



# EMC TEST REPORT

**Report No. : TS10020022-EME**

**Model No. : R9P007**

**Issued Date : Feb. 22, 2010**

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**Test Method/ Standard: 47 CFR FCC Part 15.231 & ANSI C63.4 2003**

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**Summary of Tests**

**Wireless Home Appliance Timer Remote Control Kit -Model: R9P007  
FCC ID: NHS-R9P007**

Test	Reference	Results
Radiated Emission test	15.231(b), 15.209	Pass
Measured bandwidth	15.231(c)	Pass



## 1. General information

### 1.1 Identification of the EUT

Product: Wireless Home Appliance Timer Remote Control Kit  
Model No.: R9P007  
FCC ID.: NHS-R9P007  
Frequency Range: 433.92 MHz  
Channel Number: Single channel  
Frequency of Each Channel: 433.92 MHz  
Type of Modulation: ASK  
Power Supply: DC 12 V from battery  
Power Cord: N/A  
Sample Received: Feb. 02, 2010  
Test Date(s): Feb. 08, 2010 ~ Feb. 09, 2010  
Note 1:

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Note 2: When determining the test conclusion, the Measurement Uncertainty of test has been considered.



## **1.2 Additional information about the EUT**

The EUT is a Wireless Home Appliance Timer Remote Control Kit and transmitted by manual setting. The transmission will stop once released the switch and was defined as information technology equipment.

For more detail features, please refer to User's manual as file name "Installation guide.pdf"

## **1.3 Antenna description**

The EUT uses a permanently connected antenna.

Antenna Gain : -20 dBi max  
Antenna Type : PCB printed antenna  
Connector Type : N/A



## **2. Test specifications**

### **2.1 Test standard**

The EUT was performed according to the procedures in FCC Part 2.1053 and the requirement in FCC Part 15 Subpart C Section 15.231.

### **2.2 Operation mode**

The EUT was transmitted continuously during the test.

### 2.3 Test equipment

Equipment	Brand	Frequency range	Model No.
EMI Test Receiver	Rohde & Schwarz	9 kHz~2.75 GHz	ESCS 30
Spectrum Analyzer	Rohde & Schwarz	9 kHz~30 GHz	FSP 30
Spectrum Analyzer	Rohde & Schwarz	20 Hz~40 GHz	FSEK 30
Horn Antenna	EMCO	1 GHz~18 GHz	3115
Horn Antenna	SCHWARZBECK	14 GHz~40 GHz	BBHA 9170
Bilog Antenna	SCHWARZBECK	25 MHz~1.7 GHz	VULB 9160
Pre-Amplifier	MITEQ	100 MHz~26.5 GHz	919981
Pre-Amplifier	MITEQ	26 GHz~40 GHz	828825
Controller	HDGmbH	N/A	HD 100
Antenna Tower	HDGmbH	N/A	MA 240
Turn Table	HDGmbH	N/A	DS 420S
LISN	Rohde & Schwarz	9 kHz~30 MHz	ESH3-Z5

Note: The above equipments are within the valid calibration period.

