Synspective SAR DATA PRODUCT FORMAT MANUAL

Version 22.0
Oct 14, 2026

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Version	Date	Description
v1.0	Nov 17, 2022	Initial version
v2.0	Dec 15, 2022	1. BRS File name is changed to match with IMG File name (Table 1.1-1) 2. Scene ID and Product ID in VOL File and summary.txt are changed to match with IMG File name (No. 9 and 12 in Table 1.1-7/ No. 9 in Table 1.1-9/ No. 2 and 3 in Table 1.1-18) 3. The sign for left and right looking direction is fixed (No.39 in Table 1.1-9) 4. The description of Synspective products specific implementation in SICD product is added (Table 1.2-2) 5. Orbit state vectors are added in XML Metadata for GRD product (“stateVecFormat” ~ “velZ” in Table 2.1-2) 6. Section number for the reference in Calibration Factor's Description in XML metadata data for GRD is updated (“calibrationFactor” in Table 2.1-2) 7. StriX-1 is added for Radiometric Calibration (Section 5) 8. “Intensity conversion factor” is changed to “Calibration factor” (Table 5-1) 9. Calibration factor (CF) subscripts ($CF_{SLC\ CEOS}$ and CF_{GRD})are added (Section 5) 10. New product version is added in product version history (Table 6.1-1)
v3.0	Feb 27, 2023	1. Datetype for No. 90 (Bandwidth per look in the range direction) in Data Set Summary Records in CEOS is updated from F16.7 to F16.6 (Table 1.1-9) 2. New product version is added in product version history (Table 6.1-1)
v4.0	May 15, 2023	1. Updated description of GRD Product (Section 2) 2. Updated eop:referenceSystemIdentifier Description to “Projection coordinate system ID 3. (EPSG Geodetic Parameter Dataset)“ and changed its example to “epsg:32630 (UTM zone 30N)” (Table 2.1-2) 4. Updated eop:mapProjection Description to “Map projection” and changed its example to “UTM” (Table 2.1-2) 5. Updated GeoTIFF Tag GeoAsciiParamsTag Description/Example to: “Based on GeoTIFF standards: “WGS 84 / UTM zone 18S|WGS 84|” (Table 2.1-3) 6. Updated GeoTIFF Tag ModelPixelScaleTag Description/Example to: “Pixel spacing (meters)” (Table 2.1-3) 7. Updated GeoTIFF Tag GTCitationGeoKey Description/Example to: “WGS 84 / UTM zone 18S” (Table 2.1-3) 8. New product version is added in product version history (Table 6.1-1) 9. Fixed links to Reference
v5.0	June 5, 2023	1. Added the description of New Product SR-GRD (Section 2)
v6.0	Aug 1, 2023	1. Added NESZ information to GRD and SR-GRD XML (Table 2.1-2) 2. Added Sliding Spotlight mode to SR-GRD product (Section 2) 3. New product version is added in product version history (Table 6.1-1)
v7.0	Oct 2, 2023	1. Updated the description of Field No.25 Data Set summary Records to: "reference height above the ellipsoid" (Table 1.1-9) for CEOS products 2. New product version is added in product version history (Table 6.1-1)
v7.1	Oct 19, 2023	1. New product version is added in product version history (Table 6.1-1)
v7.2	Dec 6, 2023	1. Updated the remarks of Field No.24 Facility Related Data Record (Table 1.1-14) for CEOS products 2. New product version is added in product version history (Table 6.1-1)

Version	Date	Description
v8.0	Jan 22, 2024	1. Updated the Description of Field No.22 and 23 Facility Related Data Record (Table 1.1-14) for CEOS products 2. Updated SICD format standards from NGA.STND.0024-1_1.2.1 to NGA.STND.0024-1_1.3.0 (Section 1.2) 3. Added SICD format standards reference, NGA.STND.0024-2_1.3.0 and NGA.STND.0024-3_1.3.0 (Section 1.2) 4. Changed eop:processorName from StrixProcessor to GrdProcessor in XML metadata for GRD and SR-GRD product (Table 2.1-2). 5. New product version is added in product version history (Table 6.1-1) 6. Updated reference for SICD formats ([2], [3] and [4] in Reference)
v8.1	Jan 23, 2024	1. New product version is added in product version history (Table 6.1-1)
v8.2	Mar 18, 2024	1. Corrected a reference number for radiometric calibration in SICD format (Section 5) 2. New product version is added in product version history (Table 6.1-1)
v8.3	Apr 10, 2024	1. New product version is added in product version history (Table 6.1-1)
v9.0	Apr 22, 2024	1. New product version is added in product version history (Table 6.1-1)
v9.1	May 15, 2024	1. Added Strix-3 for Satellite type 2. Consolidated GRD and SR-GRD sections (Section 2) 3. Updated radiometric calibration table (Table 5-1) 4. New product version is added in product version history (Table 6.1-1)
v10.0	Aug 1, 2024	1. Removed "Blank" in remarks of Field No. 17 and 18 Data Quality Summary Record (Table 1.1-13) 2. Added new fields No.6 and 7, Pds_SlantRangeResolution and Pds_AzimuthResolution, in Summary Information (Table 1.1-18) 3. Restructure XML metadata table (Table 2.1-2) 4. Added new fields about range and azimuth resolution in XML metadata in GRD and SR-GRD product (Table 2.1-2) 5. Changed the title of Section 6 to "Product Release History" from "Product Version History" 6. Added Table 6.1-4 Software version related fields 7. Added thumbnail image in SICD product format (Section 1.2.1 and 1.2.4) 8. Added thumbnail image in GRD and SR-GRD product format (Section 2.1.1 and 2.1.4)
v10.1	Aug 22, 2024	1. New version is added to product release history (Table 6.1-1)
v10.2	Sept 4, 2024	1. New version is added to product release history (Table 6.1-1)
v10.3	Oct 2, 2024	1. Added Staring Spotlight 2. Added Note in Radiometric Calibration (Section 5) about Staring Spotlight. 3. New version is added to product release history (Table 6.1-1)
v11.0	Nov 12. 2024	1. Added StriX-4 2. Added Cloud Optimized GeoTIFF (COG) in GRD and SR-GRD product (Section 2) 3. Removed Note in Radiometric Calibration (Section 5) about Staring Spotlight. 4. New version is added to product release history (Table 6.1-1)

Version	Date	Description
v12.0	Dec 3, 2024	1. Added note in Radiometric Calibration (Section 5) about SR-GRD. 2. New version is added to product release history (Table 6.1-1)
v13.0	Jan 14, 2025	1. New version is added to product release history (Table 6.1-1)
v14.0	Mar 25, 2025	1. Added StriX-2 2. New version is added to product release history (Table 6.1-1) 3. Changed the cover page and the colors of the tables
v14.1	Apr 2, 2025	1. New version is added to product release history (Table 6.1-1)
v15.0	June 25, 2025	1. New version is added to product release history (Table 6.1-1)
v15.1	July 15, 2025	1. New version is added to product release history (Table 6.1-1)
v16.0	Sept 30, 2025	1. Removed signs of the offnadir angle in CEOS metadata , Img_OffNadirAngle in Contents of Summary Information(Table 1.1-18) and No.135 Data Set Summary Records (Table 1.1-9) 2. Switched thumbnail images pixel-intensity mapping from linear to logarithmic in SICD and CEOS 3. Updated the description of Satellite heading angle in GRD XML Metadata (Table 2.1-2) 4. New version is added to product release history (Table 6.1-1)
v17.0	Dec 9, 2025	1. Updated descriptions of Thumbnail Image for CEOS, SICD and GRD (Section 1.1.7, 1.2.4 and 2.1.4) 2. Updated descriptions of Quicklook raster data for GRD product (Section 2.1.5) 3. Changed Standard GeoTIFF format to Cloud Optimized GeoTIFF for GRD Product (Section 2.1.1) 4. Changed a file naming convention for quicklook raster image in GRD product (Table 2.1-1) 5. Changed a format of software version in GRD XML Metadata, eop:processorVersion (Table 2.1-2) 6. Updated GeoTIFF tags (Table 2.1-3) 7. Updated the note for GRD GeoTIFF calibration (Section 5) 8. New version is added to product release history (Table 6.1-2)
v17.1	Dec 17, 2025	1. New version is added to product release history (Table 6.1-2)
v17.2	Jan 7, 2026	1. New version is added to product release history (Table 6.1-2)
v17.3	Feb 10, 2026	1. New version is added to product release history (Table 6.1-2)
v17.4	Feb 16, 2026	1. Added StriX-5 2. New version is added to product release history (Table 6.1-2)
v18.0	Mar 11, 2026	1. Added number of azimuth and range looks in in GRD XML (Table 2.1-2) 2. Added temporal metadata file in SICD (Section 1.2.1) and GRD (Section 2.1.1) products 3. New version is added to product release history (Table 6.1-2)
v18.1	Mar 17, 2026	1. New version is added to product release history (Table 6.1-2)
v18.2	Mar 24, 2026	2. New version is added to product release history (Table 6.1-2)

Version	Date	Description
v19.0	Apr 2, 2026	1. A new product, Orthorectified (ORT), has been added to Section 3. 2. The former Section 3 (Radiometric Calibration) has been moved to Section 4. 3. The former Section 4 (Product Release History) is now Section 5.
v19.1	Apr 8, 2026	1. Updated ORT XML Metadata (Table 3.1-2, Note 1), ORT GeoTIFF GeoKey Directory (Table 3.1-2, Note 3) and ORT COG File Specification (Table 3.1-5) 2. New version is added to product release history (Table 6.1-2)
v19.2	Apr 16, 2026	1. Updated ORT XML Metadata (Table 3.1-2) and COG File Specifications (Table 3.1-5, Note 3) 2. New version is added to product release history (Table 6.1-2)
v20.0	May 26, 2026	1. Added orbit source in SICD XML metadata (Table 1.2-2) and GRD XML metadata (Table 2.1-2) 2. Added orbit source and noise level in ORT XML metadata (Table 3.1-2). 3. New version is added to product release history (Table 6.1-2)
v20.1	June 1, 2026	1. New version is added to product release history (Table 6.1-2)
v20.2	June 23, 2026	1. New version is added to product release history (Table 6.1-2) 2. Added information of Latest version and Compatible version (Section 6.2)
v21.0	July 29, 2026	1. A new product, Compensated Phase History Data (CPHD), has been added (Section 4). 2. The former Section 4 (Radiometric Calibration) has been moved to Section 5. 3. The former Section 5 (Product Version) is now Section 6. 4. Updated the product list in Introduction to include CPHD. 5. Added a note for CPHD in Radiometric Calibration (Section 5). 6. Added CPHD to Product Release History and Latest/Compatible Version tables (Tables 6.1-3 / 6.2-1). 7. Added CPHD format standard references ([8] and [9] in Reference). 8. Updated Copernicus DEM version and reference URL in ORT XML metadata (Table 3.1-2). 9. Added lsmap palette sidecar (.aux.xml) to ORT delivery (Tables 3.1-1, 3.1-2, 3.1-5).
v21.1	August 26, 2026	1. Updated eop:serialIdentifier allowed values (Table 2.1-2) 2. New version is added to product release history (Table 6.1-3, Table 6.2-1)
v21.2	September 16, 2026	1. New version is added to product release history (Table 6.1-3, Table 6.2-1)
v22.0	October 14, 2026	1. New version is added to product release history (Table 6.1-3, Table 6.2-1)

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Introduction

This document defines the format of Synspective SAR data products observed by StriX satellites (Synspective products). There are five types of Synspective products: Single Look Complex (SLC), Ground Range Detected (GRD), Super Resolution GRD (SR-GRD), Orthorectified (ORT), and Compensated Phase History Data (CPHD). SLC products are available in CEOS and SICD formats. GRD, SR-GRD and ORT products are available in Cloud Optimized GeoTIFF (COG) + XML format. CPHD products are available in CPHD format.

1. SLC Product

The general specification of the SLC product:

- Single Look Complex (SLC) data after range and azimuth compression
- single look in azimuth and range
- provided in slant range geometry
- phase information is preserved
- pixel spacing is in slant geometry
- data type: 32 bit float (I) + 32 bit float (Q)
- mode of observation: Stripmap, Sliding Spotlight or Staring Spotlight
- single polarization: VV

1.1 CEOS Product Format

CEOS standard format was published in 1988 and does not specify the naming convention. In practice, Synspective's CEOS product format references the ALOS-2 PALSAR-2 CEOS format [1] .

1.1.1 Product Composition

SLC CEOS format is a wrapper, which combines multiple files:

- Volume directory file (VOL),
- SAR leader file (LED),
- SAR image data (IMG),
- SAR trailer file (TRL)

CEOS product includes the following files as well.

- Summary information
- Thumbnail image

The naming convention for SLC CEOS product files are described in the table below.

Table 1.1-1 SLC CEOS Product File Naming Convention

File Type	Number of Files	File Name	Record Name	Contents
Volume Directory File	1	VOL-<Scene ID> -<Product ID>	- Volume descriptor File Pointer	This stores the volume and file management information.
SAR Leader File	1	LED-<Scene ID> -<Product ID>	- File descriptor - Data set summary - Platform location data - Attitude data - Radiometric data - Data quality summary - Facility related data	This file stores information such as annotation data and ancillary data related to the image data.
SAR Image Data	1	IMG-<Polarization> -<Scene ID>-<Product ID>	- File descriptor - Signal data	This file stores image data.
SAR Trailer File	1	TRL-<Scene ID> -<Product ID>	- File descriptor	This file stores the final information about the image data.
Summary Information	1	summary.txt		
Thumbnail Image	1	BRS-<Polarization> -<Scene ID> -<Product ID>.png		

where:

Scene ID = AAAAAAAA-YYYYMMDDThhmmssZ

AAAAAAAA : Satellite type

- STRIX00A: StriX-α
- STRIX00B: StriX-β
- STRIX001 ~ N: StriX-1 ~ N
  - Example:
    - STRIX001: StriX-1
    - STRIX002: StriX-2

- : Separator

YYYYMMDD: Scene center observation date (YYYY: year, MM: month, DD: day)

hhmmss: Scene center observation time* (hh: hour, mm: minutes, ss: seconds)

*precise orbit is used when available

Product ID = DDEEE

DD: Observation mode

- SM: Stripmap mode
- SL: Sliding Spotlight mode
- ST: Staring Spotlight mode

EEE: Processing level (SLC: Single Look Complex)

1.1.2 Product Record Description

The table below shows SLC CEOS format record structure.

Table 1.1-2 Record Structure SLC CEOS Format

Record No.	Record Length [byte]	Number of Record	Record Name	File Name
1	360	1	Volume descriptor	Volume Directory File
3	360	3	File pointer	
4	360	1	Text	
1	720	1	SAR Leader file descriptor	SAR Leader File
2	4,096	1	Dataset summary	
3	4,680	1	Platform location data	
4	16,384	1	Attitude data	
5	9,860	1	Radiometric data	
6	1,620	1	Data quality summary	
7	5000	1	Facility related data	
1	720	1	SAR data file descriptor	SAR Image Data
2 to n+1	variable	n	Signal data	
1	720	1	SAR trailer file descriptor	SAR Trailer

1.1.3 Record Data Type

The definition of data type is shown in the table below.

Table 1.1-3 Data Type

Type (code)	Details
Am	ASCII character（Left fill if not specified）
Im	Integer number in ASCII form（Right fill）
Fm.n	Floating number in ASCII form（Right fill）
Em.n	Exponential number in ASCII form（Right fill）
Bm	Binary number（the first byte is the most significant, big endian）

where:
m：Number of digits
n：Number of decimal places

1.1.4 Record Type Code and Record Subtype Code

Each record has record type code and record subtype code to distinguish each other. Each record type is shown in the table below.

Table 1.1-4 Record Type of Each Record

Record Name	First Record Type	Record Type	Second Record Type	Third Record Type	Record Length [bytes]
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
Dataset summary	18	10	18	20	4096
Platform location data	18	30	18	20	4680
Attitude data	18	40	18	20	16384
Radiometric data	18	50	18	20	9860
Data quality summary	18	60	18	20	1620
Facility related data	18	200	18	70	5000
SAR data file descriptor	50	192	18	18	720
Signal data	50	10	18	20	Variable
SAR trailer file descriptor	63	192	18	18	720

1.1.5 Contents of Records in SLC CEOS Files

The record formats are shown in the tables below.

