

# **ASNARO-2 Product Guide**

## **Summary Edition**

2019 October  
NEC Corporation



Version	Date	Note
1.0	2019 Jan 10	First Version
A	2019 April 10	Table 3-3, 3-4, 3-5 Ground Range Scene Size of each Off-nadir angle and Table 3-6, 3-7, 3-8 Ground Range Resolution of each Off-nadir angle were added.
		Figure 3-1 Ground Range Resolution of each Off-nadir angle (SP/SP2 & SM) and Figure 3-2 Ground Range Resolution per Off-nadir angle (SS) were added.
		5. Guarantee range was added.
B	2019 June 25	Disclosure restriction was changed.
		1.3.1 Annotation was added.
		1.3.3 - Clear notification about Leve 1.5 Product was added. - Annotation was added.
		3.2 Resolution was deleted from scene size table
		3.5.1.1 Section A) Resolution was added.
		3.5.2.1 Section A) Resolution was added.
C	2019 Oct. 01	Table 1-2 -Swath of Stripmap "12km × 12km to 60km" was corrected to "12km × 12km to 52km". -Swath of ScanSAR "50km × 50km to 200km" was corrected to "50km × 50km to 183.2km". -Annotation was added. Table 3-2 -Azimuth Scene Size(long product) of Stripmap "Maximum 60km" was corrected to "Maximum 52km". -Swath of ScanSAR "Maximum 200km" was corrected to "Maximum 183.2km". -Annotation was added. Table 3-3 -Annotation was added.

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# **1. Introduction**

## **1.1. Introduction**

This document specifies the ASNARO-2 Level 1 products generated at ASNARO-2 ground system. ASNARO-2 ground system performs Level 1 processing to the data acquired by SAR sensor mounted on ASNARO-2.

## **1.2. Scope**

This document defines the specification of Level 1 products.  
Detailed format and specification of Level 1 products are also described in this document.

### 1.3. ASNARO-2 Satellite

#### 1.3.1. Mission Overview

ANSARO-2 operates in the following three acquisition modes.

Spotlight mode:

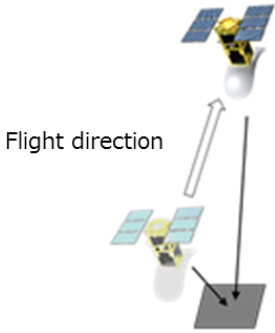
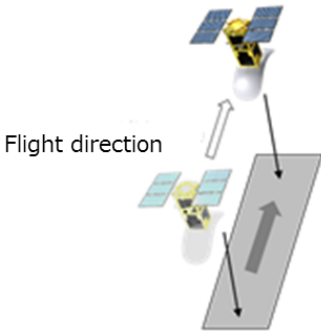
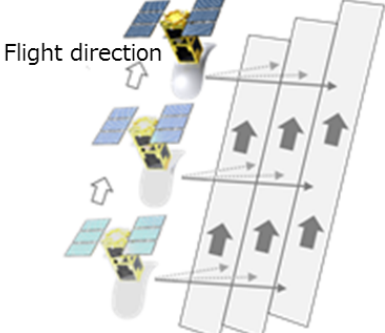
This mode can acquire detailed data with high-resolution because antenna direction is kept to the target by rotating satellite attitude. It's optimal for grasping the changes of buildings and development situation in urban areas.

Stripmap mode:

This mode observes in strip-shaped along the satellite's flight direction by fixing the antenna direction. It is used to observe wide-ranging area, such as the monitoring of large-scale natural disaster (volcanic activity, landslides, etc.).

ScanSAR mode:

This mode observes wide swath by switching sequentially the antenna beam direction to the orthogonal direction (range direction) of the satellite's flight direction. It is used to grasp the situation of broader area than stripmap mode.

Spotlight mode High-resolution	Stripmap mode Wide area & High-resolution	ScanSAR mode Further wide area
Resolution: 1m or less Swath: 10km or more	Resolution: 2m or less Swath: 12km or more	Resolution: 16m or less Swath: 50km or more
Acquires detailed image by observing the target intensively. It is used to observe buildings in urban areas.	Acquires wide-ranging image by observing in strip-shaped along the flight direction. It is used for natural disaster monitoring, resource mapping, glacial observation, etc.	Broader area's observation is possible in continuous observation by switching the antenna beam direction to the orthogonal direction of the flight direction.
<p><u>Observation image</u></p> 	<p><u>Observation image</u></p> 	<p><u>Observation image</u></p> 

Observation Mode of ASNARO-2

\* Resolution and scene size are the value in the case of Level 1.5 product/ off-nadir angle around 35 deg/ nominal pixel spacing. For details, see Section 3.5.2.1.

### 1.3.2. ASNARO-2 Specification

ASNARO-2 specification is listed in Table 1-1.

**Table 1-1 ASNARO-2 Specifications**

Mission	X-band SAR
Mass	570kg
Orbit	Sun-synchronous sub-recurrent orbit
Altitude	Approximately 505km above the equator
Inclination angle	Approximately 97.4°
Local Time of Descending Node (LTDN)	6:00 (Dawn-Dusk)
Revisit cycle	14 days

### 1.3.3. Image Product Performance (Level 1.5 product)

Image product performance of ASNARO-2 is listed in Table 1-2.

