Application for Certification

Precision Time Systems, Inc.

PT-Beltpack 100 Transmitter

Precision Time Systems, Inc.
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1.0 INTRODUCTION

1.1_ Scope

This report is intended to document conformance with the Federal Communications Commission requirements of Title 47 CFR Part 15, Subparts B, C and Part 2 (10/98 Edition), and present the results of testing performed the third quarter 1999 on the “PT-Beltpack 100 “ transmitter manufactured by Precision Time Systems, Inc.

1.2 Testing Requirements

Listed below is the information required under title 47 CFR Part 2:

2.1033(a) A completed FCC Form 731 is included with this application.

2.1033(b)(1) Applicant/Manufacturer: Michael J. Costabile
Precision Time, Inc.
PO Box 1445
1226 Dimmocks Mill Rd.
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2.1033(b)(2) FCC Identifier: OSQ-PT100

2.1033(b)(3) A copy of the instruction manual is included as Attachment A.

2.1033(b)(4) A description of circuit functions and how the device operates is included in section 2.2.

2.1033(b)(5) A block diagram and circuit schematic will be supplied by the Manufacturer of the transmitter subassembly, Proxim, Inc. under a separate cover, with a request for confidentiality.

2.1033(b)(6) A report of test measurements showing compliance with pertinent FCC technical requirements is included in Sections 4.0 and 5.0.

2.1033(b)(7) Photographs are included as Attachment B.

2.1033(b)(8) No peripheral equipment was used during testing.

2.1033(b)(9) The equipment is NOT being authorized pursuant to the transition provisions in §15.37.

2.1033(b)(10) An exhibit displaying compliance with the processing gain provisions of §15.247(e) is included in Sections 4.0 and 5.0.

2.1033(b)(11) N/A

2.1033(b)(12) N/A

2.1033(c) N/A

1.3 Summary

The Precision Time Systems, Inc. model PT-Beltpack 100 transmitter was found to be compliant to FCC Part 15 requirements per the above listed procedures when the recommended modifications are installed. Detailed test results and analyses are contained in the body of this report.

2.0 GENERAL INFORMATION

2.1 Product Description

The “PT-Beltpack 100" transmitter is a battery operated direct sequence spread spectrum transmitter that operates on a single channel in the 902-928 MHz frequency band. It is contained in a plastic housing with belt clip to be worn on the belts of basketball officials during games. A 3 inch non-removable antenna extends downward from the device along with a permanently affixed remote microphone, on a 24" wire. The microphone is routed up to the collar or lapel area of the referee’s jersey so as to pick up the sound of his whistle to start or stop play. Specialized circuitry and software within the device detect the unique characteristics of the referee’s whistle and trigger a 40 millisecond burst of data which is then received by a companion receiver at the official time-keeper’s station. The receiver is programmed to automatically stop the time clock the instant the signal is received. There is a single control button on the bottom of the belt-pack transmitter which, when pressed, initiates transmission of another 40 millisecond burst of data to resume operation of the time clock.

The PT-Beltpack 100 transmitter operates on a single 3 volt type DL123 Lithium battery. The manufacturer’s specified end of battery life is approximately 2.5 volts at which time the device will cease to operate. Two circuit boards are contained in the belt-pack transmitter; one, manufactured by Precision time Systems is a logic and control board which detects and discriminates the whistle sound from other extraneous noises. It contains the necessary logic to generate the short data stream that identifies it to the receiver and initiates a time clock stop or start action. The control board also provides the transmitter board with the proper control sequence, required to begin transmission. The second board is the transmitter board, the RDA Series radio, manufactured by Proxim, Inc. Proxim markets the transmitter board as an “FCC Part 15 Certifiable” product when used according to their instructions. Proxim has not been granted Certification for its transmitter board, but rather leaves it up to the OEM (Original Equipment Manufacturer) to gain Certification. The RDA Series transmitter board is a complete, direct sequence spread spectrum transmitter which only requires power and the proper sequence of control signals to operate. It also contains a receiver which is **not** used in this application by Precision Time Syatems. The Proxim transmitter normally has a detachable antenna but Precision Time Systems replaces that with a fixed antenna, soldered to the board in its place.

2.2 Circuit Description of Transmitter

The block diagram of the RDA Series radio board is shown in figure 2.1. Note that only the transmitter portion of the board is used in the Precision Time PT-Beltpack 100 transmitter and not the receiver. An 8MHz reference oscillator is used to synthesize the final output frequency of the transmitter. The complete transmitter with the exception of the two final amplifiers is contained under a shield which is installed by the board’s manufacturer, Proxim, Inc. Signals fed to the uProcessor Bus Interface dictate when the transmitter is keyed ON and when the desired data is transmitted. The entire transmission takes 40 milliseconds.

Proxim has requested confidentiality regarding the schematic diagrams of its RDA Series transmitter and does not provide them to Precision Time Systems. Instead, Proxim has agreed to submit schematics under a separate cover, with an agreement of confidentiality, directly to the FCC.

