MEASUREMENT/TECHNICAL REPORT

Company - Model: PinPoint
TAG-1001-01
FCC ID: OGK30011533001
May 10, 1999

Description: This is a report to support a request for an original grant of equipment authorization.

Equipment Type: Low Power Communications Device Transmitter (DXX)

Report prepared for:

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Letter of Agency

Introduction

This report is an application for Certification of a Transmitter operating pursuant to Part 15.249 of the FCC Rules, Code of Federal Regulations 47. The model number covered by this report is TAG-1001-01. This report is designed to demonstrate the compliance of this device with the requirements outlined in Part 15 of CFR 47 using the methods outlined in Part 2 of CFR 47. The current revision date, October 1,1998, of each Part has been used for technical requirements.

The confidential information and descriptions included in this application are detailed descriptions of the products, block diagrams, component specifications, and schematic diagrams. We hereby respectfully request under the provision of section 0.457d of the code that the documents listed below be held confidential.

Exhibit 6.1: Technical Descriptions and Block Diagrams

Exhibit 6.2: Schematics

Exhibit 6.3: Bill of Materials

PinPoint is requesting that the Technical Descriptions, Block Diagrams, Schematics and Bill of Materials be kept confidential in the FCC application because of the proprietary design developed by PinPoint that is unique to the industry.

EXHIBIT 1:

1.0 Statement of Conformity

The PinPoint 3D-*i*D Tag Model TAG-1001-01 has been found to conform with the following parts of the 47 CFR as detailed below:

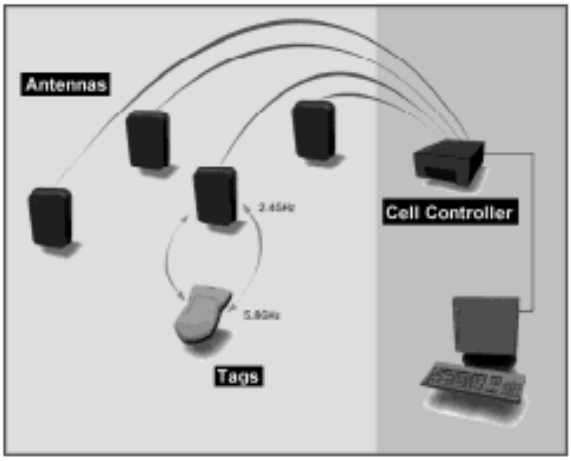
Part 2	Part 15	Comments
	15.15(b)	The product contains no user accessible controls that increase transmission power above allowable levels.
2.925	15.19	The label is shown in the label exhibit.
	15.21	Information to the user is shown in the instruction manual exhibit.
	15.27	No special accessories are required for compliance.
	15.203	The antenna is built into the board and there is no external antenna connection.
	15.205 15.209	The fundamental is not in a Restricted band and the spurious and harmonic emissions in the Restricted bands comply with the general emission limits of 15.209.
	15.207	The unit is battery powered without the capability of being recharged or operated from the AC mains.
	15.249(a)	The unit complies with the field strength limits of the 15.249(a) table including the 20dB peak restriction of 15.35(b) and 15.249(d).
	15.249(c)	The unit complies with the field strength limits of the 15.209(a) table.

EXHIBIT 2

2.0 General Description

2.1 Product Description

The 3D-*i*D Tag is a low cost RF device which transponds radio signals from the cell controller transmit antenna to the cell controller receive antenna. Additionally, it modulates tag information such as the tag ID onto the signal sent to the cell controller receive antenna. The Cell Controller broadcasts spread spectrum signals at 2.44GHz to the 3D-iD tags via its attached Antennas. It then measures the total time transpired until the return signals (at 5.77GHz) are received from the Tags. Using this information it calculates the distance the Tag is from the Antenna, called Tag Antenna Distance (TAD) data. The Cell Controller sends the TAD data it generates to the ViewPoint Software via a standard ethernet link. The software can, using TAD data from several antennas, accurately determine a Tag's location (Note: The 3D-iD cell controller is not included in this application).



Unit Tested
Model Number: TAG-1001-01
Serial Number: 3

2.2 Related Submittal(s) Grants

There are no other approvals required for this device.

