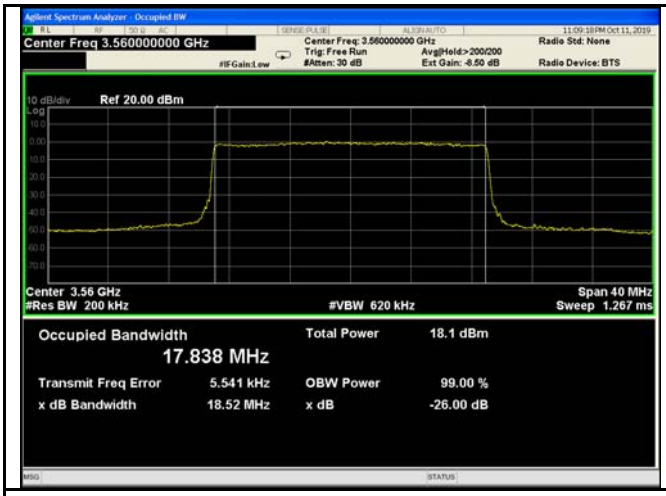
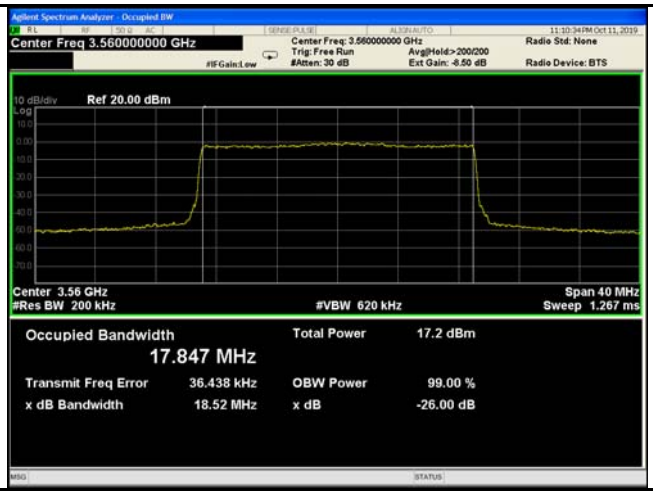
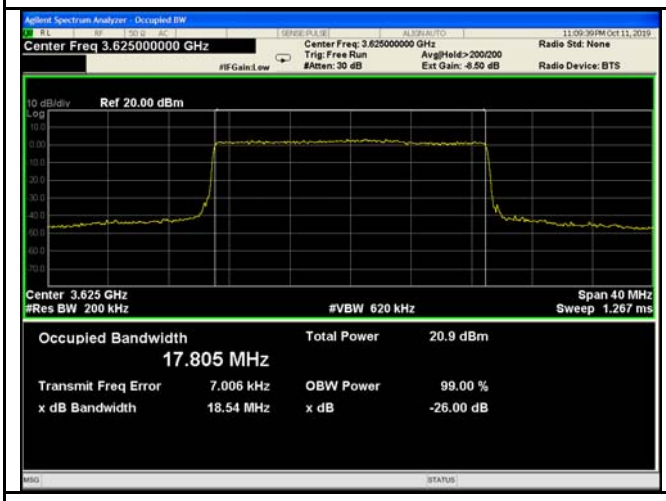


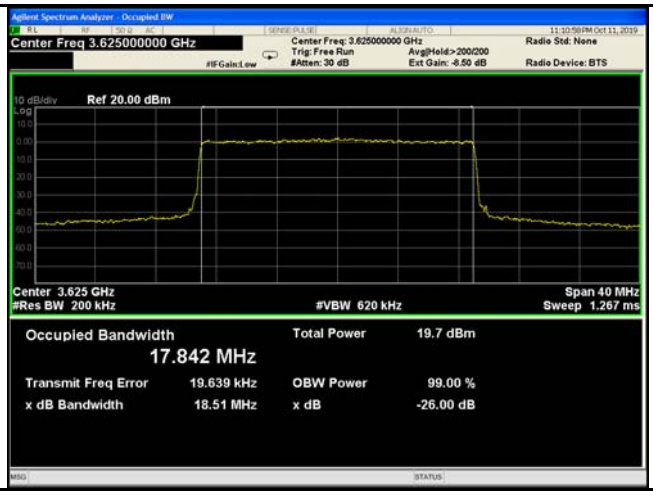
20MHz - Low CH QPSK



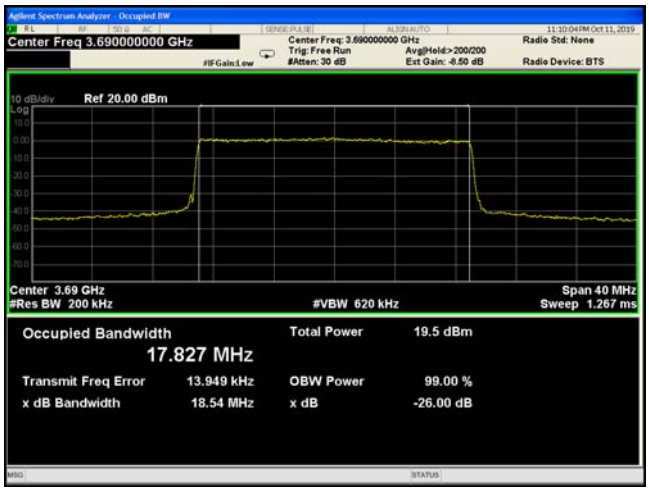
20MHz - Low CH 16QAM



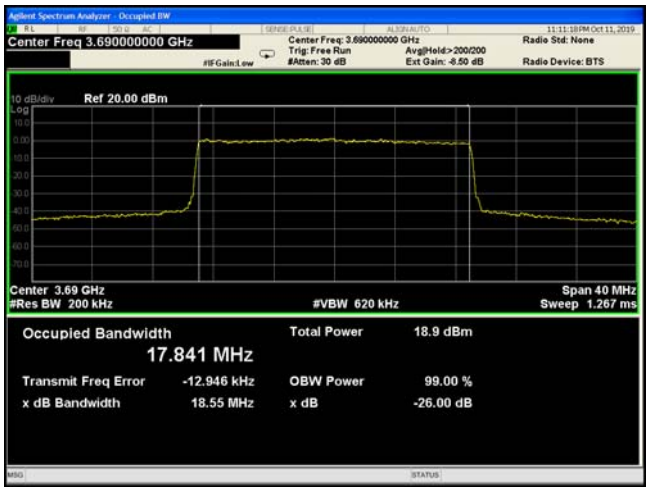
20MHz - Middle CH QPSK



20MHz - Middle CH 16QAM



20MHz - High CH QPSK



20MHz - High CH 16QAM

10 Emission outside the fundamental

Test Requirement:	FCC part 96.41(e)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	•within 0 MHz to 10 MHz above and below the assigned channel ≤ −13 dBm/MHz • greater than 10 MHz above and below the assigned channel ≤ −25 dBm/MHz • any emission below 3530 MHz and above 3720 MHz ≤ −40 dBm/MHz

10.1 EUT Operation

Operating Environment :

Temperature:	22.7 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	102.3kPa

10.2 Test Procedure

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. Measurements must be performed for low, mid, and high channels.
3. RBW=1% of fundamental for measurements within 1 MHz immediately outside the authorized channel; and 1 MHz for beyond 1 MHz outside the authorized channel. (eg. For 5MHz, RBW=51KHz within 1 MHz immediately outside the authorized channel)
4. Trace average at least 100 traces

