AUTHORITY	DESCRIPTION	DATE
RFC-00519	DRAFT IS-GPS-200N IRN003 with RFC-00519	22-OCT-2024

DISTRIBUTION STATEMENT A: Approved for Public Release. Distribution Is Unlimited.

APPROVALS

Authored By: RE Tony Anthony **Checked By:** RE Jason Bolger

AUTHORIZED SIGNATURES	REPRESENTING	DATE
N/A	PNT Technical Director, MilComm & PNT Program Executive Office, Space Systems Command (SSC)	

INTERFACE SPECIFICATION

UNLESS OTHERWISE SPECIFIED: NUMBERS ARE REPRESENTED IN DECIMAL FORM.

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

Interface Control Contractor:
SAIC (GPS SE&I)
200 N. Pacific Coast Highway, Suite 1800
El Segundo, CA 90245

TITLE:
IS-GPS-200 RevN IRN003 (09 January 2024) Navstar GPS Space Segment/Navigation User Interfaces

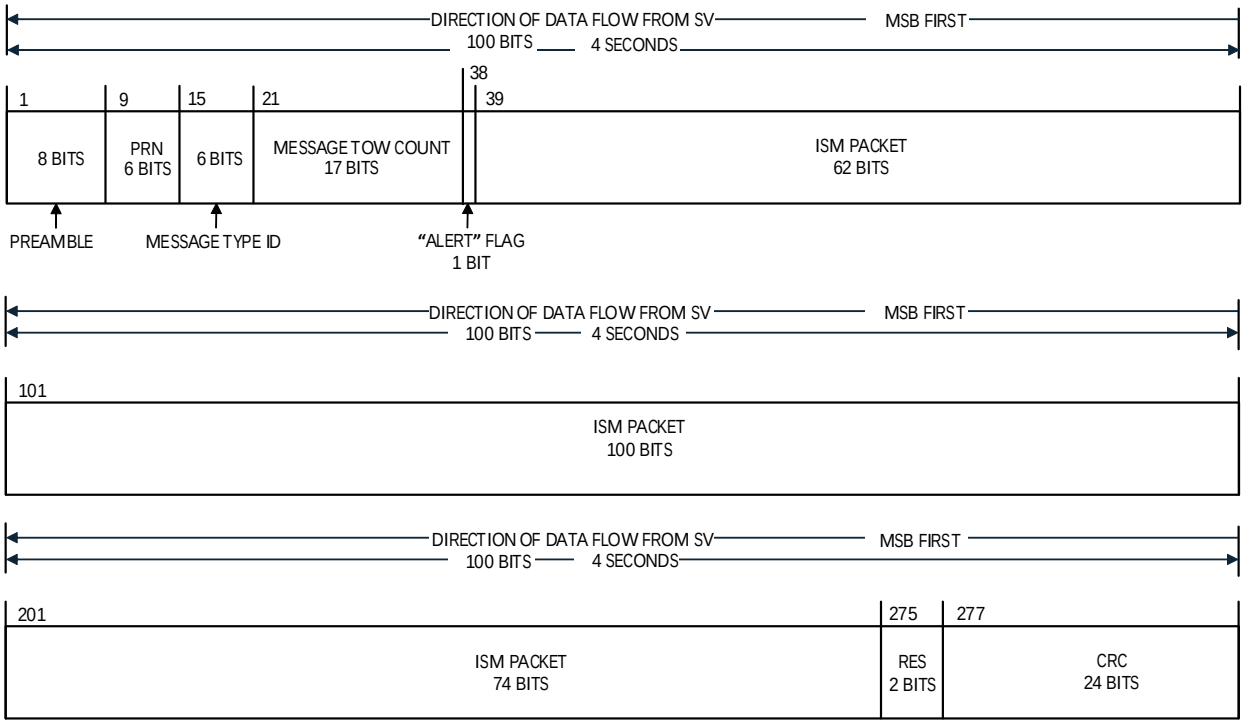
SIZE A	CODE IDENT	DOC NO.
	66RP1	**IS-GPS-200**
SCALE: N/A	REV: **N/A**	

