



CCSDS

The Consultative Committee for Space Data Systems

Recommendation for Space Data System Standards

CROSS SUPPORT SERVICE MANAGEMENT— SIMPLE SCHEDULE FORMAT SPECIFICATION

RECOMMENDED STANDARD

CCSDS 902.1-B-1

Note:
This current
issue includes
all updates through
Technical Corrigendum 1,
dated December 2021

BLUE BOOK

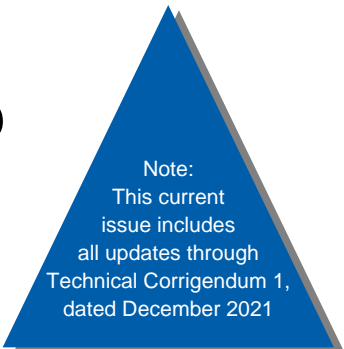
May 2018

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- Space and Upper Atmosphere Research Commission (SUPARCO)/Pakistan.
- Swedish Space Corporation (SSC)/Sweden.
- Swiss Space Office (SSO)/Switzerland.
- United States Geological Survey (USGS)/USA.

DOCUMENT CONTROL

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CCSDS 902.1-B-1	Cross Support Service Management—Simple Schedule Format Specification, Recommended Standard, Issue 1	May 2018	Original issue
CCSDS 902.1-B-1 Cor. 1	Technical Corrigendum 1	December 2021	– updates frequency band definitions for consistency with reference [8], Cor. 1; – makes changes for consistency with later CCSDS Service Management Recommended Standards.

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1 INTRODUCTION

1.1 PURPOSE AND SCOPE

1.1.1 PURPOSE

This Simple Schedule Format Recommended Standard specifies a standard format for use in transferring scheduling information related to apertures at ground stations and/or relay satellites between space agencies and commercial or governmental spacecraft operators. Such exchanges are used in:

- a) mission design, e.g., in investigating the feasibility of a mission with respect to its uplink/downlink requirements and the availability of suitable apertures;
- b) mission planning, e.g., to ensure that there are sufficient aperture resources available to carry out the planned operations;
- c) mission operations, e.g., to
 - 1) inform the spacecraft operator of the actual allocation of apertures to their mission;
 - 2) inform the spacecraft operator of any unused times of the apertures;
 - 3) return the results of a query about apertures.

1.1.2 SCOPE

The scope of this Recommended Standard is limited to the exchange of Simple Schedule information. The contents of the simple schedule format described here were derived from the analysis of the standard schedule formats used by a number of space agencies/parts of space agencies. This analysis led to the identification of a 'core' content that was (almost) universally present in all schedules analyzed. It was, however, also identified that there was a need to permit some extension to the core content to cover some use cases. Consequently an extension mechanism has been provided that can be used to add further information in the eventuality that the core content is insufficient for the required purpose.

Definition of the extended content for any specific case is outside the scope of this Recommended Standard and should be specified in an Interface Control Document (ICD) agreed upon among the involved parties.

While this Recommended Standard has been developed within the scope of the Space Communication Cross Support Service Management (SCCS SM) (references [E1] and [E2]) activity, it is intended that the Simple Schedule Format can be used to exchange schedule information where no other use of SCCS SM is made. In view of this, schedule data that is only of relevance when used in the scope of SCCS SM has been made optional. Thus there is no limiting dependency on Service Management in the Simple Schedule Format specification.

Figure 1-1 puts the Simple Schedule Format Specification into context with the various standards that together form the Space Communication Cross Support Service Management.

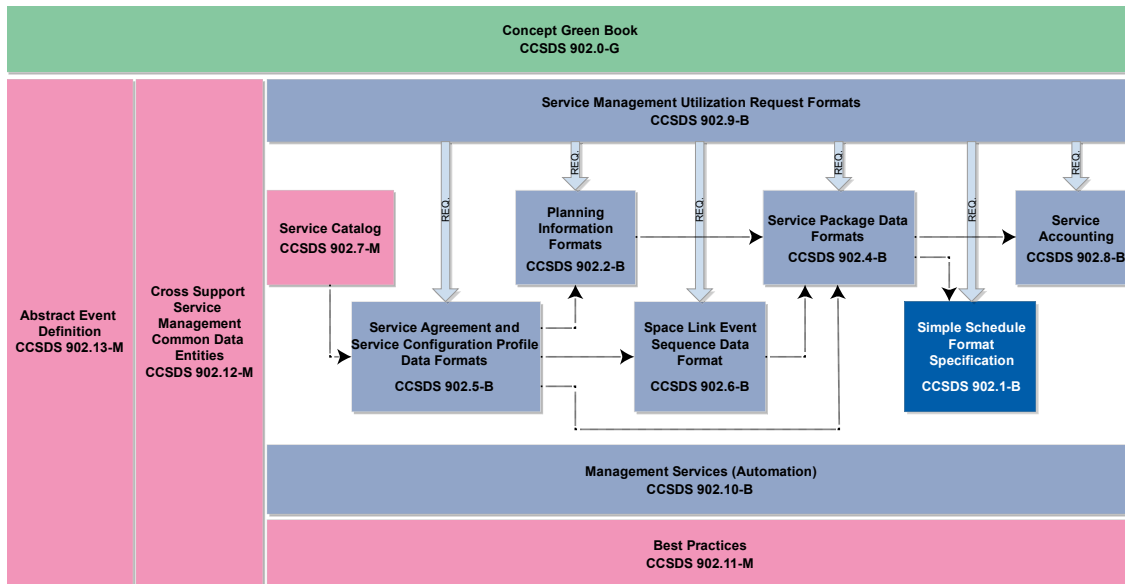


Figure 1-1: Simple Schedule Format in the Context of Space Communication Cross Support Service Management

1.2 APPLICABILITY

This Recommended Standard is applicable only to the schedule format and content, but not to its transmission. With respect to the transmission of the Simple Schedule between agencies and operators there are two scenarios:

- a) The first involves exchange of the Simple Schedule within the context of SCCS SM.
- b) The second involves exchange of the Simple Schedule outside the scope of SCCS SM. Here the mechanism by which the Simple Schedule is transmitted is outside of the scope of this document and should be specified in an ICD agreed by the parties involved.

1.3 RATIONALE

1.3.1 GENERAL

The primary goal of CCSDS is to increase the level of interoperability among agencies. This Recommended Standard furthers that goal by establishing the means to exchange schedule information where most cross support activity occurs: between the tracking stations or ground data handling systems of various agencies and the mission-specific components of a mission ground system.

The use cases described in the following subsections were considered in deriving this Recommended Standard.

1.3.2 USE CASES

1.3.2.1 Mission Design

During the design phase of a mission it is often desirable to be able to obtain some idea of aperture availability so that the feasibility of obtaining the required uplink and downlink bandwidth can be assessed. Typically, during the mission design phase, the information required relates to periods several years in the future. Currently there is no standardized way for obtaining this information from different agencies.

While this Recommended Standard does not address the mechanism by which the required schedule information can be requested (this possibly being covered in the negotiations involved in establishing the service agreement), it provides a standard format in which the possible availability of apertures can be returned.

1.3.2.2 Mission Planning

In the mission planning use case the provider agency provides the user agency with a schedule that gives the user agency the information it requires to plan its spacecraft operations with respect to the availability of uplink/downlink resources. The means by which the provider agency determines the availability for the user agency can be either:

- a) derived from a request from the user agency;

NOTE – The contents and format of such a request are outside the scope of this Recommended Standard (although this may be addressed elsewhere in the SCCS SM Recommended Standard at a later date).

- b) derived from what is specified in the service agreement between the agencies.

The planning process will typically go through a number of cycles, starting months before the actual activities are expected to take place and being finalized a few days before execution. During these planning cycles the status of the schedule can change with the initial exchanges being of a 'provisional' schedule that is likely to change. The final schedule provided is typically considered as 'operational' and can be expected to provide the actual schedule that will be executed, subject to unexpected events such as equipment failure or spacecraft emergencies.

1.3.2.3 Dissemination of Provider Cross Support Service System (CSSS)¹ Schedules

It is desirable that a standardized approach be available for disseminating Provider CSSS schedules, both between agencies and also within agencies. This Recommended Standard aims to provide that. There are, however, differences in policies between agencies with regard to the contents of distributed schedules. Some agencies provide complete schedules to

¹ A Provider Cross Support Service System is often colloquially referred to as a Network.

all users, containing information regarding all spacecraft supported by the agency (and possibly unallocated time as well). At the other extreme, other agencies provide only details regarding a spacecraft's allocation to the operators of that mission.

In view of this, this Recommended Standard has been designed to be flexible enough to be able to cope with the different policies of the various agencies with respect to the information they wish to provide in disseminating their schedules.

1.3.2.4 Dissemination of Unallocated Time Schedules

Some agencies publish a list of unallocated time of the apertures in their network. This information can be used by missions to see if it is possible to request additional coverage by using resources during periods when they would otherwise be unused.

Although not addressing the method by which the usage of unallocated resources can be requested, this Recommended Standard can be used to publish a Provider CSSS unallocated time schedule. It can also be used to inform a mission of the result of a request to use an unallocated resource.

1.3.2.5 Response to Schedule Query

The final use case of the Simple Schedule Format is to return schedule information resulting from a query about resource availability. While the contents and format of such a query are outside the scope of this Recommended Standard, the Simple Schedule Format provides a standard mechanism by which the information can be returned to the requestor. The ability to submit queries and the contents of these will depend on the capabilities and policies of the agency, but, for example, providing the agencies policy permits, it could be used by a mission to find unallocated aperture times which they could then request the use of.

1.4 DOCUMENT STRUCTURE

This document is organized as follows:

- a) Section 1 provides the purpose, scope, applicability, and rationale of this Recommended Standard and identifies the conventions and references used throughout the document. This section also describes how this document is organized. A brief description is provided for each section and annex so that the reader will have an idea of where information can be found in the document. It also identifies terminology that is used in this document but is defined elsewhere.
- b) Section 2 provides a brief overview of the CCSDS-recommended Simple Schedule Format.

