



# CONFORMANCE TEST REPORT FOR FCC 47 CFR, Part 15 Subpart C

Report No.: **12-10-MAS-291-01**

Client: TAIWAN CAROL ELECTRONICS CO., LTD.

Product: Digital Wireless Transmitter

Model: DWM-881

FCC ID: G4RCAROL881

Manufacturer/supplier: TAIWAN CAROL ELECTRONICS CO., LTD.

Date test item received: 2012/10/31

Date test campaign completed: 2013/12/18

Date of issue: 2013/12/18

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Manufacturer : TAIWAN CAROL ELECTRONICS CO .,LTD.  
Address : NO.202 TUNG KUANG ROAD, TAICHUNG, TAIWAN  
EUT : Digital Wireless Transmitter  
Trade name : Carol  
Model No. : DWM-881  
Power Source : 3Vdc (Battery)  
Regulations applied : FCC 47 CFR, Part 15 Subpart C

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- ⑤ FCC Registration Number: 91095, 392735, 278818
- ⑥ Industry Canada Site Registration Number: IC 2949A-2



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## 1 GENERAL INFORMATION

### 1.1 Product Description

- a) Type of EUT : Digital Wireless Transmitter
- b) Trade Name : Carol
- c) Model No. : DWM-881

### 1.2 Characteristics of Device

The EUT is a digital wireless microphone. It operates in the unlicensed ISM Band at 2.4GHz. Frequency Range is 2404 MHz to 2474 MHz. There are 32 channels and the modulation type is GFSK.

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (MHz)
2404	2420	2444	2460
2406	2422	2446	2462
2408	2424	2448	2464
2410	2426	2450	2466
2412	2428	2452	2468
2414	2430	2454	2470
2416	2432	2456	2472
2418	2434	2458	2474

### 1.3 Test Methodology

All testing were performed according to the procedures in ANSI C63.10 (2009) and FCC CFR 47 Part 2 and Part 15 and KDB 558074 D01 v03r01.

### 1.4 Test Facility

The semi-anechoic chamber and conducted measurement facility used to collect the radiated and conducted data are located inside the Building at No.8, Lane 29, Wen-ming Road, Lo-shan Tsun, Kweishan Hsiang, Taoyuan, Taiwan, R.O.C.

This site has been accreditation as a FCC filing site.

### 1.5 Test Summary

Requirement	FCC Paragraph #	Test Pass
Antenna Requirement	15.203	<input checked="" type="checkbox"/>
Emission Bandwidth	15.247 (a)(2)	<input checked="" type="checkbox"/>
Output Power Requirement	15.247 (b)	<input checked="" type="checkbox"/>
Power Density Requirement	15.247 (e)	<input checked="" type="checkbox"/>
Spurious Emissions	15.247 (d)	<input checked="" type="checkbox"/>
Radiated Emission	15.247 (d)	<input checked="" type="checkbox"/>

## 2 PROVISIONS APPLICABLE

### 2.1 Definition

**Unintentional radiator:**

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

**Class A Digital Device:**

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

**Class B Digital Device :**

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business or industrial environment. Example of such devices that are marketed for the general public.

**Note :** A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

**Intentional radiator:**

A device that intentionally generates and emits radio frequency energy by radiation or induction.

## 2.2 Requirement for Compliance

### (1) Conducted Emission Requirement

For unintentional device, according to §15.107(a) Line Conducted Emission Limits is as following:

Frequency MHz	Quasi Peak dB $\mu$ V	Average dB $\mu$ V
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

\*Decreases with the logarithm of the frequency.

For intentional device, according to §15.207(a) Line Conducted Emission Limits is same as above table.

### (2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	Distance Meters	Radiated dB $\mu$ V/m	Radiated $\mu$ V/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
above 960	3	54.0	500

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

### (3) Antenna Requirement

For intentional device, 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.

**(4) Bandwidth Requirement**

According to 15.247 (a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

**(5) Output Power Requirement**

For systems using digital modulation , according to 15.247(b), the maximum peak output power of the intentional radiator shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**(6) Spurious Emissions Measurement**

According to 15.247 (c) , in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

**(7) Power Density Requirement**

According to 15.247 (d) , for digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission..

## 2.3 Restricted Bands of Operation

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	4.5-5.25
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	Above 38.6
13.36-13.41			

\*\* : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

## 2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

### 3. SYSTEM TEST CONFIGURATION

#### 3.1 Devices for Tested System

Device	Manufacture	Model No.	Cable Description
Digital Wireless Transmitter *	TAIWAN CAROL ELECTRONICS CO., LTD.	DWM-881	----
Microphone	N/A	N/A	0.3m*1 Unshielded Signal Line

Note: Remark “\*” means equipment under test.

#### 3.2 Description of Test Modes

##### 3.2.1 Test Modes and Channels

Test Mode	Modulation
A	GFSK

Test Channel	Frequency (MHz)
Channel Low (L)	2404
Channel Mid (M)	2444
Channel High (H)	2474

##### 3.2.2 Test Item and Worse Case

Item	Test Item	Test Mode	Test Frequency (MHz)
1	Conducted Emission	N/A	N/A
2	Emission Bandwidth	A	L , M , H
3	Output Power	A	L , M , H
4	Power Density	A	L , M , H
5	Spurious Emission	A	L , M , H
6.1	Radiated Emission (Harmonic)	A	L , M , H
6.2	Radiated Emission (below 1GHz)	A	M (note)
6.3	Radiated Emission (above 1GHz)	A	L , M , H

note:

Pretest result is no difference by channel low, middle and high. Choose one for final testing and record the result.

## 4 CONDUCTED EMISSION MEASUREMENT

This EUT is excused from investigation of conducted emission, for it is powered by battery only. According to §15.207 (d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

## 5 ANTENNA REQUIREMENT

### 5.1 Standard Applicable

For intentional device, 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 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 5.2 Antenna Construction and Directional Gain

Antenna gain: 1.7 dBi.

The directional gain of antenna doesn't greater than 6 dBi, the power won't be reduced.

## 6 EMISSION BANDWIDTH MEASUREMENT

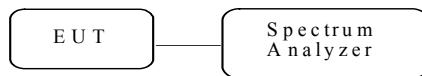
### 6.1 Standard Applicable

According to 15.247(a)(2), system using digital modulation techniques, the minimum 6dB bandwidth shall be at least 500 kHz.

### 6.2 Measurement Procedure

1. The testing follows FCC KDB 558074 D01 v03r01.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Position the EUT as shown in figure 1. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
4. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

Figure 1: Emission bandwidth measurement configuration.



### 6.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Agilent	E4446A	09/27/2013

## 6.4 Measurement Data

Test Date: Dec. 28, 2012Temperature: 20°CHumidity: 54 %

Channel	6dB Bandwidth (MHz)	FCC Limit (kHz)	Chart
Low	0.7000	500	Page 16
Mid	0.7083	500	Page 17
High	0.6750	500	Page 18

**Note:**

1. Please refer to page 16 to page 18 for chart
2. The estimated measurement uncertainty of the result measurement is  $8.25 \times 10^{-7}$  ( $1\text{GHz} \leq f \leq 18\text{GHz}$ )

File: DWM-881

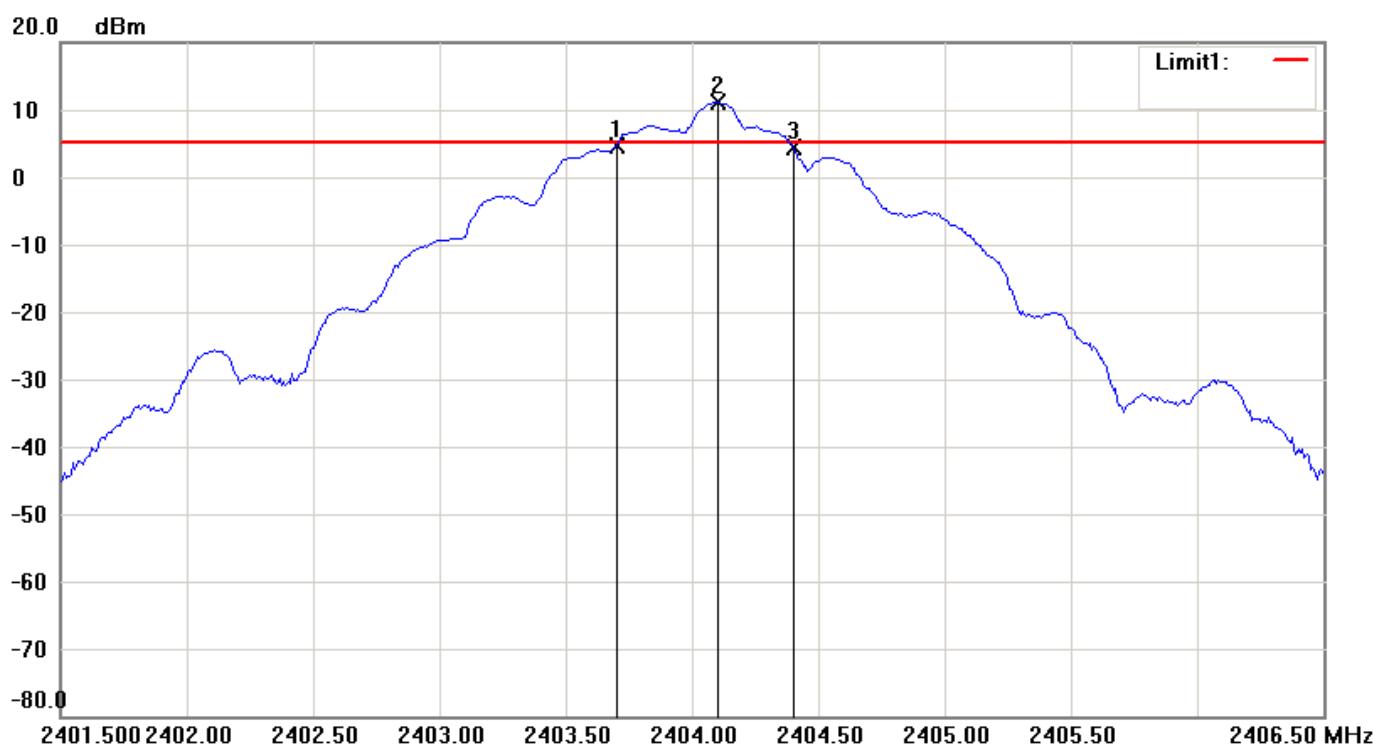
Data: #22

Date: 2012/12/28

Temperature: 20 °C

Time: PM 01:14:21

Humidity: 54 %



Condition: 5.09dBm

RF Conducted

EUT:

Sweep Time: 500ms Att.: 20dB

Model:

RBW: 100 KHz VBW: 300 KHz

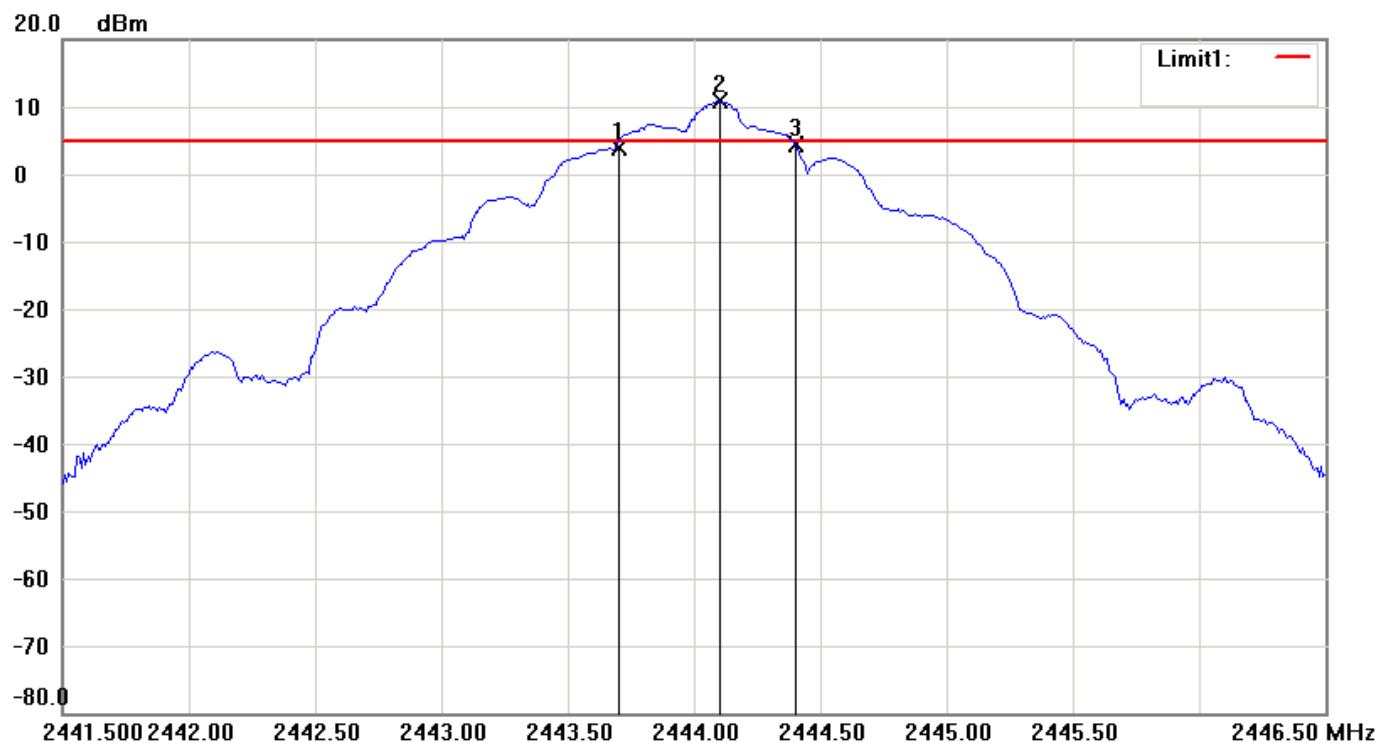
Test Mode:

Note: Channel -6dB EBW

No.	Frequency(MHz)	Level(dBm)
1	2403.7000	4.54
2	2404.1000	11.09
3	2404.4000	4.31

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	0.7	-0.23

**File:** DWM-881      **Data:** #28      **Date:** 2012/12/28      **Temperature:** 20 °C  
**Time:** PM 01:21:33      **Humidity:** 54 %

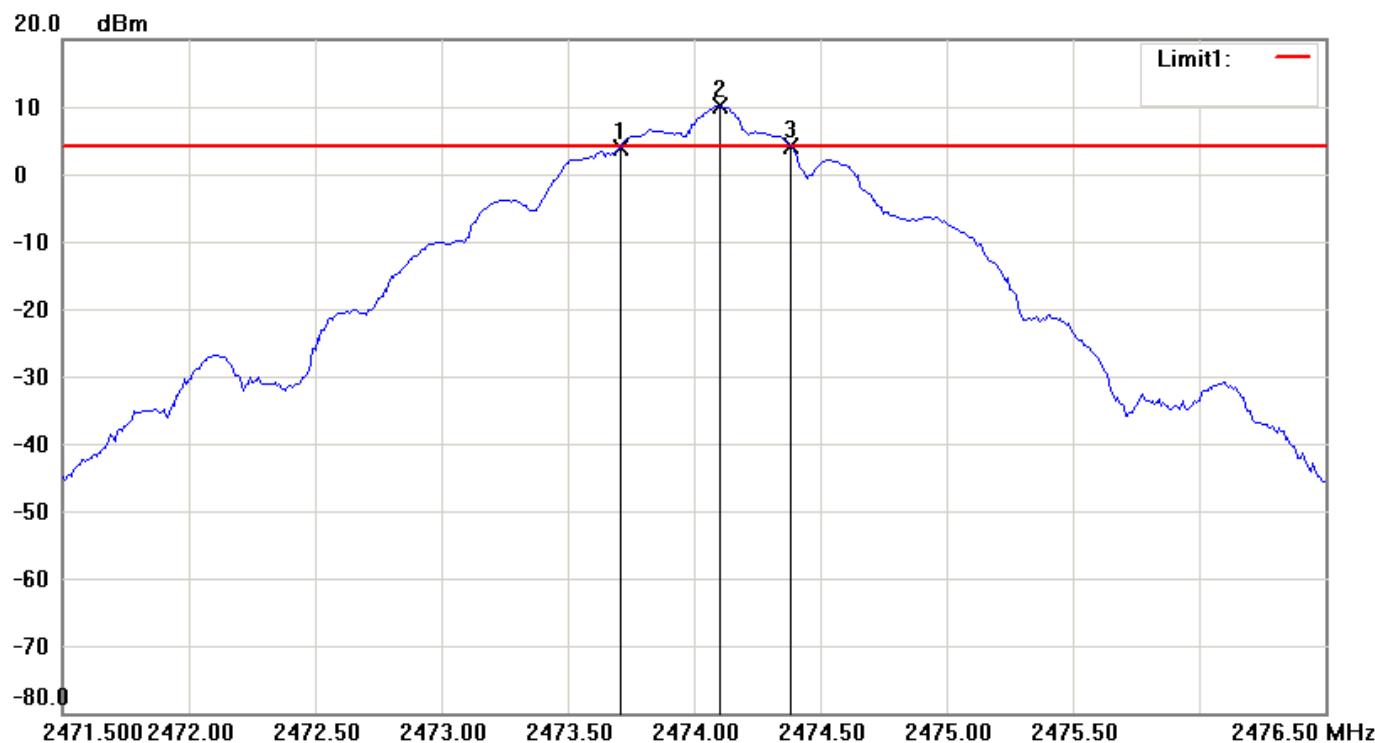


**Condition:** 4.76dBm      **RF Conducted**  
**EUT:** Sweep Time: 500ms Att.: 20dB  
**Model:** RBW: 100 KHz      VBW: 300 KHz  
**Test Mode:**  
**Note:** Channel Mid-6dB EBW

No.	Frequency(MHz)	Level(dBm)
1	2443.69170	3.92
2	2444.09170	10.76
3	2444.40000	4.34

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	0.7083	0.42

**File:** DWM-881      **Data:** #33      **Date:** 2012/12/28      **Temperature:** 20 °C  
**Time:** PM 01:28:20      **Humidity:** 54 %



**Condition:** 4.05dBm      **RF Conducted**  
**EUT:** Sweep Time: 500ms Att.: 20dB  
**Model:** RBW: 100 KHz      VBW: 300 KHz  
**Test Mode:**  
**Note:** channel High -6dB EBW

No.	Frequency(MHz)	Level(dBm)
1	2473.70830	3.89
2	2474.09170	10.05
3	2474.38330	4.01

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	0.675	0.12

## 7 OUTPUT POWER MEASUREMENT

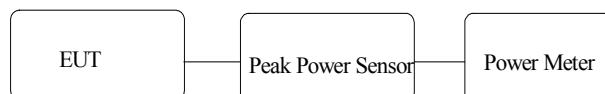
### 7.1 Standard Applicable

For direct sequence system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 7.2 Measurement Procedure

1. The testing follows FCC KDB 558074 D01 v03r01.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Position the EUT as shown in figure 2. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range.
4. Measure the highest value appearing on power meter and record the level to calculate result data.
5. Repeat above procedures until all frequencies measured were complete.

Figure 2: Output power measurement configuration.



### 7.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Power Meter	Boonton	N1922A	11/23/2013
Peak Power Sensor	Boonton	N1912A	11/22/2013

## 7.4 Measurement Data

Test Date: Dec. 28, 2012Temperature: 20°CHumidity: 54 %

Channel	Maximum Peak Output Power (dBm)	Maximum Peak Output Power (mW)	FCC Limit (mW)	Chart
Low	11.88	15.42	1000	-
Mid	11.48	14.06	1000	-
High	10.88	12.25	1000	-

**Note:**

*The estimated measurement uncertainty of the result measurement is  $\pm 1.5\text{dB}$  ( $1\text{GHz} \leq f \leq 18\text{GHz}$ )*

Channel	Average Output Power (dBm)	Average Output Power (mW)	FCC Limit (mW)	Chart
Low	8.78	7.55	-	-
Mid	8.47	7.03	-	-
High	7.84	6.08	-	-

**Note:**

*According customer's operation description, each transmitted period there is an equal receive period.*

*The transmission duty cycle of DWM-881 is 50% for end product.*

## 8 POWER DENSITY MEASUREMENT

### 8.1 Standard Applicable

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

### 8.2 Measurement Procedure

1. The testing follows FCC KDB 558074 D01 v03r01.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Position the EUT as shown in figure 1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
4. Adjust the center frequency of spectrum analyzer on highest level appearing on spectral display within a 300 kHz frequency span.
5. Set the spectrum analyzer on a 3 kHz resolution bandwidth and 10 kHz video bandwidth as well as max. hold function, then record the measurement result.
6. Repeat above procedures until all measured frequencies were complete.

