



## TEST SERVICES

**EMC EVALUATION OF THE  
ARKION SYSTEMS  
DEVICE COMMUNICATION MODULE (DCOM)**

**Date:** **OCTOBER 13, 2004**  
**Test Report Number:** **TR3994.04**

**IN ACCORDANCE WITH THE  
FCC PART 15 SUBPART C 15.247**

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**CTS Approved Signatory:** \_\_\_\_\_

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**Appendix A: Test Log****Appendix B: Customer Supplied Equipment Description**

## LIST OF DEFINITIONS/ABBREVIATIONS

|        |                               |
|--------|-------------------------------|
| AC     | Alternating Current           |
| BB     | Broadband                     |
| BW     | Bandwidth                     |
| cm     | Centimeter                    |
| CPU    | Calibrate Prior to Use        |
| dB     | Decibel                       |
| DC     | Direct Current                |
| EMC    | Electromagnetic Compatibility |
| EMI    | Electromagnetic Interference  |
| ER     | Electric Radiation            |
| EUT    | Equipment Under Test          |
| GHz    | GigaHertz                     |
| Hz     | Hertz                         |
| I-face | Interface                     |
| kHz    | KiloHertz                     |
| m      | Meter                         |
| MHz    | MegaHertz                     |
| mm     | Millimeter                    |
| mS     | Millisecond                   |
| mV     | MilliVolt                     |
| MR     | Magnetic Radiation            |
| NB     | Narrowband                    |
| NCR    | No Calibration Required       |
| PLC    | Power Line Conduction         |
| PPS    | Pulses Per Second             |
| uF     | MicroFarad                    |
| uH     | MicroHenry                    |
| uS     | Microsecond                   |
| uV     | MicroVolt                     |
| UWC    | Use With Calibrated Equipment |

**1.0 GENERAL****1.1 Introduction****1.1.1 Purpose**

The purpose of this report is to document the performance of the ArKion DCOM during a variety of radio-performance tests and record the test requirements and procedures used. At the request of the Compliance Management Group, the tests were performed by Chomerics Test Service (CTS) of Woburn, Massachusetts. The assessment will determine the compliance or non-compliance to the requirements set by FCC Part 15 Subpart C.

Iqbal Khan and Michael Frey from ArKion were present for testing. Testing was performed during the period of September 7 through September 8, 2004 under Compliance Management Group (CMG) purchase order number 18614.

**1.1.2 Requirements**

The requirements for the sequence of tests performed on the ArKion DCOM are as follows:

**FCC Part 15 Subpart C 15.247 20dB Bandwidth and Number of Channels**

15.247(al) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20-dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo-random ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have inputs bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in the synchronization with the transmitted signals.

15.247(ali) For frequencies hopping systems operating in the 902-928MHz band: if the 20-dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.04 seconds with a 20 second period; if the 20 dB bandwidth of the hopping channel is 250kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds with in any 10 second period. The maximum allowed 20 dB bandwidth of hopping channel is 500kHz.

## FCC Part 15 Subpart C 15.247 Output Power

15.247(b2) For frequency hopping systems operating in the 902-928 MHz band: 1 Watt of systems employing at least 50 hopping channels; and 0.25 Watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph 15.247 (a)(1)(i).

### Radio Frequency Exposure

15.247(b4) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See 1.1307(b)(1) of this chapter.

15.247(b) 1-3, The EUT meets the de facto EIRP limit of +36dBm.

## FCC Part 15 Subpart C 15.247 Spurious

15.247(c) In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.20(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in Section 15.209(a) See section 15.205 c.

## 1.2 Summary

The terms "Passed" or "Failed" in this section are intended to guide the reader as to whether or not the EUT met the minimum Performance Criteria that can be interpreted from the FCC Part 15. The "Results" paragraph in each test section to follow, and the test data sheets, will outline specifically how the EUT performed during each test.

|                          |        |
|--------------------------|--------|
| 20dB Bandwidth           | Passed |
| Power Output             | Passed |
| Radio Frequency Exposure | Passed |
| Spurious Emission 15.247 | Passed |

### 1.2.1 Summary of Recommendations

The ArKion DCOM will not require modifications in order to insure compliance with FCC Part 15 Subpart C.

### **1.3 Administrative Data**

#### **1.3.1 Test Facility**

Chomerics Test Services in Woburn, Massachusetts is an American Association for Laboratory Accreditation (A2LA) accredited facility as defined on Certification Number 1980-01. For Emissions and Immunity testing, the Scope of Accreditation is limited to the following tests: CFR 47, FCC Part 15 Subpart B, CISPR 11, EN 55011, CISPR 13, EN55013, CISPR 14, EN55014-1, CISPR 22, EN55022, AS/NZS 3548, CNS 13438, CNS 13783-1, VCCI, EN 61000-3-2, EN 61000-3-3, EN 50081-1, EN55081-2, EN61000-6-3, EN 61000-6-4, EN 61000-4-2, EN 61000-4-3, EN61000-4-4, EN 61000-4-5, EN 61000-4-6, EN61000-4-8, EN 61000-4-11, EN 50082-1, EN 50082-2, EN 61000-6-1, EN 61000-6-2, IEC/EN 60601-1-2, EN 300 386, EN 61326, CISPR 24, EN55024, CISPR 14, EN 55014-2, EN 50083-2, EN 55103-1, and EN 55103-2. Any tests in this report that are not listed above are not covered by the A2LA Accreditation.

Chomerics' Open Area Test Sites A and B are listed by the Federal Communications Corporation (FCC) for Radiated and Conducted Emissions testing under FCC Registration numbers 90498 and 90499 respectively.

Chomerics' Open Area Test Sites A and B are accredited for Radiated and Conducted Emissions through Industry Canada under file numbers IC2959A and IC2959B respectively.

Chomerics' Open Area Test Site B is accredited to the Voluntary Control Council for Interference (VCCI) for Radiated and Conducted Emissions testing under file R-1508 and C-1589 respectively.

Chomerics test facility operates under the current revision of Chomerics Quality Assurance (QA) Manual Document Number QA002.

The QA Manual has been constructed to reflect a quality program in accordance with the requirements of the National Institute of Standards and Technology (NIST), ISO 9002, ISO Guide 25, NIST Handbook 150, EN 45001, MIL-I-45208A, MIL-STD-461D, 462D and Chomerics Quality Assurance Program (QAP).

The QA Manual outlines and describes the procedures for establishing and maintaining the quality of analysis, research, inspection, and testing within Chomerics Test Service (CTS).

This test report does not represent an endorsement by the U.S. Government.

The results and/or conclusions within this test report refer and/or apply only to the unit(s) tested as defined by this report.

Measurements performed for this test are traceable to the National Institute of Standards and Technology (NIST) based on the fact that all test equipment used for the measurements were previously calibrated using standards traceable to NIST.

No deviations, additions to, or exclusions from the test specification(s) were made.

The system amplitude accuracy for the measurements made during the radiated emission tests was  $\pm 3\text{dB}$ . Chomerics Test Services measurement uncertainty calculations are available for review upon request.

## 1.3.2 Equipment Calibration

The calibration of Chomerics test facility equipment is controlled under the current edition of Chomerics Laboratory Test Equipment Calibration Manual Document Number QA001.

The test equipment used throughout this test sequence conforms to laboratory calibration standards, MIL-STD-45662, traceable to the National Institute of Standards and Technology. The date of the next due scheduled calibration is listed in each test section for the applicable equipment.

All test equipment is calibrated in one year intervals

## 1.3.3 Personnel

The test personnel used to perform or supervise the tests are accredited by the National Association of Radio and Telecommunications Engineers, Inc. (NARTE) as Certified Electromagnetic Compatibility Engineers (N.C.E.) and Technicians (N.C.T.).

## 1.4 Test Set-up

### 1.4.1 Test Site Matrix

The test locations used for the emissions and immunity tests are as follows: (Refer to Section 1.4.2 for test site descriptions).

#### Test Performed

20dB Bandwidth  
Power Output  
Radio Frequency Exposure  
Spurious Emission

#### Test Site

Open Area Test Site A  
Open Area Test Site A  
Open Area Test Site A  
Open Area Test Site A

### 1.4.2 Test Site Descriptions

The following is a list of the test sites and descriptions of each. Refer to Section 1.4.1 for specific test sites used for testing.

**Open Area Test Site A:** Chomerics Open Area Test Site "A" if used for this test program is located in the lower parking lot attached to the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 1). Parking is permitted on one side of test site "A" at a discrete distance from the imaginary ellipse.

