M

Emissions Testing
Performed
on the
S + S Consulting, Inc.
Transceiver
Model: TempTrak Sentry

To

FCC Part 15 Subpart B and Subpart C, Section 15.249

Date of Test: April 6, 2000

Report Number: J20003702A

Contact: Mr. Steve Fister

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I – Introduction and Summary

TO: Mr. Steve Fister
FROM: Michael J. Peters, Senior Project Engineer
DATE: April 6, 2000
JOB #: J20003702

RE: Emissions Testing Performed on the Transceiver, Model: TempTrak Sentry

On April 6, 2000 we tested the Transceiver, Model: TempTrak Sentry to determine if it was in compliance with the FCC Part 15 , Subpart B and Subpart C, Section 15.249. A Prototype version of the sample was received on Wednesday, April 05, 2000 in good condition. We found that the unit met the Part 15 requirements when tested as received.

The following Table summarizes the results of testing.

Test	Frequency (MHz)	Measurement	Requirement	Pass/Fail	Section of FCC Rules	Section of Test Report
Fundamental Field Strength	906.0 916.4	81.6 dBµV/m 82.3 dBµV/m	94.0 dBµV/m 94.0 dBµV/m	Pass Pass	15.249	Table 1 Table 2
Rectricted Band & Spurious Emissions	1812.1 2749.2	52.4 dBµV/m 53.1 dBµV/m	54.0 dBµV/m 54.0 dBµV/m	Pass Pass	15.205 15.209	Table 1 Table 2
Transmitter Line-conducted	0.496	30.3 dBµV	48.0 dBµV	Pass	15.207	Table 5
Bandwidth	906.0 916.4	72.5 kHz 74.0 kHz	N/a N/a	N/a N/a	N/a N/a	XII
Duty Cycle	N/a	61.3%	N/a	N/a	15.31	XI
Receiver Radiated Emissions	No radiated emissions were detected above the noise floor			Pass	15.107	Table 3
Receiver Conducted Emissions	0.496	30.3 dBµV	48.0 dBµV	Pass	15.207	Table 4

In summary, this report confirms that the Model: TempTrak Sentry is compliant with the FCC Part 15, Subpart B and Subpart C Section15.249 requirements when production units conform with the initial sample. Please address all questions and comments concerning this report to Candy Campbell, ITE Team Leader.

II – Technical Requirements

15.1 Scope

The device is an intentional radiator intended to operate in accordance with

15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz

Of Part 15 of the FCC rules without a license.

15.15 General Technical Requirements

There are no controls accessible to the user that would cause the device to operate in violation of the FCC rules.

15.27 Special Accessories

No special accessories are necessary to meet compliance requirements.

15.31 Measurement Standards

The measurement procedures specified by ANSI C63.4:1992 were used to setup and test the device. See Section IV of this test report for detailed description of the test procedure.

The transmitter was tested standalone.

15.33 Frequency range of measurement

The device was scanned for spurious and harmonic emissions from 30 MHz to the 10^{th} harmonic of the fundamental emission.

15.35 Measurement detector functions and bandwidth

The following table illustrates the detector functions and bandwidth used to test the device.

No deviations to the following were made.

Frequency Range	Measurement Detector	Measurement Bandwidth
450 kHz to 30 MHz	Quasi-Peak	9 kHz
30 MHz to 1000 MHz	Quasi-Peak	120 kHz
1000 MHz to 10th harmonic	Average	1 MHz

The quasi-peak detector meets the requirements of CISPR 16.

An averaging factor was used for the device because – It operates with a 66.3% duty cycle.

15.36 Transition Provisions

Transition provisions were not applied to the device.

A receiver is not being certified with the device. The receiver is integral to the device and is not separately authorized.

The device does not operate in the band 902-905 MHz.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

> NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
>
> -- Reorient or relocate the receiving antenna.
> -- Increase the separation between the equipment and receiver.
> -- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
> -- Consult the dealer or an experienced radio/TV technician for help.

15.107 Conducted limits.

(a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line shall not exceed the following. Compliance with this provision shall be

based on the measurement of the radio frequency voltage between each power line and ground at the power terminals.

Frequency of Emission Conducted Limit – Class B

Frequency (MHz)	Limit (μV)	Limit (dBμV)
0.45 to 30	250	48

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 450 kHz to 30 MHz shall not exceed the limits in the following table. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges.