### 8.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Agilent	E4446A	09/27/2013

## 8.4 Measurement Data

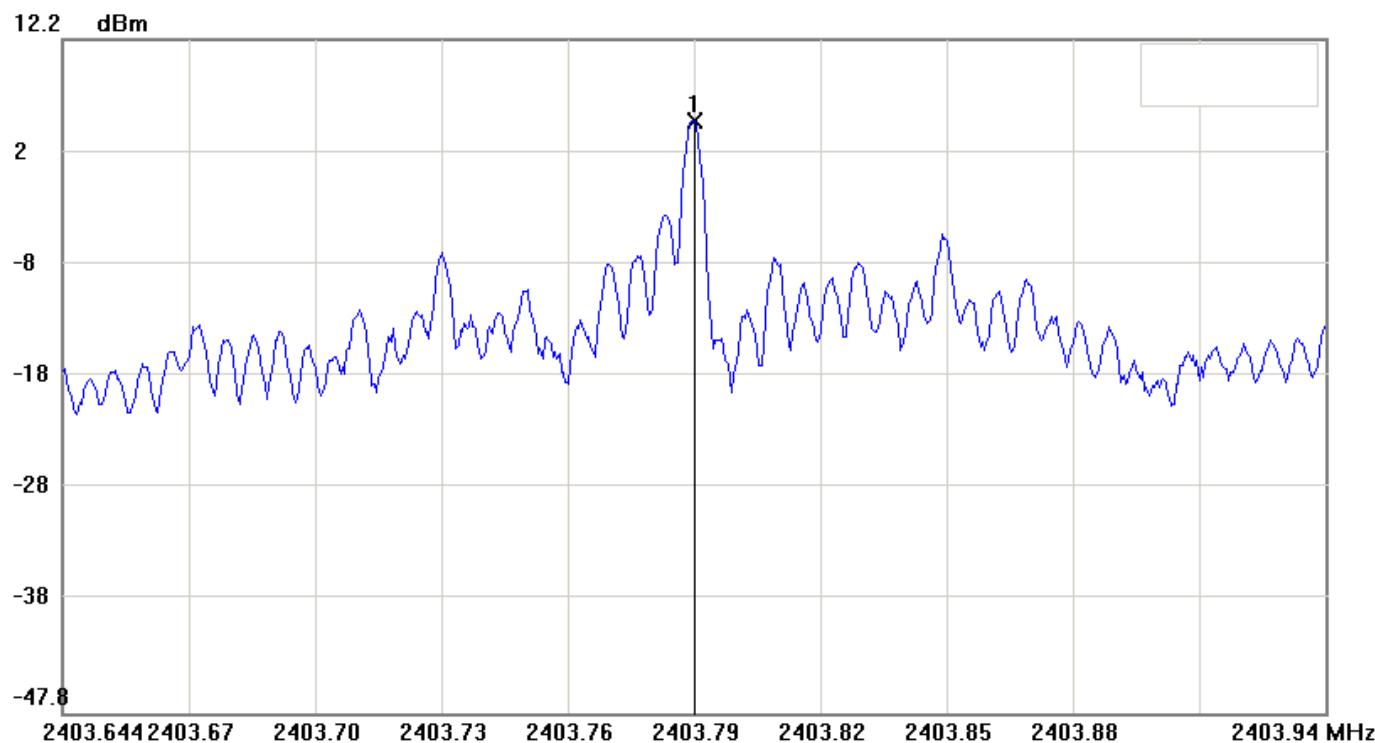
Test Date: Dec. 28, 2012Temperature: 20°CHumidity: 54 %

Channel	Peak Power Spectral Density (dBm)	FCC Limit (dBm)	Chart
Low	4.95	8	Page 23
Mid	4.47	8	Page 24
High	2.23	8	Page 25

**Note:**

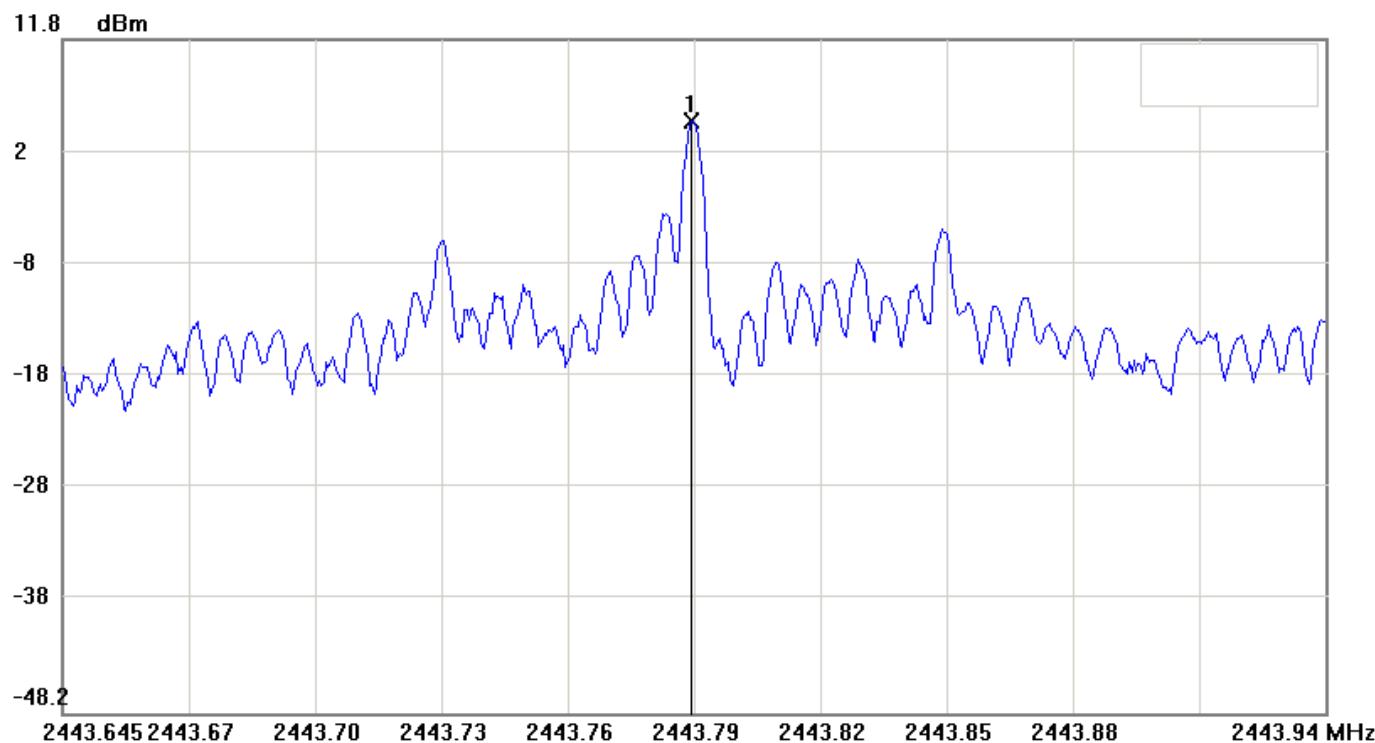
1. Please refer to page 23 to page 25 for chart
2. The estimated measurement uncertainty of the result measurement is  $\pm 1.5 \text{ dB}$  ( $1 \text{ GHz} \leq f \leq 18 \text{ GHz}$ )

**File: DWM-881**      **Data: #25**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:18:52**      **Humidity: 54 %**

**Condition:****RF Conducted****EUT:****Sweep Time: 100000ms Att.: 20dB****Model:****RBW: 3 KHz VBW: 10 KHz****Test Mode:****Note: Channel LOW-Power Density (PK)**

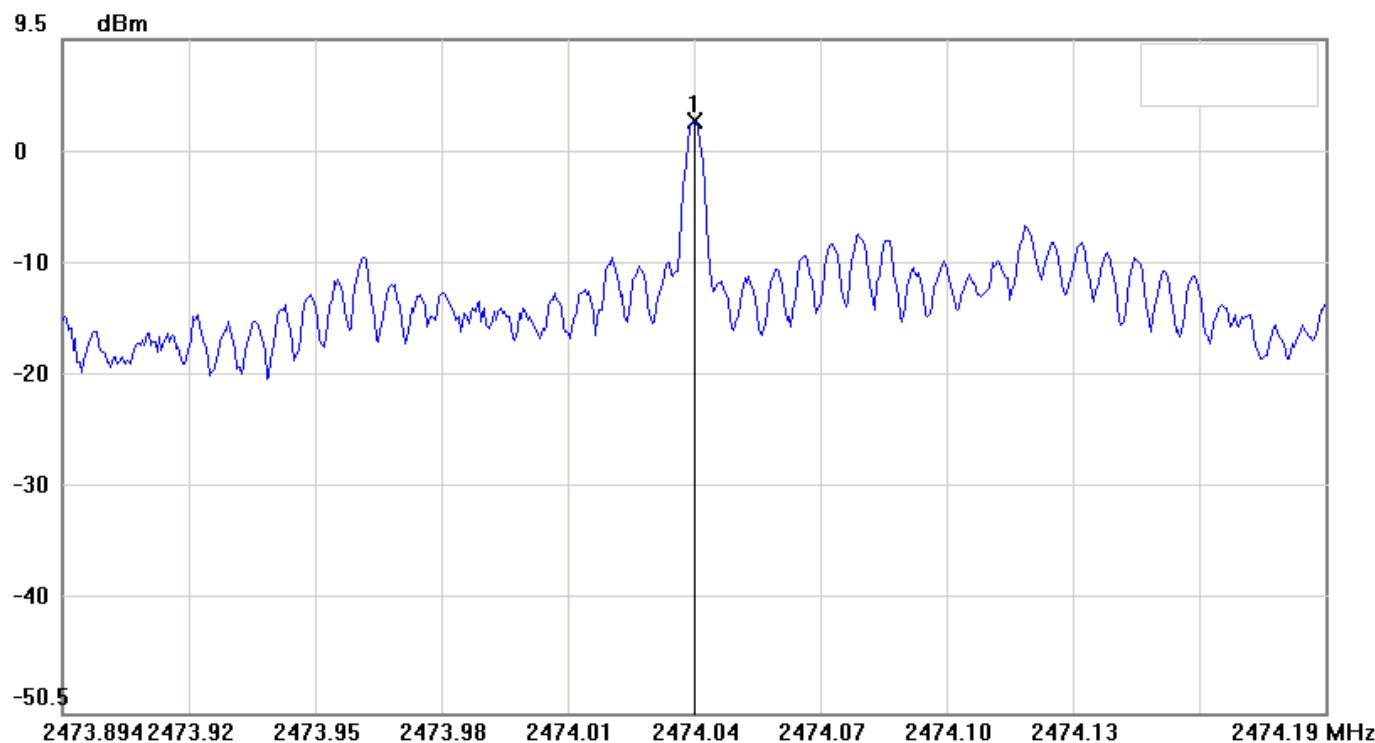
No.	Frequency(MHz)	Level(dBm)
1	2403.79370	4.95

