**MOTOROLA INDALA CORPORATION TEST REPORT**

**FOR THE**

**RFID READER, CEM-603**

**FCC PART 15 SUBPART C**
**PART 15.207 & 15.209**

**COMPLIANCE**

**DATE OF ISSUE: JULY 27, 2000**

**PREPARED FOR:**

Motorola Indala Corporation
3041 Orchard Parkway
San Jose, CA 95134-2017

P.O. No: MJS20170
W.O. No: 74399

**Report No: FC00-049**

**PREPARED BY:**

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CKC Laboratories, Inc.
5473A Clouds Rest
Mariposa, CA 95338

Date of test: May 18, 2000

**DOCUMENTATION CONTROL:**

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## ADMINISTRATIVE INFORMATION

| | |
|---|---|
| **DATE OF TEST:** | May 18, 2000 |
| **PURPOSE OF TEST:** | To demonstrate the compliance of the RFID Reader, CEM-603, with the requirements for FCC Part 15 Subpart C Part 15.207 & 15.209 devices. |
| **MANUFACTURER:** | Motorola Indala Corporation<br>3041 Orchard Parkway<br>San Jose, CA 95134-2017 |
| **REPRESENTATIVE:** | Gilbert Roque |
| **TEST LOCATION:** | CKC Laboratories, Inc.<br>5473A Clouds Rest<br>Mariposa, CA 95338 |
| **TEST PERSONNEL:** | Dustin Oaks |
| **TEST METHOD:** | ANSI C63.4 1992 |
| **FREQUENCY RANGE TESTED:** | 9 kHz - 1000 MHz |
| **EQUIPMENT UNDER TEST:** | **RFID Reader**<br>Manuf: Motorola Indala Corporation<br>Model: CEM-603<br>Serial: N/A<br>FCC ID: E9UCEM603 |

## SUMMARY OF RESULTS

The Motorola Indala Corporation RFID Reader, CEM-603, was tested in accordance with ANSI C63.4 1992 for compliance with FCC Part 15 Subpart C Part 15.207 & 15.209.

As received, the above equipment was found to be fully compliant with the limits of FCC Part 15 Subpart C Part 15.207 & 15.209. The results in this report apply only to the items tested, as identified herein.

## EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The CEM-603 reader is a modular miniaturized and rugged low power frequency reader designed for RFID uses.

## MEASUREMENT UNCERTAINTY

Associated with data in this report is a ±4dB measurement uncertainty.

## EUT OPERATING FREQUENCY

The EUT was operating at 0.125 MHz.

## TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

## PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

**Power Supply**
Manuf: TopWard Electric Instrument
Model: 6303D
Serial: 677556
FCC ID: N/A

## REPORT OF MEASUREMENTS

The following tables report the highest worst case levels recorded during the tests performed on the RFID Reader, CEM-603. All readings taken are peak readings unless otherwise noted by a "Q" or "A". The data sheets from which these tables were compiled are contained in Appendix B.

**Table 1: Fundamental Radiated Emission Levels**

| FREQUENCY MHz | METER READING dBµV | CORRECTION FACTORS Mag dB | Amp dB | Cable dB | Dist dB | CORRECTED READING dBµV/m | SPEC LIMIT dBµV/m | MARGIN dB | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| 0.125 | 50.7 | -49.4 | | | | 1.3 | 25.7 | -24.4 | N |

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.209
Test Distance: 10 Meters

NOTES:
H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply.

**Table 2: Six Highest Radiated Emission Levels - 9kHz-30MHz**

| FREQUENCY | METER READING | CORRECTION FACTORS | | | | CORRECTED READING | SPEC LIMIT | MARGIN | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | | Mag | FCC 15.31 | Cable | Dist | | | | |
| MHz | dBµV | dB | dB | dB | dB | dBµV/m | dBµV/m | dB | |
| 0.375 | 40.4 | 11.0 | -60.0 | 0.0 | | -8.6 | 16.1 | -24.7 | N |
| 0.499 | 34.4 | 10.8 | -20.0 | 0.0 | | 25.2 | 33.6 | -8.4 | N |
| 0.625 | 33.2 | 10.9 | -20.0 | 0.0 | | 24.1 | 31.7 | -7.6 | N |
| 0.751 | 28.9 | 11.0 | -20.0 | 0.0 | | 19.9 | 30.1 | -10.2 | N |
| 0.876 | 28.8 | 11.0 | -20.0 | 0.0 | | 19.8 | 28.7 | -8.9 | N |
| 1.000 | 27.2 | 10.9 | -20.0 | 0.1 | | 18.2 | 27.6 | -9.4 | N |

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.209
Test Distance: 10 Meters

