

SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch Page: 1 of 35 FCC ID: OJFDMRUG21719

Appendix -

Test Data and Result for report GZCR230600056802 (B)

(For DL 1995-2020MHz)

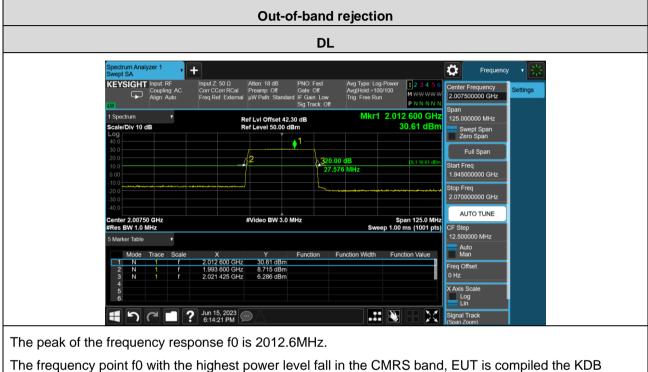


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1 Out-of-band rejection



935210 D05 Signal Booster Measurements v01r04 Out-of-band rejection verification test requirement.



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2 Input versus Output comparison

Occupied Bandwidth								
Test Path	Test Signal Test Channel Signal Level		Signal Test Channel Signal Level Ve					
	4.1MHz AWGN 100MHz AWGN	МСН	Pre-AGC	PASS				
		WOIT	3dB above AGC	PASS				
5		MCH	Pre-AGC	PASS*				
DL			3dB above AGC	PASS*				
	0014	МСН	Pre-AGC	PASS				
	GSM	MOIT	3dB above AGC	PASS				

Remark:

1. * The EUT supports maximum single channel BW is 20MHz for NR when operation in this band, so the output signal OBW was less than the input when 100MHz AWGN was as stimulus 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.

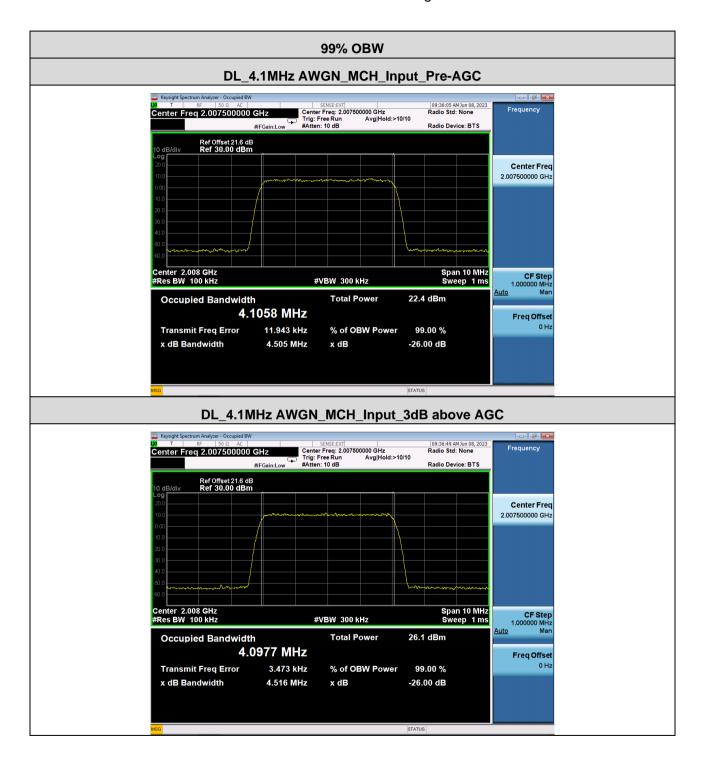


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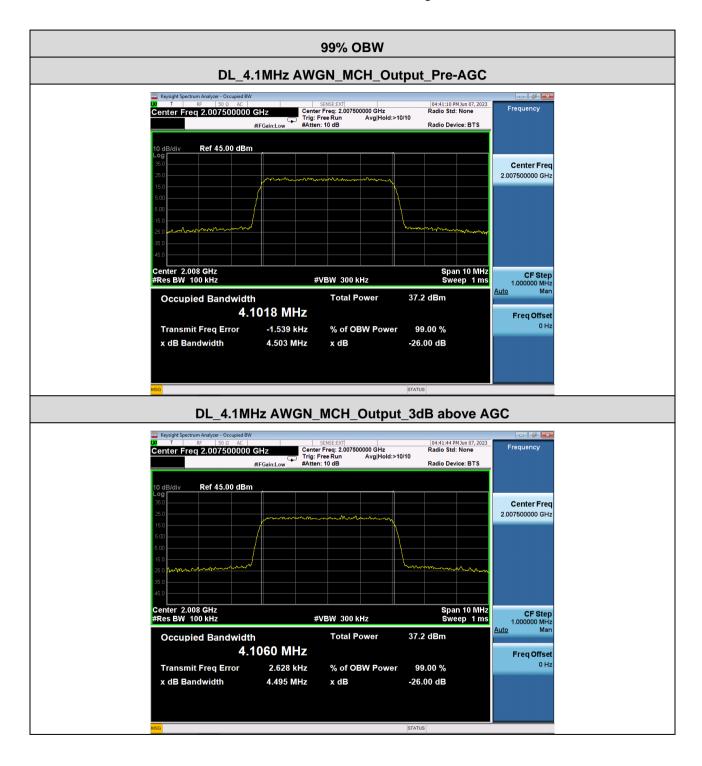
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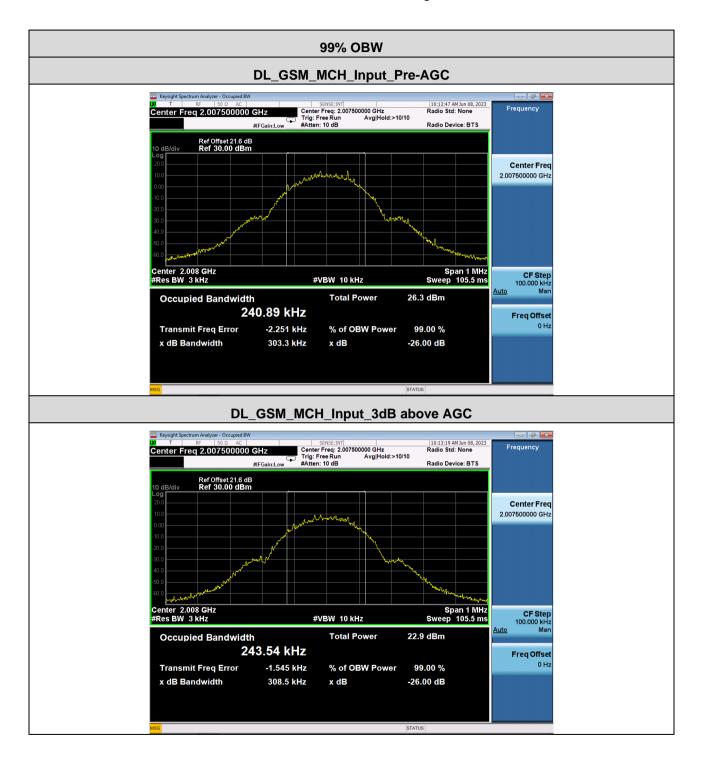


