



Silitek Corporation

Product Specification

**Model : Silitek-Scorpion
RF Wireless Keyboard**

Doc. No.:

Version: V0.1

Department: Wireless BU

Date: April-23-2001

Approved	Check By	Prepared by



Table of Contents

1. Introduction

This Product Specification is proposed for CISCO's wireless keyboard project named as Scorpion. It is subject to be modified for CISCO's preference.

This keyboard is a RF keyboard of 2.4Ghz with the pointing device known as R2. The keyboard shall operate from two standard AA batteries with a desired operating life of 4 months. There is one channel-selection button under the keyboard for channel setting purpose.

The receiver provides 32 channel operation to prevent frequency interference. The receiver interface with the system through the PS/2 connection. The receiver shall have four LEDs that indicate Caps Lock, Scroll Lock, Num Lock and Data. There is one channel-selection button under the receiver for channel setting purpose.

The keyboard, receiver and drivers shall be compatible with all operating systems that are Win95, Win98 and Windows 2000. The transmitter / receiver should have a range of up to 50 feet desired.

1.1 Main Feature

- Advance RF technology ,adopt 2.4GHz frequency band designed.
- Provide Multi-RF channel that allow several same devices to be used in a common nearby space zone at same time.
- Low profile keyboard designed to offer a more comfortable operating.
- Detachable palm rest attached to keyboard.
- 14 Multimedia keys.
- Low power consumption designed
- Operates with two AA size batteries
- Advance R2 pointing device
- Ergonomic design that comfortable to handle and easy to be portable.
- Eight channels
- Operation range over 50 feet

1.2 Key Definition of keyboard

- Key cap layout: QWERTY layout, Multiple languages (US and Europe)
- Key cap number: 99 keys in US and 100 keys in Europe
- Function keys: half scale key



1.3 Standard Key definition:

- The layout for US is 86 key while 87key for European language
- Numeric pad keys are performed by the combination keys with “Fn” key or in “NumLock” toggle function .

1.4 Multimedia key (change code type)

- 12 programmable keys to be defined by CISCO



2. Mechanical Specifications

2.1 Dimensions and Weight

2.1.1 Unpacked Dimensions and Weight

Dimensions: (Tolerance : ± 1 mm)

Length	Depth	Height
361.5 mm	177.4 mm	41.0 mm

Weight: 750 g (without batteries) (Tolerance: ± 20 g)

2.1.2 Packed Dimensions and Weight (including packing)

- **Dimensions:** (Tolerance : ± 3 mm)

	Length	Width	Height
Gift box packing	420 mm	200 mm	50 mm
Carton packing	530mm	216 mm	440 mm

- **Weight:**

Carton packing	8.0+/- 0.2 Kg (N.W)
	10.2+/- 0.2 Kg (G.W)

Note: 10 units per carton packing

2.2 Material

Upper casework	: ABS, 94HB
Lower casework	: ABS, 94HB
Palm Rest	: ABS, 94HB
Insert Panel	: ABS, 94HB
IR Lens	: LEXAN GE#121R-21051, 94HB
Keycaps	: ABS, 94HB
Led Lens	:Acrylic
Battery Cover	: ABS, 94HB
Rubber Pad	: Silicon Rubber
Membrane	: PE, 94VTM-2
Rubber Sheet	: Silicon Rubber, 94HB
Rubber Foot	: NR
Battery Spring	: Stainless Steel
Buffer	:NR
Metal Panel	:SECC

2.3 Color

Upper casework	: P222C MT-11010(OPTION)
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Lower casework	: Cool Gray 1C MT-11010
Battery Cover	: Cool Gray 1C MT-11010
Key Caps	: Cool Gray 1C(Light Key),Cool Gray(Dark Key) 4C
Palm Rest	:Cool Gray 1C MT-11010
Insert Panel	:Cool Gray 1C MT-11010
I-Point Rubber	: P444C MT-11010
Lens	: LEXAN GE#121R-21051 default
Rubber Foot	: Cool Gray 1C

2.4 Printing

Graphics on key caps : Laser & Screen P222C (“Fn” Combination keys)

