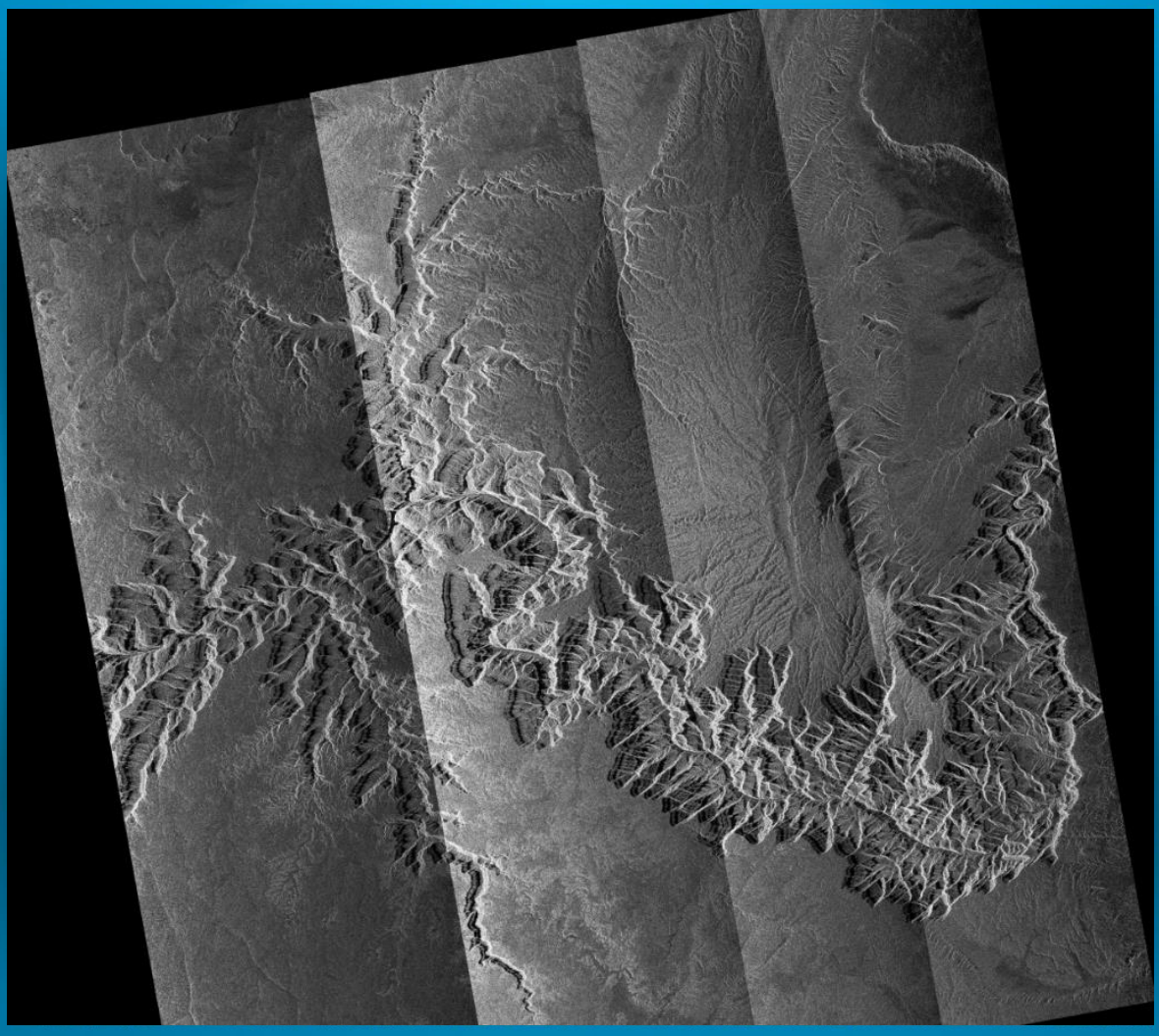

KOMPSAT At Your Service

KOMPSAT-5 Product Attributes

V1.0.1 / 2014.07.01

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KARI SIIS SI Imaging Services

TABLE OF CONTENTS

1. INTRODUCTION

Purpose of this document is to provide the list of attributes to be included in the standard products originated by the KOMPSAT-5 program from data acquired by the SAR satellite.
These products will be generated at Ground Segment level by the KOMPSAT-5 SAR processors.

1.1 Definition & Acronyms

1.1.1 Definitions

The terms whose definition is reported in the following table are used into the present document.

Term	Definition
ACQUIRED DATA FILE	Sequence of Virtual Channel Data Unit (VCDU), synchronized and descrambled but not corrected nor filtered, with CRC still attached.
ACQUISITION CONFIGURATION	Set of specific technical parameters at which the instrument can be configured to perform the sensing. More than one Configuration is allowed within the same instrument mode.
ACQUISITION MODE	One of the basic acquisition modes allowed by the SAR instrument High Resolution Wide Swath Standard
BEAM	An instrument Tx/Rx configuration characterized by homogeneous electronic parameters in terms of signal polarization and observed area. In the case of Wide Swath acquisition, multiple beams are requested to perform the full acquisition. In the case of Standard and High Resolution acquisitions, a single beam is requested to perform the full acquisition.
BURST	An image block of contiguous lines originated by the acquisition with fixed Tx/Rx radar parameters of a continuous swath on the ground. Wide Swath mode is implemented by multiple bursts acquisition. Standard and High Resolution acquisitions are considered as implemented by a single burst (though High Resolution mode foresees the electronic beam re-pointing).
CALIBRATION	Full radiometric compensation on the SAR image oriented to absolutely correct the mis-calibration originated by the SAR acquisition geometry and the radar behaviour. It includes the application of the calibration constant

	It related to the origination of the backscattering product.
EQUALIZATION	Radiometric correction on the SAR image oriented to minimize the mis-calibration (both within scene and across swaths) originated by the SAR acquisition geometry implemented by the application during the data processing of reversible image operators (LUTs). It has not to be confused with the full calibration of the output products that is considered as related to the origination of the backscattering product
FOOTPRINT	The area on ground instantaneously illuminated by a radar pulse having intensity over –3dB
GEC PRODUCT	Synonymous with Level 1C Product
GTC PRODUCT	Synonymous with Level 1D Product
INSTRUMENT CONFIGURATION	See Acquisition Configuration
INSTRUMENT MODE	See Acquisition Mode
LEVEL 0 DATA FILE	One Image Segment formatted as a sequence of Source Packets or VCDU's Data Zones (if the decryption key is not available). It is the data catalogued and archived within KGS and used as input of the processing chain. It is not formatted according to the product distribution specification.
LEVEL 0 PRODUCT	Portion of a Level 0 Data File formatted according to the product distribution specification.
RAW DOWNLINK FILE	Raw bit stream written on disk as output from demodulator (not synchronized).
RAW PRODUCT	Synonymous with Level 0 Product
SCS PRODUCT	Synonymous with Level 1A Product
SUBSWATH	A geographical portion of the on-ground acquired scene, characterized by a fixed instrument look angle. In the case of Wide Swath acquisition the full scene have to be considered as composed by multiple subswaths In the case of Standard and High Resolution acquisitions, the full scene corresponds to a single subswaths (even if including differently polarized layers)

1.1.2 List of Acronyms

The following acronyms and abbreviations are used into the present document.

A	
ACD	Automatic Call Distribution
ACK	Acknowledgement
ACS	Attitude and Control Subsystem

AD	Applicable Document
ADD	Architectural Design Document
ADM	Antenna Deployment Mechanism
AIS	Antenna Interface Simulator
AIT	Assembly Integration & Test
AIV	Assembly Integration & Verification
ANR	Aliased Noise Ratio
ANSI	American National Standards Institute
APM	Antenna Pointing Mechanism
APS	Antenna Power Supply
AR	Ambiguity Ratio
ARP	Antenna Reference Point
AS	Accessibility Swath
ASCII	American Standard Code for Information Interchange
ASIC	Application Specific Integrated Circuits
ASM	Attached Sync Marker
ASSY	Assembly
ATE	Antenna Tests Equipment
ATP	Acceptance Test Plan
AWG	American Wire Gauge
B	
BAQ	Block Adaptive Quantiser
BER	Bit Error Rate
BFN	Beam Forming Network
BITE	Built in Test
BMCD	Basic Commands
BOL	Beginning Of Life
BRF	Bi-directional Reflectance Factor
C	
CADM	Configuration and Data Management
CCA	Communication and Control Area
CCSDS	Consultative Committee for Space Data Systems
CCU	Core Control Unit
CDR	Critical Design Review
CDRL	Contract Documentation Requirements List
CD-ROM	Compact Disk - Read Only Memory
CE	Circular Error
CEOS	Committee on Earth Observation Satellites
CFE	Customer-Furnished Equipment
CFI	Customer Furnished Item
CFRP	Carbon Fibre Reinforced Plastic
CIDL	Configuration Item Data List
CIL	Critical Item List
CMD	Command
CoG	Center of Gravity
COTS	Commercial-off-the-Shelf
CPU	Central Processing Unit
CSA	Chirp Scaling Algorithm
CT&R	Command, Telemetry and Ranging
CTE	Coefficient of Thermal Expansion
CVCDU	Coded Virtual Channel Data Unit
D	
DAC	Digital to Analog Converter
DAM	Data Archive Module
dB	Decibels
dB/K	decibels per degree Kelvin
dBW	decibels above 1 Watt

DC	Direct Current
DDD	Detailed Design Document
DDSW	Data Decryption SW
DEA	Double Ended Analog / Data Encryption Algorithm
DEM	Digital Elevation Model
DES	Data Encryption Standard
DGM	Detected, Ground projected, Multi-looked
DLS	Data-Link Subsystem
DM	Development Model
DN	Digital Number
DNR	Digitization Noise Ratio
DOD	Depth of Discharge
DPC	Data Processing Centre
DQPSK	Differential QPSK
DRB	Delivery Review Boards
DSHA	Data Storage and Handling Assembly
DSM	Detected, Slant Range,Multi-looked
DVCM	Design Verification and Compliance Matrix
E	
ECC	EGSE Control Computer
ECEF	Earth Centred Earth Fixed
ECHW	External Calibration HW
ECL	Emitter Coupled Logic
ECSS	European Cooperation in Space Standardization
ECSW	External Calibration SW
EEE	Electronic, Electrical and Electromechanical
EEPROM	Electrically Erasable Programmable Read-Only Memory
EFE	Electronic Front End
EGSE	Electrical Ground Support Equipment
EIDP	End Item Data Package
EIHS	Equipment Integrated H/W & supports
EIRP	Effective Isotropic Radiated Power
EM	Engineering Model
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
E-O	Electro-Optical
EOL	End Of Life
EPC	Electronic Power Conditioner
EPS	Electronic Power Supply
EQM	Engineering Qualification Model
ERS	EGSE Radio Frequency Simulator
ESA	European Space Agency
ESI	EGSE Standard Instruments
F	
FFT	Fast Fourier Transform
FG	Frequency Generator
FMECA	Failure Modes Effects and Criticalities Analysis
G	
GCP	Ground Control Points
GEC	Geocoded Ellipsoid Corrected
GHz	Gigahertz
GIM	Geocoded Incidence Mask
GIS	Geographic Information System
GMES	Global Monitoring for Environment and Security
GN	Ground Network
GPS	Global Positioning System
GSD	Ground Samples Distance

