EarthCARE/CPR
Science Telemetry Source Packet Definition

概要 Overview

This note presents the definition of EarthCARE/CPR science telemetry source packet.

キーワード Key words	EarthCARE/CPR サイエンスデータ				
情報の区分	☐一般	☐B情報	☑B情報 (関係者限定)	☐A情報	☐AA情報
開示制限解除年月		年	月		
個人情報の種類 (該当する場合のみ)	☐B個人情報		☐A個人情報		

配付先 Distribution List	MOSS	EORC	NEC	欧州宇宙機構 (ESA)																	
配付種類	正	正	正	正																	
部数	1	1	1	1																	

関連	承認 Approved by	点検 Checked by	作成 Prepared by	技術資料番号 Document No.	改訂符号 Revision
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				EarthCARE/CPR Project Team	

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改訂記録
Change record

符号 Revision	承認年月日 Date	承認 Approved by	点検 Checked by	作成 Prepared by	改訂箇所 Changed Section	改訂内容、理由等 Description of Change
NC	2 December 2008	T. Kimura	H. Nakatsuka	H. Horie	N/A	初版制定 First Issue.
A	28 Feb. 2009	T. Kimura	H. Nakatsuka	H. Horie	Table 3-1	Reflection of the latest design.
B	24 Aug 2009	T. Kimura	H. Nakatsuka	K. Sato	Table 3-1 update	Reflection of the latest design.
C	30 November 2011	T. Kimura	H. Nakatsuka	K. Sato	Document title etc.	Document title is changed. Totally updated based on the latest design.
D	15 October 2013	E. Tomita	H. Nakatsuka	G. Kadosaki	Underline and vertical bar without Note	Updated based on the result of CPR-CDR (Underlines)
E	6 December 2013	E. Tomita	H. Nakatsuka	G. Kadosaki	Underline and vertical bar with Note “D”	Replaced with correct cells : Page 5, Table 3-6, Service Type and Subtype.
F	15 December 2014	See Cover Page	See Cover Page	See Cover Page	Underline and vertical bar with Note “E”	
					All Table No.	Reassignment of Table No. (include these change record).
					Table 3-7	ESA CPR CDR RID-ESA-SY11(ME-01) : Description of S1-4 is added.
					2.1 Applicable Documents	ESA CPR CDR RID-ESA-SY9 : Annotation is added to Page 1, PUS Document, Page 8.
					Table 3-8	Typo of title.
					Table 3-7, 3-8, 3-9, 3-10, 3-11	ESA CPR CDR RID-ESA-SY20 : PUS-Service numbers and other information are added.
					Appendix 2	ESA CPR CDR RID-ESA-SY22(ME-01) : The ISP timestamps information is added.
					Table 3-6	Fix for a incorrect description, Finetime:LSB=1/16777216 sec
					A1-1～A1-3, A2-1～2	Typo “Data”
					Table 3-7	Contents of packet were Added (S2-75,S2-76)
					3.1.1, Table 3-2(a)	Change of packet size for additional contents of packet
					3	Typo “DEFINITION”

EarthCARE
Cloud Profiling Radar (CPR)

Science Telemetry Source Packet Definition

December 2014

Japan Aerospace Exploration Agency
(JAXA)

Table of Contents

1. INTRODUCTION

1.1 Scope

This document describes EarthCARE/CPR science telemetry source packet definitions.

2. DOCUMENTS

2.1 Applicable documents

[AD1] EC.STD.ASD.SY.00001 Issue 5 Rev. 0* EarthCARE Packet Utilization Standard

*Applicable EC PUS as given in DCN "EC.DN.ASD.CPR.00016 iss.2 - PUS to issue 6.1" (see chapter 11 Annex 6.2)

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2.2 Reference documents

[RD1] EC.ICD.ASD.SY.00004 EarthCARE Product Definitions Volume 0 - Introduction

[RD2] EC.ICD.ASD.SY.00005 EarthCARE Product Definitions Volume 1 - Common Products Definitions

3. DEFINITION OF CPR SCIENCE TELEMETRY SOURCE PACKET

CPR sends the science telemetry source packets to MMFU when CPR is operated in INS-NOM mode; which includes Nominal Observation Mode, Contingency Observation Mode, External Calibration Mode, Sea Surface Calibration Mode and Internal Calibration Mode. In the other operation mode, CPR does not generate science telemetry source packets. CPR operation modes are summarized in Table 3-1.

Table 3-1 CPR Operation Modes and corresponding Satellite Operation Modes

INS-Mode	CPR MODE	Description	Comment
INS-LAU	TBD	Launch	No Science Packet generated
INS-OFF	Safety	For satellite contingency	No Science Packet generated
INS-INI	SPU-INI	To set up software parameter, memory dump	No Science Packet generated
INS-SBY	Standby	Preparation for observation, Power ON (except HPT), Primary/Redundant selection	No Science Packet generated
INS-SBR	Standby Refuse	Used in FDIR	No Science Packet generated
INS-IDL	IDLE	Preparation for observation, All components ON including HPT.	No Science Packet generated
INS-IDR	Idle Refuse	Used in FDIR	No Science Packet generated
INS-NOM	Nominal Observation	Nominal observation mode. Variable PRF. Observation window changes 12km, 16km and 20km in accordance with the latitude.	Generates two type of Science Packets; Science Status OBS ISP Science Data NOM OBS ISP
	Contingency Observation	Operation mode with fixed PRF when S/C navigation data is not available or poor accuracy	Generates two type of Science Packets; Science Status OBS ISP Science Data CON OBS ISP
	External Calibration	External calibration mode. ARC measurement is performed in this mode	Generates two type of Science Packets; Science Status OBS ISP Science Data NOM OBS ISP
	Sea Surface Calibration	Sea surface calibration with satellite roll maneuver	Generates two type of Science Packets; Science Status OBS ISP Science Data NOM OBS ISP
	Internal Calibration	Internal calibration mode without RF transmission	Generates two type of Science Packets; Science Status INT CAL ISP Science Data INT CAL ISP

Corresponding to the operation mode, to generate CPR science telemetry source packet is categorized to 3 types as listed below;

1) Nominal Observation Mode / External Calibration Mode / Sea Surface Calibration Mode
2) Contingency Observation Mode
3) Internal Calibration Mode (This mode can be used to check science data stream in ground test).

3.1 Science Telemetry Source Packet Structure

The structure of telemetry source packet defined in AD1 is shown in Figure 3. CPR science telemetry source packets are designed in accordance with this structure.

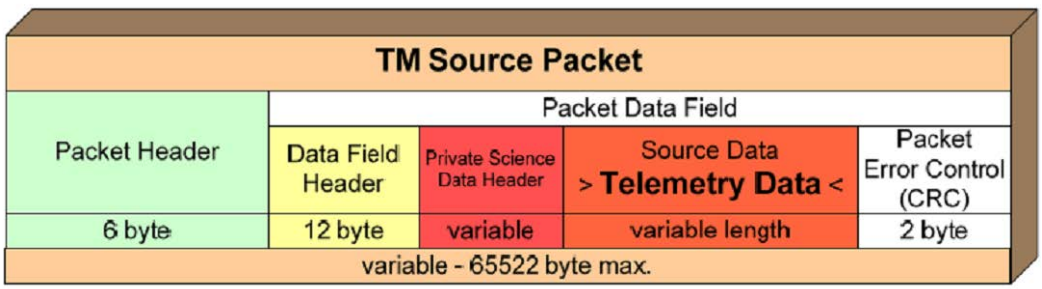

Figure 3 Telemetry Source Packet

3.1.1 Nominal Observation Mode / External Calibration Mode / Sea Surface Calibration Mode

In these modes, CPR generates 15 packets per second. However, CPR sends packets to MMFU 14 times per second because first two packets are sent in the same time (refer to Figure A1 in Appendix).

Format of the first packet is referred as (a) Science Status OBS in Table 3-2 (It is also referred as Packet_1-1 in Figure A1), while the other 14 packets are referred as (b) Science Data NOM OBS in Table 3-2 (These are also referred as Packet_1-2 and Packet_2 ~ Packet_14 in Figure A1).

In these modes, total packet data size per second is 33422 byte (242 + 14 * 2370).

Table 3-2 CPR Science Telemetry Packet Structure for Nominal Observation Mode / External Calibration Mode / Sea Surface Calibration Mode

(a) Science Status OBS

Packet_1-1 (Total Size =242 byte)				
Packet Header	Data Field Header	Instrument Data Field		
		Private Science Data Header	Source Data >Science Status<	Packet CRC
6 byte	12 byte	10 byte	212 byte	2 byte

(b)Science Data NOM OBS

Packet_1-2, Packet_2 ~ Packet_14 (Total Size =2370 byte)				
Packet Header	Data Field Header	Instrument Data Field		
		Private Science Data Header	Source Data >Science Data<	Packet CRC
6 byte	12 byte	10 byte	2340 byte	2 byte

3.1.2 Contingency Observation Mode

In this mode, CPR generates 15 packets per second. However, CPR sends packets to MMFU 14 times per second because first two packets are sent in the same time (refer to Figure A2 in Appendix).