The Open Area Test Site A enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure is sized to allow 3 meter measurements and is heated and/or air conditioned.

The structure used to support equipment under test is an EMCO 4 foot diameter motorized turntable. For tabletop equipment, a wooden table measuring 1.5 x 1 meter in size is positioned at the center of the turntable, at the proper height above the ground plane.

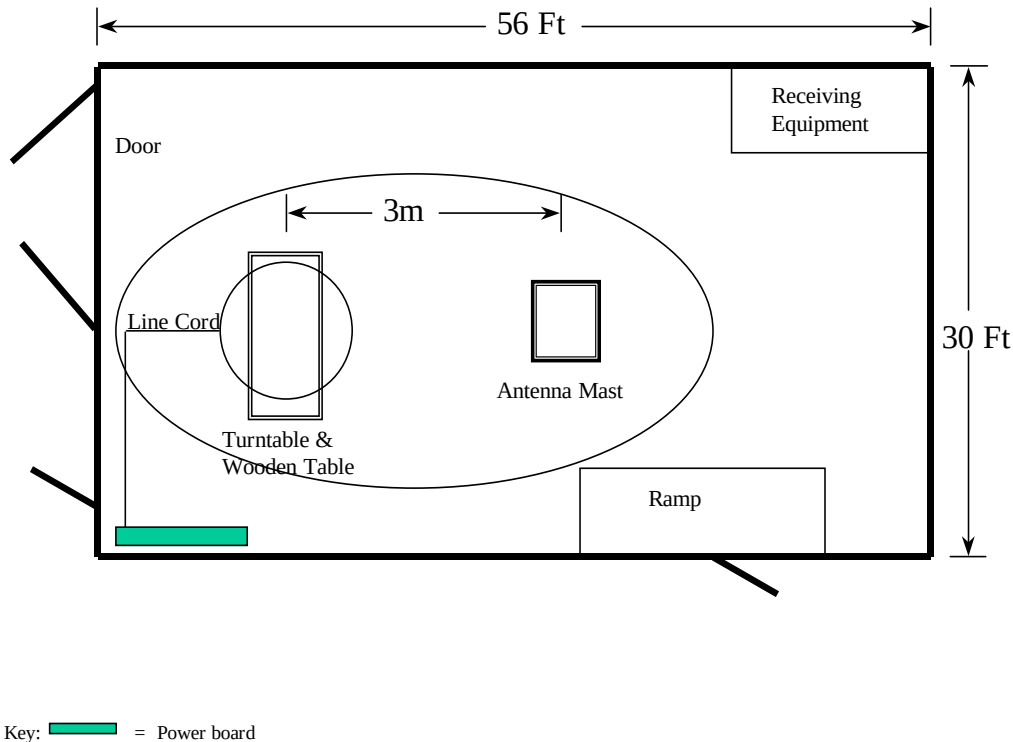
The area at the end of the Open Area Test Site "A" is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse.

The available AC power within Open Area Test Site "A" is 120V 60Hz Single Phase 60Amps; 208V 60Hz Three Phase 60Amps; 208V 60Hz Single Phase 60Amps; 230V 50Hz Single Phase 50Amps.

This Site is listed with the Federal Communications Commissions (FCC).

## OPEN AREA TEST SITE A

Figure 1



**Open Area Test Site B:** Chomerics Open Area Test Site "B" if used for this test program is located in the lower parking lot behind the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 2). Parking is permitted on one side of test site "B" at a discrete distance from the imaginary ellipse.

The Open Area Test Site "B" enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure is sized to allow both 3 and 10 meter measurements and is heated and/or air conditioned.

The structure used to support equipment under test is a 14 foot diameter motorized turntable. The sheet metal surface is flush with the ground plane. To ground the turntable, 175 copper fingers (1" x 1.5") are mounted around the outer edge of the turntable using machine screws. The spring fingers are equally spaced and provide a uniform interface between the turntable metal surface and ground plane. For tabletop equipment, a wooden table measuring 1.5 x 1 meter in size is positioned at the center of the turntable, at the proper height above the ground plane.

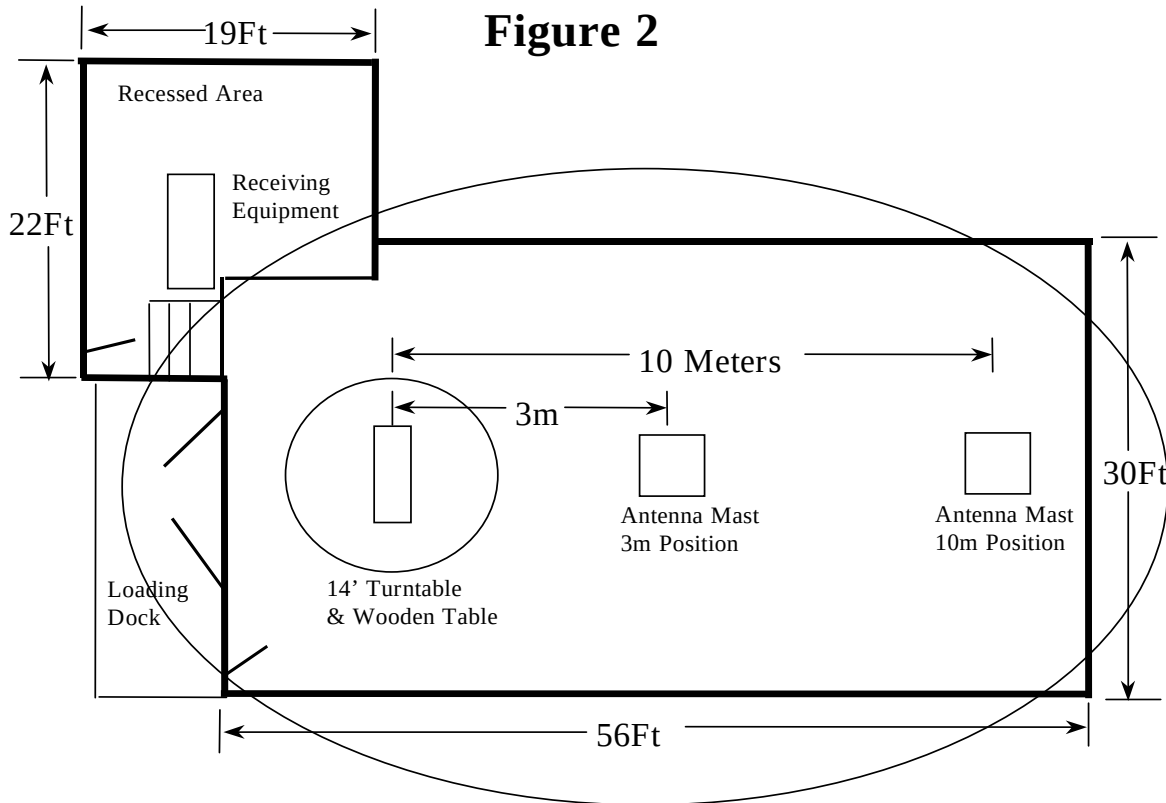
The addition at the end of the Open Area Test Site “B” is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse.

The available AC power within Open Area Test Site “B” is 120V 60Hz Single Phase 60Amps; 208V 60Hz Three Phase 60Amps; 208V 60Hz Single Phase 60Amps; 230V 50Hz Single Phase 50Amps.

This site is listed with the Federal Communications Commissions (FCC).

### OPEN AREA TEST SITE B

**Figure 2**



**Test Chamber A:** Chomerics Test Chamber A, if used for this test program, is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 3). The shielded enclosures (test chambers) were manufactured and installed by Universal Shielding Corporation of Deer Park, New York. Attenuation tests have demonstrated that the shielded enclosures meet the attenuation requirements of MIL-STD-285 and NSA 65-6. The main test chamber is 22 x 10 x 10 feet in size with an adjacent enclosure that is 8 x 8 x 8 feet in size. The adjacent room, used for support equipment, and the main test chamber are connected together and referenced to the same single point ground.

When needed for tabletop equipment, a wooden table measuring 3 x 9 feet in size is positioned within the test chamber. When used for MIL-STD-461D tests the tabletop surface is covered with a copper sheet and grounded to the test chamber wall so that the resistance is less than 2.5 milliohms.

