

# MEASUREMENT/TECHNICAL REPORT

**APPLICANT:** Wintercronics Co., Ltd.

**MODEL NO.:** TR53A

**FCC ID:** NJQTR53A

|                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| This report concerns ( check one ) :<br><b>Original Grant</b> _____ ✓<br><b>Class II Change</b> _____                                                                                                                                                                                                       |
| <b>Equipment type:</b> 433.92 MHz Remote Controller (Transmitter)                                                                                                                                                                                                                                           |
| Deferred grant requested per 47CFR 0.457(d)(1)(ii)?<br>Yes _____ No _____ ✓ If yes, defer until: _____ (date)<br>We, the undersigned, agree to notify the Commission by (date) _____ / _____ / _____ of the<br>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 _____ ✓<br>If no, assumed Part 15, Subpart B for unintentional radiator the new 47 CFR (10-1-90 Edition)<br>provision.                                                                                                                                     |
| <b>Report Prepared</b><br><b>by Testing House :</b> Neutron Engineering Inc.<br><b>for Company :</b><br><b>Name</b> Wintercronics Co., Ltd.<br><b>Address</b> 2F., No. 7-1, Ming Lee Street, Chung Ho, Taipei, Taiwan, R.O.C.                                                                               |
| <b>Applicant Signature :</b><br><br><br>_____<br><b>Apin Chang / General Manager</b>                                                                                                                                     |

## 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 :** Carol Chen

*Carol Chen*

**Reviewed by :** Vincent Su

*Vincent Su*

**Approved by :** George Yao

*George Yao*

**Issued Date :** Oct. 30, 2001

**Report No. :** NEI-FCCB-01180

**Company Stamp :**



**NEUTRON ENGINEERING INC.**

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## 1. GENERAL INFORMATION

### 1-1. Product Description

The Wintercronics Co., Ltd. Model: TR53A (referred to as the EUT in this report) is a Transceiver of car alarm security system. It offers wireless remote control, ideal for use in vehicle security system to activate the function of center door lock control system and car searching except the alarm system.

A major technical descriptions of EUT is described as following:

- A). Fundamental Frequency: 433.92 MHz
- B). Modulation : Pulse Modulation
- C). Antenna Designation: Non-User Replaceable (Fixed)
- D). Power Supply: 1.5V, Battery Operated.
- E). Receiver type : Superheterodyne

|                       |                           |
|-----------------------|---------------------------|
| Fundamental Frequency | 433.92MHz                 |
| Power Source          | 1.5v Battery Operated     |
| Transmitting Time     | Periodic $\leq$ 5 seconds |
| Associated Receiver   | FCC DOC                   |

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

This submittal(s) (test report) is intended for FCC ID : NJQTR53A filing to comply with Section 15.231 of the FCC Part 15, Subpart C Rules. The composite system(receiver) is 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 normal operating 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 placed on a 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<br>(MHz) | Field Strength of Fundamental |                  | Field Strength of Spurious |               |
|--------------------------------|-------------------------------|------------------|----------------------------|---------------|
|                                | (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 § 15.205  
 4. If spurious frequency which falls within the Restricted Bands specified in provision of § 15.205, then the general radiated emission limits in § 15.209 apply.

**3-5. Special Accessories**

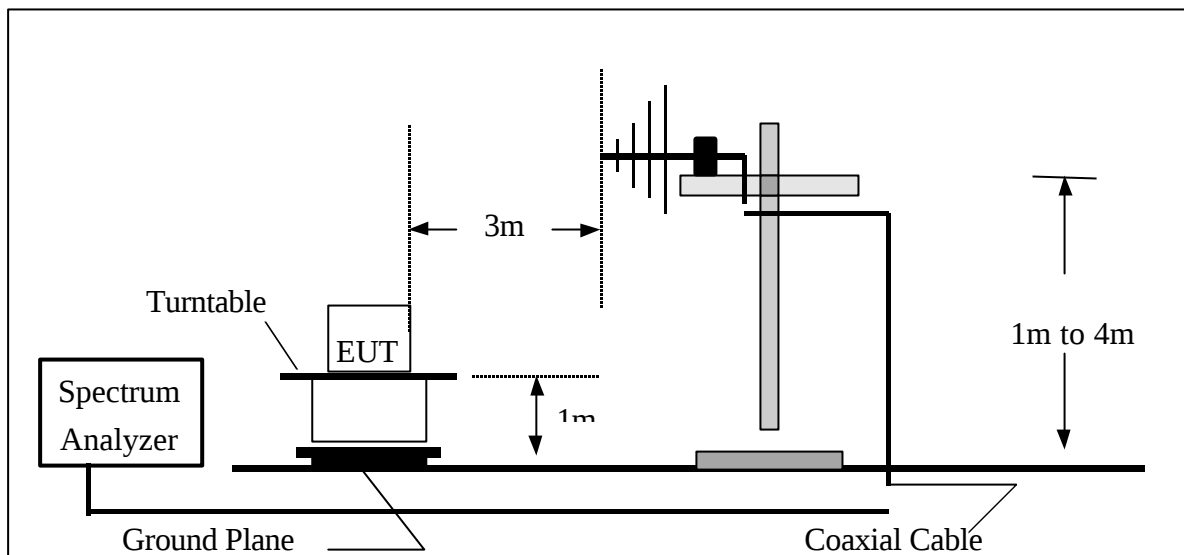
Not available for this EUT intended for grant.