10.3 Test Result

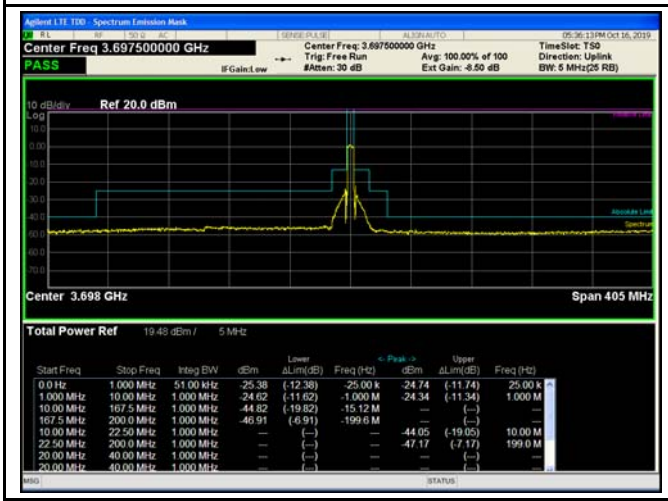
Test Plots

5MHz - Low CH QPSK- Chain 0

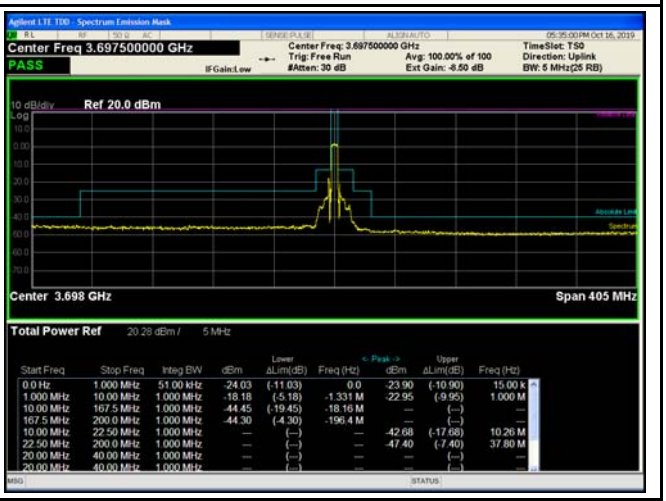
5MHz - Low CH QPSK - Chain 1

5MHz - Middle CH QPSK- Chain 0

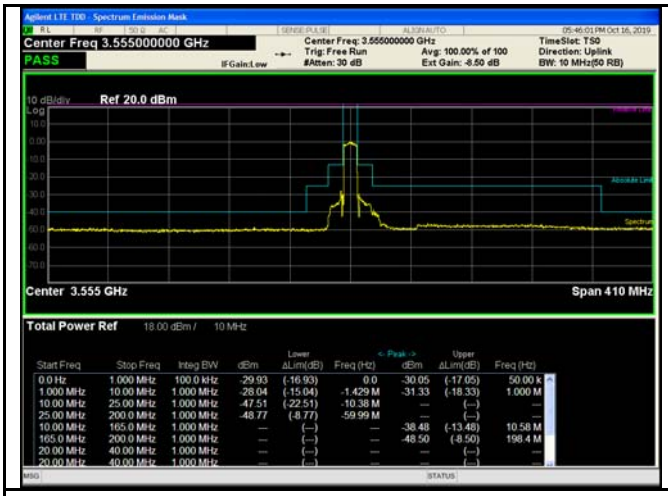
5MHz - Middle CH QPSK - Chain 1



5MHz - High CH QPSK- Chain 0



5MHz - High CH QPSK - Chain 1

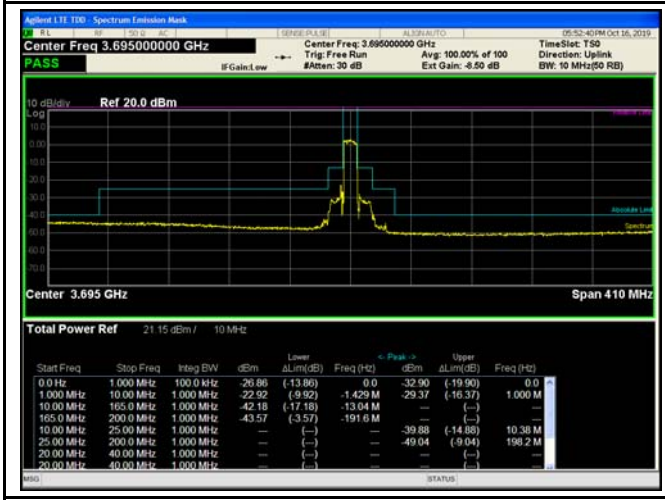


10MHz - Low CH QPSK- Chain 0

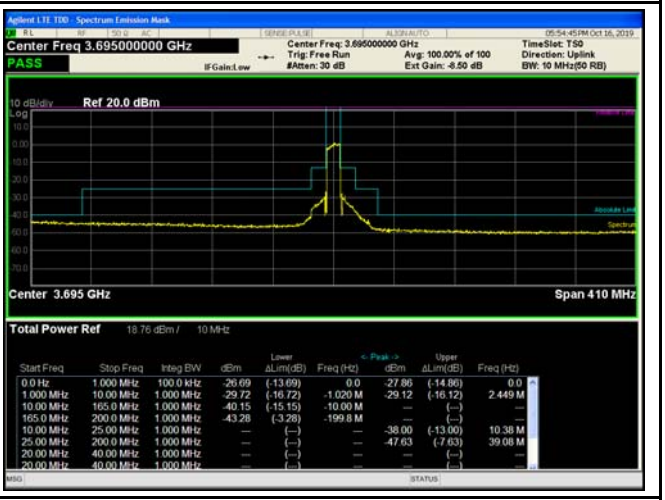
10MHz - Low CH QPSK - Chain 1

10MHz - Middle CH QPSK- Chain 0

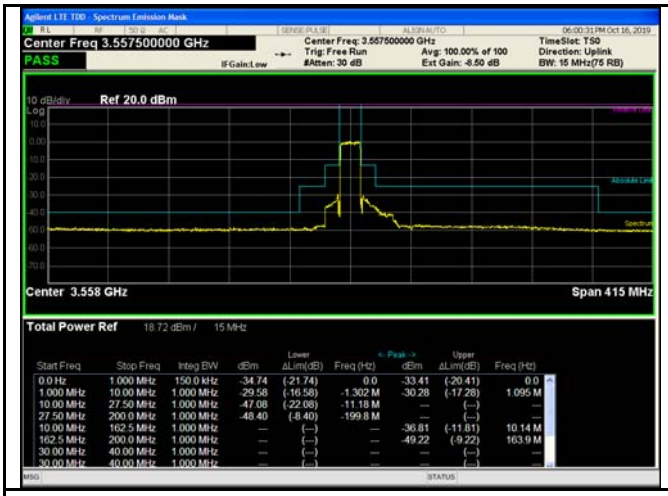
10MHz - Middle CH QPSK - Chain 1



10MHz - High CH QPSK- Chain 0



10MHz - High CH QPSK - Chain 1

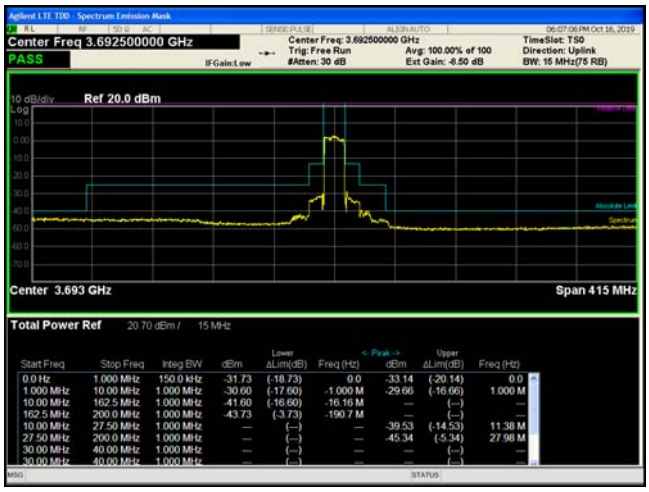


15MHz - Low CH QPSK- Chain 0

15MHz - Low CH QPSK - Chain 1

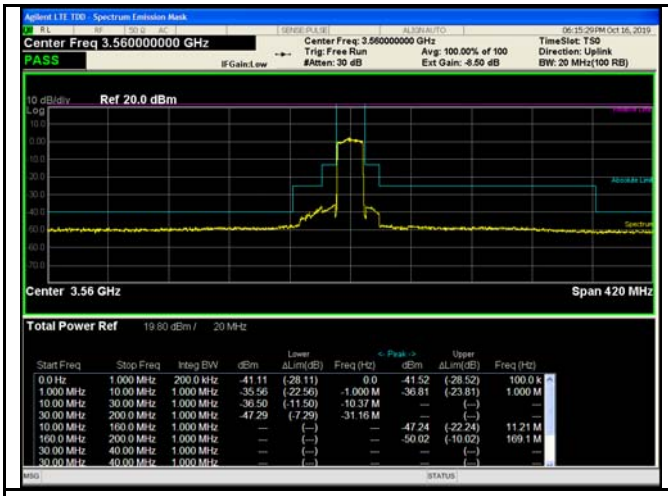
15MHz - Middle CH QPSK- Chain 0

15MHz - Middle CH QPSK - Chain 1



15MHz - High CH QPSK- Chain 0

15MHz - High CH QPSK - Chain 1



20MHz - Low CH QPSK- Chain 0

20MHz - Low CH QPSK - Chain 1

20MHz - Middle CH QPSK- Chain 0

20MHz - Middle CH QPSK - Chain 1

20MHz - High CH QPSK- Chain 0

20MHz - High CH QPSK - Chain 1

11 Out of band emission at antenna terminals

Test Requirement:	FCC part 96.41(e)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	below 3530 MHz and above 3720 MHz ≤ -40dBm

11.1 EUT Operation

Operating Environment :

Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.3kPa

11.2 Test Procedure

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was 1MHz; sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

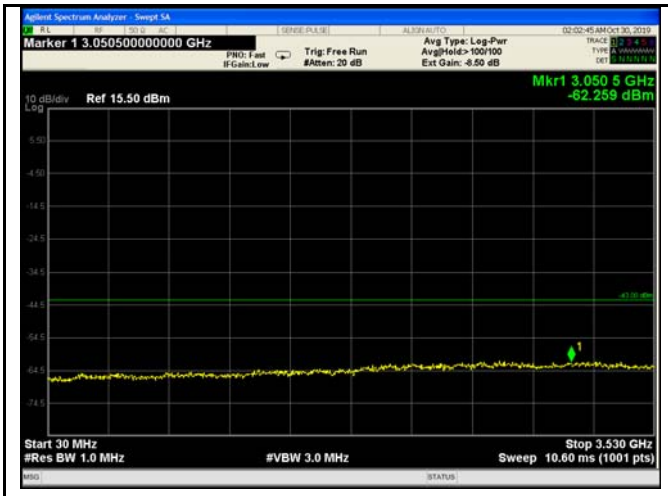
11.3 Test Result

Remark: During the test, pre-scan the QPSK, 16QAM modulation, and found the QPSK modulation(5MHz/10MHz/15MHz/20MHz) is the worst case.
The permit frequency range of Part 96 is from 3550-3700MHz.Notes as below:

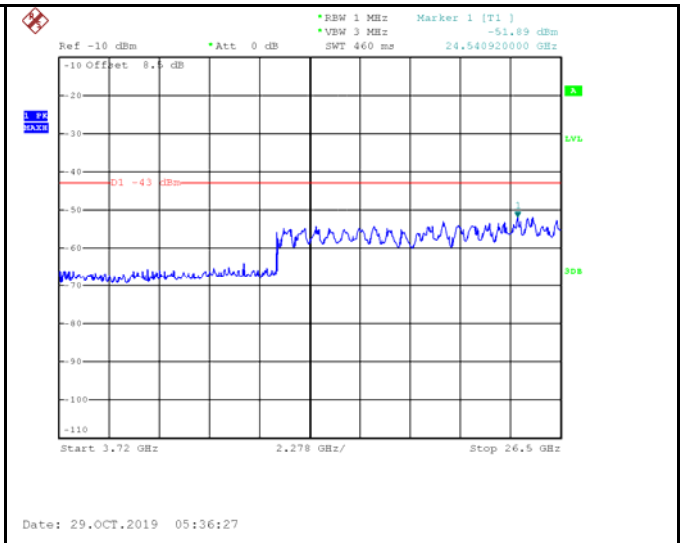
Note 1: This device can be implement MIMO function,so the limit of spurious emissions needs to be reduced by 10log($Numbers_{ANT}$) according to KDB 662911
The general limit = -40dBm
For 2x2 MIMO, the limit=-40dBm -10log2=-43dBm.

Test Plots (Worst case)