- c) Section 3 provides details about the structure and content of the Simple Schedule Format.
- d) Annex A provides the normative Implementation Conformance Statement (ICS) proforma.
- e) Annex B discusses security, SANA, and patent considerations.
- f) Annex C provides an informative listing of the normative XML schema that realizes the classes that comprise the Simple Schedule Format.
- g) Annex D contains a list of abbreviations applicable to the Simple Schedule Format.
- h) Annex E is a list of informative references.

1.5 DEFINITIONS

For the purposes of this document, the following definitions apply:

agency: A space agency.

NOTE – The word ‘agencies’ may also be construed as meaning ‘satellite operators’ or ‘satellite service providers’;

n/a: Not applicable.

1.6 NOMENCLATURE

1.6.1 NORMATIVE TEXT

The following conventions apply for the normative specifications in this Recommended Standard:

- a) the words ‘shall’ and ‘must’ imply a binding and verifiable specification;
- b) the word ‘should’ implies an optional, but desirable, specification;
- c) the word ‘may’ implies an optional specification;
- d) the words ‘is’, ‘are’, and ‘will’ imply statements of fact.

NOTE – These conventions do not imply constraints on diction in text that is clearly informative in nature.

1.6.2 INFORMATIVE TEXT

In the normative sections of this document, informative text is set off from the normative specifications either in notes or under one of the following subsection headings:

- Overview;
- Background;
- Rationale;
- Discussion.

1.7 CONVENTIONS—THE UNIFIED MODELING LANGUAGE

The Unified Modeling Language (UML) diagrams used in the specification (including class diagrams, package diagrams, sequence diagrams, and activity diagrams) follow the notation, semantics, and conventions imposed by the Version 2.4.1 UML specification of the Object Management Group (OMG) (reference [4]). An overview of UML diagramming conventions can be found in annex E of reference [1].

Within the document use is made only of class diagrams. A UML class diagram describes the structure of a message, its parts, and how those parts interrelate. A UML class, represented in the diagram as a box, represents a data set. Class diagram conventions include composition, generalization, multiplicity, and constraints. Enumeration notation is also used but only when it is involved in a composition constraint.

1.8 REFERENCES

The following publications contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All publications are subject to revision, and users of this document are encouraged to investigate the possibility of applying the most recent editions of the publications indicated below. The CCSDS Secretariat maintains a register of currently valid CCSDS publications.

- [1] *Space Communication Cross Support—Service Management—Service Specification*. Issue 1-S. Recommendation for Space Data System Standards (Historical), CCSDS 910.11-B-1-S. Washington, D.C.: CCSDS, (August 2009) June 2017.
- [2] “CCSDS-910.11-B-1_XML_schemas.”
http://public.ccsds.org/publications/archive/CCSDS-910.11-B-1_XML_schemas.zip.
- [3] *Time Code Formats*. Issue 4. Recommendation for Space Data System Standards (Blue Book), CCSDS 301.0-B-4. Washington, D.C.: CCSDS, November 2010.
- [4] *Unified Modeling Language (UML)*. Version 2.4.1. Needham, Massachusetts: Object Management Group, August 2011.

- [5] *CCSDS SANA Registry Management Policy*. Issue 1. CCSDS Record (Yellow Book), CCSDS 313.1-Y-1. Washington, D.C.: CCSDS, May 2016.
- [6] *Space Assigned Numbers Authority (SANA)—Role, Responsibilities, Policies, and Procedures*. Issue 2. CCSDS Record (Yellow Book), CCSDS 313.0-Y-2. Washington, D.C.: CCSDS, May 2016.
- Cor. 1 [7] *Cross Support Service Management—Common Data Entities*. Issue 1. Recommendation for Space Data System Practices (Magenta Book), CCSDS 902.12-M-1. Washington, D.C.: CCSDS, February 2021.
- [8] *CCSDS Spacecraft Identification Field Code Assignment Control Procedures*. Issue 7. Recommendation for Space Data System Practices (Magenta Book), CCSDS 320.0-M-7. Washington, D.C.: CCSDS, November 2017.
- Cor. 1 [9] *Abstract Event Definition*. Issue 1. Recommendation for Space Data System Practices (Magenta Book), CCSDS 902.13-M-1. Washington, D.C.: CCSDS, February 2021.

2 OVERVIEW

2.1 GENERAL

This section provides a high-level overview of the CCSDS-recommended Simple Schedule Format, which is designed to facilitate standardized exchanges of aperture schedule information between space agencies.

2.2 SIMPLE SCHEDULE

A Simple Schedule file is XML formatted. The format of the Simple Schedule file is suitable for automated interaction and/or (by means of a suitable XML viewer) human interaction.

Data in the Simple Schedule is either mandatory, in which case suitable values must be present, or optional, in which case values may be present or not. In addition it is possible to extend the contents of the Simple Schedule by defining additional parameters. The content of any additional parameters so defined is outside the scope of this document and should be documented in an ICD agreed upon by the involved parties.

2.3 MAPPING TO W3C XML SCHEMA

This Recommended Standard includes the specification of a mapping to World Wide Web Consortium (W3C) extensible Markup Language (XML) schema. The normative mapping of this Recommended Standard to XML W3C schemas is a virtual annex to this Recommended Standard and is contained in a stand-alone set of schema files (reference [2]).

NOTE – The XML schema has been elaborated on the basis of the mapping guidelines described in reference [E1].

3 SIMPLE SCHEDULE

3.1 GENERAL

The Simple Schedule shall consist of digital data exchanged in the form of a file containing an XML instance document.

NOTE – Annex subsection C2 identifies the files that contain the normative Simple Schedule XML schemas. The naming conventions for the files containing the Simple Schedule XML instance documents are outside of the scope of this recommended standard.

3.2 SIMPLE SCHEDULE CONTENT/STRUCTURE

3.2.1 OVERVIEW

Figure 3-1 shows the UML Class diagram for the Simple Schedule. For clarity, *abstract* classes are highlighted in green.

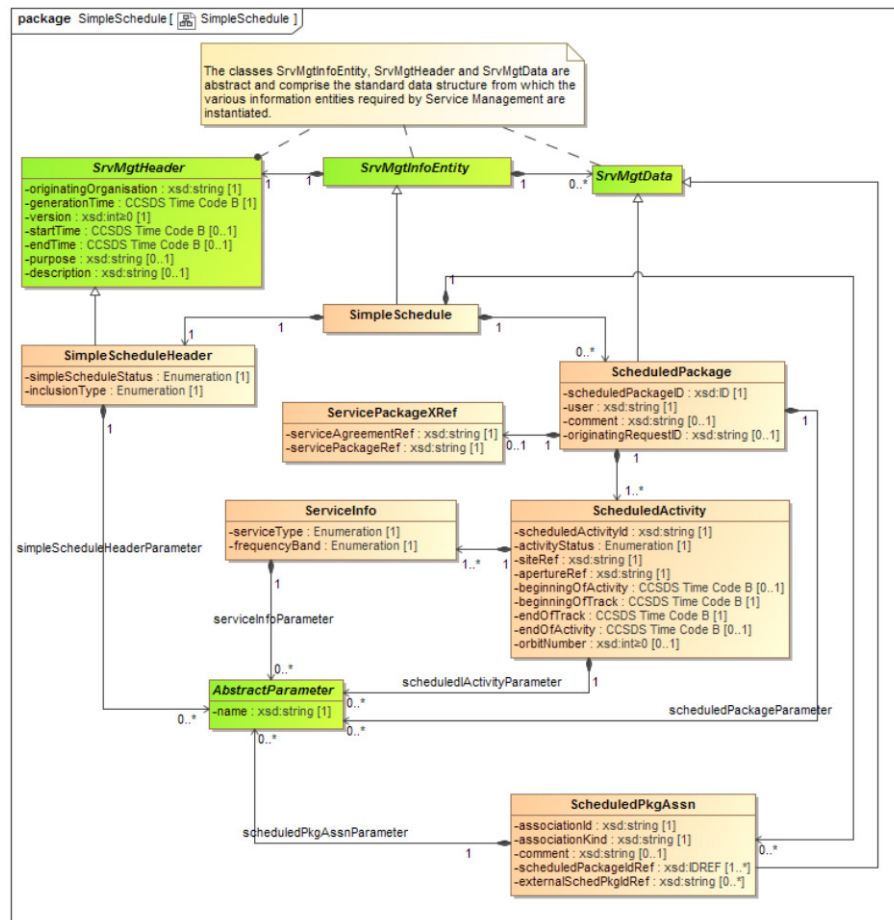


Figure 3-1: Simple Schedule Class Diagram

The attributes of each class are described further in the following subsections and tables.

NOTES

- 1 In the following tables, data types specified as ‘xsd:nnn’ are XML schema types. Thus, for example, ‘xsd:string’ indicates that the type is an XML schema string.
- 2 In general the length of strings in this Recommended Standard is unbounded; i.e., no length is specified (in practice there is obviously the constraint of the maximum string length supported). However, in a number of cases, in the various SANA registries used, a length for string values is specified. For these cases the effective restriction on string length is the value specified in the SANA registry definition.

3.2.2 CLASS SimpleSchedule

3.2.2.1 The SimpleSchedule class is mandatory and shall constitute the Simple Schedule information entity.

NOTE – The SimpleSchedule class is a specialization of class SrvMgtInfoEntity described in reference [7], and the generic description of the parameters is given in there.

3.2.2.2 The use of the parameters in the SrvMgtInfoEntity in the scope of the Simple Schedule shall be as specified in table 3-1.

Table 3-1: Class SimpleSchedule Parameters

Parameter	Description	Data Type	Data Units
Not applicable.	(See reference [7], subsection 3.1.2)		

3.2.3 CLASS SimpleScheduleHeader

3.2.3.1 The SimpleScheduleHeader class is mandatory and shall constitute the ‘header’ of the Simple Schedule.

NOTE – The SimpleScheduleHeader class is a specialization of class SrvMgtHeader described in reference [7], and the generic description of the parameters is given there.