NOTES:
H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply. Frequency Range tested: 9kHz to 30MHz

| Table 3: Highest Radiated Emission Levels - 30-1000MHz | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | METER | CORRECTION FACTORS | | | | CORRECTED | SPEC | | |
| FREQUENCY MHz | READING dBµV | Bicon dB | Amp dB | Cable dB | Dist dB | READING dBµV/m | LIMIT dBµV/m | MARGIN dB | NOTES |
| 38.803 | 36.7 | 12.0 | -25.0 | 0.7 | | 24.4 | 40.0 | -15.6 | H |
| 39.341 | 42.8 | 12.0 | -25.0 | 0.7 | | 30.5 | 40.0 | -9.5 | VQ |
| 171.099 | 32.6 | 15.4 | -24.8 | 2.2 | | 25.4 | 43.5 | -18.1 | V |
| 173.674 | 30.7 | 15.7 | -24.8 | 2.2 | | 23.8 | 43.5 | -19.7 | H |

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.209
Test Distance: 3 Meters

NOTES:
H = Horizontal Polarization
V = Vertical Polarization
N = No Polarization
D = Dipole Reading
Q = Quasi Peak Reading
A = Average Reading

COMMENTS: EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply. Frequency Range tested: 30MHz to 1000MHz.

| Table 4: Six Highest Conducted Emission Levels | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY MHz | METER READING dBµV | CORRECTION FACTORS Cable dB | LISN dB | dB | dB | CORRECTED READING dBµV | SPEC LIMIT dBµV | MARGIN dB | NOTES |
| 8.018409 | 33.1 | 0.2 | 2.4 | | | 35.7 | 48.0 | -12.3 | W |
| 8.168687 | 32.7 | 0.2 | 2.1 | | | 35.0 | 48.0 | -13.0 | W |
| 8.523890 | 33.2 | 0.2 | 1.6 | | | 35.0 | 48.0 | -13.0 | W |
| 19.004880 | 34.4 | 0.3 | 0.2 | | | 34.9 | 48.0 | -13.1 | W |
| 19.395470 | 34.7 | 0.3 | 0.2 | | | 35.2 | 48.0 | -12.8 | W |
| 20.000880 | 36.1 | 0.3 | 0.2 | | | 36.6 | 48.0 | -11.4 | W |

Test Method: ANSI C63.4 1992
Spec Limit : FCC Part 15.207

NOTES: Q = Quasi Peak Reading
A = Average Reading
B = Black Lead
W = White Lead

COMMENTS: EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply. Frequency Range tested: 450kHz to 30MHz.

## TABLE A

## LIST OF TEST EQUIPMENT

| ID # | EQUIPMENT |
|---|---|
| 439 | Quasi-Peak Adapter, Hewlett Packard, Model No. 85650A, S/N 2811A01267. Calibration Date: July 7, 1999. Calibration due: July 7, 2000. |
| 472 | SA Display Section, Hewlett Packard, Model 8566B, S/N 2403A08241. Calibration date: July 7, 1999. Calibration due date: July 7, 2000. |
| 502 | Spectrum Analyzer, Hewlett Packard, Model No. 8566B, CKC 1, S/N 2403A08241 (Display Unit), S/N 2209A01404 (rf Unit). Calibration date: July 7, 1999. Calibration due date: July 7, 2000. |
| 354 | Mag Loop Antenna, EMCO, Model No. 6502, S/N 1074. Calibration date: June 16, 1999. Calibration due date: June 16, 2000. |
| 327 | LISN, Solar Electronics, S/N 8144793, 474. Calibration date: June 5, 2000. Calibration due date: June 5, 2001. |
| 92 | Biconical Antenna, A & H Systems, Model No. SAS-200/542, S/N 156. Calibration Date: May 8, 2000. Calibration Due: May 8, 2001. |
| 341 | Log Periodic Antenna, A & H Systems, Model No. SAS-200/512, S/N 154. Calibration Date: May 8, 2000. Calibration Due: May 8, 2001. |
| 401 | Preamp, Hewlett Packard, Model No. 8447D, S/N 1937A02604. Calibration Date: April 3, 2000. Calibration Due: April 3, 2001. |

## EUT SETUP

The equipment under test (EUT) and the peripheral(s) listed were set up in a manner that represented their normal use. Any special conditions required for the EUT to operate normally are identified in the comments that accompany Table 1 for fundamental radiated emissions, Tables 2 & 3 for radiated emissions and Table 4 for conducted characteristics. Additionally, a complete description of all the ports and I/O cables is included on the information sheets contained in Appendix A.

During radiated emissions testing, the EUT was mounted on a nonconductive, rotating table 80 cm above the conductive grid. The nonconductive table dimensions were 1 meter by 1.5 meters. This configuration is typical for radiated emissions testing of wall mount devices.

I/O cables were connected to the EUT and peripherals in the manner required for normal operation of the system. Excess cabling was bundled in the center in a serpentine fashion using 30-40 centimeter lengths.

During conducted emissions testing, the EUT was located on a wooden table measuring approximately 80 cm high, 1 meter deep, and 1.5 meters in length. One wall of the room where the EUT is located, has a minimum 2 meter by 2 meter conductive plane. The EUT was mounted on the wooden table 40 cm away from the conductive plane, and 80 cm from any other conductive surface.

The vertical metal plane used for conducted emissions was grounded to the earth. Power to the EUT was provided through a LISN. The LISN was grounded to the ground plane. All other objects were kept a minimum of 80 cm away from the EUT during the conducted test. Conducted emissions tests required the use of the LISN's listed in Table A.

