

**Title: EarthCARE Products Definitions
 Volume 2a - ATLID L0 Products Definitions**

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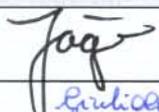
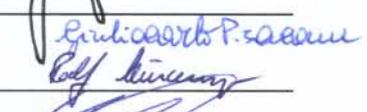
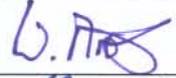
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2.1 Atmospheric LIDAR - Level 0

This specification arises in the frame of the ESSS and ECGP. The purpose of this document is to specify the format and content of the Instrument Source Packets as well as of the L0 products for the ATLID Instrument.

The current ISP format version is 6.1.

TBDs/TBCs/TBWs mark specifications that are yet to be completed. Currently, this document includes the following TBDs/TBCs/TBWs.

TBC/TBD

Product sizes and product coverage..... 5

The ATLID Instrument generates the following products.

Table 2.1-1: Products Summary Table (TBC)

Instrument Mode	Product Id	Description	Record Size (Byte)	Granularity	Product Size	Coverage	Geometric Information	Radiometric Information
Operational	ATL_NO M_0_	Level-0 product.	1786 (co-adding factor = 1)	74 s ⁻¹	734 MB (maximum)	TBD	TBD	TBD
			1964 (co-adding factor = 2)	37 s ⁻¹	404 MB (default)			

2.1.1 General Data Structures

These are the common data structures for the ATLID L0 Products.

2.1.1.1 CAScoordinates

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	Xvalue	X value	units	NC_FLOAT	4	1	4	
2	Yvalue	Y value	units	NC_FLOAT	4	1	4	
TOTAL:							8	

2.1.2 ATL_NOM_0_

2.1.2.1 Description

This is the nominal ATLID L0 product.

2.1.2.2 Input Data

The ATLID Level-0 data is a reorganisation and collation of the ISPs specified in section 2.1.2.4.4. Quality flags are computed as needed and stored in the L0 Products Header.

2.1.2.3 Auxiliary Data

No auxiliary data is needed apart from time correlation information in the case of invalid time stamps in the ISPs.

2.1.2.4 Product Structure

Table 2.1-2: Product Overview

Fixed Product Header
ATLIDNOM_L0_MainProductHeader
L0 Specific Product Header
Instrument Source Packets

2.1.2.4.1 Fixed Product Header

See Products Definitions Volume 1.

2.1.2.4.2 ATLIDNOM_L0_MainProductHeader

This is the Main Product Header for the ATLID L0 Products. It is identical to the Main Product Header in Vol. 1 but has some predefined values specific to the ATLID L0 product.

#	Field name	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	productName	unitless	NC_BYTE	55	1	55	
2	missionID	unitless	NC_BYTE	2	1	2	EC
3	fileClass	unitless	NC_BYTE	4	1	4	
4	fileCategory	unitless	NC_BYTE	4	1	4	ATL_
5	productType	unitless	NC_BYTE	3	1	3	
6	latency	unitless	NC_BYTE	1	1	1	
7	productLevel	unitless	NC_BYTE	2	1	2	0_
8	sensingStart	unitless	NC_BYTE	23	1	23	
9	sensingStop	unitless	NC_BYTE	23	1	23	
10	productVersion	unitless	NC_BYTE	4	1	4	
11	degradedProductQualityFlag	unitless	NC_SHORT	2	1	2	
12	processingMode	unitless	NC_BYTE	1	1	1	
13	dispositionMode	unitless	NC_BYTE	1	1	1	

14	description	unitless	NC_BYTE	1024	1	1024	
15	processorName	unitless	NC_BYTE	1024	1	1024	
16	processorMajorVersion	unitless	NC_SHORT	2	1	2	
17	processorMinorVersion	unitless	NC_SHORT	2	1	2	
18	formatVersion	unitless	NC_BYTE	26	1	26	
19	subsettedProduct	unitless	ECBool	1	1	1	
20	dataBlockSize	unitless	NC_UINT64	8	1	8	
21	productDuration	unitless	NC_UINT	4	1	4	
22	acquisitionStation	unitless	NC_BYTE	10	1	10	
23	processingCentre	unitless	NC_BYTE	4	1	4	
24	processingStart	unitless	NC_BYTE	23	1	23	
25	processingStop	unitless	NC_BYTE	23	1	23	
26	orbitStart	unitless	NC_USHORT	2	1	2	
27	orbitStop	unitless	NC_USHORT	2	1	2	
28	ANXTime	unitless	NC_BYTE	26	1	26	
29	ANXLongitude	unitless	NC_DOUBLE	8	1	8	
30	stateVectorSource	unitless	NC_BYTE	15	1	15	
31	stateVectorTimeStamp	unitless	NC_BYTE	26	1	26	
32	xPosition	unitless	NC_DOUBLE	8	1	8	
33	yPosition	unitless	NC_DOUBLE	8	1	8	
34	zPosition	unitless	NC_DOUBLE	8	1	8	
35	xVelocity	unitless	NC_DOUBLE	8	1	8	
36	yVelocity	unitless	NC_DOUBLE	8	1	8	
37	zVelocity	unitless	NC_DOUBLE	8	1	8	
38	subsatellitePointStart	unitless	GeographicCoordinates	45	1	45	
39	subsatellitePointStop	unitless	GeographicCoordinates	45	1	45	
TOTAL:						Size depends on XML format	

2.1.2.4.3 L0 Specific Product Header

See Products Definitions Volume 1.

2.1.2.4.4 Instrument Source Packets

ATLID operates in a number of modes. Some of the modes do not generate ISPs at all; some generate ISPs for special purposes (e.g. calibration measurements). For the ESSS some of them generate only dummy ISPs (that is ISPs in the right format with dummy values). The ATLID instrument modes are summarised in Table 2.1-3.

