

Underwriters Laboratories Inc.
1285 Walt Whitman Road
Melville, New York 11747-3081
(631) 271-6200

**Report of Measurements
of Electromagnetic Compatibility Testing**

| | | |
|-----------------------|--|--------------------------|
| Test Report File No.: | E236493 | Date of issue: 7/16/2003 |
| Applicant: | AUR°EL SPA | |
| Model: | TX-4C | |
| Product Type: | Wireless Remote Control | |
| Power Supply: | 1.5Vdc battery | |
| Manufacturer: | Same As Applicant | |
| License holder: | Same As Applicant | |
| Address: | V.le dell' Industria 31-33 35129 I- Padova, Italy | |
| Test Type: | Compliance Investigation | |
| Test Project Number: | 03CA12998 | |
| References(s) | FCC ID: RB4058402 | |

Underwriters Laboratories Inc. authorizes the above-named company to reproduce this Report provided it is reproduced in its entirety.

Underwriters Laboratories Inc. reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. Underwriters Laboratories Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from Underwriters Laboratories Inc. issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.

Report Directory

| | | |
|------------|---|-----------|
| 1.0 | <i>GENERAL - Product Description</i> | 3 |
| 1.1 | Device Configuration During Test | 3 |
| 1.2 | Deviations from ANSI C63.4 | 3 |
| 1.3 | Device Modifications Necessary for Compliance | 4 |
| 1.4 | Test Summary | 4 |
| 2.0 | <i>EMISSIONS TEST REGULATIONS</i> | 4 |
| 2.1 | Documentation Information | 4 |
| | Identification..... | 4 |
| | Compliance information | 5 |
| | Labeling | 5 |
| | User information | 7 |
| 2.2 | EUT OPERATION MODE - EMISSIONS TESTS | 8 |
| 2.2.1 | Conducted Emissions Tests..... | 9 |
| 2.2.2 | Cease Operation Within 5 Seconds | 9 |
| 2.1.3 | Radiated Emissions Test (10 Meter Semi-Anechoic Chamber)..... | 12 |
| 2.2.4 | Occupied Bandwidth..... | 20 |
| 2.2.5 | Fundamental Frequency and Spurious Emissions Measurement Limit Calculations | 23 |
| 3.0 | <i>SUMMARY:</i> | 25 |

1.0 G E N E R A L - Product Description

Device Function: RF transmitter with SAW resonator, up to 4 channels. It is for applications where codified controls are required.

According to the manufacturer, the device is not sold with any specific receiver.

There are 2 banks of dip switches in the device. The operation is described below and the switches were set for maximum emissions.

A) Bank of 10 dipswitches (easier to locate when battery compartment is removed): this is a combination that must be set to "couple" one Tx with its corresponding receiving unit. Only Tx and Rx units that will have the same switches combination can work together.

B) Bank of 4 dipswitches (under main enclosure shells): these switches ARE NOT TO BE CHANGED from original setting. Also, these switches, at AUREL discretion, could be removed and substituted with electrical shorts in the circuit. These switches are used to set the operation of the 4 push buttons on the device.

1.1 Device Configuration During Test

The device under test was tested in normal orientation that represents the worst-case orientation.

Continuously transmitting an intentional radio frequency in Continuous Wave (CW) for RF Emissions tests and in a normal Pulsed mode for all other tests.

The manufacturer configured the device.

| Device | Manufacturer | Model Number | Serial Number | FCC ID |
|-------------------------|--------------|--------------|---------------|------------|
| Wireless Remote Control | Aur°el SPA | TX-4C | NA | XXX-058402 |

"The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report"

1.2 Deviations from ANSI C63.4

Not applicable, the ANSI C63.4 test measurements procedures were employed.

1.3 Device Modifications Necessary for Compliance

N/A

1.4 Test Summary

| Test | Basic Standard | Considered | Tested | In Compliance |
|--|---|------------|--------|---------------|
| Conducted Voltage Emissions (Continuous Data Transmit Mode) | FCC Part 15 Subpart B, Class B. Paragraph 15.205 | Y | NA | NA |
| Radiated Emissions | FCC Part 15 Subpart C, Class B, Intentional Radiators, Paragraph 15.209 | Y | Y | Y |
| Cease Operation < 5 seconds | FCC Part 15 Subpart C, Paragraph 15.231 | Y | Y | Y |
| Occupied Bandwidth | FCC Part 15 Subpart C, Paragraph 15.231 | Y | Y | Y |

2.0 EMISSIONS TEST REGULATIONS

FCC Part 15 Subpart C, Paragraph 15.209 & 15.231

2.1 Documentation Information

Identification.

Devices Subject to Verification

In 47 CFR, Part 2, § 2.954:

“Devices subject only to verification shall be uniquely identified by the person responsible for marketing or importing the equipment within the United States. However, the identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified or type accepted equipment. The importer or manufacturer shall maintain adequate identification records to facilitate positive identification for each verified device.”

Devices Subject to Declaration of Conformity

In 47 CFR, Part 2, § 2.1074:

“Devices subject only to a Declaration of Conformity shall be uniquely identified by the responsible party. This identification shall not be of a format which could be confused with the FCC Identifier required on certified, notified, type accepted or type approved equipment. The responsible party shall maintain adequate identification records to facilitate positive identification for each device.”

Compliance information

§ 2.1077 Compliance information.

(a) If a product must be tested and authorized under a Declaration of Conformity, a compliance information statement shall be supplied with the product at the time of marketing or importation, containing the following information:

- (1) Identification of the product, e.g., name and model number;
- (2) A statement, similar to that contained in § 15.19(a)(3) of this chapter, that the product complies with part 15 of this chapters; and
- (3) The identification, by name, address and telephone number, of the responsible party, as defined in § 2.909.

The responsible party for a Declaration of Conformity must be located within the United States.

(c) The compliance information statement shall be included in the user’s manual or as a separate sheet.

§ 15.19(a)(3):

“ All other devices shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.”

Labeling.

