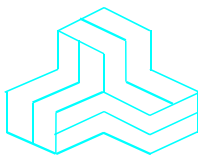


# ENGINEERING TEST REPORT



**DCU706**  
**Model No.: DCU706**  
**FCC ID: URV-DCU706**

*Applicant:*

**Spectron Electronics Inc.**  
116 Fleetwood Rd.  
Lindsay, Ontario  
Canada, K9V 6C6

*In Accordance With*

**FEDERAL COMMUNICATIONS COMMISSION (FCC)**  
**Part 15, Subpart C, Section 15.231**  
**Momentarily Operation at 433.92 MHz**

**UltraTech's File No.: SPEC-001F15C231**

This Test report is Issued under the Authority of  
Tri M. Luu, Professional Engineer,  
Vice President of Engineering  
UltraTech Group of Labs

Date: December 11, 2006



Report Prepared by: JaeWook Choi

Tested by: Hung Trinh, RFI Technician

Issued Date: December 11, 2006

Test Dates: November 20, 26 & 27, 2006

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.

## UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4

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Website: [www.ultratech-labs.com](http://www.ultratech-labs.com), Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), [tri@ultratech-labs.com](mailto:tri@ultratech-labs.com)



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SL2-IN-E-1119R

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File #: SPEC-001F15C231  
December 11, 2006

*All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)*

## EXHIBIT 1. SUBMITTAL CHECK LIST

| Annex No. | Exhibit Type            | Description of Contents                                                                                                                                                                                                                                                                                                                              | Quality Check (OK) |
|-----------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| --        | Test Report             | <ul style="list-style-type: none"><li>Exhibit 1: Submittal check lists</li><li>Exhibit 2: Introduction</li><li>Exhibit 3: Performance Assessment</li><li>Exhibit 4: EUT Operation and Configuration during Tests</li><li>Exhibit 5: Summary of test Results</li><li>Exhibit 6: Measurement Data</li><li>Exhibit 7: Measurement Uncertainty</li></ul> | OK                 |
| 1         | Test Setup Photos       | Radiated Emissions Test Setup Photos                                                                                                                                                                                                                                                                                                                 | OK                 |
| 2         | External Photos of EUT  | External EUT Photos                                                                                                                                                                                                                                                                                                                                  | OK                 |
| 3         | Internal Photos of EUT  | Internal EUT Photos                                                                                                                                                                                                                                                                                                                                  | OK                 |
| 4         | Cover Letters           | <ul style="list-style-type: none"><li>Letter from Ultratech for Certification Request</li><li>Letter from the Applicant to appoint Ultratech to act as an agent</li><li>Letter from the Applicant to request for Confidentiality Filing</li></ul>                                                                                                    | OK                 |
| 5         | ID Label/Location Info  | <ul style="list-style-type: none"><li>ID Label</li><li>Location of ID Label</li></ul>                                                                                                                                                                                                                                                                | OK                 |
| 6         | Block Diagrams          | Block Diagram                                                                                                                                                                                                                                                                                                                                        | OK                 |
| 7         | Schematic Diagrams      | Schematics                                                                                                                                                                                                                                                                                                                                           | OK                 |
| 8         | Parts List/Tune Up Info | Bill of Material                                                                                                                                                                                                                                                                                                                                     | OK                 |
| 9         | Operational Description | Operational Description                                                                                                                                                                                                                                                                                                                              | OK                 |
| 10        | RF Exposure Info        | --                                                                                                                                                                                                                                                                                                                                                   | n/a                |
| 11        | Users Manual            | User Manual                                                                                                                                                                                                                                                                                                                                          | OK                 |

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## EXHIBIT 2. INTRODUCTION

### 2.1. SCOPE

|                                      |                                                                                                                                                                                                                                                                                                              |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference:</b>                    | FCC Part 15, Subpart C, Section 15.231                                                                                                                                                                                                                                                                       |
| <b>Title:</b>                        | Telecommunication - Code of Federal Regulations, CFR 47, Part 15                                                                                                                                                                                                                                             |
| <b>Purpose of Test:</b>              | To gain FCC Certification Authorization for Section 15.231- Momentarily Operation at 433.92 MHz.                                                                                                                                                                                                             |
| <b>Test Procedures:</b>              | Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz. |
| <b>Environmental Classification:</b> | Commercial                                                                                                                                                                                                                                                                                                   |

### 2.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

### 2.3. NORMATIVE REFERENCES

| Publication                          | Year                             | Title                                                                                                                                                               |
|--------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC CFR Parts 0-15                   | 2005                             | Code of Federal Regulations – Telecommunication                                                                                                                     |
| ANSI C63.4                           | 2004                             | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz |
| CISPR 22<br>CISPR 22 +A1<br>EN 55022 | 2003-04-10<br>2004-10-14<br>2003 | Information Technology Equipment - Radio Disturbance Characteristics – Limits and Methods of Measurement                                                            |
| CISPR 16-1-1                         | 2003                             | Specification for radio disturbance and immunity measuring apparatus and methods.<br>Part 1-1: Measuring Apparatus                                                  |
| CISPR 16-2-1                         | 2004                             | Specification for radio disturbance and immunity measuring apparatus and methods.<br>Part 2-1: Conducted disturbance measurement                                    |

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## EXHIBIT 3. PERFORMANCE ASSESSMENT

