Elliott

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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15 Subpart C on the Tamrac Transmitter Model: MicroSync Transmitter and Receiver

FCC ID:	UJYMS0100
GRANTEE:	Tamrac 9240 Jordan Avenue Chatsworth, CA 91311
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Ave Sunnyvale, CA 94086
REPORT DATE:	August 22, 2006
FINAL TEST DATE:	March 22 and March 24, 2006
AUTHORIZED SIGNATORY:	Mark Briggs Principal Engineer

ACCREDITED
2016-01

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REVISION HISTORY

Revision #	Date	Comments	Modified By
1	September 8, 2006	Initial Release	David Guidotti

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SCOPE

An electromagnetic emissions test has been performed on the Tamrac model MicroSync Transmitter and Receiver pursuant to the following rules:

FCC Part 15 Subpart B (Receivers)
FCC Part 15 Subpart C
FCC Part 15 Subpart C requirements for momentarily operated devices

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada 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 Tamrac model MicroSync Transmitter and Receiver and therefore apply only to the tested sample. The sample was selected and prepared by Paul Finkel of Paul Finkel Consulting

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section. Certification of these devices is required as a prerequisite to marketing in the US.

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section. Certification of these devices is required as a prerequisite to marketing in the US. Devices categorized as Class II equipment do not require certification by Industry Canada.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's 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.

Maintenance of 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.).

STATEMENT OF COMPLIANCE

The tested sample of Tamrac model MicroSync Transmitter and Receiver complied with the requirements of the following regulations:

FCC Part 15 Subpart B (Receivers)
FCC Part 15 Subpart C
FCC Part 15 Subpart C requirements for momentarily operated devices

Maintenance of 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.).

TEST RESULTS SUMMARY – MicroSync Transmitter

MOMENTARILY OPERATED DEVICES – CONTROL SIGNALS

FCC Part 15 Reference	RSS Reference	Description	Measured Value / Comments	Limit / Requirement	Result
15.231 (a) (1)	RSS 210 A1.1.1 (1)	Duration of manually activated transmissions	350ms	< 5 seconds	Complies
15.231 (a) (2)	RSS 210 A1.1.1 (2)	Duration of automatically activated transmissions	Not applicable - all transmissions manually activated.	< 5 seconds	Complies
15.231 (a) (3)	RSS 210 A1.1.1 (3)	Transmissions at predetermined / regular intervals	No such transmissions	Such transmissions are not permitted	Complies
15.231 (a) (4)	RSS 210 A1.1.1 (4)	Pendency of transmissions used during emergencies	No such transmissions		Complies
15.231 (b)	RSS 210 Table 4	Fundamental Signal Strength @ 433.9 MHz	71.1dBμV/m (3589.2μV/m) (-9.7dB)		Complies
15.231 (b) / 15.209	RSS 210 Table 2 / 4	Radiated Spurious Emissions, 30 - 4300 MHz	79.4dBμV/m (9375.6μV/m) @ 2167.5MHz (-1.4dB)		Complies
15.231 (c)	RSS 210 A1.1.3	Bandwidth	250 kHz		Complies
15.231 (d)	RSS 210 A1.1.4	Frequency Stability - 40.66 – 40.70 MHz band	Device does not operate in this band		N/A

Note 1 – Refer to the operational description included with this application for detailed description and timing diagrams for transmission duration.
Note 2 – As the device is intended for hand-held operation it was tested in all three orthogonal orientations.

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Part 15 Section	RSS 210 Section	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Antenna is integral	-	Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	Not applicable, the device does not have a means of connecting, directly or indirectly, to an AC power source.		

TEST RESULTS SUMMARY – MicroSync Receiver

FCC Part 15 Section	RSS 210 Section	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	11.5dBμV/m (3.8μV/m) @ 357.032MHz		Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	Not applicable, the device does not have a means of connecting, directly or indirectly, to an AC power source.		

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 were calculated using the approach described in CISPR 16-4-2:2003 using a coverage factor of k=2, which gives a level of confidence of approximately 95%. The levels were found to be below levels of *U*cispr and therefore no adjustment of the data for measurement uncertainty is required.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	0.015 to 30	± ??.?
Radiated Emissions	30 to 1000	± 3.6
Radiated Emissions	1000 to 40000	± ± ??.?

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Tamrac model MicroSync Transmitter and Receiver is a wireless remote that consists of a transmitter and receiver. The transmitter is intended to connect to a camera (via the "hot shoe") and is used to trigger a remote flash unit via the receiver. The receiver connects into the flash system via a jack plug. Normally, the transmitter would be mounted on a camera and the receiver connected into a flash unit. The receiver was connected to a simulator box to represent a flash unit and the transmitter was connected to a camera. Both were treated as tabletop equipment during testing. Both transmitter and receiver are battery-powered and are not powered from the host devices.

