

Appendix -

Test Data and Result for report

GZCR230300024803 (B)

(For 100MHz AWGN test data)



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1 AWS-2 & AWS-4 (only for downlink: 1995-2020MHz)

1.1 AGC threshold level

Test Conf.	AGC Threshold level
DL_1S_M_AWGN	-0.10dBm



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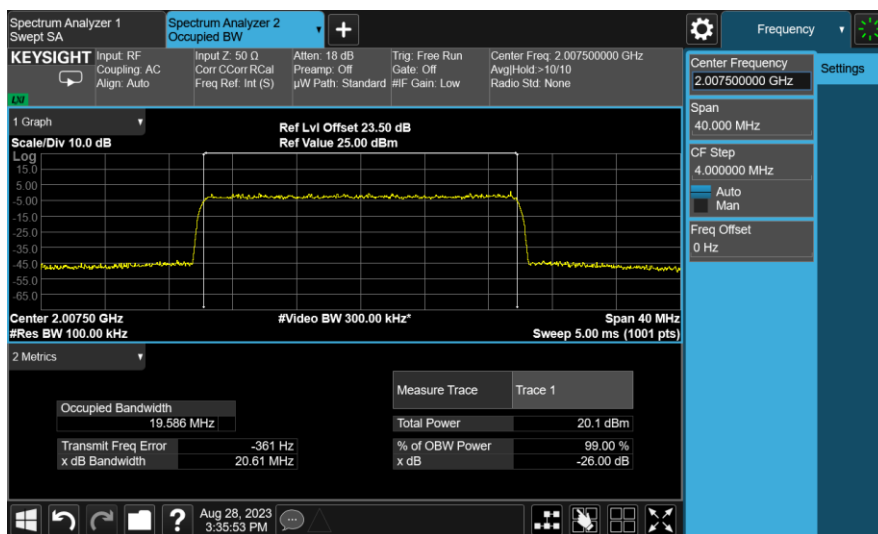
1.2 Input-versus-output signal comparison



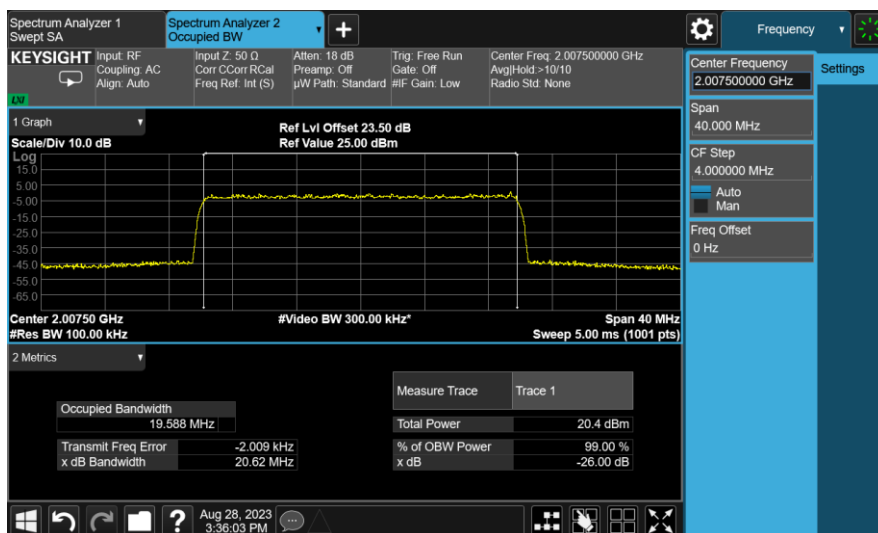
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Output_DL_1S_M_AWGN_Pre-AGC_OBW



Output_DL_1S_M_AWGN_AGC+3dB_OBW



Remark:

1. The band supports maximum channel BW is 20MHz for NR, so the output signal OBW was less than the input when 100MHz AWGN as input signal.
2. Compare the spectral plot of the input signal to the output signal affirm that they are similar (in passband and roll off characteristic features and relative spectral locations). The test result complies with the requirement.



1.3 Mean output power and amplifier/booster gain

Test Conf.	Test Freq. f_0 (MHz)	Signal Level	Input Power (dBm)	Output Power (dBm)	Gain (dB)	Verdict
DL_1S_AWGN	2009.1	Pre-AGC	-0.20	20.23	20.43	PASS
		AGC+3dB	2.80	20.17	/	PASS

Remark:

1. According to the declaration from the applicant, the antenna gain should not exceed 12.5dBi, the Directional gain = $G(\text{ANT}) + 10 \log (N\text{ANT}) \text{ dBi} = 12.5\text{dBi} + 10 \log (2) \text{ dBi} = 15.5\text{dBi}$.

The total maximum EIRP for the EUT is $(20.23\text{dBm} + 20.23\text{dBm}) + 15.5\text{dBi} = 38.74\text{dBm}$ (7.482W) which don't exceed the required EIRP limit (1640W/MHz).

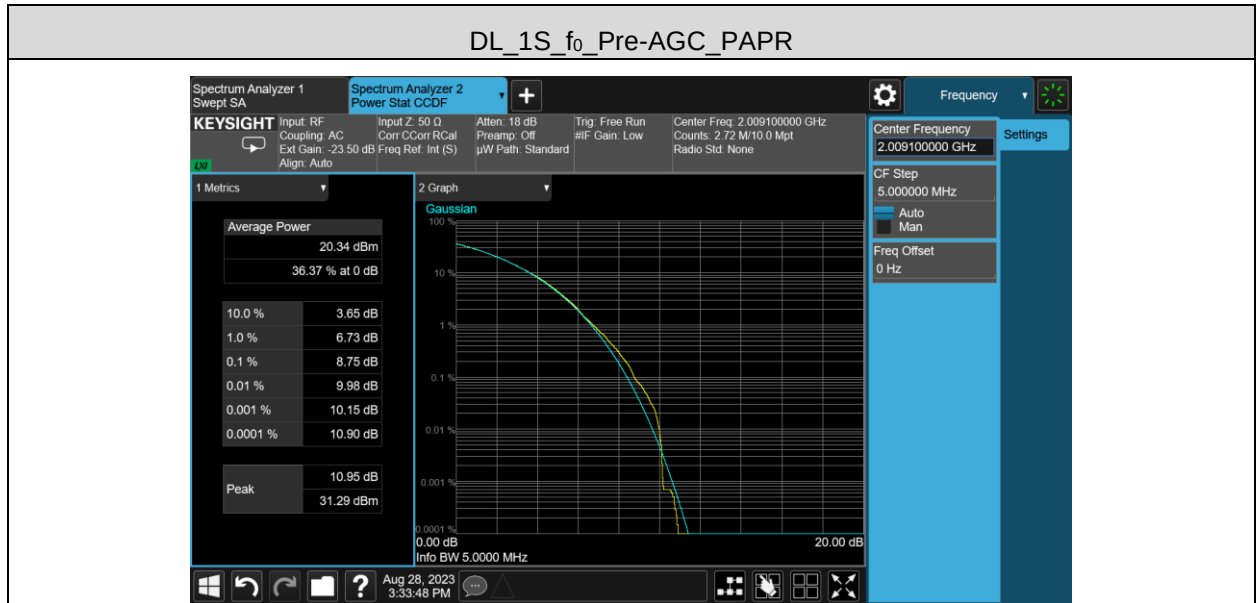
2. Based on discussion in docket No. DA 13-2409 (section 26 & 47) for operation in 2000-2020MHz in downlink, only 27.50(d)(1) and 27.50(d)(2) apply.



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Test Conf.	Test Freq. f_0 (MHz)	Signal Level	PAPR (dB)	Limit (dB)	Verdict
DL_1S_AWGN	2009.1	Pre-AGC	9.98	13	PASS



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1.4 Out-of-band/out-of-block (including intermodulation) emissions and spurious emissions

Note: The EUT support 2x2 MIMO, Per KDB662911 D01 Multiple Transmitter Output v02r01 clause (3)(a)(iii): Measure and add $10 \log(\text{NANT})$ dB, where NANT is the number of outputs to combine the emission measurements from multiple outputs prior to comparing to the emission limit.

Here, the factor $10 \log(\text{NANT})$ dB = $10 \log(2)$ dB = 3.01dB.

1. The tested max conducted power for single antenna port is 20.26dBm, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB

Here,

$P = 20.23\text{dBm} = 0.1054\text{W}$.

So the limit =

$P(\text{dBm}) - [43 + 10 \log(0.1054\text{W})] = -13\text{dBm}$

The EUT supports 2x2 MIMO and the emissions were measured at one of output port, so the limit line was set to -16.01dBm in following test plots in order to determine the test result conveniently.

2. Based on discussion in docket No. DA 13-2409 (section 26 & 47) for operation in 2000-2020MHz in downlink, only 27.53(h)(1) and 27.53(h)(3) apply.

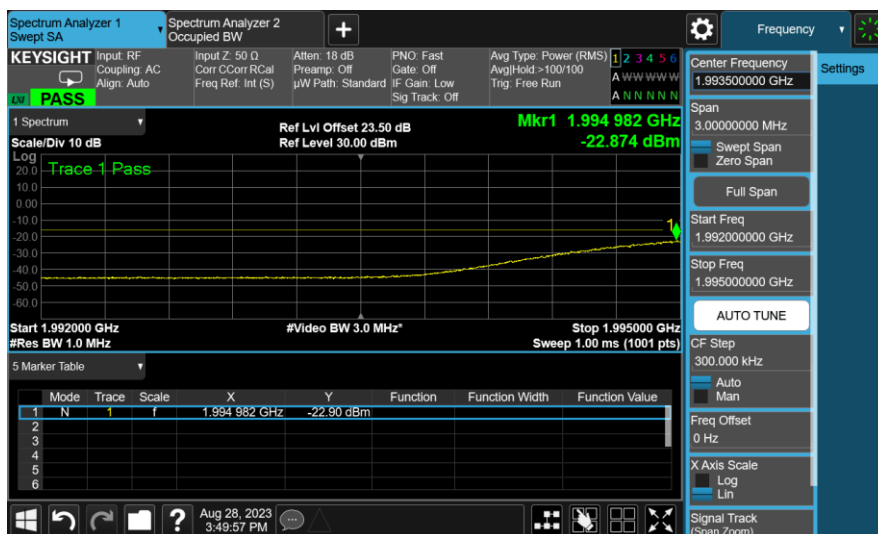
3. Pretest performe at AWS-2 block, AWS-4 block and combined AWS-4&AWS-2 block, only the worst-case combined AWS-4 and AWS-2 block test plot was record in the report.

4. The spurious emissions 9kHz to 30MHz were very low and not displayed in this report.

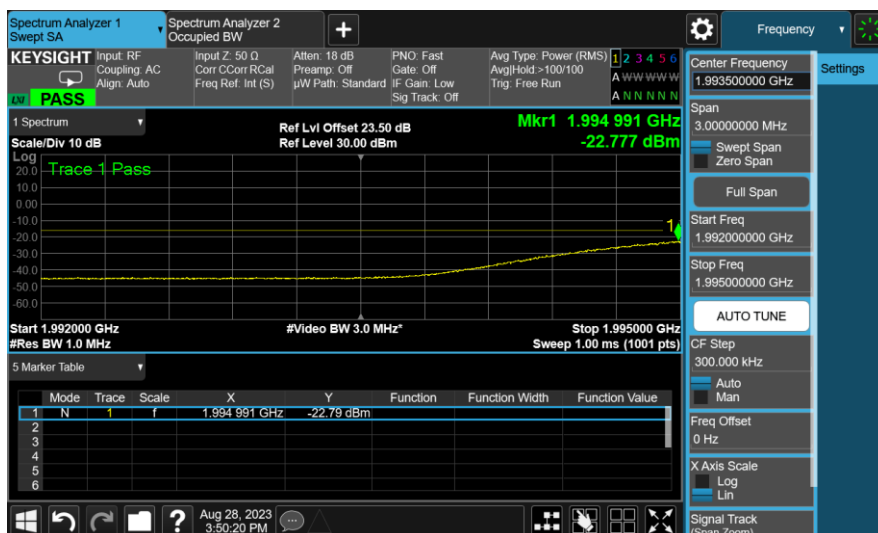


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DL_1S_B_AWGN_Pre-AGC_Out-of-band emission



