|  |  |  |
| --- | --- | --- |
|  | **Analysis Ready Data*****For Land***  | **Product Family Specification:****Normalised Radar Backscatter** |

# Tokyo, August 27, 2022

# JAXA self-assessment for CARD4L NRB v5.5 compliance.

# Valid for the following ALOS-2 PALSAR-2 products:

# Fine Beam Global Mosaics. 25 m (0.8 arcsec) resolution, 1°x1° tile multi-date products. Sample product download (Japan, quad-pol): ftp://ftp.eorc.jaxa.jp/pub/ALOS-2/ext1/PALSAR-2\_MSC/25m\_MSC/2021/ N35E135\_21\_MOS\_F02DAR.zip

# ScanSAR 25 m (0.8 arcsec) resolution, scene-based (standard ALOS-2 Path/Row system) single-date products. Sample product download (Japan, dual-pol): ftp://ftp.eorc.jaxa.jp/pub/ALOS/hidden/20220802\_to\_Ake\_san/ALOS2288172900-190924.zip

# ScanSAR, 50 m (1.6 arcsec) resolution, 1°x1° tile single-date products. Sample product download (Indonesia, dual-pol): ftp://ftp.eorc.jaxa.jp/pub/ALOS/hidden/KC/PSR2\_2022\_SE\_Asia\_NXU4edEn/Cycle186/N00E117\_C186\_RSP026\_20210831\_WBD.zip

Takeo Tadono (JAXA EORC) tadono.takeo@jaxa.jp

Ake Rosenqvist (soloEO) [ake.rosenqvist@soloEO.com](http://ake.rosenqvist@soloEO.com)

Tsutomu Yamanokuchi (RESTEC) tsutomuy@restec.or.jp

Kazufumi Kobayashi (RESTEC) kobayashi\_kazufumi@restec.or.jp

Osamu Isoguchi (RESTEC) isoguchi\_osamu@restec.or.jp

## General Metadata

| **#** | **Item** | **Threshold** **(Minimum) Requirements** | **Target** **(Desired) Requirements** | **Threshold Self-****Assessment** | **Target Self-****Assessment** | **Self-Assessment Explanation/ Justification** | **WGCV Comments** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **1.1** | **Traceability** | Not required. | Data must be traceable to SI reference standard. *Note 1. Relationship to 3.4. Traceability requires an estimate of measurement uncertainty.**Note 2: Information on traceability should be available in the metadata as a single DOI landing page.* | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **1.2** | **Metadata Machine Readability** | Metadata is provided in a structure that enables a computer algorithm to be used to consistently and automatically identify and extract each component part for further use. | As threshold, but metadata is formatted in accordance with CARD4L NRB Metadata Specifications, v.5.5, or a community endorsed standard that facilitates machine-readability, such as ISO 19115-2  | Yes | Yes | Metadata in separate metadata file in XML format, formatted in accordance with “CARD4L\_METADATA-spec\_NRB-v5.5.5.xlsx” | **Verified at Threshold** |
| **1.3** | **Product type** | CARD4L product type name and (if required by the data provider) Copyright. | As threshold. | Yes | (Yes) | <Product> in XML metadata file | **Verified at Threshold** |
| **1.4** | **Document Identifier** | Reference to CARD4L- Normalised Radar Backscatter document as URL or DOI. | As threshold. | Yes | (Yes) | <DocumentIdentifier> in XMLURL to NRB PFS on the CEOS/ARD www<https://ceos.org/ard/files/PFS/NRB/v5.5/CARD4L-PFS_NRB-v5.5.pdf> | **Verified at Threshold** **ScanSAR 25m** |
| **1.5** | **Data Collection Time** | Number of source data acquisitions of the data collection is identified. The start and stop time of data collection is identified in the metadata, expressed in date/time (UTC). In case of composite products, the dates/times of the first and last data takes.  | As threshold. | Yes | (Yes) | <DataCollectionTime><NumberOfAcquisitions> <FirstAcquistionDate><LastAcquistionDate>in XML | **Verified at Threshold** |
| **1.6** | **Source Data Attributes** | Sub-section describing (detailing) the SAR acquisition used to generate the CARD4L product.*Note: Source data attribute information are described for each acquisition and sequentially identified as acqID= 1, 2, 3, …* |  |  | <SourceAttributes> in XMLProvided for each source data take used for the CARD4L product (*acqID= 1, 2, 3, etc. in XML)* | **Verified at Threshold** |
| **1.6.1** | **Source Data Access** | The metadata identifies the location from where the source data can be retrieved, expressed as a URL or DOI. | The metadata identifies an online location from where the data can be consistently and reliably retrieved by a computer algorithm without any manual intervention being required. | Yes | No | <SourceDataRepository>in XML | **Verified at Threshold** |
| **1.6.2** | **Instrument** | The instrument used to collect the data is identified in the metadata:* Satellite name
* Instrument name
 | As threshold, but including a reference to the relevant CEOS Missions, Instruments and Measurements Database record. | Yes | Yes | <Satellite><Instrument><SatelliteReference>in XML | **Verified at Threshold** |
| **1.6.3** | **Source Data Acquisition****Time** | The start date and time of source data is identified in the metadata, expressed in UTC in date and time, at least to the second. | As threshold. | Yes | (Yes) | <SourceDataAcquisitionTime><StartTime><EndTime>in XML | **Verified at Threshold** |
| **1.6.4** | **Source Data Acquisition Parameters** | Acquisition parameters related to the SAR antenna:* Radar band
* Centre frequency Observation mode
* Polarization(s)
* Antenna pointing [Right/Left]