REVISION RECORD			
REVISION	**DESCRIPTION**	**DOC DATE**	**APPROVED**
-	Initial Release	N/A	N/A

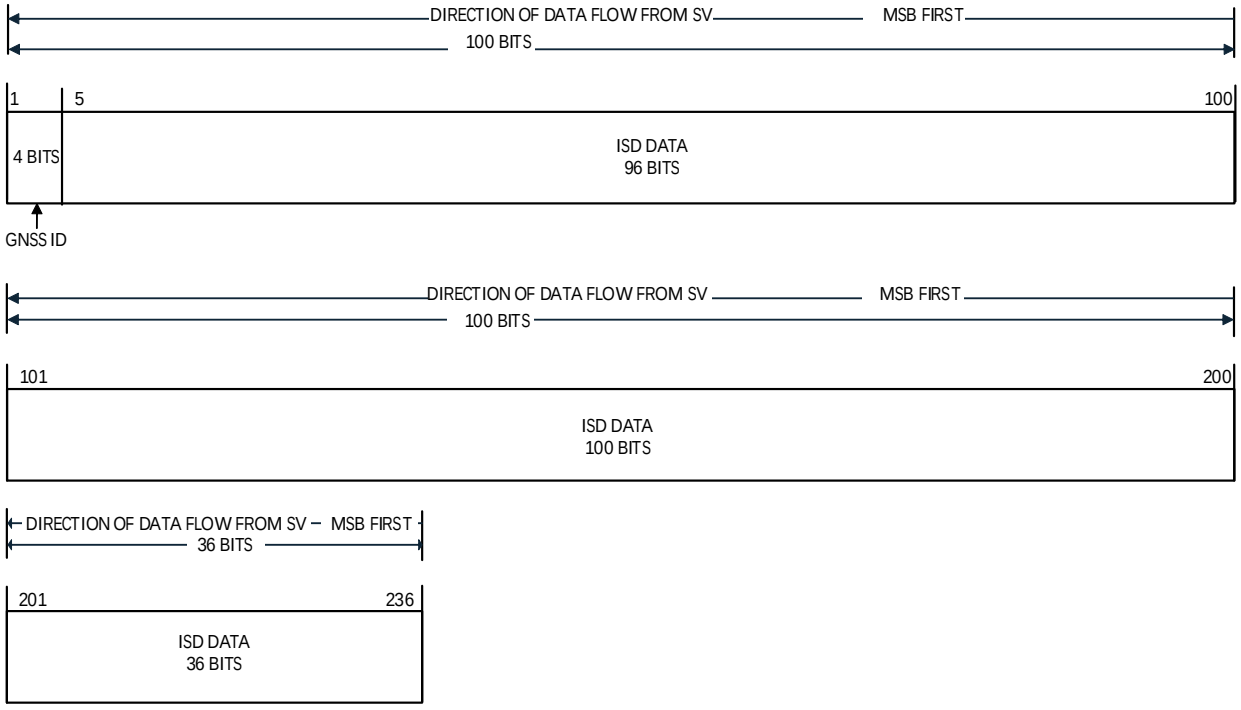
TABLE OF CONTENTS

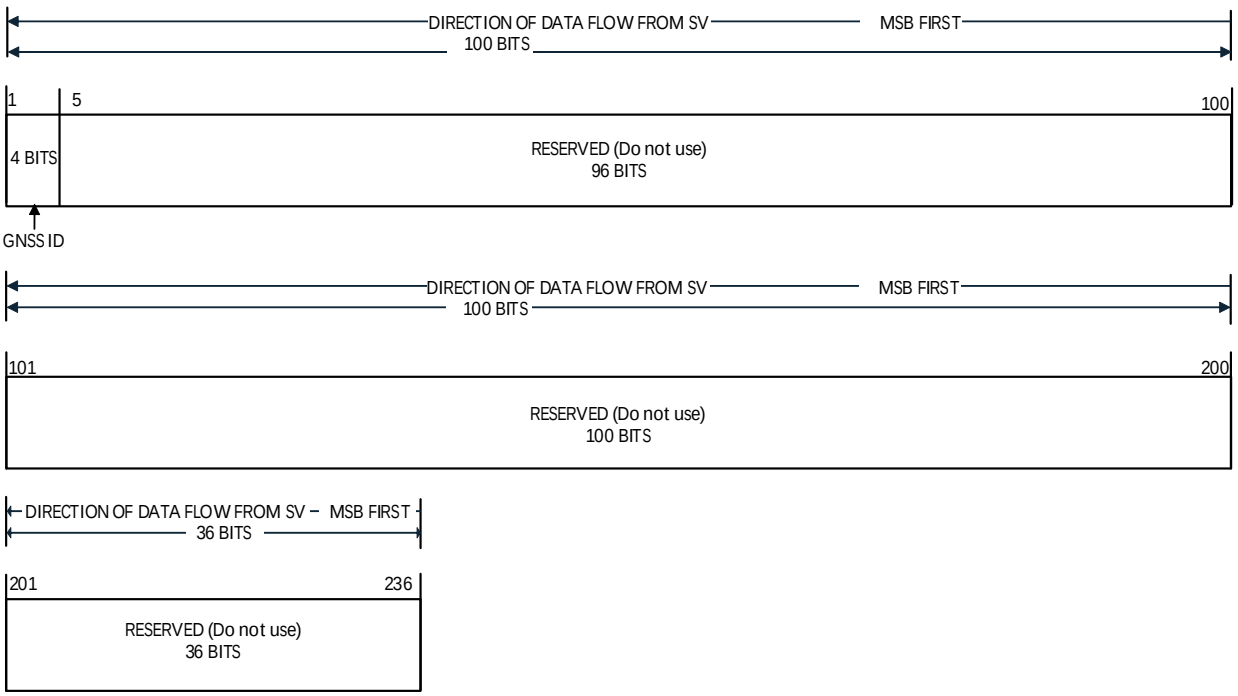
LIST OF TABLES

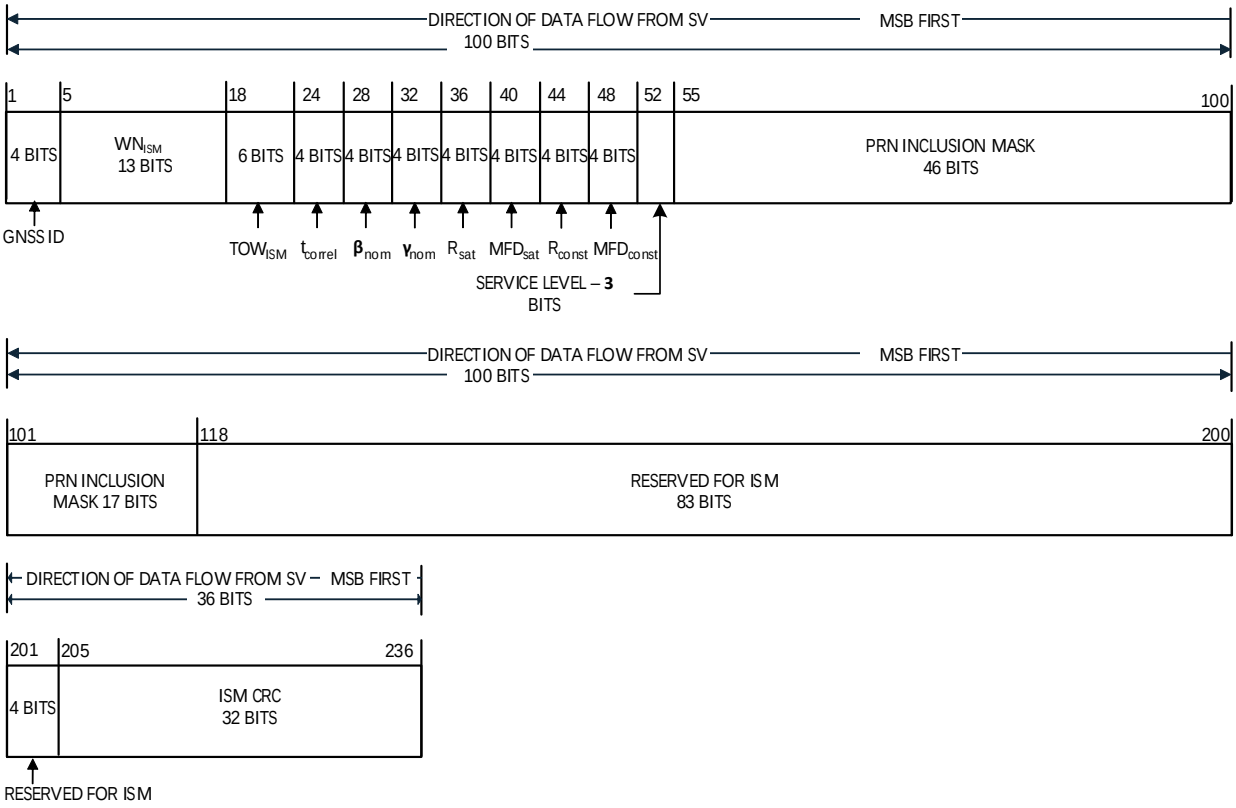
LIST OF FIGURES

DOORS ID	IS-GPS-200	Object Type
IS200-514	**30.3.3 Message Content**	Header
IS200-1808	 * MESSAGE TOW COUNT = 17 MSBs OF ACTUAL TOW COUNT AT START OF NEXT 12-SECOND MESSAGE	Figure
IS200-1809	**Figure 30-14a. Message Type 40 - Integrity Support Message**	Figure Caption

DOORS ID	IS-GPS-200	Object Type
IS200-1763	**30.3.3.10 Message Type 40 Integrity Support Message (ISM)**	Header
IS200-1764	Message Type 40, as depicted in Figure 30-14a shall contain the parameters related to GNSS constellation and satellite integrity parameters used for ARAIM algorithms. This message contains a 236-bit ISM Packet (see Figure 30-17) common among all GPS Civil signals that carry Integrity Support Data (ISD).	Requirement
