



PALSAR-2

Level 1.1/2.1/1.5/3.1 CEOS SAR Product

Format Description

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Japan Aerospace Exploration Agency



PALSAR-2

Level 1.1/1.5/3.1 CEOS SAR Product

Format Description

Japan Aerospace Exploration Agency

ALOS-2 Product Format Description
CEOS Level 1.1/1.5/3.1 Revision History (1/7)

| Rev. | Date | Revision Contents | Remark |
|------|------------|---|--------|
| NC | 2012/12/28 | First Edition | |
| A | 2014/05/16 | P22 P38 P90 Table 3.3-14 Field No.18 P95 Table 3.3-15 Field No.18 P.125 Table 4.3-1 No.44 Removed the statement about compact polarimetry. | |
| | | P24, 28-29 Changed the figure numbers. Before: Figure 3-1, 3-2, 3-3, 3-4, 3-5 After: Figure 3.1-1, 3.1-2, 3.1-3, 3.1-4, 3.1-5 | |
| | | P31 Table 3.2-1 P34 Table 3.2-18 P77 Table 3.3-11 (1/2) P78 Table 3.3-11 (2/2) Removed the statement about predicted ephemeris. | |
| | | P35 Added the description of Table 3.3-19 to Table 3.3-27. | |

ALOS-2 Product Format Description
CEOS Level 1.1/1.5/3.1 Revision History (2/7)

| Rev. | Date | Revision Contents | Remark |
|------------|------|--|--------|
| A cont. | | <p>P36 Table 3.3-1 Field No.12 P44 Table 3.3-4 Field No.12 P83 Table 3.3-13 Field No.12 P98 Table 3.3-16 Field No.12 Revised the format of “Software release and revision level”.</p> <p>Before: (Description) Software release and revision level = 'NN.NNbbbbbb' 1.00, 1.01, ... 1.10, ... 2.00 (Remarks) b1.00bbbbbb</p> <p>After: (Description) Software release and revision level = 'NNN.NNNbbbbbb' 001.000, 001.001, ... 001.100, ... 002.000 (Remarks) 001.000bbbbbb</p> | |
| | | <p>P50 Table 3.3-5 Field No.34 Removed the statement about periodical calibration.</p> | |

ALOS-2 Product Format Description
CEOS Level 1.1/1.5/3.1 Revision History (3/7)

| Rev. | Date | Revision Contents | Remark |
|------------|------|--|--------|
| A cont. | | P50 Table 3.3-5 Field No.34 Added suffix: “mode.” Before: '01': Ultra-fine '02': High-sensitive '03': Fine '18': Full (Quad.) pol./High-sensitive '19': Full (Quad.) pol./Fine After: '01': Ultra-fine mode '02': High-sensitive mode '03': Fine mode '18': Full (Quad.) pol./High-sensitive mode '19': Full (Quad.) pol./Fine mode | |
| | | P53 Table 3.3-5 Field No.82 Revised the format of “Processing version ID” Before: NN.NNbbb After: NNN.NNNb | |
| | | P55 Table 3.3-5(8/16) Field No.100, 101, 102, 104 P56 Table 3.3-5(9/16) Field No.105, 106, 109, 110, 111 P57 Table 3.3-5(10/16) Field No.113, 114, 115 P81 Table 3.3-12(3/4) Field No.21 P82 Table 3.3-12(4/4) Field No.24 Added the description of the values in the case of ScanSAR level 1.1 | |
| | | P57 Table 3.3-5 Field No.118 and 119 Revised the descriptions. Before: 'NO..bb' After: 'NObb' | |
| | | P119 Table 4.3-1 No.9 Changed the figure numbers. Before: Figure 4-1 After: Figure 4.3-1 | |

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CEOS Level 1.1/1.5/3.1 Revision History (4/7)

| Rev. | Date | Revision Contents | Remark |
|------------|------|--|--------|
| A cont. | | P122 Corrected the spelling. Before: PS reference logitude After: PS reference longitude | |
| | | P125 Table 4.3-1 No.42 Revised the description about the value of “Data size of product.” Before: Mbytes = 1024Kbyte After: Mbyte = 1024Kbyte | |
| | | P.125 Table 4.3-1 No.43 Added the number of files in the case of level 1.1 ScanSAR mode products. Before: * Level 1.1 ScanSAR mode product: ScanSAR nominal mode (Single pol.) ScanSAR wide mode (Single pol.) ScanSAR nominal mode (Dual pol.) ScanSAR wide mode (Dual pol.) After: * Level 1.1 ScanSAR mode product: ScanSAR nominal mode (Single pol.) : 8 files ScanSAR wide mode (Single pol.) : 10 files ScanSAR nominal mode (Dual pol.) : 13 files ScanSAR wide mode (Dual pol.) : 17 files | |
| | | P129-132 Changed the figure numbers. Before: Figure 5-1, 5-2, 5-3, 5-4, 5-5 After: Figure 5.2-1, 5.2-2, 5.2-3, 5.2-4, 5.2-5 | |
| B | | Missing number | |

ALOS-2 Product Format Description
CEOS Level 1.1/1.5/3.1 Revision History (6/7)

| | | |
|------------|--|--|
| C cont. | <p>P.91 Table 3.3-14 (3/5) No.36 Removed the description. Before : Data record window position (SAMPLE DELAY [nsec]) = 0)₁₀ After : Data record window position (SAMPLE DELAY [nsec])</p> | |
| | <p>P.67 Table 3.3-6 (4/4) No.77, 78 P.79 Table 3.3-12 (1/4) No. 8 Revised the recommendation about usage of the coefficients</p> <p>P.67 Table 3.3-6 (4/4) No.77 Before : Recommend to use the coefficients of 1025-2024 bytes in facility related data record 5 After : The coefficients of 1025-2024 bytes in facility related data record 5 should be used if high position accuracy is needed.</p> <p>P.67 Table 3.3-6 (4/4) No.78 Before : Recommend to use the coefficients of 2065-3064 bytes in facility related data record 5 After : The coefficients of 2065-3064 bytes in facility related data record 5 should be used if high position accuracy is needed.</p> <p>P.79 Table 3.3-12 (1/4) No. 8 Before : (Recommend to use the coefficients of 2065-3064 bytes) After : The coefficients of 2065-3064 bytes in facility related data record 5 should be used if high position accuracy is needed.</p> | |

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CEOS Level 1.1/1.5/3.1 Revision History (7/7)

| | | | |
|------------|------------|---|--|
| C cont. | | <p>P.81 Table 3.3-12 (3/4) No.22 and No.23</p> <p>Removed the description.</p> <p>Before :</p> <p>No.22 : Origin Pixel (P0) 0.0 fixed</p> <p>No.23 : Origin Line (L0) 0.0 fixed</p> <p>After :</p> <p>No.22 : Origin Pixel (P0) 0.0</p> <p>No.23 : Origin Line (L0) 0.0</p> | |
| D | 2015/08/24 | <p>P.66-67 Table 3.3-6 (3/5) and (4/5) No. 57 to No.64</p> <p>Added the note to clarify the provision.</p> <p>“at the center of pixel” or “same as above”</p> | |
| E | 2016/04/15 | <p>P.8-10 Table 2.2-7 to Table 2.2-9</p> <p>Corrected the values of “Azimuth Pixel” and “Data Volume”.</p> | |

ALOS-2 Product Format Description
(CEOS Level 1.1/1.5/3.1 Format)

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1. Overview

This document describes the CEOS (Committee on Earth Observation Satellites) SAR format specifications for ALOS-2 Level 1.1/1.5/3.1 products which are generated with ALOS-2 Data Processing System. The formats are based on the CEOS SAR formats of the ALOS/PALSAR products to take user friendliness into account and added new items for ALOS-2.

2. Product Specifications

2.1. Definition of Processing Levels

The definition of processing levels of ALOS-2 products is shown in Table 2.1-1. This document describes the data formats for CEOS level 1.1/1.5/3.1 products.

Table 2.1-1 Definition of Processing Levels

| Level | Definition | Remark |
|-------|---|---|
| 1.0 | Data corresponding to a scene area is extracted from received data. Data type is 8 bit. In the case of multi-polarization modes, the number of SAR data files is equal to the number of polarizations. In the case of ScanSAR mode, the data file is not divided into each scan. In the case of ATI and compact polarimetry observations, only level 1.0 product is generated. | |
| 1.1 | Range and single look azimuth compressed data is represented by complex I and Q channels to preserve the magnitude and phase information. Range coordinate is in slant range. L1.1 image is focused onto zero Doppler direction. In the case of ScanSAR mode, an image file is generated per each scan. | SLC: Single Look Complex. Interferometry processing requires SLC data. |
| 1.5 | Range and multi-look azimuth compressed data is represented by amplitude data. Range coordinate is converted from slant range to ground range, and map projection is performed. Pixel spacing is selectable depending on observation modes. There are two methods to transform image coordinate; G: Image coordinate in map projection is geocoded. R: Image coordinate in map projection is georeferenced. | G or R is selectable. |
| 2.1 | Level 2.1 data is orthorectified from level 1.1 data by using digital elevation model. Pixel spacing is selectable depending on observation modes. Image coordinate in map projection is geocoded. | |
| 3.1 | Image quality corrections (noise reduction and dynamic range compression) are performed to level 1.5 data. | |

2.2. Definition of Scene

2.2.1. Scene Size

Scene sizes for level 1.1/1.5/3.1 products of each observation mode are shown in Table 2.2-1 and Table 2.2-2.

**Table 2.2-1 Scene Size for Level 1.1/1.5/3.1 Products
(Except Full (Quad.) Polarimetry)**

| Observation Mode | Spotlight | Ultra-Fine | High-sensitive | Fine | ScanSAR nominal [28MHz] | ScanSAR nominal [14MHz] | ScanSAR wide [490km] |
|------------------------------------|-----------|------------|----------------|-------|-------------------------|-------------------------|----------------------|
| Length of Range Direction | 25km | 55km | 55km | 70km | 350.5km | 350.5km | 489.5km |
| Length of Azimuth Direction | 25km | 70km | 70km | 70km | 355km | 355km | 355km |
| Time Duration of Azimuth Direction | N/A | 10sec | 10sec | 10sec | 52sec | 52sec | 52sec |
| Range Resolution* | 3.0m | 3.0m | 6.0m | 9.1m | 47.5m(5look) | 95.1m(5look) | 44.2m(2look) |
| Azimuth Resolution* | 1.0m | 3.0m | 4.3m | 5.3m | 77.7m(3look) | 77.7m(3look) | 56.7m(1.5look) |

*: The values in Table 2.2-1 are defined as those in single look processing and at the incidence angle 37 deg (unless otherwise noted).

Table 2.2-2 Scene Size for Level 1.1/1.5/3.1 Products (Full (Quad.) Polarimetry)

| Observation Mode | High-sensitive | Fine |
|------------------------------------|----------------|-------|
| Length of Range Direction | 40-50km | 30km |
| Length of Azimuth Direction | 70km | 70km |
| Time Duration of Azimuth Direction | 10sec | 10sec |
| Range Resolution* | 5.1m | 8.7m |
| Azimuth Resolution* | 4.3m | 5.3m |

*: The values in Table 2.2-2 are defined as those in single look processing and at the incidence angle 37 deg (unless otherwise noted).

2.2.2. Data Volume of Scene

The number of pixels and the data volumes for each observation mode and each offnadir angle are shown in Table 2.2-3 - Table 2.2-21.

Table 2.2-3 Level 1.1 Image Size and Volume for Spotlight Mode

| Spotlight Mode | | | |
|--------------------------|-------------|---------------|---------------------|
| Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 7.3 | 2439 | 50000 | 930 |
| 13.6 | 4514 | 50000 | 1722 |
| 18.1 | 5964 | 50000 | 2275 |
| 22.6 | 7378 | 50000 | 2814 |
| 27.1 | 8746 | 50000 | 3336 |
| 31.5 | 10032 | 50000 | 3827 |
| 33.22 | 10519 | 50000 | 4013 |
| 35.8 | 11232 | 50000 | 4285 |
| 40.1 | 12368 | 50000 | 4718 |
| 44.2 | 13387 | 50000 | 5107 |
| 48.2 | 14315 | 50000 | 5461 |
| 52.1 | 15132 | 50000 | 5772 |
| 55.6 | 15845 | 50000 | 6044 |
| 58.8 | 16426 | 50000 | 6266 |

**Table 2.2-4 Level 1.1 Image size and Volume for Ultra-Fine Mode
(Single Polarization)**

| Ultra-Fine Mode | | | |
|--------------------------|-------------|---------------|---------------------|
| Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 9.6 | 6719 | 30164 | 1546 |
| 13.9 | 9679 | 30164 | 2228 |
| 18.0 | 12452 | 30164 | 2866 |
| 21.9 | 15031 | 30164 | 3460 |
| 25.6 | 17415 | 30164 | 4008 |
| 29.1 | 20535 | 30164 | 4726 |
| 32.4 | 22627 | 30164 | 5208 |
| 35.4 | 24464 | 30164 | 5630 |
| 38.2 | 26119 | 30164 | 6010 |
| 40.6 | 24990 | 30164 | 5752 |
| 42.7 | 26042 | 30164 | 5994 |
| 44.7 | 27012 | 30164 | 6216 |
| 46.4 | 27811 | 30164 | 6400 |
| 48.0 | 28541 | 30164 | 6568 |
| 49.5 | 29204 | 30164 | 6720 |
| 50.9 | 29805 | 30164 | 6860 |
| 52.1 | 30307 | 30164 | 6974 |
| 53.3 | 30795 | 30164 | 7086 |
| 54.3 | 31191 | 30164 | 7178 |
| 55.3 | 31578 | 30164 | 7268 |
| 56.2 | 31917 | 30164 | 7346 |
| 57.0 | 32213 | 30164 | 7414 |
| 57.7 | 32466 | 30164 | 7472 |
| 58.4 | 32715 | 30164 | 7528 |

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-5 Level 1.1 Image size and Volume for High-sensitive Mode
(Single Polarization)**

| High-sensitive Mode | | | |
|--------------------------|-------------|---------------|---------------------|
| Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 9.6 | 3359 | 27400 | 702 |
| 13.9 | 4839 | 27400 | 1012 |
| 18.0 | 6225 | 27400 | 1302 |
| 21.9 | 7514 | 27400 | 1570 |
| 25.6 | 8706 | 27400 | 1820 |
| 29.1 | 10266 | 27400 | 2146 |
| 32.4 | 11311 | 27400 | 2364 |
| 35.4 | 12230 | 27400 | 2556 |
| 38.2 | 13057 | 27400 | 2730 |
| 40.6 | 12492 | 27400 | 2612 |
| 42.7 | 13019 | 27400 | 2722 |
| 44.7 | 13504 | 27400 | 2822 |
| 46.4 | 13903 | 27400 | 2906 |
| 48.0 | 14268 | 27400 | 2982 |
| 49.5 | 14599 | 27400 | 3052 |
| 50.9 | 14900 | 27400 | 3114 |
| 52.1 | 15150 | 27400 | 3168 |
| 53.3 | 15394 | 27400 | 3218 |
| 54.3 | 15592 | 27400 | 3260 |
| 55.3 | 15786 | 27400 | 3300 |
| 56.2 | 15956 | 27400 | 3336 |
| 57.0 | 16103 | 27400 | 3366 |
| 57.7 | 16230 | 27400 | 3392 |
| 58.4 | 16354 | 27400 | 3418 |

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-6 Level 1.1 Image size and Volume for Fine Mode
(Single Polarization)**

| Fine Mode | | | |
|--------------------------|-------------|---------------|---------------------|
| Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 9.8 | 2608 | 13700 | 273 |
| 14.7 | 3889 | 13700 | 406 |
| 19.4 | 5092 | 13700 | 532 |
| 23.8 | 6187 | 13700 | 647 |
| 28.2 | 8452 | 13700 | 883 |
| 32.5 | 9612 | 13700 | 1005 |
| 36.2 | 9813 | 13700 | 1026 |
| 39.3 | 9716 | 13700 | 1016 |
| 41.9 | 10245 | 13700 | 1071 |
| 44.3 | 10715 | 13700 | 1120 |
| 46.4 | 10185 | 13700 | 1065 |
| 48.2 | 10485 | 13700 | 1096 |
| 49.8 | 10743 | 13700 | 1123 |
| 51.2 | 9966 | 13700 | 1042 |
| 52.4 | 10132 | 13700 | 1059 |
| 53.5 | 10280 | 13700 | 1074 |
| 54.6 | 10424 | 13700 | 1090 |
| 55.5 | 10012 | 13700 | 1046 |
| 56.3 | 10639 | 13700 | 1112 |
| 57.1 | 9127 | 13700 | 954 |
| 57.8 | 10821 | 13700 | 1131 |
| 58.5 | 10904 | 13700 | 1140 |

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-7 Level 1.1 Image size and Volume for ScanSAR nominal [14MHz] Mode
(Single Polarization, SPECAN Method *1)**

| ScanSAR Mode | | | | | |
|--------------|----------|-----------------------|-------------|---------------|------------------|
| Scan Mode | Scan No. | Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 5 | 1 | 9.1 | 1468 | 70000 | 784 |
| | 2 | 15.1 | 2418 | 70000 | 1291 |
| | 3 | 20.7 | 3282 | 70000 | 1753 |
| | 4 | 26.2 | 4523 | 70000 | 2416 |
| | 5 | 30.8 | 4265 | 105000 | 3417 |
| | total | | | | |
| 5 | 1 | 26.2 | 4523 | 70000 | 2416 |
| | 2 | 30.8 | 4265 | 87500 | 2847 |
| | 3 | 34.9 | 5499 | 70000 | 2937 |
| | 4 | 38.6 | 5597 | 70000 | 2989 |
| | 5 | 41.8 | 6194 | 87500 | 4135 |
| | total | | | | |
| 5 | 1 | 41.8 | 6194 | 70000 | 3308 |
| | 2 | 44.7 | 6538 | 52500 | 2619 |
| | 3 | 47.3 | 6831 | 52500 | 2736 |
| | 4 | 49.5 | 7069 | 70000 | 3775 |
| | 5 | 51.5 | 7275 | 70000 | 3885 |
| | total | | | | |
| 5 | 1 | 53.2 | 7444 | 52500 | 2982 |
| | 2 | 54.7 | 7588 | 52500 | 3039 |
| | 3 | 56.1 | 7717 | 70000 | 4121 |
| | 4 | 57.3 | 7824 | 70000 | 4178 |
| | 5 | 58.3 | 7911 | 70000 | 4225 |
| | total | | | | |

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*1: SPECAN: SPECTral ANalysis

*2: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-8 Level 1.1 Image size and Volume for ScanSAR nominal [28MHz] Mode
(Single Polarization, SPECAN Method)**

| ScanSAR Mode | | | | | |
|--------------|----------|-----------------------|-------------|---------------|------------------|
| Scan Mode | Scan No. | Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 5 | 1 | 9.1 | 2927 | 70000 | 1563 |
| | 2 | 15.1 | 4822 | 70000 | 2575 |
| | 3 | 20.7 | 6545 | 70000 | 3495 |
| | 4 | 26.2 | 9021 | 70000 | 4818 |
| | 5 | 30.8 | 8506 | 105000 | 6814 |
| | total | | | | |
| 5 | 1 | 26.2 | 9021 | 70000 | 4818 |
| | 2 | 30.8 | 8506 | 87500 | 5678 |
| | 3 | 34.9 | 10966 | 70000 | 5856 |
| | 4 | 38.6 | 11164 | 70000 | 5962 |
| | 5 | 41.8 | 12354 | 87500 | 8247 |
| | total | | | | |
| 5 | 1 | 41.8 | 12354 | 70000 | 6598 |
| | 2 | 44.7 | 13038 | 52500 | 5222 |
| | 3 | 47.3 | 13624 | 52500 | 5457 |
| | 4 | 49.5 | 14097 | 70000 | 7529 |
| | 5 | 51.5 | 14510 | 70000 | 7749 |
| | total | | | | |
| 5 | 1 | 53.2 | 14846 | 52500 | 5946 |
| | 2 | 54.7 | 15133 | 52500 | 6061 |
| | 3 | 56.1 | 15390 | 70000 | 8219 |
| | 4 | 57.3 | 15604 | 70000 | 8333 |
| | 5 | 58.3 | 15776 | 70000 | 8425 |
| | total | | | | |

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*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-9 Level 1.1 Image size and Volume for ScanSAR wide Mode
(Single Polarization, SPECAN Method)**

| ScanSAR Mode | | | | | |
|--------------|----------|-----------------------|-------------|---------------|------------------|
| Scan Mode | Scan No. | Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 7 | 1 | 9.1 | 1468 | 35000 | 392 |
| | 2 | 15.1 | 2418 | 35000 | 646 |
| | 3 | 20.7 | 3282 | 35000 | 876 |
| | 4 | 26.2 | 4100 | 35000 | 1095 |
| | 5 | 30.8 | 4756 | 52500 | 1905 |
| | 6 | 34.9 | 5316 | 35000 | 1420 |
| | 7 | 38.6 | 5797 | 35000 | 1548 |
| | total | | | | |
| 7 | 1 | 34.9 | 5316 | 35000 | 1420 |
| | 2 | 38.6 | 5797 | 35000 | 1548 |
| | 3 | 41.8 | 6194 | 35000 | 1654 |
| | 4 | 44.7 | 6538 | 35000 | 1746 |
| | 5 | 47.3 | 6831 | 35000 | 1824 |
| | 6 | 49.5 | 7069 | 35000 | 1888 |
| | 7 | 51.5 | 7275 | 35000 | 1943 |
| | total | | | | |
| 7 | 1 | 49.5 | 7069 | 17500 | 944 |
| | 2 | 51.5 | 7275 | 17500 | 971 |
| | 3 | 53.2 | 7444 | 35000 | 1988 |
| | 4 | 54.7 | 7588 | 35000 | 2026 |
| | 5 | 56.1 | 7717 | 35000 | 2061 |
| | 6 | 57.3 | 7824 | 35000 | 2089 |
| | 7 | 58.3 | 7911 | 35000 | 2112 |
| | total | | | | |

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*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-10 Level 1.1 Image size and Volume for ScanSAR nominal [14MHz] Mode
(Single Polarization, Full Aperture Method)**

| ScanSAR Mode | | | | | |
|--------------|----------|-----------------------|-------------|---------------|------------------|
| Scan Mode | Scan No. | Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 5 | 1 | 9.1 | 1468 | 136764 | 1532 |
| | 2 | 15.1 | 2418 | 135890 | 2507 |
| | 3 | 20.7 | 3282 | 136284 | 3413 |
| | 4 | 26.2 | 4523 | 135954 | 4691 |
| | 5 | 30.8 | 4265 | 136640 | 4446 |
| | total | | | | |
| 5 | 1 | 26.2 | 4523 | 135828 | 4687 |
| | 2 | 30.8 | 4265 | 136730 | 4449 |
| | 3 | 34.9 | 5499 | 136620 | 5732 |
| | 4 | 38.6 | 5597 | 136468 | 5827 |
| | 5 | 41.8 | 6194 | 136372 | 6444 |
| | total | | | | |
| 5 | 1 | 41.8 | 6194 | 136230 | 6438 |
| | 2 | 44.7 | 6538 | 136800 | 6824 |
| | 3 | 47.3 | 6831 | 135408 | 7057 |
| | 4 | 49.5 | 7069 | 136320 | 7352 |
| | 5 | 51.5 | 7275 | 135150 | 7501 |
| | total | | | | |
| 5 | 1 | 53.2 | 7444 | 136462 | 7750 |
| | 2 | 54.7 | 7588 | 135474 | 7843 |
| | 3 | 56.1 | 7717 | 136192 | 8018 |
| | 4 | 57.3 | 7824 | 136274 | 8135 |
| | 5 | 58.3 | 7911 | 135488 | 8178 |
| | total | | | | |

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-11 Level 1.1 Image size and Volume for ScanSAR nominal [28MHz] Mode
(Single Polarization, Full Aperture Method)**

| ScanSAR Mode | | | | | |
|--------------|----------|-----------------------|-------------|---------------|------------------|
| Scan Mode | Scan No. | Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 5 | 1 | 9.1 | 2927 | 136764 | 3054 |
| | 2 | 15.1 | 4822 | 135890 | 4999 |
| | 3 | 20.7 | 6545 | 136284 | 6805 |
| | 4 | 26.2 | 9021 | 135954 | 9357 |
| | 5 | 30.8 | 8506 | 136640 | 8867 |
| | total | | | | |
| 5 | 1 | 26.2 | 9021 | 136730 | 9410 |
| | 2 | 30.8 | 8506 | 136620 | 8866 |
| | 3 | 34.9 | 10966 | 136468 | 11417 |
| | 4 | 38.6 | 11164 | 136372 | 11615 |
| | 5 | 41.8 | 12354 | 136230 | 12840 |
| | total | | | | |
| 5 | 1 | 41.8 | 12354 | 136230 | 12840 |
| | 2 | 44.7 | 13038 | 136800 | 13608 |
| | 3 | 47.3 | 13624 | 135408 | 14075 |
| | 4 | 49.5 | 14097 | 136320 | 14661 |
| | 5 | 51.5 | 14510 | 135150 | 14961 |
| | total | | | | |
| 5 | 1 | 53.2 | 14846 | 136462 | 15457 |
| | 2 | 54.7 | 15133 | 135474 | 15641 |
| | 3 | 56.1 | 15390 | 136192 | 15991 |
| | 4 | 57.3 | 15604 | 136274 | 16223 |
| | 5 | 58.3 | 15776 | 135488 | 16308 |
| | total | | | | |

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-12 Level 1.1 Image size and Volume for ScanSAR wide Mode
(Single Polarization, Full Aperture Method)**

| ScanSAR Mode | | | | | |
|--------------|----------|-----------------------|-------------|---------------|------------------|
| Scan Mode | Scan No. | Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| 7 | 1 | 9.1 | 1468 | 136764 | 1532 |
| | 2 | 15.1 | 2418 | 135890 | 2507 |
| | 3 | 20.7 | 3282 | 136284 | 3413 |
| | 4 | 26.2 | 4100 | 135954 | 4253 |
| | 5 | 30.8 | 4756 | 136640 | 4958 |
| | 6 | 34.9 | 5316 | 135828 | 5509 |
| | 7 | 38.6 | 5797 | 136730 | 6047 |
| | total | | | | |
| 7 | 1 | 34.9 | 5316 | 136620 | 5541 |
| | 2 | 38.6 | 5797 | 136468 | 6036 |
| | 3 | 41.8 | 6194 | 136372 | 6444 |
| | 4 | 44.7 | 6538 | 136230 | 6795 |
| | 5 | 47.3 | 6831 | 136800 | 7130 |
| | 6 | 49.5 | 7069 | 135408 | 7303 |
| | 7 | 51.5 | 7275 | 136320 | 7566 |
| | total | | | | |
| 7 | 1 | 49.5 | 7069 | 135150 | 7289 |
| | 2 | 51.5 | 7275 | 136462 | 7574 |
| | 3 | 53.2 | 7444 | 135474 | 7694 |
| | 4 | 54.7 | 7588 | 136192 | 7884 |
| | 5 | 56.1 | 7717 | 136274 | 8023 |
| | 6 | 57.3 | 7824 | 135488 | 8088 |
| | 7 | 58.3 | 7911 | 135150 | 8157 |
| | total | | | | |

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2.2-13 Level 1.1 Image size and Volume for High-sensitive Mode
(Full (Quad.) Polarization)**

| High-sensitive Mode (Full (Quad.) pol.) | | | |
|---|-------------|---------------|---------------------|
| Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| | | | FP |
| 17.5 | 5769 | 22187 | 3908 |
| 21.3 | 6970 | 22187 | 4720 |
| 24.8 | 8049 | 22187 | 5448 |
| 27.8 | 8950 | 22187 | 6060 |
| 30.2 | 9653 | 22187 | 6536 |
| 32.5 | 10312 | 22187 | 6984 |
| 34.7 | 10926 | 22187 | 7396 |

**Table 2.2-14 Level 1.1 Image size and Volume for Fine Mode
(Full (Quad.) Polarization)**

| Fine Mode (Full (Quad.) pol.) | | | |
|-------------------------------|-------------|---------------|---------------------|
| Off-nadir Angle [deg] | Range Pixel | Azimuth Pixel | Data Volume [MB] |
| | | | FP |
| 21.5 | 5117 | 13700 | 2140 |

**Table 2.2-15 Level 1.5/3.1 Image Size and Volume for Spotlight Mode
(Geo-reference)**

| Spotlight Mode | | | |
|-----------------------------|-------------------------------------|---------|---------------------|
| Image Size Range×Azimuth | Number of Pixels & Data Volume [MB] | | |
| | Pixel Spacing : 0.625m | | |
| | Range | Azimuth | Data Volume [MB] |
| 25×25 km | 40000 | 40000 | 3051 |

* Data Volume shows the value for single polarization.

**Table 2.2-16 Level 1.5/3.1 Image Size and Volume for Ultra-Fine Mode
(Geo-reference)**

| Ultra-Fine Mode | | | |
|-----------------------------|-------------------------------------|---------|---------------------|
| Image Size Range×Azimuth | Number of Pixels & Data Volume [MB] | | |
| | Pixel Spacing : 2.5m | | |
| | Range | Azimuth | Data Volume [MB] |
| 55×70 km | 22000 | 28000 | 1175 |
| 52.5×70 km | 21000 | 28000 | 1122 |
| 50×70 km | 20000 | 28000 | 1068 |

* Data Volume shows the value for single polarization.

**Table 2.2-17 Level 1.5/3.1 Image Size and Volume for High-sensitive Mode
(Geo-reference)**

| High-sensitive Mode | | | |
|-----------------------------|-------------------------------------|---------|---------------------|
| Image Size Range×Azimuth | Number of Pixels & Data Volume [MB] | | |
| | Pixel Spacing : 3.125m | | |
| | Range | Azimuth | Data Volume [MB] |
| 55×70 km | 17600 | 22400 | 752 |
| 52.5×70 km | 16800 | 22400 | 718 |
| 50×70 km | 16000 | 22400 | 683 |

* Data Volume shows the value for single polarization.

**Table 2.2-18 Level 1.5/3.1 Image Size and Volume for Fine Mode
(Geo-reference)**

| Fine Mode | | | |
|-----------------------------|-------------------------------------|---------|---------------------|
| Image Size Range×Azimuth | Number of Pixels & Data Volume [MB] | | |
| | Pixel Spacing : 6.25m (2 looks) | | |
| | Range | Azimuth | Data Volume [MB] |
| 70×70 km | 11200 | 11200 | 239 |
| 65×70 km | 10400 | 11200 | 222 |
| 60×70 km | 9600 | 11200 | 205 |
| 55×70 km | 8800 | 11200 | 188 |
| 50×70 km | 8000 | 11200 | 171 |

* Data Volume shows the value for single polarization.

**Table 2.2-19 Level 1.5/3.1 Image Size and Volume for ScanSAR Mode
(Geo-reference)**

| ScanSAR Mode | | | |
|-----------------------------|-------------------------------------|---------|---------------------|
| Image Size Range×Azimuth | Number of Pixels & Data Volume [MB] | | |
| | Pixel Spacing : 25m | | |
| | Range | Azimuth | Data Volume [MB] |
| 350×350 km | 14000 | 14000 | 374 |
| 490×350 km | 19600 | 14000 | 523 |

* Data Volume shows the value for single polarization.

**Table 2.2-20 Level 1.5/3.1 Image Size and Volume for High-sensitive Mode
(Full (Quad.) Polarization) (Geo-reference)**

| High-sensitive Mode (Full (Quad.) pol.) | | | |
|---|-------------------------------------|---------|---------------------|
| Image Size Range×Azimuth | Number of Pixels & Data Volume [MB] | | |
| | Pixel Spacing : 3.125m | | |
| | Range | Azimuth | Data Volume [MB] |
| 50×70 km | 16000 | 22400 | 684 |

* Data Volume shows the value for single polarization.

**Table 2.2-21 Level 1.5/3.1 Image Size and Volume for Fine Mode (Full (Quad.) Polarization)
(Geo-reference)**

| Fine Mode (Full (Quad.) Polarization) | | | |
|---------------------------------------|-------------------------------------|---------|---------------------|
| Image Size Range×Azimuth | Number of Pixels & Data Volume [MB] | | |
| | Pixel Spacing : 6.25m (2 looks) | | |
| | Range | Azimuth | Data Volume [MB] |
| 30×70 km | 4800 | 11200 | 103 |

* Data Volume shows the value for single polarization.

2.3. Format

ALOS-2 CEOS level 1.1/1.5/3.1 data is based on the CEOS superstructure formats and consists of following files: Volume Directory File, SAR Leader File, SAR Image File and SAR Trailer File.

2.4. Product Description

In the case of multi-polarization data (i.e. Dual pol. and Full (Quad.) pol. data), the image data of ALOS-2 CEOS level 1.1/1.5/3.1 is divided in each polarization.

In the case of ScanSAR mode data, the level 1.1 image data is divided in each scan and the level 1.5/3.1 data is not divided in each scan.

The SAR Image file composition of CEOS level 1.1/1.5/3.1 for each observation mode is shown in Table 2.4-1.

Table 2.4-1 SAR Image File Composition of CEOS Level 1.1/1.5/3.1 for Each Observation Mode

| Observation Mode | Polarization | Processing Level | Number of Data Files | Data File Composition |
|---|--------------------------------------|------------------|----------------------|--|
| Spotlight | Single Pol. (HH, HV, VH or VV *1) | 1.1/1.5/3.1 | 1 | Data of HH, HV, VH or VV Polarization |
| Ultra-Fine, High-sensitive and Fine | Single Pol. (HH, HV, VH or VV) | 1.1/1.5/3.1 | 1 | Data of HH, HV, VH or VV Polarization |
| | Dual Pol. (HH+HV or VH+VV) | 1.1/1.5/3.1 | 2 | Data of HH+HV Polarization, or VH+VV Polarization |
| | Full Pol. (HH+HV+VH+VV) | 1.1/1.5/3.1 | 4 | Data of HH, HV, VH and VV Polarization |
| ScanSAR nominal and wide | Single Pol. (HH, HV, VH or VV) | 1.1 | 5 or 7 *3, *4 | Each scan data of HH, HV, VH or VV Polarization *3, *4 Storage methods vary depending on processing methods. (*5). |
| | | 1.5/3.1 | 1 | First scan data Second scan data Fifth scan data Seventh scan data *4 of HH, HV, VH or VV Polarization |
| | Dual Pol. (HH+HV or VH+VV) | 1.1 | 10 or 14 *3, *4 | Each scan data of HH, HV, VH or VV Polarization *3, *4 Storage methods vary depending on processing methods. (*5). |
| | | 1.5/3.1 | 2 | First scan data Second scan data Fifth scan data Seventh scan data *4 of HH, HV, VH or VV Polarization |

*1 The order of transmitting, receiving polarization.

*2 (Erased)

*3 The number of data files is the number of scans multiplied by the number of polarizations.

*4 In the case of ScanSAR nominal and wide mode, the number of scans is 5 or 7, respectively.

*5 See also chapter 5.2 “ Image File of ScanSAR Level 1.1 Product”.

2.5. Processing Parameter

Table 2.5-1 shows the processing parameters of each level.

Table 2.5-1 Processing Parameter

| Parameter | Processing Level | | |
|----------------------|---------------------|---------------------|--|
| | 1.0 | 1.1 | 1.5/3.1 |
| Map Projection | - | - | UTM, PS, MER, LCC |
| Framing | - | - | Geo-reference Geo-coded |
| Image Direction *1 | - | - | Map |
| Resampling Method | - | - | NN, BL, CC |
| Geodetic coordinate | - | - | ITRF97 |
| Ellipsoid | - | - | GRS80 |
| Scene Shift *2 | -5 to 4 (-25 to 20) | -5 to 4 (-25 to 20) | -5 to 4 (-25 to 20) |
| Window Function | - | Rectangle | Rectangle |
| Number of Multi-look | - | 1 | Depending on observation mode |
| Pixel Spacing | - | - | depending on observation mode and multi-look number |

*1 Geocoded Product Only.

*2 In the case of ScanSAR mode, the values in the brackets are available.

3. Product Formats

3.1. Composition of CEOS Product

The overall configuration of CEOS level 1.1/1.5/3.1 product formats is shown in section 2.3. The definition of each file is shown in Table 3.1-1. And the file structure of each polarization is represented in Figure 3.1-1 to Figure 3.1-5.

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Table 3.1-1 CEOS L1.1/1.5/3.1 File Composition and Definitions of File Names

| File Name | File Num. | Definition of File Name | Record name | Contents |
|---|--|---|--|---|
| Volume Directory File | 1 | VOL-Scene ID-Product ID | Volume descriptor File pointer Text | This file is located at the beginning of the image volume and stores the volume and file management information. |
| SAR Leader File | 1 | LED-Scene ID-Product ID | File descriptor Data set summary Map projection data (Only L1.5/3.1) Platform position data Attitude data Radiometric data Data quality summary Facility related data | This file is located before image file and stores annotation data, ancillary data and other types of data related to the image data in the succeeding image file. |
| SAR Image File (for level 1.1 of Scan SAR mode) | n (Number of polarization × Number of Scan) | IMG-XX-Scene ID-Product ID -Scan Information | File descriptor Signal data | This file is located after the leader file and stores the image data. |
| SAR Image File (except level 1.1 of Scan SAR mode) | n (Number of polarization) | IMG-XX-Scene ID-Product ID | File descriptor Signal data (Only L1.1) Processed data record (Only L1.5/3.1) | This file is located after the leader file and stores the image data. |
| SAR Trailer File | 1 | TRL-Scene ID-Product ID | File descriptor Low resolution image data | This file is located after the image file and stores the final information related to the image data. |

Scene ID = AAAAABBBBBBCCCC-YYMMDD

AAAAA : Satellite/Sensor name (ALOS2)

BBBBB : Orbit accumulation number of a scene center

CCCC : Scene frame number of a scene center

-: separator

YYMMDD: Observation date of scene center (YY: lower 2 figures of a year, MM: month, DD: day)

Product ID = DDDEFFFGHI

DDD: Observation Mode

SBS: Spotlight mode

UBS: Ultra-fine mode Single polarization

UBD: Ultra-fine mode Dual polarization

HBS: High-sensitive mode Single polarization
HBD: High-sensitive mode Dual polarization
HBQ: High-sensitive mode Full (Quad.) polarimetry
FBS: Fine mode Single polarization
FBD: Fine mode Dual polarization
FBQ: Fine mode Full (Quad.) polarimetry
WBS: Scan SAR nominal [14MHz] mode Single polarization
WBD: Scan SAR nominal [14MHz] mode Dual polarization
WWS: Scan SAR nominal [28MHz] mode Single polarization
WWD: Scan SAR nominal [28MHz] mode Dual polarization
VBS: Scan SAR wide mode Single polarization
VBD: Scan SAR wide mode Dual polarization

E: Observation Direction

L: Left looking, R: Right looking

FFF: Processing Level

1.0: Level 1.0

1.1: Level 1.1, 1.5: Level 1.5

3.1: Level 3.1

G: Processing Option

G: Geo-code, R: Geo-Reference, _(underscore): Not Specified

H: Map Projection

U: UTM, P: PS, M: MER, L: LCC, _(underscore): Not Specified

I: Orbit Direction

A: Ascending, D: Descending

Polarization (Transmission and Receiving) = XX

HH: Horizontally polarized wave transmission / Horizontally polarized wave receiving

HV: Horizontally polarized wave transmission / Vertically polarized wave receiving

VH: Vertically polarized wave transmission / Horizontally polarized wave receiving

VV: Vertically polarized wave transmission / Vertically polarized wave receiving

Scan information with Scan SAR level 1.1 Image data = XN

X: Processing method*

F: Full aperture method

B: SPECAN method

N: Scan number

350km: 1 to 5,

490km: 1 to 7

* Processing method

Full aperture method

Range compression and one look azimuth compression are performed for the data whose gaps between neighboring bursts in a sub swath are filled with zero.

This processing is performed for each scan and each polarization.

SPECAN method

Range compression and one look azimuth compression are performed for each burst.

Signal data is generated for each burst and stored in the order of the time series in the case of data of the same polarization in a sub swath.

■Single polarization (except Scan SAR level 1.1)

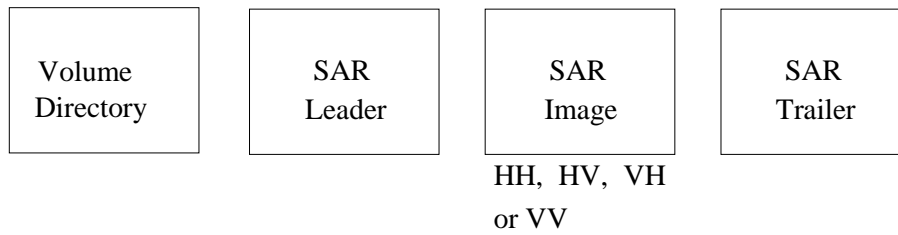


Figure 3.1-1 CEOS level 1.1(except Scan SAR)/1.5/3.1 file composition/Single polarization

|A

■Single polarization (Scan SAR level 1.1)

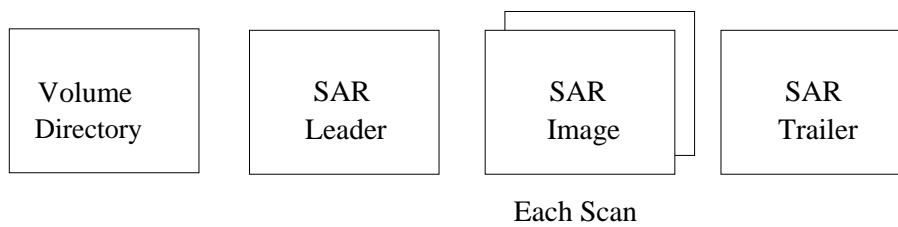


Figure 3.1-2 CEOS Level 1.1(Scan SAR) file composition/Single polarization

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■Dual polarization (except Scan SAR level 1.1)

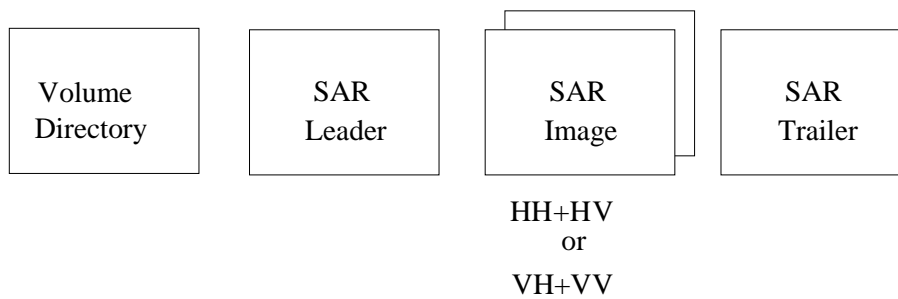


Figure 3.1-3 CEOS level 1.1(except Scan SAR mode)/1.5/3.1 file composition/Dual polarization

|A

■Dual polarization (Scan SAR level1.1)

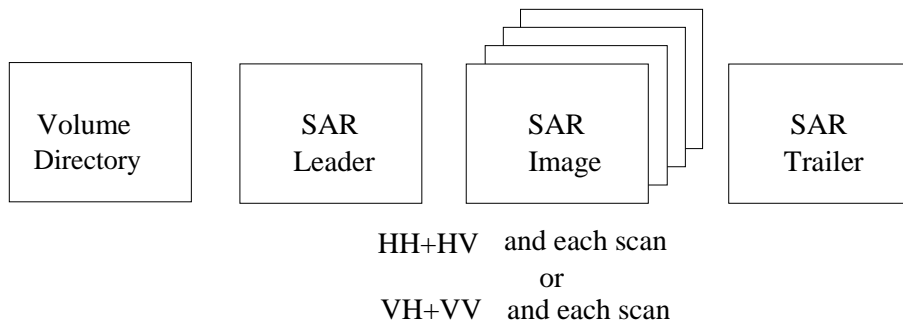


Figure 3.1-4 CEOS level 1.1(Scan SAR)/1.5/3.1 file composition/Dual polarization

|A

■High-sensitive/Fine Mode Full (Quad.) Polarimetry

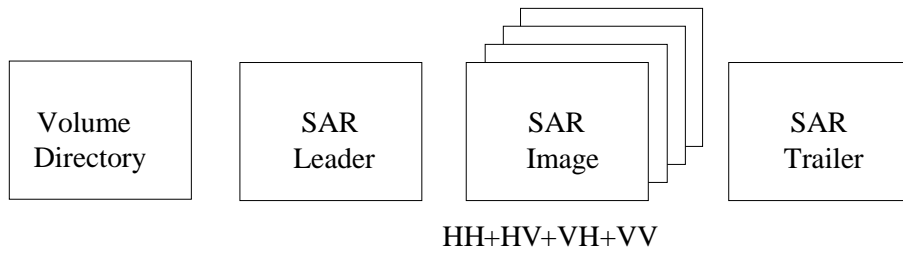


Figure 3.1-5 CEOS level 1.1/1.5/3.1 file composition/Full (Quad.) Polarimetry

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3.2. Record Structure of CEOS Product

The record structure of CEOS level 1.1/1.5/3.1 format is shown in Table 3.2-1. The sizes of the signal data record and the processed data record are shown in Table 3.3-14 and Table 3.3-15

Table 3.2-1 Record Structure of CEOS level 1.1/1.5/3.1 Format

| Record No. | | Record length [byte] | Number of records | Record name | File name |
|---|----------|-------------------------|---|---|---------------------|
| L1.1 | L1.5/3.1 | | | | |
| 1 | | 360 | 1 | Volume descriptor | Volume Directory |
| ScanSAR L1.1: 2 to 3 + number of polarizations x number of scans Except ScanSAR L1.1: 2 to 3 + number of polarizations | | 360 | ScanSAR L1.1: Number of polarizations x number of scans + 2 Except ScanSAR L1.1: Number of polarizations + 2 | File pointer | |
| ScanSAR L1.1: 4 + number of polarizations x number of scans Except ScanSAR L1.1: 4 + number of polarizations | | 360 | 1 | Text | |
| 1 | | 720 | 1 | File descriptor | SAR Leader |
| 2 | | 4,096 | 1 | Data set summary | |
| - | 3 | 1620 | 1 | Map projection data (L1.5/3.1) | |
| 3 | 4 | 4,680 | 1 | Platform position data | |
| 4 | 5 | 16,384 | 1 | Altitude data | |
| 5 | 6 | 9,860 | 1 | Radiometric data | |
| 6 | 7 | 1,620 | 1 | Data quality summary | |
| 7 | 8 | 325,000 | 1 | Facility related data 1 (Dummy data) | |
| 8 | 9 | 511,000 | 1 | Facility related data 2 (Determined ephemeris) | |
| 9 | 10 | 3,072 | 1 | Facility related data 3 (Time error information) | |
| 10 | 11 | 728,000 | 1 | Facility related data 4 (Coordinate conversion information) | |
| 11 | 12 | 5000 | 1 | Facility related data 5 (Latitude and longitude conversion factor) | |
| 1 | | 720 | 1 | File descriptor | SAR Image |
| 2 to n+1 | | variable Variable | n n | Signal data (Only L1.1) Processed data (L1.5/3.1) | |
| 1 | | 720 | 1 | File descriptor | SAR Trailer |
| ScanSAR L1.1: 2 to number of scans + 1 Except ScanSAR L1.1: 2 | | Variable | Scan SAR L1.1: Number of scans Except Scan SAR L1.1: 1 | Low resolution image data | |

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3.2.1. Record Data Type

The definition of data type that used for description of record is shown in Table 3.2-2.

Table 3.2-2 Definition of Data Types

| Type (code) | Details |
|-------------|---|
| Am | Character (Left-fill if not specified) |
| Im | ASCII that represents integer (Right-fill) |
| Fm.n | Real type data (Right-fill) |
| Em.n | Real type data (Exponential notation, right-fill) |
| Bm | Binary number representation (The first byte is the most significant, big endian) |

m: Number of digits

n: Number of decimal places

p: multiplier in an index

3.2.2. Record Type Code and Record Sub-type Code

Each record has record type code and record sub-type code (sub-type code) in order to distinguish each other. The type code of each record is shown in Table 3.2-3 and Table 3.2-4.