### 3. Radiated emission test FCC 15.231 (b)

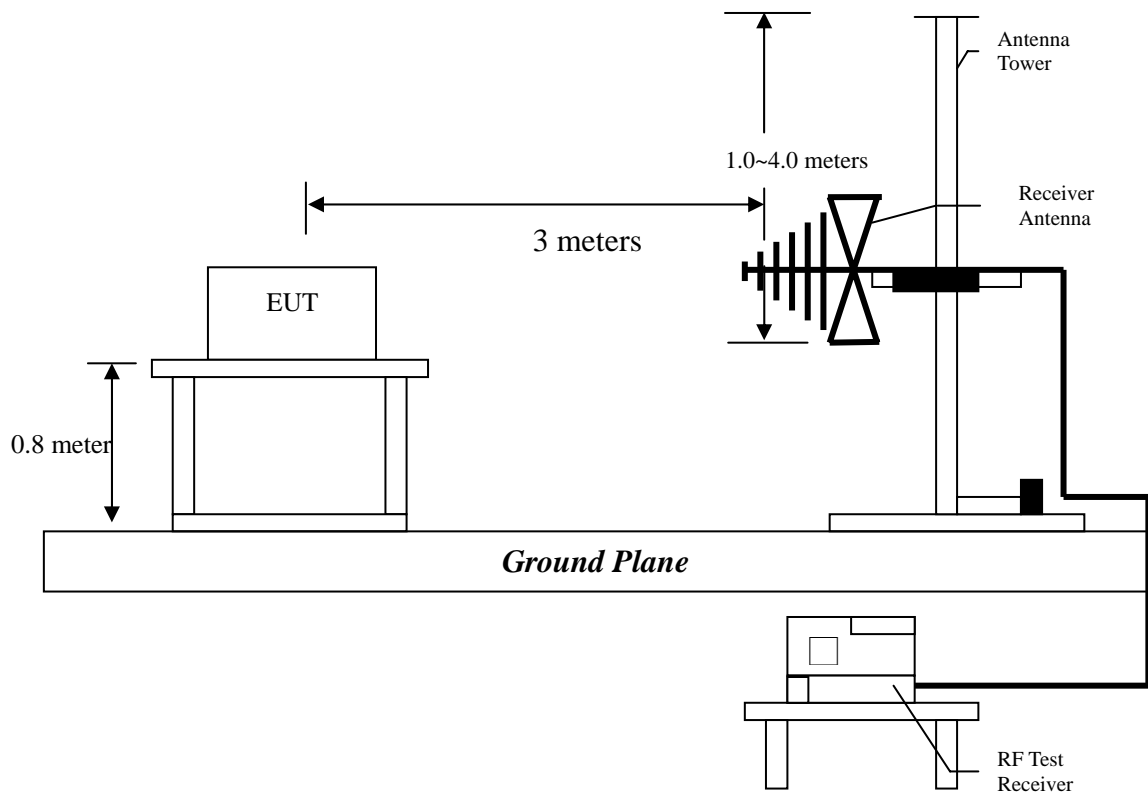
#### 3.1 Operating environment

Temperature:	24	°C
Relative Humidity:	55	%
Atmospheric Pressure	1023	hPa

#### 3.2 Test setup & procedure

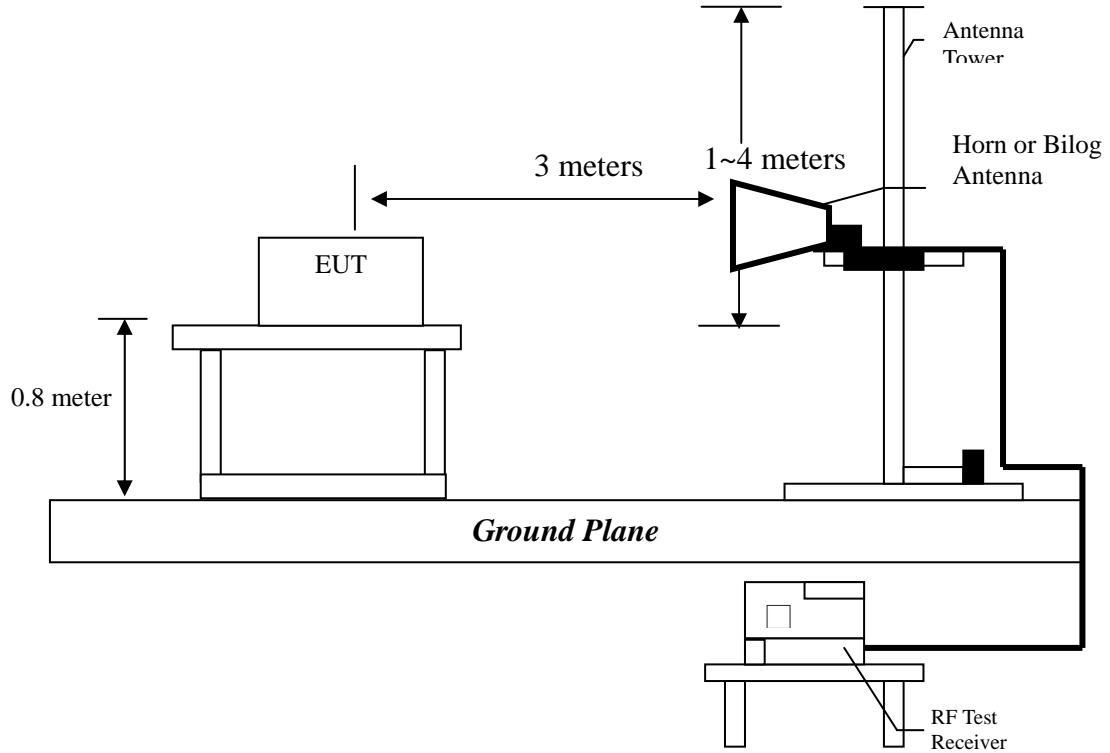
The Diagram below shows the test setup, which is utilized to make these measurements.