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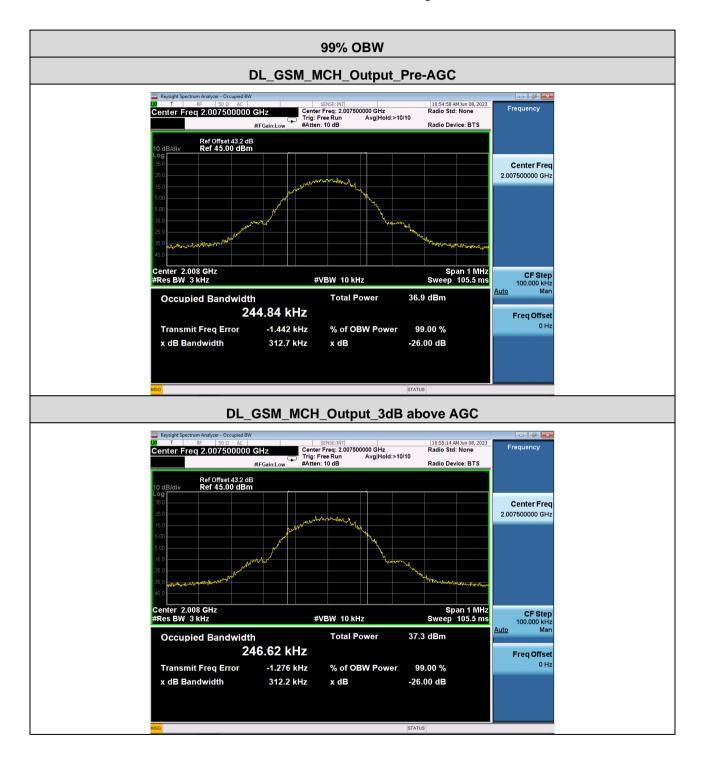


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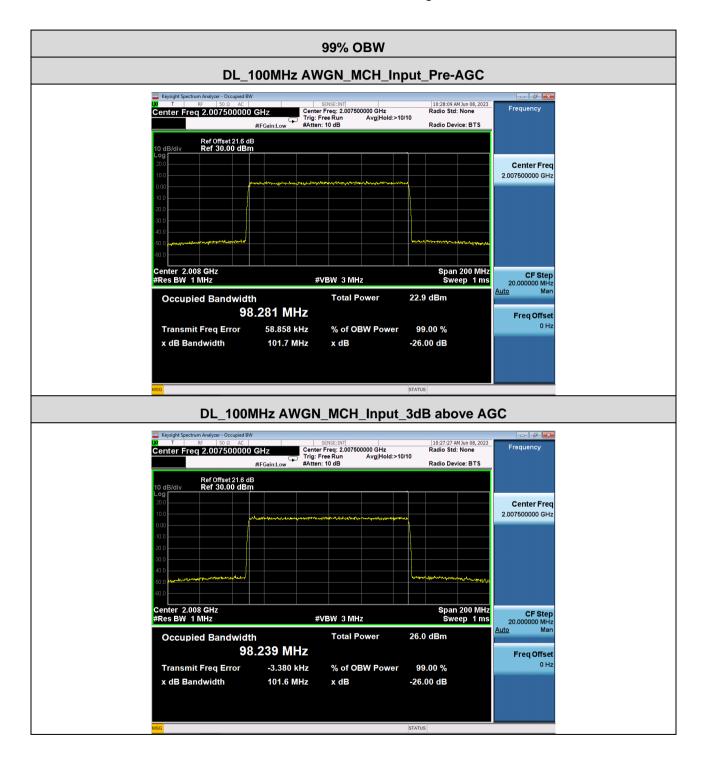


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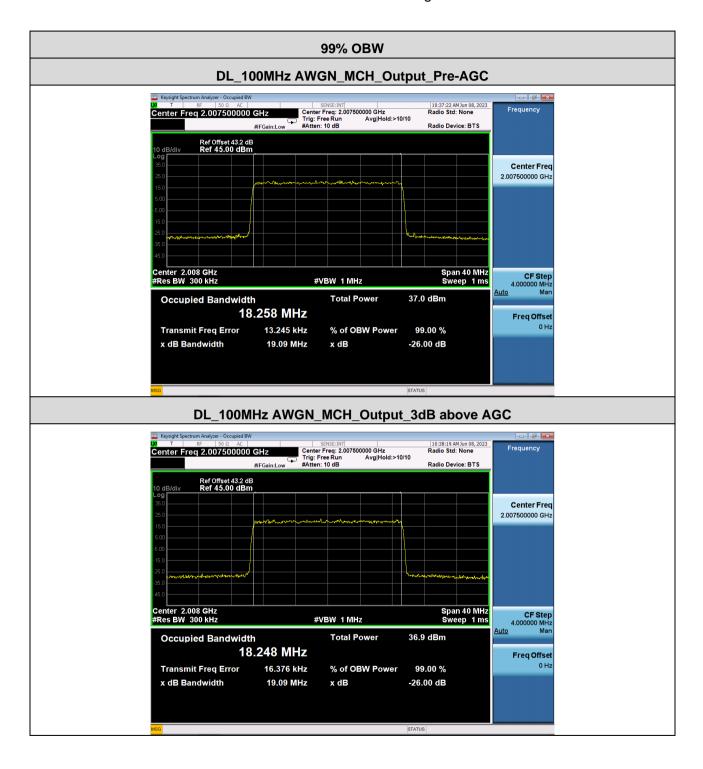


