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# FCC TEST REPORT

**REPORT NO.:** RF9901011D06

**MODEL NO.:** ZT-TRX433

**FCC ID:** YNVZTTRX433

**RECEIVED:** Oct. 11, 2010

**TESTED:** Oct. 13 ~ 19, 2010

**ISSUED:** Oct. 22, 2010

**APPLICANT:** WellAWARE Systems Inc.

**ADDRESS:** 5500 Cox Rd, Glen Allen, VA23060

**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.)  
Ltd., Taoyuan Branch

**LAB LOCATION:** No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang,  
Taipei Hsien 244, Taiwan

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## 1. CERTIFICATION

**PRODUCT:** Radio Transmitter Module  
**BRAND NAME:** WellAWARE™ System  
**MODEL NO.:** ZT-TRX433  
**APPLICANT:** WellAWARE Systems Inc.  
**TESTED:** Oct. 13 ~ 19, 2010  
**TEST SAMPLE:** MASS-PRODUCTION  
**STANDARDS:** FCC Part 15, Subpart C (Section 15.231)  
ANSI C63.4-2003

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY :** Jessica Cheng , **DATE:** Oct. 22, 2010  
( Jessica Cheng / Specialist )

**TECHNICAL ACCEPTANCE :** Jamison Chan , **DATE:** Oct. 22, 2010  
Responsible for RF ( Jamison Chan / Supervisor )

**APPROVED BY :** Ken Liu , **DATE:** Oct. 22, 2010  
( Ken Liu / Manager )

## 2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C (Section 15.231)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	Conducted Emission Test	N/A	Power supply is 5Vdc from battery
15.209 15.231(b)	Radiated Emission Test	PASS	Minimum passing margin is -0.6dB at 433.92MHz
15.231(c)	Emission Bandwidth Measurement	PASS	Meet the requirement of limit
15.231(a)	De-activation	PASS	Meet the requirement of limit

### 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

Measurement	Frequency	Uncertainty
Radiated emissions	30MHz ~ 1GHz	3.72 dB
	Above 1GHz	2.89 dB

### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>EUT</b>	Radio Transmitter Module
<b>MODEL NO.</b>	ZT-TRX433
<b>FCC ID</b>	YNVZTTTRX433
<b>POWER SUPPLY</b>	5Vdc from battery
<b>MODULATION TYPE</b>	FSK
<b>OPERATING FREQUENCY</b>	433.92MHz
<b>NUMBER OF CHANNEL</b>	1
<b>ANTENNA TYPE</b>	Monopole antenna
<b>ANTENNA CONNECTOR</b>	N/A
<b>DATA CABLE</b>	N/A
<b>I/O PORTS</b>	N/A
<b>ASSOCIATED DEVICES</b>	N/A

#### NOTE:

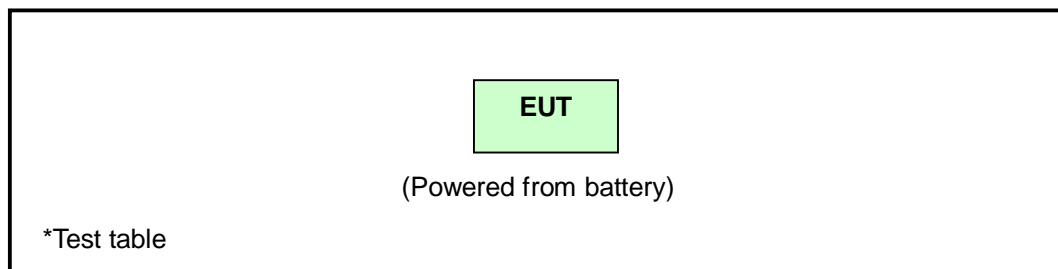
- 1.The EUT is a transceiver.
- 2.The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

## 3.2 DESCRIPTION OF TEST MODES

1 channel was provided to this EUT.

