

# FCC Test Report

for

## **Tire Pressure Monitoring System**

**Trade Name** : Kuender Co.  
**Model No.** : KD-TPMS-T03A  
**FCC ID** : UIT-TPMST03A0608  
**Report No.** : RF-B15-0606-228  
**Date of Receipt** : September 6, 2006  
**Date of Report** : September 11, 2006

Prepared for

**Kuender & Co., Ltd.**

22, Chungshan N.Rd., Sec. 3, Taipei, Taiwan. R.O.C.

Prepared by



**Central Research Technology Co.  
EMC Test Laboratory**

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# Certification of Compliance

Equipment under Test : Tire Pressure Monitoring System  
Trade Name : Kuender Co.  
Model No. : KD-TPMS-T03A  
FCC ID : UIT-TPMST03A0608  
Manufacturer : Kuender & Co., Ltd.  
Applicant : Kuender & Co., Ltd.  
Address : 22, Chungshan N.Rd., Sec. 3, Taipei, Taiwan. R.O.C.  
Applicable Standards : 47 CFR part 15, Subpart C  
Date of Testing : September 7~8, 2006  
Deviation : N/A  
Condition of Test Sample : Prototype



We, **Central Research Technology Co.**, hereby certify that one sample of the designated product was tested in our facility during the period mentioned above. The test records, data evaluation and Equipment Under Test (EUT) configurations shown in the present report are true and accurate representation of the measurements of the sample's RF characteristics under the conditions herein specified.

The test results show that the EUT as described in the present report is in compliance with the requirements set forth in the standards mentioned above and apply to the tested sample identified in the present report only. The test report shall not be reproduced, except in its entirety, without the written approval of Central Research Technology Co.

PREPARED BY : Cathy Chen , DATE : Sep. 11, 2006  
(Cathy Chen/Technical Manager)  
APPROVED BY : J. Y. Shih , DATE : Sept. 11, 2006  
(Tsun-Yu Shih/Laboratory Head)

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**Attachment 2 –External Photographs of EUT**

**Attachment 3 –Internal Photographs of EUT**

## **1 General Description**

### **1.1 General Description of EUT**

Equipment underTest : Tire Pressure Monitoring System  
Model No. : KD-TPMS-T03A  
FCC ID : UIT-TPMST03A0608  
Power in : DC 3.6V  
Test Voltage : DC 3.6V(battery\*1);

### **1.2 Characteristic of E.U.T.**

Frequency Range : 433.95MHz  
Channel Numbers : 1  
Function Modulation : FSK

The EUT contains a FSK function is used to transmit both control command and data.  
Please refer to the user's manual for the details.

Perform the function of EUT continuously by executing the test program supplied by manufacturer.

### **1.3 Test Methodology**

For Tire Pressure Monitoring System , both conducted and radiated emissions were performed according to the procrdures illustrated in ANSI C63.4 and other required measurements were illustrated in separate sections of this test report for detail.

## 1.4 Requirement for Compliance

### (1) Radiated Emission Requirement

The field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundament (uV/m)	Field Strength of Spurious Emission (uV/m)
40.66 - 40.70	1000	100
70 – 130	500	50
130 – 174	500 to 1500**	50 to 150**
174 – 260	1500	150
260 – 470	1500 to 5000**	150 to 500**
Above 470	5000	500

\*\* linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters =  $22.72727(F) - 2454.545$ ; for the band 260-470 MHz, uV/m at 3 meters =  $16.6667(F) - 2833.3333$ . The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

### (2) Bandwidth

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### (3) Dwell Time

The devices operated shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

## (4) Restricted Band

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
<sup>2</sup> 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	2690 - 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			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

**1.5 Layout of Setup**

(Transmitter)

**The Support Units :**

No.	Unit	Model No./ Serial No.	Teade Name	PowerCode	Supported by lab.
NA	*	*	*	*	*

**Connecting Cables :**

No.	Cable	Length	Shielded	Core	Shielded Backshell	Supported by lab.	Note
NA	*	*	*	*	*	*	*

**Justification:**

For both conducted and radiated emission below 1GHz, the system was configured for typical fashion as a customer could normal use it.

For radiated emission, measurement of radiated emission from digital circuit is performed with normal transmitting.

## 1.6 Test Facility

Test Room	Type of Test Room	Descriptions
<input checked="" type="checkbox"/> TR1	10m semi-anechoic chamber (23m×14m×9m)	Complying with the NSA requirements in documents CISPR 22 and ANSI C63.4. for the radiated emission measurement.
<input type="checkbox"/> TR4	Shielding Room (5m×3m×3m)	For the RF conducted emission measurement.
<input type="checkbox"/> TR5	Shielding Room (8m×5m×4m)	For the Line conducted emission measurement.

### Test Laboratory Competence Information

Central Research Technology Co. has been accredited/filed/authorized by the agencies listed in the following table.

Certificate	Nation	Agency	Code	Mark
Accreditation Certificate	USA	NVLAP	200575-0	ISO/IEC 17025
	R.O.C. (Taiwan)	CNLA	0905	ISO/IEC 17025
	R.O.C. (Taiwan)	BSMI	SL2-IN-E-0033, SL2-IS-E-0033, SL2-R1/R2-E-0033, SL2-A1-E-0033	ISO/IEC 17025
Site Filing Document	USA	FCC	474046	Test facility list & NSA Data
	Canada	IC	4699A	Test facility list & NSA Data
	Japan	VCCI	R-1527,C-1609,T-131	Test facility list & NSA Data
Authorization Certificate	Norway	Nemko	ELA 212	ISO/IEC 17025

The copy of each certificate can be downloaded from our web site: [www.crc-lab.com](http://www.crc-lab.com)



## 1.7 Measurement Uncertainty

All the measurement uncertainty evaluation procedures in this report are base on ETSI TR 100 028-1, 100 028-2,and ETSI TR 102 273-3. The assessed measurement uncertainties are:

Test Item	Measurement Uncertainty
Radiated Emission: (below 1GHz)	Horizontal 3.7dB ; Vertical 3.7dB
Radiated Emission: (above 1GHz)	Horizontal 4.44dB ; Vertical 4.41dB
Bandwidth	25Hz

## 2 Radiated Emission

Test Result: Pass

### 2.1 Applied standard

According to 15.231(b), In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundament (uV/m)	Field Strength of Spurious Emission (uV/m)
40.66 - 40.70	1000	100
70 - 130	500	50
130 - 174	500 to 1500**	50 to 150**
174 - 260	1500	150
260 - 470	1500 to 5000**	150 to 500**
Above 470	5000	500

\*\* linear interpolations

The formula for calculating the limit of field strength of fundament is  $16.6667 \times 433.95 - 2833.3333 = 4399.18 \text{ uV/m} = 72.87 \text{ dBuV/m (Average)}$ , the limit of spurious emission is  $52.87 \text{ dBuV/m (Average)}$