2.5 Standard Key Switch

Switch Life: 10 millions cycles under normal operation.
After 5 millions return force deviation less than 20% from original force.
Peak Force: 60 ± 15 grams
Return Force: 18 grams min
Total Travel: 3.4 ± 0.4 mm @ 100g. (Space Bar @ 120g)
Travel to Make: 2.5 ± 0.3 mm
Click Rate : 30% min
Typical curve of force response
Typical curve of force response as Fig 2-1

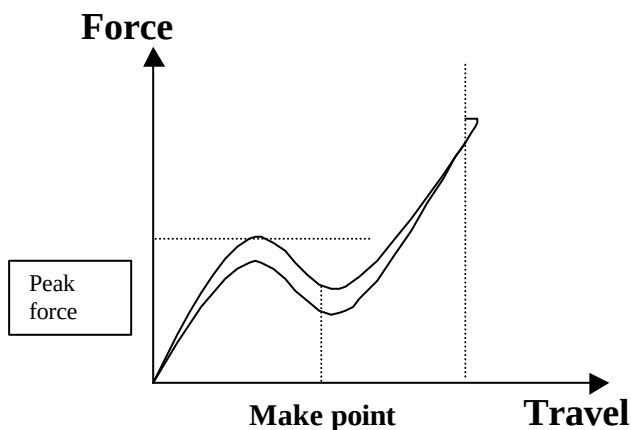


Fig 2-1

2.6 Specification of Key Cap

2.6.1 Pull Force
1.5 Kg min. to pull up the key caps from frame.

2.6.2 Gaps



Gaps between adjacent row and column of keys: 1.05 +/- 0.3 mm

2.6.3 Static Wobble

Wobble of keys defined as movement of points from its origin when force applied.
Under normal typing force, the wobbles

for standard keys	< 0.5 mm
for space bar	< 1.65 mm
for other special keys	< 0.75 mm

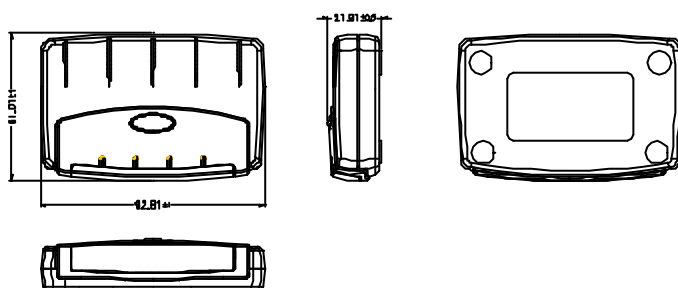
2.7 Multimedia Key Buttons

Without multimedia key.

2.8 Abrasion

Keycap printing	: 30 cycles, Force: 1 Kg, Eraser: #1107.
Logo printing	: 10 cycles, Force : 1 Kg, Eraser: #1107.

2.2 RECEIVER



2.2.1 Dimensions and Weight

Dimensions:

Length	: 92.81 mm ± 1mm
Depth	: 61.01 mm ± 1mm
Height	: 21.91 mm ± 1mm

Weight: 150 g ± 10g

2.2.2 Material

Upper Case	HI-PS,94HB
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Lower Case	HI-PS,94HB
Channel Button	HI-PS,94HB
Lens	PC
LED Lens	ACRYLIC
Insert Panel	HI-PS,94HB
Foot Pad	NR
Cable	UL material

2.2.3 Colors

Upper Case	Cool Gray 1 C
Lower Case	Cool Gray 1 C
Channel Button	Cool Gray 1 C
Lens	Smoke Gray
Insert Panel	Patone 647 C
Foot Pad	Black
Cable	Cool Gray 1 C



3. Electrical Specification

RF technology : Silitek proprietary 2.4 GHz RF module.

RF module: 2.4GHz / 16 Channels

Channel selection button: one on transmitter and one on receiver.

