

FCC DSS TEST REPORT

According to
FCC Part 15 Subpart C § 15.247

Equipment : Bluetooth Bone Conduction helmet terminal

Model No : DM-H700

Applicant : DAEMAN Co., Ltd
TECHNO PARK 201-203, 388, Songnae-daero, Bucheon-si,
Gyeonggi-do, Republic of Korea

Date of reception : June 09, 2017

Date of test : June 09, 2017 to October 13, 2017

Report Number : BWS-17-RF-0004-R2

Report Type : Original Report

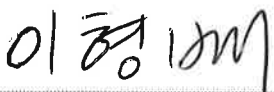
Date of issue : October 16, 2017

FCC Rule Part(s) : FCC Part 15 Subpart C §15.247

The product was received on June 09, 2017 and testing was completed on October 13, 2017. 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)10/16/2017



Tested by **Hyeong-Bae, Lee**

(Date)10/16/2017



Reviewed by **Bang-Hyun, Nam**

BWS TECH INC.

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Report Revision

TEST REPORT NO.	DATE	DESCRIPTION
BWS-17-RF-0004	September 12, 2017	- First Approval Report
BWS-17-RF-0004-R1	October 13, 2017	- Revised the test result for the Spurious and Number of channel test
BWS-17-RF-0004-R2	October 16, 2017	- Revised correcting a mistyped part

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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** : DAEMAN Co., Ltd
- **Company Address** : TECHNO PARK 201-203, 388, Songnae-daero, Bucheon-si, Gyeonggi-do, Republic of Korea
- **Phone/Fax** : Tel No. : +82-32-621-9626 Fax No. : +82-32-621-0125

1.2 Manufacturer

- **Company Name** : DAEMAN Co., Ltd
- **Company Address** : TECHNO PARK 201-203, 388, Songnae-daero, Bucheon-si, Gyeonggi-do, Republic of Korea
- **Phone/Fax** : Tel No. : +82-32-621-9626 Fax No. : +82-32-621-0125

1.3 EUT Description

- **EUT Type** : Bluetooth Bone Conduction helmet terminal
- **Model Name** : DM-H700
- **Freq. Range** : 2402-2480 MHz
- **Number of Channels** : 79
- **Modulation Method** : EDR($\pi/4$ -DQPSK), EDR(8DPSK)
- **Power source** : DC 3.7 V (Using Battery)
- **Antenna Peak Gain** : 2.00 dBi

1.4 Other Information

- **FCC Rule Part(s)** : Part 15 Subpart C §15.247
- **Test Procedure** : ANSI C63.10-2013, DA 00-705
- **FCC ID** : 2ANLU-DM-H700
- **Date of Test** : June 09, 2017 to September 12, 2017
- **Place of Test** : BWS TECH Inc.(FCC Registration Number : 287786)
#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-myeon,
Cheoin-gu, Yongin-si, Gyeonggi-do 449-853,
Republic of 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 8, 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, Republic of 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 DA 00-705.

3.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating 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 0.490-0.510 MHz.

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, and these were chosen for full testing.

Summary table of Test Cases		
Test Item	Data Rate (Modulation)	
	Bluetooth EDR 2Mbps (π /4-DQPSK)	Bluetooth EDR 3Mbps (8-DPSK)
Output Power	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Conducted Test Case	Data Rate (Modulation)	
	Bluetooth EDR 3Mbps (8-DPSK)	
	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz	
Radiated Test Case	Data Rate (Modulation)	
	Bluetooth EDR 3Mbps (8-DPSK)	
	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz	
Remark: For radiated test cases, the worst mode data rate 3Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and the conducted spurious emissions and conducted band edge measurement for each data rate are no worse than 3Mbps, and no other significantly frequencies found in conducted spurious emission.		

4. Summary of Test Results

Spread Spectrum Transmitter (DSS)				
Clause	TEST Description	Standard Section	Requirements	Result
5.1	AC Conducted Emission Measurement	§15.207	N/A	N/A ¹⁾
5.2	Number of Channel Measurement	§15.247(a)(1)	≥ 15 Channel Number	Pass
5.3	Hopping Channel Separation Measurement	§15.247(a)(1)	≥ 2/3 of 20 dB Bandwidth	Pass
5.4	Dwell Time	§15.247(a)(1)	≤ 0.4 s	Pass
5.5	20dB Bandwidth	§15.247(a)(1)	N/A	Pass
5.6	Peak Output Power Measurement	§15.247(b)(1)	≤ 125mW	Pass
5.7	Conducted Spurious Emission	§15.247(d)	≥20dBc/100kHz	Pass
5.8	Radiated Spurious Emission	§15.247(d), §15.209(a), §15.35(b)	§15.209, §15.247(d)	Pass
5.9	Band Edges Measurement	§15.247(d)	§15.205(a), §15.209(a)	Pass
5.10	Antenna Application	§15.247(b), §15.203	§15.247(b), §15.203	Pass

Note1: The 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)
ISN	8-Wire ISN CAT 5	SCHWARZBECK	145	2018/07/17
HIGH VOLTAGE PROBE	TK9420	SCHWARZBECK	9420-587	2018/03/13
CURRENT PROBE	F-16	FCC	63	2018/01/05
INJECTION PROBE	F-120-9A	FCC	289	2018/01/05
CDN	CDNS502A	TESEQ	36701	2018/03/20
MATCHING PAD	UNMP-5075+	MINI-CIRCUITS	15542	2018/01/11
SPLITTER	ZFRSC-42-S+	MINI-CIRCUITS	23301525S	2018/01/05
EMI Test Receiver	ESPI	ROHDE & SCHWARZ	1164.6407.03	2018/03/31

5.1.2 Test Limit

For an intentional radiator 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.

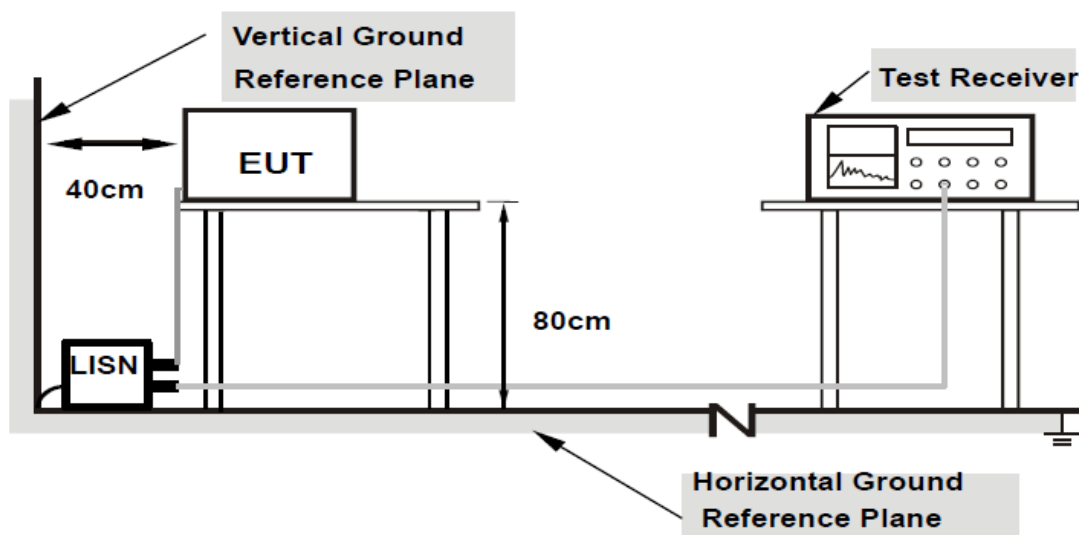
Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*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

5.2.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
MXA SIGNAL ANALYZER	Agilent	N9020A	US46220101	2018/09/07
DC Power Supply	UDP-6015R	Unicorn tech	131007	2018/09/07

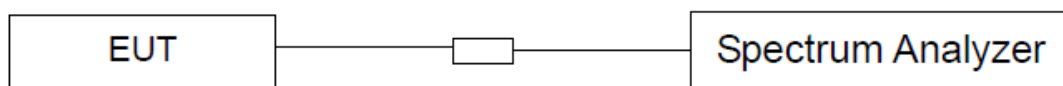
5.2.2 Test Limit

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

5.2.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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 = the frequency band of operation; RBW \geq 1% of the span; VBW \geq 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.

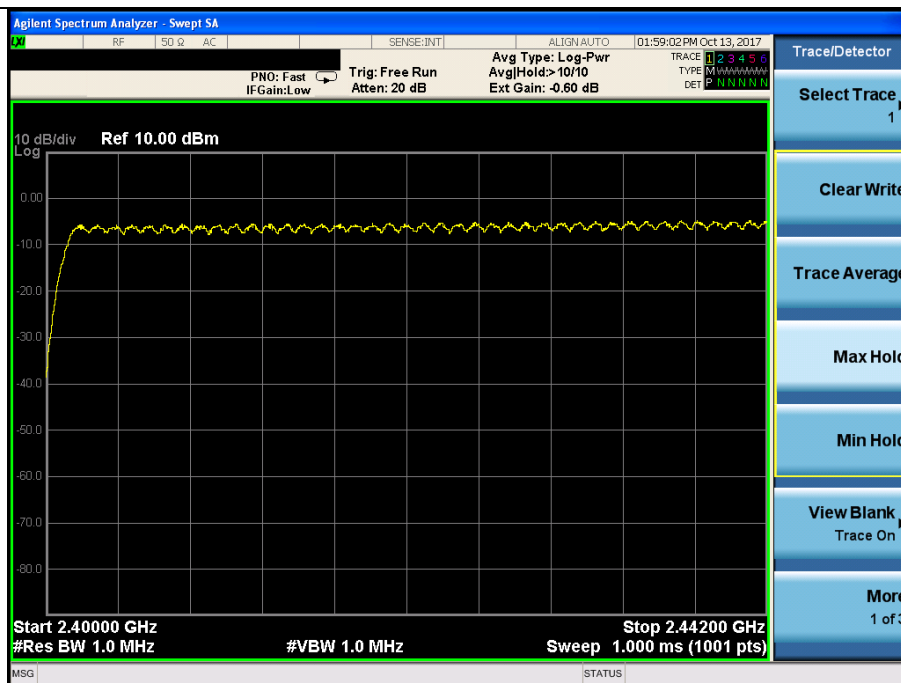
5.2.4 Block Diagram of Test Setup



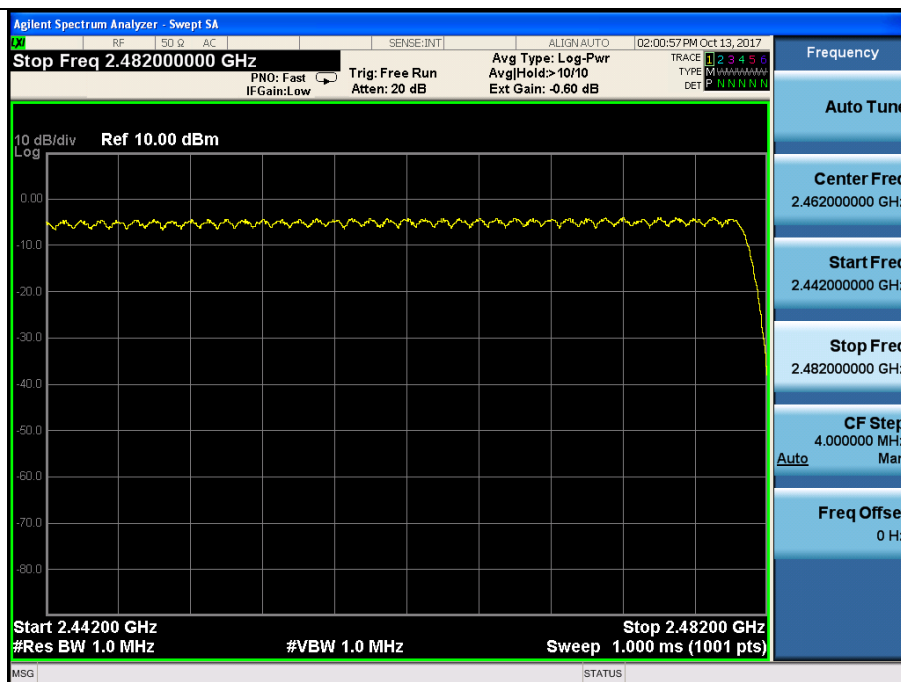
5.2.5 Test Result

Number of Hopping(Channel)	Channel Number	Rusult
79	≥ 15	Pass

Number of Hopping Channel - 1



Number of Hopping Channel - 2



5.3 Hopping Channel Separation Measurement

5.3.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum Analyzer	FSP13	ROHDE&SCHWARZ	100760	2018/10/04
DC Power Supply	UDP-6015R	Unicorn tech	131007	2017/09/07

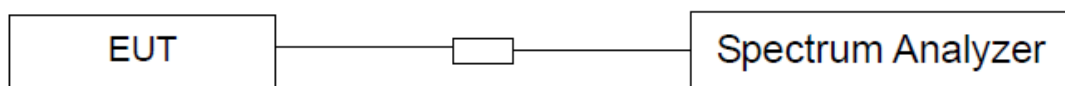
5.3.2 Test Limit

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, whichever is greater.

