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FCC ID: 2BEYB-TP-WE-WRB2I

# Appendix -

# Test Data and Result for report GZCR231000104603

(For 817-824MHz/862-869MHz)



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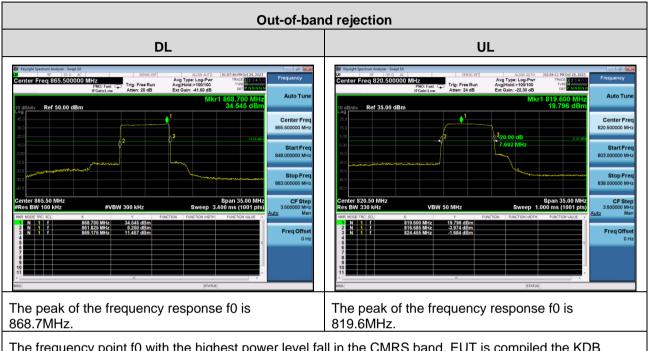
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### 1 Out-of-band rejection



The frequency point f0 with the highest power level fall in the CMRS band, EUT is compiled the KDB 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	Verdict				
	4.1MHz	MCH	Pre-AGC	PASS				
	AWGN	WOTT	3dB above AGC	PASS				
DL	GSM	MCH ·	Pre-AGC	PASS				
			3dB above AGC	PASS				
	4.1MHz AWGN	MCH	Pre-AGC	PASS				
UL			3dB above AGC	PASS				
		MCH	Pre-AGC	PASS				
	GSM	IVICIT	3dB above AGC	PASS				