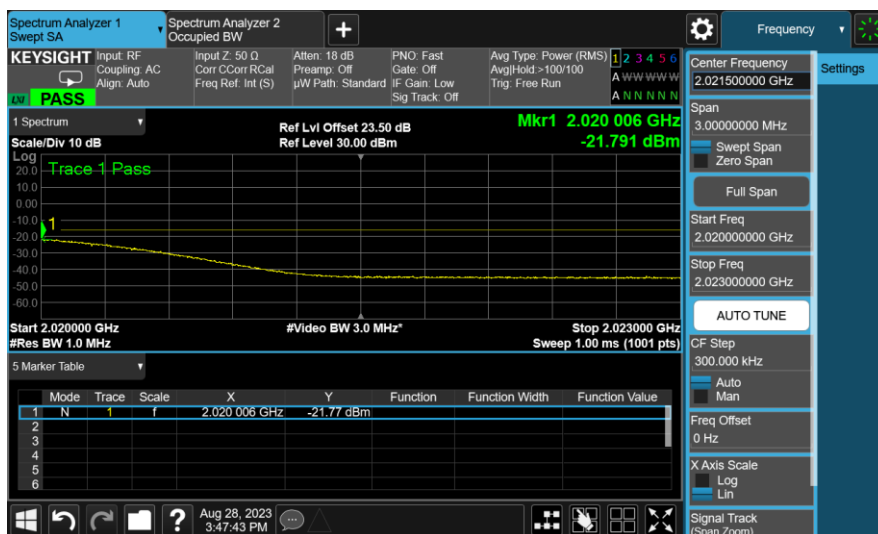
DL_1S_B_AWGN_AGC+3_Out-of-band emission



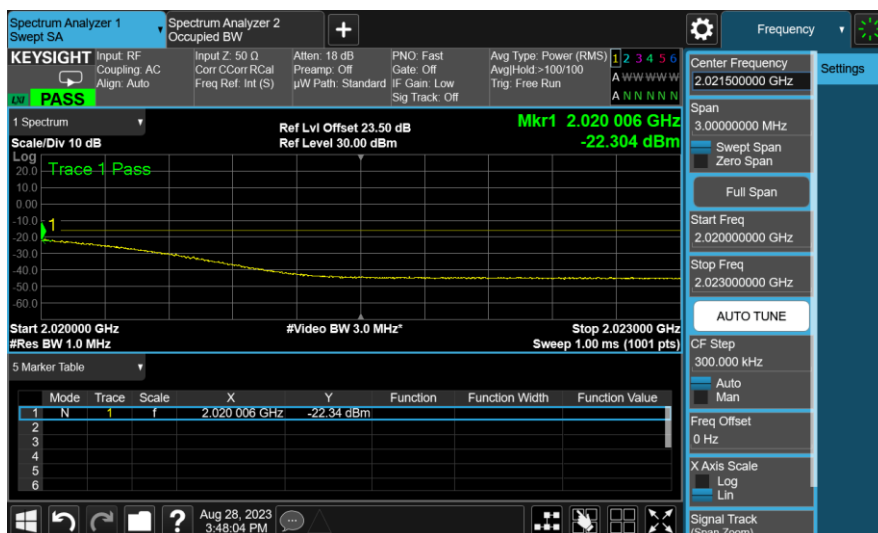
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DL_1S_T_AWGN_Pre-AGC_Out-of-band emission



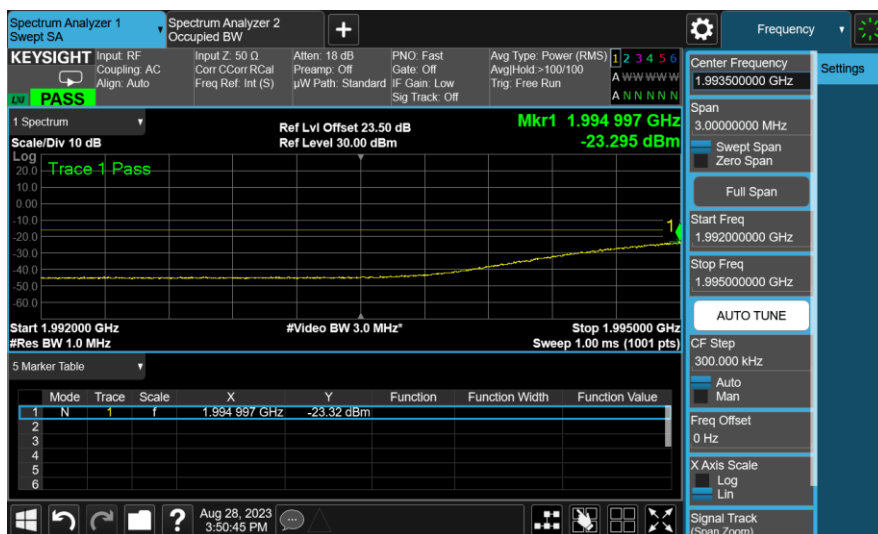
DL_1S_T_AWGN_AGC+3_Out-of-band emission



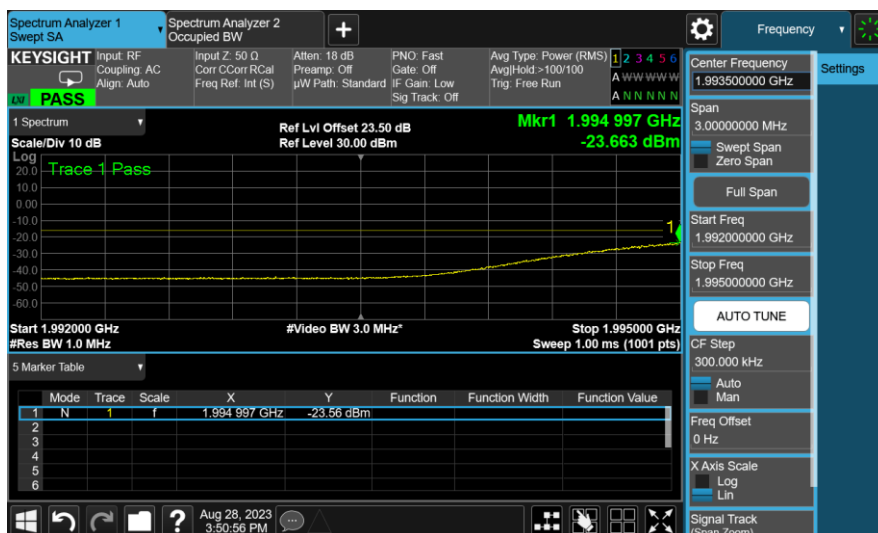
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DL_2S_B_AWGN_Pre-AGC_Out-of-band emission



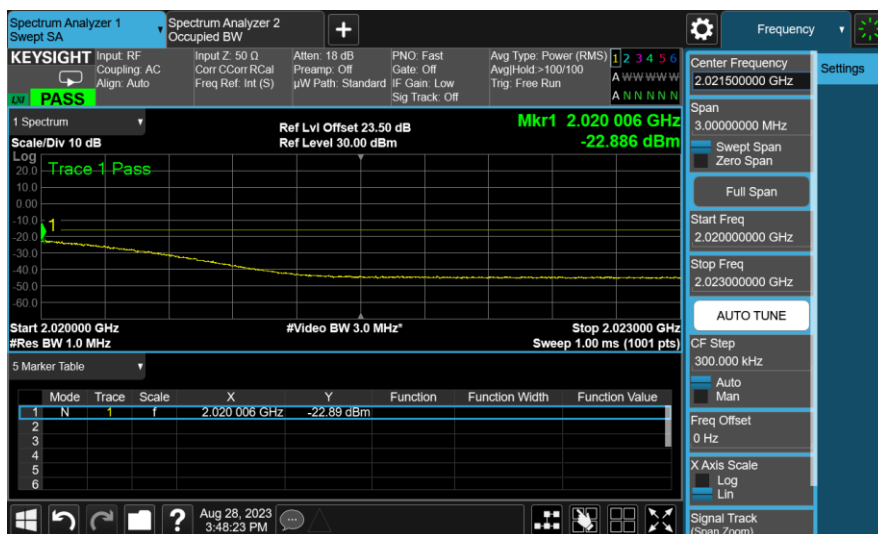
DL_2S_B_AWGN_AGC+3_Out-of-band emission



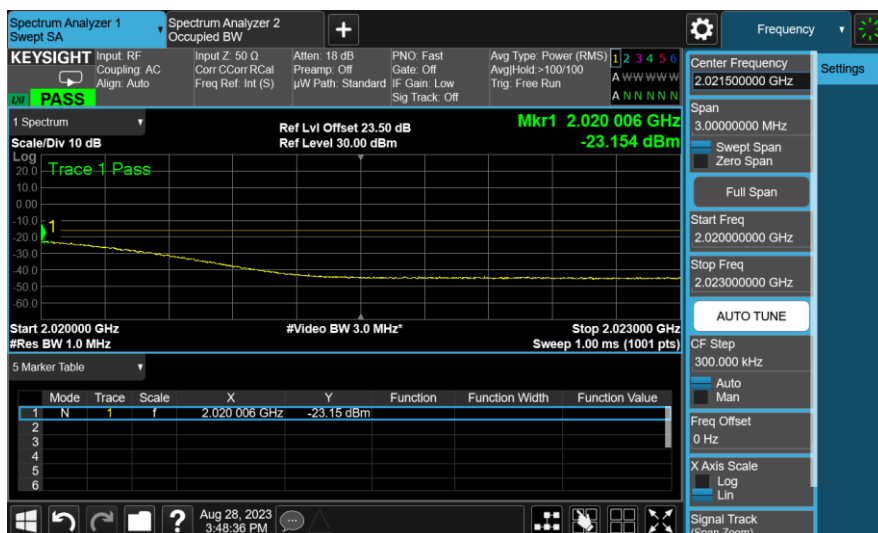
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DL_2S_T_AWGN_Pre-AGC_Out-of-band emission



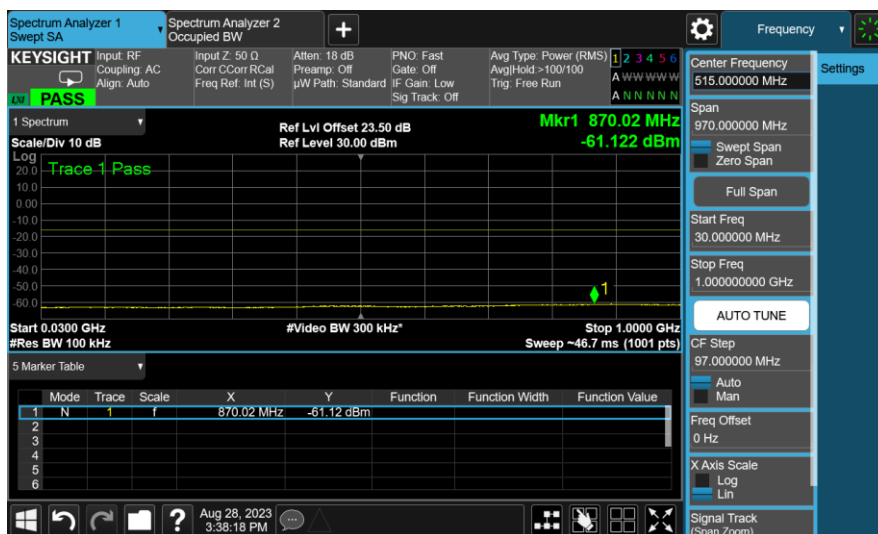
DL_2S_T_AWGN_AGC+3_Out-of-band emission



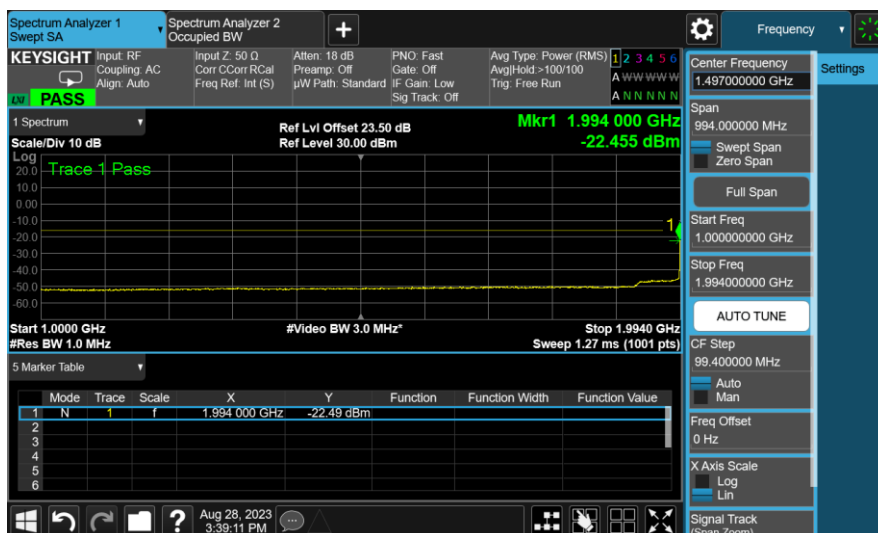
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DL_1S_B_AWGN_Pre-AGC_Spurious emission 1