Table 1.1-5 Volume Descriptor Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 1
2	5	B1	First subtype code = 192
3	6	B1	Record type code = 192
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 18
6	9-12	B4	Record length = 360
7	13-14	A2	ASCII/EBCDIC flag = ‘Ab’ : ASCII
8	15-16	A2	Blank
9	17-28	A12	Format descriptor ID = 'CEOS-SARbbbb’

Field No.	Byte No.	Type	Description
10	29-30	A2	Revision level of the document = 'bA', 'bB', ...
11	31-32	A2	Superstructure format revision level = 'bA', 'bB', ...
12	33-44	A12	Software release and revision number = ''NNN.NNNbbbbb'
13	45-60	A16	Physical Volume ID = 'SYNSbbbbbbbbbbbb'
14	61-76	A16	Logical volume ID = 'MMMMMNNNYYYYmmDD' MMMMM = Mission name ('STRIX') NNN = Mission ID（Alpha='00A', Beta='00B', 1='001', 2='002', ...） YYYY = Product creation year mm = Product creation month DD = Product creation day
15	77-92	A16	Volume set ID = 'MMMMMMMMMbbbbbbbbb' MMMMMMMM = Mission name ('Strix-00A', 'Strix-00B', 'Strix-001', 'Strix-002', ...)
16	93-94	I2	Number of physical volumes in the logical volume = 'b1'
17	95-96	I2	First tape's sequence number of the physical volume = 'b1'
18	97-98	I2	Last tape's sequence number of the physical volume = 'b1'
19	99-100	I2	Current tape's sequence number of the physical volume = 'b1'
20	101-104	I4	Number of files in the logical volume following the volume directory file = 'bbb3':
21	104-108	I4	Number of logical volumes in the volume set = 'bbb1'
22	109-112	I4	Number of logical volumes in a physical volume = 'bbb1'
23	113-120	A8	Logical volume creation date ='YYYYMMDD' (without zero suppression) YYYY: Year ('0001'-'9999') MM: Month ('01'-'12') DD: Day ('01'-'31')
24	121-128	A8	Logical volume creation time ='HHMMSSXX' (without zero suppression) HH: Hour ('00'-'23') MM: Minute ('00'-'59') SS: Second ('00'-'59') XX: 10 milliseconds ('00'-'99')
25	129-140	A12	Logical volume creation country (Japan) ='JAPANbbbbbbb'
26	141-148	A8	Logical volume creator = 'SYNSbbbb'
27	149-160	A12	Logical volume creation facility = 'SYNSbbbbbbbb'
28	161-164	I4	Number of file pointer records in the volume directory = 'bbb3'
29	165-168	I4	Number of text records in the volume directory = 'bbb1'
30	169-260	A92	Volume descriptor spare area = blank
31	261-360	A100	Private fields = blank

Table 1.1-6 File Pointer Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 1
2	5	B1	First subtype code = 219
3	6	B1	Record type code = 192
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 18
6	9-12	B4	Record length = 360
7	13-14	A2	ASCII/EBCDIC flag = ‘Ab’; ASCII
8	15-16	A2	Blank
9	17-20	I4	Reference file number Leader file ='bbb1' Image file ='bbb2' Trailer file ='bbb3'
10	21-36	A16	Reference file ID ='MMMMMNNNbTFFFFbbbb' MMMMM: Mission name ('STRIX') NNN: Mission number (Alpha ='00A', Beta='00B', 1='001', 2='002', ...) T: Processing level code (‘B' indicates SLC product) FFFF: File type 'SARL': Leader file 'IMOP': Image file 'SART': Trailer file
11	37-64	A28	Reference file class ='SARLEADERbFILEbbbbbbbbbbbbbb': For leader file ='IMAGERYbOPTIONSbFILEbbbbbbbb': For image file ='SARTRAILERbFILEbbbbbbbbbbbbb': For trailer file
12	65-68	A4	Reference file class code ='SARL': For leader files ='IMOP': For image files ='SART': For trailer files
13	69-96	A28	Reference file data type ='MIXEDbBINARYbANDbASCIIbbbbbb’
14	97-100	A4	Reference file data type code ='MBAA'
15	101-108	I8	Number of records in the reference file (zero suppression) Leader file ='bbbbbbb7' (SLC) Image file = number of SAR data records + 1 Trailer file ='bbbbbbb1'
16	109-116	I8	Length of the first record in reference file ='bbbbb720'
17	117-124	I8	Maximum record length (byte length) of the reference file: 'bbbLLLL'
18	125-136	A12	Reference file record length type ='VARIABLEbLEN': For leader files ='VARIABLEbLEN': For image files ='VARIABLEbLEN': For trailer files

Field No.	Byte No.	Type	Description
19	137-140	A4	Reference file record length type code ='VARE': For leader files ='VARE': For image files ='VARE': For trailer files
20	141-142	I2	The number of the physical volume set containing the first record of the file ='b1'
21	143-144	I2	The number of the physical volume set containing the last record of the file = 'b1'
22	145-152	I8	Record number of the first record on this physical volume ='bbbbbbb1'
23	153-160	I8	Record number of the last record on this physical volume Leader file ='bbbbbbb7' (SLC) Image file = number of lines + 1 Trailer file ='bbbbbbb1'
24	161-260	A100	Blank
25	261-360	A100	Private fields = blank

Table 1.1-7 Text Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 5
2	5	B1	First subtype code = 18
3	6	B1	Record type code = 192
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 18
6	9-12	B4	Record length = 360
7	13-14	A2	ASCII/EBCDIC flag = ‘Ab’ In case of ASCII
8	15-16	A2	Blank
9	17-56	A40	Deliverable ID (Product ID) ='PRODUCT: DDEEEb ～ b' DD: Observation mode SL: Sliding Spotlight mode SM: Stripmap mode ST: Staring Spotlight mode EEE: Processing level SLC: Single Look Complex
10	57-116	A60	Product creation location / date / time (without zero suppression) ='PROCESS: JAPAN-SYNS-STRIXNbYYYYMMDDbHHMMSSb ～ b' N: A, B, 1, 2, ... YYYYMMDD: Creation date HHMMSS: Creation time (UTC)
11	117-156	A40	Physical tape ID ='TAPEbID: b ～ b'

Field No.	Byte No.	Type	Description
12	157-196	A40	Scene ID ='ORBITb: AAAAAAAA-YYYYMMDDThhmmssZb ～ b' AAAAAAAA: Satellite type (='STRIXNNN') NNN: 00A, 00B, 001, 002, ... YYYYMMDD: Scene center observation date (YYYY: year, MM: month, DD: day) hhmmss: Scene center observation time (hh: hour, mm: minutes, ss: seconds) -: Separator
13	197-236	A40	Scene location ID (without zero suppression) ='FRAMEbCENTRE: b ～ b': SLC
14	237-360	A124	Blank

Table 1.1-8 Leader File Descriptor Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 1
2	5	B1	First subtype code = 11
3	6	B1	Record type code = 192
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 18
6	9-12	B4	Record length = 720
7	13-14	A2	ASCII/EBCDIC flag = ‘Ab’: ASCII
8	15-16	A2	Continue flag = ‘bb’
9	17-28	A12	Format control document ID='CEOS-SARbbbb'
10	29-30	A2	Format control document revision level ='bA'
11	31-32	A2	Record format revision level ='bA'
12	33-44	A12	Software Release & Revision Number ='NNN.NNNbbbbb'
13	45-48	I4	Number of files = ‘bbb1’
14	49-64	A16	File ID ='MMMMMNNNbTFFFFbbbb' MMMMM: Mission name ('STRIX') NNN: Mission ID (Alpha='00A', Beta='00B', 1='001', 2='002', ...) T: Processing level code SLC ='B' FFFF: File type Leader file ='SARL'
15	65-68	A4	Record sequence and location type flag ='FSEQ'
16	69-76	I8	Sequence number of location = 'bbbbbbb1'
17	77-80	I4	Field length of sequence number = 'bbb4'
18	81-84	A4	Record code and location type flag = 'FTYP'
19	85-92	I8	Record code position ='bbbbbbb5'
20	93-96	I4	Field length of record code ='bbb4'
21	97-100	A4	Record length and location type flag = 'FLGT'

Field No.	Byte No.	Type	Description
22	101-108	I8	Location of record length ='bbbbbbb9'
23	109-112	I4	Field length of record length ='bbb4'
24	113-180	A68	Blank
25	181-186	I6	Number of dataset summary records ='bbbbb1'
26	187-192	I6	Dataset summary record length ='bb4096'
27	193-198	I6	Number of map projection data records ='bbbbb0'
28	199-204	I6	Map projection data record length ='bbbbb0'
29	205-210	I6	Number of platform location data records ='bbbbb1'
30	211-216	I6	Platform location data record length ='bb4680'
31	217-222	I6	Number of attitude data records='bbbbb1'
32	223-228	I6	Attitude data record length = 16384
33	229-234	I6	Number of radiometric data records ='bbbbb1'
34	235-240	I6	Radiometric record length ='bb9860'
35	241-246	I6	Number of radiometric compensation records ='bbbbb0'
36	247-252	I6	Radiometric compensation record length ='bbbbb0'
37	253-258	I6	Number of data quality summary records='bbbbb1'
38	259-264	I6	Data quality summary record length ='bb1620'
39	265-270	I6	Number of data histogram records ='bbbbb0'
40	271-276	I6	Data histogram record length ='bbbbb0'
41	277-282	I6	Number of range spectra records ='bbbbb0'
42	283-288	I6	Range spectra record length ='bbbbb0'
43	289-294	I6	Number of DEM descriptor records ='bbbbb0'
44	295-300	I6	DEM descriptor record length ='bbbbb0'
45	301-306	I6	Number of radar parameter update records ='bbbbb0'
46	307-312	I6	Radar parameter update record length ='bbbbb0'
47	313-318	I6	Number of annotation data records ='bbbbb0'
48	319-324	I6	Annotation data record length ='bbbbb0'
49	325-330	I6	Number of detail processing records = 'bbbbb0'
50	331-336	I6	Detail processing record length = 'bbbbb0'
51	337-342	I6	Number of calibration records ='bbbbb0'
52	343-348	I6	Calibration record length ='bbbbb0'
53	349-354	I6	Number of GCP records ='bbbbb0'
54	355-360	I6	GCP record length ='bbbbb0'
55	361-420	A60	Blank
56	421-426	I6	Number of facility data records = 'bbbbb1'
57	427-432	I6	Facility data record length = 'bb5000'

Field No.	Byte No.	Type	Description
58	433-720	A288	Blank

Table 1.1-9 Data Set Summary Records

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 2
2	5	B1	First subtype code = 18
3	6	B1	Record type code = 10
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 20
6	9-12	B1	Record length = 4096
7	13-16	I4	Dataset summary record sequence number = ‘bbb1’
8	17-20	I4	SAR channel ID = blank
9	21-52	A32	Scene ID ='AAAAAAAA-YYYYMMDDThhmmssZb ~ b' AAAAAAAA: Satellite type (='STRIXNNN') NNN: 00A, 00B, 001, 002, ... YYYYMMDD: Scene center observation date (YYYY: year, MM: month, DD: day) hhmmss: Scene center observation time (hh: hour, mm: minutes, ss: seconds) -: Separator
10	53-68	A16	Number of scene reference = 'bbbbbbbbbbbbbbbb'
11	69-100	A32	Scene center time ='YYYYMMDDHHMMSSTTTbbbbbbbbbbbbbbb' (No zero suppression) YYYYMMDD: YYYY: year, MM: month, DD: day HHMMSSTTT: Time (UTC)
12	101-116	A16	Blank
13	117-132	F16.7	Geodetic latitude (degrees) in the center of the processed scene = blank: SLC
14	133-148	F16.7	Geodetic longitude (degrees) in the center of the processed scene = blank: SLC
15	149-164	F16.7	Processed scene center true heading (degrees) = blank: SLC
16	165-180	A16	Ellipsoidal model = 'WGS84b ~ b'
17	181-196	F16.7	Semi-major axis of ellipsoid (km) = 6378.1370000
18	197-212	F16.7	Semi-minor axis of ellipsoid (km) = 6356.7523142
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 kg) = 3.9860050
21	245-260	F16.7	Ellipsoid J2 parameter = $0.1082629*10^{-2}$
22	261-276	F16.7	Ellipsoid J3 parameter = $-0.0000254*10^{-1}$
23	277-292	F16.7	Oblong parameter (mechanical shape coefficient J4 term) (10 ^-1) = $-0.0000162*10^{-1}$

Field No.	Byte No.	Type	Description
24	293-308	A16	Blank
25	309-324	F16.7	reference height above the ellipsoid
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) = blank
29	357-372	F16.7	Processing scene width (km) = blank
30	373-388	A16	Blank
31	389-392	I4	Number of SAR channels ='bbb1
32	393-396	A4	Blank
33	397-412	A16	Sensor platform name (ID) StriX: 'STRIXbbbbbbbbbbb’
34	413-444	A32	Sensor ID and operation mode ='AAAAAAAA-BB-CCbb-bbbbbbbbbbbbbbbb' AAAAAAAA: Satellite type (='STRIXNNN') NNN:00A, 00B, 001, 002, ... BB: SAR band ('Xb') CC: Operation mode '01': Stripmap mode '02': Sliding spotlight mode '03': Staring spotlight mode
35	445-452	I8	Total satellite orbit number
36	453-460	F8.3	Sensor platform geodetic latitude at nadir corresponding to scene center = blank: SLC
37	461-468	F8.3	Sensor platform geodetic longitude at nadir corresponding to scene center = blank: SLC
38	469-476	F8.3	Sensor platform heading at nadir corresponding to scene center = blank: SLC
39	477-484	F8.3	Sensor angle (degrees) relative to the flight direction of the sensor platform = 'bb90.000' (-90.0: left side), (90.0: right side)
40	485-492	F8.3	Incidence angle (degrees) at the scene center
41	493-500	A8	Blank
42	501-516	F16.7	Radar wavelength (m): Nominal value
43	517-518	A2	Motion compensation indicator = '00' fixed = '00': no compensation = '01': on board compensation = '10': in processor compensation = '11': both on board and in processor
44	519-534	A16	Range pulse code ='LINEARbFMbCHIRPb’
45	535-550	E16.7	Range pulse amplitude coefficient #1 = Nominal Value Center frequency ξ1 with respect to pulse width τ of linear FM modulation chirp (Constant term)

Field No.	Byte No.	Type	Description
46	551-566	E16.7	Range pulse amplitude coefficient #2 = Nominal value FM rate ξ2 for pulse width τ of linear FM modulation chirp (Linear coefficient term)
47	567-582	E16.7	Range pulse amplitude coefficient #3 = Nominal value (= 0.0) FM rate ξ3 for pulse width τ of linear FM modulation chirp (Quadratic coefficient terms)
48	583-598	E16.7	Range pulse amplitude coefficient #4 = Nominal value (= 0.0) FM rate ξ4 for pulse width τ of linear FM modulation chirp (Cubic coefficient terms)
49	599-614	E16.7	Range pulse amplitude coefficient #5 = Nominal value (= 0.0) FM rate ξ5 for pulse width τ of linear FM modulation chirp (Quartic term coefficient)
50	615-630	E16.7	Range pulse phase coefficient #1 (constant term) = blank
51	631-646	E16.7	Range pulse phase coefficient #2 (linear coefficient term) = blank
52	647-662	E16.7	Range pulse phase coefficient #3 (secondary coefficient term) = blank
53	663-678	E16.7	Range pulse phase coefficient #4 (third-order coefficient term) = blank
54	679-694	E16.7	Range pulse phase coefficient #5 (quartic coefficient term) = blank
55	695-702	I8	Down linked data chirp extraction index linear-up chirp ='bbbbbbb0' linear-down chirp ='bbbbbbb1' linear-up and -down chirp ='bbbbbbb2'
56	703-710	A8	Blank
57	711-726	F16.7	Sampling frequency (MHz) nominal value Set the observation auxiliary data value of the first record
58	727-742	F16.7	Range gate (rise at the start of the image) (μsec) Set the observation auxiliary data value of the first record
59	743-758	F16.7	Range pulse width (μsec) Set the observation auxiliary data value of the first record
60	759-762	A4	Baseband conversion flag ='YESb' (fixed)
61	763-766	A4	Range compression flag = 'YESb':
62	767-782	F16.7	Receiver gain for like polarized (at the start of the image) Nominal value
63	783-798	F16.7	Receiver gain for cross-polarized (at the start of the image) Nominal value
64	799-806	I8	Quantization in bits per channel = 'bbbbbbbb'
65	807-818	A12	Quantization descriptor ='UNIFORMbI, Qb’
66	819-834	F16.7	DC bias nominal value of component I
67	835-850	F16.7	DC bias nominal value of Q component
68	851-866	F16.7	Gain imbalance for I & Q = Nominal value
69	867-882	A16	Blank
70	883-898	A16	Blank
71	899-914	F16.7	Electronic boresight
72	915-930	F16.7	Mechanical boresight