The sample was received on March 22, 2006 and tested on March 22 and March 24, 2006. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Tamrac	MicroSync Transmitter and Receiver	wireless remote that consists of a transmitter and receiver		UJYMS0100

ANTENNA SYSTEM

The antenna is integral to the device and transmitting at 433.877 MHz

ENCLOSURE

The transmitter and receiver enclosures are primarily constructed of plastic. The receiver measures approximately 3.5 cm wide by 11.1 cm deep by 2.2 cm high. The transmitter measured approximately 2.7 cm wide by 5.1 cm deep by 1.1 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with emissions specifications.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer	Model	Description	Serial Number	FCC ID
Cannon		Camera		

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
None	-	-	-	-

EUT OPERATION

The transmitter was configured to continuously transmit a pulse train (by holding down the test transmit key) for all measurements except for spurious emissions in stand-by mode and the evaluation of the transmission timing. For the stand-by mode emissions the transmitter was connected to the camera without the flash sync signal being sent to the EUT. For the evaluation of timing (duty cycle, maximum transmit time) the transmitter was triggered by manually pushing the test transmit key.

The receiver was operating in its normal mode, with the receiver circuitry active.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on March 22 and March 24, 2006 at the Elliott Laboratories Open Area Test Site #2 located at 684 West Maude Avenue, Sunnyvale, California Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission.

ANSI C63.4:2003 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 requirements of ANSI C63.4:2003 and RSS 212.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003 and RSS 212. 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 or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003 / RSS 212.

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. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak 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, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

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.

POWER METER

Power measurements are made using either a power meter (typically with a peak power sensor) or as detailed in FCC KDB558074 using a spectrum analyzer and either the built-in channel power measurement function or software to integrate the power over the displayed spectrum.

When using the integration method the analyzer's internal function or software account for the equivalent noise bandwidth of the resolution bandwidth used when performing the integration. The bandwidths, detector (peak or sample) and trace data (max held or power averaging) are detailed in the test data. When using a power averaging function the device is either in a continuous transmit mode or the analyzer is configured to only sweep when the transmitter is active to ensure that the averaging is performed over a transmit burst and not over quiet periods.

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 or incorporated into the test software.

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 C63.4:2003 and RSS 212 secify 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.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

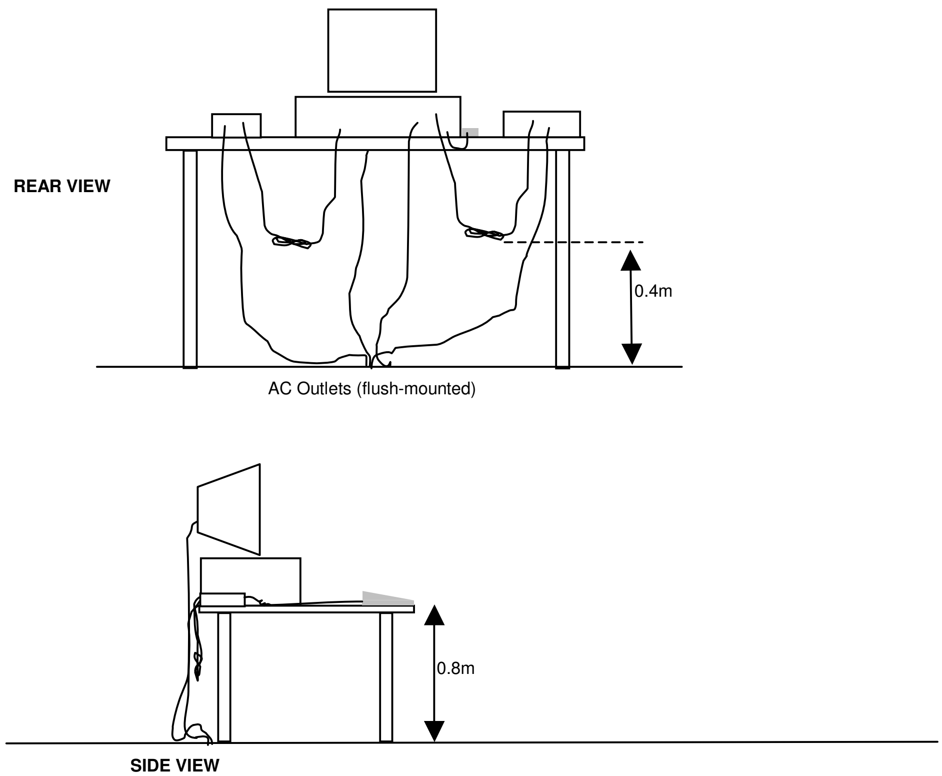
The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

