

Appendix -

Test Data and Result for report

GZCR231100125602

(B)

(Supplement test data for 5G NR with 100 MHz AWGN signal)

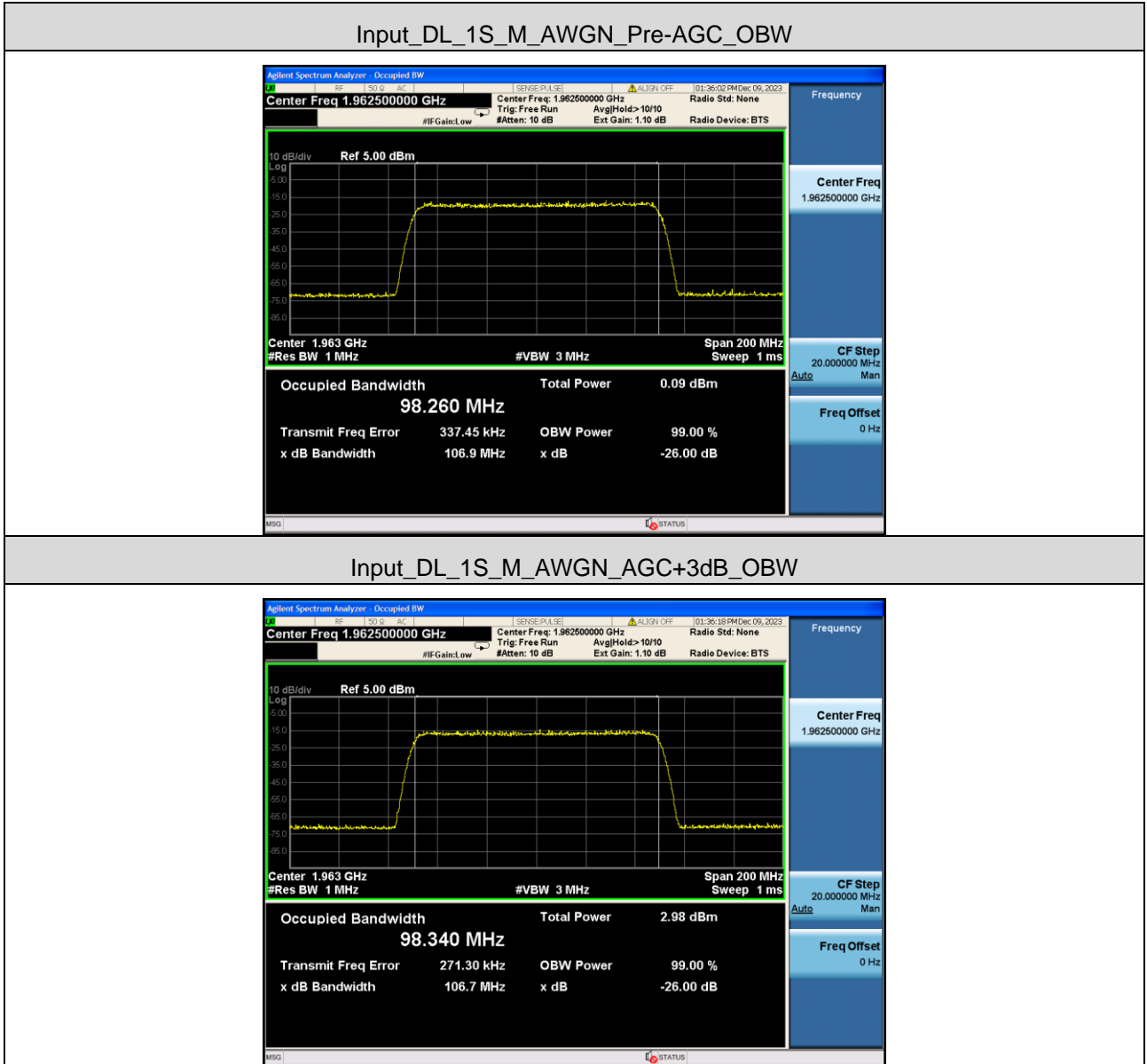


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1 Broadband PCS (only for downlink: 1930-1995MHz)

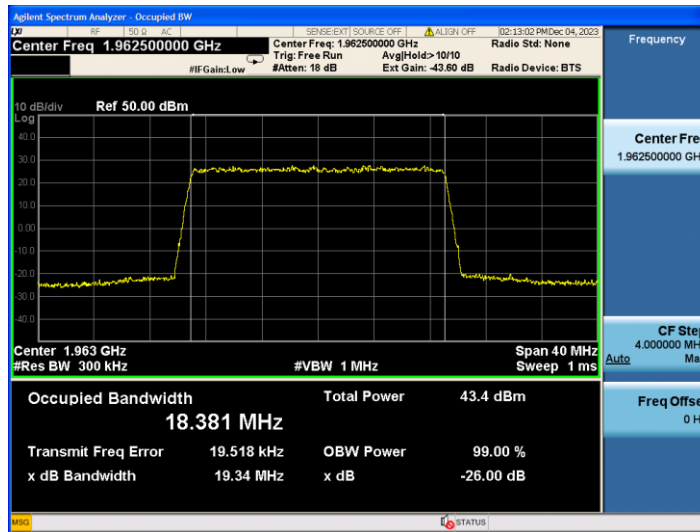
1.1 Input-versus-output signal comparison



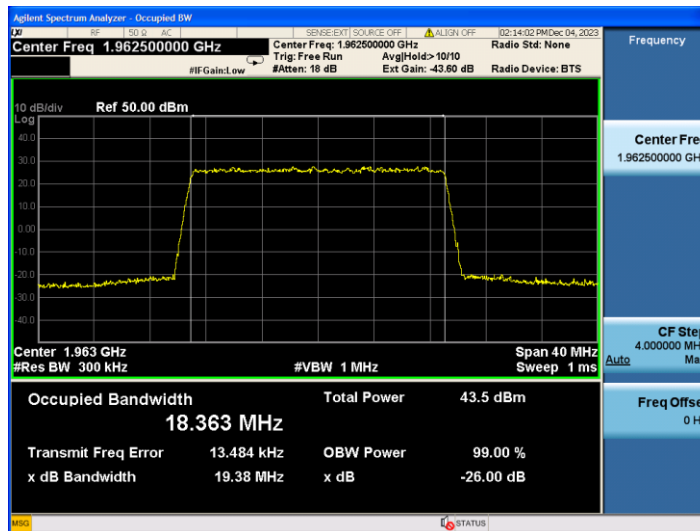
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Output_DL_1S_M_AWGN_Pre-AGC_OBW



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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1.2 Mean output power and amplifier/booster gain

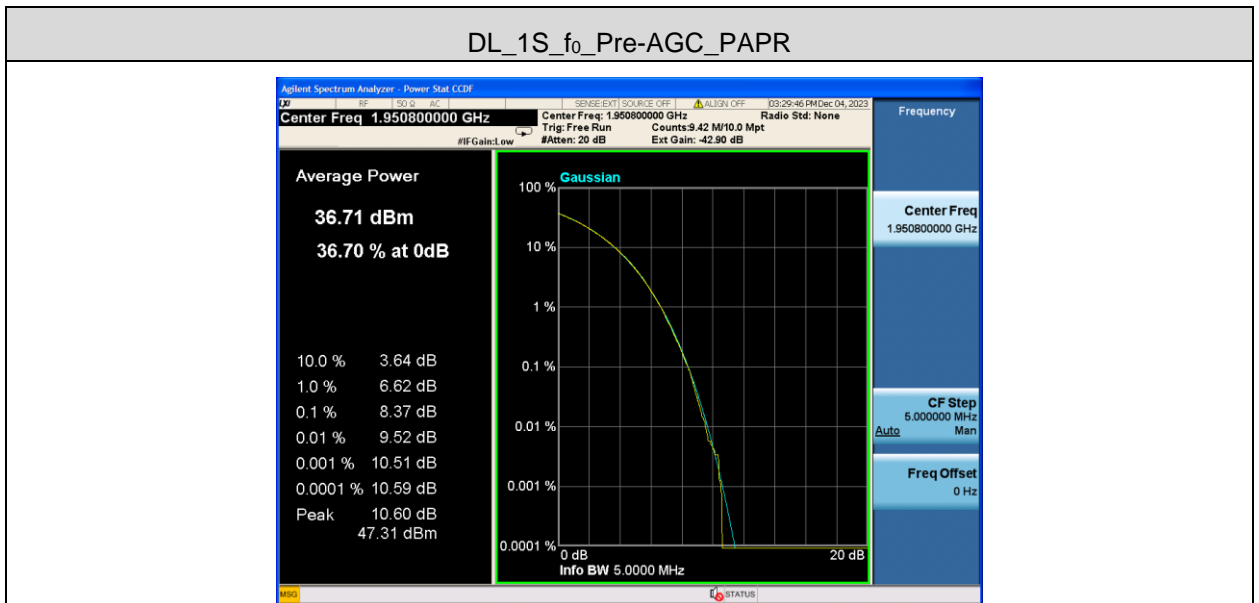
Test Conf.	Test Freq. f ₀ (MHz)	Signal Level	Input Power (dBm)	Output Power (dBm)	Gain (dB)	Verdict
DL_1S_AWGN	1950.8	Pre-AGC	-7.10	36.80	43.90	PASS
		AGC+3dB	-4.10	36.75	/	PASS

Remark:

According to the declaration from the applicant, the single antenna gain should not exceed 12.5dBi, the Directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 12.5dBi+10log (2) dBi= 15.5dBi.

The total maximum EIRP for the EUT is (36.80dBm+36.80dBm) +15.5dBi=55.31dBm (339.7W) which don't exceed the required EIRP limit (1640W/MHz).

Test Conf.	Test Freq. f ₀ (MHz)	Signal Level	PAPR (dB)	Limit (dB)	Verdict
DL_1S_AWGN	1950.8	Pre-AGC	9.52	13	PASS



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

Note: The tested max conducted power for single antenna port is 36.80dBm, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB
Here, $P=36.80\text{dBm}= 4.79\text{W}$.

So the limit = $P(\text{dBm}) - [43 + 10 \log(4.79\text{W})] = -13\text{dBm}$

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.

