

KAGUYA (SELENE)
Product Format Description
- Lunar Magnetometer (LMAG) -

Version 1.0

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1. Introduction

1.1 Purpose

This document describes the format*² used for the catalog and product files for the Lunar Magnetometer*¹(LMAG) that was board KAGUYA (SELENE). These files provided by Japan Aerospace Exploration Agency (JAXA).

*1 : Refer to the following “Project Homepage of KAGUYA” and “Image Gallery of KAGUYA” used for the LMAG mission.

- ✓ Project Homepage for KAGUYA
http://www.kaguva.jaxa.jp/en/equipment/lmag_e.htm
- ✓ Image Gallery for KAGUYA
http://wms.selene.darts.isas.jaxa.jp/selene_viewer/en/observation_mission/lmag/

*2 : The data format used for SELENE is based on the PDS (Planetary Data System) by NASA. However, the data format is not fully compliant with the PDS format.

1.2 The composition of this format description

Table 1-1 shows the composition of this format description.

Table 1-1 the composition of this format description

No .	INDEX	Title	Description content
1	Section 1.3	Table 1-2 LMAG Products List	The name of the product, the object form, and the composition of the product are described as a product list illustrated by this description.
		Table 1-3 Product Description	Concerning each product shown in the No1 product list, the content included in data and the description of the observation method are illustrated.
2	Chapter X	“ Product Name”	Concerning the product shown in the No1 product list, rules used for file naming, label format, data object format and catalog information file format are described.
3	Section X.1	Rules used for File naming	Concerning the product shown in No2, the rules of file nomenclature is described.
4	Section X.2	Label Format	Concerning the product shown in No2, the label format is described.
5	Section X.3	Data Object Format	Concerning the product shown in No2, the data format of the data object is described. (The extension of the data file is unique in each product. Therefore, refer to the file nomenclature in No3.)
6	Section X.4	Catalog Information File Format	Concerning the product shown in No2, the format of the catalog information file (extension: .ctg) of the product is described.
7	Chapter X+1		
		Same as above	

1.3 Data Set

The Data Set refers to a set consisting of: Product, Catalog Information, and Thumbnail Image (JPEG format), which are tar-archived. This set is referred to as the “L2 Data Set”. The file extension is “SL2”. However, the thumbnail image may be omitted at the by composer’s judgment.

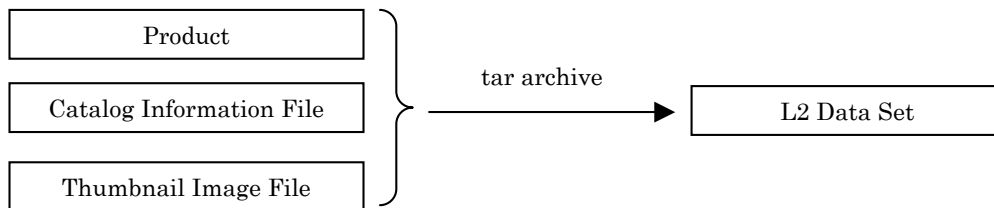


Figure 1-1 composition of the L2 Data Set

1.3.1 Product

For product composition, two possible options are available. Product Composition – Attached consists of label information and data information in a single data file. Product Composition – detached consists of separate files for the label file and data file.

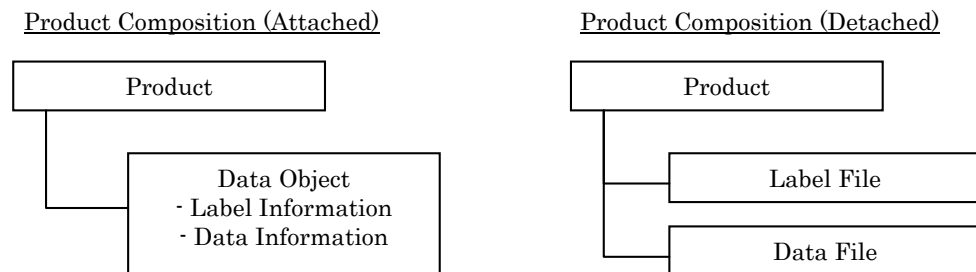


Figure 1-2 Product Composition : Attached and Detached

- (1) Label File (Data Object (Label Information))
The Label File (Label Information) is storing as text format the information that identifies the Data File (Data Information).

- (2) Data File (Data Object (Data Information))
The data File (Data Object (Data Information)) of the product are classified into the following four data types.

