

***Electromagnetic Emissions Test Report  
and  
Application for Grant of Equipment Authorization  
pursuant to  
FCC Part 15, Subpart C Specifications for an  
Intentional Radiator  
and FCC Part 15, Subpart B Specifications for a  
Receiver on the  
Mercury Photographic  
Model: MicroSync MS0100***

FCC ID: QHIMS0100

GRANTEE: Mercury Photographic  
305 Sherwood Way  
Menlo Park, CA 94025

TEST SITE: Elliott Laboratories, Inc.  
684 W. Maude Avenue  
Sunnyvale, CA 94086

REPORT DATE: July 16, 2003

FINAL TEST DATE: April 2, 2003



AUTHORIZED SIGNATORY: \_\_\_\_\_

Mark Briggs  
Director of Engineering



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**SCOPE**

An electromagnetic emissions test has been performed on the Mercury Photographic model MicroSync MS0100 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and Subpart B of Part 15 of FCC Rules for receivers. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The transceiver above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Mercury Photographic model MicroSync MS0100 and therefore apply only to the tested sample. The sample was selected and prepared by Wade McNary of Mercury Photographic.

**OBJECTIVE**

The primary objective of the manufacturer is compliance with Subparts B and C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators and receivers. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

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**STATEMENT OF COMPLIANCE**

The tested sample of Mercury Photographic model MicroSync MS0100 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators and the requirements of Subpart B of Part 15 of the FCC Rules for receivers operating between 30 MHz and 960 MHz.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

**EMISSION TEST RESULTS**

The following emissions tests were performed on the Mercury Photographic model MicroSync MS0100 transmitter and MicroSync MS0100 receiver. The actual test results are contained in an exhibit of this report.

**LIMITS OF CONDUCTED INTERFERENCE VOLTAGE**

Both the receiver and the transmitter are battery powered. The requirements of 15.107 (receiver) and 15.207 (transmitter) do not apply.

**LIMITS OF RADIATED FIELD STRENGTH -INTENTIONAL RADIATOR**

The transmitter complied with the limits detailed in FCC Rules Part 15 Section 15.231a and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

**Fundamental Signal**

| Frequency<br>MHz | Level<br>dBuV/m | Pol<br>v/h | 15.231(a) |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------|------------|-----------|--------|-----------------------|--------------------|------------------|----------|
| 433.895          | 64.7            | h          | Limit     | Margin | Pk                    | 200                | 1.0              |          |

**Spurious Emissions**

| Frequency<br>MHz | Level<br>dBuV/m | Pol<br>v/h | 15.231(a) |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------|------------|-----------|--------|-----------------------|--------------------|------------------|----------|
| 1735.580         | 42.3            | h          | Limit     | Margin | Pk                    | 205                | 1.0              |          |

**BANDWIDTH**

The transmitter complied with the limits detailed in FCC Rules Part 15 Section 15.231(c). The 20dB bandwidth was 240 kilohertz.

**DUTY CYCLE CALCULATION**

The transmitted signal is a series of 6 pulses in a 60ms period. Each pulse has a nominal duration of 50us. The duty cycle of the transmitted signal in a 100mSperiod is, therefore,  $(12 \times 0.050) / 100$ , which is 1%.

**PERIOD OF OPERATION**

The transmitter complied with the limits detailed in FCC Rules Part 15 Section 15.231(a) for control signals. The device stops transmitting within 100ms of the manual button being released when operated in the manual mode. In automatic mode (when transmission is triggered from the camera hot-shoe or flash switch) the device makes a single transmission burst

**LIMITS OF RADIATED FIELD STRENGTH -RECEIVER**

The receiver tested complied with the limits detailed in FCC Rules Part 15 Section 15109.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

Radiated Spurious Emissions, 30MHz – 1GHz

| Frequency<br>MHz | Level<br>dBuV/m | Pol<br>v/h | 15.109 |        | Detector<br>Pk/QP/Avg | Azimuth<br>degrees | Height<br>meters | Comments |
|------------------|-----------------|------------|--------|--------|-----------------------|--------------------|------------------|----------|
| 84.000           | 21.8            | h          | Limit  | Margin | QP                    | 250                | 1.8              |          |