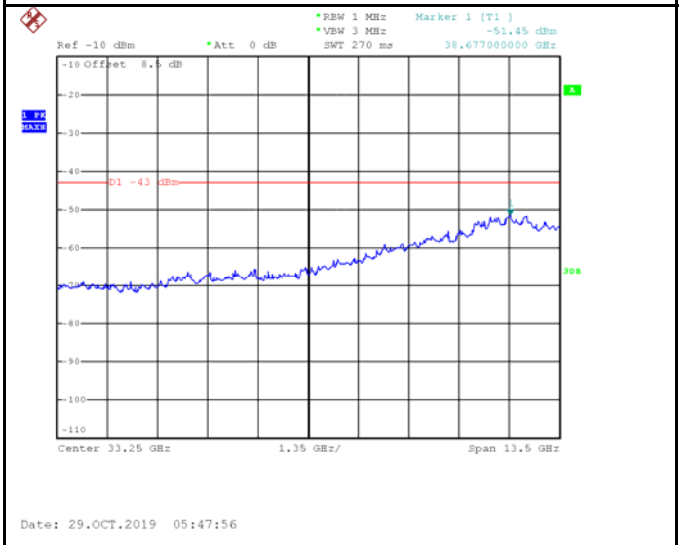
Spurious emission
Chain 0



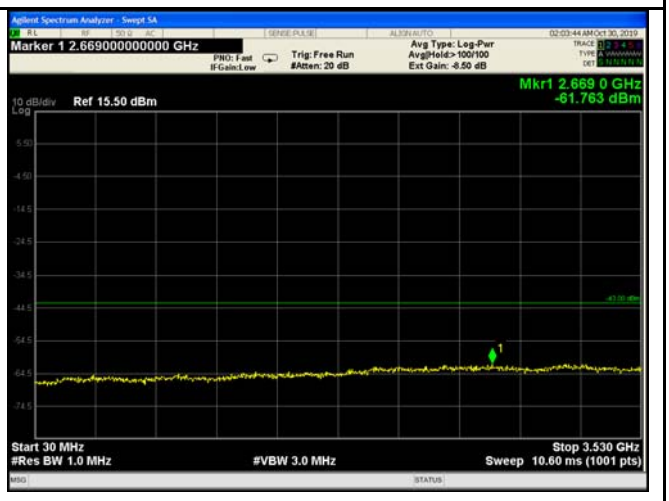
5MHz - Low CH 30MHz~3.53GHz



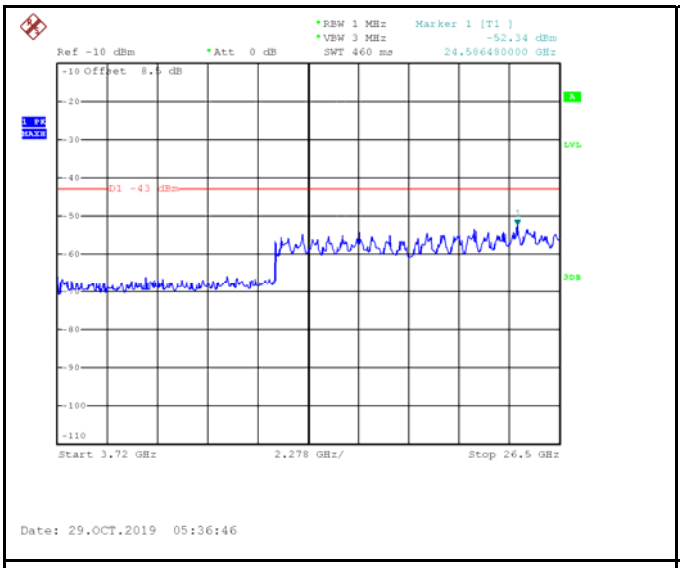
5MHz - Low CH 3.72GHz~26.5GHz



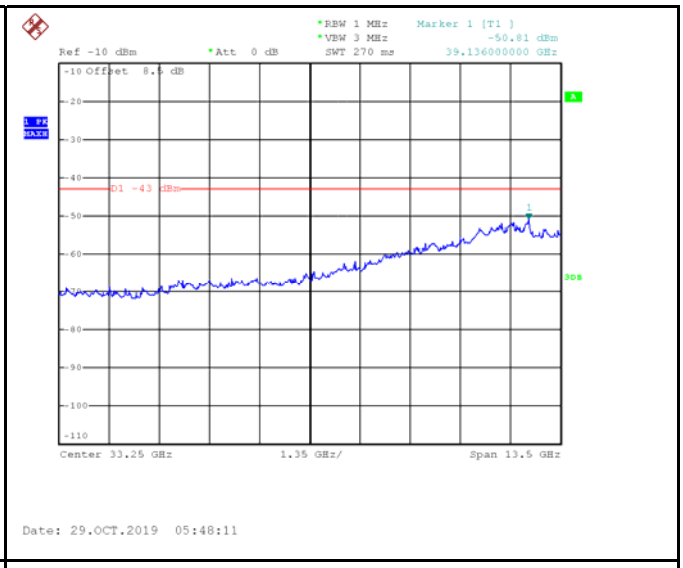
5MHz - Low CH 26.5GHz~40GHz



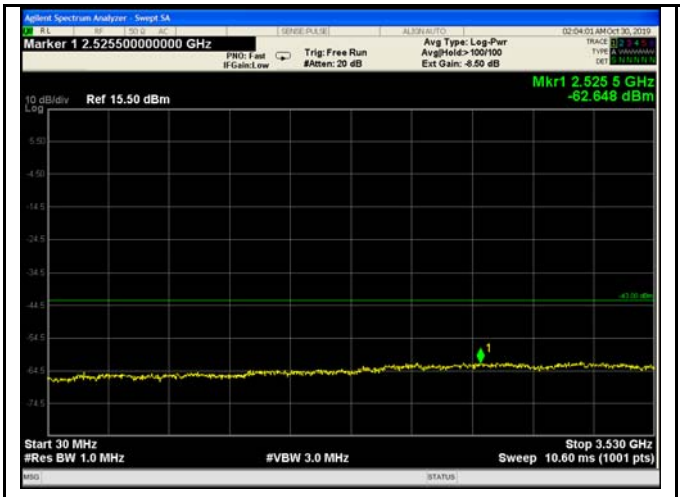
5MHz - Middle CH 30MHz~3.53GHz



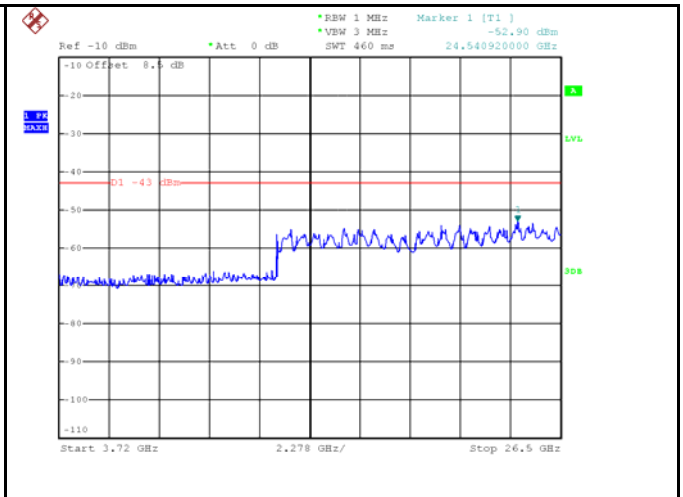
5MHz - Middle CH 3.72GHz~26.5GHz



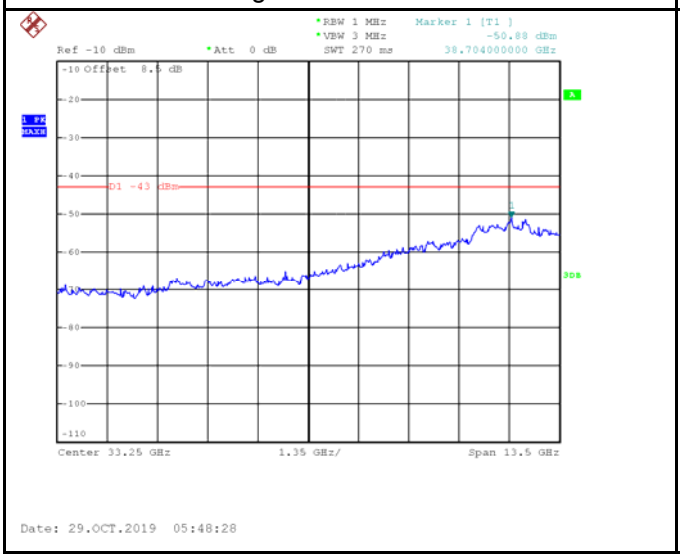
5MHz - Middle CH 26.5GHz~40GHz

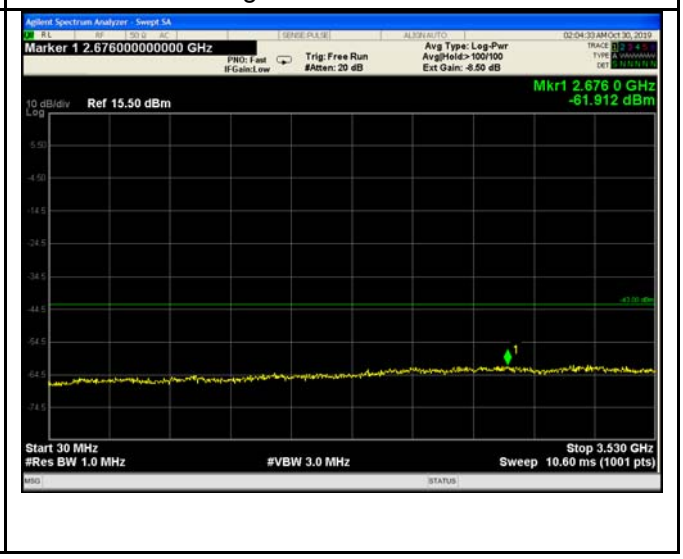


5MHz - High CH 30MHz~3.53GHz

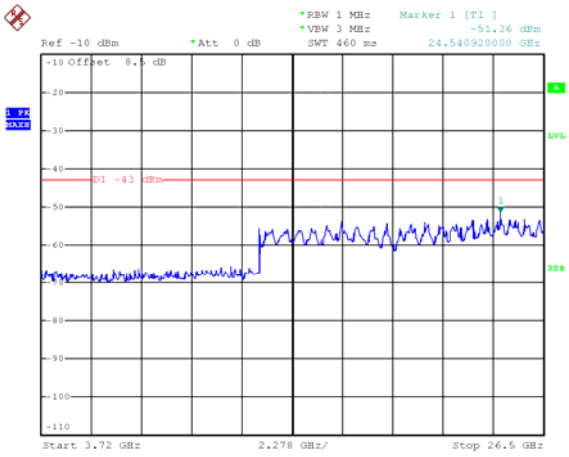


5MHz - High CH 3.72GHz~26.5GHz



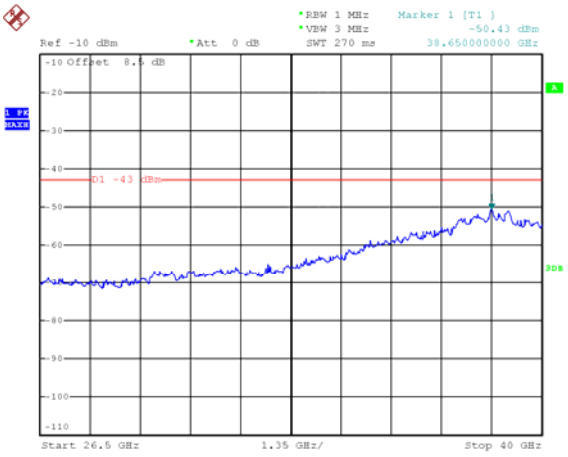


5MHz - High CH 26.5GHz~40GHz



Date: 29.OCT.2019 05:37:42

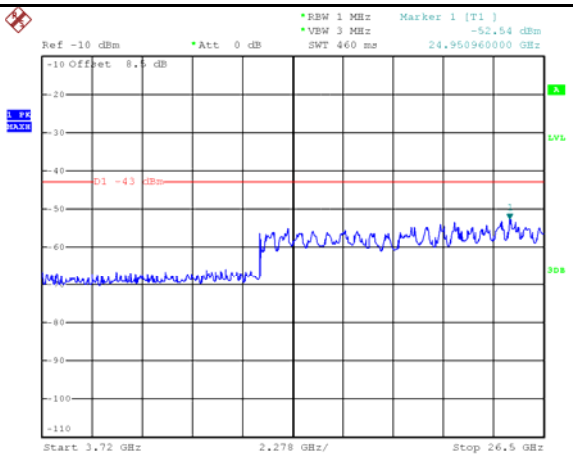
10MHz - Low CH 30MHz~3.53GHz



Date: 29.OCT.2019 05:48:43

10MHz - Low CH 3.72GHz~26.5GHz

10MHz - Low CH 26.5GHz~40GHz



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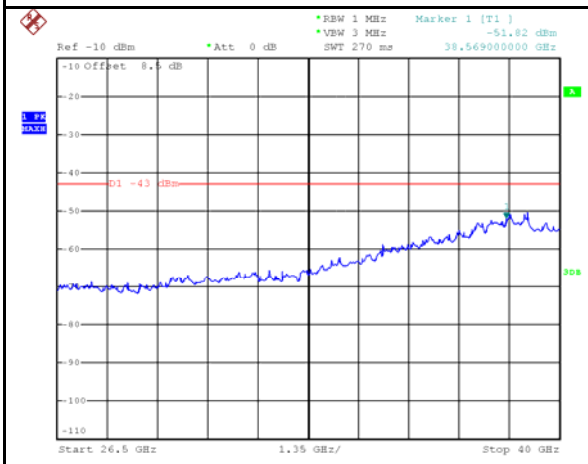
10MHz - Middle CH 30MHz~3.53GHz



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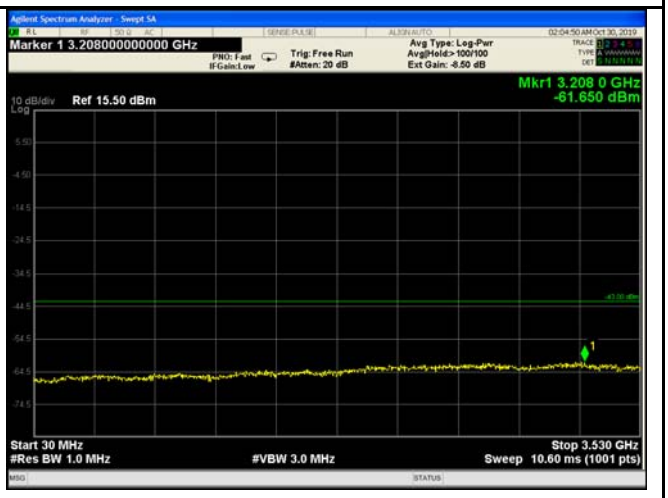
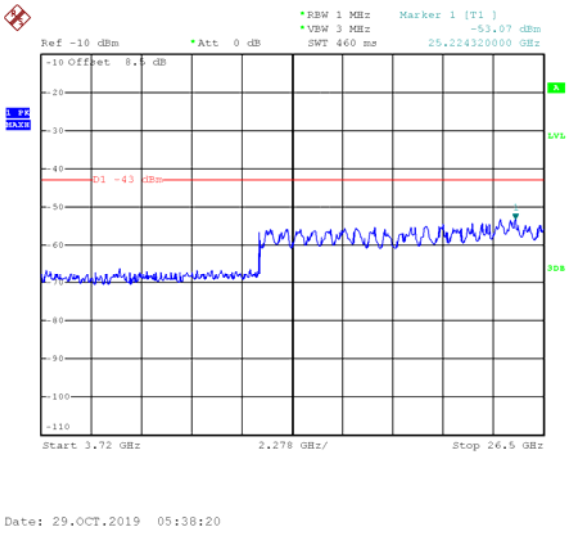
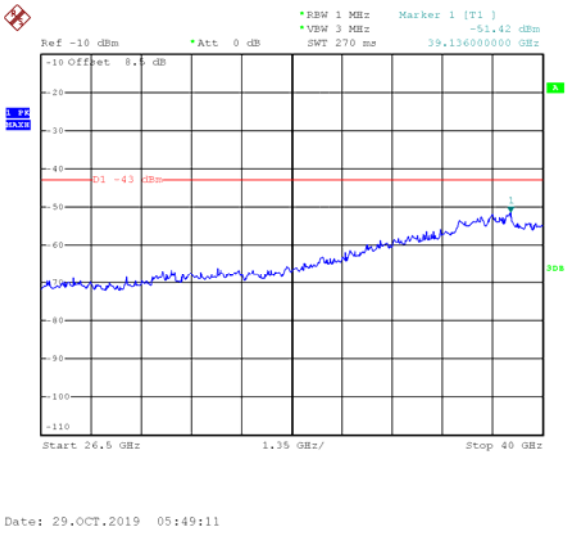
10MHz - Middle CH 3.72GHz~26.5GHz



