



Date: 2007-11-19  
No.: 60.870.7.010.03F

## TEST REPORT

**Applicant:** Electronics Tomorrow Ltd.  
Unit 903-7, 9/F, Tower 1, Harbour Center,  
1 Hok Cheung Street, Hung Hom, Kowloon, HK.

**Description of Samples:** Model name: RF Thermo Transmitter  
Brand name: Nil  
Model no.: 9451, 9452, 259NU-1, 259NC-1, 259BC-1,  
259BU-1, 261NU-1, 261NC-1, 261BC-1,  
261BU-1, 264NU-1, 264NC-1, 264BC-1,  
264BU-1  
FCCID: PEQ945190807

**Date Samples Received:** 2007-09-24

**Date Tested:** 2007-09-24 to 2007-11-16

**Investigation Requested:** FCC Part 15 Subpart C, Section 15.231

**Conclusions:** The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

**Remarks:** ----

Checked by:

A handwritten signature in blue ink, appearing to read "Prudence Poon".

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Prudence Poon  
Project Manager  
Telecom department

Approved by:-

A handwritten signature in blue ink, appearing to read "Victor Kwan".

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Victor Kwan  
Manager  
Telecom department

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## **Appendix A**

Photos of Test Setup

## **Appendix B**

External EUT Photos

## **Appendix C**

Internal EUT Photos

## **1.0 General Details**

### **1.1 Test Laboratory**

Hong Kong Productivity Council  
HKPC Building, 78 Tat Chee Avenue, Kowloon Tong,  
Hong Kong

Registration Number: 90656

### **1.2 Applicant Details**

#### **Applicant**

**Electronics Tomorrow Ltd.**  
Unit 903-7, 9/F, Tower 1, Harbour Center,  
1 Hok Cheung Street, Hung Hom, Kowloon, HK.

#### **Manufacturer**

**Electronics Tomorrow Ltd.**  
Unit 903-7, 9/F, Tower 1, Harbour Center,  
1 Hok Cheung Street, Hung Hom, Kowloon, HK.

### 1.3 Equipment Under Test [EUT]

#### Description of EUT

Model Name:	RF Thermo Transmitter
Brand Name:	Nil
Model Number:	9451
FCCID:	PEQ945190807
Rating:	3.0Vd.c. ( 2 x " AA" size batteries )
Antenna Type:	Integral
Operated Frequency:	433.990MHz
No. of Channel:	1
Accessories and Auxiliary Equipment:	None
EUT Exercising Software:	None

As per Client Declaration, circuit design, PCB Layout, shielding and interface of 9451, 9452, 259NU-1, 259NC-1, 259BC-1, 259BU-1, 261NU-1, 261NC-1, 261BC-1, 261BU-1, 264NU-1, 264NC-1, 264BC-1 and 264BU-1 are identical, only the cosmetic is different. So, 9451 is selected to be a representative model to perform all testing.

#### General Operation of EUT

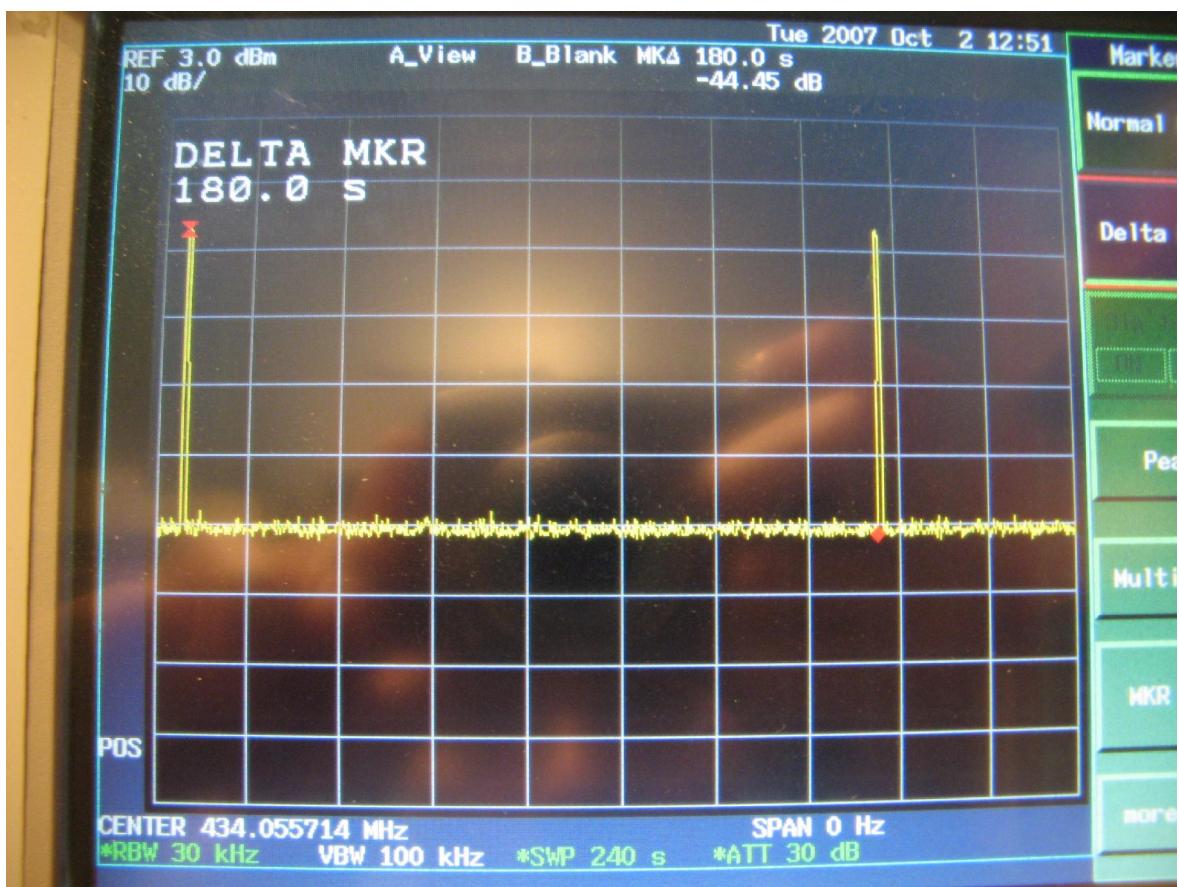
The Equipment Under Test (EUT) is a transmitter operated at 433.990MHz to detect the temperature and humidity of the surrounding and transmit this information to its associated weather station.

#### Periodic Operation of EUT

The transmitter transmits signal for every 180 seconds, that mean the silence period must not less than 180 seconds. Each data packet is continuously transmitting for approximate 990ms in one transmission, it activated automatically shall cease transmission within 1 seconds after activation.

So the EUT is deemed to fulfill FCC section 15.231( e ).

According to section 15.231(e), the EUT 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.



#### 1.4 Related Submittal(s) Grants

This is a single application for certification of the transmitter.

## **2.0 Technical Details**

### **2.1 Investigations Requested**

Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2007 and ANSI C63.4: 2003 for FCC Verification.

