

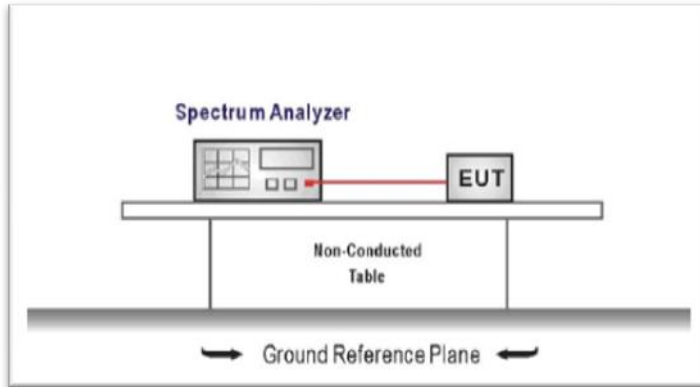
5.10. Bandedge and Spurious Emission (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

TEST CONFIGURATION



TEST PROCEDURE

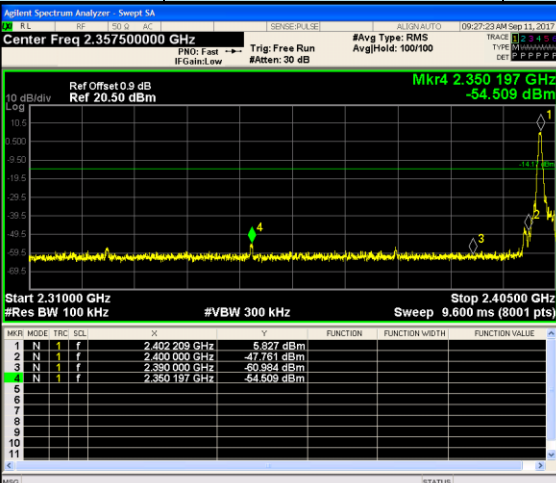
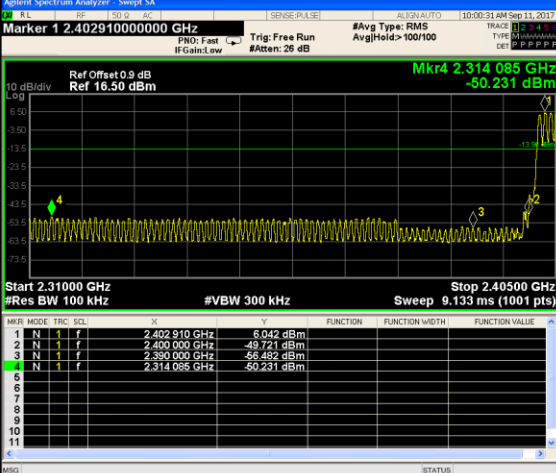
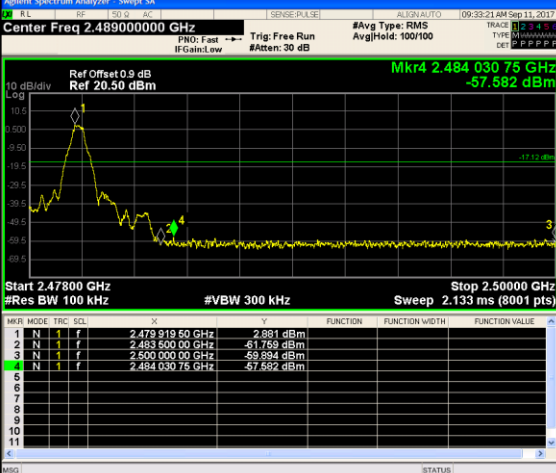
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
RBW = 100 kHz, VBW \geq RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

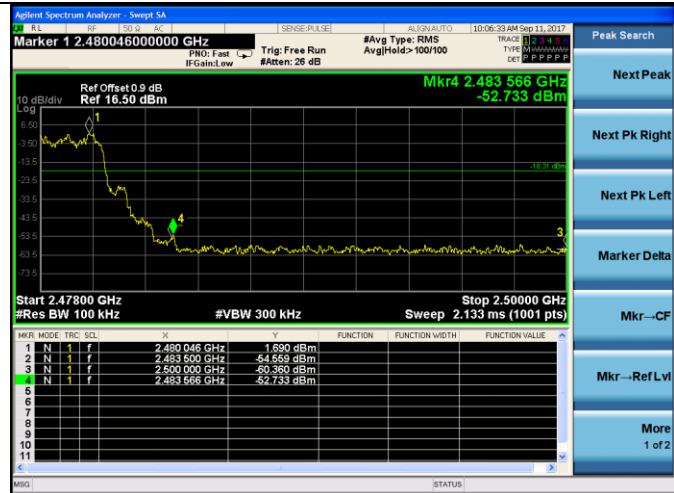
Test Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

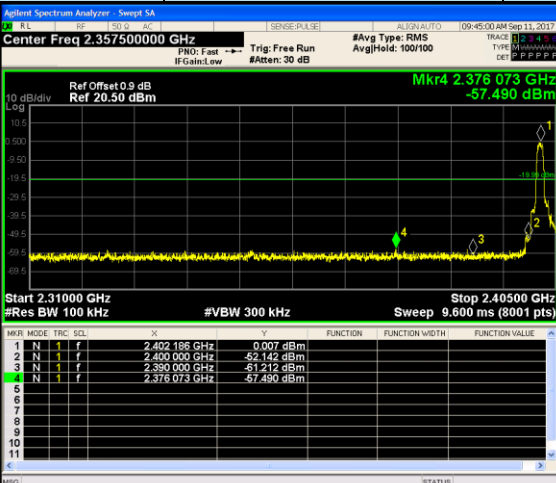
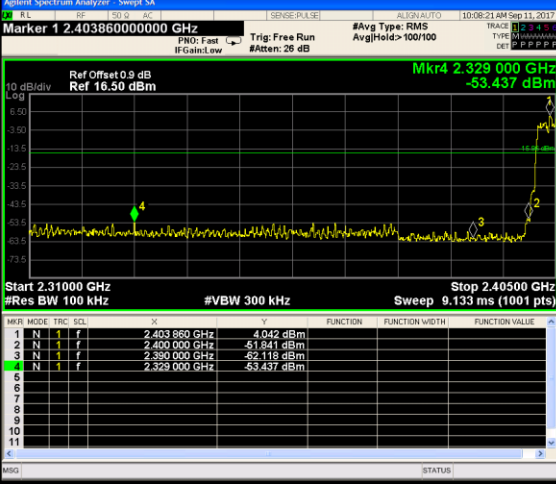
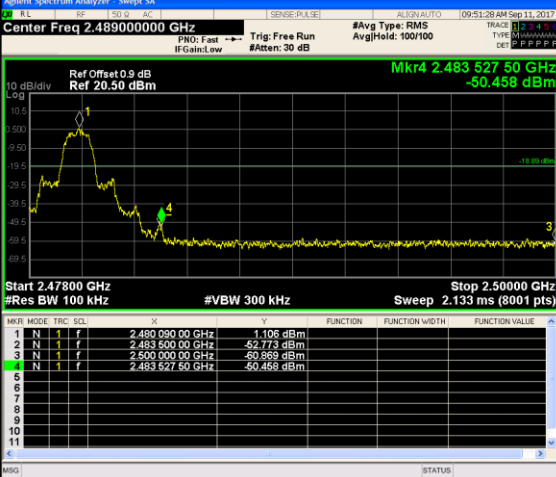
CH78
Hopping mode



Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK																																													
CH00 No hopping mode	<div><div><div>Agilent Spectrum Analyzer - Sweep SA</div><div><div>Center Freq 2.357500000 GHz</div><div>Ref Offset 0.9 dB Ref 20.50 dBm</div><div>Mkr4 2.324 321 GHz -57.297 dBm</div><div>Start 2.31000 GHz #Res BW 100 kHz</div><div>#VBW 300 kHz</div><div>Sweep 9.600 ms (8001 pts)</div><div><table><tr><th>Mkr</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.402 174 GHz</td><td>0.623 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.400 000 GHz</td><td>-62.467 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.390 000 GHz</td><td>-61.626 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.324 321 GHz</td><td>-57.297 dBm</td><td></td><td></td><td></td></tr></table></div></div></div><div><div>Frequency</div><div>Auto Tune</div><div>Center Freq 2.357500000 GHz</div><div>Start Freq 2.310000000 GHz</div><div>Stop Freq 2.405000000 GHz</div><div>CF Step 9.500000 MHz Man</div><div>Freq Offset 0 Hz</div></div></div>			Mkr	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	N	1	f	2.402 174 GHz	0.623 dBm				2	N	1	f	2.400 000 GHz	-62.467 dBm				3	N	1	f	2.390 000 GHz	-61.626 dBm				4	N	1	f	2.324 321 GHz	-57.297 dBm			
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CH00 Hopping mode	<div><div><div>Agilent Spectrum Analyzer - Sweep SA</div><div><div>Marker 1 2.404050000000 GHz</div><div>Ref Offset 0.9 dB Ref 16.50 dBm</div><div>Mkr4 2.368 045 GHz -53.666 dBm</div><div>Start 2.31000 GHz #Res BW 100 kHz</div><div>#VBW 300 kHz</div><div>Sweep 9.133 ms (1001 pts)</div><div><table><tr><th>Mkr</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.404 050 GHz</td><td>1.618 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.400 000 GHz</td><td>-63.031 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.390 000 GHz</td><td>-60.544 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.368 045 GHz</td><td>-53.666 dBm</td><td></td><td></td><td></td></tr></table></div></div></div><div><div>Peak Search</div><div>Next Peak</div><div>Next Pk Right</div><div>Next Pk Left</div><div>Marker Delta</div><div>Mkr--CF</div><div>Mkr--Ref Lvl</div><div>More 1 of 2</div></div></div>			Mkr	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	N	1	f	2.404 050 GHz	1.618 dBm				2	N	1	f	2.400 000 GHz	-63.031 dBm				3	N	1	f	2.390 000 GHz	-60.544 dBm				4	N	1	f	2.368 045 GHz	-53.666 dBm			
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CH78 No hopping mode	<div><div><div>Agilent Spectrum Analyzer - Sweep SA</div><div><div>Center Freq 2.489000000 GHz</div><div>Ref Offset 0.9 dB Ref 20.50 dBm</div><div>Mkr4 2.483 555 00 GHz -52.198 dBm</div><div>Start 2.47800 GHz #Res BW 100 kHz</div><div>#VBW 300 kHz</div><div>Sweep 2.133 ms (8001 pts)</div><div><table><tr><th>Mkr</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.480 081 75 GHz</td><td>-1.602 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.483 500 00 GHz</td><td>-66.100 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.500 000 00 GHz</td><td>-63.743 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.483 555 00 GHz</td><td>-52.198 dBm</td><td></td><td></td><td></td></tr></table></div></div></div><div><div>Frequency</div><div>Auto Tune</div><div>Center Freq 2.489000000 GHz</div><div>Start Freq 2.478000000 GHz</div><div>Stop Freq 2.500000000 GHz</div><div>CF Step 2.200000 MHz Man</div><div>Freq Offset 0 Hz</div></div></div>			Mkr	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	N	1	f	2.480 081 75 GHz	-1.602 dBm				2	N	1	f	2.483 500 00 GHz	-66.100 dBm				3	N	1	f	2.500 000 00 GHz	-63.743 dBm				4	N	1	f	2.483 555 00 GHz	-52.198 dBm			
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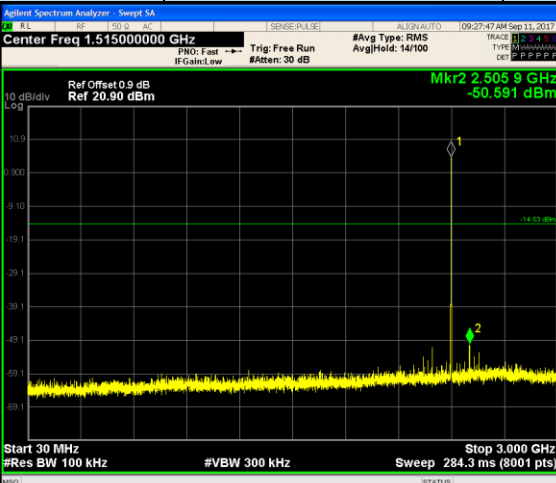

