MEASUREMENT/TECHNICAL REPORT

Current Works, Inc. Model SideKeys

FCC ID: LYN48RX

APPLICATION FOR CERTIFICATION

RF Emission Measurements Performed For Determination of Compliance with the US Code of Federal Regulations Title 47, Chapter I, FCC Part 15 Subpart B As Required for Certification for Unintentional Radiators

Radiometrics Midwest Corporation Test Document RP-3806B
Issue Date: August 14, 1998
This report concerns: Original grant
Equipment type: Personal Computer Peripheral and 418 MHz Receiver
Transition Rules per 15.37 are not requested.

Tests Performed For	*Test Facility*
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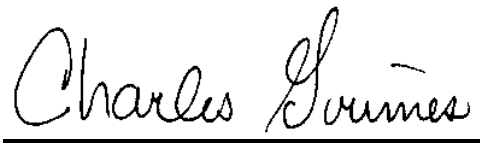
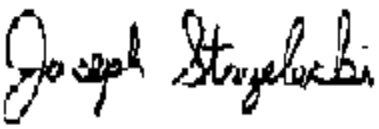
Test Report Written By  Charles Grimes EMC Engineer	*Test Report Approved By*  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE

Table of Contents

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1.0 General Information

1.1 Product Description

The Model SideKeys (referred to as the EUT in this report) is a 418 MHz receiver and a personal computer peripheral. The EUT is manufactured by Current Works, Inc. The EUT is a receiver connected to the CPU of a personal computer that receives RF signals from a matched transmitter. The receiver is connected to the computer between the computer's normal keyboard and its CPU. The computer's normal keyboard and mouse remain connected, active, and usable. There may be several remote SideKeys keypads matched to the same receiver, allowing several users to access one computer.

The transmitter sends a 418 MHz Modulated RF signal to the matching receiver. This fixed signal indicates which transmitter is being used and on which one the individual switches was pressed. The signals sent are a finite number of predetermined codes, as in a remote control security device. These codes are sent one at time for a single, predetermined meaning, not strung together in different orders to get different meanings. They do not send data to the receiver. The receiver converts this fixed signal into the prescribed scan code signal and sends it on to the computer's CPU to enter the desired keystroke. The SideKeys transmitting keypads are matched to the receiver and the individual keys are defined in the receiver by following the three simple steps described on the receiver.

1.2 Related Submittals

The associated transmitter is operated under Part 15.231. It is subject to the FCC requirements pursuant to the Certification equipment authorization under Part 15 Subpart C, and is being submitted as FCC ID: LYN20TX

1.3 Tested System Details

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system which have grants, are:

Model Number Serial Number	FCC ID	Manufacturer & Description	Cable Descriptions
M/N: SideKeys (EUT) S/N:	LYN48RX	Current Works, Inc. 418 MHz receiver	Serial (1.8m, SH, I)
M/N: 1400C S/N: QF7262G9A9Z	HFSM3571-166L2	Apple Powerbook Notebook Computer	Power (2.1m, US) See Peripherals
M/N: G5431 S/N: MB439WJVT18	BCGM2706	Apple Mouse	Serial (0.9m, SH, I)
M/N: M2003 S/N: N/A	BCGM2003	Apple Printer	Power (1.8m, US) Prn. (1.8m, SH)

Note: SH = Shielded; US = Unshielded; m = Cable Length in Meters, I = Integral

1.4 Test Methodology

The test procedures used are in accordance with the ANSI document C63.4-1992, (July 17, 1992) "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

1.5 Test Facility

The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. Details of the site characteristics are on file with the FCC. Conducted emission measurements and preliminary radiated emission scans were performed in shielded enclosure “B” at Radiometrics' Romeoville, Illinois EMI test lab. These sites have been fully described in a report and accepted by the FCC in a letter dated October 1, 1996 (31040/SIT 1300F2).

Conducted emission measurements were performed using a Line Impedance Stabilization Network (LISN) as the pick-up device. This device is constructed in accordance with the circuit diagram provided in Figure 3 of ANSI document C63.4-1992.

1.7 Test Equipment

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidths of the spectrum analyzers are adjusted to the correct bandwidths as specified by the FCC Rules. The bandwidth used from 450 kHz to 30 MHz is 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz a 1 MHz bandwidth is used. In order to increase the sensitivity of the spectrum analyzer, a preamplifier was used. The preamplifiers used had sufficient dynamic range that ensured that an overload condition was not present during the tests.

2.0 System Test Configuration

2.1 Test System and Justification

The system was configured for testing in a typical fashion (as a customer would normally use it). The EUT was installed in series with the keyboard of the of the Laptop computer. The following connections were made directly to the EUT:

The host computer system had a printer connected via a shielded printer cable with plastic connector shells. A mouse was also connected to the system keyboard connector via its integral data cable. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply.

