



## **TEST REPORT**

**Date:** 2011-04-20

**Report No.:** 60.870.11.007.01F

**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: 433MHz RF Cooking Thermometer  
(Transmitter)  
Brand name: Nil  
Model no.: 673A  
FCCID: PEQ673A900411

**Date Samples Received:** 2011-03-24

**Date Tested:** 2011-03-24 to 2011-04-19

**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:

Approved by:-

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Prudence Poon  
Technical Manager  
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Project Manager  
Wireless & Telecom Department

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**1.0    General Details**

**1.1    Test Laboratory**

Neutron Engineering Inc.  
No 3, Jinshagang 1<sup>st</sup> Road, ShiXia, Dalang Town, Dong  
Guan, China.  
Registration Number: 319330

Tested by:

  
Ares Liu

**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:	433MHz RF Cooking Thermometer (Transmitter)
Manufacturer:	Electronics Tomorrow Ltd.
Brand Name:	Nil
Model Number:	673A
FCCID:	PEQ673A900411
Rating:	DC 3.0V ( 2 x “ AAA” size batteries )
Antenna Type:	Integral
Operated Frequency:	433.970MHz
No. of Channel:	1
Accessories and Auxiliary Equipment:	None
EUT Exercising Software:	None

#### **General Operation of EUT**

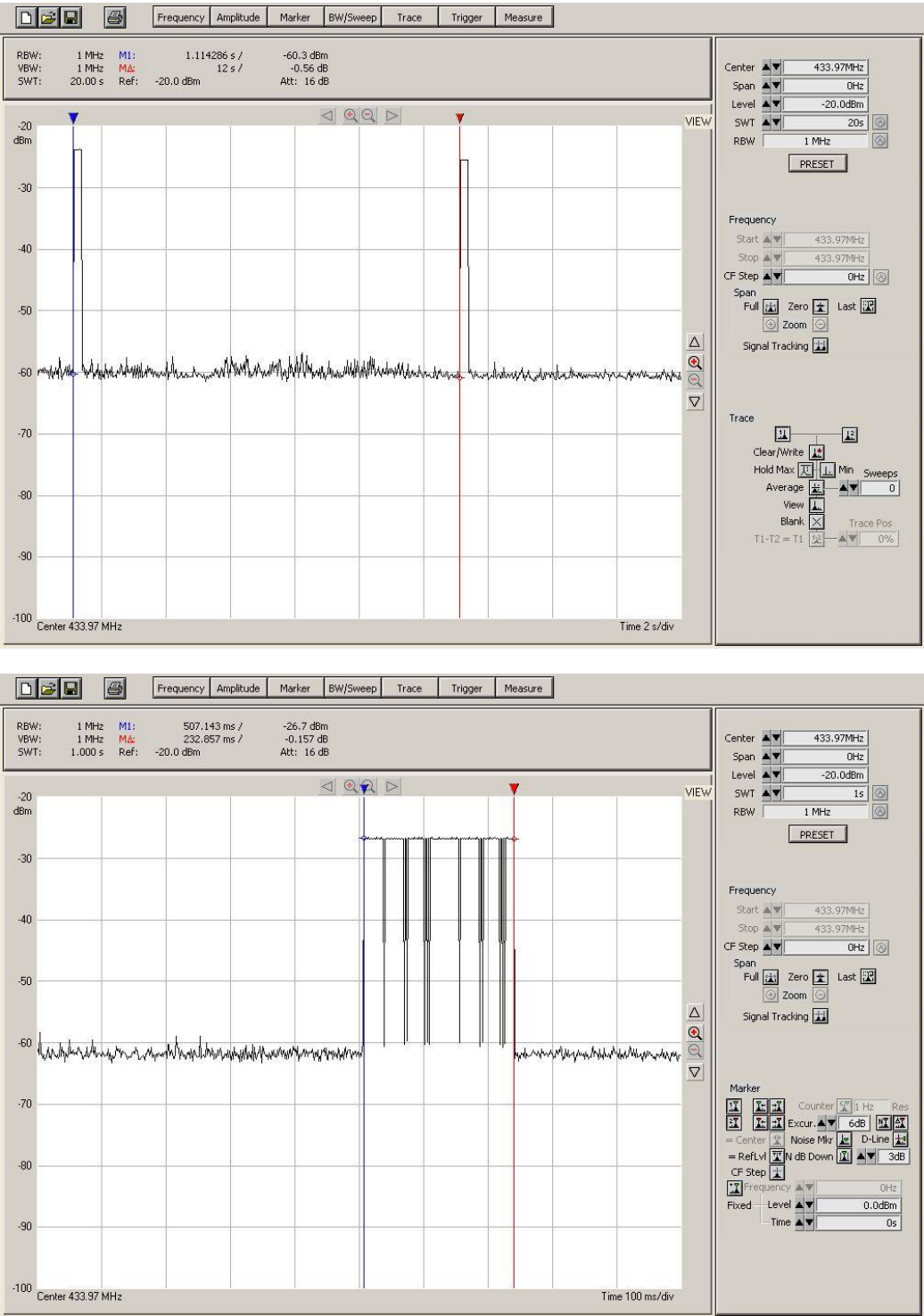
The Equipment Under Test (EUT) is a transmitter operated at 433.970MHz to detect the temperature of the food and transmit this information to its associated receiver.