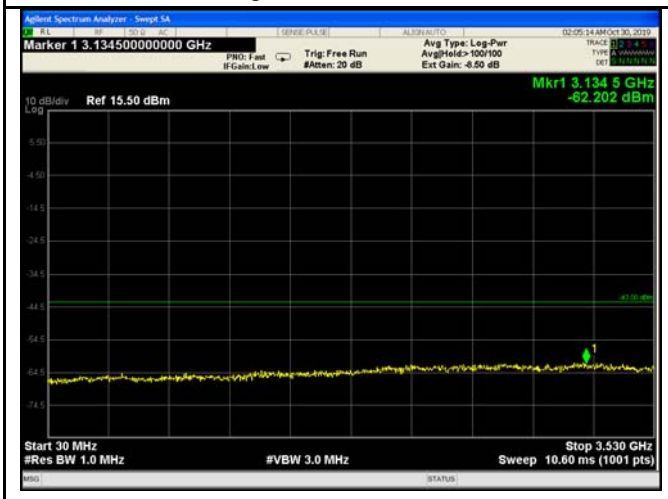
10MHz - Middle CH 26.5GHz~40GHz



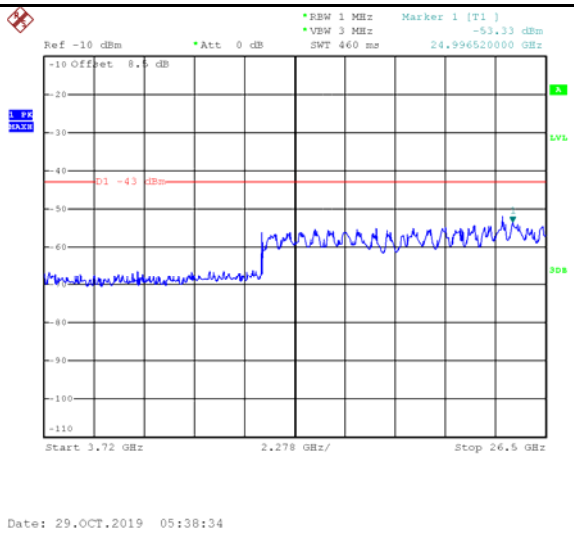
10MHz - High CH 30MHz~3.53GHz



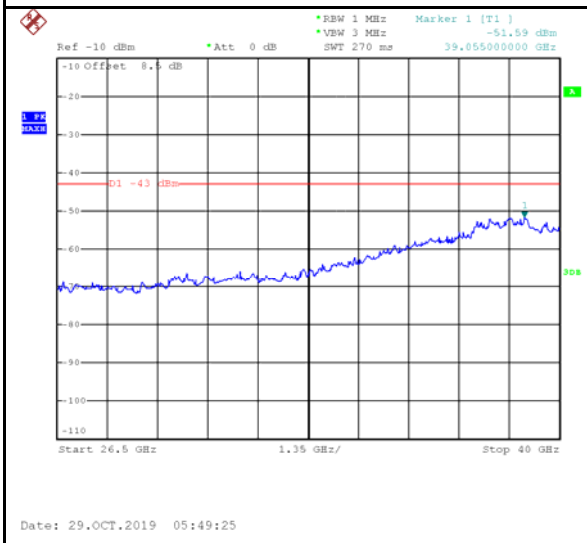
10MHz - High CH 3.72GHz~26.5GHz



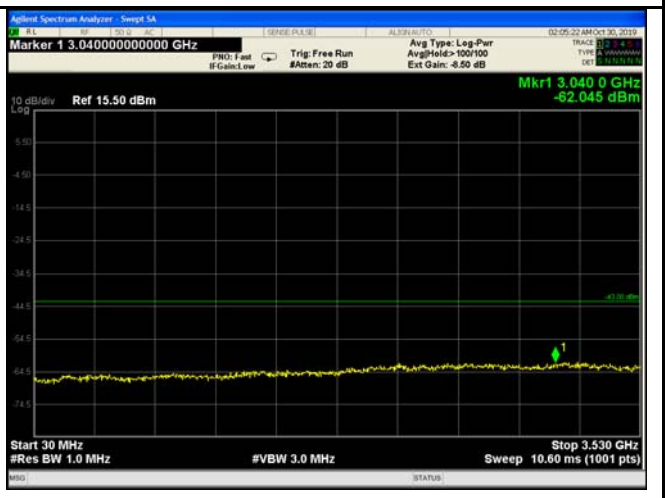
10MHz - High CH 26.5GHz~40GHz



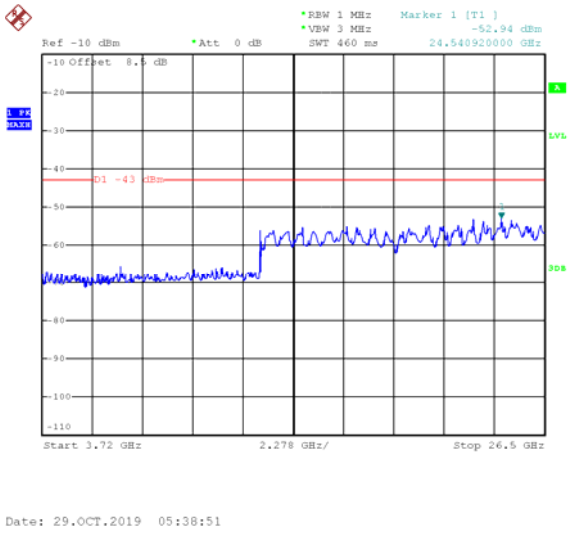
15MHz - Low CH 30MHz~3.53GHz



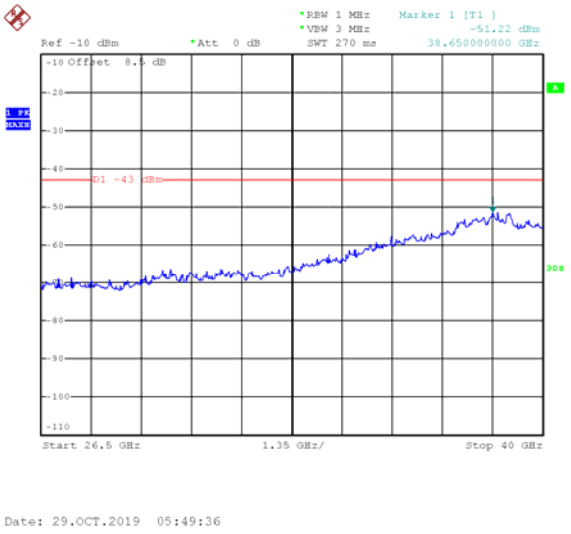
15MHz - Low CH 3.72GHz~26.5GHz



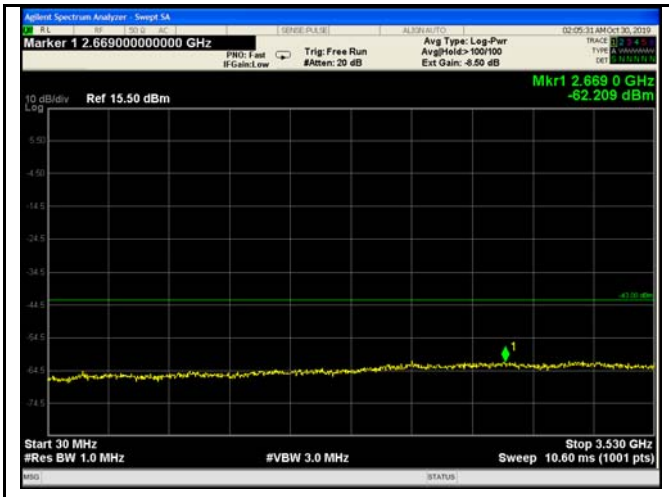
15MHz - Low CH 26.5GHz~40GHz



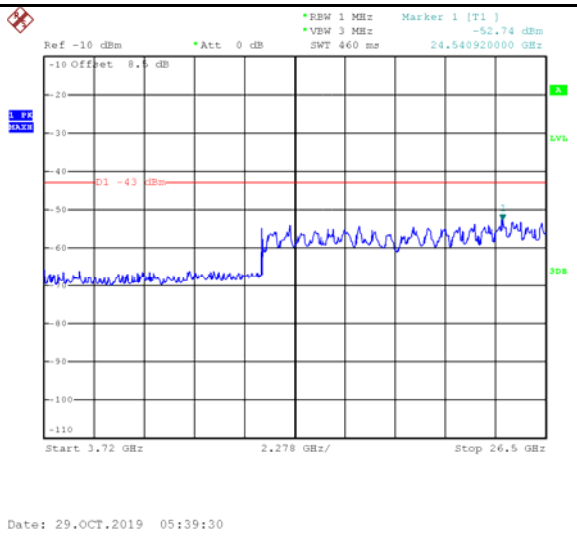
15MHz - Middle CH 30MHz~3.53GHz



15MHz - Middle CH 3.72GHz~26.5GHz

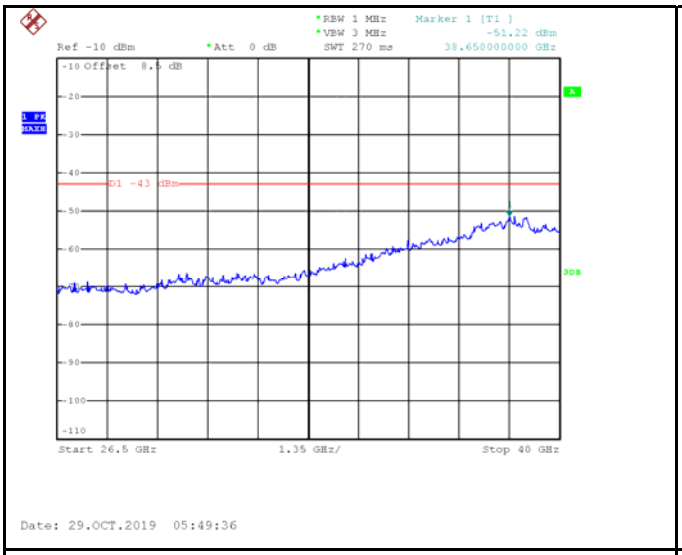


15MHz - Middle CH 26.5GHz~40GHz

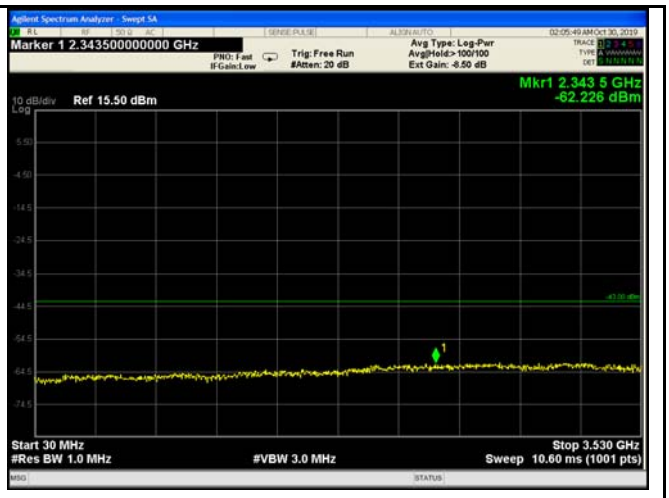


15MHz - High CH 30MHz~3.53GHz

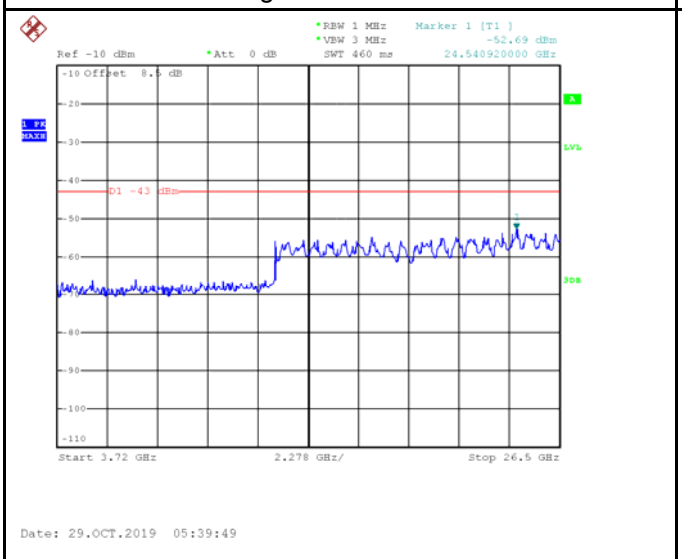
15MHz - High CH 3.72GHz~26.5GHz



