

## CCSDS Spring 2024 meetings

### SLS C&S Working Group Minutes of the Meeting



CCSDS Spring 2024 technical meetings were held from April 29<sup>th</sup> till May 3<sup>rd</sup> in Washington DC, US.

The C&S WG convened four times on May 1<sup>st</sup> and May 2<sup>nd</sup> for the following meetings: C&S, joint C&S/SLP/OPT, joint C&S/SLP/RFM, and joint C&S/RFM.

# CCSDS Spring 2024 Meetings

## Table of Contents

<b>1 C&amp;S meeting</b> .....	<b>3</b>
1.1 Opening of C&S activities .....	3
1.2 131.0-B update for TF slicing (SLS-CS_24-03).....	4
1.3 131.0-B update on the Turbo channel interleaver and response to AI_23_07 (SLS-CS_24-04) .....	4
1.4 Performance Analysis of the Tail Sequence for LDPC (128,64)-coded transmissions from CCSDS 231.0-B-4 (SLS-CS_24-08) .....	5
<b>2 Joint C&amp;S/SLP/OPT meeting</b> .....	<b>7</b>
2.1 Status of TF slicing activities in C&S Blue Books.....	7
2.2 Use of LDPC optical for RF links (SLS-CS_24-06) .....	7
<b>3 Joint C&amp;S/SLP/RFM meeting</b> .....	<b>9</b>
3.1 Proximity-1, RFM and C&S Blue Books open points.....	9
3.2 Phase Noise analysis on S-Band proximity-1 Hailing channel (SLS-CS_24-09).....	10
3.3 Update to CCSDS 211.0-B (Prox-1 SDLP) .....	10
<b>4 Joint C&amp;S/RFM meeting</b> .....	<b>11</b>
4.1 Proposed ToC for VCM Green Book (SLS-CS_24-01) .....	11
4.2 A new link budget processing method (SLS-CS_24-05) .....	11
4.3 Draft Orange Book for the Link Budget Digital Format (LBDF, SLS-CS_24-07) .....	11
4.4 C&S WG status.....	12
<b>5 C&amp;S WG Status</b> .....	<b>13</b>
5.1 Projects .....	13
5.2 Resolutions .....	13
5.3 Action Items status.....	13
<b>Annex 1: Agenda</b> .....	<b>14</b>
<b>Annex 2: Action Item List</b> .....	<b>17</b>
<b>Annex 3: list of participants</b> .....	<b>23</b>

## 1 C&S MEETING

The C&S meeting was held on May 1<sup>st</sup>.

### 1.1 Opening of C&S activities

[Presentation of the C&S chair](#) for reporting the planned agenda and objectives for this Spring meeting.

It was also raised as issue the limited manpower and travel budget of ESA/ESTEC for CCSDS activities.

Namely, ESA/ESTEC members informed that, although budget was secured last minute for attending this Spring meeting, currently there is no confirmation that they can support and attend CCSDS in Fall 2024, and in 2025.

Currently, ESA/ESTEC is supporting the WG with the following activities:

1. C&S chairmanship;
2. Proximity-1 extension project (under RFM/C&S WGs, for update of 211.1 and 211.2);
3. HoM for Scientific missions (as part of 401.0 updates project, under RFM/C&S WGs);
4. Transfer Frame slicing project – ESA prototype (if required for publication of 131.0-B-6)
5. Link Budget Digital Format (proposed new project);
6. Next review cycle of TM Green Book (planned in 2025)
7. VCM Green Book (proposed new project);

Already at this meeting, given the current situation, ESA/ESTEC was unable to complete activities on the Proximity-1 extension as per AI\_23\_18, AI\_23\_20, AI\_23\_22, with a consequent additional delay of 4 months (see Section 3.1).

Additionally, the proposal for having a VCM green book new project has been put on hold (see Section 4.1).

As fallback, the WG agreed the following plan:

- C&S WG to have an **intermediate meeting in July (remote)** for progressing on S-Band proximity-1;
- In turn, ESA-ESTEC will continue to contribute to CCSDS activities and take AIs as previously, under the assumption that travel budget for London 2024 will be approved. In case of limited budget, priority will be given to Chairmanship, and S-Band proximity-1 extension activities;
- In case ESA-ESTEC representatives in C&S should become aware of the possibility of not attending London, to inform immediately the WG for ensuring that technical meetings can be held as planned (e.g., WG delegation to deputy chair, re-assignment/re-scheduling of AIs, withdrawn of projects not yet approved);
- In parallel, to raise the issue now at SLS AD for possible escalation to CESG/CMC.

