EXHIBIT B – Technical Report

FCC ID EJM123112960

Measurement/Technical Report

Intel Corporation

Keku, Mineola, & Goose

FCC ID: EJM123112960

May 22, 2000

This report concerns (check one): Original Grant__X__ *Class II Change*____

Equipment Type: Unlicensed Spread Spectrum Transmitter

Deferred grant requested per 47 CFR 0.457 (d)(1)(ii)? Yes_____ no__X__

If yes, defer until: _____N/A_____
date

Intel Corp. agrees to notify the Commission by: _____N/A_____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37: yes_____ no__X__

If no, assumed Part 15, Subpart C for intentional radiators – new 47 CFR [10-1-92] provision.

Report prepared by:

Northwest EMC, Inc.
22975 NW Evergreen Pkwy., Ste 400
Hillsboro, OR 97124
(503) 844-4066
fax: (503) 844-3826

Table of Contents

1.0 General Information

1.1 Product Description

Manufactured By ..... Intel Corporation

Address..... 5200 NE Elam Young Parkway Hillsboro, OR 97124

Test Requested By:..... Ram Kandiar

Model..... Keku, Mineola, Goose

FCC ID EJM123112960

Serial Number(s) 952L, D3

Date of Test ..... May 15, 2000 through May 22, 2000

Job Number INTE4088

Prepared By:	**Administrative Review By:**
Vicki Albertson	Karen DePriest
Vicki Albertson, Technical Report and Documentation Manager	Karen DePriest, Technical Report & Documentation Coordinator
Technical Review By:	**Approved By:**
Greg Kiemel	Dean Ghizzone
Greg Kiemel, Director of Engineering	Dean Ghizzone, President

1.1 Product Description con't

The EUT (project names "Keku," Mineola," and "Goose") is a 902.5 to 927 MHz frequency hopping transmitter seeking authorization under 47 CFR 15.247. The receiver portion of the EUT's RF module has been verified compliant to FCC Part 15 Subpart B rules.

The EUT operates as a subassembly of three wireless PC peripherals (keyboard, mouse, and gamepad) called the Intel Wireless Series Peripherals. The Intel Wireless Series Peripherals are designed to operate with the Intel Wireless Series Base Station. The Base Station is a USB peripheral that lets the user have a wireless connection of up to eight Intel Wireless Series Peripherals with a personal computer.

The EUT will only be used as a subassembly of the Intel Wireless Series Peripherals. The EUT is factory installed inside the peripherals with a permanently attached antenna. There is no user access provided internal to the peripherals. The transmitter is identical for each peripheral; only the antenna is slightly different to accommodate the shape of each peripheral enclosure.

The Intel Wireless Series Peripherals are battery operated and have no external cables. There is no provision for connection to the AC Mains, nor any wired connection to any other device.

1.2 Related Submittals/Grants

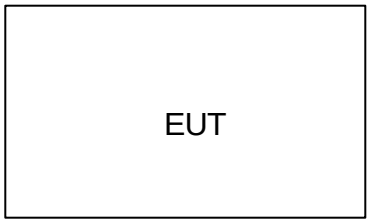
None

1.3 Tested System Details

EUT and Peripherals

Item	FCC ID	Description and Serial No.
EUT	EJM123112960	Transmitter Portion of Intel Wireless Series Peripherals, Project Name “Keku,” Mineola,” “Goose,” Serial No. 952L,D3.

Figure 1: Configuration of Tested System



1.4 Test Methodology

Testing was performed according to the procedures in ANSI C63.4 (1992), and DA 00-705. Radiated testing was performed at an antenna to EUT distance of 3 meters, from 30 MHz to 10 GHz.

1.5 Test Facility

The semi-anechoic chamber used to collect the radiated data is located at:

Northwest EMC, Inc.
22975 NW Evergreen Pkwy., Ste 400
Hillsboro, OR 97124
(503) 844-4066
Fax: 844-3826

The semi-anechoic chamber is located in Hillsboro, OR, at the address shown above. This site has been fully described in a report filed with the FCC (Federal Communications Commission), and accepted by the FCC in a letter maintained in our files.

Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program (NVLAP) for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. NVLAP Lab Code: 200059-0.

2.0 System Test Configuration

2.1 Justification

2.1.1 Operating Modes

All operating modes of the EUT were investigated including: frequency hopping with a modulated carrier and no hopping with a modulated carrier. For each test, the EUT was configured for low, mid, and high band transmit frequencies except when operated in a frequency hopping mode. During spurious radiated emissions testing, all operating modes were investigated at low, mid, and high transmit frequencies.

2.1.2 Test Configuration

For spurious radiated emissions testing, the EUT was installed in each of the three peripheral configurations (keyboard, mouse, and gamepad). Since the EUT is battery operated, and there is no provision for connection to the AC power mains, no AC powerline conducted emissions testing was performed.

2.2 EUT Exercise Software

The firmware of the EUT was programmed for changing frequencies to low, mid, and high in a no-hop mode by simply depressing the reset button on the bottom of the peripherals. This feature will not be available in production units, but was developed for testing purposes only.