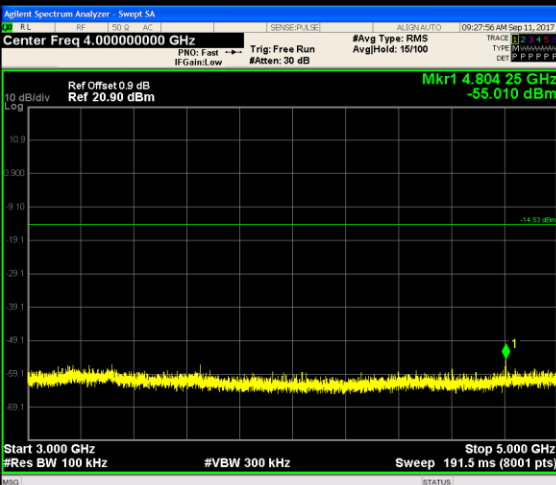

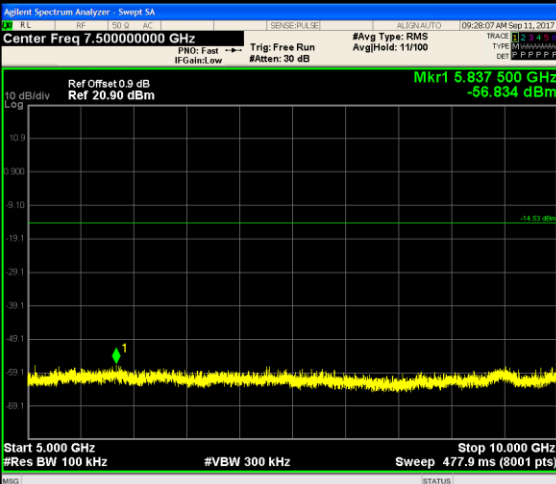

CH78
Hopping mode

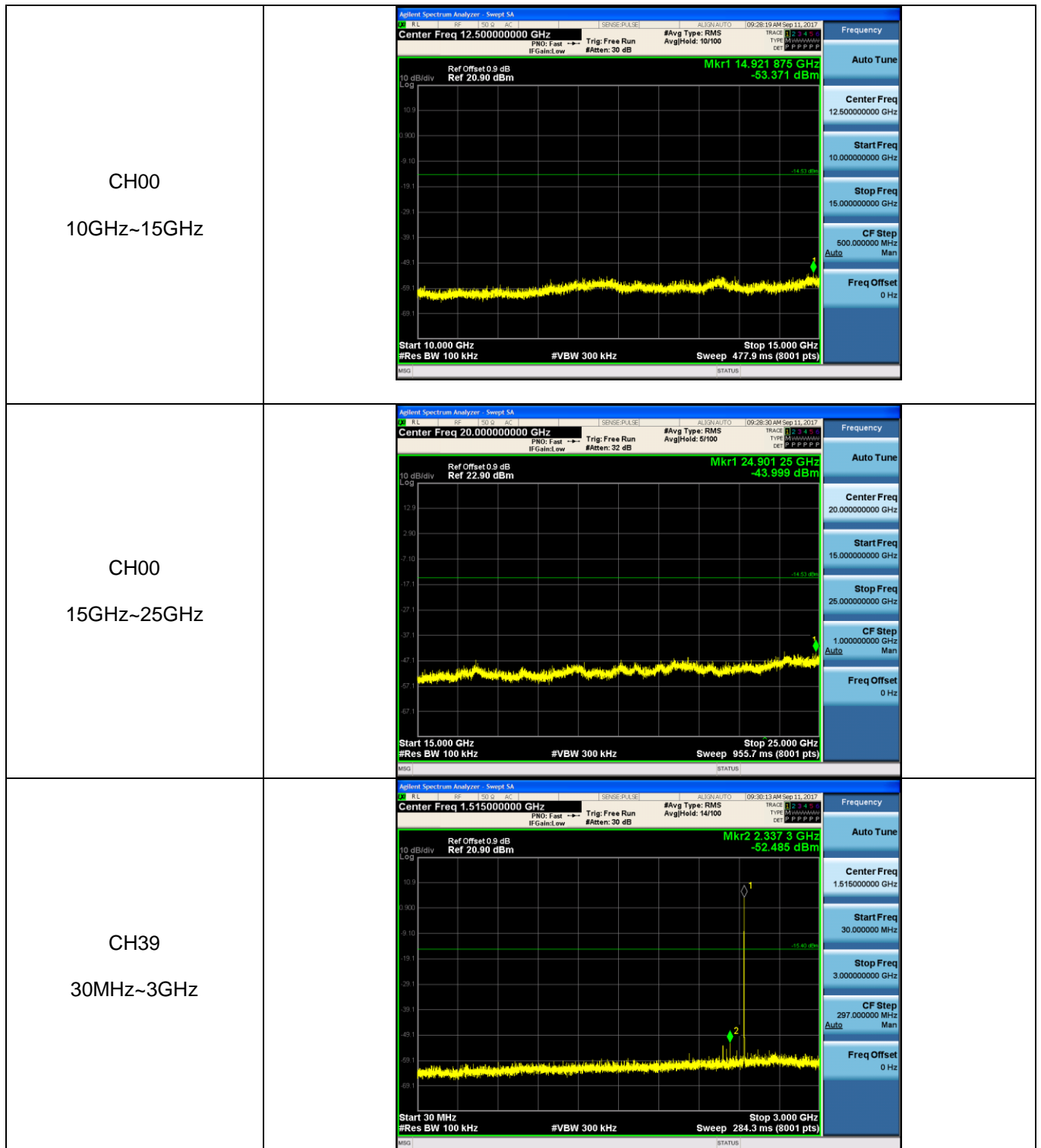


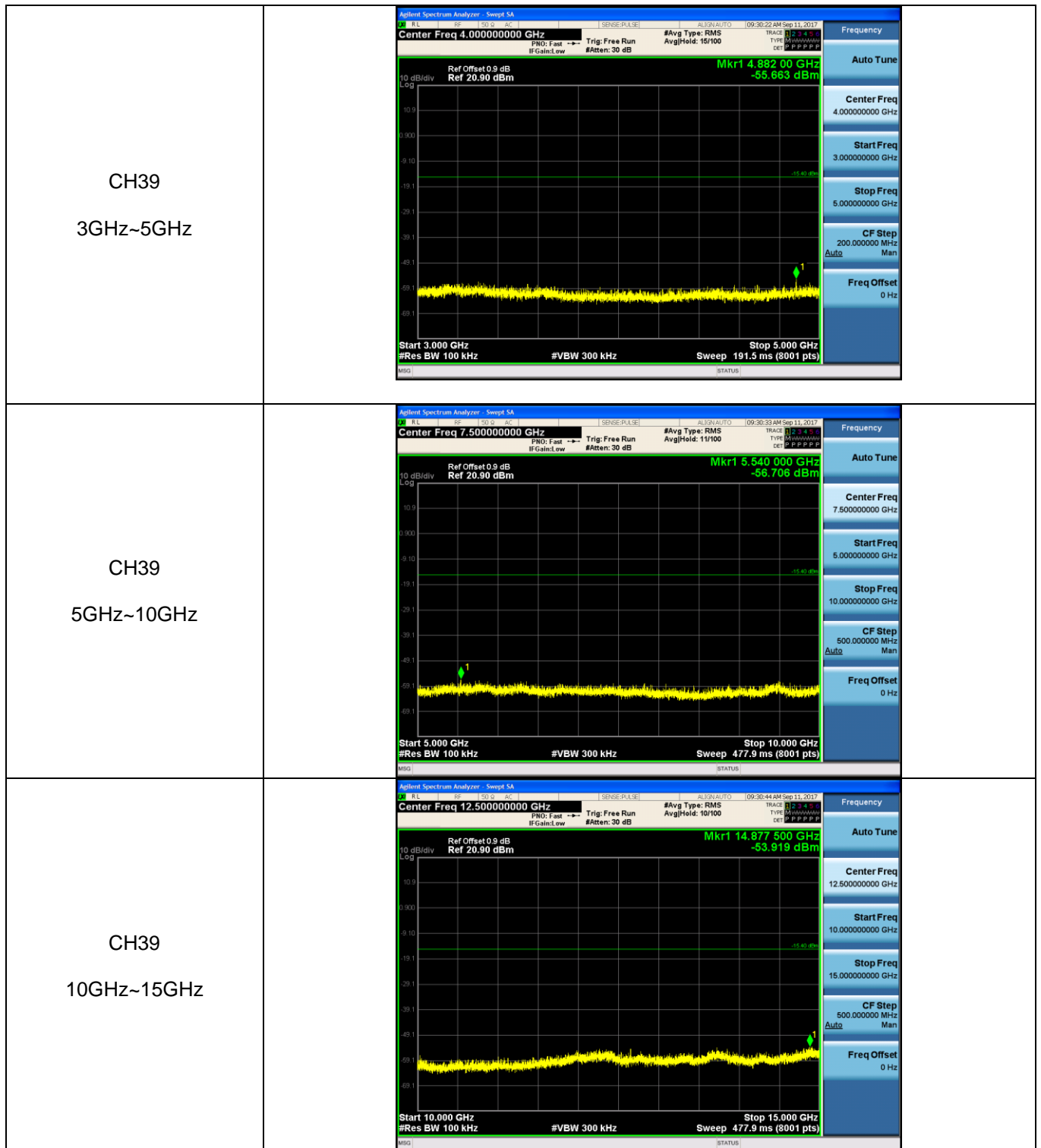
Test Item:	Band edge	Modulation type:	8DPSK
CH00 No hopping mode			
CH00 Hopping mode			
CH78 No hopping mode			