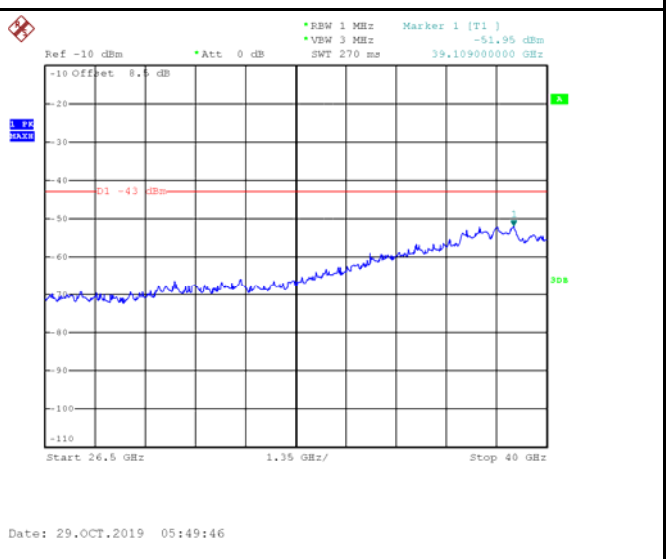
15MHz - High CH 26.5GHz~40GHz



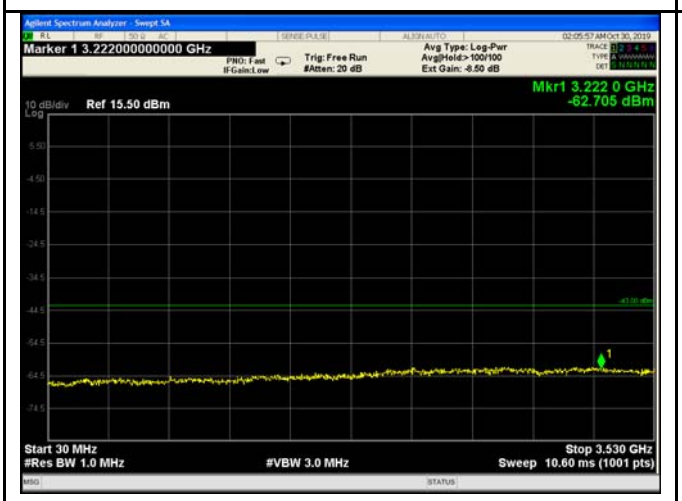
20MHz - Low CH 30MHz~3.53GHz



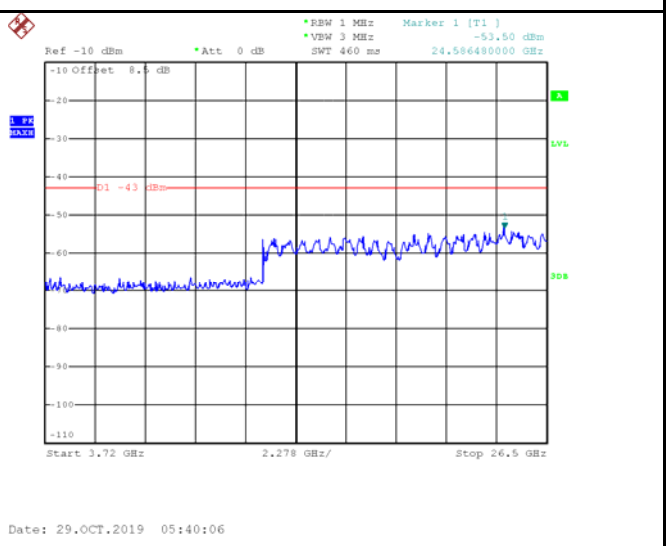
20MHz - Low CH 3.72GHz~26.5GHz



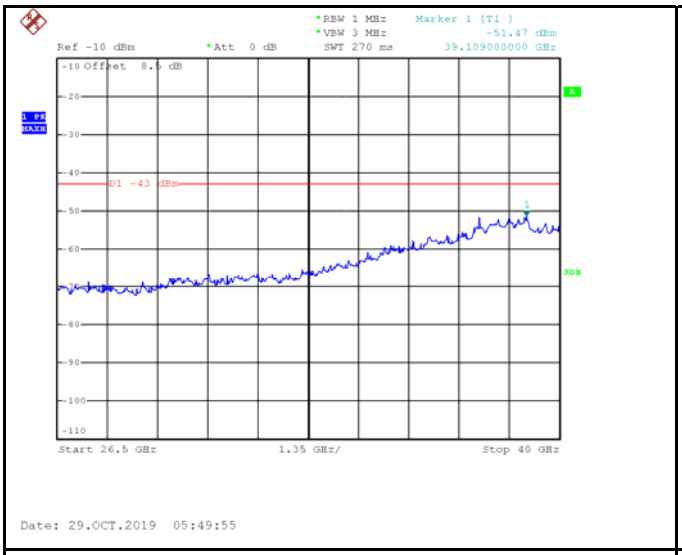
20MHz - Low CH 26.5GHz~40GHz



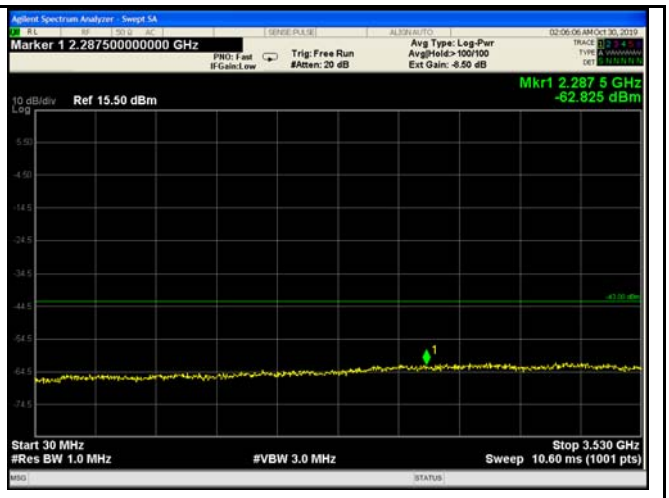
20MHz - Middle CH 30MHz~3.53GHz



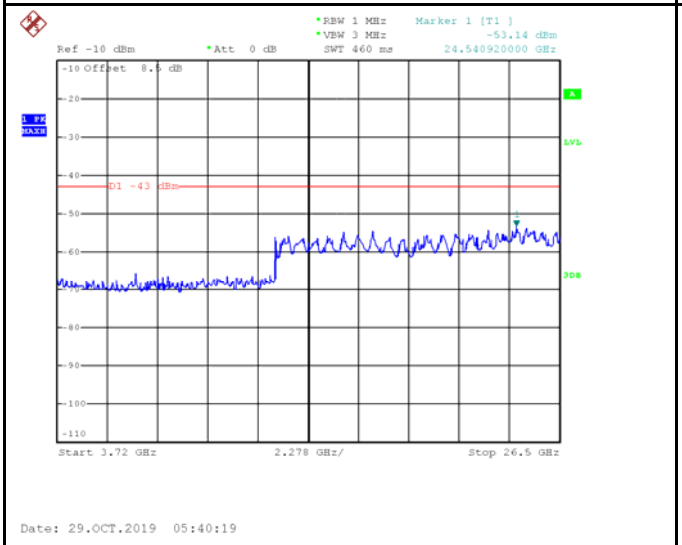
20MHz – Middle CH 3.72GHz~26.5GHz



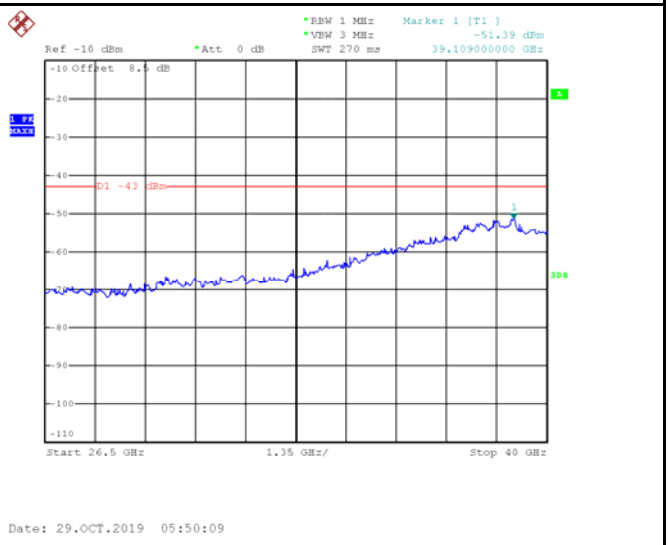
20MHz - Middle CH 26.5GHz~40GHz



20MHz - High CH 30MHz~3.53GHz



20MHz - High CH 3.72GHz~26.5GHz



20MHz - High CH 26.5GHz~40GHz

12 Field strength of spurious radiation measurement

Test Requirement:	FCC part 96.41(e)
Test Method:	ANSI/TIA-603-E:2016, ANSI C63.26:2015
Test Mode:	Data communicating mode
Limit:	-40dBm

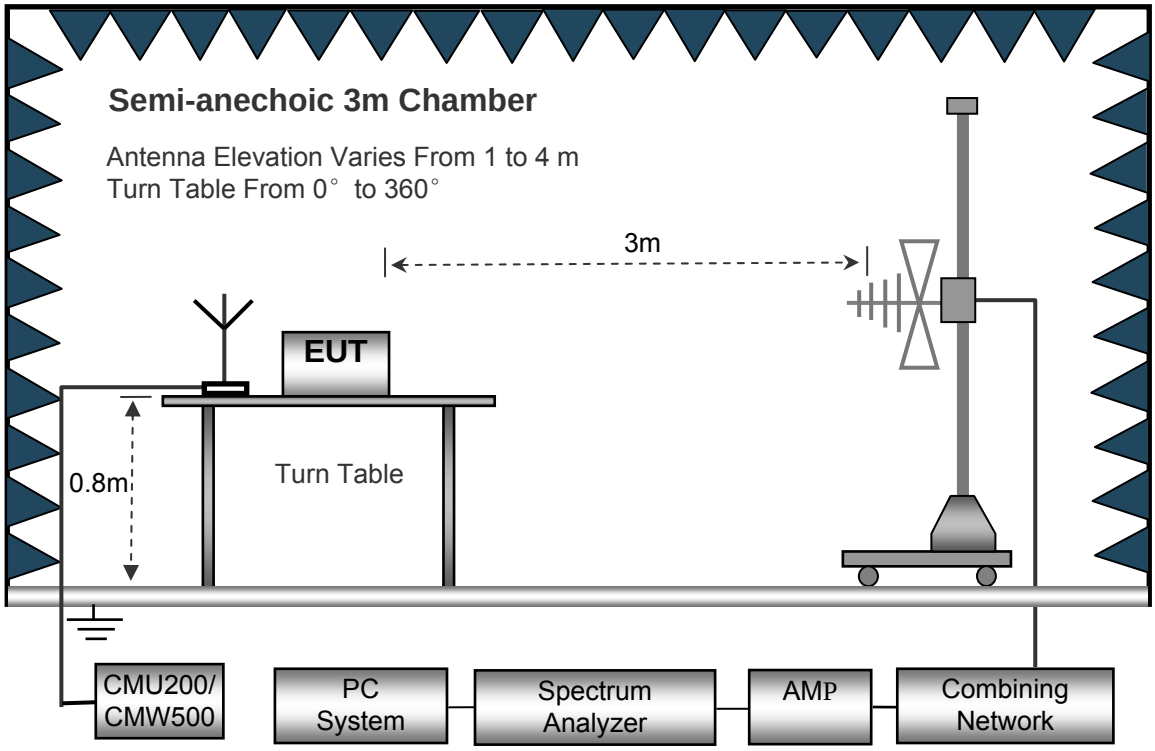
