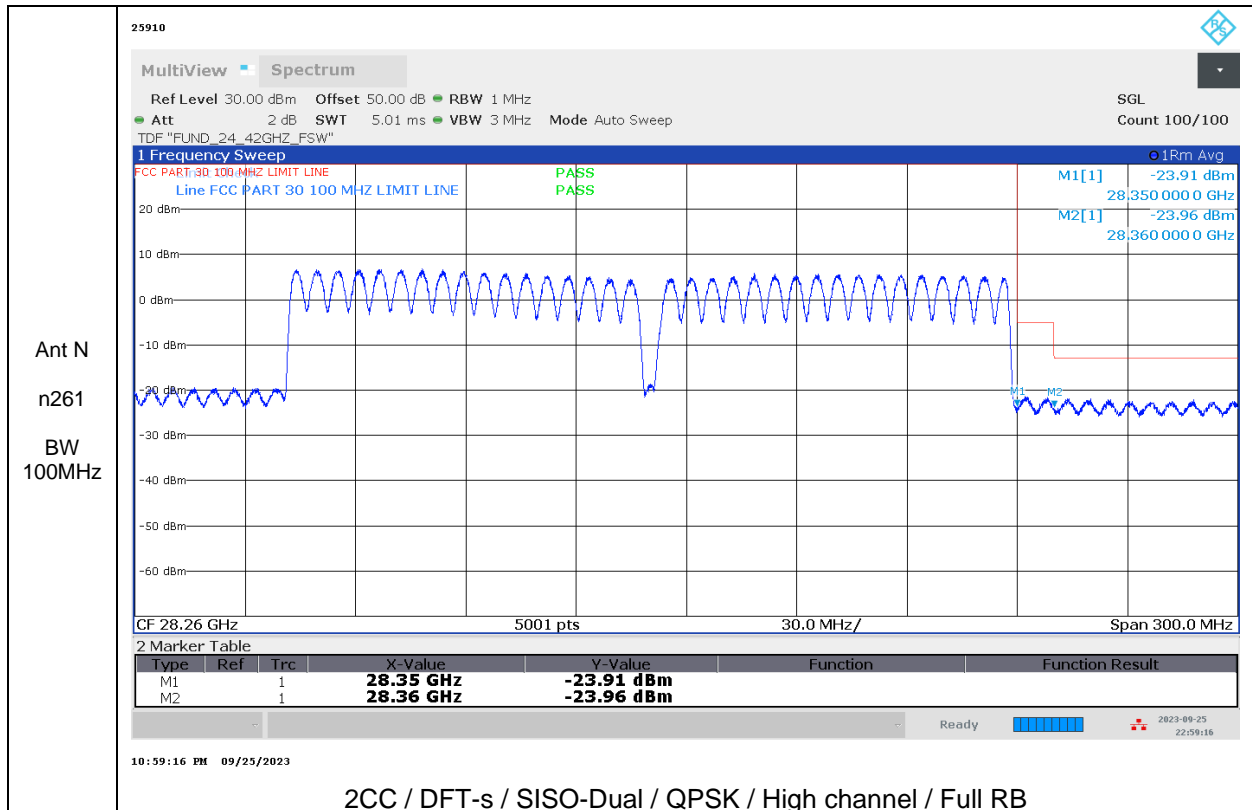


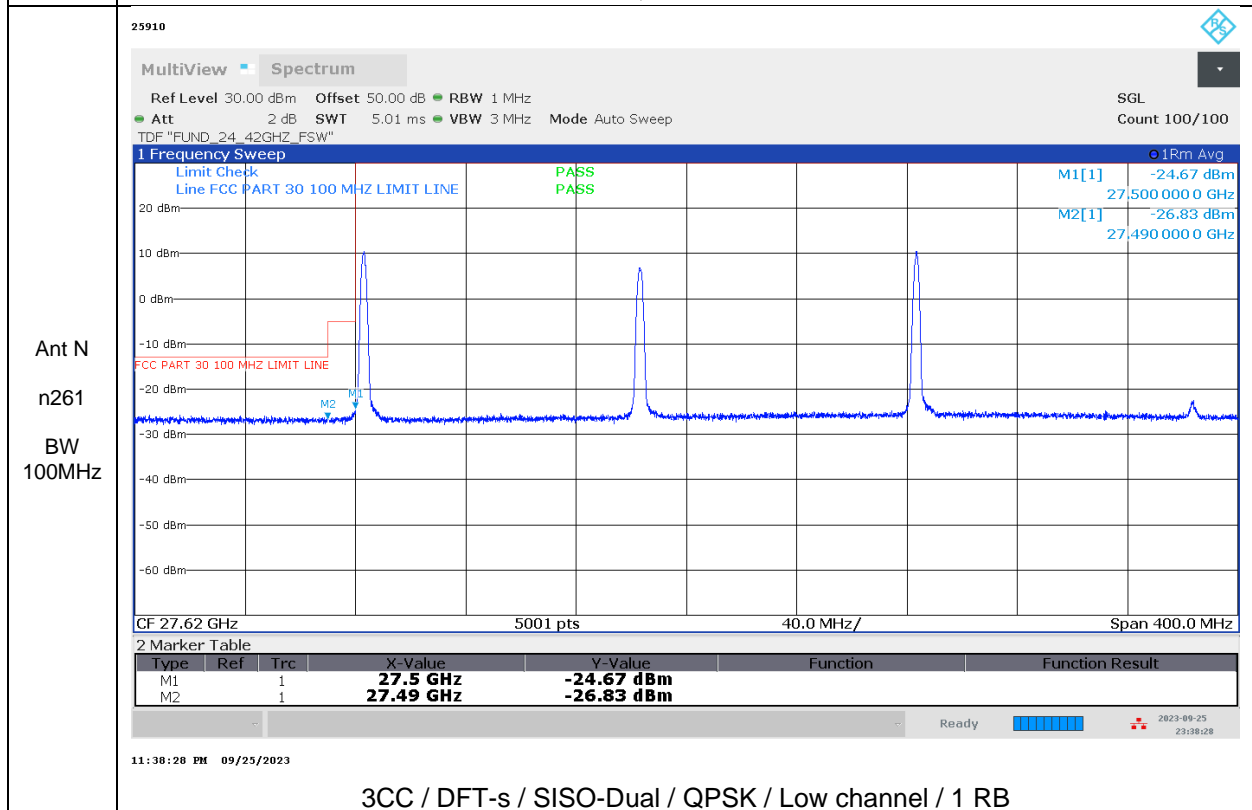
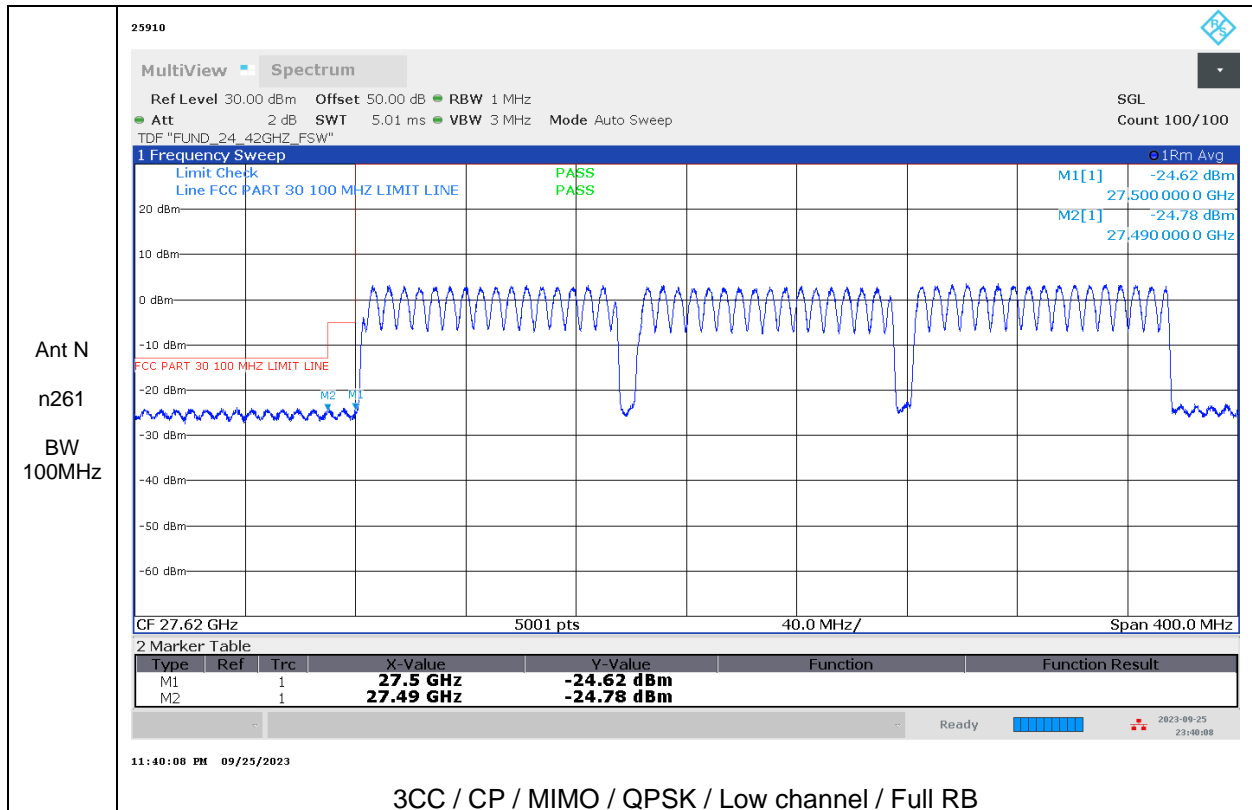


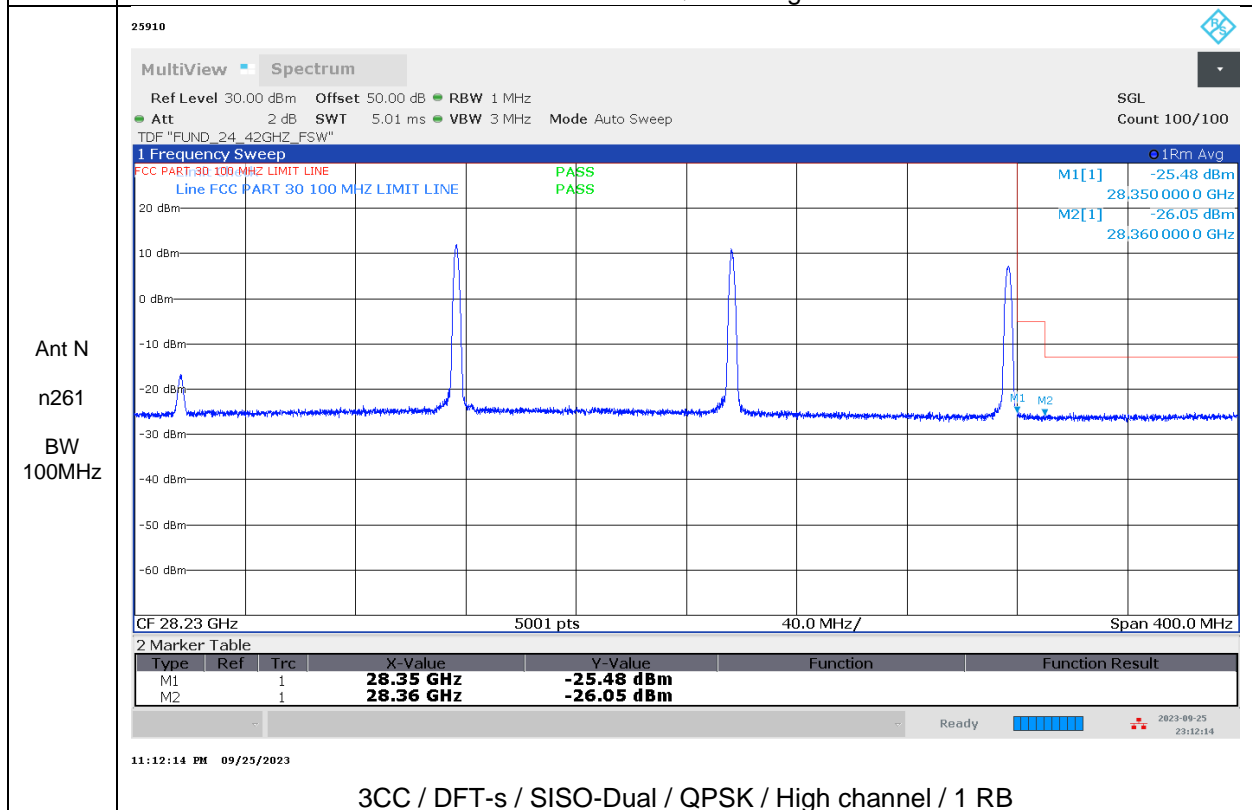
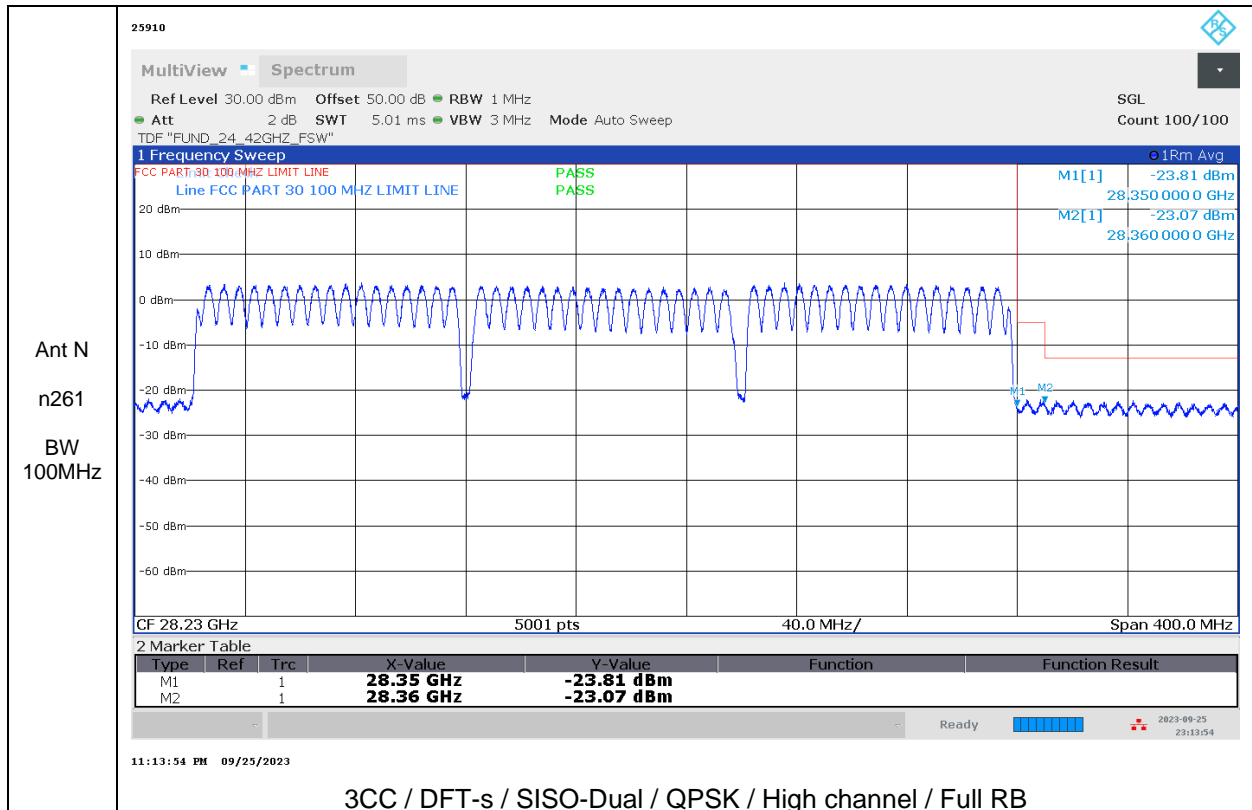


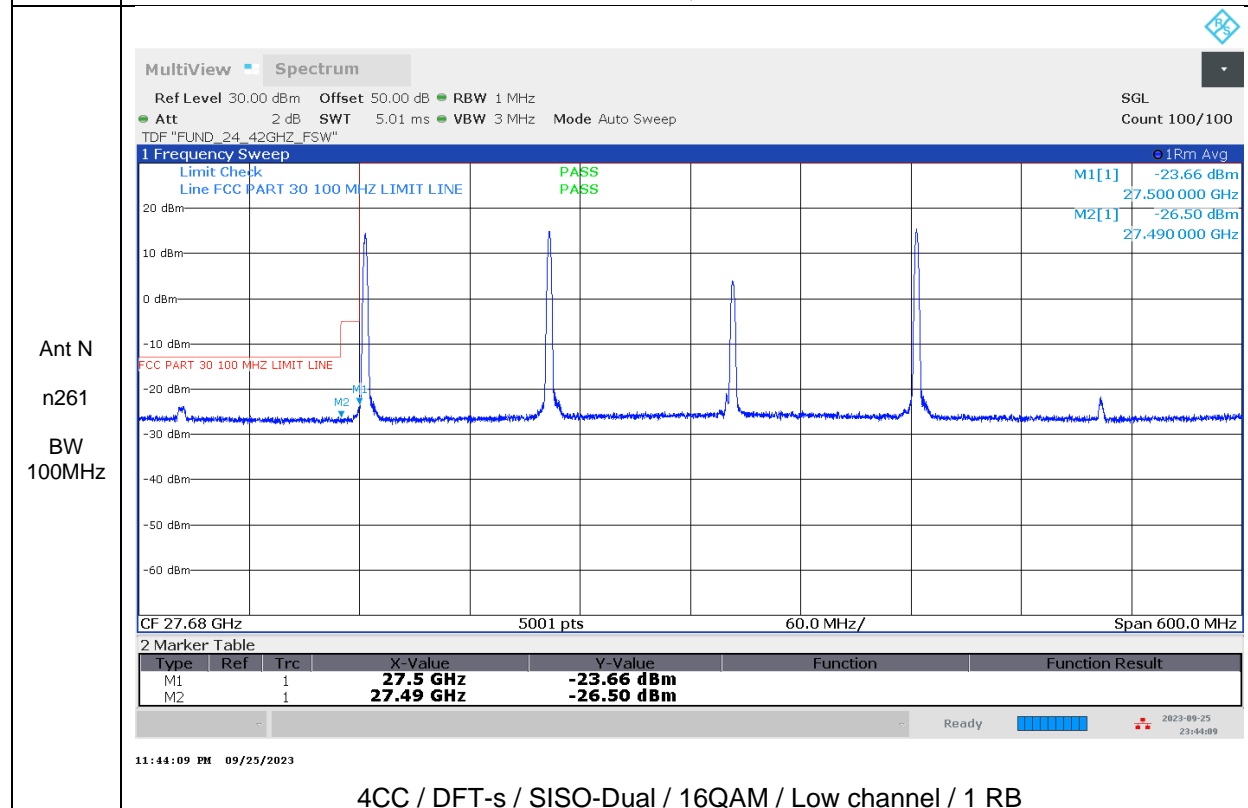
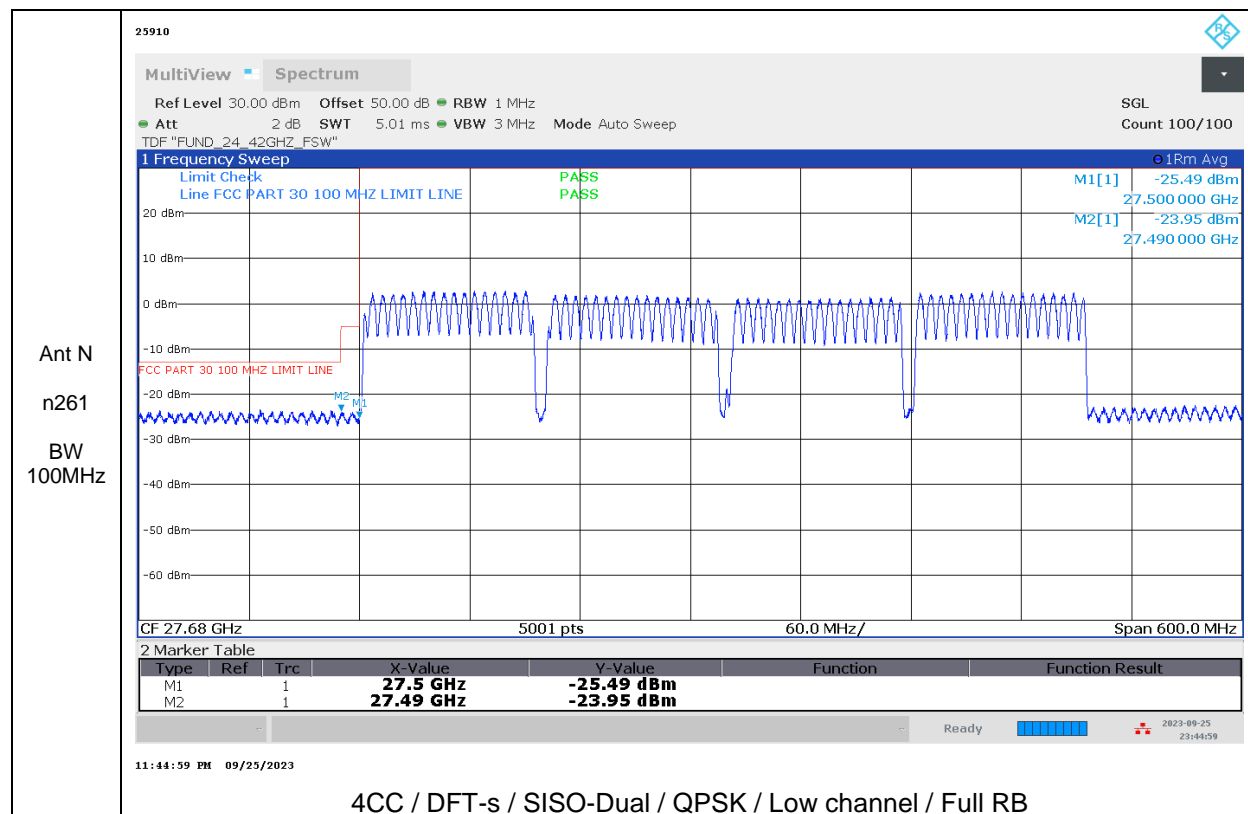


