FCC DSS TEST REPORT

According to

FCC Part 15 Subpart C § 15.247

Equipment	:	**Bone conduction amplifier**
Model No	:	**NEC-B700**
Applicant	:	**Shinhan NEC** 54-7, Banga-ro 133beon-gil, Namsa-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea
Date of reception	:	**July 04, 2016**
Date of test	:	**July 04, 2016 to September 30, 2016**
Report Number	:	**BWS-16-RF-0006**
Report Type	:	**Original Report**
Date of issue	:	**September 30, 2016**
FCC Rule Part(s)	:	**FCC Part 15 Subpart C §15.247**

The product was received on August 9, 2016 and testing was completed on August 30, 2016. We, BWS TECH Inc. would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of BWS TECH Inc. the test report shall not be reproduced except in full.

(Date) 09/30/2016

Tested by **Hyun-Yong, Seol**

(Date)09/30/2016

Reviewed by **Bang-Hyun, Nam**

BWS TECH INC.

#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si,
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FCC TEST REPORT

Scope – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

1. General Information

1.1 Applicant

● **Company Name**	: Shinhan NEC.
● **Company Address**	: 54-7, Banga-ro 133beon-gil, Namsa-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, South Korea
● **Phone/Fax**	: Tel No. : +82-31-321-0740 Fax No. : +82-31-321-0741

1.2 Manufacturer

● **Company Name**	: Shinhan NEC.
● **Company Address**	: 54-7, Banga-ro 133beon-gil, Namsa-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, South Korea
● **Phone/Fax**	: Tel No. : +82-31-321-0740 Fax No. : +82-31-321-0741

1.3 EUT Description

● **Equipment**	: Bone conduction amplifier
● **Model(s)**	: NEC-B700
● **Operation Frequency**	: 2402MHz ~ 2480MHz
● **Number of Channels**	: Channel 79
● **Modulation Method**	: 1Mbps GFSK, 2Mbps π/4-DQPSK , 3Mbps 8DPSK
● **Input Voltage**	: DC 3.7 V Battery
● **Antenna Peak Gain**	: -2.84 dBi

1.4 Other Information

● **FCC Rule Part(s)**	: Part 15 Subpart C §15.247
● **FCC ID**	: 2AKB9NECB700
● **Test Procedure**	: ANSI C63.10-2013 KDB 558074 D01 DTS Meas Guidance v03r05
● **Date of Test**	: August 09, 2016 to August 29, 2016
● **Place of Test**	: BWS TECH Inc. (FCC Registration Number : 287786) #23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 17031, South Korea TEL: +82 31 333 5997 FAX: +82 31 333 0017

2. Description of Test Facility

Site Description

Test Lab. :

Accredited by Industry Canada, February 10, 2015
The Certificate Registration Number is 4963A-2.

Accredited by FCC, September 03, 2013
The Certificate Registration Number is 287786.

Accredited by VCCI, September 11, 2015
The Certificate Registration Number is C-4326

Accredited by RRA(EMC,RF, SAR), December 16, 2016
The Certificate Registration Number is KR0017

Accredited by KOLAS(KS Q ISO/IEC 17025), April 08, 2016
The Certificate Registration Number is KT174

Name of Firm : **BWS TECH Inc.**

Site Location : **#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-853, South Korea**

3. Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and the requirements of FCC Rules Part 15.207, 15.209 and 15.247.
Radio testing was performed according to KDB 558074 D01 DTS Meas Guidance v03r05.

3.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and is operated in a manner that intends to maximize its emission characteristics in a continuous normal application

3.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 FCC Part 15.205 Restricted Bands of Operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

1 Until February 1, 1999, this restricted band shall be 0.490-0.510MHz.
2 Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.4 Description of Test Modes

The EUT has been tested under operating condition.
After verification, all tests were carried out with the worst case test modes as shown below Channel Low (2402MHz), Middle (2441MHz) and High (2480MHz), these were chosen for full testing.

4. Summary of Test Results

Clause	TEST Description	Standard Section	Limit	Result
5.1	**AC Conducted Emission**	§15.207	N/A	N/A
5.2	**Number of Channels**	§15.247(a)(1)	≥15 Channels	Pass
5.3	**Hopping Channel Separation**	§15.247(a)(1)	≥2/3 of 20dB BW	Pass
5.4	**Dwell Time of Each Channel**	§15.247(a)(1)	≤0.4sec in 31.6sec period	Pass
5.5	**20dB Bandwidth**	§15.247(a)(1)	N/A	Pass
5.6	**RF Output Power**	§15.247(b)(1)	≤ 125 mW	Pass
5.7	**Radiated Spurious Emission and Band Edge**	§15.247(d)	§15.209(a) & §15.247(d)	Pass
5.8	**Conducted Spurious Emission and Band Edge**	§15.247(d)	≤20dBc	Pass
5.9	**Antenna Requirement**	§15.247(b), §15.203	N/A	Pass

REMARK : This EUT is used to Battery

5. Test Data

5.1 AC Conducted Emission Measurement

5.1.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
Test Receiver	ESPI	ROHDE & SCHWARZ	100063	2017/01/08	1 year
#2 Conducted Cable_2.7m	N/A	N/A	N/A	2017/01/08	1 year
LISN	NSLK 8127	SCHWARZBECK	8127-414	2017/01/07	1 year
Impuls-Begrenzer Pulse Limiter	ESH3-Z2	ROHDE & SCHWARZ	100092	2017/01/06	1 year
CE CHAMBER	N/A	SY Corp.	N/A	N/A	1 year
DC POWER SUPPLY	IPS-30B03DD	INTERACT	00420502	2017/09/10	1 year

5.1.2 Test Limit

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

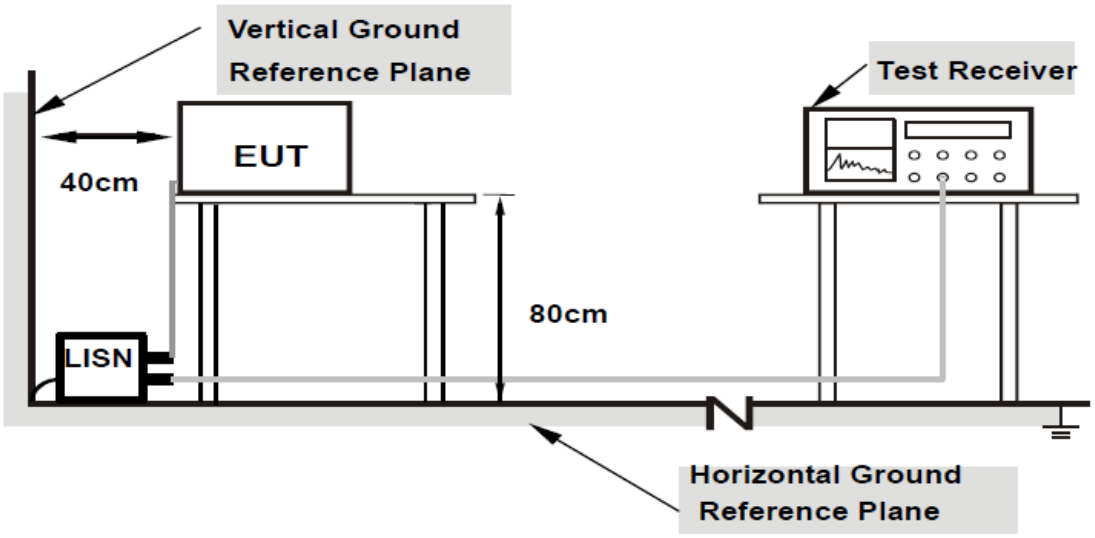
Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

5.1.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room and was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network(LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

5.1.4 Block Diagram of Test Setup



5.1.5 Test Result : NA

5.2 Number of Channel Measurement

According to FCC 15.247(a)(1), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, and frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.2.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
Spectrum Analyzer	FSV30	ROHED&SCHWARZ	100832	2017/09/07	1 Year
DC Power Supply	UDP-6015R	Unicorn tech	131007	2017/09/10	1 Year

5.2.2 Test Limit

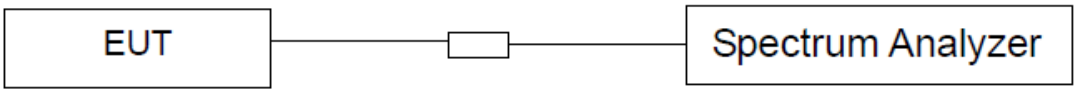
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.2.3 Measurement Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

3. Set to the maximum output power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 300kHz; VBW≥RBW; Sweep=auto; Detector function=peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel
7. Record the measurement data derived from spectrum analyzer.

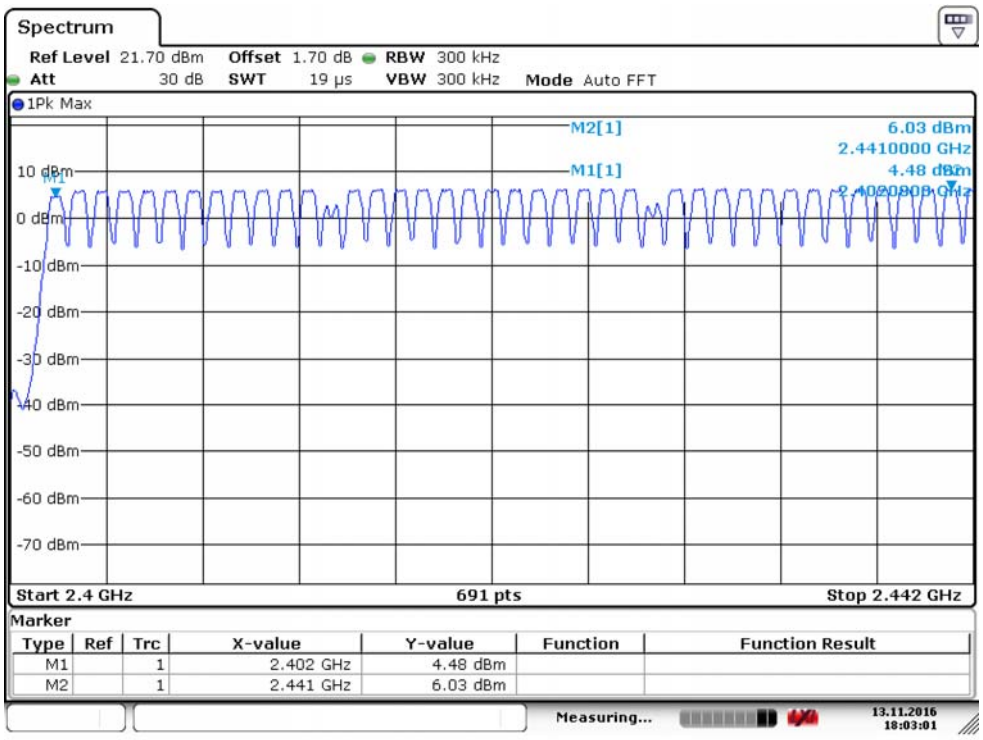
5.2.4 Test SET-UP (Block Diagram of Configuration)



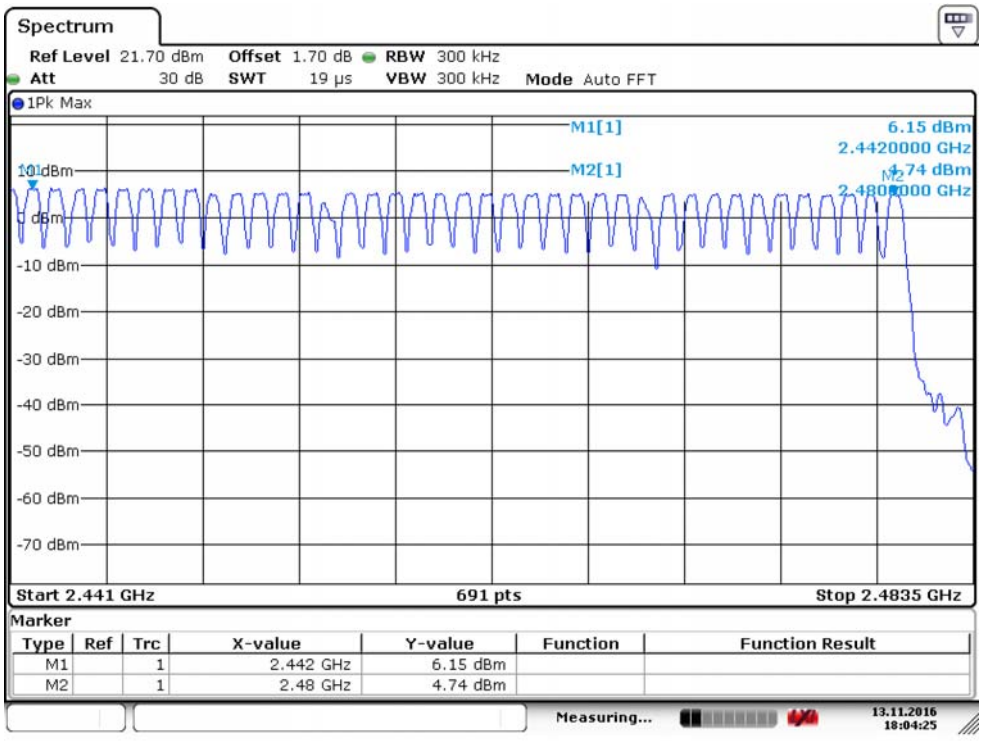
5.2.5 Test Result

Number of Hopping (Channel)	Limits (Channel)	Pass/Fail
79	≥ 15	Pass

Number of Hopping Channel Plot on Channel 0 – 39



Number of Hopping Channel Plot on Channel 40 – 78



5.3 Hopping Channel Separation Measurement

According to FCC 15.247(a)(1), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, and frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

5.3.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
Spectrum Analyzer	FSV30	ROHED&SCHWARZ	100832	2017/09/07	1 Year
DC Power Supply	UDP-6015R	Unicorn tech	131007	2017/09/10	1 Year

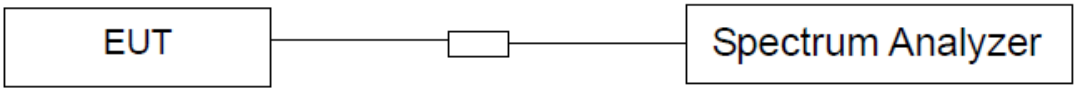
5.3.2 Test Limit

Frequency Hopping systems operating in the 2400-2484.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater

5.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 caluse 7.8.2
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function
5. Use the following spectrum analyzer settings:
   , Span = wide enough to capture the peaks of two adjacent channels; RBW = 300kHz; VBW≥ RBW; Sweep = Auto; Detector function = Peak; Trace = Max Hold.
5. Measure and record the results in the test report.