IS200-1765	**30.3.3.10.1 ISD Parameter Content**	Header
IS200-2400	**30.3.3.10.1.1 ISM Packet**	Header
IS200-1766	The ISM Packet shall contain the parameters related to GNSS constellation and satellite integrity parameters. Users who implement Advanced Receiver Autonomous Integrity Monitoring (ARAIM), may use these parameters for the ARAIM algorithm as referenced in future TSO and MSO. The ISM Packet contains the GNSS ID, and ISD data specific to the constellation's ISD needs.	Requirement
IS200-1768	The CS shall upload the current ISM parameters, when necessary, to the SVs	Requirement

DOORS ID	IS-GPS-200	Object Type
IS200-2387		Figure
IS200-2388	**Figure 30-17 ISM Packet**	Figure Caption
IS200-1775	**30.3.3.10.1.1.1 GNSS ID**	Header
IS200-1776	Bits 1 through 4 of the ISM Packet shall identify the GNSS service to which the associated ISM parameters apply. Furthermore, the GNSS ID is used as a Packet Indicator to show which ISM Packet Overlay applies to the rest of the ISM Packet (see section 30.3.3.10.1.1).	Requirement
IS200-1777	The four bits are defined as follows: 0000 = No Data Available 0001 = Reserved 0010 = Reserved 0011 = Reserved 0100 = GPS 0101 = Reserved 0110 = Reserved 0111 = Reserved 1000 through 1111 = Reserved for other systems	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-2389	**30.3.3.10.1.2 ISM Packet Overlay Formats**	Header
IS200-2392	This section describes the different constellation specific ISM Packet overlays that are currently defined to detail the ISD parameters inside bits 5 through 236 of the ISM Packet.	Requirement
IS200-2390	**30.3.3.10.1.2.1 Test Packet – GNSS ID = 0000**	Header
IS200-2393	The 236-bit Test Packet is applicable when GNSS ID = 0000 (see Figure 30-18). This packet is for test purposes and doesn't contain any data operationally useful to the ARAIM function.	Info-Only
IS200-2394	If user equipment encounters this packet, it should be ignored.	Info-Only
IS200-2395		Figure
IS200-2396	**Figure 30-18 Test Packet**	Figure Caption

