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Electromagnetic Emissions Test Report In Accordance With Industry Canada Radio Standards Specification 210 And FCC Part 15 Sections 15.249 on the Smart Systems International Transmitter Model: T6210 Occupancy Sensor

UPN:	6211A-LG4T6210
FCC ID:	LG4T6210
GRANTEE:	Smart Systems International 3271 S. Highland Drive Las Vegas, NV 89109
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	September 2, 2005
FINAL TEST DATE:	July 12, July 28, July 29, August 3 and August 5, 2005
AUTHORIZED SIGNATORY:	Mark Briggs Principal Engineer

Equipment Name and Model:

Transceiver , T6210 Occupancy Sensor

Manufacturer:

Smart Systems International
3271 S. Highland Drive
Las Vegas, NV 89109

Tested to applicable standard:
RSS-210, Issue 5, November 2001 (Low Power License-Exempt Radiocommunication Devices)
FCC Part 15.249

Test Report Prepared For:
Robert Zirpoli
Smart Systems International
3271 S. Highland Drive
Las Vegas, NV 89109

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 SV1 Dated August 16, 2007

Declaration of Compliance

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of ANSI C63.4: 2003 as referenced by FCC Part 15 and RSS-212, "Test Facilities and Test Methods for Radio Equipment" as referenced by section 4 of RSS-Gen Issue 1); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	Mark Briggs
Title	Principal Engineer
	Elliott Laboratories Inc.
Address	684 W. Maude Ave
	Sunnyvale, CA 94086
	USA
Date:	September 2, 2005

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SCOPE

An electromagnetic emissions test has been performed on the Smart Systems International model T6210 Occupancy Sensor pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and Industry Canada Radio Standards Specification RSS-210 for Low Power, License-Exempt Radio Communication Devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4:2003 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 Smart Systems International model T6210 Occupancy Sensor and therefore apply only to the tested sample. The sample was selected and prepared by Robert Zirpoli of Smart Systems International

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.

STATEMENT OF COMPLIANCE

The tested sample of Smart Systems International model T6210 Occupancy Sensor complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators and Industry Canada specification RSS 210 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands).

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.).

TEST RESULTS SUMMARY

DEVICES OPERATING IN THE 902 – 928 / 2400 – 2483.5 / 5725 – 5850 MHz BANDS

FCC Part 15 Reference	RSS Reference	Description	Measured Value / Comments	Limit / Requirement	Result
15.249 (a)	RSS 210 A2.9 (1)	Fundamental Signal Strength	89.3dBµV/m (29174.3µV/m) @ 915.035MHz	50mV/m @ 3m	Complies (-4.7dB)
15.249 (a) / 15.209	RSS 210 A2.9 (1) & Table 2	Radiated Spurious Emissions, 30 - 9150 MHz	47.6dBµV/m (239.9µV/m) @ 4575.2MHz	Harmonics 500uV/m @ 3m or general limits	Complies (-6.4dB)
	RSP 100 RSS GEN 4.4.1	99% Bandwidth	440kHz	Information only	N/A

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	Integral antenna	Unique connector or integral antenna	Complies
15.109	RSS GEN 7.2.3 Table 1	Receiver spurious emissions	40.2dBµV/m (102.3µV/m) @ 910.000MHz		Complies (- 5.8 dB)
15.207	RSS GEN Table 2	AC Conducted Emissions	Not applicable – device is battery powered	N/A	N/A

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 UKAS document LAB 34.

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

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Smart Systems International model T6210 Occupancy Sensor is an occupancy sensor that uses IR to detect motion. It is designed to be used with a Smart Systems thermostat and can connect wirelessly using 915 MHz or via a hard-wired connection.

Normally, the EUT would be wall or ceiling mounted during operation. The EUT was, therefore, treated as table-top equipment and tested in both flat and upright orientations to simulate both wall-mounted and ceiling mounted orientations during testing.

The EUT is battery powered in wireless mode and powered from the thermostat via the interface cable when in wired mode. For wireless mode testing the device was, therefore, powered form batteries.