## TEST SERVICES

The power line filters supplying the power to the enclosures provide 100dB of attenuation from 10kHz to 10GHz. The adjacent room, used for support equipment, and the main test chamber have independent AC power obtained from independent AC power line filters.

The available AC power in Test Chamber A is 120V 60Hz Single Phase 100Amps; 120V 400Hz Three Phase 50Amps; 208V 60Hz Three Phase 100Amps; 208V 60Hz Single Phase 100Amps; 230V 50Hz Single Phase 50Amps.

**Test Chamber B:** Chomerics Test Chamber B, if used for this test program, is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 3). The shielded enclosures (test chambers) were manufactured and installed by Universal Shielding Corporation of Deer Park, New York. Attenuation tests have demonstrated that the shielded enclosures meet the attenuation requirements of MIL-STD-285 and NSA 65-6.

The main test chamber is 22 x 10 x 10 feet in size with an adjacent enclosure that is 8 x 8 x 8 feet in size. The adjacent room, used for support equipment, and the main test chamber are connected together and referenced to the same single point ground.

Test Chamber B is lined with Rantec ferrite absorber tiles FT-100. All surfaces of the room are lined with FT-100. The floor is lined with removable tiles. This absorber material allows the test chamber to meet the 0-6dB field uniformity requirements of IEC 1000-4-3 and EN50140.

There are two access panels between the main test chamber and the support room. The access panels are covered with absorber tiles. The absorber tiles can be removed from the access panels.

The power line filters supplying the power to the enclosures provide 100dB of attenuation from 10kHz to 10GHz. The adjacent rooms, used for support equipment, and the main test chamber have independent AC power obtained from independent AC power line filters.

The available AC power in Test Chamber B is 120V 60Hz Single Phase 30Amps; 208V 60Hz Three Phase 30Amps; and 230V 50Hz Single Phase 30Amps. A wooden table 3 x 6 feet in size is used for tabletop equipment.

Only one power line frequency is available in the chamber at a time, 50, 60 or 400 cycle, unless power is brought through an access panel.

**Test Chamber C:** Chomerics Test Chamber C, if used for this test program, is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts (see Figure 3). The shielded enclosures (test chambers) were manufactured and installed by Universal Shielding Corporation of Deer Park, New York.

Attenuation tests have demonstrated that the shielded enclosures meet the attenuation requirements of MIL-STD-285 and NSA 65-6. The main test chamber is 16 x 20 x 10 feet in size with two adjacent enclosures on either side which are 8 x 8 x 8 and 8 x 12 x 10 feet in size, respectively.

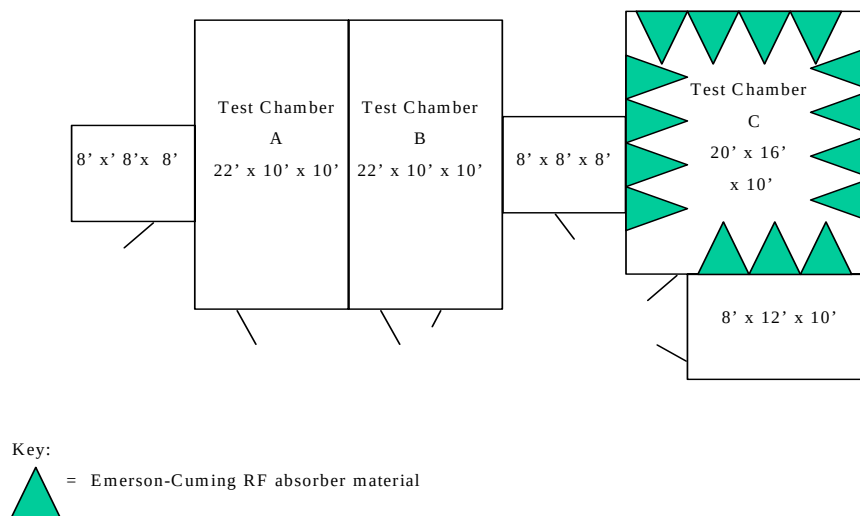
Test Chamber C is lined with Emerson-Cuming RF absorber material. This absorber material meets the following absorption specifications: 80MHz 6dB, 300MHz 30dB, 500MHz 35dB, 1GHz 40dB, and 3 to 24 GHz 50dB. Each of the two adjacent rooms used for support equipment and the main test chamber are connected together and referenced to the same single point ground.

When needed for tabletop equipment, a wooden table measuring 3 x 9 feet in size is positioned within the test chamber. When used for MIL-STD-461D tests, the tabletop surface is covered with a copper sheet and grounded to the test chamber wall so that the resistance is less than 2.5 milliohms. When used for radiated electromagnetic field tests, to some standards, the copper tabletop surface is removed.

The available AC power in Test Chamber C is 120V 60Hz AC Single Phase 60Amps; 230V 50Hz AC Single Phase 50Amps; 115V 400Hz AC Three Phase 30Amps (through access panel); 208V 60Hz AC Three Phase AC 30Amps (through access panel).

The power line filters supplying the power to the enclosures provide 100dB of attenuation from 10kHz to 10GHz. Each of the two adjacent rooms used for support equipment and the main test chamber has independent AC power obtained from independent AC power line filters.

### Immunity Lab Layout Figure 3



## TEST SERVICES

**EC Lab A:** Chomerics EC Lab A is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts.

EC Lab A is a typical room measuring 20 x 16 feet with an aluminum sheet metal (8 x 12 feet in size) in the center of the floor for a ground plane. When needed for tabletop equipment, a wooden table (0.8 meters in height) is placed on the metal ground plane that extends at least 0.1m beyond all sides of the table. A removable 3 x 6 foot sheet of aluminum is placed on top of the wooden table when a horizontal coupling plane is required.

The appropriate connections, as needed for each test, are used to interconnect the table horizontal coupling plane, ground plane floor, test equipment, and earth ground.

The available AC power in the EC Lab A is 120V 60Hz AC Single Phase 60Amps; 230V 50Hz AC Single Phase 50Amps; and 208V 60Hz AC Three Phase AC 30Amps.

EC Lab A is equipped with air and water services for use with equipment that requires it.

The humidity in EC Lab A can be automatically controlled in the range of 20% to 60%.

**EC Lab B:** Chomerics EC Lab B is located in the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts.

EC Lab B is a typical room measuring 12 x 14 feet with a copper sheet (6 x 8 feet in size) in the center of the floor for a ground plane. When needed for tabletop equipment, a wooden table (0.8 meters in height) is placed on the metal ground plane that extends at least 0.1m beyond all sides of the table. A removable 3 x 6 foot sheet of aluminum is placed on top of the wooden table when a horizontal coupling plane is required.

The appropriate connections, as needed for each test, are used to interconnect the table horizontal coupling plane, ground plane floor, test equipment, and earth ground.

The available AC power in the EC Lab B is 120V 60Hz AC Single Phase 60Amps, 230V 50Hz AC Single Phase 50Amps; and 208V 60Hz AC Three Phase AC 30Amps.

The humidity in EC Lab B can be automatically controlled in the range of 20% to 60%.

### 1.4.3 Equipment Under Test

A detailed description of the Equipment Under Test is located in Appendix B.

**2.0 TESTS PERFORMED****2.1 20dB Bandwidth and Channel Spacing****2.1.1 Equipment Used**

| Equipment Used                    | Asset # | Serial #   | Cal Date |
|-----------------------------------|---------|------------|----------|
| Agilent E4440A Spectrum Analyzer  | 704     | US41421236 | 1/05     |
| EMCO 3120 Tuned Dipole Antenna B1 | 477     | 56         | 1/05     |
| EMCO 3121 Tuned Dipole Antenna B2 | 478     | 176        | 1/05     |
| EMCO 3121 Tuned Dipole Antenna B3 | 479     | 728        | 1/05     |
| HP 83640A Signal Generator        | 38      | 3009A00188 | 4/05     |
| EMCO 3115 Microwave Horn Antenna  | 377     | 2174       | 1/05     |
| EMCO 3115 Microwave Horn Antenna  | 376     | 2796       | 1/05     |

**2.1.2 Test Conditions**

20dB Bandwidth measurement testing was performed with the DCOM set up on a wooden table above the turntable at a distance of 3 meters from a ridge guide antenna within Open Area Test Site A. The DCOM was configured to operate in the continuous full power mode of operation at the low mid and high transmit frequency.

**2.1.3 Test Method**

The bandwidth of the DCOM was measured through an air interface. The DCOM was placed on top of a wooden turntable 3 meters from a receiving antenna. The bandwidth of the DCOM was measured at the low mid and high transmit frequency.