2.2 EUT Exercise Software

The EUT exercise program used during radiated and conducted testing was contained on the hard drive of the host computer. The program sequentially exercises each system component in turn. The following sequence was used: (1) 1000 full lines of H's are printed on the monitor, (2) disk drive was read from and written to, (3) printer prints a full line of H's. The complete cycle takes about 10 seconds and is repeated continuously. The software continuously fills the screens with capitol H’s. No data was sent to the keyboard and mouse during the tests. This program ran until it was manually stopped at the end of each test.

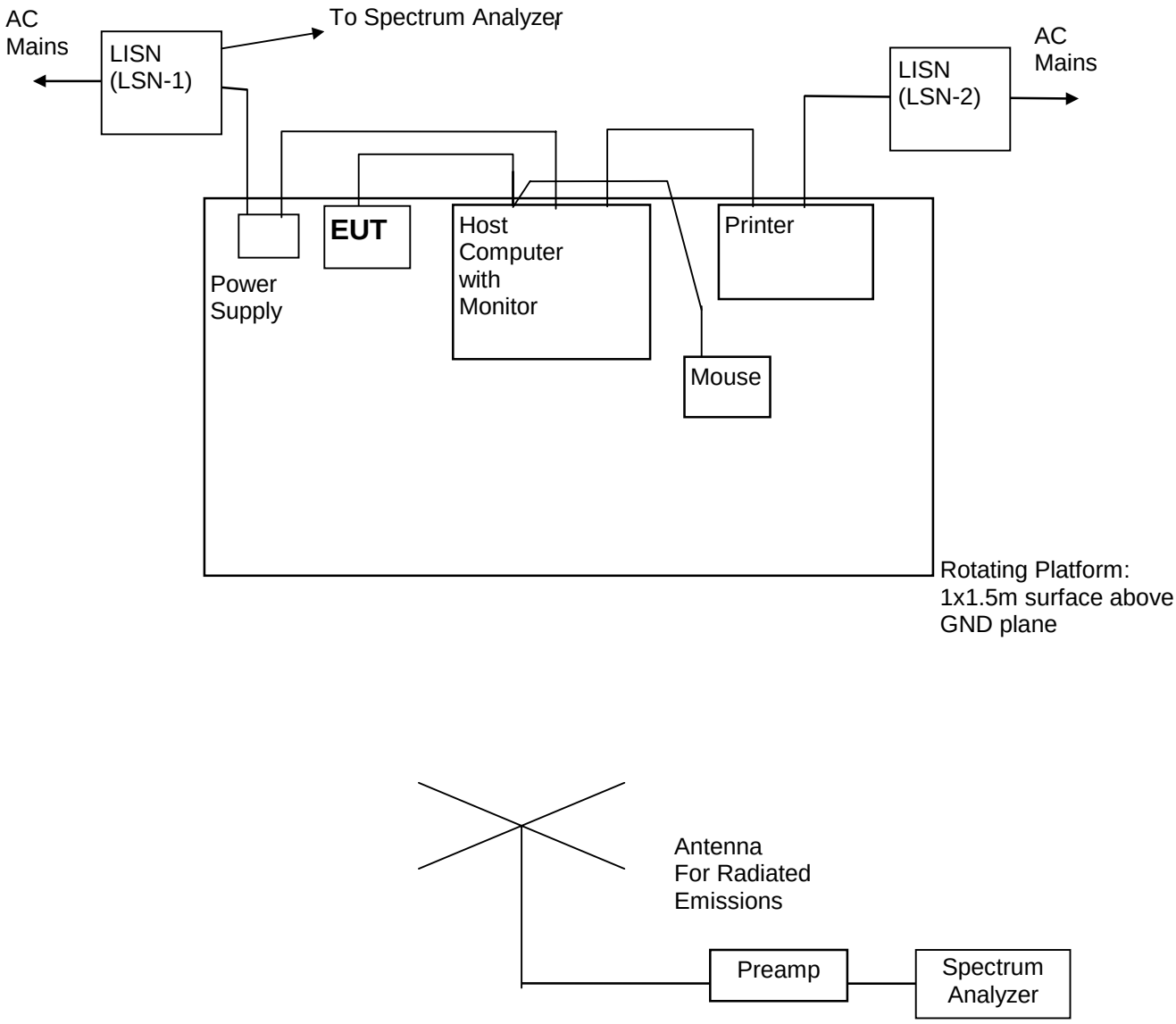
2.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

2.4 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

Figure 2.1 Configuration of Tested System



Radiated Emissions:
- LISN's not used
- AC outlet with low-pass filter at the base of the turntable
- No vertical conductive wall
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters

Notes:
- Not to Scale

Conducted Emissions:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled
- Test platform is not rotated

3.0 Conducted Emission Data

The initial step in collecting conducted data is a spectrum analyzer peak scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer (with the EUT connected) power cord, after testing all modes of operation.