GSE	Ground Support Equipment
GTC	Geo-coded Terrain Corrected
H	
H/W	Hardware
HCI	Human Computer Interface
HDF	Hierarchical Data Format
HR	High Resolution (SAR mode)
HRM	Hold-down & Release Mechanism
HW	Hardware
I	
I/F	Interface
IC	Integrated Circuit
ICD	Interface Control Document/Drawing
IEEE	Institute of Electrical and Electronics Engineers
IFFT	Inverse Fast Fourier Transform
IOP	Input/Output Processor
IOT	In-Orbit Test
IPU	Instrument Power Unit
IRF	Impulse Response Function
ISF	Image Segment File
ISLR	Integrated Side Lobe Ratio
ITU	International Telecommunication Union
J	
K	
KARI	Korea Aerospace Research Institute
KGS	KOMPSAT Ground Segment
KHz	Kilohertz
KI	Korean Industry
KOMPSAT	Korea Multi-Purpose Satellite
L	
LADM	Large Antenna Deployment Mechanism
LAN	Local Area Network
LEO	Low Earth Orbit
LEOP	Launch and Early Orbit Phase
LET	Linear Energy Transfer
LNA	Low Noise Amplifier
LRA	Linear Radiating Array
LUT	Look-Up Table
M	
MAC	Monitor and Control
MBC	Master Beam Controller
MCC	Mission Control Centre
MCMD	Macrocommand
MCS	Mission Control Segment
MDG	Multi-look Detected Ground
MDM	Mast Deployment Mechanisms
MEM&IO	Memory and Input Output
MGSE	Mechanical Ground Support Equipment
MHz	Megahertz
MIL-STD	Military Standard
MIPS	Million Instructions per Second
MLCC	Multi-Look Cross Correlation
MLFB	Multi Frequency Best Fit
MLI	Multi Layer Insulation
MMSU	Memory Storage Units
MOC	Mission Operations Centre

MOI	Moment of Inertia
MOS	Margin of Safety
MOSFET	Metal Oxide Semiconductor Field Effect Transistor
MPDU	Main Power Distribution Unit
MPS	Mission Planning System
MRB	Material Review Board
MRO	Memory Read Out
MRR	Manufacturing Readiness Review
MTF	Modulation Transfer Function
MTQ	Magnetorquer
MTRC	Motion Through Resolution Cells
N	
NaN	Not a Number
NASA	National Aeronautics and Space Administration
NCR	Non Conformance Report
NESZ	Noise Equivalent Sigma Zero
NFTR	Near Field Test Range
NRZ-M	No Return to Zero Mark
O	
OBC	On Board Computer
OBS	On Board Software
OFB	Output Feedback
OPC	Operation Planning Cell
OQPSK	Offset Quadrature Phase Shift Keying
P	
P/L	Payload
PA	Product Assurance
PBR	Product for Band Reduction
PC	Personal Computer
PCA-PDU	Physical Channel Access Protocol Data Unit
PCB	Printed Circuit Boards
PCM	Pulse Code Modulation
PCU	Power Control Unit
PDHT	Payload Data Handling and Transmission
PDL	Program Design Language
PDR	Preliminary Design Review
PDU	Power Distribution Unit
PFM	Proto Flight Model
PIE	Platform Interface Emulator
PIS	Platform Interface Simulator
PLL	Phase Locked Loop
PLM	Payload Module
PMS	Payload Module Structure
PMTH	Payload Module Thermal Control
POD	Precise Orbit Determination
PPC	Post Processing Computer
PPS	Pulse per Second
PRF	Pulse Repetition Frequency
PRI	Pulse Repetition Interval
PRN	Pseudo Random Noise
PROM	Programmable Read Only Memory
PSD	Power Spectrum Density
PSI	Pounds-Force per Square Inch
PSLR	Peak Side Lobe Ratio
PSR	Pre-Shipment Review
PVT	Position Velocity Time

Q

QDEM	Offset QPSK Demodulator
QNaN	Quit Not a Number (IEEE definition)
QPSK	Quadrature Phase Shift Keying
QST	Quantiser Selection Thresholds

R

RAM	Random Access Memory
RCS	Radar Cross Section
RF	Radio Frequency
RFD	Request for Deviation
RFI	Request for Information
RFM	Rational Function Model
RFP	Request for Proposal
RFR	Radio Frequency Receiver
RFT	Radio Frequency Transmitter
RHCP	Right Hand Circular Polarisation
RMA	Range Migration Algorithm
RMS	Root Mean Square
RPDU	Rack Power Distribution Units
Rx	Reception

S

S/C	Spacecraft
S/L	Satellite
S/S	Subsystem
S/W	Software
SAR	Synthetic Aperture Radar
SARP	SAR Processors
SAS	SAR Antenna Subsystem
SAW	Surface Acoustic Wave
SCS	Single-look Complex Slant
SDHS	Science Data & Handling Subsystem
SDI	Science Data Interface
SDNR	Signal Dependent Noise Ratio
SDR	System Design Review
SDS	SAR Data Simulator
SEB	Single Event Burn-out
SEC	Satellite Control Centre
SEE	Single Event Effect
SEGR	Single Event Gate Rupture
SEL	Single Event Latch
SEU	Single Event Up-set
SFD	Saturated Flux Density
SLC	Single Look Complex
SM	Switch Matrix
SMT	SAR Modelling Tool
SNR	Signal-to-Noise Ratio
SOC	State of Charge
SoW	Statement of Work
SPF	Single Point Failures\
SPS	Sensor Power Supply
SPV	Supervisor
SSBM	Single Side Band Modulator
SSE	Sensor Electronics
SSM	Second Surface Mirror
SSP	Sub Satellite Point
SSS	SAR Sensor Subsystem
ST	Standard (SAR mode)

STS	SAR Transceiver Subsystem
SVM	SerVice Module
SW	Swath Width
SWL	Safe Working Load / Sampling Window Length
SWST	Sampling Window Start Time
T	
T/R	Transmit and Receive
TBC	To Be Confirmed
TBD	To be Determined by mutual agreement between the KOMPSAT-5 and the Contractor for inclusion in the contractual document
TBS	To Be Specified by the Contractor for inclusion in the contractual document
T-DES	Triple DES
THC	Thermal Control
TLC	Telecommand
TLM	Telemetry
TMM	Thermal Mathematical Model
TRB	Test Review Board
TRP	Technical Review Panel
TRR	Test Readiness Review
TSS	Tethered Satellite System
TT&C	Telemetry, Tracking and Command
TTD	True Time Delay
TWT	Travelling Wave Tube
TWTA	Travelling Wave Tube Amplifier
Tx	Transmission
TXA	Transmission Assembly
U	
UFP	Uncertainty Flight Prediction
UOC	User Operations Centre
URD	User Request Desk
UTM	Universal Transverse Mercator
V	
VCDU	Virtual Channel Data Unit
VCID	Virtual Channel Identifier
VHP	Very High Power
VSNR	Video Signal to Noise Ratio
W	
W	West
WAN	Wide Area Network
WBDH	Wideband Data Handler
WGS	World Geodetic System
WIRF	Weighted Impulse Response Function
w.r.t.	With respect to
WS	Wide Swath (SAR mode)
X	
XBAA	X-Band Antenna Assembly
XBFE	X-Band Front End
Y	
Z	

1.2 Document Structure

The present document has the following structure:

- Chapter 1 is an introduction
- Chapter 2 lists the annotations annexed to each type of SAR product.

2. SAR PRODUCTS ATTRIBUTES

The tables in the following sections list, define and specify all attributes included in at least one of the SAR Standard Product. The presence of an attribute in a given product is indicated by the last columns, one for each SAR Product; the following symbols are used depending on the operation to be executed for attribute confirmation:

"a" is used when it is in complete charge of the processor which generates the product, independently on the presence and correctness of the attribute in the input product (e.g. this is the case of some attributes of the "Formatting" class)

"m" means the attribute is modified (i.e. it is present in the input product and the input value is used to determinate the output one)

"x" means the attribute is copied from the input product (i.e. its correctness depends on that one of the input value)

In the symbols usage, the exceptions applicable to some sensor modes or deriving from special algorithmic implementations are not taken into consideration.

As far as the column "HDF5 struct" included into the tables gives the dataset / group where the attribute is annexed (for more details on KOMPSAT-5 HDF5 product structure). In the case more than one location is indicated, in most cases only one of them is available into the product (therefore ambiguities are absent); for exceptions, see the description of the attribute.