**2.1.4 Results**

The maximum 20dB bandwidth of the ArKion DCOM is 3 kHz. The ArKion channel spacing and number of hopping channels is 500kHz and 50 respectively.

## 2.1.5 Test Data

### 20dB BANDWIDTH MEASUREMENTS

**CUSTOMER: ARKION**

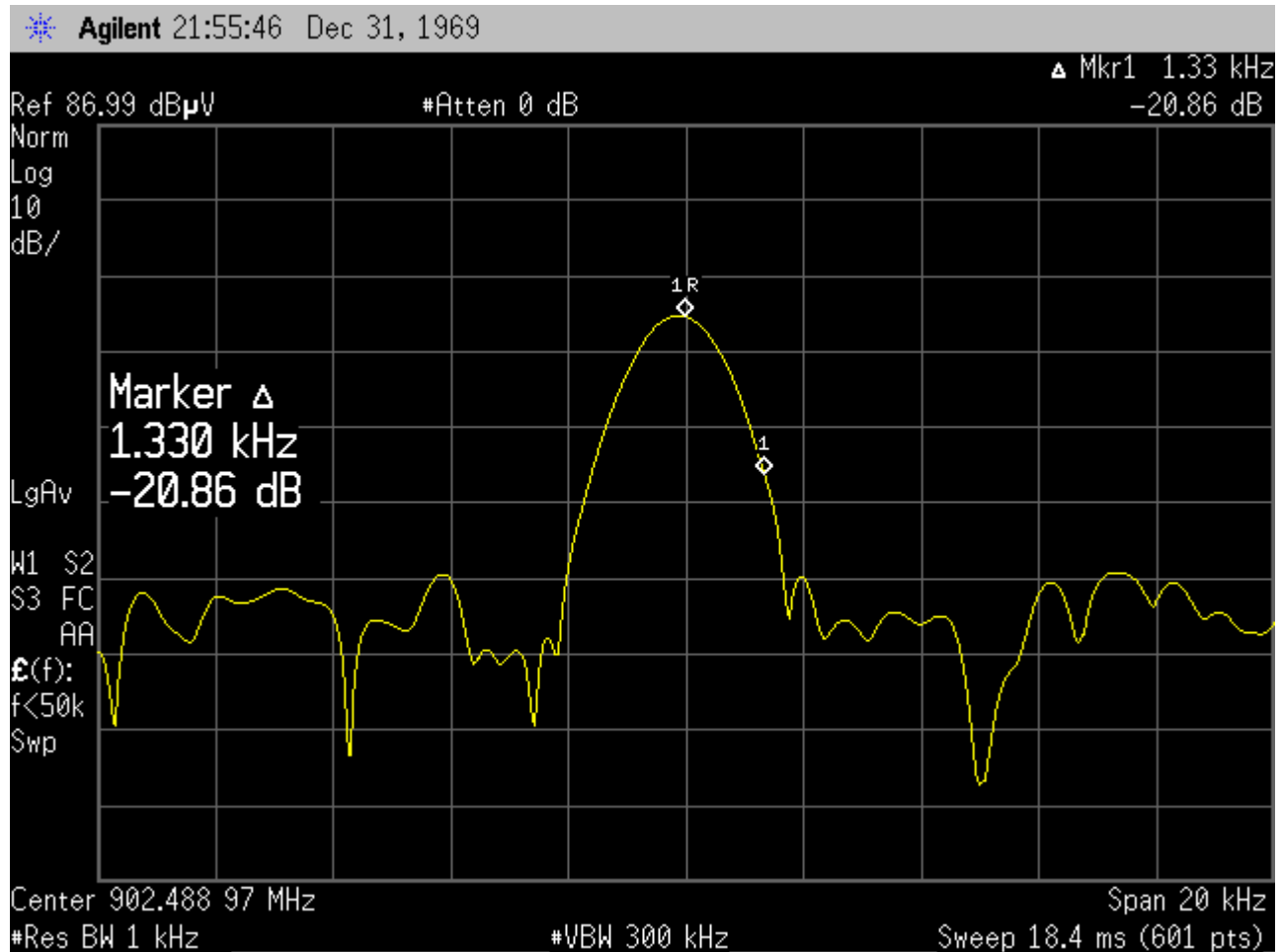
**EQUIPMENT: DCOM**

**TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ**

**DATE: 09/07/04**

**TEST NUMBER: 2**

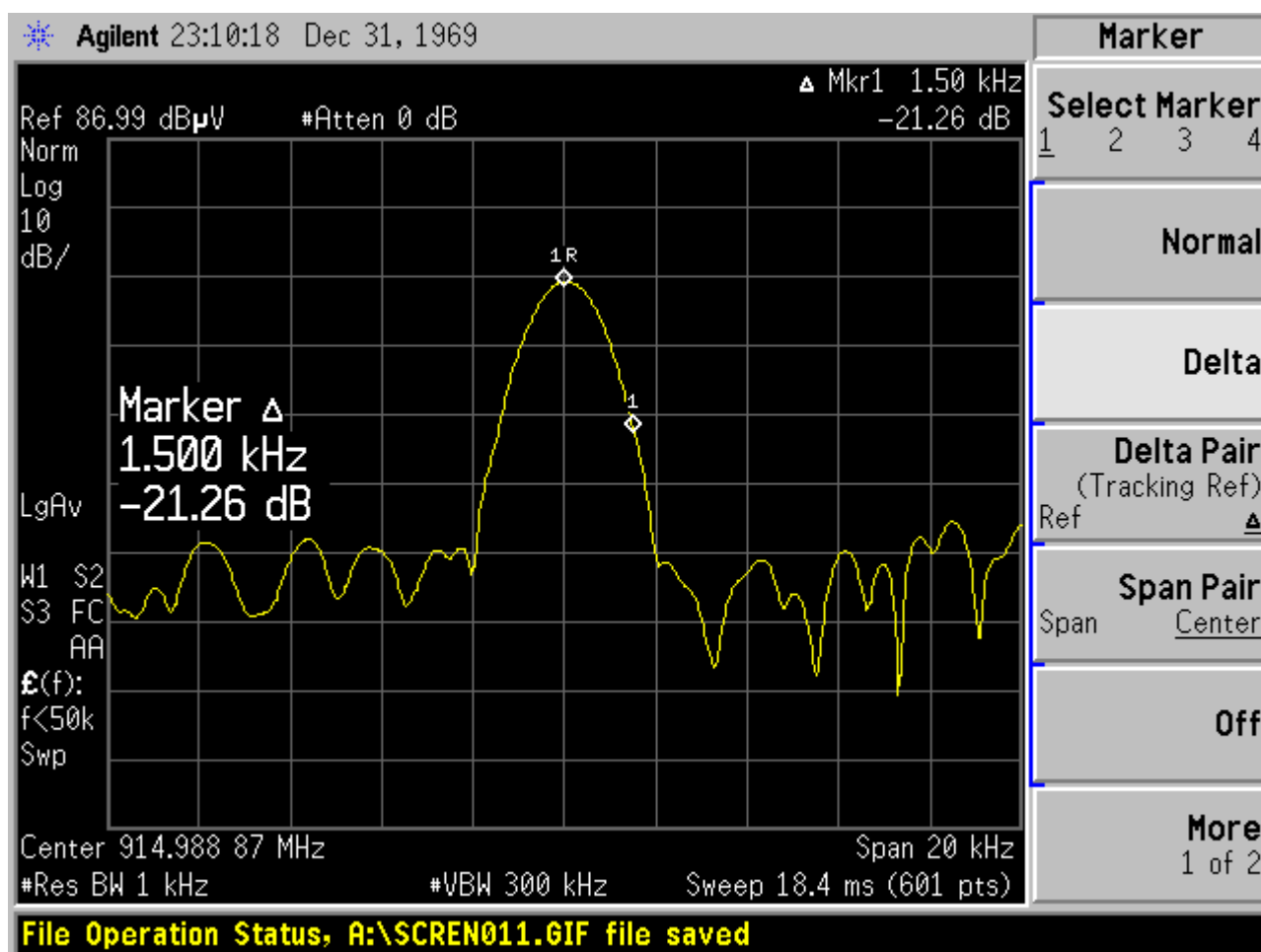
**OPERATING MODE: CONTINUOUS TRANSMISSION  
LOW FREQ.**



### 20dB BANDWIDTH MEASUREMENTS

**CUSTOMER:** ARKION  
**EQUIPMENT:** DCOM  
**TESTED BY:** ROBERT FOSTER/MANUEL MARTINEZ

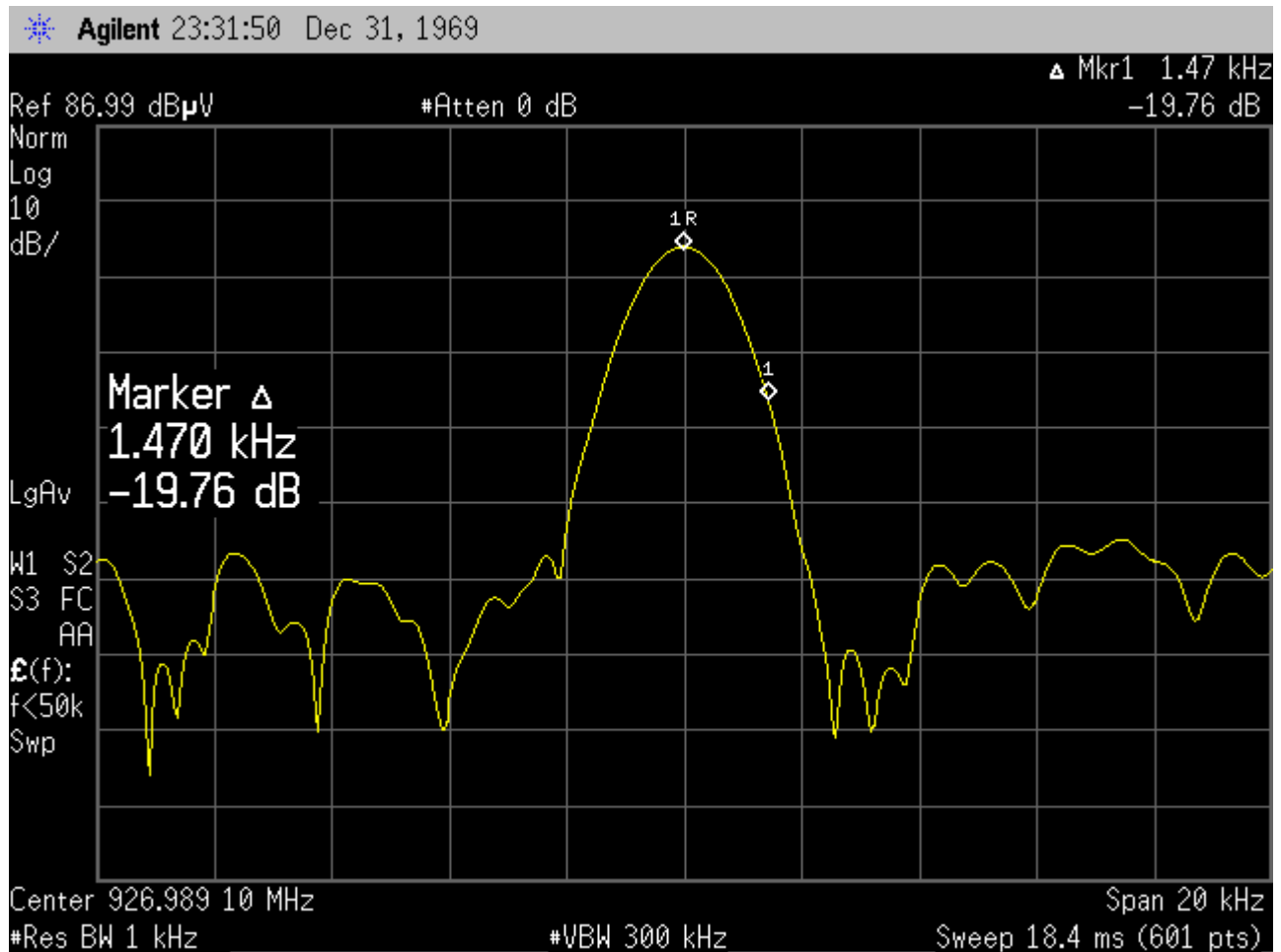
**DATE:** 09/07/04  
**TEST NUMBER:** 2  
**OPERATING MODE:** CONTINUOUS TRANSMISSION  
**MID FREQ.**



## 20dB BANDWIDTH MEASUREMENTS

**CUSTOMER:** ARKION  
**EQUIPMENT:** DCOM  
**TESTED BY:** ROBERT FOSTER/MANUEL  
**MARTINEZ**

**DATE:** 09/07/04  
**TEST NUMBER:** 2  
**OPERATING MODE:** CONTINUOUS TRANSMISSION  
**HIGH FREQ.**



## **2.2 FCC Part 15 Subpart C Output Power**

### **2.2.1 Equipment Used**

| <b>Equipment Used</b>             | <b>Asset #</b> | <b>Serial #</b> | <b>Cal Date</b> |
|-----------------------------------|----------------|-----------------|-----------------|
| Agilent E4440A Spectrum Analyzer  | 704            | US41421236      | 1/05            |