Table 2.1-3: ATLID Instrument Modes

Mode Value	Mode description	Comment
OFF	OFF All ATLID units are OFF	No ISP generated

INI	INIT	No ISP generated
SBY	Standby	No ISP generated
HWU	Idle / heater warm-up	No ISP generated
IDR	Idle / refuse	No ISP generated
DEC	Decontamination	No ISP generated
LWU	Operational /Laser warm-up / warm-up	No ISP generated
DCC	Operational /Laser warm-up / Dark current calibration Laser not emitting, laser chopper closed, detection chain in nominal mode	Special instrument mode allowing calibration of dark signal and estimation of read-out noise This mode differs from the nominal measurement mode only as far as the coding word is concerned Generates LIDAR ISP.
RNC	Operational /Laser warm-up / Read-out Noise Calibration Laser not emitting, laser chopper closed, detection chain in specific mode to read empty samples	This instrument mode will only be used for investigations on ground or in flight in case of abnormal noise detected This mode differs from the nominal measurement mode only as far as the coding word is concerned Generates LIDAR ISP. Generates RONC ISP.
MES	Operational / measurement Laser on, chopper operating, detection in nominal mode	Nominal instrument mode: continuous acquisition of LIDAR echoes, laser frequency tuned to receiver central frequency Generates LIADR ISP. Generates Coalignment ISP.
BEC	Operational / Shooting calibration / Background Etalon Spectral Calibration	The background etalon temperature is adjusted in order to optimise the reception efficiency. It belongs to Shooting Calibration operational mode. Generates LIADR ISP. Generates Coalignment ISP.
COC	Operational / Shooting calibration / Co-Alignment Calibration	The measurements are achieved in the same way that the atmospheric measurement mode. However, the beam steering mechanism is activated for scanning the receiving FOV and the best emission beam orientation is defined as initialisation data for the co-alignment close-loop. It belongs to Shooting Calibration operational mode. Generates Coalignment ISP.

<p>CSC</p>	<p>Operational / Shooting calibration / Coarse spectral calibration Same as measurement but laser frequency is scanned over its tunability range</p>	<p>Special instrument mode supporting coarse spectral calibration performance assessment</p> <p>This mode differs from the nominal measurement model in that the laser frequency is swept with respect to receiver central frequency to be able to calibrate Rx/Tx spectral registration</p> <p>Generates LIADR ISP. Generates Coalignment ISP.</p>
<p>FSC</p>	<p>Operational / Shooting calibration / Fine spectral calibration Same as measurement but laser frequency is scanned over a reduced spectral range around receiver peak frequency</p>	<p>Special instrument mode supporting fine spectral calibration performance assessment, i.e. retrieval of the receiver central frequency</p> <p>This mode differs from the nominal measurement model in that the laser frequency is swept with respect to receiver central frequency to be able to calibrate Rx/Tx spectral registration</p> <p>Generates LIADR ISP. Generates Coalignment ISP.</p>
<p>EDC</p>	<p>Operational / Shooting calibration / Emission defocus Same as measurement but telescope temperature is scanned around its nominal value (one new temperature command every n orbits), to find the optimum command. The effect of the temperature change is a variation in the instrument response.</p>	<p>The telescope defocus calibration will be done only once or twice in orbit</p> <p>This mode differs from the nominal measurement mode only as far as the coding word is concerned</p> <p>Generates LIADR ISP. Generates Coalignment ISP.</p>
<p>LDT (TBC)</p>	<p>Operational / Shooting calibration / Laser diodes temperature adjustment Laser diode currents are scanned around their nominal values while energy is monitored to find the optimum current value</p>	<p>This instrument mode corresponds to a maintenance procedure that consists in scanning the diode current commands and analysing the measured internal fluxes in order to derive optimum position</p> <p>This mode differs from the nominal measurement mode only as far as the coding word is concerned.</p> <p>Generates LIADR ISP. Generates Coalignment ISP.</p>
<p>IMG</p>	<p>Operational / Shooting calibration / Imaging Laser on, but detection chain integrates the vertical profile and provides the image of the spot on detector</p>	<p>This mode will be used at beginning of life to estimate potential spot displacement due to launch environment</p> <p>This mode differs from the nominal measurement mode only as far as the coding word is concerned</p> <p>Generates IMAGING ISP. Generates Coalignment ISP.</p>

<p>UPD</p>	<p>Operational / Shooting calibration / Unprocessed data Same as measurement, but detection chain provides raw data resulting from oversampling of two samples</p>	<p>This detection mode provides the raw over-sampled data for 2 vertical samples per shot. This mode is mostly defined for ground testing purposes (investigations during EMC tests)</p> <p>This mode differs from the nominal measurement mode only as far as the coding word is concerned</p> <p>Generates UPDATA ISP. Generates Coalignment ISP.</p>
<p>OCK</p>	<p>Operational / Laser offset check and adjustment Laser cavity control loop is checked with different mirror position offset commands to set the piezo mirror at the middle of its range</p>	<p>This is a contingency mode run in case of problems in laser frequency control</p> <p>No ISP generated</p>

The following subsections define the generated ISPs.

2.1.2.4.4.1 ATLIDAnCHRData

This data structure is repeated in the ISP for every laser shot depending on the co-adding factor. A co-adding factor of N would result in N repetitions of this data structure in the ISP. See also the description in the ISP definitions below.

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	Nacc_Cycle_Pos	Laser shot ID inside the DRD accumulation loop	unitless	NC_USHORT	2	1	2	
2	Laser_Shot_Date	Timestamp of the laser shot	unitless	ISPTime	7	1	7	
3	RHL_Frequency	TXA reference infrared frequency	BU	NC_USHORT	2	1	2	
4	TXA_Status	Bit vector indicating laser healthiness	unitless	NC_USHORT	2	1	2	
5	PD_En_UV	UV energy at output of harmonic section. Transfer function of IRDB shall be applied to get mJ	BU	NC_USHORT	2	1	2	
6	TLE_Status	Bit vector indicating TLE module healthiness	unitless	NC_USHORT	2	1	2	
7	RLH_Status	Laser frequency locking status (word = 0xFFFF if tuned, word = 0xBFFF if not tuned)	unitless	NC_USHORT	2	1	2	
8	PD_En_Amp	IR energy measurement at amplifier level	BU	NC_USHORT	2	1	2	
9	Spare1	Provision	unitless	NC_USHORT	2	1	2	
10	PD_En_MO	IR energy measurement at Master Oscillator level	BU	NC_USHORT	2	1	2	
11	Multimode_Ratio	Proportion of longitudinal useless mode in the laser emission	BU	NC_USHORT	2	1	2	
12	MO_I_sampled	Master Oscillator drive current	BU	NC_USHORT	2	1	2	