5.3.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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 \geq 1% of the span;
VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

5.3.4 Block Diagram of Test Setup

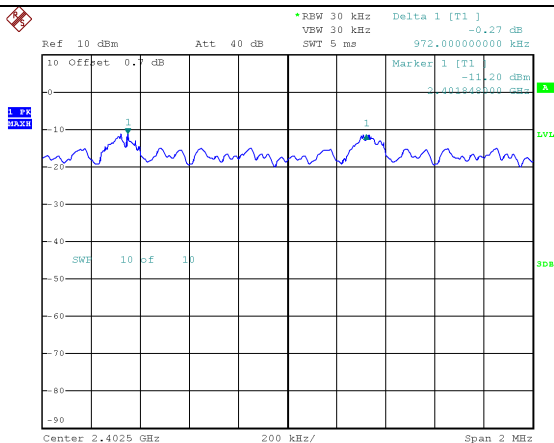


5.3.5 Test Result

Modulation	Channel	Test Result (kHz)	Limit (kHz) (2/3 of 20dB BW)
EDR(8DPSK)	Low	972	≥ 856
	Middle	960	≥ 844
	High	968	≥ 848

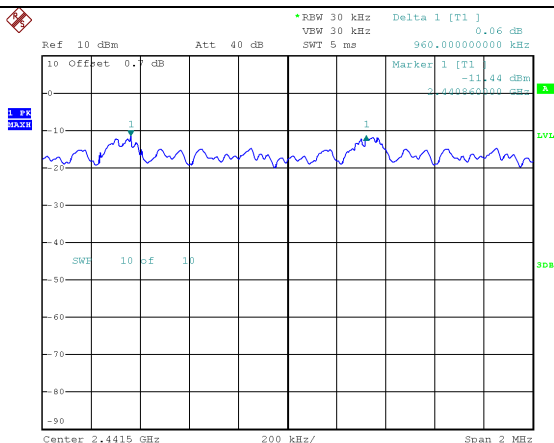
Hopping Channel Separation - EDR(8DPSK)

Low Channel



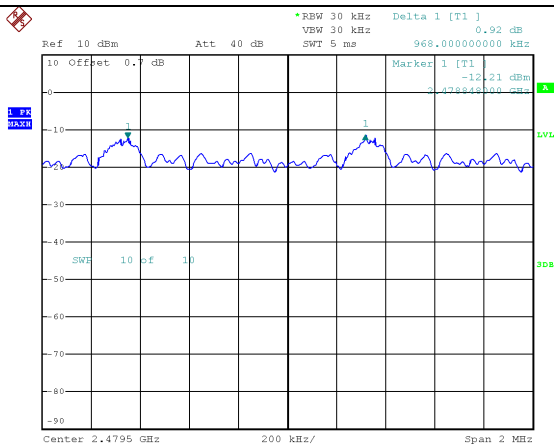
Date: 10.SEP.2017 15:07:24

Middle Channel



Date: 10.SEP.2017 15:09:05

High Channel



Date: 10.SEP.2017 15:15:47

5.4 Dwell Time Measurement

5.4.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum Analyzer	FSP13	ROHDE&SCHWARZ	100760	2018/10/04
DC Power Supply	UDP-6015R	Unicorn tech	131007	2018/09/07

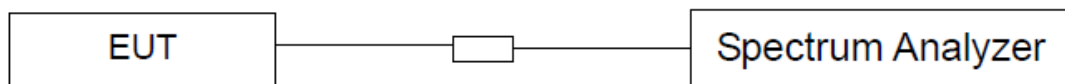
5.4.2 Test Limit

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 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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 = zero span, centered on a hopping channel; RBW = 1 MHz; VBW \geq RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

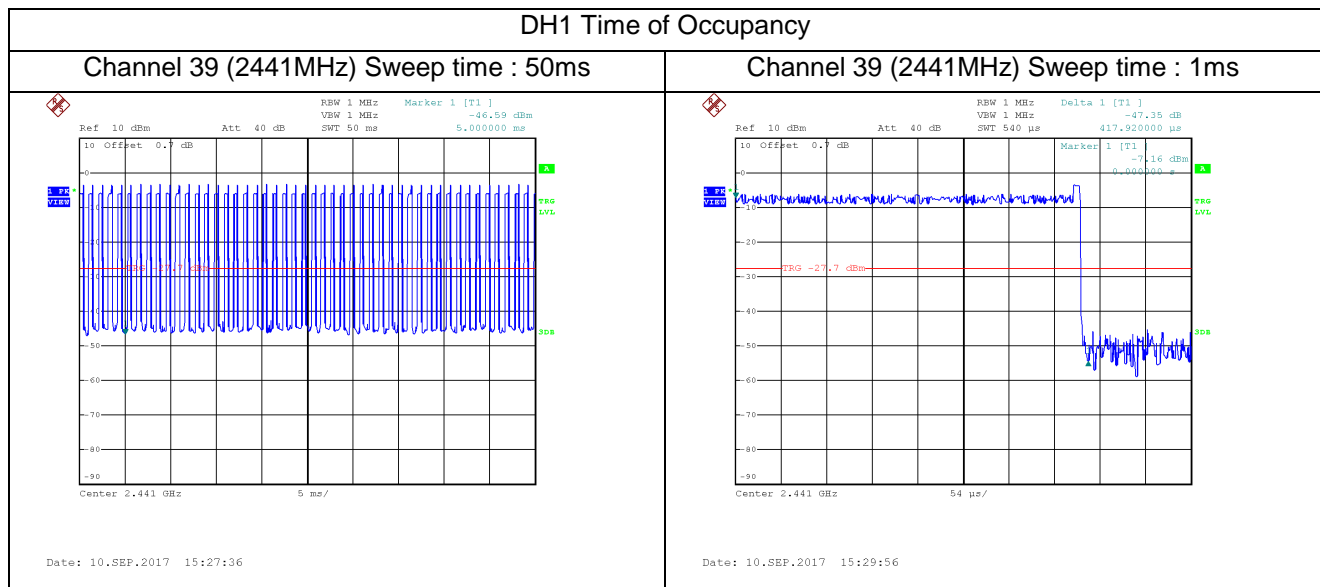
5.4.4 Block Diagram of Test Setup



5.4.5 Test Result

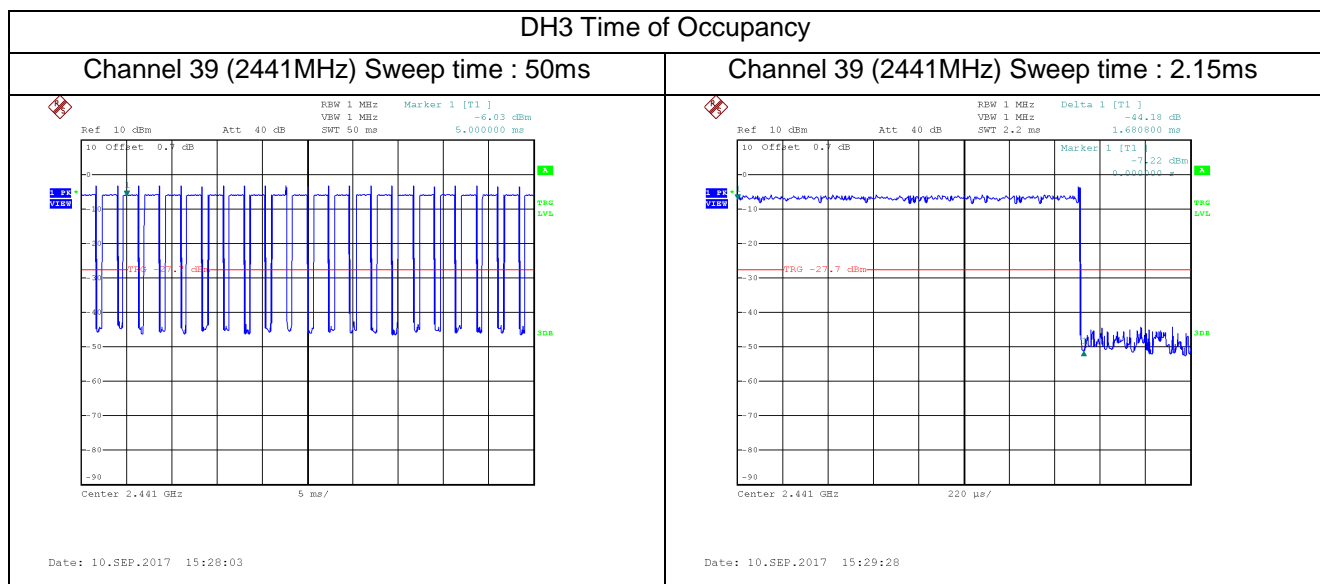
Test Mode	Channel No.	Frequency (MHz)	Time Slot Length (ms)	Dwell Time (ms)	Limit (ms)	Result
DH1	39	2441	0.418	133.76	<400	Pass
DH3	39	2441	1.681	268.96	<400	Pass
DH5	39	2441	2.926	327.71	<400	Pass