 - Beam ID | As threshold. | Yes | (Yes) | <SourceDataAcquisitionParameters><RadarBand><RadarCenterFrequency><ObservationMode><RadarBandWidth><Polarizations> <AntennaPointing><BeamID>in XML | **Verified at Threshold** |
| **1.6.5** | **Source Data Orbit Information** | Information related to the platform orbit used for data processing: * Pass direction [asc/desc)
* Orbit data source [e.g., predicted/definite/ precise/ downlinked etc.]
 | As threshold, including also:* Platform heading angle expressed in degrees [0 360] from North
* Orbit data file containing state vectors (minimum of 5 state vectors, from 10% of scene length *before* start time to 10% of scene length *after* stop time)
* Platform (mean) altitude
 | Yes | No | <OrbitInformation><PassDirection> <OrbitDataSource>in XML | **Verified at Threshold** |
| **1.6.6** | **Source Data Processing Information** | Processing parameters details of the source data:* Processing facility
* Processing date
* Software version
* Product ID (file name)
* Product level
* Azimuth number of Looks
* Range number of Looks (separate values for each beam, as necessary)
 | As threshold, Plus additional relevant processing parameters, e.g., Range- and Azimuth Look Bandwidth and LUT applied | Yes | No | <SourceProcParam><ProcessingFacility><ProcessingDate><SoftwareVersion> <ProductID> <ProductLevel> <AzimuthNumberOfLooks><RangeNumberOfLooks>in XML | **Verified at Threshold** |
| **1.6.7** | **Source Data Image Attributes** | Image attributes related to the source data:* Source Data geometry (slant range/ground range)
* Azimuth pixel spacing
* Range pixel spacing
* Azimuth resolution
* Range resolution
* Near range incident angle
* Far range incident angle
 | The geometry of the image footprint expressed in WGS84 in a standardised format (e.g., WKT). | Yes | Yes | <SourceDataImageAttributes>  <SourceDataGeometry> <AzimuthPixelSpacing> <RangePixelSpacing>  <AzimuthResolution><BeamID> <RangeResolution><BeamID> <IncAngleNearRange> <IncAngleFarRange>in XML | **Verified at Threshold****<BeamID> not required for FBM****WKT formatting used for footprint** |
| **1.6.8** | **Sensor Calibration** | Not required. | Sensor calibration parameters are identified in the metadata or can be accessed using details included in the metadata. Ideally this would support machine to machine access | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **1.6.9** | **Performance Indicators** | Provide performance indicators on data intensity noise level (NE0 and/or NE0 and/or NE0 (noise equivalent sigma and/or beta and/or gamma naught)). Provided for each polarization channel when available. Parameter may be expressed as the mean and/or minimum and maximum noise equivalent values of the source data.Values do not need to be estimated individually for each product, but may be estimated once for each acquisition mode, and annotated on all products.  | Provide additional relevant performance indicators (e.g., ENL, PSLR, ISLR etc.) | Yes | No | <PerformanceIndicators><NoiseEquivalentIntensity> <Estimates>in XML | **Verified at Threshold** |
| **1.6.10** | **Source Data Polarimetric Calibration Matrices** | Not Required. | The complex-valued polarimetric distortion matrices with the channel imbalance and the cross-talk applied for the polarimetric calibration. | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **1.6.11** | **Mean Faraday Rotation Angle** | Not Required. | The mean Faraday rotation angle estimated from the polarimetric data and/or from models with reference to the method or paper used to derive the estimate.  | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **1.6.12** | **Ionosphere Indicator** | Not required. | Flag indicating whether the backscatter imagery is “significantly impacted” by the ionosphere (0- false, 1 – true). Significant impact would imply that the ionospheric impact on the backscatter exceeds the radiometric calibration requirement or goal for the imagery. | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **1.7** | **CARD4L Product Attributes** | Sub-section containing information related to the CARD4L product generation procedure and parameters |  |  | <CARD4LProductAttributes>in XML |  |