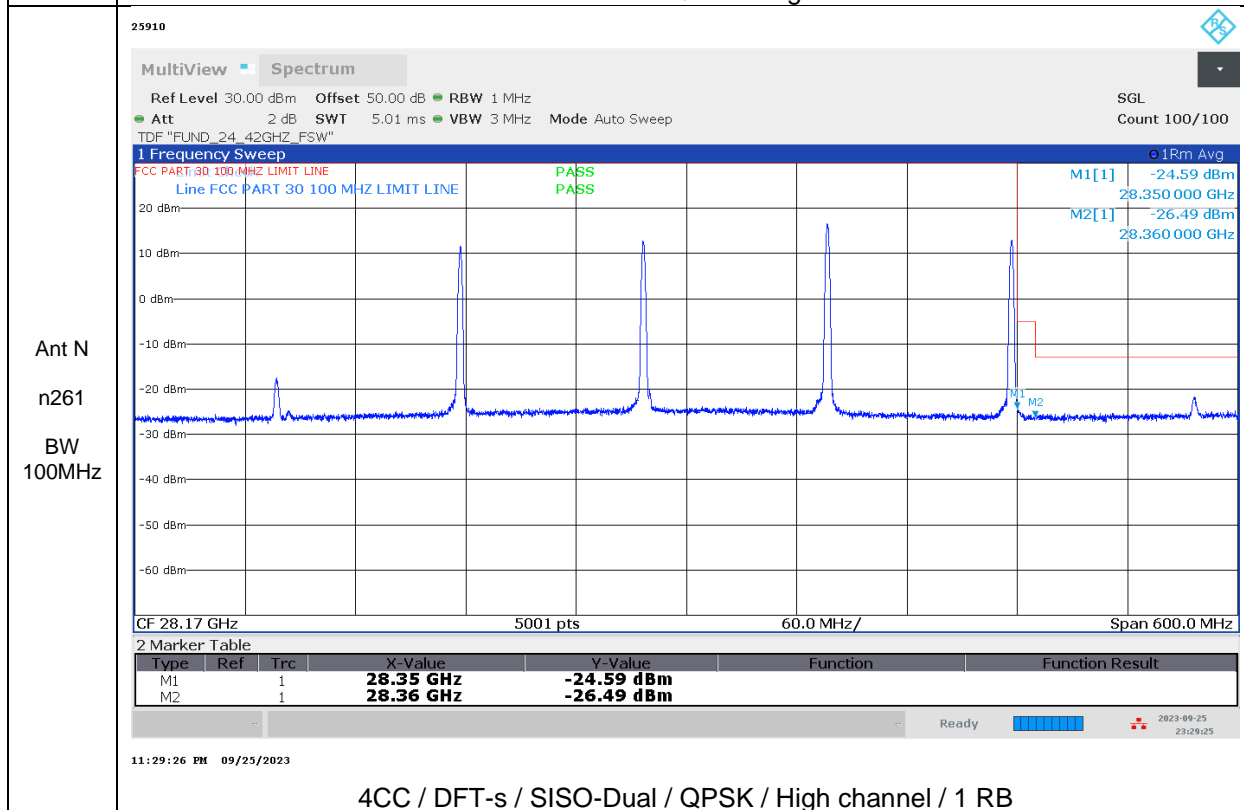
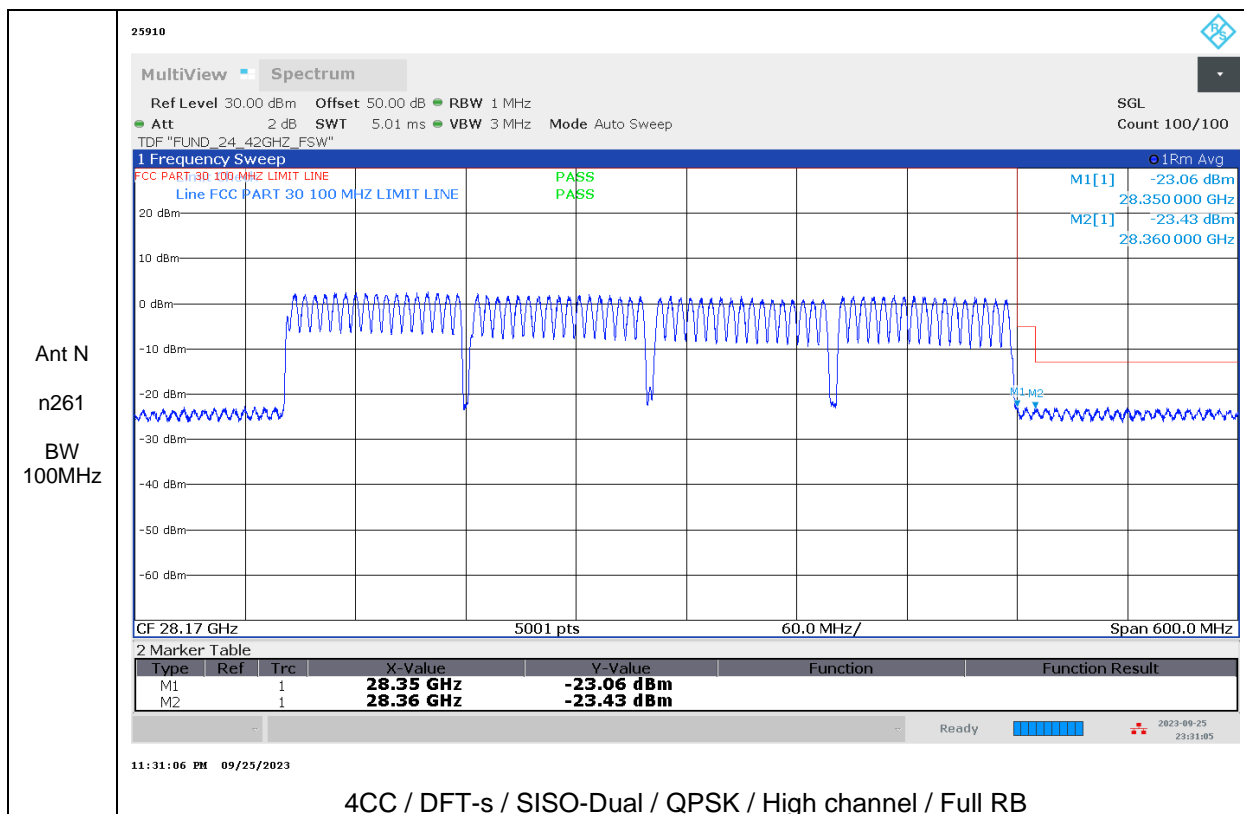




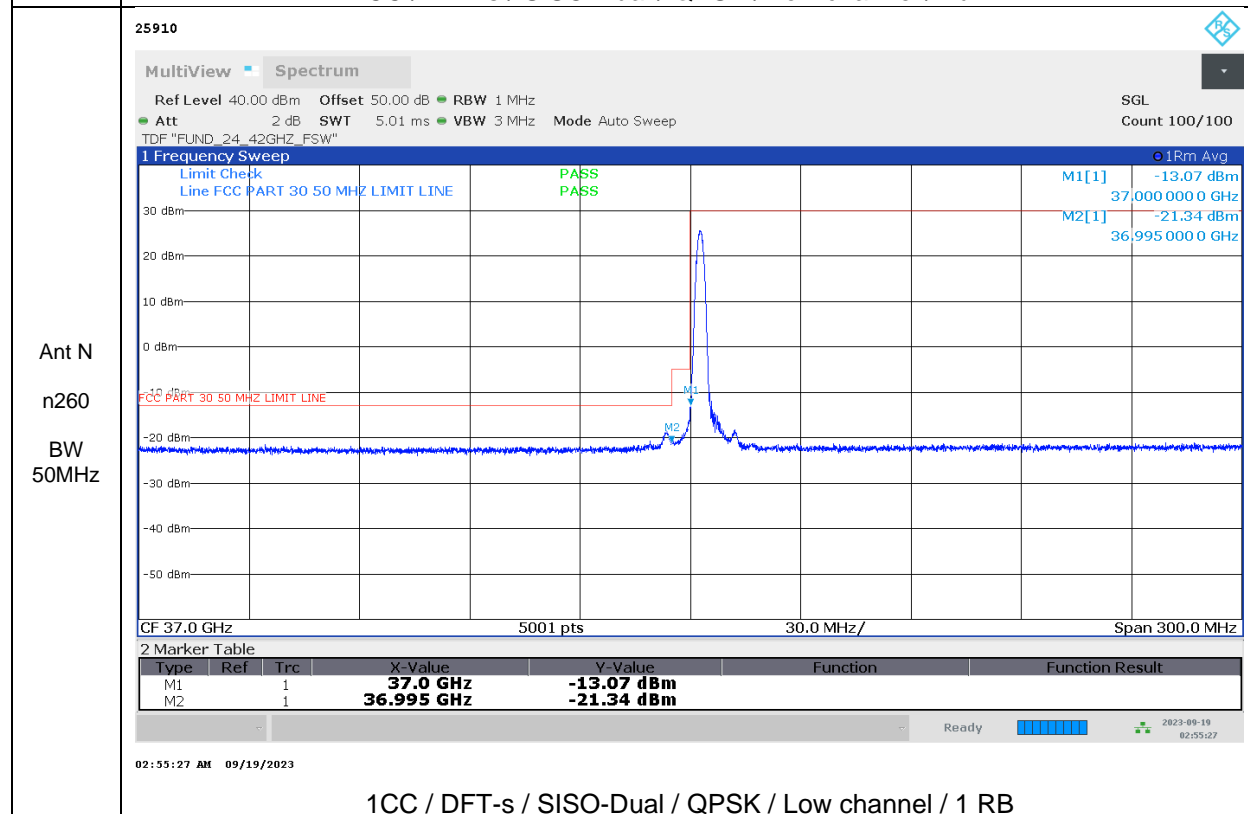
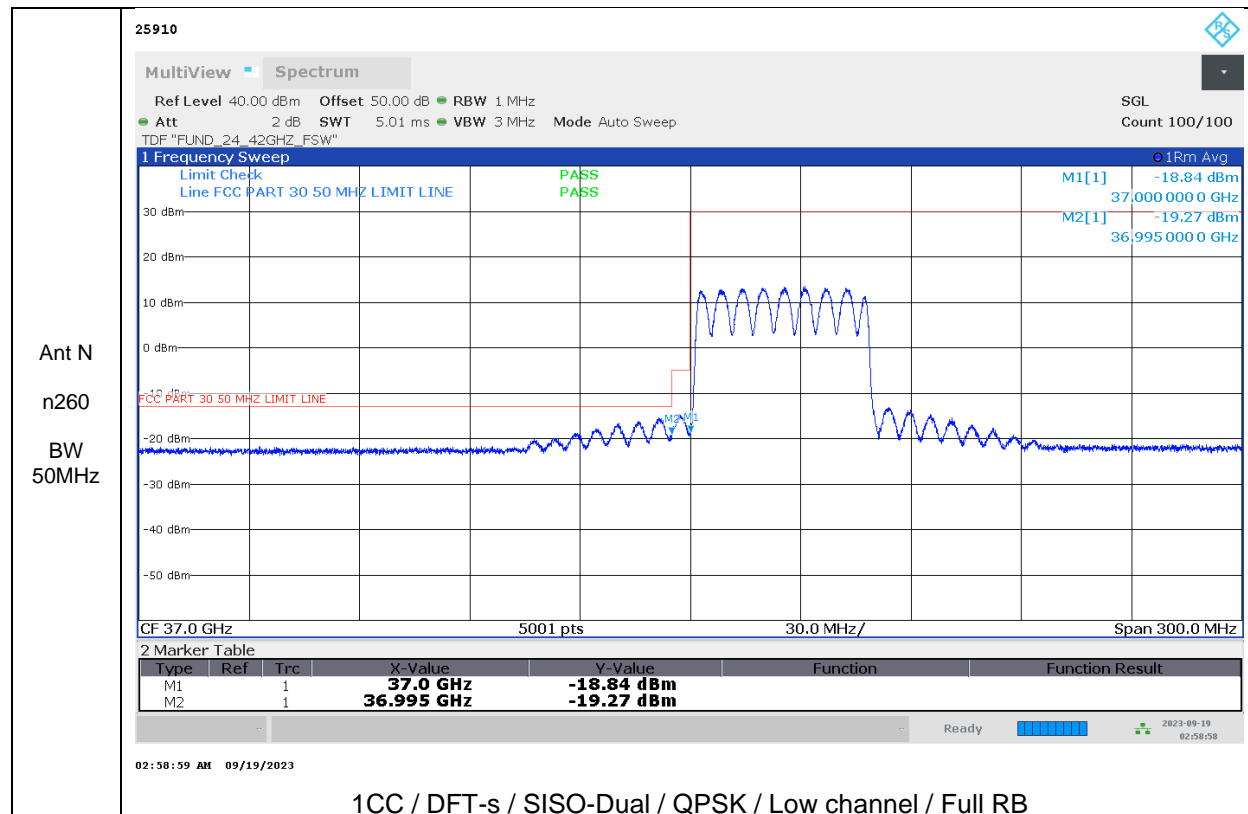


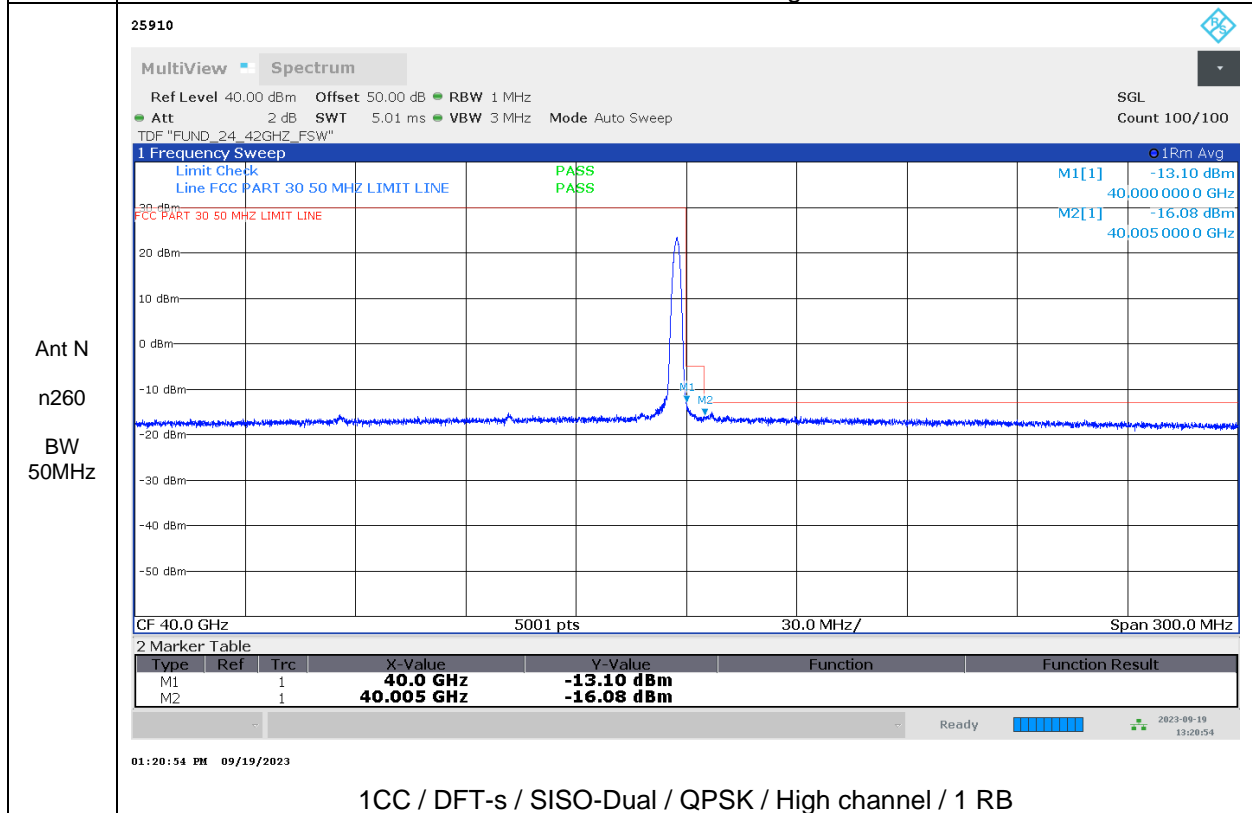
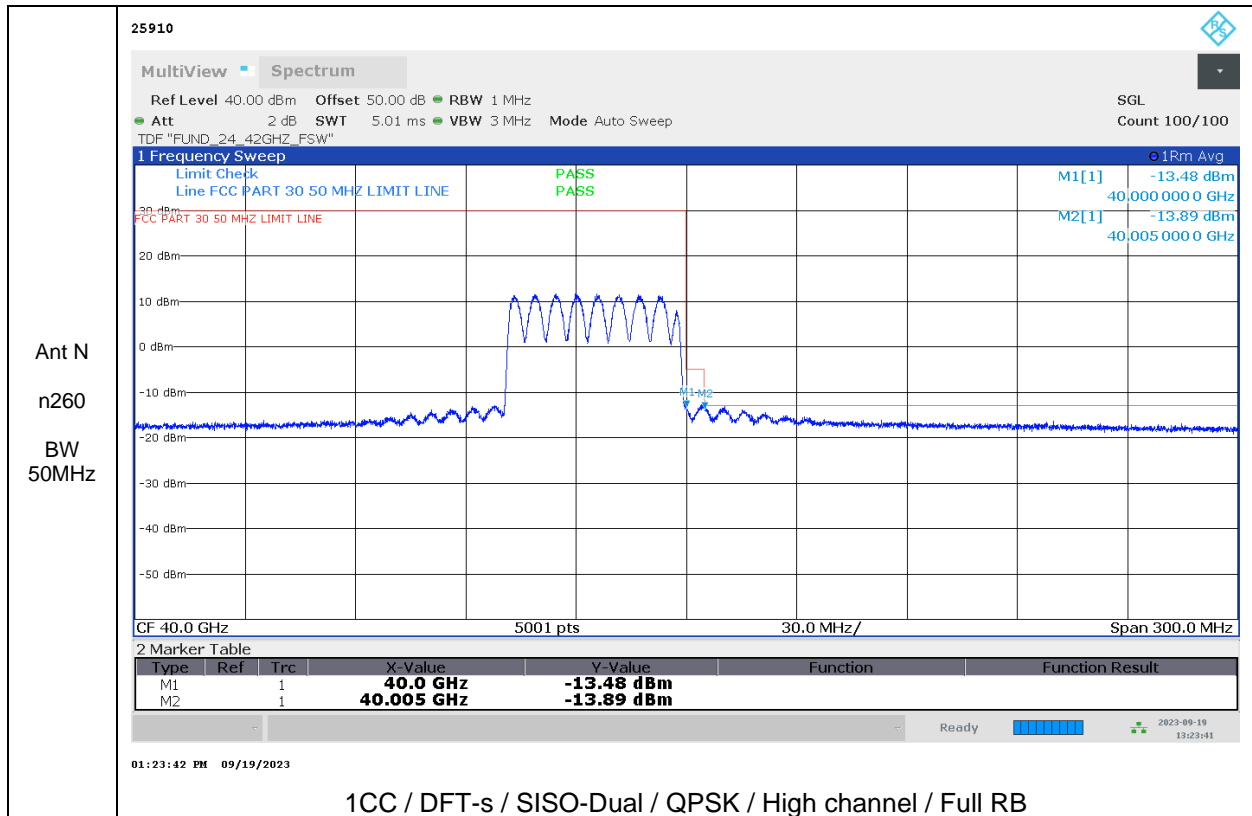