**File: DWM-881**      **Data: #31**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:26:02**      **Humidity: 54 %**

**Condition:****RF Conducted****EUT:****Sweep Time: 100000ms Att.: 20dB****Model:****RBW: 3 KHz VBW: 10 KHz****Test Mode:****Note: Channel Mid-Power Density (PK)**

No.	Frequency(MHz)	Level(dBm)
1	2443.79400	4.47

**File: DWM-881**      **Data: #36**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:33:08**      **Humidity: 54 %**

**Condition:****RF Conducted****EUT:****Sweep Time: 100000ms Att.: 10dB****Model:****RBW: 3 KHz VBW: 10 KHz****Test Mode:****Note: Channel High-Power Density (PK)**

No.	Frequency(MHz)	Level(dBm)
1	2474.04380	2.23

## 9 SPURIOUS EMISSION - RF CONDUCTED MEASUREMENT

### 9.1 Standard Applicable

According to 12.247 (c) , in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

### 9.2 Measurement Procedure

1. The testing follows FCC KDB 558074 D01 v03r01.
2. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
3. Position the EUT as shown in figure 1. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
4. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
5. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
6. Repeat above procedures until all measured frequencies were complete.

### 9.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Agilent	E4446A	09/27/2013

## 9.4 Measurement Data

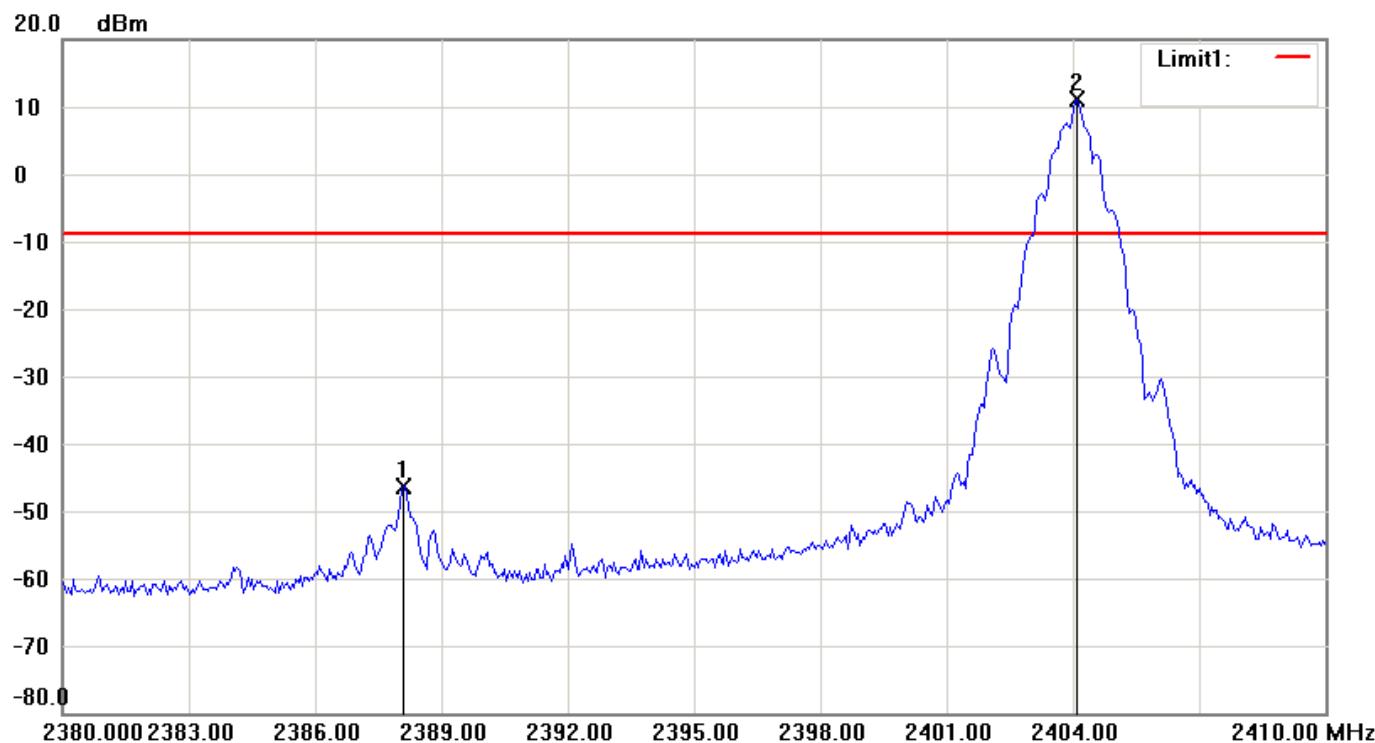
Test Date: Dec. 28, 2012Temperature: 20°CHumidity: 54 %

Channel	Chart
Low	Page 28, Page 30
Mid	Page 31
High	Page 29, Page 32

All out-of –band conducted emissions were more than 20dB below the carrier.

*Note: Please refer to page 28 to page 32 for chart*

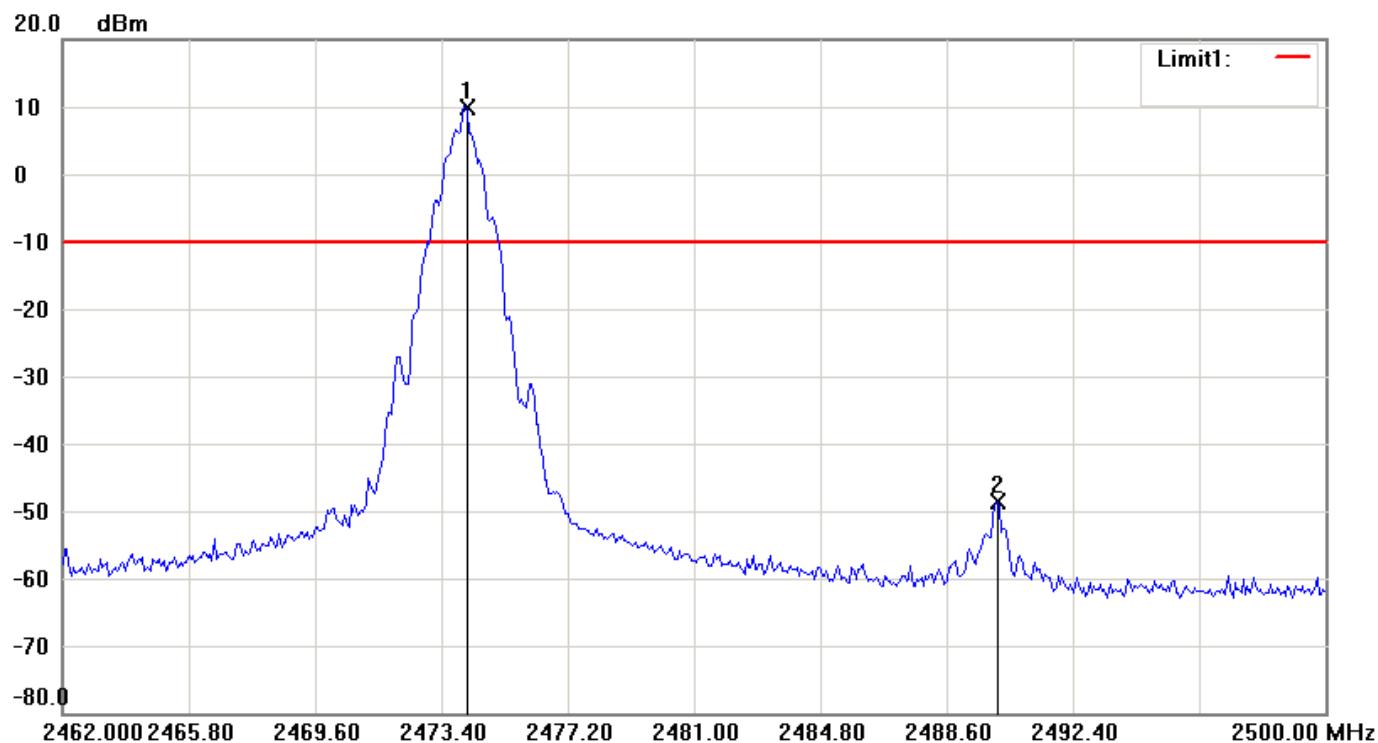
**File: DWM-881**      **Data: #26**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:19:29**      **Humidity: 54 %**



**Condition:** **-8.99dBm**      **RF Conducted**  
**EUT:**      **Sweep Time: 500ms Att.: 20dB**  
**Model:**      **RBW: 100 KHz VBW: 300 KHz**  
**Test Mode:**  
**Note:** **Channel LOW-Bandedge**