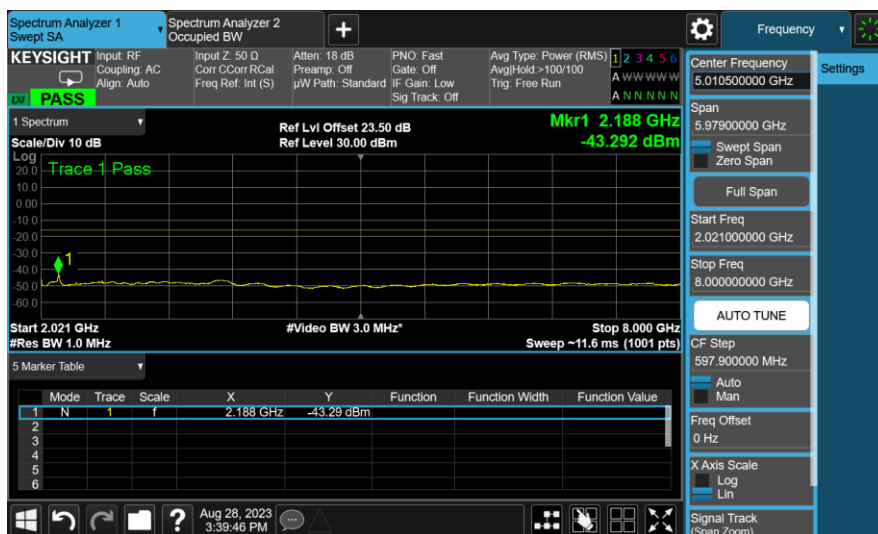
DL_1S_B_AWGN_Pre-AGC_Spurious emission 2



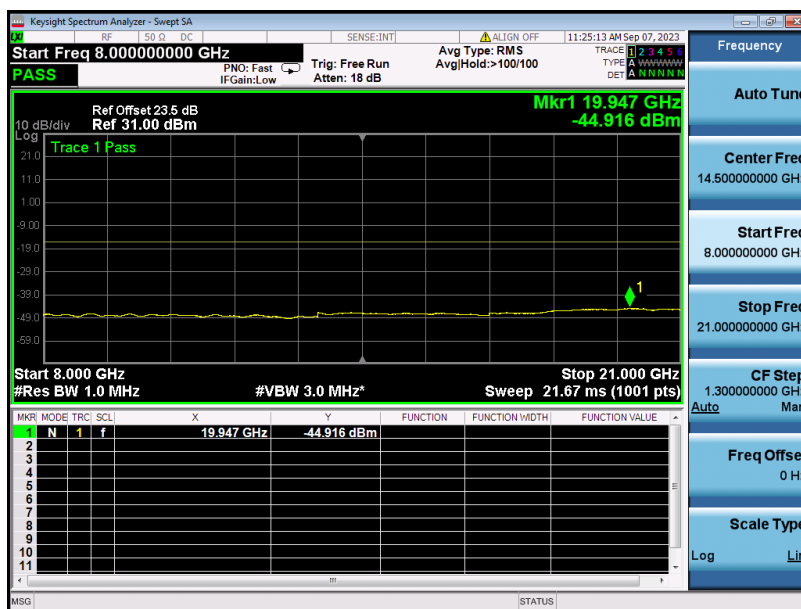
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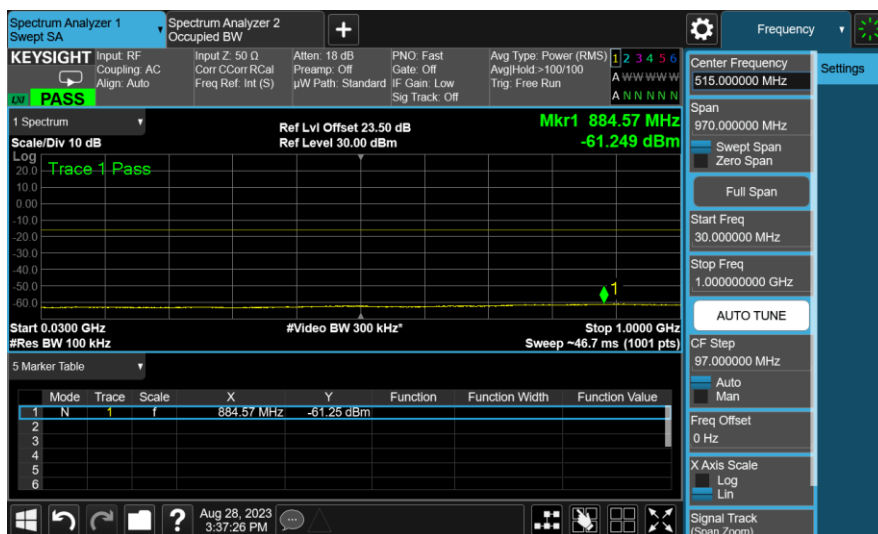
DL_1S_B_AWGN_Pre-AGC_Spurious emission 3



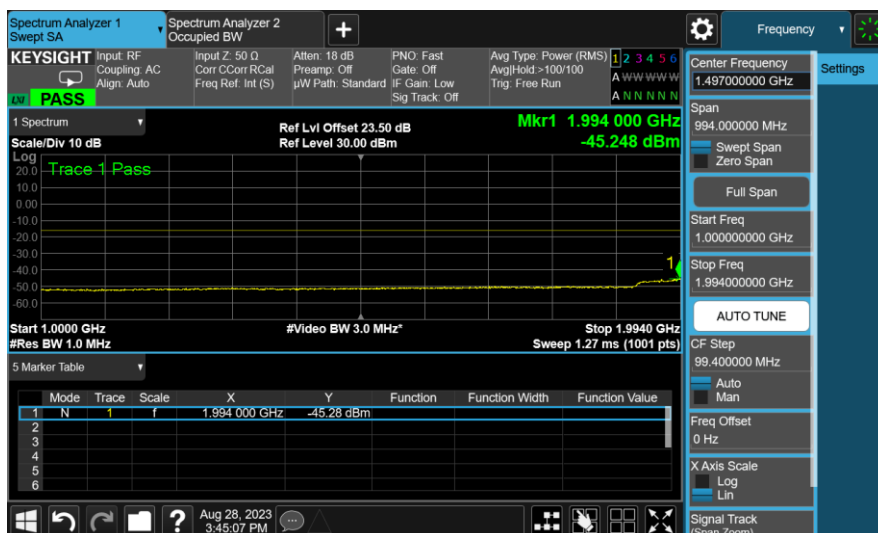
DL_1S_B_AWGN_Pre-AGC_Spurious emission 4



DL_1S_M_AWGN_Pre-AGC_Spurious emission 1



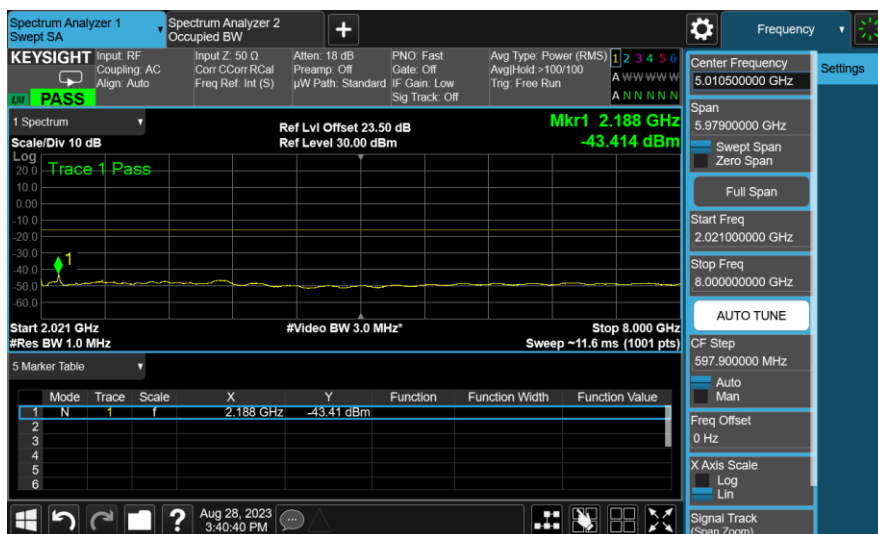
DL_1S_M_AWGN_Pre-AGC_Spurious emission 2



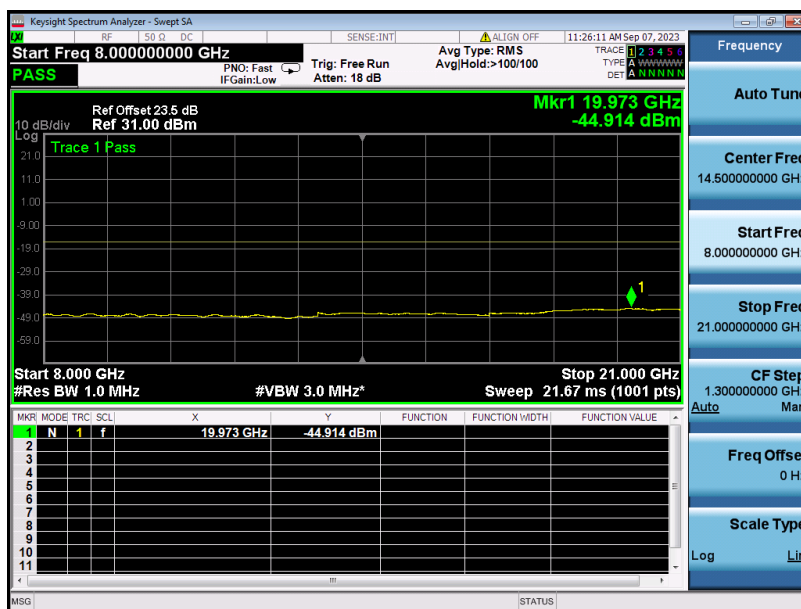
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DL_1S_M_AWGN_Pre-AGC_Spurious emission 3



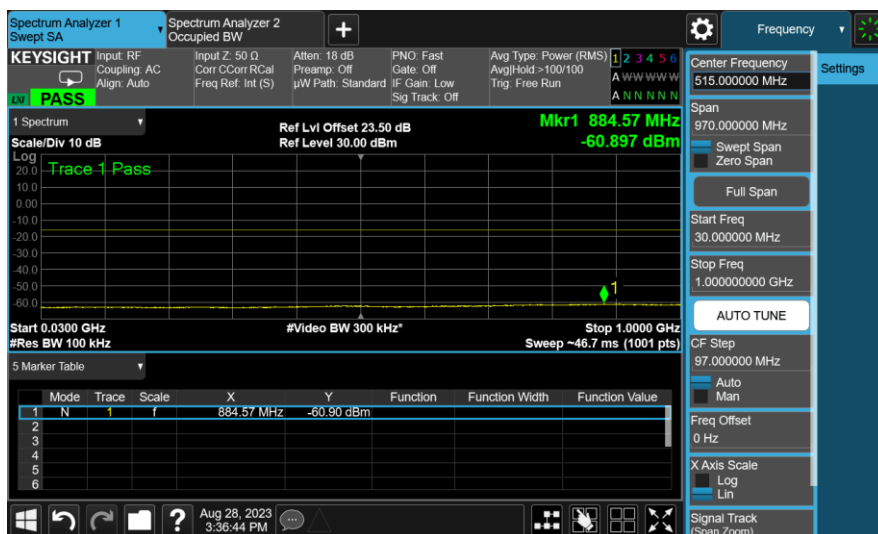
DL_1S_M_AWGN_Pre-AGC_Spurious emission 4



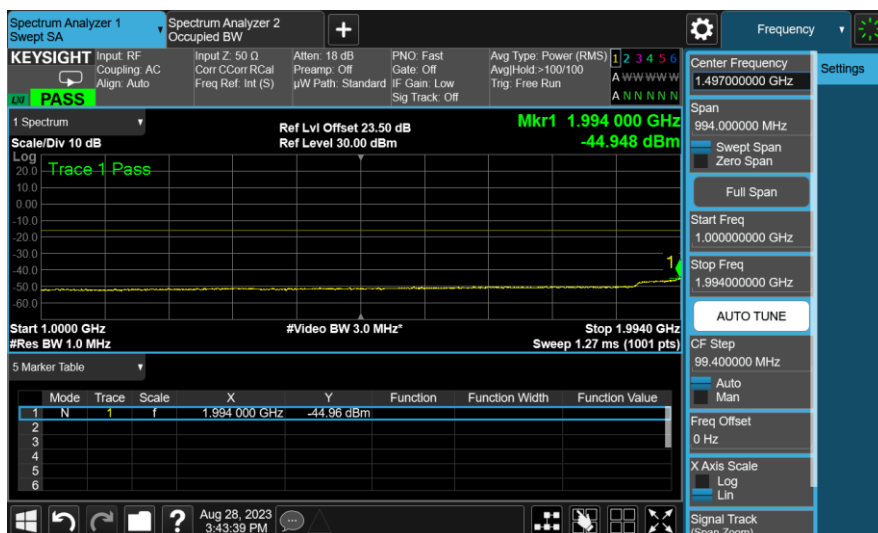
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DL_1S_T_AWGN_Pre-AGC_Spurious emission 1