Field No.	Byte No.	Type	Description
73	931-934	A4	Echo tracker-on/off = 'OFFb' (fixed value)
74	935-950	F16.7	Acquisition PRF (mHz)
75	951-966	F16.7	Two-way antenna beam width [deg] (Elevation, Effective value) = Nominal value
76	967-982	F16.7	Two-way antenna beam width [deg] (Azimuth, Effective value) = Nominal value
77	983-998	I16	Satellite encoded binary time code: Standard satellite time counter of error time information = blank
78	999-1030	A32	Satellite clock time: Standard ground time of error time information (Tgref) = blank
79	1031-1046	I16	Satellite clock increment [nsec]: Error time information of calculation satellitecounter cycle (Psc) = blank
80	1047-1062	A16	Processing equipment (ID) = 'SYNSbbbbbbbbbbbb'
81	1063-1070	A8	Processing system name (ID) = 'SYNSbbbb'
82	1071-1078	A8	Processing version ID Same as the first 8 characters of the volume descriptor software release & revision number
83	1079-1094	A16	Process code of processing equipment = 'bbbbbbbbbbbbbbbb'
84	1095-1110	A16	Product level code = 'SLCbbbbbbbbbbbbb' (SLC)
85	1111-1142	A32	Product type specifier For SLC: ='BASICbIMAGEbb ～ b'
86	1143-1174	A32	Processing algorithm ID = blank
87	1175-1190	F16.7	Number of looks in the azimuth direction (nominal value) SLC = 1.0
88	1191-1206	F16.7	Number of looks in the range direction (nominal value) = 1.0
89	1207-1222	F16.7	Bandwidth per look in azimuth (Hz) Same as 1239-1254 bytes
90	1223-1238	F16.6	Bandwidth per look in the range direction (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 direction (Hz) (3dB down width of power spectrum of the reference function for full aperture)
92	1255-1270	F16.7	Bandwidth in the range direction (kHz)
93	1271-1302	A32	Window function in azimuth direction = 1: RECTANGLE
94	1303-1334	A32	Window function in the range direction = 1: RECTANGLE
95	1335-1350	A16	Data input source (eq. HDDT-ID, etc.) Online transmission ='ONLINEb ～ b'
96	1351-1366	F16.7	Resolution in the ground range direction (nominal value) (m) = blank: For SLC
97	1367-1382	F16.7	Resolution in azimuth direction (nominal value) (m) = blank: For SLC

Field No.	Byte No.	Type	Description
98	1383-1398	F16.7	Radiometric parameter (Bias) = blank
99	1399-1414	F16.7	Radiometric parameter (Gain) = blank
100	1415-1430	F16.7	Along track Doppler frequency (center) constant term at early edge of image (Hz)
101	1431-1446	F16.7	Along track Doppler frequency (center) linear coefficient terms at early edge of image (Hz / pixel)
102	1447-1462	F16.7	Along track Doppler frequency (center) quadratic coefficient terms at early edge of image (Hz / pixel / pixel)
103	1463-1478	A16	Blank
104	1479-1494	F16.7	Cross track Doppler frequency (center) constant term at early edge of image (Hz)
105	1495-1510	F16.7	Cross track Doppler frequency (center) linear coefficient terms at early edge of image (Hz / pixel)
106	1511-1526	F16.7	Cross track Doppler frequency (center) quadratic coefficient terms at early edge of image (Hz / pixel / pixel)
107	1527-1534	A8	Time direction indicator along pixel direction= blank (fixed)
108	1535-1542	A8	Time direction indicator along line direction Ascending ='ASCENDbb' Descending ='DESCENDb'
109	1543-1558	F16.7	Along track Doppler frequency rate constant terms at early edge of the image (Hz / sec)
110	1559-1574	F16.7	Along track Doppler frequency rate linear coefficient at early edge of the image (Hz / sec / pixel)
111	1575-1590	F16.7	Along track Doppler frequency rate quadratic coefficient at early edge of the imagedata (Hz / sec / pixel / pixel)
112	1591-1606	A16	Blank
113	1607-1622	F16.7	Cross track Doppler frequency rate constant terms at early edge of the image (Hz / sec)
114	1623-1638	F16.7	Cross track Doppler frequency rate linear coefficient at early edge of the image (Hz / sec / pixel)
115	1639-1654	F16.7	Cross track Doppler frequency rate quadratic coefficient at early edge of the image (Hz / sec / pixel / pixel)
116	1655-1670	A16	Blank
117	1671-1678	A8	Line content indicator = SLC:'RANGEbbb'
118	1679-1682	A4	Clutter lock applied flag ='NOTb' ='YESb','NOTb'
119	1683-1686	A4	Auto-focusing applied flag ='NOTb' ='YESb','NOTb'
120	1687-1702	F16.7	Line spacing (m) SLC: Calculated value of spacing in the azimuth direction

Field No.	Byte No.	Type	Description
121	1703-1718	F16.7	Pixel spacing (m) SLC: Calculated value of spacing in the range direction
122	1719-1734	A16	Processor range compression designator = 'SYNTHETICbCHIRPb'
123	1735-1750	F16.7	Doppler center frequency approximation coefficient constant term (a)
124	1751-1766	F16.7	Doppler center frequency approximation coefficient Linear coefficient term (b) $fd = a + b \cdot R$ fd: Doppler center frequency (Hz) R: Slant range (km)
125	1767-1770	I4	Calibration mode data position flag ='bbb0' No calibration mode data area ='bbb0' Observation start side ='bbb1' Observation end side ='bbb2' Observation start / end side ='bbb3'
126	1771-1778	I8	Start line number of calibration at the side of start In case of calibration location flag is '0', always = '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'
128	1787-1794	I8	Start line number of calibration at the side of end In case of calibration location flag is '0', always = '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'
130	1803-1806	I4	PRF switching indicator = 'bbb0' If the PRF has not changed in one scene ='bbb0' When PRF changes in one scene ='bbb1'
131	1807-1814	I8	Line number of PRF switching No change point:'bbbbbbb1'
132	1815-1830	F16.7	Beam center direction (degrees) at the center of the scene
133	1831-1834	I4	Yaw steering flag If not yaw steering ='bbb1' If yaw steering ='bbb0'
134	1835-1838	I4	Blank
135	1839-1854	F16.7	Off Nadir angle (degrees)
136	1855-1858	A4	Blank
137	1859-1886	A28	Blank
138	1887-1906	E20.13	Incidence angle constant term (a0) (see Note 1)
139	1907-1926	E20.13	Incidence angle linear coefficient term (a1) (see Note 1)
140	1927-1946	E20.13	Incidence angle quadratic coefficient term (a2) (see Note 1)
141	1947-1966	A20	Blank
142	1967-1986	A20	Blank

Field No.	Byte No.	Type	Description
143	1987-2006	A20	Blank
Image annotation			
144	2007-2014	I8	Number of annotation points (up to 64) ='bbbbbbb0'
145	2015-2022	A8	Blank
146	2023-2030	I8	Line number of 1st annotation start = blank
147	2031-2038	I8	Pixel number of 1st annotation start = blank
148	2039-2054	A16	1st annotation text = blank
149-337	2055-4070	(I8 * 2, A * 16) * 63	2nd to 64th annotations
338	4071-4096	A26	System reserved = blank

Notes:

1. Fields 138–140: Incidence angle is computed as $\Theta = a0 + a1 \cdot R + a2 \cdot R^2$, where Θ is the incidence angle (rad) and R is the slant range (km).

Table 1.1-10 Platform Position Data Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 3
2	5	B1	First subtype code = 18
3	6	B1	Record type code = 30
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 20
6	9-12	B1	Record length = 4680
7	13-44	A32	Orbital element type Onboard orbit = '1bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb' Precise orbit = '2bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb’
8	45-60	F16.7	1st orbital element Position vector in the earth fixed coordinate system of the scene center (x) [m]
9	61-76	F16.7	2nd orbital element Position vector in the earth fixed coordinate system of the scene center (y) [m]
10	77-92	F16.7	3rd orbital element Position vector in the earth fixed coordinate system of the scene center (z) [m]
11	93-108	F16.7	4th orbital element Velocity vector in the earth fixed coordinate system of the scene center (x') [m/sec]
12	109-124	F16.7	5th orbital element Velocity vector in the earth fixed coordinate system of the scene center (y') [m/sec]

Field No.	Byte No.	Type	Description
13	125-140	F16.7	6th 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 variable up to 28 Example: Onboard orbit ='bb28' Precise orbit ='bb28’
15	145-148	I4	Year of first point ='YYYY'
16	149-152	I4	Month of first point =’bbMM’
17	153-156	I4	Day of first point = ‘bbDD’
18	157-160	I4	Day in the year of first point (Example February 2:'bb33')
19	161-182	E22.15	Seconds of the first point (Example, 0:51:30.23 = 3090.23)
20	183-204	E22.15	Interval time between points (seconds) = ss
21	205-268	A64	Reference Coordinate System (ECI, ECR) = 'ECRbb ~ b'
22	269-290	E22.15	Greenwich mean hour angle (degrees) = blank
23	291-306	F16.7	Along track position error (m) = blank
24	307-322	F16.7	Across track position error (m) = blank
25	323-338	F16.7	Radial position error (m/sec) = blank
26	339-354	F16.7	Along track velocity error (m/sec) = blank
27	355-370	F16.7	Across track velocity error (m / sec) = blank
28	371-386	F16.7	Radial velocity error (m / sec) = blank
FIRST POSITIONAL DATA POINT			
29	387-452	3E22.15	First data point position vector (x, y, z) (m)
30	453-518	3E22.15	First data point velocity vector (x', y', z') (m / sec)
	519-4082	27*6*E22.15	Repeat 387-518 for up to 28 points
35	4083-4199	A18	Blank
36	4101	I1	Leap second flag 0: None 1: Leap second present
37	4102-4680	A579	Blank

Table 1.1-11 Attitude Data Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 4
2	5	B1	First record subtype code = 18
3	6	B1	Record type code = 40
4	7	B1	Second record subtype code = 18

Field No.	Byte No.	Type	Description
5	8	B1	Third record subtype code = 20
6	9-12	B4	Record length = 16384
7	13-16	I4	Number of points = ‘nn’
8	17-20	I4	Day of the year
9	21-28	I8	Milli-second of the day
10	29-32	I4	Pitch data quality flag = blank
11	33-36	I4	Role data quality flag = blank
12	37-40	I4	Yaw data quality flag = blank
13	41-54	E14.6	Pitch [deg]
14	55-68	E14.6	Roll [deg]
15	69-82	E14.6	Yaw [deg]
16	83-86	I4	Pitch rate quality flag = blank
17	87-90	I4	Roll rate quality flag = blank
18	91-94	I4	Yaw quality flag = blank
19	95-108	E14.6	Pitch rate
20	109-122	E14.6	Roll rate
21	123-136	E14.6	Yaw rate
	137-136+120*(n-1)	120*(n-1)	Repeat bytes 17-136 for the number of points (n)
22	137+120*(n-1)-16384	A(16384-(136+120*(n-1)))	Blank

Table 1.1-12 Radiometric Data Records

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 5
2	5	B1	First record subtype code = 18
3	6	B1	Record type code = 50
4	7	B1	Second record subtype code = 18
5	8	B1	Third record subtype code= 20
6	9-12	B1	Record length = 9860
7	13-16	I4	Radiometric data record sequence number ='bbb1’
8	17-20	I4	Number of radiometric data fields ='bbb1’
RADIOMETRIC DATA SET			

Field No.	Byte No.	Type	Description
9	21-36	F16.7	Calibration factor (CF) SLC: $\beta_{0dB} = 10 * \log 10 <I^2 + Q^2> + CF$ (see Note 1)
10	37-9860	A9824	Blank

Notes:

1. Field 9: The backscattering coefficient (beta-naught) of a pixel can be obtained by ensemble averaging (<>), i.e., the spatial averaging of pixel values around the target. I and Q in the formula are the pixel values.

Table 1.1-13 Data Quality Summary Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 6
2	5	B1	First record subtype code = 18
3	6	B1	Record type code = 60
4	7	B1	Second record subtype code = 18
5	8	B1	Third record subtype code= 20
6	9-12	B4	Record length = 1620
7	13-16	I4	Data quality record number ='bbb1’
8	17-20	A4	SAR channel ID ='ABbb' A: Received polarization (V) B: Receiving antenna (S: Single beam)
9	21-26	A6	Date of the last calibration update = 'YYMMDD' YY : lower 2 figures of the year MM : Month DD : Day = blank
10	27-30	I4	Number of channels (up to 8)
ABSOLUTE RADIOMETRIC DATA QUALITY			
11	31-46	F16.7	ISLR (nominal value) [dB] = blank
12	47-62	F16.7	PSLR (nominal value) [dB] = blank
13	63-78	F16.7	Azimuth ambiguity rate (AAR) (Nominal value) = blank
14	79-94	F16.7	Range ambiguity rate (RAR) (Nominal value) = blank
15	95-110	F16.7	Estimate of SNR [dB] = blank
16	111-126	F16.7	BER (Actual value) = blank
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] = blank
20	175-190	F16.7	Instantaneous dynamic range [dB] = blank

Field No.	Byte No.	Type	Description
21	191-206	F16.7	Nominal absolute radiometric calibration magnitude uncertainty of SAR channel indicated in bytes 17-20 [dB] = blank
22	207-222	F16.7	Nominal absolute radiometric calibration phase uncertainty of SAR channel indicated in bytes 17-20 [deg] = blank
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 magnitude uncertainty of SAR channel indicated in bytes 17-20 [dB]
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)	Blank
ABSOLUTE GEOMETRIC DATA QUALITY			
27	735-750	F16.7	Absolute location error along track (Nominal value) [m] = blank
28	751-766	F16.7	Absolute location error cross track (Nominal value) [m] = blank
29	767-782	F16.7	Geometric distortion scale in line direction (Nominal value) = blank
30	783-798	F16.7	Geometric distortion scale in pixel direction (Nominal value) = blank
31	799-814	F16.7	Geometric distortion skew = blank
32	815-830	F16.7	Scene orientation error = blank
RELATIVE GEOMETRIC DATA QUALITY			
33	831-846	F16.7	Along track relative misregistration error of other channels versus SAR channel (bytes 17-20) [meters] = blank
34	847-862	F16.7	Cross track relative misregistration error of other channels versus SAR channel (bytes 17-20) [meters] = blank
35	863-1086	(n-1)*2F16.7	Repetition of bytes 831 - 862 for the other channels (up to 8 channels) = blank
36	1087-1620	A532	Blank

Table 1.1-14 Facility Related Data Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 7
2	5	B1	First record subtype code = 18
3	6	B1	Record type code = 200
4	7	B1	Second record subtype code = 18
5	8	B1	Third record subtype code= 18
6	9-12	B1	Record length = 5000

Field No.	Byte No.	Type	Description
7	13-16	A4	Blank
8	17-416	20E20.10	Twenty coefficients to convert from latitude and longitude to line(L) and pixel (P) position in the image. For SLC: blank
9	417-420	A4	Blank
10	421-428	A8	Blank
11	429-436	A8	Blank
12	437-444	A8	Blank
13	445-452	A8	Blank
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	A8	Blank
17	473-480	A8	Blank
18	481-488	A8	Blank
19	489-800	A312	Blank
20	801-1024	A224	Blank
21	1025-2024	50E20.10	Coefficients of the 8th polynomial expression to convert from pixel (P) and line (L) to latitude (φ) and longitude (λ) (see Note 1)
22	2025-2044	E20.10	Origin pixel (Po), 0.0 fixed (see Note 1)
23	2045-2064	E20.10	Origin Line (Lo), 0.0 fixed (see Note 1)
24	2065-3064	50E20.10	Coefficients of the 8th polynomial expression to convert from latitude (Φ) and longitude (Λ) to pixel (p) and line (l) (see Note 2)
25	3065-3084	E20.10	Origin Latitude (Φ_0) scene center latitude (see Note 2)
26	3085-3104	E20.10	Origin Longitude (Λ_0) scene center longitude (see Note 2)
27	3105-5000	A1896	Blank

Notes:

1. Field21: $\varphi = a_0 *L^4 *P^4 + a_1 *L^3 *P^4 + a_2 *L^2 *P^4 + a_3 *L*P^4 + a_4 *P^4 + a_5 *L^4 *P^3 + a_6 *L^3 *P^3 + a_7 *L^2 *P^3 + a_8 *L*P^3 + a_9 *P^3 + a_{10}*L^4 *P^2 + a_{11}*L^3 *P^2 + a_{12}*L^2 *P^2 + a_{13}*L*P^2 + a_{14}*P^2 + a_{15}*L^4 *P + a_{16}*L^3 *P + a_{17}*L^2 *P + a18*L*P + a_{19}*P + a_{20}*L^4 + a_{21}*L^3 + a_{22}*L^2 + a_{23}*L + a_{24}$
   $\lambda = b_0 *L4 *P4 + b_1 *L3 *P4 + b_2 *L2 *P4 + b_3 *L*P4 + b_4 *P4 + b_5 *L4 *P3 + b_6 *L3 *P3 + b_7 *L2 *P3 + b_8 *L*P3 + b_9 *P3 + b_{10}*L4 *P2 + b_{11}*L3 *P2 + b_{12}*L2 *P2 + b_{13}*L*P2 + b_{14}*P 2 + b_{15}*L4 *P + b_{16}*L3 *P + b_{17}*L2 *P + b_{18}*L*P + b_{19}*P + b_{20}*L4 + b_{21}*L3 + b_{22}*L2 + b_{23}*L + b_{24}$
   (The order of storing: $a_0, a_1, a_2, ..., a_{24}$ & $b_0, b_1, b_2, ..., b_{24}$)

   Fields 21–23: (P, L) in the polynomial expression are substituted as $P = p - P_0$, $L = l - L_0$, where (p, l) is an arbitrary coordinate address on the image. The position (p, l) = (0, 0) corresponds to the central point of the pixel at the upper left corner. (φ, λ) is measured in degrees.