- a) **IMAGE** : image data
An **IMAGE** is a two-dimensional array of values, all of the same type, each of which is referred to as a sample. **IMAGE** are normally processed with special display tools to produce a visual representation of the samples by assigning brightness levels or display colors to the values. An **IMAGE** consists of a series of lines, each containing the same number of samples.
*Refer to the PDS Standard Reference V3.8 Appendix A.20 "IMAGE".
- b) **TABLE** : tabular form data
TABLEs are a natural storage format for collections of data from many instruments. The **TABLE** is a uniform collection of rows containing ASCII or binary values stored in columns.
*Refer to the PDS Standard Reference V3.8 Appendix A.29 "TABLE".
- c) **SERIES** : time series data
The **SERIES** is a sub-class of the **TABLE**. It is used for storing a sequence of measurements organized in a specific way. The sampling parameter keywords in the **SERIES** represent the variation between the **ROWS** of data.
*Refer to the PDS Standard Reference V3.8 Appendix A.24 "SERIES"
- d) **TEXT** : text data
The **TEXT** describes a file which contains plain text.
*Refer to the PDS Standard Reference V3.8 Appendix A.30 "TEXT".

1.3.2 Catalog Information File

Catalog Information File is the information file attached to explain the general of the product and is used to search for the product from L2DB subsystem.

1.3.3 Thumbnail Image File

Thumbnail Image File is the reduced image of the data object, and is the JPEG format image. However, the thumbnail image may be omitted at the by composer's judgment.

1.4 LMAG Products

The list of LMAG products, which this document describes, is shown in Table 1-3. In addition, the description for each product is shown in Table 1-5.

Table 1-3 LMAG Products List

Level*1	Product Name	Product ID	Data Type	Product Format*2
Standard	Magnetic Field Time Series	MAG_TS	SERIES	D
Standard	Magnetic Field Time Series (Option)	MAG_TSOP	SERIES	D
Higher Level	Magnetic Anomaly Map	MA_MAP	IMAGE	A
Higher Level	Magnetic Anomaly Map (Option)	MA_MAPOP	IMAGE	A
Higher Level	Magnetic Anomaly Grid Data	MA_GD	TABLE	D
Higher Level	Magnetic Anomaly Grid Data (Option)	MA_GDOP	TABLE	D
Higher Level	1D Electrical Conductivity Structure	1DSigma	TABLE	D
Higher Level	1D Electrical Conductivity Structure (Option)	1DSigmaOP	TABLE	D


Map products

*1 : Data obtained by equipments is not clear as it is, therefore various processings and correction treatment are necessary by the ground system. According to the difference in the process of processing and correction treatment, they can be classified to the standard processing and higher-level processing. The higher-level processing refers to the standard processing data to which various processing and correction treatment are conducted according to the research purpose et cetera.

*2 Product Format : A - Attached, D - Detached

Table 1-5 Product Description

Product Name	Descriptions
Magnetic Field Time Series	Time series of magnetic field. Time, the location of the satellite and three magnetic field components are recorded in two coordinate system. Sampling time interval is four seconds. The data are those of nominal observation.
Magnetic Field Time Series (Option)	Time series of magnetic field. Time, the location of the satellite and three magnetic field components are recorded in two coordinate system. Sampling time interval is four seconds. The data are those of optional observation.
Magnetic Anomaly Map	Map of magnetic anomaly components and related quantities. Grid spacing is 1degree in each direction. The files contain north-south, west-east, vertical components of the magnetic anomaly, their standard errors, and number of data used for the calculations of the magnetic anomaly components (9 components in total). Altitude is 100km. Magnetic field data of nominal observation are used.
Magnetic Anomaly Map (Option)	Map of magnetic anomaly components and related quantities. Grid spacing is 1degree in each direction. The files contain north-south, west-east, vertical components of the magnetic anomaly, their standard errors, and number of data used for the calculations of the magnetic anomaly components (9 components in total). Altitude is 50km. Magnetic field data of optional observation are used.
Magnetic Anomaly Grid Data	Grid data of magnetic anomaly components and related quantities. Grid spacing is 1degree in each direction. The files contain north-south, west-east, vertical components of the magnetic anomaly, their standard errors, and number of data used for the calculations of the magnetic anomaly components (9 components in total). Altitude is 100km. Magnetic field data of nominal observation are used.
Magnetic Anomaly Grid Data (Option)	Grid data of magnetic anomaly components and related quantities. Grid spacing is 1degree in each direction. The files contain north-south, west-east, vertical components of the magnetic anomaly, their standard errors, and number of data used for the calculations of the magnetic anomaly components (9 components in total). Altitude is 50km. Magnetic field data of optional observation are used.
1D Electrical Conductivity Structure	One dimensional structure of electrical conductivity. Depth and conductivity values are recorded. Magnetic field data of nominal observation are used.
1D Electrical Conductivity Structure (Option)	One dimensional structure of electrical conductivity. Depth and conductivity values are recorded. Magnetic field data of entire observation period are used.