Table 3.2-3 Record Type of Each Record

| Record name | 1 st record Sub-type | Record Type | 2 nd record Sub-type | 3 rd record Sub-type | Record length [byte] |
|--------------------------------|------------------------------------|----------------|------------------------------------|------------------------------------|--------------------------|
| Volume Descriptor | 192 | 192 | 18 | 18 | 360 |
| File pointer | 219 | 192 | 18 | 18 | 360 |
| Text | 18 | 192 | 18 | 18 | 360 |
| SAR Leader file Descriptor | 11 | 192 | 18 | 18 | 720 |
| Data set summary | 18 | 10 | 18 | 20 | 4,096 |
| Map projection data | 18 | 20 | 18 | 10 | 1,620 |
| Platform position data | 18 | 30 | 18 | 20 | 4,680 |
| Attitude data | 18 | 40 | 18 | 20 | 16,384 |
| Radiometric data | 18 | 50 | 18 | 20 | 9,860 |
| Data quality summary | 18 | 60 | 18 | 20 | 1,620 |
| Facility related data | 18 | 200 | 18 | 70 | Refer to Table 3.2-4 |
| SAR data file Descriptor | 50 | 192 | 18 | 18 | 720 |
| Signal data | 50 | 10 | 18 | 20 | Refer to Table 3.3-14 |
| Processed data | 50 | 11 | 18 | 20 | Refer to Table 3.3-15 |
| SAR Trailer file Descriptor | 63 | 192 | 18 | 18 | 720 |
| Low resolution image data | - | - | - | - | Refer to Table 3.3-17 |

* Value is decimal

Table 3.2-4 Facility Related Data Record Type

| Record name | 1 st record Sub-type | Record Type | 2 nd record sub-type | 3 rd record sub-type | Record length [byte] |
|--|------------------------------------|----------------|------------------------------------|------------------------------------|-------------------------|
| Facility related 1 (Dummy data) | 18 | 200 | 18 | 70 | 325,000 |
| Facility related 2 (Determined ephemeris) | | | | | 511,000 |
| Facility related 3 (Time error information) | | | | | 3,072 |
| Facility related 4 (Coordinate conversion information) | | | | | 728,000 |
| Facility related 5 (Latitude and longitude conversion factor) | | | | | 5000 |

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* Value is decimal

3.3. Contents of Records in CEOS Files

The record formats are shown in Table 3.3-1 to Table 3.3-17. "b" in a table means blanks. In the case of "N)₁₀", "N" means decimal value. The definitions of items in CEOS level 1.1/1.5/3.1 format are shown in Table 3.3-18. The relationships between antenna beam number and parameters for each mode are shown in Table 3.3-19 to Table 3.3-27. | A

Table 3.3-1 Volume descriptor records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|------------------|
| 1 | 1 - 4 | B4 | Record sequence number = 1) ₁₀ | 00000001h |
| 2 | 5 - 5 | B1 | 1 st record subtype code = 192) ₁₀ | C0h |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | C0h |
| 4 | 7 - 7 | B1 | 2 nd record subtype code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd record subtype code = 18) ₁₀ | 12h |
| 6 | 9 - 12 | B4 | Length of this record = 360) ₁₀ | 00000168h |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC flag = 'Ab': ASCII | Ab |
| 8 | 15 - 16 | A2 | Blanks | bb |
| 9 | 17 - 28 | A12 | Superstructure format control document ID = 'CEOS-SARbbbb' | CEOS-SAR |
| 10 | 29 - 30 | A2 | Superstructure format control document revision level = 'NN' NN: 'bA'~'bZ' | bA |
| 11 | 31 - 32 | A2 | Superstructure record format revision level = 'NN' NN: 'bA'~'bZ' | bA |
| 12 | 33 - 44 | A12 | Software release and revision level = 'NNN.NNNbbbb' 001.000, 001.001, ... 001.100, ... 002.000 | 001.000bbbb |
| 13 | 45 - 60 | A16 | Physical volume ID Spacecraft Control Mission Operation system = 'SCMObbbbbbbbbb' Earth Intelligence Collection and Shearing System = 'EICSbbbbbbbbbb' | SCMObbbbbbbbbb |
| 14 | 61 - 76 | A16 | Logical volume ID = 'MMNSSSYYYYMMDDbb' MM : Mission ID (ALOS2='AL')(*) N : Mission Number (=2')(*) SSS : Sensor ID (SAR='SAR')(*) YYYY : Product generation year MM : Product generation month DD : Product generation day | AL2SAR20150101bb |
| 15 | 77 - 92 | A16 | Volume set ID = 'MMMMMMbSSSbbbbbb' MMMMMM : Mission name (ALOS2='ALOS2b') SSS : Sensor name (SAR='SAR') | ALOS2bbSARbbbbbb |
| 16 | 93 - 94 | I2 | Total number of physical volumes in the logical volume = 'b1' | b1 |
| 17 | 95 - 96 | I2 | Physical volume sequence number of the first tape = 'b1' | b1 |

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Table 3.3-1 Volume descriptor records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|----------------|
| 18 | 97 - 98 | I2 | Physical volume sequence number of the last tape = 'b1' | b1 |
| 19 | 99 - 100 | I2 | Physical volume sequence number of the current tape = 'b1' | b1 |
| 20 | 101 - 104 | I4 | File number in the logical volume follows volume directory file. = 'bbb3'~'bbb6': N+2 (N is number of polarization) (Leader, Image, Trailer) | bbb3 |
| 21 | 105 - 108 | I4 | Logical volume within a volume set = 'bbb1' | bbb1 |
| 22 | 109 - 112 | I4 | Logical volume number within physical volume = 'bbb1' | bbb1 |
| 23 | 113 - 120 | A8 | Logical volume creation data = 'YYYYMMDD'(Without zero suppression) YYYY : Year MM : Month DD : Day | 20150101 |
| 24 | 121 - 128 | A8 | Logical volume creation time = 'HHMMSSXX'(Without zero suppression) HH : Hour MM : Minute SS : Second XX : 10mili-second | 12010100 |
| 25 | 129 - 140 | A12 | Logical volume generation country (JAPAN) = 'JAPANbbbbbbb' | JAPANbbbbbbb |
| 26 | 141 - 148 | A8 | Logical volume generating agency (Japan Aerospace Exploration Agency) = 'JAXAbbbb' | JAXAbbbb |
| 27 | 149 - 160 | A12 | Logical volume generating facility Spacecraft Control and Mission Operation System = 'SCMObbbbbbb' Earth Intelligence Collection and Shearing Earth Intelligence Collection and Shearing System = 'EICSbbbbbbb' | SCMObbbbbbb |
| 28 | 161 - 164 | I4 | Number of file pointer records in volume directory Scan SAR and L1.1 = ' N+2 (N is number of polarization)' Except Scan SAR and L1.1 = ' N+2 (N is number of polarization)' | bbb3 |
| 29 | 165 - 168 | I4 | Number of text records in volume directory = 'bbb1' | bbb1 |
| 30 | 169 - 260 | A92 | Volume descriptor Spare = Blanks | Blanks (b*92) |
| 31 | 261 - 360 | A100 | Local use segment = Blanks | Blanks (b*100) |

Table 3.3-2 File pointer records (1/3)

| Field No. | Byte No. | Type | Description | Remarks | |
|-----------|----------|------|---|--|--|
| 1 | 1 - 4 | B4 | Record number (Except Scan SAR L1.1) Single Polarization Leader file = 2) ₁₀ Image file = 3) ₁₀ Trailer file = 4) ₁₀ Dual polarization Leader file = 2) ₁₀ Image file = 3), 4) ₁₀ Trailer file = 5) ₁₀ Full (Quad.) polarimetry(four polarization) Leader file = 2) ₁₀ Image file = 3), 4), 5), 6) ₁₀ Trailer file = 7) ₁₀ | Record number (Scan SAR L1.1) Single Polarization 350km Leader file = 2) ₁₀ Image file = 3) ₁₀ to 7) ₁₀ Trailer file = 8) ₁₀ Single Polarization 490km Leader file = 2) ₁₀ Image file = 3) ₁₀ to 9) ₁₀ Trailer file = 10) ₁₀ Dual polarization 350km Leader file = 2) ₁₀ Image file = 3) ₁₀ to 12) ₁₀ Trailer file = 13) ₁₀ Dual polarization 490km Leader file = 2) ₁₀ Image file = 3) ₁₀ to 16) ₁₀ Trailer file = 17) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record Sub-type code = 219) ₁₀ | DBh | |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | C0h | |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = 18) ₁₀ | 12h | |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = 18) ₁₀ | 12h | |
| 6 | 9 - 12 | B4 | Record length = 360) ₁₀ | 00000168h | |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Ab | |
| 8 | 15 - 16 | A2 | Blanks | bb | |
| 9 | 17 - 20 | I4 | Referenced file number Leader file = 'bbb1' Image file = 'bbb2' Trailer file = 'bbb3' | bbb1 | |

A

Table 3.3-2 File pointer records (2/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|---|
| 10 | 21 - 36 | A16 | Referenced File name ID = 'MMN b SSST FFFF bbbb' MM : Mission ID (ALOS2='AL')(*) N : Mission number (=2')(*) SSS : Sensor ID (SAR='SAR')(*) T : Processing level code Level 1.0 = 'A' Level 1.1 = 'B' Level 1.5 = 'C' Level 3.1 = 'D' FFFF : File Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer = 'SART' | AL2 b SARASARL bbbb |
| 11 | 37 - 64 | A28 | Referenced file class Leader file = 'SARLEADER b FILE bbbbbbbbbbbbbb ' Image file = 'IMAGERY b OPTIONS b FILE bbbbbbbb ' Trailer file = 'SARTRAILER b FILE bbbbbbbbbbbbbb ' | SARLEADER b FILE bbbbbbbbbbbbbb |
| 12 | 65 - 68 | A4 | Reference file class code Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | SARL |
| 13 | 69 - 96 | A28 | Referenced file data Type = 'MIXED b BINARY b AND b ASCII bbbbbb ' | MIXED b BINARY b AND b ASCII bbbbbb |
| 14 | 97 - 100 | A4 | Referenced file data Type code = 'MBAA'(Mixed Binary And ASCII) | MBAA |
| 15 | 101 - 108 | I8 | Number of records in referenced file Leader file = 'bbbbbb11': Level 1.1 'bbbbbb12': Level 1.5/3.1 Image file = N+1 (N is the number of image data records) Trailer file = N+1 (N is the number of Scan) : ScanSAR and Level 1.1 = 'bbbbbb2' : Other | bbbbbb15 |
| 16 | 109 - 116 | I8 | Length of the first record in referenced file = 'bbbbbb720' | bbbbbb720 |
| 17 | 117 - 124 | I8 | Maximum record length in referenced file | bbbbnnnn |

C

Table 3.3-2 File pointer records (3/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|----------------|
| 18 | 125 - 136 | A12 | Referenced file record length type Leader file = 'VARIABLEbLEN' Image file = 'VARIABLEbLEN' Trailer file = 'VARIABLEbLEN' | VARIABLEbLEN |
| 19 | 137 - 140 | A4 | Referenced file record length type code Leader file = 'VARE' Image file = 'VARE' Trailer file = 'VARE' | VARE |
| 20 | 141 - 142 | I2 | The number of the physical volume set containing the first record of the file = 'b1' | b1 |
| 21 | 143 - 144 | I2 | The number of the physical volume set containing the last record of the file = 'b1' | b1 |
| 22 | 145 - 152 | I8 | Record number of the first record appearing on this physical volume = 'bbbbbb1' | bbbbbb1 |
| 23 | 153 - 160 | I8 | Record number of the last record appearing on this physical volume Leader file = 'bbbbbb11': Level 1.1 'bbbbbb12': Level 1.5/3.1 Image file = N+1 (N is the number of image data records) Trailer file = N+1 (N is the number of Scan) : ScanSAR and Level 1.1 = 'bbbbbb2' : Other | |
| 24 | 161 - 260 | A100 | Spare = Blanks | Blanks (b*100) |
| 25 | 261 - 360 | A100 | Local use segment = Blanks | Blanks (b*100) |

C

Table 3.3-3 Text records (1/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|--|
| 1 | 1 - 4 | B4 | Record number Scan SAR and L1.1 = $N_1 \times N_2 + 4$) ₁₀ (N_1 = 'Number of polarization', N_2 = 'Number of scan') Except Scan SAR and L1.1 = $N + 4$) ₁₀ (N = 'Number of polarization') | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | 12h |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | C0h |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = 18) ₁₀ | 12h |
| 6 | 9 - 12 | B4 | Record length = 360) ₁₀ | 00000168h |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Ab |
| 8 | 15 - 16 | A2 | Blanks | bb |
| 9 | 17 - 56 | A40 | Product ID = 'PRODUCT: DDDEFFFGHIbbbbbbbbbbbbbbbbbb' DDD: Observation mode (*) SBS: Spotlight mode UBS: Ultra-fine mode (Single pol.) UBD: Ultra-fine mode (Dual pol.) HBS: High-sensitive mode (Single pol.) HBD: High-sensitive mode (Dual pol.) HBQ: High-sensitive mode (Full(Quad.) pol.) FBS: Fine mode (Single pol.) FBD: Fine mode (Dual pol.) FBQ: Fine mode (Full (Quad.) pol.) WBS: ScanSAR nominal [14MHz] mode (Single pol.) WBD: ScanSAR nominal [14MHz] mode (Dual pol.) WWS: ScanSR nominal [28MHz,] mode (Single pol.) WWD: ScanSAR nominal [28MHz] mode (Dual pol.) VBS: ScanSAR wide mode (Single pol.) VBD: ScanSAR wide mode (Dual pol.) E : Observation direction (*) L: Left looking R: Right looking | PRODUCT: HSPR1.0_UAbbbbbbbbbbb bbbbbbbbbb Refer to Table 4.3-1 No.1 |

Table 3.3-3 Text records (2/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|------------------------------|
| | | | FFF: Processing level 1.0: Level 1.0 1.1: Level 1.1 1.5: Level 1.5 3.1: Level 3.1 G : Processing option G: Geo-Coded R: Geo-Reference _: Not specified (Underscore) H : Map projection U: UTM P: PS M: MER L: LCC _: Not specified (Underscore) I : Orbit direction (*) A: Ascending D: Descending | |
| 10 | 57 - 116 | A60 | Location and date/time of product creation Spacecraft Control Mission Operation system = 'PROCESS: JAPAN-JAXA-ALOS2-SCMObbYYYYMMDDbHHMMSSb...b' Earth Intelligence Collection and Shearing system = 'PROCESS: JAPAN-JAXA-ALOS2-EICSbbYYYYMMDDbHHMMSSb...b' (without zero suppress both) YYYYMMDD : Date of creation (YYYY: Year, MM: Month, DD: Day) HHMMSS : Time of Creation (UTC) | |
| 11 | 117 - 156 | A40 | Physical tape ID = 'TAPEbID: bbbbbb' | TAPEbID: bbbbbb bbbbbb |

Table 3.3-3 Text records (3/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|--|
| 12 | 157 - 196 | A40 | Scene ID = 'ORBITb: AAAAABBBBBCCCC-YYMMDDbbbbbbbbbbb' AAAAA : Satellite (= 'ALOS2') BBBBB : Orbit accumulation number of a scene center CCCC : Scene frame number of a scene center - : Separator (hyphen) YYMMDD : Observation date of a scene center (YY: lower 2 figures of a year, MM: month, DD: day) | ORBITb: ALOS2000010001-150101bbbbbb bbbbb Refer to Table 3.3-18 No.2. |
| 13 | 197 - 236 | A40 | Scene location ID = 'FRAMEbCENTRE: bbbbbbbbbbbbbbbbbbbbbbb' : Level 1.1 = 'FRAMEbCENTRE: bN±nnn.nnbbE±nnn.nnbbbbbbb' : Level 1.5/3.1 N±nnn.nn : Latitude of a scene center [deg] E±nnn.nn : Longitude of a scene center [deg] | In the case of level 1.1 FRAMEbCENTRE: bbbbbbbbbbbbbbbbbbbbbbb |
| 14 | 237 - 360 | A124 | Blanks | Blanks (b*124) |

Table 3.3-4 SAR Leader file descriptor records (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|------------------|
| 1 | 1 - 4 | B4 | Record number = 1) ₁₀ | 0000001h |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 11) ₁₀ | 0Bh |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | C0h |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = 18) ₁₀ | 12h |
| 6 | 9 - 12 | B4 | Record length = 720) ₁₀ | 000002D0h |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Ab |
| 8 | 15 - 16 | A2 | Blanks | bb |
| 9 | 17 - 28 | A12 | Format control document ID = 'CEOS-SARbbbb' | CEOS-SARbbbb |
| 10 | 29 - 30 | A2 | Format control document revision level = 'bA' | bA |
| 11 | 31 - 32 | A2 | Record format revision level = 'bA' | bA |
| 12 | 33 - 44 | A12 | Software release and revision number = 'NNN.NNNbbbb' 001.000, 001.001, ... 001.100, ... 002.000 | 001.000bbbb |
| 13 | 45 - 48 | I4 | File number = 'bbb1' | bbb1 |
| 14 | 49 - 64 | A16 | File ID = 'MMNbSSSTFFFFbbbb' MM : Mission ID (ALOS2='AL')(*) N : Mission number (=2')(*) SSS : Sensor ID (SAR='SAR')(*) T : Processing level code Level 1.0 = 'A' Level 1.1 = 'B' Level 1.5 = 'C' Level 3.1 = 'D' FFFF : File Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | AL2bSARASARLbbbb |
| 15 | 65 - 68 | A4 | Record sequence and location type flag = 'FSEQ' | FSEQ |

A

Table 3.3-4 SAR Leader file descriptor records (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|-----------------------------------|
| 16 | 69 - 76 | I8 | Sequence number of location = 'bbbbbb1' | bbbbbb1 (Location of record No.) |
| 17 | 77 - 80 | I4 | Field length of sequence number = 'bbb4' | bbb4 (Field length of record No.) |
| 18 | 81 - 84 | A4 | Record code and location type flag = 'FTYP' | FTYP |
| 19 | 85 - 92 | I8 | Location of record code = 'bbbbbb5' | bbbbbb5 |
| 20 | 93 - 96 | I4 | Field length of record code = 'bbb4' | bbb4 |
| 21 | 97 - 100 | A4 | Record length and location type flag = 'FLGT' | FLGT |
| 22 | 101 - 108 | I8 | Location of record length = 'bbbbbb9' | bbbbbb9 |
| 23 | 109 - 112 | I4 | Field length of record length = 'bbb4' | bbb4 |
| 24 | 113 - 180 | A68 | Blanks | Blanks (b*68) |
| 25 | 181 - 186 | I6 | Number of data set summary records = 'bbbb1' | bbbb1 |
| 26 | 187 - 192 | I6 | Data set summary record length = 'bb4096' | bb4096 |
| 27 | 193 - 198 | I6 | Number of map projection data records = 'bbbb0': Level 1.1 = 'bbbb1': Level 1.5/3.1 | |
| 28 | 199 - 204 | I6 | Map projection data record length = 'bbbb0': Level 1.1 = 'bb1620': Level 1.5/3.1 | |
| 29 | 205 - 210 | I6 | Number of platform position data records = 'bbbb1' | bbbb1 |
| 30 | 211 - 216 | I6 | Platform position record length = 'bb4680' | bb4680 |
| 31 | 217 - 222 | I6 | Number of attitude data records = 'bbbb1' | bbbb1 |
| 32 | 223 - 228 | I6 | Attitude data record length = 'b16384' | b16384 |
| 33 | 229 - 234 | I6 | Number of radiometric data records = 'bbbb1' | |
| 34 | 235 - 240 | I6 | Radiometric record length = 'bb9860' | |
| 35 | 241 - 246 | I6 | Number of radiometric compensation records = 'bbbb0' | bbbb0 |
| 36 | 247 - 252 | I6 | Radiometric compensation record length = 'bbbb0' | bbbb0 |
| 37 | 253 - 258 | I6 | Number of data quality summary records = 'bbbb1' | |
| 38 | 259 - 264 | I6 | Data quality summary record length = 'bb1620' | |
| 39 | 265 - 270 | I6 | Number of data histograms records = 'bbbb0' | bbbb0 |
| 40 | 271 - 276 | I6 | Data histogram record length = 'bbbb0' | bbbb0 |

Table 3.3-4 SAR Leader file descriptor records (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|---------------|
| 41 | 277 - 282 | I6 | Number of range spectra records = 'bbbb0' | bbbb0 |
| 42 | 283 - 288 | I6 | Range spectra record length = 'bbbb0' | bbbb0 |
| 43 | 289 - 294 | I6 | Number of DEM descriptor records = 'bbbb0' | bbbb0 |
| 44 | 295 - 300 | I6 | DEM descriptor record length = 'bbbb0' | bbbb0 |
| 45 | 301 - 306 | I6 | Number of radar parameter update records = 'bbbb0' | bbbb0 |
| 46 | 307 - 312 | I6 | Radar parameter update record length = 'bbbb0' | bbbb0 |
| 47 | 313 - 318 | I6 | Number of annotation data records = 'bbbb0' | bbbb0 |
| 48 | 319 - 324 | I6 | Annotation data record length = 'bbbb0' | bbbb0 |
| 49 | 325 - 330 | I6 | Number of detail processing records = 'bbbb0' | bbbb0 |
| 50 | 331 - 336 | I6 | Detail processing record length = 'bbbb0' | bbbb0 |
| 51 | 337 - 342 | I6 | Number of calibration records = 'bbbb0' | |
| 52 | 343 - 348 | I6 | Calibration record length = 'bbbb0' | |
| 53 | 349 - 354 | I6 | Number of GCP records = 'bbbb0' | bbbb0 |
| 54 | 355 - 360 | I6 | GCP record length = 'bbbb0' | bbbb0 |
| 55 | 361 - 420 | 10A6 | Spare | Blanks(b*A58) |
| 56 | 421 - 426 | I6 | Number of facility data(1) records = 'bbbb1' | bbbb1 |
| 57 | 427 - 434 | I8 | Facility data(1) record length = 'bb325000' | bb325000 |
| 58 | 435 - 440 | I6 | Number of facility data(1) records = 'bbbb1' | bbbb1 |
| 59 | 441 - 448 | I8 | Facility data(2) record length = 'bb511000' | bb511000 |
| 60 | 449 - 454 | I6 | Number of facility data(2) records = 'bbbb1' | bbbb1 |
| 61 | 455 - 462 | I8 | Facility data(3) record length = 'bbb3072' | bbb3072 |
| 62 | 463 - 468 | I6 | Number of facility data(3) records = 'bbbb1' | bbbb1 |
| 63 | 469 - 476 | I8 | Facility data(4) record length = 'bb728000' | bb728000 |

Table 3.3-4 SAR Leader file descriptor records (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|---------|
| 64 | 477 - 482 | I6 | Number of facility data(5) records = 'bbbb1' | |
| 65 | 483 - 490 | I8 | Facility data(5) record length = 'bbb5000' | |
| 66 | 491 - 720 | A230 | Blanks | |

Table 3.3-5 Data set summary records (1/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|--|---|
| 1 | 1 - 4 | B4 | Records number = 2) ₁₀ | 0000002h |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | 12h |
| 3 | 6 - 6 | B1 | Record type code = 10) ₁₀ | 0Ah |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | 14h |
| 6 | 9 - 12 | B4 | Data set summary records length = 4096) ₁₀ | 00001000h |
| 7 | 13 - 16 | I4 | Data set summary records sequence number = 'bbb1' | bbb1 |
| 8 | 17 - 20 | A4 | SAR channel ID = Blanks (fixed value) | bbbb |
| 9 | 21 - 52 | A32 | Scene ID = 'AAAAABBBBBBCCCC-YYMMDDbbbbbbbbbb' AAAAA : Satellite ID (= 'ALOS2') BBBBB : Orbit accumulation number of a scene center CCCC : Scene frame number of a scene center - : Separator (hyphen) YYMMDD : Observation date of a scene center (YY: lower 2 figures of a year, MM: month, DD: day) | ALOS2000010001-150101bbbbbbbbbb Refer to Table 3.3-18 No.2 |
| 10 | 53 - 68 | A16 | Number of scene reference = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 11 | 69 - 100 | A32 | Scene center time = 'YYYYMMDDHHMSSttbbbbbbbbbbbbbb' (Without zero suppression, YYYY: year, MM: month, DD: day) HHMSStt : Time (UTC) | In the case of level 1.1 2015010112000000bbbbbbbbbbbbbb |
| 12 | 101 - 116 | A16 | Spare = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 13 | 117 - 132 | F16.7 | Geodetic latitude (defined as positive to the north of the equator and negative to the south) of processed scene center [deg] = Blanks: Level 1.1 = Positive value to the north of the equator : Level 1.5/3.1 = Negative value to the south of the equator : Level 1.5/3.1 | In the case of level 1.1 bbbbbbbbbbbbbb |
| 14 | 133 - 148 | F16.7 | Geodetic longitude (defined as positive to the east of the prime meridian and negative to the west) of processed scene center [deg] = Blanks: Level 1.1 = Positive value to the east of the prime meridian: Level 1.5/3.1 = Positive value to the west of the prime meridian: Level 1.5/3.1 | In the case of level 1.1 bbbbbbbbbbbbbb |

Table 3.3-5 Data set summary records (2/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|---|--|
| 15 | 149 - 164 | F16.7 | Processed scene center true heading [deg] = Blanks: Level 1.1 = Value: Level 1.5/3.1 | In the case of level 1.1 bbbbbbbbbbbbbbbb |
| 16 | 165 - 180 | A16 | Ellipsoid designator = 'GRS80bbbbbbbbbb'(fixed value) | GRS80bbbbbbbbbbbb |
| 17 | 181 - 196 | F16.7 | Ellipsoid semi-major axis [km] = 6378.1370000 | |
| 18 | 197 - 212 | F16.7 | Ellipsoid semi-minor axis [km] = 6356.7523141 | |
| 19 | 213 - 228 | F16.7 | Earth mass [10^{24} kg] = 5.9740000 | |
| 20 | 229 - 244 | F16.7 | Gravitational constant [10^{-14} m ³ /s ²] = 3.9860050 | |
| 21 | 245 - 260 | F16.7 | Ellipsoid J2 parameter = 0.1082629×10^{-2} | (Ellipsoid J2 parameter) |
| 22 | 261 - 276 | F16.7 | Ellipsoid J3 parameter = $-0.0000254 \times 10^{-1}$ | (Ellipsoid J3 parameter) |
| 23 | 277 - 292 | F16.7 | Ellipsoid J4 parameter = $-0.0000162 \times 10^{-1}$ | (Ellipsoid J4 parameter) |
| 24 | 293 - 308 | A16 | Spare = Blanks(fixed value) | bbbbbbbbbbbbbbbb |
| 25 | 309 - 324 | F16.7 | Average terrain height above ellipsoid at scene center = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 26 | 325 - 332 | I8 | Scene center line No. (Including zero fill) | N/2 (N: number of lines) |
| 27 | 333 - 340 | I8 | Scene center pixel No. (Including zero fill) | M/2 (M: number of pixels) |
| 28 | 341 - 356 | F16.7 | Processing scene length [km] = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 29 | 357 - 372 | F16.7 | Processed scene width [km] = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 30 | 373 - 388 | A16 | Spare = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 31 | 389 - 392 | I4 | Number of SAR channel = 'bbbn' Single Beam type 2: Fine [10m] mode (Single pol.) 4: Fine [10m] mode (Dual pol. and Full (Quad.) pol.) Dual beam type 4: Spotlight mode, High resolution mode (Single pol.), ScanSAR mode (Single pol.) 8: High resolution mode (Dual pol. and Full (Quad.) pol.) ScanSAR mode (Dual pol.) | bbb2 |
| 32 | 393 - 396 | A4 | Spare = Blanks (fixed value) | bbbb |
| 33 | 397 - 412 | A16 | Sensor platform mission identifier (ID) = 'ALOS2bbbbbbbbbb' | ALOS2bbbbbbbbbbbb |

Table 3.3-5 Data set summary records (3/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|--------------------------------------|
| 34 | 413 - 444 | A32 | Sensor ID and operation mode = 'AAAAAA-BB-CCDD-bbbbbbbbbbbbbbbb' AAAAAA : Satellite ID (= 'ALOS2b') BB : SAR band (= 'Lb') CC : Operation mode '00': Spotlight mode '01': Ultra-fine mode '02': High-sensitive mode '03': Fine mode '04': spare '05': spare '08': ScanSAR nominal mode '09': ScanSAR wide mode '18': Full (Quad.) pol./High-sensitive mode '19': Full (Quad.) pol./Fine mode '64': Manual observation Other: spare DD : Calibration mode '00': A/D offset before observation '01': A/D noise measure before observation '02': Pulse replica before observation '03': Range zero before observation '04': Pulse replica after observation '05': Range zero after observation '06': Noise measure after observation '14': Calibration in observation '15': During observation Other: spare | ALOS2b-Lb-015-bbbbbbbbbbbb bbbbbb |

A

Table 3.3-5 Data set summary records (4/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|---|---|
| 35 | 445 - 452 | I8 | Orbit number or flight line indicator | bbbbbb1 |
| 36 | 453 - 460 | F8.3 | Sensor platform geodetic latitude at nadir corresponding to scene center [deg] = Blanks: Level 1.1 = Value: Level 1.5/3.1 | In the case of level 1.1 bbbbbbb |
| 37 | 461 - 468 | F8.3 | Sensor platform geodetic longitude at nadir corresponding to scene center [deg] = Blanks: Level 1.1 = Value: Level 1.5/3.1 | In the case of level 1.1 bbbbbbb |
| 38 | 469 - 476 | F8.3 | Sensor platform heading at nadir corresponding to scene center [deg] = Blanks: Level 1.1 = Value: Level 1.5/3.1 | In the case of level 1.1 bbbbbbb |
| 39 | 477 - 484 | F8.3 | Sensor clock angle as measured relative to sensor platform flight direction [deg] Left = 'b-90.000' Right = 'bb90.000' | b-90.000 |
| 40 | 485 - 492 | F8.3 | Incidence angle at scene center [deg] = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Nominal value: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded (Incidence angle) |
| 41 | 493 - 500 | A8 | Spare = Blanks | bbbbbbb |
| 42 | 501 - 516 | F16.7 | Radar wavelength [m] = Nominal value | (Radar wavelength) |
| 43 | 517 - 518 | A2 | Motion compensation indicator = '00'(Always '00') 00 : No. compensation 01 : on board compensation 10 : in processor compensation 11 : both on board and in processor | 00 |
| 44 | 519 - 534 | A16 | Range pulse code = 'LINEARbFMbCHIRPb' | LINEARbFMbCHIRPb |
| 45 | 535 - 550 | E16.7 | Range pulse amplitude coefficient #1 = Nominal value Center frequency ξ_1 for pulse width τ of linearFMmodulationchirp (Constant term) | (Range pulse amplitude coefficient #1) |
| 46 | 551 - 566 | E16.7 | Range pulse amplitude coefficient #2 = Nominal value FMrate ξ_2 for pulse width τ of linearFMmodulationchirp (Linear coefficient terms) | (Range pulse amplitude coefficient #2) |

Table 3.3-5 Data set summary records (5/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|--|---|
| 47 | 567 - 582 | E16.7 | Range pulse amplitude coefficient #3 = Nominal value (= 0.0) FMrate ξ_3 for pulse width τ of linearFMmodulationchirp (Quadratic coefficient terms) | (Range pulse amplitude coefficient #3) |
| 48 | 583 - 598 | E16.7 | Range pulse amplitude coefficient #4 = Nominal value (= 0.0) FMrate ξ_4 for pulse width τ of linearFMmodulationchirp (Cubic coefficient terms) | (Range pulse amplitude coefficient #4) |
| 49 | 599 - 614 | E16.7 | Range pulse amplitude coefficient #5 = Nominal value (= 0.0) FMrate ξ_5 for pulse width τ of linearFMmodulationchirp (Quartic term coefficient) | (Range pulse amplitude coefficient #5) |
| 50 | 615 - 630 | E16.7 | Range pulse phase coefficient # 1 (Constant term) = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 51 | 631 - 646 | E16.7 | Range pulse phase coefficient # 2 (Linear coefficient terms) = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 52 | 647 - 662 | E16.7 | Range pulse phase coefficient # 3 (Quadratic coefficient terms) = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 53 | 663 - 678 | E16.7 | Range pulse phase coefficient # 4 (Cubic coefficient terms) = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 54 | 679 - 694 | E16.7 | Range pulse phase coefficient # 5 (Quartic term coefficient) = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 55 | 695 - 702 | I8 | Down linked data chirp extraction index linear-up chirp = 'bbbbbb0' linear-down chirp = 'bbbbbb1' linear-up and -down chirp = 'bbbbbb2' | |
| 56 | 703 - 710 | A8 | Spare = Blanks | bbbbbb |
| 57 | 711 - 726 | F16.7 | Sampling rate [MHz] Extracted from auxiliary data of first PALSAR frame | (Sampling rate) Refer to Table 3.3-18 No.3 |
| 58 | 727 - 742 | F16.7 | Range gate (early edge (in time) at the start of the image) [μ sec] Extracted from auxiliary data of first PALSAR frame | (Range gate) Refer to Table 3.3-18 No.4 |
| 59 | 743 - 758 | F16.7 | Range pulse width [μ sec] Extracted from auxiliary data of first PALSAR frame | (Range pulse width) Refer to Table 3.3-18 No.5 |
| 60 | 759 - 762 | A4 | Base band conversion flag = 'YESb' (Always 'YESb') | YESb Refer to Table 3.3-18 No.6 |
| 61 | 763 - 766 | A4 | Range compressed flag = 'YESb': Level 1.1 or later: range compressed (Always) | |
| 62 | 767 - 782 | F16.7 | Receiver gain for like polarized at early edge at the start of the image = Nominal value | (Receiver gain for like polarized) |
| 63 | 783 - 798 | F16.7 | Receiver gain for cross polarized at early edge at the start of the image = Nominal value | (Receiver gain for cross polarized) |
| 64 | 799 - 806 | I8 | Quantization in bits per channel = 'bbbbbb8' | bbbbbb8 |
| 65 | 807 - 818 | A12 | quantized descriptor = 'UNIFORMbI,Qb' | UNIFORMbI,Qb |
| 66 | 819 - 834 | F16.7 | DC Bias for I-component = Nominal value | (DC Bias for I-component) |

Table 3.3-5 Data set summary records (6/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|--|---|
| 67 | 835 - 850 | F16.7 | DC Bias for Q-component = Nominal value | (DC Bias for Q-component) |
| 68 | 851 - 866 | F16.7 | Gain imbalance for I & Q = Nominal value | (Gain imbalance for I & Q) |
| 69 | 867 - 882 | F16.7 | Spare = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 70 | 883 - 898 | F16.7 | Spare = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 71 | 899 - 914 | F16.7 | electronic boresight = fixed value | Electronic boresight and mechanical boresight is the same definition (The same value) |
| 72 | 915 - 930 | F16.7 | mechanical boresight = fixed value | Electronic boresight and mechanical boresight is the same definition (The same value) |
| 73 | 931 - 934 | A4 | Echo tracker-on/off = 'OFFb' (fixed value) | OFFb ONOFF: Always 'OFF' on ALOS2 |
| 74 | 935 - 950 | F16.7 | PRF[mHz] | |
| 75 | 951 - 966 | F16.7 | Two-way antenna beam width [deg] (Elevation, Effective value) = Nominal value | (Two-way antenna beam width elevation) |
| 76 | 967 - 982 | F16.7 | Two-way antenna beam width [deg] (Azimuth, Effective value) = Nominal value | (Two-way antenna beam width azimuth) |
| 77 | 983 - 998 | I16 | Satellite encoded binary time code: Standard satellite time counter of error time information (Tref) | (Standard satellite time of error time information) Refer to Table 3.3-18 No. 11 |
| 78 | 999 - 1030 | A32 | Satellite clock time: Standard ground time of error time information (Tgref) | (Standard ground time) Refer to Table 3.3-18 No. 12 |
| 79 | 1031 - 1046 | I16 | Satellite clock increment [nsec]: Error time information of calculation satellite counter cycle (Psc) | (Calculation satellite counter cycle) Refer to Table 3.3-18 No.13 |
| 80 | 1047 - 1062 | A16 | Processing facility ID Spacecraft Control Mission Operation system = 'SCMObbbbbbbbbb' Earth Intelligence Collection and Shearing System = 'EICSbbbbbbbbbb' | SCMObbbbbbbbbb |
| 81 | 1063 - 1070 | A8 | Processing system ID Spacecraft Control Mission Operation System = 'SCMObbbb' Earth Intelligence Collection and Shearing System = 'EICSbbbb' | |
| 82 | 1071 - 1078 | A8 | Processing version ID Note: This is the same as first 8 characters of software release and version ID for volume descriptor | NNN.NNNb |
| 83 | 1079 - 1094 | A16 | Processing code of processing facility = Blanks (fixed value) | bbbbbbbbbbbbbbbb |

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Table 3.3-5 Data set summary records (7/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|---|---|
| 84 | 1095 - 1110 | A16 | Product level code = '1.1bbbbbbbbbbbb': Level 1.1 = '1.5bbbbbbbbbbbb': Level 1.5 = '3.1bbbbbbbbbbbb': Level 3.1 | |
| 85 | 1111 - 1142 | A32 | Product type specifier = 'BASICbIMAGEbbbbbbbbbbbbbbbb': Level 1.1 = 'STANDARDbGEOCODEDbIMAGEbbbbbbbb': Level 1.5 = 'CORRECTEDbGEOCODEDbIMAGEbbbbbbbb': Level 3.1 | |
| 86 | 1143 - 1174 | A32 | Processing algorithm ID = Blanks (fixed value) | bbbbbbbbbbbbbbbbbbbbbbbbbbbb bbbbbb |
| 87 | 1175 - 1190 | F16.7 | Number of looks in azimuth Level 1.1 : 1.0 Level 1.5/3.1 : 2 (Fine [10m], Full (Quad.) pol. fine [10m]) 3 (ScanSAR [14MHz], ScanSAR [28MHz]) 1.5 (ScanSAR (490km)) 1 (Others) | The pixel spacing measured not on the reference ellipsoid but on map coordinates. |
| 88 | 1191 - 1206 | F16.7 | Number of looks in range Level 1.1 : 1.0 Level 1.5/3.1 : 5 (ScanSAR [14MHz], ScanSAR [28MHz]) 2(ScanSAR (490km)) 1(Others) | |
| 89 | 1207 - 1222 | F16.7 | Bandwidth per look in azimuth [Hz] Same value as 1239-1254 bytes | |
| 90 | 1223 - 1238 | F16.7 | Bandwidth per look in range [Hz] 3dB down width of the power spectrum of the reference function for a sub aperture look | |
| 91 | 1239 - 1254 | F16.7 | Bandwidth in azimuth [Hz] 3dB down width of power spectrum of the reference function for full aperture ScanSAR: Blanks | In ScanSAR: bbbbbbbbbbbbbbbb |
| 92 | 1255 - 1270 | F16.7 | Bandwidth in range [kHz] | bbbbbbbbbbbbbbbb |

Table 3.3-5 Data set summary records (8/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|---|--|
| 93 | 1271 - 1302 | A32 | Weighing function in azimuth = 'bbbbbbbbbbbbbbbbbbbbbbbbbbbb1': RECTANGLE | |
| 94 | 1303 - 1334 | A32 | Weighing function in range = 'bbbbbbbbbbbbbbbbbbbbbbbbbb1': RECTANGLE | |
| 95 | 1335 - 1350 | A16 | Data input source (e.g.HDDT-ID) = 'ONLINEbbbbbbbb': Online transfer (fixed value) | ONLINEbbbbbbbb |
| 96 | 1351 - 1366 | F16.7 | Resolution in ground range [m] = Nominal value | In the case of level 1.1 bbbbbbbbbbbbbbbb |
| 97 | 1367 - 1382 | F16.7 | Resolution in azimuth [m] = Nominal value | In the case of level 1.1 bbbbbbbbbbbbbbbb |
| 98 | 1383 - 1398 | F16.7 | Radiometric parameter (Bias) = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 99 | 1399 - 1414 | F16.7 | Radiometric parameter (Gain) = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 100 | 1415 - 1430 | F16.7 | Along track Doppler frequency (center) constant term at early edge of image [Hz] = Value: Level 1.1 (ScanSAR mode: = 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbbbb |
| 101 | 1431 - 1446 | F16.7 | Along track Doppler frequency (center) linear coefficient terms at early edge of image [Hz/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbbbb |
| 102 | 1447 - 1462 | F16.7 | Along track Doppler frequency (center) quadratic coefficient terms at early edge of image [Hz/pixel/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbbbb |
| 103 | 1463 - 1478 | A16 | Spare = Blanks (fixed value) | bbbbbbbbbbbbbbbb |
| 104 | 1479 - 1494 | F16.7 | Cross track Doppler frequency (center) constant term at early edge of image [Hz] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbbbb |

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Table 3.3-5 Data set summary records (9/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|---|--|
| 105 | 1495 - 1510 | F16.7 | Cross track Doppler frequency (center) linear coefficient terms at early edge of image [Hz/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 106 | 1511 - 1526 | F16.7 | Cross track Doppler frequency (center) quadratic coefficient terms at early edge of image [Hz/pixel/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 107 | 1527 - 1534 | A8 | Time direction indicator along pixel direction = Blanks (fixed value) | bbbbbb |
| 108 | 1535 - 1542 | A8 | Time direction indicator along line direction (Nominal value) Ascending = 'ASCENDbb' Descending = 'DESCENDb' | ASCENDbb |
| 109 | 1543 - 1558 | F16.7 | Along track Doppler frequency rate constant terms at early edge of the image [Hz/sec] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 110 | 1559 - 1574 | F16.7 | Along track Doppler frequency rate linear coefficient at early edge of the image [Hz/sec/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 111 | 1575 - 1590 | F16.7 | Along track Doppler frequency rate quadratic coefficient at early edge of the image [Hz/sec/pixel/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 112 | 1591 - 1606 | A16 | Spare = Blanks (fixed value) | bbbbbbbbbbbbbb |

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Table 3.3-5 Data set summary records (10/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|--|---|
| 113 | 1607 - 1622 | F16.7 | Cross track Doppler frequency rate constant terms at early edge of the image [Hz/sec] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 114 | 1623 - 1638 | F16.7 | Cross track Doppler frequency rate linear coefficient at early edge of the image [Hz/sec/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 115 | 1639 - 654 | F16.7 | Cross track Doppler frequency rate quadratic coefficient at early edge of the image [Hz/sec/pixel/pixel] = Value: Level 1.1 (ScanSAR mode: 0 (fixed value)) = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbb |
| 116 | 1655 - 1670 | A16 | Spare = Blanks (fixed value) | bbbbbbbbbbbbbb |
| 117 | 1671 - 1678 | A8 | Line content indicator = 'RANGEbbb': Level 1.1 = 'OTHERbbb': Level 1.5/3.1 | In the case of level 1.1 RANGEbbb |
| 118 | 1679 - 1682 | A4 | Clutter lock applied flag = 'YESb', 'NObb' | |
| 119 | 1683 - 1686 | A4 | Auto-focusing applied flag = 'YESb', 'NObb' | |
| 120 | 1687 - 1702 | F16.7 | Line spacing [m] Level 1.1 : Calculated azimuth spacing Level 1.5/3.1 : 0.625 (Spotlight) 2.5 (Ultra-fine) 3.125 (Ultra-fine, High-sensitive (Full (Quad.) pol.)) 6.25 (Fine, Fine (Full (Quad.) pol.)) 25 (ScanSAR nominal [14MHz], ScanSAR nominal [28MHz], ScanSAR wide) | In level 1.5/3.1, the pixel spacing is not defined as the value on a reference ellipsoid but as the value on a map coordinates. |

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Table 3.3-5 Data set summary records (11/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------------------------------|-------------|-------|---|---|
| 121 | 1703 - 1718 | F16.7 | Pixel spacing [m] Level 1.1: Calculated range spacing Level 1.5/3.1: 0.625 (Spotlight) 2.5 (Ultra-fine) 3.125 (Ultra-fine, High-sensitive (Full (Quad.) pol.)) 6.25 (Fine, Fine (Full (Quad.) pol.)) 25 (ScanSAR nominal [14MHz], ScanSAR nominal [28MHz], ScanSAR wide) | In level 1.5/3.1, the pixel spacing is not defined as the value on a reference ellipsoid but as the value on a map coordinates. |
| 122 | 1719 - 1734 | A16 | Processor range compression designator = 'EXTRACTEDbCHIRPb' | |
| 123 | 1735 - 1750 | F16.7 | Doppler center frequency approximately coefficient constant term (a) | fd = a + b • R |
| 124 | 1751 - 1766 | F16.7 | Doppler center frequency approximately linear coefficient term (b) | fd: Doppler center frequency [Hz] R: Slant range [km] |
| SENSOR SPECIFIC LOCAL USE SEGMENT | | | | |

Table 3.3-5 Data set summary records (12/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|------|---|--|
| 125 | 1767 - 1770 | I4 | Calibration mode data location flag No calibration data = 'bbb0' The side of observation start = 'bbb1' The side of observation end = 'bbb2' The side of observation start/end = 'bbb3' | bbb0 In the case of no calibration data <u>Observation mode</u> Start line number of calibration mode at upper image = 0 End line number of calibration mode at upper image = 0 Start line number of calibration mode at bottom image = 0 End line number of calibration mode at bottom image = 0 In the case of including calibration data at the edge of upper image 1 m n <u>Calibration mode</u> <u>Observation mode</u> Start line number of calibration mode at upper image = 1 End line number of calibration mode at upper image = m Start line number of calibration mode at bottom image = 0 End line number of calibration mode at bottom image = 0 |

Table 3.3-5 Data set summary records (14/16)

| Field No. | Byte No. | Type | Description | Remarks |
|---------------------------------------|-------------|-------|---|--|
| 126 | 1771 - 1778 | I8 | Start line number of calibration at the side of start In case of calibration location flag is '0', always = 'bbbbbbb0' | bbbbbbb0 |
| 127 | 1779 - 1786 | I8 | End line number of calibration at the side of start In case of calibration location flag is '0', always = 'bbbbbbb0' | bbbbbbb0 |
| 128 | 1787 - 1794 | I8 | Start line number of calibration at the side of end In case of calibration location flag is '0', always = 'bbbbbbb0' | bbbbbbb0 |
| 129 | 1795 - 1802 | I8 | End line number of calibration at the side of end In case of calibration location flag is '0', always = 'bbbbbbb0' | bbbbbbb0 |
| 130 | 1803 - 1806 | I4 | PRF switching indicator A fixed PRF 1 scene = 'bbb0' Variable PRFs = 'bbb1' ScanSAR mode = 'bbb1' | bbb0 |
| 131 | 1807 - 1814 | I8 | Line number of PRF switching A fixed PRF = 'bbbbbbb1' ScanSAR mode = 'bbbbbbb0' | bbbbbbb1 |
| 132 | 1815 - 1830 | F16.7 | The direction of a beam center in a scene center [deg] = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | In level 1.5/3.1 Geo-coded bbbbbbbbbbbbbbbb |
| 133 | 1831 - 1834 | I4 | Yaw steering mode flag No yaw steering mode = 'bbb1' Yaw steering mode = 'bbb0' | bbb0 |
| 134 | 1835 - 1838 | I4 | Parameter table number of automatically setting = 'bbbb' | bbbb |
| 135 | 1839 - 1854 | F16.7 | Nominal off nadir angle | bbbbbb24.2000000 Nominal value |
| 136 | 1855 - 1858 | I4 | Antenna beam number | bb10 |
| 137 | 1859 - 1886 | A28 | Spare = Blanks | bbbbbbbbbbbbbbbbbbbbbbbbbbbb |
| PROCESSING SPECIFIC LOCAL USE SEGMENT | | | | |

Table 3.3-5 Data set summary records (15/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|--------|--|--|
| 138 | 1887 - 1906 | E20.13 | Incidence angle constant term (a0) = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | Level 1.5/3.1 Geo-coded Blanks (b*120) $\theta = a_0 + a_1 * R + a_2 * R^2 + a_3 * R^3 + a_4 * R^4 + a_5 * R^5$ θ : Incidence angle [rad] R: Slant range [km] |
| 139 | 1907 - 1926 | E20.13 | Incidence angle linear coefficient term (a1) = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | |
| 140 | 1927 - 1946 | E20.13 | Incidence angle quadratic coefficient term (a2) = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | |
| 141 | 1947 - 1966 | E20.13 | Incidence angle cubic coefficient term (a3) = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | |
| 142 | 1967 - 1986 | E20.13 | Incidence angle fourth coefficient term (a4) = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | |
| 143 | 1987 - 2006 | E20.13 | Incidence angle fifth coefficient term (a5) = Value: Level 1.1 = Value: Level 1.5/3.1 Geo-reference = Blanks: Level 1.5/3.1 Geo-coded | |
| | | | IMAGE ANNOTATION SEGMENT | |
| 139 | 2007 - 2014 | I8 | Number of annotation points (up to 64) = 'bbbbbb0' | bbbbbb0 |

