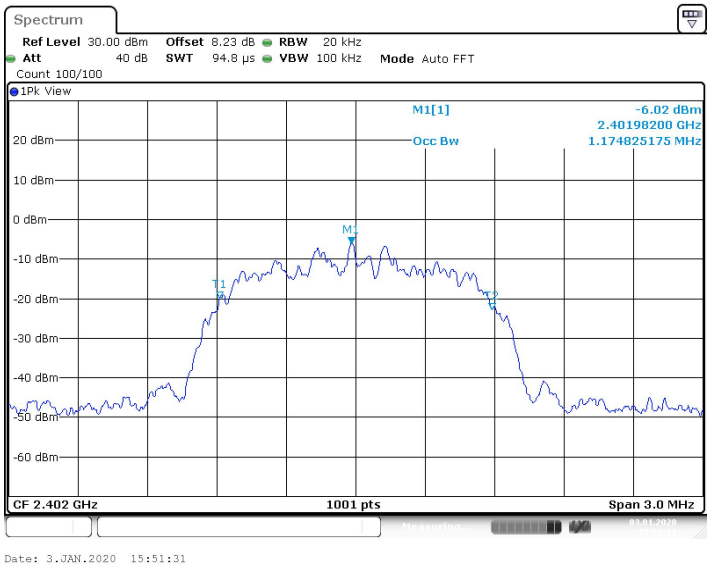
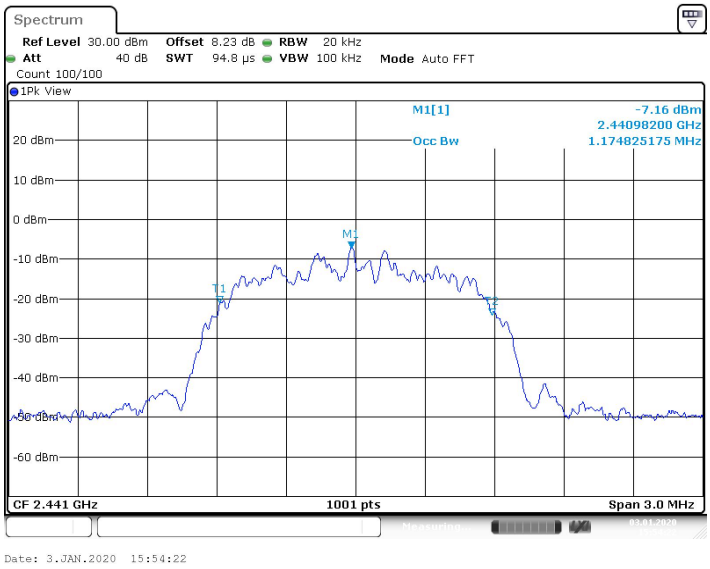
Test Mode:	2DH5			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.175	2401.413	2402.587	PASS
2441	1.175	2440.413	2441.587	PASS
2480	1.175	2479.413	2480.587	PASS

