

## CHANGE NOTICE

<b>Affected Document:</b> IS-GPS-800 Rev J	<b>IRN/SCN Number</b> XXX-XXXX-XXX	<b>Date:</b> DD-MMM-YYYY
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<b>Authority:</b> RFC-000544	<b>Proposed Change Notice</b> PCN_IS-800J-RFC544	<b>Date:</b> 18-MAR-2026
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**Document Title:** NAVSTAR GPS Space Segment/Navigation User Segment L1C Interfaces

**RFC Title:** Eccentric Anomaly Rate Fix and No Cost Items

**Reason For Change (Driver):**

1. The Eccentric Anomaly Rate formula in all documents that describe this CNAV formula are incorrect
2. There are requirements and description changes from RFC-495A and RFC-502 which did not make it into the requirements baseline but are still correct and would help civil user equipment engineers make better civil receivers. This includes a number of Core CEI description changes that were worked out, but did not make it into RFC-502.
3. PRAT Item 2020-03 to normalize the use of scientific notation across the Public GPS interface documents has only been partially implemented
4. During the last Public ICWG, it became apparent that the Public interface documents do not use a uniform method of documenting multiplication in formulas
5. RFC-515 made a number of changes to XML which still need to be made to ICD-GPS-870 to ensure that Public users of XML are executing XML correctly

**Description of Change:**

1. The Eccentric Anomaly Rate formula will be corrected in all CNAV Public documents (PRAT 2025-02, Pre-RFC-1445)
2. The changes from RFCs-495A and 502 would be added into the requirements baseline (PRAT 2021-03)
3. The changes needed to normalize the use of scientific notation in the Public GPS interface documents will be completed (PRAT 2020-03)
4. The few places that use "\*" or "x" to denote multiplication of scalar values will be normalized to what is used across the Public Signal-In-Space documents
5. The XML to ICD-GPS-870 would be completed so it describes the as-built XML system (Pre-RFC-1354, promulgates and completes the work started in RFC-515)

**Authored By: RE: Tony Anthony**

**Checked By: RE: Sean Gutierrez**

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	System Delta 831	
	Mission Delta 31	

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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:  
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200 N. Pacific Coast Highway, Suite 1800  
El Segundo, CA 90245  
CODE IDENT 66RP1

**IS800-635:**

**Section Number:**

3.2.1.1.0-2

**WAS:**

The nominal frequency of this source as it appears to an observer on the ground is 10.23 MHz. The SV carrier frequency and clock rates, as they would appear to an observer located in the SV, are offset to compensate for relativistic effects. The clock rates are offset by  $\Delta f/f = -4.4647\text{E-}10$ , which is equivalent to a change in the L1C-code chipping rate of 1.023 MHz by a  $\Delta f = -4.5674\text{E-}4$  Hz. This results in an offset L1C-code chipping rate of 1.02299999954326 MHz. The nominal carrier frequency ( $f_0$ ) - as it appears to an observer on the ground - shall be 1575.42 MHz.

**Redlines:**

The nominal frequency of this source as it appears to an observer on the ground is 10.23 MHz. The SV carrier frequency and clock rates, as they would appear to an observer located in the SV, are offset to compensate for relativistic effects. The clock rates are offset by  $\Delta f/f = -4.4647\text{E}4647 \times 10^{-10}$ , which is equivalent to a change in the L1C-code chipping rate of 1.023 MHz by a  $\Delta f = -4.5674\text{E}5674 \times 10^{-4}$  Hz. This results in an offset L1C-code chipping rate of 1.02299999954326 MHz. The nominal carrier frequency ( $f_0$ ) - as it appears to an observer on the ground - shall be 1575.42 MHz.

**IS:**

The nominal frequency of this source as it appears to an observer on the ground is 10.23 MHz. The SV carrier frequency and clock rates, as they would appear to an observer located in the SV, are offset to compensate for relativistic effects. The clock rates are offset by  $\Delta f/f = -4.4647 \times 10^{-10}$ , which is equivalent to a change in the L1C-code chipping rate of 1.023 MHz by a  $\Delta f = -4.5674 \times 10^{-4}$  Hz. This results in an offset L1C-code chipping rate of 1.02299999954326 MHz. The nominal carrier frequency ( $f_0$ ) - as it appears to an observer on the ground - shall be 1575.42 MHz.

**Rationale:**

8/27/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

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**IS800-1190:**

Insertion after object IS800-78

**Section Number:**

3.2.2.1.3

**WAS:**

<INSERTED OBJECT>

**Redlines:**

*Object Heading* 3.2.2.1.3 [L1C Code Cross-correlation Mitigation](#)

*Object Type:* [Header](#)

**IS:**

*Object Heading* 3.2.2.1.3 L1C Code Cross-correlation Mitigation

*Object Type:* Header

**Rationale:**

3/9/2026 CRM #6 Add Cross-Correlation Advice (T. Anthony)

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**IS800-1191:**

Insertion below object IS800-1190

**Section Number:**

3.2.2.1.3.0-1

**WAS:**

<INSERTED OBJECT>

**Redlines:**

To preclude cross-correlation on the L1C signal, users should perform a cross-correlation check on signal acquisition or reacquisition. One cross-correlation check for equipment that processes the data (L1C<sub>D</sub>) and the pilot (L1C<sub>P</sub>) components using a single tracking loop driven by the pilot signal is to check the PRN code number used for signal tracking with the PRN parameter broadcast in Subframe 3 of the CNAV-2 messages.

*Object Type:* [Info-Only](#)

**IS:**

To preclude cross-correlation on the L1C signal, users should perform a cross-correlation check on signal acquisition or reacquisition. One cross-correlation check for equipment that processes the data (L1C<sub>D</sub>) and the pilot (L1C<sub>P</sub>) components using a single tracking loop driven by the pilot signal is to check the PRN code number used for signal tracking with the PRN parameter broadcast in Subframe 3 of the CNAV-2 messages.

*Object Type:* Info-Only

**Rationale:**

3/19/2026 Per Govt AWG corrected CNAV to CNAV-2 (T.Anthony)

3/9/2026 CRM #6 Add Cross-Correlation Advice (T. Anthony)

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**IS800-105:**

**Section Number:**

3.2.3.3.0-1

**WAS:**

Twenty-four bits of CRC will provide protection against burst as well as random errors with a probability of undetected error  $\leq 2^{-24} = 5.96 \times 10^{-8}$  for all channel bit error probabilities  $\leq 0.5$ . The CRC word is calculated in the forward direction on a given message using a seed of 0. The sequence of 24 bits  $(p_1, p_2, \dots, p_{24})$  is generated from the sequence of information bits  $(m_1, m_2, \dots, m_k)$  (MSB to LSB sequence) in a given message. This is done by means of a code that is generated by the polynomial

$$g(X) = \sum_{i=0}^{24} g_i X^i$$

where

$$g_i = 1 \text{ for } i = 0, 1, 3, 4, 5, 6, 7, 10, 11, 14, 17, 18, 23, 24$$

$$= 0 \text{ otherwise}$$

**Redlines:**

Twenty-four bits of CRC parity will provide protection against burst as well as random errors with a probability of undetected error  $\leq 2^{-24} = 5.96 \times 10^{-8}$  for all channel bit error probabilities  $\leq 0.5$ . The CRC word is calculated in the forward direction on a given message using a seed of 0. The sequence of 24 bits  $(p_1, p_2, \dots, p_{24})$  is generated from the sequence of information bits  $(m_1, m_2, \dots, m_k)$  (MSB to LSB sequence) in a given message. This is done by means of a code that is generated by the polynomial

$$g(X) = \sum_{i=0}^{24} g_i X^i$$

where

$$g_i = 1 \text{ for } i = 0, 1, 3, 4, 5, 6, 7, 10, 11, 14, 17, 18, 23, 24$$

$$= 0 \text{ otherwise}$$

**IS:**

Twenty-four bits of CRC parity will provide protection against burst as well as random errors with a probability of undetected error  $\leq 2^{-24} = 5.96 \times 10^{-8}$  for all channel bit error probabilities  $\leq 0.5$ . The CRC word is calculated in the forward direction on a given message using a seed of 0. The sequence of 24 bits  $(p_1, p_2, \dots, p_{24})$  is generated from the sequence of information bits  $(m_1, m_2, \dots, m_k)$  (MSB to LSB sequence) in a given message. This is done by means of a code that is generated by the polynomial

$$g(X) = \sum_{i=0}^{24} g_i X^i$$

where

$$g_i = 1 \text{ for } i = 0, 1, 3, 4, 5, 6, 7, 10, 11, 14, 17, 18, 23, 24$$

$$= 0 \text{ otherwise}$$

**Rationale:**

8/25/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/25/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

Administrative fix 8/25/2025 Replaced less than or equal signs with graphics from Equation Editor (T. Anthony)

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**IS800-1139:**

**Section Number:**

3.2.3.3.0-9

**WAS:**

This code has the following characteristics:

It detects all single bit errors per code word.

It detects all double bit error combinations in a codeword because the generator polynomial  $g(X)$  has a factor of at least three terms.

It detects any odd number of errors because  $g(X)$  contains a factor  $1+X$ .

It detects any burst error for which the length of the burst is  $\leq 24$  bits.

It detects most large error bursts with length greater than the CRC length  $r = 24$  bits. The fraction of error bursts of length  $b > 24$  that are undetected is:

$$2^{-24} = 5.96 \times 10^{-8}, \text{ if } b > 25 \text{ bits}$$

$$2^{-23} = 1.19 \times 10^{-7}, \text{ if } b = 25 \text{ bits}$$

**Redlines:**

This code has the following characteristics:

1) It detects all single bit errors per code word.

2) It detects all double bit error combinations in a codeword because the generator polynomial  $g(X)$  has a factor of at least three terms.

3) It detects any odd number of errors because  $g(X)$  contains a factor  $1+X$ .

4) It detects any burst error for which the length of the burst is  ~~$\leq$~~  24 bits.