Format of first packet is referred as (a) Science Status OBS in Table 3-2 (It is also referred as Packet_1-1 in Figure A2), while the other 14 packets are referred as (b) Science Data CON OBS in Table 3-3. (These are also referred as Packet_1-2 and Packet_2 ~ Packet_14 in Figure A2)

In this mode, total packet data size per second is 17934 byte (= 238 + 14 * 1264).

Table 3-3 CPR Science Telemetry Packet Structure for Contingency Observation Mode

(a) Science Status OBS

First Science Status OBS Packet is same as Nominal Observation Mode, External Calibration Mode and Sea Surface Calibration Mode in Table 3-2 (a).

(b) Science Data CON OBS

Packet_1-2, Packet_2 ~ Packet_14 (Total Size =1264 byte)				
Packet Header	Data Field Header	Instrument Data Field		
		Private Science Data Header	Source Data >Science Data<	Packet CRC
6 byte	12 byte	10 byte	1234 byte	2 byte

3.1.3 Internal Calibration Mode

In this mode, CPR generates 8 packets per second. However, CPR sends packets to MMFU 7 times per second because first two packets are sent in the same time (refer to Figure A3 in Appendix).

Format of first packet is referred as (a) Science Status INT CAL in Table 3-4 (It is also referred as Packet_1-1 in Figure A3), while the other 7 packets are referred as (b) Science Data INT CAL in Table 3-4 (These are also referred as Packet_1-2 and Packet_2 ~ Packet_7 in Figure A3).

In this mode, total packet data size per second is 15630 byte (= 216 + 7 * 2202).

Table 3-4 CPR Science Telemetry Packet Structure for Internal Calibration Mode

(a) Science Status INT CAL

Packet_1-1 (Total Size = 216 byte)				
Packet Header	Data Field Header	Instrument Data Field		
		Private Science Data Header	Source Data >Science Status<	Packet CRC
6 byte	12 byte	10 byte	186 byte	2 byte

(b) Science Data INT CAL

Packet_1-2, Packet_2 ~ Packet_7 (Total Size = 2202 byte)				
Packet Header	Data Field Header	Instrument Data Field		
		Private Science Data Header	Source Data >Science Data<	Packet CRC
6 byte	12 byte	10 byte	2172 byte	2 byte

3.2 Detailed ISP Definitions

3.2.1 Science Status OBS ISP

3.2.1.1 Packet Header

Packet Header of CPR Science Status OBS ISP is shown in Table 3-5.

Table 3-5 CPR Science Status OBS ISP Packet Header Bit Vector Table

#	Parameter	MSB	Description	Value	
1	Version Number	b0-b2	CCSDS Version Number	000b	
2	Type	b3	Packet type (0=telemetry, 1=telecommand)	0b	
3	Data field Header Flag	b4	Indicates the presence of a secondary (data field) header(when set to 1)	1b	F
4	PRID	b5-b11	Process ID (part of the APID)	0x4C	
5	PCAT	b12-b15	Packet category	12	
6	Grouping Flags	b16-b17	Indicates the grouping of TM source packets	0x3	
7	Sequence Count	b18-b31	Must be set to 0 for first packet, increments up to 2^{14}-1, wrap around to 0		
8	Packet Length	b32-b47	Number of bytes contained in the packet data field minus 1 (even and odd values are allowed)		

3.2.1.2 Data Field Header

Data Field Header of CPR Science Status OBS ISP is shown in Table 3-6.

Table 3-6 CPR Science Status OBS ISP Data Field Header Bit Vector Table

#	Parameter	MSB	Description	Value		
1	Spare-1	b0	Not used	Must be set to 0 for all TM Source Packet		
2	TM Source Packet PUS Version Number	b1-b3		Must be 1		
3	Spare-2	b4-b7	Filler to complete the byte	Must be set to 0 for all TM Source Packet		
4	Service Type	b8-b15	indicates the service to which the packet relates	240	E	
5	Service Subtype	b16-b23	indicates the service subtype to which the packet relates	Depend on each telemetry service subtype	E	
6	Destination ID	b24-b31	indicates the destination of the packet	0		
7	Time	b32-b87	Onboard time (OBT)	Coarse time :LSB=1sec Fine time :LSB=1/16777216 sec		F
8	Sync Time Quality	b88-b95	This shall give the status of the time reporting sub-service, i.e. current PPS source and whether synchronization is enabled	Bit 0 - Bit 2:set to 0 Bit 3(Time Type): 0 = Elapsed Time (ET); 1 = OBT Bit 4(Sync. Source): 0 = internal; 1 = external Bit 5(Sync. Method): 1 = 1Hz Pulse; 0 = MIL-Bus Major Frame Bit 6(Sync. Status): 0 = NoSync; 1 = InSync Bit 7(Sync. Enabled/Disabled): 0 = Disabled; 1 = Enabled		

3.2.1.3 Instrument Data Field

Instrument Data Field (=“Private Science Data Header”+“Source Data”+“CRC”) for Science Status OBS is shown in Table 3-7.

Table 3-7 Instrument Data Field for CPR Science Status OBS ISP

No.	Science Telemetry Name	PUS-Service		Parameter			Comment	Units	NetCDF C-Type	Total size (Byte)
		Service	Subservice	Parameter Name	Bit Length (bit)	Value				
Private Science Data Header										
1	S/C State Vector Quality	240	1	AOCS Mode& SubMode	8	0x00:AOC_SBM 0x10:AOC_ASM_DEP 0x11:AOC_ASM_RD 0x12:AOC_ASM_EA 0x13:AOC_ASM_YA 0x14:AOC_ASM_SS 0x15:AOC_ASM_SEM 0x20:AOC_NOM_DEP 0x21:AOC_NOM_ACQ 0x22:AOC_NOM_AH 0x23:AOC_NOM_FP 0x24:AOC_NOM_AM 0x31:AOC_OCM_ACQ 0x32:AOC_OCM_SL 0x33:AOC_OCM_STAB 0x34:AOC_OCM_DV 0x35:AOC_OCM_BSL		Unitless	NC_UNIT	4
				OBC Sync Time Quality	8					
				Spare	14					
				Nadir Pointing Performance Identifier	1	0:Nominal Performance 1:Degraded Performance				
				S/C State Vector Status	1	0:valid 1:Invalid				
2	ISPS version number	240	1					Unitless	NC_USHORT	2
3	Instrument Ancillary Data	240	1	CPR Offset Time			1LSB=1/48M [s]	Unitless	NC_UNIT	4
Total										10
Source Data >Science Status<										
S1-1A	EC Coarse Time	240	1				1LSB=1[s]	Unitless	NC_UNIT	4
S1-1B	CPR Fine Time	240	1				1LSB=1/48M [s]	Unitless	NC_UNIT	4
S1-1C	CPR Offset Time	240	1				1LSB=1/48M [s]	Unitless	NC_UNIT	4
S1-2	Operational Mode	240	1	Operational mode	4	0:SPU INI 1:Standby 2:IDLE 4:Nom-Obs 5:Sea-Cal 6:Ext-Cal 7:Int-Cal 8:Cont 9:IDLE-REF 10:Stadby-REF		Unitless	NC_CHAR	1
				Obs Sub mode	3	1:12km_obs 2:16km_obs 3:20km_obs 5:MIX_12km_Obs 6:MIX_16km_Obs 7:MIX_20km_Obs	In the case of Operational Mode=4			
						1:Nominal 2:External Cal 3:Sea Cal	In the case of Operational Mode=8			
				Transition Status	1	0:Complete 1:Not Complete				
S1-3	Satellite orbital data	240	1	S/C State Vector Quality	32			Unitless	NC_INT	48
				Time (Local); Integer of Seconds	32					
				spare	8	0				
				Time (Local); Sub Seconds	24		0 to 16777215(1/16777215) sec, LSB = 59.6 nsec			
				Position X	32		Unit: cm LSB = 1cm			
				Position Y	32		Unit: cm LSB = 1cm			
				Position Z	32		Unit: cm LSB = 1cm			
				Velocity X	32		Unit: mm/s LSB = 1mm/s			
				Velocity Y	32		Unit: mm/s LSB = 1mm/s			
				Velocity Z	32		Unit: mm/s LSB = 1mm/s			
				Geodetic Altitude	32		Unit: cm LSB = 1cm			
				Geodetic Argument of Latitude	32		Unit: rad LSB = 10^-4 rad			
				geocentric latitude	32		Result of Calculation by SPUFS			
S1-4	PRF Parameter Table ID	240	1	PRF Table Number	4	0:Obs(20km) 1:Obs(16km) 2:Obs(12km) 3:Sea-Cal 4:Ext-Cal 5:Cont		Unitless	NC_USHORT	2
				PRF Parameter Number	12	0～440(dec)	※Depend On Altitude			
S1-5	PRI	240	1				1LSB=1/48M [s]	Unitless	NC_USHORT	2
S1-6	CAL DATA#0(HOT)	240	1				Coherent data bit (16bit)	BU	NC_SHORT	2
S1-7	CAL DATA#0(Normal)	240	1				Coherent data bit (16bit)	BU	NC_SHORT	2
S1-8	CAL DATA#0(Log Amp Term)	240	1				Coherent data bit (16bit)	BU	NC_SHORT	2
S1-9	ATT status for Doppler REF.	240	1	Register Value(LSB 8bit)	8			Unitless	NC_CHAR	1
S1-10	ATT status for Echo.	240	1	Register Value(LSB 8bit)	8			Unitless	NC_CHAR	1