### **2.2 Test Standards and Results Summary Tables**

EMISSION Results Summary					
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result	
				Pass	Failed
Radiated Emission of Carrier Frequency	FCC 47CFR 15.231	ANSI C63.4:2003	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Radiated Emission, 30MHz to 5GHz	FCC 47CFR 15.231	ANSI C63.4:2003	Class B	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Conducted Emission on AC, 0.15MHz to 30MHz	FCC 47CFR 15.207	ANSI C63.4:2003	Class B	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Bandwidth Measurement	FCC 47CFR 15.231	ANSI C63.4:2003	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Note: N/A - Not Applicable

### **3.0 Test Methodology**

#### **3.1 Radiated Emission**

The sample was placed 0.8m above the ground plane on a standard emission test site \*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

\*On a standard emission test site with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 90656.

#### **3.2 Field Strength Calculation**

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$$FS = R + \text{System Factor}$$

$$\text{System Factor} = AF + CF + FA - PA$$

Where FS = Net Field Strength in dBuV/m at 3 meters.

R = Reading of Spectrum Analyzer / Test Receiver in dBuV.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

#### **3.3 Conducted Emissions**

The EUT was placed on a non-metallic table 0.8m above the horizontal metal reference place and 0.4m from a vertical ground plane which is connected to the horizontal metal ground plane. Meanwhile, the AC main of EUT was connected to the distance of 0.8m line impedance stabilization network (LISN) during measurement.

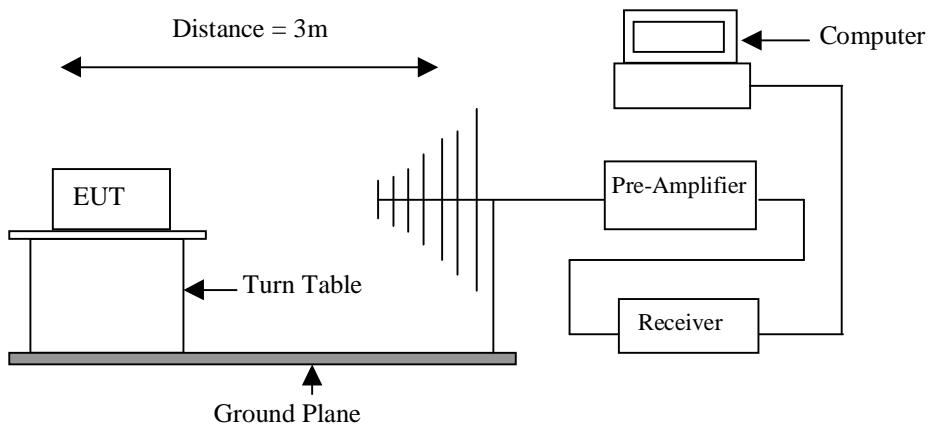
Initial measurements were performed in quasi-peak and average detection modes by the test receiver, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

## **4.0 Test Results**

### **4.1 Radiated Emission of Fundamental Frequency**

Test Requirement: FCC part 15 section 15.231( e )  
Test Method: ANSI C63.4:2003  
Test Date: 2007-11-16  
Mode of Operation: Transmitting mode.  
Detector Function: Peak  
Measurement BW: 100 kHz

#### **Test Setup:**



**Results: PASS**

Radiated Emissions									
Value	Emissions Frequency MHz	E-Field Polarity	Reading dB $\mu$ V/m	System Factor dB	Field Strength at 3m dB $\mu$ V/m	Average Factor dB	Net Field Strength at 3m dB $\mu$ V/m	Limit dB $\mu$ V/m	Delta to Limit dB $\mu$ V/m
PK	433.990	V	59.27	18.23	77.50	0.00	77.50	92.86	-15.36
AV	433.990	V	59.27	18.23	77.50	-7.07	70.43	72.86	-2.43
PK	433.990	H	54.97	18.23	73.20	0.00	73.20	92.86	-19.66
AV	433.990	H	54.97	18.23	73.20	-7.07	66.13	72.86	-6.73

Remark:

- Calculated measurement uncertainty:  $\pm 5.0$ dB
- Refer to section 4.4 for average factor calculation.

**Limits for Fundamental Frequency: [ Section 15.231( e ) ]:**

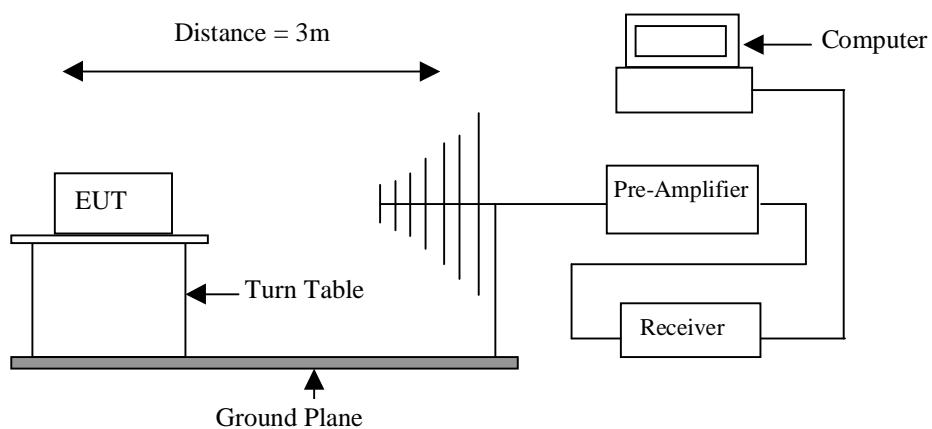
Fundamental Frequency [MHz]	Field Strength of Fundamental [ $\mu$ V/m]	Field Strength of Fundamental [dB $\mu$ V/m]
433.990	4399.847	72.86

Compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR peak detector.

## 4.2 Spurious Radiated Emission

Test Requirement: FCC part 15 section 15.231( e )  
Test Method: ANSI C63.4:2003  
Test Date: 2007-11-16  
Mode of Operation: Transmitting mode.  
Detector Function: Peak  
Measurement BW: 100 kHz

### Test Setup:



**Results: PASS**

Radiated Emissions									
Value	Emissions Frequency	E-Field Polarity	Reading	System Factor	Field strength at 3m	Average Factor	Net Field Strength at 3m	Limit	Delta to Limit
	MHz		dB $\mu$ V/m	dB	dB $\mu$ V/m	dB	dB $\mu$ V/m	dB $\mu$ V/m	dB $\mu$ V/m
AV	*1302.00	V	45.32	-8.41	36.91	-7.07	29.84	54.00	-24.16
AV	1736.00	V	48.40	-6.39	42.01	-7.07	34.94	52.86	-17.92
AV	2170.25	V	45.49	-4.29	41.20	-7.07	34.13	52.86	-18.73
AV	3038.25	V	44.62	-1.73	42.89	-7.07	35.82	52.86	-17.04
AV	*3905.90	V	46.82	1.38	48.20	-7.07	41.13	54.00	-12.87
AV	2169.75	H	43.64	-4.29	39.35	-7.07	32.28	52.86	-20.58
AV	*3906.00	H	41.88	1.38	43.26	-7.07	36.19	54.00	-17.81

Note: No further spurious emissions found between 30 MHz and lowest internal used/generated frequency.

