MEASUREMENT/TECHNICAL REPORT

APPLICTNT: Fego Precision Industrial Co., Ltd.

MODEL NO.: 3430TX;3930TX

FCC ID: M8CBRC7000

This report concerns (check one) : **Original Grant** ✓
Class II Change _____

Equipment type: 314.768 MHz Remote Controller (Transmitter)

Deferred grant requested per 47CFR 0.457(d)(1)(ii)?
Yes _____ No ✓ If yes, defer until: _____ (date)
We, the undersigned, agree to notify the Commission by (date) _____ / _____ / _____ of the intended date of announce meant of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No ✓
If no, assumed Part 15, Subpart B for unintentional radiator the new 47 CFR (10-1-90 Edition) provision.

Report Prepared

by Testing House : Neutron Engineering Inc.

for Company :

Name Fego Precision Industrial Co., Ltd.

Address No 947 Lin-Sen Rd. Taichung Hsien, Taiwan

Applicant Signature :

Bruce Chang

Bruce Chang / Director

CERTIFICATION

We hereby certify that:

The test data , data evaluation , test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (1992) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.

Prepared by :	Lydia Chiang	Lydia Chiang
Reviewed by :	Vincent Su	Vincent Su
Approved by :	George Yao	George Yao
Issued Date :	May 17, 2002	
Report No. :	NEI-FCCB-02112	
Company Stamp :		NEUTRON ENGINEERING INC.

NEUTRON ENGINEERING INC.

No. 132-1, Lane 329, Sec. 2, Palain Rd.,
Shijr Jen, Taipei, Taiwan
TEL: (02) 2646-5426 FAX : (02) 2646-6815

Table of Contents

1. GENERAL INFORMATION

1-1. Product Description

The Fego Precision Industrial Co., Ltd. Model: 3430TX;3930TX (referred to as the EUT in this report) is a wireless transmitter of Heater Fan Remote Control.
A major technical descriptions of EUT is described as following:

A). Fundamental Frequency: 315 MHz

B). Modulation : Pulse Modulation

C). Antenna Designation: Non-User Replaceable (Fixed)

D). Power Supply: DC 4.5V, Battery Operated.

E). Transmitting Time: Periodic < 5 seconds by manual

F) Associated Receiver: FCC Doc

1-2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID : M8CBRC7000 filing to comply with Section 15.231 of the FCC Part 15, Subpart C Rules. The composite system(receiver) in compliance with Subpart B is authorized under a DoC procedure.

1-3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance 3 meters.

1-4. Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the address of No. 132-1, Lane 329, Sec. 2, Palain Road, Shijr Jen, Taipei, Taiwan, R.O.C. of NEUTRON ENGINEERING INC. This site has been fully described in report dated Jun. 4, 1999 Submitted to your office, and accepted in a letter dated Sep. 02, 1999 (Reg. No. 95335).

3. System Test Configuration

3-1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

3-2. EUT Exercise

The EUT (Transmitter) was operated continuously in its engineering test mode for the purpose of the measurements.

3-3. Test Procedure

3-3-1. Conducted Emissions (Not applicable in this report)

3-3-2. Radiated Emissions

The EUT is a placed on as turn table which is 1.0m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-1992.

Radiated emissions from the EUT measured in the **frequency range between 30 MHz and 1000MHz** were made with a **Spectrum Analyzer, HP Model 8568B,** using **CISPR Quasi-Peak detector mode** and appropriate broadband linearly polarized antenna or **Peak detector mode** and a **duty cycle correction factor** corrected for the average value of the emission.

Radiated emissions measurement for **frequency above 1000MHz** were made with a **Test Receiver, R&S model ESMI**, plus a **Pre-amplifier R&S model ESMI-Z7** , and a **Horn Antenna, EMCO model 3115** to measure its **Peak Detector Mode** level and correct it with the duty cycle correction factor.