### 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.



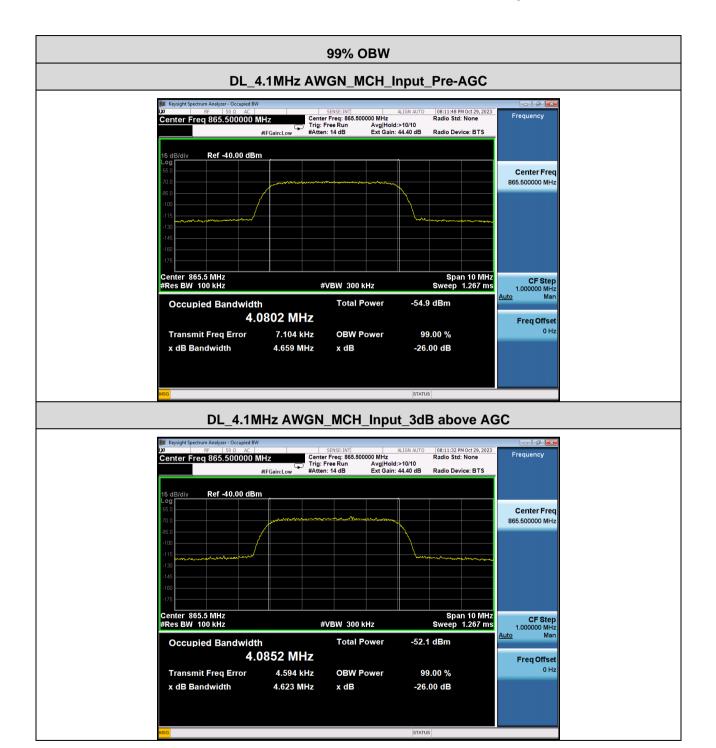
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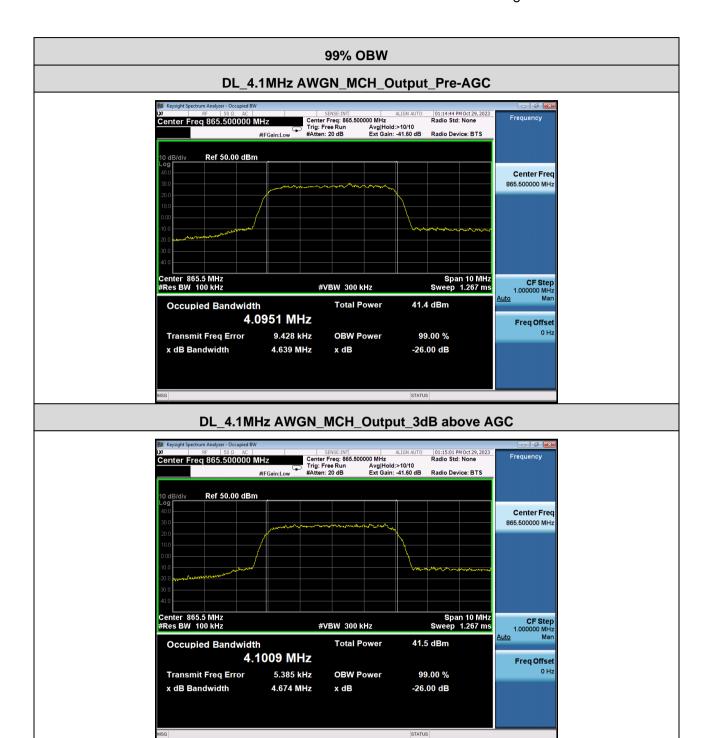
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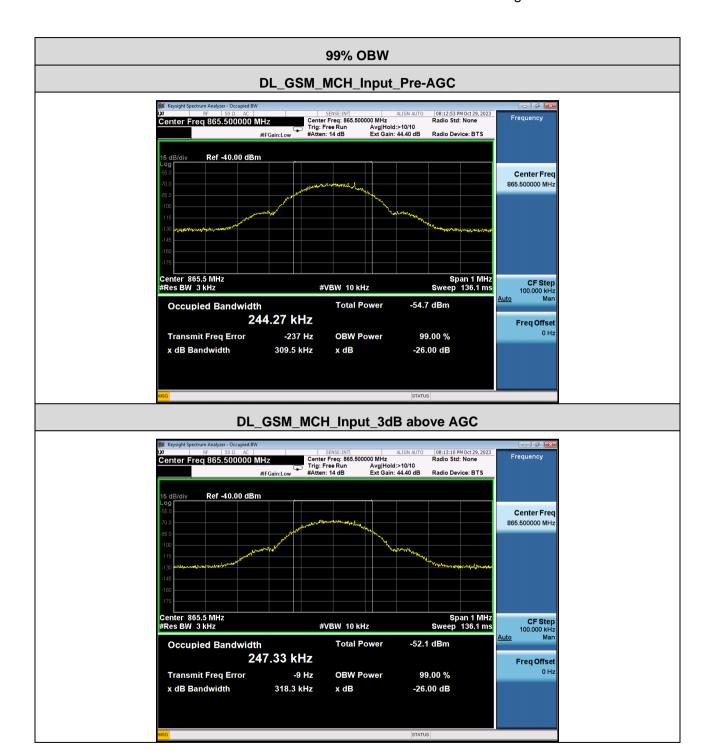
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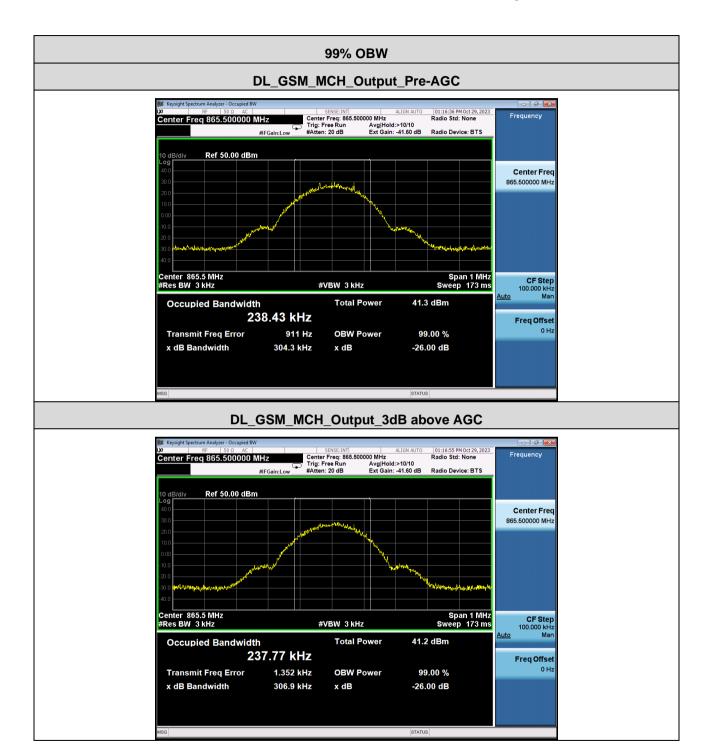