#### **Periodic Operation of EUT**

The transmitter transmits signal for every 12 seconds that mean the silence period must not less than 12 seconds. Each data packet is continuously transmitting for approximate 232.8 ms 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: 2009 and ANSI C63.4: 2003 for FCC Verification.

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

<b>EMISSION Results Summary</b>						
Test Condition	Test Requirement	Test Method	Class / Severity	Test Result		
				Pass	Failed	N/A
Radiated Emission of Carrier Frequency	FCC 47CFR 15.231	ANSI C63.4:2003	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Emission, 30MHz to 4.5GHz	FCC 47CFR 15.231	ANSI C63.4:2003	Class B	<input checked="" type="checkbox"/>	<input 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 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"/>	<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: 319330.

#### **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:

$$\begin{aligned} \text{FS} &= \text{R} + \text{System Factor} \\ \text{System Factor} &= \text{AF} + \text{CF} + \text{FA} - \text{PA} \end{aligned}$$

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.

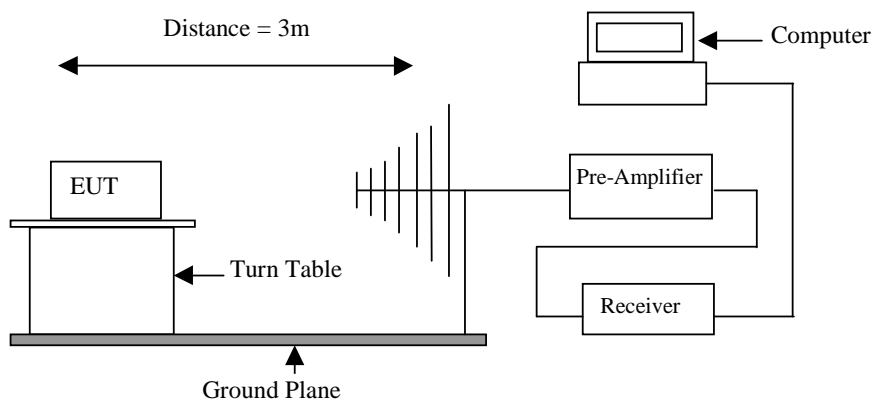
Initial measurements were performed in quasi-peak and average detection modes by the test receiver, any emissions recorded within 30dB of the relevant limit lines were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

#### **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:	2011-04-18
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	433.970	V	76.49	-8.40	68.09	0.00	68.09	92.87	-24.78
AV	433.970	V	76.49	-8.40	68.09	-3.41	64.68	72.87	-8.19
PK	433.970	H	83.40	-8.40	75.00	0.00	75.00	92.87	-17.87
AV	433.970	H	83.40	-8.40	75.00	-3.41	71.59	72.87	-1.28

Remark:

-Calculated measurement uncertainty:  $\pm 5.0$ dB

-Refer to section 4.5 for average factor calculation.

