**CCSDS Spring 2024 meetings**

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

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

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

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# C&S meeting

The C&S meeting was held on May 1st.

## Opening of C&S activities

[Presentation of the C&S chair](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B6B8FD0AA-AB77-4B8B-BF13-255AC108918F%7D&file=CS_status_Spring2024.pptx&action=default&CT=1714943506511&OR=DocLibClassicUI) 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.

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

K. Andrews/NASA gave [a presentation](https://cwe.ccsds.org/sls/docs/SLS-CandS/CWE%20Private/Meeting%20Materials/2024/2024%20-%20Spring/inputs/SLS-CS_24-03.pdf) about the [draft pink sheets of 131.0-B (TM BB)](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7BACCA0F84-C76E-4F26-8886-EB407E2BEA91%7D&file=SLS-CS_24-03.doc&action=default&CT=1714297344739&OR=DocLibClassicUI), 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 I>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. SLS AD will request the waiver at CESG level.

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

[Presentation of J. Quintanilla/ESA](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B3AEF1E46-B1EF-4BB8-A2BE-5C6D07A3E85D%7D&file=SLS-CS_24-04%20-%20131.0-B%20update%20on%20the%20channel%20interleaver%20and%20response%20to%20AI_23_07.pptx&action=default&CT=1714297870946&OR=DocLibClassicUI) for showing the [consolidated draft pink sheets to 131.0-B (TM BB)](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7BACCA0F84-C76E-4F26-8886-EB407E2BEA91%7D&file=SLS-CS_24-03.doc&action=default&CT=1714297344739&OR=DocLibClassicUI), 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).

A screenshot of a computer

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

## 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](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7BF6CF3CBF-1363-4962-83AC-EC3FDC746989%7D&file=SLS-CS_24-08%20-%20Performance%20Analysis%20of%20the%20Tail%20Sequence%20for%20LDPC%20(128,64)-coded%20transmissions%20from%20CCSDS%20231.0-B-4.pptx&action=default&CT=1714948206687&OR=DocLibClassicUI), 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 (64,128)
* 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](https://public.ccsds.org/Pubs/231x0b4e0.pdf))
* 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 was moved after LDPC encoding](https://cwe.ccsds.org/sls/docs/SLS-CandS/CWE%20Private/Meeting%20Materials/2020/2020-Spring/SLS-CS%20Spring%202020%20MoM.pdf), 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(64,128) decoder;
* No simulations were done for LDPC(256,512) 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 issue is limited to LDPC(64,128), and not to LDPC(256,512).

# Joint C&S/SLP/OPT meeting

The C&S meeting was held on May 1st.

## 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](https://cwe.ccsds.org/sls/docs/SLS-CandS/CWE%20Private/Meeting%20Materials/2024/2024%20-%20Spring/inputs/SLS-CS_24-03.pdf) (Section 1.2 of this MoM).

This was integrated by [slides of C&S chair](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B580218B4-C1E7-4356-9157-7E67706FC691%7D&file=CS_joint_OPT.pptx&action=default&CT=1714946048099&OR=DocLibClassicUI) 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), and 142.0-B (OPT C&S).

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](https://cwe.ccsds.org/sls/docs/SLS-CandS/CWE%20Private/Meeting%20Materials/2024/2024%20-%20Spring/inputs/SLS-CS_24-03.pdf) will be added also to the SCCC and DVB-S2 blue books (by means of editorial update, or technical corrigendum, **AI\_24\_13**).

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

Input of G. Arnoud/CNES about the [potential use of O3K LDPC coding](https://cwe.ccsds.org/sls/docs/SLS-CandS/CWE%20Private/Meeting%20Materials/2024/2024%20-%20Spring/inputs/SLS-CS_24-06%20-%20LDPC%20O3K%20RF.pdf) 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.

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

# Joint C&S/SLP/RFM meeting

The C&S meeting was held on May 2nd.

## 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](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B9686EA16-CF20-4216-87E4-E4C4630D86C2%7D&file=Informative%20-%20Prox_1_CCSDS_Spring2024.pptx&action=default&CT=1714948256767&OR=DocLibClassicUI) 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. In this respect, ESA and NASA will further re-iterate for checking the feasibility of having RF lock (**AI\_24\_04**) for the Proximity-1 hailing channel;
* WG took action (**AI\_24\_05**) to comment on the need of having an EVM requirement (see slide 5 of the [presentation](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B9686EA16-CF20-4216-87E4-E4C4630D86C2%7D&file=Informative%20-%20Prox_1_CCSDS_Spring2024.pptx&action=default&CT=1714948256767&OR=DocLibClassicUI));
* 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](https://www.sfcgonline.org/Recommendations/REC%20SFCG%2041-1%20(Eff.%20Spectrum%20Use%20SRS%20Lunar%20Region).pdf). 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](https://www.sfcgonline.org/Recommendations/PROV%20REC%20SFCG%2042-1%20(Frequency%20plan%20for%20Lunar%20Relays)-corrected.pdf) 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.