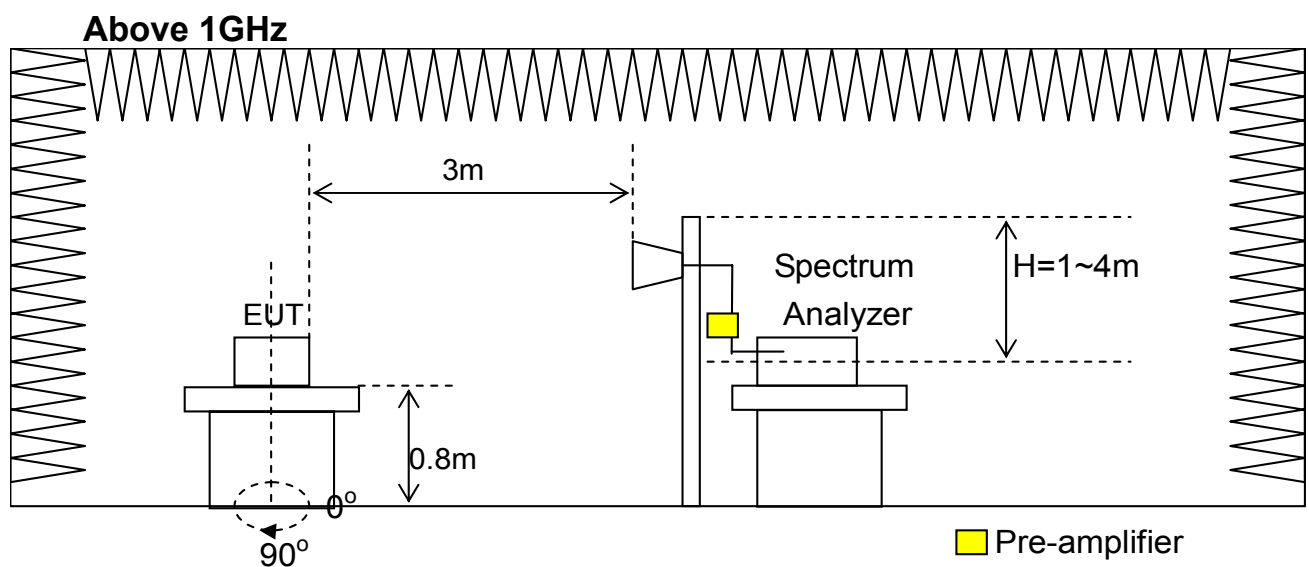
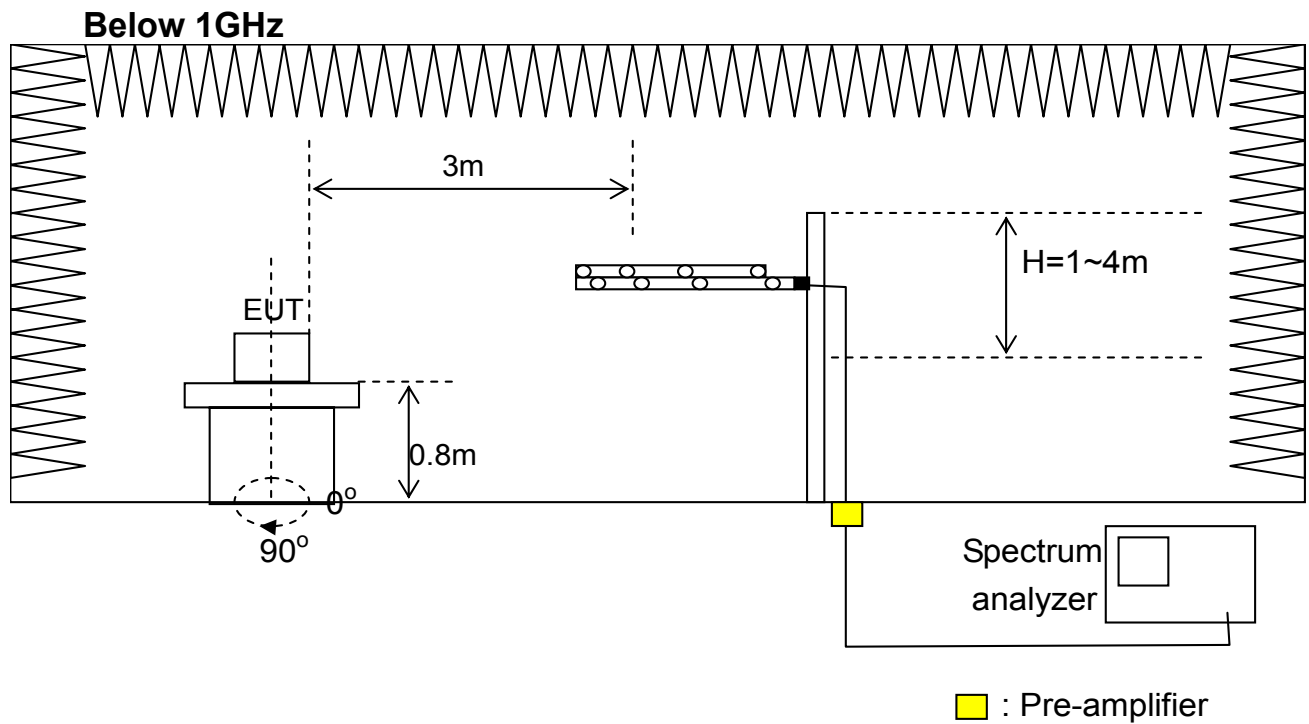
Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

### 2.2 Measurement Procedure

- The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- A software provided by client enabled the EUT to transmit and receive data.

- c. If the EUT is tabletop equipment, it was placed on a wooden table with a height of 0.8 meters above the reference ground plane in the semi-anechoic chamber. If the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 12 millimeters above the reference ground plane in the semi-anechoic chamber.
- d. The EUT was set 3m away from the interference receiving antenna.
- e. Rapidly sweep the signal in the test frequency range by using the spectrum through the Maximum-peak detector.
- f. Rotate the EUT from 0° to 360° and position the receiving antenna at heights from 1 to 4 meters above the reference ground plane continuously to determine at least six frequencies associated with higher emission levels and record them.
- g. Then measure each frequency found from step f. by using the spectrum with rotating the EUT and positioning the receiving antenna height to determine the maximum level.
- h. For measurement of frequency below 1000MHz, set the receiver detector to be Quasi-Peak per CISPR 16-1 to find out the maximum level occurred.
- i. For measurement of frequency above 1000MHz, set the spectrum detector to be Peak or Average to find out the maximum level occurred, if any.
- j. Record frequency, azimuth angle of the turntable, height, and polarization of the receiving antenna and compare the maximum level with the required limit.
- k. Change the receiving antenna to another polarization to measure radiated emission by following step e. to j. again.
- l. If the peak emission level below 1000MHz measured from step f. is 4dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. value will be measured and presented.
- m. If the peak emission level above 1000MHz measured from step f. is 20dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate A.V. value will be measured and presented.

## 2.3 Test configuration



## 2.4 Test Instruments

Test Site and Equipment	Manufacturer	Model No./Serial No.	Last Calibration Data	Calibration Due Data
Semi-anechoic Chamber	ETS.LINDGREN	TR1/17627-B	April 12, 2006	April 12, 2007
Test Receiver	R&S	ESCS30/ 836858/020	July 30,2006	July 30, 2007
Spectrum Analyzer*	R&S	FSP40/ 100031	June 16, 2006	June 16, 2007
Antenna	R&S	HL562/360543/010	July 7, 2006	July 7, 2007
Antenna*	R&S	HF906/359287/001	Aug. 11, 2006	Aug. 11, 2007
Antenna*	EMCO	3116/ 20552	Dec. 10, 2005	Dec. 10, 2006
Pre-amplifier*	MITEQ	AMF-4D-005180-24-10P/1072962	May 19, 2006	May 19, 2007
Pre-amplifier*	MITEQ	JS4-18002600-30-5A/741923	June 27, 2006	June 27, 2007
Pre-amplifier*	MITEQ	AMF-6F-260400-33-8P/ 928336	June 27, 2006	June 27, 2007
Pre-amplifier	Mini Circuit	ZKL-2/ 002	April 9, 2006	April 9, 2007

Note:

1. “\*” : These instruments are used only for the measurement of emission frequency above 1000MHz.
2. The calibrations are traceable to NML/ROC.
3. NCR : No Calibration Required.
4. The calibration date of the semi-anechoic chamber listed above is the date of NSA measurement.

