

ADEN data products description and ordering recommendations

Version 1.7 – 22 September 2005

1. Products supported by ADEN

The definition of ALOS data product formats is provided in Annex A. PIs can order ADEN products processed at level 1 from the 3 ALOS instruments. Ordering of level 0 products is not foreseen by ADEN.

PALSAR:

Orders for PALSAR ADEN products are based on the sensor mode, which may be one of the following:

- FBS: Fine Resolution, single polarisation, 70km swath typically
- FBD: Fine Resolution, dual polarisation, 70km swath typically
- FL: Fine Resolution Direct DownLink mode, single polarisation, 70km swath typically
- SL: ScanSAR, single polarisation, 350km swath typically
- P: Polarimetry mode, 30km swath.

The characteristics of the PALSAR instrument can be seen in detail in Table 1 below.

Reference: <http://www.eorc.jaxa.jp/ALOS/about/palsar.htm>.

Mode	Fine Resolution (FBS/FBD)		Direct Downlink (FL)	ScanSAR (SL)	Polarimetry (P) (Experimental mode) *1
Center Frequency	1270 MHz (L-band)				
Chirp Bandwidth	28MHz	14MHz	14MHz	14MHz, 28MHz	14MHz
Polarization	HH or VV	HH+HV or VV+VH	HH or VV	HH or VV	HH+HV+VH+VV
Incident angle	8 ~ 60 deg.	8 ~ 60 deg.	8 ~ 60 deg.	18 ~ 43 deg.	8 ~ 30 deg.
Range Resolution	7 ~ 44m	14 ~ 88m	14 ~ 88m	100m (multi look)	24 ~ 89m
Observation Swath	40 ~ 70 km	40 ~ 70 km	40 ~ 70 km	250 (3 scans) 300 (4 scans) 350km (5 scans)	20 ~ 65km
Bit Length	5 bits	5 bits	5 bits	5 bits	3 or 5bits
Data rate	240Mbps	240Mbps	120Mbps	120Mbps, 240Mbps	240Mbps
NE sigma zero *2	< -23dB (Swath Width 70km)			< -25dB	< -29dB
	< -25dB (Swath Width 60km)				
S/A *2,*3	> 16dB (Swath Width 70km)			> 21dB	> 19dB
	> 21dB (Swath Width 60km)				
Radiometric accuracy	scene :1dB / orbit :1.5 dB				

Table 1: PALSAR characteristics

Note: PALSAR cannot observe the areas beyond 87.8 deg. north latitude and 75.9 deg. south latitude when the off-nadir angle is 41.5 deg.

*1 Due to power consumption, the operation time will be limited.

*2 Valid for off-nadir angle 34.3 deg. (Fine mode), 34.1 deg. (ScanSAR mode), 21.5 deg. (Polarimetric mode)