Channel	Frequency
1	433.92MHz

### 3.2.1 CONFIGURATION OF SYSTEM UNDER TEST



### 3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

EUT configure mode	Applicable to					Description
	PLC	RE<1G	RE <sup>≥</sup> 1G	EB	DT	
-	Note	√	√	√	√	-

Where **PLC**: Power Line Conducted Emission      **RE<1G**: Radiated Emission below 1GHz  
**RE<sup>≥</sup>1G**: Radiated Emission above 1GHz      **EB**: 20dB Bandwidth Measurement  
**DT**: Deactivation Time Measurement

**Note**: No need to concern of Conducted Emission due to the EUT is powered by DC power supply.

#### RADIATED EMISSION TEST (BELOW 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XY Axis and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	AXIS
1	1	FSK	Y

#### RADIATED EMISSION TEST (ABOVE 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulation, XY Axis and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	AXIS
1	1	FSK	Y

#### EMISSION BANDWIDTH MEASUREMENT:

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	FSK

**DEACTIVATION TIME MEASUREMENT:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1	1	FSK

**TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE<1G	24deg. C, 73% RH, 1011hPa	5Vdc	Nick Chen
RE <sup>3</sup> 1G	24deg. C, 73% RH, 1011hPa	5Vdc	Nick Chen
EB	24deg. C, 78% RH, 1011hPa	5Vdc	Nick Chen
DT	24deg. C, 78% RH, 1011hPa	5Vdc	Nick Chen





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### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C. (15.231)**

**ANSI C63.4-2003**

All test items have been performed and recorded as per the above standards.

### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	DC power supply	Topward	6603D	713072	FCC DoC Approved

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A

**NOTE:** All power cords of the above support units are non shielded (1.8m).

## 4. TEST TYPES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

N/A

### 4.2 RADIATED EMISSION MEASUREMENT

#### 4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

According to 15.231 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	uV/meter	dBuV/meter	uV/meter	dBuV/meter
40.66 ~ 40.70	2250	67.04	225	48.04
70 ~ 130	1250	61.94	125	41.94
130 ~ 174	1250 ~ 3750	61.94 ~ 71.48	125 ~ 375	41.94 ~ 51.48
174 ~ 260	3750	71.48	75	37.50
260 ~ 470	3750 ~ 12500	71.48 ~ 81.94	375 ~ 1250	51.48 ~ 61.94
Above 470	12500	81.94	1250	61.94

#### NOTE:

- Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters =  $56.81818(F) - 6136.3636$ ; for the band 260-470 MHz, uV/m at 3 meters =  $41.6667(F) - 7083.3333$ .  
The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
- The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (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

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

## 4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	May 06, 2010	May 05, 2011
HP Preamplifier	8449B	3008A01924	Jul. 14, 2010	Jul. 13, 2011
HP Preamplifier	8449B	3008A01292	Jul. 14, 2010	Jul. 13, 2011
ROHDE & SCHWARZ TEST RECEIVER	ESU26	100005	Jun. 10, 2010	Jun. 09, 2011
Schwarzbeck Antenna	VULB 9168	137	Apr. 29, 2010	Apr. 28, 2011
Schwarzbeck Antenna	VHBA 9123	480	Apr. 29, 2010	Apr. 28, 2011
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	ADT_Radiated_V 7.6.15.9.2	NA	NA	NA
SUHNER RF cable	SF102	CABLE-CH6	Aug. 20, 2010	Aug. 19, 2011
ROHDE & SCHWARZ Spectrum Analyzer	FSP 40	100036	Apr. 06, 2010	Apr. 05, 2011

- NOTE:** 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in Chamber No. 6.
4. The Industry Canada Reference No. IC 7450E-6.
5. The FCC Site Registration No. is 447212.

### 4.2.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi- anechoic. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak method or average method as specified and then reported in data sheet.