12.1 EUT Operation

Operating Environment :

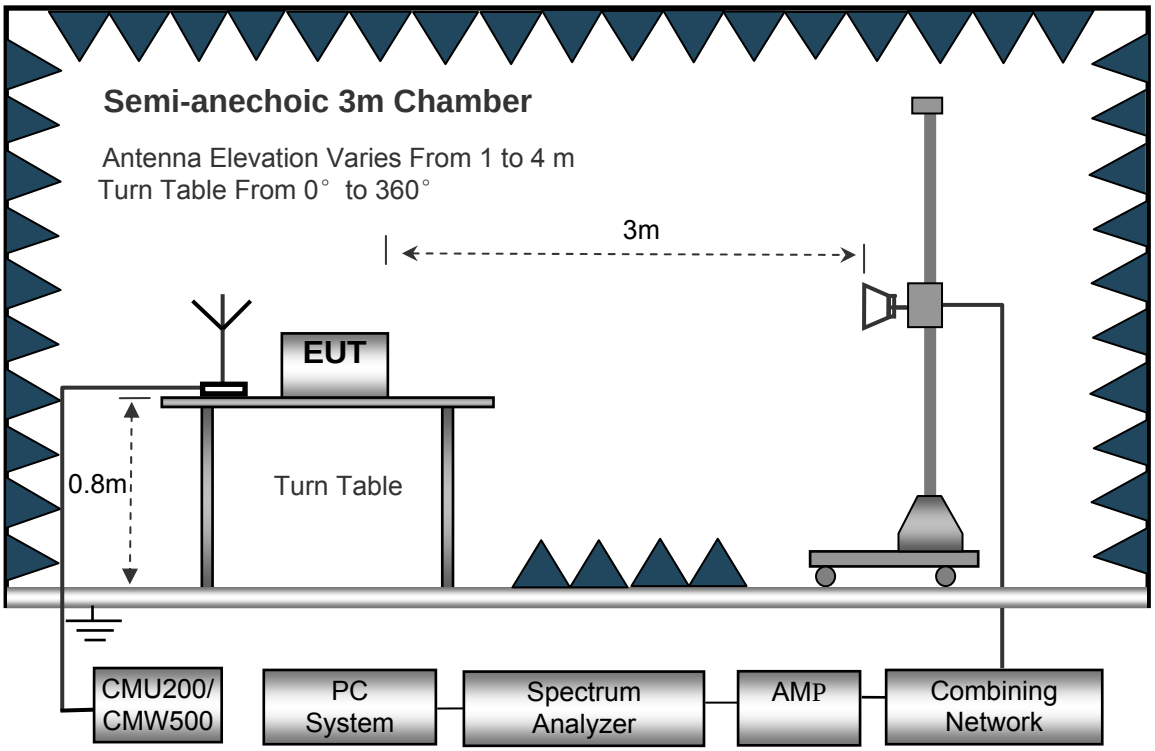
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

12.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site.
The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



12.3 Spectrum Analyzer Setup

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz

12.4 Test Procedure

1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.
2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.
3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method.
4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency.

   ERP / EIRP = S.G. output (dBm) + Antenna Gain(dB/dBi) – Cable Loss (dB)

12.5 Test Result

30MHz-18GHz

Remark: During the test, pre-scan the QPSK, 16QAM modulation, and found the QPSK modulation and 10MHz bandwitch is the worst case.