| EMCO 3120 Tuned Dipole Antenna B1 | 477            | 56              | 1/05            |
| EMCO 3121 Tuned Dipole Antenna B2 | 478            | 176             | 1/05            |
| EMCO 3121 Tuned Dipole Antenna B3 | 479            | 728             | 1/05            |
| HP 83640A Signal Generator        | 38             | 3009A00188      | 4/05            |
| EMCO 3115 Microwave Horn Antenna  | 377            | 2174            | 1/05            |
| EMCO 3115 Microwave Horn Antenna  | 376            | 2796            | 1/05            |

### **2.2.2 Test Conditions**

Output Power tests were performed on the ArKion DCOM.

Output Power measurements testing was performed with the DCOM placed on top of a wooden turntable located in Open Area Test Site A. The output connected directly to the spectrum analyzer.

The DCOM was configured to operate in the continuous full power mode of operation and tested at the low, mid, and high frequency.

### **2.2.3 Test Method**

The Output Power of the DCOM was measured with the transceiver directly connected to the input of the Spectrum Analyzer. The output power was measured with a 1MHz resolution bandwidth and a 3MHz video bandwidth.

### **2.2.4 Results**

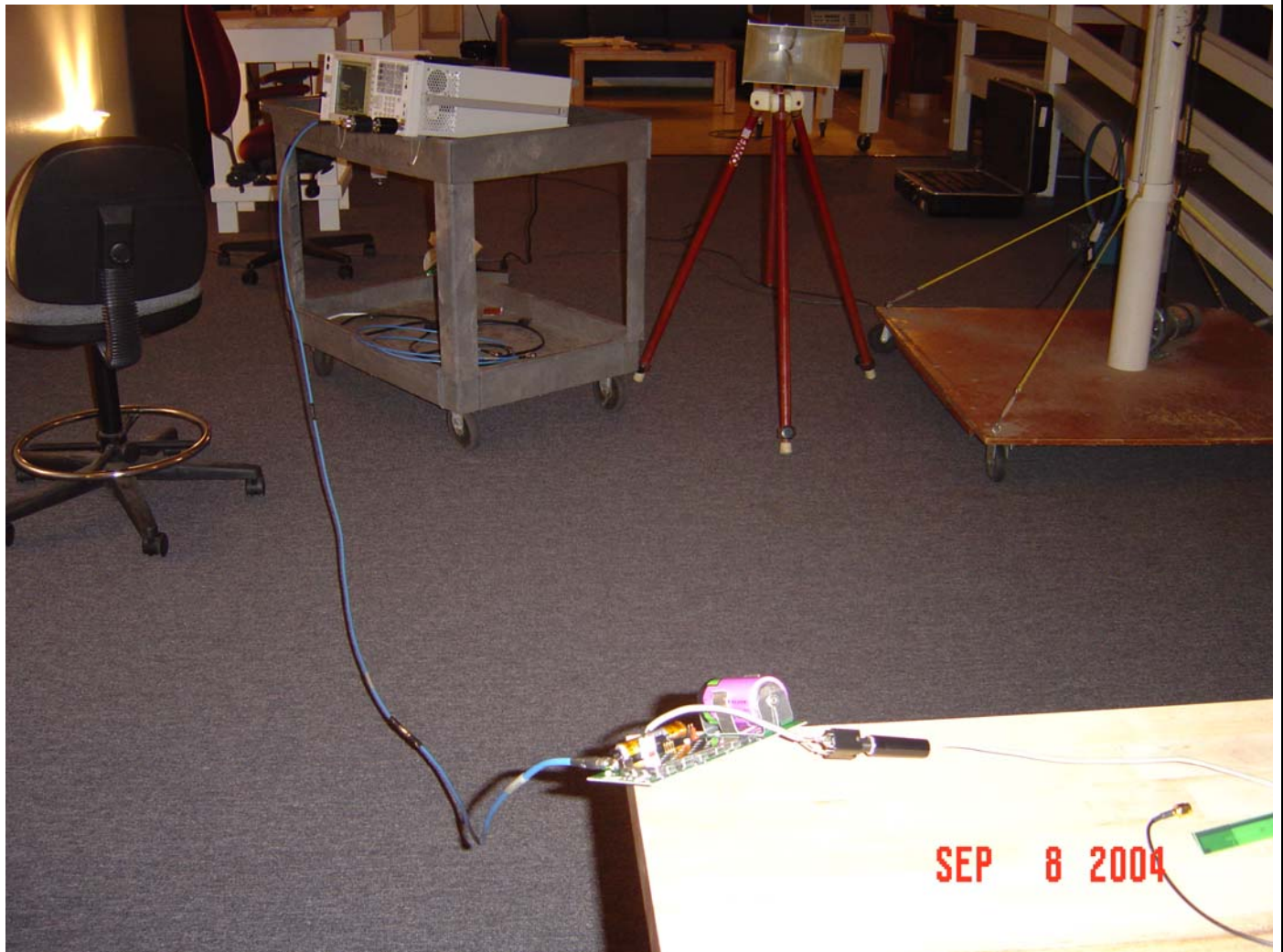
The ArKion DCOM meets the Output Power requirement of FCC Part 15 Subpart C 15.247.