				T				
13	Amp_1_Isampled	Amplifier 1 drive current	BU	NC_USHORT	2	1	2	
14	Amp_2_Isampled	Amplifier 2 drive current	BU	NC_USHORT	2	1	2	
15	Command_Rejection_Status_Word	TxA command acknowledge return	units	NC_USHORT	2	1	2	
16	Failure_Status_Word_1	TxA failure description message (LSW)	units	NC_USHORT	2	1	2	
17	Failure_Status_Word_2	TxA failure description message (MSW)	units	NC_USHORT	2	1	2	
18	TxA_LCLK_Counter	Laser PRF count ID	units	NC_USHORT	2	1	2	
19	delay_dt0	ACDM/TxA PRF delay in TMC(ACDM)	BU	NC_UINT	4	1	4	
20	delay_dt3_Fixed	TLE/IDE delay offset in TMC(ACDM)	BU	NC_UINT	4	1	4	
21	delay_dt3_Variable	TLE/IDE delay altitude adjustment in TMC(ACDM)	BU	NC_UINT	4	1	4	
22	delay_dt5	OGSE synchronisation delay wrt IDE counter start in TMC(ACDM)	BU	NC_UINT	4	1	4	
23	delay_dt6	OGSE synchronisation delay wrt ACDM PRF active edge in TMC(ACDM)	BU	NC_UINT	4	1	4	
24	Synchro_Enable	Bit vector indicating instrument synchronisation status	units	NC_USHORT	2	1	2	
25	Spare2	Provision	units	NC_USHORT	2	1	2	
26	Spare3	Provision	units	NC_USHORT	2	1	2	
27	Spare4	Provision	units	NC_USHORT	2	1	2	
28	Spare5	Provision	units	NC_USHORT	2	1	2	
29	TXA_Mode	Laser mode (EMISSION, WARM-UP, OFFSET_CHECK, INIT, STAND-BY, OFF)	units	NC_USHORT	2	1	2	
30	IDE_Mode	IDE mode (LIDAR, RONC, IMAGING, UP-DATA, STAND-BY, OFF)	units	NC_USHORT	2	1	2	
31	INS_Mode	Instrument mode (INS_OPE, INS_IDL, INS_IDR, INS_DEC, INS_SBY, INS_SBR, INS_INI, INS_LAU, INS_OFF)	units	NC_USHORT	2	1	2	
32	Atlid_Mode	ATLID mode (MEAS, SHTG_CAL, OCKA, LWU, DEC, RDY, HWU, IDLE_R, ST_BY, ST_BY_R, INIT, OFF)	units	NC_USHORT	2	1	2	
33	Spare6	Provision	units	NC_USHORT	2	1	2	
34	Spare7	Provision	units	NC_USHORT	2	1	2	
35	Validity	Bit vector : pointing validity, frequency locked, nominal thermal map, transition state during calibration	units	NC_USHORT	2	1	2	
36	Status	Bit vector : ACDM Instrument HW check-up	units	NC_USHORT	2	1	2	

37	Current_Procedure	ATLID sub-mode (NOCAL, DCC, RNC, OCK, BEC, EDC, COC, CSC, FSC, LDT, IMG, UPD)	units	NC_USHORT	2	1	2	
38	Calibration_Step	Frequency step ID inside the CSC/FSC scan	units	NC_USHORT	2	1	2	
39	Calibration_Setpoint	Frequency of the step	BU	NC_USHORT	2	1	2	
40	SW_Anomaly_Code	Software failure description message	units	NC_USHORT	2	1	2	
41	ACDM_LCLK_Counter	ACDM PRF count ID	units	NC_USHORT	2	1	2	
42	DRD_Packet_Date	IDE Timestamp of the Detection Raw Data packet	units	ISPTime	7	1	7	
43	DRD_Packet_Counter	DRD count ID	units	NC_UINT	4	1	4	
44	M1_Mirror_Temp	Primary mirror temperature	BU	NC_USHORT	2	1	2	
45	BKGE_Temp	Background etalon temperature	BU	NC_USHORT	2	1	2	
46	E_BEX_A_Temp	Beam expander A temperature	BU	NC_USHORT	2	1	2	
47	E_BEX_B_Temp	Beam expander B temperature	BU	NC_USHORT	2	1	2	
48	BSM_Pos_1	Beam steering actuator 1 position	BU	NC_USHORT	2	1	2	
49	BSM_Pos_2	Beam steering actuator 2 position	BU	NC_USHORT	2	1	2	
50	BSM_Pos_3	Beam steering actuator 3 position	BU	NC_USHORT	2	1	2	
51	BSM_Pos_4	Beam steering actuator 4 position	BU	NC_USHORT	2	1	2	
52	SpareArray	Provision	units	NC_USHORT	2	27	54	
TOTAL:							178	

2.1.2.4.4.2 ATLID_LIDAR_PacketHeader Bit Vector Table

These are the actual values of the Packet Header for the ATLID LIDAR ISP.

Parameter	MSB	Description	Value
Version_Number	b0 - b2	CCSDS Version Number	000b
Type	b3	Packet type	0b
Data_Field_Header_Flag	b4	Indicates the presence of a secondary (data field) header (when set to 1).	0x01
Application_Process_ID_PID	b5 - b11	Process ID (part of the APID)	0x40
Application_Process_ID_PCAT	b12 - b15	Packet category	12
Segmentation_Flags	b16 - b17	Indicates the grouping (segmentation) of TM source packets.	11b
Source_Sequence_Count	b18 - b31	Wrap around counter used to count each TM packet. For the ESSS in contrast to the PUS, only one counter for all APIDs is maintained.	source packet count value modulo 2 ¹⁴ (0 - 16383)
Packet_Length	b32 - b47	Number of bytes contained in the packet data field minus 1.	number of octets in packed data field - 1

2.1.2.4.4.3 ATLID_LIDAR_PUSDataFieldHeader Bit Vector Table

These are the actual values of the PUS Data Field Header described in Vol. 1 for the ATLID LIDAR ISP.

Parameter	MSB	Description	Value
Spare_1	b0	Not used.	Must be set to 0 for all TM source packets.
TM_Source_Packet_PUS_Version_Number	b1 - b3	Not used.	(0 was used for ESA PUS version) 1 for ECSS PUS
Spare_2	b4 - b7	Filler to complete the byte.	Must be set to 0 for all TM source packets
Service_Type	b8 - b15	Indicates the service to which the packet relates.	225
Service_Subtype	b16 - b23	Indicates the service subtype to which the packet relates.	1
Destination_ID	b24 - b31	Indicates the destination of the packet (May be omitted if only one destination exists).	0
Time	b32 - b87	Onboard time (OBT).	Coarse time: LSB = 1 sec Fine time: LSB = 1/16777215 sec
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.	Bit3 (Time type): 0 = Elapsed Time (ET); 1 = OBT Bit 4 (Sync. Source): 0 = internal; 1 = external Bit 5 (Ext. Sync. Source Detail): 0 = 1Hz Pulse; 1 = MIL-BUS Bit 6 (Sync. Status): 0 = NoSync; 1 = InSync Bit 7 (Sync. Enabled/Disabled): 0 = Disabled; 1 = Enabled

2.1.2.4.4.4 ATLIDLIDARISP

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	stateVectorQuality	Contains details about the S/C state vector quality information as received from the S/C	units	NC_UINT	4	1	4	
2	ISPFormatVersion	Stores the version number of the ICD where the ISP format definition is specified. The most significant byte shall store the major version and the least significant byte shall store the minor version.	units	NC_USHORT	2	1	2	
3	AncDataSetsCount	Nanc (=Nacc nominally) : nb of sets of high rate ancillary per DRD / nb of laser shots per DRD if less or equal 10	units	NC_USHORT	2	1	2	
4	anchHRDataSets	This data structure is repeated in the ISP for every laser shot depending on the co-adding factor. A co-adding factor of N would result in N repetitions of this data structure in the ISP. See also the description in the ISP definitions below.	units	ATLIDAnchRData	178	1 - 10	178 - 1780	
5	Packet_Header	Detection Raw Data numerical ID	units	NC_USHORT	2	1	2	
6	IDE_Mode_Selection	IDE mode (LIDAR, RONC, IMAGING or UP-DATA) : here LIDAR	units	NC_USHORT	2	1	2	
7	N_PRF_IDE_Parameter	Nacc : nb of laser shots per DRD	units	NC_USHORT	2	1	2	
8	Sample_Number	Total number of samples in the echo profile (3 x 260 =780)	units	NC_USHORT	2	1	2	
9	Pixel_Index_UPD	Pixel ID when in UPD mode; not applicable when on LIDAR sub-mode	units	NC_USHORT	2	1	2	
10	Validity	Bit vector indicating the quality of the acquisition (copy of ACDM TC content)	units	NC_USHORT	2	1	2	
11	Spare1	Provision	units	NC_USHORT	2	1	2	
12	Spare2	Provision	units	NC_USHORT	2	1	2	
13	Detection_Saturation_Status	Bit vector for channels saturation indicator	units	NC_USHORT	2	1	2	
14	Background_Integration_Time	Number of TMC(IDE) for background samples, depends on number of accumulation	units	NC_USHORT	2	1	2	
15	DataArray_MieCospolar	Contains 255 laser return samples [1..255], 4 offset evaluation samples [256..259] and 1 spare sample N#260	BU	NC_USHORT	2	260	520	
16	DataArray_MieCrosspolar	Contains 255 laser return samples [1..255], 4 offset evaluation samples [256..259] and 1 spare sample N#261	BU	NC_USHORT	2	260	520	
17	DataArray_Raylei	Contains 255 laser return samples	BU	NC_USHORT	2	260	520	

	gh	[1..255], 4 offset evaluation samples [256..259] and 1 spare sample N#262		T				
18	AppendedCRC			AppendedCRC	2	1	2	
TOTAL:							1768 - 3370	

2.1.2.4.4.5 ATLID_RONC_PacketHeader Bit Vector Table

These are the actual values of the Packet Header for the ATLID RONC ISP.

Parameter	MSB	Description	Value
Version_Number	b0 - b2	CCSDS Version Number	000b
Type	b3	Packet type	0b
Data_Field_Header_Flag	b4	Indicates the presence of a secondary (data field) header (when set to 1).	0x01
Application_Process_ID_PID	b5 - b11	Process ID (part of the APID)	0x40
Application_Process_ID_PCAT	b12 - b15	Packet category	12
Segmentation_Flags	b16 - b17	Indicates the grouping (segmentation) of TM source packets.	11b
Source_Sequence_Count	b18 - b31	Wrap around counter used to count each TM packet. For the ESSS in contrast to the PUS, only one counter for all APIDs is maintained.	source packet count value modulo 2 ¹⁴ (0 - 16383)
Packet_Length	b32 - b47	Number of bytes contained in the packet data field minus 1.	number of octets in packed data field - 1

2.1.2.4.4.6 ATLID_RONC_PUSDataFieldHeader Bit Vector Table

These are the actual values of the PUS Data Field Header described in Vol. 1 for the ATLID RONC ISP.

Parameter	MSB	Description	Value
Spare_1	b0	Not used.	Must be set to 0 for all TM source packets.
TM_Source_Packet_PUS_Version_Number	b1 - b3	Not used.	(0 was used for ESA PUS version) 1 for ECSS PUS
Spare_2	b4 - b7	Filler to complete the byte.	Must be set to 0 for all TM source packets
Service_Type	b8 - b15	Indicates the service to which the packet relates.	225
Service_Subtype	b16 - b23	Indicates the service subtype to which the packet relates.	2
Destination_ID	b24 - b31	Indicates the destination of the packet (May be omitted if only one destination exists).	0
Time	b32 - b87	Onboard time (OBT).	Coarse time: LSB = 1 sec Fine time: LSB = 1/16777215 sec
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.	Bit3 (Time type): 0 = Elapsed Time (ET); 1 = OBT Bit 4 (Sync. Source): 0 = internal; 1 = external Bit 5 (Ext. Sync. Source Detail): 0 = 1Hz Pulse; 1 = MIL-BUS Bit 6 (Sync. Status): 0 = NoSync; 1 = InSync Bit 7 (Sync. Enabled/Disabled): 0 = Disabled; 1 = Enabled

2.1.2.4.4.7 ATLIDRONCISP

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	stateVectorQuality	Contains details about the S/C state vector quality information as received from the S/C	units	NC_UINT	4	1	4	
2	ISPFormatVersion	Stores the version number of the ICD where the ISP format definition is specified. The most significant byte shall store the major version and the least significant byte shall store the minor version.	units	NC_USHORT	2	1	2	
3	AncDataSetsCount	Nanc (=Nacc nominally) : nb of sets of high rate ancillary per DRD / nb of laser shots per DRD if less or equal 10	units	NC_USHORT	2	1	2	
4	anchHRDataSets	This data structure is repeated in the ISP for every laser shot depending on the co-adding factor. A co-adding factor of N would result in N repetitions of this data structure in the ISP. See also the description in the ISP definitions below.	units	ATLIDAnchRData	178	1 - 10	178 - 1780	
5	Packet_Header	Detection Raw Data numerical ID	units	NC_USHORT	2	1	2	
6	IDE_Mode_Selection	IDE mode (LIDAR, RONC, IMAGING or UP-DATA) : here RONC	units	NC_USHORT	2	1	2	
7	N_PRF_IDE_Parameter	Nacc : nb of laser shots per DRD	units	NC_USHORT	2	1	2	
8	Sample_Number	Total number of samples in the echo profile (3 x 260 =780)	units	NC_USHORT	2	1	2	
9	Pixel_Index_UPD	Pixel ID when in UPD mode; not applicable when on RONC sub-mode	units	NC_USHORT	2	1	2	
10	Validity	Bit vector indicating the quality of the acquisition (copy of ACDM TC content)	units	NC_USHORT	2	1	2	
11	Spare1	Provision	units	NC_USHORT	2	1	2	
12	Spare2	Provision	units	NC_USHORT	2	1	2	
13	Detection_Saturation_Status	Bit vector for channels saturation indicator	units	NC_USHORT	2	1	2	
14	Background_Integration_Time	Number of TMC(IDE) for background samples, depends on number of accumulation	units	NC_USHORT	2	1	2	
15	DataArray_MieCospolar	Contains 255 laser return samples [1..255], 4 offset evaluation samples [256..259] and 1 spare sample N#260	BU	NC_USHORT	2	260	520	
16	DataArray_MieCrosspolar	Contains 255 laser return samples [1..255], 4 offset evaluation samples [256..259] and 1 spare sample N#261	BU	NC_USHORT	2	260	520	
17	DataArray_Raylei	Contains 255 laser return samples	BU	NC_USHORT	2	260	520	

	gh	[1..255], 4 offset evaluation samples [256..259] and 1 spare sample N#262		T				
18	AppendedCRC			AppendedCRC	2	1	2	
TOTAL:							1768 - 3370	

2.1.2.4.4.8 ATLID_IMAGING_PacketHeader Bit Vector Table

These are the actual values of the Packet Header for the ATLID IMAGING ISP.

Parameter	MSB	Description	Value
Version_Number	b0 - b2	CCSDS Version Number	000b
Type	b3	Packet type	0b
Data_Field_Header_Flag	b4	Indicates the presence of a secondary (data field) header (when set to 1).	0x01
Application_Process_ID_PID	b5 - b11	Process ID (part of the APID)	0x40
Application_Process_ID_PCAT	b12 - b15	Packet category	12
Segmentation_Flags	b16 - b17	Indicates the grouping (segmentation) of TM source packets.	11b
Source_Sequence_Count	b18 - b31	Wrap around counter used to count each TM packet. For the ESSS in contrast to the PUS, only one counter for all APIDs is maintained.	source packet count value modulo 2 ¹⁴ (0 - 16383)
Packet_Length	b32 - b47	Number of bytes contained in the packet data field minus 1.	number of octets in packed data field - 1

2.1.2.4.4.9 ATLID_IMAGING_PUSDataFieldHeader Bit Vector Table

These are the actual values of the PUS Data Field Header described in Vol. 1 for the ATLID IMAGING ISP.

Parameter	MSB	Description	Value
Spare_1	b0	Not used.	Must be set to 0 for all TM source packets.
TM_Source_Packet_PUS_Version_Number	b1 - b3	Not used.	(0 was used for ESA PUS version) 1 for ECSS PUS
Spare_2	b4 - b7	Filler to complete the byte.	Must be set to 0 for all TM source packets
Service_Type	b8 - b15	Indicates the service to which the packet relates.	225
Service_Subtype	b16 - b23	Indicates the service subtype to which the packet relates.	3
Destination_ID	b24 - b31	Indicates the destination of the packet (May be omitted if only one destination exists).	0
Time	b32 - b87	Onboard time (OBT).	Coarse time: LSB = 1 sec Fine time: LSB = 1/16777215 sec
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.	Bit3 (Time type): 0 = Elapsed Time (ET); 1 = OBT Bit 4 (Sync. Source): 0 = internal; 1 = external Bit 5 (Ext. Sync. Source Detail): 0 = 1Hz Pulse; 1 = MIL-BUS Bit 6 (Sync. Status): 0 = NoSync; 1 = InSync Bit 7 (Sync. Enabled/Disabled): 0 = Disabled; 1 = Enabled

2.1.2.4.4.10 ATLIDIMAGINGISP

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	stateVectorQuality	Contains details about the S/C state vector quality information as received from the S/C	units	NC_UINT	4	1	4	
2	ISPFormatVersion	Stores the version number of the ICD where the ISP format definition is specified. The most significant byte shall store the major version and the least significant byte shall store the minor version.	units	NC_USHORT	2	1	2	
3	AncDataSetsCount	Nanc (=Nacc nominally): nb of sets of high rate ancillary per DRD / nb of laser shots per DRD if less or equal 10	units	NC_USHORT	2	1	2	
4	anchHRDataSets	This data structure is repeated in the ISP for every laser shot depending on the co-adding factor. A co-adding factor of N would result in N repetitions of this data structure in the ISP. See also the description in the ISP definitions below.	units	ATLIDAnchRData	178	1 - 10	178 - 1780	
5	Packet_Header	Detection Raw Data numerical ID	units	NC_USHORT	2	1	2	
6	IDE_Mode_Selection	IDE mode (LIDAR, RONC, IMAGING or UP-DATA); here IMAGING	units	NC_USHORT	2	1	2	
7	N_PRF_IDE_Parameter	Nacc : nb of laser shots per DRD	units	NC_USHORT	2	1	2	
8	Sample_Number	Total number of samples in the echo profile (3 x 260 =780)	units	NC_USHORT	2	1	2	
9	Pixel_Index_UPD	Pixel ID when in UPD mode; not applicable when on IMAGING sub-mode	units	NC_USHORT	2	1	2	
10	Validity	Bit vector indicating the quality of the acquisition (copy of ACDM TC content)	units	NC_USHORT	2	1	2	
11	Spare1	Provision	units	NC_USHORT	2	1	2	
12	Spare2	Provision	units	NC_USHORT	2	1	2	
13	Detection_Saturation_Status	Bit vector for channels saturation indicator	units	NC_USHORT	2	1	2	
14	Background_Integration_Time	Number of TMC(IDE) for background samples, depends on number of accumulation	units	NC_USHORT	2	1	2	
15	DataArray_BKG_MIE_Copolar	Mie detector background map	units	NC_USHORT	2	48	96	
16	DataArray_OFS_MIE_Copolar	Mie detector offset data	units	NC_USHORT	2	4	8	
17	DataArray_SMP_MIE_Copolar	Mie detector signal map	units	NC_USHORT	2	48	96	
18	DataArray_BKG_MIE_Crosspolar	Cross-polar detector background map	units	NC_USHORT	2	48	96	
19	DataArray_OFS_MIE_Crosspolar	Cross-polar detector offset data	units	NC_USHORT	2	4	8	

	MIE_Crosspolar		s	T				
20	DataArray_SMP_ MIE_Crosspolar	Cross-polar detector signal map	unitles s	NC_USHOR T	2	48	96	
21	DataArray_BKG_ MIE_Rayleigh	Rayleigh detector background map	unitles s	NC_USHOR T	2	48	96	
22	DataArray_OFS_ MIE_Rayleigh	Rayleigh detector offset data	unitles s	NC_USHOR T	2	4	8	
23	DataArray_SMP_ MIE_Rayleigh	Rayleigh detector signal map	unitles s	NC_USHOR T	2	48	96	
24	SpareArray	Provision	unitles s	NC_USHOR T	2	480	960	
25	AppendedCRC			AppendedCR C	2	1	2	
TOTAL:							1768 - 3370	

2.1.2.4.4.11 ATLID_UPDATA_PacketHeader Bit Vector Table

These are the actual values of the Packet Header for the ATLID UPDATA ISP.

Parameter	MSB	Description	Value
Version_Number	b0 - b2	CCSDS Version Number	000b
Type	b3	Packet type	0b
Data_Field_Header_Flag	b4	Indicates the presence of a secondary (data field) header (when set to 1).	0x01
Application_Process_ID_PID	b5 - b11	Process ID (part of the APID)	0x40
Application_Process_ID_PCAT	b12 - b15	Packet category	12
Segmentation_Flags	b16 - b17	Indicates the grouping (segmentation) of TM source packets.	11b
Source_Sequence_Count	b18 - b31	Wrap around counter used to count each TM packet. For the ESSS in contrast to the PUS, only one counter for all APIDs is maintained.	source packet count value modulo 2 ¹⁴ (0 - 16383)
Packet_Length	b32 - b47	Number of bytes contained in the packet data field minus 1.	number of octets in packed data field - 1

2.1.2.4.4.12 ATLID_UPDATA_PUSDataFieldHeader Bit Vector Table

These are the actual values of the PUS Data Field Header described in Vol. 1 for the ATLID UPDATA ISP.

Parameter	MSB	Description	Value
Spare_1	b0	Not used.	Must be set to 0 for all TM source packets.
TM_Source_Packet_PUS_Version_Number	b1 - b3	Not used.	(0 was used for ESA PUS version) 1 for ECSS PUS
Spare_2	b4 - b7	Filler to complete the byte.	Must be set to 0 for all TM source packets
Service_Type	b8 - b15	Indicates the service to which the packet relates.	225
Service_Subtype	b16 - b23	Indicates the service subtype to which the packet relates.	4
Destination_ID	b24 - b31	Indicates the destination of the packet (May be omitted if only one destination exists).	0
Time	b32 - b87	Onboard time (OBT).	Coarse time: LSB = 1 sec Fine time: LSB = 1/16777215 sec
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.	Bit3 (Time type): 0 = Elapsed Time (ET); 1 = OBT Bit 4 (Sync. Source): 0 = internal; 1 = external Bit 5 (Ext. Sync. Source Detail): 0 = 1Hz Pulse; 1 = MIL-BUS Bit 6 (Sync. Status): 0 = NoSync; 1 = InSync Bit 7 (Sync. Enabled/Disabled): 0 = Disabled; 1 = Enabled