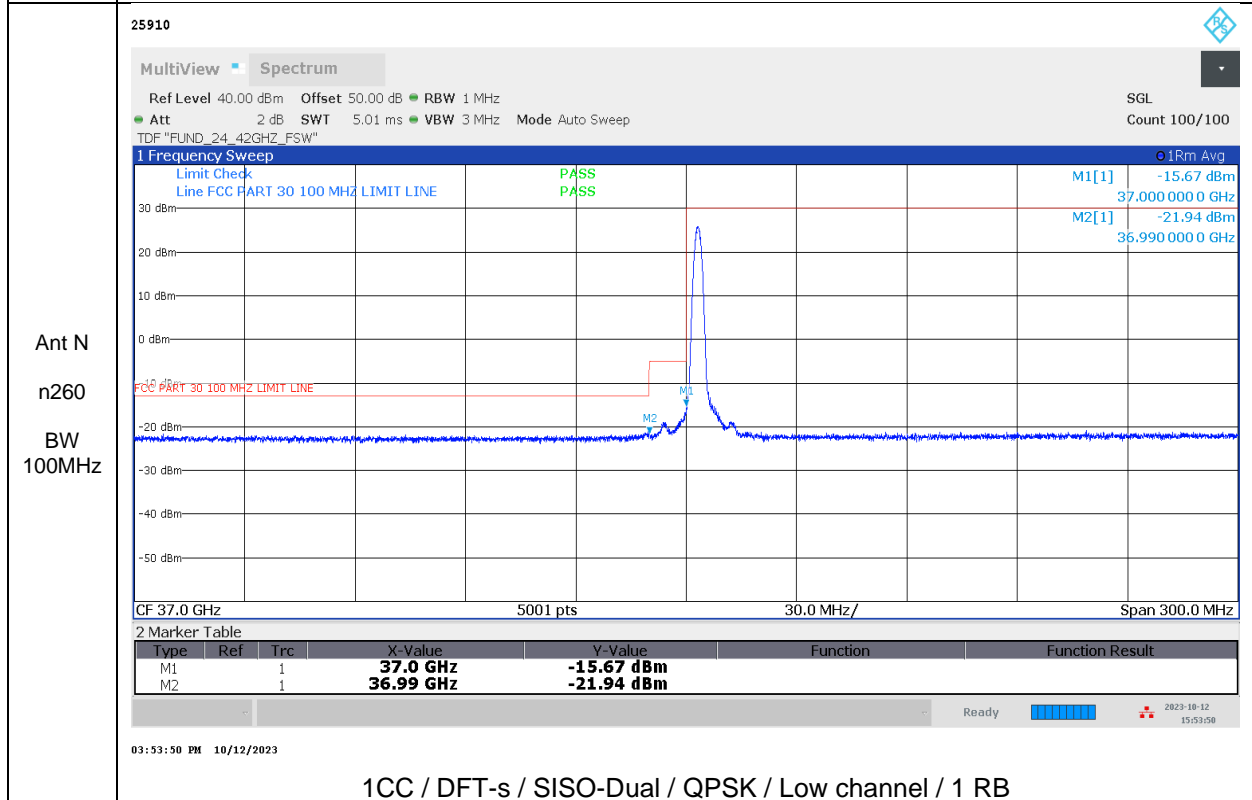
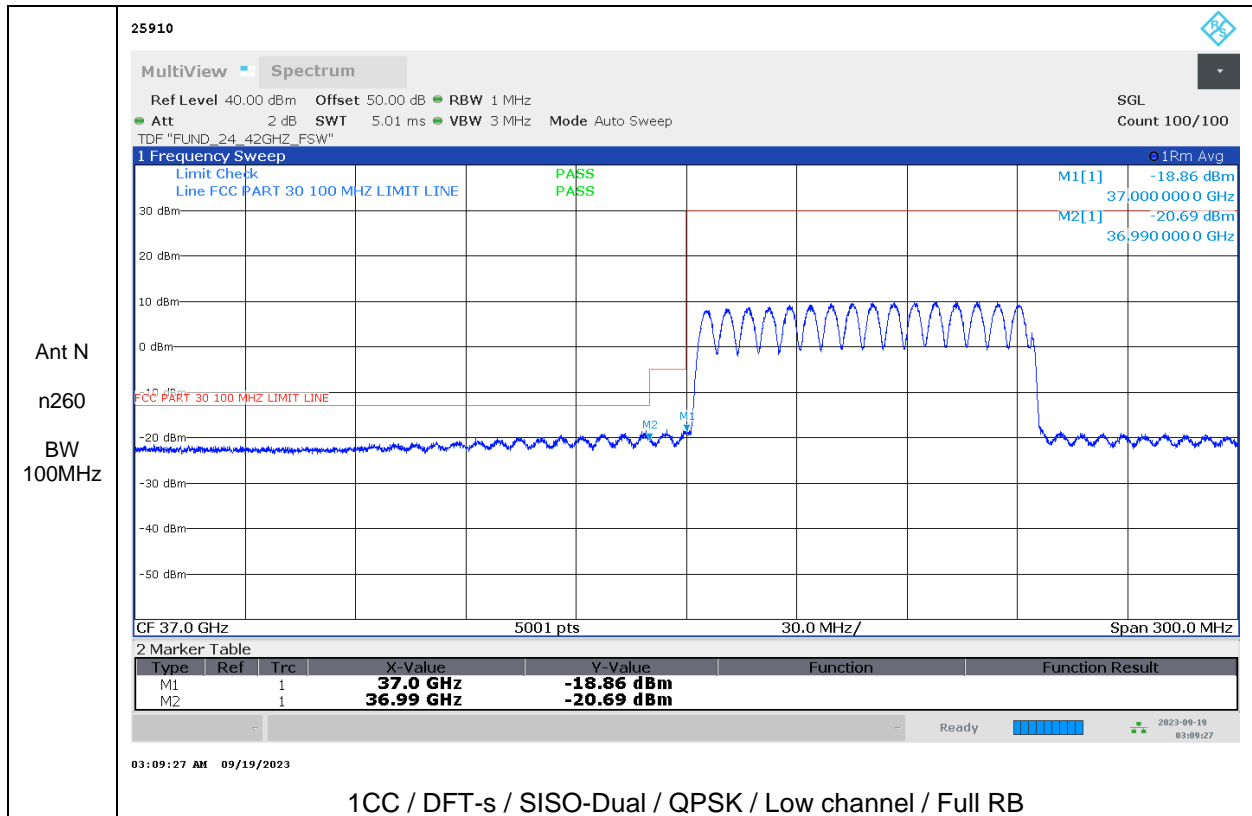


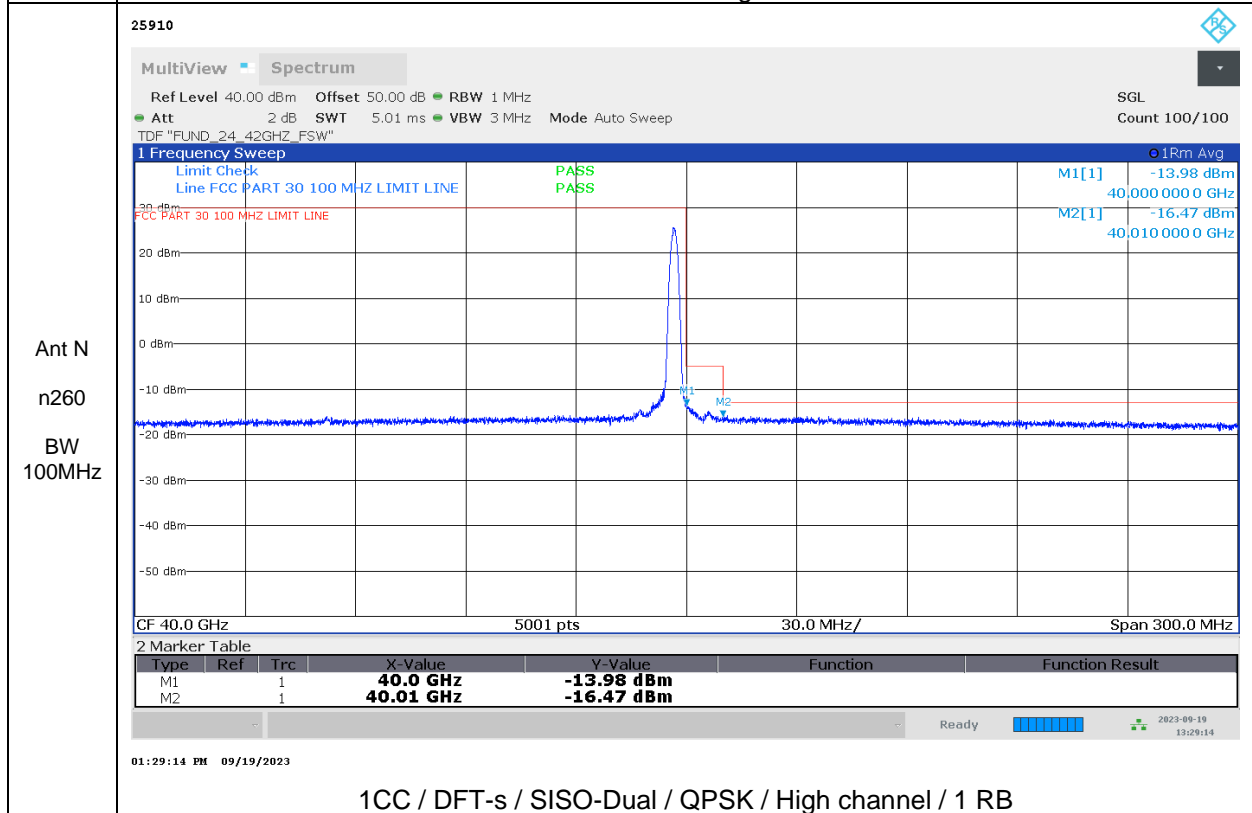
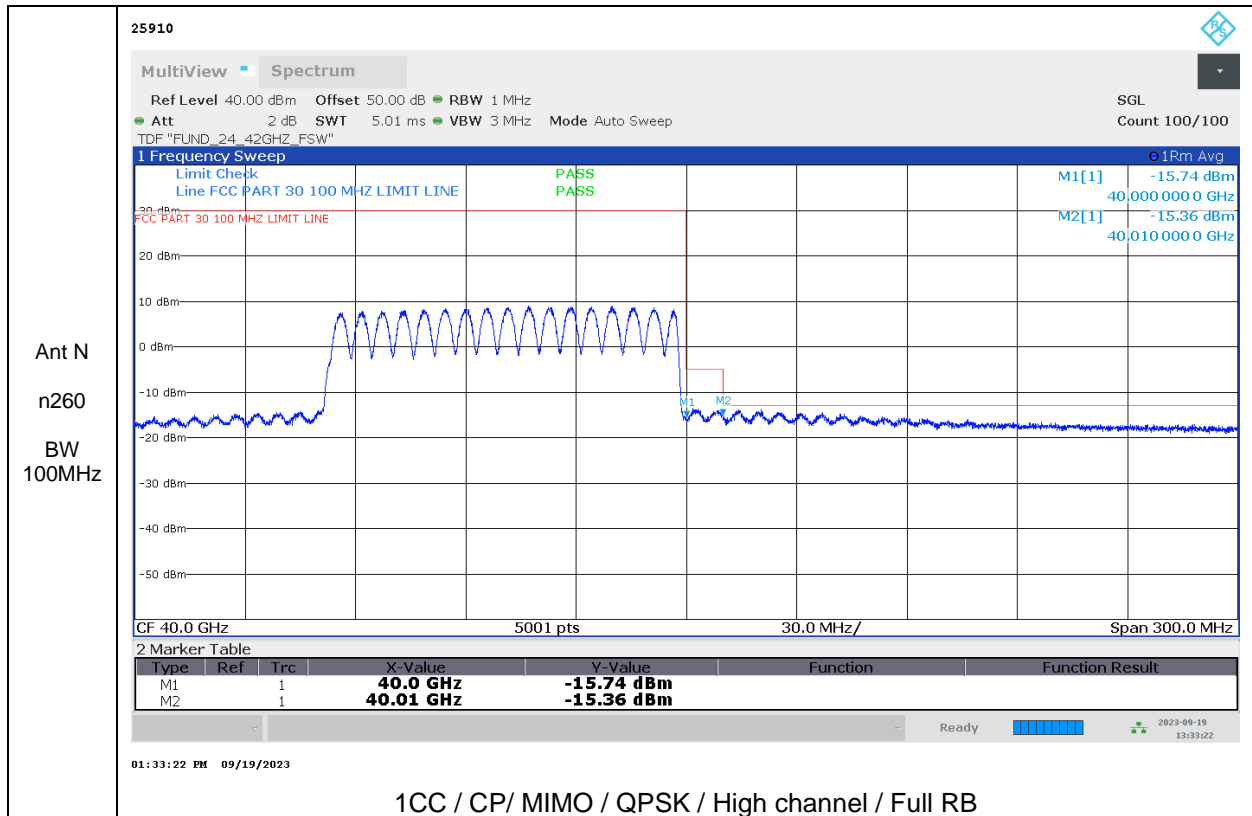


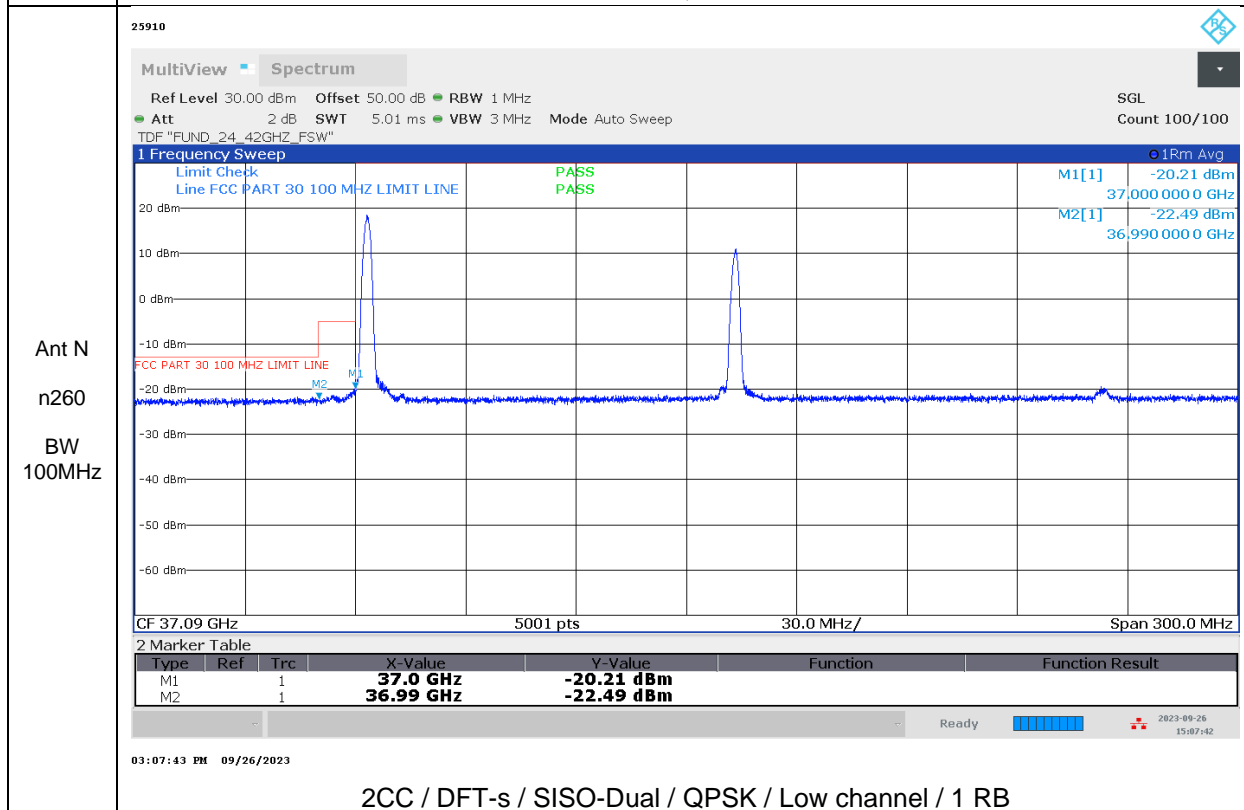
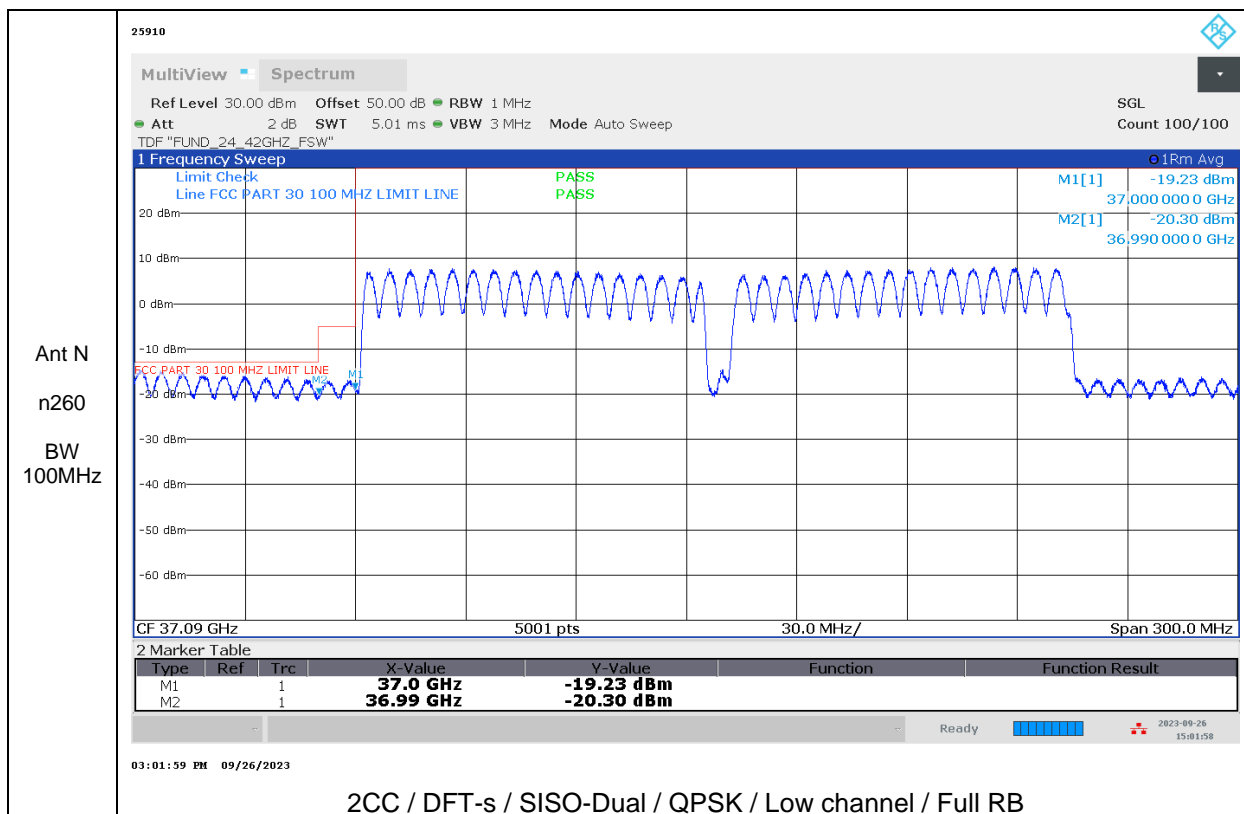
Antenna 2 / Ant N / Band n260

