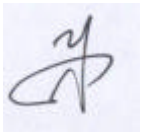
SKT

SK TECH CO., LTD.

Certificate of Compliance

Test Report No.:	**STR-02002U**		
NVLAP CODE:	**200220-0**		
Applicant:	**HITRON SYSTEMS INC.**		
Applicant Address:	109-19 MAJEON-RI, SAMJUK-MYEON, ANSUNG-CITY, KYUNGKI-DO, 456-880, KOREA		
Device Under Test:	**Remote Controller**		
FCC ID:	**LLIHSCR**	**Model No.:**	**HSCR50**
Receipt No.:	TEA-02-009	**Date of receipt:**	June 04, 2002
Date of Issue:	July 03, 2002		
Location of Testing:	**SK TECH CO., LTD.** 820-2, Wolmoon-Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea		
Test Procedure:	**ANSI C63.4 / 2000**		
Test Specification:	**FCC Title 47 Part 15 Subpart C**		
Equipment Class:	**Part 15 Security/Remote Control Transmitter**		
Test Result:	The above-mentioned device has been tested and passed.		

Tested & Reported by: *Jong-Soo, Yoon*



2002. 07. 11

Signature *Date*

Approved by: *Kyu-Sun, Kim r*

2002. 07. 11

Signature *Date*

Other Aspects:	
Abbreviations:	**· OK, Pass = passed · Fail = failed · N/A = not applicable**

- **This test report is not permitted to copy partly without our permission.**
- **This test result is dependent on only equipment to be used.**
- **This test result is based on a single evaluation of one sample of the above mentioned.**
- **This test report must not be used to claim product endorsement by NVLAP or any agency of the U.S Government.**
- **We certify that this test report has been based on the measurement standards that is traceable to the national or International standards.**

NVLAP®

NVLAP Lab. Code: 200220-0

》》 Contents 《《

1. General

These tests were performed using the test procedure outlined in ANSI C64.4, 1992 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.231, for periodic transmitter and the equipment under test has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by SK Tech Co., Ltd. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. Test Site

SK TECH Co., Ltd.

2.1 Location

820-2, Wolmoon Ri, Wabu-Up, Namyangju-Si, Kyunggi-Do, Korea

This test site is in compliance with ISO/IEC 17025 for general requirements for the competence of testing and calibration laboratories.
This laboratory is accredited by NVLAP for NVLAP Lab. Code: 200220-0 and DATech for DAR-Registration No.: TTI-P-G155/97-10

2.2 List of Test and Measurement Instruments

Equipment Type	Manufacturer	Model No.	Serial No.	Cal. Due Date
EMI Test Receiver	Rohde&Schwarz	ESVS 10	825120/013	02. 2003
EMI Test Receiver	Rohde&Schwarz	ESVS 10	834468/008	11. 2002
Spectrum Analyzer	Advantest	R3361A	11730187	06. 2002
Amplifier	H.P	8447F	3113A05153	06.2003
Log Periodic Antenna	Schwarzbeck	UHALP9107	1819	02.2003
Biconical Antenna	Schwarzbeck	BBA9106	91031626	02.2003
Horn Antenna	Schwarzbeck	SAS-200/571	304	04.2003
Antenna Mast	TOKIN	5907	N/A	N/A
Antenna & Turntable controller	TOKIN	5906	N/A	N/A
50O Switcher	Anritsu	MP59B	6100214538	N/A

2.3 Test Date

Date of Application : June 04, 2002
Date of Test : June 17, 2002 ~ June 28, 2002

2.4 Test Environment

See each test item's description.

3. Description of the Equipment Under Test

The EUT is a small remote control transmitter that sends a control code to a receiver located in a camera using the method of the FSK modulation, and has ten buttons for the purpose of controlling the camera manufactured by HITRON SYSTEMS INC.
The EUT is manually operated and deactivated automatically within 40msec after pressing any button to transmit the control code.

3.1 Rating and Physical Characteristics

Power source	3 X 1.5V (AAA battery)
Output Power	5mW under
Operating frequency	433.92 MHz
Data Rate	2400 bps
Operating temperature	-20 ~ +60℃
Etc	Binary FSK modulation (deviation 64KHz)

3.2 Equipment Modifications

The test sample was programmed to send its activation code repeatedly by using modified firmware which was programmed into the sample's processor, during the field strength measurements of the fundamental and spurious/harmonic emissions in FCC Section 15.231(b), to permit radiated emission measurements to be readily performed. This unit was then returned to normal operation for testing of the transmission duration, duty cycle and occupied bandwidth.