5) It detects most large error bursts with length greater than the ~~CRC~~parity length  $r = 24$  bits. The fraction of error bursts of length  $b > 24$  that are undetected is:

a)  ~~$2^{-24} = 5.96 \times 10^{-8}$~~ , if  $b > 25$  bits

b)  ~~$2^{-23} = 1.19 \times 10^{-7}$~~ , if  $b = 25$  bits

**IS:**

This code has the following characteristics:

- 1) It detects all single bit errors per code word.
- 2) It detects all double bit error combinations in a codeword because the generator polynomial  $g(X)$  has a factor of at least three terms.
- 3) It detects any odd number of errors because  $g(X)$  contains a factor  $1+X$ .
- 4) It detects any burst error for which the length of the burst is  $\leq 24$  bits.
- 5) It detects most large error bursts with length greater than the parity length  $r = 24$  bits. The fraction of error bursts of length  $b > 24$  that are undetected is:
  - a)  $2^{-24} = 5.96 \times 10^{-8}$ , if  $b > 25$  bits
  - b)  $2^{-23} = 1.19 \times 10^{-7}$ , if  $b = 25$  bits

**Rationale:**

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

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**IS800-120:**

**Section Number:**

3.3.0-4

**WAS:**

The bitstream of the L1C<sub>P</sub> signal is modulated on L1 carrier frequency using TMBOC modulation technique. The L1C<sub>P</sub> TMBOC technique uses a mixture of BOC (1, 1) spreading symbols and BOC (6,1) spreading symbols, where each BOC (6,1) spreading symbol consists of 6 cycles of a 6 x 1.023 MHz squarewave, defined as binary 1010101010 (1= binary bit value), with total duration 1/1.023 microseconds (see Figure 3.3-2b).

**Redlines:**

The bitstream of the L1C<sub>P</sub> signal is modulated on L1 carrier frequency using TMBOC modulation technique. The L1C<sub>P</sub> TMBOC technique uses a mixture of BOC (1, 1) spreading symbols and BOC (6,1) spreading symbols, where each BOC (6,1) spreading symbol consists of 6 cycles of a 6 \* 1.023 MHz squarewave, defined as binary 1010101010 (1= binary bit value), with total duration 1/1.023 microseconds (see Figure 3.3-2b).

**IS:**

The bitstream of the L1C<sub>P</sub> signal is modulated on L1 carrier frequency using TMBOC modulation technique. The L1C<sub>P</sub> TMBOC technique uses a mixture of BOC (1, 1) spreading symbols and BOC (6,1) spreading symbols, where each BOC (6,1) spreading symbol consists of 6 cycles of a 6 x 1.023 MHz squarewave, defined as binary 1010101010 (1= binary bit value), with total duration 1/1.023 microseconds (see Figure 3.3-2b).

**Rationale:**

8/17/2025: as part of the normalization of multiplier notation, it was determined to also normalize that discussion of integer multiples of the transmission squarewave should use the Unicode character for multiplication and not lower case "x" (T. Anthony)

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**IS800-1094:**

**Section Number:**

3.4.3.0-2

**WAS:**

$c = 2.99792458 \times 10^8$  meters per second

**Redlines:**

$c = \del{2.99792458} * \del{299,792,458} \del{10^8} meters per second$

**IS:**

$c = 299,792,458$  meters per second

**Rationale:**

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

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IS800-160:

Section Number:  
3.5.3.0-10

WAS:

Parameter		No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
$\Omega_{0-n}$	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	33*	$2^{-32}$		semi-circles
$\dot{\Delta} \Omega$ ****	Rate of right ascension difference	17*	$2^{-44}$		semi-circles/sec
$i_{0-n}$	Inclination angle at reference time	33*	$2^{-32}$		semi-circles
IDOT	Rate of inclination angle	15*	$2^{-44}$		semi-circles/sec
$C_{is-n}$	Amplitude of the sine harmonic correction term to the angle of inclination	16*	$2^{-30}$		radians
$C_{ic-n}$	Amplitude of the cosine harmonic correction term to the angle of inclination	16*	$2^{-30}$		radians
$C_{rs-n}$	Amplitude of the sine correction term to the orbit radius	24*	$2^{-8}$		meters
$C_{rc-n}$	Amplitude of the cosine correction term to the orbit radius	24*	$2^{-8}$		meters
$C_{us-n}$	Amplitude of the sine harmonic correction term to the argument of latitude	21*	$2^{-30}$		radians
$C_{uc-n}$	Amplitude of the cosine harmonic correction term to the argument of latitude	21*	$2^{-30}$		radians
<p>* Parameters so indicated are in two's complement notation;  ** See Figure 3.5-1 for complete bit allocation in Subframe 2;  *** Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor.  **** Relative to <math>\dot{\Omega}_{REF} = -2.6 \times 10^{-9}</math> semi-circles/second.</p>					

**Redlines:**

Parameter	No. of Bits**NOTE2	Scale Factor (LSB)	Valid Range***NOTE3	Units
$\Omega_{0-n}$	33*NOTE1	$2^{-32}$		semi-circles
$\Delta\dot{\Omega}$ ****	17*NOTE1	$2^{-44}$		semi-circles/sec
$i_{0-n}$	33*NOTE1	$2^{-32}$		semi-circles
IDOT	15*NOTE1	$2^{-44}$		semi-circles/sec
$C_{is-n}$	16*NOTE1	$2^{-30}$		radians
$C_{ic-n}$	16*NOTE1	$2^{-30}$		radians
$C_{rs-n}$	24*NOTE1	$2^{-8}$		meters
$C_{rc-n}$	24*NOTE1	$2^{-8}$		meters
$C_{us-n}$	21*NOTE1	$2^{-30}$		radians
$C_{uc-n}$	21*NOTE1	$2^{-30}$		radians
<b>NOTE1:*</b>	Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB			
<b>NOTE2:**</b>	See Figure 3.5-1 for complete bit allocation in Subframe 2			
<b>NOTE3:***</b>	Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor			
<b>NOTE4:****</b>	Relative to $\dot{\Omega}_{REF} = -2.6 \times 10^{-9}$ semi-circles/second			

IS:

	Parameter	No. of Bits <sup>NOTE2</sup>	Scale Factor (LSB)	Valid Range <sup>NOTE3</sup>	Units
$\Omega_{0-n}$	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	33 <sup>NOTE1</sup>	2 <sup>-32</sup>		semi-circles
$\Delta\dot{\Omega}$	Rate of right ascension difference <sup>NOTE4</sup>	17 <sup>NOTE1</sup>	2 <sup>-44</sup>		semi-circles/sec
$i_{0-n}$	Inclination angle at reference time	33 <sup>NOTE1</sup>	2 <sup>-32</sup>		semi-circles
IDOT	Rate of inclination angle	15 <sup>NOTE1</sup>	2 <sup>-44</sup>		semi-circles/sec
$C_{is-n}$	Amplitude of the sine harmonic correction term to the angle of inclination	16 <sup>NOTE1</sup>	2 <sup>-30</sup>		radians
$C_{ic-n}$	Amplitude of the cosine harmonic correction term to the angle of inclination	16 <sup>NOTE1</sup>	2 <sup>-30</sup>		radians
$C_{rs-n}$	Amplitude of the sine correction term to the orbit radius	24 <sup>NOTE1</sup>	2 <sup>-8</sup>		meters
$C_{rc-n}$	Amplitude of the cosine correction term to the orbit radius	24 <sup>NOTE1</sup>	2 <sup>-8</sup>		meters
$C_{us-n}$	Amplitude of the sine harmonic correction term to the argument of latitude	21 <sup>NOTE1</sup>	2 <sup>-30</sup>		radians
$C_{uc-n}$	Amplitude of the cosine harmonic correction term to the argument of latitude	21 <sup>NOTE1</sup>	2 <sup>-30</sup>		radians

NOTE1: Parameters so indicated are two's complement, with the sign bit (+ or -) occupying the MSB  
NOTE2: See Figure 3.5-1 for complete bit allocation in Subframe 2  
NOTE3: Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor  
NOTE4: Relative to  $\dot{\Omega}_{REF} = -2.6 \times 10^{-9}$  semi-circles/second

**Rationale:**

P8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

**IS800-1100:**

**Section Number:**

3.5.3.5.0-5

**WAS:**

URA <sub>ED</sub> Index	URA <sub>ED</sub> (meters)
15	6144.00 < URA <sub>ED</sub> (or no accuracy prediction is available)
14	3072.00 < URA <sub>ED</sub> ≤ 6144.00
13	1536.00 < URA <sub>ED</sub> ≤ 3072.00
12	768.00 < URA <sub>ED</sub> ≤ 1536.00
11	384.00 < URA <sub>ED</sub> ≤ 768.00
10	192.00 < URA <sub>ED</sub> ≤ 384.00
9	96.00 < URA <sub>ED</sub> ≤ 192.00
8	48.00 < URA <sub>ED</sub> ≤ 96.00
7	24.00 < URA <sub>ED</sub> ≤ 48.00
6	13.65 < URA <sub>ED</sub> ≤ 24.00
5	9.65 < URA <sub>ED</sub> ≤ 13.65
4	6.85 < URA <sub>ED</sub> ≤ 9.65
3	4.85 < URA <sub>ED</sub> ≤ 6.85
2	3.40 < URA <sub>ED</sub> ≤ 4.85
1	2.40 < URA <sub>ED</sub> ≤ 3.40
0	1.70 < URA <sub>ED</sub> ≤ 2.40
-1	1.20 < URA <sub>ED</sub> ≤ 1.70
-2	0.85 < URA <sub>ED</sub> ≤ 1.20
-3	0.60 < URA <sub>ED</sub> ≤ 0.85
-4	0.43 < URA <sub>ED</sub> ≤ 0.60
-5	0.30 < URA <sub>ED</sub> ≤ 0.43
-6	0.21 < URA <sub>ED</sub> ≤ 0.30
-7	0.15 < URA <sub>ED</sub> ≤ 0.21
-8	0.11 < URA <sub>ED</sub> ≤ 0.15
-9	0.08 < URA <sub>ED</sub> ≤ 0.11
-10	0.06 < URA <sub>ED</sub> ≤ 0.08
-11	0.04 < URA <sub>ED</sub> ≤ 0.06
-12	0.03 < URA <sub>ED</sub> ≤ 0.04
-13	0.02 < URA <sub>ED</sub> ≤ 0.03
-14	0.01 < URA <sub>ED</sub> ≤ 0.02
-15	URA <sub>ED</sub> ≤ 0.01
-16	No accuracy prediction available-use at own risk

For each URA<sub>ED</sub> index (N), users may compute a nominal URA<sub>ED</sub> value (X) as given by:

- If the value of N is 6 or less, but more than -16,  $X = 2^{(1 + N/2)}$ ,
- If the value of N is 6 or more, but less than 15,  $X = 2^{(N - 2)}$ ,
- N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk.