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S1-11	Science TLM Quality Status	240	1	spare	4	0		Unitless	NC_USHORT	2
				PRF parameter setting Error	1	0:Normal 1:Error				
				1PPS Resync Status	1	0:Normal 1:Resynchronizing				
				spare	1	0				
				spare	1	0				
				spare	1	0				
				spare	1	0				
				S/C navigation data quality	1	0:Valid 1:Invalid				
				S/C navigation data stop	1	0:Normal 1:Error				
				HPT Restart Status	1	0:Normal 1:Restarting				
				1PPS Sync, Status	1	0:EC_1PPS 1:CPR_1PPS				
				spare	1	0				
				HPT quality status	1	0:Valid 1:Invalid	300s from RF ON			
S1-12	Offset Voltage Status	240	1	Ich	16		Including Dynamic Offset Voltage Value	Unitless	NC_SHORT	4
				Qch	16		Including Dynamic Offset Voltage Value			
S1-13	RF ON/OFF	240	1			0:OFF 1:ON		Unitless	NC_CHAR	1
S1-14	SPU Variable Timing Parameter Status	240	1	T5	16		Sample Starting Time of Doppler Refference(Log)	Unitless	NC_USHORT	24
				T7	16		Sample Starting Time of System Noise and CAL DATA#0(Log Amp Term)			
				T18	16		Sample Starting Time of CAL DATA(HOT) and CAL DATA(Normal)			
				T7+T18	16		Sample Starting Time of CAL DATA#0(HOT) and CAL DATA#0(Normal)			
				T23	16		Sample Starting Time of Tx Monitor Signal			
				T24	16		Sample Starting Time of System Noise in Contingency Mode			
				T25	16		Sample Starting Time of Doppler Refference(IQ)			
				Rx_Timing	16		Switching Time of RX_ATT in SPU(IFU) (Dopp_REF → Echo)			
				IP_Timing	16		Switching Time of IP_SELECT CMD (Noise → Echo)			
				N_Timing	16		Switching Time of N_SOURCE CMD (HOT → Normal)			
				IQ_Delay	16		IQ Delay Time for booster circuit			
				spare	16	FFFFh				
S2-1	RCV-A TEMP	240	1				Redundant RCV	BU	NC_SHORT	2
S2-2	RCV-B TEMP	240	1				Nominal RCV	BU	NC_SHORT	2
S2-3	Noise Diode-A TEMP	240	1				Redundant Noise Diode	BU	NC_SHORT	2
S2-4	Noise Diode-B TEMP	240	1				Nominal Noise Diode	BU	NC_SHORT	2
S2-5	QOF Detector1 TEMP	240	1				MD1 Tx	BU	NC_SHORT	2
S2-6	QOF Detector2 TEMP	240	1				MD1 Tx	BU	NC_SHORT	2
S2-7	QOF TEMP1	240	1				QOFE	BU	NC_SHORT	2
S2-8	QOF TEMP2	240	1				Sub-Reflector	BU	NC_SHORT	2
S2-9	QOF TEMP3	240	1				FH Tx - Main	BU	NC_SHORT	2
S2-10	QOF TEMP4	240	1				FH Tx - Red	BU	NC_SHORT	2
S2-11	QOF TEMP5	240	1				QOF TRP	BU	NC_SHORT	2
S2-12	STR TEMP3	240	1				TRUSS -Y	BU	NC_SHORT	2
S2-13	STR TEMP4	240	1				TRUSS +Y	BU	NC_SHORT	2
S2-14	STR TEMP5	240	1				DPM +Y	BU	NC_SHORT	2
S2-15	STR TEMP6	240	1				HPT	BU	NC_SHORT	2
S2-16	HPT-A(-B) Body Current	240	1					BU	NC_SHORT	2
S2-17	HPT-A(-B) Beam Current	240	1					BU	NC_SHORT	2
S2-18	HPT Status	240	1	HPT-A Ready	1	0:Not Ready 1:Ready		Unitless	NC_CHAR	1
				HPT-B Ready	1	0:Not Ready 1:Ready				
				HPT-A Pulse_Protection	1	0:Normal 1:Abnormal				
				HPT-B Pulse_Protection	1	0:Normal 1:Abnormal				
				HPT-A HEATER ON/OFF	1	0:OFF 1:ON				
				HPT-B HEATER ON/OFF	1	0:OFF 1:ON				
				spare	2	0				
S2-25	LPE-A(-B) Status	240	1	LPE-A(-B) ON/OFF TLM	1	0:OFF 1:ON		Unitless	NC_CHAR	1
				LPE-A(-B) ERROR	1	0:Normal 1:Error				
				LPE-A(-B) PLO_LOCK1	1	0:Unlock 1:Lock				
				LPE-A(-B) PLO_LOCK2	1	0:Unlock 1:Lock				
				LPE-A(-B) PLO_LOCK3	1	0:Unlock 1:Lock				
				spare	3	0				
S2-31	QOF Status	240	1	QOF-A(-B) ON/OFF TLM	1	0:OFF 1:ON		Unitless	NC_CHAR	1
				QOF Heater-A(-B) ON/OFF TLM	1	0:OFF 1:ON				
				Tx MON-A1(B1) ON/OFF TLM	1	0:OFF 1:ON				
				Tx MON-A2(B2) ON/OFF TLM	1	0:OFF 1:ON				
				spare	4	0				
S2-38	Doppler ON/OFF	240	1			0:OFF 1:ON		Unitless	NC_CHAR	1
S2-39	LOG DET TEMP	240	1				SPU (IFU) LOG Detector	BU	NC_SHORT	2
S2-40	IQ DET TEMP	240	1				SPU (IFU) IQ Detector	BU	NC_SHORT	2
S2-41	IQ ADC TEMP	240	1				SPU IQ AD Converter	BU	NC_SHORT	2
S2-42	Component Select Table Status	240	1	SPU Select	1	0: SPU A 1: SPU B		Unitless	NC_CHAR	1
				Component Select	7	1:Pattern 1 2:Pattern 2 3:Pattern 3 4:Pattern 4 5:Pattern 5 6:Pattern 6 7:Pattern 7 8:Pattern 8				
S2-43	Offset Function Status	240	1	Offset Function Status	1	0:DIS 1:ENA		Unitless	NC_CHAR	1
				Offset Temp Select Status	2	0:LOG DET TEMP 1:IQ DET TEMP 2:IQ ADC TEMP				
				spare	5	0				