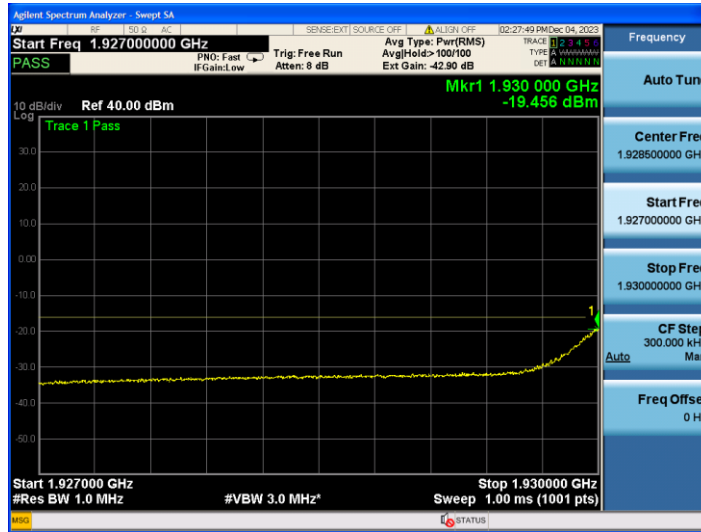
The spurious emissions from 9kHz to 30MHz was very low and 20dB below the limit, therefore, the data was not recorded in the report.



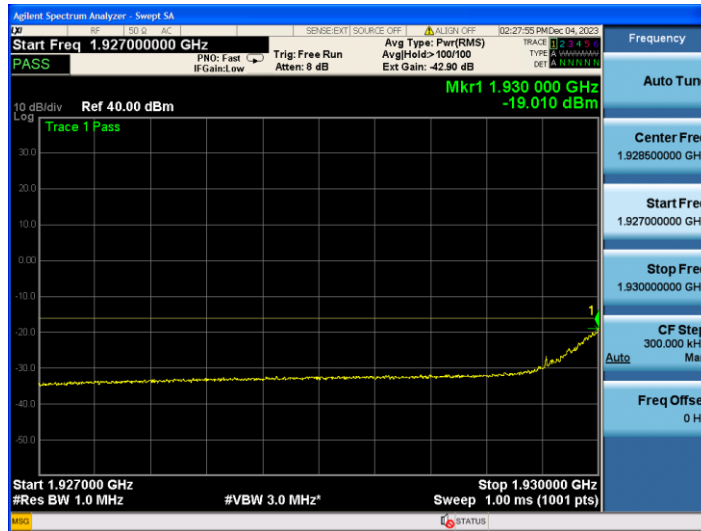
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DL_1S_B_AWGN_Pre-AGC_Out-of-band emission



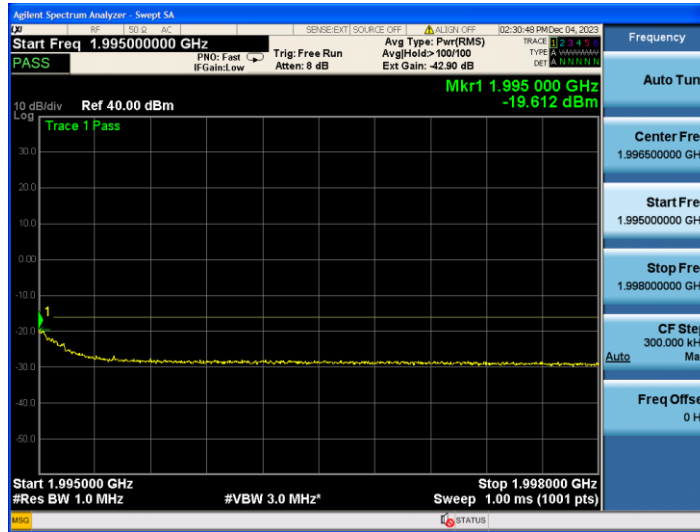
DL_1S_B_AWGN_AGC+3_Out-of-band emission



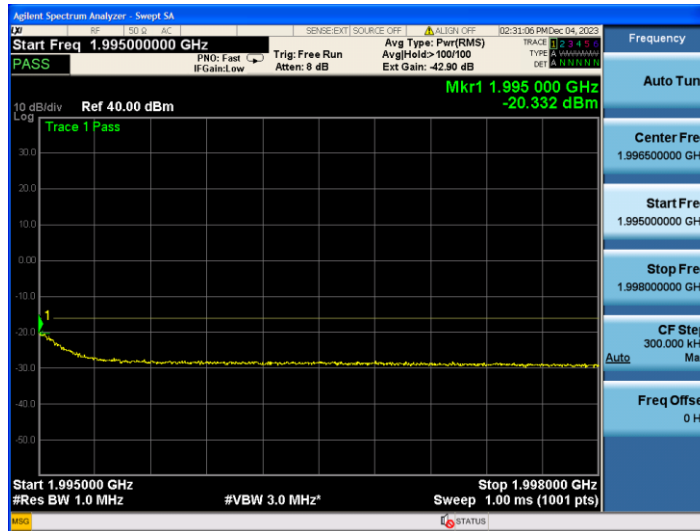
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DL_1S_T_AWGN_Pre-AGC_Out-of-band emission



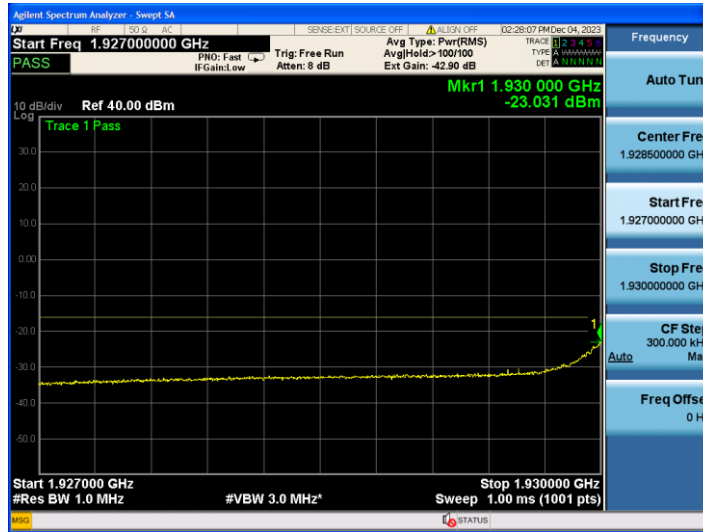
DL_1S_T_AWGN_AGC+3_Out-of-band emission



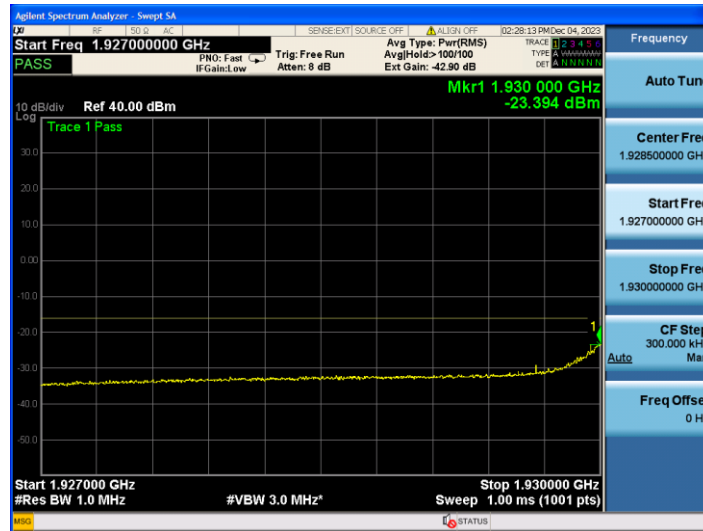
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DL_2S_B_AWGN_Pre-AGC_Out-of-band emission



DL_2S_B_AWGN_AGC+3_Out-of-band emission



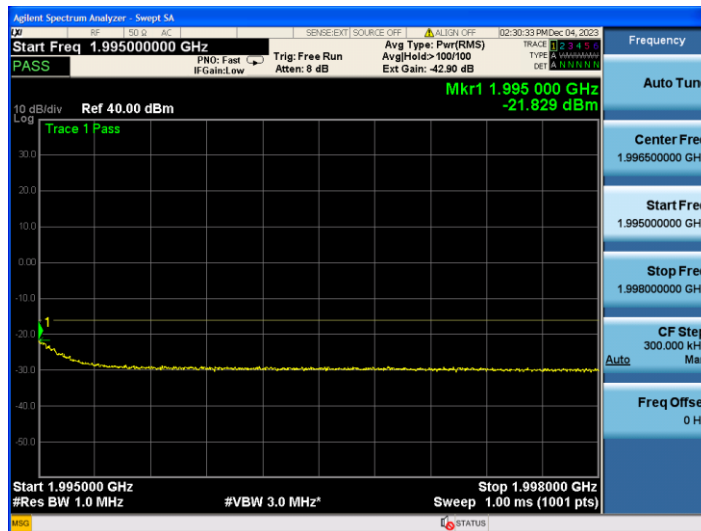
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DL_2S_T_AWGN_Pre-AGC_Out-of-band emission



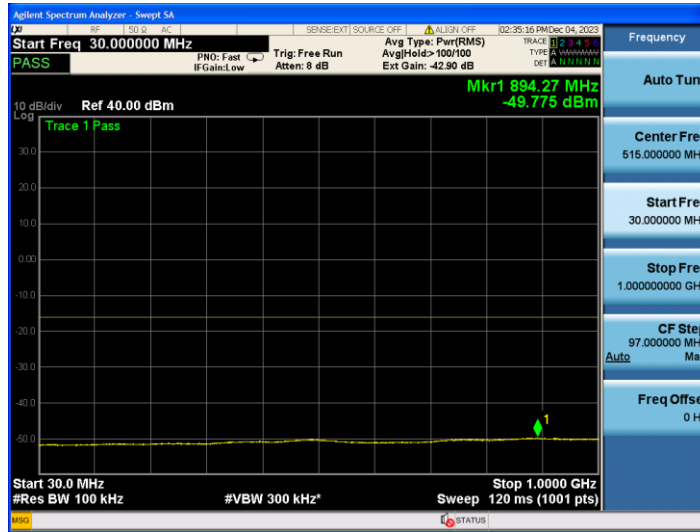
DL_2S_T_AWGN_AGC+3_Out-of-band emission



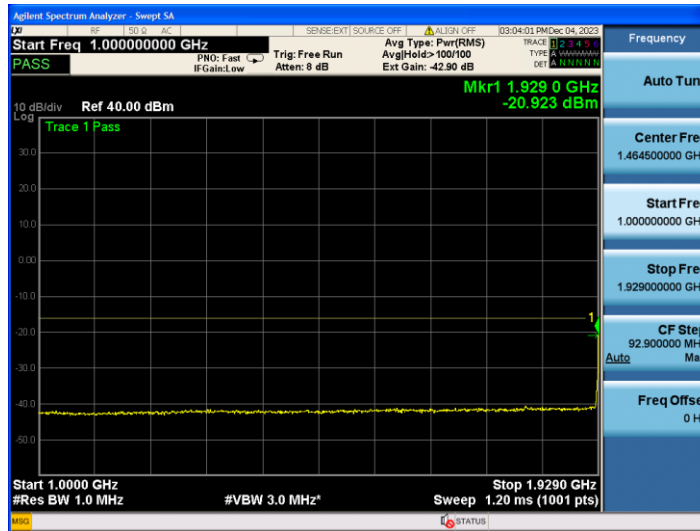
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DL_1S_B_AWGN_Pre-AGC_Spurious emission 1