**3-6. Equipment Modifications**

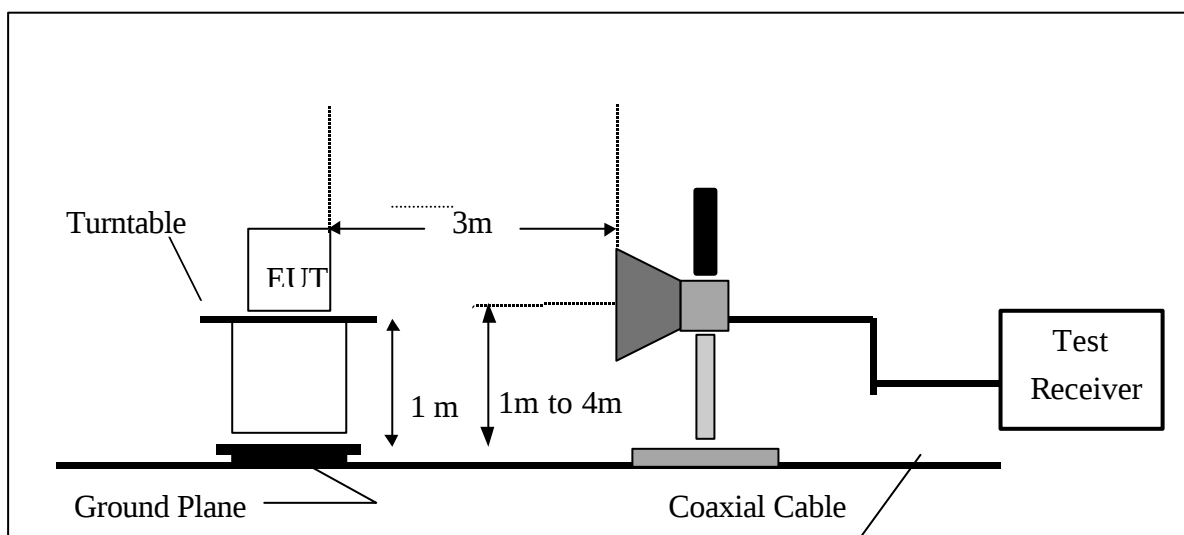
Not available for this EUT intended for grant.

### 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**

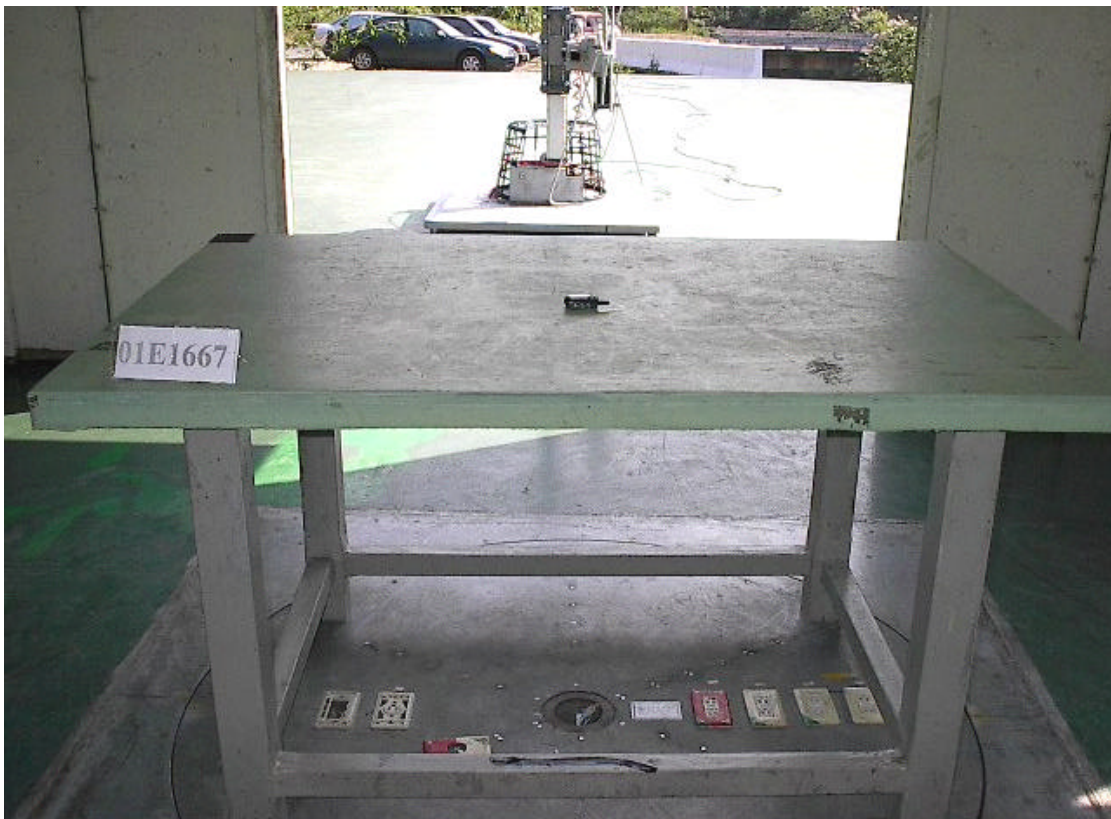
| Item | Instruments        | Mfr/Brand       | Model/Type No.  | Serial No.  | Calibrated Date | Next Cali. Date | Note |
|------|--------------------|-----------------|-----------------|-------------|-----------------|-----------------|------|
| 1    | Log-Bicon Antenna  | MESS-ELEKTRONIK | VULB 9160       | 3058        | 2001-10-27      | 2002-10-26      |      |
| 2    | Log-Bicon Antenna  | MESS-ELEKTRONIK | VULB 9160       | 3060        | 2001-10-20      | 2002-10-19      | ✓    |
| 3    | Log-Bicon Antenna  | MESS-ELEKTRONIK | VULB 9161       | 4022        | 2001-07-04      | 2002-07-03      |      |
| 4    | LISN               | EMCO            | 3825/2          | 9605-2539   | 2001-06-22      | 2002-06-21      |      |
| 5    | LISN               | Rolf Heine      | NNB-2/16Z       | 98083       | 2001-10-20      | 2002-10-19      |      |
| 6    | LISN               | Rolf Heine      | NNB-2/16Z       | 98053       | 2000-11-23      | 2001-11-22      |      |
| 7    | Horn Antenna       | EMCO            | 3115            | 9605-4803   | 2001-05-09      | 2002-05-08      | ✓    |
| 8    | Quasi-Peak Adapter | HP              | 85650A          | 2521A00844  | 2001-09-25      | 2002-03-24      | ✓    |
| 9    | RF Pre-Selector    | HP              | 85685A          | 2648A00417  | 2001-09-25      | 2002-03-24      | ✓    |
| 10   | Spectrum Analyzer  | HP              | 85680B          | 2634A03025  | 2001-09-25      | 2002-03-24      | ✓    |
| 11   | Spectrum Monitor   | HP              | 85662B          | 2648A13616  | 2001-09-25      | 2002-03-24      | ✓    |
| 12   | Pre-Amplifier      | Anritsu         | MH648A          | M09961      | 2001-06-04      | 2002-06-03      | ✓    |
| 13   | Test Receiver      | R&S             | ESMI            | 843977/005  | 2000-11-07      | 2001-11-06      | ✓    |
| 14   | Pre-Amplifier      | R&S             | ESMI-Z7         | 1045.5020   | 2001-05-21      | 2002-05-20      | ✓    |
| 15   | Test Receiver      | R&S             | ESH3            | 860156/018  | 2001-10-23      | 2002-10-22      |      |
| 16   | Test Receiver      | R&S             | ESVP            | 860687/009  | 2001-10-23      | 2002-10-22      |      |
| 17   | Test Receiver      | MEB             | SMV41           | 130         | 2000-12-20      | 2001-12-19      |      |
| 18   | Absorbing Clamp    | R&S             | MDS-21          | 841077/011  | 2001-08-18      | 2002-08-17      |      |
| 19   | Voltage Probe      | R&S             | ESH2-Z3         | 841.800/023 | 2001-08-20      | 2002-08-19      |      |
| 20   | Pulse Limiter      | Electro-Metrics | EM-7600         | 112644      | 2001-02-09      | 2002-02-08      |      |
| 21   | Spectrum Analyzer  | ADVAN TEST      | R3261C          | 81720298    | 2001-08-17      | 2002-08-16      |      |
| 22   | Oscilloscope       | Tektronix       | 2465B           | J305135     | 2000-11-02      | 2001-11-01      |      |
| 23   | Impedance PAD      | HRS             | HI-NNF-PJ-50/75 | 0264        | 2001-03-15      | 2002-03-14      |      |
| 24   | Attenuator         | Stack           | 10dB            | 1           | 2001-03-15      | 2002-03-14      |      |
| 25   | Audio Generator    | Good Will       | GAG808A         | 21845       | N/A             | N/A             |      |
| 26   | Antenna Mast       | Chance Most     | CMTB-1.5        | N/A         | N/A             | N/A             | ✓    |
| 27   | Turn Table         | Chance Most     | CMTB-1.5        | N/A         | N/A             | N/A             | ✓    |
| 28   | Signal Generator   | HP              | 8648A           | 3426A01034  | 2000-02-10      | 2002-02-09      |      |
| 29   | Test Receiver      | PMM             | PMM 9000        | 4310J01002  | 2000-11-26      | 2001-11-27      |      |