Remark ( \* ) : Radiated emissions which fall in the restricted bands as defined in Section 15.205(a).

Remark:

- Calculated measurement uncertainty:  $\pm 5.0$ dB.
- Refer to section 4.4 for average factor calculation.

**Limits for Radiated Emission [ Section 15.231( e ) ]:**

Fundamental Frequency [MHz]	Field Strength of Spurious Emission [ $\mu$ V/m]	Field Strength of Spurious Emission [dB $\mu$ V/m]
433.990	439.984	52.86

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 permits a higher field strength.

**Limit for Radiated Emission Falling in Restricted Bands [ Section 15.209 ]:**

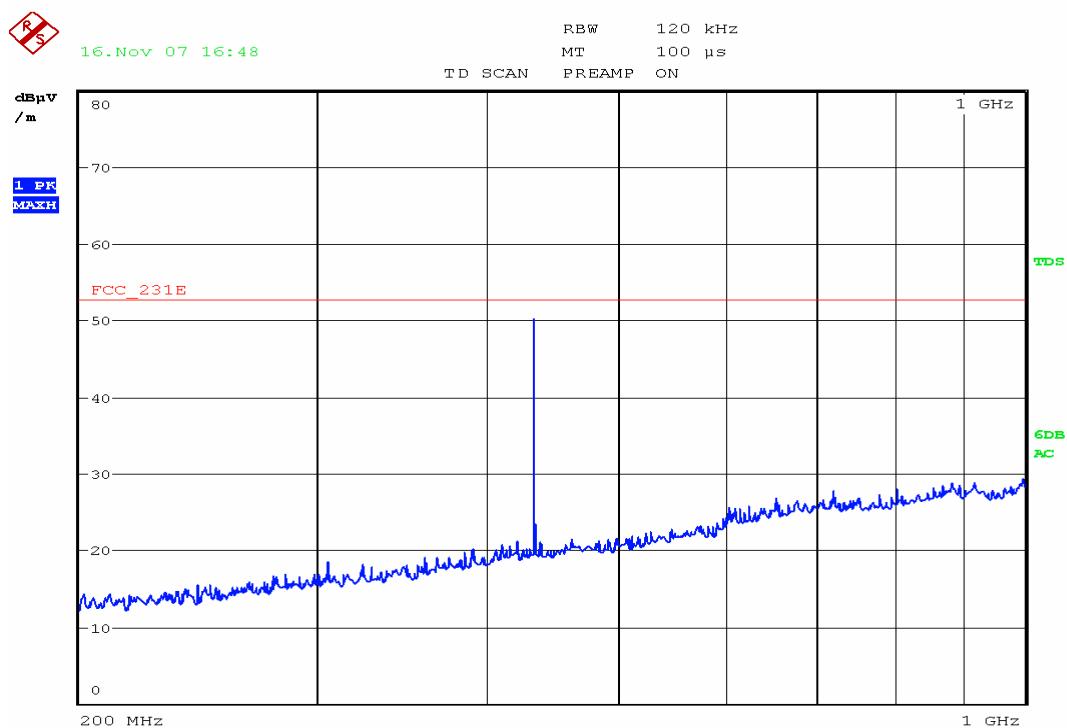
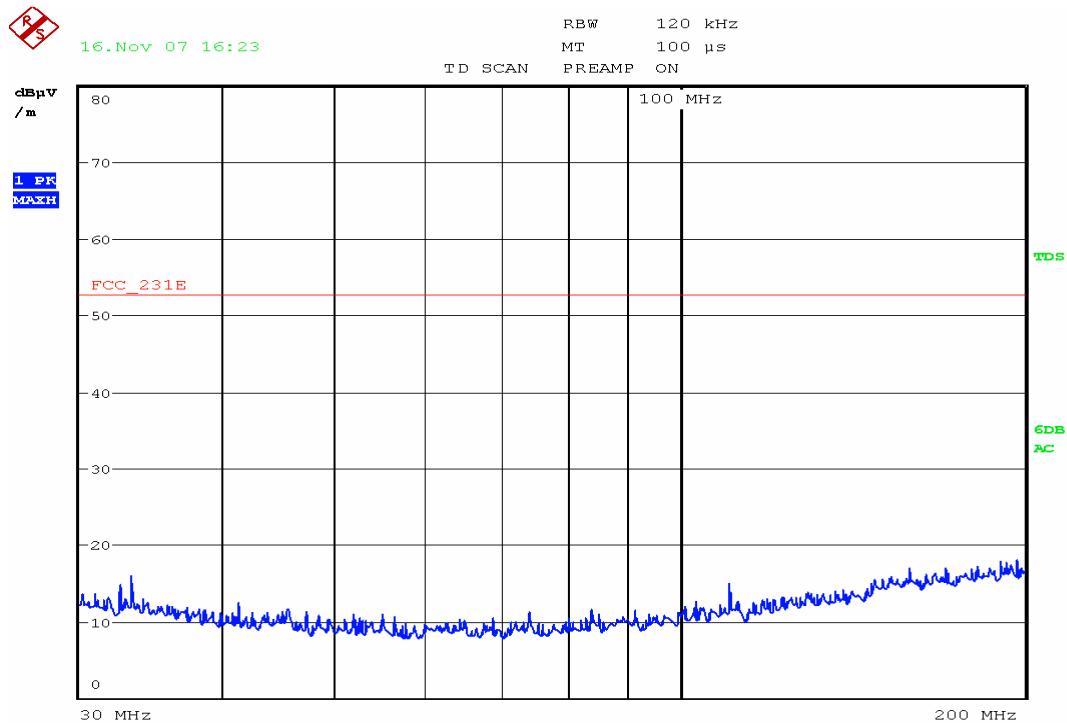
Frequency (MHz)	Field Strength [ $\mu$ V/m]	Field Strength [dB $\mu$ V/m]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-2500	500	54.0

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.