2.3 Test Methodology

Radiated emission testing was performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at an antenna to EUT distance of 3 meters below 1 GHz, and at a distance of 3 or 1 meter(s) above 1 GHz. The actual test distance used is noted in the test data sheets. The device's performance was investigated to 40GHz. A fresh battery was used for all testing. Although the device does contain voltage regulating circuitry, the emissions in each configuration were maximized and the battery changed in the maximized configuration just prior to the reading being taken to insure that maximum emissions were recorded.

All other performance tests were made in accordance with the procedures outlined in Part 15 of CFR 47 with the expansion noted below. The applicable sections provided under Part 15 are provided in the measurement section of this report, Exhibit 3.

Discussion of CFR47 Part 15.249 Testing Procedure

The PinPoint 3DiD tag is a low-power transponder. It accepts incoming signals in the 2400-2483.5MHz band and shifts these signals to the 5725-5875MHz band. The PinPoint 3DiD cell controller emits a spread-spectrum signal in the 2400-2483.5MHz band which is "reflected" by the tag, with some modifications (principally modulation of the tag ID) into the 5725-5875MHz band. The cell controller then correlates the received signal to determine the tag location. For all legal Part 15.247 input signals, the tag conforms to the requirements of Part 15.249 using automatic gain control (AGC) techniques to limit output amplitude. Our testing was performed at the maximum point before AGC cut in.

There is a possibility that signals present at and below 2367MHz and at and above 2517MHz will be seen and shifted in frequency by the tag. These frequencies translate to the band edges at 5725MHz and 5875MHz at the tag output. For these frequencies, there is not such a clear-cut definition of emitter power as for 2400-2483.5MHz. To show conformance to the requirements of Part 15.249, we looked at the Part 2 allocations around these frequencies and found that the primary likely emitters are amateur radio below 2400MHz and passive, non-transmitting astronomical use above 2483.5MHz.

Power components at 2.4GHz are expensive, so for amateur operation, an effective isotropic radiated power of 10 watts is a top-end estimate of likely emission. PinPoint 3DiD system installations will be within areas owned by private companies, which have typical separations to residences (likely amateur radio operators) of at least 100 feet. Following this reasoning, the search for tag outputs corresponding to input signals outside the ISM band proceeds with looking at the tag output with inputs corresponding to the likely worst-case emission from amateur radio operation at a distance of 100 feet.

It is difficult to provide the radiated signals necessary to excite the 3DiD tag while still measuring the tag output on an open-air test site. To facilitate the testing process, a 3DiD tag had the input antenna removed and an SMA connector installed at the input to the receive bandpass filter. This allowed the introduction of wired signals, both spread signals from PinPoint 3DiD cell controllers and CW signals representing potential in-band and out-of-band emitters to the tag so the tag output could be examined for compliance to 15.249.

The determination of the input signal for the in-band signals was done as follows. The input signals were brought up in power from very low levels until the tag entered the input LNA shut-down mode. The input power was then reduced (by about 1dB) until the the tag output was stable (shutdown was not activated). The reason for this choice of input power is bench measurements have showed that the tag experiences the maximum non-linearity just before the LNA shut-down trips, so out-of-band signals from spectral regrowth are largest at this point.

For signals present outside the frequencies of 2400-2483.5MHz, the input bandpass filter reduces the amplitude of the input sufficiently that the AGC is not operating (the tag sets the RF gain to the maximum value). This also represents the worst case for the out-of-band signals because any additional AGC gain reduction also reduces the tag output signal. The test for compliance to 15.249 at the 5725-5875MHz band edges then merely needs to be examination of the tag output for an input at 2367MHz and below as well as 2517MHz and above at a level into the tag corresponding to the scenario outlined above.

So, the input signal level at 2367MHz will be the effective power 30 meters from a 10 watt isotropic radiator. This power level is:

$P_{rx} = P_{tx} – P_{path}$

$P_{rx} = +40dBm – (32.44db + 20 * \log(f) + 20 * \log(D))$,

where f is expressed in GHz and D is expressed in meters.

Thus,

$P_{rx} = +40 - (32.44 + 7.48 + 29.54) = -29.6dBm$

represents the isotropic power level impinging on the tag receive antenna. This signal experiences a gain of 4.6dB from the tag Rx antenna, so the signal into the tag itself should be –25dBm.

