



AVNIR-2 Ortho Rectified Image Product Format Description

Version 2.0

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Change Records

Ver.	Date	Page	Field No.	Contents
1.0	Mar. 2018			First edition
2.0	Jun. 2020	2.1	-	Description of browse image was added.
		2.2	-	Change of file naming rule.
		3.2	No.124	Table 3-2(4/4) Addition of AW3D30 to DSM type

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1. Introduction

1.1 Purpose

This paper provides the user with a description of the ALOS / AVNIR-2 ORI (Ortho Rectified Image) product output files.

ORI product – ORI data generated from the AVNIR-2 image of standard product Level 1B1 with DEM / DSM data set.

2. Overview of ORI product

2.1 File structures of ORI product

The ORI product consists of Browse Data File, Header File and its corresponding Data File. The ORI Data File is separated into each bands and is in GeoTIFF format raster image. Fig. 2-1 shows the ORI product file structure.

【AVNIR-2】

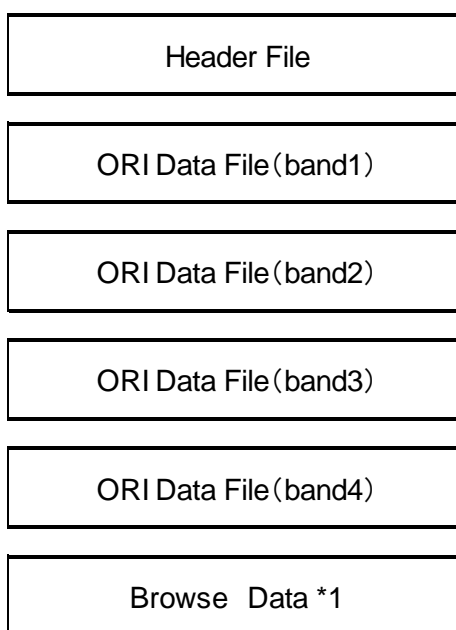


Fig. 2-1 ORI product file structure

The Header File includes text information of its corresponding Data Files which provides users with a size of Data Files, format, geo-location information, etc. The detailed format of Header File is described in section 3.2. The ORI Data is the image data of 8 bit unsigned integer.

*1 Some products don't have browse images

2.2 File naming

The file naming convention for ORI product is following;

Header file:

HDR-ALAV2CDDDDDEEEEE-OORIFFG_NNN (Header File)

Raster image file:

IMG-ALAV2CDDDDDEEEEE-OORIFFG_NNN.tif (ORI Data File)

Browse data file:

ALAV2CDDDDDEEEEE-OORIFFG_NNN.png (Browse Data File)

ALAV2CDDDDDEEEEE-OORIFFG_NNN.aux.xml (Browse xml File)

where

HDR	=	Header File extension
IMG	=	ORI Data File extension
AL	=	Satellite code (ALOS)
AV2	=	Sensor code (AVNIR-2)
C	=	'A': AVNIR-2 of ORI Data File
DDDDD	=	Total orbit number of input image
EEEE	=	Frame number of input image
O	=	Observation mode (OBS)
ORI	=	ORI processed data extension
FF	=	Data resampled frame direction, 'RF': Geo-reference or 'GT': Geo-coded True-north or 'GM' Geo-coded Map-north
G	=	Data resampled coordinates 'U': UTM map or 'P': PS map.
NNN	=	Product revision

3. Output File Formats

3.1 ORI product Header file items definition

There is one Header File in the ORI product data set. The file is described with plane text ASCII characters. Table 3-1 shows the items definitions.

Table 3-1 ORI product Header File Items definition

File	Item	Contents
Header File	Product Record	Data Identifier
	Scene ID	Scene Identifier
	Product Information	Product Identifier
	Scene Information	Scene Information
	Processing Information	Processing Details
	Map Projection	Map Projection Parameters
	Satellite Info.	Satellite Parameters
	Datum	Datum Parameters
	Coordinates	Coordinates Transform Parameters
	Format Record	Data Format Information
	System Record	Data Processing System Information
	Source Image Record	Source Image Data of ORI Processing Information
	Source DSM Record	Source DSM data of ORI Processing Information
Source Physical Quantity Record	Gain and offset value for estimating source Radiometric Physical value Information	

3.2 ORI product Header file description

Table 3-2 shows the format of the Header File described along these items.