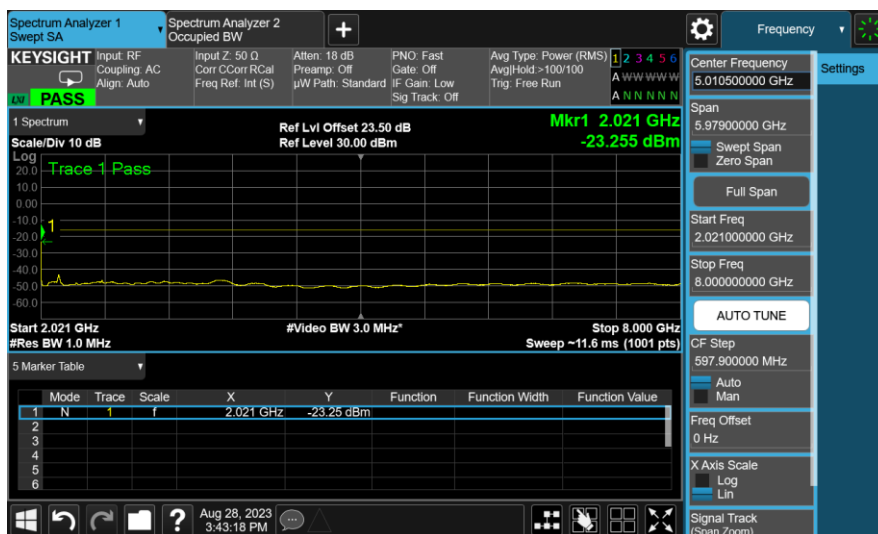
DL_1S_T_AWGN_Pre-AGC_Spurious emission 2



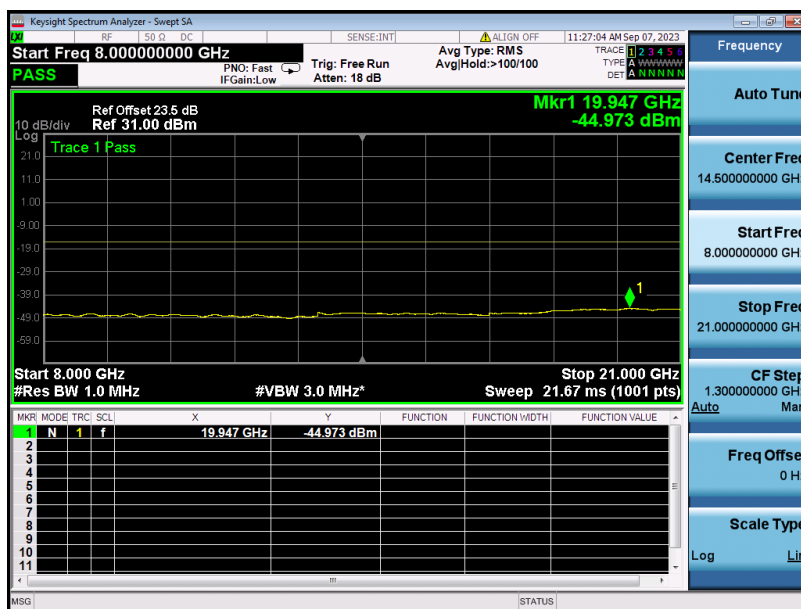
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DL_1S_T_AWGN_Pre-AGC_Spurious emission 3



DL_1S_T_AWGN_Pre-AGC_Spurious emission 4



1.5 Frequency Stability

- Note:
1. At 10 °C intervals of temperatures between -30 °C and +50 °C at the manufacturer's rated supply voltage, here the rated supply voltage is DC 48V.
 2. At +20 °C temperature and $\pm 15\%$ supply voltage variations. If a product is specified to operate over a range of input voltage, then the -15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.
 3. The frequency stabilities can be maintained within the authorized bands of operation. Meet the requirement.

Frequency stability vs temperature				
Temperature (°C)	Test Conf.	Frequency Error (Hz)	Tolerance (ppm)	Verdict
50	DL_1S_M_AWGN	103	0.051	PASS
40		103	0.051	PASS
30		111	0.055	PASS
20		95	0.047	PASS
10		115	0.057	PASS
0		102	0.051	PASS
-10		95	0.047	PASS
-20		112	0.056	PASS
-30		97	0.048	PASS

Frequency stability vs voltage				
Voltage (V)	Test Conf.	Frequency Error (Hz)	Tolerance (ppm)	Verdict
DC 40.8	DL_1S_M_AWGN	95	0.047	PASS
DC 48		95	0.047	PASS
DC 55.2		100	0.050	PASS



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1.6 Radiated spurious emissions

Note: 1. The tested max conducted power for single antenna port is 20.26dBm, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB

Here,

$P=20.26\text{dBm}=0.1062\text{W}$.

So the limit =

$P(\text{dBm}) - [43 + 10 \log(0.1062\text{W})] = -13\text{dBm}$

2. Based on discussion in docket No. DA 13-2409 (section 26 & 47) for operation in 2000-2020MHz in downlink, only 27.53(h)(1) and 27.53(h)(3) apply.

3. The radiated test performed at bottom / middle / top channel, the data with more than 20db margin, therefore, only the worst-case middle channel test data was recorded in the report.

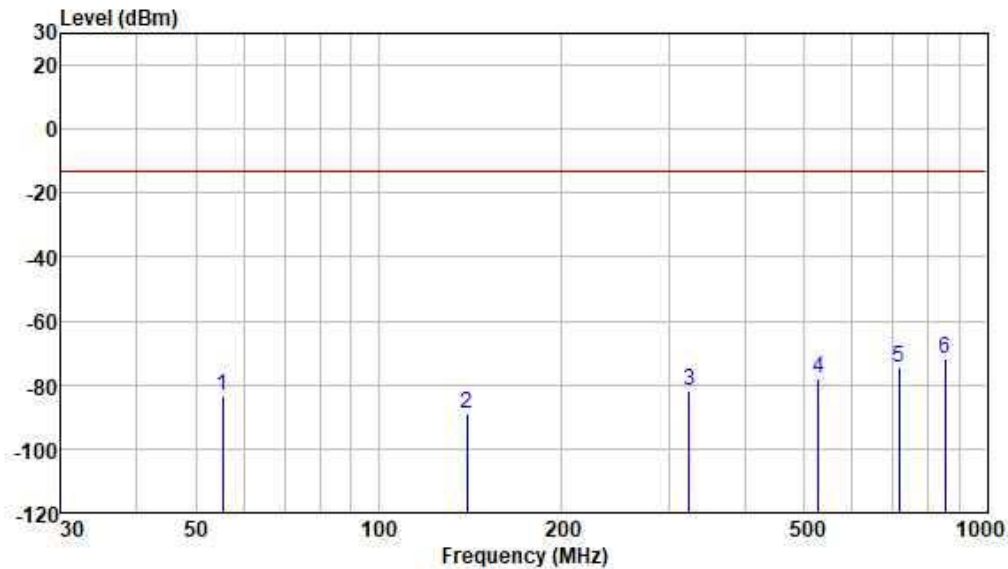
4. The disturbance 9kHz to 30MHz was very low and 20dB below the limit, therefore, the data was not recorded in the report.



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DL_1S_M_AWGN_Horizontal_30MHz~1GHz



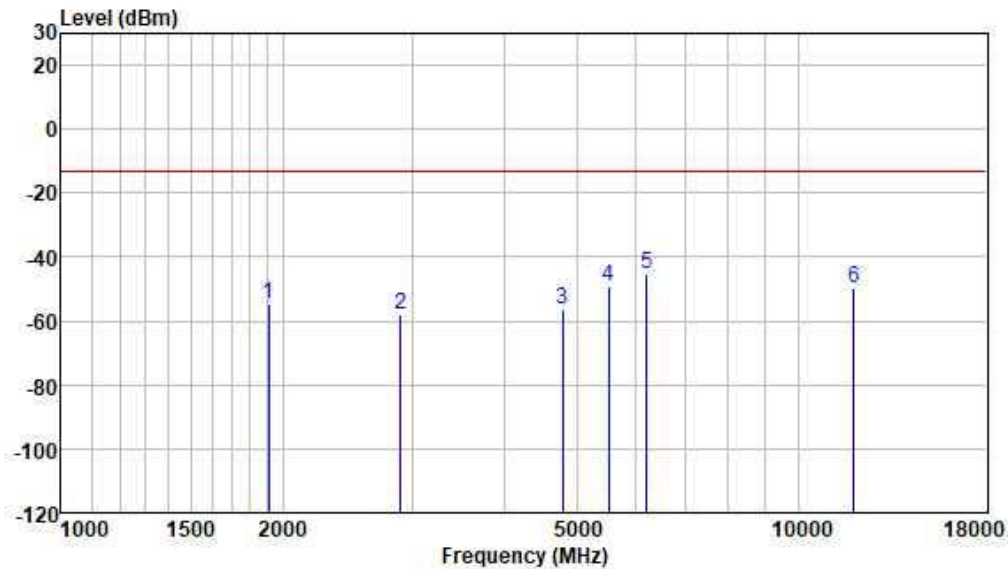
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	55.22	-81.52	-1.98	-83.50	-13.00	-70.50	HORIZONTAL
2	139.36	-81.42	-7.84	-89.26	-13.00	-76.26	HORIZONTAL
3	323.32	-78.94	-2.92	-81.86	-13.00	-68.86	HORIZONTAL
4	528.25	-78.46	0.60	-77.86	-13.00	-64.86	HORIZONTAL
5	716.68	-78.01	3.64	-74.37	-13.00	-61.37	HORIZONTAL
6	854.02	-78.97	7.28	-71.69	-13.00	-58.69	HORIZONTAL



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DL_1S_M_AWGN_Horizontal_above 1GHz



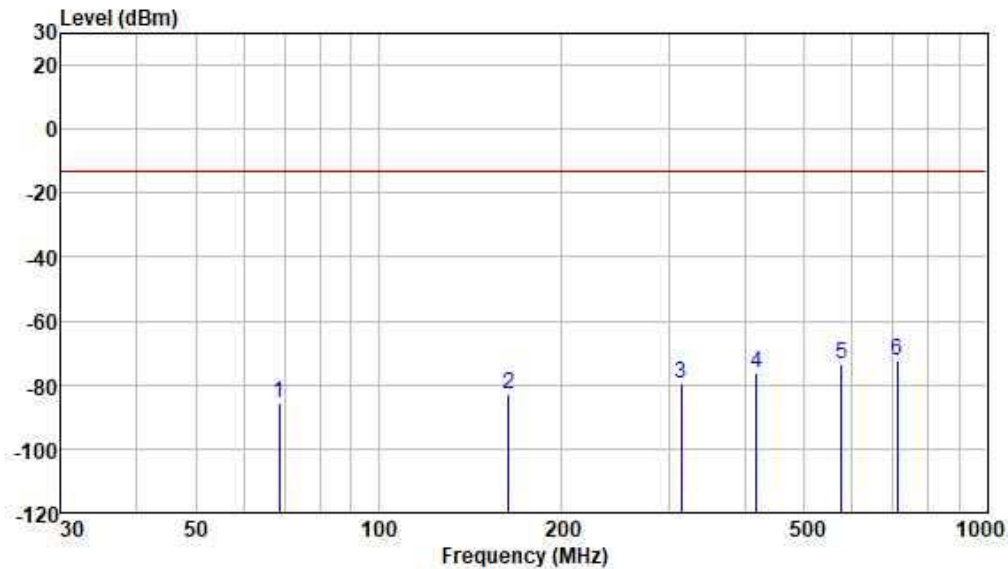
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	1910.65	-61.65	6.73	-54.92	-13.00	-41.92	HORIZONTAL
2	2888.58	-62.15	4.09	-58.06	-13.00	-45.06	HORIZONTAL
3	4790.25	-64.46	8.23	-56.23	-13.00	-43.23	HORIZONTAL
4	5519.07	-63.30	14.34	-48.96	-13.00	-35.96	HORIZONTAL
5	6213.44	-64.49	19.08	-45.41	-13.00	-32.41	HORIZONTAL
6	11871.71	-70.73	21.13	-49.60	-13.00	-36.60	HORIZONTAL



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DL_1S_M_AWGN_Vertical_30MHz~1GHz