3-4. Limitation

(1) Conducted Emission (Not applicable in this report)

(2) Radiated Emission

According to 15.231(b), the field strength of emissions from Intentional Radiators operated under this section shall not exceed the following:

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Spurious	
(MHz)	(dBuV/m)	(uV/m)	(dBuV/m)	(uV/m)
40.66 - 40.70	67.04	2,250	47.04	225
70 - 130	61.94	1,250	41.94	125
130 - 174	* 61.94 - 71.48	* 1,250 -3,750	* 41.94 - 51.48	* 125 - 375
174 - 260	71.48	3,750	51.48	375
260 - 470	* 71.48 - 81.94	* 3,750 - 12,500	* 51.48 - 61.94	* 375 - 1,250
above 470	81.94	12,500	61.94	1,250

* Linear Interpolations.

Remark: 1. Emission level in dBuV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. Fundamental frequency shall not be located within the Restricted Bands specified in provision of ξ 15.205
4. If spurious frequency which falls within the Restricted Bands specified in provision of ξ15.205, then the general radiated emission limits in ξ 15.209 apply.

3-5. Special Accessories

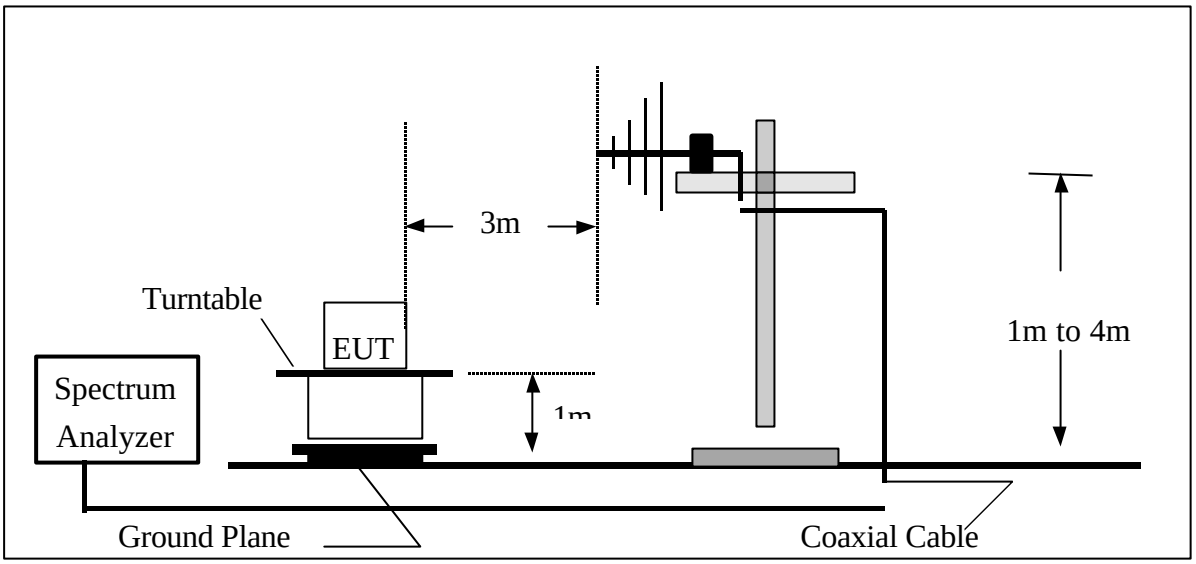
Not available for this EUT intended for grant.