5.3.4 Block Diagram of Test Setup

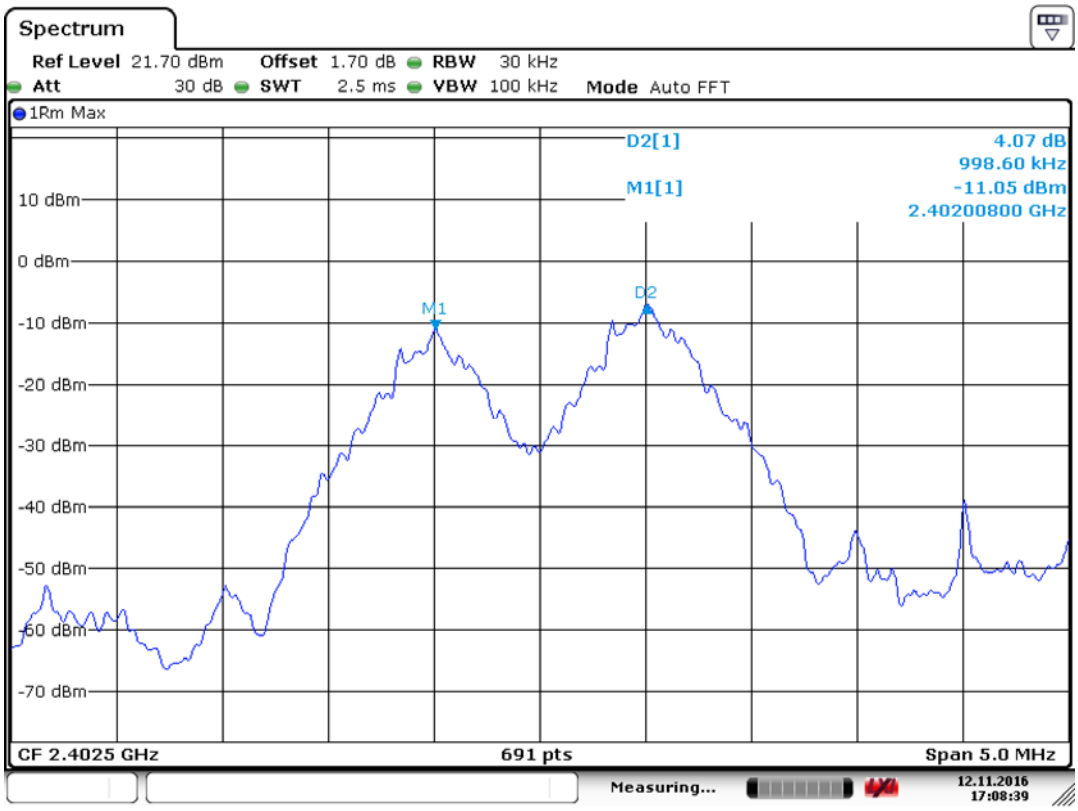


5.3.5 Test Result

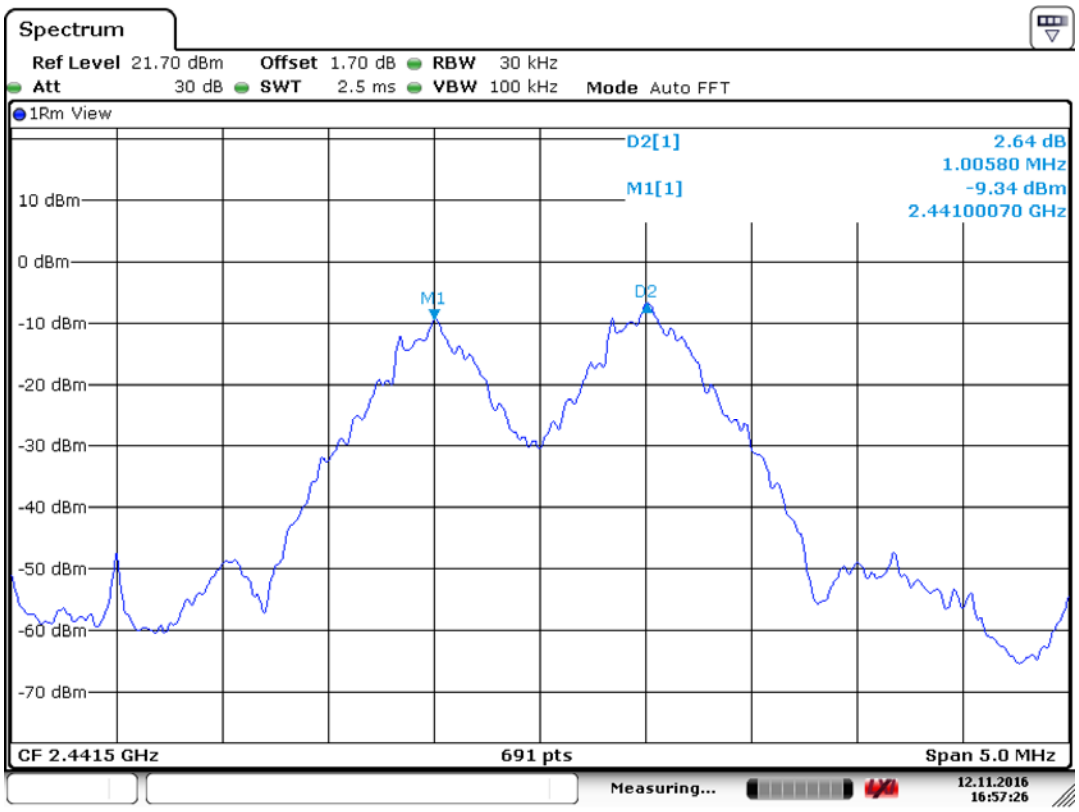
GFSK mode

Channel	Frequency (MHz)	Frequency Separation (kHz)	(2/3 of 20dB BW) Limits (kHz)	Pass/Fail
0	2402	998.6	>566	Pass
39	2441	1000.6	>571	Pass
78	2480	991.3	>566	Pass

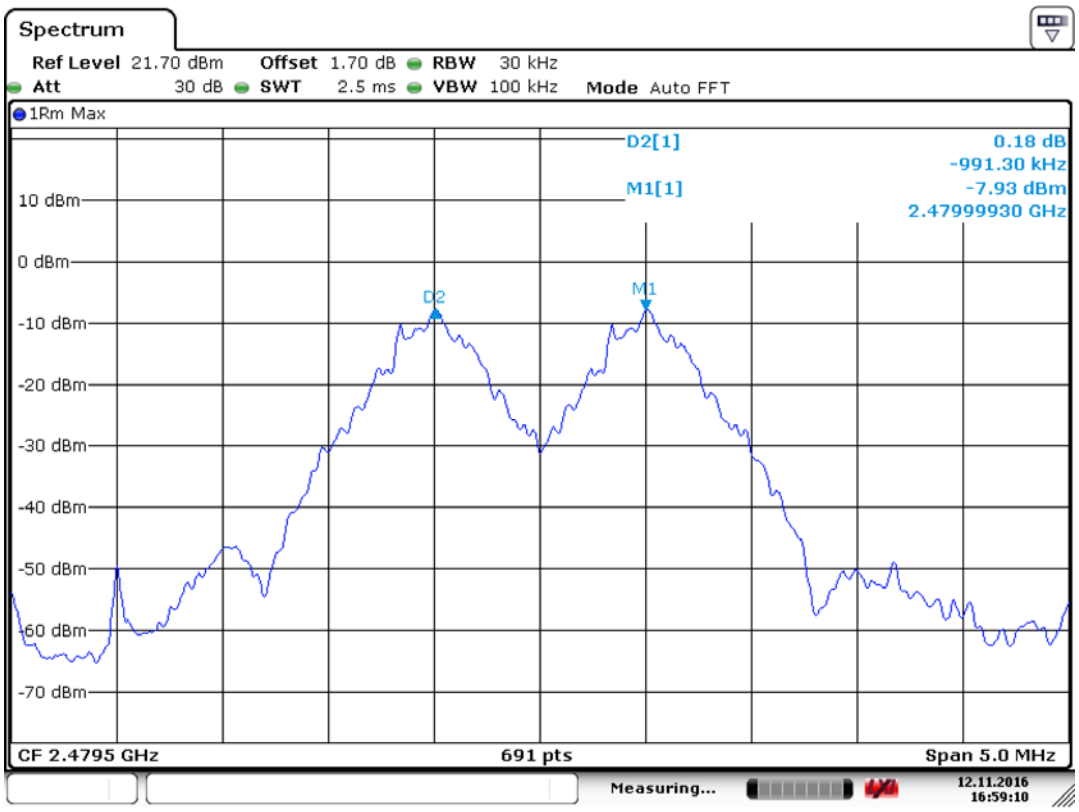
Channel Separation Plot on Channel 01 – 02



Channel Separation Plot on Channel 39 – 40



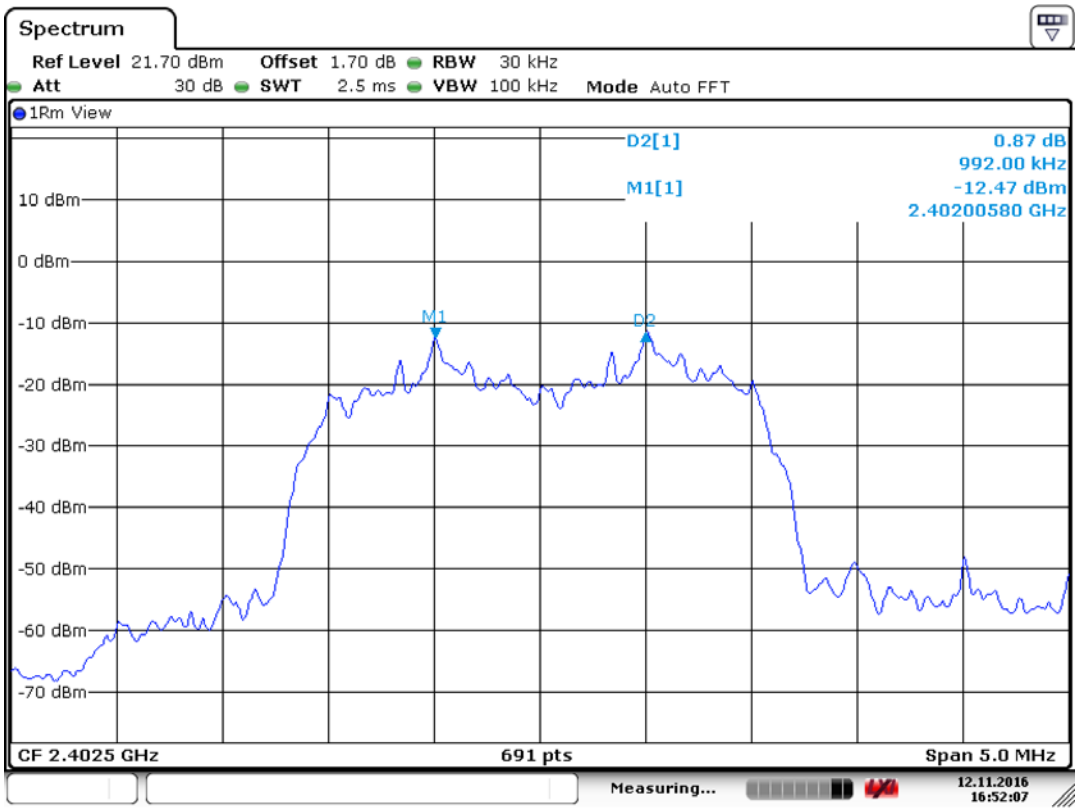
Channel Separation Plot on Channel 78 – 79



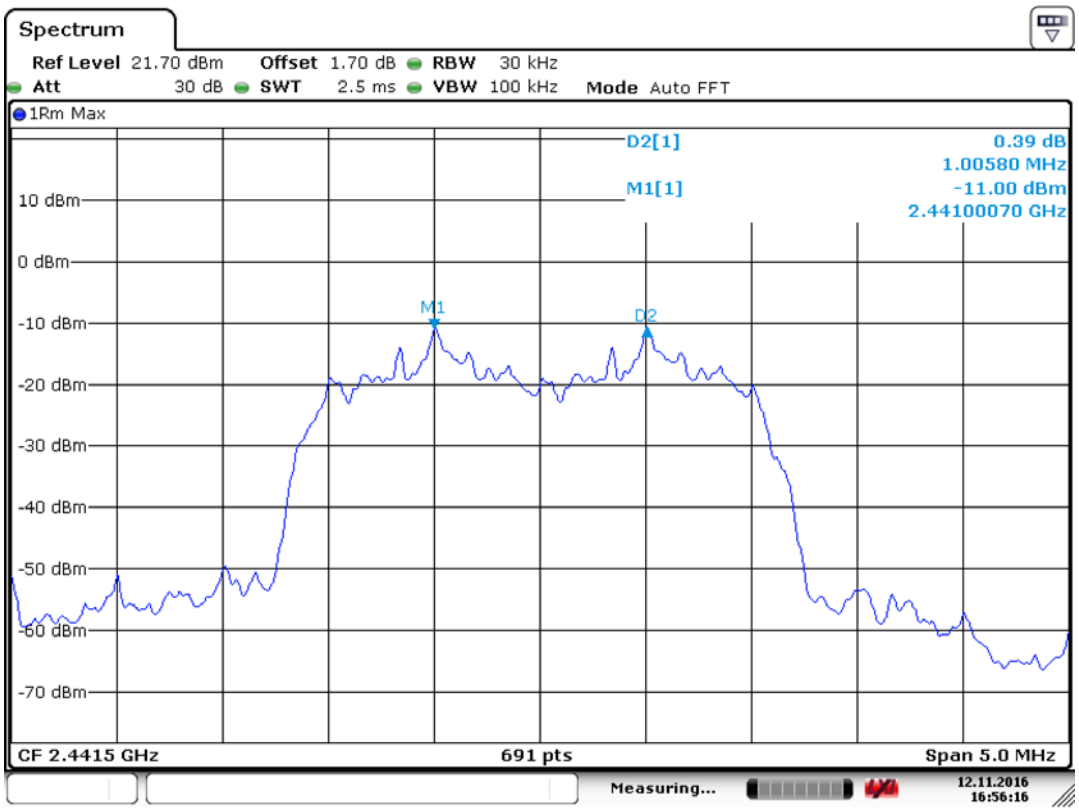
π/4-DQPSK mode

Channel	Frequency (MHz)	Frequency Separation (kHz)	(2/3 of 20dB BW) Limits (kHz)	Pass/Fail
0	2402	992.0	>824	Pass
39	2441	1000.6	>826	Pass
78	2480	991.3	>833	Pass