## 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](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B75471FEE-3C88-468F-B171-4C8DEF189A87%7D&file=SLS-CS_24-09%20-%20Phase%20Noise%20Analysis%20on%20S-Band%20Proximity-1%20Hailing%20Channel.pptx&action=default&CT=1715009714271&OR=DocLibClassicUI) was not repeated during the joint meeting.

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

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

Presentation of G. Kazz/SLP chair about [the latest updates](https://cwe.ccsds.org/sls/docs/Forms/AllItems.aspx?RootFolder=%2Fsls%2Fdocs%2FSLS%2DCandS%2FCWE%20Private%2FMeeting%20Materials%2F2024%2F2024%20%2D%20Spring%2Finputs%2FSLP%20inputs%20to%20joint%20SLP%2DCS%2DRFM&FolderCTID=0x012000439B56FF51847E41B5728F9730D7B55F&View=%7BAE8FB44C%2DE80A%2D42CF%2D8558%2DFB495ABB675F%7D) 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 2022. 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).

# Joint C&S/RFM meeting

The C&S meeting was held on May 2nd.

## 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](https://cwe.ccsds.org/sls/docs/SLS-CandS/CWE%20Private/Meeting%20Materials/2023/2023%20-%20Spring/SLS-CS%20Spring%202023%20MoM%20iss1r2_final_clean.pdf) 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.

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

Input of M. Vialard/CNES about [an alternative methodology for computing statistical link budgets](https://cwe.ccsds.org/sls/docs/SLS-CandS/CWE%20Private/Meeting%20Materials/2024/2024%20-%20Spring/inputs/SLS-CS_24-01%20-%20Proposed%20Table%20of%20contents%20for%20VCM%20Green%20Book.pdf), 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 then 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.

## 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)](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B1EDB4A56-6AC6-4455-8FDE-A7D59EE9E559%7D&file=SLS-CS_24-07%20-%20LBDF%20Orange%20Book%20-%20CCSDS%20Spring%20Meeting.pptx&action=default&CT=1715004263384&OR=DocLibClassicUI) and preparing an experimental specification, an Orange Book.

During the presentation:

* 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](https://cwe.ccsds.org/fm/Lists/Projects/DispFormDraft.aspx?ID=798&Source=http://cwe.ccsds.org/fm/Lists/Projects/AllOpenChartersWithDraftProjects.aspx) for LBDF to SLS AD, for CESG/CMC approval.

## C&S WG status

Presentation of C&S chair reporting the status of WG activities. See [presentation in CWE](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B6B8FD0AA-AB77-4B8B-BF13-255AC108918F%7D&file=CS_status_Spring2024.pptx&action=default&CT=1715008201280&OR=DocLibClassicUI) and Section 5 of this MoM.

# C&S WG Status

This section provides highlights of C&S activities. An executive summary can be found in the [presentation in CWE](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B6B8FD0AA-AB77-4B8B-BF13-255AC108918F%7D&file=CS_status_Spring2024.pptx&action=default&CT=1715008201280&OR=DocLibClassicUI).

## Projects

Currently C&S WG is working on the [following projects](https://cwe.ccsds.org/fm/Lists/Charters/DispForm.aspx?ID=32):

* *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*.*

## 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](https://cwe.ccsds.org/fm/Lists/Projects/DispFormDraft.aspx?ID=798&Source=http://cwe.ccsds.org/fm/Lists/Projects/AllOpenChartersWithDraftProjects.aspx), 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.

## Action Items status

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

# Annex 1: Agenda

**Joint C&S meeting, Wednesday 1st 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 |
|  | | | **TOTAL hours** | **2.0** |  |

**Joint OPT/C&S/SLP meeting, Wednesday 1st 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 |
|  | | | **TOTAL hours** | **1.5** |  |

**Joint SLP/C&S/RFM meeting, Thursday May 2nd, 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:  a. Directives for S-band Lunar ops  b. The link establishment negotiation mechanism  c. Default Hailing Parameters for UHF (Mars) vs S-band (Lunar) | | 30 | N/A |
|  | | | **TOTAL hours** | **1.5** |  |

**Joint C&S/RFM meeting, Thursday May 2nd, 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:   * Project status review * Review of AIs (up to this meeting) * AoB | | 30 | N/A |
|  | | | **TOTAL hours** | **2.0** |  |

**NOTES**:

* input SLS-CS\_24-02 was moved in RFM working group, on Tuesday 30th April.
* Inputs are available on CWE at <https://tinyurl.com/CCSDSSpring2024>   
  (C&S WG private folder, requires login)

# Annex 2: Action Item List

Open action items are listed in the table below.

