

Monday, December 29, 2003

Federal Communications Commission Laboratory
7435 Oakland Mills Road
Columbia, MD 21046

Re: Certification Test Results for Wireless Bathroom Device

Gentlemen:

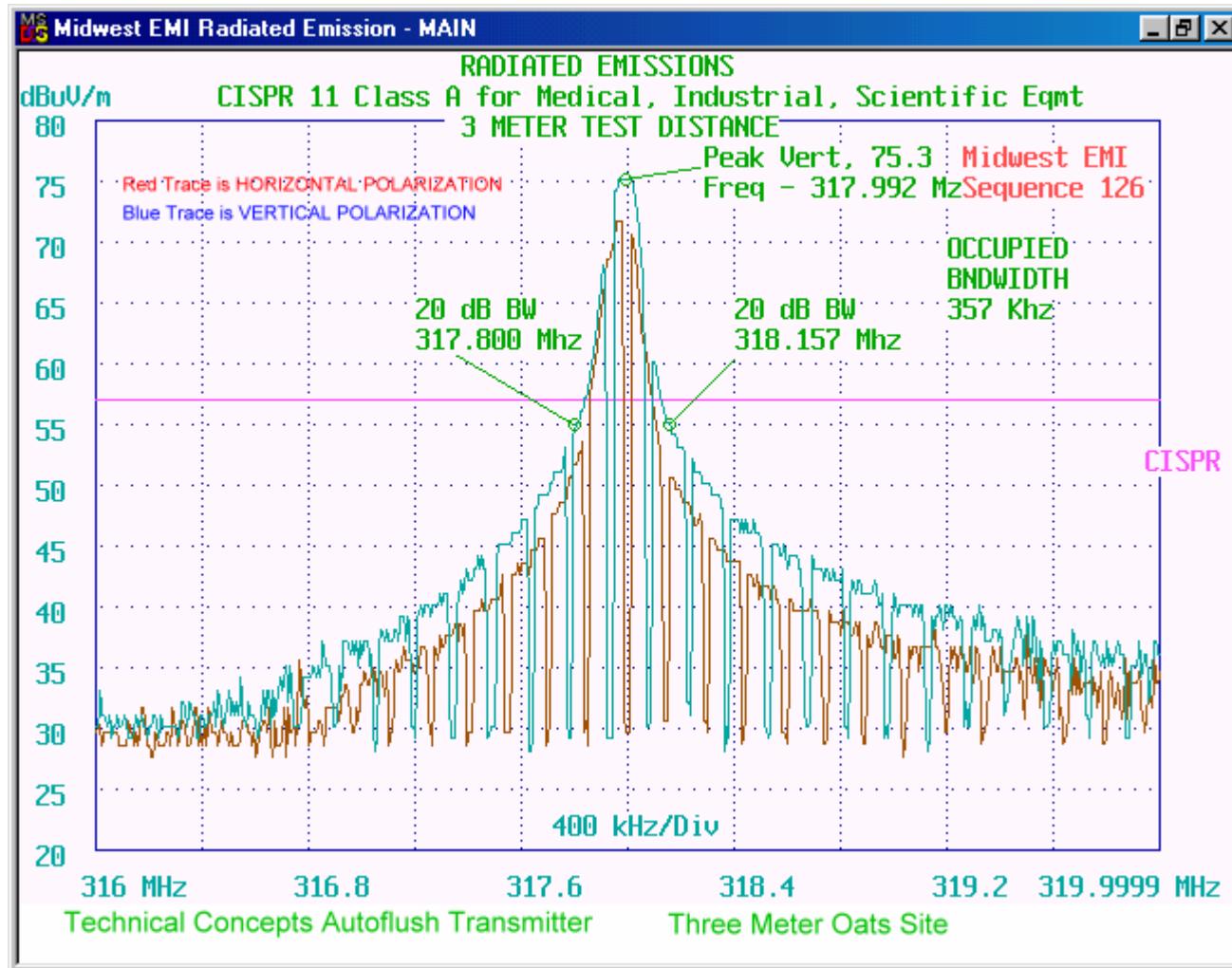
This correspondence concerns certification data for a personal hygiene bathroom device, Technical Concepts Autoflush system. The FCC ID for this device is RNV0009919150, Confirmation number EA817616. The FCC registration number of our laboratory is 496406, FRN 0005-8509-95. The technical contact for Technical Concepts on this device is Mr. George Jost, Chief Engineer, and for our laboratory is the undersigned. Test data was taken from this device in November and December, 2003. The location of the 10 meter OATS used is 7017 Miller Road, Wonder Lake, Illinois. The location of the 3 and 5 meter indoor site used is 21234 West Commercial Drive, Mundelein, Illinois.