2. Field24: $p = c_0 *\Lambda4 *\Phi4 + c_1 *\Lambda3 *\Phi4 + c_2 *\Lambda2 *\Phi4 + c_3 *\Lambda*\Phi4 + c_4 *\Phi4 + c_5 *\Lambda4 *\Phi3 + c_6 *\Lambda3 *\Phi3 + c_7 *\Lambda2 *\Phi3 + c_8 *\Lambda*\Phi3 + c_9 *\Phi3 + c_{10}*\Lambda4 *\Phi2 + c_{11}*\Lambda3 *\Phi2 + c_{12}*\Lambda2 *\Phi2 + c_{13}*\Lambda*\Phi2 +$

$c_{14}*\Phi 2 + c_{15}*\Lambda 4 *\Phi + c_{16}*\Lambda 3 *\Phi + c_{17}*\Lambda 2 *\Phi + c_{18}*\Lambda*\Phi + c_{19}*\Phi + c_{20}*\Lambda 4 + c_{21}*\Lambda 3 + c_{22}*\Lambda 2 + c_{23}*\Lambda + c_{24}$

$l = d_0 *\Lambda^4 *\Phi^4 + d_1 *\Lambda^3 *\Phi^4 + d_2 *\Lambda^2 *\Phi^4 + d_3 *\Lambda*\Phi^4 + d_4 *\Phi^4 + d_5 *\Lambda^4 *\Phi^3 + d_6 *\Lambda^3 *\Phi^3 + d_7 *\Lambda^2 *\Phi^3 + d_8 *\Lambda*\Phi^3 + d_9 *\Phi^3 + d_{10}*\Lambda^4 *\Phi^2 + d_{11}*\Lambda^3 *\Phi^2 + d_{12}*\Lambda^2 *\Phi^2 + d_{13}*\Lambda*\Phi^2 + d_{14}*\Phi^2 + d_{15}*\Lambda^4 *\Phi + d_{16}*\Lambda^3 *\Phi + d_{17}*\Lambda^2 *\Phi + d_{18}*\Lambda*\Phi + d_{19}*\Phi + d_{20}*\Lambda^4 + d_{21}*\Lambda^3 + d_{22}*\Lambda^2 + d_{23}*\Lambda + d_{24}$

(The order of storing: $c_0, c_1, c_2, ..., c_{24}$ & $d_0, d_1, d_2, ..., d_{24}$)

Fields 24–26: (Φ, Λ) in the polynomial expression are substituted as $\Phi = \varphi - \Phi_0$ (degrees), $\Lambda = \lambda - \Lambda_0$ (degrees), where (φ, λ) is an arbitrary position on the image. The position (p, l) = (0, 0) corresponds to the central point of the pixel at the upper left corner.

Table 1.1-15 Image File Descriptor Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 1
2	5	B1	First subtype code = 50
3	6	B1	Record type code = 192
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 18
6	9-12	B4	Record length = 720
7	13-14	A2	ASCII/EBCDIC flag = ‘Ab’ In case of ASCII
8	15-16	A2	Blank
9	17-28	A12	Format Manual ID ='CEOS-SARbbbb'
10	29-30	A2	Format Manual Management Revision Number ='bA'
11	31-32	A2	Record format revision level ='bA'
12	33-44	A12	Software Release & Revision Number ='NNN.NNNbbbbb' 001.000, 001.001,... 002.000
13	45-48	I4	File number = ‘bbb1’
14	49-64	A16	File ID ='MMMMMNNNbTFFFFbbbb' MMMMM: Mission name ('STRIX') NNN: Mission ID (Alpha='00A', Beta='00B', 1='001', 2='002', ...) T: Processing level code SLC ='B' FFFF: File type Image file ='IMOP'
15	65-68	A4	Record sequence and location type flag = 'FSEQ'
16	69-76	I8	Sequence number of location = 'bbbbbbb1'
17	77-80	I4	Field length of sequence number = 'bbb4'
18	81-84	A4	Record code and location type flag = 'FTYP'
19	85-92	I8	Record code position ='bbbbbbb5'
20	93-96	I4	Record code field length ='bbb4'
21	97-100	A4	Record length and position format flag ='FLGT'
22	101-108	I8	Record length position ='bbbbbbb9'

Field No.	Byte No.	Type	Description
23	109-112	I4	Record length bytes ='bbb4'
24	113-180	A68	Blank
25	181-186	I6	Number of SAR data records = 1056 Number of signal data records
26	187-192	I6	Data set summary record length
27	193-216	A24	Blank
SAMPLE GROUP DATA			
28	217-220	I4	Bit length per sample = 'bb32': SLC
29	221-224	I4	Number of samples per data group = 'bbb2': SLC
30	225-228	I4	Number of bytes per data group='bbb8': SLC
31	229-232	A4	Justification and order of samples within data group = blank (fixed value)
SAR RELATED DATA IN THE RECORD			
32	233-236	I4	Number of SAR channels ='bbb1'
33	237-244	I8	Number of lines per data set (one channel) (Excluding border lines)
34	245-248	I4	Number of left border pixels per line = 'bbb0'
35	249-256	I8	Number of data group (or pixels) per line (see Note 1)
36	257-260	I4	Number of right border pixels per line = 'bbb0'
37	261-264	I4	Number of top border lines = 'bbb0'
38	265-268	I4	Number of bottom border lines = 'bbb0'
39	269-272	A4	Interleaving ID = 'BSQb' (fixed value)
RECORD DATA IN THE FILE			
40	273-274	I2	Number of physical records per line = 'b1' (fixed value)
41	275-276	I2	Number of physical records per multi-channel line in this file = 'b1' (fixed value)
42	277-280	I4	Number of bytes of PREFIX DATA per record SLC = '1056'
43	281-288	I8	Number of bytes of SAR data per record (zero suppression) (see Note 1)
44	289-292	I4	Number of bytes of suffix data per record = 'bbb0' (fixed value)
45	293-296	I4	Prefix/suffix repeat flag = 'bbbb' (fixed value)
PREFIX / SUFFIX DATA LOCATORS			
46	297-304	A8	Sample data line number locator = 'bb13b4PB' 'P': Prefix, 'S': Suffix 'A': ASCII, 'B': Binary, 'N': Numeric
47	305-312	A8	SAR channel number locator = 'bb49b2PB'
48	313-320	A8	Time of SAR data line locator = 'bb45b4PB'
49	321-328	A8	Left-fill count locator = 'bb21b4PB'
50	329-336	A8	Right-fill count locator = 'bb29b4PB'

Field No.	Byte No.	Type	Description
51	337-340	A4	Pad pixels present indicator = 'bbbb'
52	341-368	A28	Blank
53	369-376	A8	SAR data line quality code locator = 'bb97b4PB'
54	377-384	A8	Calibration information field locator = 'bbbbbbbb'
55	385-392	A8	Gain values field locator = 'bbbbbbbb'
56	393-400	A8	Bias values filed locator = 'bbbbbbbb'
57	401-428	A28	SAR data format type indicator ='COMPLEX * 8bbbbbbbbbbbbbbbbb': SLC
58	429-432	A4	SAR data format type code ='C * 8b': SLC 'COMPLEX * 8bbbbbbbbbbbbbbbbbbb'''C * 8b'(8 byte wide) -The first half (4 bytes) in the 8-byte field is two's complement representation Including real number components in floating point format A complex representation in which the second half contains an imaginary component.
59	433-436	I4	Pixel left justified bits ='bbb0'
60	437-440	I4	Pixel right-justified bits ='bbb0'
61	441-448	I8	Maximum pixel value (starting from 0) (zero suppression)= blank: SLC
62	449-452	A4	Blank
63	453-456	A4	Blank
64	457-460	A4	Blank
65	461-720	A260	Blank

Notes:

1. Fields 35, 43: For SLC products, each data record corresponds to one image range line. Each range line begins at the nearest-range pixel and ends at the farthest-range pixel.

Table 1.1-16 Signal Data Records

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 2,3,..
2	5	B1	First record subtype code = 50
3	6	B1	Record type code = 10
4	7	B1	Second record subtype code = 18
5	8	B1	Third record subtype code= 20
6	9-12	B4	Record length
PREFIX DATA-GENERAL INFORMATION			
7	13-16	B4	SAR image data line number = 1, 2, 3 ...

Field No.	Byte No.	Type	Description
8	17-20	B4	SAR image data record index = 1 (fixed value) (indicates the record sequence number in the image line)
9	21-24	B4	Actual count of left-fill pixels = 0 (fixed value)
10	25-28	B4	Actual count of data pixels (see Note 1)
11	29-32	B4	Actual count of right-fill pixels = 0
PREFIX DATA-SENSOR PARAMETERS			
12	33-36	B4	Sensor parameters update flag = 0
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
16	49-50	B2	SAR channel ID Single polarization = 1
17	51-52	B2	SAR channel code = 3 L = 0, S = 1, C = 2, X = 3, KU = 4, KA = 5
18	53-54	B2	Transmit pulse polarization (0 = H, 1 = V)
19	55-56	B2	Received pulse polarization (0 = H, 1 = V)
20	57-60	B4	Processing PRF [mHz]
21	61-64	B4	0 (fixed)
22	65-66	B2	Onboard range compressed flag = 0 NO = 0, YES = 1
23	67-68	B2	Chirp type designator LINEAR FM CHIRP = 0 PHASE MODULATORS = 1
24	69-72	B4	Chirp length (pulse width) [nsec]
25	73-76	B4	Chirp constant coefficient [Hz] = Nominal value
26	77-80	B4	Chirp linear coefficient [Hz/μsec] = Nominal value
27	81-84	B4	Chirp quadratic coefficient [Hz/μsec^2] = Nominal value
28	85-92	B8	Sensor acquisition micro-seconds of day
29	93-96	B4	Receiver gain [dB] = Nominal value
30	97-100	B4	Invalid line flag NO. (Effective line) = 0 YES (Loss line) = 1
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]

Field No.	Byte No.	Type	Description
36	121-124	B4	Data record window position (SAMPLE DELAY [nsec])
37	125-128	B4	Blank
PREFIX DATA-PLATFORM REFERENCE INFORMATION			
38	129-132	B4	Platform position parameters update flag = 0 (fixed) Repeat = 0 Update = 1
39	133-136	B4	Platform latitude [1/1,000,000 deg] = 0
40	137-140	B4	Platform longitude [1/1,000,000 deg] = 0
41	141-144	B4	Platform altitude [m] = 0
42	145-148	B4	Platform ground speed [cm/sec] = 0
43	148-160	3B4	Platform velocity X', Y', Z'[cm/sec] = 0
44	161-172	3B4	Platform acceleration X”, Y”, Z”[cm/sec^2] = 0
45	173-176	B4	Platform track angle [1/1,000,000 deg] = 0
46	177-180	B4	Platform true track angle [1/1,000,000 deg] = 0
47	181-184	B4	Platform pitch angle [1/1,000,000 deg] = 0
48	185-188	B4	Platform roll angle [1/1,000,000 deg] = 0
49	189-192	B4	Platform yaw angle [1/1,000,000 deg] = 0
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]
52	201-204	B4	Latitude of last pixel [1/1,000,000 deg]
53	205-208	B4	Longitude of 1st pixel [1/1,000,000 deg]
54	209-212	B4	Longitude of center-pixel [1/1,000,000 deg]
55	213-216	B4	Longitude of last pixel [1/1,000,000 deg]
56	217-288	B72	Blank
57	289-1056	B768	Observation auxiliary data = 0
SAR RAW SIGNAL DATA			
	1057-i	jBk	SAR data (see Note 2) i: Number of bytes of data + 1056 j: Number of pixels in this record k: Pixel size (byte) Repeat by the number of pixels

Notes:

1. Field 10: For SLC products, actual count of data pixels corresponds to the number of one image range line. Each range line begins at the nearest-range pixel and ends at the farthest-range pixel.

Table 1.1-17 Trailer Descriptor Record

Field No.	Byte No.	Type	Description
1	1-4	B4	Record Number = 1
2	5	B1	First subtype code = 63
3	6	B1	Record type code = 192
4	7	B1	Second subtype code = 18
5	8	B1	Third subtype code= 18
6	9-12	B4	Record length = 720
7	13-14	A2	ASCII/EBCDIC flag = ‘Ab’ In case of ASCII
8	15-16	A2	Blank
9	17-28	A12	Format Manual ID = 'CEOS-SARbbbb'
10	29-30	A2	Format Manual Management Revision Number = 'bA'
11	31-32	A2	Record format revision level = 'bA'
12	33-44	A12	Software Release & Revision Number ='NNN.NNNbbbbb' 001.000, 001.001,... 002.000
13	45-48	I4	Number of files = ‘bbb1’
14	49-64	A16	File ID ='MMMMMNNNbTFFFFbbbb' MMMMM: Mission name ('STRIX') NNN: Mission ID (Alpha='00A', Beta='00B', 1='001', 2='002', ...) T: Processing level code SLC ='B' FFFF: File type Trailor file ='SART'
15	65-68	A4	Command software v203 is used = 'FSEQ'
16	69-76	I8	Sequence number position ='bbbbbbb1'
17	77-80	I4	Sequence number field length = 'bbb4'
18	81-84	A4	Record code and location type flag = 'FTYP'
19	85-92	I8	Record code location = 'bbbbbbb5'
20	93-96	I4	Record code field length ='bbb4'
21	97-100	A4	Record length and location format flag ='FLGT'
22	101-108	I8	Record length location ='bbbbbbb9'
23	109-112	I4	Record length field length = 'bbb4'
24	113-180	A68	Blank
25	181-186	I6	Number of data set summary records = ‘bbbbb0’
26	187-192	I6	Dataset Summary Record Length = ‘bbbbb0’
27	193-198	I6	Number of map projection data records = ‘bbbbb0’
28	199-204	I6	Map projection data record length ='bbbbb0'
29	205-210	I6	Number of platform position data records ='bbbbb0'
30	211-216	I6	Platform position data record length ='bbbbb0'

Field No.	Byte No.	Type	Description
31	217-222	I6	Number of attitude data records = 'bbbbb0'
32	223-228	I6	Attitude data record length = 'bbbbb0'
33	229-234	I6	Number of radiometric data records = 'bbbbb0'
34	235-240	I6	Radiometric data record length = 'bbbbb0'
35	241-246	I6	Number of radiometric compensation records = 'bbbbb0'
36	247-252	I6	Radiometric Compensation Record Length = 'bbbbb0'
37	253-258	I6	Number of data quality summary records ='bbbbb0'
38	259-264	I6	Data Quality Summary Record Length = 'bbbbb0'
39	265-270	I6	Number of data histograms records = 'bbbbb0'
40	271-276	I6	Data Histogram Record Length ='bbbbb0'
41	277-282	I6	Number of range spectra records ='bbbbb0'
42	283-288	I6	Range spectrum record length ='bbbbb0'
43	289-294	I6	Number of DEM descriptor records ='bbbbb0'
44	295-300	I6	DEM Descriptor Record Length ='bbbbb0'
45	301-306	I6	Number of radar parameter update records ='bbbbb0'
46	307-312	I6	Radar parameter update record length ='bbbbb0'
47	313-318	I6	Number of annotation data records ='bbbbb0'
48	319-324	I6	Annotation data record length ='bbbbb0'
49	325-330	I6	Number of detailed processing parameter records ='bbbbb0'
50	331-336	I6	Detailed processing parameter record length ='bbbbb0'
51	337-342	I6	Number of calibration records ='bbbbb0'
52	343-348	I6	Calibration record length ='bbbbb0'
53	349-354	I6	Number of GCP records ='bbbbb0'
54	355-360	I6	GCP record length ='bbbbb0'
55	361-420	A60	Blank
56	421-426	I6	Number of facility data records ='bbbbb0'
57	427-432	I6	Facility data (1) record length ='bbbbb0'
58	433-720	A288	Blank

1.1.6 Summary Information

The summary information file shows a snapshot of meta data for an SLC CEOS product and is included in the product. The table below shows the contents of the summary information.

