

Appendix -

Test Data and Result for report

GZCR231100125502

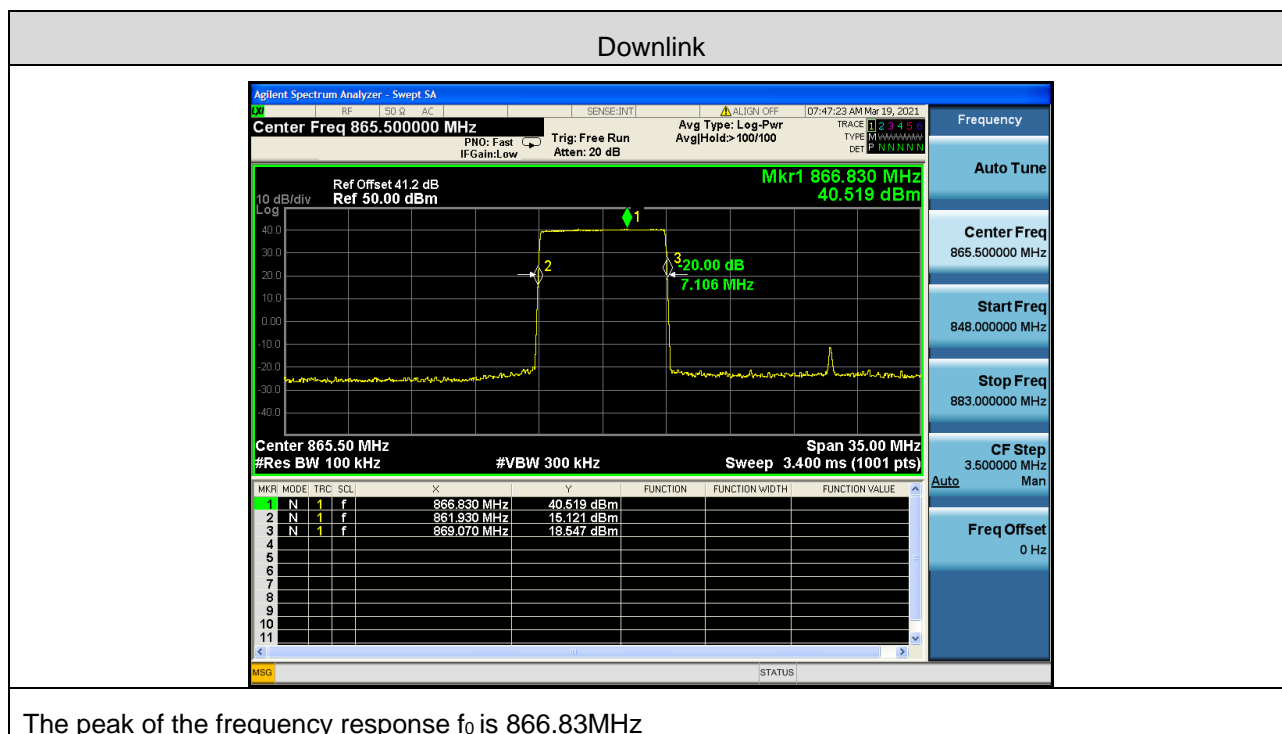
(A)

(For copied data from original report GZCR210300001402)



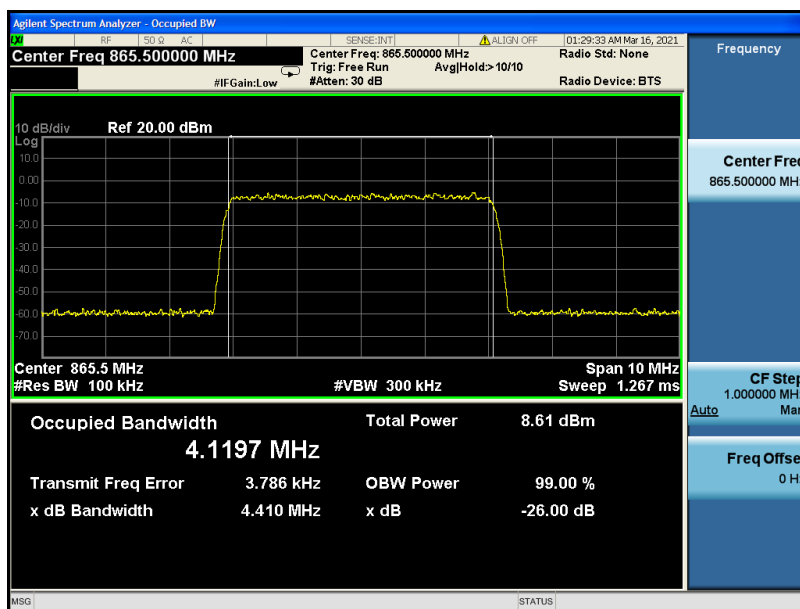
1 ESMR (only for downlink: 862-869MHz)

1.1 Out-of-band rejection

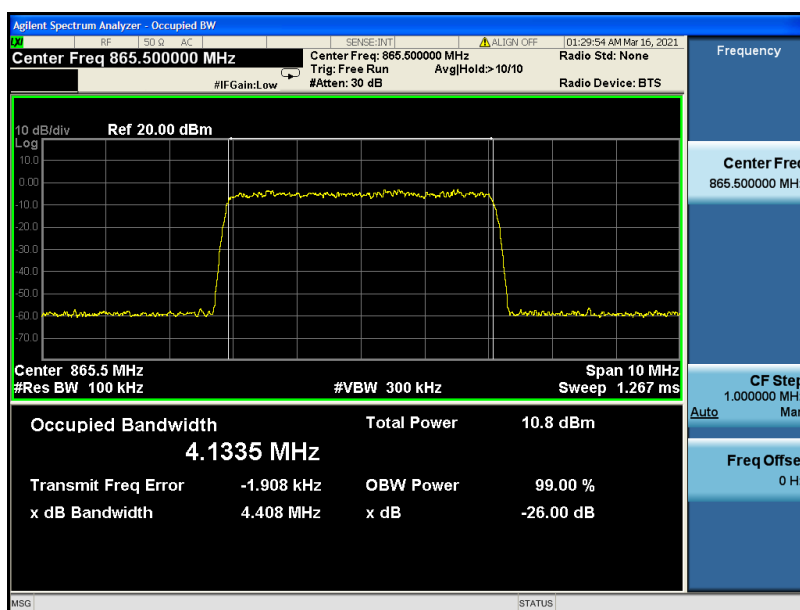


1.2 Input-versus-output signal comparison

Input_DL_1S_M_AWGN_Pre-AGC_OBW



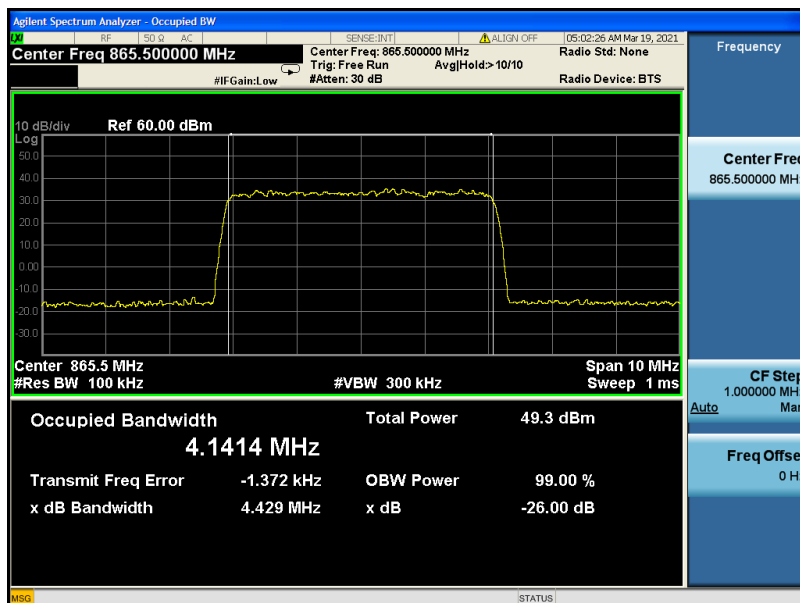
Input_DL_1S_M_AWGN_AGC+3dB_OBW



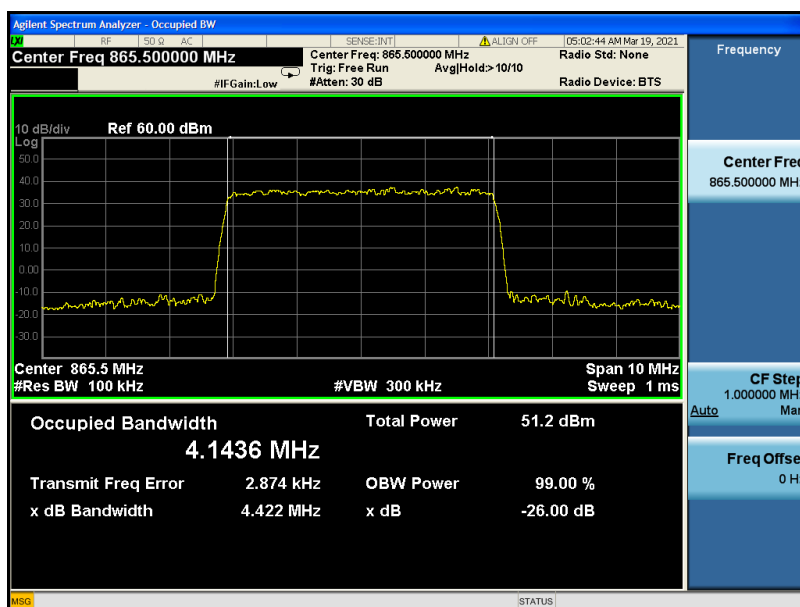
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Output_DL_1S_M_AWGN_Pre-AGC_OBW



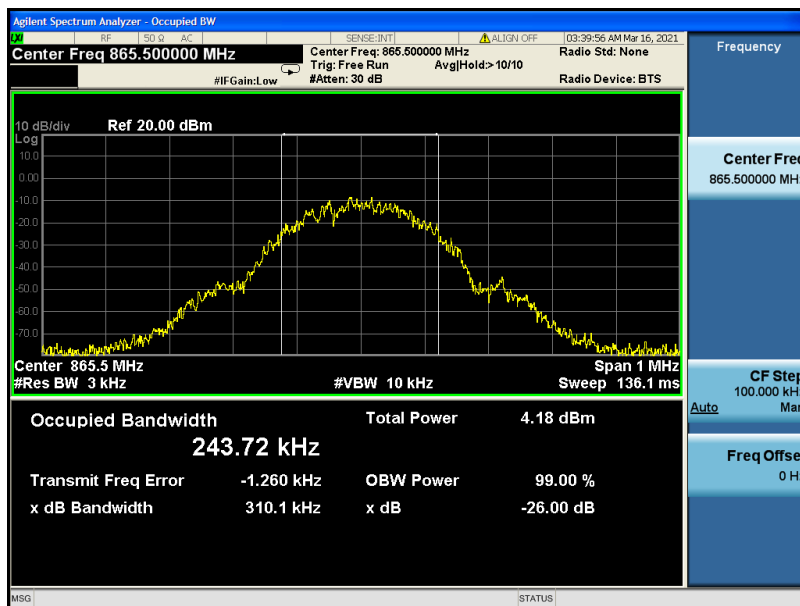
Output_DL_1S_M_AWGN_AGC+3dB_OBW



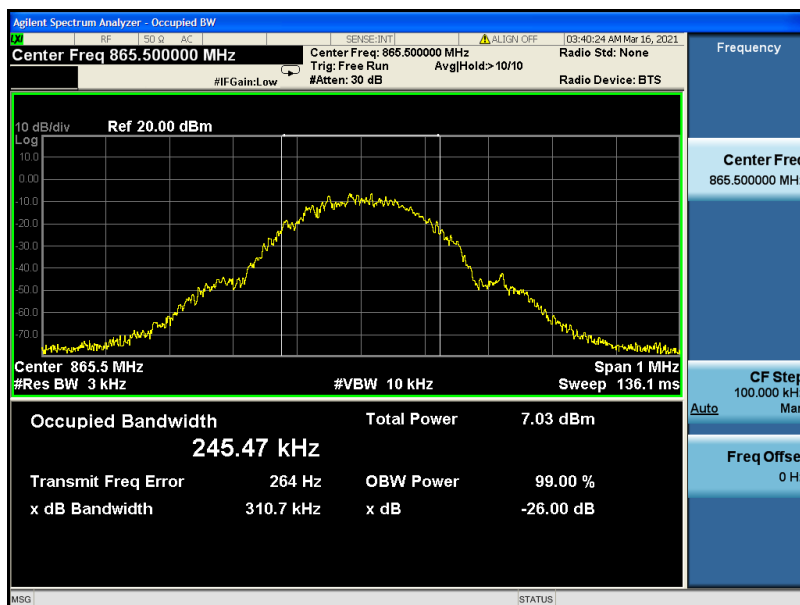
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Input_DL_1S_M_GSM_Pre-AGC_OBW



Input_DL_1S_M_GSM_AGC+3dB_OBW



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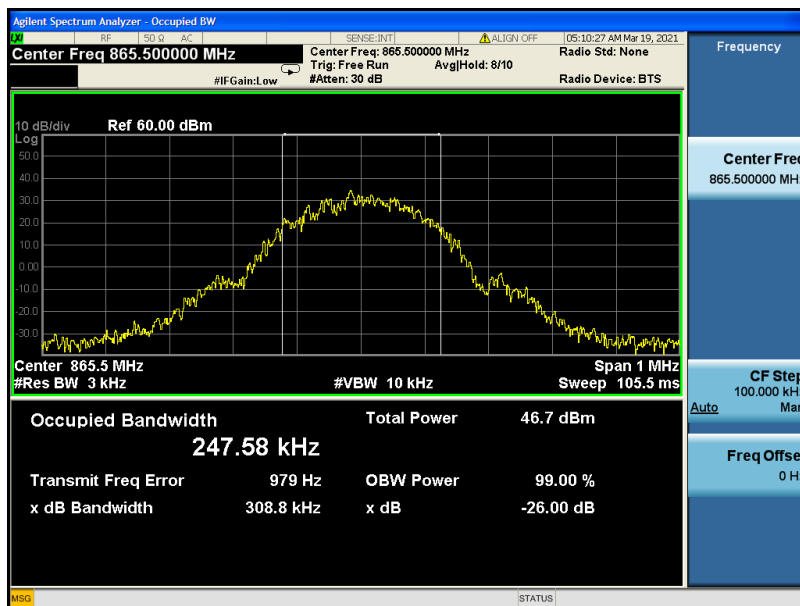
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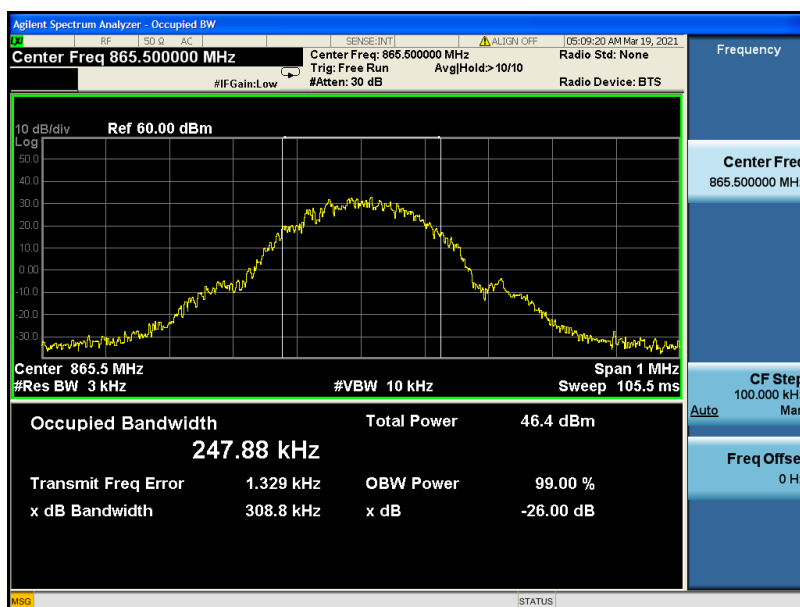
No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663
中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编: 510663

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Output_DL_1S_M_GSM_Pre-AGC_OBW



Output_DL_1S_M_GSM_AGC+3dB_OBW



Remark:

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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Guangzhou Branch

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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	866.83	Pre-AGC	0.23	42.89	42.66	PASS
		AGC+3dB	3.23	42.78	/	PASS
DL_1S_GSM	866.83	Pre-AGC	0.07	42.72	42.65	PASS
		AGC+3dB	3.07	42.76	/	PASS

Remark:

According to the declaration from the applicant, the single antenna gain should not exceed 10dBi, the Directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 10dBi+10log (2) dBi= 13dBi.

ERP= EIRP-2.15dB,

The total maximum ERP for the EUT is (42.89dBm+42.89dBm) +13dBi-2.15dB=56.75dBm (473.15W) which don't exceed the required ERP limit (1000W/MHz).



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

Note: 1. 90.691 a (1) Limit:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

The tested max conducted power for single antenna port is 42.89dBm, the power of any emission must be reduced below the mean output power (P) by at least $50 + 10 \log(P)$ dB

Here, $P=42.89\text{dBm}=19.45\text{W}$.

So the limit = $P(\text{dBm}) - [50 + 10 \log(19.45)] = -20\text{dBm}$

The EUT supports 2x2 MIMO and the emissions were measured at one of output port, so the limit line was set to -23.01dBm in following test plots in order to determine the test result conveniently.

2. 90.691 a (2) Limit:

(1) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

The tested max conducted power for single antenna port is 42.89dBm, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10 \log(P)$ dB

Here, $P=42.89\text{dBm}=19.45\text{W}$.

So the limit = $P(\text{dBm}) - [43 + 10 \log(19.45\text{W})] = -13\text{dBm}$

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.