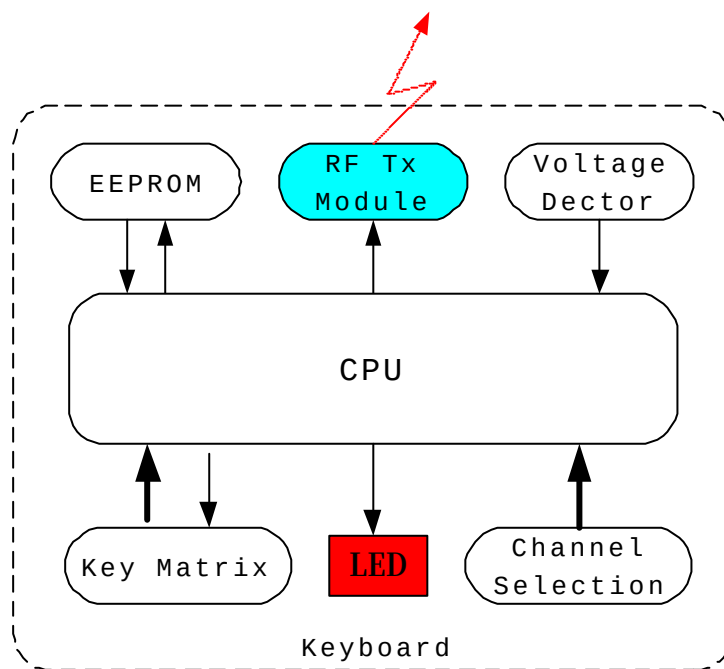
Receiver : USB interface connecting with PC host.

3.1 Keyboard Transmitter

System structure

The functional block diagram of SK7255 Keyboard is shown below. The components are described in the following.

- CPU: using EM78P451 (ELAN Microelectronics CORP.)
- EEPROM: using ATC24C02, record the Channel No. and Device ID (Optional).
- RF Tx Module: Silitek SR-2412A radio frequency transmitter module.
- Voltage Detector: active if battery voltage is less than 2.5 Volt.
- Key Matrix: 8x18 key pads
- LED: shown if battery low. It also turns on in the process of channel broadcasting, and power-on setting.
- Channel Selection: C.S. key to change RF channel.



Block Diagram of Keyboard

3.1.1 Operating voltage

The operating voltage range for keyboard is 2.5 ~ 3.3 Vdc. It is capable of supplying a load current up to 25 mA(Maxmum). There are 2 AA batteries providing 3.0V for operation.

3.1.2 Power consumption

The power consumption is less than 15 mA (Typical) at operation mode and 100uA at sleep



mode.

3.1.3 Low Power Indicator

Low power indicator on the screen will be lit when the battery voltage in the keyboard transmitter is less than 2.5V.

3.1.4 Circuitry

PCB Assembly

Microprocessor EMC 451 QFP 44 pin is applied. The module is placed on top of the PCB main board. There is also an antenna connected to this PCB.

Membrane

Key matrix traces with switch contact fingers are placed and routed on three layers . Switch contacts and route path are printed with silver ink. The contact resistance is less than 400 ohm.

Connecting PCBA and membrane

Mechanical clamping mechanism provides contact between membrane and PCBA for connection scan lines and return lines on membrane key matrix to PCBA circuits via Contact fingers.

3.1.5 Battery Life

The battery life under the operating condition of 10 keystrokes/sec continuous use is 80 hours for alkaline type and 30 hours for Zinc-Carbon type.

Typical battery life of normal using : 4 months minimum

3.1.6 Effective Transmission Distance

Effective transmission distance is 2 meters. Effective transmission is defined as the distance where no one character in a continuous **transmission of 40** characters is dropped.

3.2 Receiver

Receiver Interface: USB

Cable length: 1.2 meters.

3.2.1 Operating voltage

Voltage supplied to keyboard: 5+/-0.25 VDC

With ripple lower than 150mv, and capable of supply load current up to 100 mA with voltage drop less than 0.25 VDC

3.2.2 Current consumption

Under nominal 5 VDC power supplied, typical current

Consumption is 90 mA +/- 10% with three LED indicators on.



3.2.3 Power consumption

Under normal operation, the power consumption of total unit will be less than 0.5/0.8 Watt.

3.2.4 Signal timing and level

Level and timing of signals presented on data and clock Pins are compatible with both TTL or MOS termination on the host PC motherboard.

3.2.5 Pin outs of 4 pin USB min-DIN connector

Compatible with USB spec V1.1.

