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<u>Doc.-Title:</u>	Aeolus Level 2B Processor Software Requirements Document
<u>Number of pages:</u>	1 <u>6</u> pages
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0.1 Document Change Log

Issue.	Date	New pages	Modified pages	Observations	Name
V 0.1	30.10.06	--	--	draft	Huber/Tan
1.0	04.12.06			Comments on V0.1	Tan
1.1	23.02.07		Change bars wrt v1.0	Comments on V1.0	Tan


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1 Introduction and Purpose of Document


The present document is the Software Requirements Specification Document for the ADM-Aeolus L2B operational processors [and the operational Level-1b EE2BUFR convertor](#).

[Regarding Level-2B processing](#), nominal processing takes place with the operational processor installed at ECMWF. Late- and re-processing is possible with the operational processor planned for the Long-Term Archive, which will operate within the Thin Layer interface environment.

[Regarding Level-1B EE2BUFR conversion](#), operational conversion takes place within the PDS in preparation for dissemination to ECMWF and national weather services (on a request basis).

This document describes the requirements identified for the L2B operational processor [and the operational Level-1B EE2BUFR convertor](#).

Chapter two contains lists of documents and acronyms, and Chapter 3 lists the L2BP software requirements.

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2 Documents

2.1 Applicable Documents

- [AD 1] PDS-IPF ICD Generic Interface Guideline, Issue 2.2, 02/08/2006, **ESA-ID-ACS-GS-0001**
- [AD 2] Statement of Work: 'Aeolus Level 2B/2C Processing Facility', Issue 1B, 16/09/2004, **AE-SW-ESA-GS-0117**. Supplemented by [AD 3]
- [AD 3] Statement of Work: "Enhanced Aeolus Level-2B/2C Functionalities & Pre-Launch Validation", Issue 1.0, 29/11/2005, **AE-SW-ESA-GS-023**.
- [AD 4] ADM-Aeolus Implementation of Level-2B/2C Processing Facility - Technical Requirements, Issue 1.1, 06/06/2004, **XADM-GSEG-EOPG-RD-04-0003**.
- [AD 5] ADM-Aeolus PDS-ECMWF Interface Control Document, Issue 1.5, 18/10/2006, **XADM-GSEG-EOPG-ID-04-0002**.
- [AD 6] Earth Explorer Ground Segment File Format Standard, Issue 1.4, 13/06/2003, **PE-TN-ESA-GS-0001**.
- [\[AD 7\] Level-1B Input/Output Data Definitions Interface Control document, Issue 3/2, 22/01/2007, ADM-IC-52-1666](#)
- [\[AD 8\] ADM-Aeolus Level-2B/2C Processor Input/Output Data Definitions Interface Control Document, Version 1.3, 23/02/2007, AE-IF-ECMWF-L2BP-001](#)
- [\[AD 9\] Aeolus Level 2B Processor External Interface Control Document, Issue 1.1, 23/02/2007, AE-IF-ECMWF-L2BP-001](#)
- [\[AD 10\] WMO FM94 \(BUFR\) description of ADM-Aeolus L1B/L2B products, Issue 1.0, 06/03/2006, AE-TN-ECMWF-L2P-0072-TEMPLATE](#)
- [\[AD 11\] ADM-Aeolus Level-1B EE2BUFR Converter: Installation and User Instruction, Issue 1.0, 11/12/2006, AE-TN-ECMWF-L2BP-0072](#)


2.2 Reference Documents

- [RD 1] Aeolus Level 2B Processor Design Document. Currently referred to as Definition of Baseline Aeolus Level-2B Processing and Design, Issue 1.2, 09/09/2005, **AE-TN-ECMWF-L2BP-0022**
- [RD 2] [Moved to \[AD 7\]](#)
- [RD 3] Aeolus Level 2a Processor Input/output Data Definition, Issue 1.3, 17/01/2007, **AE-IF-DLR-L2A-004**
- [RD 4] [Moved to \[AD 8\]](#)
- [RD 5] [Moved to \[AD 9\]](#)
- [RD 6] Aeolus Level-2B Algorithm Theoretical Baseline Document (Mathematical Description of the Aeolus Level-2B Processor), Issue 2.1, 23/02/2007, **AE-TN-ECMWF-L2BP-0023**
- [RD 7] [Moved to \[AD 10\]](#)
- [\[RD 8\] Aeolus Level-2B Processor Software User's Manual, Issue 1.2, 07/12/2006, AE-MA-ECMWF-L2BP-001](#)