## Instrument Setting

RBW	VBW	Detector	Trace	Comment
100kHz	300kHz/10Hz	Peak	Maxhold	Peak/Average

## Climatic Condition

Ambient Temperature : 28°C ;      Relative Humidity : 64%

## 2.5 Test Data

### Field Strength of Fundament

Test Mode : Continuous Transmitting

Test Distance : 3m

Tester : Bill

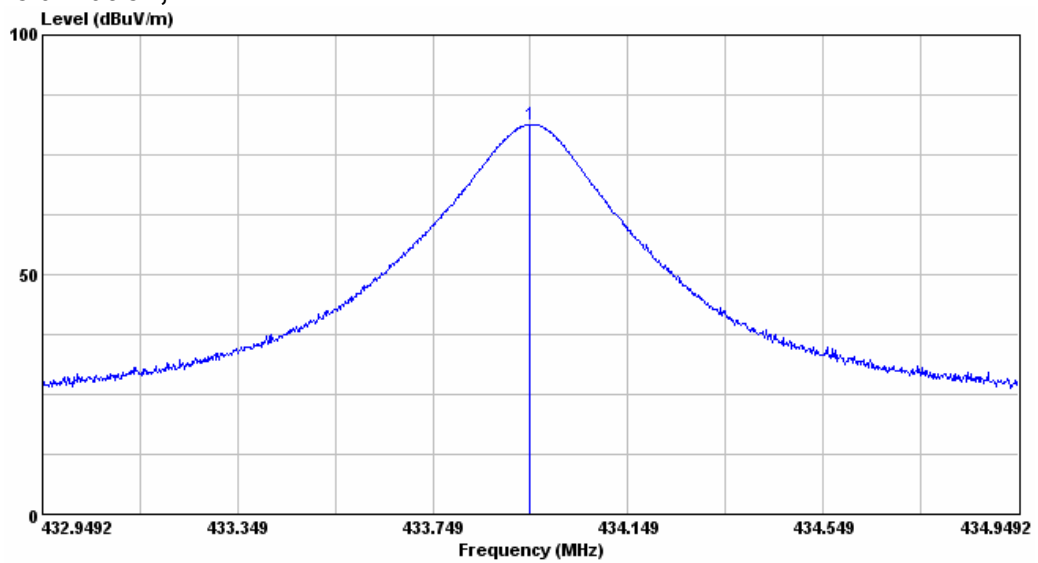
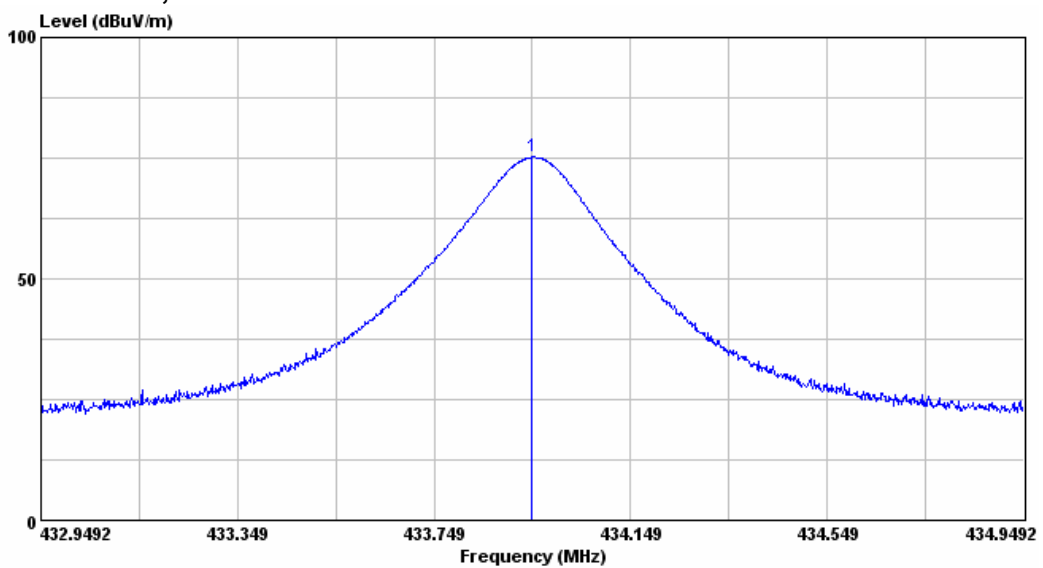
Frequency (MHz)	Polarization	Reading Data (dBuV)		Correction Factor (dB/m)	Field Strength (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
433.95	V	91.96	71.96	-10.59	81.37	61.37	92.87	72.87	11.50	11.50
433.95	H	85.77	65.77	-10.59	75.18	55.18	92.87	72.87	17.69	17.69

Note :

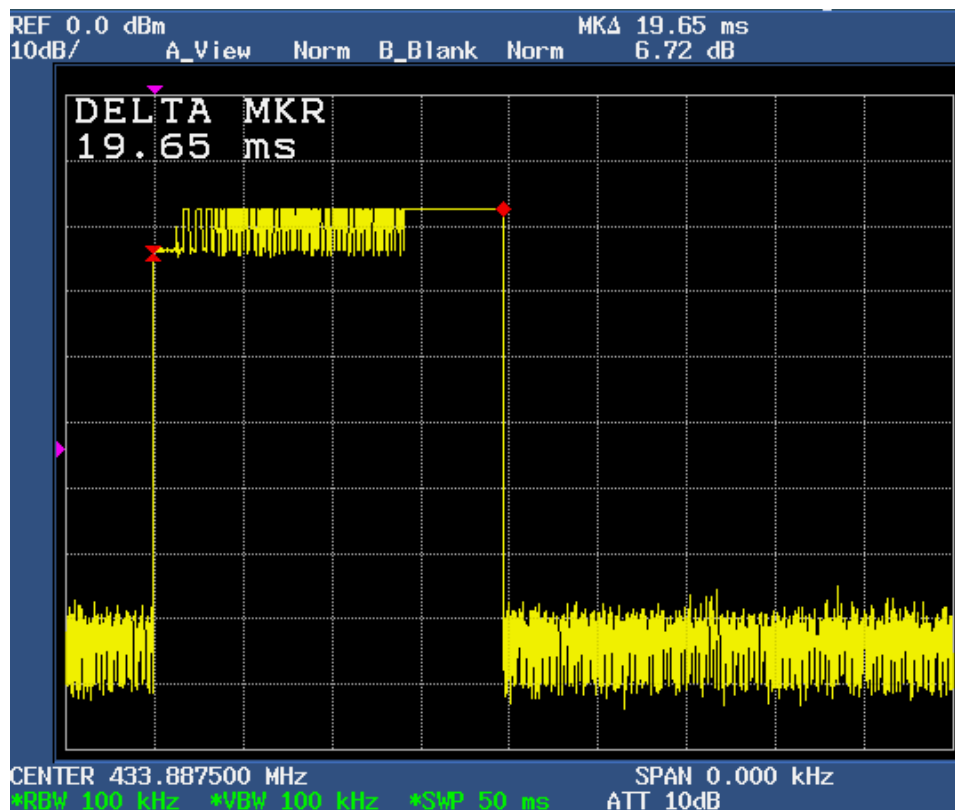
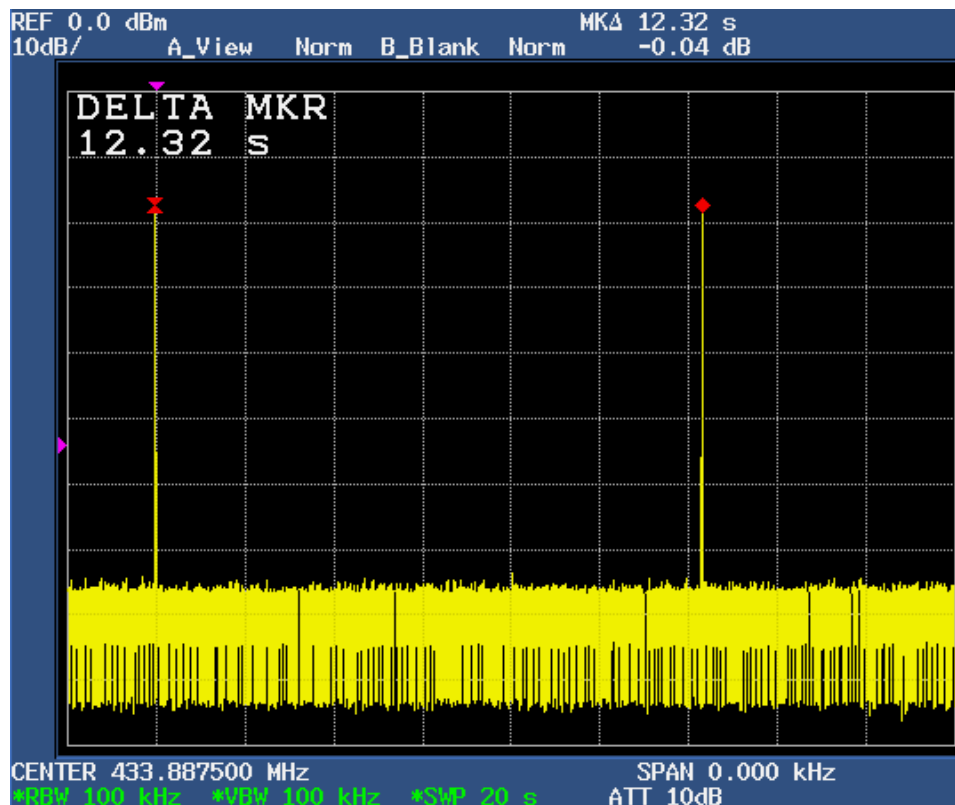
1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier
2. Field Strength (dBuV/m) = Reading Data + Correction Factor
3. Margin (dB) = Limit – Field Strength
4. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle)  
Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log \frac{0.01965}{12.32} < -20\text{dB}$$