The equipment under test consists of two portions, the Autoflush transmitter system, a battery operated (4 AA cell) wireless transmitter that operates at 318 Mhz fixed frequency controlled by a surface acoustic wave resonator and the receiver system, a companion device that is comprised of an integrated superhetrodyne receiver system powered by 4 C cells. The device is used in the bathrooms of hotels, office buildings, restaurants and other places used by the general public. The transmitter generates a signal based on movement detected by an infrared sensor and converts that indication into an amplitude modulated and 24 bit encoded signal that may be transmitted to the receiver up to about 4 feet away. The receiver may detect such a transmission and if it is a match to an encrypted code, will activate a flushing mechanism on a commode. The flushing system is comprised of a motorized apparatus that is installed inside the commode. The transmitter is normally located behind the patron on a wall of the enclosure. A block diagram is included in the submittal.

The sponsor group and Midwest EMI Associates have determined the certification standard for the EUT should be Part 15.231. In use the device complies with all relevant portions of 15.231 section (a) that allows 6166 uV/m at 318 Mhz or 75.8 dBuV/m for the fundamental and 55.8 dBuV/m for any harmonics. The device complies with 15.231 Items 1, 2, and 3 while item 4 is not relevant to this application. The device complies with section (b) and was tested in accordance with Items 1, 2 and 3 exclusively in PEAK MODE while computations are shown here for the relaxations in accordance with Item 4 and sections (c) and (e), Item (d) is not relevant.

Calculation of Item (c) of 15.231 (Occupied Bandwidth):

The fundamental of the transmitter was measured on the 3 meter indoor site and is shown here:



The 20 dB down occupied bandwidth is 357 Khz and measured as a percent is .112% meeting the FCC requirement of .25% (15.231 (c)). [This and any other data taken on the 3 meter site used a Tek 2712 with EMC option SN B022981 calibrated on 27 Aug 03. The antenna used is a linearly polarized Antenna Research LPB 2520 SN 1151 calibrated on 27 Oct 03. A 20 dB calibrated preamp, Minicircuits ZKL-2R7 SN D111502, 3 dB matching pad and 61 feet of RG214 cable is also utilized that has been calibrated using a Tektronix TR503 SN B010531 calibrated on 25 Aug 03 and Tektronix 495P analyzer SN B020147 calibrated on 26 Aug 03. The number of points of calibration for this antenna is 2400].

Calculation of Relaxation (15.231 (b) (2))

The FCC allows a quasi peak or average detector to be used for measurement of emissions. In this case, Midwest EMI Associates measures the peak level and calculates the average based on the worst case emissions profile of the device. The baseband emissions profile was measured using a Tektronix TDS 420 oscilloscope [SN B021212 calibrated 25 Aug 03] on a point driving the RF section of the transmitter, pin 5 of the encoder chip, HTPP20 shown on the transmitter schematic. The encoder amplitude modulates the RF carrier with a coded block of which 24 bits is the address code and 23 clocks is the synchronized pilot. [Please see the file "Holtek HT6P20X Encoder.pdf for details]. A one bit was measured with a 640 μ s on time in a 1.06 ms period while a zero bit was measured with a 290 μ s on time in a 1.06 ms period.

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Calculation assuming all “one” periods results in a relaxation of 4.38 dB. In addition to this the maximum possible rate at which the encoder may generate a code is with a transmission period of 30.6 mS and a silence period of 8.16 ms. When this is calculated an additional relaxation of 2.05 dB is realized for a total computed relaxation of 6.43 dB. [Measured data taken from the oscilloscope is in hard copy form and can be faxed to the FCC on request]

Schematic of Transmitter

The schematic of the transmitter is shown in the PDF file “Transmitter Schematic”. The sponsor group has supplied a writeup, block diagram, parts descriptions and layout.

Schematic of Receiver

The schematic of the receiver is shown in the PDF file “Receiver Schematic”. The sponsor group has supplied a writeup, block diagram, parts description and layout.

Temperature Testing

This device is only used at room temperature conditions and not specified for use under any extreme ambient conditions. The sponsor group does not specify an operating temperature range.