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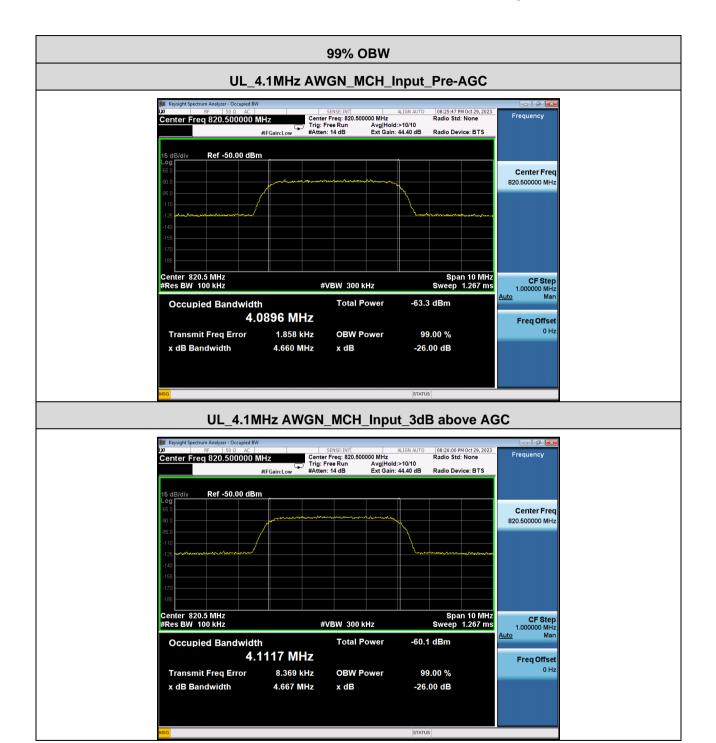
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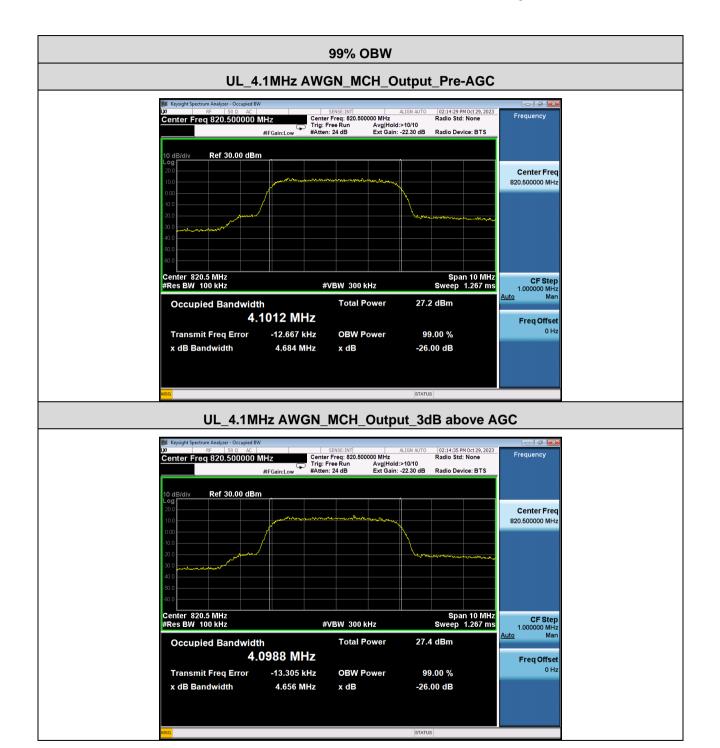
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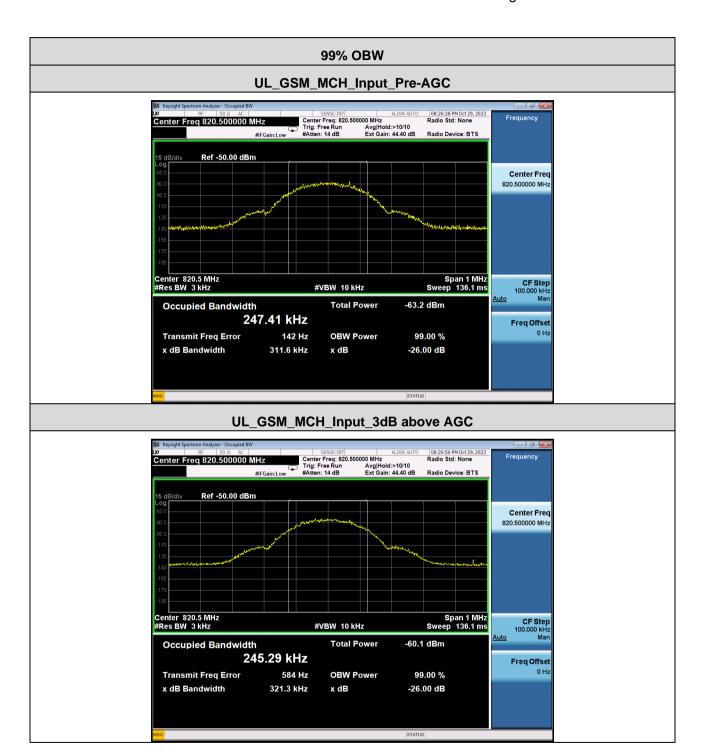
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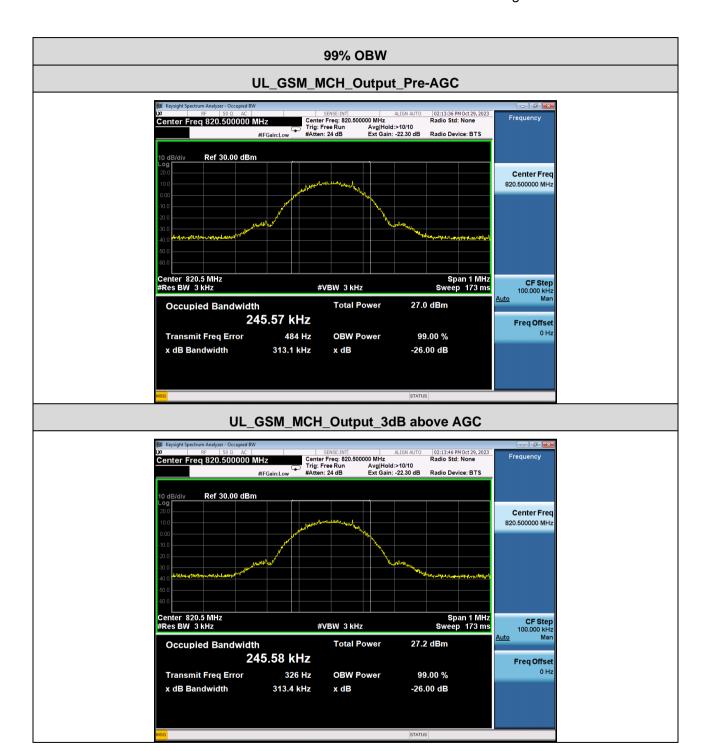
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# 3 Mean output power and amplifier/booster gain