Table3-3 The Header File formats of ORI products (1/4)

Field No.	Description	Number of Bytes	Start Byte Position	Type	Note
Product Record		Data Identifier			
	Scene ID				Field No.1~13
1	Scene ID = 'AABBBCCDDDDDEEEEEbbbbb' AA : Satellite code = 'AL' BBB : Sensor code = 'PSM':PRISM / 'AV2':AVNIR-2 C : Sensor type = 'N':nadir35km / 'F':forward35km / 'B':backward35km / 'W':nadir70km / 'A':AVNIR-2 DDDDD : Total orbit number of scene center = '00001'~'99999' EEEE : Frame number of scene center (including scene shift) = '0000'~'7199'	24	1	A24	Reference:[NCX-000022] Reference:[NCX-000022] Number of scene shifted
2	RSP ID = 'MPPPPFFFSNbbbbb' M : orbit direction = 'A' / 'D' PPP : RSP path no. = '001'~'671' FFFF : RSP frame no. = '0000'~'7199' SN : RSP scene shift = '-2'~'b2' S : scene shift direction N : scene shift (5 steps for PRISM)	16	25	A16	Number of scene shifted '+' : satellite flight direction
3	Satellite name = 'ALOSbbbb'	8	41	A8	
4	Sensor code = 'PSMbbbbb':PRISM / 'AV2bbbbb':AVNIR-2	8	49	A8	
5	Sensor type = 'Nbbb'nadir35km / 'Fbbb'forward35km / 'Bbbb'backward35km / 'Wbbb'nadir70km / 'Abbb':AVNIR-2	4	57	A4	
6	Total orbit number of scene center = 'bb00001'~'bb99999'	8	61	I8	
7	Frame number of scene center (including scene shift) = 'bbbb0000'~'bbbb7199'	8	69	I8	
8	orbit direction = 'bbA' / 'bbD'	4	77	A4	
9	RSP path no. = 'bbbb001'~'bbbb671'	8	81	I8	
10	RSP frame no. = 'bbbb0000'~'bbbb7199'	8	89	I8	
11	Scene shift = 'bbbbbbSN' = '-2'~'b2':5 steps for PRISM, '-5'~'b4':10 steps for AVNIR-2 S : scene shift direction N : scene shift	8	97	A8	'+' : satellite flight direction
12	Product serial number = 'NNN'	3	105	A3	
13	Blank	21	108	A21	Total 128 bytes
Product Information		Product Identifier			Field No.14~21
14	Product ID = 'ABBBCCEbbbbb' A : Observation mode = 'O':Observation BBB : Processing level = 'ORI' CC : Framing = 'RF':Geo-reference / 'GT':Geo-coded True-north / 'GM':Geo-coded Map-north D : Map projection = 'U':UTM / 'P':PS E : Sensor type = 'N':nadir35km / 'F':forward35km / 'B':backward35km / 'W':nadir70km / 'A':AVNIR-2	16	129	A16	
15	Product type = 'PSM-ORlbbbbb' / 'AV2-ORlbbbbb'	16	145	A16	
16	Framing type = 'Rbbb':Geo-reference / 'Gbbb':Geo-coded	4	161	A4	
17	Framing direction = 'bbbb':N/A / 'Tbbb':True North / 'Mbbb':Map North	4	165	A4	
18	Map projection = 'UTMbbbbb' / 'PSbbbbb'	8	169	A8	
19	Resampling method = 'CCbbbbb' / 'NNbbbbb' / 'BLbbbbb'	8	177	A8	
20	Number of bands = 'bbb1':PRISM / 'bbb4':AVNIR-2	4	185	I4	
21	Blank	4	189	A4	Total 64 bytes



Table 3-4 The Header File formats of ORI products (2/4)