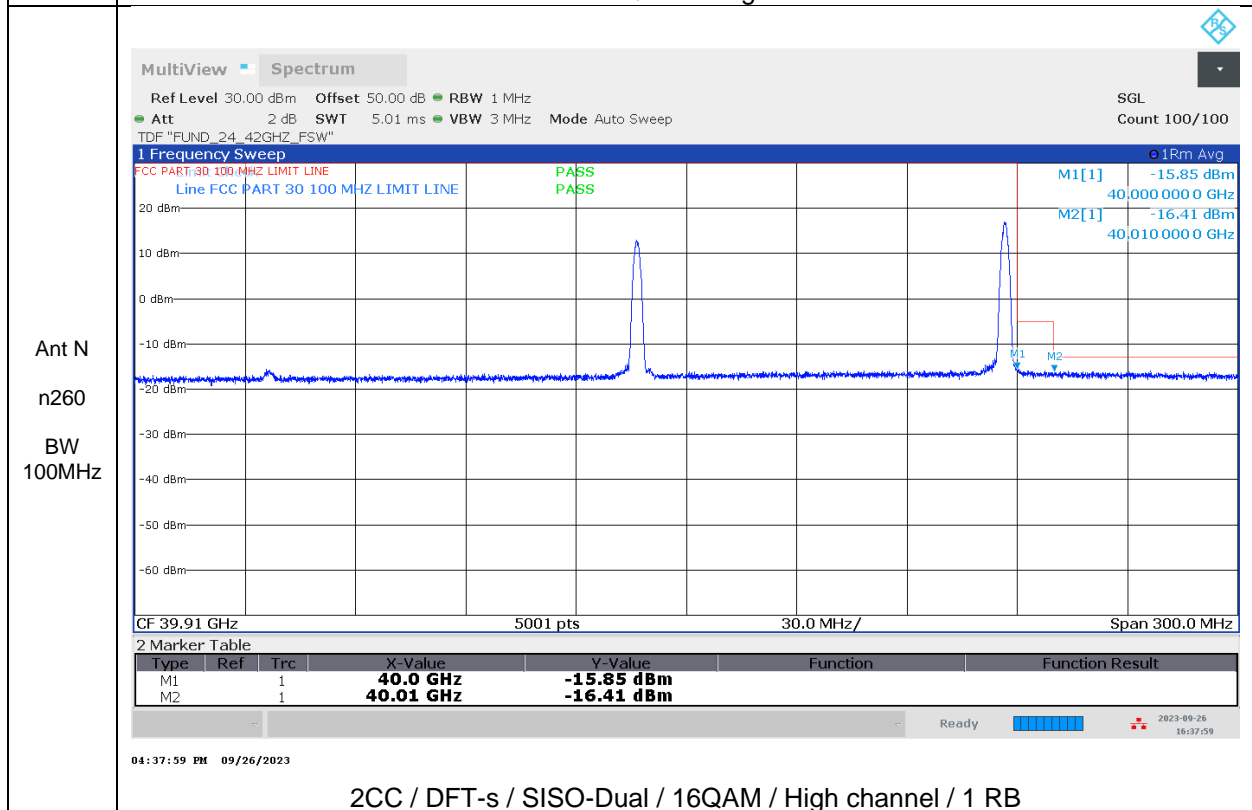
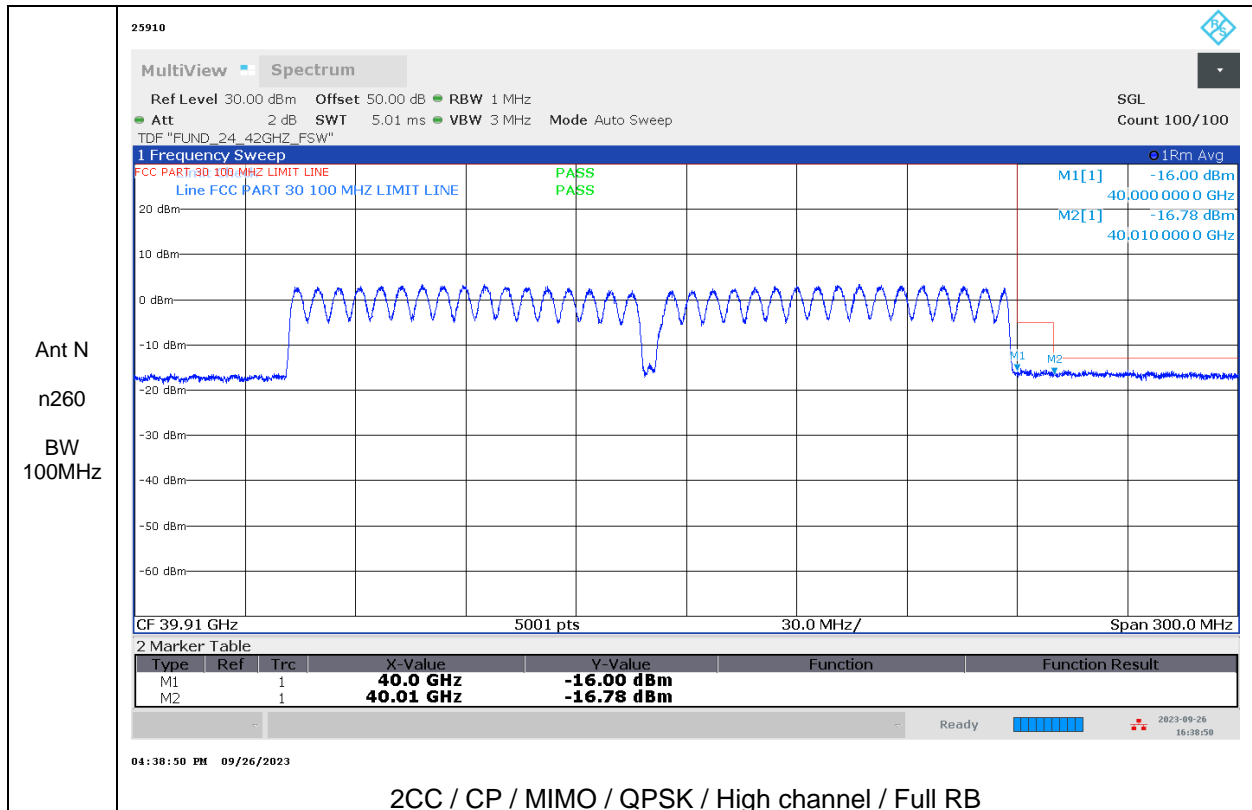


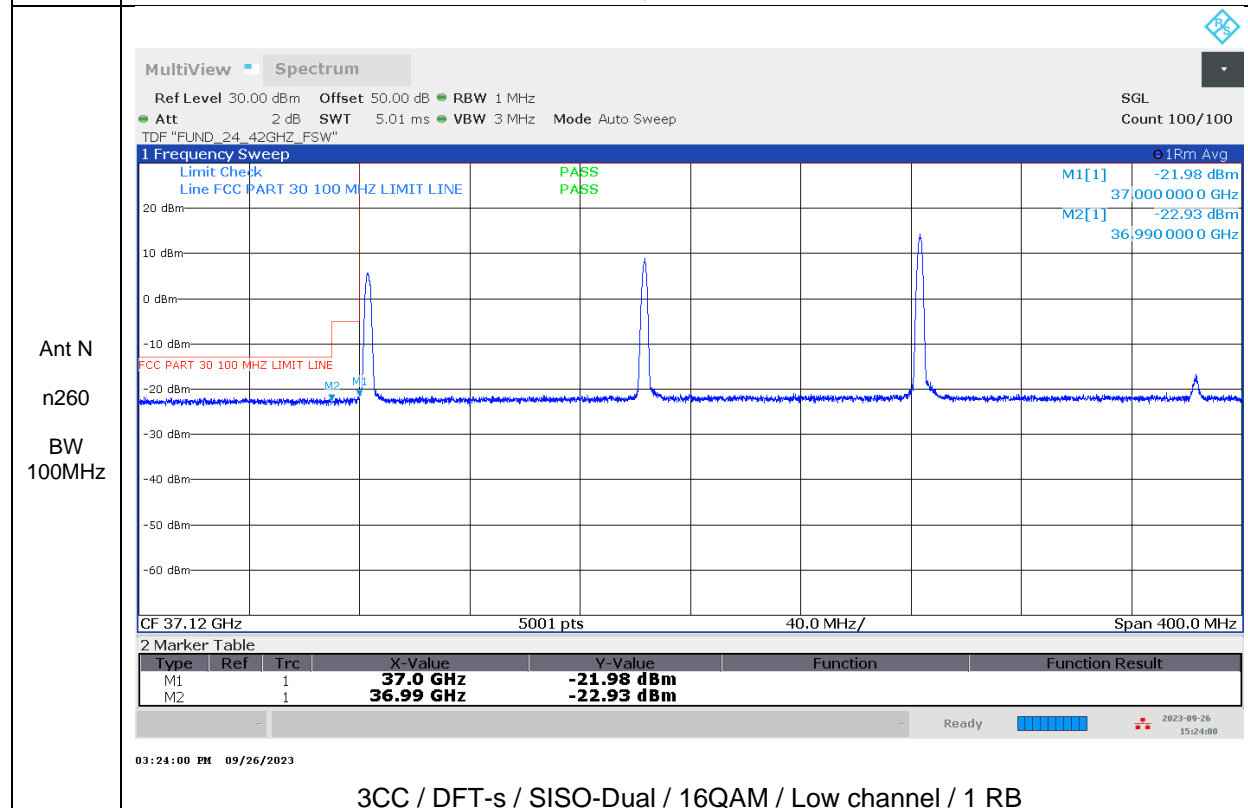
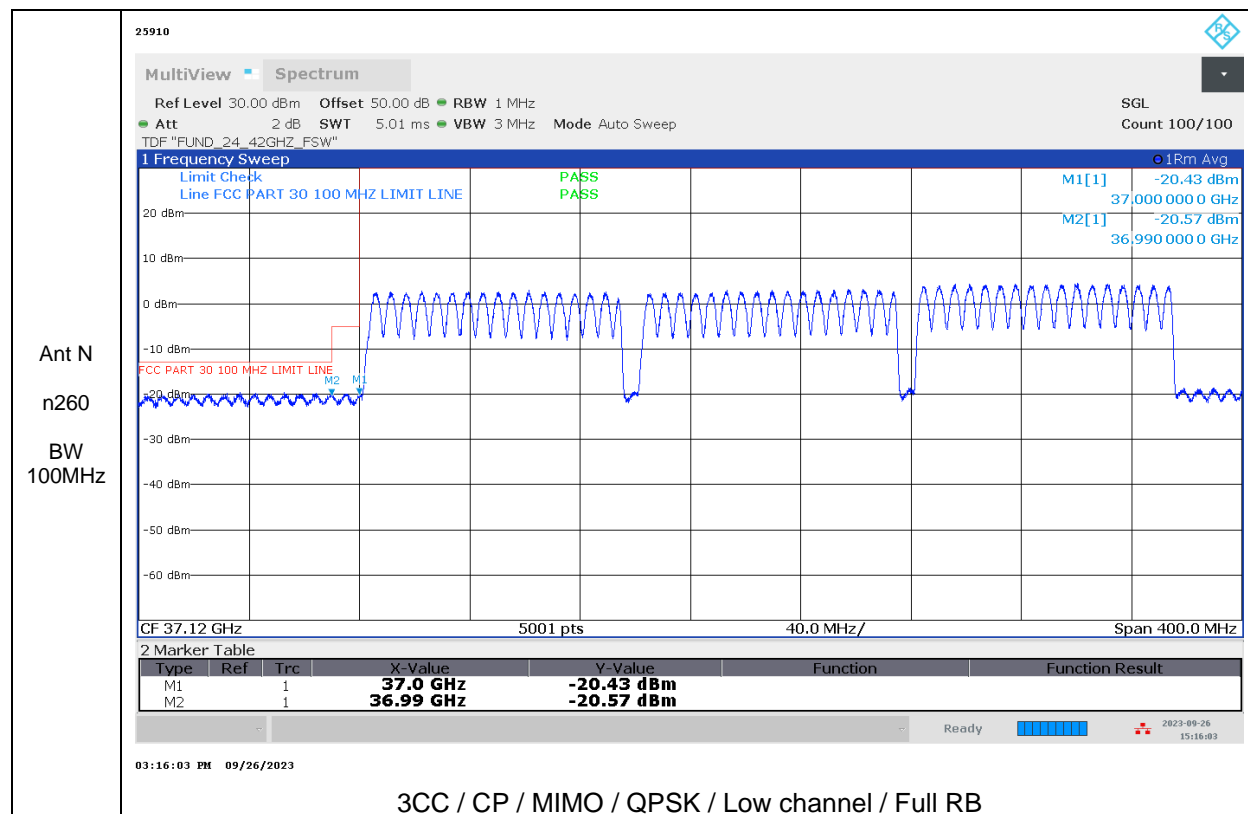


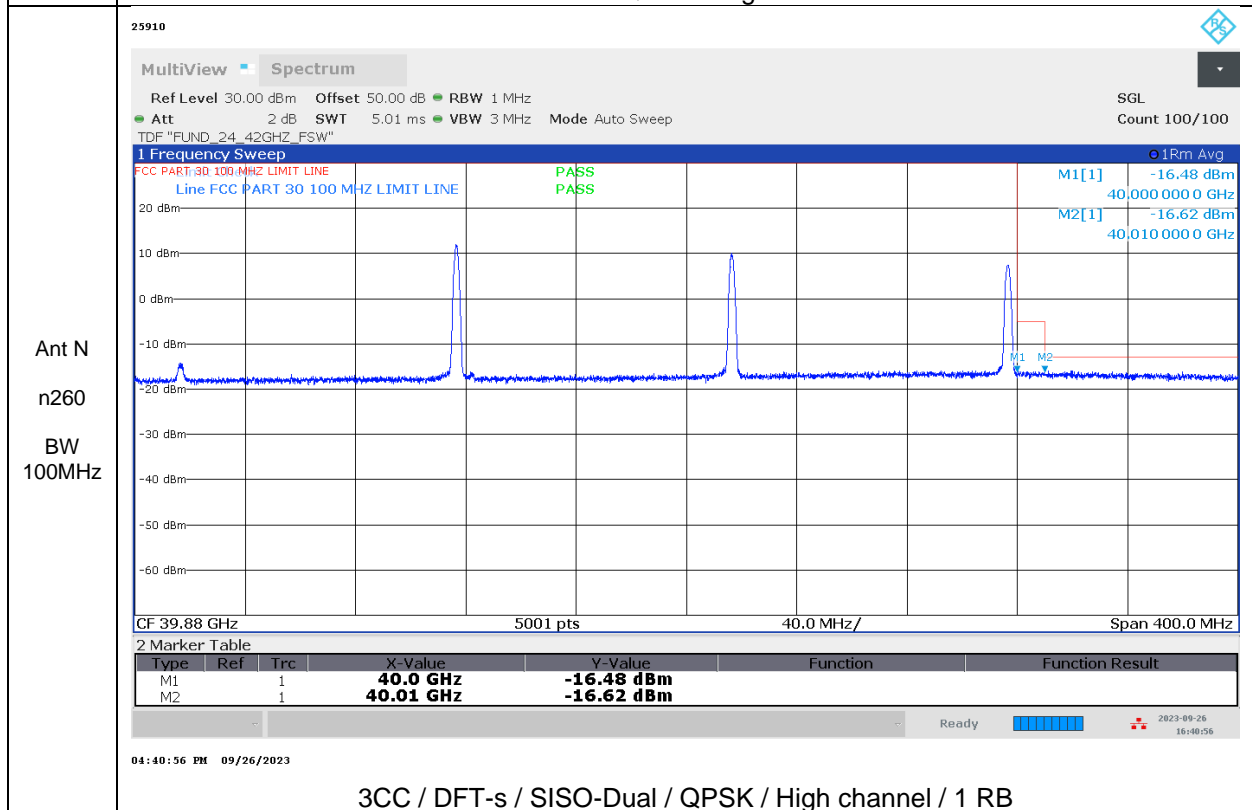
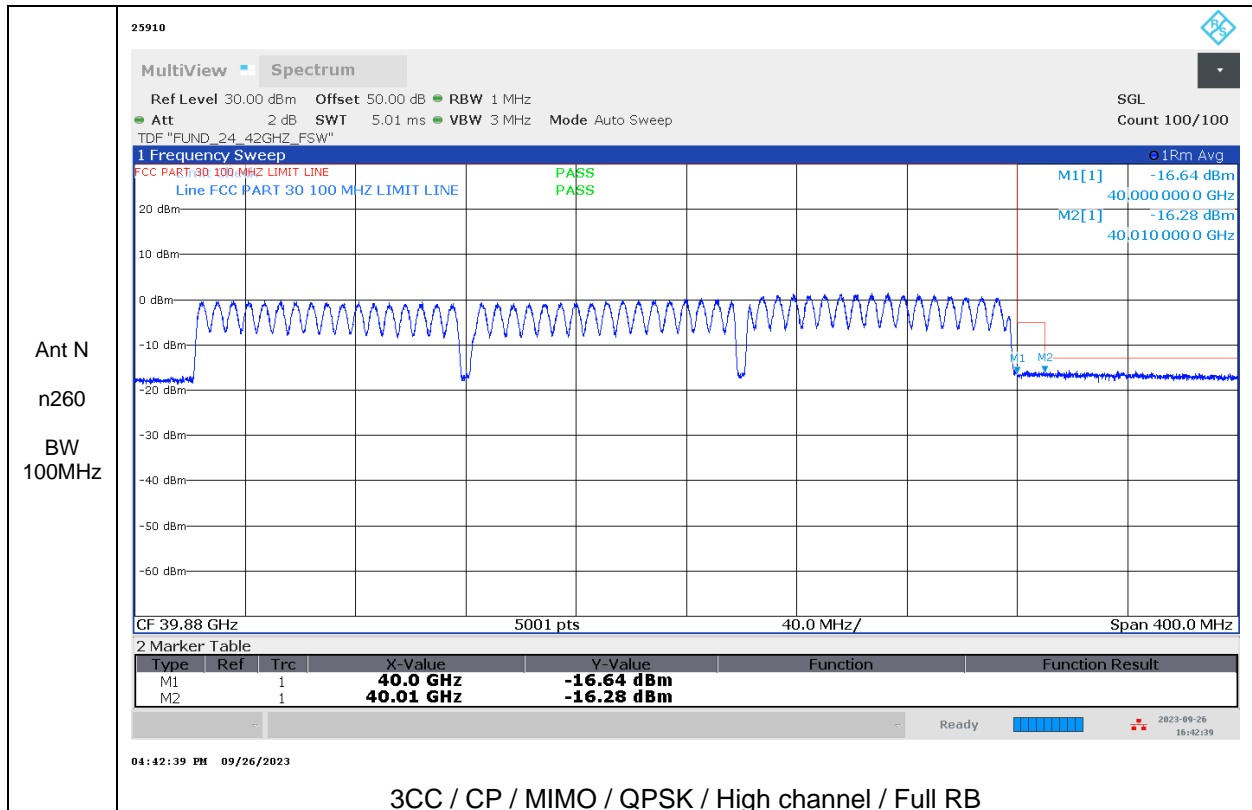