Mean output power and gain										
Test Path	Test Freq. f0 (MHz)	Test Signal	Signal Level	Input power (dBm)	Output Power (dBm)	ERP (W)	Gain (dB)			
	DL 868.7	4.1MHz AWGN	Pre-AGC	-55	41.6	88.2	96.6			
			3dB above AGC	-52	41.9	94.5	/			
DL		GSM	Pre-AGC	-55	41.4	84.2	96.4			
			3dB above AGC	-52	41.2	80.4	/			
		4.1MHz AWGN 819.6 GSM	Pre-AGC	-63	27.5	3.5	90.5			
UL			3dB above AGC	-60	27.8	3.7	/			
	819.6		Pre-AGC	-63	27.2	3.2	90.2			
			3dB above AGC	-60	27.3	3.3	/			

### Remark:

- 1. f0 is from Out-of-band Rejection test in the report.
- 2. ERP= output power (dBm)+ antenna gain (dBi)- 2.15, the antenna gain is 10dBi declared by the manufacturer.
- 3. The output power is limited to an ERP of 1000W and the total ERP does not exceed the limit.



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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			
1.011	LCH	4.1MHz AWGN	One signal	Pre-AGC	-23.76	≤-13	PASS			
	LCH		input	3dB above AGC	-23.41		PASS			
	HCH		One signal	Pre-AGC	-20.82		PASS			
	ПСП		input	3dB above AGC	-20.81		PASS			
			One signal	Pre-AGC	-23.76		PASS			
DI	LCH		input	3dB above AGC	-22.61		PASS			
DL	LCH		Two signals	Pre-AGC	-22.56		PASS			
		0014	input	3dB above AGC	-22.16	≤-13	PASS			
	НСН	GSM	One signal input  Two signals input	Pre-AGC	-20.79		PASS			
				3dB above AGC	-20.45		PASS			
				Pre-AGC	-22.69		PASS			
				3dB above AGC	-22.66		PASS			
	LCH	4.1MHz AWGN	One signal input	Pre-AGC	-26.77	≤-13	PASS			
	LCH			3dB above AGC	-26.60		PASS			
	НСН		One signal input	Pre-AGC	-27.73		PASS			
	псп			3dB above AGC	-28.36		PASS			
		- GSM	One signal input	Pre-AGC	-27.28	<u>-</u> ≤-13	PASS			
	1.011			3dB above AGC	-27.27		PASS			
UL	LCH		Two signals	Pre-AGC	-29.96		PASS			
			input	3dB above AGC	-29.82		PASS			
			One signal input	Pre-AGC	-20.30		PASS			
	HCH			3dB above AGC	-20.79		PASS			
	псн		Two signals	Pre-AGC	-22.75		PASS			
			input	3dB above AGC	-22.27		PASS			



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### Remark:

- 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 Log10(f/6.1) decibels or 50 + 10 Log10(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 rated max conducted power for single antenna port is 40dBm for DL, 27dBm for UL. the power of any emission must be reduced below the mean output power (P) by at least  $50 + 10\log(P) dB$ 

Here,

For DL, P = 40dBm = 10W

The limit =  $40dBm - [50 + 10 \log 10 (10W)] dB = -20dBm$ 

For UL, P = 27dBm = 0.5W

The limit =  $27dBm - [50 + 10 \log 10 (0.5W)] dB = -20dBm$ 

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 + 10Log10(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 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