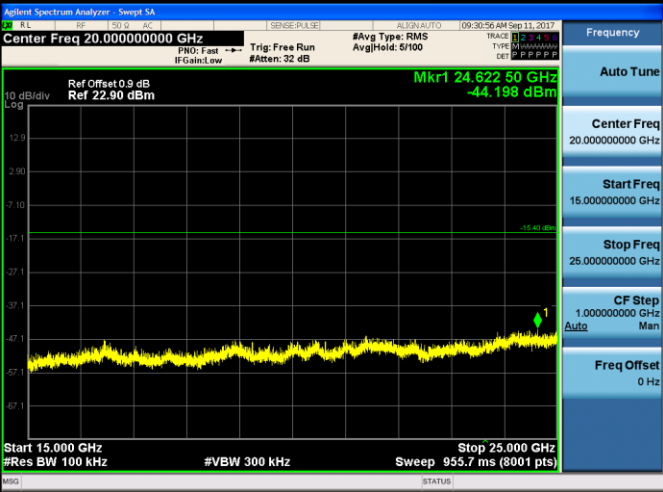
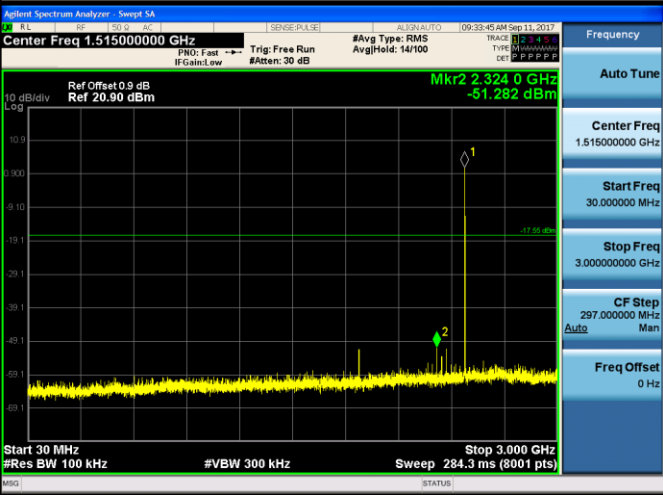
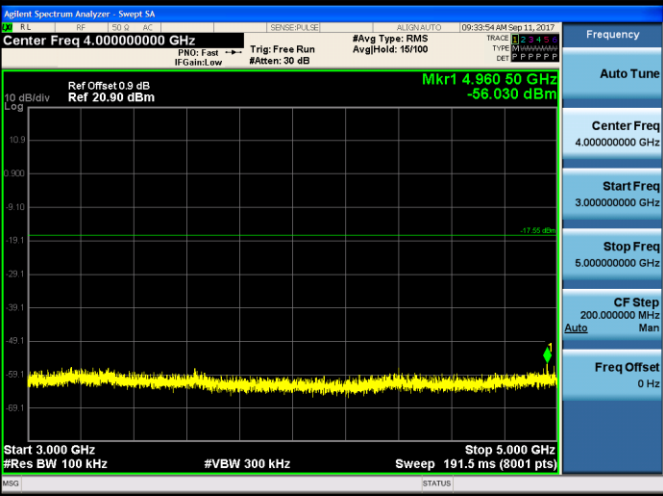
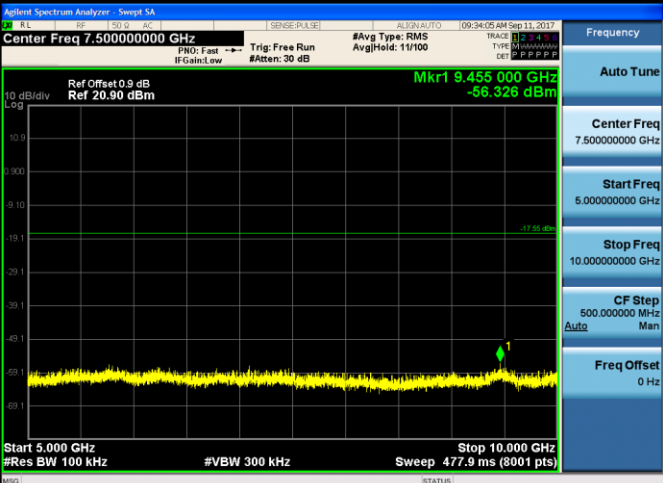
CH78
Hoppig mode