No.	Frequency(MHz)	Level(dBm)
1	2388.1000	-46.40
2	2404.1000	11.01

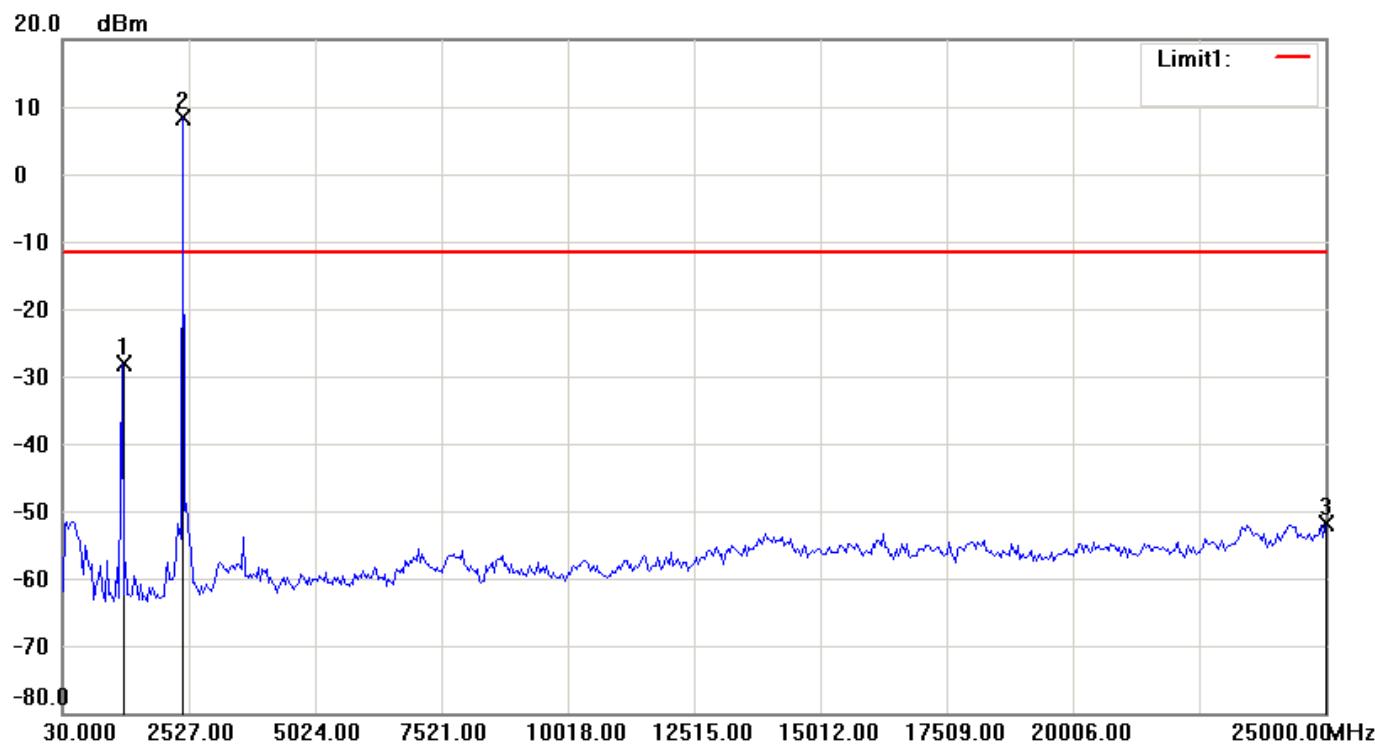
**File: DWM-881**      **Data: #37**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:33:46**      **Humidity: 54 %**



**Condition:** -10dBm      **RF Conducted**  
**EUT:** Sweep Time: 500ms Att.: 20dB  
**Model:** RBW: 100 KHz      VBW: 300 KHz  
**Test Mode:**  
**Note:** Channel High-Bandedge

No.	Frequency(MHz)	Level(dBm)
1	2474.09670	10.00
2	2490.12000	-48.51

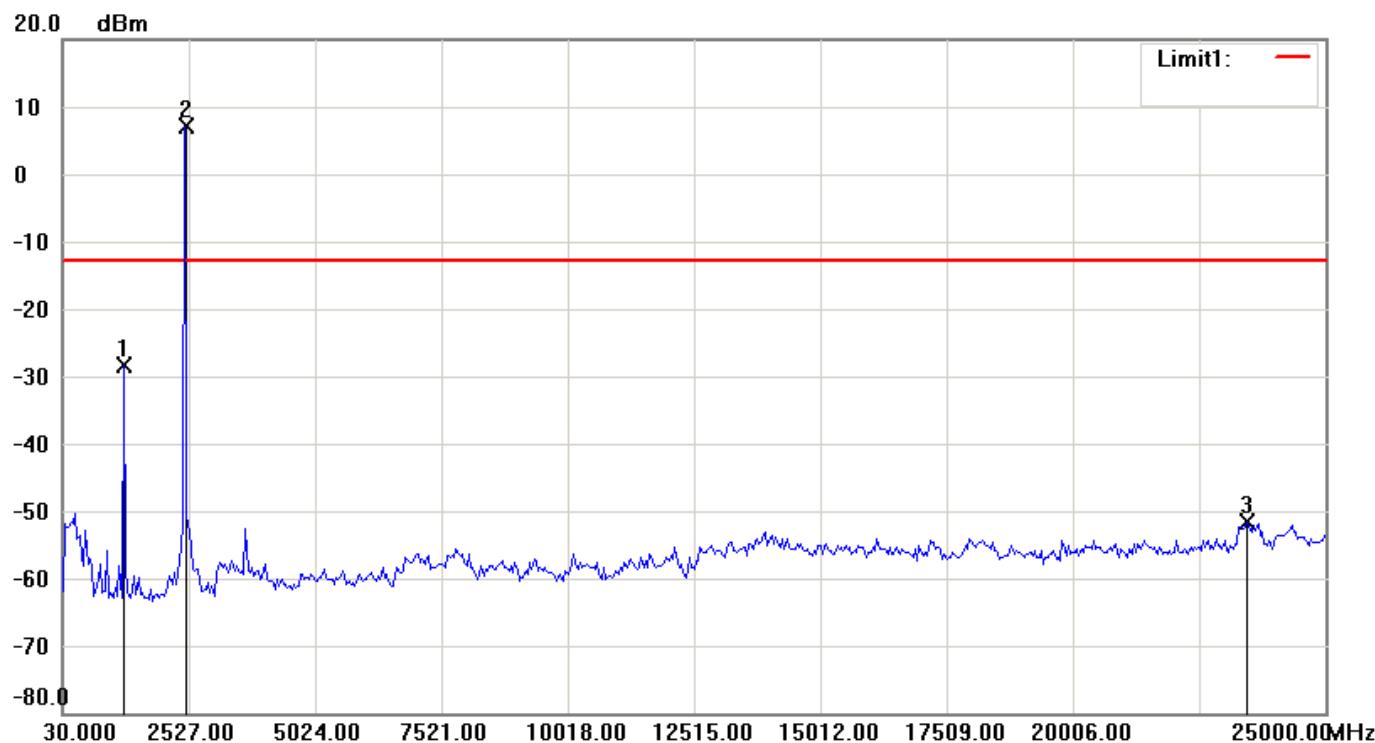
**File: DWM-881**      **Data: #23**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:15:14**      **Humidity: 54 %**



**Condition:** **-11.59dBm**      **RF Conducted**  
**EUT:**      **Sweep Time: 2386.4ms Att.: 20dB**  
**Model:**      **RBW: 100 KHz      VBW: 300 KHz**  
**Test Mode:**  
**Note:** **Channel LOW-Conducted Spurious**

No.	Frequency(MHz)	Level(dBm)
1	1195.26670	-28.21
2	2402.15000	8.41
3	25000.00000	-51.80

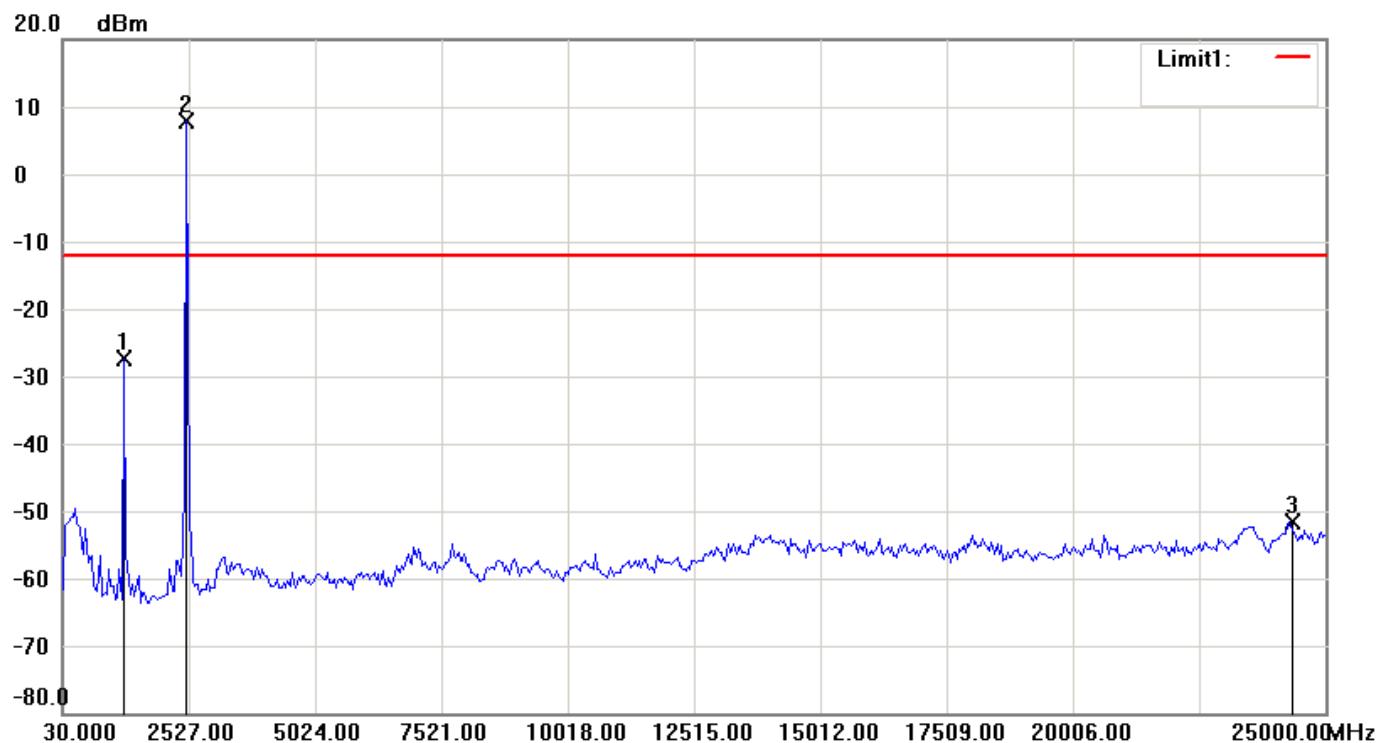
**File: DWM-881**      **Data: #29**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:22:25**      **Humidity: 54 %**



**Condition:** -12.77dBm      **RF Conducted**  
**EUT:** Sweep Time: 2386.4ms Att.: 20dB  
**Model:** RBW: 100 KHz      VBW: 300 KHz  
**Test Mode:**  
**Note:** Channel Mid-Conducted Spurious

No.	Frequency(MHz)	Level(dBm)
1	1236.88330	-28.43
2	2443.76670	7.23
3	23460.18330	-51.70

**File: DWM-881**      **Data: #34**      **Date: 2012/12/28**      **Temperature: 20 °C**  
**Time: PM 01:29:12**      **Humidity: 54 %**



**Condition:** -12.07dBm      **RF Conducted**  
**EUT:** Sweep Time: 2386.4ms Att.: 20dB  
**Model:** RBW: 100 KHz      VBW: 300 KHz  
**Test Mode:**  
**Note:** channel High-Conducted Spurious

No.	Frequency(MHz)	Level(dBm)
1	1236.88330	-27.46
2	2485.38330	7.93
3	24292.51670	-51.61

## 10 RADIATED EMISSION MEASUREMENT

### 10.1 Standard Applicable

For unintentional radiator, the radiated emission shall comply with §15.109(a).