3.2.6 LED indicators

There are four indicators on the receiver, including Num Lock, Cap Lock, Scrol Lock and Data. The Data indicators will be ON only when data is receiving from the transmitter. All indicators set ON will be turn OFF during the Suspend or Sleep modes.

3.2.7 Circuitry

3.2.7.1 PCB Assembly

Microprocessor Cypress 63743 and ATMEL 24C02N is applied. The module is placed on top of the PCB board. .

3.2.7.2 Cable

Pin outs of cable at mini-DIN end connector and is USB compatible. The cable length is 1.2 meter.

3.3 Function description

3.3.2 Illegal ghost keys free

Key matrix layout has been properly managed such that no ghost key occurs for any three key combination. Ghost key is defined as that three key combination where a valid third key falls in the ‘#’ pattern in the key matrix formed by the preceding valid two key combination. Normally in this case, the third key will be masked without sending any code because the third key and fourth key in this ‘#’ patterns are confusing the microprocessor of the keyboard. If the third key was not masked properly, the ghost key—different key presses having the same electrical connection in scan lines and return lines matrix – will occur.

Ghost key exceptions, which are legal –Accepted by Microsoft

1 st Key	2 nd key	3 rd key
L WIN	R WIN	Up Arrow
R WIN	L ALT	Key 56
R WIN	R ALT	Key 42
R WIN	R CTRL	Caps Lock



R WIN	L CTRL	Caps Lock
L WIN	L ALT	Key 107
L CTRL	L SHIFT	Pause, Caps Lock
L CTRL	R SHIFT	Pause, Caps Lock

3.3.3 Interface specification with host PC

The keyboard uses bi-directional serial interface to transmit and receive signals between the keyboard and the host unit.

3.3.4 USB Mode Protocol

Data transmission from the keyboard consists of D+/D- different data stream sent out serially over the 'D+/D-' lines.

3.3.5 Power-on Setting

RX: In order to reset the contents in the EPROM, user could press the C.S. key before mounting the batteries. In progressing of power on setting, the LED will turn on ,after initialization setting, the LED will turn OFF and the C.S. key could be released.

3.3.6 Watch dog function

Watchdog reset CPU when error occurs. Its timer is absolute and not relative to the crystal. For maximum time-out, it is about 2 sec.

3.3.7 Sleep function

There are two types of sleep modes. They are defined as following.

Sleep1: When keys stay pressed and not changed over **than 30 sec, it** would enter **sleep mode**. In this mode, it use watch dog time-out to wake up. When waking up, it will detect whether pressed keys are changed. If status is not changed, it will **enter Sleep1** again, else, it will enter normal operation.

Sleep2: When no key is pressed over 1 sec, keyboard will enter IDLE mode to reduce power consumption.

3.3.8 Low voltage warning

When the battery voltage is lower than 2.5 voltage, CPU will turn on warning LED when scanning keys. The transmitter will also inform the receiver the status of Power Low.

3.4 Channel Selection

3.4.1 Channel and ID default setting

	Channel	ID
K/B	0	0



Note: preset in the production line as default setting before delivery

3.4.2 Channel and ID numbers

Channel: 8 channels to Keyboard

ID: There are 16 ID from 0000 to 1111 for keyboard and another same 16 for Mouse on each channel.

Keyboard		Mouse	
1	0000	1	0000
2	0001	2	0001
3	0010	3	0010
4	0011	4	0011
5	0100	5	0100
6	0101	6	0101
7	0110	7	0110
8	0111	8	0111
9	1000	9	1000
10	1001	10	1001
11	1010	11	1010
12	1011	12	1011
13	1100	13	1100
14	1101	14	1101
15	1110	15	1110
16	1111	16	1111

Note: The ID indication is to prevent one keyboard/Mouse controlling more than one receiver when more than one set device are in the same channel.

3.4.3. EEPROM

There is one EEPROM IC in the Receiver and provided a EEPROM in Transmitter.

3.4.4 Operations

3.4.4.1 Battery removal

When the batteries are removed from the keyboard, the channel goes back to its default setting on the keyboard while the channel in Receiver is no change.

When batteries are removed and re-installed, the channel on the Tx is different than the channel on the Rx. Therefore, a Channel Reset procedure is to follow.

3.4.4.2 Channel Reset

Case1: For Tx W/O EEPROM

Auto reset when batteries are removed and re-installed.