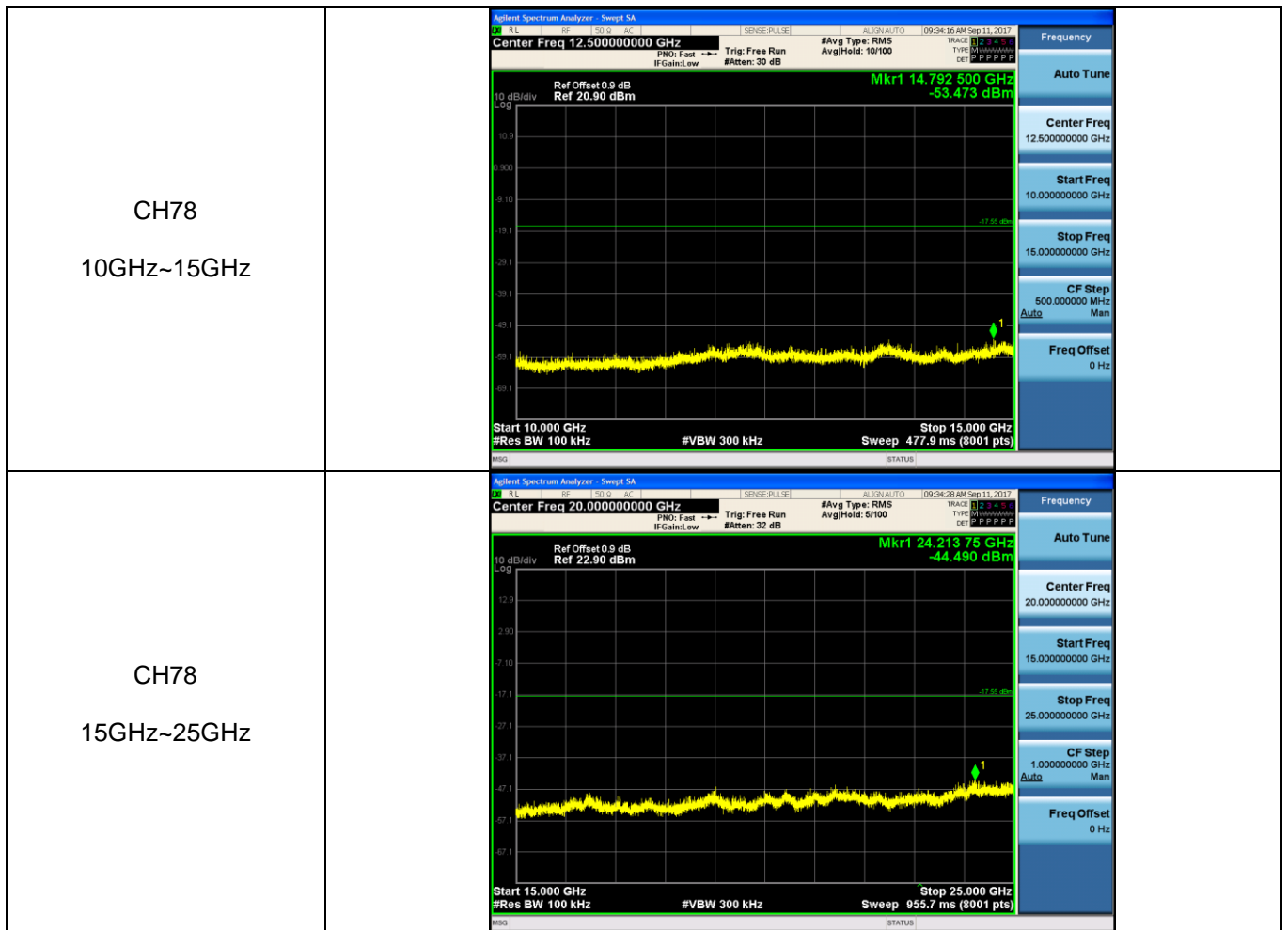


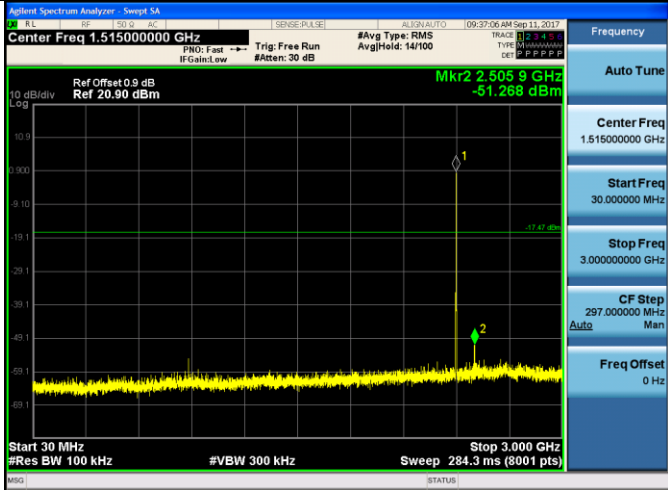
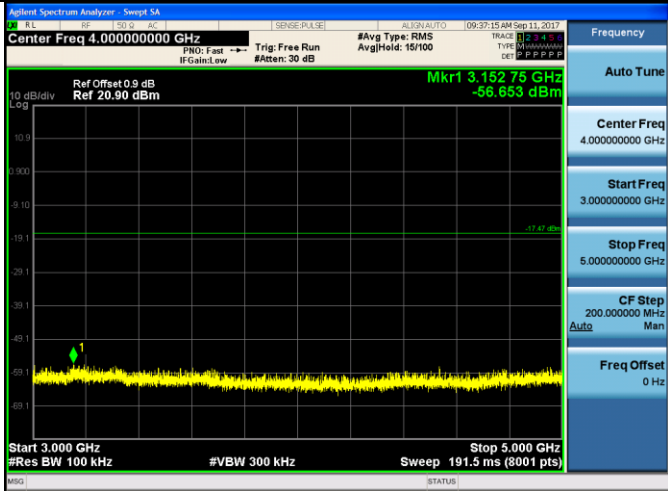
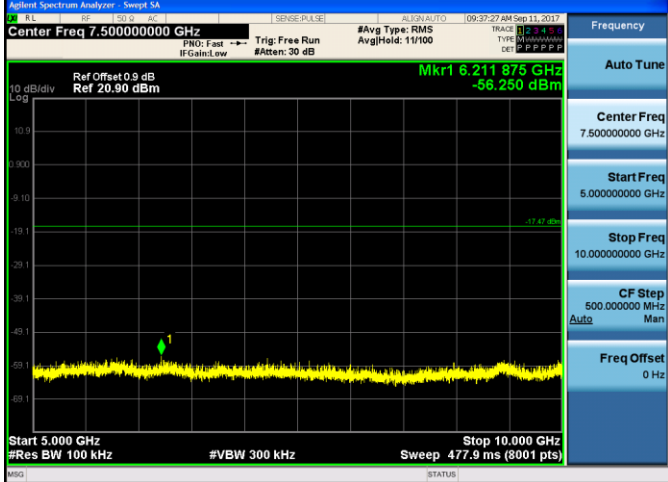
Test Item:	SE	Modulation type:	GFSK
CH00 30MHz~3GHz			
CH00 3GHz~5GHz			
CH00 5GHz~10GHz			