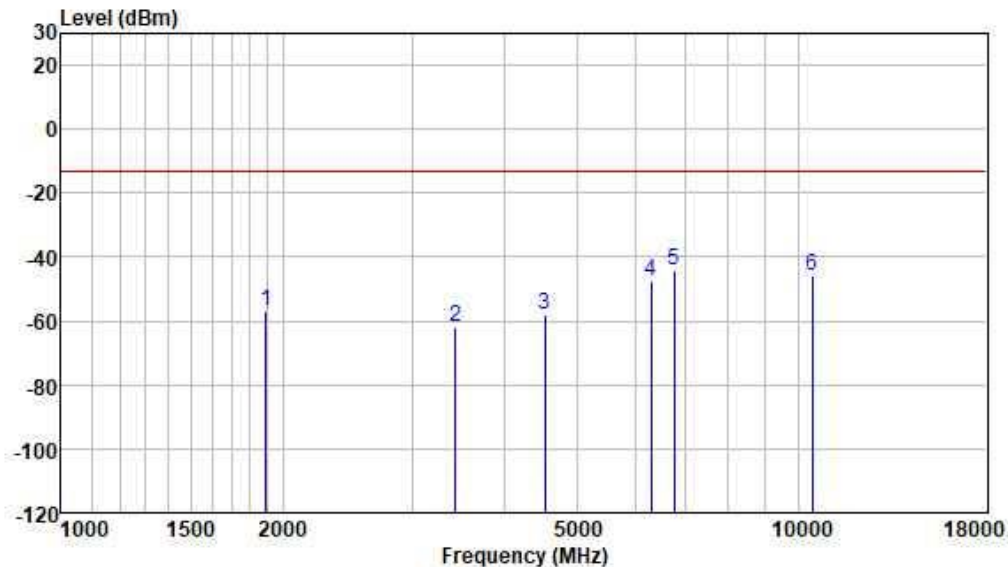
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	68.63	-77.94	-7.91	-85.85	-13.00	-72.85	VERTICAL
2	163.18	-78.73	-3.94	-82.67	-13.00	-69.67	VERTICAL
3	314.38	-77.27	-2.59	-79.86	-13.00	-66.86	VERTICAL
4	417.64	-77.09	0.72	-76.37	-13.00	-63.37	VERTICAL
5	576.64	-76.41	3.02	-73.39	-13.00	-60.39	VERTICAL
6	711.67	-76.74	4.35	-72.39	-13.00	-59.39	VERTICAL



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DL_1S_M_AWGN_Vertical_above 1GHz



	Freq	Read Level	Correction Factor	Level	Limit	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	1894.15	-63.93	6.87	-57.06	-13.00	-44.06	VERTICAL
2	3425.68	-65.12	3.31	-61.81	-13.00	-48.81	VERTICAL
3	4521.19	-64.29	6.17	-58.12	-13.00	-45.12	VERTICAL
4	6303.89	-66.48	19.12	-47.36	-13.00	-34.36	VERTICAL
5	6776.27	-64.92	20.97	-43.95	-13.00	-30.95	VERTICAL
6	10423.80	-69.74	24.00	-45.74	-13.00	-32.74	VERTICAL



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2 AWS-4 (only for downlink: 2180-2200MHz)

2.1 AGC threshold level

Test Conf.	AGC Threshold level
DL_1S_M_AWGN	0.10dBm



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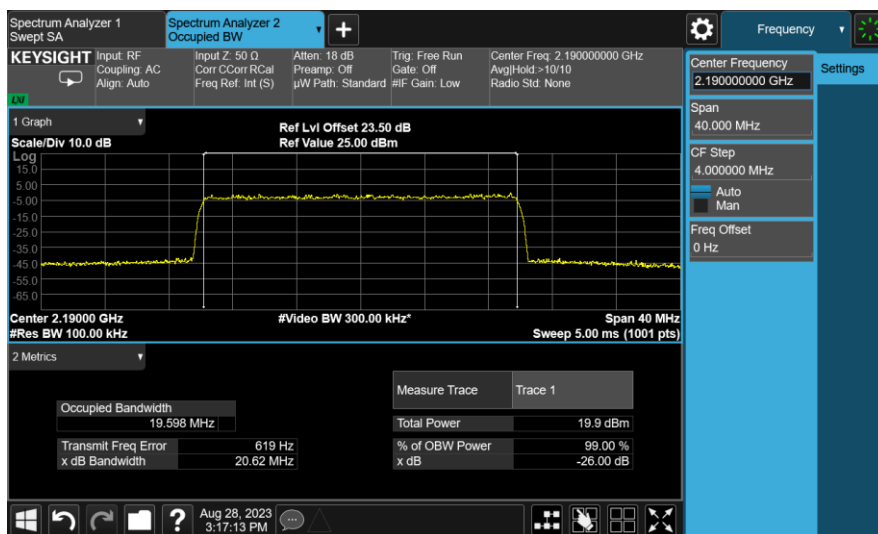
2.2 Input-versus-output signal comparison



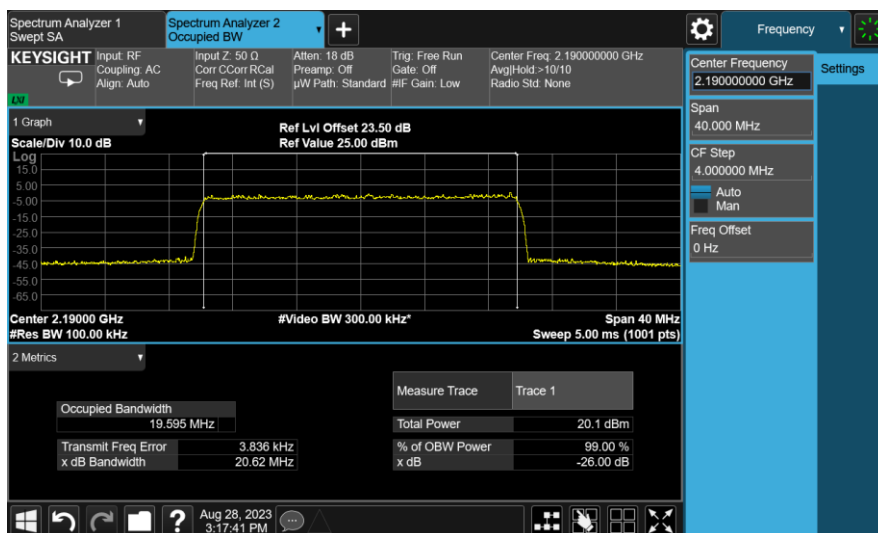
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Output_DL_1S_M_AWGN_Pre-AGC_OBW



Output_DL_1S_M_AWGN_AGC+3dB_OBW



Remark:

1. The band supports maximum channel BW is 20MHz for NR, so the output signal OBW was less than the input when 100MHz AWGN as input signal.
2. Compare the spectral plot of the input signal to the output signal affirm that they are similar (in passband and roll off characteristic features and relative spectral locations). The test result complies with the requirement.



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2.3 Mean output power and amplifier/booster gain

Test Conf.	Test Freq. f_0 (MHz)	Signal Level	Input Power (dBm)	Output Power (dBm)	Gain (dB)	Verdict
DL_1S_AWGN	2180.6	Pre-AGC	0.00	19.95	19.95	PASS
		AGC+3dB	3.00	19.89	/	PASS

Remark:

According to the declaration from the applicant, the antenna gain should not exceed 12.5dBi, the Directional gain = $G(\text{ANT}) + 10 \log (\text{NANT}) \text{ dBi} = 12.5\text{dBi} + 10 \log (2) \text{ dBi} = 15.5\text{dBi}$.

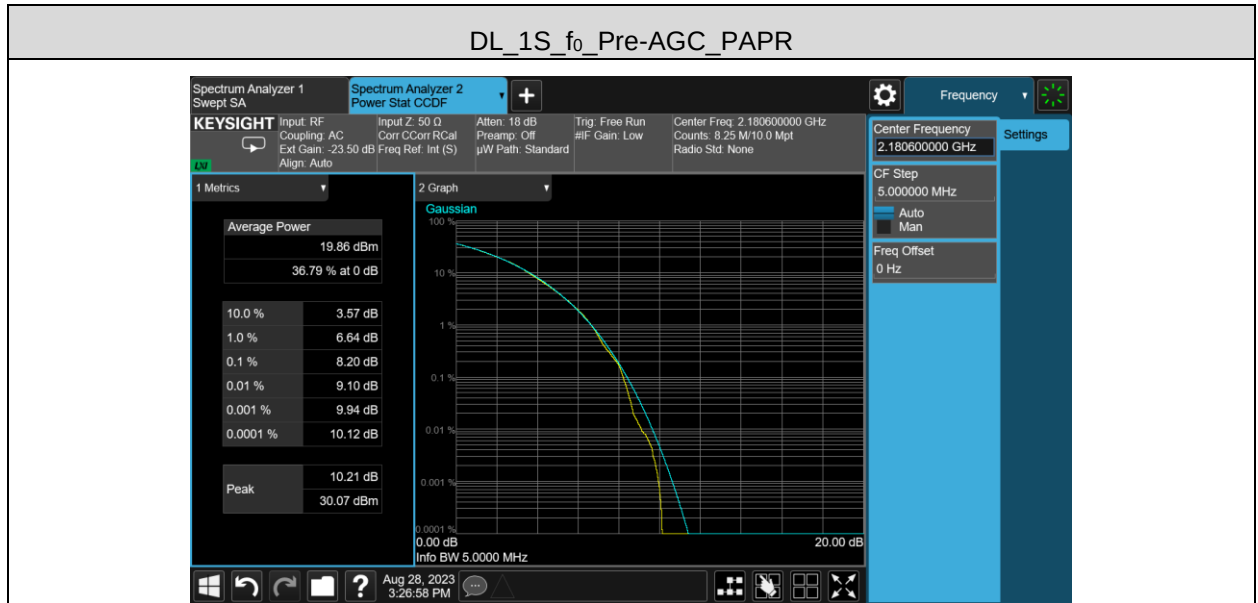
The total maximum EIRP for the EUT is $(19.95\text{dBm} + 19.95\text{dBm}) + 15.5\text{dBi} = 38.46\text{dBm}$ (7.015W) which don't exceed the required EIRP limit (1640W/MHz)



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Test Conf.	Test Freq. f_0 (MHz)	Signal Level	PAPR (dB)	Limit (dB)	Verdict
DL_1S_AWGN	2180.6	Pre-AGC	9.1	13	PASS



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Guangzhou Branch Testing Center EEC Laboratory. 中国·广州·经济技术开发区科学城科珠路198号 邮编: 510663 t (86-20) 82155555 f (86-20) 82075058 sgs.china@sgs.com

2.4 Out-of-band/out-of-block (including intermodulation) emissions and spurious emissions

Note: 1. The tested max conducted power for single antenna port is 19.95dBm, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB

Here,

$P = 19.95\text{dBm} = 0.1081\text{W}$.

So the limit =

$P(\text{dBm}) - [43 + 10 \log(0.098\text{W})] = -13\text{dBm}$

The EUT supports 2x2 MIMO and the emissions were measured at one of output port, so the limit line was set to -16.01dBm in following test plots in order to determine the test result conveniently.

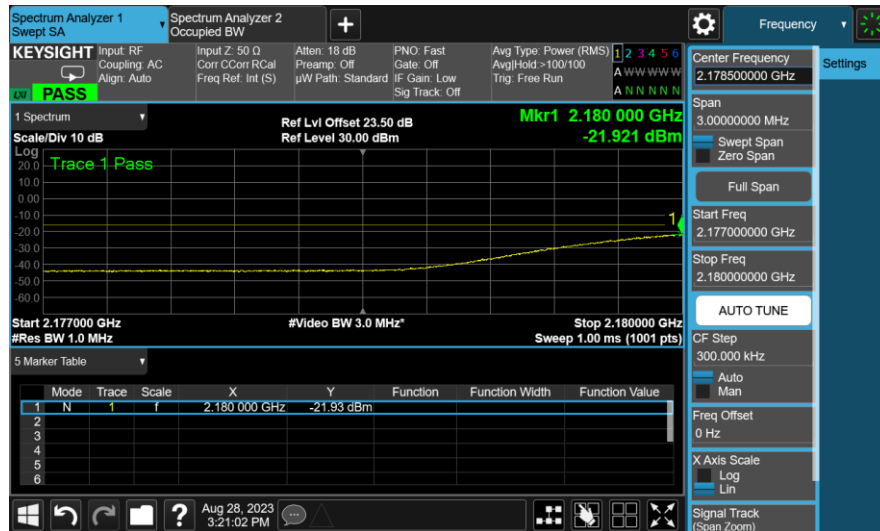
2. The spurious emissions 9kHz to 30MHz were very low and not displayed in this report.