DOORS ID	IS-GPS-200	Object Type
IS200-2391	**30.3.3.10.1.2.2 GPS ISM Packet – GNSS ID = 0100**	Header
IS200-2397	Each 236-bit GPS ISM Packet (see Figure 30-19) is applicable to a specific subset of SVs identified in the GPS PRN Inclusion Mask for the given Service Level, constellation identified by GNSS ID and start time. This packet is applicable only when GNSS ID = 0100.	Requirement
IS200-1767	The bit lengths, scale factors, ranges, and units of this packet's parameters are given in Table 30-XIa.	Info-Only
IS200-2398		Figure
IS200-2399	**Figure 30-19 GPS ISM Packet**	Figure Caption

DOORS ID	IS-GPS-200	Object Type
IS200-1772	**Table 30-XIa – GPS ISM Packet Parameters**	Table Caption

IS200-1770 — Table

Parameter	No. of Bits*	Scale Factor (LSB)	Valid Range**	Units
WN_{ISM}	13	1		weeks
TOW_{ISM}	6	4	0 to 164	hours
t_{correl}	4	See text		
β_{nom}	4	0.1		meters
γ_{nom}	4	0.05		dimensionless
R_{sat}	4	See text		
MFD_{sat}	4	See text		
R_{const}	4	See text		
MFD_{const}	4	See text		
Service Level***	3	See text		
GPS PRN Inclusion Mask ****	63	See text		
Reserved For ISM	87	See text		
ISM CRC	32	See text		

* See Figures 30-19 for complete bit allocations in the GPS ISM Packet

** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor

*** See Table 30-XIb for Service Level Descriptions

**** See Table 30-XIc for GPS PRN Inclusion Mask bit mapping

IS200-1778	**30.3.3.10.1.2.2.1 ISM Effectivity Time Stamp Week Number**	Header
IS200-1779	Bits 5 through 17 of the GPS ISM Packet shall provide the ISM Week Number (WN_{ISM}) applicable to the start of the time of validity for a given ISM Packet (see paragraph 6.2.4).	Requirement
IS200-1780	This parameter describes the time stamp, in terms of weeks, for the ISD parameters.	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-1781	**30.3.3.10.1.2.2.2 ISM Effectivity Time Stamp Time of Week**	Header
IS200-1782	Bits 18 through 23 of the GPS ISM Packet shall provide the ISM Time of Week (TOW_{ISM}) applicable to the start of the time of validity for a given ISM Packet.	Requirement
IS200-1783	This parameter describes the time stamp, in terms of hours, for the ISD parameters.	Info-Only
IS200-1990	Users should use the ISM parameters with the most recent WN_{ISM} and TOW_{ISM} time stamp. All time stamps should be in the past.	Info-Only
IS200-1790	**30.3.3.10.1.2.2.3 Correlation Time Constant**	Header
IS200-1791	Bits 24 through 27 of the GPS ISM Packet shall provide the Correlation Time Constant (t_{correl}) value for use consistent with the other parameters in the ISM packet.	Requirement
IS200-1792	The four bits are defined as follows: 0000 = 0.25 hours 0001 = 0.33 hours 0010 = 0.50 hours 0011 = 0.67 hours 0100 = 0.83 hours 0101 = 1.00 hour 0110 = 1.17 hours 0111 = 1.33 hours 1000 = 1.50 hours 1001 = 2.10 hours 1010 = 3.00 hours 1011 = 4.20 hours 1100 = 6.00 hours 1101 = 8.50 hours 1110 = 12.00 hours 1111 = Reserved	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-1802	**30.3.3.10.1.2.2.4 IAURA-Independent Additive Term for Nominal Pseudorange Error Bias**	Header
IS200-1803	Bits 28 through 31 of the GPS ISM Packet shall provide the IAURA-Independent Additive Term (β_{nom}) value for use consistent with the other parameters in the ISM packet. The β_{nom} bounds additive biases in the instantaneous URE that do not scale with IAURA, which is defined in section 30.3.3.1.1.	Requirement