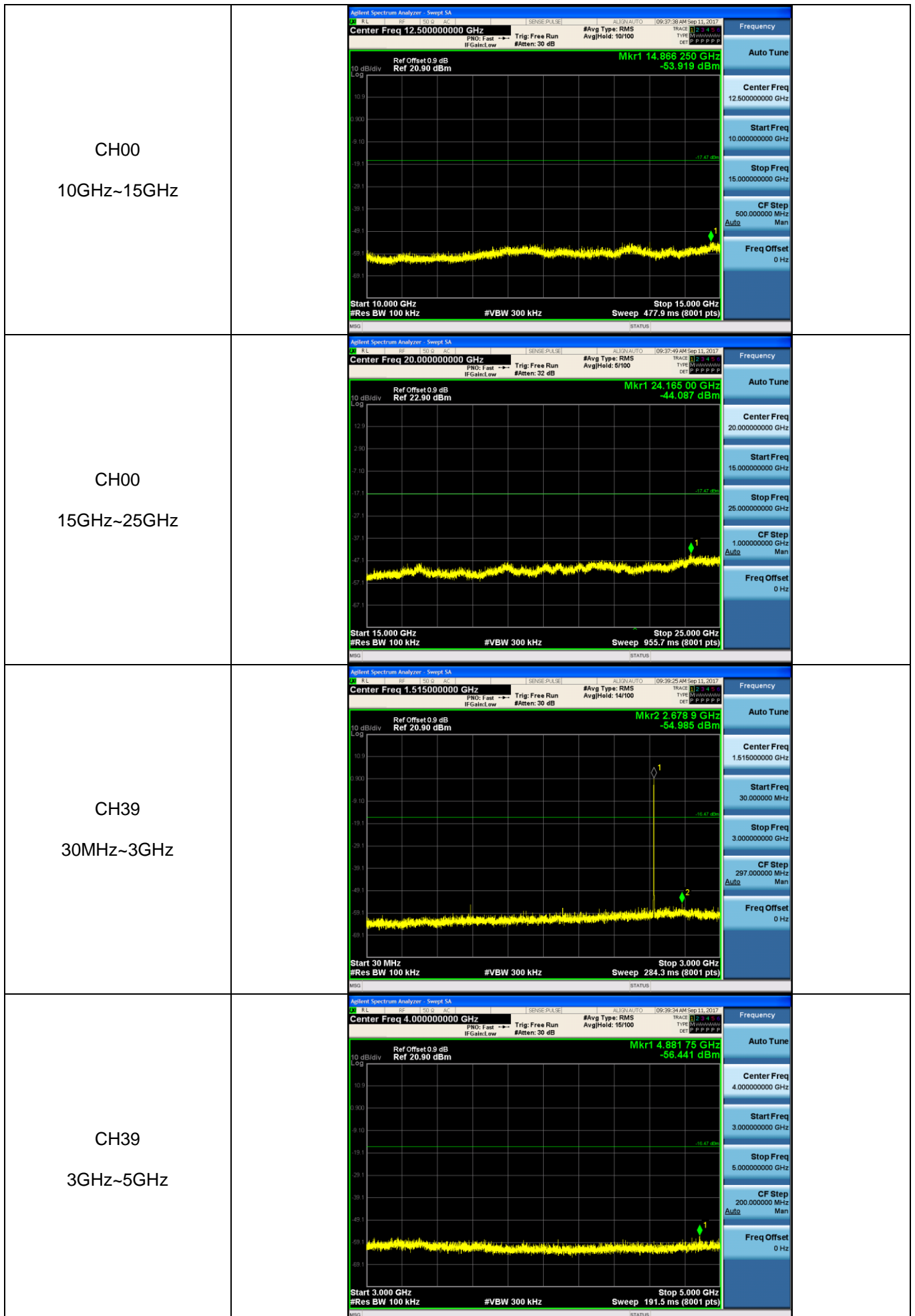


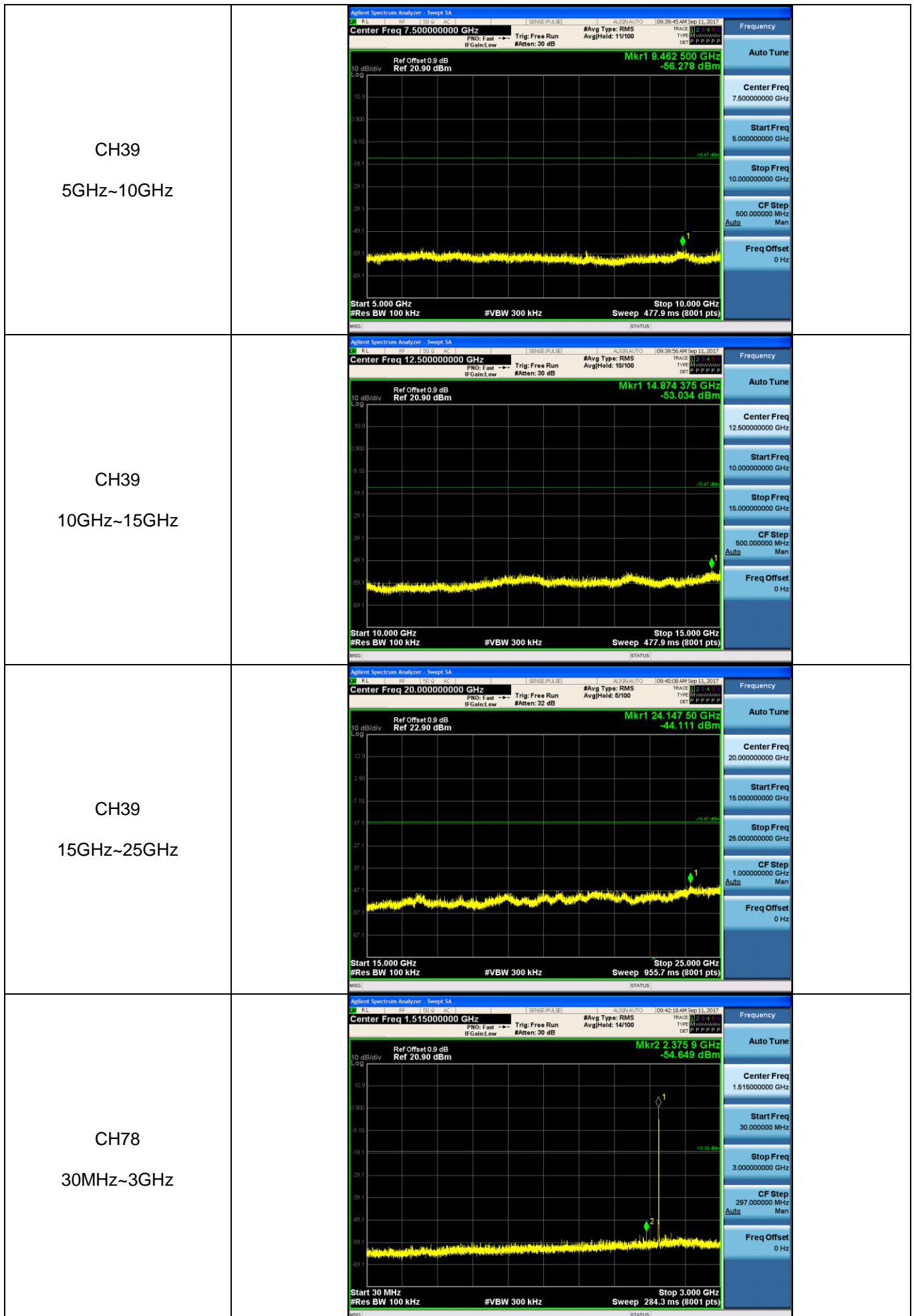


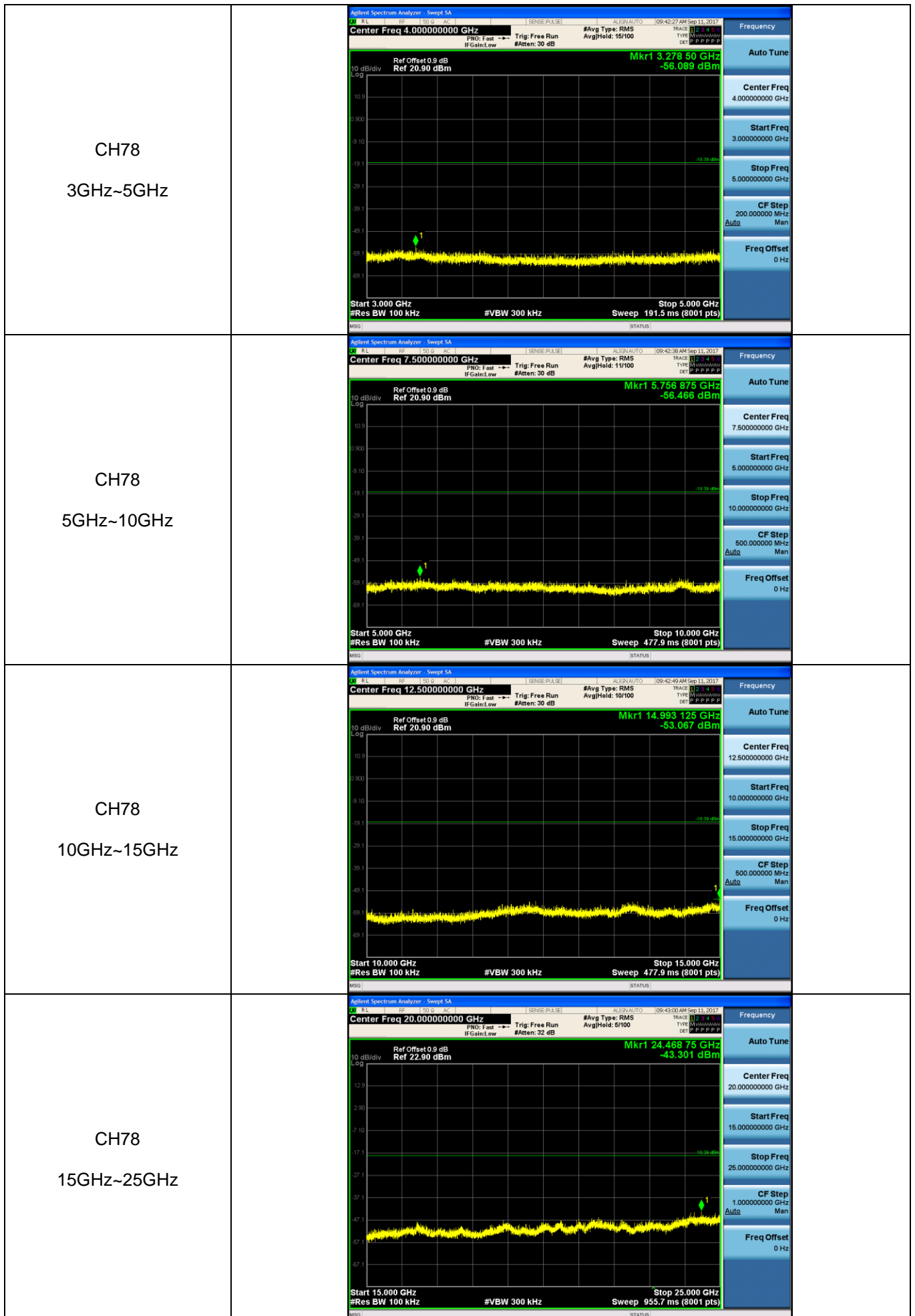
<p>CH39</p> <p>15GHz~25GHz</p>	
<p>CH78</p> <p>30MHz~3GHz</p>	
<p>CH78</p> <p>3GHz~5GHz</p>	
<p>CH78</p> <p>5GHz~10GHz</p>	



Test Item:	SE	Modulation type:	$\pi/4$ DQPSK
CH00 30MHz~3GHz			
CH00 3GHz~5GHz			
CH00 5GHz~10GHz			







5.11. Spurious Emission (radiated)

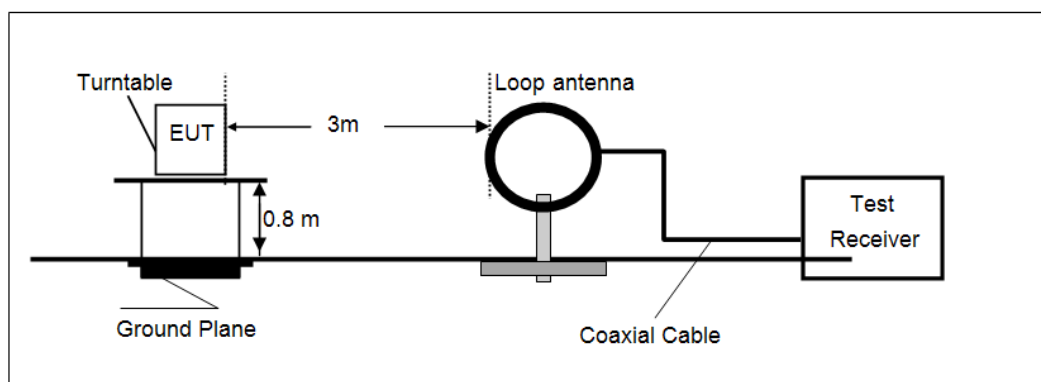
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