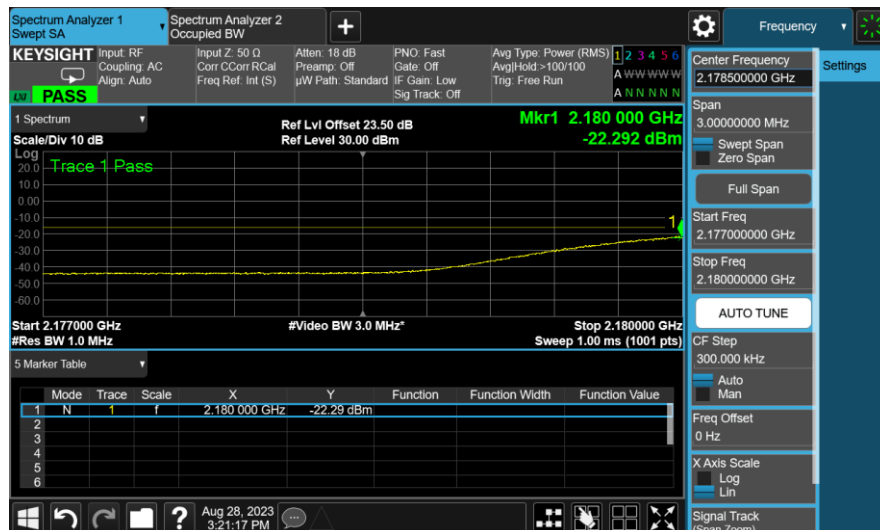
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DL_1S_B_AWGN_Pre-AGC_Out-of-band emission



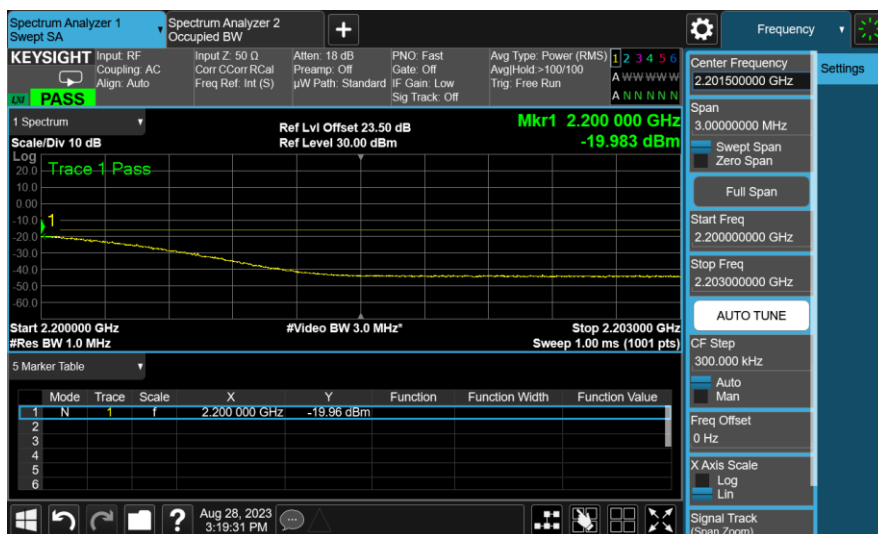
DL_1S_B_AWGN_AGC+3_Out-of-band emission



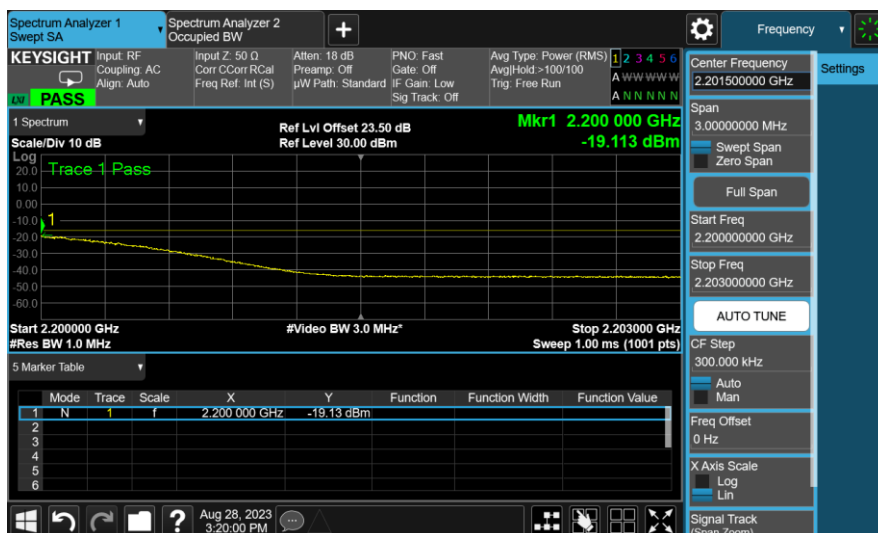
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DL_1S_T_AWGN_Pre-AGC_Out-of-band emission



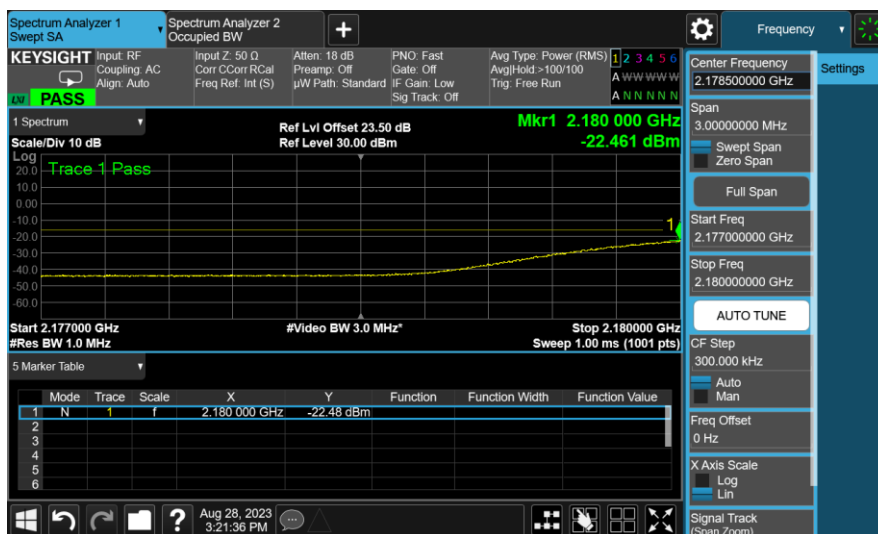
DL_1S_T_AWGN_AGC+3_Out-of-band emission



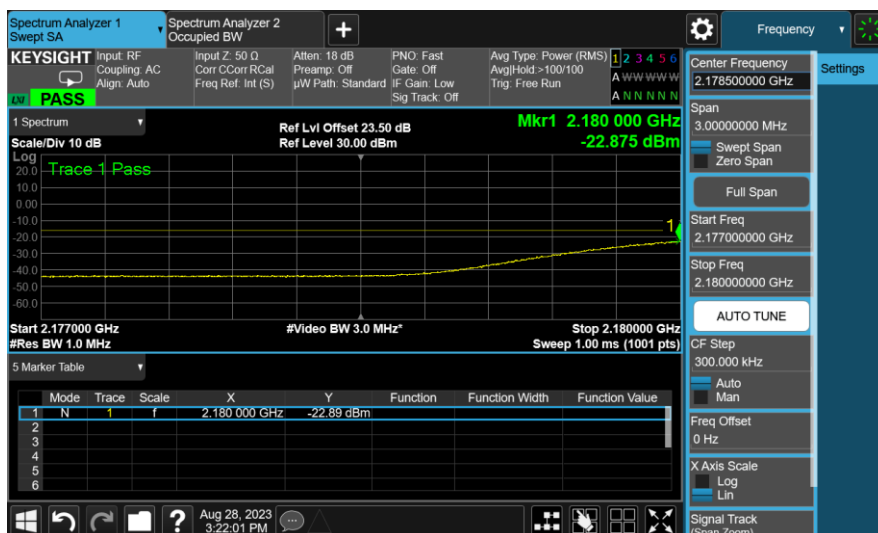
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DL_2S_B_AWGN_Pre-AGC_Out-of-band emission



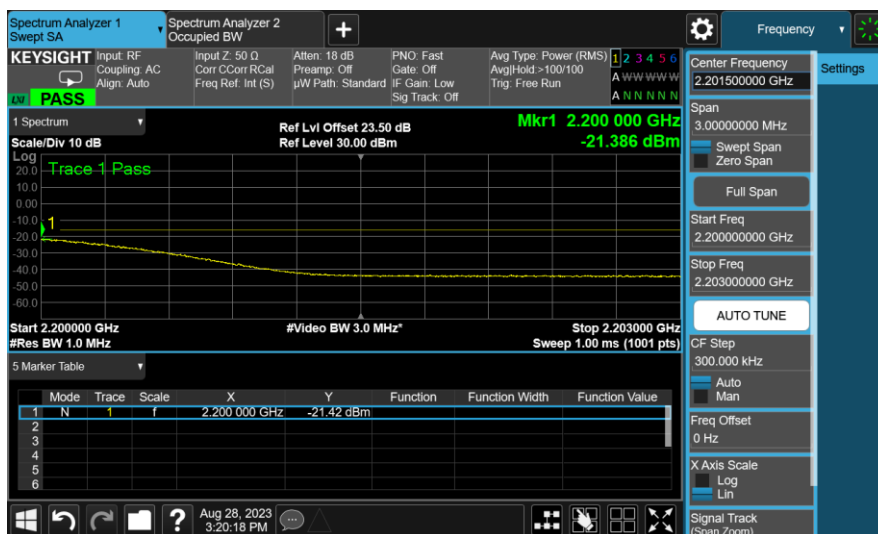
DL_2S_B_AWGN_AGC+3_Out-of-band emission



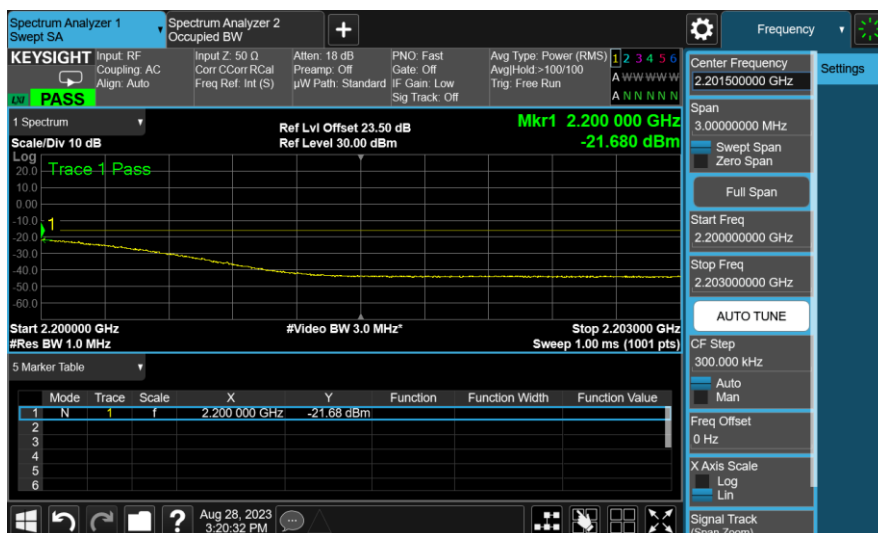
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DL_2S_T_AWGN_Pre-AGC_Out-of-band emission



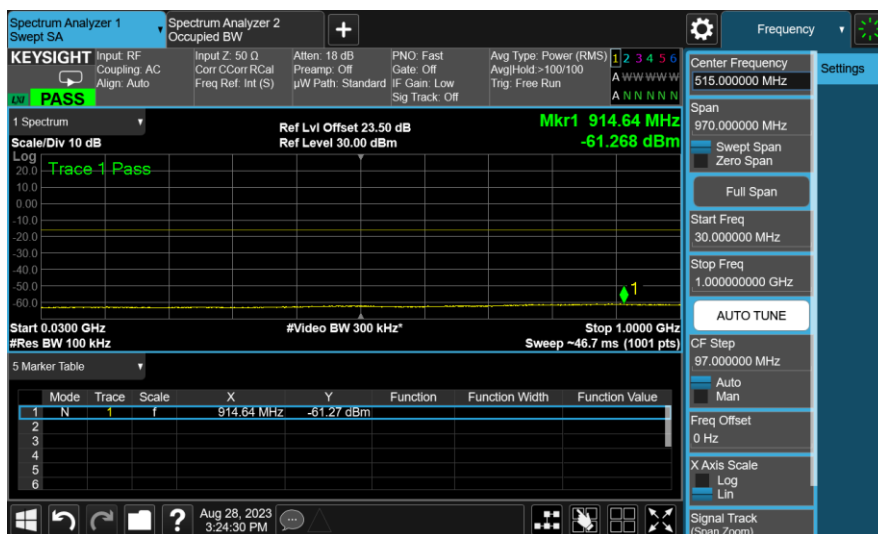
DL_2S_T_AWGN_AGC+3_Out-of-band emission



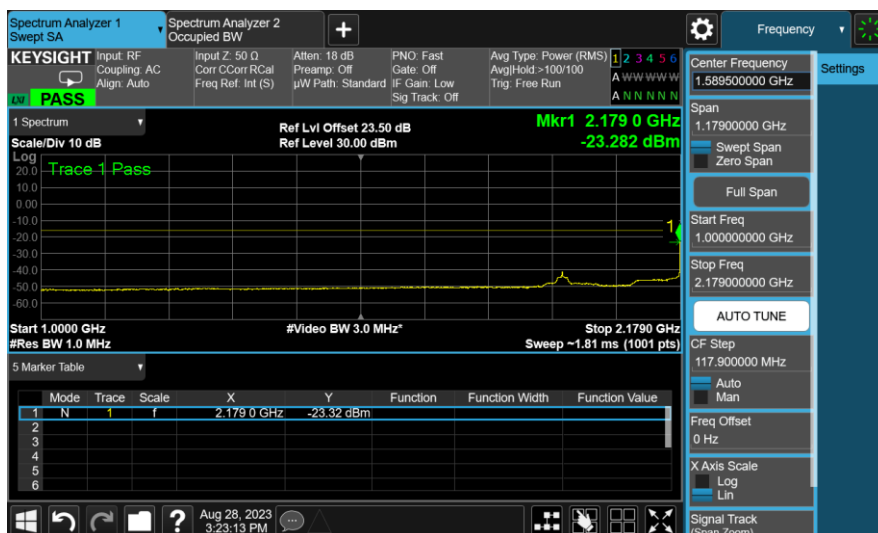
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DL_1S_M_AWGN_Pre-AGC_Spurious emission 1