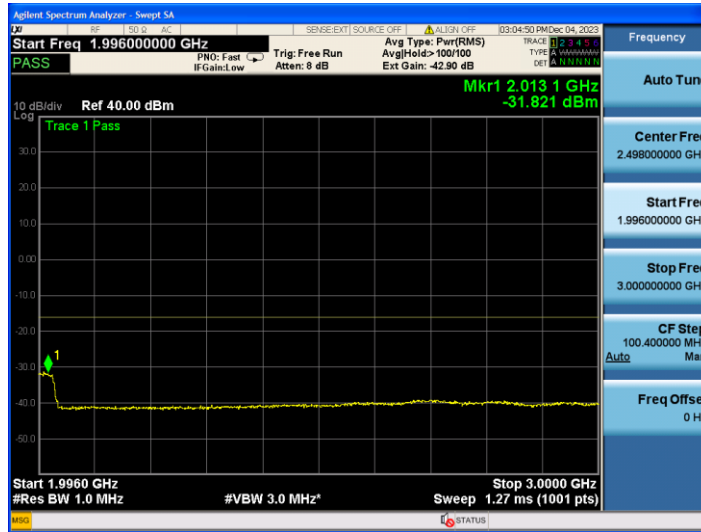
DL_1S_B_AWGN_Pre-AGC_Spurious emission 2



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DL_1S_B_AWGN_Pre-AGC_Spurious emission 3



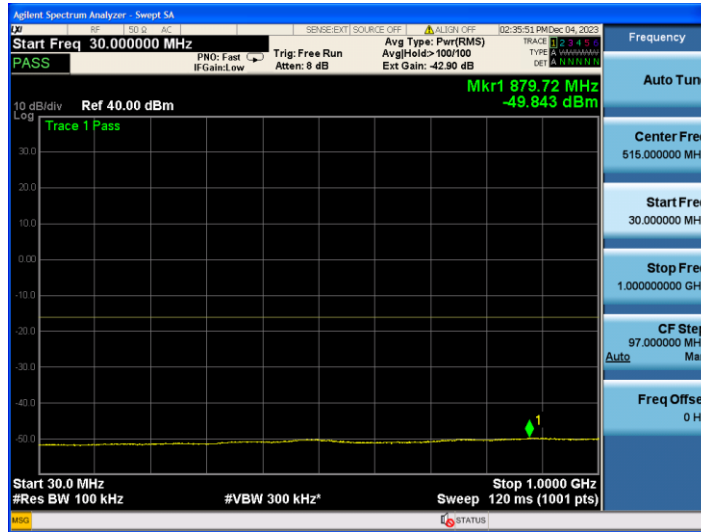
DL_1S_B_AWGN_Pre-AGC_Spurious emission 4



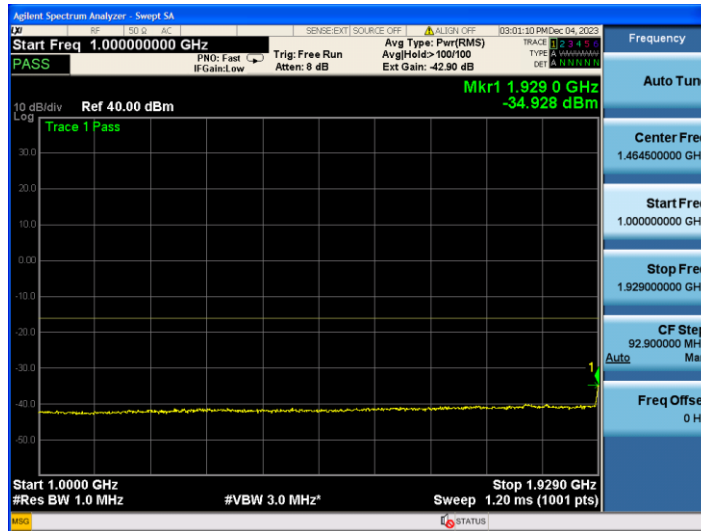
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DL_1S_M_AWGN_Pre-AGC_Spurious emission 1



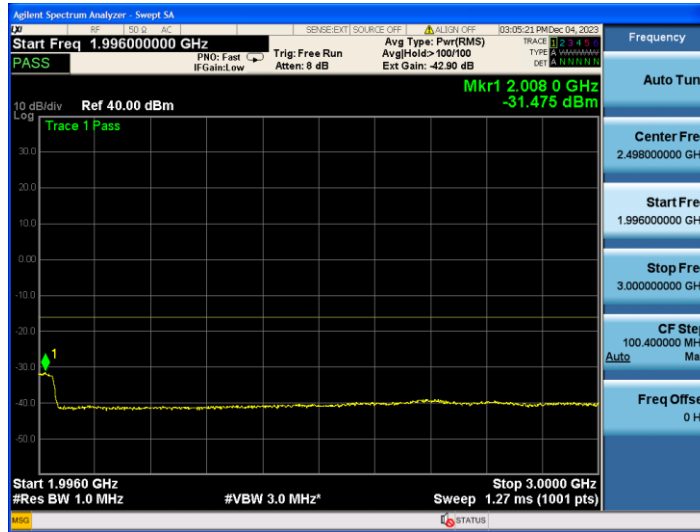
DL_1S_M_AWGN_Pre-AGC_Spurious emission 2



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DL_1S_M_AWGN_Pre-AGC_Spurious emission 3



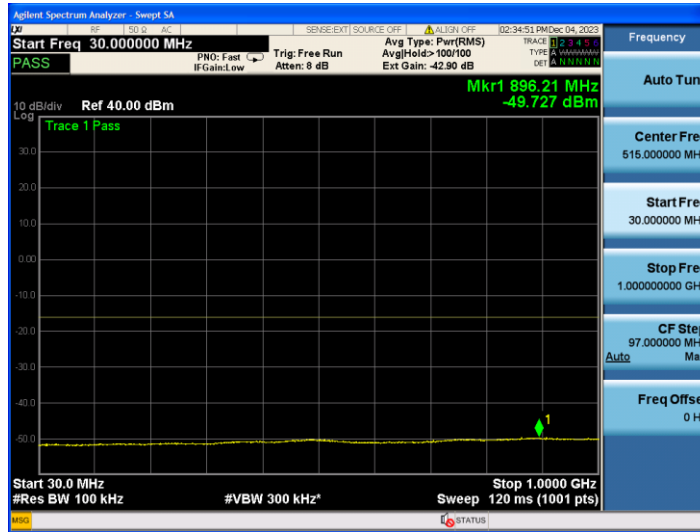
DL_1S_M_AWGN_Pre-AGC_Spurious emission 4



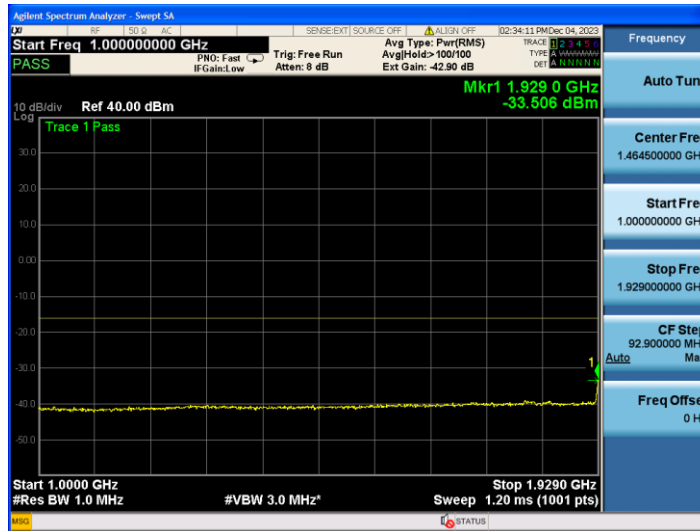
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DL_1S_T_AWGN_Pre-AGC_Spurious emission 1



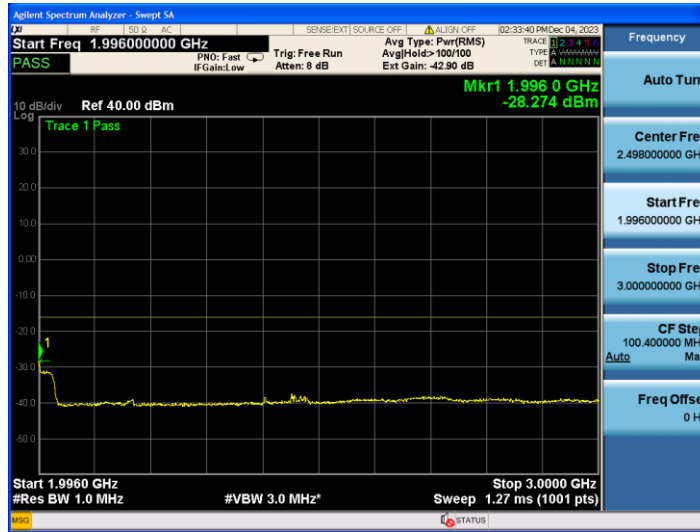
DL_1S_T_AWGN_Pre-AGC_Spurious emission 2



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DL_1S_T_AWGN_Pre-AGC_Spurious emission 3



DL_1S_T_AWGN_Pre-AGC_Spurious emission 4



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1.4 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 AC 110V.
 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 and less than 1.5ppm. Meet the requirement.

Frequency stability vs temperature				
Temperature (°C)	Test Conf.	Frequency Error (Hz)	Tolerance (ppm)	Verdict
50	DL_1S_M_AWGN	43	0.022	PASS
40		32	0.016	PASS
30		46	0.023	PASS
20		36	0.018	PASS
10		35	0.018	PASS
0		35	0.018	PASS
-10		36	0.018	PASS
-20		41	0.021	PASS
-30		47	0.024	PASS

Frequency stability vs voltage				
Voltage (V)	Test Conf.	Frequency Error (Hz)	Tolerance (ppm)	Verdict
AC 93.5	DL_1S_M_AWGN	36	0.018	PASS
AC 110		36	0.018	PASS
AC 126.5		36	0.018	PASS



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1.5 Radiated spurious emissions

Note: 1.The tested max conducted power for single antenna port is 36.80dBm, the 2x2 MIMO total power is 36.80dBm+36.80dBm= 9.58W.

The power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB

Here, $P=9.58W$.

the limit = $P(\text{dBm}) - [43 + 10 \log(9.58W)] = -13\text{dBm}$

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.