Table 1.1-18 Contents of Summary Information

No.	Section	Item Name	Keyword	Value
1	Ordering information (Odi)	Processed Site/Date/Time	Odi_SiteDateTime	'PROCESS:JAPAN-SYNS-STRIXNNNbYYYYMMDDbHHMMSS' NNN: 00A, 00B, 001, 002, ... YYYYMMDD : Processed date (YYYY: year, MM: month, DD: day) HHMMSS : Processed time (UTC)
2		Scene description ID	Scs_SceneID	'AAAAAAAA-YYYYMMDDThhmmssZ' AAAAAAAA : Satellite name (='STRIXNNN')NN N:00A, 00B , 001, 002, ... YYYYMMDD: Scene center observation date (YYYY: year, MM: month, DD: day) hhmmss: Scene center observation time (hh: hour, mm: minutes, ss: seconds) -: Separator
3	Product specification (Pds)	Product ID	Pds_ProductID	'DDEEE' DD: Observation mode SM: Stripmap mode SL: Sliding Spotlight mode ST: Staring Spotlight mode EEE: Processing level SLC: Single Look Complex
4		Precision of orbit data	Pds_OrbitDataPrecision	‘Precise’ / ‘Onboard’
5		Precision of attitude data	Pds_AttitudeDataPrecision	'Onboard'
6		Nominal slant range resolution	Pds_SlantRangeResolution	
7		Nominal azimuth resolution	Pds_AzimuthResolution	
8	Image information (Img)	Date and time of scene center	Img_SceneCenterDateTime	'YYYYMMDDbhh:mm:ss.ttt' (UT) YYYY : Year (A.D) MM : Month (01～12) DD : Day (01～31) 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)
9		Date and time of scene start	Img_SceneStartDateTime	
10		Date and time of scene end	Img_SceneEndDateTime	
11		Off-nadir angle	Img_OffNadirAngle	NN.N [degree] (Measured)

No.	Section	Item Name	Keyword	Value
12	Product information (Pdi)	Data size of product	Pdi_ProductDataSize	
13		Number of files in SLC product	Pdi_CntOfSLCProductFileName	
14		Filename of SLC product	Pdi_SLCProductFileNamennnn：01～99	
15		Number of pixels	Pdi_NoOfPixels	
16		Number of lines	Pdi_NoOfLines	
17		Product format	Pdi_ProductFormat	
18	Label information (Lbi)	Satellite name	Lbi_Satellite	'StriX-NNN' NNN: 00A, 00B, 001, 002, ...
19		Sensor name	Lbi_Sensor	'SAR'
20		Processing level	Lbi_ProcessLevel	'SLC'
21		Processing facility	Lbi_ProcessFacility	'SYNS'
22		Observation date	Lbi_ObservationDate	'YYYYMMDD' YYYYMMDD : (YYYY: year, MM: month, DD: day)

1.1.7 Thumbnail Image

A thumbnail image is generated by transforming a processed data type to 8 bit integer and by aggregating neighboring pixels. The image format is PNG and map projection is in slant range.

1.2 SICD Product Format

Sensor Independent Complex Data (SICD) product is contained in National Imagery Transmission Format (NITF) and is presented by single file (.nitf) [2], [3] , [4], [5] . The NITF file includes both image and metadata. The SICD format follows the standard, NGA.STND.0024-1_1.3.0, NGA.STND.0024-2_1.3.0 and NGA.STND.0024-3_1.3.0.

1.2.1 Product Composition

SLC SICD product includes:

- image raster data and metadata (nitf)
- thumbnail image (jpeg)
- temporal metadata file (xml)

Note: The temporal metadata file (META_*.xml) is provided for interim use only and is not intended for image analysis. Its file format specification is not included in this document.

The naming convention for SLC SICD product files is described in the table below.

Table 1.2-1 SLC SICD product file naming convention

File Type	Number of Files	File Name	Type	Contents
Image File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-SICD.nitf	NITF	This file stores raster image and metadata
Thumbnail Image	1	IMG-<Polarization>-<Scene ID> -<Product ID>-SICD.jpeg	JPEG	

Where:

Scene ID = AAAAAAAA-YYYYMMDDThhmmssZ

AAAAAAAA : Satellite type

- STRIX00A: StriX-α
- STRIX00B: StriX-β
- STRIX001 ~ N: StriX-1 ~ N
  - Example:
    - STRIX001: StriX-1
    - STRIX002: StriX-2

- : Separator

YYYYMMDD: Scene center observation date (YYYY: year, MM: month, DD: day)

hhmmss: Scene center observation time* (hh: hour, mm: minutes, ss: seconds)

*precise orbit is used when available

Product ID = DDEEE

DD: Observation mode

- SM: Stripmap mode
- SL: Sliding Spotlight mode
- ST: Staring Spotlight mode

EEE: Processing level (SLC: Single Look Complex)

1.2.2 SICD XML Metadata

XML metadata of Synspective's SICD product are compliant with the table in Section 3.2 XML Metadata Parameter Lists in the SICD standard [2]. The field for Synspective products specific implementation is listed below.

Table 1.2-2 XML Field for Synspective products specific implementation in SICD product

Field Name	Type	Description	Example
ModeID	TXT	Radar imaging mode: AAB AA – Observation mode SM – Stripmap SL – Sliding Spotlight ST – Staring Spotlight B – Looking direction L – Left, R – Right	SMR
Parameter name="orbit Source"	TXT	Orbit source used for processing	Precise or Onboard

1.2.3 NITF Metadata

NITF metadata of Synspective's SICD product are compliant with the table in Section 3.3 NITF Header Parameters in the SICD standard [3].

1.2.4 Thumbnail Image

A thumbnail image is generated by transforming a processed data type to 8 bit integer and by aggregating neighboring pixels. The image format is JPEG and map projection is slant range.

2. GRD and SR-GRD Product

GRD and SR-GRD products are offered with GeoTIFF + XML format

The general specification of the GRD and SR-GRD product:

- image projected to ellipsoid (WGS 84 / UTM)
- magnitude representation (DN: Digital Number)
- no phase information
- image is resampled
- mode of observation:
    - GRD: Stripmap, Sliding Spotlight, Staring Spotlight or Spotlight Enhanced
    - SR-GRD: Stripmap, Sliding Spotlight or Staring Spotlight
- single polarization: VV
- bit depth: 16 bit
- Coordinate reference system:
    - Universal Polar Stereographic Projection(UPS) :
      S 90 deg. <= phi < S 80 deg or N 84 deg. < phi <= N 90 deg
    - Universal Transverse Mercator(UTM): S 80 deg. <= phi <= N 84 deg.
    - phi : scene center latitude (deg.)

The specification of the SR-GRD product:

- Applied Spatially Variant Apodization (SVA) to produce Super-Resolution Ground Range Detected Images (SR-GRD)

2.1 GeoTIFF + XML Product Format

2.1.1 Product Composition

GRD product includes:

- image raster data (COG)
- metadata (xml)
- thumbnail image (jpeg)
- Quicklook raster data (COG)
- temporal metadata file (xml)

Note: The temporal metadata file(META_*.xml) is provided for interim use only and is not intended for image analysis. Its file format specification is not included in this document.

The naming convention for the product files is described in the table below.

Table 2.1-1 GRD Product File Naming Convention

File Type	Number of Files	File Name	Type	Contents
Image File	1	(GRD) IMG-<Polarization>-<Scene ID>-<Product ID>.tif (SR-GRD) IMG-<Polarization>-<Scene ID>-SR-<Product ID>.tif	Cloud Optimized GeoTIFF	This file stores a raster image. The raster is calibrated. The file is tiled, but doesn't have overviews.
Metadata File	1	(GRD) PAR-<Polarization>-<Scene ID>-<Product ID>.xml (SR-GRD) PAR-<Polarization>-<Scene ID>-SR-<Product ID>.xml	xml	This file stores information about raster image and observation
Thumbnail Image	1	(GRD) IMG-<Polarization>-<Scene ID>-<Product ID>.jpeg (SR-GRD) IMG-<Polarization>-<Scene ID>-SR-<Product ID>.jpeg	JPEG	
Image File	1	(GRD) IMG-<Polarization>-<Scene ID>-<Product ID>_quicklook.tif (SR-GRD) IMG-<Polarization>-<Scene ID>-SR-<Product ID>_quicklook.tif	Cloud Optimized GeoTIFF	This file stores a raster image. This raster is not calibrated. The details are in Section 2.1.5.

Where:

Scene ID = AAAAAAAA-YYYYMMDDThhmmssZ

AAAAAAAA : Satellite type

- STRIX00A: StriX-α
- STRIX00B: StriX-β
- STRIX001 ~ N: StriX-1 ~ N
  - Example:
    - STRIX001: StriX-1
    - STRIX002: StriX-2

- : Separator

YYYYMMDD: Scene center observation date (YYYY: year, MM: month, DD: day)

hhmmss: Scene center observation time* (hh: hour, mm: minutes, ss: seconds)

*precise orbit is used when available

Product ID = DDEEE

DD: Observation mode

- SM: Stripmap mode
- SL: Sliding Spotlight mode
- ST: Staring Spotlight mode

EEE: Processing level (GRD: Ground Range Detected)

2.1.2 XML Metadata

The definition of data type is shown in the table below.

Table 2.1-2 GRD XML Tag and Attribute Name

Tag / Attribute Name	Type [Unit]	Description	Example / Remarks
gml:metaDataProperty			
eop:EarthObservationMetaData			Nested under **gml:metaDataProperty**
eop:creationDate	date time	Creation date (ISO 8601) YYYY-MMDDThh:mm:ssZ	2026-04-09T03:45:05Z
eop:acquisitionType	string	Acquisition type	NOMINAL / CALIBRATION
eop:acquisitionSubType	string	Acquisition mode	StaringSpotlight, SlidingSpotlight, or Stripmap
eop:status	string	Product status	ARCHIVED
eop:processing			Nested under **eop:EarthObservationMetaData**
eop:ProcessingInformation			Nested under **eop:processing**
eop:processingDate	date time	Processing date (UTC, ISO 8601) YYYY-MMDDThh:mm:ssZ	2026-04-09T03:45:05Z
eop:method	string	GRD interpolation method	NN: Nearest Neighbor, BL: Bilinear
eop:processorName	string	Processing software name	GrdProcessor
eop:processorVersion	string	Software version (Major.Minor.Patch)	2.2.2
eop:processingLevel	string	Processing level	GRD
sar:sarProcessingParameter			Nested under **eop:ProcessingInformation**
sar:numberOfRangeLooks	integer	Number of looks in range direction	1
sar:numberOfAzimuthLooks	integer	Number of looks in azimuth direction	1
sar:rangePixelSpacing	double [m]	Pixel spacing in range at the scene center	1.0
sar:azimuthPixelSpacing	double [m]	Pixel spacing in azimuth at the scene center	1.0

Tag / Attribute Name	Type [Unit]	Description	Example / Remarks
sar:processingPRF	double [Hz]	Pulse repetition frequency used for processing	8896.880937
eop:nativeProductFormat	string	Data format	GeoTIFF
eop:vendorSpecific			Nested under **eop:EarthObservationMetaData**
eop:SpecificInformation		Consists of a pair of <eop:localAttribute> and <eop:localValue>.	Nested under **eop:vendorSpecific**
<eop:localAttribute> = 'offnadirAngle'	double	[Value stored in eop:localValue] Off-nadir angle	43.32
<eop:localAttribute> = 'calibrationFactor'	double	[Value stored in eop:localValue] Calibration factor (CF) to convert DN to σ0. σ0 = DN^2 / CF^2. Refer to Section 4 for details.	251.2
<eop:localAttribute> = 'sceneCenterDateTime'	datetime	[Value stored in eop:localValue] Scene center time (ISO 8601). Precise orbit is used when available.	2026-04-09T00:38:17Z
<eop:localAttribute> = 'neszMaximumPower'	double [dB]	[Value stored in eop:localValue] Maximum Noise Equivalent Sigma Zero value	-17.387
<eop:localAttribute> = 'neszMinimumPower'	double [dB]	[Value stored in eop:localValue] Minimum Noise Equivalent Sigma Zero value	-20.755
<eop:localAttribute> = 'groundRangeResolution'	double [m]	[Value stored in eop:localValue] Ground range resolution	0.674
<eop:localAttribute> = 'orbitSource'	string	[Value stored in eop:localValue] Orbit source used for processing	Onboard or Precise
gml:target			
eop:Footprint			Nested under **gml:target**
gml:posList	string [deg]	Scene footprint corners (latitude, longitude). See Note 1.	-1.896944000 42.996389000 -2.650000000 42.862778000 -2.861667000 43.381667000 -2.102500000 43.516667000 -1.896944000 42.996389000
gml:pos	string [deg]	Scene center (latitude, longitude). See Note 2.	42.88490961640794 27.6624521478024
gml:using			

Tag / Attribute Name	Type [Unit]	Description	Example / Remarks
eop:EarthObservationEquipment			Nested under **gml:using**
eop:platform			Nested under **eop:EarthObservationEquipment**
eop:shortName	string	Satellite name	StriX
eop:serialIdentifier	string	Satellite ID	alpha, beta, 1, 2, 3,....
eop:orbitType	string	Orbit category LEO : Low earth orbit	LEO
orbit			Nested under **eop:platform**
orbitHeader			Nested under **orbit**
stateVecFormat	string	Format of orbit state vectors	pos(m),vel(m/s)
numStateVectors	integer	Number of orbit state vector data points	28
firstStateTime			Nested under **orbitHeader**
firstStateTimeUTC	date time	UTC time of the first state vector	2026-04-09T00:33:17.803476
lastStateTime			Nested under **orbitHeader**
lastStateTimeUTC	date time	UTC time of the last state vector	2026-04-09T00:43:17.803470
stateVec		Repeated for each data point	Nested under **orbit**
timeUTC	date time	UTC time at Nth point	2026-04-09T00:33:17.803476
posX	single [m]	Satellite position (x) in Earth-fixed coordinate system	1.616347930072013E+06
posY	single [m]	Satellite position (y) in Earth-fixed coordinate system	3.012035692491928E+06
posZ	single [m]	Satellite position (z) in Earth-fixed coordinate system	5.983871157491785E+06
velX	single [m/s]	Satellite velocity (x) in Earth-fixed coordinate system	5.026816675713698E+03
velY	single [m/s]	Satellite velocity (y) in Earth-fixed coordinate system	4.520546614900161E+03
velZ	single [m/s]	Satellite velocity (z) in Earth-fixed coordinate system	-3.623394296869903E+03

Tag / Attribute Name	Type [Unit]	Description	Example / Remarks
eop:instrument			Nested under **eop:EarthObservationEquipment**
eop:shortName	string	Instrument name	SAR
eop:sensor			Nested under **eop:EarthObservationEquipment**
eop:sensorType	string	Sensor type	RADAR
eop:operationalMode	string	Observation mode	StaringSpotlight, SlidingSpotlight, or Stripmap
eop:slantRangeResolution	double [m]	Nominal slant range resolution	0.5
eop:azimuthResolution	double [m]	Nominal azimuth resolution	0.9
eop:acquisitionParameters			Nested under **eop:EarthObservationEquipment**
sar:Acquisition			Nested under **eop:acquisitionParameters**
eop:instrumentAzimuthAngle	single [deg]	Azimuth angle. North is 0 degrees, clockwise (0 to 360).	357.462
eop:orbitDirection	string	Orbit direction	ASCENDING or DESCENDING
sar:polarisationMode	string	Polarization mode. S: single, D: dual, Q: quad	S
sar:polarisationChannels	string	Polarization channels	VV
sar:antennaLookDirection	string	Observation direction	LEFT or RIGHT
sar:satelliteHeadingAngle	single [deg]	Satellite heading angle. North is 0 degrees, clockwise (0 to 360).	189.013
sar:minimumIncidenceAngle	single [deg]	Minimum incidence angle "NN.NNN"	47.572
sar:maximumIncidenceAngle	single [deg]	Maximum incidence angle "NN.NNN"	48.199
sar:incidenceAngleVariation	single [deg]	Difference between minimum and maximum incidence angle "NN.NNN"	0.626
sar:incidenceAngleConstant	single [deg]	Incidence angle polynomial constant term (see Note 3)	8.303E-01

Tag / Attribute Name	Type [Unit]	Description	Example / Remarks
sar:incidenceAngleLinearCoefficient	single [deg/pixel]	Incidence angle polynomial linear term (see Note 3)	9.567E-07
sar:incidenceAngleQuadraticCoefficient	single [deg/pixel²]	Incidence angle polynomial quadratic term (see Note 3)	-1.177E-12
sar:acquisitionPRF	double [Hz]	Pulse repetition frequency used for data acquisition	4480.287
sar:carrierFrequency	single [Hz]	Carrier frequency	9650000000
sar:rangeSamplingFrequency	single [Hz]	Range sampling frequency	375000000
sar:chirpBandWidth	single [Hz]	Frequency chirp bandwidth	300000000
gml:resultOf			
eop:EarthObservationResult			Nested under **gml:resultOf**
eop:ProductInformation			Nested under **eop:EarthObservationResult**
eop:referenceSystemIdentifier	string	Projection coordinate system ID (EPSG)	epsg:32638
eop:mapProjection	string	Map projection	UTM
eop:size	int [byte]	Raster file size	133051382
eop:numberOfPixel	int	Number of pixels	11593
eop:numberOfLine	int	Number of lines	11072
eop:imageNumberOfBits	int [bit]	Number of bits per pixel	16

Notes:

1. gml:posList contains 5 coordinate pairs (latitude, longitude) forming a closed polygon (first pair = last pair). Values are separated by spaces. Corner order: left-top, left-bottom, right-bottom, right-top, left-top. Latitude is expressed as "SNN.NNNNNNNNN", longitude as "SNNN.NNNNNNNNN", where S is the sign (plus sign omitted).
2. gml:pos contains a single coordinate pair (latitude, longitude) separated by a space. Latitude is expressed as "SNN.NNNNNNNNNNNNNN", longitude as "SNNN.NNNNNNNNNNNNNN" (14 decimal places), where S is the sign (plus sign omitted).
3. Incidence angle is computed as: $\Theta = a0 + a1 \cdot P + a2 \cdot P^2$, where Θ is the incidence angle (rad) and P is the pixel position. The three coefficients correspond to sar:incidenceAngleConstant (a0), sar:incidenceAngleLinearCoefficient (a1), and sar:incidenceAngleQuadraticCoefficient (a2).