3.2.3.2 Each instance of the SimpleScheduleHeader class may have zero or more instances of parameter classes derived from the abstract AbstractParameter class described in reference [7]. Usage of any additional parameters so specified is not within the scope of this document and should be specified in an ICD between by the relevant parties.

3.2.3.3 The SimpleScheduleHeader class, in addition to the parameters in the abstract SrvMgtHeader class, described in reference [7], shall contain parameters as specified in table 3-2.

3.2.3.4 The parameter `inclusionType` of the SimpleScheduleHeader shall be used to specify the type of inclusion rule that has been used to select the ScheduledPackages (see 3.2.4) that are contained in the schedule.

3.2.3.5 Two types of inclusion rules are supported and are discussed below; the following shall apply to both types:

- a) The start time of a ScheduledPackage (t_{ssp}) is defined to be the earliest `beginningOfActivity` or `beginningOfTrack` time of any ScheduledActivity (see 3.2.7) contained within that ScheduledPackage.
- b) The end time of a ScheduledPackage (t_{esp}) is defined to be the latest `endOfActivity` or `endOfTrack` time of any ScheduledActivity contained within that ScheduledPackage.

3.2.3.6 In the case of inclusion type OVERLAP_INCLUSION where the `startTime` and `endTime` specified in the SimpleScheduleHeader are respectively T_s and T_e , ScheduledPackages shall be included in the schedule where:

$$t_{esp} > T_s \text{ and } t_{ssp} < T_e$$

3.2.3.7 In the case of inclusion type START_INCLUSION, in the event that one or more ScheduledPackage are associated via a ScheduledPkgAssn (see 3.2.5), the start time of the associated ScheduledPackages (t_{sasp}) is defined to be the earliest ScheduledPackage time (t_{ssp}) of the associated ScheduledPackages; thus where the `startTime` and `endTime` specified in the SimpleScheduleHeader are respectively T_s and T_e , ScheduledPackages shall be included in the schedule where:

$$t_{ssp} \geq T_s \text{ and } t_{ssp} < T_e \text{ (ScheduledPackage is not associated with other ScheduledPackages)}$$

or

$$t_{sasp} \geq T_s \text{ and } t_{sasp} < T_e \text{ (ScheduledPackage associated with other ScheduledPackages).}$$

NOTES

- 1 It is implicit in the above definition of the inclusion type START_INCLUSION that if the criteria $t_{sasp} \geq T_s$ and $t_{sasp} < T_e$ are satisfied for a set of associated ScheduledPackages then all of the associated ScheduledPackages will appear in the schedule even though individual ServicePackages in the association may not satisfy the $t_{ssp} \geq T_s$ and $t_{ssp} < T_e$ criteria.
- 2 Similarly, if the criteria $t_{sasp} \geq T_s$ and $t_{sasp} < T_e$ is not satisfied for a set of associated ScheduledPackages, then none of the associated ScheduledPackages will appear in the schedule even though individual ServicePackages in the association may satisfy the $t_{ssp} \geq T_s$ and $t_{ssp} < T_e$ criteria.

Table 3-2: Class SimpleScheduleHeader Parameters

Parameter	Description	Data Type	Data Units
simpleSchedules tatus	The status of the information entity.	Enumeration The permitted values are: – TEST—The schedule has been generated for test purposes only. – PROVISIONAL—The schedule contained is provisional and may still be subject to change. – OPERATIONAL—This is an operational schedule. – OTHER—This message has been generated for other purposes. In this case the optional parameter purpose can be used to further specify the purpose of the message.	n/a
inclusionType	The inclusion type rule that has been applied to the contained simple schedule.	Enumeration The permitted values are – OVERLAP_INCLUSION (see 3.2.3.6 for a description). – START_INCLUSION (see 3.2.3.7 for a description).	n/a

NOTE – In the context of the SimpleScheduleHeader class the usage of the SrvMgtHeader parameters in table 3-3 (as described in reference [7]) should be noted.

Table 3-3: Class SimpleScheduleHeader Use of Class SrvMgtHeader Parameters

Parameter	Description	Data Type	Data Units
startTime	Mandatory parameter for the Simple Schedule. The start time of the simple schedule contained.	CCSDS ASCII Time Code B (reference [3])	UTC
endTime	Mandatory parameter for the Simple Schedule. The end time of the simple schedule contained.	CCSDS ASCII Time Code B (reference [3])	UTC

NOTE – Permitted combinations of parameters SimpleScheduleHeader—status, ScheduledPackage—user, ServiceInfo—serviceType, and ScheduledActivity—activityStatus are specified in 3.3.

3.2.4 CLASS ScheduledPackage

3.2.4.1 The ScheduledPackage class is optional and may be used to specify the information for service packages that have been scheduled in the time interval bounded by the SimpleSchedule parameters startTime and endTime.

NOTE – The ScheduledPackage class is a specialization of class SrvMgtData described in reference [7]. The abstract SrvMgtData class contains zero parameters.

3.2.4.2 There shall be zero or more instances of the ScheduledPackage class for each instance of the SimpleSchedule class.

3.2.4.3 There shall be one or more instances of the ScheduledActivityClass for each instance of the ScheduledPackage Class.

3.2.4.4 There shall be zero or one instances of the ServicePackageXRef class for each instance of the ScheduledPackage Class.

3.2.4.5 Each instance of the ScheduledPackage class may have zero or more instances of parameter classes derived from the abstract AbstractParameter class described in reference [7]. Usage of any additional parameters so specified is not within the scope of this document and should be specified in an ICD between the relevant parties.

3.2.4.6 The ScheduledPackage class shall extend the SrvMgtData class with the parameters specified in table 3-6.

3.2.4.7 The scheduledPackageID must be unique for every scheduled package in a schedule.

3.2.4.8 The user shall be one of

- a) a spacecraft (the typical case);

- b) PROVIDER-CSSS (indicating that the time is allocated to the Provider CSSS for tests, maintenance, upgrades, etc.); or
- c) UNALLOCATED (indicating that the aperture is unallocated during the specified time range).

NOTE – The case for zero instances of the ScheduledPackage is where a Simple Schedule has been returned as a result of a query. In this case it is possible that no ScheduledPackages are scheduled in the time range specified. As noted in 1.3.2.5 the contents and format of such a query are outside the scope of this Recommended Standard.

Table 3-4: Class ScheduledPackage Parameters

Parameter	Description	Data Type	Data Units
scheduledPackageId	An identifier that is unique for every ScheduledPackage in a schedule. NOTE – If a schedule is regenerated, then the scheduledPackageID for a particular Scheduled Package may change.	xsd:ID	n/a
user	The user of the scheduled package. This will typically be a spacecraft name, as specified in SANA, but may also be 'PROVIDER-CSSS' and 'UNALLOCATED', with the meanings indicated in the adjacent column.	xsd:string Permitted values are registered in SANA (see B2.3 for further information). The following strings are also permitted values with the meaning indicated: – UNALLOCATED—The time is unallocated. – PROVIDER-CSSS—The time is allocated to the Provider CSSS (e.g., for tests, maintenance, upgrades, etc.).	n/a
comment	Optional parameter: may be used for the provision of ad-hoc information.	xsd:string Exact use of this may be specified in an ICD between relevant parties.	n/a
originatingRequestID	Optional parameter: if present must echo the identifier from the request that caused the scheduled package to be generated.	xsd:string	n/a

3.2.4.9 The `xsd:ID` type is used for an attribute that uniquely identifies an element in an XML document. An `xsd:ID` value must be an `NCName`. This means that it must start with a letter or underscore, and can only contain letters, digits, underscores, hyphens, and periods. `xsd:ID` carries several additional constraints:

- a) Their values must be unique within an XML instance, regardless of the attribute's name or its element name.
- b) A complex type cannot include more than one attribute of type `xsd:ID`, or any type derived from `xsd:ID`.
- c) `xsd:ID` attributes cannot have default or fixed values specified.

NOTE – Permitted combinations of parameters `SimpleScheduleHeader—status`, `ScheduledPackage—user`, `ServiceInfo—serviceType`, and `ScheduledActivity—activityStatus` are specified in 3.3.

3.2.5 CLASS ScheduledPkgAssn

3.2.5.1 The `ScheduledPkgAssn` class is optional and may be used to specify associations between scheduled packages.

NOTES

- 1 This may be useful in the case where there may be dependencies between scheduled packages on two or more antennas (e.g., Delta-Differential One-way Range [Delta-DOR] measurements), or where there are two or more spacecraft using the same aperture at the same time (Multiple Spacecraft per Aperture [MSPA]).
- 2 The `ScheduledPkgAssn` class is a specialization of class `SrvMgtData` described in reference [7]. The abstract `SrvMgtData` class contains zero parameters.

3.2.5.2 There shall be zero or more instances of the `ScheduledPkgAssn` class for each instance of the `SimpleSchedule` class.

3.2.5.3 Each instance of the `ScheduledPkgAssn` class may have zero or more instances of parameter classes derived from the abstract `AbstractParameter` class described in reference [7]. Usage of any additional parameters so specified is not within the scope of this document and should be specified in an ICD between the relevant parties.

3.2.5.4 The `ScheduledPkgAssn` class shall extend the `SrvMgtData` class with the parameters specified in table 3-5.

Table 3-5: Class ScheduledPkgAssn Parameters

Parameter	Description	Data Type	Data Units
associationId	An identifier that uniquely identifies the association. This is assigned by the Provider CSSS. It should be noted that if a schedule is regenerated then the associationId for a particular scheduled package association may change	xsd:string	n/a
associationKind	The type of the association.	xsd:string Permitted values are registered in SANA (see B2.5 for further information).	n/a
comment	Optional parameter: may be used for the provision of ad hoc information.	xsd:string Exact use of this may be specified in an ICD between relevant parties.	n/a
scheduledPackageIdRef	A list of the scheduledPackageIds (see table 3-4) of the scheduled packages that are associated.	Array of xsd:IDREF	n/a
externalSchedPkgIdRef	Optional parameter: may be used to indicate association to scheduled packages that are not contained in the current file.	Array of xsd:string	n/a

3.2.5.5 The xsd:IDREF type shall be used for an attribute that references an ID:

- a) all attributes of type xsd:IDREF must reference an xsd:ID in the same XML document;
- b) as with ID, an xsd:IDREF value must be an NCName.