 :Map product

2. Magnetic Field Time Series (MAG_TS, MAG_TSOP)

2.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file names are case-independent.

AAAAAAAAAYYYMMDD.ext

- AAAAAAA : Product ID
 - MAG_TS :Magnetic Field Time Series
 - MAG_TSOP :Magnetic Field Time Series (Option)
- YYYMMDD :Observation Date
- ext : File Extension
 - ✓ lbl : Label File
 - ✓ dat : Data File
 - ✓ ctg : Catalog Information File
 - ✓ jpg : Thumbnail JPEG Image File
 - ✓ sl2 : L2 Data Set (tar archive)

<Example of Name : Magnetic Field Time Series>

- MAG_TS20080101.dat (Magnetic Field Time Series data File for January 1, 2008)

2.2 Label Format

The Label format for the SERIES object used for the Magnetic Field Time Series is shown in Table 2-1. The Label for the SERIES object includes: Standard Item and Object Format Description Part.

In Table 2-1, the numerical Values and character strings that correspond to the type of product, etc. is set, with exception of the Value shown as “STATIC”.

Table 2-1 Object Label for the Magnetic Field Time Series

No	Items	Elements	Types	Values
Standard Item				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	FIXED_LENGTH
3	Byte count of the file records	RECORD_BYTES = %d	int	XXX
4	Count of the file records	FILE_RECORDS = %d	int	XXXXX
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
6	Name of instrument (Full name)	INSTRUMENT_NAME = %s	char	LMAG [STATIC]
7	Product name	PRODUCT_NAME = %s	char	See Table 1-2 “Product_ID”.
8	Target name	TARGET_NAME = %s	char	MOON [STATIC]
9	Comment	COMMENT_TEXT = "%s"	char	
Object Format Description Part				
		OBJECT = TIME_SERIES		
10	Type of data	INTERCHANGE_FORMAT = %s	char	ASCII [STATIC]
11	Number of lines of data	ROWS = %d	int	XXXXX
12	Number of columns of data	COLUMNS = %d	int	XX
13	Byte count of data line	ROW_BYTES = %d	int	XXX

14	Parameter name	SAMPLING_PARAMETER_NAME = %s	char	TIME [STATIC]
15	Unit of parameter	SAMPLING_PARAMETER_UNIT = %s	char	SECOND [STATIC]
16	Parameter interval	SAMPLING_PARAMETER_INTERVAL = %f	float	X.X
17	Start time of data	START_TIME = %s	char	YYYY-MM-DDThh:mm:ss
18	Stop time of data	STOP_TIME = %s	char	YYYY-MM-DDThh:mm:ss
		END_OBJECT = TIME_SERIES		
END Statements				
		END		

<Example of Label : Magnetic Field Time Series product>

```
PDS_VERSION_ID = PDS3
RECORD_TYPE = FIXED_LENGTH
RECORD_BYTES = 131
FILE_RECORDS = 21600
SPACECRAFT_NAME = SELENE-M
INSTRUMENT_NAME = LMAG
PRODUCT_SET_ID = MAG_TS
TARGET_NAME = MOON
COMMENT_TEXT = "Magnetic field timeseries. 4second values. Time, position, magnetic field components in
the cartesian coordinate, position (alt, lon, lat), magnetic field north, east and downward
components are stored."
```

```
/* TIME SERIES */
OBJECT = TIME_SERIES
INTERCHANGE_FORMAT = ASCII
ROWS = 21600
COLUMNS = 13
ROW_BYTES = 131
SAMPLING_PARAMETER_NAME = TIME
SAMPLING_PARAMETER_UNIT = SECOND
SAMPLING_PARAMETER_INTERVAL = 4.0
START_TIME = 2007-02-14T00:00:00
STOP_TIME = 2007-02-14T23:59:56
END_OBJECT = TIME_SERIES

END
```

2.3 Data Object Format

The Magnetic Field Time Series product is composed of a data segment (.dat), as described in a series format, and a thumbnail image (.jpg) that is plotted against time.

The Time Information, location of the satellite and the three magnetic field components are stored in the data segment. The location of the satellite (X, Y, Z) and the three magnetic field components (Bz, By, Bx) are stored, moon center fixed ME coordinate, as well as, includes the value in GSE. The data sequence is as follows: each data element is separated by a comma.

- Time Information, X1, Y1, Z1, Bx1, By1, Bz1, X2, Y2, Z2, Bx2, By2, Bz2

The Time Information is described in a "YYYY-MM-DDThh:mm:ss" format, eg., "2008-01-01T00:00:00". The location of the satellite is described in real numbers to one decimal place. The magnetic field is described in real numbers to two decimal places. The number of characters in a single line should be 129. The details of expressions (Cartesian, polar coordinate system) in a Coordinate System and the appropriate Coordinate System are described in the Label and in the Catalog Information File.