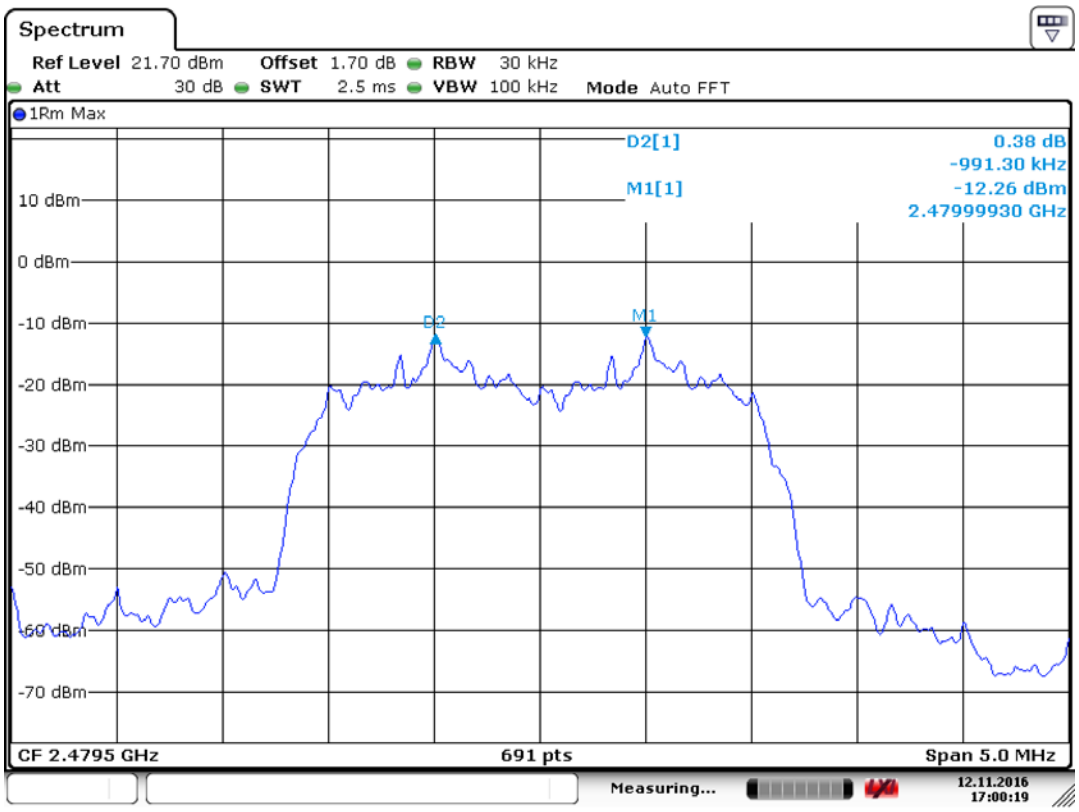
Channel Separation Plot on Channel 01 – 02



Channel Separation Plot on Channel 39 – 40



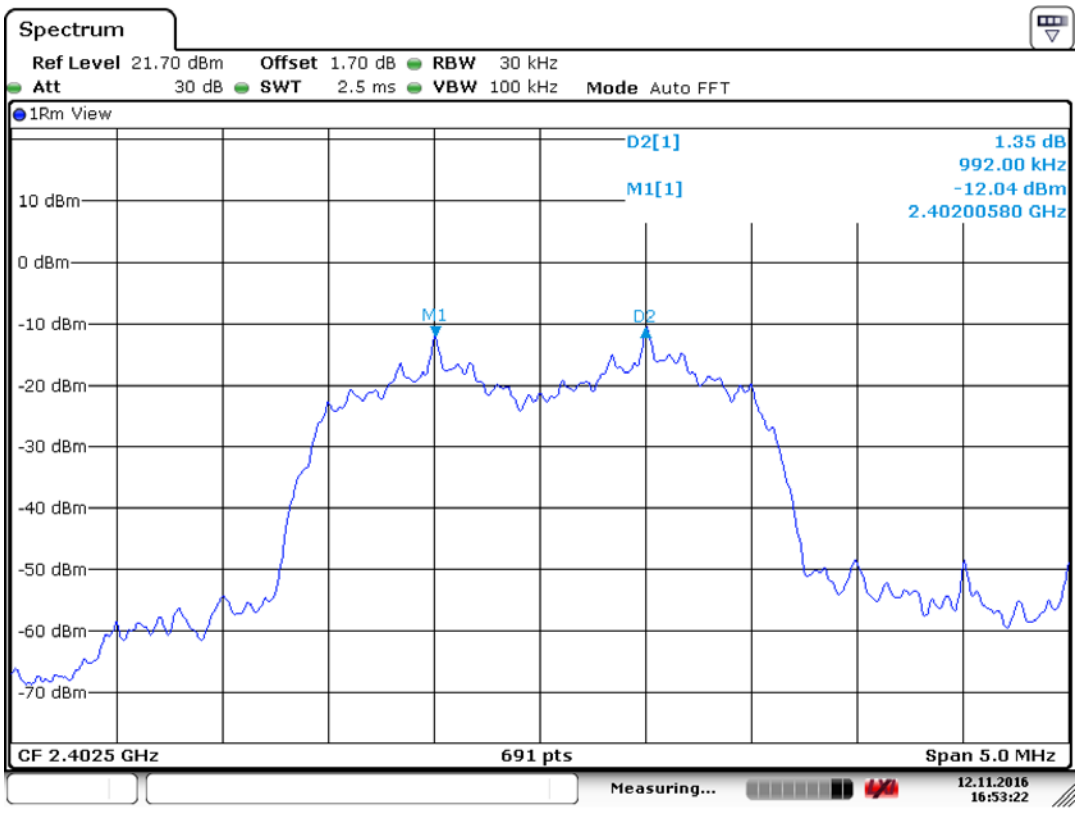
Channel Separation Plot on Channel 78 – 79



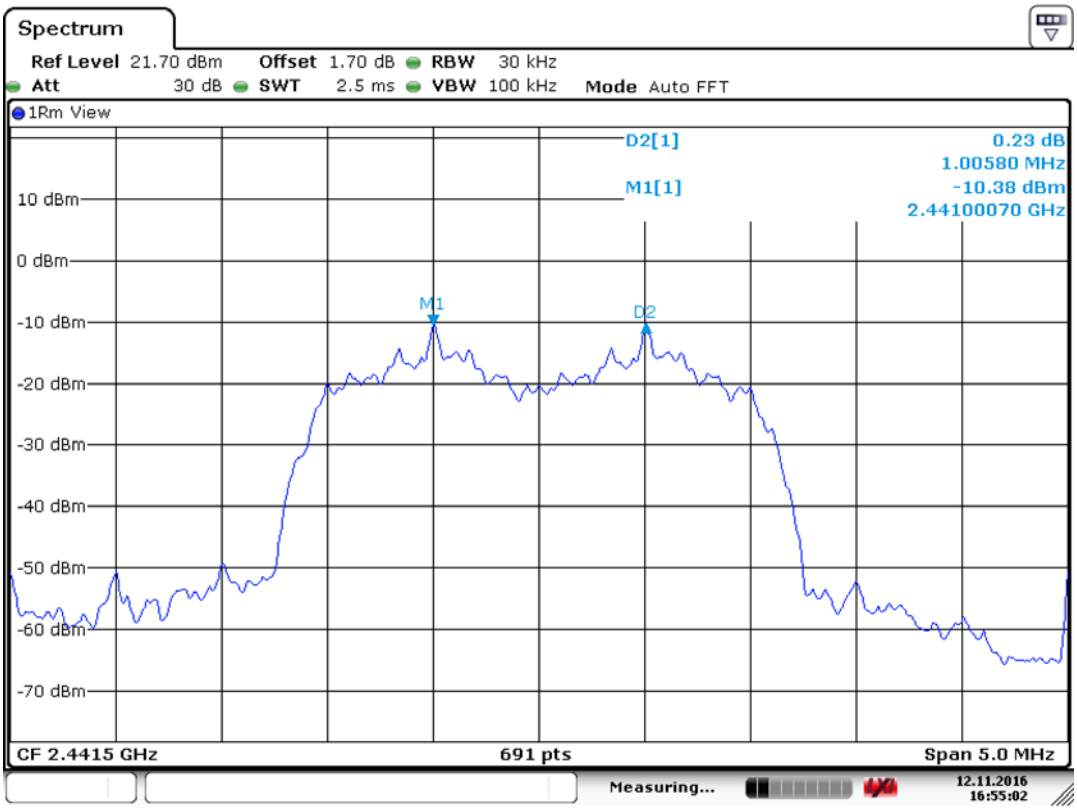
8DPSK mode

Channel	Frequency (MHz)	Frequency Separation (kHz)	(2/3 of 20dB BW) Limits (kHz)	Pass/Fail
0	2402	992.0	>826	Pass
39	2441	1000.6	>826	Pass
78	2480	991.3	>824	Pass

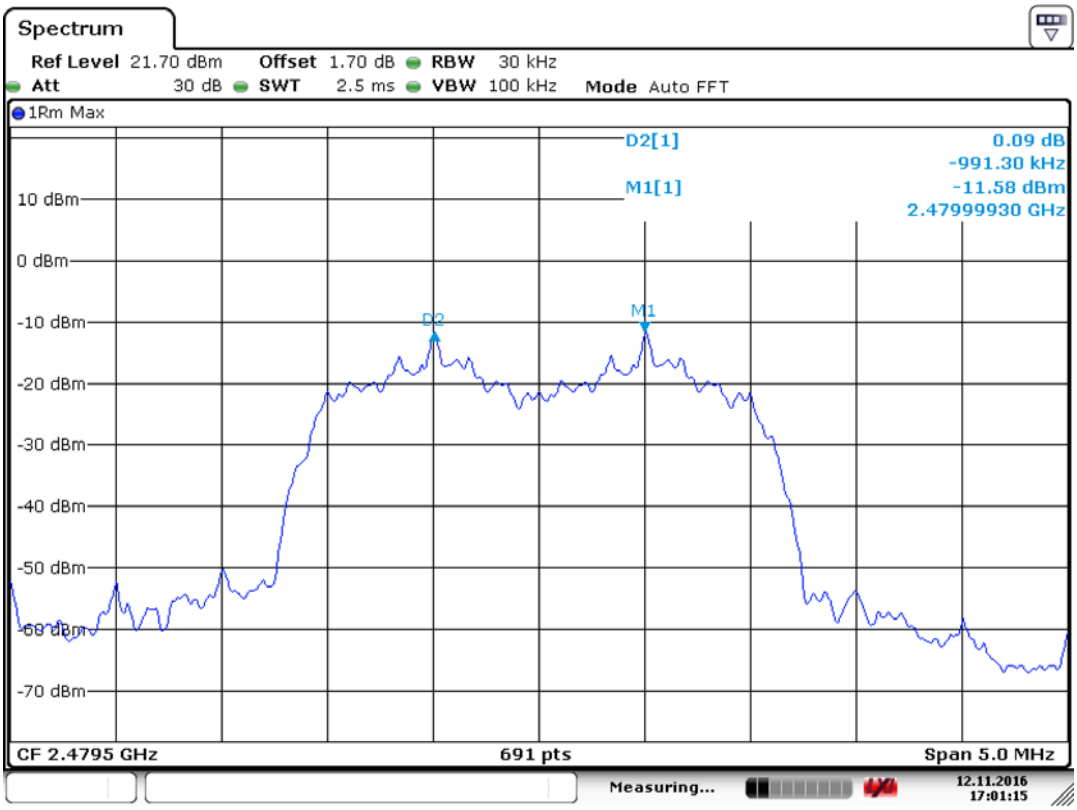
Channel Separation Plot on Channel 01 – 02



Channel Separation Plot on Channel 39 – 40



Channel Separation Plot on Channel 78 – 79



5.4 Dwell Time Measurement

According to 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.4.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
Spectrum Analyzer	FSV30	ROHED&SCHWARZ	100832	2017/09/07	1 Year
DC Power Supply	UDP-6015R	Unicorn tech	131007	2017/09/10	1 Year

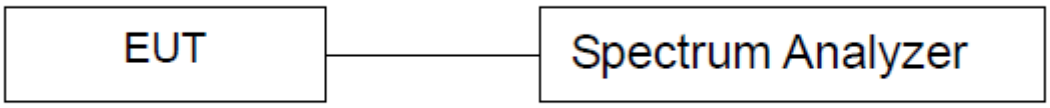
5.4.2 Test Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.4.3 Measurement Procedure

1. The testing test follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings:
   Span = zero span, centered on a hopping channel; RBW = 1MHz; VBW≥RBW; Sweep = Auto; Detector function = Peak; Trace = Max Hold.
5. Measure and record the results in the test report.

5.4.4 Test SET-UP (Block Diagram of Configuration)



5.4.5 Test Result

The dwell time within a period in data mode is independent from the packet type (packet length). The data is corrected with the worse case, which the packet length is DH1,DH3 and DH5 .