2.1.3 GeoTIFF Tag

The definition of data type is shown in the table below.

Table 2.1-3 GeoTIFF Tag

Tag / Attribute Name	Key ID	Type	Count	Description/ Example
ImageWidth	256	LONG	1	Number of pixels
ImageLength	257	LONG	1	Number of lines
BitsPerSample	258	SHORT	1	16
Compression	259	SHORT	1	5: LZW (Lempel-Ziv-Welch)
PhotometricInterpretation	262	SHORT	1	1
SamplePerPixel	277	SHORT	1	1
PlanarConfiguration	284	SHORT	1	1
Predictor	317	SHORT	1	1: no predictor
TileWidth	322	LONG	1	Tile width
TileLength	323	LONG	1	Tile length
TileOffsets	324	LONG	Number of tiles	Offsets to each tile
TileByteCounts	325	LONG	Number of tiles	Byte counts for each tile
SampleFormat	339	SHORT	SamplesPerPixel	1: unsigned integer
GTModelTypeGeoKey	1024	SHORT	1	1: ModelTypeProjected 2: ModelTypeGeographic 3: ModelTypeGeocentric
GTRasterTypeGeoKey	1025	SHORT	1	1: RasterPixelIsArea 2: RasterPixelIsPoint
GTCitationGeoKey	1026	ASCII	1	WGS 84 / UTM zone 18S
GeogLinearUnitsGeoKey	2052	SHORT	1	9001=Linear_Meter[m]
GeogAngularUnitsGeoKey	2054	SHORT	1	9102=Angular_Degree[deg]
ProjectedCSTypeGeoKey	3072	SHORT	1	Projected coordinate reference system
ModelPixelScaleTag	33550	DOUBLE	3	Pixel spacing (meters)
ModelTiepointTag	33922	DOUBLE	6*number of tie points	longitude and latitude of the left top corner
GeoKeyDirectoryTag	34735	SHORT	4	Based on GeoTIFF standards
GeoAsciiParamsTag	34737	ASCII	-	Based on GeoTIFF standards: “WGS 84 / UTM zone 18S|WGS 84|”

2.1.4 Thumbnail Image

A thumbnail image is generated by transforming a processed data type to 8 bit integer and by aggregating neighboring pixels. The image format is JPEG and map projection is in north-up orientation. The pixel value is generated with HDR tone mapping techniques.

2.1.5 Quicklook raster data (COG)

QuickLook raster file is optimized for web display with tiling, six overview levels, 8-bit conversion, and JPEG formatting. It contains two bands: the first band holds the actual data, while the second band is an alpha channel for masking not data values. Additionally, the 8bit data is generated with HDR tone mapping techniques.

3. ORT Product

The overall specifications for the ORT product are detailed below:

- input: SLC (SICD format)
- output: Cloud Optimized GeoTIFF
    - ORT sigma-naught - backscatter calibrated using the ellipsoid incidence angle
    - ORT gamma-naught - backscatter normalised by the local illuminated area using Radiometric Terrain Correction (RTC).
- Backscatter values are radiometrically calibrated and expressed in linear power scale. No additional calibration factor or scale factor needs to be applied — pixel values can be used directly for quantitative analysis.
- metadata: XML format
- image projected to DEM surface
- mode of observation:
    - Stripmap
    - Sliding Spotlight
    - Staring Spotlight
- single polarization: VV
- coordinate reference system:
    - Universal Transverse Mercator (UTM)
    - S 80 deg. <= phi <= N 84 deg.
- pixel spacing:
    - Stripmap: 5.0 m x 5.0 m
    - Sliding Spotlight: 1.25 m x 1.25 m
    - Staring Spotlight: 1.25 m x 1.25 m

3.1 GeoTIFF + XML Product Format

3.1.1 Product Composition

The ORT product is delivered with the following files, each provided for both sigma-naught and gamma-naught:

- backscatter image (COG)
- quicklook image (COG)
- Metadata (xml)

Additional files:

- thumbnail image (jpeg)

- local incidence angle map (COG)
- layover/shadow mask (COG)
- layover/shadow mask palette sidecar (XML)

The naming convention for ORT product files is described in the table below.

Table 3.1-1 ORT Product File Naming Convention

File Type	Number of Files	File Name	Type	Contents
Image File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-sigma0.tif	COG	sigma-naught calibrated backscatter image
Image File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-gamma0.tif	COG	gamma-naught with RTC calibrated backscatter image
Image File	1	IMG-<Polarization>-<Scene ID> -<ProductID>-sigma0-quicklook.tif	COG	sigma-naught quicklook image in dB scale
Image File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-gamma0-quicklook.tif	COG	gamma-naught quicklook image in dB scale
Thumbnail Image	1	IMG-<Polarization>-<Scene ID> -<Product ID>.jpeg	JPEG	gamma-naught thumbnail image in dB scale (1st-99th percentile contrast stretch).
Metadata File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-sigma0-metadata.xml	XML	sigma-naught product metadata
Metadata File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-gamma0-metadata.xml	XML	gamma-naught product metadata
Image File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-incmap.tif	COG	incidence angle map
Image File	1	IMG-<Polarization>-<Scene ID> -<Product ID>-lsmap.tif	COG	layover and shadow classification mask
Sidecar File	1	IMG-<Polarization>-<Scene ID>-<Product ID>-lsmap.tif.aux.xml	XML	GDAL PAM sidecar for lsmap. Provides per-class RGBA colour palette + RasterAttributeTable so ValidData (=1) renders transparent in QGIS/ArcGIS

Total: 10 files per ORT delivery.

where:
Scene ID = AAAAAAAA-YYYYMMDDThhmmssZ

- AAAAAAAA : satellite id (e.g. STRIX001)
- - : separator
- YYYYMMDD: scene center observation date
  - YYYY: year, MM: month, DD: day
- hhmmss: scene center observation time using precise orbit when available
  - hh: hour, mm: minutes, ss: seconds

- Z : time is expressed in UTC time zone

Product ID = DDEEE

- DD: Observation mode
  - SM: Stripmap mode
  - SL: Sliding Spotlight mode
  - ST: Staring Spotlight mode
- EEE: Processing level (ORT: Orthorectified)

Example, for the stripmap mode, an input Single Look Complex (SLC) filename like `IMG-VV-STRIX003-20260309T154126Z-SMSLC-SICD.nitf` is transformed into an Orthorectified (ORT) output filename, such as `IMG-VV-STRIX003-20260309T154126Z-SMORT-sigma0.tif`.

3.1.2 XML Metadata

The metadata files follow the CEOS-ARD Normalised Radar Backscatter (NRB) schema as defined in [6]. The Synspective ORT gamma-naught product is CEOS-ARD NRB-compliant as of 4 May 2026. The sigma-naught and gamma-naught metadata files share the same structure but differ in a few fields (see XML Metadata Note 1). The table below describes all XML tags and attributes for the gamma-naught metadata file. In the table, XML elements are listed as tag names (e.g., `Product`, `Satellite`) and their attributes are prefixed with `@` (e.g., `@type`, `@copyright`).

Table 3.1-2 ORT XML Metadata Tag and Attribute Name

Tag / Attribute Name	Type	Description	Example / Remarks
Product		Root element	
@type	string	CEOS-ARD product type name	Normalised Radar Backscatter
@copyright	string	Copyright holder	Synspective
DocumentIdentifier		Reference to CEOS-ARD PFS document	
@name	string	Specification name	CEOS-ARD for Synthetic Aperture Radar
@version	string	Specification version	1.2
(text value)	string (URL)	URL to PFS document	https://ceos.org/ard/files/PFS/SAR/v1.2/CEOS-ARD_PFS_Synthetic_Aperture_Radar_v1.2.pdf
DataCollectionTime		Time range of the data collection	
NumberOfAcquisitions	integer	Number of source data acquisitions	1

Tag / Attribute Name	Type	Description	Example / Remarks
FirstAcquisitionDate	date time	Start UTC time of data collection (ISO 8601)	2026-04-01T15:41:21.533261Z
LastAcquisitionDate	date time	End UTC time of data collection (ISO 8601)	2026-04-01T15:41:31.979895Z
SourceAttributes		Source data attributes for each acquisition	Repeats per acquisition
@acqID	string	Sequential acquisition identifier	1
SourceDataRepository	string (URL)	Location from where source data can be retrieved	https://data.synspective.io/
Satellite	string	Satellite name	StriX-3
Instrument	string	Instrument name	SAR
SatelliteReference	string (URL)	Reference URL to satellite information	https://synspective.com/satellite/satellite-strix/
SourceDataAcquisitionTime		Acquisition start and end times	Nested under **SourceAttributes**
StartTime	date time	Acquisition start time (UTC, ISO 8601)	2026-04-01T15:41:21.533261Z
EndTime	date time	Acquisition end time (UTC, ISO 8601)	2026-04-01T15:41:31.979895Z
SourceDataAcquisitionParameters		SAR antenna acquisition parameters	Nested under **SourceAttributes**
RadarBand	string	Radar frequency band	X
RadarCenterFrequency	float [Hz]	Radar center frequency	9.65e+09
ObservationMode	string	Acquisition mode name	Stripmap, Sliding Spotlight, or Staring Spotlight
Polarizations	string	Polarization channel(s)	VV
AntennaPointing	string	Antenna look direction	Right or Left
BeamID	string	Beam mode mnemonic (ModeID from SICD, see Table 1.2-2)	SMR, SLL, STR, etc.
OrbitInformation		Platform orbit information	Nested under **SourceAttributes**
PassDirection	string	Orbit pass direction	Ascending or Descending
OrbitDataSource	string	Source of orbit ephemeris used in ORT processing. Precise is used when available; otherwise Onboard.	Precise or Onboard
PlatformHeading	float [deg]	Platform heading angle. North is 0 degrees; clockwise positive. Range [0, 360). Rounded to 2 decimal places. Matches GRD eop:platformHeading convention.	193.51 (descending), 346.66 (ascending)

Tag / Attribute Name	Type	Description	Example / Remarks
SourceProcParam		Source data processing parameters	Nested under **SourceAttributes**
ProcessingFacility	string	Source product processing facility	Synspective/Tokyo
ProcessingDate	date time	Source product processing date (UTC, ISO 8601)	2026-04-01T20:56:16.470679Z
SoftwareVersion	string	SLC SICD version (see Table 5-2)	2.2.2
ProductID	string	Source product filename	IMG-VV-STRIX003-20260401T154126Z-SMSLC-SICD.nitf
ProductLevel	string	Source product processing level	SLC
AzimuthNumberOfLooks	integer	Number of looks in azimuth direction	1
RangeNumberOfLooks	integer	Number of looks in range direction	1
SourceDataImageAttributes		Source SLC image attributes	Nested under **SourceAttributes**
SourceDataGeometry	string	Source SLC acquisition geometry descriptor. Fixed value slant range	slant range
SourceGeographicalExtent	string (WKT)	Source SLC image footprint geometry in WGS84 order (longitude latitude)	POLYGON ((-50.43387168.982555,...))
AzimuthPixelSpacing	float [m]	Source SLC azimuth pixel spacing	2.20 (SM), 0.80 (SL)
RangePixelSpacing	float [m]	Source SLC range pixel spacing	1.50 (SM), 0.40 (SL)
AzimuthResolution	float [m]	Source SLC azimuth resolution	2.39 (SM), 0.80 (SL)
RangeResolution	float [m]	Source SLC slant range resolution	1.77 (SM), 0.44 (SL)
IncAngleNearRange	float [deg]	Incidence angle at near range	27.89
IncAngleFarRange	float [deg]	Incidence angle at far range	29.79
PerformanceIndicators		Source SLC performance indicators (per polarisation)	Nested under **SourceAttributes**
@pol	string	Polarisation channel	VV
NoiseEquivalentIntensity		Noise Equivalent Intensity for the listed polarisation	Nested under **PerformanceIndicators**
@type	string	Backscatter convention (matches the ORT product variant)	gamma0 or sigma0
@units	string	Units of the estimates values	dB

Tag / Attribute Name	Type	Description	Example / Remarks
Estimates @type="min"	float [dB]	Minimum NESZ over the scene	-22.96
Estimates @type="max"	float [dB]	Maximum NESZ over the scene	-18.22
CEOS-ARDProductAttributes		ORT product attributes and parameters	
DataAccess		ORT product processing information	Nested under **CEOS-ARD ProductAttributes**
ProcessingFacility	string	ORT product processing facility	Synspective/Tokyo
ProcessingTime	date time	ORT product processing date (UTC, ISO 8601)	2026-04-01T21:06:09.144751Z
SoftwareVersion	string	ORT processor software version (CalVer)	2026.04.1
Repository	string (URL)	Location from where ORT product can be retrieved	https://data.synspective.io/
ProductSampleSpacing		Output pixel spacing	Nested under **CEOS-ARD ProductAttributes**
ProductColumnSpacing	float [m]	Pixel spacing in easting (column) direction	5.00 (SM), 1.25 (SL/ST)
ProductRowSpacing	float [m]	Pixel spacing in northing (row) direction	5.00 (SM), 1.25 (SL/ST)
Filtering		Speckle filter information	Nested under **CEOS-ARD ProductAttributes**
FilterApplied	string (bool)	Flag if speckle filter has been applied	False
ProductBoundingBox		Bounding box corners of the product file	Two instances: UL and LR
@Corner	string	Corner identifier	UL or LR
Northing	float [m]	Northing coordinate in product CRS	5079400.00
Easting	float [m]	Easting coordinate in product CRS	331655.00
Latitude	float [deg]	Geodetic latitude (WGS84)	-44.419119
Longitude	float [deg]	Geodetic longitude (WGS84)	168.885325
ProductGeographicalExtentUTM		Product bounding box polygon in product CRS	Nested under **CEOS-ARD ProductAttributes**
@type	string	Geometry format	WKT
@order	string	Coordinate order	easting northing

Tag / Attribute Name	Type	Description	Example / Remarks
(text value)	string (WKT)	Bounding box polygon in product map projection coordinates	POLYGON ((...))
ProductGeographicalExtent		Product bounding box polygon in geographic coordinates	Nested under **CEOS-ARD ProductAttributes**
@type	string	Geometry format	WKT
@order	string	Coordinate order	longitude latitude
(text value)	string (WKT)	Bounding box polygon in WGS84 longitude/latitude	POLYGON ((...))
ImageFootprintAttributes		Center and corners of the SAR acquisition footprint in ORT product	Nested under **CEOS-ARD ProductAttributes**
CenterNorthing	float [m]	Footprint center northing in product CRS	5039318.64
CenterEasting	float [m]	Footprint center easting in product CRS	353015.69
CenterLatitude	float [deg]	Footprint center geodetic latitude (WGS84)	-44.784416
CenterLongitude	float [deg]	Footprint center geodetic longitude (WGS84)	169.142036
CornerNorthing	string [m]	Footprint corner northing coordinates (comma-separated)	5078425.00, 5007320.00, 5073820.00, 5001590.00
@order	string	Corner order	UL, LL, UR, LR
CornerEasting	string [m]	Footprint corner easting coordinates (comma-separated)	353330.00, 332910.00, 371005.00, 354945.00
@order	string	Corner order	UL, LL, UR, LR
CornerLatitude	string [deg]	Footprint corner geodetic latitudes (comma-separated)	-44.432608, -45.067857, -44.477416, -45.124269
@order	string	Corner order	UL, LL, UR, LR
CornerLongitude	string [deg]	Footprint corner geodetic longitudes (comma-separated)	169.157170, 168.877473, 169.378006, 169.155566
@order	string	Corner order	UL, LL, UR, LR
ProductImageSize		Output image dimensions	Nested under **CEOS-ARD ProductAttributes**
NumberLines	integer	Number of lines (rows) in the image	15595
NumPixelsPerLine	integer	Number of pixels (columns) per line	8354
PixelCoordinateConvention	string	Pixel coordinate reference point	Pixel Centre
CoordinateReferenceSystem		Map projection of the product. Provided twice: as EPSG code and as WKT.	Nested under **CEOS-ARD ProductAttributes**
@type	string	CRS representation type	EPSG or WKT