**MEASUREMENT UNCERTAINTIES**

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

| Measurement Type    | Frequency Range<br>(MHz) | Calculated Uncertainty<br>(dB) |
|---------------------|--------------------------|--------------------------------|
| Conducted Emissions | 0.15 to 30               | ± 2.4                          |
| Radiated Emissions  | 30 to 1000               | ± 3.6                          |

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The Mercury Photographic model MicroSync MS0100 is a camera radio sync transmitter and associated receiver that are designed to remotely activate strobe lighting. Normally, the transmitter would be affixed to a camera during operation and the receiver would be connected to the trigger input of a strobe light. The transmitter was tested in a stand-alone mode and the receiver was connected to a strobe light during testing.

Both the transmitter and the receiver are designed to operate from internal batteries.

The samples were received and tested on April 2, 2003.

The EUT consisted of the following components:

| Manufacturer         | Model            | Description                           | Serial Number | FCC ID    |
|----------------------|------------------|---------------------------------------|---------------|-----------|
| Mercury Photographic | MicroSync MS0100 | Photography Radio Slave (transmitter) | N/A           | QHIMS0100 |
| Mercury Photographic | MicroSync MS0100 | Photography Radio Receiver            | N/A           | N/A       |

**ENCLOSURE**

The transmitter enclosure measures approximately 27 x 51 x 11mm and the receiver measures approximately 35 x 111 x 22mm. They are primarily constructed of plastic.

**SUPPORT EQUIPMENT**

| Manufacturer | Model      | Description  | Serial Number | FCC ID |
|--------------|------------|--------------|---------------|--------|
| Comet        | Twinkle 04 | Strobe Light | N/A           | N/A    |

**EXTERNAL I/O CABLING**

The receiver connected directly to the strobe unit. The transmitter connects directly to a camera hot shoe or can be hand held.

**EUT OPERATION**

The transmitter was configured to continuously transmit its pulsed code by holding the transmit button down using a cable-tie. The receiver was in receive mode. The two devices were tested separately.

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**TEST SITE****GENERAL INFORMATION**

Final test measurements were taken on April 2, 2003 at the Elliott Laboratories Open Area Test Site #1 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

**CONDUCTED EMISSIONS CONSIDERATIONS**

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

**RADIATED EMISSIONS CONSIDERATIONS**

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

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**MEASUREMENT INSTRUMENTATION****RECEIVER SYSTEM**

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

**INSTRUMENT CONTROL COMPUTER**

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

**LINE IMPEDANCE STABILIZATION NETWORK (LISN)**

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

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**FILTERS/ATTENUATORS**

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

**ANTENNAS**

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

**ANTENNA MAST AND EQUIPMENT TURNTABLE**

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

**INSTRUMENT CALIBRATION**

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

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**TEST PROCEDURES****EUT AND CABLE PLACEMENT**

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst-case orientation is used for final measurements.

**CONDUCTED EMISSIONS**

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

**RADIATED EMISSIONS**

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions, which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

**SPECIFICATION LIMITS AND SAMPLE CALCULATIONS**

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

**CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207 & 15.107(a)**

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

| Frequency<br>(MHz) | Average<br>Limit<br>(dBuV)                                                | Quasi Peak<br>Limit<br>(dBuV)                                             |
|--------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|
| 0.150 to 0.500     | Linear decrease on<br>logarithmic frequency axis<br>between 56.0 and 46.0 | Linear decrease on<br>logarithmic frequency axis<br>between 66.0 and 56.0 |
| 0.500 to 5.000     | 46.0                                                                      | 56.0                                                                      |
| 5.000 to 30.000    | 50.0                                                                      | 60.0                                                                      |

**FUNDAMENTAL AND HARMONIC LIMITS 15.231 (b)**

The table below shows the limits for both the Fundamental and Harmonic emissions for each frequency band of operation detailed in Section 15.231 (b) for control signals.

| Operating<br>Frequency<br>(MHz) | Field strength<br>(microvolts/m) | Harmonics<br>(microvolts/m) |
|---------------------------------|----------------------------------|-----------------------------|
| 70 - 130                        | 1250                             | 125                         |
| 130 - 174                       | 1250 - 3750                      | 125 - 375                   |
| 174 - 260                       | 3750                             | 375                         |
| 260 - 470                       | 3750 - 12,500                    | 375 - 1250                  |
| Above 470                       | 12,500                           | 1250                        |

