SAMSUNG ELECTRONICS

# EMI TEST REPORT

According to FCC Part 15 Subpart B/Class B

**Product : Wireless Hand PC**
**Model No. : S160**

**FCC ID : A3LS160**

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2. *This test reports does not constitute an endorsement by NIST/NVLAP or U.S Government.*
3. *This test report is to certify that the tested device properly complies with the requirements of FCC Rules and Regulations Part 15 Subpart B Unintentional Radiators.*
   *All tests necessary to show compliance to the requirements were and these results met the specifications requirement.*

**Date of test :** August 2, 2002 ~ August 5, 2002

**Issued Date :** August 14, 2002

**Tested by:**
*Tae Young, JANG / Test Engineer*

**Reviewed by:**
*Yang Soo, KIM / Manager of EMC Lab.*

**Authorised by:**
*Kyu Baek, CHUNG / Chief of EMC Lab.*

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NVLAP®

NVLAP Code: 200447

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# 1. General Information

**Applicant** : Samsung Electronics Co., Ltd.

**Full Address** : 416 Maetan 3 Dong, Paldal-Ku,
Suwon City, Kyungki Do, Korea, 442-742

**Kind of Product** : **Wireless Hand PC**

**FCC ID** : **A3LS160**

**Project Name** : **Freesia**

**Model & Variant Names** : **S160** (Brand Name: Samsung)

**Test Report Produced by :** Tae Young, JANG / Test Engineer

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## 7) Justification

The system was configured for testing in typical fashion use. Cable were attached to each of the available I/O Ports. Where applicable, peripherals were attached to the I/O cables. The mode of operation utilized for testing was selected to best simulate typical EUT use.

Further details of cabling and configuration are shown in the test system configuration.

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### 8) Operating Frequency :

400MHz(CPU Speed), 3.6864MHz(Main Clock), 32.768KHz(RTC Clock),
100MHz(SDRAM Clock), 48MHz(LCD Controller Bus Clock),
27MHz(LCD Controller Pixel Clock), 27MHz(NAND Flash Controller Clock),
3.6864MHz(SA1111 Clock), 12.288MHz(Audio Bit Clock), 24.576MHz(Audio 97)

### 9) Description of Testing operating mode

| Operating Mode | Operating section of EUT |
|---|---|
| "H" Pattern display | LCD Screen |
| | external Monitor(TFT-LCD) |
| | |
| Audio Output | audio to Ear-phone |

### 10) Tested Resolution :

| Tested Video mode | Resolutions | Refresh rates | Colors |
|---|---|---|---|
| LCD(5.0") | 800 X 480 | 60Hz | 16bits |
| Ext. Monitor | 1280 X 1024 | 85Hz | 32bits |
| | | | |
| | | | |

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## 11) Assemble Parts

| Item | Specification | Remark |
|---|---|---|
| CPU | Intel PXA250<br>Xscale core 400MHz<br>32K / 32K / 2KB Cache | |
| Memory | Samsung, K9F1208U0M, NAND Falsh 64MB<br>Samsung, K4S511533C-YN1L, SDRAM 128MB | |
| Graphic Contoller | Epson, S1D13806B00B100<br>48MHz LCD Controller Clock, 27MHz LCD Pixel Clock<br>64K Color(256 Color for dual display) Depth | |
| Flat Panel Dispay | SEC, LCD 5" TFT<br>Upto 800x480 Pixels; 16-bit 64k colors<br>White LED Backlight | |
| Companion Chip | Xilinx, XCR3032XL-10CS48C, CPLD<br>Intel, SA1111 | |
| Analog LSI | Wolfson, WM9705<br>TSP Controller, 18-bit stereo audio codecs<br>Headphone drivers on AUX and MONO outputs<br>Auxiliary ADC input for direct battery measurement | |
| AC Adapter | SEM, AD-1005, 100-120V, 0.6A, 50/60Hz, 2 pin | |
| Wireless LAN | SEM, SWL-2220C, Built-in Wi-Fi certified 802.11b | |
| Input Devices | Samsung, SKB-160E, Keyboard,<br>CF Type II<br>Samsung, SPA-160E, PCMCIA Adapter, | Optional<br><br>Optional |
| Battery | Built-in, Lithium Polymer Rechargeable Battery | |
| Docking Cradle | Samsung, SDO-160E | DC-IN, SYNC cable or VGA cable IN |
| Ports | Extened Lithium Pollymer Rechargeable battery<br>DC IN, HEADPHONE-OUT,<br>CF Type II Slot, PCMCIA External Slot,<br>VGA-OUT (SYNC-OUT) | Optional |