3.2.5.6 For a ScheduledPkgAssn to be valid it must refer to a least one scheduled package that is in the same xml document (file).

3.2.5.7 If it is required in a ScheduledPkgAssn to refer to scheduled packages that are not contained in the same xml document (e.g., not contained in the time range covered by the simple schedule contained in the file or, in the case for Delta-DOR, for example, from another Provider CSSS), then the appropriate reference(s) shall be placed in the externalSchedPkgIdRef parameter.

3.2.6 CLASS ServicePackageXRef

3.2.6.1 The ServicePackageXRef class is optional and may be used to map the contents of the Simple Schedule to the appropriate SCCS SM service packages.

3.2.6.2 There shall be zero or one instance of the ServicePackageXRef class for each instance of the ScheduledPackage class.

3.2.6.3 The ServicePackageXRef class shall include the parameters specified in table 3-6.

NOTE – The contents of the ServicePackageXRef class are relevant only when the Simple Schedule is used in the context of SCCS SM.

Table 3-6: Class ServicePackageXRef Parameters

Parameter	Description	Data Type	Data Units
serviceAgreementRef	The Service Agreement (as per CCSDS 910.11-B-1, reference [1]; see also reference [E2] for additional information) to which the following servicePackageRef applies.	xsd:string	n/a
servicePackageRef	Cross-reference to the service package (as per CCSDS 910.11-B-1, reference [1]; see also reference [E2] for additional information), where the aperture allocation is contained in the event that the aperture allocation was obtained via SCCS SM. NOTE – Several ScheduledActivity instances may have the same servicePackageRef since one service package can contain a number of aperture allocations.	xsd:string	n/a

3.2.7 CLASS ScheduledActivity

3.2.7.1 The ScheduledActivity class shall contain the details of the scheduled activity and shall include parameters specified in table 3-7.

3.2.7.2 The ScheduledActivity class shall include two time windows,

- a) the interval within which the aperture is allocated (optional);
- b) the interval within the first window within which the spacecraft is actually being tracked by the aperture.

3.2.7.3 There shall be at least one instance of the ScheduledActivity class for each instance of the ScheduledPackage class.

3.2.7.4 There shall be one or more instances of the ServiceInfo class for each instance of the ScheduledActivity Class.

3.2.7.5 Each instance of the ScheduledActivity class may have zero or more instances of parameter classes derived from the abstract AbstractParameter class described in reference [7]. Usage of any additional parameters so specified is not within the scope of this document and should be specified in an ICD between by the relevant parties.

Table 3-7: Class ScheduledActivity Parameters

Parameter	Description	Data Type	Data Units
scheduledActivityID	Identifier that is unique for every ScheduledActivity in a schedule. It should be noted that if a schedule is regenerated then the scheduledActivityID for a particular Scheduled Activity may change.	xsd:string	n/a
activityStatus	Used to indicate how firm the commitment to the activity is.	Enumeration The permitted values are: <ul style="list-style-type: none"> – COMMITTED—barring unforeseen circumstances the activity will be supported. – TENTATIVE—the activity is currently scheduled but may still be subject to change. In addition to the above, one of the following two values must be used when the ScheduledPackage—user parameter is UNALLOCATED and the ServiceInfo—serviceType is UNUSED. <ul style="list-style-type: none"> – AVAILABLE indicates that the aperture could be scheduled during the UNUSED time. – UNAVAILABLE indicates that the aperture is completely unavailable during the UNUSED time. 	n/a
siteRef	The site to which the scheduled activity applies.	xsd:string Permitted values are registered in SANA (see B2.4 for further information).	n/a

Parameter	Description	Data Type	Data Units
apertureRef	Identifier specifying which aperture is to be used. The apertureRef must uniquely identify the aperture at a particular site (i.e., ground station/ relay satellite) that is to be used.	xsd:string Permitted values are registered in SANA (see B2.4 for further information).	n/a
beginningOfActivity	Optional parameter: must be present if endOfActivity parameter is present. Time at which the allocation of the site/aperture starts. This is assumed to allow for all necessary setup activities, etc. Where available this time should be supplied subject to agency policy. If it is not possible to specify the actual value this parameter shall be omitted.	CCSDS ASCII Time Code B (reference [3])	UTC
beginningOfTrack	Time at which tracking the spacecraft is scheduled to start.	CCSDS ASCII Time Code B (reference [3])	UTC
endOfTrack	Time at which tracking the spacecraft is scheduled to end.	CCSDS ASCII Time Code B (reference [3])	UTC
endOfActivity	Optional parameter: must be present if beginningOfActivity parameter is present. Time at which the allocation of the site/aperture ends. This is assumed to allow for all necessary teardown activities, etc. Where available this time should be supplied subject to agency policy. If it is not possible to specify the actual value this parameter shall be omitted.	CCSDS ASCII Time Code B (reference [3])	UTC
orbitNumber	Optional parameter. The Orbit Number on which the beginningOfTrack occurs. If this is not relevant (e.g., deep space missions) or not available, this parameter shall be omitted.	xsd:integer≥0	n/a

NOTE – Permitted combinations of parameters SimpleScheduleHeader—status, ScheduledPackage—user, ServiceInfo—serviceType, and ScheduledActivity—activityStatus are specified in 3.3.

3.2.8 CLASS ServiceInfo

3.2.8.1 The ServiceInfo class shall be used to provide information about the type of operations to be carried out during a pass.

3.2.8.2 The ServiceInfo class shall use the parameters specified in table 3-8 to specify the type of service and frequency band to be used.

3.2.8.3 There shall be at least one instance of the ServiceInfo class for each instance of the ScheduledActivity class.

NOTE – Multiple instances of the ServiceInfo Class are required where more than one service is provided during a pass; e.g.,

- a) Telemetry and telecommanding services are provided;
- b) Telemetry is downlinked on both X- and S-band simultaneously.

3.2.8.4 Each instance of the ServiceInfo class may have zero or more instances of parameter classes derived from the abstract AbstractParameter class described in reference [7]. Usage of any additional parameters so specified is not within the scope of this document and should be specified in an ICD between by the relevant parties.

Table 3-8: Class ServiceInfo Parameters

Parameter	Description	Data Type	Data Units
serviceType	<p>The type of service that will be carried out during an activity.</p> <p>It should be noted that:</p> <ul style="list-style-type: none"> – APA-AZ/EL indicates Antenna Pointing Angles, Azimuth/Elevation; – APA-X/Y indicates Antenna Pointing Angles, X/Y; – VLBI indicates Very-Long-Baseline Interferometry. 	<p>Enumeration</p> <p>The permitted values are:</p> <ul style="list-style-type: none"> – APA-AZ/EL – APA-X/Y – DELTADOR – DOPPLER – OFFLINE-TM-RECORDING – OFFLINE-TM-PROVISION – RF-ONLY – RANGING – RESERVED – TBD – TELECOMMAND – TELEMETRY – TEST – UNUSED – VLBI 	n/a
frequencyBand	<p>The frequency band that will be used by the service. (See table 2-1 in reference [8] for a definition of the frequencies each band refers to.) If the frequency band is not relevant the value N/A (not applicable) shall be used. If the frequency band to be used is not defined in table 2-1 in reference [8] then the value OTHER shall be used. For use of the value ALL see 3.2.8.5, below.</p>	<p>Enumeration</p> <p>The permitted values are as specified in the Frequency Band Designator (FBD) columns of table 2-1 in reference [8] with the addition of the following:</p> <ul style="list-style-type: none"> – N/A – OTHER – ALL 	n/a

3.2.8.5 For the case of unused time it is possible (but not mandatory) to specify a frequency band. To specify the unused time on a particular band of an Aperture the following shall be specified:

- a) ScheduledPackage—user parameter set to UNALLOCATED;
- b) ScheduledActivity—siteRef parameter set as appropriate;
- c) ScheduledActivity—apertureRef parameter set as appropriate;
- d) ServiceInfo—serviceType parameter set to UNUSED;
- e) ServiceInfo—frequencyBand set to either
 - 1) the appropriate frequency band as contained in table 2-1 in reference [8]; or
 - 2) the value ALL if all frequency bands supported by the aperture are UNUSED.

NOTE – Permitted combinations of parameters SimpleScheduleHeader—status, ScheduledPackage—user, ServiceInfo—serviceType, and ScheduledActivity—activityStatus are specified in 3.3.

3.2.9 CLASS AbstractParameter (ABSTRACT)

The AbstractParameter is an abstract class and is fully defined in reference [7].

3.3 PERMITTED COMBINATIONS OF PARAMETERS SimpleScheduleHeader—status, ScheduledPackage—user, ServiceInfo—serviceType, AND ScheduledActivity—activityStatus

3.3.1 The permitted combinations of the following parameters shall be those specified in table 3-9:

- a) SimpleScheduleHeader—status;
- b) ScheduledPackage—user;
- c) ServiceInfo—serviceType;
- d) ScheduledActivity—activityStatus.

Table 3-9: Permitted Combinations of Parameters SimpleScheduleHeader—status, ScheduledPackage—user, ServiceInfo—serviceType and ScheduledActivity—activityStatus

SimpleScheduleHeader— status value	ScheduledPackage— user value	ServiceInfo— serviceType value	ScheduledActivity— activityStatus value
TEST	Any permitted value	Any permitted value	Any permitted value
PROVISIONAL	Spacecraft—Permitted values registered in SANA	Any permitted value	TENTATIVE
	UNALLOCATED	UNUSED	AVAILABLE
			UNAVAILABLE
	PROVIDER-CSSS	Any permitted value	TENTATIVE
OPERATIONAL	Spacecraft—Permitted values registered in SANA	Any permitted value	TENTATIVE
			COMMITTED
	UNALLOCATED	UNUSED	AVAILABLE
			UNAVAILABLE
PROVIDER-CSSS	Any permitted value	TENTATIVE	
		COMMITTED	
OTHER	Any permitted value, although this may be further constrained in an ICD between relevant parties	Any permitted value, although this may be further constrained in an ICD between relevant parties	Any permitted value, although this may be further constrained in an ICD between relevant parties

3.4 ORDERING OF SCHEDULED PACKAGES

3.4.1 The ordering of ScheduledPackages in a file containing a Simple Schedule shall be by increasing order of the earliest beginningOfTrack times of all the ScheduledActivities contained in a ScheduledPackage.