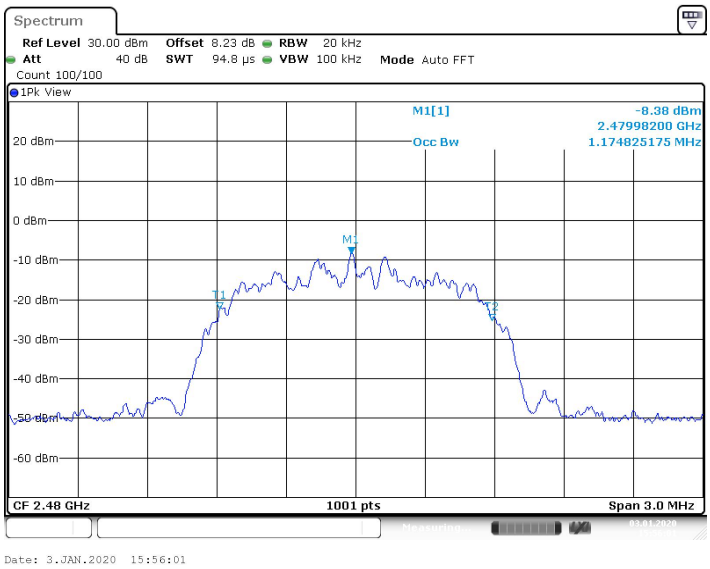
2402 MHz



2441 MHz

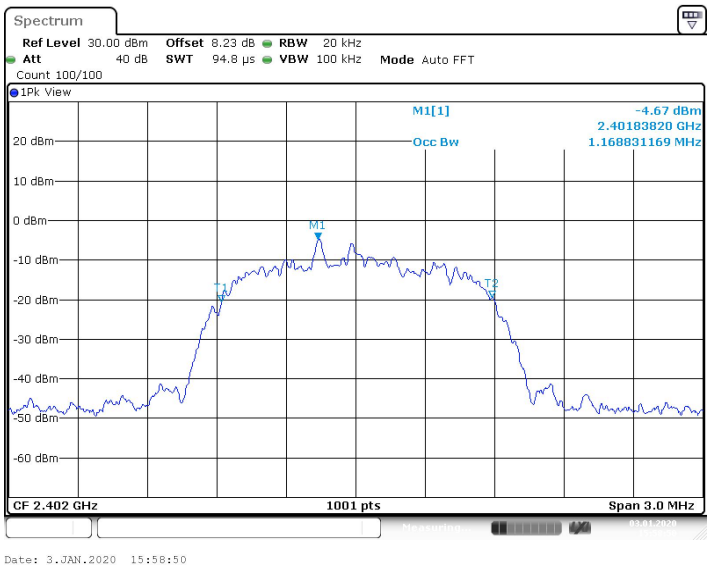


2480 MHz

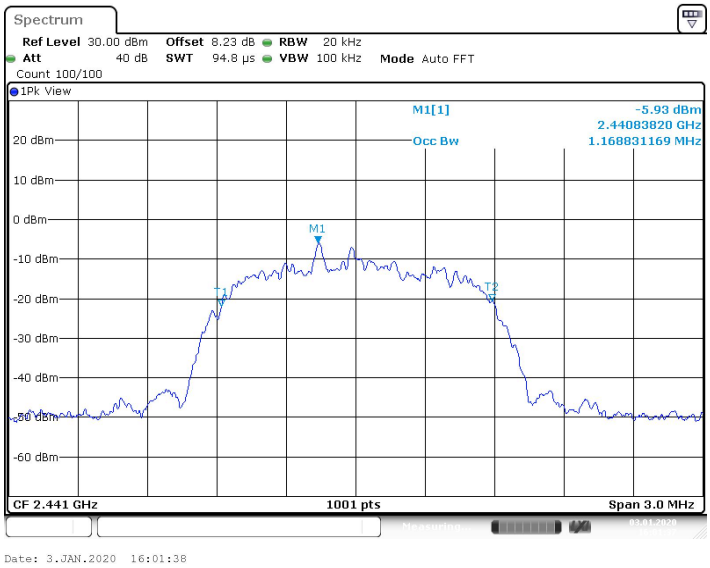

Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz
Att 40 dB SWT 94.8 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -8.38 dBm
2.47998200 GHz
Occ Bw 1.174825175 MHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Date: 3.JAN.2020 15:56:01

Test Mode:	3DH5			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.169	2401.419	2402.587	PASS
2441	1.169	2440.419	2441.587	PASS
2480	1.172	2479.419	2480.590	PASS

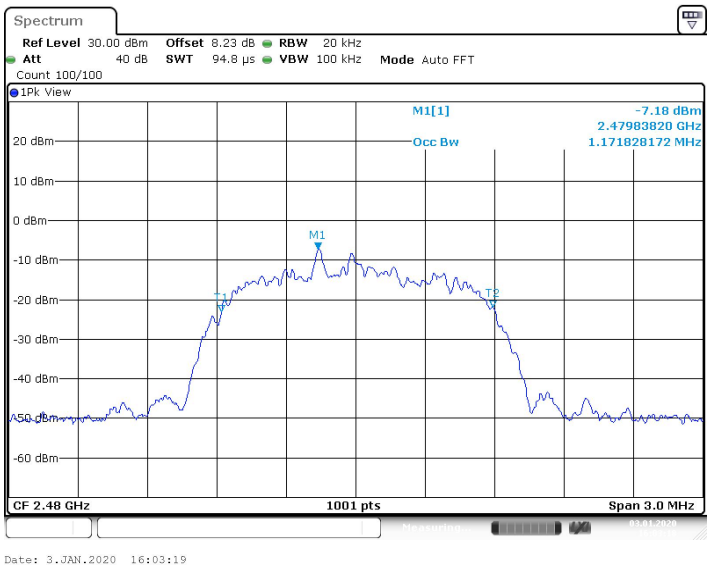
2402 MHz



2441 MHz



2480 MHz


Spectrum
Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz
Att 40 dB SWT 94.8 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -7.18 dBm
2.47983820 GHz
Occ Bw 1.171828172 MHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
T1
T2
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Date: 3.JAN.2020 16:03:19

3.5. Carrier Frequencies Separation

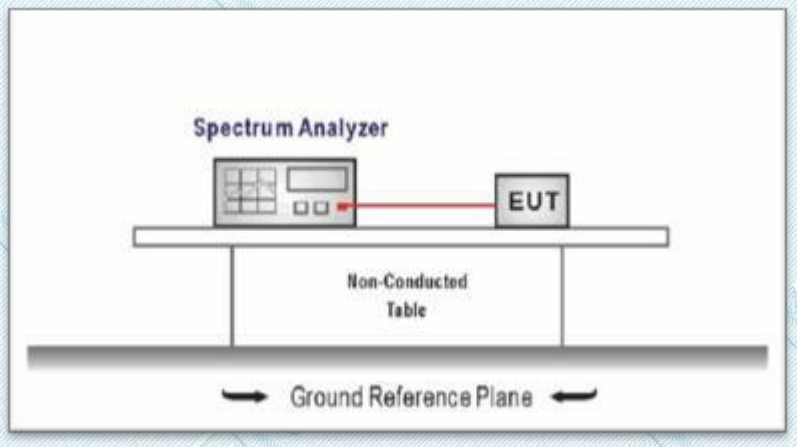
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

Test Item	Limit	Frequency Range(MHz)
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test, and found the middle channel which is the worse case, so only show the test date for worse case.

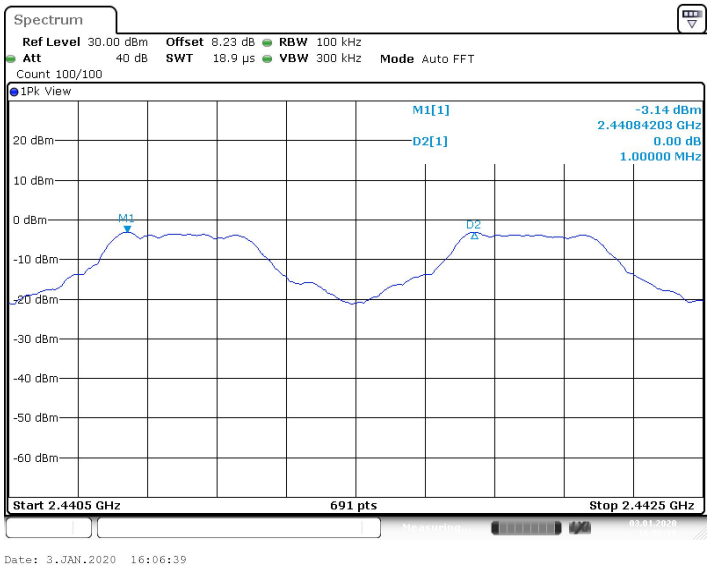
Test Mode

Please refer to the clause 2.3.