Scene Information		Scene Information			Field No.22'63
22	Scene center time (UTC) = 'YYYYMMDDHHMMSSXXXZZZbbb' YYYY : Year MM : Month DD : Day HH : Hour MM : Minute SS : Second XXX : Millisecond ZZZ : Microsecond	24	193	A24	
23	Scene center line number = 'NNNNNNNN.NNNNNNN'	16	217	F16.7	
24	Scene center column number = 'NNNNNNNN.NNNNNNN'	16	233	F16.7	
25	Scene center latitude (deg) = 'NNNNNNNN.NNNNNNN' (-90.0000000~90.0000000)	16	249	F16.7	
26	Scene center longitude (deg) = 'NNNNNNNN.NNNNNNN' (-180.0000000~180.0000000)	16	265	F16.7	
27	Scene center map address X (km) = 'NNNNNNNN.NNNNNNN'	16	281	F16.7	Northing for UTM
28	Scene center map address Y (km) = 'NNNNNNNN.NNNNNNN'	16	297	F16.7	Easting for UTM
29	Scene upper-left line number = 'bNNNNNN'	8	313	F8.1	Addresses correspond to the pixel corner, not the pixel center.
30	Scene upper-left column number = 'bNNNNNN'	8	321	F8.1	
31	Scene upper-right line number = 'bNNNNNN'	8	329	F8.1	The pixel center address [Line,Column] of upper-left corner is [1,1], so that the corner address is [0.5,0.5].
32	Scene upper-right column number = 'bNNNNNN'	8	337	F8.1	
33	Scene lower-left line number = 'bNNNNNN'	8	345	F8.1	
34	Scene lower-left column number = 'bNNNNNN'	8	353	F8.1	
35	Scene lower-right line number = 'bNNNNNN'	8	361	F8.1	
36	Scene lower-right column number = 'bNNNNNN'	8	369	F8.1	
37	Scene upper-left latitude (deg) = 'NNNNNNNN.NNNNNNN' (-90.0000000~90.0000000)	16	377	F16.7	Negative value for southern hemisphere
38	Scene upper-left longitude (deg) = 'NNNNNNNN.NNNNNNN' (-180.0000000~180.0000000)	16	393	F16.7	Negative value for west longitude
39	Scene upper-right latitude (deg) = 'NNNNNNNN.NNNNNNN' (-90.0000000~90.0000000)	16	409	F16.7	Negative value for southern hemisphere
40	Scene upper-right longitude (deg) = 'NNNNNNNN.NNNNNNN' (-180.0000000~180.0000000)	16	425	F16.7	Negative value for west longitude
41	Scene lower-left latitude (deg) = 'NNNNNNNN.NNNNNNN' (-90.0000000~90.0000000)	16	441	F16.7	Negative value for southern hemisphere
42	Scene lower-left longitude (deg) = 'NNNNNNNN.NNNNNNN' (-180.0000000~180.0000000)	16	457	F16.7	Negative value for west longitude
43	Scene lower-right latitude (deg) = 'NNNNNNNN.NNNNNNN' (-90.0000000~90.0000000)	16	473	F16.7	Negative value for southern hemisphere
44	Scene lower-right longitude (deg) = 'NNNNNNNN.NNNNNNN' (-180.0000000~180.0000000)	16	489	F16.7	Negative value for west longitude
45	Scene upper-left map address X (km) = 'NNNNNNNN.NNNNNNN' (Northing for UTM)	16	505	F16.7	
46	Scene upper-left map address Y (km) = 'NNNNNNNN.NNNNNNN' (Easting for UTM)	16	521	F16.7	
