



# IS-GPS-800 ICWG Minutes



**Minutes Date:** 24 Nov 08  
**Minutes By:** Thomas Davis

**Meeting Date:** 18 Nov 08  
**Organizer:** GPSW/SE&I

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## **ICWG Co-Chairs**

Capt Neal Roach  
Thomas Davis

## **ICWG Administration:**

Presentations on correlation loss and carrier phase noise were given by D. Bakeman. The Comments Resolution Matrix (CRM) was reviewed line by line allowing the ICWG members to provide feedback on the proposed changes and in some cases the proposed resolution. The CRM and IS documents were updated in real-time and was the method used for capturing/documenting the disposition of each comment. Not all recommended changes will be incorporated into the document for the 12 Feb 09 revision. Some of the issues need further review by one or more of the stakeholders (e.g., carrier phase noise language), refer to the CRM for more detail.

The CRM was sorted by importance/subject area in order to expedite the discussions during the meeting. The minutes are organized in the same manner.

## **Master CRM Review**

### ***Correlation Loss***

*Comments 139, 130, 126*

The comment recommended modifying the requirement for correlation loss. New proposed change presented at ICWG by D. Bakeman. There was some discussion that the proposed change was written more like a factory test spec as opposed to a SIS spec. Action assigned to Mike Deelo to set up a meeting with the appropriate stakeholders to revise the proposed change. Comment will remain open.

### ***Carrier Phase Noise***

*Comments 138 & 229*

The comment recommended modifying the requirement for carrier phase noise. The present spec defines phase noise only in terms of the performance of a phase lock loop, but doesn't completely define the loop. The comment was accepted with some modifications. The language of the proposed change will be modified by B. Bakeman but was not available for inclusion into the Minutes. The updated language will be brought to a future ICWG for stakeholder review.

#### *Comment 175*

The comment stated the accuracy of 0.01 radians RMS is not achievable. Recommend to close with resolution of comment 138.

#### *Comment 226*

The description of the additional PRN sequences is not consistent between IS-GPS-200, IS-GPS-705 and IS-GPS-800. An action was assigned to Dr. Munoz to resolve the issue. This comment will remain open.

### **Signal Power Levels**

#### *Comment 224*

The comment originator believed the current SV attitude error for L1C signals should be removed. The stakeholders concurred with the deletion.

#### *Comment 223*

The comment suggested that the off-axis power gain value of “no more than 18 dB from EOE to 23.5 degrees off nadir” be replaced with “no more than 19 dB from EOE to 23.5 degrees off nadir”. The comment originator updated the value in real-time to “19.5 db”. The modification does not change the received power; only the antenna roll-off. The requirement of “nor more than 10 dB from EOE to 20 degrees off nadir” will not be removed from the document. The stakeholders concurred with the change. There is some discussion on changing this to a power spec., antenna gain, or EIRP. An action was assigned to Mike Munoz to lead this effort.

#### *Comment 222*

It was suggested that the angular range for the L1 ellipticity be changed from “ $\pm 14.3$  degrees from boresight, plus pointing error” to “ $\pm 13.8$  degrees from nadir”. The stakeholders concurred with the change.

#### *Comment 196*

There was concern that an integrity assured URA was not mentioned within the document. The Integrity Status Flag was added to section 3.5.3.10. Need section title was renamed from “Reserved” to “Integrity Status Flag”. This information may need to be moved to 3.5.3.5. An action was assigned to Karl Kovach to coordinate the proposed change with the PSICA team. This will be incorporated in this revision of the document if the action is completed in time. The stakeholders concurred.

### **Signal Component Phase Relationship (TBR)**

#### *Comments 148, 249, 250, 251, 252*

The comment was to hold the phase relationship of civilian L1 signals fixed. Lockheed Martin (LM) evaluated the four (4) options and provided a brief to GPS Wing. LM has recommendations to modify each alternative. Need to look at SS-SS-800 at the requirement for continuous phase. LM stated that they believe the modulation portion of each option is not physically obtainable, and they would like the last sentence of each option removed. The action was assigned to Thomas Stansell to follow up on four (4) phases.

## **Signal Power Levels**

### *Comments 140*

It was suggested that a new requirement for signal combining be added to the document. This is to be worked to be worked with comment 223.