| **1.7.1** | **Product Data Access** | Processing parameters details of the CARD4L product:* Processing facility
* Processing date
* Software version
* Location from where the CARD4L product can be retrieved, expressed as a URL or DOI.
 | The metadata identifies an online location from where the data can be consistently and reliably retrieved by a computer algorithm without any manual intervention being required. | Yes | No | <DataAccess> <ProcessingFacility> <ProcessingTime> <SoftwareVersion> <Repository>in XML | **Verified at Threshold** |
| **1.7.2** | **Ancillary Data** | Not required. | The metadata identifies the sources of ancillary data used in the generation process, ideally expressed as DOIs.*Note: Ancillary data includes DEMs and any additional data sources used in the generation of the product.* | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **1.7.3** | **Product****Sample Spacing** | CARD4L product processing parameters details:* Pixel (column) spacing
* Line (row) spacing
 | As threshold. | Yes | (Yes) | <ProductSampleSpacing> < ProductColumnSpacing> < ProductRowSpacing>in XML | **Verified at Threshold** |
| **1.7.4** | **Product****Filtering** | Flag if filter has been applied [true/false] Metadata should include* Reference to algorithm
* Input filtering parameters
	+ Type
	+ Window size
	+ Other filter parameters
 | As threshold. | Yes | (Yes) |  <FilterApplied>Flag set to **FALSE**Hence the following are not required as no filter has been applied<WindowSizeCol><WindowSizeLine><OtherParameters ..> | **Verified at Threshold****Flag set to FALSE for all ALOS-2 products thus WindowSizeCol etc are missing** |
| **1.7.5** | **Product Bounding Box** | Two opposite corners of the product file (bounding box) are identified, expressed in the coordinate reference system defined in 1.7.9. | As threshold. | Yes | (Yes) | <ProductBoundingBox>in XML <Latitude> <Longitude> for mosaic products Verified for FBGM product<Northing> <Easting> for scene-based products Verified for ScanSAR products | **Verified at Threshold****Provided for each of the UL and LR corners of the bounding box** |
| **1.7.6** | **Product Image Extent** | The geometry of the image footprint expressed in WGS84, in a standardised format (e.g., WKT). | As threshold. | Yes | (Yes) | <ProductGeographicalExtent> in XML | **Verified at Threshold****WKT formatting used** |
| **1.7.7** | **Product Image Size** | Image attributes of the CARD4L product:* Number of lines
* Number of pixels/line
* File header size (if applicable)
* Number of no-data border pixels (if appl.)
 | As threshold. | Yes | (Yes) | <ProductImageSize> <NumberLines> <NumPixelsPerLine> in XMLNo header or no-data border pixels in the CARD4L products | **Verified at Threshold** |
| **1.7.8** | **Product** **Pixel Coordinate Convention** | Coordinate referring to the Centre, or the Upper Left Corner or the Lower Left Corner of a pixel.  Values are [pixel centre, pixel ULC or pixel LLC] | As threshold. | Yes | (Yes) | <PixelCoordinateConvention> in XML | **Verified at Threshold****(see 1.7.5)** |
| **1.7.9** | **Product Coordinate Reference System** | The metadata lists the map projection (or geographical coordinates, if applicable) that has been used and any relevant parameters required to use of data in that map projection, expressed in a standardised format (e.g., WKT). Indicate EPSG code, if defined for the CRS. | As threshold. | Yes | (Yes) | <CoordinateReferenceSystem> in XML | **Verified at Threshold****Provided both as EPSG and WKT**  |