For DL, P = 40dBm = 10W

The limit =  $40dBm - [43 + 10 \log 10 (10W)] dB = -13dBm$ 

For UL, P = 27dBm = 0.5W

The limit =  $27dBm - [43 + 10 \log 10 (0.5W)] dB = -13dBm$ 

3. The EUT supported frequency band (817-824 MHz, 862-869 MHz) with max bandwidth 7MHz that is narrow than two 4.1MHz AWGN signal, so EUT cannot accommodate two simultaneous AWGN signals within the passband, it should be excluded from the Out-ofband/out-of-block emissions test with two AWGN signals input.



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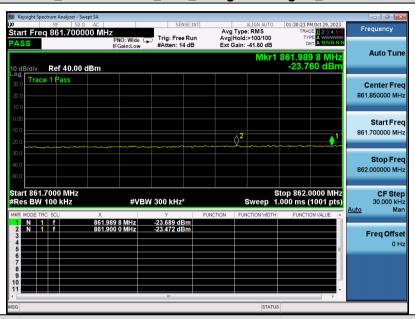
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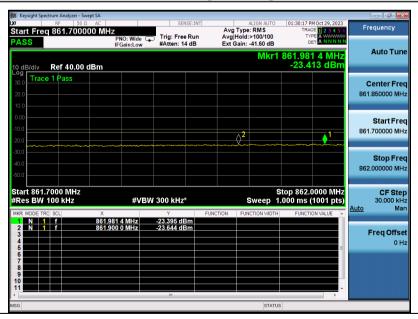
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### Out-of-band/out-of-block emissions

### DL\_4.1MHz AWGN\_LCH\_a single test signal\_Pre-AGC



### DL\_4.1MHz AWGN\_LCH\_a single test signal\_3dB above AGC





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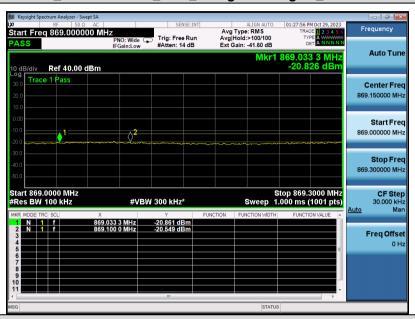
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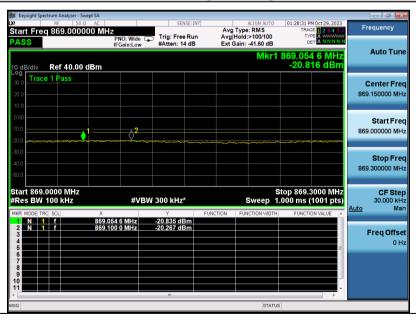
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### Out-of-band/out-of-block emissions

### DL 4.1MHz AWGN HCH a single test signal Pre-AGC



### DL\_4.1MHz AWGN\_HCH\_a single test signal\_3dB above AGC





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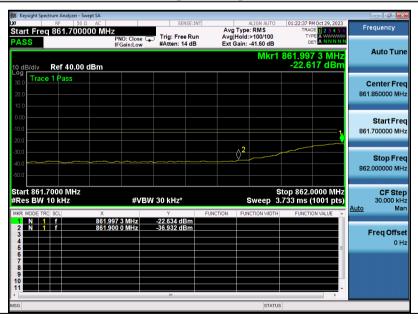
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### Out-of-band/out-of-block emissions

### DL\_GSM\_LCH\_a single test signal\_Pre-AGC



### DL\_GSM\_LCH\_a single test signal\_3dB above AGC





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### Out-of-band/out-of-block emissions

### DL\_GSM\_LCH\_two adjacent test signals\_Pre-AGC



### DL\_GSM\_LCH\_two adjacent test signals\_3dB above AGC





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# Out-of-band/out-of-block emissions DL GSM HCH a single test signal Pre-AGC Avg Type: RMS Avg|Hold:>100/100 Ext Gain: -41.60 dB Auto Tun dB/div Ref 40.00 dBm Trace 1 Pass 869 150000 MH 869 000000 MH $\langle \rangle^2$ 869.300000 MH Start 869.0000 MHz #Res BW 10 kHz Stop 869.3000 MHz Sweep 3.733 ms (1001 pts) #VBW 30 kHz\* -20.834 dB -25.720 dB Freq Offset DL\_GSM\_HCH\_a single test signal\_3dB above AGC ALIGN AUTO Avg Type: RMS Avg|Hold:>100/100 Ext Gain: -41.60 dB Start Freq 869.000000 MHz Frequency Auto Tune Ref 40.00 dBm Center Fred 869.150000 MH Start Fred **⊘**<sup>2</sup> Stop Fred Start 869.0000 MHz #Res BW 10 kHz Stop 869.3000 MHz Sweep 3.733 ms (1001 pts) CF Step 30.000 kHz Man #VBW 30 kHz\* 869.000 0 MHz 869.100 0 MHz -20.482 dBm -25.344 dBm Freq Offset



