TEST REPORT #021002A

STANDARD: FCC PART 15

SUBPART C--INTENTIONAL RADIATORS

SECTION 15.247 OPERATION IN THE BANDS 902-928 Mhz, 2400-2483.5 Mhz, and 5725-5850 Mhz

EQUIPMENT TESTED:

AMERICAN TELECARE, INC.

MODEL: WIRELESS ADAPTER 210A

TEST DATE: 02 OCTOBER 2002

1100 Falcon Avenue
Glencoe, MN 55336

INTERNATIONAL

CERTIFICATION SERVICES, INC.

Tele: 320-864-4444
Fax: 320-864-6611

Prepared for:

American TeleCare, Inc.
7640 Golden Triangle Drive
Eden Prairie, MN 55344

Test agent:

International Certification Services, Inc.
1100 Falcon Avenue
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Test location:

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Prepared by:

International Certification Services, Inc.
1100 Falcon Avenue
Glencoe, MN 55336

International Certification Services represents to the client that testing is done in accordance with standard procedures applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy.

This report only applies to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Certification Services shall have no liability for any deductions, inferences or generalizations drawn by the client or others from this report.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval.

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1.0 TEST SUMMARY

TEST REPORT: #021002A	
COMPANY:	American TeleCare, Inc.
AGENT:	International Certification Services, Inc.
PHONE:	320-864-4444
TEST DATE:	02 October, 2002
EQUIPMENT UNDER TEST:	Wireless Adapter Model: 210A
GENERAL TEST SUMMARY:	The testing was performed at International Certification Services, Inc. at 1100 Falcon Ave, Glencoe, MN 55336
VERIFICATION / CERTIFICATION STATUS:	The American TeleCare, Inc. Model: Wireless Adapter 210A system was found to be in compliance with the FCC Part 15 Subpart C, Section 15.247 requirements.
MODIFICATIONS NECESSARY:	None

TESTED BY

Steve Wendlandt

WRITTEN BY

Duane R. Bagdons

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Applicable Standards

47 CFR Ch.1 (10-1-98 Edition)

FCC Part 15 Radio Frequency Devices

Subpart C Intentional Radiators

Section 15.247 Operation in the Bands 902-928 Mhz, 2400-2483.5 Mhz, 5725-5850 Mhz

2.1 Referenced Standards

ANSI C63.4-1992 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 Khz to 40 Ghz.

2.2 Equipment Units Tested

The equipment tested is a small device that converts an RS232 signal fed into its stereo audio cable to the Bluetooth wireless standard. It can communicate with the Bluetooth Wireless Interface circuit inside the American TeleCare, Inc. NX Patient Station. The NX Patient Station can record vital signs (e.g. blood pressure, pulse, weight, blood sugar, oxygen saturation) from medical device peripherals that are connected to it, either by cable or wireless.

The Wireless Adapter can be attached to a medical device that has a data port, with a stereo audio plug connected to the device's data jack. This replaces the cable which would otherwise connect between the medical device and the NX Patient Station, thus allowing the device to be locally mobile.

The incorporated Spread Spectrum (Blue Tooth) wireless transmitter communicates between the peripheral health measuring devices and the computer to record the measured data. The Spread Spectrum signal generation and transmission is performed by a chip made by CSR, Ltd (BlueCore 2 External single chip Blue Tooth System P/N: BC212013). All hardware functions are generated in this chip for the RF signals. The antenna is a BlueChip by Centurion Wireless Technologies, Inc. This component is ¼ wave antenna self contained in a miniature chip package. All RF and spread spectrum controls are hardware and software with no adjustments left to the operator.

The Spread Spectrum output transmits on 79 frequencies with a dwell time at each frequency of 420 uS and a carrier frequency separation of 1.006 Mhz. The exact measured data is given in subsequent sections of this report.

The receiver is a SAW based type device and do not have a local oscillator. This part of the system has been verified here at the lab also for radiated emissions and found to be compliant with the 15.109 regulation for Radiated Emission Limits.

2.3 Equipment and Cable Configuration

See photos of the EUT PC board and schematic and test configuration setup in additional attachments associated with this report filing.

2.4 List of Test Equipment

Test Equipment	Model	S/N	Last Calibration Date
Spectrum Analyzer	Hewlett-Packard 8566B	2421A00458	08/01/02
Preamp	MiniCircuits ZKL-2R7	N/A	06/24/02
Log Periodic Antenna (200-1000 MHz)	EMCO 3146	9101-2991	12/17/01
Horn Antenna (1-18 Ghz)	EMCO 3115	5697	12/17/01
Horn Antenna (18-40 Ghz)	EMCO 3116	4829	12/17/01

Measurement cable losses, and antenna correction factors are included in the Corrected Data column of the data sheet. Quasi Peak Detection was used for measuring the Fundamental frequency signal and Average detection method was used to measure the Harmonics since they were all above 1000 Mhz. The Resolution BW was set at 100 Khz and the Video BW was set at 1 Hz with a Span of 0 Hz to perform the correct average detected measurements. All measurements were taken using the "Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" (FCC DA 00-705 released March 20, 2000). Most measurements were taken with the Spectrum Analyzer directly connected to the EUT Transmitter as required by the above mentioned FCC Guidelines document. Only the Radiated Spurious Harmonics was measured on the OATS site.

2.5 Units of Measurement.

All OATS measurements were taken in dBuV/m with the antenna located at 1 meter distance from the EUT. Frequency measurements are recorded in Mhz.

2.6 Location of Test Site

The open area test site (OATS) and conducted measurement facility used to collect the data was International Certification Services, Inc. at 1100 Falcon Ave. in Glencoe, MN 55336. This site has been certified to be in compliance with the normalized site attenuation section of CISPR 16-1. (See FCC Registration number: 91103 and Industry Canada File number: IC 3701.)

2.7 Measurement Procedures

The antenna was placed at a distance of 1 meter from the EUT. The EUT was set on an insulating table in the OATS site and rotated through 360 degrees to determine the worst case EUT orientation. The antenna was then positioned vertical and horizontal to determine which antenna polarity orientation was worst case. Then certification data was recorded at all the transmitter frequencies from the fundamental to the 10th harmonic at an antenna height variation of from 1-4 meters.

2.8 Reporting Measurement Data

See data sheets and plots in Attachment B for the Transmitter section and in Attachment C for the Receiver section of the product.

2.9 Radiated Spurious Emissions Data

The frequency and amplitude of the Fundamental frequency of the EUT along with the frequencies and amplitudes of the harmonics up to the 10th harmonic were observed and are reported in the data sheets in Attachment B. Signal frequencies above 7440.0 Mhz were below the noise floor of the measurement system. This information is plotted against the limit of section 15.247 of FCC Part 15 subpart C. Both Horizontal and Vertical antenna polarities as well as antenna heights of 1 to 4 meters were observed but all maximum signal strengths occurred in the Horizontal antenna polarity and at 1 meter antenna height.

The Final Level, expressed in dBuV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBuV) and adding the antenna correction factor and cable loss factor (Factor dB) and subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the margin which gives the tabular data as shown in the data sheets in Attachment B.

Example:

Frequency (MHz)	Level (dBuV)	+	Factor (dB)	=	Corr Data (dBuV/m)	-	FCC Limit (dBuV/m)	=	Margin (dB)
100.0	20.6	+	11.0	=	31.6	-	43.5	=	-11.9

2.10 Summary of Results

The EUT passed all of the requirements of FCC Part 15 Subpart C, Section 15.247. No modifications were necessary to accomplish this compliance.

ATTACHMENT A

RADIATED MEASUREMENT SCHEMATIC AND PHOTOS

American TeleCare, Inc.
Model: Wireless Adapter 210A
Transmitter Test Configuration (direct coupled to the Spectrum Analyzer)

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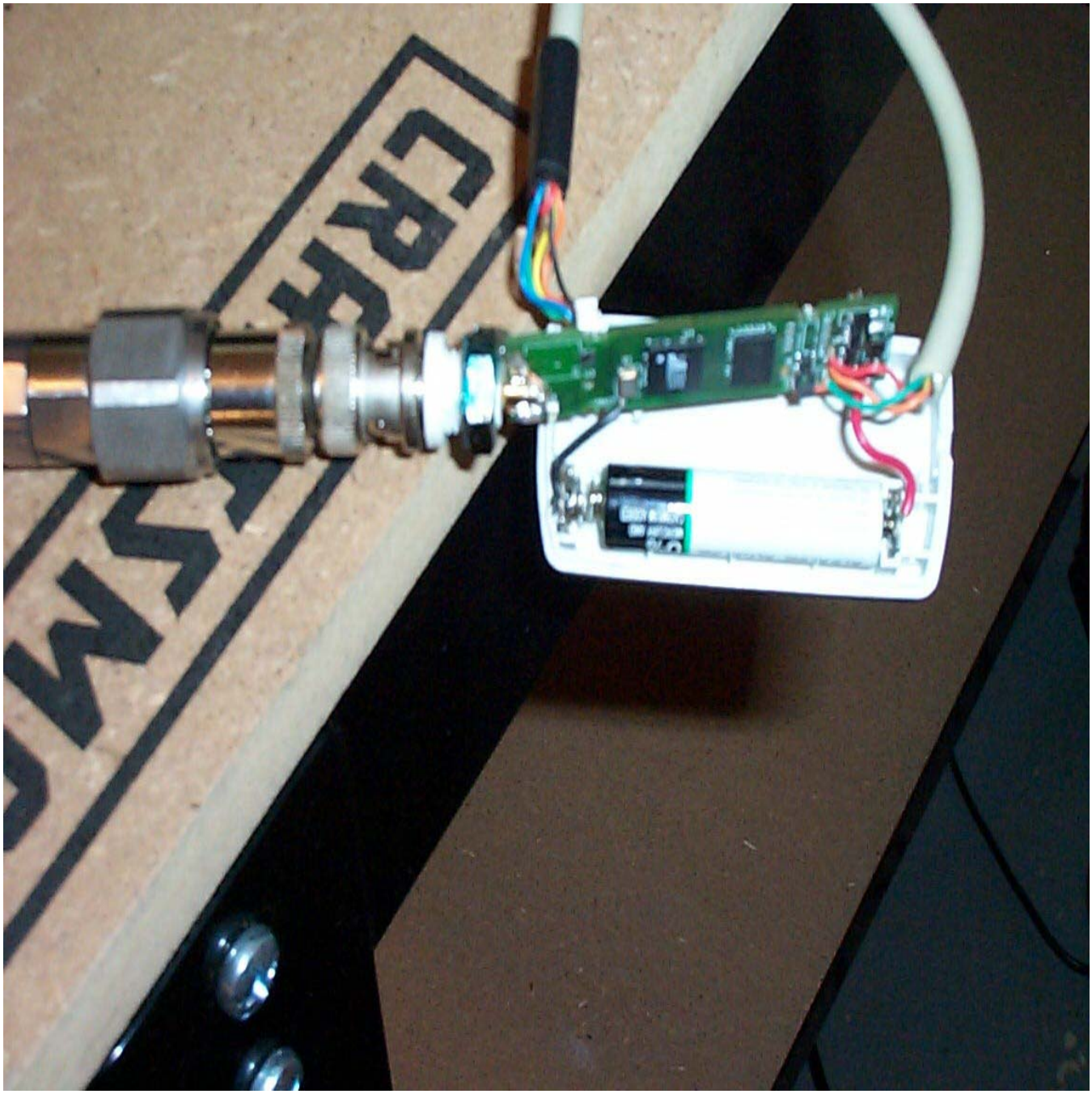
American TeleCare, Inc.
Model: Wireless Adapter 210A
Transmitter Test Configuration (direct coupled to the Spectrum Analyzer)



ATTACHMENT B
TRANSMITTER SECTION
DETAILED TEST DATA SHEETS

Each radiated emissions plot takes into consideration the antenna distance in meters compared to the distance that the limit is defined at (3 Meters) as well as all the correction factors in the measuring system.

American TeleCare, Inc.
Model: Wireless Adapter 210A
Temperature: 71 Deg F.
Humidity: 51 % R.H.

Test Technician: Steve Wendlandt

The following measurements were performed per the "…Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" FCC Document #DA 00-705 released March 30, 2000.

Section 15.31 (m)

This rule specifies the number of operating frequencies to be examined for tunable equipment.

This equipment is not tunable, all frequencies and output levels are set at the design and are not adjustable.

Section 15.203:

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

The EUT uses a PC board mounted chip type antenna. One and only one antenna P/N is used in this product. The chip antenna is a BlueChip Antenna made by Centurion Wireless Technologies, Inc.

Section 15.203:

Provide the following information for every antenna proposed for use with the EUT: (a) type (e.g., Yagi, Patch, Grid, dish, etc.,), (b) manufacturer and model number , and (c) gain with reference to an isotropic radiator.

The antenna used is a Model: BlueChip Antenna made by Centurion Wireless Technologies, Inc. The specified Peak Gain > 2 dBi (azimuth plane – vertical polarization) and the Average Gain >0 dBi (azimuth plane – vertical polarization)

Section 15.207:

If the unit is designed to be connected to the public utility power line, the voltage conducted back onto the AC power line must be measured, in order to demonstrate compliance with the limit specified in this Section.

The EUT is battery powered with no connection to the AC Mains therefore this test is not applicable.

Section 15.247 (a)

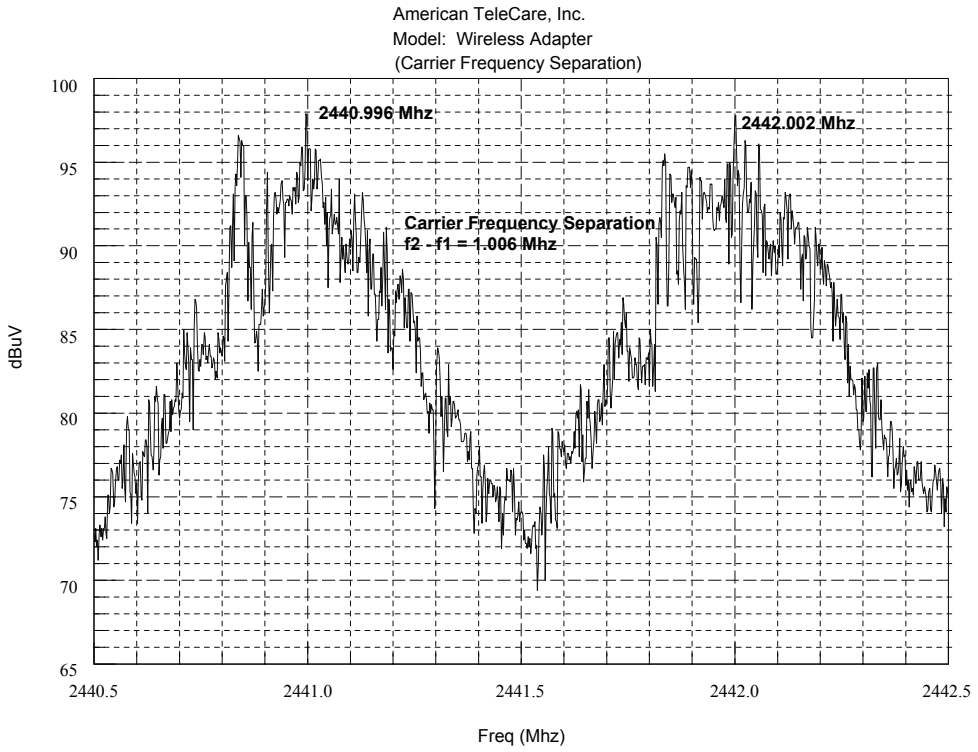
Describe how the EUT meets the definition of a frequency hopping spread spectrum system, found in Section 2.1, based on the technical description.

The technical description listed in Section 2.1 states that the definition of a frequency hopping system is that the frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. The near term distribution of hops appears random, the long term distribution appears evenly distributed over the hop set, and sequential hops are randomly distributed in both direction and magnitude of change in the hop set. In this device, there is a set of 79 frequencies that are used. The frequency sequence is pseudo-randomly generated by the master BlueTooth device in the system of 8 units. This is a pseudo random generation with a repeating pattern based on a 23 hour 30 minute cycle. A typical frequency hopping sequence is as follows: 40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04. Dwell times at each frequency are fixed and the various frequencies appear to have a random sequence but over the long term they are used equally in the allowed spectrum of 2402 to 2480 Mhz..

Carrier Frequency Separation:

Specified Limit 15.247 (a) (1)

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



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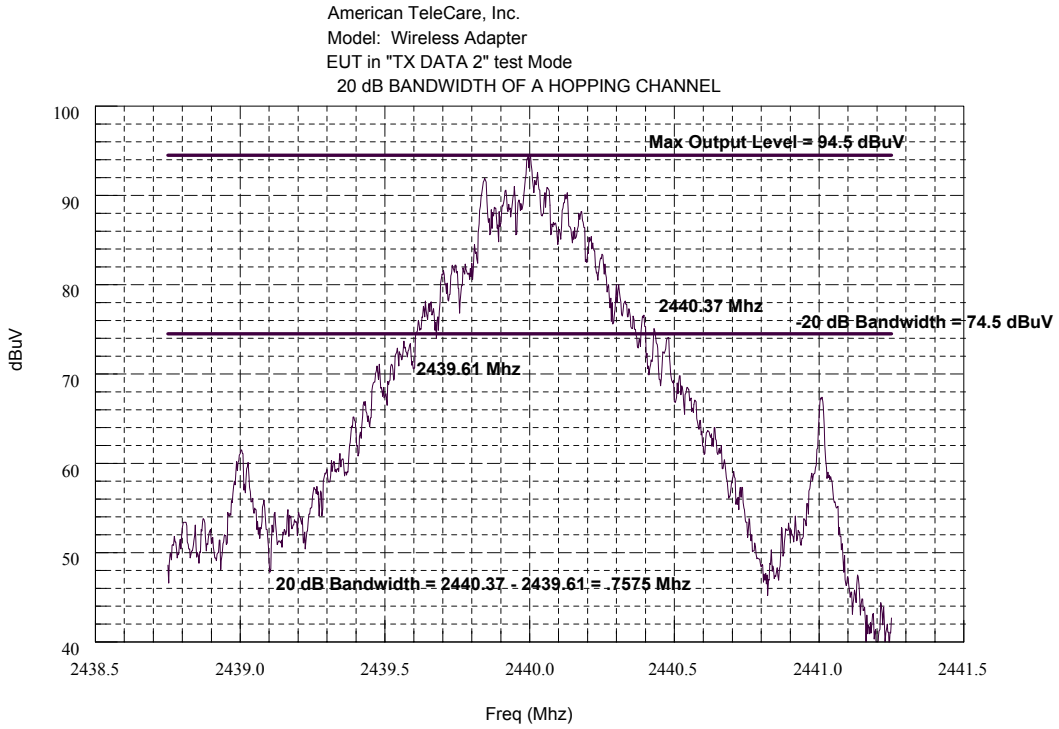


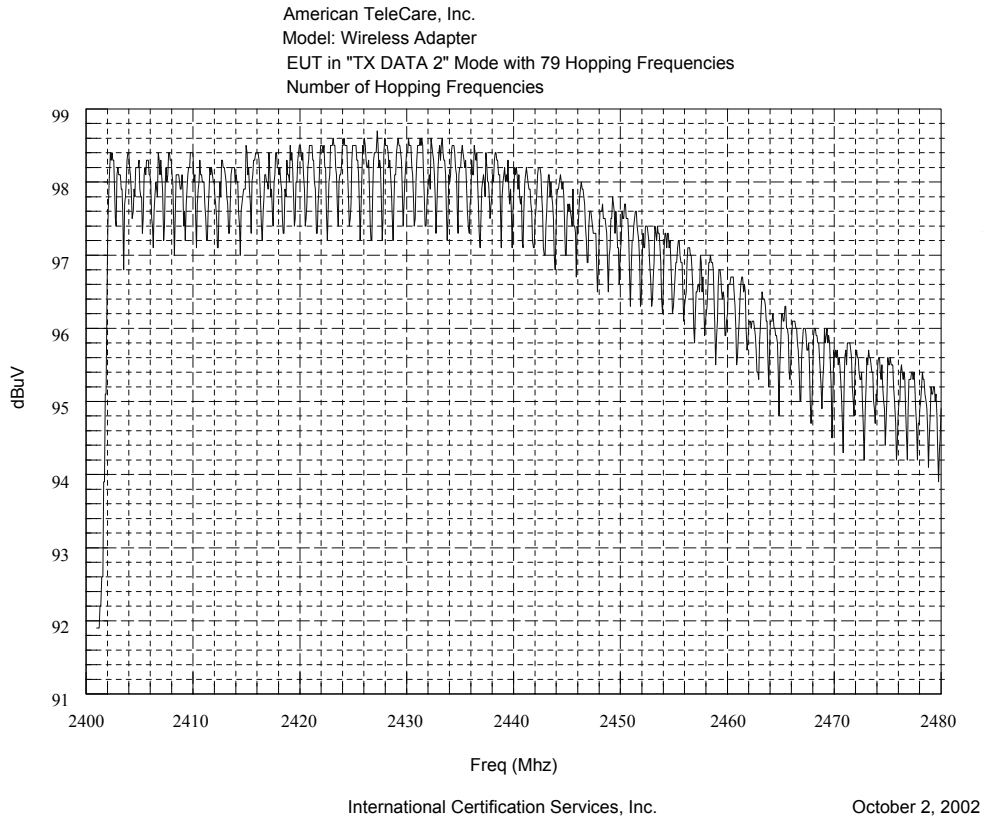
20 dB BW of a Hopping Channel = 2440.37 – 2439.61 = .7575 Mhz

Carrier Frequency Separation = 1.006 Mhz

The Carrier Frequency Separation (1.006 Mhz) is greater than the 20 dB BW of a Hopping Channel (0.7575 Mhz) hence this EUT complies with the 15.247 requirement.

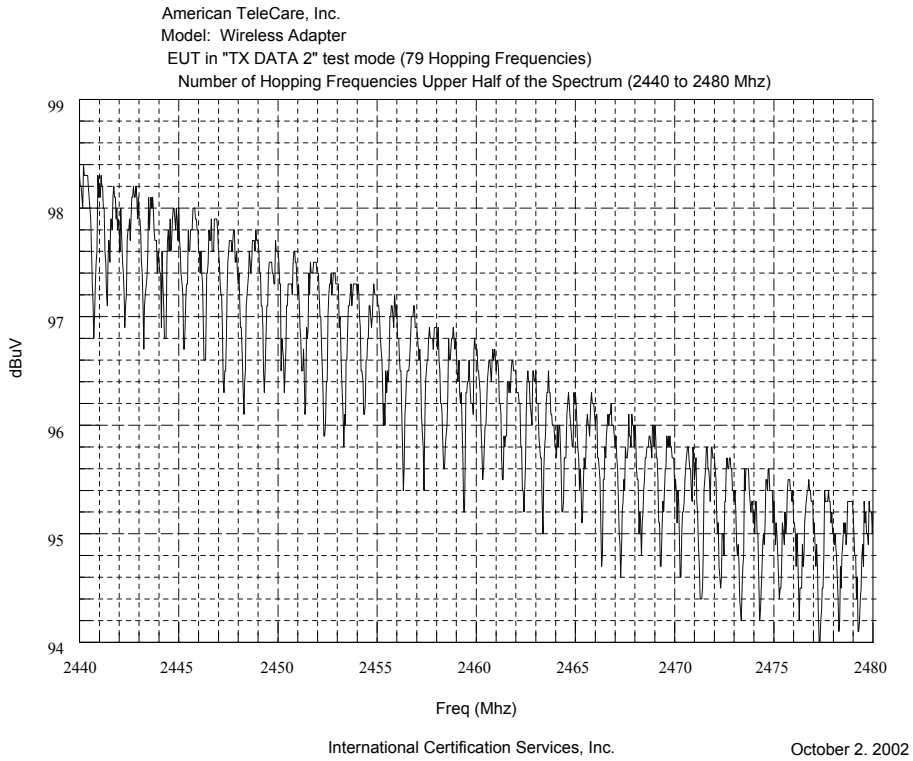
Number of Hopping Frequencies:

With the Hopping function enabled, plot the frequencies being transmitted with a Max Hold function on the spectrum analyzer.



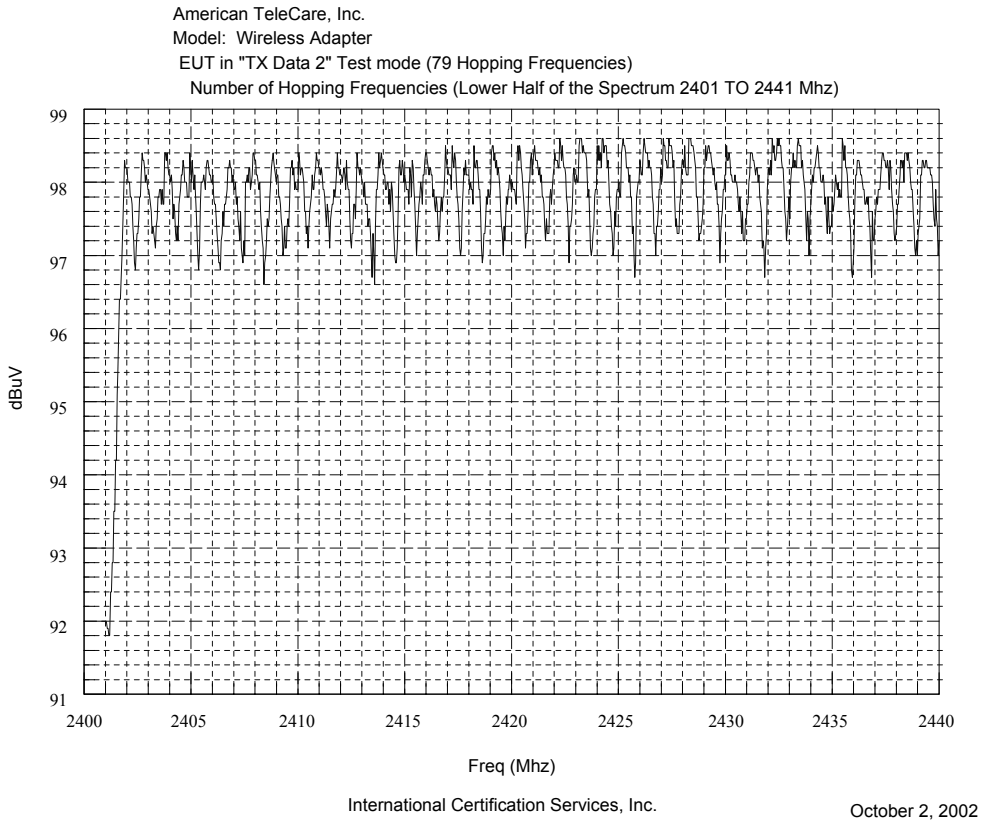
All 79 frequencies from the full spectrum 2400 to 2480 Mhz

Number of Hopping Frequencies:



Half of the frequencies (Upper half of the RF spectrum)

Number of Hopping Frequencies:



Half of the frequencies (Lower Half of the spectrum)

The plots above show the full 79 hopping frequencies as required.

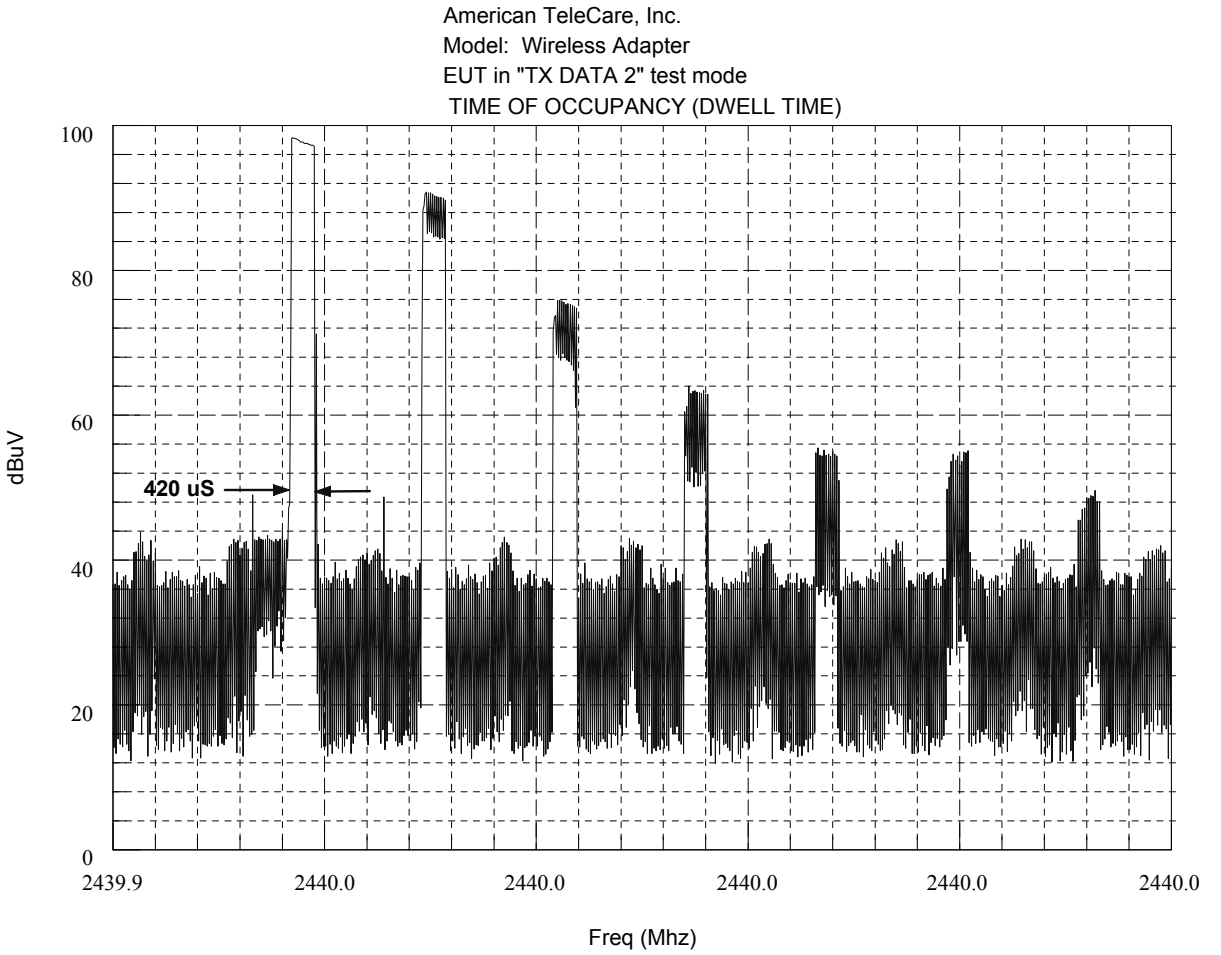
Time of Occupancy (Dwell Time)

Hopping function enabled

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

79 X 0.4 seconds =31.6 seconds

0.4 seconds within a 31.6 second period



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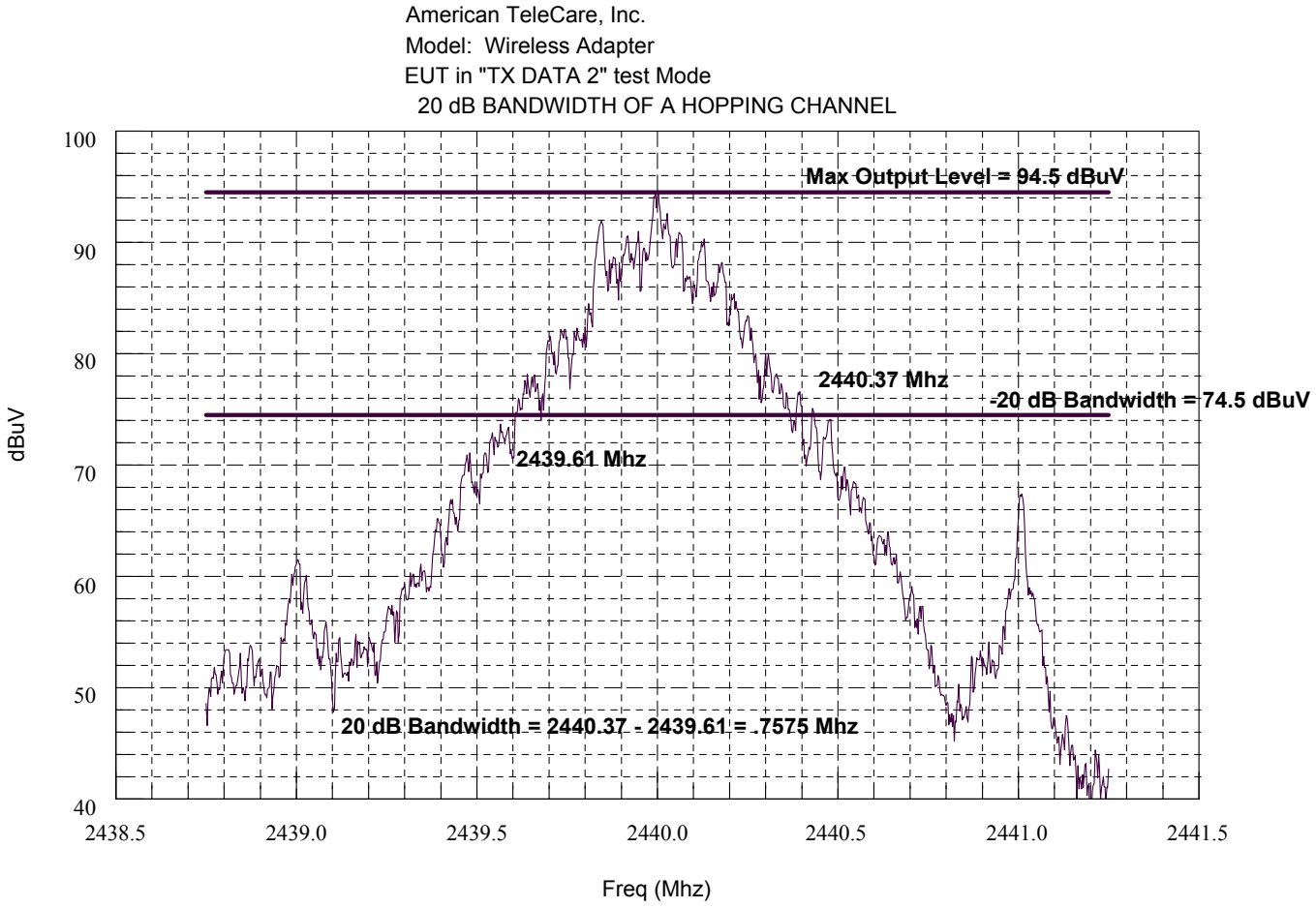
20 dB Bandwidth



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October 2, 2002

Pseudorandom Frequency Hopping Sequence

Describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, in order to demonstrate that the sequence meets the requirement specified in the definition of a frequency hopping spread spectrum system, found in Section 2.1.

The internal clock is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units, only the offsets are used. It has no relation to the time of day. Its resolution is at least half the RX / TX slot length of 312.5 uS. The clock has a cycle of about one day (23 hours, 30 seconds). The clock is

implemented as a 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (input 2) are used. With these input values, different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This is done at the beginning of every new transmission. A typical frequency hopping sequence is as follows: 40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04.

Equal Hopping Frequency Use

Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g., that each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event).

In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slots according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) that is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be sent on the same frequency, it is sent on the next frequency of the hopping sequence.

System Receiver Input Bandwidth

Describe how the associated receiver complies with the requirement that its input bandwidth (either RF or IF) matches the bandwidth of the transmitted signal.

The design of the BlueTooth transceiver chip implements a TX bandwidth of 1 Mhz and a RX bandwidth of 1 Mhz. There are no external components that effect this arrangement.

System Receiver Hopping Capability

Describe how the associated receiver has the ability to shift frequencies in synchronization with the transmitted signals.

In every connection, one Bluetooth device is the master (TX) and the other one is the slave (RX). The master (TX) determines the hopping sequence. The slave (RX) follows this sequence. Both devices shift between RX and TX time slots according to the clock of the master (TX). Additionally the type of connection (e.g. single or multi-slot packet) that is set up at the beginning of the connection. The master (TX) adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also, the slave (RX) of the connection uses these settings.

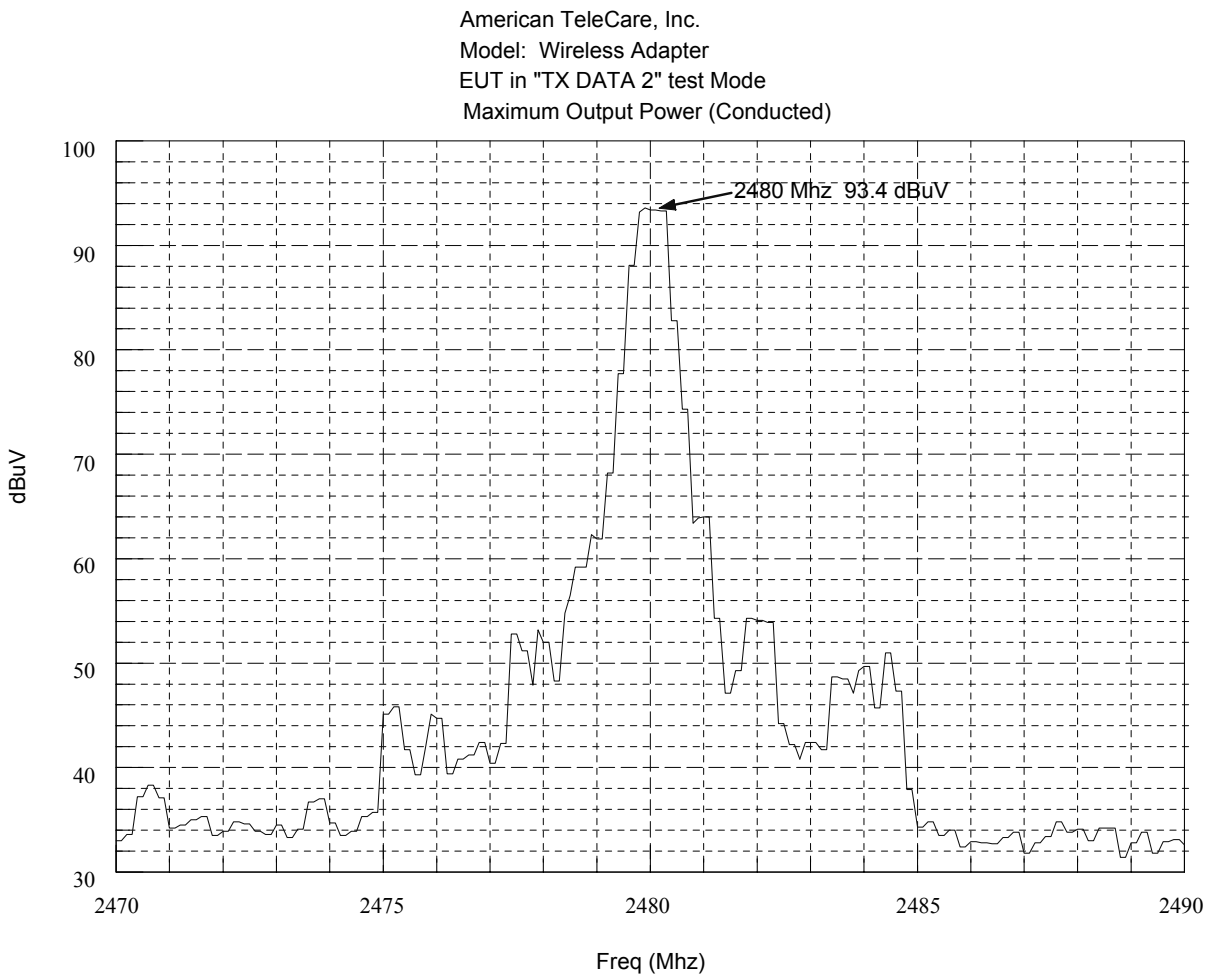
Section 15.247 (b)
Peak Output Power

15.247 (b)

The Maximum peak output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 Mhz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 Mhz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 Mhz band: 0.125 watts.

For this system operating at 2400-2483.5 Mhz with 79 Hopping frequencies, the Maximum allowed power output is 1 watt. The measured power output (using direct coupling to the spectrum analyzer) is 93.4 dBuV into 50 ohms which equals 43.7552 uW. This is well within the allowed FCC Limit described. See plot below.



DeFacto EIRP Limit

Describe how the EUT complies with the de facto EIRP limit for every antenna proposed for use with the EUT. This includes those devices that will be used in point-to-point applications. If the peak output power, as measured above , must be reduced so that the de facto EIRP limit may be met for a particular antenna, describe exactly how much it will be reduced for that antenna. If the peak output power level is raised above the limit in order to compensate for cable loss between the EUT and the antenna, specify the minimum length of cable with will always be used, the type of cable, and its loss, in dB per unit length, for the frequency of the emissions. The limit is specified in one of the subparagraphs of this Section. Also, specify who will be responsible for ensuring that compliant operation is maintained for every antenna that will be used with the EUT.

The only antenna that is used is the internal BlueChip antenna that is soldered the the PC board internally. Also, there are no power adjustments for the operator. This system as shown on the Peak Power Output section previous to this shows that it is within the 1 watt of power that is allowed by this section 15.247.

Point-to-Point Operation

If the EIRP relaxation for point-to-point operation is proposed for any particular antenna, describe who will be responsible for ensuring that the EUT is only used in such an application.

This is not applicable for this device since the EIRP relaxation is not used.

RF Exposure Compliance Requirements

Spread spectrum transmitters operating under Section 15.247 are categorically excluded from routine environmental evaluation for demonstrating RF exposure compliance with respect to MPE and/or SAR limits. These devices are not exempted from compliance. As indicated in Section 15.247 (b) (4), these transmitters are required to operate in a manner that ensures that exposure to the public (users and nearby persons) does not exceed the Commission's RF exposure guidelines (see Section 1.1307, 2.1091 and 2.1093). Unless a device operates at substantially low output power levels, with a low gain antenna, supporting information is generally needed to establish the various potential operating configurations and exposure conditions of a transmitter and its antenna, in order to determine compliance with the RF exposure guidelines.

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed: (1) calculations that estimate the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits (defined for free-space), (2) antenna installation and device operating instructions for installers (professional and/or unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirements, (3) any caution statements and/or warning labels that are necessary in order for a device to comply with the exposure limits, and (4) any other RF exposure related issues that may affect MPE compliance.

This device is not a handheld device, it is a table top setting device and would never be operated near the human body as a cell phone would be. The proximity to the human

body would typically be at least 24 inches (60.96 cm) away. Also, the low power level used (59.024 uW) and the spread spectrum transmitting technique coupled with the fact that this device does not transmit continually and not even periodically. It only transmits when data is ready to transmit which typically would be perhaps at the most minutes in between transmissions. Also the antenna is a built in device soldered onto the PC board and not adjustable and the output power is not operator adjustable as well. I believe this device is not a threat to MPE or SAR limits.

Installation/Operation Manual Requirements

The operation manual is a separate attached document to this project filing. The power output settings are fixed at the manufacturing time and are set based on the testing that was performed for this filing.

Section 15.247 (c)
Band-edge Compliance of RF Conducted Emissions

First with the EUT set to transmit only on the frequency channel closest to the band edge, plot the signals outside the band edge against the allowed limit per 15.247 (c)

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. Attenuation below the general limits specified in Section 15.209 (a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in Section 15.209 (a) (see Section 15.205(c)

In Single Frequency operating mode, the Maximum In Band Output Level occurs at 2479.99 Mhz and is 95.4 dBuV and the Maximum Out of Band Output Level occurs at 2483.52 Mhz and measures 59.5 dBuV.

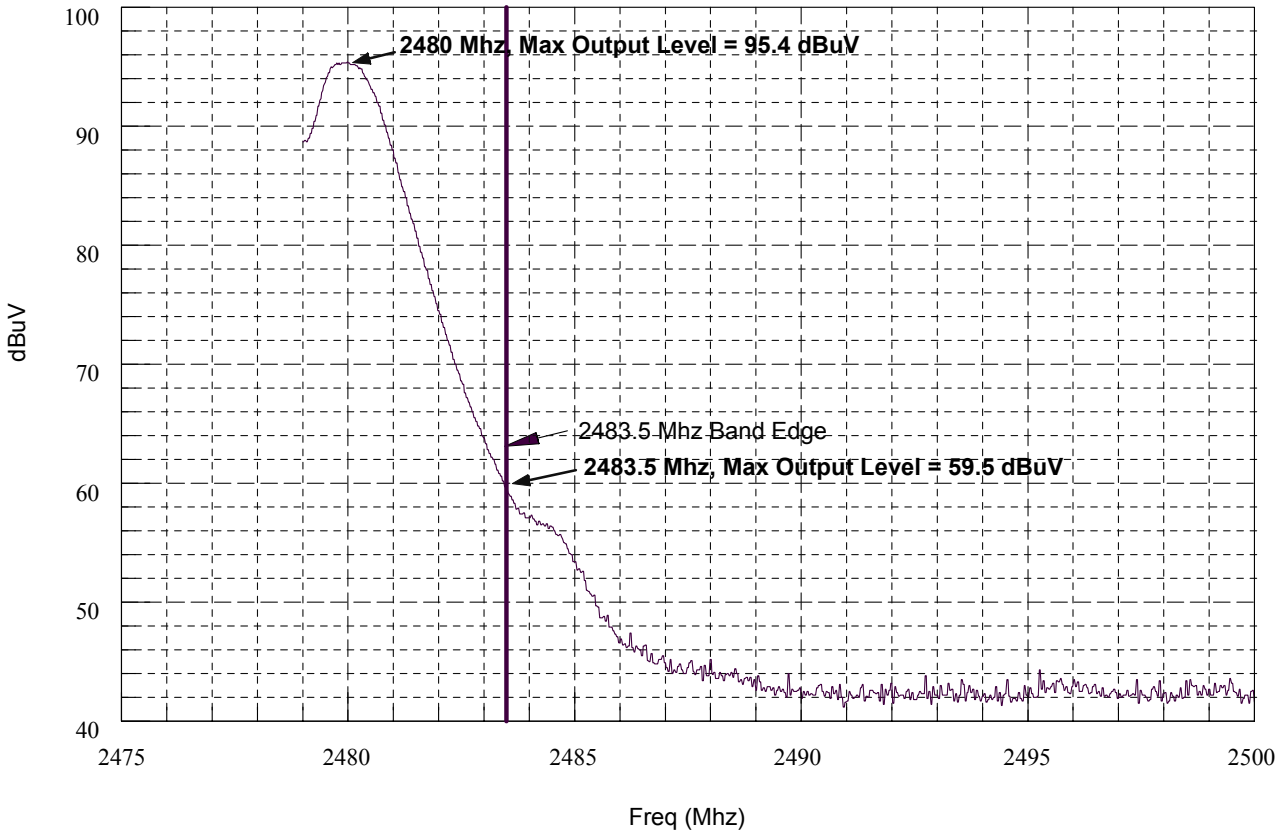
In Spread Spectrum operating mode, the Maximum In Band Output Level occurs at 2479.02 Mhz and is 95.3 dBuV and the Maximum Out of Band Output Level occurs at 2483.52 Mhz and measures 59.1 dBuV.

Considering the FCC 15.247 (c) limit of -20 dB down from the maximum In Band Power level, the Limit for Out of Band signals would be 74 dBuV. Both of these measurements meet the requirement of FCC 15.247 (c)

See the two plots on the next page of the above data.

Band-edge Compliance of RF Conducted Emissions

American TeleCare, Inc.
Model: Wireless Adapter
EUT in "TX DATA 1" test mode (single frequency mode 2480 Mhz)
BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS



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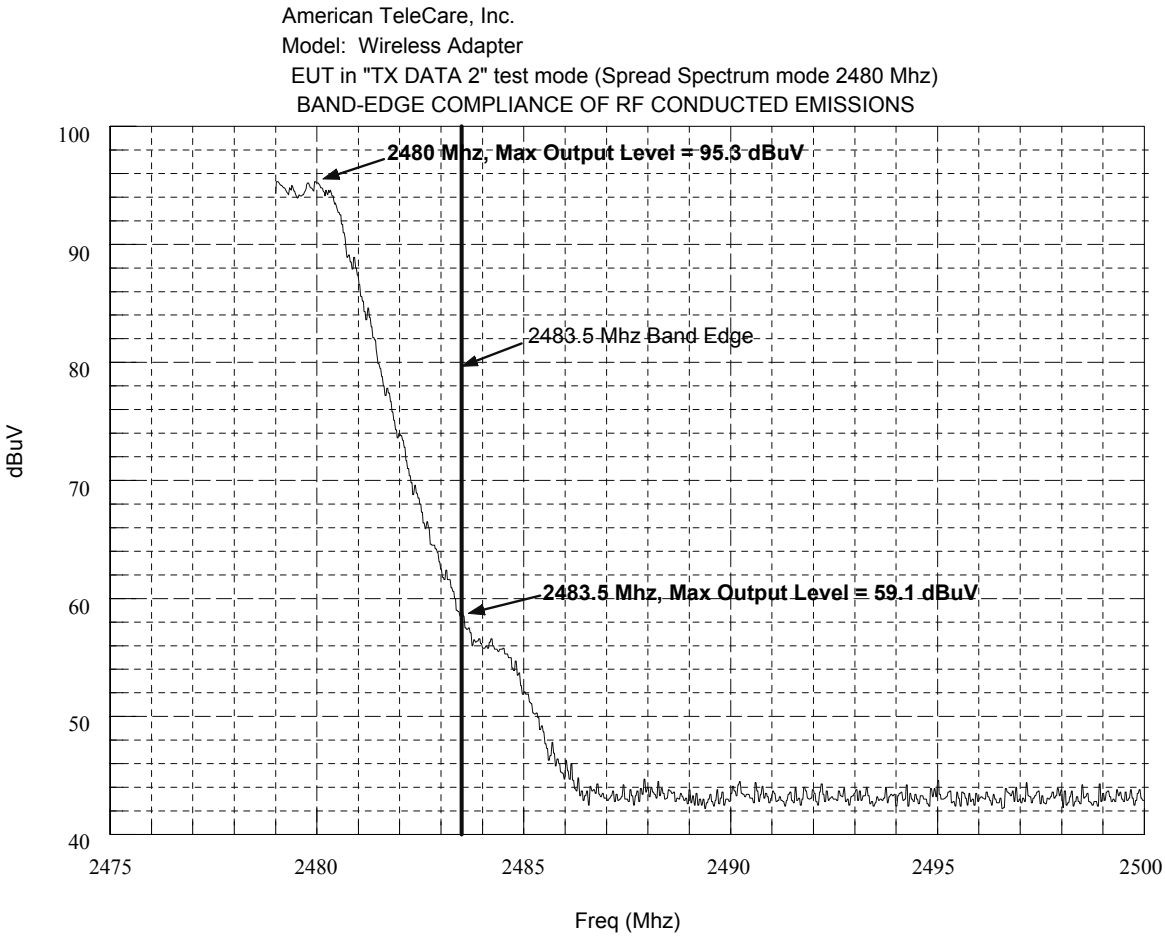
Band-edge Compliance of RF Conducted Emissions