Case2: For Tx with EEPROM can be reset by following step:

Tx: Keep pressing channel button then install batteries to K/B and



release pressing channel button when indicator is light up

Rx: Keep pressing channel button then make the plug connected to Host PC; and release pressing channel button when “Data” indicator lighting up consequently turn off. (POR reset completed).

3.4.4.3 Channel Change

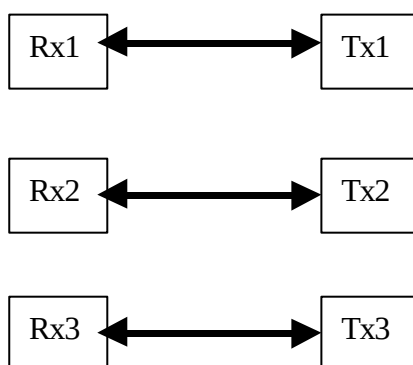
Situation: When there is an interference suspected.

Procedure: 1. press the channel button on the Tx once. The Rx receives new channel setting automatically. (The DATA LED on the Rx flashes quickly and turns off.)

Case1: Only one set of Keyboard or/and Mouse with the Receiver

Channel is in the default setting. No manual setting is required when initial use.

Case 2: For more than one set of same devices within available transmission distance



Follow the Channel Reset procedure from the first set, second set and third set ...etc.

Channel display

The computer screen will display the Channel number.

3.4.4.5 Action before packaging – Channel Reset **** Manufacturer Note****

Tx: there is no need to reset.

Rx: While holding the receiver channel button, plug in the USB cable to the system.



4. RF Module

4.1 Receiver - Model Number: SR-2423A

- SK-2423A is a 2.4GHz RF receiver module. The module is designed in compact size, low power consumption and stable RF operating characteristic.
- SR-2423A is a 2.4GHz RF receiver module designed in FSK technology to provide ISM band wireless data communication. Multi channels are specially designed to enhance the function of automatic frequency turning as well as digital PLL technology.

4.1.1 Mechanical requirements

Top shield enclosure material: **Ferrous**

PCB dimension: 24 mm long x 37 mm wide x 7 mm high

Packing: TBD

4.1.2 Hardware requirements

No	Parameter	Specification	
1	Frequency band	2443.7 ~ 2459.2 MHz	
2	Channel	16 for Keyboard, 16 for Mouse	
3	Technology	PLL	
4	Channel spacing	1MHz / each device application	
5	Receive sensitivity (BER=0.1%)	-70dBm	
6	Demodulation mode	FSK	
7	Frequency deviation	60KHz	
8	Maximum data rate	30Kbit/s	
9	Power Consumption	Operation mode 25mA	
10	Selectivity	45dB	
11	EMI out of band spurious emission	Operation mode	Idle mode
	30MHz ~ 1 GHz	-36dBm	-57dBm
	1 GHz ~ 12.75GHz	-30dBm	-47dBm
	1.8GHz ~ 5.3GHz	-47dBm	-47dBm
12	Antenna	Track on board	

Operating angles: Omni-direction

ESD protection test: **TBD**



4.2 Transmitter - Model Number: SR-2412A

- SR-2412A is a 2.4GHz RF transmitter module designed in FSK technology to provide ISM band wireless data communication. Multi channels are specially designed to enhance the function of automatic frequency turning as well as digital PLL technology.

4.2.1 Mechanical requirements

Top shield enclosure material: Ferrous

PCB dimension: 18 mm long x 20 mm wide x 6 mm high

4.2.2. Hardware requirements

No	Parameter	Specification	
1	Frequency band	2454.4 ~ 2469.9 MHz	
2	Channel	16 for Keyboard, 16 for Mouse	
3	Technology	PLL	
4	Channel spacing	1 MHz / each device application	
5	Transmission Power	-25dBm $\pm$ 5dBm	
6	Modulation mode	FSK	
7	Frequency deviation	60KHz $\pm$ 15KHz	
8	Maximum data rate	30Kbit/sec.	
9	Power Consumption	Operation mode 8mA Idle mode 0.08mA	
10	EMI in band spurious emission $\pm$ 550KHz	-20dB	
11	EMI out of band spurious emission	Operation mode	Idle mode
	30MHz ~ 1 GHz	-36dBm	-57dBm
	1 GHz ~ 12.75GHz	-30dBm	-47dBm
	1.8GHz ~ 5.3GHz	-47dBm	-47dBm
12	Antenna	Track on board	