**Table 1-2 ASNARO-2 Image Product Performance (Level 1.5 product)**

Items		Performance			
Observation mode		Spotlight 1	Spotlight 2	Stripmap	ScanSAR
NESZ *1		Under -14.0dB	Under -15.5dB	Under -17.0dB	Under -25.0dB
Spatial resolution *1	Rg	Under 1.0m		Under 2.0m	Under 16.0m
	Az	Under 1.0m		Under 2.0m	Under 16.0m
S/A *1		Over 20dB			
Swath *1		Rg×Az			
		10km × 10km		12km × 12km to 52km *2	50km × 50km to 183.2km *2
Off-nadir angle		15° to 45°			
Frequency		Approximately 9.65GHz			
Polarization		VV or HH			

\*1 The value at the center of the image; off-nadir angle is around 35 deg. and flight height above the equator is 505 km. For details, see Section 3.5.2.1.

\*2 The overlap between scenes is about 2 km in Stripmap and about 5.6 km in ScanSAR.

## 2. Documents

### 2.1. Reference Documents

**A) GeoTIFF**

"TIFF Revision 6.0", Adobe Developers Association.

"GeoTIFF Format Specification GeoTIFF Revision 1.0", Niles Ritter, Mike Ruth.

**B) NITF 2.1**

MIL-STD-2500C "DEPARTMENT OF DEFENSE INTERFACE STANDARD NATIONAL IMAGERY TRANSMISSION FORMAT VERSION 2.1", Department Of Defense, United States of America.

**C) Metadata format of OGC standard**

OGC 06-080r4 "OpenGIS Geography Markup Language (GML) Application Schema for Earth Observation Products", Open Geospatial Consortium.

OGC 06-131r6 "OGC® Catalogue Services Standard 2.0 Extension Package for ebRIM Application Profile: Earth Observation Products", Open Geospatial Consortium.

OGC 10-157r1 "Earth Observation Metadata profile of Observations & Measurements", Open Geospatial Consortium.

**D) EPSG code**

"EPSG Geodetic Parameter Dataset Version 8.2" (EPSG\_v8\_2.mdb), International Association of Oil & Gas Products.

"Geomatics Guidance Note Number 7, part 2 Coordinate Conversions and Transformations including Formulas", International Association of Oil & Gas Products.

### 3. Level 1 Product Specification

Level 1 product is classified into Level 1.1 product and Level 1.5 product.

#### 3.1. Definition of Processing Level

Processing level of ASNARO-2 product is shown in Table 3-1

**Table 3-1 Definition of Processing Levels**

Level	Definition
1.1	<p>Range compression and single look azimuth compression are performed, and data is output on the slant range coordinate.</p> <p>[In case of Spotlight mode 1, Spotlight mode 2, and Stripmap mode] Level 1.1 data is SLC (Single Look Complex) data. It consists of 32 bit real part and 32 bit imaginary part per one pixel.</p> <p>[In case of ScanSAR mode] Level 1.1 data is SLI (Single Look Intensity) data. It consists of 32 bit real number data per one pixel.</p>
1.5	<p>Multi-look processing, ground range conversion and map projection are performed.</p> <p>Level 1.5 data consists of 16 bit quantized unsigned integer data per one pixel.</p>



### 3.2. Definition of Scene

Scene size is defined by observation width and observation length and is varied by observation mode and off-nadir angle.

Scene size of each observation mode is shown in Table 3-2. Ground Range Scene Size of each Off-nadir angle is shown in Table 3-3.

**Table 3-2 Scene Size**

Observation Mode	Spotlight 1	Spotlight 2	Stripmap	ScanSAR
Ground Range Scene Size *1	10km	10km	12km	50km
Azimuth Scene Size (standard product)	10km	10km	12km	50km
Azimuth Scene Size (long product)*2	–	–	Maximum 52km	Maximum 183.2km

\*1 In the case of off-nadir angle of 35 degrees.

For observation width for each off-nadir angle, refer to Table 3-3.

\*2 The overlap between scenes is about 2 km in Stripmap and about 5.6 km in ScanSAR.

**Table 3-3 Ground Range Scene Size of each Off-nadir angle (1/3)**

Observation Mode	Off-nadir angle [degree]					Ground Range Scene Size [km]
Spotlight 1 Spotlight 2	15.0	less				10.0
	15.0	greater or equal	~	16.0	less or equal	10.0
	16.0	greater	~	17.0	less or equal	10.0
	17.0	greater	~	18.0	less or equal	10.0
	18.0	greater	~	19.0	less or equal	10.0
	19.0	greater	~	20.0	less or equal	10.0
	20.0	greater	~	21.0	less or equal	10.0
	21.0	greater	~	22.0	less or equal	10.0
	22.0	greater	~	23.0	less or equal	10.0
	23.0	greater	~	24.0	less or equal	10.0
	24.0	greater	~	25.0	less or equal	10.0
	25.0	greater	~	26.0	less or equal	10.0
	26.0	greater	~	27.0	less or equal	10.0
	27.0	greater	~	28.0	less or equal	10.0
	28.0	greater	~	29.0	less or equal	10.0
	29.0	greater	~	30.0	less or equal	10.0
	30.0	greater	~	31.0	less or equal	10.0
	31.0	greater	~	32.0	less or equal	10.0
	32.0	greater	~	33.0	less or equal	10.0
	33.0	greater	~	34.0	less or equal	10.0
	34.0	greater	~	35.0	less or equal	10.0
	35.0	greater	~	36.0	less or equal	10.0
	36.0	greater	~	37.0	less or equal	10.0
	37.0	greater	~	38.0	less or equal	10.0
38.0	greater	~	39.0	less or equal	10.0	
39.0	greater	~	40.0	less or equal	10.0	
40.0	greater	~	41.0	less or equal	10.0	
41.0	greater	~	42.0	less or equal	10.0	
42.0	greater	~	43.0	less or equal	10.0	
43.0	greater	~	44.0	less or equal	10.0	
44.0	greater	~	45.0	less or equal	10.0	
45.0	greater				10.0	