## Per-Pixel Metadata

| **#** | **Item** | **Threshold** **(Minimum) Requirements** | **Target** **(Desired) Requirements** | **Threshold Self-Assessment** | **Target Self-Assessment** | **Self-Assessment Explanation/ Justification** | **WGCV Comments** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **2.1** | **Metadata Machine Readability** | Metadata is provided in a structure that enables a computer algorithm to be used to consistently and automatically identify and extract each component part for further use. | As threshold, but metadata is formatted in accordance with CARD4L NRB Metadata Specifications, v.5.5 | Yes | Yes | Metadata in separate metadata file in XML format, formatted in accordance with “CARD4L\_METADATA-spec\_NRB-v5.5.5.xlsx” | **Verified at Threshold****As per CARD4L Metadata specification** |
| **2.2** | **Data Mask Image** | Mask image indicating:* Valid data
* Invalid data
* No data

File format specifications/ contents provided in metadata:* Sample Type [Mask]
* Data Format [Raw/GeoTif/COG, …]
* Data Type [Byte/Int/Float, ...]
* Bits per sample
* Byte order
* Bit value representation
 | As threshold, including in addition e.g.* Layover (masked as invalid data in Threshold)
* Radar shadow (masked as invalid data in Threshold)
* Ocean water, etc.
 | Yes | Yes | <DataMask> <FileName>  <SampleType> <DataFormat> <DataType> <BitsPerSample>  <ByteOrder> <BitValues> <ValidData> <InvalidData> <NoData> <Layover> <Shadow> <OceanWater> in XML | **Verified at Threshold as GEOTIFF** |
| **2.3** | **Scattering Area Image** | Not required. | DEM-based scattering area image used for terrain normalisation is provided. File format specifications/ contents provided in metadata:* Sample Type [Scattering Area]
* Data Format
* Data Type
* Byte Order
* Bits per sample
 | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **2.4** | **Local Incident Angle Image** | DEM-based Local Incident angle image is provided.File format specifications/ contents provided in metadata:* Sample Type [Angle]
* Data Format
* Data Type
* Byte Order
* Bits per sample
 | As threshold. | Yes | (Yes) | <LocalIncAngle> <FileName>  <SampleType> <DataFormat> <DataType> <BitsPerSample>  <ByteOrder>in XML | **Verified at Threshold as GEOTIFF** |
| **2.5** | **Ellipsoidal Incident Angle Image** | Not required. | Ellipsoidal incident angle is provided.Indicate which ellipsoidal height was used.File format specifications/ contents provided in metadata:* Sample Type [Angle]
* Data Format
* Data Type
* Byte Order
* Bits per sample
 | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **2.6** | **Noise Power Image** | Not required. | Estimated noise equivalent σo (or 0 or o, as applicable) used for Noise Removal, if applied, for each channel.File format specifications/ contents provided in metadata:* Sample Type [NESZ or NEBZ]
* Data Format
* Data Type
* Byte Order
* Bits per sample
 | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **2.7** | **Gamma-to-****Sigma Ratio Image** | Not required. | Ratio of the integrated area in the Gamma projection over the integrated area in the Sigma projection (ground). Multiplying RTC o by this ratio results in an estimate of RTC o .File format specifications/ contents provided in metadata:* Sample Type [Ratio]
* Data Format
* Data Type
* Byte Order
* Bits per sample
 | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **2.8** | **Acquisition ID Image** | **Note: Required for multi-source product only.** Acquisition ID, or acquisition date, for each pixel is identified. In case of multi-temporal image stacks, use source acquisition ID (i.e., 1.6 acqID values) to list contributing images.In case of Date, data represent day offset to reference observation date [UTC]. Date used as reference (“Day 0”) is provided in the metadata.Pixels not representing a unique date (e.g., pixels averaged in image overlap zones) are flagged with a pre-set pixel value that is provided in the metadata.File format specifications/ contents provided in metadata:* Sample Type [Day, ID]
* Data Format
* Data Type
* Byte Order
* Bits per sample
 | In case of image composites, the sources for each pixel are uniquely identified. | Yes | Yes | <AcquisitionIDImage> <FileName>  <SampleType> <DataFormat> <DataType> <BitsPerSample>  <ByteOrder>in XML | **Verified at Threshold****Provided for the multi-date global mosaic product as GEOTIFF.** **Not required for the single-date ScanSAR products** |
| **2.9** | **Per-pixel DEM** | Not required. | Provide DEM as used during the geometric and radiometric processing of the SAR data, resampled to an exact geometric match in extent and resolution with the CARD4L SAR image product.File format specifications/ contents provided in metadata:* Sample Type [Height]
* Data Format
* Data Type
* Byte Order
* Bits per sample
 | Not required | No | Not provided, not required. | **Not Required at Threshold** |