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	Mean output power and gain											
Test Path	Test Freq. f0 (MHz)	Test Signal	Signal Level	Input power (dBm)	Output Power (dBm)	SISO EIRP (W)	Total EIRP (W)	Gain (dB)				
		4.1MHz AWGN 100MHz AWGN	Pre-AGC	23.00	37.44	55.47	221.83	14.44				
			3dB above AGC	26.00	37.38	54.71	218.78	/				
			Pre-AGC	22.00	36.35	43.16	172.59	14.35				
DL	2012.6		3dB above AGC	25.00	36.30	42.66	170.61	/				
		GSM	Pre-AGC	23.00	37.75	59.57	238.24	14.75				
			3dB above AGC	26.00	37.70	58.89	235.51	/				

3 Mean output power and amplifier/booster gain



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	Mean output power											
Test Path	Test Freq. f0 (MHz)	Test Signal	Signal Level	Output Power (dBm/MHz)	SISO EIRP (W/MHz)	Total EIRP (W/MHz)	Verdict					
		4.1MHz AWGN 2012.6 100MHz AWGN	Pre-AGC	31.03	12.68	50.70	PASS					
			3dB above AGC	31.11	12.92	51.65	PASS					
			Pre-AGC	24.37	2.74	10.95	PASS					
DL	2012.6		3dB above AGC	24.85	3.06	12.22	PASS					
		GSM	Pre-AGC	37.75	59.57	238.24	PASS					
			3dB above AGC	37.70	58.89	235.51	PASS					

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Remark:

1. f0 is from Out-of-band Rejection test in the report. EIRP= output power (dBm)+ antenna gain (dBi), the antenna gain is 10dBi declared by the manufacturer, the directional gain = G_{ANT} + 10 log (N_{ANT}) dBi = 13dBi. 2. The output power is limited to an EIRP of 1640W/MHz

2. The output power is limited to an EIRP of 1640W/MHz.

3. FCC part 27.50 d(7) require the Fixed, mobile, and portable (hand-held) stations operating in the 2000–2020 MHz band are limited to 2 watts EIRP, however, 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, therefore, the EIRP limit for fixed stations operating in the 2000–2020MHz band are 1640 W/MHz.

47. *Downlink Operations in 2000-2020 MHz*. If DISH does elect to use 2000-2020 MHz for downlink operations, in place of the rules waived above, the following requirements (based on our technical analysis detailed above), shall apply:¹⁴⁴

Technical Issue	Requirement
Power Limits	 (1) The EIRP limits for rural and non-rural areas set forth in rule sections 27.50(d)(1)-(2); and (2) Coordination with 1995-2000 MHz licensees in the same manner that rule section 27.50(d)(10) requires 1995-2000 MHz licensees to coordinate with 1990-1995 MHz licensees.
OOBE Limits	The OOBE limit set forth in rule section $27.53(h)(1)$, with the measurement procedure set forth in rule $27.53(h)(3)$.

4. The conducted test performed at ANT 1 port only due to the two MIMO ports with identical design(Hardware & software) and radio output.



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Test path	Test freq. f0 (MHz)	Test Signal	Signal level	PAR (dB)	Limit (dB)	Verdict
DL 20		4.1MHz AWGN 12.6 100MHz AWGN	Pre-AGC	8.42		PASS
	0040.0		3dB above AGC	8.29		PASS
	2012.6		Pre-AGC	8.40	≤13	PASS
			3dB above AGC	8.26		PASS

only the test plots for 4.1MHz and 100MHz AWGN (pre-AGC) were record in the report for demonstrate PAR compliance.

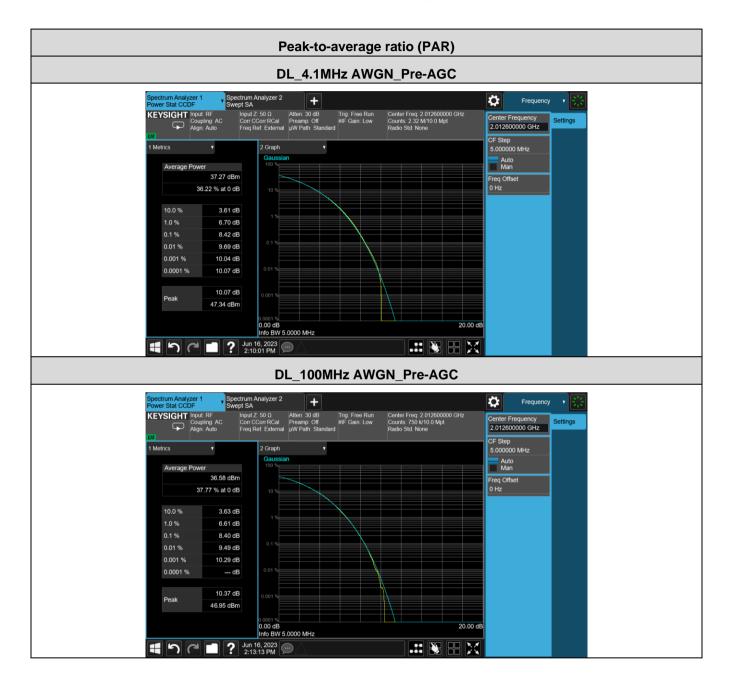


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4 Out-of-band/out-of-block(including intermodulation) emissions

	Out-of-band/out-of-block(including intermodulation) emissions															
Test Path	Test Channel	Test Signal	Stimulus Condition	Signal Level	Worst conducted test level (dBm)	Limit (dBm)	Verdict									
			One signal	Pre-AGC	-25.28		PASS									
	LCH		input	3dB above AGC	-24.52		PASS									
	LCH		Two signals	Pre-AGC	-24.55		PASS									
		4.1MHz	input	3dB above AGC	-24.52	< 10	PASS									
DL		AWGN		Pre-AGC	-26.79	≤-16	PASS									
				3dB above AGC	-26.90		PASS									
	HCH		Two signals input	Pre-AGC	-28.21		PASS									
				3dB above AGC	-27.35		PASS									
			One signal	Pre-AGC	-20.99		PASS									
	LCH		input	3dB above AGC	-19.89		PASS									
	LCH												Two signals	Pre-AGC	-20.16	
		100MHz	input	3dB above AGC	-21.34	≤-16	PASS									
DL		AWGN	One signal	Pre-AGC	-22.03		PASS									
			input	3dB above AGC	-21.64		PASS									
	HCH		Two signals	Pre-AGC	-26.32		PASS									
			input	3dB above AGC	-24.90		PASS									



