SDS File Library

Version 2.0

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Change Log		
Date	***Rev***	***Action/Preparer***
April 6, 2005	1.0	Weston, Bencke
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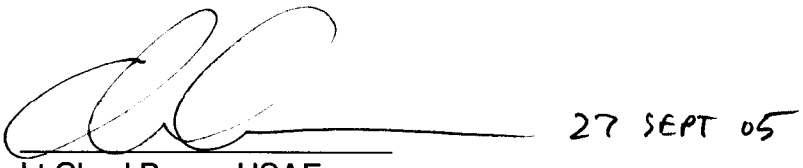

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1 Introduction

1.1 Purpose

The primary purpose of this document is to define the MNSA unique MUE M-code test requirements, and the SDS files that will be used to generate the test signals. The MNSA unique requirements of concern are all MUE functions not adequately addressed via pseudo M-code testing, that is, all operational (MNSA) unique receiver functions. The test requirements and test scenarios are listed below in one of two categories, those that will be addressed by initial SDS scenarios ("9 red keys" based), and higher fidelity test scenarios that will use black keys generated by NSA.

The "9 red keys" are limited functionality keying material being used for early testing of MNSA implementations, and are not suitable for exercising important MUE functionality such as black key processing and over-the-air rekeying. In addition, the MNAV message sequences lack the realistic content of message types 4 and 13. Thus the "9 red keys" SDS scenarios are provided for use only until standard NSA produced black keys are available.

The GPS JPO will determine which SDS files will be provided to testers. The intent of the GPS JPO is to support test scenarios needed for the development of GPS equipment, and reasonable requests for files to support such development will be considered. However, the GPS JPO will make the final decision on the distribution of SDS materials.

1.2 Document Overview

Section 3 provides the file requirements. Subsection 3.1 lists the test requirements and section 3.2 describes the modernized military UE functions that can be exercised using SDS file sets based on the requirements. Appendix A provides an acronym list that includes SDS related terms.

2 Applicable Documents

IS-GPS-200, Current Issue	Navstar GPS Space Segment/Navigation User Interface
ICD-GPS-203, Current Issue	(S) Navstar GPS Selective Availability and Anti-Spoofing Requirements (U)
ICD-GPS-226, Current Issue	(S) Navstar GPS Precise Positioning Service (PPS) Satellite Signal Simulator (SSS) Design Requirements (U)
ICD-GPS-700, Current Issue	Navstar GPS Military-Unique Space Segment/User Segment Interfaces

IS-GPS-703, Current Issue	(S) Navstar GPS Military-Unique Space Segment/User Segment Classified Interfaces (U)

3 Requirements

3.1 Test Requirements

This section lists specific test requirements, first those that will be addressed using the "9 red keys", and then those that will be met using the full set of black MNSA test keys. Both AES and MNSA M-code SDS files will be available to meet these requirements.

3.1.1 Test Requirements for MNSA "9 red key" Initial SDS Files

SDS files shall be generated to meet the following requirements.

- An M-code sequence shall be provided corresponding to unique PRN values. Note, type field of source identifier shall be "Satellite".
- An M-code sequence shall be provided corresponding to the L1 and L2 earth Link Ids.
- The nominal MNAV data rate will be 200 symbols/second, but there will also be transitions between the two data rates.
- An M-code sequence shall be provided with puncture code turned on.
- An M-code sequence shall be provided that extends through a change in week numbers.
- An M-code sequence shall be provided that extends through a transition to a new key.
- MNAV messages 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and the default message, shall be provided (full message functionality may not be supported).
- SDS file categories 1 and 2 shall be generated.
- Both a MNSA and an AES file set shall be generated.

3.1.2 Test Requirements for MNSA Black Key Files

The MNSA Black Key Files will add the fidelity of NSA generated black keys and realistic message type 4 and 13 content to the "9 red key" files. The MNSA Black Key Files will meet all requirements of the "9 red key" files listed in 3.1.1 above, but will also meet the following additional requirements.

- Black MNSA test keys will be used instead of red keys
- The content and ordering of messages will conform to the "Theory of Operations", as of January 2006
  - Realistic M-code OTAR messaging will be included
  - Receiver key processing will be exercised
  - Unusual events will be included
  - Simultaneous use of the legacy (SAASM) and M-code signals will be supported
  - Other functions may be exercised as identified in the Theory of Operations
- There will be transitions between PA modes.
- Category 1, 2, 3 and 4 files shall be provided.