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2.3 Acronyms

ACCD	Accumulating Charge Coupled Device
ADMAG	Atmospheric Dynamics Mission Advisory Group
ADM-Aeolus	Atmospheric Dynamics Mission: Aeolus keeper of the winds
ALADIN	Atmospheric LAsEr Doppler INstrument
ALIENS	Atmospheric Lidar End-to-end Simulator
ASCII	American Standard Code for Information Interchange
DELPHI	Coherent Detection at Low Photon number per measurement Interval
DE2S	DLR End-to-end Simulator
D3WL	Direct Detection Doppler Wind Lidar
ECMWF	European Centre for Medium-Range Weather Forecasts
ESA	European Space Agency
ESTEC	European Space Research and Technology Centre
FWHM	Full Width Half Maximum
FSR	Free Spectral Range
HLOS	Horizontal Line-Of-Sight
LOS	Line-Of-Sight
ML	Maximum Likelihood
MT1	Mid time, 1 week (100 orbits) scale
PDS	Payload Data Segment
RMA	Reference Model for the Atmosphere
SNR	Signal-to-Noise Ratio
TRO	Transmitter-Receiver Optics
USR	Useful Spectral Range
WIND	Wind Infrared Doppler lidar

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3 Requirements

3.1 General

3.1.1 Bit/Byte Numbering Convention, Data Representation

- [GEN 10] The L2BP shall use bit 0 as the most significant bit for each external interface.
- [GEN 20] The L2BP shall use byte 0 as the most significant byte for each external interface.
- [GEN 30] The L2BP shall be designed to transmit bit 0 of byte 0 first over each external interface.

3.1.2 Tasks

- [GEN 40] The L2BP software system shall be designed to separate process tasks into modular configuration items.

3.1.3 Documentation

- [GEN 50] All documentation produced in the context of this contract shall be produced in accordance with the pertinent European Cooperation for Space Standardisation (ECSS) standards, as tailored by Statement of Work document [AD 2], [AD 3].
- [GEN 60] All documentation produced in the context of this contract shall be delivered in the following formats: PDF (drafts and final versions) and RTF (final versions only). MS Word shall be used for intermediate versions and drafts, for the purposes of change tracking.


3.1.4 Maintenance and Warranty

- [L2BP 10] [Deleted.](#)
- [L2BP 20] A new release of the L2BP software will take less than 4 hours to install.
- [GEN 70] Deleted.
- [GEN 80] The L2BP systems will be built upon a commercial Linux operating system (OS). Upgrades to the versions of the OS and other COTS and public domain software initiated by ECMWF will be mutually agreed between ECMWF and ESA at least 2 months prior to a planned software delivery.
- [GEN 90] The L2BP systems will be designed to use files and directory structures for storage and management of system data.

3.1.5 Reliability

- [GEN 100] The L2BP software will be designed to trap mathematical exceptions.
- [GEN 110] When a mathematical exception has been triggered, a warning log message will be issued if execution is allowed to continue.
- [GEN 120] When a mathematical exception has been triggered, an error log message will be issued if execution is terminated.
- [GEN 130] Error and warning messages will identify the module or function where the exception occurred when possible.
- [L2BP 30] The L2BP shall process to completion each Job Order for which valid L1B observations are available.

Criteria for valid observations are specified in the Aeolus Level 2B Processor Design Document [RD 1]. The criteria include no-process decisions based on invalid or missing data.

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3.1.6 Security

- [L2BP 40] Deleted (section not applicable).
- [L2BP 50] Deleted (section not applicable).
- [L2BP 60] Deleted (section not applicable).
- [L2BP 70] Deleted (section not applicable).