Tag / Attribute Name	Type	Description	Example / Remarks
(text value, EPSG)	integer	EPSG code of the projected CRS	32759 (WGS 84 / UTM zone 59S)
(text value, WKT)	string	Full CRS definition in WKT format	PROJCRS["WGS 84 / UTM zone 59S", ...]
PerPixelMetadata		Per-pixel auxiliary data layers	Nested under **CEOS-ARD ProductAttributes**
DataMask		Layover/shadow mask file specification	Nested under **PerPixelMetadata**
FileName	string	Mask file name	IMG-VV-STRIX003-20260401T154126Z-SMORT-lsmap.tif
SampleType	string	Data layer type	Mask
DataFormat	string	File format	Cloud Optimized GeoTIFF
DataType	string	Pixel data type	Byte
BitsPerSample	integer	Bits per pixel	8
BitValues		Bit value definitions	Nested under **DataMask**
NoData	integer	No data pixel value	0
ValidData	integer	Valid data pixel value	1
Layover	integer	Layover pixel value	5
Shadow	integer	Shadow pixel value	17
Layover_shadow	integer	Combined layover and shadow pixel value	21
InvalidData	integer	Invalid data pixel value	255
LocalIncAngle		Local incidence angle file specification	Nested under **PerPixelMetadata**
FileName	string	Incidence angle file name	IMG-VV-STRIX003-20260401T154126Z-SMORT-incmap.tif
SampleType	string [deg]	Data layer type	Angle
DataFormat	string	File format	Cloud Optimized GeoTIFF
DataType	string	Pixel data type	UINT
BitsPerSample	integer	Bits per pixel	16
ByteOrder	string	Byte order	Little Endian
ConversionEq	string [deg]	Equation to convert DN (digital number) to angle in degrees	0.01*DN
BackscatterMeasurementData		Backscatter image file specification	Nested under **CEOS-ARD ProductAttributes**
Backscatter Measurement	string	Backscatter type	gamma0

Tag / Attribute Name	Type	Description	Example / Remarks
Backscatter Convention	string	Backscatter value format	Linear Power
Backscatter ConversionEq	string	Equation to convert pixel values to dB	$10 \cdot \log_{10}(DN)$
Polarization	string	Polarization channel	VV
FileName	string	Backscatter image file name	IMG-VV-STRIX003-20260401T154126Z-SMORT-gamma0.tif
DataFormat	string	File format	Cloud Optimized GeoTIFF
DataType	string	Pixel data type	Float
BitsPerSample	integer	Bits per pixel	32
ByteOrder	string	Byte order	Little Endian
NoiseRemoval		Noise removal information	Nested under **CEOS-ARD ProductAttributes**
NoiseRemovalApplied	string (bool)	Flag if thermal noise removal has been applied	False
RadiometricTerrainCorrections		RTC algorithm reference (gamma0 metadata only)	Nested under **CEOS-ARD ProductAttributes**
RTCAlgorithm	string (DOI)	DOI reference to the RTC algorithm (Small, 2011 [7])	https://doi.org/10.1109/TGRS.2011.2120616
GeometricCorrections		Geometric correction information	Nested under **CEOS-ARD ProductAttributes**
DigitalElevationModel		DEM used for terrain correction	Nested under **GeometricCorrections**
@dem	string	DEM type	Surface
DEMReference	string (URL)	Reference URL to the DEM data source	https://dataspace.copernicus.eu/explore-data/data-collections/copernicus-contributing-missions/collections-description/COP-DEM
DEMVersion	string	DEM version identifier	2024_1
EGMReference	string (DOI)	Reference to Earth Gravitational Model used	https://doi.org/10.1029/2011JB008916
GeoCorrAccuracy		Absolute location error (ALE) estimates	Nested under **GeometricCorrections**
@type	string	Accuracy measurement type	Orthorectified
@ALESource	string	ALE measurement context. "ARD" indicates end-to-end ALE measured directly in the orthorectified product.	ARD
NorthernSTDev	float [m]	Standard deviation of absolute location error in northing direction	2.59

Tag / Attribute Name	Type	Description	Example / Remarks
EasternSTDev	float [m]	Standard deviation of absolute location error in easting direction	2.16
NorthernBias	float [m]	Bias (systematic offset) in northing direction. Positive = northward shift.	1.52
EasternBias	float [m]	Bias (systematic offset) in easting direction. Positive = eastward shift.	0.54
GriddingConvention		Fixed grid alignment convention	Nested under **GeometricCorrections**
@type	string	Description type	Description
(text value)	string	Grid alignment rule. Upper left corner coordinates are aligned to exact multiples of the pixel spacing, offset by half a pixel, ensuring pixel-aligned repeat acquisitions.	Scene Upper Left Corner coordinates (Northing and Easting) are aligned to multiples of 5.00 m, offset by half a pixel.

XML Metadata Notes:

1. Differences between sigma0 and gamma0 metadata: The two XML files per ORT delivery differ in:
    - Product/@type: "Normalised Radar Backscatter" (gamma0) vs "Sigma-0 Backscatter" (sigma0)
    - DocumentIdentifier: present in gamma0 only
    - Parent element for product attributes: CEOS-ARDProductAttributes (gamma0) vs ProductAttributes (sigma0)
    - BackscatterMeasurementData/BackscatterMeasurement: gamma0 vs sigma0
    - BackscatterMeasurementData/FileName: corresponding image filename
    - RadiometricTerrainCorrections: present only in the gamma0 metadata file (RTC is not applicable to the sigma0 variant)
    - All other elements and values are identical between the two files
2. Geometric accuracy (ALE): Values are provided per satellite and per observation mode, measured as end-to-end ARD ALE directly in the orthorectified product in map projection coordinates (Northing and Easting), following the CEOS-ARD NRB PFS v1.2 requirements. A positive bias indicates a shift in the positive map direction (northward / eastward); a negative bias indicates a shift in the negative direction (southward / westward).
3. Gridding convention: ORT products use a fixed UTM grid where pixel upper-left corners are aligned to exact multiples of the pixel spacing, offset by half a pixel. This ensures that all ORT acquisitions over the same area share identical pixel positions, enabling direct time-series analysis without resampling. For Stripmap, the grid spacing is 5.00 m; for Sliding Spotlight and Staring Spotlight, 1.25 m. Both spacings nest exactly (4 x 4 Sliding Spotlight/ Staring Spotlight pixels = 1 Stripmap pixel).
4. Coordinate reference system: ORT products use UTM projection only. The EPSG code and full WKT definition are both provided in the metadata. The UTM zone is determined by the scene center longitude.

3.1.3 GeoTIFF Tag

The table below describes the GeoTIFF tags present in the ORT image files (sigma0.tif and gamma0.tif) . The definition of data type is shown in the table below.

Table 3.1-3 ORT GeoTIFF Tag

Tag / Attribute Name	Key ID	Type	Count	Description / Example
ImageWidth	256	SHORT	1	Number of pixels per line
ImageLength	257	SHORT	1	Number of lines
BitsPerSample	258	SHORT	1	32
Compression	259	SHORT	1	8: Deflate
PhotometricInterpretation	262	SHORT	1	1: MinIsBlack
SamplesPerPixel	277	SHORT	1	1
PlanarConfiguration	284	SHORT	1	1: Contiguous (single band)
Software	305	ASCII	variable	Processing software identifier
DateTime	306	ASCII	20	File creation date and time in TIFF format "YYYY:MM:DD HH:MM:SS". Example: "2026:03:25 01:09:16"
Predictor	317	SHORT	1	3: Floating-point predictor (horizontal differencing of floating-point values, improves Deflate compression ratio for float32 data)
TileWidth	322	SHORT	1	512
TileLength	323	SHORT	1	512
TileOffsets	324	LONG	Number of tiles	Byte offset to each tile
TileByteCounts	325	LONG	Number of tiles	Compressed byte count for each tile
SampleFormat	339	SHORT	1	3: IEEE floating point
ModelPixelScaleTag	33550	DOUBLE	3	Pixel spacing in meters: (ScaleX, ScaleY, 0.0). Example: (5.0, 5.0, 0.0) for Stripmap; (1.25, 1.25, 0.0) for Spotlight
ModelTiepointTag	33922	DOUBLE	6	Tiepoint mapping pixel coordinates to map coordinates: (I, J, K, X, Y, Z). Maps pixel (0, 0) to its map coordinate (Easting, Northing,

Tag / Attribute Name	Key ID	Type	Count	Description / Example
				0). Since GTRasterTypeGeoKey = RasterPixelIsPoint, the tiepoint refers to the centre of the upper-left pixel. Example: (0.0, 0.0, 0.0, 738337.5, 9465177.5, 0.0)
GeoKeyDirectoryTag	34735	SHORT	4 + 4*N	GeoTIFF key directory. Contains N GeoKey entries (see GeoKey table 3.1-4)
GeoAsciiParamsTag	34737	ASCII	variable	String values referenced by GeoKeys. Example: "WGS 84 / UTM zone 50S|WGS 84|"
GDAL_METADATA	42112	ASCII	variable	GDAL metadata XML block containing band statistics (STATISTICS_MAXIMUM, STATISTICS_MEAN, STATISTICS_MINIMUM, STATISTICS_STDDEV, STATISTICS_VALID_PERCENT)
GDAL_NODATA	42113	ASCII	variable	NoData pixel value. "0" (pixels with value 0.0 represent no data)

The GeoKeyDirectoryTag (34735) contains the following GeoKeys:

Table 3.1-4 ORT GeoTIFF GeoKey Directory

GeoKey ID	GeoKey Name	Value	Description
1024	GTModelTypeGeoKey	1	ModelTypeProjected
1025	GTRasterTypeGeoKey	2	RasterPixelIsPoint — pixel coordinates refer to the centre of a pixel. This is consistent with the "Pixel Centre" convention declared in the XML metadata.
1026	GTCitationGeoKey	(string)	Projected CRS citation. Example: "WGS 84 / UTM zone 50S"
2049	GeogCitationGeoKey	(string)	Geographic CRS citation: "WGS 84"
2054	GeogAngularUnitsGeoKey	9102	Angular_Degree
3072	ProjectedCSTypeGeoKey	(EPSG code)	EPSG code of the projected coordinate reference system. Example: 32750 (WGS 84 / UTM zone 50S). The UTM zone varies per scene.
3076	ProjLinearUnitsGeoKey	9001	Linear_Meter

GeoTIFF Tag Notes:

1. Pixel coordinate convention: The GeoTIFF uses GTRasterTypeGeoKey = 2 (RasterPixelIsPoint), meaning the ModelTiepointTag coordinates refer to the centre of the upper-left pixel, not its corner. The GDAL metadata item AREA_OR_POINT = Point is also set consistently. When computing the upper-left corner of the raster extent, half a pixel offset must be subtracted from the tiepoint easting and added to the tiepoint northing.
2. NoData handling: The NoData value is 0.0 (float), recorded in both the GDAL_NODATA tag (42113) and in the band metadata. Pixels with value 0.0 represent areas outside the SAR image

extent. Since calibrated backscatter values in linear power are strictly positive for valid measurements, 0.0 is an unambiguous NoData sentinel.

3. Band statistics: The GDAL_METADATA tag (42112) contains precomputed band statistics including maximum, mean, minimum, standard deviation, and valid pixel percentage. STATISTICS_MINIMUM and STATISTICS_MAXIMUM are set to 0 and 0.5 (linear power, corresponding to -3 dB) to provide a useful default display range when GIS software auto-scales the colour ramp from these values. These are not the true data extremes but a display hint that clips the colour scale at -3 dB, which is suitable for most SAR backscatter visualisation. STATISTICS_VALID_PERCENT indicates the fraction of the raster extent covered by actual SAR data (the remainder being zero-fill in the rectangular GeoTIFF bounding box).

3.1.4 COG Layer Specifications

The ORT product delivery includes six distinct types of Cloud Optimized GeoTIFF files, each optimized for its specific role. The table below summarises the COG properties for each file type.

Table 3.1-5 ORT COG File Specifications

Property	**sigma0.tif / gamma0.tif**	**quicklook (sigma0/gamma0)**	**incmap.tif**	**lsmap.tif**
Role	backscatter quantitative analysis	backscatter qualitative analysis and visualisation	auxiliary (local incidence angle)	auxiliary (layover/shadow mask)
Bands	1	2 (data + alpha)	1	1
Data type	Float32	Byte (UINT8)	UInt16	Byte (UINT8)
Pixel values	Calibrated backscatter, linear power	Band 1: dB-encoded backscatter (see Note 2). Band 2: alpha mask (0=transparent, 255=opaque)	Incidence angle: DN x 0.01 = degrees	Classification mask
Compression	Deflate	Deflate	Deflate	Deflate
Predictor	3 (floating-point)	1 (none)	2 (horizontal differencing)	2 (horizontal differencing)
Tile size	512 x 512	512 x 512	512 x 512	512 x 512
Overviews	None (see Note 1)	5 levels (2x, 4x, 8x, 16x, 32x)	5 levels (2x, 4x, 8x, 16x, 32x)	5 levels (2x, 4x, 8x, 16x, 32x)
Overview resampling	—	Average (see Note 2)	Average	Nearest neighbour
NoData value	0	None (alpha band masks NoData)	0	0(see Note 3)
GTRasterType GeoKey	2 (RasterPixelIsPoint)	1 (RasterPixelIsArea)	1 (RasterPixelIsArea)	2 (RasterPixelIsPoint)

Property	sigma0.tif / gamma0.tif	quicklook (sigma0/gamma0)	incmap.tif	lsmap.tif
Scale / Offset metadata	None	Scale=0.25, Offset=-25.25	Scale=0.01, Offset=0	None

COG Layer Specifications Notes:

1. Backscatter files (sigma0.tif, gamma0.tif): These are the primary analysis products. No overview pyramids are included — the full-resolution tiled COG layout supports efficient partial reads via HTTP range requests for streaming access. Overviews would add ~33% to the file size with no benefit for analysis workflows.
2. Quicklook files (sigma0-quicklook.tif, gamma0-quicklook.tif): These are visualisation-optimised 2-band COGs designed for display in GIS applications such as QGIS. Band 1 contains dB-encoded UINT8 data; band 2 is a Byte alpha mask (ColorInterp=Alpha) where 255=opaque (valid) and 0=transparent (NoData). No NoData value is set on the data band — NoData regions are identified exclusively via the alpha band, which GIS applications such as QGIS detect automatically. The dB encoding uses the following mapping:
    - DN = 0 to 255: backscatter in dB, where dB = DN x 0.25 - 25.25
    - This gives a range of approximately -25.25 dB (DN=0) to +38.50 dB (DN=255) in 0.25 dB steps
    - The Scale=0.25 and Offset=-25.25 band metadata allow GIS software to display values directly in dB units
    - Five overview levels (2x through 32x) provide smooth zoom navigation
    - Overview pyramids are computed by averaging in the linear power domain before dB conversion; averaging directly in dB would be radiometrically incorrect and would systematically underestimate backscatter intensity at lower zoom levels. Both bands have overviews at each level.
    - Deflate compression without predictor (Predictor=1) is used — predictors are not effective for classified/quantised byte data
    - Compressed file size does not exceed 110 MB, approximately 3x smaller than the corresponding backscatter file
3. Layover/shadow mask (lsmap.tif): Classification mask with discrete values (0, 1, 5, 17, 21, 255) and an RGB colour palette embedded in the GeoTIFF (ColorInterp=Palette). GDAL NoData value is 0, matching the NoData entry in BitValues.
   Per-class alpha and class names cannot be stored inside the TIFF — the TIFF 6.0 ColorMap tag (320) stores 3 × 2^BitsPerSample entries (RGB only, no alpha channel). They are provided in a GDAL PAM sidecar `<lsmap>.tif.aux.xml` shipped alongside the .tif (see Table 3.1-1):
    - RGBA colour table with 256 entries; class rows carry alpha, unused rows are zero-filled
    - RasterAttributeTable columns: Value, Class, Red, Green, Blue, Alpha
    - Valid Data (value = 1) is set to RGBA (0, 0, 0, 0) so valid pixels render transparent — the overlay shows only layover / shadow / invalid / no-data regions
    - QGIS and ArcGIS detect the sidecar automatically when it is placed next to the .tif — no user configuration required. Five overview levels (2x through 32x) use nearest-neighbour resampling to preserve discrete class values.

3.1.5 Thumbnail Image

A thumbnail image is provided as a JPEG file for quick visual identification of the scene content. The thumbnail is derived from the gamma-naught backscatter image.

- Format: JPEG, single-band grayscale (8-bit)
- Resolution: Half the full-resolution image dimensions (2x downsampled, average resampling)
- Pixel values: Percentile-normalised dB scale. The gamma-naught linear power values are converted to decibels, then a contrast stretch is applied using the 1st and 99th percentile of the scene values. This produces an image optimised for human perception of the overall scene content.
- Map projection: North-up orientation
- Coordinate information: Not included. The JPEG is intended for visual preview only, not for geospatial analysis.

The thumbnail provides a qualitative overview of the scene suitable for cataloguing, browsing, and quick quality assessment. It is not suitable for quantitative analysis.

4. CPHD Product

The Compensated Phase History Data (CPHD) product provides range-compressed phase history in a single file (.cphd) that contains the signal array(s), XML metadata, and Per-Vector Parameters (PVP) [8], [9]. Unlike SLC products, CPHD is not range-call migration corrected and azimuth-compressed and is intended for users who need access to compensated phase history prior to image formation. The CPHD format follows the standard, Version 1.1.0.