Table 3.3-5 Data set summary records (16/16)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|------|--|-------------------------------|
| 140 | 2015 - 2022 | A8 | Spare = Blanks | bbbbbbbbb |
| 141 | 2023 - 2030 | I8 | Line number of 1 st annotation start = Blanks | bbbbbbbbb |
| 142 | 2031 - 2038 | I8 | Pixel number of 1 st annotation start = Blanks | bbbbbbbbb |
| 143 | 2039 - 2054 | A16 | 1 st annotation text = Blanks | bbbbbbbbbbbbbbbb |
| 144 | 2055 - 2062 | I8 | Line number of 2 nd annotation start = Blanks | bbbbbbbbb |
| 145 | 2063 - 2070 | I8 | Pixel number of 2 nd annotation start = Blanks | bbbbbbbbb |
| 146 | 2071 - 2086 | A16 | 2 nd annotation text = Blanks | bbbbbbbbbbbbbbbb |
| . | . | . | Line number of N th annotation start = Blanks | Repeat up to 64 th |
| . | . | . | Pixel number of N th annotation start = Blanks | Repeat up to 64 th |
| . | . | . | N th annotation text = Blanks | Repeat up to 64 th |
| 147 | 4039 - 4046 | I8 | Line number of 64 th annotation start = Blanks | bbbbbbbbb |
| 148 | 4047 - 4054 | I8 | Pixel number of 64 th annotation start = Blanks | bbbbbbbbb |
| 149 | 4055 - 4070 | A16 | 64 th annotation text = Blanks | bbbbbbbbbbbbbbbb |
| 150 | 4071 - 4096 | A26 | System reserve = Blanks | bbbbbbbbbbbbbbbbbbbbbbbb |

Table 3.3-6 Map projection data records (1/5)

| Field No. | Byte No. | Type | Description | Remarks |
|---|-----------|-------|---|--|
| 1 | 1 - 4 | B4 | Record number = 3) ₁₀ | Only level 1.5/3.1 has this record. |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | |
| 3 | 6 - 6 | B1 | Record type code = 20) ₁₀ | |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | |
| 6 | 9 - 12 | B4 | Map projection data record length = 1620) ₁₀ | |
| 7 | 13 - 28 | A16 | Blanks | |
| MAP PROJECTION GENERAL INFORMATION | | | | |
| 8 | 29 - 60 | A32 | Map projection Geo-coded = 'GEOCODEDbbbbbbbbbbbbbbbbbb' Geo-reference = 'GEOREFERENCEbbbbbbbbbbbbbbbbbb' | |
| 9 | 61 - 76 | I16 | Number of pixel per line | |
| 10 | 77 - 92 | I16 | Number of lines | |
| 11 | 93 - 108 | F16.7 | Inter-line distance in output scene [m] (Nominal value) 0.625 (Spotlight) 2.5 (Ultra-fine) 3.125 (Ultra-fine, High-sensitive (Full (Quad.) pol.)) 6.25 (Fine, Fine (Full (Quad.) pol.)) 25 (ScanSAR nominal [14MHz], ScanSAR nominal [28MHz], ScanSAR wide) | The inter-line/pixel distances is not defined as the value on a reference ellipsoid but as the value on a map coordinates. |
| 12 | 109 - 124 | F16.7 | Inter-pixel distance in output scene [m] (Nominal value) 0.625 (Spotlight) 2.5 (Ultra-fine) 3.125 (Ultra-fine, High-sensitive (Full (Quad.) pol.)) 6.25 (Fine, Fine (Full (Quad.) pol.)) 25 (ScanSAR nominal [14MHz], ScanSAR nominal [28MHz], ScanSAR wide) | |
| 13 | 125 - 140 | F16.7 | The angle between projection axis from true north at processed scene center [deg] | |
| 14 | 141 - 156 | F16.7 | Actual platform orbital Inclination = 0.0000000 | |
| 15 | 157 - 172 | F16.7 | Actual ascending node = 0.0000000 | |
| 16 | 173 - 188 | F16.7 | Distance of platform at input scene center from the geocentric [m] | |
| 17 | 189 - 204 | F16.7 | Geodetic altitude of the platform relative to the ellipsoid [m] | |

Table 3.3-6 Map projection data records (2/5)

| Field No. | Byte No. | Type | Description | Remarks |
|--|-----------|-------|--|-------------------|
| 18 | 205 – 220 | F16.7 | Actual ground speed at nadir at input scene center time [m/sec] | |
| 19 | 221 – 236 | F16.7 | Platform headings [deg] | |
| PROJECTION ELLIPSOID PARAMETERS | | | | |
| 20 | 237 - 268 | A32 | Name of reference ellipsoid = 'GRS80bbbbbbbbbbbbbbbbbbbb' | |
| 21 | 269 - 284 | F16.7 | Semi-major axis of referenced ellipsoid [m] = 6378137.0000000 | |
| 22 | 285 - 300 | F16.7 | Semi-minor axis of referenced ellipsoid [m] = 6356752.3141000 | |
| 23 | 301 – 316 | F16.7 | Datum shift parameter (dx) [m] = 0.0000000 | |
| 24 | 317 - 332 | F16.7 | Datum shift parameter (dy) [m] = 0.0000000 | |
| 25 | 333 - 348 | F16.7 | Datum shift parameter (dz) [m] = 0.0000000 | |
| 26 | 349 - 364 | F16.7 | Datum shift (1 st rotation angle) = 0.0000000 | |
| 27 | 365 – 380 | F16.7 | Datum shift (2 nd rotation angle) = 0.0000000 | |
| 28 | 381 - 396 | F16.7 | Datum shift (3 rd rotation angle) = 0.0000000 | |
| 29 | 397 - 412 | F16.7 | Scale factor of referenced ellipsoid = 0.0000000 | |
| MAP PROJECTION DESIGNATOR | | | | |
| 30 | 413 - 444 | A32 | Alphanumeric description of map projection = 'UTM-PROJECTIONbbbbbbbbbbbbbbbb': UTM-projection = 'UPS-PROJECTIONbbbbbbbbbbbbbbbb': PS-projection = 'MER-PROJECTIONbbbbbbbbbbbbbbbb': Mercator-projection = 'LCC-PROJECTIONbbbbbbbbbbbbbbbb': LCC-projection | |
| UTM-PROJECTION (1 st default) | | | | |
| 31 | 445 - 476 | A32 | Type of UTM = 'UNIVERSALbTRANSVERSEbMERCATORbbb' | Blanks except UTM |
| 32 | 477 - 480 | A4 | UTM zone number | |
| 33 | 481 - 496 | F16.5 | Map origin (false easting) [m] = 500000.00000 | |
| 34 | 497 - 512 | F16.5 | Map origin (false northing)[m] = 0.00000: Northern Hemisphere = 10000000.00000: Southern Hemisphere | |
| 35 | 513 - 528 | F16.7 | Center of projection longitude [deg] | |
| 36 | 529 - 544 | F16.7 | Center of projection latitude [deg] | |
| 37 | 545 - 560 | A16 | Blanks | |

Table 3.3-6 Map projection data records (3/5)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|------------|-------|--|--|
| 38 | 561 – 576 | A16 | Blanks | Blanks except UTM |
| 39 | 577 - 592 | F16.7 | Scale factor = 0.9996000 | |
| | | | UPS-PROJECTION (2 nd default) | |
| 40 | 593 - 624 | A32 | Type of UPS = 'UNIVERSALbPOLARbSTEREOGRAPHICbbb' | Blanks except UPS |
| 41 | 625 – 640 | F16.7 | Center of projection longitude [deg] | |
| 42 | 641 - 656 | F16.7 | Center of projection latitude [deg] | |
| 43 | 657 - 672 | F16.7 | Scale factor = 1.0000000 | |
| | | | NATIONAL SYSTEM PROJECTION (any other) | |
| 44 | 673 - 704 | A32 | Projection descriptor = 'MERCATORbbbbbbbbbbbbbbbbbbbb': MER-PROJECTION = 'LAMBERT-CONFORMALbCONICbbbbbbbb': LCC-PROJECTION | Blanks except MER and LCC |
| 45 | 705 - 720 | F16.5 | Map origin (false easting) [m] = Blanks | |
| 46 | 721 – 736 | F16.5 | Map origin (false northing) [m] = Blanks | |
| 47 | 737 – 752 | F16.7 | Center of projection longitude [deg] (In either case MER/LCC, set up center map origin lat/lon) | |
| 48 | 753 – 768 | F16.7 | Center of projection latitude [deg] (In either case MER/LCC, set up center map origin lat/lon) | |
| 49 | 769 - 784 | F16.7 | Standard parallel [deg] (Standard parallel ϕ_1) MER: 0.0 fixed, LCC: latitude of scene center | |
| 50 | 785 – 800 | F16.7 | Standard parallel [deg] (Standard parallel ϕ_2) MER: 0.0 fixed, LCC: latitude of scene center | |
| 51 | 801 - 816 | F16.7 | Standard parallel [deg] = Blanks | |
| 52 | 817 – 832 | F16.7 | Standard parallel [deg] = Blanks | |
| 53 | 833 - 848 | F16.7 | Central meridian [deg] = Blanks | |
| 54 | 849 – 864 | F16.7 | Central meridian [deg] = Blanks | |
| 55 | 865 - 880 | F16.7 | Central meridian [deg] = Blanks | |
| 56 | 881 - 944 | A64 | Blanks | |
| | | | COORDINATES OF FOUR CORNER POINTS | |
| 57 | 945 – 960 | F16.7 | Top left corner northing [km] | Set the X coordinate value (at the center of pixel) |
| 58 | 961 – 976 | F16.7 | Top left corner easting [km] | Set the Y coordinate value (same as above) |
| 59 | 977 – 992 | F16.7 | Top right corner northing [km] | Set the X coordinate value (same as above) |
| 60 | 993 - 1008 | F16.7 | Top right corner easting [km] | Set the Y coordinate value |

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| | | | | |
|--|--|--|--|-----------------|
| | | | | (same as above) |
|--|--|--|--|-----------------|

Table 3.3-6 Map projection data records (4/5)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|---|---|
| 61 | 1009 – 1024 | F16.7 | Bottom right corner northing [km] | Set the X coordinate value (same as above) |
| 62 | 1025 – 1040 | F16.7 | Bottom right corner easting [km] | Set the Y coordinate value (same as above) |
| 63 | 1041 – 1056 | F16.7 | Bottom left corner northing [km] | Set the X coordinate value (same as above) |
| 64 | 1057 - 1072 | F16.7 | Bottom left corner easting [km] | Set the Y coordinate value (same as above) |
| 65 | 1073 – 1088 | F16.7 | Top left corner latitude [deg] | Set latitude at the center of pixel at the top left corner |
| 66 | 1089 – 1104 | F16.7 | Top left corner longitude [deg] | Set longitude at the center of pixel at the top left corner |
| 67 | 1105 – 1120 | F16.7 | Top right corner latitude [deg] | Set latitude at the center of pixel at the top right corner |
| 68 | 1121 – 1136 | F16.7 | Top right corner longitude [deg] | Set longitude at the center of pixel at the top right corner |
| 69 | 1137 – 1152 | F16.7 | Bottom right corner latitude [deg] | Set latitude at the center of pixel at the bottom right corner |
| 70 | 1153 – 1168 | F16.7 | Bottom right corner longitude [deg] | Set longitude at the center of pixel at the bottom right corner |
| 71 | 1169 - 1184 | F16.7 | Bottom left corner latitude [deg] | Set latitude at the center of pixel at the bottom left corner |
| 72 | 1185 - 1200 | F16.7 | Bottom left corner longitude [deg] | Set longitude at the center of pixel at the bottom left corner |
| 73 | 1201 - 1216 | A16 | Top left corner terrain height relative to ellipsoid [m] = Blanks | |
| 74 | 1217 – 1232 | A16 | Top right corner terrain height relative to ellipsoid [m] = Blanks | |
| 75 | 1233 – 1248 | A16 | Bottom right corner terrain height relative to ellipsoid [m] = Blanks | |
| 76 | 1249 – 1264 | A16 | Bottom left corner terrain height relative to ellipsoid [m] = Blanks | |

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Table 3.3-6 Map projection data records (5/5)

| | | | | |
|----|-------------|---------|--|--|
| 77 | 1265 - 1424 | 8E20.10 | <p>Eight coefficients to convert a line(L) and pixel(P) position to the map projection frame of reference, say (E, N) where: $E = A11 + A12*L + A13*P + A14*L*P$ $N = A21 + A22*L + A23*P + A24*L*P$ The order of storing: A11, A12, A13, ..., A24 The coefficients of 1025-2024 bytes in facility related data record 5 should be used if high position accuracy is needed.</p> | <p>For the expressions, the position defined as (P, L) = (1, 1). corresponds to the central point of the pixel at the upper left corner and (E, N) show a longitude [deg] and a latitude [deg.].</p> |
| 78 | 1425 - 1584 | 8E20.10 | <p>Eight coefficients to convert from the map projection (E, N) to line(L) and pixel(P) position in the image, say (L, P) where: $L = B11 + B12*E + B13*N + B14*E*N$ $P = B21 + B22*E + B23*N + B24*E*N$ The order of storing: B11, B12, B13, ..., B24 The coefficients of 2065-3064 bytes in facility related data record 5 should be used if high position accuracy is needed.</p> | |
| 79 | 1585 - 1620 | A36 | Blanks | |

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Table 3.3-7 Platform position data records (1/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|--|---------------------------------------|
| 1 | 1 - 4 | B4 | Record number Level 1.1 = 3) ₁₀ Level 1.5/3.1 = 4) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | 12h |
| 3 | 6 - 6 | B1 | Record type code = 30) ₁₀ | 1Eh |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd record sun-type code = 20) ₁₀ | 14h |
| 6 | 9 - 12 | B4 | Platform position data record length = 4680) ₁₀ | 00001248h |
| 7 | 13 - 44 | A32 | Orbital elements designator Orbit information (preliminary) = '0bbbbbbbbbbbbbbbbbbbbbbbbbb' Orbit information (decision) = '1bbbbbbbbbbbbbbbbbbbbbbbbbb' High precision orbit information = '2bbbbbbbbbbbbbbbbbbbbbbbbbb' | 2bbbbbbbbbbbbbbbbbbbbbbbbbb bbbbbb |
| 8 | 45 - 60 | F16.7 | 1 st orbital element Position vector in the earth fixed coordinate system of the scene center (x) [m] | |
| 9 | 61 - 76 | F16.7 | 2 nd orbital element Position vector in the earth fixed coordinate system of the scene center (y) [m] | |
| 10 | 77 - 92 | F16.7 | 3 rd orbital element Position vector in the earth fixed coordinate system of the scene center (z) [m] | |
| 11 | 93 - 108 | F16.7 | 4 th orbital element Velocity vector in the earth fixed coordinate system of the scene center (x') [m/sec] | |
| 12 | 109 - 124 | F16.7 | 5 th orbital element Velocity vector in the earth fixed coordinate system of the scene center (y') [m/sec] | |
| 13 | 125 - 140 | F16.7 | 6 th orbital element Velocity vector in the earth fixed coordinate system of the scene center (z') [m/sec] | |
| 14 | 141 - 144 | I4 | Number of data points Orbit information (preliminary) = 'bb28' Orbit information (decision) = 'bb28' High precision orbit information = 'bb28' | bb28 |
| 15 | 145 - 148 | I4 | YYYY : Year of 1 st point | 2015 |
| 16 | 149 - 152 | I4 | bbMM : Month of 1 st point | bb02 |

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Table 3.3-7 Platform position data records (2/3)

| Field No. | Byte No. | Type | Description | Remarks |
|------------------------------------|------------|-----------------|---|---|
| 17 | 153 - 156 | I4 | bbDD : Day of 1 st point | bb02 |
| 18 | 157 - 160 | I4 | Day in the year of 1 st point (Ex: 2 nd February = 33 th) | bb33 |
| 19 | 161 - 182 | E22.15 | Seconds of day of 1 st point (Ex: 0:51:30.23 = 3090.23) | b0.3090230000000000E+04 |
| 20 | 183 - 204 | E22.15 | Time interval between data points [sec] = 60 | b0.6000000000000000E+02 |
| 21 | 205 - 268 | A64 | Reference co-ordinate system (ECI, ECR) = 'ECRbb' | ECRbb bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb |
| 22 | 269 - 290 | E22.15 | Greenwich mean hour angle [deg] = Blanks (fixed value) | bbbbbbbbbbbbbbbbbbbb |
| 23 | 291 - 306 | F16.7 | Along track position error [m] = Nominal value | (Along track position error) |
| 24 | 307 - 322 | F16.7 | Across track position error [m] = Nominal value | (Across track position error) |
| 25 | 323 - 338 | F16.7 | Radial position error [m] = Nominal value | (Radial position error) |
| 26 | 339 - 354 | F16.7 | Along track velocity error [m/sec] = Nominal value | (Along track velocity error) |
| 27 | 355 - 370 | F16.7 | Across track velocity error [m/sec] = Nominal value | (Across track velocity error) |
| 28 | 371 - 386 | F16.7 | Radial velocity error [m/sec] = Nominal value | (Radial velocity error) |
| FIRST POSITIONAL DATA POINT | | | | |
| 29 | 387 - 408 | E22.15 | 1 st data point position vector (x) [m] | (1 st data point position vector) |
| 30 | 409 - 430 | E22.15 | 1 st data point position vector (y) [m] | (1 st data point position vector) |
| 31 | 431 - 452 | E22.15 | 1 st data point position vector (z) [m] | (1 st data point position vector) |
| 32 | 453 - 474 | E22.15 | 1 st data point position vector (x') [m/sec] | (1 st data point position vector) |
| 33 | 475 - 496 | E22.15 | 1 st data point position vector (y') [m/sec] | (1 st data point position vector) |
| 34 | 497 - 518 | E22.15 | 1 st data point position vector (z') [m/sec] | (1 st data point position vector) |
| | 519 - 4082 | 27*6* E22.15 | Repeat 2 nd - 28 th data point same as 387-518 bytes | |

Table 3.3-7 Platform position data records (3/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|------|---|--|
| 35 | 4083 - 4100 | A18 | Blanks | bbbbbbbbbbbbbbbb |
| 36 | 4101 - 4101 | I1 | Occurrence flag of a leap second No leap second = '0' Occurrence of a leap second = '1' | 0 This flag is "1" if a scene includes line times before and after the TAI-UTC change time. |
| 37 | 4102 - 4680 | A579 | Blanks | Blanks (b*579) |

Table 3.3-8 Attitude data records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|-------|---|-----------|
| 1 | 1 - 4 | B4 | Record number Level 1.1 = 4) ₁₀ Level 1.5/3.1 = 5) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | 12h |
| 3 | 6 - 6 | B1 | Record type code = 40) ₁₀ | 28h |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | 14h |
| 6 | 9 - 12 | B4 | Attitude data records length = 16384) ₁₀ | 00004000h |
| 7 | 13 - 16 | I4 | Number of points = 'bb22': Except ScanSAR mode = 'bb62': ScanSAR mode | bb22 |
| 8 | 17 - 20 | I4 | Day of the year | bbb1 |
| 9 | 21 - 28 | I8 | Milli-second of the day = 'bbbbbb0'~'86399999' | bbb28800 |
| 10 | 29 - 32 | I4 | Pitch data quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | bbb0 |
| 11 | 33 - 36 | I4 | Roll data quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | bbb0 |
| 12 | 37 - 40 | I4 | Yaw data quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | bbb0 |
| 13 | 41 - 54 | E14.6 | Pitch [deg] | (Pitch) |
| 14 | 55 - 68 | E14.6 | Roll [deg] | (Roll) |
| 15 | 69 - 82 | E14.6 | Yaw [deg] | (Yaw) |

Table 3.3-8 Attitude data records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|--------------------------|----------------------------------|---|----------------------------------|
| 16 | 83 - 86 | I4 | Pitch rate quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | bbb0 |
| 17 | 87 - 90 | I4 | Roll rate quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | bbb0 |
| 18 | 91 - 94 | I4 | Yaw rate quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | bbb0 |
| 19 | 95 - 108 | E14.6 | Pitch rate | (Pitch rate) |
| 20 | 109 - 122 | E14.6 | Roll rate | (Roll rate) |
| 21 | 123 - 136 | E14.6 | Yaw rate | (Yaw rate) |
| | 137 - 136+120*(n-1) | 120*(n-1) | Repeat bytes 17-136 for the number of points (n) in section 7 | |
| 22 | 137+120*(n-1) - 16384 | A(16384- (136+120 *(n-1))) | Blanks | The value of Level 1.0 is copied |

Table 3.3-9 Radiometric data records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------------------------|-----------|-------|---|---------|
| 1 | 1 - 4 | B4 | Record number Level 1.1 = 5) ₁₀ Level 1.5/3.1 = 6) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | |
| 3 | 6 - 6 | B1 | Record type code = 50) ₁₀ | |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = 18) ₁₀ | |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = 20) ₁₀ | |
| 6 | 9 - 12 | B4 | Radiometric data record length = 9860) ₁₀ | |
| 7 | 13 - 16 | I4 | Radiometric data records sequence number = 'bbb1' | |
| 8 | 17 - 20 | I4 | Number of radiometric fields = 'bbb1' | |
| RADIOMETRIC DATA SET | | | | |
| 9 | 21 - 36 | F16.7 | Calibration factor (CF) Level 1.1: $\sigma^0 = 10 * \log_{10} \langle I^2 + Q^2 \rangle + CF - 32.0$ Level 1.5/3.1: $\sigma^0 = 10 * \log_{10} \langle DN^2 \rangle + CF$ This means that the sigma-naught of a pixel can be obtained by the ensemble averaging ($\langle \rangle$), i.e., the spatial averaging of pixel values around the target. Here, I, Q, and DN in $\langle \rangle$ of the above formulas are the pixel values in levels 1.1, and 1.5/3.1, respectively. | |
| 10 | 37 - 52 | F16.7 | Transmission distortion matrix for High-sensitive/Fine modes (Full (Quad.) pol.) level 1.1 (DT) (*) Real part of DT(1, 1) | |
| 11 | 53 - 68 | F16.7 | Imaginary part of DT(1, 1) | |
| 12 | 69 - 84 | F16.7 | Real part of DT(1, 2) | |
| 13 | 85 - 100 | F16.7 | Imaginary part of DT(1, 2) | |
| 14 | 101 - 116 | F16.7 | Real part of DT(2, 1) | |
| 15 | 117 - 132 | F16.7 | Imaginary part of DT(2, 1) | |
| 16 | 133 - 148 | F16.7 | Real part of DT(2, 2) | |
| 17 | 149 - 164 | F16.7 | Imaginary part of DT(2, 2) | |
| 18 | 165 - 180 | F16.7 | Reception distortion matrix for High-sensitive/Fine modes (Full (Quad.) pol.) level 1.1 (DR) (*) Real part of DR(1, 1) | |
| 19 | 181 - 196 | F16.7 | Imaginary part of DR(1, 1) | |

Table 3.3-9 Radiometric data records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|------------|-------|----------------------------|---------|
| 20 | 197 - 212 | F16.7 | Real part of DR(1, 2) | |
| 21 | 213 - 228 | F16.7 | Imaginary part of DR(1, 2) | |
| 22 | 229 - 244 | F16.7 | Real part of DR(2, 1) | |
| 23 | 245 - 260 | F16.7 | Imaginary part of DR(2, 1) | |
| 24 | 261 - 276 | F16.7 | Real part of DR(2, 2) | |
| 25 | 277 - 292 | F16.7 | Imaginary part of DR(2, 2) | |
| 26 | 293 - 9860 | A9568 | Reserve (Blanks) | |

(*)Notes:

The measured scattering matrix can be expressed by

$$\begin{pmatrix} Z_{hh} & Z_{hv} \\ Z_{vh} & Z_{vv} \end{pmatrix} = A \frac{1}{r} \exp\left(-\frac{4\pi r}{\lambda} j\right) \begin{pmatrix} 1 & \delta_3 \\ \delta_4 & f_2 \end{pmatrix} \begin{pmatrix} S_{hh} & S_{hv} \\ S_{vh} & S_{vv} \end{pmatrix} \begin{pmatrix} 1 & \delta_1 \\ \delta_2 & f_1 \end{pmatrix} + \begin{pmatrix} N_{hh} & N_{hv} \\ N_{vh} & N_{vv} \end{pmatrix}$$

where Z_{ij} is the measurement matrix of the target, j is the transmission polarization, i is the reception polarization, A is the amplitude, r is the slant range, S_{ij} is the true scattering matrix of the target, f_1 is the channel imbalance of the transmission distortion matrix, f_2 is that for the reception matrix, δ_1 and δ_2 are the cross talks of transmission, and δ_3 and δ_4 are the those for the reception, N_{ij} are the noise component. Here, N_{ij} is assumed to be zero. It should be noted that polarization notation of the product is different from the above, i.e., IMG-HV-ALPSR..., means the data acquired at H transmission and V reception.

Complex transmission distortion matrix $(1, \delta_1, \delta_2, f_1)$ are stored from 37 to 164 bytes, and reception distortion matrix $(1, \delta_3, \delta_4, \text{and } f_2)$ are stored from 165 to 292 bytes.

Calibration factor is stored from 21 to 36 bytes.

Table 3.3-10 Data quality summary records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|--|-----------|-------|---|--|
| 1 | 1 - 4 | B4 | Record number Level 1.1 = 6) ₁₀ Level 1.5/3.1 = 7) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | |
| 3 | 6 - 6 | B1 | Record type code = 60) ₁₀ | |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | |
| 6 | 9 - 12 | B4 | Data quality summary record length = 1620) ₁₀ | |
| 7 | 13 - 16 | I4 | Data quality summary record number = 'bbb1' | |
| 8 | 17 - 20 | A4 | SAR channel ID = 'ABCb' A: Reception of polarization (H, V) B: Reception antenna (S: Single beam, F: F-system, R: R-system) C : I, Q | Describe the channel that is the radiometric standard of channels used in observation. |
| 9 | 21 - 26 | A6 | Date of the last calibration update = 'YYMMDD' YY : lower 2 figures of the year MM : Month DD : Day | |
| 10 | 27 - 30 | A4 | Number of channels (up to 8) | |
| ABSOLUTE RADIOMETRIC DATA QUALITY | | | | |
| 11 | 31 - 46 | F16.7 | ISLR (nominal value) [dB] | |
| 12 | 47 - 62 | F16.7 | PSLR (nominal value) [dB] | |
| 13 | 63 - 78 | F16.7 | Azimuth ambiguity rate (AAR) (Nominal value) | |
| 14 | 79 - 94 | F16.7 | Range ambiguity rate (RAR) (Nominal value) | |
| 15 | 95 - 110 | F16.7 | Estimate of SNR [dB] | |
| 16 | 111 - 126 | F16.7 | BER (Actual value) | |
| 17 | 127 - 142 | F16.7 | Slant range resolution (Nominal value) [m] | |
| 18 | 143 - 158 | F16.7 | Azimuth resolution (Nominal value) [m] | |
| 19 | 159 - 174 | F16.7 | Radiometric resolution (Nominal value) [dB] | |
| 20 | 175 - 190 | F16.7 | Instantaneous dynamic range [dB] | |

Table 3.3-10 Data quality summary records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|--|-----------------------|---------------------|---|---------|
| 21 | 191 - 206 | F16.7 | Nominal absolute radiometric calibration magnitude uncertainty of SAR channel indicated in bytes 17-20 [dB] | |
| 22 | 207 - 222 | F16.7 | Nominal absolute radiometric calibration phase uncertainty of SAR channel indicated in bytes 17-20 [deg] | |
| RELATIVE RADIOMETRIC QUALITY | | | | |
| 23 | 223 - 238 | F16.7 | Nominal relative radiometric calibration magnitude uncertainty of SAR channel indicated in bytes 17-20 [dB] | |
| 24 | 239 - 254 | F16.7 | Nominal relative radiometric calibration phase uncertainty of SAR channel indicated in bytes 17-20 [deg] | |
| 25 | 255 - (n-1)*32+254 | (n-1)*2F16.7 | Repetition of bytes 223 - 254 for the remaining channels (up to 8 channels) | |
| 26 | (n-1)*32+255 - 734 | A(480 -(n-1)*32) | Blanks | |
| ABSOLUTE GEOMETRIC DATA QUALITY | | | | |
| 26 | 735 - 750 | F16.7 | Absolute location error along track (Nominal value) [m] | |
| 27 | 751 - 766 | F16.7 | Absolute location error cross track (Nominal value) [m] | |
| 28 | 767 - 782 | F16.7 | Geometric distortion scale in line direction (Nominal value) | |
| 29 | 783 - 798 | F16.7 | Geometric distortion scale in pixel direction (Nominal value) | |
| 30 | 799 - 814 | F16.7 | Geometric distortion skew | |
| 31 | 815 - 830 | F16.7 | Scene orientation error | |
| RELATIVE GEOMETRIC DATA QUALITY | | | | |
| 32 | 831 - 846 | F16.7 | Along track relative misregistration error of other channels versus SAR channel (bytes 17-20) [meters] | |
| 33 | 847 - 862 | F16.7 | Cross track relative misregistration error of other channels versus SAR channel (bytes 17-20) [meters] | |
| 34 | 863 - 1102 | (n-1)*2F16.7 | Repetition of bytes 831 - 862 for the other channels (up to 8 channels) | |
| 35 | 1103 - 1620 | A518 | Blanks | |

Table 3.3-11 Facility related data records 1 - 4 (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|---------|
| 1 | 1 - 4 | B4 | Record sequence number Level 1.1 Dummy data = 7) ₁₀ Determined ephemeris = 8) ₁₀ Time error information = 9) ₁₀ Coordinate conversion information = 10) ₁₀ Level 1.5/3.1 Dummy data = 8) ₁₀ Determined ephemeris = 9) ₁₀ Time error information = 10) ₁₀ Coordinate conversion information = 11) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | 12h |
| 3 | 6 - 6 | B1 | Record type code = 200) ₁₀ | C8h |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | 12h |

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Table 3.3-11 Facility related data records 1 - 4 (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|-----------------|
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 70) ₁₀ CEOS = 20) ₁₀ , CCRS = 36) ₁₀ , ESA = 50) ₁₀ , NASA = 60) ₁₀ , JPL = 61) ₁₀ JAXA = 70) ₁₀ , DFVLR = 80) ₁₀ , RAE = 90) ₁₀ , TELESPIAZIO = 10) ₁₀ UNSPECIFIED = 18) ₁₀ , etc. | 46h |
| 6 | 9 - 12 | B4 | Record length Dummy data = 325,000 Determined ephemeris = 511,000 Time error information = 3,072 Coordinate conversion information = 728,000 | |
| 7 | 13 - 16 | I4 | Facility related data record sequence number = 'bbbb1'~'bbb4' | |
| 8 | 17 - 66 | A50 | Blanks | Blanks(b*50) |
| 9 | 67 - | | Set the following files which were used for level 1.0 processing, for each record. Dummy data Determined ephemeris Time error information Coordinate conversion information | (Raw file data) |

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Table 3.3-12 Facility related data records 5 (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|----------|--|---|
| 1 | 1 - 4 | B4 | Record sequence number Level 1.1 = 11) ₁₀ Level 1.5/3.1 = 12) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | |
| 3 | 6 - 6 | B1 | Record type code = 200) ₁₀ | |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 70) ₁₀ CEOS = 20) ₁₀ , CCRS = 36) ₁₀ , ESA = 50) ₁₀ , NASA = 60) ₁₀ , JPL = 61) ₁₀ JAXA = 70) ₁₀ , DFVLR = 80) ₁₀ , RAE = 90) ₁₀ , TELESPAZIO = 10) ₁₀ UNSPECIFIED = 18) ₁₀ , etc. | |
| 6 | 9 - 12 | B4 | Record length = 5000) ₁₀ | |
| 7 | 13 - 16 | I4 | Facility related data record number = 'bbb5' | |
| 8 | 17 - 416 | 20E20.10 | Twenty coefficients to convert from the map projection (E, N) to Line(L) and pixel (P) position in the image, say (P, L) where: Level 1.5/3.1: $P = a_0 + a_1*\varphi + a_2*\lambda + a_3*\varphi*\lambda + a_4*\varphi^2 + a_5*\lambda^2 + a_6*\varphi^2*\lambda + a_7*\varphi*\lambda^2 + a_8*\varphi^3 + a_9*\lambda^3$ $L = b_0 + b_1*\varphi + b_2*\lambda + b_3*\varphi*\lambda + b_4*\varphi^2 + b_5*\lambda^2 + b_6*\varphi^2*\lambda + b_7*\varphi*\lambda^2 + b_8*\varphi^3 + b_9*\lambda^3$ Coefficients $a_0 - a_9$ and $b_0 - b_9$ (The order of storing $a_0, a_1, a_2, \dots, a_9$ and $b_0, b_1, b_2, \dots, b_9$) Level 1.1: Blanks The coefficients of 2065-3064 bytes in facility related data record 5 should be used if high position accuracy is needed. | For the expressions, the position defined as (P, L) = (1, 1). corresponds to the central point of the pixel at the upper left corner and (E, N) show a longitude [deg] and a latitude [deg] |
| 9 | 417 - 420 | I4 | Calibration mode data location flag No calibration data = 'bbb0' The side of observation start = 'bbb1' The side of observation end = 'bbb2' The side of observation start/end = 'bbb3' | |

C

Table 3.3-12 Facility related data records 5 (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|------------|------|---|---------|
| 10 | 421 - 428 | I8 | Start line number of calibration at upper image In case of no calibration data ('0'), always = 'bbbbbbb0' | |
| 11 | 429 - 436 | I8 | End line number of calibration at upper image In case of no calibration data ('0'), always = 'bbbbbbb0' | |
| 12 | 437 - 444 | I8 | Start line number of calibration at bottom image In case of no calibration data ('0'), always = 'bbbbbbb0' | |
| 13 | 445 - 452 | I8 | Stop line number of calibration at bottom image In case of no calibration data ('0'), always = 'bbbbbbb0' | |
| 14 | 453 - 456 | I4 | PRF switching flag No change in a scene = 'bbb0' (fixed value) | |
| 15 | 457 - 464 | I8 | Start line number of PRF switching No change = 'bbbbbbb1' (fixed value) | |
| 16 | 465 - 472 | I8 | Blanks | |
| 17 | 473 - 480 | I8 | Number of loss lines (Level 1.0) | |
| 18 | 481 - 488 | I8 | Number of loss lines (range for processing in Level 1.1/1.5/3.1) | |
| 19 | 489 - 800 | A312 | Blanks | |
| 20 | 801 - 1024 | A224 | System reserve | |

Table 3.3-12 Facility related data records 5 (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|----------|---|--|
| 21 | 1025 - 2024 | 50E20.10 | <p>Coefficients of the 8th polynomial expression to convert from pixel (P) and line (L) to latitude (ϕ) and longitude (λ), say (ϕ, λ) where:</p> $\phi = a_0 * L^4 * P^4 + a_1 * L^3 * P^4 + a_2 * L^2 * P^4 + a_3 * L * P^4 + a_4 * P^4$ $+ a_5 * L^4 * P^3 + a_6 * L^3 * P^3 + a_7 * L^2 * P^3 + a_8 * L * P^3 + a_9 * P^3$ $+ a_{10} * L^4 * P^2 + a_{11} * L^3 * P^2 + a_{12} * L^2 * P^2 + a_{13} * L * P^2 + a_{14} * P^2$ $+ a_{15} * L^4 * P + a_{16} * L^3 * P + a_{17} * L^2 * P + a_{18} * L * P + a_{19} * P$ $+ a_{20} * L^4 + a_{21} * L^3 + a_{22} * L^2 + a_{23} * L + a_{24}$ $\lambda = b_0 * L^4 * P^4 + b_1 * L^3 * P^4 + b_2 * L^2 * P^4 + b_3 * L * P^4 + b_4 * P^4$ $+ b_5 * L^4 * P^3 + b_6 * L^3 * P^3 + b_7 * L^2 * P^3 + b_8 * L * P^3 + b_9 * P^3$ $+ b_{10} * L^4 * P^2 + b_{11} * L^3 * P^2 + b_{12} * L^2 * P^2 + b_{13} * L * P^2 + b_{14} * P^2$ $+ b_{15} * L^4 * P + b_{16} * L^3 * P + b_{17} * L^2 * P + b_{18} * L * P + b_{19} * P$ $+ b_{20} * L^4 + b_{21} * L^3 + b_{22} * L^2 + b_{23} * L + b_{24}$ <p>(The order of storing: $a_0, a_1, a_2, \dots, a_{24}$ & $b_0, b_1, b_2, \dots, b_{24}$) In the case of ScanSAR level 1.1, all coefficients are set 0.0</p> | <p>(P, L) referred in the upper left pixel(p) and line (l) are substituted by the following expressions as $P = p - P_0, L = l - L_0$, where (p, l) is an arbitrary coordinate address on the image. For the expressions above, the position defined as (p, l)=(0, 0) corresponds to the central point of the pixel at the upper left corner and (ϕ, λ) is measured in "degrees".</p> <p>In the case of ScanSAR level 1.1, refer to the field No. 50-55 in Table 3.3-14 "Signal data records (4/5)" about the relationship between an address and the location information (latitude/longitude) on the image.</p> |
| 22 | 2025 - 2044 | E20.10 | Origin Pixel (P_0) 0.0 | |
| 23 | 2045 - 2064 | E20.10 | Origin Line (L_0) 0.0 | |

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C

Table 3.3-12 Facility related data records 5 (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|----------|---|--|
| 24 | 2065 - 3064 | 50E20.10 | <p>Coefficients of the 8th polynomial expression to convert from latitude (Φ) and longitude (Λ) to pixel (p) and line (l), say (p, l) where:</p> $p = c_0 * \Lambda^4 * \Phi^4 + c_1 * \Lambda^3 * \Phi^4 + c_2 * \Lambda^2 * \Phi^4 + c_3 * \Lambda * \Phi^4 + c_4 * \Phi^4$ $+ c_5 * \Lambda^4 * \Phi^3 + c_6 * \Lambda^3 * \Phi^3 + c_7 * \Lambda^2 * \Phi^3 + c_8 * \Lambda * \Phi^3 + c_9 * \Phi^3$ $+ c_{10} * \Lambda^4 * \Phi^2 + c_{11} * \Lambda^3 * \Phi^2 + c_{12} * \Lambda^2 * \Phi^2 + c_{13} * \Lambda * \Phi^2 + c_{14} * \Phi^2$ $+ c_{15} * \Lambda^4 * \Phi + c_{16} * \Lambda^3 * \Phi + c_{17} * \Lambda^2 * \Phi + c_{18} * \Lambda * \Phi + c_{19} * \Phi$ $+ c_{20} * \Lambda^4 + c_{21} * \Lambda^3 + c_{22} * \Lambda^2 + c_{23} * \Lambda + c_{24}$ $l = d_0 * \Lambda^4 * \Phi^4 + d_1 * \Lambda^3 * \Phi^4 + d_2 * \Lambda^2 * \Phi^4 + d_3 * \Lambda * \Phi^4 + d_4 * \Phi^4$ $+ d_5 * \Lambda^4 * \Phi^3 + d_6 * \Lambda^3 * \Phi^3 + d_7 * \Lambda^2 * \Phi^3 + d_8 * \Lambda * \Phi^3 + d_9 * \Phi^3$ $+ d_{10} * \Lambda^4 * \Phi^2 + d_{11} * \Lambda^3 * \Phi^2 + d_{12} * \Lambda^2 * \Phi^2 + d_{13} * \Lambda * \Phi^2 + d_{14} * \Phi^2$ $+ d_{15} * \Lambda^4 * \Phi + d_{16} * \Lambda^3 * \Phi + d_{17} * \Lambda^2 * \Phi + d_{18} * \Lambda * \Phi + d_{19} * \Phi$ $+ d_{20} * \Lambda^4 + d_{21} * \Lambda^3 + d_{22} * \Lambda^2 + d_{23} * \Lambda + d_{24}$ <p>(The order of storing: $c_0, c_1, c_2, \dots, c_{24}$ & $d_0, d_1, d_2, \dots, d_{24}$) In the case of ScanSAR level 1.1, all coefficients are set 0.0</p> | <p>(Φ, Λ) referred in the upper left latitude(ϕ), longitude(λ) are substituted by the following expressions as $F=f-F_0$ (degrees), $L=l-L_0$ (degrees), where (f, l) is an arbitrary position on the image. For the expressions, the position defined as $(p, l)=(0, 0)$ corresponds to the central point of the pixel at the upper left corner.</p> |
| 25 | 3065 - 3084 | E20.10 | Origin Latitude (Φ_0) scene center latitude | <p>In the case of ScanSAR level 1.1, refer to the field No. 50-55 in Table 3.3-14 "Signal data records (4/5)" about the relationship between an address and the location information (latitude/longitude) on the image.</p> |
| 26 | 3085 - 3104 | E20.10 | Origin Longitude (Λ_0) scene center longitude | |
| 27 | 3105 - 5000 | A1896 | Blanks | |

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Table 3.3-13 SAR Image file descriptor records (1/6)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|--------------------------------------|
| 1 | 1 - 4 | B4 | Record number = $1)_{10}$ | 00000001h |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = $50)_{10}$ | 32h |
| 3 | 6 - 6 | B1 | Record type code = $192)_{10}$ | C0h |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = $18)_{10}$ | 12h |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = $18)_{10}$ | 12h |
| 6 | 9 - 12 | B4 | Record length = $720)_{10}$ | 000002D0h |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC flag = 'Ab': ASCII | Ab |
| 8 | 15 - 16 | A2 | Blanks | bb |
| 9 | 17 - 28 | A12 | Format control document ID = 'CEOS-SARbbbb' | CEOS-SARbbbb |
| 10 | 29 - 30 | A2 | Format control document revision level = 'bA' | bA |
| 11 | 31 - 32 | A2 | File design descriptor revision letter = 'bA' | bA |
| 12 | 33 - 44 | A12 | Software release & revision number = 'NNN.NNNbbbb' 001.000, 001.001, ... 001.100, ... 002.000 | 001.000bbbb |
| 13 | 45 - 48 | I4 | File number = 'bbb1' | bbb1 |
| 14 | 49 - 64 | A16 | File ID = 'MMNbSSSTFFFFbbbb' MM: Mission ID (ALOS2='AL')(*) N: Mission number(='2')(*) SSS: Sensor ID (SAR='SAR')(*) T: Processing level code Level 1.0 = 'A' Level 1.1 = 'B' Level 1.5 = 'C' Level 3.1 = 'D' FFFF : File Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | AL2bSARAIMOPbbbb |
| 15 | 65 - 68 | A4 | Record sequence and location type flag = 'FSEQ' | FSEQ |
| 16 | 69 - 76 | I8 | Location sequence number = 'bbbbbbb1' | bbbbbbb1 (Location of record number) |
| 17 | 77 - 80 | I4 | Field length of sequence number = 'bbb4' | bbb4 (Field length of record number) |

A

Table 3.3-13 SAR Image file descriptor records (2/6)

| Field No. | Byte No. | Type | Description | Remarks |
|--------------------------|-----------|------|--|--|
| 18 | 81 - 84 | A4 | Record code and location type flag = 'FTYP' | FTYP |
| 19 | 85 - 92 | I8 | Record code location = 'bbbbbb5' | bbbbbb5 (Record code location) |
| 20 | 93 - 96 | I4 | Record code field length = 'bbb4' | bbb4 (Record code field length) |
| 21 | 97 - 100 | A4 | Record length and location type flag = 'FLGT' | FLGT |
| 22 | 101 - 108 | I8 | Record length location = 'bbbbbb9' | bbbbbb9 (Record length location) |
| 23 | 109 - 112 | I4 | Record length field length = 'bbb4' | bbb4 (Record length field length) |
| 24 | 113 - 113 | A1 | Reserved = Blanks | b |
| 25 | 114 - 114 | A1 | Reserved = Blanks | b |
| 26 | 115 - 115 | A1 | Reserved = Blanks | b |
| 27 | 116 - 116 | A1 | Reserved = Blanks | b |
| 28 | 117 - 180 | A64 | Reserved = Blanks | Blanks(b*64) |
| 29 | 181 - 186 | I6 | Number of SAR data records Number of signal data records | The order of recode sequence is the order of observation time. |
| 30 | 187 - 192 | I6 | SAR data record length | |
| 31 | 193 - 216 | A24 | Reserved = Blanks | bbbbbbbbbbbbbbbbbbbb |
| SAMPLE GROUP DATA | | | | |
| 32 | 217 - 220 | I4 | Bit length per sample Level 1.1 = 'bb32' Level 1.5/3.1 = 'bb16' | |
| 33 | 221 - 224 | I4 | Number of samples per data group Level 1.1 = 'bbb2' Level 1.5/3.1 = 'bbb1' | |
| 34 | 225 - 228 | I4 | Number of bytes per data group Level 1.1 = 'bbb8' Level 1.5/3.1 = 'bbb2' | |
| 35 | 229 - 232 | A4 | Justification and order of samples within data group = Blanks(fixed value) | bbbb |

Table 3.3-13 SAR Image file descriptor records (3/6)

| Field No. | Byte No. | Type | Description | Remarks |
|---------------------------------------|-----------|------|---|---|
| SAR RELATED DATA IN THE RECORD | | | | |
| 36 | 233 - 236 | I4 | Number of SAR channels = 'bbb1' (fixed value) (Only L-band) | bbb1 |
| 37 | 237 - 244 | I8 | Number of lines per data set (one channel) (Excluding border lines) | |
| 38 | 245 - 248 | I4 | Number of left border pixels per line = 'bbb0' | bbb0 |
| 39 | 249 - 256 | I8 | Number of data group (or pixels) per line | For level 1.1 products, each data record corresponds to 1 image range line. Each range line begins at the nearest-range pixel and ends at the farthest-range pixel. |
| 40 | 257 - 260 | I4 | Number of right border pixels per line = 'bbb0' | |
| 41 | 261 - 264 | I4 | Number of top border lines = 'bbb0' | bbb0 |
| 42 | 265 - 268 | I4 | Number of bottom border lines = 'bbb0' | bbb0 |
| 43 | 269 - 272 | A4 | Interleaving ID = 'BSQb' (fixed value) | BSQb |
| RECORD DATA IN THE FILE | | | | |
| 44 | 273 - 274 | I2 | Number of physical records per line = 'b1' (fixed value) | b1 |
| 45 | 275 - 276 | I2 | Number of physical records per multi-channel line in this file = 'b1' (fixed value) | <p>b1</p> <p>This item means the number of records that compose BIL when the data observed by multi-channels are stored as BIL in a SAR signal data file. That is, when the signal data is stored as BIL of n channels and each channel composes one record, this item is set as “n”</p> <p>Channel definition of ALOS2 is as follows. Here the number of channels of dual pol. is twice as that of a single pol.</p> <p>Fine (Single Polarization) = 1 channel Spotlight, Ultra-fine/High-sensitive (Single pol.), Fine (Dual pol.), ScanSAR (Single pol.) = 2 channels Ultra-fine (Dual pol.), High-sensitive (Dual pol.)</p> |

Table 3.3-13 SAR Image file descriptor records (4/6)

| Field No. | Byte No. | Type | Description | Remarks |
|------------------------------------|-----------|------|---|---|
| 45 (cont.) | | | | ScanSAR (Dual pol.), Full (Quad.) pol. = 4 channels In the case of ALOS2, set '1' (fixed value) because each polarization is stored in separate files. |
| 46 | 277 - 280 | I4 | Number of bytes of prefix data per record Level 1.1 = 'b544' Level 1.5/3.1 = 'b192' | level 1.1: b544 |
| 47 | 281 - 288 | I8 | Number of bytes of SAR data per record | For level 1.1 products, each data record corresponds to 1 image range line. Each range line begins at the nearest-range pixel and ends at the farthest-range pixel. |
| 48 | 289 - 292 | I4 | Number of bytes of suffix data per record = 'bbb0' (fixed value) | bbb0 |
| 49 | 293 - 296 | A4 | Prefix/suffix repeat flag = 'bbbb' (fixed value) | bbbb |
| PREFIX/SUFFIX DATA LOCATORS | | | | |
| 50 | 297 - 304 | A8 | Sample data line number locator = 'bb13b4PB' 'P': Prefix, 'S': Suffix 'A': ASCII, 'B': Binary, 'N': Numeric | bb13b4PB (Data line number location) 4 bytes from 13 th byte in signal data record |
| 51 | 305 - 312 | A8 | SAR channel number locator = 'bb49b2PB' | bb49b2PB (SAR channel ID location) |
| 52 | 313 - 320 | A8 | Time of SAR data line locator = 'bb45b4PB' | bb45b4PB (Description position of sensor acquiring milli-seconds) |
| 53 | 321 - 328 | A8 | Left-fill count locator = 'bb21b4PB' | bb21b4PB (Description position of number of left-fill) |
| 54 | 329 - 336 | A8 | Right-fill count locator = 'bb29b4PB' | bb29b4PB (Description position of number of right-fill) |
| 55 | 337 - 340 | A4 | Pad pixels present indicator = 'bbbb' | bbbb |
| 56 | 341 - 368 | A28 | Blanks | bbbbbbbbbbbbbbbbbbbbbbbbbbbb |
| 57 | 369 - 376 | A8 | SAR data line quality code locator = 'bb97b4PB' | bb97b4PB (Invalid line flag location) |