Test mode : DH1



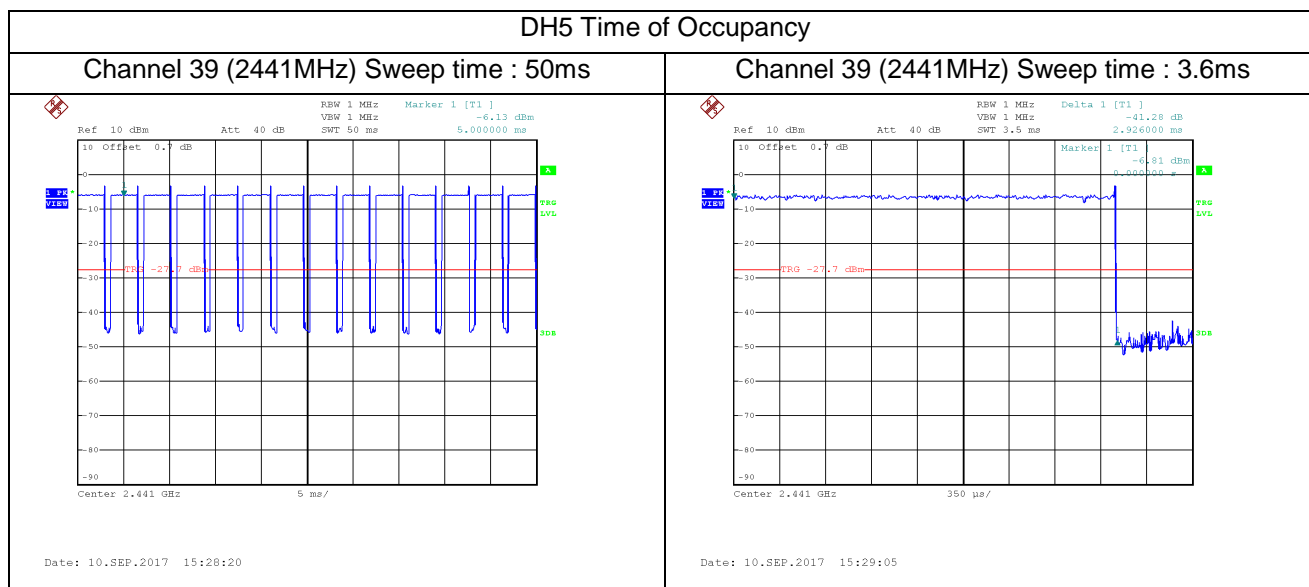
Note : Test Time Period: $0.4 * 79 = 31.6\text{sec}$, Hopping Time with 1sec : $40/50\text{ms} = 800\text{ hops/sec}$.
The Maximum Occupancy Time within 31.6sec : $[(0.418\text{ms} * 800) / 79] * 31.6 = 133.76\text{msec}$.

Test mode : DH3



Note : Test Time Period: $0.4 * 79 = 31.6\text{sec}$, Hopping Time with 1sec : $20/50\text{ms} = 400\text{ hops/sec}$.
The Maximum Occupancy Time within 31.6sec : $[(1.681\text{ms} * 400) / 79] * 31.6 = 268.96\text{msec}$.

Test mode : DH5



Note : Test Time Period: $0.4 * 79 = 31.6\text{sec}$, Hopping Time with 1sec : $14/50\text{ms} = 280\text{ hops/sec}$.

The Maxmum Occupancy Time within 31.6sec : $[(2.926\text{ms} * 280) / 79] * 31.6 = 327.71\text{msec}$.

5.5 20dB Bandwidth

5.5.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Spectrum Analyzer	FSP13	ROHDE&SCHWARZ	100760	2018/10/04
DC Power Supply	UDP-6015R	Unicorn tech	131007	2018/09/07

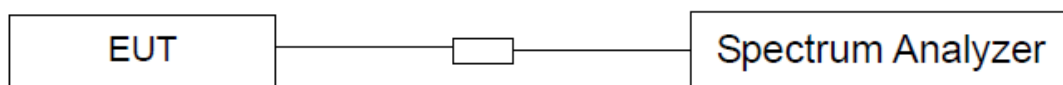
5.5.2 Test Limit

Reporting only

5.5.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
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 for 20dB Bandwidth measurement.
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;
RBW \geq 1% of the 20 dB bandwidth; VBW \geq RBW; Sweep = auto; Detector function = peak;
Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
For 99% Bandwidth measurement, the RBW=30kHz, and VBW = 100kHz. Sweep = auto ;
Detector function = sample. Trace = max hold.
6. Measure and record the results in the test report.

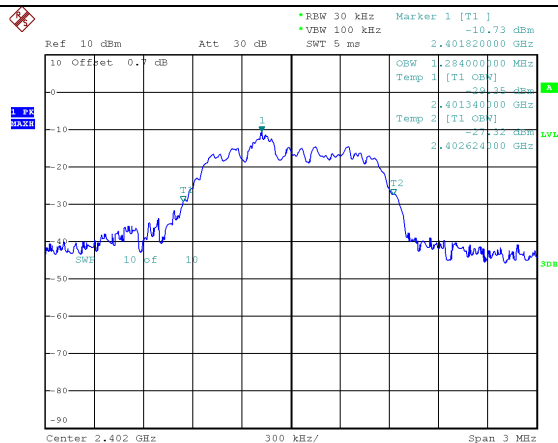
5.5.4 Block Diagram of Test Setup



5.5.5 Test Result

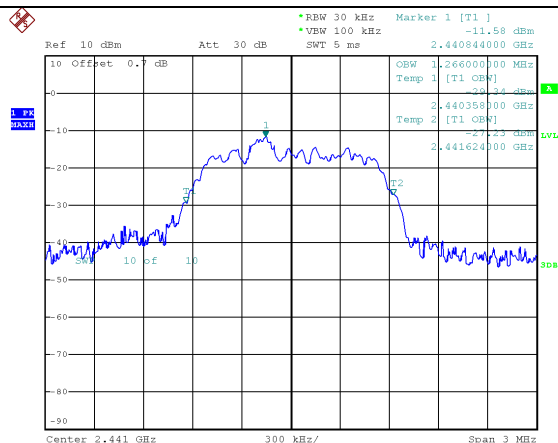
20dB Bandwidth - EDR(8DPSK)

2402MHz



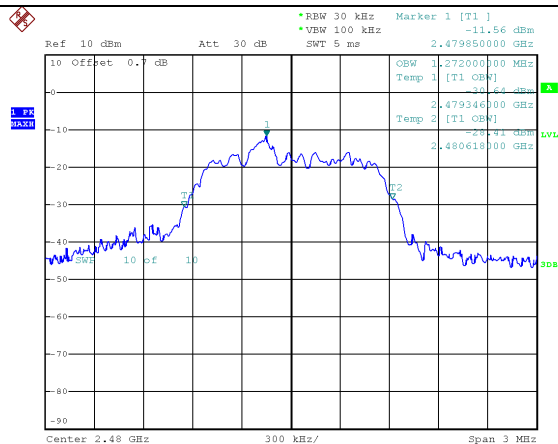
Date: 10.SEP.2017 15:22:42

2441MHz



Date: 10.SEP.2017 15:23:25

2480MHz



Date: 10.SEP.2017 15:24:56

5.6 Peak Output Power Measurement

5.6.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Power Meter	RPR3006W	D.A.R.E!! Instruments	14I000048SNO09	2018/04/18
DC Power Supply	UDP-6015R	Unicorn tech	131007	2018/09/07

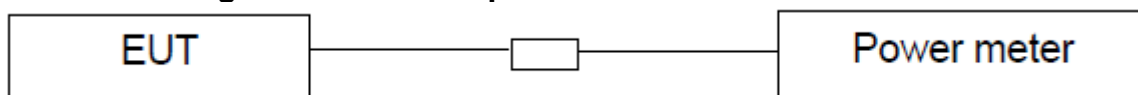
5.6.2 Test Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

5.6.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the power meter 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. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

5.6.4 Block Diagram of Test Setup



5.6.5 Test Result

EDR($\pi/4$ -DQPSK)

Frequency(MHz)	Test Result(dBm)	Limit(dBm)
2402	-7.41	≤ 20.97
2441	-8.23	≤ 20.97
2480	-7.33	≤ 20.97

EDR(8DPSK)

Frequency(MHz)	Test Result(dBm)	Limit(dBm)
2402	-7.43	≤ 20.97
2441	-8.27	≤ 20.97
2480	-7.26	≤ 20.97

Note: Limit(dBm) is the value of Limit(mW) to be conversioned as follows: $10\log 125 = 20.97\text{dBm}$

5.7 Conducted Spurious Emission

5.7.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
MXA SIGNAL ANALYZER	Agilent	N9020A	US46220101	2018/09/07
DC Power Supply	UDP-6015R	Unicorn tech	131007	2018/09/07

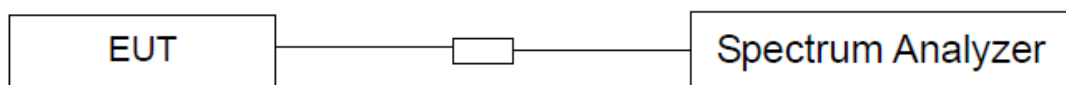
5.7.2 Test Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is 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 in §15.209(a).

5.7.3 Test Procedure

1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz ($\geq 1\%$ span=10MHz), VBW = 300kHz (\geq RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB, when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

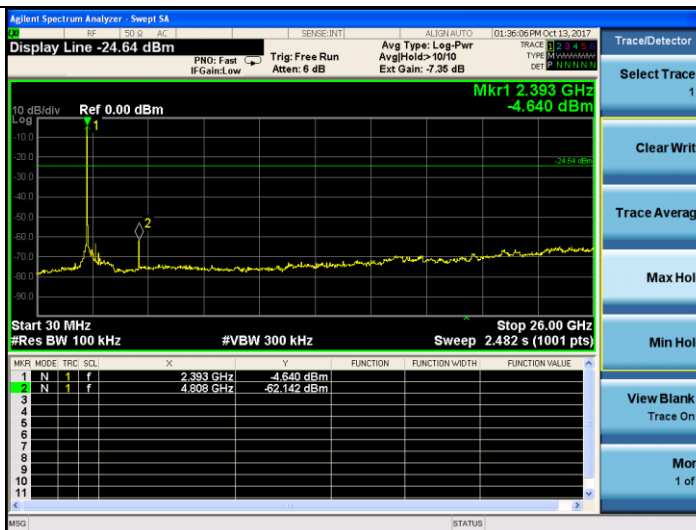
5.7.4 Block Diagram of Test Setup



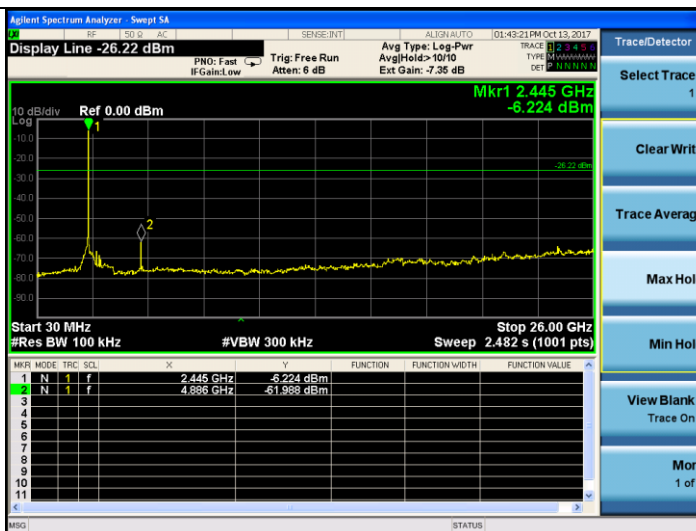
5.7.5 Test Result

Conducted Spurious Emission - EDR(8DPSK)

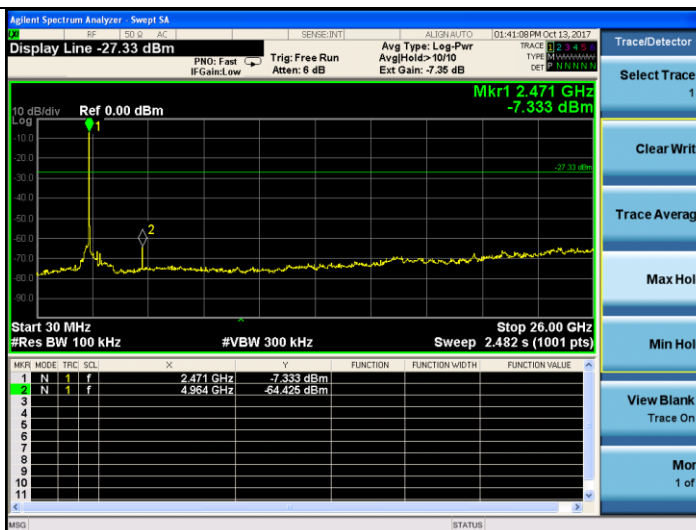
Low Channel



Middle Channel



High Channel



5.8 Radiated Spurious Emission

5.8.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Loop Antenna	FMZB 1519 B	SCHWARZBECK	00025	2018/07/11
BILOG Antenna	VULB 9160	SCHWARZBECK	9160-3052	2018/10/17
Horn Antenna	BBHA9120D	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D517	2018/01/05
RF Amplifier	8449B	Agilent	3947A04710	2018/06/21
Antenna Master	JAC-3	Daeil EMC	N/A	N/A
Antenna Turntable Controller	JAC-2	Daeil EMC	N/A	N/A
EMI Test Receiver	ESPI	ROHDE & SCHWARZ	100012	2018/01/06
Antenna Master	N/A	AUDIX	N/A	N/A
Antenna Turntable Controller	ACT	AUDIX	N/A	N/A
MXA SIGNAL ANALYZER	Agilent	N9020A	US46220101	2018/09/07
PROGRAMMABLE DC POWER SUPPLY	IPS-30B03DD	INTERACT	00420502	2018/09/07

5.8.2 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.