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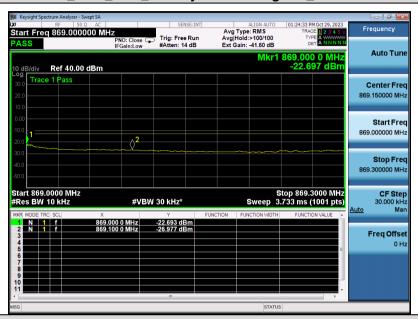
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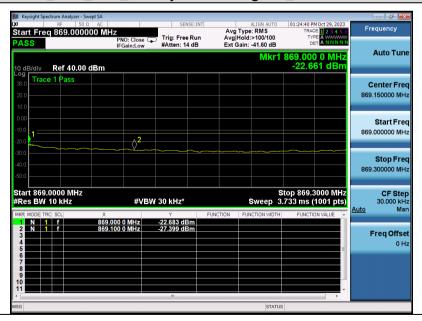
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### Out-of-band/out-of-block emissions

### DL GSM HCH two adjacent test signals Pre-AGC



### DL\_GSM\_HCH\_two adjacent test signals\_3dB above AGC





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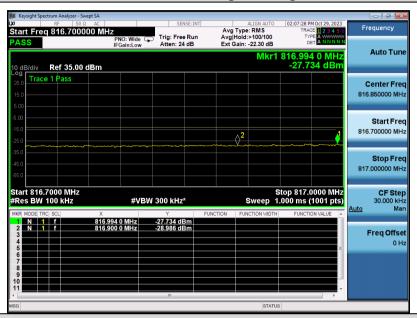
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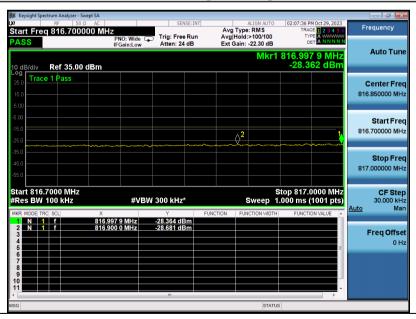
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### Out-of-band/out-of-block emissions

### UL\_4.1MHz AWGN\_LCH\_a single test signal\_Pre-AGC



### UL\_4.1MHz AWGN\_LCH\_a single test signal\_3dB above AGC





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# Out-of-band/out-of-block emissions UL 4.1MHz AWGN HCH a single test signal Pre-AGC Start Freq 824.000000 MHz PNO: Wide FGain.Low FGain.Low Free Run Atten: 24 dB Avg Type: RMS Avg|Hold:>100/100 Ext Gain: -22.30 dB Auto Tun dB/div Ref 35.00 dBm Trace 1 Pass 824 150000 MH 824 000000 MH $\Diamond^2$ 824.300000 MH Start 824.0000 MHz #Res BW 100 kHz Stop 824.3000 MHz 1.000 ms (1001 pts) CF Step 30.000 kHz Man #VBW 300 kHz\* -26.807 dB -28.147 dB Freq Offset UL\_4.1MHz AWGN\_HCH\_a single test signal\_3dB above AGC AUGN AUTO Avg Type: RMS Avg|Hold:>100/100 Ext Gain: -22.30 dB Start Freq 824.000000 MHz Auto Tune Ref 35.00 dBm Center Fred 824.150000 MH Start Fred $\Diamond^2$ Stop Fred



Start 824.0000 MHz #Res BW 100 kHz

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Stop 824.3000 MHz 1.000 ms (1001 pts)

CF Step 30.000 kHz Man

Freq Offset

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#VBW 300 kHz\* -26.498 dBm

824.000 0 MHz 824.100 0 MHz



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# Out-of-band/out-of-block emissions UL\_GSM\_LCH\_a single test signal\_Pre-AGC Start Freq 815.700000 MHz PNO: Close Space Avg Type: RMS Avg|Hold:>100/100 Ext Gain: -22.30 dB Auto Tun dB/div Ref 35.00 dBm Trace 1 Pass 816 700000 MH 817.000000 MH Start 816.7000 MHz #Res BW 10 kHz CF Step 30.000 kHz Man #VBW 30 kHz\* 816.997 3 MHz 816.900 0 MHz -27.321 dB -41.636 dB Freq Offset UL\_GSM\_LCH\_a single test signal\_3dB above AGC ALIGN AUTO Avg Type: RMS Avg|Hold:>100/100 Ext Gain: -22.30 dB Start Freq 816.700000 MHz Frequency Auto Tune Mkr1 816.988 3 MF -27.272 dBi Ref 35.00 dBm Frace 1 Pass Center Fred 816.850000 MH Start Fred Stop Fred Start 816.7000 MHz #Res BW 10 kHz Stop 817.0000 MHz 3.733 ms (1001 pts) CF Step 30.000 kHz Man #VBW 30 kHz\* -27.287 dBm -42.143 dBm 816.988 3 MHz 816.900 0 MHz Freq Offset