3-6. Equipment Modifications

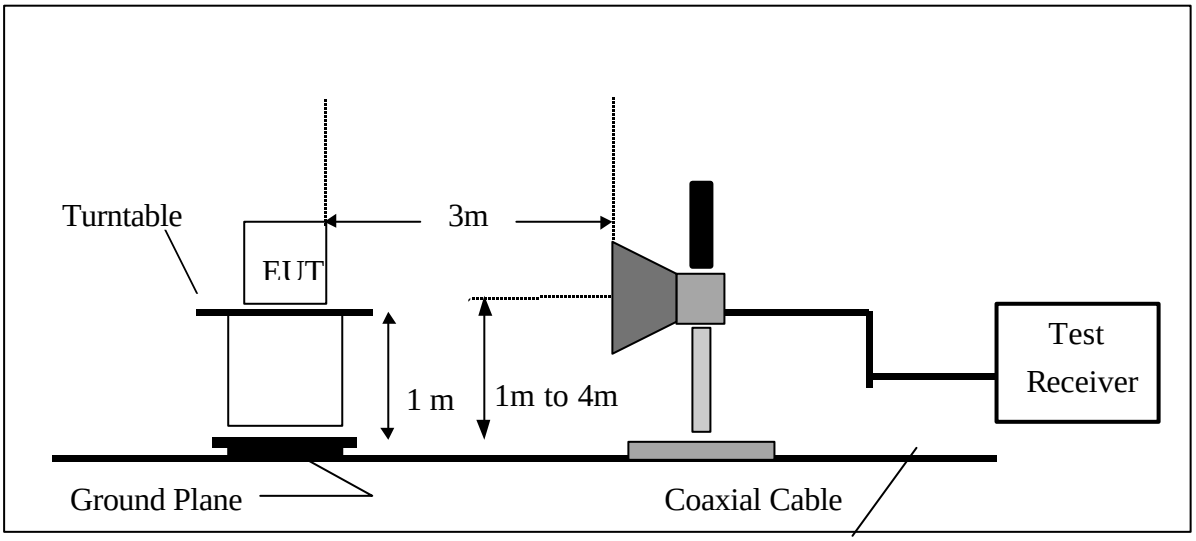
Not available for this EUT intended for grant.

3-7. Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



3-8 Tested Equipments

Item	Instruments	Mfr/Brand	Model/Type No.	Serial No.	Calibrated Date	Next Cali. Date	Note
1	LISN	EMCO	3825/2	9605-2539	2001-06-22	2002-06-21	
2	LISN	Rolf Heine	NNB-2/16Z	98083	2001-10-20	2002-10-19	
3	LISN	Rolf Heine	NNB-2/16Z	98053	2001-11-22	2002-11-21	
4	Pulse Limiter	Electro-Metrics	EM-7600	112644	2001-12-10	2002-12-19	
5	50Ω Terminator	N/A	N/A	N/A	2001-05-21	2002-05-20	
6	Test Cable	N/A	C01	N/A	2001-12-08	2002-12-07	
7	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3058	2001-10-27	2002-10-26	
8	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9160	3060	2001-10-20	2002-10-19	✓
9	Log-Bicon Antenna	MESS-ELEKTRONIK	VULB 9161	4022	2001-07-04	2002-07-03	
10	Test Cable	N/A	10M_OS01	N/A	2001-12-08	2002-12-07	
11	Test Cable	N/A	OS01-1/-2	N/A	2001-12-08	2002-12-07	
12	Test Cable	N/A	10M_OS02	N/A	2001-12-08	2002-12-07	✓
13	Test Cable	N/A	OS02-1/-2/-3	N/A	2001-12-08	2002-12-07	✓
14	RF Switch	Anritsu	MP59B	M65982	2001-12-10	2002-12-09	✓
15	Quasi-Peak Adapter	HP	85650A	2521A00844	2002-04-08	2002-10-07	✓
16	RF Pre-Selector	HP	85685A	2648A00417	2002-04-08	2002-10-07	✓
17	Spectrum Analyzer	HP	85680B	2634A03025	2002-04-08	2002-10-07	✓
18	Spectrum Monitor	HP	85662B	2648A13616	2002-04-08	2002-10-07	✓
19	Pre-Amplifier	Anritsu	MH648A	M09961	2001-12-10	2002-12-09	✓
20	Spectrum Analyzer	ADVAN TEST	R3261C	81720298	2001-08-17	2002-08-16	
21	Test Receiver	R&S	ESH3	860156/018	2001-10-23	2002-10-22	
22	Test Receiver	R&S	ESVP	860687/009	2001-10-23	2002-10-22	
23	Test Receiver	MEB	SMV41	130	2001-12-05	2002-12-04	
24	Test Receiver	PMM	PMM 9000	4310J01002	2001-12-31	2002-12-30	
25	Horn Antenna	EMCO	3115	9605-4803	2001-05-09	2002-05-08	✓
26	Test Receiver	R&S	ESMI	843977/005	2001-11-14	2002-11-05	✓
27	Pre-Amplifier	R&S	ESMI-Z7	1045.5020	2001-05-21	2002-05-20	✓
28	Absorbing Clamp	R&S	MDS-21	841077/011	2001-08-18	2002-08-17	
29	Voltage Probe	R&S	ESH2-Z3	841.800/023	2001-08-20	2002-08-19	
30	Signal Generator	HP	8648A	3426A01034	2000-02-10	2003-09-23	
31	Antenna Mast	Chance Most	CMTB-1.5	N/A	N/A	N/A	✓
32	Turn Table	Chance Most	CMTB-1.5	N/A	N/A	N/A	✓

