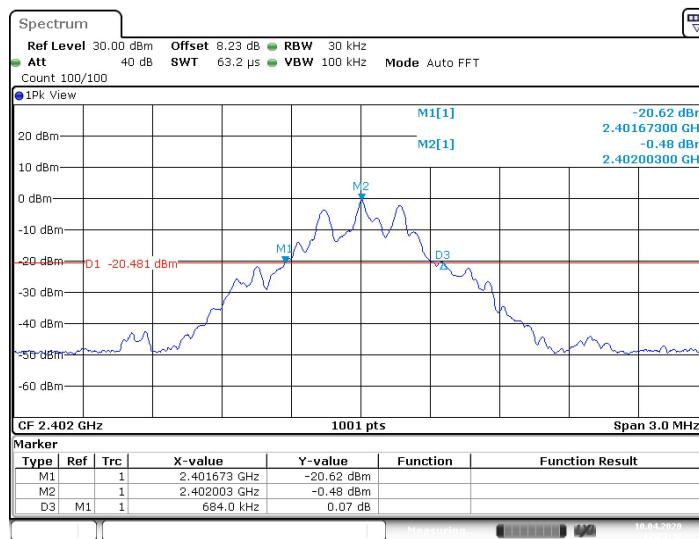
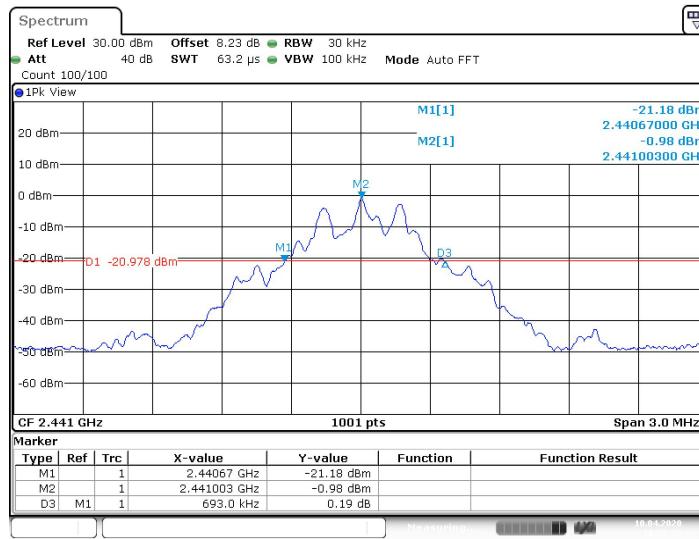
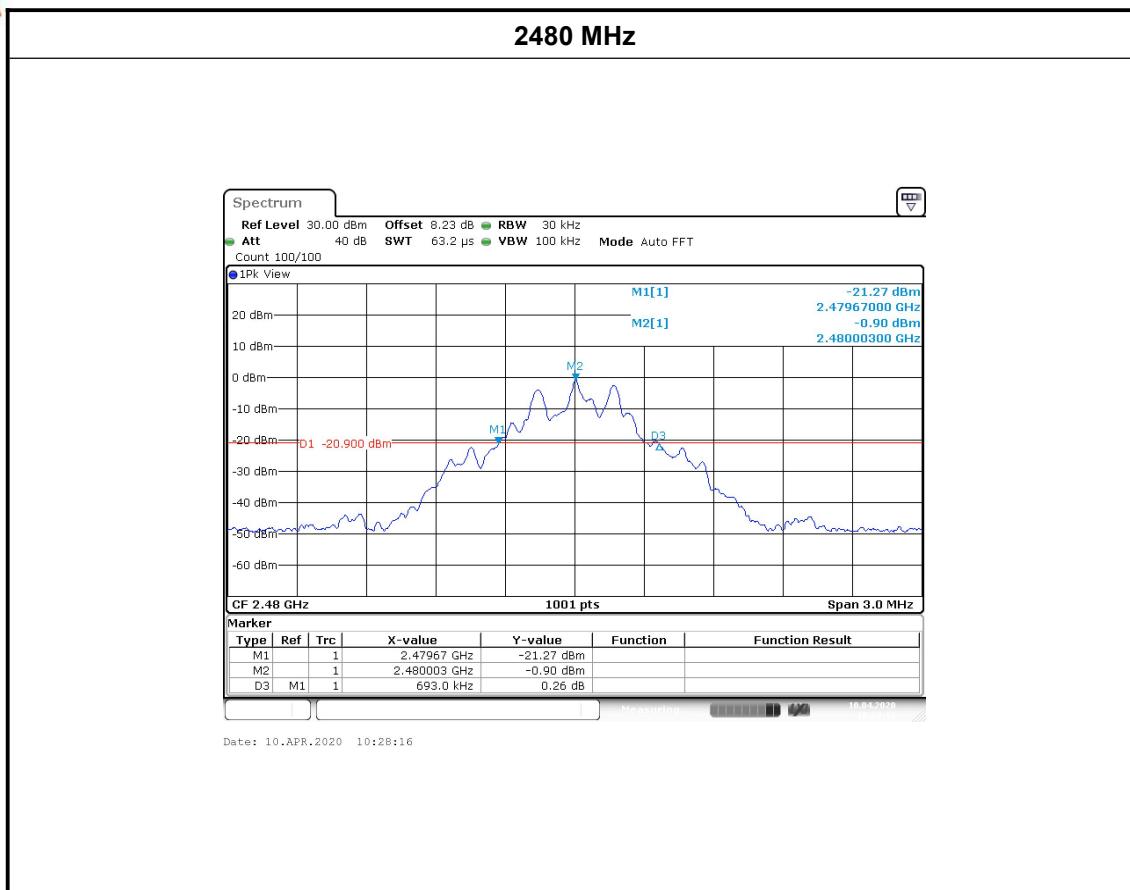
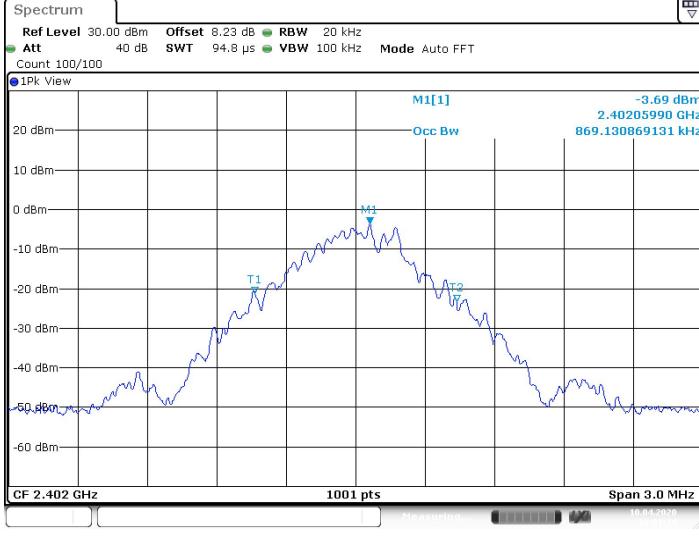
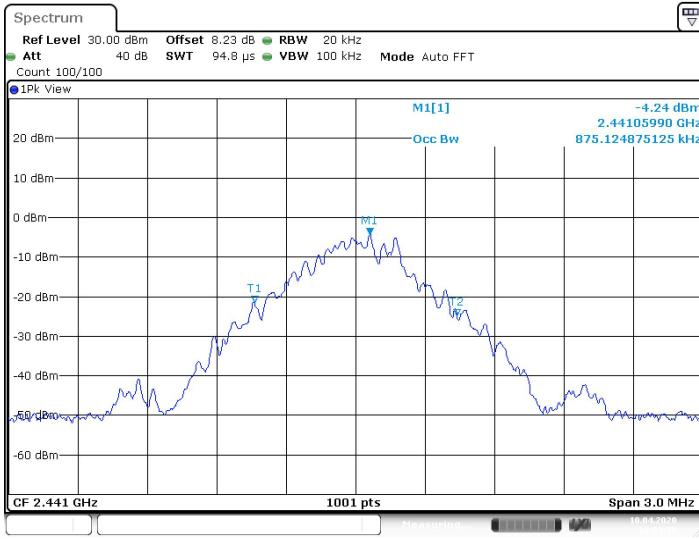
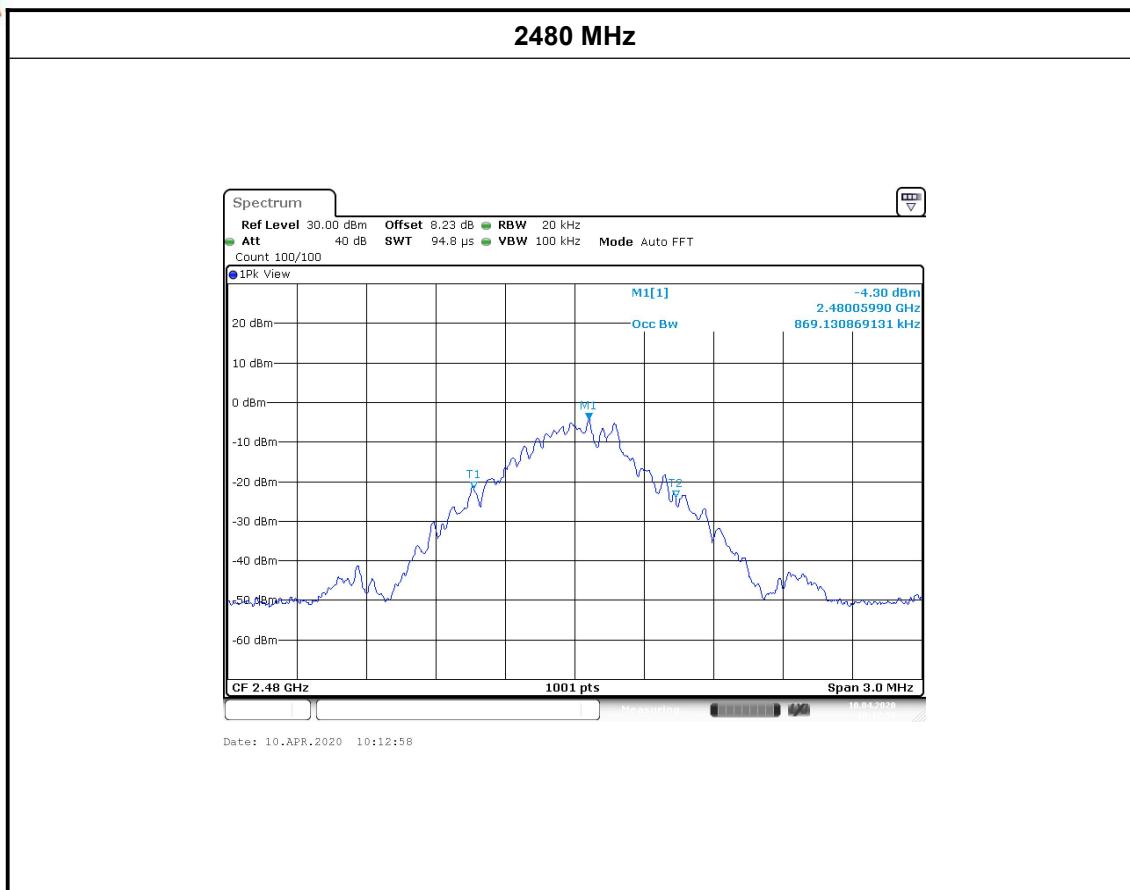