**Table 3-3 Ground Range Scene Size of each Off-nadir angle (2/3)**

Observation Mode	Off-nadir angle [degree]					Ground Range Scene Size [km]
Stripmap	15.0	less				10.0
	15.0	greater or equal	~	16.0	less or equal	10.0
	16.0	greater	~	17.0	less or equal	10.0
	17.0	greater	~	18.0	less or equal	10.0
	18.0	greater	~	19.0	less or equal	10.0
	19.0	greater	~	20.0	less or equal	10.0
	20.0	greater	~	21.0	less or equal	10.0
	21.0	greater	~	22.0	less or equal	10.0
	22.0	greater	~	23.0	less or equal	10.0
	23.0	greater	~	24.0	less or equal	12.0
	24.0	greater	~	25.0	less or equal	12.0
	25.0	greater	~	26.0	less or equal	12.0
	26.0	greater	~	27.0	less or equal	12.0
	27.0	greater	~	28.0	less or equal	12.0
	28.0	greater	~	29.0	less or equal	12.0
	29.0	greater	~	30.0	less or equal	12.0
	30.0	greater	~	31.0	less or equal	12.0
	31.0	greater	~	32.0	less or equal	12.0
	32.0	greater	~	33.0	less or equal	12.0
	33.0	greater	~	34.0	less or equal	12.0
	34.0	greater	~	35.0	less or equal	12.0
	35.0	greater	~	36.0	less or equal	12.0
	36.0	greater	~	37.0	less or equal	12.0
	37.0	greater	~	38.0	less or equal	12.0
	38.0	greater	~	39.0	less or equal	12.0
39.0	greater	~	40.0	less or equal	12.0	
40.0	greater	~	41.0	less or equal	12.0	
41.0	greater	~	42.0	less or equal	12.0	
42.0	greater	~	43.0	less or equal	12.0	
43.0	greater	~	44.0	less or equal	12.0	
44.0	greater	~	45.0	less or equal	12.0	
45.0	greater				12.0	

**Table 3-3 Ground Range Scene Size of each Off-nadir angle (3/3)**

Observation Mode	Off-nadir angle [degree]					Ground Range Scene Size [km]
ScanSAR*1	15.0	less				35.0
	15.0	greater or equal	~	16.0	less or equal	35.0
	16.0	greater	~	17.0	less or equal	35.0
	17.0	greater	~	18.0	less or equal	35.0
	18.0	greater	~	19.0	less or equal	35.0
	19.0	greater	~	20.0	less or equal	35.0
	20.0	greater	~	21.0	less or equal	35.0
	21.0	greater	~	22.0	less or equal	35.0
	22.0	greater	~	23.0	less or equal	35.0
	23.0	greater	~	24.0	less or equal	35.0
	24.0	greater	~	25.0	less or equal	35.0
	25.0	greater	~	26.0	less or equal	40.0
	26.0	greater	~	27.0	less or equal	40.0
	27.0	greater	~	28.0	less or equal	40.0
	28.0	greater	~	29.0	less or equal	40.0
	29.0	greater	~	30.0	less or equal	40.0
	30.0	greater	~	31.0	less or equal	40.0
	31.0	greater	~	32.0	less or equal	40.0
	32.0	greater	~	33.0	less or equal	40.0
	33.0	greater	~	34.0	less or equal	40.0
	34.0	greater	~	35.0	less or equal	50.0
	35.0	greater	~	36.0	less or equal	50.0
	36.0	greater	~	37.0	less or equal	50.0
	37.0	greater	~	38.0	less or equal	50.0
	38.0	greater	~	39.0	less or equal	50.0
39.0	greater	~	40.0	less or equal	50.0	
40.0	greater	~	41.0	less or equal	50.0	
41.0	greater	~	42.0	less or equal	50.0	
42.0	greater	~	43.0	less or equal	50.0	
43.0	greater	~	44.0	less or equal	40.0	
44.0	greater	~	45.0	less or equal	40.0	
45.0	greater				40.0	

\*1 In ScanSAR, the image quality may deteriorate in case of 42.0 degree greater or equal.

### 3.3. Format

The relation between corresponding formats of Level 1 product and processing level is shown in Table 3-4.

**Table 3-4 Format of Level 1 Product**

Format	Description	Processing Level	
		1.1	1.5
CEOS	This format is created by Committee on Earth Observation Satellite and it is based on the CCT format. Image information and metadata are divided into multiple files and stored in CEOS. CEOS has two types of format: CEOS-BSQ (Band Sequential) and CEOS-BIL (Band Interleaved by Line). Format of this product is CEOS-BSQ.	O	O
GeoTIFF	This format is based on TIFF 6.0. Image information and geo-referenced information are stored in one file.	O	O
NITF 2.1	This format is based on National Imagery Transmission Format version 2.1. Image information and metadata are stored in one file.	O	O

O: corresponded

### 3.4. Level 1 Product Dataset

Product dataset consists of some components such as product, metadata, browse image, and so on.

The structure of Level 1 product dataset is shown in Table 3-5.