**Remark :**

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

#### **4. Block Diagram(s)**

## 5. Radiated Measurement Photos



## 5. Radiated Measurement Photos



## 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 -11.57 dB at 1300.00 MHz Ant.Pol. Ver. EUT Axis X

| Freq.<br>(MHz) | F | Ant.Pol.<br>(H/V) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Duty  |        | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak              | AV                | Margin<br>(dB) | AV |
|----------------|---|-------------------|-------------------|-------------------|-------|--------|------------------|----------------|-------------------|-------------------|----------------|----|
|                |   |                   |                   |                   | Cycle | CF(dB) |                  |                | Limit<br>(dBuV/m) | Limit<br>(dBuV/m) |                |    |
| 433.9          | F | V                 | 69.37             | -13.09            | -7.12 | 56.28  | 49.16            | 99.00          | 79.00             | -29.84            | AV             |    |
| 867.9          | S | V                 | 38.74             | -6.49             | -7.12 | 32.25  | 25.13            | 79.00          | 59.00             | -33.87            | AV             |    |
| 1300.0         | S | V                 | 39.55             | 10.00             | -7.12 | 49.55  | 42.43            | 74.00          | 54.00             | * -11.57          | AV             |    |
| 1744.0         | S | V                 | 33.86             | 12.14             | -7.12 | 46.00  | 38.88            | 79.00          | 59.00             | -20.12            | AV             |    |
| 2176.0         | S | V                 | 24.62             | 13.86             | -7.12 | 38.48  | 31.36            | 79.00          | 59.00             | -27.64            | AV             |    |
| 2608.0         | S | V                 | 20.81             | 15.64             | -7.12 | 36.45  | 29.33            | 79.00          | 59.00             | -29.67            | AV             |    |
| 3044.0         | S | V                 | 19.89             | 16.53             | -7.12 | 36.42  | 29.30            | 79.00          | 59.00             | -29.70            | AV             |    |
| 3480.0         | S | V                 | 21.26             | 17.40             | -7.12 | 38.66  | 31.54            | 79.00          | 59.00             | -27.46            | AV             |    |
| 3905.4         | S | V                 | -                 |                   |       |        |                  |                | 54.00             | *                 |                |    |

Remark :

- (1) + F/S F : denotes Fundamental Frequency ; S : denotes Spurious Frequency
- (2) EUT Orthogonal Axes : X denotes Laid on Table ; Z denotes Side Stand ; Y denotes Vertical Stand .
- (3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 433.92 MHz.
- (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 §15.205, then the general radiated emission limits in § 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 : Timent Test Engr. : Nelson Test Date : Oct. 23, 2001

## 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 -16.58 dB at 1300.00 MHz Ant.Pol. Hor. EUT Axis X

| Freq.<br>(MHz) | F<br>/S | Ant.Pol.<br>(H/V) | Reading<br>(dBuV) | Ant/CL<br>CF(dB) | Duty<br>Cycle<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>Limit<br>(dBuV/m) | AV<br>Limit<br>(dBuV/m) | Margin<br>(dB) |    |
|----------------|---------|-------------------|-------------------|------------------|-------------------------|------------------|----------------|---------------------------|-------------------------|----------------|----|
| 433.9          | F       | H                 | 72.49             | -13.09           | -7.12                   | 59.40            | 52.28          | 99.00                     | 79.00                   | -26.72         | AV |
| 867.9          | S       | H                 | 44.72             | -6.49            | -7.12                   | 38.23            | 31.11          | 79.00                     | 59.00                   | -27.89         | AV |
| 1300.0         | S       | H                 | 34.72             | 9.82             | -7.12                   | 44.54            | 37.42          | 74.00                     | 54.00                   | * -16.58       | AV |
| 1744.0         | S       | H                 | 28.43             | 12.14            | -7.12                   | 40.57            | 33.45          | 79.00                     | 59.00                   | -25.55         | AV |
| 2176.0         | S       | H                 | 23.02             | 13.86            | -7.12                   | 36.88            | 29.76          | 79.00                     | 59.00                   | -29.24         | AV |
| 2608.0         | S       | H                 | 22.00             | 15.64            | -7.12                   | 37.64            | 30.52          | 79.00                     | 59.00                   | -28.48         | AV |
| 3044.0         | S       | H                 | 21.59             | 16.53            | -7.12                   | 38.12            | 31.00          | 79.00                     | 59.00                   | -28.00         | AV |
| 3480.0         | S       | H                 | 21.06             | 17.40            | -7.12                   | 38.46            | 31.34          | 79.00                     | 59.00                   | -27.66         | AV |
| 3905.0         | S       | H                 | -                 | 20.11            | -7.12                   |                  |                |                           | 54.00                   | *              |    |
| 4339.3         | S       | H                 | -                 |                  |                         |                  |                |                           | 59.00                   |                |    |