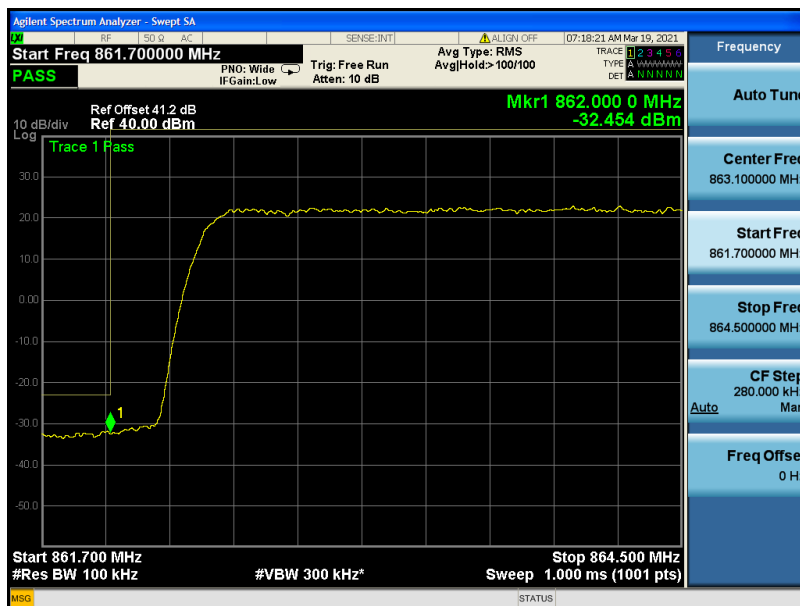
The spurious emissions from 9kHz to 30MHz was very low and 20dB below the limit, therefore, the data was not recorded in the report.



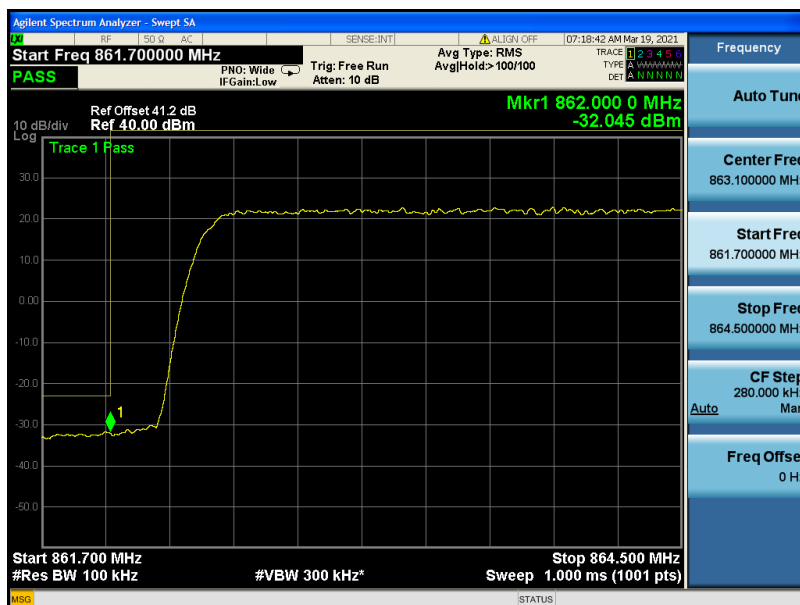
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DL_1S_B_AWGN_Pre-AGC_Out-of-band emission



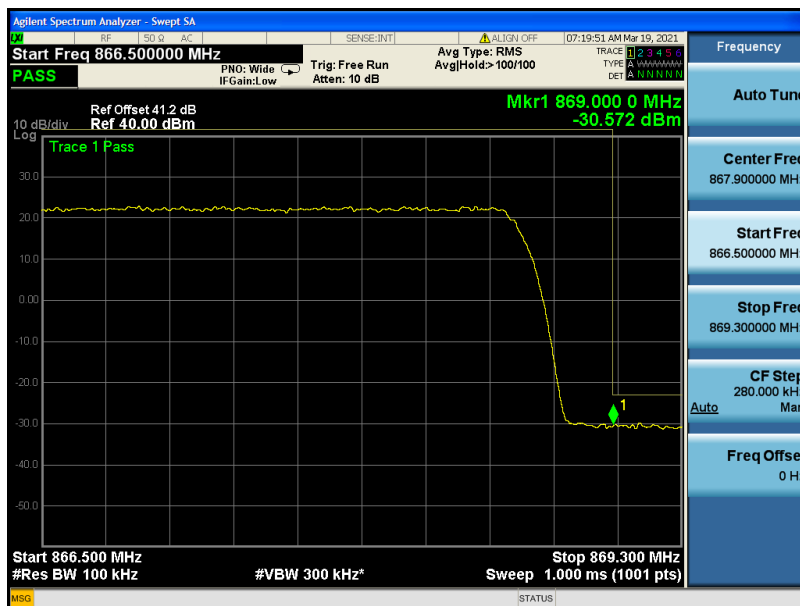
DL_1S_B_AWGN_AGC+3_Out-of-band emission



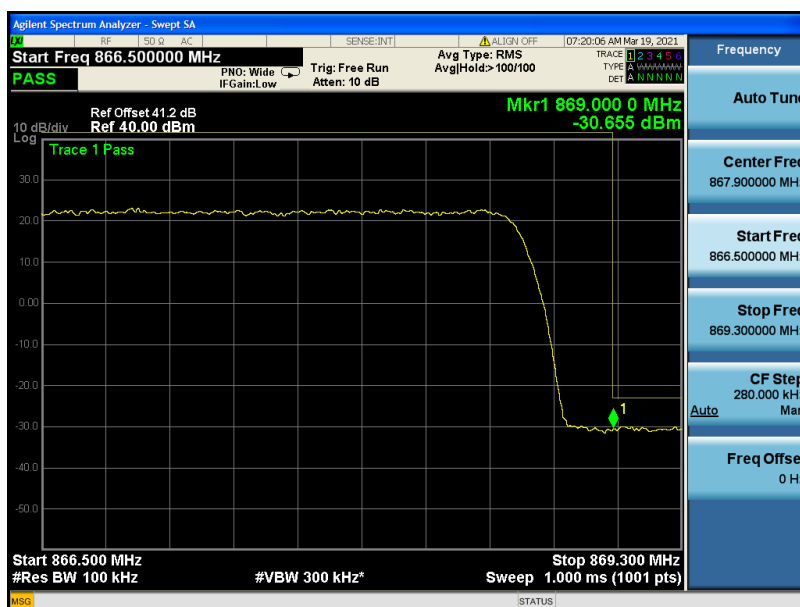
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DL_1S_T_AWGN_Pre-AGC_Out-of-band emission



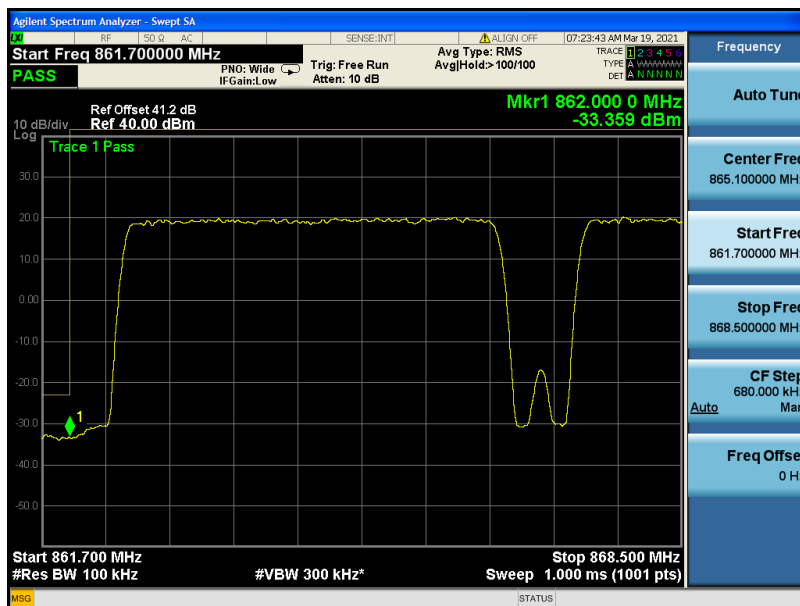
DL_1S_T_AWGN_AGC+3_Out-of-band emission



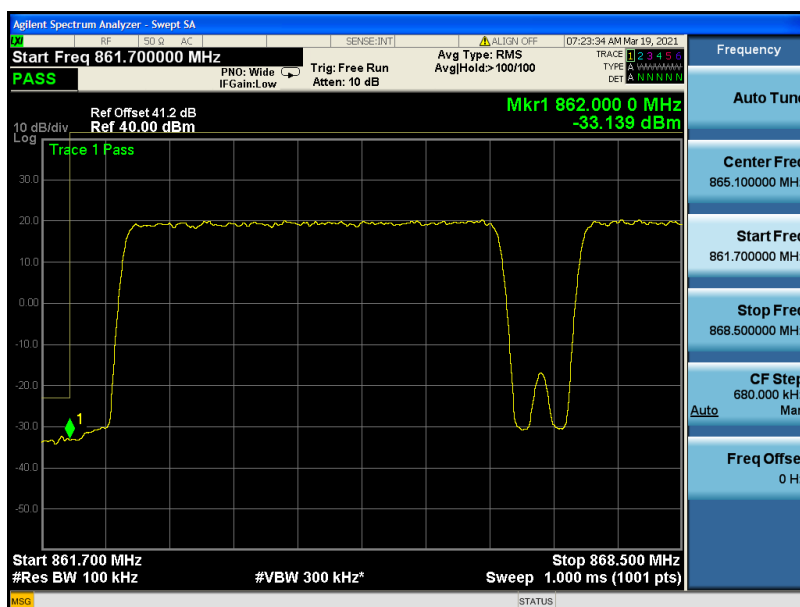
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DL_2S_B_AWGN_Pre-AGC_Out-of-band emission



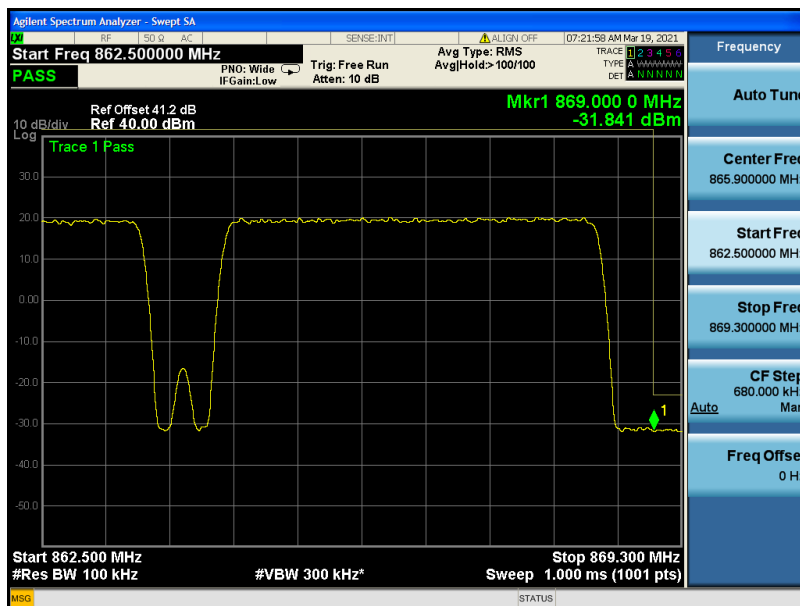
DL_2S_B_AWGN_AGC+3_Out-of-band emission



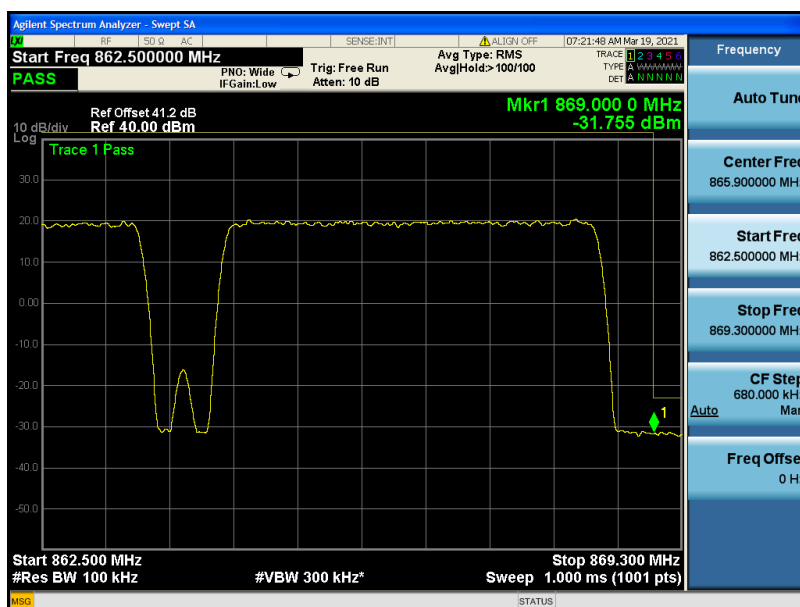
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DL_2S_T_AWGN_Pre-AGC_Out-of-band emission



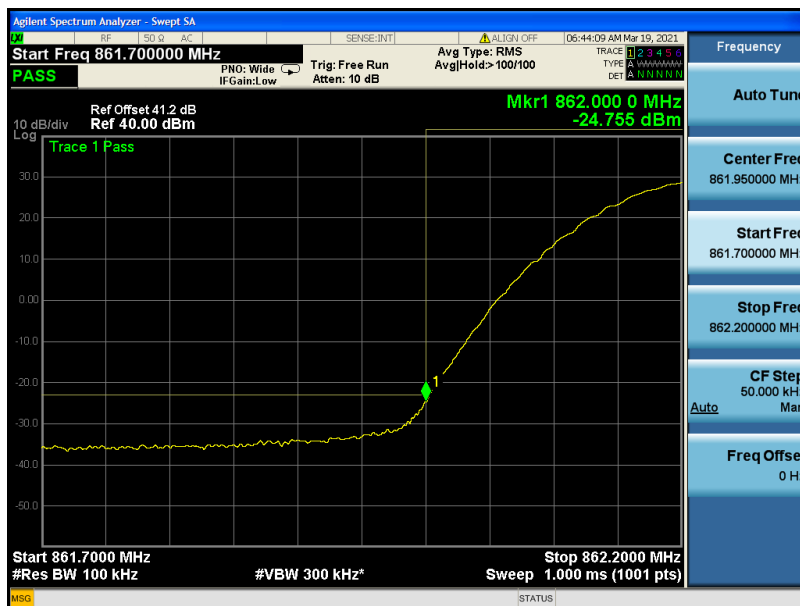
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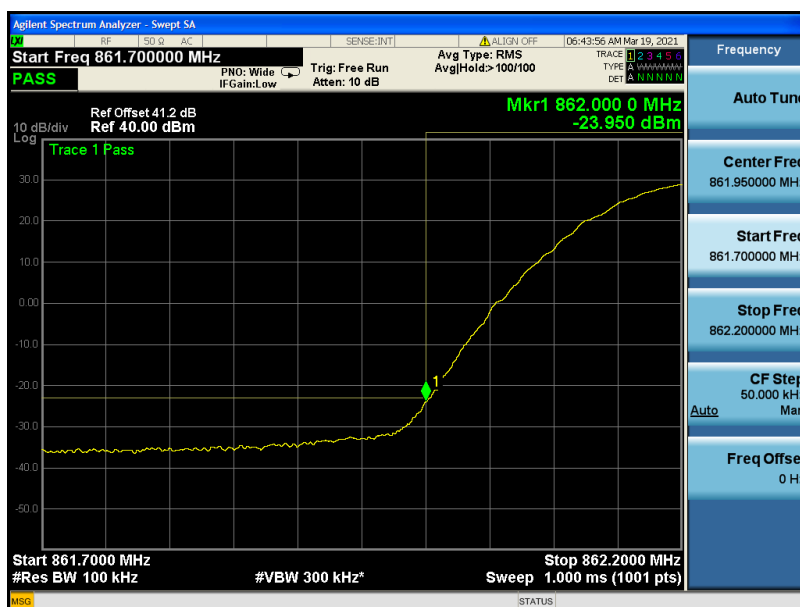
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DL_1S_B_GSM_Pre-AGC_Out-of-band emission