Table 3.3-13 SAR Image file descriptor records (5/6)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|---|
| 58 | 377 - 384 | A8 | Calibration information field locator = 'bbbbbbbb' | bbbbbbbb |
| 59 | 385 - 392 | A8 | Gain values field locator = 'bbbbbbbb' | bbbbbbbb |
| 60 | 393 - 400 | A8 | Bias values field locator = 'bbbbbbbb' | bbbbbbbb |
| 61 | 401 - 428 | A28 | SAR data format type indicator Level 1.1 = 'COMPLEX*8bbbbbbbbbbbbbbbbbb' Level 1.5/3.1 = 'UNSIGNEDbINTEGER*2bbbbbbbbbb' | 'UNSIGNEDbINTEGER*2bbbbbbbbbb"U2b' : 2-bytes unsigned integer |
| 62 | 429 - 432 | A4 | SAR data format type code Level 1.1 = 'C*8b' Level 1.5/3.1 = 'U2b' | 'COMPLEX*8bbbbbbbbbbbbbbbbbb"C*8b' : The front half of the 8 bytes field (4 bytes) is two complement notations. Including real value of floating point type, rear half of that is complex representation including imaginary part. And undefined data is stored 0 values. |
| 63 | 433 - 436 | I4 | Number of left fill bits within pixel = 'bbb0' | |
| 64 | 437 - 440 | I4 | Number of right fill bits within pixel = 'bbb0' | bbb0 |
| 65 | 441 - 448 | I8 | Maximum data range of pixel (starting from 0) Level 1.1 = Blank ('bbbbbbbb') Level 1.5/3.1 = 'bbb65535' | |
| 66 | 449 - 452 | I4 | ScanSAR level 1.1 (SPECAN method): Number of burst data in this file (starting from 1) Except ScanSAR level 1.1(SPECAN method): Blanks | For ScanSAR level 1.1(SPECAN method), set number of burst data in image file. Refer to 5.2 Except ScanSAR level 1.1(SPECAN method), set blanks. |
| 67 | 453 - 456 | I4 | ScanSAR level 1.1(SPECAN method): Number of lines per one burst (starting from 1) Except ScanSAR level 1.1(SPECAN method): Blanks | For ScanSAR level 1.1, set number of lines per one burst data (number of lines is the same as each burst data). Refer to 5.2 Except ScanSAR level 1.1 (SPECAN method), set blanks. |

Table 3.3-13 SAR Image file descriptor records (6/6)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|--|
| | | | SCANSAR BURST DATA INFORMATION | |
| 68 | 457 – 460 | I4 | ScanSAR level 1.1 (SPECAN method): Number of overlap lines with adjacent bursts (starting from 0) Except ScanSAR level 1.1 (SPECAN method) Blanks | For ScanSAR level 1.1 (SPECAN method), set number of overlap lines of adjacent burst (If no overlap lines, set 0). Refer to 5.2. Except ScanSAR level 1.1 (SPECAN method), set blanks. |
| 69 | 461 – 720 | A260 | Blanks | Blanks (b*272) |

Table 3.3-14 Signal data records (1/5)

| Field No. | Byte No. | Type | Description | Remarks |
|--|----------|------|--|--|
| 1 | 1 - 4 | B4 | Record sequence number = 2, 3, ...) ₁₀ | Level 1.1 has this record. |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 50) ₁₀ | 32h |
| 3 | 6 - 6 | B1 | Record type code = 10) ₁₀ | 0Ah |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | 14h |
| 6 | 9 - 12 | B4 | Record length | |
| PREFIX DATA-GENERAL INFORMATION | | | | |
| 7 | 13 - 16 | B4 | SAR image data line number = 1, 2, 3 ...) ₁₀ | |
| 8 | 17 - 20 | B4 | SAR image data record index = 1) ₁₀ (fixed value) (indicates the record sequence number in the image line) | |
| 9 | 21 - 24 | B4 | Actual count of left-fill pixels = 0) ₁₀ (fixed value) | |
| 10 | 25 - 28 | B4 | Actual count of data pixels | For level 1.1 products, actual count of data pixels corresponds to the number of 1 image range pixels. Each range line begins at the nearest-range pixel and ends at the farthest-range pixel. |
| 11 | 29 - 32 | B4 | Actual count of right-fill pixels = 0) ₁₀ | |
| PREFIX DATA-SENSOR PARAMETERS | | | | |
| 12 | 33 - 36 | B4 | Sensor parameters update flag = 0) ₁₀ | |
| 13 | 37 - 40 | B4 | Sensor acquisition year Scene start line year | |
| 14 | 41 - 44 | B4 | Sensor acquisition day of year Scene start line day of year | |
| 15 | 45 - 48 | B4 | Sensor acquisition milli-seconds of day | |

Table 3.3-14 Signal data records (2/5)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|---|
| 16 | 49 - 50 | B2 | SAR channel ID Single polarization = 1) ₁₀ Dual polarization = 2) ₁₀ Full (Quad.) pol. = 4) ₁₀ | 0001h |
| 17 | 51 - 52 | B2 | SAR channel code = 0) ₁₀ L = 0) ₁₀ S = 1) ₁₀ C = 2) ₁₀ X = 3) ₁₀ KU = 4) ₁₀ KA = 5) ₁₀ | 0000h |
| 18 | 53 - 54 | B2 | Transmitted pulse polarization Horizontal polarization (H) = 0) ₁₀ Vertical polarization (V) = 1) ₁₀ | 0000h |
| 19 | 55 - 56 | B2 | Received pulse polarization H = 0) ₁₀ V = 1) ₁₀ | 0000h |
| 20 | 57 - 60 | B4 | PRF[mHz] | |
| 21 | 61 - 64 | B4 | Scan ID ScanSAR = 1 to 7) ₁₀ Except ScanSAR = 0) ₁₀ (fixed value) | For ScanSAR level 1.1, set scan number. Refer to 5.2. Except ScanSAR level 1.1, set 0. |
| 22 | 65 - 66 | B2 | Onboard range compressed flag = 0) ₁₀ NO = 0) ₁₀ YES = 1) ₁₀ | 0000h |

A

Table 3.3-14 Signal data records (3/5)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-------------------------------|
| 23 | 67 - 68 | B2 | Chirp type designator LINEAR FM CHIRP = 0) ₁₀ PHASE MODULATORS = 1) ₁₀ | 0000h |
| 24 | 69 - 72 | B4 | Chirp length (pulse width) [nsec] | (Chirp length) |
| 25 | 73 - 76 | B4 | Chirp constant coefficient [Hz] = Nominal value | (Chirp constant coefficient) |
| 26 | 77 - 80 | B4 | Chirp linear coefficient [Hz/μsec] = Nominal value | (Chirp linear coefficient) |
| 27 | 81 - 84 | B4 | Chirp quadratic coefficient [Hz/μsec ²] = Nominal value | (Chirp quadratic coefficient) |
| 28 | 85 - 92 | B8 | Sensor acquisition micro-seconds of day | |
| 29 | 93 - 96 | B4 | Receiver gain [dB] = Nominal value | (Receiver gain) |
| 30 | 97 - 100 | B4 | Invalid line flag NO. (Effective line) = 0) ₁₀ YES (Loss line) = 1) ₁₀ | |
| 31 | 101 - 104 | B4 | Electronic elevation angle at nadir of antenna [deg] | |
| 32 | 105 - 108 | B4 | Mechanical elevation angle at nadir of antenna [deg] | |
| 33 | 109 - 112 | B4 | Electronic antenna squint angle [deg] | |
| 34 | 113 - 116 | B4 | Mechanical antenna squint angle [deg] | |
| 35 | 117 - 120 | B4 | Slant range to 1st data sample [m] | |
| 36 | 121 - 124 | B4 | Data record window position (SAMPLE DELAY[nsec]) | |
| 37 | 125 - 128 | B4 | Spare = Blanks (0: NULL) | Blanks (0: NULL) |

C

Table 3.3-14 Signal data records (4/5)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|--|
| | | | PREFIX DATA-PLATFORM REFERENCE INFORMATION | |
| 38 | 129 - 132 | B4 | Platform position parameters update flag = 0) ₁₀ (fixed value) Repeat = 0) ₁₀ Update = 1) ₁₀ | |
| 39 | 133 - 136 | B4 | Platform latitude [1/1,000,000 deg] = 0) ₁₀ | Blanks (0: NULL) |
| 40 | 137 - 140 | B4 | Platform longitude [1/1,000,000 deg] = 0) ₁₀ | Blanks (0: NULL) |
| 41 | 141 - 144 | B4 | Platform altitude [m] = 0) ₁₀ | Blanks (0: NULL) |
| 42 | 145 - 148 | B4 | Platform ground speed [cm/sec] = 0) ₁₀ | Blanks (0: NULL) |
| 43 | 149 - 160 | 3B4 | Platform velocity X', Y', Z'[cm/sec] = 0) ₁₀ | Blanks (0: NULL) |
| 44 | 161 - 172 | 3B4 | Platform acceleration X'', Y'', Z''[cm/sec ²] = 0) ₁₀ | Blanks (0: NULL) |
| 45 | 173 - 176 | B4 | Platform track angle [1/1,000,000 deg] = 0) ₁₀ | Blanks (0: NULL) |
| 46 | 177 - 180 | B4 | Platform true track angle [1/1,000,000 deg] = 0) ₁₀ | Blanks (0: NULL) |
| 47 | 181 - 184 | B4 | Platform pitch angle [1/1,000,000 deg] = 0) ₁₀ | Blanks (0: NULL) |
| 48 | 185 - 188 | B4 | Platform roll angle [1/1,000,000 deg] = 0) ₁₀ | Blanks (0: NULL) |
| 49 | 189 - 192 | B4 | Platform yaw angle [1/1,000,000 deg] = 0) ₁₀ | Blanks (0: NULL) |
| | | | PREFIX DATA-SENSOR/FACILITY SPECIFIC AUXILIARY DATA | |
| 50 | 193 - 196 | B4 | Latitude of 1 st pixel [1/1,000,000 deg] | |
| 51 | 197 - 200 | B4 | Latitude of center-pixel [1/1,000,000 deg] | The latitude at M/2th pixel is set. (M: number of pixels) |
| 52 | 201 - 204 | B4 | Latitude of last pixel [1/1,000,000 deg] | |
| 53 | 205 - 208 | B4 | Longitude of 1 st pixel [1/1,000,000 deg] | |
| 54 | 209 - 212 | B4 | Longitude of center-pixel [1/1,000,000 deg] | The longitude at M/2th pixel is set. (M: number of pixels) |
| 55 | 213 - 216 | B4 | Longitude of last pixel [1/1,000,000 deg] | |

Table 3.3-14 Signal data records (5/5)

| Field No. | Byte No. | Type | Description | Remarks |
|--------------------------------------|-----------|------|---|--|
| SCANSAR BURST DATA PARAMETERS | | | | |
| 56 | 217 – 220 | B4 | ScanSAR level 1.1 (SPECAN method): Burst number = starting from 0) ₁₀ Except ScanSAR level 1.1 (SPECAN method): Blanks = 0) ₁₀ | ScanSAR level 1.1 (SPECAN method), set 0 at first burst in image file, and continue 1, 2, 3... Except ScanSAR level 1.1 (SPECAN method), set blanks (0). |
| 57 | 221 – 224 | B4 | ScanSAR level 1.1 (SPECAN method): Line number in this burst = starting from 0) ₁₀ Except ScanSAR level 1.1 (SPECAN method) Blanks = 0) ₁₀ | Except ScanSAR level 1.1 (SPECAN method), set line number of 1, 2, 3... in this burst. Except ScanSAR level 1.1 (SPECAN method) is blanks (0). |
| 58 | 225 - 284 | B60 | Blanks = 0) ₁₀ | |
| 59 | 285 - 288 | B4 | ALOS2 frame number = 0) ₁₀ | |
| 60 | 289 - 544 | B256 | PALSAR auxiliary data= 0) ₁₀ | |
| SAR RAW SIGNAL DATA | | | | |
| | 545 - i | jBk | SAR data i: number of bytes of data + 544 j: number of pixels on this record k: pixel size [8byte] | Repeat by the number of pixels |

Table 3.3-15 Processed data records (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|--|----------|------|---|-------------------------------------|
| 1 | 1 - 4 | B4 | Record sequence number = 2, 3, ...) ₁₀ | Only level 1.5/3.1 has this record. |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 50) ₁₀ | |
| 3 | 6 - 6 | B1 | Record type code = 11) ₁₀ | |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | |
| 6 | 9 - 12 | B4 | Record length | |
| PREFIX DATA-GENERAL INFORMATION | | | | |
| 7 | 13 - 16 | B4 | SAR image data line number = 1, 2, 3 ...) ₁₀ | |
| 8 | 17 - 20 | B4 | SAR image data record index = 1) ₁₀ (fixed value) (indicates the record sequence number in the same line) | |
| 9 | 21 - 24 | B4 | Actual count of left-fill pixels = 0) ₁₀ (fixed value) | |
| 10 | 25 - 28 | B4 | Actual count of data pixels | |
| 11 | 29 - 32 | B4 | Actual count of right-fill pixels = 0) ₁₀ | |
| PREFIX DATA-SENSOR PARAMETERS | | | | |
| 12 | 33 - 36 | B4 | Sensor parameters update flag = 0) ₁₀ | |
| 13 | 37 - 40 | B4 | Sensor acquisition year Year of scene start line | |
| 14 | 41 - 44 | B4 | Sensor acquisition day of year Scene start day of year | |
| 15 | 45 - 48 | B4 | Sensor acquisition milliseconds of day = 0) ₁₀ | |

Table 3.3-15 Processed data records (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|---------|
| 16 | 49 - 50 | B2 | SAR channel ID Single polarization = 1) ₁₀ Dual polarization = 2) ₁₀ Full (Quad.) pol. = 4) ₁₀ | |
| 17 | 51 - 52 | B2 | SAR channel code = 0) ₁₀ L = 0) ₁₀ S = 1) ₁₀ C = 2) ₁₀ X = 3) ₁₀ KU = 4) ₁₀ KA = 5) ₁₀ | |
| 18 | 53 - 54 | B2 | Transmitted polarization Horizontal polarization (H) = 0) ₁₀ Vertical polarization (V) = 1) ₁₀ | |
| 19 | 55 - 56 | B2 | Received pulse polarization H = 0) ₁₀ V = 1) ₁₀ | |
| 20 | 57 - 60 | B4 | PRF[mHz] Except ScanSAR mode = The same through the one scene ScanSAR = 0) ₁₀ (fixed value) | |
| 21 | 61 - 64 | B4 | Scan number = 0) ₁₀ (fixed value) | |

A

Table 3.3-15 Processed data records (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|---|-----------|------|---|---|
| 22 | 65 – 68 | B4 | Slant range to 1 st pixel [m] | |
| 23 | 69 – 72 | B4 | Slant range to mid-pixel [m] | |
| 24 | 73 – 76 | B4 | Slant range to last-pixel [m] | |
| 25 | 77 – 80 | B4 | Doppler centroid value at 1 st pixel [1/1,000Hz] | |
| 26 | 81 – 84 | B4 | Doppler centroid value at mid-pixel [1/1,000Hz] | |
| 27 | 85 – 88 | B4 | Doppler centroid value at last pixel [1/1,000Hz] | |
| 28 | 89 – 92 | B4 | Azimuth FM rate of 1 st pixel [Hz/msec] | |
| 29 | 93 – 96 | B4 | Azimuth FM rate of mid-pixel [Hz/msec] | |
| 30 | 97 - 100 | B4 | Azimuth FM rate of last pixel [Hz/msec] | |
| 31 | 101 - 104 | B4 | Look angle of nadir [1/1,000,000 deg] = 0) ₁₀ | |
| 32 | 105 - 108 | B4 | Azimuth squint angle [1/1,000,000 deg] = 0) ₁₀ | |
| 33 | 109 – 128 | B4 | Blanks = 0) ₁₀ | |
| PREFIX DATA-GEOGRAPHIC REFERENCE INFO. | | | | |
| 34 | 129 – 132 | B4 | Geographic ref. Parameter update flag = 0) ₁₀ | |
| 35 | 133 - 136 | B4 | Latitude of 1 st pixel [1/1,000,000 deg] | |
| 36 | 137 - 140 | B4 | Latitude of mid-pixel [1/1,000,000 deg] | The latitude at M/2th pixel is set. (M: number of pixels) |
| 37 | 141 - 144 | B4 | Latitude of last pixel [1/1,000,000 deg] | |
| 38 | 145 - 148 | B4 | Longitude of 1 st pixel [1/1,000,000 deg] | |
| 39 | 149 – 152 | B4 | Longitude of mid-pixel [1/1,000,000 deg] | The longitude at M/2th pixel is set. (M: number of pixels) |
| 40 | 153 – 156 | B4 | Longitude of last pixel [1/1,000,000 deg] | |
| 41 | 157 - 160 | B4 | Northing of 1 st pixel [m] | |
| 42 | 161 – 164 | B4 | Blanks = 0) ₁₀ | |
| 43 | 165 – 168 | B4 | Northing of last pixel [m] | |
| 44 | 169 – 172 | B4 | Easting of 1 st pixel [m] | |
| 45 | 173 – 176 | B4 | Blanks = 0) ₁₀ | |
| 46 | 177 – 180 | B4 | Easting of last pixel [m] | |

Table 3.3-15 Processed data records (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|---------|
| 47 | 181 - 184 | B4 | Line heading (orientation of the perpendicular to the data line center relative to true north) [1/1,000,000 deg] | |
| 48 | 185 - 192 | B8 | Blanks = 0) ₁₀ | |
| | | | SAR PROCESSED DATA | |
| | 193 - i | jBk | SAR processed data i: number of bytes of data + 192 j: number of pixels on this record k: size of pixel in bytes [2byte] | |
| | | | SUFFIX DATA | |
| | | 0*B | Processing Facility specific details | |

Table 3.3-16 SAR Trailer file descriptor (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|----------------------------------|
| 1 | 1 - 4 | B4 | Record number = 1) ₁₀ | 00000001h |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 63) ₁₀ | 3Fh |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | C0h |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | 12h |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 18) ₁₀ | 12h |
| 6 | 9 - 12 | B4 | Record length = 720) ₁₀ | 000002D0h |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Ab |
| 8 | 15 - 16 | A2 | Blanks | bb |
| 9 | 17 - 28 | A12 | Format control document ID = 'CEOS-SARbbbb' | CEOS-SARbbbb |
| 10 | 29 - 30 | A2 | Format control document revision number = 'bA' | bA |
| 11 | 31 - 32 | A2 | Record format revision level = 'bA' | bA |
| 12 | 33 - 44 | A12 | Software release & revision = 'NNN.NNNbbbb' 001.000, 001.001, ... 001.100, ... 002.000 | 001.000bbbb |
| 13 | 45 - 48 | I4 | Number of files = 'bbb1' | bbb1 |
| 14 | 49 - 64 | A16 | File ID = 'MMNbSSSTFFFFbbbb' MM: Mission ID(ALOS2='AL')(*) N: Mission number (=2')(*) SSS: Sensor ID (SAR='SAR')(*) T: Processing level code Level 1.0 = 'A' Level 1.1 = 'B' Level 1.5 = 'C' Level 3.1 = 'D' FFFF : Tile Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | AL2bSARASARTbbbb |
| 15 | 65 - 68 | A4 | Record sequence and location type flag = 'FSEQ' | FSEQ |
| 16 | 69 - 76 | I8 | Sequence number location = 'bbbbbb1' | bbbbbb1 (Record number location) |

A

Table 3.3-16 SAR Trailer file descriptor (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-----------------------------------|
| 17 | 77 - 80 | I4 | Sequence number field length = 'bbb4' | bbb4 (Record number field length) |
| 18 | 81 - 84 | A4 | Record code and location type flag = 'FTYP' | FTYP |
| 19 | 85 - 92 | I8 | Record code location = 'bbbbbb5' | bbbbbb5 (Record code location) |
| 20 | 93 - 96 | I4 | Record code field length = 'bbb4' | bbb4 (Record code field length) |
| 21 | 97 - 100 | A4 | Record length and location type flag = 'FLGT' | FLGT |
| 22 | 101 - 108 | I8 | Record length location = 'bbbbbb9' | bbbbbb9 (Record length location) |
| 23 | 109 - 112 | I4 | Record length field length = 'bbb4' | bbb4 (Record length field length) |
| 24 | 113 - 180 | A68 | Blanks | Blanks (b*68) |
| 25 | 181 - 186 | I6 | Number of data set summary records = 'bbbb0' | bbbb0 |
| 26 | 187 - 192 | I6 | Data set summary record length = 'bbbb0' | bbbb0 |
| 27 | 193 - 198 | I6 | Number of map projection data records = 'bbbb0' | bbbb0 |
| 28 | 199 - 204 | I6 | Map projection record length = 'bbbb0' | bbbb0 |
| 29 | 205 - 210 | I6 | Number of platform position data records = 'bbbb0' | bbbb0 |
| 30 | 211 - 216 | I6 | Platform position record length = 'bbbb0' | bbbb0 |
| 31 | 217 - 222 | I6 | Number of attitude data records = 'bbbb0' | bbbb0 |
| 32 | 223 - 228 | I6 | Attitude data record length = 'bbbb0' | bbbb0 |
| 33 | 229 - 234 | I6 | Number of radiometric data records = 'bbbb0' | bbbb0 |
| 34 | 235 - 240 | I6 | Radiometric record length = 'bbbb0' | bbbb0 |
| 35 | 241 - 246 | I6 | Number of radiometric compensation records = 'bbbb0' | bbbb0 |
| 36 | 247 - 252 | I6 | Radiometric compensation record length = 'bbbb0' | bbbb0 |
| 37 | 253 - 258 | I6 | Number of data quality summary records = 'bbbb0' | bbbb0 |
| 38 | 259 - 264 | I6 | Data quality summary record length = 'bbbb0' | bbbb0 |
| 39 | 265 - 270 | I6 | Number of data histograms records = 'bbbb0' | bbbb0 |
| 40 | 271 - 276 | I6 | Data histogram record length = 'bbbb0' | bbbb0 |
| 41 | 277 - 282 | I6 | Number of range spectra records = 'bbbb0' | bbbb0 |
| 42 | 283 - 288 | I6 | Range spectra record length = 'bbbb0' | bbbb0 |
| 43 | 289 - 294 | I6 | Number of DEM descriptor records = 'bbbb0' | bbbb0 |
| 44 | 295 - 300 | I6 | DEM descriptor record length = 'bbbb0' | bbbb0 |
| 45 | 301 - 306 | I6 | Number of Radar parameter update records = 'bbbb0' | bbbb0 |

Table 3.3-16 SAR Trailer file descriptor (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|----------|
| 46 | 307 - 312 | I6 | Radar parameter update record length = 'bbbbbb0' | bbbbbb0 |
| 47 | 313 - 318 | I6 | Number of Annotation data records = 'bbbbbb0' | bbbbbb0 |
| 48 | 319 - 324 | I6 | Annotation data record length = 'bbbbbb0' | bbbbbb0 |
| 49 | 325 - 330 | I6 | Number of detail processing records = 'bbbbbb0' | bbbbbb0 |
| 50 | 331 - 336 | I6 | Detail processing record length = 'bbbbbb0' | bbbbbb0 |
| 51 | 337 - 342 | I6 | Number of Calibration records = 'bbbbbb0' | bbbbbb0 |
| 52 | 343 - 348 | I6 | Calibration record length = 'bbbbbb0' | bbbbbb0 |
| 53 | 349 - 354 | I6 | Number of GCP records = 'bbbbbb0' | bbbbbb0 |
| 54 | 355 - 360 | I6 | GCP record length = 'bbbbbb0' | bbbbbb0 |
| 55 | 361 - 420 | 10A6 | Spare = Blanks | Blanks |
| 56 | 421 - 426 | I6 | Number of facility data (1) records = 'bbbbbb0' | bbbbbb0 |
| 57 | 427 - 434 | I8 | Facility data (1) record length = 'bbbbbbb0' | bbbbbbb0 |
| 58 | 435 - 440 | I6 | Number of facility data (2) records = 'bbbbbb0' | bbbbbb0 |
| 59 | 441 - 448 | I8 | Facility data (2) record length = 'bbbbbbb0' | bbbbbbb0 |
| 60 | 449 - 454 | I6 | Number of facility data (3) records = 'bbbbbb0' | bbbbbb0 |
| 61 | 455 - 462 | I8 | Facility data (3) record length = 'bbbbbbb0' | bbbbbbb0 |
| 62 | 463 - 468 | I6 | Number of facility data (4) records = 'bbbbbb0' | bbbbbb0 |
| 63 | 469 - 476 | I8 | Facility data (4) record length = 'bbbbbbb0' | bbbbbbb0 |
| 64 | 477 - 482 | I6 | Number of facility data (5) records = 'bbbbbb0' | |
| 65 | 483 - 490 | I8 | Facility data (5) record length = 'bbbbbbb0' | |

Table 3.3-16 SAR Trailer file descriptor (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------------------|-------------------------------|--|---------|
| 66 | 491 – 496 | I6 | Number of low resolution image data records ScanSAR L1.1 = 'bbbb5'~'bbbb7' (Scan number) Except ScanSAR L1.1 = 'bbbb1' | |
| 67 | 497 – 504 | I8 | Low resolution image data 1 record length (Variable) | |
| 68 | 505 - 510 | I6 | Number of pixels of low resolution image data 1 (Variable) | |
| 69 | 511 - 516 | I6 | Number of lines of low resolution image data 1 (Variable) | |
| 70 | 517 - 522 | I6 | Number of bytes per one sample of low resolution image data 1 = 'bbbb2' | |
| | 523 – 522+26*(n-1) | 26*(n-1) | Repetition of bytes 497 to 522 for the number of records(n) of section 66 th | |
| 71 | 523+26*(n-1) - 720 | A(720- (522+26 *(n-1))) | Blanks | |

Table 3.3-17 Low resolution image data records (1/1)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|---------|
| 1 | 1 - i | jBk | Low resolution image data for 16bit i: number of bytes of data j: number of pixels on this record k: size of pixel in bytes = 2 | |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (1/8)

| No. | Record | Location | Items | Definition |
|-----|--------|----------|------------|---|
| 1 | Text | 17 - 56 | Product ID | 'PRODUCT: DDDEFFFGHIbbbbbbbbbbbbbbbbbbbb' DDD: Observation mode SBS: Spotlight mode UBS: Ultra-fine mode (Single pol.) UBD: Ultra-fine mode (Dual pol.) HBS: High-sensitive mode (Single pol.) HBD: High-sensitive mode (Dual pol.) HBQ: High-sensitive mode (Full (Quad.) pol.) FBS: Fine mode (Single pol.) FBD: Fine mode (Dual pol.) FBQ: Fine mode (Full (Quad.) pol.) WBS: ScanSAR nominal [14MHz] mode (Single pol.) WBD: ScanSAR nominal [14MHz] mode (Dual pol.) WWS: ScanSR nominal [28MHz] mode (Single pol.) WWD: ScanSAR nominal [28MHz] mode (Dual pol.) VBS: ScanSAR wide mode (Single pol.) VBD: ScanSAR wide mode (Dual pol.) E : Observation direction L: Left looking R: Right looking FFF: Processing level 1.0: Level 1.0 1.1: Level 1.1 1.5: Level 1.5 3.1: Level 3.1 |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (2/8)

| No. | Record | Location | Items | Definition |
|-----|-----------------------|----------------------|--------------------------|---|
| 1 | Text | 17 - 56 | Product ID | G : Processing option G: Geo-Coded R: Geo-Reference _: Not specified (Underscore) H : Map projection U: UTM P: PS M: MER L: LCC _: Not specified (Underscore) I : Orbit direction (*) A: Ascending D: Descending |
| 2 | Text data set summary | 157 - 196 21 - 52 | Scene ID | 'ORBITb: AAAAABBBBBBCCCC-YYMMDDbbbbbbbbbbb' AAAAA: Satellite ID (= 'ALOS2') BBBBB: Orbit accumulation number of a scene center CCCC: Scene frame number of a scene center - : Separator (hyphen) YYMMDD : Observation date of a scene center (YY: lower 2 figures of a year, MM: month, DD: day) |
| 3 | Data set summary | 711 - 726 | Sampling frequency | Sampling frequency of auxiliary data first frame Relationships between product setting values (left) and accurate values used by processing (right) are as follows: 1) (Setting value) 104.7915957[MHz]: (Accurate value) 1.047915957140240E+08[Hz] 2) (Setting value) 52.3957979[MHz]: (Accurate value) 5.239579785701190E+07[Hz] 3) (Setting value) 34.9305319[MHz]: (Accurate value) 3.493053190467460E+07[Hz] 4) (Setting value) 17.4652660[MHz]: (Accurate value) 1.746526595233730E+07[Hz] |
| 4 | | 727 - 742 | Range gate | AD gate start delay of auxiliary data first frame [µsec] |
| 5 | | 743 - 758 | Range pulse width | Pulse width of ALOS2 signal generator of auxiliary data first frame |
| 6 | | 759 - 762 | Baseband conversion flag | YES/NOT: ALOS2 is baseband conversion (YES) |
| 7 | | 899 - 914 | electronic boresight | Electronic boresight and mechanical boresight is the same definition (the same value) |
| 8 | | 915 - 930 | mechanical boresight | Electronic boresight and mechanical boresight is the same definition (the same value) |
| 9 | | 931 - 934 | Echo tracker On/Off | On/Off: ALOS2 is echo tracker = OFF |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (3/8)

| No. | Record | Location | Items | Definition | | | | | | | | | | | | | | | | | | | | | |
|---|------------------|------------------|---|--|------------------|--|--|--|--|--|---|--|---|--|---|---|---|------------------|------------------|--|---|---|---|------------------|--|
| 10 | Data set summary | 935 - 950 | PRF | Reciprocal of PRI of auxiliary data first frame (1/PRI) | | | | | | | | | | | | | | | | | | | | | |
| 11 | | 983 - 998 | Binary time code of satellite | Time reference of satellite (Tref) | | | | | | | | | | | | | | | | | | | | | |
| 12 | | 999 - 1030 | Clock time of satellite | Time ground reference: UTC (Tgref) | | | | | | | | | | | | | | | | | | | | | |
| 13 | | 1031 - 1046 | Satellite clock increment | Satellite clock counter period (Psc) Observation ground time for a satellite time counter is calculated using the following formula: Ground time (UTC) = Psc×(Tsc-Tref)+ Tgref | | | | | | | | | | | | | | | | | | | | | |
| 14 | | 1767 - 1770 | Calibration mode data location flag and star line number and end number | <p>In the case of no calibration data</p> <table border="1" style="margin-left: 40px;"> <tr> <td colspan="2" style="text-align: center;">Observation mode</td> </tr> <tr> <td colspan="2">Start line number of calibration mode at upper image = 0</td> </tr> <tr> <td colspan="2">End line number of calibration mode at upper image = 0</td> </tr> <tr> <td colspan="2">Start line number of calibration mode at bottom image = 0</td> </tr> <tr> <td colspan="2">End line number of calibration mode at bottom image = 0</td> </tr> </table> <p>In the case of including calibration data at the edge of upper image</p> <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;">l</td> <td style="text-align: center;">m</td> <td style="text-align: center;">n</td> </tr> <tr> <td style="text-align: center;">Calibration mode</td> <td colspan="2" style="text-align: center;">Observation mode</td> </tr> </table> <p>Start line number of calibration mode at upper image = 1 End line number of calibration mode at upper image = m Start line number of calibration mode at bottom image = 0 End line number of calibration mode at bottom image = 0</p> <p>In the case of including calibration data at the edge of bottom image</p> <table border="1" style="margin-left: 40px;"> <tr> <td style="text-align: center;">l</td> <td style="text-align: center;">m</td> <td style="text-align: center;">n</td> </tr> <tr> <td colspan="2" style="text-align: center;">Observation mode</td> <td style="text-align: center;">Calibration mode</td> </tr> </table> <p>Start line number of calibration mode at upper image = 0 End line number of calibration mode at upper image = 0 Start line number of calibration mode at bottom image = m End line number of calibration mode at bottom image = n</p> | Observation mode | | Start line number of calibration mode at upper image = 0 | | End line number of calibration mode at upper image = 0 | | Start line number of calibration mode at bottom image = 0 | | End line number of calibration mode at bottom image = 0 | | l | m | n | Calibration mode | Observation mode | | l | m | n | Observation mode | |
| Observation mode | | | | | | | | | | | | | | | | | | | | | | | | | |
| Start line number of calibration mode at upper image = 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| End line number of calibration mode at upper image = 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Start line number of calibration mode at bottom image = 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| End line number of calibration mode at bottom image = 0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| l | m | n | | | | | | | | | | | | | | | | | | | | | | | |
| Calibration mode | Observation mode | | | | | | | | | | | | | | | | | | | | | | | | |
| l | m | n | | | | | | | | | | | | | | | | | | | | | | | |
| Observation mode | | Calibration mode | | | | | | | | | | | | | | | | | | | | | | | |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (4/8)

| No. | Record | Location | Items | Definition | | | | | | | | | | | | |
|------------------|------------------|---------------------------------|---|---|---|---|------------------|--|---|----|----|---|------------------|------------------|------------------|--|
| 14 | Data set summary | 1767 - 1770 | Calibration mode data location flag and star line number and end number | <p>In the case of including calibration data at the edges of upper and bottom image</p> <table border="1"> <tr> <td>1</td> <td>n</td> </tr> <tr> <td colspan="2">Calibration mode</td> </tr> </table> <p>Start line number of calibration mode at upper image = 1 End line number of calibration mode at upper image = n Start line number of calibration mode at bottom image = 1 End line number of calibration mode at bottom image = n</p> <p>or</p> <table border="1"> <tr> <td>1</td> <td>m1</td> <td>m2</td> <td>n</td> </tr> <tr> <td>Calibration mode</td> <td>Observation mode</td> <td>Calibration mode</td> <td></td> </tr> </table> <p>Start line number of calibration mode at upper image = 1 End line number of calibration mode at upper image = m1 Start line number of calibration mode at bottom image = m2 End line number of calibration mode at bottom image = n</p> | 1 | n | Calibration mode | | 1 | m1 | m2 | n | Calibration mode | Observation mode | Calibration mode | |
| 1 | | n | | | | | | | | | | | | | | |
| Calibration mode | | | | | | | | | | | | | | | | |
| 1 | m1 | m2 | n | | | | | | | | | | | | | |
| Calibration mode | Observation mode | Calibration mode | | | | | | | | | | | | | | |
| 15 | 1835 - 1838 | Parameter auto-set table number | Parameter auto-set of observed auxiliary data acquired at first frame Table number | | | | | | | | | | | | | |
| 16 | 1839 - 1854 | Off-nadir angle | Actual value | | | | | | | | | | | | | |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (5/8)

| No. | Record | Location | Items | Definition |
|-----|--------------------------|-------------|---|--|
| 17 | Data set summary | 1855 - 1858 | Antenna beam number | The number corresponding to each off-nadir angle |
| 18 | Platform position data | 4101 - 4101 | Leap second flag | This flag is "1" if a scene includes line times before and after the TAI-UTC change time. |
| 19 | SAR data file descriptor | 187 - 192 | SAR data record length | |
| 20 | | 275 - 276 | Number of physical records per multi-channel in this file | <p>This item means the number of records that compose BIL when the data observed by multi-channels are stored as BIL in a SAR signal data file. That is, when the signal data is stored as BIL of n channels and each channel composes one record, this item is set as "n"</p> <p>Channel definition of ALOS2 is as follows. Here the number of channels of dual pol. is twice as that of a single pol. Fine (Single pol.) = 1 channel Spotlight, Ultra-fine/High-sensitive (Single pol.), Fine (Dual pol.), SacnSAR (Single pol.) = 2 channels Ultra-fine (Dual pol.), High-sensitive (Dual pol.), ScanSAR (Dual pol.), Full pol. = 4 channels</p> <p>In the case of ALOS2, set '1' (fixed value) because each polarization is stored in separate files.</p> |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (6/8)

| No. | Record | Location | Items | Definition | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|--|--|---|-----------------|------------------|------------------------|----------------|------------|--|---|--|------------------------|---|---|------------------------|---|---|------------------------|---|---|------------------------|---|---|------------------------|---|---|
| 21 | Signal data | 13 - 16 | SAR image data line number | Count up every lines, one frame as one line Default value is 1 in all files | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | | 17 - 20 | SAR image data record index | It means counter if one line data across multi records. Therefore, when 1 line composed of three lines is as follows: <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;"></th> <th style="padding: 5px;">SAR line number</th> <th style="padding: 5px;">SAR record index</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">1st record</td> <td style="padding: 5px; text-align: center;">1</td> <td style="padding: 5px; text-align: center;">1</td> </tr> <tr> <td style="padding: 5px;">2nd record</td> <td style="padding: 5px; text-align: center;">1</td> <td style="padding: 5px; text-align: center;">2</td> </tr> <tr> <td style="padding: 5px;">3rd record</td> <td style="padding: 5px; text-align: center;">1</td> <td style="padding: 5px; text-align: center;">3</td> </tr> <tr> <td style="padding: 5px;">4th record</td> <td style="padding: 5px; text-align: center;">2</td> <td style="padding: 5px; text-align: center;">1</td> </tr> <tr> <td style="padding: 5px;">5th record</td> <td style="padding: 5px; text-align: center;">2</td> <td style="padding: 5px; text-align: center;">2</td> </tr> <tr> <td style="padding: 5px;">6th record</td> <td style="padding: 5px; text-align: center;">2</td> <td style="padding: 5px; text-align: center;">3</td> </tr> <tr> <td style="padding: 5px;">7th record</td> <td style="padding: 5px; text-align: center;">3</td> <td style="padding: 5px; text-align: center;">1</td> </tr> </tbody> </table> ALOS2 is 1(fixed value). | | SAR line number | SAR record index | 1 st record | 1 | 1 | 2 nd record | 1 | 2 | 3 rd record | 1 | 3 | 4 th record | 2 | 1 | 5 th record | 2 | 2 | 6 th record | 2 | 3 | 7 th record | 3 | 1 |
| | | SAR line number | SAR record index | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 st record | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 nd record | 1 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 rd record | 1 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 th record | 2 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 th record | 2 | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 th record | 2 | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 th record | 3 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | 21 - 24 25 - 28 29 - 32 | Actual number of left-fill, actual number of data pixels, actual pixel number of right-fill | <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; width: 100%;"> <tr> <td rowspan="2" style="padding: 5px; vertical-align: middle;">Prefix data</td> <td colspan="3" style="text-align: center; padding: 5px;">← Bytes length of SAR data per record →</td> </tr> <tr> <td style="padding: 5px; text-align: center;">Observation data</td> <td style="padding: 5px; text-align: center;">Undefined data</td> <td style="padding: 5px; text-align: center;">Dummy data</td> </tr> <tr> <td colspan="2" style="padding: 5px; text-align: center;">Actual number of data pixels = Number of samples</td> <td colspan="2" style="padding: 5px; text-align: center;">Actual number of pixels of right-filled = (SAR data length - Number of samples *2)/2</td> </tr> </table> Actual number of pixels of left-filled is 0 (fixed value). | Prefix data | ← Bytes length of SAR data per record → | | | Observation data | Undefined data | Dummy data | Actual number of data pixels = Number of samples | | Actual number of pixels of right-filled = (SAR data length - Number of samples *2)/2 | | | | | | | | | | | | | | | |
| Prefix data | ← Bytes length of SAR data per record → | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Observation data | Undefined data | Dummy data | | | | | | | | | | | | | | | | | | | | | | | | | |
| Actual number of data pixels = Number of samples | | Actual number of pixels of right-filled = (SAR data length - Number of samples *2)/2 | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (7/8)

| No. | Record | Location | Items | Definition |
|-----|-------------|-----------|-------------------------------|---|
| 24 | Signal data | 97 - 100 | Invalid line flag | Invalid line flag is where: 0: NO. (Normal data) 1: YES (The line is treated as a loss line) When extracting ALOS2 frame data, If I or Q has 1 or more packet loss (discontinuity in the packet sequence counter), this flag is YES. |
| 25 | | 117 - 120 | Slant range to the first data | Calculation formula of near range is where: $R_n = T_0 \times c / 2$ $T_0 = \text{Trange0} + n \times \text{Tpri} + T_{\text{ADSTART}} + \text{Tchdelay}$ Rn: Near range distance T0: Time to receiving from transmitting c: Speed of light (Constant) Trange0: Time corrected range zero n: Number of pulses received round trip (including in auxiliary data) Tpri: PRI (including in auxiliary data) T _{ADSTART} : AD gate start delay (including in auxiliary data) Tchdelay: Delay time between CHs |

Table 3.3-18 Definition of items written in CEOS level 1.1/1.5/3.1 format (8/8)

| No. | Record | Location | Items | Definition |
|-----|-------------|-----------|---|--|
| 26 | Signal data | 121 - 124 | Data record window location (SAMPLEDELAY[nsec]) | SAMPLEDELAY is calculated using the following formula: $T_{sdlay} = T_{range0} + T_{ADSTART} + T_{chdelay}$ T _{range0} : range zero corrected time T _{ADSTART} : AD gate start delay (including auxiliary data) T _{chdelay} : Delay time between CH |
| 27 | | 285 - 288 | ALOS2 frame number | Extract and set a frame number per each frame. |
| 28 | | 289 - 544 | Auxiliary data | Extract and set (raw) auxiliary data per each frame. |
| 29 | | 545 - | SAR data | “SAR data” is shown in No. 19, it is composed of ALOS2 data, undefined data and dummy data. Dummy data is filled with 0 (NULL) values until it reaches the fixed value frame length in level 1.0 processing. |

**Table 3.3-19 Relationship between Antenna Beam Number and Parameters
for Spotlight Mode (Single Polarization)**

| Beam No. | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|-----------|------------------------|------------------|--------------|-------------------------|-------------------------------|
| 1 (8.0) | 7.3 | 1853 | 2670 | 104.8 | 2 |
| 2 (15.0) | 13.6 | 1853 | 2670 | 104.8 | 2 |
| 3 (20.0) | 18.1 | 1853 | 2670 | 104.8 | 2 |
| 4 (25.0) | 22.6 | 1853 | 2670 | 104.8 | 2 |
| 5 (30.0) | 27.1 | 1853 | 2670 | 104.8 | 2 |
| 6 (35.0) | 31.5 | 1853 | 2670 | 104.8 | 2 |
| 7 (37.0) | 33.22 | 1853 | 2670 | 104.8 | 2 |
| 8 (40.0) | 35.8 | 1853 | 2670 | 104.8 | 2 |
| 9 (45.0) | 40.1 | 1853 | 2670 | 104.8 | 2 |
| 10 (50.0) | 44.2 | 1853 | 2670 | 104.8 | 2 |
| 11 (55.0) | 48.2 | 1853 | 2670 | 104.8 | 2 |
| 12 (60.0) | 52.0 | 1853 | 2670 | 104.8 | 2 |
| 13 (65.0) | 55.6 | 1853 | 2670 | 104.8 | 2 |
| 14 (70.0) | 58.8 | 1853 | 2670 | 104.8 | 2 |

* The values in brackets show the incidence angles at beam center. Here, the incidence angles are described 18.0, 37.0 degrees and the values in every 5 degrees from 15 to 70 degrees because the spotlight mode does not have the concept of the number of beams.