The sample was received on July 12, 2005 and tested on July 12, July 28, July 29, August 3 and August 5, 2005. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Smart Systems	T6210	Occupancy Sensor		

OTHER EUT DETAILS

The sensor comes in two different plastic housings to accommodate different IR lenses. The circuit board and all other hardware is identical in the two housing. The dimensions of the two housings are approximately the same.

ENCLOSURE

The EUT enclosure is primarily constructed of molded plastic. It measures approximately 15 cm in diameter by 5 cm high.

SUPPORT EQUIPMENT

No support equipment was used during emissions testing.

EXTERNAL I/O CABLING

The EUT has no external connections when in wireless mode. When a cable is connected to the sensor power/data port the wireless function is disabled.

EUT OPERATION

The EUT was continuously transmitting at 915MHz for transmit mode measurements and in a continuous receive mdoe for receive mode measurements.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on July 12, July 28, July 29, August 3 and August 5, 2005 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 C63.4:2003 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.

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.

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 C63.4:2003 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.

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 C63.4:2003 , 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: 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

RADIATED EMISSIONS SPECIFICATION LIMITS – 15.247 and RSS 210 A2.9

The table below shows the limits for the fundamental emission and for its harmonics. Harmonics that that fall in restricted bands[1] and all other spurious emissions are subject to the general limits of RSS 210 and FCC Part 15 Subpart C.

Frequency Range (MHz)	Limit for Fundamental @ 3m	Limit for Harmonics @ 3m
902 - 928	50,000 uV/m 94dBuV/m	500 uV/m 54dBuV/m
2400 – 2483.5	50,000 uV/m 94dBuV/m	500 uV/m 54dBuV/m
5725 - 5850	50,000 uV/m 94dBuV/m	500 uV/m 54dBuV/m

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

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

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

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

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 - 6,500 MHz, 11-Jul-05
Engineer: Mehran Birgani

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	Log Periodic Antenna 300-1000 MHz	EL300.1000	55	06-Dec-05
Elliott Laboratories	Biconical Antenna, 30-300 MHz	DM-105-T1	382	21-Sep-05
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	780	26-May-06
Hewlett Packard	Microwave Preamplifier 0.5-26.5GHz	83017A	1257	22-Sep-05
Electro Metrics	Conical log spiral antenna	LCA-25	1291	04-Nov-05
Hewlett Packard	RF Preamplifier, 100 kHz - 1.3 GHz	8447E	1606	28-Jul-05
ETS-Lindgren	Horn Antenna, D. Ridge 1-18GHz	3117	1662	11-Apr-06

Radiated Emissions, 30 - 10,000 MHz, 12-Jul-05
Engineer: Chris Byleckie

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Biconical Antenna, 30-300 MHz	3110B	801	09-Aug-05
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	13-Jan-06
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037 (84125C)	1154	09-Jun-06
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	28-Mar-06
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	12-Jan-06
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	03-Nov-05
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	08-Nov-05

Radiated Emissions, 30 - 10,000 MHz, 28-Jul-05
Engineer: Yu Chien Ho

Manufacturer	Description	Model #	Asset #	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	54	07-Mar-07
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	17-Dec-05
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	13-Jan-06
Filtek	High Pass Filter, 1GHz	HP12/1000-5BA	955	31-Mar-06
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	19-Oct-06
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	12-Jan-06
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	03-Nov-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T60382 12 Pages

Elliott

EMC Test Data

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Emissions Spec:	FCC 15.249, RSS 210	Class:	B
Immunity Spec:		Environment:	

EMC Test Data

For The

Smart Systems International

Model

T6210 Occupancy Sensor

Date of Last Test: 8/3/2005

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Emissions Spec:	FCC 15.249, RSS 210	Class:	B
Immunity Spec:		Environment:	

EUT INFORMATION

General Description

The EUT is an occupancy sensor that uses IR to detect motion. It is designed to be used with a Smart Systems thermostat and can connect wirelessly using 915 MHz or via a hard-wired connection. Normally, the EUT would be wall or ceiling mounted during operation. The EUT was, therefore, treated as table-top equipment and tested in both flat and upright orientations to simulate both wall-mounted and ceiling mounted orientations during testing. The EUT is battery powered in wireless mode and powered from the thermostat via the interface cable when in wired mode.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Smart Systems	T6210	Occupancy Sensor		

Other EUT Details

The test data in this test log covers wireless mode. The wired configuration was tested with the Smart Systems model T6510 thermostat.
The sensor comes in two different plastic housings to accommodate different IR lenses. The circuit board and all other hardware is identical in the two housing. The dimensions of the two housings are approximately the same.