Operating angles: Omni-direction

ESD protection test: TBD



5. Reliability and Environmental Characteristics

5.1 Environment Specification

5.1.1 Operation Specification

- Temperature : 5 °C to 40 °C
- Humidity : Relative humidity under 80% without condensation
- Altitude : 0 to 15,000 feet

5.1.2 Storage Specification

- Temperature : -25 °C to 55 °C
- Humidity : Relative humidity under 95% without condensation
- Non-operating shipping: -40 °C to 60 °C
- Altitude : 0 to 30000 feet

5.2 Temperature and Humidity Test

5.2.1 High Humidity Operation

Test Condition

Transmitter put in a chamber at 40°C and 80% RH with power turned on for 48 hours.

Test Equipment

- Temperature / Humidity chamber
- Standard test receiver
- Silitek test program

Test Procedure

1. Set the chamber's temperature to 40°C and humidity to 80% RH.
2. Put both the transmitters into the chamber.
3. The transmitter should have brand new batteries in it.
4. Wait for 48 hours. Remove the transmitter from the chamber set to room temperature 2 hours then perform function check.

5.2.2 Low Temperature Operation

Test Condition

Transmitter put in chamber at 5°C with power turned on for 48 hours.

Test Equipment

- Temperature / Humidity Chamber
- Standard test receiver



- Silitek test program

Test Procedure

1. Set the chamber's temperature to 5°C.
2. Put both the transmitters into the chamber.
3. The transmitter should have brand new batteries in it.
4. Wait for 48 hours. Remove the transmitter from the chamber and set to room temperature 2 hours then perform function check.

5.2.3 High Temperature and High Humidity Storage

Test Condition

Transmitter put in the chamber at 60°C and 95%RH for 96 hours.

Test Equipment

- Temperature / Humidity Chamber
- Standard test receiver
- Silitek test program

Test Procedure

1. Set the chamber's temperature to 60°C and 95% RH.
2. Put both the transmitters into the chamber.
3. Wait for 96 hours. Remove the transmitter from the chamber and wait for them to return to room temperature 2 hours then performing function check.

5.2.4 Low Temperature Storage

Test Condition

The transmitter is put in chamber at -40°C for 96 hours.

Test Equipment

- Temperature / Humidity Chamber
- Standard test receiver
- Silitek test program

Test Procedure

1. Set the chamber's temperature to -40°C.
2. Put transmitter into the chamber.
3. Wait for 96 hours. Remove the transmitter from the chamber and set to room temperature for 2 hours then performing function check.



5.2.5 Temperature Cycling

Test Condition

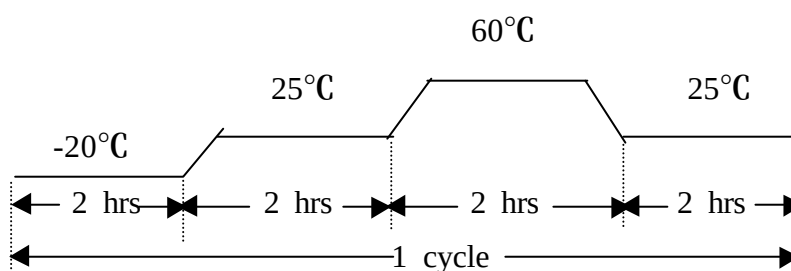
Both the transmitter and receiver are set to various temperature and humidity conditions for 10 cycles.

Test Equipment

- Temperature / Humidity Chamber
- Standard test receiver
- Silitek test program

Test Procedure

1. Put both the transmitter and receiver into the chamber.
2. Set the chamber's temperature to -20°C . Wait for 2 hours
3. Change chamber's temperature to 25°C . Wait for 2 hours.
4. Change chamber's temperature to 60°C with 95% RH. Wait for 2 hours.
5. Adjust chamber's temperature back to 25°C . Wait for 2 hours.
6. Repeat procedure 2 to 5 for 10 cycles.