Test Mode:	3DH5																															
Channel frequency (MHz)	20dB Bandwidth [MHz]	FL[MHz]	FH[MHz]	Verdict																												
2402	0.684	2401.673	2402.357	PASS																												
2441	0.693	2440.670	2441.363	PASS																												
2480	0.693	2479.670	2480.363	PASS																												
<b>2402 MHz</b>																																
 <p><b>Spectrum</b>  Ref Level 30.00 dBm Offset 8.23 dB RBW 30 kHz  Att 40 dB SWT 63.2 μs VBW 100 kHz Mode Auto FFT  Count 100/100</p> <p><b>Marker</b></p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.401673 GHz</td> <td>-20.62 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.402003 GHz</td> <td>-0.48 dBm</td> <td></td> <td></td> </tr> <tr> <td>D1</td> <td>M1</td> <td>1</td> <td>684.0 kHz</td> <td>0.07 dB</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 10.APR.2020 10:23:47</p>					Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.401673 GHz	-20.62 dBm			M2	1		2.402003 GHz	-0.48 dBm			D1	M1	1	684.0 kHz	0.07 dB		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																										
M1	1		2.401673 GHz	-20.62 dBm																												
M2	1		2.402003 GHz	-0.48 dBm																												
D1	M1	1	684.0 kHz	0.07 dB																												
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 <p><b>Spectrum</b>  Ref Level 30.00 dBm Offset 8.23 dB RBW 30 kHz  Att 40 dB SWT 63.2 μs VBW 100 kHz Mode Auto FFT  Count 100/100</p> <p><b>Marker</b></p> <table border="1"> <thead> <tr> <th>Type</th> <th>Ref</th> <th>Trc</th> <th>X-value</th> <th>Y-value</th> <th>Function</th> <th>Function Result</th> </tr> </thead> <tbody> <tr> <td>M1</td> <td>1</td> <td></td> <td>2.440670 GHz</td> <td>-21.18 dBm</td> <td></td> <td></td> </tr> <tr> <td>M2</td> <td>1</td> <td></td> <td>2.441003 GHz</td> <td>-0.98 dBm</td> <td></td> <td></td> </tr> <tr> <td>D1</td> <td>M1</td> <td>1</td> <td>693.0 kHz</td> <td>0.19 dB</td> <td></td> <td></td> </tr> </tbody> </table> <p>Date: 10.APR.2020 10:26:36</p>					Type	Ref	Trc	X-value	Y-value	Function	Function Result	M1	1		2.440670 GHz	-21.18 dBm			M2	1		2.441003 GHz	-0.98 dBm			D1	M1	1	693.0 kHz	0.19 dB		
Type	Ref	Trc	X-value	Y-value	Function	Function Result																										
M1	1		2.440670 GHz	-21.18 dBm																												
M2	1		2.441003 GHz	-0.98 dBm																												
D1	M1	1	693.0 kHz	0.19 dB																												



Test Mode:	DH5			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	0.869	2401.565	2402.435	PASS
2441	0.875	2440.562	2441.438	PASS
2480	0.869	2479.565	2480.435	PASS
<b>2402 MHz</b>				
				
<b>2441 MHz</b>				
				



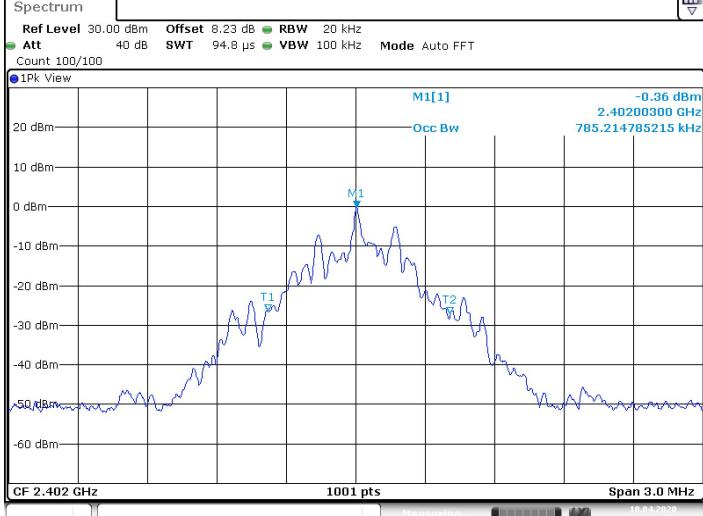
Test Mode:	2DH5			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	0.785	2401.622	2402.408	PASS
2441	0.806	2440.607	2441.414	PASS
2480	0.809	2479.607	2480.417	PASS

**2402 MHz**

Spectrum

Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz  
Att 40 dB SWT 94.8  $\mu$ s VBW 100 kHz Mode Auto FFT  
Count 100/100

1PK View



CF 2.402 GHz 1001 pts Span 3.0 MHz

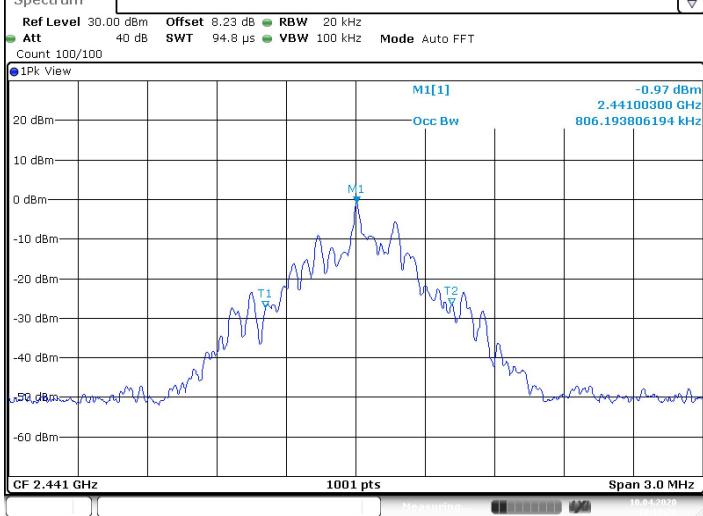
Date: 10.APR.2020 10:16:32

**2441 MHz**

Spectrum

Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz  
Att 40 dB SWT 94.8  $\mu$ s VBW 100 kHz Mode Auto FFT  
Count 100/100

1PK View



CF 2.441 GHz 1001 pts Span 3.0 MHz

Date: 10.APR.2020 10:19:21



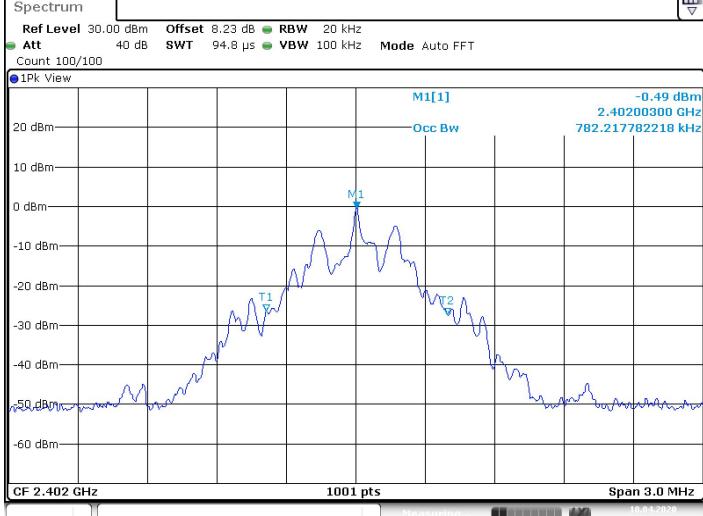
Test Mode:	3DH5			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	0.782	2401.613	2402.396	PASS
2441	0.788	2440.613	2441.402	PASS
2480	0.704	2479.655	2480.360	PASS