DOORS ID	IS-GPS-200	Object Type
IS200-1805	**30.3.3.10.1.2.2.5 Scalar Term for Nominal Pseudorange Error Bias**	Header
IS200-1806	Bits 32 through 35 of the GPS ISM Packet shall provide the Scalar Term (γ_{nom}) value for use consistent with the other parameters in the ISM packet. The γ_{nom} bounds normalized additive biases in the instantaneous URE that scale with IAURA, which is defined in section 30.3.3.1.1.	Requirement

DOORS ID	IS-GPS-200	Object Type
IS200-1796	**30.3.3.10.1.2.2.6 Satellite Fault Rate**	Header
IS200-1797	Bits 36 through 39 of the GPS ISM Packet shall provide the Satellite Fault Rate (R_{sat}) value for use consistent with the other parameters in the ISM packet. R_{sat} is the onset rate at which the instantaneous URE of any given satellite exceeds 4.42 times the IAURA.	Requirement
IS200-1798	The four bits are defined as follows: 0000 = 1×10^{-8} /hour 0001 = 3.16×10^{-8} /hour 0010 = 1×10^{-7} /hour 0011 = 3.16×10^{-7} /hour 0100 = 1×10^{-6} /hour 0101 = 3.16×10^{-6} /hour 0110 = 1×10^{-5} /hour 0111 = 3.16×10^{-5} /hour * 1000 = 1×10^{-4} /hour * 1001 = Reserved 1010 = Reserved 1011 = Reserved 1100 = Reserved 1101 = Reserved 1110 = Reserved 1111 = Reserved * Values inconsistent with GPS performance commitments are included to support Service Level 4 operations	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-2126	**30.3.3.10.1.2.2.7 Mean Duration of a Satellite Fault**	Header
IS200-2127	Bits 40 through 43 of the GPS ISM Packet shall provide the mean duration of a satellite fault (MFD_{sat}) value for use consistent with the other parameters in the ISM packet. MFD_{sat} is the mean duration the instantaneous URE of any given satellite exceeds 4.42 times the IAURA without a timely notification issued to the user.	Requirement
IS200-2128	The four bits are defined as follows: 0000 = 0.25 hour 0001 = 0.5 hour 0010 = 1.0 hour 0011 = 2.0 hours * 0100 = 4.0 hours * 0101 = 6.0 hours * 0110 = 8.0 hours * 0111 = Reserved 1000 = Reserved 1001 = Reserved 1010 = Reserved 1011 = Reserved 1100 = Reserved 1101 = Reserved 1110 = Reserved 1111 = Reserved * Values inconsistent with GPS performance commitments are included to support Service Level 4 operations.	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-1787	**30.3.3.10.1.2.2.8 Constellation Fault Rate**	Header
IS200-1788	Bits 44 through 47 of the GPS ISM Packet shall provide the constellation fault rate (R_{const}) value for use consistent with the other parameters in the ISM packet. R_{const} is the onset rate at which the instantaneous URE of two or more satellites exceed, due to a common cause, 4.42 times the IAURA.	Requirement
IS200-1789	The four bits are defined as follows: 0000 = 3.16×10^{-10} /hour 0001 = 1.00×10^{-9} /hour 0010 = 3.16×10^{-9} /hour 0011 = 1.00×10^{-8} /hour 0100 = 3.16×10^{-8} /hour * 0101 = 1.00×10^{-7} /hour * 0110 = 3.16×10^{-7} /hour * 0111 = 1.00×10^{-6} /hour * 1000 = 3.16×10^{-6} /hour * 1001 = Reserved 1010 = Reserved 1011 = Reserved 1100 = Reserved 1101 = Reserved 1110 = Reserved 1111 = Reserved * Values inconsistent with GPS performance commitments are included to support Service Level 4 operations.	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-1799	**30.3.3.10.1.2.2.9 Mean Duration of a Constellation Fault**	Header
IS200-1800	Bits 48 through 51 of the GPS ISM Packet shall provide the mean duration of a constellation fault (MFD_{const}) value for use consistent with the other parameters in the ISM packet. MFD_{const} is the mean duration the instantaneous URE of two or more satellites exceed, due to a common cause, 4.42 times the IAURA without a timely notification issued to the user.	Requirement
IS200-1801	The four bits are defined as follows: 0000 = 0.25 hour 0001 = 0.5 hour 0010 = 1.0 hour 0011 = 2.0 hours * 0100 = 4.0 hours * 0101 = 6.0 hours * 0110 = 8.0 hours * 0111 = Reserved 1000 = Reserved 1001 = Reserved 1010 = Reserved 1011 = Reserved 1100 = Reserved 1101 = Reserved 1110 = Reserved 1111 = Reserved * Values inconsistent with GPS performance commitments are included to support Service Level 4 operations.	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-1784	**30.3.3.10.1.2.2.10 Service Level**	Header
IS200-1785	Bits 52 through 54 of the GPS ISM Packet shall provide the Service Level, as described in Table 30-XIb, for use consistent with the other parameters in the ISM packet.	Requirement
IS200-1786	Three bits are allocated to the four identified service levels as follows: 000 = Level 1 001 = Level 2 010 = Level 3 011 = Level 4 100 = Level 5 101 to 111 = Reserved for future use	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-1773	**Table 30-XIb - Service Level**	Table Caption

