

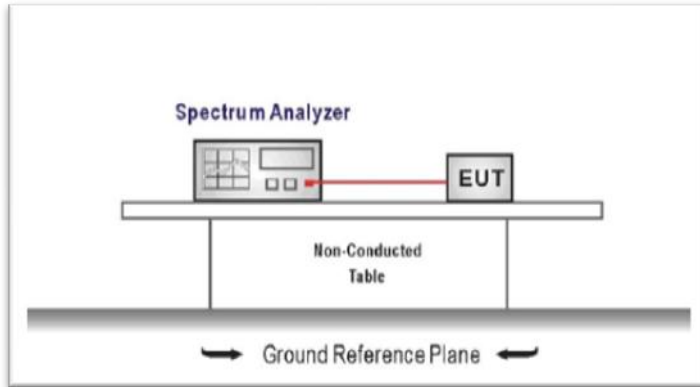
5.10. Bandedge and Spurious Emission (conducted)

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

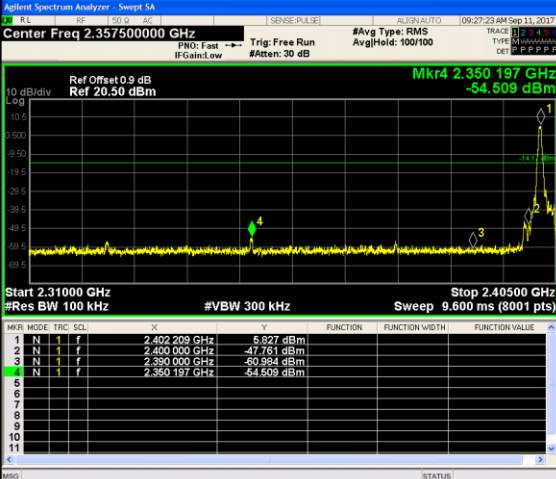
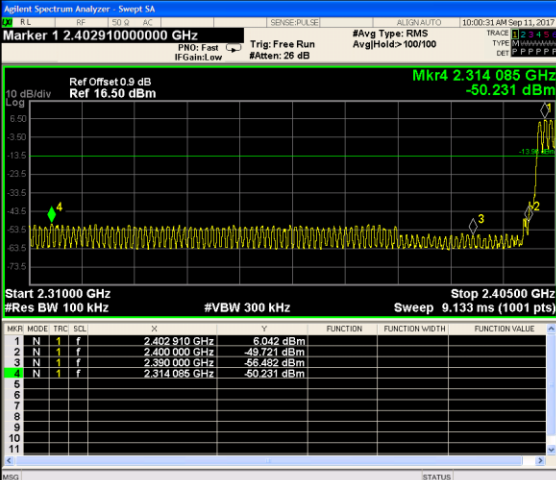
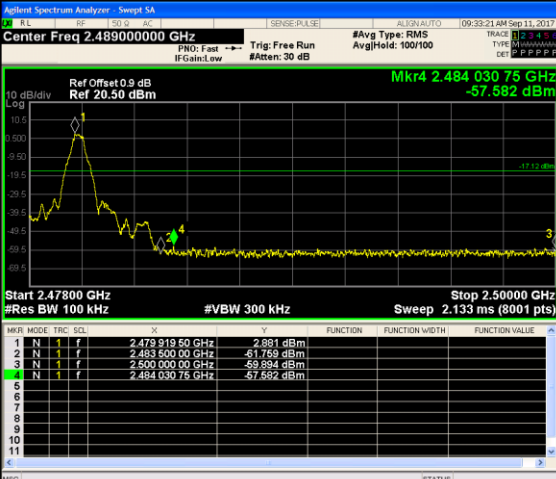
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
RBW = 100 kHz, VBW \geq 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

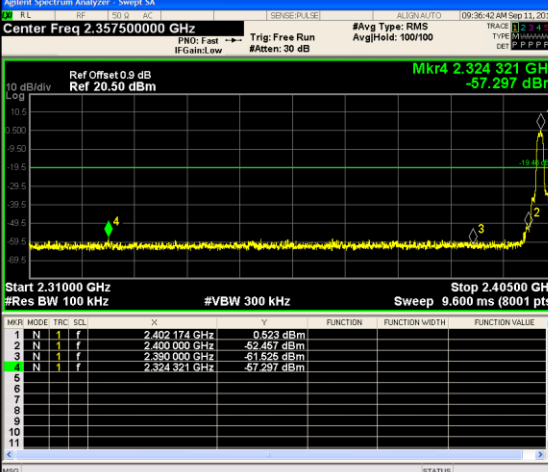
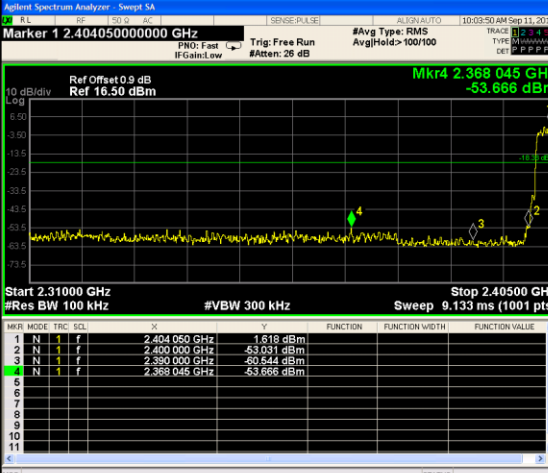
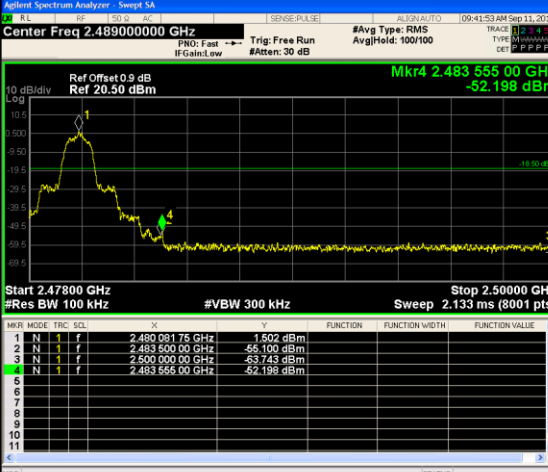
TEST RESULTS

Passed Not Applicable

Test Item:	Band edge	Modulation type:	GFSK
<p>CH00 No hopping mode</p>		<p>Center Freq 2.357500000 GHz</p> <p>Start Freq 2.310000000 GHz</p> <p>Stop Freq 2.405000000 GHz</p> <p>CF Step 9.500000 MHz</p> <p>Freq Offset 0 Hz</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.357500000 GHz</p> <p>Start Freq 2.310000000 GHz</p> <p>Stop Freq 2.405000000 GHz</p> <p>CF Step 9.500000 MHz</p> <p>Freq Offset 0 Hz</p>
<p>CH00 Hopping mode</p>		<p>Marker 1 2.402910000000 GHz</p> <p>Mkr4 2.314085 GHz</p> <p>Start 2.310000 GHz</p> <p>Stop 2.405000 GHz</p>	<p>Peak Search</p> <p>Next Peak</p> <p>Next Pk Right</p> <p>Next Pk Left</p> <p>Marker Delta</p> <p>Mkr--CF</p> <p>Mkr--Ref Lvl</p> <p>More 1 of 2</p>
<p>CH78 No hopping mode</p>		<p>Center Freq 2.489000000 GHz</p> <p>Mkr4 2.48403075 GHz</p> <p>Start 2.478000 GHz</p> <p>Stop 2.500000 GHz</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.489000000 GHz</p> <p>Start Freq 2.478000000 GHz</p> <p>Stop Freq 2.500000000 GHz</p> <p>CF Step 2.200000 MHz</p> <p>Freq Offset 0 Hz</p>