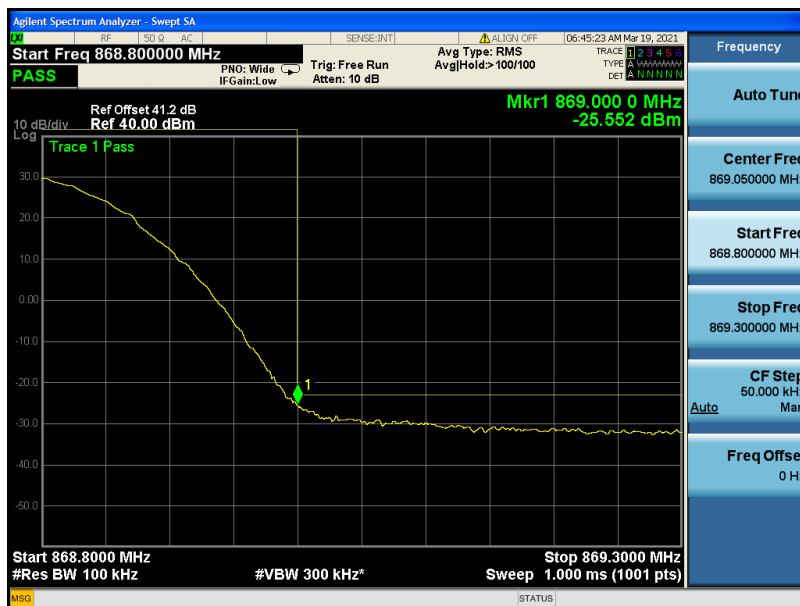
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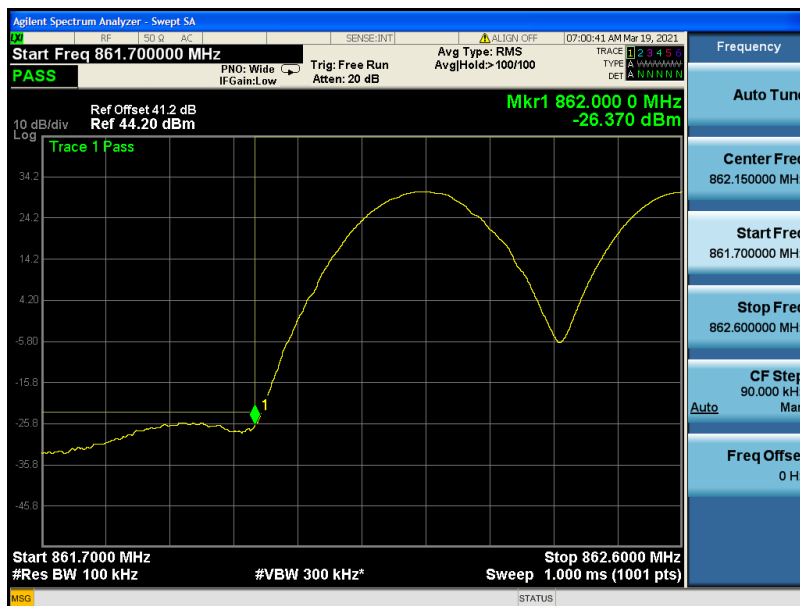
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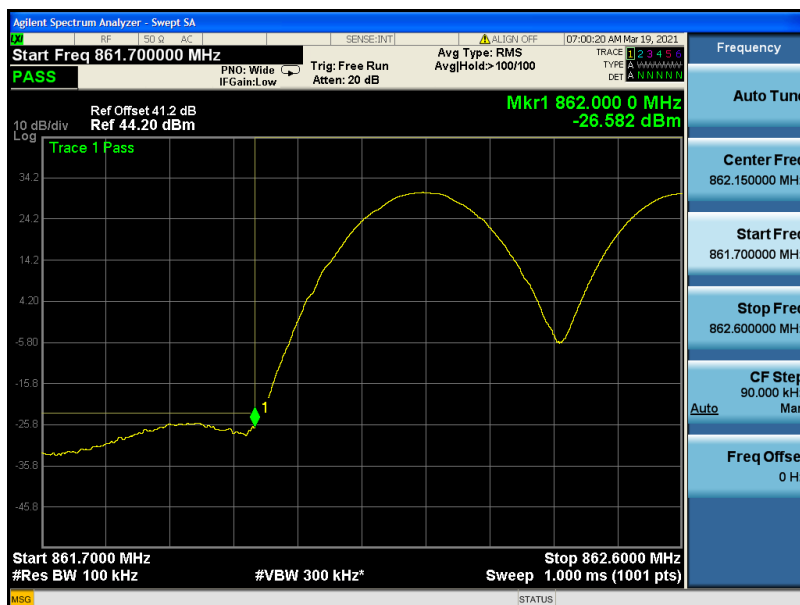
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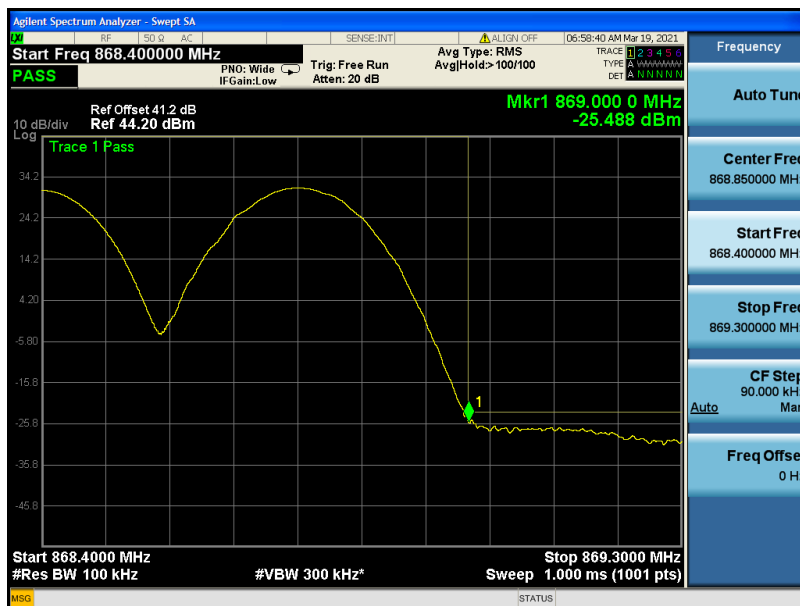
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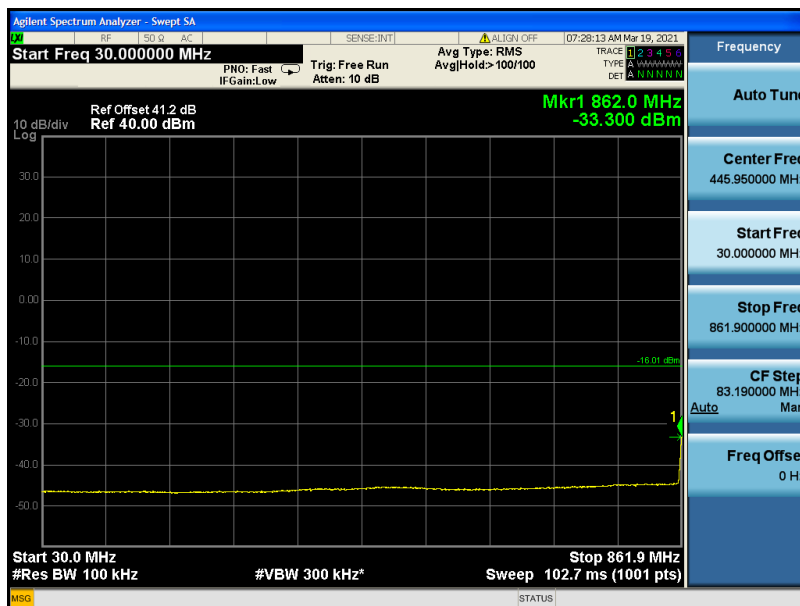
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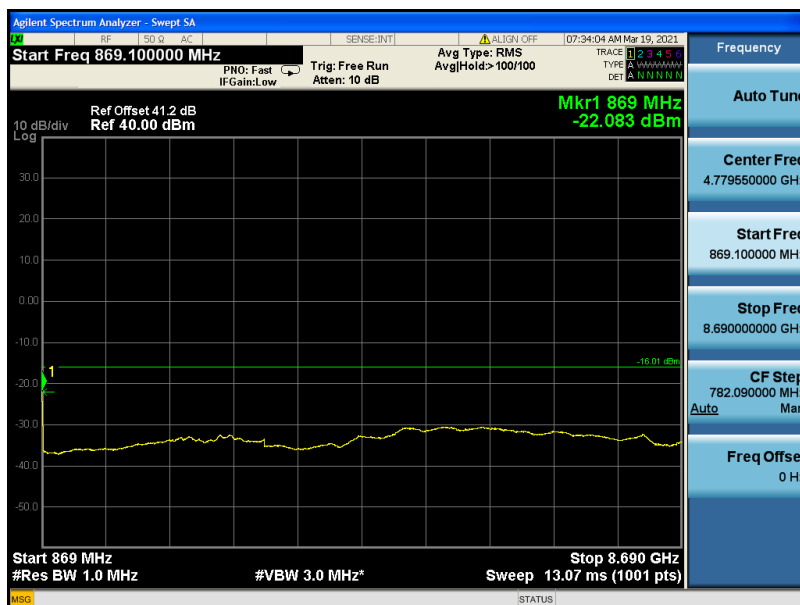
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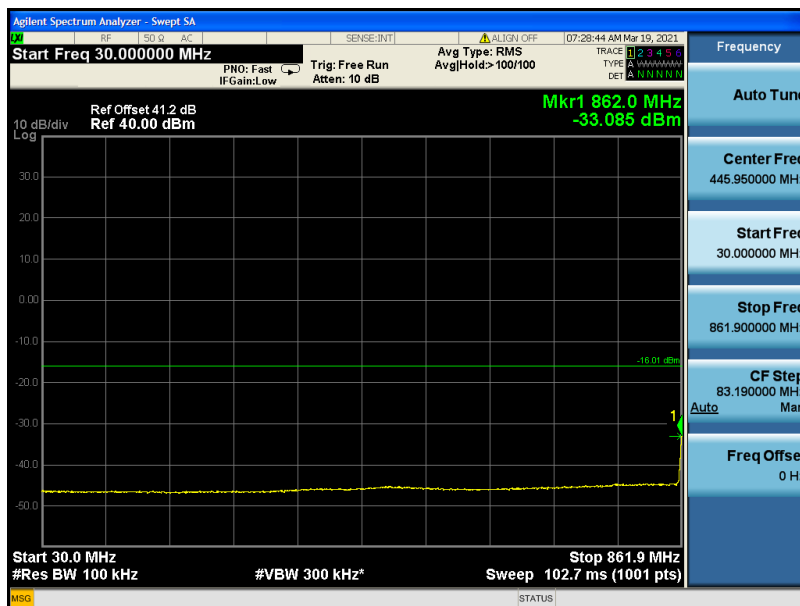
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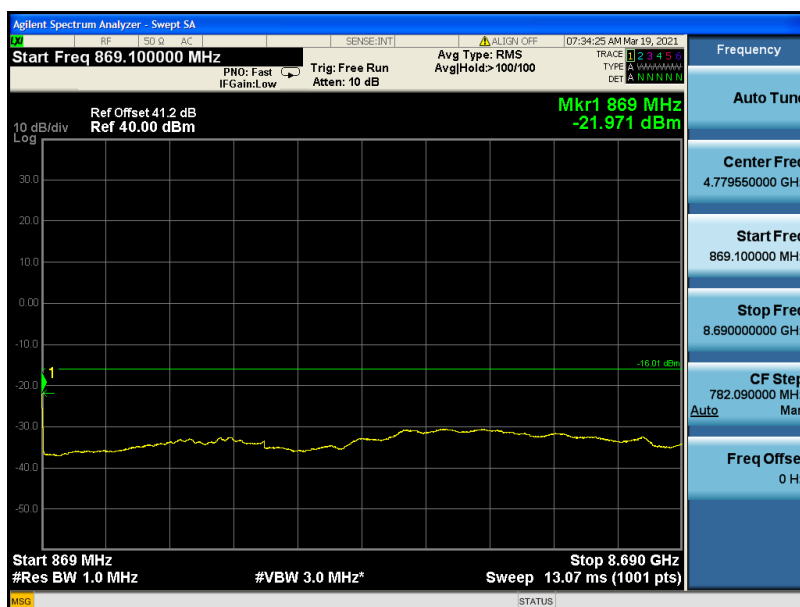
DL_1S_B_AWGN_Pre-AGC_Spurious emission 2



DL_1S_M_AWGN_Pre-AGC_Spurious emission 1



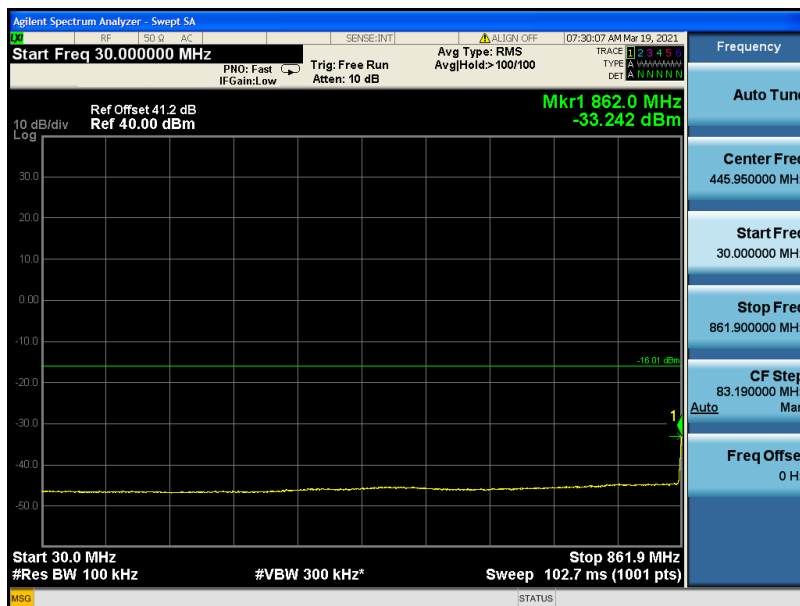
DL_1S_M_AWGN_Pre-AGC_Spurious emission 2



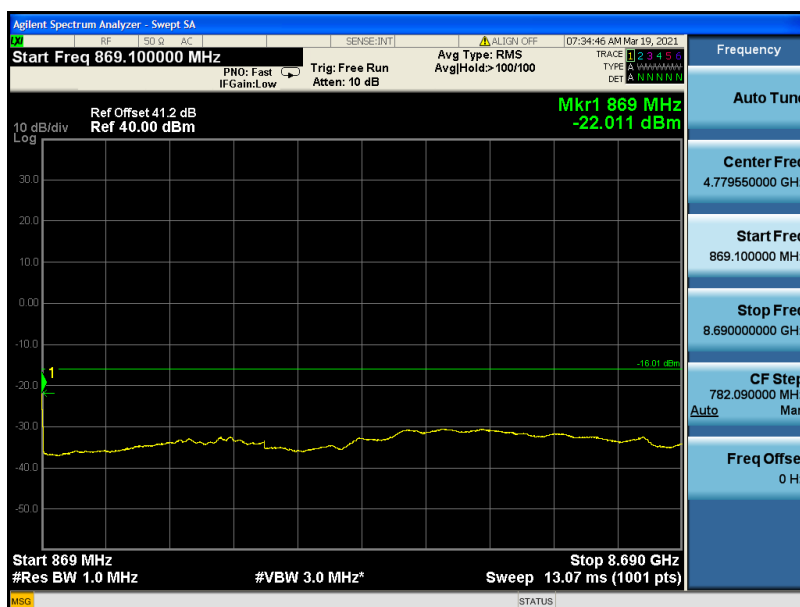
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DL_1S_T_AWGN_Pre-AGC_Spurious emission 1



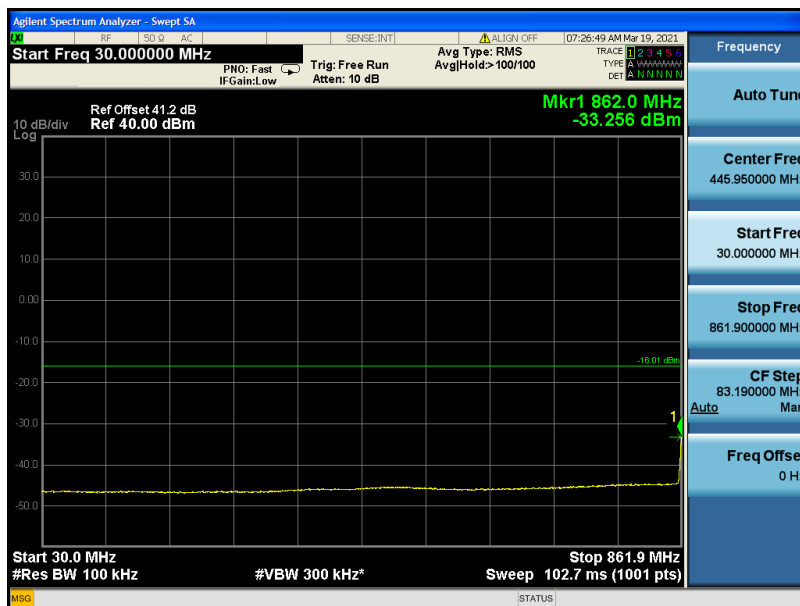
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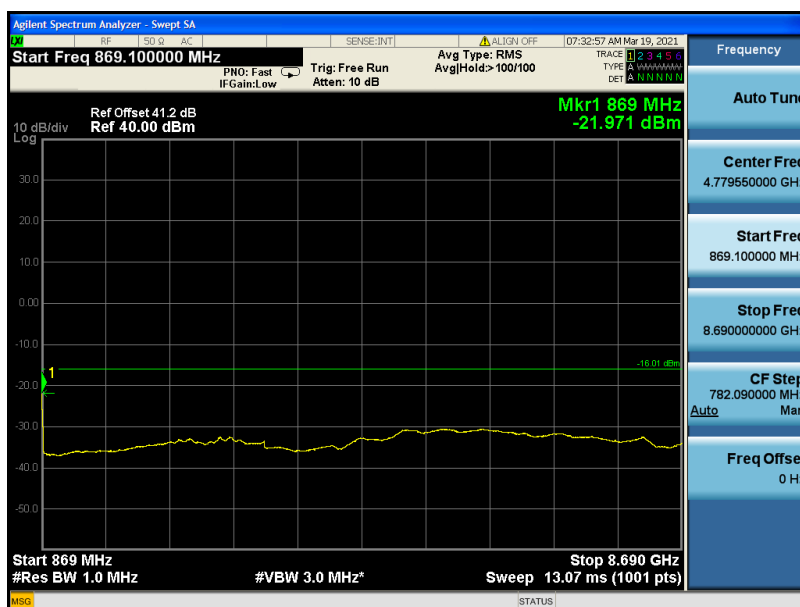
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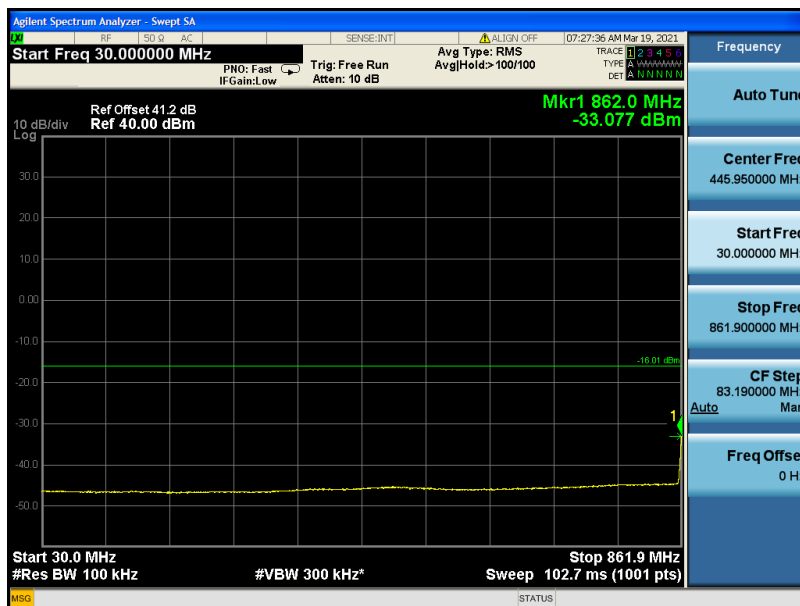
DL_1S_B_GSM_Pre-AGC_Spurious emission 1