The test period: T=0.4 Second * 79 Channel = 31.6 s

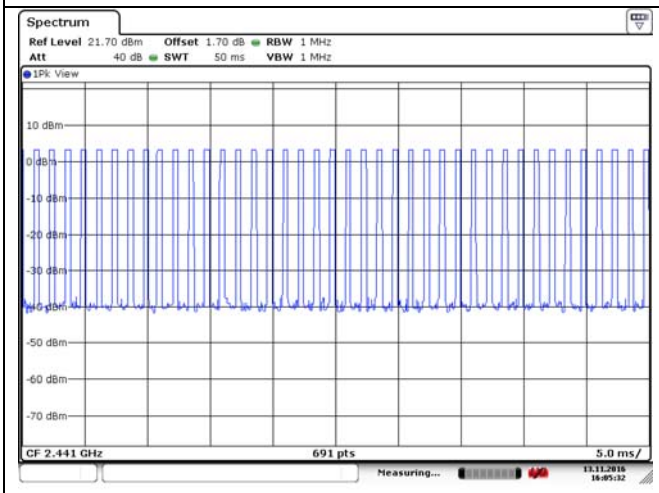
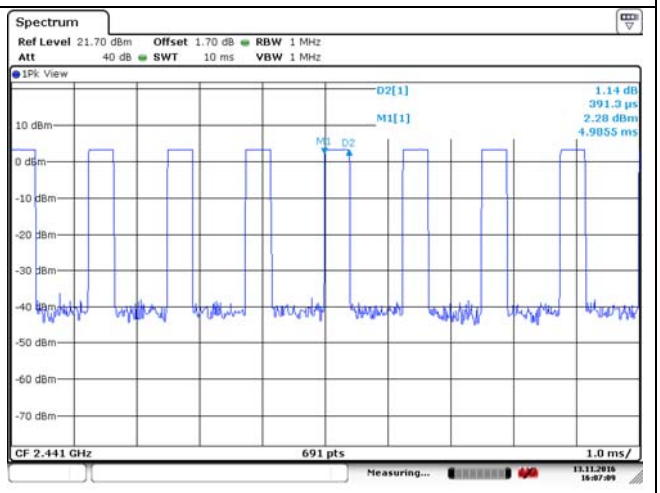
Dwell time = [(time slot length * Hopping rate) /number of hopping channels] x Period

Test Mode	Channel No.	Frequency (MHz)	Time Slot Length (ms)	Dwell Time (ms)	Limit (ms)	Result
DH1	39	2441	0.39	124.8	<400	Pass
DH3	39	2441	1.638	262.1	<400	Pass
DH5	39	2441	2.899	301.5	<400	Pass

Please refer to the test plots as below :

Test mode : DH1

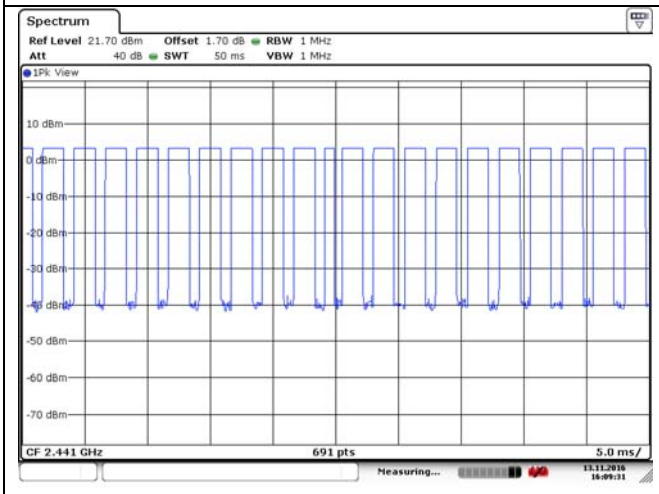
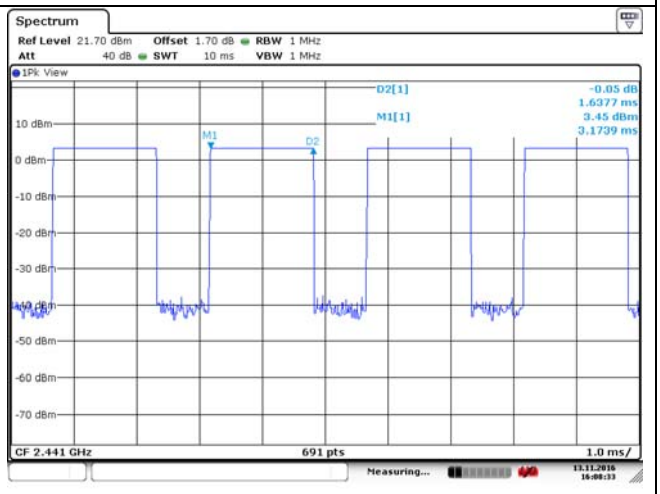
DH1 Time of Occupancy

Channel 39 (2441MHz) Sleep time : 50ms	Channel 39 (2441MHz) Sleep time : 10ms
	

Note : Test Time Period: 0.4 * 79 = 31.6sec, Hopping Time with 1sec : 40/50ms = 800 hops/sec.
The Maxmum Occupancy Time within 31.6sec : [(0.39ms*800)/79]*31.6=124.8msec.

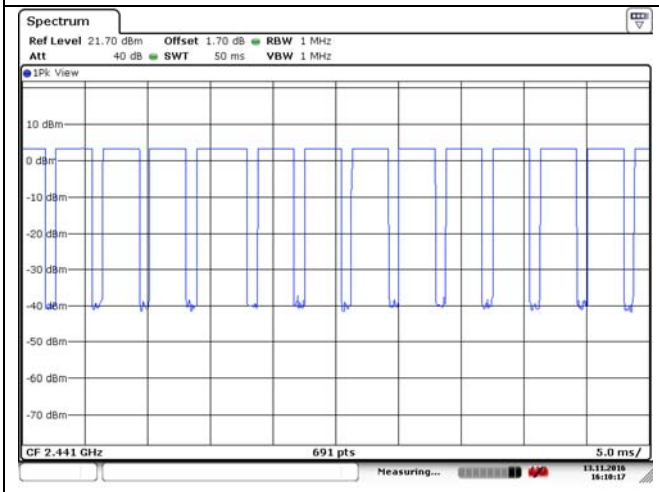
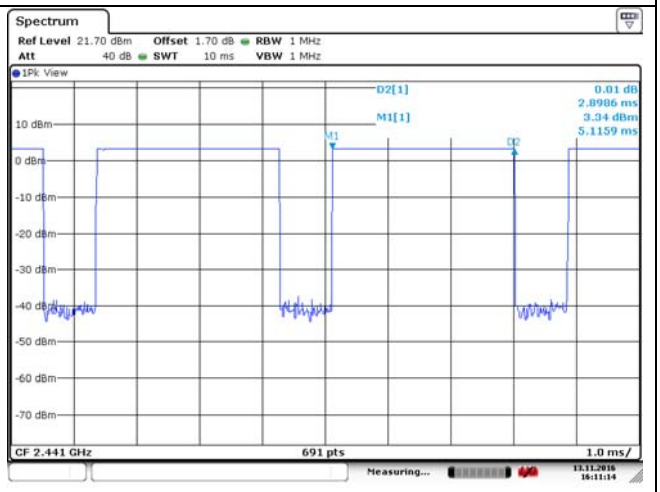
Test mode : DH3

DH3 Time of Occupancy

Channel 39 (2441MHz) Sleep time : 50ms	Channel 39 (2441MHz) Sleep time : 10ms
	

Note : Test Time Period: 0.4 * 79 = 31.6sec, Hopping Time with 1sec : 20/50ms = 400 hops/sec.
The Maxmum Occupancy Time within 31.6sec : [(1.638ms*400)/79]*31.6=262.1msec.

Test mode : DH5

DH5 Time of Occupancy	
Channel 39 (2441MHz) Sleep time : 50ms	Channel 39 (2441MHz) Sleep time : 10ms
	

Note : Test Time Period: 0.4 * 79 = 31.6sec, Hopping Time with 1sec : 13/50ms = 260 hops/sec.
The Maxmum Occupancy Time within 31.6sec : [(2.899ms*260)/79]*31.6=301.5msec.

5.5 20dB Bandwidth Measurement

5.5.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
Spectrum Analyzer	FSV30	ROHED&SCHWARZ	100832	2017/09/07	1 Year
DC Power Supply	UDP-6015R	Unicorn tech	131007	2017/09/10	1 Year

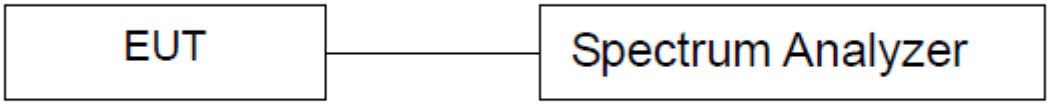
5.5.2 Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

5.5.3 Measurement Procedure

1. The testing test follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels; RBW = 300kHz; VBW≥ RBW; Sweep = Auto; Detector function = Peak; Trace = Max Hold.
5. Measure and record the results in the test report.

5.5.4 Test SET-UP (Block Diagram of Configuration)

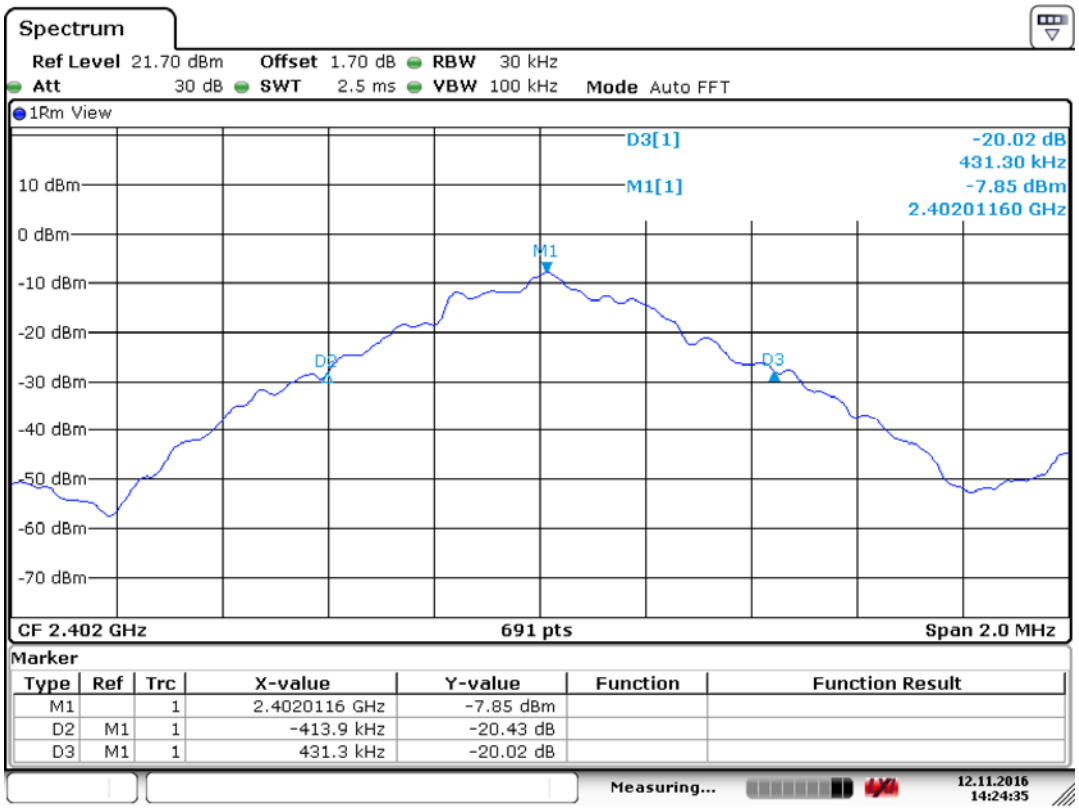


5.5.5 Test Result

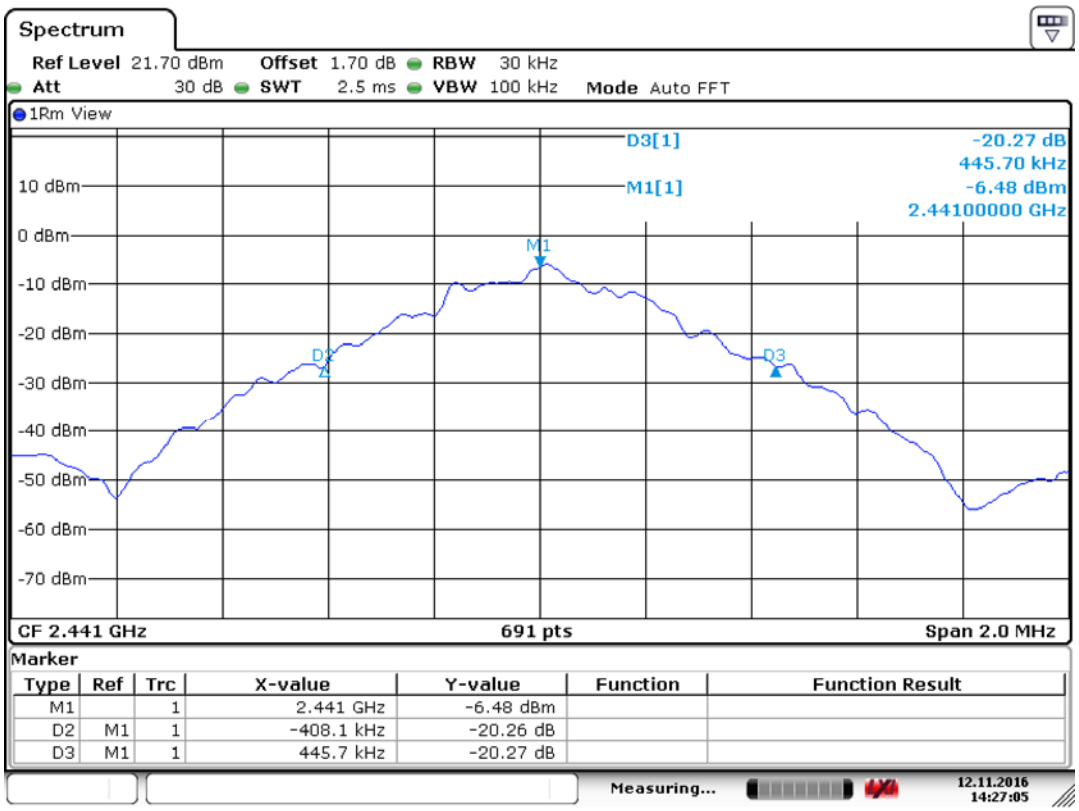
Test mode: GFSK

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
00	2402	845
39	2441	853
78	2480	845