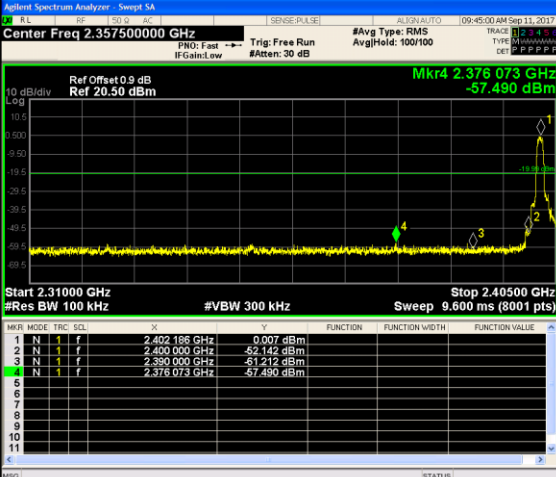
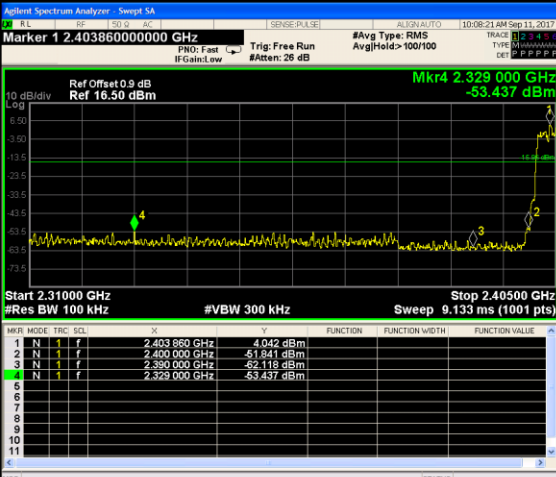
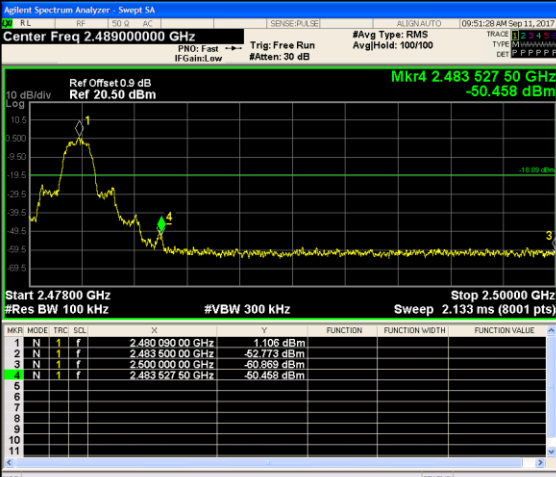
CH78
Hopping mode



Test Item:	Band edge	Modulation type:	$\pi/4$ DQPSK
<p>CH00</p> <p>No hopping mode</p>		<p>Center Freq 2.357500000 GHz</p> <p>Start Freq 2.310000000 GHz</p> <p>Stop Freq 2.405000000 GHz</p> <p>CF Step 9.500000 MHz</p> <p>Freq Offset 0 Hz</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.357500000 GHz</p> <p>Start Freq 2.310000000 GHz</p> <p>Stop Freq 2.405000000 GHz</p> <p>CF Step 9.500000 MHz</p> <p>Freq Offset 0 Hz</p>
<p>CH00</p> <p>Hopping mode</p>		<p>Marker 1 2.404050000 GHz</p> <p>Start 2.31000 GHz</p> <p>Stop 2.40500 GHz</p>	<p>Peak Search</p> <p>Next Peak</p> <p>Next Pk Right</p> <p>Next Pk Left</p> <p>Marker Delta</p> <p>Mkr--CF</p> <p>Mkr--Ref Lvl</p> <p>More 1 of 2</p>
<p>CH78</p> <p>No hopping mode</p>		<p>Center Freq 2.489000000 GHz</p> <p>Start Freq 2.478000000 GHz</p> <p>Stop Freq 2.500000000 GHz</p> <p>CF Step 2.200000 MHz</p> <p>Freq Offset 0 Hz</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.489000000 GHz</p> <p>Start Freq 2.478000000 GHz</p> <p>Stop Freq 2.500000000 GHz</p> <p>CF Step 2.200000 MHz</p> <p>Freq Offset 0 Hz</p>

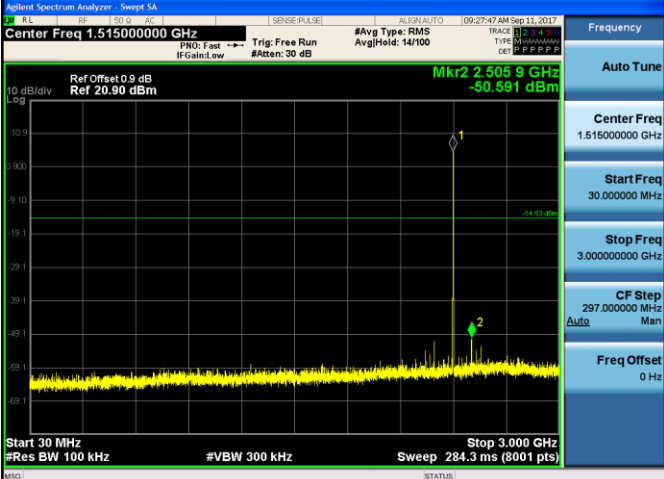
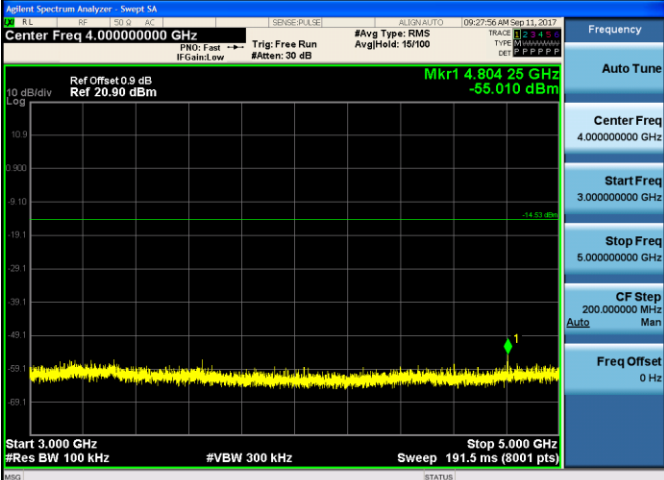
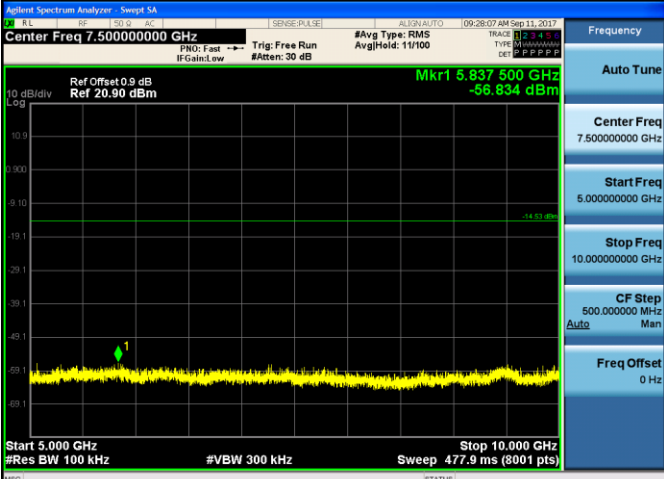
CH78
Hopping mode