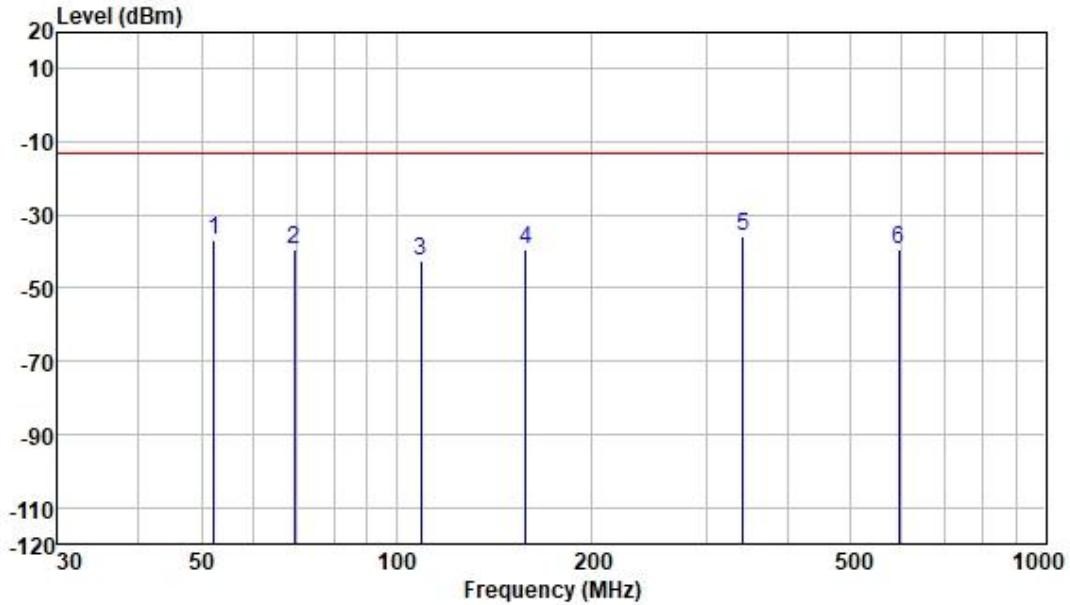
3. The disturbance from 9kHz to 30MHz was very low and 20db below the limit, therefore, the data was not recorded in the report.



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DL_1S_M_AWGN_Horizontal_30MHz~1GHz



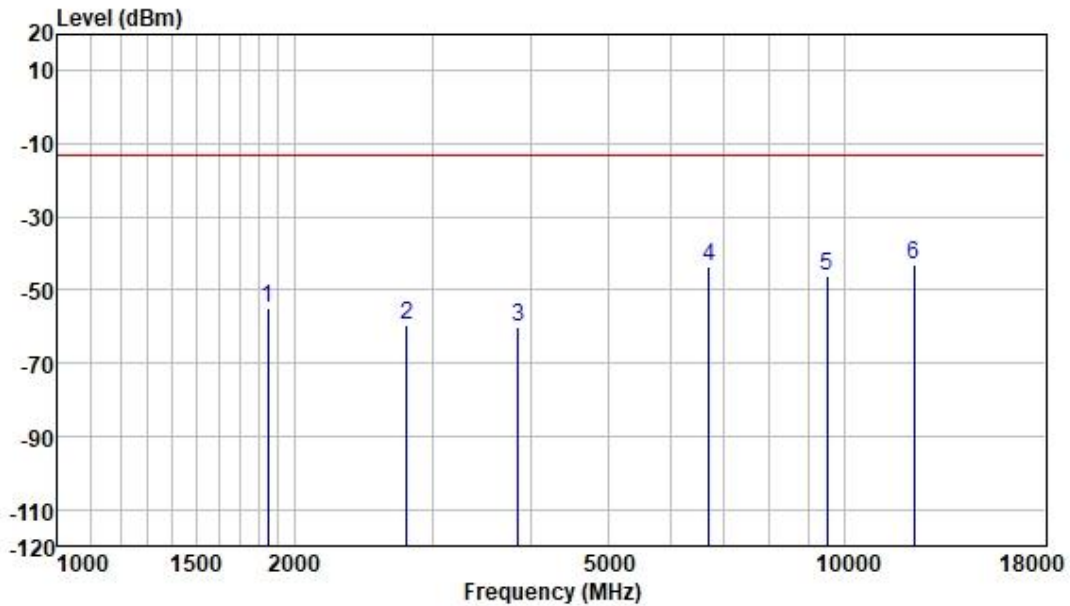
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	52.21	-35.29	-1.46	-36.75	-13.00	-23.75	HORIZONTAL
2	69.36	-33.07	-6.29	-39.36	-13.00	-26.36	HORIZONTAL
3	109.03	-33.64	-9.10	-42.74	-13.00	-29.74	HORIZONTAL
4	158.11	-32.69	-6.52	-39.21	-13.00	-26.21	HORIZONTAL
5	341.98	-34.17	-1.70	-35.87	-13.00	-22.87	HORIZONTAL
6	593.05	-42.11	2.73	-39.38	-13.00	-26.38	HORIZONTAL



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DL_1S_M_AWGN_Horizontal_above 1GHz



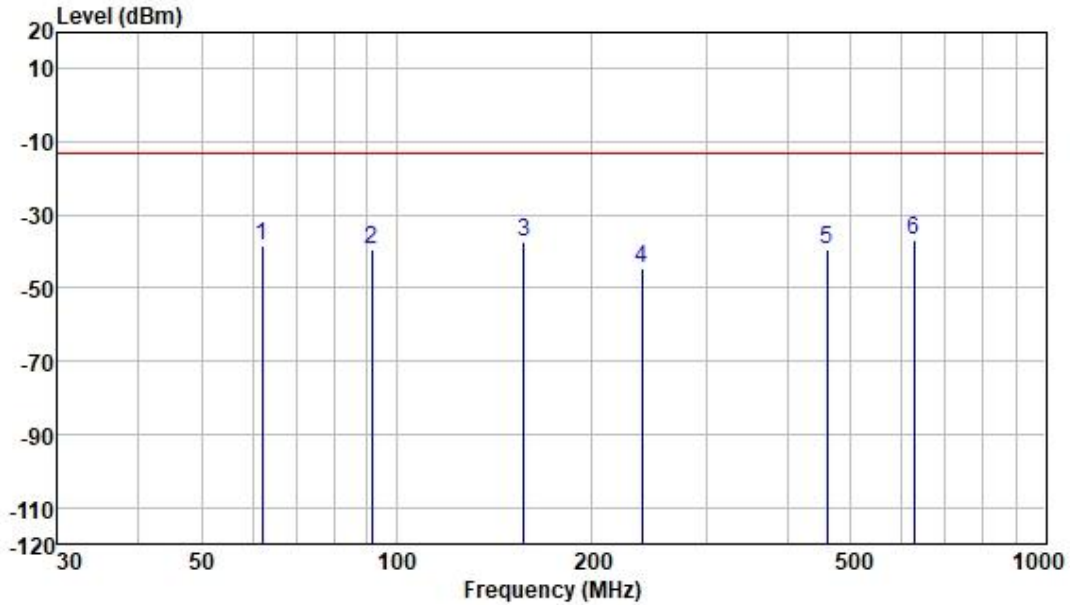
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	1850.86	-61.14	6.09	-55.05	-13.00	-42.05	HORIZONTAL
2	2774.03	-63.41	3.86	-59.55	-13.00	-46.55	HORIZONTAL
3	3845.54	-63.44	3.14	-60.30	-13.00	-47.30	HORIZONTAL
4	6717.76	-63.76	20.32	-43.44	-13.00	-30.44	HORIZONTAL
5	9502.93	-63.55	17.52	-46.03	-13.00	-33.03	HORIZONTAL
6	12255.22	-65.83	22.55	-43.28	-13.00	-30.28	HORIZONTAL



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DL_1S_M_AWGN_Vertical_30MHz~1GHz



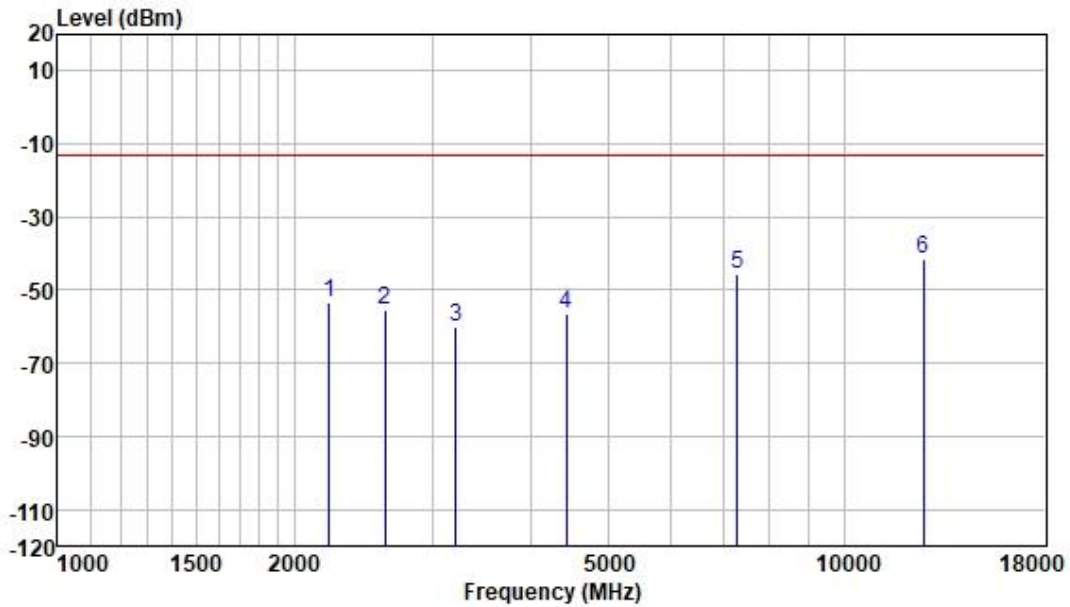
	Freq	Read Level	Correction Factor	Limit Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	62.00	-35.38	-3.01	-38.39	-13.00	-25.39	VERTICAL
2	91.49	-32.76	-6.87	-39.63	-13.00	-26.63	VERTICAL
3	157.01	-33.37	-3.94	-37.31	-13.00	-24.31	VERTICAL
4	238.31	-37.70	-6.65	-44.35	-13.00	-31.35	VERTICAL
5	460.73	-41.22	1.67	-39.55	-13.00	-26.55	VERTICAL
6	627.27	-41.49	4.49	-37.00	-13.00	-24.00	VERTICAL



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DL_1S_M_AWGN_Vertical_above 1GHz



	Freq	Read Level	Correction Factor	Limit Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	2214.11	-62.55	9.44	-53.11	-13.00	-40.11	VERTICAL
2	2603.13	-61.24	5.69	-55.55	-13.00	-42.55	VERTICAL
3	3205.35	-62.80	2.62	-60.18	-13.00	-47.18	VERTICAL
4	4430.63	-61.76	5.09	-56.67	-13.00	-43.67	VERTICAL
5	7305.12	-63.58	18.01	-45.57	-13.00	-32.57	VERTICAL
6	12578.21	-64.47	22.91	-41.56	-13.00	-28.56	VERTICAL