The Thumbnail image is in a JPEG format and is a plotted component of the magnetic field in the ME coordinate. The image size is 50 kB or less.

Table 2-3 Data Format

	Column	Byte position	Byte count	Item	Format	Unit	Description
129 byte	1	1	19	Time	YYYY-MM-DDThh:mm:ss	N/A	Time Information
		20	1	(comma)	N/A	N/A	Delimiter
	2	21	8	X1	F8.1	km	X-coordinate of the satellite position at the moon center fixed ME coordinate system
		29	1	(comma)	N/A	N/A	Delimiter
	3	30	8	Y1	F8.1	km	Y-coordinate of the satellite position at the moon center fixed ME coordinate system
		38	1	(comma)	N/A	N/A	Delimiter
	4	39	8	Z1	F8.1	km	Z-coordinate of the satellite position at the moon center fixed ME coordinate system
		47	1	(comma)	N/A	N/A	Delimiter
	5	48	7	Bx1	F7.2	nT	X- component of the magnetic field at the moon center fixed ME coordinate system
		55	1	(comma)	N/A	N/A	Delimiter
	6	56	7	By1	F7.2	nT	Y- component of the magnetic field at the moon center fixed ME coordinate system
		63	1	(comma)	N/A	N/A	Delimiter
	7	64	7	Bz1	F7.2	nT	Z- component of the magnetic field at the moon center fixed ME coordinate system
		71	1	(comma)	N/A	N/A	Delimiter
	8	72	10	X2	F10.1	km	X-coordinate of the satellite position in GSE
		82	1	(comma)	N/A	N/A	Delimiter
	9	83	10	Y2	F10.1	km	Y-coordinate of the satellite position in GSE
		93	1	(comma)	N/A	N/A	Delimiter
	10	94	10	Z2	F10.1	km	Z-coordinate of the satellite position in GSE
		104	1	(comma)	N/A	N/A	Delimiter
	11	105	7	Bx2	F7.2	nT	X- component of the magnetic field in GSE
		112	1	(comma)	N/A	N/A	Delimiter
	12	113	7	By2	F7.2	nT	Y- component of the magnetic field in GSE
		120	1	(comma)	N/A	N/A	Delimiter
	13	121	7	Bz2	F7.2	nT	Z- component of the magnetic field in GSE
		128	2	<CR><LF>statement	N/A	N/A	<0x0D><0x0A>

2.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 2-4.

Table 2-4 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA....AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 2.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN N (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA....AAAA (Up to 16 digits)	character strings	PDS[STATIC]
Name of the thumbnail file	ThumbnailFileName	AAAA....AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 2.1 "Rules used for File naming".)
Size of the thumbnail file	ThumbnailFileSize	NNNNNNNNNNNN N (Up to 12 digits)	unit:<byte>	depend on a product
File format of the thumbnail file	ThumbnailFileFormat	AAAA (Up to 4 digits)	JPEG	JPEG[STATIC]
Name of the instrument	InstrumentName	AAAA....AAAA (Up to 16 digits)	character strings	LMAG [STATIC]
Processing level	ProcessingLevel	AAAA....AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level")
Product ID	ProductID	AAAA....AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID")
Version number of the product	ProductVersion	AAAA....AAAA (Up to 16 digits)	character strings	dependent on the product
Access level	AccessLevel	N	values of 0-4	N/A
Start time	StartDateTime	yyyy - mm - ddT hh: mm: ss.ssZ	DATE & TIME	dependent on the product
Stop time	EndDateTime	yyyy- mm - ddT hh: mm: ss.ssZ	DATE & TIME	dependent on the product

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information : Magnetic Field Time Series>

DataFileName = MAG_TS20071221.dat
 DataFileSize = 2786400
 DataFileFormat = PDS
 ThumbnailFileName = MAG_TS20071221.jpg
 ThumbnailFileSize = 28375
 ThumbnailFileFormat = JPEG
 InstrumentName = LMAG
 ProcessingLevel = Standard
 ProductID = MAG_TS
 ProductVersion = 1.0
 AccessLevel = 4
 StartDateTime = 2007-12-21T00:00:00Z
 EndDateTime = 2007-12-21T23:59:56Z

3. Magnetic Anomaly Map (MA_MAP, MA_MAPOP)

3.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file names are case-independent.

AAAAAAAA_NNN.ext

- AAAAAAA : Product ID
 - MA_MAP:Magnetic Anomaly Map
 - MA_MAPOP :Magnetic Anomaly Map (Option)
- NNN : Version Number (three digits)
- ext : File Extension
 - ✓ img : Data File
 - ✓ ctg : Catalog Information File
 - ✓ sl2 : L2 Data Set (tar archive)

<Example of Name :Magnetic Anomaly Map>

- MA_MAP_001.img (Data File Version 1)

3.2 Label Format

The Label format for the IMAGE object used for the LMAG product is shown in Table 3-1. The Label for the IMAGE object includes: Standard Item, Image Data Object Format Description Part and IMAGE_MAP_PROJECTION Object Description Part.