### *Comment 248*

There is concern that the document states variously that the received signal power is 1.) measured at the antenna output and 2.) measured at the correlation outputs of a receiver. Describing a receiver “without combining loss” is confusing. The comment was deferred and GPC is to follow up.

## **GPS and GNSS Time**

### *Comment 247*

In the GPS/GNSS-time relationship equation, term “ $WN_n$ ” is not defined in the CNAV-2 message types. The comment was withdrawn by GPC.

## **L1/L2/L5 Pair Issues**

### *Comment 246*

The pseudorange (corrected for ionospheric effects) equations are to be removed and placed elsewhere in the document. These sections will include references/pointers to the new location. An action was given to GPSW/GPC to determine where in the document the equations and parameters should be located.

### *Comment 243*

It was suggested that section 3.5.3.4 be reworded to describe L1, L2 and L5 signal health. The Stakeholders concur with the proposed change. Duplicate information from IS-GPS-200.

### *Comment 242*

The suggestion is to replace “will” with “shall” in the fourth paragraph of section 3.5.3. The Stakeholders concur with the proposed change with some modification. Add some language relating to the timeframe constraints. Changes made in real-time.

### *Comment 241 and 240*

It was suggested that “ $T_{oa}$ ” be replaced by “ $t_{oa}$ ” in Figures 3.5-4 and 3.5-5,. The stakeholders concurred with the change.

### *Comment 239*

It is suggested that Figure 3.5-1 add 2 bits for the “L2 and L5 health bits”. The Stakeholders concurred. Need to determine the location of the health bits prior to making changes.

### *Comment 238*

In Figure 3.5-1, bit 33 is labeled as “L1C Health”. To avoid confusion/complications, “L1C Health” was replaced with “L1 Health”. The stakeholders concurred.

### *Comment 237*

The comment states that the last section/paragraph of section 3.2.3.5 is confusing. The stakeholders concurred.

### **Received Minimum RF Signal Strength (Table 3.2-1)**

#### *Comment 234*

Comment to provide information on “received minimum RF signal strength” for orbital users such as “LEO, MEO, or GEO”. The stakeholders agreed the comment was OBE. This comment is related to Action Item #17.

### **Space Service Volume Group Delay**

#### *Comment 233 & 232*

The comment originator was unclear as to some of the values related to the group delay differential and how they applied. Section 3.3.1.7.3 was edited, and the comment was found to be OBE. An action was given to GPSW/GPC to determine where in the document the equations and parameters should be located.

### **Signal Coherence**

#### *Comment 231*

It was suggested that the average time difference between the transitions shall not exceed “2 nanoseconds 95% of the time” be changed to “2 nanoseconds 95% of the time”. The stakeholders requested better rationale for the proposed change. Action assigned to GPC to follow up.

### **Non-Standard Codes**

#### *Comment 220*

It was suggested that “a malfunction in the SV” be replaced with “receiving anomalous NAV data” to reflect the fact that the cause of anomalous NAV signals is not limited to a malfunction in the SV. The stakeholders concurred.

### **UDRA**

#### *Comment 205*

There was a question as to if the User Differential Range Accuracy (UDRA) parameters will be integrity-assured, since the document states that UDRA and UDRA-dot enable users to estimate the accuracy obtained after corrections are applied. The action was assigned to the PSICA working group.

### **SV Clock Accuracy Estimates**

#### *Comment 200*

There was concern that no guidance is provided for determining the overall URA from URAoc and URAoe. The suggested change was to provide clarification on how the overall URA should be computed. This comment was deferred and action assigned to the PSICA working group.

#### *Comment 199*

Section 3.5.3.8 needs clarification since it is not clear as to whether the URA accounts for errors in the inter-signal group delay differential corrections. The comment was deferred and assigned to the PSICA working group.

#### *Comment 198*

There was concern that the clock-related URA equations may be incorrect. The comment was withdrawn by GPC.

## **Subframe 2**

### *Comment 192*

It was suggested that there be a spec. that provides a value for the duration in which the previous clock parameters' data set will remain valid after the transmission of a new data set for subframe 2. The comment was deferred and action assigned to the PSICA working group.