2.3 Special Accessories

None

2.4 Equipment Modifications

None.

3.0 Antenna Requirement

Per 47 CFR 15.203, the EUT uses antennas that are designed to ensure that no other antennas other than those supplied by Intel will be used with the device.

Each peripheral utilizes a different type of antenna. Certification is sought for three antennas. Each of the three antennas is very similar and only differs in their shape to accommodate each peripheral enclosure.

The EUT uses only one antenna at a time. The permanently attached antenna is mounted on a printed circuit board using a soldering connection. The antenna is completely enclosed inside the plastic chassis of the peripheral and is not user accessible.

3.1 Antenna Information

Per 47 CFR 15.204 (c), a list of antennas tested with the EUT is provided. The type, manufacturer, model number, and gain with reference to an isotropic radiator are given.

Please reference exhibit "U", file name "Antenna Information.pdf" for that information.

Photographs of those antennas are in exhibit "O", file name "Internal Photos.pdf"

3.2 Frequency Hopping System

Per 47 CFR 15.247(a), a description of how the EUT meets the definition (found in 47 CFR 2.1) of a frequency hopping spread spectrum system is provided.

The description includes the number of hopping frequencies, the time of occupancy (dwell time) per hopping channel, and an explanation of how the hopping sequence is generated (an example is provided of the hopping channel sequence). Also, a description of how the EUT's hopping channels are used equally on average is provided.

In an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters; a description is provided of how the EUT does not have the ability to coordinate with other frequency hopping systems.

Please reference exhibit "T", file name"Description of Frequency Hopping System" for that information

3.3 Frequency Hopping Receiver

Per 47 CFR 15.247 (a)(1), a description is provided of how the EUT's associated receiver complies with the requirement that the input bandwidth matches the hopping channel bandwidth of the transmitter, and shifts frequencies in synchronization with the transmitted signals.

Please reference exhibit "T", file name "Description of Frequency Hopping System" for that information

3.4 De Facto EIRP Limit

Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm. The peak output power of the EUT is approximately 2 dBm, and the maximum gain of the antenna used with the EUT is -5 dBi. Therefore, the EUT's maximum EIRP is –3 dBm.

3.5 RF Exposure Compliance Requirements

Per 47 CFR 15.247 (b)(4), the EUT meets the requirement that it be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines (ref . 47 CFR 1.1307, 1.1310, 2.1091, and 2.1093. Also OET Bulletin 65, Supplement C).

The EUT is part of a PC peripheral that will be used with personal computers and can therefore be considered a mobile transmitter per 47 CFR 2.1091.

The MPE estimates are as follows:

Table 1 in 47 CFR 1.1310 defines the maximum permissible exposure (MPE) for the general population as (f/1500)mW/cm^2., where f = frequency in MHz. The distance from the EUT's transmitting antenna where the exposure level reaches the maximum permitted level is calculated using the general equation:

$$S = (PG)/4\pi R^2$$

Where: S = power density (0.602mW/cm^2 maximum permitted level)
P = power input to the antenna (1.54mW)
G = linear power gain relative to an isotropic radiator (-5 dBi = numeric gain of .316)
R = distance to the center of the radiation of the antenna

Solving for R, the 0.602mW/cm^2 limit is reached .253 cm or closer to the transmitting antenna. Therefore, no warning labels, no RF exposure warnings in the manual, or other protection measures will be used with the EUT.

3.6 AC Powerline Conducted Emissions

Per 47CFR 15.207(d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines.

The EUT is battery operated and does not make provisions for battery chargers or any other connection to the AC power lines. Therefore, no AC powerline conducted emissions measurements were made.

3.7 Spurious Radiated Emissions

The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, was measured. For each antenna/peripheral device, the EUT was configured for low, mid, and high band transmit frequencies in a no-hop modulated carrier mode. For each configuration, the spectrum was scanned from 30 MHz to 10 GHz.

While scanning, emissions from the EUT were maximized by rotating the EUT, adjusting the measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.4:1992). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

3.7.1 Results

The peak level complies with the limits specified in 47 CFR 15.35 (b). The average level (taken with a 10Hz VBW) complies with the limits specified in 15.209. Since the dwell time per channel of the hopping signal was less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(dwell time/100ms).

Per 47 CFR 15.247 (c) , the field strength of any spurious emissions or modulation products that fall in a restricted band does not exceed 15.209 limits.

The final radiated data may be referenced in Exhibit “L”, file name “Spurious Radiated Emissions.pdf”.

3.8 Occupied Bandwidth

The occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate with a modulated carrier in a no hopping mode..

Frequency Hopping

Per 47 CFR 15.247(a)(1)(i), the 20 dB bandwidth of a hopping channel is less than 500 kHz. The spectrum analyzer's resolution bandwidth was ≥1% of the 20dB bandwidth and the video bandwidth was greater than or equal to the resolution bandwidth.

Band	Bandwidth (kHz)
Low	455
Mid	460
High	456

The occupied bandwidth data may be referenced in Exhibit "E", file name " 20dB Bandwidth.pdf"

3.9 Peak Output Power

The peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in the following mode of operation: no hopping with a modulated carrier.