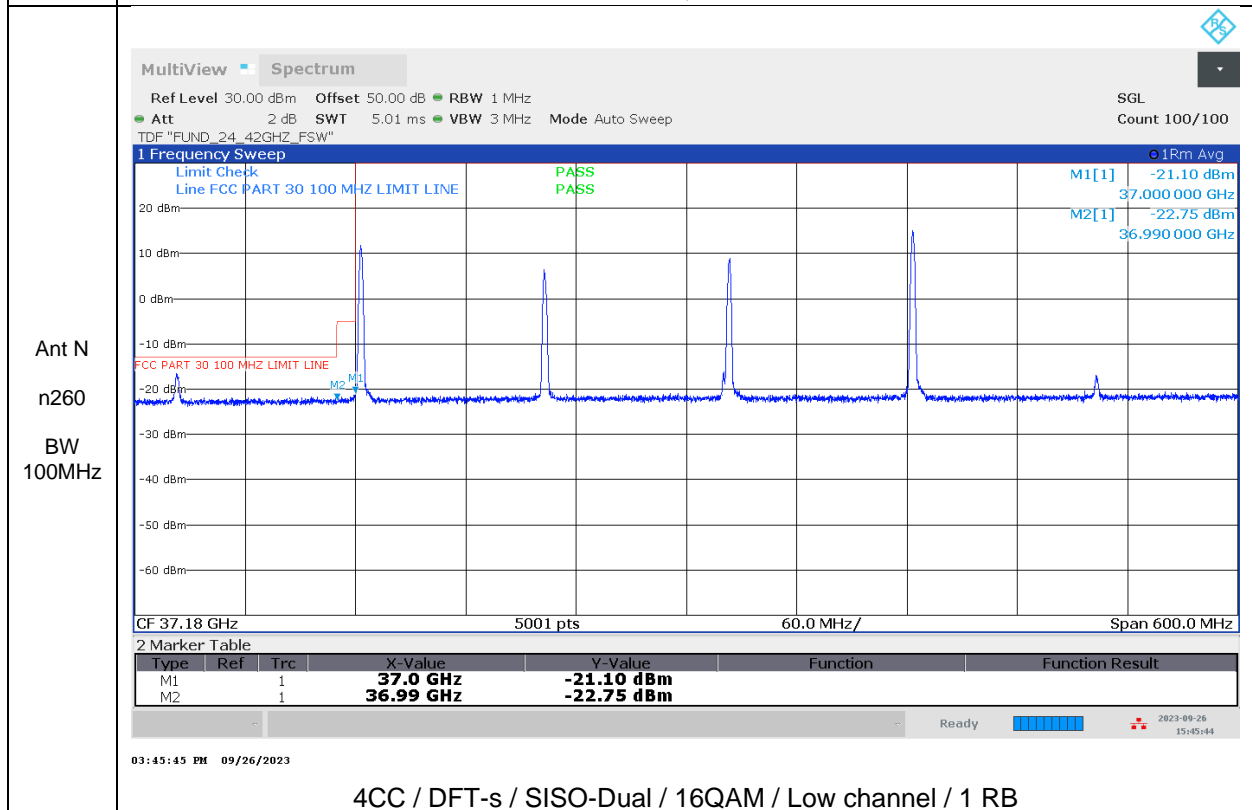
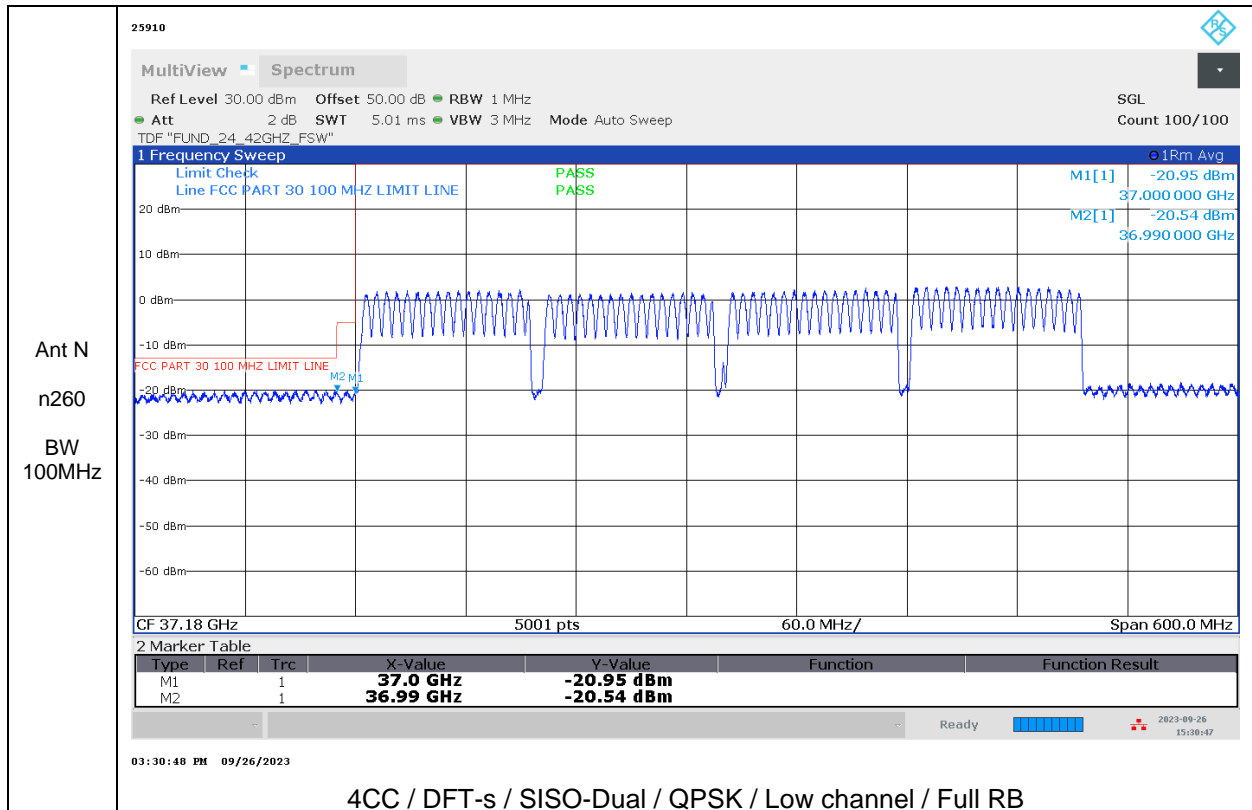


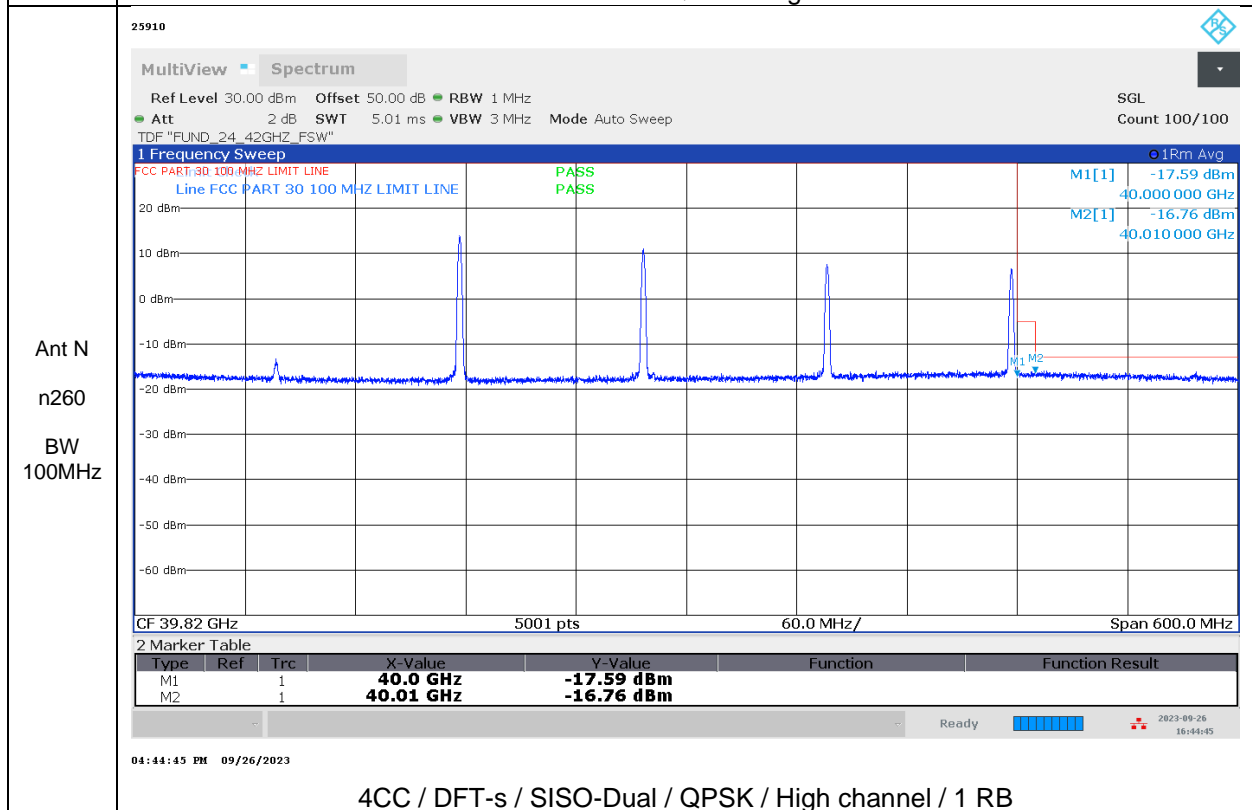
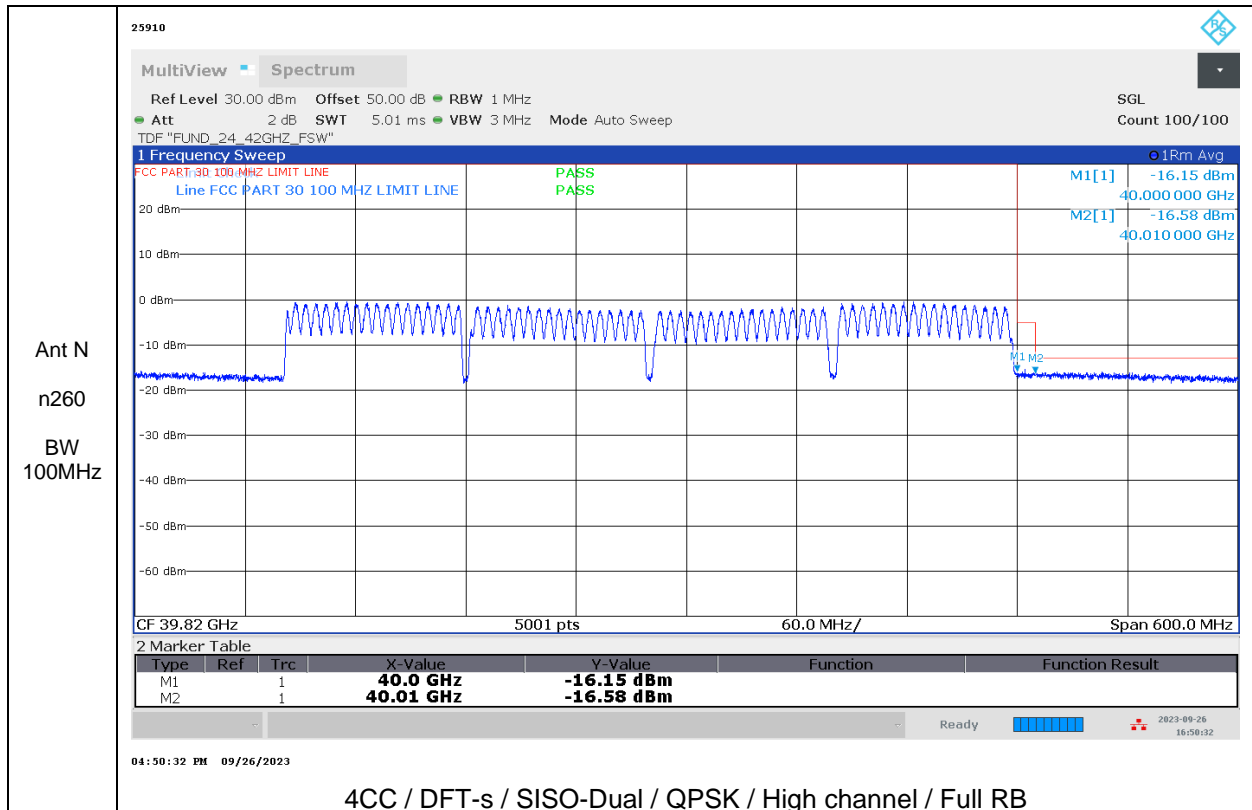












8.4. RADIATED SPURIOUS AND HARMONIC EMISSIONS

RULE PART(S)

FCC: §2.1051, §30.203

LIMITS

30.203 - (a) The conductive power or the total radiated power of any emission outside a licensee's frequency block shall be -13 dBm/MHz or lower.

TEST PROCEDURE

- a) Start frequency was set to 30MHz and stop frequency was set to 100 GHz for n261 and 200GHz for n260.
- b) Set the RBW = 100kHz for emission below 1GHz and 1MHz for emissions above 1GHz
- c) Set VBW $\geq 3 \times$ RBW;
- d) Detector = RMS;
- e) Trace mode = trace average;
- f) Sweep time = auto couple;
- g) Number of sweep points $\geq 2 \times$ Span/RBW

(KDB 842590 D01 Upper Microwave Flexible Use Service v01r02 Section 4.4.2 and Section 4.4.3)
(ANSI C63.26-2015 Section 5.7.4)

NOTE

The EUT was tested in three orthogonal planes and in all possible test configurations and positioning.

All radiated spurious emissions were measured as EIRP to compare with the §30.203 TRP limits.

The plots from 1-200GHz show corrected average EIRP levels. Plots below 1GHz are corrected field strength levels. The average EIRP reported below is calculated per section 5.2.7 of ANSI C63.26-2015 which states: $EIRP \text{ (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m. The field strength E is calculated $E \text{ (dB}\mu\text{V/m)} = \text{Spectrum Analyzer Level (dBm)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + \text{Harmonic Mixer Conversion Loss (dB)} + 107$. All appropriate Antenna Factor and Cable Loss have been applied in the spectrum analyzer for each measurement. For measurements $> 50\text{GHz}$, Harmonic Mixer Conversion Loss was also applied to the spectrum analyzer.

Sample Analyzer Offset Calculation (1 - 50GHz, test distance = 1m)

$EIRP \text{ (dBm)} = \text{Spectrum Analyzer Level (dBm)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + 107 + 20\log(D) - 104.8$

All factors except spectrum analyzer level are applied as correction factors each band in the analyzer.

Sample Analyzer Offset Calculation (50 - 200GHz, test distance = 1m)

$EIRP \text{ (dBm)} = \text{Spectrum Analyzer Level (dBm)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} + \text{Harmonic Mixer Conversion Loss (dB)} + 107 + 20\log(D) - 104.8$

All factors except spectrum analyzer level are applied as correction factors each band in the analyzer.

Emissions below 18GHz were measured at a 3 meter test distance, while emissions above 18GHz were measured at the appropriate far field distance. The far field of the mmWave signal is based on formula: $R > 2D^2/\text{wavelength}$, where D is the larger between the dimension of the measurement antenna and the transmitting antenna of the EUT. In this case, D is the largest dimension of the measurement antenna.

Frequency Range(GHz)	Wavelength(m)	Far Field Distance(m)	Measurement Distance(m)
18-40	0.008	0.54	1.00 (EIRP and Band Edge = 3.00)
40-50	0.006	1.05	1.50
50-75	0.004	0.69	1.00
75-110	0.003	0.46	1.00
110-175	0.002	0.34	1.00
175-200	0.002	0.16	1.00

All emissions from 18GHz - 50GHz were measured using a spectrum analyzer with an internal preamplifier. Emissions above 50GHz were measured using a harmonic mixer with the spectrum analyzer.

All RSE's were measured with for n258, n261 and n260 band by Low, Mid and High Channel with 1CC. It was determined that adding more CC's causes the overall amplitude of just 1CC to decrease, therefore, 1CC is the worst case for the purposes of spurious emissions measurements.

$\pi/2$ -BPSK, QPSK, 16QAM and 64QAM modulations were all investigated in SISO, SISO-Dual and MIMO configurations, QPSK was set for final test as the worst-case modulation. The highest spurious emissions were for the SISO-Dual antenna configuration consistent with this also being the configuration with the highest EIRP. The SISO-Dual configuration was, therefore, use for the final emission measurements.

All Waveforms (CP-OFDM vs DFT-s OFDM) were investigated and DFT-s OFDM was determined as the worst-case used for test.

Band n258, n261 and n 260 RSE reported worst case test data.
 And the no emissions test case was reported mid channel test data.

All RSE's were investigated in EN-DC mode and with 802.11 chipset active. It was determined that there is no new emission introduced by EN-DC mode or the 802.11 chipset.
 For EN-DC mode n258 band uses LTE B2, B5, B12, B66 and B71, n261 band uses LT B2, B5, B12, B13, B48 and B66. And n260 band uses LTE B2, B5, B12, B13, B14, B30, B48 and B66.

There was no discernible difference in the spurious emission levels when using different LTE anchor bands. Thus, LTE Band 66 was used as a representative anchor band for EN-DC investigations.

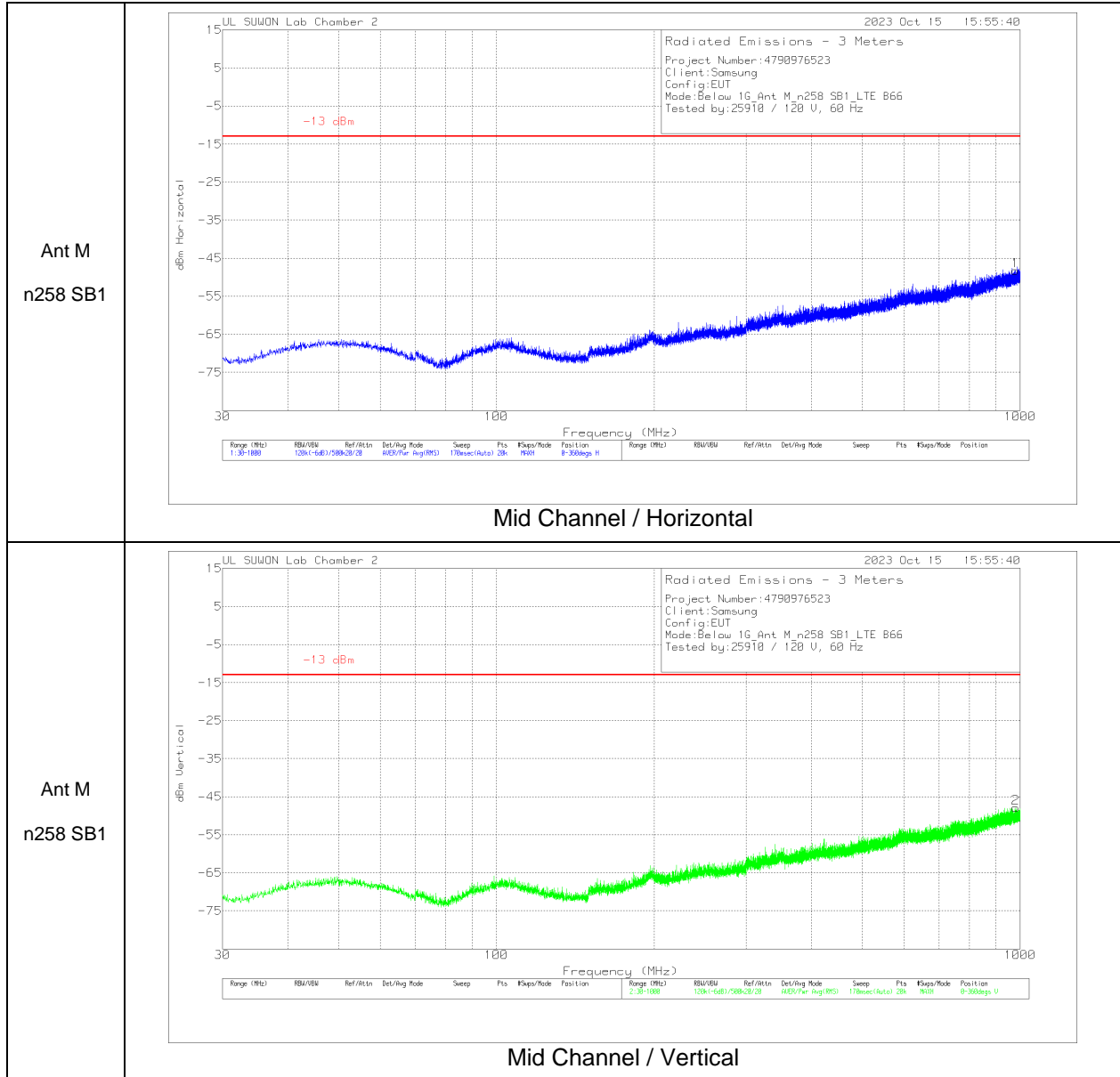
RESULTS

See the following pages.

8.4.1. RADIATED SPURIOUS AND HARMONIC EMISSIONS RESULT

Antenna 1 / Ant M / n258 SB1

30 – 1000 MHz Result



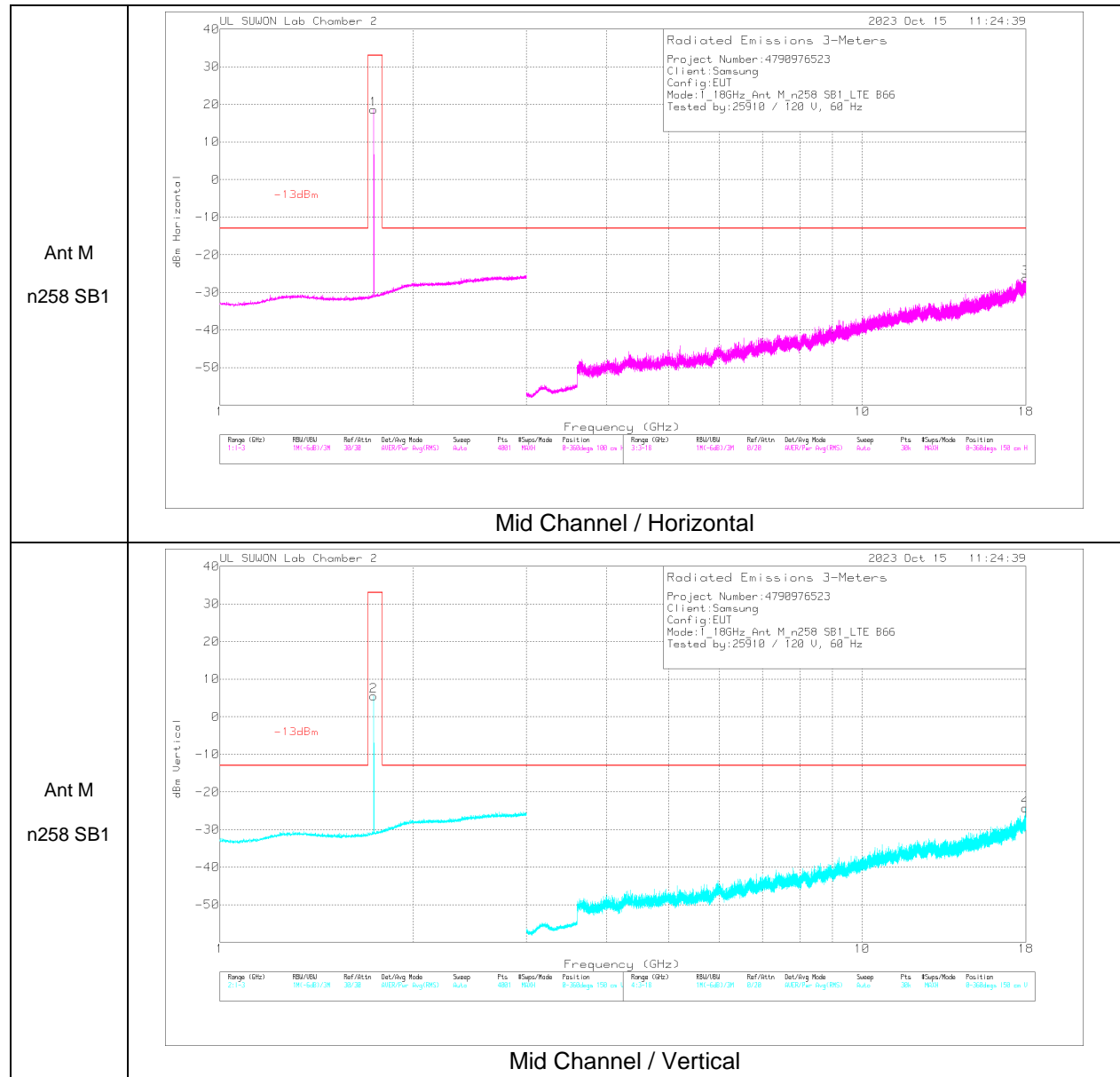
Trace Markers

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	979.8818	-61.01	RMS	27.6	-26.7	11.8	-48.31	-13	-35.31	0-360	300	H
2	980.3183	-60.62	RMS	27.6	-26.7	11.8	-47.92	-13	-34.92	0-360	100	V

RMS - RMS detection

No emissions were detected above noise floor this antenna and band.