**2402 MHz**

Spectrum

Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz  
Att 40 dB SWT 94.8  $\mu$ s VBW 100 kHz Mode Auto FFT  
Count 100/100

1Pk View



CF 2.402 GHz 1001 pts Span 3.0 MHz

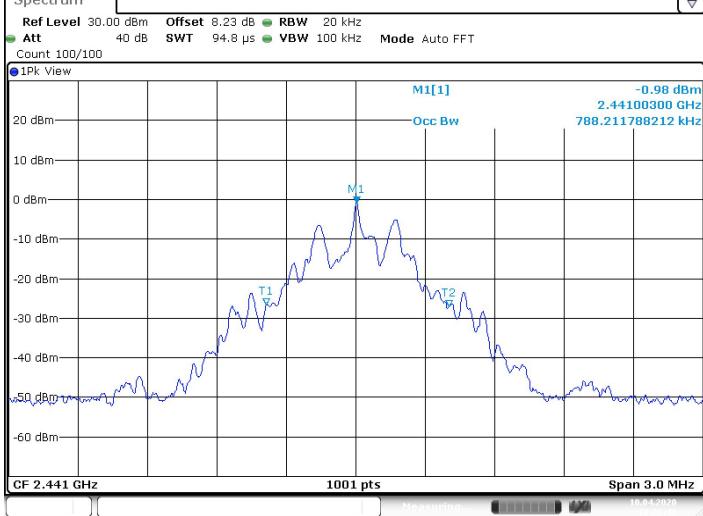
Date: 10.APR.2020 10:23:59

**2441 MHz**

Spectrum

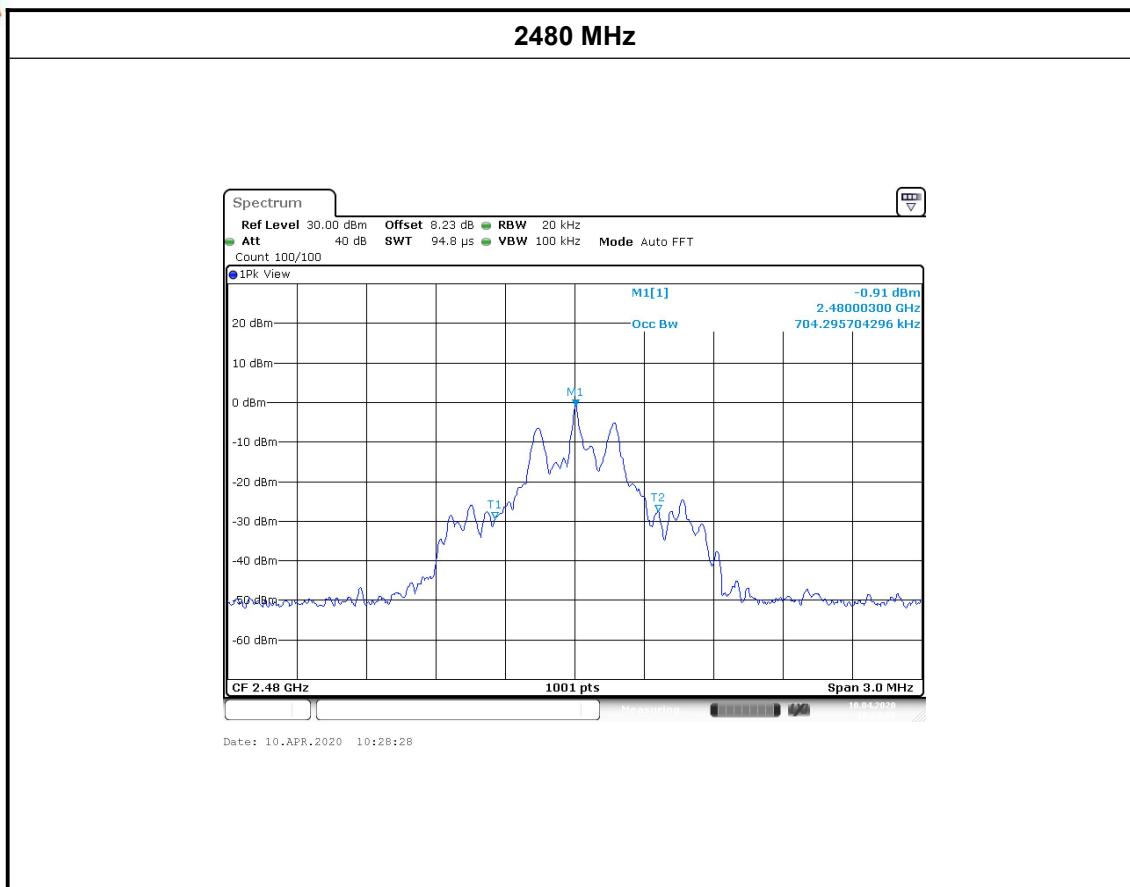
Ref Level 30.00 dBm Offset 8.23 dB RBW 20 kHz  
Att 40 dB SWT 94.8  $\mu$ s VBW 100 kHz Mode Auto FFT  
Count 100/100

1Pk View



CF 2.441 GHz 1001 pts Span 3.0 MHz

Date: 10.APR.2020 10:26:48



### 3.5. Carrier Frequencies Separation

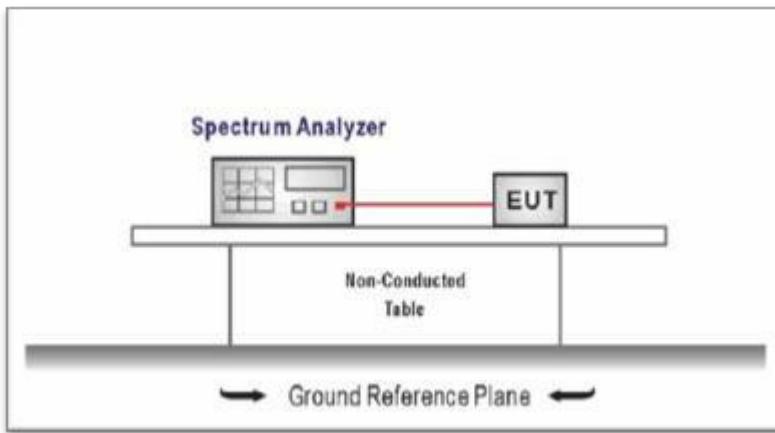
#### LIMIT

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  $2/3 \times 20$  dB 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

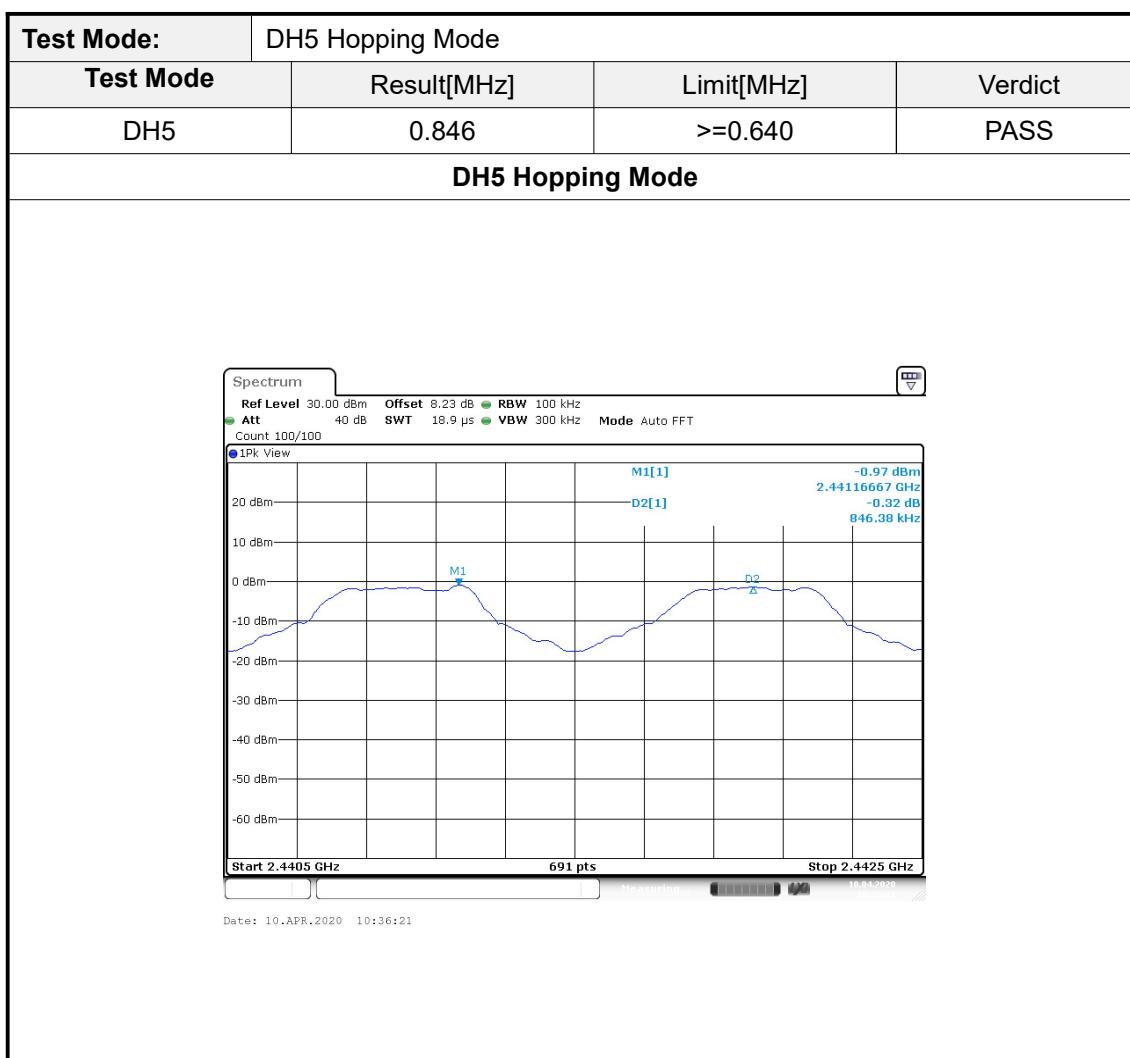
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
  - (1) Set RBW = 100 kHz.
  - (2) Set the video bandwidth (VBW)  $\geq 3$  RBW.
  - (3) Detector = Peak.
  - (4) Trace mode = Max hold.
  - (5) Sweep = Auto couple.