IS200-1774 — Table

Service Level	Severity	Description	Notes/Applicability
Level 1	No Data Available	Broadcast ISD parameter values are invalid. Applicable performance commitments remain valid	Any ISD parameter received for the associated GNSS ID with an effectivity time stamp earlier than the Service Level 1 effectivity time stamp (WN_{ISM} and TOW_{ISM}) is invalid. The Service Level 1 applies to ISD parameters for all other Service Levels
Level 2	Non-Safety of Life Use	These parameters are for non-safety of life (i.e., uncertified ARAIM) applications	
Level 3	Safety of Life Use (Horizontal)	These parameters are for applications requiring integrity less than or equivalent to H-ARAIM solutions	ISD parameters for GPS for Service Level 3 are valid for use with elevation angles greater than or equal to 2 degrees
Level 4	Safety of Life Use (Vertical)	These parameters are for applications requiring integrity less than or equivalent to V-ARAIM solutions	ISD parameters for GPS for Service Level 4 are valid for use with elevation angles greater than or equal to 2 degrees
Level 5	Safety of Life Use (Horizontal and Vertical)	These parameters are for applications requiring integrity less than or equivalent to H-ARAIM and V-ARAIM solutions. These parameters apply to both Service Level 3 and Service Level 4	

IS200-1793	**30.3.3.10.1.2.2.11 GPS PRN Inclusion Mask**	Header
IS200-1794	Bits 55 through 117 of the GPS ISM Packet shall provide the GPS PRN Inclusion Mask. Refer to Table 30-XIc for complete GPS PRN Inclusion Mask Mapping.	Requirement
IS200-1795	The applicability of each PRN shall be indicated by: 0 = Information in this GPS ISM Packet does not apply to this PRN 1 = Information in this GPS ISM Packet does apply to this PRN	Info-Only

DOORS ID	IS-GPS-200	Object Type
IS200-1815	**Table 30-XIc GPS PRN Inclusion Mask Mapping**	Table Caption
IS200-1816		Table