## TEST INSTRUMENTATION AND ANALYZER SETTINGS

The test instrumentation and equipment listed in Table A were used to collect both the radiated and conducted emissions data for the RFID Reader, CEM-603. For frequencies below 30 MHz the magnetic loop antenna was used. For radiated measurements below 300 MHz, the biconical antenna was used. For frequencies from 300 to 1000 MHz, the log periodic antenna was used. All antennas were located at a distance of either 3 or 10 meters from the edge of the EUT. Conducted emissions tests required the use of the FCC type LISN's.

The HP spectrum analyzer was used for all measurements. Table B shows the analyzer bandwidth settings that were used in designated frequency bands. For conducted emissions, an appropriate reference level and a vertical scale size of 10 dB per division were used. A 10 dB external attenuator was also used during conducted tests, with internal offset correction in the analyzer. During radiated testing, the measurements were made with 0 dB of attenuation, a reference level of 97 dBµV, and a vertical scale of 10 dB per division.

| TABLE B : ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE | | | |
|---|---|---|---|
| TEST | BEGINNING FREQUENCY | ENDING FREQUENCY | BANDWIDTH SETTING |
| CONDUCTED EMISSIONS | 450 kHz | 30 MHz | 9 kHz |
| RADIATED EMISSIONS | 9 kHz | 30 MHz | 200 Hz |
| RADIATED EMISSIONS | 30 MHz | 1000 MHz | 120 kHz |

## SPECTRUM ANALYZER DETECTOR FUNCTIONS

The notes that accompany the measurements contained in Tables 1-4 indicate the type of detector function used to obtain the given readings. Unless otherwise noted, all readings were made in the "Peak" mode. Whenever a "Quasi-Peak" or "Average" reading is listed as one of the highest readings, this is indicated as a "Q" or an "A" in the appropriate table. The following paragraphs describe in more detail the detector functions and when they were used to obtain the emissions data for the RFID Reader, CEM-603.

### Peak

In this mode, the Spectrum Analyzer or test engineer recorded all emissions at their peak value as the frequency band selected was scanned. By combining this function with another feature of the analyzer called "peak hold," the analyzer had the ability to measure transients or low duty cycle transient emission peak levels. In this mode the analyzer made a slow scan across the frequency band selected and measured the peak emission value found at each frequency across the band.

### Quasi-Peak

When the true peak values exceeded or were within 2 dB of the specification limit, quasi-peak measurements were taken using the HP Quasi-Peak Adapter for the HP Spectrum Analyzer. The detailed procedure for making quasi peak measurements contained in the HP Quasi-Peak Adapter manual were followed.

## Average

For certain frequencies, average measurements may be made using the spectrum analyzer. To make these measurements, the test engineer reduces the video bandwidth on the analyzer until the modulation of the signal is filtered out. At this point the analyzer is set into the linear mode and the scan time is reduced.

## TEST METHODS

The radiated and conducted emissions data of the RFID Reader, CEM-603, was taken with the HP Spectrum Analyzer. Incorporating the applicable correction factors for distance, antenna, cable loss and amplifier gain, the data was reduced as shown in the "Sample Calculations". The corrected data was then compared to the FCC Part 15, Subpart C Part 15.207 & 15.209 emissions limits to determine compliance.

Preliminary and final measurements were taken in order to better ensure that all emissions from the EUT were found and maximized.

## Radiated Emissions Testing

During the preliminary radiated scan, the EUT was powered up and operating in its defined FCC test mode with the I/O cables and line cords facing the antenna. For frequencies below 30 MHz the magnetic loop antenna was used. The frequency range of 30 MHz - 88 MHz was then scanned with the biconical antenna located about 1.5 meter above the ground plane in the vertical configuration. During this scan, the turntable was rotated and all peaks which were at or near the limit were recorded. The frequency range of 100 - 300 MHz was scanned with the biconical antenna in the same manner, and the peaks recorded. Lastly, a scan of the FM band from 88 - 110 MHz was made, using a reduced resolution bandwidth and a reduced frequency span. The biconical antenna was changed to the horizontal polarity and the above steps were repeated. After changing to the log periodic antenna in the horizontal configuration, the frequency range of 300 - 1000 MHz was scanned. The log periodic antenna was changed to the vertical polarity and the frequency range of 300 - 1000 MHz was again scanned. Care was taken to ensure that no frequencies were missed within the FM and TV bands. An analysis was performed to determine if the signals that were at or near the limit were caused by an ambient transmission. If unable to determine by analysis, the equipment was powered down to make the final determination if the EUT was the source of the emission.

For the final radiated scan, the equipment was again positioned with its I/O and power cables facing the antenna. A thorough scan of all frequencies was manually made using a small frequency span, rotating the turntable as needed. Comparison with the previously recorded measurements was then made.

Using the peak readings from both scans as a guide, the test engineer then maximized the readings with respect to the table rotation, antenna height and configuration of the peripherals and cables. Maximizing of the cables was achieved by monitoring the spectrum analyzer on a closed circuit television monitor while the EUT cables were being moved and rearranged on the EUT table for maximum emissions. Photographs showing the final worst case configuration of the EUT are contained in Appendix A.