For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and direct sequence spread spectrum, and the out band emission shall be comply with §15.247 (c)

### 10.2 Measurement Procedure

The testing follows FCC KDB 558074 D01 v03r01.

#### A.Preliminary Measurement For Portable Devices.

For portable devices, the following procedure was performed to determine the maximum emission axis of EUT (X Y and Z axis):

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. The axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.
4. The position in which the maximum noise occurred was “X axis”. (Please see the test setup photos)

#### B. Final Measurement

1. Setup the configuration per figure 3 and 4 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, it is performed in a semi-anechoic chamber to determine the accurate frequencies of higher emissions. For emission frequencies measured above 1 GHz, a pre-scan be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 120 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

Note : A filter was used to avoid pre-amplifier saturated when measure TX operation mode.

5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the datarate, placement of ANT. cables associated with EUT to obtain the worse case and record the result.

Figure 3 : Frequencies measured below 1 GHz configuration

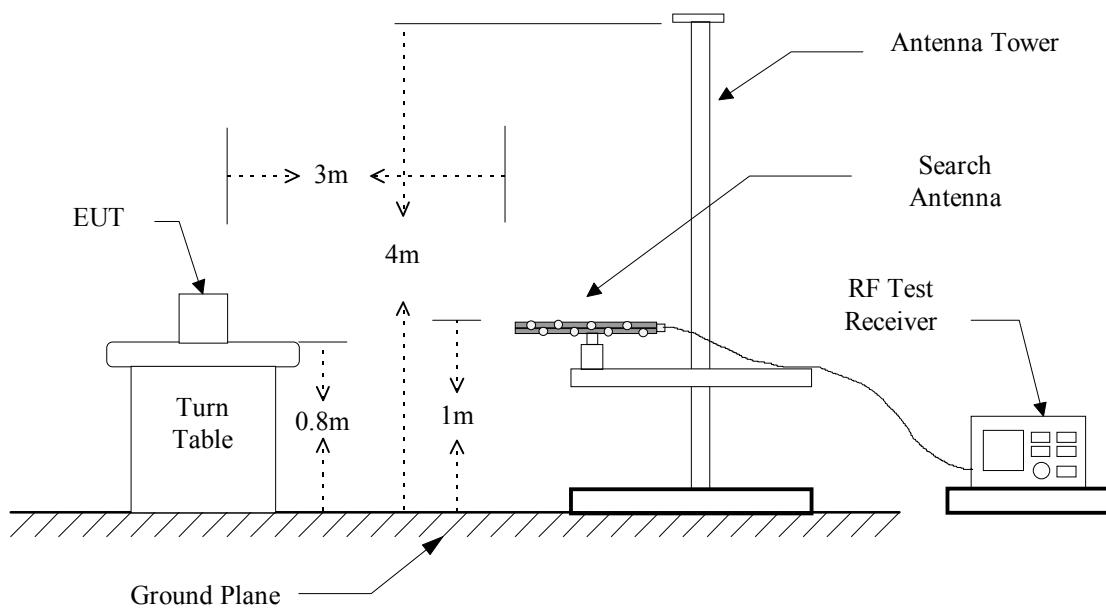
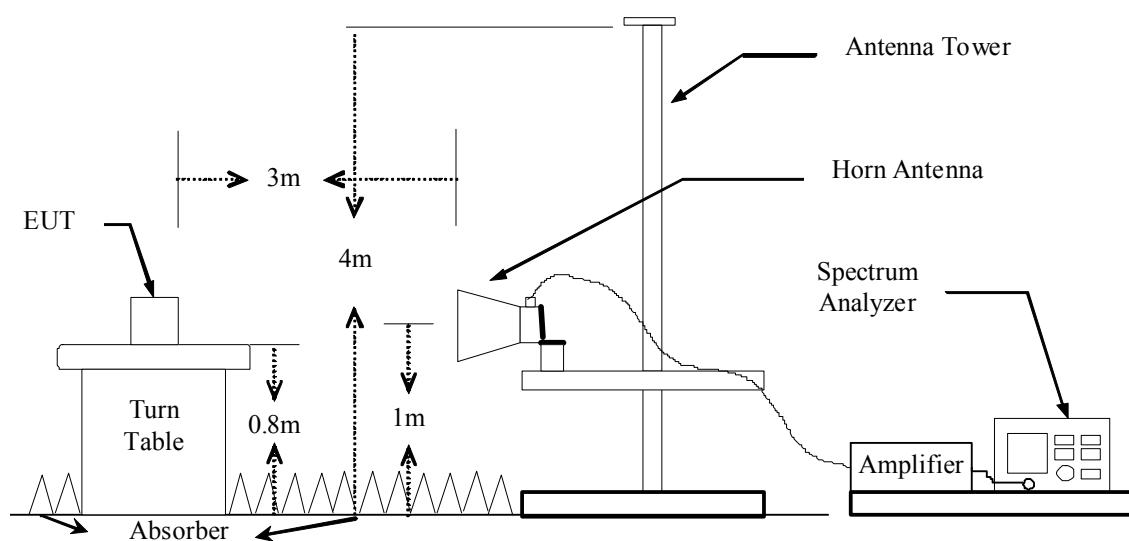


Figure 4 : Frequencies measured above 1 GHz configuration



### 10.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

Equipment	Manufacturer	Model No.	Next Cal. Due
EMI Test Receiver	R&S	ESIB7	07/10/2013
Spectrum Analyzer	Rohde & Schwarz	FSU46	01/08/2014
Horn Antenna	EMCO	3115	07/17/2013
BiLog Antenna	ETC	MCTD2986	11/25/2013
Horn Antenna	EMCO	3116	07/17/2013
Preamplifier	Hewlett-Packard	8449A	11/20/2013

Measuring instrument setup in measured frequency band when specified detector function is used :

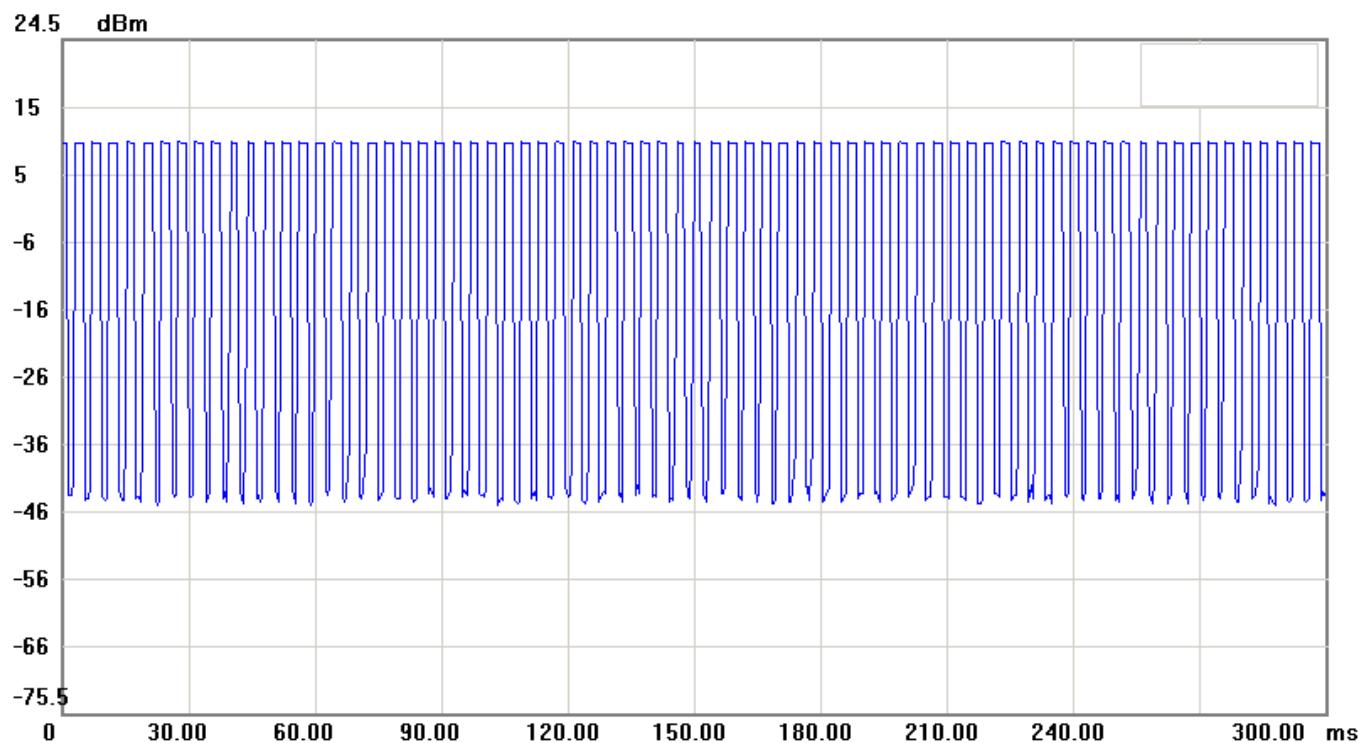
Frequency Band (MHz)	Instrument	Function	Resolution Bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	300 kHz
	Spectrum Analyzer	Peak	120 kHz	300 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	VBW_avg(Note1)

#### Note1:For average measurement

Condition	VBW_avg
Duty cycle is no less than 98 percent	10 Hz
Duty cycle is less than 98 percent, 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	$\geq \frac{1}{T}$ (Note2)
Current use	500 Hz

Note2:  $T=2\text{ms}$ ,  $\frac{1}{T}=1/(2*10^{-3})=0.5*10^3=500 \text{ Hz}$ .