*3 S/A level may deteriorate due to engineering changes in PALSAR

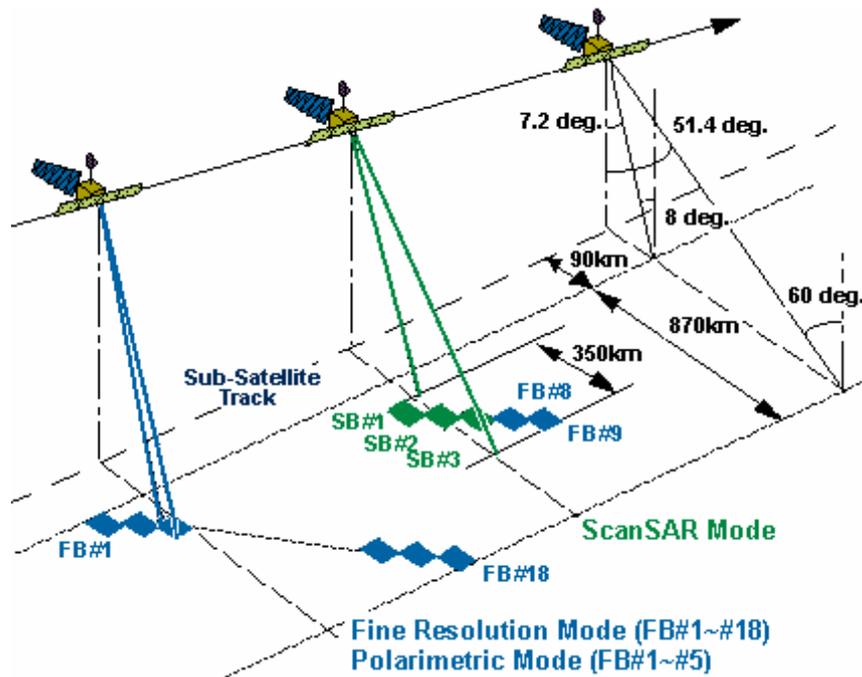


Figure 1: The 132 PALSAR observation modes, resulting from the combination of 18 different off-nadir beams for strip SAR and five observation modes (FBS, FBD, FL, SL, P)

Only a subset of PALSAR modes will be calibrated by JAXA (see section 2). Out of these operational modes calibrated by JAXA, 4 pre-selected default modes are foreseen in the PALSAR basic observation scenario (see table 2)

Pre-selected Default Mode	Polarisation	Pass Designation	Incidence angle (deg)
FBS - Fine Resolution, Single Polarisation Mode (28MHz)	HH	Ascending	41.5
FBD - Fine Resolution, Dual Polarisation Mode (14MHz)	HH&HV	Ascending	41.5
SL - ScanSAR, Burst Mode 1 (14MHz)	HH	Descending	20.1-36.5
P - Polarimetry Mode	HH&HV&VH&VV	Ascending	21.5

Table 2 PALSAR sensor default modes

In addition to the 4 default modes, two more modes (FBS HH at 34.3° and 21.5°) will be used for some limited, local-scale observations in descending mode.

Reference: http://www.eorc.jaxa.jp/ALOS/obs_strat/toppage.htm

For a description of the JAXA basic observation scenario see section 4.

PRISM:

Orders for PRISM ADEN products are based on the sensor view: Nadir, Forward, Backward or Wide. The swath width is 35km in all cases except for the Wide which is 70km. For future acquisitions, the mission planning facility within ADEN is responsible for combining user orders for these views into the PRISM modes OB1, OB2 and OB3 where:

- OB1 – Nadir, Forward and Backward views (Triplet mode)
- OB2 – Wide and Backward view
- OB3 – Wide view only.

A specific across-track pointing angle may be requested in the range +/- 1.5 deg. in the Triplet mode.

AVNIR-2:

Orders for AVNIR-2 ADEN products are based on the nominal observation mode (OBS). A specific across-track pointing angle may be requested in the range +/- 44 deg., however the Nadir view is recommended as explained further.

2. Operational modes calibrated by JAXA

JAXA has identified six operational modes that will be calibrated in priority. It is therefore highly recommended to order products issued from these modes. Within the first year of operations, ESA foresees to distribute only the JAXA calibrated products.

PALSAR:

Synchronized with the ALOS observation scenario, six PALSAR observation modes were selected for calibration by JAXA, all specified in the standard observations. As listed in Table 3, they are FBS of 21.5°, FBS of 34.3°, FBS of 41.5°, FBD of 41.5°, SCANSAR (short burst), and P of 21.5°.

In case of emergency disaster monitoring, all the modes are available.

Mode selection is based on that

- 1) 21.5° off-nadir has higher sensitivity for oil-spill detection, 34.3° has the similarity to the JERS-1 SAR, and 41.5° reduces geometric distortion,
- 2) HH polarization is the mode reference because of high penetration and similarity to JERS-1 SAR,
- 3) HH+HV shows good sensitivity to vegetation structure,
- 4) FULL-pol at 21.5° is the baseline, and
- 5) five-beam SCANSAR Burst Mode 1 (350 Km swath) with direct downlink capability at 120 Mbps.

Mode	Description
1	FBS + 21.5 + HH
2	FBS + 34.4 + HH
3	FBS + 41.5 + HH
4	FBD + 41.5 + HH+HV
5	P + 21.5 + HH+HV+VH+VV
6	SL + 5 scans + HH

Table 3 PALSAR operation modes

Reference: **PALSAR Calibration and Validation -2005 update**, Shimada, Watanabe, Rosenqvist, Tadono IGARSS05, Seoul, Korea

PRISM:

JAXA will calibrate in priority the PRISM Triplet mode with pointing of -1.2 deg. and +1.2 deg.