1.6.3.1 Certification or Verification

In addition to the requirements in Part 2 of this CFR 47 (See **1.6.1 Identification** above), a device subject to certification or verification shall be labeled as follows:

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

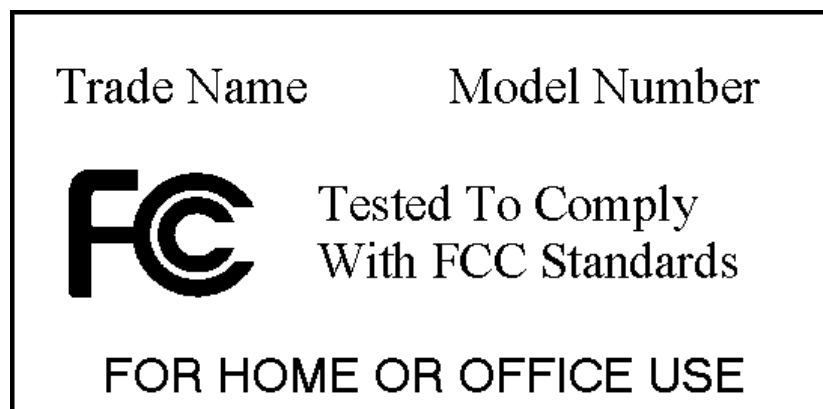
(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

1.6.3.2 Declaration of Conformity Labeling

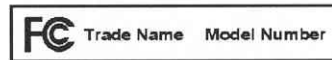
In addition to the requirements in Part 2 of CFR 47 (See **1.6.1 Identification** above), a device subject to authorization under a Declaration of Conformity shall be labeled as follows:

(1) The label shall be located in a conspicuous location on the device and shall contain the unique identification described in Section 2.1074 of this chapter and the following logo:

(i) If the product is authorized based on testing of the product or system:



Alternate label format for small devices:



***Tested To Comply
With FCC Standards
FOR HOME OR OFFICE USE***

The text shown in ***bold-face italics*** may be placed in a prominent location in the instruction manual or pamphlet supplied to the user.

- (2) Label text and information should be in a size of type large enough to be readily legible, consistent with the dimensions of the equipment and the label. However, the type size for the text is not required to be larger than eight point.
- (3) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (b)(1) of this section on it, such as for a CPU board or a plug-in circuit board peripheral device, the text associated with the logo may be placed in a prominent location in the instruction manual or pamphlet supplied to the user. However, the unique identification (trade name and model number) and the logo must be displayed on the device.
- (4) The label shall not be a stick-on, paper label. The label on these products shall be permanently affixed to the product and shall be readily visible to the purchaser at the time of purchase, as described in Section 2.925(d) of this chapter. "Permanently affixed" means that the label is etched, engraved, stamped, silk-screened, indelibly printed, or otherwise permanently marked on a permanently attached part of the equipment or on a nameplate of metal, plastic, or other material fastened to the equipment by welding, riveting, or a permanent adhesive. The label must be designed to last the expected lifetime of the equipment in the environment in which the equipment may be operated and must not be readily detachable.

User information.

In 47 CFR, Part 15, § **15.21 Information to user:**

"The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

In 47 CFR, Part 15, § **15.105 Information to the user:**

Class A Devices

"(a) For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not

installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense."

Class B Devices

"(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help*

"(d) For systems incorporating several digital devices, the statement shown in paragraph (a) or (b) of this section needs to be contained only in the instruction manual for the main control unit."

2.2 EUT OPERATION MODE - EMISSIONS TESTS

As per manufacturer's instructions: Continuous transmission for Radiated Emissions testing and normal transmission for all other tests.

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

2.2.1 Conducted Emissions Tests

Test Not Applicable

EUT is powered by 1.5Vdc battery.

2.2.2 Cease Operation Within 5 Seconds

Test Applicable

Temperature: 21.6 °C
Humidity: 45 %RH
Pressure: 994 milbar
Date test performed: 29 May 2003

Test Procedure:

This test is performed one time at any frequency band. A manual operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test equipment for Cease Operation:

| | | | |
|--------------|-----------------------------|-----------------------|--------------------------------|
| ESI26 | Rhode & Schwartz | EMI Receiver | Equipment No.: ME5B-081 |
| | | Quasi Peak BW: | 200Hz |
| | | RBW | 10 KHz |
| | | Quasi Peak BW: | 9kHz |
| | | RBW | 100 KHz |
| | | Quasi Peak BW: | 10 kHz |
| | | RBW | 300 MHz |

Range: 0 – 7 sec Last Calibration Date: 20 Aug 2002 Calibration Due Date: 20 Aug 2002

| | | | |
|--------------|-------------|---------------------------|-------------------------------|
| 3121C | EMCO | Dipole Antenna Set | Equipment No.: ME5-751 |
|--------------|-------------|---------------------------|-------------------------------|

Range: 433MHz +/-2MHz Last Calibration Date: 06 Mar 2003 Calibration Due Date: 06 Mar 2004

| | | | |
|-----------------|--------------------|--|-------------------------------|
| 99760-00 | Cole Parmer | Humidity/Temp/Barometric Pressure | Equipment No.: ME4-268 |
|-----------------|--------------------|--|-------------------------------|