Concerning with the "Data Type" field the following semantics have to be considered (the column "Default Invalid Value", represents the value to be given to the attribute – if not differently specified - in the case it is present into the product format but it is not used by processor, or not applicable to the product)

"Data Type"	**Number of bits**	**Sign feature**	**Type Representation**	**Default Invalid Value**
UByte	8	Unsigned		0
UShort	16	Unsigned	Little Endian	0
Short	16	Signed	Little Endian	-(215)
UInt	32	Unsigned	Little Endian	0
Int	32	Signed	Little Endian	-(231)
ULong	64	Unsigned	Little Endian	0
Long	64	Signed	Little Endian	-(263)
Float	32	Signed	Little Endian IEEE	QNaN
Double	64	Signed	Little Endian IEEE	QNaN
String	-	-	-	"N/A"

2.1 Identification

Area	Attribute name	Descriptiotn	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Identification	Acquisition Station ID	Acquisition Station identifier	Root	String			a	x	x	x	x
Identification	Delivery Mode	Identification of the processing mode used to meet the delivery time constraints. It is strictly related to the accuracy level of the support data (in particular of the orbital data) used to originate the product	Root	String	STANDARD		a	x	x	x	x
Identification	Downlink Start UTC	Downlink time of the first line of the Level 0 file used as input to generate the product	Root	String		Epoch	a	x	x	x	x
Identification	Downlink Stop UTC	Downlink time of the last line of the Level 0 file used as input to generate the product	Root	String		Epoch	a	x	x	x	x
Identification	Mission ID	Mission identifier	Root	String	KMPS		a	x	x	x	x
Identification	Processing Centre	Identifier of the processing centre which generated the core preocessing step of the current product	Root	String			a	a	a	a	a
Identification	Product Filename	Product file name according to the standard convention fixed in the Product Specification Document	Root	String			a	a	a	a	a
Identification	Product Specification Document	Code of the Specification Document (including Version and Issue) where the product content and format are detailed	Root	String	SPE/KMPS/0008/AASI		a	a	a	a	a

Area	Attribute name	Descriptiotn	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Identification	Product Type	Indication of the product type. Enumerated value without suffix are for internal use only.	Root	String	RAW_B SCS_B SCS_U DSM_U DSM_E DGM_B GEC_B GTC_B		a	a	a	a	a
Identification	Satellite ID	Satellite Identifier	Root	String	KMPS5		a	x	x	x	x

Table 2-1 –Attributes of HDF5 SAR Products, Identification Area

2.2 Formatting

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Formatting	Analog Signal Reconstruction Levels	Look Up Table to be used for reconstruction of the analogue signal level from the quantized levels included into the RAW product. Equal to QNaN for unused levels	Root	Double(256)		mV	a				
Formatting	Analog Cal Reconstruction Levels	Look Up Table to be used for reconstruction of the analogue calibration level from the quantized levels included into the RAW product. Equal to QNaN for unused levels	Root	Double(256)		mV	a				
Formatting	Analog Noise Reconstruction Levels	Look Up Table to be used for reconstruction of the analogue noise level from the quantized levels included into the RAW product. Equal to QNaN for unused levels	Root	Double(256)		mV	a				
Formatting	Bits per Sample	Number of bit per image sample	Root	UByte	8 16 32 64		a	a	a	a	a
Formatting	Columns Order	Order of columns in the formatted product.	Root	String	WEST-EAST NEAR-FAR		a	a	a	a	a
Formatting	Equivalent Column Time Interval	Equivalent time spacing in the range direction between columns	S<mm>	Double		s	a				
Formatting	Equivalent First Column Time	Equivalent time of the first column of the data in seconds. If set to QNaN it indicates that the compensation of SWST change has not been performed and the attribute "Range First Times" must be considered. In the case of burst mode data, it is set to the minimum of the equivalent times of the bursts included into the subswath	S<mm>	Double		s	a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Formatting	Equivalent First Line Time	Equivalent time of the first line of the data in seconds since the annotated reference UTC. In the case of burst mode data, it is set to the equivalent time of the first burst included into the subswath	S<mm>	Double		s	a				
Formatting	Equivalent Line Time Interval	Equivalent time spacing in the azimuth direction between lines	S<mm>	Double		s	a				
Formatting	Image Layers	Number of Image Layers	Root	UByte	1		a	x	x	x	x
Formatting	Image Scale	Scale used for image representation	Root	String	LINEAR POWER DB		a	a	a	a	a
Formatting	Layover Pixel Value	Value used for representation of pixels in layover geometry	GIM	Short	9999						a
Formatting	Lines Order	Order of lines in the formatted product.	Root	String	NORTH-SOUTH EARLY-LATE		a	a	a	a	a
Formatting	Quick Look Columns Order	Order of columns in the quick look layer. For quick look annexed to Level 0 product, it is conditioned by the consideration about geometric representation of the Quick Look product aiming to simplify the image intepretation. For other products, it inherits the order of the full resolution layer.	QLK	String	WEST-EAST NEAR-FAR		a	a	a	a	a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Formatting	Quick Look Lines Order	Order of lines in the quick look layer. For quick look annexed to Level 0 product, it is conditioned by the consideration about geometric representation of the Quick Look product aiming to simplify the image intepretation. For other products, it inherits the order of the full resolution layer.	QLK	String	NORTH-SOUTH EARLY-LATE		a	a	a	a	a
Formatting	Quick Look Scale	Scale used for quick look representation	QLK	String	LINEAR DB				a		
Formatting	Sample Format	Sample data type	Root	String	INT UINT FLOAT		a	a	a	a	a
Formatting	Samples per Pixel	Number of samples per pixels	Root	UByte	2 for complex data 1 otherwise		a	a	a	a	a
Formatting	Shadowing Pixel Value	Value used for representation of pixels in shadowing geometry	GIM	Short	-9999						a
Formatting	Signal Reconstruction Levels Segments	Number of analog signal recosntruction levels	Root	Short(4)			a				
Formatting	Zero Doppler Azimuth First Time	Time of the first line of the zero doppler focused block in seconds since the annotated reference UTC	SBI MBI	Double		s		a	m	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Formatting	Zero Doppler Azimuth Last Time	Time of the last line of the zero doppler focused block in seconds since the annotated reference UTC	SBI MBI	Double		s		a	m	x	x
Formatting	Zero Doppler Range First Time	Time of the first image column of the segment, including near and far zero padding effects due to SWST readjustment, multilooking, zero-doppler processing, …	SBI MBI	Double		s		a	m	x	x
Formatting	Zero Doppler Range Last Time	Time of the last image column of the segment, including near and far zero padding effects due to SWST readjustment, transients removal, multilooking, zero-doppler processing, …	SBI MBI	Double		s		a	m	x	x

Table 2-2 –Attributes of HDF5 SAR Products, Formatting Area

2.3 Acquisition

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Acquisition	Final On Board Time	Value of the on-board time (derived from the on-board counter annotated in the Level 0 data) corresponding to the last line of the Level 0 file used as input. It is not referred to the Reference UTC attribute, but to the last time the on board counter was zeroed.	B<nnn>	Double		s	a	x	x	x	x
Acquisition	Initial On Board Time	Value of the on-board time (derived from the on-board counter annotated in the Level 0 data) corresponding to the first line of the Level 0 file used as input. It is not referred to the Reference UTC attribute, but to the last time the on board counter was zeroed.	B<nnn>	Double		s	a	x	x	x	x
Acquisition	Leap Sign	Sign of the occurrence of the leap second (if occurred during the scene acquisition)	Root	Short	+1 if positive -1 if negative 0 if not used		a	x	x	x	x
Acquisition	Leap UTC	UTC time of the occurence of the leap second (if occurred during the scene acquisition); equal to "NULL" if no leap second occurred	Root	String	UTC Epoch "NULL"	Epoch	a	x	x	x	x
Acquisition	Orbit Number	Orbit Number relevant to the Scene Start Time. Set to zero if not available.	Root	UInt			a	x	x	x	x
Acquisition	Programmed Image ID	Image ID as it was programmed by Ground Segment and downlinked in the packet header	Root	UShort	[0, 65535]		a	x	x	x	x
Acquisition	Scene Sensing Start UTC	Initial acquisition time of the scene in UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	String		Epoch	a	m	m	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Acquisition	Scene Sensing Stop UTC	Final acquisition time of the scene in UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	String		Epoch	a	m	m	x	x
Acquisition	Selective Availability Status	Status of the Selective Availability during the acquisition, affecting Orbital Data derived by GPS Instrument	Root	String	ON OFF		a	x	x	x	x