1 – 18 GHz Result



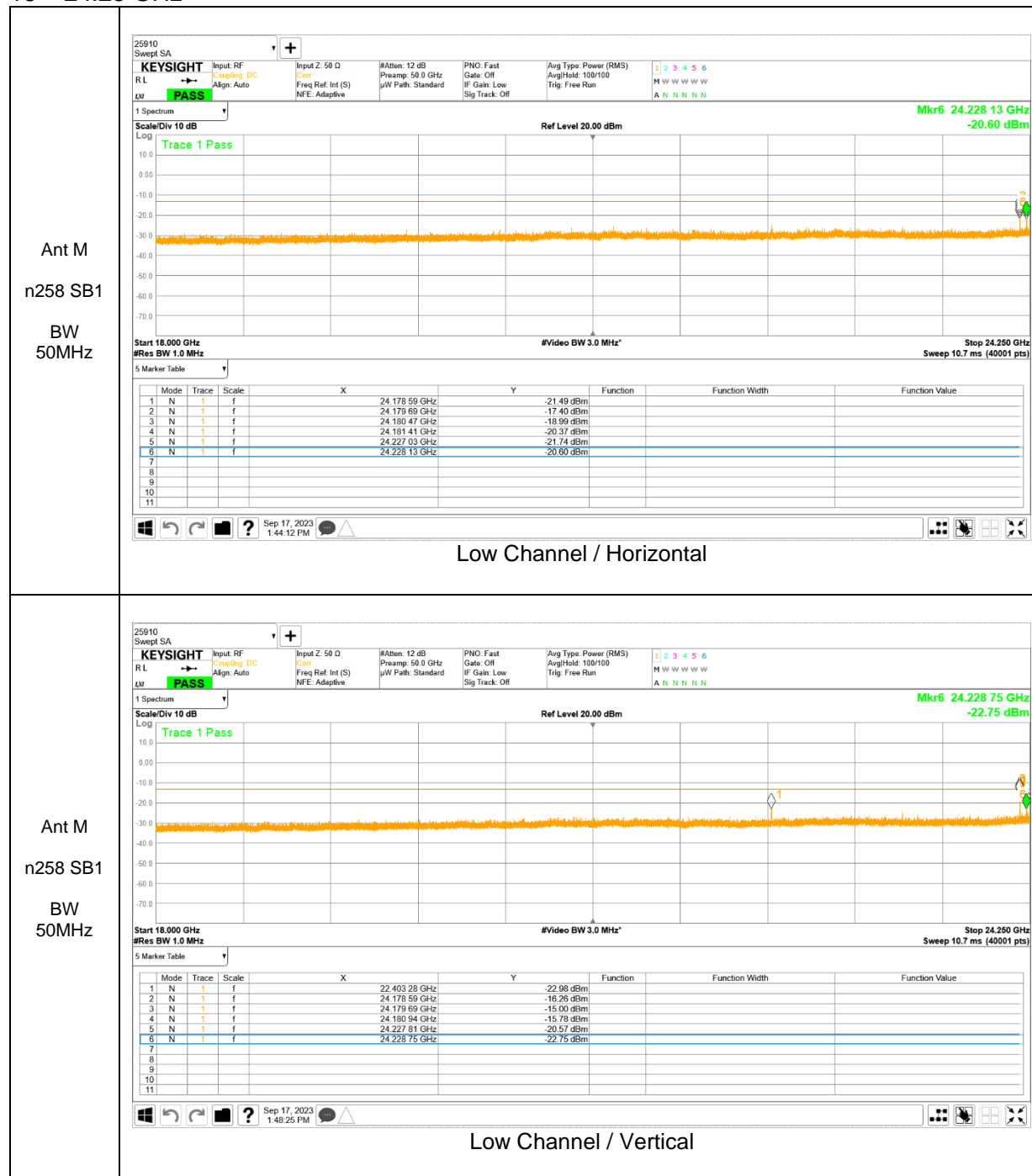
Trace Markers

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	1.736	-1.55	RMS	28.9	-20.5	11.8	18.65	33	-14.35	0-360	100	H
2	1.736	-14.65	RMS	28.9	-20.5	11.8	5.55	33	-27.45	0-360	150	V
3	17.98899	-63.35	RMS	41.5	-16.2	11.8	-26.25	-13	-13.25	0-360	150	H
4	17.98199	-61.54	RMS	41.5	-16.1	11.8	-24.34	-13	-11.34	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 the noise floor which was at least 20dB below the specification limit.

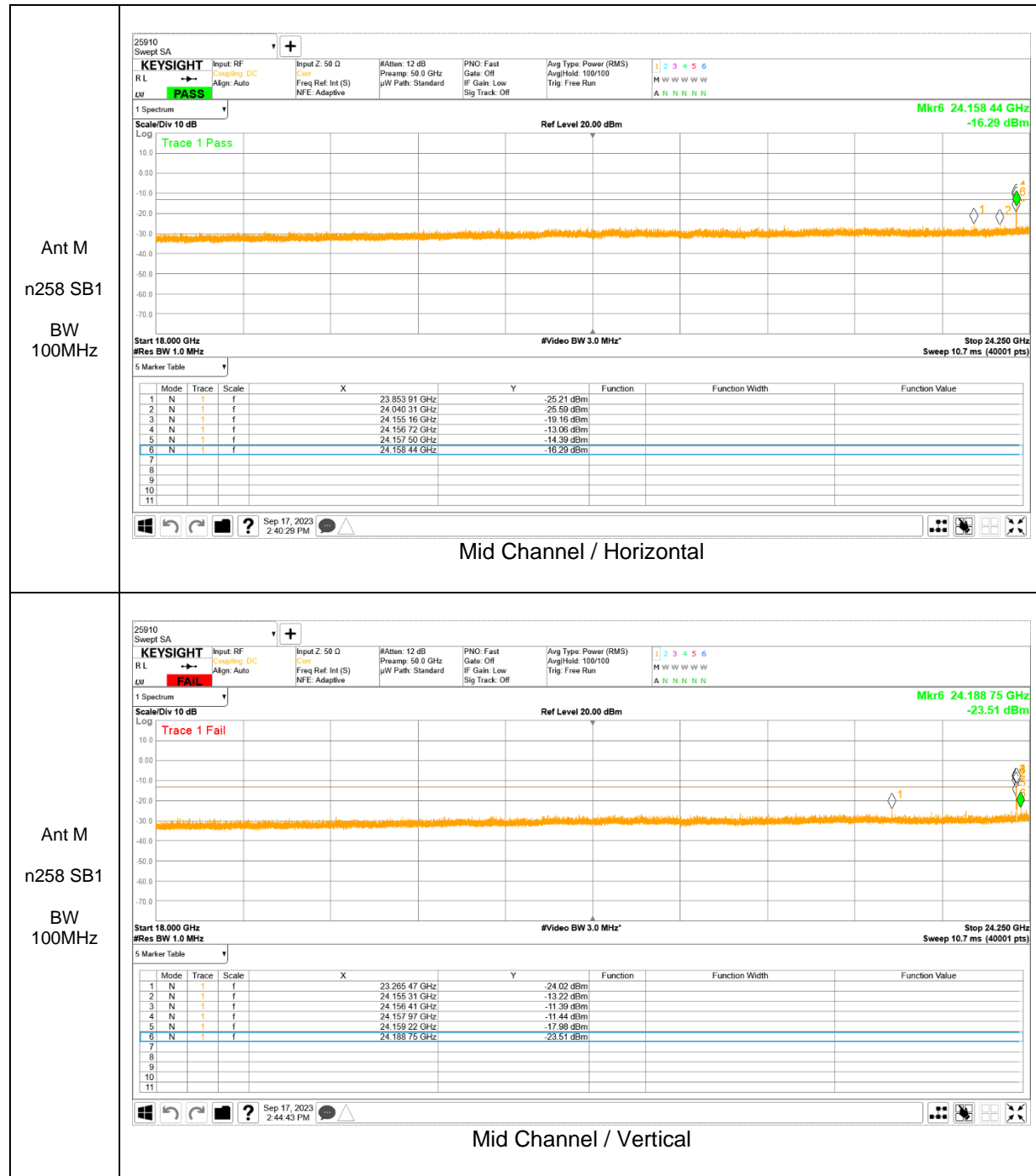
18 – 24.25 GHz



Note. After pre-scan, a zoom scan was performed on the identified spurious emissions.

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]
24.18	50	SISO-Dual	QPSK	V	187.8	181.1	-19.57	-13	6.57
24.18	50	SISO-Dual	QPSK	H	202.4	142.7	-19.65	-13	6.65

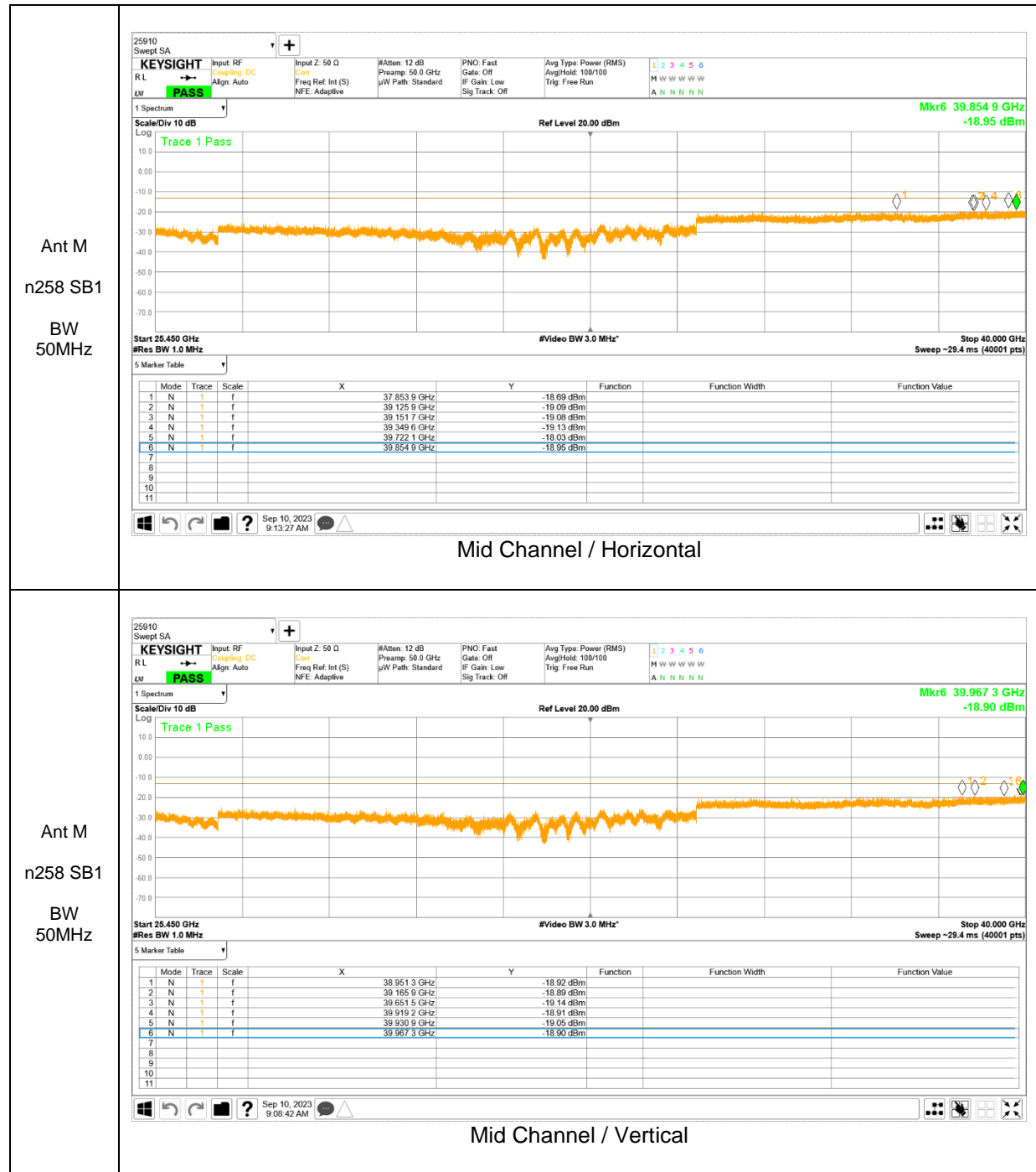


Note. After pre-scan, a zoom scan was performed on the identified spurious emissions.

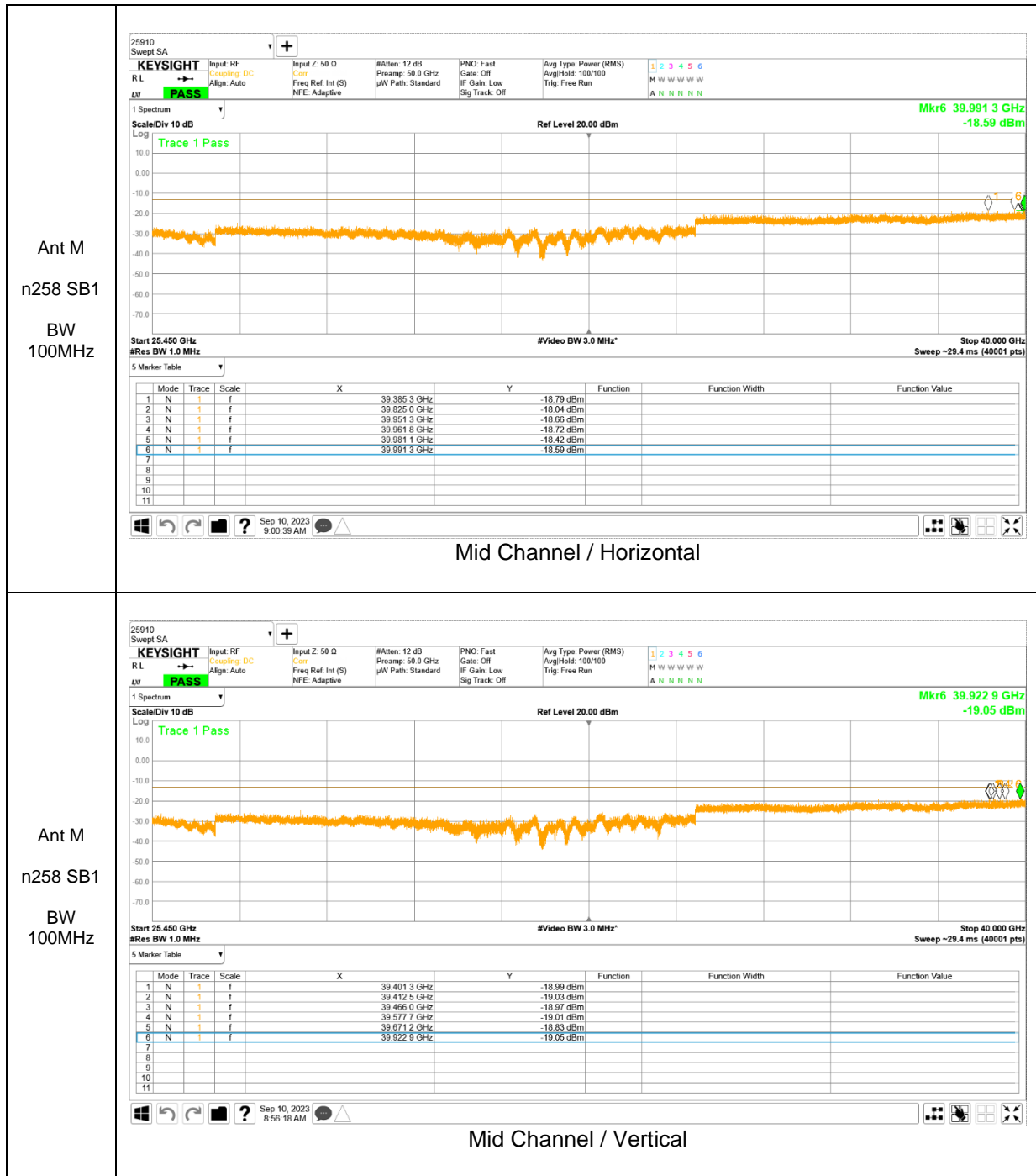
Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
24.16	100	SISO-Dual	QPSK	V	195.4	143.36	-16.78	-13	3.78
24.16	100	SISO-Dual	QPSK	H	197.1	126.22	-18.00	-13	5.00

24.45 – 40 GHz Result



No emissions were detected above noise floor this antenna and band.



40 – 50 GHz Result



Note. After pre-scan, a zoom scan was performed on the identified spurious emissions.

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]
48.85	50	SISO-Dual	QPSK	H	195.7	186.3	-25.82	-13	12.82

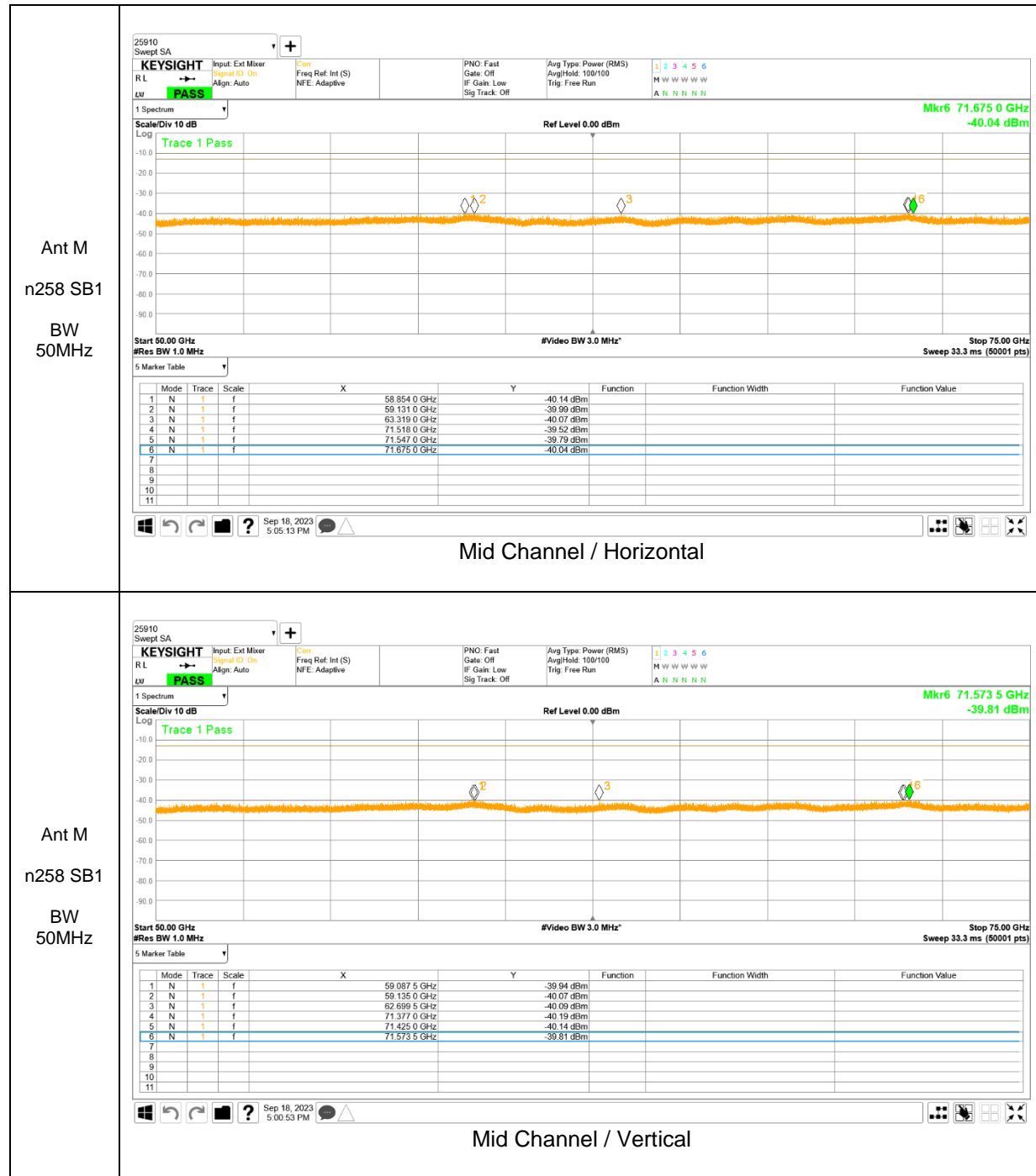


Note. After pre-scan, a zoom scan was performed on the identified spurious emissions.