Remark :

- (1) + F/S F : denotes Fundamental Frequency ; S : denotes Spurious Frequency
- (2) **EUT Orthogonal Axes : X** denotes Laid on Table ; Z denotes Side Stand ; Y denotes Vertical Stand .
- (3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 433.92 MHz.
- (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 §15.205, then the general radiated emission limits in § 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 Actual FS 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 : Jiment Test Engr. : Nelson Test Date : Oct. 23, 2001

## 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 -9.3 dB at 1308.0 MHz Ant.Pol. Ver. EUT Axis Y

| Freq.<br>(MHz) | F<br>/S | Ant.Pol.<br>(H/V) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Duty<br>Cycle<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>Limit<br>(dBuV/m) | AV<br>Limit<br>(dBuV/m) | Margin<br>(dB) |    |
|----------------|---------|-------------------|-------------------|-------------------|-------------------------|------------------|----------------|---------------------------|-------------------------|----------------|----|
| 433.9          | F       | V                 | 70.3              | -13.1             | -7.1                    | 57.2             | 50.1           | 99.0                      | 79.0                    | -28.9          | AV |
| 867.9          | S       | V                 | 41.6              | -6.5              | -7.1                    | 35.1             | 28.0           | 79.0                      | 59.0                    | -31.0          | AV |
| 1308.0         | S       | V                 | 41.8              | 10.0              | -7.1                    | 51.8             | 44.7           | 74.0                      | 54.0                    | * -9.3         | AV |
| 1744.0         | S       | V                 | 32.9              | 12.1              | -7.1                    | 45.1             | 37.9           | 79.0                      | 59.0                    | -21.1          | AV |
| 2176.0         | S       | V                 | 29.8              | 13.9              | -7.1                    | 43.6             | 36.5           | 79.0                      | 59.0                    | -22.5          | AV |
| 2608.0         | S       | V                 | 22.2              | 15.6              | -7.1                    | 37.9             | 30.8           | 79.0                      | 59.0                    | -28.3          | AV |
| 3044.0         | S       | V                 | 20.9              | 16.5              | -7.1                    | 37.4             | 30.3           | 79.0                      | 59.0                    | -28.7          | AV |
| 3480.0         | S       | V                 | 20.6              | 17.4              | -7.1                    | 38.0             | 30.9           | 79.0                      | 59.0                    | -28.1          | AV |
| 3905.4         | S       | V                 | -                 |                   |                         |                  |                |                           | 54.0                    | *              |    |

Remark :

- (1) + F/S F : denotes Fundamental Frequency ; S : denotes Spurious Frequency
- (2) **EUT Orthogonal Axes** : X denotes Laid on Table ; Z denotes Side Stand ; Y denotes Vertical Stand .
- (3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 433.92MHz.
- (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 §15.205, then the general radiated emission limits in § 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 Actual FS 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 :

Jiment

Test Engr. :

Nelson

Test Date :

Oct. 23, 2001

## 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 -18.48 dB at 1300.00 MHz Ant.Pol. Hor. EUT Axis Y

| Freq.<br>(MHz) | F<br>(S) | Ant.Pol.<br>(H/V) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Duty<br>Cycle<br>CF(dB) | Peak<br>(dBuV/m) | A V<br>(dBuV/m) | Peak<br>Limit<br>(dBuV/m) | A V<br>Limit<br>(dBuV/m) | Margin<br>(dB) |     |
|----------------|----------|-------------------|-------------------|-------------------|-------------------------|------------------|-----------------|---------------------------|--------------------------|----------------|-----|
| 433.9          | F        | H                 | 74.28             | -13.09            | -7.12                   | 61.19            | 54.07           | 99.00                     | 79.00                    | -24.93         | A V |
| 867.9          | S        | H                 | 47.10             | -6.49             | -7.12                   | 40.61            | 33.49           | 79.00                     | 59.00                    | -25.51         | A V |
| 1300.0         | S        | H                 | 32.82             | 9.82              | -7.12                   | 42.64            | 35.52           | 74.00                     | 54.00                    | * -18.48       | A V |
| 1744.0         | S        | H                 | 25.25             | 12.14             | -7.12                   | 37.39            | 30.27           | 79.00                     | 59.00                    | -28.73         | A V |
| 2176.0         | S        | H                 | 22.00             | 13.86             | -7.12                   | 35.86            | 28.74           | 79.00                     | 59.00                    | -30.26         | A V |
| 2608.0         | S        | H                 | 22.41             | 15.64             | -7.12                   | 38.05            | 30.93           | 79.00                     | 59.00                    | -28.07         | A V |
| 3044.0         | S        | H                 | 20.30             | 16.53             | -7.12                   | 36.83            | 29.71           | 79.00                     | 59.00                    | -29.29         | A V |
| 3480.0         | S        | H                 | 25.63             | 17.62             | -7.12                   | 43.25            | 36.13           | 79.00                     | 59.00                    | -22.87         | A V |
| 3905.4         | S        | H                 | -                 |                   |                         |                  |                 |                           | 54.00                    | *              |     |

### Remark :

- (1) + F/S F : denotes Fundamental Frequency ; S : denotes Spurious Frequency
- (2) EUT Orthogonal Axes : X denotes Laid on Table ; Z denotes Side Stand ; Y denotes Vertical Stand .
- (3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 433.92MHz.
- (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 §15.205, then the general radiated emission limits in § 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 Actual FS 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 :



Test Engr. :



Test Date :