2.1.2.4.4.13 ATLIDUPDATAISP

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	stateVectorQuality	Contains details about the S/C state vector quality information as received from the S/C	units	NC_UINT	4	1	4	
2	ISPFormatVersion	Stores the version number of the ICD where the ISP format definition is specified. The most significant byte shall store the major version and the least significant byte shall store the minor version.	units	NC_USHORT	2	1	2	
3	AncDataSetsCount	Nanc (=Nacc nominally) : nb of sets of high rate ancillary per DRD / nb of laser shots per DRD if less or equal 10	units	NC_USHORT	2	1	2	
4	anchHRDataSets	This data structure is repeated in the ISP for every laser shot depending on the co-adding factor. A co-adding factor of N would result in N repetitions of this data structure in the ISP. See also the description in the ISP definitions below.	units	ATLIDAnchRData	178	1 - 10	178 - 1780	
5	Packet_Header	Detection Raw Data numerical ID	units	NC_USHORT	2	1	2	
6	IDE_Mode_Selection	IDE mode (LIDAR, RONC, IMAGING or UP-DATA) : here UP-DATA	units	NC_USHORT	2	1	2	
7	N_PRF_IDE_Parameter	Nacc : nb of laser shots per DRD	units	NC_USHORT	2	1	2	
8	Sample_Number	Total number of samples in the echo profile (3 x 260 =780)	units	NC_USHORT	2	1	2	
9	Pixel_Index_UPD	Pixel ID (p) of the first pixel where UPD mode is applied	units	NC_USHORT	2	1	2	
10	Validity	Bit vector indicating the quality of the acquisition (copy of ACDM TC content)	units	NC_USHORT	2	1	2	
11	Spare1	Provision	units	NC_USHORT	2	1	2	
12	Spare2	Provision	units	NC_USHORT	2	1	2	
13	Detection_Saturation_Status	Bit vector for channels saturation indicator	units	NC_USHORT	2	1	2	
14	Background_Integration_Time	Number of TMC(IDE) for background samples, depends on number of accumulation	units	NC_USHORT	2	1	2	
15	DataArray_MIE_Copolar_p	Pixel p of Mie detector video signal sampling	BU	NC_USHORT	2	130	260	
16	DataArray_MIE_Copolar_p1	Pixel p+1 of Mie detector video signal sampling	BU	NC_USHORT	2	130	260	
17	DataArray_MIE_Crosspolar_p	Pixel p of cross-polar detector video signal sampling	BU	NC_USHORT	2	130	260	
18	DataArray_MIE_Crosspolar_p1	Pixel p+1 of cross-polar detector video signal sampling	BU	NC_USHORT	2	130	260	
19	DataArray_MIE_Rayleigh_p	Pixel p of Rayleigh detector video signal sampling	BU	NC_USHORT	2	130	260	

20	dataArray_MIE_Rayleigh_p1	Pixel p+1 of Rayleigh detector video signal sampling	BU	NC_USHORT	2	130	260	
21	AppendedCRC			AppendedCRC	2	1	2	
TOTAL:							1768 - 3370	

2.1.2.4.4.14 ATLIDCoalignmentPacketHeader Bit Vector Table

These are the actual values of the Packet Header for the ATLID Coalignment ISP.

Parameter	MSB	Description	Value
Version_Number	b0 - b2	CCSDS Version Number	000b
Type	b3	Packet type	0b
Data_Field_Header_Flag	b4	Indicates the presence of a secondary (data field) header (when set to 1).	0x01
Application_Process_ID_PID	b5 - b11	Process ID (part of the APID)	0x40
Application_Process_ID_PCAT	b12 - b15	Packet category	12
Segmentation_Flags	b16 - b17	Indicates the grouping (segmentation) of TM source packets.	11b
Source_Sequence_Count	b18 - b31	Wrap around counter used to count each TM packet. For the ESSS in contrast to the PUS, only one counter for all APIDs is maintained.	source packet count value modulo 2 ¹⁴ (0 - 16383)
Packet_Length	b32 - b47	Number of bytes contained in the packet data field minus 1.	number of octets in packed data field - 1

2.1.2.4.4.15 ATLIDCoalignmentPUSDataFieldHeader Bit Vector Table

These are the actual values of the PUS Data Field Header described in Vol. 1 for the ATLID Coalignment ISP.

Parameter	MSB	Description	Value
Spare_1	b0	Not used.	Must be set to 0 for all TM source packets.
TM_Source_Packet_PUS_Version_Number	b1 - b3	Not used.	(0 was used for ESA PUS version) 1 for ECSS PUS
Spare_2	b4 - b7	Filler to complete the byte.	Must be set to 0 for all TM source packets
Service_Type	b8 - b15	Indicates the service to which the packet relates.	226
Service_Subtype	b16 - b23	Indicates the service subtype to which the packet relates.	1
Destination_ID	b24 - b31	Indicates the destination of the packet (May be omitted if only one destination exists).	0
Time	b32 - b87	Onboard time (OBT).	Coarse time: LSB = 1 sec Fine time: LSB = 1/16777215 sec
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.	Bit3 (Time type): 0 = Elapsed Time (ET); 1 = OBT Bit 4 (Sync. Source): 0 = internal; 1 = external Bit 5 (Ext. Sync. Source Detail): 0 = 1Hz Pulse; 1 = MIL-BUS Bit 6 (Sync. Status): 0 = NoSync; 1 = InSync Bit 7 (Sync. Enabled/Disabled): 0 = Disabled; 1 = Enabled

