

FCC Part 15 TEST REPORT

EUT : neoSnap

MODEL : NS-10

FCC ID : QE6IH-NEOSNAP04

APPLICANT : INFOHAND Co., Ltd.

ADDRESS : #1207 Kranz-Techno bldg., 5442-1,
Sangdaewon-dong, Jungwon-gu
Seongnam-si, Gyeonggi-do, Korea

May 20, 2004

TUV Rheinland Korea Ltd.

TEST REPROT CERTIFICATION

Applicant : INFOHAND Co., Ltd

Adderss : #1207 Kranz-Techno bldg., 5442-1, Sangdaewon-dong,
Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea

EUT Name : neoSnap

Model no. : NS-10

Serial No. : Engineering Sample

FCCID : QE6IH-NEOSNAP04

Testing location : LG Innotek Co.,Ltd.
133, Gongdan-dong, Gumi-City , Gyeongbuk 730-703, R.O.K

Applied specification : FCC Part 15 , ANSI C63.4-2001 , CISPR 22:1997

Test result : The above mentioned test item passed.

Tested by : **Gui-Lim Woo**

Reviewed by : **Uon-Chae Song**

May 17,2004



Date

Signature

May 24,2004



Date

Signature

I HEREBY CERTIFY THAT the data shown in this report were made in accordance with the Procedures given in the applied specification and I assume full responsibility for accuracy and completeness of these data.

Note : This test report relates to the a. m. test item. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark on this or similar products.

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1. General Information

1.1 Product Description

Product Name : neoSnap
Product ID : NS-10
Serial No. : Engineering Sample
FCC ID : QE6IH-NEOSNAP04

1.2 Project data

Receipt of EUT : May 2,2003
Date of Test : May 12, 2004
Data of report : May 17,2004

1.3 Applicant

Company Name : INFOHAND Co., Ltd
Address : #1207 Kranz-Techno bldg., 5442-1, Sangdaewon-dong,
Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea
Contact Person : Jin-Gu Yoon

1.4 Manufacturer

Company Name : INFOHAND co., Ltd
Address : #1207 Kranz-Techno bldg., 5442-1, Sangdaewon-dong,
Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea
Contact Person : Jin-Gu Yoon

2. EUT Information

2.1 General EUT Information

Type	Transmitter	Receiver
FCC Classification	FHSS Sequence Spread Spectrum (FHSS)	FHSS Sequence Spread Spectrum (FHSS)
Frequency Range	2402 – 2480 MHz	2402 – 2480 MHz
Number of Channels	79	79
Channel Separation	1MHz	1MHz
Type of Antenna	Surface Mountable Chip Antenna	Surface Mountable Chip Antenna
Power Supply	DC 3.7V Lithium Polymer	DC 3.7V Lithium Polymer

2.2 Center Frequency of Tested Channel

Frequency	Tx (MHz)	Rx (MHz)
Lowest	2402	2402
Middle	2441	2441
Highest	2480	2480

2.3 Test Environment

Temperature	20°C
Relative Humidity	30 ~ 60%
Voltage	DC 2.7V

2.4 Accessories and Ancillary Equipment

Equipment	Model No.	Serial Number	Maker
Laptop PC	PS428L-OE142	30014068J	Toshiba

3. Testing Facilities

LG Innotek Co.,Ltd.

133, Gongdan-dong, Gumi-City , Gyeongbuk 730-703, R.O.K

4. EUT Description and Operational Description

4.1 General Description

Bluetooth is a short-range radio link intended to replace the cable(s) connecting portable and/or fixed electronic devices. Key features are robustness, low complexity, low power, and low cost.

Bluetooth operates in the unlicensed ISM band at 2.4 GHz. A frequency hop transceiver is applied to combat interference and fading. A shaped, binary FM modulation is applied to minimize transceiver complexity. The symbol rate is 1Ms/s. A slotted channel is applied with a nominal slot length of 625 μ s. For full duplex transmission, a Time-Division Duplex (TDD) scheme is used.

4.2 Product Function and Intended use

The neoSnap is a connected digital camera that links with the neoPone to send all your neoSnap images automatically to the myneo.com Website. Users can have their images sent from the Web to their friends and relatives via e-mail.

5. Test Set-up

5.1 Principle of configuration

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes and test settings were adapted accordingly in reference to the instructions for use.