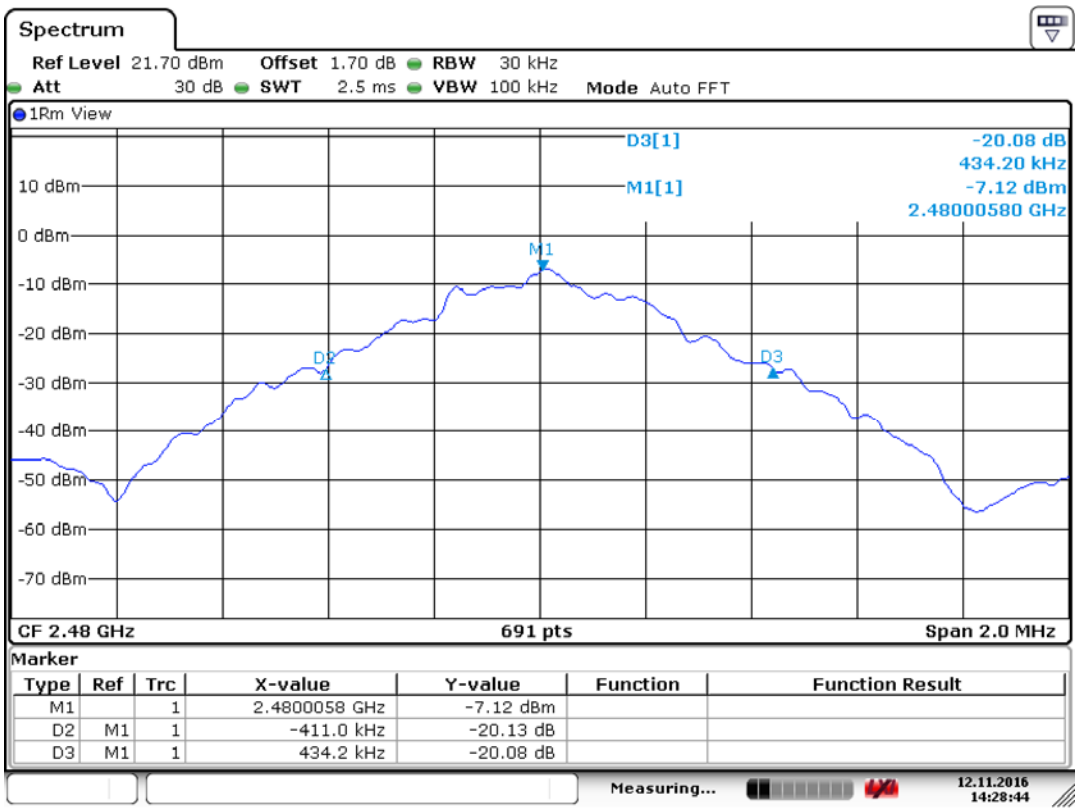
Test mode : Ch00 2402MHz



Test mode : Ch39 2441MHz



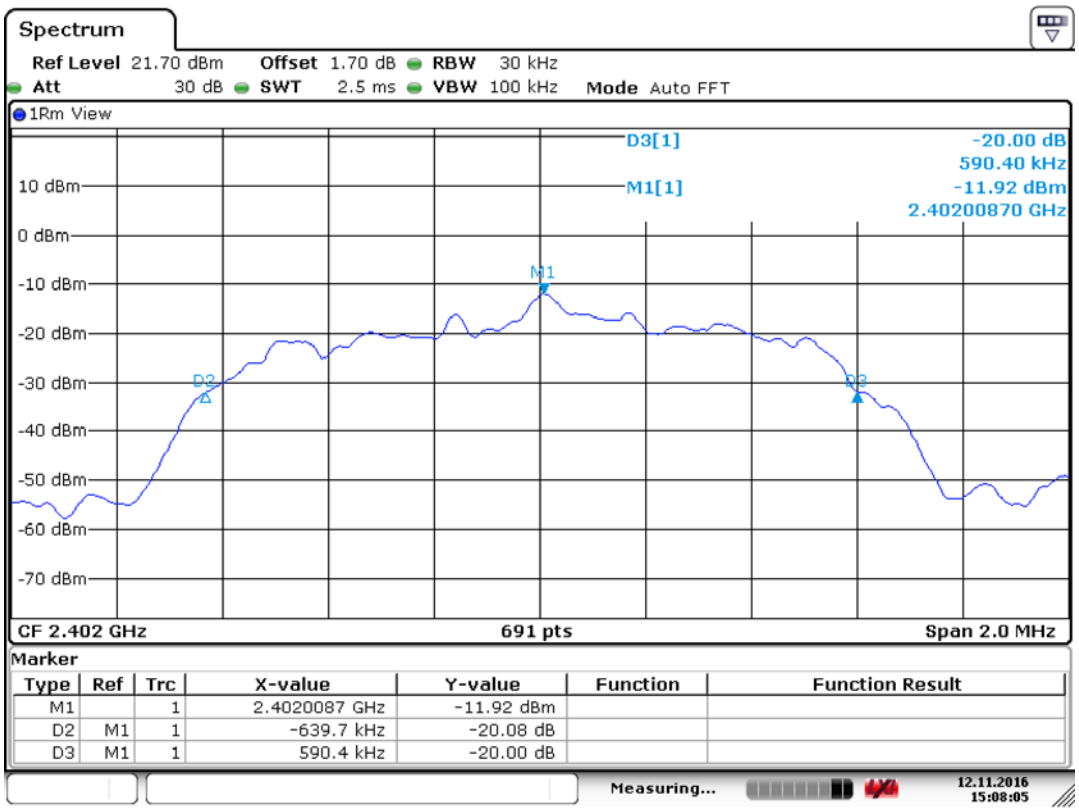
Test mode : Ch78 2480MHz



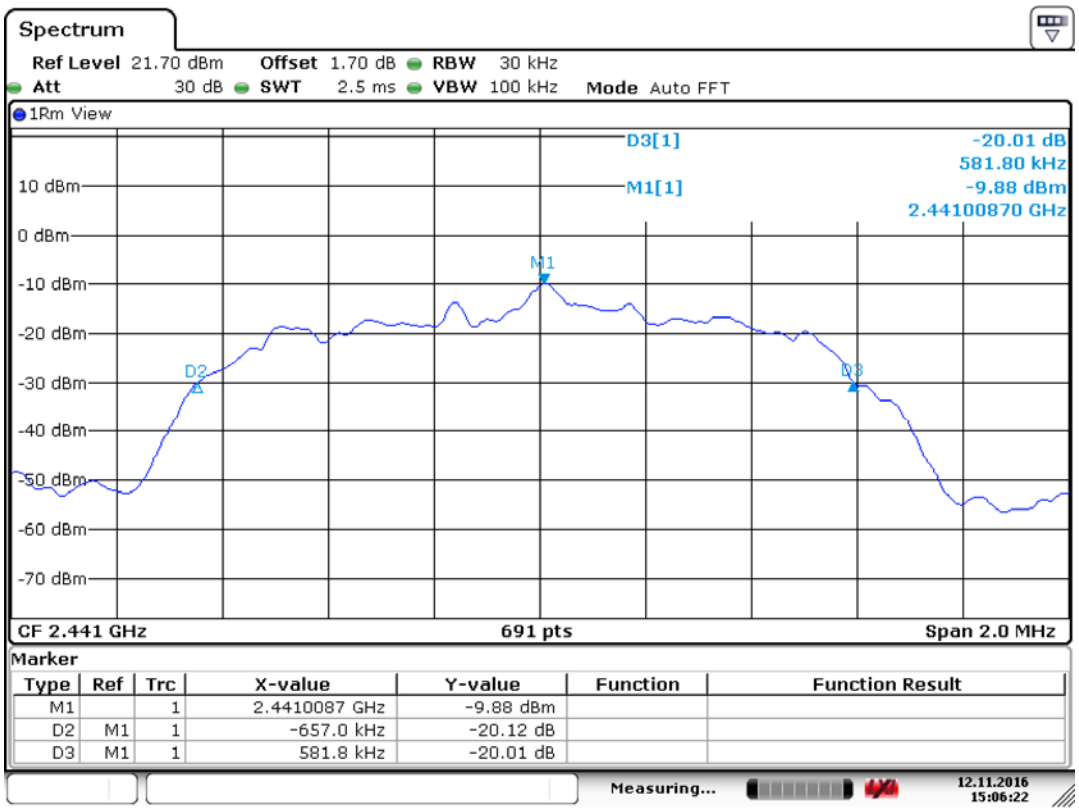
Test mode: π/4-DQPSK

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1230
39	2441	1238
78	2480	1244

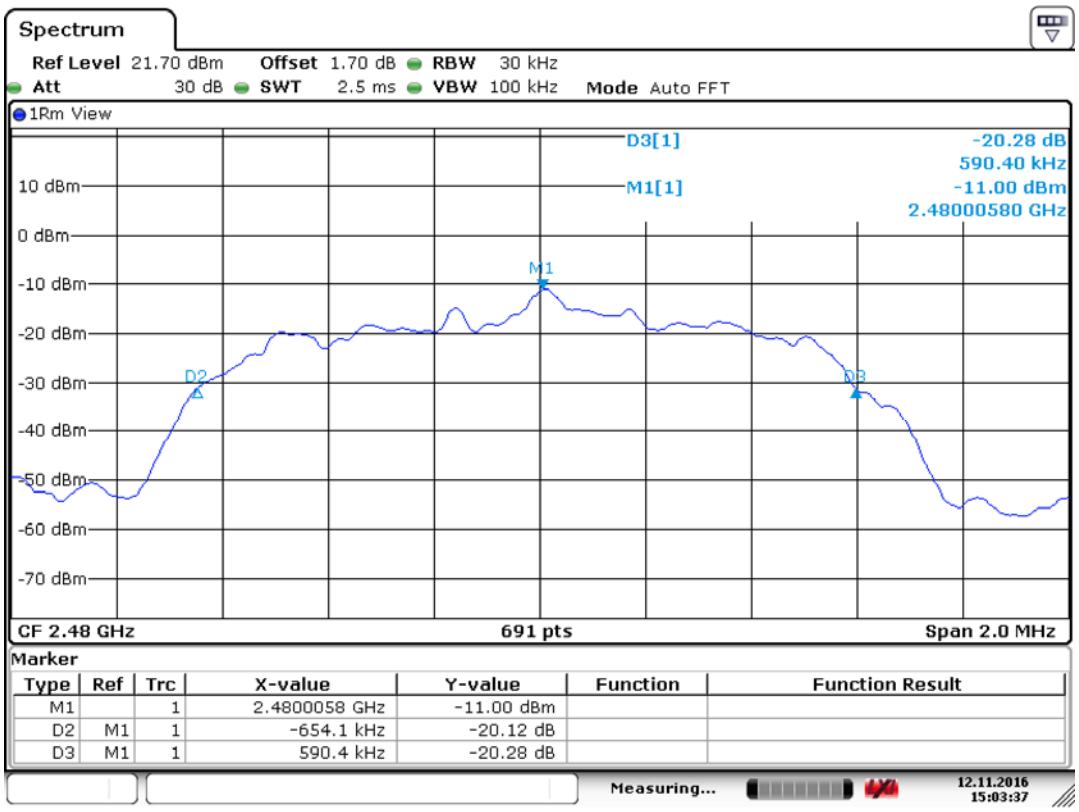
Test mode : Ch00 2402MHz



Test mode : Ch39 2441MHz



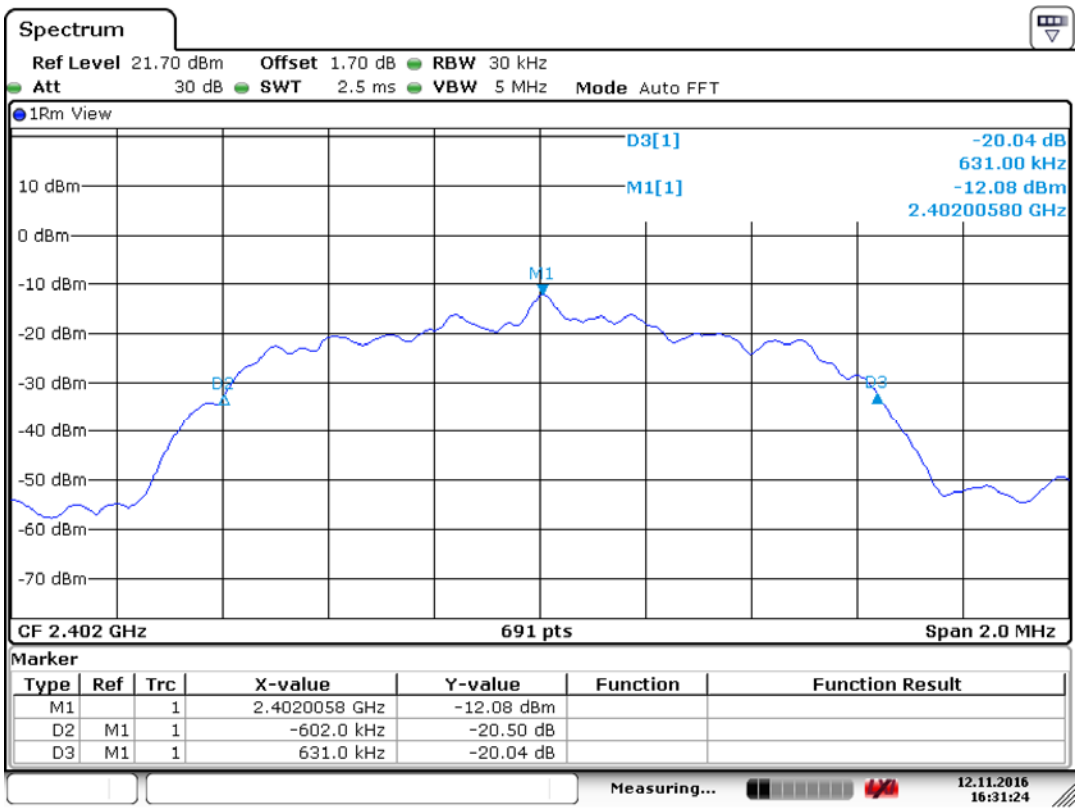
Test mode : Ch78 2480MHz



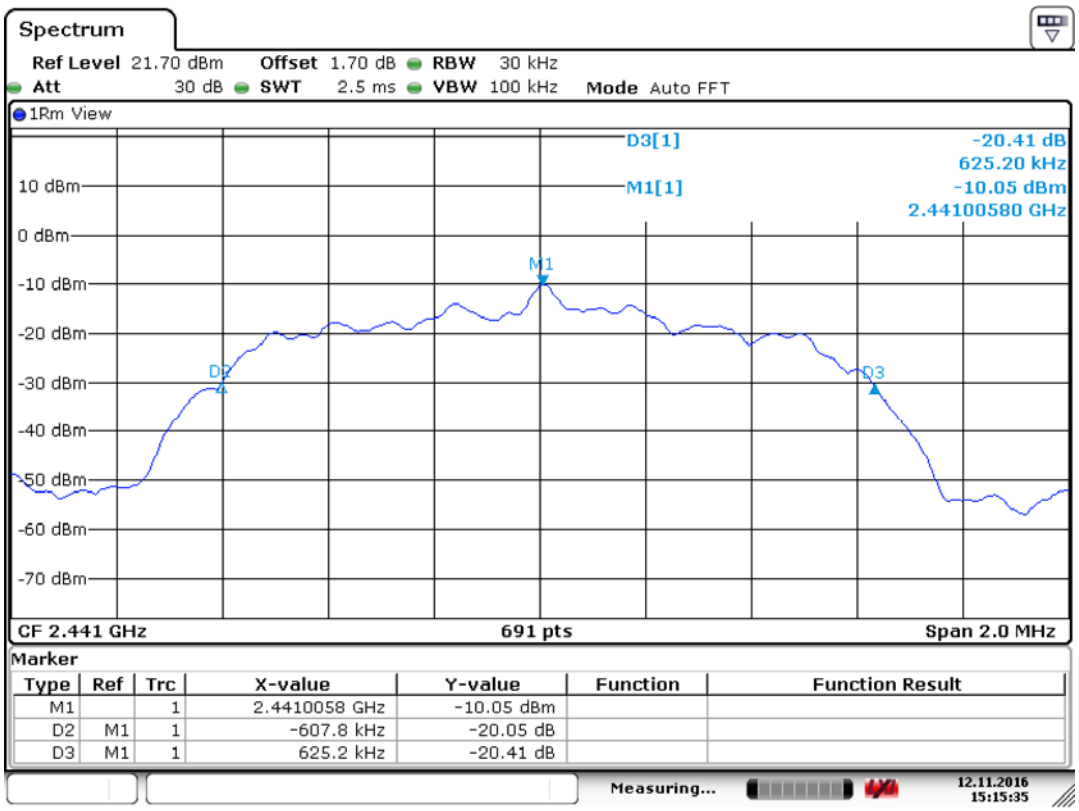
Test mode: 8DPSK

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1233
39	2441	1233
78	2480	1230