3.2 Test Scenarios

This section describes test scenarios that can be generated from the files defined above. Equivalent scenarios for both AES and MNSA can be supported.

3.2.1 MNSA "9 red key" Initial SDS Scenarios

The tester can generate nominal eight-satellite, dual frequency scenarios using the SDS MNSA "9 red keys" files. For all scenarios the simulator must generate legacy C/A and P(Y) signals and provide code delays and Dopplers for the desired satellite and UE dynamics, and for atmospheric effects. A UE at 33˚ N latitude and 117˚ W longitude will have all satellites in view based on the MNAV orbital data (MNAV messages 6 and 7).

These scenarios are ideal for initial, nominal exercising of an MUE. The receiver can acquire satellite M-code signals from eight satellites using C/A code then handover to M, direct Y then handover to M, C/A-to-P(Y)-to-M, or a direct acquisition of M using PA. Once M-code is tracked on at least one satellite the constellation status message (message 5) and reduced almanac (message 8) messages are available to aid the acquisition of the other satellites. Each satellite broadcasts its own precise ephemeris and clock offset data (messages 6 and 7). The UTC correction data and single frequency ionospheric correction are provided in message 11, and the Inter-Signal Bias data is provided in message 12 for correcting measurements from different codes/frequencies. These MNAV messages will allow the MUE to acquire satellites and navigate, using only M-code, or any combination of the three codes. Twenty minutes into the scenario the MUE's ability to track and navigate through end of week is exercised. The MUE can be turned on at any time within the one-hour scenario to control the acquisition and tracking status when the end-of-week transition occurs.

3.2.2 MNSA Black Key Scenarios

These SDS Files generated for the MUE vendors will support the "9 red key" scenario requirements described above, but will more closely approximate the actual RF environment that will exist when there is full satellite and Control Segment support for the modernized signals. Use of black MNSA keys and full support for message 4 and 13 will allow UE's key processing to be more completely exercised, including a variety of OTAR scenarios and mixed Y and M code acquisition modes.

Appendix A: Acronyms

AES	Advanced Encryption Standard
AES M-code	Unclassified M-code used for testing – AKA pseudo M-code and M’
ALM	Almanac
A-S	Anti-spoof
ASCII	American Standard Code for Information Interchange
BOC	Binary Offset Carrier
C/A	Coarse/Acquisition code
CON	Constellation
CRC	Cyclic Redundancy Checkword
Epoch	Time reference - Number of times the 10-bit GPS week number has rolled over
FA	Frequency Hop Acquisition
FEC	Forward Error Correction
GPS	Global Positioning System
Hex	Hexadecimal
HI	High
Hz	Hertz
ICD	Interface Control Document
ID	Identifier
Int	Integer
IS	Interface Specification
JPO	Joint Program Office
L1	The GPS signal band centered at 1575.42 MHz
L1ME	L1 M-code Earth coverage signal
L1MS	L1 M-code Spot beam signal
L1PY	L1 P(Y)
L2	The GPS signal band centered at 1227.6 MHz
L2ME	L2 M-code Earth coverage signal
L2MS	L2 M-code Spot beam signal
LM	L-band M-code signal
LO	Low
LSB	Least Significant Bit/Byte
MHz	Megahertz
MICE	Military Clock & Ephemeris (i.e., MNAV precise ephemeris)
MNAV	Military Navigation (data stream for M-code)
MNSA	Modernized NAVSTAR Security Algorithm
MSB	Most Significant Bit/Byte
MSG	Message
MUE	Modernized Military User Equipment
MMCT	MNAV Message Correction Table
NAV	Navigation

PA	Puncture Code
P-code	Precise code
PPS	Precise Positioning Service
PRN	Pseudo-Random Noise (also satellite identifier)
PSI	Pseudorandom Secure Interleaver
P(Y) - code	Precise (Anti-Spoof) - code
RF	Radio Frequency
SA/A-S	Selective Availability/ Anti-Spoof
SAASM	SA/A-S Security Module
SDS	Simulator Data Set
Sec	Seconds
SQRT	Square Root
SSS	Satellite Signal Simulator
SVID	Satellite identifier
TBD	To Be Determined
TDDM	Time Division Data Modulation
TLM	Telemetry
UE	User Equipment
URA	User Range Accuracy
UTC	Coordinated Universal Time