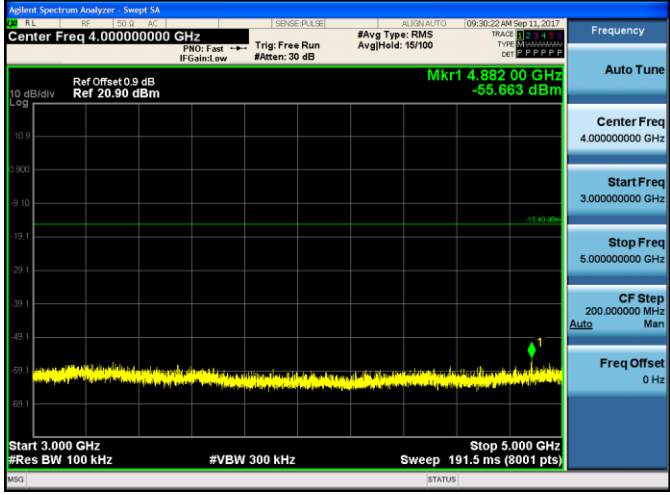
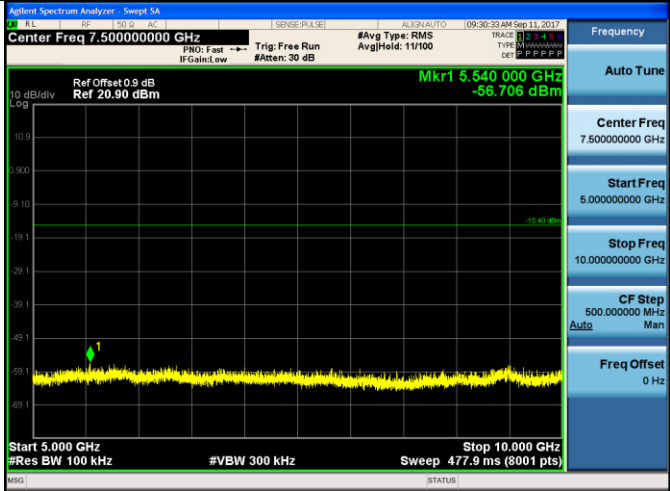
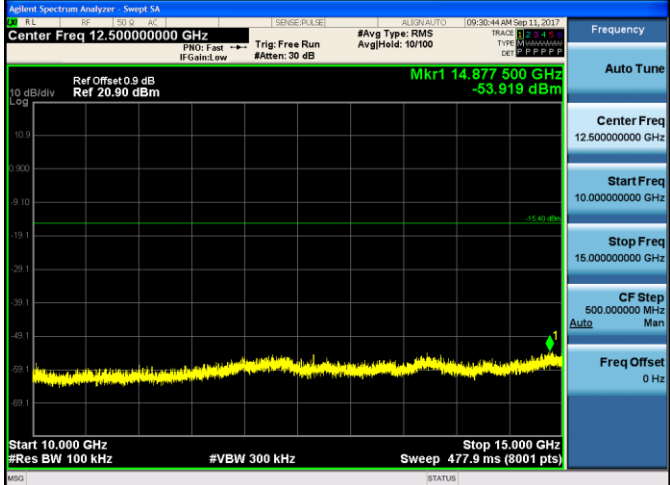
Test Item:	Band edge	Modulation type:	8DPSK
<p>CH00 No hopping mode</p>			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.357500000 GHz</p> <p>Start Freq 2.310000000 GHz</p> <p>Stop Freq 2.405000000 GHz</p> <p>CF Step 9.500000 MHz</p> <p>Freq Offset 0 Hz</p>
<p>CH00 Hopping mode</p>			<p>Peak Search</p> <p>Next Peak</p> <p>Next Pk Right</p> <p>Next Pk Left</p> <p>Marker Delta</p> <p>Mkr--CF</p> <p>Mkr--Ref Lvl</p> <p>More 1 of 2</p>
<p>CH78 No hopping mode</p>			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.489000000 GHz</p> <p>Start Freq 2.478000000 GHz</p> <p>Stop Freq 2.500000000 GHz</p> <p>CF Step 2.200000 MHz</p> <p>Freq Offset 0 Hz</p>


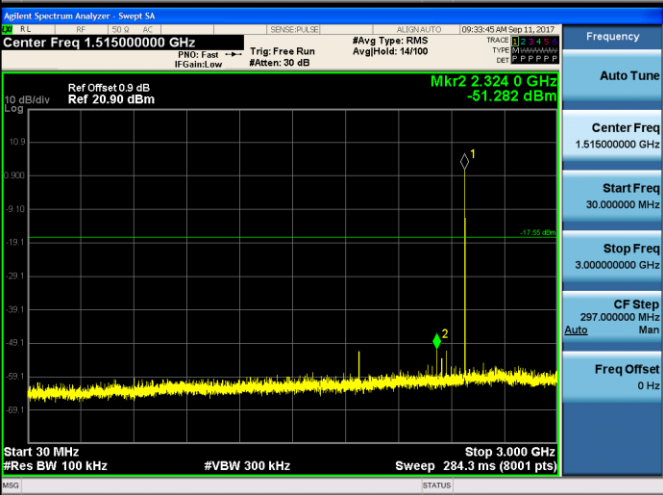
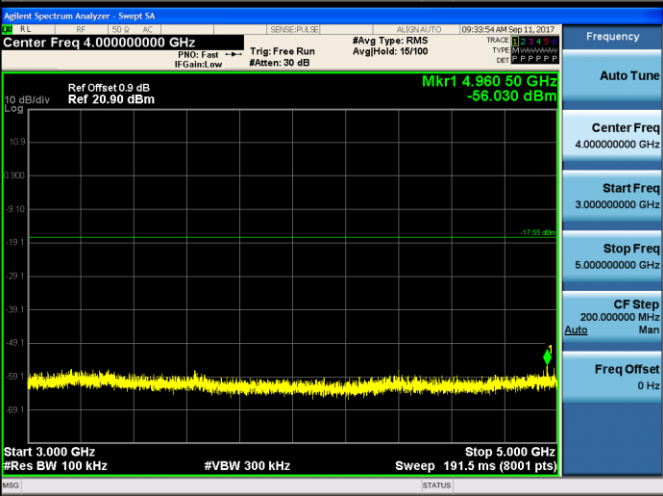
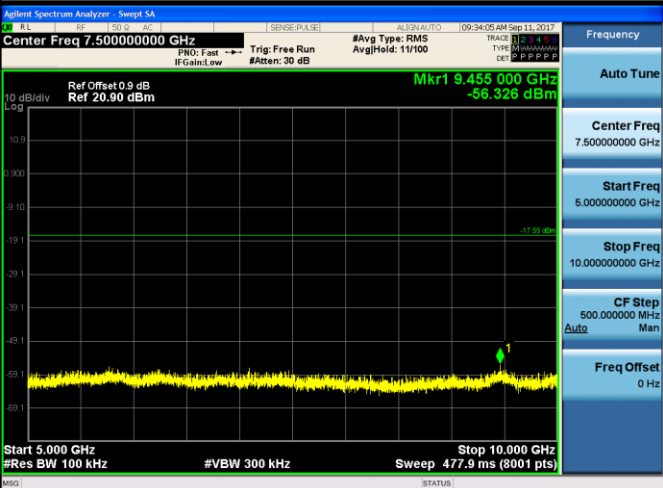
CH78
Hoppig mode