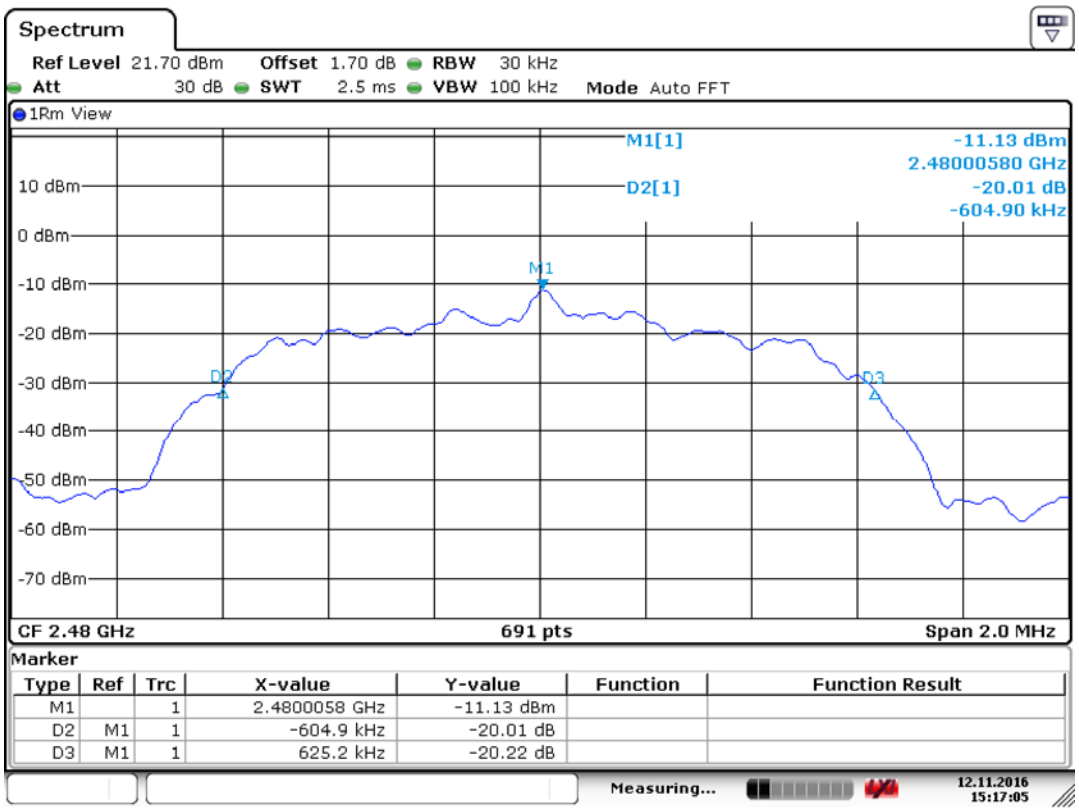
Test mode : Ch00 2402MHz



Test mode : Ch39 2441MHz



Test mode : Ch78 2480MHz



5.6 Peak Output Power Measurement

5.6.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
Spectrum Analyzer	FSV30	ROHED&SCHWARZ	100832	2017/09/07	1 Year
DC Power Supply	UDP-6015R	Unicorn tech	131007	2017/09/10	1 Year

5.6.2 Test Limit

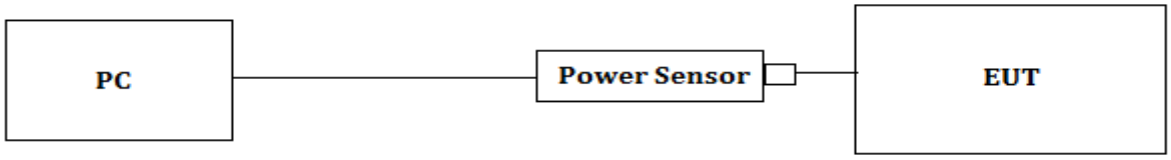
The maximum peak power shall be less than 1 Watt (30dBm).

Note: If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the direction gain of the antenna exceeds 6dBi, In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

5.6.3 Measurement Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The RF output of EUT was connected to the power meter. The path loss was compensated to the results for each measurement.
3. Set to the maximum output power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.

5.6.4 Test SET-UP (Block Diagram of Configuration)



5.6.5 Test Result

Test Mode	Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
GFSK	Low	2402	5.09	≤30	Pass
	Middle	2441	3.51	≤30	Pass
	High	2480	3.02	≤30	Pass
π/4-DQPSK	Low	2402	2.53	≤30	Pass
	Middle	2441	3.90	≤30	Pass
	High	2480	2.55	≤30	Pass
8DPSK	Low	2402	2.40	≤30	Pass
	Middle	2441	4.17	≤30	Pass
	High	2480	2.83	≤30	Pass

5.7 Radiated Spurious Emission

5.7.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
EMI Receiver	ESR	Rohde & Schwarz	101320	2017/03/25	1 Year
Bilog Antenna	VULB9160	Schwarzbeck	9160-3052	2017/10/06	2 Year
Antenna Mast(4m)	AM-4.0	MATURO	AM4.0/225/17240915	-	-
Antenna Mast(2m)	AM-2.5	MATURO	AM2.5/226/17240915	-	-
Positioner Controller	CO2000	MATURO	NCU/459/17240915		-
Loop Antenna	HEH2-Z2	Rohde & Schwarz	881056/6	2017/01/06	2 Year
Horn Antenna	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D 234	2017/09/03	2 Year
Horn Antenna	BBHA 9170	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170157	2017/11/14	2 Year
Amplifier	LPA-10-20	RF Bay	11160801	2017/03/25	1 Year
RF Amplifier	PAM-118A	COM-POWER	551019	2017/07/20	1 Year
RE_10 m CHAMBER #1	N/A	SY Corp.	N/A	N/A	-

5.7.2 Test Limit

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Note: Wireless charger configuration was evaluated.

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

5.7.3 Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable. For emissions testing at or below 1 GHz, the table height was 80cm above the reference ground plane. For emission measurements above 1 GHz, the table height was 1.5m.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

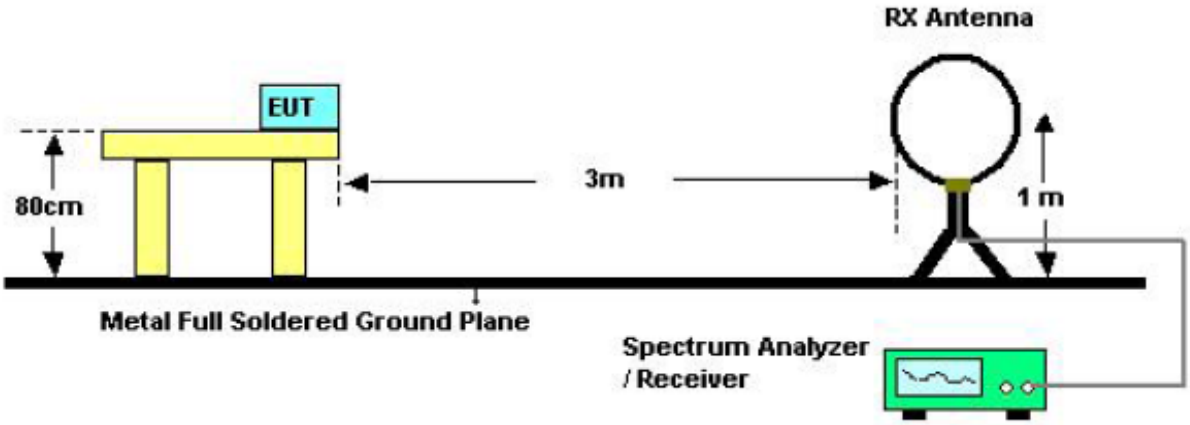
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings and peak emission levels are measured :
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW (9-150kHz: 200Hz, 0.15-30MHz: 9kHz, 30-1000MHz: 120kHz, above 1GHz: 1MHz).
   (3) VBW ≥ 3 x RBW ; Sweep = auto; Detector function = peak; Trace = max hold

   For average measurement:
   • VBW = 10 Hz, when duty cycle is no less than 98 percent.
   • VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

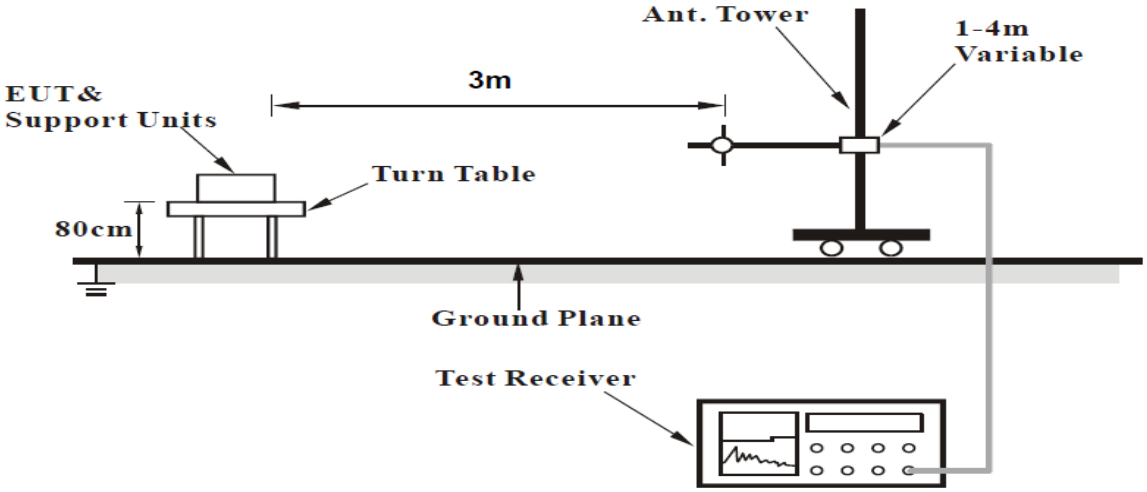
8. Measure and record the results in the test report.

5.7.4 Test SET-UP (Block Diagram of Configuration)

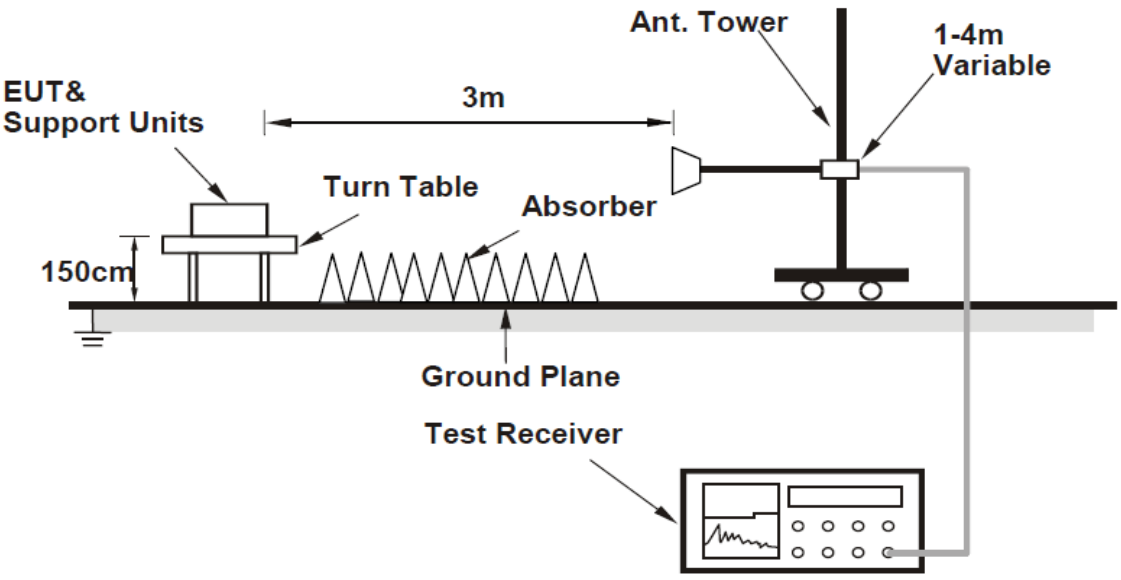
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



5.7.5 Test Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r05.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable. For emissions testing at or below 1 GHz, the table height was 80cm above the reference ground plane. For emission measurements above 1 GHz, the table height was 1.5m.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, 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.
7. Use the following spectrum analyzer settings and peak emission levels are measured :
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW (9-150kHz: 200Hz, 0.15-30MHz: 9kHz, 30-1000MHz: 120kHz, above 1GHz: 1MHz).
   (3) VBW ≥ 3 x RBW ; Sweep = auto; Detector function = peak; Trace = max hold

   For average measurement:
   • VBW = 10 Hz, when duty cycle is no less than 98 percent.
   • VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

8. Measure and record the results in the test report.

5.7.5 Test Result

5.7.5.1 Frequency Below 30MHz

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	State
-	-	-	-	-	-	-	PASS

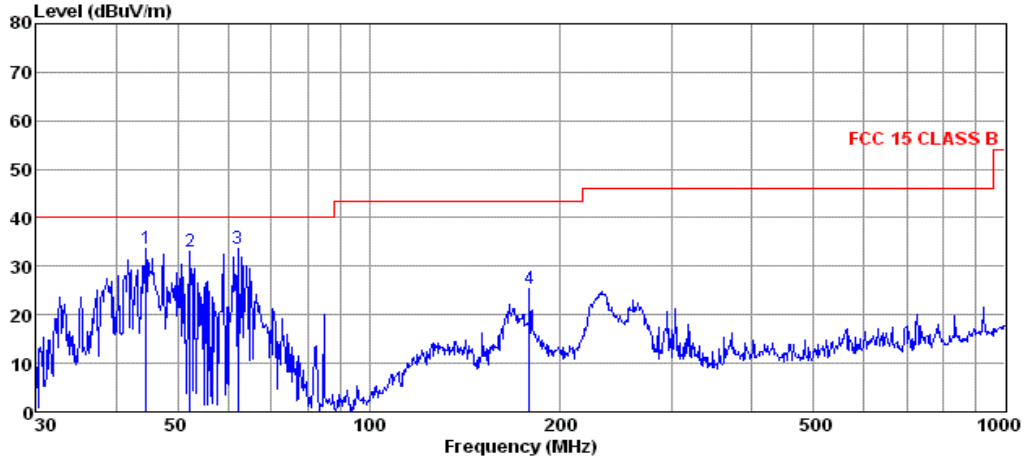
Remark: §15.31(o)_The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