Remark :
(1) ✓ indicates the instrument used in this test report.
(2) N/A denotes No Brand measurement facility.

4. Block Diagram(s)

6. Radiated Emission Data

6.1 The following data lists the significant emission frequencies, measured emission levels, correction factor (including calve loss antenna factor, and if any needed, the duty cycle correction factor), the corrected field strength, as well as the limitation. Explanation of the correction factor is given in 6.2 and 6.3.

Judgement：Passed by -13.67 dB at 945.5 MHz Ant.Pol. Ver. EUT Axis X

Freq. (MHz)	F /S	Ant.Pol. (H/V)	Reading (dBuV)	Ant./CL CF(dB)	Duty Cycle CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)		Margin (dB)	
315.16	F	V	78.53	-8.13	-9.7	70.40	60.70	95.60	75.60		-14.90	AV
630.32	S	V	49.09	1.34	-9.7	50.43	40.73	75.60	55.60		-14.87	AV
945.5	S	V	43.59	8.04	-9.7	51.63	41.93	75.60	55.60		-13.67	AV
1260.6	S	V	65.83	-14.94	-9.7	50.89	41.19	75.60	55.60		-14.41	AV
1575.8	S	V	63.41	-14.74	-9.7	48.67	38.97	74.00	54.00	*	-15.03	AV
1890.9	S	V	60.32	-14.55	-9.7	45.77	36.07	75.60	55.60		-19.53	AV
2206.1	S	V	62.89	-14.36	-9.7	48.53	38.83	74.00	54.00	*	-15.17	AV
2521.3	S	V	62.03	-14.47	-9.7	47.56	37.86	75.60	55.60		-17.74	AV
2836.4	S	V	60.59	-13.98	-9.7	46.61	36.91	74.00	54.00	*	-17.09	AV
3151.6	S	V	-						55.60			

Remark：

(1) + F/S F：denotes Fundamental Frequency；S： denotes Spurious Frequency

(2) EUT Orthogonal Axes：X denotes Laid on Table；Y denotes; Vertical Stand .

(3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 315MHz。

(4) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(5) * denotes spurious frequency which falls within the Restricted Bands specified in provision of ξ15.205, then the general radiated emission limits in ξ 15.209 apply.

(6) Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode and a duty cycle correct factor corrected for the average value of the emission shown in AV column。 Example of calculation for actual field strength express in average value is exhibited in paragraph **(B)** of **6-2. Field Strength Calculation** in this test report.

(7) Radiated emissions measured in frequency **above 1000MHz** were made with a Test Receiver, R&S model ESMI, plus a Pre-amplifier R&S model ESMI-Z7, and a Horn Antenna, EMCO model 3115.

(8) Spectrum Setting : 30MHz – 1000MHz , RBW= 100KHz, VBW=100KHz, Sweep time = 200 ms. 1GHz- 5GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms

Review： Vincent Test Engr.： Jason Test Date： Apr. 25, 2002

6. Radiated Emission Data

6.1 The following data lists the significant emission frequencies, measured emission levels, correction factor (including calve loss antenna factor, and if any needed, the duty cycle correction factor), the corrected field strength, as well as the limitation. Explanation of the correction factor is given in 6.2 and 6.3.

