

Technical Note: SecureSync®

STANAG / HaveQuick Synchronization

Introduction

STANdard NAto Agreement is a set of minimal specifications aiming at providing interoperability between military equipment deployed by NATO nations. These specifications include performances, interfaces, and functionalities of various systems.

In the area of communications, several STANAGs include specifications related to time and frequency. Time and Frequency signals are indeed vital to allow reliable operation of highly protected radio communication networks or links.

As a leading provider of Time & Frequency systems for military forces, Spectracom offers high accuracy, high reliability and flexible solutions to synchronize communication systems in compliance with the relevant STANAGs.

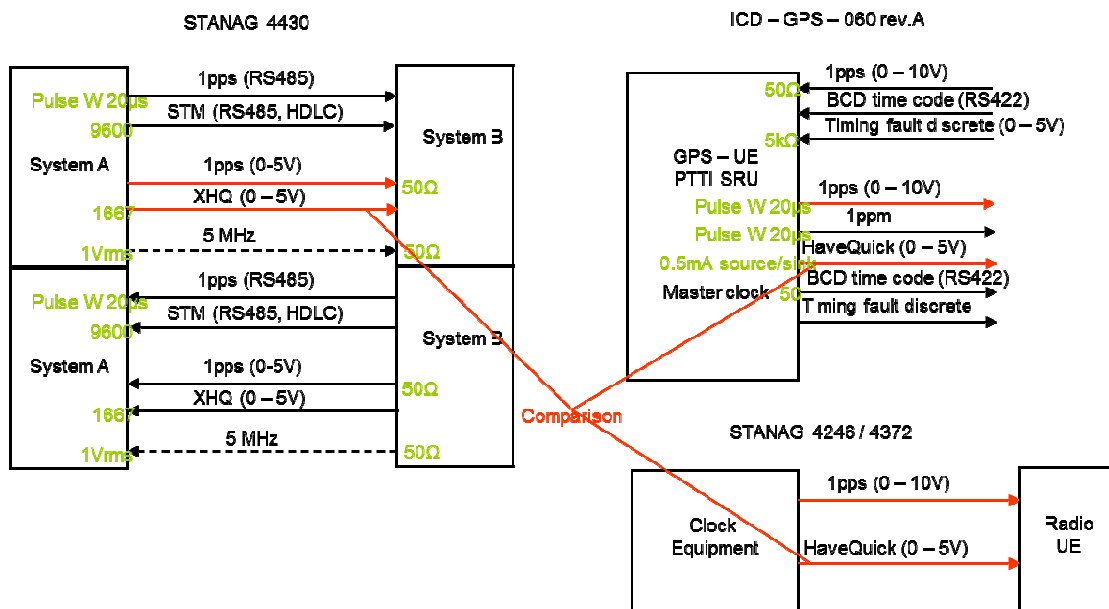
This technical note provides a brief description of the main time and frequency related STANAGs as well as the description of their implementation as an option board for SecureSync Master Clock system.

STANAG Principles

The main Time & Frequency STANAGs are:

- STANAG 4246 for Have Quick UHF radio (second release)
- STANAG 4372 for SATURN UHF radio, include Have Quick modes
- ICD-GPS-060 timing interface for GPS User Equipments
- STANAG 4430 interface for precise time and frequency transfer (generic)

The principles of synchronizing signals, for the various STANAGs, are pictured below:



STANAG Content

These STANAG basically are based on two main types of signals:

- 1 pulse per second (1 PPS), as an exact phase referenced to UTC
- Time of Day (ToD), as a time scale, according to different time code formats (Have Quick, HQII, HQIIA, XHQ, BCD, STM). Some of these formats include a synchronization quality indicator field (XHQ includes the Time Factor Of Merit – TFOM – indicator)
- Frequency signal, in general 5 MHz signal
- Other signals can be also present, like alarms (Time Fault discrete)

Electrical format of these signals can be chosen, depending on the considered STANAG, amongst the following:

- 1 PPS : 0 – 5V (TTL) ; 0 – 10 V ; RS485
- ToD : TTL ; RS485

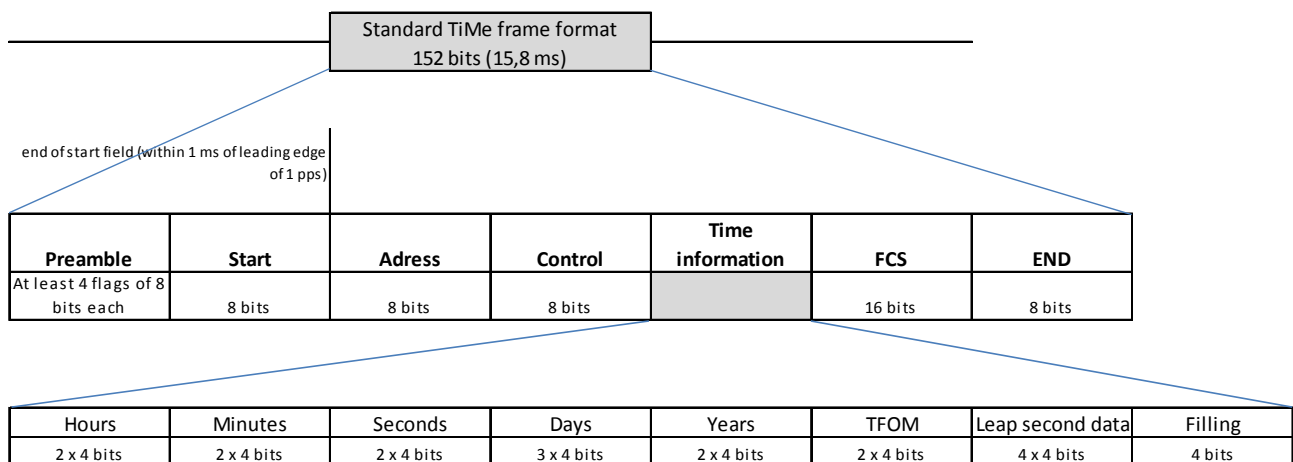
The following table provides the correspondence between STANAGs and related signals:

Interface Configuration - High Level Selection	
TX selection	Generated signals
STANAG 4372	1PPS (10V) - XHQ (TTL)
STANAG 4246	1PPS (10V) - XHQ (TTL)
STANAG 4430	1PPS (5V) - 1PPS (RS485) - STM (RS485) - XHQ (TTL) - 5MHz
ICD-GPS-060	1PPS (10V) - 1PPM - BCD (RS485) - TF discrete
RX selection	Processed signals
STANAG 4372	1PPS (10V) - XHQ (TTL)
STANAG 4246	1PPS (10V) - XHQ (TTL)
STANAG 4430	1PPS (5V) - 1PPS (RS485) - STM (RS485) - XHQ (TTL)
ICD-GPS-060	1PPS (10V) - BCD (RS485) - TF discrete

Time of Day (ToD) Formats

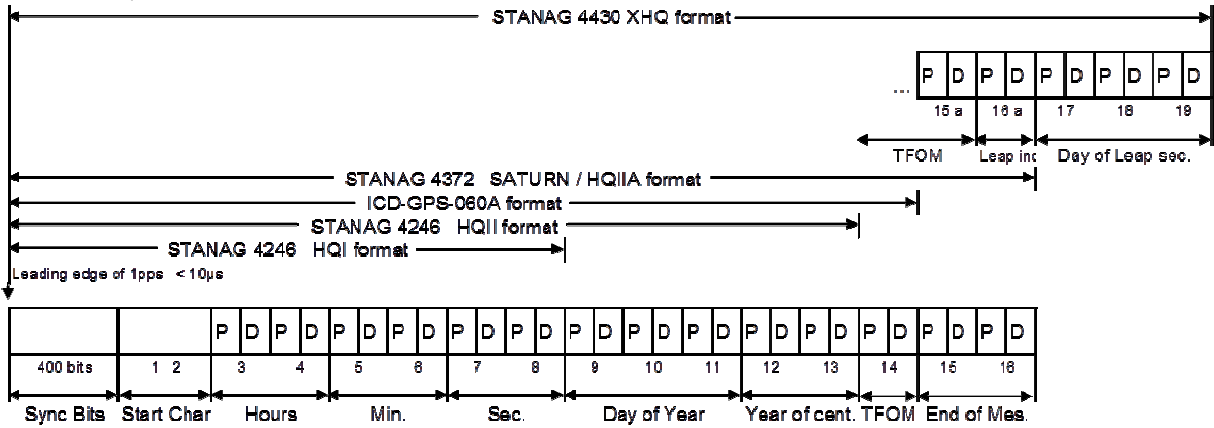
The ToD content, for the different formats, is as below:

STM Frame Format



Note : in each digit, octet and word, the least significant bit is transmitted first

STANAG 4430 & HaveQuick Format

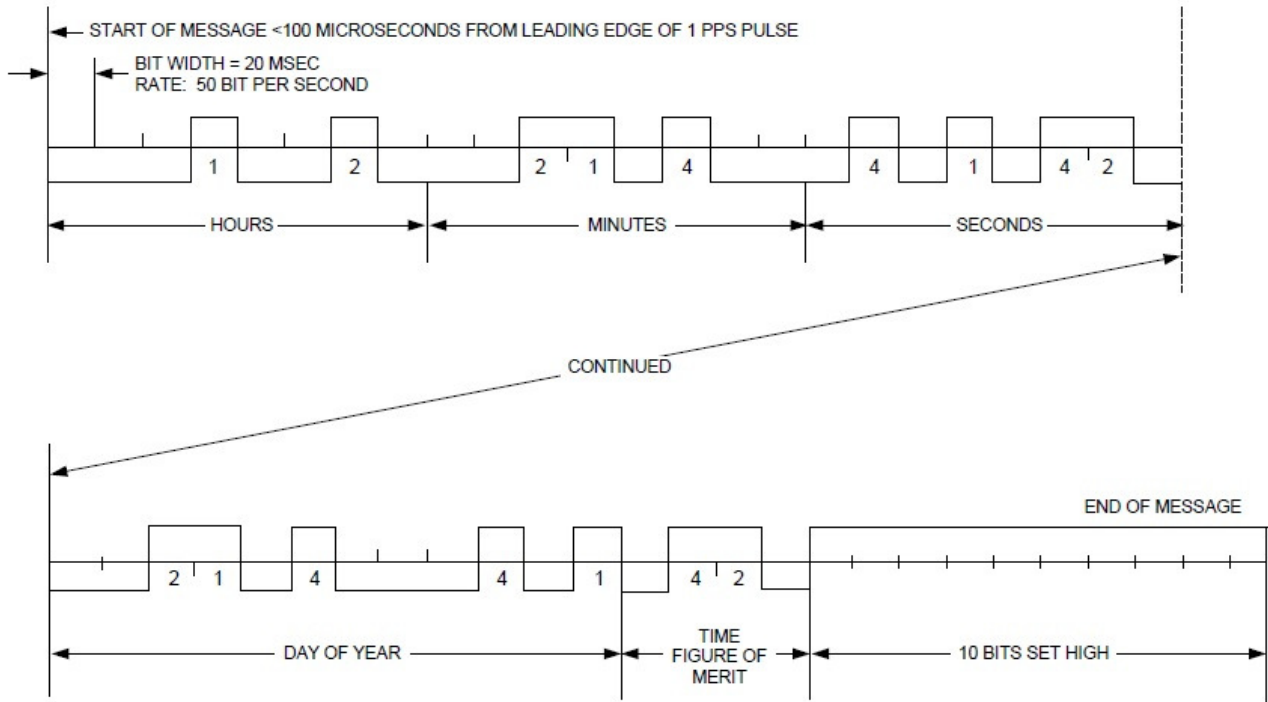


Time scale is UTC

Each character is one octet of Hamming code: 4 bits of parity preceding 4 bits of data except for specific Start character