RADIATED EMISSIONS

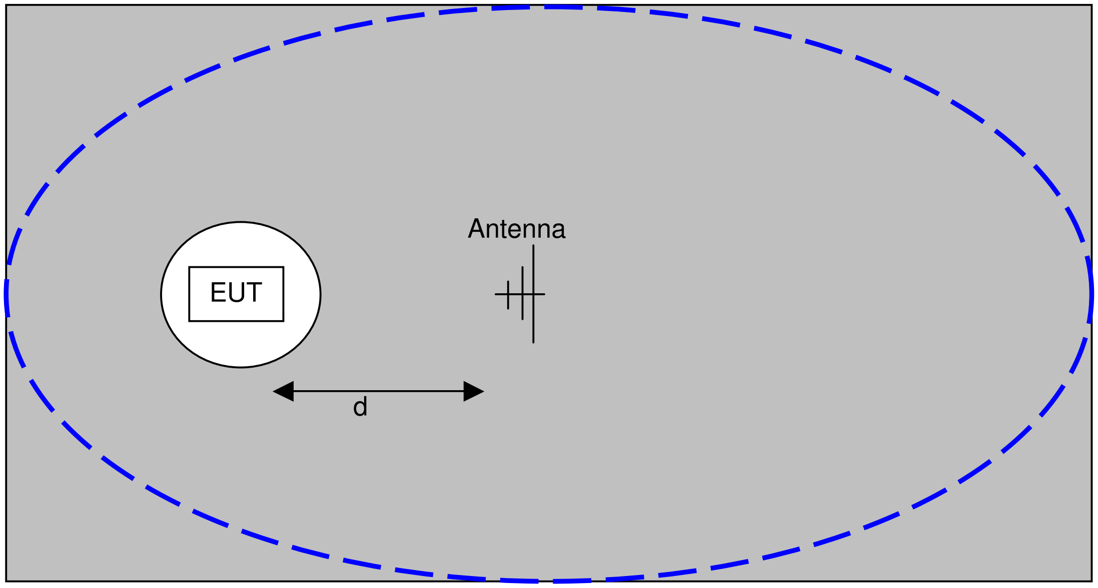
Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation 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. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

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.

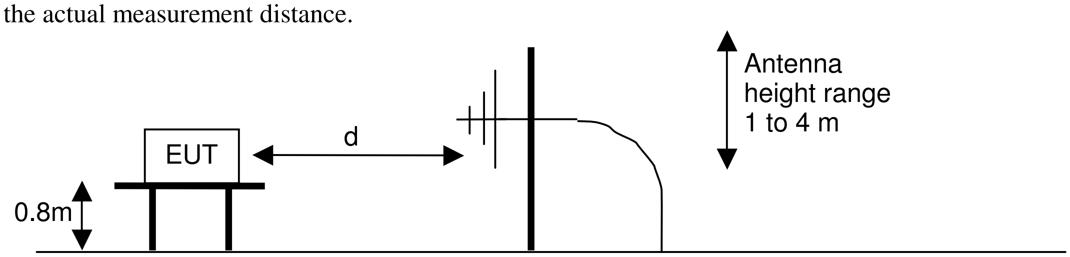
Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna 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.



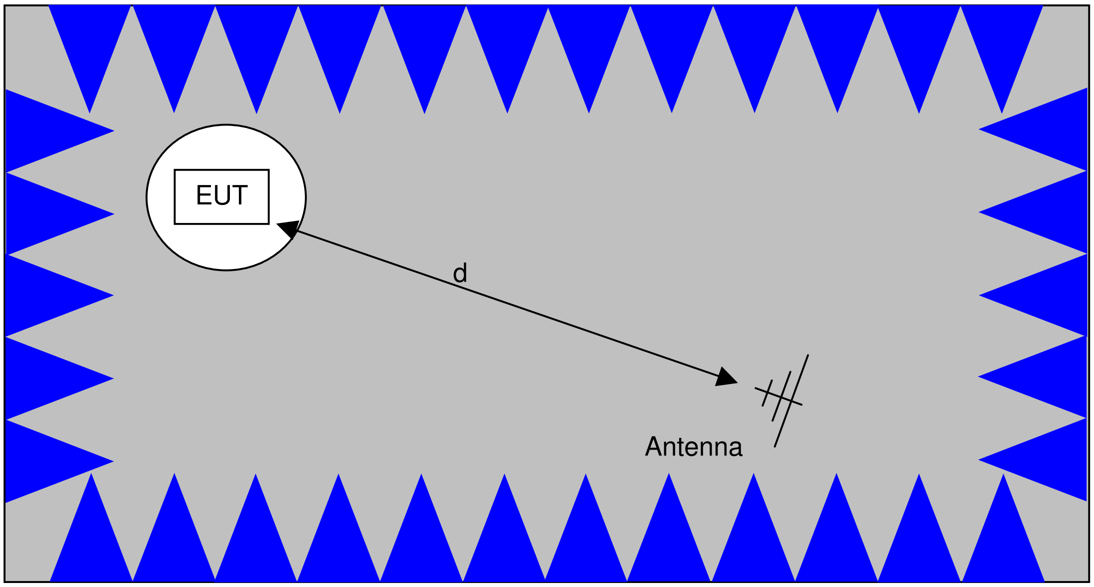
Typical Test Configuration for Radiated Field Strength Measurements



The ground plane extends beyond the ellipse defined in CISPR 16 / CISPR 22 / ANSI C63.4 and is large enough to accommodate test distances (d) of 3m and 10m. Refer to the test data tables for the actual measurement distance.