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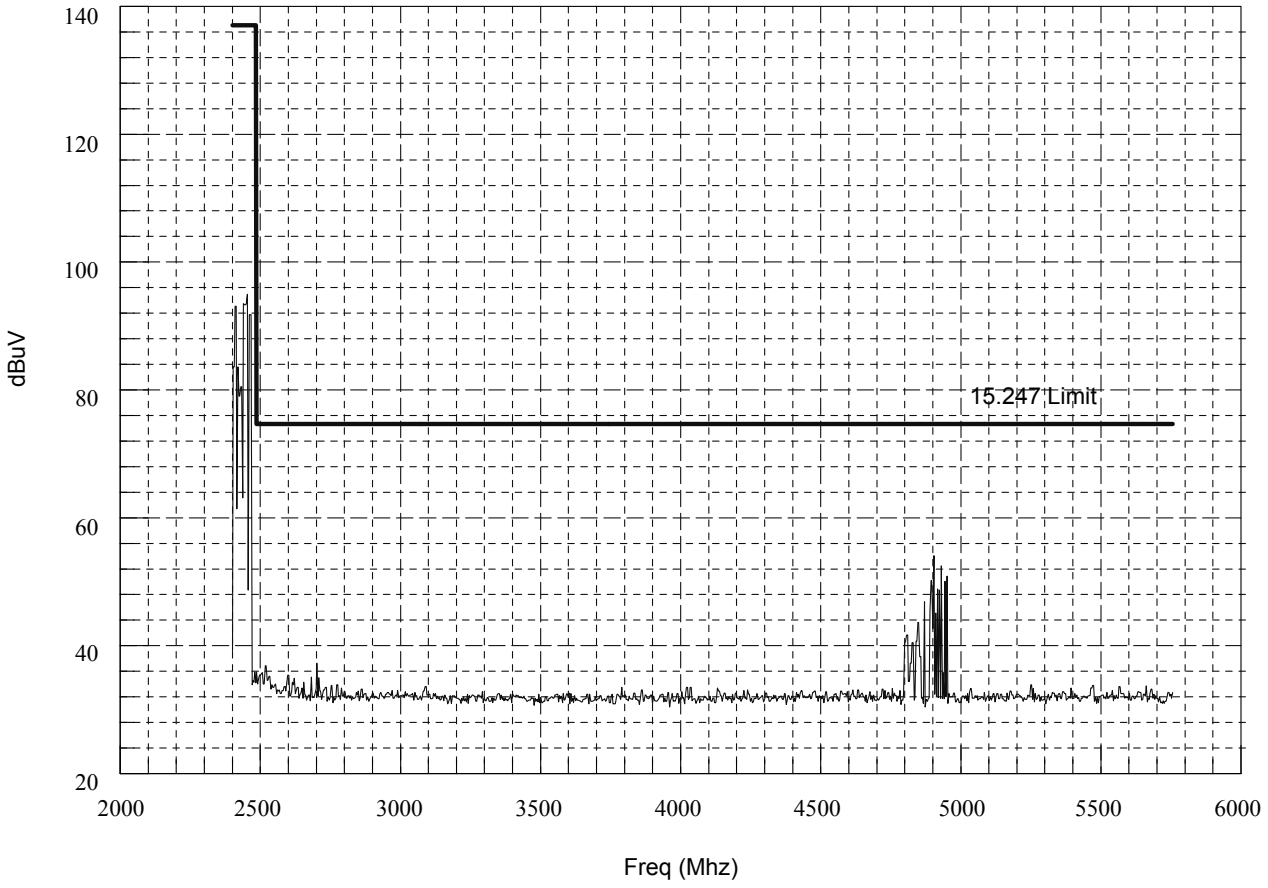
Spurious RF Conducted Emissions

American TeleCare, Inc.
Model: Wireless Adapter
Spurious Conducted Emissions (2400 to 5756 Mhz)



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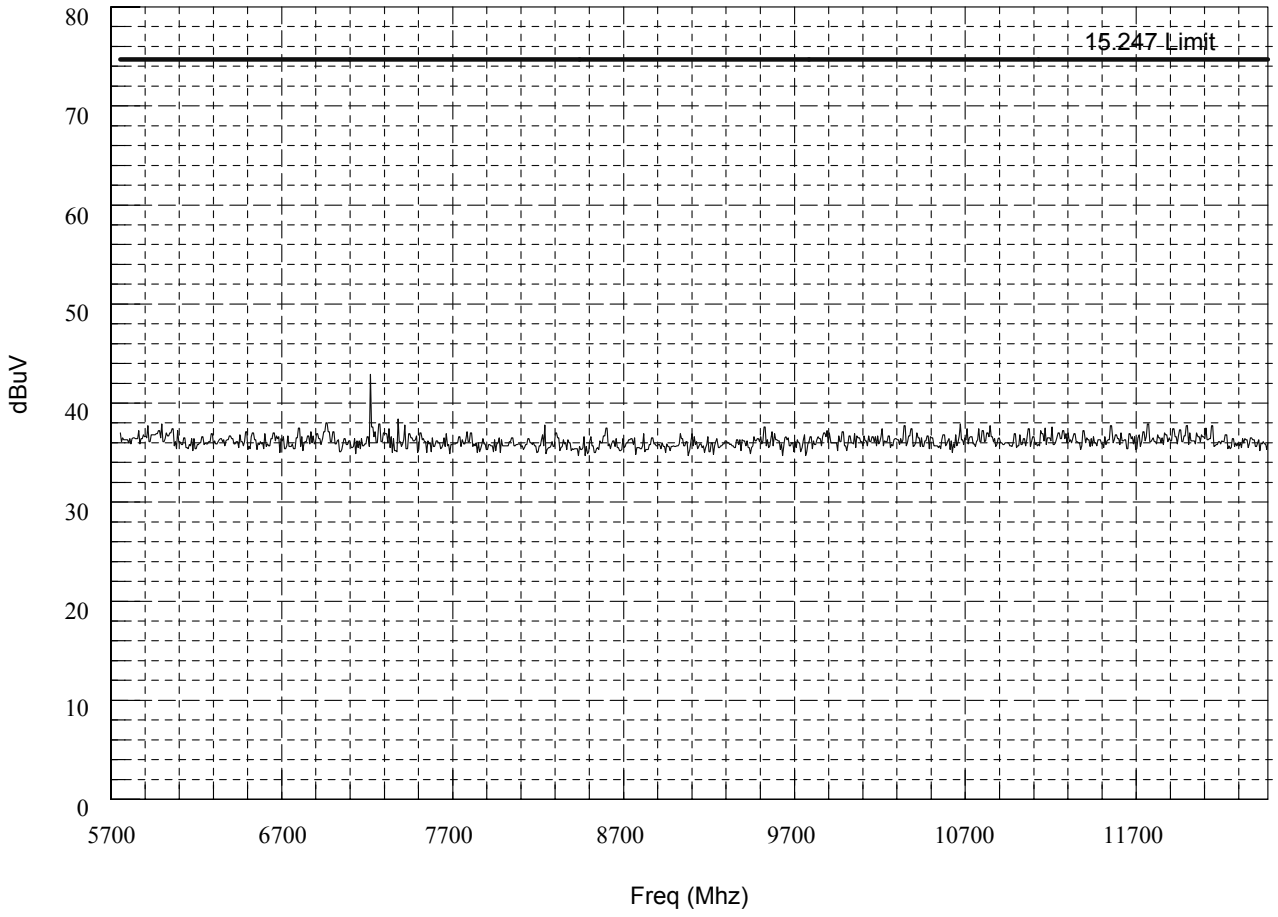
Spurious RF Conducted Emissions