For N = 1, 3, and 5, X should be rounded to 2.8, 5.7, and 11.3 meters, respectively.

The nominal URA<sub>ED</sub> value (X) is suitable for use as a conservative prediction of the RMS ED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement deweighting, RAIM, FOM computations). Integrity properties of the IAURA<sub>ED</sub> are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound values of the broadcast URA<sub>ED</sub> index (see 30.3.3.1.1).

For the nominal URA<sub>ED</sub> value and the IAURA<sub>ED</sub> value, users may compute an adjusted URA<sub>ED</sub> value as a function of SV elevation angle (E), for E ≥ 0, as follows:

$$\text{Adjusted Nominal URA}_{ED} = \text{Nominal URA}_{ED} (\sin(E+90 \text{ degrees}))$$

$$\text{Adjusted IAURA}_{ED} = \text{IAURA}_{ED} (\sin(E+90 \text{ degrees}))$$

$\text{URA}_{ED}$  and  $\text{IAURA}_{ED}$  account for SIS contributions to user range error which include, but are not limited to, the following: LSB representation/truncation error, alongtrack ephemeris errors, and crosstrack ephemeris errors.  $\text{URA}_{ED}$  and  $\text{IAURA}_{ED}$  do not account for user range error contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

**Redlines:**

URA <sub>ED</sub> Index	URAED (meters)	
15	6144.00	< URA <sub>ED</sub> (or no accuracy prediction is available)
14	3072.00	< URA <sub>ED</sub> ≤ 6144.00
13	1536.00	< URA <sub>ED</sub> ≤ 3072.00
12	768.00	< URA <sub>ED</sub> ≤ 1536.00
11	384.00	< URA <sub>ED</sub> ≤ 768.00
10	192.00	< URA <sub>ED</sub> ≤ 384.00
9	96.00	< URA <sub>ED</sub> ≤ 192.00
8	48.00	< URA <sub>ED</sub> ≤ 96.00
7	24.00	< URA <sub>ED</sub> ≤ 48.00
6	13.65	< URA <sub>ED</sub> ≤ 24.00
5	9.65	< URA <sub>ED</sub> ≤ 13.65
4	6.85	< URA <sub>ED</sub> ≤ 9.65
3	4.85	< URA <sub>ED</sub> ≤ 6.85
2	3.40	< URA <sub>ED</sub> ≤ 4.85
1	2.40	< URA <sub>ED</sub> ≤ 3.40
0	1.70	< URA <sub>ED</sub> ≤ 2.40
-1	1.20	< URA <sub>ED</sub> ≤ 1.70
-2	0.85	< URA <sub>ED</sub> ≤ 1.20
-3	0.60	< URA <sub>ED</sub> ≤ 0.85
-4	0.43	< URA <sub>ED</sub> ≤ 0.60
-5	0.30	< URA <sub>ED</sub> ≤ 0.43
-6	0.21	< URA <sub>ED</sub> ≤ 0.30
-7	0.15	< URA <sub>ED</sub> ≤ 0.21
-8	0.11	< URA <sub>ED</sub> ≤ 0.15
-9	0.08	< URA <sub>ED</sub> ≤ 0.11
-10	0.06	< URA <sub>ED</sub> ≤ 0.08
-11	0.04	< URA <sub>ED</sub> ≤ 0.06
-12	0.03	< URA <sub>ED</sub> ≤ 0.04
-13	0.02	< URA <sub>ED</sub> ≤ 0.03
-14	0.01	< URA <sub>ED</sub> ≤ 0.02
-15		URA <sub>ED</sub> ≤ 0.01
-16	No accuracy prediction available-use at own risk	

For each URA<sub>ED</sub> index (N), users may compute a nominal URA<sub>ED</sub>-value (X) as given by:

- If the value of N is 6 or less, but more than -16,  $X = 2^{(1 + N/2)}$ ,
- If the value of N is 6 or more, but less than 15,  $X = 2^{(N - 2)}$ ,
- N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk.

For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively.

The nominal URA<sub>ED</sub>-value (X) is suitable for use as a conservative prediction of the RMS ED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement deweighting, RAIM, FOM computations).- Integrity properties of the IAURA<sub>ED</sub>-are specified with respect to the scaled (multiplied by either  $\pm 4.42$  or  $\pm 5.73$  as appropriate) upper bound values of the broadcast URA<sub>ED</sub>-index (see 30.3.3.1.1).

For the nominal URA<sub>ED</sub>-value and the IAURA<sub>ED</sub>-value, users may compute an adjusted URA<sub>ED</sub>-value as a function of SV elevation angle (E), for  $E \geq 0$ , as follows:

$$\begin{aligned} \text{Adjusted Nominal URA}_{ED} &= \text{Nominal URA}_{ED} \cos(\sin(E+90 \text{ degrees})) \\ \text{Adjusted IAURA}_{ED} &= \text{IAURA}_{ED} \cos(\sin(E+90 \text{ degrees})) \end{aligned}$$

$\text{URA}_{ED}$  and  $\text{IAURA}_{ED}$  account for SIS contributions to user range error which include, but are not limited to, the following: [CNAV-2](#) LSB representation/truncation error, ~~along-track~~[CNAV-2 along-track](#) ephemeris errors, and ~~cross-track~~[cross-track CNAV-2](#) ephemeris errors.  $\text{URA}_{ED}$  and  $\text{IAURA}_{ED}$  do not account for user range error contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

IS:

URA <sub>ED</sub> Index	URA <sub>ED</sub> (meters)
15	6144.00 < URA <sub>ED</sub> (or no accuracy prediction is available)
14	3072.00 < URA <sub>ED</sub> ≤ 6144.00
13	1536.00 < URA <sub>ED</sub> ≤ 3072.00
12	768.00 < URA <sub>ED</sub> ≤ 1536.00
11	384.00 < URA <sub>ED</sub> ≤ 768.00
10	192.00 < URA <sub>ED</sub> ≤ 384.00
9	96.00 < URA <sub>ED</sub> ≤ 192.00
8	48.00 < URA <sub>ED</sub> ≤ 96.00
7	24.00 < URA <sub>ED</sub> ≤ 48.00
6	13.65 < URA <sub>ED</sub> ≤ 24.00
5	9.65 < URA <sub>ED</sub> ≤ 13.65
4	6.85 < URA <sub>ED</sub> ≤ 9.65
3	4.85 < URA <sub>ED</sub> ≤ 6.85
2	3.40 < URA <sub>ED</sub> ≤ 4.85
1	2.40 < URA <sub>ED</sub> ≤ 3.40
0	1.70 < URA <sub>ED</sub> ≤ 2.40
-1	1.20 < URA <sub>ED</sub> ≤ 1.70
-2	0.85 < URA <sub>ED</sub> ≤ 1.20
-3	0.60 < URA <sub>ED</sub> ≤ 0.85
-4	0.43 < URA <sub>ED</sub> ≤ 0.60
-5	0.30 < URA <sub>ED</sub> ≤ 0.43
-6	0.21 < URA <sub>ED</sub> ≤ 0.30
-7	0.15 < URA <sub>ED</sub> ≤ 0.21
-8	0.11 < URA <sub>ED</sub> ≤ 0.15
-9	0.08 < URA <sub>ED</sub> ≤ 0.11
-10	0.06 < URA <sub>ED</sub> ≤ 0.08
-11	0.04 < URA <sub>ED</sub> ≤ 0.06
-12	0.03 < URA <sub>ED</sub> ≤ 0.04
-13	0.02 < URA <sub>ED</sub> ≤ 0.03
-14	0.01 < URA <sub>ED</sub> ≤ 0.02
-15	URA <sub>ED</sub> ≤ 0.01
-16	No accuracy prediction available-use at own risk

For each URA<sub>ED</sub> index (N), users may compute a nominal URA<sub>ED</sub> value (X) as given by:

- If the value of N is 6 or less, but more than -16,  $X = 2^{(1 + N/2)}$ ,
- If the value of N is 6 or more, but less than 15,  $X = 2^{(N - 2)}$ ,
  - N = -16 or N = 15 shall indicate the absence of an accuracy prediction and shall advise the standard positioning service user to use that SV at his own risk.

For N = -15, 1, 3, and 5, X should be rounded to .01, 2.8, 5.7, and 11.3 meters, respectively.

The nominal URA<sub>ED</sub> value (X) is suitable for use as a conservative prediction of the RMS ED range errors for accuracy-related purposes in the pseudorange domain (e.g., measurement deweighting, RAIM, FOM computations). Integrity properties of the IAURA<sub>ED</sub> are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) upper bound values of the broadcast URA<sub>ED</sub> index (see 30.3.3.1.1).

For the nominal URA<sub>ED</sub> value and the IAURA<sub>ED</sub> value, users may compute an adjusted URA<sub>ED</sub> value as a function of SV elevation angle (E), for E ≥ 0, as follows:

$$\text{Adjusted Nominal URA}_{ED} = \text{Nominal URA}_{ED} \cos E$$

$$\text{Adjusted IAURA}_{\text{ED}} = \text{IAURA}_{\text{ED}} \cos E$$

$\text{URA}_{\text{ED}}$  and  $\text{IAURA}_{\text{ED}}$  account for SIS contributions to user range error which include, but are not limited to, the following: CNAV-2 LSB representation/truncation error, CNAV-2 along-track ephemeris errors, and cross-track CNAV-2 ephemeris errors.  $\text{URA}_{\text{ED}}$  and  $\text{IAURA}_{\text{ED}}$  do not account for user range error contributions due to the inaccuracy of the broadcast ionospheric data parameters used in the single-frequency ionospheric model or for other atmospheric effects.