**Table 3-5 Structure of Level 1 Product Dataset**

No.	Data Type	Description	Format
1.	Level 1 product	It is the data which data processing depending on the processing level is performed to the earth observation data obtained through sensor.	CEOS GeoTIFF NITF 2.1
2.	Metadata	Metadata stores the information which explains products.	XML [OGC 06-080r4]
3.	Browse data	It is the image data for displaying products easily.	JPEG
4.	Attached data	Orbit data	Binary
5.		Attitude data	Binary

Level 1 product structure of each processing level are shown in Table 3-6.

The detailed structure of each processing level is described in the following section.

**Table 3-6 Structure of Level 1 Product per Processing**

No.	Processing Level (Level 1.n)	Components of Level 1 Product dataset				
		Level 1 Product	Metadata	Attached data		
				Browse	Orbit	Attitude
1.	Level 1.1	○	○	○	○	○
2.	Level 1.5	○	○	○	○	○

### 3.5. Structure of Level 1 Product Dataset

#### 3.5.1. Level 1.1 Product Dataset

Level 1 product dataset generated in Level 1.1 processing is shown in Table 3-7.

**Table 3-7 Structure of Level 1.1 Product Dataset**

No.	Data	Description	File Format	No. of files
1.	Level 1.1 Product	It is the file storing image data which Level 1.1 processing was performed. It is generated for each product ID.	CEOS GeoTIFF NITF 2.1	4/1 (*1)
2.	Browse image	It is the reduced image of Level 1.1 product	JPEG	1
3.	Level 1.1 metadata	It stores the attached information of Level 1.1 product. It is generated for each product ID.	XML [OGC-06-080r4]	1
4.	Orbit data	It is used when product is generated.	Binary	1
5.	Attitude data	It is used when product is generated.	Binary	1

\*1: In the case of CEOS, there are four files, otherwise there is one file.

### 3.5.1.1. Level 1.1 Product

The specification of Level 1.1 product is shown in Table 3-8.

**Table 3-8 Specification of Level 1.1 Product**

No.	Product Specification	Observation Mode			
		Spotlight 1	Spotlight 2	Stripmap	ScanSAR
1.	File name	Refer to the naming rules of Level 1 product in section 4.			
2.	File format	Choose one of the following formats CEOS GeoTIFF NITF 2.1			
3.	Type of one pixel	Image data of complex number Real part (32 bits real number) + imaginary part (32 bits real number) (IEEE754: binary 32)			Amplitude data 32 bit real number
4.	Pixel Spacing (Rg x Az)	0.5m x 0.64m	0.5m x 0.35m	1.0m x 1.4m	1.0m x 8.0m
5.	Size (No. of pixels x No. of lines)	15000x40000	15000x80000	12000x16000	45000x7500
6.	Image data size	Approximately 1.9GB	Approximately 3.5GB	Approximately 1.0GB	Approximately 1.4GB
7.	Scope on the surface	Approximately 10km x 10km	Approximately 10km x 10km	Approximately 12km x 12km	Approximately 50km x 50km

\*: Since product size differs depending on the observation condition, these sizes described above are the sample as nominal condition.

### A) Resolution

The resolution of Level 1.1 product is shown in Table 3-9.

**Table 3-9 Resolution of Level 1.1 product**

Observation Mode	Spotlight 1	Spotlight 2	Stripmap	ScanSAR
Ground Range Resolution of Level 1.1	1.0m	1.0m	2.0m	16.0m
Azimuth Resolution of Level 1.1	1.0m	1.0m	2.0m	16.0m

\* In the case of off-nadir angle of 35 degrees/ pixel spacing SP: 0.5m, SM: 1.0, SS: 10.0m.



### 3.5.1.2. Browse Image

Browse image is the rescaled image data of Level 1.1 product.  
Its format is shown in Table 3-10.

Relation between the image direction of Level 1.1 data and Level 1.5 and the browse image direction of Level 1.1 and Level 1.5 is shown in Figure 3-1.

**Table 3-10 Format of Level 1.1 Browse Image**

No.	Item	Specification
1	File name	Refer to the naming rules of Level 1 product in section 4.
2	Format	JPEG (not JPEG2000)
3	Data format	Amplitude data
4	Data type	Integer of one byte
5	Size	Pixel direction: 1024 or less Line direction: 1024 or less  Rescale the longer side of either pixel direction or line direction to 1024 pixels or less. Browse image of long product also defines as the same size. Aspect ratio is not changed.

### 3.5.1.3. Level 1.1 Metadata

Level 1.1 metadata stores the information which explains products.

### 3.5.1.4. Orbit Data

Orbit data stores the orbit used when product is generated.

### 3.5.1.5. Attitude Data

Attitude data stores the attitude used when product is generated.

### 3.5.2. Level 1.5 Product Dataset

Level 1.5 product dataset generated in Level 1.5 processing is shown in Table 3-11

**Table 3-11 Structure of Level 1.5 Product Dataset**

No.	Data	Description	File Format	No. of files
1.	Level 1.5 Product	It is the file storing image data which Level 1.5 processing was performed. It is generated for each product ID.	CEOS GeoTIFF NITF 2.1	4/1 (*1)
2.	Browse image	It is the reduced image of Level 1.5 product	JPEG	1
3.	Level 1.5 metadata	It is the file which stores the attached information of Level 1.5 product. It is generated for each product ID.	XML [OGC-06-080r4]	1
4.	Orbit data	It is the orbit data used when product is generated.	Binary	1
5.	Attitude data	It is the attitude data used when product is generated.	Binary	1

\*1: In the case of CEOS, there are four files, otherwise there is one file.