3.4.2 In the event that two or more ScheduledPackages contain ScheduledActivities that have the same earliest beginningOfTrack times, the user value of ScheduledPackage shall be used as a secondary key in increasing alphabetic order.

NOTE – Figure 3-2 is an example of how the order of ScheduledPackages should appear. For clarity not all parameters of ScheduledActivities are shown.

CCSDS RECOMMENDED STANDARD FOR SIMPLE SCHEDULE FORMAT

```
ScheduledPackage
  scheduledPackageID    = Package-A
  user                  = Mission-A
  ScheduledActivity
    scheduledActivityID = Activity-A1
    beginningOfTrack    = 2020-123T12:00:00.000Z
    .
    .
  ScheduledActivity
    scheduledActivityID = Activity-A2
    beginningOfTrack    = 2020-123T12:30:00.000Z
    .
    .
ScheduledPackage
  scheduledPackageID    = Package-B
  user                  = Mission-B
  ScheduledActivity
    scheduledActivityID = Activity-B1
    beginningOfActivity = 2020-123T12:15:00.000Z
    beginningOfTrack    = 2020-123T12:30:00.000Z
    .
    .
ScheduledPackage
  scheduledPackageID    = Package-C
  user                  = Mission-C
  ScheduledActivity
    scheduledActivityID = Activity-C1
    beginningOfActivity = 2020-123T12:00:00.000Z
    beginningOfTrack    = 2020-123T12:30:00.000Z
    .
    .
  ScheduledActivity
    scheduledActivityID = Activity-C2
    beginningOfActivity = 2020-123T12:10:00.000Z
    beginningOfTrack    = 2020-123T12:40:00.000Z
    .
    .
ScheduledPackage
  scheduledPackageID    = Package-D
  user                  = Mission-A
  ScheduledActivity
    scheduledActivityID = Activity-A3
    beginningOfTrack    = 2020-123T13:00:00.000Z
    .
    .
  ScheduledActivity
    scheduledActivityID = Activity-A4
    beginningOfTrack    = 2020-123T13:30:00.000Z
    .
    .
```

Figure 3-2: Example of Ordering of Scheduled Packages in Simple Schedule

3.5 USAGE OF SIMPLE SCHEDULE FOR SPECIFYING APERTURE AVAILABLE FREE TIME

3.5.1 DISCUSSION

Aperture Free Time, for the purposes of the Simple Schedule, is defined as those time periods outside of scheduled activities; following on from this,

- Aperture Available Free Time is aperture free time which is available for scheduling.
- Aperture Unavailable Free Time is aperture free time which is not available for scheduling.

The objective of using the simple schedule to disseminate Aperture Available Free Time is to provide a standard mechanism by which, subject to the Provider-CSSS policies, missions can be informed of time slots on apertures which are currently unused and are available for use. A detailed description of how Aperture Available Free Time can be specified is contained in 3.5.2.

It is possible for the PROVIDER-CSSS to disseminate a combined schedule that contains scheduled aperture time, i.e., time allocated to specific users, as well as Aperture Available Free Time.

The Aperture Available Free Time is specified as a UTC time range. It is not orbit- or spacecraft-specific. It should be noted that the Aperture Available Free Time may not all be available for tracking of a spacecraft; e.g., time may be required at the start and end of the time interval for station configuration, teardown, etc., and/or antenna slewing in the case of relay satellites.

Figure 3-3 indicates, diagrammatically, what is meant by Aperture Available Free Time. It should be noted that in this diagram it is assumed that all Aperture Free Time is available for use.

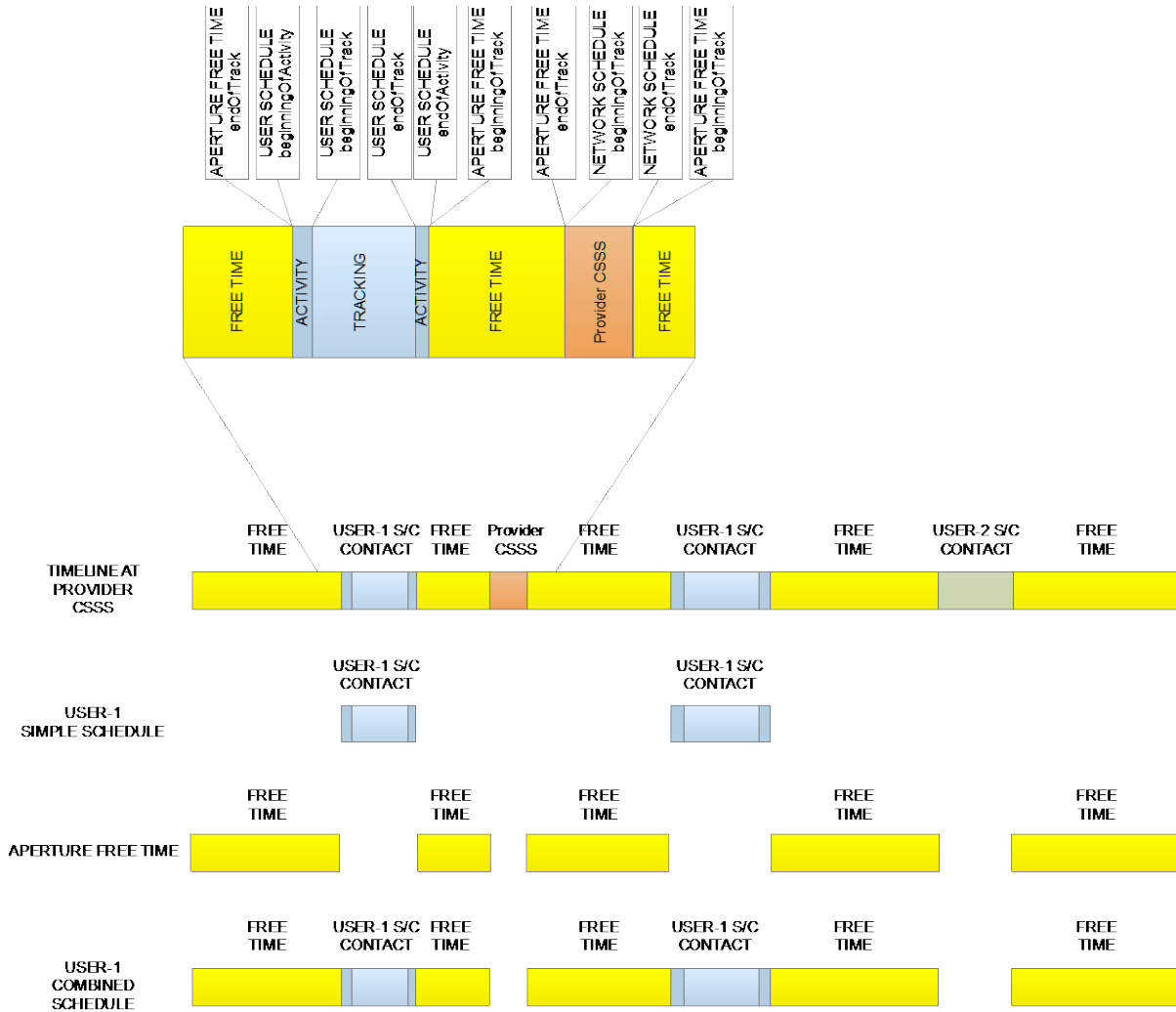


Figure 3-3: Schematic of Schedule to Illustrate Use of Simple Schedule for Aperture Free Time

3.5.2 SPECIFICATION OF APERTURE AVAILABLE FREE TIME

3.5.2.1 As of this issue, Aperture Available Free Time is not user-/spacecraft-specific.

3.5.2.2 When specifying Aperture Available Free Time in the Simple Schedule Format:

- a) the ScheduledPackage—user parameter shall be specified as ‘UNALLOCATED’;
- b) the ScheduledActivity—activityStatus parameter shall be specified as ‘AVAILABLE’;

- c) the ScheduledActivity—beginningOfTrack parameter shall be set to the UTC time at which the Aperture Available Free Time starts;
- d) the ScheduledActivity—endOfTrack parameter shall be set to the UTC time at which the Aperture Available Free Time ends;
- e) The ScheduledActivity—beginningOfActivity and endOfActivity parameters shall be omitted;
- f) the ServiceInfo—serviceType parameter shall be set to ‘UNUSED’;
- g) the ServiceInfo frequencyBand parameter shall be set to either
 - 1) ‘ALL’ indicating that all frequency bands supported by the aperture are available; or
 - 2) a specific frequency band (see table 3-8 for allowed values) indicating that the aperture is free to support that frequency band only.

Cor. 1

ANNEX A

IMPLEMENTATION CONFORMANCE STATEMENT (ICS) PROFORMA

(NORMATIVE)

A1 INTRODUCTION

A1.1 OVERVIEW

This annex provides the Implementation Conformance Statement (ICS) Requirements List (RL) for an implementation of the *Simple Schedule Format Specification* (CCSDS 902.1-B-1). The ICS for an implementation is generated by completing the RL in accordance with the instructions below. An implementation shall satisfy the mandatory conformance requirements referenced in the RL.

The RL in this annex is blank. An implementation's completed RL is called the ICS. The ICS states which capabilities and options have been implemented. The following can use the ICS:

- the implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight;
- a supplier or potential acquirer of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard ICS proforma;
- a user or potential user of the implementation, as a basis for initially checking the possibility of interworking with another implementation (it should be noted that, while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible ICSes);
- a tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A1.2 ABBREVIATIONS AND CONVENTIONS

A1.2.1 General

The RL consists of information in tabular form. The status of features is indicated using the abbreviations and conventions described below.

A1.2.2 Item Column

The item column contains sequential numbers for items in the table.