The general specification of the CPHD product:

- Compensated phase history (range-compressed; azimuth not compressed)
- Signal domain: FX (default); TOA is allowed by the standard but the product default is FX
- Monostatic / single channel / VV
- Sample format: CF8
- Modes: Stripmap / Sliding Spotlight / Staring Spotlight

4.1. CPHD Product Format

4.1.1 Product Composition

CPHD product includes:

- Compensated phase history data(cphd)

The naming convention for CPHD product files is described in the table below.

Table 4.1-1 CPHD product file naming convention

File Type	Number of Files	File Name	Type	Contents
Image File	1	IMG-<Polarization>-<Scene ID> -<Product ID>.cphd	CPHD	Signal + XML + PVP

Where:
Scene ID = AAAAAAAA-YYYYMMDDThhmmssZ
AAAAAAAA : Satellite type
- STRIX00A: StriX-α
- STRIX00B: StriX-β
- STRIX001 ~ N: StriX-1 ~ N
  - Example:
    - STRIX001: StriX-1

- STRIX002: StriX-2

- : Separator

YYYYMMDD: Scene center observation date (YYYY: year, MM: month, DD: day)

hhmmss: Scene center observation time* (hh: hour, mm: minutes, ss: seconds)

*precise orbit is used when available

Product ID = DDCPHD

DD: Observation mode

- SM: Stripmap mode
- SL: Sliding Spotlight mode
- ST: Staring Spotlight mode

CPHD: Processing level (CPHD: Compensated phase history data)

4.1.2 CPHD XML Metadata

XML metadata of Synspective's CPHD product are compliant with the parameter tables in the CPHD standard [8]. The fields for Synspective products specific implementation are listed below.

Table 4.1-2 XML Field for Synspective products specific implementation in CPHD product

Field Name	Type	Description	Example
CollectorName	TXT	Radar platform identifier	StriX-1
CoreName	TXT	Observation order code that uniquely identifies the collection	202407-00104
CollectType	TXT	Collection geometry type. Synspective products are monostatic only	MONOSTATIC
ModeType	TXT	SAR imaging mode: STRIPMAP (Stripmap), DYNAMIC STRIPMAP (Sliding Spotlight), SPOTLIGHT (Staring Spotlight)	STRIPMAP
DomainType	TXT	Domain of the CPHD signal array(s). Product default is FX	FX
SignalArrayFormat	TXT	Binary format of signal array samples (Data)	CF8
Identifier	TXT	Channel identifier (Channel). Synspective products use a single channel	Primary
CODId	TXT	Identifier of the Center of Dwell Time polynomial (Channel)	Primary
DwellId	TXT	Identifier of the Dwell Time polynomial (Channel)	Primary
TxPol	TXT	Transmit polarization (Channel/Polarization). Synspective products are V	V
RcvPol	TXT	Receive polarization (Channel/Polarization). Synspective products are V	V

5. Radiometric Calibration

The following corrections are applied to the Synspective products.

Table 5-1 Radiometric Correction

Satellite	Mode	Antenna Pattern Correction	Range Spread Loss Correction	Incidence Angle Correction*	Calibration factor
StriX-α	Stripmap		√	√	√
StriX-β	Stripmap	√	√	√	√
StriX-β	Sliding Spotlight	√	√	√	√
StriX-1	Stripmap/ Sliding Spotlight	√	√	√	√
StriX-2 and later	Stripmap/ Sliding Spotlight/ Staring Spotlight	√	√	√	√

*GRD/ SR-GRD only

- SLC CEOS

The following equation will be applied to convert I and Q values to beta naught (β_{0dB}) ,

$$\text{SLC: } \beta_{0dB} = 10 * \log_{10} \langle I^2 + Q^2 \rangle + CF_{SLC\ CEOS}$$

To convert from β_0 to σ_0, the incident angle correction will be applied by

$$\sigma_0 = \beta_0 * \sin(\theta),$$

where θ is the incidence angle.

- SLC SICD

Follow the NITF format document in Section 4.10 [2] to perform radiometric calibration.

- GRD GeoTIFF

The following equation will be applied to convert Digital Number (DN) to sigma naught (σ_0) using Calibration Factor (CF_{GRD}) in XML metadata in GRD product ,

$$\sigma_0 = DN^2 / CF_{GRD}^2$$

$$\sigma_{0dB} = 10\log_{10}(\sigma_0)$$

Note: To radiometrically calibrate GRD product, the image raster data should be used, not the quicklook raster data (*_quicklook.tif).

Note: SR-GRD product is not radiometrically calibrated. The above equation is not applied.

Note: For StriX-α Stripmap, antenna pattern correction is not applied. This results in 2~3dB uncertainty for the calibration factor when applying the above formula.

- ORT GeoTIFF

ORT products are delivered with calibrated backscatter values in linear power scale. No calibration factor needs to be applied — pixel values can be used directly:

$\sigma_{0dB} = 10 \cdot \log_{10}(DN)$ for sigma-naught
$\gamma_{0dB} = 10 \cdot \log_{10}(DN)$ for gamma-naught

Note: For quantitative analysis, the backscatter image files (*-sigma0.tif, *-gamma0.tif) in linear power scale should be used. The quicklook files (*-quicklook.tif) contain dB-encoded UINT8 data with embedded Scale and Offset metadata, so GIS software automatically displays calibrated dB values. Quicklook files are intended for qualitative analysis and visualization, and may be sufficient for some applications, but the linear power files are recommended for rigorous quantitative work. Quicklook encoding clips at +38.50 dB, which may be a limitation for applications involving strong reflectors (e.g., corner reflectors, metallic structures).

6. Product Version

6.1 Product Release History

The product release history is shown in the following tables with the software version used to create each SAR product.

Table 6.1-1 Product release history

Date	Version (SLC SICD)	Version (SLC CEOS, GRD/SR-GRD GeoTIFF+XML)	Description
May 24, 2022	v0.0.3	v003.009	- StriX-β is released
July 19, 2022	v0.0.4	v003.010	- Calibration factor is added for Stripmap StriX-β
Sept 7, 2022	v0.0.5	v004.000	- Calibration factor is added for Sliding Spotlight StriX-β - Calculation for doppler frequency (center) is updated in SLC product
Oct 24, 2022	v0.0.6	v005.000	- Heading angle and incidence angle polynomial is added in GRD product
Dec 15, 2022	v0.8.0	v006.000	- StriX-1 is released - Orbit state vectors are added in XML metadata in GRD product - Calculation for doppler frequency is updated in SLC product
Feb 27, 2023	v0.9.0	v007.000	- Geolocation algorithm is updated in SLC and GRD product - ImpRespWid in SICD is fixed to match with azimuth frequency bandwidth - StriX-1 for Stripmap range sampling frequency is reduced from 187.5 MHz to 100 MHz in SLC product - linear and quadratic coefficients are set for along track Doppler rate polynomial in CEOS
May 15, 2023	v0.10.0	v008.000	- Add resampling in the azimuth direction to reduce data size for the given resolution - Fix SFDRatePoly constant coefficient sign - UTM CRS for GRD products
Aug 1, 2023	v0.11.0	v009.000	- Noise Equivalent Sigma Zero metadata was added to GRD and SR-GRD XML Product
Oct 2, 2023	v0.12.0	v010.000	- Geolocation algorithm is updated in GRD product - Fixed an issue with the extent of GRD GeoTIFF raster

Date	Version (SLC SICD)	Version (SLC CEOS, GRD/SR-GRD GeoTIFF+XML)	Description
Oct 19, 2023	v0.12.2	v010.001	- Fixed a minor raster alignment issue with the GRD GeoTIFF raster in Ascending observations
Dec 6, 2023	v0.12.3	v010.002	- Fixed a bug in GRD geocoding algorithm
Jan 22, 2024	v0.13.0	v011.000	- Updated geocoding algorithm of GRD - Updated SICD format version from 1.2.1 to 1.3.0
Jan 23, 2024	v0.13.1	v011.000	- Fixed a bug in processing system
Mar 18, 2024	v0.13.2	v011.000	- Fixed a minor bug in an interface between processing library and platform pipeline
Apr 10, 2024	v0.13.3	v011.000	- Fixed a minor bug in an interface to precise orbit
Apr 22, 2024	v0.14.0	v012.000	- Fixed a minor bug that generated subpixel geolocation offset in GRD products
May 15, 2024	v0.14.1	v012.000	- Support StriX-3 observations
Aug 1, 2024	v0.15.0	v013.000	- Filled values for nominal slant range and azimuth resolutions in CEOS fields - Added fields nominal slant range and azimuth resolutions in Summary Information for CEOS product - Added metadata fields for image resolutions in XML file in GRD and SR-GRD product
Aug 22, 2024	v0.15.1	v013.000	- Fixed a bug in the processing management system (products are not affected)
Sept 4, 2024	v0.15.2	v013.000	- Fixed a bug in the processing management system (products are not affected)
Oct 2, 2024	v0.15.3	v013.000	- Support Staring Spotlight observations
Nov 12, 2024	v1.0.0	v014.000	- Support StriX-4 - Add Cloud Optimized GeoTIFF in GRD and SR-GRD product - Update focusing algorithm
Dec 3, 2024	v1.1.0	v014.000	- Support Staring Spotlight with 0.25m Azimuth resolution - Update processing kernel for Staring Spotlight
Jan 15, 2025	v1.2.0	v014.001	- Fixed a bug in Field No. 55 in Table 1.1-16 Signal Data Records in CEOS Product Format

Date	Version (SLC SICD)	Version (SLC CEOS, GRD/SR-GRD GeoTIFF+XML)	Description
Mar 25, 2025	v1.3.0	v015.000	- Support StriX-2 - Updated a reference chirp for focusing
Apr 2, 2025	v1.3.1	v015.000	- Fixed a bug in Staring Spotlight focusing
June 25, 2025	v1.4.0	v015.001	- Updated timing calculation for Staring Spotlight and Sliding Spotlight - Added overlap when processing subaperture for Staring Spotlight and Sliding Spotlight - Support longer observation durations for Stripmap
July 15, 2025	v1.4.1	v015.001	- Fixed a bug when retrieving satellite telemetry information
Sept 30, 2025	v2.0.0	v015.002	- Switched thumbnail images pixel-intensity mapping from linear to logarithmic in SICD and CEOS - Updated sign in the offnadir angle as per product format manual - Updated heading angle calculation in GRD XML metadata

Table 6.1-2 Product release history (after Dec 9, 2025)

Date	Version (SLC SICD, GRD/SR-GRD GeoTIFF+XML)	Version (SLC CEOS)	Version (ORT GeoTIFF+XML)	Description
Dec 9, 2025	v2.1.0	v015.003	-	- Updated GRD product format - Update thumbnail images for all products
Dec 17, 2025	v2.1.1	v015.003	-	- Reduced memory consumption when creating GRD product
Jan 7, 2026	v2.1.2	v015.003	-	- Fixed a bug when processing calibration signals
Feb 10, 2026	v2.1.3	v015.003	-	- Fixed a bug in an interface to an internal platform system
Feb 16, 2026	v2.1.4	v015.003	-	- Support StriX-5
Mar 11, 2026	v2.2.0	v015.004	-	- Support Spotlight Enhanced product

Date	Version (SLC SICD, GRD/SR-GRD GeoTIFF+XML)	Version (SLC CEOS)	Version (ORT GeoTIFF+XML)	Description
Mar 17, 2026	v2.2.1	v015.004	-	- Fixed a bug in an interface to an internal platform system
Mar 24, 2026	v2.2.2	v015.004	-	- Fixed a bug in an interface to an internal platform system
April 2, 2026	v2.2.2	v015.004	v2026.04	- Added ORT product
April 9, 2026	v2.2.2	v015.004	v2026.04.1	- Updated ORT XML metadata - Converted incmap and lsmap to valid COG
April 16, 2026	v2.2.2	v015.004	v2026.04.2	- Updated ORT XML metadata - Fixed lsmap.tif NoData value (1 → 0)
May 26, 2026	v2.3.0	v015.005	v2026.04.3	- Added orbit source to SICD and GRD product - Added orbit source and noise level to ORT product - Updated focusing algorithm for Sliding Spotlight and Staring Spotlight
June 1, 2026	v2.3.1	v015.005	v2026.04.3	- Fixed a bug in an interface to an internal platform system
June 23, 2026	v2.3.2	v015.005	v2026.04.4	- Updated algorithm for radiometric calibration - Update an interface to an internal tasking systems - Fixed UTM EPSG code for low-numbered zones in ORT product - Fixed SICD/GAMMA acquisition-date mismatch in ORT product

Table 6.1-3 Product release history (after Jul 29, 2026)

Date	Version (SLC SICD, GRD/SR-GRD GeoTIFF+XML, CPHD)	Version (SLC CEOS)	Version (ORT GeoTIFF+XML)	Description
July 29, 2026	v2.4.0	v015.006	v2026.04.5	- Added CPHD product - Updated CEOS software version - Added azimuth angle field to GRD XML metadata - Fixed GeoAsciiParamsTag in GRD GeoTIFF metadata - Support three-digit satellite names in product filenames/metadata - Updated Copernicus DEM to version 2024_1 - Added lsmap.tif.aux.xml palette sidecar to ORT product so Valid Data renders transparent in GIS
July 29, 2026	v2.4.0	v015.006	v2026.04.6	- Fixed DEM version in ORT metadata
August 26, 2026	v2.4.1	v015.006	v2026.04.7	- Support StriX-7 and StriX-8 - Updated radiometric calibration for StriX-6
September 16, 2026	v2.4.2	v015.006	v2026.04.7	- Fixed a bug in an interface to an internal processing management system
October 14, 2026	v2.5.0	v015.007	v2026.04.7	- Improved azimuth geolocation accuracy for Stripmap - Changed the resampling window in post-processing to Lanczos to reduce power oscillation in range - Improved focusing accuracy for StriX-6 and for products processed with onboard orbits - Fixed range motion compensation, Doppler spectrum centering and metadata in CPHD product

The above versions can be confirmed in each product metadata in the table below.

Table 6.1-4 Software version related fields

Product type	File	Field
CEOS	VOL	Volume Descriptor Record, Field no. 12: Software release and revision number

SICD	nitf	SICD.ImageCreation.Application
GRD	XML	eop:processorVersion
ORT	XML	Product.ProductAttributes.DataAccess.SoftwareVersion
CPHD	cphd	TBD

6.2 Latest Version and Compatible Version

Synspective SAR data products are delivered as data processed with one of the following versions:

- Latest version: the newest product version currently released. For tasking orders, and for archive orders where no data processed with the Compatible version exists, we process and deliver the data using this version.
- Compatible version: a product version considered equivalent in quality to the Latest version. For archive orders where data already processed with this version exists, we deliver it immediately without reprocessing.

When a version update does not affect the imagery or metadata, data processed before the update remains compatible (the Latest version and the Compatible version are different values). On the other hand, when an update does affect the imagery or metadata, data processed before it is no longer considered compatible, and the Latest version and the Compatible version become the same.

The table below shows the current Latest version and Compatible version.

Table 6.2-1 Latest version and Compatible version

Version type	**Supported version (SLC SICD, GRD/ SR-GRD GeoTIFF+XML, CPHD)**	**Supported version (SLC CEOS)**	**Supported version (ORT GeoTIFF+XML)**
Latest version	v2.5.0	v015.007	v2026.04.7
Compatible version	V2.5.0 and later	V015.007 and later	V2026.04.6 and later

Reference

[1] ALOS-2/PALSAR-2 Level 1.1/1.5/2.1/3.1 CEOS SAR Product Format Description Dec. 06, 2021. https://www.eorc.jaxa.jp/ALOS/en/alos-2/pdf/product_format_description/PALSAR-2_xx_Format_CEOS_E_g.pdf

[2] Sensor Independent Complex Data (SICD), Volume 1, Design & Implementation Description Document, Version 1.3.0 2021-11-30. https://nsgreg.nga.mil/doc/view?i=5381

[3] Sensor Independent Complex Data (SICD), Volume 2, File Format Description Document, Version 1.3.0 2021-11-30. https://nsgreg.nga.mil/doc/view?i=5382

[4] Sensor Independent Complex Data (SICD), Volume 3, Image Projections Description Document, Version 1.3.0 2021-11-30 .https://nsgreg.nga.mil/doc/view?i=5442

[5] National Imagery Transmission Format (Version 2.1) for the National Imagery Transmission Format Standard, 01 May 2006. https://nsgreg.nga.mil/doc/view?i=4324

[6] CEOS Analysis Ready Data for Synthetic Aperture Radar, Product Family Specification v1.2. https://ceos.org/ard/files/PFS/SAR/v1.2/CEOS-ARD_PFS_Synthetic_Aperture_Radar_v1.2.pdf (accessed March 31, 2026)

[7] D. Small, "Flattening Gamma: Radiometric Terrain Correction for SAR Imagery," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 49, no. 8, pp. 3081–3093, Aug. 2011, doi: 10.1109/TGRS.2011.2120616.

[8] CPHD Design & Implementation Description, Version 1.1.0 https://nsgreg.nga.mil/doc/view?i=5388.

[9] CPHD Design & Implementation Schema, V1.1.0 https://nsgreg.nga.mil/doc/view?i=5421.