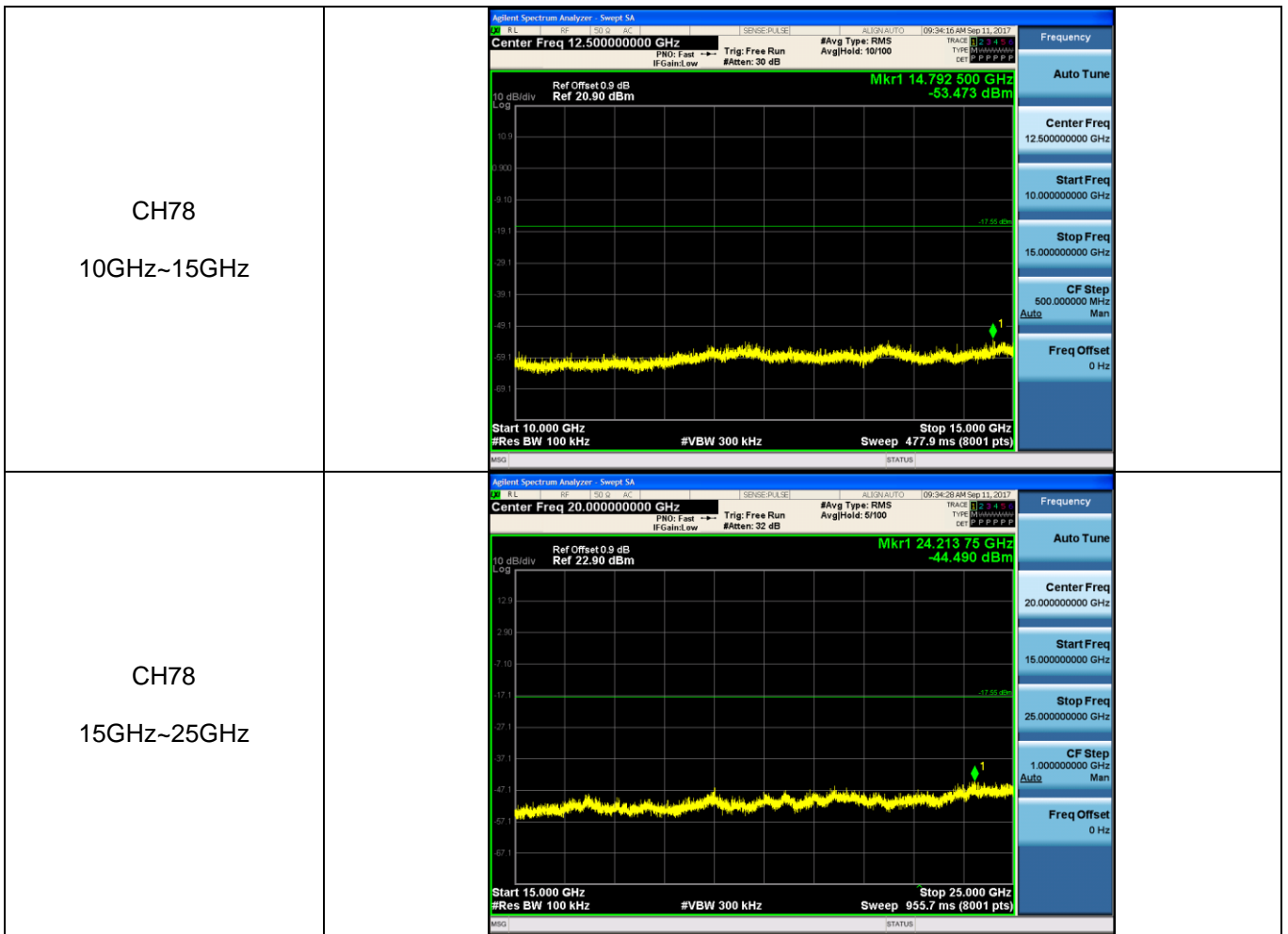


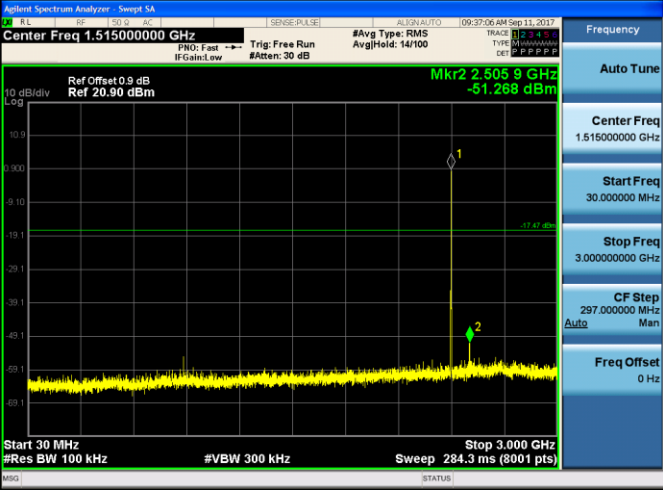
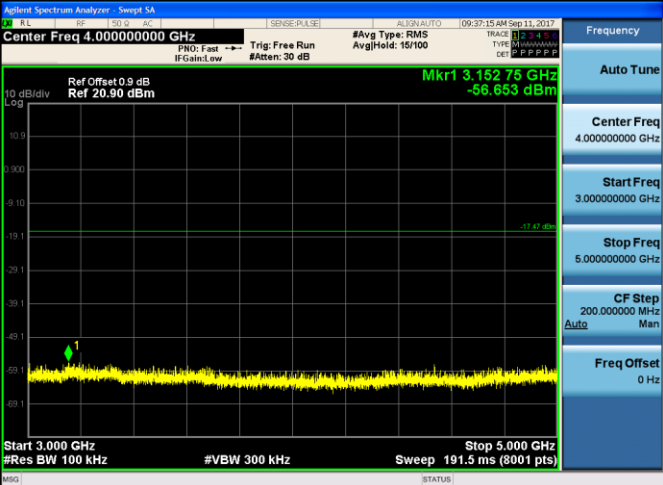
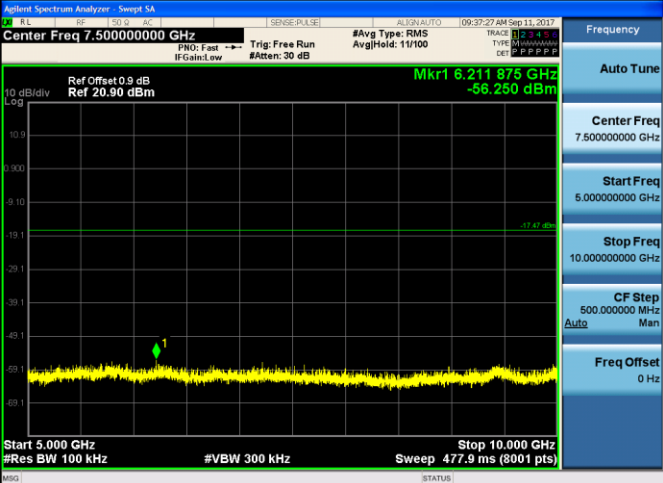
Test Item:	SE	Modulation type:	GFSK
<p>CH00 30MHz~3GHz</p>			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 1.515000000 GHz</p> <p>Start Freq 30.0000000 MHz</p> <p>Stop Freq 3.000000000 GHz</p> <p>CF Step 297.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH00 3GHz~5GHz</p>			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 4.000000000 GHz</p> <p>Start Freq 3.000000000 GHz</p> <p>Stop Freq 5.000000000 GHz</p> <p>CF Step 200.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH00 5GHz~10GHz</p>			<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 7.500000000 GHz</p> <p>Start Freq 5.000000000 GHz</p> <p>Stop Freq 10.000000000 GHz</p> <p>CF Step 500.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>

