ITS Intertek Testing Services
ETL SEMKO

**FCC Part 90 Test Report**
for
**M/A-Com, Inc.**
on the
**Control Station**
**Model: CS-803**

**FCC ID: BV8CS803**

Test Report #: 3037377
Date of Report: January 28, 2003

Project #: 3037377
Dates of Test: February 4-7, 2002, January 23-24, 2003

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|---|---|
| | Nicholas Abbondante, Test Engineer |
| | Michael F. Murphy, Staff Engineer, EMC |





**Intertek Testing Services NA, Inc.**
70 Codman Hill Road, Boxborough, MA 01719
Telephone 978-263-2662 Fax 978-263-4120 Home Page www.etlsemko.com

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# Model No.: CS-803

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Test Engineer: _____ Date: 1/30/03
Nicholas Abbondante

Staff Engineer, EMC: _____ Date: 1/31/03
Michael F. Murphy

**2.0 General Description**

2.1 Product Description

The CS-803 Control Station is a versatile voice and data radio designed for the office environment. The CS-803 operates in the 800 MHz SMR frequency band. A production version of the CS-803 Control Station was received on January 23, 2003 in good condition, with serial number A40058000005. Only the OpenSky digital modulation (OTP/ORP which employs a GSFK modulation) software was provided and tested.

The EUT has been tested at the request of

| | |
|---|---|
| **Company:** | M/A-Com<br>1011 Pawtucket Blvd.<br>Lowell, MA, 01853-2395 |
| **Name of contact:** | Andy Moysenko |
| **Telephone:** | (978) 442-4762 |
| **Fax:** | (978) 442-5442 |

**Overview of CS-803 CS-803 Unit**

| | |
|---|---|
| Applicant | M/A-Com |
| Trade Name | CS-803 Control Station |
| FCC Identifier | BV8CS803 |
| Use of Product | Voice and Data Communication |
| Type of Modulation | GFSK and FM |
| Bit Rate | 19200 bps |
| Baud Rate | 9600 |
| Occupied Bandwidth | 16.5 kHz measured |
| RF Output | 17.4 Watts measured |
| DC voltage and current into the final RF amplifying device | Voltage: 12VDC<br>Current: 9A |
| Frequency Range | 806 – 824 MHz |
| Transmitter L.O. Frequency | 736 – 754 MHz, 921 – 939 MHz, 966 – 984 MHz |
| Max. Number of Channels | 830 |
| Antenna(e) & Gain | 0 dBd and 3 dBd |
| Detachable Antenna? | [X] Yes [ ] No |
| Receiver L.O. Frequency | 58 MHz, 70.455 MHz, 736 – 754 MHz, 921 – 939 MHz, 966 – 984 MHz |
| External Input | [X] Audio [X] Digital Data |

2.2 Related Submittal(s) Grants

None.

2.3 Test Facility

**SITE 3C** - At this time, three weather-sheltered open field test sites are in use. Site 3 is surrounded by a wire mesh groundplane extension of 25m x 37m to permit 30m operation, and a turntable capacity is increased to 12,000 lbs.

Each site is comprised of a 33' x 57' continuous metal sheet groundplane, sheltered by an arched, flexible plastic cover supported by semicircular fiberglass ribs. Maximum interior height is 16'. The groundplane is earthed at 3' intervals around its periphery by grounding straps outside of the foundation. Access to the site is provided by both a personnel door and a 10' x 10' operable flap in the plastic cover.

Each site has a 12' diameter flush-mounted motorized turntable and remote-controlled mast for antenna height and polarization. A half-basement provides access below the turntable for support equipment and mains power selection.

The operation and test equipment are located below the groundplane at a mezzanine level, permitting observation of the EUT without affecting the measurement of radiated emissions.

For 30m antenna distances in Site 3, the antenna mast is located outside of the plastic shelter, on the wire mesh extension of the groundplane.

All unnecessary equipment is removed from the site following the shipping and storing procedures of the Standard Operating Procedures. Any packaging material is moved to a corner of the site. Packing material is generally non-conductive. Any metal shipping contains are removed entirely from the site, and, if necessary due to inclement weather, either sheltered in plastic or removed to another location.