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Out-of-band/out-of-block(including intermodulation) emissions									
Test Path	Test Channel	Test Signal	Stimulus Condition	Signal Level	Worst conducted test level (dBm)	Limit (dBm)	Verdict		
			One signal	Pre-AGC	-19.96		PASS		
	LCH	GSM	input	3dB above AGC	-19.33	 ≤-16	PASS		
			Two signals input	Pre-AGC	-21.48		PASS		
Downlink				3dB above AGC	-21.03		PASS		
DOWNIINK	НСН		One signal input	Pre-AGC	-27.88		PASS		
				3dB above AGC	-27.07		PASS		
			Two signals input	Pre-AGC	-21.18		PASS		
				3dB above AGC	-20.29		PASS		

Remark:

1. 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 + 10log10 (P) dB, here,

P = 37 dBm = 5.02W

the limit = 37dBm - [43 + 10 log10 (5.02W)] dB = -13dBm

2. For 2x2 MIMO, only ANT1 port was measured, and the limit was showed -13dBm- 10lg(2)= -16dBm to determine the test result conveniently.

3. Based on discussion in docket No. DA 13-2409 (section 26 & 47) the Downlink operations in 2000-2020Mhz, the OOBE limit is set forth in rule section 27.53(h)(1) ,(h)(3) applied.

47. Downlink Operations in 2000-2020 MHz. If DISH does elect to use 2000-2020 MHz for downlink operations, in place of the rules waived above, the following requirements (based on our technical analysis detailed above), shall apply:¹⁴⁴

Technical Issue	Requirement					
Power Limits	 The EIRP limits for rural and non-rural areas set forth in rule sections 27.50(d)(1)-(2); and Coordination with 1995-2000 MHz licensees in the same manner that rule section 27.50(d)(10) requires 1995-2000 MHz licensees to coordinate with 1990-1995 MHz licensees. 					
OOBE Limits	The OOBE limit set forth in rule section 27.53(h)(1), with the measurement procedure set forth in rule 27.53(h)(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.

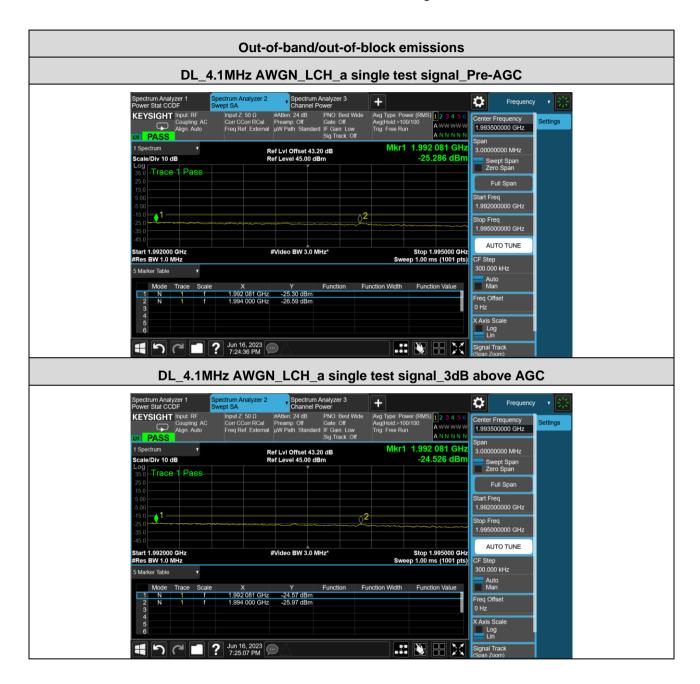


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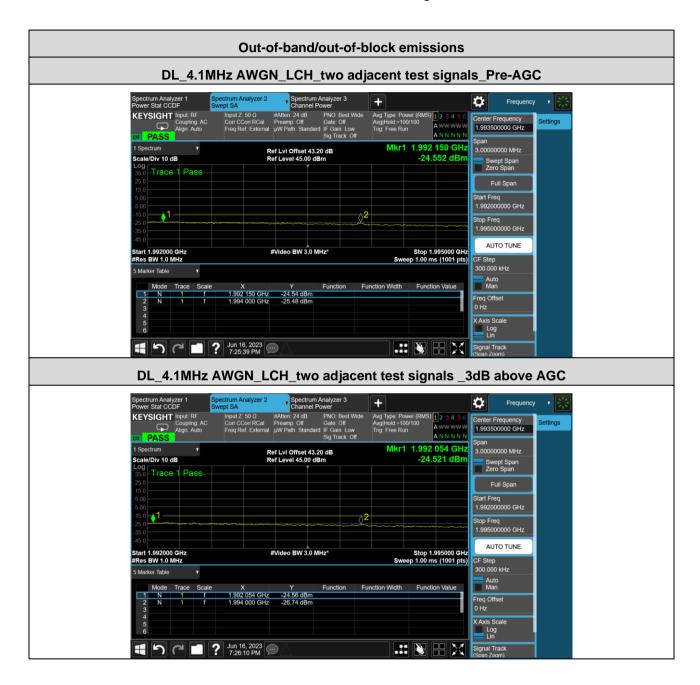