47	Scene upper-right map address X (km) = 'NNNNNNNN.NNNNNNN' (Northing for UTM)	16	537	F16.7	
48	Scene upper-right map address Y (km) = 'NNNNNNNN.NNNNNNN' (Easting for UTM)	16	553	F16.7	
49	Scene lower-left map address X (km) = 'NNNNNNNN.NNNNNNN' (Northing for UTM)	16	569	F16.7	
50	Scene lower-left map address Y (km) = 'NNNNNNNN.NNNNNNN' (Easting for UTM)	16	585	F16.7	
51	Scene lower-right map address X (km) = 'NNNNNNNN.NNNNNNN' (Northing for UTM)	16	601	F16.7	
52	Scene lower-right map address Y (km) = 'NNNNNNNN.NNNNNNN' (Easting for UTM)	16	617	F16.7	
53	Satellite altitude at scene center (km) = 'NNNNNNNN.NNNNNNN'	16	633	F16.7	
54	Satellite ground speed at scene center (km/sec) = 'NNNNNNNN.NNNNNNN'	16	649	F16.7	
55	Elevation angle of the sun at scene center (deg) = 'NNNNNNNN.NNNNNNN' (-90.0000000~90.0000000)	16	665	F16.7	Negative value when the sun position is lower than the horizon
56	Azimuth angle of the sun at scene center (deg) = 'NNNNNNNN.NNNNNNN' (0.0000000~359.9999999)	16	681	F16.7	Clockwise angle from north direction
57	Image skew angle at scene center (milli-radian) = 'NNNNNNNN.NNNNNNN'	16	697	F16.7	
58	Satellite heading angle including earth rotation at scene center (radian) = 'NNNNNNNN.NNNNNNN'	16	713	F16.7	
59	Pointing angle (deg) = 'bbbSNNNNNbbbbbb' Data extraction start point of scene center line (Absolute pixel no.) = 'bbbNNNNNNbbbbbb'(0~39424)	16	729	F16.7	N/A
60	Incident angle = 'bbbSNNNNbbbbbb' S : Incident direction = 'R' / 'L'	16	745	A16	
61	Orientation angle (deg) = 'NNNNNNNN.NNNNNNN'	16	761	F16.7	Angle of the vertical axis of image frame from the map northing axis
62	Angle between vertical axis of coordinates and true north direction (deg) = 'NNNNNNNN.NNNNNNN'	16	777	F16.7	At scene center
63	Blank	16	793	A16	Total 616 bytes
Processing Information		Processing Details			Field No.63'93
Map Projection		Map Projection Parameters			
64	Coordinates = 'LTLNbbbb' / 'UTMbbbb' / 'PSbbbb'	8	809	A8	
65	PS origin latitude (deg) = 'NNNNNNNN.NNNNNNN'	16	817	F16.7	
66	PS origin longitude (deg) = 'NNNNNNNN.NNNNNNN'	16	833	F16.7	
67	PS reference latitude (deg) = 'NNNNNNNN.NNNNNNN'	16	849	F16.7	All blank for UTM product
68	PS reference longitude / UTM central meridian (deg) = 'NNNNNNNN.NNNNNNN'	16	865	F16.7	
69	Hemisphere = 'bbbN' / 'North' / 'bbbS' / 'Source'	4	881	A4	
70	UTM zone no. = 'bbb1' ~ 'bbb60'	4	885	I4	All blank for PS product
71	Scene center map address X (km) = 'NNNNNNNN.NNNNNNN'	16	889	F16.7	
72	Scene center map address Y (km) = 'NNNNNNNN.NNNNNNN'	16	905	F16.7	
73	Angle between vertical axis of coordinates and true north direction (deg) = 'NNNNNNNN.NNNNNNN'	16	921	F16.7	
74	Blank	16	937	A16	Total 144 bytes