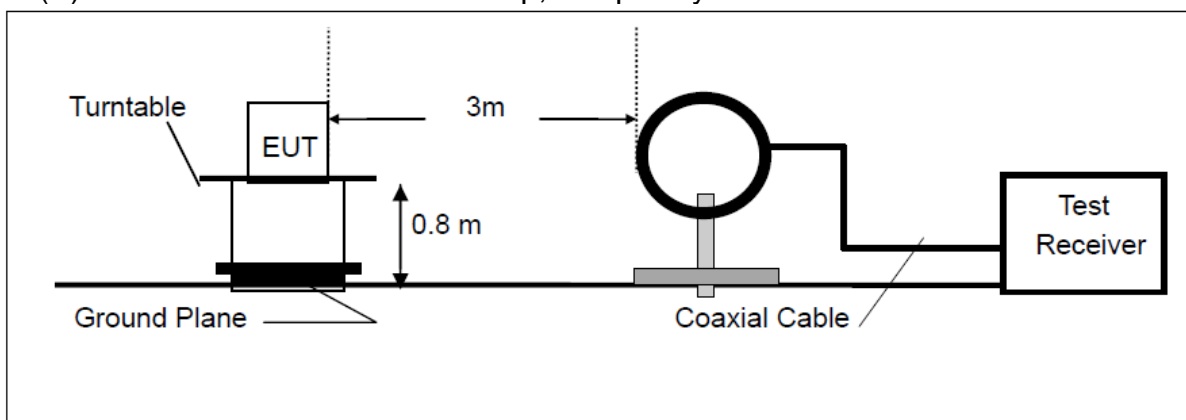
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

5.8.3 Test Procedure

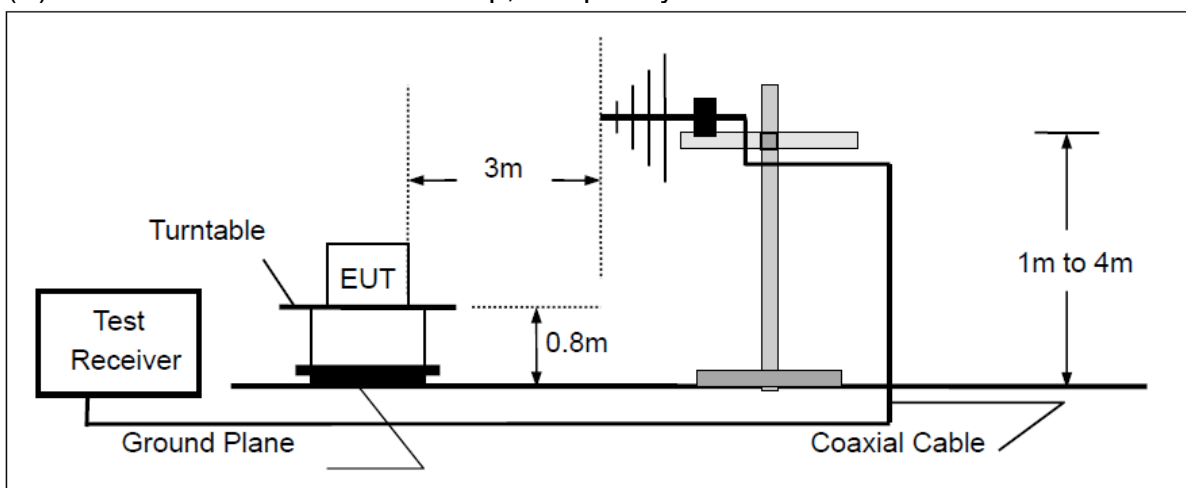
1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, 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 to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$ GHz ; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - (3) For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
On time = $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 \cdot \log(\text{Duty cycle})$
7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

5.8.4 Block Diagram of Test Setup

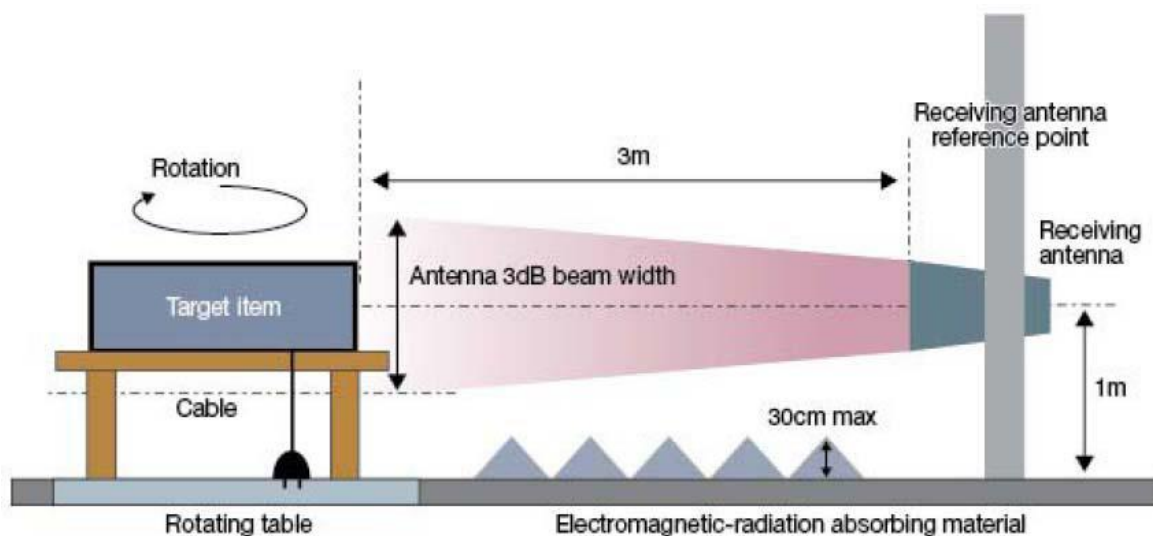
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



5.8.5 Test Result

5.8.5.1 0.009–30 MHz

Frequency [MHz]	Reading [dB μ V]	Polarization [*H/**V]	Ant. Factor [dB]	Cable Loss [dB]	AMP Gain [dB]	Limit [dB μ V/m]	Emission Level [dB μ V/m]	Result.
-	-	-	-	-	-	-	-	Pass

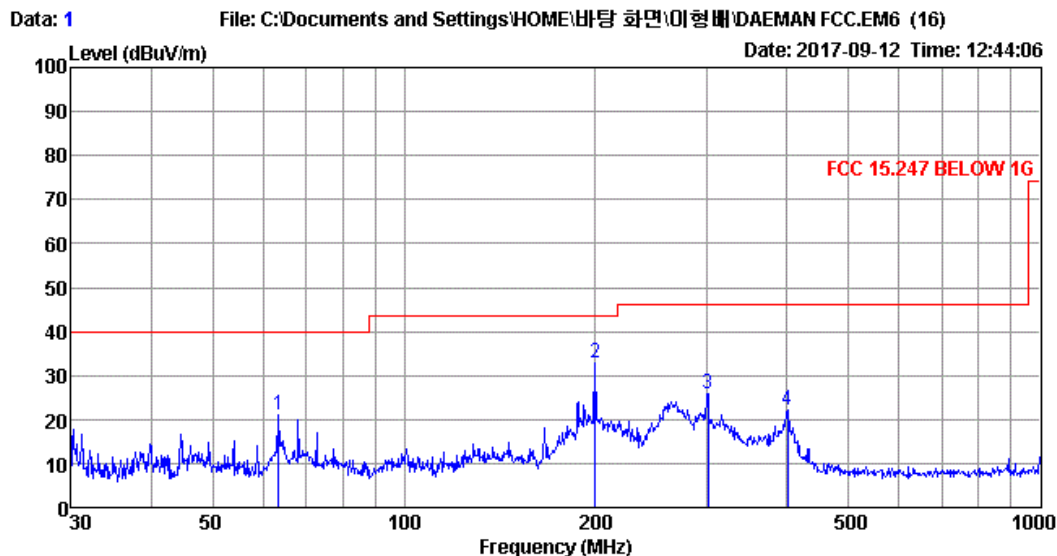
Note: §15.31(o) The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

5.8.5.2 30–1000 MHz

EDR(8-DPSK)- 2402 MHz(Low)_Horizontal



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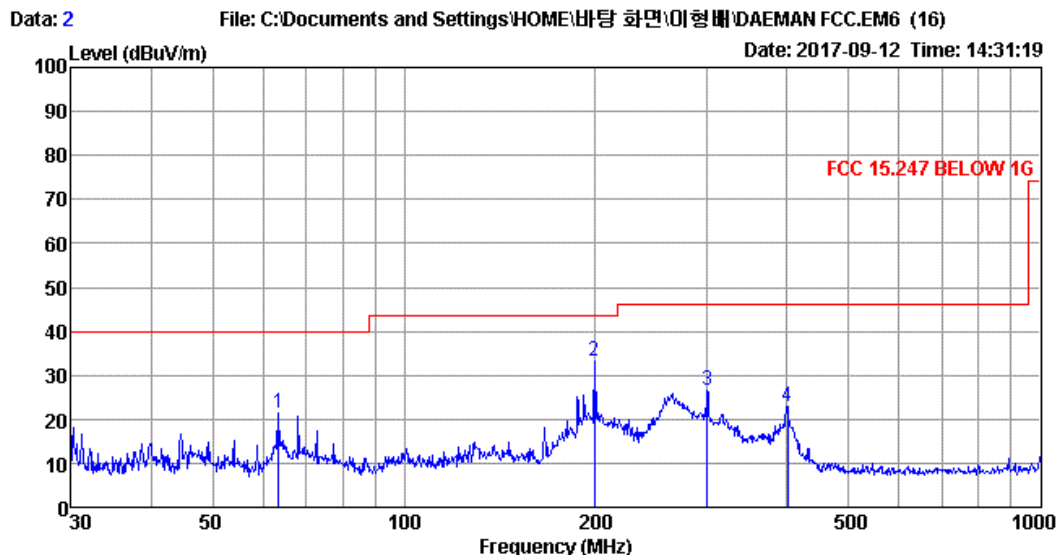
Site : RF Center Shield
Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006
: RBW:100.000KHz VBW:1000.000KHz SWT:Auto
euter : DM-H700
mode : EDR
memo :