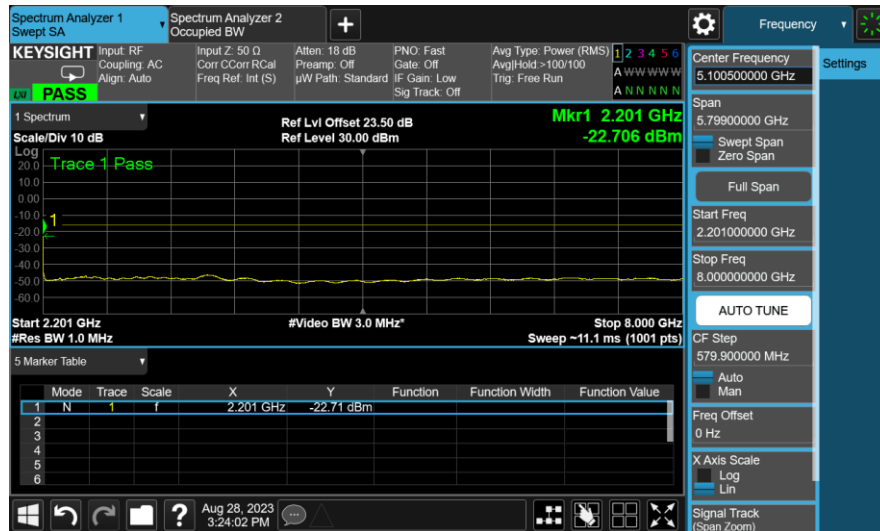
DL_1S_M_AWGN_Pre-AGC_Spurious emission 2



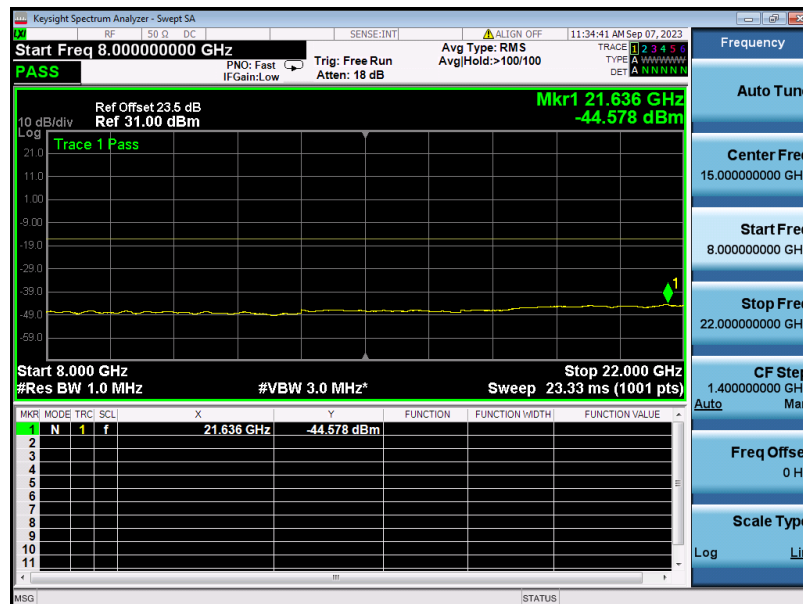
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DL_1S_M_AWGN_Pre-AGC_Spurious emission 3



DL_1S_M_AWGN_Pre-AGC_Spurious emission 4



2.5 Frequency Stability

- Note:
1. At 10 °C intervals of temperatures between -30 °C and +50 °C at the manufacturer's rated supply voltage, here the rated supply voltage is DC 48V.
 2. At +20 °C temperature and ±15% supply voltage variations. If a product is specified to operate over a range of input voltage, then the -15% variation is applied to the lowermost voltage and the +15% is applied to the uppermost voltage.
 3. The frequency stabilities can be maintained within the authorized bands of operation. Meet the requirement.

Frequency stability vs temperature				
Temperature (°C)	Test Conf.	Frequency Error (Hz)	Tolerance (ppm)	Verdict
50	DL_1S_M_AWGN	108	0.049	PASS
40		105	0.048	PASS
30		113	0.052	PASS
20		106	0.048	PASS
10		95	0.043	PASS
0		94	0.043	PASS
-10		105	0.048	PASS
-20		93	0.042	PASS
-30		110	0.050	PASS

Frequency stability vs voltage				
Voltage (V)	Test Conf.	Frequency Error (Hz)	Tolerance (ppm)	Verdict
DC 40.8	DL_1S_M_AWGN	110	0.050	PASS
DC 48		106	0.048	PASS
DC 55.2		101	0.046	PASS



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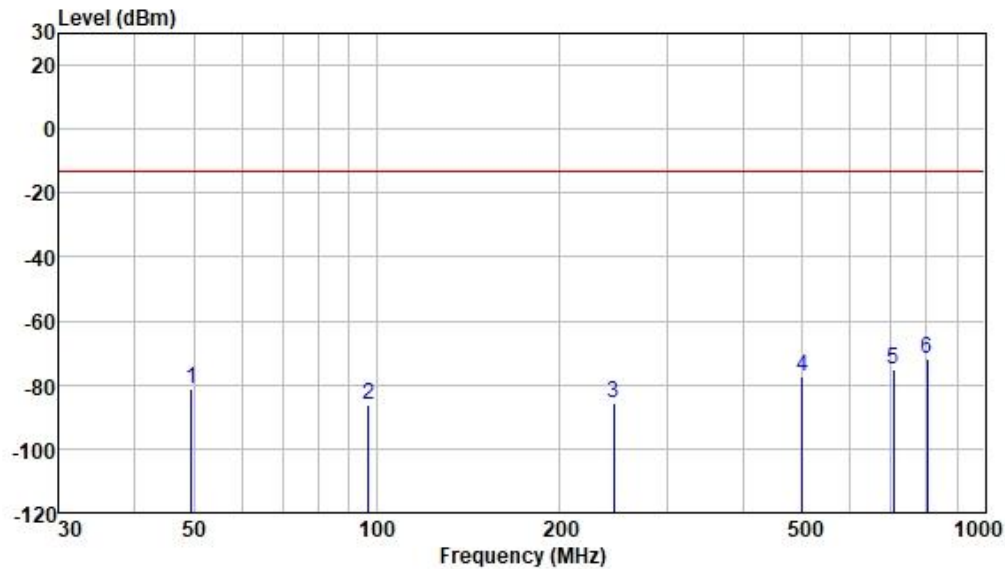
2.6 Radiated spurious emissions

- Note:
1. The tested max conducted power for single antenna port is 20.23dBm. the 2x2 MIMO total power is $20.23\text{dBm} + 20.23\text{dBm} = 0.2103\text{W}$.
the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB
Here,
 $P = 0.2103\text{W}$,
So the limit =
 $P(\text{dBm}) - [43 + 10 \log (0.2103\text{W})] = -13\text{dBm}$
For these AWS-4 operations in the 2180-2200 MHz band, the power of any emissions on all frequencies between 2200 and 2290 MHz shall not exceed an EIRP of -100.6 dBW/4 kHz ,
 $-100.6 \text{ dBW/4 kHz} = -70.6 \text{ dBm/4 kHz} = -46.6 \text{ dBm/1 MHz}$
 2. The radiated test performed at bottom / middle / top channel, the data with more than 20db margin, therefore, only the worst-case middle channel test data was recorded in the report.
 3. The disturbance 9kHz to 30MHz was very low and 20dB below the limit, therefore, the data was not recorded in the report.



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DL_1S_M_AWGN_Horizontal_30MHz~1GHz



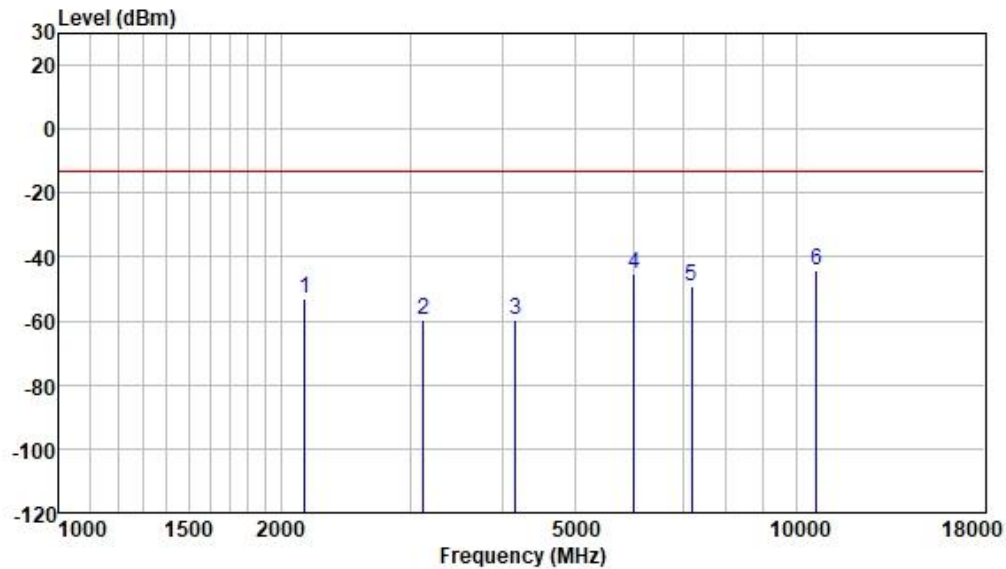
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	49.53	-79.89	-1.50	-81.39	-13.00	-68.39	HORIZONTAL
2	96.77	-76.80	-9.66	-86.46	-13.00	-73.46	HORIZONTAL
3	245.09	-79.79	-5.83	-85.62	-13.00	-72.62	HORIZONTAL
4	501.18	-78.01	0.39	-77.62	-13.00	-64.62	HORIZONTAL
5	706.70	-78.96	4.06	-74.90	-13.00	-61.90	HORIZONTAL
6	801.79	-78.87	6.79	-72.08	-13.00	-59.08	HORIZONTAL



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DL_1S_M_AWGN_Horizontal_above 1GHz



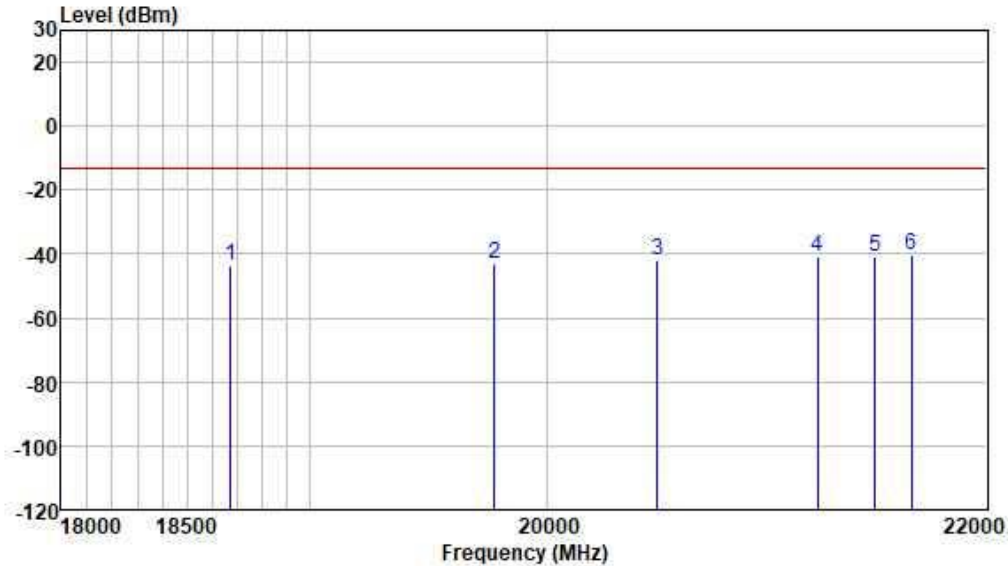
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	2151.03	-62.58	9.34	-53.24	-13.00	-40.24	HORIZONTAL
2	3114.03	-62.10	2.33	-59.77	-13.00	-46.77	HORIZONTAL
3	4157.66	-63.75	3.87	-59.88	-13.00	-46.88	HORIZONTAL
4	6019.00	-64.46	19.17	-45.29	-13.00	-32.29	HORIZONTAL
5	7200.31	-67.63	18.41	-49.22	-13.00	-36.22	HORIZONTAL
6	10636.85	-67.70	23.79	-43.91	-13.00	-30.91	HORIZONTAL



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DL_1S_M_AWGN_Horizontal_above 1GHz