Bits	GPS PRN
55	PRN 1
56	PRN 2
57	PRN 3
58	PRN 4
59	PRN 5
60	PRN 6
61	PRN 7
62	PRN 8
63	PRN 9
64	PRN 10
65	PRN 11
66	PRN 12
67	PRN 13
68	PRN 14
69	PRN 15
70	PRN 16
71	PRN 17
72	PRN 18
73	PRN 19
74	PRN 20
75	PRN 21
76	PRN 22
77	PRN 23
78	PRN 24
79	PRN 25
80	PRN 26
81	PRN 27
82	PRN 28
83	PRN 29
84	PRN 30
85	PRN 31
86	PRN 32

Bits	GPS PRN
87	PRN 33
88	PRN 34
89	PRN 35
90	PRN 36
91	PRN 37
92	PRN 38
93	PRN 39
94	PRN 40
95	PRN 41
96	PRN 42
97	PRN 43
98	PRN 44
99	PRN 45
100	PRN 46
101	PRN 47
102	PRN 48
103	PRN 49
104	PRN 50
105	PRN 51
106	PRN 52
107	PRN 53
108	PRN 54
109	PRN 55
110	PRN 56
111	PRN 57
112	PRN 58
113	PRN 59
114	PRN 60
115	PRN 61
116	PRN 62
117	PRN 63
PRN = Pseudorandom Noise Number	

DOORS ID	IS-GPS-200	Object Type
IS200-2129	**30.3.3.10.1.2.2.12 Reserved for ISM**	Header
IS200-2130	Bits 118 through 204 of the GPS ISM Packet are reserved for future ISD use.	Info-Only
IS200-1817	**30.3.3.10.1.2.2.13 Integrity Support Message Cyclic Redundancy Check**	Header
IS200-1818	Bits 205 through 236 of the GPS ISM Packet is a 32-bit Cyclic Redundancy Check (CRC) specific to the ISD in the ISM Packet. This CRC covers the data in bits 1 through 204 in the GPS ISM Packet.	Info-Only
IS200-2136	This sequence of bits and the ISM CRC may be represented as polynomials of a bit position operator X (the powers of which denote the distance of the bit from the end of the applicable bit sequence) with coefficients from the Galois field of two elements, or GF(2). GF(2) is the finite field constructed on the set {0,1} and the operations of modulo-2 addition and modulo-2 multiplication. In this representation, the CRC is the remainder polynomial r(X) left over from the polynomial division of the ISM Packet bits 1 through 204 (right-padded with 32 zeros and represented as $m(X) \cdot X^{32}$) by a generator polynomial g(X). The generator polynomial, g(X), which does not depend on the specific ISM Packet data, is: $g(X) = X^{32} + X^{31} + X^{24} + X^{22} + X^{16} + X^{14} + X^{8} + X^{7} + X^{5} + X^{3} + X + 1$ If the terms b_1 through b_{204} signify bits 1 through 204 of the GPS ISM Packet, the information field, m(X), is: $m(X) = b_1X^{203} + b_2X^{202} + b_3X^{201} + ... + b_{203}X + b_{204}$ If the terms b_{205} through b_{236} signify bits 205 through 236 of the GPS ISM Packet, the remainder polynomial, r(X), is: $r(X) = b_{205}X^{31} + b_{206}X^{30} + b_{207}X^{29} + ... + b_{235}X + b_{236}$ The ISD in the GPS ISM Packet is valid when the ISM CRC matches r(X) in the following equation: $r(X) = m(X) \cdot X^{32} \bmod g(X)$	Requirement

DOORS ID	IS-GPS-200	Object Type
IS200-2132	**30.3.3.10.2 Use of GPS ISM Data**	Header
IS200-2133	To calculate the nominal pseudorange error bias (b_{nom}), use the following equation:	Requirement
IS200-2134	$b_{nom} = \beta_{nom} + \gamma_{nom}$ IAURA	Info-Only
IS200-2135	Where IAURA is defined in section 30.3.3.1.1.	Info-Only