A1.2.3 Feature Column

The feature column contains a brief descriptive name for a feature. It implicitly means ‘Is this feature supported by the implementation?’

NOTE – The features itemized in the RL are elements of the Simple Schedule Format. Therefore support for a mandatory feature indicates that a generated file will include that feature, and support for an optional feature indicates that generated files can include that feature.

A1.2.4 Class Column/Parameters

The Class/Parameters column contains, where applicable, the Simple Schedule Format class associated with the feature.

A1.2.5 Reference Column

The reference column indicates the relevant subsection or table in the *Simple Schedule Format Specification* (CCSDS 902.1-B-1) (this document).

A1.2.6 Status Column

The status column uses the following notations:

M mandatory.

O optional.

C<n> conditional as defined in corresponding expression below table.

It should be noted that a parameter may be marked as M(andatory) while the class that contains it is marked O(ptional). This should be interpreted to mean that while the class is optional if it is present then the parameter must be present.

A1.2.7 Support Column Symbols

The support column is to be used by the implementer to state whether a feature is supported by entering Y, N, or N/A, indicating:

Y Yes, supported by the implementation.

N No, not supported by the implementation.

N/A Not applicable.

A1.3 INSTRUCTIONS FOR COMPLETING THE RL

An implementer shows the extent of compliance to the Recommended Standard by completing the RL; that is, the state of compliance with all mandatory requirements and the options supported are shown. The resulting completed RL is called an ICS. The implementer shall complete the RL by entering appropriate responses in the support or values supported column, using the notation described in A1.2. If a conditional requirement is inapplicable, N/A should be used. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference X_i , where i is a unique identifier, to an accompanying rationale for the noncompliance.

A2 ICS PROFORMA FOR SIMPLE SCHEDULE FORMAT

A2.1 GENERAL INFORMATION

A2.1.1 Identification of ICS

Date of Statement (DD/MM/YYYY)	
ICS serial number	
System Conformance statement cross-reference	

A2.1.2 Identification of Implementation Under Test (IUT)

Implementation name	
Implementation version	
Special Configuration	
Other Information	

A2.1.3 Identification of Supplier

Supplier	
Contact Point for Queries	
Implementation Name(s) and Versions	
Other Information necessary for full identification, e.g., names(s) and version(s) for machines and/or operating systems;	

A2.1.4 Document Version

CCSDS 902.1-B-1, Issue 1	
Have any exceptions been required? NOTE – A YES answer means that the implementation does not conform to the Recommended Standard. Non-supported mandatory capabilities are to be identified in the ICS, with an explanation of why the implementation is non-conforming	Yes _____ No _____

A2.1.5 Requirements List

A2.1.5.1 Class SimpleSchedule

A2.1.5.1.1 General

Item	Description	Ref.	Status	Support
1.	SimpleSchedule	3.2.2	M	

A2.1.5.1.2 Class SimpleSchedule Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
1.1.	Not applicable.	Table 3-1	N/A	N/A

A2.1.5.2 Class SimpleScheduleHeader

A2.1.5.2.1 General

Item	Description	Ref.	Status	Support
2.	SimpleScheduleHeader	3.2.3	M	

A2.1.5.2.2 Class SimpleScheduleHeader Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
2.1.	simpleScheduleStatus	Table 3-2	M	
2.2.	inclusionType	Table 3-2	M	
2.3.	originatingOrganization	Reference [7], Table 3-1	M	
2.4.	generationTime	Reference [7], Table 3-1	M	
2.5.	version	Reference [7], Table 3-1	M	
2.6.	startTime	Reference [7], Table 3-1	M	
2.7.	endTime	Reference [7], Table 3-1	M	
2.8.	purpose	Reference [7], Table 3-1	O	
2.9.	description	Reference [7], Table 3-1	O	

A2.1.5.3 Class ScheduledPackage**A2.1.5.3.1 General**

Item	Description	Ref.	Status	Support
3.	ScheduledPackage	3.2.4	O	

A2.1.5.3.2 Class ScheduledPackage Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
3.1.	scheduledPackageID	Table 3-4	M	
3.2.	user	Table 3-4	M	
3.3.	comment	Table 3-4	O	
3.4.	originatingRequestID	Table 3-4	O	

A2.1.5.4 Class ScheduledPkgAssn**A2.1.5.4.1 General**

Item	Description	Ref.	Status	Support
4.	ScheduledPkgAssn	3.2.5	O	

A2.1.5.4.2 Class ScheduledPkgAssn Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
4.1.	associationId	Table 3-5	M	
4.2.	associationKind	Table 3-5	M	
4.3.	comment	Table 3-5	O	
4.4.	scheduledPackageIdRef	Table 3-5	M	
4.5.	externalSchedPkgIdRef	Table 3-5	O	

A2.1.5.5 Class ServicePackageXRef**A2.1.5.5.1 General**

Item	Description	Ref.	Status	Support
5.	ServicePackageXRef	3-9	O	

A2.1.5.5.2 Class ServicePackageXRef Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
5.1.	serviceAgreementRef	Table 3-6	M	
5.2.	servicePackageRef	Table 3-6	M	

A2.1.5.6 Class ScheduledActivity**A2.1.5.6.1 General**

Item	Description	Ref.	Status	Support
6.	ScheduledActivity	3.2.7	C1	

C1: If a ScheduledPackage class is contained in the Simple Schedule then there must be at least one ScheduledActivity for each ScheduledPackage.

A2.1.5.6.2 Class ScheduledActivity Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
6.1.	scheduledActivityID	Table 3-7	M	
6.2.	activityStatus	Table 3-7	M	
6.3.	siteRef	Table 3-7	M	
6.4.	apertureRef	Table 3-7	M	
6.5.	beginningOfActivity	Table 3-7	O	
6.6.	beginningOfTrack	Table 3-7	M	
6.7.	endOfTrack	Table 3-7	M	
6.8.	endOfActivity	Table 3-7	O	
6.9.	orbitNumber	Table 3-7	O	

A2.1.5.7 Class ServiceInfo

A2.1.5.7.1 General

Item	Class	Ref.	Status	Support
7.	ServiceInfo	3.2.8	C2	

C2: If a ScheduledActivity class is contained in the Simple Schedule then there must be at least one ServiceInfo for each ScheduledActivity.

A2.1.5.7.2 Class ServiceInfo Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
7.1.	serviceType	Table 3-8	M	
7.2.	frequencyBand	Table 3-8	M	

A2.1.5.8 Class AbstractParameter

A2.1.5.8.1 General

Item	Description	Ref.	Status	Support
8.	AbstractParameter	Reference [7], subsection 3.2.2	O	

A2.1.5.8.2 Class AbstractParameter Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
8.1.	name	Reference [7], Table 3-2	M	

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A2.1.5.9 Class BooleanParameter

A2.1.5.9.1 General

Item	Description	Ref.	Status	Support
9.	BooleanParameter	Reference [7], subsection 3.2.3	O	

A2.1.5.9.2 Class BooleanParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
9.1.	value	Reference [7], Table 3-3	M	

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A2.1.5.10 Class UnsignedIntParameter

A2.1.5.10.1 General

Item	Description	Ref.	Status	Support
10.	UnsignedIntParameter	Reference [7], subsection 3.2.4	O	

A2.1.5.10.2 Class UnsignedIntParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
10.1.	value	Reference [7], Table 3-4	M	

A2.1.5.11 Class IntParameter

A2.1.5.11.1 General

Item	Description	Ref.	Status	Support
11.	IntParameter	Reference [7], subsection 3.2.5	O	

A2.1.5.11.2 Class IntParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
11.1.	value	Reference [7], Table 3-5	M	

A2.1.5.12 Class FloatParameter

A2.1.5.12.1 General

Item	Description	Ref.	Status	Support
12.	FloatParameter	Reference [7], subsection 3.2.6	O	

A2.1.5.12.2 Class FloatParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
12.1.	value	Reference [7], Table 3-6	M	

A2.1.5.13 Class DoubleParameter

A2.1.5.13.1 General

Item	Description	Ref.	Status	Support
13.	DoubleParameter	Reference [7], subsection 3.2.7	O	

A2.1.5.13.2 Class DoubleParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
13.1.	value	Reference [7], Table 3-7	M	

A2.1.5.14 Class StringParameter

A2.1.5.14.1 General

Item	Description	Ref.	Status	Support
14.	StringParameter	Reference [7], subsection 3.2.8	O	

A2.1.5.14.2 Class StringParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
14.1.	value	Reference [7], Table 3-8	M	

A2.1.5.15 Class ExtendedParameter

A2.1.5.15.1 General

Item	Description	Ref.	Status	Support
15.	ExtendedParameter	Reference [7], subsection 3.2.9	O	

A2.1.5.15.2 Class ExtendedParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
15.1.	value	Reference [7], Table 3-9	M	

A2.1.5.16 Class DurationUnIntParameter

A2.1.5.16.1 General

Item	Description	Ref.	Status	Support
16.	DurationUnIntParameter	Reference [7], subsection 3.2.10	O	

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A2.1.5.16.2 Class DurationUnIntParameter Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
16.1.	value	Reference [7], Table 3-10	M	

A2.1.5.17 Class DurationDbIParameter**A2.1.5.17.1 General**

Item	Description	Ref.	Status	Support
17.	DurationDbIParameter	Reference [7], subsection 3.2.11	O	

A2.1.5.17.2 Class DurationDbIParameter Parameters

As per section A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
17.1.	value	Reference [7], Table 3-11	M	

A2.1.5.18 Class TimeParameterA**A2.1.5.18.1 General**

Item	Description	Ref.	Status	Support
18.	TimeParameterA	Reference [7], subsection 3.2.12	O	

A2.1.5.18.2 Class TimeParameterA Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
18.1.	value	Reference [7], Table 3-12	M	

A2.1.5.19 Class TimeParameterB

A2.1.5.19.1 General

Item	Description	Ref.	Status	Support
19.	TimeParameterB	Reference [7], subsection 3.2.13	O	

A2.1.5.19.2 Class TimeParameterB Parameters

As per A2.1.5.8.1 with the addition of the following:

Item	Parameter	Ref.	Status	Item Support or Values Supported
19.1.	value	Reference [7], Table 3-13	M	

A2.1.5.20 Additional Parameters defined by using Classes instantiated from Class AbstractParameter

If additional parameters for classes SimpleScheduleHeader, ScheduledPackage, ScheduledPkgAssn, ScheduledActivity or ServiceInfo are specified by using one of the classes instantiated from class AbstractParameter (i.e., classes BooleanParameter, UnsignedIntParameter, IntParameter, FloatParameter, DoubleParameter, StringParameter, ExtendedParameter, DurationIntParameter, DurationDbIParameter, TimeParameterA or TimeParameterB) the additional parameters and permitted values for these should be specified in tables A-1–A-5.