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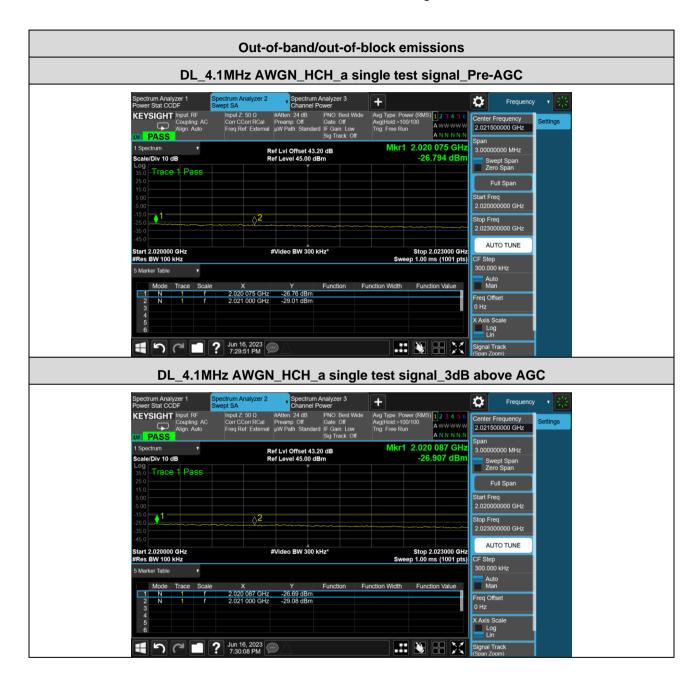


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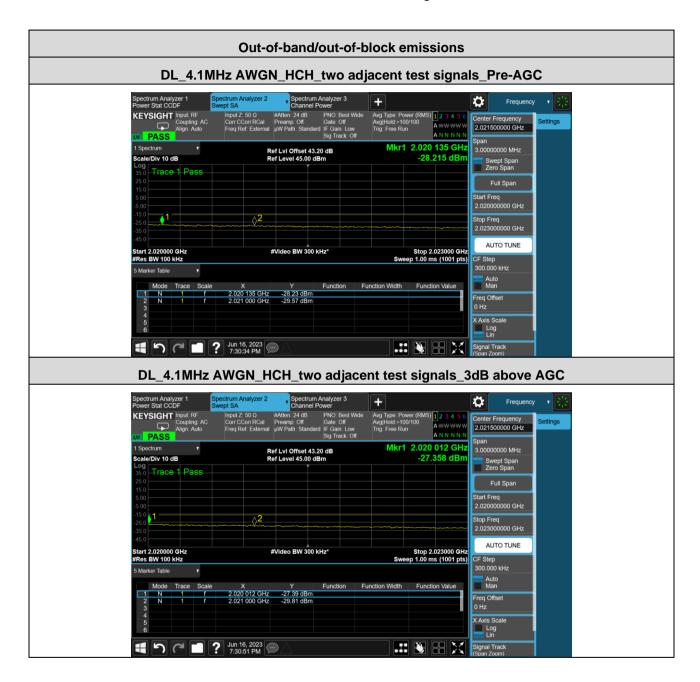


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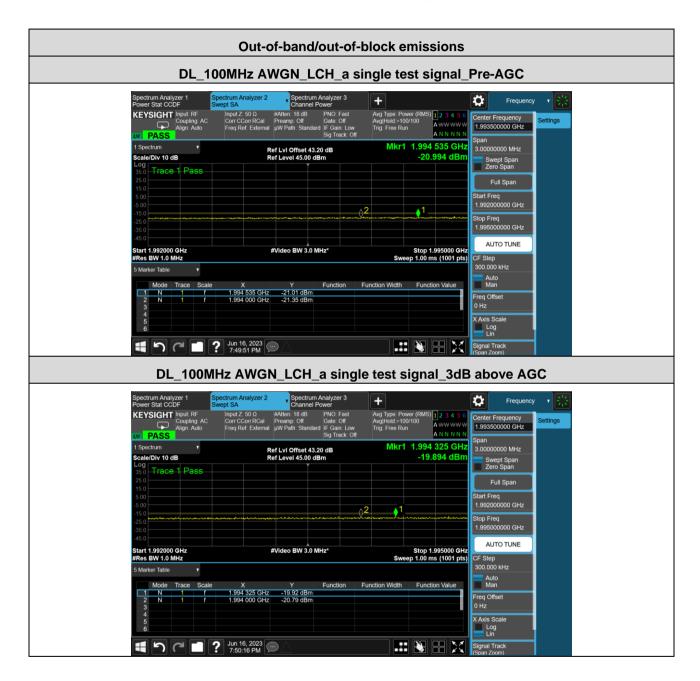


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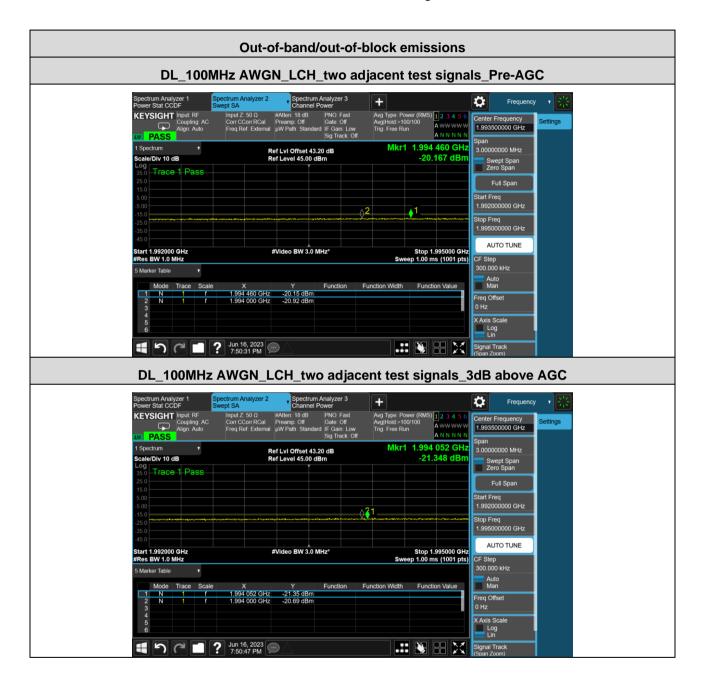