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

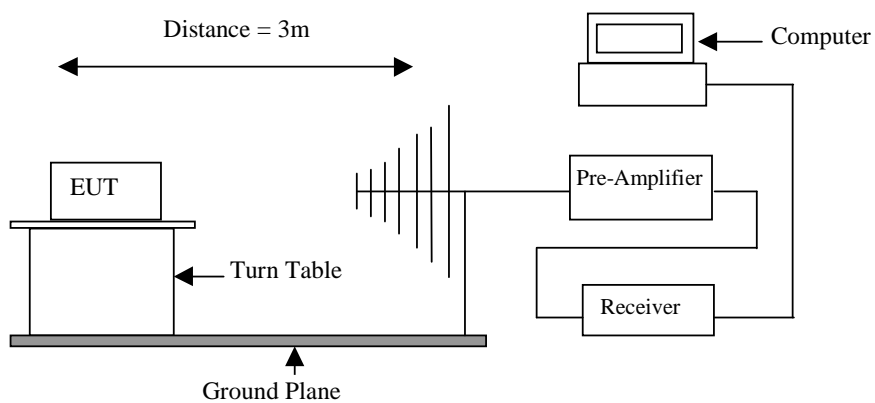
Fundamental Frequency [MHz]	Field Strength of Fundamental [ $\mu$ V/m]	Field Strength of Fundamental [dB $\mu$ V/m]
433.970	4399.514	72.87

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:	2011-04-18
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	868.00	V	48.84	-0.58	48.26	-3.41	44.85	52.87	-8.02
AV	*1302.12	V	64.39	-7.47	56.92	-3.41	53.51	54.00	-0.49
AV	1735.96	V	50.36	-3.82	46.54	-3.41	43.13	52.87	-9.74
AV	2107.06	V	48.57	-1.16	47.41	-3.41	44.00	52.87	-8.87
AV	2603.96	H	45.78	-1.27	44.51	-3.41	41.10	52.87	-11.77
AV	868.03	H	49.61	-0.58	49.03	-3.41	45.62	52.87	-7.25
AV	*1302.14	H	58.89	-7.47	51.42	-3.41	48.01	54.00	-5.99
AV	1736.28	H	47.25	-3.82	43.43	-3.41	40.02	52.87	-12.85
AV	2170.00	H	46.81	-1.16	45.65	-3.41	42.24	52.87	-10.63
AV	2604.08	H	54.03	-1.27	52.76	-3.41	49.35	52.87	-3.52

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 4.5 for average factor calculation.

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

Fundamental Frequency [MHz]	Field Strength of Spurious Emission [ $\mu\text{V/m}$ ]	Field Strength of Spurious Emission [dB $\mu\text{V/m}$ ]
433.970	439.951	52.87

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 ]:**

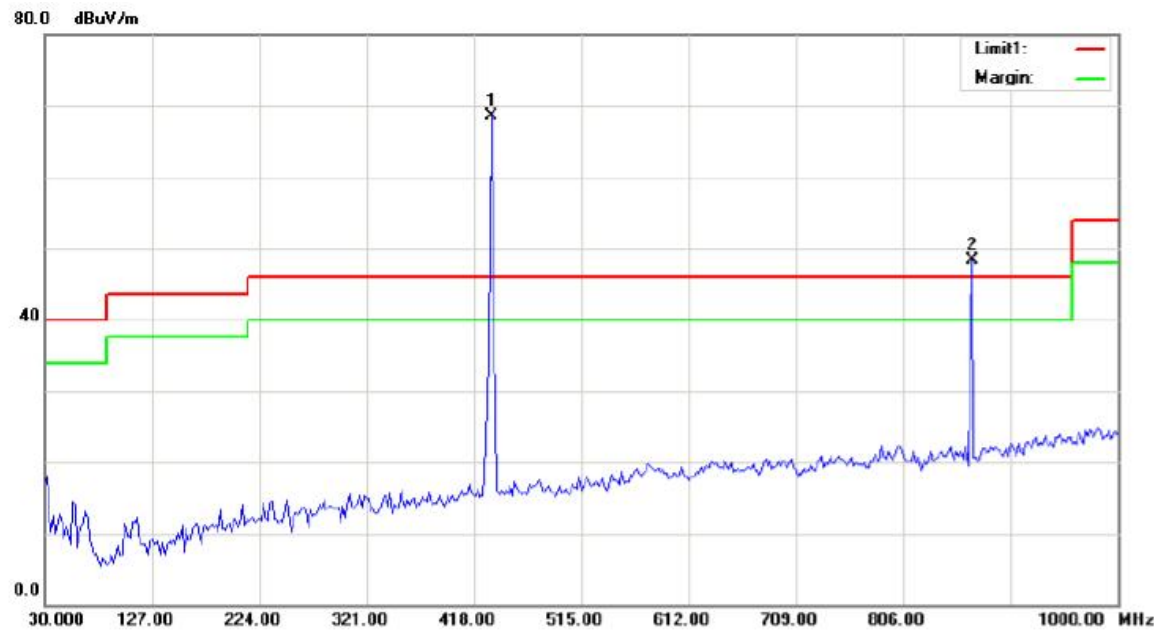
Frequency (MHz)	Field Strength [ $\mu\text{V/m}$ ]	Field Strength [dB $\mu\text{V/m}$ ]
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
Above 960	500	54.0