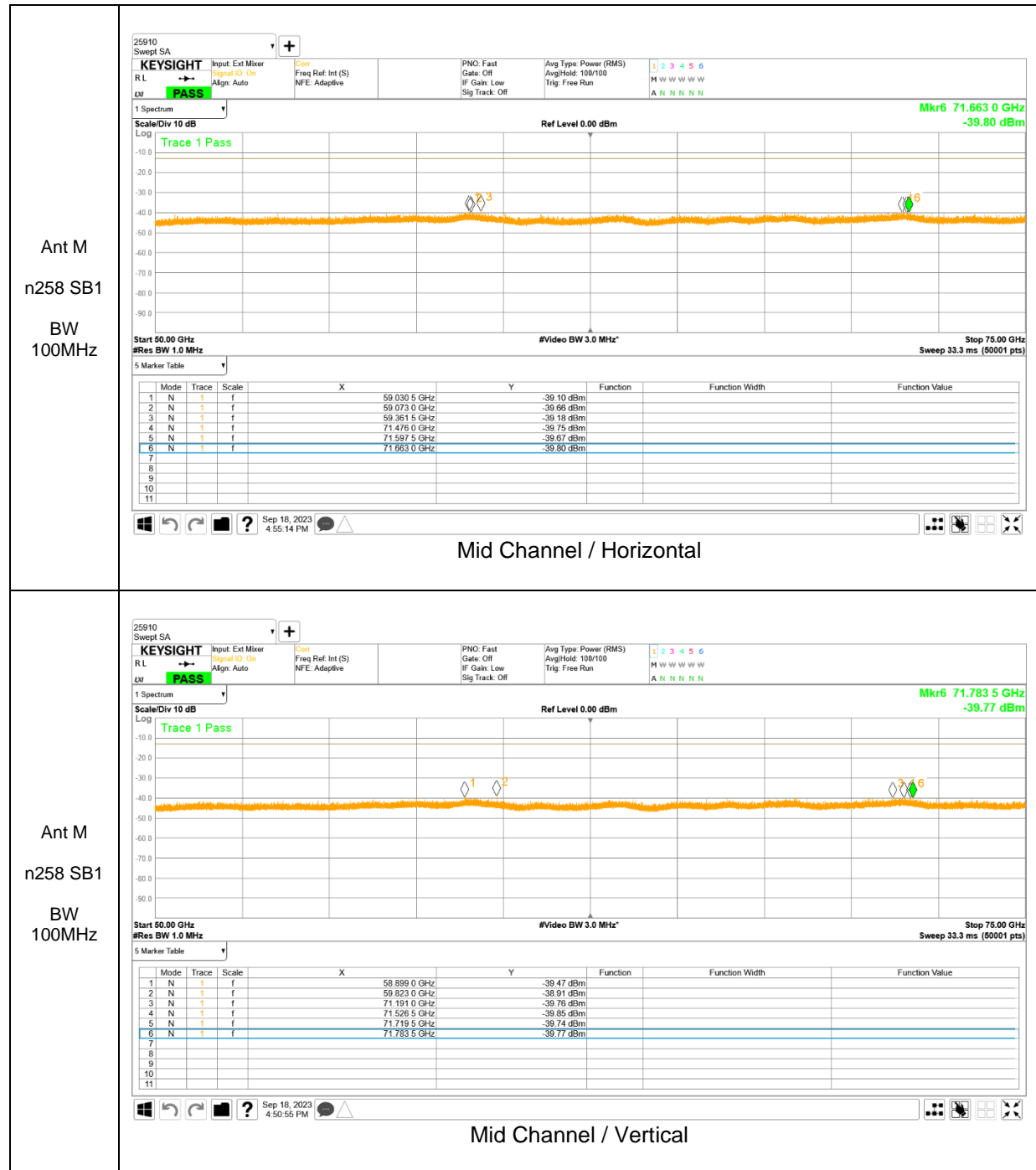
Final Measurement Data Table

Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
48.80	100	SISO-Dual	QPSK	H	193.65	191.0	-24.81	-13	11.81

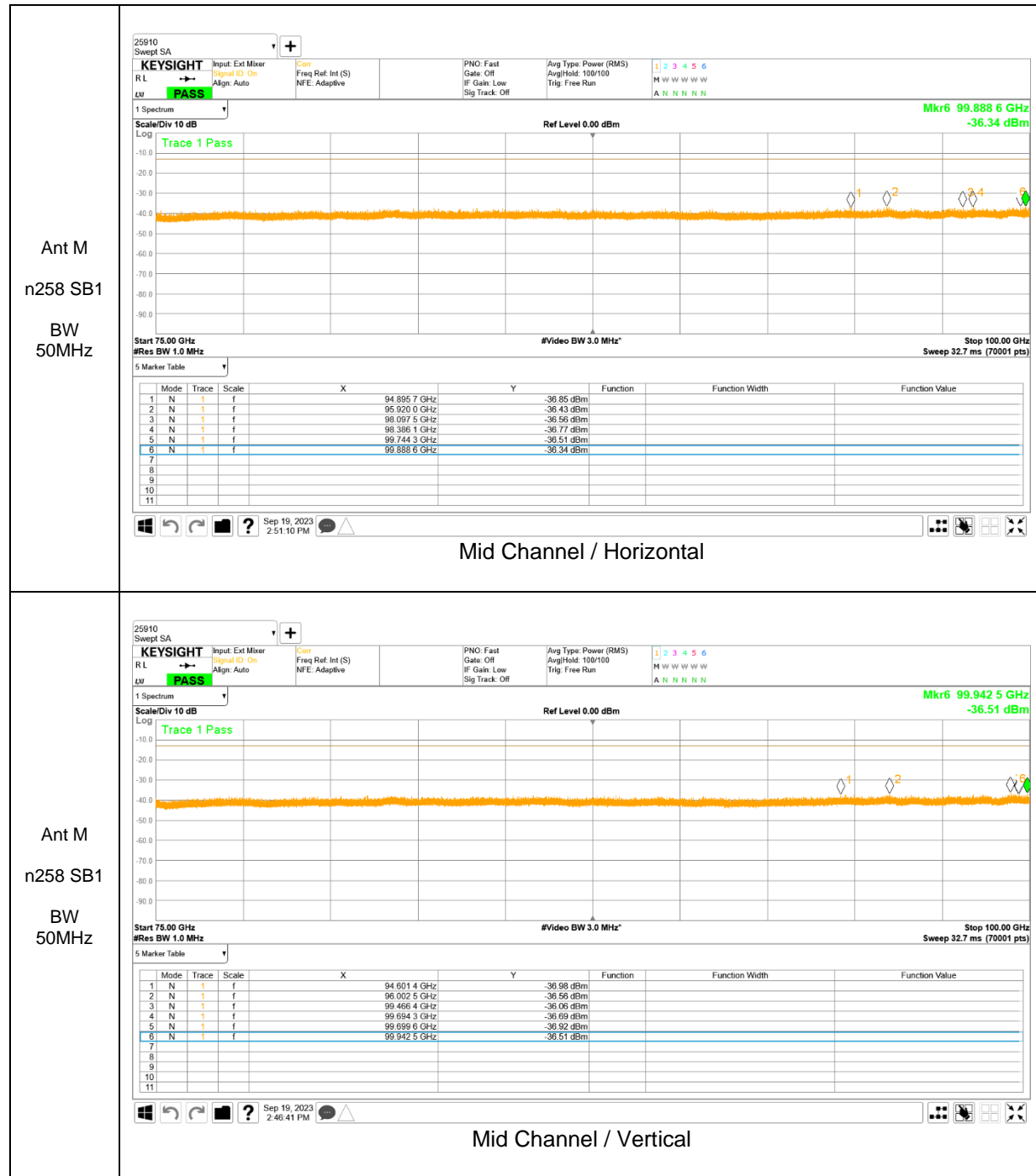
50 – 75 GHz Result

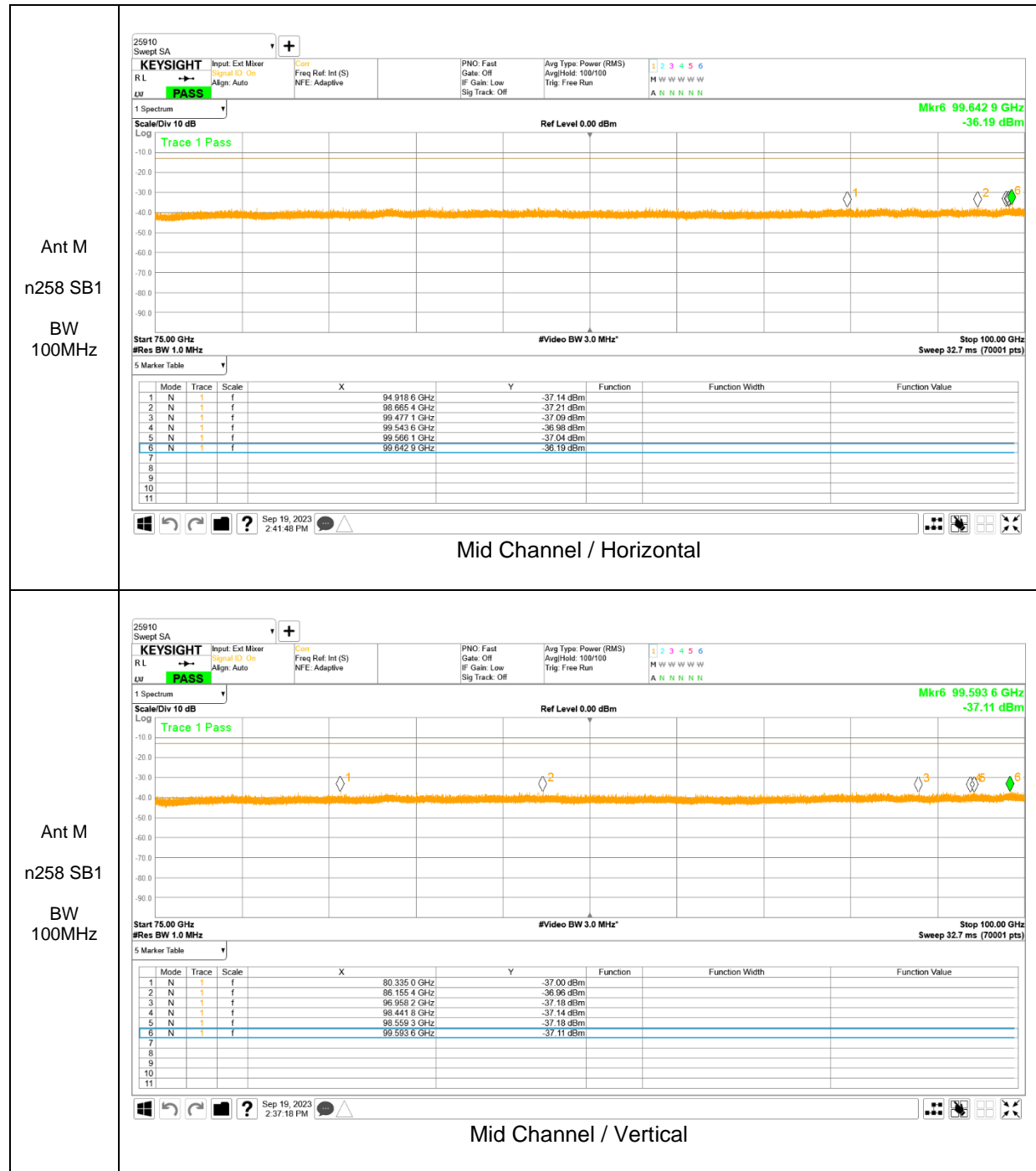


No emissions were detected above noise floor this antenna and band.



75 – 100 GHz Result

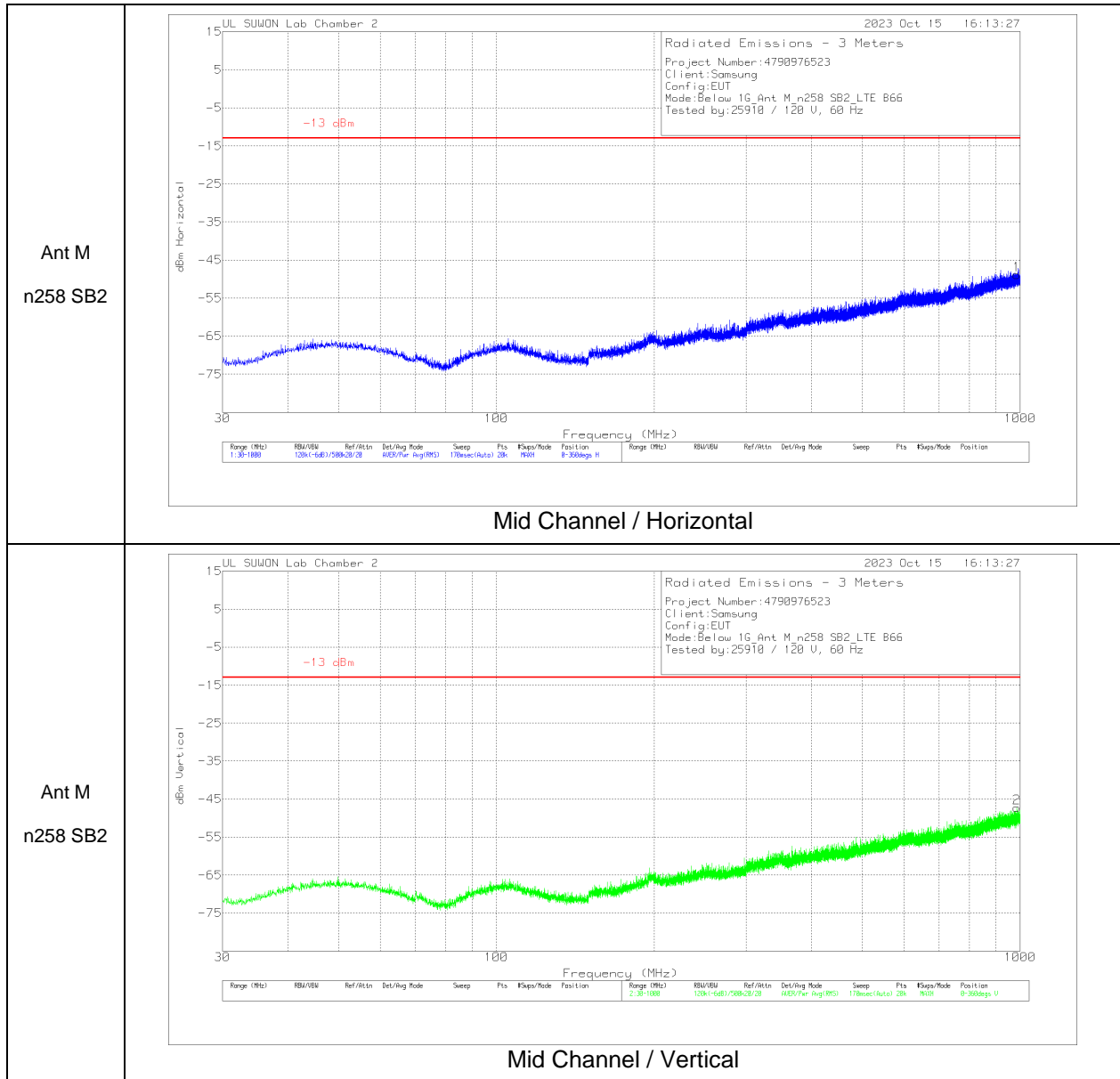




No emissions were detected above noise floor this antenna and band.

Antenna 1 / Ant M / n258 SB2

30 – 1000 MHz Result



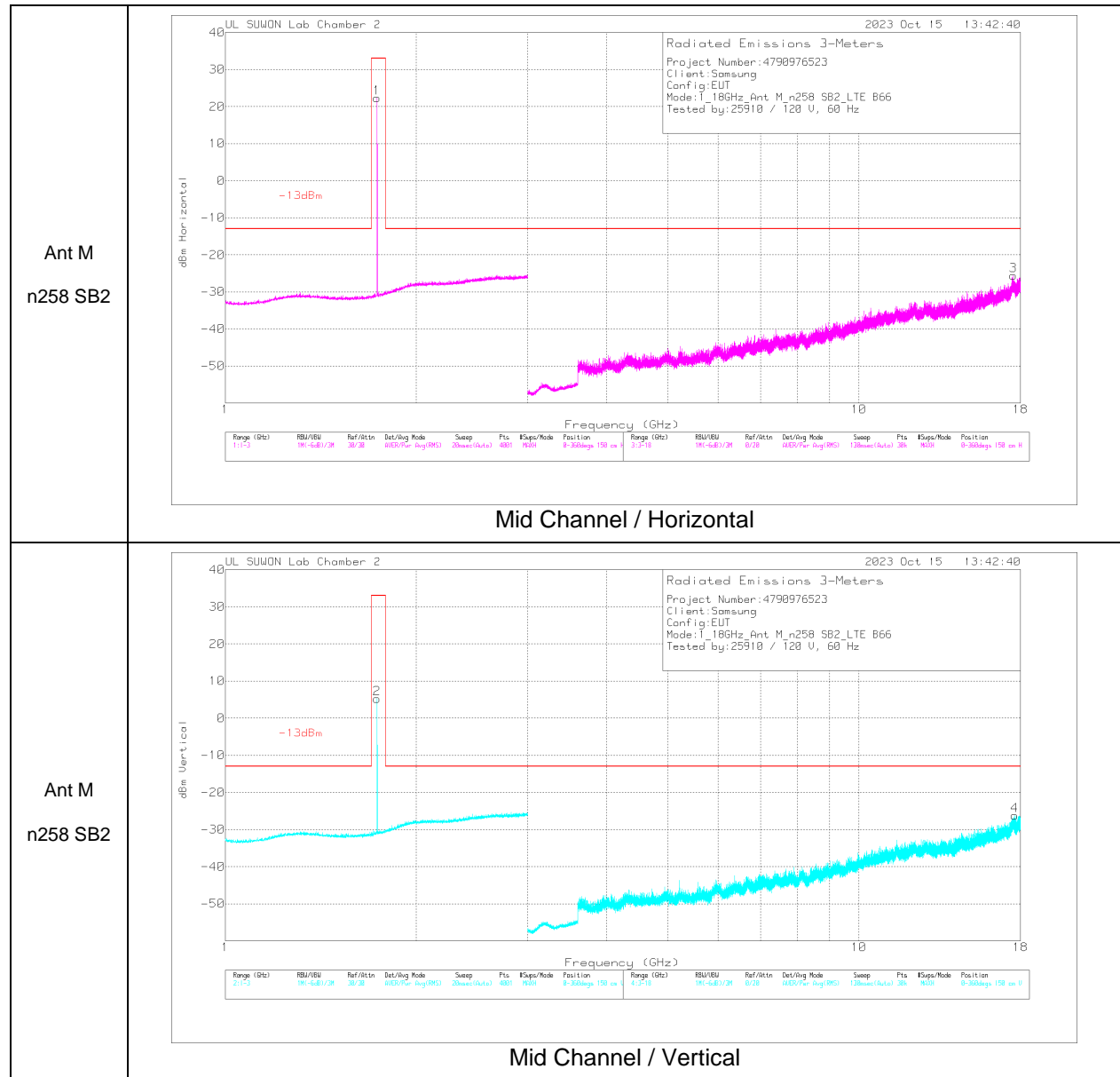
Trace Markers

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	985.0226	-61.54	RMS	27.7	-26.8	11.8	-48.84	-13	-35.84	0-360	100	H
2	984.6346	-59.92	RMS	27.7	-26.8	11.8	-47.22	-13	-34.22	0-360	300	V

RMS - RMS detection

No emissions were detected above noise floor this antenna and band.