5.7.5.2 Frequency Below 1000MHz

Test mode: Ch00:2402MHz Vertical

BWS Testing Laboratory

BWS TECH INC.
3m Full Chamber

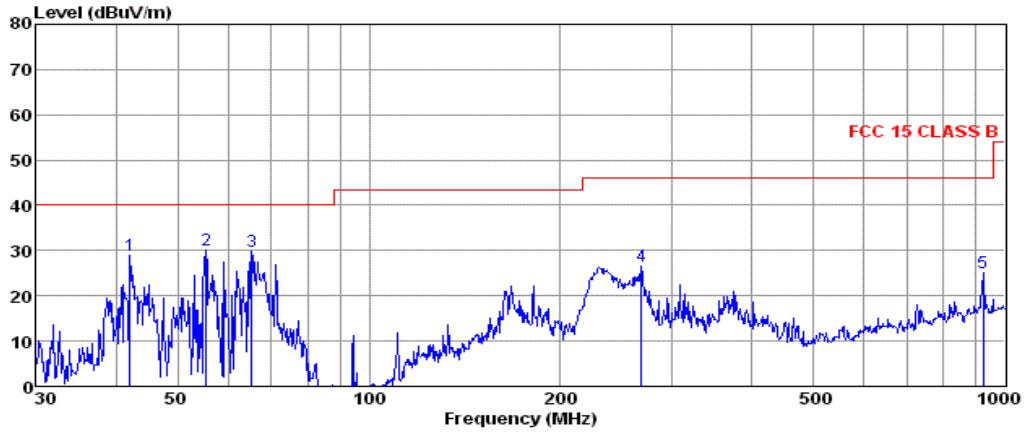


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1	44.59	60.80	-27.13	48	40.00	-6.33	370	54	Peak
2	52.39	59.84	-26.84	45	40.00	-7.00	320	45	Peak
3 p	62.21	61.79	-28.11	48	40.00	-6.32	151	265	Peak
4	178.76	51.60	-26.29	18	43.50	-18.19	122	150	Peak

Test mode: Ch00:2402MHz Horizontal

BWS Testing Laboratory

BWS TECH INC.
3m Full Chamber

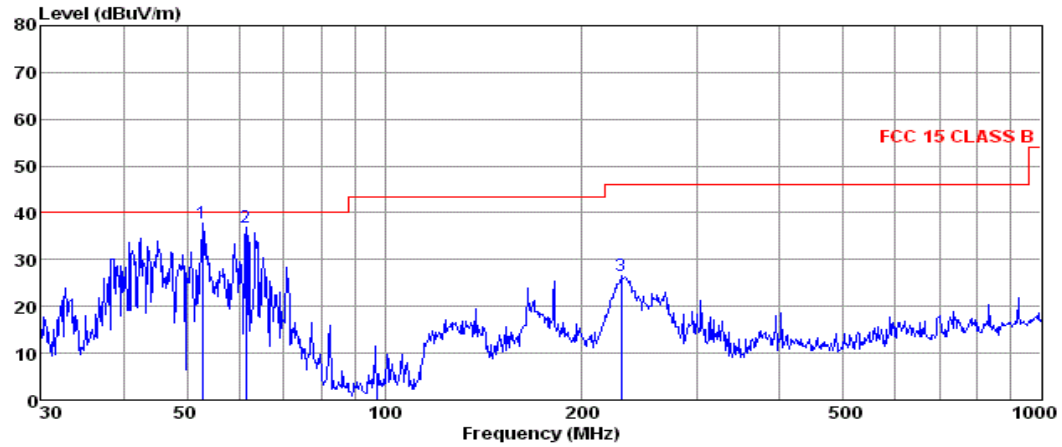


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1	42.15	56.27	-27.44	28	40.00	-11.17	300	45	Peak
2 p	55.41	57.25	-27.23	32	40.00	-9.98	300	65	Peak
3	65.34	58.51	-28.56	31	40.00	-10.05	300	65	Peak
4	267.55	51.91	-25.41	21	46.00	-19.50	135	245	Peak
5	922.52	37.92	-12.71	18	46.00	-20.79	110	45	Peak

Test mode: Ch39:2441MHz Vertical

BWS Testing Laboratory

BWS TECH INC.
3m Full Chamber



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	52.76	64.55	-26.87	77	40.00	-2.32	330	65	Peak
2	61.56	64.78	-28.01	69	40.00	-3.23	310	45	Peak
3	229.29	53.77	-27.22	21	46.00	-19.45	130	275	Peak

Test mode: Ch39:2441MHz Horizontal

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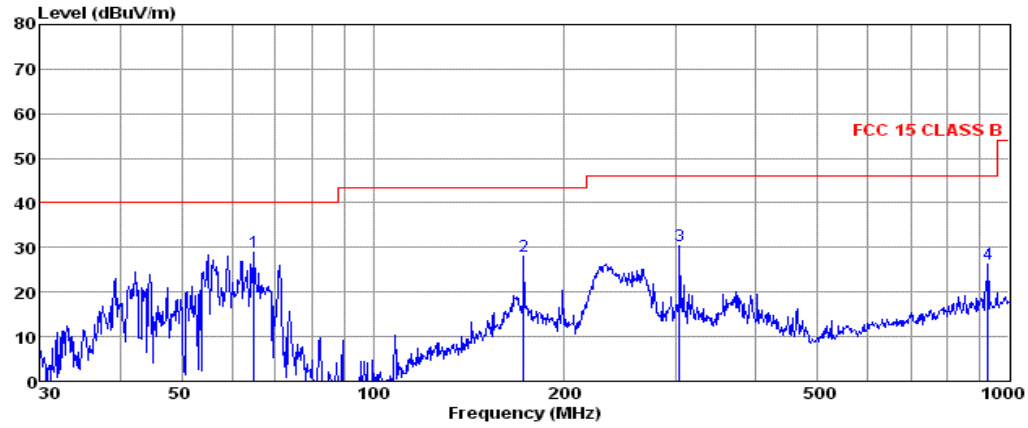
BWS TECH INC.
3m Full Chamber



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	65.11	57.50	-28.52	28	40.00	-11.02	340	66	Peak
2	172.60	53.82	-25.84	25	43.50	-15.52	110	265	Peak
3	303.54	54.45	-24.05	33	46.00	-15.60	100	45	Peak
4	925.76	38.91	-12.71	20	46.00	-19.80	100	288	Peak

Test mode: Ch78:2480MHz Vertical

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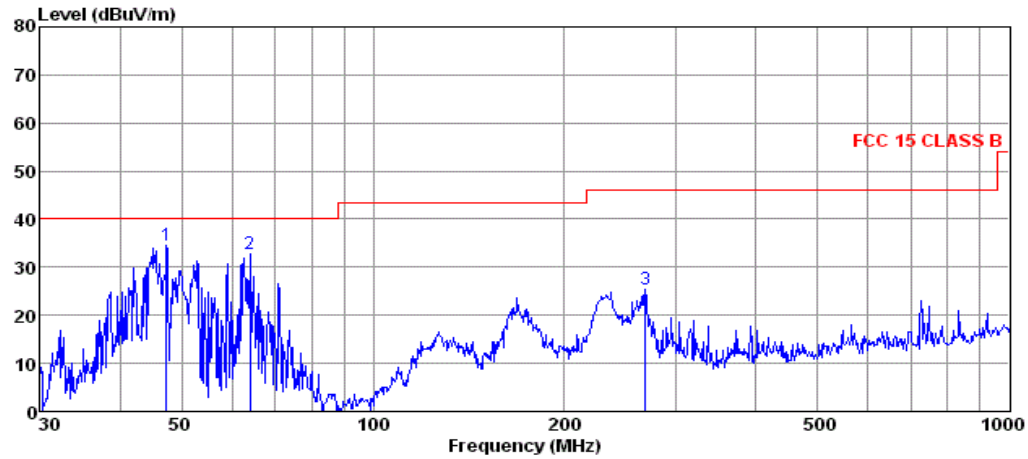
3m Full Chamber



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	47.33	61.39	-26.81	54	40.00	-5.42	310	65	Peak
2	63.98	61.11	-28.36	43	40.00	-7.25	300	85	Peak
3	267.55	50.67	-25.41	18	46.00	-20.74	125	245	Peak

Test mode: Ch78:2480MHz Horizontal

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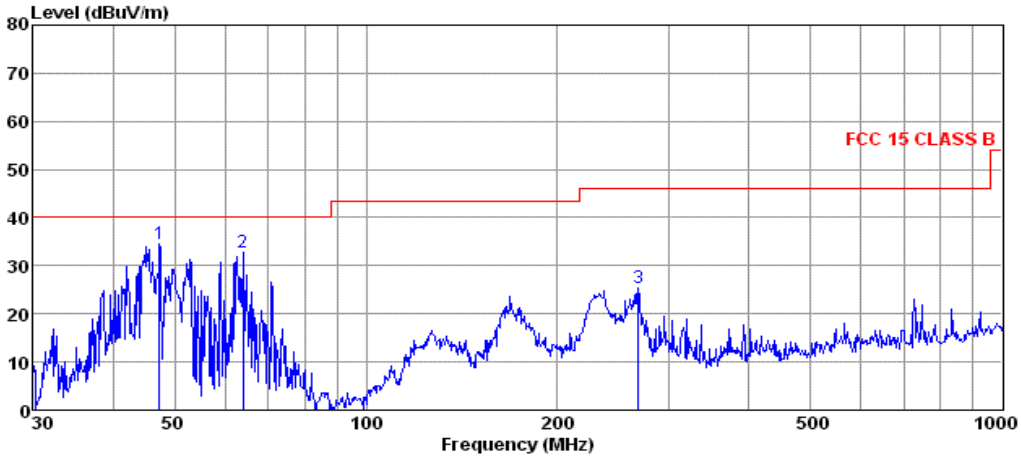
BWS TECH INC.
3m Full Chamber



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	47.33	61.39	-26.81	54	40.00	-5.42	310	65	Peak
2	63.98	61.11	-28.36	43	40.00	-7.25	300	85	Peak
3	267.55	50.67	-25.41	18	46.00	-20.74	125	245	Peak

5.7.5.3 Frequency above 1 GHz

Frequency [MHz]	Reading [dB μV]	Polari-zation [H/V]	Correction Factor [dB]	Result [dB μV/m]	Limit [dB μV/m]	Margin [dB]	Detector
4962.12	42.15	V	13.36	55.51	74.0	18.49	Peak

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

[Radiated Band Edges Test]

Test Mode: Channel 00: 2402MHz Vertical

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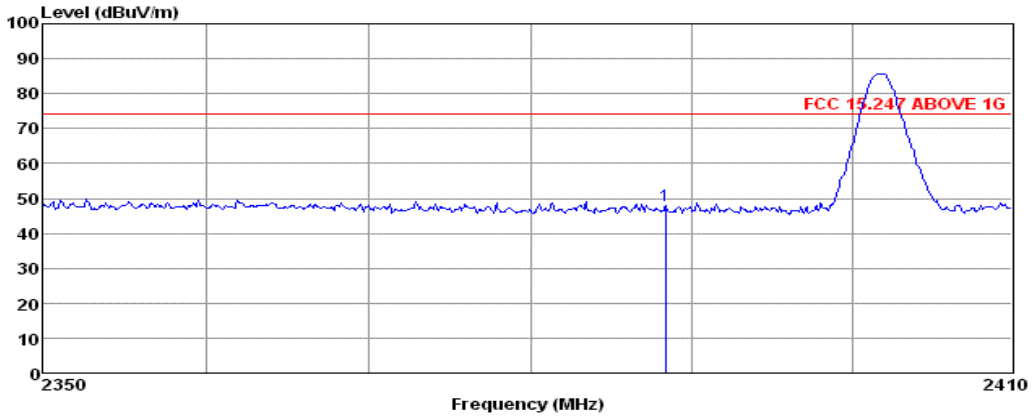
3m Full Chamber

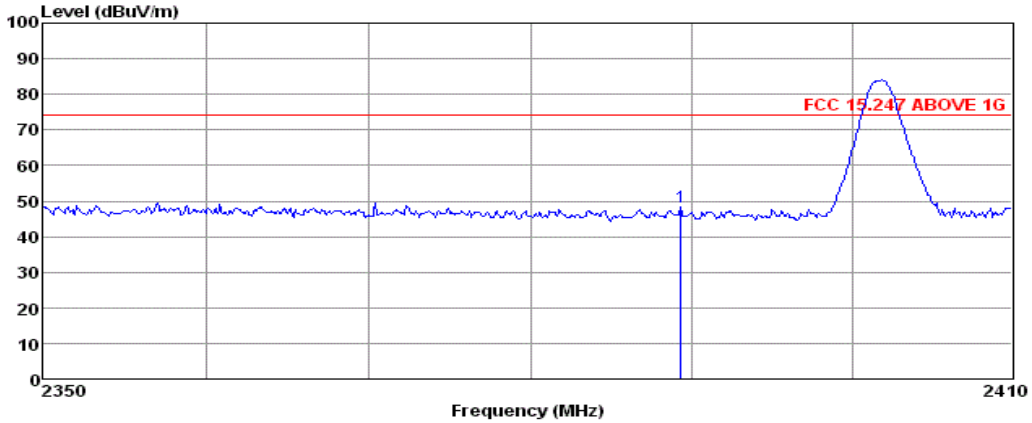


	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	2388.35	55.64	-7.57	253	74.00	-25.93	150	165	Peak