Temp: 0-55°

Humidity: 25% to 95% RH

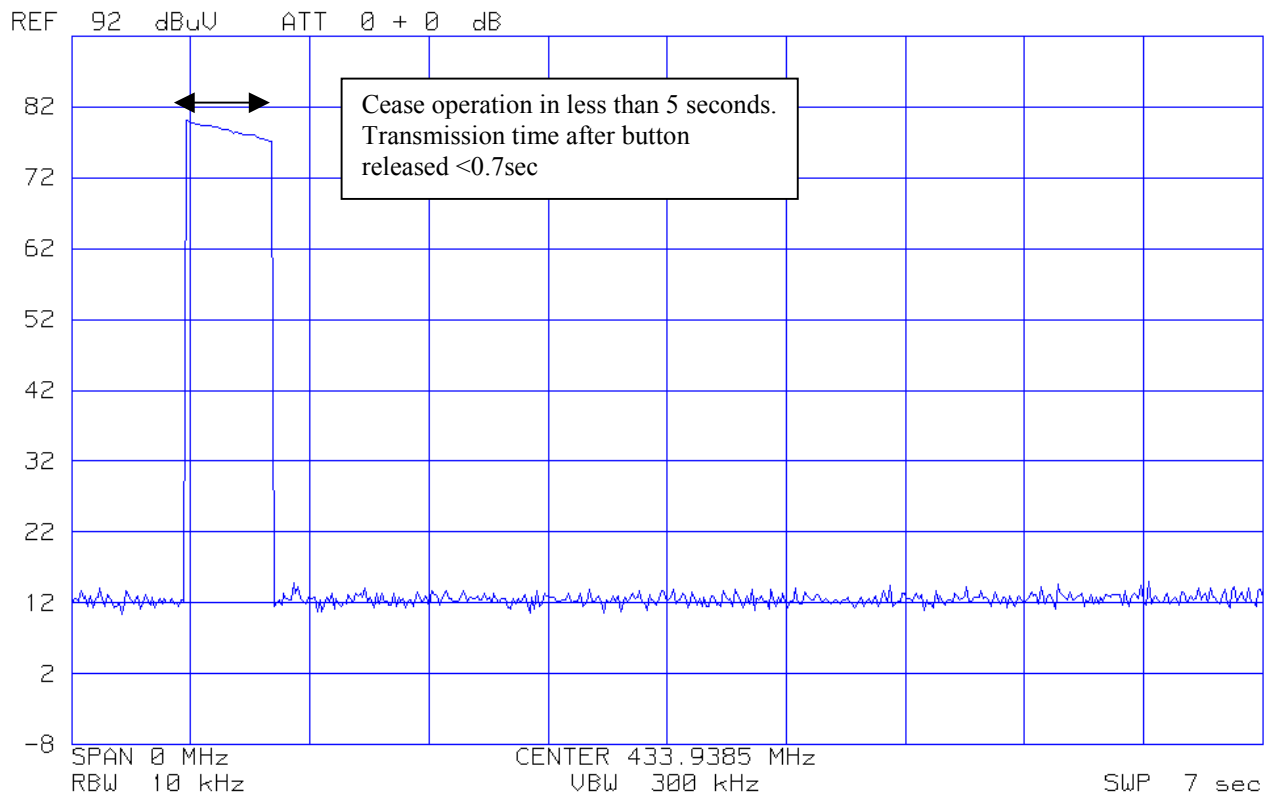
Pressure: 765 to 1050 mbar

Last Calibration Date: 27 May 2003

Calibration Due Date: 27 May 2004

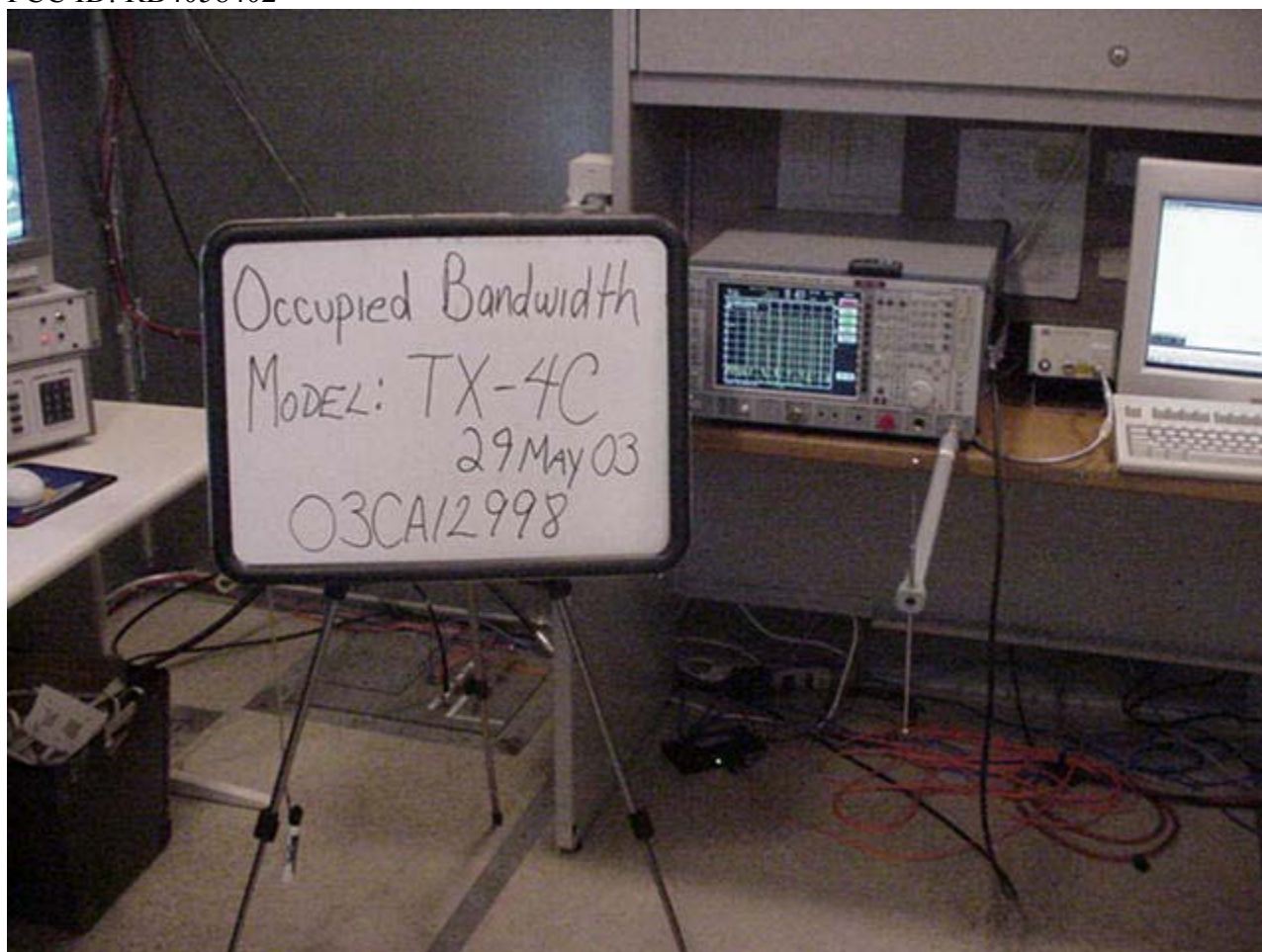
File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003



File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003



Cease Operation Test Set-Up

(although the photo shown is labeled "Occupied BW", the setup for Cease Operation is identical and this picture is representative for this investigation.)

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

2.1.3 Radiated Emissions Test (10 Meter Semi-Anechoic Chamber)

Test Applicable

Temperature: 22.0 °C
Humidity: 44% RH
Pressure: 1030 milbar
Date test performed: 27 May 2003

The EUT (equipment under test) was tested in 3 orthogonal axes and the orientation depicted in the Radiated Emission test set-up was deemed worst case.