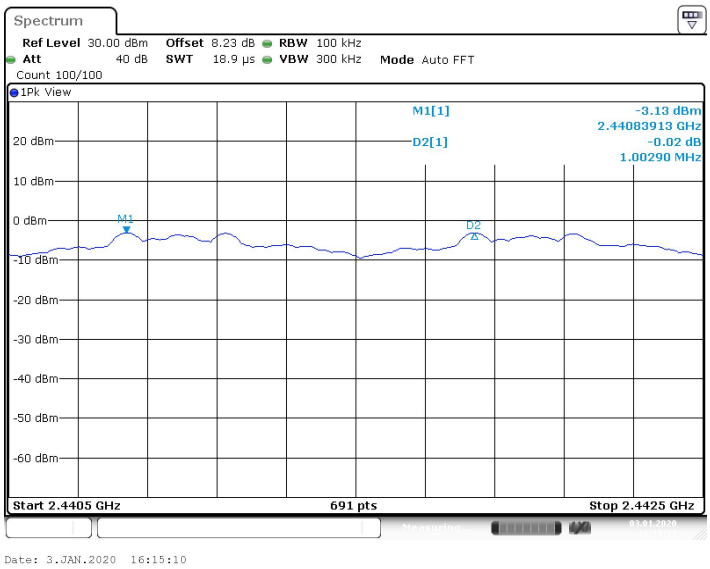
Test Results

Test Mode:	DH5 Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
DH5	1	>=0.870	PASS

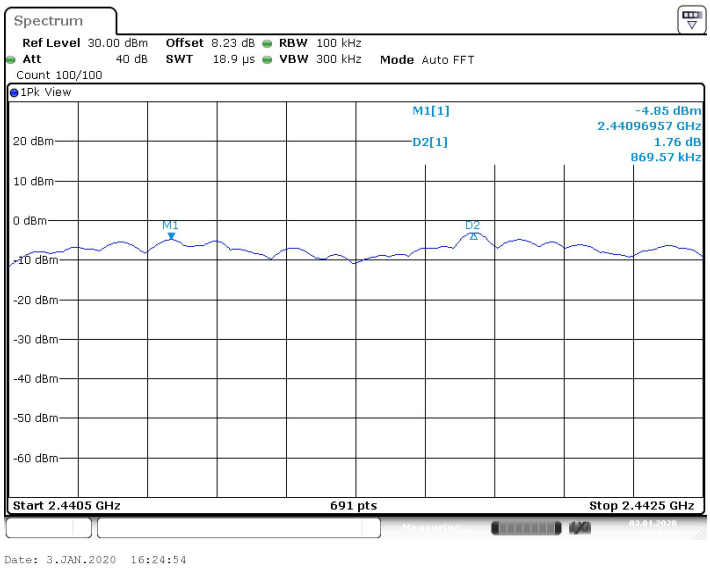
DH5 Hopping Mode



Test Mode:	2DH5 Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
2DH5	1.003	>=0.882	PASS
2DH5 Hopping Mode			



Test Mode:	3DH5 Hopping Mode		
Test Mode	Result[MHz]	Limit[MHz]	Verdict
3DH5	0.870	>=0.860	PASS
3DH5 Hopping Mode			

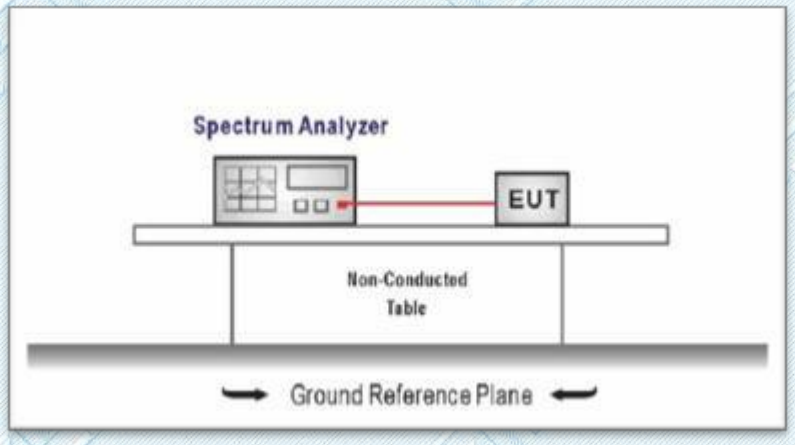


3.6. Number of Hopping Channel

Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Peak Detector: RBW=100 kHz, VBW≥RBW, Sweep time= Auto.

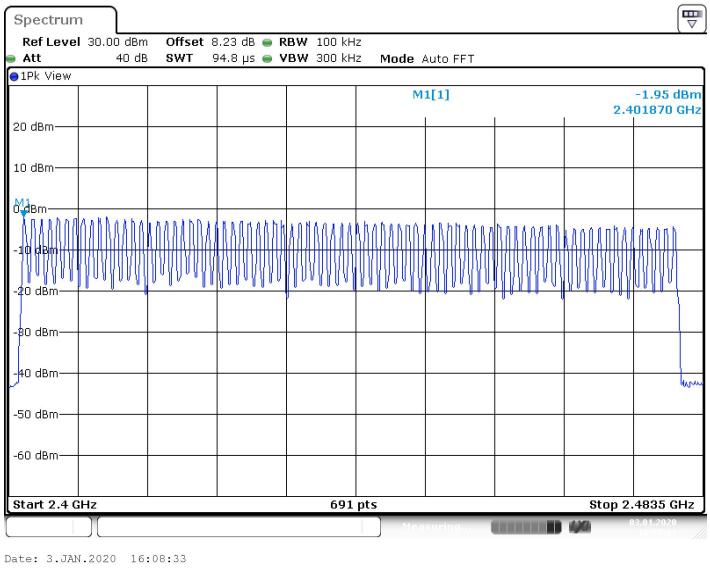
Test Mode

Please refer to the clause 2.3.