In Table 3-1with the exception of the Values expressed as “STATIC”, the numerical values and the character strings corresponding to the type of the product etc., are set.

Table 3-1 IMAGE Object Label for the LMAG products

No	Items	Elements	Types	Values
Standard Item				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	UNDEFINED [STATIC]
3	File name	FILE_NAME = %s	char	See Section 3.1 “Rules used for File naming”.
4	Starting position of the image object	^IMAGE = %d <BYTES>	int	XXXX <BYTES>
5	Byte count of the file records	RECORD_BYTES = %d	int	XXXXXX
6	Name of the mission	MISSION_NAME = %s	char	SELENE [STATIC]
7	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M [STATIC]
8	Name of the instrument (Full name)	INSTRUMENT_NAME = %s	char	LMAG [STATIC]
9	Product name	PRODUCT_NAME = %s	char	See Table 1-2 “Product_ID”.
10	Target name	TARGET_NAME = %s	char	MOON [STATIC]
11	Comment	COMMENT_TEXT = "%s"	char(
Image Data Object Format Description Part(* IMAGE *)				
		OBJECT = IMAGE		
12	Band storage type	BAND_STORAGE_TYPE = %s	char	SAMPLE_INTERLEAVED [STATIC]
13	Number of bands	BANDS = %d	smallint	X

14	Compression class and encoding type	ENCODING_TYPE = %s	char	N/A [STATIC]
15	Horizontal pixel count of image	LINE_SAMPLES = %d	int	XXX
16	Vertical pixel count of image	LINES = %d	int	XXX
17	Pixel bit length	SAMPLE_BITS = %d	int	X
18	Pixel type	SAMPLE_TYPE = %s	char	MSB_INTEGER[STATIC]
19	Stretched Flag	STRETCHED_FLAG = %s	char	FALSE[STATIC]
20	Alternative value outside assumption	INVALID_CONSTANT = %s	char	X
21	Offset	OFFSET = %f	float	X.X
22	Scaling factor	SCALING_FACTOR = %f	float	X.X
		END_OBJECT = IMAGE		
IMAGE_MAP_PROJECTION				
		Object	Description	Part(/*
		IMAGE_MAP_PROJECTION */)		
		OBJECT = IMAGE_MAP_PROJECTION		
23	Resolution	MAP_RESOLUTION = %f<PIXEL/DEGREE>	float	X < PIXEL/DEGREE>
24	Semi-major axis of the ellipsoidal body	A_AXIS_RADIUS = %f<M>	float	1738000 <m> [STATIC]
25	medial axis of ellipsoidal body	B_AXIS_RADIUS = %f<M>	float	1738000 <m> [STATIC]
26	Semi-minor axis of ellipsoidal body	C_AXIS_RADIUS = %f<M>	float	1738000 <m> [STATIC]
27	Name of coordinate system	COORDINATE_SYSTEM_NAME = "%s"	char	"PLANETOCENTRIC" [STATIC]
28	Type of coordinate system	COORDINATE_SYSTEM_TYPE = "%s"	char	"BODY-FIXED ROTATING" [STATIC]
29	Maximum latitude	MAXIMUM_LATITUDE = %f	float	89.0 [STATIC]
30	Minimum latitude	MINIMUM_LATITUDE = %f	float	-89.0 [STATIC]
31	Westernmost longitude	WESTERNMOST_LONGITUDE = %f	float	0.0 [STATIC]
32	Easternmost longitude	EASTERNMOST_LONGITUDE = %f	float	359.0 [STATIC]
		END_OBJECT =		
		IMAGE_MAP_PROJECTION		
END statement				
		END		

<Example of Label : Magnetic Anomaly Map product>

```

PDS_VERSION_ID          = PDS3
RECORD_TYPE              = UNDEFINED
FILE_NAME                = MA_MAP_001.img
^IMAGE                   = 1072 <BYTES>

RECORD_BYTES             = 579960
MISSION_NAME             = SELENE
SPACECRAFT_NAME          = SELENE-M
INSTRUMENT_NAME          = LMAG
PRODUCT_NAME             = MA_MAP
TARGET_NAME              = MOON
COMMENT_TEXT             = "Magnetic field anomaly map. 9 bands."

/* IMAGE */
OBJECT = IMAGE
BAND_STORAGE_TYPE        = SAMPLE_INTERLEAVED
BANDS                    = 9
ENCODING_TYPE            = N/A
LINE_SAMPLES              = 360
LINES                    = 179
SAMPLE_BITS              = 8
SAMPLE_TYPE              = MSB_INTEGER
STRETCHED_FLAG           = FALSE

INVALID_CONSTANT         = 0
OFFSET                   = 0.0
SCALING_FACTOR           = 0.5