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S2-44	Average number of #0 Noise Diode	240	1				NIN*NIC In Nominal/Sea Cal/ Ext Cal /Contingency Mode Applied to ·TM(240.1) S1-6 CAL DATA#0(HOT) ·TM(240.1) S1-7 CAL DATA#0Normal)	Unitless	NC_SHORT	2
S2-45	Average number of #0 Log Amp Term	240	1				NIL*NID In Nominal/Sea Cal/ Ext Cal /Contingency Mode Applied to ·TM(240.1) S1-8 CAL DATA#0(Log Amp Term)	Unitless	NC_SHORT	2
S2-46	Average number of System Noise	240	1				NA*NN*K In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.2) P3 Coherent Noise Data NA*NB*K In Contingency Mode ·TM(240.3) P3 Coherent Noise Data	Unitless	NC_SHORT	2
S2-47	Average number of Pulse Pair	240	1				NA*(NB-1) In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.2) P4 Doppler Data_Real ·TM(240.2) P5 Doppler Data_Imag In Contingency Mode Not Applied	Unitless	NC_SHORT	2
S2-48	Data position of Echo Log	240	1				In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.2) P2 Coherent Echo Data In Contingency Mode ·TM(240.3) P3 Coherent Echo Data	Unitless	NC_SHORT	2
S2-49	Data position of Echo Pulse Pair	240	1				In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.2) P4 Doppler Data_Real ·TM(240.2) P5 Doppler Data_Imag ·TM(240.2) P9C Doppler Reference_Real ·TM(240.2) P9D Doppler Reference_Imag In Contingency Mode Not Applied	Unitless	NC_SHORT	2
S2-50	Data position of System Noise	240	1				In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.2) P3 Coherent Noise Data In Contingency Mode ·TM(240.3) P3 Coherent Noise Data	Unitless	NC_SHORT	2
S2-51	Data position of Noise Diode	240	1				In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.1) S1-6 CAL DATA#0(HOT) ·TM(240.1) S1-7 CAL DATA#0Normal) ·TM(240.2) P6B CAL DATA (HOT) ·TM(240.2) P6C CAL DATA (Normal) In Contingency Mode Applied to ·TM(240.1) S1-6 CAL DATA#0(HOT) ·TM(240.1) S1-7 CAL DATA#0Normal)	Unitless	NC_SHORT	2
S2-52	Data position of Log Amp Term	240	1				In Nominal/Sea Cal/ Ext Cal /Contingency Mode Applied to ·TM(240.1) S1-8 CAL DATA#0(Log Amp Term)	Unitless	NC_SHORT	2
S2-53	Data position of Doppler Ref Log	240	1				In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.2) P9B Doppler Reference(LOG) In Contingency Mode ·TM(240.3) P9B Doppler Reference(LOG)	Unitless	NC_SHORT	2
S2-54	Data position of Tx Monitor	240	1				In Nominal/Sea Cal/ Ext Cal Mode Applied to ·TM(240.2) P9A Tx Monitor Signal In Contingency Mode ·TM(240.3) P9A Tx Monitor Signal	Unitless	NC_SHORT	2
S2-55	Observasion height selection Table Version	240	1					Unitless	NC_CHAR	1
S2-56	PRF Table Version	240	1					Unitless	NC_CHAR	1
S2-57	SPU Variable Table Version	240	1					Unitless	NC_CHAR	1
S2-58	Dynamic Offset Table Version	240	1					Unitless	NC_CHAR	1
S2-59	Data Position Table Version	240	1					Unitless	NC_CHAR	1
S2-60	Program Version	240	1				SPUFS EEPROM Version	Unitless	NC_CHAR	1
S2-61	Fixed Offset Voltage Status	240	1	Ich Qch	16 16			Unitless	NC_USHORT	4
S2-62	LPE-A TEMP	240	1				Redundant LPE	Unitless	NC_SHORT	2
S2-63	LPE-B TEMP	240	1				Nominal LPE	Unitless	NC_SHORT	2
S2-64	LPT-A TEMP	240	1				Redundant LPT	Unitless	NC_SHORT	2
S2-65	LPT-B TEMP	240	1				Nominal LPT	Unitless	NC_SHORT	2
S2-66	EIK-A TEMP	240	1				Redundant HPT	Unitless	NC_SHORT	2
S2-67	EIK-B TEMP	240	1				Nominal HPT	Unitless	NC_SHORT	2
S2-68	MREF TEMP1	240	1				MREF Center	Unitless	NC_SHORT	2
S2-69	MREF TEMP2	240	1				MREF Upper	Unitless	NC_SHORT	2
S2-70	MREF TEMP3	240	1				MREF Lower	Unitless	NC_SHORT	2
S2-71	MREF TEMP4	240	1				MREF Left	Unitless	NC_SHORT	2
S2-72	MREF TEMP5	240	1				MREF Right	Unitless	NC_SHORT	2
S2-73	EPC-A TEMP	240	1				Redundant HPT	Unitless	NC_SHORT	2
S2-74	EPC-BTEMP	240	1				Nominal HPT	Unitless	NC_SHORT	2
S2-75	PHS(for Internal CAL) status	240	1				SPU Phase Shifter Status	Unitless	NC_BYTE	1
S2-76	ATT(for Internal CAL) status	240	1	Spare CAL_ATT3 Spare CAL_ATT2 Spare CAL_ATT1	2 6 2 6 2 6	0 0 0 	SPU Calibration ATT Status	Unitless	NC_BYTE	3
Total										212
Packet CRC										
1	AppendedCRC							Unitless	NC_USHORT	2
Total										2

F

3.2.2 Science Data NOM OBS ISP

3.2.2.1 Packet Header

Packet Header of CPR Science Data NOM OBS ISP is same as 3.2.1.1 Packet Header.

3.2.2.2 Data Field Header

Data Field Header of CPR Science Data NOM OBS ISP is same as 3.2.1.2 Data Field Header.

3.2.2.3 Instrument Data Field

Instrument Data Field (="Private Science Data Header"+"Source Data" +"CRC") for CPR Science Data NOM OBS ISP is shown in Table 3-8.

Table 3-8 Instrument Data Field for Science Data NOM OBS ISP

No.	Science Telemetry Name	PUS-Service		Parameter			Comment	Units	NetCDF C-Type	Total size (Byte)
		Service	Subservice	Parameter Name	Bit Length (bit)	Value				
Private Science Data Header										
1	S/C State Vector Quality	240	2	AOCS Mode& SubMode	8	0x00:AOC_SBM 0x10:AOC_ASM_DEP 0x11:AOC_ASM_RD 0x12:AOC_ASM_EA 0x13:AOC_ASM_YA 0x14:AOC_ASM_SS 0x15:AOC_ASM_SEM 0x20:AOC_NOM_DEP 0x21:AOC_NOM_ACQ 0x22:AOC_NOM_AH 0x23:AOC_NOM_FP 0x24:AOC_NOM_AM 0x31:AOC_OCM_ACQ 0x32:AOC_OCM_SL 0x33:AOC_OCM_STAB 0x34:AOC_OCM_DV 0x35:AOC_OCM_BSL		Unitless	NC_UNIT	4
				OBC Sync Time Quality	8					
				Spare	14					
				Nadir Pointing Performance Identifier	1	0:Nominal Performance 1:Degraded Performance				
				S/C State Vector Status	1	0:valid 1:Invalid				
2	ISPS version number	240	2					Unitless	NC_USHORT	2
3	Instrument Ancillary Data	240	2	CPR Offset Time			1LSB=1/48M[s]	Unitless	NC_UNIT	4
Total										10
Source Data >Science Status<										
P1A	Frame Number	240	2					Unitless	NC_UNIT	4
P1B	Average Number	240	2				NA*NB Applied to ・TM(240.2) P2 Coherent Echo Data	Unitless	NC_USHORT	2
P2	Coherent Echo Data	240	2				Coherent data bit ＊ Range gate(H) (= 16bit * 218 range)	BU	NC_SHORT	436
P3	Coherent Noise Data	240	2				Coherent data bit (16bit) *System Noise Data	BU	NC_SHORT	2
P4	Doppler Data_Real	240	2				Doppler data bit ＊ Range gate(H) (= 32bit * 218 range)	BU	NC_INT	872
P5	Doppler Data_Imag	240	2				Doppler data bit ＊ Range gate(H) (= 32bit * 218 range)	BU	NC_INT	872
P6A	Average Number of CAL	240	2				NA*NC Applied to ・TM(240.2) P6B CAL DATA (HOT) ・TM(240.2) P6C CAL DATA (Normal)	Unitless	NC_SHORT	2
P6B	CAL DATA (HOT)	240	2				Coherent data bit (16bit)	BU	NC_SHORT	2
P6C	CAL DATA (Normal)	240	2				Coherent data bit (16bit)	BU	NC_SHORT	2
P9A	Tx Monitor Signal	240	2				16bit ＊ TxMonitorSampleNum('NM) (= 16bit * 34 sample)	BU	NC_SHORT	68
P9B	Doppler Reference(LOG)	240	2				Coherent data bit ＊ Doppler Reference(Log)SampleNum(NDL) (= 16bit * 34 sample)	BU	NC_SHORT	68
P9C	Doppler Reference_Real	240	2				Coherent data bit ＊ Doppler Reference(IQ)SampleNum(NDIQ=1) (= 32bit * 1 sample)	BU	NC_INT	4
P9D	Doppler Reference_Imag	240	2				Coherent data bit ＊ Doppler Reference(IQ)SampleNum(NDIQ=1) (= 32bit * 1 sample)	BU	NC_INT	4
P10	Processing Error Status	240	2	spare	12	0		Unitless	NC_USHORT	2
				Tx_MON Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
				Doppler Log Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
				IQ Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
				Log Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
Total										2340
Packet CRC										
1	AppendedCRC							Unitless	NC_USHORT	2
Total										2

3.2.3 Science Data CON OBS ISP

3.2.3.1 Packet Header

Packet Header of CPR Science Data CON OBS ISP is same as 3.2.1.1 Packet Header.

3.2.3.2 Data Field Header

Data Field Header of CPR Science Data CON OBS ISP is same as 3.2.1.2 Data Field Header.

3.2.3.3 Instrument Data Field

Instrument Data Field (="Private Science Data Header"+"Source Data" +"CRC") for CPR Science Data CON OBS ISP is shown in Table 3-9.