**FUNDAMENTAL AND HARMONIC LIMITS 15.231 (e)**

The table below shows the limits for both the Fundamental and Harmonic emissions (that do not fall in restricted bands) for each frequency band of operation detailed in Section 15.231 (e) for data signals.

| Operating<br>Frequency<br>(MHz) | Field strength<br>(microvolts/m) | Harmonics<br>(microvolts/m) |
|---------------------------------|----------------------------------|-----------------------------|
| 70 - 130                        | 500                              | 50                          |
| 130 - 174                       | 500 - 1500                       | 50 - 150                    |
| 174 - 260                       | 1500                             | 150                         |
| 260 - 470                       | 1500 - 5000                      | 150 - 500                   |
| Above 470                       | 5000                             | 500                         |

**RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209**

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands.

| Frequency<br>Range<br>(MHz) | Limit<br>(uV/m @ 3m)                | Limit<br>(dBuV/m @ 3m)                            |
|-----------------------------|-------------------------------------|---------------------------------------------------|
| 0.009-0.490                 | $2400/F_{\text{KHz}} @ 300\text{m}$ | $67.6-20*\log_{10}(F_{\text{KHz}}) @ 300\text{m}$ |
| 0.490-1.705                 | $24000/F_{\text{KHz}} @ 30\text{m}$ | $87.6-20*\log_{10}(F_{\text{KHz}}) @ 30\text{m}$  |
| 1.705 to 30                 | 30 @ 30m                            | 29.5 @ 30m                                        |
| 30 to 88                    | 100                                 | 40                                                |
| 88 to 216                   | 150                                 | 43.5                                              |
| 216 to 960                  | 200                                 | 46.0                                              |
| Above 960                   | 500                                 | 54.0                                              |

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**RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.109(a) (RECEIVER)**

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The table below shows the limits for emissions from the receiver.

| Frequency<br>Range<br>(MHz) | Limit<br>(uV/m @ 3m) | Limit<br>(dBuV/m @ 3m) |
|-----------------------------|----------------------|------------------------|
| 30 to 88                    | 100                  | 40                     |
| 88 to 216                   | 150                  | 43.5                   |
| 216 to 960                  | 200                  | 46.0                   |
| Above 960                   | 500                  | 54.0                   |

**SAMPLE CALCULATIONS - CONDUCTED EMISSIONS**

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

$R_r$  = Receiver Reading in dBuV

$S$  = Specification Limit in dBuV

$M$  = Margin to Specification in +/- dB

**SAMPLE CALCULATIONS - RADIATED EMISSIONS**

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$$F_d = \text{Distance Factor in dB}$$

$$D_m = \text{Measurement Distance in meters}$$

$$D_s = \text{Specification Distance in meters}$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_C = R_R + F_d$$

and

$$M = R_C - L_S$$

where:

$$R_R = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_C = \text{Corrected Reading in dBuV/m}$$

$$L_S = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

**EXHIBIT 1: Test Equipment Calibration Data**

1 Page

**Radiated Emissions, 30 - 4333 MHz, 03-Apr-03****Engineer: Rafael**

| <u>Manufacturer</u> | <u>Description</u>                  | <u>Model #</u> | <u>Assett #</u> | <u>Cal interval</u> | <u>Last Calibrated</u> | <u>Cal Due</u> |
|---------------------|-------------------------------------|----------------|-----------------|---------------------|------------------------|----------------|
| EMCO                | Biconical Antenna, 30-300 MHz       | 3110B          | 363             | 12                  | 5/28/2002              | 5/28/2003      |
| EMCO                | Horn Antenna, D. Ridge 1-18GHz      | 3115           | 1242            | 12                  | 10/9/2002              | 10/9/2003      |
| EMCO                | Log Periodic Antenna, 0.3-1 GHz     | 3146A          | 364             | 12                  | 9/12/2002              | 9/12/2003      |
| Filtek              | High Pass Filter, 1GHz              | HP12/1000-5AB  | 1343            | 12                  | 10/17/2002             | 10/17/2003     |
| Hewlett Packard     | EMC Spectrum Analyzer 9kHz - 6.5GHz | 8595EM         | 780             | 12                  | 2/20/2003              | 2/20/2004      |
| Hewlett Packard     | Microwave Preamplifier, 1-26.5GHz   | 8449B          | 870             | 12                  | 1/10/2003              | 1/10/2004      |
| Rohde & Schwarz     | Test Receiver, 9kHz-2750MHz         | ESCS 30        | 1337            | 12                  | 12/27/2002             | 12/27/2003     |