please see page 17 for plotted duty cycle.

**V Polarization, PK****H Polarization, PK**

## Duty cycle





## Radiated Emission Measurement below 1000MHz

Test Mode : Continuous Transmitting

Test Distance : 3m

Tester : Bill

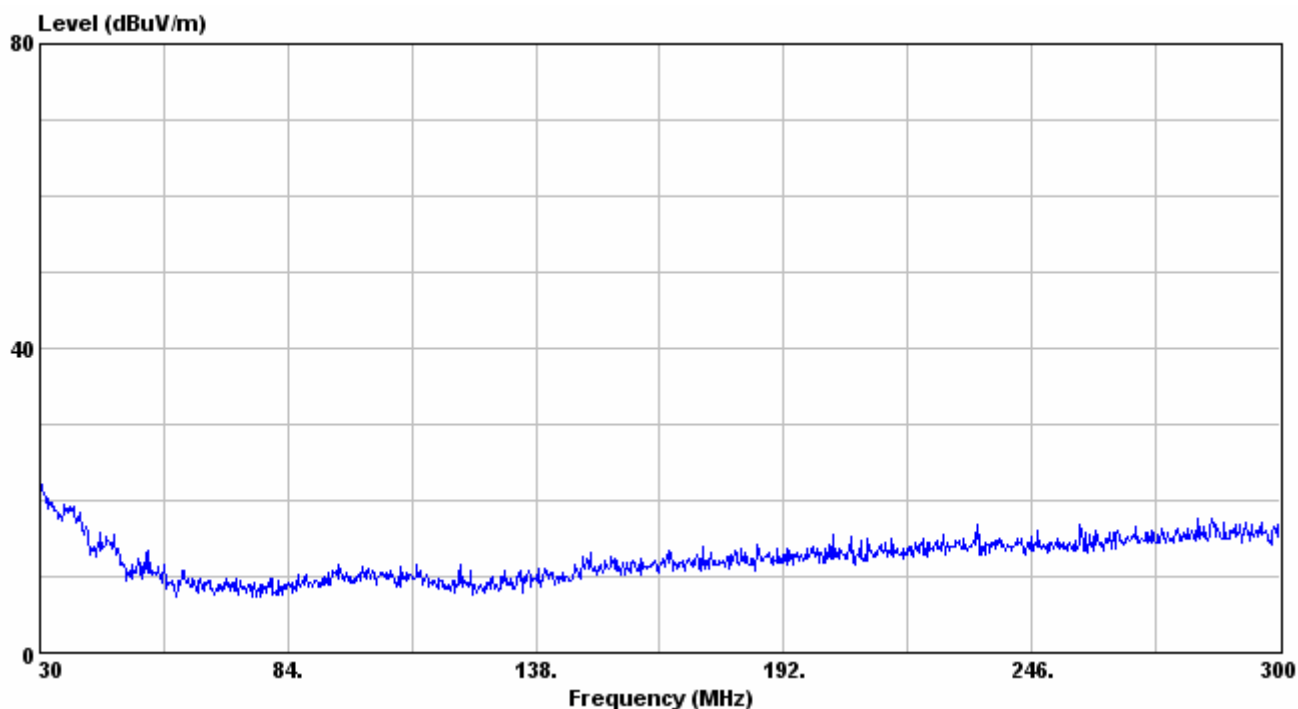
Polarization : Vertical

Frequency Range : 30MHz~300MHz

	Frequency (MHz)	Reading Data (dBuV)		Correction Factor (dB/m)	Emission Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		PK.	AV.		PK.	AV.	PK.	AV.	PK.	AV.
NA	*	*	*	*	*	*	74.00	54.00	*	*

Note:

1. Emission Level (dBuV/m) = Reading Value + Correction Factor.
2. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier.
3. Margin (dB) = Limit–Emission Level.
4. “\*”: The emission is too low to be measured.



Test Mode : Continuous Transmitting

Test Distance : 3m

Tester : Bill

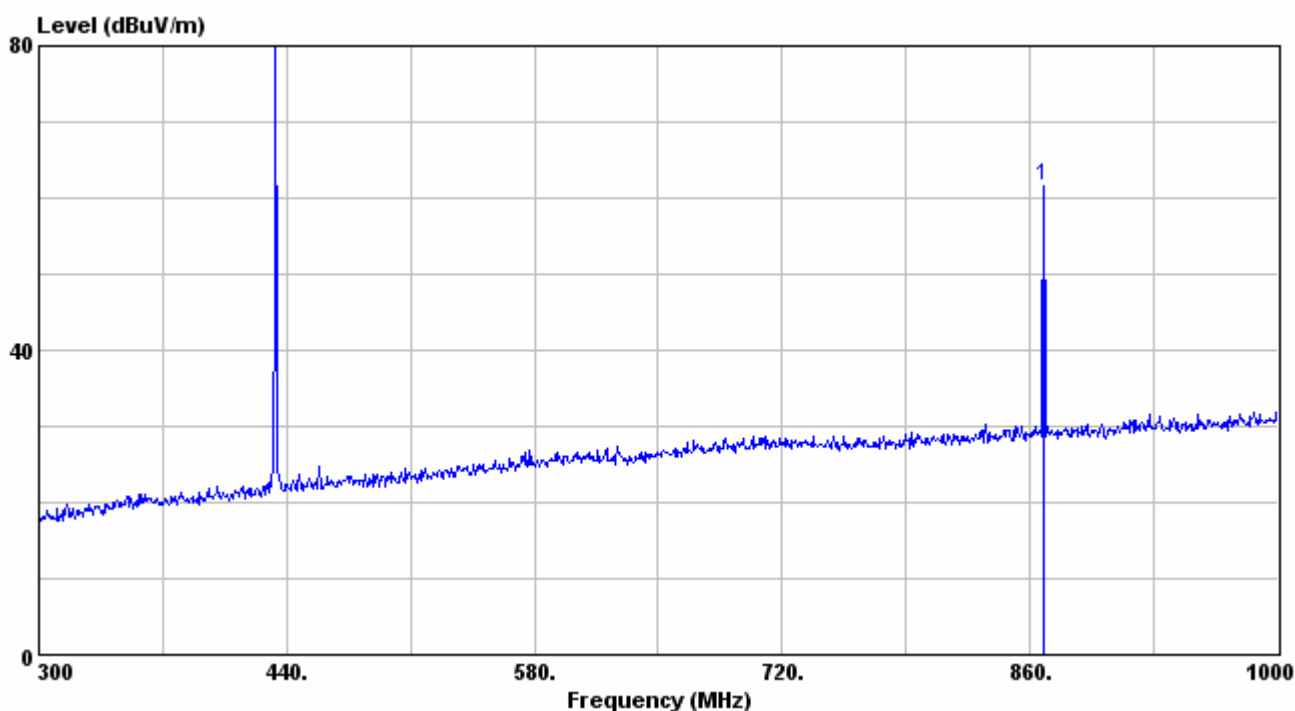
Polarization : Vertical

Frequency Range : 300MHz~1GHz

	Frequency (MHz)	Reading Data (dBuV)		Correction Factor (dB/m)	Emission Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		PK.	AV.		PK.	AV.	PK.	AV.	PK.	AV.
1	867.70	64.49	44.49	-2.82	61.67	41.67	74.00	54.00	12.33	12.33

Note:

1. Emission Level (dBuV/m) = Reading Value + Correction Factor.
2. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier.
3. Margin (dB) = Limit–Emission Level.
4. “\*”: The emission is too low to be measured.