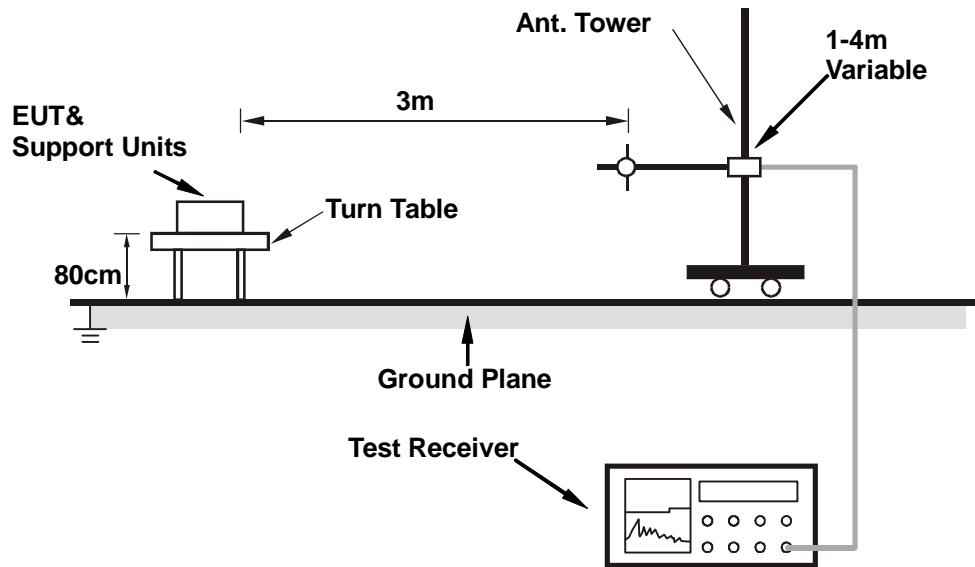
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

### 4.2.4 DEVIATION FROM TEST STANDARD

No deviation

## 4.2.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

## 4.2.6 EUT OPERATING CONDITIONS

Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.

## 4.2.7 TEST RESULTS

### ABOVE 1GHz DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 1	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER	5Vdc	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 73%RH 1011 hPa	TESTED BY	Nick Chen

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2169.60	70.1 PK	80.8	-10.7	1.00 H	78	38.55	31.55
2	2169.60	53.4 AV	60.8	-7.4	1.00 H	78	21.85	31.55
3	3037.44	58.4 PK	80.8	-22.4	1.04 H	86	23.33	35.07
4	3037.44	41.7 AV	60.8	-19.1	1.04 H	86	6.63	35.07
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2169.60	60.8 PK	80.8	-20.0	1.00 V	130	29.29	31.55
2	2169.60	44.1 AV	60.8	-16.7	1.00 V	130	12.59	31.55
3	3037.44	51.6 PK	80.8	-29.2	1.03 V	163	16.55	35.07
4	3037.44	34.9 AV	60.8	-25.9	1.03 V	163	-0.15	35.07

- REMARKS:**
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
  2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
  3. The other emission levels were very low against the limit.
  4. Margin value = Emission level – Limit value.
  5. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log \frac{14.58\text{ms} \times 1}{100 \text{ ms}} = -16.7\text{dB}$$

Please see page 17 for plotted duty.



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## BELOW 1GHz WORST-CASE DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 1	FREQUENCY RANGE	Below 1000MHz
INPUT POWER	5Vdc	DETECTOR FUNCTION	Quasi-Peak Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 73%RH 1011 hPa	TESTED BY	Nick Chen