**3.5.2.1. Level 1.5 Product**

The specification of Level 1.5 product is shown in Table 3-12.

**Table 3-12 Specification of Level 1.5 Product**

No.	Product Specification	Observation Mode			
		Spotlight 1	Spotlight 2	Stripmap	ScanSAR
1.	File name	Refer to the naming rules of Level 1 product in section 4.			
2.	File format	Choose one of the following formats CEOS GeoTIFF NITF 2.1			
3.	Type of one pixel	Amplitude data 16 bits unsigned integer			
4.	Pixel Spacing (Rg x Az)	Pixel spacing is selectable based on the observation mode. Correspondence between observation mode and pixel spacing is shown in Table 3-14.			
5.	Size (No. of pixels x No. of lines)	Refer to 3.5.2.1 B).			
6.	Image data size	Refer to 3.5.2.1 B).			
7.	Scope on the surface	Approximately 10km x 10km	Approximately 10km x 10km	Approximately 12km x 12km	Approximately 50km x 50km
8.	Geodetic type	Choose one of the following types. WGS84 GRS80/ITRF97			
9.	Map projection	Choose one of the following projections. Universal Transverse Mercator (UTM) Polar Stereo (PS) Mercator (MER)			
10.	Resampling	Choose one of the following resampling. NN (Nearest Neighbor) CC (Cubic Convolution) BL (Bi-linear) CS (Cubic Spline)			
11.	Framing	Choose one of the following framing Geo-reference Geo-coded			

**A) Resolution**

The resolution of Level 1.5 product is shown in Table 3-13.

The pixel spacing, resolution, number of Looks is shown in Table 3-14.

The ground range resolution of each off-nadir angle is shown in Table 3-15.

Figure 3-1 and Figure 3-2 shows graph of the ground range resolution of each off-nadir angle.

**Table 3-13 Resolution of Level 1.5 product**

Observation Mode	Spotlight 1	Spotlight 2	Stripmap	ScanSAR
Ground Range Resolution of Level 1.5	1.0m	1.0m	2.0m	16.0m
Azimuth Resolution of Level 1.5	1.0m	1.0m	2.0m	16.0m

\* In the case of off-nadir angle of 35 degrees/ pixel spacing SP: 0.5m, SM: 1.0, SS: 10.0m.

**Table 3-14 Pixel Spacing, Resolution, Number of Looks (L1.5)**

Observation Mode	Pixel Spacing (meter)	Resolution (Az x Rg)	No. of Looks (Az x Rg)
SP1	0.5	1m x 1m	1 x 1
	1.0	2m x 2m	2 x 2
	2.0	4m x 4m	4 x 4
SP2	0.5	1m x 1m	2 x 1
	1.0	2m x 2m	4 x 2
	2.0	4m x 4m	8 x 4
SM	1.0	2m x 2m	1 x 1
	2.0	4m x 4m	2 x 2
	4.0	8m x 8m	4 x 4
SS	10.0	16m x 16m	1 x 1
	20.0	32m x 32m	2 x 2

\* In the case of off-nadir angle of 35 degrees.

**Table 3-15 Ground Range Resolution of each Off-nadir angle (1/3)**

Observation Mode	Off-nadir angle [degree]					Ground Range Resolution [m]
Spotlight 1 Spotlight 2	15.0	less				-
	15.0	greater or equal	~	16.0	less or equal	2.2
	16.0	greater	~	17.0	less or equal	2.1
	17.0	greater	~	18.0	less or equal	1.9
	18.0	greater	~	19.0	less or equal	1.8
	19.0	greater	~	20.0	less or equal	1.7
	20.0	greater	~	21.0	less or equal	1.7
	21.0	greater	~	22.0	less or equal	1.6
	22.0	greater	~	23.0	less or equal	1.5
	23.0	greater	~	24.0	less or equal	1.5
	24.0	greater	~	25.0	less or equal	1.4
	25.0	greater	~	26.0	less or equal	1.3
	26.0	greater	~	27.0	less or equal	1.3
	27.0	greater	~	28.0	less or equal	1.2
	28.0	greater	~	29.0	less or equal	1.2
	29.0	greater	~	30.0	less or equal	1.2
	30.0	greater	~	31.0	less or equal	1.1
	31.0	greater	~	32.0	less or equal	1.1
	32.0	greater	~	33.0	less or equal	1.1
	33.0	greater	~	34.0	less or equal	1.0
	34.0	greater	~	35.0	less or equal	1.0
	35.0	greater	~	36.0	less or equal	1.0
	36.0	greater	~	37.0	less or equal	1.0
	37.0	greater	~	38.0	less or equal	0.9
38.0	greater	~	39.0	less or equal	0.9	
39.0	greater	~	40.0	less or equal	0.9	
40.0	greater	~	41.0	less or equal	0.9	
41.0	greater	~	42.0	less or equal	0.9	
42.0	greater	~	43.0	less or equal	0.8	
43.0	greater	~	44.0	less or equal	0.8	
44.0	greater	~	45.0	less or equal	0.8	
45.0	greater				-	

\* In the case of pixel spacing SP1,SP2: 0.5m.

**Table 3-15 Ground Range Resolution of each Off-nadir angle (2/3)**

Observation Mode	Off-nadir angle [degree]					Ground Range Resolution [m]
Stripmap	15.0	less				-
	15.0	greater or equal	~	16.0	less or equal	4.4
	16.0	greater	~	17.0	less or equal	4.1
	17.0	greater	~	18.0	less or equal	3.9
	18.0	greater	~	19.0	less or equal	3.7
	19.0	greater	~	20.0	less or equal	3.5
	20.0	greater	~	21.0	less or equal	3.3
	21.0	greater	~	22.0	less or equal	3.2
	22.0	greater	~	23.0	less or equal	3.0
	23.0	greater	~	24.0	less or equal	2.9
	24.0	greater	~	25.0	less or equal	2.8
	25.0	greater	~	26.0	less or equal	2.7
	26.0	greater	~	27.0	less or equal	2.6
	27.0	greater	~	28.0	less or equal	2.5
	28.0	greater	~	29.0	less or equal	2.4
	29.0	greater	~	30.0	less or equal	2.3
	30.0	greater	~	31.0	less or equal	2.3
	31.0	greater	~	32.0	less or equal	2.2
	32.0	greater	~	33.0	less or equal	2.1
	33.0	greater	~	34.0	less or equal	2.1
	34.0	greater	~	35.0	less or equal	2.0
	35.0	greater	~	36.0	less or equal	2.0
	36.0	greater	~	37.0	less or equal	1.9
	37.0	greater	~	38.0	less or equal	1.9
38.0	greater	~	39.0	less or equal	1.8	
39.0	greater	~	40.0	less or equal	1.8	
40.0	greater	~	41.0	less or equal	1.8	
41.0	greater	~	42.0	less or equal	1.7	
42.0	greater	~	43.0	less or equal	1.7	
43.0	greater	~	44.0	less or equal	1.7	
44.0	greater	~	45.0	less or equal	1.6	
45.0	greater				-	

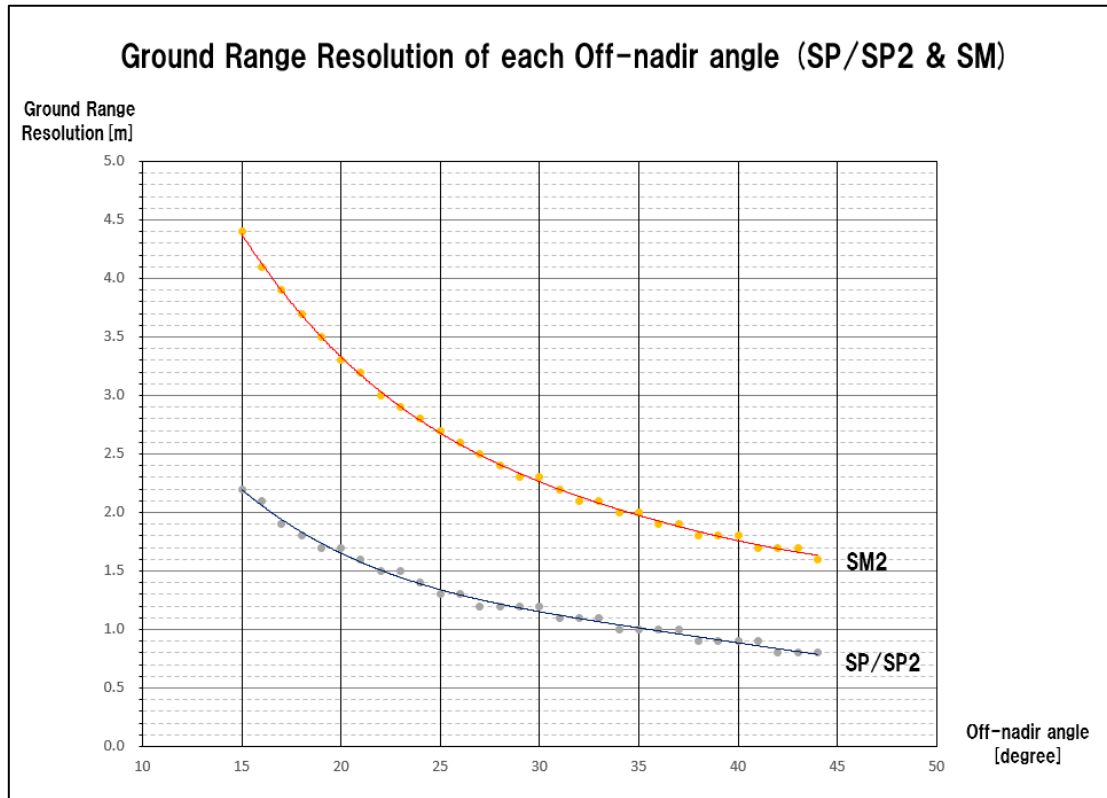
\* In the case of SM: 1.0m.