```

```

END_OBJECT = IMAGE

/* IMAGE_MAP_PROJECTION */
OBJECT = IMAGE_MAP_PROJECTION
MAP_RESOLUTION      = 1 < PIXEL / DEGREE>

A_AXIS_RADIUS  = 1738000 <m>
B_AXIS_RADIUS  = 1738000 <m>
C_AXIS_RADIUS  = 1738000 <m>
COORDINATE_SYSTEM_NAME = "PLANETOCENTRIC"
COORDINATE_SYSTEM_TYPE = "BODY-FIXED ROTATING"
MAXIMUM_LATITUDE      = 89.0
MINIMUM_LATITUDE      = -89.0
WESTERNMOST_LONGITUDE = 0.0
EASTERNMOST_LONGITUDE = 359.0
END_OBJECT = IMAGE_MAP_PROJECTION

END

```

3.3 Data Object Format

The Magnetic Anomaly Map describes the magnetic anomaly(X, Y, Z, F(total magnetic intensity-component)) in a 1-degree grid, each Standard Errors (four components) and the number for each grid of effective data in a interleaved format. The bit count for each pixel is 8 bits, and it is stored with a MSB INTEGER.

3.4 Catalog Information File Format

The Catalog Information File Format is shown in Table 3-3.

Table 3-3 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA...AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 3.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA...AAAA (Up to 16 digits)	character strings	PDS[STATIC]
Name of the instrument	InstrumentName	AAAA...AAAA (Up to 16 digits)	character strings	LMAG [STATIC]
Processing level	ProcessingLevel	AAAA...AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level")
Product ID	ProductID	AAAA...AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID")
Version number of the product	ProductVersion	AAAA...AAAA (Up to 16 digits)	character strings	dependent on the product
Access level	AccessLevel	N	the value of 0-4	N/A

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information : Magnetic Anomaly Map >

```

DataFileName = MA_MAP_001.img
DataFileSize = 581055
DataFileFormat = PDS
InstrumentName = LMAG
ProductVersion = 1.0
ProductID = MA_MAP
ProcessingLevel = Higher Level
AccessLevel = 4

```

4. Magnetic Anomaly Grid Data (MA_GD, MA_GDOP)

4.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file names are case-independent.

AAAAAAAAA_NNN.ext

- AAAAAAAAA : Product ID
 - MA_GD : Magnetic Anomaly Grid Data
 - MA_GDOP : Magnetic Anomaly Grid Data (Option)
- NNN : Version Number (three digits)
- ext : File Extension
 - ✓ lbl : Label File
 - ✓ dat : Data File
 - ✓ ctg : Catalog Information File
 - ✓ sl2 : L2 Data Set (tar archive)

<Example of Name :Magnetic Anomaly Grid Data>

- MA_GD_001.dat (Data File Version 1)

4.2 Label Format

The Label format for the TABLE object used for the LMAG product is shown in Table 4-1. The Label of TABLE object includes: Standard Item and Object Format Description Part.

In Table 4-1, the numerical values and the character strings that correspond to the type of the product, etc. is set, with the exception of those values shown as "STATIC".

Table 4-1 Object Label for the Magnetic Anomaly Grid Data

No	Items	Elements	Types	Values
Standard Item				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	FIXED_LENGTH
3	Byte count of the file records	RECORD_BYTES = %d	int	XXX
4	Count of the file records	FILE_RECORDS = %d	int	XXXXX
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M[STATIC]
6	Name of the instrument (Full name)	INSTRUMENT_NAME = %s	char	LMAG [STATIC]
7	Product name	PRODUCT_NAME = %s	char	See Table 1-2 "Product_ID".
8	Target name	TARGET_NAME = %s	char	MOON [STATIC]
9	Comment	COMMENT_TEXT = "%s"	char	
Object Format Description Part				
		OBJECT = TABLE		
10	Type of data	INTERCHANGE_FORMAT = %s	char	ASCII [STATIC]
11	Number of lines of data	ROWS = %d	int	XXXXX
12	Number of columns of data	COLUMNS = %d	int	XX
13	Byte count of data line	ROW_BYTES = %d	int	XXX
		END_OBJECT = TABLE = %s		
END Statements				
		END		