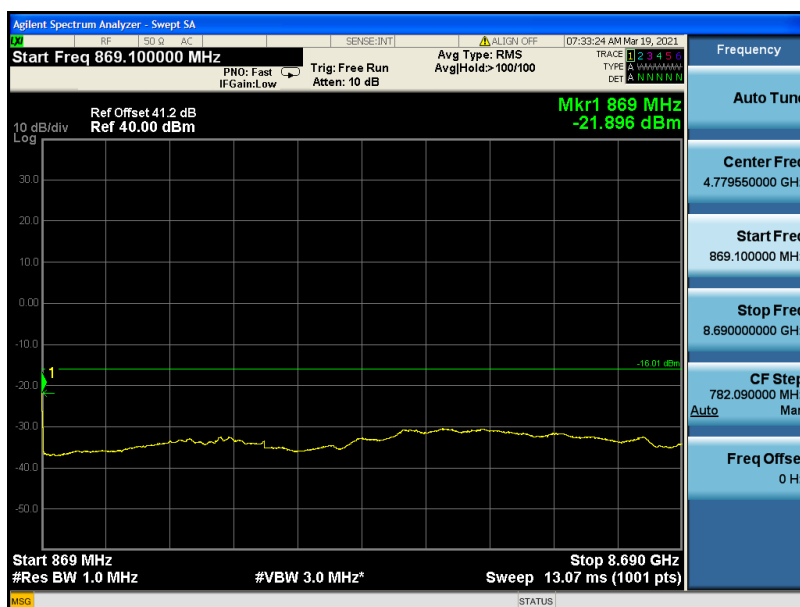
DL_1S_B_GSM_Pre-AGC_Spurious emission 2



DL_1S_M_GSM_Pre-AGC_Spurious emission 1



DL_1S_M_GSM_Pre-AGC_Spurious emission 2



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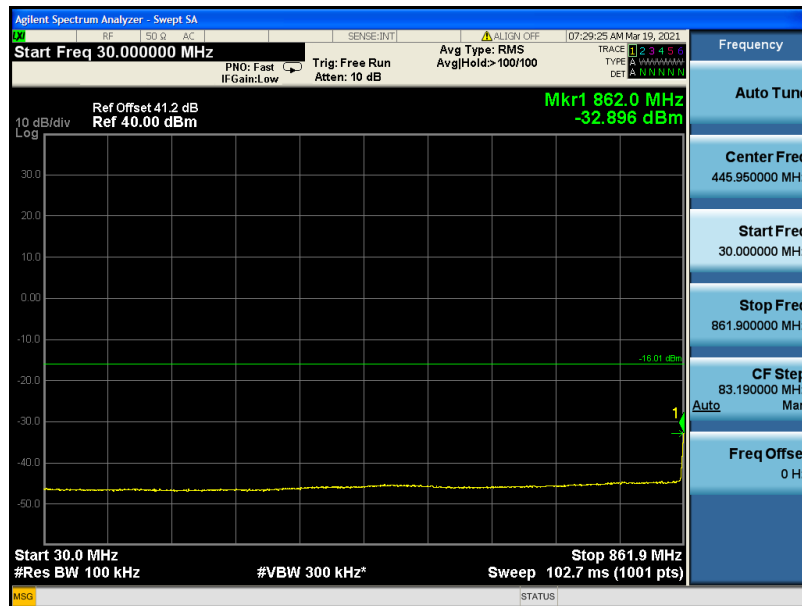
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SGS-CSTC Standards Technical Services Co., Ltd.
Guangzhou Branch, Testing Services, EMC Laboratory

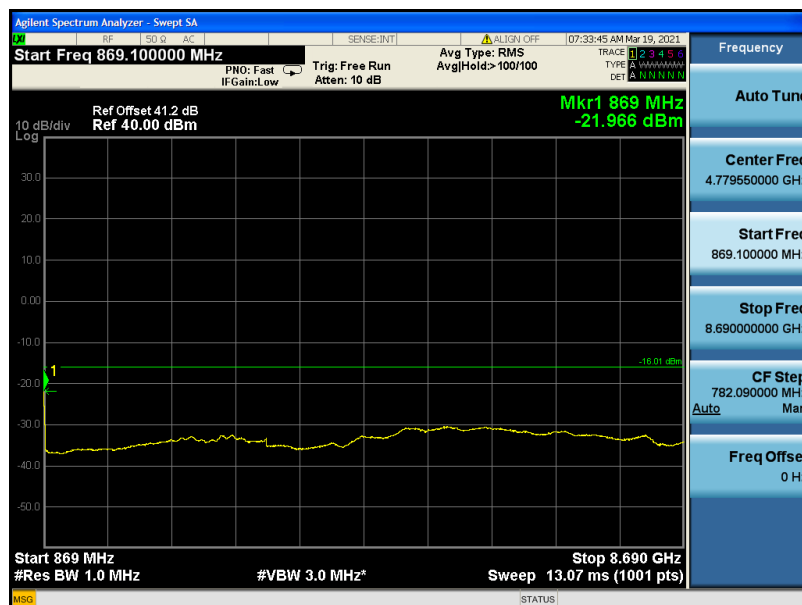
No.198, Kezhu Road, Science City, Economic & Technological Development Area, Guangzhou, Guangdong, China 510663
中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编: 510663

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DL_1S_T_GSM_Pre-AGC_Spurious emission 1



DL_1S_T_GSM_Pre-AGC_Spurious emission 2



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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 AC 110V.
 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 and less than 1.5ppm. Meet the requirement.
 4. Frequency stability has been tested using an AWGN test signal and a GSM-TDMA test signal, only the worst-case was recorded in this report.

Frequency stability vs temperature				
Temperature (°C)	Test Conf.	Test data (MHz)	Tolerance (ppm)	Verdict
50	DL_1S_M_AWGN	865.501345	-0.44	PASS
40		865.501536	-0.22	PASS
30		865.501132	-0.69	PASS
20		865.501726	Reference	PASS
10		865.501893	0.19	PASS
0		865.502038	0.36	PASS
-10		865.501683	-0.05	PASS
-20		865.502103	0.44	PASS
-30		865.501898	0.20	PASS

Frequency stability vs voltage				
Voltage (V)	Test Conf.	Test data (MHz)	Tolerance (ppm)	Verdict
AC 93.5	DL_1S_M_AWGN	865.501115	-0.71	PASS
AC 110		865.501726	Reference	PASS
AC 126.5		865.502035	0.35	PASS



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1.6 Radiated spurious emissions

Note: 1. The tested max conducted power for single antenna port is 42.89dBm, the 2x2 MIMO total power is 42.89dBm+42.89dBm=38.9W

a) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

Here, $P=38.90W$,

the limit = $P(\text{dBm}) - [50 + 10 \log (38.90W)] = -20\text{dBm}$

b) For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

Here, $P=38.90W$,

the limit = $P(\text{dBm}) - [43 + 10 \log (38.90W)] = -13\text{dBm}$

The limit line was set to -20dBm (the strictest limit) in following test plots in order to determine the test result conveniently.

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.

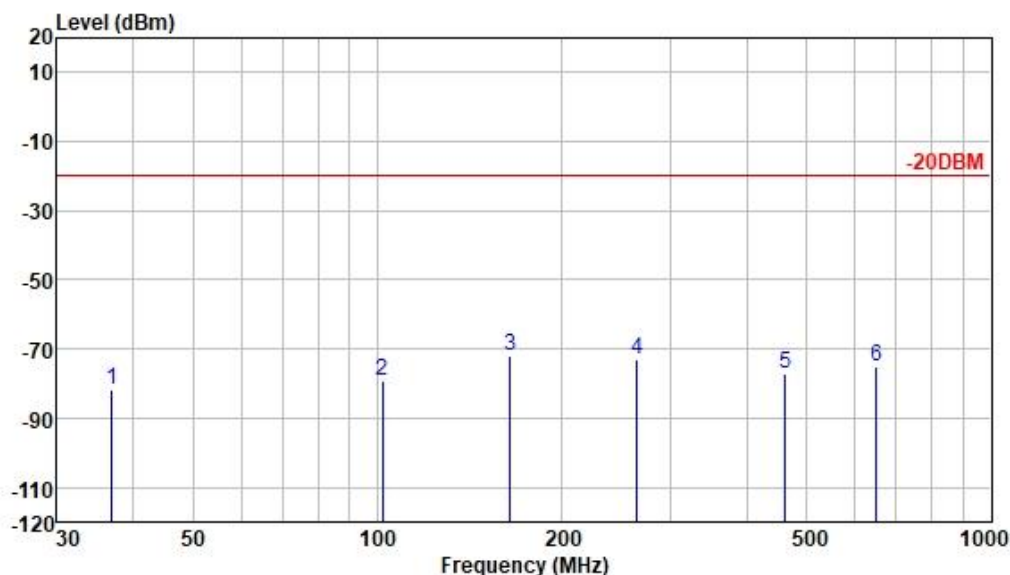
3. The disturbance from 9kHz to 30MHz was very low and 20dB below the limit, therefore, the data was not recorded in the report.



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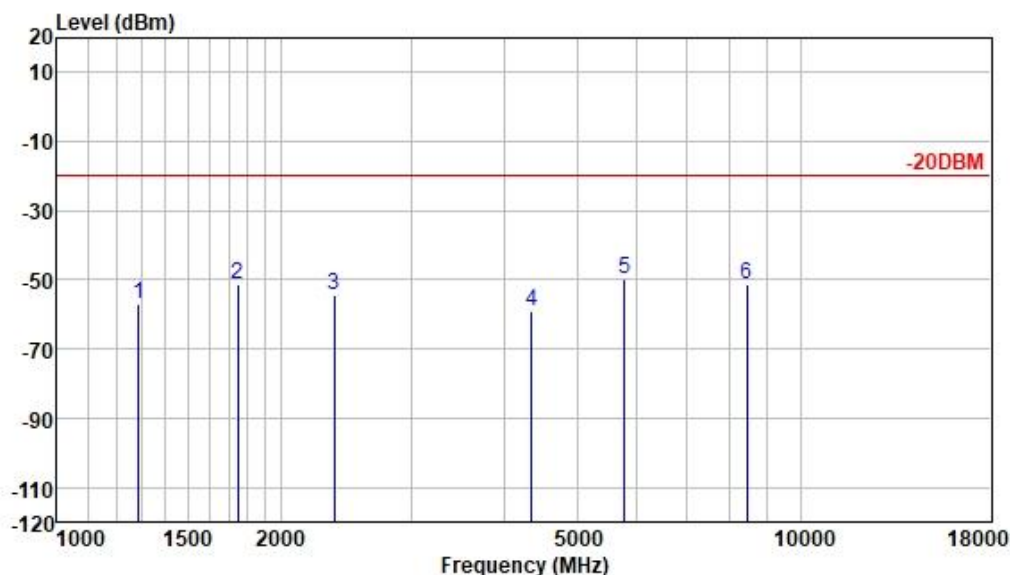
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DL_1S_M_AWGN_Horizontal_30MHz~1GHz



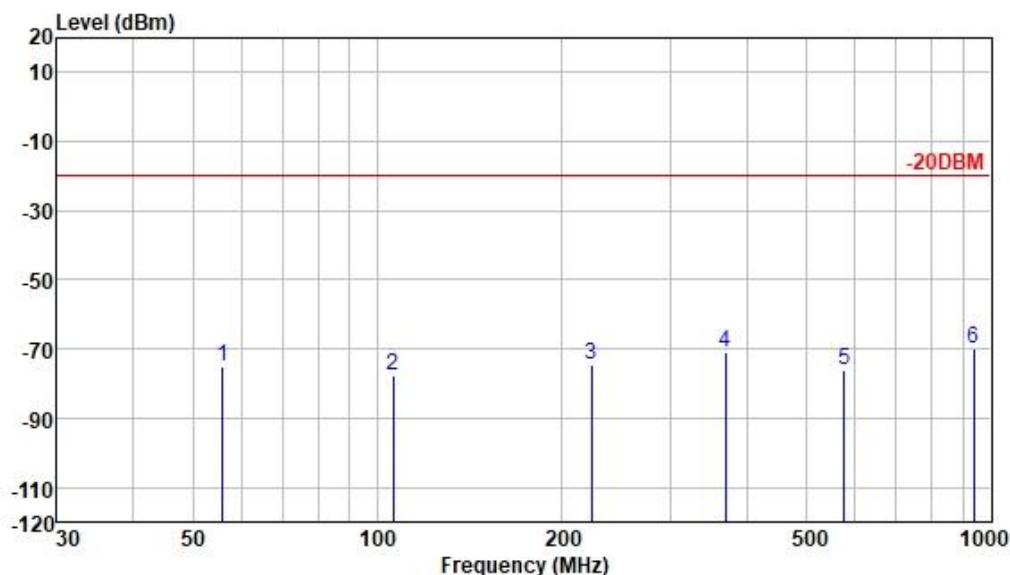
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	36.90	-84.12	2.53	-81.59	-19.99	-61.60	HORIZONTAL
2	101.64	-69.59	-9.56	-79.15	-19.99	-59.16	HORIZONTAL
3	164.33	-65.62	-6.32	-71.94	-19.99	-51.95	HORIZONTAL
4	264.75	-69.43	-3.53	-72.96	-19.99	-52.97	HORIZONTAL
5	462.35	-77.38	0.30	-77.08	-19.99	-57.09	HORIZONTAL
6	649.66	-79.01	3.79	-75.22	-19.99	-55.23	HORIZONTAL

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	1285.90	-61.25	4.06	-57.19	-19.99	-37.20	HORIZONTAL
2	1751.96	-57.07	6.03	-51.04	-19.99	-31.05	HORIZONTAL
3	2359.48	-63.78	9.54	-54.24	-19.99	-34.25	HORIZONTAL
4	4341.89	-63.21	4.38	-58.83	-19.99	-38.84	HORIZONTAL
5	5797.03	-65.26	15.33	-49.93	-19.99	-29.94	HORIZONTAL
6	8465.38	-64.85	13.43	-51.42	-19.99	-31.43	HORIZONTAL

DL_1S_M_AWGN_Vertical_30MHz~1GHz



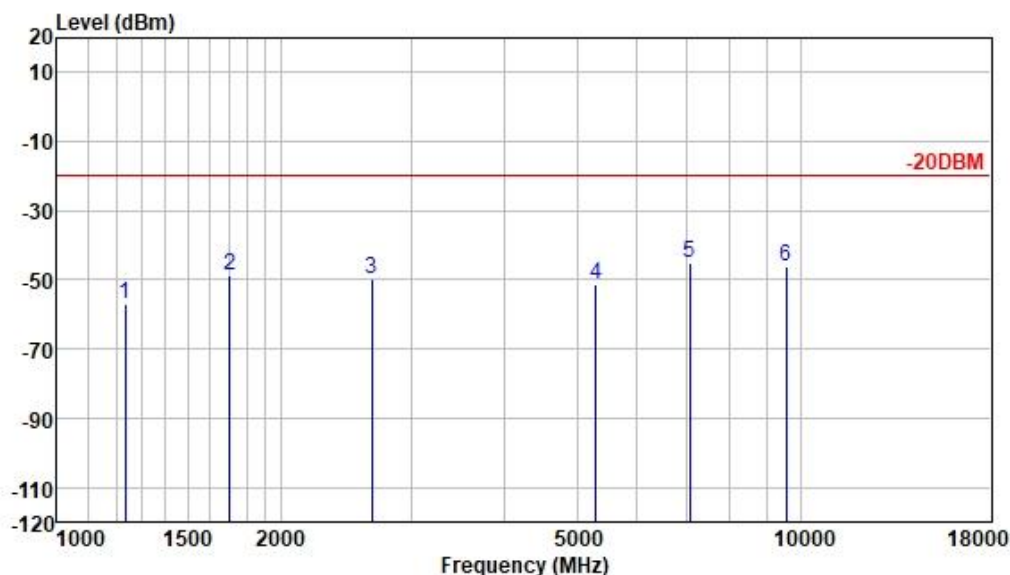
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	55.80	-71.09	-3.71	-74.80	-19.99	-54.81	VERTICAL
2	106.01	-72.79	-4.84	-77.63	-19.99	-57.64	VERTICAL
3	222.95	-68.39	-6.03	-74.42	-19.99	-54.43	VERTICAL
4	369.40	-69.30	-1.50	-70.80	-19.99	-50.81	VERTICAL
5	576.64	-79.11	3.02	-76.09	-19.99	-56.10	VERTICAL
6	935.55	-78.72	8.94	-69.78	-19.99	-49.79	VERTICAL



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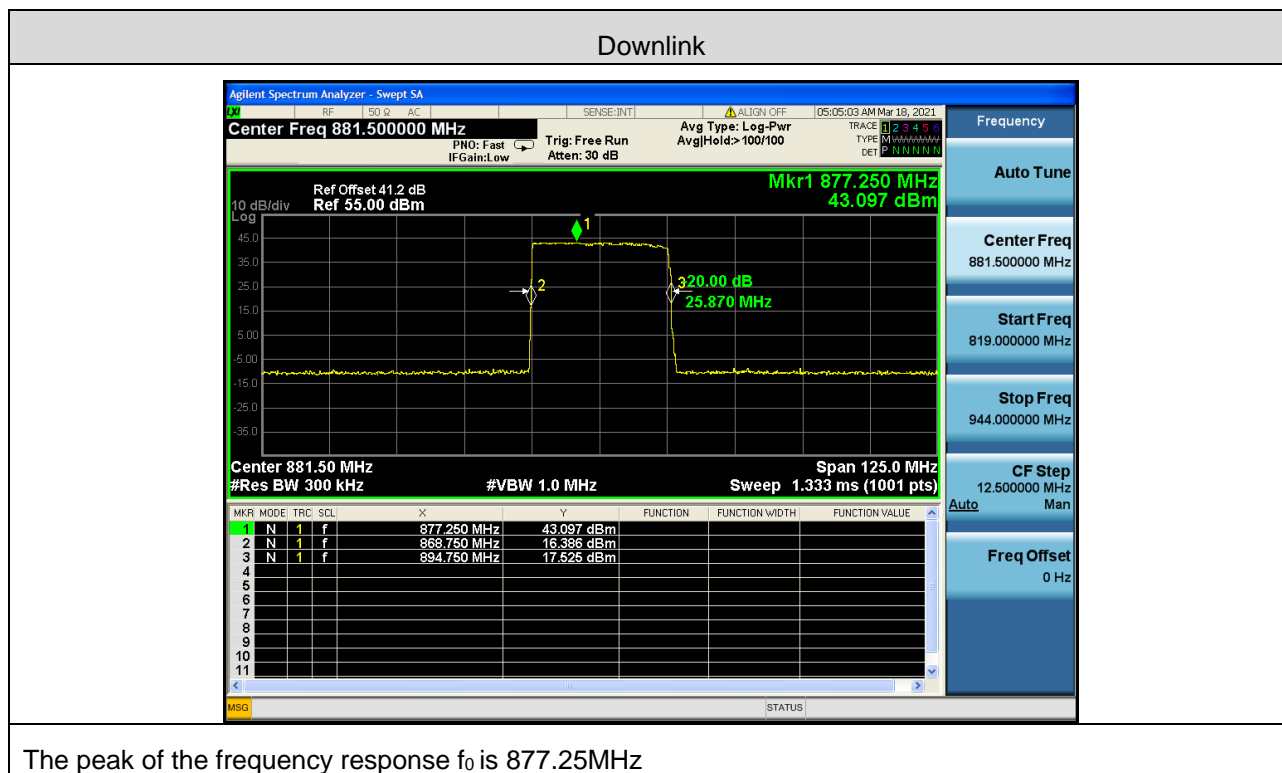
DL_1S_M_AWGN_Vertical_above 1GHz