### 3.1. CLIENT INFORMATION

| APPLICANT              |                                                                                                                                                |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name:</b>           | Spectron Electronics Inc.                                                                                                                      |
| <b>Address:</b>        | 116 Fleetwood Rd.<br>Lindsay, Ontario<br>Canada, K9V 6C6                                                                                       |
| <b>Contact Person:</b> | Mr. Michael Peart<br>Phone #: 705-878-0149<br>Fax #: 705-878-0180<br>Email Address: <a href="mailto:Spectron@accel.net">Spectron@accel.net</a> |

| MANUFACTURER           |                                                                                                                                                |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name:</b>           | Spectron Electronics Inc.                                                                                                                      |
| <b>Address:</b>        | 116 Fleetwood Rd.<br>Lindsay, Ontario<br>Canada, K9V 6C6                                                                                       |
| <b>Contact Person:</b> | Mr. Michael Peart<br>Phone #: 705-878-0149<br>Fax #: 705-878-0180<br>Email Address: <a href="mailto:Spectron@accel.net">Spectron@accel.net</a> |

### 3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

|                                       |                       |
|---------------------------------------|-----------------------|
| <b>Product Name:</b>                  | DCU706                |
| <b>Model Name or Number:</b>          | DCU706                |
| <b>Serial Number:</b>                 | Test Sample           |
| <b>Type of Equipment:</b>             | Low Power Transmitter |
| <b>Power Input Source:</b>            | 12 VAC                |
| <b>Primary User Functions of EUT:</b> | Remote Control        |

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### 3.3. EUT'S TECHNICAL SPECIFICATIONS

| Transmitter only @ 433.92 MHz   |                                                                                        |
|---------------------------------|----------------------------------------------------------------------------------------|
| Equipment Type:                 | Base station (fixed use)                                                               |
| Intended Operating Environment: | Commercial                                                                             |
| RF Output Power Rating:         | 71.8 dBμV/m E-field @ 3 meters                                                         |
| Operating Frequency Range:      | 433.92 MHz                                                                             |
| Duty Cycle:                     | 4.86 %                                                                                 |
| 20 dB Bandwidth:                | 51.46 kHz                                                                              |
| Modulation Type:                | ASK                                                                                    |
| Antenna Connector Type:         | Integral antenna (part of the printed circuit board) housed inside the enclosure.      |
| Antenna Description:            | Type: Integral<br>Model: Printed on PCB<br>Gain: -18 dB<br>Frequency Range: 433.92 MHz |

### 3.4. LIST OF EUT'S PORTS

None.

### 3.5. ANCILLARY EQUIPMENT

None.

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## EXHIBIT 4. EUT OPERATION CONDITIONS AND CONFIGURATIONS DURING TESTS

### 4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

|                     |         |
|---------------------|---------|
| Temperature:        | 21°C    |
| Humidity:           | 51%     |
| Pressure:           | 102 kPa |
| Power Input Source: | 12 VAC  |

### 4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

|                                  |                                                                                                                                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Operating Modes:</b>          | The EUT was set to transmit continuously by means of special setting of jumpers on the printed circuit board for testing purpose only. |
| <b>Special Test Software:</b>    | None                                                                                                                                   |
| <b>Special Hardware Used:</b>    | EUT which is set to force 1 second of the silence periods (instead of 11 seconds) between each burst of 250 millisecond was provided.  |
| <b>Transmitter Test Antenna:</b> | The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral antenna equipment.                 |

|                                |            |
|--------------------------------|------------|
| <b>Transmitter Test Signal</b> |            |
| <b>Frequency</b>               | 433.92 MHz |

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## EXHIBIT 5. SUMMARY OF TEST RESULTS

### 5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049-1). Last Date of Site Calibration: June. 20, 2005.

### 5.2. APPLICABILITY & SUMMARY OF EMC EMISSIONS TEST RESULTS

| FCC Sections                                                                                                                                                                                                                                                              | Test Requirements                                                                                              | Compliance (Yes/No) |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------|
| <b>FCC 15.231 – MOMENTARILY TRANSMITTER @ 433.92 MHz</b>                                                                                                                                                                                                                  |                                                                                                                |                     |
| 15.203                                                                                                                                                                                                                                                                    | Antenna requirement (The transmitter shall use a transmitting antenna that is an integral part of the device). | Yes                 |
| 15.231(a)                                                                                                                                                                                                                                                                 | Provisions of FCC 15.231                                                                                       | Yes                 |
| 15.231(e)                                                                                                                                                                                                                                                                 | Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious                                            | Yes                 |
| 15.231(c)                                                                                                                                                                                                                                                                 | 20 dB Bandwidth                                                                                                | Yes                 |
| 15.107(a)                                                                                                                                                                                                                                                                 | AC Power Line Conducted Emissions Measurements (Transmit)                                                      | Yes                 |
| <b>DCU706, Model No.: DCU706, by Spectron Electronics Inc.</b> has also been tested and found to comply with <b>FCC Part 15, Subpart B - Class B Digital Devices</b> . The engineering test report has been documented and kept on file and it is available upon request. |                                                                                                                |                     |

### 5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

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## **EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS**

### **6.1. TEST PROCEDURES**

This section contains test results only. Details of test methods and procedures can be found in Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

### **6.2. MEASUREMENT UNCERTAINTIES**

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

### **6.3. MEASUREMENT EQUIPMENT USED**

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C64.3, FCC 15.209 and CISPR 16-1.