### 1.2 131.0-B update for TF slicing (SLS-CS\_24-03)

K. Andrews/NASA gave [a presentation](#) about the [draft pink sheets of 131.0-B \(TM BB\)](#), for including a transfer frame (TF) slicing (AI\_23\_11), following the comments received by the WG review (AI\_23\_09), and the proposal for the nomenclature (AI\_23\_10).

In line with the presentation, the WG agreed all the proposed edits, with the following differences:

- To add a note under Figure 3-1 and 3-3 that for RS (only) the codeword is actually a codeblock when  $l > 1$ ;
- To review the title text in 3.3;
- To reinstate the CADU term (instead of removing it as reported in Slide 12);
- To make the pseudo-randomizer as mandatory.

In this respect, K. Andrews/NASA took **AI\_24\_01** of performing a final polishing of the draft for having it ready for Agency review.

**NOTE:** during SLS plenary, C&S chair also asked for a waiver concerning the prototype implementation for TF slicing, since already implemented in 131.0-B-5 for LDPC, in 131.2-B-2 for SCCC, 131.3-B-2 for DVB-S2.

This was pushed forward by SLS AD in CESG, and it was approved by consensus.

### 1.3 131.0-B update on the Turbo channel interleaver and response to AI\_23\_07 (SLS-CS\_24-04)

[Presentation of J. Quintanilla/ESA](#) for showing the [consolidated draft pink sheets to 131.0-B \(TM BB\)](#), for including a Turbo Channel interleaver as per AI\_23\_11, following the comments received by the WG review (AI\_23\_09), and a proposal for the nomenclature (AI\_23\_10).

J. Quintanilla/ESA developed a SW prototype for performing a simulation campaign. Results from VIRTUDE project were replicated and, in response to AI\_23\_07, it was shown that placing the channel interleaver before and after the pseudo-randomizer does not change performance results.

The WG had consensus in having the channel interleaver placed after Turbo encoding, and before pseudo-randomizer, as already reflected in the current pink sheets. In fact, this allows to maintain the current 131.0-B organization (see Figure 1, right) versus having a change of paradigm (Figure 1, left).



Figure 1: comparison of the eventual 131.0-B functions if Turbo channel interleaver is placed after pseudo-randomizer (left) vs being placed before (right).

Considering also that the J. Quintanilla/ESA developed an independent SW prototype from the one done by the company Deimos in the framework of the VIRTUDE project, it is agreed to close AI\_22\_08, and to start preparing the YB (AI\_24\_02).

## 1.4 Performance Analysis of the Tail Sequence for LDPC (128,64)-coded transmissions from CCSDS 231.0-B-4 (SLS-CS\_24-08)

Input of R. Giuliani, from University of Ancona, Italy, on behalf of ESA, about a potential issue in the CLTU termination when using short LDPC coding.

R. Giuliani/ESA carried out an extensive simulation campaign for computing the TC probability of rejection in the following conditions:

- LDPC (128,64)
- CLTU terminated with Tail sequence or idle sequence, thus causing an intentional failed decoding at the receiver (Event E4, [as provided in 231.0-B](#))
- CLTU tail sequence not randomized or randomized at the sending end (although the latter is not part of the standard).

In all cases it was found that the probability of TC rejection has a floor between  $1e-4$  and  $1e-5$ , limited by the probability of wrong termination (i.e., when the decoder provides syndrome equal to zero, instead of  $>0$ ). This floor does not appear when CLTUs are BCH coded.

During the presentation it was also observed that:

- When tail sequence is not randomized (in line with current standard) causes a wrong termination, the decoder tends to converge always to three specific codewords with distance 15. This is in line with K. Andrews/NASA analysis done when the [randomizer](#)

## CCSDS Spring 2024 Meetings

[was moved after LDPC encoding](#), in which it was found that the tail sequence has 3 codewords at minimum distance of 15.

- Even by designing a tail sequence from scratch, the floor appears not disappearing, thus indicating that is more a limitation of the LDPC(128,64) decoder;
- The floor stays also when the idle sequence is adopted for CLTU termination, instead of tail sequence;
- No simulations were done for LDPC(512,256) to check if the perimeter is confined to the short code.

