Concept Paper for Orange Book – CCSDS Space Link Protocols over ETSI DVB-S2X standard

1. Purpose

The proposed work is to create an Orange Book to start activities related to ETSI DVB-S2X standard (released in 2014), an extension of ETSI DVB-S2 standard. The Orange Book will consequently include all the features of CCSDS 131.3-B regarding DVB-S2.

The work will consist in:

- Defining an interface to CCSDS TM and AOS data link protocol to work with the ETSI DVB-S2X standard, and DVB-S2X options suited to High Data Rate Telemetry (HDRT),
- Performing measurements through software simulations and hardware equipment tests.
- Editing, reviewing and releasing the Orange Book.

2. Key Technical Features

Material to be included in the Orange Book:

- The CCSDS 131.3-B document
- An option to use new DVB-S2X modulation and coding schemes (MODCOD) with very high spectral efficiencies together with the corresponding interface with CCSDS TM and AOS Space Data Link Protocols
- An option to use the DVB-S2 and DVB-S2X "time-slicing" mode to be compatible with very low cost and very high data rate mass market telecom receivers (see SLS-CS_17-06)
- Some annexes summarizing the activities results.

It is worth noting that the Very-Low Signal-to-Noise Ratio mode of the DVB-S2X standard and the Super-Framing Structure of the DVB-S2X standard will not be proposed in the CCSDS standard. In other words, the proposed standard will only address HDRT scenarios and not Deep-Space ones.

3. Benefits

Additional MODCOD will allow increasing the spectral efficiency from 4.45 bits/channel symbol when using the DVB-S2 standard to 5.9 bits/channel symbol when using the DVB-S2X standard. Moreover, the new DVB-S2X MODCODs will be more power efficient than those from DVB-S2 with similar spectral efficiencies. Finally, DVB-S2X will allow smaller rolloffs (0.05 instead of 0.2) and thus an additional increase of spectral efficiency equal to 12.5%.

The "time-slicing" option (see SLS-CS_17-06) will allow using receivers working with many parallel low cost ASIC from the telecom mass market. It will allow decreasing the cost of HDRT receivers, even for very high data rates (500 Msps).

4. Requirements of prospective missions

Additional MODCODs will allow saving bandwidth or saving on-board power or increasing missions downloading throughput. In particular, new very highly spectrally efficient MODCODs will be useful for very high dynamic link budgets such as in EESS Ka-band.

DVB-S2X can be used for both X and Ka-bands.

JAXA has started the research to apply the DVB-S2X for post ALOS-3/-4 Earth observation projects.

The “time-slicing” option will allow decreasing ground receiver costs. This feature is of particular interest for low-cost projects such as CNES CO3D Earth observation project (CO3D = optical constellation for 3D imagery, on-going phase A).

ANNEX 1 – Consistency with charter

The DVB-S2 blue book is in the C&S working group charter. The DVB-S2X orange book could be a natural extension of the DVB-S2 Blue Book.

As stated in the C&S working group charter: “the wide range of environment (space-Earth or space-space, near Earth congested bands and deep space link operations in extreme conditions of SNR, links dependent of atmospheric conditions in the new high frequency bands, optical links) requires coding systems with different levels of power efficiency and bandwidth efficiency”. DVB-S2X will allow extending the range of SNR with respect to DVB-S2.

ANNEX 2 – Proposed CWE Projects

Title: Orange Book – CCSDS Space Link Protocols over ETSI DVB-S2X standard

Document Number: TBD

Document Type: Orange Book

Description of Document: Orange Book to start activities related to ETSI DVB-S2X standard (released in 2014) in order to prepare a possible introduction in the CCSDS 131.3-B.

Applicable Patents: Similar to DVB-S2 (TBC).

Patents Comments: Currently under investigation at ETSI level, up to now no new patent identified for DVB-S2X with respect to DVB-S2.

Book Editor (estimated resources + Agency Volunteering): Total resources: 4 work-months, shared between CNES and JAXA. Nominal time from other Working Group members to review the document. Lead editors: CNES and JAXA.

Prototyping: Compatibility and performance tests to be performed between JAXA and CNES possibly using off-the shelf (telecoms) equipment

Expected Contributing Agencies: CNES, JAXA.

Schedule

November 2017 – June 2019

Total time to complete: 18 months

Schedule Milestones	**Forecast**	**Comments**
Project Approved	January 2018	
Internal WG Review		
First draft circulated to WG	February 2018	
First draft comments due	April 2018	For Spring 18 Meeting
Tests results presentation	Fall 2018	
Second draft circulated to WG	February/March 2019	
Second draft comments due	March/April 2019	For Spring 19 Meeting
Final document proposed to the area director	June 2019	
Secretariat Document Processing	September 2019	
Publication	December 2019	Approved by CMC Poll