Table 3-9 Instrument Data Field for CPR Science Data CON OBS ISP

No.	Science Telemetry Name	PUS-Service		Parameter			Comment	Units	NetCDF C-Type	Total size (Byte)
		Service	Subservice	Parameter Name	Bit Length (bit)	Value				
Private Science Data Header										
1	S/C State Vector Quality	240	3	AOCS Mode& SubMode	8	0x00:AOC_SBM 0x10:AOC_ASM_DEP 0x11:AOC_ASM_RD 0x12:AOC_ASM_EA 0x13:AOC_ASM_YA 0x14:AOC_ASM_SS 0x15:AOC_ASM_SEM 0x20:AOC_NOM_DEP 0x21:AOC_NOM_ACQ 0x22:AOC_NOM_AH 0x23:AOC_NOM_FP 0x24:AOC_NOM_AM 0x31:AOC_OCM_ACQ 0x32:AOC_OCM_SL 0x33:AOC_OCM_STAB 0x34:AOC_OCM_DV 0x35:AOC_OCM_BSL		Unitless	NC_UNIT	4
				OBC Sync Time Quality	8					
				Spare	14					
				Nadir Pointing Performance Identifier	1	0:Nominal Performance 1:Degraded Performance				
				S/C State Vector Status	1	0:valid 1:Invalid				
2	ISPS version number	240	3					Unitless	NC_USHORT	2
3	Instrument Ancillary Data	240	3	CPR Offset Time			1LSB=1/48M [s]	Unitless	NC_UNIT	4
Total										10
Source Data >Science Status<										
P1A	Frame Number	240	3					Unitless	NC_UNIT	4
P1B	Average Number	240	3				NA*NB Applied to ・TM(240.3) P2 Coherent Echo Data	Unitless	NC_USHORT	2
P2	Coherent Echo Data	240	3				Coherent data bit ＊ Range gate(H) (＝16bit＊544 sample)	BU	NC_SHORT	1088
P3	Coherent Noise Data	240	3				Coherent data bit (16bit)	BU	NC_SHORT	2
P9A	Tx Monitor Signal	240	3				16bit ＊ TxMonitorSampleNum('NM) (＝16bit＊34 sample)	BU	NC_SHORT	68
P9B	Doppler Reference(Log)	240	3				Coherent data bit ＊ Doppler Reference(Log)SampleNum(NDL) (＝16bit＊34 sample)	BU	NC_SHORT	68
P10	Processing Error Status	240	3	spare	12	0		Unitless	NC_USHORT	2
				Tx_MON Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
				Doppler Log Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
				spare	1	0				
				Log Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
Total										1234
Packet CRC										
1	AppendedCRC							Unitless	NC_USHORT	2
Total										2

3.2.4 Science Status INT CAL ISP

3.2.4.1 Packet Header

Packet Header of CPR Science Status INT CAL ISP is same as 3.2.1.1 Packet Header.

3.2.4.2 Data Field Header

Data Field Header of CPR Science Status INT CAL ISP is same as 3.2.1.2 Data Field Header.

3.2.4.3 Instrument Data Field

Instrument Data Field (="Private Science Data Header"+"Source Data" +"CRC") for CPR Science Status INT CAL ISP is shown in Table 3-10.

Table 3-10 Instrument Data Field for CPR Science Status INT CAL ISP

No.	Science Telemetry Name	PUS-Service		Parameter			Comment	Units	NetCDF C-Type	Total size (Byte)
		Service	Subservice	Parameter Name	Bit Length (bit)	Value				
Private Science Data Header										
1	S/C State Vector Quality	240	4	AOCS Mode& SubMode	8	0x00:AOC_SBM 0x10:AOC_ASM_DEP 0x11:AOC_ASM_RD 0x12:AOC_ASM_EA 0x13:AOC_ASM_YA 0x14:AOC_ASM_SS 0x15:AOC_ASM_SEM 0x20:AOC_NOM_DEP 0x21:AOC_NOM_ACQ 0x22:AOC_NOM_AH 0x23:AOC_NOM_FP 0x24:AOC_NOM_AM 0x31:AOC_OCM_ACQ 0x32:AOC_OCM_SL 0x33:AOC_OCM_STAB 0x34:AOC_OCM_DV 0x35:AOC_OCM_BSL		Unitless	NC_UNIT	4
				OBC Sync Time Quality	8					
				Spare	14					
				Nadir Pointing Performance Identifier	1	0:Nominal Performance 1:Degraded Performance				
				S/C State Vector Status	1	0:valid 1:Invalid				
2	ISPS version number	240	4					Unitless	NC_USHORT	2
3	Instrument Ancillary Data	240	4	CPR Offset Time			1LSB=1/48M[s]	Unitless	NC_UNIT	4
Total										10
Source Data >Science Status<										
S1-1A	EC Coarse Time	240	4				1LSB=1[s]	Unitless	NC_UNIT	4
S1-1B	CPR Fine Time	240	4				1LSB=1/48M[s]	Unitless	NC_UNIT	4
S1-1C	CPR Offset Time	240	4				1LSB=1/48M[s]	Unitless	NC_UNIT	4
S1-2	Operational Mode	240	4	Operational mode	4	0:SPU INI 1:Standby 2:IDLE 4:Nom-Obs 5:Sea-Cal 6:Ext-Cal 7:Int-Cal 8:Cont 9:IDLE-REF 10:Stadby-REF		Unitless	NC_CHAR	1
				Spare	3	0				
				Transition Status	1	0:Complete 1:Not Complete				
S1-3	Satellite orbital data	240	4	S/C State Vector Quality	32			Unitless	NC_INT	48
				Time (Local); Integer of Seconds	32		0 to 2^32-1 sec, LSB= 1 sec			
				Spare	8	0				
				Time (Local); Sub Seconds	24		0 to 16777215(1/16777215) sec, LSB = 59.6 nsec			
				Position X	32		Unit: cm LSB = 1cm			
				Position Y	32		Unit: cm			
				Position Z	32		Unit: cm LSB = 1cm			
				Velocity X	32		Unit: mm/s LSB = 1mm/s			
				Velocity Y	32		Unit: mm/s LSB = 1mm/s			
				Velocity Z	32		Unit: mm/s LSB = 1mm/s			
				Geodetic Altitude	32		Unit: cm			
				Geodetic Argument of Latitude	32		Unit: rad LSB = 10^-4 rad			
				geocentric latitude	32		Result of Calculation by SPUFS			
S1-4	PRF Parameter Table ID	240	4				0xFFFF(Fixed)	Unitless	NC_USHORT	2
S1-5	PRI	240	4				0x1EBC(Fixed)	Unitless	NC_USHORT	2
S1-11	Science TLM Quality Status	240	4	spare	4	0		Unitless	NC_USHORT	2
				PRF parameter setting Error	1	0:Normal 1:Error				
				1PPS Resync Status	1	0:Normal				
				spare	1	0				
				spare	1	0				
				spare	1	0				
				spare	1	0				
				S/C navigation data quality	1	0:Valid 1:Invalid				
				S/C navigation data stop	1	0:Normal 1:Error				
				HPT Restart Status	1	0:Normal 1:Restarting				
				1PPS Sync, Status	1	0:EC_1PPS				
				spare	1	0				
				HPT quality status	1	0:Valid	300s from RF ON			
S1-12	Offset Voltage Status	240	4	Ich	16		Including Dynamic Offset Voltage Value	Unitless	NC_SHORT	4
				Qch	16		Including Dynamic Offset Voltage Value			