**Table 3.3-20 Relationship between Antenna Beam Number and Parameters
for Ultra Fine Mode (Single/Dual Polarization)**

| Beam No. | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|----------|------------------------|------------------|--------------|-------------------------|-------------------------------|
| 1 | 9.6 | 1626 | 1970 | 104.8 | 2 |
| 2 | 13.9 | 1626 | 1970 | 104.8 | 2 |
| 3 | 18.0 | 1626 | 1970 | 104.8 | 2 |
| 4 | 21.9 | 1626 | 1970 | 104.8 | 2 |
| 5 | 25.6 | 1626 | 1970 | 104.8 | 2 |
| 6 | 29.1 | 1626 | 1970 | 104.8 | 2 |
| 7 | 32.4 | 1626 | 1970 | 104.8 | 2 |
| 8 | 35.4 | 1626 | 1970 | 104.8 | 2 |
| 9 | 38.2 | 1626 | 1970 | 104.8 | 2 |
| 10 | 40.6 | 1626 | 1970 | 104.8 | 2 |
| 11 | 42.7 | 1626 | 1970 | 104.8 | 2 |
| 12 | 44.7 | 1626 | 1970 | 104.8 | 2 |
| 13 | 46.4 | 1626 | 1970 | 104.8 | 2 |
| 14 | 48.0 | 1626 | 1970 | 104.8 | 2 |
| 15 | 49.5 | 1626 | 1970 | 104.8 | 2 |
| 16 | 50.9 | 1626 | 1970 | 104.8 | 2 |
| 17 | 52.1 | 1626 | 1970 | 104.8 | 2 |
| 18 | 53.3 | 1626 | 1970 | 104.8 | 2 |
| 19 | 54.3 | 1626 | 1970 | 104.8 | 2 |
| 20 | 55.3 | 1626 | 1970 | 104.8 | 2 |
| 21 | 56.2 | 1626 | 1970 | 104.8 | 2 |
| 22 | 57.0 | 1626 | 1970 | 104.8 | 2 |
| 23 | 57.7 | 1626 | 1970 | 104.8 | 2 |
| 24 | 58.4 | 1626 | 1970 | 104.8 | 2 |

**Table 3.3-21 Relationship between Antenna Beam Number and Parameters
for High-sensitive Mode (Single/Dual Polarization)**

| Beam No. | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|----------|------------------------|------------------|--------------|-------------------------|-------------------------------|
| 1 | 9.6 | 1477 | 1570 | 52.4 | 2 |
| 2 | 13.9 | 1477 | 1570 | 52.4 | 2 |
| 3 | 18.0 | 1477 | 1570 | 52.4 | 2 |
| 4 | 21.9 | 1477 | 1570 | 52.4 | 2 |
| 5 | 25.6 | 1477 | 1570 | 52.4 | 2 |
| 6 | 29.1 | 1477 | 1570 | 52.4 | 2 |
| 7 | 32.4 | 1477 | 1570 | 52.4 | 2 |
| 8 | 35.4 | 1477 | 1570 | 52.4 | 2 |
| 9 | 38.2 | 1477 | 1570 | 52.4 | 2 |
| 10 | 40.6 | 1477 | 1570 | 52.4 | 2 |
| 11 | 42.7 | 1477 | 1570 | 52.4 | 2 |
| 12 | 44.7 | 1477 | 1570 | 52.4 | 2 |
| 13 | 46.4 | 1477 | 1570 | 52.4 | 2 |
| 14 | 48.0 | 1477 | 1570 | 52.4 | 2 |
| 15 | 49.5 | 1477 | 1570 | 52.4 | 2 |
| 16 | 50.9 | 1477 | 1570 | 52.4 | 2 |
| 17 | 52.1 | 1477 | 1570 | 52.4 | 2 |
| 18 | 53.3 | 1477 | 1570 | 52.4 | 2 |
| 19 | 54.3 | 1477 | 1570 | 52.4 | 2 |
| 20 | 55.3 | 1477 | 1570 | 52.4 | 2 |
| 21 | 56.2 | 1477 | 1570 | 52.4 | 2 |
| 22 | 57.0 | 1477 | 1570 | 52.4 | 2 |
| 23 | 57.7 | 1477 | 1570 | 52.4 | 2 |
| 24 | 58.4 | 1477 | 1570 | 52.4 | 2 |

**Table 3.3-22 Relationship between Antenna Beam Number and Parameters
for Fine Mode (Single/Dual Polarization)**

| Beam No. | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|----------|------------------------|------------------|--------------|-------------------------|-------------------------------|
| 1 | 10.3 | 1861 | 2180 | 34.9 | 2 |
| 2 | 16.0 | 1861 | 2180 | 34.9 | 2 |
| 3 | 21.4 | 1861 | 2180 | 34.9 | 2 |
| 4 | 26.4 | 1861 | 2180 | 34.9 | 2 |
| 5 | 30.9 | 1861 | 2180 | 34.9 | 2 |
| 6 | 34.9 | 1861 | 2180 | 34.9 | 2 |
| 7 | 38.4 | 1861 | 2180 | 34.9 | 2 |
| 8 | 41.0 | 1861 | 2180 | 34.9 | 2 |
| 9 | 43.1 | 1861 | 2180 | 34.9 | 2 |
| 10 | 45.0 | 1861 | 2180 | 34.9 | 2 |
| 11 | 46.7 | 1861 | 2180 | 34.9 | 2 |
| 12 | 48.3 | 1861 | 2180 | 34.9 | 2 |
| 13 | 49.7 | 1861 | 2180 | 34.9 | 2 |
| 14 | 51.1 | 1861 | 2180 | 34.9 | 2 |
| 15 | 52.3 | 1861 | 2180 | 34.9 | 2 |
| 16 | 53.4 | 1861 | 2180 | 34.9 | 2 |
| 17 | 54.5 | 1861 | 2180 | 34.9 | 2 |
| 18 | 55.4 | 1861 | 2180 | 34.9 | 2 |
| 19 | 56.3 | 1861 | 2180 | 34.9 | 2 |
| 20 | 57.1 | 1861 | 2180 | 34.9 | 2 |
| 21 | 57.9 | 1861 | 2180 | 34.9 | 2 |
| 22 | 58.6 | 1861 | 2180 | 34.9 | 2 |

**Table 3.3-23 Relationship between Antenna Beam Number and Parameters
for ScanSAR nominal [14MHz] Mode (Single/Dual Polarization)**

| Scan Mode | Scan No. (Beam No.) | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|-----------|---------------------------|---------------------------|---------------------|-----------------|-------------------------------|----------------------------------|
| 1 | 1 | 9.0 | 1249 | 1860 | 17.5 | 2 |
| | 2 | 15.0 | 1249 | 1860 | 17.5 | 2 |
| | 3 | 20.7 | 1249 | 1860 | 17.5 | 2 |
| | 4 | 25.9 | 1249 | 1860 | 17.5 | 2 |
| | 5 | 30.6 | 1249 | 1860 | 17.5 | 2 |
| 2 | 1 | 20.7 | 1249 | 1860 | 17.5 | 2 |
| | 2 | 25.9 | 1249 | 1860 | 17.5 | 2 |
| | 3 | 30.6 | 1249 | 1860 | 17.5 | 2 |
| | 4 | 34.8 | 1249 | 1860 | 17.5 | 2 |
| | 5 | 38.5 | 1249 | 1860 | 17.5 | 2 |
| 3 | 1 | 41.8 | 1249 | 1860 | 17.5 | 2 |
| | 2 | 44.7 | 1249 | 1860 | 17.5 | 2 |
| | 3 | 47.2 | 1249 | 1860 | 17.5 | 2 |
| | 4 | 49.5 | 1249 | 1860 | 17.5 | 2 |
| | 5 | 51.5 | 1249 | 1860 | 17.5 | 2 |
| 4 | 1 | 53.2 | 1249 | 1860 | 17.5 | 2 |
| | 2 | 54.7 | 1249 | 1860 | 17.5 | 2 |
| | 3 | 56.1 | 1249 | 1860 | 17.5 | 2 |
| | 4 | 57.3 | 1249 | 1860 | 17.5 | 2 |
| | 5 | 58.3 | 1249 | 1860 | 17.5 | 2 |

**Table 3.3-24 Relationship between Antenna Beam Number and Parameters
for ScanSAR nominal [28MHz] Mode (Single/Dual Polarization)**

| Scan Mode | Scan No. (Beam No.) | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|-----------|---------------------------|---------------------------|---------------------|-----------------|-------------------------------|----------------------------------|
| 1 | 1 | 9.0 | 1249 | 1860 | 34.9 | 2 |
| | 2 | 15.0 | 1249 | 1860 | 34.9 | 2 |
| | 3 | 20.7 | 1249 | 1860 | 34.9 | 2 |
| | 4 | 25.9 | 1249 | 1860 | 34.9 | 2 |
| | 5 | 30.6 | 1249 | 1860 | 34.9 | 2 |
| 2 | 1 | 20.7 | 1249 | 1860 | 34.9 | 2 |
| | 2 | 25.9 | 1249 | 1860 | 34.9 | 2 |
| | 3 | 30.6 | 1249 | 1860 | 34.9 | 2 |
| | 4 | 34.8 | 1249 | 1860 | 34.9 | 2 |
| | 5 | 38.5 | 1249 | 1860 | 34.9 | 2 |
| 3 | 1 | 41.8 | 1249 | 1860 | 34.9 | 2 |
| | 2 | 44.7 | 1249 | 1860 | 34.9 | 2 |
| | 3 | 47.2 | 1249 | 1860 | 34.9 | 2 |
| | 4 | 49.5 | 1249 | 1860 | 34.9 | 2 |
| | 5 | 51.5 | 1249 | 1860 | 34.9 | 2 |
| 4 | 1 | 53.2 | 1249 | 1860 | 34.9 | 2 |
| | 2 | 54.7 | 1249 | 1860 | 34.9 | 2 |
| | 3 | 56.1 | 1249 | 1860 | 34.9 | 2 |
| | 4 | 57.3 | 1249 | 1860 | 34.9 | 2 |
| | 5 | 58.3 | 1249 | 1860 | 34.9 | 2 |

**Table 3.3-25 Relationship between Antenna Beam Number and Parameters
for ScanSAR wide Mode (Single/Dual Polarization)**

| Scan Mode | Scan No. (Beam No.) | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|-----------|---------------------------|---------------------------|---------------------|-----------------|-------------------------------|----------------------------------|
| 1 | 1 | 9.1 | 1249 | 1860 | 17.5 | 2 |
| | 2 | 15.1 | 1249 | 1860 | 17.5 | 2 |
| | 3 | 20.7 | 1249 | 1860 | 17.5 | 2 |
| | 4 | 26.2 | 1249 | 1860 | 17.5 | 2 |
| | 5 | 30.8 | 1249 | 1860 | 17.5 | 2 |
| | 6 | 34.9 | 1249 | 1860 | 17.5 | 2 |
| | 7 | 38.6 | 1249 | 1860 | 17.5 | 2 |
| 2 | 1 | 34.9 | 1249 | 1860 | 17.5 | 2 |
| | 2 | 38.6 | 1249 | 1860 | 17.5 | 2 |
| | 3 | 41.8 | 1249 | 1860 | 17.5 | 2 |
| | 4 | 44.7 | 1249 | 1860 | 17.5 | 2 |
| | 5 | 47.3 | 1249 | 1860 | 17.5 | 2 |
| | 6 | 49.5 | 1249 | 1860 | 17.5 | 2 |
| | 7 | 51.5 | 1249 | 1860 | 17.5 | 2 |
| 3 | 1 | 49.5 | 1249 | 1860 | 17.5 | 2 |
| | 2 | 51.5 | 1249 | 1860 | 17.5 | 2 |
| | 3 | 53.2 | 1249 | 1860 | 17.5 | 2 |
| | 4 | 54.7 | 1249 | 1860 | 17.5 | 2 |
| | 5 | 56.1 | 1249 | 1860 | 17.5 | 2 |
| | 6 | 57.3 | 1249 | 1860 | 17.5 | 2 |
| | 7 | 58.3 | 1249 | 1860 | 17.5 | 2 |

**Table 3.3-26 Relationship between Antenna Beam Number and Parameters
for High-sensitive Mode (Full (Quad.) Polarimetry)**

| Beam No. | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|----------|------------------------|------------------|--------------|-------------------------|-------------------------------|
| 1 | 17.5 | 2392 | 3000 | 52.4 | 2 |
| 2 | 21.3 | 2392 | 3000 | 52.4 | 2 |
| 3 | 24.8 | 2392 | 3000 | 52.4 | 2 |
| 4 | 27.8 | 2392 | 3000 | 52.4 | 2 |
| 5 | 30.2 | 2392 | 3000 | 52.4 | 2 |
| 6 | 32.5 | 2392 | 3000 | 52.4 | 2 |
| 7 | 34.7 | 2392 | 3000 | 52.4 | 2 |

**Table 3.3-27 Relationship between Antenna Beam Number and Parameters
for Fine Mode (Full (Quad.) Polarimetry)**

| Beam No. | Off-nadir Angle [deg.] | Nominal PRF [Hz] | Max PRF [Hz] | Sampling Frequency [Hz] | No. of Bytes per Pixel [byte] |
|----------|------------------------|------------------|--------------|-------------------------|-------------------------------|
| 1 | 19.5 | 3623 | 3640 | 52.4 | 2 |

4. Summary Information

The summary information on CEOS level 1.1/1.5/3.1 is shown in below.

4.1. Outline of Summary Information

The summary information file includes the information for creating processed data created at ALOS-2 Data Processing System, and it is always made in a pair with its processed data.

4.2. Filename of Summary Information

The filename of summary information is fixed as follows.

summary.txt

4.3. File Format of Summary Information

The summary information file consists of some record lines which use LF (line feed code) as a termination, and does not include header information, footer information, etc. A record line consists of a keyword, an equal mark (=), and a value. A summary information file format outline is shown in Figure 4.3-1.

| | | | |
|---------|-----|-------|-----|
| Keyword | = | Value | LF |
| ... | ... | ... | ... |
| Keyword | = | Value | LF |

Figure 4.3-1 Outline of Summary Information File Format

4.3.1. Format Definition of Keyword

- (1) The keyword is stored from the head of a record line.
- (2) The equal mark '=' is stored after the keyword.
- (3) There is no blank character between a keyword and '=', in principle.

4.3.2. Format Definition of Value

- (1) The value is a text string bundled with double quotation letters (").
- (2) The value can contain alphabets, digits, and some special characters (except for double quotation). Numerical values are also stored as an ASCII string.
- (3) There is no blank character between '=' and the former double quotation letter, in principle.

4.3.3. Contents of Summary Information

The items of the CEOS Level 1.1/1.5/3.1 summary information are described in Table 4.3-1. "b" in a table means blanks.

Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (1/8)

| No. | Section | Item name | Keyword | Value |
|-----|----------------------------|--------------------------|------------------|---|
| 1 | Ordering information (Odi) | Scene description ID | Odi_SceneId | ID for specifying a scene uniquely 'AAAAAAAAAAAAAAAAA-NNNNN-xxx-nnn' AAAAAAAAAAAAAAAAA: Operation Segment No NNNNN: Observation ID xxx: 001~999 nnn: Scene no. |
| 2 | | Processed Site/Date/Time | Odi_SiteDateTime | Spacecraft Control Mission Operation system = 'PROCESS: JAPAN-JAXA-ALOS2-SCMObbYYYYMMDDbHHMMSS' Earth Intelligence Collection and Shearing System = 'PROCESS: JAPAN-JAXA-ALOS2-EICSbbYYYYMMDDbHHMMSS' YYYYMMDD : Processed date (YYYY: year, MM: month, DD: day) HHMMSS : Processed time (UTC) |
| 3 | Scene specification (Scs) | Scene ID | Scs_SceneID | 'AAAAABBBBBCCCC-YYMMDD' AAAAA : Satellite name (= 'ALOS2') BBBBB : Orbit accumulation number of a scene center CCCC : Scene frame number of a scene center - : separator (hyphen) YYMMDD: Observation date of scene center |
| 4 | | Amount of scene shift | Scs_SceneShift | '-5'~'4' : Except ScanSAR mode '-25'~'20' : ScanSAR mode Zero and positive number have no sign. |

Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (2/8)

| No. | Section | Item name | Keyword | Value |
|-----|-----------------------------|------------|---------------|--|
| 5 | Product specification (Pds) | Product ID | Pds_ProductID | 'DDDEFFFGHI' DDD: Observation mode SBS: Spotlight mode UBS: Ultra-fine mode (Single pol.) UBD: Ultra-fine mode (Dual pol.) HBS: High-sensitive mode (Single pol.) HBD: High-sensitive mode (Dual pol.) HBQ: High-sensitive mode (Full (Quad.) pol.) FBS: Fine mode (Single pol.) FBD: Fine mode (Dual pol.) FBQ: Fine mode (Full (Quad.) pol.) WBS: ScanSAR nominal [14MHz] mode (Single pol.) WBD: ScanSAR nominal [14MHz] mode (Dual pol.) WWS: ScanSR nominal [28MHz] mode (Single pol.) WWD: ScanSR nominal [28MHz] mode (Dual pol.) VBS: ScanSAR wide mode (Single pol.) VBD: ScanSAR wide mode (Dual pol.) E : Observation direction L: Left looking, R: Right looking FFF: Processing level 1.0: Level 1.0, 1.1: Level 1.1, 1.5: Level 1.5, 3.1: Level 3.1 G : Processing option G: Geo-Coded, R: Geo-Reference, _ : n/a (underscore) H : Map projection type U: UTM, P: PS, M: MER, L: LCC, _ :n/a (underscore) I : Orbit direction A: Ascending, D: Descending |

Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (3/8)

| No. | Section | Item name | Keyword | Value |
|-----|-----------------------------|----------------------------------|---|--|
| 6 | Product specification (Pds) | Resampling method | Pds_ResamplingMethod | 'NN' / 'BL' / 'CC' (specify only for level 1.5/3.1 product) Nearest Neighbor / Bi-Linear / Cubic Convolution |
| 7 | | UTM zone no. | Pds_UTM_ZoneNo | '1'~'60' (specify only for level 1.5/3.1 UTM projected product) |
| 8 | | PS reference latitude | Pds_PS_ReferenceLatitude | Northern Hemisphere: '90.000', Southern Hemisphere: '-90.000' (specify only for level 1.5/3.1 PS projected product) |
| 9 | | PS reference longitude | Pds_PS_ReferenceLongitude | '-179.999' ≤ reference longitude ≤ '180.000' (specify only for level 1.5/3.1 PS projected product) |
| 10 | | LCC reference latitudinal line 1 | Pds_LCC_ReferenceLatitudinalLine1 | '-90.000' < reference latitude < '90.000' (specify only for level 1.5/3.1 LCC projected product) |
| 11 | | LCC reference latitudinal line 2 | Pds_LCC_ReferenceLatitudinalLine2 | '-90.000' < reference latitude < '90.000' (specify only for level 1.5/3.1 LCC projected product) |
| 12 | | Map direction | Pds_MapDirection | 'MapNorth' (specify only for level 1.5/3.1 geocoded product) |
| 13 | | LCC origin latitude | Pds_LCC_OriginLatitude | '-90.000' ≤ origin latitude ≤ '90.000' (specify only for level 1.5/3.1 LCC projected product) |
| 14 | LCC origin longitude | Pds_LCC_OriginLongitude | '-179.999' ≤ origin longitude ≤ '180.000' (specify only for level 1.5/3.1 LCC projected product) | |

A

Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (4/8)

| No. | Section | Item name | Keyword | Value |
|-----|-------------------------------------|-----------------------------------|--|---|
| 15 | Product specification (Pds) | Pixel spacing | Pds_PixelSpacing | unit: m (specify only for level 1.5/3.1 product) |
| 16 | | Precision of orbit data | Pds_OrbitDataPrecision | 'Precision' / 'Onboard' / 'RARR_Predict' Precision : High precision orbit information Onboard : Onboard orbit determination RARR_Predict : Predicted orbit information |
| 17 | | Precision of attitude data | Pds_AttitudeDataPrecision | 'Onboard' Onboard : Onboard attitude determination |
| 18 | Image information (Img) | Date and time of scene center | Img_SceneCenterDateTime | 'YYYYMMDDbh: mm: ss.ttt'(UT) YYYY : Year (A.D.) |
| 19 | | Date and time of scene start | Img_SceneStartDateTime | MM : Month (01~12) DD : Day (01~31) |
| 20 | | Date and time of scene end | Img_SceneEndDateTime | hh : Hour (00~23) mm : Minute (00~59) ss : Second (00~60) (ss=60 is used only by a leap second.) ttt : Milli-second (000~999) |
| 21 | | Latitude of image scene center | Img_ImageSceneCenterLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 22 | | Longitude of image scene center | Img_ImageSceneCenterLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 23 | | Latitude of image scene Left-Top | Img_ImageSceneLeftTopLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 24 | | Longitude of image scene Left-Top | Img_ImageSceneLeftTopLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 25 | Latitude of image scene Right-Top | Img_ImageSceneRightTopLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. | |
| 26 | Longitude of image scene Right-Top | Img_ImageSceneRightTopLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. | |
| 27 | Latitude of image scene Left-Bottom | Img_ImageSceneLeftBottomLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. | |

Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (5/8)

| No. | Section | Item name | Keyword | Value |
|-----|-------------------------|---------------------------------------|------------------------------------|--|
| 28 | Image information (Img) | Longitude of image scene Left-Bottom | Img_ImageSceneLeftBottomLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 29 | | Latitude of image scene Right-Bottom | Img_ImageSceneRightBottomLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 30 | | Longitude of image scene Right-Bottom | Img_ImageSceneRightBottomLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 31 | | Latitude of frame scene center | Img_FrameSceneCenterLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 32 | | Longitude of frame scene center | Img_FrameSceneCenterLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 33 | | Latitude of frame scene Left-Top | Img_FrameSceneLeftTopLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 34 | | Longitude of frame scene Left-Top | Img_FrameSceneLeftTopLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 35 | | Latitude of frame scene Right-Top | Img_FrameSceneRightTopLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 36 | | Longitude of frame scene Right-Top | Img_FrameSceneRightTopLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 37 | | Latitude of frame scene Left-Bottom | Img_FrameSceneLeftBottomLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 38 | | Longitude of frame scene Left-Bottom | Img_FrameSceneLeftBottomLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 39 | | Latitude of frame scene Right-Bottom | Img_FrameSceneRightBottomLatitude | '-90.000'~'90.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 40 | | Longitude of frame scene Right-Bottom | Img_FrameSceneRightBottomLongitude | '-179.999'~'180.000' [degree] (specify only for level 1.5/3.1 product) Third decimal places are not omissible. Zero and positive number have no sign. |
| 41 | | | Off-nadir angle | Img_OffNadirAngle |

Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (6/8)

| No. | Section | Item name | Keyword | Value |
|-----|---------------------------|--|---|---|
| 42 | Product information (Pdi) | Data size of product | Pdi_ProductDataSize | unit: Mbyte = 1024Kbyte Rounded off by the 2nd place of a decimal point. The first place of a decimal is not omissible. |
| 43 | | Number of files in level 1.1/1.5/3.1 product | Pdi_CntOfL11ProductFileName Pdi_CntOfL15ProductFileName Pdi_CntOfL31ProductFileName | Spotlight mode: 4 files High-sensitive/Fine modes (Single pol.) : 4 files High-sensitive/Fine modes (Dual pol.) : 5 files ScanSAR mode (Single pol.): 4 files ScanSAR mode (Dual pol.): 5 files High-sensitive/Fine modes (Full (Quad.) pol.): 7 files * Level 1.1 ScanSAR mode product: ScanSAR nominal mode (Single pol.) : 8 files ScanSAR wide mode (Single pol.) : 10 files ScanSAR nominal mode (Dual pol.) : 13 files ScanSAR wide mode (Dual pol.) : 17 files |
| 44 | | Filename of level 1.1/1.5/3.1 product | Pdi_L11ProductFileNamenn Pdi_L15ProductFileNamenn Pdi_L31ProductFileNamenn nn: 01~99 | Volume directory file 'VOL-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPPP' Leader file 'LED-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPPP' Image file 'IMG-XX-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPPP' Image file (Level 1.1 wide mode product) 'IMG-XX-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPPP-YZ' Trailer file 'TRL-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPPP' SSSSSSSSSSSSSSSSSSSS : Scene ID PPPPPPPPPP : Product ID XX : Polarization (HH, HV, VH, VV) (in order of Tx-Rx) Y : Processing mode(F: Full aperture, B: Burst) Z : Scan number (1-7) |
| 45 | | Bits per pixel | Pdi_BitPixel | 'NN' 16: Level 1.5/3.1 (specify only for level 1.5/3.1 product) |

A

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Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (7/8)

| No. | Section | Item name | Keyword | Value |
|-----|----------------------------|---|---|--|
| 46 | Product information (Pdi) | Number of pixels | Pdi_NoOfPixels_N N: Scan no. ('1-7' for Level 1.1 Wide mode product, '0' for others) | '0' - '99999' (Zero-suppressible) The number of pixels of the SAR signal data in signal data record (prefix is not included). |
| 47 | | Number of lines | Pdi_NoOfLines_N N: Scan no. ('1-7' for Level 1.1 Wide mode product, '0' for others) | '0' - '99999' (Zero-suppressible) The number of lines of the SAR signal data in signal data record (file descriptor is not included). |
| 48 | | Product format | Pdi_ProductFormat | 'CEOS' (fixed value) |
| 49 | Result of auto check (Ach) | Checking result of Time data | Ach_TimeCheck | 'GOOD' / 'POOR' GOOD: All lines are GPS-aligned, POOR: other than GOOD |
| 50 | | Checking result of attitude data | Ach_AttitudeCheck | 'GOOD' / 'POOR' GOOD: other than POOR. POOR: There are two or more lines which the posture and the rate are not converging. |
| 51 | | Status of absolute navigation | Ach_AbsoluteNavigationStatus | blank |
| 52 | | Checking result of house keeping data | Ach_HouseKeepingDataCheck | 'GOOD' / 'FAIR' FAIR: There are one or more FAIR(s) among check items. |
| 53 | | Checking result of orbit data | Ach_OrbitCheck | 'GOOD' / 'FAIR' GOOD: All values are normal. FAIR: All abnormal values are interpolated correctly. |
| 54 | | Checking result of on-board attitude data | Ach_OnBoardAttitudeCheck | 'GOOD' / 'FAIR' GOOD: All values are normal. FAIR: All abnormal values are interpolated correctly. |
| 55 | | Loss lines | Ach_LossLines | 'GOOD' / 'FAIR' / 'POOR' GOOD: There is no loss line. FAIR: Number of loss line is 1 or more, but is not more than threshold value. POOR: Number of loss line is more than threshold value. |
| 56 | | Absolute navigation time | Ach_AbsoluteNavigationTime | blank |
| 57 | | Checking result of PRF change | Ach_PRF_Check | blank |

Table 4.3-1 Summary information for CEOS Level 1.1/1.5/3.1 product (8/8)

| No. | Section | Item name | Keyword | Value |
|-----|----------------------------|-------------------------------------|--------------------------|---|
| 58 | Result of auto check (Ach) | Checking result of calibration data | Ach_CalibrationDataCheck | blank |
| 59 | Result information (Rad) | Practice result code | Rad_PracticeResultCode | 'GOOD' / 'FAIR' GOOD: normal FAIR: A product can be created by interpolating |
| 60 | Label information (Lbi) | Satellite name | Lbi_Satellite | 'ALOS2' (fixed value) |
| 61 | | Sensor name | Lbi_Sensor | 'SAR' (fixed value) |
| 62 | | Processing level | Lbi_ProcessLevel | '1.0' / '1.1' / '1.5' / '3.1' |
| 63 | | Processing facility | Lbi_ProcessFacility | 'SCMO' / 'EICS' SCMO : Spacecraft Control Mission Operation system EICS : Earth Intelligence Collection and Shearing System |
| 64 | | Observation date | Lbi_ObservationDate | 'YYYYMMDD' YYYYMMDD : (YYYY: year, MM: month, DD: day) |

5. Appendix

5.1. Thumbnail Image

A thumbnail image is generated by transforming a processed data type to 8 bit integer and by averaging pixels to be 50, 100 or 500m spacing (spotlight, High resolution[UB, HB, FB] and ScanSAR modes, respectively), in the level 1.1/1.5/3.1 processing. The number of thumbnail images of multi-polarization modes (dual pol., compact pol. and full (quad.) pol.) is equal to the number of polarizations, and that of level 1.1 of ScanSAR mode is equal to the number of polarizations multiplied by scans.

The image format is JPEG or PDF. The thumbnail image format is shown in Table 5.1-1.

Table 5.1-1 Thumbnail Image Format

| Item | Definition |
|--------------------------------------|---|
| File Name (ScanSAR level 1.1) | JPEG file : BRS-polarization-scene ID-product ID-scan.jpg PDF file : BRS-polarization-scene ID-product ID-scan.pdf |
| File Name (except ScanSAR level 1.1) | JPEG file : BRS-polarization-scene ID-product ID.jpg PDF file : BRS-polarization-scene ID-product ID.pdf |
| Data Type | 8 bit Integer |
| Record Length | Variable |
| Record Number | Variable |
| Image Frame | Same as Image File |
| Pixel Spacing | 50m : Spotlight Mode 100m : High Resolution Mode 500m : ScanSAR Mode |
| Map Projection | Same as Image File |

5.2. Image File of ScanSAR Level 1.1 Product

5.2.1. Processing Mode and Data Storage Outline of ScanSAR Level 1.1 Product

A level 1.1 product of ScanSAR mode is generated by “Full-Aperture method” or “SPECAN method”.

< Full-Aperture Method >

In each scan and polarization, the gaps between bursts in a sub swath are filled with zeros and range and azimuth compressions are performed. An image file per each scan and polarization is generated (see Figure 5.2-1 and Figure 5.2-2).

A

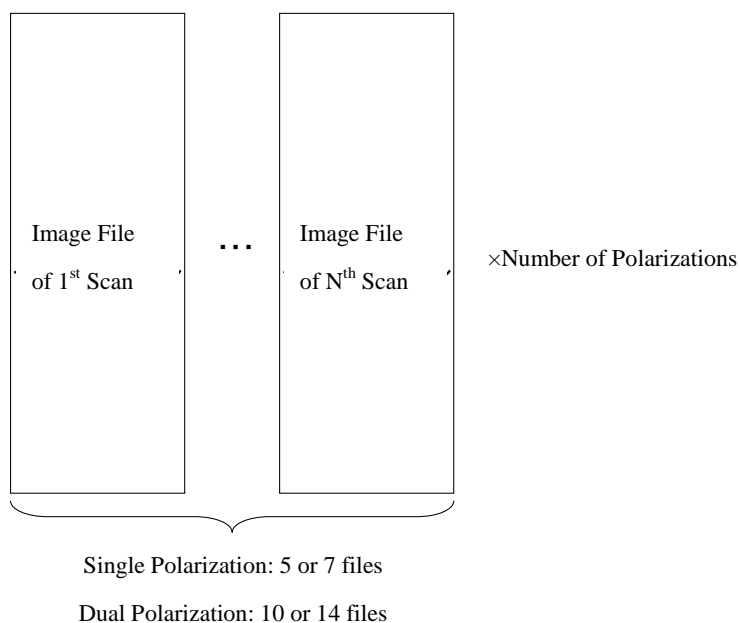


Figure 5.2-1 Level 1.1 Image File of ScanSAR Mode (Full-Aperture Method)

A

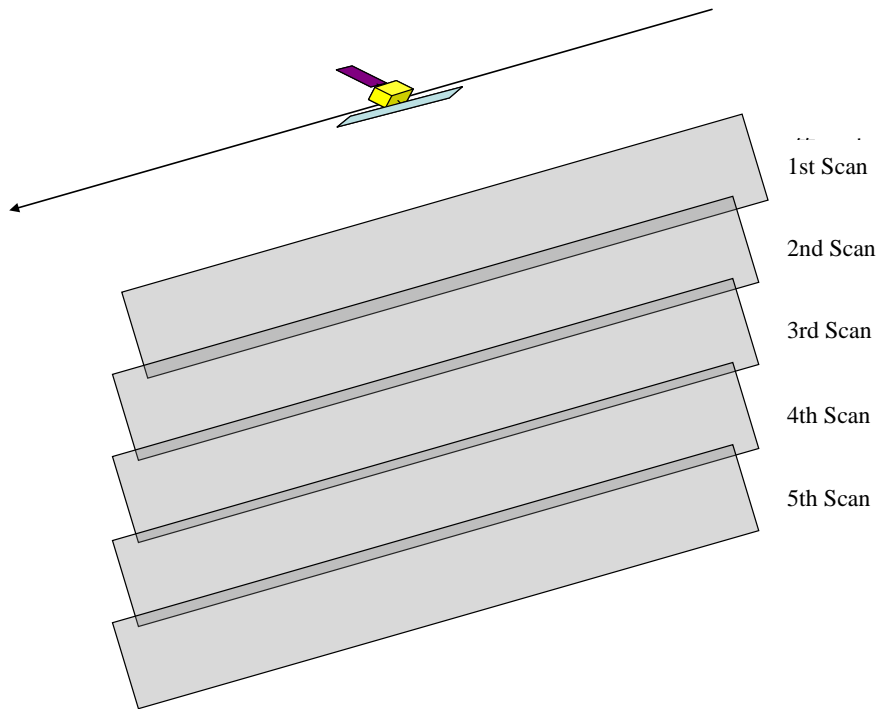


Figure 5.2-2 Relationship between Level 1.1 Image Files of ScanSAR Mode and Observed Areas (Full-Aperture Method) (5 scans)

| A

< SPECAN Method >

Range and azimuth compressions are performed per each burst.

Burst data of a sub swath is stored in a same image file sequentially. In the case of the SPECAN method, an image file per each scan and polarization is generated.

Successive burst images are overlapped (Figure 5.2-4 represents the relationship between Level 1.1 image file of ScanSAR mode and observed area). A

Images of successive burst data are represented in Figure 5.2-5. The image of a ground target is included in successive bursts, as shown in Figure 5.2-4 and Figure 5.2-5.

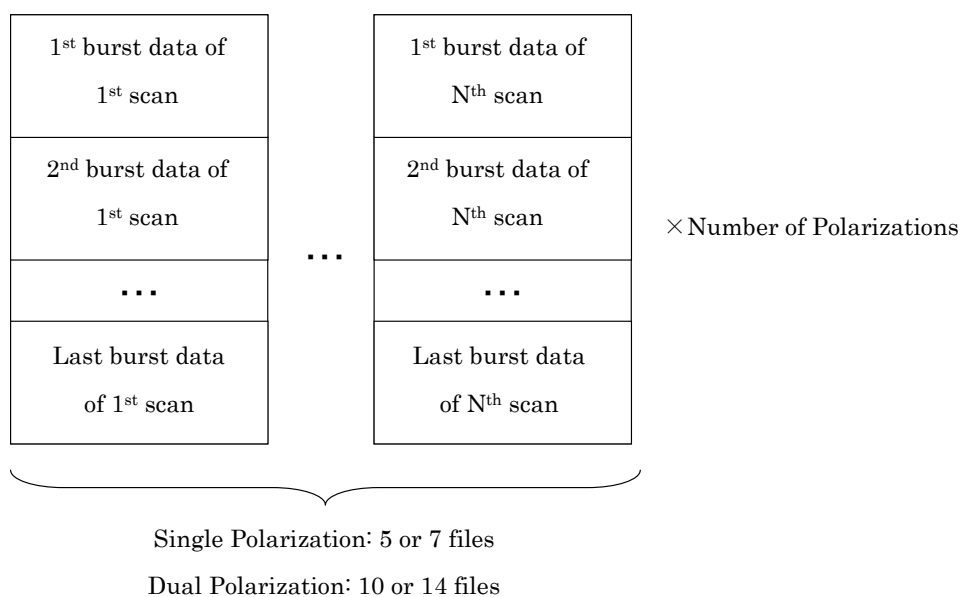


Figure 5.2-3 Level 1.1 Image File of ScanSAR Mode (SPECAN method)

A

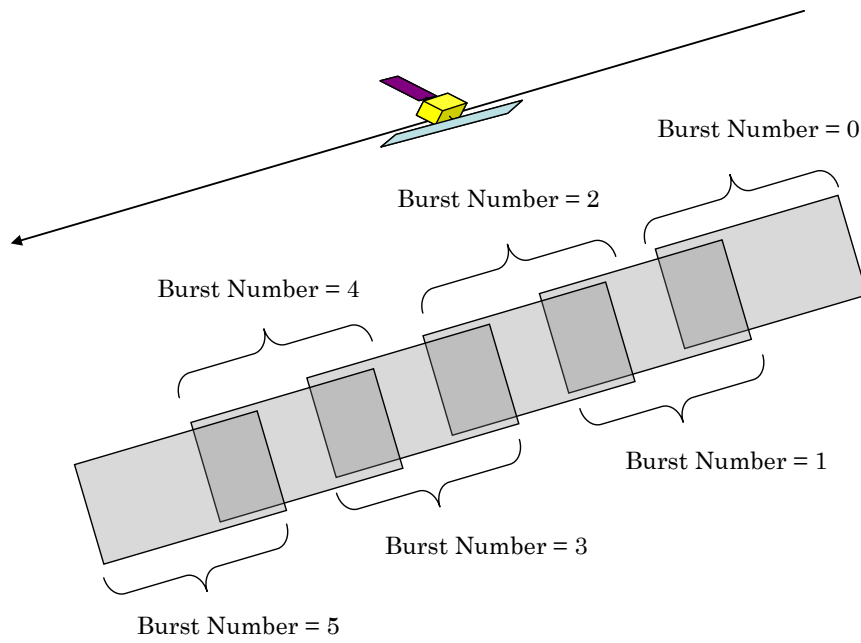


Figure 5.2-4 Relationship between Level 1.1 Image Files of ScanSAR Mode and Observed Area (SPECAN method) (1 scan)

| A

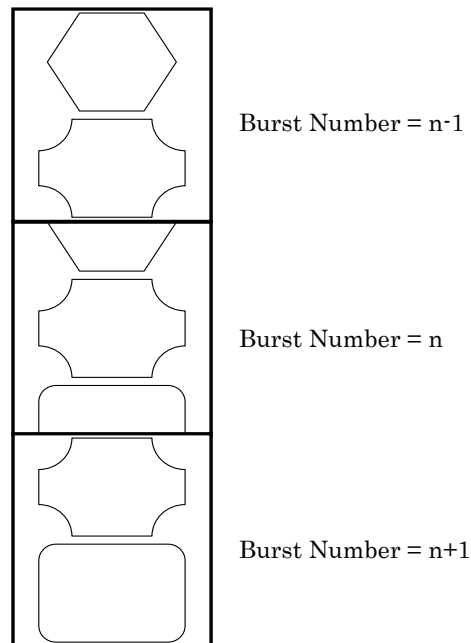


Figure 5.2-5 Images of Successive Burst Data in a CEOS Image File

| A

5.2.2. Acquisition of Parameters from Image File in SPECAN method

This section describes about the parameter acquisition to extract a burst data from the level 1.1 image file generated by the burst algorithm.

< Acquisition of Parameters from SAR Image File Descriptor Record (see also Table 5.2-1)>

- (1) Read the value of “Byte No 187-192 SAR data record length”.

This value means the byte number of each signal data record and is defined as “BytePerLine”.

- (2) Read the value of “Byte No 249-256 Number of data group (or pixels) per line”.

This value means the number of pixels of each signal data record and is defined as “NPixel”.

In the case of the level 1.1, the byte number per pixel is 8 and there are no zero padding data outside of valid pixels. Therefore, $\text{BytePerLine} = 8 * \text{NPixel}$.

- (3) Read the value of “Byte No 449-452 Number of burst data in this file”

This value means the number of burst data in an image file and is defined as “NBurst”.

- (4) Read the value of “Byte No 453-456 Number of lines per one burst”

This value means the number of lines in a burst data and is defined as “NLinePerBurst”.

- (5) Read the value of “Byte No 457-460 Number of overlap lines with adjacent bursts”

This value means the number of overlap lines between adjacent bursts and is defined as “NOverlapLine”.

In the case of $\text{NLinePerBurst} = 300$ and $\text{NOverlapLine} = 100$, the signal data corresponding to the area overlapped by one third in between adjacent bursts are stored in the signal data record.

Table 5.2-1 SAR Image File Descriptor Record (Show necessary part only)

| Field No. | Byte No. | Type | Description (Definition and Value) | Remark |
|-----------|-----------|------|---|--|
| omission | | | | |
| 30 | 187 - 192 | I6 | SAR DATA record length | |
| omission | | | | |
| 39 | 249 - 256 | I8 | Total number of data groups (or pixels) per line per SAR channel | For a level 1.1 product, each data record corresponds to 1 image range line. Each range line begins at the nearest-range pixel and ends at the farthest-range pixel. |
| omission | | | | |
| 66 | 449 - 452 | I4 | In the case of the level 1.1 of ScanSAR mode and the SPECAN method: The number of burst data in a SAR Image file (from one). In other cases: blank | In the case of ScanSAR level 1.1 and SPECAN method, set the number of burst data in a SAR Image file. In other cases, set blank (0). |
| 67 | 453 - 456 | I4 | In the case of the level 1.1 of ScanSAR mode and the SPECAN method: The number of lines per burst data (from one) In other cases: blank | In the case of ScanSAR level 1.1 and SPECAN method, set the number of lines per burst data (the number of lines does not change dependent on bursts) In other cases, set blank (0). |
| 68 | 457 - 460 | I4 | In the case of the level 1.1 of ScanSAR mode and the SPECAN method: The number of overlapped lines between adjacent bursts (from zero) In other cases: blank | In the case of ScanSAR level 1.1 and SPECAN method, set the number of overlapped lines between adjacent bursts. In the case of no overlapping, set 0. In other cases, set blank (0). |
| omission | | | | |

< Acquisition of Parameters from Signal Data Record (see also Table 5.2-2)>

(1) Read the value of “Byte No 217-220 Burst number”

This value means the sequential number for each burst data in an image file (0 – Nburst-1) and is defined as “BurstNo”.

(2) Read the value of “Byte No 221-224 Line number in this burst”

This value means the sequential number for each line in a burst (0 – NlinePerBurst-1) and is defined as “LineNoInBurst”.

Table 5.2-2 Signal Data Record (Show necessary part only)

| Field No. | Byte No. | Type | Description (Definition and Value) | Remark |
|-----------|--------------|------|--|--|
| omission | | | | |
| 57 | 217 – 220 | B4 | In the case of ScanSAR level 1.1: Burst number = 0) ₁₀ ~ Except ScanSAR level 1.1: Blank = 0) ₁₀ | In the case of ScanSAR level 1.1 and SPECAN method, define the first burst number as zero. In other cases, set blank (0). |
| 58 | 221 – 224 | B4 | In the case of ScanSAR level 1.1: Line number in this burst = 0) ₁₀ ~ Except ScanSAR level 1.1: Blank = 0) ₁₀ | In the case of ScanSAR level 1.1 and SPECAN method, set numbers sequentially from zero. In other cases, set blank (0). |
| omission | | | | |

Table 5.2-3 shows total line number, burst number and line number in a burst.

Table 5.2-3 Total Line Number, Burst Number and Line Number in a Burst

| Total Line Number (LineNo) | Burst Number (BurstNo) | Line Number in a Burst (LineNoInBurst) |
|-------------------------------|---------------------------|---|
| 1 | 0 | 0 |
| 2 | 0 | 1 |
| ... | 0 | ... |
| NLinePerBurst | 0 | NLinePerBurst-1 |
| NLinePerBurst+1 | 1 | 0 |
| NLinePerBurst+2 | 1 | 1 |
| ... | 1 | ... |
| 2 * NLinePerBurst | 1 | NLinePerBurst-1 |
| (2 * NLinePerBurst) + 1 | 2 | 0 |
| (2 * NLinePerBurst) + 2 | 2 | 1 |
| ... | 2 | ... |
| 3 * NLinePerBurst | 2 | NLinePerBurst-1 |
| ... | ... | ... |

5.3. Low Resolution Image Data Record

A low resolution image data in a trailer file is generated by transforming a processed data type to 8 bit integer and by averaging pixels to be 50, 100 or 500m spacing (spotlight, High resolution[UB, HB, FB] and ScanSAR modes, respectively), in the level 1.1/1.5/3.1 processing.

A trailer file stores the image of HH or VV polarization in the case of the dual polarization mode and stores the image of HH polarization in the case of the polarimetry mode. The format of the low resolution image data is shown in Table 5.3-1.

Table 5.3-1 Format of Low Resolution Image Data

| Item | Specification |
|-------------------|--|
| Data Type | 16 bit integer |
| Record Length | Variable |
| Number of Records | Variable |
| Image Frame | Same as SAR Image file |
| Pixel Spacing | 50m : Spotlight Mode 100m : High Resolution Mode 500m : ScanSAR Mode |
| Map Projection | Same as SAR Image file |



PALSAR-2
Level 2.1 CEOS SAR Product
Format Description

Japan Aerospace Exploration Agency

ALOS-2 Product Format Description
CEOS Level 2.1 Revision History (1/5)

| Rev. | Date | Revision Contents | Remark |
|------|------------|---|--------|
| NC | 2012/12/28 | First Edition | |
| A | 2014/5/16 | <p>p.17, p.20, p.56</p> <p>Removed the statement about predicted ephemeris.</p> <p>Before: Predicted ephemeris</p> <p>After: Dummy data</p> <p>Corresponding sections are as follows:</p> <ul style="list-style-type: none"> • p.17 Table3-2 Record Structure of CEOS level 2.1 Format • p.20 Table 3-5 Facility Related Data Record Type • p.56 Table 3 16 Facility related data records 1 - 4 (1/1) Field No.1, 6, 9 | |
| | | <p>p.22, p29, p.61, p69</p> <p>Revised 'software release and revision level' from NN.NN to NNN.NNN.</p> <p>Before:</p> <p>Software release and revision level = 'NN.NNbbbbbb'</p> <p>1.00, 1.01, ... 1.10, ... 2.00</p> <p>After:</p> <p>Software release and revision level = 'NNN.NNNbbbbbb'</p> <p>001.000, 001.001, ... 001.100, ...002.000</p> <p>Corresponding sections are as follows:</p> <ul style="list-style-type: none"> • p.22 Table 3-6 Volume descriptor records (1/2) Field No.12 • p.29 Table 3-9 SAR Leader file descriptor records (1/3) Field No.12 • p.61 Table 3-18 SAR Image file descriptor records (1/4) Field No.12 • p.69 Table 3-20 SAR Trailer file descriptor (1/3) Field No.12 | |

ALOS-2 Product Format Description
CEOS Level 2.1 Revision History (2/5)

| Rev. | Date | Revision Contents | Remark |
|------------|------|---|--------|
| A cont. | | <p>P34 Table 3-10 Field No.34 Added suffix: "mode." Before: '01': Ultra-fine '02': High-sensitive '03': Fine '18': Full (Quad.) pol./High-sensitive '19': Full (Quad.) pol./Fine After: '01': Ultra-fine mode '02': High-sensitive mode '03': Fine mode '18': Full (Quad.) pol./High-sensitive mode '19': Full (Quad.) pol./Fine mode</p> | |
| | | <p>p.37 Table 3-10 Data set summary records (6/12) Added description of 'Processing version ID' (Field No.82) due to revise of software release & revision number format. Before: Processing version ID After: Processing version ID='NNN.NNNb'</p> | |

ALOS-2 Product Format Description
CEOS Level 2.1 Revision History (3/5)

| Rev. | Date | Revision Contents | Remark |
|------------|------|---|--------|
| A cont. | | <p>p.38 Table 3-10 Data set summary records (7/12) Revised description as follows. [Field No.96] Before: Resolution in ground range [m] = Nominal value After: Resolution in ground range [m] = Nominal value * number of looks in range direction [Field No.97] Before: Resolution in azimuth [m] = Nominal value After: Resolution in azimuth [m] = Nominal value * number of looks in azimuth direction [Field No.102] Before: Along track Doppler frequency (center) quadratic coefficient terms at early edge of image [Hz/pixel/pixel] = Value After: Along track Doppler frequency (center) quadratic coefficient terms at early edge of image [Hz/pixel/pixel] = Blanks</p> | |
| | | <p>p.57 Table 3-17 Facility related data records (1/4) Erased the following description of 'Twenty coefficients to convert from the map projection (E, N) to Line (L) and pixel (P) position in the image', Level 1.5/3.1: Level 1.1: Blanks</p> | |

ALOS-2 Product Format Description
CEOS Level 2.1 Revision History (4/5)

| Rev. | Date | Revision Contents | Remark |
|------------|------|---|--------|
| A cont. | | <p>p.62 Table 3-18 SAR Image file descriptor records (2/4) Revised remarks as follows. [Field No.28] Before: Number of actual records After: Copy the value of Level 1.1 [Field No.29] Before: Actual record length After: Number of actual records [Field No.30] Before: (Blank) After: Actual record length</p> | |
| | | <p>p.77 Table 4-1 Summary information for CEOS Level 2.1 product (3/8) Corrected misdescription. Before: GSIGEO2000: Japanese Geoid Model (Geographical Survey Institute) After: GSIGEO2000: Japanese Geoid Model (Geospatial Information Authority of Japan)</p> | |
| | | <p>p.80 Table 4-1 Summary information for CEOS Level 2.1 product (6/8) Revised description of 'Data size of product'. Before: Mbytes = 1024Kbyte After: Mbyte = 1024Kbyte</p> | |
| | | <p>p.80 Table 4-1 Summary information for CEOS Level 2.1 product (6/8) Erased the following description of 'Filename of level 2.1 product', Image file (Level 1.1 wide mode product) 'IMG-XX-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPPP-YZ'</p> | |

ALOS-2 Product Format Description
CEOS Level 2.1 Revision History (5/5)

| Rev. | Date | Revision Contents | Remark |
|------------|-----------|--|--------|
| A cont. | | p.80 Table 4-1 Summary information for CEOS Level 2.1 product (6/8) Revised the value of 'Product format'. Before: 'CEOS'/'GeoTIFF' After: 'CEOS' | |
| | | p.81 Table 4-1 Summary information for CEOS Level 2.1 product (7/8) Revised the value of 'Status of absolute navigation' Before: Blank After: 'OK'/'NG' | |
| | | p.82 Table 4-1 Summary information for CEOS Level 2.1 product (8/8) Erased description of 'Copy the value of L1.1' written in remark of 'Processing facility' | |
| B | 2015/2/10 | P.25 Table 3-7 File pointer records (2/3) No.15 Correct the number of records. Before : Trailer file = N+1 (N is the number of low resolution image data records) After : Trailer file = 'bbbbbbb2' | |
| | | P.26 Table 3-7 File pointer records (3/3) No.23 Correct the number of records. Before : Trailer file = N+1 (N is the number of low resolution image data records) After : Trailer file = 'bbbbbbb2' | |
| | | P.38 Table 3-10 Data set summary records (7/12) No.100 Added description of ('= Blanks') | |
| | | P.48 Table 3-12 Platform position data records (1/2) No.11-13 Correct the descriptions. Before : Position vector in the earth /// After : Velocity vector in the earth /// | |

ALOS-2 Product Format Description
(CEOS Level 2.1 Format)

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1. Overview

This document describes the CEOS (Committee on Earth Observation Satellites) SAR format specifications for ALOS-2 Level 2.1 products which are generated with the ALOS-2 Data Processing System. The formats are based on the CEOS SAR formats of the ALOS/PALSAR products to take user friendliness into account and added new items for ALOS-2.

2. Product Specifications

2.1. Definition of Processing Levels

The definition of processing levels of ALOS-2 products is shown in Table 2-1. This document describes the data formats for CEOS level 2.1 products.

Table 2-1 Definition of Processing Levels

| Level | Definition | Remark |
|-------|---|--|
| 1.0 | Data corresponding to a scene area is extracted from received data. Data type is 8 bit. In the case of multi-polarization modes, the number of SAR data files is equal to the number of polarizations. In the case of ScanSAR mode, the data file is not divided into each scan. In the case of ATI and compact polarimetry observations, only level 1.0 product is generated. | |
| 1.1 | Range and single look azimuth compressed data is represented by complex I and Q channels to preserve the magnitude and phase information. Range coordinate is in slant range. Level 1.1 image is focused onto zero Doppler direction. In the case of ScanSAR mode, an image file is generated per each scan. | SLC : Single Look Complex. Interferometry processing requires SLC data. |
| 1.5 | Range and multi-look azimuth compressed data is represented by amplitude data. Range coordinate is converted from slant range to ground range, and map projection is performed. Pixel spacing is selectable depending on observation modes. There are two methods to transform image coordinate; G : Image coordinate in map projection is geocoded. R : Image coordinate in map projection is georeferenced. | G or R is selectable. |
| 2.1 | Level 2.1 data is orthorectified from level 1.1 data by using digital elevation model. Pixel spacing is selectable depending on observation modes. Image coordinate in map projection is geocoded. | |
| 3.1 | Image quality corrections (noise reduction and dynamic range compression) are performed to level 1.5 data. | |

2.2. Definition of Scene

2.2.1. Scene Size

Scene sizes for level 2.1 products of each observation mode are shown in Table 2-2 and Table 2-3.

**Table 2-2 Scene Size for Level 2.1 Products
(Except Full (Quad.) Polarimetry)**

| Observation Mode | Spotlight | Ultra-Fine | High-sensitive | Fine | ScanSAR nominal [28MHz] | ScanSAR nominal [14MHz] | ScanSAR wide [490km] |
|------------------------------------|-----------|------------|----------------|-------|-------------------------|-------------------------|----------------------|
| Length of Range Direction | 25km | 55km | 55km | 70km | 350.5km | 350.5km | 489.5km |
| Length of Azimuth Direction | 25km | 70km | 70km | 70km | 355km | 355km | 355km |
| Time Duration of Azimuth Direction | N/A | 10sec | 10sec | 10sec | 52sec | 52sec | 52sec |
| Range Resolution* | 3.0m | 3.0m | 6.0m | 9.1m | 47.5m(5look) | 95.1m(5look) | 44.2m(2look) |
| Azimuth Resolution* | 1.0m | 3.0m | 4.3m | 5.3m | 77.7m(3look) | 77.7m(3look) | 56.7m(1.5look) |

*: The values in Table 2-2 are defined as those in single look processing and at the incidence angle 37 deg (unless otherwise noted).