Test Mode : Continuous Transmitting

Test Distance : 3m

Tester : Bill

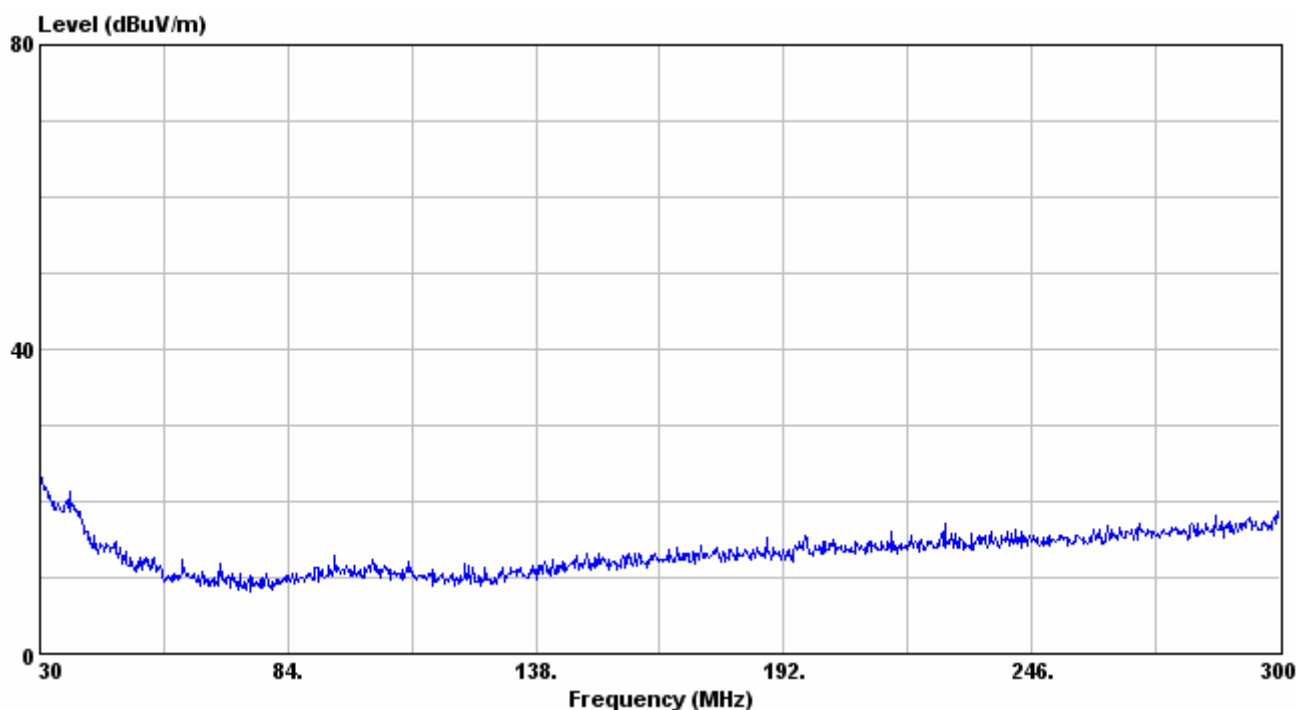
Polarization : Horizontal

Frequency Range : 30MHz~300MHz

	Frequency (MHz)	Reading Data (dBuV)		Correction Factor (dB/m)	Emission Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		PK.	AV.		PK.	AV.	PK.	AV.	PK.	AV.
NA	*	*	*	*	*	*	74.00	54.00	*	*

Note:

1. Emission Level (dBuV/m) = Reading Value + Correction Factor.
2. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier.
3. Margin (dB) = Limit–Emission Level.
4. “\*”: The emission is too low to be measured.



Test Mode : Continuous Transmitting

Test Distance : 3m

Tester : Bill

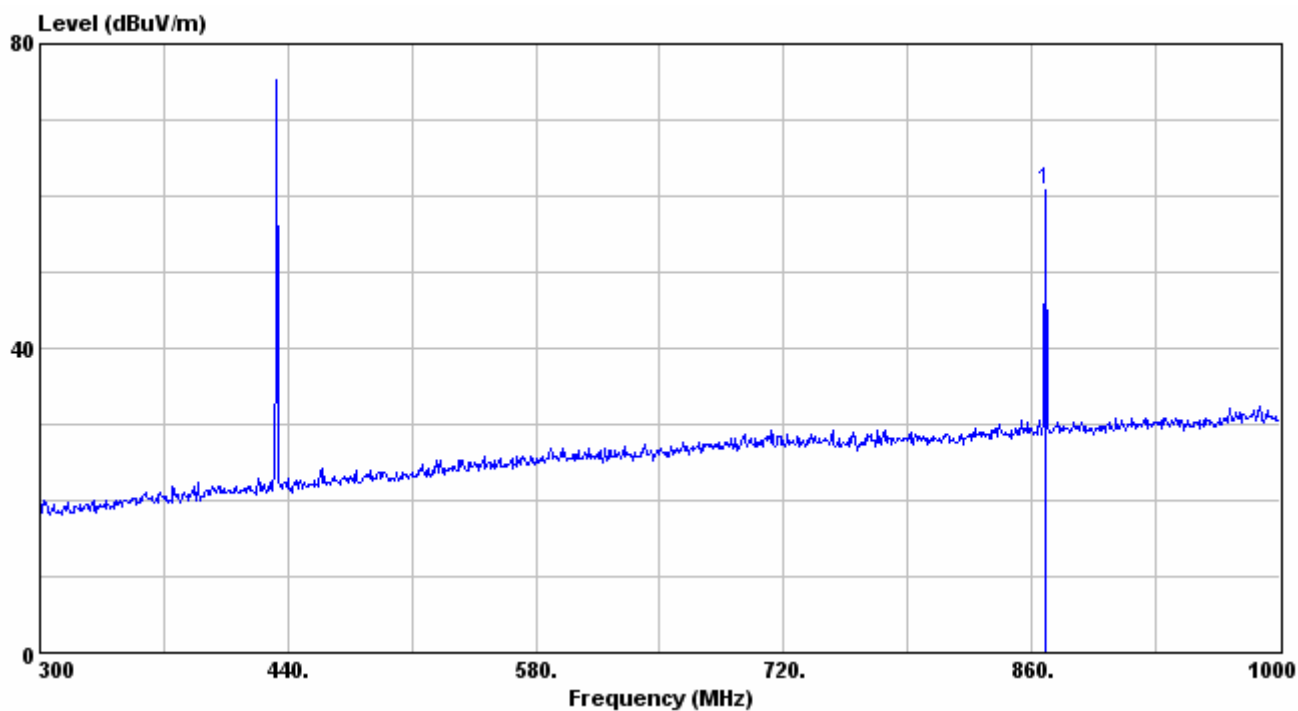
Polarization : Horizontal

Frequency Range : 300MHz~1GHz

	Frequency (MHz)	Reading Data (dBuV)		Correction Factor (dB/m)	Emission Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		PK.	AV.		PK.	AV.	PK.	AV.	PK.	AV.
1	867.70	63.68	*	-2.82	60.86	*	74.00	54.00	13.14	*

Note:

1. Emission Level (dBuV/m) = Reading Value + Correction Factor.
2. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier.
3. Margin (dB) = Limit–Emission Level.
4. “\*”: The emission is too low to be measured.