5.2.6 Altitude Test

5.2.6.1 Test Condition

Both the transmitters to the altitude chamber for total 6 hours.

5.2.6.2 Test Equipment

- Altitude & Temperature Chamber
- Standard test receiver
- Silitek test program

5.2.6.3 Test Procedure

Put both the transmitters into the altitude chamber.

0 feet, 25°C . Wait for 2 hours

15000 feet, 0°C . Wait for 2 hours.

30000 feet, -40°C . Wait for 2 hours.



5.3 Drop Test (Packaged)

5.3.1 Test Condition

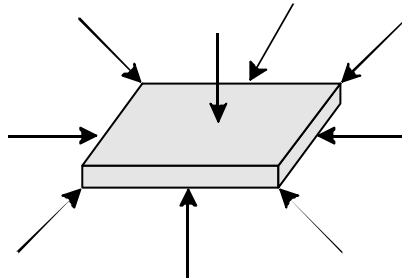
Packaged keyboard is dropped onto carpete floor.

5.3.2 Test Equipment

- Drop Tester
- Standard test receiver
- Silitek test program

5.3.3 Test Procedure

1. Set the height of drop tester to 76 cm.
2. Use carpet floor surface.
3. Let the keyboard package fall on 4 corners and 6 faces one at a time.



4. Check if both transmitter and receiver are still functioning.

5.4 Drop Test (Naked), Two conditions

5.4.1 Test Condition

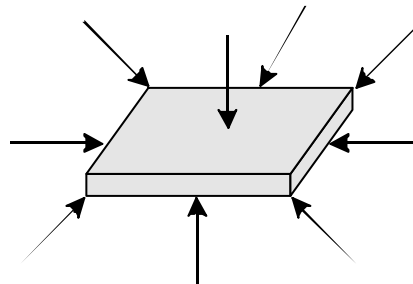
Naked keyboard is dropped onto carpet floor surface.

5.4.2 Test Equipment

- Drop Tester
- Standard test receiver
- Silitek test program

5.4.3 Test Procedure

1. Set the height of drop tester to 76 cm. Drop onto carpet floor surface.
2. Set the height of drop tester to 38 cm. Drop on steel floor surface.
3. Let the keyboard fall on 4 corners and 6 faces one at a time.





4. Check if both transmitter and receiver are still functioning.

5.5 Vibration Test (Packaged)

5.5.1 Test Condition

Vibrate keyboard at various frequencies.

5.5.2 Test Equipment

- Vibration Tester
- Standard test receiver
- Silitek test program

5.5.3 Test Procedure

1. Set the amplitude to 1 mm and frequency from 10 Hz to 55 Hz period 30 second, and next is from 55 Hz to 10 Hz period 30 second, setting total of test cycle is 60 times.
2. Insert the transmitter with new batteries.
3. Put the keyboard package on vibration table. Start vibration tester.
4. Test for 1 hours per 3 axis.
5. Check if both transmitter and receiver are still functioning. The batteries should not drop out.

5.6 Battery Cover Strain Relief Test

5.6.1 Test Condition

Normal condition.

5.6.2 Test Equipment

- Standard test receiver
- Silitek test program

5.6.3 Test Procedure

1. Insert new batteries into transmitter and close the battery cover.
2. Open the cable covers and removes the battery sets.
3. Repeat item 1 and 2 to 100 cycles.
4. Check if both transmitter and receiver are still functioning. The batteries should not drop out, and the battery cover mechanical shall no any of degradation.



6. Labeling and Packing

6.1 FCC Label

- ◆ A FCC label shall be stacked on the central area of the bottom surface of keyboard.

6.2 Packing

6.2.1 Color Box

Each keyboard unit shall be packed with color box or another style box according to Customer requesting.

6.2.2 Carton

Each carton packing shall contain ten pcs keyboard unit.

6.3 Pallet and Quantity

A standard shipping will take one of the following:

Quantity per Pallet: 192 PCs

Quantity per 20 feet Container: 3840 PCs

Quantity per 40 feet Container: 7680 PCs

7. Regulation Conformance

7.1 Safety

UL/CUL , TUV-GS

7.2 EMC

FCC, CE



Appendix: Keyboard Layout:

