Thursday, February 19, 2004

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

Re: Certification Test Results for Wireless Bathroom Device – In Wall

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 December through February, 2004. 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.

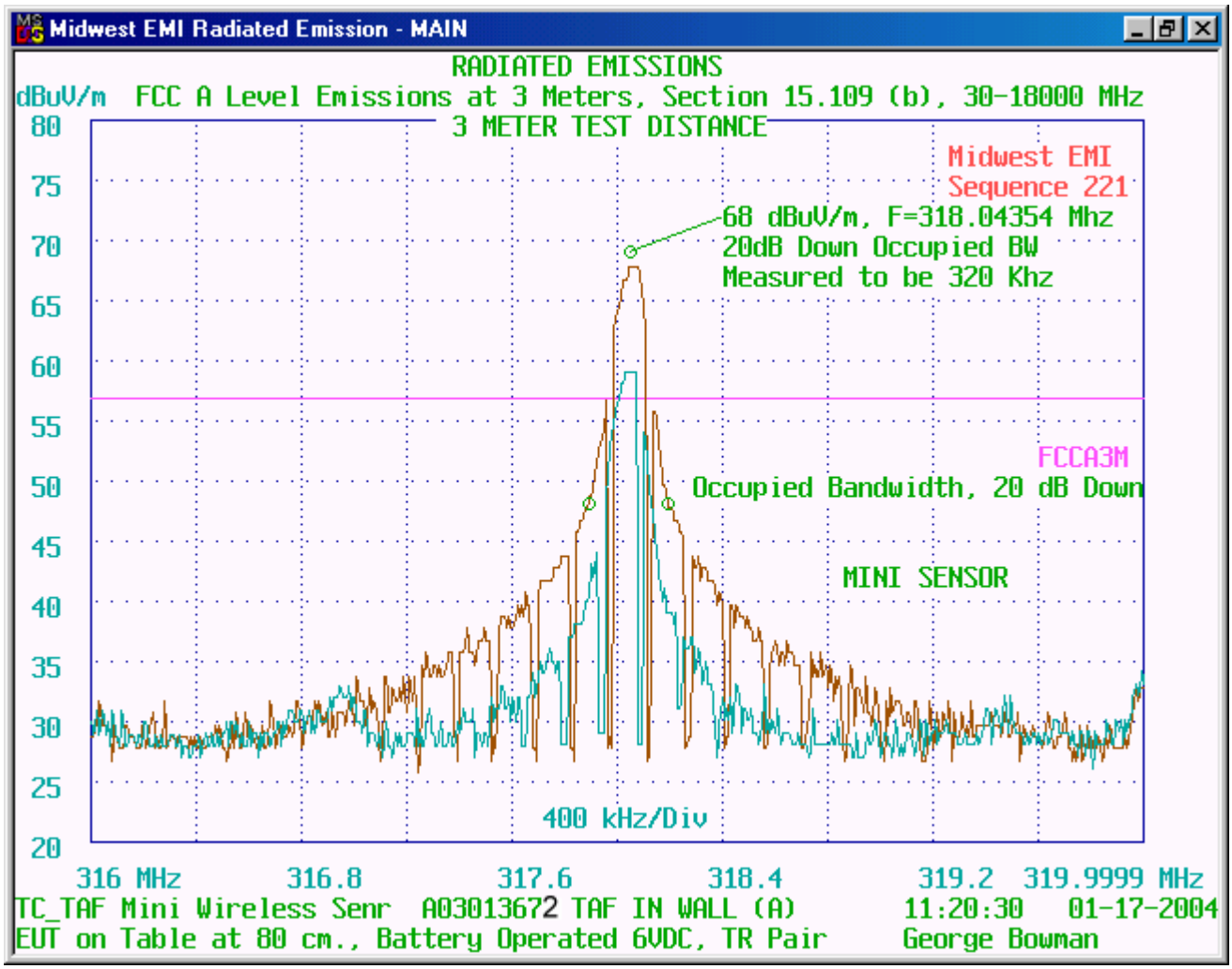
The equipment tested consists of two additional companion wireless sensors to the TAF Autoflush wall mounted series previously tested. In this new submission a "C Cell In-Wall Mounted" and "AA Cell Minisensor In-Wall" transmitter and receiver system was characterized. These two systems use almost exactly the same circuitry as previously submitted however in an alternate PCB configuration more compatible with inside the wall mounting. Previous data on the components of this system should be reviewed because the theory of operation and components used are almost identical electrically. The two packages are referred to as the "C cell" transmitter and the "Minisensor" transmitter. The smallest of the two is the Minisensor and either of them fit flush to the wall of the restroom where installed. Additionally a new receiver is supplied with exactly the same electronics with a "new style" flushing mechanism. As in the first submittal the devices are tested as a TR pair.

In review, the equipment under test consists of two portions, the Autoflush transmitter system, a battery operated (4 C or 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 a integrated superhetrodyne receiver system powered by 4 C cells. The device is used in 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 sponsor group and Midwest EMI Associates have determined the certification standard for the EUT should be Part 15.231 for these companion devices. 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 new transmitter was measured on the 3 meter indoor site and is shown here:



The 20 dB down occupied bandwidth is 328 Khz and measured as a percent is .103% 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, HT6P20X shown on the transmitter schematic. The encoder amplitude modulates the RF carrier with a 30 bit code of which 24 bits is the code and 6 bits is the synchronized preamble. A one bit consists of a 640 uS on time in a 1.06 mS period while a zero bit consists of a 290 uS on time in a 1.06 ms period. 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. [Data taken from the oscilloscope is in hard copy form and can be faxed to the FCC on request]

Schematic of Transmitter

The schematic and layout of the new "C cell" transmitter is shown in the PDF file "C In-wall Schematic" and "C In Wall PCB layout". The sponsor group had previously supplied a writeup, block diagram, and parts descriptions. The schematic and layout of the new "Minisensor" transmitter is shown in "Minisensor Schematic" and "Minisensor Layout"

Schematic of Receiver

The schematic and layout of the receiver is shown in the PDF file "Wireless TAF Receiver Schematic" and "Wireless TAF Receiver Layout". The sponsor group has supplied a writeup, block diagram, and parts description. There is no differences in the receiver from the previous submission however the Minisensor TR pair utilized the "new style" flushing mechanism.

Temperature Testing

These device are 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.

General Description of Measurements Taken

The measurements taken consist of 3 meter harmonics measurements, 10 meter "C cell" case measurements, 10 meter "Minisensor" case measurements, site ambient measurements and finally a complete 3 meter scan for each device. It was necessary to use three separate antenna systems, two

of which used similar equipment except for the length of cable and one that uses a 3 meter horn antenna for high frequencies. The ten and three meter 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 quasipeak measurements using a Tektronix 2712 with EMC option [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.

The EUT was tested as a system because the receiver activates a motor function. The repetition rate was increased to the maximum possible and the sweep rate adjusted to the slowest necessary to capture peak emissions from the EUT. The action of the transmitter was to send out a 24 bit data stream as quickly as possible 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 C cell Case Data – 10 meter OATS

The C Cell case data is shown in five bands in exhibits entitled "ON WALL C cell 25-75 QP", "ON WALL C cell 75-175 QP", "ON WALL C cell 170-300 QP", "ON WALL C cell 300-640 Peak" and "ON WALL C cell 620-1MM Peak". This data may be compared with ambient data similarly entitled as "Ambient". These five ranges are named "Band 1" through "Band 5" 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 marked on the graph.

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 and 5, 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. From this data, however, it is possible to pick out the 1st, 2nd and 3rd harmonic of the transmitter. Tabular data for the quasipeak analysis is similarly identified as "QP Data".

A similar complete scan on this device was also conducted at our indoor 3 meter site. It is identified as "C cell 3 Meter" in each graph and ambient and QP mode graphs were taken in 4 bands identified as 25-75, 75-175, 160-300 Mhz, and 300-1000 Mhz. In our opinion there are no excess emissions due to this device except for the intentional emissions of the transmitter.

Description of Minisensor Case Data – 10 meter OATS

The Minisensor case data is shown in five bands in exhibits entitled "ON WALL MINI 25-75 QP", "ON WALL MINI 75-175 QP", "ON WALL MINI 170-300 QP", "ON WALL MINI 300-640 Peak" and "ON WALL MINI 640-1000 Peak. This data may be compared with ambient data similarly entitled as "Ambient" and tabular data similarly entitled as "Data". These five 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 emissions close to the limit above this range to 300 Mhz. Other emissions were judged to be from the ambient. The antenna height found to produce highest emissions was 3 meters.

When compared in Band 4 and 5, 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.

A similar complete scan on this device was also conducted at our indoor 3 meter site. It is identified as "Mini 3 Meter" in each graph and ambient and QP mode graphs were taken in 4 bands identified as 25-75, 75-175, 160-300 Mhz, and 300-1000 Mhz. In our opinion there are no excess emissions due to this device except for the intentional emissions of the transmitter.

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Harmonics Data Results

Harmonics data taken from the C cell and Minisensor cases are shown in several graphs labeled either "IN WALL C Harmonic Modified xxxx" or "IN WALL Harmonic Mini A xxxx" where "xxxx" refers to the frequency in Mhz. Tabular data of the highest emission whether it is vertical or horizontal polarization is written directly on the graph. The worst case emissions from the ten measured harmonics from 318 to 3180 Mhz is shown. Others were lower in level than those presented. When compared to the limit for the fundamental, the C cell case shows transmit emissions of 68.9 dBuV/m where 75.8 plus 6.4 dB is allowed. The Minisensor case showed a level of 68 dBuV/m on the fundamental. The highest higher harmonics measured were the third (1271 Mhz) on the C Cell case at 60.9 dBuV/m where 55.8 plus 6.4 dB is allowed and 58.9 dBuV/m and at 2.5442 Ghz on the Minisensor 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 of the dielectric table to further maximize emissions.

MODIFICATIONS REQUIRED

The "C cell" transmitter as delivered did not pass the harmonics test at 2.544 Ghz. A modification was added to the antenna port of the device (antenna port to ground) in the form of a 1 pF high Q capacitor, style 0603, Murata GRM39C0G010C50 or equivalent, to reduce emissions. This provided a virtual short at that frequency resulting in very low emissions. The sponsor group has agreed to make this modification.

Thank you for your review of our submitted data.

Sincerely,

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