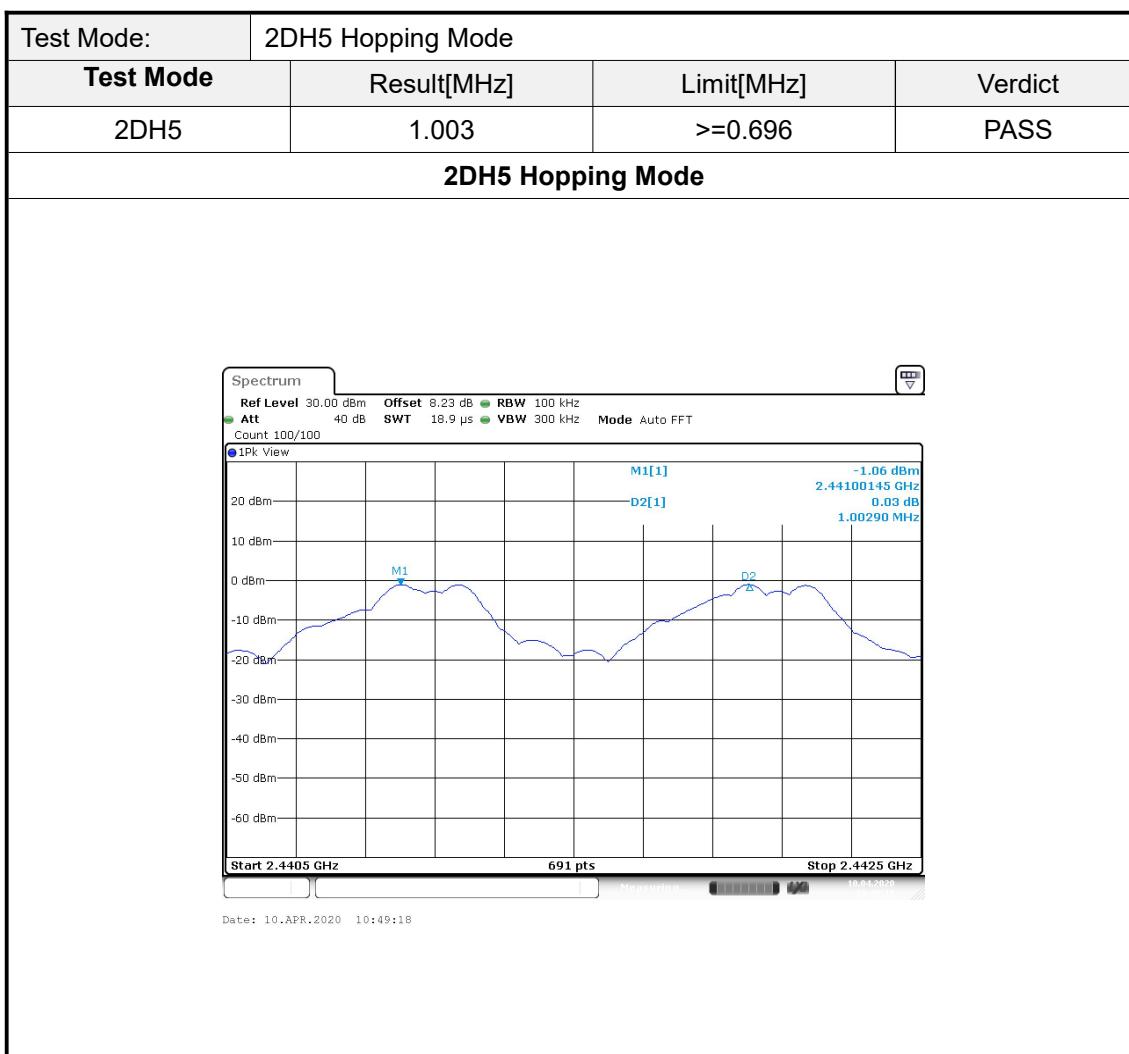
NOTE: The EUT was set to continuously transmitting in each mode and low, middle and high channel for the test, and found the middle channel which is the worse case, so only show the test date for worse case.

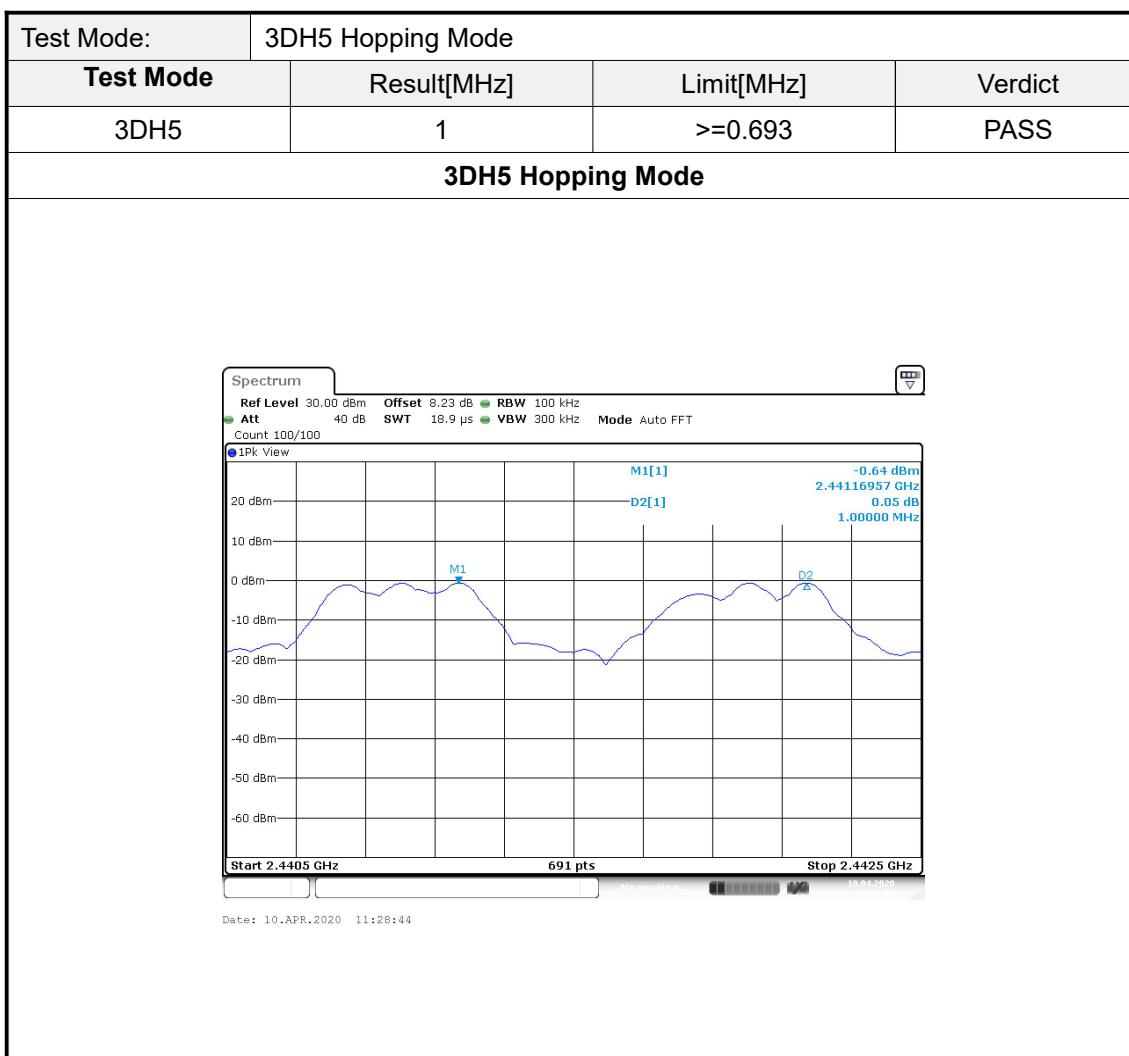
#### Test Mode

Please refer to the clause 2.3.