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## 1.2 Configuration of EUT and peripherals

| Mark | Item | Model No. | Serial No. | Manufacturer | FCC ID |
|---|---|---|---|---|---|
| A | Hand PC | S160 | - | Samsung | A3LS160 |
| B | Monitor | M17D-AN | N106H4JT100839 | Samsung | Doc |
| C | Docking Cradle | SDO-160E | - | Samsung | - |
| D | Adapter | AD-4214N | C011108523 | Samsung | - |
| E | Earphone Cable | - | - | - | - |
| F | | | | | |
| G | | | | | |
| H | | | | | |
| I | | | | | |
| J | | | | | |
| K | | | | | |
| L | | | | | |
| M | | | | | |
| N | | | | | |
| O | | | | | |
| | | | | | |

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## 1.3 Used Cable Description

| No. | Item | Length[m] | Shielded (Y/N) | Remark |
|---|---|---|---|---|
| 1 | AC Power Cable | 1.5 | N | |
| 2 | Earphone Cable | 1.0 | N | |
| 3 | Monitor Cable | 1.6 | Y | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| | | | | |

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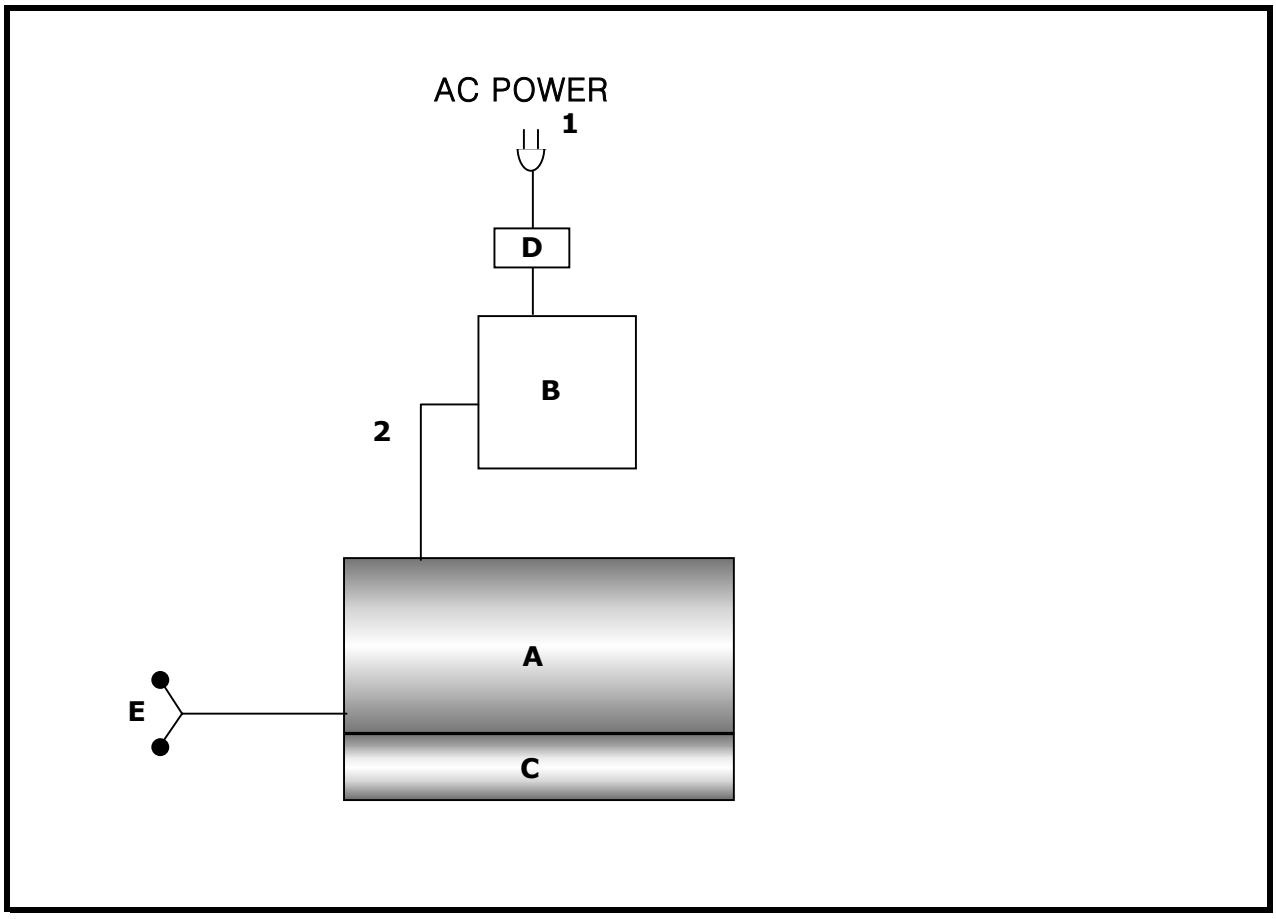
## 1.4 System Block Diagram of Test Configuration