## Conducted Emissions Testing

For conducted emissions testing, a 30 to 50 second sweep time was used for automated measurements in the frequency bands of 450 kHz to 1.705 MHz, 1.705 MHz to 3 MHz, and 3 MHz to 30 MHz. All readings within 20 dB of the limit were recorded. At frequencies where the recorded emissions were close to the limit, further investigation was performed manually at a slower sweep rate.

## SAMPLE CALCULATIONS

The basic spectrum analyzer reading was converted using correction factors as shown in the emissions readings in Tables 1-4. For radiated emissions in dBµV/m, the spectrum analyzer reading in dBµV was corrected by using the following formula:

Meter reading (dBµV)
+ Antenna Factor (dB)
+ Cable Loss (dB)
- Distance Correction (dB)
- Pre-amplifier Gain (dB)

= Corrected Reading (dBµV/m)

This reading was then compared to the applicable specification limit to determine compliance.

A typical data sheet will display the following in column format:

| # | Freq MHz | Rdng dBuV | Cable | Amp | Bicon | Mag | Log | Dist | Corr dBuV/m | Spec | Margin | Polar |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FCC 15.31 | | | | | | | | | | | |

**#** means reading number
**Freq MHz** is the frequency in MHz of the obtained reading.
**Rdng dBuV** is the reading obtained on the spectrum analyzer in dBµV.
**Amp** is short for the preamplifier factor or gain in dB.
**Bicon** is the biconical antenna factor in dB.
**Log** is the log periodic antenna factor in dB.
**Mag** is the magnetic loop antenna factor in dB.
**Cable** is the cable loss in dB of the coaxial cable on the OATS.
**Dist** is the distance factor (in dB). It is used when testing at a different test distance than the one stated in the spec.
**Corr dBµV/m** is the corrected reading which is now in dBµV/m (field strength).
**Spec** is the specification limit (dB) stated in the regulations.
**Margin** is the closeness to the specified limit in dB; + is over and - is under the limit.
**Polar** is the Polarity of the antenna with respect to earth.
**LISN** is the line impedance stabilization network factor in dB.
**FCC 15.31** is the average correction called out in FCC Part 15.31.

# APPENDIX A

# INFORMATION ABOUT THE EQUIPMENT UNDER TEST

| INFORMATION ABOUT THE EQUIPMENT UNDER TEST | |
|---|---|
| Test Software/Firmware: | - |
| CRT was displaying: | - |
| Power Supply Manufacturer: | Any regulated power supply |
| Power Supply Part Number: | N/A |
| AC Line Filter Manufacturer: | N/A |
| AC Line Filter Part Number: | N/A |
| Line voltage used during testing: | 12 VDC |

| I/O PORTS | |
|---|---|
| Type | # |
| Wiegand, ABA track 2 Magnetic Strip | 1 |

| CRYSTAL OSCILLATORS | |
|---|---|
| Type | Freq In MHz |
| OSC, Crystal, SM, Y1 | 8 MHz |

| PRINTED CIRCUIT BOARDS | | | | |
|---|---|---|---|---|
| Function | Model & Rev | Clocks, MHz | Layers | Location |
| Main Board | 23255-001 rev. D | 8 MHz | 4 | Center |

## CABLE INFORMATION

| Cable #: 1 | | Cable(s) of this type: 1 | |
|---|---|---|---|
| Cable Type: | Serial I/O | Shield Type: | foil |
| Construction: | 8 conductor with shield | Length In Meters: | 1.5 |
| Connected To End (1): | Main board | Connected To End (2): | Float |
| Connector At End (1): | None | Connector At End (2): | None |
| Shield Grounded At (1): | yes | Shield Grounded At (2): | yes |
| Part Number: | 31006-001 | Number of Conductors: | 8 +shield |
| Notes: | | | |