## Radiated Emission Measurement above 1000MHz

Test Model : Continuous Transmitting

Test Distance : 3m

Tester : Bill

Antenna Polarization : Vertical

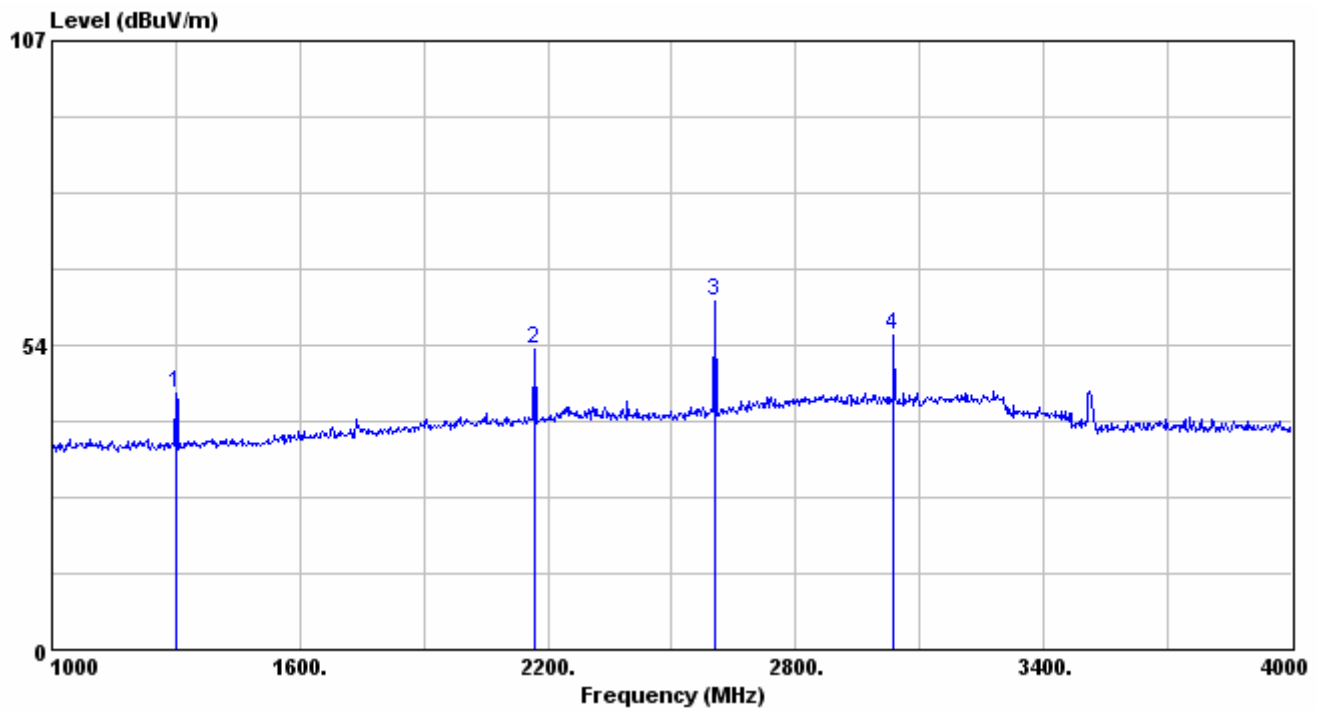
Frequency Range :1GHz~8GHz

	Frequency (MHz)	Reading Data (dBuV)		Correction Factor (dB/m)	Emission Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		PK.	AV.		PK.	AV.	PK.	AV.	PK.	AV.
1	1300	51.59	*	-6.63	44.96	*	74.00	54.00	29.04	*
2	2170	54.28	34.28	-1.33	52.95	32.95	74.00	54.00	21.05	21.05
3	2602	61.51	41.51	-0.31	61.20	41.20	74.00	54.00	12.80	12.80
4	3037	54.23	34.23	1.00	55.23	35.23	74.00	54.00	18.77	18.77
5	4340	41.92	*	2.85	44.77	*	74.00	54.00	29.23	*

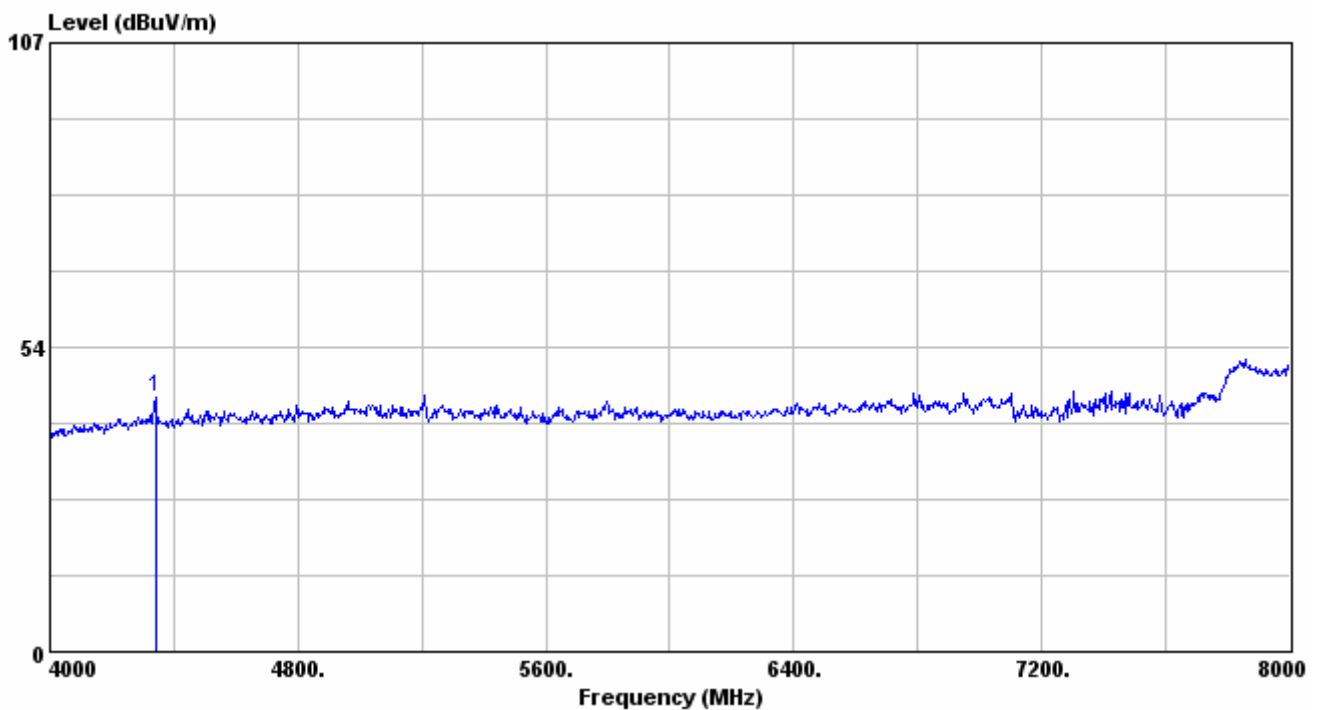
Note:

1. Emission Level (dBuV/m) = Reading Value + Correction Factor.
2. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier.
3. Margin (dB) = Limit–Emission Level.
4. “\*”: The emission is too low to be measured.
5. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle)  
20log(Duty cycle) < -20dB                      please see page 17 for plotted duty cycle.