**EXHIBIT 2: Test Data Log Sheets**

**ELECTROMAGNETIC EMISSIONS**

**TEST LOG SHEETS**

**AND**

**MEASUREMENT DATA**

T50727 10 Pages



## EMC Test Data

|                 |                           |                  |             |
|-----------------|---------------------------|------------------|-------------|
| Client:         | Mercury Photographic      | Job Number:      | J50695      |
| Model:          | MicroSync MS0100          | T-Log Number:    | T50727      |
|                 |                           | Account Manager: | Mark Briggs |
| Contact:        | Wade McNary               |                  |             |
| Emissions Spec: | FCC 15.231 (a) and 15.109 | Class:           | B           |
| Immunity Spec:  | N/A                       | Environment:     | -           |

## EMC Test Data

For The

**Mercury Photographic**

Model

**MicroSync MS0100**



## EMC Test Data

|                 |                           |                  |             |
|-----------------|---------------------------|------------------|-------------|
| Client:         | Mercury Photographic      | Job Number:      | J50695      |
| Model:          | MicroSync MS0100          | T-Log Number:    | T50727      |
|                 |                           | Account Manager: | Mark Briggs |
| Contact:        | Wade McNary               |                  |             |
| Emissions Spec: | FCC 15.231 (a) and 15.109 | Class:           | B           |
| Immunity Spec:  | N/A                       | Environment:     | -           |

### EUT INFORMATION

#### General Description

The EUT is a camera radio sync transmitter and receiver which is designed to remotely activate strobe lighting. Normally, the transmitter would be affixed to a camera during operation and the receiver would be connected to the trigger input of a strobe light. The transmitter was tested in a stand-alone mode and the receiver was connected to a strobe light during testing. Both the transmitter and the receiver are designed to operate from internal batteries.

#### Equipment Under Test

| Manufacturer         | Model            | Description                | Serial Number | FCC ID    |
|----------------------|------------------|----------------------------|---------------|-----------|
| Mercury Photographic | MicroSync MS0100 | Photography Radio Slave    | n/a           | QHIMS0100 |
| Mercury Photographic | MicroSync MS0100 | Photography Radio Receiver | n/a           | n/a       |

#### EUT Enclosure

The transmitter enclosure measures approximately 27 x 51 x 11mm and the receiver measures approximately 35 x 111 x 22mm. They are primarily constructed of plastic.

#### Modification History

| Mod. # | Test | Date | Modification |
|--------|------|------|--------------|
| 1      |      |      | None made    |

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.



## EMC Test Data

|                 |                           |                  |             |
|-----------------|---------------------------|------------------|-------------|
| Client:         | Mercury Photographic      | Job Number:      | J50695      |
| Model:          | MicroSync MS0100          | T-Log Number:    | T50727      |
|                 |                           | Account Manager: | Mark Briggs |
| Contact:        | Wade McNary               |                  |             |
| Emissions Spec: | FCC 15.231 (a) and 15.109 | Class:           | B           |
| Immunity Spec:  | N/A                       | Environment:     | -           |

### Test Configuration #1

#### Local Support Equipment

| Manufacturer | Model      | Description  | Serial Number | FCC ID |
|--------------|------------|--------------|---------------|--------|
| Comet        | Twinkle 04 | Strobe Light | None          | N/A    |

#### Interface Cabling and Ports

| Port              | Connected To | Cable(s)          |                        |           |
|-------------------|--------------|-------------------|------------------------|-----------|
|                   |              | Description       | Shielded or Unshielded | Length(m) |
| ReceiverSync Plug | Strobe light | Direct connection | N/A                    | N/A       |

#### EUT Operation During Emissions

The transmitter was configured to constantly transmit by using a cable tie to hold down the transmit button. The receiver was powered and in receive mode.