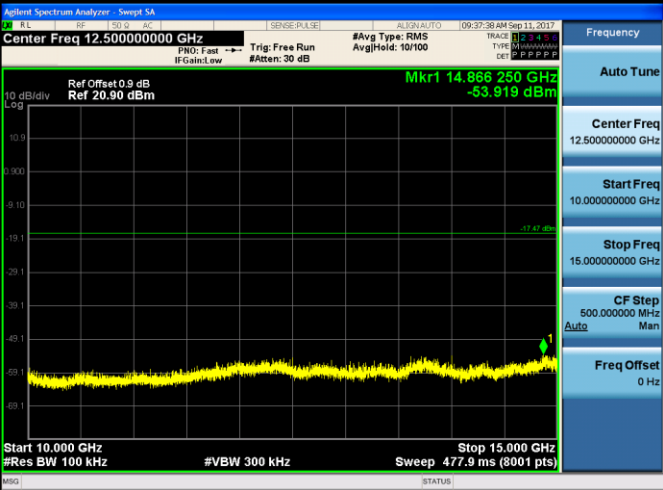

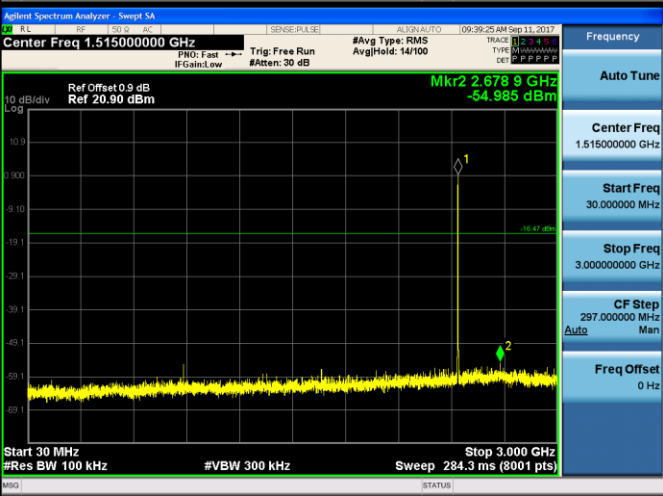
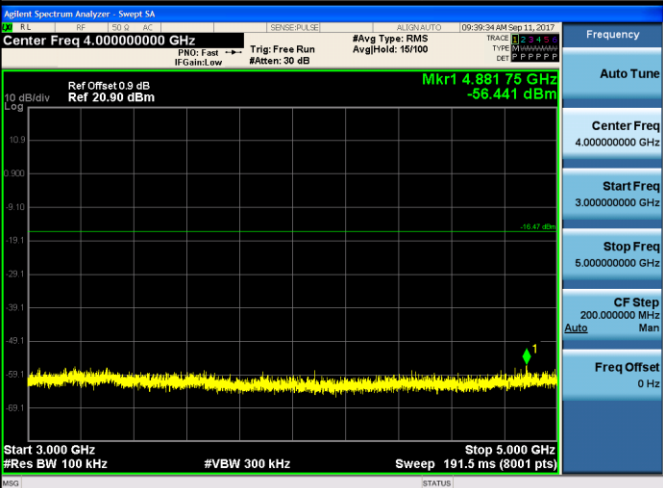
<p>CH00 10GHz~15GHz</p>	
<p>CH00 15GHz~25GHz</p>	
<p>CH39 30MHz~3GHz</p>	

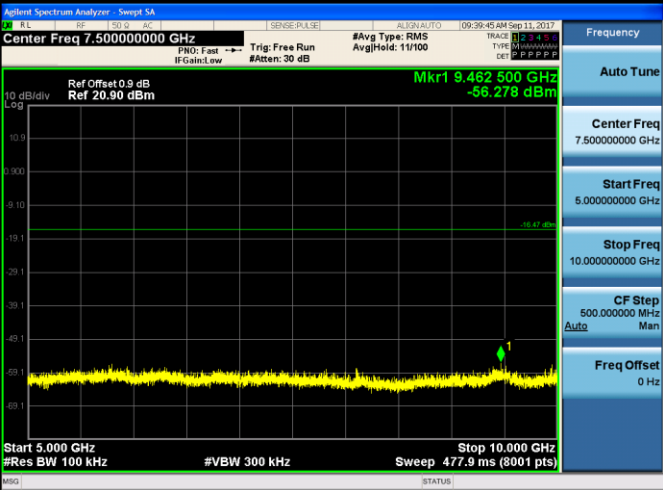
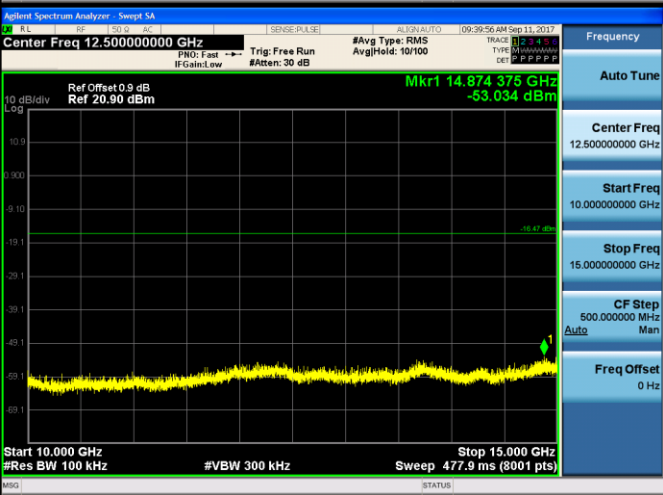