	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	1234.91	-60.53	3.71	-56.82	-19.99	-36.83	VERTICAL
2	1706.97	-54.45	5.65	-48.80	-19.99	-28.81	VERTICAL
3	2648.66	-55.20	5.42	-49.78	-19.99	-29.79	VERTICAL
4	5300.20	-64.57	13.20	-51.37	-19.99	-31.38	VERTICAL
5	7076.52	-65.03	19.82	-45.21	-19.99	-25.22	VERTICAL
6	9558.02	-63.87	17.80	-46.07	-19.99	-26.08	VERTICAL

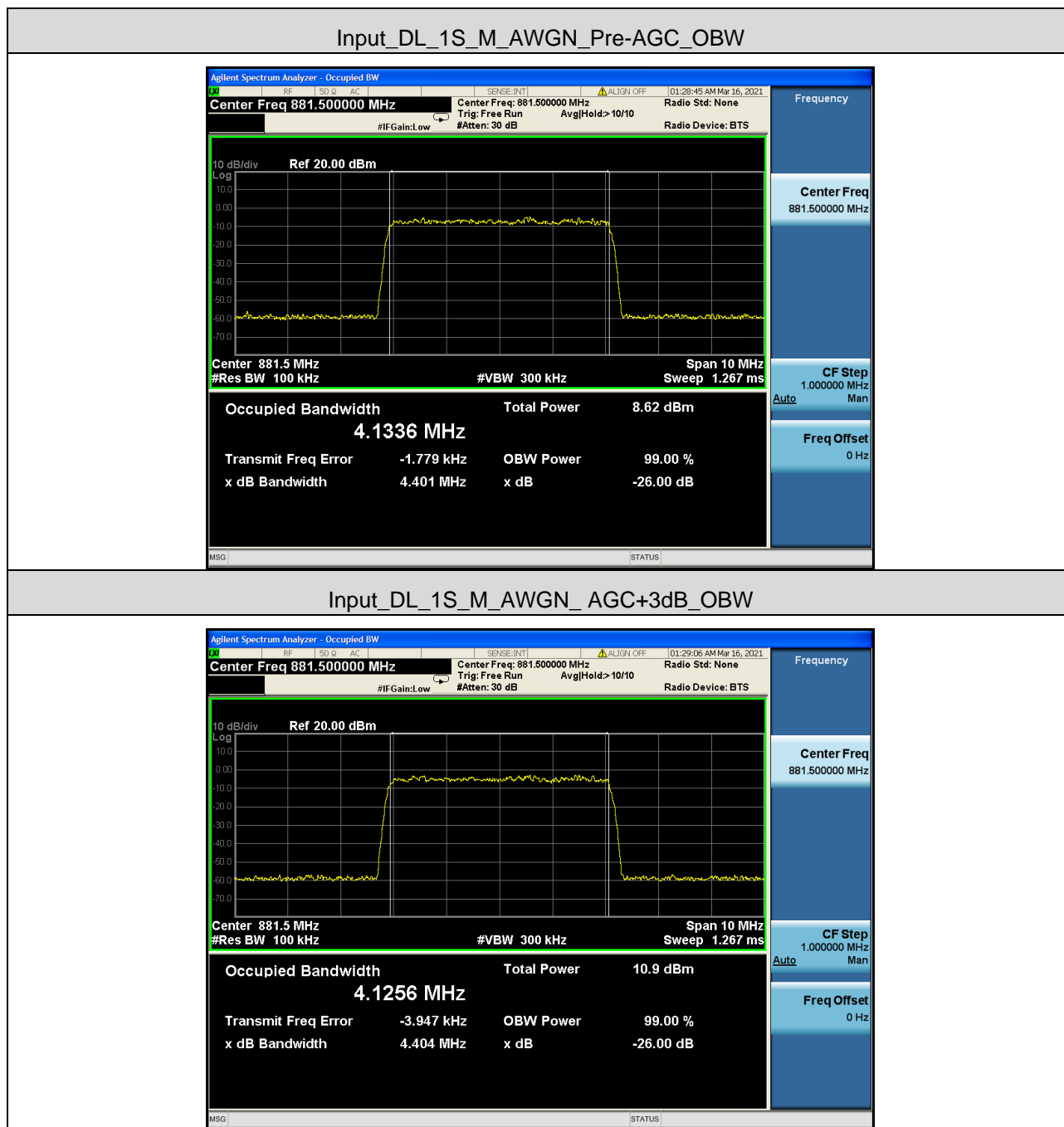
2 Cellular (only for downlink: 869-894MHz)

2.1 Out-of-band rejection



The peak of the frequency response f_0 is 877.25MHz

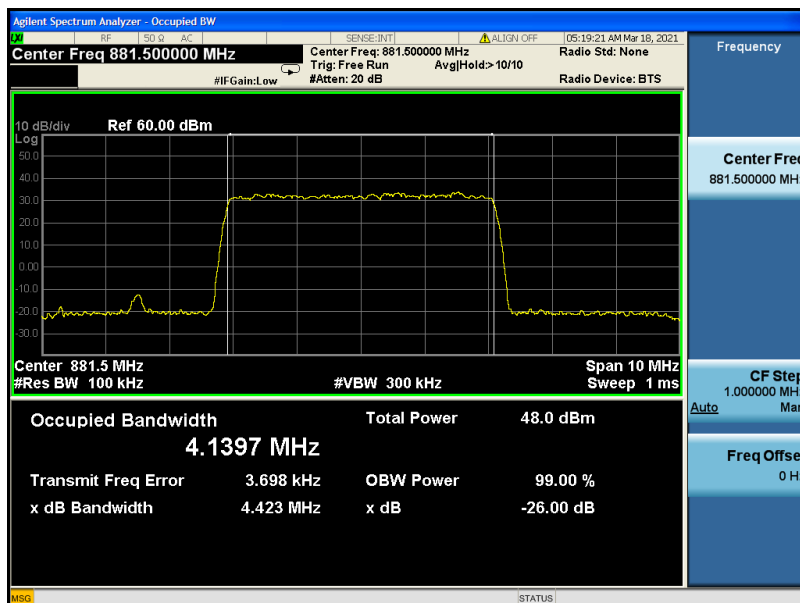
2.2 Input-versus-output signal comparison



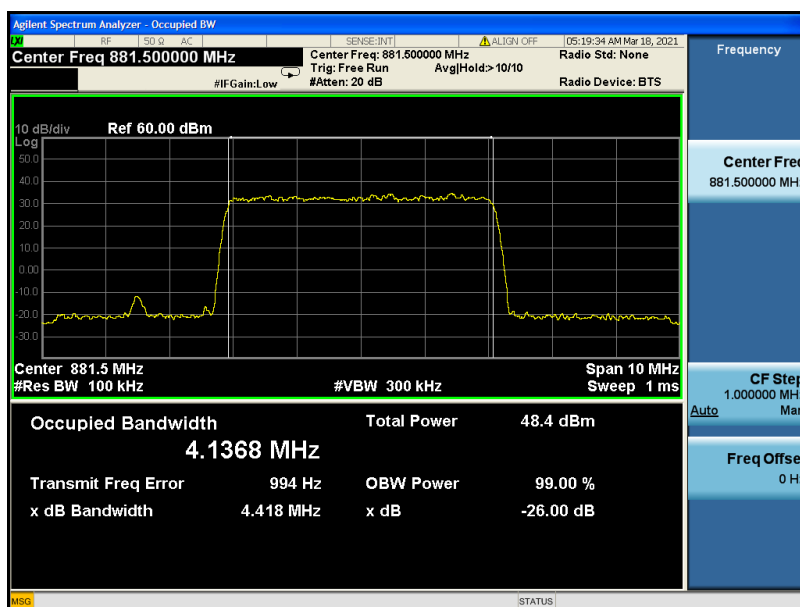
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Output_DL_1S_M_AWGN_Pre-AGC_OBW



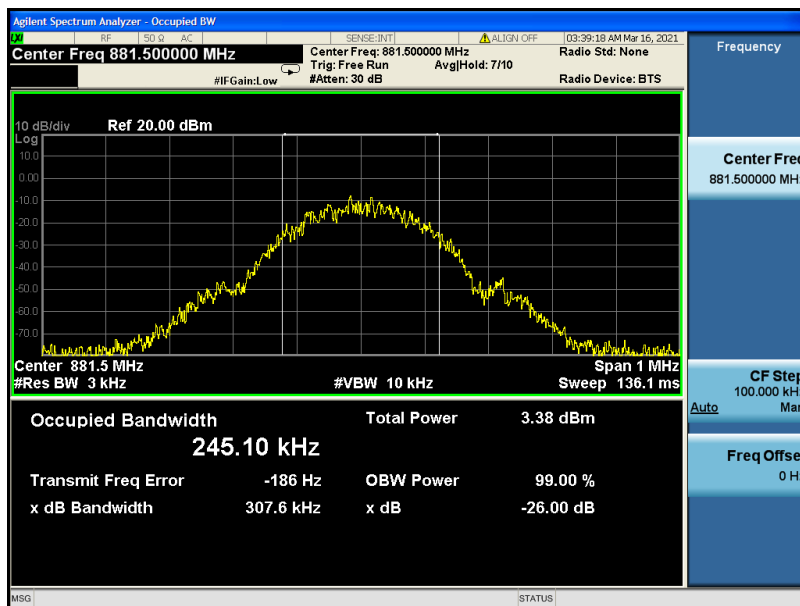
Output_DL_1S_M_AWGN_AGC+3dB_OBW



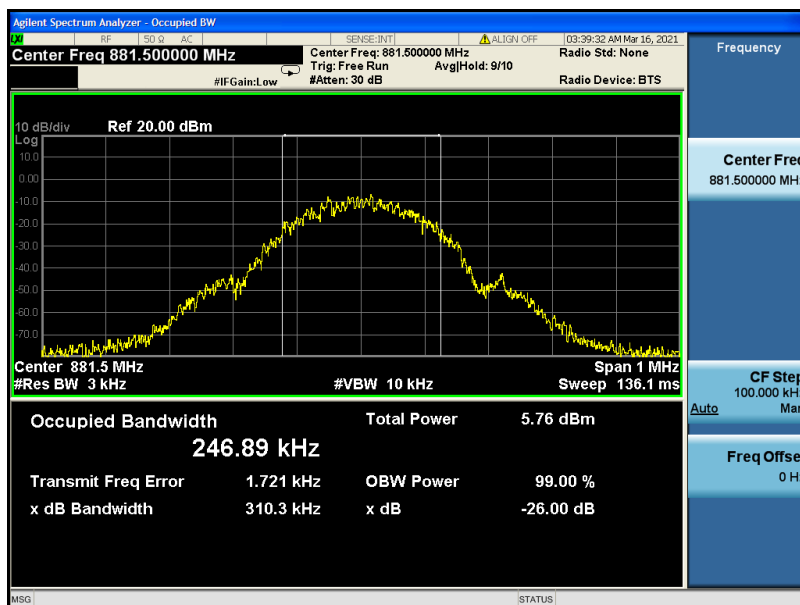
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Input_DL_1S_M_GSM_Pre-AGC_OBW

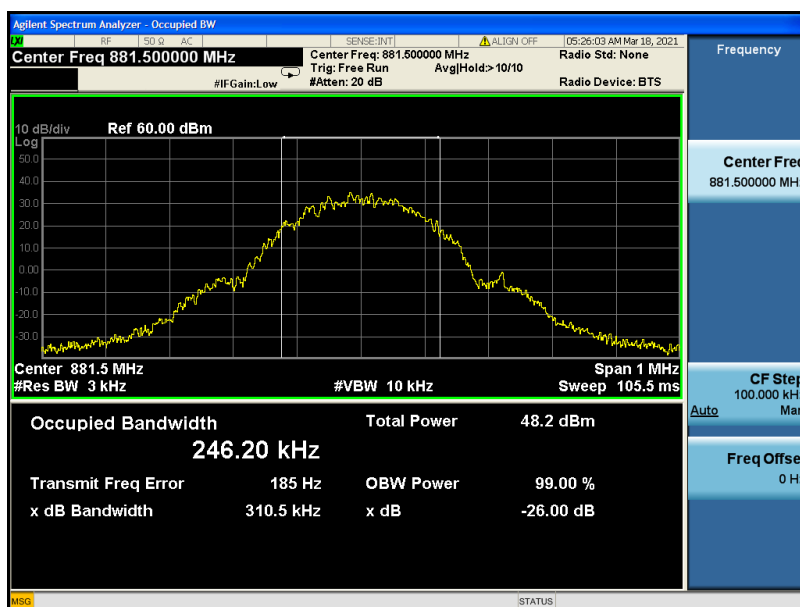
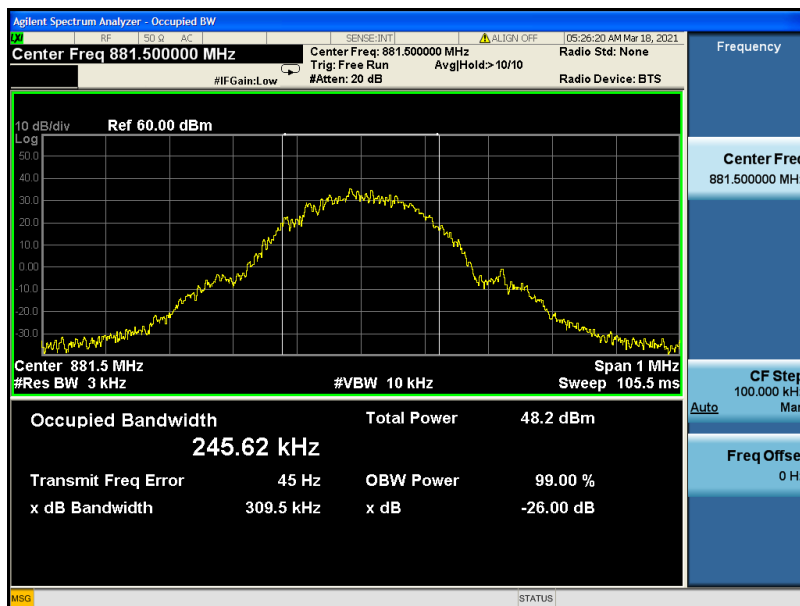


Input_DL_1S_M_GSM_AGC+3dB_OBW



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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	877.25	Pre-AGC	0.00	42.94	42.94	PASS
		AGC+3dB	3.00	42.76	/	PASS
DL_1S_GSM	877.25	Pre-AGC	-0.10	42.76	42.86	PASS
		AGC+3dB	2.90	42.87	/	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 = 10dBi+10log (2) dBi= 13dBi.

ERP= EIRP-2.15dB,

The total maximum ERP for the EUT is (42.94dBm+42.94dBm) +13dBi-2.15dB=56.8dBm (478.63W) which don't exceed the required ERP limit (500W).

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

Note: The tested max conducted power for single antenna port is 42.94dBm, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10 \log (P)$ dB

Here,

$P=42.94\text{dBm}= 19.7\text{W}$.

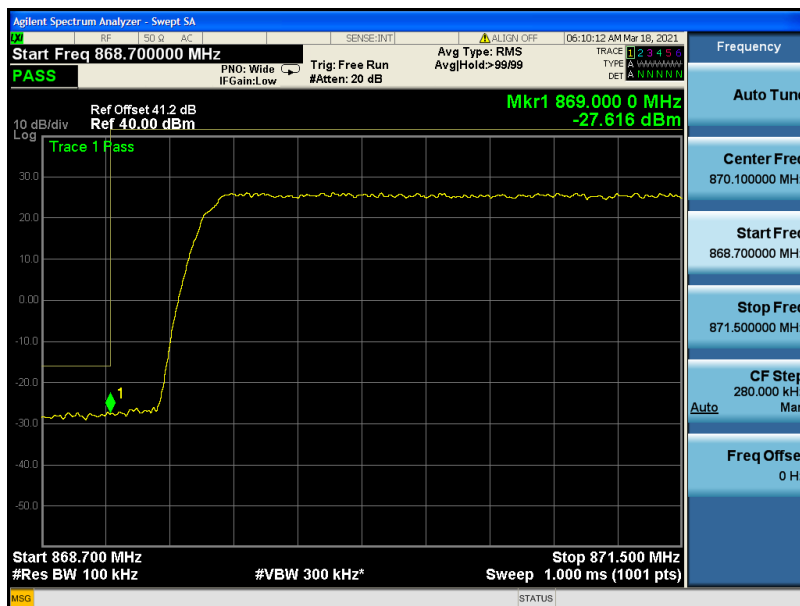
So the limit =

$P(\text{dBm}) - [43 + 10 \log (19.7\text{W})] = -13\text{dBm}$

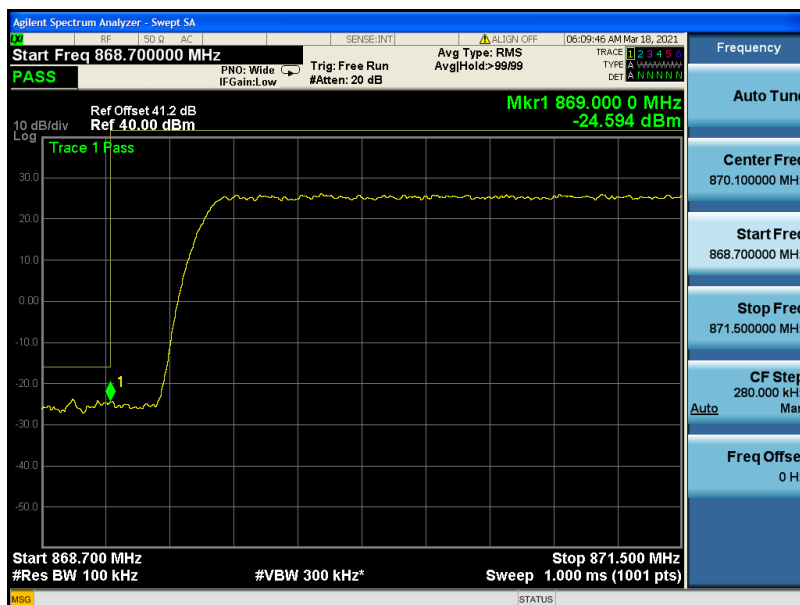
The EUT supports 2x2 MIMO and the emissions were measured at one of output port, so the limit line was set to -16.01dBm in following test plots in order to determine the test result conveniently.