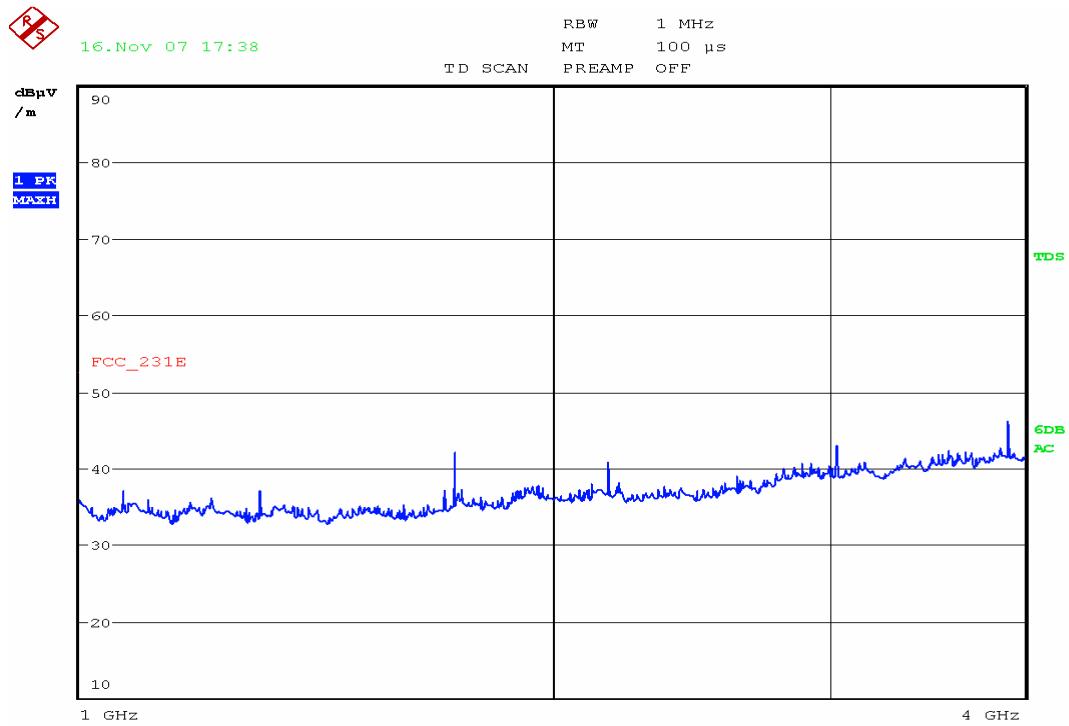
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

- Result data graph is attached at the next pages for reference.

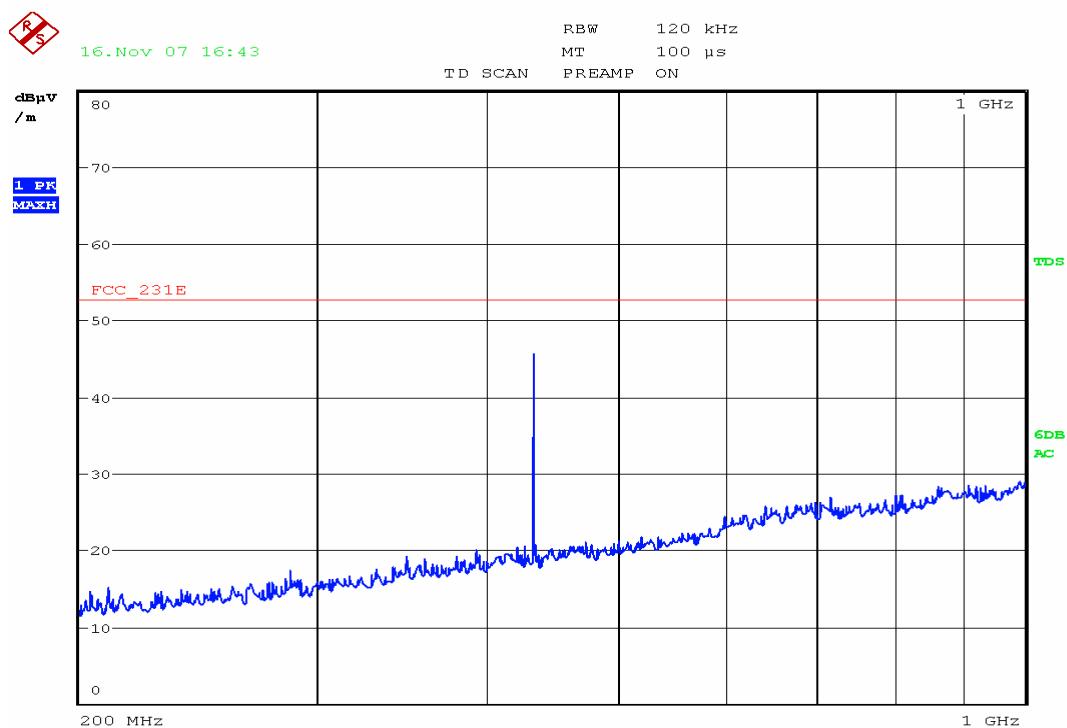
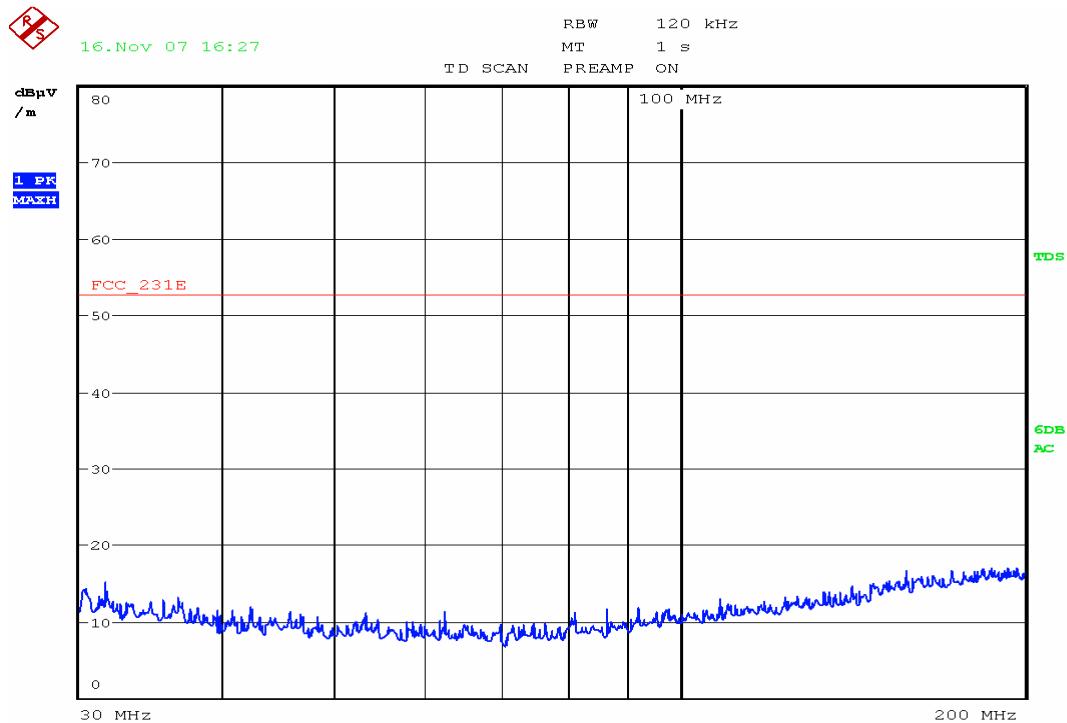
### Vertical