**2.2.5 Test Data****OUTPUT POWER MEASUREMENTS****CUSTOMER: ARKION****EQUIPMENT: DCOM****TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ****OPERATING MODE: CONTINUOUS TRANSMIT****DATE: 09/08/04****TEST NUMBER: 4****TEST SPEC: FCC PART 15 SUBPART C****TEST PROCEDURE: FCC 97-114**

| FREQUENCY<br>MHz | PEAK<br>MEASURED<br>LEVEL<br>dBm | CABLE<br>LOSS +<br>ATTENUATION<br>dB | OUTPUT<br>POWER<br>dBm | LIMIT<br>dBm |
|------------------|----------------------------------|--------------------------------------|------------------------|--------------|
| Low Frequency    |                                  |                                      |                        |              |
| 902.5            | -25                              | 41.5                                 | 15.5                   | 30           |
| Mid Frequency    |                                  |                                      |                        |              |
| 915              | -27                              | 41.5                                 | 14.5                   | 30           |
| High Frequency   |                                  |                                      |                        |              |
| 927              | -28.5                            | 41.5                                 | 12.5                   | 30           |
|                  |                                  |                                      |                        |              |
|                  |                                  |                                      |                        |              |
|                  |                                  |                                      |                        |              |
|                  |                                  |                                      |                        |              |
|                  |                                  |                                      |                        |              |
|                  |                                  |                                      |                        |              |

**NOTES: Measured with 1MHz BW**  
**Measured with 3MHz BW**

**FORM CTS-DS-001R**

**2.2.6 Photographic Documentation****CUSTOMER: ARKION****EQUIPMENT: DCOM****TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ****DATE: 09/08/04****TEST NUMBER: 4****OPERATING MODE: CONTINUOUS TRANSMISSION****FORM CTS-PHOTO**

Arkion DCOM  
Document #: TR3994.04  
Date: October 13, 2004

## **2.3 FCC RF Exposure**

### **2.3.1 Equipment Used**

| <b>Equipment Used</b>             | <b>Asset #</b> | <b>Serial #</b> | <b>Cal Date</b> |
|-----------------------------------|----------------|-----------------|-----------------|
| Agilent E4440A Spectrum Analyzer  | 704            | US41421236      | 1/05            |
| EMCO 3120 Tuned Dipole Antenna B1 | 477            | 56              | 1/05            |
| EMCO 3121 Tuned Dipole Antenna B2 | 478            | 176             | 1/05            |
| EMCO 3121 Tuned Dipole Antenna B3 | 479            | 728             | 1/05            |
| HP 83640A Signal Generator        | 38             | 3009A00188      | 4/05            |
| EMCO 3115 Microwave Horn Antenna  | 377            | 2174            | 1/05            |
| EMCO 3115 Microwave Horn Antenna  | 376            | 2796            | 1/05            |

### **2.3.2 Test Conditions**

EIRP measurements were performed with the ArKion DCOM set up on a wooden table above the turntable at a distance of 3 meters from a tuned dipole and ridge guide antenna within Open Area Test Site A.

The DCOM was configured to operate in the continuous mode of operation to maximize the emissions. The DCOM was tested with the low, mid, and high frequencies. DCOM was set up and powered by a fully charged battery for the tests. The low, mid, and high transmit frequency were measured.

### **2.3.3 Test Method**

The test method of TIA/RIA 603A was followed for the EIRP measurement. A manual signal substation test was performed. During this test, the antenna, turntable and the EUT' were manipulated to maximize the emission level.

### **2.3.4 Results**

The ArKion DCOM is fully compliant with the MPE requirement for general public radio. The ArKion DCOM is less than .03 Watts. According to OET bulletin 65 supplement C, no special instruction or warnings is necessary.

The maximum EIRP measured was 2.1mW at 902.5MHz.

### 2.3.5 Test Data

#### EIRP OF THE FUNDAMENTAL

**CUSTOMER:** ARKION

**DATE:** 09/07/04

**EQUIPMENT:** DCOM

**TEST NUMBER:** 3

**TESTED BY:** ROBERT FOSTER/MANUEL MARTINEZ

**PROCEDURE:** TIA/EI 603A

**OPERATING MODE:** CONTINUOUS TRANSMIT

**TEST SPEC:** FCC PART 15 SUBPART C

**ANTENNA DISTANCE:** 3 METERS

| FREQUENCY<br>MHz | Signal<br>Generator<br>-dBm | ANTENNA<br>HEIGHT<br>(METERS) | TURNTABLE<br>AZIMUTH<br>(DEGREES) | ANTENNA<br>V | ANTENNA<br>GAIN dBi | EIRP |
|------------------|-----------------------------|-------------------------------|-----------------------------------|--------------|---------------------|------|
| 902.5            | 1                           | 1.2                           | 0                                 | V            | 4.1                 | 2.1  |
|                  |                             |                               |                                   |              |                     |      |

All signals greater than 3dB from the limit are calculate to the nearest whole number.

Field Level (dBuV/m) = [107 – Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Ambient Temperature: 68°F

Humidity: 25 %

Atmospheric Pressure: 29.8 "

**NOTES:** 3MHz BW  
1MHz BW

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**2.3.6 Photographic Documentation****CUSTOMER: ARKION****DATE: 09/07/04****EQUIPMENT: DCOM****TEST NUMBER: 3****TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ**Photograph Description: Set-up**FORM CTS-PHOTO**

Arkion DCOM  
Document #: TR3994.04  
Date: October 13, 2004

## **2.4 Spurious Emissions**

### **2.4.1 Equipment Used**

| <b>Equipment Used</b>             | <b>Asset #</b> | <b>Serial #</b> | <b>Cal Date</b> |
|-----------------------------------|----------------|-----------------|-----------------|
| Agilent E4440A Spectrum Analyzer  | 704            | US41421236      | 1/05            |
| EMCO 3120 Tuned Dipole Antenna B1 | 477            | 56              | 1/05            |
| EMCO 3121 Tuned Dipole Antenna B2 | 478            | 176             | 1/05            |
| EMCO 3121 Tuned Dipole Antenna B3 | 479            | 728             | 1/05            |
| HP 83640A Signal Generator        | 38             | 3009A00188      | 4/05            |
| EMCO 3115 Microwave Horn Antenna  | 377            | 2174            | 1/05            |
| EMCO 3115 Microwave Horn Antenna  | 376            | 2796            | 1/05            |

### **2.4.2 Test Conditions**

Radiated spurious emissions test was performed with the ArKion DCOM set up on a wooden table above the turntable at a distance of 3 meters from a tuned dipole and ridge guide antenna within Open Area Test Site A.