Table 2-3 Scene Size for Level 2.1 Products (Full (Quad.) Polarimetry)

| Observation Mode | High-sensitive | Fine |
|------------------------------------|----------------|-------|
| Length of Range Direction | 40-50km | 30km |
| Length of Azimuth Direction | 70km | 70km |
| Time Duration of Azimuth Direction | 10sec | 10sec |
| Range Resolution* | 5.1m | 8.7m |
| Azimuth Resolution* | 4.3m | 5.3m |

*: The values in Table 2-3 are defined as those in single look processing and at the incidence angle 37 deg (unless otherwise noted).

2.2.2. Data Volume of Scene

The number of pixels, pixel spacing and data volumes for each observation mode are shown in Table 2-4 - Table 2-10.

Table 2-4 Level 2.1 Image Size and Volume for Spotlight Mode

| Spotlight Mode | | | | |
|----------------|---------------------------------------|----------------------------------|---------------|-------------|
| Pixel Spacing | Image Size East-West x South-North | Number of Pixels and Data Volume | | |
| | | East-West | South-North | Volume [MB] |
| 0.625m | 25x25km | 40,000~56,600 | 40,000~56,600 | 3,052~6,110 |
| 1.25m | 25x25km | 20,000~28,300 | 20,000~28,300 | 763~1,528 |
| 2.5m | 25x25km | 10,000~14,200 | 10,000~14,200 | 191~385 |

*: 1MB = 2²⁰Bytes

*: Maximum data volume (not included the expanding by the differences of map projections.)

**Table 2-5 Level 2.1 Image size and Volume for Ultra-Fine Mode
(Single Polarization)**

| Ultra-Fine Mode | | | | |
|-----------------|---------------------------------------|----------------------------------|---------------|-------------|
| Pixel Spacing | Image Size East-West x South-North | Number of Pixels and Data Volume | | |
| | | East-West | South-North | Volume [MB] |
| 2.5m | 55x70km | 22,000~35,400 | 28,000~35,400 | 1,175~2,390 |
| | 52.5x70km | 21,000~34,700 | 28,000~34,700 | 1,122~2,297 |
| | 50x70km | 20,000~34,000 | 28,000~34,000 | 1,068~2,205 |
| 5m | 55x70km | 11,000~17,700 | 14,000~17,700 | 294~598 |
| | 52.5x70km | 10,500~17,400 | 14,000~17,400 | 280~577 |
| | 50x70km | 10,000~17,000 | 14,000~17,000 | 267~551 |
| 10m | 55x70km | 5,500~8,900 | 7,000~8,900 | 73~151 |
| | 52.5x70km | 5,250~8,700 | 7,000~8,700 | 70~144 |
| | 50x70km | 5,000~8,500 | 7,000~8,500 | 67~138 |

*: 1MB = 2²⁰Bytes

*: Maximum data volume (not included the expanding by the differences of map projections.)

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2-6 Level 2.1 Image size and Volume for High-sensitive Mode
(Single Polarization)**

| High-sensitive Mode | | | | |
|---------------------|---------------------------------------|----------------------------------|---------------|-------------|
| Pixel Spacing | Image Size East-West x South-North | Number of Pixels and Data Volume | | |
| | | East-West | South-North | Volume [MB] |
| 3.125m | 55x70km | 17,600~28,300 | 22,400~28,300 | 752~1,528 |
| | 52.5x70km | 16,800~27,800 | 22,400~27,800 | 718~1,474 |
| | 50x70km | 16,000~27,200 | 22,400~27,200 | 684~1,411 |
| 6.25m | 55x70km | 8,800~14,200 | 11,200~14,200 | 188~385 |
| | 52.5x70km | 8,400~13,900 | 11,200~13,900 | 179~369 |
| | 50x70km | 8,000~13,600 | 11,200~13,600 | 171~353 |
| 12.5m | 55x70km | 4,400~7,100 | 5,600~7,100 | 47~96 |
| | 52.5x70km | 4,200~7,000 | 5,600~7,000 | 45~93 |
| | 50x70km | 4,000~6,800 | 5,600~6,800 | 43~88 |

*: 1MB = 2²⁰Bytes

*: Maximum data volume (not included the expanding by the differences of map projections.)

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

Table 2-7 Level 2.1 Image size and Volume for Fine Mode (Single Polarization)

| Fine Mode | | | | |
|---------------|---------------------------------------|----------------------------------|---------------|-------------|
| Pixel Spacing | Image Size East-West x South-North | Number of Pixels and Data Volume | | |
| | | East-West | South-North | Volume [MB] |
| 6.25m | 70x70km | 11,200~15,900 | 11,200~15,900 | 239~482 |
| | 65x70km | 10,400~15,300 | 11,200~15,300 | 222~446 |
| | 60x70km | 9,600~14,800 | 11,200~14,800 | 205~418 |
| | 55x70km | 8,800~14,200 | 11,200~14,200 | 188~385 |
| | 50x70km | 8,000~13,600 | 11,200~13,600 | 171~353 |
| 12.5m | 70x70km | 5,600~8,000 | 5,600~8,000 | 60~122 |
| | 65x70km | 5,200~7,700 | 5,600~7,700 | 56~113 |
| | 60x70km | 4,800~7,400 | 5,600~7,400 | 51~104 |
| | 55x70km | 4,400~7,100 | 5,600~7,100 | 47~96 |
| | 50x70km | 4,000~6,800 | 5,600~6,800 | 43~88 |

*: 1MB = 2²⁰Bytes

*: Maximum data volume (not included the expanding by the differences of map projections.)

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

Table 2-8 Level 2.1 Image size and Volume for ScanSAR Mode (Single Polarization)

| ScanSAR Mode | | | | |
|---------------|---------------------------------------|----------------------------------|---------------|-------------|
| Pixel Spacing | Image Size East-West x South-North | Number of Pixels and Data Volume | | |
| | | East-West | South-North | Volume [MB] |
| 25m | 350x350km | 14,000~19,800 | 14,000~19,800 | 374~748 |
| | 490x350km | 19,600~23,800 | 14,000~23,800 | 523~1,080 |
| 50m | 350x350km | 7,000~9,900 | 7,000~9,900 | 93~187 |
| | 490x350km | 9,800~11,900 | 7,000~11,900 | 131~270 |
| 100m | 350x350km | 3,500~5,000 | 3,500~5,000 | 23~48 |
| | 490x350km | 4,900~6,000 | 3,500~6,000 | 83~69 |

*: 1MB = 2²⁰Bytes

*: Maximum data volume (not included the expanding by the differences of map projections.)

*: In the case of dual polarization, the data volume is twice as that of a single polarization.

**Table 2-9 Level 2.1 Image size and Volume for High-sensitive Mode
(Full (Quad.) Polarization)**

| High-sensitive Mode (Full (Quad.) pol.) | | | | |
|---|---------------------------------------|----------------------------------|---------------|-------------|
| Pixel Spacing | Image Size East-West x South-North | Number of Pixels and Data Volume | | |
| | | East-West | South-North | Volume [MB] |
| 3.125m | 50x70km | 16,000~27,200 | 22,400~27,200 | 2,734~5,645 |
| 6.25m | 50x70km | 8,000~13,600 | 11,200~13,600 | 684~1,411 |
| 12.5m | 50x70km | 4,000~6,800 | 5,600~6,800 | 171~353 |

*: 1MB = 2²⁰Bytes

*: Maximum data volume (not included the expanding by the differences of map projections.)

*: Total data volume for four polarizations

**Table 2-10 Level 2.1 Image size and Volume for Fine Mode
(Full (Quad.) Polarization)**

| Fine Mode (Full (Quad.) pol.) | | | | |
|-------------------------------|---------------------------------------|----------------------------------|---------------|-------------|
| Pixel Spacing | Image Size East-West x South-North | Number of Pixels and Data Volume | | |
| | | East-West | South-North | Volume [MB] |
| 6.25m | 30x70km | 4,800~11,400 | 11,200~11,400 | 410~992 |
| 12.5m | 30x70km | 2,400~5,700 | 5,600~5,700 | 103~248 |

*: 1MB = 2²⁰Bytes

*: Maximum data volume (not included the expanding by the differences of map projections.)

*: Total data volume for four polarizations

2.3. Format

ALOS-2 CEOS level 2.1 data is based on the CEOS superstructure formats and consists of following files: Volume Directory File, SAR Leader File, SAR Image File and SAR Trailer File.

2.4. Product Description

In the case of multi-polarization data (i.e. Dual pol. and Full (Quad.) pol. data), the image data of ALOS-2 CEOS level 2.1 is divided in each polarization.

The SAR Image file composition of CEOS level 2.1 for each observation mode is shown in Table 2-11.

Table 2-11 SAR Image File Composition of CEOS Level 2.1 for Each Observation Mode

| Observation Mode | Polarization | Processing Level | Number of Data Files | Data File Composition |
|---|--------------------------------------|------------------|----------------------|---|
| Spotlight | Single Pol. (HH, HV, VH or VV *1) | 2.1 | 1 | Data of HH, HV, VH or VV Polarization |
| Ultra-Fine, High-sensitive and Fine | Single Pol. (HH, HV, VH or VV) | 2.1 | 1 | Data of HH, HV, VH or VV Polarization |
| | Dual Pol. (HH+HV or VH+VV) | 2.1 | 2 | Data of HH+HV Polarization, or VH+VV Polarization |
| | Full Pol. (HH+HV+VH+VV) | 2.1 | 4 | Data of HH, HV, VH and VV Polarization |
| ScanSAR nominal and wide | Single Pol. (HH, HV, VH or VV) | 2.1 | 1 | Data of HH, HV, VH or VV Polarization |
| | Dual Pol. (HH+HV or VH+VV) | 2.1 | 2 | Data of HH+HV Polarization, or VH+VV Polarization |

*1 The order of transmitting, receiving polarization.

2.5. Processing Parameter

Table 2-12 shows the processing parameters of level 2.1.

Table 2-12 Processing Parameter

| Parameter | Level 2.1 |
|-------------------------------|---|
| Map Projection | UTM, PS, MER(*4), LCC(*4) (refer to Table 2-13) |
| Framing | Geo-coded |
| Image Direction | Map |
| Resampling Method | NN, BL, CC |
| Geodetic coordinate | ITRF97 |
| Ellipsoid | GRS80 |
| Scene Shift | -5 to 4 (-25 to 20 *4) |
| Window Function | Rectangle |
| Number of Multi-look | Depending on observation mode and pixel spacing (refer to Table 2-14) |
| Pixel Spacing | Spotlight mode 0.625m/1.25m/2.5m Ultra-fine mode 2.5m/5.0m/10.0m High-sensitive mode 3.125m/6.25m/12.5m Fine mode 6.25m/12.5m ScanSAR mode 25.0m/50.0m/100.0m (refer to Table 2-14) |
| Digital Elevation Model (DEM) | GISMAP Terrain (Hokkaido-Chizu Company Ltd.) (*1) SRTM 90m Digital Elevation Database v4.1 (CSI) (*2) |
| Geoid Model | GSIGEO2000 (Geospacial Information Authority of Japan) (*1) Earth Gravitational Model 1996 (EGM96) (National Geospacial-Intelligence Agency) (*3) |

*1 GISMAP Terrain is available in only Japan.

*2 SRTM covers the regions within +/-60 degrees latitudes in the world.

*3 EGM96 is available in the world.

*4 In the case of ScanSAR mode, the values in the brackets are available.

Table 2-13 Conditions for specifying Map Projection

| Map projection | Parameter | Condition | Default Value (not specified) |
|----------------|----------------------------------|---|--|
| UTM | | Range of scene center latitude: -83 ~ +83 deg. | |
| | UTM zone No. | Zone No. including scene center longitude +/- 4. | Zone No. including scene center longitude |
| PS | | Range of scene center latitude: -83 ~ -25 deg. or +25 ~ +83 deg. | |
| | PS reference latitude | Scene center in the northern hemisphere: +25 ~ +90 deg. Scene center in the southern hemisphere: -90 ~ -25 deg. | Northern hemisphere: +90 deg. Southern hemisphere: -90 deg. |
| | PS reference longitude | Arbitrary (-179.999 ~ +180.000 deg.) | Scene center longitude |
| MER | | Range of scene center latitude: -70 ~ +70 deg. | |
| LCC | | Range of scene center latitude: -70 ~ +70 deg. | |
| | LCC standard parallel 1 ϕ_1 | Scene center in the northern hemisphere: $0 \leq \phi_2 < \phi_1 < +90$ deg. Scene center in the southern hemisphere: | Northern hemisphere: +50 deg. Southern hemisphere: -50 deg. |
| | LCC standard parallel 2 ϕ_2 | hemisphere: $-90 < \phi_1 < \phi_2 \leq 0$ deg. | Northern hemisphere: +20 deg. Southern hemisphere: -20 deg. |
| | LCC origin latitude | -90.000 ~ +90.000 deg. | 0 deg. |
| | LCC origin longitude | -179.999 ~ +180.000 deg. | Scene center longitude |

Table 2-14 Relationship between Pixel Spacing and Multilook Numbers

| Observation Mode | Pixel Spacing | Number of Multi-look | | Resolution | |
|------------------------------------|---------------|----------------------|----|------------|--------|
| | | Az | Rg | Az | Rg |
| Spotlight | 0.625m | 1 | 1 | 1.0m | 3.0m |
| | 1.25m | 2 | 1 | 2.0m | 3.0m |
| | 2.5m | 3 | 1 | 3.0m | 3.0m |
| Ultra-Fine | 2.5m | 1 | 1 | 3.0m | 3.0m |
| | 5m | 2 | 2 | 6.0m | 6.0m |
| | 10m | 4 | 4 | 12.0m | 12.0m |
| High-sensitive (Single, Dual pol.) | 3.125m | 1 | 1 | 4.3m | 6.0m |
| | 6.25m | 2 | 2 | 8.6m | 12.0m |
| | 12.5m | 3 | 3 | 12.9m | 18.0m |
| Fine (Single, Dual pol.) | 6.25m | 2 | 1 | 10.6m | 9.1m |
| | 12.5m | 3 | 2 | 15.9m | 18.2m |
| High-sensitive (Full (Quad.) pol.) | 3.125m | 1 | 1 | 4.3m | 5.1m |
| | 6.25m | 2 | 2 | 8.6m | 10.2m |
| | 12.5m | 3 | 3 | 12.9m | 15.3m |
| Fine Beam (full (quad.) pol.) | 6.25m | 2 | 1 | 10.6m | 8.7m |
| | 12.5m | 3 | 2 | 15.9m | 17.4m |
| ScanSAR nominal (28 MHz) | 25.0m | 3 | 3 | 77.7m | 28.5m |
| | 50.0m | 3 | 6 | 77.7m | 57.0m |
| | 100.0m | 6 | 12 | 155.4m | 114.0m |
| ScanSAR nominal (14 MHz) | 25.0m | 3 | 2 | 77.7m | 38.0m |
| | 50.0m | 3 | 3 | 77.7m | 57.0m |
| | 100.0m | 6 | 6 | 155.4m | 114.0m |
| ScanSAR wide | 25.0m | 1.5 | 2 | 56.7m | 44.2m |
| | 50.0m | 1.5 | 3 | 56.7m | 66.3m |
| | 100.0m | 3 | 5 | 113.4m | 110.5m |

* The number of multi-look in the azimuth direction is the number of effective looks in the case of ScanSAR mode.

* The resolution is defined as the value specified when the incidence angle is 37 degrees (reference value).

2.6. Definition of Level 2.1 Image

The image of level 2.1 is corrected geometrically (map projection) and output as the image whose upper side is consistent with the north direction. All valid data of input level 1.1 is included in a level 2.1 image frame. The areas out of valid data are stored dummy data (zero values). (Refer to Figure 2-1)

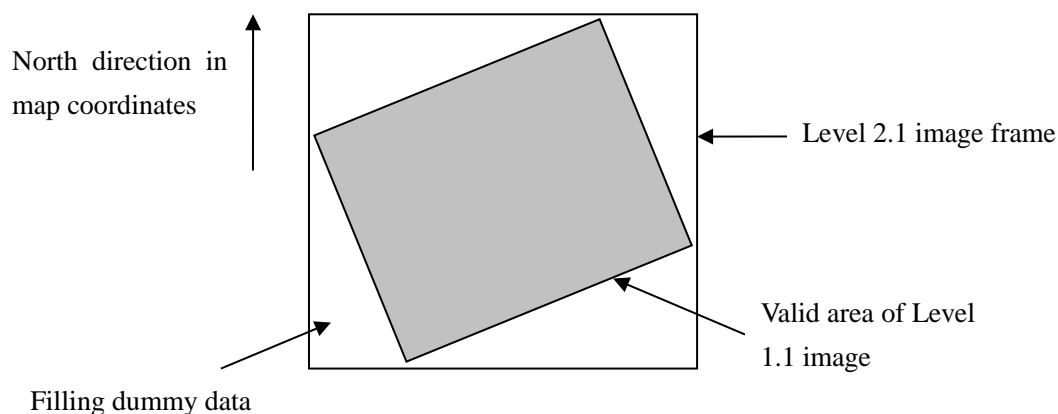


Figure 2-1 Definition of Level 2.1 Image

2.7. Notes

- If the observational mode is ScanSAR and the DEM is not specified, SRTM 90m DEM and EGM96 geoid model are used in level 2.1 processing.
- If the observational mode is other mode than ScanSAR and the DEM is not specified, the location (Japan/overseas) of a scene is determined automatically by the latitudes and longitudes of four corners of the scene and DEM is selected. When Japan region is included in a scene, GISMAP Terrain DEM and GSIGEO2000 geoid model are used in processing. In the case of other region than Japan, SRTM 90m DEM and EGM96 geoid model are used in processing.
- If the region without DEM is included in a scene, the region is processed as 0m altitude.

3. Product Formats

3.1. Composition of CEOS Product

The overall configuration of CEOS level 2.1 product formats is shown in section 2.3. The definition of each file is shown in Table 3-1. The file structure of each polarization is represented in Figure 3-1 to Figure 3-3.

Table 3-1 CEOS L2.1 File Composition and Definitions of File Names

| File Name | File Num. | Definition of File Name | Record name | Contents |
|-----------------------|-------------------------------|--|--|---|
| Volume Directory File | 1 | VOL-Scene ID-Product ID | Volume descriptor File pointer Text | This file is located at the beginning of the image volume and stores the volume and file management information. |
| SAR Leader File | 1 | LED-Scene ID-Product ID | File descriptor Data set summary Map projection data Platform position data Attitude data Radiometric data Data quality summary Facility related data | This file is located before image file and stores annotation data, ancillary data and other types of data related to the image data in the succeeding image file. |
| SAR Image File | n (Number of polarization) | IMG-polarization information-Scene ID-Product ID | File descriptor Processed data record | This file is located after the leader file and stores the image data. |
| SAR Trailer File | 1 | TRL-Scene ID-Product ID | File descriptor Low resolution image data | This file is located after the image file and stores the final information related to the image data. |

Scene ID = AAAAABBBBBCCCC-YYMMDD

AAAAA : Satellite/Sensor name (ALOS2)

BBBBB : Orbit accumulation number of a scene center

CCCC : Scene frame number of a scene center

-: separator

YYMMDD: Observation date of scene center (YY: lower 2 figures of a year, MM: month, DD: day)

Product ID = DDDEFFFGHI

DDD: Observation Mode

SBS: Spotlight Mode

UBS: Ultra-fine mode Single polarization

UBD: Ultra-fine mode Dual polarization

HBS: High-sensitive mode Single polarization

HBD: High-sensitive mode Dual polarization

HBQ: High-sensitive mode Full (Quad.) polarimetry

FBS: Fine mode Single polarization

FBD: Fine mode Dual polarization

FBQ: Fine mode Full (Quad.) polarimetry
WBS: Scan SAR nominal [14MHz] mode Single polarization
WBD: Scan SAR nominal [14MHz] mode Dual polarization
WWS: Scan SAR nominal [28MHz] mode Single polarization
WWD: Scan SAR nominal [28MHz] mode Dual polarization
VBS: Scan SAR wide mode Single polarization
VBD: Scan SAR wide mode Dual polarization

E: Observation Direction

L: Left looking, R: Right looking

FFF: Processing Level

2.1: Level 2.1

G: Processing Option

G: Geo-coded

H: Map Projection

U: UTM, P: PS, M: MER, L: LCC

I: Orbit Direction

A: Ascending, D: Descending

Polarization (Transmission and Receiving) = XX

HH: Horizontally polarized wave transmission / Horizontally polarized wave receiving

HV: Horizontally polarized wave transmission / Vertically polarized wave receiving

VH: Vertically polarized wave transmission / Horizontally polarized wave receiving

VV: Vertically polarized wave transmission / Vertically polarized wave receiving

■Single polarization

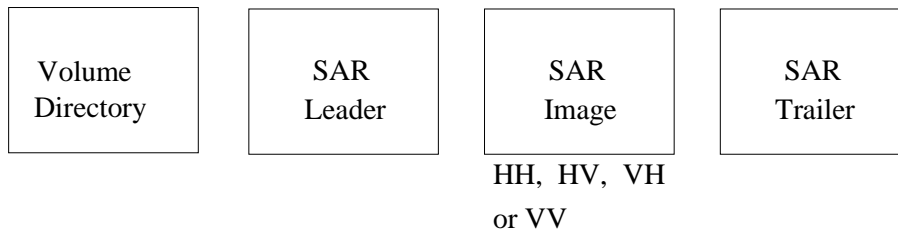


Figure 3-1 CEOS level 2.1 file composition/Single polarization

■Dual polarization

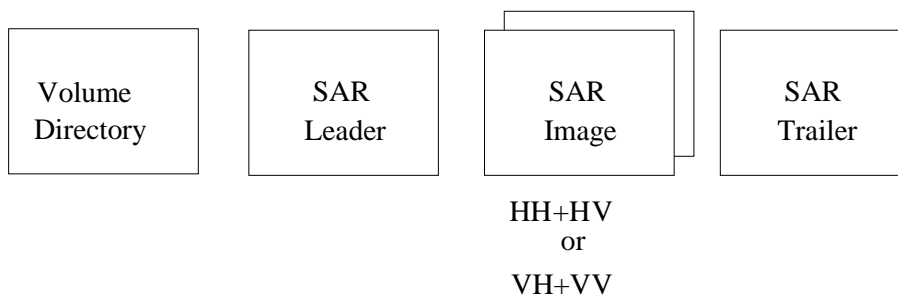


Figure 3-2 CEOS level 2.1 file composition/Dual polarization

■High-sensitive/Fine Mode Full (Quad.) Polarimetry

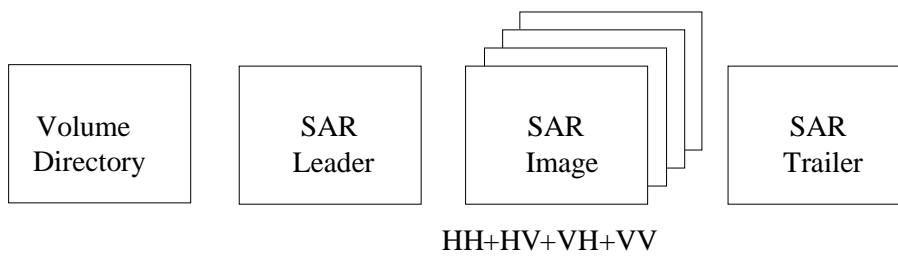


Figure 3-3 CEOS level 2.1 file composition/Full (Quad.) Polarimetry

3.2. Record Structure of CEOS Product

The record structure of CEOS level 2.1 format is shown in Table 3-2. The sizes of the processed data record are shown in Table 3-19.

Table 3-2 Record Structure of CEOS level 2.1 Format

| Record No. | Record length [byte] | Number of records | Record name | File name |
|---------------------------------|----------------------|----------------------------|--|------------------|
| 1 | 360 | 1 | Volume descriptor | Volume Directory |
| 2 to 3 + number of polarization | 360 | Number of polarization + 2 | File pointer | |
| 4 + number of polarization | 360 | 1 | Text | |
| 1 | 720 | 1 | File descriptor | SAR Leader |
| 2 | 4,096 | 1 | Data set summary | |
| 3 | 1620 | 1 | Map projection data | |
| 4 | 4,680 | 1 | Platform position data | |
| 5 | 16,384 | 1 | Altitude data | |
| 6 | 9,860 | 1 | Radiometric data | |
| 7 | 1,620 | 1 | Data quality summary | |
| 8 | 325,000 | 1 | Facility related data 1 (Dummy data) | |
| 9 | 511,000 | 1 | Facility related data 2 (Determined ephemeris) | |
| 10 | 3,072 | 1 | Facility related data 3 (Time error information) | |
| 11 | 728,000 | 1 | Facility related data 4 (Coordinate conversion information) | |
| 12 | 5000 | 1 | Facility related data 5 (Latitude and longitude conversion factor) | |
| 1 | 720 | 1 | File descriptor | SAR Image |
| 2 to 1+n | Variable | n | Processed data | |
| 1 | 720 | 1 | File descriptor | SAR Trailer |
| 2 | Variable | 1 | Low resolution image data | |

* n: number of processed data line.

A

3.2.1. Record Data Type

The definition of data type that used for description of record is shown in Table 3-3.

Table 3-3 Definition of Data Types

| Type (code) | Details |
|-------------|---|
| Am | Character (Left-fill if not specified) |
| Im | ASCII that represents integer (Right-fill) |
| Fm.n | Real type data (Right-fill) |
| Em.n | Real type data (Exponential notation, right-fill) |
| Bm | Binary number representation (The first byte is the most significant, big endian) |

m: Number of digits

n: Number of decimal places

p: multiplier in an index

3.2.2. Record Type Code and Record Sub-type Code

Each record has record type code and record sub-type code (sub-type code) in order to distinguish each other. The type code of each record is shown in Table 3-4

Table 3-4 Record Types of Each Record

| Record name | 1 st record Sub-type | Record Type | 2 nd record Sub-type | 3 rd record Sub-type | Record length [byte] |
|--------------------------------|------------------------------------|----------------|------------------------------------|------------------------------------|-------------------------|
| Volume Descriptor | 192 | 192 | 18 | 18 | 360 |
| File pointer | 219 | 192 | 18 | 18 | 360 |
| Text | 18 | 192 | 18 | 18 | 360 |
| SAR Leader file Descriptor | 11 | 192 | 18 | 18 | 720 |
| Data set summary | 18 | 10 | 18 | 20 | 4,096 |
| Map projection data | 18 | 20 | 18 | 10 | 1,620 |
| Platform position data | 18 | 30 | 18 | 20 | 4,680 |
| Attitude data | 18 | 40 | 18 | 20 | 16,384 |
| Radiometric data | 18 | 50 | 18 | 20 | 9,860 |
| Data quality summary | 18 | 60 | 18 | 20 | 1,620 |
| Facility related data | 18 | 200 | 18 | 70 | Refer to Table 3-5 |
| SAR data file Descriptor | 50 | 192 | 18 | 18 | 720 |
| Processed data | 50 | 11 | 18 | 20 | Refer to Table 3-19 |
| SAR Trailer file Descriptor | 63 | 192 | 18 | 18 | 720 |
| Low resolution image data | - | - | - | - | Refer to Table 3-21 |

* Value is decimal

Table 3-5 Facility Related Data Record Type

| Record name | 1 st record Sub-type | Record Type | 2 nd record sub-type | 3 rd record sub-type | Record length [byte] |
|--|------------------------------------|----------------|------------------------------------|------------------------------------|-------------------------|
| Facility related 1 (Dummy data) | 18 | 200 | 18 | 70 | 325,000 |
| Facility related 2 (Determined ephemeris) | | | | | 511,000 |
| Facility related 3 (Time error information) | | | | | 3,072 |
| Facility related 4 (Coordinate conversion information) | | | | | 728,000 |
| Facility related 5 (Latitude and longitude conversion factor) | | | | | 5000 |

A

* Value is decimal

3.3. Contents of Records in CEOS Files

Record formats are shown in Table 3-6 to Table 3-21. "b" in a table means blanks. In the case of "N)₁₀", "N" means decimal value.

Table 3-6 Volume descriptor records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|--------------------------------|
| 1 | 1 - 4 | B4 | Record sequence number = 1) ₁₀ | Copy the value of Level 1.1 |
| 2 | 5 - 5 | B1 | 1 st record subtype code = 192) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record subtype code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record subtype code = 18) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Length of this record = 360) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC flag = 'Ab': ASCII | Copy the value of Level 1.1 |
| 8 | 15 - 16 | A2 | Blanks | Copy the value of Level 1.1 |
| 9 | 17 - 28 | A12 | Superstructure format control document ID = 'CEOS-SARbbbb' | Copy the value of Level 1.1 |
| 10 | 29 - 30 | A2 | Superstructure format control document revision level = 'NN' NN: 'bA'~'bZ' | Copy the value of Level 1.1 |
| 11 | 31 - 32 | A2 | Superstructure record format revision level = 'NN' NN: 'bA'~'bZ' | Copy the value of Level 1.1 |
| 12 | 33 - 44 | A12 | Software release and revision level = 'NNN.NNNbbbbbb' 001.000, 001.001, ... 001.100, ...002.000 | |
| 13 | 45 - 60 | A16 | Physical volume ID Spacecraft Control Mission Operation system = 'SCMObbbbbbbbbb' Earth Intelligence Collection and Shearing System = 'EICSbbbbbbbbbb' | |
| 14 | 61 - 76 | A16 | Logical volume ID = 'MMNSSSSYYYYMMDDbb' MM : Mission ID (ALOS2='AL')(*) N : Mission Number (=2')(*) SSS : Sensor ID (SAR='SAR')(*) YYYY : Product generation year MM : Product generation month DD : Product generation day | (*)Copy the value of Level 1.1 |
| 15 | 77 - 92 | A16 | Volume set ID = 'MMMMMMbSSSbbbbbb' MMMMMM : Mission name (ALOS2='ALOS2b') SSS : Sensor name (SAR='SAR') | Copy the value of Level 1.1 |
| 16 | 93 - 94 | I2 | Total number of physical volumes in the logical volume = 'b1' | Copy the value of Level 1.1 |
| 17 | 95 - 96 | I2 | Physical volume sequence number of the first tape = 'b1' | Copy the value of Level 1.1 |

A

Table 3-6 Volume descriptor records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|-----------------------------|
| 18 | 97 - 98 | I2 | Physical volume sequence number of the last tape = 'b1' | Copy the value of Level 1.1 |
| 19 | 99 - 100 | I2 | Physical volume sequence number of the current tape = 'b1' | Copy the value of Level 1.1 |
| 20 | 101 - 104 | I4 | File number in the logical volume follows volume directory file. = 'bbb3'~'bbb6': N+2 (N is number of polarization) (Leader, Image, Trailer) | Copy the value of Level 1.1 |
| 21 | 105 - 108 | I4 | Logical volume within a volume set = 'bbb1' | Copy the value of Level 1.1 |
| 22 | 109 - 112 | I4 | Logical volume number within physical volume = 'bbb1' | Copy the value of Level 1.1 |
| 23 | 113 - 120 | A8 | Logical volume creation data = 'YYYYMMDD'(Without zero suppression) YYYY : Year MM : Month DD : Day | |
| 24 | 121 - 128 | A8 | Logical volume creation time = 'HHMMSSXX'(Without zero suppression) HH : Hour MM : Minute SS : Second XX : 10mili-second | |
| 25 | 129 - 140 | A12 | Logical volume generation country (JAPAN) = 'JAPANbbbbbbb' | Copy the value of Level 1.1 |
| 26 | 141 - 148 | A8 | Logical volume generating agency (Japan Aerospace Exploration Agency) = 'JAXAbbbb' | Copy the value of Level 1.1 |
| 27 | 149 - 160 | A12 | Logical volume generating facility Spacecraft Control and Mission Operation System = 'SCMObbbbbbb' Earth Intelligence Collection and Shearing Earth Intelligence Collection and Shearing System = 'EICSbbbbbbb' | |
| 28 | 161 - 164 | I4 | Number of file pointer records in volume directory = ' N+2 (N is number of polarization)' | |
| 29 | 165 - 168 | I4 | Number of text records in volume directory = 'bbb1' | Copy the value of Level 1.1 |
| 30 | 169 - 260 | A92 | Volume descriptor Spare = Blanks | Copy the value of Level 1.1 |
| 31 | 261 - 360 | A100 | Local use segment = Blanks | Copy the value of Level 1.1 |

Table 3-7 File pointer records (1/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|-----------------------------|
| 1 | 1 - 4 | B4 | Record number Single Polarization Leader file = 2) ₁₀ Image file = 3) ₁₀ Trailer file = 4) ₁₀ Dual polarization Leader file = 2) ₁₀ Image file = 3), 4) ₁₀ Trailer file = 5) ₁₀ Full (Quad.) polarimetry(four polarization) Leader file = 2) ₁₀ Image file = 3), 4), 5), 6) ₁₀ Trailer file = 7) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record Sub-type code = 219) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Record length = 360) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Copy the value of Level 1.1 |
| 8 | 15 - 16 | A2 | Blanks | Copy the value of Level 1.1 |
| 9 | 17 - 20 | I4 | Referenced file number Leader file = 'bbb1' Image file = 'bbb2' Trailer file = 'bbb3' | Copy the value of Level 1.1 |

Table 3-7 File pointer records (2/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|--------------------------------|
| 10 | 21 - 36 | A16 | Referenced File name ID = 'MMNbSSSTFFFFbbbb' MM : Mission ID (ALOS2='AL')(*) N : Mission number (=2')(*) SSS : Sensor ID (SAR='SAR')(*) T : Processing level code Level 2.1 = 'E' FFFF : File Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer = 'SART' | (*)Copy the value of Level 1.1 |
| 11 | 37 - 64 | A28 | Referenced file class Leader file = 'SARLEADERbFILEbbbbbbbbbbbb' Image file = 'IMAGERYbOPTIONSbFILEbbbbbbbb' Trailer file = 'SARTRAILERbFILEbbbbbbbbbbbb' | Copy the value of Level 1.1 |
| 12 | 65 - 68 | A4 | Reference file class code Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | Copy the value of Level 1.1 |
| 13 | 69 - 96 | A28 | Referenced file data Type = 'MIXEDbBINARYbANDbASCIIbbbbbb' | Copy the value of Level 1.1 |
| 14 | 97 - 100 | A4 | Referenced file data Type code = 'MBAA'(Mixed Binary And ASCII) | Copy the value of Level 1.1 |
| 15 | 101 - 108 | I8 | Number of records in referenced file Leader file = 'bbbbbb12' Image file = N+1 (N is the number of image data records) Trailer file = 'bbbbbb2' | |
| 16 | 109 - 116 | I8 | Length of the first record in referenced file = 'bbbbbb720' | Copy the value of Level 1.1 |
| 17 | 117 - 124 | I8 | Maximum record length in referenced file | bbbbnnnn |

B

Table 3-7 File pointer records (3/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-----------------------------|
| 18 | 125 - 136 | A12 | Referenced file record length type Leader file = 'VARIABLEbLEN' Image file = 'VARIABLEbLEN' Trailer file = 'VARIABLEbLEN' | Copy the value of Level 1.1 |
| 19 | 137 - 140 | A4 | Referenced file record length type code Leader file = 'VARE' Image file = 'VARE' Trailer file = 'VARE' | Copy the value of Level 1.1 |
| 20 | 141 - 142 | I2 | The number of the physical volume set containing the first record of the file = 'b1' | Copy the value of Level 1.1 |
| 21 | 143 - 144 | I2 | The number of the physical volume set containing the last record of the file = 'b1' | Copy the value of Level 1.1 |
| 22 | 145 - 152 | I8 | Record number of the first record appearing on this physical volume = 'bbbbbb1' | Copy the value of Level 1.1 |
| 23 | 153 - 160 | I8 | Record number of the last record appearing on this physical volume Leader file = 'bbbbbb12' Image file = N+1 (N is the number of image data records) Trailer file = 'bbbbbb2' | |
| 24 | 161 - 260 | A100 | Spare = Blanks | Copy the value of Level 1.1 |
| 25 | 261 - 360 | A100 | Local use segment = Blanks | Copy the value of Level 1.1 |

B

Table 3-8 Text records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|---------------------------------|
| 1 | 1 - 4 | B4 | Record number = $N + 4)_{10}$ (N = 'Number of polarization') | Copy the value of Level 1.1 |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = $18)_{10}$ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = $192)_{10}$ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = $18)_{10}$ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = $18)_{10}$ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Record length = $360)_{10}$ | Copy the value of Level 1.1 |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Copy the value of Level 1.1 |
| 8 | 15 - 16 | A2 | Blanks | Copy the value of Level 1.1 |
| 9 | 17 - 56 | A40 | Product ID = 'PRODUCT: DDDEFFFGHIbbbbbbbbbbbbbbbbbbbb' DDD: Observation mode (*) SBS: Spotlight mode UBS: Ultra-fine mode (Single pol.) UBD: Ultra-fine mode (Dual pol.) HBS: High-sensitive mode (Single pol.) HBD: High-sensitive mode (Dual pol.) HBQ: High-sensitive mode (Full(Quad.) pol.) FBS: Fine mode (Single pol.) FBD: Fine mode (Dual pol.) FBQ: Fine mode (Full (Quad.) pol.) WBS: ScanSAR nominal [14MHz] mode (Single pol.) WBD: ScanSAR nominal [14MHz] mode (Dual pol.) WWS: ScanSR nominal [28MHz,] mode (Single pol.) WWD: ScanSAR nominal [28MHz] mode (Dual pol.) VBS: ScanSAR wide mode (Single pol.) VBD: ScanSAR wide mode (Dual pol.) E : Observation direction (*) L: Left looking R: Right looking | (*) Copy the value of Level 1.1 |

Table 3-8 Text records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|---------------------------------|
| | | | FFF: Processing level 2.1: Level 2.1 G : Processing option G: Geo-Coded H : Map projection U: UTM P: PS M: MER L: LCC I : Ascending node (*) A: Ascending D: Descending | (*) Copy the value of Level 1.1 |
| 10 | 57 - 116 | A60 | Location and date/time of product creation Spacecraft Control Mission Operation system = 'PROCESS: JAPAN-JAXA-ALOS2-SCMObbYYYYMMDDbHHMMSSb...b' Earth Intelligence Collection and Shearing system = 'PROCESS: JAPAN-JAXA-ALOS2-EICsbYYYYMMDDbHHMMSSb...b' (without zero suppress both) YYYYMMDD : Date of creation (YYYY: Year, MM: Month, DD: Day) HHMMSS : Time of Creation (UTC) | |
| 11 | 117 - 156 | A40 | Physical tape ID = 'TAPEbID: bbbbbb' | Copy the value of Level 1.1 |
| 12 | 157 - 196 | A40 | Scene ID = 'ORBITb: AAAAABBBBBCCCC-YMMDDbbbbbb' AAAA : Satellite (= 'ALOS2') BBBB : Orbit accumulation number of a scene center CCCC : Scene frame number of a scene center - : Separator (hyphen) YMMDD : Observation date of a scene center (YY: lower 2 figures of a year, MM: month, DD: day) | Copy the value of Level 1.1 |
| 13 | 197 - 236 | A40 | Scene location ID = 'FRAMEbCENTRE: bN±nnn.nnbbE±nnn.nbbbbbb': Level 2.1 N±nnn.nn : Latitude of a scene center [deg] E±nnn.nn : Longitude of a scene center [deg] | Copy the value of Level 1.1 |
| 14 | 237 - 360 | A124 | Blanks | Blanks (b*124) |

Table 3-9 SAR Leader file descriptor records (1/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|---------------------------------|
| 1 | 1 - 4 | B4 | Record number = 1) ₁₀ | Copy the value of Level 1.1 |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 11) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Record length = 720) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Copy the value of Level 1.1 |
| 8 | 15 - 16 | A2 | Blanks | Copy the value of Level 1.1 |
| 9 | 17 - 28 | A12 | Format control document ID = 'CEOS-SARbbbb' | Copy the value of Level 1.1 |
| 10 | 29 - 30 | A2 | Format control document revision level = 'bA' | Copy the value of Level 1.1 |
| 11 | 31 - 32 | A2 | Record format revision level = 'bA' | Copy the value of Level 1.1 |
| 12 | 33 - 44 | A12 | Software release and revision level = 'NNN.NNNbbbbbb' 001.000, 001.001, ... 001.100, ...002.000 | Copy the value of Level 1.1 |
| 13 | 45 - 48 | I4 | File number = 'bbb1' | Copy the value of Level 1.1 |
| 14 | 49 - 64 | A16 | File ID = 'MMNbSSSTFFFFbbbb' MM : Mission ID (ALOS2='AL')(*) N : Mission number (=2')(*) SSS : Sensor ID (SAR='SAR')(*) T : Processing level code Level 2.1 = 'E' FFFF : File Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | (*) Copy the value of Level 1.1 |
| 15 | 65 - 68 | A4 | Record sequence and location type flag = 'FSEQ' | Copy the value of Level 1.1 |

A

Table 3-9 SAR Leader file descriptor records (2/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-----------------------------|
| 16 | 69 - 76 | I8 | Sequence number of location = 'bbbbbb1' | Copy the value of Level 1.1 |
| 17 | 77 - 80 | I4 | Field length of sequence number = 'bbb4' | Copy the value of Level 1.1 |
| 18 | 81 - 84 | A4 | Record code and location type flag = 'FTYP' | Copy the value of Level 1.1 |
| 19 | 85 - 92 | I8 | Location of record code = 'bbbbbb5' | Copy the value of Level 1.1 |
| 20 | 93 - 96 | I4 | Field length of record code = 'bbb4' | Copy the value of Level 1.1 |
| 21 | 97 - 100 | A4 | Record length and location type flag = 'FLGT' | Copy the value of Level 1.1 |
| 22 | 101 - 108 | I8 | Location of record length = 'bbbbbb9' | Copy the value of Level 1.1 |
| 23 | 109 - 112 | I4 | Field length of record length = 'bbb4' | Copy the value of Level 1.1 |
| 24 | 113 - 180 | A68 | Blanks | Copy the value of Level 1.1 |
| 25 | 181 - 186 | I6 | Number of data set summary records = 'bbbb1' | Copy the value of Level 1.1 |
| 26 | 187 - 192 | I6 | Data set summary record length = 'bb4096' | Copy the value of Level 1.1 |
| 27 | 193 - 198 | I6 | Number of map projection data records = 'bbbb1' | |
| 28 | 199 - 204 | I6 | Map projection data record length = 'bb1620' | |
| 29 | 205 - 210 | I6 | Number of platform position data records = 'bbbb1' | Copy the value of Level 1.1 |
| 30 | 211 - 216 | I6 | Platform position record length = 'bb4680' | Copy the value of Level 1.1 |
| 31 | 217 - 222 | I6 | Number of attitude data records = 'bbbb1' | Copy the value of Level 1.1 |
| 32 | 223 - 228 | I6 | Attitude data record length = 'b16384' | Copy the value of Level 1.1 |
| 33 | 229 - 234 | I6 | Number of radiometric data records = 'bbbb1' | Copy the value of Level 1.1 |
| 34 | 235 - 240 | I6 | Radiometric record length = 'bb9860' | Copy the value of Level 1.1 |
| 35 | 241 - 246 | I6 | Number of radiometric compensation records = 'bbbb0' | Copy the value of Level 1.1 |
| 36 | 247 - 252 | I6 | Radiometric compensation record length = 'bbbb0' | Copy the value of Level 1.1 |
| 37 | 253 - 258 | I6 | Number of data quality summary records = 'bbbb1' | Copy the value of Level 1.1 |
| 38 | 259 - 264 | I6 | Data quality summary record length = 'bb1620' | Copy the value of Level 1.1 |
| 39 | 265 - 270 | I6 | Number of data histograms records = 'bbbb0' | Copy the value of Level 1.1 |
| 40 | 271 - 276 | I6 | Data histogram record length = 'bbbb0' | Copy the value of Level 1.1 |

Table 3-9 SAR Leader file descriptor records (3/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-----------------------------|
| 41 | 277 - 282 | I6 | Number of range spectra records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 42 | 283 - 288 | I6 | Range spectra record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 43 | 289 - 294 | I6 | Number of DEM descriptor records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 44 | 295 - 300 | I6 | DEM descriptor record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 45 | 301 - 306 | I6 | Number of radar parameter update records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 46 | 307 - 312 | I6 | Radar parameter update record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 47 | 313 - 318 | I6 | Number of annotation data records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 48 | 319 - 324 | I6 | Annotation data record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 49 | 325 - 330 | I6 | Number of detail processing records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 50 | 331 - 336 | I6 | Detail processing record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 51 | 337 - 342 | I6 | Number of calibration records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 52 | 343 - 348 | I6 | Calibration record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 53 | 349 - 354 | I6 | Number of GCP records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 54 | 355 - 360 | I6 | GCP record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 55 | 361 - 420 | 10A6 | Spare | Copy the value of Level 1.1 |
| 56 | 421 - 426 | I6 | Number of facility data(1) records = 'bbbbbb1' | Copy the value of Level 1.1 |
| 57 | 427 - 434 | I8 | Facility data(1) record length = 'bb325000' | Copy the value of Level 1.1 |
| 58 | 435 - 440 | I6 | Number of facility data(1) records = 'bbbbbb1' | Copy the value of Level 1.1 |
| 59 | 441 - 448 | I8 | Facility data(2) record length = 'bb511000' | Copy the value of Level 1.1 |
| 60 | 449 - 454 | I6 | Number of facility data(2) records = 'bbbbbb1' | Copy the value of Level 1.1 |
| 61 | 455 - 462 | I8 | Facility data(3) record length = 'bbbb3072' | Copy the value of Level 1.1 |
| 62 | 463 - 468 | I6 | Number of facility data(3) records = 'bbbbbb1' | Copy the value of Level 1.1 |
| 63 | 469 - 476 | I8 | Facility data(4) record length = 'bb728000' | Copy the value of Level 1.1 |
| 64 | 477 - 482 | I6 | Number of facility data(5) records = 'bbbbbb1' | Copy the value of Level 1.1 |
| 65 | 483 - 490 | I8 | Facility data(5) record length = 'bbbb5000' | Copy the value of Level 1.1 |
| 66 | 491 - 720 | A230 | Blanks | Copy the value of Level 1.1 |

Table 3-10 Data set summary records (1/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|---|-----------------------------|
| 1 | 1 - 4 | B4 | Records number = 2) ₁₀ | Copy the value of Level 1.1 |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 10) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Data set summary records length = 4096) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 16 | I4 | Data set summary records sequence number = 'bbb1' | Copy the value of Level 1.1 |
| 8 | 17 - 20 | A4 | SAR channel ID = Blanks (fixed value) | Copy the value of Level 1.1 |
| 9 | 21 - 52 | A32 | Scene ID = 'AAAAABBBBBCCCC-YYMMDDbbbbbbbbbb' AAAAA : Satellite ID (= 'ALOS2') BBBBB : Orbit accumulation number of a scene center CCCC : Scene frame number of a scene center - : Separator (hyphen) YYMMDD : Observation date of a scene center (YY: lower 2 figures of a year, MM: month, DD: day) | Copy the value of Level 1.1 |
| 10 | 53 - 68 | A16 | Number of scene reference = Blanks (fixed value) | Copy the value of Level 1.1 |
| 11 | 69 - 100 | A32 | Scene center time = 'YYYYMMDDHHMMSSttbbbbbbbbbbbbbb' (Without zero suppression, YYYY: year, MM: month, DD: day) HHMMSSttt : Time (UTC) | Copy the value of Level 1.1 |
| 12 | 101 - 116 | A16 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 13 | 117 - 132 | F16.7 | Geodetic latitude (defined as positive to the north of the equator and negative to the south) of processed scene center [deg] = Positive value to the north of the equator = Negative value to the south of the equator | |
| 14 | 133 - 148 | F16.7 | Geodetic longitude (defined as positive to the east of the prime meridian and negative to the west) of processed scene center [deg] = Positive value to the east of the prime meridian = Positive value to the west of the prime meridian | |
| 15 | 149 - 164 | F16.7 | Processed scene center true heading [deg] = Value | |