S1-13	RF ON/OFF	240	4			0:OFF 1:ON		Unitless	NC_CHAR	1
S1-14	SPU Variable Timing Parameter Status	240	4	T5	16		Sample Starting Time of Doppler Refference(Log)	Unitless	NC_USHORT	24
				T7	16		Sample Starting Time of System Noise and CAL DATA#0(Log Amp Term)			
		240		T18	16		Sample Starting Time of CAL DATA(HOT) and CAL			
		240		T7+T18	16		Sample Starting Time of CAL DATA#0(HOT) and CAL DATA#0(Normal)			
				T23	16		Sample Starting Time of Tx Monitor Signal			
		240		T24	16		Sample Starting Time of System Noise in			
				T25	16		Sample Starting Time of Doppler Refference(IQ)			
		240		Rx_Timing	16		Switching Time of RX_ATT in SPU(IFU) (Dopp_REF → Echo)			
		240		IP_Timing	16		Switching Time of IP_SELECT CMD (Noise → Echo)			
		240		N_Timing	16		Switching Time of N_SOURCE CMD (HOT → Normal)			
				IQ_Delay	16		IQ Delay Time for booster circuit			
		240		spare	16	FFFFh				
S2-1	LPE-A(-B) Status	240	4	LPE-A(-B) ON/OFF TLM	1	0:OFF 1:ON		Unitless	NC_CHAR	1
				LPE-A(-B) ERROR	1	0:Normal 1:Error				
				LPE-A(-B) PLO_LOCK1	1	0:Unlock 1:Lock				
				LPE-A(-B) PLO_LOCK2	1	0:Unlock 1:Lock				
				LPE-A(-B) PLO_LOCK3	1	0:Unlock 1:Lock				
				spare	3	0				
S2-7	Doppler ON/OFF	240	4			0:OFF 1:ON		Unitless	NC_CHAR	1
S2-8	LOG DET TEMP	240	4				SPU (IFU) LOG Detector	BU	NC_SHORT	2
S2-9	IQ DET TEMP	240	4				SPU (IFU) IQ Detector	BU	NC_SHORT	2
S2-10	IQ ADC TEMP	240	4				SPU IQ AD Converter	BU	NC_SHORT	2
S2-11	Component Select Table Status	240	4	SPU Select	1	0: SPU A 1: SPU B		Unitless	NC_CHAR	1
				Component Select	7	1:Pattern 1 2:Pattern 2 3:Pattern 3 4:Pattern 4 5:Pattern 5 6:Pattern 6 7:Pattern 7 8:Pattern 8				
S2-12	Offset Function Status	240	4	Offset Function Status	1	0:DIS 1:ENA		Unitless	NC_CHAR	1
				Offset Temp Select Status	2	0:LOG DET TEMP 1:IQ DET TEMP 2:IQ ADC TEMP				
				spare	5	0				
S2-13	Data position of Echo Log	240	4				Applied to ·TM(240.5) P3 Coherent Echo Data	Unitless	NC_USHORT	2
S2-14	Data position of Echo Pulse Pair	240	4				Not Applied	Unitless	NC_USHORT	2
S2-15	Data position of System Noise	240	4				Not Applied	Unitless	NC_USHORT	2
S2-16	Data position of Noise Diode	240	4				Not Applied	Unitless	NC_USHORT	2
S2-17	Data position of Log Amp Term	240	4				Not Applied	Unitless	NC_USHORT	2
S2-18	Data position of Doppler Ref Log	240	4				Not Applied	Unitless	NC_USHORT	2
S2-19	Data position of Tx Monitor	240	4				Not Applied	Unitless	NC_USHORT	2
S2-20	Observasion hight selection Table Version	240	4					Unitless	NC_CHAR	1
S2-21	PRF Table Version	240	4					Unitless	NC_CHAR	1
S2-22	SPU Variable Table Version	240	4					Unitless	NC_CHAR	1
S2-23	Dynamic Offset Table Version	240	4					Unitless	NC_CHAR	1
S2-24	Data Position Table Version	240	4					Unitless	NC_CHAR	1
S2-25	Program Version	240	4				SPUFS EEPROM Version	Unitless	NC_CHAR	1
S2-26	Fixed Offset Voltage Status	240	4	Ich	16			Unitless	NC_SHORT	4
				Qch	16					
S2-27	RCV-A TEMP	240	4				Redundant RCV	BU	NC_SHORT	2
S2-28	RCV-B TEMP	240	4				Nominal RCV	BU	NC_SHORT	2
S2-29	Noise Diode-A TEMP	240	4				Redundant Noise Diode	BU	NC_SHORT	2
S2-30	Noise Diode-B TEMP	240	4				Nominal Noise Diode	BU	NC_SHORT	2
S2-31	QOF Detector1 TEMP	240	4				MD1 Tx	BU	NC_SHORT	2
S2-32	QOF Detector2 TEMP	240	4				MD1 Tx	Unitless	NC_USHORT	2
S2-33	QOF TEMP1	240	4				QOFE	Unitless	NC_USHORT	2
S2-34	QOF TEMP2	240	4				Sub-Reflector	Unitless	NC_USHORT	2
S2-35	QOF TEMP3	240	4				FH Tx - Main	Unitless	NC_USHORT	2
S2-36	QOF TEMP4	240	4				FH Tx - Red	Unitless	NC_USHORT	2
S2-37	QOF TEMP5	240	4				QOF TRP	Unitless	NC_USHORT	2
S2-38	STR TEMP3	240	4				TRUSS -Y	Unitless	NC_USHORT	2
S2-39	STR TEMP4	240	4				TRUSS +Y	Unitless	NC_USHORT	2
S2-40	STR TEMP5	240	4				DPM +Y	Unitless	NC_USHORT	2
S2-41	STR TEMP6	240	4				HPT	Unitless	NC_USHORT	2
S2-42	LPE-A TEMP	240	4				Redundant LPE	Unitless	NC_USHORT	2
S2-43	LPE-B TEMP	240	4				Nominal LPE	Unitless	NC_USHORT	2
S2-44	LPT-A TEMP	240	4				Redundant LPT	Unitless	NC_USHORT	2
S2-45	LPT-B TEMP	240	4				Nominal LPT	Unitless	NC_USHORT	2
S2-46	EIK-A TEMP	240	4				Redundant HPT	Unitless	NC_USHORT	2
S2-47	EIK-B TEMP	240	4				Nominal HPT	Unitless	NC_USHORT	2
S2-48	MREF TEMP1	240	4				MREF Center	Unitless	NC_USHORT	2
S2-49	MREF TEMP2	240	4				MREF Upper	Unitless	NC_USHORT	2
S2-50	MREF TEMP3	240	4				MREF Lower	Unitless	NC_USHORT	2
S2-51	MREF TEMP4	240	4				MREF Left	Unitless	NC_USHORT	2
S2-52	MREF TEMP5	240	4				MREF Right	Unitless	NC_USHORT	2
S2-53	EPC-A TEMP	240	4				Redundant HPT	Unitless	NC_USHORT	2
S2-54	EPC-BTEMP	240	4				Nominal HPT	Unitless	NC_USHORT	2
Total										186
Packet CRC										
1	AppendedCRC							Unitless	NC_USHORT	2
Total										2

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3.2.5 Science Data INT CAL ISP

3.2.5.1 Packet Header

Packet Header of CPR Science Data INT CAL ISP is same as 3.2.1.1 Packet Header.

3.2.5.2 Data Field Header

Data Field Header of CPR Science Data INT CAL ISP is same as 3.2.1.2 Data Field Header.

3.2.5.3 Instrument Data Field

Instrument Data Field (= "Private Science Data Header"+"Source Data" +"CRC") for CPR Science Data INT CAL ISP is shown in Table 3-11.

Table 3-11 Instrument Data Field for CPR Science Data INT CAL ISP

No.	Science Telemetry Name	PUS-Service		Parameter			Comment	Units	NetCDF C-Type	Total size (Byte)
		Service	Subservice	Parameter Name	Bit Length (bit)	Value				
Private Science Data Header										
1	S/C State Vector Quality	240	5	AOCS Mode& SubMode	8	0x00:AOC_SBM 0x10:AOC_ASM_DEP 0x11:AOC_ASM_RD 0x12:AOC_ASM_EA 0x13:AOC_ASM_YA 0x14:AOC_ASM_SS 0x15:AOC_ASM_SEM 0x20:AOC_NOM_DEP 0x21:AOC_NOM_ACQ 0x22:AOC_NOM_AH 0x23:AOC_NOM_FP 0x24:AOC_NOM_AM 0x31:AOC_OCM_ACQ 0x32:AOC_OCM_SL 0x33:AOC_OCM_STAB 0x34:AOC_OCM_DV 0x35:AOC_OCM_BSL		Unitless	NC_UNIT	4
				OBC Sync Time Quality	8					
				Spare	14					
				Nadir Pointing Performance Identifier	1	0:Nominal Performance 1:Degraded Performance				
				S/C State Vector Status	1	0:valid 1:Invalid				
2	ISPS version number	240	5					Unitless	NC_USHORT	2
3	Instrument Ancillary Data	240	5	CPR Offset Time			1LSB=1/48M [s]	Unitless	NC_UNIT	4
Total										10
Source Data >Science Status<										
P1A	Frame Number	240	5					Unitless	NC_UNIT	4
P1B	Average Number	240	5				NA*NB Applied to ・TM(240,5) P3 Coherent Echo Data ・TM(240,5) P5 Doppler Data_Real ・TM(240,5) P6 Doppler Data_Imag	Unitless	NC_USHORT	2
P2	Internal Calibration Mode Status	240	5	Internal Calibration Mode Status	8	1:Log_AMP 2:LIN_I_0 3:LIN_I_180 4:LIN_Q_+90 5:LIN_Q_-90 6:LIN_AMP 8:IQ_CAL 9:Invalid Data		Unitless	NC_CHAR	1
P3	Coherent Echo Data	240	5				Coherent data bit * Range gate(H) (= 16bit * 216 sample)	BU	NC_SHORT	432
P5	Integral Data_Ich	240	5				Doppler data bit * Range gate(H) (= 32bit * 216 sample)	BU	NC_INT	864
P6	Integral Data_Qch	240	5				Doppler data bit * Range gate(H) (= 32bit * 216 sample)	BU	NC_INT	864
P8	PHS(for Internal CAL) status	240	5					Unitless	NC_BYTE	1
P9	ATT(for Internal CAL) status	240	5	Spare	2	0		Unitless	NC_BYTE	3
				CAL_ATT3	6					
				Spare	2	0				
				CAL_ATT2	6					
				Spare	2	0				
				CAL_ATT1	6					
P10	Processing Error Status	240	5	spare	6	0		Unitless	NC_USHORT	1
				IQ Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
				Log Processing Error	1	0 : Normal 1 : ECC 2bit ERROR				
Total										2172
Packet CRC										
1	AppendedCRC							Unitless	NC_USHORT	2
Total										2