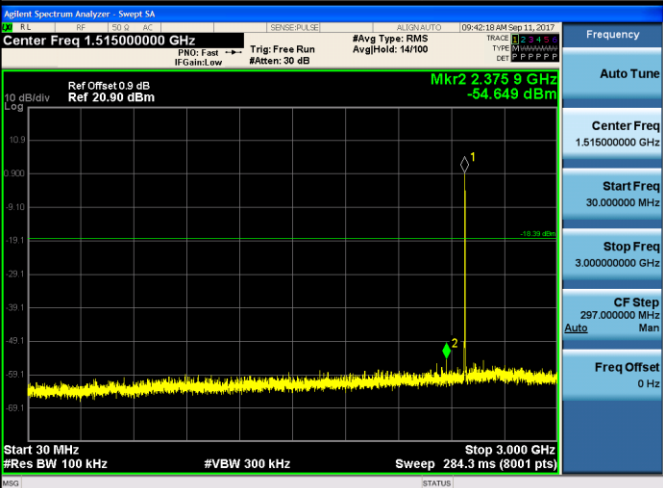
<p>CH39 3GHz~5GHz</p>	
<p>CH39 5GHz~10GHz</p>	
<p>CH39 10GHz~15GHz</p>	

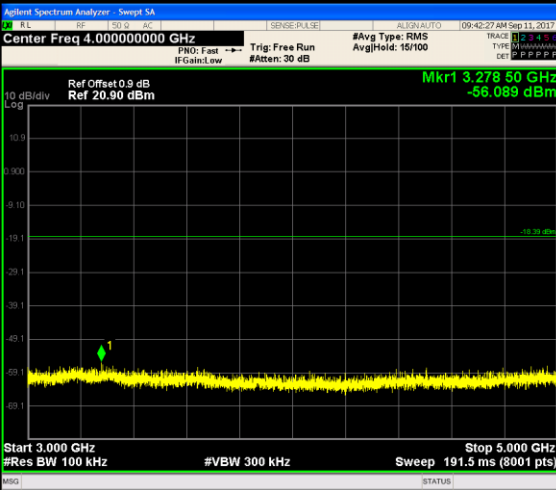
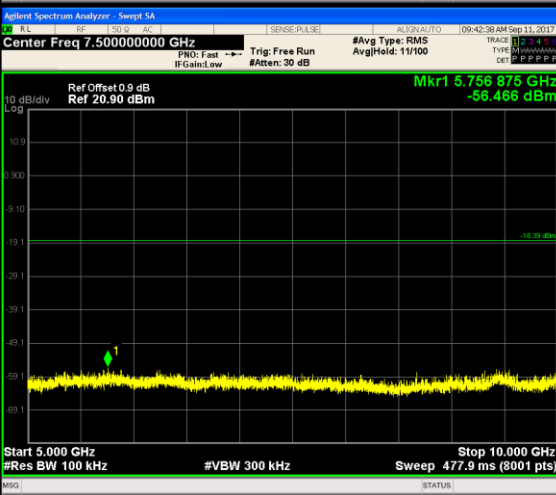
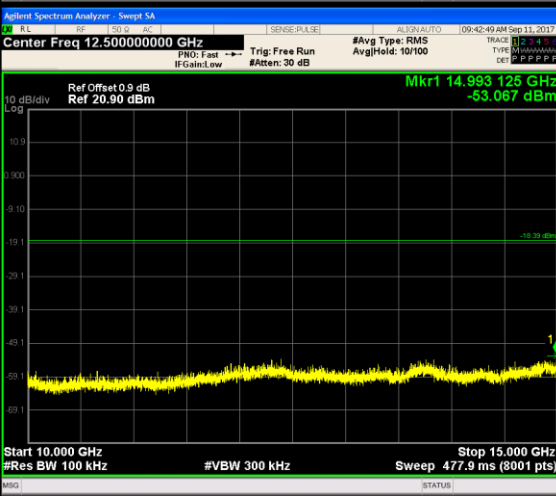
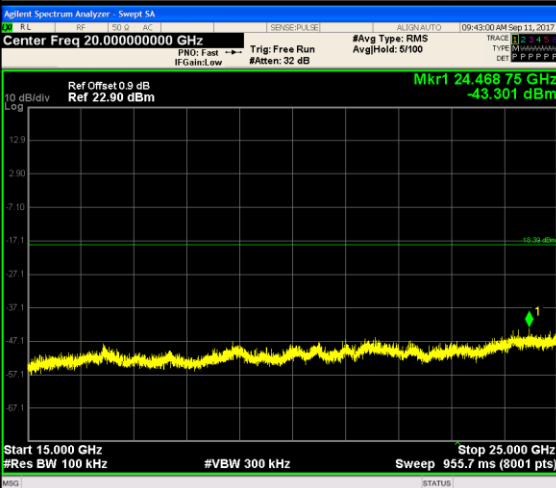
<p>CH39 15GHz~25GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 20.00000000 GHz</p> <p>Start Freq 15.00000000 GHz</p> <p>Stop Freq 25.00000000 GHz</p> <p>CF Step 1.00000000 GHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH78 30MHz~3GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 1.515000000 GHz</p> <p>Start Freq 30.000000 MHz</p> <p>Stop Freq 3.000000000 GHz</p> <p>CF Step 297.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH78 3GHz~5GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 4.000000000 GHz</p> <p>Start Freq 3.000000000 GHz</p> <p>Stop Freq 5.000000000 GHz</p> <p>CF Step 200.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH78 5GHz~10GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 7.500000000 GHz</p> <p>Start Freq 5.000000000 GHz</p> <p>Stop Freq 10.00000000 GHz</p> <p>CF Step 500.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>



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

<p>CH00 10GHz~15GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 12.50000000 GHz</p> <p>Start Freq 10.00000000 GHz</p> <p>Stop Freq 15.00000000 GHz</p> <p>CF Step 500.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH00 15GHz~25GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 20.00000000 GHz</p> <p>Start Freq 15.00000000 GHz</p> <p>Stop Freq 25.00000000 GHz</p> <p>CF Step 1.00000000 GHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH39 30MHz~3GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 1.515000000 GHz</p> <p>Start Freq 30.000000 MHz</p> <p>Stop Freq 3.000000000 GHz</p> <p>CF Step 297.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH39 3GHz~5GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 4.000000000 GHz</p> <p>Start Freq 3.000000000 GHz</p> <p>Stop Freq 5.000000000 GHz</p> <p>CF Step 200.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>

<p>CH39 5GHz~10GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 7.50000000 GHz</p> <p>Start Freq 5.00000000 GHz</p> <p>Stop Freq 10.00000000 GHz</p> <p>CF Step 500.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH39 10GHz~15GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 12.50000000 GHz</p> <p>Start Freq 10.00000000 GHz</p> <p>Stop Freq 15.00000000 GHz</p> <p>CF Step 500.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH39 15GHz~25GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 20.00000000 GHz</p> <p>Start Freq 15.00000000 GHz</p> <p>Stop Freq 25.00000000 GHz</p> <p>CF Step 1.00000000 GHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH78 30MHz~3GHz</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 1.51500000 GHz</p> <p>Start Freq 30.000000 MHz</p> <p>Stop Freq 3.00000000 GHz</p> <p>CF Step 297.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>