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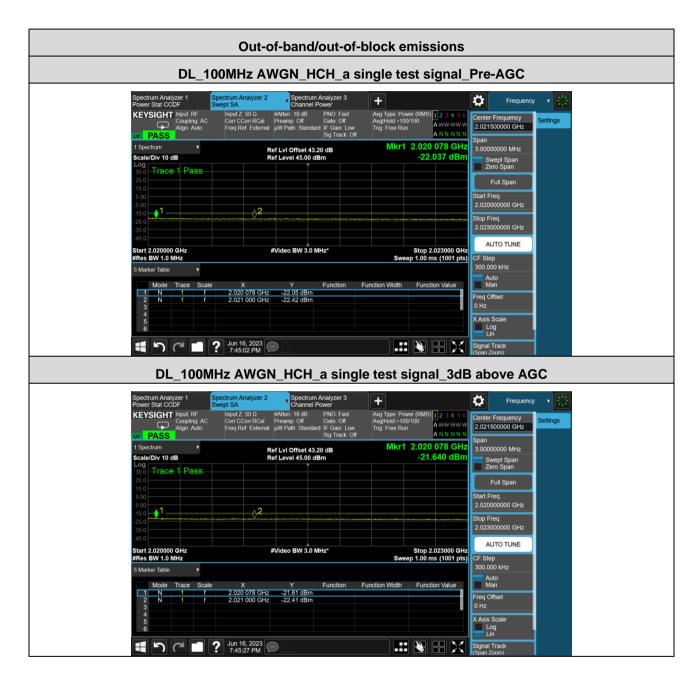


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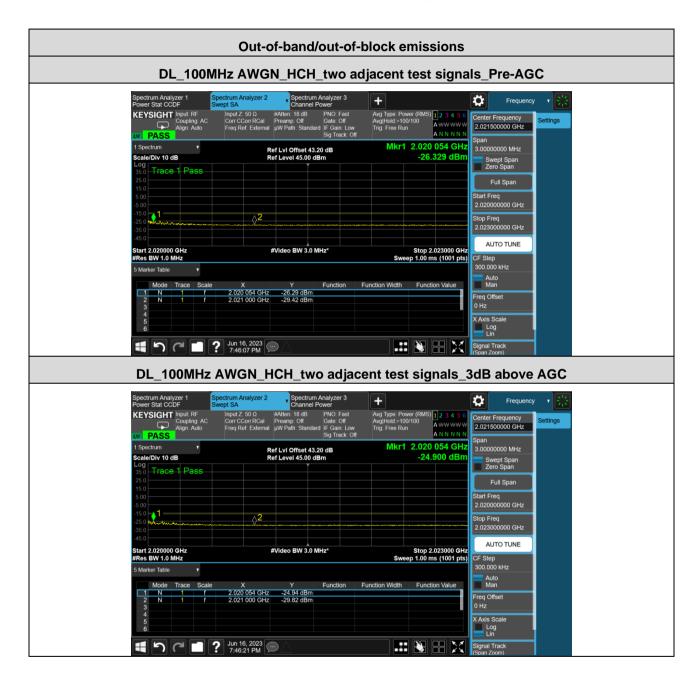


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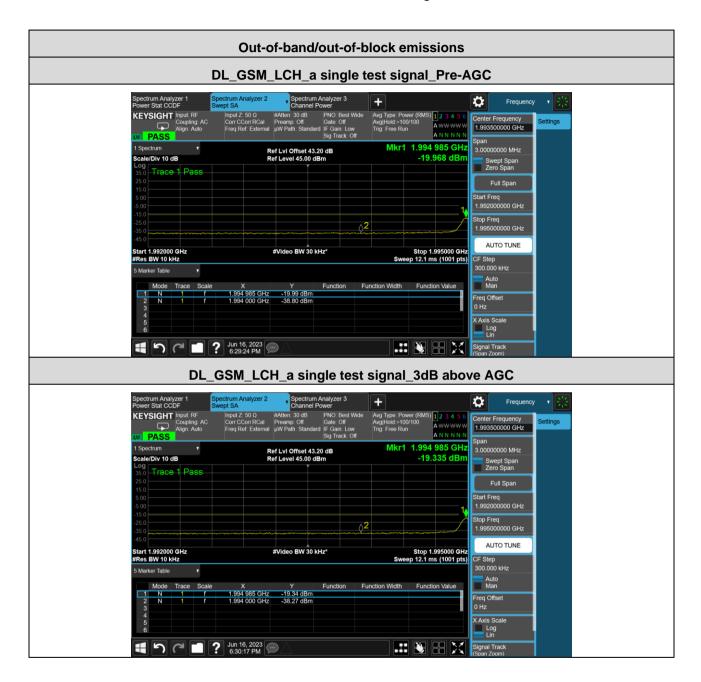


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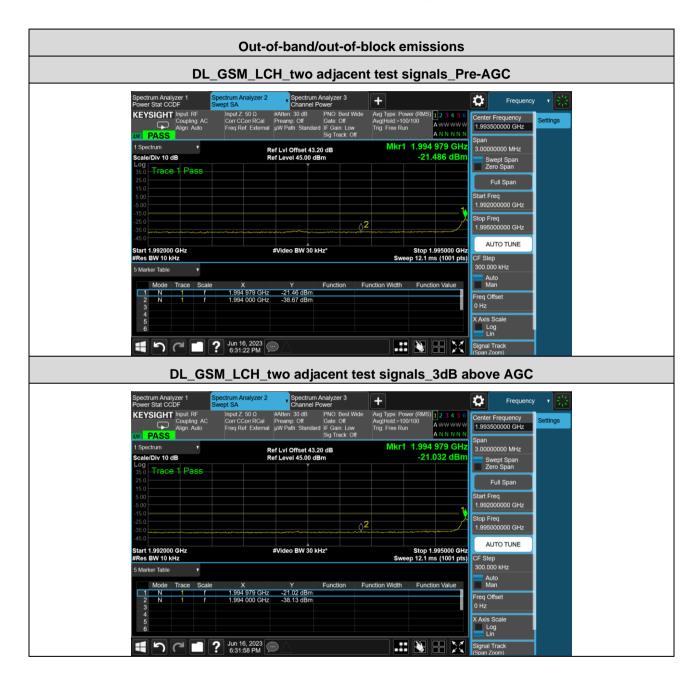