Oct. 23, 2001

## 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 -21.72 dB at 1744.00 MHz Ant.Pol. Ver. EUT Axis Z

| Freq.<br>(MHz) | F<br>/S | Ant.Pol.<br>(H/V) | Reading<br>(dBuV) | Ant./CL<br>CF(dB) | Duty<br>Cycle<br>CF(dB) | Peak<br>(dBuV/m) | AV<br>(dBuV/m) | Peak<br>Limit<br>(dBuV/m) | AV<br>Limit<br>(dBuV/m) | Margin<br>(dB) |    |
|----------------|---------|-------------------|-------------------|-------------------|-------------------------|------------------|----------------|---------------------------|-------------------------|----------------|----|
| 433.9          | F       | V                 | 71.27             | -13.09            | -7.12                   | 58.18            | 51.06          | 99.00                     | 79.00                   | -27.94         | AV |
| 867.9          | S       | V                 | 46.56             | -6.49             | -7.12                   | 40.07            | 32.95          | 79.00                     | 59.00                   | -26.05         | AV |
| 1308.0         | S       | V                 | 25.02             | 10.00             | -7.12                   | 35.02            | 27.90          | 74.00                     | 54.00                   | * -26.10       | AV |
| 1744.0         | S       | V                 | 32.26             | 12.14             | -7.12                   | 44.40            | 37.28          | 79.00                     | 59.00                   | -21.72         | AV |
| 2176.0         | S       | V                 | 26.34             | 13.86             | -7.12                   | 40.20            | 33.08          | 79.00                     | 59.00                   | -25.92         | AV |
| 2608.0         | S       | V                 | 20.99             | 15.64             | -7.12                   | 36.63            | 29.51          | 79.00                     | 59.00                   | -29.49         | AV |
| 3044.0         | S       | V                 | 21.16             | 16.53             | -7.12                   | 37.69            | 30.57          | 79.00                     | 59.00                   | -28.43         | AV |
| 3912.0         | S       | V                 | 22.46             | 19.31             | -7.12                   | 41.77            | 34.65          | 79.00                     | 59.00                   | -24.35         | AV |
| 3905.5         | S       | V                 | -                 |                   |                         |                  |                |                           | 54.00                   | *              |    |
| 4339.5         | S       | V                 | -                 |                   |                         |                  |                |                           | 59.00                   |                |    |

### Remark :

- (1) + F/S F : denotes Fundamental Frequency ; S : denotes Spurious Frequency
- (2) **EUT Orthogonal Axes** : X denotes Laid on Table ; Z denotes Side Stand ; Y denotes Vertical Stand .
- (3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 433.92 MHz.
- (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 §15.205, then the general radiated emission limits in § 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 Actual FS 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 : Timent Test Engr. : Nelson Test Date : Oct. 23, 2001

## 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 -15.85 dB at 3912.0 MHz Ant.Pol. Hor. EUTAxis Z

| Freq.<br>(MHz) | F<br>/S | Ant.Pol.<br>(H/V) | Reading<br>(dBuV) | Ant./CL<br>CF (dB) | Duty<br>Cycle<br>CF (dB) | Peak<br>dBuV/m | A V<br>dBuV/m | Peak<br>Limit<br>dBuV/m | A V<br>Limit<br>dBuV/m | Margin<br>(dB) |     |
|----------------|---------|-------------------|-------------------|--------------------|--------------------------|----------------|---------------|-------------------------|------------------------|----------------|-----|
| 433.9          | F       | H                 | 72.76             | -13.1              | -7.12                    | 59.67          | 52.55         | 99.00                   | 79.00                  | -26.45         | A V |
| 867.9          | S       | H                 | 31.92             | -6.49              | -7.12                    | 25.43          | 18.31         | 79.00                   | 59.00                  | -40.69         | A V |
| 1300.0         | S       | H                 | 33.02             | 9.82               | -7.12                    | 42.84          | 35.72         | 74.00                   | 54.00                  | * -18.28       | A V |
| 1744.0         | S       | H                 | 35.99             | 12.14              | -7.12                    | 48.13          | 41.01         | 79.00                   | 59.00                  | -17.99         | A V |
| 2176.0         | S       | H                 | 23.93             | 13.86              | -7.12                    | 37.79          | 30.67         | 79.00                   | 59.00                  | -28.33         | A V |
| 2608.0         | S       | H                 | 20.10             | 15.64              | -7.12                    | 35.74          | 28.62         | 79.00                   | 59.00                  | -30.38         | A V |
| 3044.0         | S       | H                 | 20.33             | 16.53              | -7.12                    | 36.86          | 29.74         | 79.00                   | 59.00                  | -29.26         | A V |
| 3480.0         | S       | H                 | 20.60             | 17.40              | -7.12                    | 38.00          | 30.88         | 79.00                   | 59.00                  | -28.12         | A V |
| 3912.0         | S       | H                 | 25.96             | 19.31              | -7.12                    | 45.27          | 38.15         | 74.00                   | 54.00                  | * -15.85       | A V |
| 4348.0         | S       | H                 | 26.47             | 19.61              | -7.12                    | 46.08          | 38.96         | 79.00                   | 59.00                  | -20.04         | A V |

### Remark :

- (1) + F/S F : denotes Fundamental Frequency ; S : denotes Spurious Frequency
- (2) **EUT Orthogonal Axes** : X denotes Laid on Table ; Z denotes Side Stand ; Y denotes Vertical Stand .
- (3) Measuring frequencies from 30 MHz to the 10th harmonic of fundamental frequency of 433.92MHz.
- (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 §15.205, then the general radiated emission limits in § 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 Actual FS 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 :

Test Engr. :

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## 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

$$\text{Correction Factor} = AF + CL - AG = 13.3 + 10.0 - 15.0 = 8.3 \text{ (dB)}$$

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

2. The Field Strength will be calculated by

$$FS = RA + \text{Correction Factor} = 23.7 + 8.3 = 32 \text{ (dBuV/m)}.$$

### (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

$$\text{Correction Factor} = AF + CL = 7.2 + 1.1 = 8.3 \text{ (dB)}$$

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

2. The Field Strength will be calculated by

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

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:

$$\text{Log}^{-1} \left[ (32.0 \text{ dBuV/m}) / 20 \right] = 39.8 \text{ (uV/m)}$$

**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 calculated as **61.8 ms ( refer to Attachment- A)**

$$T_{(p)} = 41\text{ms}$$

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

$$T_{(on)} = 0.2 \times 6 + 0.4333 \times 26 + 0.9333 \times 6 = 18.06\text{ms}$$

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

$$\text{Factor} = 20 \log[ T_{(on)} / T_{(p)} ] = 20 \log(18.06/41) = -7.12 \text{ (dB)}$$