2.4 Test Equipment and Support Equipment

**Test Equipment**

| Description | Manufacturer | Model Number | Serial Number | Cal Due Date |
|---|---|---|---|---|
| Average Power Meter | Boonton | 4232A | 55601 | 12/5/03 |
| 50 Ohm Load | Weinschel | 1430-4 | BE5403 | Cal Verified |
| EMI Receiver Set W/RF Filter | Hewlett Packard | 85462A | 3650A00362 | 8/19/03 |
| Cable, SMA – SMA <18 GHz | Sucoflex | 104PE | CBL203 | 4/01/03 |
| BNC – BNC Cable | Alpha | RG214B/U | CBL303S | 9/19/03 |
| Power Sensor | Boonton | 51011-EMC | 31974 | 12/5/03 |
| Low to High Temperature Chamber | Bryant Manufacturing Associates | TH-5S | 1207 | 7/17/02* |
| Chart Recorder (TH-5S) | Honeywell | DR45AT | 0028Y047153900001 | 6/25/02* |
| Antenna | EMCO | 3142 | 9711-1224 | 12/24/03 |
| Horn Antenna | EMCO | 3115 | 9602-4675 | 6/06/03 |
| Spectrum Analyzer | Agilent | E7405A | US40240205 | 11/11/03 |

* - Note that this equipment was used to determine frequency stability on February 4-7, 2002.

| **Support Equipment** | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model Number** | **Serial Number** |
| 40 dB Attenuator | Weinschel Corporation | 46-40-34 | BM0544 |
| Laptop Computer Compaq Armada | Compaq | 7800 6300/T/8000/V/M/1 | 7919CB630126 |

| **Cables** | | | | | |
|---|---|---|---|---|---|
| **Quantity** | **Type** | **Length (m)** | **Shielding** | **Ferrite** | **Connector Type** |
| 1 | Serial Cable | 4 | No | No | Metal w/360 |
| 1 | AC Power Cable | 2 | No | No | Plastic |

**3.0 RF Power Output**

FCC § 2.1046, § 90.205(i), § 90.635(d)

3.1 Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to an average power meter. The readings were taken from the power meter in dBm.

Requirement: The RF Power Output must be below 20 dBW.

3.2 Test Results

| Results: Passed |
|---|

Conducted RF Output Power

| Frequency (MHz) | Description | Value (dBm) | Value (dBW) | Limit (dBW) |
|---|---|---|---|---|
| 806.0125 | Low Channel | 42.41 | 12.41 | 20 |
| 816.3625 | Middle Channel | 42.11 | 12.11 | 20 |
| 823.9875 | High Channel | 42.00 | 12.00 | 20 |

**4.0 Occupied Bandwidth, Bandwidth Limitation, Emission Masks**
FCC §2.1049, 90.209(b)(5), 90.210

4.1 Test Procedure

The antenna was disconnected from the transmitter and a spectrum analyzer was connected to the transmitter RF output through sufficient attenuation to prevent overloading of the analyzer. The resolution bandwidth of the spectrum analyzer was set up to 300 Hz in the 100 kHz span around the transmit frequency, and the spectrum of the transmitting signal was recorded. This spectrum was compared to the required emission mask. Readings were taken of the carrier power at low, middle, and high values of the transmit frequency using an average power meter. These readings are used to determine the upper limit for the applicable emissions masks.

Occupied bandwidth was measured using the 99% power function on the spectrum analyzer.

The emission designators were defined as 16K5F7D and 16K5F7E, where 16.5 kHz is the Necessary Bandwidth, determined using the maximum Occupied Bandwidth. The EUT implements a digital data stream through software GFSK modulation which shapes and constrains the Necessary Bandwidth and therefore the equations for Necessary Bandwidth are not appropriate.

4.2 Test Results

Plots of the test results can be found in appendix A.

| Frequency (MHz) | Occupied Bandwidth (kHz) | Authorized Bandwidth (kHz) |
|---|---|---|
| 807.2375 (Low Channel, VRM) | 16.5 | 20 |
| 816.3625 (Middle Channel, VRM) | 15.3 | 20 |
| 823.9875 (High Channel, VRM) | 15.3 | 20 |

Results: Passed

## 5.0 Out-of-Band Emissions at Antenna Terminals

FCC §2.1051, FCC §90.210

### 5.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through sufficient attenuation to prevent overloading the analyzer; a high-pass or band stop filter is used where necessary to prevent the fundamental emission from overloading the analyzer. The resolution bandwidth of the spectrum analyzer was set at 100 kHz below 1 GHz. Above 1 GHz the bandwidth was set to 1 MHz. Sufficient scans were taken to show the out-of-band emissions, if any, up to 10th harmonic.