	Freq	ReadAntenna	Cable	Preamp	Limit	Over			
	MHz	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	63.54	33.70	10.88	0.09	23.47	21.20	40.00	-18.80	Peak
2	199.99	45.83	10.21	0.42	23.45	33.01	43.50	-10.49	Peak
3	300.37	35.48	13.20	0.57	23.46	25.79	46.00	-20.21	Peak
4	400.43	29.22	15.41	0.80	23.42	22.01	46.00	-23.99	Peak

EDR(8-DPSK)- 2402 MHz(Low)_Vertical



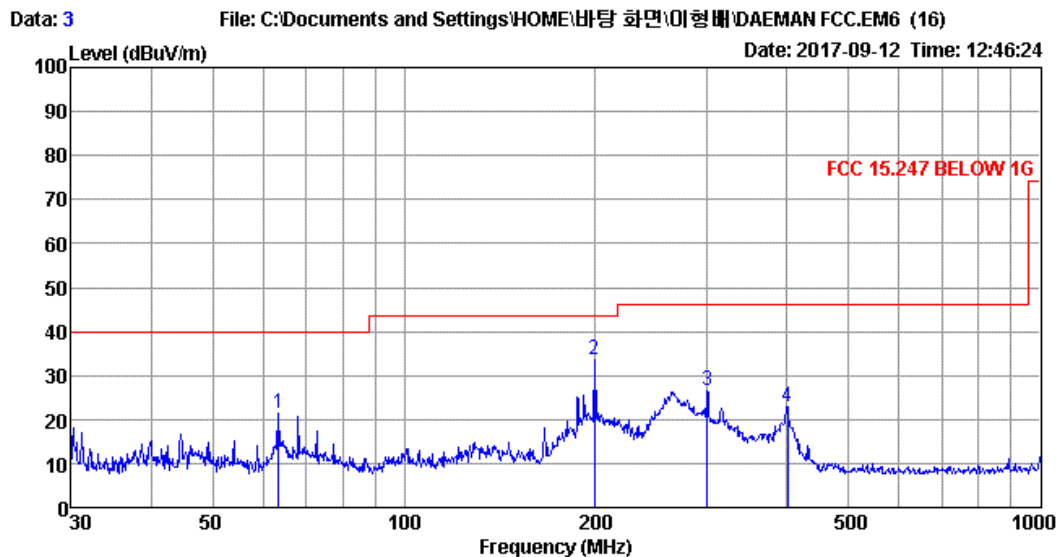
BWS TECH INC



Site : RF Center Shield
Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006
RBW:100.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo :

		ReadAntenna	Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	63.54	33.85	10.88	0.09	23.47	21.35	40.00	-18.65	Peak
2	199.29	46.13	10.24	0.42	23.45	33.34	43.50	-10.16	Peak
3	299.32	36.26	13.16	0.57	23.46	26.53	46.00	-19.47	Peak
4	400.43	30.01	15.41	0.80	23.42	22.80	46.00	-23.20	Peak

EDR(8-DPSK)- 2441 MHz(Middle)_Horizontal



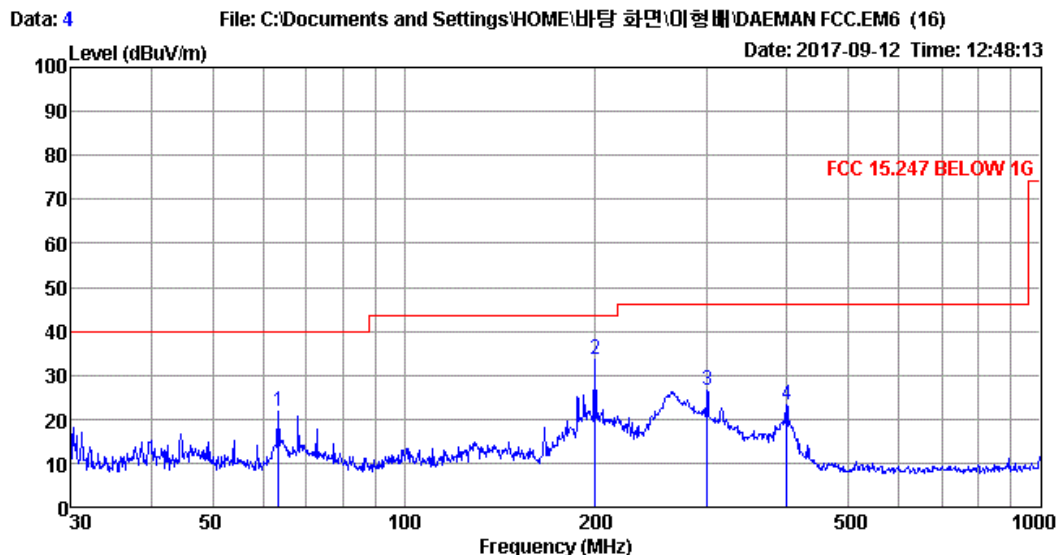
Site : RF Center Shield
Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006
: RBW:100.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo :

		ReadAntenna	Cable	Preampl	Limit	Over			
	Freq	Level	Loss	Factor	Line	Limit	Remark	Pol/Phase	
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	63.54	33.85	10.88	0.09	23.47	21.35	40.00	-18.65	Peak
2	199.29	46.29	10.24	0.42	23.45	33.50	43.50	-10.00	Peak
3	299.32	36.33	13.16	0.57	23.46	26.60	46.00	-19.40	Peak
4	400.43	30.01	15.41	0.80	23.42	22.80	46.00	-23.20	Peak

EDR(8-DPSK)- 2441 MHz(Middle)_Vertical



BWS TECH INC



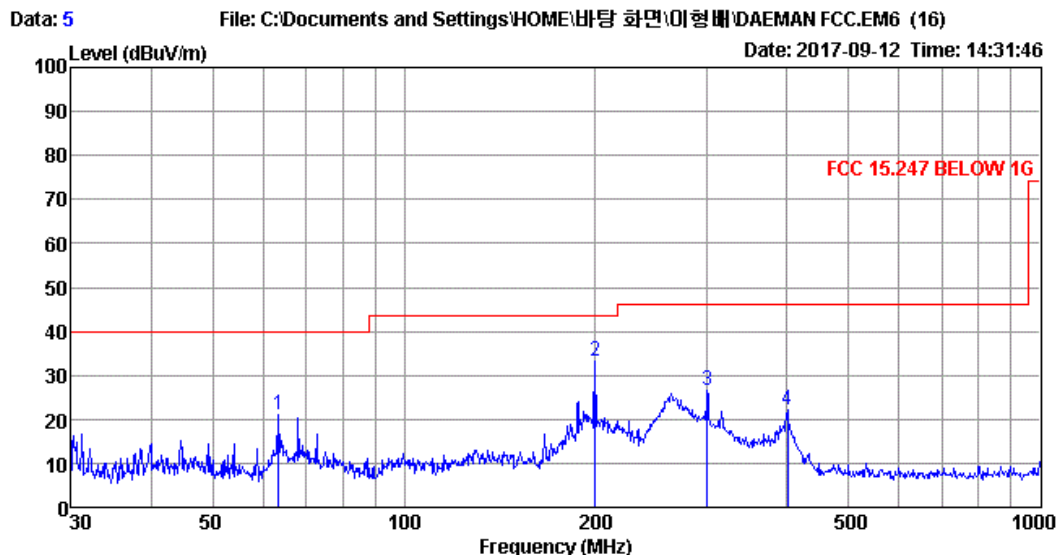
Site : RF Center Shield
Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006
RBW:100.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo :

		ReadAntenna	Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	63.54	34.12	10.88	0.09	23.47	21.62	40.00	-18.38	Peak
2	199.99	46.45	10.21	0.42	23.45	33.63	43.50	-9.87	Peak
3	299.32	36.43	13.16	0.57	23.46	26.70	46.00	-19.30	Peak
4	399.03	30.53	15.39	0.80	23.42	23.30	46.00	-22.70	Peak

EDR(8-DPSK)- 2480 MHz(Upper)_Horizontal



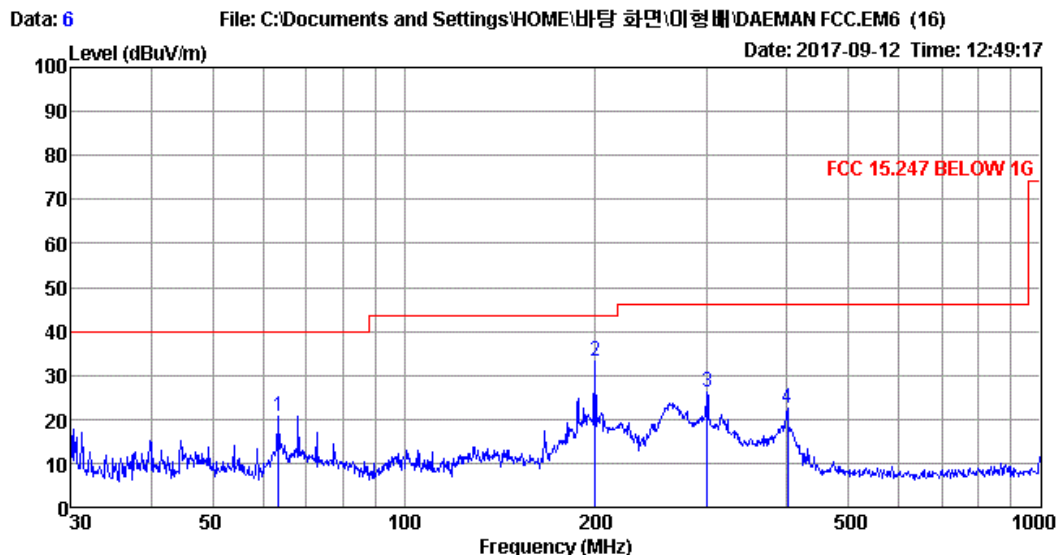
BWS TECH INC



Site : RF Center Shield
Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006
: RBW:100.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo :

		ReadAntenna	Cable	Preamplifier			Limit	Over	Remark	Pol/Phase
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit		
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1	63.54	33.55	10.88	0.09	23.47	21.05	40.00	-18.95	Peak	HORIZONTAL
2	pp 199.99	45.90	10.21	0.42	23.45	33.08	43.50	-10.42	Peak	HORIZONTAL
3	299.32	36.27	13.16	0.57	23.46	26.54	46.00	-19.46	Peak	HORIZONTAL
4	400.43	29.41	15.41	0.80	23.42	22.20	46.00	-23.80	Peak	HORIZONTAL

EDR(8-DPSK)- 2480 MHz(Upper)_Vertical



Site : RF Center Shield
Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006
RBW:100.000KHz VBW:1000.000KHz SWT:Auto
euteut : DM-H700
mode : EDR
memo :