## EMC Test Data

|          |                           |                  |             |
|----------|---------------------------|------------------|-------------|
| Client:  | Mercury Photographic      | Job Number:      | J50695      |
| Model:   | MicroSync MS0100          | T-Log Number:    | T50727      |
|          |                           | Account Manager: | Mark Briggs |
| Contact: | Wade McNary               |                  |             |
| Spec:    | FCC 15.231 (a) and 15.109 | Class:           | B           |

### Radiated Emissions

#### Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 4/2/2003

Test Engineer: Rafael

Test Location: SVOATS #1

Config. Used: 1

Config Change: None

EUT Voltage: Battery

#### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 1000 MHz.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

**Ambient Conditions:**              Temperature:              7 °C  
                                                 Rel. Humidity:              86 %

#### Summary of Results

| Run # | Test Performed                        | Limit | Result | Margin              |
|-------|---------------------------------------|-------|--------|---------------------|
| 2     | RE, 30 - 1000MHz, Maximized Emissions | FCC B | Pass   | -18.2dB @ 84.000MHz |

#### Modifications Made During Testing:

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.



## EMC Test Data

|          |                           |                  |             |
|----------|---------------------------|------------------|-------------|
| Client:  | Mercury Photographic      | Job Number:      | J50695      |
| Model:   | MicroSync MS0100          | T-Log Number:    | T50727      |
| Contact: | Wade McNary               | Account Manager: | Mark Briggs |
| Spec:    | FCC 15.231 (a) and 15.109 | Class:           | B           |

### Run #1: Preliminary Radiated Emissions, 30-1000 MHz

| Frequency | Level  | Pol | FCCB  |        | Detector  | Azimuth | Height | Comments |
|-----------|--------|-----|-------|--------|-----------|---------|--------|----------|
| MHz       | dBuV/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters |          |
| 84.000    | 21.8   | h   | 40.0  | -18.2  | QP        | 250     | 1.8    |          |
| 84.000    | 21.4   | v   | 40.0  | -18.6  | QP        | 260     | 1.0    |          |
| 270.980   | 26.3   | v   | 46.0  | -19.7  | QP        | 15      | 1.0    |          |
| 899.880   | 25.8   | v   | 46.0  | -20.2  | QP        | 300     | 1.0    |          |
| 899.880   | 25.5   | h   | 46.0  | -20.5  | QP        | 200     | 1.0    |          |
| 32.100    | 19.3   | v   | 40.0  | -20.7  | QP        | 330     | 1.0    |          |
| 266.980   | 23.6   | v   | 46.0  | -22.4  | QP        | 335     | 1.0    |          |
| 270.980   | 21.7   | h   | 46.0  | -24.3  | QP        | 290     | 1.0    |          |
| 269.110   | 21.5   | v   | 46.0  | -24.5  | QP        | 0       | 1.0    |          |
| 266.980   | 20.2   | h   | 46.0  | -25.8  | QP        | 100     | 1.0    |          |
| 269.110   | 19.0   | h   | 46.0  | -27.0  | QP        | 200     | 1.2    |          |
| 32.100    | 12.5   | h   | 40.0  | -27.5  | QP        | 95      | 1.6    |          |
| 356.860   | 17.8   | v   | 46.0  | -28.2  | QP        | 345     | 1.0    |          |
| 356.860   | 17.2   | h   | 46.0  | -28.8  | QP        | 220     | 1.0    |          |
| 441.800   | 16.8   | v   | 46.0  | -29.2  | QP        | 100     | 1.0    |          |
| 441.800   | 16.8   | h   | 46.0  | -29.2  | QP        | 150     | 1.0    |          |
| 300.000   | 15.4   | v   | 46.0  | -30.6  | QP        | 80      | 1.0    |          |
| 300.000   | 14.7   | h   | 46.0  | -31.3  | QP        | 115     | 1.0    |          |