Mode: "Constant Wave Transmit"

Measurement distance: 3 Meters

Frequency Range: 30MHz - 5000MHz Electric

Paragraph 15.35 :

When the Radiated Limits are expressed in terms of the average value of the emissions, and pulse operation is employed, the pulse measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds (100ms) or in cases where the pulse train exceeds 0.1seconds the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Test equipment used for final radiated emissions tests:

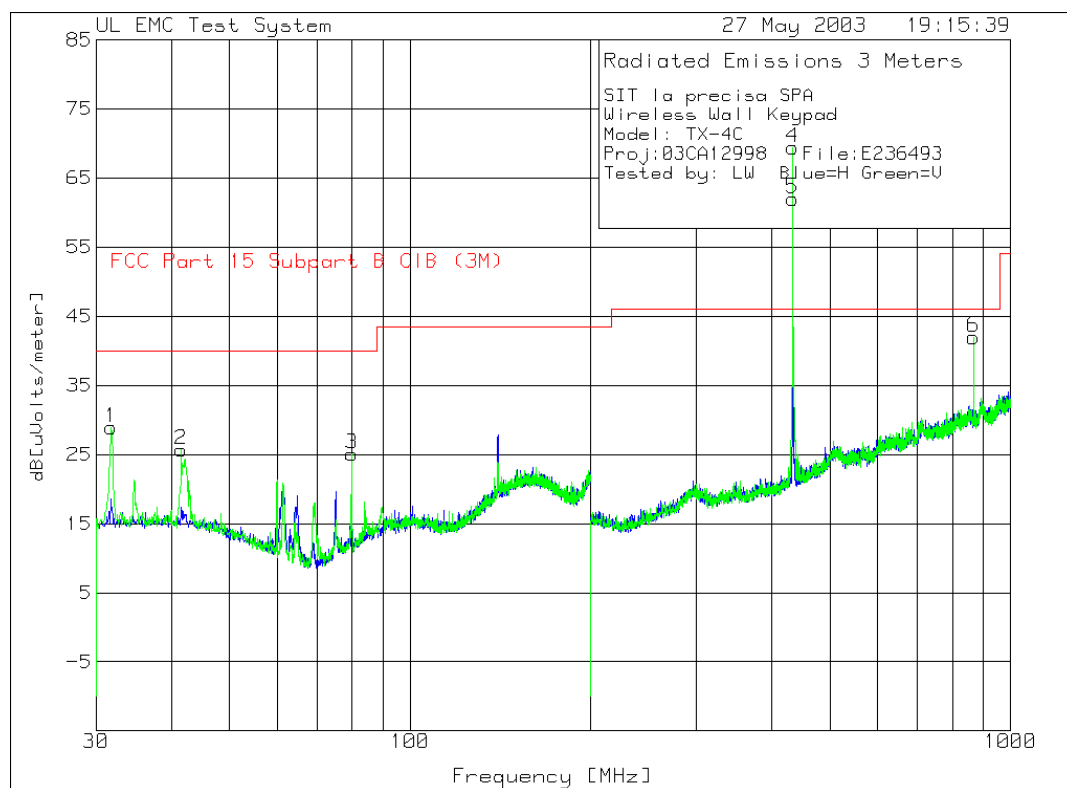
| | | | |
|-------------------|---------------------------------------|--------------------------------------|-------------------------|
| ESI26 | Rhode & Schwartz | EMI Receiver | Equipment No.: ME5B-081 |
| | | Quasi Peak BW: | 200Hz |
| | | RBW | 10 KHz |
| | | Quasi Peak BW: | 9kHz |
| | | RBW | 100 KHz |
| | | Quasi Peak BW: | 120 kHz |
| | | RBW | 1.0 MHz |
| Range: 30MHz-5GHz | Last Calibration Date: 20 August 2002 | Calibration Due Date: 20 August 2003 | |

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

Test Accessories for Radiated Emissions:

| | | | |
|---|-----------------------------|--|-------------------------------|
| 94455-1 | Ailtech | Biconnical Antenna | Equipment No.: ME5-439 |
| Last Calibration Date: 15 November 2002 | | Calibration Due Date: 15 November 2003 | |
| 3146 EMCO | Log Periodic Antenna | Equipment No.: ME5-451 | |
| Last Calibration Date: 21 November 2002 | | Calibration Due Date: 21 November 2003 | |
| RGA-180 | EMCO | Horn Antenna | Equipment No.: ME5-565 |
| Last Calibration Date: 17 June 2002 | | Calibration Due Date: 17 June 2003 | |
| 8449BHewlett Packard | 1-26GHz Pre-Amp | Equipment No.: ME5-914 | |
| 99760-00 | Cole Parmer | Humidity/Temp/Barometric Pressure | Equipment No.: ME4-268 |
| Range: Temp: 0-55° | | Humidity: 25% to 95% RH | Pressure: 765 to 1050 mbar |
| Last Calibration Date: 27 May 2003 | | Calibration Due Date: 27 May 2004 | |



File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

SIT la precisa SPA
Wireless Remote Control
Model: TX-4C

Proj:03CA12998 File:E236493

Tested by: LW Blue=H Green=V

| No. | Test Frequency [MHz] | Meter Reading [dB (uV)] | Gain/Loss Factor [dB] | Transducer Factor [dB] | Level dB[uVolts/meter] | Limit:1 |
|-----|----------------------------|-------------------------------|-----------------------------|------------------------------|---------------------------|---------|
|-----|----------------------------|-------------------------------|-----------------------------|------------------------------|---------------------------|---------|

| | | | | | | |
|----------------------------|-------------|------------|------|-------------|-------|--------|
| ===== | | | | | | |
| Vertical 30 - 200MHz ----- | | | | | | |
| 1 | 31.7859 | 14.7 pk | .9 | 13.3 | 28.9 | 40 |
| | Azimuth:356 | Height:198 | Vert | Margin [dB] | | -11.1 |
| 2 | 41.5658 | 11.75 pk | .9 | 13 | 25.65 | 40 |
| | Azimuth:87 | Height:198 | Vert | Margin [dB] | | -14.35 |
| 3 | 80.005 | 15.34 pk | 1.3 | 8.4 | 25.04 | 40 |
| | Azimuth:152 | Height:100 | Vert | Margin [dB] | | -14.96 |

| | | | | | | |
|--------------------------------|-------------|------------|------|-------------|-------|--------|
| Horizontal 200 - 1000MHz ----- | | | | | | |
| 5 | 433.9446 | 43.08 pk | 3.2 | 15.7 | 61.98 | 80.7 |
| | Azimuth:359 | Height:299 | Horz | Margin [dB] | | -18.72 |

| | | | | | | |
|------------------------------|-------------|------------|------|-------------|-------|-------|
| Vertical 200 - 1000MHz ----- | | | | | | |
| 4 | 433.9446 | 50.5 pk | 3.2 | 15.7 | 69.4 | 80.7 |
| | Azimuth:62 | Height:101 | Vert | Margin [dB] | | -11.3 |
| 6 | 867.956 | 15.58 pk | 4.4 | 22 | 41.98 | 46 |
| | Azimuth:247 | Height:101 | Vert | Margin [dB] | | -4.02 |