In the following tables the columns have the following use:

- Name This column is used to specify the names of the additional parameter(s).
- Description This column is used to enter the description of what the additional parameter(s) is/are.
- Type This column is used to specify what type the parameter is, e.g., String, Integer, Unsigned Integer, Float, CCSDS ASCII Time Code B, etc.
- Permitted Values This column is used to specify the values that are permitted for the additional parameter(s).
- Data units This column is used to specify the Data Unit of the additional parameter(s), e.g., Seconds, Hertz, Volts, UTC, etc.

Table A-1: Class AbstractParameter Instantiated for Class SimpleScheduleHeader

Name	Description	Type	Permitted Values	Data units

Table A-2: Class AbstractParameter Instantiated for Class ScheduledPackage

Name	Description	Type	Permitted Values	Data units

Table A-3: Class AbstractParameter Instantiated for Class ScheduledPkgAssn

Name	Description	Type	Permitted Values	Data units

Table A-4: Class AbstractParameter Instantiated for Class ScheduledActivity

Name	Description	Type	Permitted Values	Data units

Table A-5: Class AbstractParameter Instantiated for Class ServiceInfo

Name	Description	Type	Permitted Values	Data units

ANNEX B

SECURITY, SANA, AND PATENT CONSIDERATIONS

(INFORMATIVE)

B1 SECURITY CONSIDERATIONS

B1.1 OVERVIEW

This annex presents the results of an analysis of security considerations applied to the technologies specified in this Recommended Standard.

B1.2 CONSEQUENCES OF NOT APPLYING SECURITY TO THE TECHNOLOGY

The consequences of not applying security to the systems and networks on which this Recommended Standard is implemented could include potential loss, corruption, and theft of data. Since it is possible to utilize these messages in preparing and disseminating schedules relating to the availability of communications and tracking resources for spacecraft, the consequences of not applying security to the systems and networks on which this Recommended Standard is implemented could include compromise or loss of the mission if malicious tampering of a particularly severe nature occurs.

B1.3 POTENTIAL THREATS AND ATTACK SCENARIOS

Potential threats or attack scenarios include, but are not limited to, (a) unauthorized access to the programs/processes that generate and interpret the messages, and (b) unauthorized access to the messages during transmission between exchange partners. Protection from unauthorized access during transmission is especially important if the mission utilizes open ground networks such as the Internet to provide ground station connectivity for the exchange of data formatted in compliance with this Recommended Standard. It is strongly recommended that potential threats or attack scenarios applicable to the systems and networks on which this Recommended Standard is implemented be addressed by the management of those systems and networks and the utilization of adequate authentication, suitable protocols, and secured interfaces for the exchange of this information.

B1.4 SECURITY CONCERNS RELATED TO THIS RECOMMENDED STANDARD

B1.4.1 Data Privacy

Privacy of data formatted in compliance with the specifications of this Recommended Standard should be assured by the systems and networks on which this Recommended Standard is implemented.

B1.4.2 Data Integrity

Integrity of data formatted in compliance with the specifications of this Recommended Standard should be assured by the systems and networks on which this Recommended Standard is implemented.

B1.4.3 Authentication of Communicating Entities

Authentication of communicating entities involved in the transport of data which complies with the specifications of this Recommended Standard should be provided by the systems and networks on which this Recommended Standard is implemented.

B1.4.4 Data Transfer between Communicating Entities

The transfer of data formatted in compliance with this Recommended Standard between communicating entities should be accomplished via secure mechanisms approved by the Information Technology Security functionaries of exchange participants.

B1.4.5 Control of Access to Resources

Control of access to resources should be managed by the systems upon which provider formatting and recipient processing are performed.

B1.4.6 Auditing of Resource Usage

Auditing of resource usage should be handled by the management of systems and networks on which this Recommended Standard is implemented.

B1.5 UNAUTHORIZED ACCESS

Unauthorized access to the programs/processes that generate and interpret the messages should be prohibited in order to minimize potential threats and attack scenarios.

B1.6 DATA SECURITY IMPLEMENTATION SPECIFICS

Specific information-security interoperability provisions that apply between agencies and other independent users involved in an exchange of data formatted in compliance with this Recommended Standard should be specified in an ICD.

B2 SANA CONSIDERATIONS

B2.1 GENERAL

The recommendations of this document rely on the SANA registries described below. New assignments in these registries, in conformance with the policies identified, will be available at the SANA registry Web site: <http://sanaregistry.org>. Therefore the reader shall look at the SANA Web site for all the assignments contained in these registries.

B2.2 REGISTRY FOR `originatingOrganization`

(See subsection A2.2 in reference [7].)

B2.3 REGISTRY FOR `user`

(See subsection A2.3 in reference [7].)

In addition to the values for the ‘`user`’ parameter contained in the CCSDS Spacecraft Identifiers registry, the following values need to be recognized by implementations (see table 3-4):

<code>user</code>	Description
UNALLOCATED	Indicates that the time is unallocated.
PROVIDER-CSSS	Indicates that the time is allocated for the Provider CSSS.

B2.4 REGISTRY FOR `siteRef` AND `apertureRef`

(See subsection A2.2 in reference [7].)

B2.5 REGISTRY FOR `associationKind`

The usage of Agency defined `associationKind` (see table 3-5) is outwith the scope of this Recommended Standard. However, to assist with inter-agency inter-operations, the agency defined `associationKind` values are registered.

The information registered is:

- a) Status – the status of the `associationKind`;
- b) Organization – the agency that is registering the `associationKind`;

NOTE – This should be the same as the agency name in the SANA Organizations registry.

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- c) Point of Contact – the responsible party of the agency registering the particular associationKind;

NOTE – This should be one of the names found in the SANA Contacts registry.

- d) Name – the name of the associationKind.
 e) Description – a brief description of the nature of the associationKind.
 f) Applicable Start Date – the date when an agency recognizes and processes this particular associationKind.
 g) Applicable End Date – the date when an agency will no longer recognize and process this particular associationKind.

NOTE – This can have the value of ‘indefinite’ if the agency has no plans for ending implementation of the agency-specific associationKind.

- h) References – specifies any references that may be relevant to the associationKind. May be left empty.

In accordance with reference [6], subsection 3.11 (c), updates to this registry are at the discretion of CCSDS member agencies or registered organizations, via the registered agency or organization representative. The associationKind registry is located at

https://sanaregistry.org/r/association_kinds

B2.6 REGISTRY FOR EXTENDED PARAMETER

(See subsection A2.3 in reference [9].)

B2.7 USE OF UNREGISTERED VALUES

Only values that have been registered should be used for the originatingOrganization, user and apertureRef parameters. Unregistered values for the originatingOrganization, user, and apertureRef parameters may be used. If unregistered values are used they should be prefixed with the string ‘UNR::’.

NOTES

- 1 ‘UNR::’ indicates an unregistered value;
- 2 this helps eliminate potential confusion in a multi-agency cross support context;
- 3 use of unregistered values is not recommended and should be avoided if possible.

B3 PATENT CONSIDERATIONS

No patent rights are known to adhere to any of the specifications of the Recommended Standard.

ANNEX C

XML SCHEMA FOR THE SIMPLE SCHEDULE FORMAT

(INFORMATIVE)

C1 PURPOSE

This annex provides information regarding the XML Schema organization and packaging. Examples of the simple schedule are also given.

C2 SCHEMA ORGANIZATION AND PACKAGING

The normative simple schedule schema types and global elements are contained in the file '902x01b1TC1-SmplSchd.xsd'.

The communications planning information types and global elements are registered in the 'urn:ccsds:schema:csm:1.0.0' name space.

The planning information schema includes the following schemas:

a) 902x13m1-AbsEvt-TimCde.xsd

Types and global elements in this schema are registered in the 'urn:ccsds:schema:csm:1.0.0' name space.

b) 902x13m1-AbsEvt-AbsParm.xsd

Types and global elements in this schema are registered in the 'urn:ccsds:schema:csm:1.0.0' name space.

c) 902x12m1-SmCmnEnt-InfEntHdr.xsd

Types and global elements in this schema are registered in the 'urn:ccsds:schema:csm:1.0.0' name space.

The source of the following schema files,

- 902x01b1TC1-SmplSchd.xsd,
- 902x13m1-AbsEvt-TimCde.xsd.xsd,
- 902x13m1-AbsEvt-AbsParm.xsd, and
- 902x12m1-SmCmnEnt-InfEntHdr.xsd,

is the SANA SCCS-SM Information Entity XML Schemas registry:

http://sanaregistry.org/r/service_management_xml_schemas

C3 EXAMPLES

C3.1 OVERVIEW

The following subsections give examples of using the simple schedule format.