3.2 Level 2B Processor

3.2.1 Deliverables

3.2.1.1 Software

- [L2BP 80] The L2BP software shall be delivered [as](#) source code including all scripts and libraries required for the installation, [plus binary data needed for testing](#).
- [L2BP 90] The L2BP software delivery shall include a tool for viewing the contents of each input Auxiliary Data File.
- [L2BP 100] The L2BP software delivery shall include instructions for constructing a Job Order.
- [L2BP 110] The L2BP software delivery shall include a tool for viewing the contents of each L2BP product.
- [L2BP 120] The L2BP software delivery shall include a tool for graphical display of [wind](#) data from a Level [2b](#) product.
- [L2BP 130] The L2BP software delivery shall include a tool for graphical display of calibration data from Auxiliary Calibration products.
- [L2BP 140] The L2BP software delivery shall include the input data and output products used in the L2BP factory acceptance test.
- [L2BP 150] The L2BP software delivery shall include the installation scripts and tools required to execute the L2BP factory acceptance test and evaluate the test results.
- [L2BP 160] One representative set of input Auxiliary Data Files shall be provided with the L2BP system delivery.
- [L2BP 161] The L2BP software shall include functionalities to generate or update any L2B input auxiliary data files
- [L2BP 162] The L2BP software shall provide a functionality to convert L2B products in EE format to Ascii (for user selected ADS, MDS and range of records).

3.2.1.2 Operational System

- [L2BP 170] The L2BP delivery shall include a user manual in Adobe Portable Document Format (PDF).


3.2.1.3 Development System

- [L2BP 180] Deleted (section not applicable).
- [L2BP 190] Deleted (section not applicable).

3.2.2 Infrastructure

3.2.2.1 Platform

N.A.

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3.2.2.2 Operational

[L2BP 200] [Deleted.](#)

[L2BP 210] [Deleted.](#)

[L2BP 220] [Deleted.](#)

[L2BP 230] It shall be possible to install and change configuration settings of the L2BP by a user with no administrator privileges.

3.2.2.3 Operating System Event Logging

[L2BP 240] Deleted (section not applicable).

3.2.3 Interfaces

3.2.3.1 Data Files

[L2BP 250] The L2BP shall accept as input any valid Level 1b product provided by the Front-End-Processor (FEP) of the PDS. The content of the Level 1b product is defined in [RD 2].

[L2BP 260] The L2BP shall produce a Level 2B formatted product as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition [RD 4].

[L2BP 270] The L2BP shall accept an Auxiliary L2B Processing Parameters file as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition [RD 4].

[L2BP 280] The L2BP shall accept an Auxiliary Climatology file as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition [RD 4].

[L2BP 290] The L2BP shall accept an Auxiliary Rayleigh-Brillouin Calibration file as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition [RD 4].

[L2BP 300] The L2BP shall accept an Auxiliary L2b Meteorological Parameters file as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition [RD 4], [irrespective of whether the file is created for the “nominal” case \(meteorological profile geolocations aligned with observation geolocations from the L1B input product\) or for the “late processing” case \(meteorological profile geolocations created from orbit prediction data\).](#)

[L2BP 301] The L2BP shall accept an Auxiliary Calibration Parameters file as specified in the Aeolus L2A Processor Input/Output Data Definition [RD 3]

[L2BP 302] The L2BP shall be capable of processing a Level 1B input product (EE or Bufr format) containing up to 8 orbits worth of data.

3.2.3.2 Thin Layer Interface

3.2.3.2.1 Job Order

[L2BP 310] The L2BP shall provide for processing a Job Order initiated by the Thin Layer.

[L2BP 320] The L2BP Job Order shall be formatted as specified in the Aeolus Level 2B Processor External Interface Control Document [RD 5].

3.2.3.2.2 Exit Code


[L2BP 330] The L2BP shall produce an Exit Code upon the completion or termination of each processing job as defined in the Aeolus Level 2B Processor External Interface Control Document [RD 5].

3.2.3.2.3 Product List

[L2BP 335] The L2BP shall produce a Product List file for each L2BP processing Job Order as defined in the Aeolus Level 1b Processor External Interface Control Document [RD 5].

3.2.3.2.4 Event Logging

[L2BP 340] The L2BP shall provide L2BP Informational messages on the stdout or stderr stream.

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- [L2BP 350] The L2BP shall provide L2BP Progress messages on the stdout or stderr stream.
- [L2BP 360] The L2BP shall provide L2BP Warning messages on the stdout or stderr stream.
- [L2BP 370] The L2BP shall provide L2BP Error messages on the stdout or stderr stream.
- [L2BP 380] The L2BP shall provide L2BP Debug messages on the stdout or stderr stream.
- [L2BP 381] It shall be possible to write log/warning/error messages to a log file (for use when the L2BP is not operated via the Thin Layer).
- [L2BP 382] It shall be possible to generate a “short” log file (messages for low-level processing steps suppressed).
- [L2BP 383] It shall be possible to view log/warning/error messages during execution of a processing run.

3.2.3.2.5 Workstation Configuration File

- [L2BP 390] One Workstation Configuration file shall be provided with the L2BP system delivery as specified in the Aeolus Level 2B Processor External Interface Control Document [RD 5].
- [L2BP 400] The L2BP Workstation Configuration file shall list each L2BP processing service.

3.2.3.2.6 Task Table

- [L2BP 410] At least one Task Table shall be provided with the L2BP system delivery as specified in the Aeolus Level 2B Processor External Interface Control Document [RD 5].
- [L2BP 420] The L2BP Task Table file shall define the L2BP processing tasks required to provide a processing service.
- [L2BP 430] The L2BP Task Table file shall define the input and outputs for each L2BP processing task.

3.2.3.2.7 Processor Control

- [L2BP 440] Each L2BP processing task shall be initiated as a command line task with the Job Order filename as the only parameter.
- [L2BP 450] The L2BP shall provide for stopping each processing task by a kill or terminate signal. Under normal conditions, the different tasks constituting a processor shall terminate on their own without the need to receive a kill or terminate signal.

3.2.3.2.8 Product Report

- [L2BP 460] The L2BP shall produce a Product Report file upon completion of each processing Job Order as specified in the Aeolus Level 2B Processor External Interface Control Document [RD 5].

3.2.3.2.9 Test Interface


- [L2BP 470] The L2BP shall provide for processing a Job Order initiated by the Thin Layer Emulator.
- [L2BP 480] The L2BP shall use the Thin Layer Emulator as a Thin Layer emulation interface for testing the L2BP independently of the rest of the PDS.

3.2.4 Alternatives to the Thin Layer Interface

- [L2BP 490] Ways to operate the L2BP through interfaces different from the Thin Layer shall be specified in the L2BP Software User Manual.

3.2.5 Processing

- [L2BP 500] The L2BP shall process all complete observations in a Level 1b product.

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[L2BP 510] The L2BP shall process all complete observations in a Level 1b product that are within the start and end times specified in the Job Order.

3.2.5.1 Level 2B Processing

[L2BP 520] The L2BP shall process valid observations in a Level 1b file to produce an Aeolus Level 2B product.

[L2BP 530] The L2BP will use the Level 2B processing algorithms specified in the Algorithm Theoretical Baseline Document [RD 6]

3.2.5.2 Data Validation

[L2BP 540] The L2BP shall detect missing or corrupted data in the input Level 1b product and continue to process remaining valid data. [As stated in Section 3.1.5, criteria for valid L1B observations are specified elsewhere. Nonetheless, the L2BP shall exhibit the following behaviour for specific cases:](#)

<u>Invalidity case</u>	<u>L2BP Behaviour</u>	<u>Comments</u>
No valid observations in L1B input (or in the processing window specified in the JobOrder)	L2B outputs produced with consistent header data and dataset structure	
Partially valid data (Mie or Rayleigh data unavailable at some altitudes)	L2B outputs produced whenever processing algorithms (as selected by AUX_PAR_2B processing parameter settings) permit	
Failed matchup of L1B input data and AuxMetData	L2B outputs produced with consistent header data and dataset structure	TBC
Misalignment of Mie and Rayleigh range bins	Regarded as aligned provided misalignment is within tolerances.	

[L2BP 550] The L2BP shall stop processing and produce an error message if any input file is not accessible prior to the start of an L2BP processing task.

[L2BP 560] The L2BP shall log messages in the L2BP event log listing each input file that was not accessible to a started L2BP executable.

[L2BP 570] If an L2BP processing run fails irrecoverably, the L2BP event log will list the last successfully completed processing step and no further events will be listed for that Job Order.