EUT Antenna

The antenna is integral to the device.

EUT Enclosure

The EUT enclosure is primarily constructed of molded plastic. It measures approximately 15 cm in diameter by 5 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	-

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:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Emissions Spec:	FCC 15.249, RSS 210	Class:	B
Immunity Spec:		Environment:	

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

The EUT had no I/O ports

EUT Operation During Emissions Tests

The EUT was continuously transmitting at 915MHz

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	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: 7/28/2005 & 7/29/2005
Test Engineer: Yu-Chien Ho / Jmartinez
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.

The test distance and extrapolation factor (if used) are detailed under each run description.

Ambient Conditions:

Temperature: 18.9 °C
Rel. Humidity: 72 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Bandwidth	RSS 210	N/A	26dB bandwidth: 440kHz
1	RE, Fundamental	FCC 15.249	Pass	89.3dBµV/m (29174.3µV/m) @ 915.035MHz (-4.7dB)
2	RE, Tx Spurious Emissions	FCC 15.249	Pass	47.6dBµV/m (239.9µV/m) @ 4575.2MHz (-6.4dB)
3	RE, Rx Spurious Emissions	15.109	Pass	40.2dBµV/m (102.3µV/m) @ 910.000MHz (-5.8dB)

Modifications Made During Testing:

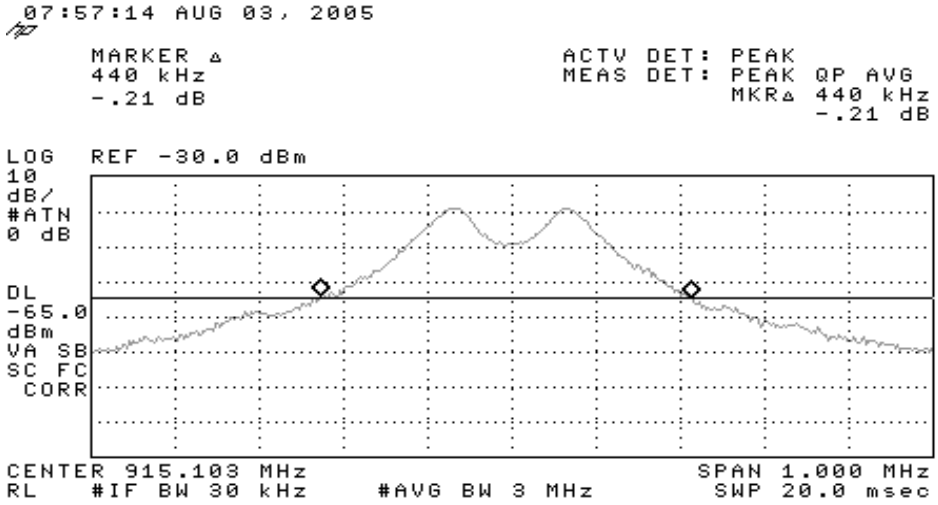
No modifications were made to the EUT during testing