### **6.4. METHOD OF MEASUREMENTS**

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

### **6.5. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER**

The essential function of the EUT is to remotely start a car engine via RF link.

---

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## 6.6. PERIODIC OPERATION PROVISIONS [§15.231(a)]

### 6.6.1. Engineering Analysis

| FCC PROVISIONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ANALYSIS ON COMPLIANCE                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| The intentional radiator restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted.                                                                                                                                                                                                                                                | Transmitter is sending control signal to remote temperature monitor unit, similar to door openers, remote switches                      |
| A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.                                                                                                                                                                                                                                                                                                                                    | N/A                                                                                                                                     |
| A transmitter activated automatically shall cease transmission within 5 seconds after activation.                                                                                                                                                                                                                                                                                                                                                                                             | One transmission duration is 4.86 msec                                                                                                  |
| Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions do not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed 2 seconds per hour. | This is periodic transmission every 11 seconds<br>Duty cycle is 4.86% of 100 msec period<br>Which gives 1.6 second of transmission time |
| Internal Radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.                                                                                                                                                                                                                                                                  | N/A                                                                                                                                     |

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## 6.7. TRANSMITTER RADIATED EMISSIONS @ 3 METERS – FUNDAMENTAL & SPURIOUS EMISSIONS [§§15.231(e), 15.209 & 15.205]

### 6.7.1. Limits

The RF radiated emissions measured at 3 Meters distance shall not exceed the field strength below:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (microvolts/meter) | Field Strength of Spurious Emission (microvolts/meter) |
|-----------------------------|--------------------------------------------------|--------------------------------------------------------|
| 260 - 470                   | <sup>1</sup> 1,500 to 5,000                      | <sup>1</sup> 150 to 500                                |

<sup>1</sup> Linear interpolation.

**Field Strength of Fundamental Limit @ 433.92 MHz = 72.9 dBµV/m at 3 meters**

**Field Strength of Spurious Limit (outside restricted bands) = 52.9 dBµV/m**

Emissions within the restricted bands specified in §15.205(a) shall not exceed the general radiated emission limits specified in §15.209(a).

### 47 CFR 15.205(a) - Restricted Frequency Bands

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090–0.110       | 16.42–16.423        | 399.9–410     | 4.5–5.15    |
| 0.495–0.505       | 16.69475–16.69525   | 608–614       | 5.35–5.46   |
| 2.1735–2.1905     | 16.80425–16.80475   | 960–1240      | 7.25–7.75   |
| 4.125–4.128       | 25.5–25.67          | 1300–1427     | 8.025–8.5   |
| 4.17725–4.17775   | 37.5–38.25          | 1435–1626.5   | 9.0–9.2     |
| 4.20725–4.20775   | 73–74.6             | 1645.5–1646.5 | 9.3–9.5     |
| 6.215–6.218       | 74.8–75.2           | 1660–1710     | 10.6–12.7   |
| 6.26775–6.26825   | 108–121.94          | 1718.8–1722.2 | 13.25–13.4  |
| 6.31175–6.31225   | 123–138             | 2200–2300     | 14.47–14.5  |
| 8.291–8.294       | 149.9–150.05        | 2310–2390     | 15.35–16.2  |
| 8.362–8.366       | 156.52475–156.52525 | 2483.5–2500   | 17.7–21.4   |
| 8.37625–8.38675   | 156.7–156.9         | 2655–2900     | 22.01–23.12 |
| 8.41425–8.41475   | 162.0125–167.17     | 3260–3267     | 23.6–24.0   |
| 12.29–12.293      | 167.72–173.2        | 3332–3339     | 31.2–31.8   |
| 12.51975–12.52025 | 240–285             | 3345.8–3358   | 36.43–36.5  |
| 12.57675–12.57725 | 322–335.4           | 3600–4400     | Above 38.6  |
| 13.36–13.41       |                     |               |             |

### 47 CFR 15.209(a) - Field Strength Limits within Restricted Frequency Bands

| Frequency (MHz) | Field Strength Limits (microvolts/m) | Distance (Meters) |
|-----------------|--------------------------------------|-------------------|
| 0.009 - 0.490   | 2,400 / F (KHz)                      | 300               |
| 0.490 - 1.705   | 24,000 / F (KHz)                     | 30                |
| 1.705 - 30.0    | 30                                   | 30                |
| 30 – 88         | 100                                  | 3                 |
| 88 – 216        | 150                                  | 3                 |
| 216 – 960       | 200                                  | 3                 |
| Above 960       | 500                                  | 3                 |

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### 6.7.2. Method of Measurements

Refer to ULTRATECH Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

Note: Because the EUT employs pulsed operation, the unit was modified for continuous operation and the readings were corrected by subtraction the peak-average correction factor derived from the appropriate duty cycle calculation. See §15.35 (c).