**Rationale:**

3/5/2026 CRM #73 Reference to  $\text{URA}_{\text{ED}}$  index was referencing the paragraph in IS-GPS-200 when it should have been the corresponding paragraph in IS-GPS-800 3.5.3.10.1 (T. Anthony)

2/16/2026 CRM #4 added  $\pm$  bounds to 4.4.2 and 5.73 factors in keeping with RFC-519 CRM #138 where the  $\pm$  sign was weighed against "using absolute value". This is compatible with SPS PS (T. Anthony)

10/29/2025 CRM #14 Removed "Degrees" from inside the "cos" input parameter and adjusted parentheses as applicable (T. Anthony)

9/3/2025 Siplified the sinusoidal formulas from  $\sin(E+90)$  to  $\cos(E)$  per stakeholder request (T. Anthony)

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**IS800-180:**

**Section Number:**

3.5.3.6.1.0-3

**WAS:**

The sensitivity of the SV's position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters A,  $C_{rc-n}$ , and  $C_{rs-n}$  is about one meter/meter. The sensitivity of position to the angular parameters is on the order of  $10^8$  meters/semi-circle, and to the angular rate parameters is on the order of  $10^{12}$  meters/semi-circle/second. Because of this extreme sensitivity to angular perturbations, the value of  $\pi$  used in the curve fit is given here.  $\pi$  is a mathematical constant, the ratio of a circle's circumference to its diameter. Here  $\pi$  is taken as 3.1415926535898.

**Redlines:**

The sensitivity of the SV's position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters A,  $C_{rc-n}$ , and  $C_{rs-n}$  is about one meter/meter. The sensitivity of position to the angular parameters is on the order of ~~108~~ $1 \times 10^8$  meters/semi-circle, and to the angular rate parameters is on the order of ~~1012~~ $1 \times 10^{12}$  meters/semi-circle/second. Because of this extreme sensitivity to angular perturbations, the value of  ~~$\pi$~~  $\pi$  used in the curve fit is given here.  ~~$\pi$~~  $\pi$  is a mathematical constant, the ratio of a circle's circumference to its diameter. Here  ~~$\pi$~~  $\pi$  is taken as 3.1415926535898.

**IS:**

The sensitivity of the SV's position to small perturbations in most ephemeris parameters is extreme. The sensitivity of position to the parameters A,  $C_{rc-n}$ , and  $C_{rs-n}$  is about one meter/meter. The sensitivity of position to the angular parameters is on the order of  $1 \times 10^8$  meters/semi-circle, and to the angular rate parameters is on the order of  $1 \times 10^{12}$  meters/semi-circle/second. Because of this extreme sensitivity to angular perturbations, the value of  $\pi$  used in the curve fit is given here.  $\pi$  is a mathematical constant, the ratio of a circle's circumference to its diameter. Here  $\pi$  is taken as 3.1415926535898.

**Rationale:**

9/30/2025: Administrative. Replaced PI with Unicode for sustainability. (T. Anthony)

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

**IS800-181:**

**Section Number:**

3.5.3.6.1.0-5

**WAS:**

Element/Equation	Description
$\mu = 3.986005 \times 10^{14} \text{ meters}^3/\text{sec}^2$	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5} \text{ rad/sec}$	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A *$	Semi-Major Axis at reference time
$A_k = A_0 + (\dot{A}) t_k$	Semi-Major Axis
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion (rad/sec)
$t_k = t - t_{oe} **$	Time from ephemeris reference time
$\Delta n_A = \Delta n_0 + \frac{1}{2} \dot{\Delta n}_0 t_k$	Mean motion difference from computed value
$n_A = n_0 + \Delta n_A$	Corrected Mean Motion
$M_k = M_0 + n_A t_k$	Mean Anomaly
<p>Kepler's equation (<math>M_k = E_k - e \sin E_k</math>) may be solved for Eccentric anomaly (<math>E_k</math>) by iteration:</p>	
$E_0 = M_k$	- Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	- Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	- Final Value (radians)
$v_k = 2 \tan^{-1} \left( \sqrt{\frac{1+e}{1-e}} \tan \frac{E_k}{2} \right)$	True Anomaly (unambiguous quadrant)
<p>* <math>A_{REF} = 26,559,710</math> meters</p>	
<p>** <math>t</math> is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, <math>t_k</math> shall be the actual total difference between the time <math>t</math> and the epoch time <math>t_{oe}</math>, and must account for beginning or end of week crossovers. That is if <math>t_k</math> is greater than 302,400 seconds, subtract 604,800 seconds from <math>t_k</math>. If <math>t_k</math> is less than -302,400 seconds, add 604,800 seconds to <math>t_k</math>.</p>	

**Redlines:**

Element/Equation	Description
$\mu = 3.986005 \times 10^{14}$ meters <sup>3</sup> /sec <sup>2</sup>	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5}$ rad/sec	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$ NOTE1*	Semi-Major Axis at reference time NOTE1
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time (rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time NOTE2
$A_k = A_0 + (\dot{A}) t_k$	Semi-Major Axis
<del><math>t_k = t - t_{oe} - \delta t</math></del>	<del>Time from ephemeris reference time</del>
<del><math>\Delta n_A = \Delta n_0 + 1/2 \Delta \dot{n}_0 t_k</math></del>	<del>Mean motion difference from computed value</del>
<del><math>n_A = n_0 + \Delta n_A</math></del>	<del>Corrected Mean Motion</del>
$n'_0 = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n'_0 + \Delta \dot{n}_0 t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^t n_k dt$ $= M_0 + n'_0 t_k + \Delta \dot{n}_0 t_k^2 / 2$	Mean Anomaly
<del><math>M_k = M_0 + n_A t_k</math></del>	
<b>Kepler's equation (<math>M_k = E_k - e \sin E_k</math>) may be solved for Eccentric Anomaly (<math>E_k</math>) by iteration</b>	
$E_0 = M_k$	—Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	—Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	—Final Value (radians)
$v_k = 2 \tan^{-1} \left( \sqrt{\frac{1+e}{1-e}} \tan \left( \frac{E_k}{2} \right) \right)$	True Anomaly (unambiguous quadrant)

**NOTE1:** \*  $A_{REF} = 26,559,710$  meters

**NOTE2:** \*\*  $t$  is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore,  $t_k$  shall be the actual total difference between the time  $t$  and the epoch time  $t_{oe}$ , and must account for beginning or end of week crossovers. That is if  $t_k$  is greater than 302,400 seconds, subtract 604,800 seconds from  $t_k$ . If  $t_k$  is less than -302,400 seconds, add 604,800 seconds to  $t_k$ .

IS:

Element/Equation	Description
$\mu = 3.986005 \times 10^{14} \text{ meters}^3/\text{sec}^2$	WGS 84 value of the earth's gravitational constant for GPS user
$\dot{\Omega}_e = 7.2921151467 \times 10^{-5} \text{ rad/sec}$	WGS 84 value of the earth's rotation rate
$A_0 = A_{REF} + \Delta A$	Semi-Major Axis at reference time <sup>NOTE1</sup>
$n_0 = \sqrt{\frac{\mu}{A_0^3}}$	Computed Mean Motion at reference time(rad/sec)
$t_k = t - t_{oe}$	Time from ephemeris reference time <sup>NOTE2</sup>
$A_k = A_0 + (\dot{A}) t_k$	Semi-Major Axis
$n'_0 = n_0 + \Delta n_0$	Corrected Mean Motion at reference time
$n_k = n'_0 + \Delta \dot{n}_0 t_k$	Mean Motion
$M_k = M_0 + \int_{t_{oe}}^t n_k dt$ $= M_0 + n'_0 t_k + \Delta \dot{n}_0 t_k^2/2$	Mean Anomaly
<b>Kepler's equation (<math>M_k = E_k - e \sin E_k</math>) may be solved for Eccentric Anomaly (<math>E_k</math>) by iteration</b>	
$E_0 = M_k$	Initial Value (radians)
$E_j = E_{j-1} + \frac{M_k - E_{j-1} + e \sin E_{j-1}}{1 - e \cos E_{j-1}}$	Refined Value, minimum of three iterations, (j=1,2,3)
$E_k = E_j$	Final Value (radians)
$v_k = 2 \tan^{-1} \left( \sqrt{\frac{1+e}{1-e}} \tan \left( \frac{E_k}{2} \right) \right)$	True Anomaly (unambiguous quadrant)
NOTE1: $A_{REF} = 26,559,710$ meters	
NOTE2: $t$ is GPS system time at time of transmission, i.e., GPS time corrected for transit time (range/speed of light). Furthermore, $t_k$ shall be the actual total difference between the time $t$ and the epoch time $t_{oe}$ , and must account for beginning or end of week crossovers. That is if $t_k$ is greater than 302,400 seconds, subtract 604,800 seconds from $t_k$ . If $t_k$ is less than -302,400 seconds, add 604,800 seconds to $t_k$ .	

**Rationale:**

11/26/2025 CRM #18 Added "+" to the exponent for the power of 2 to be consistent with the #3 Description of Change on the cover page which involves normalizing the power of 10 notation across the public documents. (T. Anthony)

10/29/2025 CRM #15 Removed dashes from Kepler's Equation related formula Descriptions (T. Anthony)

8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

8/19/2025: Mean Motion equation correction from  $\delta\dot{n}_k$  to  $\delta\dot{n}_0$  (T. Anthony)

PRAT 2025-02, Pre-RFC-1445 8/5/2025 Responds to Eccentric Anomaly Rate Fix. (T. Anthony)

Replaced Mean Motion difference from computed value and Corrected Mean Motion with Corrected Mean Motion at reference time and Mean Motion.

Also replace the Mean Anomaly equation.