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.

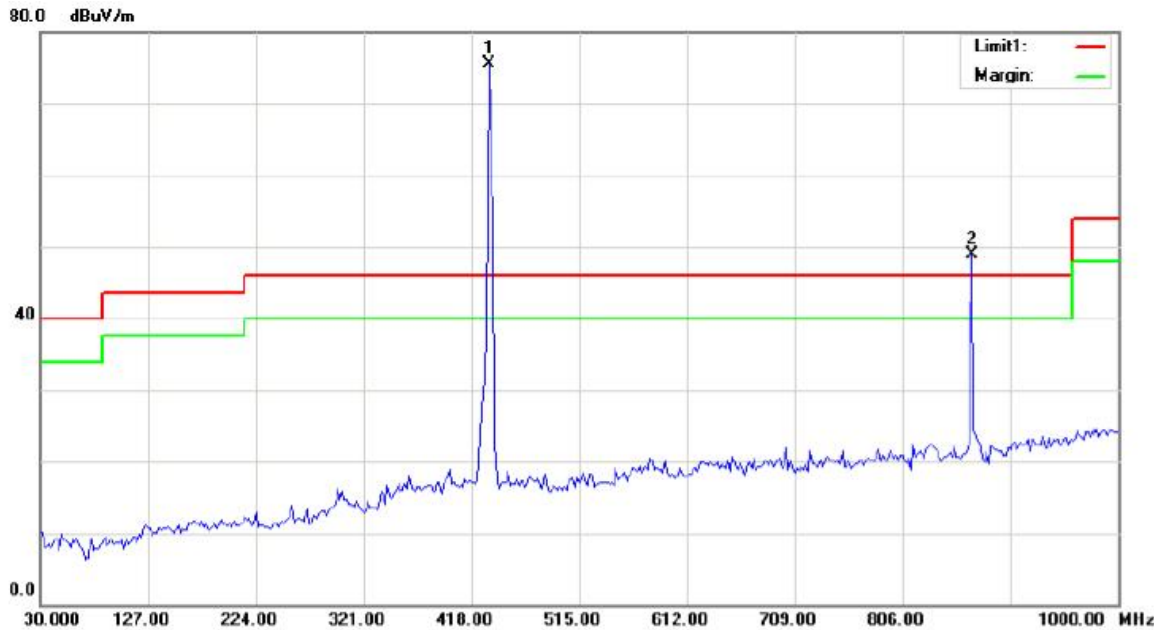
The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

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

Vertical



Horizontal



Remark: Only background noise was measured from 1GHz-4.5GHz without the operation frequency related harmonic.