#### Test Results





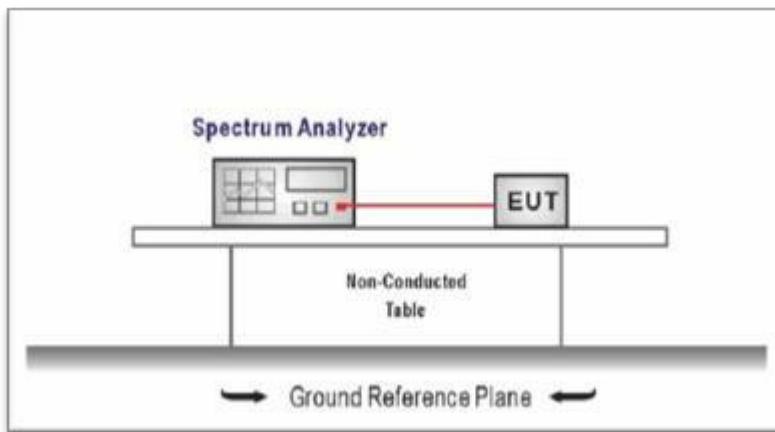


### 3.6. Number of Hopping Channel

#### Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

#### Test Configuration



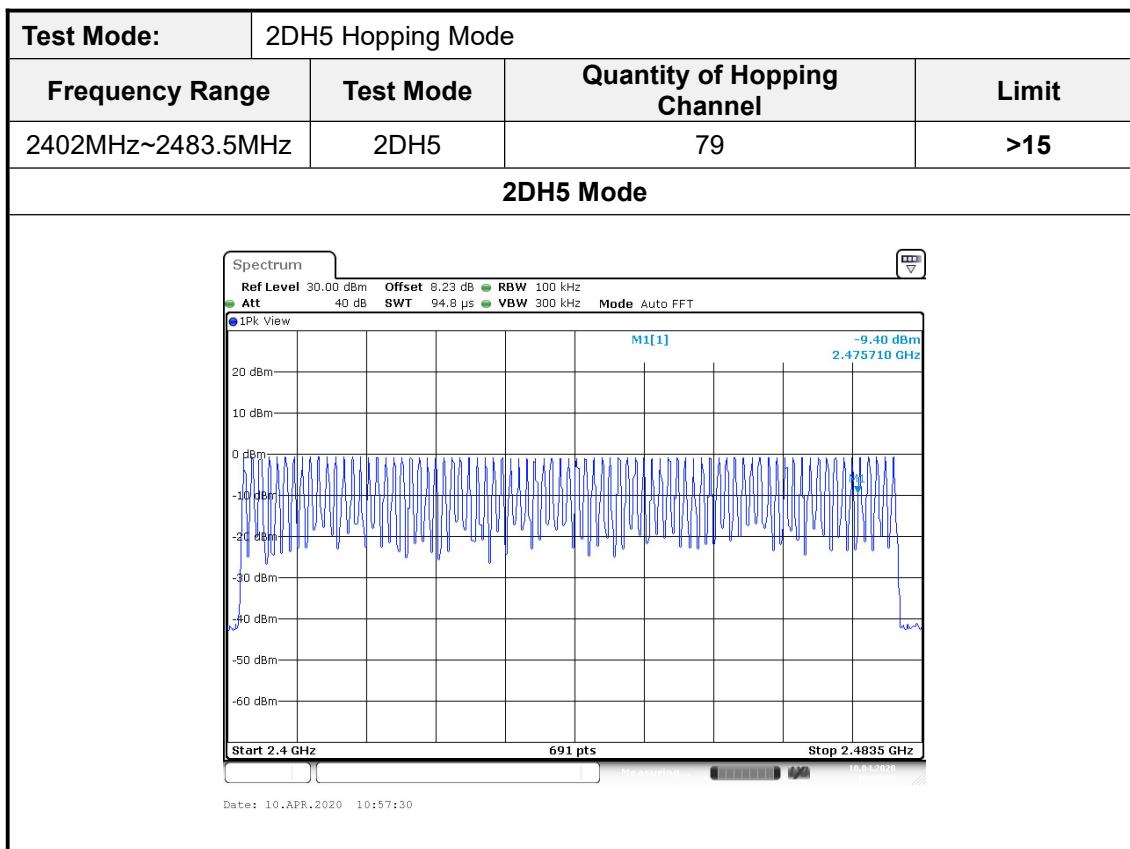
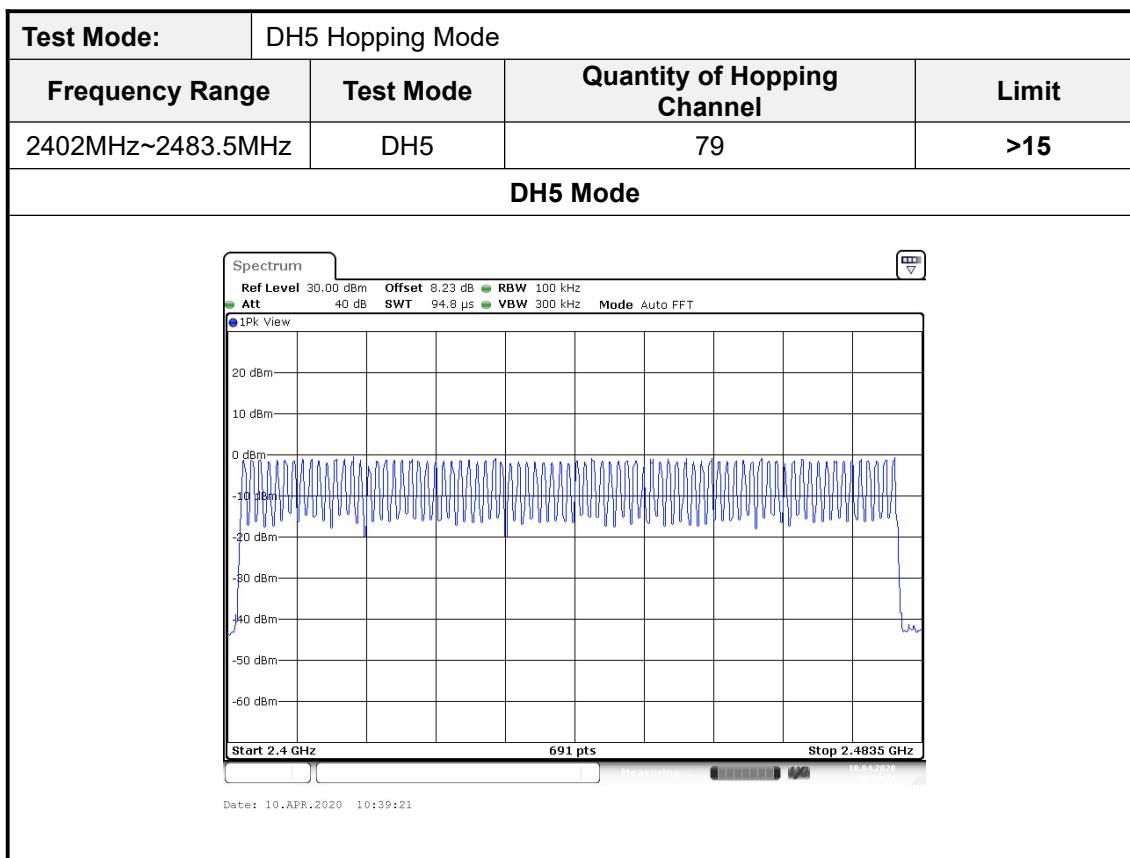
#### Test Procedure

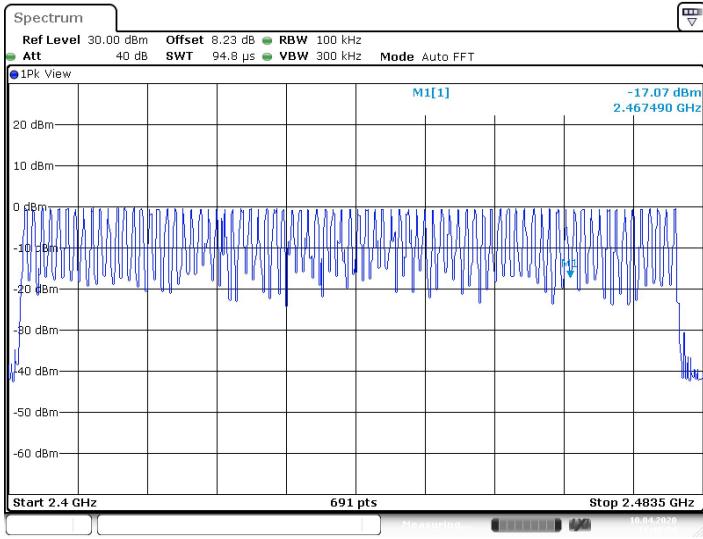
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
  - (1) Peak Detector: RBW=100 kHz, VBW $\geq$ RBW, Sweep time= Auto.

#### Test Mode

Please refer to the clause 2.3.

#### Test Result



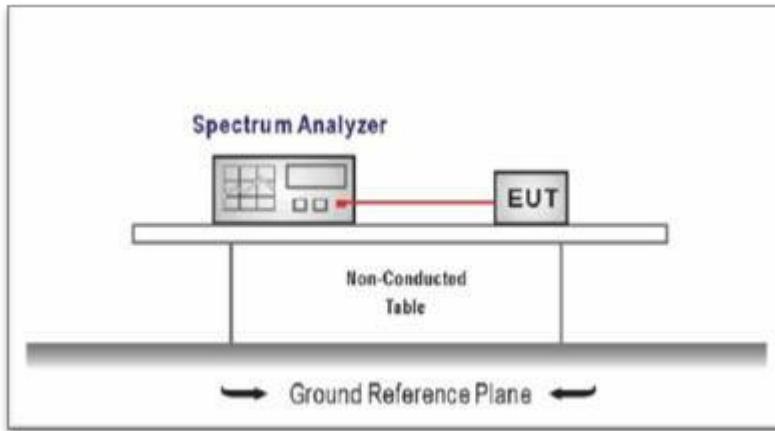
Test Mode:	3DH5 Hopping Mode		
Frequency Range	Test Mode	Quantity of Hopping Channel	Limit
2402MHz~2483.5MHz	3DH5	79	>15
3DH5 Mode			
			
Date: 10.APR.2020 11:40:04			

### 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 $\geq$ 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 recorded worst case at middle channel.

2. Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  2  $\div$  79)  $\times$  31.6 Second for DH1, 2DH1, 3DH1

Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  4  $\div$  79)  $\times$  31.6 Second for DH3, 2DH3, 3DH3

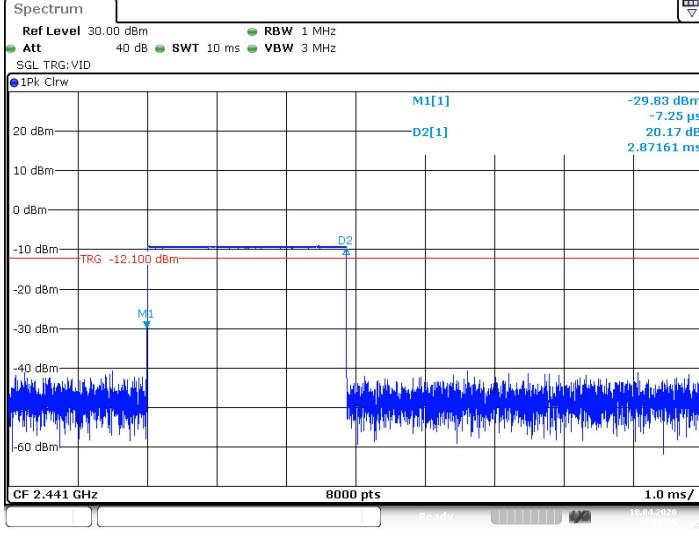
Dwell time = Pulse time (ms)  $\times$  (1600  $\div$  6  $\div$  79)  $\times$  31.6 Second for DH5, 2DH5, 3DH5

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	306.133	0.115	400	<b>PASS</b>	

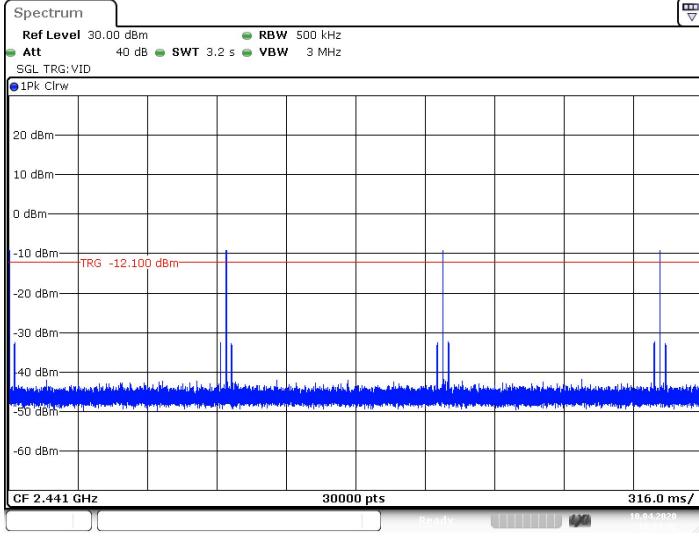
1DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second

**DH5 Hopping Mode**

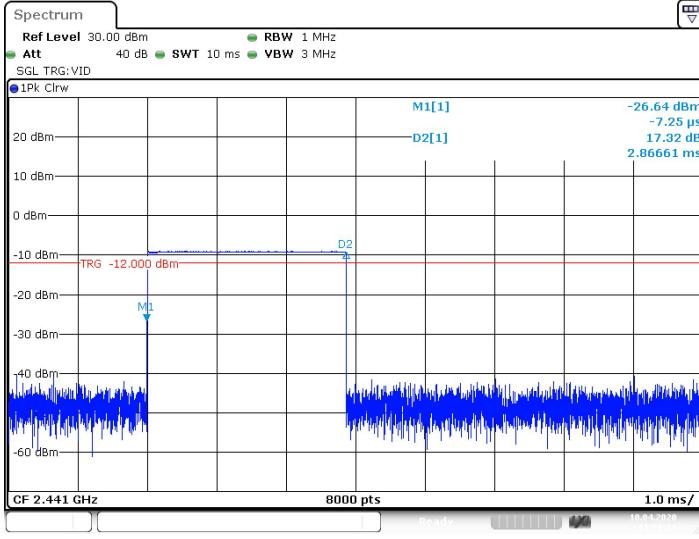
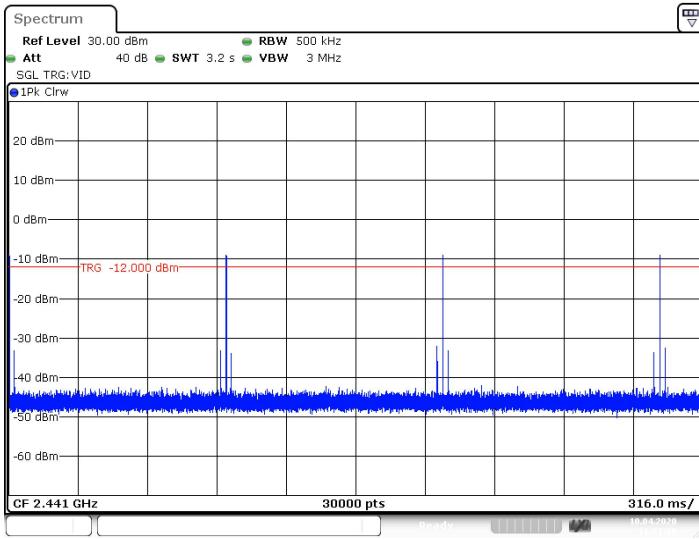
**2441 MHz**

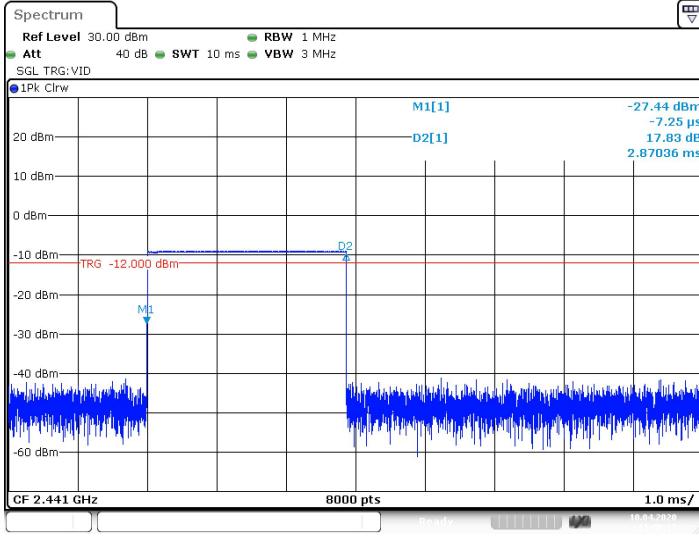
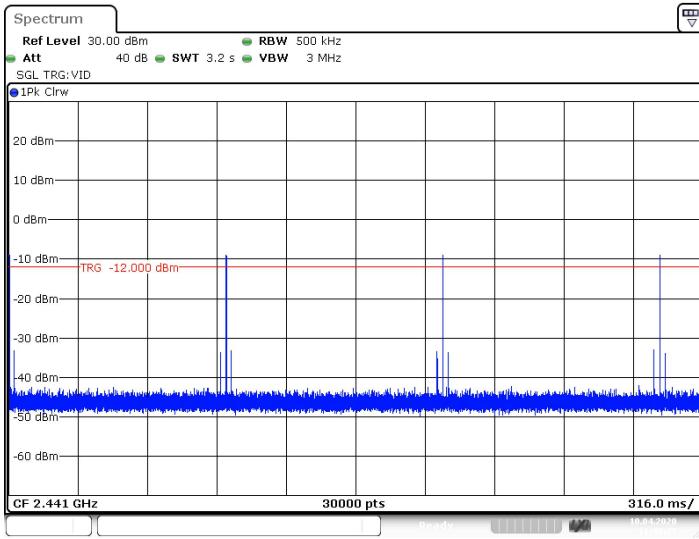


Date: 10.APR.2020 10:39:35



Date: 10.APR.2020 10:39:42

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	306.133	0.115	400	PASS
2DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second						
<b>2DH5 Hopping Mode</b>						
<b>2441 MHz</b>						
 <p>Spectrum</p> <p>Ref Level 30.00 dBm RBW 1 MHz</p> <p>Att 40 dB SWT 10 ms VBW 3 MHz</p> <p>SGL TRG:VID</p> <p>1Pk Clrw</p> <p>M1[1] D2[1]</p> <p>-26.64 dBm -7.25 μs 17.32 dB 2.86661 ms</p> <p>CF 2.441 GHz 8000 pts 1.0 ms/</p> <p>Date: 10.APR.2020 11:21:23</p>						
 <p>Spectrum</p> <p>Ref Level 30.00 dBm RBW 500 kHz</p> <p>Att 40 dB SWT 3.2 s VBW 3 MHz</p> <p>SGL TRG:VID</p> <p>1Pk Clrw</p> <p>M1</p> <p>TRG -12.000 dBm</p> <p>CF 2.441 GHz 30000 pts 316.0 ms/</p> <p>Date: 10.APR.2020 11:21:30</p>						