Frequency Hopping

Per 47 CFR 15.247(b)(2), the maximum peak output power does not exceed 250 milliwatts. The spectrum analyzer's resolution bandwidth was greater than the 20dB bandwidth of the modulated carrier and the video bandwidth was greater than or equal to the resolution bandwidth. The data plots include the cable loss of 1.5 dB.

Band	Peak Output Power (mW)
Low	.974 *
Mid	.953
High	.882

* Note: The Form 731 reflects this maximum measured output power +2dB (tolerance permitted by the Commission)

The Peak Output Power data may be referenced in Exhibit "N", file name "Output Power.pdf"

4.0 Spurious RF Conducted Emissions

The spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in the following mode of operation: no hopping with a modulated carrier. The spectrum was scanned from 0 MHz to 10 GHz.

Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power is at least 20dB down from the highest emission level within the authorized band. The spectrum analyzer's resolution bandwidth was 100 kHz and the video bandwidth was greater than or equal to the resolution bandwidth.

The spurious RF conducted emissions data may be referenced in Exhibit "H", file name "Conducted Spurious Emissions.pdf"

4.1 Band Edge Compliance of RF Conducted Emissions

The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in the following mode of operation: no hopping with a modulated carrier. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 2.5 MHz below the band edge to 2.5 MHz above the band edge.

Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power is at least 20dB down from the highest emission level within the authorized band. The spectrum analyzer's resolution bandwidth was 100 kHz and the video bandwidth was greater than or equal to the resolution bandwidth.

The data for spurious RF conducted emissions at the edges of the authorized band may be referenced in Exhibit "G", file name "Band Edges.pdf

4.2 Carrier Frequency Separation

The carrier frequency separation was measured between each of 5 hopping channels in the middle of the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

Per 47 CFR 15.247(a)(1), the hopping channel carrier frequencies are separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. The spectrum analyzer's resolution bandwidth was greater than or equal to 1% of the span, and the video bandwidth was greater than or equal to the resolution bandwidth.

Measured value of carrier frequency separation for hopping channels is 500 kHz.

The data for carrier frequency separation may be referenced in Exhibit "F", file name "Adjacent Channel Spacing.pdf"

4.3 Time of Occupancy (Dwell Time)

The average dwell time per hopping channel was measured at one hopping channel in the middle of the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

Per 47 CFR 15.247(a)(1)(i), the average time of occupancy on any frequency is not greater than 0.4 seconds within a 10 second period. The spectrum analyzer's span was set to zero, the resolution bandwidth was 1 MHz, and the video bandwidth was 7 MHz. The measurement was made in two steps. First, the sweep speed was adjusted to capture the pulse width or dwell time of a single transmission. Then, the sweep speed was set to 10 seconds to count the number of transmissions during a 10 second period.

The dwell time for a single transmission is 725uS. The number of transmissions during a 10 second period is 58. The dwell time, multiplied by the number of transmissions during a 10 second period equals the average time of occupancy during a 10 second period.

725uS x 58 = .042 seconds

The data for time of occupancy may be referenced in Exhibit "J", file name "Dwell Time.pdf"

4.4 Number of Hopping Frequencies

The number of hopping frequencies was measured across the authorized band. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The hopping function of the EUT was enabled.

Per 47 CFR 15.247(a)(1)(i), the number of hopping channels is at least 25. The spectrum analyzer's resolution bandwidth was 100 kHz, and the video bandwidth was greater than or equal to the resolution bandwidth.

The data for the number of hopping frequencies may be referenced in Exhibit "M", file name "Number of Hopping Frequencies.pdf"

4.5 Field Strength Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured level. The basic equation with a sample calculation is as follows:
FS = RA + AF + CF - AG

where : FS = Field Strength

RA = Measured Level

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/meter.

FS = 52.5 + 7.4 + 1.1 - 29 = 32 dBuV/meter
Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20] = 39.8 uV/m

4.6 Measurement Bandwidths

Peak Data

150 kHz - 30 MHz ..... 10 kHz
30 MHz - 1000 MHz..... 100 kHz
1000 MHz - 10000 MHz ..... 1000 kHz

Quasi-peak Data

150 kHz - 30 MHz ..... 9 kHz
30 MHz - 1000 MHz..... 120 kHz

5.0 Measurement Equipment

Instrument	Manufacturer	Model	Serial No	Cal Due
Spectrum Analyzer	Hewlett-Packard	8566B	2747A05213	1/19/2001
Pre-Amplifier	Amplifier Research	LN1000A	25660	7/18/2000
Antenna, Biconlog	EMCO	3141	9906-1146	6/15/2000
Antenna, Horn	EMCO	3115	9804-5441	7/10/2000
Pre-Amplifier 0.5-18 GHz	Miteq	AMF-4D-005180-24-10P	621707	7/18/2000
Spectrum Analyzer	Tektronix	2784	B010105	12/18/2000
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	577858	1/17/2001
High Pass Filter 1.5 GHz	RLC Electronics	84300-80037	001	4/10/2001