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
Low channel										
223.12	41.64	130	1.9	H	-68.87	0.15	0.00	-69.02	-40.00	-29.02
223.12	44.54	333	1.2	V	-63.05	0.15	0.00	-63.20	-40.00	-23.20
7110.00	56.32	183	1.4	H	-57.65	0.30	9.40	-48.55	-40.00	-8.55
7110.00	58.23	333	2.0	V	-55.30	0.30	9.40	-46.20	-40.00	-6.20
10665.00	58.83	23	1.7	H	-55.17	0.43	10.60	-45.00	-40.00	-5.00
10665.00	48.45	118	1.1	V	-61.83	0.43	10.60	-51.66	-40.00	-11.66
Middle channel										
199.38	41.43	354	1.6	H	-69.08	0.15	0.00	-69.23	-40.00	-29.23
199.38	45.65	328	1.4	V	-61.94	0.15	0.00	-62.09	-40.00	-22.09
7250.00	55.24	24	1.3	H	-58.73	0.30	9.40	-49.63	-40.00	-9.63
7250.00	58.32	15	1.1	V	-55.21	0.30	9.40	-46.11	-40.00	-6.11
10875.00	57.83	129	1.8	H	-56.17	0.43	10.60	-46.00	-40.00	-6.00
10875.00	48.14	360	1.1	V	-62.14	0.43	10.60	-51.97	-40.00	-11.97
High channel										
199.38	41.43	225	1.1	H	-69.08	0.15	0.00	-69.23	-40.00	-29.23
199.38	45.65	27	1.2	V	-61.94	0.15	0.00	-62.09	-40.00	-22.09
7390.00	57.23	73	2.1	H	-56.74	0.30	9.40	-47.64	-40.00	-7.64
7390.00	58.32	146	2.0	V	-55.21	0.30	9.40	-46.11	-40.00	-6.11
11085.00	57.83	60	1.4	H	-56.17	0.43	10.60	-46.00	-40.00	-6.00
11085.00	48.14	338	1.4	V	-62.14	0.43	10.60	-51.97	-40.00	-11.97

Remark:

Test Frequency: 18GHz~40GHz

The measurements were more than 20 dB below the limit and not recorded.

13 Frequency stability V.S. Temperature measurement

Test Requirement: FCC Part2.1055

Test Method: FCC Part2.1055

Test Mode: Data communicating mode

Limit: :

Frequency range (MHz)	Fixed and base stations (±ppm)	Mobile stations (±ppm)	
		Over 2 watts output power	2 watts or less output power
Below 25	100	100	200
25–50	20	20	50
72–76	5		50
150–174	5	5	50
216–220	1.0		1.0
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1.0	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928	2.5	2.5	2.5
929–930	1.5		
935–940	0.1	1.5	1.5
1427–1435	300	300	300
Above 2450			

13.1 EUT Operation

Operating Environment :

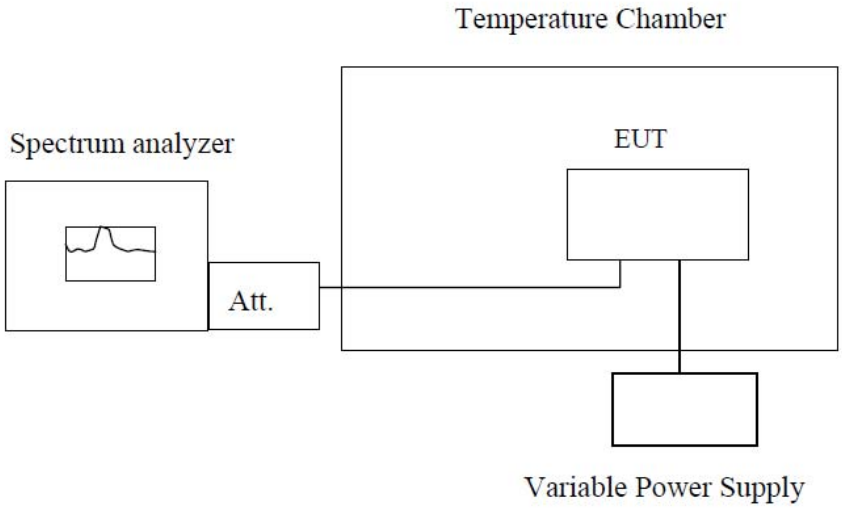
Temperature: 23.6 °C

Humidity: 52.2 % RH

Atmospheric Pressure: 101.3kPa

13.2 Test Procedure

1. The equipment under test was connected to an external DC power supply and input rated voltage.
2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.
3. The EUT was placed inside the temperature chamber.
4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25℃ operating frequency as reference frequency.
5. Turn EUT off and set the chamber temperature to –30℃. After the temperature stabilized for approximately 30 minutes recorded the frequency.
6. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.



Note : Measurement setup for testing on Antenna connector

13.3 Test Result

Remark: All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Chain 0

Test Frequency: 3552.5MHz QPSK 5MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	97	0.0273
-25		108	0.0304
-10		102	0.0287
0		100	0.0281
10		97	0.0273
20		94	0.0265
30		101	0.0284
40		101	0.0284
55		106	0.0298

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	106	0.0298
-25		101	0.0284
-10		94	0.0264
0		98	0.0276
10		97	0.0273
20		105	0.0295
30		96	0.0270
40		106	0.0298
55		98	0.0276

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	100	0.0281
-25		101	0.0284
-10		105	0.0295
0		96	0.0270
10		99	0.0278
20		88	0.0247
30		101	0.0284
40		90	0.0253
55		100	0.0281

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	91	0.0256
-25		101	0.0284
-10		101	0.0284
0		97	0.0272
10		96	0.0270
20		99	0.0278
30		98	0.0275
40		95	0.0267
55		94	0.0264

Chain 1

Test Frequency: 3552.5MHz QPSK 5MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	97	0.0273
-25		106	0.0298
-10		105	0.0296
0		99	0.0279
10		103	0.0290
20		99	0.0279
30		93	0.0262
40		107	0.0301
55		91	0.0256

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	102	0.0287
-25		96	0.0270
-10		96	0.0270
0		95	0.0267
10		87	0.0245
20		97	0.0273
30		97	0.0273
40		87	0.0245
55		94	0.0264

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	101	0.0284
-25		90	0.0253
-10		103	0.0290
0		96	0.0270
10		97	0.0273
20		98	0.0275
30		93	0.0261
40		98	0.0275
55		88	0.0247

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
-40	120	103	0.0289
-25		95	0.0267
-10		98	0.0275
0		97	0.0272
10		99	0.0278
20		90	0.0253
30		89	0.0250
40		101	0.0284
55		104	0.0292

14 Frequency stability V.S. Voltage measurement

Test Requirement: FCC Part2.1055

Test Method: FCC Part2.1055

Test Mode: Data communicating mode

Limit: FCC:

Frequency range (MHz)	Fixed and base stations (±ppm)	Mobile stations (±ppm)	
		Over 2 watts output power	2 watts or less output power
Below 25	100	100	200
25–50	20	20	50
72–76	5		50
150–174	5	5	50
216–220	1.0		1.0
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1.0	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1.0	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928	2.5	2.5	2.5
929–930	1.5		
935–940	0.1	1.5	1.5
1427–1435	300	300	300
Above 2450			

14.1 EUT Operation

Operating Environment :

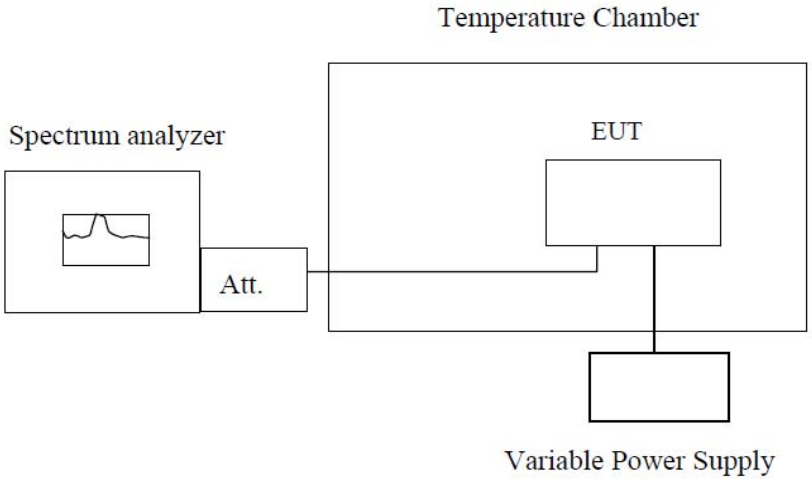
Temperature: 23.7 °C

Humidity: 52.9 % RH

Atmospheric Pressure: 101.4kPa

14.2 Test Procedure

1. Set chamber temperature to 25℃. Use a variable DC power source to power the EUT and set the voltage to rated voltage.
2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
3. Reduce the input voltage to specify extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change.



Note : Measurement setup for testing on Antenna connector

14.3 Test Result

Remark: All three channels of all modulations have been tested, but only the worst channel and the worst modulation show in this test item.

Chain 0

Test Frequency: 3552.5MHz QPSK 5MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	93	0.0262
	120	107	0.0301
	144	91	0.0256

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	96	0.0270
	120	95	0.0267
	144	87	0.0245

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	101	0.0284
	120	90	0.0253
	144	103	0.0290

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	99	0.0278
	120	90	0.0253
	144	89	0.0250

Chain 1

Test Frequency: 3552.5MHz QPSK 5MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	97	0.0273
	120	94	0.0265
	144	101	0.0284

Test Frequency: 3555MHz QPSK 10MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	96	0.0270
	120	106	0.0298
	144	98	0.0276

Test Frequency: 3557.5MHz QPSK 15MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	105	0.0295
	120	96	0.0270
	144	99	0.0278

Test Frequency: 3560MHz QPSK 20MHz			
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)
25	105	101	0.0284
	120	101	0.0284
	144	97	0.0272

15 Photographs of test setup and EUT.

Note: Please refer to appendix: EG7010C-M11_Photos.

====== End of Report ======