Frequency of Emission Conducted Limit – Class A

Frequency (MHz)	Limit (μV)	Limit (dBμV)
0.45 to 1.705	1000	60
1.705 to 30	3000	69.5

The following option may be employed if the conducted emissions exceed the limits in paragraph (a) or (b) of this Section, as appropriate, when measured using instrumentation employing a quasi-peak detector function: if the level of the emission measured using the quasi-peak instrumentation is 6 dB, or more, higher than the level of the same emission measured with instrumentation having an average detector and a 9 kHz minimum bandwidth, that emission is considered broadband and the level obtained with the quasi-peak detector may be reduced by 13 dB for comparison to the limits. When employing this option, the following conditions shall be observed:

(1) The measuring instrumentation with the average detector shall employ a linear IF amplifier.

(2) Care must be taken not to exceed the dynamic range of the measuring instrument when measuring an emission with a low duty cycle.

(3) The test report required for verification or for an application for a grant of equipment authorization shall contain all details supporting the use of this option.

Summary of Test Results

Configuration	Frequency (MHz)	Measurement (dBμV)	Measurement (μV)	Limit (μV)	Pass/Fail
Receiving	0.496	30.3	32.7	250	Pass

15.109 Radiated emission limits.

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency of Emission Radiated Limit – Class B

Frequency (MHz)	Limit (μV/m)	Limit (dBμV/m)
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0

Above 960	500	54.0

The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of Emission Radiated Limit – Class A

Frequency (MHz)	Limit (µV/m)	Limit (dBµV/m)
30 to 88	90	39.1
88 to 216	150	43.5
216 to 960	210	46.4
Above 960	300	49.5

In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

For a receiver which employs terminals for the connection of an external receiving antenna, the receiver shall be tested to demonstrate compliance with the provisions of this Section with an antenna connected to the antenna terminals unless the antenna conducted power is measured as specified in Section 15.111(a). If a permanently attached receiving antenna is used, the receiver shall be tested to demonstrate compliance with the provisions of this Section.

Summary of Test Results

Configuration	Frequency (MHz)	Measurement (dBµV)	Measurement (µV)	Limit (µV)	Pass/Fail
Receiving	No emissions were detected above the measurement equipment noise floor.				Pass

15.111 Antenna power conduction limits for receivers.

In addition to the radiated emission limits, receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers that provide terminals for the connection of an external receiving antenna may be tested to demonstrate compliance with the provisions of Section 15.109 with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna, provided these receivers also comply with the following: with the receiver antenna terminal connected to a resistive termination equal to the impedance specified or employed for the antenna, the power at the antenna terminal at any frequency within the range of measurements specified in Section 15.33 shall not exceed 2.0 nanowatts.

Summary of Test Results

Configuration	Frequency (MHz)	Measurement (dBµV)	Measurement (µV)	Limit (µV)	Pass/Fail
The device does not have the ability to connect to an external antenna measurements were not performed.					

15.201 Certification

The device is required to be certified in accordance with Part 2 of the FCC rules, Subpart J.

15.203 Antenna Requirements

The antennas are soldered to the PC board and cannot be readily removed from the device. The device itself is a closed plastic container that the user would not be able to open to service.

15.204 External Radio Amplifier

The device is not an amplifier.

15.205 Restricted bands of operation

The attenuation required by 15.249 is greater than the general requirements of 15.209. All un-wanted emissions, from the transmitter, were compared to the general limits which are the requirement for restricted band emissions.

Below 1000 MHz a quasi-peak detector was employed to measure emissions.

Above 1000 MHz an average detector was employed to measure emissions. Peak measurements were also performed above 1000 MHz to insure that they were not greater than 20 dB of the average.

15.207 Conducted limits

The device was tested for line-conducted emissions both in transmit and receive modes. See Table 5 for the summary of line-conducted emissions measured. Note that the limits are identical for a Class B Digital Device.

15.209 Radiated emission limits; general requirements

All un-wanted emissions from the transmitter were compared to the general requirements.

Detailed Description of Operation

The device was programmed to transmit or receive continuously. Two radiated emissions scans were performed while transmitting (while transmitting at 906.0 and 916.4 MHz). One radiated emissions scan was performed while the device was receiving. An additional scan was performed with device operating as a digital device. This testing is addressed in another report.

The Commander consists of an RF circuit board and a Control circuit board contained within a plastic domed housing. The Control board provides control signals to the RF board to facilitate transmit and receive functions and sends data to the host system via a wired Ethernet connection. The RF board uses permanently attached wires for both the transmit and receive antennas. All circuitry is contained within the plastic housing and will not normally be accessible to the user. The Commander operates from a wall transformer included with the test unit.

The Commander is a two channel transceiver operating at 906.0 MHz and 916.55 MHz. An ASK modulation scheme is used with only one channel active at any given time. Maximum transmission length is 99.8 ms with a maximum duty cycle of 61.4% in a 100ms period.

All timing is derived from the following:

- Control board timing for transceiver control and data collection: 3.6864 MHz and 20 MHz oscillators.
- Receive channel 1 timing: 7.0041 MHz oscillator.
- Receive channel 2 timing: 7.1244 MHz oscillator.
- Transmit channel 1 timing: 906.0 MHz oscillator.
- Transmit channel 2 timing: 916.55 MHz oscillator.

Test Method Justifications

For maximizing emissions, the system was rotated through 360o, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed.

The EUT was mounted on a non-conductive box to allow the engineer to manipulate the EUT in the three orthogonal axes.

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in C63.4 (1992).

The arrangement of the cables dangling from the rear of the table was varied to the extent possible to produce the maximum emissions.

15.249 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz

The Field strength limit for the device was based on the operating frequency of 906.0 and 916.4 MHz:

Frequency (MHz)	Emission Limit (mV/m)	Emission Limit (dBμV/m)	Test Distance (meters)
906.0	50	94.0	3
916.4	50	94.0	3

The emission requirement for harmonic emission is identical to the general requirement of 15.209. Spurious

emission measurements were compared to the general requirement of 15.209.

The fundamental emission was measured with a quasi-peak detector. For above 1000 MHz, measurements were made with both a peak and average detector to insure that peak measurements did not exceed the average by more than 20 dB.

Part 2

2.201 Emission Modulation and transmission characteristics

The emission designator is determined as follows

Bandwidth is measured to be: 74 kHz

The main carrier modulation is ASK, shift in duration/width of pulses. Therefore the first symbol is L

The modulating signal is a single channel containing quantized information. Therefore the second symbol is [symbol] 1

The type of information transmitted is Telemetry. Therefore the third symbol is D

The emissions designator is:

74K0L1D

2.1041 Measurement Procedures

Only the measurement procedures of Part 15 are required for this device. The device was not evaluated to the requirements of 2.1046 through 2.1057.

2.1091 Radiofrequency radiation exposure evaluation: Mobile Devices

The device does not fall under any of the categories that require routine RF exposure measurements and is therefore exempt from the requirements of this section.

2.1093 Radiofrequency radiation exposure evaluation: Portable Devices

The device does not meet the definition of a portable device (That is it is not intended to operate within 20 cm of a persons body).

III - Attestation

LABORATORY MEASUREMENTS

Pursuant To
Part 15, Subpart C
For
Intentional Radiators

Company Name:	S + S Consulting, Inc.
Address:	PO Box 18999 Tucson, AZ 85731
Model:	TempTrak Sentry
Date of Test(s):	April 6, 2000
Test Site Location:	INTERTEK TESTING SERVICES NA INC. 70 Codman Hill Road Boxborough, MA 01719
Site:	1

We attest to the accuracy of this report:

Signature	Signature
Michael J. Peters	Candy Campbell
Testing Performed By:	Reviewer
Senior Project Engineer	ITE Team Leader
Title	Title

IV - Site Description

Introduction

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C, General Requirements.

A. **Test Set-Up**: The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 (1992).

1. The test site is a Plastic/Fiberglass structure with a groundplane. The site has attenuation characteristics which meet the requirements of ANSI C63.4 (1992). Information on the site has been filed with the FCC as required by Rule 2.948. The address of the site is 70 Codman Hill Road, Boxborough, MA 01719.

2. Power to the site is nominal line voltage of 117 V_{AC} and 230 V_{AC}, 60 Hz.

3. The equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the groundplane. During the radiated emissions test, the turntable is rotated 360 degrees and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the search for maximum signal levels. The height of the antenna is varied from one meter to four meters. Body-worn, hand-held and small portable devices are mounted on a non-conductive box and emissions are investigated on three orthogonal axis.

4. Detector function for radiated emissions is in peak or quasi-peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings according to the following formula:

   Averaging Factor in dB = 20 LOG (duty cycle)

   The time period over which the duty cycle is measured is 100 msec. The worst-case (highest percentage on) duty cycle is used and described specifically in the data section. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix 465 Oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

5. Antennas used below 1000 MHz were EMCO Model 3142 Biconolog Antennas and Compliance Design Inc. Model A100 tuned Dipole Antennas. For measurements between 1000 MHz and 18000 MHz above 1 GHz, an EMCO Model: 3115 Horn Antenna is used. The Antennas used are listed in the Test Equipment Summary in Section 6
6. The field strength measuring equipment used included:

V - Measurement Equipment

The following equipment was used to make measurements for emissions testing:

Description	Manufacturer	Model	Serial #	Cal Due
SPECTRUM ANALYZER	TEKTRONIX	2784	B010153	11/26/2000
LISN	SOLAR ELECTRONICS	8012-50-R-24-BNC	934610	06/16/2000
PREAMPLIFIER	MITEQ	NSP4000-NF	507145	11/25/2000
RECEIVER	HEWLETT PACKARD	8546A	3325A00160	12/13/2000
RF FILTER	HEWLETT PACKARD	85460A	3330A00158	12/13/2000
HORN ANTENNA	EMCO	3115	9602-4675	11/04/2000
TUNED DIPOLE SET	COMPLIANCE DESIGN	A100	402	07/26/2000

7. The frequency range to be scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency, or 40 GHz, whichever is lower. For line-conducted emissions, the range scanned is 450 kHz to 30 MHz.

8. The EUT is warmed up for 15 minutes prior to the test. AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new battery is used.

9. Conducted measurements were made as described in ANSI C63.4 (1992). An IF bandwidth of 9 kHz is used, and peak or quasi-peak detection is employed.

10. The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application No. 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report. Above 1000 MHz, a bandwidth of 1 MHz is generally used.

11. Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz (where no preamplifier is used), signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

12. For measurements made in the 9 kHz to 30 MHz range, a distance of 30 meters was used unless a good signal-to-noise ratio could not be obtained. In that case, a closer distance was used and that distance is so marked in the data table.

VI – Summary of Equipment Under Test

1	**Manufacturer**:	Critical Link, LLC 404 Oak Street Syracuse, NY 13203 (315) 425-4045 TIN 16-1534393 Contact: John Fayos
2	**Grantee**:	KatchAll Technology Group 5800 Creek Road Cincinnati, Ohio 45242 (513) 793-5366 TIN 31-1037180 Contact: Jack Kennamer
3	**Model No.**:	TempTrak Sentry
4	**Trade Name**:	TempTrak
5	**Serial No.**:	Not Labeled
6	**Date of Test**:	
7	**Frequencies to which device can be tuned**:	906.0, 916.4 MHz
8	**Can customer tune device?**	No
9	**Detailed description of operation pursuant to 15.209**:	See 15.209
10	**Applicable emissions limits**:	15.105, 15.109, 15.205, 15.207,15.209 and 15.249

VII - Configuration Information

Equipment Under Test: Transceiver

Model: TempTrak Sentry

Serial No.: Not Labelled

FCC Identifier: Not Labelled

Support Equipment:

Power Supply

Manufacturer: Radio Shack
Model: 273-1758
Serial Number: Not Labeled

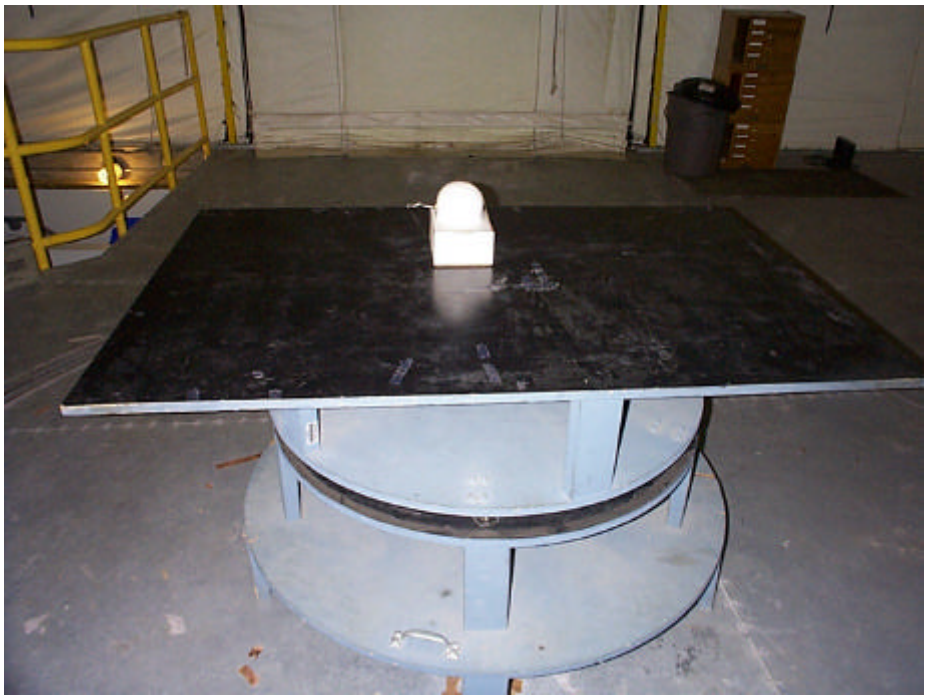
Cables:

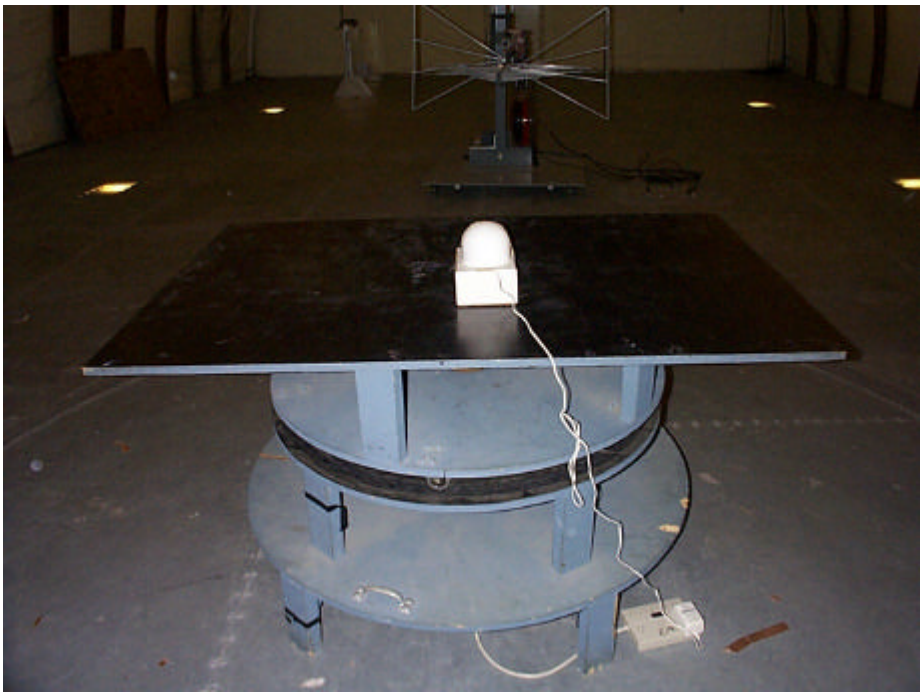
QTY	Description	Shield Description	Hood Description	Length (m)

None

VIII - Configuration Photographs

Worst-Case Radiated Emissions





Worst-Case Line-Conducted Emissions

IX - Sample Calculation

The following is how net field strength readings were determined:

NF = RF + AF + CF + PF + DF

Where,

NF = Net Reading in dBµV/m
RF = Reading from receiver in dBµV/m
AF = Antenna Correction Factor in dB
CF = Cable Correction Factor in dB
PF = Preamplifier Correction Factor in dB
DF = Distance Factor in dB (using 20 dB/decade), from 3 to 1 meters 10.5 dB was added for measurements performed at 1 meter

To convert from dBµV/m to µV/m or mV/m the following was used:

$UF = 10^{(NF / 20)}$

Where,

UF = Net Reading in µV/m

Example:

For the fundamental field strength measurement at 906.0 (distance = 3 meters) see table [1].