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

DL_1S_B_AWGN_Pre-AGC_Out-of-band emission



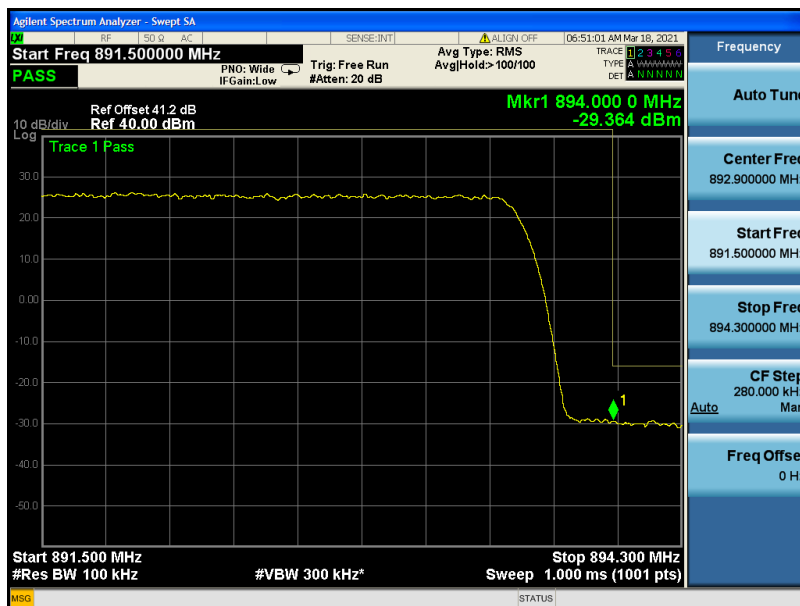
DL_1S_B_AWGN_AGC+3_Out-of-band emission



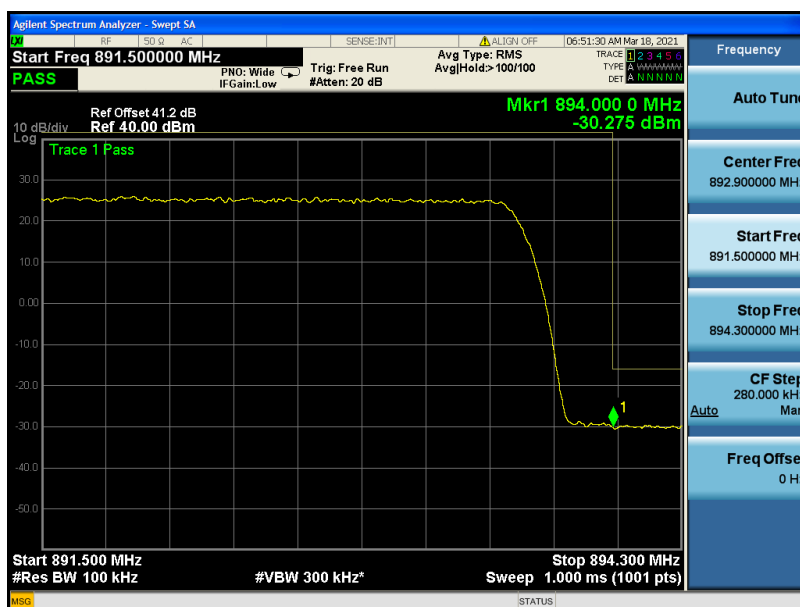
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DL_1S_T_AWGN_Pre-AGC_Out-of-band emission



DL_1S_T_AWGN_AGC+3_Out-of-band emission



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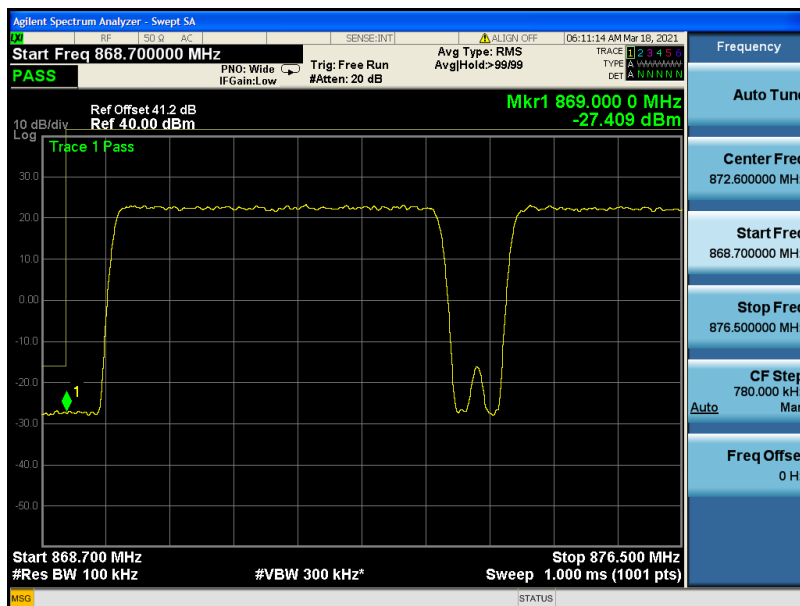
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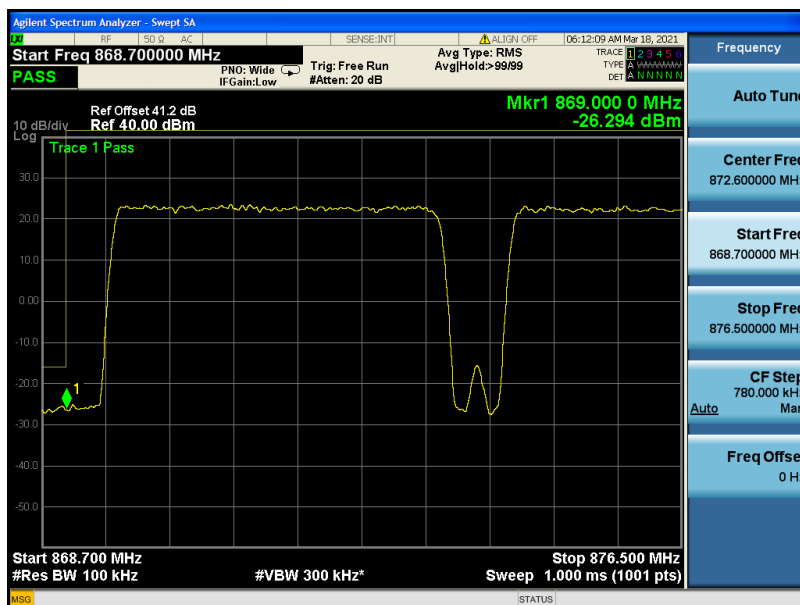
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中国·广东·广州高新技术产业开发区科学城科珠路198号 邮编: 510663

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DL_2S_B_AWGN_Pre-AGC_Out-of-band emission



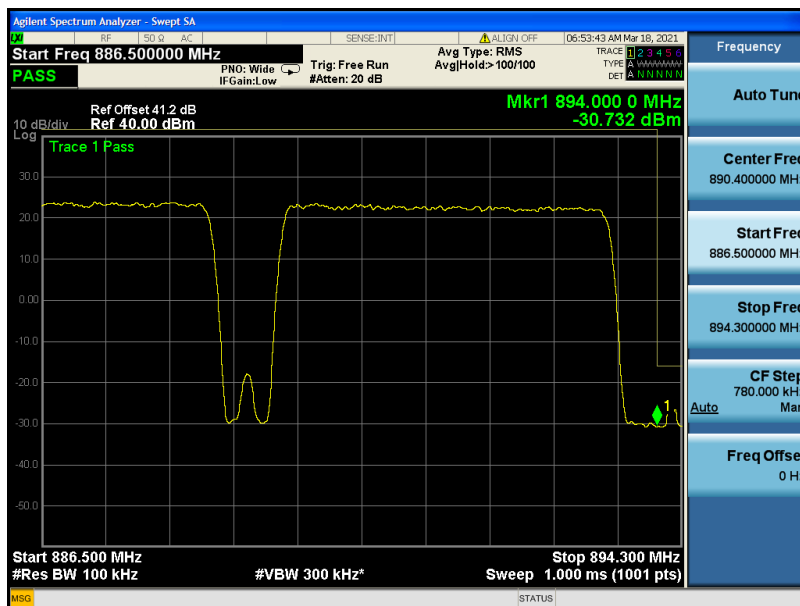
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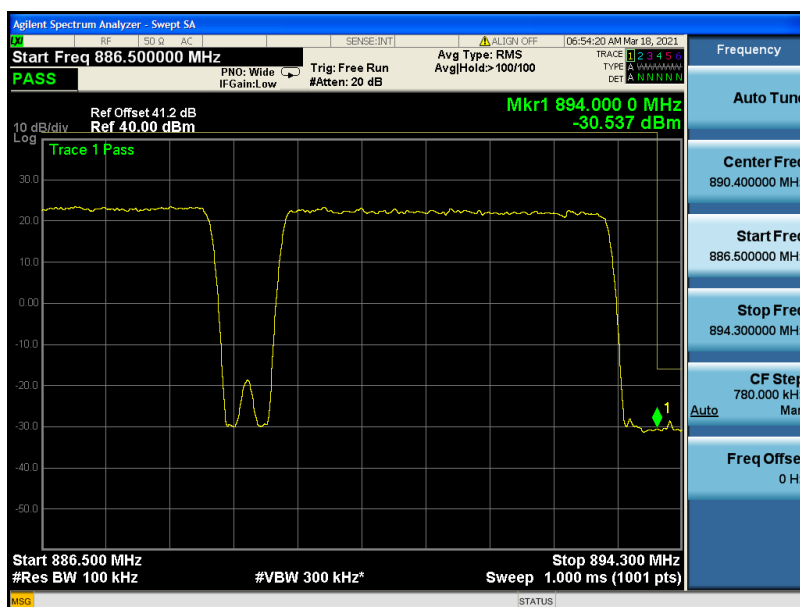
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DL_2S_T_AWGN_Pre-AGC_Out-of-band emission



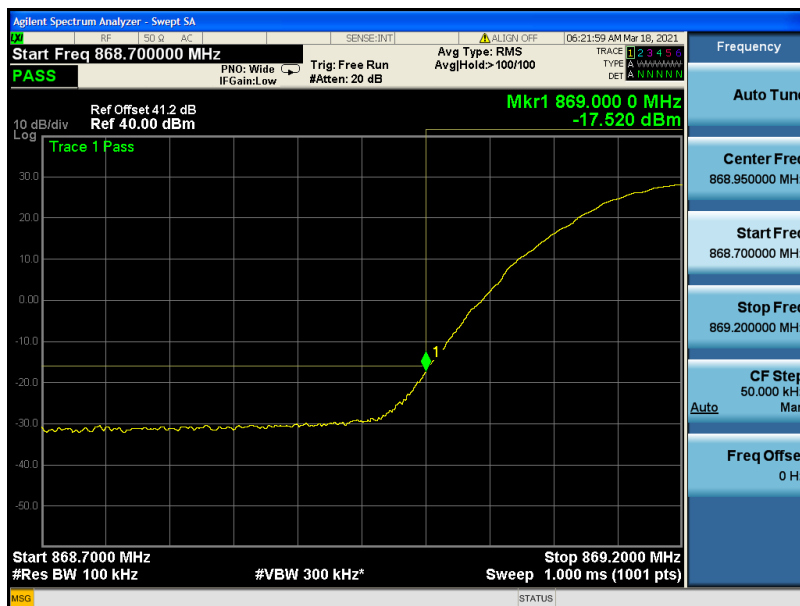
DL_2S_T_AWGN_AGC+3_Out-of-band emission



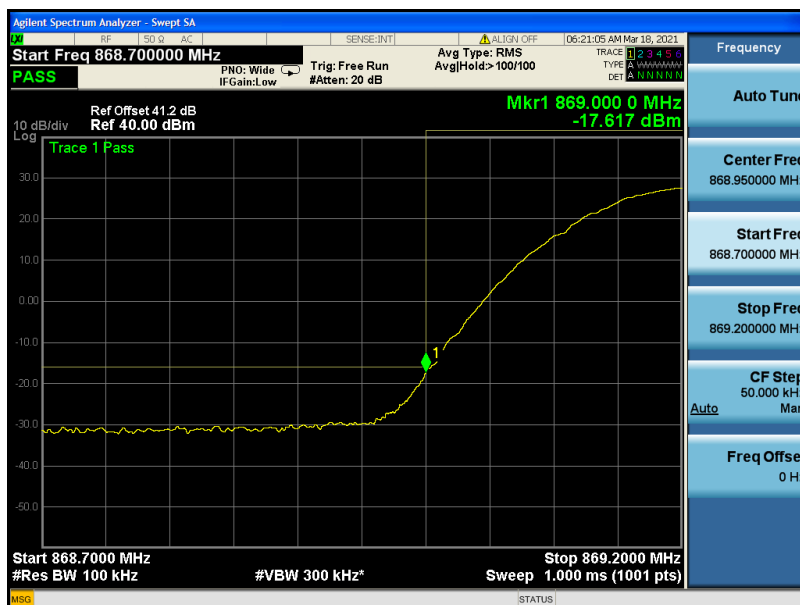
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DL_1S_B_GSM_Pre-AGC_Out-of-band emission



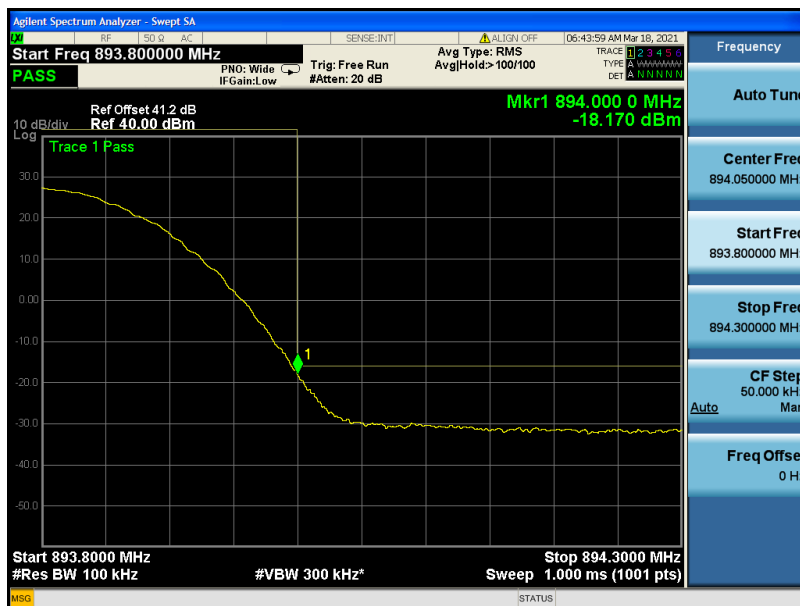
DL_1S_B_GSM_AGC+3_Out-of-band emission



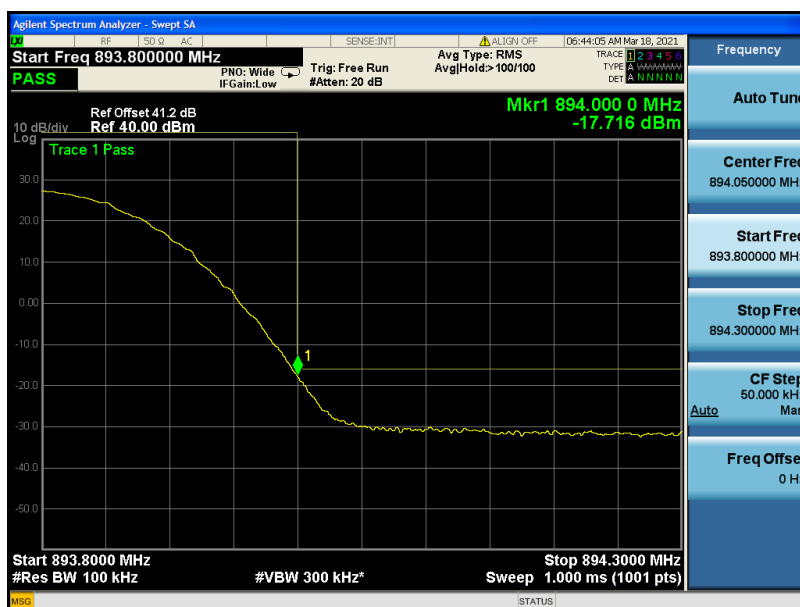
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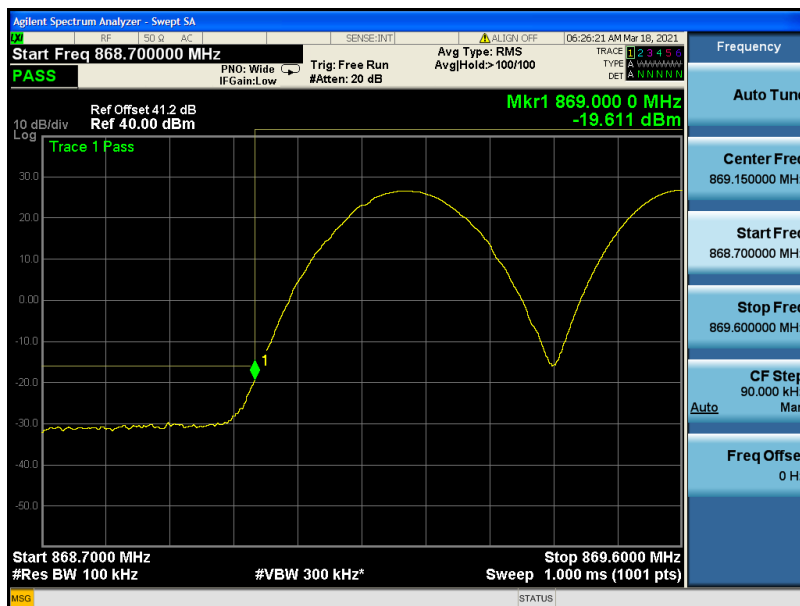
DL_1S_T_GSM_AGC+3_Out-of-band emission