Judgement：Passed by -2.75 dB at 630.46 MHz Ant.Pol. Hor. EUT Axis X

Freq. (MHz)	F /S	Ant.Pol. (H/V)	Reading (dBuV)	Ant./CL CF(dB)	Duty Cycle CF(dB)	Peak (dBuV/m)	AV (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)		Margin (dB)	
315.23	F	H	86.73	-8.13	-9.7	78.60	68.90	95.60	75.60		-6.70	AV
630.46	S	H	61.21	1.34	-9.7	62.55	52.85	75.60	55.60		-2.75	AV
945.7	S	H	52.29	8.04	-9.7	60.33	50.63	75.60	55.60		-4.97	AV
1260.9	S	H	66.11	-14.94	-9.7	51.17	41.47	75.60	55.60		-14.13	AV
1576.2	S	H	64.23	-14.74	-9.7	49.49	39.79	74.00	54.00	*	-14.21	AV
1891.4	S	H	63.80	-14.55	-9.7	49.25	39.55	75.60	55.60		-16.05	AV
2206.6	S	H	62.46	-14.36	-9.7	48.10	38.40	74.00	54.00	*	-15.60	AV
2521.8	S	H	61.27	-14.17	-9.7	47.10	37.40	75.60	55.60		-18.20	AV
2837.1	S	H	60.13	-13.98	-9.7	46.15	36.45	74.00	54.00	*	-17.55	AV
3152.3	S	H	-						55.60			

Remark：

(1) + F/S F：denotes Fundamental Frequency；S： denotes Spurious Frequency

(2) EUT Orthogonal Axes：X denotes Laid on Table；Y denotes; Vertical Stand .

(3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 315MHz。

(4) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(5) ***** denotes spurious frequency which falls within the Restricted Bands specified in provision of ξ15.205, then the general radiated emission limits in ξ 15.209 apply.

(6) Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode and a duty cycle correct factor corrected for the average value of the emission shown in AV column。 Example of calculation for actual field strength express in average value is exhibited in paragraph **(B)** of **6-2. Field Strength Calculation** in this test report.

(7) Radiated emissions measured in frequency **above 1000MHz** were made with a Test Receiver, R&S model ESMI, plus a Pre-amplifier R&S model ESMI-Z7, and a Horn Antenna, EMCO model 3115.

(8) Spectrum Setting : 30MHz – 1000MHz , RBW= 100KHz, VBW=100KHz, Sweep time = 200 ms. 1GHz- 5GHz, RBW= 1MHz, VBW= 1MHz, Sweep time= 200 ms

Review： Vincent Test Engr.： Jason Test Date： Apr. 25, 2002

6-2. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG - DFC

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor (1)
CL = Cable Attenuation Factor (Cable Loss) (1)
AG = Amplifier Gain (1)
DFC = Duty Cycle Correction Factor (2)

Remark :
(1) The Correction Factor = AF + CL - AG, as shown in the data tables' Correction Factor column.
(2) DFC is available only for radiated emissions measurement(s) in frequency above 1000MHz.

(A). Example of Calculation for frequency over 1000MHz:

Assume a Receiver Reading of 23.7 dBuV is obtained with an Antenna Factor of 17.0 dB and a Cable Factor of 25.0 dB and Pre-Amplifier Gain of 20 dB. Then:
1. The Correction Factor will be calculated by

Correction Factor = AF + CL - AG = 13.3 + 10.0 - 15.0= 8.3 (dB)

as shown in the data tables' Ant./CL CF column.

2. The Field Strength will be calculated by

FS = RA + Correction Factor = 23.7+8.3 = 32 (dBuV/m).