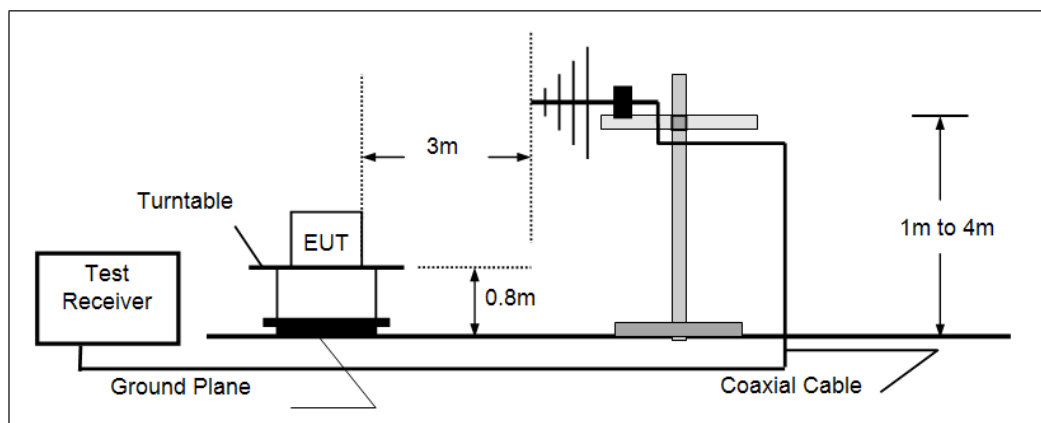
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

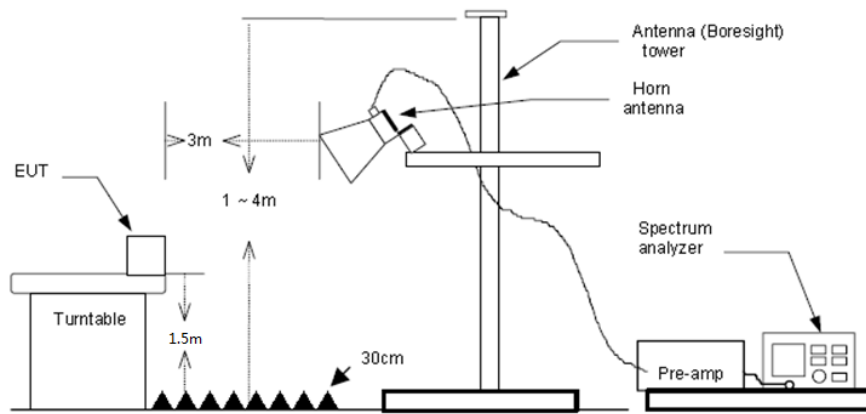
- Below 30 MHz



- 30 MHz ~1000 MHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna.
5. Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Below 1 GHz, RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (3) Above 1 GHz, RBW=1 MHz, VBW=3 MHz for Peak value
RBW=1 MHz, VBW=10 Hz for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

Note:

- 1) Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- 2) The emission levels of other frequencies are very lower than the limit and not show in test report.
- 3) Below 1 GHz, Have pre-scan all modulation mode, found the GFSK modulation High channel which it was worst case, so only the worst case's data on the test report.
- 4) Above 1 GHz, Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report
- 5) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

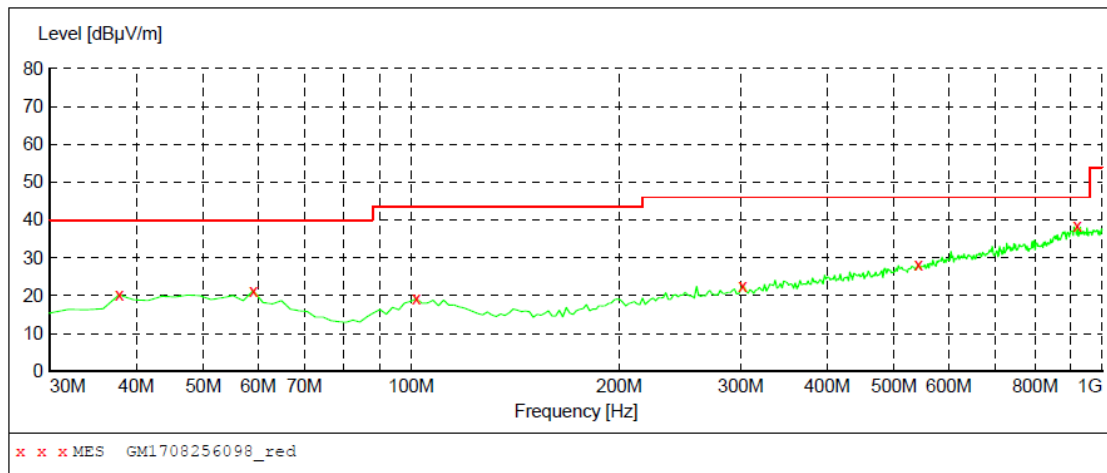
➤ **9 kHz ~ 30 MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

➤ 30 MHz ~ 1 GHz

Polarization:

Vertical

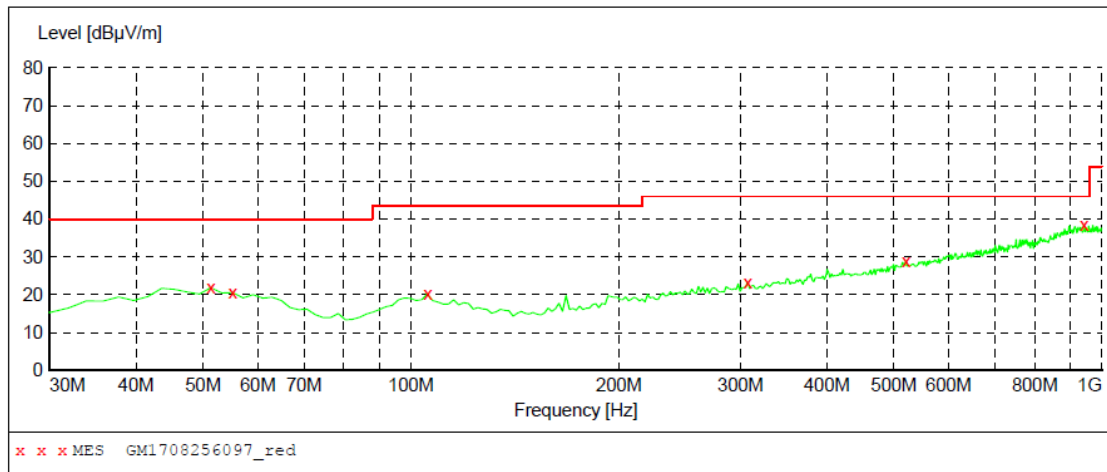
**MEASUREMENT RESULT: "GM1708256098_red"**

8/25/2017 8:44PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
37.760000	20.20	-10.8	40.0	19.8	QP	100.0	146.00	VERTICAL
59.100000	21.40	-9.8	40.0	18.6	QP	100.0	200.00	VERTICAL
101.780000	19.20	-10.5	43.5	24.3	QP	100.0	322.00	VERTICAL
301.600000	22.60	-7.2	46.0	23.4	QP	100.0	170.00	VERTICAL
542.160000	28.30	-0.9	46.0	17.7	QP	100.0	5.00	VERTICAL
920.460000	38.40	7.0	46.0	7.6	QP	100.0	359.00	VERTICAL

Polarization:

Horizontal

**MEASUREMENT RESULT: "GM1708256097_red"**

8/25/2017 8:42PM

Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
51.340000	21.90	-8.8	40.0	18.1	QP	100.0	322.00	HORIZONTAL
55.220000	20.60	-9.2	40.0	19.4	QP	300.0	242.00	HORIZONTAL
105.660000	20.20	-10.5	43.5	23.3	QP	300.0	272.00	HORIZONTAL
307.420000	23.30	-7.1	46.0	22.7	QP	300.0	25.00	HORIZONTAL
520.820000	28.90	-1.3	46.0	17.1	QP	300.0	25.00	HORIZONTAL
941.800000	38.40	7.2	46.0	7.6	QP	300.0	66.00	HORIZONTAL