The test is performed as follows. A tag is supplied with the antenna removed and a connector installed at the input bandpass filter. A cable is then attached to this connector and to a signal generator set to a frequency of 2367MHz and a level of –25dBm. The output signal radiated from the tag is examined to determine if the radiated field strength at 3 meters complies with the requirements of 15.249. This signal is then swept down in frequency to ensure that the tag signal rolls off. This procedure is then repeated with the signal generator set to 2517MHz and –25.5dBm (the frequency term in the path loss equation increases by 0.5dB from 2367MHz to 2517MHz) and swept up.

2.4 Test Facility

Curtis-Straus LLC
All testing for the range 30 – 18000MHz was performed at Curtis-Straus (NVLAP Lab Code: 200057-0). The open area test site used to collect the radiated data is located at 527 Great Road, Littleton, MA 01460. Sites “F” and “T” were used. These test facilities have been fully described in a report submitted to your office, and a letters from your office dated February 28, 1997 and August 8, 1997 verified receipt of these reports and confirmed compliance of these sites. Please reference your file # 31040/SIT 1300F2 should you have any questions regarding the test site construction.

Chomerics Test Service
All testing for the range 18000-40000MHz was performed at Chomerics Test Service (NVLAP Lab Code: 100296-0). Chomerics’ Open Area Test Site "A" is located in the lower parking lot attached to the Seeger Building at Chomerics, 84 Dragon Court, Woburn, Massachusetts. The Open Area Test Site “A” enclosure is a wooden structure measuring 56 x 30 x 25 feet in size with galvanized steel sheet metal used as the ground plane. The structure used to support equipment under test is an EMCO 4 foot diameter motorized turntable. For tabletop equipment, a wooden table measuring 1.5 x 1 meter in size is positioned at the center of the turntable, at the proper height above the ground plane. The area at the end of the Open Area Test Site “A” is the location for the test personnel and equipment to ensure they are outside the imaginary ellipse. This Site is listed with the Federal Communications Commissions (FCC).

2.5 Test Equipment Used

Curtis- Straus

SPECTRUM ANALYZER(S)

GREEN 8593E 9 kHz-26.5 GHz	HP	S/N:3829A03618	Calibration Due:31-AUG-99

ANTENNA(S)

RED 3143 Biconilog 30 MHz-1.1 GHz	EMCO	S/N:1270	Calibration Due:28-MAY-99
YELLOW 3115 Horn Antenna	EMCO 1-18 GHz	S/N:9608-4989	Calibration Due:10-MAR-00

PREAMPLIFIER(S)

BLACK ZFL-1000-LN RF Preamplifier 0.01 - 2000 MHz	MiniCircuits		Calibration Due:01-MAR-00
WHITE SMC-12A RF Preamplifier 2000 - 18000 MHz	MITEQ	S/N:426643	Calibration Due:30-OCT-99

OPEN AREA TEST SITE(S)

SITE "F"	Calibration Due:18-OCT-99
SITE "T"	Calibration Due:28-MAY-99

Unless otherwise noted the calibration interval is one year. All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Chomerics Test Service

HP 8566B Spectrum Analyzer	S/N: 2747A05761	Calibration Due: August 1999
HP 85685A Preselector	S/N: 2837A00803	Calibration Due: August 1999
HP 11975A Amplifier	S/N: 2738A01696	Calibration Due: UWC
HP 11970K Harmonic Mixer	S/N: 3003A02298	Calibration Due: UWC
HP 11794A Preselector RF Section	S/N: 3001A6019	Calibration Due: UWC
HP 1197-60028 Power Supply	S/N: 00126	Calibration Due: n/a
AI 861A/529 18-28GHz Antenna	S/N: 468	Calibration Due: Oct 1999
AI 861K/595 26-40GHz Antenna	S/N: 188	Calibration Due: Oct 1999

(UWC = use with calibrated equipment)

EXHIBIT 3

3.0 Measurement Results

3.1 Operating Frequency

This device operates at 5800.0 MHz.

3.2 Electric Field Strength Radiation Measurements

Radiated Emissions Table — *Curtis-Straus*

Date: 27-Apr-99 **Company:** PinPoint **Table** 1
Engineer: Michael Buchholz **EUT Desc:** 3D-*i*D Tag **Work Order:** 990391

Frequency Range: Harmonics of 5800.0MHz **Measurement Distance:** 3 m

Notes: Tag harmonics and band edge scan using substitution method.
Scan performed to the 3rd harmonic.

Antenna Polarization (H / V)	Frequency (MHz)	Antenna Reading (dBµV)	Substituted Power (dBm)	Substituted Reading (dBµV)	Antenna Factor (dB/m)	Duty-Cycle Factor (dB)	Distance Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Part 15 Sec 15.249 Limit (dBµV/m)	FCC Part 15 Sec 15.249 Margin (dB)	FCC Part 15 Sec 15.249 Result (Pass/Fail)
Tag TX Clock Harmonics														
V (z)	5800.0	74.1	-41.0	66.0	36.9	20.0	0.0	82.9	---	---	---	93.97	-11.1	Pass
NF	11600.0	25.7	-67.3	39.7	40.6	20.0	9.5	50.8	---	---	---	54.0	-3.2	Pass
NF	17400.0	27.0	-69.0	38.0	44.4	20.0	9.5	52.9	---	---	---	54.0	-1.1	Pass
Tag TX Band Edge Readings at Fundamental - Continuous Wave														
V (z)	5725.0	21.7	-76.4	30.6	36.9	20.0	0.0	47.5	---	---	---	54.0	-6.5	Pass
V (z)	5875.0	19.5	-78.6	28.4	36.9	20.0	0.0	45.3	---	---	---	54.0	-8.7	Pass
Tag TX Peak and Band Edge Readings at Fundamental - Spread Source														
V (z)	5800.0	60.4	-55.4	51.6	36.9	20.0	0.0	68.5	---	---	---	93.97	-25.5	Pass
V (z)	5725.0	29.2	-89.2	17.8	36.9	20.0	0.0	34.7	---	---	---	54.0	-19.3	Pass
V (z)	5875.0	29.9	-88.5	18.5	36.9	20.0	0.0	35.4	---	---	---	54.0	-18.6	Pass

Test Site: "F" **Pre-Amp:** Black, White **Cable:** 65&12 ft RG8A/U **Analyzer:** Green **Antenna:** Red, Yellow

Radiated Emissions Table - Provided by Chomerics Test Service — *Curtis-Straus LLC*

Date: 07-May-99 **Company:** PinPoint **Table** 2
Engineer: Bob Foster **EUT Desc:** 3D-*i*D Tag **Work Order:** 990391

Frequency Range: 18-40GHz **Measurement Distance:** 3m

Notes: Spurious scan including Tag TX harmonics above 18GHz as performed by Chomerics.

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Averaging Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Part 15 Class B Limit (dBµV/m)	FCC Part 15 Class B Margin (dB)	FCC Part 15 Class B Result (Pass/Fail)
NF	23200.0	24.1	---	32.9	---	20.0	37.0	---	---	---	54.0	-17.0	Pass
NF	29000.0	23.7	---	35.6	---	20.0	39.3	---	---	---	54.0	-14.7	Pass
NF	34800.0	21.8	---	36.4	---	20.0	38.2	---	---	---	54.0	-15.8	Pass

Test Site: "A" **Pre-Amp:** n/a **Cable:** Flexible Waveguide **Analyzer:** 8566B **Antenna:** Horns

Radiated Emissions Table

Curtis-Straus LLC

Date: 27-Apr-99 **Company:** PinPoint **Table** 3
Engineer: Michael Buchholz **EUT Desc:** 3D*i* D **Work Order:** 990391