## 1000MHz~4000MHz



## 4000MHz~8000MHz



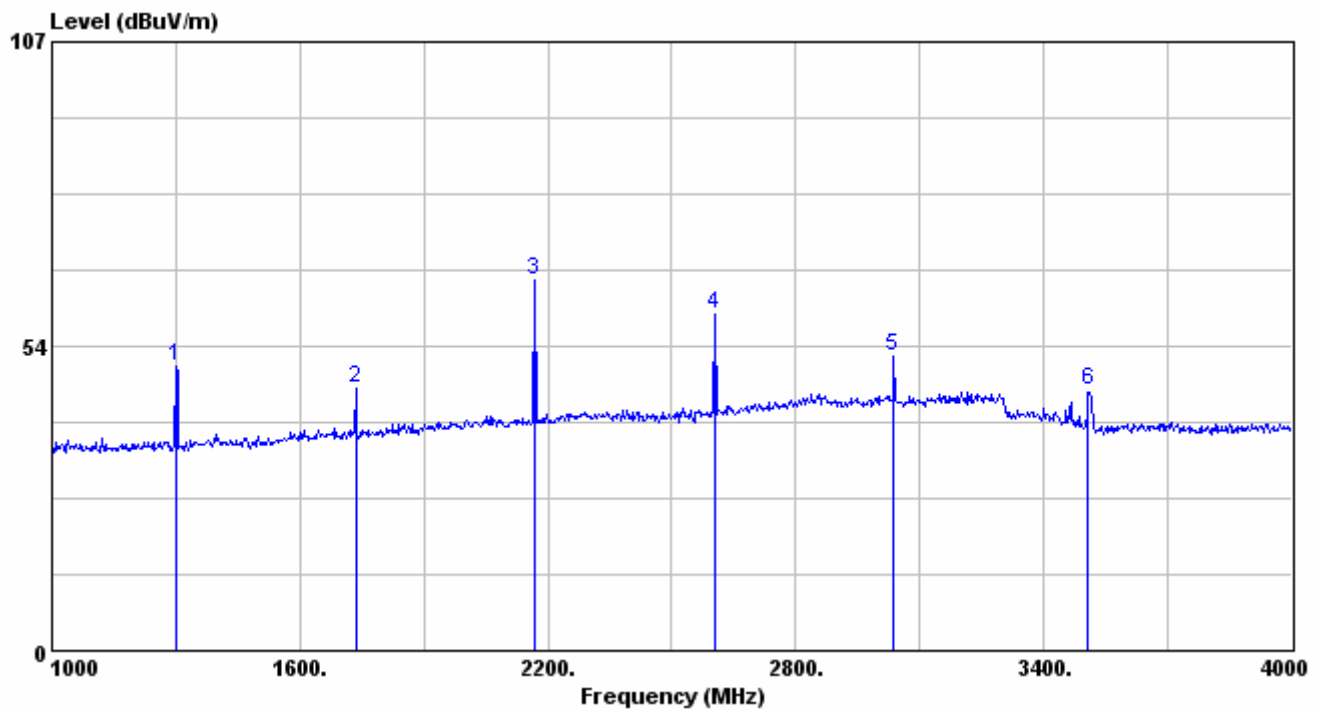
**Test Model : Continuous Transmitting**
**Test Distance : 3m**
**Tester : Bill**
**Antenna Polarization : Horizontal**
**Frequency Range :1GHz~8GHz**

	Frequency (MHz)	Reading Data (dBuV)		Correction Factor (dB/m)	Emission Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
		PK.	AV.		PK.	AV.	PK.	AV.	PK.	AV.
1	1300	56.61	*	-6.63	49.98	*	74.00	54.00	24.02	*
2	1735	50.09	*	-3.98	46.11	*	74.00	54.00	27.89	*
3	2170	66.42	46.42	-1.33	65.09	45.09	74.00	54.00	8.91	8.91
4	2602	59.44	39.44	-0.31	59.13	39.13	74.00	54.00	14.87	14.87
5	3037	50.91	*	1.00	51.91	*	74.00	54.00	22.09	*
6	3471	43.03	*	0.58	43.61	*	74.00	54.00	30.39	*

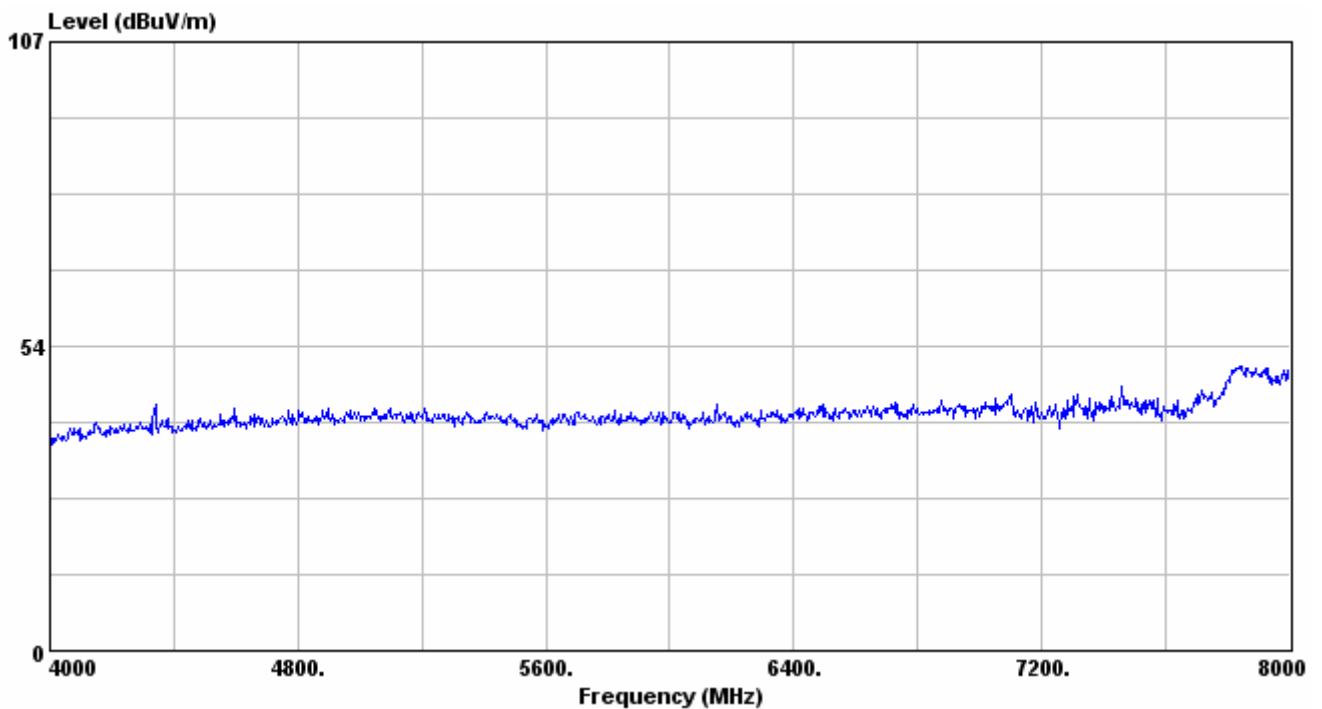
**Note:**

1. Emission Level (dBuV/m) = Reading Value + Correction Factor.
2. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier.
3. Margin (dB) = Limit–Emission Level.
4. “\*”: The emission is too low to be measured.
5. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle)  
 $20\log(\text{Duty cycle}) < -20\text{dB}$       please see page 17 for plotted duty cycle.

## 1000MHz~4000MHz



## 4000MHz~8000MHz





### 3 Bandwidth

Test Result: Pass

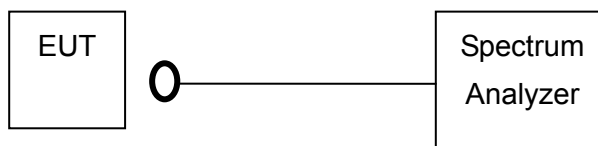
#### 3.1 Applied standard

According to 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

#### 3.2 Measurement Procedure

1. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
2. The Transmitter output of EUT was connected to the spectrum analyzer.
3. Measure the 20dB bandwidth and compare with the required limit.