Table 3-10 Data set summary records (2/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|---|-----------------------------|
| 16 | 165 - 180 | A16 | Ellipsoid designator = 'GRS80bbbbbbbbbb'(fixed value) | Copy the value of Level 1.1 |
| 17 | 181 - 196 | F16.7 | Ellipsoid semi-major axis [km] = 6378.1370000 | Copy the value of Level 1.1 |
| 18 | 197 - 212 | F16.7 | Ellipsoid semi-minor axis [km] = 6356.7523141 | Copy the value of Level 1.1 |
| 19 | 213 - 228 | F16.7 | Earth mass [10^{24} kg] = 5.9740000 | Copy the value of Level 1.1 |
| 20 | 229 - 244 | F16.7 | Gravitational constant [10^{-14} m ³ /s ²] = 3.9860050 | Copy the value of Level 1.1 |
| 21 | 245 - 260 | F16.7 | Ellipsoid J2 parameter = 0.1082629×10^{-2} | Copy the value of Level 1.1 |
| 22 | 261 - 276 | F16.7 | Ellipsoid J3 parameter = $-0.0000254 \times 10^{-1}$ | Copy the value of Level 1.1 |
| 23 | 277 - 292 | F16.7 | Ellipsoid J4 parameter = $-0.0000162 \times 10^{-1}$ | Copy the value of Level 1.1 |
| 24 | 293 - 308 | A16 | Spare = Blanks(fixed value) | Copy the value of Level 1.1 |
| 25 | 309 - 324 | F16.7 | Average terrain height above ellipsoid at scene center = Blanks (fixed value) | Copy the value of Level 1.1 |
| 26 | 325 - 332 | I8 | Scene center line No. (Including zero fill) | N/2 (N: number of lines) |
| 27 | 333 - 340 | I8 | Scene center pixel No. (Including zero fill) | M/2 (M: number of pixels) |
| 28 | 341 - 356 | F16.7 | Processing scene length [km] = Blanks (fixed value) | Copy the value of Level 1.1 |
| 29 | 357 - 372 | F16.7 | Processed scene width [km] = Blanks (fixed value) | Copy the value of Level 1.1 |
| 30 | 373 - 388 | A16 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 31 | 389 - 392 | I4 | Number of SAR channel = 'bbbn' Single Beam type 2: Fine [10m] mode (Single pol.) 4: Fine [10m] mode (Dual pol., Full (Quad.) pol.) Dual beam type 4: Spotlight mode, High-resolution mode (Single pol.), ScanSAR mode (Single pol.) 8: High resolution mode (Dual pol., Full (Quad.) pol.) ScanSAR mode (Dual pol.) | Copy the value of Level 1.1 |
| 32 | 393 - 396 | A4 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 33 | 397 - 412 | A16 | Sensor platform mission identifier (ID) = 'ALOS2bbbbbbbbbb' | Copy the value of Level 1.1 |

Table 3-10 Data set summary records (3/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-----------------------------|
| 34 | 413 - 444 | A32 | Sensor ID and operation mode = 'AAAAAA-BB-CCDD-bbbbbbbbbbbbbbbb' AAAAAA : Satellite ID (= 'ALOS2b') BB : SAR band (= 'Lb') CC : Operation mode '00': Spotlight mode '01': Ultra-fine mode '02': High-sensitive mode '03': Fine mode '08': ScanSAR nominal mode '09': ScanSAR wide mode '18': Full (Quad.) pol./High-sensitive mode '19': Full (Quad.) pol./Fine mode DD : Calibration mode '15': During observation | Copy the value of Level 1.1 |

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Table 3-10 Data set summary records (4/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|---|-----------------------------|
| 35 | 445 - 452 | I8 | Orbit number or flight line indicator | Copy the value of Level 1.1 |
| 36 | 453 - 460 | F8.3 | Sensor platform geodetic latitude at nadir corresponding to scene center [deg] = Value Blanks | |
| 37 | 461 - 468 | F8.3 | Sensor platform geodetic longitude at nadir corresponding to scene center [deg] = Value Blanks | |
| 38 | 469 - 476 | F8.3 | Sensor platform heading at nadir corresponding to scene center [deg] = Value Blanks | |
| 39 | 477 - 484 | F8.3 | Sensor clock angle as measured relative to sensor platform flight direction [deg] Left = 'b-90.000' Right = 'bb90.000' | Copy the value of Level 1.1 |
| 40 | 485 - 492 | F8.3 | Incidence angle at scene center [deg] = Value | Copy the value of Level 1.1 |
| 41 | 493 - 500 | A8 | Spare = Blanks | Copy the value of Level 1.1 |
| 42 | 501 - 516 | F16.7 | Radar wavelength [m] = Nominal value | Copy the value of Level 1.1 |
| 43 | 517 - 518 | A2 | Motion compensation indicator = '00'(fixed value) 00 : No. compensation 01 : on board compensation 10 : in processor compensation 11 : both on board and in processor | Copy the value of Level 1.1 |
| 44 | 519 - 534 | A16 | Range pulse code = 'LINEARbFMbCHIRPb' | Copy the value of Level 1.1 |
| 45 | 535 - 550 | E16.7 | Range pulse amplitude coefficient #1 = Nominal value Center frequency ξ_1 for pulse width τ of linearFMmodulationchirp (Constant term) | Copy the value of Level 1.1 |
| 46 | 551 - 566 | E16.7 | Range pulse amplitude coefficient #2 = Nominal value FMrate ξ_2 for pulse width τ of linearFMmodulationchirp (Linear coefficient terms) | Copy the value of Level 1.1 |
| 47 | 567 - 582 | E16.7 | Range pulse amplitude coefficient #3 = Nominal value (= 0.0) FMrate ξ_3 for pulse width τ of linearFMmodulationchirp (Quadratic coefficient terms) | Copy the value of Level 1.1 |
| 48 | 583 - 598 | E16.7 | Range pulse amplitude coefficient #4 = Nominal value (= 0.0) FMrate ξ_4 for pulse width τ of linearFMmodulationchirp (Cubic coefficient terms) | Copy the value of Level 1.1 |
| 49 | 599 - 614 | E16.7 | Range pulse amplitude coefficient #5 = Nominal value (= 0.0) FMrate ξ_5 for pulse width τ of linearFMmodulationchirp (Quartic term coefficient) | Copy the value of Level 1.1 |

Table 3-10 Data set summary records (5/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|--|-----------------------------|
| 50 | 615 - 630 | E16.7 | Range pulse phase coefficient # 1 (Constant term) = Blanks (fixed value) | Copy the value of Level 1.1 |
| 51 | 631 - 646 | E16.7 | Range pulse phase coefficient # 2 (Linear coefficient terms)= Blanks (fixed value) | Copy the value of Level 1.1 |
| 52 | 647 - 662 | E16.7 | Range pulse phase coefficient # 3 (Quadratic coefficient terms) = Blanks (fixed value) | Copy the value of Level 1.1 |
| 53 | 663 - 678 | E16.7 | Range pulse phase coefficient # 4 (Cubic coefficient terms) = Blanks (fixed value) | Copy the value of Level 1.1 |
| 54 | 679 - 694 | E16.7 | Range pulse phase coefficient # 5 (Quartic term coefficient) = Blanks (fixed value) | Copy the value of Level 1.1 |
| 55 | 695 - 702 | I8 | Down linked data chirp extraction index linear-up chirp = 'bbbbbb0' linear-down chirp = 'bbbbbb1' linear-up and -down chirp = 'bbbbbb2' | Copy the value of Level 1.1 |
| 56 | 703 - 710 | A8 | Spare = Blanks | Copy the value of Level 1.1 |
| 57 | 711 - 726 | F16.7 | Sampling rate [MHz] Extracted from auxiliary data of first PALSAR frame | Copy the value of Level 1.1 |
| 58 | 727 - 742 | F16.7 | Range gate (early edge (in time) at the start of the image) [µsec] Extracted from auxiliary data of first PALSAR frame | Copy the value of Level 1.1 |
| 59 | 743 - 758 | F16.7 | Range pulse width [µsec] Extracted from auxiliary data of first PALSAR frame | Copy the value of Level 1.1 |
| 60 | 759 - 762 | A4 | Base band conversion flag = 'YESb' (fixed value) | Copy the value of Level 1.1 |
| 61 | 763 - 766 | A4 | Range compressed flag = 'YESb': Level 1.1 or later: range compressed (fixed value) | Copy the value of Level 1.1 |
| 62 | 767 - 782 | F16.7 | Receiver gain for like polarized at early edge at the start of the image = Nominal value | Copy the value of Level 1.1 |
| 63 | 783 - 798 | F16.7 | Receiver gain for cross polarized at early edge at the start of the image = Nominal value | Copy the value of Level 1.1 |
| 64 | 799 - 806 | I8 | Quantization in bits per channel = 'bbbbbb8' | Copy the value of Level 1.1 |
| 65 | 807 - 818 | A12 | quantized descriptor = 'UNIFORMbI,Qb' | Copy the value of Level 1.1 |
| 66 | 819 - 834 | F16.7 | DC Bias for I-component = Nominal value | Copy the value of Level 1.1 |
| 67 | 835 - 850 | F16.7 | DC Bias for Q-component = Nominal value | Copy the value of Level 1.1 |
| 68 | 851 - 866 | F16.7 | Gain imbalance for I & Q = Nominal value | Copy the value of Level 1.1 |
| 69 | 867 - 882 | F16.7 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 70 | 883 - 898 | F16.7 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 71 | 899 - 914 | F16.7 | electronic boresight = fixed value | Copy the value of Level 1.1 |
| 72 | 915 - 930 | F16.7 | mechanical boresight = fixed value | Copy the value of Level 1.1 |
| 73 | 931 - 934 | A4 | Echo tracker-on/off = 'OFFb' (fixed value) | Copy the value of Level 1.1 |
| 74 | 935 - 950 | F16.7 | PRF[mHz] | Copy the value of Level 1.1 |
| 75 | 951 - 966 | F16.7 | Two-way antenna beam width [deg] (Elevation, Effective value) = Nominal value | Copy the value of Level 1.1 |
| 76 | 967 - 982 | F16.7 | Two-way antenna beam width [deg] (Azimuth, Effective value) = Nominal value | Copy the value of Level 1.1 |

Table 3-10 Data set summary records (6/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|--|-----------------------------|
| 77 | 983 - 998 | I16 | Satellite encoded binary time code: Standard satellite time counter of error time information (Tref) | Copy the value of Level 1.1 |
| 78 | 999 - 1030 | A32 | Satellite clock time: Standard ground time of error time information (Tgref) | Copy the value of Level 1.1 |
| 79 | 1031 - 1046 | I16 | Satellite clock increment [nsec]: Error time information of calculation satellite counter cycle (Psc) | Copy the value of Level 1.1 |
| 80 | 1047 - 1062 | A16 | Processing facility ID Spacecraft Control Mission Operation system = 'SCMObbbbbbbbbb' Earth Intelligence Collection and Shearing System = 'EICSbbbbbbbbbb' | |
| 81 | 1063 - 1070 | A8 | Processing system ID Spacecraft Control Mission Operation System = 'SCMObbbb' Earth Intelligence Collection and Shearing System = 'EICSbbbb' | |
| 82 | 1071 - 1078 | A8 | Processing version ID='NNN.NNNb' Note: This is the same as first 8 characters of software release and version ID for volume descriptor | |
| 83 | 1079 - 1094 | A16 | Processing code of processing facility = Blanks (fixed value) | Copy the value of Level 1.1 |
| 84 | 1095 - 1110 | A16 | Product level code = '2.1bbbbbbbbbb' | |
| 85 | 1111 - 1142 | A32 | Product type specifier = 'CORRECTEDbGEOCODEDbIMAGEbbbbbb' | |
| 86 | 1143 - 1174 | A32 | Processing algorithm ID = Blanks (fixed value) | Copy the value of Level 1.1 |
| 87 | 1175 - 1190 | F16.7 | Number of looks in azimuth = Value | |
| 88 | 1191 - 1206 | F16.7 | Number of looks in range = Value | |
| 89 | 1207 - 1222 | F16.7 | Bandwidth per look in azimuth [Hz] = Blanks | |
| 90 | 1223 - 1238 | F16.7 | Bandwidth per look in range [Hz] = Blanks | |
| 91 | 1239 - 1254 | F16.7 | Bandwidth in azimuth [Hz] 3dB down width of power spectrum of the reference function for full aperture ScanSAR: Blanks | |
| 92 | 1255 - 1270 | F16.7 | Bandwidth in range [kHz] = Blanks | |
| 93 | 1271 - 1302 | A32 | Weighing function in azimuth = 'bbbbbbbbbbbbbbbbbbbbbbbbbb1': RECTANGLE | Copy the value of Level 1.1 |
| 94 | 1303 - 1334 | A32 | Weighing function in range = 'bbbbbbbbbbbbbbbbbbbbbbbbbb1': RECTANGLE | Copy the value of Level 1.1 |
| 95 | 1335 - 1350 | A16 | Data input source (eg.HDDT-ID) = 'ONLINEbbbbbb': Online transfer (fixed value) | Copy the value of Level 1.1 |

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Table 3-10 Data set summary records (7/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|--|-----------------------------|
| 96 | 1351 - 1366 | F16.7 | Resolution in ground range [m] = Nominal value * number of looks in range direction | |
| 97 | 1367 - 1382 | F16.7 | Resolution in azimuth [m] = Nominal value * number of looks in azimuth direction | |
| 98 | 1383 - 1398 | F16.7 | Radiometric parameter (Bias) = Blanks (fixed value) | Copy the value of Level 1.1 |
| 99 | 1399 - 1414 | F16.7 | Radiometric parameter (Gain) = Blanks (fixed value) | Copy the value of Level 1.1 |
| 100 | 1415 - 1430 | F16.7 | Along track Doppler frequency (center) constant term at early edge of image [Hz] =Blanks | |
| 101 | 1431 - 1446 | F16.7 | Along track Doppler frequency (center) linear coefficient terms at early edge of image [Hz/pixel] = Blanks | |
| 102 | 1447 - 1462 | F16.7 | Along track Doppler frequency (center) quadratic coefficient terms at early edge of image [Hz/pixel/pixel] = Blanks | |
| 103 | 1463 - 1478 | A16 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 104 | 1479 - 1494 | F16.7 | Cross track Doppler frequency (center) constant term at early edge of image [Hz] = Blanks | |
| 105 | 1495 - 1510 | F16.7 | Cross track Doppler frequency (center) linear coefficient terms at early edge of image [Hz/pixel] = Blanks | |
| 106 | 1511 - 1526 | F16.7 | Cross track Doppler frequency (center) quadratic coefficient terms at early edge of image [Hz/pixel/pixel] = Blanks | |
| 107 | 1527 - 1534 | A8 | Time direction indicator along pixel direction = Blanks (fixed value) | Copy the value of Level 1.1 |
| 108 | 1535 - 1542 | A8 | Time direction indicator along line direction (Nominal value) Ascending = 'ASCENDbb' Descending = 'DESCENDb' | Copy the value of Level 1.1 |

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B

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Table 3-10 Data set summary records (8/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|--|-----------------------------|
| 109 | 1543 - 1558 | F16.7 | Along track Doppler frequency rate constant terms at early edge of the image [Hz/sec] = Blanks | |
| 110 | 1559 - 1574 | F16.7 | Along track Doppler frequency rate linear coefficient at early edge of the image [Hz/sec/pixel] = Blanks | |
| 111 | 1575 - 1590 | F16.7 | Along track Doppler frequency rate quadratic coefficient at early edge of the image [Hz/sec/pixel/pixel] = Blanks | |
| 112 | 1591 - 1606 | A16 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 113 | 1607 - 1622 | F16.7 | Cross track Doppler frequency rate constant terms at early edge of the image [Hz/sec] = Blanks | |
| 114 | 1623 - 1638 | F16.7 | Cross track Doppler frequency rate linear coefficient at early edge of the image [Hz/sec/pixel] = Blanks | |
| 115 | 1639 - 654 | F16.7 | Cross track Doppler frequency rate quadratic coefficient at early edge of the image [Hz/sec/pixel/pixel] = Blanks | |
| 116 | 1655 - 1670 | A16 | Spare = Blanks (fixed value) | Copy the value of Level 1.1 |
| 117 | 1671 - 1678 | A8 | Line content indicator = 'OTHERbbb' | |
| 118 | 1679 - 1682 | A4 | Clutter lock applied flag = 'YESb', 'NO..bb' | Copy the value of Level 1.1 |
| 119 | 1683 - 1686 | A4 | Auto-focusing applied flag = 'YESb', 'NO..bb' | Copy the value of Level 1.1 |

Table 3-10 Data set summary records (9/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|---|---|
| 120 | 1687 - 1702 | F16.7 | Line spacing [m] Spotlight: 0.625/ 1.25/ 2.5 Ultra-fine: 2.5/ 5.0/ 10.0 High-sensitive: 3.125/ 6.25/ 12.5 Fine: 6.25/ 12.5 ScanSAR: 25.0/ 50.0/ 100.0 | The pixel spacing is not defined as the value on a reference ellipsoid but as the value on a map coordinates. |
| 121 | 1703 - 1718 | F16.7 | Pixel spacing [m] Spotlight: 0.625/ 1.25/ 2.5 Ultra-fine: 2.5/ 5.0/ 10.0 High-sensitive: 3.125/ 6.25/ 12.5 Fine: 6.25/ 12.5 ScanSAR: 25.0/ 50.0/ 100.0 | The pixel spacing is not defined as the value on a reference ellipsoid but as the value on a map coordinates. |
| 122 | 1719 - 1734 | A16 | Processor range compression designator = 'EXTRACTEDbCHIRPb' | Copy the value of Level 1.1 |
| 123 | 1735 - 1750 | F16.7 | Doppler center frequency approximately coefficient constant term (a) | $fd = a + b \cdot R$ |
| 124 | 1751 - 1766 | F16.7 | Doppler center frequency approximately linear coefficient term (b) | fd: Doppler center frequency [Hz] R: Slant range [km] Copy the value of Level 1.1 |

Table 3-10 Data set summary records (10/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-------|---|-----------------------------|
| | | | SENSOR SPECIFIC LOCAL USE SEGMENT | |
| 125 | 1767 - 1770 | I4 | Calibration mode data location flag No calibration data = 'bbb0' The side of observation start = 'bbb1' The side of observation end = 'bbb2' The side of observation start/end = 'bbb3' | Copy the value of Level 1.1 |
| 126 | 1771 - 1778 | I8 | Start line number of calibration at the side of start In case of calibration location flag is '0', always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 127 | 1779 - 1786 | I8 | End line number of calibration at the side of start In case of calibration location flag is '0', always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 128 | 1787 - 1794 | I8 | Start line number of calibration at the side of end In case of calibration location flag is '0', always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 129 | 1795 - 1802 | I8 | End line number of calibration at the side of end In case of calibration location flag is '0', always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 130 | 1803 - 1806 | I4 | PRF switching indicator A fixed PRF 1 scene = 'bbb0' Variable PRFs = 'bbb1' ScanSAR mode = 'bbb1' | Copy the value of Level 1.1 |
| 131 | 1807 - 1814 | I8 | Line number of PRF switching A fixed PRF = 'bbbbbbb1' ScanSAR mode = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 132 | 1815 - 1830 | F16.7 | The direction of a beam center in a scene center [deg] = Blanks | |
| 133 | 1831 - 1834 | I4 | Yaw steering mode flag No yaw steering mode = 'bbb1' Yaw steering mode = 'bbb0' | Copy the value of Level 1.1 |
| 134 | 1835 - 1838 | I4 | Parameter table number of automatically setting = 'bbbb' | Copy the value of Level 1.1 |
| 135 | 1839 - 1854 | F16.7 | Nominal off nadir angle | Copy the value of Level 1.1 |
| 136 | 1855 - 1858 | I4 | Antenna beam number | Copy the value of Level 1.1 |
| 137 | 1859 - 1886 | A28 | Spare = Blanks | Copy the value of Level 1.1 |

Table 3-10 Data set summary records (11/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|--------|--|---|
| | | | PROCESSING SPECIFIC LOCAL USE SEGMENT | |
| 138 | 1887 - 1906 | E20.13 | Incidence angle constant term (a0) = Blanks | $\theta = a_0 + a_1 \cdot R + a_2 \cdot R^2 + a_3 \cdot R^3 + a_4 \cdot R^4 + a_5 \cdot R^5$ θ : Incidence angle [rad] R: Slant range [km] |
| 139 | 1907 - 1926 | E20.13 | Incidence angle linear coefficient term (a1) = Blanks | |
| 140 | 1927 - 1946 | E20.13 | Incidence angle quadratic coefficient term (a2) = Blanks | |
| 141 | 1947 - 1966 | E20.13 | Incidence angle cubic coefficient term (a3) = Blanks | |
| 142 | 1967 - 1986 | E20.13 | Incidence angle fourth coefficient term (a4) = Blanks | |
| 143 | 1987 - 2006 | E20.13 | Incidence angle fifth coefficient term (a5) = Blanks | |

Table 3-10 Data set summary records (12/12)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|------|--|-----------------------------|
| | | | IMAGE ANNOTATION SEGMENT | |
| 144 | 2007 - 2014 | I8 | Number of annotation points (up to 64) = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 145 | 2015 - 2022 | A8 | Spare = Blanks | Copy the value of Level 1.1 |
| 146 | 2023 - 2030 | I8 | Line number of 1 st annotation start = Blanks | Copy the value of Level 1.1 |
| 147 | 2031 - 2038 | I8 | Pixel number of 1 st annotation start = Blanks | Copy the value of Level 1.1 |
| 148 | 2039 - 2054 | A16 | 1 st annotation text = Blanks | Copy the value of Level 1.1 |
| 149 | 2055 - 2062 | I8 | Line number of 2 nd annotation start = Blanks | Copy the value of Level 1.1 |
| 150 | 2063 - 2070 | I8 | Pixel number of 2 nd annotation start = Blanks | Copy the value of Level 1.1 |
| 151 | 2071 - 2086 | A16 | 2 nd annotation text = Blanks | Copy the value of Level 1.1 |
| | . | | . | . |
| | . | | . | . |
| | . | | . | . |
| 152 | 4039 - 4046 | I8 | Line number of 64 th annotation start = Blanks | Copy the value of Level 1.1 |
| 153 | 4047 - 4054 | I8 | Pixel number of 64 th annotation start = Blanks | Copy the value of Level 1.1 |
| 154 | 4055 - 4070 | A16 | 64 th annotation text = Blanks | Copy the value of Level 1.1 |
| 155 | 4071 - 4096 | A26 | System reserve = Blanks | Copy the value of Level 1.1 |

Table 3-11 Map projection data records (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|---|-----------|-------|--|--|
| 1 | 1 - 4 | B4 | Record number = 3) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | |
| 3 | 6 - 6 | B1 | Record type code = 20) ₁₀ | |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | |
| 6 | 9 - 12 | B4 | Map projection data record length = 1620) ₁₀ | |
| 7 | 13 - 28 | A16 | Blanks | |
| MAP PROJECTION GENERAL INFORMATION | | | | |
| 8 | 29 - 60 | A32 | Map projection = 'GEOCODEDbbbbbbbbbbbbbbbbbbbb' | |
| 9 | 61 - 76 | I16 | Number of pixel per line | |
| 10 | 77 - 92 | I16 | Number of lines | |
| 11 | 93 - 108 | F16.7 | Inter-line distance in output scene [m] (Nominal value) Spotlight: 0.625/ 1.25/ 2.5 Ultra-fine: 2.5/ 5.0/ 10.0 High-sensitive: 3.125/ 6.25/ 12.5 Fine: 6.25/ 12.5 ScanSAR: 25.0/ 50.0/ 100.0 | The inter-line/pixel distances is not defined as the value on a reference ellipsoid but as the value on a map coordinates. |
| 12 | 109 - 124 | F16.7 | Inter-pixel distance in output scene [m] (Nominal value) Spotlight: 0.625/ 1.25/ 2.5 Ultra-fine: 2.5/ 5.0/ 10.0 High-sensitive: 3.125/ 6.25/ 12.5 Fine: 6.25/ 12.5 ScanSAR: 25.0/ 50.0/ 100.0 | |
| 13 | 125 - 140 | F16.7 | The angle between projection axis from true north at processed scene center [deg] | |
| 14 | 141 - 156 | F16.7 | Actual platform orbital Inclination = 0.0000000 | |
| 15 | 157 - 172 | F16.7 | Actual ascending node = 0.0000000 | |
| 16 | 173 - 188 | F16.7 | Distance of platform at input scene center from the geocentric [m] = Blanks | |
| 17 | 189 - 204 | F16.7 | Geodetic altitude of the platform relative to the ellipsoid [m] = Blanks | |
| 18 | 205 - 220 | F16.7 | Actual ground speed at nadir at input scene center time [m/sec] = Blanks | |
| 19 | 221 - 236 | F16.7 | Platform headings [deg] = Blanks | |

Table 3-11 Map projection data records (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|--|-------------------|
| | | | PROJECTION ELLIPSOID PARAMETERS | |
| 20 | 237 - 268 | A32 | Name of reference ellipsoid = 'GRS80bbbbbbbbbbbbbbbbbbbb' | |
| 21 | 269 - 284 | F16.7 | Semi-major axis of referenced ellipsoid [m] = 6378137.0000000 | |
| 22 | 285 - 300 | F16.7 | Semi-minor axis of referenced ellipsoid [m] = 6356752.3141000 | |
| 23 | 301 - 316 | F16.7 | Datum shift parameter (dx) [m] = 0.0000000 | |
| 24 | 317 - 332 | F16.7 | Datum shift parameter (dy) [m] = 0.0000000 | |
| 25 | 333 - 348 | F16.7 | Datum shift parameter (dz) [m] = 0.0000000 | |
| 26 | 349 - 364 | F16.7 | Datum shift (1 st rotation angle) = 0.0000000 | |
| 27 | 365 - 380 | F16.7 | Datum shift (2 nd rotation angle) = 0.0000000 | |
| 28 | 381 - 396 | F16.7 | Datum shift (3 rd rotation angle) = 0.0000000 | |
| 29 | 397 - 412 | F16.7 | Scale factor of referenced ellipsoid = 0.0000000 | |
| | | | MAP PROJECTION DESIGNATOR | |
| 30 | 413 - 444 | A32 | Alphanumeric description of map projection = 'UTM-PROJECTIONbbbbbbbbbbbbbbbb': UTM-projection = 'UPS-PROJECTIONbbbbbbbbbbbbbbbb': PS-projection = 'MER-PROJECTIONbbbbbbbbbbbbbbbb': Mercator-projection = 'LCC-PROJECTIONbbbbbbbbbbbbbbbb': LCC-projection | |
| | | | UTM-PROJECTION (1st default) | |
| 31 | 445 - 476 | A32 | Type of UTM = 'UNIVERSALbTRANSVERSEbMERCATORbbb' | Blanks except UTM |
| 32 | 477 - 480 | A4 | UTM zone number | |
| 33 | 481 - 496 | F16.5 | Map origin (false easting) [m] = 500000.00000 | |
| 34 | 497 - 512 | F16.5 | Map origin (false northing)[m] = 0.00000: Northern Hemisphere = 1000000.00000: Southern Hemisphere | |
| 35 | 513 - 528 | F16.7 | Center of projection longitude [deg] | |
| 36 | 529 - 544 | F16.7 | Center of projection latitude [deg] | |
| 37 | 545 - 560 | A16 | Blanks | |
| 38 | 561 - 576 | A16 | Blanks | Blanks except UTM |
| 39 | 577 - 592 | F16.7 | Scale factor = 0.9996000 | |
| | | | UPS-PROJECTION (2nd default) | |
| 40 | 593 - 624 | A32 | Type of UPS = 'UNIVERSALbPOLARbSTEREOGRAPHICbbb' | Blanks except UPS |
| 41 | 625 - 640 | F16.7 | Center of projection longitude [deg] | |
| 42 | 641 - 656 | F16.7 | Center of projection latitude [deg] | |
| 43 | 657 - 672 | F16.7 | Scale factor = 1.0000000 | |

Table 3-11 Map projection data records (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|--|---------------------------|
| | | | NATIONAL SYSTEM PROJECTION (any other) | |
| 44 | 673 - 704 | A32 | Projection descriptor = 'MERCATORbbbbbbbbbbbbbbbbbbbb': MER-PROJECTION = 'LAMBERT-CONFORMALbCONICbbbbbbbb': LCC-PROJECTION | Blanks except MER and LCC |
| 45 | 705 - 720 | F16.5 | Map origin (false easting) [m] = Blanks | |
| 46 | 721 - 736 | F16.5 | Map origin (false northing) [m] = Blanks | |
| 47 | 737 - 752 | F16.7 | Center of projection longitude [deg] (In either case MER/LCC, set center map origin lat/lon) | |
| 48 | 753 - 768 | F16.7 | Center of projection latitude [deg] (In either case MER/LCC, set center map origin lat/lon) | |
| 49 | 769 - 784 | F16.7 | Standard parallel [deg] (Standard parallel ϕ_1) MER: 0.0 fixed, LCC: latitude of scene center | |
| 50 | 785 - 800 | F16.7 | Standard parallel [deg] (Standard parallel ϕ_2) MER: 0.0 fixed, LCC: latitude of scene center | |
| 51 | 801 - 816 | F16.7 | Standard parallel [deg] = Blanks | |
| 52 | 817 - 832 | F16.7 | Standard parallel [deg] = Blanks | |
| 53 | 833 - 848 | F16.7 | Central meridian [deg] = Blanks | |
| 54 | 849 - 864 | F16.7 | Central meridian [deg] = Blanks | |
| 55 | 865 - 880 | F16.7 | Central meridian [deg] = Blanks | |
| 56 | 881 - 944 | A64 | Blanks | |

Table 3-11 Map projection data records (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|---------|---|---|
| | | | COORDINATES OF FOUR CORNER POINTS | |
| 57 | 945 - 960 | F16.7 | Top left corner northing [km] | Set the X coordinate value at the center of pixel at the top left corner |
| 58 | 961 - 976 | F16.7 | Top left corner easting [km] | Set the Y coordinate value at the center of pixel at the top left corner |
| 59 | 977 - 992 | F16.7 | Top right corner northing [km] | Set the X coordinate value at the center of pixel at the top right corner |
| 60 | 993 - 1008 | F16.7 | Top right corner easting [km] | Set the Y coordinate value at the center of pixel at the top right corner |
| 61 | 1009 - 1024 | F16.7 | Bottom right corner northing [km] | Set the X coordinate value at the center of pixel at the bottom right corner |
| 62 | 1025 - 1040 | F16.7 | Bottom right corner easting [km] | Set the Y coordinate value at the center of pixel at the bottom right corner |
| 63 | 1041 - 1056 | F16.7 | Bottom left corner northing [km] | Set the X coordinate value at the center of pixel at the bottom left corner |
| 64 | 1057 - 1072 | F16.7 | Bottom left corner easting [km] | Set the Y coordinate value at the center of pixel at the bottom left corner |
| 65 | 1073 - 1088 | F16.7 | Top left corner latitude [deg] | Set latitude at the center of pixel at the top left corner |
| 66 | 1089 - 1104 | F16.7 | Top left corner longitude [deg] | Set longitude at the center of pixel at the top left corner |
| 67 | 1105 - 1120 | F16.7 | Top right corner latitude [deg] | Set latitude at the center of pixel at the top right corner |
| 68 | 1121 - 1136 | F16.7 | Top right corner longitude [deg] | Set longitude at the center of pixel at the top right corner |
| 69 | 1137 - 1152 | F16.7 | Bottom right corner latitude [deg] | Set latitude at the center of pixel at the bottom right corner |
| 70 | 1153 - 1168 | F16.7 | Bottom right corner longitude [deg] | Set longitude at the center of pixel at the bottom right corner |
| 71 | 1169 - 1184 | F16.7 | Bottom left corner latitude [deg] | Set latitude at the center of pixel at the bottom left corner |
| 72 | 1185 - 1200 | F16.7 | Bottom left corner longitude [deg] | Set longitude at the center of pixel at the bottom left corner |
| 73 | 1201 - 1216 | A16 | Top left corner terrain height relative to ellipsoid [m] = Blanks | |
| 74 | 1217 - 1232 | A16 | Top right corner terrain height relative to ellipsoid [m] = Blanks | |
| 75 | 1233 - 1248 | A16 | Bottom right corner terrain height relative to ellipsoid [m] = Blanks | |
| 76 | 1249 - 1264 | A16 | Bottom left corner terrain height relative to ellipsoid [m] = Blanks | |
| 77 | 1265 - 1424 | 8E20.10 | <p>Eight coefficients to convert a line(L) and pixel(P) position to the map projection frame of reference, say (E, N) where:</p> $E = A11 + A12*L + A13*P + A14*L*P$ $N = A21 + A22*L + A23*P + A24*L*P$ <p>The order of storing: A11, A12, A13, ..., A24 Recommend to use the coefficients of 1025-2024 bytes in facility related data record 5</p> | <p>For the expressions, the position defined as (P, L) = (1, 1). corresponds to the central point of the pixel at the upper left corner and (E, N) show a longitude [deg] and a latitude [deg].</p> |
| 78 | 1425 - 1584 | 8E20.10 | <p>Eight coefficients to convert from the map projection (E, N) to line(L) and pixel(P) position in the image, say (L, P) where:</p> $L = B11 + B12*E + B13*N + B14*E*N$ $P = B21 + B22*E + B23*N + B24*E*N$ <p>The order of storing: B11, B12, B13, ..., B24 Recommend to use the coefficients of 2065-3064 bytes in facility related data record 5</p> | |
| 79 | 1585 - 1620 | A36 | Blanks | |

Table 3-12 Platform position data records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|-------|--|-----------------------------|
| 1 | 1 - 4 | B4 | Record number = 4) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 30) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record sun-type code = 20) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Platform position data record length = 4680) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 44 | A32 | Orbital elements designator Orbit information (preliminary) = '0bbbbbbbbbbbbbbbbbbbbbbbbbbbb' Orbit information (decision) = '1bbbbbbbbbbbbbbbbbbbbbbbbbbbb' High precision orbit information = '2bbbbbbbbbbbbbbbbbbbbbbbbbbbb' | Copy the value of Level 1.1 |
| 8 | 45 - 60 | F16.7 | 1 st orbital element Position vector in the earth fixed coordinate system of the scene center (x) [m] | Copy the value of Level 1.1 |
| 9 | 61 - 76 | F16.7 | 2 nd orbital element Position vector in the earth fixed coordinate system of the scene center (y) [m] | Copy the value of Level 1.1 |
| 10 | 77 - 92 | F16.7 | 3 rd orbital element Position vector in the earth fixed coordinate system of the scene center (z) [m] | Copy the value of Level 1.1 |
| 11 | 93 - 108 | F16.7 | 4 th orbital element Velocity vector in the earth fixed coordinate system of the scene center (x') [m/sec] | Copy the value of Level 1.1 |
| 12 | 109 - 124 | F16.7 | 5 th orbital element Velocity vector in the earth fixed coordinate system of the scene center (y') [m/sec] | Copy the value of Level 1.1 |
| 13 | 125 - 140 | F16.7 | 6 th orbital element Velocity vector in the earth fixed coordinate system of the scene center (z') [m/sec] | Copy the value of Level 1.1 |
| 14 | 141 - 144 | I4 | Number of data points Orbit information (preliminary) = 'bb28' Orbit information (decision) = 'bb28' High precision orbit information = 'bb28' | Copy the value of Level 1.1 |
| 15 | 145 - 148 | I4 | YYYY : Year of 1 st point | Copy the value of Level 1.1 |
| 16 | 149 - 152 | I4 | bbMM : Month of 1 st point | Copy the value of Level 1.1 |

B

B

B

Table 3-12 Platform position data records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|-----------------|--|-----------------------------|
| 17 | 153 - 156 | I4 | bbDD : Day of 1 st point | Copy the value of Level 1.1 |
| 18 | 157 - 160 | I4 | Day in the year of 1 st point (Ex: 2 nd February = 33 th) | Copy the value of Level 1.1 |
| 19 | 161 - 182 | E22.15 | Seconds of day of 1 st point (Ex: 0:51:30.23 = 3090.23) | Copy the value of Level 1.1 |
| 20 | 183 - 204 | E22.15 | Time interval between data points [sec] = 60 | Copy the value of Level 1.1 |
| 21 | 205 - 268 | A64 | Reference co-ordinate system (ECI, ECR) = 'ECRbb' | Copy the value of Level 1.1 |
| 22 | 269 - 290 | E22.15 | Greenwich mean hour angle [deg] = Blanks (fixed value) | Copy the value of Level 1.1 |
| 23 | 291 - 306 | F16.7 | Along track position error [m] = Nominal value | Copy the value of Level 1.1 |
| 24 | 307 - 322 | F16.7 | Across track position error [m] = Nominal value | Copy the value of Level 1.1 |
| 25 | 323 - 338 | F16.7 | Radial position error [m] = Nominal value | Copy the value of Level 1.1 |
| 26 | 339 - 354 | F16.7 | Along track velocity error [m/sec] = Nominal value | Copy the value of Level 1.1 |
| 27 | 355 - 370 | F16.7 | Across track velocity error [m/sec] = Nominal value | Copy the value of Level 1.1 |
| 28 | 371 - 386 | F16.7 | Radial velocity error [m/sec] = Nominal value | Copy the value of Level 1.1 |
| | | | FIRST POSITIONAL DATA POINT | Copy the value of Level 1.1 |
| 29 | 387 - 408 | E22.15 | 1 st data point position vector (x) [m] | Copy the value of Level 1.1 |
| 30 | 409 - 430 | E22.15 | 1 st data point position vector (y) [m] | Copy the value of Level 1.1 |
| 31 | 431 - 452 | E22.15 | 1 st data point position vector (z) [m] | Copy the value of Level 1.1 |
| 32 | 453 - 474 | E22.15 | 1 st data point position vector (x') [m/sec] | Copy the value of Level 1.1 |
| 33 | 475 - 496 | E22.15 | 1 st data point position vector (y') [m/sec] | Copy the value of Level 1.1 |
| 34 | 497 - 518 | E22.15 | 1 st data point position vector (z') [m/sec] | Copy the value of Level 1.1 |
| | 519 - 4082 | 27*6* E22.15 | Repeat 2 nd - 28 th data point same as 387-518 bytes | Copy the value of Level 1.1 |
| 35 | 4083 - 4100 | A18 | Blanks | Copy the value of Level 1.1 |
| 36 | 4101 - 4101 | I1 | Occurrence flag of a leap second No leap second = '0' Occurrence of a leap second = '1' | Copy the value of Level 1.1 |
| 37 | 4102 - 4680 | A579 | Blanks | Copy the value of Level 1.1 |

Table 3-13 Attitude data records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|-------|---|-----------------------------|
| 1 | 1 - 4 | B4 | Record number = 5) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 40) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Attitude data records length = 16384) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 16 | I4 | Number of points = 'bb22': Except ScanSAR mode = 'bb62': ScanSAR mode | Copy the value of Level 1.1 |
| 8 | 17 - 20 | I4 | Day of the year | Copy the value of Level 1.1 |
| 9 | 21 - 28 | I8 | Mil li-second of the day = 'bbbbbb0'~'8639999' | Copy the value of Level 1.1 |
| 10 | 29 - 32 | I4 | Pitch data quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | Copy the value of Level 1.1 |
| 11 | 33 - 36 | I4 | Roll data quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | Copy the value of Level 1.1 |
| 12 | 37 - 40 | I4 | Yaw data quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | Copy the value of Level 1.1 |
| 13 | 41 - 54 | E14.6 | Pitch [deg] | Copy the value of Level 1.1 |
| 14 | 55 - 68 | E14.6 | Roll [deg] | Copy the value of Level 1.1 |
| 15 | 69 - 82 | E14.6 | Yaw [deg] | Copy the value of Level 1.1 |

Table 3-13 Attitude data records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|--------------------------|----------------------------------|---|-----------------------------|
| 16 | 83 - 86 | I4 | Pitch rate quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | Copy the value of Level 1.1 |
| 17 | 87 - 90 | I4 | Roll rate quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | Copy the value of Level 1.1 |
| 18 | 91 - 94 | I4 | Yaw rate quality flag Good (within limit check) = 'bbb0' NG (out of limit check) = 'bbb1' | Copy the value of Level 1.1 |
| 19 | 95 - 108 | E14.6 | Pitch rate | Copy the value of Level 1.1 |
| 20 | 109 - 122 | E14.6 | Roll rate | Copy the value of Level 1.1 |
| 21 | 123 - 136 | E14.6 | Yaw rate | Copy the value of Level 1.1 |
| | 137 - 136+120*(n-1) | 120*(n-1) | Repeat bytes 17-136 for the number of points (n) in section 7 | Copy the value of Level 1.1 |
| 22 | 137+120*(n-1) - 16384 | A(16384- (136+120 *(n-1))) | Blanks | Copy the value of Level 1.1 |

Table 3-14 Radiometric data records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------------------------|-----------|-------|---|-----------------------------|
| 1 | 1 - 4 | B4 | Record number = 6) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 50) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd sub-type code = 20) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Radiometric data record length = 9860) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 16 | I4 | Radiometric data records sequence number = 'bbb1' | Copy the value of Level 1.1 |
| 8 | 17 - 20 | I4 | Number of radiometric fields = 'bbb1' | Copy the value of Level 1.1 |
| RADIOMETRIC DATA SET | | | | |
| 9 | 21 - 36 | F16.7 | Calibration factor (CF) $\sigma^0 = 10 * \log_{10} \langle DN^2 \rangle + CF$ This means that the sigma-naught of a pixel can be obtained by the ensemble averaging (<>), i.e., the spatial averaging of pixel values around the target. Here, DN in <> of the above formula is the pixel values in levels 2.1. | |
| 10 | 37 - 52 | F16.7 | Transmission distortion matrix for High-sensitive/Fine modes (Full (Quad.) pol.) level 1.1 (DT) (*) Real part of DT(1, 1) | Copy the value of Level 1.1 |
| 11 | 53 - 68 | F16.7 | Imaginary part of DT(1, 1) | Copy the value of Level 1.1 |
| 12 | 69 - 84 | F16.7 | Real part of DT(1, 2) | Copy the value of Level 1.1 |
| 13 | 85 - 100 | F16.7 | Imaginary part of DT(1, 2) | Copy the value of Level 1.1 |
| 14 | 101 - 116 | F16.7 | Real part of DT(2, 1) | Copy the value of Level 1.1 |
| 15 | 117 - 132 | F16.7 | Imaginary part of DT(2, 1) | Copy the value of Level 1.1 |
| 16 | 133 - 148 | F16.7 | Real part of DT(2, 2) | Copy the value of Level 1.1 |
| 17 | 149 - 164 | F16.7 | Imaginary part of DT(2, 2) | Copy the value of Level 1.1 |
| 18 | 165 - 180 | F16.7 | Reception distortion matrix for High-sensitive/Fine modes (Full (Quad.) pol.) level 1.1 (DR) (*) Real part of DR(1, 1) | Copy the value of Level 1.1 |
| 19 | 181 - 196 | F16.7 | Imaginary part of DR(1, 1) | Copy the value of Level 1.1 |

Table 3-14 Radiometric data records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|------------|-------|----------------------------|-----------------------------|
| 20 | 197 - 212 | F16.7 | Real part of DR(1, 2) | Copy the value of Level 1.1 |
| 21 | 213 - 228 | F16.7 | Imaginary part of DR(1, 2) | Copy the value of Level 1.1 |
| 22 | 229 - 244 | F16.7 | Real part of DR(2, 1) | Copy the value of Level 1.1 |
| 23 | 245 - 260 | F16.7 | Imaginary part of DR(2, 1) | Copy the value of Level 1.1 |
| 24 | 261 - 276 | F16.7 | Real part of DR(2, 2) | Copy the value of Level 1.1 |
| 25 | 277 - 292 | F16.7 | Imaginary part of DR(2, 2) | Copy the value of Level 1.1 |
| 26 | 293 - 9860 | A9568 | Reserve (Blanks) | Copy the value of Level 1.1 |

(*)Notes:

The measured scattering matrix can be expressed by

$$\begin{pmatrix} Z_{hh} & Z_{hv} \\ Z_{vh} & Z_{vv} \end{pmatrix} = A \frac{1}{r} \exp\left(-\frac{4\pi r}{\lambda} j\right) \begin{pmatrix} 1 & \delta_3 \\ \delta_4 & f_2 \end{pmatrix} \begin{pmatrix} S_{hh} & S_{hv} \\ S_{vh} & S_{vv} \end{pmatrix} \begin{pmatrix} 1 & \delta_1 \\ \delta_2 & f_1 \end{pmatrix} + \begin{pmatrix} N_{hh} & N_{hv} \\ N_{vh} & N_{vv} \end{pmatrix}$$

where Z_{ij} is the measurement matrix of the target, j is the transmission polarization, i is the reception polarization, A is the amplitude, r is the slant range, S_{ij} is the true scattering matrix of the target, f_1 is the channel imbalance of the transmission distortion matrix, f_2 is that for the reception matrix, δ_1 and δ_2 are the cross talks of transmission, and δ_3 and δ_4 are the those for the reception, N_{ij} are the noise component. Here, N_{ij} is assumed to be zero. It should be noted that polarization notation of the product is different from the above, i.e., IMG-HV-ALPSR..., means the data acquired at H transmission and V reception.

Complex transmission distortion matrix ($1, \delta_1, \delta_2, f_1$) are stored from 37 to 164 bytes, and reception distortion matrix ($1, \delta_3, \delta_4, \text{ and } f_2$) are stored from 165 to 292 bytes.

Calibration factor is stored from 21 to 36 bytes.