AVNIR-2:

In the nominal AVNIR-2 observation mode (OBS), JAXA will calibrate in priority the data issued from the following incidence angles (deg): -41.5, -34.3, -21.5, 0, +21.5, +34.3, +41.5 deg.

3. Off-line and Near Real Time data distribution

The ADEN zone covers Europe, Middle East and Africa – see AO main text for more details.

Off-line:

ADEN will systematically receive from JAXA and archive in the ADEN off-line centre(s) all ALOS data acquired over the ADEN zone by JAXA reception means, which are mainly based on the use of the JAXA Data Relay Satellite and the ALOS on-board recorder capability. Such huge amount of data (i.e. in the order of 250GB per day), ingested in off-line, will be made available to ADEN users, in particular to the PIs of the present AO, upon level 1 processing requests. It shall be possible to order data older than typically 2 weeks after sensing, which should satisfy a major part of the data requirements of the Category 1 projects of the present AO.

Near Real Time/short term:

During the operational Phase of ALOS, ADEN intends to set up a Near Real Time capability based on the use of X-band stations located within the ADEN zone, in which acquisition and processing of ALOS data has to cope with the time critical applications, i.e. requiring data in the period from few hours to typically 2 weeks from sensing. The ground segment will be designed so that the delivery of products can be made within few hours from sensing (e.g. 2 hours), depending on the dissemination system still to be selected (satellite based dissemination system, FTP, etc).

Provided the approval of the ESA Programm Board on Earth Observation in November 2005, ESA plans to issue on an open Invitation To Tender to set up the respective stations.

While the acquisition through the JAXA Data Relay Satellite allows an instrument data stream at 240 Mbps and therefore ensures the recovery of data in high-resolution modes, the acquisition by direct transmission to X-band station is limited to 120Mbps and therefore only certain operational modes are possible, as illustrated in the Table 4 below.

Transmission	Real time	Real time	Real time	Real time	Playback
Sensor	PRISM	AVNIR-2	PALSAR	PALSAR	Any
Mode	OB1, OB2, OB3	OBS	FL Direct Downlink	SL ScanSAR Burst Mode 1 (14MHz)	Any
Resolution	2.5 m	10m	20 m	100 m	Any
Swath	35km	70 km	70 km	350 km	Any
Compression	1/9	3/4	None	None	Any
Polarisation	-	-	HH or VV	HH or VV	Any
Data rate	120 Mbps	120 Mbps	120 Mbps	120 Mbps	120 Mbps

Table 4: ALOS instrument modes possible via direct downlink to X-band station

The AVNIR-2 nominal observation mode and the PALSAR ScanSAR mode are the only modes for which simultaneous transmission through the JAXA Data Relay Satellite with direct transmission to X-band station is possible.

The mode “playback” corresponds to the possibility to use the on-board solid-state recorder, i.e. to record at 240 Mbps and read out at 120 Mbps up to 80 sec of data, for transmission to an X-band station (one dump per orbit). The use of this capability will be exceptional and will mainly support disaster monitoring related requests.

ADEN allows users to order Level 1 scenes both in NRT at ADEN stations and in off-line at the off-line processing centre(s). No systematic level 1 production is planned by ADEN, therefore users shall order the level 1 products, either from the archive or in the future when specific programming is required. In the latter case, the orders shall be placed at least 2 weeks before sensing.

Specific recommendations on data ordering, in particular selection of instrument modes for programming requests, type of data to be ordered through X-band stations etc., are provided in section 5.

4. JAXA basic observation scenario

JAXA has defined an ALOS basic observation scenario based on seasonal observations, aiming at properly supporting the mission objectives.

This observation plan:

- covers the 3 years of nominal operations
- has priority over individual user requests, including the ones from the Nodes and in particular the PI requests as part of the present AO.
- will be frozen before Launch.