<p>CH78 3GHz~5GHz</p>	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 4.00000000 GHz Mkr1 3.278 50 GHz -56.089 dBm Start 3.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 191.5 ms (8001 pts)</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 4.00000000 GHz</p> <p>Start Freq 3.00000000 GHz</p> <p>Stop Freq 5.00000000 GHz</p> <p>CF Step 200.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH78 5GHz~10GHz</p>	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 7.50000000 GHz Mkr1 5.756 875 GHz -56.468 dBm Start 5.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 477.9 ms (8001 pts)</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 7.50000000 GHz</p> <p>Start Freq 5.00000000 GHz</p> <p>Stop Freq 10.00000000 GHz</p> <p>CF Step 500.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH78 10GHz~15GHz</p>	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 12.50000000 GHz Mkr1 14.993 125 GHz -53.067 dBm Start 10.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 477.9 ms (8001 pts)</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 12.50000000 GHz</p> <p>Start Freq 10.00000000 GHz</p> <p>Stop Freq 15.00000000 GHz</p> <p>CF Step 500.000000 MHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH78 15GHz~25GHz</p>	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 20.00000000 GHz Mkr1 24.468 75 GHz -43.301 dBm Start 15.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 955.7 ms (8001 pts)</p>	<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 20.00000000 GHz</p> <p>Start Freq 15.00000000 GHz</p> <p>Stop Freq 25.00000000 GHz</p> <p>CF Step 1.00000000 GHz Auto Man</p> <p>Freq Offset 0 Hz</p>

5.11. Spurious Emission (radiated)

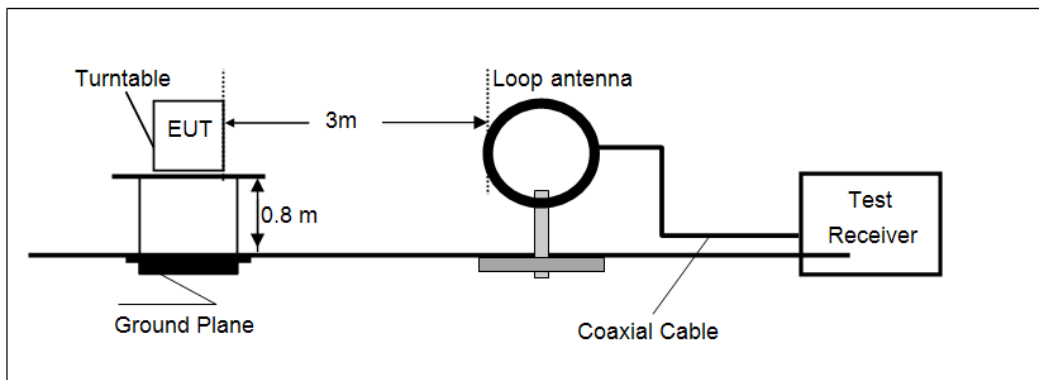
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

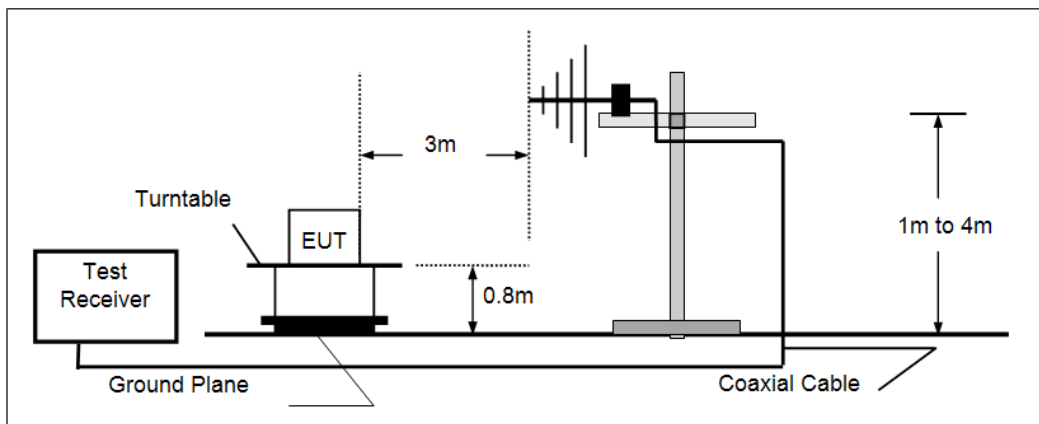
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

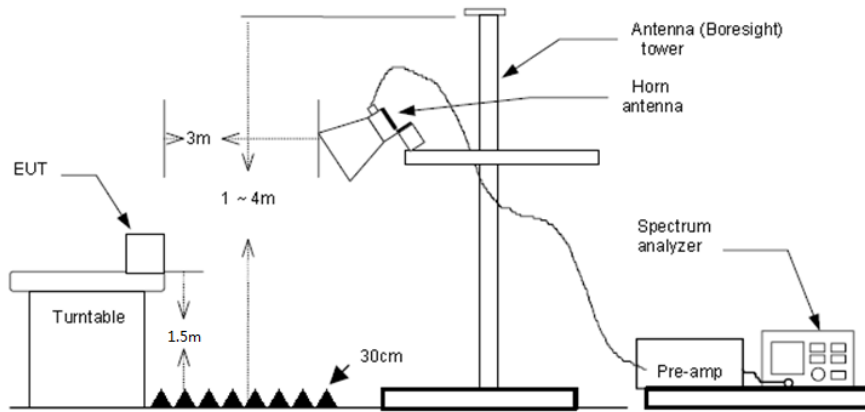
- Below 30 MHz



- 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:

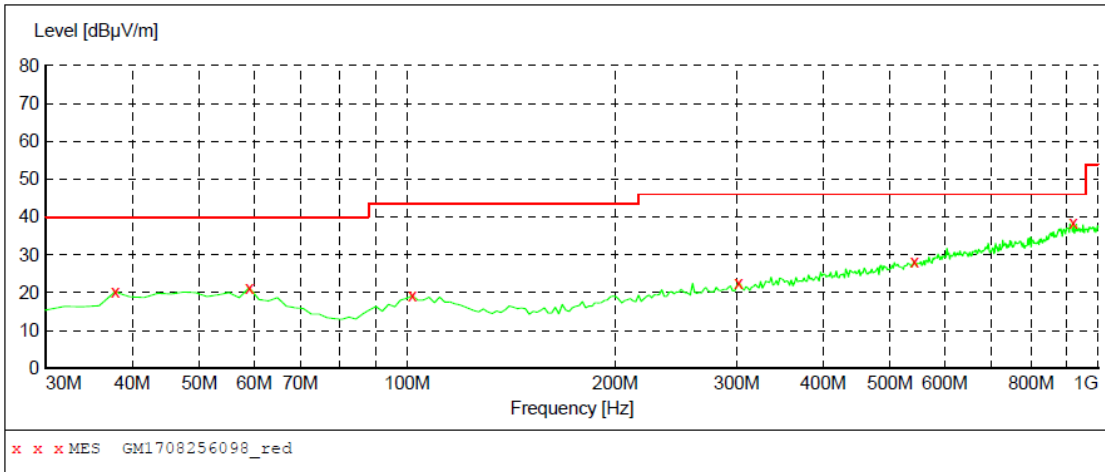
- 1) Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- 2) The emission levels of other frequencies are very lower than the limit and not show in test report.
- 3) Below 1 GHz, Have pre-scan all modulation mode, found the GFSK modulation High channel which it was 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