Test Result

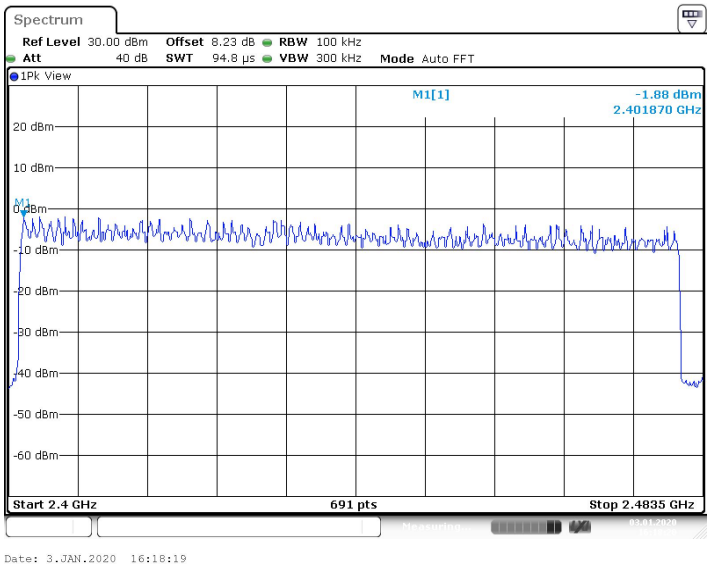
Test Mode:	DH5 Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	DH5	79	**>15**

DH5 Mode

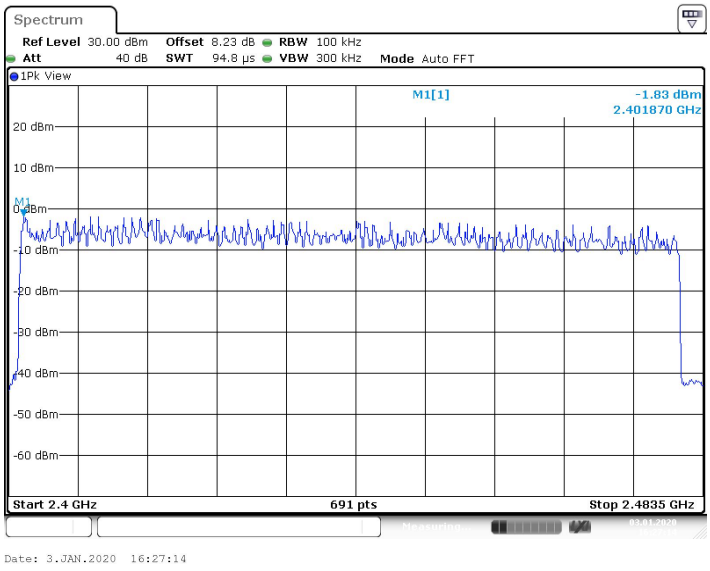


Test Mode:	2DH5 Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	2DH5	79	**>15**

2DH5 Mode



Test Mode:	3DH5 Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	3DH5	79	**>15**
3DH5 Mode			

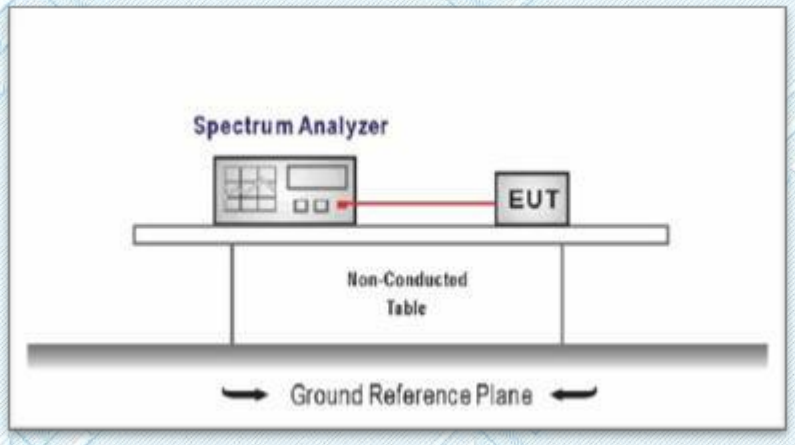


3.7. Dwell Time

Limit

Section	Test Item	Limit
15.247(a)(1)	Average Time of Occupancy	0.4 sec

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Spectrum Setting: RBW=1MHz, VBW≥RBW.
   (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
   (3) Sweep Time is more than once pulse time.
   (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
   (5) Measure the maximum time duration of one single pulse.
   (6) Set the EUT for packet transmitting.

Test Mode

Please refer to the clause 2.3

Test Result

Note:

1.We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.