NF = NF = RF + AF + CF + PF + DF = 53.5 + 27.7 + 3.9 + 0.0 + 0.0 = 81.6 dBµV/m

$UF = 10^{(81.6\ dB\mu V / 20)} = 12{,}022\ \mu V/m$

X - Data Tables

Radiated Emissions / Interference

Table: 1

Company: **S+S Consulting**
Model: **Sentry**
Job No.: **J20003702**
Date: 04/06/00
Standard: FCC15
Class: 15.249 Group: None
Notes: Transmitting at 906.0 MHz

Tested by: Michael Peters
Location: Site 1C
Detector: HP 8546A TEK 2784
Antenna: HORN2 11-4-99 H3m Dipole
PreAmp: PRE8 11-25-99
Cable(s): CBL004 1-18-00 216
Distance: **3**

Axis	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Preamp Factor dB	Average Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
1	H	906.000	47.1	27.7	3.9	0.0	0.0	78.7	94.0	-15.3
1	V	906.000	51.8	27.7	3.9	0.0	0.0	83.4	94.0	-10.6
2	V	906.000	47.5	27.7	3.9	0.0	0.0	79.1	94.0	-14.9
2	H	906.000	53.1	27.7	3.9	0.0	0.0	84.7	94.0	-9.3
3	H	906.000	53.5	27.7	3.9	0.0	0.0	85.1	94.0	-8.9
3	V	906.000	48.9	27.7	3.9	0.0	0.0	80.5	94.0	-13.5
4	V	906.000	51.6	27.7	3.9	0.0	0.0	83.2	94.0	-10.8
4	H	906.000	47.8	27.7	3.9	0.0	0.0	79.4	94.0	-14.6
1	H	1812.060	41.7	28.0	2.6	21.6	4.2	46.5	54.0	-7.5
2	H	1812.060	40.6	28.0	2.6	21.6	4.2	45.4	54.0	-8.6
3	H	1812.060	38.5	28.0	2.6	21.6	4.2	43.3	54.0	-10.7
3	V	1812.060	46.9	28.0	2.6	21.6	4.2	51.7	54.0	-2.3
2	V	1812.060	40.4	28.0	2.6	21.6	4.2	45.2	54.0	-8.8
1	V	1812.060	38.5	28.0	2.6	21.6	4.2	43.3	54.0	-10.7
1	V	2718.090	36.8	30.5	3.2	21.8	4.2	44.6	54.0	-9.4
2	V	2718.090	39.2	30.5	3.2	21.8	4.2	47.0	54.0	-7.0
3	V	2718.090	37.8	30.5	3.2	21.8	4.2	45.6	54.0	-8.4
3	H	2718.090	39.3	30.5	3.2	21.8	4.2	47.1	54.0	-6.9
2	H	2718.090	40.8	30.5	3.2	21.8	4.2	48.6	54.0	-5.4
1	H	2718.090	43.4	30.5	3.2	21.8	4.2	51.2	54.0	-2.8
							DF+AF			
1	H	3624.120	37.6	32.9	4.0	22.0	7.7	44.8	54.0	-9.2
2	H	3624.120	37.1	32.9	4.0	22.0	7.7	44.3	54.0	-9.7
3	H	3624.120	38.2	32.9	4.0	22.0	7.7	45.4	54.0	-8.6
3	V	3624.120	37.6	32.9	4.0	22.0	7.7	44.8	54.0	-9.2
2	V	3624.120	37.6	32.9	4.0	22.0	7.7	44.8	54.0	-9.2
nf	h/v	4530.000	33.6	34.3	4.7	22.0	7.7	42.8	54.0	-11.2
nf	h/v	5436.000	33.6	35.9	5.4	21.6	7.7	45.6	54.0	-8.4
nf	h/v	6342.000	35.0	36.3	6.1	20.8	7.7	49.0	54.0	-5.0
nf	h/v	7248.000	31.0	37.8	6.8	20.1	7.7	47.9	54.0	-6.1
nf	h/v	8154.000	30.0	38.7	8.0	20.1	14.2	42.5	54.0	-11.5
nf	h/v	9060.000	30.5	39.7	9.8	19.8	14.2	46.0	54.0	-8.0

DF+ AF = Distance Factor and Average Factor combined (alternate distance used was 2 and 1 meters respectively)