For details, please refer to the Operation mode in chapter 7.

5.2 Operational Modes

Page Scan,

Inquiry Scan

Hopping Mode

Fixed mode (2402Mhz, 2441Mhz and 2480Mhz)

5.3 Applied Specification

FCC Part 15

ANSI C63.4-1992

CISPR 22:1997

6. Test Report Summary

Related Clause	Test case or Requirements	Subclause	Limit	Result (Note1)
7.1	Antenna Connector Requirements	15.203 15.204	15.203 15.204(c)	C
7.2	AC Connected Emission	15.207	15.207(a)	NA
7.3	Carrier Frequency Separation	15.247	15.247(a)(1)	Pass
7.4	Time of Occupancy(Dwell time)	15.247	15.247(a)(1)(ii)	Pass
7.5	20dB Bandwidth	15.247	15.247(a)(1)(ii)	Pass
7.6	Number of Hopping Frequencies Requirements	15.247	15.247(a)(1)(ii)	C
7.7	Pseudorandom Frequency Hopping Sequence and Equal Hopping Frequency use Requirements	15.247	15.247(a)(1)	C
7.8	Receiver Input Bandwidth Requirements	15.247	15.247(a)(1)	C
7.9	Peak Output Power	15.247	15.247(b)(1)	Pass
7.10	Band-edge Compliance	15.247	15.247(c)	Pass
7.11	Spurious Conducted emissions	15.247	15.247(c)	Pass
7.12	Spurious Radiated emissions	15.247	15.247(c)	Pass

* Note1 : C: Complies, Pass: Passed, Fail : Failed and NA: Not Applicable

7. Test Results

7.1 Antenna Connector Requirements

RESULT:

Complies

The antenna is permanently attached on the PCB.

The EUT has a Surface Mountable Dielectric Chip Antenna soldered to the circuit board.

For more information on antenna follows;

Antenna gain : -2.0dBi.

Manufacturer : AMOTECH CO., LTD.

Model No. : AMAN903010U2P3

Type : Surface Mountable Dielectric Chip Antenna

7.2 AC Connected Emission

Test Specification : CISPR 22: 1997
 Mode of operation : N/A
 Port of testing : N/A
 Supply voltage : N/A
RESULT : N/A

This test case is not applicable. It is just operated with a rechargeable battery.

Limit

Subclause 15.207(a)

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency of Emission (M Hz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

7.3 Carrier Frequency Separation

Test specification : FCC § 15
Mode of operation : Tx mode (hopping on), DH1 packet
Port of testing : Temporary antenna port
Detector : PK
Trace : Max hold
RBW/VBW : 100kHz/300kHz
RESULT : Pass

The centre frequencies of the hopping channels are separated by more than the 20dB bandwidth.

For test results refer to Appendix 1(13002911), page 1

Limit

Subclause 15.247(a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

7.4 Time of Occupancy(Dwell time)

Test specification : FCC § 15
Mode of operation : Tx mode (2441MHz), DH5 packet
Port of testing : Temporary antenna port
Detector : PK
Trace : Max hold
RBW/VBW : 1MHz/3MHz
RESULT : Pass

The system makes 1600 hops per second or has a length of 625us.

Let take DH5 packet in worst case. A DH5 packet has 5 slots for transmitting and 1 slot for receiving. It means it can have maximum 266.67 (=1600/6)hops per second.

Therefore it has 3.38 hops(=266.67/79) per second for each channel.

And it has 106.81hops appearance for 31.6 seconds (= 0.4x79channels).

Each TX length per appearance is 2.89 ms.

i.e. The dwell time for DH5 Packet (in worst case) :

$$106.81 \times 2.89 \text{ ms} = 308.68 \text{ ms}$$

For test results(Each TX length per appearance) please refer to Appendix 1(13002911), page 2.

Limit

Subclause15.247(a)(1)(ii)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 75 hopping frequencies. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

7.5 20dB Bandwidth

Test specification : FCC § 15
Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH5 packet
Port of testing : Temporary antenna port
Detector : PK
Trace : Max hold
RBW/VBW : 30kHz/100kHz
RESULT : Pass

20dB bandwidth (MHz)		
2402	2441	2480
0.995	0.985	0.975

For test results refer to Appendix 1(13002911), page 3.

Limit

Subclause 15.247(a)(1)(ii)

The maximum 20dB bandwidth of the hopping channel is 1Mhz.