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### Out-of-band/out-of-block emissions

### UL\_GSM\_LCH\_two adjacent test signals\_Pre-AGC



### UL\_GSM\_LCH\_two adjacent test signals\_3dB above AGC





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### Out-of-band/out-of-block emissions

### UL GSM HCH a single test signal Pre-AGC



### UL\_GSM\_HCH\_a single test signal\_3dB above AGC





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### Out-of-band/out-of-block emissions

### UL GSM HCH two adjacent test signals Pre-AGC



### UL\_GSM\_HCH\_two adjacent test signals\_3dB above AGC





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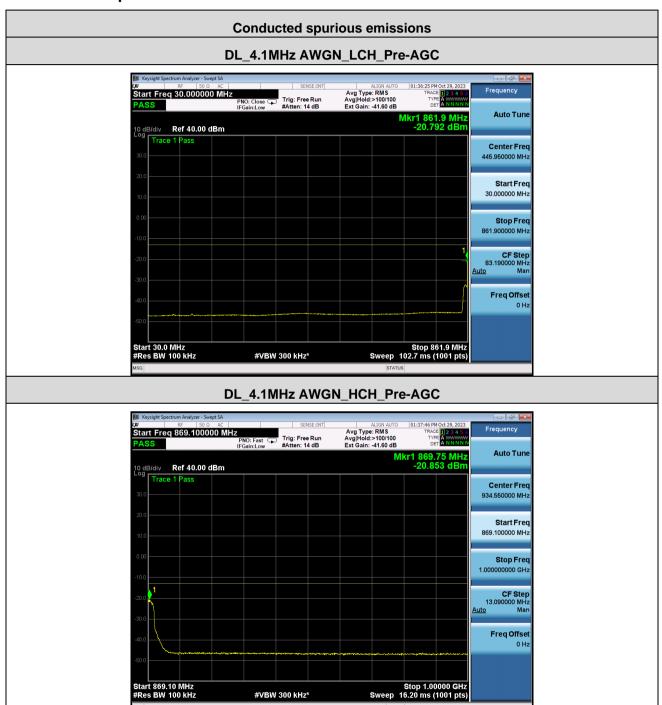
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### **5 Conducted Spurious emissions**





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### **Conducted spurious emissions**

### DL 4.1MHz AWGN HCH Pre-AGC



### UL 4.1MHz AWGN LCH Pre-AGC



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# **Conducted spurious emissions** UL 4.1MHz AWGN HCH Pre-AGC



### UL 4.1MHz AWGN HCH Pre-AGC





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### Remark:

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 Log10(f/6.1) decibels or 50 + 10 Log10(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.

For LTE and GSM-TDMA signals, f is greater than 200kHz and exceeds the range 12.5kHz~37.5kHz. Therefore, above limit is not applicable.

2. 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 +10Log10(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.

For DL, P = 40dBm = 10W

The limit = 40dBm - [43 + 10 log10 (10W)] dB = -13dBm

For UL, P = 27dBm = 0.5W

The limit = 27dBm - [43 + 10 log10 (0.5W)] dB = -13dBm

- 3. The spurious emissions 9kHz to 30MHz were very low and not displayed in this report.
- 4. All modes (LCH/MCH/HCH, with GSM signal/ with 4.1MHz 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		
	865.5	4.1MHz AWGN	TN	VL	27	0.0312	PASS		
			TN	VH	31	0.0358	PASS		
DL		GSM	TN	VL	18	0.0208	PASS		
			TN	VH	21	0.0243	PASS		
	820.5	0.5  4.1MHz AWGN  GSM	TN	VL	35	0.0427	PASS		
DL			TN	VH	38	0.0463	PASS		
			TN	VL	24	0.0293	PASS		
			TN	VH	20	0.0244	PASS		