<Example of Label : Magnetic Anomaly Grid Data product>

```

PDS_VERSION_ID          = PDS3
RECORD_TYPE             = FIXED_LENGTH
RECORD_BYTES           = 96
FILE_RECORDS           = 64440

SPACECRAFT_NAME         = SELENE-M
INSTRUMENT_NAME = LMAG
PRODUCT_NAME = MA_GD
TARGET_NAME             = MOON
COMMENT_TEXT            = "Magnetic field anomaly gridded data at
                           100km. Lat, Lon, X, Y, Z, F, sX, sY, sZ, sF
                           and N are stored."

/* TABLE */
OBJECT = TABLE
  INTERCHANGE_FORMAT    = ASCII
  ROWS                  = 64440
  COLUMNS              = 11
  ROW_BYTES             = 96
END_OBJECT = TABLE

END

```

4.3 Data Object Format

The format for the Magnetic Anomaly Grid Data is in a Table format. The stored data consists of a total 11 elements consisting of: Latitude, Longitude and Magnetic Anomaly(X, Y, Z, and F (total magnetic intensity-component)) in a moon fixed ME coordinate, Standard Errors (four components) and effective data for each grid. Each data element is separated by a comma. The Latitude and Longitude are real number of a decimal place. The Magnetic Anomaly and Standard Errors are real number of two decimal places. The number of effective data is integers. The number of characters in a single line should be 96.

Table 4-3 Data Format

	Column	Byte position	Byte count	Item	Format	Unit	Description
96 byte	1	1	8	Latitude	F8.1	degree	Latitude in a moon fixed ME coordinate
		9	1	(comma)	N/A	N/A	Delimiter
	2	10	8	Longitude	F8.1	degree	Longitude in a moon fixed ME coordinate
		18	1	(comma)	N/A	N/A	Delimiter
	3	19	8	X	F8.2	nT	X-component of the Magnetic Anomaly data
		27	1	(comma)	N/A	N/A	Delimiter
	4	28	8	Y	F8.2	nT	Y-component of the Magnetic Anomaly data
		36	1	(comma)	N/A	N/A	Delimiter
	5	37	8	Z	F8.2	nT	Z-component of the Magnetic Anomaly data
		45	1	(comma)	N/A	N/A	Delimiter
6	46	8	F	F8.2	nT	F-component (total magnetic intensity-component) of the Magnetic Anomaly data	

	54	1	(comma)	N/A	N/A	Delimiter
7	55	8	X1	F8.2	nT	Standard Error of X-component of the Magnetic Anomaly data
	63	1	(comma)	N/A	N/A	Delimiter
8	64	8	Y2	F8.2	nT	Standard Error of Y-component of the Magnetic Anomaly data
	72	1	(comma)	N/A	N/A	Delimiter
9	73	8	Z2	F8.2	nT	Standard Error of Z-component of the Magnetic Anomaly data
	81	1	(comma)	N/A	N/A	Delimiter
10	82	8	F2	F8.2	nT	Standard Error of F-component (total magnetic intensity-component) of the Magnetic Anomaly data
	90	1	(comma)	N/A	N/A	Delimiter
11	91	4	A	I4	N/A	Effective data for each grid
	95	2	<CR><LF> statement	N/A	N/A	<0x0D><0x0A>

4.4 Catalog Information File Format

The catalog information file format is shown in Table 4-4.

Table 4-4 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA...AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 4.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA...AAAA (Up to 16 digits)	character strings	PDS[STATIC]
Name of the instrument	InstrumentName	AAAA...AAAA (Up to 16 digits)	character strings	LMAG [STATIC]
Processing level	ProcessingLevel	AAAA...AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level")
Product ID	ProductID	AAAA...AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID")
Version number of the product	ProductVersion	AAAA...AAAA (Up to 16 digits)	character strings	dependent on the product
Access level	AccessLevel	N	the value of 0-4	N/A

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information : Magnetic Anomaly Grid Data>

DataFileName = MA_GD_001.dat
DataFileSize = 6186240
DataFileFormat = PDS
InstrumentName = LMAG
ProcessingLevel = Higher Level
ProductID = MA_GD
ProductVersion = 1.0
AccessLevel = 4

5. 1D Electrical Conductivity Structure (1DSigma, 1DSigmaOP)

5.1 Rules used for File naming

The nomenclature used for Label, Data Object and Catalog Information File the product files are described below. In addition, the file names are case-independent.

AAAAAAAAA_NNN.ext

- AAAAAAAAA : Product ID
 - 1DSigma :1D Electrical Conductivity Structure
 - 1DSigmaOP :1D Electrical Conductivity Structure (Option)
- NNN : Version Number (three digits)
- ext : File Extension
 - ✓ lbl : Label File
 - ✓ dat : Data File
 - ✓ ctg : Catalog Information File
 - ✓ sl2 : L2 Data Set (tar archive)

<Example of Name :1D Electrical Conductivity Structure>

- 1DSigma_001.dat (Data File Version 1)

5.2 Label Format

The Label format for the TABLE object* used for the LMAG product is shown in Table 5-1. The Label of TABLE object includes: Standard Item and Object Format Description Part.