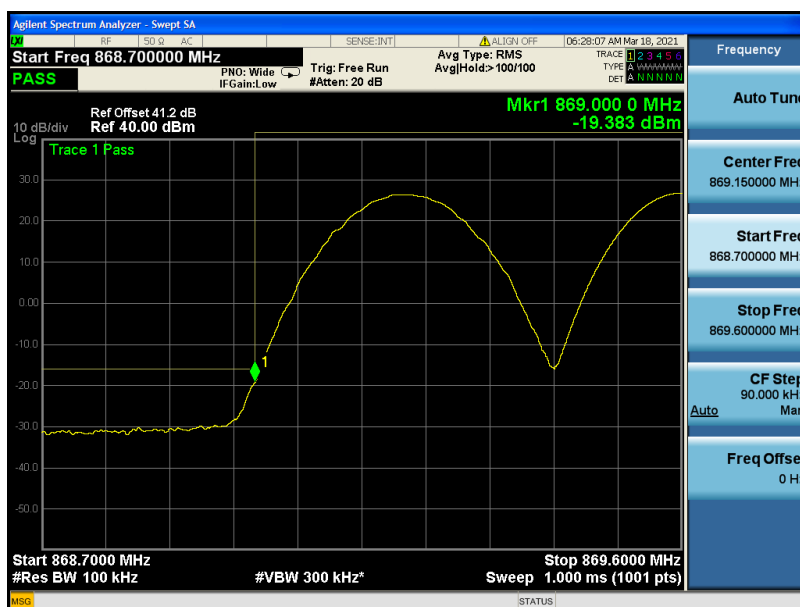
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DL_2S_B_GSM_Pre-AGC_Out-of-band emission



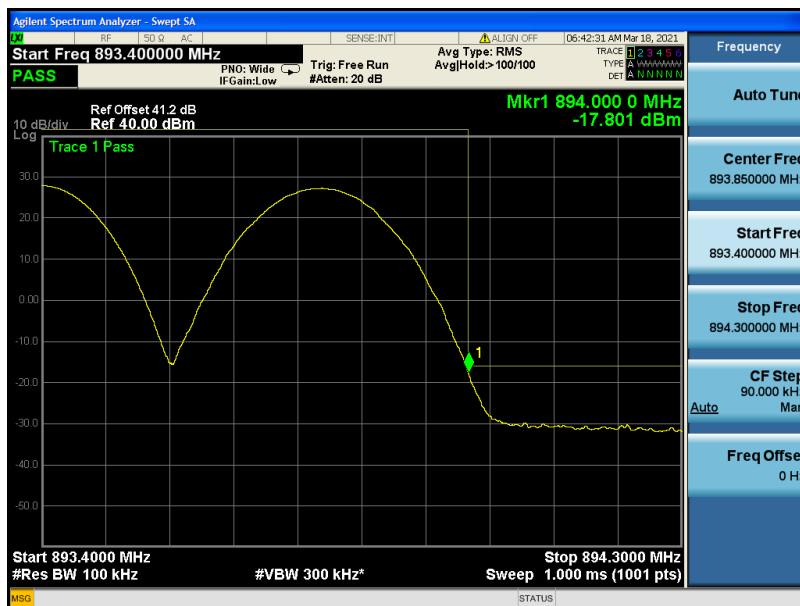
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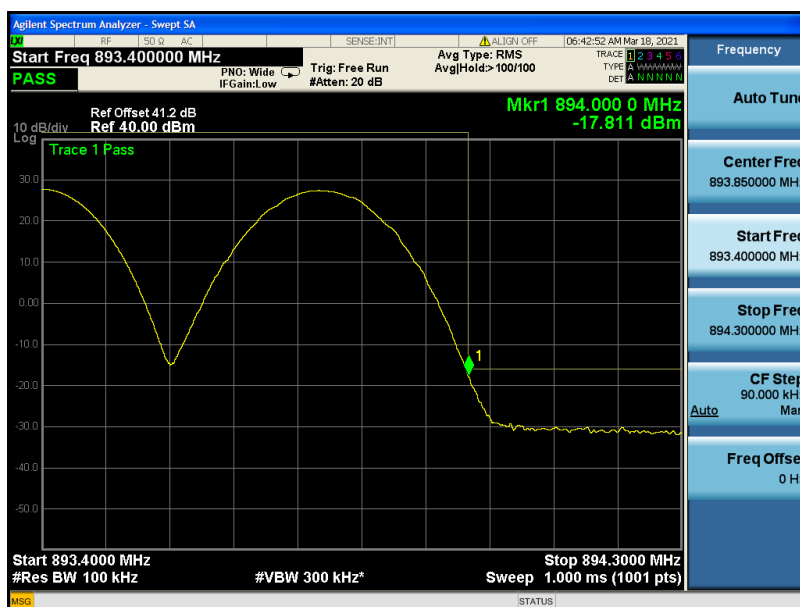
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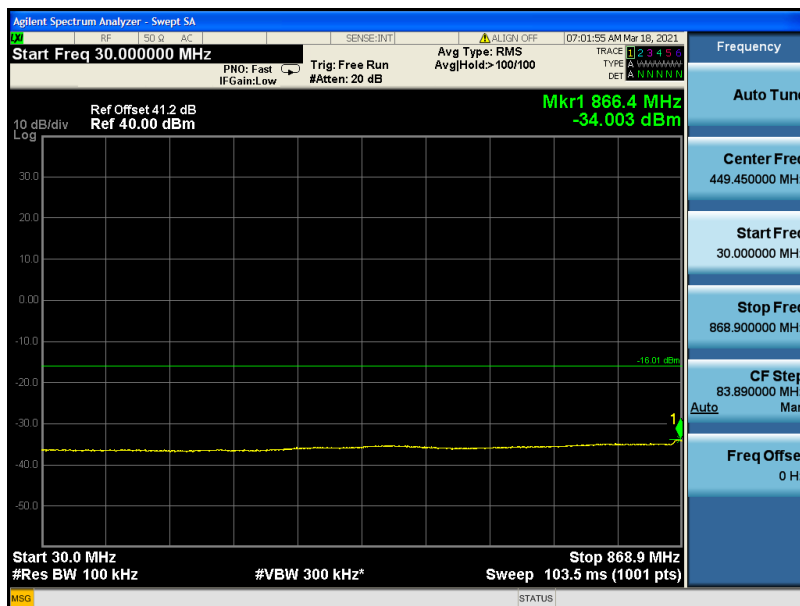
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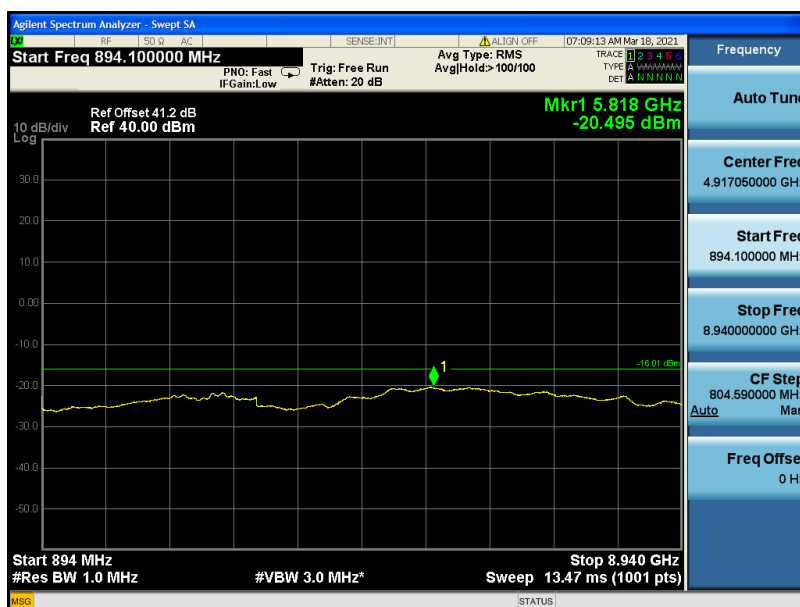
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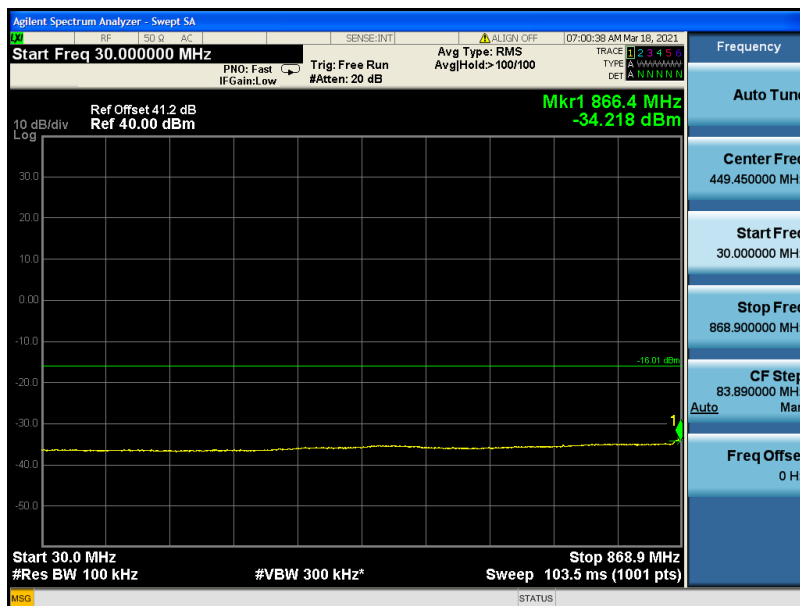
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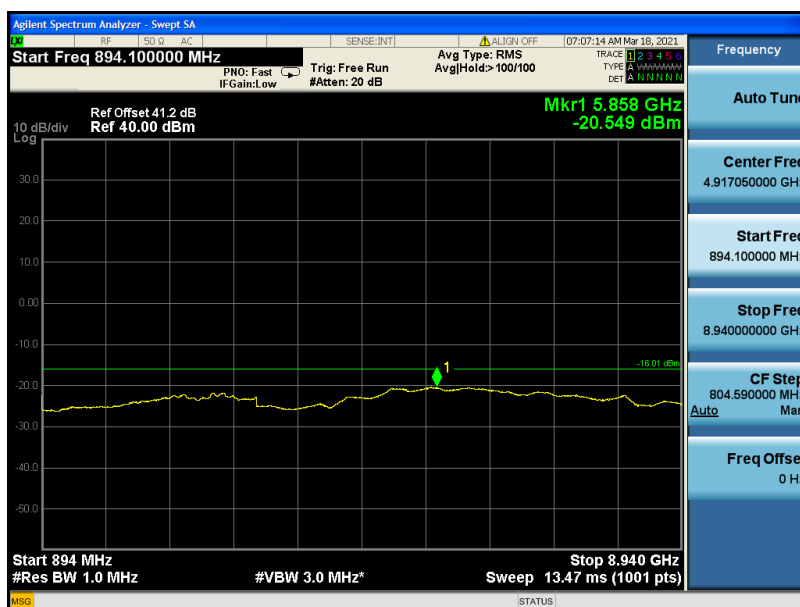
DL_1S_B_AWGN_Pre-AGC_Spurious emission 2



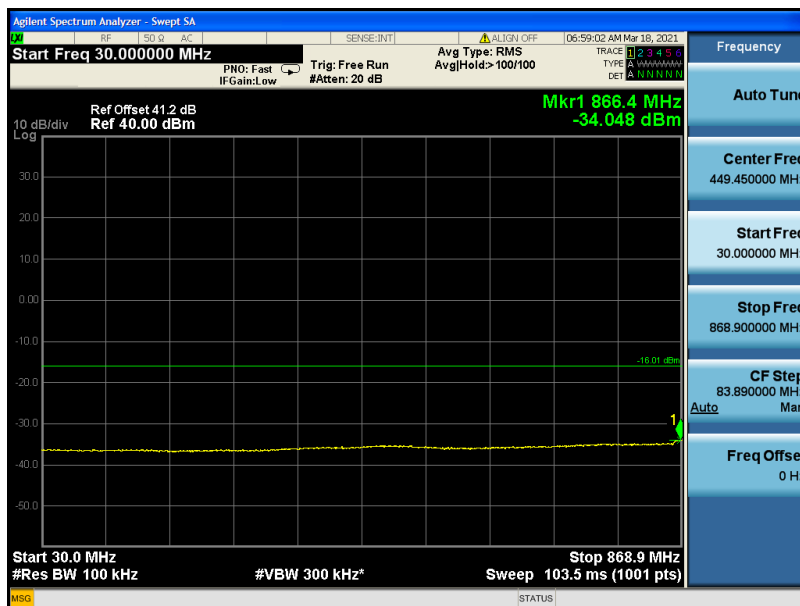
DL_1S_M_AWGN_Pre-AGC_Spurious emission 1



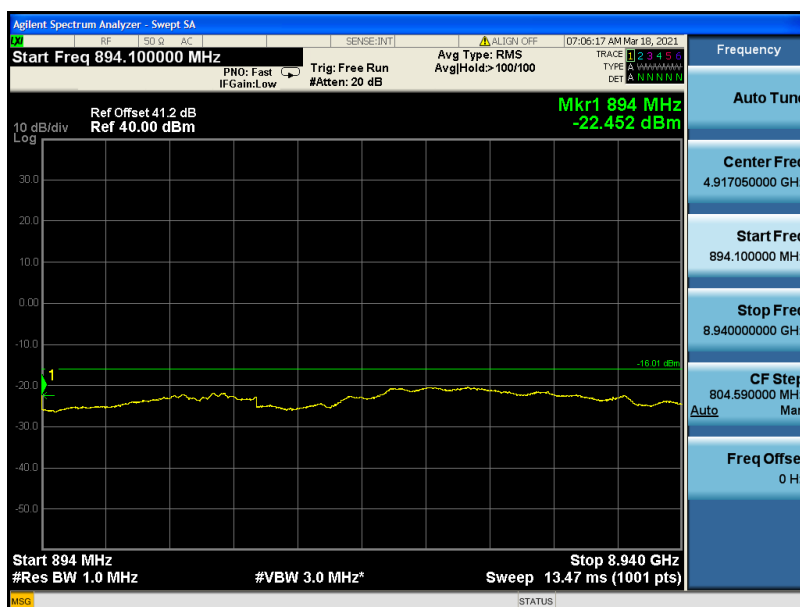
DL_1S_M_AWGN_Pre-AGC_Spurious emission 2



DL_1S_T_AWGN_Pre-AGC_Spurious emission 1



DL_1S_T_AWGN_Pre-AGC_Spurious emission 2



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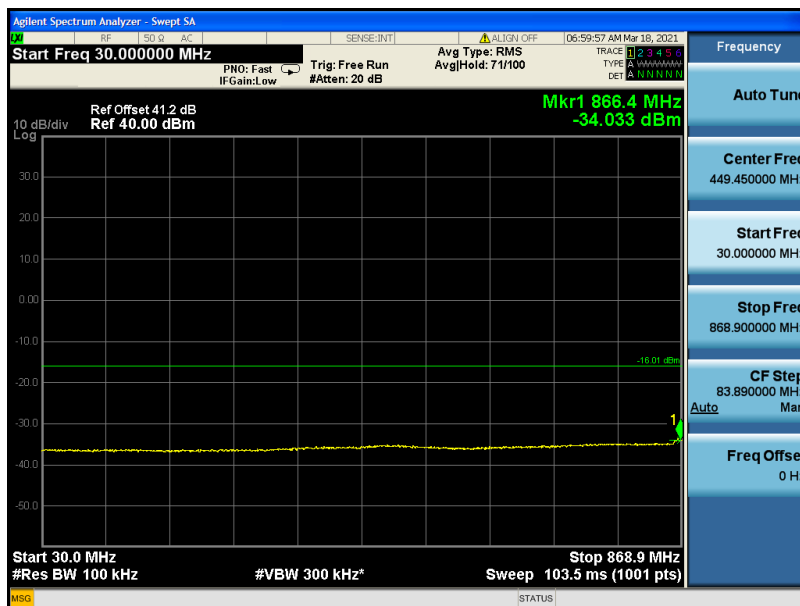
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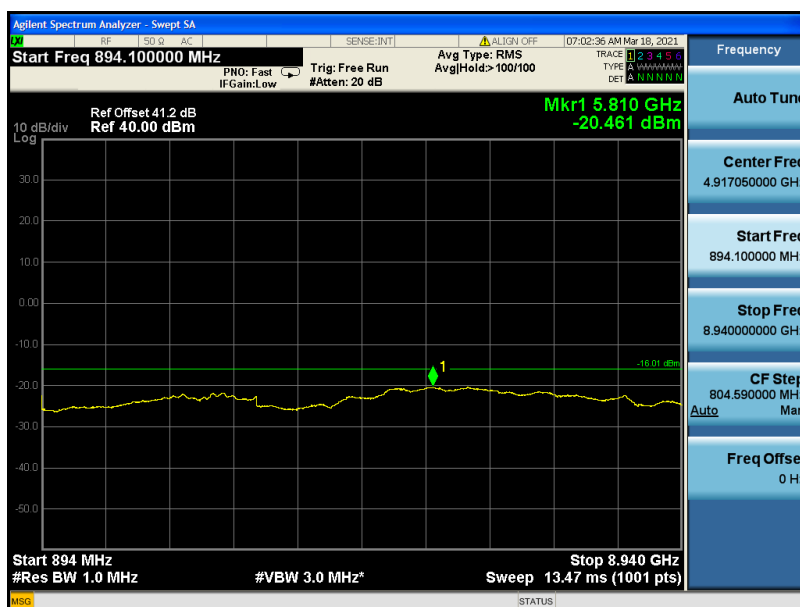
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DL_1S_B_GSM_Pre-AGC_Spurious emission 1