### Run #2: Maximized Readings From Run #1

| Frequency | Level  | Pol | FCC B |        | Detector  | Azimuth | Height | Comments |
|-----------|--------|-----|-------|--------|-----------|---------|--------|----------|
| MHz       | dBuV/m | v/h | Limit | Margin | Pk/QP/Avg | degrees | meters |          |
| 84.000    | 21.8   | h   | 40.0  | -18.2  | QP        | 250     | 1.8    |          |
| 84.000    | 21.4   | v   | 40.0  | -18.6  | QP        | 260     | 1.0    |          |
| 270.980   | 26.3   | v   | 46.0  | -19.7  | QP        | 15      | 1.0    |          |
| 899.880   | 25.8   | v   | 46.0  | -20.2  | QP        | 300     | 1.0    |          |
| 899.880   | 25.5   | h   | 46.0  | -20.5  | QP        | 200     | 1.0    |          |
| 32.100    | 19.3   | v   | 40.0  | -20.7  | QP        | 330     | 1.0    |          |



## EMC Test Data

|          |                           |                  |             |
|----------|---------------------------|------------------|-------------|
| Client:  | Mercury Photographic      | Job Number:      | J50695      |
| Model:   | MicroSync MS0100          | T-Log Number:    | T50727      |
|          |                           | Account Manager: | Mark Briggs |
| Contact: | Wade McNary               |                  |             |
| Spec:    | FCC 15.231 (a) and 15.109 | Class:           | B           |

### Radiated Emissions

#### Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 4/2/2003  
Test Engineer: Rafael Varelas  
Test Location: SVOATS #1

Config. Used: 1  
Config Change: None  
EUT Voltage: Battery

#### General Test Configuration

The EUT was located on the turntable for radiated emissions testing.

On the OATS, the measurement antenna was located 3 meters from the EUT for the measurement range 30 - 4333 MHz.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

**Ambient Conditions:** Temperature: 7 °C  
Rel. Humidity: 86 %

#### Summary of Results

| Run # | Test Performed                        | Limit          | Result | Margin                   |
|-------|---------------------------------------|----------------|--------|--------------------------|
| 1     | RE, 30 - 4333MHz, Maximized Emissions | FCC 15.231 (a) | Pass   | Refer to individual runs |

#### Modifications Made During Testing:

No modifications were made to the EUT during testing

#### Deviations From The Standard

No deviations were made from the requirements of the standard.



## EMC Test Data

|          |                           |                  |             |
|----------|---------------------------|------------------|-------------|
| Client:  | Mercury Photographic      | Job Number:      | J50695      |
| Model:   | MicroSync MS0100          | T-Log Number:    | T50727      |
| Contact: | Wade McNary               | Account Manager: | Mark Briggs |
| Spec:    | FCC 15.231 (a) and 15.109 | Class:           | B           |

### Duty Cycle Calculation:

Refer to plots

Each pulse train consists of 6pulses, each pulse is a nominal 50us long (measured length = 44us)

The pulse train occurs at a period of 60ms.

Total duty cycle equals  $(12 \times 0.050) / 100 = 0.6/60 = 0.010$

The duty cycle correction to apply to the peak reading is, therefore,  $20\log(0.010) = -40\text{dB}$ .

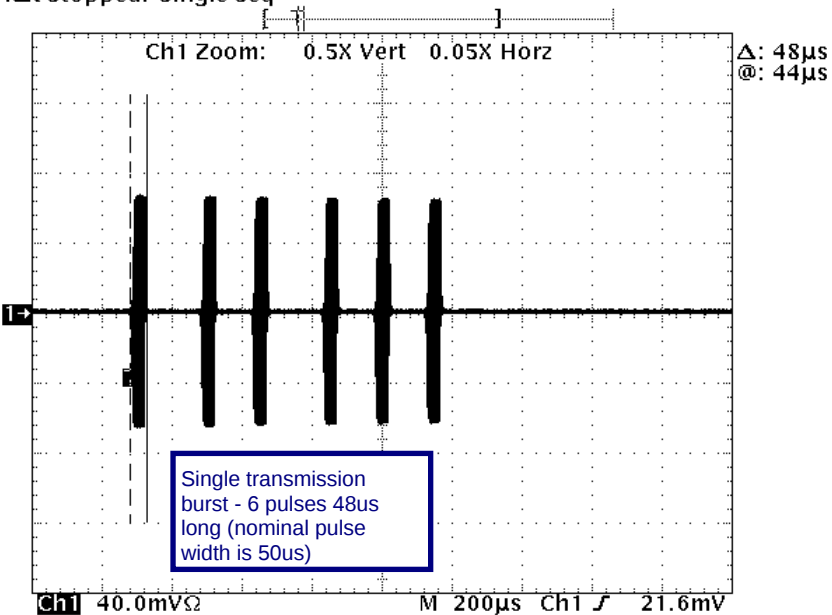
It was confirmed that in manual mode the device stopped transmitting as soon as the button was released and that in automatic mode (with the device triggered by a camera hot shoe) only one pulse train was transmitted.