**File:** DMW-881      **Data:** #9      **Date:** 2013/12/18      **Temperature:** 26 °C  
**Time:** PM 05:32:26      **Humidity:** 60 %



**Condition:**

**RF Conducted**

**EUT:**

**Sweep Time:** 300ms   **Att.:** 30dB

**Model:**

**RBW:** 1000 KHz      **VBW:** 1000 KHz

**Test Mode:**

**Note:**

File: DMW-881

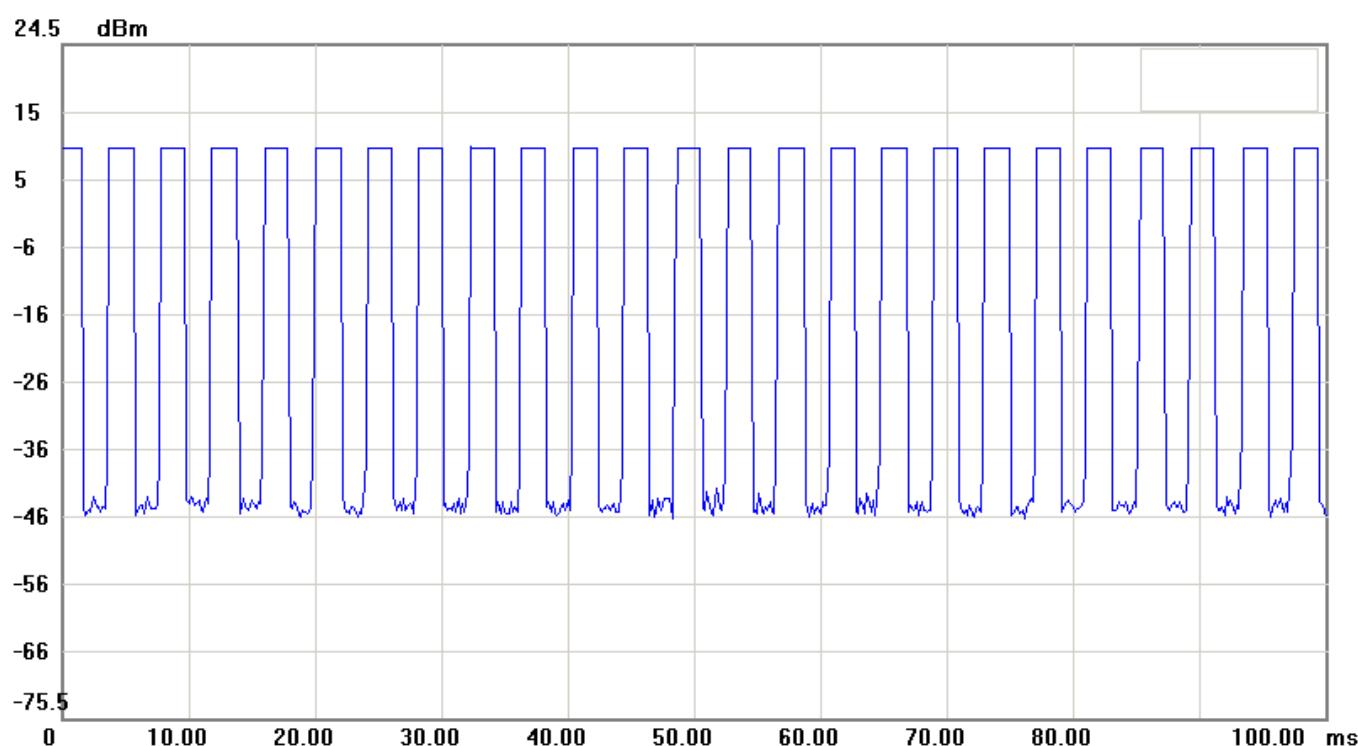
Data: #6

Date: 2013/12/18

Temperature: 26 °C

Time: PM 05:27:46

Humidity: 60 %



Condition:

RF Conducted

EUT:

Sweep Time: 100ms Att.: 30dB

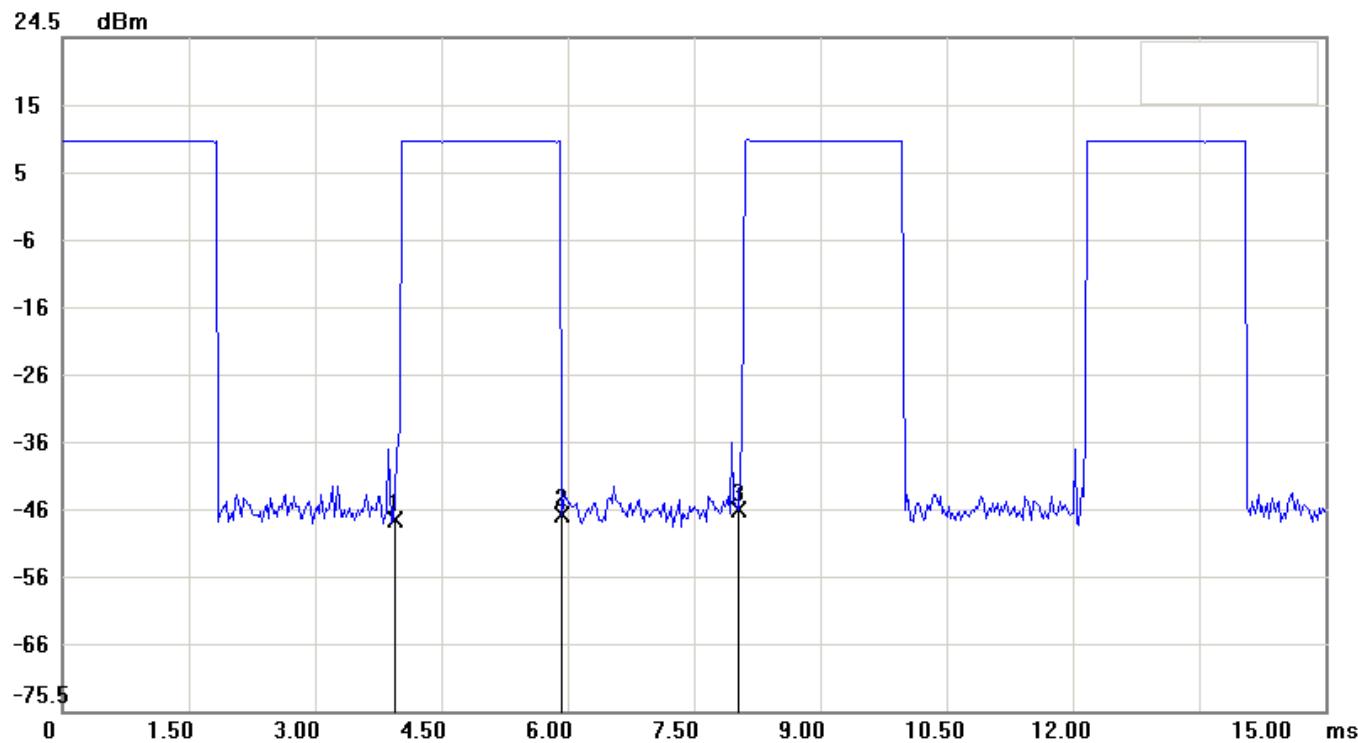
Model:

RBW: 1000 KHz VBW: 1000 KHz

Test Mode:

Note:

File: DMW-881      Data: #8      Date: 2013/12/18      Temperature: 26 °C  
Time: PM 05:29:02      Humidity: 60 %

**Condition:****RF Conducted****EUT:****Sweep Time: 15ms Att.: 30dB****Model:****RBW: 1000 KHz VBW: 1000 KHz****Test Mode:****Note:**

No.	Sweep time(ms)	Level(dBm)
1	3.9250	-47.06
2	5.9250	-46.47
3	8.0250	-45.69

No.		ΔTime(ms)	ΔLevel(dB)
1	mk3-mk1	4.1	1.37
2	mk2-mk1	2	0.59

## 10.4 Radiated Emission Data

### 10.4.1 Harmonic

Operation Mode: TXTest Date: Jan. 12, 2013Temperature: 23°CHumidity: 58 %

#### a) Channel Low

Fundamental Frequency: 2404 MHz

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m		Limit @3m	
	H		V			Peak	Ave	Peak	Ave
4808.000	---	---	47.1	---	-2.37	44.7	---	74.0	54.0
7212.000	---	---	---	---	0.51	---	---	74.0	54.0
9616.000	---	---	---	---	2.37	---	---	74.0	54.0
14424.000	---	---	---	---	9.23	---	---	74.0	54.0
19232.000	---	---	---	---	12.10	---	---	74.0	54.0

#### b) Channel Mid

Fundamental Frequency: 2444 MHz

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m		Limit @3m	
	H		V			Peak	Ave	Peak	Ave
4888.000	---	---	---	---	-2.38	---	---	74.0	54.0
7332.000	---	---	---	---	0.59	---	---	74.0	54.0
12220.000	---	---	---	---	4.47	---	---	74.0	54.0
19552.000	---	---	---	---	-4.68	---	---	74.0	54.0

#### c) Channel High

Fundamental Frequency: 2474 MHz

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m		Limit @3m	
	H		V			Peak	Ave	Peak	Ave
4948.000	---	---	---	---	-2.27	---	---	74.0	54.0
7422.000	---	---	---	---	0.76	---	---	74.0	54.0
12370.000	---	---	---	---	4.52	---	---	74.0	54.0
19792.000	---	---	---	---	-4.66	---	---	74.0	54.0
22266.000	---	---	---	---	-3.09	---	---	74.0	54.0