3.2.5.3 Processing Reference Frame

Not applicable.


3.2.5.4 Product Report

[L2BP 580] The L2BP Product Report shall contain the version number of the L2BP executable software.

[L2BP 590] The L2BP Product Report shall contain the names of the input files.

[L2BP 600] The L2BP Product Report shall contain the names of the generated product files.

[L2BP 610] The L2BP Product Report shall contain the size of each generated product file.

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[L2BP 620] The L2BP Product Report shall contain an exit code indicating success or failure.

[L2BP 630] The L2BP Product Report shall contain a list of errors and warnings if applicable.

[L2BP 640] The L2BP Product Report shall include the start and stop date and time of operation.

3.2.5.5 Processor Event Logging

[L2BP 650] The L2BP shall generate log messages indicating L2BP processing task status.

[L2BP 660] The L2BP shall generate log messages indicating L2BP process warnings and errors.

[L2BP 670] The L2BP shall provide the event log data stream through the stdout and stderr.

[L2BP 680] The L2BP software shall generate log messages for the Informational/Warning/Error events specified in the Aeolus Level 2B Processor External Interface Control Document [RD 5].

[L2BP 690] The L2BP software shall store event log data in a log file per Job Order.

3.2.6 Products

3.2.6.1 Product Types

[L2BP 700] [Duplicated requirement deleted.](#)

3.2.6.2 Product Format

[L2BP 710] Each L2BP product shall be annotated with the Job Order Type as Nominal Processing, Reprocessing, or Backlog Processing.

[L2BP 720] Each L2BP product file shall annotate quality statistics as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition document [RD 4].

[L2BP 730] Each L2BP product file shall contain a Main Product Header (MPH) as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition document [RD 4].

[L2BP 740] Each L2BP product shall contain a Specific Product Header (SPH) as specified in the Aeolus L2B/L2C Processor Input/Output Data Definition document [RD 4].

[L2BP 750] Deleted.

[L2BP 760] Each L2BP product shall contain at least one Data Set Descriptor (DSD) as specified in the Aeolus L2BP Input/Output Data Definition document [RD 4].

3.2.7 Performance

[L2BP 770] The L2BP shall be capable of processing a full orbit worth of L1B data (EE or Bufr format) within 30 minutes (TBD) on the specified target platform.

3.2.8 Resource requirements


3.2.8.1 Hardware

[L2BP 780] The L2BP [code and related standalone applications](#) shall be [installable and](#) run on a Pentium PC (clock rate 2.5GHz) with a minimum of 256 Mbytes RAM and [a usable disk space of 20 Gbytes, and the following configuration:](#)

[OS:](#) [Redhat Linux Enterprise 3 \(update 2\) Server, kernel 2.4.21](#)

[Compiler:](#) [GNU Compiler Collection \(gcc\) v. 3.3.2](#)

[Python:](#) [version at least 2.2](#)

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3.2.8.2 Software

[L2BP 790] The L2BP shall be programmed in Fortran-90 and/or Ansi C/C++ and/or Python (TBC).

[L2BP 800] A list of any non-standard functions/modules (compiler-specific) shall be maintained and included in the Design Document.

3.2.8.3 Licences and Tools

[L2BP 810] The [auxiliary tools for viewing L2BP products and associated auxiliary data](#) shall make use of the following commercial tool: Matlab. [This commercial tool shall not be used for: the L2BP itself, the L1B EE2BUFR convertor.](#)

3.3 Level 1B EE2BUFR Convertor

3.3.1 Deliverables

3.3.1.1 Software

[\[L1B-EE2BUFR 10\]](#) The L1B EE2BUFR software shall be delivered as part of the Level 2B Processor software delivery.

[\[L1B-EE2BUFR 20\]](#) It shall be possible to install and test the L1B EE2BUFR software as a subset of the L2B installation.

[\[L1B-EE2BUFR 30\]](#) The L1B EE2BUFR software shall provide a functionality to convert L1B BUFR-format files to Ascii (for user selected ADS, MDS and range of records).

[\[L1B-EE2BUFR 40\]](#) Reserved for future use.

3.3.1.2 Operational System

[\[L1B-EE2BUFR 50\]](#) Reserved for future use.