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	53.32	31.4 QP	60.8	-29.4	1.24 H	88	17.88	13.54
2	176.21	34.7 QP	60.8	-26.1	1.09 H	357	22.08	12.64
3	289.63	35.2 QP	60.8	-25.6	1.27 H	24	19.87	15.35
4	317.58	36.2 QP	60.8	-24.6	1.08 H	241	19.98	16.24
5	433.92	96.9 PK	100.8	-3.9	1.00 H	163	77.96	18.98
6	433.92	80.2 AV	80.8	-0.6	1.00 H	163	61.26	18.98
7	595.83	34.0 QP	60.8	-26.8	1.14 H	174	10.76	23.20
8	867.84	55.2 PK	80.8	-25.6	1.00 H	187	27.74	27.42
9	867.84	38.5 AV	60.8	-22.3	1.00 H	187	11.04	27.42
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	196.33	38.4 QP	60.8	-22.4	1.02 V	310	27.28	11.13
2	433.92	90.4 PK	100.8	-10.4	1.17 V	199	71.38	18.98
3	433.92	73.7 AV	80.8	-7.1	1.17 V	199	54.68	18.98
4	491.68	42.6 QP	60.8	-18.2	1.18 V	22	22.04	20.59
5	528.97	40.6 QP	60.8	-20.2	1.00 V	261	19.02	21.60
6	609.83	30.7 QP	60.8	-30.1	1.00 V	274	7.24	23.45
7	647.16	32.5 QP	60.8	-28.3	1.07 V	251	8.43	24.04
8	867.84	42.4 PK	80.8	-38.4	1.06 V	218	14.99	27.42
9	867.84	25.7 AV	60.8	-35.1	1.06 V	218	-1.71	27.42

**REMARKS:** 1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).

2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).

3. The other emission levels were very low against the limit.

4. Margin value = Emission level – Limit value.

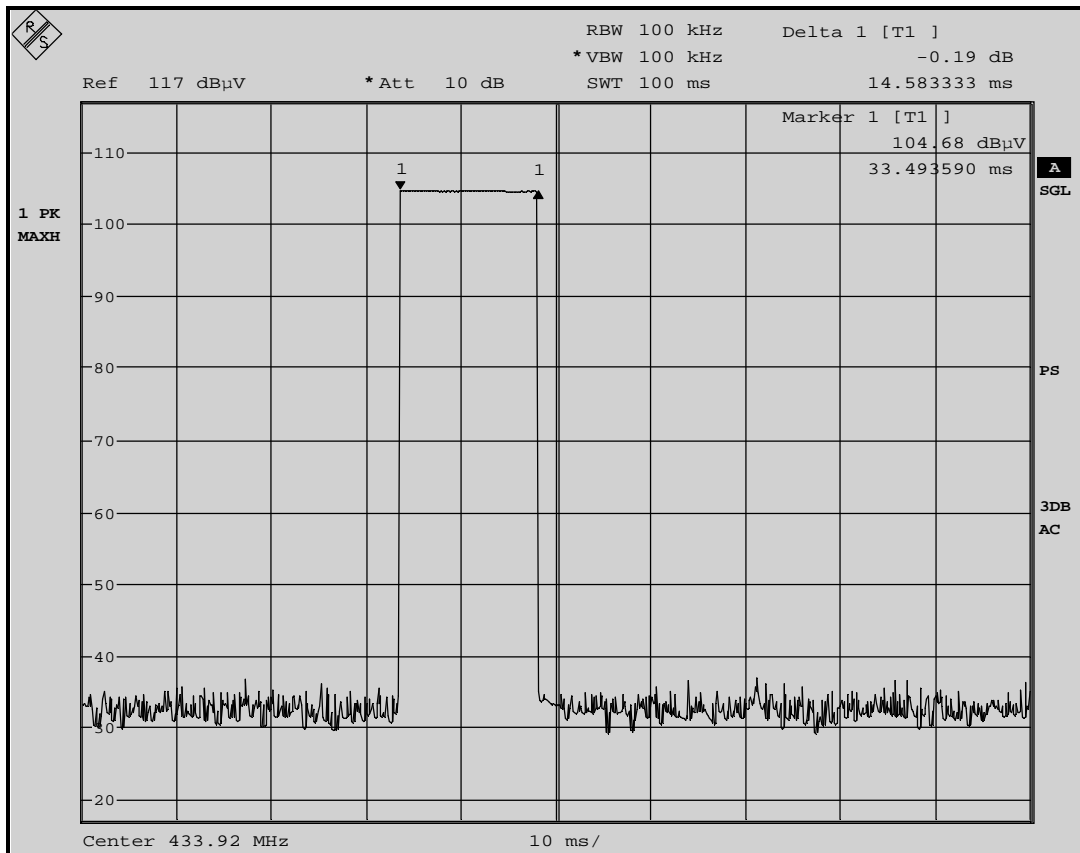
5. “ \* ” : Fundamental frequency

6. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log \frac{14.58\text{ms} \times 1}{100 \text{ ms}} = -16.7\text{dB}$$