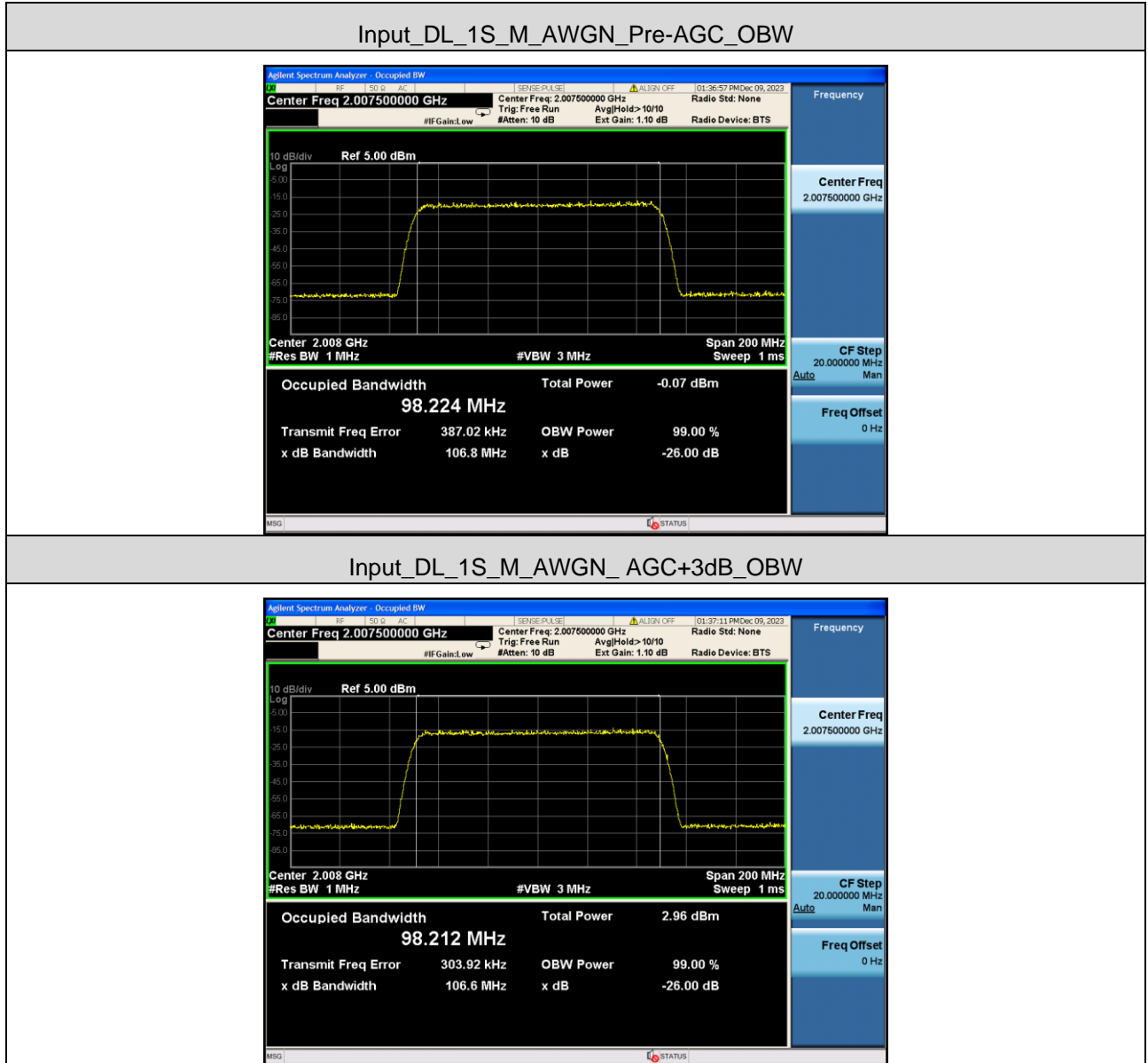


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2 AWS-2 & AWS-4 (only for downlink: 1995-2020MHz)

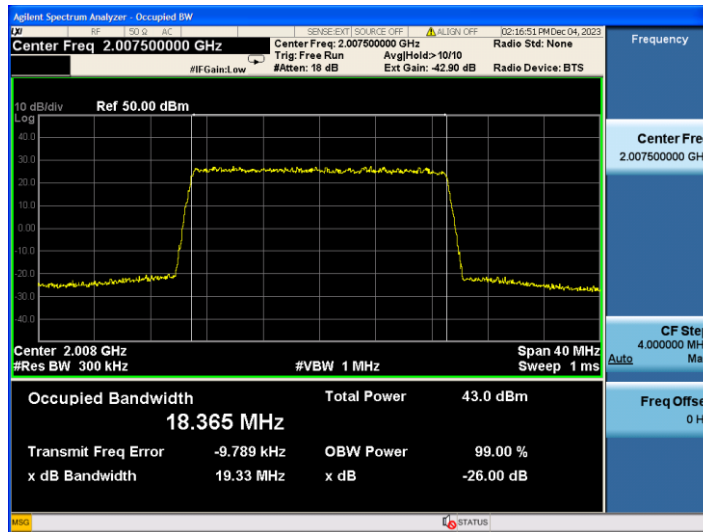
2.1 Input-versus-output signal comparison



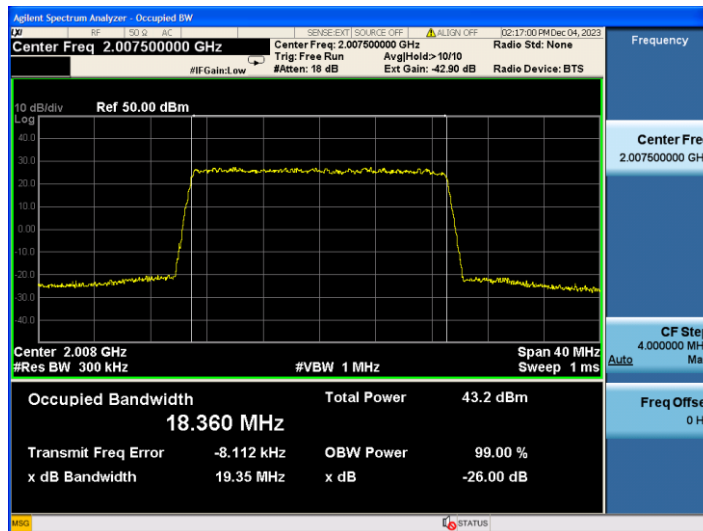
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Output_DL_1S_M_AWGN_Pre-AGC_OBW



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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2.2 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	2001.25	Pre-AGC	-6.50	37.10	43.60	PASS
		AGC+3dB	-3.50	37.23	/	PASS

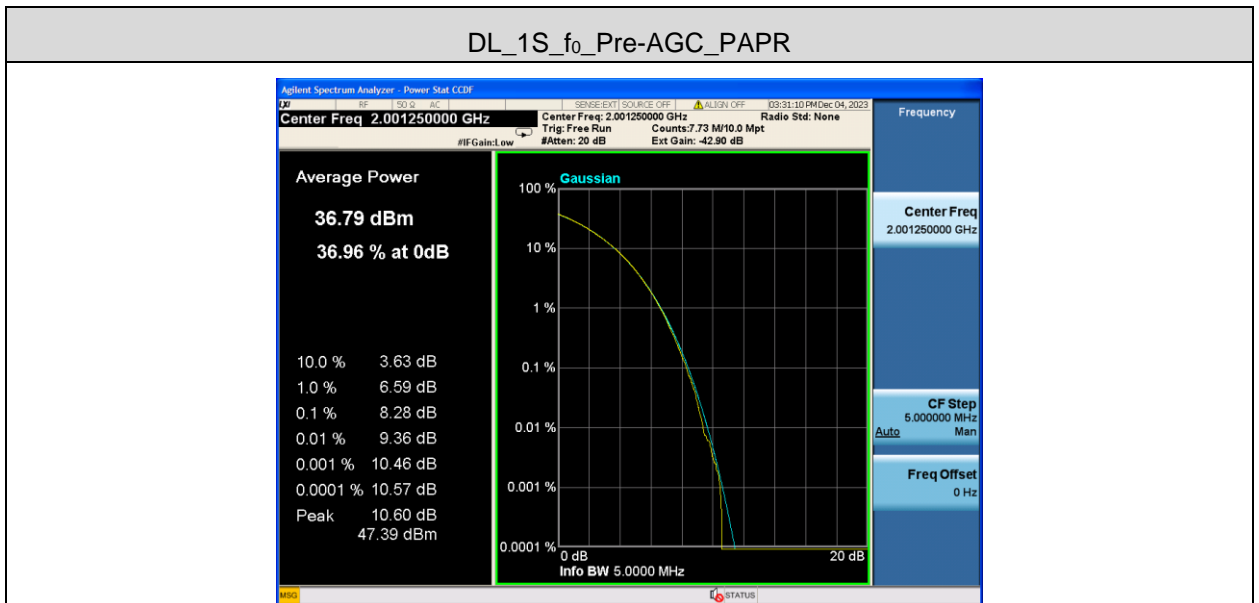
Remark:

1. According to the declaration from the applicant, the single antenna gain should not exceed 12.5dBi, the Directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 12.5dBi+10log (2) dBi= 15.5dBi.

The total maximum EIRP for the EUT is (37.23dBm+37.23dBm) +15.5dBi=55.74dBm (375.0W) 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.

Test Conf.	Test Freq. f ₀ (MHz)	Signal Level	PAPR (dB)	Limit (dB)	Verdict
DL_1S_AWGN	2001.25	Pre-AGC	9.36	13	PASS



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

Note: The EUT support 2x2 MIMO, Per 662911 D01 Multiple Transmitter Output v02r01 clause (3)(a)(iii): Measure and add $10 \log(N_{ANT})$ dB, where N_{ANT} is the number of outputs to combine the emission measurements from multiple outputs prior to comparing to the emission limit.

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

1. The tested max conducted power for single antenna port is 37.23dBm, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10 \log(P)$ dB

Here,

$P = 37.23 \text{ dBm} = 5.29 \text{ W}$.

So the limit =

$P(\text{dBm}) - [43 + 10 \log(5.29 \text{ W})] = -13 \text{ dBm}$.

The EUT supports 2x2 MIMO and the both antenna port with identical out emissions, therefore only perform measurement at output port 1, the limit line was decreased 3.01dB as -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 : 1995MHz to 2000MHz block ;

Pretest performe at AWS-4 : 2000MHz to 2020MHz block ;

Pretest performe at combined AWS-4 and AWS-2 : 1995MHz to 2020MHz block ;

As the emission limit of above sub-block are identical, therefore, only the worst-case combined AWS-4 and AWS-2 block test plot was record in the report.