[\[L1B-EE2BUFR 60\]](#) Reserved for future use.

3.3.2 Infrastructure

3.3.2.1 Operational

[\[L1B-EE2BUFR 70\]](#) Reserved for future use.


3.3.3 Interfaces

3.3.3.1 Data Files

[\[L1B-EE2BUFR 80\]](#) The L1B EE2BUFR convertor shall accept as input any valid Level 1b product provided by the LTA. The content of the Level 1b product is defined in [RD 2].

[\[L1B-EE2BUFR 90\]](#) The L1B EE2BUFR convertor shall produce a Level 1B BUFR-product formatted as specified in [AD 10].

[\[L1B-EE2BUFR 100\]](#) Reserved for future use.

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3.3.3.2 Thin Layer Interface

Not applicable for the L1B EE2BUFR convertor.

3.3.4 Alternatives to the Thin Layer Interface

3.3.4.1.1 Invocation

[L1B-EE2BUFR 110] The L1B EE2BUFR convertor shall be operated from a Unix shell using a command-line instruction as specified in the L1B EE2BUFR User Instructions [AD 11]

3.3.4.1.2 Exit Code

[L1B-EE2BUFR 120] The L1B EE2BUFR convertor shall produce an Exit Code upon the completion or termination of each processing job as defined in the L1B EE2BUFR User Instructions [AD 11]

[L1B-EE2BUFR 130] Reserved for future use.

[L1B-EE2BUFR 140] Reserved for future use.

3.3.4.1.3 Processor Control

[L1B-EE2BUFR 150] Reserved for future use.

[L1B-EE2BUFR 160] Reserved for future use.

3.3.5 Processing

[L1B-EE2BUFR 170] The L1B EE2BUFR convertor shall process all complete observations in a Level 1b product.

3.3.5.1 Level 1B EE2BUFR Processing

[L1B-EE2BUFR 180] Reserved for future use.

3.3.5.2 Data Validation

[L1B-EE2BUFR 190] The L1B EE2BUFR convertor shall detect Level 1b data violating the L1B IODD [RD 2] and continue to process remaining valid data.

3.3.5.3 Product Report

[L1B-EE2BUFR 200] Reserved for future use.



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[\[L1B-EE2BUFR 210\]](#) Reserved for future use.

[\[L1B-EE2BUFR 220\]](#) Reserved for future use.

[\[L1B-EE2BUFR 230\]](#) Reserved for future use.

[\[L1B-EE2BUFR 240\]](#) Reserved for future use.

[\[L1B-EE2BUFR 250\]](#) Reserved for future use.

[\[L1B-EE2BUFR 260\]](#) Reserved for future use.

3.3.5.4 Processor Event Logging

[\[L1B-EE2BUFR 270\]](#) Reserved for future use.

[\[L1B-EE2BUFR 280\]](#) Reserved for future use.

[\[L1B-EE2BUFR 290\]](#) Reserved for future use.

[\[L1B-EE2BUFR 300\]](#) Reserved for future use.

[\[L1B-EE2BUFR 310\]](#) Reserved for future use.

3.3.6 Products

3.3.6.1 Product Types

[\[L1B-EE2BUFR 320\]](#) Reserved for future use.

3.3.6.2 Product Format

[\[L1B-EE2BUFR 330\]](#) Reserved for future use.

[\[L1B-EE2BUFR 340\]](#) Reserved for future use.

[\[L1B-EE2BUFR 350\]](#) Reserved for future use.

3.3.7 Performance

[\[L1B-EE2BUFR 360\]](#) Reserved for future use.

[\[L1B-EE2BUFR 370\]](#) Reserved for future use.

3.3.8 Resource requirements

3.3.8.1 Hardware

[\[L1B-EE2BUFR 380\]](#) Reserved for future use.

[\[L1B-EE2BUFR 390\]](#) Reserved for future use.

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3.3.8.2 Software

[\[L1B-EE2BUFR 400\]](#) Reserved for future use.

[\[L1B-EE2BUFR 410\]](#) Reserved for future use.

3.3.8.3 Licences and Tools

[\[L1B-EE2BUFR 420\]](#) Reserved for future use.

[\[L1B-EE2BUFR 430\]](#) Reserved for future use.