In this respect, ESA/NASA agreed to have **AI\_24\_03**, for cross-checking the analyses and see if the issue is confirmed. Additionally, it will be checked that the floor issue is limited to LDPC(128,64), and not to LDPC(512,256) (for idle sequence only, since no tail sequence is foreseen for the latter code).

## 2 JOINT C&S/SLP/OPT MEETING

The C&S meeting was held on May 1<sup>st</sup>.

### 2.1 Status of TF slicing activities in C&S Blue Books

For the joint meeting with SLP/OPT WGs, K. Andrews/NASA gave again the presentation [SLS-CS\\_24-03](#) (Section 1.2 of this MoM).

This was integrated by [slides of C&S chair](#) about the status of TF activities and how currently TF slicing is implemented in all synchronization and coding layers in CCSDS, namely 131.0-B (TM C&S), 131.2-B (SCCC), 131.3-B (DVB-S2), 142.0-B (OPT C&S).

**NOTE:** although not discussed during the meeting it is reported that based on AI\_23\_18, TF slicing is implemented also for 211.2-B (Proximity-1 C&S).

During the presentation, J. Hamkins/NASA expressed a concern that the proposed TM blue book update ([SLS-CS\\_24-03](#), p. 4) includes a non-normative note that a bitstream can be ingested instead of Transfer Frames, while the normative language says Transfer Frames shall be ingested. This language makes it unclear whether a bitstream can be ingested. A figure showing the stream ingestion and ASM bypass would be helpful as well.

Following the presentations, WGs agreed that after completion of AI\_24\_01 (see Section 1.2 of this MoM), 131.0-P (draft pink sheets) will be sent to the three WGs for the last spot checks before sending them for Agency review.

**NOTE:** during SLS plenary, C&S chair agreed that (for harmonizing the implementation across 131.x blue books) the Note on slide 4 of [SLS-CS\\_24-03](#) will be added also to the SCCC and DVB-S2 blue books (by means of editorial update, or technical corrigendum, AI\_24\_13).

### 2.2 Use of LDPC optical for RF links (SLS-CS\_24-06)

Input of G. Artaud/CNES about the [potential use of O3K LDPC coding](#) also to RF links. The presentation shows that O3K LDPC codes have the following features:

- Constant encoded block size (n);
- Low complexity for FPGA implementation, with the target of achieving >10 Gbps (e.g., on Xilinx Zyn-q the encoder took ~10 times less FFs and LUTs, vs ARJA and DVB-S2);
- Very low error floor, allowing FER < 1e-7, w/o need of BCH external coding as done in DVB-S2.

The presentation is informative, there is no proposal to change current standards or for new projects.

## CCSDS Spring 2024 Meetings

The WG took note of the presentation, and member agencies can contact CNES for additional technical information or to provide feedback.



### 3 JOINT C&S/SLP/RFM MEETING

The C&S meeting was held on May 2<sup>nd</sup>.

#### 3.1 Proximity-1, RFM and C&S Blue Books open points

Following the ESA/ESTEC limitation for CCSDS activities (see Section 1.1), N. Maturo/ESA was unable to complete AI\_23\_18, AI\_23\_20, and AI\_23\_22, for providing an update of Proximity-1 blue books 211.1 and 211.2.

However, with consensus of the WG, N. Maturo/ESA was permitted to provide an [informative input](#) about the open points for S-Band Proximity-1 activities.

During the presentation:

- An update of the phase noise mask and Doppler/Doppler rate values was given. As follow up, ESA agreed to check with LPF if they can provide block diagram information in regard to the heterodyning of the RF chains and oscillators (also frequency multiplier and divider, if possible) specs for transmitter and receivers. Given this information, NASA agreed to re-iterate the analysis for the total phase noise (**AI\_24\_04**);
- WG took action (**AI\_24\_05**) to comment on the need of having an EVM requirement (see slide 5 of the [presentation](#));
- the WG agreed that it CCSDS preference is to have SFCG doing an exclusion for the hailing channel about the mask in [REC 41-1](#). Namely, an exclusion allows to avoid filtering on the Bi-phase-L modulation, thus providing better margins on the hailing. In this respect, N. Maturo/ESA will re-iterate with ESA frequency management as part of normal work;
- the WG agreed on having the coherent mode for ranging purposes. It also identified the need of updating the PN ranging 414.0-B, for extending it to space-to-space and one-way ranging. D. Lee/RFM chair will prepare a draft new project (**AI\_24\_06**) for tackling the activity under RFM;
- it was observed that LNIS requires modulation indexes in [0.2,1.4] for which the extremes 0.2 and 1.4 are not much practical. S. Rodriguez/NASA will check (**AI\_24\_07**) with LNIS the rationale of having such large modulation index range. In turn, N. Maturo/ESA (**AI\_24\_08**) will provide an update list of the modulation indexes.
- D. Lee/NASA reported latest information about SFCG. The WGs were informed that:
  - in [REC 41-2](#) the frequency allocations to be considered are those in Table 3,
  - multiple sub-channels can be allocated per each channel, with the exception of the hailing channel.

The WGs took note of the presentation and follow-up AIs were assigned.

### 3.2 Phase Noise analysis on S-Band proximity-1 Hailing channel (SLS-CS\_24-09)

Because of limited time, and since the topic was already presented during RFM WG, [the presentation](#) was not repeated during the joint meeting.

For the technical discussion during RFM WG, the reader can refer to the RFM MoM.

### 3.3 Update to CCSDS 211.0-B (Prox-1 SDLP)

Presentation of G. Kazz/SLP chair about [the latest updates](#) of lunar proximity directives and default parameters.

During the presentation:

- Frequency of the channel is currently encoded in 5 bits, corresponding up to 32 channels. Since sub-channels are possible, A. Modenini and N. Maturo/ESA took action to draft a proposal on how to encode the frequency, e.g., by means of a floating point as done for the symbol rate (**AI\_24\_09**).
- The WGs observed that hailing channel was reported as 2 ksps (~1 kbps) instead of 1 ksps (~0.5 kbps) as originally agreed in Huntsville 2023. The WG will check with vendors about the implementation status to see if 1 ksps can be kept as originally agreed (**AI\_24\_10**);
- The WGs discussed about the polarization to be adopted for S-Band proximity-1 hailing channel. In particular, there were both an interest in protecting the hailing channel (by avoiding cross-polarization) but also in giving flexibility for to future missions. It was eventually agreed that:
  - **LHCP** shall be adopted for **Hailing channel 0**;
  - **RHCP** shall be adopted for the alternative **Hailing channel 9**;
- The WG briefly discussed about the potential extension of Proximity-1 to Ka-Band (~27 GHz), for which limited inputs were provided so far. A main concern is if the current definition of the S-Band directives can be easily extended to Ka-Band, where higher data rates, symbol rates, and channel frequencies will be adopted. M. Cosby/UKSA took AI (**AI\_24\_11**) to preliminary assess possible incompatibilities of the current directives when extended to Ka-Band.

In general the WGs saw good progress about S-Band proximity-1 activities, but identified the need of reconvene before Fall 2024, also for recovering the delays on pink sheets for 211.1 and 211.2 (see Section 1.1).

Thus, **an intermediate meeting will be held in July 2024** (remotely).

### 4 JOINT C&S/RFM MEETING

The C&S meeting was held on May 2<sup>nd</sup>.

#### 4.1 Proposed ToC for VCM Green Book (SLS-CS\_24-01)

A. Modenini/ESA, in response to AI 23\_12 provided in January 2024 a table of contents (ToC) for a potential VCM green book to be paired with the 431.1-B (see [Huntsville MoM 2023](#) for details about the intended project).

The WG confirmed the interest in having the project with preference that it is led by ESA, given its background and experience with VCM developments.

However, given the current situation of ESA ESTEC manpower, it was decided to keep the project on-hold.

#### 4.2 A new link budget processing method (SLS-CS\_24-05)

Input of M. Vialard/CNES about [an alternative methodology for computing statistical link budgets](#), different from the one foreseen in CCSDS and the European standards (ECSS).

The presentation proposes to model distributions of dominating elements by using an estimation based on actual measurements. If the latter are not available, a distribution defined as PLCKMOD, based on Planck's law, can be adopted as alternative to the classical Gaussian, Triangular, and Uniform distributions.

It was shown that this methodology is way less conservative than CCSDS/ECSS, especially when there is a dominating element with a wide distribution.