2.1.2.4.4.16 ATLIDCoalignmentISP

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	stateVectorQuality	Contains details about the S/C state vector quality information as received from the S/C	units	NC_UINT	4	1	4	
2	ISPFormatVersion	Stores the version number of the ICD where the ISP format definition is specified. The most significant byte shall store the major version and the least significant byte shall store the minor version.	units	NC_USHORT	2	1	2	
3	CIC	Co-alignment image count index	units	NC_USHORT	2	1	2	
4	N_AV	Number of CAS sets of images used for IDE averaging	units	NC_USHORT	2	1	2	
5	M_AV	Number of IDE sets of images used for ACDM averaging	units	NC_USHORT	2	1	2	
6	N_Sub	Number of lines in the CAS images for centroiding	units	NC_USHORT	2	1	2	
7	P_Sub	Number of columns in the CAS images for centroiding	units	NC_USHORT	2	1	2	
8	N0	Top-left corner line of the centroiding sub-window	units	NC_USHORT	2	1	2	
9	P0	Top-left corner column of the centroiding sub-window	units	NC_USHORT	2	1	2	
10	Treshold	CAS signal threshold for centroiding	BU	NC_SHORT	2	1	2	
11	Centroid_XY	CAS Centroid position	BU	CAScoordinates	8	1	8	
12	Pointing_Setpoint_XY	CAS Target	BU	CAScoordinates	8	1	8	
13	Pointing_Setpoint_Alpha	Chosen pointing pitch	rad	NC_FLOAT	4	1	4	
14	Pointing_Setpoint_Beta	Chosen pointing roll	rad	NC_FLOAT	4	1	4	
15	Pointing_Setpoint_1	Beam steering actuator 1 target	BU	NC_USHORT	2	1	2	
16	Pointing_Setpoint_2	Beam steering actuator 2 target	BU	NC_USHORT	2	1	2	
17	Pointing_Setpoint_3	Beam steering actuator 3 target	BU	NC_USHORT	2	1	2	
18	Pointing_Setpoint_4	Beam steering actuator 4 target	BU	NC_USHORT	2	1	2	
19	Pointing_Position_1	Beam steering actuator 1 current position	BU	NC_USHORT	2	1	2	
20	Pointing_Position_2	Beam steering actuator 2 current position	BU	NC_USHORT	2	1	2	
21	Pointing_Position_3	Beam steering actuator 3 current position	BU	NC_USHORT	2	1	2	
22	Pointing_Position_4	Beam steering actuator 4 current position	BU	NC_USHORT	2	1	2	
23	Image_Quality_Indicator	Image SNR estimation	units	NC_FLOAT	4	1	4	
24	Spare_Array	Provision	units	NC_USHORT	2	20	40	

25	CAS_Signal_Imag e	CAS Averaged signal image	BU	NC_USHOR T	2	48	96	
26	CAS_Background _Image	CAS Averaged background image	BU	NC_USHOR T	2	48	96	
27	AppendedCRC			AppendedCR C	2	1	2	
TOTAL:							300	

2.1.2.4.4.17 ATLIDTelemetryPacketHeader Bit Vector Table

These are the actual values of the Packet Header for the ATLID Telemetry ISP.

Parameter	MSB	Description	Value
Version_Number	b0 - b2	CCSDS Version Number	000b
Type	b3	Packet type	0b
Data_Field_Header_Flag	b4	Indicates the presence of a secondary (data field) header (when set to 1).	0x01
Application_Process_ID_PID	b5 - b11	Process ID (part of the APID)	0x40
Application_Process_ID_PCAT	b12 - b15	Packet category	12
Segmentation_Flags	b16 - b17	Indicates the grouping (segmentation) of TM source packets.	11b
Source_Sequence_Count	b18 - b31	Wrap around counter used to count each TM packet. For the ESSS in contrast to the PUS, only one counter for all APIDs is maintained.	source packet count value modulo 2 ¹⁴ (0 - 16383)
Packet_Length	b32 - b47	Number of bytes contained in the packet data field minus 1.	number of octets in packed data field - 1

2.1.2.4.4.18 ATLIDTelemetryPUSDataFieldHeader Bit Vector Table

These are the actual values of the PUS Data Field Header described in Vol. 1 for the ATLID Telemetry ISP.

Parameter	MSB	Description	Value
Spare_1	b0	Not used.	Must be set to 0 for all TM source packets.
TM_Source_Packet_PUS_Version_Number	b1 - b3	Not used.	(0 was used for ESA PUS version) 1 for ECSS PUS
Spare_2	b4 - b7	Filler to complete the byte.	Must be set to 0 for all TM source packets
Service_Type	b8 - b15	Indicates the service to which the packet relates.	226
Service_Subtype	b16 - b23	Indicates the service subtype to which the packet relates.	2
Destination_ID	b24 - b31	Indicates the destination of the packet (May be omitted if only one destination exists).	0
Time	b32 - b87	Onboard time (OBT).	Coarse time: LSB = 1 sec Fine time: LSB = 1/16777215 sec
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.	Bit3 (Time type): 0 = Elapsed Time (ET); 1 = OBT Bit 4 (Sync. Source): 0 = internal; 1 = external Bit 5 (Ext. Sync. Source Detail): 0 = 1Hz Pulse; 1 = MIL-BUS Bit 6 (Sync. Status): 0 = NoSync; 1 = InSync Bit 7 (Sync. Enabled/Disabled): 0 = Disabled; 1 = Enabled

2.1.2.4.4.19 ATLIDTelemetryISP

#	Field name	Description	Units	NetCDF C-Types	Size of each element	Number of elements	Total size	Value
1	stateVectorQuality	Contains details about the S/C state vector quality information as received from the S/C	units	NC_UINT	4	1	4	
2	ISPFormatVersion	Stores the version number of the ICD where the ISP format definition is specified. The most significant byte shall store the major version and the least significant byte shall store the minor version.	units	NC_USHORT	2	1	2	
3	Timestamp	Packet Timestamp	units	ISPTime	7	1	7	
4	Attitude_Q1	ACDM considered PFM quaternion 1	BU	NC_SHORT	2	1	2	
5	Attitude_Q2	ACDM considered PFM quaternion 2	BU	NC_SHORT	2	1	2	
6	Attitude_Q3	ACDM considered PFM quaternion 3	BU	NC_SHORT	2	1	2	
7	Attitude_Q4	ACDM considered PFM quaternion 4	BU	NC_SHORT	2	1	2	
8	OrbitalPosition	ACDM considered orbital position	deg	NC_SHORT	2	1	2	
9	SolarAngle	ACDM considered sun zenithal angle	deg	NC_SHORT	2	1	2	
10	PacketCounter	Packet numerical ID	units	NC_SHORT	2	1	2	
11	Spare1	Parameter linked to the packet	units	NC_BYTE	1	1	1	
12	SpareArray	Provision	units	NC_SHORT	2	385	770	
13	AppendedCRC			AppendedCRC	2	1	2	
TOTAL:							800	