### 6.7.3. Test Equipment List

| Test Instruments                   | Manufacturer    | Model No.     | Serial No. | Frequency Range                       |
|------------------------------------|-----------------|---------------|------------|---------------------------------------|
| Spectrum Analyzer/<br>EMI Receiver | Rohde & Schwarz | FSEK20/B4/B21 | 834157/005 | 9 kHz – 40 GHz<br>with external mixer |
| Microwave Amplifier                | Hewlett Packard | HP 83017A     |            | 1 GHz to 26.5 GHz                     |
| Biconilog Antenna                  | EMCO            | 3143          | 1029       | 20 MHz to 2 GHz                       |
| Horn Antenna                       | EMCO            | 3155          | 9701-5061  | 1 GHz – 18 GHz                        |

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## 6.7.4. Test Data

### 6.7.4.1. ASK Modulation

| Frequency (MHz) | Peak E-Field @3m (dBμV/m) | Average E-Field @3m (dBμV/m) | Antenna Plane (V/H) | §15.231(e) Limits @3m (dBμV/m) | §15.209 (a) Limits @3m (dBμV/m) | Margin (dB) |
|-----------------|---------------------------|------------------------------|---------------------|--------------------------------|---------------------------------|-------------|
| 433.92          | 98.0                      | 71.8                         | V                   | 72.9                           | --                              | -1.1        |
| 433.92          | 93.4                      | 67.1                         | H                   | 72.9                           | --                              | -5.8        |
| 867.84          | 49.9                      | 23.6                         | V                   | 52.9                           | 46.0                            | -29.2       |
| 867.84          | 51.7                      | 25.4                         | H                   | 52.9                           | 46.0                            | -27.5       |
| 1301.76         | 44.8                      | 18.6                         | V                   | 52.9                           | 54.0                            | -34.3       |
| 1301.76         | 48.8                      | 22.5                         | H                   | 52.9                           | 54.0                            | -30.4       |
| 1735.68         | 46.8                      | 20.5                         | V                   | 52.9                           | 54.0                            | -32.4       |
| 1735.68         | 48.9                      | 22.6                         | H                   | 52.9                           | 54.0                            | -30.3       |
| 2169.60         | 50.3                      | 24.1                         | V                   | 52.9                           | 54.0                            | -28.8       |
| 2169.60         | 55.3                      | 29.0                         | H                   | 52.9                           | 54.0                            | -23.9       |
| 2603.52         | 45.2                      | 19.0                         | V                   | 52.9                           | 54.0                            | -33.9       |
| 2603.52         | 45.9                      | 19.6                         | H                   | 52.9                           | 54.0                            | -33.2       |
| 3037.44         | 45.1                      | 18.9                         | V                   | 52.9                           | 54.0                            | -34.0       |
| 3037.44         | 47.8                      | 21.5                         | H                   | 52.9                           | 54.0                            | -31.4       |
| 3471.36         | 52.0                      | 25.7                         | V                   | 52.9                           | 54.0                            | -27.2       |
| 3471.36         | 54.2                      | 27.9                         | H                   | 52.9                           | 54.0                            | -25.0       |
| 3905.28         | 50.8                      | 24.5                         | V                   | 52.9                           | 54.0                            | -28.3       |
| 3905.28         | 52.6                      | 26.4                         | H                   | 52.9                           | 54.0                            | -26.5       |
| 4339.20         | 0.0                       | -26.3                        | V                   | 52.9                           | 54.0                            | -79.1       |
| 4339.20         | 0.0                       | -26.3                        | H                   | 52.9                           | 54.0                            | -79.1       |

• The emissions were scanned from 30 MHz to 4 GHz at 3 meters distance and all spurious emissions less than 20 dB below the limits were recorded.  
 • The transmitter was placed in three different orthogonal positions for searching maximum field strength level.  
 • The peak-average correction factor was obtained from the duty cycle calculation. See the Remarks below for details.

### Remarks:

- Txon = (4\*601.20us) + (8\*180.36us) + 1.02ms = 2.40ms + 1.44ms + 1.02 = 4.86 ms
- Duty cycle = Txon/100 = 0.0486
- Peak-to-Average Factor = 20\*log (0.0486) = -26.27 dB