As example, it was reported the case of a satellite in survival mode, for which antenna gain (towards Earth station) is unknown due to the loose satellite pointing. Instead of modelling the antenna gain as triangular, a pdf was computed based on the 3-D antenna gain pattern measurements.

In this way, it was shown that the novel methodology gives margins higher by 6-8 dB w.r.t. CCSDS/ECSS.

The presentation is informative, there is no proposal to change current standards or for new projects.

The WG took note of the presentation, and member agencies can contact CNES for additional technical information or to provide feedback.

#### 4.3 Draft Orange Book for the Link Budget Digital Format (LBDF, SLS-CS\_24-07)

Input of A. Miraglia/ESA for presenting the [status of developing a Link Budget Digital Format \(LBDF\)](#) and preparing an experimental specification, an Orange Book.

During the presentation:

## CCSDS Spring 2024 Meetings

- A draft of the orange book was presented. However, ESA points out that work is still in progress and not ready for a WG review. For the time being, the WG can start looking at the introduction chapters 1, 2, 3.
- Most of the ESA efforts since last meeting went on the definition of the UML that represents the “core” of the standard. Namely, the UML automatically defines the XML schemas that in turn allow to define the XML files.
- It was clarified that there is no intention to constrain the calculation methodologies, or the practice currently done by member agencies. In fact, LBDF is meant only for exchanging results (link budgets’ snapshots), and possibly notice (with dedicated tools) possible discrepancies in the assumptions/practices done by one party that the other may not be aware. For instance, ESA has already developed with Thales Italy a LBDF file comparison tool that can highlight differences when numbers differs over a threshold decided by the user;
- The WG had consensus in having a project for the LBDF (**RES#1**).

As follow up, it was agreed:

- The WG can review the UML diagram and, since no full documentation is yet available, contact ESA for clarifications as needed (**AI\_24\_12**);
- In turn, ESA will progress on the implementation of the schema files, produce LBDF examples, and improve the draft orange book. Main target is to consolidate the UML/XSD definition, for doing a LBDF live demonstration at Spring 2025.
- C&S chair will send the [CWE project](#) for LBDF to SLS AD, for CESC/CMC approval.

### 4.4 C&S WG status

Presentation of C&S chair reporting the status of WG activities. See [presentation in CWE](#) and Section 5 of this MoM.

### 5 C&S WG STATUS

This section provides highlights of C&S activities. An executive summary can be found in the [presentation in CWE](#).

#### 5.1 Projects

Currently C&S WG is working on the [following projects](#):

- *TM synchronization and coding – new channel interleaver for Turbo codes.*
- *Proximity-1 extension*
- *Slicing of Transfer Frames*

and has three project proposals (still pending CMC approval):

- *VCM Greenbook*
- *Link Budget Digital Format (LBDF)*

With respect to Fall 2024 it is highlighted that:

- *TM synch & coding – new channel interleaver for Turbo Codes and Slicing of TFs* have now pink sheets that reached a good level of maturity and may be sent to Agency review in the following 6 months;
- *Proximity-1 extension* is delayed by 4 months, and an intermediate meeting is planned in July 2024;
- *Link Budget Digital Format (LBDF)* draft project will be sent to SLS AD for approval;
- *VCM Greenbook* draft project is kept on-hold for the time being;
- *Erasure correcting codes for NE and DS* is withdrawn. Since last call, no member agencies raised the interest in pursuing the project.

#### 5.2 Resolutions

The WG had a single resolution (**RES#1**) about having a new project for having a Link Budget Digital Format. C&S chair will send the draft project, [available in CWE](#), to SLS AD.

In the next 6 months, it is also expected to have as further resolution the request of Agency Review for 131.0-P about TF slicing and Turbo Channel Interleaver.

#### 5.3 Action Items status

Als list was reviewed. Latest status is reported in Annex.