Requirement: The power of emissions must be attenuated below the power of the unmodulated carrier (P) on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth at least (43 + 10 log P) dB. P is the measured RF output power of 17.4 Watts. Therefore all emissions should be attenuated by 55.4 dB below the carrier power.

### 5.2 Test Results

Plots can be located in appendix B. Note that no emissions were detected emanating from the antenna port other than the two fundamentals.

| Results: Passed |
|---|

## 6.0 Field Strength of Spurious Radiation

FCC §2.1053, §90.210

### 6.1 Test Procedure

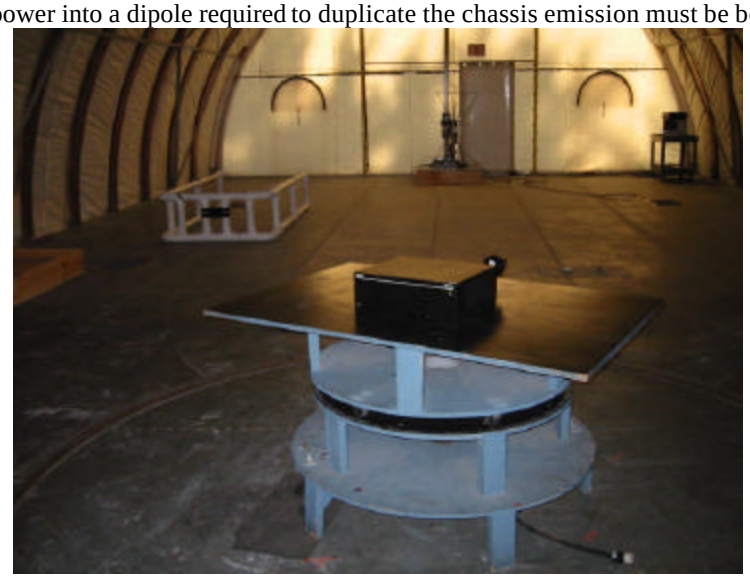
The transmitter was placed on a wooden turntable. The measurement antenna was placed at a distance of 10 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The Field Strength (FS) in the frequency range up to tenth harmonic of the fundamental frequency was measured. At the frequencies where the FS exceed 51.8 dBuV/m, the EIRP of spurious emissions was measured by the substitution method using the double-ridged horn antenna. The FS=51.8 dBuV/m corresponds to the EIRP equal –33 dBm which is 20 less than the limit (-13 dBm), adjusted by 20 dB to account for the test distance of 10 meters, adjusted by the gain of a typical dipole antenna, 2.14 dBi. The Radiated Power was measured by the substitution method using horn antenna connected to a generator. Power P (in dBm) was calculated as follows:

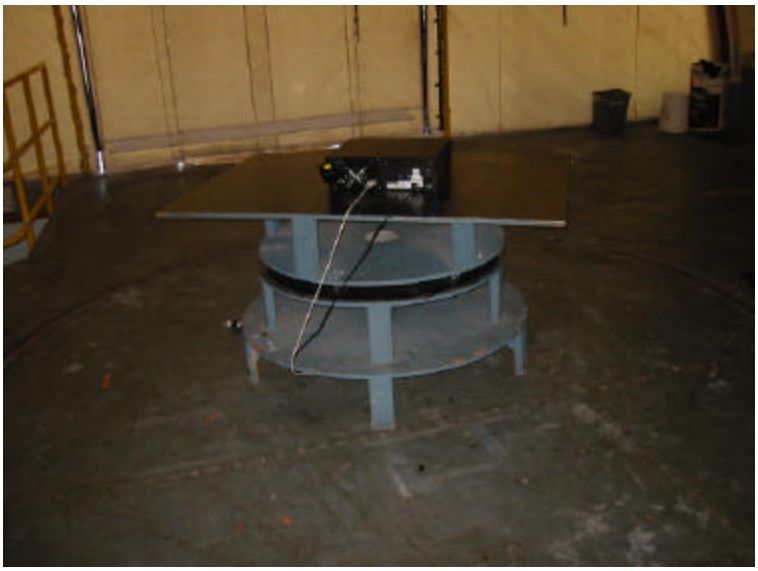
$$P = P_{sg} – L + G_H - G_d$$

Where $G_H$ is the gain of the transmit horn antenna attached to the signal generator
L is the loss in the cable between the signal generator and the transmit antenna
$P_{sg}$ is the generator output power (on the end of the cable connected to an antenna)
$G_d$ is 2.14 dBi – the gain of the half-wave dipole.