C3.2 EXAMPLE OF SIMPLE SCHEDULE WITHOUT EXTENSIONS

The following is a listing of a simple schedule which does not use extensions.

```
<?xml version="1.0" encoding="UTF-8"?>
<simpleSchedule xmlns="urn:ccsds:schema:cissm:1.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xmi="http://www.omg.org/XMI"
  xsi:schemaLocation="urn:ccsds:schema:cissm:1.0.0 902x01b1TC1-SmplSchd.xsd" >
  <simpleScheduleHeader originatingOrganization="RKPNI"
    generationTime="2016-307T13:46:48.247Z"
    status="TEST"
    inclusionType="OVERLAP_INCLUSION"
    version="1"
    startTime="2016-134T00:00:00.000Z"
    endTime="2016-164T00:00:00.000Z"
    purpose="Purpose of the schedule."
    description="Schedule description."/>
  <scheduledPackage scheduledPackageId="EVENT-2015.190.11.41.47.243348-821429"
    user="GAIA"
    originatingRequestId ="GAIA_Dummy_Request_001">
    <servicePackageXRef serviceAgreementRef="GAIA_Routine_1.daily_TTC.nominal_definition.GAIA"
      servicePackageRef="EVENT-2015.190.11.41.47.243348-821429"/>
    <scheduledActivity scheduledActivityId="EVENT-2015.190.11.41.47.243348-821429"
      activityStatus="COMMITTED"
      siteRef="MLG"
      apertureRef="MLG"
      beginningOfActivity="2016-134T02:47:52.000Z"
      beginningOfTrack="2016-134T03:32:52.000Z"
      endOfTrack="2016-134T10:10:29.000Z"
      endOfActivity="2016-134T10:25:29.000Z">
      <serviceInfo serviceType="TELEMETRY"
        frequencyBand="XS-DS" >
      </serviceInfo>
    </scheduledActivity>
  </scheduledPackage>
  <scheduledPackage scheduledPackageId="EVENT-2015.190.10.48.15.165576-808510"
    user="LIPF"
    originatingRequestId ="LIPF_Dummy_Request_001">
    <servicePackageXRef serviceAgreementRef="Lisa_Pathfinder_1.daily_TTC.nominal_definition.LIPF"
      servicePackageRef="EVENT-2015.190.10.48.15.165576-808510"/>
  </scheduledPackage>
</simpleSchedule>
```

```

<scheduledActivity scheduledActivityId="EVENT-2015.190.10.48.15.165576-808510"
  activityStatus="COMMITTED"
  siteRef="CEB"
  apertureRef="CEB"
  beginningOfActivity="2016-134T05:15:00.000Z"
  beginningOfTrack="2016-134T06:00:00.000Z"
  endOfTrack="2016-134T14:00:00.000Z"
  endOfActivity="2016-134T14:15:00.000Z">
  <serviceInfo serviceType="TELEMETRY"
    frequencyBand="XS-DS" >
  </serviceInfo>
</scheduledActivity>
</scheduledPackage>
<scheduledPackage scheduledPackageId="EVENT-2015.190.13.59.48.510482-846702"
  user="ROS"
  comment="This is an example of an optional comment for a scheduled package..."
  originatingRequestId ="ROS_Dummy_Request_001">
  <servicePackageXRef serviceAgreementRef="ROSETTA_Routine_2.Continuous_TTC.nominal_definition.ROS"
    servicePackageRef="EVENT-2015.190.13.59.48.510482-846702"/>
  <scheduledActivity scheduledActivityId="EVENT-2015.190.13.59.48.510482-846702"
    activityStatus="COMMITTED"
    siteRef="NNO"
    apertureRef="NNO"
    beginningOfActivity="2016-134T06:36:08.000Z"
    beginningOfTrack="2016-134T07:21:08.000Z"
    endOfTrack="2016-134T16:05:48.000Z"
    endOfActivity="2016-134T16:20:48.000Z">
    <serviceInfo serviceType="TELEMETRY"
      frequencyBand="XS-DS" >
    </serviceInfo>
  </scheduledActivity>
</scheduledPackage>
<scheduledPackage scheduledPackageId="TEST-SC1_Scheduled_Package_001"
  user="TEST-SC1"
  originatingRequestId ="TEST-SC1_Dummy_Request_001">
  <servicePackageXRef serviceAgreementRef="TEST-SC1_Service_Agreement"
    servicePackageRef="TEST-SC1_Service_Package_001"/>
  <scheduledActivity scheduledActivityId="TEST-SC1_Schedule_Activity_001"
    activityStatus="TENTATIVE"
    siteRef="NNO"
    apertureRef="NNO"

```

```

                beginningOfActivity="2016-136T16:00:00.000Z"
                beginningOfTrack="2016-136T17:16:30.000Z"
                endOfTrack="2016-136T22:00:00.000Z"
                endOfActivity="2016-136T22:30:00.000Z">
    <serviceInfo serviceType="TELEMETRY"
                frequencyBand="XS-DS" >
    </serviceInfo>
    <serviceInfo serviceType="TELECOMMAND"
                frequencyBand="XS-DS" >
    </serviceInfo>
  </scheduledActivity>
</scheduledPackage>
<scheduledPackage scheduledPackageId="TEST-SC2_Scheduled_Package_001"
  user="TEST-SC2"
  originatingRequestId = "TEST-SC2_Dummy_Request_001">
  <servicePackageXRef serviceAgreementRef="TEST-SC2_Service_Agreement"
    servicePackageRef="TEST-SC2_Service_Package_001"/>
  <scheduledActivity scheduledActivityId="TEST-SC2_Schedule_Activity_001"
    activityStatus="TENTATIVE"
    siteRef="NNO"
    apertureRef="NNO"
    beginningOfActivity="2016-136T17:00:00.000Z"
    beginningOfTrack="2016-136T17:30:00.000Z"
    endOfTrack="2016-136T23:00:00.000Z"
    endOfActivity="2016-136T23:30:00.000Z">
    <serviceInfo serviceType="TELEMETRY"
      frequencyBand="XS-DS" >
    </serviceInfo>
  </scheduledActivity>
</scheduledPackage>
<scheduledPkgAssn associationId = "Association_TEST-SC1_Schedule_Package_001_and_TEST-
SC2_Schedule_Package_001"
  associationKind = "MSPA"
  comment = "MSPA pass on New Norcia for TEST-SC1 and TEST-SC2" >
  <scheduledPackageIdRef ref="TEST-SC1_Scheduled_Package_001" />
  <scheduledPackageIdRef ref="TEST-SC2_Scheduled_Package_001" />
  <externalSchedPkgIdRef
ref="This_is_an_example_of_a_reference_to_an_external_Scheduled_Package_i.e._One_that_is_not_contained_in_th
e_same_XML_file" />
  </scheduledPkgAssn>
</simpleSchedule>

```

C3.3 EXAMPLE OF SIMPLE SCHEDULE WITH EXTENSIONS

The following is a listing of a simple schedule which uses extensions. Examples of the use of the extended and string additional parameters are given.

```
<?xml version="1.0" encoding="UTF-8"?>
<simpleSchedule xmlns="urn:ccsds:schema:csm:1.0.0"
  xmlns:fn="http://www.w3.org/2005/02/xpath-functions"
  xmlns:emsmodel="platform:/resource/esa.egos.ems.portal.model/schemas/Ems.xsd"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xmi="http://www.omg.org/XMI"
  xmlns:ems="http://esa.egos.ems"
  xsi:schemaLocation="urn:ccsds:schema:csm:1.0.0 902x01b1TC1-SmplSchd.xsd http://esa.egos.ems
EmsExternal.xsd">
  <simpleScheduleHeader originatingOrganization="RKPNI"
    generationTime="2016-307T13:46:48.247Z"
    status="TEST"
    inclusionType="OVERLAP_INCLUSION"
    version="1"
    startTime="2016-134T00:00:00.000Z"
    endTime="2016-164T00:00:00.000Z"
    purpose="Purpose of the schedule..."
    description="Schedule description..."/>
  <scheduledPackage scheduledPackageId="EVENT-2015.190.11.41.47.243348-821429"
    user="GAIA"
    comment="ESOC MCP">
    <servicePackageXRef serviceAgreementRef="GAIA_Routine_1.daily_TTC.nominal_definition.GAIA"
      servicePackageRef="EVENT-2015.190.11.41.47.243348-821429"/>
    <extendedParameter name="configurationProfiles">
      <ems:configuration_profile default="true"
        requirement="TM_requirement"
        service="telemetryReception">
        <configuration_profile_name xmlns="">default_setup</configuration_profile_name>
        <parameter xmlns="" identifier="Throw_event" type="enum">NO</parameter>
      </ems:configuration_profile>
    </extendedParameter>
    <stringParameter name="additionalStringExample" value="This is an example of an additional string
parameter in a schedule package..."/>
    <scheduledActivity scheduledActivityId="EVENT-2015.190.11.41.47.243348-821429"
      activityStatus="COMMITTED">
```

```
        siteRef="MLG"  
        apertureRef="MLG"  
        beginningOfActivity="2016-134T02:47:52.000Z"  
        beginningOfTrack="2016-134T03:32:52.000Z"  
        endOfTrack="2016-134T10:10:29.000Z"  
        endOfActivity="2016-134T10:25:29.000Z">  
    <serviceInfo    serviceType="TELEMETRY"  
        frequencyBand="XS-DS" />  
    </scheduledActivity>  
    </scheduledPackage>  
</simpleSchedule>
```

ANNEX D**ABBREVIATIONS AND ACRONYMS****(INFORMATIVE)**

Abbreviation	Meaning
ASCII	American Standard Code for Information Interchange
CCSDS	Consultative Committee on Space Data Systems
CSSM	Cross Support Service Management
CSSS	Cross Support Service System
Delta-DOR	delta-differential one-way range
ICD	interface control document
ICS	implementation conformance statement
IUT	implementation under test
MSPA	multiple spacecraft per aperture
NCName	non-colonized name
OMG	Object Management Group
RL	requirements list
SANA	Space Assigned Numbers Authority
SCCS SM	Space Communication Cross Support Service Management
TBD	to be decided
UML	Unified Modeling Language
UTC	Coordinated Universal Time
VLBI	very-long-baseline interferometry
W3C	World Wide Web Consortium
XML	eXtensible Markup Language

ANNEX E

INFORMATIVE REFERENCES

(INFORMATIVE)

- [E1] *Space Communication Cross Support—Service Management—Operations Concept*. Issue 1. Report Concerning Space Data System Standards (Green Book), CCSDS 910.14-G-1. Washington, D.C.: CCSDS, May 2011.
- [E2] *Extensible Space Communication Cross Support—Service Management—Concept*. Report Concerning Space Data System Standards (Green Book). CCSDS 902.0-G-1, Washington, D.C.: CCSDS, September 2014.