Radiated Emissions / Interference

Table: 2

Company: **S+S Consulting**
Model: **Sentry**
Job No.: **J20003702**
Date: 04/06/00
Standard: FCC15
Class: 15.249 Group: None
Notes: Transmitting at 916.4 MHz

Tested by: Michael Peters
Location: Site 1C
Detector: HP 8546A TEK 2784
Antenna: HORN2 11-4-99 H3m Dipole
PreAmp: PRE8 11-25-99
Cable(s): CBL004 1-18-00 216
Distance: **3**

Axis	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Preamp Factor dB	Average Factor dB	Net	Limit dB(uV/m)	Margin dB	
1	H	916.400	52.0	27.7	3.9	0.0	0.0	83.6	94.0	-10.4	
1	V	916.400	51.6	27.7	3.9	0.0	0.0	83.2	94.0	-10.8	
2	V	916.400	49.1	27.7	3.9	0.0	0.0	80.7	94.0	-13.3	
2	H	916.400	53.8	27.7	3.9	0.0	0.0	85.4	94.0	-8.6	
3	H	916.400	54.2	27.7	3.9	0.0	0.0	85.8	94.0	-8.2	
3	V	916.400	52.0	27.7	3.9	0.0	0.0	83.6	94.0	-10.4	
1	H	1832.800	40.1	28.1	2.6	21.6	4.2	45.0	54.0	-9.0	
3	V	1832.800	41.5	28.1	2.6	21.6	4.2	46.4	54.0	-7.6	
3	H	1832.800	38.6	28.1	2.6	21.6	4.2	43.5	54.0	-10.5	
1	V	1832.800	38.9	28.1	2.6	21.6	4.2	43.8	54.0	-10.2	
2	V	1832.800	40.3	28.1	2.6	21.6	4.2	45.2	54.0	-8.8	
2	H	1832.800	39.5	28.1	2.6	21.6	4.2	44.4	54.0	-9.6	
2	H	2749.170	40.4	30.6	3.3	21.8	4.2	48.3	54.0	-5.7	
3	H	2749.170	42.2	30.6	3.3	21.8	4.2	50.1	54.0	-3.9	
1	H	2749.170	44.5	30.6	3.3	21.8	4.2	52.4	54.0	-1.6	*
1	V	2749.170	37.6	30.6	3.3	21.8	4.2	45.5	54.0	-8.5	
3	V	2749.170	38.3	30.6	3.3	21.8	4.2	46.2	54.0	-7.8	
2	V	2749.170	40.6	30.6	3.3	21.8	4.2	48.5	54.0	-5.5	
							DF+AF				
	h/v	3665.600	38.5	33.0	4.0	22.0	7.7	45.8	54.0	-8.2	
nf	h/v	4571.600	33.6	34.4	4.7	22.0	7.7	42.9	54.0	-11.1	
nf	h/v	5488.000	33.6	36.0	5.4	21.6	7.7	45.8	54.0	-8.2	
nf	h/v	6404.400	35.0	36.4	6.1	20.7	7.7	49.1	54.0	-4.9	
nf	h/v	7320.800	31.0	38.0	6.9	20.1	7.7	48.1	54.0	-5.9	
nf	h/v	8237.200	30.0	38.7	8.2	20.1	14.2	42.7	54.0	-11.3	
nf	h/v	9164.000	30.5	39.7	10.0	19.7	14.2	46.4	54.0	-7.6	

Radiated Emissions / Interference

Table: 3

Company: S+S Consulting, Inc.
Model: Sentry
Job No.: J20003702
Date: 04/06/00
Standard: FCC 15
Class: B Group: None
Notes: 30Mhz-5Ghz
Receive Channel 1

Tested by: Vathana Ven
Location: Site 1
Detector: HP 8546A
Antenna: EMCO BICON 1224
PreAmp: none
Cable(s): 3m None
Distance: 3

Ant. Pol. (v h)	Frequency (MHz)	Reading (dBuV)	Antenna Factor Antenna	Cable Loss (dB)	Pre-amp Factor (dB)	Distance Factor (dB)	Net dBuV/m	Limit dBuV/m	Margin (dB)

No radiated emissions were measured above the measuring equipment noise floor which is at least 6 dB below the applicable limit.