American TeleCare, Inc.
Model: Wireless Adapter
Spurious Conducted Emissions (5756 Mhz to 12470 Mhz)



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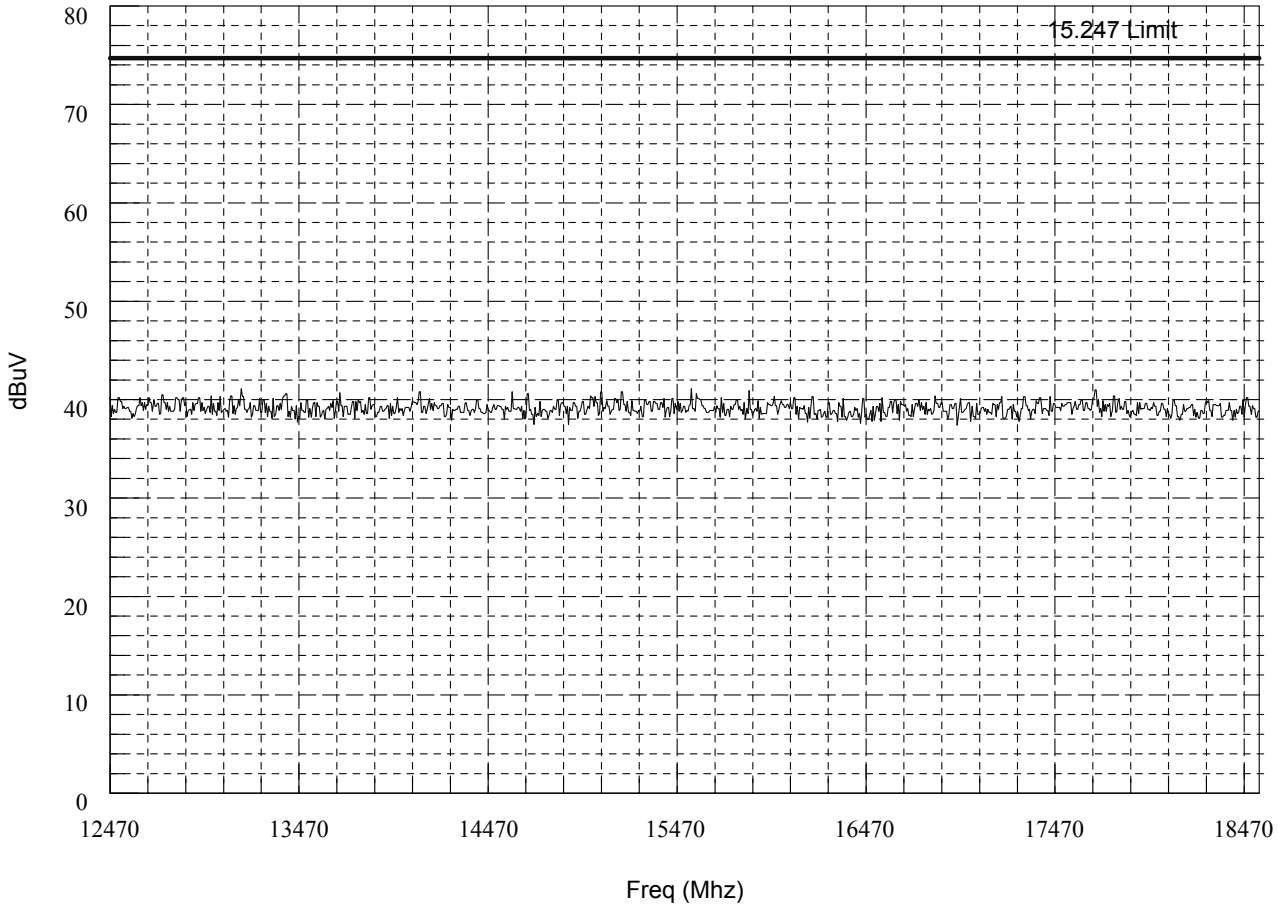
Spurious RF Conducted Emissions

American TeleCare, Inc.
Model: Wireless Adapter
Spurious Conducted Emissions (12470 to 18550 Mhz)



International Certification Services, Inc. October 2. 2002

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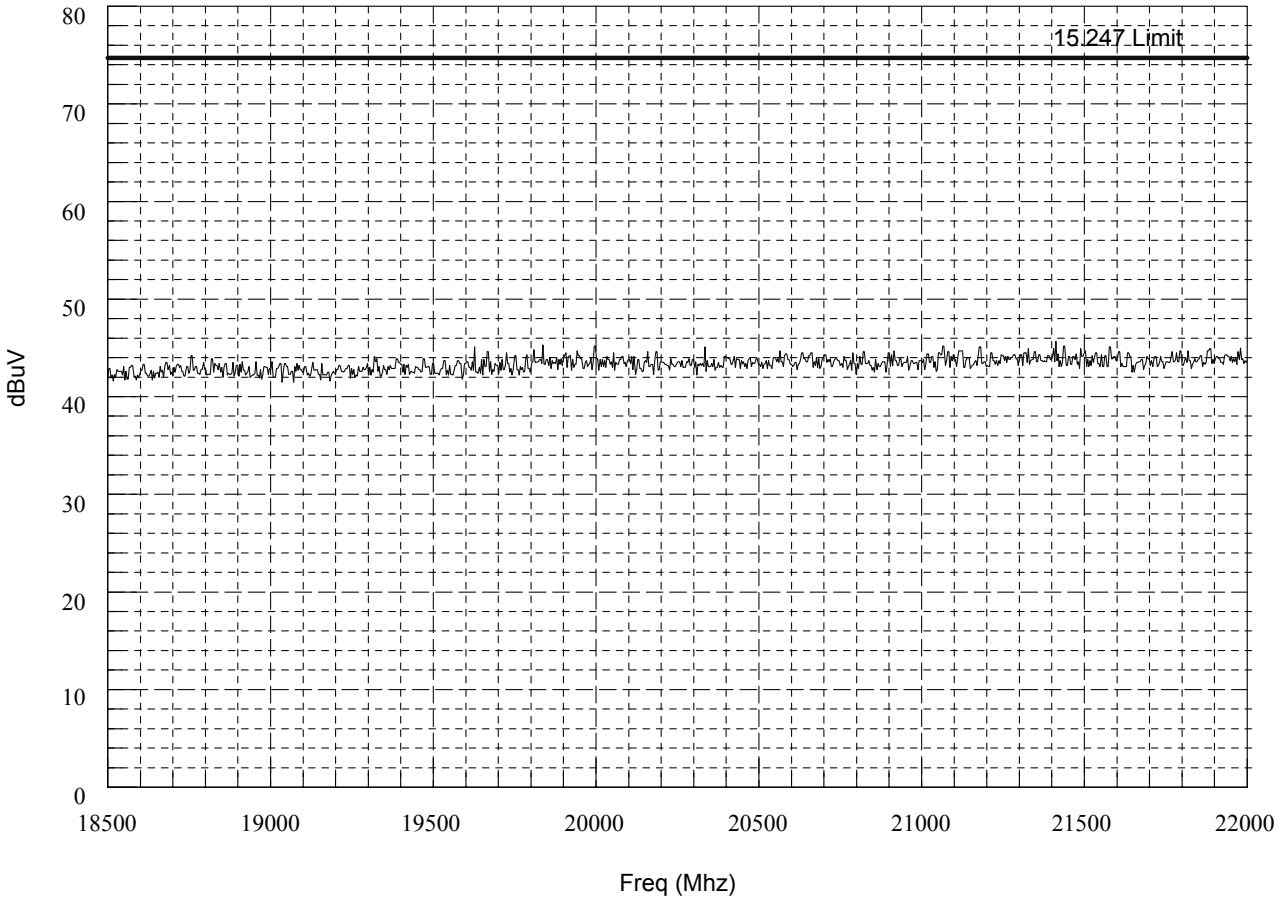
CERTIFICATION SERVICES, INC.

Spurious RF Conducted Emissions

American TeleCare, Inc.
Model: Wireless Adapter
Spurious Conducted Emissions (18500 to 22000 Mhz)



International Certification Services, Inc.

October 2, 2002

INTERNATIONAL

CERTIFICATION SERVICES, INC.