Appendix 1

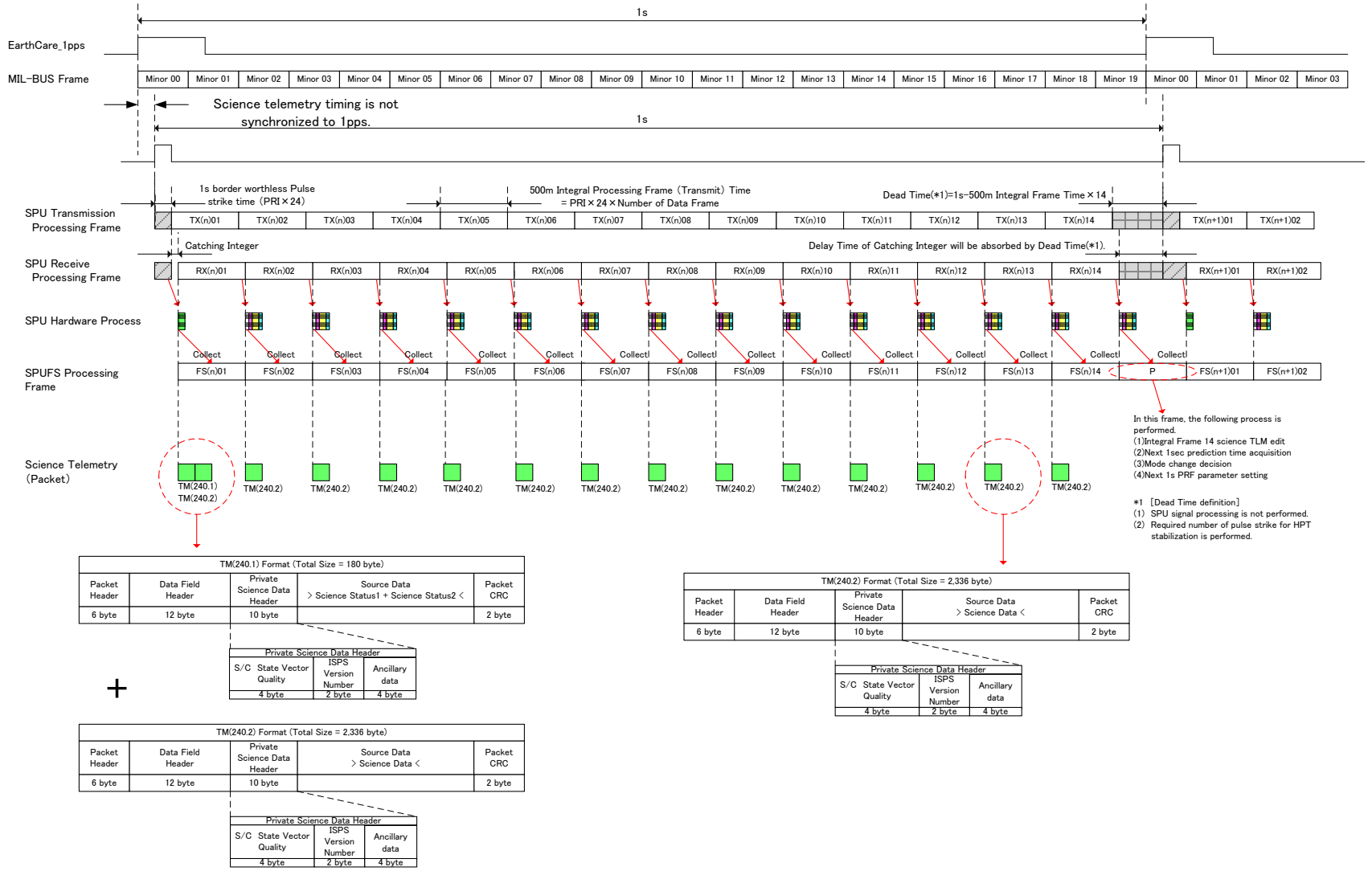

Figure A1 CPR Science Telemetry Processing Timing (Nominal Observation Mode)

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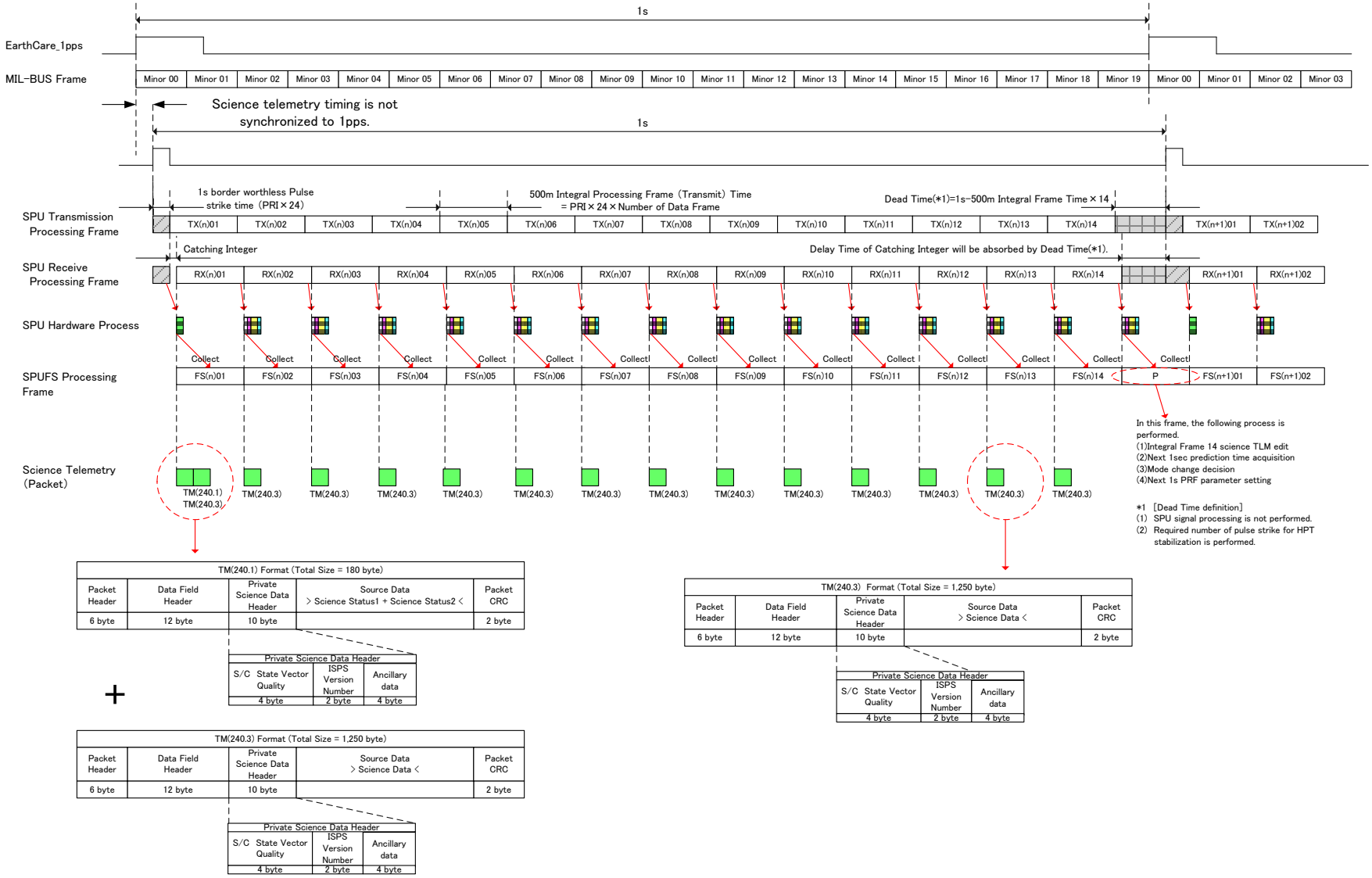


Figure A2 CPR Science Telemetry Processing Timing (Contingency Observation Mode)