**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:	2011-04-06
Mode of Operation:	Transmitting mode.
Detector Function:	Peak

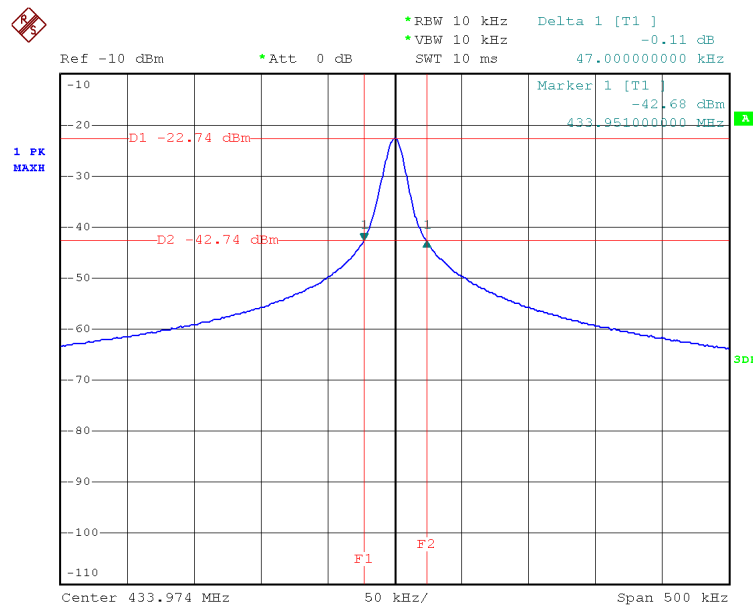
#### Results: PASS

Refer to the data graph, the 20dB points Bandwidth 47kHz so that from the centre modulated carrier, the bandwidth of the emission is 0.011% 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 as below for reference.



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#### **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 = 232.8ms

Effective period of the cycle per 100ms =  $(17 \times 3\text{ms} + 6 \times 1\text{ms} + 10.5 \times 1\text{ms}) / 100\text{ms}$