## 1.5 Test Facility

All test described in this report were performed by :

SAMSUNG ELECTRONICS CO., LTD.
EMC TESTING LABORATORY
416 Maetan 3 Dong, Paldal-Ku, Suwon City, Kyungki Do, Korea, 442-742
Semi Anechoic Chamber #2(Registration Number:873282) and Shielded Room.

This test facility has been filed in FCC under the criteria in ANSI C63.4-1992.

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# 2. System Test Configuration

## 2.1 Configuration of Radiated and Conducted Interference Measurement

* Cabling was taken into consideration and test data was taken under worse case conditions.

**1)Conduction(Front View)**

**2)Conduction(Rear View)**

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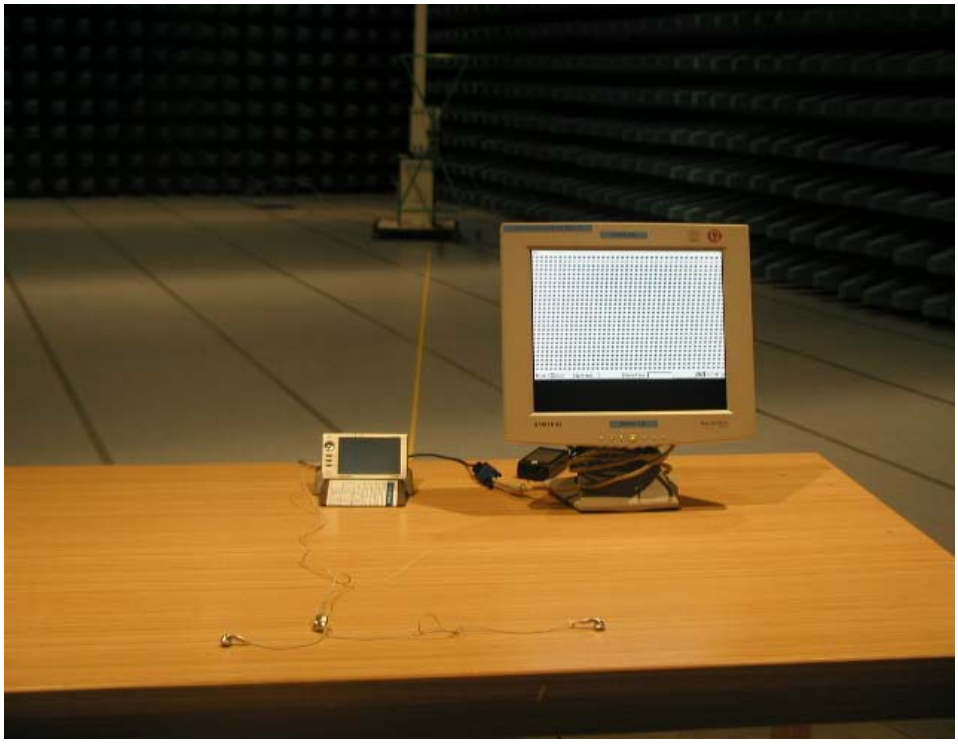
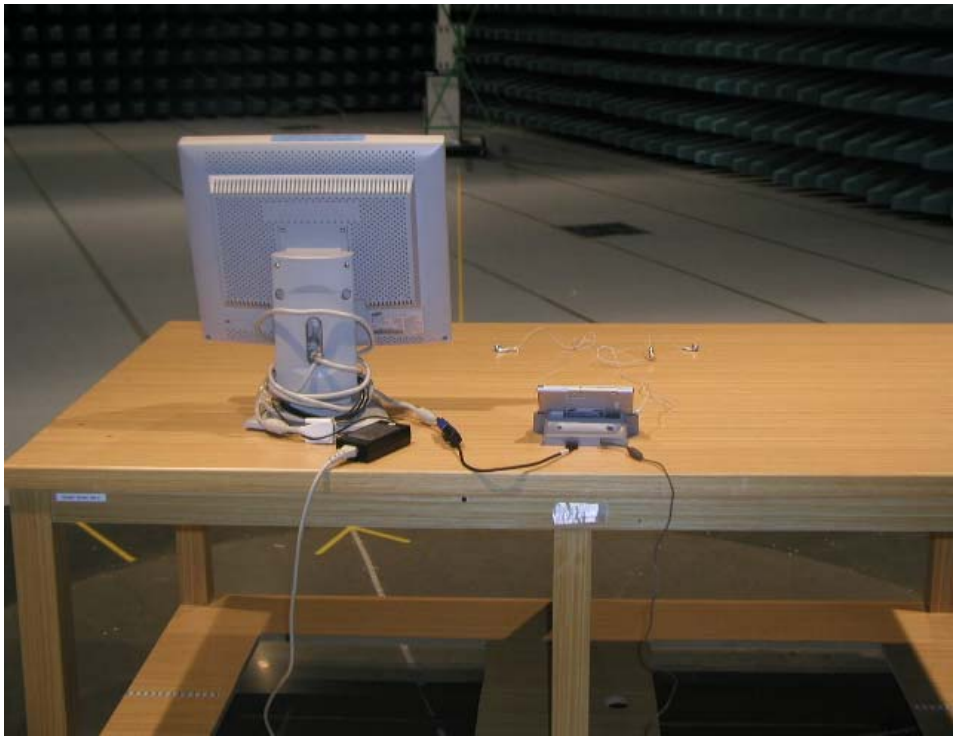
**3) Radiation(Front View)**