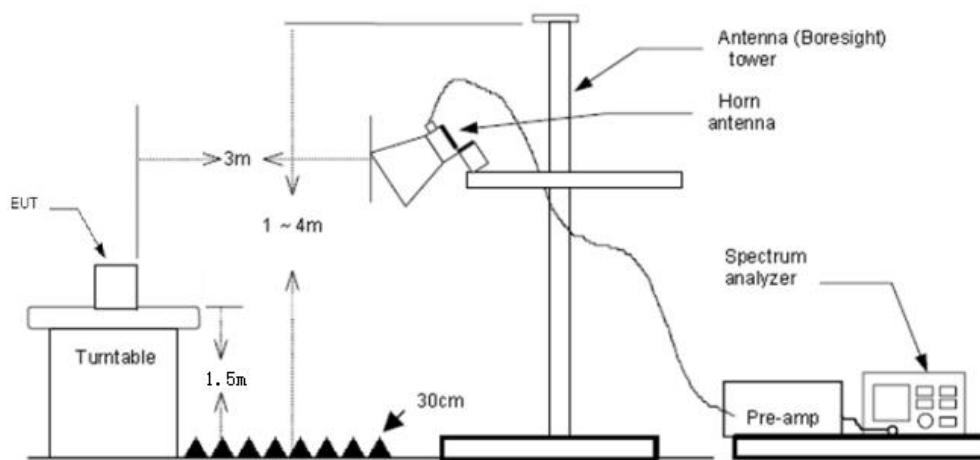
Test Mode:		3DH5 Hopping Mode				
Test Mode	Channel (MHz)	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
3DH5	2441	2.87	306.1333	0.115	400	PASS
2DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second						
<b>3DH5 Hopping Mode</b>						
<b>2441 MHz</b>						
 <p>Spectrum</p> <p>Ref Level 30.00 dBm      Att 40 dB      SWT 10 ms      RBW 1 MHz      VBW 3 MHz</p> <p>SGL TRG:VID</p> <p>1Pk Clrw</p> <p>M1[1]      D2[1]</p> <p>-27.44 dBm      -7.25 µs -17.83 dB      2.87036 ms</p> <p>CF 2.441 GHz      8000 pts      1.0 ms/</p> <p>Date: 10.APR.2020 11:40:17</p>						
 <p>Spectrum</p> <p>Ref Level 30.00 dBm      Att 40 dB      SWT 3.2 s      RBW 500 kHz      VBW 3 MHz</p> <p>SGL TRG:VID</p> <p>1Pk Clrw</p> <p>CF 2.441 GHz      30000 pts      316.0 ms/</p> <p>Date: 10.APR.2020 11:40:25</p>						

### 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
<b>Note: All restriction bands have been tested, only the worst case is reported.</b>		

#### 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.

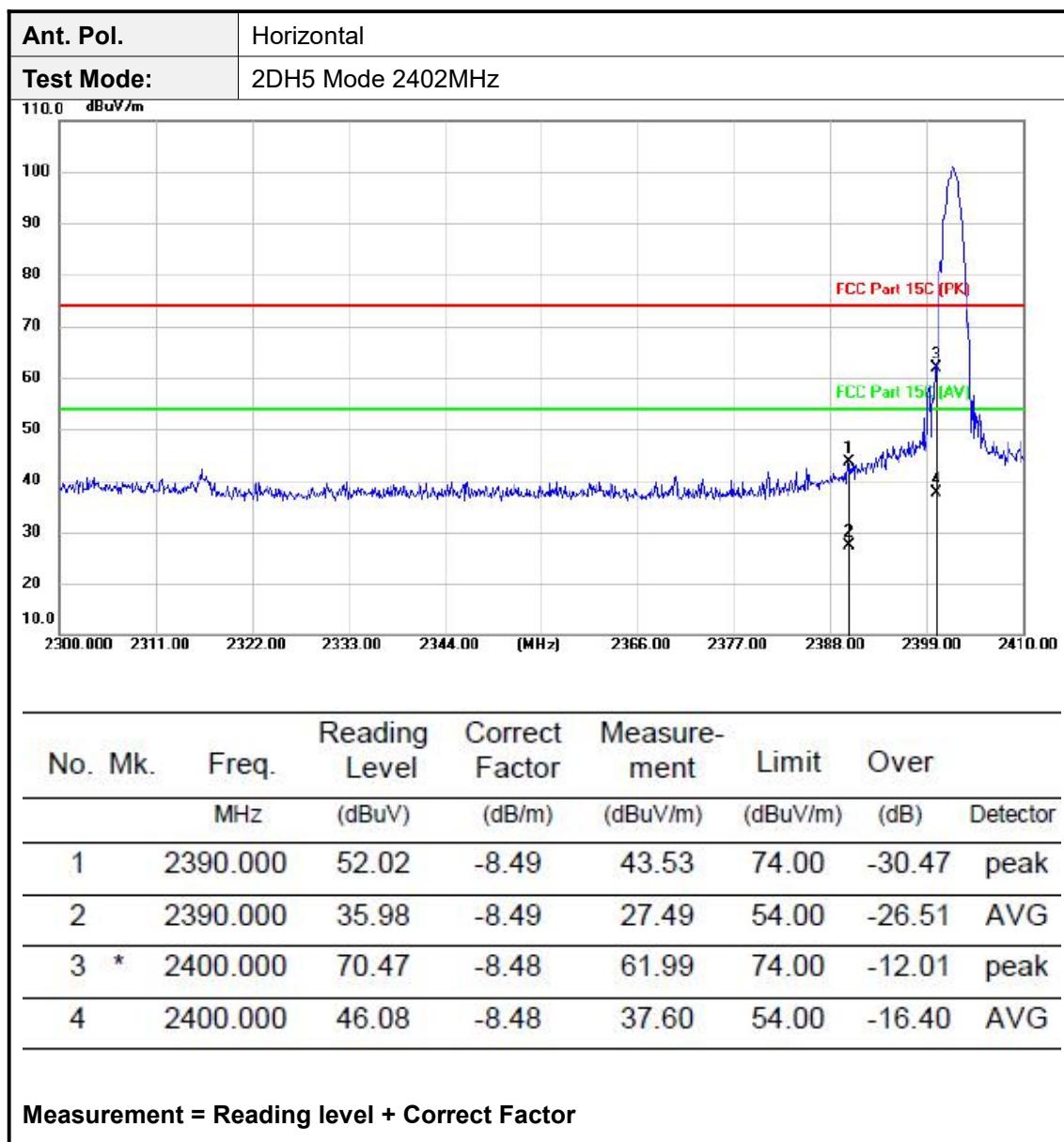
#### Test Results

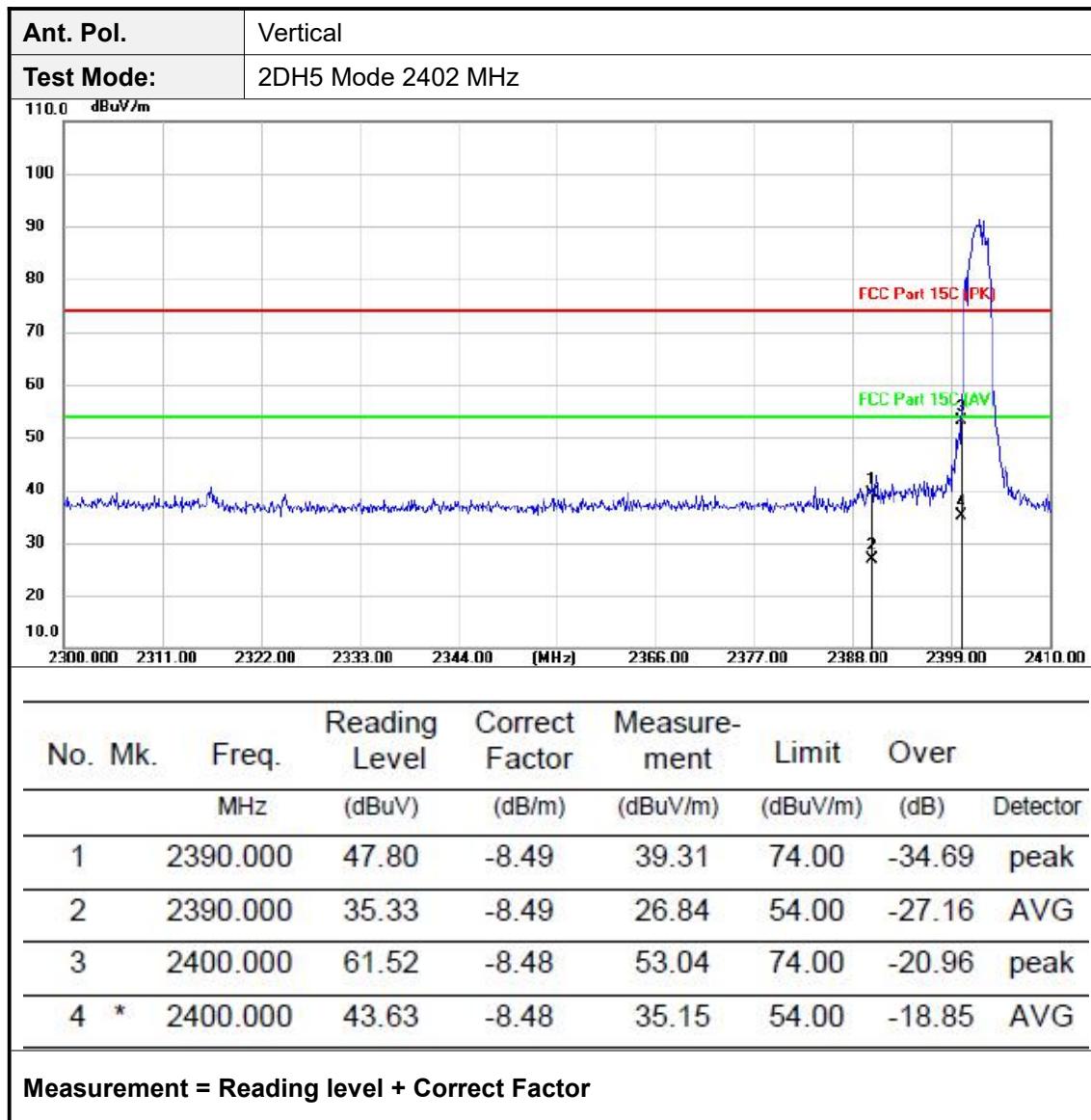
Note:

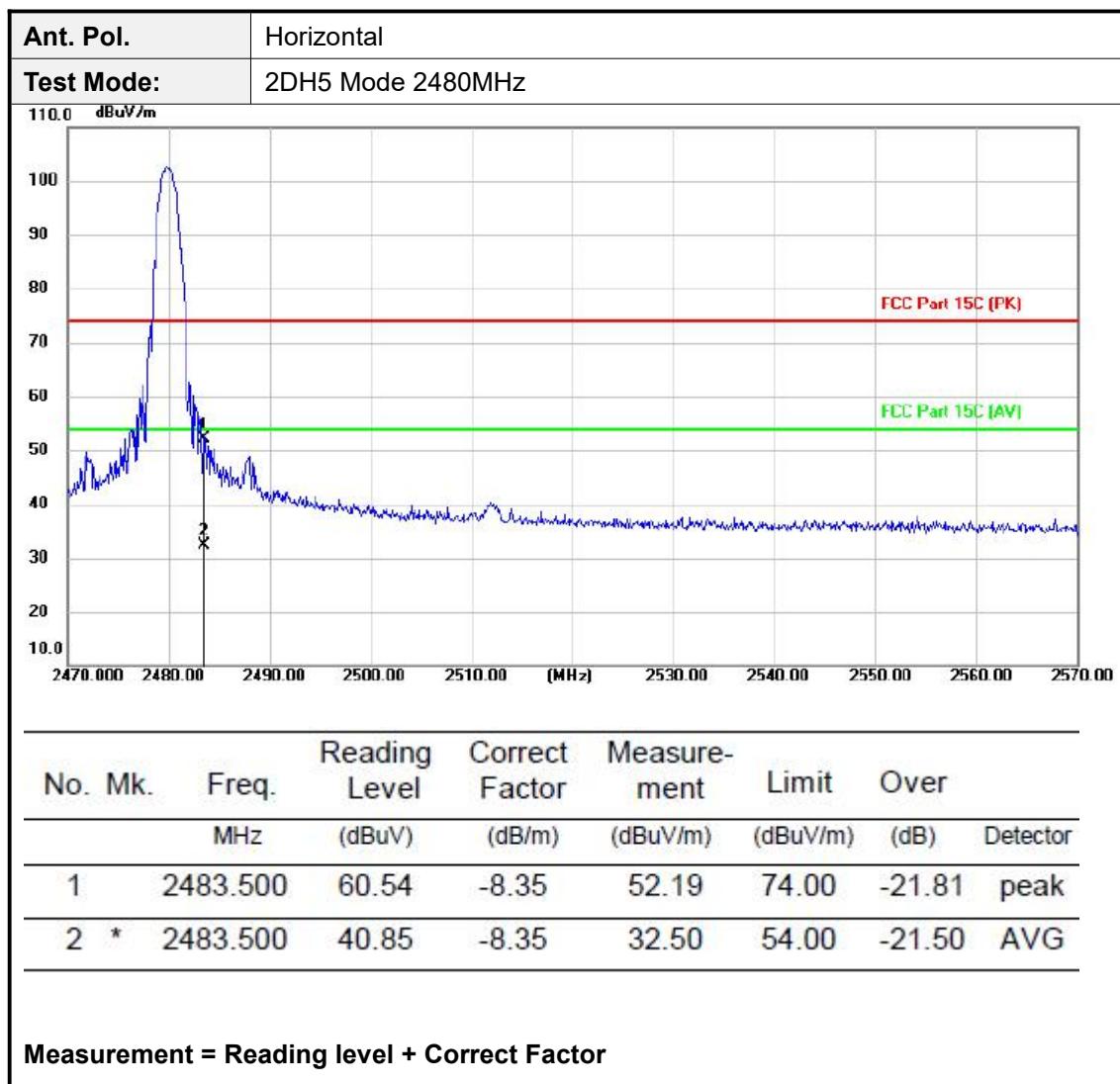
1. Measurement = Reading level + Correct Factor

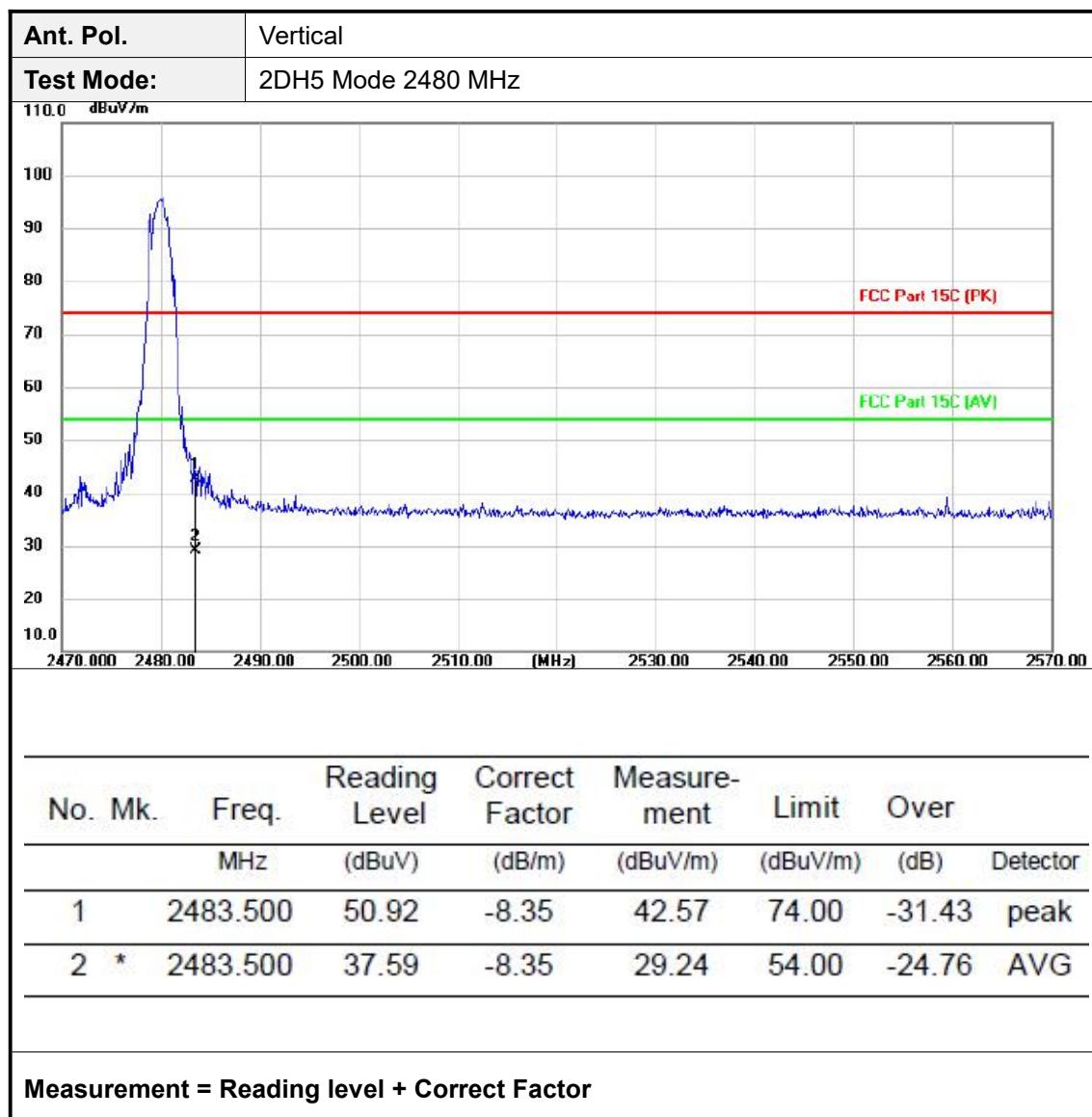
Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor

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









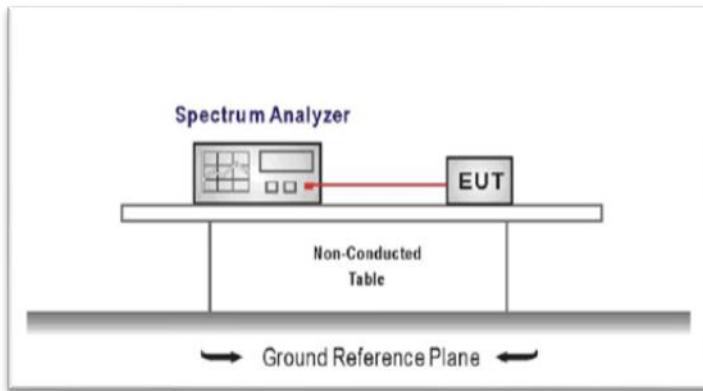
### 3.9. Band Edge and Spurious Emission (Conducted)

#### 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 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  $\geq$  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 2.3.

#### TEST RESULTS