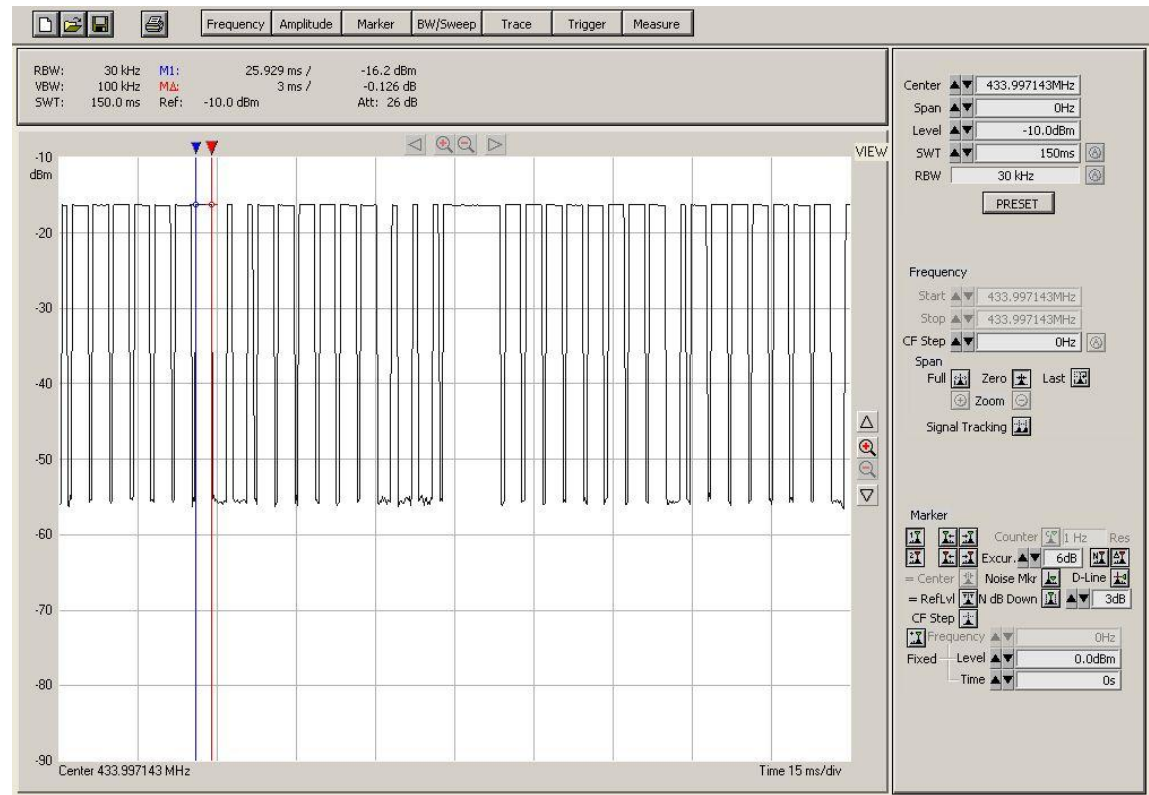
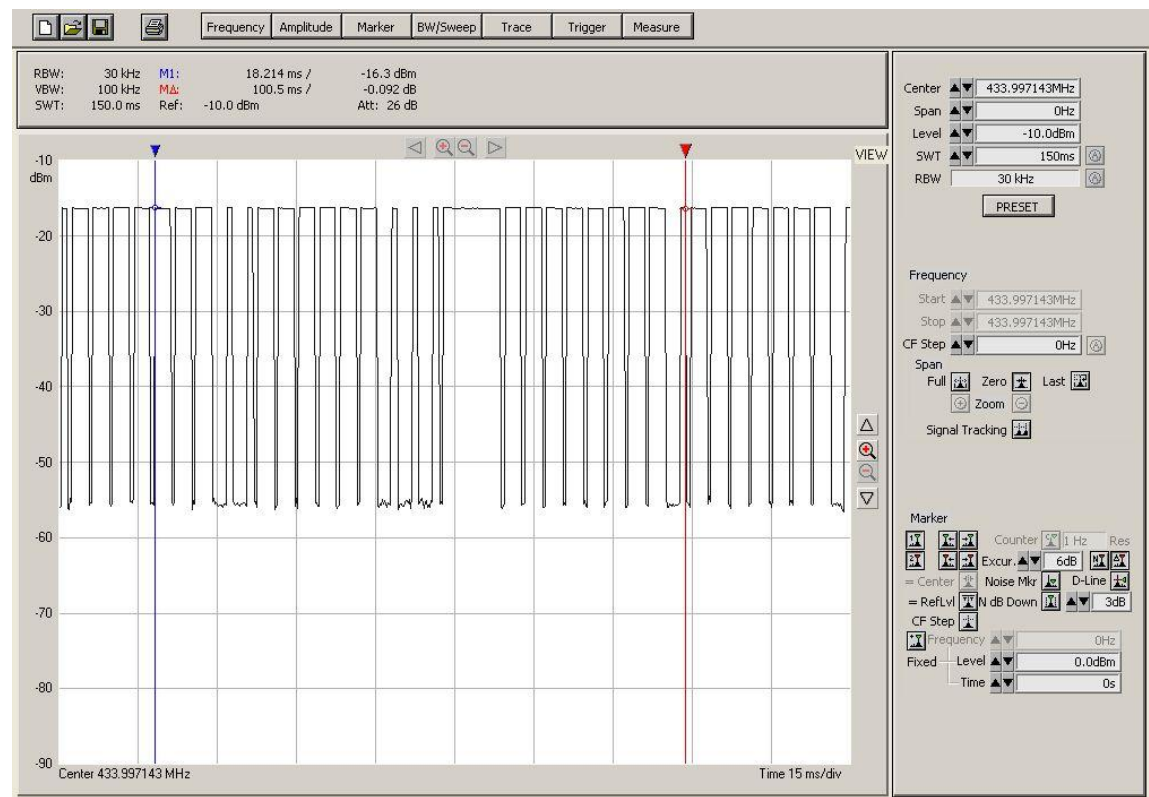
= 67.5ms / 100ms