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Frequency stability vs temperature									
Test Path	Test Freq. (MHz)	Test Signal	Voltage	Temperature (°C)	Freq. error (Hz)	Tolerance (ppm)	Verdict		
			VN	+50	32	0.0370	PASS		
			VN	+40	28	0.0324	PASS		
			VN	+30	33	0.0381	PASS		
		4.4541.1	VN	+20	25	0.0289	PASS		
	865.5	4.1MHz AWGN	VN	+10	20	0.0231	PASS		
			VN	0	19	0.0220	PASS		
			VN	-10	24	0.0277	PASS		
			VN	-20	21	0.0243	PASS		
DI			VN	-30	27	0.0312	PASS		
DL	865.5	GSM	VN	+50	33	0.0381	PASS		
			VN	+40	28	0.0324	PASS		
			VN	+30	25	0.0289	PASS		
			VN	+20	28	0.0324	PASS		
			VN	+10	30	0.0347	PASS		
			VN	0	21	0.0243	PASS		
			VN	-10	22	0.0254	PASS		
			VN	-20	27	0.0312	PASS		
			VN	-30	21	0.0243	PASS		



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	Frequency stability vs temperature									
Test Path	Test Freq. (MHz)	Test Signal	Voltage	Temperature (°C)	Freq. error (Hz)	Tolerance (ppm)	Verdict			
			VN	+50	39	0.0475	PASS			
			VN	+40	33	0.0402	PASS			
			VN	+30	37	0.0451	PASS			
		4 4 5 4 1 1	VN	+20	27	0.0329	PASS			
	820.5	4.1MHz AWGN	VN	+10	21	0.0256	PASS			
			VN	0	24	0.0293	PASS			
			VN	-10	20	0.0244	PASS			
			VN	-20	31	0.0378	PASS			
			VN	-30	28	0.0341	PASS			
UL		GSM	VN	+50	30	0.0366	PASS			
			VN	+40	24	0.0293	PASS			
			VN	+30	21	0.0256	PASS			
			VN	+20	27	0.0329	PASS			
	820.5		VN	+10	20	0.0244	PASS			
			VN	0	17	0.0207	PASS			
			VN	-10	15	0.0183	PASS			
			VN	-20	11	0.0134	PASS			
			VN	-30	16	0.0195	PASS			



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### 7 Radiated Spurious emissions

### **Radiated Spurious emissions** DL 4.1MHz AWGN MCH 30MHz-1GHz 10 Level (dBm) -100 -12030 Frequency (MHz) Cable Preamp Loss Factor Level ReadAntenna Cable Preamp evel Factor Loss Factor Level Limit Over Line Limit Pol/Phase Remark ReadAntenna Freq Level Factor Limit Over Line Limit Pol/Phase Remark Freq Level Factor dBm dB/m dB dBm/m dBm/m dB dBm/m dBm/m MHz dB dB 0.00 -86.30 -13.00 -73.30 VERTICAL 0.00 -85.87 -13.00 -72.87 VERTICAL 0.00 -83.91 -13.00 -79.91 VERTICAL 0.00 -83.91 -13.00 -68.84 VERTICAL 0.00 -76.66 -13.00 -63.86 VERTICAL 0.00 -75.65 -13.00 -60.65 VERTICAL 45.535 -73.89 -12.41 85.598 -76.62 -9.25 144.842 -79.98 -3.93 273.234 -78.71 -3.13 459.114 -78.30 1.64 0.00 -75.17 -13.00 -62.17 HORIZONTAL Peak 0.00 -82.02 -13.00 -69.02 HORIZONTAL Peak 0.00 -85.39 -13.00 -72.39 HORIZONTAL Peak 0.00 -82.56 -13.00 -69.56 HORIZONTAL Peak 0.00 -77.78 -13.00 -64.78 HORIZONTAL Peak 0.00 -72.86 -13.00 -59.86 HORIZONTAL Peak 47.994 -72.69 88.652 -72.17 151.597 -78.56 317.701 -79.36 444.851 -78.01 755.387 -78.24 -2.48 -9.85 -6.83 -3.20 0.23 5.38



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### **Radiated Spurious emissions** DL 4.1MHz AWGN MCH above 1GHz Frequency (MHz) Frequency (MHz) Read Correction Level Factor Level Limit Line Limit Line -56.46 -55.66 -53.79 -55.43 -47.39 -13.00 -13.00 -13.00 -13.00 -13.00 -56.36 -53.42 -46.17 -49.18 -41.57 -13.00 -13.00 -13.00 -13.00 -13.00 4.10 5.56 9.03 7.89 18.84 24.03 -43.46 -42.66 -40.79 -42.43 -34.39 -31.71 4.04 8.77 9.60 14.09 20.83 24.78 -43.36 -40.42 -33.17 -36.18 -28.57 -29.11 -60.40 -62.19 -55.77 -63.27 -61.22 -62.82 -63.32 2047.90 2414.67 5455.63 HORIZONTAL HORIZONTAL 2471.16 4721.52 VERTICAL VERTICAL HORIZONTAL

Remark: Pre-test was performed for all modes (DL/UL, LCH/MCH/HCH, with GSM signal/with 4.1MHz 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 in this report.

-- End of Appendix--



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