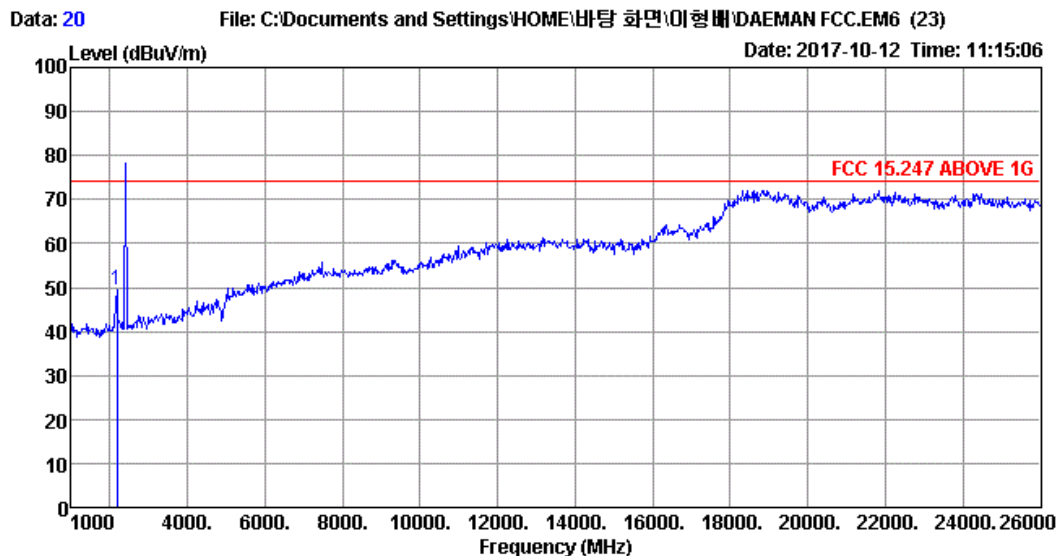
		ReadAntenna	Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	63.54	33.15	10.88	0.09	23.47	20.65	40.00	-19.35	Peak
2	199.99	45.85	10.21	0.42	23.45	33.03	43.50	-10.47	Peak
3	299.32	35.80	13.16	0.57	23.46	26.07	46.00	-19.93	Peak
4	400.43	29.71	15.41	0.80	23.42	22.50	46.00	-23.50	Peak

5.8.5.3 Above 1 GHz

EDR(8DPSK)- 2402 MHz(Low)_Horizontal



BWS TECH INC



Site : RF Center Shield
Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517(1G~26G
: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo : 1G-ABOVE-SPU-F1-H

	ReadAntenna	Cable	Preamp		Limit	Over			
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark	Pol/Phase
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 pp 2175.00	41.18	28.05	2.48	22.32	49.39	74.00	-24.61	Peak	HORIZONTAL

EDR(8DPSK)- 2402 MHz(Low)_Vertical

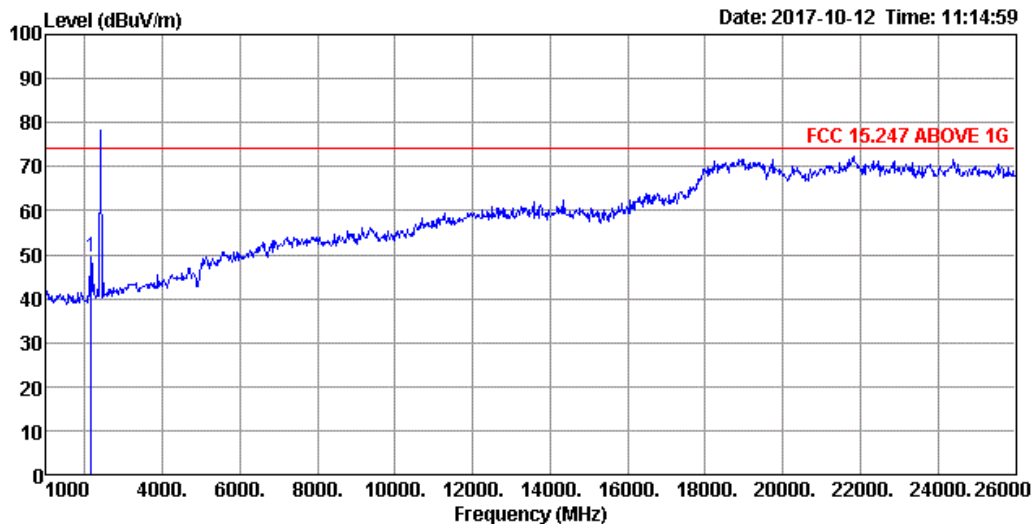


BWS TECH INC

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Date: 2017-10-12 Time: 11:14:59



Site : RF Center Shield

Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517(1G~26G

: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto

eut : DM-H700

mode : EDR

memo : 1G-ABOVE-SPU-F1-V

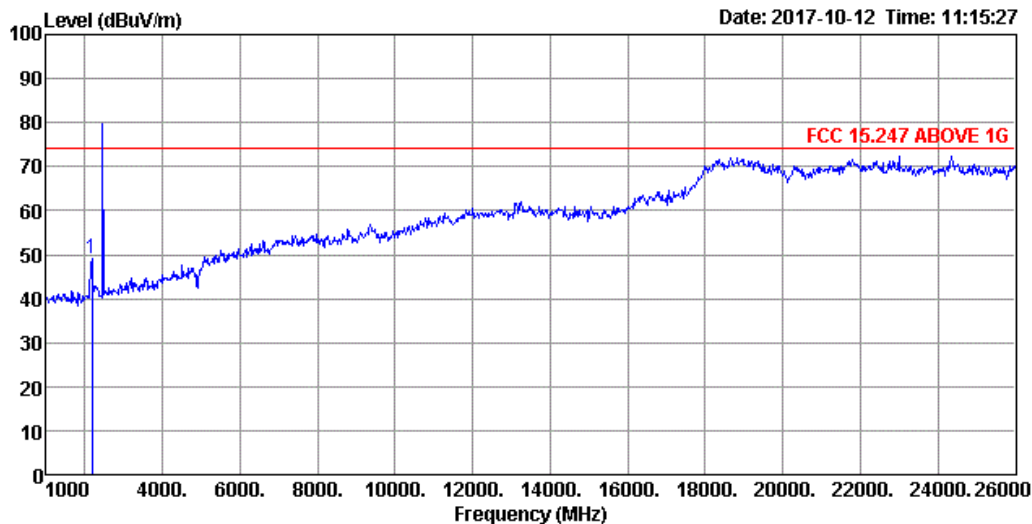
	ReadAntenna	Cable	Preamp	Limit	Over				
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark	Pol/Phase
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 pp 2150.00	41.83	27.70	2.45	22.39	49.59	74.00	-24.41	Peak	VERTICAL

EDR(8DPSK)- 2441 MHz(Middle)_Horizontal

Data: 23

File: C:\Documents and Settings\HOME\바탕 화면\이형배\DAEMAN FCC\EM6 (23)

Date: 2017-10-12 Time: 11:15:27



Site : RF Center Shield

Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517(1G~26G

: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto

eut : DM-H700

mode : EDR

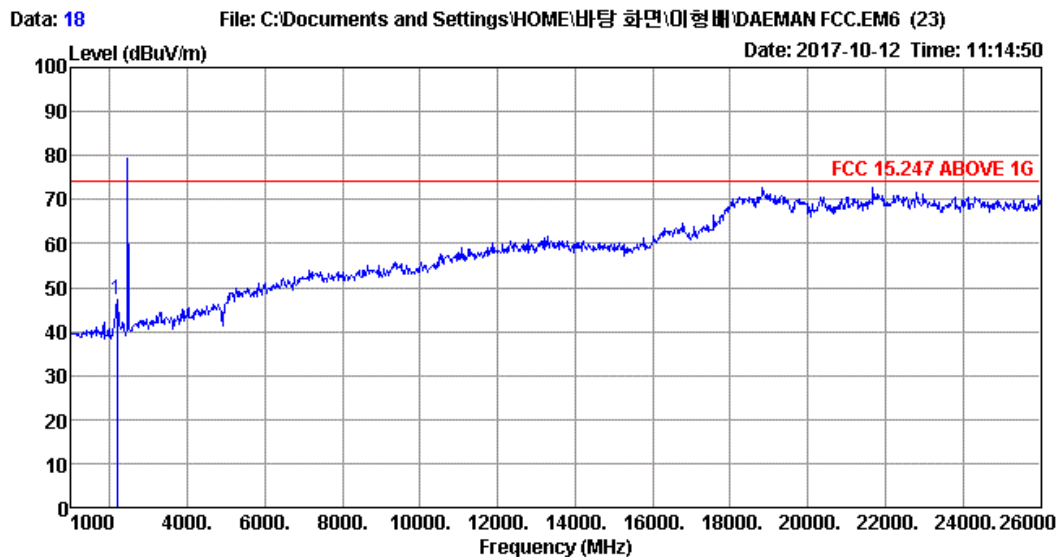
memo : 1G-ABOVE-SPU-F2-H

	ReadAntenna	Cable	Preamp	Limit	Over				
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark	Pol/Phase
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 pp 2175.00	40.75	28.05	2.48	22.32	48.96	74.00	-25.04	Peak	HORIZONTAL

EDR(8DPSK)- 2441 MHz(Middle)_Vertical



BWS TECH INC



Site : RF Center Shield
Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517(1G~26G
: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo : 1G-ABOVE-SPU-F2-V

	Freq	ReadAntenna Level	Cable Factor	Preamplifier Loss	Preamp Factor	Limit Level	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1 pp	2175.00	39.20	28.05	2.48	22.32	47.41	74.00	-26.59 Peak	VERTICAL

EDR(8DPSK)- 2480 MHz(Upper) _Horizontal

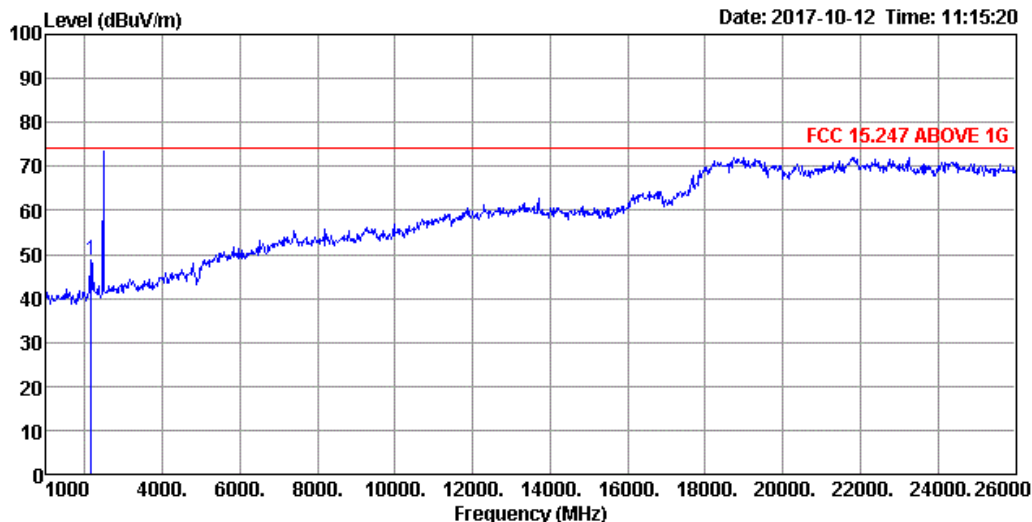


BWS TECH INC

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Date: 2017-10-12 Time: 11:15:20