## **Clock, Ephemeris, ITOW (Figure 3.5-1)**

### *Comment 191*

It was suggested that Inter-Signal Corrections (ISCs) for L1C/A, L2C, L5I5, and L5Q5 be added to the document. The stakeholders concurred with the comment, but the location in the document needs to be determined. An action was assigned to Karl Kovach and Chris Hegarty to determine the location in the document. The change will be included in this revision of the document if the action is completed in time.

## **L1C Message Structure**

### *Comment 188*

There is no definition provided in the document that describes how a superframe is made of frames. The stakeholders concurred to remove the superframe concept. Changes were made in real-time. An action was assigned to Dr. Munoz to create a similar table to IS-200 Table 30-XII. The comment will remain open.

## **L1C<sub>0</sub>-Code Generator Configuration (Figure 3.2-2)**

### *Comment 183*

It was suggested that m0 and m11 figure 3.2-2 be labeled as discussed in the notes section of Table 3.2-3. The "m" coefficient does not show in the polynomial. No need for modification of the table. GPC will follow up and clarify or withdraw the comment.

## **Signal Coherence**

### *Comment 176*

It was suggested that the L1C signal shall be clocked coherently with the clock of the P-code signal, not the transitions. The stakeholders agreed to reject the comment and leave the original text unchanged.

## **Subframe 3 (Figure 3.5-7 Text)**

### *Comment 154*

The comment originator did not know if the Subframe 3, Page 6 had a most significant bit and believes an explanation should be included in figure 3.5-7. The stakeholders concurred to reject the comment.

## Action Items

No	Due date	Actionee	Item	Resolution
1	01-Jul-08	Mike Deelo	3.2.1.7: Look at wording in IS GPS 200 and see if it clarifies the req. spec. for L1CP & L1CD, signal coherence.	No additional clarity from 200. Wording is essentially the same; slight difference in wording adds nothing.
2	30-May-08	Mike Deelo	3.2.1.5: Ensure CRM comment 126 and document changes are the same.	Proposed resolution to be presented by Bakeman at ICWG. Closed with ICWG approval of new language.
3	01-Jul-08	Soon Yi	3.2.1.5: Set up meeting w/ Aero & Mitre to review current correlation loss for verifiability.	Action completed pending approval of new language. Proposed resolution to be presented by Bakeman at ICWG
4	Barring results of #6	Mike Deelo	3.2.1.3: To harmonize phase noise spec. across all signals in space documents.	Closed with closure of action 6.
5	Barring results of #6	Soon Yi	3.2.1.3: Provide analysis to show how the phase lock loop requirements and phase noise mask are related.	Closed with closure of action 6.
6	01-Aug-08	Mike Deelo	3.2.1.3: Set up working group to discuss and resolve re-wording of carrier phase noise language.	Proposed resolution to be presented by Bakeman at ICWG. Closed with ICWG approval of new language.
7	01-Jul-08	Soon Yi/Mike Deelo	3.2.1.8.1: Look at IIF/IIRM data and analyze to see if 1 nanosecond is sufficient, justify the need for 1 nanosecond.	Ongoing
8	Barring results of # 7	Mike Deelo	3.2.1.8.1, 3.2.1.8.2: Add GPS III req. of 1 nanosecond to legacy interface documents (200 & 705)	Not going to be done, impacts legacy systems as per TIM on 13 Nov 08. 11/18: Requires further discussion
9	01-Jul-08	Soon Yi	3.2.1.9: Text added by Space IPT needs review by Aerospace and Mitre	
10	Next ICWG	Thomas Davis/AJ	Setup a meeting to ensure ICD wording is consistent in all docs & add applicable requirements from 800 to 705 and 200, clearly identify which requirements apply to each block, including symmetry requirements.	Part of DOORS conversion
11	Next ICWG	Thomas Davis	Evaluate removal of PRN code assignments from 800, 200, & 705 documents.	Deferred until resolution of comment #226 in the CRM
12	15-Jun-08	Thomas Davis	Renumber paragraphs because of duplicate paragraph #s	Completed
13	01-Aug-08	Mike Munoz	Create a working group to discuss the integrity status flag further.	Separate working group not needed, PSICA took lead on documenting integrity CONOPS.
14	31-Jan-08	Mike Deelo	Form WG to discuss Correlation Loss language (CRM comment 139; 3.2.1.5 Correlation Loss)	
15	31-Jan-08	Thomas Davis / Bud Bakeman	Include new Phase Noise Language in ICWG minutes (CRM comment 138; 3.2.1.3 Carrier	