Deviations From The Standard

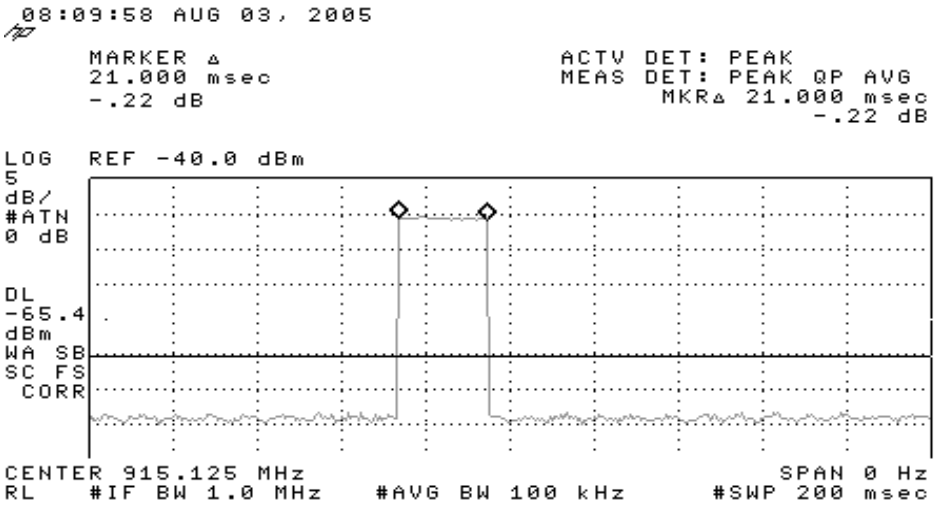
No deviations were made from the requirements of the standard.

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

Plots of Transmitted Signal Showing Bandwidth and Timing



Plot Showing Bandwidth - 26dB bandwidth = 440kHz



Plot Showing Timing - duty cycle in any 100ms is 21ms/100ms, average correction factor is 20log(21/100) = **-13.6dB**

Elliott

EMC Test Data

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

Run #1: Fundamental Radiated Emissions, 915 MHz
Measurement taken at 3meters

Frequency	Level	Pol	FCC 15.249		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters		
915.035	89.3	h	94.0	-4.7	Pk	296	1.0	EUT Horizontal	Note 1
915.035	86.0	v	94.0	-8.0	Pk	46	1.2	EUT Vertical	Note 1
915.035	85.8	h	94.0	-8.2	Pk	360	1.0	EUT Vertical	Note 1
915.035	80.6	v	94.0	-13.4	Pk	253	1.9	EUT Horizontal	Note 1

Note 1:	Limit is based on 20*log(50000) per 15.249. Per 15.35, for a pulse modulated signal less than 20Hz, peak reading are required in place of QP measurements. Measurement bandwidth was 120kHz.

Run #2a: Maximized readings, 1000 - 10000 MHz
EUT Vertical

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4575.155	47.6	h	54.0	-6.4	Avg	52	1.6	Note 2
4575.155	46.5	v	54.0	-7.5	Avg	310	1.0	Note 2
3660.155	46.1	v	54.0	-7.9	Avg	84	1.2	Note 2
3660.155	45.9	h	54.0	-8.1	Avg	20	1.9	Note 2
4575.155	61.2	h	74.0	-12.8	PK	52	1.6	
1830.000	40.2	v	54.0	-13.8	Avg	213	1.0	Note 2
1830.000	40.2	h	54.0	-13.8	Avg	103	1.9	Note 2
4575.155	60.1	v	74.0	-13.9	PK	310	1.0	
3660.155	59.7	v	74.0	-14.3	PK	84	1.2	
2745.155	39.5	h	54.0	-14.5	Avg	338	2.1	Note 2
3660.155	59.5	h	74.0	-14.5	PK	20	1.9	
2745.155	39.1	v	54.0	-14.9	Avg	216	1.0	Note 2
1830.000	53.8	v	74.0	-20.2	PK	213	1.0	
1830.000	53.8	h	74.0	-20.2	PK	103	1.9	
2745.155	53.1	h	74.0	-20.9	PK	338	2.1	
2745.155	52.7	v	74.0	-21.3	PK	216	1.0	

Note 1:	Non-Restricted band emissions limit is = 20*log(500) per 15.249 (54 dBuV/m). For above 1 GHz, the limit for average measurements. For restricted band emissions the limit is per 15.209.
Note 2:	Average measurement calculated from peak measurement - duty cycle of 13.6 dB.