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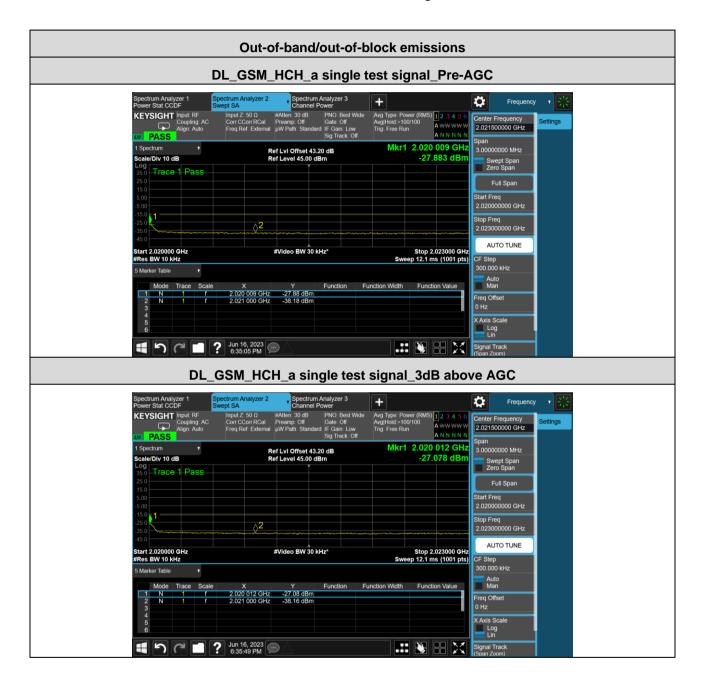


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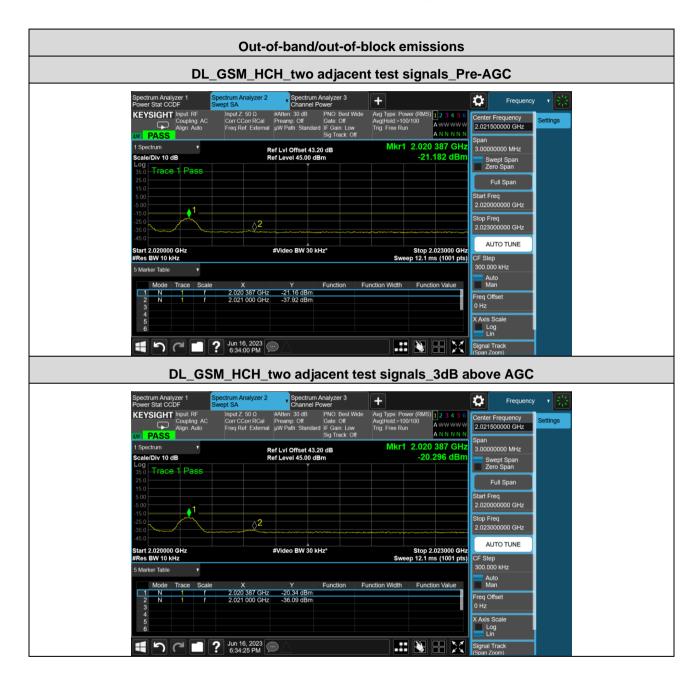


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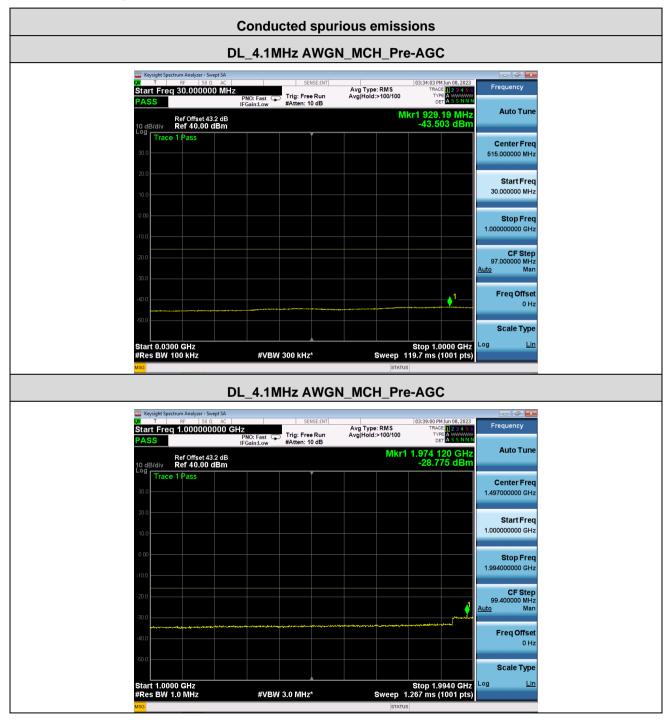
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5 Conducted Spurious emissions



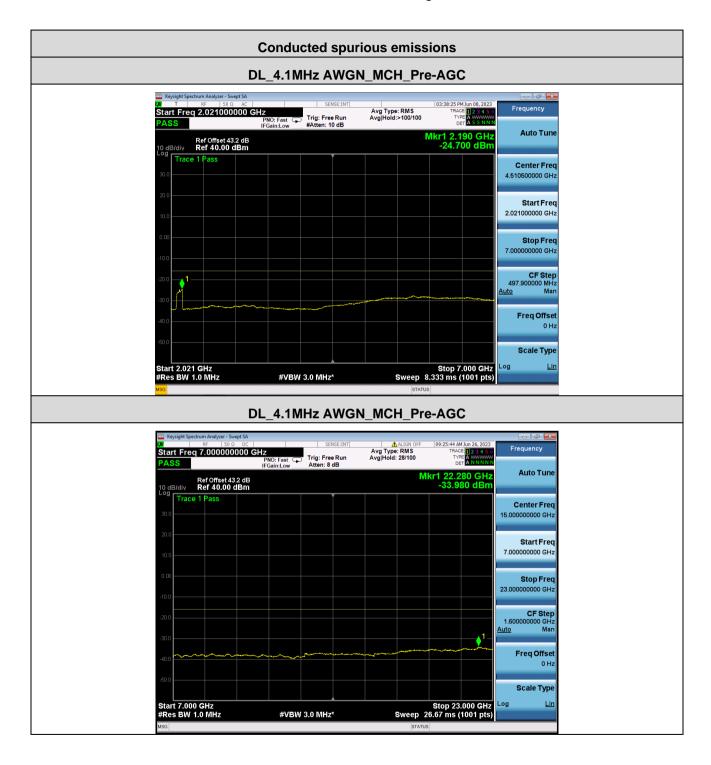
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Remark:

1. 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 + 10log10 (P) dB, here,

P = 37 dBm = 5.02W,

the limit = 37dBm - [43 + 10 log10 (5.02W)] dB = -13dBm

2. For 2×2 MIMO, ANT1 port was measured and the limit was showed -13dBm- 10lg(2)= -16dBm to determine the test result conveniently.