LIMIT 1: FCC Part 15 Subpart B ClB (3M) and FCC Part 15, Subpart C, 15.231
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

pk - Peak detector
qp - Quasi-Peak detector
av - Average detector
avlg - denotes average log detection
avem - denotes EMI average detection
tm - Trace Math Result

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

SIT la precisa SPA
Wireless Remote Control
Model: TX-4C
Proj:03CA12998 File:E236493
Tested by: LW Blue=H Green=V

| Test | Meter | Gain/Loss | Transducer | Level | Limit:1 |
|-----------|----------|-----------|------------|------------------|---------|
| Frequency | Reading | Factor | Factor | dB[uVolts/meter] | |
| [MHz] | [dB(uV)] | [dB] | [dB] | | |

=====

Vertical 30 - 200MHz

| | | | | | |
|-------------|------------|------|--------------|------|------|
| 31.808 | 17.5 qp | .9 | 13.3 | 31.7 | 40 |
| Azimuth: 19 | Height:359 | Vert | Margin [dB]: | | -8.3 |

| | | | | | |
|-------------|------------|------|--------------|------|------|
| 42.435 | 17.5 qp | .9 | 13 | 31.4 | 40 |
| Azimuth: 61 | Height:303 | Vert | Margin [dB]: | | -8.6 |

| | | | | | |
|------------|------------|------|--------------|------|-------|
| 79.9985 | 20 qp | 1.3 | 8.4 | 29.7 | 40 |
| Azimuth: 4 | Height:378 | Vert | Margin [dB]: | | -10.3 |

Horizontal 200 - 1000MHz

| | | | | | |
|--------------|------------|------|--------------|-------|--------|
| 433.9287 | 44.18 qp | 3.2 | 15.7 | 63.08 | 80.7* |
| Azimuth: 177 | Height:313 | Horz | Margin [dB]: | | -17.62 |

| | | | | | |
|--------------|------------|------|--------------|-------|--------|
| 433.9193 | 38.54 avem | 3.2 | 15.7 | 57.44 | 80.7* |
| Azimuth: 170 | Height:314 | Horz | Margin [dB]: | | -23.26 |

Vertical 200 - 1000MHz

| | | | | | |
|-------------|------------|------|--------------|------|-------|
| 433.9231 | 54 qp | 3.2 | 15.7 | 72.9 | 80.7* |
| Azimuth: 90 | Height:133 | Vert | Margin [dB]: | | -7.8 |

| | | | | | |
|-------------|------------|------|--------------|-------|--------|
| 433.9212 | 47.44 avem | 3.2 | 15.7 | 66.34 | 80.7* |
| Azimuth: 84 | Height:133 | Vert | Margin [dB]: | | -14.36 |

| | | | | | |
|--------------|------------|------|--------------|-------|--------|
| 867.8273 | 22.16 qp | 4.4 | 22 | 48.56 | 60.7* |
| Azimuth: 221 | Height:136 | Vert | Margin [dB]: | | -12.14 |

| | | | | | |
|--------------|------------|------|--------------|-------|--------|
| 867.8489 | 18.32 avem | 4.4 | 22 | 44.72 | 60.7* |
| Azimuth: 218 | Height:134 | Vert | Margin [dB]: | | -15.98 |