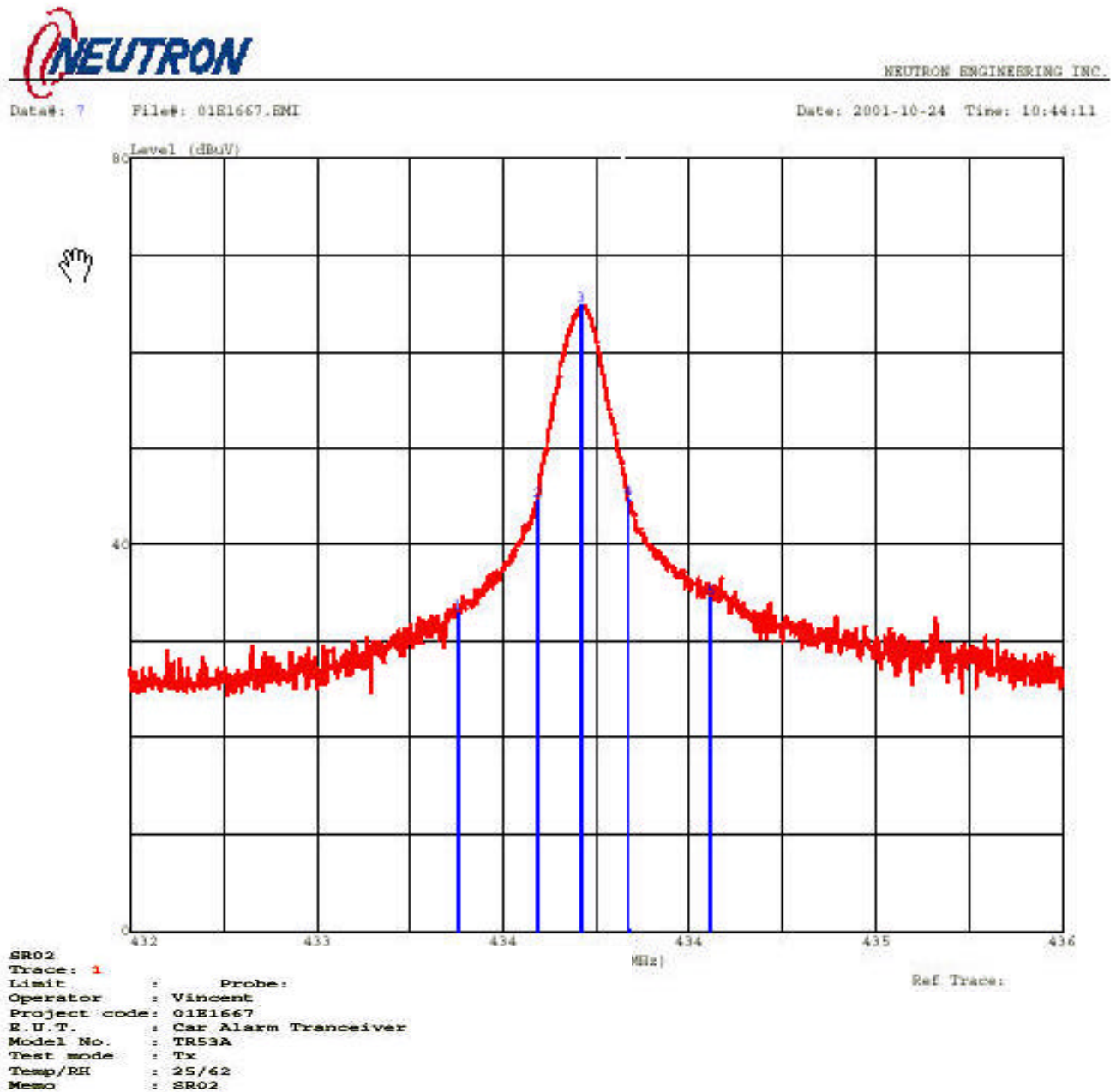
**4. Retails information refers to Attachment A.**

**6-4. Correction Factor VS Frequency**

| <b>Frequency (MHz)</b> | <b>Antenna Factor (dB)</b> | <b>Cable Loss (dB)</b> |
|------------------------|----------------------------|------------------------|
| 30.00                  | 11.60                      | 0.10                   |
| 35.00                  | 10.80                      | 0.20                   |
| 40.00                  | 11.20                      | 0.20                   |
| 45.00                  | 11.30                      | 0.20                   |
| 50.00                  | 11.10                      | 0.40                   |
| 55.00                  | 10.50                      | 0.50                   |
| 60.00                  | 9.90                       | 0.60                   |
| 65.00                  | 8.70                       | 0.60                   |
| 70.00                  | 7.70                       | 0.60                   |
| 75.00                  | 6.60                       | 0.60                   |
| 80.00                  | 6.30                       | 0.60                   |
| 85.00                  | 7.20                       | 0.70                   |
| 90.00                  | 8.60                       | 0.70                   |
| 95.00                  | 10.10                      | 0.70                   |
| 100.00                 | 11.40                      | 0.70                   |
| 110.00                 | 12.90                      | 0.90                   |
| 120.00                 | 13.40                      | 1.00                   |
| 130.00                 | 13.20                      | 1.00                   |
| 140.00                 | 12.50                      | 1.00                   |
| 150.00                 | 12.20                      | 1.10                   |
| 160.00                 | 13.00                      | 1.10                   |
| 170.00                 | 14.50                      | 1.10                   |
| 180.00                 | 15.90                      | 1.10                   |
| 190.00                 | 17.00                      | 1.10                   |
| 200.00                 | 17.50                      | 1.20                   |
| 225.00                 | 12.20                      | 1.20                   |
| 250.00                 | 13.30                      | 1.30                   |
| 275.00                 | 14.20                      | 1.40                   |
| 300.00                 | 15.90                      | 1.30                   |
| 325.00                 | 14.80                      | 1.40                   |
| 350.00                 | 15.90                      | 1.50                   |
| 375.00                 | 20.80                      | 1.60                   |
| 400.00                 | 17.10                      | 1.60                   |
| 450.00                 | 18.10                      | 1.70                   |
| 500.00                 | 19.40                      | 1.60                   |
| 550.00                 | 19.70                      | 2.00                   |
| 600.00                 | 20.10                      | 2.10                   |
| 650.00                 | 21.00                      | 2.00                   |
| 700.00                 | 22.30                      | 2.30                   |
| 750.00                 | 22.20                      | 2.40                   |
| 800.00                 | 22.20                      | 2.50                   |
| 850.00                 | 23.50                      | 2.50                   |
| 900.00                 | 24.30                      | 2.70                   |
| 950.00                 | 24.60                      | 2.60                   |
| 1000.00                | 25.70                      | 2.80                   |