Table 2-3 –Attributes of HDF5 SAR Products, Acquisition Area

2.4 Instrument

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Acquisition Mode	Instrument mode enabled during acquisition	Root	String	STANDARD WIDE SWATH HIGH RESOLUTION		a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Antenna Beam Code	Code of the antenna beam as it is reported in the Level 0 data.	S<mm>	Ubyte	[1, 150]		a	x	x	x	x
Instrument	Antenna Beam Elevation	Nominal elevation angle associated to the antenna beam. It represent the signed (positive sign means the beam moving to the left) offset of the nominal main lobe w.r.t. the mechanical perpendicular to the antenna, measured in the elevation plane. It is derived from a configuration table. Such angle, in conjuction with the additional elevation and azimuth steering, is used to derive the antenna electrical pointing	S<mm>	Double	[-20, 20]	deg	a	x	x	x	x
Instrument	Antenna Length	Antenna length in the azimuth direction	Root	Double		m	a	x	x	x	x
Instrument	Azimuth Beamwidth	Antenna azimuth beam width	Root	Double		deg	a	x	x	x	x
Instrument	Azimuth First Time	Initial acquisition time of the burst in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	B<nnn>	Double		s	a	m	m	x	x
Instrument	Azimuth Instrument Geometric Resolution	Theoretical azimuth geometric resolution of the data as derived from the radar parameters (that is not considering weighting and multilooking effects)	S<mm>	Double		m		a	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Azimuth Last Time	Final acquisition time of the portion of the burst in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	B<nnn>	Double		s	a	m	m	x	x
Instrument	Azimuth Ramp Code	Code of the azimuth scanning ramp as it is reported in the Level 0 data. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UByte(N13)	[1, 150]		a	x	x	x	x
Instrument	Azimuth Ramp Code Change Lines	Image Rows indexes at which the azimuth scanning ramp has been changed (within data segment) w.r.t. the corresponding values of the previous line. Line 0 is always considered as a changing line. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UInt(N13)			a	x	x	x	x
Instrument	Azimuth Steering	Array of the Azimuth angles of the antenna beam set at the Azimuth Ramp Code Change Lines. While for the Wide Swath and Standard case such value should be constant within the strip/burst, in the High Resolution case the array including the azimuth direction of the antenna beam due to the repointing implied by the instrument mode should be given. The array dimension corresponds to the number of occurrences of angle's changes.	B<nnn>	Double(N13)	[-2, 2]	deg	a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Beam ID	Identifier of the beam which contributes to the full swath	S<mm>	String	ST-01…ST-19 HR-01....HR-31 WS-01...WS-19		a	x	x	x	x
Instrument	Beam Off-Nadir Angle	Angle between the main lobe of the antenna beam and the geodetic nadir, measured in acquisition geometry. It can be used for a coarse approach to the antenna pattern compensation.	S<mm>	Double	[15, 55]	deg	a	x	x	x	x
Instrument	Bursts per Subswath	Bursts per Subswath. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	S<mm>	UShort			a	m	m	x	x
Instrument	Calibration Pulse Azimuth Times	Slow times of the Calibration Pulses in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product	CAL	Double(N8)		s	a				
Instrument	Calibration Sampling Window Length	Sampling Window Lengths of the Periodic Calibration Data (in number of range samples) during the acquisition of the subswath.	S<mm>	UShort			a				
Instrument	Dechirping Pulse Length	Dechirping Pulse Length in HR mode. Set to 0 in WS and ST mode.	S<mm>	Double		s	a	x	x	x	x
Instrument	Echo Sampling Window Length	Sampling Window Lengths (in number of range samples) during the acquisition of the subswath.	S<mm>	UShort			a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Elevation Ramp Code	Code of the elevation scanning ramp as it is reported in the Level 0 data. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UByte(N17)	[1, 150]		a	x	x	x	x
Instrument	Elevation Ramp Code Change Lines	Image Rows indexes at which the elevation scanning ramp has been changed (within data segment) w.r.t. the corresponding values of the previous line. Line 0 is always considered as a changing line. The array dimension corresponds to the number of occurrences of code's changes.	B<nnn>	UInt(N17)			a	x	x	x	x
Instrument	Elevation Steering	Array of the signed (positive sign means the main lobe moves to the left) additional Elevation angles of the antenna beam, as it is set at the Elevation Ramp Code Change Lines. Such angle, in conjuction with the nominal antenna beam elevation, gives the total elevation angle The array dimension corresponds to the number of occurrences of angle's changes.	B<nnn>	Double(N17)	[-20, 20]	deg	a	x	x	x	x
Instrument	Ground Range Instrument Geometric Resolution	Theoretical ground range geometric resolution in the worst case (that is at near range), as derived from the radar parameters (that is not considering weighting and multilooking effects)	S<mm>	Double		m		a	x	x	x
Instrument	Image Cycle Length		Root	UInt	[0, 2048]		a	x	x	x	x
Instrument	Image Cycles	Number of Image Cycles of the acquisition	Root	UInt			a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Lines per Burst	Lines per burst	S<mm>	UInt			a	x	x	x	x
Instrument	Look Side	Antenna direction	Root	String	RIGHT LEFT		a	x	x	x	x
Instrument	Multi-Beam ID	Identifier of the beams combinated to form the full swath	Root	String	ST-01…ST-19 HR-01....HR-31 WD-01...WD-05		a	x	x	x	x
Instrument	Noise Data Azimuth Times	Slow times of the Noise data in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product. The attribute is not present in HR mode dataset S01/NOISE since there are no noise acquisitions within the acquisition sequence.	NOISE	Double(N11)		s	a				
Instrument	Noise Sampling Window Length	Sampling Window Lengths of the Noise Data (in number of range samples) during the acquisition of the subswath.	S<mm>	UShort			a				
Instrument	Original Bit Quantisation	Number of quantization bits of each channel of the RAW signal at origin (i.e. before the adaptive quantisation removal)	Root	UByte	1 2 3 4 8		a	x	x	x	x
Instrument	Pass Band IF Filter	Bandwidth of the IF filter in Hz	S<mm>	Double	40MHz 80MHz 120MHz		a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Polarisation	Transmit/Receive polarisation enabled during data sensing. H = Horizontal V = Vertical	S<mm>	String	HH VV VH HV		a	x	x	x	x
Instrument	PRF	Pulse Repetition Frequency of the instrument during the scene acquisition	S<mm>	Double		Hz	a	m	x	x	x
Instrument	Radar Frequency	Radar frequency	Root	Double	9650 * 10^6	Hz	a	x	x	x	x
Instrument	Radar Wavelength	Radar wavelength	Root	Double		m	a	x	x	x	x
Instrument	Range Chirp Length	Range chirp length	S<mm>	Double	[3e-6, 100e-6]	s	a	m	x	x	x
Instrument	Range Chirp Rate	Rate of the transmitted pulse	S<mm>	Double		Hz/s	a	m	x	x	x
Instrument	Range Chirp Samples	Number of chirp samples, as derived from Range Chirp Length and Sampling Frequency	S<mm>	UShort			a	x	x	x	x
Instrument	Range First Time Change Lines	Image Rows indexes (starting from 0) at which the Sampling Window Start Time has been changed (within burst) w.r.t. the corresponding values of the previous line. Line 0 of the burst is always considered as a changing line.	B<nnn>	UInt(N7)			a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Range First Times	List of times between the rising edge of the transmit pulse and the rising edge of the receiving window opened to sample the echo of the same pulse, relevant to lines included in "Range First Time Change Lines". It differs from the value of the Sampling Window Start Time annotated into the downlinked data, as it take into account the time between the rising edge of the transmit pulse and the rising edge of the sampling window within the same PRI.	B<nnn>	Double(N7)		s	a	x	x	x	x
Instrument	Rank	In flight pulses	S<mm>	UByte			a	x	x	x	x
Instrument	Receiver Gain	The receiver attenuation settings used during the acquisition (see also Receiver Gain Change Lines)	B<nnn>	UByte(N15)	[0, 30]	dB	a	x	x	x	x
Instrument	Receiver Gain Change Lines	Image Rows indexes at which the Receiver Gain has been changed (within burst) w.r.t. the corresponding values of the previous line. Line 0 is always considered as a changing line. The array dimension corresponds to the number of occurrences of changes.	B<nnn>	UInt(N15)			a	x	x	x	x
Instrument	Reference Dechirping Time	Offset w.r.t. the range first time, of the reference time (null frequency time) of dechirping signal (used only for the High Resolution case, set to QNaN otherwise). As default, it corresponds to the range central time.	S<mm>	Double		s	a	x	x	x	x
Instrument	Replica Azimuth Times	Slow times of the reconstructed replica in seconds since the annotated reference UTC, derived from the OBT extracted from the downlinked product	REPLICA	Double(N8)		s	a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Instrument	Sampling Rate	Range Sampling rate of the instrument during the scene acquisition	S<mm>	Double		Hz	a	m	x	x	x
Instrument	Subswaths Number	Number of subswaths included in scene	Root	UByte	1 (ST/HR) 4 (WS)		a	x	x	x	x
Instrument	Swath Cycle Length	Swath Cycle Length	S<mm>	UInt			a	x	x	x	x
Instrument	Synthetic Aperture Duration	Duration of the synthetic aperture at the central slant range	S<mm>	Double		s	a	x	x	x	x

Table 2-4 –Attributes of HDF5 SAR Products, Instrument Area

2.5 Specification

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Specification	Geometric Conformity	Performance guaranteed for Geometric Conformity in order to be compliant with the product specifications	Root	Double					a	a	a
Specification	Ground Range Geometric Resolution	Performance guaranteed for Ground Range geometric resolution 1 look @45° incidence angle in order to be compliant with the product specifications	Root	Double		m			a	x	x
Specification	Azimuth Geometric Resolution	Performance guaranteed for Azimuth geometric resolution (1 look) in order to be compliant with the product specifications.	Root	Double		m			a	x	x
Specification	Phase Continuity	Performance guaranteed for Phase Continuity in each operation mode	Root	String	YES NO			a			
Specification	Doppler Centroid Accuracy	Performance guaranteed for Doppler Centroid estimation accuracy in order to be compliant with the product specifications	Root	Int	5	Hz	a				
Specification	Doppler Rate Accuracy	Performance guaranteed for Doppler Rate estimation accuracy in order to be compliant with the product specifications	Root	Int	0.2	Hz/s	a				
Specification	Ground Range Swath width	Performance guaranteed for Ground Range Swath width in order to be compliant with the product specifications	Root	Double		km			a	x	x

Table 2-5 –Attributes of HDF5 SAR Products, Specification Area

2.6 Platform

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Platform	Attitude Quaternions	Array of quaternions representing the satellite attituded associated to the annotated times. They are stored in notation (q1, q2, q3, q4) where q1 represents the so-called "real" part and (q2, q3, q4), is the so-called "imaginary" part of the quaternion	Root	Double(N12, 4)			a	x	x	x	x
Platform	Attitude Times	Array of times (in seconds since the annotated reference UTC) at which the satellite attitude is supplied	Root	Double(N12)		s	a	x	x	x	x
Platform	ECEF Satellite Position	Satellite Position in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)		m	a	x	x	x	x
Platform	ECEF Satellite Velocity	Satellite Velocity in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)		m/s	a	x	x	x	x
Platform	ECEF Satellite Acceleration	Satellite Acceleration in Earth Centred - Earth Fixed Cartesian coordinate system, corresponding to the annotated times	Root	Double(N6, 3)		m/s^2	a	x	x	x	x
Platform	Number of State Vectors	Number of annotated state vectors (N6).	Root	UShort			a	x	x	x	x
Platform	Number of Attitude data	Number of attitude samples (N12)	Root	UShort			a	x	x	x	x
Platform	Orbit Direction	Ascending or descending orbit designator, as it is derived from the third component of the ECEF satellite velocity at scene centre time	Root	String	ASCENDING DESCENDING		a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Platform	Pitch Angle	Satellite Pitch angle rotation wrt geodetic quaternion from the ATT auxiliary input file	Root	Double(N12)	[-180, 179.999999]		a	x	x	x	x
Platform	Pitch Rate	Satellite Pitch angular rate corresponding to the annotated times.	Root	Double(N12)	[-180, 179.999999]	deg/s	a	x	x	x	x
Platform	Roll Angle	Satellite Roll angle rotation wrt geodetic quaternion from the ATT auxiliary input file	Root	Double(N12)	[-180, 179.999999]		a	x	x	x	x
Platform	Roll Rate	Satellite Roll angular rate corresponding to the annotated times.	Root	Double(N12)	[-180, 179.999999]	deg/s	a	x	x	x	x
Platform	Satellite Height	Satellite ellipsoidal height measured at the image central azimuth time	Root	Double		m	a	x	x	x	x
Platform	State Vectors Times	Array of times (in seconds since the annotated reference UTC) at which the satellite state vectors (Position, Velocity) are supplied	Root	Double(N6)		s	a	x	x	x	x
Platform	Yaw Angle	Satellite Yaw angle rotation wrt geodetic quaternion from the ATT auxiliary input file	Root	Double(N12)	[-180, 179.999999]		a	x	x	x	x
Platform	Yaw Rate	Satellite Yaw angular rate corresponding to the annotated times.	Root	Double(N12)	[-180, 179.999999]	deg/s	a	x	x	x	x

Table 2-6 –Attributes of HDF5 SAR Products, Platform Area

2.7 Doppler

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Doppler	Azimuth Polynomial Reference Time	Reference azimuth time (in seconds since the annotated reference UTC) used to represent the azimuth polynomial of Doppler variation and Range spectrum central frequency	Root	Double		s	a	x	x	x	x
Doppler	Centroid vs Azimuth Time Polynomial	Coefficients of the doppler centroid azimuth polynomial coefficients (from the lower to the higher degree)	Root	Double(6)		Hz/s^i	a	x	x	x	x
Doppler	Centroid vs Range Time Polynomial	Coefficients of the doppler centroid range polynomial coefficients (from the lower to the higher degree)	Root	Double(6)		Hz/s^i	a	x	x	x	x
Doppler	Doppler Ambiguity Estimation Method	Identifier of the algorithm adopted for estimation of the doppler ambiguity .	Root	String	GEOMETRY		a	x	x	x	x
Doppler	Doppler Centroid Estimation Method	Identifier of the algorithm adopted for estimation of the fractional part of the doppler centroid .	Root	String	GEOMETRY ACCC MLCC		a	x	x	x	x
Doppler	Doppler Rate Estimation Method	Identifier of the algorithm adopted for estimation of the doppler rate.	Root	String	GEOMETRY		a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Doppler	Doppler Rate vs Azimuth Time Polynomial	Coefficients of the doppler rate azimuth polynomial coefficients (from the lower to the higher degree)	Root	Double(6)		$Hz/s^{(i+1)}$	a	x	x	x	x
Doppler	Doppler Rate vs Range Time Polynomial	Coefficients of the doppler rate range polynomial coefficients (from the lower to the higher degree)	Root	Double(6)		$Hz/s^{(i+1)}$	a	x	x	x	x
Doppler	Range Polynomial Reference Time	Reference range time used to represent the range doppler polynomial	Root	Double		s	a	x	x	x	x

Table 2-7 –Attributes of HDF5 SAR Products, Doppler Area

2.8 Processing

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	Azimuth Bandwidth per Look	Bandwidth per look in azimuth used for the multilooked image formation	S<mm>	Double		Hz			a	x	x
Processing	Azimuth Focusing Bandwidth	The Doppler bandwidth used at the single-look generation time	S<mm>	Double		Hz		a	x	x	x
Processing	Azimuth Focusing Transition Bandwidth	The transition bandwidth in azimuth used at the single-look generation time	S<mm>	Double		Hz		a	x	x	x
Processing	Azimuth Focusing Weighting Coefficient	Azimuth coefficients used for the weighting function applied at the focusing time to the processed portion of the full band	Root	Double	[0, 1]			a	x	x	x
Processing	Azimuth Focusing Weighting Function	Type of matched filter windowing in the azimuth direction at the focusing time	Root	String	NONE HAMMING GENERAL_COSINE			a	x	x	x
Processing	Azimuth Multilooking Transition Bandwidth	The transition bandwidth in azimuth used at the multilooked image formation	S<mm>	Double		Hz			a	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	Azimuth Multilooking Weighting Coefficient	Azimuth coefficients used for the weighting function applied at the multilooking time to each look	Root	Double	[0, 1]				a	x	x
Processing	Azimuth Multilooking Weighting Function	Type of matched filter windowing in the azimuth direction at the multilooking time	Root	String	NONE HAMMING				a	x	x
Processing	Azimuth Processing Number of Looks	Number of processing azimuth looks	Root	UByte	>0			a	m	x	x
Processing	Subswath Change Column	Column index at which the subswath changes (used only for L1B Wide Swath products, set to invalid value otherwise). Its dimension, is: - equal to 3 for DSM_U product; - equal to 3 for DSM_E_and DGM_B products in the case of 'DISJOINT' mosaicking policy. - equal to 6 for DSM_E_and DGM_B products in the case of 'FIFTY' or 'LINEAR' mosaicking policies. (One pair of values for each subswath change. In this way overlapped image areas are characterized by start and end column indexes)	SBI MBI	UInt(N3)					a		

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	Beam Mosaicking Policy	Algorithm used for merging of overlapped beams (used only for Wide Swath mode, set to invalid value otherwise) 'FIFTY' and 'LINEAR' policy are performed only for DSM_E and DGM_B products.	Root	String	DISJOINT FIFTY LINEAR N/A				a	x	x
Processing	Column Spacing	Spacing among columns of the products.	SBI MBI	Double		m		a	m	m	m
Processing	Column Time Interval	Time spacing in the range direction between columns Set to invalid value in the case of ground projected products	SBI MBI	Double		s		a	m		
Processing	ECEF Beam Centre Direction for Processing	Unitary vector corresponding to the direction of the beam central plane in Earth Centred - Earth Fixed reference frame. It models the average behavior of the antenna beam central plane within each subswath acquired, hence in the case of High Resolution mode, the jumping steering scheme adopted at the scene acquisition time, is ignored.	Root	Double(N6, 3)			a	x	x	x	x
Processing	ECEF Beam Pointing for Processing	Unitary vector corresponding to the pointing of the antenna main lobe in Earth Centred - Earth Fixed reference frame. It models the average behavior of the antenna pointing within each subswath acquired. In the case of Wide Swath mode, a different model per each subswath is used.	S<mm>	Double(N6, 3)			a	x	x	x	x
Processing	Equivalent Number of Looks	Theorical value of the equivalent number of looks	SBI MBI	Double				a	m	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	Focusing Algorithm ID	Identifier of the processing algorithm adopted	Root	String	OMEGA-KEY CHIRP SCALING RANGE DOPPLER SPECAN TIME DOMAIN			a	x	x	x
Processing	Incidence Angle Rescaling Factor	Scaling factor used for representation of Incidence Angle in the GIM layer	GIM	Double	100						a
Processing	Invalid Value	Value used to fill invalid pixels/lines. Are catalogued as invalid, the following categories of data: - compensated missing lines; - area of geocoded products outside the SAR sensed data limits. As far as portion of lines added by SWST readjustment, they are in any case filled by zero. In the case of complex dataset (hence represented by two samples per pixel), invalid pixels will be characterized by Invalid Value loaded in both of its channels For L0 product, invalid pixels are associated only to missing lines. Allowed values depend on the Product Type.	Root	Float			a	a	a	a	a
Processing	L0 Software Version	Version of the L0 processor used for the core processing step	Root	String		n.m	a	x	x	x	x
Processing	L1A Software Version	Version of the L1A processor used for the core processing step	Root	String		n.m		a	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	L1B Software Version	Version of the L1B processor used for the core processing step	Root	String		n.m			a	x	x
Processing	L1C Software Version	Version of the L1C processor used for the core processing step	Root	String		n.m				a	
Processing	L1D Software Version	Version of the L1D processor used for the core processing step	Root	String		n.m					a
Processing	Light Speed	Light Speed	Root	Double	2.99792458d+08	m/s	a	x	x	x	x
Processing	Line Spacing	Spacing among lines of the products.	SBI MBI	Double		m		a	m	m	m
Processing	Line Time Interval	Time spacing in the azimuth direction between lines	SBI MBI	Double		s		a	m		
Processing	Despeckle Technique	Identifier of the despeckle technique adopted	Root	String	NONE MULTILOOK FILTER				a	x	x
Processing	Despeckle Direction	Identifier of the direction along which the despeckle technique is applied. -Range or Azimuth in case of Multilooking (2D not allowed) -2D in case of Filter (Range and/or Azimuth not allowed) Set to invalid value in the case of Despeckle Technique equal to NONE	Root	String	AZIMUTH RANGE 2D				a	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	Product Error Flag	Flag indicating if errors have been reported during the product generation process. If set, it means that some quality measure is not compliant to the product specification. User should then refer to the product confidence data for details about the error condition.	Root	UByte	1 if errors have been reported 0 otherwise		a	a	a	a	a
Processing	Product Generation UTC	Product generation time in UTC time format	Root	String		Epoch	a	a	a	a	a
Processing	Quick Look Column Spacing	Spacing among columns of the quick look layer.	QLK	Double		m	a	a	a	a	a
Processing	Quick Look Line Spacing	Spacing among columns of the quick look layer.	QLK	Double		m	a	a	a	a	a
Processing	Range Bandwidth per Look	Bandwidth per look in range used for the multilooked image formation	S<mm>	Double		Hz			a	x	x
Processing	Range Focusing Bandwidth	The bandwidth in range used at the single-look generation time	S<mm>	Double		Hz		a	x	x	x
Processing	Range Focusing Transition Bandwidth	The transition bandwidth in range used at the single-look generation time	S<mm>	Double		Hz		a	x	x	x
Processing	Range Focusing Weighting Coefficient	Range coefficients used for the weighting function applied at the focusing time to the processed portion of the full band	Root	Double	[0, 1]			a	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	Range Focusing Weighting Function	Type of matched filter windowing in the range direction at the focusing time	Root	String	NONE HAMMING GENERAL_COSINE			a	x	x	x
Processing	Range Multilooking Transition Bandwidth	The transition bandwidth in range used at the multilooked image formation	S<mm>	Double		Hz			a	x	x
Processing	Range Multilooking Weighting Coefficient	Range coefficients used for the weighting function applied at the multilooking time to each look	Root	Double	[0, 1]				a	x	x
Processing	Range Multilooking Weighting Function	Type of matched filter windowing in the range direction at the multilooking time	Root	String	HAMMING NONE				a	x	x
Processing	Range Processing Number of Looks	Number of nominal looks in the range direction	Root	UByte	>0			a	m	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	RAW Statistics Block Size	Size (in number of rows and number of columns) of the block where statistics on the RAW data are evaluated. In the following, N9 (resp. N10) will indicate the number of azimuth (resp. range) blocks (derived from the block size for statistics evaluation) in the burst over which statistics are evaluated. It is always assumed that: - first block for statistics evaluation is anchored to the first row/col of the burst - moving steps for other block determination is equal to the block size - block size is defined so that N9 <= 300 and N10 <= 3	S<mm>	UInt(2)			a	x	x	x	x
Processing	Reference UTC	UTC with respect the annotated slow times are referred to. It is set to the 00:00:00.000000000 of the day at which the acquisition started	Root	String		Epoch	a	x	x	x	x
Processing	Replica Reconstruction Method	Designator of method for reconstruction of chirp used for image processing. Set to invalid value in the High Resolution case.	Root	String	NOMINAL REPLICA MEAN			a	x	x	x
Processing	Rescaling Factor	Rescaling Factor F, used at processing time as a multiplier term applied to the signal amplitude to appropriately use the dynamic range allowed by the data type (avoiding the image saturation and minimizing quantization error).	Root	Double				a	m	m	m
Processing	Despeckle Filter Moving Window	Despeckle Filter squared window size Set to 0 in the case speckle filtering is not applied.	Root	UShort	0 [3 300]				a	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Processing	Despeckle Filter	Applied Despeckle Filter Set to invalid value in the case speckle filtering is not applied.	Root	String	MEAN MEDIAN FROST LEE				a	x	x
Processing	Range Time Offset	Time offset applied to Zero Doppler Range Time computed using the Ground Reference Points	SBI MBI	Double							a
Processing	Azimuth Time Offset	Time offset applied to Zero Doppler Azimuth Time computed using the Ground Reference Points	SBI MBI	Double							a
Processing	Internal Power	It represents the power level of a reference signal internal to the radar, computed at the epoch of the present acquisition	S<mm>	Double			a	x	x	x	x
Processing	DB Rescaling Factor	DB Rescaling Factor DBRF, used at processing time applied to the L1D Product to appropriately use the dynamic range allowed by the data type (avoiding the image saturation and minimizing quantization error). The first component is the SCALE while the second one is the OFFSET, in order to reconstruct the dataset in LINEAR scale, the following transformation shall be used: L1D_linear = 10.^(DBRF(2) + dataset*DBRF(1)) ;	Root	Double(2)							a

Table 2-8 –Attributes of HDF5 SAR Products, Processing Area

2.9 Projection

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Projection	Datum Rotation	XYZ Datum rotations with respect to WGS84 Ellipsoid to be used for Helmert transformation	Root	Double(3)		deg	a	x	x	x	x
Projection	Datum Scale	XYZ Datum scale with respect to WGS84 Ellipsoid to be used for Helmert transformation	Root	Double			a	x	x	x	x
Projection	Datum Shift	XYZ Datum shifts with respect to WGS84 Ellipsoid to be used for Helmert transformation	Root	Double(3)		m	a	x	x	x	x
Projection	Ellipsoid Designator	Ellipsoid designator name	Root	String	WGS84		a	x	x	x	x
Projection	Ellipsoid Semimajor Axis	Semi-major axis length	Root	Double	6378137	m	a	x	x	x	x
Projection	Ellipsoid Semiminor Axis	Semi-minor axis length	Root	Double	6356752.3142	m	a	x	x	x	x
Projection	Ground Projection Polynomial Reference Range	Reference slant range used as zero to represent the ground to slant (and viceversa) polynomials. Set to invalid value in the case of products not represented in “ground range/azimuth” projection (e.g. L1C and L1D)	Root	Double		m			a	a	a
Projection	Ground Projection Reference Surface	Designator of the surface used for the ground projection	Root	String	NONE WGS84 TERRAIN				a	a	a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Projection	Ground to Slant Polynomial	Ground range (pixels) to relative (w.r.t. the Ground Projection Polynomial Reference Zero) slant range (meters) polynomial coefficient (from lower to higher degree). Set to invalid value in the case of products not represented in ground range/azimuth projection	Root	Double(6)		1/pix[i]			a		
Projection	Map Projection Centre	Geodetic coordinates (lat/lon) of the map projection centre (for UTM/UPS) In the case of UTM projection, latitude is set to 0 and longitude is set equal to that one of the central meridian of the UTM zone of the product. In the case of UPS projection, a projection centre equal to [90, 0] is used in the Northern emisphere, [-90, 0] is used in the Southern one	Root	Double(2)	[[-90, 90], [-180, 179,999999]]					a	a
Projection	Map Projection False East-North	Map Projection False East/North (for UTM/UPS) In the case of UTM projection, false east equal to 500000 is used, while false north equal to 0 in the Northern emisphere and 10000000 in the Southern one are used. In the case of UPS zone, a value of 2000000 is used both for false east and false north Set to QNaN otherwise	Root	Double(2)		m				a	a
Projection	Map Projection Scale Factor	Map Projection Scale factor (for UTM/UPS). In the case of UTM projection, a value of 0.9996 is used. In the case of UPS projection, a value of 0.994 is used. Set to QNaN otherwise	Root	Double	{0.994; 0.9996}					a	a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Projection	Map Projection Zone	Map Projection Zone	Root	UByte	[1, 60] for UTM 0 for UPS - South 61 for UPS - North					a	a
Projection	Projection ID	Projection descriptor For geocoded product UPS projection is used if the scene centre latitude is greater than 84° or lower than -80°, otherwise UTM is used	Root	String	N/A SLANT RANGE/AZIMUTH GROUND RANGE/AZIMUTH UTM UPS		a	m	m	m	m
Projection	Quick Look Projection ID	Projection descriptor for Quick Look Layer For geocoded product UPS projection is used if the scene centre latitude is greater than 84° or lower than -80°, otherwise UTM is used	QLK	String	N/A SLANT RANGE/AZIMUTH GROUND RANGE/AZIMUTH UTM UPS		a	a	a	a	a
Projection	Slant to Ground Polynomial	Relative (w.r.t. the Ground Projection Polynomial Reference Zero) slant range (meters) to ground range (pixels) polynomial coefficients (from the lower to the higher degree). Set to invalid value in the case of products not represented in ground range/azimuth projection	Root	Double(6)		$1/m^i$			a		

Table 2-9 –Attributes of HDF5 SAR Products, Projection Area

2.10 Scene

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Scene	Azimuth Coverage	Coverage in the azimuth direction of the full scene estimated on the ellipsoid. Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	Double		m	a	m	m	x	x
Scene	Bottom Left East-North	Coordinates of the first pixel of the last image line for metric projections. Set to QNaN otherwise	SBI MBI	Double(2)		m				a	a
Scene	Bottom Left Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the first pixel of the last image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)		a	m	m	m
Scene	Bottom Right East-North	Coordinates of the last pixel of the last image line for metric projections. Set to QNaN otherwise	SBI MBI	Double(2)		m				a	a
Scene	Bottom Right Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the last pixel of the last image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)		a	m	m	m

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Scene	Centre Earth Radius	Earth radius at image centre Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	Double		m	a	m	m	x	x
Scene	Centre Geodetic Coordinates	Geodetic coordinates (lat-lon-height) of the central image point (estimated on DEM for terrain projected products, on the ellipsoid otherwise) of the swath. For RAW data it is estimated in acquisition geometry on the basis of the acquisition time of the central line discarding transients to be removed by range compression. Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data.	S<mm>	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)	a	m	m	m	m
Scene	Far Early Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the far range at the azimuth first time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)				a	a
Scene	Far Incidence Angle	Absolute value of the incidence angle measured at the far range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	[0, 90[	deg		a	x	x	x
Scene	Far Late Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the far range at the azimuth last time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)				a	a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Scene	Far Look Angle	Look angle measured at the far range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	[15, 55]	deg		a	x	x	x
Scene	Ground Range Coverage	Coverage in ground range of the specific portion of data projected on the ellipsoid. For RAW data it is computed on the basis of the acquisition times and geometry, with right transient removed (i.e. only considering scatterers which returns a complete chirp's echo to the SAR receiver). Attribute updating is applicable in the case of processing of image portion starting from Level 0 data.	Root	Double		m	a	m	m	x	x
Scene	Near Early Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the near range at the azimuth first time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)				a	a
Scene	Near Incidence Angle	Absolute value of the incidence angle measured at the near range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	[0, 90[	deg		a	x	x	x
Scene	Near Late Geodetic Coordinates	Geodetic coordinates of the pixel of the scene acquired at the near range at the azimuth last time (estimated on DEM for terrain projected products, on the ellipsoid otherwise) It is useful for geocoded products that are not represented in range azimuth projection, hence the image geometry doesn't correspond to the acquisition geometry	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)				a	a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Scene	Near Look Angle	Look angle measured at the near range on the ellipsoid in zero-doppler geometry as derived by the sampling window times represented in data	SBI MBI	Double	[15, 55]	deg		a	x	x	x
Scene	Scene Centre Geodetic Coordinates	Geodetic coordinates (lat-lon-height) of the central image point (estimated on DEM for terrain projected products, on the ellipsoid otherwise) of the full scene For RAW data it is estimated in acquisition geometry on the basis of the acquisition time of the central line discarding transients (at the farthest subswath in the case of Wide Swath data) to be removed by range compression. Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data.	Root	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)	a	m	m	a	a
Scene	Scene Orientation	Counter-clockwise measured angle between the local north at scene centre and the opposite of the azimuth oriented direction	Root	Double		deg	a	m	m	x	x
Scene	Terrain Elevation Standard Deviation	Standard deviation of the elevation of the observed scene	Root	Double		m					a
Scene	Terrain Maximum Elevation	Maximum elevation of the observed scene	Root	Double		m					a
Scene	Terrain Mean Elevation	Mean elevation of the observed scene	Root	Double		m					a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Scene	Terrain Minimum Elevation	Minimum elevation of the observed scene	Root	Double		m					a
Scene	Top Left East-North	Coordinates of the first pixel of the first image line for metric projections. Set to QNaN otherwise	SBI MBI	Double(2)		m				a	a
Scene	Top Left Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the first pixel of the first image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)		a	m	m	m
Scene	Top Right East-North	Coordinates of the last pixel of the first image line for metric projections. Set to QNaN otherwise	SBI MBI	Double(2)		m				a	a
Scene	Top Right Geodetic Coordinates	Geodetic coordinates (Lat-Lon-Ellipsoidal Height) of the last pixel of the first image line (estimated on DEM for terrain projected products, on the ellipsoid otherwise) Attribute updating is also applicable in the case of processing of image portion starting from Level 0 data	SBI MBI	Double(3)	[[-90, 90], [-180, 179,999999], -200, 9000]	(deg, deg, m)		a	m	m	m

Table 2-10 –Attributes of HDF5 SAR Products, Scene Area

2.11 Calibration

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Calibration	ADC Characterization	Look Up Table for ADC Characterization; it associates the signal power detected in the 8 bits RAW data to the ideal analog level in dB. For future usage	Root	Double(256, 2)			a	x	x	x	x
Calibration	ADC Compensation	Flag showing the application of the ADC compensation. For future usage	Root	UByte	0 = Not Applied 1 = Applied			a	x	x	x
Calibration	Antenna Pattern Compensation Reference Surface	Designator of the surface used for the compensation of the range antenna pattern. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String	NONE WGS84 TERRAIN			a	m	x	m