*Denotes Fundamental or Spurious Emission

LIMIT 1: FCC Part 15 Subpart B ClB (3M) and FCC Part 15, Subpart C, 15.231

LIMIT 2: NONE

LIMIT 3: NONE

LIMIT 4: NONE

LIMIT 5: NONE

LIMIT 6: NONE

pk - Peak detector

qp - Quasi-Peak detector

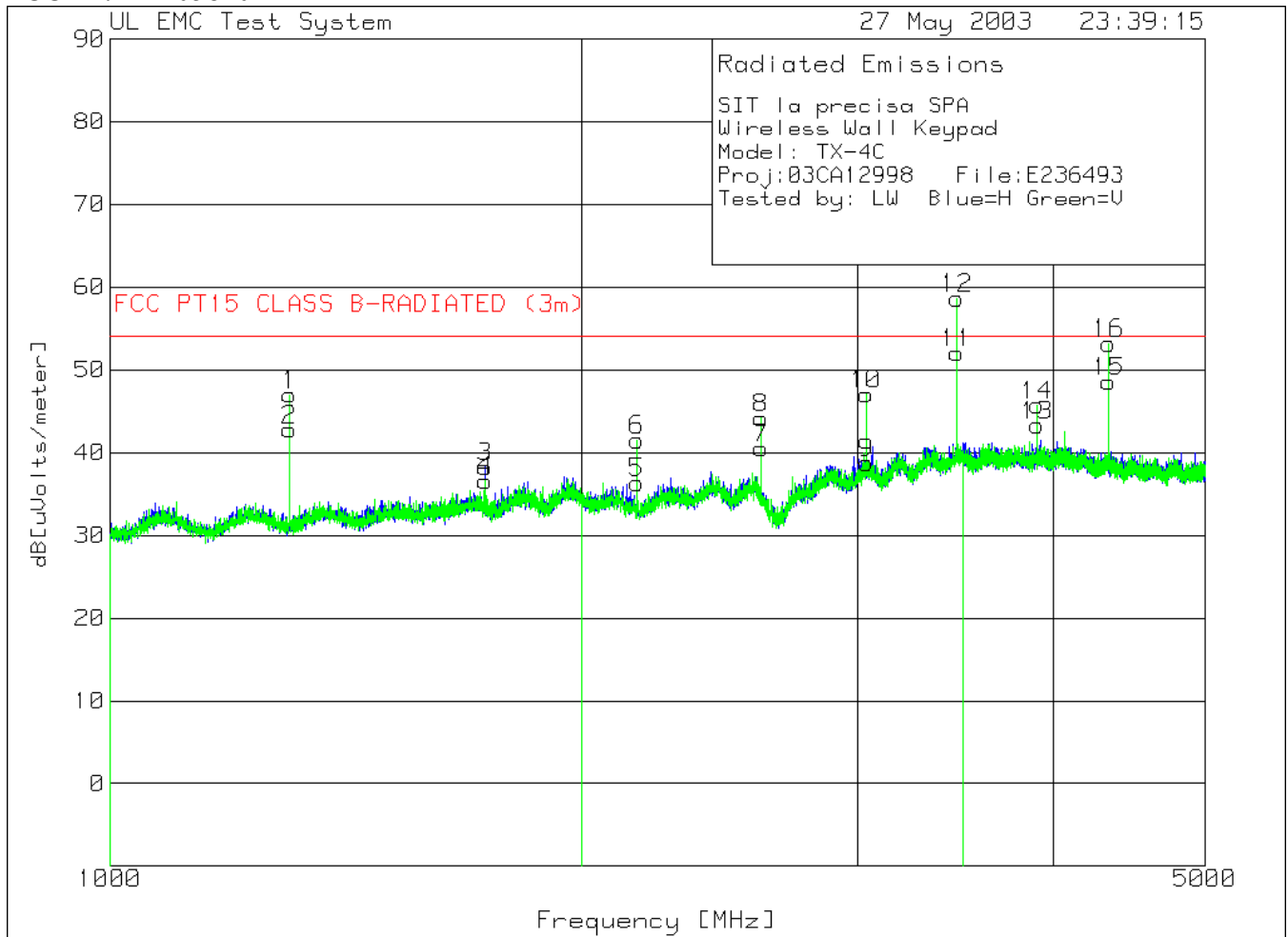
av - Average detector

avlg - Average log detector

avem - EMI Average detector

File Number: E236493
 Project Number: 03CA12998
 Model Number: TX-4C
 FCC ID: RB4058402

Issued: 7/16/2003



SIT la precisa SPA
 Wireless Remote Control
 Model: TX-4C
 Proj:03CA12998 File:E236493
 Tested by: LW Blue=H Green=V

| Test Frequency [MHz] | Meter Reading [dB(uV)] | Gain/Loss Factor [dB] | Transducer Factor [dB] | Level [dB] | Limit [dB] |
|----------------------|------------------------|-----------------------|------------------------|------------|------------|
|----------------------|------------------------|-----------------------|------------------------|------------|------------|

Horizontal 1000 - 2000MHz

| | | | | | | |
|------------------------------|-------|------|-------|---------------------|-------|----|
| 1301.8281 | 35.52 | avem | -32.9 | 26 | 28.62 | 54 |
| Azimuth: 176 Height:112 Horz | | | | Margin [dB]: -25.38 | | |

| | | | | | | |
|------------------------------|-------|------|-------|---------------------|-------|----|
| 1736.2878 | 29.21 | avem | -31.6 | 27.7 | 25.31 | 54 |
| Azimuth: 184 Height:189 Horz | | | | Margin [dB]: -28.69 | | |

Horizontal 2000 - 3500MHz

| | | | | | | |
|------------------------------|------|------|-------|--------------------|------|----|
| 2169.5269 | 28.9 | avem | -30.6 | 29.5 | 27.8 | 54 |
| Azimuth: 164 Height:119 Horz | | | | Margin [dB]: -26.2 | | |

| | | | | | | |
|----------------------------|-------|------|-------|---------------------|-------|----|
| 2603.8129 | 27.34 | avem | -30.2 | 30.8 | 27.94 | 54 |
| Azimuth: 7 Height:156 Horz | | | | Margin [dB]: -26.06 | | |

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

| | | | | | | |
|------------------------------|-------|------|-----|--------------|--------|----|
| 3039.8987 | 26.61 | avem | -29 | 31.6 | 29.21 | 54 |
| Azimuth: 132 Height:103 Horz | | | | Margin [dB]: | -24.79 | |

| | | | | | | |
|-----------------------------|-------|------|-------|--------------|--------|----|
| 3471.5374 | 34.51 | avem | -27.2 | 32.7 | 40.01 | 54 |
| Azimuth: 23 Height:143 Horz | | | | Margin [dB]: | -13.99 | |

Horizontal 3500 - 5000MHz

| | | | | | | |
|------------------------------|-------|------|-------|--------------|--------|----|
| 3905.7738 | 25.56 | avem | -27.3 | 34.1 | 32.36 | 54 |
| Azimuth: 173 Height:105 Horz | | | | Margin [dB]: | -21.64 | |

| | | | | | | |
|------------------------------|-------|------|-------|--------------|--------|----|
| 4339.1669 | 28.63 | avem | -27.3 | 33.9 | 35.23 | 54 |
| Azimuth: 197 Height:108 Horz | | | | Margin [dB]: | -18.77 | |

Vertical 1000 - 2000MHz

| | | | | | | |
|------------------------------|-------|------|-------|--------------|--------|----|
| 1301.72 | 42.21 | avem | -32.9 | 26 | 35.31 | 54 |
| Azimuth: 276 Height:105 Vert | | | | Margin [dB]: | -18.69 | |

| | | | | | | |
|------------------------------|-------|------|-------|--------------|--------|----|
| 1735.579 | 31.91 | avem | -31.6 | 27.7 | 28.01 | 54 |
| Azimuth: 174 Height:110 Vert | | | | Margin [dB]: | -25.99 | |

Vertical 2000 - 3500MHz

| | | | | | | |
|-----------------------------|-------|------|-------|--------------|--------|----|
| 2169.7766 | 30.64 | avem | -30.6 | 29.5 | 29.54 | 54 |
| Azimuth: 43 Height:151 Vert | | | | Margin [dB]: | -24.46 | |

| | | | | | | |
|-----------------------------|-------|------|-------|--------------|--------|----|
| 2603.7 | 28.73 | avem | -30.2 | 30.8 | 29.33 | 54 |
| Azimuth: 80 Height:149 Vert | | | | Margin [dB]: | -24.67 | |

| | | | | | | |
|-----------------------------|-------|------|-----|--------------|--------|----|
| 3037.6388 | 29.31 | avem | -29 | 31.6 | 31.91 | 54 |
| Azimuth: 54 Height:155 Vert | | | | Margin [dB]: | -22.09 | |

| | | | | | | |
|-----------------------------|-------|------|-------|--------------|--------|----|
| 3471.3193 | 37.45 | avem | -27.2 | 32.7 | 42.95 | 54 |
| Azimuth: 15 Height:132 Vert | | | | Margin [dB]: | -11.05 | |