Ambient TV and FM Channels

Channels that are ambient in the vicinity of Wonder Lake or Mundelein, Illinois are Chicago channels 2, 5, 7, 9, 11, 20, 26, 28, 32, 34, 38, 44, 50, 60, 66; Milwaukee channels 4, 6, 10, 12, 18, 36, 58; Rockford channels 13, 17, 23, 39; and Madison channels 3, 15, and 21. The FM channels in these areas form a continuum of frequencies from 88 to 108 Mhz. These channels have been noticed regularly in emissions measurements taken from these two sites and are relatively strong in conditions of cold and clear weather.

General Description of Measurements Taken

The measurements taken consist of 3 meter harmonics measurements, 10 meter plastic case measurements, 10 meter chrome case measurements, site ambient measurements and finally a 3 meter high frequency test to allow better visualization of EUT emissions from 300-1000 Mhz. It was necessary to use three separate antenna setups, two of which feature similar equipment except for the length of cable and test distance and one that uses a horn antenna for high frequencies. The ten meter (Wonder Lake) and three meter (Mundelein) sites both use a CC Moore antenna mast model DAPM4/6 that allows extension of the antenna to either 1-4 or 1-6 meters, the 10 meter site uses a CC Moore 3 meter metal turntable while the 3 meter site uses a 2 meter dielectric turntable model DTT-4. The height above the ground plane on a purely wooden table is 80 cm. in either case.

Both sites make peak or quasipeak measurements using a Tektronix 2712 with EMC option [the 10 meter site spectrum analyzer is SN B022981 calibrated 25 Aug 03. The ten meter site utilizes 100 feet of LMR-4—UL Ultraflex coaxial cable and Minicircuits ZKL-2R7 preamp. For high frequency measurements, a horn antenna is used, Antenna Research Model DRG -118/A S/N 1281 calibrated on 9 Oct 03 and is used with a 30 dB preamplifier, Tiger Microelectronics, Model TGWA02183020, SN 0310WA051 used with 20 feet of Astrolab 32055 ultraflexible microwave cable. The microwave preamp and cable assembly, because of it's high precision, was calibrated as a pair at J & H Metrology, Rolling Meadows, Illinois on 27 Oct 03. The procedures used are called out from ANSI 63.4: 2000 version]. Data taken on the three and 10 meter sites are taken using identical bands, 25-75 Mhz, 75-175 Mhz, 160-300 Mhz, and 300 to 1000 Mhz. Separate data sets were taken per FCC recommendation on the plastic and chrome cases.

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The EUT was tested as a system because the receiver activates a motor function and the transmitter needs to transmit continuously to activate the receiver. The repetition rate was increased to the maximum possible and the sweep rate adjusted to the slowest necessary to capture valid peak emissions from the EUT. The action of the transmitter was to send out a 24 bit data stream to maintain the receiver activity and the receiver, in turn, sent control signals to the motor as rapidly as possible to activate the motor repetitively. In actual use this sequence would be much slower (by a factor of 100 or so). The turntable was rotated and antenna height adjusted to obtain the worst case composite radiated emissions from these devices. These devices are exclusively battery operated and no connection to AC power is made.

Description of Plastic Case Data – 10 meter OATS

The plastic case data is shown in four bands in exhibits entitled “Plastic Cover 25-75 Mhz”, “ Plastic Cover 75-175 Mhz”, “ Plastic Cover 170-300 Mhz”, and “Plastic Cover 300-1000 Mhz”. This data may be compared with ambient data entitled “Ambient 25-75 Mhz”, “Ambient 75-175 Mhz”, “Ambient 160-300 Mhz”, and “Ambient 300-1000 Mhz”. These four ranges are named “Band 1” through “Band 4” for the remainder of the description.

When compared in Band 1, the ambient shows TV channels 2 (Chicago) with HDTV sideband, 3 (Madison) and 4 (Milwaukee). Other frequencies were individually checked and found not to be due to the EUT. The antenna height found to produce the highest emissions was 3 meters.

When compared in Band 2, the ambient shows TV Channel 5 (Chicago), FM Band (88-108 Mhz), sporadic airplane emissions from 110-145 Mhz, police and weather repeaters at 158 and 162 Mhz and various other common carriers. When the EUT emissions were checked against the ambient, all emissions were judged to be from the ambient. The antenna height found to produce highest emissions was 3 meters.

When compared in Band 3, the ambient shows TV channels 7 (Chicago) with HDTV sideband, 9 (Chicago), 10 (Milwaukee), 11 (Chicago), 12 (Milwaukee), and 13 (Rockford). There were no EUT emissions close to the limit in the range to 300 Mhz. Other emissions were judged to be from the ambient.