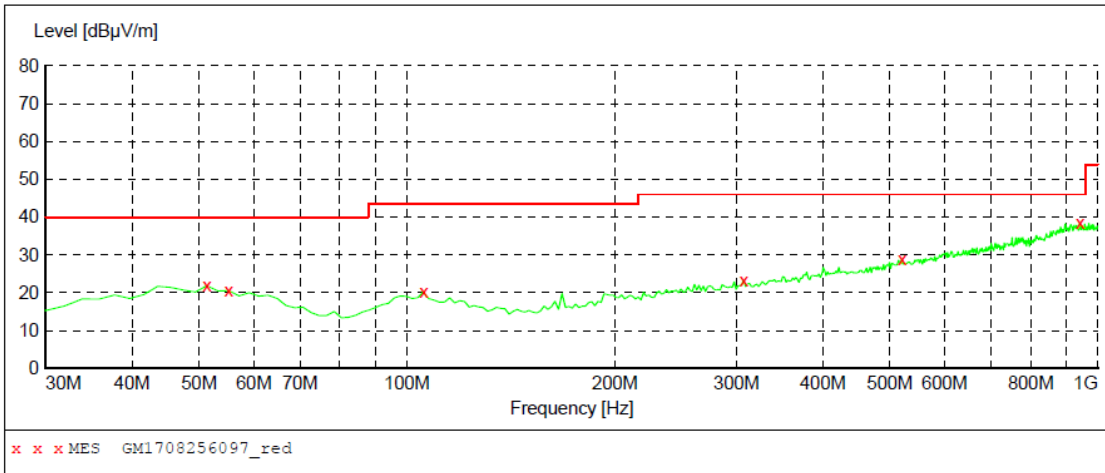


MEASUREMENT RESULT: "GM1708256098_red"

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	

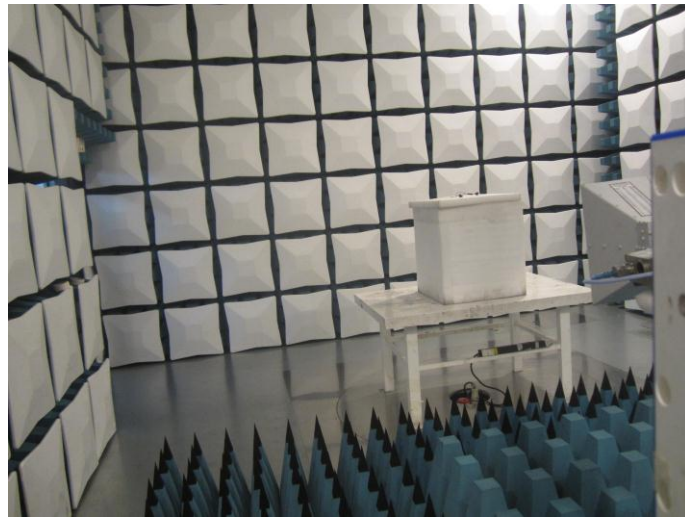
6. Test Setup Photos of the EUT

Conducted Emission (AC Mains)



Radiated Emission





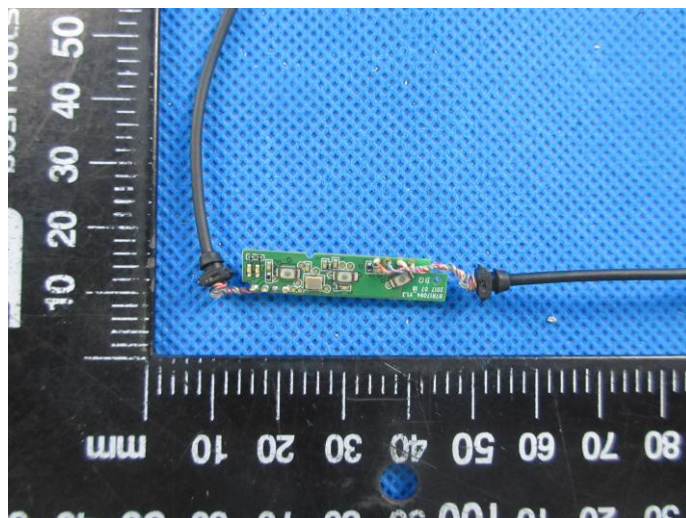
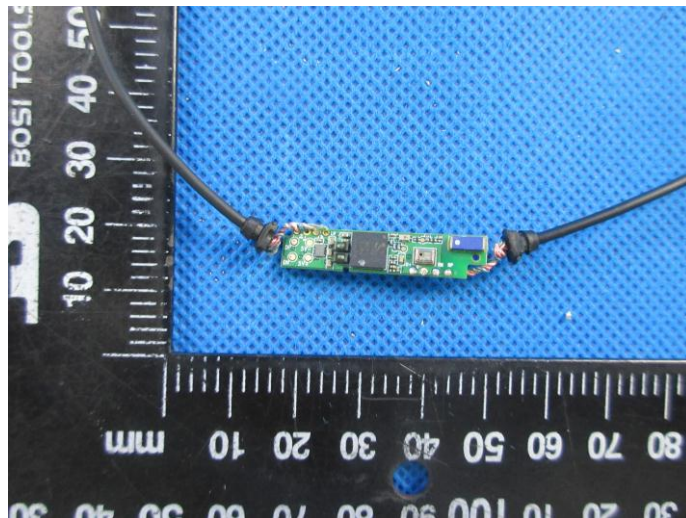
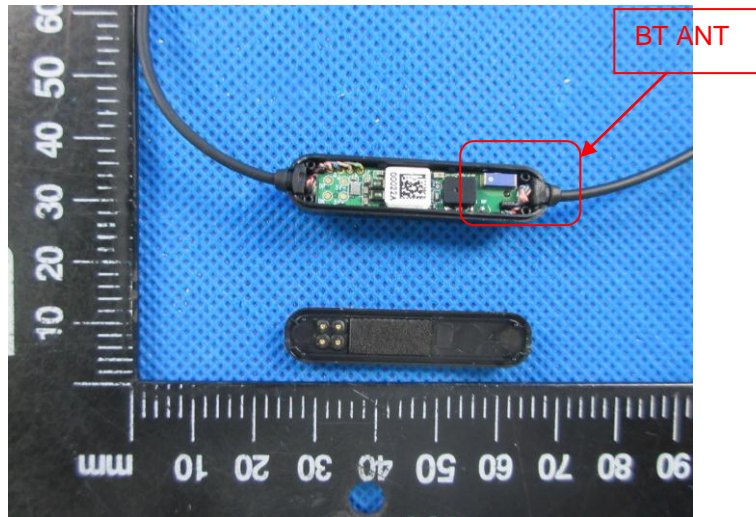
7. External and Internal Photos of the EUT

External Photos of the EUT





Internal Photos of the EUT



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