| REQUIRED EUT CHANGES TO COMPLY: |
|---|
| None. |

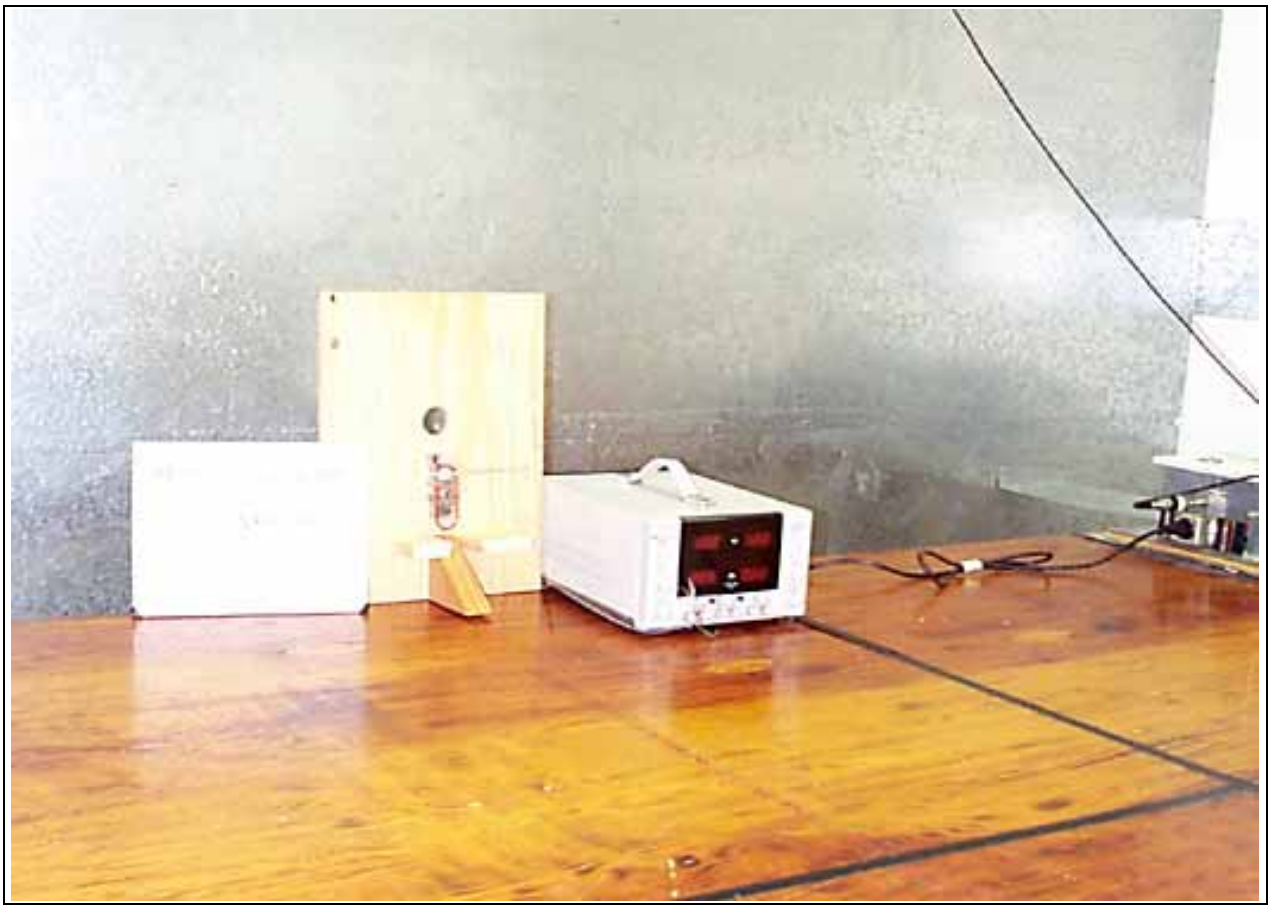
## PHOTOGRAPH SHOWING RADIATED EMISSIONS


Radiated Emissions - Front View

## PHOTOGRAPH SHOWING RADIATED EMISSIONS


Radiated Emissions - Back View

## PHOTOGRAPH SHOWING CONDUCTED EMISSIONS



Conducted Emissions - Front View

# APPENDIX B

# MEASUREMENT DATA SHEETS

Test Location: CKC Laboratories • 5473A Clouds Rest • Mariposa Ca, 95338 • 209-966-5240

Customer: **Motorola**
Specification: **FCC 15 C PARA 15.209**
Work Order #: **74399** Date: 05/18/2000
Test Type: **Field Strength** Time: 09:14:23
Equipment: **RFID Reader** Sequence#: 1
Manufacturer: Motorola Indala Tested By: Dustin Oaks
Model: CEM-603
S/N: N/A

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| RFID Reader* | Motorola Indala | CEM-603 | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Power Supply | TopWard Electric Instrument | 6303D | 677556 |

***Test Conditions / Notes:***

EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply.

***Measurement Data:*** Reading listed by margin. Test Distance: 10 Meters

| # | Freq MHz | Rdng dBµV | Mag dB | Cable dB | FCC 15.31 dB | dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 124.969k | 50.7 | +10.6 | +0.0 | -60.0 | | +0.0 | 1.3 | 25.7 | -24.4 | None |

Test Location: CKC Laboratories • 5473A Clouds Rest • Mariposa Ca, 95338 • 209-966-5240

Customer: **Motorola**
Specification: **FCC 15 C PARA 15.209**
Work Order #: **74399** Date: 05/18/2000
Test Type: **Spurious Emissions** Time: 09:29:35
Equipment: **RFID Reader** Sequence#: 2
Manufacturer: Motorola Indala Tested By: Dustin Oaks
Model: CEM-603
S/N: N/A

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| RFID Reader* | Motorola Indala | CEM-603 | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Power Supply | TopWard Electric Instrument | 6303D | 677556 |

***Test Conditions / Notes:***

EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply. Frequency Range tested: 9kHz to 30MHz