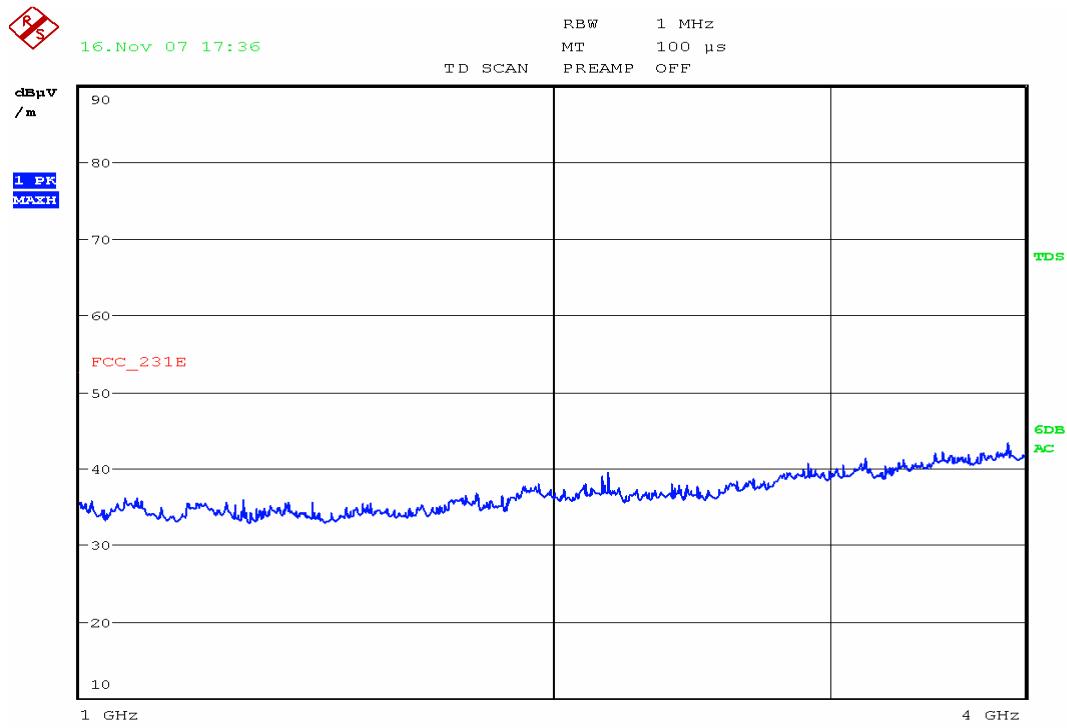
**Vertical**



## Horizontal



## Horizontal



#### 4.3 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement: FCC part 15 Section 15.207 Class B  
Test Method: ANSI C63.4:2003  
Test Date: ---  
Mode of Operation: ---

**Results:** N/A

**Note :** This testing is not applicable for the battery operated EUT.

#### Limits for Conducted Emission [ Section 15.207]:

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

\* Decreases with the logarithm of the frequency.

Remarks:

Calculated measurement uncertainty:  $\pm 2.8$ dB

#### 4.4 Bandwidth Measurement

Test Requirement: FCC part 15 section 15.231 (c)  
Test Method: ANSI C63.4:2003  
Test Date: 2007-11-15  
Mode of Operation: Transmitting mode.  
Detector Function: Peak

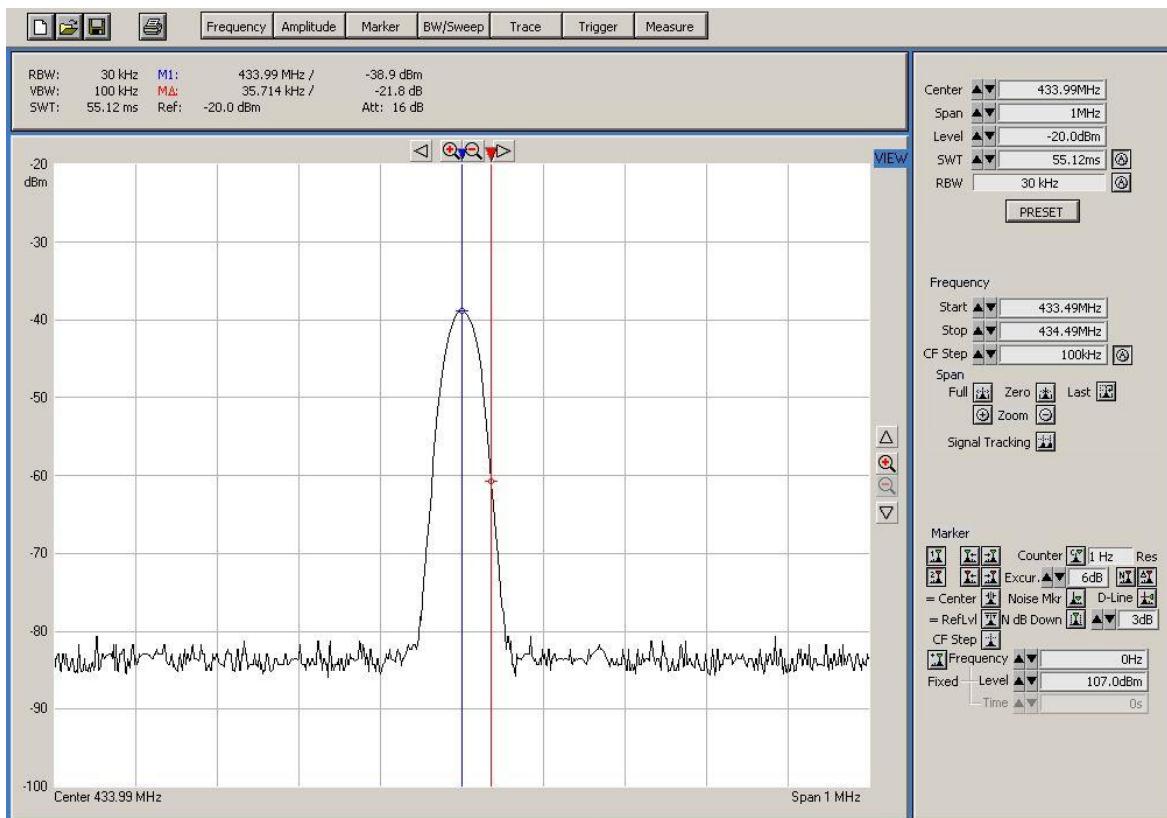
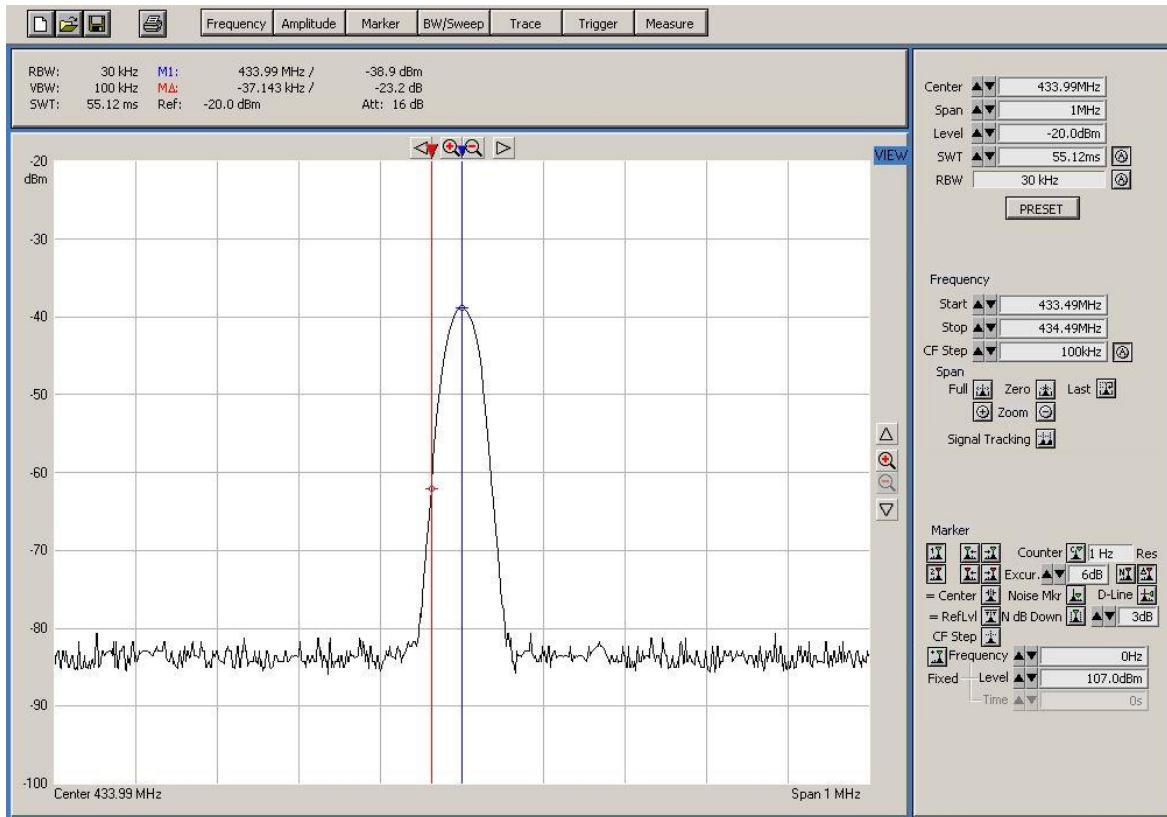
#### Results: PASS