The frequency spectrum from 30MHz to 1000MHz was investigated.





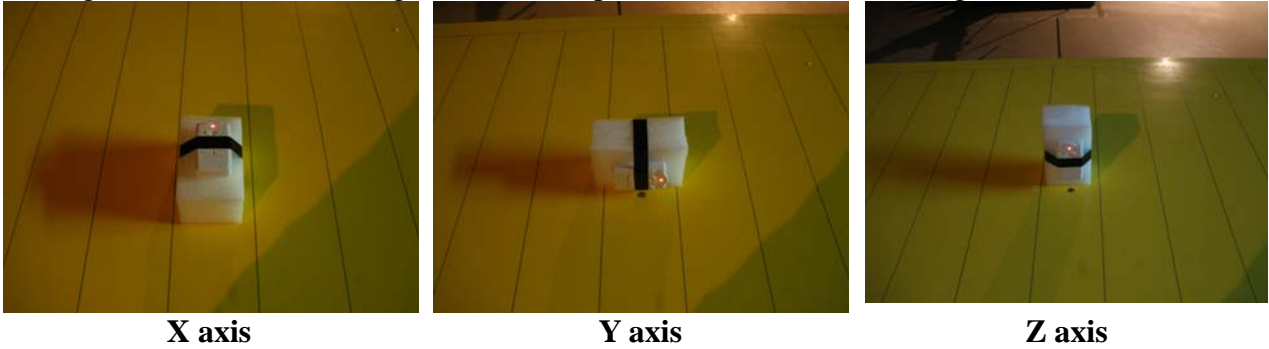
The frequency spectrum from over 1GHz was investigated.



The signal is maximized through rotation and placement in the three orthogonal axes. Radiated emission measurements were performed from 30 MHz to 25 GHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1 GHz, 1MHz – for frequencies above 1 GHz. The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The signal is maximized through rotation and placement in the three orthogonal axes.



After verifying three axes, we found the maximum electromagnetic field was occurred at Z axis. The final test data was executed under this configuration.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

**3.3 Radiated emission limit**

**3.3.1 Fundamental and harmonics emission limits**

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(uV/m@3 m)	(dBuV/m@3 m)	(uV/m@3 m)	(dBuV/m@3 m)
433.92	10958	80.8	1096.5	60.8

### 3.3.2 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. 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).

Frequency MHz	15.209 Limits (dB $\mu$ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Measurement uncertainty was calculated in accordance with TR 100 028-1.

Parameter	Uncertainty
Radiated Emission	$\pm 5.056$ dB
Conducted Emission	$\pm 2.786$ dB

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

### 3.4 Calculation of Average Factor

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period over which the duty cycle is measured is 100 ms or the repetition cycle, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer in zero span mode at 100 resolution bandwidth.