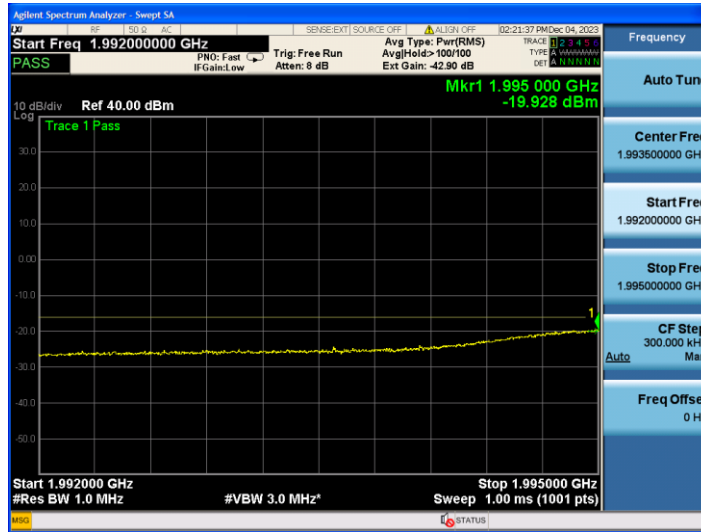
The spurious emissions from 9kHz to 30MHz was very low and 20dB below the limit, therefore, the data was not recorded in the report.



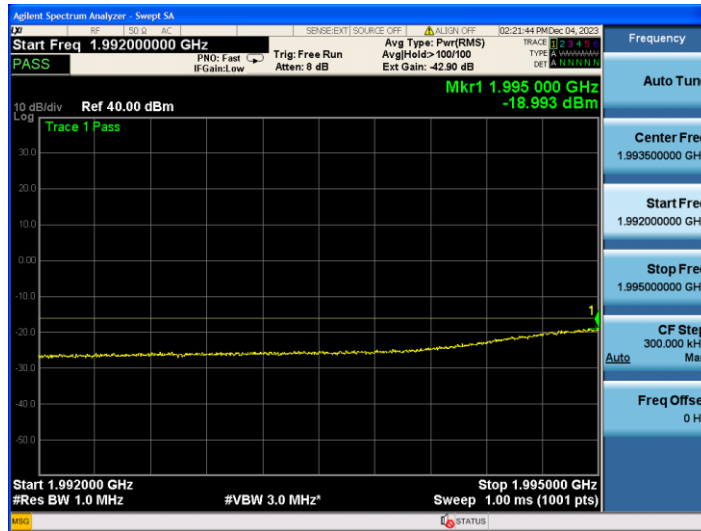
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DL_1S_B_AWGN_Pre-AGC_Out-of-band emission



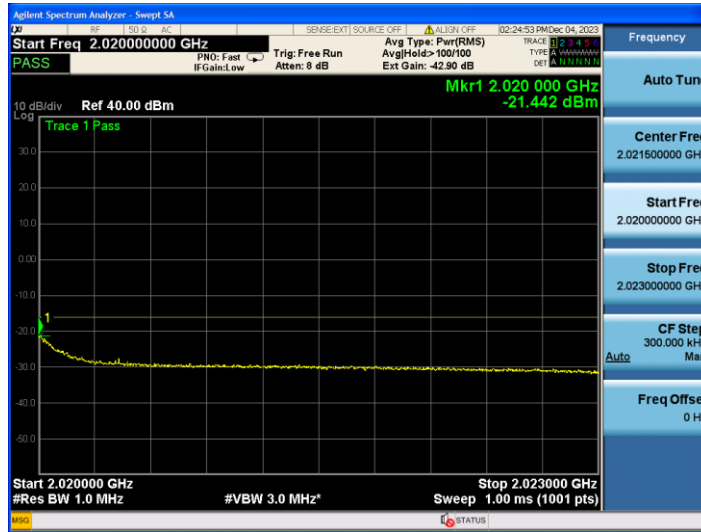
DL_1S_B_AWGN_AGC+3_Out-of-band emission



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DL_1S_T_AWGN_Pre-AGC_Out-of-band emission



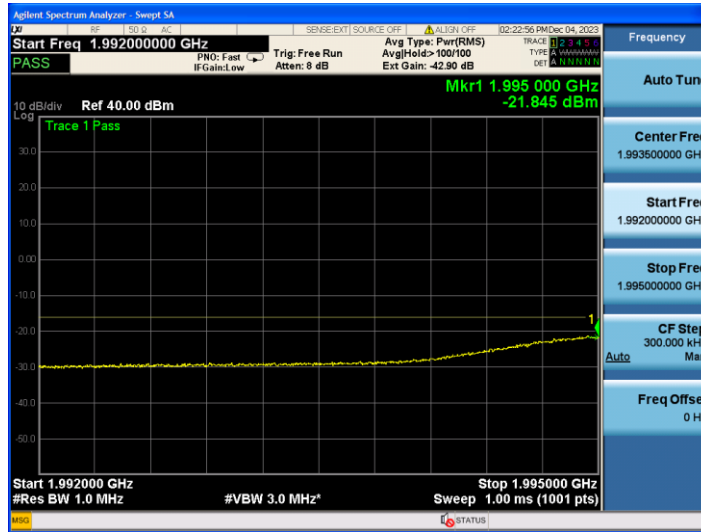
DL_1S_T_AWGN_AGC+3_Out-of-band emission



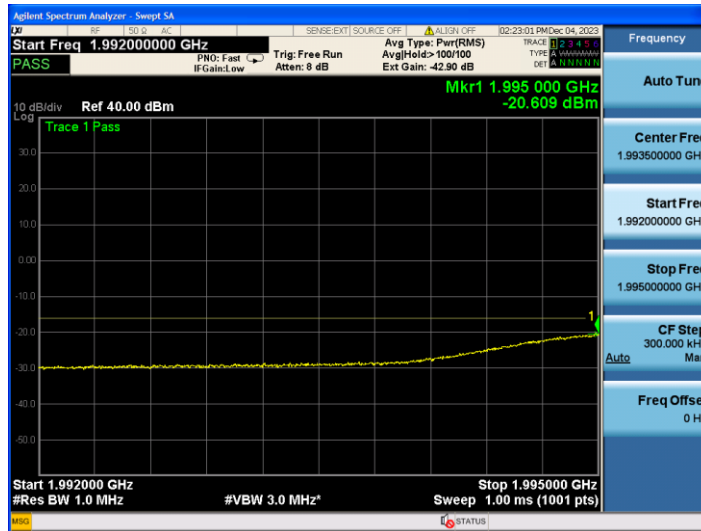
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DL_2S_B_AWGN_Pre-AGC_Out-of-band emission



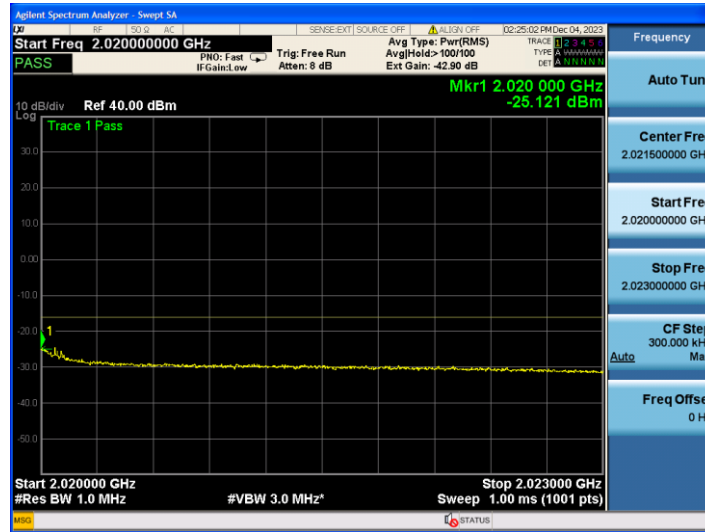
DL_2S_B_AWGN_AGC+3_Out-of-band emission



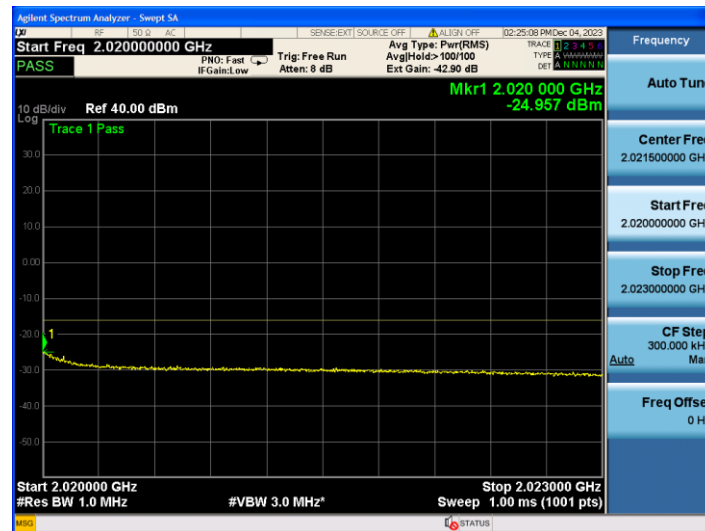
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DL_2S_T_AWGN_Pre-AGC_Out-of-band emission



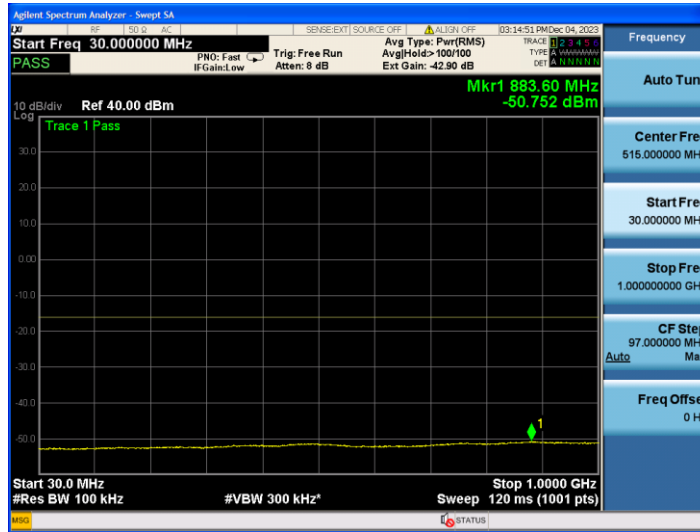
DL_2S_T_AWGN_AGC+3_Out-of-band emission



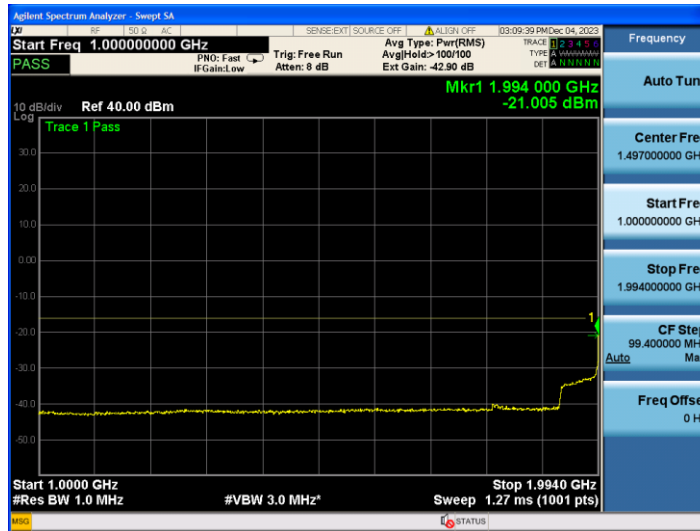
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DL_1S_B_AWGN_Pre-AGC_Spurious emission 1