Table 3-15 Data quality summary records (1/2)

| Field No. | Byte No. | Type | Description | Remarks |
|--|-----------|-------|---|---|
| 1 | 1 - 4 | B4 | Record number = 7) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 60) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Data quality summary record length = 1620) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 16 | I4 | Data quality summary record number = 'bbb1' | Copy the value of Level 1.1 |
| 8 | 17 - 20 | A4 | SAR channel ID = 'ABCb' A: Reception of polarization (H, V) B: Reception antenna (S: Single beam, F: F-system, R: R-system) C : I, Q | Describe the channel that is the radiometric standard of channels used in observation. Copy the value of Level 1.1 |
| 9 | 21 - 26 | A6 | Date of the last calibration update = 'YYMMDD' YY : last two figure of the year MM : Month DD : Day | Copy the value of Level 1.1 |
| 10 | 27 - 30 | A4 | Number of channels (up to 8) | Copy the value of Level 1.1 |
| ABSOLUTE RADIOMETRIC DATA QUALITY | | | | |
| 11 | 31 - 46 | F16.7 | ISLR (nominal value) [dB] | Copy the value of Level 1.1 |
| 12 | 47 - 62 | F16.7 | PSLR (nominal value) [dB] | Copy the value of Level 1.1 |
| 13 | 63 - 78 | F16.7 | Azimuth ambiguity rate (AAR) (Nominal value) | Copy the value of Level 1.1 |
| 14 | 79 - 94 | F16.7 | Range ambiguity rate (RAR) (Nominal value) | Copy the value of Level 1.1 |
| 15 | 95 - 110 | F16.7 | Estimate of SNR [dB] | Copy the value of Level 1.1 |
| 16 | 111 - 126 | F16.7 | BER (Actual value) | Copy the value of Level 1.1 |
| 17 | 127 - 142 | F16.7 | Slant range resolution (Nominal value) [m] | Copy the value of Level 1.1 |
| 18 | 143 - 158 | F16.7 | Azimuth resolution (Nominal value) [m] | Copy the value of Level 1.1 |
| 19 | 159 - 174 | F16.7 | Radiometric resolution (Nominal value) [dB] | Copy the value of Level 1.1 |
| 20 | 175 - 190 | F16.7 | Instantaneous dynamic range [dB] | Copy the value of Level 1.1 |

Table 3-15 Data quality summary records (2/2)

| Field No. | Byte No. | Type | Description | Remarks |
|--|-----------------------|---------------------|---|-----------------------------|
| 21 | 191 - 206 | F16.7 | Nominal absolute radiometric calibration magnitude uncertainty of SAR channel indicated in bytes 17-20 [dB] | Copy the value of Level 1.1 |
| 22 | 207 - 222 | F16.7 | Nominal absolute radiometric calibration phase uncertainty of SAR channel indicated in bytes 17-20 [deg] | Copy the value of Level 1.1 |
| RELATIVE RADIOMETRIC QUALITY | | | | |
| 23 | 223 - 238 | F16.7 | Nominal relative radiometric calibration magnitude uncertainty of SAR channel indicated in bytes 17-20 [dB] | Copy the value of Level 1.1 |
| 24 | 239 - 254 | F16.7 | Nominal relative radiometric calibration phase uncertainty of SAR channel indicated in bytes 17-20 [deg] | Copy the value of Level 1.1 |
| 25 | 255 - (n-1)*32+254 | (n-1)*2F16.7 | Repetition of bytes 223 - 254 for the remaining channels (up to 8 channels) | Copy the value of Level 1.1 |
| 26 | (n-1)*32+255 - 734 | A(480 -(n-1)*32) | Blanks | Copy the value of Level 1.1 |
| ABSOLUTE GEOMETRIC DATA QUALITY | | | | |
| 26 | 735 - 750 | F16.7 | Absolute location error along track (Nominal value) [m] | Copy the value of Level 1.1 |
| 27 | 751 - 766 | F16.7 | Absolute location error cross track (Nominal value) [m] | Copy the value of Level 1.1 |
| 28 | 767 - 782 | F16.7 | Geometric distortion scale in line direction (Nominal value) | Copy the value of Level 1.1 |
| 29 | 783 - 798 | F16.7 | Geometric distortion scale in pixel direction (Nominal value) | Copy the value of Level 1.1 |
| 30 | 799 - 814 | F16.7 | Geometric distortion skew | Copy the value of Level 1.1 |
| 31 | 815 - 830 | F16.7 | Scene orientation error | Copy the value of Level 1.1 |
| RELATIVE GEOMETRIC DATA QUALITY | | | | |
| 32 | 831 - 846 | F16.7 | Along track relative misregistration error of other channels versus SAR channel (bytes 17-20) [meters] | Copy the value of Level 1.1 |
| 33 | 847 - 862 | F16.7 | Cross track relative misregistration error of other channels versus SAR channel (bytes 17-20) [meters] | Copy the value of Level 1.1 |
| 34 | 863 - 1102 | (n-1)*2F16.7 | Repetition of bytes 831 - 862 for the other channels (up to 8 channels) | Copy the value of Level 1.1 |
| 35 | 1103 - 1620 | A518 | Blanks | Copy the value of Level 1.1 |

Table 3-16 Facility related data records 1 - 4 (1/1)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|-----------------------------|
| 1 | 1 - 4 | B4 | Record sequence number Dummy data = 8) ₁₀ Determined ephemeris = 9) ₁₀ Time error information = 10) ₁₀ Coordinate conversion information = 11) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 200) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3rd record sub-type code = 70) ₁₀ CEOS = 20) ₁₀ , CCRS = 36) ₁₀ , ESA = 50) ₁₀ , NASA = 60) ₁₀ , JPL = 61) ₁₀ JAXA = 70) ₁₀ , DFVLR = 80) ₁₀ , RAE = 90) ₁₀ , TELESPAZIO = 10) ₁₀ UNSPECIFIED = 18) ₁₀ , etc. | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Record length Dummy data = 325,000 Determined ephemeris = 511,000 Time error information = 3,072 Coordinate conversion information = 728,000 | Copy the value of Level 1.1 |
| 7 | 13 - 16 | I4 | Facility related data record sequence number = 'bbbb1' - 'bbb4' | Copy the value of Level 1.1 |
| 8 | 17 - 66 | A50 | Blanks | Copy the value of Level 1.1 |
| 9 | 67 - | | Set the following files which were used for level 1.0 processing, for each record. Dummy data Determined ephemeris Time error information Coordinate conversion information | Copy the value of Level 1.1 |

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Table 3-17 Facility related data records 5 (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|----------|--|---|
| 1 | 1 - 4 | B4 | Record sequence number = 12) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 200) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 70) ₁₀ CEOS = 20) ₁₀ , CCRS = 36) ₁₀ , ESA = 50) ₁₀ , NASA = 60) ₁₀ , JPL = 61) ₁₀ JAXA = 70) ₁₀ , DFVLR = 80) ₁₀ , RAE = 90) ₁₀ , TELESPAZIO = 10) ₁₀ UNSPECIFIED = 18) ₁₀ , etc. | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Record length = 5000) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 16 | I4 | Facility related data record number = 'bbb5' | |
| 8 | 17 - 416 | 20E20.10 | Twenty coefficients to convert from the map projection (E, N) to Line(L) and pixel (P) position in the image, say (P, L) where: $P = a_0 + a_1 * \varphi + a_2 * \lambda + a_3 * \varphi * \lambda + a_4 * \varphi^2 + a_5 * \lambda^2 + a_6 * \varphi^2 * \lambda + a_7 * \varphi * \lambda^2 + a_8 * \varphi^3 + a_9 * \lambda^3$ $L = b_0 + b_1 * \varphi + b_2 * \lambda + b_3 * \varphi * \lambda + b_4 * \varphi^2 + b_5 * \lambda^2 + b_6 * \varphi^2 * \lambda + b_7 * \varphi * \lambda^2 + b_8 * \varphi^3 + b_9 * \lambda^3$ Coefficients a ₀ - a ₉ and b ₀ - b ₉ (The order of storing a ₀ , a ₁ , a ₂ , ..., a ₉ and b ₀ , b ₁ , b ₂ , ..., b ₉) (Recommend to use the coefficients of 2065-3064 bytes) | For the expressions, the position defined as (P, L) = (1, 1). corresponds to the central point of the pixel at the upper left corner and (E, N) show a longitude [deg] and a latitude [deg] |
| 9 | 417 - 420 | I4 | Calibration mode data location flag No calibration data = 'bbb0' The side of observation start = 'bbb1' The side of observation end = 'bbb2' The side of observation start/end = 'bbb3' | Copy the value of Level 1.1 |

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Table 3-17 Facility related data records 5 (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|------------|------|---|-----------------------------|
| 10 | 421 - 428 | I8 | Start line number of calibration at upper image In case of no calibration data ('0'), always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 11 | 429 - 436 | I8 | End line number of calibration at upper image In case of no calibration data ('0'), always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 12 | 437 - 444 | I8 | Start line number of calibration at bottom image In case of no calibration data ('0'), always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 13 | 445 - 452 | I8 | Stop line number of calibration at bottom image In case of no calibration data ('0'), always = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 14 | 453 - 456 | I4 | PRF switching flag No change in a scene = 'bbb0' (fixed value) | Copy the value of Level 1.1 |
| 15 | 457 - 464 | I8 | Start line number of PRF switching No change = 'bbbbbbb1' (fixed value) | Copy the value of Level 1.1 |
| 16 | 465 - 472 | I8 | Blanks | Copy the value of Level 1.1 |
| 17 | 473 - 480 | I8 | Number of loss lines (Level 1.0) | Copy the value of Level 1.1 |
| 18 | 481 - 488 | I8 | Number of loss lines (range for processing in Level 1.1) | Copy the value of Level 1.1 |
| 19 | 489 - 800 | A312 | Blanks | Copy the value of Level 1.1 |
| 20 | 801 - 1024 | A224 | System reserve | Copy the value of Level 1.1 |

Table 3-17 Facility related data records 5 (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|----------|---|--|
| 21 | 1025 - 2024 | 50E20.10 | <p>Coefficients of the 8th polynomial expression to convert from pixel (P) and line (L) to latitude (ϕ) and longitude (λ), say (ϕ, λ) where:</p> $\phi = a_0 * L^4 * P^4 + a_1 * L^3 * P^4 + a_2 * L^2 * P^4 + a_3 * L * P^4 + a_4 * P^4$ $+ a_5 * L^4 * P^3 + a_6 * L^3 * P^3 + a_7 * L^2 * P^3 + a_8 * L * P^3 + a_9 * P^3$ $+ a_{10} * L^4 * P^2 + a_{11} * L^3 * P^2 + a_{12} * L^2 * P^2 + a_{13} * L * P^2 + a_{14} * P^2$ $+ a_{15} * L^4 * P + a_{16} * L^3 * P + a_{17} * L^2 * P + a_{18} * L * P + a_{19} * P$ $+ a_{20} * L^4 + a_{21} * L^3 + a_{22} * L^2 + a_{23} * L + a_{24}$ $\lambda = b_0 * L^4 * P^4 + b_1 * L^3 * P^4 + b_2 * L^2 * P^4 + b_3 * L * P^4 + b_4 * P^4$ $+ b_5 * L^4 * P^3 + b_6 * L^3 * P^3 + b_7 * L^2 * P^3 + b_8 * L * P^3 + b_9 * P^3$ $+ b_{10} * L^4 * P^2 + b_{11} * L^3 * P^2 + b_{12} * L^2 * P^2 + b_{13} * L * P^2 + b_{14} * P^2$ $+ b_{15} * L^4 * P + b_{16} * L^3 * P + b_{17} * L^2 * P + b_{18} * L * P + b_{19} * P$ $+ b_{20} * L^4 + b_{21} * L^3 + b_{22} * L^2 + b_{23} * L + b_{24}$ <p>(The order of storing: $a_0, a_1, a_2, \dots, a_{24}$ & $b_0, b_1, b_2, \dots, b_{24}$)</p> | <p>(P, L) referred in the upper left pixel(p) and line (l) are substituted by the following expressions as $P = p - P_0, L = l - L_0$, where (p, l) is an arbitrary coordinate address on the image. For the expressions above, the position defined as $(p, l) = (0, 0)$ corresponds to the central point of the pixel at the upper left corner and (ϕ, λ) is measured in "degrees".</p> |
| 22 | 2025 - 2044 | E20.10 | Origin Pixel (P_0) 0.0 fixed | |
| 23 | 2045 - 2064 | E20.10 | Origin Line (L_0) 0.0 fixed | |

Table 3-17 Facility related data records 5 (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-------------|----------|--|---|
| 24 | 2065 - 3064 | 50E20.10 | <p>Coefficients of the 8th polynomial expression to convert from latitude (Φ) and longitude (Λ) to pixel (p) and line (l), say (p, l) where:</p> $p = c_0 * \Lambda^4 * \Phi^4 + c_1 * \Lambda^3 * \Phi^4 + c_2 * \Lambda^2 * \Phi^4 + c_3 * \Lambda * \Phi^4 + c_4 * \Phi^4$ $+ c_5 * \Lambda^4 * \Phi^3 + c_6 * \Lambda^3 * \Phi^3 + c_7 * \Lambda^2 * \Phi^3 + c_8 * \Lambda * \Phi^3 + c_9 * \Phi^3$ $+ c_{10} * \Lambda^4 * \Phi^2 + c_{11} * \Lambda^3 * \Phi^2 + c_{12} * \Lambda^2 * \Phi^2 + c_{13} * \Lambda * \Phi^2 + c_{14} * \Phi^2$ $+ c_{15} * \Lambda^4 * \Phi + c_{16} * \Lambda^3 * \Phi + c_{17} * \Lambda^2 * \Phi + c_{18} * \Lambda * \Phi + c_{19} * \Phi$ $+ c_{20} * \Lambda^4 + c_{21} * \Lambda^3 + c_{22} * \Lambda^2 + c_{23} * \Lambda + c_{24}$ $l = d_0 * \Lambda^4 * \Phi^4 + d_1 * \Lambda^3 * \Phi^4 + d_2 * \Lambda^2 * \Phi^4 + d_3 * \Lambda * \Phi^4 + d_4 * \Phi^4$ $+ d_5 * \Lambda^4 * \Phi^3 + d_6 * \Lambda^3 * \Phi^3 + d_7 * \Lambda^2 * \Phi^3 + d_8 * \Lambda * \Phi^3 + d_9 * \Phi^3$ $+ d_{10} * \Lambda^4 * \Phi^2 + d_{11} * \Lambda^3 * \Phi^2 + d_{12} * \Lambda^2 * \Phi^2 + d_{13} * \Lambda * \Phi^2 + d_{14} * \Phi^2$ $+ d_{15} * \Lambda^4 * \Phi + d_{16} * \Lambda^3 * \Phi + d_{17} * \Lambda^2 * \Phi + d_{18} * \Lambda * \Phi + d_{19} * \Phi$ $+ d_{20} * \Lambda^4 + d_{21} * \Lambda^3 + d_{22} * \Lambda^2 + d_{23} * \Lambda + d_{24}$ <p>(The order of storing: $c_0, c_1, c_2, \dots, c_{24}$ & $d_0, d_1, d_2, \dots, d_{24}$)</p> | <p>($\Phi, \Lambda$) referred in the upper left latitude(ϕ), longitude(λ) are substituted by the following expressions as $F=f-F_0$ (degrees), $L=l-L_0$ (degrees), where (f, l) is an arbitrary position on the image. For the expressions, the position defined as $(p, l)=(0, 0)$ corresponds to the central point of the pixel at the upper left corner.</p> |
| 25 | 3065 - 3084 | E20.10 | Origin Latitude (Φ_0) scene center latitude | |
| 26 | 3085 - 3104 | E20.10 | Origin Longitude (Λ_0) scene center longitude | |
| 27 | 3105 - 5000 | A1896 | Blanks | |

Table 3-18 SAR Image file descriptor records (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|---|--------------------------------|
| 1 | 1 - 4 | B4 | Record number = 1) ₁₀ | Copy the value of Level 1.1 |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 50) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Record length = 720) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC flag = 'Ab': ASCII | Copy the value of Level 1.1 |
| 8 | 15 - 16 | A2 | Blanks | Copy the value of Level 1.1 |
| 9 | 17 - 28 | A12 | Format control document ID = 'CEOS-SARbbbb' | Copy the value of Level 1.1 |
| 10 | 29 - 30 | A2 | Format control document revision level = 'bA' | Copy the value of Level 1.1 |
| 11 | 31 - 32 | A2 | File design descriptor revision letter = 'bA' | Copy the value of Level 1.1 |
| 12 | 33 - 44 | A12 | Software release and revision level = 'NNN.NNNbbbbbb' 001.000, 001.001, ... 001.100, ...002.000 | |
| 13 | 45 - 48 | I4 | File number = 'bbb1' | Copy the value of Level 1.1 |
| 14 | 49 - 64 | A16 | File ID = 'MMNbSSSTFFFFbbbb' MM: Mission ID (ALOS2='AL')(*) N: Mission number(='2')(*) SSS: Sensor ID (SAR='SAR')(*) T: Processing level code Level 2.1 = 'E' FFFF : File Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | (*)Copy the value of Level 1.1 |
| 15 | 65 - 68 | A4 | Record sequence and location type flag = 'FSEQ' | Copy the value of Level 1.1 |
| 16 | 69 - 76 | I8 | Location sequence number = 'bbbbbb1' | Copy the value of Level 1.1 |
| 17 | 77 - 80 | I4 | Field length of sequence number = 'bbb4' | Copy the value of Level 1.1 |

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Table 3-18 SAR Image file descriptor records (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|-----------------------------|
| 18 | 81 - 84 | A4 | Record code and location type flag = 'FTYP' | Copy the value of Level 1.1 |
| 19 | 85 - 92 | I8 | Record code location = 'bbbbbb5' | Copy the value of Level 1.1 |
| 20 | 93 - 96 | I4 | Record code field length = 'bbb4' | Copy the value of Level 1.1 |
| 21 | 97 - 100 | A4 | Record length and location type flag = 'FLGT' | Copy the value of Level 1.1 |
| 22 | 101 - 108 | I8 | Record length location = 'bbbbbb9' | Copy the value of Level 1.1 |
| 23 | 109 - 112 | I4 | Record length field length = 'bbb4' | Copy the value of Level 1.1 |
| 24 | 113 - 113 | A1 | Reserved = Blanks | Copy the value of Level 1.1 |
| 25 | 114 - 114 | A1 | Reserved = Blanks | Copy the value of Level 1.1 |
| 26 | 115 - 115 | A1 | Reserved = Blanks | Copy the value of Level 1.1 |
| 27 | 116 - 116 | A1 | Reserved = Blanks | Copy the value of Level 1.1 |
| 28 | 117 - 180 | A64 | Reserved = Blanks | Copy the value of Level 1.1 |
| 29 | 181 - 186 | I6 | Number of SAR data records Number of signal data records | Number of actual records |
| 30 | 187 - 192 | I6 | SAR data record length | Actual record length |
| 31 | 193 - 216 | A24 | Reserved = Blanks | Copy the value of Level 1.1 |

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Table 3-18 SAR Image file descriptor records (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|-----------------------------|
| | | | SAMPLE GROUP DATA | |
| 32 | 217 - 220 | I4 | Bit length per sample = 'bb16' | |
| 33 | 221 - 224 | I4 | Number of samples per data group = 'bbb1' | |
| 34 | 225 - 228 | I4 | Number of bytes per data group = 'bbb2' | |
| 35 | 229 - 232 | A4 | Justification and order of samples within data group = Blanks(fixed value) | Copy the value of Level 1.1 |
| | | | SAR RELATED DATA IN THE RECORD | |
| 36 | 233 - 236 | I4 | Number of SAR channels = 'bbb1' (fixed value) (Only L-band) | Copy the value of Level 1.1 |
| 37 | 237 - 244 | I8 | Number of lines per data set (one channel) (Excluding border lines) | |
| 38 | 245 - 248 | I4 | Number of left border pixels per line = 'bbb0' | Copy the value of Level 1.1 |
| 39 | 249 - 256 | I8 | Number of data group (or pixels) per line | |
| 40 | 257 - 260 | I4 | Number of right border pixels per line = 'bbb0' | Copy the value of Level 1.1 |
| 41 | 261 - 264 | I4 | Number of top border lines = 'bbb0' | Copy the value of Level 1.1 |
| 42 | 265 - 268 | I4 | Number of bottom border lines = 'bbb0' | Copy the value of Level 1.1 |
| 43 | 269 - 272 | A4 | Interleaving ID = 'BSQb' (fixed value) | Copy the value of Level 1.1 |
| | | | RECORD DATA IN THE FILE | |
| 44 | 273 - 274 | I2 | Number of physical records per line = 'b1' (fixed value) | Copy the value of Level 1.1 |
| 45 | 275 - 276 | I2 | Number of physical records per multi-channel line in this file = 'b1' (fixed value) | Copy the value of Level 1.1 |
| 46 | 277 - 280 | I4 | Number of bytes of prefix data per record = 'b192' | |
| 47 | 281 - 288 | I8 | Number of bytes of SAR data per record | |
| 48 | 289 - 292 | I4 | Number of bytes of suffix data per record = 'bbb0' (fixed value) | Copy the value of Level 1.1 |
| 49 | 293 - 296 | A4 | Prefix/suffix repeat flag = 'bbbb' (fixed value) | Copy the value of Level 1.1 |

Table 3-18 SAR Image file descriptor records (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|---------------------------------------|-----------|------|---|---|
| PREFIX/SUFFIX DATA LOCATORS | | | | |
| 50 | 297 - 304 | A8 | Sample data line number locator = 'bb13b4PB' 'P': Prefix, 'S': Suffix 'A': ASCII, 'B': Binary, 'N': Numeric | Copy the value of Level 1.1 |
| 51 | 305 - 312 | A8 | SAR channel number locator = 'bb49b2PB' | Copy the value of Level 1.1 |
| 52 | 313 - 320 | A8 | Time of SAR data line locator = 'bb45b4PB' | Copy the value of Level 1.1 |
| 53 | 321 - 328 | A8 | Left-fill count locator = 'bb21b4PB' | Copy the value of Level 1.1 |
| 54 | 329 - 336 | A8 | Right-fill count locator = 'bb29b4PB' | Copy the value of Level 1.1 |
| 55 | 337 - 340 | A4 | Pad pixels present indicator = 'bbbb' | Copy the value of Level 1.1 |
| 56 | 341 - 368 | A28 | Blanks | Copy the value of Level 1.1 |
| 57 | 369 - 376 | A8 | SAR data line quality code locator = 'bbbbbbbb' | |
| 58 | 377 - 384 | A8 | Calibration information field locator = 'bbbbbbbb' | Copy the value of Level 1.1 |
| 59 | 385 - 392 | A8 | Gain values field locator = 'bbbbbbbb' | Copy the value of Level 1.1 |
| 60 | 393 - 400 | A8 | Bias values field locator = 'bbbbbbbb' | Copy the value of Level 1.1 |
| 61 | 401 - 428 | A28 | SAR data format type indicator = 'UNSIGNEDbINTEGER*2bbbbbbbb' | 'UNSIGNEDbINTEGER*2bbbb bbbbbb'IU2b' : 2-bytes unsigned integer |
| 62 | 429 - 432 | A4 | SAR data format type code = 'IU2b' | |
| 63 | 433 - 436 | I4 | Number of left fill bits within pixel = 'bbb0' | Copy the value of Level 1.1 |
| 64 | 437 - 440 | I4 | Number of right fill bits within pixel = 'bbb0' | Copy the value of Level 1.1 |
| 65 | 441 - 448 | I8 | Maximum data range of pixel (starting from 0) = 'bbb65535' | |
| SCANSAR BURST DATA INFORMATION | | | | |
| 66 | 449 - 452 | I4 | Blanks | |
| 67 | 453 - 456 | I4 | Blanks | |
| 68 | 457 - 460 | I4 | Blanks | |
| 69 | 461 - 720 | A260 | Blanks | |

Table 3-19 Processed data records (1/4)

| Field No. | Byte No. | Type | Description | Remarks |
|--|----------|------|---|---------|
| 1 | 1 - 4 | B4 | Record sequence number = 2, 3, ...) ₁₀ | |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 50) ₁₀ | |
| 3 | 6 - 6 | B1 | Record type code = 11) ₁₀ | |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 20) ₁₀ | |
| 6 | 9 - 12 | B4 | Record length | |
| PREFIX DATA-GENERAL INFORMATION | | | | |
| 7 | 13 - 16 | B4 | SAR image data line number = 1, 2, 3 ...) ₁₀ | |
| 8 | 17 - 20 | B4 | SAR image data record index = 1) ₁₀ (fixed value) (indicates the record sequence number in the same line) | |
| 9 | 21 - 24 | B4 | Actual count of left-fill pixels = 0) ₁₀ (fixed value) | |
| 10 | 25 - 28 | B4 | Actual count of data pixels | |
| 11 | 29 - 32 | B4 | Actual count of right-fill pixels = 0) ₁₀ | |

Table 3-19 Processed data records (2/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|-----------------------------|
| | | | PREFIX DATA-SENSOR PARAMETERS | |
| 12 | 33 - 36 | B4 | Sensor parameters update flag = 0) ₁₀ | |
| 13 | 37 - 40 | B4 | Sensor acquisition year | Copy the value of Level 1.1 |
| 14 | 41 - 44 | B4 | Sensor acquisition day of year | Copy the value of Level 1.1 |
| 15 | 45 - 48 | B4 | Sensor acquisition milliseconds of day = 0) ₁₀ | |
| 16 | 49 - 50 | B2 | SAR channel ID Single polarization = 1) ₁₀ Dual polarization = 2) ₁₀ Full (Quad.) pol. = 4) ₁₀ | Copy the value of Level 1.1 |
| 17 | 51 - 52 | B2 | SAR channel code = 0) ₁₀ L = 0) ₁₀ | Copy the value of Level 1.1 |
| 18 | 53 - 54 | B2 | Transmitted polarization Horizontal polarization (H) = 0) ₁₀ Vertical polarization (V) = 1) ₁₀ | |
| 19 | 55 - 56 | B2 | Received pulse polarization H = 0) ₁₀ V = 1) ₁₀ | |
| 20 | 57 - 60 | B4 | PRF[mHz] Except ScanSAR mode = The same through the one scene ScanSAR = 0) ₁₀ (fixed value) | |
| 21 | 61 - 64 | B4 | Scan number = 0) ₁₀ (fixed value) | |

Table 3-19 Processed data records (3/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|---------|
| 22 | 65 - 68 | B4 | Slant range to 1 st pixel [m] | |
| 23 | 69 - 72 | B4 | Slant range to mid-pixel [m] | |
| 24 | 73 - 76 | B4 | Slant range to last-pixel [m] | |
| 25 | 77 - 80 | B4 | Doppler centroid value at 1 st pixel [1/1,000Hz] | |
| 26 | 81 - 84 | B4 | Doppler centroid value at mid-pixel [1/1,000Hz] | |
| 27 | 85 - 88 | B4 | Doppler centroid value at last pixel [1/1,000Hz] | |
| 28 | 89 - 92 | B4 | Azimuth FM rate of 1 st pixel [Hz/msec] | |
| 29 | 93 - 96 | B4 | Azimuth FM rate of mid-pixel [Hz/msec] | |
| 30 | 97 - 100 | B4 | Azimuth FM rate of last pixel [Hz/msec] | |
| 31 | 101 - 104 | B4 | Look angle of nadir [1/1,000,000 deg] = 0) ₁₀ | |
| 32 | 105 - 108 | B4 | Azimuth squint angle [1/1,000,000 deg] = 0) ₁₀ | |
| 33 | 109 - 128 | B20 | Blanks = 0) ₁₀ | |

Table 3-19 Processed data records (4/4)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|---|--|
| | | | PREFIX DATA-GEOGRAPHIC REFERENCE INFO. | |
| 34 | 129 – 132 | B4 | Geographic ref. Parameter update flag = 0) ₁₀ | |
| 35 | 133 - 136 | B4 | Latitude of 1 st pixel [1/1,000,000 deg] | |
| 36 | 137 - 140 | B4 | Latitude of mid-pixel [1/1,000,000 deg] | The latitude at M/2th pixel is set. (M: number of pixels) |
| 37 | 141 - 144 | B4 | Latitude of last pixel [1/1,000,000 deg] | |
| 38 | 145 - 148 | B4 | Longitude of 1 st pixel [1/1,000,000 deg] | |
| 39 | 149 – 152 | B4 | Longitude of mid-pixel [1/1,000,000 deg] | The longitude at M/2th pixel is set. (M: number of pixels) |
| 40 | 153 – 156 | B4 | Longitude of last pixel [1/1,000,000 deg] | |
| 41 | 157 - 160 | B4 | Northing of 1 st pixel [m] | Set X axis |
| 42 | 161 – 164 | B4 | Blanks = 0) ₁₀ | |
| 43 | 165 – 168 | B4 | Northing of last pixel [m] | Set X axis |
| 44 | 169 – 172 | B4 | Easting of 1 st pixel [m] | Set Y axis |
| 45 | 173 – 176 | B4 | Blanks = 0) ₁₀ | |
| 46 | 177 – 180 | B4 | Easting of last pixel [m] | Set Y axis |
| 47 | 181 - 184 | B4 | Line heading (orientation of the perpendicular to the data line center relative to true north) [1/1,000,000 deg] = 0) ₁₀ | |
| 48 | 185 – 192 | B8 | Blanks = 0) ₁₀ | |
| | | | SAR PROCESSED DATA | |
| | 193 - i | jBk | SAR processed data i: number of bytes of data + 192 j: number of pixels on this record k: size of pixel in bytes [2byte] | |
| | | | SUFFIX DATA | |
| | | 0*B | Processing Facility specific details | |

Table 3-20 SAR Trailer file descriptor (1/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|--------------------------------|
| 1 | 1 - 4 | B4 | Record number = 1) ₁₀ | Copy the value of Level 1.1 |
| 2 | 5 - 5 | B1 | 1 st record sub-type code = 63) ₁₀ | Copy the value of Level 1.1 |
| 3 | 6 - 6 | B1 | Record type code = 192) ₁₀ | Copy the value of Level 1.1 |
| 4 | 7 - 7 | B1 | 2 nd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 5 | 8 - 8 | B1 | 3 rd record sub-type code = 18) ₁₀ | Copy the value of Level 1.1 |
| 6 | 9 - 12 | B4 | Record length = 720) ₁₀ | Copy the value of Level 1.1 |
| 7 | 13 - 14 | A2 | ASCII/EBCDIC code = 'Ab': ASCII | Copy the value of Level 1.1 |
| 8 | 15 - 16 | A2 | Blanks | Copy the value of Level 1.1 |
| 9 | 17 - 28 | A12 | Format control document ID = 'CEOS-SARbbbb' | Copy the value of Level 1.1 |
| 10 | 29 - 30 | A2 | Format control document revision number = 'bA' | Copy the value of Level 1.1 |
| 11 | 31 - 32 | A2 | Record format revision level = 'bA' | Copy the value of Level 1.1 |
| 12 | 33 - 44 | A12 | Software release and revision level = 'NNN.NNNbbbbbb' 001.000, 001.001, ... 001.100, ...002.000 | |
| 13 | 45 - 48 | I4 | Number of files = 'bbb1' | Copy the value of Level 1.1 |
| 14 | 49 - 64 | A16 | File ID = 'MMNbSSSTFFFFbbbb' MM: Mission ID(ALOS2='AL')(*) N: Mission number (=2')(*) SSS: Sensor ID (SAR='SAR')(*) T: Processing level code Level 2.1 = 'E' FFFF : Tile Type(*) Leader file = 'SARL' Image file = 'IMOP' Trailer file = 'SART' | (*)Copy the value of Level 1.1 |
| 15 | 65 - 68 | A4 | Record sequence and location type flag = 'FSEQ' | Copy the value of Level 1.1 |
| 16 | 69 - 76 | I8 | Sequence number location = 'bbbbbb1' | Copy the value of Level 1.1 |
| 17 | 77 - 80 | I4 | Sequence number field length = 'bbb4' | Copy the value of Level 1.1 |
| 18 | 81 - 84 | A4 | Record code and location type flag = 'FTYP' | Copy the value of Level 1.1 |
| 19 | 85 - 92 | I8 | Record code location = 'bbbbbb5' | Copy the value of Level 1.1 |
| 20 | 93 - 96 | I4 | Record code field length = 'bbb4' | Copy the value of Level 1.1 |

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Table 3-20 SAR Trailer file descriptor (2/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-----------------------------|
| 21 | 97 - 100 | A4 | Record length and location type flag = 'FLGT' | Copy the value of Level 1.1 |
| 22 | 101 - 108 | I8 | Record length location = 'bbbbbb9' | Copy the value of Level 1.1 |
| 23 | 109 - 112 | I4 | Record length field length = 'bbb4' | Copy the value of Level 1.1 |
| 24 | 113 - 180 | A68 | Blanks | Copy the value of Level 1.1 |
| 25 | 181 - 186 | I6 | Number of data set summary records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 26 | 187 - 192 | I6 | Data set summary record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 27 | 193 - 198 | I6 | Number of map projection data records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 28 | 199 - 204 | I6 | Map projection record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 29 | 205 - 210 | I6 | Number of platform position data records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 30 | 211 - 216 | I6 | Platform position record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 31 | 217 - 222 | I6 | Number of attitude data records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 32 | 223 - 228 | I6 | Attitude data record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 33 | 229 - 234 | I6 | Number of radiometric data records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 34 | 235 - 240 | I6 | Radiometric record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 35 | 241 - 246 | I6 | Number of radiometric compensation records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 36 | 247 - 252 | I6 | Radiometric compensation record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 37 | 253 - 258 | I6 | Number of data quality summary records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 38 | 259 - 264 | I6 | Data quality summary record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 39 | 265 - 270 | I6 | Number of data histograms records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 40 | 271 - 276 | I6 | Data histogram record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 41 | 277 - 282 | I6 | Number of range spectra records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 42 | 283 - 288 | I6 | Range spectra record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 43 | 289 - 294 | I6 | Number of DEM descriptor records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 44 | 295 - 300 | I6 | DEM descriptor record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 45 | 301 - 306 | I6 | Number of Radar parameter update records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 46 | 307 - 312 | I6 | Radar parameter update record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 47 | 313 - 318 | I6 | Number of Annotation data records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 48 | 319 - 324 | I6 | Annotation data record length = 'bbbbbb0' | Copy the value of Level 1.1 |
| 49 | 325 - 330 | I6 | Number of detail processing records = 'bbbbbb0' | Copy the value of Level 1.1 |
| 50 | 331 - 336 | I6 | Detail processing record length = 'bbbbbb0' | Copy the value of Level 1.1 |

Table 3-20 SAR Trailer file descriptor (3/3)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|-----------|------|--|-----------------------------|
| 51 | 337 - 342 | I6 | Number of Calibration records = 'bbbbb0' | Copy the value of Level 1.1 |
| 52 | 343 - 348 | I6 | Calibration record length = 'bbbbb0' | Copy the value of Level 1.1 |
| 53 | 349 - 354 | I6 | Number of GCP records = 'bbbbb0' | Copy the value of Level 1.1 |
| 54 | 355 - 360 | I6 | GCP record length = 'bbbbb0' | Copy the value of Level 1.1 |
| 55 | 361 - 420 | 10A6 | Spare = Blanks | Copy the value of Level 1.1 |
| 56 | 421 - 426 | I6 | Number of facility data (1) records = 'bbbbb0' | Copy the value of Level 1.1 |
| 57 | 427 - 434 | I8 | Facility data (1) record length = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 58 | 435 - 440 | I6 | Number of facility data (2) records = 'bbbbb0' | Copy the value of Level 1.1 |
| 59 | 441 - 448 | I8 | Facility data (2) record length = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 60 | 449 - 454 | I6 | Number of facility data (3) records = 'bbbbb0' | Copy the value of Level 1.1 |
| 61 | 455 - 462 | I8 | Facility data (3) record length = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 62 | 463 - 468 | I6 | Number of facility data (4) records = 'bbbbb0' | Copy the value of Level 1.1 |
| 63 | 469 - 476 | I8 | Facility data (4) record length = 'bbbbbbb0' | Copy the value of Level 1.1 |
| 64 | 477 - 482 | I6 | Number of facility data (5) records = 'bbbbb0' | |
| 65 | 483 - 490 | I8 | Facility data (5) record length = 'bbbbbbb0' | |
| 66 | 491 - 496 | I6 | Number of low resolution image data records = 'bbbbb1' | |
| 67 | 497 - 504 | I8 | Low resolution image data 1 record length (Variable) | |
| 68 | 505 - 510 | I6 | Number of pixels of low resolution image data 1 (Variable) | |
| 69 | 511 - 516 | I6 | Number of lines of low resolution image data 1 (Variable) | |
| 70 | 517 - 522 | I6 | Number of bytes per one sample of low resolution image data 1 = 'bbbbb2' | |
| 71 | 523- 720 | A198 | Blanks | |

Table 3-21 Low resolution image data records (1/1)

| Field No. | Byte No. | Type | Description | Remarks |
|-----------|----------|------|--|---------|
| 1 | 1 - i | jBk | Low resolution image data for 16bit i: number of bytes of data j: number of pixels on this record k: size of pixel in bytes = 2 | |

Characteristics of low resolution image data

- Data type
16 bit integer
- Record length
Variable ([Number of pixels] x [Number of lines] x 2)
- Number of records
1
- Pixel spacing
Spotlight mode: 50m
High-resolution mode: 100m
ScanSAR mode: 500m
- Stored polarization
Single polarization: HH, HV, VH or VV
Dual polarization: HH or VV
Full (Quad.) polarization: Only HH

4. Summary Information

The summary information on CEOS level 2.1 is shown in below.

4.1. Outline of Summary Information

The summary information file includes the information for creating processed data created at ALOS-2 Data Processing System, and it is always made in a pair with its processed data.

4.2. Filename of Summary Information

The filename of summary information is fixed as follows.

summary.txt

4.3. File Format of Summary Information

The summary information file consists of some record lines which use LF (line feed code) as a termination, and does not include header information, footer information, etc. A record line consists of a keyword, a equal mark (=), and a value. A summary information file format outline is shown in Figure 4-1.

| | | | |
|---------|-----|-------|-----|
| Keyword | = | Value | LF |
| ... | ... | ... | ... |
| Keyword | = | Value | LF |

Figure 4-1 Outline of Summary Information File Format

4.3.1. Format Definition of Keyword

- (1) The keyword is stored from the head of a record line.
- (2) The equal mark '=' is stored after the keyword.
- (3) There is no blank character between a keyword and '=', in principle.

4.3.2. Format Definition of Value

- (1) The value is a text string bundled with double quotation letters (").
- (2) The value can contain alphabets, digits, and some special characters (except for double quotation). Numerical values are also stored as an ASCII string.
- (3) There is no blank character between '=' and the former double quotation letter, in principle.

4.3.3. Contents of Summary Information

The items of the CEOS Level 2.1 summary information are described in Table 4-1. "b" in a table means blanks.

Table 4-1 Summary information for CEOS Level 2.1 product (1/8)

| Section | Item name | Keyword | Value | Remark |
|----------------------------|--------------------------|------------------|---|------------------------|
| Ordering information (Odi) | Scene description ID | Odi_SceneId | ID for specifying a scene uniquely 'AAAAAAAAAAAAAAAAA-NNNNN-xxx-nnn' AAAAAAAAAAAAAAAAA: Operation Segment No NNNNN: Observation ID xxx: 001~999 nnn: Scene no. | Copy the value of L1.1 |
| | Processed Site/Date/Time | Odi_SiteDateTime | Spacecraft Control Mission Operation system ='PROCESS: JAPAN-JAXA-ALOS2-SCMObbYYYYMMDDbHHMMSS' Earth Intelligence Collection and Shearing System ='PROCESS: JAPAN-JAXA-ALOS2-EICSbbYYYYMMDDbHHMMSS' YYYYMMDD : Processed date (YYYY: year, MM: month, DD: day) HHMMSS : Processed time (UTC) | |
| Scene specification (Scs) | Scene ID | Scs_SceneID | 'AAAAABBBBBCCCC-YYMMDD' AAAAA : Satellite name (= 'ALOS2') BBBBB : Orbit accumulation number of a scene center CCCC : Scene frame number of a scene center - : separator (hyphen) YYMMDD: Observation date of scene center (YY: lower 2 figures of a year, MM: month, DD: day) | Copy the value of L1.1 |
| | Amount of scene shift | Scs_SceneShift | '-5'~'4' : Except ScanSAR mode '-25'~'20' : ScanSAR mode Zero and positive number have no sign. | Copy the value of L1.1 |

Table 4-1 Summary information for CEOS Level 2.1 product (2/8)

| Section | Item name | Keyword | Value | Remark |
|-----------------------------|-------------------|----------------------|--|----------------------------|
| Product specification (Pds) | Product ID | Pds_ProductID | 'DDDEFFFGHI' DDD: Observation mode (*) SBS: Spotlight mode (Single pol.) UBS: Ultra-Fine mode (Single pol.) UBD: Ultra-Fine mode (Dual pol.) HBS: High-sensitive mode (Single pol.) HBD: High-sensitive mode (Dual pol.) HBQ: High-sensitive mode (Full (Quad.) pol.) FBS: Fine mode (Single pol.) FBD: Fine mode (Dual pol.) FBQ: Fine mode (Full (Quad.) pol.) WBS: ScanSAR nominal [14MHz] mode (Single pol.) WBD: ScanSAR nominal [14MHz] mode (Dual pol.) WWS: ScanSAR nominal [28MHz] mode (Single pol.) WWD: ScanSAR nominal [28MHz] mode (Dual pol.) VBS: ScanSAR wide mode (Single pol.) VBD: ScanSAR wide mode (Dual pol.) E : Observation direction (*) L: Left looking, R: Right looking FFF: Processing level 2.1: Level 2.1 G : Processing option G: Geo-Coded H : Map projection type U: UTM, P: PS, M: MER, L: LCC I : Orbit direction (*) A: Ascending, D: Descending | (*) Copy the value of L1.1 |
| | Resampling method | Pds_ResamplingMethod | 'NN' / 'BL' / 'CC' Nearest Neighbor / Bi-Linear / Cubic Convolution | |
| | UTM zone no. | Pds_UTM_ZoneNo | '1'~'60' (specify only for UTM projected product) | |

Table 4-1 Summary information for CEOS Level 2.1 product (3/8)

| Section | Item name | Keyword | Value | Remark |
|-----------------------------|----------------------------------|--|---|------------------------|
| Product specification (Pds) | PS reference latitude | Pds_PS_ReferenceLatitude | Northern Hemisphere: '25.000' <= reference latitude <='90.000' Southern Hemisphere: '-90.000' <= reference latitude <= '-25.000' (specify only for PS projected product) | |
| | PS reference longitude | Pds_PS_ReferenceLongitude | '-179.999' ≤ reference longitude ≤ '180.000' (specify only for PS projected product) | |
| | LCC reference latitudinal line 1 | Pds_LCC_ReferenceLatitudinalLine1 | '-90.000' < reference latitude < '90.000' (specify only for LCC projected product) | |
| | LCC reference latitudinal line 2 | Pds_LCC_ReferenceLatitudinalLine2 | '-90.000' < reference latitude < '90.000' (specify only for LCC projected product) | |
| | Map direction | Pds_MapDirection | 'MapNorth' | |
| | LCC origin latitude | Pds_LCC_OriginLatitude | '-90.000' ≤ origin latitude ≤ '90.000' (specify only for LCC projected product) | |
| | LCC origin longitude | Pds_LCC_OriginLongitude | '-179.999' ≤ origin longitude ≤ '180.000' (specify only for LCC projected product) | |
| | Pixel spacing | Pds_PixelSpacing | Spotlight mode: '0.625'/'1.25'/'2.5' [m] Ultra-Fine mode: '2.5'/'5.0'/'10.0' [m] High-sensitive mode: '3.125'/'6.25'/'12.5' [m] Fine beam mode: '6.25'/'12.5' [m] ScanSAR mode: '25.0'/'50.0'/'100.0' [m] | |
| | Precision of orbit data | Pds_OrbitDataPrecision | 'Precision' / 'Onboard' / 'RARR_Predict' Precision : High precision orbit information Onboard : Onboard orbit determination RARR_Predict : Predicted orbit information | Copy the value of L1.1 |
| | Precision of attitude data | Pds_AttitudeDataPrecision | 'Onboard' Onboard : Onboard attitude determination | Copy the value of L1.1 |
| Digital Elevation Model | Pds_DigitalElevationModel | 'GISMAP_Terrain'/'SRTM90m_v4.1' GISMAP_Terrain: GIS MAP Terrain (Hokkaido-Chizu Company Ltd.) SRTM90m_v4.1: SRTM 90m Digital Elevation Database v4.1 (CSI) | | |
| Geoid Model | Pds_GeoidModel | 'GSIGEO2000'/'EGM96' GSIGEO2000: Japanese Geoid Model (Geospatial Information Authority of Japan) EGM96: Earth Gravitational Model 1996 (NGA) | | |

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Table 4-1 Summary information for CEOS Level 2.1 product (4/8)

| Section | Item name | Keyword | Value | Remark |
|-------------------------|---------------------------------------|------------------------------------|---|------------------------|
| Image information (Img) | Date and time of scene center | Img_SceneCenterDateTime | 'YYYYMMDDbhh: mm: ss.ttt'(UT) YYYY : Year (A.D.) MM : Month (01~12) | Copy the value of L1.1 |
| | Date and time of scene start | Img_SceneStartDateTime | DD : Day (01~31) hh : Hour (00~23) mm : Minute (00~59) | Copy the value of L1.1 |
| | Date and time of scene end | Img_SceneEndDateTime | ss : Second (00~60) (ss=60 is used only by a leap second.) ttt : Milli-second (000~999) | Copy the value of L1.1 |
| | Latitude of image scene center | Img_ImageSceneCenterLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of image scene center | Img_ImageSceneCenterLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of image scene Left-Top | Img_ImageSceneLeftTopLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of image scene Left-Top | Img_ImageSceneLeftTopLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of image scene Right-Top | Img_ImageSceneRightTopLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of image scene Right-Top | Img_ImageSceneRightTopLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of image scene Left-Bottom | Img_ImageSceneLeftBottomLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of image scene Left-Bottom | Img_ImageSceneLeftBottomLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of image scene Right-Bottom | Img_ImageSceneRightBottomLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of image scene Right-Bottom | Img_ImageSceneRightBottomLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |

Table 4-1 Summary information for CEOS Level 2.1 product (5/8)

| Section | Item name | Keyword | Value | Remark |
|-------------------------|---------------------------------------|------------------------------------|---|------------------------|
| Image information (Img) | Latitude of frame scene center | Img_FrameSceneCenterLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of frame scene center | Img_FrameSceneCenterLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of frame scene Left-Top | Img_FrameSceneLeftTopLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of frame scene Left-Top | Img_FrameSceneLeftTopLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of frame scene Right-Top | Img_FrameSceneRightTopLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of frame scene Right-Top | Img_FrameSceneRightTopLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of frame scene Left-Bottom | Img_FrameSceneLeftBottomLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of frame scene Left-Bottom | Img_FrameSceneLeftBottomLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Latitude of frame scene Right-Bottom | Img_FrameSceneRightBottomLatitude | '-90.000'~'90.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Longitude of frame scene Right-Bottom | Img_FrameSceneRightBottomLongitude | '-179.999'~'180.000' [degree] Third decimal places are not omissible. Zero and positive number have no sign. | |
| | Off-nadir angle | Img_OffNadirAngle | NN.N [degree] | Copy the value of L1.1 |

Table 4-1 Summary information for CEOS Level 2.1 product (6/8)

| Section | Item name | Keyword | Value | Remark |
|---------------------------|--------------------------------------|--|---|--------|
| Product information (Pdi) | Data size of product | Pdi_ProductDataSize | unit: Mbyte = 1024Kbyte Rounded off by the 2nd place of a decimal point. The first place of a decimal is not omissible. | |
| | Number of files in level 2.1 product | Pdi_CntOfL21ProductFileName | Spotlight mode: 4 files High resolution mode (Single pol.) : 4 files High resolution mode (Dual pol.) : 5 files ScanSAR mode (Single pol.) : 4 files ScanSAR mode (Dual pol.) : 5 files High resolution mode (Full (Quad.) pol.) : 7 files | |
| | Filename of level 2.1 product | Pdi_L21ProductFileName n nn: 01~99 | Volume directory file 'VOL-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPP' Leader file 'LED-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPP' Image file 'IMG-XX-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPP' Trailer file 'TRL-SSSSSSSSSSSSSSSSSSSS-PPPPPPPPP' SSSSSSSSSSSSSSSSSSSS : Scene ID PPPPPPPPP : Product ID XX : Polarization (HH, HV, VH, VV) (in order of Tx-Rx) | |
| | Bits per pixel | Pdi_BitPixel | 'NN' 16: (fixed value) | |
| | Number of pixels | Pdi_NoOfPixels_0 | '0' - '99999' (Zero-suppressible) The number of pixels of the SAR signal data in processed data record (prefix is not included). | |
| | Number of lines | Pdi_NoOfLines_0 | '0' - '99999' (Zero-suppressible) The number of lines of the SAR signal data in processed data record (file descriptor is not included). | |
| | Product format | Pdi_ProductFormat | 'CEOS' | |

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Table 4-1 Summary information for CEOS Level 2.1 product (7/8)

| Section | Item name | Keyword | Value | Remark |
|----------------------------|---|------------------------------|--|------------------------|
| Result of auto check (Ach) | Checking result of Time data | Ach_TimeCheck | 'GOOD' / 'POOR' GOOD: All lines are GPS-aligned, POOR: other than GOOD | Copy the value of L1.1 |
| | Checking result of attitude data | Ach_AttitudeCheck | 'GOOD' / 'POOR' GOOD: other than POOR. POOR: There are two or more lines which the posture and the rate are not converging. | Copy the value of L1.1 |
| | Status of absolute navigation | Ach_AbsoluteNavigationStatus | 'OK' / 'NG' | Copy the value of L1.1 |
| | Checking result of house keeping data | Ach_HouseKeepingDataCheck | 'GOOD' / 'FAIR' FAIR: There are one or more FAIR(s) among check items. | Copy the value of L1.1 |
| | Checking result of orbit data | Ach_OrbitCheck | 'GOOD' / 'FAIR' GOOD: All values are normal. FAIR: All abnormal values are interpolated correctly. | Copy the value of L1.1 |
| | Checking result of on-board attitude data | Ach_OnBoardAttitudeCheck | 'GOOD' / 'FAIR' GOOD: All values are normal. FAIR: All abnormal values are interpolated correctly. | Copy the value of L1.1 |
| | Loss lines | Ach_LossLines | 'GOOD' / 'FAIR' / 'POOR' GOOD: There is no loss line. FAIR: Number of loss line is 1 or more, but is not more than threshold value. POOR: Number of loss line is more than threshold value. | Copy the value of L1.1 |
| | Absolute navigation time | Ach_AbsoluteNavigationTime | blank | Copy the value of L1.1 |
| | Checking result of PRF change | Ach_PRF_Check | blank | Copy the value of L1.1 |
| | Checking result of calibration data | Ach_CalibrationDataCheck | blank | Copy the value of L1.1 |

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Table 4-1 Summary information for CEOS Level 2.1 product (8/8)

| Section | Item name | Keyword | Value | Remark |
|--------------------------|----------------------|------------------------|---|------------------------|
| Result information (Rad) | Practice result code | Rad_PracticeResultCode | 'GOOD' GOOD: normal | |
| Label information (Lbi) | Satellite name | Lbi_Satellite | 'ALOS2' (fixed value) | Copy the value of L1.1 |
| | Sensor name | Lbi_Sensor | 'SAR' (fixed value) | Copy the value of L1.1 |
| | Processing level | Lbi_ProcessLevel | '2.1' | |
| | Processing facility | Lbi_ProcessFacility | 'SCMO' / 'EICS' SCMO : Spacecraft Control Mission Operation system EICS : Earth Intelligence Collection and Shearing System | |
| | Observation date | Lbi_ObservationDate | 'YYYYMMDD' YYYYMMDD : (YYYY: year, MM: month, DD: day) | Copy the value of L1.1 |

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