In Table 5-1, the numerical values and the character strings that correspond to the type of the product, etc. is set, with the exception of those values shown as "STATIC".

Table 5-1 Object Label for the 1D Electrical Conductivity Structure

No	Items	Elements	Types	Values
Standard Item				
1	PDS version number	PDS_VERSION_ID = %s	char	PDS3 [STATIC]
2	Record format of the file	RECORD_TYPE = %s	char	FIXED_LENGTH
3	Byte count of the file records	RECORD_BYTES = "%d"	int	XXX
4	Count of the file records	FILE_RECORDS = "%d"	int	XXXXX
5	Name of the spacecraft	SPACECRAFT_NAME = %s	char	SELENE-M[STATIC]
6	Name of the instrument (Full name)	INSTRUMENT_NAME = %s	char	LMAG [STATIC]
7	Product name	PRODUCT_NAME = "%s"	char	See Table 1-2 "Product_ID".
8	Target name	TARGET_NAME = %s	char	MOON [STATIC]
9	Comment	COMMENT_TEXT = "%s"	char	
Object Format Description Part				
		OBJECT = TABLE		
10	Type of data	INTERCHANGE_FORMAT = "%s"	char	ASCII [STATIC]
11	Number of lines of data	ROWS = "%d"	int	XXXXX
12	Number of columns of data	COLUMNS = "%d"	int	XX
13	Byte count of data line	ROW_BYTES = "%d"	int	XXX
		END_OBJECT = TABLE		
END Statements				
		END		

<Example of Label : 1D Electrical Conductivity Structure>

```

PDS_VERSION_ID          = PDS3
RECORD_TYPE             = FIXED_LENGTH
RECORD_BYTES           = 128
FILE_RECORDS           = 4

SPACECRAFT_NAME          = SELENE-M
INSTRUMENT_NAME = LMAG
PRODUCT_NAME = 1DSigma
TARGET_NAME              = MOON
COMMENT_TEXT             = "Electrical conductivity profile
                           in the moon."

/* TABLE */
OBJECT = TABLE
  INTERCHANGE_FORMAT    = ASCII
  ROWS                   = 4
  COLUMNS               = 3
  ROW_BYTES             = 32
END_OBJECT = TABLE

END

```

5.3 Data Object Format

The 1D Electrical Conductivity Structure is described in a Table format. The sequence is: Stored data is the top radius and the under radius of the layer and the electrical conductance in the layer. The radius is a real number (km) to three decimal places. The electrical conductance is a real number (S/m) within three significant places.

Table 5-3 Data Format

Column	Byte position	Byte count	Item	Format	Unit
1	1	8	Top radius of the layer	F8.1	km
	9	1	Comma (Delimiter)	N/A	N/A
2	10	8	Under radius of the layer	F8.1	km
	18	1	Comma (Delimiter)	N/A	N/A
3	19	12	Electrical conductance in the layer	E12.3	S/m
	31	2	<CR><LF>statement (<0x0D><0x0A>)	N/A	N/A

5.4 Catalog Information File Format

The catalog information file format is shown in Table 5-4.

Table 5-4 Catalog Information File Format

Item Name	Elements	Format of Value	Range of Value	Values
Name of the data file (*1)	DataFileName	AAAA...AAAA (Up to 31 digits)	alphanumeric characters	dependent on the product (See Section 5.1 "Rules used for File naming".)
Size of the data file	DataFileSize	NNNNNNNNNNNN (Up to 12 digits)	unit:<byte>	dependent on the product
File format of the data file	DataFileFormat	AAAA...AAAA (Up to 16 digits)	character strings	PDS[STATIC]
Name of the instrument	InstrumentName	AAAA...AAAA (Up to 16 digits)	character strings	LMAG [STATIC]
Processing level	ProcessingLevel	AAAA...AAAA (Up to 16 digits)	character strings	dependent on the product (See Table 1-2 "Level")
Product ID	ProductID	AAAA...AAAA (Up to 30 digits)	character strings	dependent on the product (See Table 1-2 "Product_ID")
Version number of the product	ProductVersion	AAAA...AAAA (Up to 16 digits)	character strings	dependent on the product
Access level	AccessLevel	N	the value of 0-4	N/A

(*1) "DataFileName" is the stored file name of the product. For the detached format, this is the stored file name.

<Example of Catalog Information : 1D Electrical Conductivity Structure >

DataFileName = 1DSigma.dat
 DataFileSize = 128
 DataFileFormat = PDS
 InstrumentName = LMAG
 ProcessingLevel = Higher Level
 ProductID = 1DSigma
 ProductVersion = 1.0
 AccessLevel = 4