DL_1S_B_GSM_Pre-AGC_Spurious emission 2



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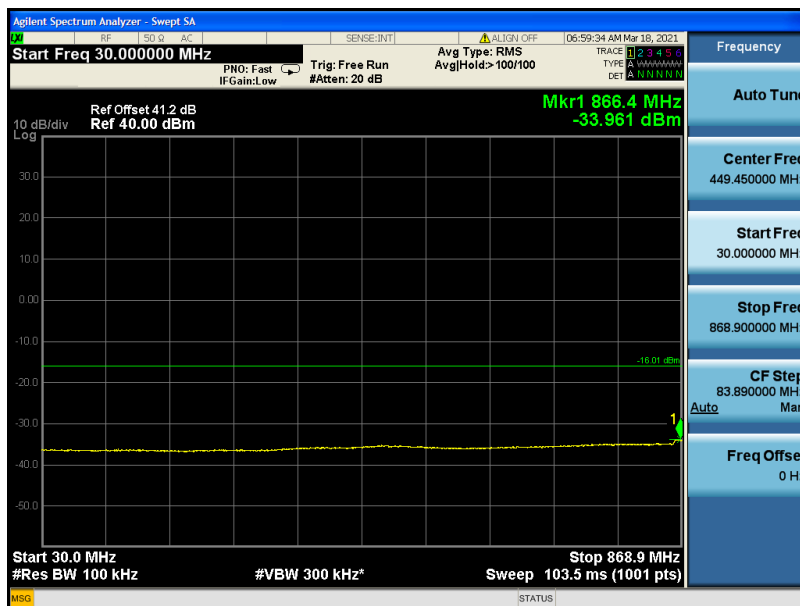
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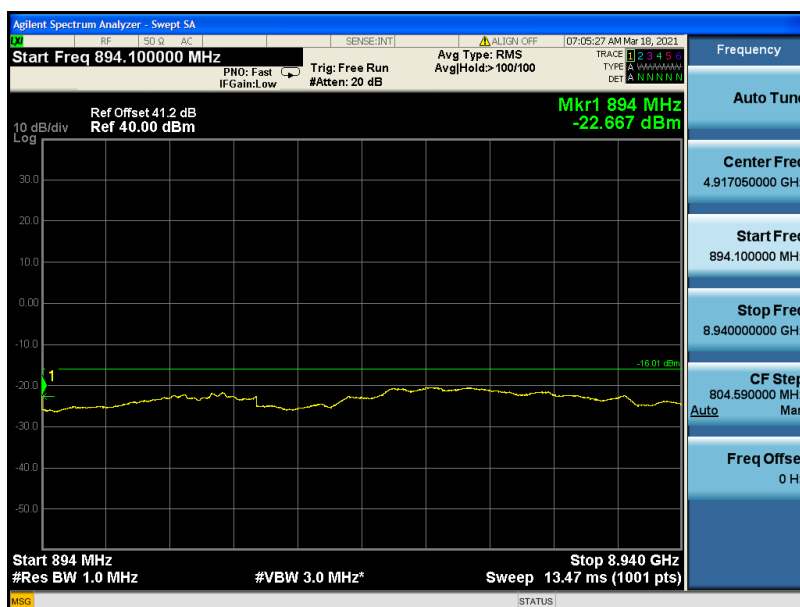
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DL_1S_M_GSM_Pre-AGC_Spurious emission 1



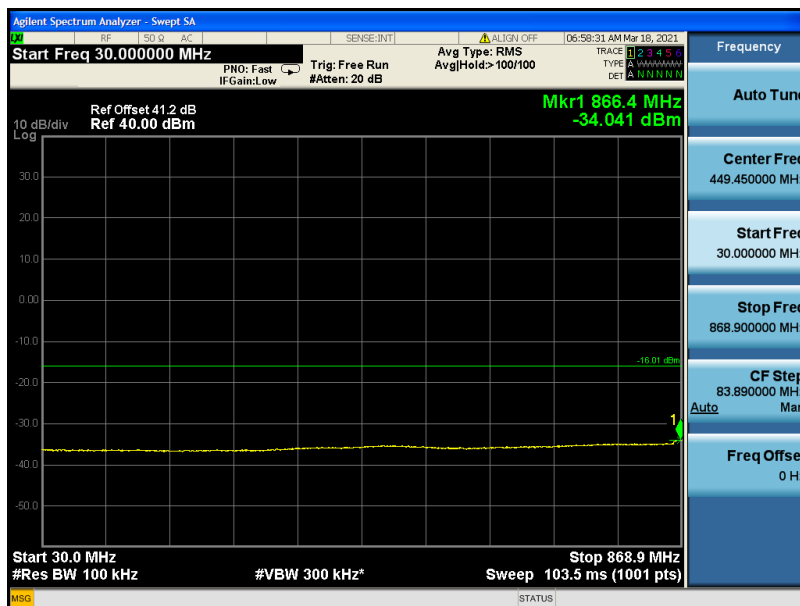
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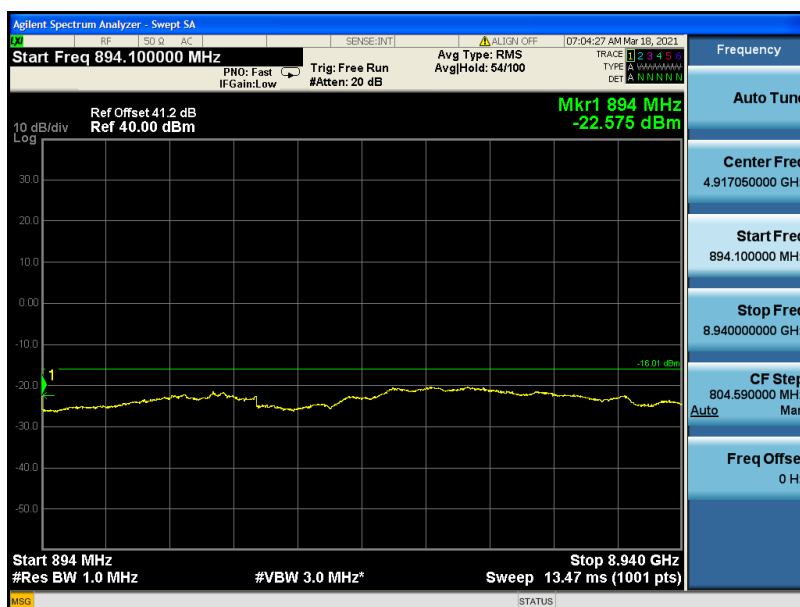
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DL_1S_T_GSM_Pre-AGC_Spurious emission 1



DL_1S_T_GSM_Pre-AGC_Spurious emission 2



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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 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.
 4. Frequency stability has been tested using an AWGN test signal and a GSM-TDMA test signal, only the worst-case was recorded in this report.

Frequency stability vs temperature				
Temperature (°C)	Test Conf.	Test data (MHz)	Tolerance (ppm)	Verdict
50	DL_1S_M_AWGN	881.500935	-1.31	PASS
40		881.501526	-0.64	PASS
30		881.502518	-0.48	PASS
20		881.502093	Reference	PASS
10		881.501283	-0.92	PASS
0		881.502612	0.59	PASS
-10		881.502003	-0.10	PASS
-20		881.501678	-0.47	PASS
-30		881.502341	0.28	PASS

Frequency stability vs voltage				
Voltage (V)	Test Conf.	Test data (MHz)	Tolerance (ppm)	Verdict
AC 93.5	DL_1S_M_AWGN	881.501872	-0.25	PASS
AC 110		881.502093	Reference	PASS
AC 126.5		881.501986	-0.12	PASS



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2.6 Radiated spurious emissions

Note: 1. The tested max conducted power for single antenna port is 42.94dBm, the 2x2 MIMO total power is 42.94dBm+42.94dBm=39.4W, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB

Here,

$P = 39.4W$.

So the limit =

$P(dBm) - [43 + 10 \log(39.4W)] = -13dBm$

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.

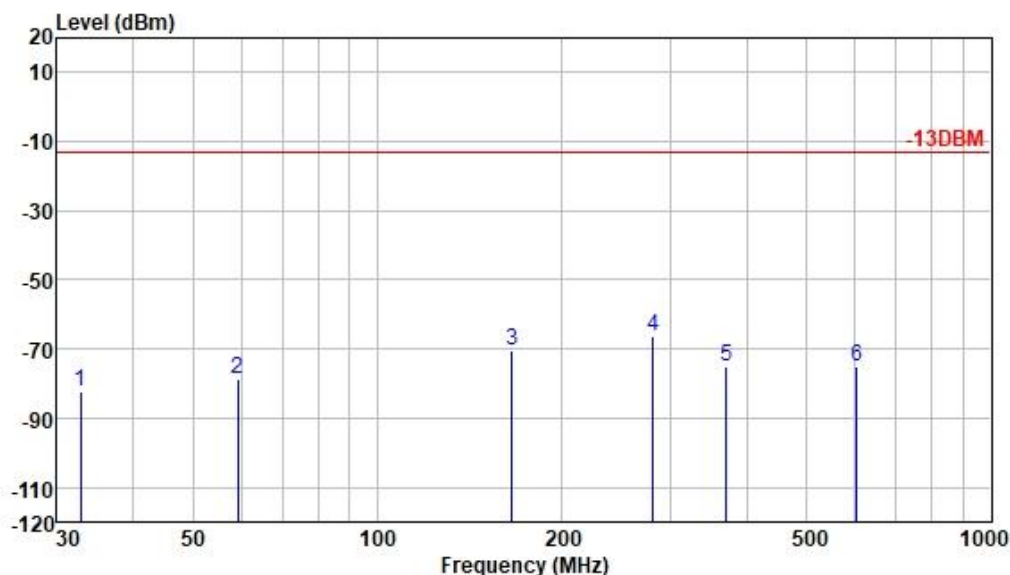
3. The disturbance from 9kHz to 30MHz was very low and 20dB below the limit, therefore, the data was not recorded in the report.



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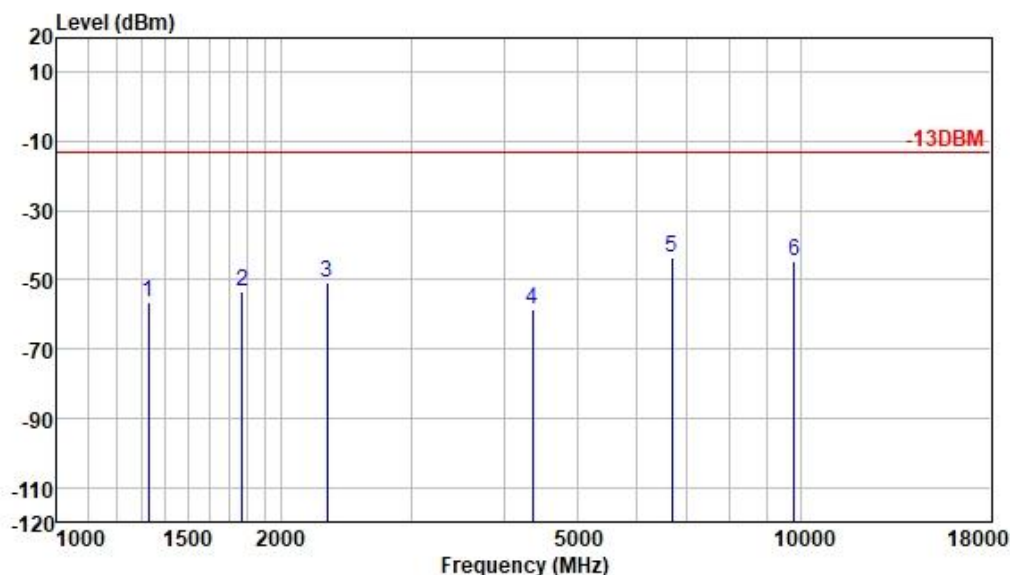
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DL_1S_M_AWGN_Horizontal_30MHz~1GHz



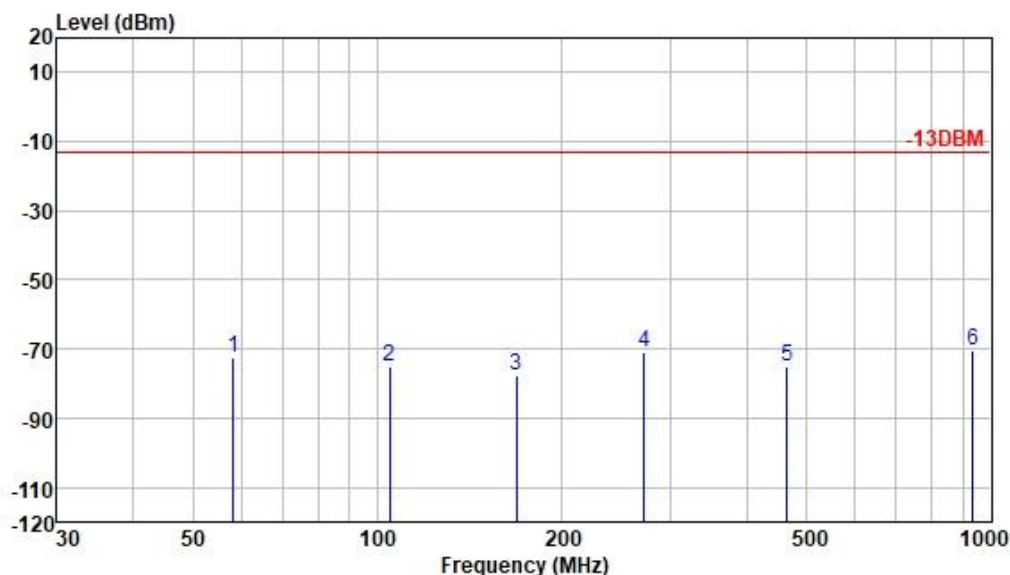
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	32.75	-85.47	3.13	-82.34	-12.99	-69.35	HORIZONTAL
2	59.23	-76.43	-2.46	-78.89	-12.99	-65.90	HORIZONTAL
3	165.49	-64.07	-6.29	-70.36	-12.99	-57.37	HORIZONTAL
4	281.01	-64.03	-2.44	-66.47	-12.99	-53.48	HORIZONTAL
5	370.70	-73.79	-1.25	-75.04	-12.99	-62.05	HORIZONTAL
6	603.54	-78.42	3.11	-75.31	-12.99	-62.32	HORIZONTAL

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	1327.45	-60.31	4.06	-56.25	-12.99	-43.26	HORIZONTAL
2	1772.33	-59.36	5.83	-53.53	-12.99	-40.54	HORIZONTAL
3	2305.55	-60.33	9.59	-50.74	-12.99	-37.75	HORIZONTAL
4	4354.45	-63.13	4.40	-58.73	-12.99	-45.74	HORIZONTAL
5	6698.37	-63.99	20.28	-43.71	-12.99	-30.72	HORIZONTAL
6	9781.60	-63.30	18.61	-44.69	-12.99	-31.70	HORIZONTAL

DL_1S_M_AWGN_Vertical_30MHz~1GHz



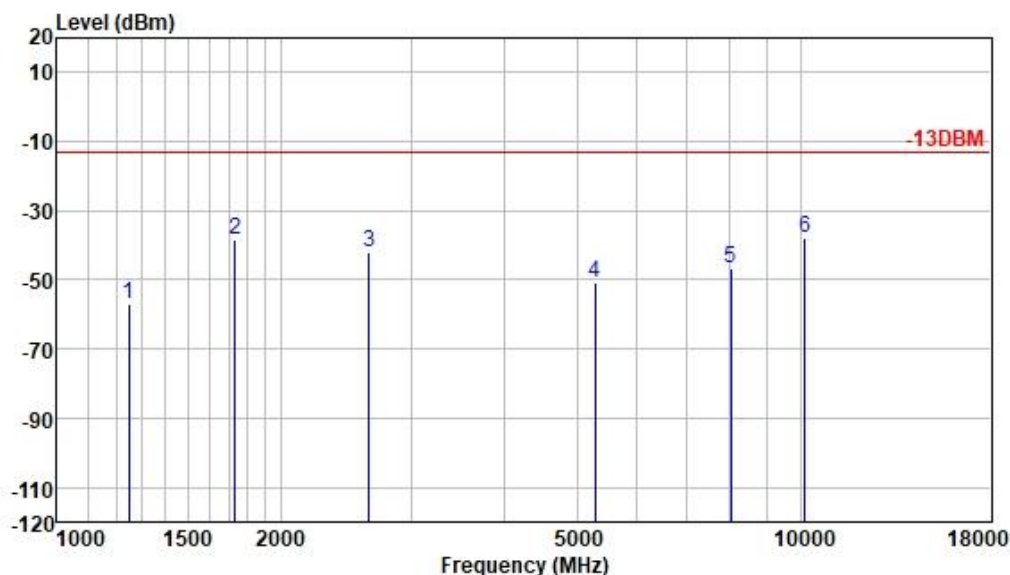
	Freq	Read Level	Correction Factor	Level	Limit Line	Over Limit	Pol/Phase
	MHz	dBm	dB	dBm	dBm	dB	
1	58.20	-69.76	-2.63	-72.39	-12.99	-59.40	VERTICAL
2	104.54	-69.88	-4.93	-74.81	-12.99	-61.82	VERTICAL
3	168.41	-73.46	-3.94	-77.40	-12.99	-64.41	VERTICAL
4	272.28	-67.71	-3.20	-70.91	-12.99	-57.92	VERTICAL
5	465.60	-76.57	1.75	-74.82	-12.99	-61.83	VERTICAL
6	932.27	-79.55	8.90	-70.65	-12.99	-57.66	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	1249.27	-60.97	3.92	-57.05	-12.99	-44.06	VERTICAL
2	1736.83	-44.25	5.68	-38.57	-12.99	-25.58	VERTICAL
3	2625.80	-47.69	5.57	-42.12	-12.99	-29.13	VERTICAL
4	5284.90	-62.94	11.95	-50.99	-12.99	-38.00	VERTICAL
5	8036.21	-62.78	16.06	-46.72	-12.99	-33.73	VERTICAL
6	10126.82	-58.88	21.01	-37.87	-12.99	-24.88	VERTICAL

--End of Appendix--



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