Model : SideKeys
Test Date : July 27, 1998

Line Tested	Freq MHz	Reading dBuV	Cable Loss dB	Strength of Signal dBuV	Limit dBuV	Margin Under Limit dB
AC Hot	0.52	36.1	0.1	36.2	48.0	11.8
AC Hot	0.74	34.7	0.1	34.8	48.0	13.2
AC Hot	7.2	31.3	0.2	31.5	48.0	16.5
Neutral	0.53	35.6	0.1	35.7	48.0	12.3
Neutral	0.74	34.5	0.1	34.6	48.0	13.4
Neutral	1.9	32.6	0.1	32.7	48.0	15.3

* All reading are quasi-peak with a 9 kHz bandwidth and no video filter.

Changing the frequency of the transmitter did not affect the emissions listed above.
Judgment: Passed by 11.8 dB

Test Personnel: Charles Grimes
EMC Engineer

4.0 Radiated Emissions Data

The following table lists the highest measured emission frequencies, and measured levels and the Class B limit. A sample calculation is given in paragraph 4.1. The analyzer readings are quasi-peak with a 120 kHz bandwidth and no video filter.

Model : SideKeys
Test Date : July 27, 1998
Notes : Pol = Antenna Polarization; V = Vertical; H = Horizontal
BC = Biconical; LP = Log Periodic; DP = Dipole; P = Peak; Q = QP
Corr. Factors = cable loss - preamp gain

Freq MHz	Meter Reading dBuV	Antenna Factor dB	Antenna Pol/Type	Corr. Factors dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m	Margin Under Limit dB
46.6	31.9	12.7	V/BC	-17.5	27.1	40.0	12.9
53.5	32.5	12.0	V/BC	-16.7	27.7	40.0	12.3
53.5	33.5	12.1	V/BC	-16.7	28.9	40.0	11.1
51.8	28.0	12.4	V/BC	-17.0	23.4	40.0	16.6
50.1	27.0	12.8	V/BC	-17.2	22.7	40.0	17.3
57.0	31.5	11.4	V/BC	-16.0	26.9	40.0	13.1
62.2	27.6	9.8	V/BC	-14.6	22.7	40.0	17.3
63.9	34.2	9.0	V/BC	-14.4	28.8	40.0	11.2
67.3	31.6	7.6	V/BC	-14.4	24.8	40.0	15.2
72.9	33.2	7.0	V/BC	-15.0	25.2	40.0	14.8
74.2	34.5	7.2	V/BC	-15.3	26.5	40.0	13.5
215.8	27.4	11.7	V/LP	-15.8	23.2	43.5	20.3
217.7	33.1	11.5	V/LP	-15.8	28.8	46.0	17.2
334.2	25.2	15.1	V/LP	-15.3	25.0	46.0	21.0
203.8	38.1	12.9	H/LP	-15.9	35.2	43.5	8.3
211.3	40.0	12.1	H/LP	-15.9	36.2	43.5	6.3
215.8	32.0	11.7	H/LP	-15.8	27.9	43.5	15.6
243.6	31.5	11.9	H/LP	-15.6	27.8	46.0	18.2
422.0	23.7	17.0	H/LP	-15.2	25.4	46.0	20.6
495.4	30.0	18.9	H/LP	-15.0	33.9	46.0	12.1
645.4	27.4	19.6	H/LP	-14.3	32.7	46.0	13.3
36.7	26.7	12.0	H/BC	-18.0	20.8	40.0	19.2
190.3	32.1	17.8	H/BC	-15.8	34.0	43.5	9.5

Judgment: Passed by 6.3 dB
No Emissions were detected from 650 to 2000 MHz within 15 dB of the limits.
Test Personnel: Charles Grimes
EMC Engineer

4.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 49.5 dBuV is obtained. The Antenna Factor of 8.1 and a Cable Factor of 1.7 is added. The Amplifier Gain of 23.3 dB is subtracted, giving a field strength of 36 dBuV/m. The 36 dBuV/m can be mathematically converted to its corresponding level in uV/m.

FS = 49.5 + 8.1 + 1.7 - 23.3 = 36.0 dBuV/m

Level in uV/m = Common Antilogarithm [(36 dBuV/m)/20] = 63.1 uV/m