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	1.736	2.13	RMS	28.9	-20.5	11.8	22.33	33	-10.67	0-360	150	H
2	1.736	-14.96	RMS	28.9	-20.5	11.8	5.24	33	-27.76	0-360	150	V
3	17.54551	-62.62	RMS	41.6	-16.4	11.8	-25.62	-13	-12.62	0-360	150	H
4	17.639	-63.19	RMS	41.7	-16.5	11.8	-26.19	-13	-13.19	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 the noise floor which was at least 20dB below the specification limit.

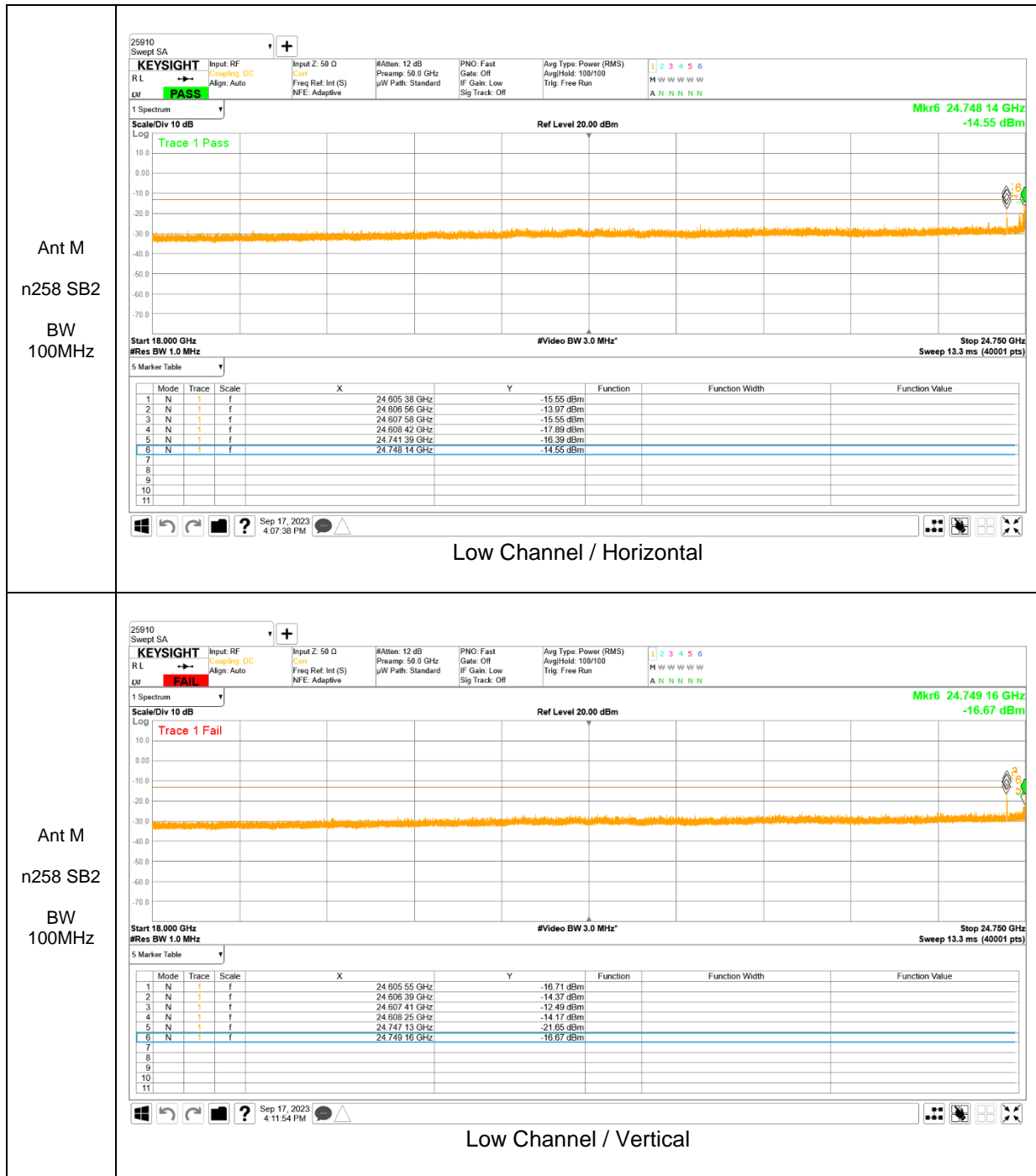
18 – 24.75 GHz



Note. After pre-scan, a zoom scan was performed on the identified spurious emissions.

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]
24.68	50	SISO-Dual	QPSK	V	193.24	159.9	-20.94	-13	7.94
24.68	50	SISO-Dual	QPSK	H	191.48	144.9	-22.59	-13	9.59

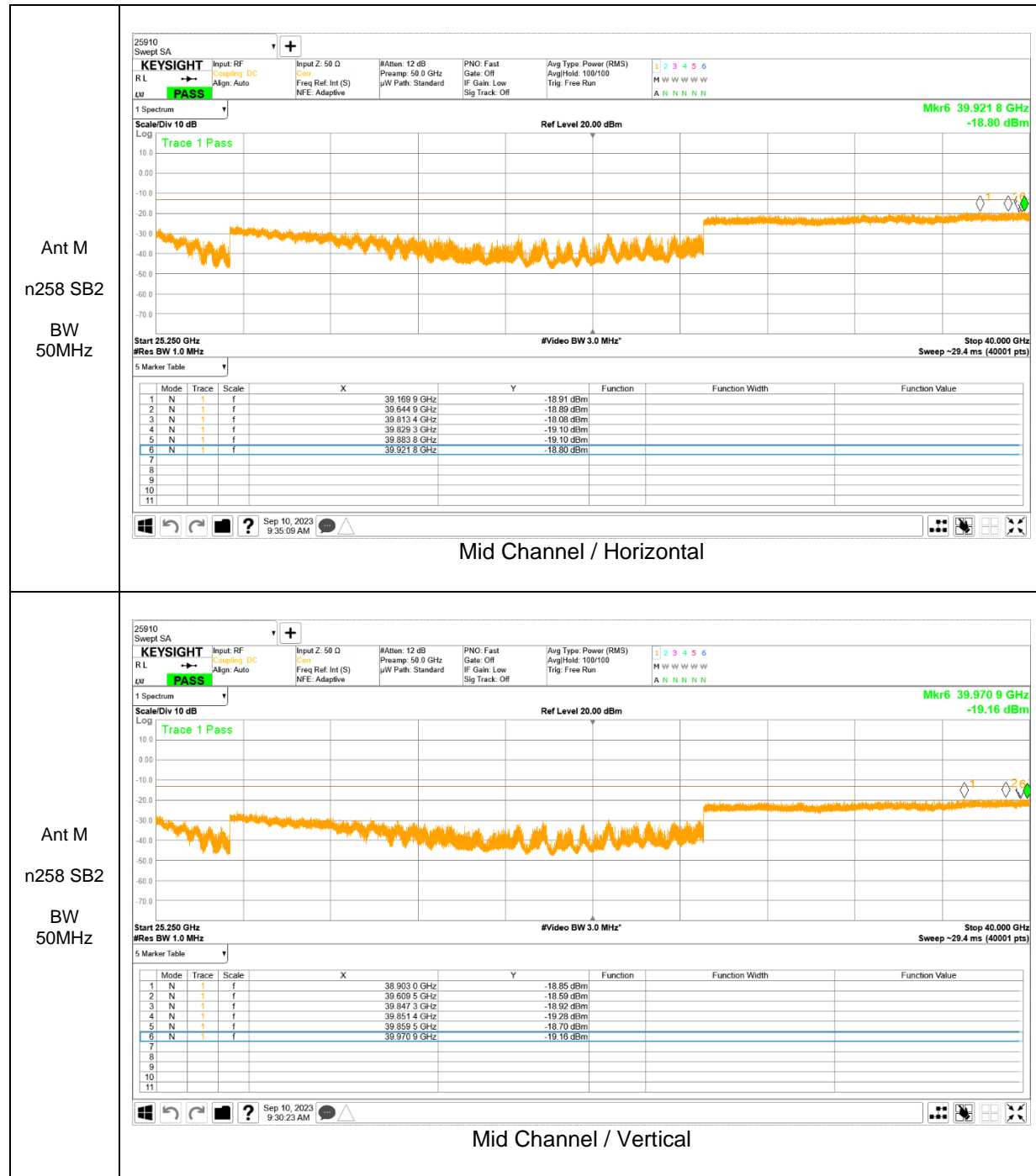


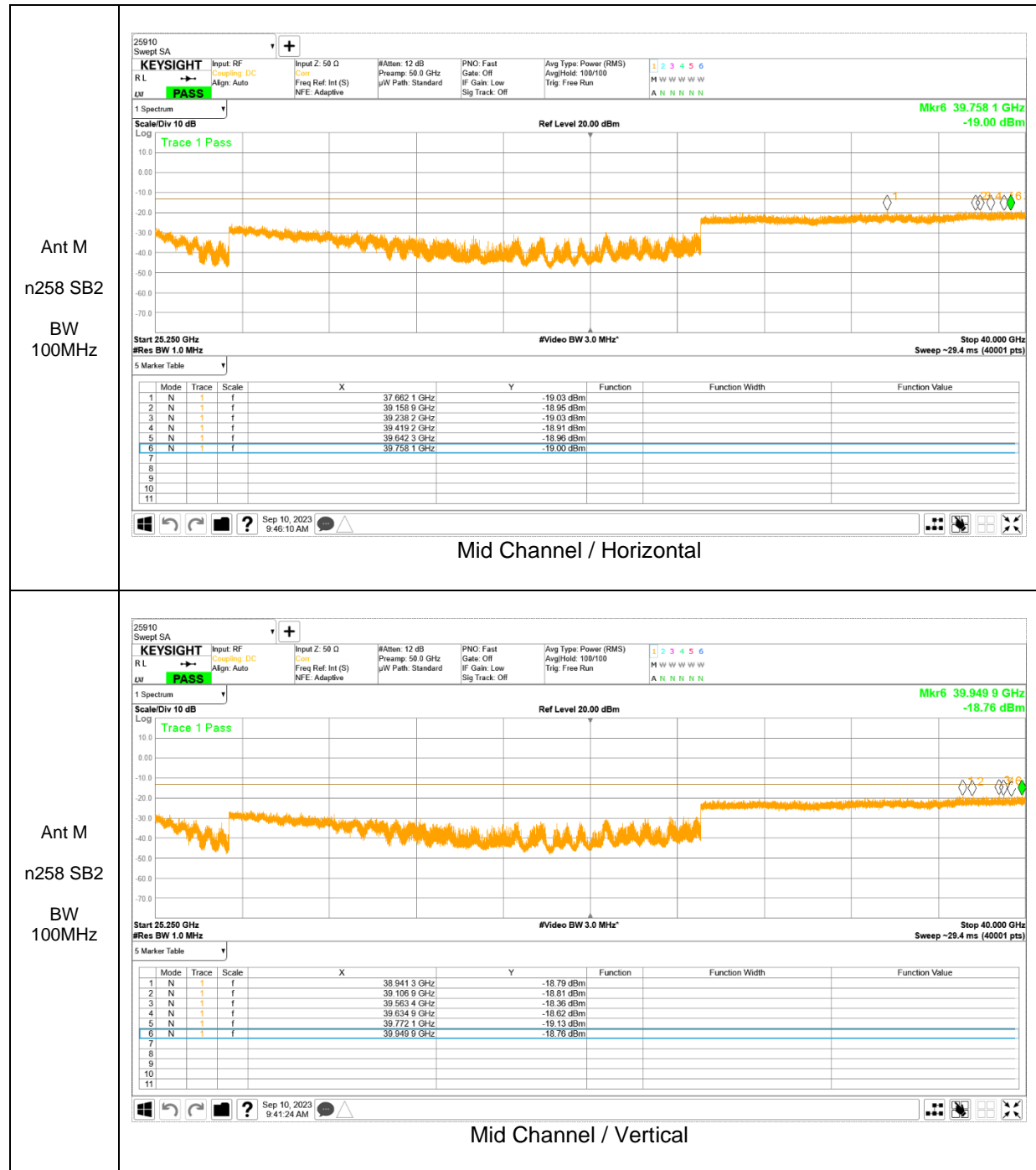
Note. After pre-scan, a zoom scan was performed on the identified spurious emissions.

Final Measurement Data Table

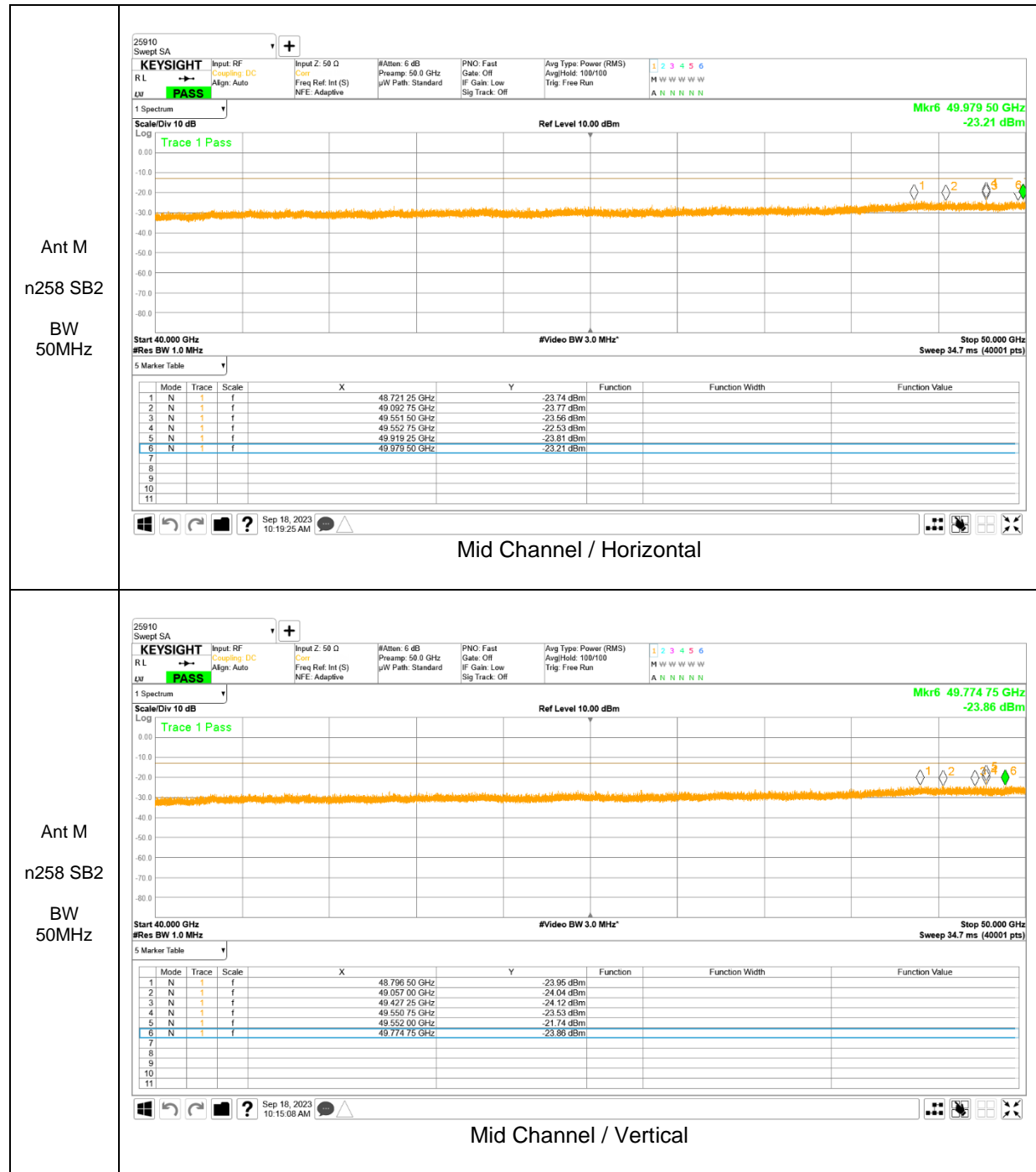
Frequency [GHz]	Bandwidth [MHz]	EUT Beam	Modulation	Ant pol [H/V]	X-Axis [degree]	Y-Axis [degree]	EIRP [dBm]	Limit [dBm]	Margin [dB]
24.61	100	SISO-Dual	QPSK	V	192.0	164.45	-15.48	-13	2.48
24.61	100	SISO-Dual	QPSK	H	197.2	144.91	-18.06	-13	5.06

25.25 – 40 GHz Result





40 – 50 GHz Result



No emissions were detected above noise floor this antenna and band.

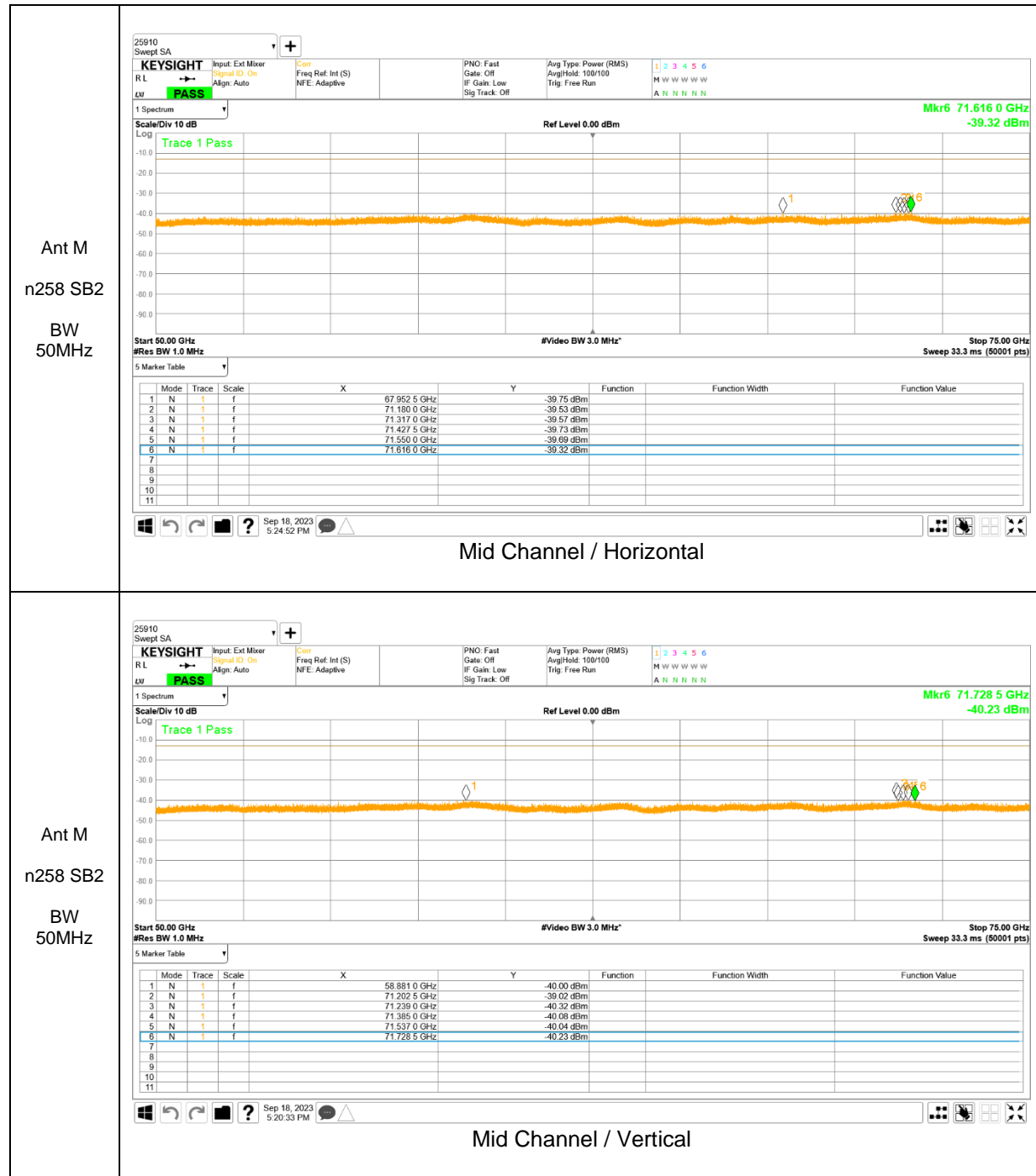


Note. After pre-scan, a zoom scan was performed on the identified spurious emissions.

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]
49.60	100	SISO-Dual	QPSK	V	156.7	202.0	-28.38	-13	15.38

50 – 75 GHz Result



No emissions were detected above noise floor this antenna and band.