Character	Meaning	Character	Meaning
1	Lead Ind. (00010001)	9	Day of Year 100's digit
2	Lead Ind. (11101001)	10	Day of Year 10's digit
3	Hours MSD	11	Day of Year 1's digit
4	Hours LSD	12	Year of century MSD
5	Minutes MSD	13	Year of century LSD
6	Minutes LSD	14	Time Figure of Merit, power of 10^{-10}
7	Seconds MSD	15	End of Message
8	Second LSD	16	End of Message
15a	Time Figure of Merit, scale factor	17	Leap sec. Day of Year 100's digit
16a	Leap activity indicators	18	Leap sec. Day of Year 10's digit
		19	Leap sec. Day of Year 1's digit

BCD Format



EXAMPLE SHOWN IS: TIME 12:34:56
 DAY 345
 TFOM 6

Spectracom Implementation Principles

Spectracom implementation of STANAG interfaces is based on the combination of SecureSync, as high performance and modular MasterClock System, and a set of STANAG option boards that fit into SecureSync. These STANAG modules operate as input (STANAG signals are used as a time reference for SecureSync), and as outputs (SecureSync provides STANAG compliant time & frequency signals).

Module Ref	Description
1204-10	4 HaveQuick ToD TTL outputs –BNC 50ohms
1204-1B	4 HaveQuick ToD RS485 outputs –terminal block
1204-1D	1 PPS, STANAG ToD input module (supports RS485, TTL and 10 V) on one DB25 connector
1204-11	1 PPS, STANAG ToD, 5 MHz output module (supports RS485, TTL and 10 V) on one DB25 connector
1204-24	1 PPS, STANAG ToD isolated input module (supports RS485, TTL and 10 V) on one DB25 connector
1204-25	1 PPS, STANAG ToD, isolated output module (supports RS485, TTL and 10 V) on one DB25 connector

Comparative Module Interface Table

Output option modules provide the following configurable interfaces as outputs:

Module	1 PPS Outputs	Time of Day Outputs		Other Output Signals
1204-10	—	4 x TTL	HQ, HQII, HQIIA, XHQ, ICD-GPS-060A	—
1204-1B	—	4 x RS485	HQ, HQII, HQIIA, XHQ, ICD-GPS-060A	—
1204-11	1 x TTL or RS485	2 x TTL or RS485	HQ, HQII, HQIIA, XHQ, STM, BCD, ICD-GPS-060A	Time Fault Discrete 5 MHz sine wave 1V Rms
1204-25	1 x TTL or RS485 with galvanic isolation	2 x TTL or RS485 with galvanic isolation	HQ, HQII, HQIIA, XHQ, STM, BCD, ICD-GPS-060A	Time Fault Discrete

Input option modules provide the following configurable interfaces as synchronization reference inputs.

Module	1 PPS Input	Time of Day Input		Other Input Signals
1204-1D	1 x TTL or RS485	1 x TTL or RS485	HQ, HQII, HQIIA, XHQ, STM, BCD, ICD-GPS-060A	Time Fault Discrete
1204-24	1 x TTL or RS485 with galvanic isolation	1 x TTL or RS485 with galvanic isolation	HQ, HQII, HQIIA, XHQ, STM, BCD, ICD-GPS-060A	Time Fault Discrete

Configurations

Type	Master Clock	Option Modules	Comments
For a STANAG 4372 or 4246 clock	SecureSync unit	1204-19 Quad 1PPS out (10V), 1204-10 or 1204-1B Quad HQ TOD	1 set of cards gives 4 sets of outputs. 3 sets of cards can be used for a maximum of 12 sets of outputs.
For a STANAG 4430 or ICD-GPS-0060 clock	SecureSync unit	1204-11 or 1204-25 STANAG output module	1 card gives 2 ToD signals, up to 6 cards can be used per unit.
For a STANAG 4430 or ICD-GPS-0060 slave	SecureSync unit	1204-24 or 1204-1D STANAG input module	Add other time and frequency output cards for other devices

Additional Notes

Up to 6 input or output modules can be integrated in one SecureSync chassis. Modules 1204-10, 1D, 24 and 25 provide all the signals on the different pins of a single DB25 connector. The pin-out of this connector is identical to the pin-out of the STANAG option which is available for former Epsilon Clock 2S and 3S products.

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