➤ Above 1 GHz

CH00 for GFSK									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1597.40	45.26	24.92	5.56	36.72	39.02	74.00	-34.98	Vertical	Peak
3192.37	41.10	28.80	7.71	38.20	39.41	74.00	-34.59	Vertical	
4809.50	43.65	31.58	9.55	36.93	47.85	74.00	-26.15	Vertical	
7209.02	33.22	36.21	11.87	35.07	46.23	74.00	-27.77	Vertical	
1593.34	38.12	24.96	5.55	36.71	31.92	74.00	-42.08	Horizontal	Peak
2995.54	41.72	28.60	7.48	38.23	39.57	74.00	-34.43	Horizontal	
4809.50	42.93	31.58	9.55	36.93	47.13	74.00	-26.87	Horizontal	
7209.02	34.90	36.21	11.87	35.07	47.91	74.00	-26.09	Horizontal	

CH39 for GFSK									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1860.99	40.31	25.34	6.05	37.19	34.51	74.00	-39.49	Vertical	Peak
3489.84	37.12	28.92	8.10	38.42	35.72	74.00	-38.28	Vertical	
4883.52	43.31	31.43	9.59	36.73	47.60	74.00	-26.40	Vertical	
7319.96	32.41	36.30	11.99	34.92	45.78	74.00	-28.22	Vertical	
1350.36	36.83	26.05	4.92	36.49	31.31	74.00	-42.69	Horizontal	Peak
3225.04	36.98	28.65	7.75	38.24	35.14	74.00	-38.86	Horizontal	
4883.52	43.17	31.43	9.59	36.73	47.46	74.00	-26.54	Horizontal	
7527.83	32.21	36.13	12.49	34.92	45.91	74.00	-28.09	Horizontal	

CH78 for GFSK									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin Limit (dB)	Polarization	Test value
1601.47	39.65	24.90	5.57	36.72	33.40	74.00	-40.60	Vertical	Peak
4256.33	39.92	30.11	8.99	37.62	41.40	74.00	-32.60	Vertical	
4958.68	42.01	31.46	9.64	36.52	46.59	74.00	-27.41	Vertical	
7840.75	32.23	36.35	13.06	34.96	46.68	74.00	-27.32	Vertical	
1597.40	41.50	24.92	5.56	36.72	35.26	74.00	-38.74	Horizontal	Peak
2995.54	38.48	28.60	7.48	38.23	36.33	74.00	-37.67	Horizontal	
4958.68	42.06	31.46	9.64	36.52	46.64	74.00	-27.36	Horizontal	
6921.30	32.79	34.83	11.75	34.87	44.50	74.00	-29.50	Horizontal	

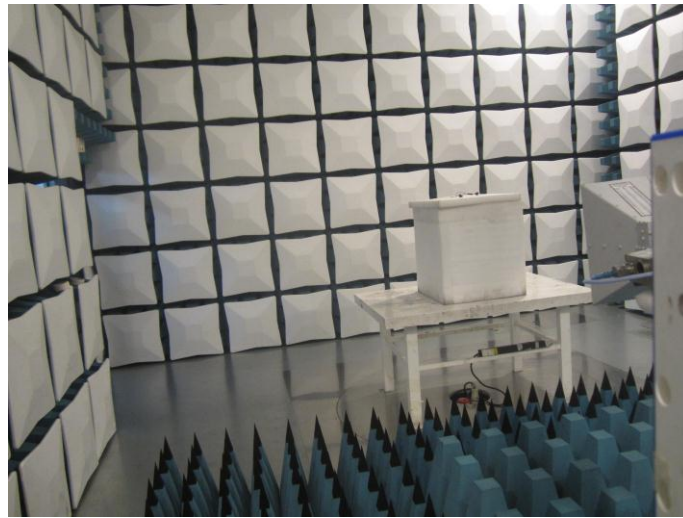
6. Test Setup Photos of the EUT

Conducted Emission (AC Mains)



Radiated Emission





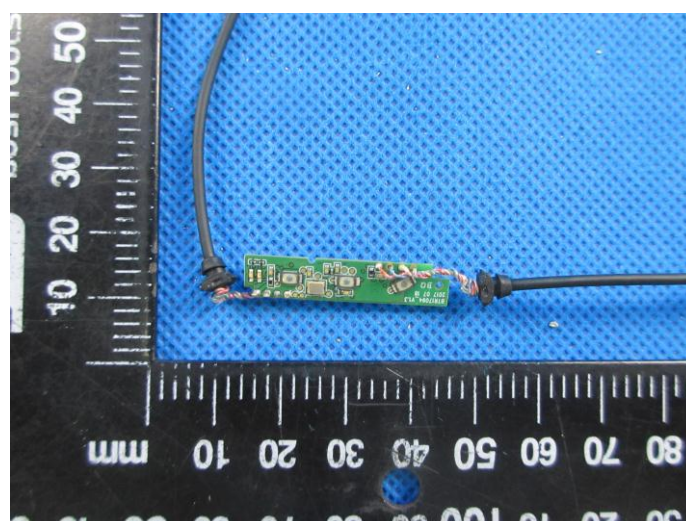
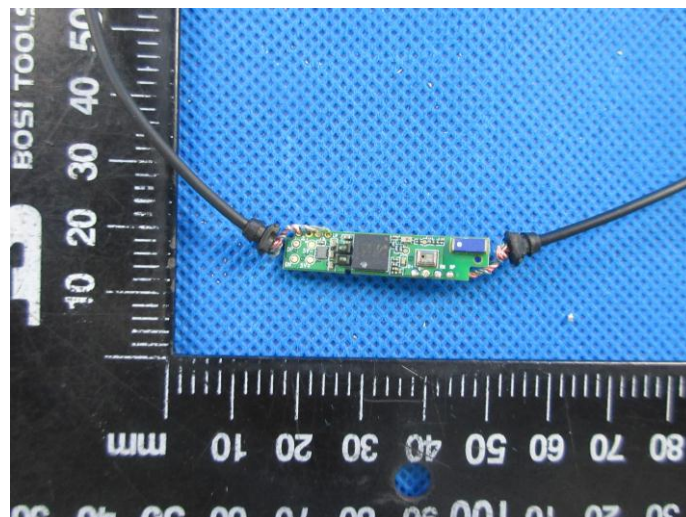
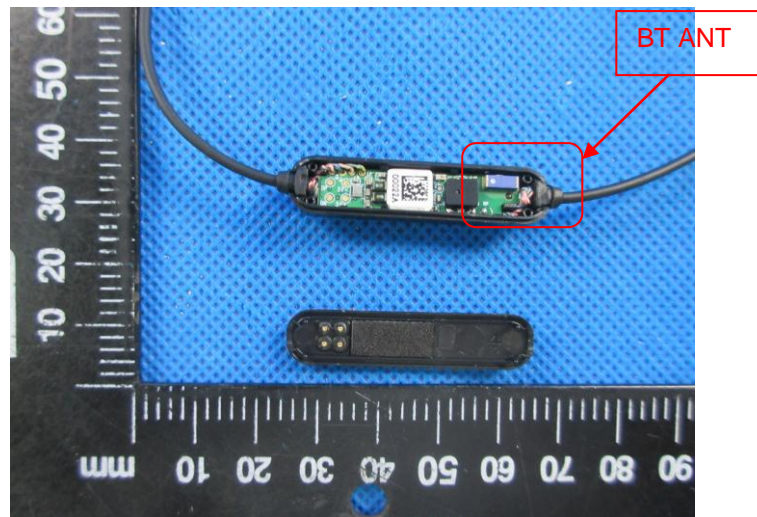
7. External and Internal Photos of the EUT

External Photos of the EUT





Internal Photos of the EUT



-----End of Report-----