## 7. Supplementary Information for Section 15.231(C) Requirements

## 7.1 Bandwidth requirement



Page: 1

|   | Freq    | Level | Over  | Limit | Read  |        | Ant | Table |        |
|---|---------|-------|-------|-------|-------|--------|-----|-------|--------|
|   | MHz     | dB    | Limit | Line  | Level | Factor | Pos | Pos   | Remark |
|   |         |       | dB    | dB    | dB    | dB     | cm  | deg   |        |
| 1 | 433.404 | 32.88 | ----- | ----- | 32.88 | 0.00   | --- | ---   |        |
| 2 | 433.744 | 44.54 | ----- | ----- | 44.54 | 0.00   | --- | ---   |        |
| 3 | 433.932 | 64.72 | ----- | ----- | 64.72 | 0.00   | --- | ---   |        |
| 4 | 434.136 | 44.64 | ----- | ----- | 44.64 | 0.00   | --- | ---   |        |
| 5 | 434.488 | 34.33 | ----- | ----- | 34.33 | 0.00   | --- | ---   |        |

The center frequency  $f_c$  is **433.92Mhz (point 3)**, according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at-20dB should be calculated as following:

$$433.92 \times 0.0025 = 1.0848(\text{Mhz})$$

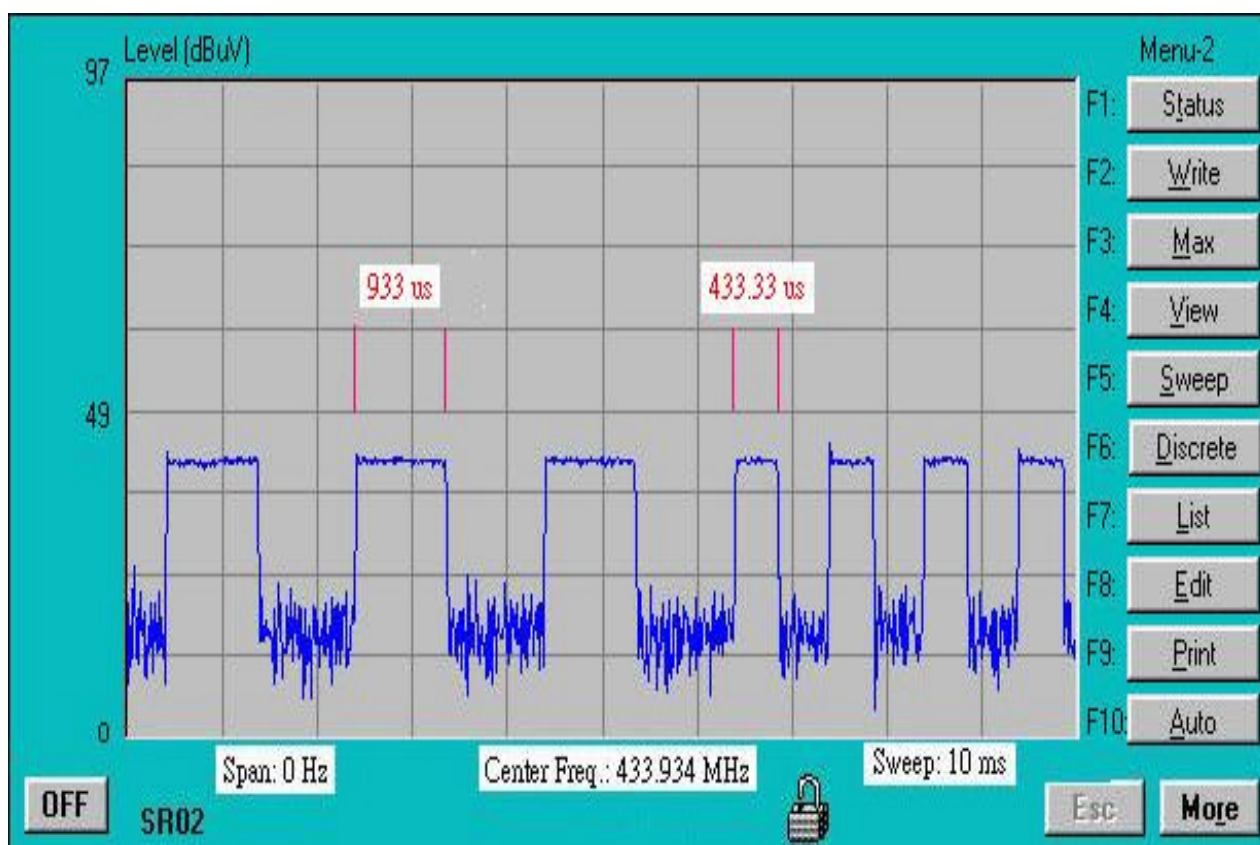
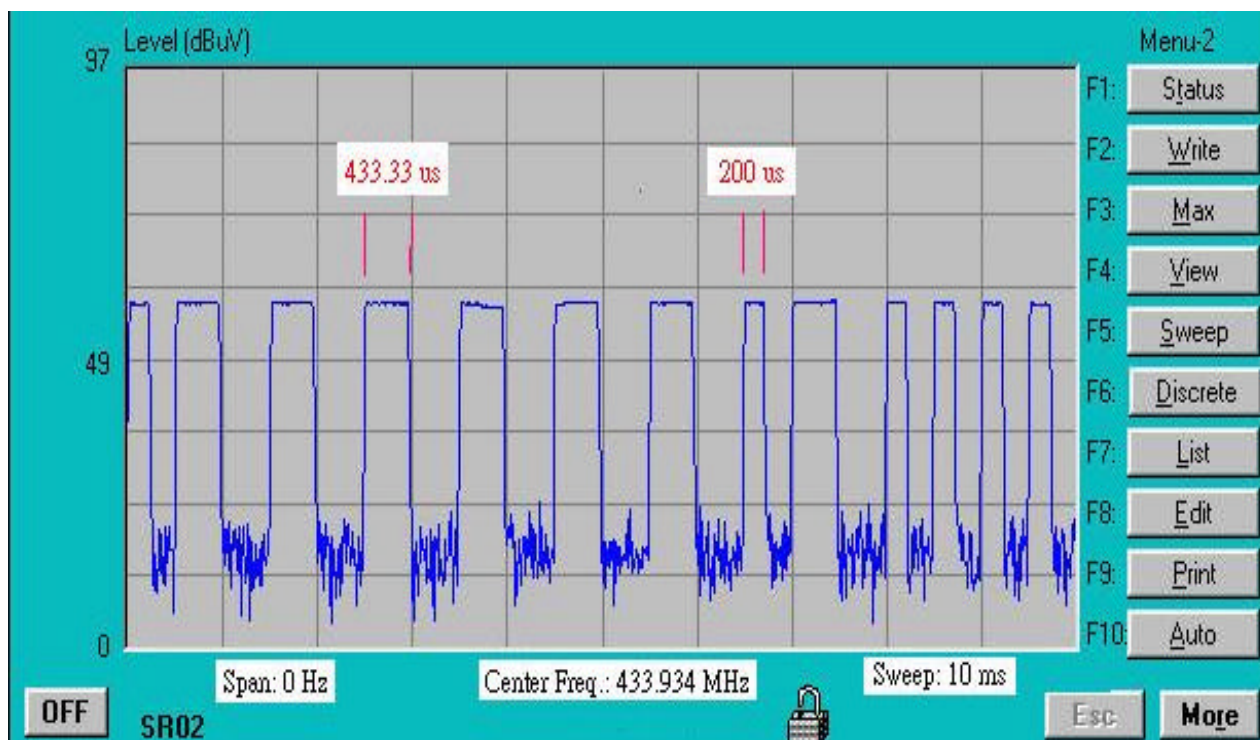
So, the Uper/Lower frequencies should be specified as :

$$f_{(U)} = f_c + D f/2 = 433.92 + 0.5424 = 434.46(\text{Mhz}) \text{ (point 5)}$$

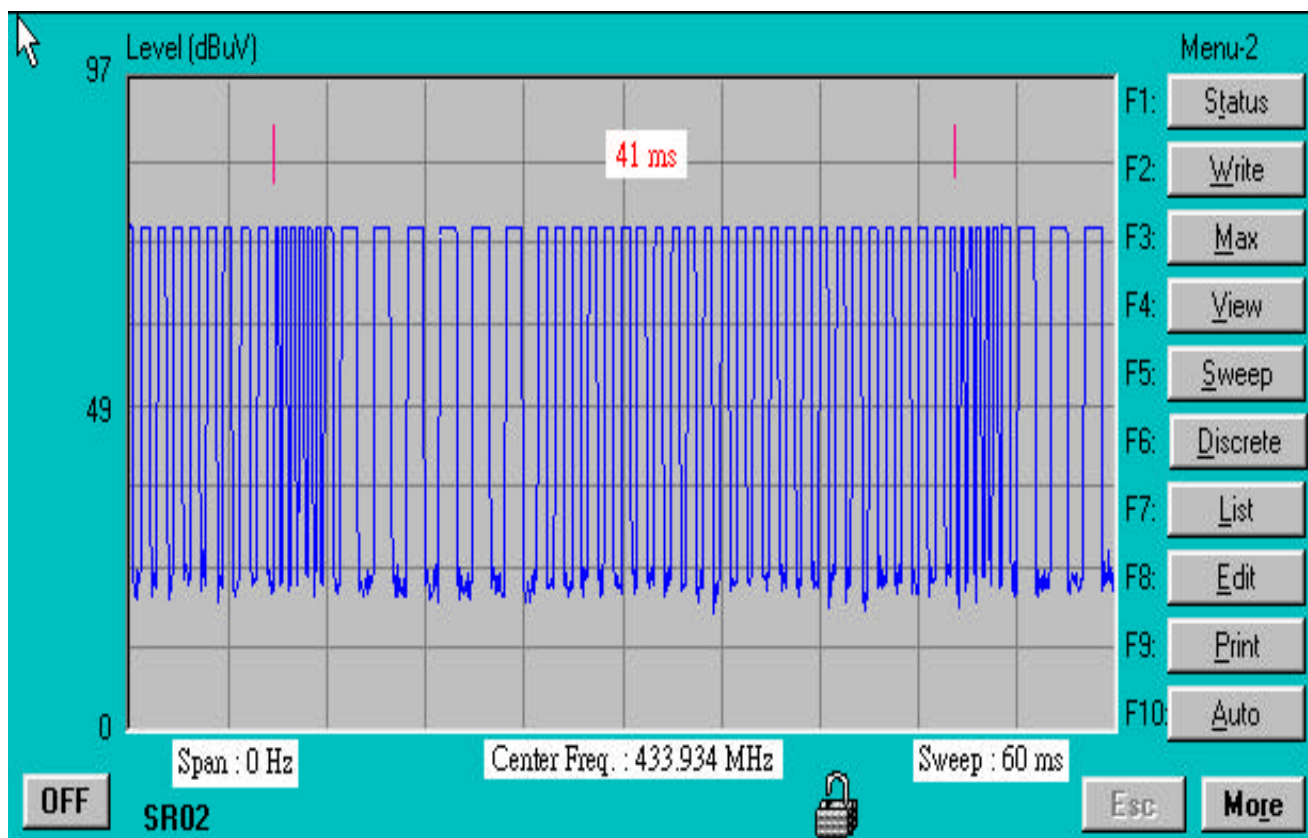
$$f_{(L)} = f_c - D f/2 = 433.92 - 0.5424 = 433.377 \text{ (MHz) (point 1)}$$

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  $f_{(L)}=433.377 \text{ Mhz}$  and  $f_{(U)} = 434.46 \text{ Mhz}$ . So, it is complacence with the requirements.

**Attachment - A.**  
**Supplementary Information of Pulsed Transmission & Pulse Code Timing Chart**  
**Duty cycle test**



## Duty cycle test



$$T_{on} = 0.2 * 6 + 0.4333 * 26 + 0.9333 * 6 \text{ (ms)} = 18.06 \text{ (ms)}$$

$$T_p = 41 \text{ ms}$$

$$\begin{aligned} \text{Factor} &= 20 * \log(T_{on} / T_p) = 20 * \log(18.06 / 41) \\ &= -7.12 \text{ dB} \end{aligned}$$

**Attachment - B.**

**Photos of Tested EUT**

- 1. Photo EUT 1.      Front View   Rear View**
- 2. Photo EUT 2-4      Unit partially Disassembled**

## **Attachment C.**

### **User Manual**