The DCOM was configured to operate in the continuous mode of operation to maximize the emissions. The DCOM was tested with the low, mid, and high frequencies. The DCOM was set up and powered by 120V 60Hz for radiated emission tests. The worst case signals detected were recorded. Three scans were performed from 30MHz to 10GHz.

### **2.4.3 Test Method**

The test method of ANSI C63.4 was followed for the radiated spurious emission. A manual scan was performed from 30MHz to 10GHz. During this scan, the antenna, turntable and the EUT was manipulated to maximize the emission levels in a given frequency band displayed on the spectrum analyzer.

### **2.4.4 Results**

The ArKion DCOM meets the FCC Part 15.247 spurious emission requirements.

### 2.4.5 Test Data

#### RADIATED SPURIOUS EMISSIONS 15.247

CUSTOMER: ARKION

DATE: 09/07/04

EQUIPMENT: DCOM

TEST NUMBER: 1

TESTED BY: MANUEL MARTINEZ/ROBERT FOSTER

BANDWIDTH: 100 kHz (PEAK) AND 1MHz AVE

OPERATING MODE: CONTINUOUS TRANSMIT LOW FREQ.

| FREQUENCY<br>MHz                   | PEAK<br>MEASURED<br>LEVEL<br>-dBm | AVERAGE<br>MEASURED<br>LEVEL<br>dBuV | ANTENNA<br>HEIGHT<br>(METERS) | TURNTABLE<br>AZIMUTH<br>(DEGREES) | ANTENNA<br>H/V | ANTENNA<br>FAC/CABLE<br>LOSS dB | FIELD<br>LEVEL<br>dBuV/m † | LIMIT<br>dBuV/m<br>(QP) |
|------------------------------------|-----------------------------------|--------------------------------------|-------------------------------|-----------------------------------|----------------|---------------------------------|----------------------------|-------------------------|
| 902.5                              | 66                                |                                      | 1.5                           | 0                                 | V              | 32.5                            | 96.5                       | N/A                     |
| 1805                               |                                   | 33                                   | 1.5                           | 0                                 | V              | 27                              | 60                         | 76.5                    |
| 2707.5                             |                                   | 36                                   | 1.5                           | 0                                 | V              | 29.7                            | 65.7                       | 76.5                    |
| 3610                               |                                   | 27                                   | 1.5                           | 0                                 | V              | 32.3                            | 59.3                       | 76.5                    |
| 4512.44                            |                                   | 18                                   | 1.5                           | 0                                 | V              | 33.1                            | 51.1                       | 76.5                    |
| 5415.05                            |                                   | 15                                   | 1.5                           | 0                                 | V              | 34.6                            | 49.6                       | 76.5                    |
| 6217.57                            |                                   | 21                                   | 1.5                           | 0                                 | V              | 35.2                            | 56.2                       | 76.5                    |
| 7220.07                            |                                   | 17                                   | 1.5                           | 0                                 | V              | 36.7                            | 53.7                       | 76.5                    |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
| No other signals detected to 10GHz |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |

†All signals greater than 3dB from the limit are calculate to the nearest whole number.

†Field Level (dBuV/m) = [107 – Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Ambient Temperature: 68°F

Humidity: 25 %

Atmospheric Pressure: 29.8 "

NOTES: \* = Noise floor of equipment.

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## TEST SERVICES

## RADIATED SPURIOUS EMISSIONS 15.247

CUSTOMER: ARKION

DATE: 09/07/04

EQUIPMENT: DCOM

TEST NUMBER: 1

TESTED BY: MANUEL MARTINEZ/ROBERT FOSTER

BANDWIDTH: 100 KHz (PEAK) AND 1MHz AVE

OPERATING MODE: CONTINUOUS TRANSMIT MID. FREQ.

| FREQUENCY<br>MHz                   | PEAK<br>MEASURED<br>LEVEL<br>-dBm | AVERAGE<br>MEASURED<br>LEVEL<br>dBuV | ANTENNA<br>HEIGHT<br>(METERS) | TURNTABLE<br>AZIMUTH<br>(DEGREES) | ANTENNA<br>H/V | ANTENNA<br>FAC/CABLE<br>LOSS dB | FIELD<br>LEVEL<br>dBuV/m † | LIMIT<br>dBuV/m<br>(QP) |
|------------------------------------|-----------------------------------|--------------------------------------|-------------------------------|-----------------------------------|----------------|---------------------------------|----------------------------|-------------------------|
| 915                                | 66                                | -                                    | 1.5                           | 0                                 | V              | 32.5                            | 98.5                       | N/A                     |
| 1830.07                            | -                                 | 28                                   | 1.5                           | 0                                 | V              | 27                              | 55                         | 78.5                    |
| 2744.8                             | -                                 | 32                                   | 1.5                           | 0                                 | V              | 29.7                            | 61.7                       | 78.5                    |
| 3659.93                            | -                                 | 19                                   | 1.5                           | 0                                 | V              | 32.3                            | 51.3                       | 78.5                    |
| 4575.1                             | -                                 | 16                                   | 1.5                           | 0                                 | V              | 33.1                            | 49.1                       | 78.5                    |
| 5489.93                            | -                                 | 5                                    | 1.5                           | 0                                 | V              | 34.6                            | 39.6                       | 78.5                    |
| 6404.95                            | -                                 | 13                                   | 1.5                           | 0                                 | V              | 35.2                            | 48.2                       | 78.5                    |
| 7319.9                             | -                                 | 1                                    | 1.5                           | 0                                 | V              | 36.7                            | 37.7                       | 78.5                    |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
| No other signals detected to 10GHz |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |

†All signals greater than 3dB from the limit are calculate to the nearest whole number.

†Field Level (dBuV/m) = [107 – Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Ambient Temperature: 68°F

Humidity: 25 %

Atmospheric Pressure: 29.8 "

NOTES: \* = Noise floor of equipment.

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# TEST SERVICES

## RADIATED SPURIOUS EMISSIONS 15.247

CUSTOMER: ARKION

DATE: 09/07/04

EQUIPMENT: DCOM

TEST NUMBER: 1

TESTED BY: MANUEL MARTINEZ/ROBERT FOSTER

BANDWIDTH: 100 KHz (PEAK) AND 1MHz AVE

OPERATING MODE: CONTINUOUS TRANSMIT HIGH FREQ.

| FREQUENCY<br>MHz                   | PEAK<br>MEASURED<br>LEVEL<br>-dBm | AVERAGE<br>MEASURED<br>LEVEL<br>dBuV | ANTENNA<br>HEIGHT<br>(METERS) | TURNTABLE<br>AZIMUTH<br>(DEGREES) | ANTENNA<br>H/V | ANTENNA<br>FAC/CABLE<br>LOSS dB | FIELD<br>LEVEL<br>dBuV/m † | LIMIT<br>dBuV/m<br>(QP) |
|------------------------------------|-----------------------------------|--------------------------------------|-------------------------------|-----------------------------------|----------------|---------------------------------|----------------------------|-------------------------|
| 926.92                             | 71                                | -                                    | 1.5                           | 0                                 | V              | 32.5                            | 103.5                      | N/A                     |
| 1851.17                            | -                                 | 27                                   | 1.5                           | 0                                 | V              | 27                              | 54                         | 83.5                    |
| 2780.83                            | -                                 | 29                                   | 1.5                           | 0                                 | V              | 29.7                            | 58.7                       | 83.5                    |
| 3708                               | -                                 | 18                                   | 1.5                           | 0                                 | V              | 32.3                            | 50.3                       | 83.5                    |
| 4634.91                            | -                                 | 15                                   | 1.5                           | 0                                 | V              | 33.1                            | 48.1                       | 83.5                    |
| 5562                               | -                                 | 5                                    | 1.5                           | 0                                 | V              | 34.6                            | 39.6                       | 83.5                    |
| 6489                               | -                                 | 4                                    | 1.5                           | 0                                 | V              | 35.2                            | 39.2                       | 83.5                    |
| 7416                               | -                                 | 3                                    | 1.5                           | 0                                 | V              | 36.7                            | 39.7                       | 83.5                    |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
| No other signals detected to 10GHz |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |
|                                    |                                   |                                      |                               |                                   |                |                                 |                            |                         |

†All signals greater than 3dB from the limit are calculate to the nearest whole number.

†Field Level (dBuV/m) = [107 – Measured level (dBm)] + Antenna Factor/Cable Loss (dB)

Ambient Temperature: 68°F

Humidity: 25 %

Atmospheric Pressure: 29.8 "

NOTES: \* = Noise floor of equipment.