Averaging factor in dB =  $20\log(\text{duty cycle})$

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 47.484 ms

The number of long pulses in each period (10) multiplied by the duration of each short pulses (0.684ms) = 6.84 ms

The number of short pulses in each period (23) multiplied by the duration of each long pulses (0.224ms) = 5.152ms

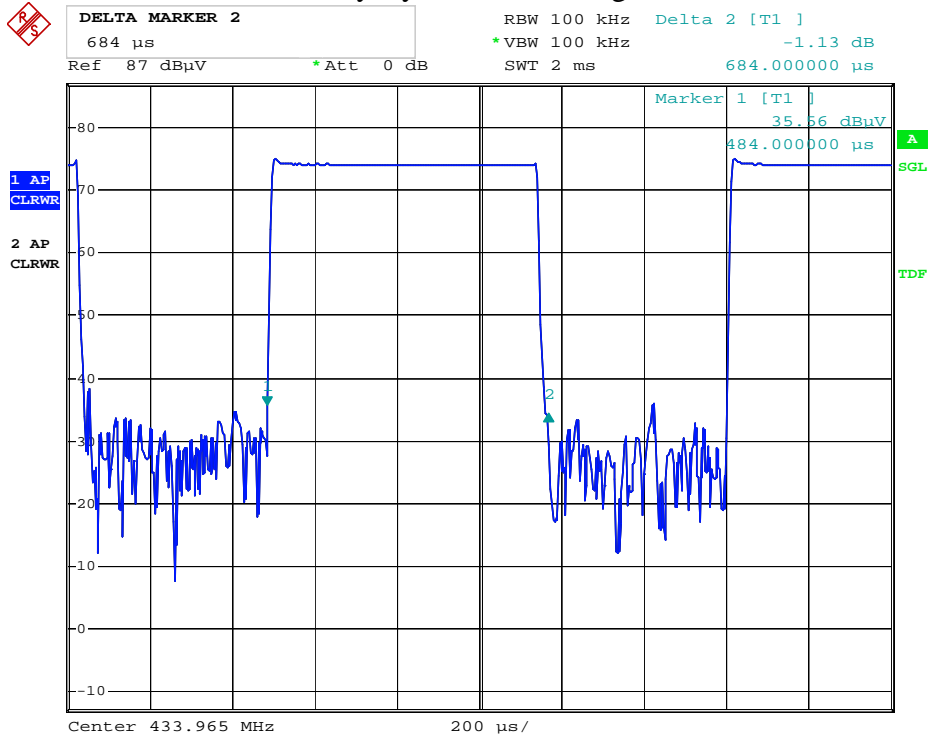
Effective period of the cycle =  $6.84 + 5.152 = 11.992$  ms

Duty Cycle =  $11.992 \text{ ms} / 47.484 \text{ ms} = 0.2525$

Therefore, the duty cycle correction factor will be  $20 \log_{10} 0.2525 = -11.95$  dB

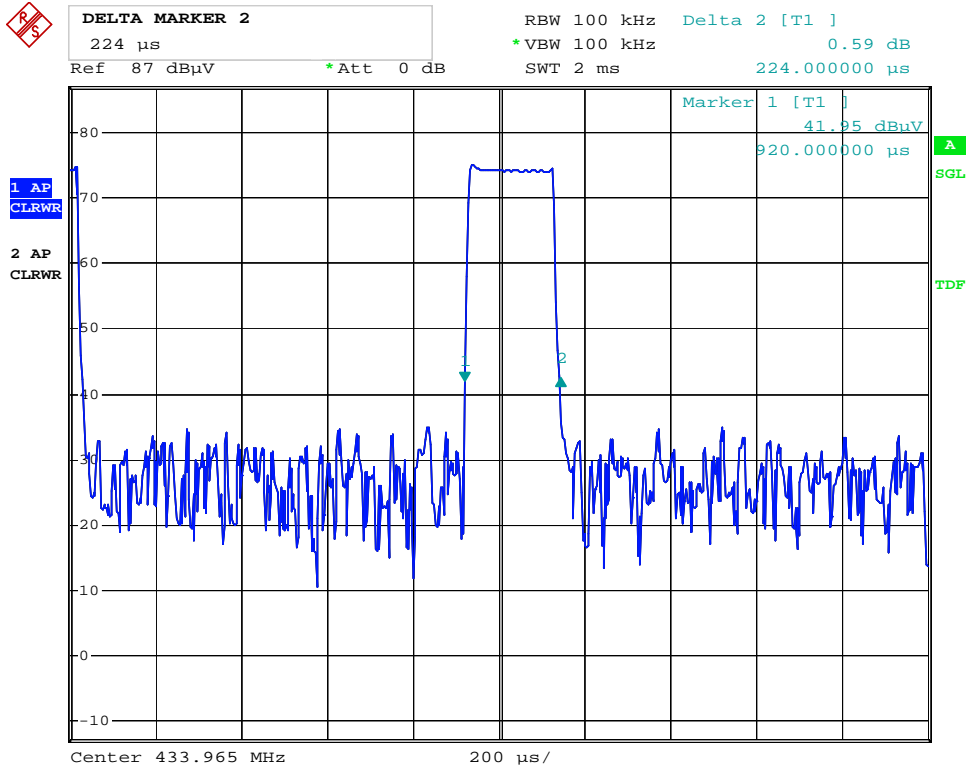
Please see the plot below.