**Table 3-15 Ground Range Resolution of each Off-nadir angle (3/3)**

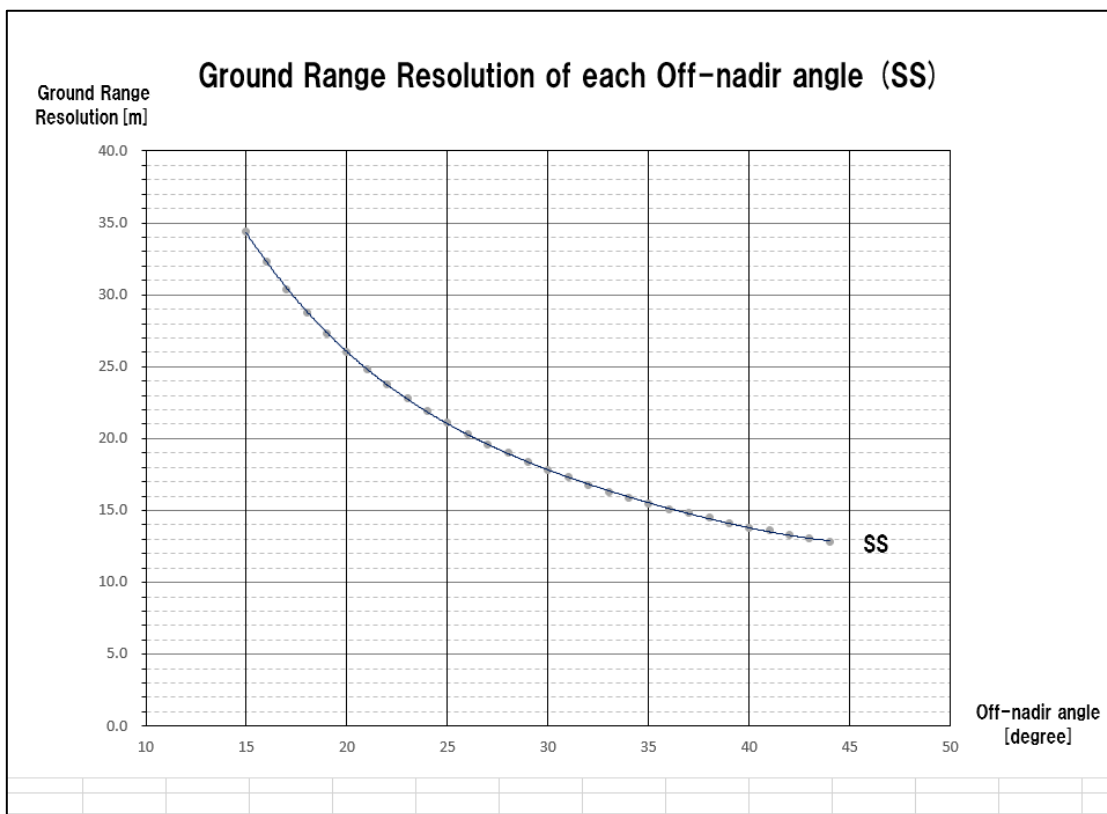
Observation Mode	Off-nadir angle [degree]					Ground Range Resolution [m]
ScanSAR	15.0	less				-
	15.0	greater or equal	~	16.0	less or equal	34.4
	16.0	greater	~	17.0	less or equal	32.3
	17.0	greater	~	18.0	less or equal	30.4
	18.0	greater	~	19.0	less or equal	28.8
	19.0	greater	~	20.0	less or equal	27.3
	20.0	greater	~	21.0	less or equal	26.0
	21.0	greater	~	22.0	less or equal	24.8
	22.0	greater	~	23.0	less or equal	23.8
	23.0	greater	~	24.0	less or equal	22.8
	24.0	greater	~	25.0	less or equal	21.9
	25.0	greater	~	26.0	less or equal	21.1
	26.0	greater	~	27.0	less or equal	20.3
	27.0	greater	~	28.0	less or equal	19.6
	28.0	greater	~	29.0	less or equal	19.0
	29.0	greater	~	30.0	less or equal	18.4
	30.0	greater	~	31.0	less or equal	17.8
	31.0	greater	~	32.0	less or equal	17.3
	32.0	greater	~	33.0	less or equal	16.8
	33.0	greater	~	34.0	less or equal	16.3
	34.0	greater	~	35.0	less or equal	15.9
	35.0	greater	~	36.0	less or equal	15.5
	36.0	greater	~	37.0	less or equal	15.1
	37.0	greater	~	38.0	less or equal	14.8
38.0	greater	~	39.0	less or equal	14.5	
39.0	greater	~	40.0	less or equal	14.1	
40.0	greater	~	41.0	less or equal	13.8	
41.0	greater	~	42.0	less or equal	13.6	
42.0	greater	~	43.0	less or equal	13.3	
43.0	greater	~	44.0	less or equal	13.1	
44.0	greater	~	45.0	less or equal	12.8	
45.0	greater				-	

\* In the case of SS: 10.0m.

**Figure 3-1 Ground Range Resolution of each Off-nadir angle (SP/SP2 & SM)**



**Figure 3-2 Ground Range Resolution per Off-nadir angle (SS)**





## **B) Image Data Size**

Estimated value of each product size of Geo-reference and Geo-coded is shown in Table 3-16 and Table 3-17.

Distortion caused by map projection is not considered.

These values in the tables are only for the image size, not including any other information.

In actuality, the size of header information of image format is added to them.

Its size differs depending on formats and the maximum size is approximately 10MB.

**Table 3-16 Level 1.5 Estimated Value of Product Size (Geo-reference)**

No.	Observation Mode	Pixel Spacing [meter]	Number of pixels	Number of lines	Image data size [MB]
1.	Spotlight mode 1	0.5	20000	20000	763.0
2.		1.0	10000	10000	191.0
3.		2.0	5000	5000	47.7
4.	Spotlight mode 2	0.5	20000	20000	763.0
5.		1.0	10000	10000	191.0
6.		2.0	5000	5000	47.7
7.	Stripmap mode	1.0	12000	12000	275.0
8.		2.0	6000	6000	68.7
9.		4.0	3000	3000	17.2
10.	ScanSAR mode	10.0	5000	5000	47.7
11.		20.0	2500	2500	12.0

\*Size of dummy data is included.  
 Distortion caused by map projection is not included.