**4) Radiation(Rear View)**



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## 2.2 Operation Environment

| | Conduction | Radiation |
|---|---|---|
| **Temperature [ C ] :** | 21.5C | 25.5C |
| **Humidity [ % ]** | 65 | 54 |
| **Power supply :** | AC220V/60Hz | AC220V/60Hz |

## 2.3 Test Procedure

2.3.1 Conducted Emissions

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting ground plane.
The rear of EUT,including peripherals was aligned and flush with rear of tabletop.
All other surfaces of tabletop was at least 80cm from any other grounded conducting surface. I/O cables and AC cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane.
Each EUT current-carrying power lead,except the ground(safety) lead, were individually connected through a LISN to the input power source.
All unused 50 ohm connectors of the LISN were resistively terminated in 50 ohm when not connected to the measuring equipment.

The EUT was switched on and allowed to warm up to its normal operating condition.
A quick scan, from 150kHz to 30MHz, was made on the L1 & L2 line by LISN.
High peaks, relative to the limit line, over the frequency range were then selected.
The EMI TEST RECEIVER was then tuned to the selected frequencies.
CISPR quasi-peak measurements with a receiver bandwidth setting of 10kHz, were taken.

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2.3.2 Radiated Emissions

EUT was placed on a platform of nominal size, 1m by 1.5m, raised 80cm above the conducting ground plane.
The rear of EUT,including peripherals was aligned and flush with rear of tabletop.
I/O cables that were connected to the peripherals were bundle in center.
They were folded back and forth forming a bundle 30cm to 40cm long and were hanged 40cm height to the ground plane.

The system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna were noted for each frequency found.
The spectrum was scanned from 30 to 1000 MHz using biconiLog antenna.
Also, the EMI TEST RECEIVER was scanned from 1000 to 18000MHz using linearly polarized double ridge horn antennas were used.

Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment; powering the monitor from the floor mounted outlet box and the computer aux AC outlet if applicable, and changing the polarity of the antenna; whichever determined the worst-case emission.