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**IS800-182:**

**Section Number:**  
3.5.3.6.1.0-7

**WAS:**

Element/Equation	Description
$\Phi_k = v_k + \omega_n$	Argument of Latitude
$\delta u_k = C_{us-n} \sin 2\Phi_k + C_{uc-n} \cos 2\Phi_k$	Argument of Latitude Correction
$\delta r_k = C_{rs-n} \sin 2\Phi_k + C_{rc-n} \cos 2\Phi_k$	Radial Correction
$\delta i_k = C_{is-n} \sin 2\Phi_k + C_{ic-n} \cos 2\Phi_k$	Inclination Correction
	} Second Harmonic Perturbations
$u_k = \Phi_k + \delta u_k$	Corrected Argument of Latitude
$r_k = A_k(1 - e_n \cos E_k) + \delta r_k$	Corrected Radius
$i_k = i_{o-n} + (IDOT)t_k + \delta i_k$	Corrected Inclination
$x_k' = r_k \cos u_k$	Positions in orbital plane
$y_k' = r_k \sin u_k$	
$\dot{\Omega} = \dot{\Omega}_{REF} + \Delta\dot{\Omega} \quad ***$	Rate of Right Ascension
$\Omega_k = \Omega_{0-n} + (\dot{\Omega} - \dot{\Omega}_e) t_k - \dot{\Omega}_e t_{oc}$	Corrected Longitude of Ascending Node
$x_k = x_k' \cos \Omega_k - y_k' \cos i_k \sin \Omega_k$	Earth-fixed coordinates of SV antenna phase center
$y_k = x_k' \sin \Omega_k + y_k' \cos i_k \cos \Omega_k$	
$z_k = y_k' \sin i_k$	
<p>*** <math>\dot{\Omega}_{REF} = -2.6 \times 10^{-9}</math> semi-circles/second.</p>	

**Redlines:**

Element/Equation	Description
$\Phi_k = v_k + \omega_n$ $\delta u_k = C_{us-n} \sin 2\Phi_k + C_{uc-n} \cos 2\Phi_k$ $\delta r_k = C_{rs-n} \sin 2\Phi_k + C_{rc-n} \cos 2\Phi_k$ $\delta i_k = C_{is-n} \sin 2\Phi_k + C_{ic-n} \cos 2\Phi_k$	Argument of Latitude Argument of Latitude Correction Radial Correction Inclination Correction <div style="float: right; margin-left: 20px;">             }              Second Harmonic              Perturbations           </div>
$u_k = \Phi_k + \delta u_k$ $r_k = A_k(1 - e_n \cos E_k) + \delta r_k$ $i_k = i_{o-n} + (\text{IDOT}) t_k + \delta i_k$	Corrected Argument of Latitude Corrected Radius Corrected Inclination
$x_k' = r_k \cos u_k$ $y_k' = r_k \sin u_k$	Positions in orbital plane
$\dot{\Omega} = \dot{\Omega}_{\text{REF}} + \Delta\dot{\Omega} \text{ ***}$ $\Omega_k = \Omega_{0-n} + (\Omega - \Omega_e) t_k - \Omega_e t_{0e}$	Rate of Right Ascension <a href="#">NOTE3</a> Corrected Longitude of Ascending Node
$x_k = x_k' \cos \Omega_k - y_k' \sin \Omega_k$ $y_k = x_k' \sin \Omega_k + y_k' \cos \Omega_k$ $z_k = y_k' \sin i_k$	Earth-fixed coordinates of SV antenna phase center
<a href="#">NOTE3:***</a> $\dot{\Omega}_{\text{REF}} = -2.6 \times 10^{-9}$ semi-circles/second	

IS:

Element/Equation	Description
$\Phi_k = v_k + \omega_n$ $\delta u_k = C_{us-n} \sin 2\Phi_k + C_{uc-n} \cos 2\Phi_k$ $\delta r_k = C_{rs-n} \sin 2\Phi_k + C_{rc-n} \cos 2\Phi_k$ $\delta i_k = C_{is-n} \sin 2\Phi_k + C_{ic-n} \cos 2\Phi_k$	Argument of Latitude Argument of Latitude Correction Radial Correction Inclination Correction <span style="float: right; font-size: 2em;">}</span> Second Harmonic Perturbations
$u_k = \Phi_k + \delta u_k$ $r_k = A_k(1 - e_n \cos E_k) + \delta r_k$ $i_k = i_{0-n} + (\text{IDOT}) t_k + \delta i_k$	Corrected Argument of Latitude Corrected Radius Corrected Inclination
$\left. \begin{aligned} x_k' &= r_k \cos u_k \\ y_k' &= r_k \sin u_k \end{aligned} \right\}$	Positions in orbital plane
$\dot{\Omega} = \dot{\Omega}_{\text{REF}} + \Delta \dot{\Omega}$ $\Omega_k = \Omega_{0-n} + (\Omega - \Omega_e) t_k - \Omega_e t_{oe}$	Rate of Right Ascension <sup>NOTE3</sup> Corrected Longitude of Ascending Node
$\left. \begin{aligned} x_k &= x_k' \cos \Omega_k - y_k' \sin \Omega_k \\ y_k &= x_k' \sin \Omega_k + y_k' \cos \Omega_k \\ z_k &= y_k' \sin i_k \end{aligned} \right\}$	Earth-fixed coordinates of SV antenna phase center
NOTE3: $\dot{\Omega}_{\text{REF}} = -2.6 \times 10^{-9}$ semi-circles/second	

**Rationale:**

8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-1011:

Section Number:

3.5.3.6.1.0-9

WAS:

Element/Equation	Description
<b><u>SV Velocity</u></b>	
$\dot{E}_k = n / (1 - e \cos E_k)$	Eccentric Anomaly Rate
$\dot{\nu}_k = \dot{E}_k \sqrt{1 - e^2} / (1 - e \cos E_k)$	True Anomaly Rate
$(di_k / dt) = (IDOT) + 2 \dot{\nu}_k (c_{is} \cos 2\phi_k - c_{ic} \sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u}_k = \dot{\nu}_k + 2 \dot{\nu}_k (c_{us} \cos 2\phi_k - c_{uc} \sin 2\phi_k)$	Corrected Argument of Latitude Rate
$\dot{r}_k = \dot{A}(1 - e \cos(E_k)) + A e \sin(E_k) \dot{E}_k + 2(c_{rs} \cos(2\phi_k) - c_{rc} \sin(2\phi_k)) \dot{\nu}_k$	Corrected Radius Rate for CNAV-2
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r}_k \cos u_k - r_k \dot{u}_k \sin u_k$	In- plane x velocity
$\dot{y}'_k = \dot{r}_k \sin u_k + r_k \dot{u}_k \cos u_k$	In- plane y velocity
$\dot{x}_k = -x'_k \dot{\Omega}_k \sin \Omega_k + \dot{x}'_k \cos \Omega_k - \dot{y}'_k \sin \Omega_k \cos i_k - y'_k (\dot{\Omega}_k \cos \Omega_k \cos i_k - (di_k / dt) \sin \Omega_k \sin i_k)$	Earth- Fixed x velocity (m/s)
$\dot{y}_k = x'_k \dot{\Omega}_k \cos \Omega_k + \dot{x}'_k \sin \Omega_k + \dot{y}'_k \cos \Omega_k \cos i_k - y'_k (\dot{\Omega}_k \sin \Omega_k \cos i_k + (di_k / dt) \cos \Omega_k \sin i_k)$	Earth- Fixed y velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k (di_k / dt) \cos i_k$	Earth- Fixed z velocity (m/s)

Redlines:

Element/Equation	Description
<b>SV Velocity</b>	
$\dot{E}_k = \frac{n_k}{1 - e \cos E_k}$	Eccentric Anomaly Rate
$\dot{\nu}_k = \dot{E}_k \sqrt{1 - e^2} / (1 - e \cos E_k)$	True Anomaly Rate
$(di_k / dt) = (\text{IDOT}) + 2 \dot{\nu}_k (eC_{is} \cos 2\phi_k - eC_{ic} \sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u}_k = \dot{\nu}_k + 2\dot{\nu}_k (eC_{us} \cos 2\phi_k - eC_{uc} \sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r}_k = \dot{A}(1 - e \cos(E_k)) + A_k e \sin(E_k) \dot{E}_k + 2 (eC_{rs} \cos(2\phi_k) - eC_{rc} \sin(2\phi_k)) \dot{\nu}_k$	Corrected Radius Rate for CNAV-2
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r}_k \cos u_k - r_k \dot{u}_k \sin u_k$	In-plane x velocity
$\dot{y}'_k = \dot{r}_k \sin u_k + r_k \dot{u}_k \cos u_k$	In-plane y velocity
$\dot{x}_k = -\dot{x}'_k \dot{\Omega}_k \sin \Omega_k + \dot{x}'_k \cos \Omega_k - \dot{y}'_k \sin \Omega_k \cos i_k - \dot{y}'_k (\dot{\Omega}_k \cos \Omega_k \cos i_k - (di_k / dt) \sin \Omega_k \sin i_k)$	Earth-Fixed x velocity (m/s)
$\dot{y}_k = \dot{x}'_k \dot{\Omega}_k \cos \Omega_k + \dot{x}'_k \sin \Omega_k + \dot{y}'_k \cos \Omega_k \cos i_k - \dot{y}'_k (\dot{\Omega}_k \sin \Omega_k \cos i_k + (di_k / dt) \cos \Omega_k \sin i_k)$	Earth-Fixed y velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + \dot{y}'_k (di_k / dt) \cos i_k$	Earth-Fixed z velocity (m/s)

IS:

Element/Equation	Description
<b>SV Velocity</b>	
$\dot{E}_k = \frac{n_k}{1 - e \cos E_k}$	Eccentric Anomaly Rate
$\dot{\nu}_k = \dot{E}_k \sqrt{1 - e^2} / (1 - e \cos E_k)$	True Anomaly Rate
$(di_k / dt) = (IDOT) + 2 \dot{\nu}_k (C_{is} \cos 2\phi_k - C_{ic} \sin 2\phi_k)$	Corrected Inclination Angle Rate
$\dot{u}_k = \dot{\nu}_k + 2\dot{\nu}_k (C_{us} \cos 2\phi_k - C_{uc} \sin 2\phi_k)$	Corrected Argument of Latitude Rat
$\dot{r}_k = \dot{A}(1 - e \cos(E_k)) + A_k e \sin(E_k) \dot{E}_k + 2 (C_{rs} \cos(2\phi_k) - C_{rc} \sin(2\phi_k)) \dot{\nu}_k$	Corrected Radius Rate for CNAV-2
$\dot{\Omega}_k = \dot{\Omega} - \dot{\Omega}_e$	Longitude of Ascending Node Rate
$\dot{x}'_k = \dot{r}_k \cos u_k - r_k \dot{u}_k \sin u_k$	In-plane x velocity
$\dot{y}'_k = \dot{r}_k \sin u_k + r_k \dot{u}_k \cos u_k$	In-plane y velocity
$\dot{x}_k = -\dot{x}'_k \dot{\Omega}_k \sin \Omega_k + \dot{x}'_k \cos \Omega_k - \dot{y}'_k \sin \Omega_k \cos i_k - y'_k (\dot{\Omega}_k \cos \Omega_k \cos i_k - (di_k / dt) \sin \Omega_k \sin i_k)$	Earth-fixed x velocity (m/s)
$\dot{y}_k = \dot{x}'_k \dot{\Omega}_k \cos \Omega_k + \dot{x}'_k \sin \Omega_k + \dot{y}'_k \cos \Omega_k \cos i_k - y'_k (\dot{\Omega}_k \sin \Omega_k \cos i_k + (di_k / dt) \cos \Omega_k \sin i_k)$	Earth-fixed y velocity (m/s)
$\dot{z}_k = \dot{y}'_k \sin i_k + y'_k (di_k / dt) \cos i_k$	Earth-fixed z velocity (m/s)

**Rationale:**

12/10/2025 CRM #24 Correct "CNAV" to "CNAV-2" for Corrected Radius Rate (T. Anthony)

10/29/2025 CRM #16 "In-plane" and "Earth-fixed" is correct English use of hyphens for compound adjectives (T. Anthony)

Administrative Change: 9/11/2025 Capitalize the Cxx parameters and space out the multiplied terms for easier reading. (T. Anthony)

8/19/2025: Corrected Radius Rate for CNAV equation changed "A" to A-sub-k (T. Anthony)

PRAT 2025-02, Pre-RFC-1445 8/5/2025 Responds to Eccentric Anomaly Rate Fix. (T. Anthony)

Adjusted the Eccentric Anomaly Rate equation

**IS800-213:**

**Section Number:**

3.5.3.10.1.0-1

**WAS:**

Bit 566 of subframe 2 shall be the Integrity Status Flag (ISF). A “0” in bit position 566 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal exceeds 4.42 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than  $1 \times 10^{-5}$  per hour. A “1” in bit position 566 indicates that the conveying signal is provided with an enhanced level of integrity assurance.

**Redlines:**

Bit 566 of subframe 2 shall be the Integrity Status Flag (ISF). A “0” in bit position 566 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal ~~exceeds~~goes outside the interval defined by  $\pm 4.42$  times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than  $1 \times 10^{-5}$  per hour. A “1” in bit position 566 indicates that the conveying signal is provided with an enhanced level of integrity assurance.

**IS:**

Bit 566 of subframe 2 shall be the Integrity Status Flag (ISF). A “0” in bit position 566 indicates that the conveying signal is provided with the legacy level of integrity assurance. That is, the probability that the instantaneous URE of the conveying signal goes outside the interval defined by  $\pm 4.42$  times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than  $1 \times 10^{-5}$  per hour. A “1” in bit position 566 indicates that the conveying signal is provided with an enhanced level of integrity assurance.

**Rationale:**

3/10/2026 CRM #3 Negotiated the use of “ $\pm$ ” where applicable to instantaneous error bounds and changed all use of “exceeds” to the unambiguous “goes outside the interval defined by” (T. Anthony)

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

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**IS800-1108:**

**Section Number:**

3.5.3.10.1.0-2

**WAS:**

That is, the probability that the instantaneous URE of the conveying signal exceeds 5.73 times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than  $1 \times 10^{-8}$  per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA are not defined.

**Redlines:**

That is, the probability that the instantaneous URE of the conveying signal ~~exceeds~~goes outside the interval defined by  $\pm 5.73$  times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than  $1 \times 10^{-8}$  per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA are not defined.

**IS:**

That is, the probability that the instantaneous URE of the conveying signal goes outside the interval defined by  $\pm 5.73$  times the upper bound value of the current broadcast URA index, for more than 5.2 seconds, without an accompanying alert, is less than  $1 \times 10^{-8}$  per hour. The probabilities associated with the nominal and lower bound values of the current broadcast URA are not defined.

**Rationale:**

3/10/2026 CRM #3 Negotiated the use of “±” where applicable to instantaneous error bounds and changed all use of “exceeds” to the unambiguous “goes outside the interval defined by” (T. Anthony)

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

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**IS800-954:**

**Section Number:**

3.5.4.3.5.1.1.0-5

**WAS:**

Table 3.5-6. Reduced Almanac Parameters\*\*\*\*\*

**Redlines:**

Table 3.5-6. Reduced Almanac ~~Parameters\*\*\*\*\*~~Parameters<sup>NOTE5</sup>

**IS:**

Table 3.5-6. Reduced Almanac Parameters<sup>NOTE5</sup>

**Rationale:**

8/28/2025 Caught up in the transition of asterisk notes to NOTEn (T. Anthony)

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**IS800-260:**

**Section Number:**  
3.5.4.3.5.1.1.0-6

**WAS:**

Parameter	No. of Bits	Scale Factor (LSB)	Valid Range **	Units
$\delta_A$ ***	8 *	$2^{+9}$	**	Meters
$\Omega_0$	7 *	$2^{-6}$	**	semi-circles
$\Phi_0$ ****	7 *	$2^{-6}$	**	semi-circles

\* Parameters so indicated shall be in two’s complement notation;  
\*\* Valid range is the maximum range attainable with indicated bit allocation and scale factor;  
\*\*\* Relative to  $A_{ref} = 26,559,710$  meters;  
\*\*\*\*  $\Phi_0 =$  Argument of Latitude at Reference Time =  $M_0 + \omega$ ;  
\*\*\*\*\* Relative to following reference values:  
 $e = 0$   
 $\delta_i = +0.0056$  semi-circles (i = 55 degrees)  
 $\dot{\Omega} = -2.6 \times 10^{-9}$  semi-circles/second

**Redlines:**

Parameter	No. of Bits <sup>NOTE1</sup>	Scale Factor (LSB)	Valid Range <sup>NOTE2</sup>	Units
$\delta_A$ <sup>NOTE3***</sup>	8 *	$2^{+9}$	—**	meters
$\Omega_0$	7 *	$2^{-6}$	—**	semi-circles
$\Phi_0$ <sup>NOTE4****</sup>	7 *	$2^{-6}$	—**	semi-circles

**NOTE1:\*** Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;

**NOTE2:\*\*** Valid range is the maximum range attainable with indicated bit allocation and scale factor;

**NOTE3:\*\*\*** Relative to  $A_{ref} = 26,559,710$  meters;

**NOTE4:\*\*\*\***  $\Phi_0 =$  Argument of Latitude at Reference Time =  $M_0 + \omega$ ;

**NOTE5:\*\*\*\*\*** Relative to following reference values:  
 $e = 0$   
 $\delta_i = +0.0056$  semi-circles ( $i = 55$  degrees)  
 $\dot{\Omega} = -2.6 \times 10^{-9}$  semi-circles/second.

**IS:**

Parameter	No. of Bits <sup>NOTE1</sup>	Scale Factor (LSB)	Valid Range <sup>NOTE2</sup>	Units
$\delta_A$ <sup>NOTE3</sup>	8	$2^{+9}$	—	meters
$\Omega_0$	7	$2^{-6}$	—	semi-circles
$\Phi_0$ <sup>NOTE4</sup>	7	$2^{-6}$	—	semi-circles

NOTE1: Parameters so indicated shall be two's complement with the sign bit (+ or -) occupying the MSB;

NOTE2: Valid range is the maximum range attainable with indicated bit allocation and scale factor;

NOTE3: Relative to  $A_{ref} = 26,559,710$  meters;

NOTE4:  $\Phi_0 =$  Argument of Latitude at Reference Time =  $M_0 + \omega$ ;

NOTE5: Relative to following reference values:  
 $e = 0$   
 $\delta_i = +0.0056$  semi-circles ( $i = 55$  degrees)  
 $\dot{\Omega} = -2.6 \times 10^{-9}$  semi-circles/second.

**Rationale:**

8/21/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)

8/21/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)

PRAT 2020-03 8/5/2025 Normalize the use of scientific notation across the public GPS interface documents. (T. Anthony)

IS800-263:

Section Number:

3.5.4.3.6.0-4

WAS:

Parameter	No. of Bits**	Scale Factor (LSB)	Valid Range***	Units
$t_{oa}$	8	$2^{12}$	0 to 602,112	seconds
$e$	11	$2^{-16}$	0.0 to 0.03	dimensionless
$\delta_i^{****}$	11*	$2^{-14}$		semi-circles
$\dot{\Omega}$	11*	$2^{-33}$	-1.19E-07 to 0	semi-circles/sec
$\sqrt{A}$	17	$2^{-4}$	2530 to 8192	$\sqrt{\text{meters}}$
$\Omega_0$	16*	$2^{-15}$		semi-circles
$\omega$	16*	$2^{-15}$		semi-circles
$M_0$	16*	$2^{-15}$		semi-circles
$a_{f0}$	11*	$2^{-20}$		seconds
$a_{f1}$	10*	$2^{-37}$		sec/sec

\* Parameters so indicated shall be in two's complement notation;

\*\* See Figure 3.5-5 for complete bit allocation in subframe 3, page 4;

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

\*\*\*\* Relative to  $i_0 = 0.30$  semi-circles.