This systematic observation strategy is explained and detailed at (see “ALOS Systematic Observation Strategy”):

http://www.eorc.jaxa.jp/ALOS/obs_strat/toppage.htm

5. IMPORTANT: recommendations for ADEN data ordering

A major part of the data systematically received in off-line from JAXA will be issued from the ALOS systematic observation scenario elaborated by JAXA (see previous section). If specific payload planning is required by an AO project, PIs are strongly encouraged to align their observation requests with the JAXA observation strategy in order to avoid programming conflicts. As the JAXA basic observation scenario is implemented with higher priority than general user requests, such alignment will result in improved individual request success rates.

JAXA has very precisely described the planned observations for each repeat cycle of the whole mission nominal lifetime for the 3 instruments. Detailed information is available at:

http://www.eorc.jaxa.jp/ALOS/obs_strat/alos_scenario/palsar_asc/palsar_asc.htm

http://www.eorc.jaxa.jp/ALOS/obs_strat/alos_scenario/palsar_desc/palsar_desc.htm

http://www.eorc.jaxa.jp/ALOS/obs_strat/alos_scenario/prism/prism.htm

http://www.eorc.jaxa.jp/ALOS/obs_strat/alos_scenario/avnir-2/avnir-2.htm

Specific guidelines have been prepared by JAXA to support users in formulating programming requests. ESA strongly encourages the PIs to follow these guidelines.

See “User Request Guidelines” at:

http://www.eorc.jaxa.jp/ALOS/obs_strat/palsar_guide.htm

http://www.eorc.jaxa.jp/ALOS/obs_strat/prism_av2_guide.htm

It must be noted that each year, a full repeat cycle of 45 days is left free by the JAXA basic observation scenario (cycles 10, 18, 26) of PALSAR. PIs wishing to order very specific instrument operational modes (the ones that are not included in the JAXA basic observation scenario) are encouraged to place their orders during this specific repeat cycle. In this, PIs should keep in mind the modes that JAXA plans to calibrate in priority, as presented in Section 2.

As far as acquisitions requests through ADEN X-band stations are concerned, out of the possible modes at 120Mbps presented in Table 4, only the AVNIR-2 nominal observation mode, the PALSAR ScanSAR mode and the Direct downlink mode (not calibrated) can be simultaneously transmitted through the JAXA Data Relay Satellite and directly transmitted to an ADEN X-band station. ESA therefore recommends to follow primarily these two calibrated modes for ordering to increase the programming success:

- AVNIR-2 nominal observation mode (in Nadir view, i.e. like in the JAXA basic observation scenario)
- PALSAR ScanSAR mode (5 beams/350km swath, Burst Mode 1, polarization HH, in descending orbits, i.e. like in the JAXA basic observation scenario)

Annex A

Definition of ALOS data products/processing levels

PRISM Level1 Products

LEVEL	DEFINITION	OPTION
1A	Uncompressed, reconstructed digital counts appended with radiometric calibration coefficients and geometric correction coefficients (appended but not applied) Individual files for forward, nadir and backward looking data	
1B1	Radiometrically calibrated data at sensor input	
1B2	Geometrically corrected data Option: <ul style="list-style-type: none">• G: Systematically geo-coded• R: Systematically geo-referenced	Map projection Resampling Image orientation Pixel spacing

AVNIR-2 Level1 Products

LEVEL	DEFINITION	OPTION
1A	Uncompressed, reconstructed digital counts appended with radiometric calibration coefficients and geometric correction coefficients (appended but not applied)	
1B1	Radiometrically calibrated data at sensor input	
1B2	Geometrically corrected data Options: <ul style="list-style-type: none">• G: Systematically geo-coded• R: Systematically geo-referenced• D: correction with coarse DEM (Japan only)	Map projection Resampling Image orientation Pixel spacing

PALSAR Level1 Products

LEVEL	DEFINITION	OPTION
1.0	Reconstructed, unprocessed signal data appended with radiometric and geometric correction coefficients (appended but not applied) In Polarimetry mode, each polarimetry is a separate file. The data in SCAN SAR mode is not divided into individual scans.	
1.1	Complex data on slant range coordinate after range compression and 1 look azimuth compression. The phase history is included. Full resolution	SLC: Single Look Complex Used for interferometry
1.5	After range and multi-look azimuth compression are performed, radiometric and geometric corrections are performed according to the map projection. Pixel spacing can be selected for the Fine mode. Option: <ul style="list-style-type: none"> • G: Systematically Geo-coded • R: Systematically geo-referenced 	Map projection Resampling Image orientation Pixel spacing