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Calibration	Azimuth Antenna Pattern Compensation Geometry	Geometry used for the compensation of the azimuth antenna pattern. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String	NONE ACQUISITION ZERO DOPPLER			a	m	x	x
Calibration	Azimuth Antenna Pattern Gains	Antenna two-way power azimuth pattern gain values, corresponding to the Antenna Pattern angles obtainable by other specific tags	S<mm>	Double(N1)		dB	a	x	x	x	x
Calibration	Azimuth Antenna Pattern Origin	Angular offset in degrees from azimuth beam centre, the first value of the azimuth antenna pattern gains is referred to.	S<mm>	Double		deg	a	x	x	x	x
Calibration	Azimuth Antenna Pattern Resolution	The angular step in degrees the values of the azimuth antenna pattern gains are referred to.	S<mm>	Double		deg	a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Calibration	Calibration Constant	It is the Calibration Constant value (K) of the subswath. It includes all constant proportionality terms between the target energy in the input product and the actual backscattering of the scene. It excludes terms related to Range Spreading Loss, Incidence angle and Antenna Pattern compensation operators. The multiplier term (1/sqrt(K)) have to be applied to calibrate the signal amplitude. It is applied to the output SAR image if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product is set to "Not Calibrated".	S<mm>	Double			a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Calibration	Calibration Constant Compensation Flag	Flag showing the application of the calibration constant. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	UByte	0 = Not Applied 1 = Applied			a	m	x	m
Calibration	Calibration Constant Estimation UTC	Calibration constant estimation date	S<mm>	String		Epoch	a	x	x	x	x
Calibration	Incidence Angle Compensation Geometry	Geometry used for the compensation of the incidence angle. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String	NONE ACQUISITION ZERO DOPPLER			a	m	x	m

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Calibration	Incidence Angle Compensation Reference Surface	Designator of the surface used for the compensation of the incidence angle. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String	NONE WGS84 TERRAIN			a	m	x	m
Calibration	Range Antenna Pattern Compensation Geometry	Geometry used for the compensation of the range antenna pattern. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String	NONE ACQUISITION ZERO DOPPLER			a	m	x	m
Calibration	Range Antenna Pattern Gains	Antenna two-way power range pattern gain values, corresponding to the Antenna Pattern angles obtainable by other specific tags	S<mm>	Double(N2)		dB	a	x	x	x	x
Calibration	Range Antenna Pattern Origin	Angular offset in degrees from range beam centre, the first value of the range antenna pattern gains is referred to.	S<mm>	Double		deg	a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Calibration	Range Antenna Pattern Resolution	The angular step in degrees the values of the range antenna pattern gains are referred to.	S<mm>	Double		deg	a	x	x	x	x
Calibration	Range Spreading Loss Compensation Geometry	Geometry used for the compensation of the range spreading loss. It is modified into the output product if the following conditions are simultaneously verified: - processor capability to perform the specific calibration - calibration is explicitly requested by Processing Request File (or, if card is not allowed, if calibration is implicit into specification of output product) - calibration status retrieved from the input product	Root	String	NONE ACQUISITION ZERO DOPPLER			a	x	x	x
Calibration	Reference Incidence Angle	Reference incidence angle (a) used at processing time (by the divisor term sqrt(sin(a)) applied to the signal amplitude) for the normalization of the incidence angle correction. It should be univocally defined for the entire SAR access area for the cross-equalization of data acquired at different swaths. It is set to invalid value if unused. Processing algorithms oriented to image calibration (e.g. L1D processor), must remove this factor on the SAR image and set the attribute to invalid value. (It is worth stating that in the L1A column ”a” or “m” is missing since the L1A processor will only populate this attribute for SCS_B product and not for SCS_U product)	Root	Double		deg		a	m	x	m

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Calibration	Reference Slant Range	Reference slant range R used at processing time (raised by the relevant exponent) for the normalization of the range spreading loss compensation. It should be univocally defined for the entire SAR access area for the cross-equalization of data acquired at different swaths. It is set to 1 if unused. Processing algorithms oriented to image calibration (e.g. L1D processor), must remove this factor on the SAR image and set the attribute to one.	Root	Double		m		a	x	x	m
Calibration	Reference Slant Range Exponent	Exponent of the reference slant range R used on the image amplitude at processing time for the normalization of the range spreading loss compensation.	Root	Double				a	x	x	x
Calibration	Along Track Vector	Along track coordinate Not present in ST and WS modes.	S<mm>	Double		m	a	x	x	x	x
Calibration	Azimuth Calibration Factor	Radiometric correction factor in the along track direction Not present in ST and WS modes.	S<mm>	Double		dB	a	x	m	x	x
Calibration	Reference Internal Power	It represents the power level of a reference signal internal to the radar, computed at the epoch of the acquisition used to retrieve the calibration constant (CALCO).	S<mm>	Double			a	x	x	x	x

Table 2-11 –Attributes of HDF5 SAR Products, Calibration Area

2.12 Thresholds

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Thresholds	Doppler Ambiguity Confidence Measure Threshold	Normalized confidence measure of doppler centroid ambiguity. A value of zero means poor confidence.	Root	Double	[0, 1]		a	x	x	x	x
Thresholds	Doppler Ambiguity Threshold	Threshold for setting the Doppler Centroid ambiguity quality flag	Root	UShort			a	x	x	x	x
Thresholds	Doppler Centroid Confidence Measure Threshold	Threshold for setting the Doppler Centroid confidence quality flag	Root	Double	[0, 1]		a	x	x	x	x
Thresholds	Doppler Centroid Estimation Accuracy Threshold	Threshold for setting the Doppler Centroid Accuracy quality flag	Root	Double	>=0	Hz	a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Thresholds	Doppler Rate Confidence Measure Threshold	Threshold for setting the Doppler Rate confidence quality flag	Root	Double	[0, 1]		a	x	x	x	x
Thresholds	Doppler Rate Estimation Accuracy Threshold	Threshold for setting the Doppler Rate accuracy quality flag	Root	Double	>=0	Hz/s	a	x	x	x	x
Thresholds	Image OverSaturated Percentage Threshold	Threshold for setting the OverSaturated Percentage quality flag	Root	Double	[0, 100]			a	x	x	x
Thresholds	Image UnderSaturated Percentage Threshold	Threshold for setting the UnderSaturated Percentage quality flag	Root	Double	[0, 100]			a	x	x	x
Thresholds	RAW Bias Threshold	Bias of RAW data used as threshold to set the product quality flag; two samples for the In-Phase and Quadrature signal (I-Q)	Root	Double			a	x	x	x	x
Thresholds	RAW Gain Imbalance Threshold	Gain imbalance of the I and Q channel of the RAW data used as threshold to set the product quality flag	Root	Double			a	x	x	x	x
Thresholds	RAW I|Q Normality Threshold	Measure of the Gaussian properties of I and Q channels distribution used as threshold to set the product quality flag	Root	Double		deg	a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Thresholds	RAW I|Q Orthogonality Threshold	Phase difference (orthogonality) between I and Q channels of RAW data used as threshold to set the product quality flag	Root	Double		deg	a	x	x	x	x
Thresholds	RAW Missing Lines per Block Threshold	Number of allowed missing lines which constitute a gap	Root	UShort			a	x	x	x	x
Thresholds	RAW Missing Lines Percentage Threshold	Maximum percentage of missing lines to total lines.	Root	Double			a	x	x	x	x
Thresholds	RAW OverSaturated Percentage Threshold	Percentage of RAW oversaturated pixels used as threshold to set the product quality flag	Root	Double	[0, 100]		a	x	x	x	x
Thresholds	RAW Phase Uniformity Threshold	Measure of the uniform properties of phase distribution of the RAW data used as threshold to set the product quality flag	Root	Double		deg	a	x	x	x	x
Thresholds	RAW UnderSaturated Percentage Threshold	Percentage of RAW undersaturated pixels used as threshold to set the product quality flag	Root	Double	[0, 100]		a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
Thresholds	Replica Geometric Resolution Threshold	Geometric resolution (meters in slant range) of the replica cross correlation function; it represents a threshold for setting the replica quality flag.	Root	Double		m	a				
Thresholds	Replica ISLR Threshold	ISLR of the chirp cross correlation function; it represents a threshold for setting the chirp quality flag.	Root	Double		dB	a				
Thresholds	Replica PSLR Threshold	PSLR of the chirp cross correlation function; it represents a threshold for setting the replica quality flag.	Root	Double		dB	a				
Thresholds	Replica Shape -10dB|-3dB Threshold	Aperture ratio of main lobe of reconstructed replica measured at -10 dB and -3dB; it represents a threshold for setting the replica quality flag.	Root	Double		dB	a				
Thresholds	Replica Shape -6dB|-3dB Threshold	Aperture ratio of main lobe of reconstructed replica measured at -6 dB and -3dB; it represents a threshold for setting the replica quality flag.	Root	Double		dB	a				
Thresholds	Replica SSLR Threshold	SSLR of the chirp cross correlation function; it represents a threshold for setting the replica quality flag.	Root	Double		dB	a				

Table 2-12 –Attributes of HDF5 SAR Products, Thresholds Area

2.13 Product Confidence Data

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	Attitude Product Category	It indicates the origin of the orbital data annexed to the product. ON-GROUND DATA indicates that the orbital data annexed to the Level 0 are provided by KARI UGS.	Root	String	ON-GROUND DATA		a	x	x	x	x
PCD	Central Range Frequency vs Azimuth Time Polynomial	Coefficients of the polynomial representing the variation (w.r.t. the relative azimuth times) of the central frequency of the range spectrum in the azimuth direction (from the lower to the higher degree). Annotated only in complex products. Not estimated (hence set to QNaN) in the case of intermediate products.	S<mm>	Double(3)		Hz/s[1]		a			
PCD	Doppler Ambiguity	Ambiguity number of doppler centroid on the scene. Expected value equal to zero, if Yaw Steering enabled.	S<mm>	Short	[-20, 20]		a	x	x	x	x
PCD	Doppler Ambiguity Confidence Measure	Normalized confidence measure of doppler centroid ambiguity. A value of zero means poor confidence.	Root	Double	[0, 1]		a	x	x	x	x
PCD	Doppler Centroid Confidence Measure	Normalized confidence measure of doppler centroid. A value of zero means poor confidence.	Root	Double	[0, 1]		a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	Doppler Centroid Estimation Accuracy	Standard deviation in the estimation of doppler centroid.	Root	Double	>=0	Hz	a	x	x	x	x
PCD	Doppler Rate Confidence Measure	Normalized confidence measure of doppler rate A value of zero means poor confidence.	Root	Double	[0, 1]		a	x	x	x	x
PCD	Doppler Rate Estimation Accuracy	Standard deviation in the estimation of doppler rate.	Root	Double	>=0	Hz/s	a	x	x	x	x
PCD	Image Max	Image maximum value estimated separately on each channel of data excluding saturated pixels; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)				a	a	a	a
PCD	Image Mean	Image mean value estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)				a	a	a	a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	Image Min	Image minimum value estimated separately on each channel of data excluding pixel with values lying on the lower (underflow) quantisation bins; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)				a	a	a	a
PCD	Image OverSaturated Percentage	Percentage of Oversaturated pixels in the image estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)	[0, 100]			a	a	a	a
PCD	Image Standard Deviation	Image sigma value estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)				a	a	a	a
PCD	Image UnderSaturated Percentage	Percentage of Undersaturated pixels in the image estimated separately on each channel of data; second element of the array set to zero in the case of real data. Not estimated (hence set to QNaN) in the case of intermediate products.	SBI MBI	Double(2)	[0, 100]			a	a	a	a
PCD	Layover Pixel Percentage	Percentage of pixels in layover geometry with respect to the pixel of the scene (hence not considering invalid zones at the image borders deriving from image reprojection)	GIM	Double	[0, 100]						a

