Harris Semiconductor

APPNOTE

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PRISM™ DSSS Radio Operation in Continuous Links

Authors: Carl Andren, John Fakatselis

Introduction

This application note addresses ways to design the PRISM™ for continuous data transmissions. The PRISM™ has been primarily targeting packetized data transmissions for WLAN applications. The baseband processor though, the HSP3824, is flexible enough to allow for a variety of continuous data transmissions applications.

Description

The PRISM™ Radio is designed for packet radio operating modes which are characterized by short bursts of data with rapid acquisition of a preamble, header and data. It can be used, however, for continuous links if certain conditions are met. Continuous operation implies that the normal preamble and header the radio expects to acquire on are non existent or only available at the outset. The modem design is configured to expect a BPSK modulated header in both BPSK and QPSK modes. In BPSK, this is not a difficult requirement as a short resynchronization header can be embedded in the data stream. This makes it difficult, however, to reacquire the signal after a dropout in QPSK mode. One straight forward way to provide for continuous QPSK operation is to embed a periodic BPSK preamble and header in the data stream to allow reacquisition. If the link has not dropped, this preamble and header will be treated as data and sent to the user. The user can ignore it or use it to reestablish frame timing if needed. This is a small overhead that requires some rate buffering in the data. In BPSK mode, the modem will reacquire readily without the need for this periodic header, but some other timing considerations need to be addressed.

In the simplest header mode (mode 0 in HSP3824 data sheet), where only a Start Frame Delimiter is used as part of the header fields, the demodulator expects to see the Start Frame Delimiter (SFD) to direct the receive state machine to begin data demodulation. The SFD also serves to tell the data user where the data starts and to identify the byte or word boundaries. After acquisition, and before seeing the SFD, the modem begins to output data to the Media Access Controller (MAC). For continuous operation, the MAC can be a simple controller or state machine rather than a full network protocol engine. Upon detecting the SFD, the modem (HSP3824) raises the MD_RDY signal to let the MAC know when the first bit of payload data starts. The MAC can, however, look for the SFD itself and do its own frame timing adjustment. To provide for continuous operation with possible dropouts, the data should, in any case, have periodic resynchronizing words embedded in it. For binary messages, this is mainly needed to tell where the byte boundaries are. This is a very small amount of essential overhead. For text or ASCII messages, this can be a simple matter of determining an alignment that allows the 8th bit of most bytes to be low.

In the case of a BPSK transmission the link can potentially reacquire from drop outs without the need of the embedded synchronization word. The SFD is a 16-bit word that will occur with a probability of 1/65536 in random data. Thus, if it is needed and the data is random enough, you can be assured that a suitable facsimile will quickly be found in the data (if BPSK). This will not usually, however, set the correct byte boundaries.

In BPSK mode, the modem will track any signal that has the right properties. These are: spread with the correct sequence and modulated with BPSK. In the acquisition mode, the modem will transition to tracking mode once the acquisition thresholds have been met. If there is a problem in acquiring the signal, the signal acquisition thresholds can be set to accept noise as a suitable signal and transition the receive state machine into the tracking mode. This is like setting the squelch threshold of a voice radio to its lowest setting (off). After acquisition, the demodulator will track as well as it can until a signal drop out occurs or the SFD timer times out. The SFD timer can be disabled to keep it from forcing acquisition and the drop lock thresholds can similarly be set to never drop lock. Thus, once in tracking with the drop lock thresholds disabled, it will never exit back to the acquisition mode. Then, as long as a signal is there to be tracked and demodulated, the modem will try to recover it. Whenever no suitable signal is present, the modem will output erroneous data (noise) with these settings. All of these settings are programmable at the HSP3824.

The only question left is the state of the MD_RDY signal of the HSP3824. This signal is an output from the HSP3824 and provides the dual functions of declaring that a good signal is being received and of providing the frame timing mark. If this signal is not needed, it's a don't care. If it's needed, include a periodic SFD in the data and set thresholds to allow the modem to go back to the acquisition state if the signal is lost (squelch on). In header modes 1-3, the CRC is checked in the modem and failure to pass keeps the MD_RDY signal low. Therefore, set the CRC check to ON.

In the 1 MBPS mode with 11 chips per bit, the demodulator will track out to a carrier offset of 1.2MHz before giving up, but can false lock at 0.75MHz where the first sideband of the data modulation occurs. Since these offsets are way beyond the normal frequency offsets encountered, they shouldn't be a problem, but this does constitute one weak reason to not defeat the acquisition and drop lock thresholds.

The following are HSP3824 programmable settings that impact the operation in continuous mode.

SFD Timer (HSP3824 CR 0)	Set for disable
CRC Check (HSP3824 CR 2)	ON if you are using MD_RDY and header modes 1-3
Acquisition Threshold, SQ1 (HSP3824 CR 22, 23)	Set normally or to 0000
Acquisition Threshold, SQ2 (HSP3824 CR 30, 31)	Set normally or to FFFF
Data Threshold, SQ1, Drop Lock (HSP3824 CR26, 27)	Set normally or to 0000
Data Threshold, SQ2 (HSP3824 CR 34, 35)	Set normally or to FFFF

Figure 1, A and B illustrates the format of the continuous link for the BPSK and QPSK cases.

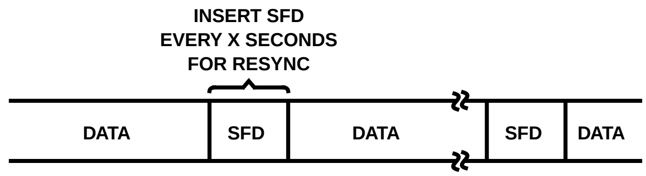

FIGURE 1A. BPSK CONTINUOUS LINK

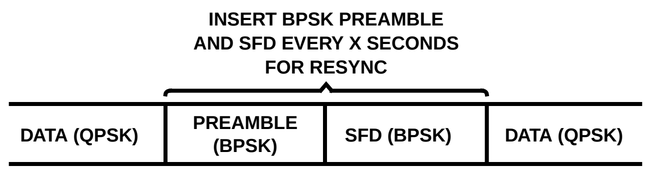

FIGURE 1B. QPSK CONTINUOUS LINK

FIGURE 1. CONTINUOUS PRIMS LINKS

Sales Office Headquarters

For general information regarding Harris Semiconductor and its products, call **1-800-4-HARRIS**

NORTH AMERICA
Harris Semiconductor
P. O. Box 883, Mail Stop 53-210
Melbourne, FL 32902
TEL: 1-800-442-7747
(407) 729-4984
FAX: (407) 729-5321

EUROPE
Harris Semiconductor
Mercure Center
100, Rue de la Fusee
1130 Brussels, Belgium
TEL: (32) 2.724.2111
FAX: (32) 2.724.22.05

ASIA
Harris Semiconductor PTE Ltd.
No. 1 Tannery Road
Cencon 1, #09-01
Singapore 1334
TEL: (65) 748-4200
FAX: (65) 748-0400

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