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**2.4.6 Photographic Documentation**

**CUSTOMER: ARKION**

**DATE: 09/07/04**

**EQUIPMENT: PLAYER PATCH**

**TEST NUMBER: 1**

**TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ**



**FORM CTS-PHOTO**

**Photographic Documentation**

**CUSTOMER: ARKION**

**DATE: 09/07/04**

**EQUIPMENT: PLAYER PATCH**

**TEST NUMBER: 1**

**TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ**



**FORM CTS-PHOTO**

**Photographic Documentation**

**CUSTOMER: ARKION**

**DATE: 09/07/04**

**EQUIPMENT: PLAYER PATCH**

**TEST NUMBER: 1**

**TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ**



**FORM CTS-PHOTO**

Arkion DCOM  
Document #: TR3994.04  
Date: October 13, 2004

**Photographic Documentation**

**CUSTOMER: ARKION**

**DATE: 09/07/04**

**EQUIPMENT: DCOM**

**TEST NUMBER: 1**

**TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ**



**FORM CTS-PHOTO**

**APPENDIX A**

**TEST LOG**

## TEST SERVICES

### TEST LOG

**CUSTOMER: ARKION**

**PROGRAM: FCC CERTIFICATION**

**EQUIPMENT: ELAPS**

**TESTED BY: ROBERT FOSTER/MANUEL MARTINEZ**

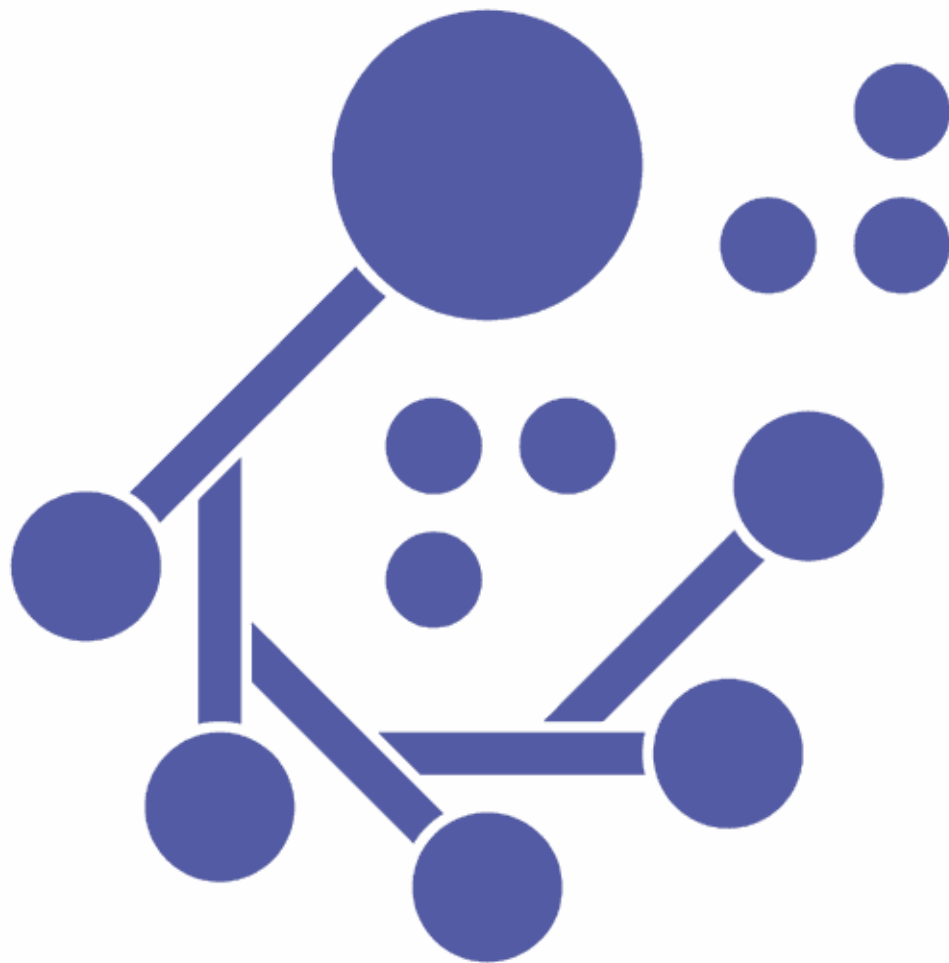
|                           |                   |                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                   |                                         |                                     |                |
|---------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------|----------------|
| Pre-Test Checklist        | Date              | Comments                                                                                                                                                                                                                                                                                                                                     |                    |                                                                                                                                                   |                                         |                                     |                |
|                           | 09/07/04          | <b>Test Plan/Procedure: ANSI C63.4</b><br><b>Test Specification: FCC Part 15 Subpart C</b><br><b>Chomerics Procedure: CHO TPEC T1, T2</b><br><b>EUT Power Requirement Verified:</b><br><b>DCOM: 9VDCe</b><br><b>EUT Functional Operational Check: [ X ] Pass [ ] Fail</b><br><b>Environmental: Bonding/Grounding: N/A Safety Issues: N/A</b> |                    |                                                                                                                                                   |                                         |                                     |                |
| In-Process Test Checklist | Date              | Test #                                                                                                                                                                                                                                                                                                                                       | Test Type          | Test Equipment Calibrated                                                                                                                         | Test Performed Properly – Data Accepted | EUT Set-up Check/ Operational Check | EUT Pass/ Fail |
|                           | 09/07/04          | 1                                                                                                                                                                                                                                                                                                                                            | Spurious Emissions | Yes                                                                                                                                               | Yes                                     | Yes                                 | Pass           |
|                           | 09/07/07          | 2                                                                                                                                                                                                                                                                                                                                            | 20 dB bandwidth    | Yes                                                                                                                                               | Yes                                     | Yes                                 | Pass           |
|                           | 09/07/04          | 3                                                                                                                                                                                                                                                                                                                                            | RF Exposure        | Yes                                                                                                                                               | Yes                                     | Yes                                 | Pass           |
|                           | 09/08/04          | 4                                                                                                                                                                                                                                                                                                                                            | Output Power       | Yes                                                                                                                                               | Yes                                     | Yes                                 | Pass           |
|                           |                   |                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                   |                                         |                                     |                |
|                           |                   |                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                   |                                         |                                     |                |
|                           |                   |                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                   |                                         |                                     |                |
|                           |                   |                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                   |                                         |                                     |                |
|                           |                   |                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                   |                                         |                                     |                |
|                           |                   |                                                                                                                                                                                                                                                                                                                                              |                    |                                                                                                                                                   |                                         |                                     |                |
| Post Test Checklist       | Date:<br>09/08/04 | <b>EUT Functional Operation Check:</b><br><b>[ X ] Pass [ ] Fail</b>                                                                                                                                                                                                                                                                         |                    | <div style="display: flex; justify-content: space-between;"> <div> <b>Test Engineer/Tech</b> </div> <div> <b>Approved Signatory</b> </div> </div> |                                         |                                     |                |

FORM CTS-010

Arkion DCOM  
Document #: TR3994.04  
Date: October 13, 2004

## APPENDIX B

### CUSTOMER SUPPLIED EQUIPMENT DESCRIPTION



# ArKion Systems

## DCOM Technical Description

Rev 0.1

ArKion DCOM  
Document #: TR3994.04  
Date: October 13, 2004

## DCOM Overview

The Device Communications Module(DCOM) by Arkion Systems is versatile module for connecting Electric Meter, Water Meter, Gas Meter or any other Serial Port enabled device to internet(WAN) by communicating with Central Communications Module(CCOM) using 900MHz ISM Band Radio and then using CCOM as router to WAN.



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Arkion DCOM  
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## Technical Specifications

- **System Resources**
  - High performance, low power ATmega32 processor
  - 32Kbytes of FLASH
  - 2Kbytes of SRAM
  - 1Kbytes of EEPROM
- **Special Ports**
  - One Water Meter Port
  - One Pulse InputPorts
- **LAN Connectivity**
  - DTE RS232 Port
  - 915MHz FHSS RADIO
- **Electrical Specifications**
  - 3.6V DC Li-ion 19Ah Battery
- **Mechanical Specifications**
  - Size 5.5 " x 5" x 2.5"
  - Weight about 1 lb
- **Environmental Specifications**
  - -20 Deg C to +70 Deg C Operating Temperature Range
  - -40 Deg C to +85 Deg C Storage Temperature Range