Test Mode: Channel 00: 2402MHz Horizontal

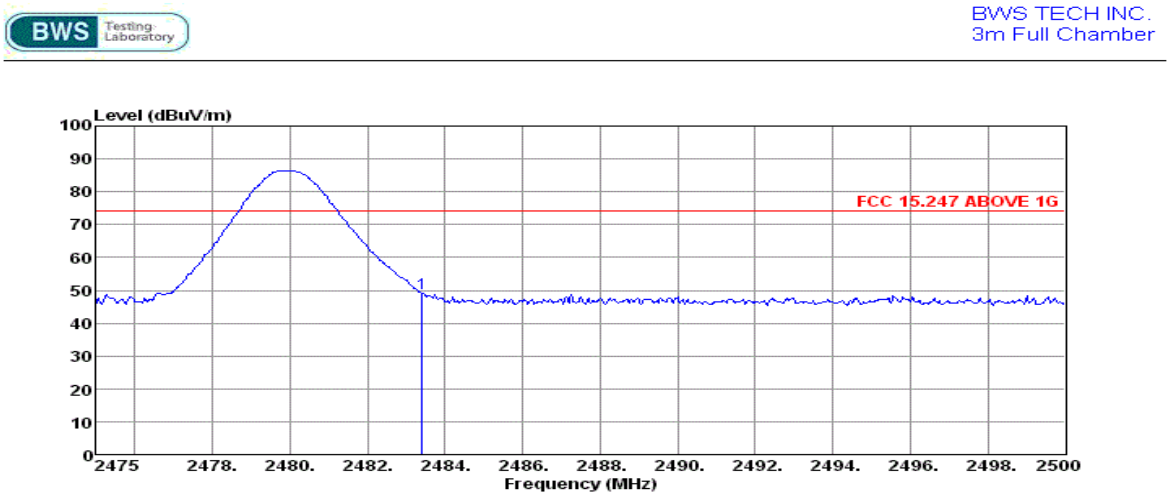
BWS Testing Laboratory

BWS TECH INC.
3m Full Chamber



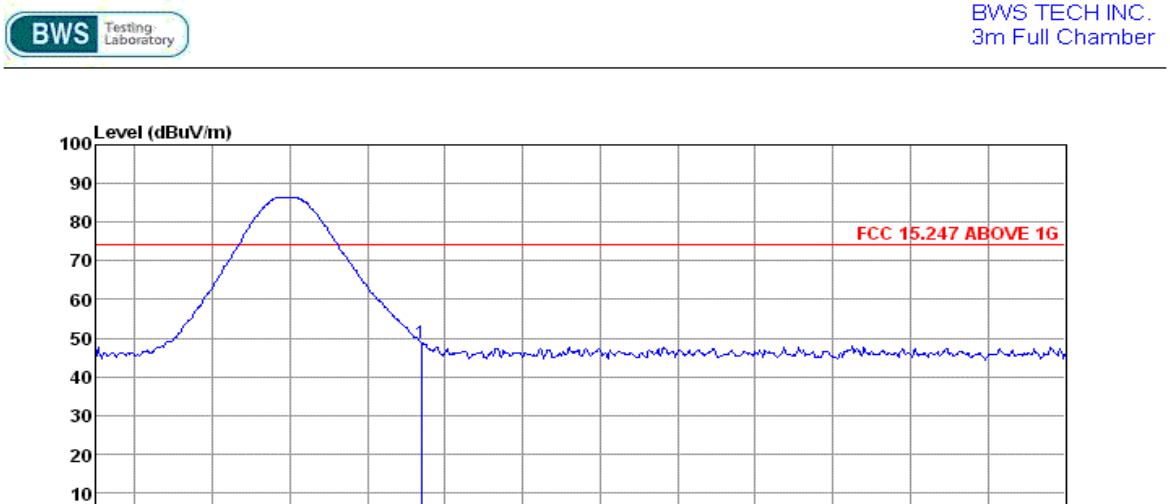
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	2389.31	55.96	-7.58	262	74.00	-25.62	150	235	Peak

Test Mode: Channel 78: 2480MHz Vertical



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	2483.40	57.08	-7.98	285	74.00	-24.90	150	175	Peak

Test Mode: Channel 78: 2480MHz Horizontal



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	A/Pos	T/Pos	Remark
	MHz	dBuV	dB/m	uV/m	dBuV/m	dB	cm	deg	
1 p	2483.38	56.86	-7.98	278	74.00	-25.12	150	190	Peak

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],
Result [dB μV/m] = Reading [dB μV] + Correction Factor [dB],
Margin[dB] = Limit [dB μV/m] - Result [dB μV/m]

5.8 Conducted Spurious Emission

5.8.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)	Calibration Interval
Spectrum Analyzer	FSV30	ROHED&SCHWARZ	100832	2017/09/07	1 Year
DC Power Supply	UDP-6015R	Unicorn tech	131007	2017/09/10	1 Year

5.8.2 Test Limit

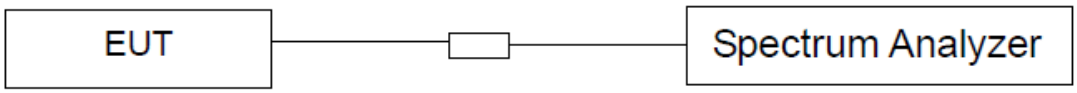
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

5.8.3 Test Procedure

Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

PEAK: RBW=VBW=1MHz / Sweep=AUTO

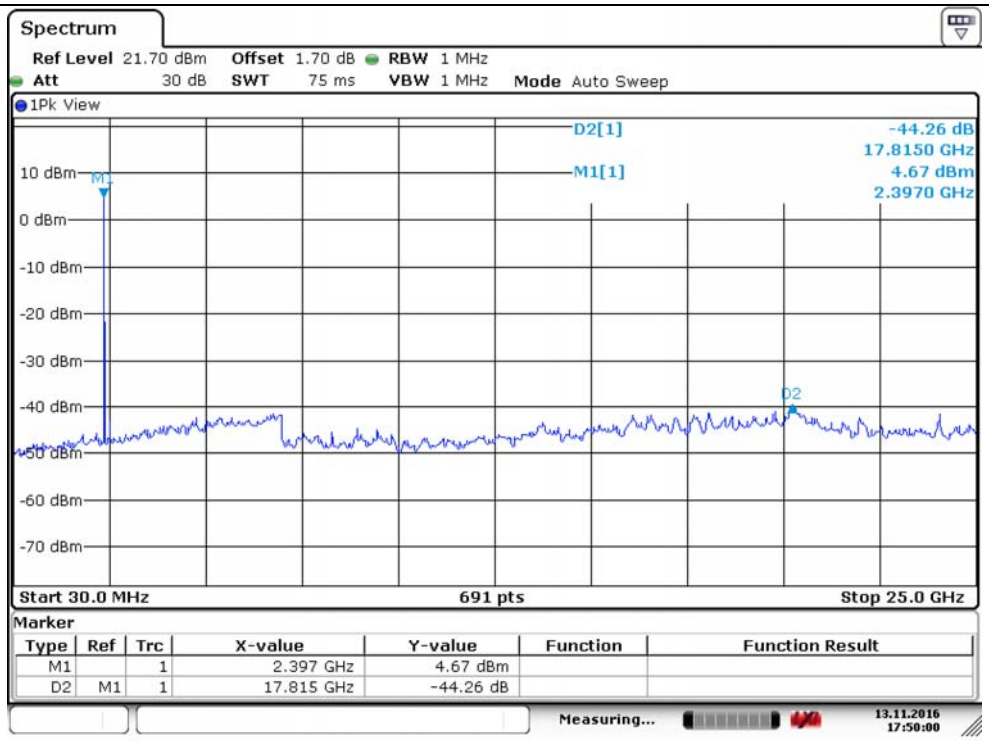
5.8.4 Test SET-UP (Block Diagram of Configuration)



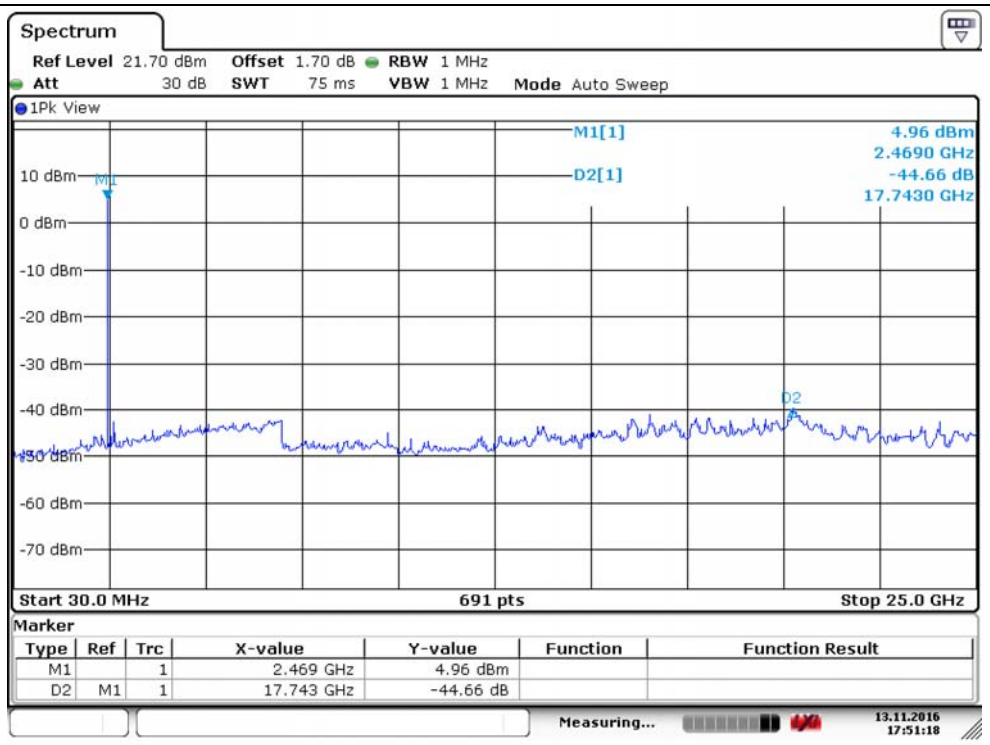
5.8.5 Test Result

[Conducted Spurious Emission Test]

Test mode: 2402MHz

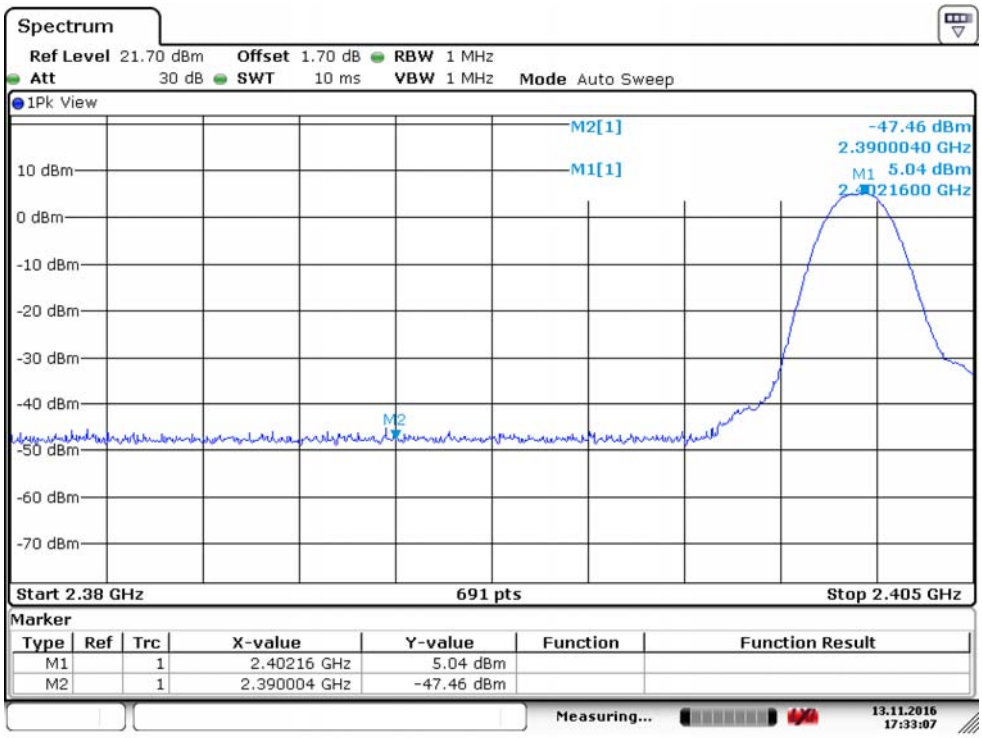


Test mode: 2480MHz

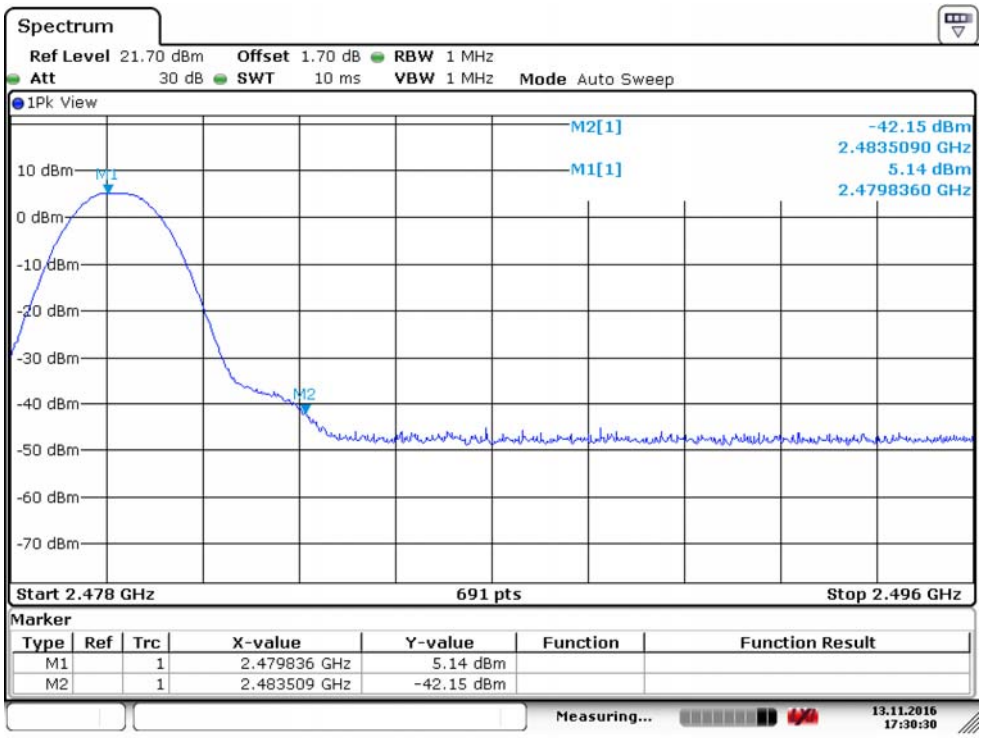


[Conducted Band Edges Test]

Test mode: 2402MHz



Test mode: 2480MHz



5.9 Antenna Application

5.9.1 Antenna Requirement

Standard	Requirement
FCC CFR Part 15.203	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Antenna Type	Frequency	Antenna Gain	Limit
PCB Pattern Antenna	2.4GHz	-2.84 dBi	≤6dBi

5.9.2 Result

PASS