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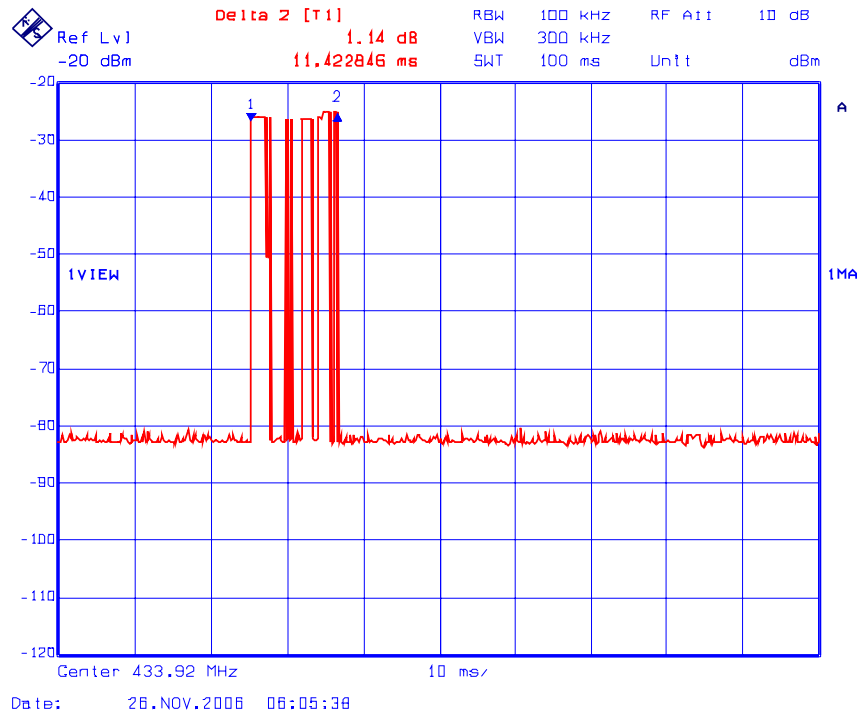
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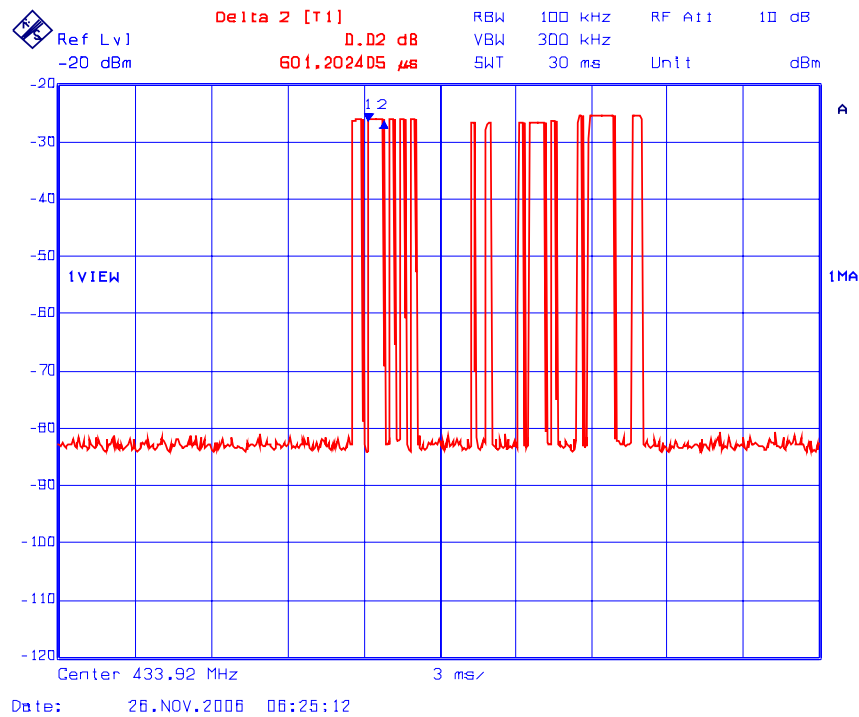
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## 6.8. EMISSION BANDWIDTH [§15.231(c)]

### 6.8.1. Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### 6.8.2. Method of Measurements

Refer to ULTRATECH Test Procedures, File # ULTR P001-2004, §15.231(c) & ANSI C63.4.

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI C63.4.

### 6.8.3. Test Equipment List

| Test Instruments  | Manufacturer    | Model No.     | Serial No. | Frequency Range |
|-------------------|-----------------|---------------|------------|-----------------|
| Spectrum Analyzer | Rohde & Schwarz | FSEK20/B4/B21 | 834157/005 | 9 kHz – 40 GHz  |

### 6.8.4. Test Data

| Frequency (MHz) | Modulation | 20 dB Bandwidth (kHz) | Maximum Limit (kHz) | Pass/Fail |
|-----------------|------------|-----------------------|---------------------|-----------|
| 433.92          | ASK        | 51.46                 | 1084.8              | Pass      |

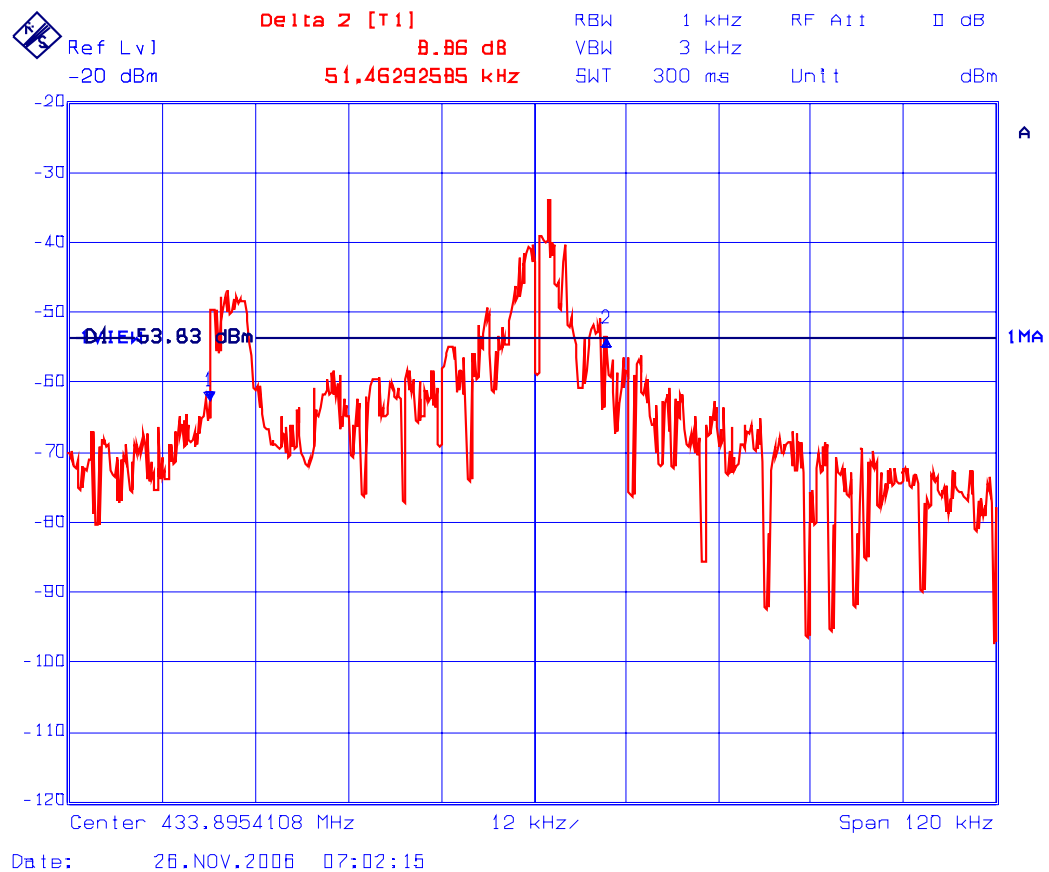
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**Plot 1.:**  
**20 dB Bandwidth, ASK**  
**Test Frequency: 433.92 MHz**