The explanation of measuring instrument setup when respective function is used in any frequency band is as following:

| Frequency Band [MHz] | Instrument | Detector function | resolution Bandwidth | Video Bandwidth |
|---|---|---|---|---|
| 30 to 1000 | Spectrum analyzer | Peak | 1MHz | 1MHz |
| | EMI Test receiver | Quasi-Peak | 120kHz | - |
| Above 1000 | EMI Test receiver | Peak | 1MHz | - |

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## 3. Conducted Emission Test Data

**O Test Data Sheet**

| Frequency | Meter reading (a) | | Total Loss (b) | Results (a) + (b) | | Limits | | Margin (Limits-Result) | |
|---|---|---|---|---|---|---|---|---|---|
| | QP | AV | | QP | AV | QP | AV | QP | AV |
| [MHz] | [dBuV] | | [dB] | [dBuV] | | [dBuV] | | [dB] | |
| 0.162 | 50.4 | - | 0.6 | 51.0 | - | **65.4** | **55.4** | 14.4 | 4.4 |
| 0.181 | 48.9 | - | 0.6 | 49.5 | - | **64.4** | **54.4** | 14.9 | 4.9 |
| 0.189 | 50.3 | - | 0.6 | 50.9 | - | **64.1** | **54.1** | 13.2 | 3.2 |
| 0.240 | 40.8 | - | 0.6 | 41.4 | - | **62.1** | **52.1** | 20.7 | 10.7 |
| 0.295 | 41.0 | - | 0.5 | 41.5 | - | **60.4** | **50.4** | 18.9 | 8.9 |
| 0.494 | 36.1 | - | 0.6 | 36.7 | - | **56.1** | **46.1** | 19.4 | 9.4 |
| 0.677 | 39.0 | - | 0.6 | 39.6 | - | **56.0** | **46.0** | 16.4 | 6.4 |
| 0.720 | 35.2 | - | 0.5 | 35.7 | - | **56.0** | **46.0** | 20.3 | 10.3 |
| 1.568 | 35.8 | - | 0.6 | 36.4 | - | **56.0** | **46.0** | 19.7 | 9.7 |
| 1.662 | 36.2 | - | 0.5 | 36.7 | - | **56.0** | **46.0** | 19.3 | 9.3 |
| 2.642 | 34.5 | | 0.6 | 35.1 | - | **56.0** | **46.0** | 20.9 | 10.9 |
| 3.451 | 34.2 | - | 0.7 | 35.0 | - | **56.0** | **46.0** | 21.0 | 11.0 |
| 5.345 | 35.6 | - | 0.8 | 36.4 | - | **60.0** | **50.0** | 23.6 | 13.6 |
| 6.978 | 34.2 | - | 0.8 | 35.0 | - | **60.0** | **50.0** | 25.0 | 15.0 |
| 7.095 | 34.5 | - | 0.8 | 35.3 | - | **60.0** | **50.0** | 24.7 | 14.7 |
| 8.084 | 30.1 | - | 1.0 | 31.1 | - | **60.0** | **50.0** | 28.9 | 18.9 |
| 21.291 | 37.7 | - | 1.7 | 39.4 | - | **60.0** | **50.0** | 20.6 | 10.6 |
| 26.634 | 36.7 | - | 2.1 | 38.8 | - | **60.0** | **50.0** | 21.2 | 11.2 |

* QP : Quasi-peak, AV: Average

* Results = Meter Reading(QP or AV) + Total Loss(LISN Insertion loss + Cable loss)

*"-":The Quasi-peak reading value also meets average limit so it is not necessary to measure with Average detector

* Measurement detector function and bandwidth

Detector function : CISPR quasi-peak

Bandwidth : 10kHz

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## 4. Radiated Emission Test Data