Photographs of the test setup used to test for radiated emissions from the EUT chassis are below.
Requirement: The power into a dipole required to duplicate the chassis emission must be below –13 dBm.



Radiated Spurious Test Setup, Front View



Radiated Spurious Test Setup, Back View

6.2 Test Results

No emissions were detected that fell within 20 dB of the limit.

| Results: Pass |
|---|

**7.0 Frequency Stability vs Temperature**
FCC § 2.1055, § 90.213

7.1 Test Procedure

Note: Testing of the frequency stability of the components used in the CS-803 system was performed during testing of the M-803 VTAC mobile radio system, FCC ID:BV8-M803VTAC on February 4-7, 2002.

The equipment under test was connected to an external DC power supply and the RF output was connected to a spectrum analyzer through an attenuator pad. The EUT was placed inside the temperature chamber. The DC power cable, RF output cable, exited the chamber through an opening insulated to minimize heat flow. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the analyzer.

Requirement: The frequency must not deviate by more than 1.5 parts-per-million (ppm) in the frequency band 806-821 MHz, and 2.5 ppm in the frequency band 821-824 MHz. The tighter limit of 1.5 ppm will be applied from 806-824 MHz in order to show compliance, with the lowest frequency 806 MHz selected from the band to provide the lowest possible limit.

7.2 Test Results

| Temperature, C | Reading (MHz) | Difference (Hz) | Limit (Hz) |
|---|---|---|---|
| +50 | 816.362 | 1000 | 1209 |
| +40 | 816.362 | 1000 | 1209 |
| +30 | 816.363 | 0 | 1209 |
| +20 | 816.363 | 0 (Nominal Value) | 1209 |
| +10 | 816.363 | 0 | 1209 |
| 0 | 816.363 | 0 | 1209 |
| -10 | 816.363 | 0 | 1209 |
| -20 | 816.363 | 0 | 1209 |
| -30 | 816.363 | 0 | 1209 |

Results: Passed

**8.0 Frequency Stability vs Voltage**
FCC §2.995(d)(2)

8.1 Test Procedure

Note: Testing of the frequency stability of the components used in the CS-803 system was performed during testing of the M-803 VTAC mobile radio system, FCC ID:BV8-M803VTAC on February 4-7, 2002.

An external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115% of the DC nominal value and for 85% of the nominal value.

Requirement: The frequency must not deviate by more than 1.5 parts-per-million (ppm) in the frequency band 806-821 MHz, and 2.5 ppm in the frequency band 821-824 MHz. The tighter limit of 1.5 ppm will be applied from 806-824 MHz in order to show compliance, with the lowest frequency 806 MHz selected to provide the lowest possible limit.

8.2 Test Results

| Voltage, VDC | Reading (Hz) | Difference (Hz) | Limit (Hz) |
|---|---|---|---|
| 11.73 (85%) | 816.364 | 1000 | 1209 |
| 12.42 (90%) | 816.362 | 1000 | 1209 |
| 13.11 (95%) | 816.363 | 0 | 1209 |
| 13.8 (100%) | 816.363 | 0 (Nominal Voltage) | 1209 |
| 14.49 (105%) | 816.363 | 0 | 1209 |
| 15.18 (110%) | 816.362 | 1000 | 1209 |
| 15.87 (115%) | 816.362 | 1000 | 1209 |

Results: Passed

**9.0 Transient Frequency Behavior**
FCC §90.214

9.1 Test Procedure

This test is required for transmitters operating the frequency bands 150-174 MHz and 421-512 MHz. The EUT does not transmit in these bands.

9.2 Test Results

| Results: Not Applicable |
|---|