2.Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2DH1, 3DH1

Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2DH3, 3DH3

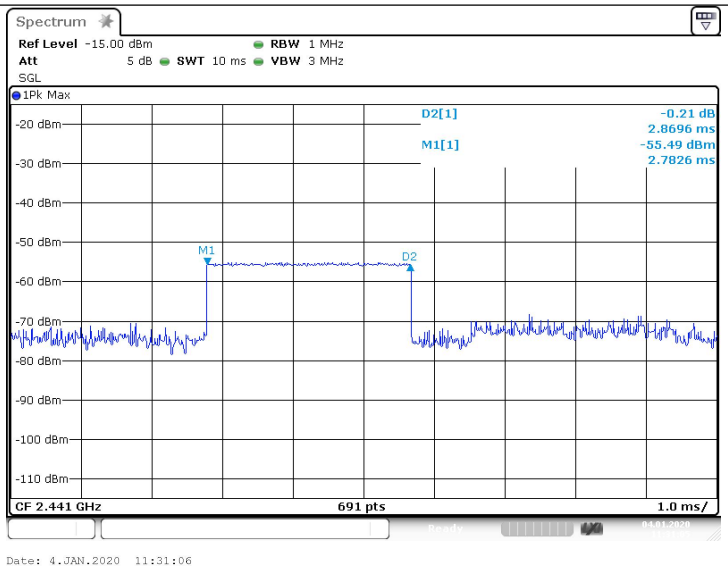
Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2DH5, 3DH5

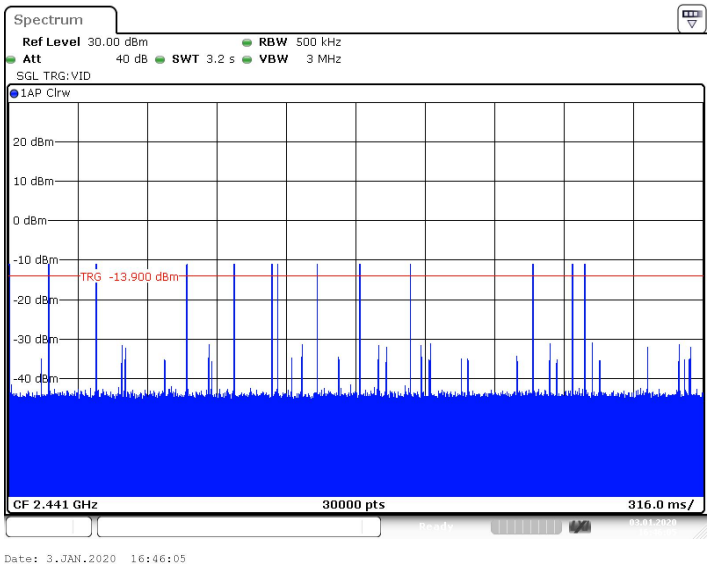
Test Mode:	DH5 Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
DH5	2441	2.87	306.13	31.60	**400**	**PASS**

1DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second

DH5 Hopping Mode

2441 MHz



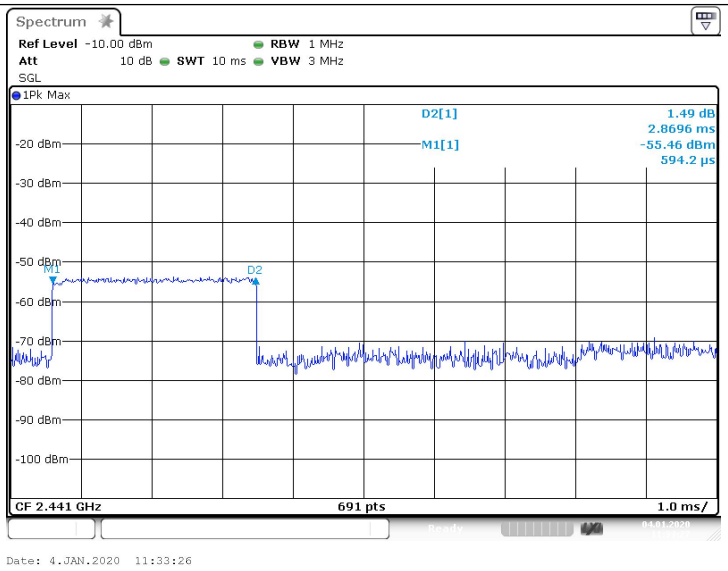


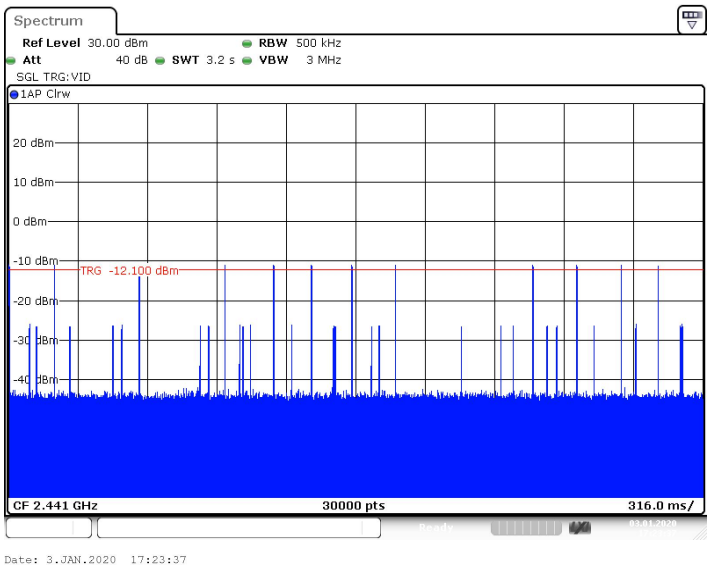
Test Mode:	2DH5 Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
2DH5	2441	2.87	306.13	31.60	**400**	**PASS**

2DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second

2DH5 Hopping Mode

2441 MHz



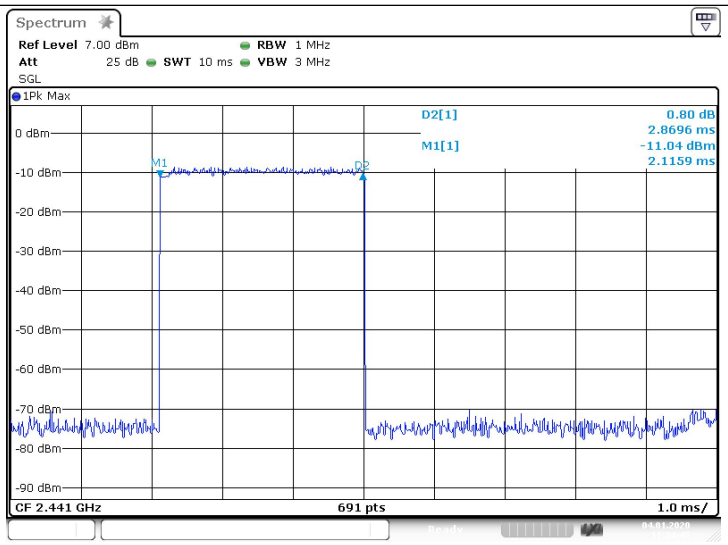


Test Mode:	3DH5 Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
3DH5	2441	2.87	306.13	31.60	**400**	**PASS**

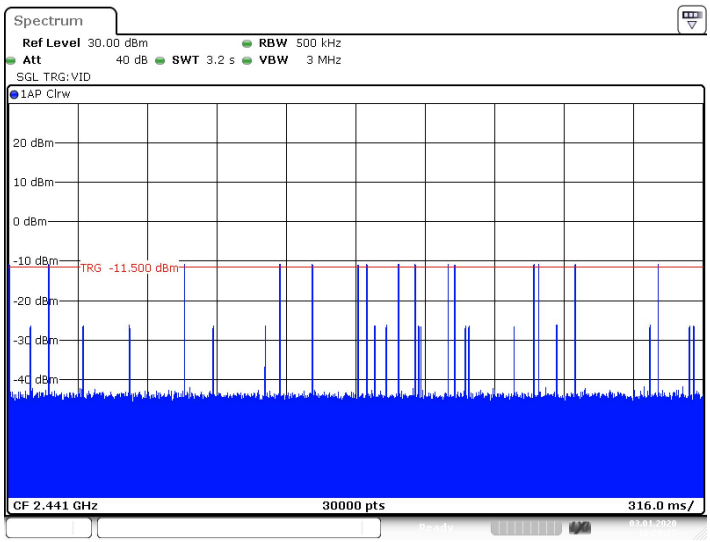
3DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second

3DH5 Hopping Mode

2441 MHz



Date: 4.JAN.2020 11:34:45



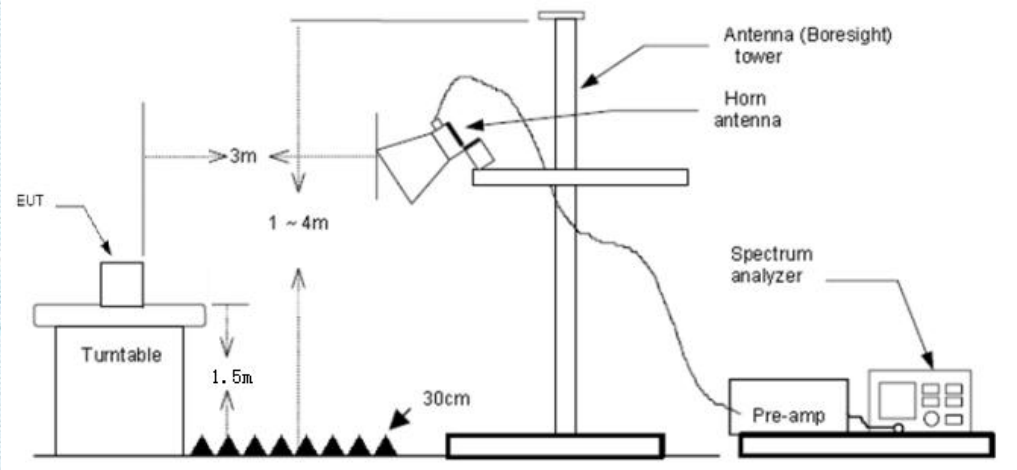
Date: 3.JAN.2020 16:28:27

3.8. Band Edge Emissions(Radiated)

Limit

Restricted Frequency Band (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

Test Configuration



Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 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. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1MHz, VBW=3MHz PEAK detector for Peak value.
   RBW=1MHz, VBW=10Hz with Average Detector for Average Value.

Test Mode

Please refer to the clause 2.3.

Test Results

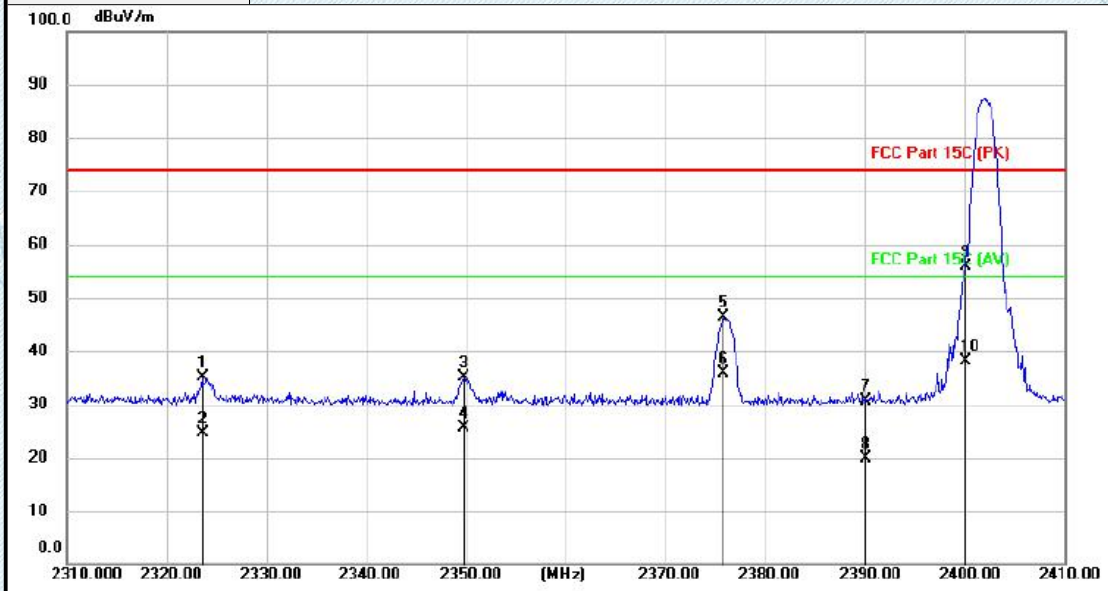
Note:

1.Measurement = Reading level + Correct Factor

Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor

2.Pre-scan DH5, 2DH5 and 3DH5 modulation, and found the DH5 modulation which it is worse case, so only show the test data for worse case.

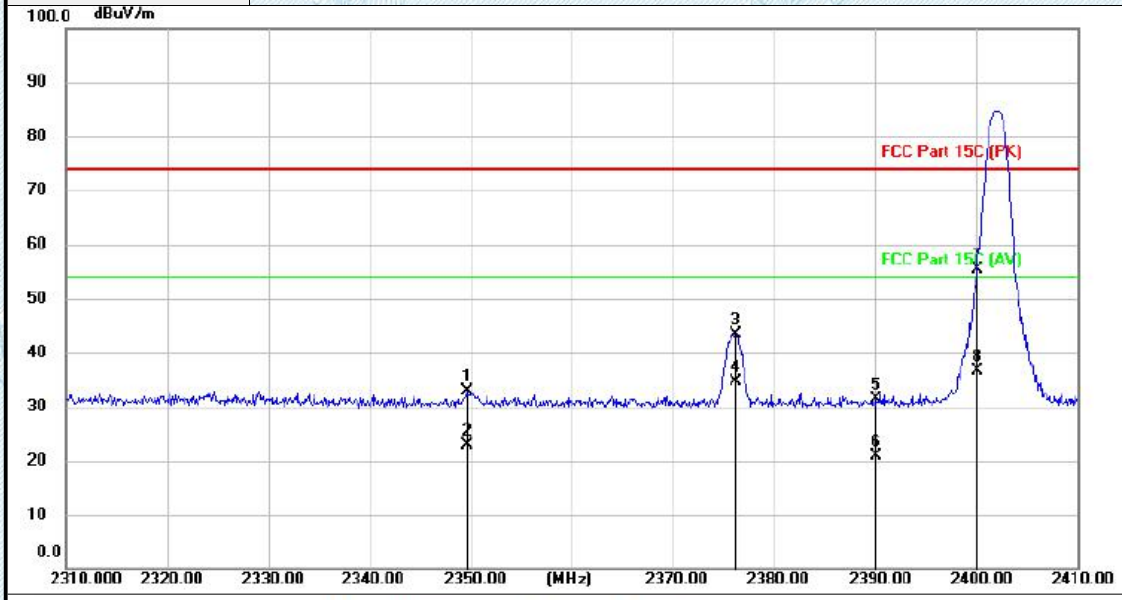
Ant. Pol.	Horizontal
Test Mode:	DH5 Mode 2402MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1		2323.600	48.65	-13.58	35.07	74.00	-38.93	peak
2		2323.600	38.17	-13.58	24.59	54.00	-29.41	AVG
3		2349.800	48.58	-13.55	35.03	74.00	-38.97	peak
4		2349.800	39.28	-13.55	25.73	54.00	-28.27	AVG
5		2375.800	59.79	-13.52	46.27	74.00	-27.73	peak
6		2375.800	49.30	-13.52	35.78	54.00	-18.22	AVG
7		2390.000	44.05	-13.49	30.56	74.00	-43.44	peak
8		2390.000	33.36	-13.49	19.87	54.00	-34.13	AVG
9		2400.000	69.26	-13.48	55.78	74.00	-18.22	peak
10	*	2400.000	51.71	-13.48	38.23	54.00	-15.77	AVG

Measurement = Reading level + Correct Factor

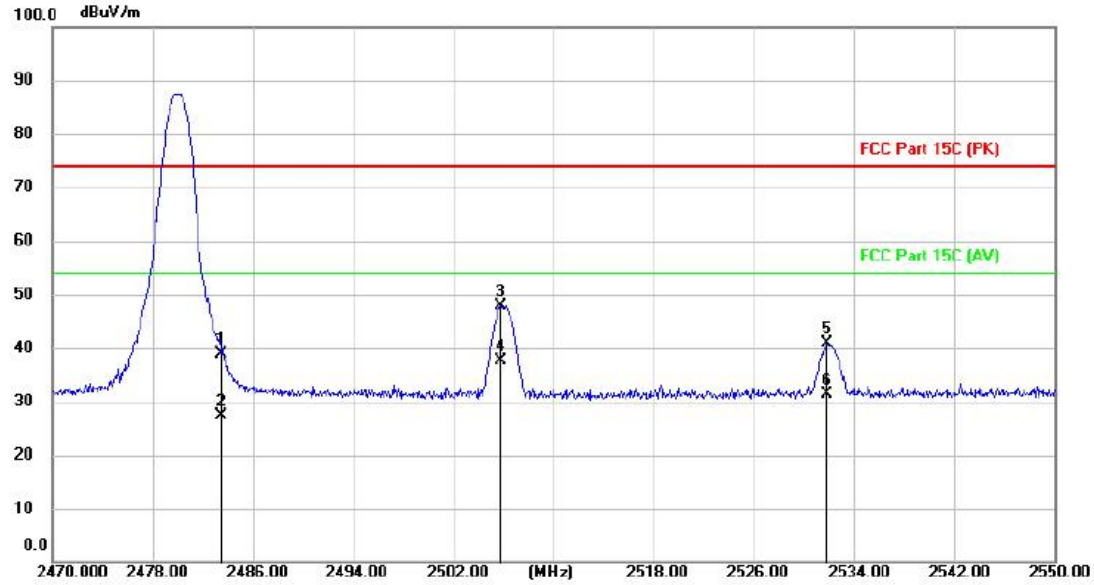
Ant. Pol.	Vertical
Test Mode:	DH5 Mode 2402 MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1		2349.600	46.39	-13.55	32.84	74.00	-41.16	peak
2		2349.600	36.49	-13.55	22.94	54.00	-31.06	AVG
3		2376.200	56.81	-13.52	43.29	74.00	-30.71	peak
4		2376.200	48.14	-13.52	34.62	54.00	-19.38	AVG
5		2390.000	44.88	-13.49	31.39	74.00	-42.61	peak
6		2390.000	34.33	-13.49	20.84	54.00	-33.16	AVG
7		2400.000	68.77	-13.48	55.29	74.00	-18.71	peak
8	*	2400.000	50.00	-13.48	36.52	54.00	-17.48	AVG