(B). Example of Calculation for frequency range between 30MHz and 1GHz:

Assume a Receiver Reading of 73.7 dBuV is obtained with an Antenna Factor of 7.2 dB and a Cable Factor of 1.1 dB and Duty Cycle Correction Factor Calculated as - 7.6dB. Then:
1. The Correction Factor will be calculated by

Correction Factor = AF + CL = 7.2 + 1.1 = 8.3 (dB)

as shown in the data tables' Ant./CL CF column.

2. The Field Strength will be calculated by

FS = RA + Ant./CL CF + Duty Cycle CF = 31.3 + 8.3 - 7.6 = 32 (dBuV/m).

FS is the value shown in the data tables' Actual FS column and RA is the value shown in the data tables' Reading column. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m as:

$$\mathbf{Log^{-1}【(32.0dBuV/m)/20】 = 39.8 (uV/m)}$$

6-3. Supplementary Information for Duty Cycle Correction Factor Calculated

1. **Duty Cycle of a Pulse Train $T_{(P)}$**
   The periodic of a pulse train measured as **41.777ms (refer to Attachment- A)**

   $T_{(P)}$ = 41.777ms

2. **Total Duration of EUT at active state(high level state)**

   $T_{(on)}$ = 8x0.933+14x0.444=13.68ms

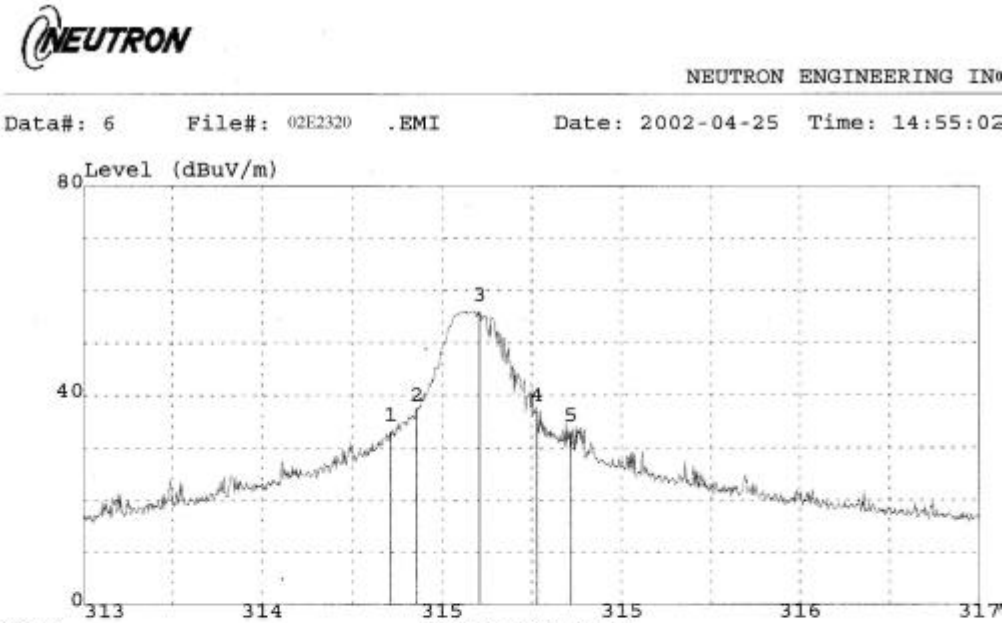
3. **The duty cycle correction factor then calculated as the follows：**

   Factor = 20 log[$T_{(on)}$/ $T_{(P)}$] = 20 log(13.68/41.777) = -9.7 (dB)

4. **Retails information refers to Attachment A.**

7. Supplementary Information for Section 15.231(C) Requirements

7.1 Bandwidth requirement



SR02 Ref Trace: 5
Trace:
Limit : 3m Probe:
Operator : Jason Huang
Project Code: 02E2320
E.U.T. : Heater Fan Remote Control
Model No. : 3430TX;3930TX
Test Mode : BW
Temp/ RH : 24/58
Memo :