**Table 3-17 Level 1.5 Estimated Value of Product Size (Geo-coded)**

No.	Observation Mode	Pixel Spacing [meter]	Number of pixels	Number of lines	Image data size [MB]
1.	Spotlight mode 1	0.5	28300	28300	1530.0
2.		1.0	14200	14200	382.0
3.		2.0	7100	7100	95.4
4.	Spotlight mode 2	0.5	28300	28300	1530.0
5.		1.0	14200	14200	382.0
6.		2.0	7100	7100	95.4
7.	Stripmap mode	1.0	17000	17000	550.0
8.		2.0	8490	8490	138.0
9.		4.0	4250	4250	34.4
10.	ScanSAR mode	10.0	7080	7080	95.4
11.		20.0	3540	3540	23.9

\*Size of dummy data is included.  
 Distortion caused by map projection is not included.

**3.5.2.2. Browse Image**

Browse image is the reduced image of Level 1.5 product.

**3.5.2.3. Level 1.5 Metadata**

Level 1.5 metadata stores the information which explains products.

**3.5.2.4. Orbit Data**

Orbit data stores the orbit used when product is generated.

**3.5.2.5. Attitude Data**

Attitude data stores the attitude used when product is generated.

## 4. File Naming Rules of Level 1 Product

Structure of file name in each data composed of Level 1 product dataset is described below.  
 Details of them are shown in Table 4-1.

[GG...G]-AAABBBBBBCCCCC-YYMMDDNNL-DDDEFFFGHIU[file extension]

**Table 4-1 Naming Rules of Level 1 Product (1/2)**

No.	Field	Name	Value, Specification
1.	G...G	Data type	Variable length character string Fixed character string for each data type. For details, refer to Table 4-2.
2.	-	Delimiter	"-" : Hyphen
3.	AAABBBBBB CCCCC- YYMMDD	Scene ID	
4.	AAA	Satellite ID	"AS2"
5.	BBBBBB	Orbit accumulation number	Five digits
6.	CCCCC	Frame number	Five digits
7.	-	Delimiter	"-" : Hyphen
8.	YYMMDD	Observation date	Six digits
9.	NNL	Scene option ID	
10.	NN	Scene shift	"SN" S : sign (-:M, +: P) N : Scene shift value (1 to 5) "_" : No scene shift value Two-underscore Sample) -5: M5 +4: P4
11.	L	Long product identifier	"L" : Long product "_" : Nominal product Underscore
12.	-	Delimiter	"-" : Hyphen
13.	DDDEFFFGHI	Product ID	
14.	DDD	Observation mode	SP_ : Spotlight mode 1 SP2 : Spotlight mode 2 SM_ : Stripmap mode SS_ : ScanSAR mode
15.	E	Observation direction	L : Left looking R : Right looking
16.	FFF	Processing level	1.1 : Level 1.1 1.5 : Level 1.5
17.	G	Processing option	G : Geo-coded R : Geo-Reference "_" : Not specified Underscore

**Table 4-1 Naming Rules of Level 1 Product (2/2)**

No.	Field	Name	Value, Specification
18.	H	Map projection	U : UTM P : PS M : MER “_” : Not specified Underscore
19.	I	Orbit direction	A : Ascending D : Descending
20.	U	Product calibration mode Option ID	“_” : Nominal product (calibrated) Underscore A : Uncalibrated absolute calibration T : Uncalibrated geometric calibration P : Uncalibrated antenna pattern Users can order nominal product only.
21.	[Extension]	Extension	Variable length character string Fixed character string for each data type. For details, refer to Table 4-3.

**Table 4-2 Naming Rules of Level 1 Product (Data Type)**

No.	Data Type	Value of G..G Field (Data Type)		
1.	Level 1 product	CEOS	Volume directory	"VOL"
			SAR Leader	"LED"
			SAR Image	"IMG-XX"
			SAR Trailer	"TRL"
		GeoTIFF	"IMG-XX"	
		NITF	"IMG-XX"	
2.	Metadata	"MET"		
3.	Browse image	"BRO"		
4.	Attached data	Orbit data	"ORB"	
		Attitude data	"POS"	

- \* XX: Polarization information  
 HH: Horizontally polarized wave transmission / Horizontally polarized wave receiving  
 VV: Vertically polarized wave transmission / Vertically polarized wave receiving

**Table 4-3 Naming Rules of Level 1 Product (Extension)**

No.	Data Type	Value of Extension Field
1.	Level 1 product	Fixed character string for each file format CEOS : Omit GeoTIFF : ".tif" NITF : ".ntf"
2.	Metadata	".xml"
3.	Browse image	".jpg"
4.	Attached data	".bin"

## 5. Guarantee range

Guarantee range of the contents of this document is written below.

- It should be noted that, the values in each table refer to nominal operational status, while actual values depend upon satellite configuration or observation condition. Nominal status is written outside of the table.
- We are not responsible for any defect of product due to natural events occurred in space or observation area. There is some possibility of appearing noise, moire, and ghost in product depending on condition of observation area (e.g. radio wave source, high reflection intensity, boundary between land and water surface) or condition of atmosphere (e.g. amount of water vapor).
- We are not responsible for any defect of product due to satellite trouble including defect of sensor.
- Any claim regarding defects in the product must be submitted within 40 days of the date the product was delivered to remedy deficiency or exchange product, after which time we will not accept any complaint.