When compared in Band 4, the ambient shows numerous UHF TV stations and heavy congestion due to spectrum allocations, the cell phone band and HDTV sidecarriers. On the date of the test the conditions were cold and clear, optimum for reception of distant signals. We elected to do further analysis (described later) on our 3 meter test site in Mundelein which would allow better discrimination of signals. In the ten meter Band 4 data it is possible to pick out the transmitter fundamental and harmonics.

[Note: At the present time our data acquisition system can print out tabular data locally but we cannot print to a file for transmission to the FCC therefore raw data for the tests have been provided. Printouts are available by fax on request.]

Description of Chrome Case Data – 10 meter OATS

The chrome case data is shown in four bands in exhibits entitled “Chrome Cover 25-75 Mhz”, “ Chrome Cover 75-175 Mhz”, “ Chrome Cover 170-300 Mhz”, and “Chrome Cover 300-1000 Mhz”. This data may be compared with ambient data entitled “Ambient 25-75 Mhz”, “Ambient 75-175 Mhz”, “Ambient 160-300 Mhz”, and “Ambient 300-1000 Mhz”. These four ranges are named “Band 1” through “Band 4” for the remainder of the description.

When compared in Band 1, the ambient shows TV channels 2 (Chicago) with HDTV sideband, 3 (Madison) and 4 (Milwaukee). Other frequencies were individually checked and found not to be due to the EUT. The antenna height found to produce the highest emissions was 3 meters.

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When compared in Band 2, the ambient shows TV Channel 5 (Chicago), FM Band (88-108 Mhz), sporadic airplane emissions from 110-145 Mhz, police and weather repeaters at 158 and 162 Mhz and various other common carriers. When the EUT emissions were checked against the ambient, all emissions were judged to be from the ambient. The antenna height found to produce highest emissions was 3 meters.

When compared in Band 3, the ambient shows TV channels 7 (Chicago) with HDTV sideband, 9 (Chicago), 10 (Milwaukee), 11 (Chicago), 12 (Milwaukee), and 13 (Rockford). There were no emissions close to the limit above this range to 300 Mhz. Other emissions were judged to be from the ambient.

When compared in Band 4, the ambient shows numerous UHF TV stations and heavy congestion due to spectrum allocations, the cell phone band and HDTV sidecarriers. On the date of the test the conditions were cold and clear, optimum for reception of distant signals. We elected to do further analysis on our 3 meter test site in Mundelein which would allow better discrimination of signals.

The high frequency data in Band 4 at the Mundelein 3 meter site is shown as two comparison graphs "Retest Chrome Cover Indoor 3 meter test" and "Retest Plastic Cover Indoor 3 meter test". The former graph shows the ambient emissions versus Chrome cover emissions while the latter compares ambient emissions versus Plastic cover emissions. When overlaid, there were no emissions that appeared close to the limit other than the ambient TV channel signals. Separate scans were undertaken to isolate any emissions from the EUT appearing close to the limit but none were found and it was judged passing in that range. These separate scans were performed from 300-450 Mhz, 440-640 Mhz, 620-820 Mhz, and 800-1000 Mhz, both vertical and horizontal polarization.

Harmonics Data Results

Harmonics data taken from the plastic and chrome cases have been shown in several graphs labeled either "Harmonics data Chrome Cover xxxx" or "Harmonics data Plastic Cover xxxx" where "xxxx" refers to the measured frequency in Mhz. Tabular data of the highest emission whether it was vertical or horizontal polarization was written directly on the graph. The worst case emissions from the ten measured harmonics from 318 to 3180 Mhz has been shown. Others measured were lower in level than those presented. When compared to the limit for the fundamental, the plastic case exhibited the highest level emissions of 75.3 dBuV/m where 75.8 plus 6.4 dB is allowed. The chrome (or called "silver") case showed a level of 67.2 dBuV/m on the fundamental. The highest other harmonics measured were the tenth (3180 Mhz) on the plastic case at 57.8 dBuV/m where 55.8 plus 6.4 dB is allowed and 55 dBuV/m on the second (636 Mhz) on the plastic case where 55.8 plus 6.4 dB is allowed. This data was taken with the horn antenna critically aimed at the portion of the EUT transmitter with highest emissions and then by rotation the dielectric table to further maximize emissions.

Thank you for your review of our submitted data.

Sincerely,
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