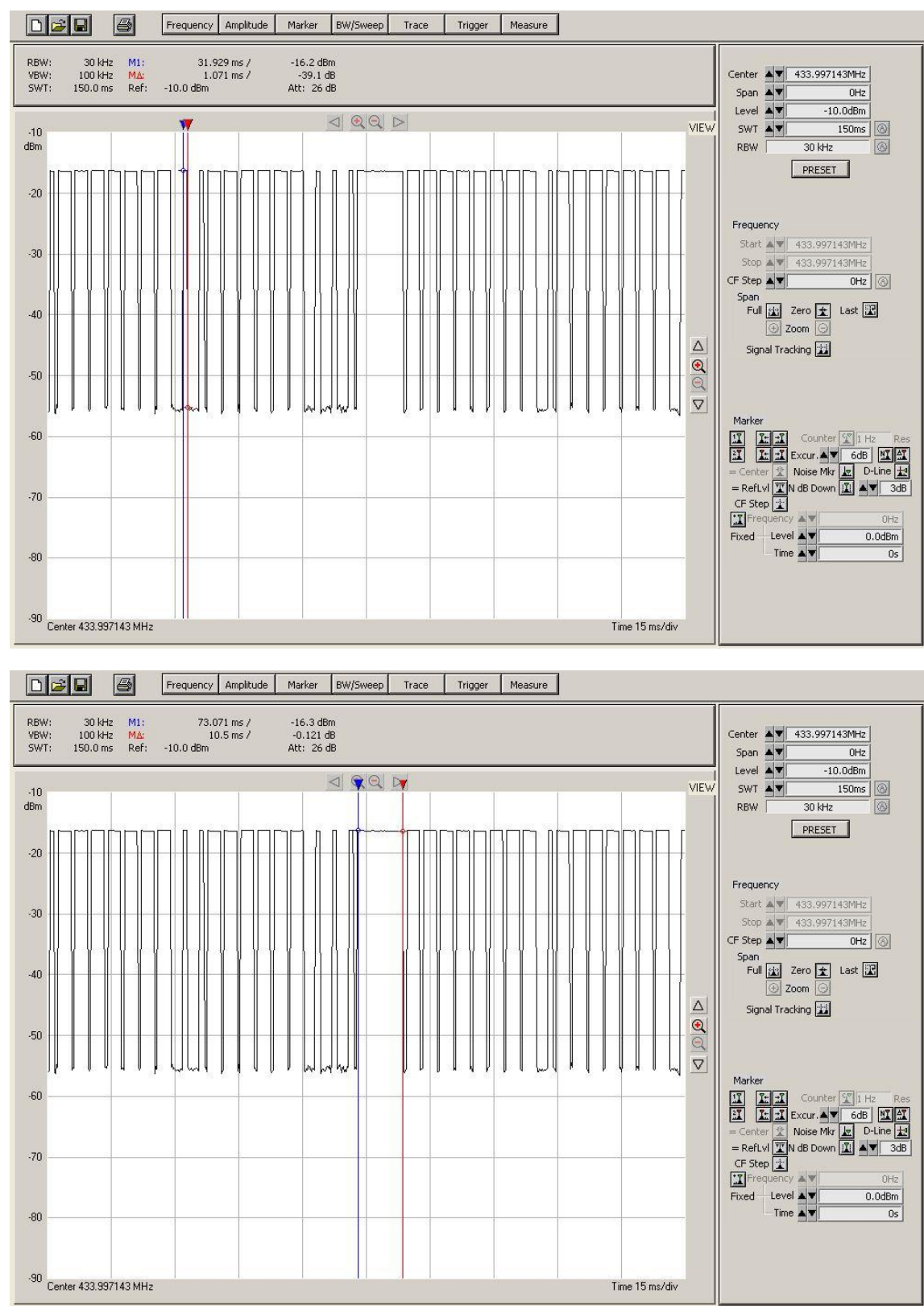
Duty cycle = 0.675

Therefore, the averaging factor is  $20 \log (0.675)$   
= -3.41dB

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







**5.0 List of Measurement Equipment**

**Radiated Emission and Bandwidth Emissions**

Description	Manufacturer	Model no.	Serial no.	CAL due
Test Receiver	R & S	ESCI	100382	26 May 2011
Spectrum Analyzer	Agilent	E4408B	US39240143	26 Nov 2011
Spectrum Analyzer	R & S	FS300	101335	21 Jul 2011
Antenna	Schwarbeck	VULB9106	9160-3232	08 Jun 2011
Antenna	ETS	3115	00075789	27 May 2011
Amplifier	Agilent	8449B	3008A02274	26 May 2011
Test Cable	Huber+Suhner	SUCOFLEX_8	313794/4	12 Apr 2012
Controller	CT	SC100	N/A	N/A

Remarks:

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