			Phase Noise)	
16	31-Jan-08	Mike Munoz	Provide language for PRN sequences to be incorporated in all three public documents (CRM comment 226; 6.3.1).	
17	31-Jan-08	Mike Munoz	Determine language for off-axis power gain (antenna gain vs. EIRP) (CRM comment 223; 3.2.1.9)	
18	05-Dec-08	Thomas Davis	Move Integrity Status Flag information to appropriate section (potentially 3.5.3.5) (CRM comment 196; 3.5.3.5)	
19	05-Dec-08	Karl Kovach	Coordinate Integrity Status Flag information with PSICA WG (CRM comment 196; 3.5.3.5)	
20	31-Jan-08	Tom Stansell / LM	Follow up on phase options for fixed phase requirement. LM to provide language on implementation of phase relation. (CRM comment 148; 3.2.1.6)	
21	31-Jan-08	GPC	Follow up on comment on specifying power at receiver antennas (space user) (CRM comment 248; 3.2.1.9)	
22	31-Jan-08	GPC / Mike Munoz	Determine appropriate location of PR equations and parameters (SSV group delay bias and values) (CRM comment 246; 3.5.3.9.3)	
23	05-Dec-08	Thomas Davis / Steve Brown	Remove equations and SSV information from IS-GPS-800 and provide reference/pointer to TBD location. Steve Brown to verify removal. (CRM comment 246; 3.5.3.9.3)	Reference statement (add to 3.2.1.8.3 - keep first sentence): "The details are provided in TBD." Delete remainder of this section. Partial changes made in real time during ICWG for reference/pointer statement.
24	31-Jan-08	GPC	Provide more rationale for proposed change to chip transition of two modulating signals (CRM comment 231; 3.2.1.7.1)	
25	31-Jan-08	Karl Kovach and Chris Hegarty	Determine appropriate location for ISCs for L1C/A, L2C, L5I5, and L5Q5. (CRM comment 191; Figure 3.5-1)	
26	31-Jan-08	Mike Munoz	Create table similar to IS-GPS-200 Table 30-XII (CRM comment 188; 3.2.3.1)	
27	05-Dec-08	GPC	Follow up and provide clarification or withdraw comment on Figure 3.2-2 (CRM comment 183)	

## ICWG Participants

<b>Name</b>	<b>Organization</b>	<b>Citizenship</b>
Abayon, Annabelle	SE&I	US
Bakeman, Bud	Aerospace	US
Bencke, Joseph	GPET	US
Bernales, Carlos	SE&I	US
Brown, Steven A	Infinity Systems Engineering	US
Caceres, Dennis	ITT Space Systems	US
Davis, Thomas	SE&I	US
Deelo, Mike	SE&I	US
DeLiso, Sebastian	SE&I	US
Dobyne III, John C	GPSW/GPC	US
Fan, Tiange	Aerospace	US
Frey, Charles	Lockheed Martin (GPSIII Space Segment)	US
Hegarty, Chris	MITRE	US
Holmes, Jack K.	Aerospace	US
Kauffman, Matthew Lt	GPSW/GPSG	US
Knight, Jerry	NavCom Technology (John Deere)	US
Kovach, Karl	Aerospace	US
Lorge, Frank	DOT/FAA	US
Maniego, Edgar	ITT Space Systems	US
Metzger, Dave	ARINC/GPA	US
Mullikin, Tom	Raytheon	US
Munoz, Mike	SE&I	US
Naick, Purvis	GPSW/GPC	US
Notley, William	NASA	US
Peetz, Bruce	Trimble Navigation Limited	US
Peplowski, Thomas	ITT Space Systems	US
Ranney, Scott	Lockheed Martin (GPSIII Space Segment)	US
Reigh, Daniel	Lockheed Martin (GPSIII Space Segment)	US
Roach, Neal, Capt	GPSW	US
Shibata, Tomoya	NEC Corporation	Japan
Stansell, Tom	Aerospace	US
Stroing, Craig	SPAWAR	US
Vaughan, Paul	Northrop Grumman	US
Williams, Chris Maj	GPSW/EN	US
Wingate, Carina	SE&I	US