Page: 1

	Freq	Level	Over Limit	Limit Line	Read Level	Factor	Ant Pos	Table Pos	Remark
	MHz	dB	dB	dB	dB	dB	cm	deg	
1	314.372	33.11	------	------	50.11	-17.00	---	---	
2	314.488	36.97	------	------	53.97	-17.00	---	---	
3	314.768	56.12	------	------	73.12	-17.00	---	---	
4	315.024	36.90	------	------	53.90	-17.00	---	---	
5	315.172	33.06	------	------	50.06	-17.00	---	---	

The center frequency **f_c is 314.768MHz (point 3),** according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at-20dB should be calculated as following:

314.768 X 0.0025 = 0.7869(MHz)

So, the Uper/Lower frequencies should be specified as :

$f_{(U)} = f_c + D\ f/2 = 314.768 + 0.3934 = 315.1614$(MHz) (point 5)

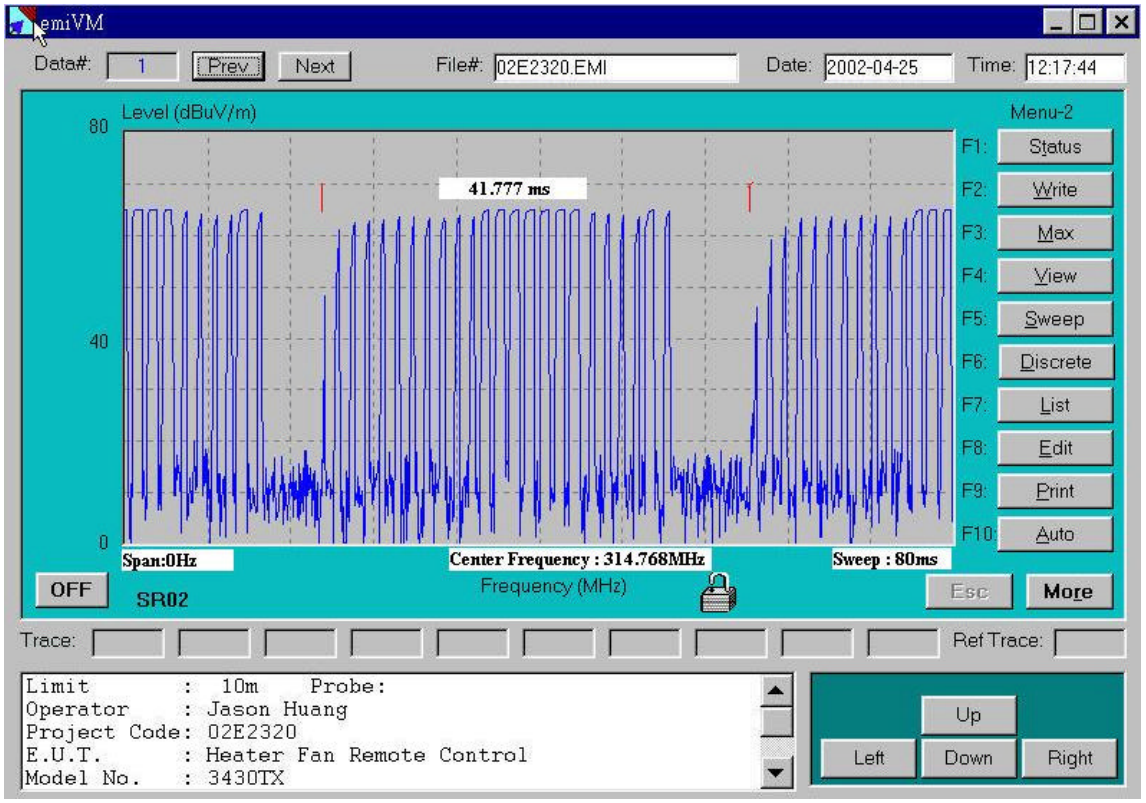
$f_{(L)} = f_c - D\ f/2 = 314.768 – 0.3934 = 314.3746$ (MHz) (point 1)