## CCSDS Spring 2024 Meetings

### ANNEX 1: AGENDA

#### Joint C&S meeting, Wednesday 1<sup>st</sup> May, 2024 – starting at 8:45

N°	Author	Agenda Topic C&S meeting	Estimated time allocation in minutes	REMARKS
1	C&S Chair	Opening of C&S activities (with discussion of ESA ESTEC limited manpower/budget for CCSDS activities)	30	N/A
2	NASA	131.0-B update for TF slicing	30	SLS-CS_24-03
3	ESA	131.0-B update on the channel interleaver and response to AI_23_07	30	SLS-CS_24-04
4	ESA	Performance Analysis of the Tail Sequence for LDPC (128,64)-coded transmissions from CCSDS 231.0-B-4	30	SLS-CS_24-08
<b>TOTAL hours</b>			<b>2.0</b>	

#### Joint OPT/C&S/SLP meeting, Wednesday 1<sup>st</sup> May, 2024 – starting at 13:30

N°	Author	Agenda Topic OPT/C&S/SLP meeting	Estimated time allocation in minutes	REMARKS
5	NASA	131.0-B update for TF slicing	30	SLS-CS_24-03 (same as Item 2)
6	C&S Chair	Status of TF slicing activities in C&S Blue Books	30	N/A
7	CNES	Use of LDPC optical for RF links	30	SLS-CS_24-06
<b>TOTAL hours</b>			<b>1.5</b>	

## CCSDS Spring 2024 Meetings

### Joint SLP/C&S/RFM meeting, Thursday May 2<sup>nd</sup>, 2024 – starting at 8:45

N°	Author	Agenda Topic SLP/C&S/RFM	Time allocation in minutes	REMARKS
8	ESA	Proximity-1, RFM and C&S Blue Books Open Points	30	N/A Informative input
9	NASA	Phase noise analysis on S-Band proximity-1 Hailing Channel	30	SLS-CS_24-09
10	SLP Chair	update to CCSDS 211.0-B (Prox-1 SDLP) concerning: <ul style="list-style-type: none"> <li>a. Directives for S-band Lunar ops</li> <li>b. The link establishment negotiation mechanism</li> <li>c. Default Hailing Parameters for UHF (Mars) vs S-band (Lunar)</li> </ul>	30	N/A
<b>TOTAL hours</b>			<b>1.5</b>	

### Joint C&S/RFM meeting, Thursday May 2<sup>nd</sup>, 2024 – after joint SLP/C&S/RFM

N°	Author	Agenda Topic C&S/RFM	Time allocation in minutes	REMARKS
11	ESA	Proposed Table of contents for VCM Green Book	30	SLS-CS_24-01
13	CNES	A new link budget processing method	30	SLS-CS_24-05
14	ESA	Draft Orange Book for the Link Budget Digital Format	30	SLS-CS_24-07
15	C&S Chair	C&S Working Group Status: <ul style="list-style-type: none"> <li>• Project status review</li> <li>• Review of AIs (up to this meeting)</li> <li>• AoB</li> </ul>	30	N/A
<b>TOTAL hours</b>			<b>2.0</b>	

## CCSDS Spring 2024 Meetings

### NOTES:

- input SLS-CS\_24-02 was moved in RFM working group, on Tuesday 30<sup>th</sup> April.
- Inputs are available on CWE at <https://tinyurl.com/CCSDSpring2024>  
(C&S WG private folder, requires login)



## CCSDS Spring 2024 Meetings

### ANNEX 2: ACTION ITEM LIST

Open action items are listed in the table below.

Als closed during this meeting are cancelled out in the table below (with traceability about their closure).

The new Als are those starting from AI\_24\_01.

Latest version of AI list can be found on CWE (private folder, requires login): <https://tinyurl.com/jyripz6a>

AI#	Action	Actionee	Due date	Status	Traceability
AI_22_08	<del>To implement a SW prototype for the Turbo Channel Interleaver</del>	K. Andrews/NASA	Spring 2024	Closed	Section 1.3
AI_22_09	<del>To prepare C&amp;S resolution for AOS max length technical corrigendum, and possibly inject changes as part of TF slicer TM BB randomizer Agency Review</del>  <del>Edited between Fall 2022 and Spring 2023: SLS AD recommended as part of TF slicer</del>	A. Modenini/ESA	Spring 2024	Closed	SLS-CS_24_03
AI_23_07	<del>to perform a SW simulation to see if VIRTUDE results can be replicated when Turbo-Code interleaving is done before pseudo-randomization</del>	J. Quintanilla/ESA	Spring 2024	Closed	SLS-CS_24_04
AI_23_08	Provide an update of 130.1-G (TM GB), in preparation of 2025 reconfirmation, for including the following: <ul style="list-style-type: none"> <li>• Use of TM codes in Ground-to-space links;</li> <li>• Compatibility with USLP;</li> <li>• 17-cell randomizer;</li> <li>• Turbo channel interleaver;</li> <li>• Transfer frame slicing.</li> </ul> Book captain: J. Quintanilla/ESA	J. Quintanilla/ESA, A. Modenini/ESA, N. Maturo/ESA, K. Andrews/NASA	Spring 2025	Open	