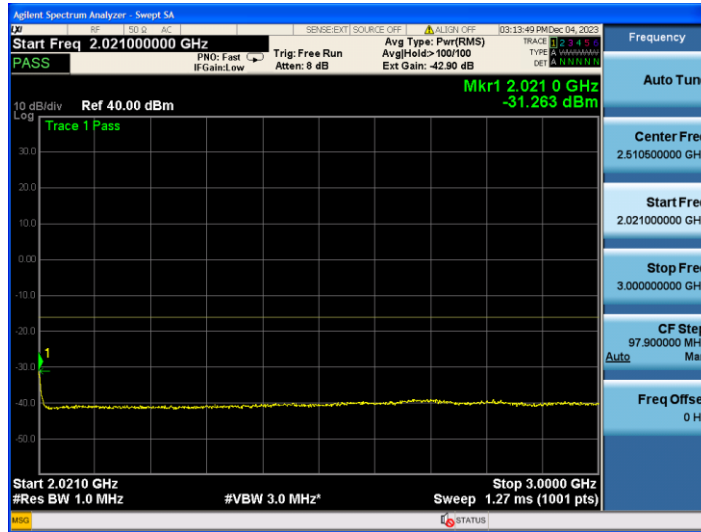
DL_1S_B_AWGN_Pre-AGC_Spurious emission 2



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DL_1S_B_AWGN_Pre-AGC_Spurious emission 3



DL_1S_B_AWGN_Pre-AGC_Spurious emission 4



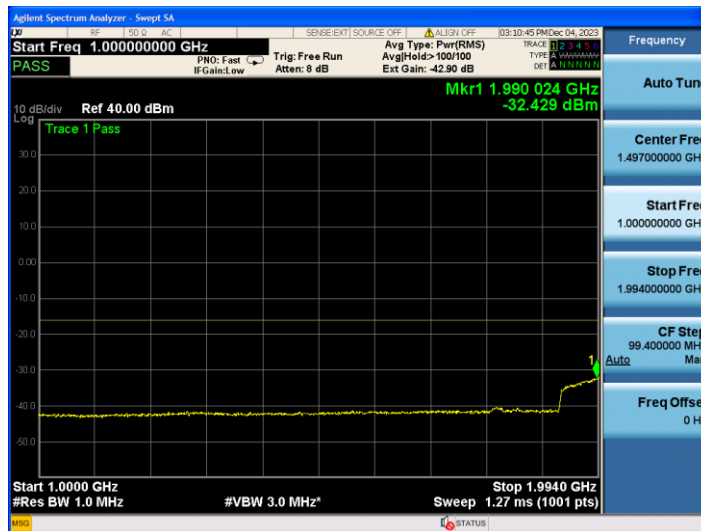
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DL_1S_M_AWGN_Pre-AGC_Spurious emission 1



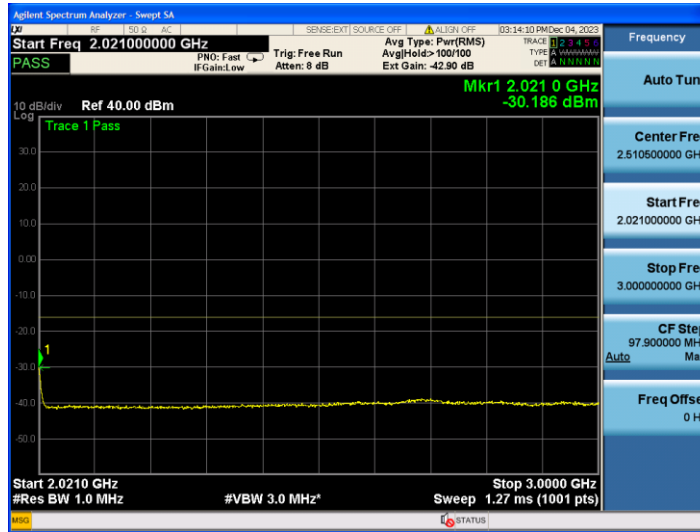
DL_1S_M_AWGN_Pre-AGC_Spurious emission 2



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DL_1S_M_AWGN_Pre-AGC_Spurious emission 3



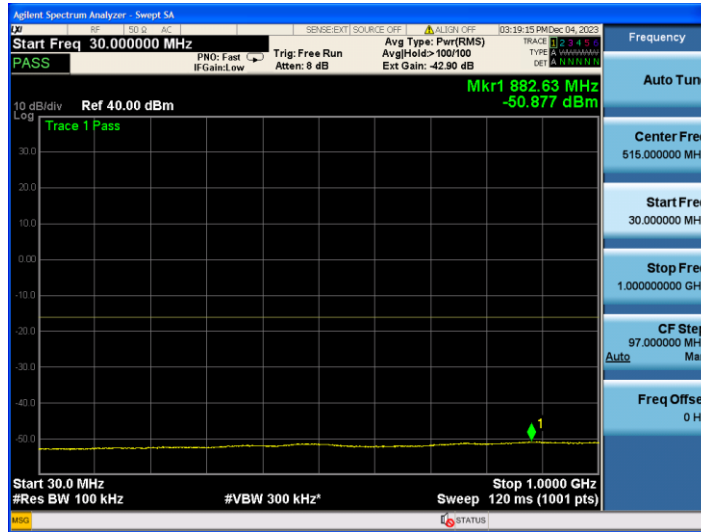
DL_1S_M_AWGN_Pre-AGC_Spurious emission 4



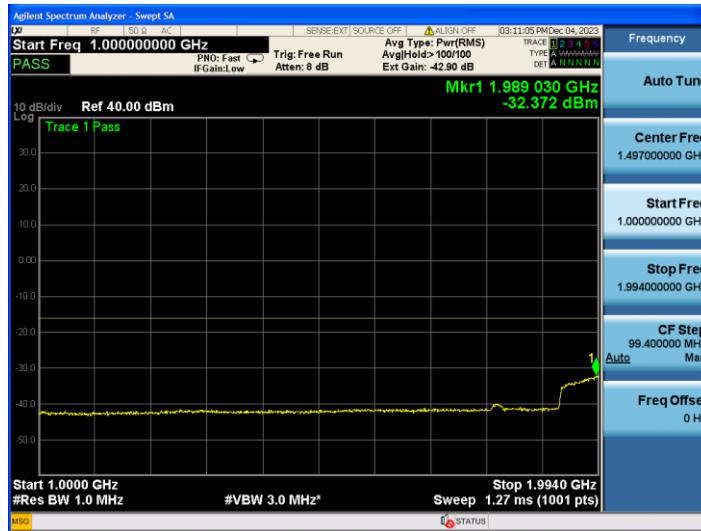
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DL_1S_T_AWGN_Pre-AGC_Spurious emission 1



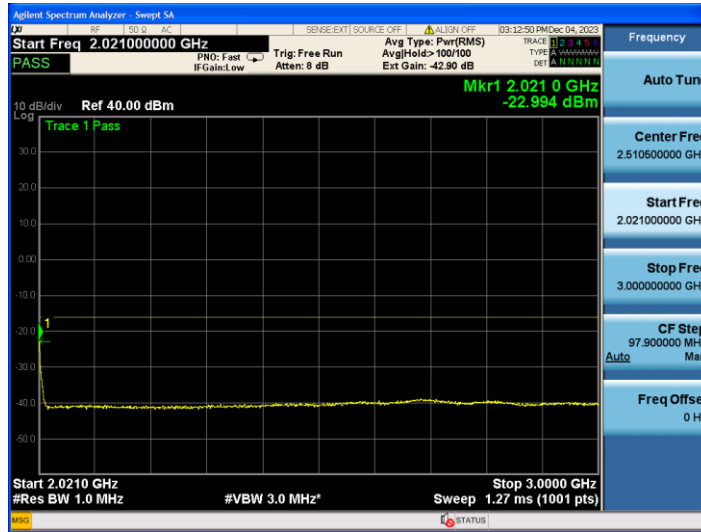
DL_1S_T_AWGN_Pre-AGC_Spurious emission 2



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DL_1S_T_AWGN_Pre-AGC_Spurious emission 3



DL_1S_T_AWGN_Pre-AGC_Spurious emission 4



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2.4 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 AC 110V.
 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	83	0.041	PASS
40		103	0.051	PASS
30		102	0.051	PASS
20		104	0.052	PASS
10		81	0.040	PASS
0		79	0.039	PASS
-10		81	0.040	PASS
-20		100	0.050	PASS
-30		103	0.051	PASS

Frequency stability vs voltage				
Voltage (V)	Test Conf.	Frequency Error (Hz)	Tolerance (ppm)	Verdict
AC 93.5	DL_1S_M_AWGN	104	0.052	PASS
AC 110		104	0.052	PASS
AC 126.5		104	0.052	PASS



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2.5 Radiated spurious emissions

Note: 1. The tested max conducted power for single antenna port is 37.23dBm, the 2x2 MIMO total power is 37.23dBm+37.23dBm=6.67W, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10log (P) dB

Here,

$P=6.67W$.

So the limit =

$P(\text{dBm}) - [43 + 10 \log (6.67W)] = -13\text{dBm}$

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.