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	Orbit Product Category	It indicates the origin of the orbital data annexed to the product. ORBNAV, OOE, POES and POED indicate the kind of orbital data provided by KARI UGS.	Root	String	ORBNAV OOE POES POED		a	x	x	x	x
PCD	Range Far Bound	Index of far bound range swath	B<nnn>	Double			a	x	x	x	x
PCD	Range Far Mean Standard Deviation	Mean Echo Amplitude Standard Deviation computed at far bound on N14 different range zones	B<nnn>	Double(N14)			a	x	x	x	x
PCD	Range Near Bound	Index of near bound range swath	B<nnn>	Double			a	x	x	x	x
PCD	Range Near Mean Standard Deviation	Mean Echo Amplitude Standard Deviation computed at near bound on N14 different range zones	B<nnn>	Double(N14)			a	x	x	x	x
PCD	RangeComp Ambiguous Doppler Centroid	Doppler centroid estimates from RAW data range-compressed on a grid made up of N9xN10 blocks	B<nnn>	Double(N9, N10)		Hz	a	x	x	x	x
PCD	RAW Ambiguous Doppler Centroid	Doppler centroid estimates from RAW data on a grid made up of N9xN10 blocks	B<nnn>	Double(N9, N10)		Hz	a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	RAW Bias	Bias of RAW data; two samples for the In-Phase and Quadrature signal (I-Q) estimated on valid lines of the block	B<nnn>	Double(N9, N10, 2)			a	x	x	x	x
PCD	RAW Gain Imbalance	Gain imbalance of the I and Q channel of the RAW data estimated on valid lines of the block	B<nnn>	Double(N9, N10)			a	x	x	x	x
PCD	RAW I|Q Normality	Measure of the Gaussian properties of I and Q channels distribution	B<nnn>	Double(N9, N10, 2)		deg	a	x	x	x	x
PCD	RAW I|Q Orthogonality	Phase difference (orthogonality) between I and Q channels of RAW data estimated on valid lines	B<nnn>	Double(N9, N10)		deg	a	x	x	x	x
PCD	RAW Missing Blocks Start Lines	Image Lines' indexes at which a readjusted (e.g. by zero filling) missing block starts. If no missing blocks occurr in data, the attribute is not present in the dataset.	B<nnn>	UInt(N16)			a	x	x	x	x
PCD	RAW Missing Lines per Block	Number of missing lines within each readjusted missing block If no missing blocks occurr in data, the attribute is not present in the dataset.	B<nnn>	UShort(N16)			a	x	x	x	x
PCD	RAW Missing Lines Percentage	Percentage of missing lines to total lines of the burst	B<nnn>	Double			a	x	x	x	x
PCD	RAW Out-of-Band Standard Deviation	Standard dev of amplitude RAW data for frequencies outside the range chirp pulse bandwidth.	B<nnn>	Double(N9)			a	x	x	x	x

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	RAW OverSaturated Percentage	Percentage of RAW Oversaturated; two samples for the In-Phase and Quadrature signal (I-Q)	B<nnn>	Double(2)	[0, 100]		a	x	x	x	x
PCD	RAW Phase Uniformity	Measure of the uniform properties of phase distribution of the RAW data	B<nnn>	Double(N9, N10)		deg	a	x	x	x	x
PCD	RAW Standard Deviation	Standard dev of RAW data; two samples for the In-Phase and Quadrature signal (I-Q)	B<nnn>	Double(N9, N10, 2)			a	x	x	x	x
PCD	RAW UnderSaturated Percentage	Percentage of RAW Undersaturated; two samples for the In-Phase and Quadrature signal (I-Q)	B<nnn>	Double(2)	[0, 100]		a	x	x	x	x
PCD	Replica Geometric Resolution	Array including geometric resolution of each reconstructed replica	REPLICA	Double(N8)			a				
PCD	Replica ISLR	Array including ISLR of each reconstructed replica	REPLICA	Double(N8)			a				
PCD	Replica PSLR	Array including left and right PSLR of each reconstructed replica	REPLICA	Double(N8, 2)			a				
PCD	Replica Shape -10dB|-3dB	Aperture ratio of main lobe of reconstructed replica measured at -10 dB and -3dB	REPLICA	Double(N8)			a				
PCD	Replica Shape -6dB|-3dB	Aperture ratio of main lobe of reconstructed replica measured at -10 dB and -3dB	REPLICA	Double(N8)			a				
PCD	Replica SSLR	Array including left and right SSLR of each reconstructed replica	REPLICA	Double(N8, 2)			a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	Shadowing Pixel Percentage	Percentage of pixels in shadowing geometry with respect to the pixel of the scene (hence not considering invalid zones at the image borders deriving from image reprojection)	GIM	Double	[0, 100]						a
PCD	SPF Mean Intensity Ratio	Average of the Intensity Ratio between input and speckle filtered image Set to QNaN in the case speckle filtering is not applied.	Root	Double					a	x	x
PCD	SPF Standard Deviation Intensity Ratio	Standard Deviation of the intensity ratio between input and speckle filtered image Set to QNaN in the case speckle filtering is not applied.	Root	Double					a	x	x
PCD	Replica Geometric Resolution (WIRF)	Replica Geometric Resolution (WIRF) The measurement of Geometric Resolution obtained using autocorrelative replica for pulse compression and applying the standard amplitude weight function to match PSLR	REPLICA	Double(N8)			a				
PCD	Replica ISLR (WIRF)	Replica ISLR (WIRF) The measurement of Integrated Side Lobe Ratio obtained using autocorrelative replica for pulse compression and applying the standard amplitude weight function to match PSLR	REPLICA	Double(N8)			a				
PCD	Replica PSLR (WIRF)	Replica PSLR (WIRF) The measurement of Peak Side Lobe Ratio obtained using autocorrelative replica for pulse compression and applying the standard amplitude weight function to match PSLR	REPLICA	Double(N8, 2)			a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	Estimated Time Width	Estimated Time Width Measurement of Chirp Pulse Width as derived using calibration pulses over ShortCal Path	REPLICA	Double(N8)			a				
PCD	Estimated Bandwidth	Estimated Bandwidth Measurement of Chirp Pulse Bandwidth as derived using calibration pulses over ShortCal Path	REPLICA	Double(N8)			a				
PCD	Estimated Quadratic Aberration	Estimated Quadratic Aberration Measurement of third order phase term error as derived using calibration pulses over ShortCal Path	REPLICA	Double(N8)			a				
PCD	Estimated Cubic Aberration	Estimated Cubic Aberration Measurement of fourth order phase term error as derived using calibration pulses over ShortCal Path	REPLICA	Double(N8)			a				
PCD	Estimated Time Center	Estimated Time Center Measurement of Pulse Energy Center as derived using calibration pulses over ShortCal Path	REPLICA	Double(N8)			a				
PCD	Resolution vs Analytic Waveform	Resolution vs Analytic Waveform The measurement of Geometric Resolution obtained using an analytic reference waveform (phase law up to the fourth degree) for pulse compression	REPLICA	Double(N8)			a				
PCD	ISLR vs Analytic Waveform	ISLR vs Analytic Waveform The measurement of Integrated Side Lobe Ratio obtained using an analytic reference waveform (phase law up to the fourth degree) for pulse compression	REPLICA	Double(N8)			a				

Area	Attribute name	Description	HDF5 Struc.	Data Type	Allowed values/ Validity range	Unit / ASCII repr.	L0	L1A	L1B	L1C	L1D
PCD	PSLR vs Analytic Waveform	PSLR vs Analytic Waveform The measurement of Peak Side Lobe Ratio obtained using an analytic reference waveform (phase law up to the fourth degree) for pulse compression	REPLICA	Double(N8, 2)			a				
PCD	Resolution vs Analytic Waveform (WIRF)	Resolution vs Analytic Waveform (WIRF) The measurement of Geometric Resolution obtained using an analytic reference waveform (phase law up to the fourth degree) for pulse compression and applying the standard amplitude weight function to match PSLR	REPLICA	Double(N8)			a				
PCD	ISLR vs Analytic Waveform (WIRF)	ISLR vs Analytic Waveform (WIRF) The measurement of Integrated Side Lobe Ratio obtained using an analytic reference waveform (phase law up to the fourth degree) for pulse compression and applying the standard amplitude weight function to match PSLR	REPLICA	Double(N8)			a				
PCD	PSLR vs Analytic Waveform (WIRF)	PSLR vs Analytic Waveform (WIRF) The measurement of Peak Side Lobe Ratio obtained using an analytic reference waveform (phase law up to the fourth degree) for pulse compression and applying the standard amplitude weight function to match PSLR	REPLICA	Double(N8, 2)			a				

Table 2-13 –Attributes of HDF5 SAR Products, PDC Area

3. ATTRIBUTES VS. STANDARD PRODUCTS

The following table reports the attributes number of each group or dataset.

	Root	S<mm>	B<nnn>	SBI MBI	QLK	CAL	REPLICA	NOISE	DOP	GIM	Attributes Total Number
RAW	114	41 (39 ST&WS)°	32 (30 HR)*		5	1	21	1 (0 HR)**			213 (212 HR)
SCS	126	42 (40 ST&WS)°	32 (30 HR)*	23	5						226
DGM	145	45 (43 ST&WS) °	32 (30 HR	24	6						250
GEC	148	43 (45 HR)°	32 (30 HR)*	29	5						257
GTC	153	43 (45 HR)°	32 (30 HR)*	31	5					5	269

(°) 2 attributes less in ST and WS modes, since Along Track Vector and Azimuth Calibration Factor are not applicable for those operating modes
(*) 2 attributes less in HR Mode according to the SAR instrument timeline, since there are no missing lines in the acquisition sequence
(**) no attributes in HR mode according to the SAR instrument timeline, since there are no missing lines in the acquisition sequence