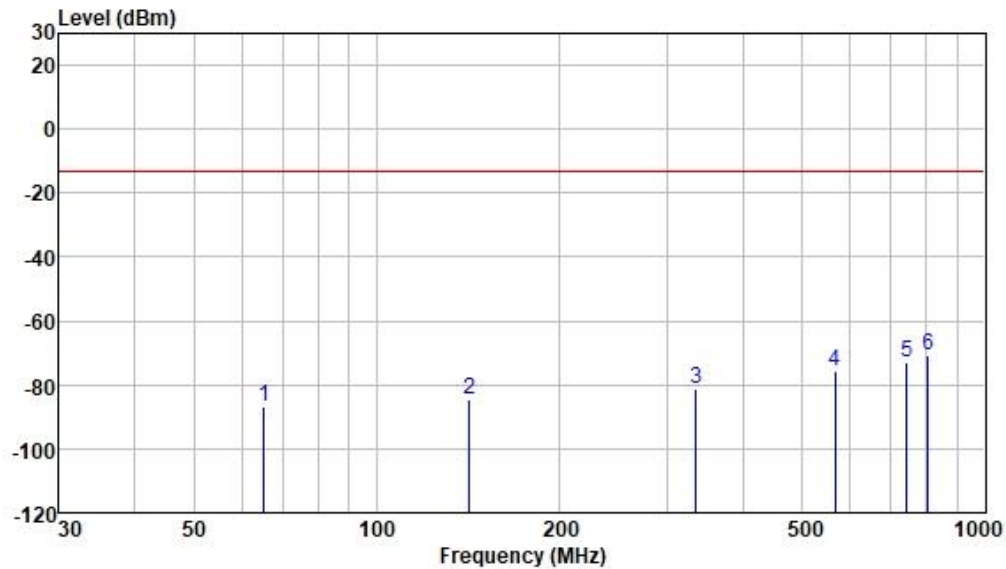
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	18673.30	-80.17	36.75	-43.42	-13.00	-30.42	HORIZONTAL
2	19772.37	-81.47	38.39	-43.08	-13.00	-30.08	HORIZONTAL
3	20483.17	-80.50	38.54	-41.96	-13.00	-28.96	HORIZONTAL
4	21206.75	-79.20	38.62	-40.58	-13.00	-27.58	HORIZONTAL
5	21472.25	-79.48	38.66	-40.82	-13.00	-27.82	HORIZONTAL
6	21640.95	-78.98	38.69	-40.29	-13.00	-27.29	HORIZONTAL



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DL_1S_M_AWGN_Vertical_30MHz~1GHz



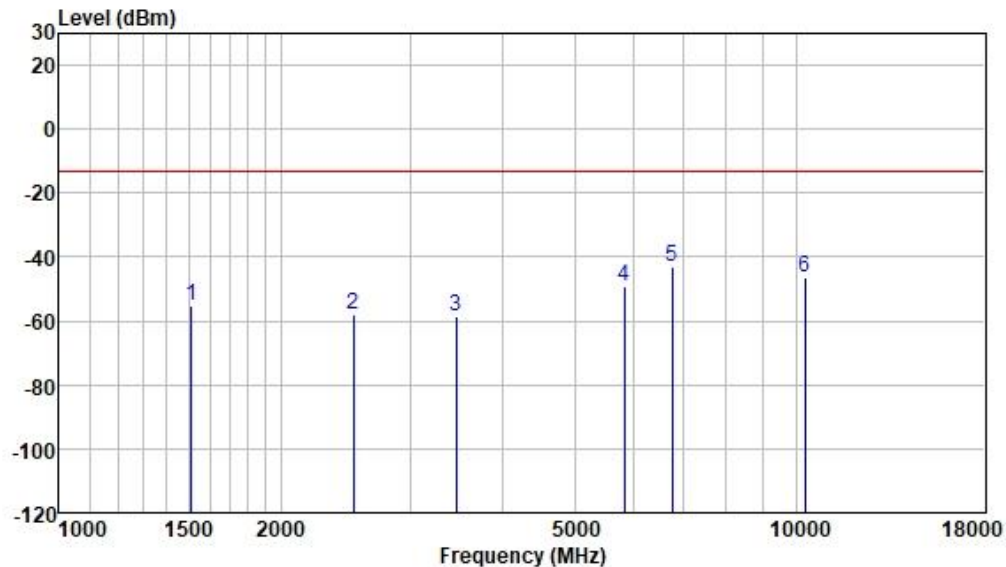
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	65.11	-81.28	-5.55	-86.83	-13.00	-73.83	VERTICAL
2	141.83	-80.79	-3.93	-84.72	-13.00	-71.72	VERTICAL
3	334.86	-79.17	-2.31	-81.48	-13.00	-68.48	VERTICAL
4	566.62	-78.62	2.75	-75.87	-13.00	-62.87	VERTICAL
5	742.26	-78.31	5.52	-72.79	-13.00	-59.79	VERTICAL
6	804.60	-78.44	7.46	-70.98	-13.00	-57.98	VERTICAL



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DL_1S_M_AWGN_Vertical_above 1GHz



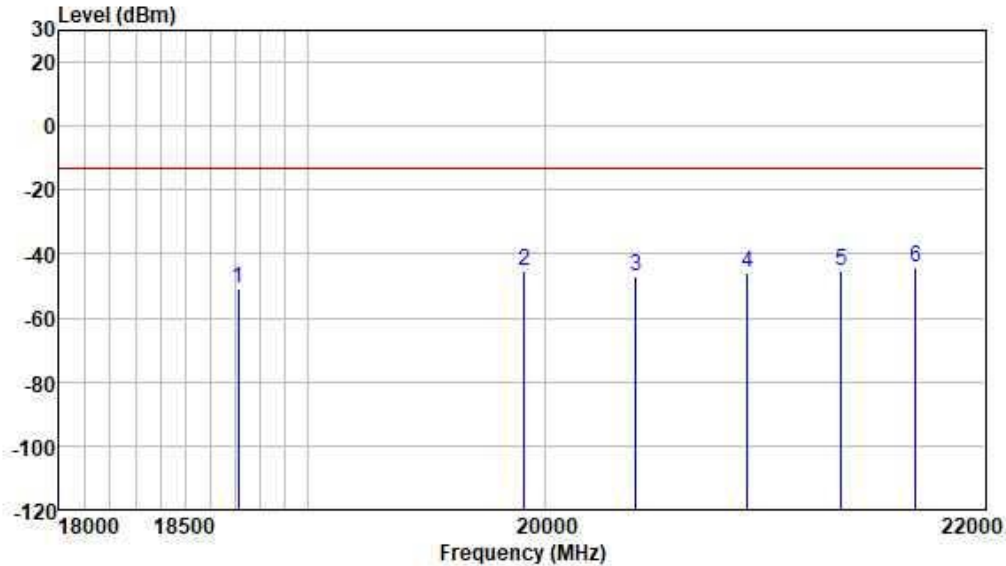
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	1511.83	-62.24	6.77	-55.47	-13.00	-42.47	VERTICAL
2	2507.13	-65.01	7.15	-57.86	-13.00	-44.86	VERTICAL
3	3455.51	-62.27	3.55	-58.72	-13.00	-45.72	VERTICAL
4	5830.64	-64.93	16.00	-48.93	-13.00	-35.93	VERTICAL
5	6776.27	-63.79	20.97	-42.82	-13.00	-29.82	VERTICAL
6	10244.58	-68.15	21.88	-46.27	-13.00	-33.27	VERTICAL



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DL_1S_M_AWGN_Vertical_above 1GHz



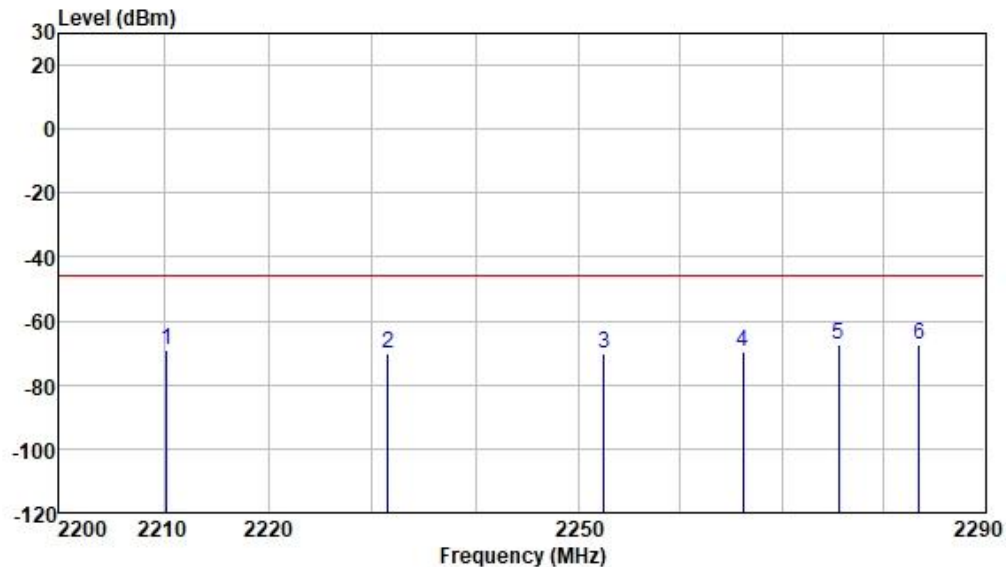
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	18714.56	-80.33	29.66	-50.67	-13.00	-37.67	VERTICAL
2	19907.74	-80.09	35.05	-45.04	-13.00	-32.04	VERTICAL
3	20397.04	-82.41	35.28	-47.13	-13.00	-34.13	VERTICAL
4	20894.17	-81.18	35.39	-45.79	-13.00	-32.79	VERTICAL
5	21326.25	-80.62	35.52	-45.10	-13.00	-32.10	VERTICAL
6	21671.37	-79.76	35.66	-44.10	-13.00	-31.10	VERTICAL



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DL_1S_M_AWGN_Horizontal_2200-2290MHz



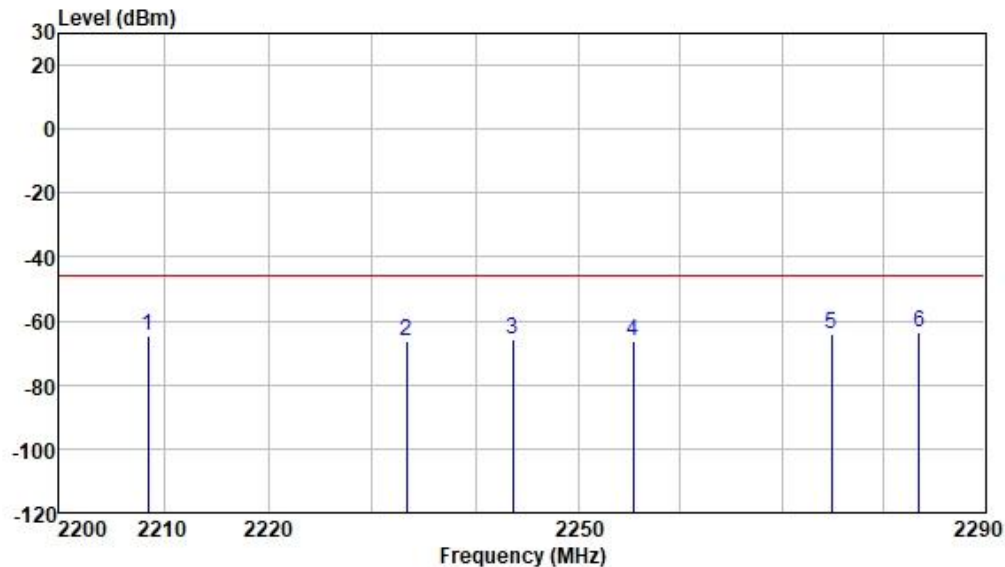
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	2210.26	-78.10	9.25	-68.85	-46.00	-22.85	HORIZONTAL
2	2231.54	-79.26	9.35	-69.91	-46.00	-23.91	HORIZONTAL
3	2252.48	-79.37	9.44	-69.93	-46.00	-23.93	HORIZONTAL
4	2266.16	-79.12	9.49	-69.63	-46.00	-23.63	HORIZONTAL
5	2275.54	-76.87	9.51	-67.36	-46.00	-21.36	HORIZONTAL
6	2283.49	-76.77	9.55	-67.22	-46.00	-21.22	HORIZONTAL



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DL_1S_M_AWGN_Vertical_2200-2290MHz



	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	2208.48	-74.28	9.43	-64.85	-46.00	-18.85	VERTICAL
2	2233.33	-75.74	9.47	-66.27	-46.00	-20.27	VERTICAL
3	2243.65	-75.22	9.50	-65.72	-46.00	-19.72	VERTICAL
4	2255.37	-75.72	9.51	-66.21	-46.00	-20.21	VERTICAL
5	2274.81	-73.82	9.55	-64.27	-46.00	-18.27	VERTICAL
6	2283.49	-73.01	9.56	-63.45	-46.00	-17.45	VERTICAL

--End of Appendix--



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