7.6 Number of Hopping Frequencies Requirements

Test specification : FCC § 15
Mode of operation : Hopping
Port of testing : Temporary antenna port
Detector : PK
Trace : Max hold
RBW/VBW : 100kHz/100kHz
RESULT : Complies

It uses exactly 79 hopping frequencies.

For test results refer to Appendix 1(13002911), page 6.

Limit

15.247(a)(1)(ii)

Frequency hopping systems operating in the 2400-2483.5 bands shall use at least 75 Hopping frequencies.

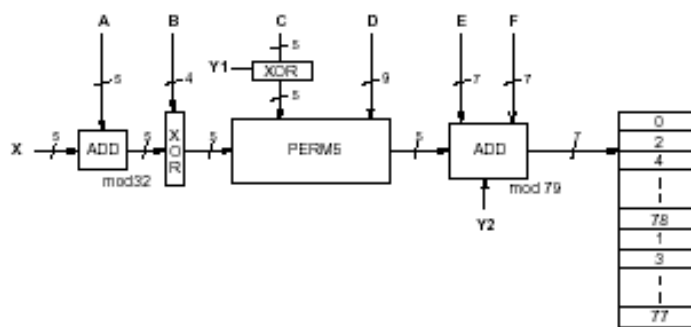
7.7 Pseudorandom Frequency Hopping Sequence and Equal Hopping Frequency use Requirements

RESULT:

Complies

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master. The X input determines the phase in the 32-hop segment, whereas Y1 and Y2 selects between master-to-slave and slave-to-master transmission. The inputs A to D determine the ordering within the segment, the inputs E and F determine the mapping onto the hop frequencies.

The example shows the each of its hopping channels us used equally on average.



Example data:

Hop sequence {k} for CONNECTION STATE:

CLK start: 0x0000010

ULAP: 0x00000000

#ticks: 00 02 | 04 06 | 08 0a | 0c 0e | 10 12 | 14 16 | 18 1a | 1c 1e |

0x0000010: 08 66 | 10 70 | 12 19 | 14 23 | 16 01 | 18 05 | 20 33 | 22 37 |
 0x0000030: 24 03 | 26 07 | 28 35 | 30 39 | 32 72 | 34 76 | 36 25 | 38 29 |
 0x0000050: 40 74 | 42 78 | 44 27 | 46 31 | 48 09 | 50 13 | 52 41 | 54 45 |
 0x0000070: 56 11 | 58 15 | 60 43 | 62 47 | 32 17 | 36 19 | 34 49 | 38 51 |
 0x0000090: 40 21 | 44 23 | 42 53 | 46 55 | 48 33 | 52 35 | 50 65 | 54 67 |
 0x00000b0: 56 37 | 60 39 | 58 69 | 62 71 | 64 25 | 68 27 | 66 57 | 70 59 |
 0x00000d0: 72 29 | 76 31 | 74 61 | 78 63 | 01 41 | 05 43 | 03 73 | 07 75 |