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

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

Latest version of AI list can be found on CWE (private folder, requires login): <https://tinyurl.com/jyrjpz6a>

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **AI#** | **Action** | **Actionee** | **Due date** | **Status** | **Traceability** |
| **AI\_22\_08** | ~~To implement a SW prototype for the Turbo Channel Interleaver~~ | ~~K. Andrews/NASA~~ | ~~Spring 2024~~ | ~~Closed~~ | Section 1.3 |
| **~~AI\_22\_09~~** | ~~To prepare C&S resolution for AOS max length technical corrigendum, and possibly inject changes as part of TF slicer TM BB randomizer Agency Review~~  ~~Edited between Fall 2022 and Spring 2023: SLS AD recommended as part of TF slicer~~ | ~~A. Modenini/ESA~~ | ~~Spring 2024~~ | ~~Closed~~ | SLS-CS\_24\_03 |
| **~~AI\_23\_07~~** | ~~to perform a SW simulation to see if VIRTUDE results can be replicated when Turbo-Code interleaving is done before pseudo-randomization~~ | ~~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:   * Use of TM codes in Ground-to-space links; * Compatibility with USLP; * 17-cell randomizer; * Turbo channel interleaver; * Transfer frame slicing.   Book captain: J. Quintanilla/ESA | J. Quintanilla/ESA,  A. Modenini/ESA,  N. Maturo/ESA,  K. Andrews/NASA | Spring 2025 | Open |  |
| **~~AI\_23\_09~~** | ~~To review~~ [~~proposed changes to 131.0-B (TM BB)~~](https://cwe.ccsds.org/sls/_layouts/15/WopiFrame.aspx?sourcedoc=%7B268245E7-865E-4BC4-B4F0-9F813DEDF27F%7D&file=SLS-CS_23-14%20and%20SLS-CS_23-15%20-%20update%20of%20131x0%20to%20include%20slicing%20and%20turbo%20chanel%20interleaver.doc&action=default&CT=1698844042951&OR=DocLibClassicUI) ~~and send comments to K. Andrews/NASA and J. Quintanilla/ESA (with CC C&S Chair)~~ | ~~C&S WG~~ | ~~30~~~~th~~ ~~November 2023~~ | ~~Closed~~ | SLS-CS\_24-03 |
| **~~AI\_23\_10~~** | ~~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 SFCG recommendations.~~ | ~~A. Modenini/C&S Chair~~ | ~~30~~~~th~~ ~~November 2023~~ | ~~Closed~~ | SLS-CS\_24-03 |
| **~~AI\_23\_11~~** | ~~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 |
| **AI\_23\_12** | ~~Provide draft ToC for proposed new VCM green book~~ | ~~A. Modenini~~ | ~~December 2023~~ | ~~Closed~~ | SLS-CS\_24-01 |
| **AI\_23\_13** | 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 |  |
| **AI\_23\_14** | ~~Provide draft Orange book on link budget data exchange format~~ | ~~A. Modenini, A. Miraglia~~ | ~~Spring 2024~~ | ~~Closed~~ | SLS-CS\_24-07 |
| **AI\_23\_15** | ~~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 |
| **AI\_23\_16** | ~~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 |
| **AI\_23\_17** | ~~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 |
| **AI\_23\_18** | 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 |  |
| **AI\_23\_19** | ~~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 |
| **AI\_23\_20** | 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 |  |
| **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):   * Note about codeblock (for RS only) under figure 3-1 and 3-3 * Review title of Section 3.3 * Reinstate CADU * 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). | 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 |  |  |
| **AI\_24\_03** | ESA/NASA to:   * cross check results about CLTU termination performance (with tail and idle sequence) for identifying the reason of the discrepancy between the two analyses * in case issue is confirmed, to check if also LDPC(256,512) has same problematic | K. Andrews  R. Giuliani | Fall 2024 |  |  |
| **AI\_24\_04** | ESA/NASA to re-iterate on assumptions about PN mask and Doppler profiles for refining analysis about RF lock for Proximity-1 hailing channel | 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) |  |  |
| **AI\_24\_09** | 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) |  |  |
| **AI\_24\_10** | 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) |  |  |
| **AI\_24\_11** | 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) |  |  |
| **AI\_24\_12** | 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 |  |  |
| **AI\_24\_13** | 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 |  |  |

# 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.

|  |  |
| --- | --- |
| **Name** | **Affiliation** |
| 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 |