## Duty Cycle on time-long



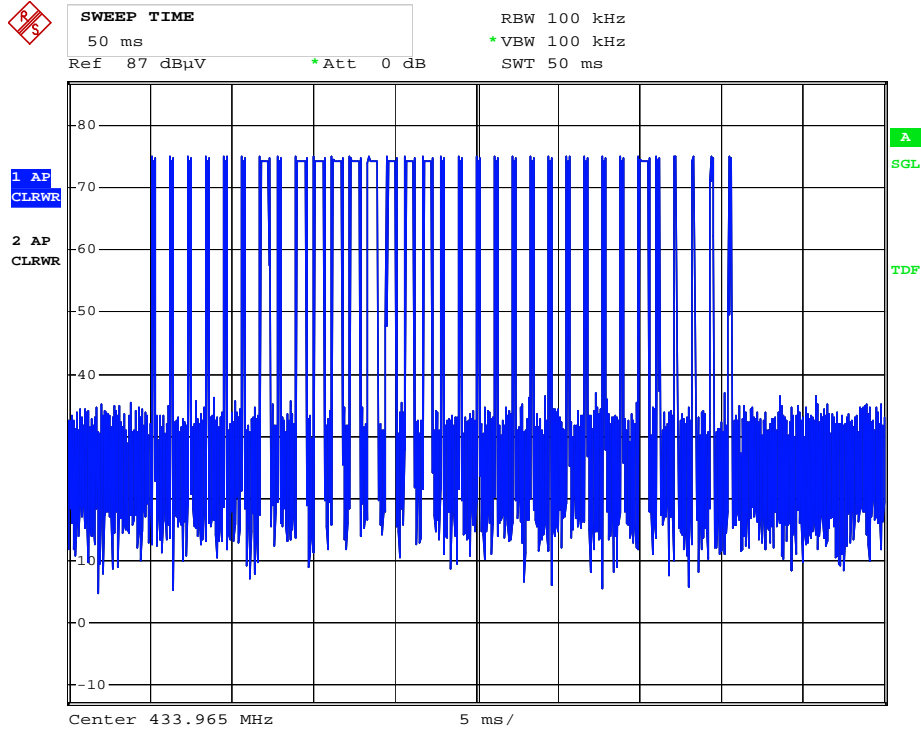
Date: 8.FEB.2010 17:48:31

## Duty Cycle on time-Short



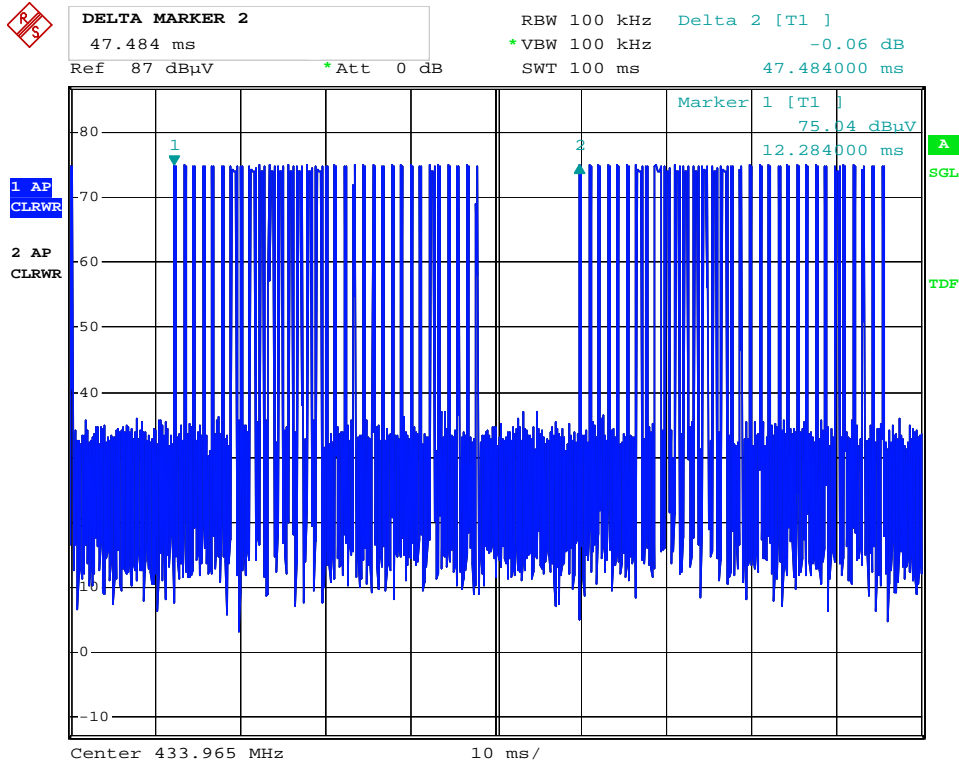
Date: 8.FEB.2010 17:47:40

## Duty Cycle on-time



Date: 8.FEB.2010 17:46:34

## Duty Cycle period



Date: 8.FEB.2010 17:49:33



### 3.5 Radiated emission test data FCC 15.231

#### 3.5.1 Measurement results: frequencies equal to or less than 1 GHz

EUT : R9P007  
Worst Case : Tx at 433.92 MHz at Z axis

#### Fundamental

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Vertical	433.92	QP	19.42	60.45	79.87	80.828	-0.96
Vertical	868.02	QP	26.48	22.70	49.18	60.828	-11.65
Horizontal	433.92	QP	19.42	50.26	69.68	80.828	-11.15
Horizontal	868.02	QP	26.48	17.10	43.58	60.828	-17.25

Remark:

1. Calculated = Reading + Corr. Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. Margin = Calculated - Limit

### 3.5.2 Measurement results: frequencies above 1GHz

EUT : R9P007  
 Worst Case : Tx at 433.92 MHz at Z axis

Polarization (circle)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Calculated (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Vertical	1302.00	PK	29.28	30.57	0.00	59.85	74.000	-14.15