## CCSDS Spring 2024 Meetings

<b>AI_23_09</b>	To review <a href="#">proposed changes to 131.0-B (TM BB)</a> and send comments to K. Andrews/NASA and J. Quintanilla/ESA (with CC-C&S Chair)	C&S WG	30 <sup>th</sup> November 2023	Closed	SLS-CS_24-03
<b>AI_23_10</b>	to check the terminology of coded/channel bit/symbol in 131.0-B and eventually provide a proposal for harmonizing the book with RFM and SFCC recommendations.	A. Modenini/C&S Chair	30 <sup>th</sup> November 2023	Closed	SLS-CS_24-03
<b>AI_23_11</b>	following AI_23_09 and AI_23_10, to provide an updated draft of 131.0-B suitable for SLS AD Review, with the target of having the 'start Agency Review' resolution by Spring 2024	K. Andrews/NASA, J. Quintanilla/ESA	1st February 2024	Closed	SLS-CS_24-03 SLS-CS_24-04
<b>AI_23_12</b>	Provide draft ToC for proposed new VCM green book	A. Modenini	December 2023	Closed	SLS-CS_24-01
<b>AI_23_13</b>	Review draft VCM GB ToC and provide feedback to C&S chair on whether to proceed with development of the GB  NOTE: during Spring 2024 project was decided to be put on-hold, and action kept open for Fall 2024.	All	Fall 2024	Open	
<b>AI_23_14</b>	Provide draft Orange book on link budget data exchange format	A. Modenini, A. Miraglia	Spring 2024	Closed	SLS-CS_24-07

## CCSDS Spring 2024 Meetings

<b>AI_23_15</b>	Provide analysis or measurements of the link performance degradation as a function of the carrier suppression for 16APSK/32APSK/64APSK modulation	A. Modenini	Spring 2024	Closed	SLS-CS_24-02  See RFM MoM
<b>AI_23_16</b>	Provide draft revision of Recommendation (401) 2.4.17A to include high order modulations	A. Modenini	Spring 2024	Closed	SLS-CS_24-02  See RFM MoM
<b>AI_23_17</b>	Liaise to the SFCG that the hailing channel in SFCG Rec 42-1 should be specified as a frequency rather than a frequency range.	D. Lee	Next SFCG in June 2024	Closed	See Section 3.1
<b>AI_23_18</b>	Modify text in the draft 211.2 Prox-1 Data Link Layer Blue Book to explicitly indicate that slicing will be used, instead of partitioning as stated in the current draft.	N. Maturo	Spring 2024	Open	
<b>AI_23_19</b>	Consider the number of mod indices that should be recommended for Prox-1 S-band and Ka band.	RFM WG members	Spring 2024	Closed	Informative input of ESA  Superseded by AI_24_08
<b>AI_23_20</b>	Include specification of the filtering of the bi-phase signal in the draft update of 211.1 Prox-1 Physical Layer Blue Book based on the pink Recommendation 2.4.7A	N. Maturo	Spring 2024	Open	

## CCSDS Spring 2024 Meetings

AI_23_21	Perform analysis to determine if the Prox-1 S-band phase noise mask in Figure 5-2 of the draft 211.1 Prox-1 Physical Layer Blue Book is appropriate for low symbol rates.	W. Lee	Spring 2024	Closed	SLS-CS_24-09
AI_23_22	Update the spurious emissions mask in Figure 5-3 of the draft 211.1 Prox-1 Physical Layer Blue Book to be in-line with the spurious lines resulting from filtering of the bi-phase signal	N. Maturo	Spring 2024	Open	
AI_23_23	Confirm the S-band Doppler frequency range and rate in Section 5.2.5	N. Maturo	Spring 2024	Closed	Informative input of ESA  Superseded by AI_24_04
AI_24_01	To provide consolidated pink sheets for Agency Review of 131.0-B with following editorial edits (on top of those already presented at Spring 2024): <ul style="list-style-type: none"> <li>• Note about codeblock (for RS only) under figure 3-1 and 3-3</li> <li>• Review title of Section 3.3</li> <li>• Reinstate CADU</li> <li>• Make randomization mandatory (Review Figure 2-2, 2-3, and Sections 4.2.2, 5.2.1, 7.2.1, 8.2.2, and 10.x).</li> </ul>	K. Andrews	June 2024		
AI_24_02	To provide Draft Yellow Book for the two prototypes of the Turbo channel interleaver	J. Quintanilla	Spring 2025		