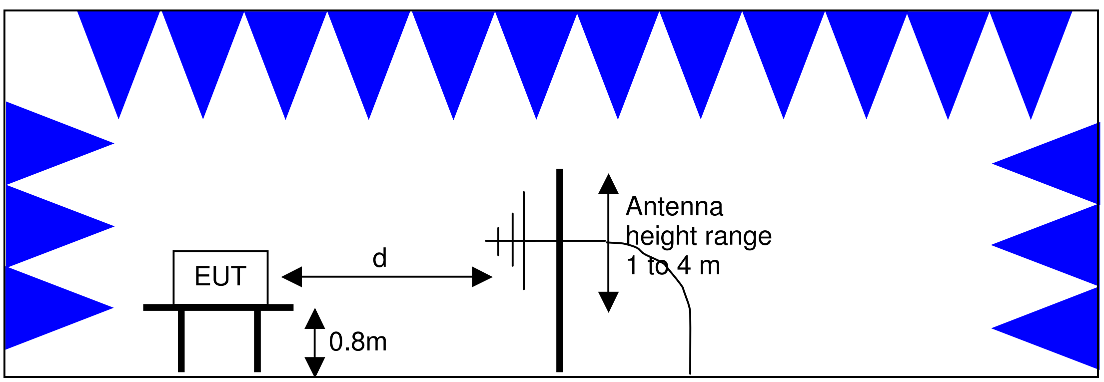


Test Configuration for Radiated Field Strength Measurements
OATS- Plan and Side Views



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

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: FCC 15.207; FCC 15.107(a), RSS GEN

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

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

GENERAL RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D) and the limits for all emissions for a low power device operating under the general rules of RSS 210, FCC Part 15 Subpart C.

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

RADIATED SPURIOUS EMISSIONS – MOMENTARILY OPERATED DEVICES

The table below shows the limits for both the fundamental and spurious emissions for control signals. The limits for data signals, or signals with predetermined transmissions, are given in the second table

Operating Frequency (MHz)	Fundamental Field Strength (microvolts/m)	Spurious Emissions (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

<u>Spurious Emissions Limits – Control Signals</u>

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

RECEIVER SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for emissions from the receiver as detailed in FCC Part 15.109, RSS 210 table 2, RSS GEN table 1.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (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 above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

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 = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

Radiated Emissions, 30 - 4,400 MHz, 15-May-06
Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, 9 kHz - 6.5 GHz	8595EM	780	26-May-06
Filtek	Filter, 1 GHz High Pass	HP12/1000-5BA	957	24-Apr-07
Hewlett Packard	Microwave Preamplifier 0.5-26.5 GHz	83017A	1257	28-Sep-06
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	30-Mar-07
EMCO	Antenna, Horn, 1-18 GHz (SA40)	3115	1386	07-Jul-06
EMCO	Biconical Antenna, 30-300 MHz	3110B	1498	03-Mar-07

EXHIBIT 2: Test Measurement Data

10 Pages

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Emissions Spec:	EN300 220, FCC Part 15.231(a)	Class:	-
Immunity Spec:	EN 301 489-3	Environment:	-

EMC Test Data

For The

Paul Finkel Consulting

Model

MicroSync Transmitter and Receiver

Date of Last Test: 9/6/2006

Elliott

EMC Test Data

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Emissions Spec:	EN300 220, FCC Part 15.231(a)	Class:	-
Immunity Spec:	EN 301 489-3	Environment:	-

EUT INFORMATION

General Description

The EUT is a wireless remote that consists of a transmitter and receiver. the transmitter is intended to connect to a camera (via the "hot shoe") and is used to trigger a rmeote flash unit via the receiver. the recive connects into the flash system via a jack plug. Normally, the transmitter would be mounted on a camera and the reciver connected into a flash unit. The receiver was connected to a simulaotr box to represent a flash unit and the transmitter was connected to a camera. Both were treated as table top equipment during testing. Bot transmitter and receiver are battery-powered and are not powered from the host devices.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Tamrac	MicroSync Transmitter	433.9 MHz flash control Transmitter	None	UJYMS0100
Tamrac	MicroSync Receiver	433.9 MHz flash control receiver	None	

EUT Antenna

The antennas are integral to the transmitter and receiver.

EUT Enclosure

The transmitter and receiver enclosures are primarily constructed of plastic. The receiver measures approximately 3.5 cm wide by 11.1 cm deep by 2.2 cm high. The transmitter measured approximately 2.7 cm wide by 5.1 cm deep by 1.1 cm high.

Modification History

Mod. #	Test	Date	Modification
1			
2			

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

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EMC Test Data

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Emissions Spec:	EN300 220, FCC Part 15.231(a)	Class:	-
Immunity Spec:	EN 301 489-3	Environment:	-

Test Configuration #1

Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Canon	None	SLR Camera	-	N/A
Paul Finkel Consulting	None	Flash Gun simulator	-	N/A

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Camera Hot Shoe	EUT	Direct connection	N/A	
Receiver output	Flash Simulator	Direct connection	N/A	

EUT Operation During Emissions Tests

The transmitter was configured to continuously transmit a pulse train (by holding down the test transmit key) for all measurements except for spurious emissions in stand-by mode and the evaluation of the transmission timing. For the stand-by mode emissions the transmitter was connected to the camera without the flash sync signal being sent to the EUT. For the evaluation of timing (duty cycle, maximum transmit time) the transmitter was triggered by manually pushing the test transmit key.

The receiver was operating in its normal mode, with the receiver circuitry active.

EUT Operation During Immunity Tests

During immunity testing the transmitter was located approximately 1m from the receiver. The transmitter was configured to continuously transmit a series of modulated pulses to the receiver, which was connected to a test fixture that gave a visual indication of a received and correctly decoded signal. In addition a field probe and analyzer were used to verify that there were no unintentional transmissions from the transmitter by monitoring the transmitted signal for transmitted bursts interspersed between the regularly-spaced intentionally transmitted signals.

Performance Criteria for Immunity Tests

Criterion A and B:

Performance criteria to be based on definition of transmitter and receiver as Class 3 SRDs - Standard reliable SRD communication media; e.g. inconvenience to persons, which can simply be overcome by other means (e.g. manual). As such there may be loss of function during a test provided there are no unintentional transmissions. After the test the device shall operate as intended with no degradation of performance and any lost functions shall be self-recoverable.

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Spec:	EN300 220, FCC Part 15.231(a)	Class:	N/A

FCC 15.231(a) Transmiter Fundamental & Spurious 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: 3/22/2006
Test Engineer: Rafael Varelas
Test Location: SVOATS #2

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 spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 8 °C
Rel. Humidity: 90 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Transmitter Fundamental Field Strength, 433.9MHz	FCC Part 15.231(a)	Pass	71.1dBμV/m (3589.2μV/m) @ 3m (-9.7dB)
1	Transmitter Spurious Emissions, 30 - 4500 MHz	FCC Part 15.231(a)	Pass	79.4dBμV/m (9375.6μV/m) @ 2167.5MHz (-1.4dB)
2	Timing of transmissions	FCC Part 15.231(a)	Pass	Manual transmissions cease within 5s of button release. Automatic transmissions cease
2	Bandwidth	FCC Part 15.231(a)	Pass	250kHz
3	Receiver Spurious Emissions, 30 - 4000 MHz	FCC 15.109 / RSS 210	Pass	11.5dBμV/m (3.8μV/m) @ 357.032MHz (-34.5dB)

Modifications Made During Testing:

No modifications were made to the EUT during testing

EMC Test Data

Elliott

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Spec:	EN300 220, FCC Part 15.231(a)	Class:	N/A

Deviations From The Standard

No deviations were made from the requirements of the standard.

Run #1: Radiated Spurious Emissions, Tx mode at 433.892MHz

Date of Test:	3/22/2006	Config. Used:	1
Test Engineer:	Rafael Varelas	Config Change:	None
Test Location:	SVOATS #2	EUT Voltage:	Battery

Fundamental Signal

Frequency MHz	Level dBμV/m	Pol v/h	FCC 15.231(a) Limit	Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments	Orientation
433.892	71.1	h	80.8	-9.7	Avg	145	1.0	Fundamental	Side
433.892	91.1	h	100.8	-9.7	Pk	145	1.0	Fundamental	Side
433.892	89.6	v	100.8	-11.2	Pk	360	1.0	Fundamental	Upright
433.892	69.6	v	80.8	-11.2	Avg	360	1.0	Fundamental	Upright
433.892	83.4	v	100.8	-17.4	Pk	360	1.0	Fundamental	Side
433.892	63.4	v	80.8	-17.4	Avg	360	1.0	Fundamental	Side
433.892	81.7	h	100.8	-19.1	Pk	120	1.0	Fundamental	Upright
433.892	61.7	h	80.8	-19.1	Avg	120	1.0	Fundamental	Upright

Note - all average values taken by applying a 20dB average correction factor to the peak reading based on a duty cycle of less than 10%.

Spurious Signals

Frequency MHz	Level dBμV/m	Pol v/h	FCC 15.231(a) Limit	Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments	Orientation
2167.475	79.4	H	80.8	-1.4	PK	282	1.7	5th harmonic	Side
2167.475	59.4	H	60.8	-1.4	Avg	282	1.7	5th harmonic	Side
1735.578	52.0	H	60.8	-8.8	Avg	279	1.9	4th harmonic	Side
1735.578	72.0	H	80.8	-8.8	PK	279	1.9	4th harmonic	Side
2168.307	71.9	V	80.8	-8.9	PK	199	1.0	5th harmonic	Side
2168.307	51.9	V	60.8	-8.9	Avg	199	1.0	5th harmonic	Side
1735.300	70.5	V	80.8	-10.3	PK	346	1.0	4th harmonic	Side
1735.300	50.5	V	60.8	-10.3	Avg	346	1.0	4th harmonic	Side
3035.948	70.2	H	80.8	-10.6	PK	208	1.3	7th harmonic	Side
3035.948	50.2	H	60.8	-10.6	Avg	208	1.3	7th harmonic	Side

Note - all average values taken by applying a 20dB average correction factor to the peak reading based on a duty cycle of less than 10%.

Table continued on next page …

Elliott **EMC Test Data**

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Spec:	EN300 220, FCC Part 15.231(a)	Class:	N/A

Continued from previous page

Frequency MHz	Level dBμV/m	Pol v/h	FCC 15.231(a) Limit	Margin	Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments	Orientation
3471.956	49.8	H	60.8	-11.0	Avg	27	1.2	8th harmonic	Side
3471.956	69.8	H	80.8	-11.0	PK	27	1.2	8th harmonic	Side
1302.929	61.4	V	74.0	-12.6	PK	110	1.0	3rd harmonic	Side
1302.929	41.4	V	54.0	-12.6	Avg	110	1.0	3rd harmonic	Side
3905.436	61.0	H	74.0	-13.0	PK	275	1.5	9th harmonic	Side
3905.436	41.0	H	54.0	-13.0	Avg	275	1.5	9th harmonic	Side
867.784	67.4	v	80.8	-13.4	Pk	50	1.1	2nd harmonic	Upright
867.784	47.4	v	60.8	-13.4	AVG	50	1.1	2nd harmonic	Upright
1302.231	59.1	H	74.0	-14.9	PK	127	1.6	3rd harmonic	Side
1302.231	39.1	H	54.0	-14.9	Avg	127	1.6	3rd harmonic	Side
867.784	62.4	h	80.8	-18.4	Pk	45	1.0	2nd harmonic	Side
867.784	42.4	h	60.8	-18.4	AVG	45	1.0	2nd harmonic	Side
3038.026	62.2	V	80.8	-18.6	PK	259	1.0	7th harmonic	Side
3038.026	42.2	V	60.8	-18.6	Avg	259	1.0	7th harmonic	Side
4339.928	54.4	H	74.0	-19.6	PK	289	1.5	10th harmonic	Side
4339.928	34.4	H	54.0	-19.6	Avg	289	1.5	10th harmonic	Side
867.784	60.2	v	80.8	-20.6	Pk	300	1.0	2nd harmonic	Side
867.784	40.2	v	60.8	-20.6	AVG	300	1.0	2nd harmonic	Side
3906.793	52.6	V	74.0	-21.4	PK	95	1.0	9th harmonic	Side
3906.793	32.6	V	54.0	-21.4	Avg	95	1.0	9th harmonic	Side
2604.404	58.7	H	80.8	-22.1	PK	269	2.0	6th harmonic	Side
2604.404	38.7	H	60.8	-22.1	Avg	269	2.0	6th harmonic	Side
3472.016	58.7	V	80.8	-22.1	PK	260	1.0	8th harmonic	Side
3472.016	38.7	V	60.8	-22.1	Avg	260	1.0	8th harmonic	Side
867.784	56.7	h	80.8	-24.1	Pk	355	1.0	2nd harmonic	Upright
867.784	36.7	h	60.8	-24.1	AVG	355	1.0	2nd harmonic	Upright
4341.660	24.2	V	54.0	-29.8	Avg	168	1.0	10th harmonic	Side
4341.660	44.2	V	74.0	-29.8	PK	168	1.0	10th harmonic	Side

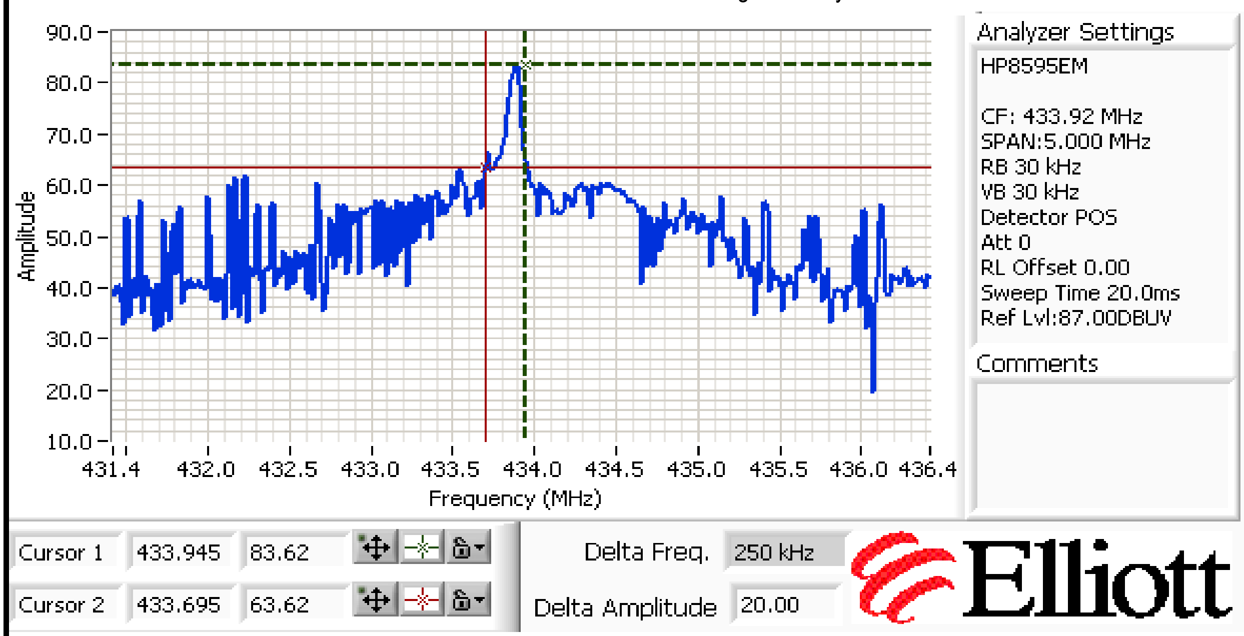
Note - all average values taken by applying a 20dB average correction factor to the peak reading based on a duty cycle of less than 10%. See below

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Spec:	EN300 220, FCC Part 15.231(a)	Class:	N/A

Run #2: Bandwidth and timing

Date of Test: 3/23/2006
Test Engineer: Mark Briggs
Test Location: SVOATS #1

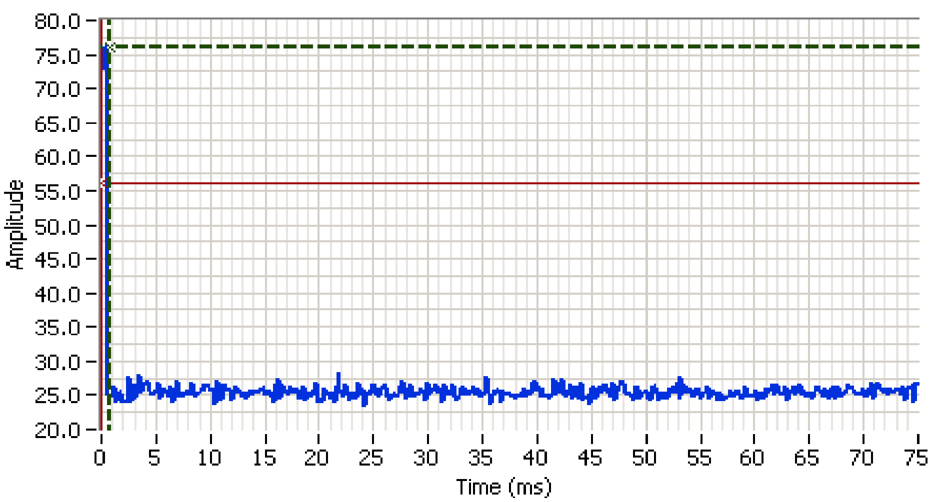
Config. Used: 1 - Receive Mode
Config Change: None
EUT Voltage: Battery



Bandwidth (20dB) = 250khz
Limit = 1.05MHz

Elliott — EMC Test Data

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Spec:	EN300 220, FCC Part 15.231(a)	Class:	N/A



Analyzer Settings

HP8595EM

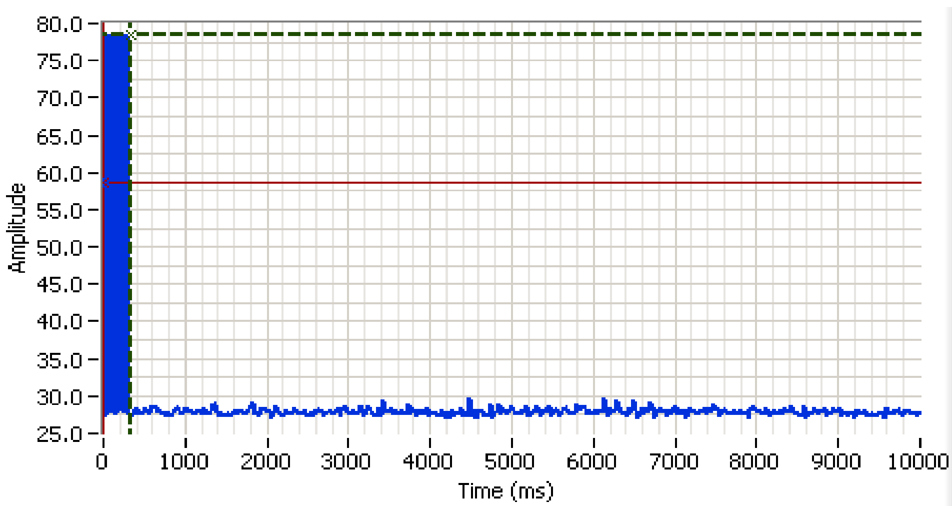
CF: 433.88 MHz
SPAN:0.00 MHz
RB 1.000 MHz
VB 3.000 MHz
Detector POS
Att 0
RL Offset 0.00
Sweep Time 75.0ms
Ref Lvl:87.00DBUV

Comments

Timing of automatic transmission (triggered from flash)

Cursor 1	0.773	76.00
Cursor 2	0.000	56.00

Delta Time (ms) 0.77
Delta Amplitude 20.00



Analyzer Settings

HP8595EM

CF: 433.88 MHz
SPAN:0.00 MHz
RB 1.000 MHz
VB 3.000 MHz
Detector POS
Att 0
RL Offset 0.00
Sweep Time 10.0s
Ref Lvl:87.00DBUV

Comments

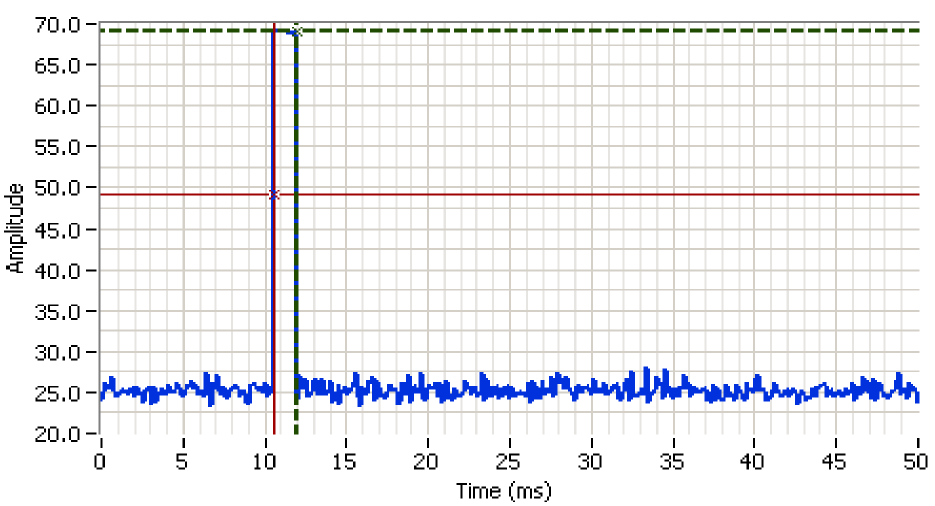
activated transmissions showing device switching off in less than 5s after button released

Cursor 1	335.052	78.50
Cursor 2	0.000	58.50

Delta Time (ms) 335.05
Delta Amplitude 20.00

Elliott | *EMC Test Data*

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Spec:	EN300 220, FCC Part 15.231(a)	Class:	N/A



Analyzer Settings

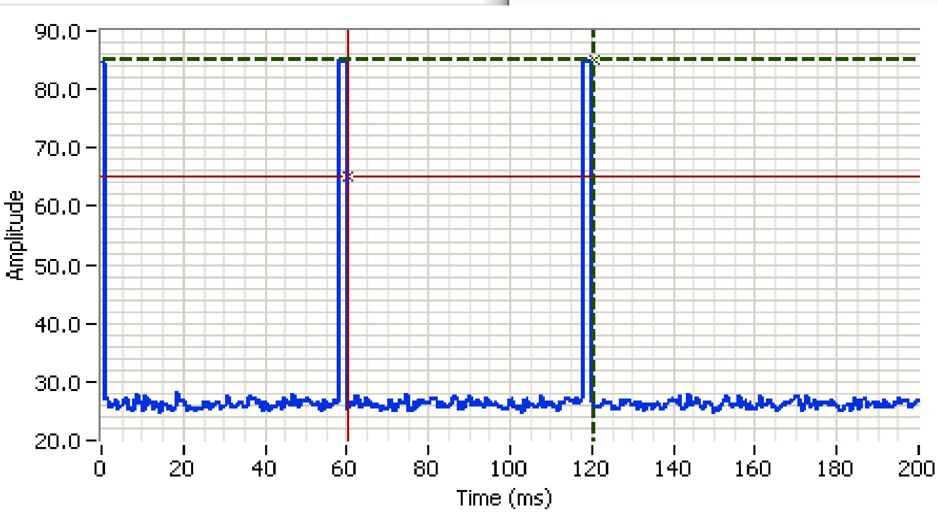
HP8595EM

CF: 433.88 MHz
SPAN:0.00 MHz
RB 1.000 MHz
VB 3.000 MHz
Detector POS
Att 0
RL Offset 0.00
Sweep Time 50.0ms
Ref Lvl:87.00DBUV

Comments

Pulse width = 1.4ms

Cursor 1	11.985	69.14	Delta Time (ms)	1.36
Cursor 2	10.625	49.14	Delta Amplitude	20.00



Analyzer Settings

HP8595EM

CF: 433.88 MHz
SPAN:0.00 MHz
RB 1.000 MHz
VB 3.000 MHz
Detector POS
Att 0
RL Offset 0.00
Sweep Time 200.0ms
Ref Lvl:87.00DBUV

Comments

Time between pulses = 60ms

Cursor 1	120.619	84.97	Delta Time (ms)	60.31
Cursor 2	60.309	64.97	Delta Amplitude	20.00

Elliott

EMC Test Data

Client:	Paul Finkel Consulting	Job Number:	J60983
Model:	MicroSync Transmitter and Receiver	T-Log Number:	T60996
		Account Manager:	Chris
Contact:	Paul Finkel Consulting		
Spec:	EN300 220, FCC Part 15.231(a)	Class:	N/A

Run #3: Radiated Spurious Emissions, Rx mode for receiver, stand-by for the Tx

Date of Test: 3/23/2006
Test Engineer: Mark Briggs
Test Location: SVOATS #1

Config. Used: 1 - Receive Mode
Config Change: None
EUT Voltage: Battery

Measurement frequencies based on preliminary chamber scans.

Frequency	Level	Pol	FCC 15.109		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
357.032	11.5	V	46.0	-34.5	QP	-	-	Noise floor
433.039	10.8	V	46.0	-35.2	QP	-	-	Noise floor
357.032	10.0	H	46.0	-36.0	QP	-	-	Noise floor
433.039	10.6	H	46.0	-35.4	QP	-	-	Noise floor

EXHIBIT 3: Photographs of Test Configurations

2 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of Tamrac Model MicroSync Transmitter and ReceiverConstruction

External	4 Pages
Internal	8 Pages

EXHIBIT 6: Operator's Manual for Tamrac Model MicroSync Transmitter and Receiver

2 Pages

EXHIBIT 7: Block Diagram of Tamrac Model MicroSync Transmitter and Receiver

1 Page

EXHIBIT 8: Schematic Diagrams for Tamrac Model MicroSync Transmitter and Receiver

1 Page

EXHIBIT 9: Theory of Operation for Tamrac Model MicroSync Transmitter and Receiver

2 Pages