Annex B

In the below table in **bold** are the **JAXA calibrated Modes** and products that will be distributed by ADEN during the first year of operations through this AO

PRISM Data products

Product	Mode	Data rate	Incidence angle	Processing level	Product type	Pixel spacing	Scene size
PSM_N PSM_F PSM_B	Nadir	120 Mbps (lossy:1/9) 240 Mbps (lossy:1/4.5)	+1.2 deg/-1.2 deg (across track)	1A	Uncompressed, reconstructed digital counts appended with radiometric calibration coefficients and geometric correction coefficients (appended but not applied)	2,5m	35 km x 35 km
				1B1	Radiometrically calibrated data at sensor input		
	1B2			Geometrically corrected data			
				Option: R = Systematically Geo-referenced G = Systematically geo-coded	variable		
PSM_W = Wide swath	Nadir	240 Mbps	The observation modes other than triplet (OB1) can be requested, but not recommended.	1A	Uncompressed, reconstructed digital counts appended with radiometric calibration coefficients and geometric correction coefficients (appended but not applied)	2,5m	75 km x 35 km
				1B1	Radiometrically calibrated data at sensor input		
				1B2	Geometrically corrected data		
					Option: R = Systematically Geo-referenced G = Systematically geo-coded		70 km x 35 km
-	-	-	-	-	-	-	

AVNIR-2 Data products

Product	Mode	Data rate	Incidence angle	Processing level	Product type	Pixel spacing	Scene size
AV2	Nadir	120 Mbps	Nadir	1A	Uncompressed, reconstructed digital counts appended with radiometric calibration coefficients and geometric correction coefficients (appended but not applied)	10 m	70 km x 70 km (Nadir)
				1B1	Radiometrically calibrated data at sensor input		
				1B2	Geometrically corrected data		
	Options: R = Systematically Geo-referenced G = Systematically geo-coded				variable		
	1A				Uncompressed, reconstructed digital counts appended with radiometric calibration coefficients and geometric correction coefficients (appended but not applied)	10m, 15m, 20m	70 km x 70 km (Nadir)
	1B1			Radiometrically calibrated data at sensor input			
1B2	Geometrically corrected data						
	Options: R = Systematically Geo-referenced G = Systematically geo-coded	variable					
	1A	Uncompressed, reconstructed digital counts appended with radiometric calibration coefficients and geometric correction coefficients (appended but not applied)	-				

PALSAR Data Products

Product	Mode	Polarisation	Available beams/inc. angle	Proc. level	Product type
PSR_FBS	Fine Resolution Mode Single Polarisation	HH <i>(VV not calibrated)</i>	21.5 or 34.3 or 41.5 deg (out of 18 possible beams ranging from 8-60 deg)	1.0	RAW
				1.1	SLC
				1.5	Georeferenced Geocoded
PSR_FBD	Fine Resolution Mode Dual Polarisation	HH&HV <i>(VV&VH not calibrated)</i>	41.5 deg (out of 18 possible beams ranging from 8-60 deg)	1.0	RAW
				1.1	SLC
				1.5	Georeferenced Geocoded
PSR_FL <i>(not calibrated)</i>	Direct downlink	HH or VV	18 possible beams ranging from 8-60 deg	1.0	RAW
				1.1	SLC
				1.5	Georeferenced Geocoded
PSR_SL	ScanSAR Burst mode 1 (14MHz)	HH <i>(VV not calibrated)</i>	5 scans (out of 3 possible scans: 3/4/5)	1.0	RAW
				1.5	Georeferenced Geocoded
PSR_SL <i>(not calibrated)</i>	ScanSAR burst mode 2 (28MHz)	HH or VV	3 possible scans: 3/4/5	1.0	RAW
				1.5	Georeferenced Geocoded
PSR_P	Polarimetry Mode	HH&HV&VV&VH	21.5 deg (out of 12 possible beams ranging from 8-30 deg)	1.0	RAW
				1.1	SLC
				1.5	Georeferenced Geocoded

In bold, the 6 JAXA calibrated PALSAR modes