### Run #1: Preliminary Radiated Emissions, 30-4333 MHz

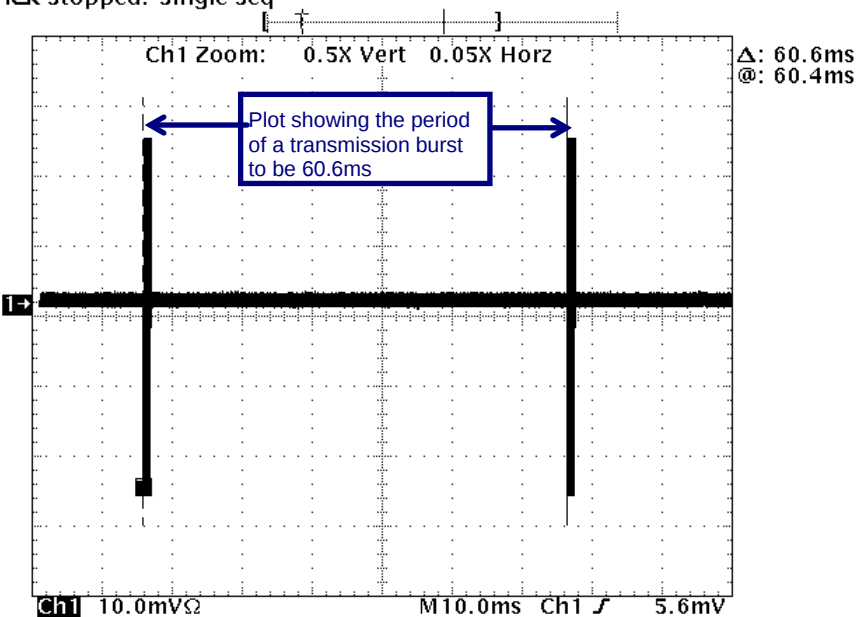
No average measurements made - the average correction factor is -46dB so provided the peak reading is below the peak limit, the average reading will be below the average limit.

