US006351235B1

(12) **United States Patent**
Stilp

(10) **Patent No.: US 6,351,235 B1**
(45) **Date of Patent: Feb. 26, 2002**

(54) **METHOD AND SYSTEM FOR SYNCHRONIZING RECEIVER SYSTEMS OF A WIRELESS LOCATION SYSTEM**

(75) Inventor: **Louis A. Stilp**, Berwyn, PA (US)

(73) Assignee: **TruePosition, Inc.**, King of Prussia, PA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/495,417**

(22) Filed: **Jan. 31, 2000**

Related U.S. Application Data

(62) Division of application No. 09/227,764, filed on Jan. 8, 1999, now Pat. No. 6,184,829.

(51) **Int. Cl.**[7] **H04B 7/185**

(52) **U.S. Cl.** **342/357.06**; 342/356

(58) **Field of Search** 342/352, 356, 342/357.06, 457; 701/213; 331/3, 44, 47

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,921,076	A		11/1975	Currie	325/321
4,169,245	A		9/1979	Crom et al.	325/58
RE31,254	E		5/1983	Brodeur	343/103
4,899,117	A	*	2/1990	Vig	331/3
5,155,590	A		10/1992	Beyers, II et al.	358/86
5,191,342	A		3/1993	Alsup et al.	342/465
5,251,232	A		10/1993	Nonami	375/5
5,327,144	A		7/1994	Stilp et al.	342/387
5,402,347	A		3/1995	McBurney et al.	364/443
5,428,667	A		6/1995	Easterling et al.	379/59
5,512,908	A		4/1996	Herrick	342/387
5,526,357	A		6/1996	Jandrell	370/95.2
5,553,101	A		9/1996	Lim et al.	375/340
5,570,099	A		10/1996	DesJardins	342/378
5,577,087	A		11/1996	Furuya	375/377
5,606,575	A		2/1997	Williams	375/219
5,608,410	A		3/1997	Stilp et al.	342/387
5,623,414	A	*	4/1997	Misra	364/449.1
5,668,837	A		9/1997	Dent	375/316
5,786,790	A		7/1998	Abbott	342/357
5,812,609	A		9/1998	McLochlin	375/340
5,844,522	A		12/1998	Sheffer et al.	342/457
5,861,842	A	*	1/1999	Hitch et al.	342/357
5,874,916	A		2/1999	DesJardins	342/378
5,890,068	A		3/1999	Fattouche et al.	455/456
5,936,571	A		8/1999	DesJardins	342/357
5,973,643	A	*	10/1999	Hawkes et al.	342/457
6,014,102	A		1/2000	Mitzlaff et al.	342/457

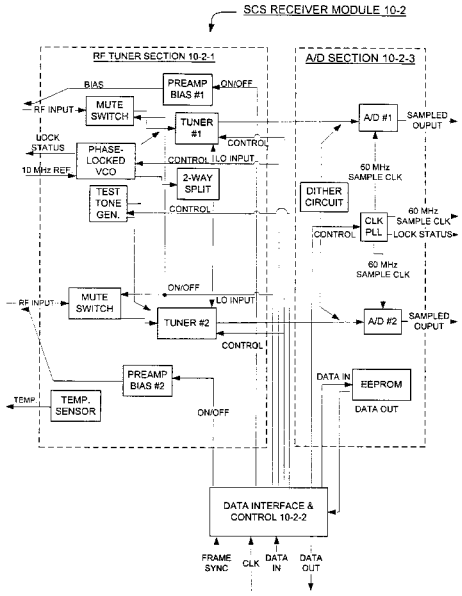
OTHER PUBLICATIONS

Chester, D.B. et al., "VLSI Implementation of a Wide Band, High Dynamic Range Digital Drop Receiver," *IEEE*, 1991, 1605–1608.

* cited by examiner

Primary Examiner—Dao Phan
(74) *Attorney, Agent, or Firm*—Woodcock Washburn LLP

(57) **ABSTRACT**

In a wireless location system (WLS) including a plurality of geographically separated receiver systems, a system for synchronizing the respective receiver systems includes the use of an enhanced GPS receiver including a mechanism for receiving GPS signals and removing at least a portion of the timing instability of the GPS signals. An output of the enhanced GPS receiver is provided to a low phase noise phase-locked loop circuit that is used to produce reference signals with less than 0.01 degrees RMF of phase noise.

20 Claims, 27 Drawing Sheets