Redlines:

Parameter	No. of Bits**NOTE2	Scale Factor (LSB)	Valid Range***NOTE3	Units
$t_{oa}$	8	$2^{+12}$	0 to 602,112	seconds
$e$	11	$2^{-16}$	0.0 to 0.03	dimensionless
$\delta_r$ ****NOTE4	11 NOTE1	$2^{-14}$		semi-circles
$\dot{\Omega}$	11 NOTE1	$2^{-33}$	$-1.19 \times 10^{-7} E-7$ to 0	semi-circles/sec
$\sqrt{A}$	17	$2^{-4}$	2530 to 8192	$\sqrt{\text{meters}}$
$\Omega_0$	16 NOTE1	$2^{-15}$		semi-circles
$\omega$	16 NOTE1	$2^{-15}$		semi-circles
$M_0$	16 NOTE1	$2^{-15}$		semi-circles
$a_{f0}$	11 NOTE1	$2^{-20}$		seconds
$a_{f1}$	10 NOTE1	$2^{-37}$		sec/sec

NOTE1:\* Parameters so indicated shall be in two's complement notation;

NOTE2:\*\* See Figure 3.5-5 for complete bit allocation in subframe 3, page 4;

NOTE3:\*\*\* Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor;

NOTE4:\*\*\*\* Relative to  $i_0 = 0.30$  semi-circles.

IS:

Parameter	No. of Bits <sup>NOTE2</sup>	Scale Factor (LSB)	Valid Range <sup>NOTE3</sup>	Units
$t_{oa}$	8	$2^{+12}$	0 to 602,112	seconds
$e$	11	$2^{-16}$	0.0 to 0.03	dimensionless
$\delta_i^{NOTE4}$	11 <sup>NOTE1</sup>	$2^{-14}$		semi-circles
$\dot{\Omega}$	11 <sup>NOTE1</sup>	$2^{-33}$	$-1.19 \times 10^{-7}$ to 0	semi-circles/sec
$\sqrt{A}$	17	$2^{-4}$	2530 to 8192	$\sqrt{\text{meters}}$
$\Omega_0$	16 <sup>NOTE1</sup>	$2^{-15}$		semi-circles
$\omega$	16 <sup>NOTE1</sup>	$2^{-15}$		semi-circles
$M_0$	16 <sup>NOTE1</sup>	$2^{-15}$		semi-circles
$a_{\theta}$	11 <sup>NOTE1</sup>	$2^{-20}$		seconds
$a_{fl}$	10 <sup>NOTE1</sup>	$2^{-37}$		sec/sec
NOTE1: Parameters so indicated shall be in two's complement notation				
NOTE2: See Figure 3.5-5 for complete bit allocation in subframe 3, page 4				
NOTE3: Unless otherwise indicated in this column, valid range is the maximum range attainable with indicated bit allocation and scale factor				
NOTE4: Relative to $i_0 = 0.30$ semi-circles				

**Rationale:**

11/26/20205 CRM #18 Added "+" to the exponent for the power of 2 to be consistent with the #3 Description of Change on the cover page which involves normalizing the power of 10 notation across the public documents. (T. Anthony)  
8/27/2025: Converted the exponential notation to CSE Manual standard. (T. Anthony)  
8/27/2025: At TIM #1, SMEs asked for NOTE identifiers to replace asterisks (T. Anthony)

IS800-297:

**Section Number:**

6.2.1.0-1

**WAS:**

User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV. URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the transmitting SV. It includes all errors for which the Space and Control Segments are responsible. Whether the integrity status flag is 'off' or 'on', 4.42 times URA bounds the instantaneous URE under all conditions with 1-(1e-5) per hour probability ('legacy' level of integrity assurance). When the integrity status flag is 'on', 5.73 times URA bounds the instantaneous URE under all conditions with 1-(1e-8) per hour probability ('enhanced' level of integrity assurance). Integrity properties of the URA are specified with respect to the scaled (multiplied by either 4.42 or 5.73 as appropriate) upper bound value of the URA index or to the scaled composite of the upper bound values of all component URA indexes.

**Redlines:**

User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV for all errors for which the Space and Control Segments are responsible. Nominal URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the transmitting specific signal and SV. ~~It~~ Integrity includes Assured ~~all URA errors~~ (IAURA) is a statistical indicator for which bounding the Space instantaneous and URE Control obtainable Segments with are a responsible specific signal and SV. Whether the integrity status flag is 'off' ~~"0"~~ or ~~"on"~~ "1", ~~±4.42 times URA~~ IAURA bounds the instantaneous URE ~~under all conditions~~ with 1-(~~1e1 × 10<sup>-5</sup>~~) per hour probability ('legacy' level of integrity assurance). When the integrity status flag is ~~'on'~~ set to "1", ~~±5.73 times URA~~ IAURA bounds the instantaneous URE ~~under all conditions~~ with 1-(~~1e1 × 10<sup>-8</sup>~~) per hour probability ('enhanced' level of integrity assurance). Integrity properties of the URA ~~IAURA~~ are specified with respect to the scaled (multiplied by either ~~±4.42~~ or ~~±5.73~~ as appropriate) upper sum bound of value of an the elevation-dependent URA index and or a to non-elevation the dependent sealed URA composite developed of using the upper bound values of all the component associated URA indexes when using the CNAV-2 CEI data set.

**IS:**

User Range Accuracy (URA) is a statistical indicator of the GPS ranging accuracy obtainable with a specific signal and SV for all errors for which the Space and Control Segments are responsible. Nominal URA provides a conservative RMS estimate of the user range error (URE) in the associated navigation data for the specific signal and SV. Integrity Assured URA (IAURA) is a statistical indicator for bounding the instantaneous URE obtainable with a specific signal and SV. Whether the integrity status flag is "0" or "1", ±4.42 times IAURA bounds the instantaneous URE with 1-(1 × 10<sup>-5</sup>) per hour probability ('legacy' level of integrity assurance). When the integrity status flag is set to "1", ±5.73 times IAURA bounds the instantaneous URE with 1-(1 × 10<sup>-8</sup>) per hour probability ('enhanced' level of integrity assurance). Integrity properties of the IAURA are specified with respect to the scaled (multiplied by either ±4.42 or ±5.73 as appropriate) sum of an elevation-dependent URA and a non-elevation dependent URA developed using the upper bound values of the associated URA indexes when using the CNAV-2 CEI data set.

**Rationale:**

- 3/19/2026 During Government AWG, caught that the addition of "CNAV" should have been "CNAV-2" (T. Anthony)
- 3/10/2026 CRM #3 Negotiated the use of "±" where applicable to instantaneous error bounds and changed all use of "exceeds" to the unambiguous "goes outside the interval defined by" (T. Anthony)
- 2/19/2026 CRM #32 Replace on/off with 1/0 and upgrade the wording in this paragraph to match the corresponding IS200-157 (excluding references to LNAV which don't apply here) (T. Anthony)
- 9/2/2025: Converted E notation to power of scientific Power of 10 notation. (T. Anthony)

**IS800-1188:**

Insertion after object IS800-855

**Section Number:**

6.2.1.0-6

**WAS:**

<INSERTED OBJECT>

**Redlines:**

Note #4: The URA will bound the instantaneous URE, with the stated probability, only if the user applies all of the broadcast parameters in the same CEI data set as defined in 3.5.5.2 CEI Data Sets.

*Object Type:* [Info-Only](#)

**IS:**

Note #4: The URA will bound the instantaneous URE, with the stated probability, only if the user applies all of the broadcast parameters in the same CEI data set as defined in 3.5.5.2 CEI Data Sets.

*Object Type:* Info-Only

**Rationale:**

5/5/2023 CRM #90, #82 Propagated User Range Accuracy Note 4 to IS-GPS-800. (T. Anthony)

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**IS800-912:**

**Section Number:**

6.2.8.0-1

**WAS:**

The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6.2-18. The entire CEI data set is needed for maximum accuracy. However, the core CEI data set (parameters without NOTE1 in Table 6.2-18) is sufficient for an initial position solution. The top term provides the epoch time of week of the state data utilized for the core CEI data set.

**Redlines:**

The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6.2-18. The entire CEI data set is needed for maximum accuracy. However, the core [CNAV-2](#) CEI data set (parameters without ~~NOTE1~~[NOTE2](#) in Table 6.2-18) is sufficient for an initial position solution. ~~The top term provides the epoch time of week of the state data utilized for the~~[without core](#)[full CEI](#)~~accuracy data~~[and set](#)[integrity](#).

**IS:**

The Clock, Ephemeris, Integrity (CEI) data set is the collection of SV-specific clock correction polynomial parameters, ephemeris parameters, and related parameters (health flags, URA parameters, time tags, etc.) needed to use the SV's broadcast signal(s) in the positioning service. The parameters in the CEI data set are explicitly listed in Table 6.2-18. The entire CEI data set is needed for maximum accuracy. However, the core CNAV-2 CEI data set (parameters without NOTE2 in Table 6.2-18) is sufficient for an initial position solution without full accuracy and integrity.

**Rationale:**

3/19/2026 CRM #9 At Govt AWG, combining NOTE2 and NOTE3 in the CEI Data Set Parameter table caused NOTE3 to be changed to NOTE2 in this paragraph. (T. Anthony)

2/16/2026 CRM #4 Clarified the accuracy of an initiation position of a CNAV-2 solution somewhat differently than the commenter had suggested. (T. Anthony)

5/9/2023: CRM #128 Remove the top sentence here and keep it in 6.2.8.1 (T. Anthony)

5/1/2023: CRM #14 With the re-engineering of CEI Parameter NOTES, the correct NOTE here is now NOTE3. (T. Anthony)

3/7/2023: Changes to the Notes section of the CEI Parameters Table has caused NOTE1 in this paragraphs to be renumbered to NOTE2 (T. Anthony)

**IS800-920:**

**Section Number:**

6.2.8.1.0-1

**WAS:**

A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac); broadcast to users with the shortest broadcast interval. The  $t_{op}$  term provides the epoch time of week of the state data utilized for CEI data, except for parameters marked with a Note1 in Table 6.2-18.

**Redlines:**

A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac); broadcast to users with the shortest broadcast interval. The  $t_{op}$  term provides the epoch time of week of the state data utilized for CEI data, except for parameters marked with a Note1 in Table 6.2-18. Parameters marked with a Note1 in Table 6.2-18 are properties of the SV and do not routinely change with CEI curve fits. For proper IAURA bounding, users must apply the CEI refinement parameters.

**IS:**

A Core CEI Data Set are the CEI parameters necessary for a satellite to be used for a position solution (non-almanac). The  $t_{oc}$  term provides the reference Time Of Week for the CEI curve fit. The  $t_{op}$  term provides the epoch time of week of the state data used for predicting the CEI curve fit. Parameters marked with NOTE2 in Table 6.2-18 are properties of the SV and do not routinely change with CEI curve fits. For proper IAURA bounding, users must apply the CEI refinement parameters.