| Frequency                     | Level  | Pol | FCC 15.231(a) |        | Detector  | Azimuth | Height | Comments                 |
|-------------------------------|--------|-----|---------------|--------|-----------|---------|--------|--------------------------|
| MHz                           | dBμV/m | v/h | Limit         | Margin | Pk/QP/Avg | degrees | meters |                          |
| EUT on Horizontal orientation |        |     |               |        |           |         |        |                          |
| 1735.580                      | 42.3   | h   | 60.8          | -18.5  | Pk        | 205     | 1.0    |                          |
| 2169.475                      | 41.7   | h   | 60.8          | -19.1  | Pk        | 215     | 1.0    |                          |
| 1735.580                      | 36.5   | v   | 60.8          | -24.3  | Pk        | 225     | 1.0    |                          |
| 433.895                       | 64.7   | h   | 100.8         | -36.1  | Pk        | 200     | 1.0    |                          |
| 1301.685                      | 34.4   | h   | 74.0          | -39.6  | Pk        | 200     | 1.0    | Falls in restricted band |
| 433.895                       | 56.4   | v   | 100.8         | -44.4  | Pk        | 220     | 2.4    |                          |
| EUT on Vertical orientation   |        |     |               |        |           |         |        |                          |
| 2169.475                      | 42.3   | h   | 60.8          | -18.5  | Pk        | 205     | 1.0    |                          |
| 1735.580                      | 38.7   | h   | 60.8          | -22.1  | Pk        | 230     | 1.0    |                          |
| 433.895                       | 62.5   | h   | 100.8         | -38.3  | Pk        | 210     | 1.0    |                          |
| 1301.685                      | 35.7   | h   | 74.0          | -38.3  | Pk        | 200     | 1.0    | Falls in restricted band |
| 433.895                       | 60.8   | v   | 100.8         | -40.0  | Pk        | 240     | 1.2    |                          |
| EUT on its side               |        |     |               |        |           |         |        |                          |
| 2169.475                      | 39.4   | v   | 60.8          | -21.4  | Pk        | 215     | 1.0    |                          |
| 1735.580                      | 38.2   | v   | 60.8          | -22.6  | Pk        | 200     | 1.0    |                          |
| 2169.475                      | 38.1   | h   | 60.8          | -22.7  | Pk        | 230     | 1.0    |                          |
| 3905.055                      | 49.7   | v   | 74.0          | -24.3  | Pk        | 210     | 1.0    | Falls in restricted band |
| 3905.055                      | 43.2   | h   | 74.0          | -30.8  | Pk        | 200     | 1.0    | Falls in restricted band |
| 1301.685                      | 35.9   | v   | 74.0          | -38.1  | Pk        | 210     | 1.0    | Falls in restricted band |
| 433.895                       | 62.2   | v   | 100.8         | -38.6  | Pk        | 250     | 1.4    |                          |
| 433.895                       | 56.0   | h   | 100.8         | -44.8  | Pk        | 215     | 1.0    |                          |

tek Stopped: Single Seq



tek Stopped: Single Seq





## EMC Test Data

|          |                           |                  |             |
|----------|---------------------------|------------------|-------------|
| Client:  | Mercury Photographic      | Job Number:      | J50695      |
| Model:   | MicroSync MS0100          | T-Log Number:    | T50727      |
| Contact: | Wade McNary               | Account Manager: | Mark Briggs |
| Spec:    | FCC 15.231 (a) and 15.109 | Class:           | B           |

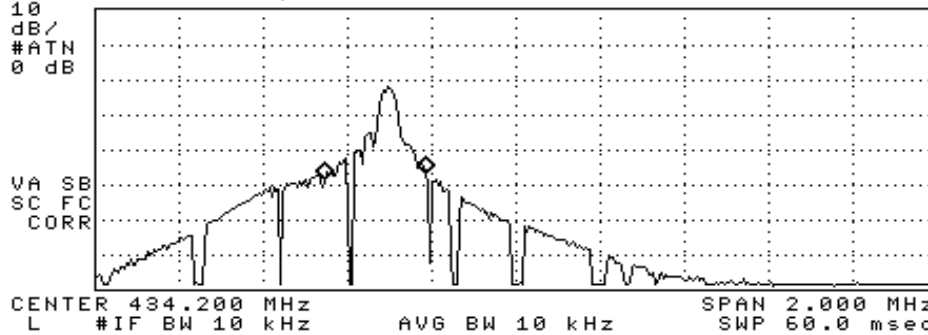
### Run #2: 26dB Bandwidth

Bandwidth measured to be 240kHz. Maximum permitted is 1.08MHz (0.25% of 433.

20:04:05 APR 02, 2003  
Run 1 30-300 MHz H

ACTV DET: PEAK  
MEAS DET: PEAK QP AVG  
MKRA 240 kHz  
1.77 dB

LOG REF OFFST 2.5 dB  
10 dB/ REF 92.0 dBμV  
#ATN  
0 dB



### ***EXHIBIT 3: Test Configuration Photographs***

**EXHIBIT 4: Theory of Operation Mercury Photographic Model MicroSync MS0100**

1 Page

***EXHIBIT 5: Proposed FCC ID Label & Label Location***

2 Pages

***EXHIBIT 6: Detailed Photographs Mercury Photographic Model MicroSync MS0100***

Pages

***EXHIBIT 7: User's Guide Mercury Photographic Model MicroSync MS0100***

2 Pages

**EXHIBIT 8: Block Diagram Mercury Photographic Model MicroSync MS0100**

1 Page

**EXHIBIT 9: Schematic Diagrams Mercury Photographic Model MicroSync MS0100**

1 Page