Site : RF Center Shield

Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517(1G~26G

: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto

eut : DM-H700

mode : EDR

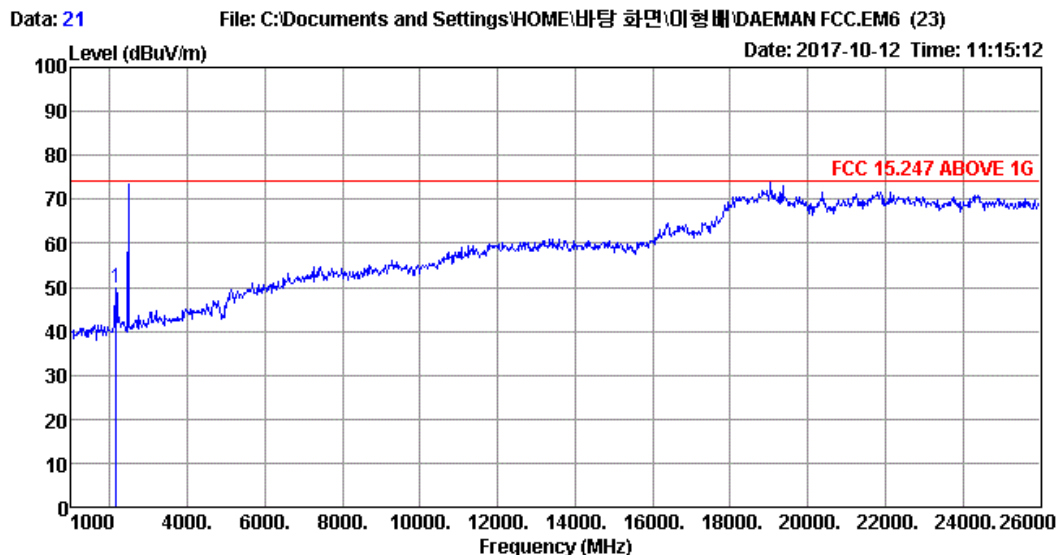
memo : 1G-ABOVE-SPU-F3-H

	ReadAntenna	Cable	Preampl	Limit	Over				
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark	Pol/Phase
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 pp 2150.00	40.81	27.70	2.45	22.39	48.57	74.00	-25.43	Peak	HORIZONTAL

EDR(8DPSK)- 2480 MHz(Upper)_Vertical



BWS TECH INC



Site : RF Center Shield
Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517(1G~26G
: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo : 1G-ABOVE-SPU-F3-V

	ReadAntenna	Cable	Preampl	Limit	Over				
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark	Pol/Phase
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB		
1 pp 2150.00	42.03	27.70	2.45	22.39	49.79	74.00	-24.21	Peak	VERTICAL

5.9 Band Edges Measurement

5.9.1 Test Equipment

EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date (year/month/date)
Loop Antenna	FMZB 1519 B	SCHWARZBECK	00025	2018/07/11
BILOG Antenna	VULB 9160	SCHWARZBECK	9160-3052	2018/10/17
Horn Antenna	BBHA9120D	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D517	2018/01/05
RF Amplifier	8449B	Agilent	3947A04710	2018/06/21
Antenna Master	JAC-3	Daeil EMC	N/A	N/A
Antenna Turntable Controller	JAC-2	Daeil EMC	N/A	N/A
EMI Test Receiver	ESPI	ROHDE & SCHWARZ	100012	2018/01/06
Antenna Master	N/A	AUDIX	N/A	N/A
Antenna Turntable Controller	ACT	AUDIX	N/A	N/A
MXA SIGNAL ANALYZER	Agilent	N9020A	US46220101	2018/09/07
Spectrum Analyzer	FSP13	ROHDE&SCHWARZ	100760	2018/10/04

5.9.2 Test Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is 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 in §15.209(a).

5.9.3 Test Procedure

The EUT is placed on a turntable with 1.5 meter above ground.

The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.

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

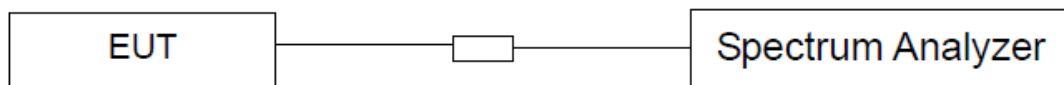
PEAK: RBW=VBW=1MHz / Sweep=AUTO

AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

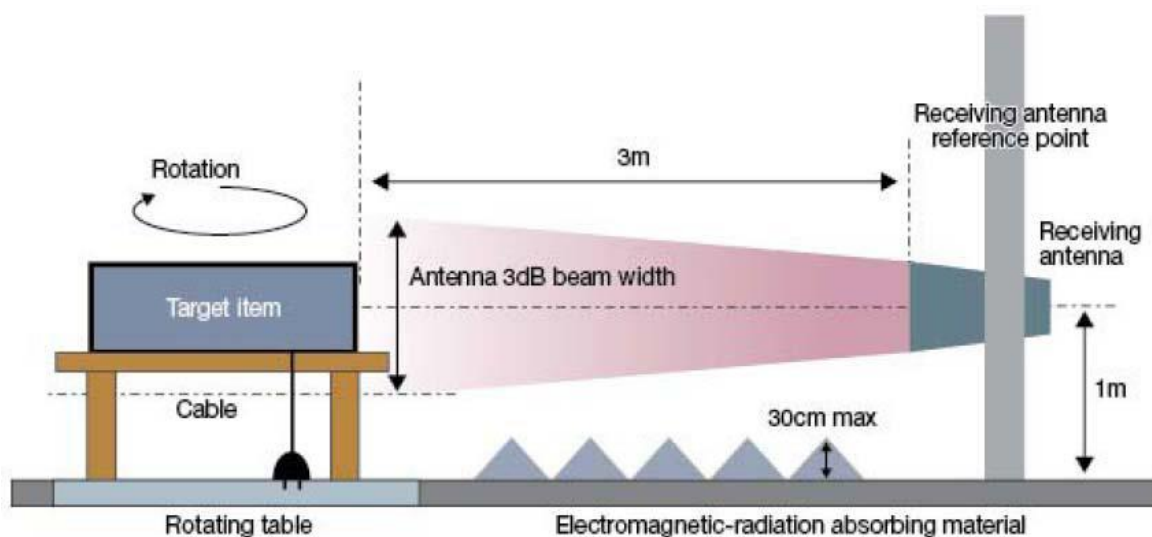
Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

5.9.4 Test SET-UP (Block Diagram of Configuration)

(a) Conducted Emission Test Set-Up, Frequency above 1000MHz

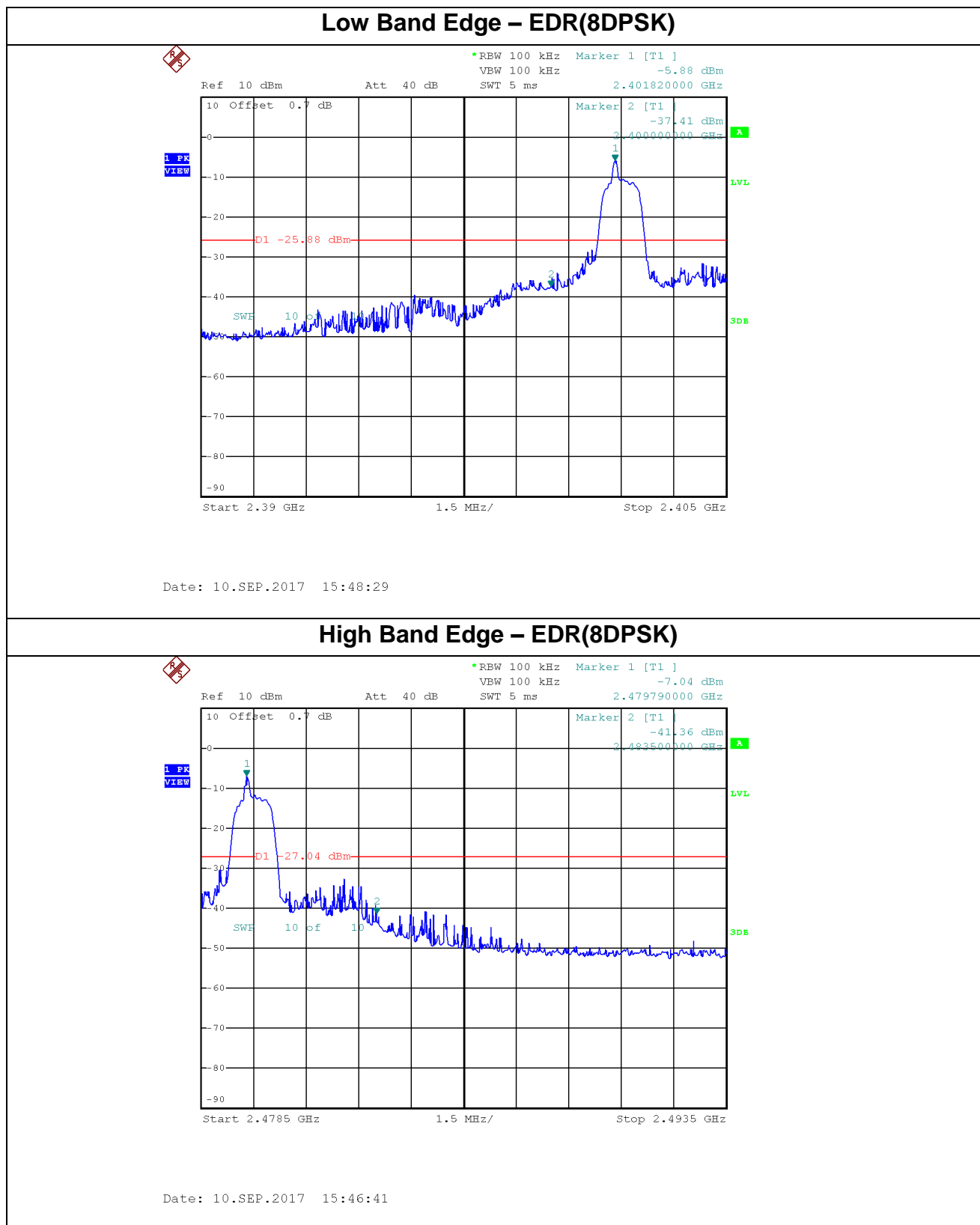


(b) Radiated Emission Test Set-Up, Frequency above 1000MHz

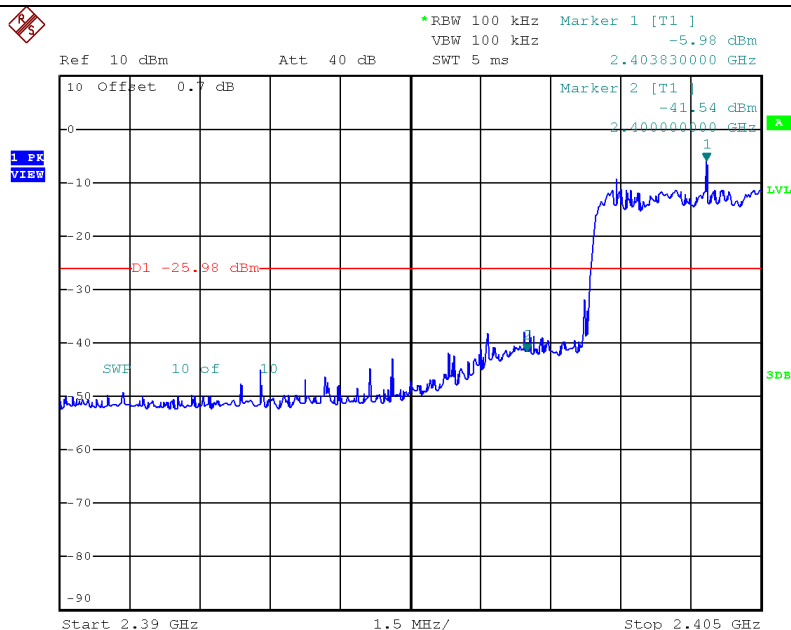


5.9.5 Test Result

5.9.5.1 Conducted Band Edges

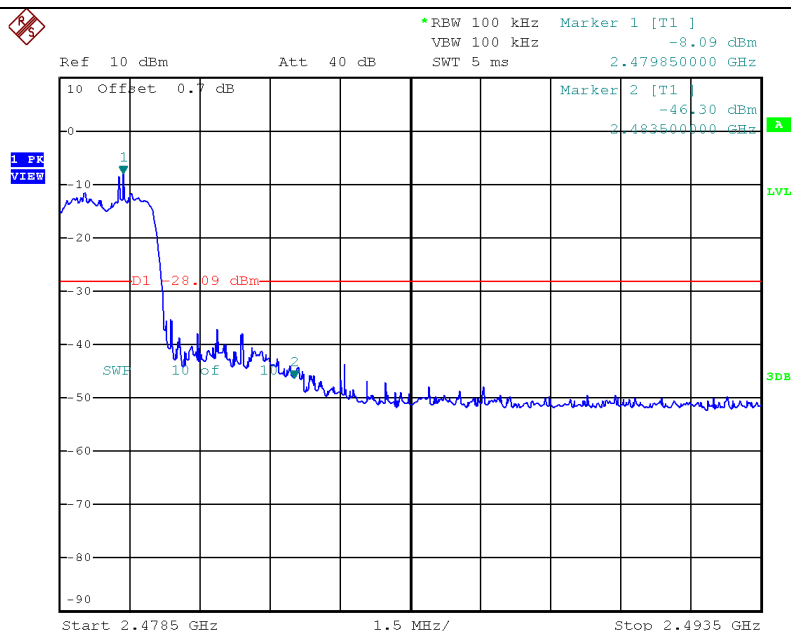


Hopping Mode - Low Band Edge – EDR(8DPSK)