***Measurement Data:*** Reading listed by margin. Test Distance: 10 Meters

| # | Freq MHz | Rdng dBµV | Mag dB | Cable dB | FCC 15.31 dB | dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 625.430k | 33.2 | +10.9 | +0.0 | -20.0 | | +0.0 | 24.1 | 31.7 | -7.6 | None |
| 2 | 498.780k | 34.4 | +10.8 | +0.0 | -20.0 | | +0.0 | 25.2 | 33.6 | -8.4 | None |
| 3 | 875.800k | 28.8 | +11.0 | +0.0 | -20.0 | | +0.0 | 19.8 | 28.7 | -8.9 | None |
| 4 | 1.000M | 27.2 | +10.9 | +0.1 | -20.0 | | +0.0 | 18.2 | 27.6 | -9.4 | None |
| 5 | 750.800k | 28.9 | +11.0 | +0.0 | -20.0 | | +0.0 | 19.9 | 30.1 | -10.2 | None |
| 6 | 374.930k | 40.4 | +11.0 | +0.0 | -60.0 | | +0.0 | -8.6 | 16.1 | -24.7 | None |
| 7 | 249.930k | 40.2 | +10.8 | +0.0 | -60.0 | | +0.0 | -9.0 | 19.6 | -28.6 | None |

Test Location: CKC Laboratories • 5473A Clouds Rest • Mariposa Ca, 95338 • 209-966-5240

Customer: **Motorola**
Specification: **FCC 15.209**
Work Order #: **74399** Date: 05/18/2000
Test Type: **Spurious Emissions** Time: 11:15:36
Equipment: **RFID Reader** Sequence#: 3
Manufacturer: Motorola Indala Tested By: Dustin Oaks
Model: CEM-603
S/N: N/A

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| RFID Reader* | Motorola Indala | CEM-603 | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Power Supply | TopWard Electric Instrument | 6303D | 677556 |

***Test Conditions / Notes:***

EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply. Frequency Range tested: 30MHz to 1000MHz

***Measurement Data:*** Reading listed by margin. Test Distance: 3 Meters

| # | Freq MHz | Rdng dBµV | Amp dB | Bicon dB | Log dB | Cable dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 QP | 39.341M | 42.8 | -25.0 | +12.0 | +0.0 | +0.7 | +0.0 | 30.5 | 40.0 | -9.5 | Vert |
| ^ | 39.286M | 45.9 | -25.0 | +12.0 | +0.0 | +0.7 | +0.0 | 33.6 | 40.0 | -6.4 | Vert |
| 3 | 38.803M | 36.7 | -25.0 | +12.0 | +0.0 | +0.7 | +0.0 | 24.4 | 40.0 | -15.6 | Horiz |
| 4 | 171.099M | 32.6 | -24.8 | +15.4 | +0.0 | +2.2 | +0.0 | 25.4 | 43.5 | -18.1 | Vert |
| 5 | 173.674M | 30.7 | -24.8 | +15.7 | +0.0 | +2.2 | +0.0 | 23.8 | 43.5 | -19.7 | Horiz |

Test Location: CKC Laboratories • 5473A Clouds Rest • Mariposa Ca, 95338 • 209-966-5240

Customer: **Motorola**
Specification: **FCC 15.207**
Work Order #: **74399** Date: 05/18/2000
Test Type: **Conducted Emissions** Time: 11:21:43
Equipment: **RFID Reader** Sequence#: 4
Manufacturer: Motorola Indala Tested By: Dustin Oaks
Model: CEM-603
S/N: N/A

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| RFID Reader* | Motorola Indala | CEM-603 | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Power Supply | TopWard Electric Instrument | 6303D | 677556 |