3.3 Submitted Documents

N/A

4. Measurement Conditions

4.1 Description of test configuration

The EUT was powered using three new 1.5V AAA batteries and placed on a tabletop. The radiated data were taken in the peak detector function while the EUT sent its activation code repeatedly. The measurements of the transmission duration, duty cycle and occupied bandwidth were performed in the normal operation at the operating frequency. All initial investigations were performed with a spectrum analyzer or EMI receiver in manual mode scanning the frequency range continuously. Photographs are included in Test set up photos.

4.2 List of Peripherals

Equipment Type	Manufacture	Model	Serial Number

N/A

4.3 Type of Used Cables

Description	Length	Type of shield	Manufacturer

N/A

4.4 Uncertainty

Radiated disturbance

Uc (Combined standard Uncertainty) = ± 1.9 dB

Expanded uncertainty U = KUc

K = 2

∴ U = ±3.8dB

5. Test and Measurements

5.1 Transmission Requirement according to § 15.231(a)(1)

Results: **PASS**

The results of the transmission duration and duty cycle are shown in Appendix 1. The transmission duration was 39.75 ms and the duty cycle correction factor was computed to be –8.0 dB.

The intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, such as voice or video, and data transmissions are not permitted.
According to §15.231(a)(1), a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

The test of the transmission duration was performed in the normal operation at the operating frequency. And the duty cycle correction factor was used to convert peak-detected readings to average readings. This factor was calculated from the time domain trace. With the transmitter setup to transmit for maximum pulse density, the time domain trace was displayed on the spectrum analyzer. This trace was obtained by tuning center frequency to the transmitter frequency and then setting zero-span. The sweep time was then adjusted in order to display one full pulse train. The duty cycle correction factor was determined using the worst-case duty cycle. The transmission duration was measured, as the markers were set at beginning and end of a word period. The EUT transmits a control code continuously without OFF time during the duration of the data transmission, because the EUT uses the method of the Binary FSK modulation. The duty cycle correction factor was then calculated as following:

Calculation of Duty cycle correction factor (Average factor)

Transmission duration = 39.75 ms
Transmitter Duty Cycle = 39.75 %
Correction Factor = 20 log(0.3975) = – 8.0 dB

5.2 Field strength of emissions according to § 15.231(b)

Results: **PASS**

The results of the field strength of the fundamental and spurious/harmonic emissions are shown in *Appendix 2*. The worst-case emission level is 49.0 dBuV/m @ 3m at 1302 MHz, This is 5.0 dB below the specification limit.

According to §15.231(b), the field strength of emissions from intentional radiators operated under these frequency bands shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (uV/m @ 3m)	Field strength of spurious emissions (uV/m @ 3m)
260–470	3,750 to 12,500	375 to 1,250

<*Use quasi-peak or average detector function*>

Measurement Procedures

Preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters. The EUT was programmed to operate in continuous transmit by using modified firmware which was programmed into the sample's processor, and then was placed on the top of the 0.8 meter high, 1 x 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 300 MHz using the biconical antenna and from 300 to 1000 MHz using the log-periodic antenna. Above 1GHz, linearly polarized double ridge horn antenna was used.

To obtain the final test data, the EUT was arranged on a turntable situated on a 4x4 meter at the Open Area Test Site. The EUT was tested at a 3-meter test distance. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set to peak detector function and specified bandwidth with "max hold" mode. The presence

of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.

Calculation of the field strength limits by linear interpolation (F=433.92)

Field strength limit of the fundamental frequency:

Limit = (F-260)(12500-3750)/(470-260) + 3750 = 10996.6 uV/m = 80.825 dBuV/m*

Field strength limit of spurious emissions:

Limit = (F-260) (1250-375)/(470-260) + 375 = 1099.66 uV/m = 60.825 dBuV/m*

5.3 Occupied bandwidth according to § 15.231(c)

Results: **PASS**

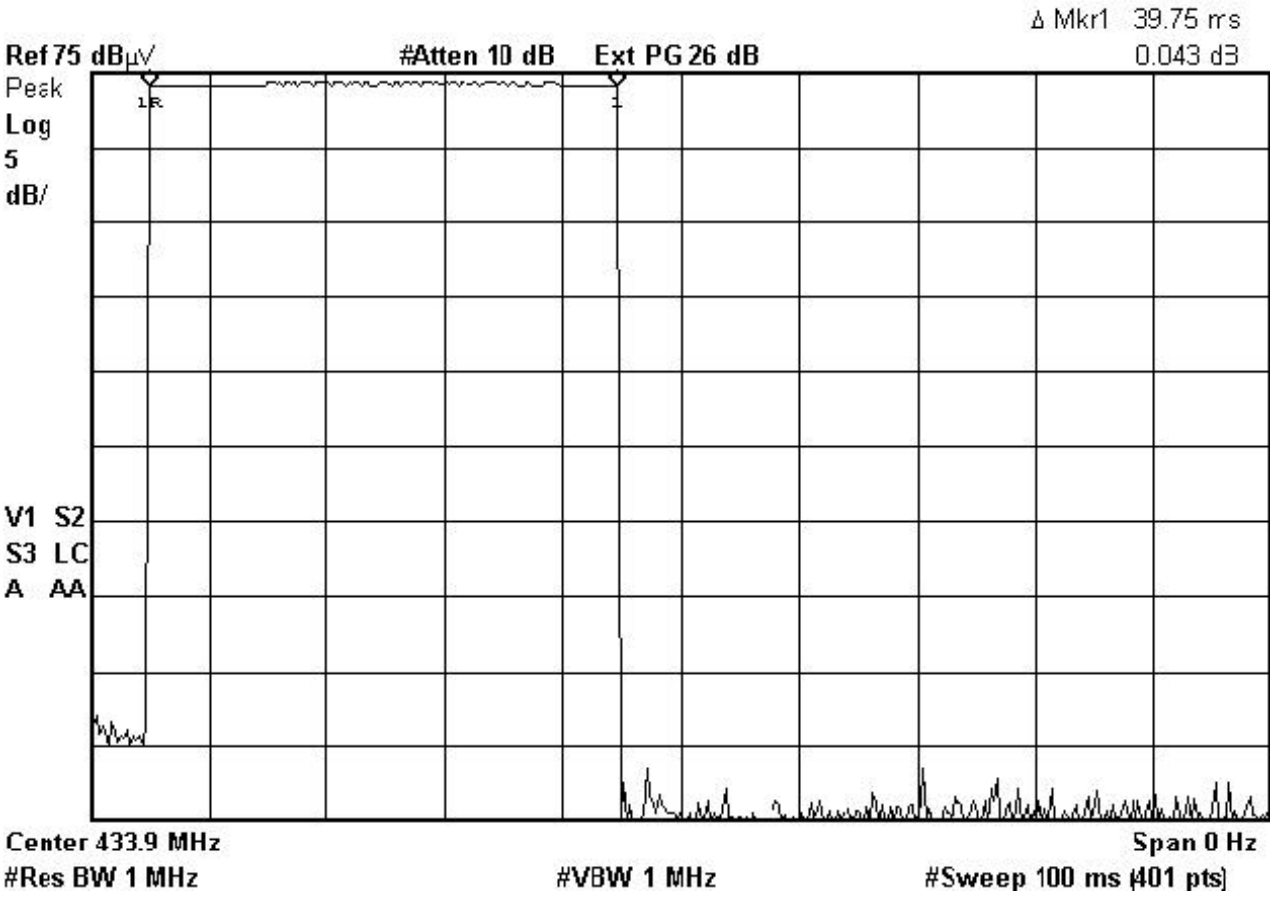
The measured spectrum of the signal is shown in Appendix 3. From the plot, we can see that in the worst case, the occupied bandwidth is 138.4 KHz.

This test was performed to demonstrate that the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. The measurement was performed at the operating frequency, 433.92MHz. The spectrum trace data around fundamental frequency of the EUT was obtained with the spectrum analyzer in "Max Hold" mode. The bandwidth value was determined between the two points of 20dB down from the modulated carrier.

Calculation of the bandwidth limit

Limit = F ´ 0.0025 = 433.92 MHz ´ 0.0025 = 1.0848 MHz

Appendix 1: Figure of the measured Transmission Duration



Appendix 2: Table of the measured Field strength

Frequency (MHz)	Pol. (V/H)	Ant. Height (m)	Table Angle (°)	Reading (dBuV)	AFCL (dB/m)	Amp. Gain (dB)	Avg. Factor (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
434.01	H	2.1	297	88.7	21.7	27.3	- 8.0	75.1	80.8	5.7
868.01	H	1.0	93	58.0	30.6	26.7	- 8.0	53.9	60.8	6.9
1302.02	V	1.0	93	51.9	31.7	26.6	- 8.0	49.0	54.0	5.0
1736.04	V	1.0	93	42.8	35.3	26.4	- 8.0	43.7	60.8	17.1

1. *H = Horizontal, V = Vertical Polarization*
2. *AFCL = Antenna Factor and Cable Loss*
3. *Avg. Factor = Duty Cycle correction factor derived from Section 5.1 of this report, page 7.*
4. *All readings were taken utilizing a peak detector function at a distance of 3 meters.*
5. *The frequency range was scanned from 30MHz to 4.5GHz. All emissions not reported were more than 20dB below the specified limit.*

Margin (dB) = Limit – Actual

[Actual = Reading + AFCL – Amp. Gain + Avg. Factor]

Appendix 3: Figure of the measured Occupied bandwidth