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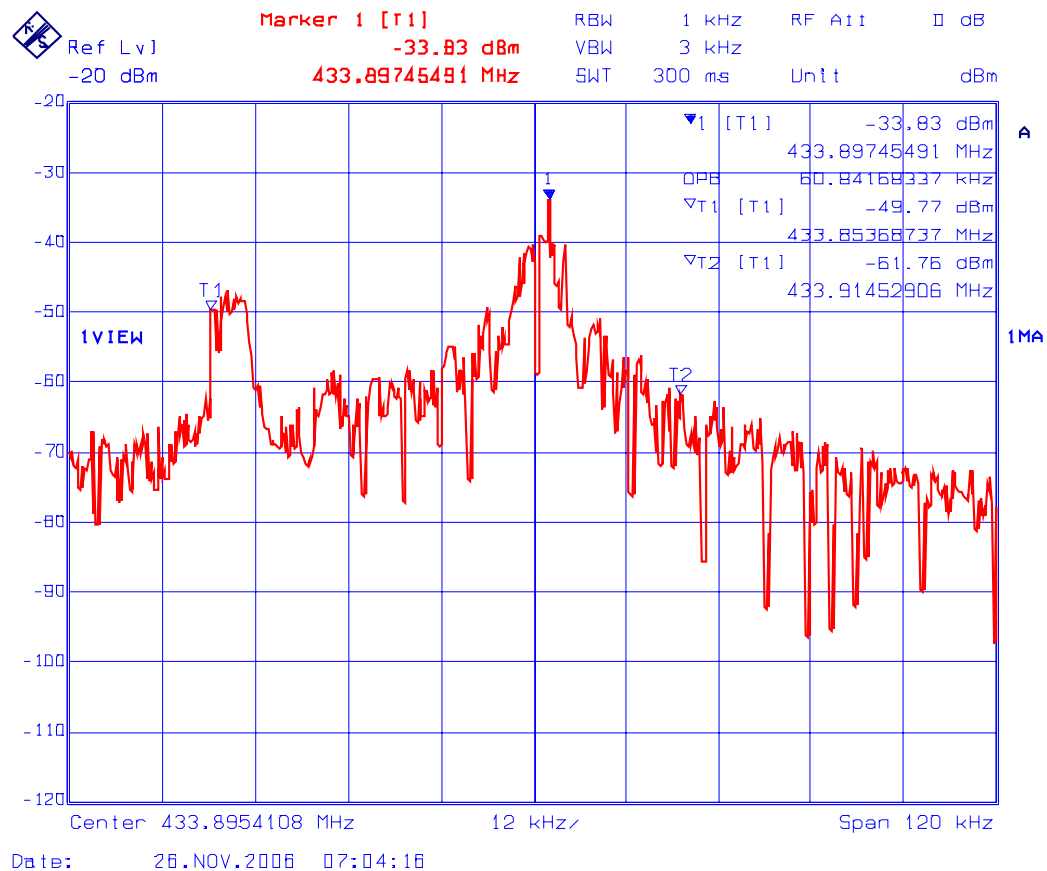
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**Plot 2.:**  
**99% Occupied Bandwidth, ASK**  
**Test Frequency: 433.92 MHz**



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## 6.9. POWER LINE CONDUCTED EMISSIONS [§ 15.107 (b) & 15.207]

### 6.9.1. Limits

The equipment shall meet the limits of the following table:

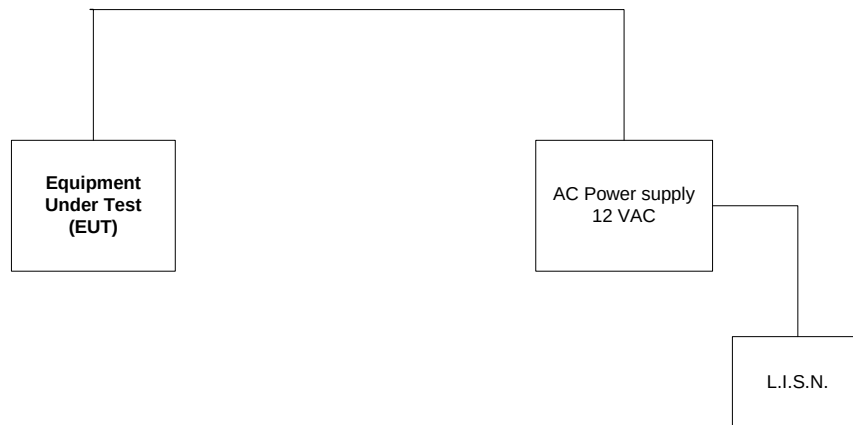
| Frequency of emission<br>(MHz) | Class B Conducted Limits (dB $\mu$ V) |           | Measuring Bandwidth                                              |
|--------------------------------|---------------------------------------|-----------|------------------------------------------------------------------|
|                                | Quasi-peak                            | Average   |                                                                  |
| 0.15–0.5                       | 66 to 56*                             | 56 to 46* | RBW = 9 kHz<br>VBW $\geq$ 9 kHz for QP<br>VBW = 1 Hz for Average |
| 0.5–5                          | 56                                    | 46        |                                                                  |
| 5–30                           | 60                                    | 50        |                                                                  |