0x00000f0: 09 45 | 13 47 | 11 77 | 15 00 | 64 49 | 66 53 | 68 02 | 70 06 |
0x0000110: 01 51 | 03 55 | 05 04 | 07 08 | 72 57 | 74 61 | 76 10 | 78 14 |
0x0000130: 09 59 | 11 63 | 13 12 | 15 16 | 17 65 | 19 69 | 21 18 | 23 22 |
0x0000150: 33 67 | 35 71 | 37 20 | 39 24 | 25 73 | 27 77 | 29 26 | 31 30 |
0x0000170: 41 75 | 43 00 | 45 28 | 47 32 | 17 02 | 21 04 | 19 34 | 23 36 |
0x0000190: 33 06 | 37 08 | 35 38 | 39 40 | 25 10 | 29 12 | 27 42 | 31 44 |
0x00001b0: 41 14 | 45 16 | 43 46 | 47 48 | 49 18 | 53 20 | 51 50 | 55 52 |
0x00001d0: 65 22 | 69 24 | 67 54 | 71 56 | 57 26 | 61 28 | 59 58 | 63 60 |
0x00001f0: 73 30 | 77 32 | 75 62 | 00 64 | 49 34 | 51 42 | 57 66 | 59 74 |
0x0000210: 53 36 | 55 44 | 61 68 | 63 76 | 65 50 | 67 58 | 73 03 | 75 11 |
0x0000230: 69 52 | 71 60 | 77 05 | 00 13 | 02 38 | 04 46 | 10 70 | 12 78 |
0x0000250: 06 40 | 08 48 | 14 72 | 16 01 | 18 54 | 20 62 | 26 07 | 28 15 |
0x0000270: 22 56 | 24 64 | 30 09 | 32 17 | 02 66 | 06 74 | 10 19 | 14 27 |
0x0000290: 04 70 | 08 78 | 12 23 | 16 31 | 18 03 | 22 11 | 26 35 | 30 43 |
0x00002b0: 20 07 | 24 15 | 28 39 | 32 47 | 34 68 | 38 76 | 42 21 | 46 29 |
0x00002d0: 36 72 | 40 01 | 44 25 | 48 33 | 50 05 | 54 13 | 58 37 | 62 45 |
0x00002f0: 52 09 | 56 17 | 60 41 | 64 49 | 34 19 | 36 35 | 50 51 | 52 67 |
0x0000310: 38 21 | 40 37 | 54 53 | 56 69 | 42 27 | 44 43 | 58 59 | 60 75 |
0x0000330: 46 29 | 48 45 | 62 61 | 64 77 | 66 23 | 68 39 | 03 55 | 05 71 |
0x0000350: 70 25 | 72 41 | 07 57 | 09 73 | 74 31 | 76 47 | 11 63 | 13 00 |
0x0000370: 78 33 | 01 49 | 15 65 | 17 02 | 66 51 | 70 67 | 03 04 | 07 20 |
0x0000390: 68 55 | 72 71 | 05 08 | 09 24 | 74 59 | 78 75 | 11 12 | 15 28 |
0x00003b0: 76 63 | 01 00 | 13 16 | 17 32 | 19 53 | 23 69 | 35 06 | 39 22 |
0x00003d0: 21 57 | 25 73 | 37 10 | 41 26 | 27 61 | 31 77 | 43 14 | 47 30 |
0x00003f0: 29 65 | 33 02 | 45 18 | 49 34 | 19 04 | 21 08 | 23 20 | 25 24

7.8 Receiver Input Bandwidth Requirements

RESULT:

Complies

The receiver bandwidth is equal to the receiver bandwidth in the 79 hopping channel mode, which is 1 MHz. The receiver bandwidth is indirectly verified during Bluetooth RF conformance testing.

7.9 Peak Output Power

Test specification : FCC § 15
 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
 Port of testing : Temporary antenna port
 Detector : PK
 Trace : Max hold
 RBW/VBW : 1MHz/3MHz
 RESULT : Pass

Frequency (MHz)	Maximum peak output power (dBm)	Cable attenuation (dB)	Actual value (dBm)
2402	-1.176	1.80	0.62
2441	-2.616	1.83	-0.82
2480	-2.989	1.85	-1.14

All three transmit frequency modes comply with the maximum peak output power limit.
 For test results refer to Appendix 1(13002911), page 7.

Limit

Subclause 15.247(b)(1)

Frequency range	RF output power
2.400-2.483,5MHz	0.125W (21.0dBm)

7.10 Band-edge Compliance

Test specification : FCC § 15
Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
Port of testing : Temporary antenna port
Detector : PK
Trace : Max hold
RBW/VBW : 300kHz/1.0MHz
RESULT : Pass

There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency. All three transmit frequency modes comply with the limit stated in subclause 15.247(c).

For test results refer to Appendix 1(13002911), page 10.

Limit

Subclause 15.247(c)

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

7.11 Spurious Conducted emissions

Test specification : FCC § 15
 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
 Port of testing : Temporary antenna port
 Detector : PK
 Trace : Max hold
 RBW/VBW : 100kHz/300kHz
RESULT : Pass

Operating frequency : 2402MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)
No Peak Found	-	-	-

Operating frequency : 2441MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)
No Peak Found	-	-	-

Operating frequency : 2480MHz

Spurious Frequency (MHz)	Power level (dBm)	Reference value (dBm)	Delta to reference level (dB)
No Peak Found	-	-	-

All three transmit frequency modes comply with the 20dB limit stated in subclause 15.247(c).

For test results refer to Appendix 1(13002911), page 13.