## CCSDS Spring 2024 Meetings

AI_24_03	ESA/NASA to: <ul style="list-style-type: none"> <li>• cross check results about CLTU termination performance (with tail and idle sequence) for identifying the reason of the discrepancy between the two analyses</li> <li>• in case issue is confirmed, to check if also LDPC(256,512) has same problematic</li> </ul>	K. Andrews R. Giuliani	Fall 2024		
AI_24_04	ESA to check with LPF if possible to provide block diagram information of heterodyning of RF chain and oscillators specs for transmitter and receiver.  Given this information, NASA to reiterate analysis for total phase.	W. Lee N. Maturo	July 2024 (intermediate C&S Meeting)		
AI_24_05	To check the need of having an EVM requirement in the Proximity-1 211.1-B, or if this can be considered a specification at unit level	C&S/RFM WGs	July 2024 (intermediate C&S meeting)		
AI_24_06	To draft CWE project for an update of 414.0-B (PN ranging), with the objective of adding space-to-space and one-way ranging	D. Lee	July 2024 (intermediate C&S Meeting)		
AI_24_07	To check rationale in LNIS for having modulation index range 0.2-1.4, since 0.2 and 1.4 appears not practicable cases	S. Rodriguez	May 2024 (before intermediate C&S meeting)		
AI_24_08	To provide an updated list of modulation index (in deg) to be supported, taking into account that LPF uses $\pi/3$ , and (possibly) input by LNIS (see AI_24_06)	N. Maturo	July 2024 (intermediate C&S Meeting)		

## CCSDS Spring 2024 Meetings

<b>AI_24_09</b>	To provide a proposal for fixed or floating point definition of the channel frequency in S-Band proximity-1	N. Maturo A. Modenini	July 2024 (intermediate C&S Meeting)		
<b>AI_24_10</b>	WG to check with vendors if hailing channel is 1 ksps (coded symbol rate) as agreed in Huntsville 2023	C&S/RFM/SLP WGs	July 2024 (intermediate C&S Meeting)		
<b>AI_24_11</b>	To assess possible incompatibilities of the current S-Band directives for a possible extension to Ka-Band	M. Cosby	July 2024 (intermediated C&S meeting)		
<b>AI_24_12</b>	To review UML diagram for LBDF for checking parameters to add/remove.  NOTE: Member agencies can contact ESA as needed since there is not yet documentation available, with the exception of Section 1,2,3 in the draft Orange Book.	C&S WG	Fall 2024		
<b>AI_24_13</b>	To add non-normative note about having as input bistream instead of TFs, as will be done in 131.0-B-6	C&S chair	After Agency Review of 131.0-B-6 for TF slicing		

## CCSDS Spring 2024 Meetings

### ANNEX 3: LIST OF PARTICIPANTS

**NOTE:** participation list is only for C&S members. It does not account of participants from RFM, OPT, SLP WGs in joint meetings.

<b>Name</b>	<b>Affiliation</b>
Amanuel Geda	DLR
Andrea Domenica Mourglia	ESA
Andrea Modenini	ESA
Antonio Miraglia	ESA
Dennis Lee	NASA
Eric Pitts	NASA
Gabriele Dona	ESA
Greg Kazz	NASA
Gunther Sessler	ESA
Jean-Luc Issler	CNES
Jorge Quintanilla	ESA
Kenneth Andrews	NASA
Klaus-Juergen Schulz	ESA
Marie Vialard	CNES
Massimo Battaglioni	ESA
Mitsuhiro Nakadai	JAXA
Nicola Maturo	ESA
Rebecca Giuliani	ESA
Shannon Rodriguez	NASA
Stefan Veit	DLR
Victor Sank	NASA
Wai Fong	NASA
Wing-Tsz Lee	NASA
Xavier Enrich	Eumetsat