Please see page 17 for plotted duty.





$$20 \log (\text{Duty cycle}) = 20 \log (14.58 \text{ ms} \times 1 / 100 \text{ ms}) = -16.7 \text{ dB}$$

## 4.3 20dB OCCUPIED BANDWIDTH MEASUREMENT

### 4.3.1 LIMITS OF EMISSION BANDWIDTH MEASUREMENT

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and below 900 MHz.

Fundamental Frequency (MHz)	Limit of Emission Bandwidth(kHz)
433.92	1084.80

### 4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 27, 2010	Apr. 26, 2011

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

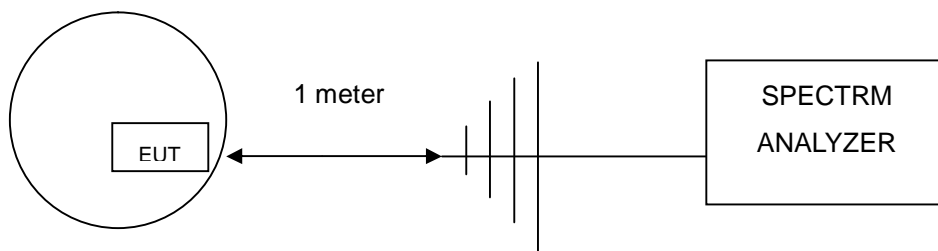
### 4.3.3 TEST PROCEDURE

- The EUT was placed on the turn table.
- The signal was coupled to the spectrum analyzer through an antenna.
- Set the resolution bandwidth to 100kHz and video bandwidth to 300kHz then select Peak function to scan the channel frequency.
- The emission bandwidth was measured and recorded.

#### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation

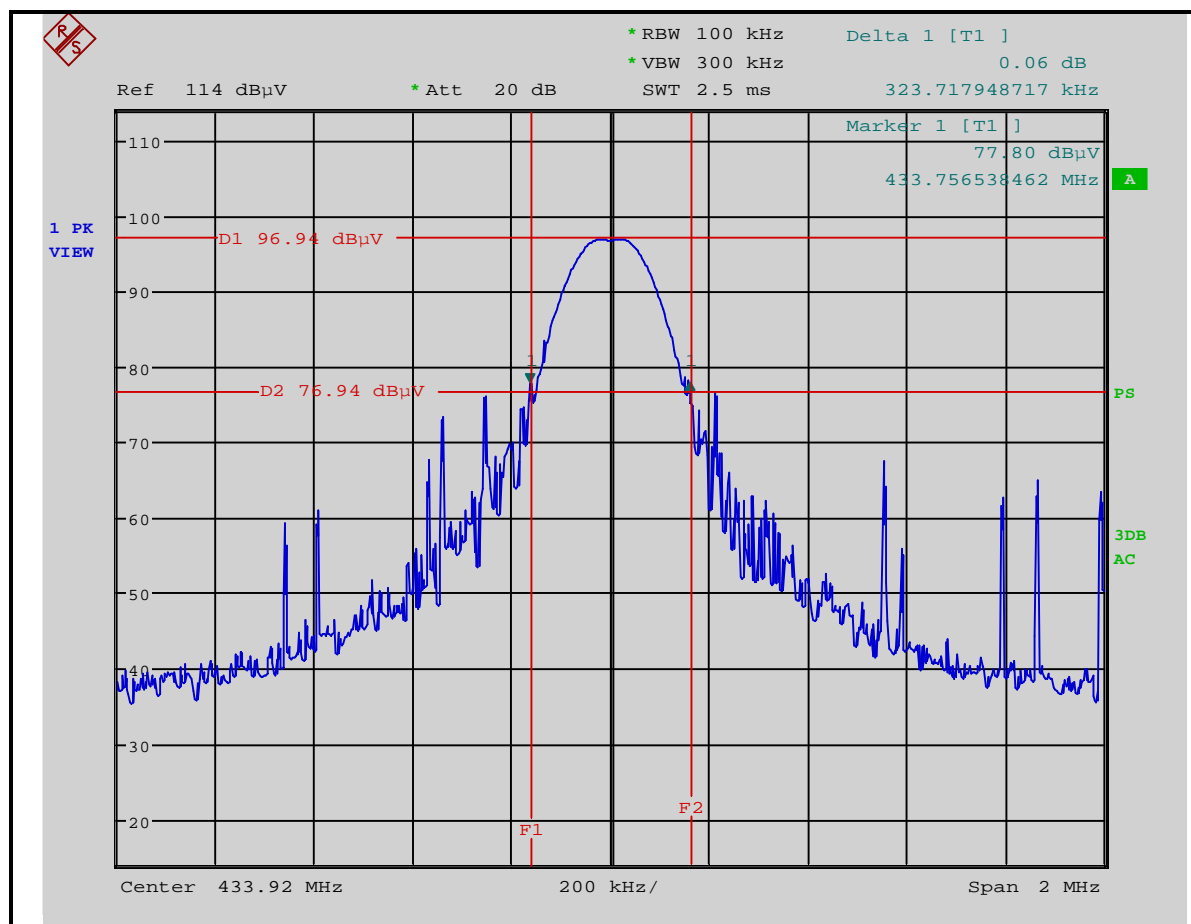
#### 4.3.5 TEST SETUP



## 4.3.6 TEST RESULTS

Frequency (MHz)	20dB Bandwidth (kHz)	Maximum Limit (kHz)	PASS/FAIL
433.92	323.71	1084.80	PASS

The plot of test result is attached as below.



## 4.4 DEACTIVATION TIME

### 4.4.1 LIMITS OF DEACTIVATION TIME MEASUREMENT

A transmitter activated automatically shall cease transmission within 5 seconds after activation.

### 4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP 40	100036	Apr. 27, 2010	Apr. 26, 2011

**NOTE:** The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

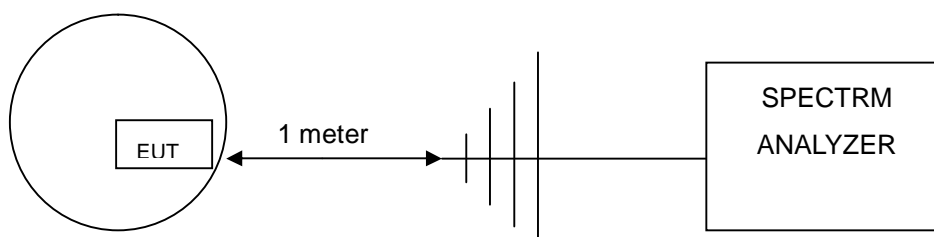
### 4.4.3 TEST PROCEDURES

- The EUT was placed on the turning table.
- The signal was coupled to the spectrum analyzer through an antenna.
- Set the resolution bandwidth to 100kHz and video bandwidth to 300kHz. The spectrum analyser was turned to the centre frequency of the transmitter's and the analyser's marker function was used to determine the duration of transmission.
- The transmission duration was measured and recorded.

### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation

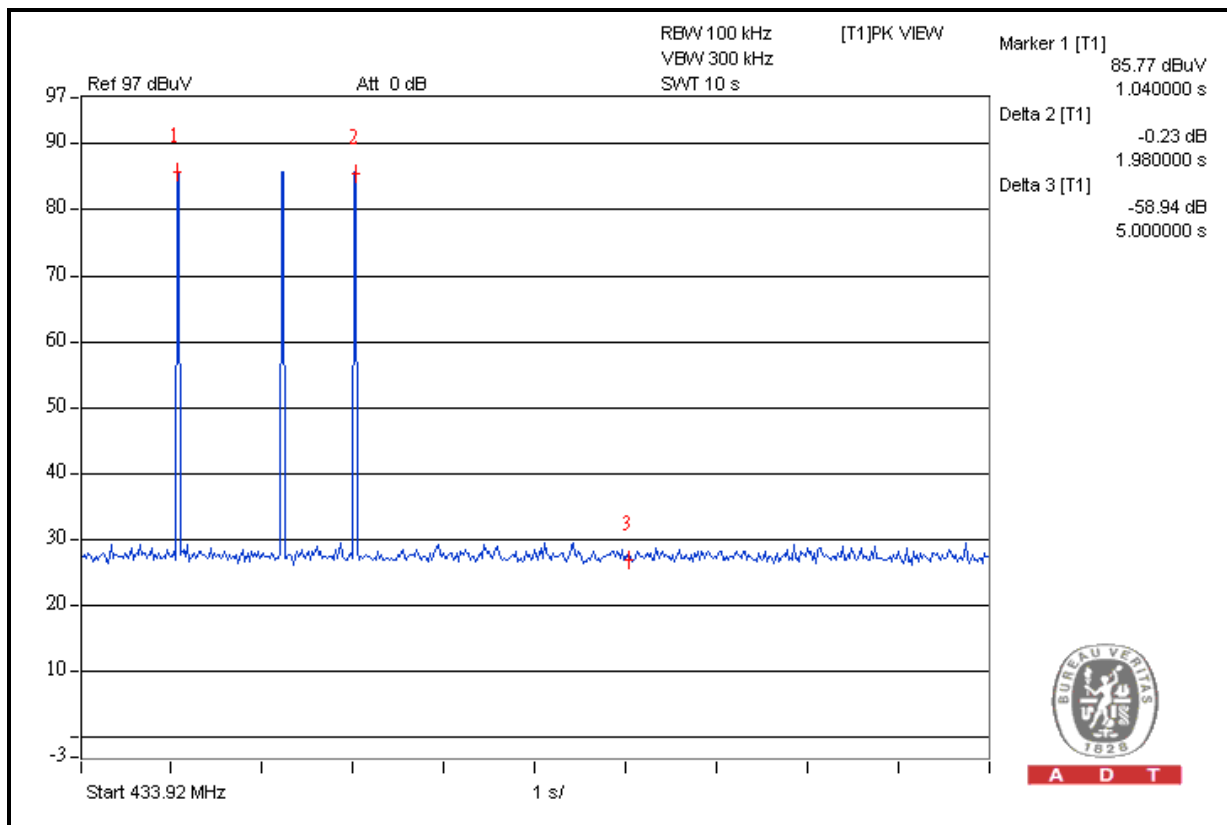
### 4.4.5 TEST SETUP



## 4.4.6 TESE RESULTS

Trigger	Frequency (MHz)	Maximum limit (sec)	PASS/FAIL
1	433.92	5	PASS

The plots of test results are attached as below.





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## 5. PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).

## 6. INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: [www.adt.com.tw/index.5/phtml](http://www.adt.com.tw/index.5/phtml).  
If you have any comments, please feel free to contact us at the following:

**Linko EMC/RF Lab:**

Tel: 886-2-26052180

Fax: 886-2-26051924

**Hsin Chu EMC/RF Lab:**

Tel: 886-3-5935343

Fax: 886-3-5935342

**Hwa Ya EMC/RF/Safety Telecom Lab:**

Tel: 886-3-3183232

Fax: 886-3-3185050

**Web Site:** [www.adt.com.tw](http://www.adt.com.tw)

The address and road map of all our labs can be found in our web site also.





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## **7. APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB**

No any modifications are made to the EUT by the lab during the test.

**---END---**