Table 3-2 The Header File formats of ORI products (3/4)

Satellite Info.		Satellite Parameters			
75	Nominal satellite orbit inclination (deg) = 'NNNNNNNN.NNNNNNN'	16	953	F16.7	
76	Nominal satellite orbit cycle period (min) = 'NNNNNNNN.NNNNNNN'	16	969	F16.7	
77	Nominal satellite altitude (km) = 'NNNNNNNN.NNNNNNN'	16	985	F16.7	
78	Nominal satellite ground speed (km/sec) = 'NNNNNNNN.NNNNNNN'	16	1001	F16.7	
79	Nominal swath angle (deg) = 'NNNNNNNN.NNNNNNN'	16	1017	F16.7	
80	Nominal scan rate (msec/scan) = 'NNNNNNNN.NNNNNNN'	16	1033	F16.7	
81	Blank	32	1049	A32	Total 128 bytes
Datum		Datum Parameters			
82	ECR coordinates = 'TTRF97bbbbbbbb'	16	1081	A16	
83	Ellipsoid model = 'GRS80bbbbbbbb'	16	1097	A16	
84	Equator radius of ellipsoid model (km) = 'NNNNNNNN.NNNNNNN'	16	1113	F16.7	
85	Polar radius of ellipsoid model (km) = 'NNNNNNNN.NNNNNNN'	16	1129	F16.7	
86	Inverse flattening (1/f) of ellipsoid model = 'NNNNNNNN.NNNNNNN'	16	1145	F16.7	
87	Blank	48	1161	A48	Total 128 bytes
Coordinates		Coordinates Transform Parameters			
88	Line pixel spacing (m)/(sec) = 'NNN.NNNb'	8	1209	A8	Standard settings are as follows PRISM:2.5m/10.0m
89	Column pixel spacing (m)/(sec) = 'NNN.NNNb'	8	1217	A8	Standard settings are as follows PRISM:2.5m/10.0m AVNIR-2:10.0m/12.5m/15.0m/ 20.0m/30.0m
90	Affine transform coefficients from Map address (X, Y) to Image address (C, L) $\begin{pmatrix} C \\ L \end{pmatrix} = \begin{pmatrix} a & b \\ -b & a \end{pmatrix} \begin{pmatrix} X \\ Y \end{pmatrix} + \begin{pmatrix} c \\ d \end{pmatrix}$ Affine transform coefficient a = 'NNNNNNNN.NNNNNNN'	16	1225	F16.7	The center of the pixel of an upper-left Image corner corresponds to address (1,1). No false northing (10000km) is applied for UTM south.
91	Affine transform coefficient b = 'NNNNNNNN.NNNNNNN'	16	1241	F16.7	
92	Affine transform coefficient c = 'NNNNNNNN.NNNNNNN'	16	1257	F16.7	
93	Affine transform coefficient d = 'NNNNNNNN.NNNNNNN'	16	1273	F16.7	
94	Blank	48	1289	A48	Total 128 bytes
Format Record		Data Format Information			
95	Header record length (byte) = 'bbbbNNNN'	8	1337	I8	
96	Data column length (number of pixels for each line) = 'bbNNNNNN'	8	1345	I8	Variable
97	Data line length (number of pixels for each column) = 'bbNNNNNN'	8	1353	I8	Variable
98	Number of bits for ORI 1 pixel (bit) = 'bbb8'	4	1361	I4	
99	Number of pixels for ORI 1 data (pixel) = 'bbb1'	4	1365	I4	
100	Number of bytes for ORI 1 data (byte) = 'bbb1'	4	1369	I4	
101	Byte order = 'bbbbMSB' / 'bbbbLSB'	8	1373	A8	
102	Bands per file = 'bbb1'	4	1381	I4	
103	Number of ORI files = 'bbb1':PRISM / 'bbb4':AVNIR-2	4	1385	I4	
104	Blank	12	1389	A12	Total 64 bytes
System Record		Data Processing System Information			
105	Processing date (JST) = 'YYYYMMDDbbbbbbbb' YYYY : Year MM : Month DD : Day	16	1401	A16	Field No.105'112
106	Processing time (JST) = 'HHMMSSbbbbbbbb' HH : Hour MM : Minute SS : Second	16	1417	A16	
107	Processing country = 'JAPANbbbbbbbb'	16	1433	A16	All blank for distribution software package
108	Processing organization = 'JAXAbbbbbbbb'	16	1449	A16	All blank for distribution software package
109	Processing facility = 'EORC-AGAPbbbbbb'	16	1465	A16	All blank for distribution software package
110	Software version = 'VVV-RRR-YYYYMMDDbbbbbbbb' VVV : Version No. RRR : Release No. YYYY : Release year MM : Release month DD : Release date	24	1481	A24	
111	DFOB revision = 'Abbb'~'Zbbb'	4	1505	A4	
112	Production method = 'M:Manual / 'A:Automatic processing	4	1509	A4	
113	Blank	20	1513	A20	Total 128 bytes

Table 3-2 The Header File formats of ORI products (4/4)