\* Decreases linearly with logarithm of the frequency

### 6.9.2. Method of Measurements

Refer to Section 8.2 of this test report & ANSI C63.4.

### 6.9.3. Test Arrangement



### 6.9.4. Test Equipment List

| Test Instruments                               | Manufacturer        | Model No. | Serial No. | Frequency Range                         |
|------------------------------------------------|---------------------|-----------|------------|-----------------------------------------|
| Spectrum Analyzer/<br>EMI Receiver             | Hewlett<br>Packard  | HP 8593EM | 3412A00103 | 9 kHz – 26.5 GHz                        |
| Transient Limiter                              | Hewlett<br>Packard  | 11947A    | 310701998  | 9 kHz – 200 MHz<br>10 dB attenuation    |
| L.I.S.N.                                       | EMCO                | 3825/2    | 89071531   | 9 kHz – 200 MHz<br>50 Ohms / 50 $\mu$ H |
| 24'(L) x 16'(W) x 8'(H)<br>RF Shielded Chamber | Braden<br>Shielding | ...       | ...        | ...                                     |

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### 6.9.5. Test Data

#### Line Voltage: 12 VAC

| Frequency (MHz)                              | RF Level (dBμV) | Receiver Detector (P/QP/AVG) | QP Limit (dBuV) | AVG Limit (dBuV) | Margin (dB) | Pass/ Fail | Line Tested (L1/L2) |
|----------------------------------------------|-----------------|------------------------------|-----------------|------------------|-------------|------------|---------------------|
| <b>Test Configuration : Transmitter Mode</b> |                 |                              |                 |                  |             |            |                     |
| 20.907                                       | 19.7            | QP                           | 60              | 50               | -40.3       | Pass       | L1                  |
| 20.907                                       | 14.2            | AVG                          | 60              | 50               | -35.8       | Pass       | L1                  |
| 22.624                                       | 20.1            | QP                           | 60              | 50               | -39.9       | Pass       | L1                  |
| 22.624                                       | 14.4            | AVG                          | 60              | 50               | -35.6       | Pass       | L1                  |
| 24.177                                       | 40.5            | QP                           | 60              | 50               | -19.5       | Pass       | L1                  |
| 24.177                                       | 37.2            | AVG                          | 60              | 50               | -12.8       | Pass       | L1                  |
| 24.173                                       | 43.3            | QP                           | 60              | 50               | -16.7       | Pass       | L2                  |
| 24.173                                       | 40.1            | AVG                          | 60              | 50               | -9.9        | Pass       | L2                  |

Note: See the following test data plots for detailed measurements.

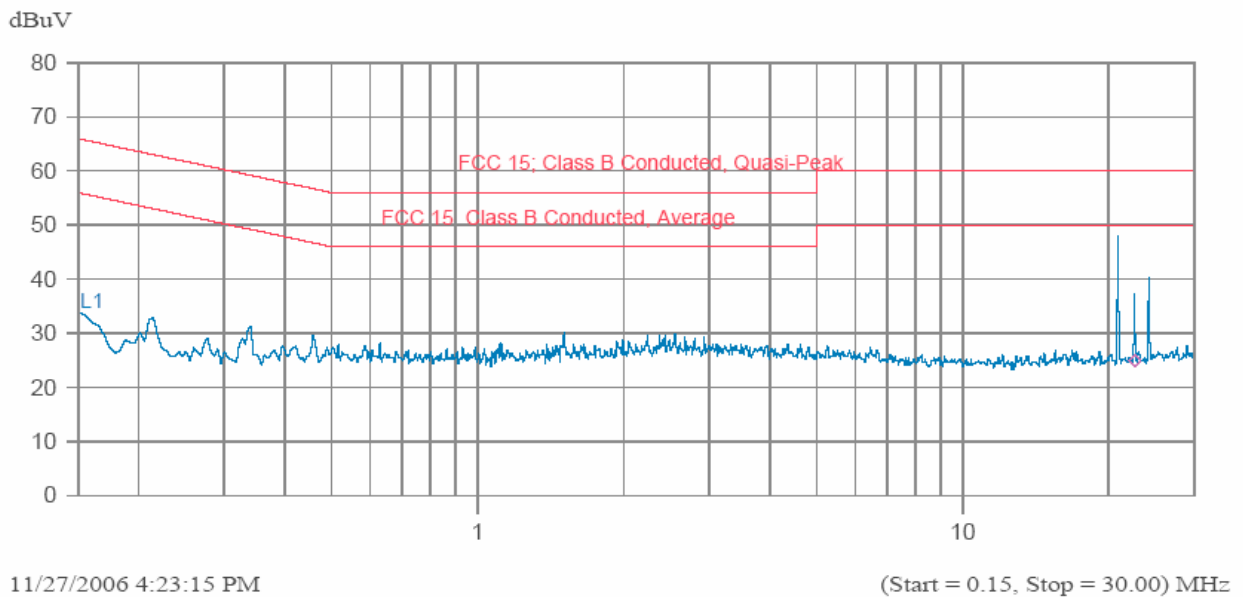
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**Plot 3.:**  
**AC Power Line Conducted Emissions**  
**Test Configuration : Transmitter Mode**  
**Line Voltage : 12 VAC**  
**Line Tested: L1**