Conducted Emissions / Interference

Table: 4

Company: S+S Consulting, Inc.
Model: Sentry
Job No.: J20003702
Date: 04/06/00
Standard: FCC 15
Class: B Group: None
Notes: Receive Channel 1

Tested by: Vathana Ven
Location: Site 1
Detector: HP 8546A
Cable(s): 3m None

Frequency (MHz)	Reading Side A (dB)	Reading Side B (dB)	Attenuator Factor (dB)	Quasi-Peak Net (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)
0.496	10.2	10.3	20.0	30.3	48.0	-17.7
0.510	9.8	9.8	20.0	29.8	48.0	-18.2
0.545	8.6	8.6	20.0	28.6	48.0	-19.4
0.612	6.7	6.7	20.0	26.7	48.0	-21.3

Conducted Emissions / Interference

Table: 5

Company: S+S Consulting, Inc.
Model: Sentry
Job No.: J20003702
Date: 04/06/00
Standard: FCC 15
Class: B Group: None
Notes: Transmit Channel 1

Tested by: Vathana Ven
Location: Site 1
Detector: HP 8546A
Cable(s): 3m None

Frequency (MHz)	Reading Side A (dB)	Reading Side B (dB)	Attenuator Factor (dB)	Quasi-Peak Net (dBuV)	Quasi-Peak Limit (dBuV)	Quasi-Peak Margin (dB)
0.496	10.2	10.3	20.0	30.3	48.0	-17.7
0.510	9.7	9.8	20.0	29.8	48.0	-18.2
0.545	8.5	8.6	20.0	28.6	48.0	-19.4
0.612	6.6	6.7	20.0	26.7	48.0	-21.3

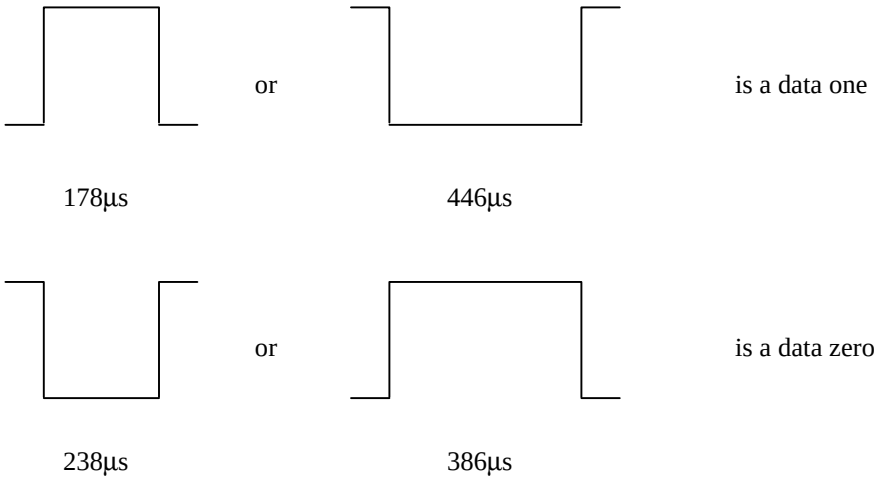
XI - Duty Cycle (Average Factor)

Average factor is subtracted from peak readings to compare emissions readings to average limits. The average factor iscalculated from duty cycle measurements from the following plots.

The average factor is 20 Log (ON-TIME/PERIOD) of the emission. If the period is longer than 100 milliseconds then 100 milliseconds is used for the period. Average factor is determined using the worst-case duty cycle.

TempTrack Duty Cycle Derivation

The TempTrak system implements a variable pulse width modulated (VPWM) ASK data format. This format utilizes two distinct pulse widths to describe either a one or zero. The transmit pulse widths are shown below with a logic high state corresponding to RF on and a logic low state corresponding to RF off.



Bits in the data stream always alternate between the high and low state representations. The specific binary data being transmitted determines which of the pulse widths represent a one or a zero.

The maximum length data packet possible is 39 bytes (312 bits). Also included in each data packet is a start and stop bit each with a transmit pulse width of 594µs. Assuming a worse case scenario where RF on is always a long pulse yields a maximum RF on time of:

(156 bits * 386µs) + 594µs start bit + 594µs stop bit = 61.4ms maximum RF on time per transmission

Maximum duty cycle over a 100ms period is 61.4% resulting in an averaging factor of 4.2 dB.

XII - Bandwidth

The following plot(s) show bandwidth measurements made. The Bandwidth is the 99% power.