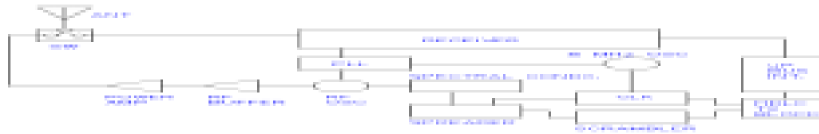

Figure 2-1 Transmitter Block Diagram

4.0 TEST CONFIGURATIONS AND JUSTIFICATIONS

Tests were conducted on a production sample that was deemed representative of actual product performance. In all tests, the EUT had been modified so as to transmit continuously when powered ON. In the test descriptions that follow, references are made to pertinent paragraphs of CFR 47, Parts 2 and 15 as well as ET Docket No. 96-8;FCC 97-114, Report and Order released April 10, 1997, specifically the Appendix - Measurement Procedures for Spread Spectrum Transmitters.

It should be noted that the EUT failed the Radiated Spurious Emissions test in the configuration that it was originally tested, although it had already passed all of the conducted tests. A circuit modification (described later) was made and the EUT was retested with the modification in place. All reported test data, both conducted and radiated was taken with the circuit modification installed.

4.1 Bandwidth (Section 15.247(a)(2), ET 96-8;FCC 97-114)

Bandwidth was measured with the following procedure. The antenna was removed and a 6 inch coaxial cable was soldered to the RF output of the EUT, at the point where the antenna is soldered to the board. A fresh battery was installed and the coax cable was connected to the RF input of the spectrum analyzer through a 10dB attenuator. The spectrum analyzer's resolution bandwidth (RBW) was set to 100 KHz and its video bandwidth (VBW) was set to 3 MHz. The span (set >>RBW) was set to 5MHz. Because the emissions were rapidly changing, producing a rough and jagged display, the max hold feature of the spectrum analyzer was utilized to somewhat "smooth out" the display. This allowed for a more accurate reading of the actual bandwidth occupied over time.

4.2 Power Output (§15.247(b), ET 96-8;FCC97-114)

Power Output was measured with the same 6 inch coaxial cable and attenuator as the previous test. The spectrum analyzer's RBW was set to 5MHz (RBW>6dB BW of emission). VBW was set to 3MHz, the maximum setting of the spectrum analyzer which is equivalent to turning video filtering OFF. Again, fresh batteries were used.

4.3 RF Antenna Conducted Spurious Emissions (§15.247(c), ET96-8;FCC97-114)

Conducted spurious emissions were measured with the same 6 inch coaxial cable as in the previous two tests but with the 10dB attenuator removed. The spectrum was investigated in three bands; from 900 MHz to 10 GHz, 1 MHz to 1 GHz and 9KHz to 1 MHz. The band from 900 MHz to 10 GHz was examined with the spectrum analyzer's RBW set to 100 KHz, VBW = 3 MHz. This covered the EUT's fundamental through its 10^{th} harmonic output. The remaining two bands were measured because the EUT has circuitry operating at less than the fundamental frequency and it was desirable to examine the spectrum from 9 KHz to the EUT's fundamental frequency as well.

4.4 Radiated Emissions (§15.205, 15.209, 15.247, ET 96-8;FCC 97-114)

Radiated spurious emissions were measured according to the procedures of TIA/EIA 603:1993. First, a preliminary emission profile was performed inside an anechoic chamber where the EUT was placed on a non-conductive table 1m above the floor, in a typical configuration. The receiving antenna was placed at a distance of 1m. and at a fixed height of 1.2m. The EUT was powered ON and the table was rotated 360° in small degree increments while peak emission data was observed and recorded over the frequency range of interest. The scan was made in horizontal and vertical antenna polarizations.

Only those emissions falling within the restricted bands of §15.205 were measured on the OATS. The emission limits were determined from §15.209.

Final testing was performed on the OATS. The EUT was placed on a non-conductive table 1m above the ground plane. The EUT was positioned on the center of the table. The search antenna was placed at a distance of 3 meters and its height was varied until the emissions were maximized. That height was recorded as 1.2m. The antenna was then adjusted for boresite orientation resulting in the maximum emission reading. The search antenna was kept at that boresite and moved to a distance of 1m to make the final measurements. Each emission noted in the preliminary emission profile was measured at OATS in this manner.

4.5 Power Spectral Density (§15.247(d), ET 96-8;FCC 97-114)

Power Spectral Density was measured as follows: The max hold and the peak search functions were first used to identify the frequency within the passband with the highest emissions. At this frequency, the spectrum analyzer could not resolve the spectrum line spacing therefore the noise power density was measured directly, normalized to a 1Hz bandwidth. The 34.8dB correction factor was then applied to the reading to correct for a 3KHz band.

4.6 Processing Gain (§15.247(c), ET 96-8;FCC 97-114)

Processing Gain was measured by using the CW Jamming method. This test was performed by the manufacturer of the transmitter in accordance with ET 96-8;FCC 94-114 and results were supplied to Precision Time, Inc. This was necessary in order for the transmitter's manufacturer to maintain confidentiality regarding the schematic diagrams and detailed operation of their circuitry.