Vertical	1302.00	AV	29.28	30.57	-11.95	47.90	54.000	-6.10
Vertical	1736.00	PK	30.62	30.16	0.00	60.78	80.828	-20.05
Vertical	1736.00	AV	30.62	30.16	-11.95	48.83	60.828	-12.00
Vertical	2170.00	PK	31.90	32.26	0.00	64.16	80.828	-16.67
Vertical	2170.00	AV	31.90	32.26	-11.95	52.21	60.828	-8.62
Horizontal	1302.00	PK	29.28	23.99	0.00	53.27	74.000	-20.73
Horizontal	1302.00	AV	29.28	23.99	-11.95	41.32	54.000	-12.68
Horizontal	1736.00	PK	30.62	24.47	0.00	55.09	80.828	-25.74
Horizontal	1736.00	AV	30.62	24.47	-11.95	43.14	60.828	-17.69
Horizontal	2170.00	PK	31.90	24.78	0.00	56.68	80.828	-24.15
Horizontal	2170.00	AV	31.90	24.78	-11.95	44.73	60.828	-16.10

Remark:

1. Calculated = Reading + Corr. Factor – Average Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. Margin= Calculated - Limit



#### 4. Measured bandwidth FCC 15.231(C)

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

$$B.W(20dBc) \text{ Limit} = 0.25\% \times f(\text{MHz}) = 0.25\% \times 433.92 \text{ MHz} = 1.0848 \text{ MHz}$$

From the plot, the bandwidth is observed to be 433.92 MHz, at 20dBc where the bandwidth limit is 1.0848 MHz.

Please see the plot below.