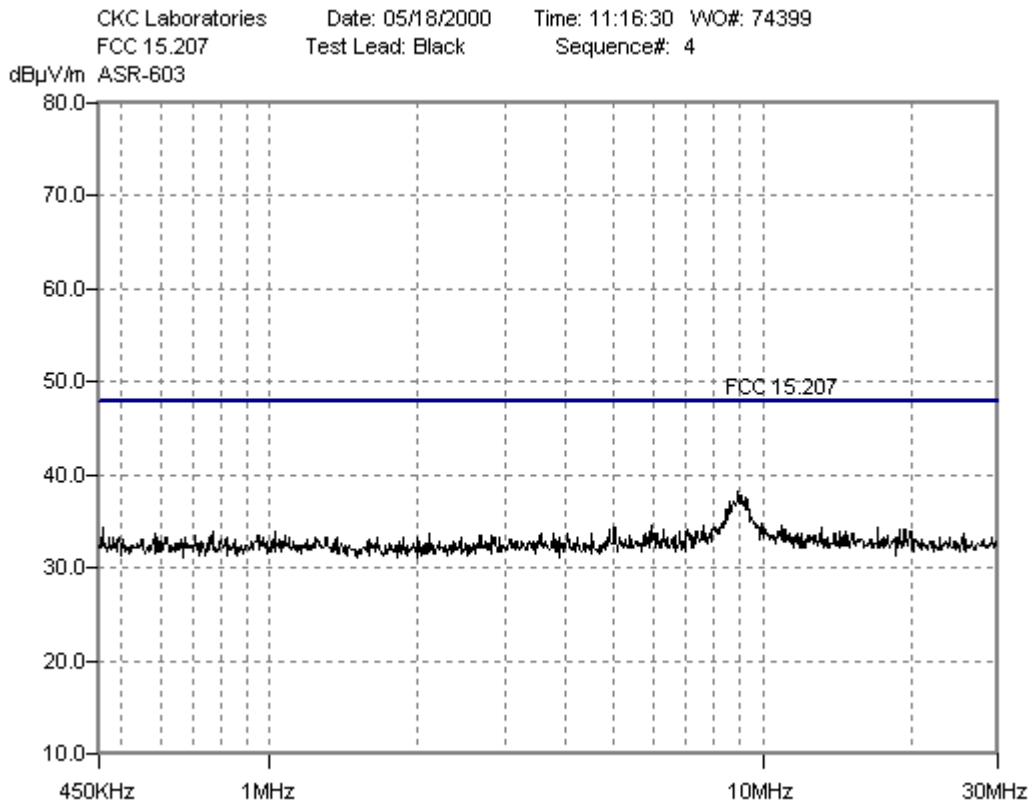
***Test Conditions / Notes:***

EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply. Frequency Range tested: 450kHz to 30MHz

***Measurement Data:*** Reading listed by margin. Test Lead: Black

| # | Freq MHz | Rdng dBµV | Cable dB | LISN dB | dB | dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7.622M | 33.1 | +0.2 | +1.2 | | | +0.0 | 34.5 | 48.0 | -13.5 | Black |
| 2 | 5.020M | 33.6 | +0.2 | +0.6 | | | +0.0 | 34.4 | 48.0 | -13.6 | Black |
| 3 | 7.950M | 32.5 | +0.2 | +1.6 | | | +0.0 | 34.3 | 48.0 | -13.7 | Black |
| 4 | 6.297M | 33.3 | +0.2 | +0.7 | | | +0.0 | 34.2 | 48.0 | -13.8 | Black |
| 5 | 4.890M | 33.5 | +0.1 | +0.6 | | | +0.0 | 34.2 | 48.0 | -13.8 | Black |
| 6 | 7.048M | 33.3 | +0.2 | +0.7 | | | +0.0 | 34.2 | 48.0 | -13.8 | Black |
| 7 | 7.527M | 32.7 | +0.2 | +1.1 | | | +0.0 | 34.0 | 48.0 | -14.0 | Black |
| 8 | 7.356M | 32.7 | +0.2 | +1.0 | | | +0.0 | 33.9 | 48.0 | -14.1 | Black |
| 9 | 6.816M | 33.1 | +0.2 | +0.6 | | | +0.0 | 33.9 | 48.0 | -14.1 | Black |
| 10 | 7.813M | 32.2 | +0.2 | +1.4 | | | +0.0 | 33.8 | 48.0 | -14.2 | Black |
| 11 | 7.185M | 32.5 | +0.2 | +0.8 | | | +0.0 | 33.5 | 48.0 | -14.5 | Black |
| 12 | 6.652M | 32.5 | +0.2 | +0.7 | | | +0.0 | 33.4 | 48.0 | -14.6 | Black |
| 13 | 7.267M | 32.2 | +0.2 | +0.9 | | | +0.0 | 33.3 | 48.0 | -14.7 | Black |
| 14 | 6.584M | 32.3 | +0.2 | +0.7 | | | +0.0 | 33.2 | 48.0 | -14.8 | Black |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 6.912M | 32.1 | +0.2 | +0.6 | | +0.0 | 32.9 | 48.0 | -15.1 | Black |


CKC Laboratories
Date: 05/18/2000
Time: 11:16:30
WO#: 74399
FCC 15.207
Test Lead: Black
Sequence#: 4
dBµV/m
ASR-603
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
FCC 15.207
450KHz
1MHz
10MHz
30MHz

Test Location: CKC Laboratories • 5473A Clouds Rest • Mariposa Ca, 95338 • 209-966-5240

Customer: **Motorola**
Specification: **FCC 15.207**
Work Order #: **74399** Date: 05/18/2000
Test Type: **Conducted Emissions** Time: 11:24:12
Equipment: **RFID Reader** Sequence#: 5
Manufacturer: Motorola Indala Tested By: Dustin Oaks
Model: CEM-603
S/N: N/A

***Equipment Under Test* (* = EUT):**

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| RFID Reader* | Motorola Indala | CEM-603 | N/A |

***Support Devices:***

| Function | Manufacturer | Model # | S/N |
|---|---|---|---|
| Power Supply | TopWard Electric Instrument | 6303D | 677556 |