| Frequency Range [MHz] | Tested Frequency [MHz] | ANT Pol. | Meter Reading [A] [dBuV/m] | Total Loss [B] [dB] | Antenna Height [Cm] | Turn table Degree [Deg] | Results [A+B] [dBuV/m] | Limits [dBuV/m] | Margin (Limit-Result) [dB] |
|---|---|---|---|---|---|---|---|---|---|
| ***30 - 230*** | 32.0 | V | 4.1 | 17.8 | 107 | 42 | 21.9 | **30.0** | 8.1 |
| | 53.3 | V | 9.0 | 7.9 | 100 | 198 | 16.9 | **30.0** | 13.1 |
| | 69.2 | V | 10.5 | 6.7 | 279 | 176 | 17.2 | **30.0** | 12.8 |
| | 74.6 | V | 10.8 | 7.2 | 236 | 0 | 18.0 | **30.0** | 12.0 |
| | 100.8 | V | 2.5 | 12.1 | 193 | 176 | 14.6 | **30.0** | 15.4 |
| | 106.2 | V | 1.1 | 12.8 | 100 | 148 | 13.9 | **30.0** | 16.1 |
| | 159.7 | H | 5.0 | 11.7 | 400 | 97 | 16.7 | **30.0** | 13.3 |
| | 184.3 | V | 8.6 | 10.4 | 102 | 347 | 19.0 | **30.0** | 11.0 |
| | 208.9 | V | 10.4 | 10.8 | 100 | 238 | 21.2 | **30.0** | 8.8 |
| | 213.0 | H | 9.3 | 10.4 | 400 | 259 | 19.7 | **30.0** | 10.3 |
| ***230 - 1000*** | 454.6 | | 8.9 | 20.1 | 250 | 75 | 29.0 | **37.0** | 8.0 |
| | 741.8 | V | 6.0 | 24.4 | 178 | 35 | 30.4 | **37.0** | 6.6 |
| | 985.3 | H | 0.6 | 25.8 | 178 | 148 | 26.4 | **37.0** | 10.6 |
| ***1000 - 2000*** | 1035.0 | V | 13.2 | 28.6 | 100 | 0 | 41.8 | **74.0** | 32.2 |
| | 1901.0 | V | 9.9 | 33.2 | 100 | 0 | 43.1 | **74.0** | 30.9 |

** "<" Means equal or less then 5dB*

** Receiving Antenna Mode :* ***Horizontal, Vertical***

** Results = Meter Reading + Total Loss(Antenna factor + Cable loss)*

* Measurement detector function and bandwidth

Detector function : CISPR quasi-peak(Above 1000MHz: Peak)

Resolution Bandwidth : 120kHz(Above 1000MHz: 1MHz)

** Test distance*

*- Below 1000MHz: 10m(Quasi-peak)*

*- Above 1000MHz: 3m(Peak)*

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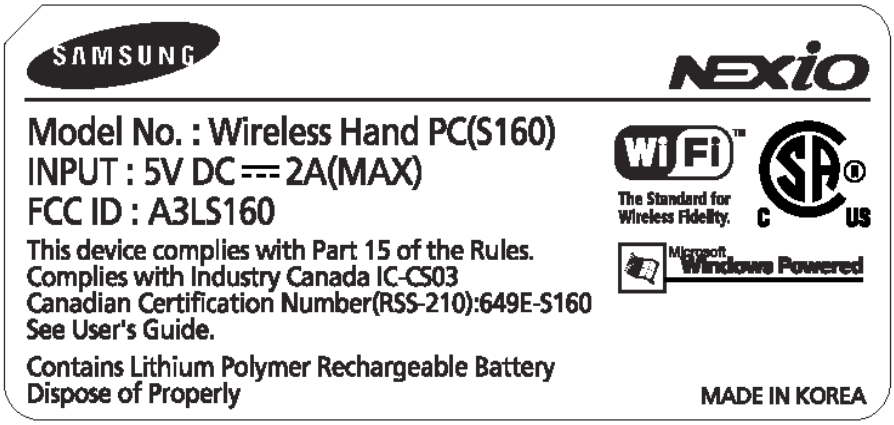
# 5. FCC Label Configuration and Location

## 5.1 Label Configulation




## 5.2 Location of Label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## 6. Test Equipment Used

| Equipment | Model No. | Makers. | Serial No | Calibration Last calibration and Interval |
|---|---|---|---|---|
| Field strength meter | ESCS30 | 830986/004 | R & S | 2003-02-15 |
| | **Firmware versions : Main 2.22, OTP 02.01, GRA 02.36** | | | |
| Test Receiver | ESI26 | 100010 | R&S | 2003-05-04 |
| L.I.S.N | ESH2-Z5 | 831886/006 | R & S | 2002-11-20 |
| L.I.S.N | ESH3-Z5 | 831887/0004 | R & S | 2003-08-06 |
| Horn Antenna | HF906 | 100028 | R & S | 2003-07-26 |
| BILOG Antenna | CBL6112B | 2804 | Schaffner | 2003-04-23 |

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