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

Run #2b: Maximized readings, 1000 - 10000 MHz
EUT Horizontal

Frequency	Level	Pol	FCC 15.249		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4575.155	46.1	v	54.0	-7.9	Avg	360	2.2	Note 2
4575.155	45.0	h	54.0	-9.0	Avg	179	1.0	Note 2
3660.155	43.6	h	54.0	-10.4	Avg	318	2.1	Note 2
3660.155	42.4	v	54.0	-11.6	Avg	91	1.0	Note 2
1830.000	41.5	v	54.0	-12.5	Avg	87	1.2	Note 2
4575.155	59.7	v	74.0	-14.3	PK	360	2.2	
4575.155	58.6	h	74.0	-15.4	PK	179	1.0	
2745.155	38.5	v	54.0	-15.5	Avg	273	1.0	Note 2
2745.155	38.5	h	54.0	-15.5	Avg	90	1.6	Note 2
3660.155	57.2	h	74.0	-16.8	PK	318	2.1	
1830.000	36.9	h	54.0	-17.1	Avg	269	2.0	Note 2
3660.155	56.0	v	74.0	-18.0	PK	91	1.0	
1830.000	55.1	v	74.0	-18.9	PK	87	1.2	
2745.155	52.1	v	74.0	-21.9	PK	273	1.0	
2745.155	52.1	h	74.0	-21.9	PK	90	1.6	
1830.000	50.5	h	74.0	-23.5	PK	269	2.0	

Note 1:	Non-Restricted band emissions limit is = 20*log(500) per 15.249 (54 dBuV/m). For above 1 GHz, the limit for average measurements. For restricted band emissions the limit is per 15.209.
Note 2:	Average measurement calculated from peak measurement - duty cycle of 13.6 dB.

Run #3: Receiver emissions, 30 - 5000 MHz

Frequency	Level	Pol	FCC 15.109		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
910.000	40.2	v	46.0	-5.8	QP	361	1.0	EUT vertical
910.000	37.4	h	46.0	-8.6	QP	130	1.0	EUT vertical
910.000	42.5	h	46.0	-3.5	QP	152	1.0	EUT horizontal
910.000	33.7	v	46.0	-12.3	QP	361	1.0	EUT horizontal

Note 1	No other emission detected within 20-dB of the limit.

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

Radiated Emissions - Digital Device (Wired Configuration)

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: See run
Test Engineer: See run
Test Location: See run
Config. Used: 2
Config Change: -
EUT Voltage: 120V/60Hz

General Test Configuration

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

The measurement antenna was located 3m from the EUT.

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.

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 -1000 MHz, Preliminary Scan	FCC B	-	Perfromed in anechoic chamber
3	RE, 30 - 1000MHz, Maximized Emissions	FCC B	Pass	37.6dBµV/m @ 58.990MHz (-2.4dB)

Modifications Made During Testing:

The following modifications were made to the EUT during testing in order to comply with the requirements of the standard:

Added clip on ferrites to cable connecting the sensor to the thermostat, one at each end. Fair-Rite P/N0431167281, single wrap

Deviations From The Standard

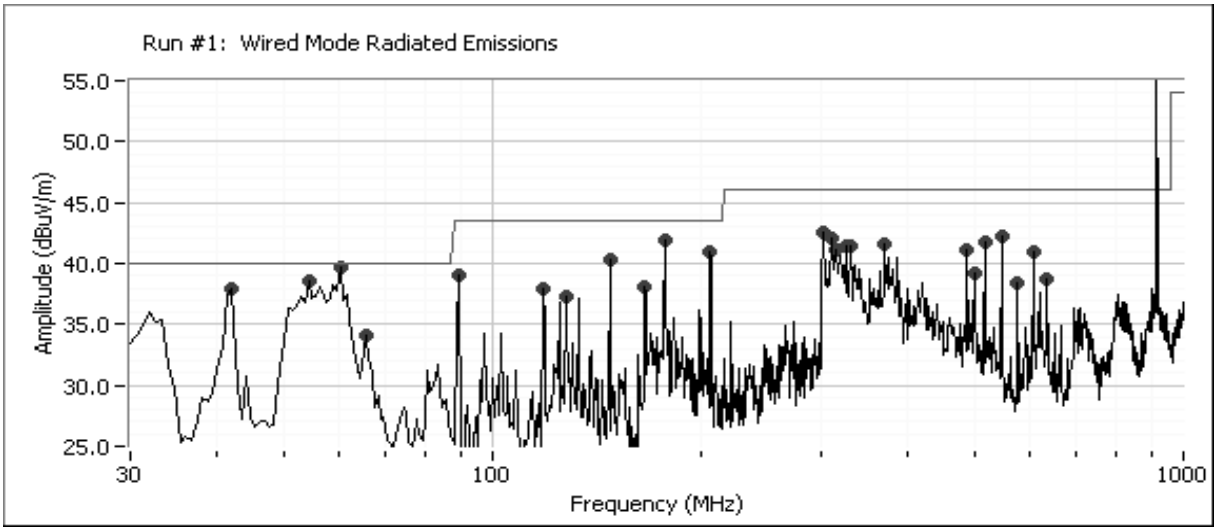
No deviations were made from the requirements of the standard.

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

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

Date of Test: 8/3/2005
Test Engineer: Mark Briggs
Test Location: Chamber #2

Temperature: 18 °C
Rel. Humidity: ??? %



Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
915.064	*60.7*	*H*	*46.0*	*14.7*	*Peak*	*114*	*1.7*	*CW Tx signal - should not be present*
58.990	39.7	H	40.0	-0.3	Peak	91	1.7	
914.933	45.2	H	46.0	-0.8	Peak	200	1.7	Signal close to CW Tx signal
176.943	42.0	V	43.5	-1.5	Peak	360	1.7	
41.638	38.0	H	40.0	-2.0	Peak	211	1.7	BB Noise
206.452	41.0	V	43.5	-2.5	Peak	119	1.7	
147.465	40.3	H	43.5	-3.2	Peak	211	1.7	
298.603	42.6	H	46.0	-3.4	Peak	281	1.7	BB
545.666	42.3	H	46.0	-3.8	Peak	264	1.7	
309.716	42.1	V	46.0	-3.9	Peak	275	1.7	
516.151	41.8	V	46.0	-4.2	Peak	193	1.7	
88.478	39.1	H	43.5	-4.4	Peak	181	1.7	
368.707	41.6	H	46.0	-4.4	Peak	283	1.7	NB and BB signals
53.842	35.5	H	40.0	-4.5	Peak	61	1.7	BB Noise
328.326	41.4	V	46.0	-4.6	Peak	277	1.7	BB

table continued on following page ...

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

Run #1, continued from previous page

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
486.662	41.1	H	46.0	-4.9	Peak	22	1.7	
331.718	41.0	V	46.0	-5.0	Peak	310	1.7	BB
604.644	40.9	H	46.0	-5.1	Peak	120	1.7	
165.801	38.1	V	43.5	-5.4	Peak	0	1.7	
117.967	37.9	H	43.5	-5.6	Peak	271	1.7	
64.037	34.1	H	40.0	-5.9	Peak	151	1.7	
127.156	37.2	H	43.5	-6.3	Peak	181	1.7	BB, intermittent signal
497.489	39.2	V	46.0	-6.8	Peak	309	1.7	BB
634.133	38.7	V	46.0	-7.3	Peak	30	1.7	
575.155	38.5	H	46.0	-7.5	Peak	274	1.7	

Note 1:	NB - narrowband; BB - broadband

Elliott

EMC Test Data

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

Run #2: OATS Measurements

Date of Test: 8/5/2005
Test Engineer: Chris Byleckie
Test Location: SVOATS #1

Temperature: 21 °C
Rel. Humidity: 68 %

Test notes:

If device fails try ferrite on interface cable to sensor. First try with ferrite by the thermostat, if necessary add one to the end of the cable by the sensor.

When measuring the signal close to the CW Tx signal (i.e. signal at 914.933 MHz) will need to do signal sub as it is very close to the transmit signal.

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
58.990	37.6	V	40.0	-2.4	QP	269	1.0	
575.155	43.2	V	46.0	-2.8	QP	302	1.0	
117.967	40.5	V	43.5	-3.0	QP	165	1.0	Note 2
575.155	42.9	H	46.0	-3.1	QP	151	1.3	
545.666	42.8	H	46.0	-3.2	QP	172	1.4	
914.933	42.4	V	46.0	-3.6	QP	344	1.0	Signal close to CW Tx signal
147.465	39.8	V	43.5	-3.7	QP	84	1.0	
545.666	42.0	V	46.0	-4.0	QP	308	1.0	
368.707	41.7	V	46.0	-4.3	QP	18	1.0	NB and BB signals
516.151	41.5	V	46.0	-4.5	QP	281	1.0	
914.933	41.3	H	46.0	-4.7	QP	77	2.2	Signal close to CW Tx signal
64.037	35.1	V	40.0	-4.9	QP	138	1.0	
309.716	40.5	H	46.0	-5.5	QP	210	1.0	
117.967	37.6	H	43.5	-5.9	QP	188	2.4	
176.943	37.6	V	43.5	-5.9	QP	121	1.0	
516.151	39.5	H	46.0	-6.5	QP	170	1.6	
486.662	39.0	H	46.0	-7.0	QP	163	1.3	
486.662	38.8	V	46.0	-7.2	QP	303	1.0	
604.644	38.6	H	46.0	-7.4	QP	220	1.6	
176.943	34.3	H	43.5	-9.2	QP	0	1.5	
53.842	30.0	V	40.0	-10.0	QP	131	1.0	BB Noise Note 1
368.707	36.0	H	46.0	-10.0	QP	281	1.0	NB and BB signals
309.716	34.8	V	46.0	-11.2	QP	86	1.0	
147.465	31.1	H	43.5	-12.4	QP	182	2.1	
206.452	31.1	V	43.5	-12.4	QP	0	1.0	Signal Substitution

table continued on following page ...

Client:	Smart Systems International	Job Number:	J60181
Model:	T6210 Occupancy Sensor	T-Log Number:	T60382
		Account Manager:	Mark Hill
Contact:	Robert Zirpoli		
Spec:	FCC 15.249, RSS 210	Class:	B

Run #2, continued from previous page

Frequency	Level	Pol	FCC B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
634.133	31.2	H	46.0	-14.8	QP	0	1.0	Signal Substitution
634.133	31.0	V	46.0	-15.0	QP	0	1.0	Signal Substitution
604.644	30.1	V	46.0	-15.9	QP	0	1.0	Signal Substitution
58.990	24.0	H	40.0	-16.0	QP	120	1.9	
41.638	20.3	V	40.0	-19.7	QP	0	1.0	BB Noise
165.801	23.8	V	43.5	-19.7	QP	0	1.0	
127.156	22.9	H	43.5	-20.6	QP	348	2.0	BB, intermittent signal
127.156	21.3	V	43.5	-22.2	QP	0	1.0	BB, intermittent signal
298.603	22.1	V	46.0	-23.9	QP	0	1.0	BB

Note 1:	Level was 40.2dBuV/m. Moved clip on ferrite from thermostat side of power supply cable to the wall wart side .
Note 2:	Level was 44.2dBuV/m. Added clip on ferrites to cable connecting the sensor to the thermostat, one at each end. Fair-Rite P/N0431167281, single wrap

Run #3: Maximized readings from run #2

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
58.990	37.6	V	40.0	-2.4	QP	269	1.0	
575.155	43.2	V	46.0	-2.8	QP	302	1.0	
117.967	40.5	V	43.5	-3.0	QP	165	1.0	Note 2
575.155	42.9	H	46.0	-3.1	QP	151	1.3	
545.666	42.8	H	46.0	-3.2	QP	172	1.4	
914.933	42.4	V	46.0	-3.6	QP	344	1.0	Signal close to CW Tx signal

EXHIBIT 3: Test Configuration Photographs

Uploaded as A Separate Attachment

EXHIBIT 4: Theory of Operation
Smart Systems International Model T6210 Occupancy Sensor

Uploaded as A Separate Attachment

EXHIBIT 5: Proposed FCC ID Label & Label Location

Uploaded as A Separate Attachment

EXHIBIT 6: Detailed Photographs
Smart Systems International Model T6210 Occupancy Sensor

Uploaded as A Separate Attachment

EXHIBIT 7: Installation Guide
Smart Systems International Model T6210 Occupancy Sensor

Uploaded as A Separate Attachment

EXHIBIT 8: Block Diagram
Smart Systems International Model T6210 Occupancy Sensor

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EXHIBIT 9: Schematic Diagrams
Smart Systems International Model T6210 Occupancy Sensor

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