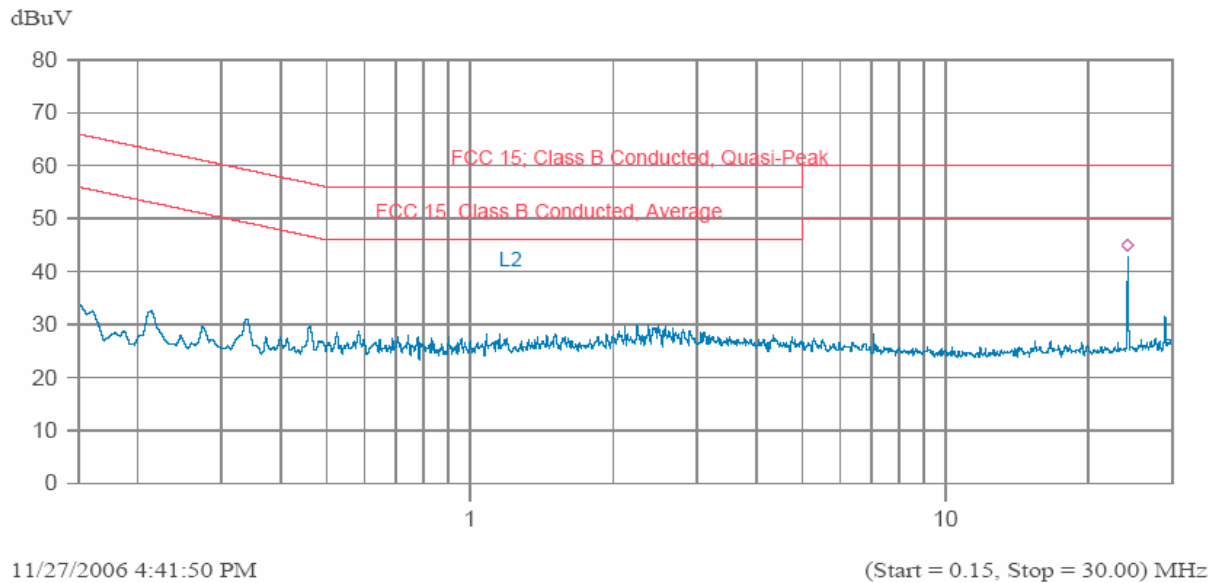
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**Plot 4.:**  
**AC Power Line Conducted Emissions**  
**Test Configuration : Transmitter Mode**  
**Line Voltage : 12 VAC**  
**Line Tested: L2**



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## EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

### 7.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

| CONTRIBUTION<br>(Radiated Emissions)                                                                                                                              | PROBABILITY<br>DISTRIBUTION | UNCERTAINTY (+ dB) |                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------|-----------------|
|                                                                                                                                                                   |                             | 3 m                | 10 m            |
| Antenna Factor Calibration                                                                                                                                        | Normal (k=2)                | $\pm 1.0$          | $\pm 1.0$       |
| Cable Loss Calibration                                                                                                                                            | Normal (k=2)                | $\pm 0.3$          | $\pm 0.5$       |
| EMI Receiver specification                                                                                                                                        | Rectangular                 | $\pm 1.5$          | $\pm 1.5$       |
| Antenna Directivity                                                                                                                                               | Rectangular                 | $\pm 0.5$          | $\pm 0.5$       |
| Antenna factor variation with height                                                                                                                              | Rectangular                 | $\pm 2.0$          | $\pm 0.5$       |
| Antenna phase center variation                                                                                                                                    | Rectangular                 | 0.0                | $\pm 0.2$       |
| Antenna factor frequency interpolation                                                                                                                            | Rectangular                 | $\pm 0.25$         | $\pm 0.25$      |
| Measurement distance variation                                                                                                                                    | Rectangular                 | $\pm 0.6$          | $\pm 0.4$       |
| Site imperfections                                                                                                                                                | Rectangular                 | $\pm 2.0$          | $\pm 2.0$       |
| Mismatch: Receiver VRC $\Gamma_1 = 0.2$<br>Antenna VRC $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$<br>Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$ | U-Shaped                    | $+1.1$<br>$-1.25$  | $\pm 0.5$       |
| System repeatability                                                                                                                                              | Std. Deviation              | $\pm 0.5$          | $\pm 0.5$       |
| Repeatability of EUT                                                                                                                                              |                             | -                  | -               |
| Combined standard uncertainty                                                                                                                                     | Normal                      | $+2.19 / -2.21$    | $+1.74 / -1.72$ |
| Expanded uncertainty U                                                                                                                                            | Normal (k=2)                | $+4.38 / -4.42$    | $+3.48 / -3.44$ |

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$

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