Refer to the data graph, the 20dB points at lower edge and at higher edge are 433.953MHz and 434.026MHz, so that is 37.143 kHz and 35.714 kHz respectively apart from the centre modulated carrier, the bandwidth of the emission is 0.017% of the centre frequency. Therefore, the EUT meets the requirement of section 15.231(c).

#### Limit for Bandwidth [ Section 15.231 (c) ]

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

**Test Result:** Result data graph is shown at the next pages for reference.



#### 4.5 Average Factor

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

When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the specification for output field strengths in accordance with the FCC rules specify measurements with an average detector.

The duty cycle is the total signal on time per one transmission.

The duration of one cycle = 990ms

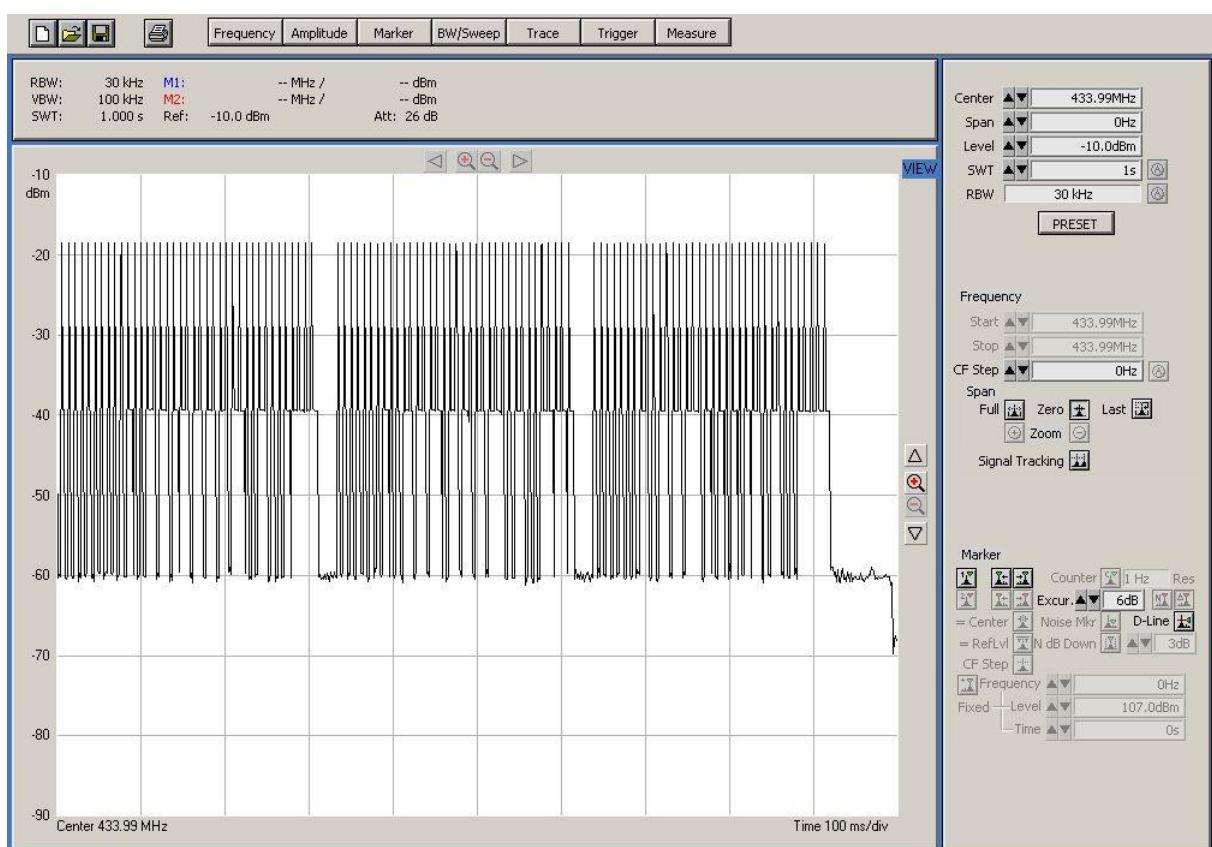
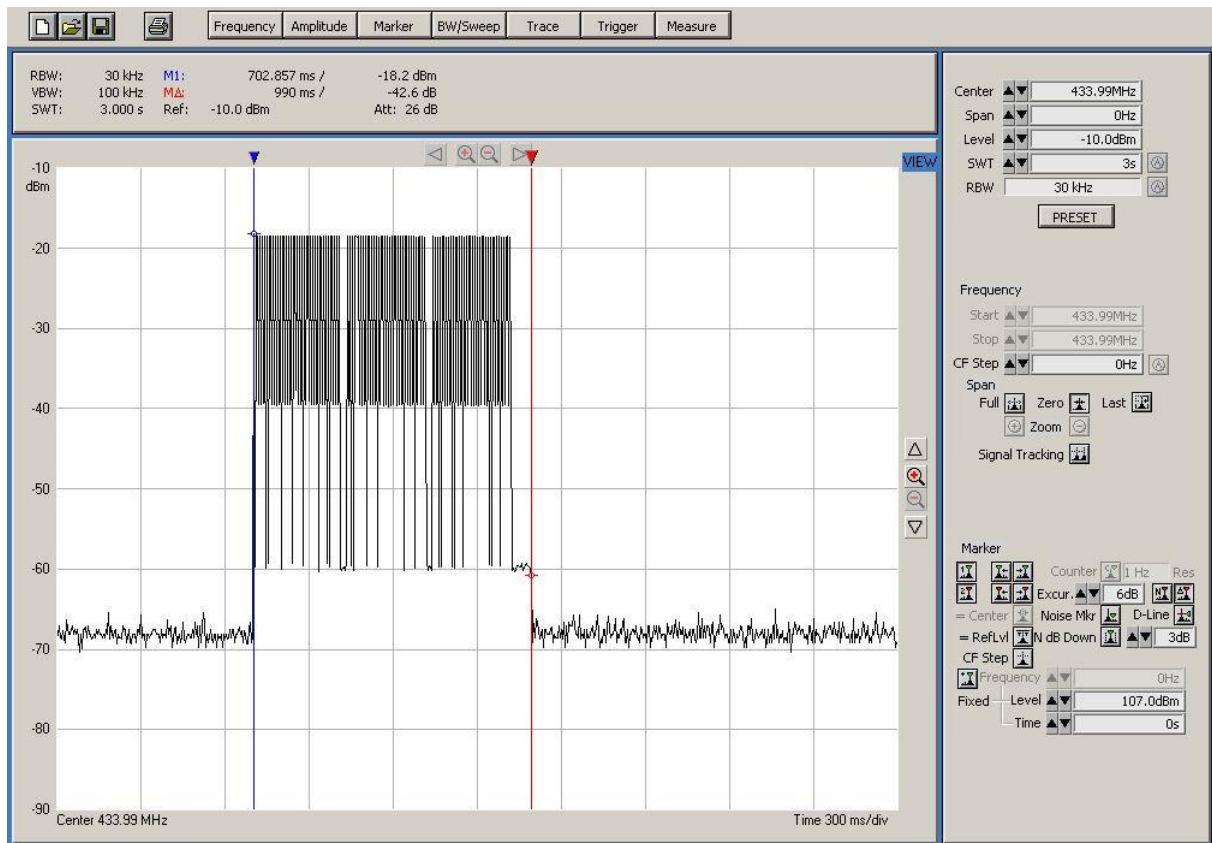
The duration of part of one cycle = 279.771ms