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

4. All modes (Low Channel/MCH/High Channel, with GSM signal/ with 4.1MHz AWGN signal/ with 100MHz AWGN signal) had been tested, only show the worst-case in this report.



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6 Frequency Stability

Frequency stability vs voltage									
Test path	Test Freq. (MHz)	Test Signal	Temperature	Voltage	Freq. error (Hz)	Tolerance (ppm)	Verdict		
	2007.5	4.1MHz AWGN 100MHz AWGN	TN	VL	14	0.0070	PASS		
			TN	VH	22	0.0110	PASS		
			TN	VL	15	0.0075	PASS		
DL			TN	VH	18	0.0090	PASS		
		GSM	TN	VL	23	0.0115	PASS		
			TN	VH	10	0.0050	PASS		



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			Frequency stal	bility vs tempera	ture		
Test Path	Test Freq. (MHz)	Test Signal	Voltage	Temperature (℃)	Freq. error (Hz)	Tolerance (ppm)	Verdict
			VN	+50	26	0.0130	PASS
			VN	+40	23	0.0115	PASS
			VN	+30	15	0.0075	PASS
			VN	+20	12	0.0060	PASS
	2007.5	5MHz AWGN	VN	+10	22	0.0110	PASS
			VN	0	28	0.0139	PASS
			VN	-10	19	0.0095	PASS
			VN	-20	15	0.0075	PASS
			VN	-30	13	0.0065	PASS
	2007.5	100MHz AWGN	VN	+50	22	0.0110	PASS
			VN	+40	24	0.0120	PASS
			VN	+30	17	0.0085	PASS
			VN	+20	19	0.0095	PASS
DL			VN	+10	14	0.0070	PASS
			VN	0	20	0.0100	PASS
			VN	-10	17	0.0085	PASS
			VN	-20	16	0.0080	PASS
			VN	-30	18	0.0090	PASS
			VN	+50	13	0.0065	PASS
			VN	+40	21	0.0105	PASS
			VN	+30	27	0.0134	PASS
			VN	+20	20	0.0100	PASS
	2007.5	GSM	VN	+10	16	0.0080	PASS
			VN	0	18	0.0090	PASS
			VN	-10	17	0.0085	PASS
			VN	-20	24	0.0120	PASS
			VN	-30	21	0.0105	PASS

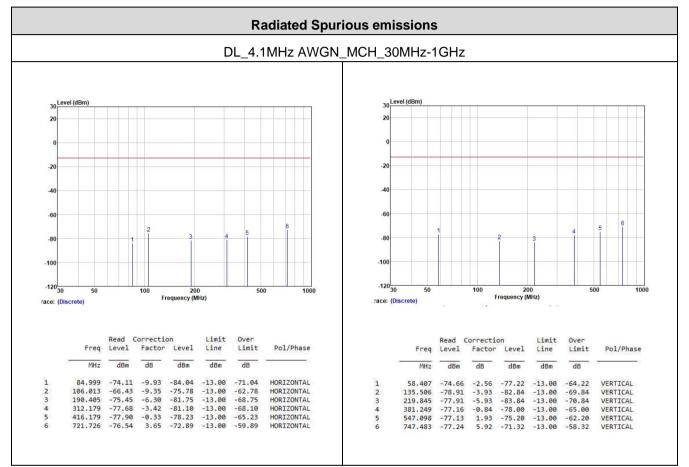


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7 Radiated Spurious emissions

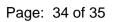


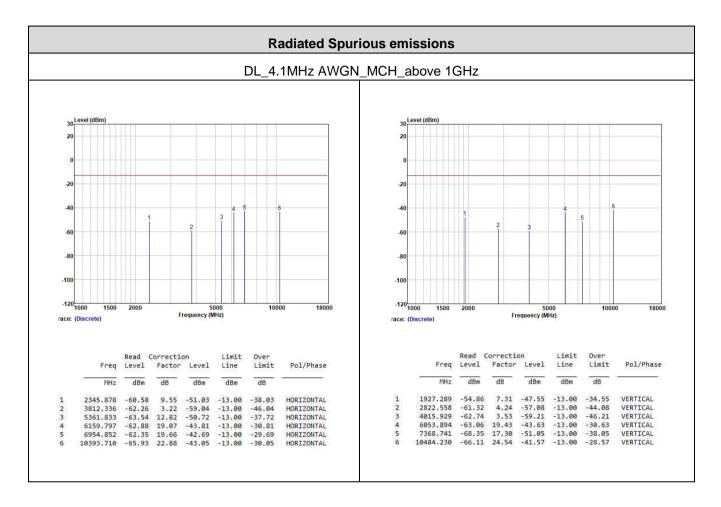
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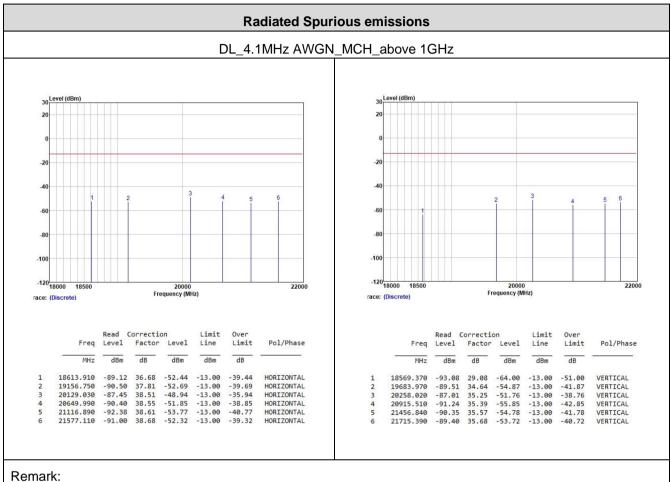


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Pre-test was performed for all modes (LCH/MCH/HCH, with GSM signal/ with 4.1MHz AWGN signals/ with 100MHz AWGN signals), the test result always keeps more than 20dB margin, The spurious emissions 9kHz to 30MHz were very low and not displayed in this report. Therefore, only show the worst-case data in this report.

--End of Appendix--



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