#### 3.3 Test configuration



#### 3.4 Test Instruments

Test Site and Equipment	Manufacturer	Model No./Serial No.	Last Calibration Data	Calibration Due Data
Shielded Room	ETS.LINDGREN	TR4/ <b>15353-E</b>	NCR	NCR
Spectrum Analyzer	Advantest	R3132/ <b>103082587</b>	Sep. 7,2005	Sept. 7, 2006

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR:No Calibration Required.

**Instrument Setting**

RBW	VBW	Span	Detector	Comment
100kHz	300kHz	Peak	Maxhold	

**Climatic Condition**

Ambient Temperature : 26°C ;

Relative Humidity : 67%

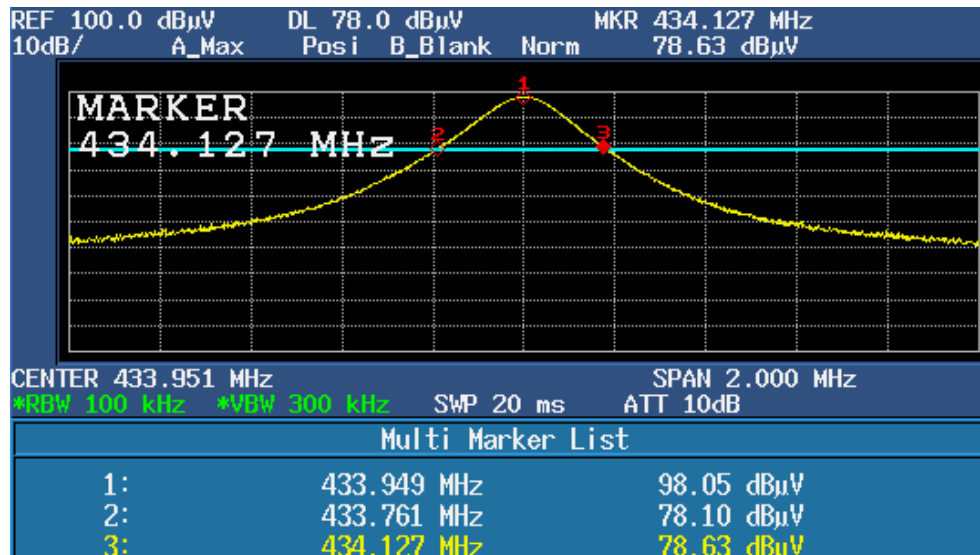
### 3.5 Test Data

Test Mode : Continuous Transmitting

Emission Freq. : 433.95MHz

Tester

: Bill



Measured 20dB bandwidth is 366 kHz <  $433.95\text{MHz} \times 0.25\% = 1084.88\text{kHz}$ .

## 4 Dwell Time

Test Result: Pass

### 4.1 Applied standard

According to 15.231(a)(2), automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

### 4.2 Measurement Procedure

- The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.
- The Transmitter output of EUT was connected to the spectrum analyzer through an attenuator.
- Measure the dwell time and compare with the required limit.

### 4.3 Test configuration



### 4.4 Test Instruments

Test Site and Equipment	Manufacturer	Model No./Serial No.	Last Calibration Data	Calibration Due Data
Shielded Room	ETS.LINDGREN	TR4/ <b>15353-E</b>	NCR	NCR
Spectrum Analyzer	Advantest	R3132/ <b>103082587</b>	Sep. 7,2005	Sept. 7, 2006

Note:

- The calibrations are traceable to NML/ROC.
- NCR:No Calibration Required.

#### Instrument Setting

RBW	VBW	Detector	Trace	Comment
100kHz	100kHz	Peak	Maxhold	

#### Climatic Condition

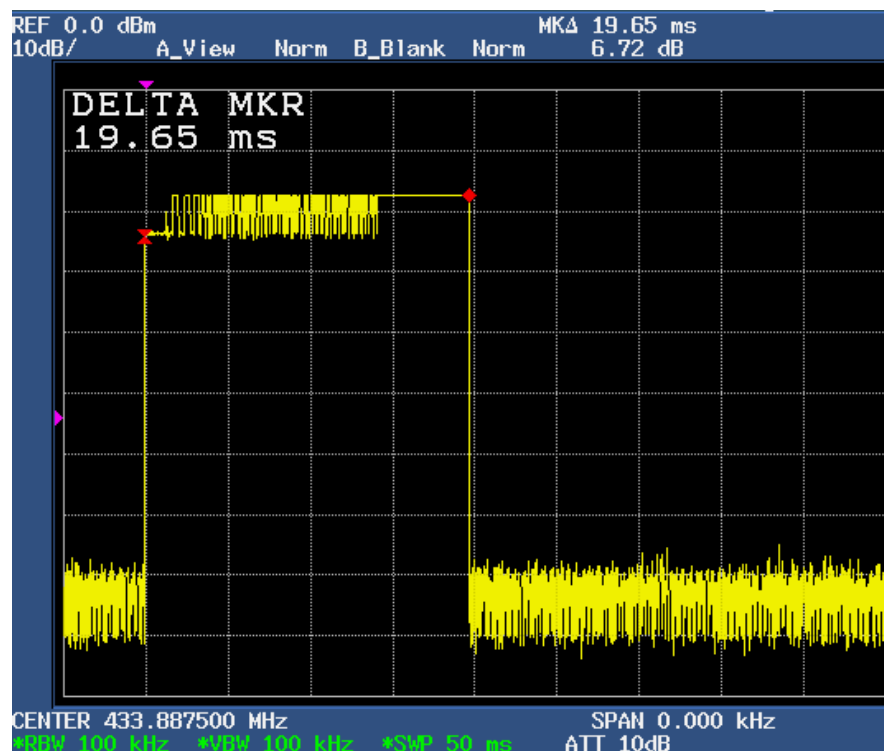
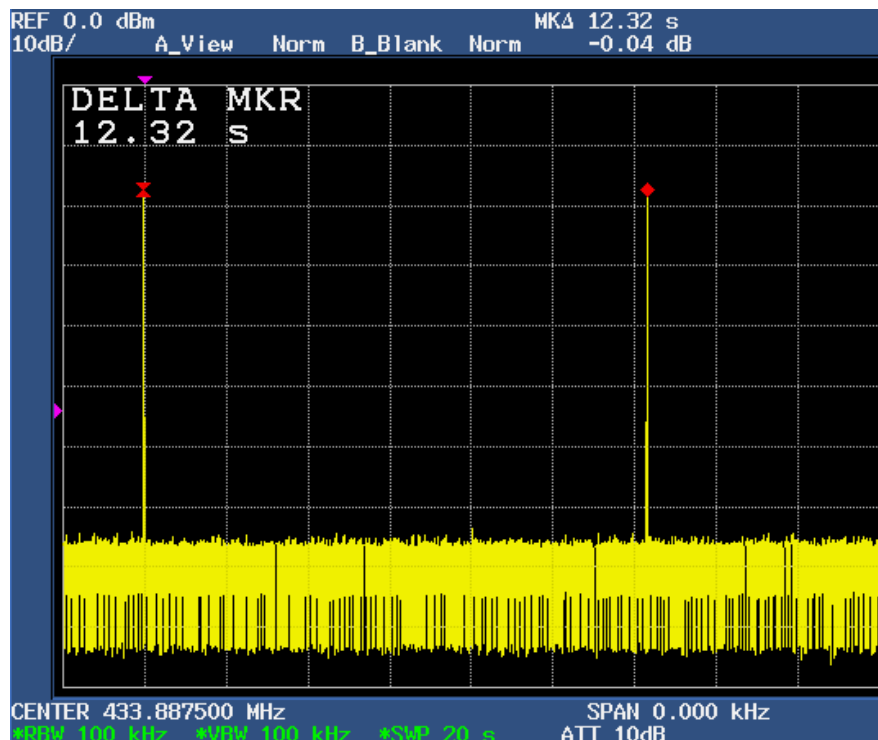
Ambient Temperature : 26°C ;

Relative Humidity : 67%

## 4.5 Test Data

Test Mode : Continuous Transmitting

Tester : Bill



The duration of each transmission is 19.65ms less than 1s .The silent period between transmissions is 12.30s more than 30 times the duration of the transmission and more than 10s.