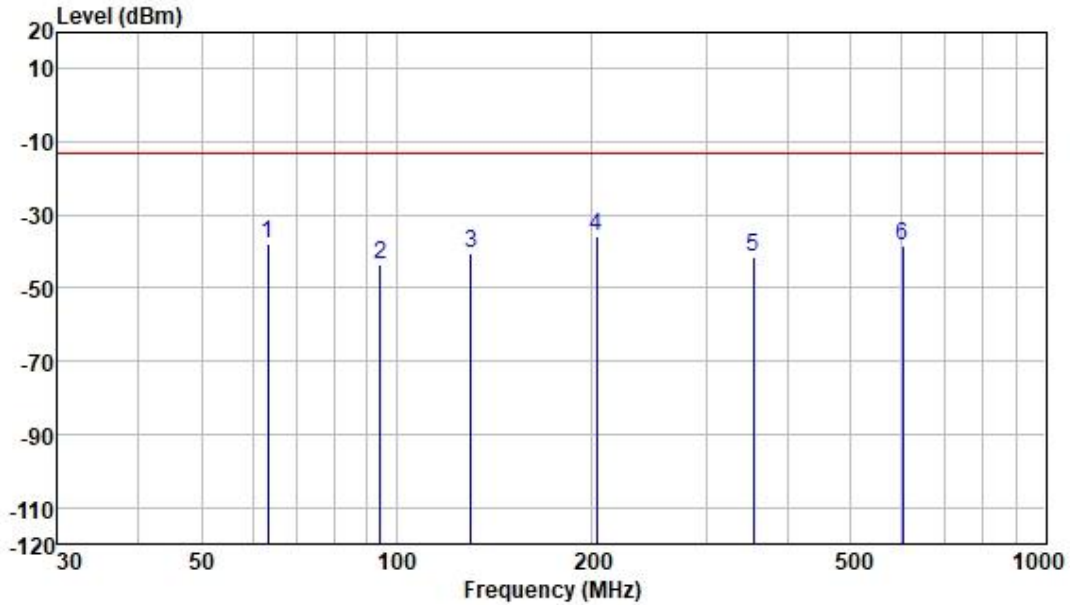
3. The disturbance from 9kHz to 30MHz was very low and 20db below the limit, therefore, the data was not recorded in the report.



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DL_1S_M_AWGN_Horizontal_30MHz~1GHz



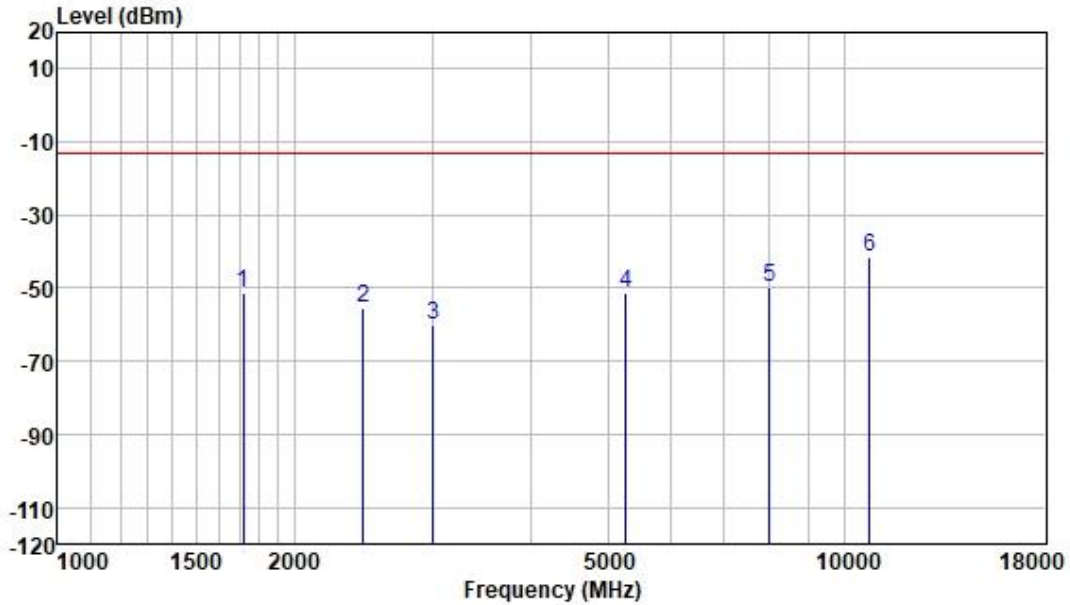
	Freq	Read Level	Correction Factor	Level	Limit	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	63.31	-34.40	-3.59	-37.99	-13.00	-24.99	HORIZONTAL
2	94.10	-33.70	-9.70	-43.40	-13.00	-30.40	HORIZONTAL
3	129.92	-32.19	-8.22	-40.41	-13.00	-27.41	HORIZONTAL
4	202.81	-28.86	-6.97	-35.83	-13.00	-22.83	HORIZONTAL
5	354.18	-40.16	-1.36	-41.52	-13.00	-28.52	HORIZONTAL
6	601.43	-41.26	3.09	-38.17	-13.00	-25.17	HORIZONTAL



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DL_1S_M_AWGN_Horizontal_above 1GHz



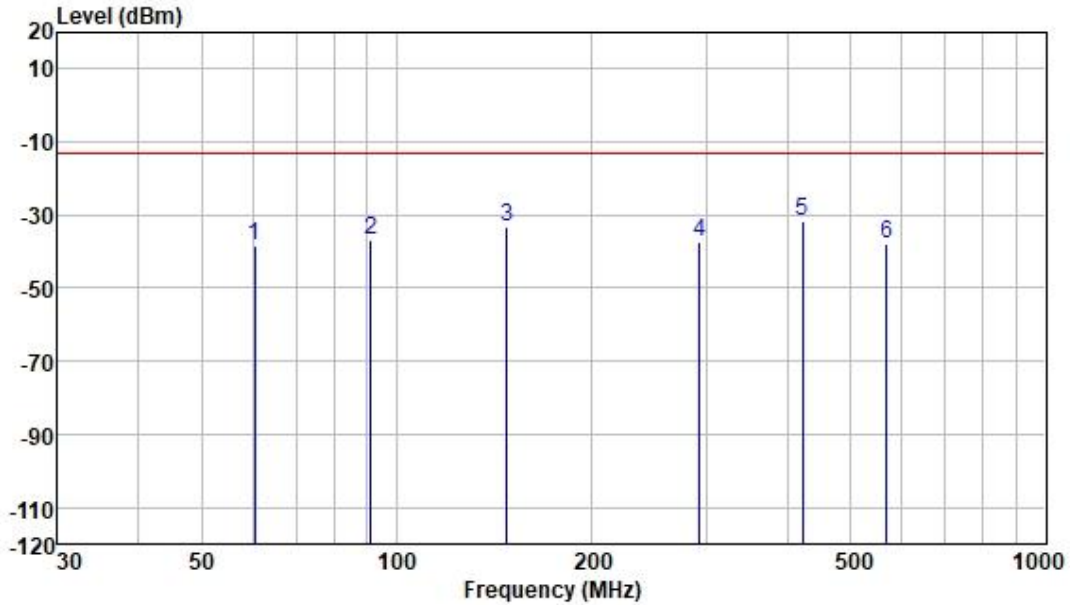
	Freq	Read Level	Correction Factor	Limit Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	1721.83	-57.65	6.28	-51.37	-13.00	-38.37	HORIZONTAL
2	2442.75	-64.42	8.86	-55.56	-13.00	-42.56	HORIZONTAL
3	2999.19	-62.77	2.49	-60.28	-13.00	-47.28	HORIZONTAL
4	5269.65	-63.44	12.14	-51.30	-13.00	-38.30	HORIZONTAL
5	8013.02	-63.69	13.75	-49.94	-13.00	-36.94	HORIZONTAL
6	10760.54	-65.39	23.90	-41.49	-13.00	-28.49	HORIZONTAL



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DL_1S_M_AWGN_Vertical_30MHz~1GHz



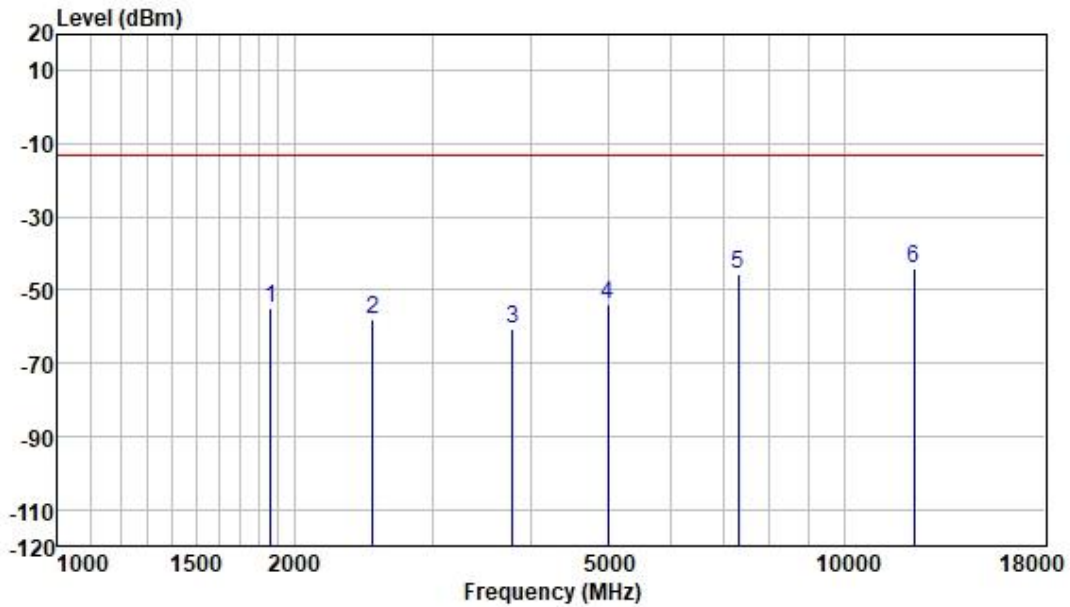
	Freq	Read Level	Correction Factor	Limit Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	60.28	-36.30	-2.19	-38.49	-13.00	-25.49	VERTICAL
2	91.17	-29.67	-6.99	-36.66	-13.00	-23.66	VERTICAL
3	147.92	-29.51	-3.94	-33.45	-13.00	-20.45	VERTICAL
4	293.08	-34.41	-2.68	-37.09	-13.00	-24.09	VERTICAL
5	422.06	-32.61	0.96	-31.65	-13.00	-18.65	VERTICAL
6	568.61	-40.84	2.81	-38.03	-13.00	-25.03	VERTICAL



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DL_1S_M_AWGN_Vertical_above 1GHz



	Freq	Read Level	Correction Factor	Limit Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	1866.98	-61.52	6.61	-54.91	-13.00	-41.91	VERTICAL
2	2514.39	-64.93	7.06	-57.87	-13.00	-44.87	VERTICAL
3	3779.42	-63.70	2.98	-60.72	-13.00	-47.72	VERTICAL
4	5002.50	-63.66	10.04	-53.62	-13.00	-40.62	VERTICAL
5	7326.27	-63.13	17.76	-45.37	-13.00	-32.37	VERTICAL
6	12255.22	-66.43	22.52	-43.91	-13.00	-30.91	VERTICAL

--End of Appendix --



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