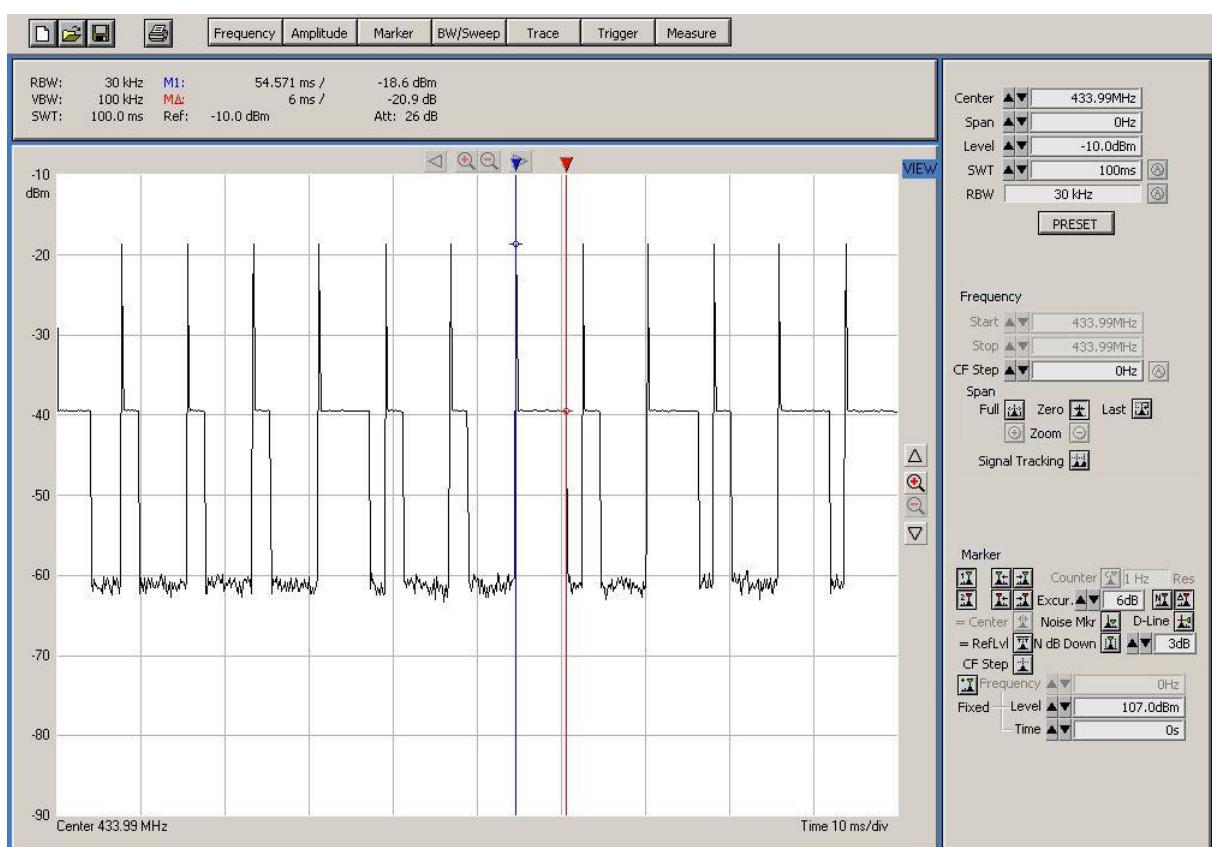
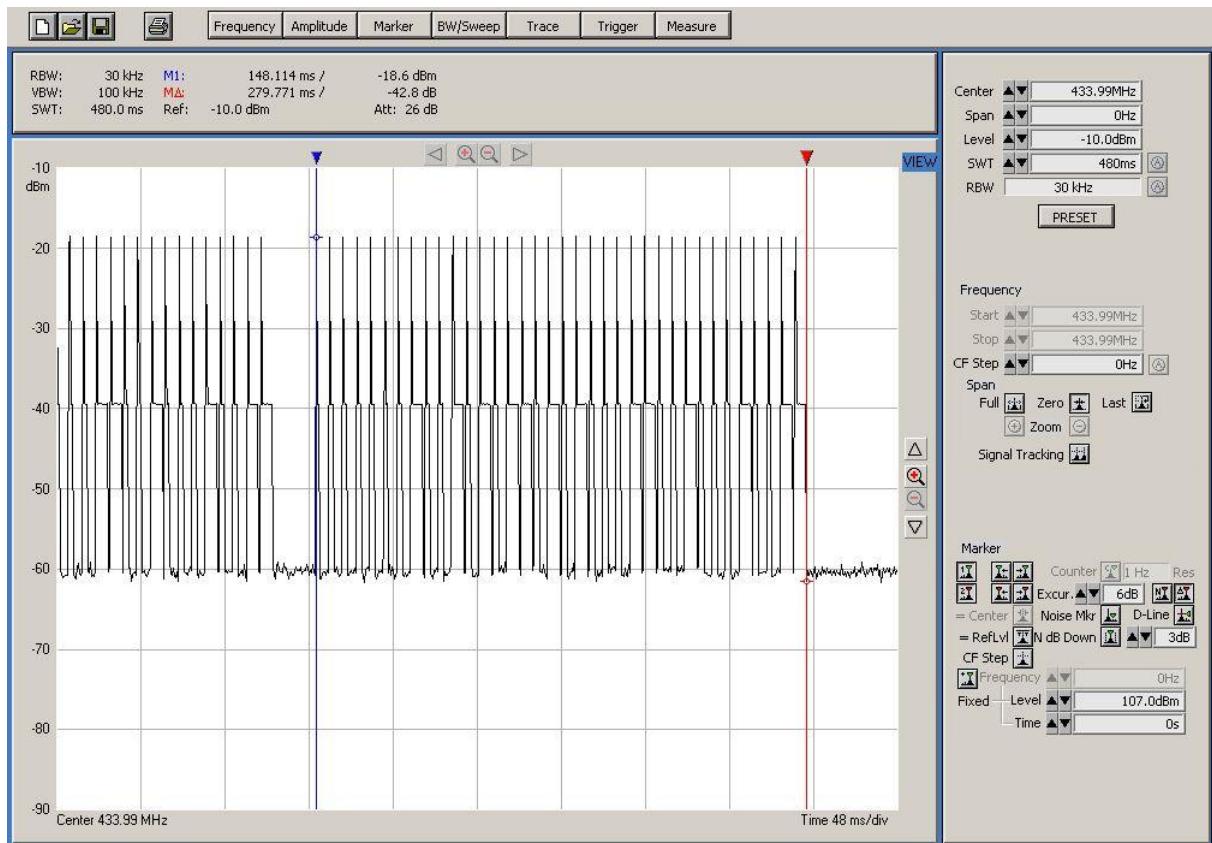
Effective period of part of the cycle =  $(13 \times 6\text{ms} + 23 \times 2\text{ms})$