Frequency Range: 30-18000MHz **Measurement Distance:** 3 m

Notes: Final Spurious Scan
Tag and Cell Controller
EUT Max Freq: 6246MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Duty-Cycle Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
V	128.9	45.9	22.3	8.0	1.1	0.0	32.7	---	---	---	43.5	-10.8	Pass
V	167.1	47.2	22.3	9.4	1.3	0.0	35.6	---	---	---	43.5	-7.9	Pass
H	200.0	44.4	22.4	10.1	1.5	0.0	33.6	---	---	---	43.5	-9.9	Pass
V	250.0	36.6	22.5	12.7	1.7	0.0	28.5	---	---	---	46.0	-17.5	Pass
H	280.0	42.6	22.5	13.4	1.9	0.0	35.4	---	---	---	46.0	-10.6	Pass
H	300.8	40.7	22.5	13.9	2.0	0.0	34.1	---	---	---	46.0	-11.9	Pass
H	320.0	47.7	22.5	14.4	2.0	0.0	41.6	---	---	---	46.0	-4.4	Pass
H	350.0	33.4	22.4	15.1	2.2	0.0	28.3	---	---	---	46.0	-17.7	Pass
V	360.0	48.6	22.4	15.3	2.2	0.0	43.7	---	---	---	46.0	-2.3	Pass
H	400.0	42.5	22.3	16.3	2.4	0.0	38.9	---	---	---	46.0	-7.1	Pass
H	450.0	41.6	22.5	17.4	2.6	0.0	39.1	---	---	---	46.0	-6.9	Pass
V	500.0	36.3	22.6	18.4	2.8	0.0	34.9	---	---	---	46.0	-11.1	Pass
H	560.0	37.2	22.4	19.1	3.0	0.0	36.9	---	---	---	46.0	-9.1	Pass
H	600.0	42.3	22.3	19.5	3.1	0.0	42.6	---	---	---	46.0	-3.4	Pass
H	650.0	36.1	22.2	20.3	3.3	0.0	37.5	---	---	---	46.0	-8.5	Pass
H	720.0	35.6	22.0	21.4	3.5	0.0	38.5	---	---	---	46.0	-7.5	Pass
V	1000.0	32.0	21.5	23.4	4.4	0.0	38.3	---	---	---	54.0	-15.7	Pass
V	1440.0	34.4	20.5	26.8	5.6	0.0	46.3	---	---	---	54.0	-7.7	Pass
V	1679.0	51.2	20.3	27.8	6.2	20.0	44.9	---	---	---	54.0	-9.1	Pass
V	2082.0	39.1	20.3	29.6	1.3	0.0	49.7	---	---	---	54.0	-4.3	Pass
V	2160.0	28.2	20.3	29.8	1.4	0.0	39.1	---	---	---	54.0	-14.9	Pass
NF	3694.0	26.8	19.9	33.3	2.0	0.0	42.2	---	---	---	54.0	-11.8	Pass
V	4164.0	31.5	19.8	33.9	2.1	0.0	47.7	---	---	---	54.0	-6.3	Pass
V	5037.0	44.1	20.5	36.3	2.4	20.0	42.3	---	---	---	54.0	-11.7	Pass
V	6246.0	31.2	18.6	36.9	2.8	0.0	52.3	---	---	---	54.0	-1.7	Pass

Final Result: Pass by 1.7 dB ***Worst Freq:*** 6246.0 MHz

Test Site: "F","T" **Pre-Amp:** Black, White **Cable:** 65&12 ft RG8A/U **Analyzer:** Green **Antenna:** Red, Yellow

Emissions Plots:

Fundamental

2nd Harmonic

3rd Harmonic

4th Harmonic

5th Harmonic

6th Harmonic

3.3 Occupied Bandwidth Measurements

In order to obtain accurate restricted band intrusion measurements, plots were obtained with the unit operating with a continuous wave source and a spread source. As shown in the plots below and the table in section 3.2, the Tag meets all bandwidth requirements (all components are within the 15.249 5.8GHz band).

Spread Source Across Tx Band

Upper Band Edge – Max CW Input

Lower Band Edge – Max CW Input

3.4 Test Setup Photographs

See file "990391 Exhibit 3.4 - Test Setup Photos.doc"

EXHIBIT 4

4.0 Equipment Photographs

External

See file "990391 Exhibit 4 - External Photos.doc"

Internal

See file "990391 Exhibit 4 - Internal Photos.doc"

EXHIBIT 5

5.0 Product Labeling

See file "990391 Exhibit 5 - Label Info.doc"

EXHIBIT 6

6.0 Technical Specifications

6.1 Technical Description and Block Diagram

See file "990391 Exhibit 6.1 -Technical Description & Block Diagram.doc"

6.2 Schematics

See file "990391 Exhibit 6.2 – Tag Schematic.pdf"

6.3 Bill of Materials

See file "990391 Exhibit 6.3 – Tag BoM.pdf"

EXHIBIT 7

7.0 Instruction Manuals

Please note the required user warnings that appear on page 2 of the manual. Also, the required FCC warnings appear on page 11 of the manual since there is not enough room on the tag itself.

See file "990391 Exhibit 7 – Tag Manual.pdf"

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