Source Image Record		Source Image Data of ORI Processing Information			Field No.112~121
114	Scene ID = 'AABBBCDDDDDEEEebbbbbbb' AA : Satellite code = 'AL' BBB : Sensor code = 'PSM':PRISM / 'AV2':AVNIR-2 C : Sensor type = 'N':nadir35km / 'F':forward35km / 'B':backward35km / 'W':nadir70km / 'A':AVNIR-2 DDDDD : Total orbit number of scene center = '00001'~'99999' EEEE : Frame number of scene center (including scene shift) = '0000'~'7199'	24	1529	A24	Reference:'NCX-000022' Reference:'NCX-000022' Number of scene shifted
115	RSP ID = 'MPPPPFFFSNbbbbbb' M : orbit direction = 'A' / 'D' PPP : RSP path no. = '001'~'671' FFFF : RSP frame no. = '0000'~'7199' SN : RSP scene shift = '-2'~'b2':PRISM / '-5'~'b2':AVNIR-2 S : scene shift direction N : scene shift (5 steps for PRISM / 10 steps for AVNIR-2)	16	1553	A16	Number of scene shifted
116	Product ID = 'ABBBCCEebbbbbbb' A : Observation mode = 'O':Observation BBB : Processing level = '1B1' CC : Processing option = '._':none(except for 1B2) D : map projection = '._':none(except for 1B2) E : Sensor type = 'N':nadir35km / 'F':forward35km / 'B':backward35km / 'W':nadir70km / 'A':AVNIR-2	16	1569	A16	
117	Scene center time (UTC) = 'YYYYMMDDHHMMSSXXZZZbbb' YYYY : Year MM : Month DD : Day HH : Hour MM : Minute SS : Second XXX : Millisecond ZZZ : Microsecond	24	1585	A24	
118	Processing level = '1B1bbbb'	8	1609	A8	
119	Orientation processing = 'Rbbb':Relative / 'Abbb':Absolute / 'Mbbb':Model / 'bbbb':none	4	1617	A4	
120	Orbit data type = 'NNbb' '10': Precision(Accuracy Index A) '11': Precision(Accuracy Index B) '12': Precision(Accuracy Index C) '13': Precision(Accuracy Index D) '14': Precision(Accuracy Index E) '15': Precision(Accuracy Index Unknown) '20': RARR_Determine '30': RARR_Predict '40': GPSR_Raw '50': GPSR_PCD	4	1621	I4	
121	Attitude data type = 'NNbb' '10': HighFrequency '20': OnSitePrecision '30': AOCS_Precision '40': PCD_Precision '50': Standard '60': Precision_Pointing_Determinaion (TBD)	4	1625	I4	
122	Cloud cover reference = 'NNbb' 00:0~2% / '01':3~10% / '02':11~20% / '03':21~30% / '04':31~40% / '05':41~50% / '06':51~60% / '07':61~70% / '08':71~80% / '09':81~90% / '10':91~100% / '99':not assessed	4	1629	I4	Cloud rate of whole image All blank for default product
123	Blank	24	1633	A24	Total 128 bytes
Source DSM Record		Source DSM data of ORI Processing Information			Field No.122~131
124	DSM type = 'GSI-DEM50bbbbbb':GSI 50m grid DEM / 'USGS-GTOPO30bbbb':USGS GTOPO30 DEM / 'USGS-SRTM-1bbbb':USGS SRTM-1 DEM / 'USGS-SRTM-3bbbb':USGS SRTM-3 DEM / 'USGS-SRTM30bbbb':USGS SRTM30 DEM / 'PSM-DSM05bbbbbb':AW3D30 ALOSGlobalDigitalSurfaceModel(ALOS World 3D- 30m) / 'PSM-DSM10bbbbbb':PRISM 10m grid standard DSM / 'AV2-DSM30bbbbbb':AVNIR2 30m grid standard DSM / 'OVN-DSM20bbbbbb':VNIR 20m grid standard DSM / 'DSM No usebbbbbb':DSM is not used /	16	1657	A16	
125	DSM type sup. = 'Rbbb':Relative / 'Abbb':Absolute	4	1673	A4	
126	Height type = 'Ebbb':Ellipsoid Height / 'Obbb':Orthometric Height	4	1677	A4	
127	Geoid data = 'XXXXXXXXXXXXXXXX' : 'GSI-2000bbbbbb': Japan Geoid 2000 / 'NGA-EGM96bbbbbb': EGM96	16	1681	A16	All blank for height type 'E'
128	Mask (00000000) rate = 'bNNN'	4	1697	I4	All blank
129	Mask (00000001) rate = 'bNNN'	4	1701	I4	
130	Mask (00000010) rate = 'bNNN'	4	1705	I4	
131	Mask (00000011) rate = 'bNNN'	4	1709	I4	
132	DSM data quality = 'bbX'	4	1713	A4	
133	Blank	4	1717	A4	Total 128 bytes
Source Physical Quantity Record		Source Radiometric Physical Quantity Information			Field No.134~141
134	Gain of Band1	8	1721	F8.4	Absolute calibration factor copied from LIB1 data. PRISM : band1 offset gain are set Band2-4 of PRISM are set 'b'
135	Offset of Band1	8	1729	F8.4	
136	Gain of Band2	8	1737	F8.4	
137	Offset of Band2	8	1745	F8.4	
138	Gain of Band3	8	1753	F8.4	
139	Offset of Band3	8	1761	F8.4	
140	Gain of Band4	8	1769	F8.4	
141	Offset of Band4	8	1777	F8.4	
				1784	byte