Date: 10.SEP.2017 15:49:32

Hopping Mode - High Band Edge – EDR(8DPSK)



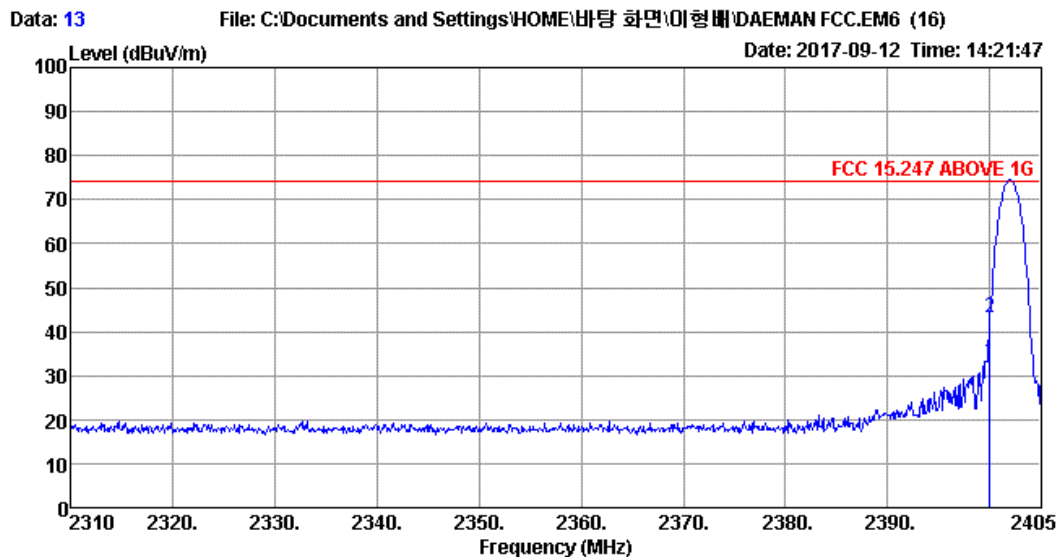
Date: 10.SEP.2017 15:53:14

5.9.5.2 Radiated Band Edges

Low Band Edge – EDR(8DPSK)_Horizontal



BWS TECH INC



Site : RF Center Shield
Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517
 : RBW:1000.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo :

		ReadAntenna	Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	Pol/Phase
1 av	2400.06	24.87	27.80	2.74	22.16	33.25	74.00	-40.75	Average
2 pp	2400.06	34.97	27.80	2.74	22.16	43.35	74.00	-30.65	Peak

Low Band Edge – EDR(8DPSK)_Vertical

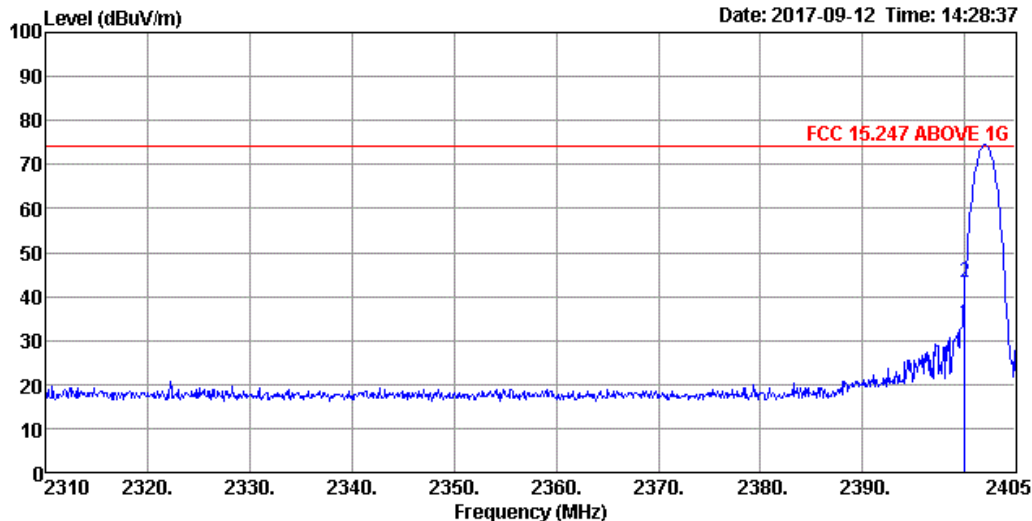


BWS TECH INC

Data: 14

File: C:\Documents and Settings\HOME\바탕 화면\이형배\DAEMAN FCC.EM6 (16)

Date: 2017-09-12 Time: 14:28:37



Site : RF Center Shield

Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517

: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto

eut : DM-H700

mode : EDR

memo :

		ReadAntenna	Cable	Preamplifier	Limit	Over			
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	Pol/Phase
1 av	2400.06	25.41	27.80	2.74	22.16	33.79	74.00	-40.21	Average
2 pp	2400.06	34.72	27.80	2.74	22.16	43.10	74.00	-30.90	Peak

High Band Edge – EDR(8DPSK)_Horizontal

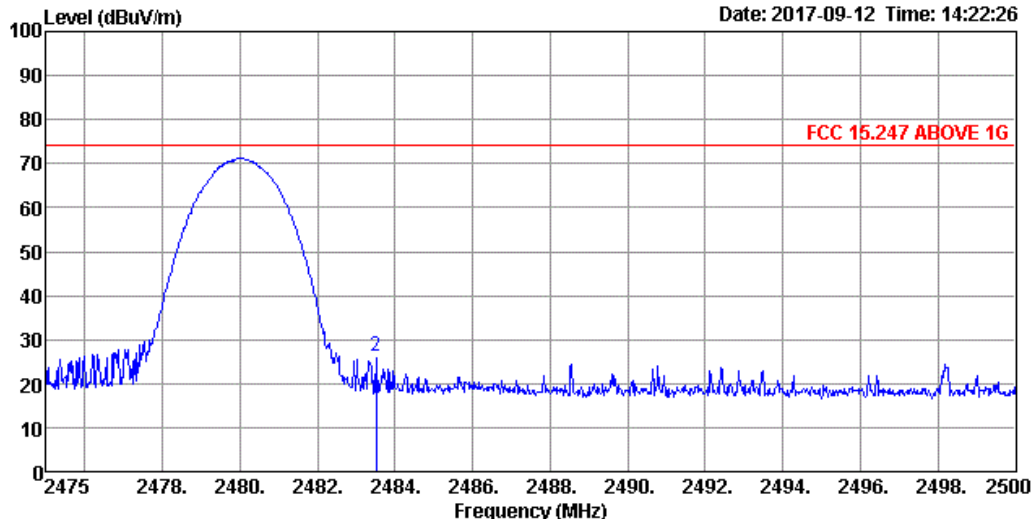


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Data: 12

File: C:\Documents and Settings\HOME\바탕 화면\미형배\DAEMAN FCC.EM6 (16)

Date: 2017-09-12 Time: 14:22:26



Site : RF Center Shield

Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517

: RBW:1000.000KHz VBW:1000.000KHz SWT:Auto

eut : DM-H700

mode : EDR

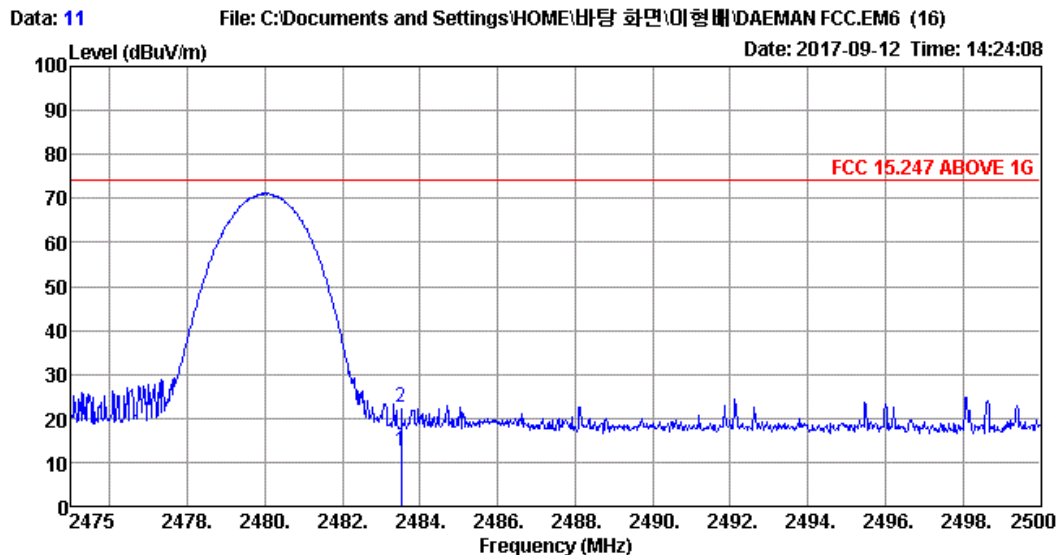
memo :

		ReadAntenna	Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1 av	2483.50	8.22	27.72	2.83	22.01	16.76	74.00	-57.24	Average
2 pp	2483.50	17.76	27.72	2.83	22.01	26.30	74.00	-47.70	Peak

High Band Edge – EDR(8DPSK)_Vertical



BWS TECH INC



Site : RF Center Shield
Condition: FCC 15.247 ABOVE 1G 3m BBHA9120D_517
RBW:1000.000KHz VBW:1000.000KHz SWT:Auto
eut : DM-H700
mode : EDR
memo :

		ReadAntenna	Cable	Preamp		Limit	Over		
	Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	Pol/Phase
1 av	2483.50	3.89	27.72	2.83	22.01	12.43	74.00	-61.57	Average
2 pp	2483.50	14.05	27.72	2.83	22.01	22.59	74.00	-51.41	Peak

5.10 Antenna Application

5.10.1 Antenna Requirement

According to §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 §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
Chip Antenna	2.4 GHz	2.00 dBi	≤6 dBi

5.10.2 Result

PASS