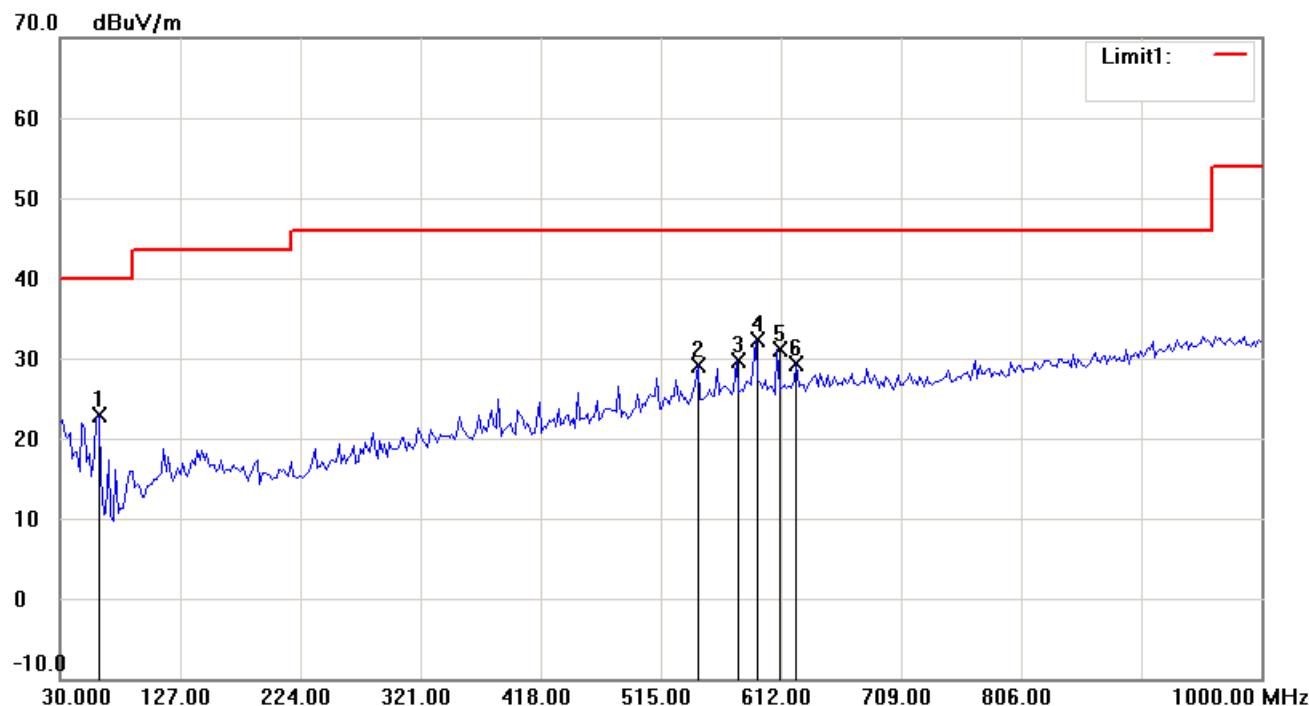
Note :

1. Item of margin shown in above table refer to average limit.
2. Remark “---” means that the emissions level is too low to be measured.

## 10.4.2 Spurious Emission

### 10.4.2.1 Emission frequencies below 1 GHz

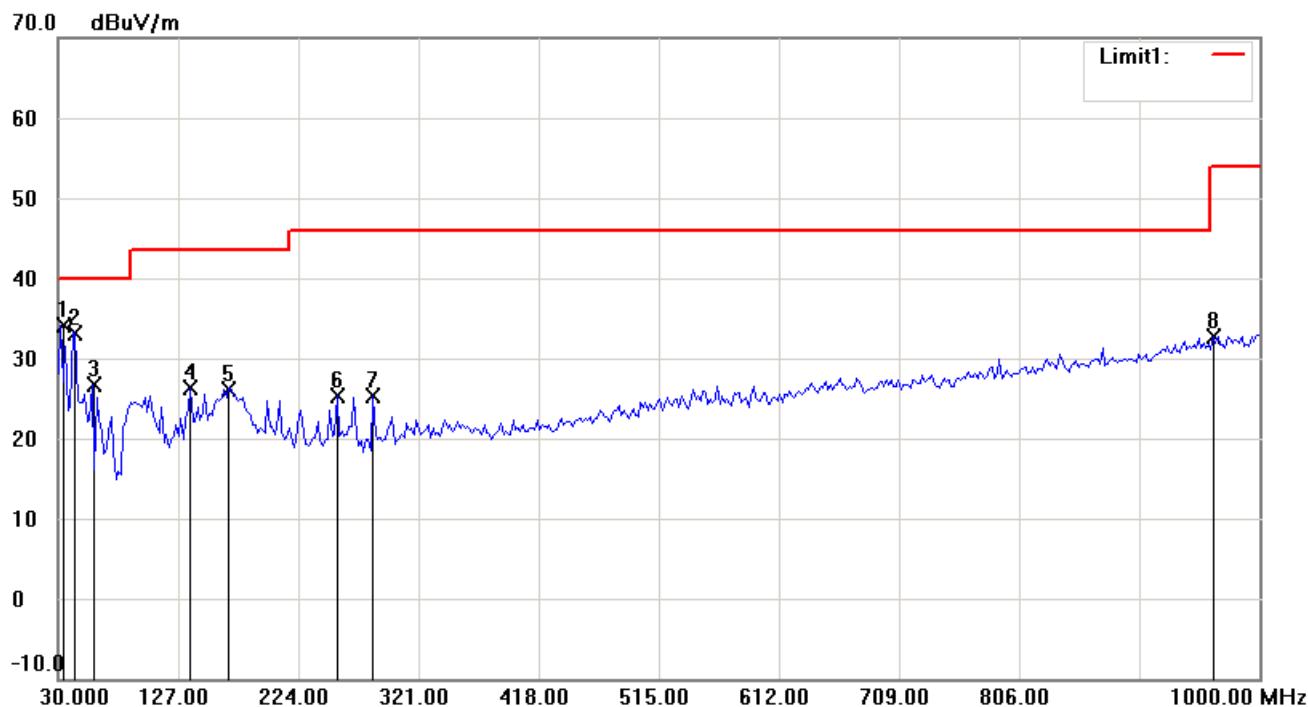
File: DWM-881      Data: #1      Date: 2013/1/12      Temperature: 23 °C  
Time: AM 09:21:13      Humidity: 58 %



Condition: FCC\_30-1000MHz      Polarization: Horizontal  
EUT:      Distance: 3m  
Model:  
Test Mode:  
Note:

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	61.1022	15.77	peak	7.21	22.98	40.00	-17.02
2	545.1303	5.96	peak	23.19	29.15	46.00	-16.85
3	576.2325	6.29	peak	23.37	29.66	46.00	-16.34
4	591.7836	8.84	peak	23.42	32.26	46.00	-13.74
5	609.2786	7.36	peak	23.80	31.16	46.00	-14.84
6	624.8297	4.84	peak	24.37	29.21	46.00	-16.79

**File: DWM-881**      **Data: #2**      **Date: 2013/1/12**      **Temperature: 23 °C**  
**Time: AM 09:24:01**      **Humidity: 58 %**



**Condition:** FCC\_30-1000MHz      **Polarization:** Vertical

**EUT:**      **Distance:** 3m

**Model:**

**Test Mode:**

**Note:**

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	31.9440	14.76	peak	19.39	34.15	40.00	-5.85
2	41.6633	18.66	peak	14.54	33.20	40.00	-6.80
3	57.2144	18.61	peak	8.14	26.75	40.00	-13.25
4	136.9138	12.30	peak	13.94	26.24	43.50	-17.26
5	168.0160	12.68	peak	13.52	26.20	43.50	-17.30
6	255.4910	8.69	peak	16.58	25.27	46.00	-20.73
7	284.6492	7.78	peak	17.54	25.32	46.00	-20.68
8	963.0661	2.98	peak	29.78	32.76	54.00	-21.24

## 10.4.2.1.2 Emission frequencies above 1 GHz

## 10.4.2.1.2.1 Fundamental Frequency : 2404 MHz

Frequency	Ant Pol	Reading (dBuV/m) @3m		Correct Factor	Result (dBuV/m) @3m		Limit (dBuV/m) @3m		Margin
		Peak	AVG		Peak	AVG	Peak	AVG	
(MHz)	H/V	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
1202.1218	H	64.3	---	-13.49	50.8	---	74.0	54.0	-3.2
1201.9054	V	58.7	---	-13.49	45.2	---	74.0	54.0	-8.8
8227.5890	V	47.1	---	1.67	48.8	---	74.0	54.0	-5.2

## 10.4.2.1.2.2 Fundamental Frequency : 2444 MHz

Frequency	Ant Pol	Reading (dBuV/m) @3m		Correct Factor	Result (dBuV/m) @3m		Limit (dBuV/m) @3m		Margin
		Peak	AVG		Peak	AVG	Peak	AVG	
(MHz)	H/V	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
1222.1153	H	63.2	---	-13.39	49.8	---	74.0	54.0	-4.2
1222.1153	V	59.6	---	-13.39	46.2	---	74.0	54.0	-7.8

## 10.4.2.1.2.3 Fundamental Frequency : 2474 MHz

Frequency	Ant Pol	Reading (dBuV/m) @3m		Correct Factor	Result (dBuV/m) @3m		Limit (dBuV/m) @3m		Margin
		Peak	AVG		Peak	AVG	Peak	AVG	
(MHz)	H/V	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)	(dB)
1235.5770	V	60.8	---	-13.33	47.5	---	74.0	54.0	-6.5
1237.8205	H	64.4	---	-13.30	51.1	---	74.0	54.0	-2.9
2166.6667	H	48.0	---	-8.94	39.1	---	74.0	54.0	-14.9

Note:

1. Place of Measurement: Measuring site of the ETC.
2. If the data table appeared symbol of "---" means the value was too low to be measured.
3. The estimated measurement uncertainty of the result measurement is  
 $\pm 4.6\text{dB}$  ( $30\text{MHz} \leq f < 300\text{MHz}$ ).  
 $\pm 4.4\text{dB}$  ( $300\text{MHz} \leq f \leq 1000\text{MHz}$ ).  
 $\pm 2.9\text{dB}$  ( $1\text{GHz} < f \leq 18\text{GHz}$ ).  
 $\pm 3.4\text{dB}$  ( $18\text{GHz} < f \leq 40\text{GHz}$ ).

Test Date: Jan. 12, 2013Temperature: 23°CHumidity: 58 %Operation Mode: TX

Operatio n Channel	Frequenc	Reading @3m (dBu/m)				Factor	Result		Limit @3m		Margin	
		H		V			(dBuV/m)		(dBuV/m)		(dB)	
		(MHz)	Peak	Ave	Peak	Ave	(dB)	Peak	Ave	Peak	Ave	Peak
CH Low	2390.000	28.5	16.7	27.9	16.0	30.3	58.8	47.0	74.0	54.0	-15.2	-7.0
CH High	2483.500	28.8	15.4	28.5	15.3	30.3	59.1	45.7	74.0	54.0	-14.9	-8.3

Note :

1. Remark “---” means that the emissions level is too low to be measured.
2. The result is the highest value of radiated emission from restrict band of 2310 ~ 2390 MHz and 2483.5 ~ 2500 MHz.

## 10.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

$$\text{Result} = \text{Reading} + \text{Corrected Factor}$$

where

$$\text{Corrected Factor} = \text{Antenna Factor} + \text{Cable Loss} + \text{High Pass Filter Loss} - \text{Amplifier Gain}$$