Measurement = Reading level + Correct Factor

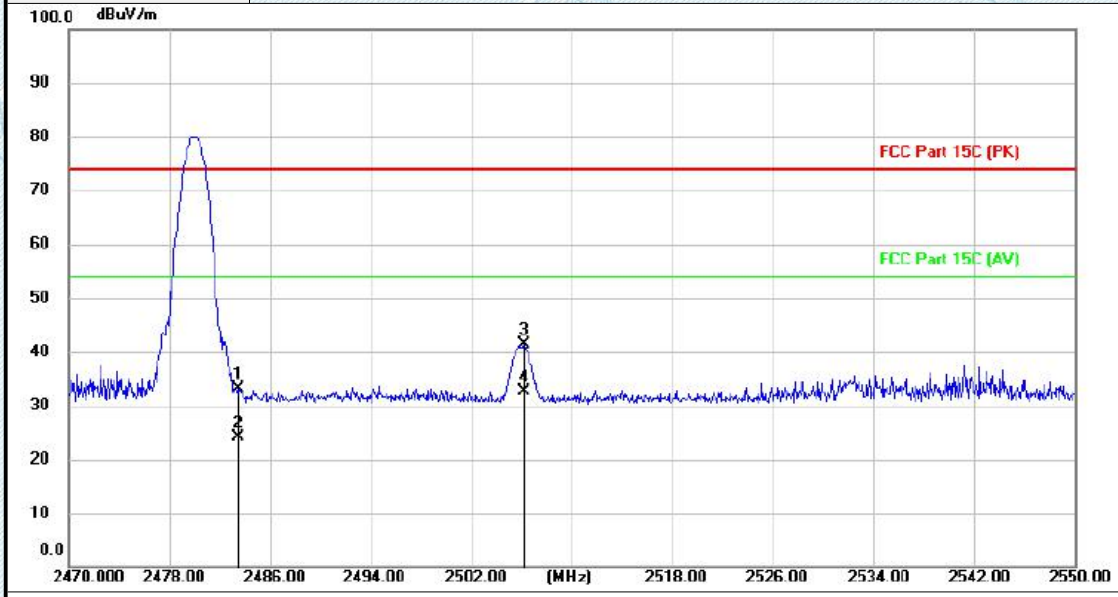
Ant. Pol.	Horizontal
Test Mode:	DH5 Mode 2480MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1		2483.500	52.33	-13.35	38.98	74.00	-35.02	peak
2		2483.500	40.64	-13.35	27.29	54.00	-26.71	AVG
3		2505.760	61.19	-13.33	47.86	74.00	-26.14	peak
4	*	2505.760	50.87	-13.33	37.54	54.00	-16.46	AVG
5		2531.840	54.18	-13.28	40.90	74.00	-33.10	peak
6		2531.840	44.54	-13.28	31.26	54.00	-22.74	AVG

Measurement = Reading level + Correct Factor

Ant. Pol.	Vertical
Test Mode:	DH5 Mode 2480 MHz



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	(dBuV)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	Detector
1		2483.500	46.38	-13.35	33.03	74.00	-40.97	peak
2		2483.500	37.43	-13.35	24.08	54.00	-29.92	AVG
3		2506.240	54.71	-13.32	41.39	74.00	-32.61	peak
4	*	2506.240	45.99	-13.32	32.67	54.00	-21.33	AVG

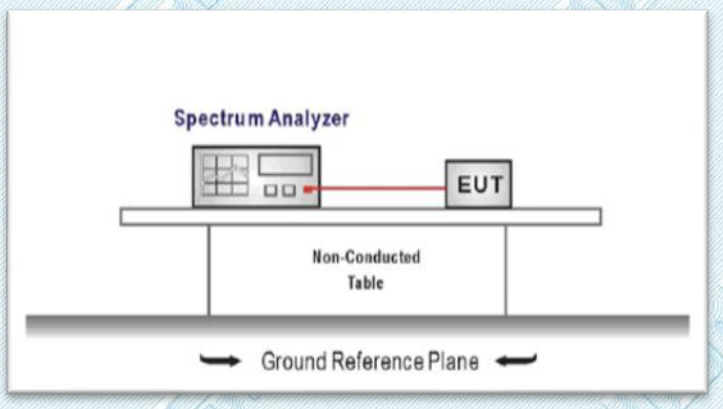
Measurement = Reading level + Correct Factor

3.9. Band Edge and Spurious Emission (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section15.247 (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 pathloss 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≥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 2.3.

TEST RESULTS