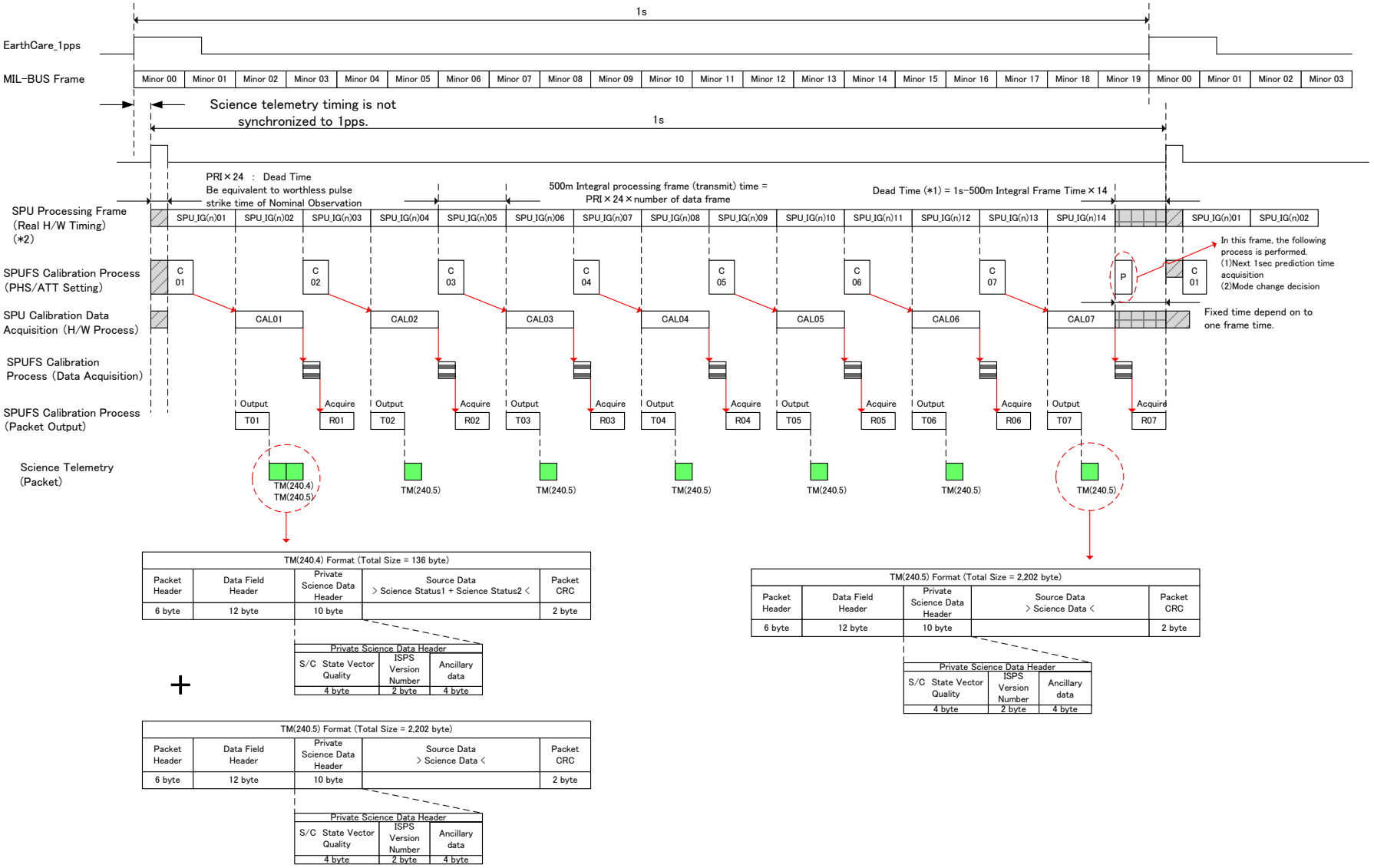


Figure A3 CPR Science Telemetry Processing Timing (Internal Calibration Mode)

Appendix 2
CPR ISP time stamp information

LOBT of the CPR shows the time when the CPR received EC_1pps.

(1) LOBT of Data Field Header :

Calculate ⊿tx from Tx and Fx of Chapter 4 and decide COARSE and FINE

⊿tx = Fx – 48M_Counts（Theoretical one second count level (=48000000counts)）

・In the case of ⊿tx ≧ 0
COARSE : Tx
FINE : ⊿tx

・In the case of ⊿tx < 0
COARSE : Tx – 1sec
FINE : Fx

1LSB of FINE is $1/(48\times10^6)$.

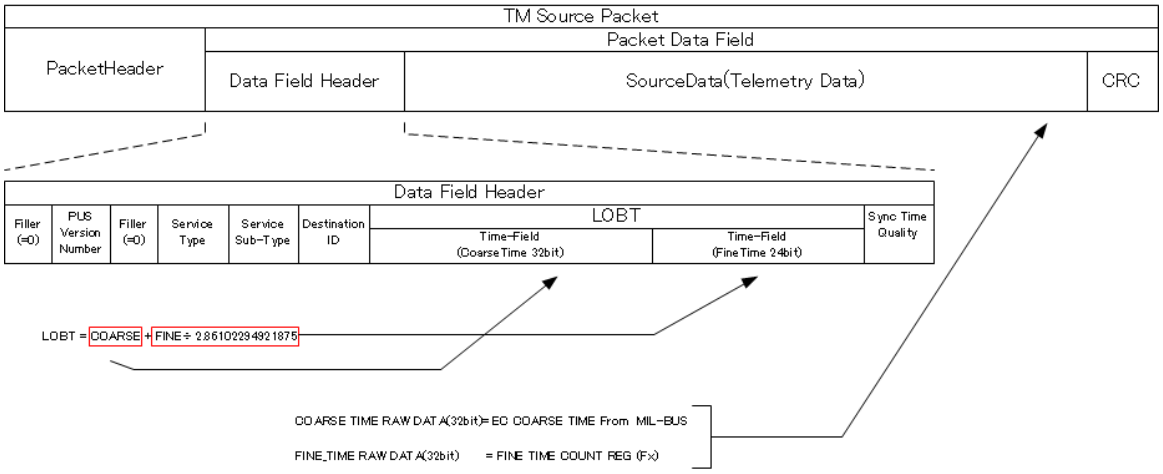
LOBT = COARSE + FINE÷2.86102294921875

A coefficient called "2.86102294921875" is a coefficient to convert heaviness of 1LSB of Sub second defined in PUS document and heaviness of 1LSB of Fine Time Count Register in the CPR.
$2.86102294921875 = 48\times10^6 / 2^{24}$

(2) LOBT of Source Data :

Stores RAW data of Tx and Fx.
（Outputs same data into Health Status Message.）

The LOBT structure in the TM packet is shown in below.



F

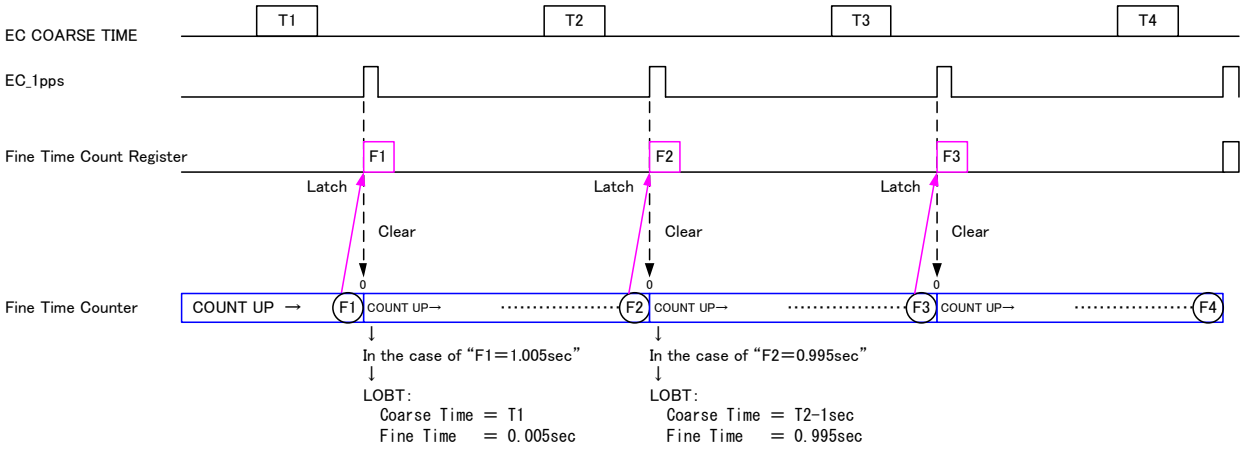


Figure 4.1-1 Time generation concept chart

CPR provides time stamps for HK telemetry and science telemetry. The following time stamps are provided.

1) EC Coarse Time: This is provided from S/C. CPR provides the same value in HK telemetry.
2) CPR Fine Time:

These are provided in Data Field Header and HK telemetry

Data Field Header
Parameter :Time
Position :bit 32 to 87
HK telemetry
No.35-1: EC Coarse Time
No.35-2: CPR Fine Time
Science telemetry
S1-1A: EC Coarse Time
S1-1B: CPR Fine Time

The timing budget is as follows.

CPR internal clock is 48MHz. And the accuracy to determine the time is 4 clocks.
Then the time accuracy is 20.8ns* 4= 83.2ns.
On the other hand, CPR internal oscillator short term stability is 100 us.
Then the time stamp accuracy is 100us according to CPR internal oscillator short term stability

Time stamp accuracy: less than100 us.