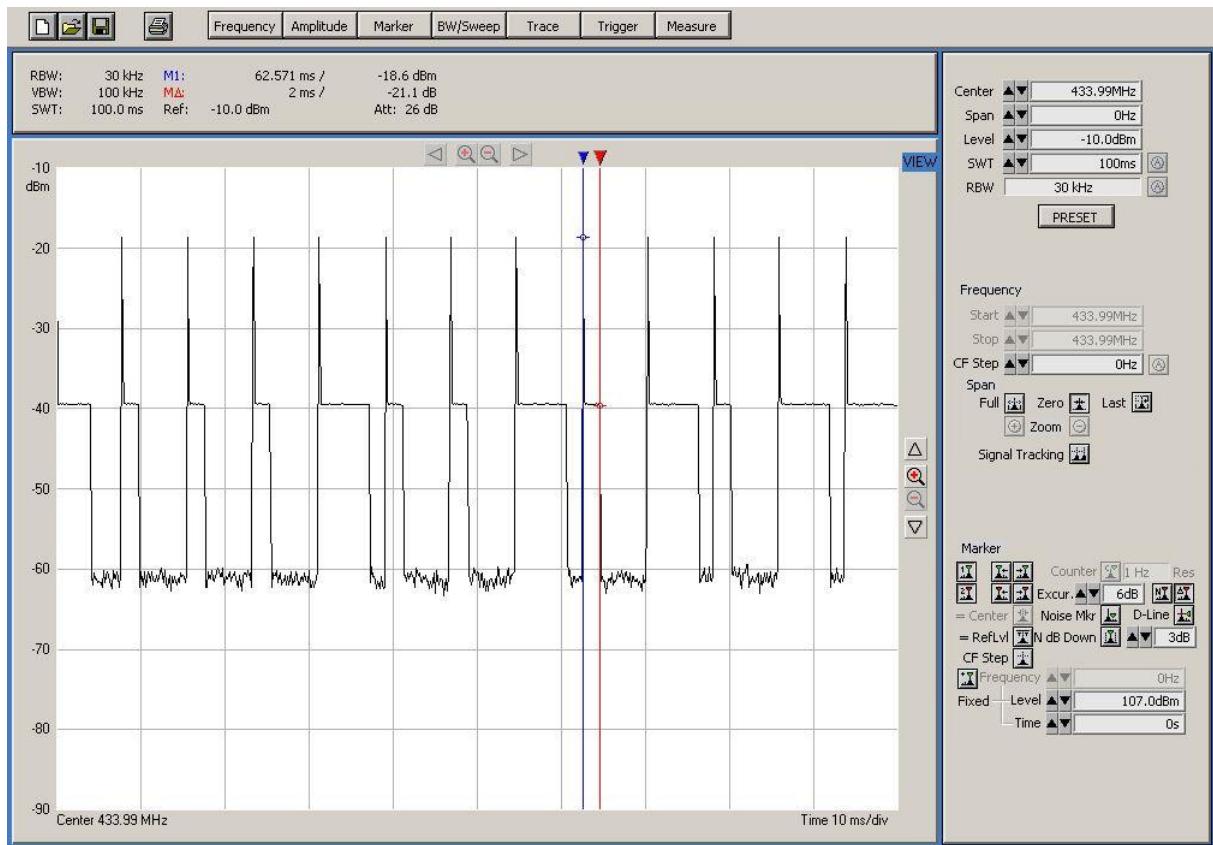
Duty cycle =  $124\text{ms} / 279.771\text{ms}$   
= 0.4432

Therefore, the averaging factor is  $20 \log ( 0.4432 )$   
= -7.07dB

Refer to the following graph for the detail.







## **5.0 List of Measurement Equipment**

### **Radiated Emission and Bandwidth Measurement**

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	CAL DUE
EMC209	Semi-anechoic Chamber	Frankonia	N/A	N/A	28-Mar-07	28-Mar-08
EMC017	Test Receiver	R & S	ESVS30	842807/009	06-Aug-07	06-Aug-08
EMC040	Bi-conical Antenna	R & S	HK116	841489/016	08-Feb-06	08-Feb-08
EMC045	Log Periodic Antenna	R & S	HL223	841516/020	03-Feb-06	03-Feb-08
EMC184	Horn Antenna	EMCO	3115	9002-3347	02-Feb-06	02-Feb-08
EMC138	Loop Antenna	Chase	LLA6142	1019	07-Jun-07	07-Jun-08
EMC406	Coaxial Cable 50ohm	Rosenberger	RTK081-05S-10m	LA2-001-10M/002	15-May-07	15-May-08
EMC556	Spectrum Analyser	R & S	FSP 30	100416	08-Jun-07	08-Jun-08
60/2-74-05-042	Spectrum Analyser	R & S	FS 300	101335	04-Apr-07	04-Apr-09

Remarks:

CM      Corrective Maintenance  
N/A     Not Applicable or Not Available  
TBD     To Be Determined