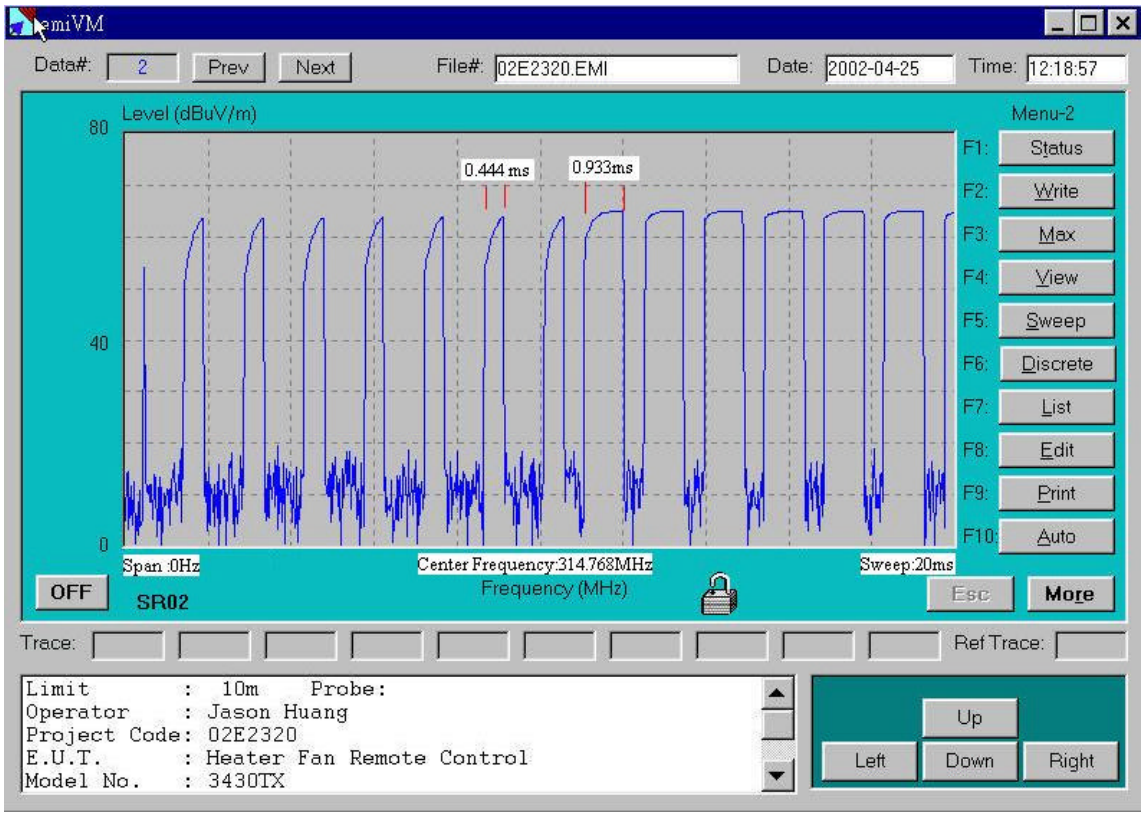
The measured frequencies at -20dB Bandwidth of Fundamental are f (point 4) and f (point 2) as shown in the spectrum graphic above. Either f (point 4) or f(point 2) located within the band of frequency between $f_{(L)}$ =314.3746 MHz and $f_{(U)}$ = 315.1614 MHz. So, it is complacence with the requirements.

Attachment - A.

Supplementary Information of Pulsed Transmission & Pulse Code Timing Chart

Duty cycle test





$T_{(on)}$ = 8x0.933+14x0.444=13.68ms

$T_{(P)}$ = 41.777ms

Factor = 20 log[$T_{(on)}$/ $T_{(P)}$] = 20 log(13.68/41.777) = -9.7 (dB)

Attachment - B.

Photos of Tested EUT

1. **Photo 1 Front View Rear View**

2. **Photo 2-4 Unit partially Disassembled**

Attachment C.

User Manual