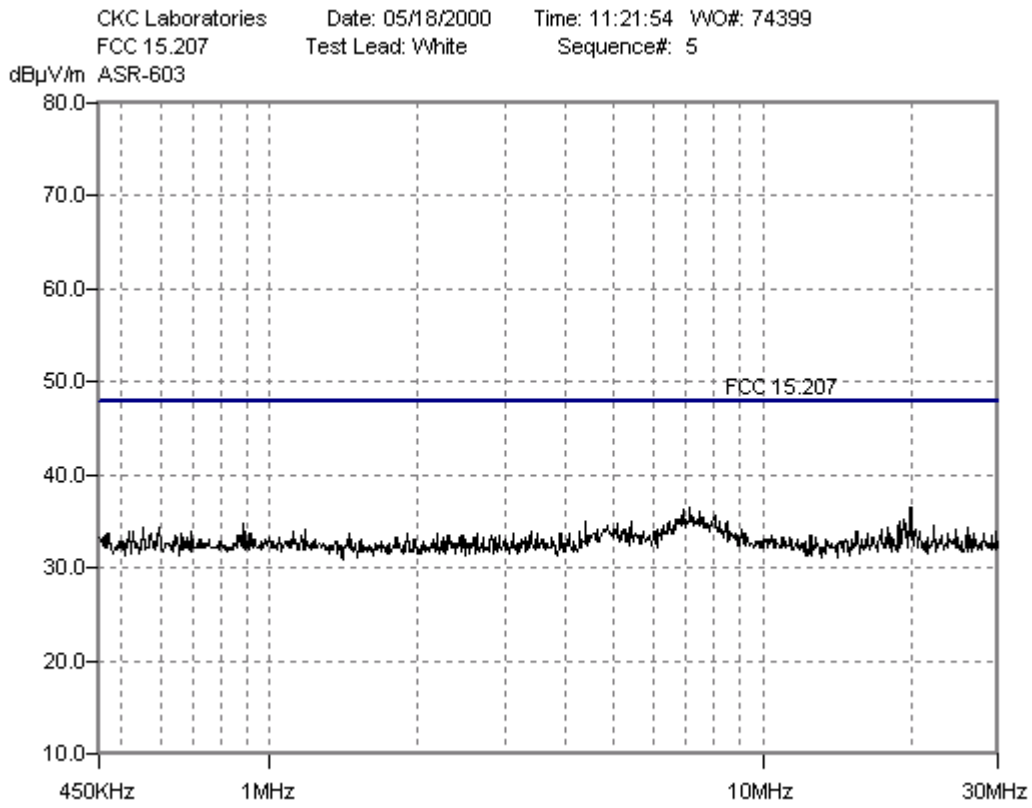
***Test Conditions / Notes:***

EUT is a RFID reader operating at 125kHz. EUT is operating in a normal mode with NO tag in the field. 12VDC supplied by the DC power supply. Frequency Range tested: 450kHz to 30MHz

***Measurement Data:*** Reading listed by margin. Test Lead: White

| # | Freq MHz | Rdng dBµV | Cable dB | dB | LISN dB | dB | Dist Table | Corr dBµV/m | Spec dBµV/m | Margin dB | Polar Ant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 20.001M | 36.1 | +0.3 | | +0.2 | | +0.0 | 36.6 | 48.0 | -11.4 | White |
| 2 | 8.018M | 33.1 | +0.2 | | +2.4 | | +0.0 | 35.7 | 48.0 | -12.3 | White |
| 3 | 19.395M | 34.7 | +0.3 | | +0.2 | | +0.0 | 35.2 | 48.0 | -12.8 | White |
| 4 | 8.169M | 32.7 | +0.2 | | +2.1 | | +0.0 | 35.0 | 48.0 | -13.0 | White |
| 5 | 8.524M | 33.2 | +0.2 | | +1.6 | | +0.0 | 35.0 | 48.0 | -13.0 | White |
| 6 | 19.005M | 34.4 | +0.3 | | +0.2 | | +0.0 | 34.9 | 48.0 | -13.1 | White |
| 7 | 8.456M | 32.9 | +0.2 | | +1.7 | | +0.0 | 34.8 | 48.0 | -13.2 | White |
| 8 | 22.325M | 34.0 | +0.3 | | +0.3 | | +0.0 | 34.6 | 48.0 | -13.4 | White |
| 9 | 8.305M | 32.1 | +0.2 | | +1.9 | | +0.0 | 34.2 | 48.0 | -13.8 | White |
| 10 | 9.057M | 33.0 | +0.2 | | +0.9 | | +0.0 | 34.1 | 48.0 | -13.9 | White |
| 11 | 8.818M | 32.3 | +0.2 | | +1.2 | | +0.0 | 33.7 | 48.0 | -14.3 | White |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | 9.125M | 32.6 | +0.2 | +0.9 | +0.0 | 33.7 | 48.0 | -14.3 | White |
| 13 | 9.303M | 32.6 | +0.2 | +0.8 | +0.0 | 33.6 | 48.0 | -14.4 | White |
| 14 | 8.961M | 32.1 | +0.2 | +1.0 | +0.0 | 33.3 | 48.0 | -14.7 | White |
| 15 | 9.671M | 32.0 | +0.2 | +0.7 | +0.0 | 32.9 | 48.0 | -15.1 | White |


CKC Laboratories
Date: 05/18/2000
Time: 11:21:54
WO#: 74399
FCC 15.207
Test Lead: White
Sequence#: 5
dBµV/m
ASR-603
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
FCC 15.207
450KHz
1MHz
10MHz
30MHz