**Rationale:**

3/19/2026 CRM #9 At Govt AWG, combining NOTE2 and NOTE3 in the CEI Data Set Parameter table caused NOTE3 to be changed to NOTE2 in this paragraph. (T. Anthony)

3/19/2026 During Govt AWG decided that "These parameters may not change with top or toc." no longer serves any purpose and should be deleted. (T. Anthony)

3/19/2026 CRM #7 Option B was modified at the Government AWG to just its last sentence (T. Anthony)

3/9/2026 CRM #7 ISC Clarification (T. Anthony)

2/16/2026 CRM #5 Clarified what top and toe covers and what might indicate a change in ISC. (T. Anthony)

2/16/2026 CRM #8 Clarifies that ISC related terms don't routinely change with curve fit changes (T. Anthony)

5/1/2023: CRM #129 With the re-engineering of CEI Parameter NOTES, the correct NOTE here is now NOTE3. (T. Anthony)

3/7/2023: Changes to the Notes section of the CEI Parameters Table has caused NOTE1 in this paragraphs to be renumbered to NOTE2 (T. Anthony)

IS800-917:

Section Number:

6.2.8.1-2

WAS:

Symbol	Parameter Name	Subframe
$\dot{A}$	Change Rate in Semi-major Axis	2
$\Delta A$	Semi-major Axis Difference at Reference Time	2
$\Delta n_0$	Mean Motion Difference from Computed Value at Reference Time	2
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	2
$\Omega_0$	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	2
$\Delta \dot{\Omega}$	Rate of Right Ascension Difference	2
$\omega$	Argument of Perigee	2
$a_{f0}$	SV Clock Bias Correction Coefficient	2
$a_{f1}$	SV Clock Drift Correction Coefficient	2
$a_{f2}$	Drift Rate Correction Coefficient	2
$C_{ic}$	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	2
$C_{is}$	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	2
$C_{rc}$	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	2
$C_{rs}$	Amplitude of the Sine Correction Term to the Orbit Radius	2
$C_{uc}$	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	2
$C_{us}$	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	2
$e$	Eccentricity	2
$i_0$	Inclination Angle at Reference Time	2
IDOT	Rate of Inclination Angle	2
ISCL1CP	Inter-signal Correction	2
ISCL1CD	Inter-signal Correction	2
ISCL1CA	Inter-signal Correction	3
ISCL2C	Inter-signal Correction	3
ISCL5I5	Inter-signal Correction	3
ISCL5Q5	Inter-signal Correction	3
ISF	Integrity Status Flag <sup>NOTE1</sup>	2
ITOW	Interval Time of Week	2
L1C	Signal Health (1 bits)	2

<b>Symbol</b>	<b>Parameter Name</b>	<b>Subframe</b>
$M_0$	Mean Anomaly at Reference Time	2
$T_{GD}$	Group Delay Differential	2
$W_{NOP}$	CEI Data Sequence Propagation Week Number	2
$t_{oe}$	Time of Ephemeris	2
$t_{op}$	CEI Data Sequence Propagation Time of Week	2
$URA_{ED}$ Index	Elevation Dependent User Range Accuracy, $URA_{ED}$ Index	2
$URA_{NED0}$ Index	NED Accuracy Index	2
$URA_{NED1}$ Index	NED Accuracy Change Index	2
$URA_{NED2}$ Index	NED Accuracy Change Rate Index	2
WN	Week Number	2
<p>NOTE1: Parameters so indicated are for CEI Refinement – not limited to curve fit. Parameters not indicated are needed for/limited to curve fit. Updates to parameters in table shall prompt changes in <math>t_{oe}</math>. Any parameter marked with NOTE1 may be changed with or without a change in <math>t_{oe}</math>.</p>		

**Redlines:**

Symbol	Parameter Name	Subframe
ISCL2C	Inter-signal Correction <sup>NOTE2</sup>	3
ISCL5I5	Inter-signal Correction <sup>NOTE2</sup>	3
ISCL5Q5	Inter-signal Correction <sup>NOTE2</sup>	3
ISF	Integrity Status Flag <sup>NOTE1</sup>	2
ITOW	Interval Time of Week	2
L1C	Signal Health (1 bits) <sup>NOTE2</sup>	2
M <sub>0</sub>	Mean Anomaly at Reference Time	2
T <sub>GD</sub>	Group Delay Differential <sup>NOTE2</sup>	2
WN <sub>OP</sub>	CEI Data Sequence Propagation Week Number	2
t <sub>oe</sub>	Time of Ephemeris	2
t <sub>op</sub>	CEI Data Sequence Propagation Time of Week	2
URA <sub>ED</sub> Index	Elevation Dependent User Range Accuracy, URA <sub>ED</sub> Index	2
URA <sub>NED0</sub> Index	NED Accuracy Index	2
URA <sub>NED1</sub> Index	NED Accuracy Change Index	2
URA <sub>NED2</sub> Index	NED Accuracy Change Rate Index	2
WN	Week Number	2
<p><u>Updates to parameters in this table will prompt changes in t<sub>oe</sub></u></p> <p><u>NOTE1: Updates to this parameter are independent of curve fit and may occur without updates to t<sub>oe</sub></u></p> <p><u>NOTE2: This parameter is for CEI Refinement and are independent of ephemeris estimation (state vector and curve fit) so it commonly remains constant across changes in t<sub>oe</sub></u></p> <p><del>NOTE1: Parameters so indicated are for CEI Refinement—not limited to curve fit. Parameters not indicated are needed for/limited to curve fit.</del></p> <p><del>Updates to parameters in table shall prompt changes in t<sub>oe</sub>.—Any parameter marked with NOTE1 may be changed with or without a change in t<sub>oe</sub>.</del></p>		

IS:

Symbol	Parameter Name	Subframe
$\dot{A}$	Change Rate in Semi-major Axis	2
$\Delta A$	Semi-major Axis Difference at Reference Time	2
$\Delta n_0$	Mean Motion Difference from Computed Value at Reference Time	2
$\Delta \dot{n}_0$	Rate of Mean Motion Difference from Computed Value	2
$\Omega_0$	Longitude of Ascending Node of Orbit Plane at Weekly Epoch	2
$\Delta \dot{\Omega}$	Rate of Right Ascension Difference	2
$\omega$	Argument of Perigee	2
$a_{f0}$	SV Clock Bias Correction Coefficient	2
$a_{f1}$	SV Clock Drift Correction Coefficient	2
$a_{f2}$	Drift Rate Correction Coefficient	2
$C_{ic}$	Amplitude of the Cosine Harmonic Correction Term to the Angle of Inclination	2
$C_{is}$	Amplitude of the Sine Harmonic Correction Term to the Angle of Inclination	2
$C_{rc}$	Amplitude of the Cosine Harmonic Correction Term to the Orbit Radius	2
$C_{rs}$	Amplitude of the Sine Correction Term to the Orbit Radius	2
$C_{uc}$	Amplitude of Cosine Harmonic Correction Term to the Argument of Latitude	2
$C_{us}$	Amplitude of Sine Harmonic Correction Term to the Argument of Latitude	2
$e$	Eccentricity	2
$i_0$	Inclination Angle at Reference Time	2
IDOT	Rate of Inclination Angle	2
ISCLICP	Inter-signal Correction <sup>NOTE2</sup>	2
ISCLICD	Inter-signal Correction <sup>NOTE2</sup>	2
ISCLICA	Inter-signal Correction <sup>NOTE2</sup>	3
ISCL2C	Inter-signal Correction <sup>NOTE2</sup>	3
ISCL5I5	Inter-signal Correction <sup>NOTE2</sup>	3
ISCL5Q5	Inter-signal Correction <sup>NOTE2</sup>	3
ISF	Integrity Status Flag <sup>NOTE1</sup>	2
ITOW	Interval Time of Week	2
L1C	Signal Health (1 bits)	2
$M_0$	Mean Anomaly at Reference Time	2
$T_{GD}$	Group Delay Differential <sup>NOTE2</sup>	2
WN <sub>OP</sub>	CEI Data Sequence Propagation Week Number	2

Symbol	Parameter Name	Subframe
$t_{oe}$	Time of Ephemeris	2
$t_{op}$	CEI Data Sequence Propagation Time of Week	2
URA <sub>ED</sub> Index	Elevation Dependent User Range Accuracy, URA <sub>ED</sub> Index	2
URA <sub>NED0</sub> Index	NED Accuracy Index	2
URA <sub>NED1</sub> Index	NED Accuracy Change Index	2
URA <sub>NED2</sub> Index	NED Accuracy Change Rate Index	2
WN	Week Number	2
<p>Updates to parameters in this table will prompt changes in <math>t_{oe}</math></p> <p>NOTE1: Updates to this parameter are independent of curve fit and may occur without updates to <math>t_{oe}</math></p> <p>NOTE2: This parameter is for CEI Refinement and are independent of ephemeris estimation (state vector and curve fit) so it commonly remains constant across changes in <math>t_o</math>)</p>		

**Rationale:**

3/19/2026 CRM #9 At Govt AWG, negotiated new notes which combined NOTE 2 & 3 and required modifying the NOTE3 reference from outside the table to NOTE2. (T. Anthony)

2/16/2026 CRM #10 Fixed Redlines by properly showing the added NOTE2 to SV Health (T. Anthony)

2/16/2026 CRM #11 NOTE2 was enhanced to make it relevant and was not deleted as requested by this CRM (T. Anthony)

5/13/2023: Reworked clarifying the NOTES based on the feedback from AWG #1. (T. Anthony)

4/26/2023: CRM #5 Reworked NOTES across all documents with SMEs to more accurately address flags and health bits. (T. Anthony)

3/7/2023: At TIM #2, the NOTES were completely reworked resulting in a new NOTE1 and other changes. (T. Anthony)

2/27/2023: This simplified note was argued as being compatible with the rest of IS-GPS-200. The comments about “curve-fit” do not speak to the main point of the note. (T. Anthony)

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