Limit

Subclause 15.247(c)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

7.12 Spurious Radiated emissions

Test specification : ANSI C63.4 - 1992
 Mode of operation : Tx mode (2402MHz, 2441MHz, 2480MHz), DH1 packet
 Detector : PK
 Trace : Max hold
 Port of testing : Enclosure
 Measurement Distance : 3m
 Measurement BW : 1 MHz
RESULT : Pass

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (Peak)
2402	Horizontal	-	No Peak above the limit	-

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (Peak)
2402	Vertical	-	No Peak above the limit	-

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (Peak)
2441	Horizontal	-	No Peak above the limit	-

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (Peak)
2441	Vertical	-	No Peak above the limit	-

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (Peak)
2480	Horizontal	-	No Peak above the limit	-

Tx frequency (MHz)	Polarization	Spurious Frequency (MHz)	Power Level (dBuV/m)	Detector (Peak)
2480	Vertical	-	No Peak above the limit	-

All three transmit frequency modes comply with the field strength within the restricted bands.

For test results refer to Appendix 1(13002911), page 20.

Limit

Subclause 15.247(c)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209 (a) (see Section 15.205(c)).

Field strength limits within the restricted bands using average detector:

Frequency (MHz)	Field strength (microvolts/meter)	Field strength (dB μ V/m)	Measurement distance (meters)
30-88	100	$20 \cdot \log(100) = 40.0$	3
88-216	150	$20 \cdot \log(150) = 43.5$	3
216-960	200	$20 \cdot \log(200) = 46.0$	3
960-2500	500	$20 \cdot \log(500) = 54.0$	3

According to section 15.35(b), on any frequency or frequencies above 1000 MHz the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in this part, including emission measurements below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated.

8. List of Test and Measurement Instruments

	Kind of Equipment	Type	Manufacturer	S/N
☒	EMI Test Receiver	ESMI	R/S	1032.5510.53
☐	Spectrum Analyzer	FSP30	R/S	1093.4495.30
☐	Tracking Generator	ESMI-B1	R/S	1033.3240.52
☐	Spectrum Analyzer	8566B	HP	3638A0857E
☒	Spectrum Analyzer	E4407B	HP	N10149
☐	Wave Dipole Antenna	HZ-12	R/S	842006/0012
☐	Wave Dipole Antenna	HZ-12	R/S	846556/0004
☒	Biconical Antenna	3104C	EMCO	9408-4667
☐	Biconical Antenna	3109	EMCO	9405-2812
☒	Log-Periodic Antenna	3146A	EMCO	1064
☐	Biconilog Antenna	3142	EMCO	9710-1220
☐	V-Network	ESH3-Z5	R/S	847265/030
☐	V-Network	ESH3-Z6	R/S	847250/016
☐	T-Network	E-Z10	R/S	84480/011
☐	LISN	6338-5-PJ-50-N	Solar	953938/953939
☒	Turn Table	2081	EMCO	
☒	Antenna Tower	2075	EMCO	
☒	Multi Device Controller	2090	EMCO	9708-1255
☐	Printer	C4569A	HP	SG78K1H1FS
☐	Absorbing Clamp	MDS 21	R/S	847905/005
☐	Signal Generator	2023	MARCONI	112246067
☐	Swept Signal Generator	83620B	HP	3722A00549
☐	10dB Attenuator	23-10-34	Weinschel co	BD4316
☐	10dB Attenuator	33-10-34	Weinschel co	BB9784
☒	Antenna	3142	EMCO	9710-1220
☒	Antenna	3115	EMCO	9511-4612

☒	Antenna	3160-08	EMCO	1168
☒	Antenna	3160-09	EMCO	1304
☒	Amplifier	HP8447F	HP	3113A06911
☒	Amplifier	HP83006	HP	3104A00611
☒	Amplifier	HP8449B	HP	3008A00859
☒	EMI test receiver	ESCS30	R&S	839809/003
☒	Artificial mains network	ESH2-Z5	R&S	829991/009
☒	Artificial hand	FCC-AH-1	Fischer custom communications Inc.	2008

9. Complementary Materials

9.1 Appendix 1 (Test report)

9.2 ID Label and Location Information

9.3 Operational Description

9.4 Test Setup Photos

9.5 Internal Photos

9.6 External Photos

9.7 Block diagram

9.8 User Manual

9.9 Technical Documents :

- Schematics
- PCB Layout