Vertical 3500 - 5000MHz

| | | | | | | |
|------------------------------|-------|------|-------|--------------|--------|----|
| 3905.1749 | 26.15 | avem | -27.3 | 34.1 | 32.95 | 54 |
| Azimuth: 250 Height:101 Vert | | | | Margin [dB]: | -21.05 | |

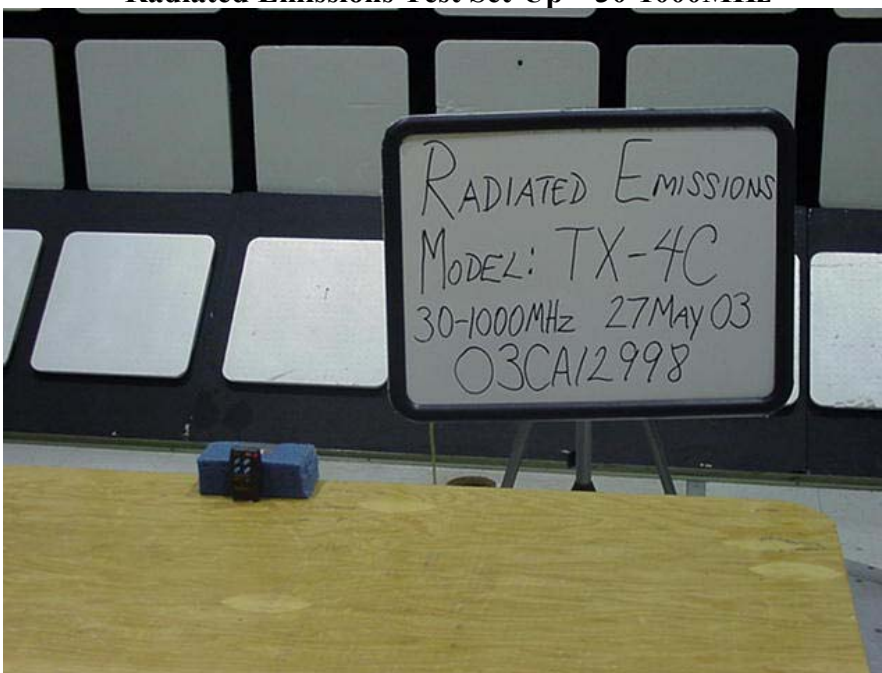
| | | | | | | |
|------------------------------|-------|------|-------|--------------|--------|----|
| 4339.2634 | 27.32 | avem | -27.3 | 33.9 | 33.92 | 54 |
| Azimuth: 238 Height:106 Vert | | | | Margin [dB]: | -20.08 | |

LIMIT 1: FCC Part 15 Subpart B ClB (3M) and FCC Part 15, Subpart C, 15.231
LIMIT 2: NONE
LIMIT 3: NONE
LIMIT 4: NONE
LIMIT 5: NONE
LIMIT 6: NONE

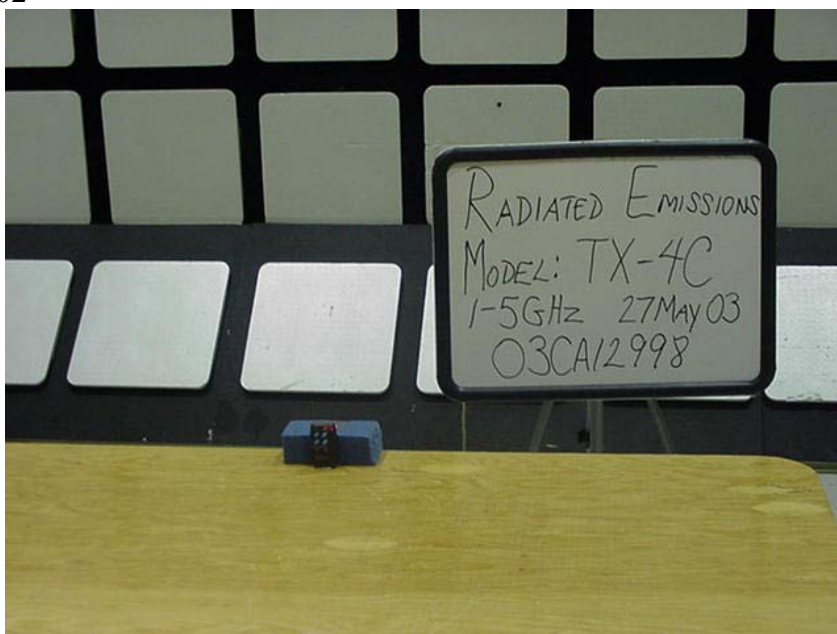
pk - Peak detector
qp - Quasi-Peak detector
av - Average detector
avlg - Average log detector
avem - EMI Average detector



Radiated Emissions Test Set-Up – 30-1000MHz



Radiated Emissions Test Set-Up – 30-1000MHz



Radiated Emissions Test Set-Up –1-5GHz



Radiated Emissions Test Set-Up –1-5GHz

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

2.2.4 Occupied Bandwidth

Temperature: 22 °C
Humidity: 45 %RH
Pressure: 994 mbar
Date test performed: 29 May 2003

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

433.92MHz

Limit: Bandwidth = 0.25% of 433.92MHz = 1.0848MHz

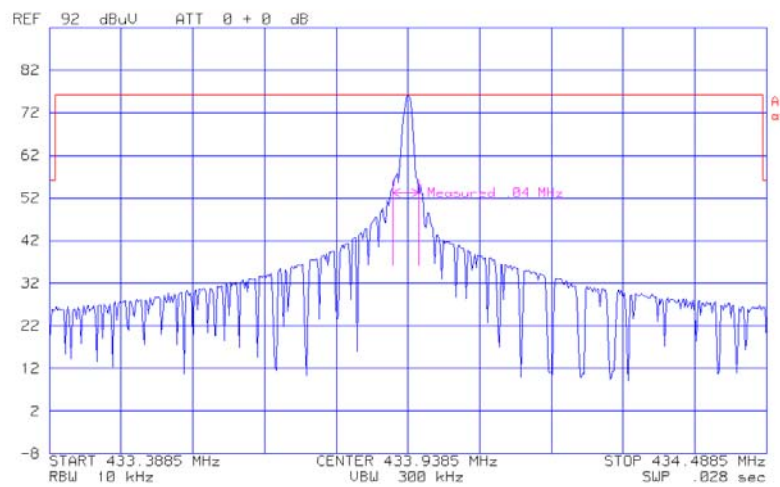
Actual: 0.04MHz

Test equipment used for Occupied Bandwidth Measurements:

| | | | |
|------------------------------------|------------------------------------|--|--------------------------------|
| ESI26 | Rhode & Schwartz | EMI Receiver | Equipment No.: ME5B-081 |
| | | Quasi Peak BW: | 200Hz |
| | | RBW | 10 KHz |
| | | Quasi Peak BW: | 9kHz |
| | | RBW | 300 KHz |
| | | Quasi Peak BW: | 120 kHz |
| | | RBW | 10 KHz |
| Range: 400-500MHz | Last Calibration Date: 20 AUG 2002 | Calibration Due Date: 20 AUG 2002 | |
| 3121C | EMCO | Dipole Antenna Set | Equipment No.: ME5-751 |
| Range: 433MHz +/-2MHz | Last Calibration Date: 06 Mar 2003 | Calibration Due Date: 06 Mar 2004 | |
| 99760-00 | Cole Parmer | Humidity/Temp/Barometric Pressure | Equipment No.: ME4-268 |
| | Range: Temp: 0-55° | Humidity: 25% to 95% RH | Pressure: 765 to 1050 mbar |
| Last Calibration Date: 27 May 2003 | Calibration Due Date: 27 May 2004 | | |

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003



File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003



Occupied Bandwidth Test Set-Up

2.2.5 Fundamental Frequency and Spurious Emissions Measurement Limit Calculations

Limit Calculation

Fundamental Frequency is 433.92MHz

From table in section 15.231

Limit = $41.6667(433.92\text{MHz}) - 7083.3333$

Limit = 10846.3uV

Limit = $\text{Log } 10846.3(20)$

Limit = 80.7dBuV

Limit for Spurious Emissions = 20dB lower then fundamental = 60.7dBuV/m

Radiated Emissions test data obtained during measurements.

Field Strength (dBμV/m) = Measured field strength(dBμV/m) + Antenna Factor(dB) + Cable Factor(dB)

Field Strength (dBμV/m) = 19.7dBμV/m + 12.5dB + 0.3dB

Field Strength (dBμV/m) = 32.5

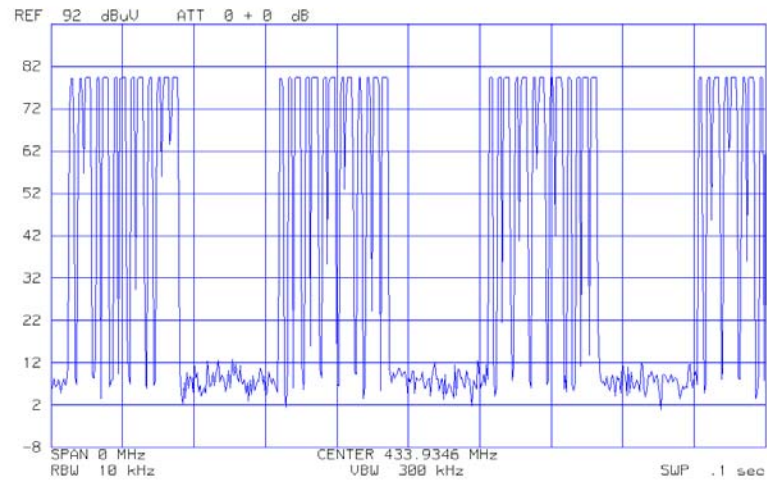
Duty Cycle factor calculation.

Total number of pulses counted in 29.26ms.

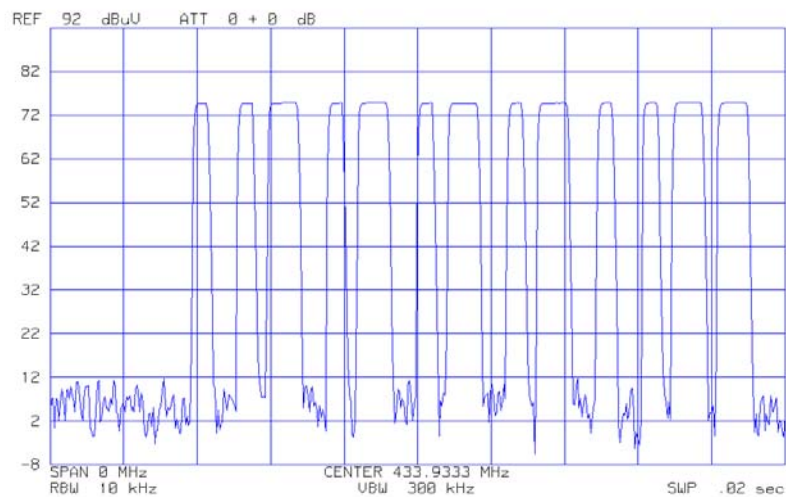
Total time on = 15 ms

Duty cycle correction factor = $20 \log (15 \text{ ms} / 29.26 \text{ ms})$
= $20 \log (0.51)$
= - 5.8

The correction factor is added to the measured field strength in dBuV/m



Pulse Train



Individual Pulses

File Number: E236493
Project Number: 03CA12998
Model Number: TX-4C
FCC ID: RB4058402

Issued: 7/16/2003

3.0 SUMMARY:

The equipment under test has met the technical requirements as defined under section(s) 2.0 and 3.0.

Test Start Date: 27 May 2003

Test Completion Date: 29 May 2003

- UNDERWRITERS LABORATORIES, INC. -

Project Engineer



Robert DeLisi (Ext.22452)
Senior Staff Engineer
International EMC Services
Conformity Assessment Services-3014AMEL

Reviewer



Bernard Papocchia (Ext.23294)
Lead Engineering Associate
International EMC Services
Conformity Assessment Services -3014AMEL