## Radiometric Terrain Corrected Measurements

| **#** | **Item** | **Threshold** **(Minimum) Requirements** | **Target** **(Desired) Requirements** | **Threshold Self-Assessment** | **Target**  **Self-Assessment** | **Self-Assessment Explanation/ Justification** | **WGCV Comments** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **3.1** | **Backscatter Measurements** | Terrain-flattened Gamma-Nought backscatter coefficient ($ϒ\_{T}^{0}$) is provided for each polarization (e.g., HH, HV, VV, VH).File format specifications/contents provided in metadata:* Measurement Type [Gamma-Nought]
* Backscatter Expression Convention [linear amplitude or linear power\*]
* Polarization [HH/HV/VV/VH]
* Data Format [Raw/GeoTif/COG, …]
* Data Type [Byte/Int/Float, ...]
* Byte order
* Bits per sample

*\*Note: transformation to the logarithm decibel scale is not required or* desired *as this step can be easily completed by the user if necessary.* | As threshold. | Yes | (Yes) | <BackscatterMeasurementData> <BackscatterMeasurement> <BackscatterConvention> <BackscatterConversionEq> <Polarization> <FileName>  <DataFormat> <DataType> <BitsPerSample>  <ByteOrder> in XML | **Verified at Threshold** |
| **3.2** | **Scaling Conversion**  | Indicate equation to convert from pixel linear amplitude/power to logarithmic decibel scale, including, if applicable, associated calibration (dB offset) factor. | As threshold. | Yes | (Yes) | < BackscatterConversionEq> in XML | **Verified at Threshold****(as part of 3.1)** |
| **3.3** | **Noise Removal** | Flag if noise removal\* has been applied (Y/N). Metadata should include reference to algorithm as URL or DOI\* *Note: Thermal noise removal and image border noise removal to remove overall scene noise and scene edge artefacts, respectively.* | As threshold. | Yes | (Yes) |  <NoiseRemoval> | **Verified at Threshold****Flag set to FALSE for all ALOS-2 products** |
| **3.4** | **Radiometric Terrain Correction Algorithms** | Adjustments are made for terrain by modelling the local illuminated reference area using the preferred choice of a traceable published peer reviewed algorithm to produce a radiometrically terrain corrected (RTC) Gamma-Nought ($ϒ\_{T}^{0}$). Metadata references:* a citable peer-reviewed algorithm
* technical documentation regarding the implementation of that algorithm expressed as URLs or DOIs
* the sources of ancillary data used to make corrections.

*Note 1: Examples of technical* *documentation include an Algorithm, Theoretical Basis Document, product user guide, etc.* | Require resolution of DEM better than the output product resolution when applying terrain corrections.  | Yes | No | <RadiometricTerrainCorrections> <RTCAlgorithm> | **Verified at Threshold** |
| **3.5** | **Radiometric Accuracy** | Not required. | Uncertainty (e.g., bounds on *ϒ*0) information is provided as document referenced as URL or DOI. SI traceability is achieved. | Not required | No | Not provided, not required. | **Not Required at Threshold** |

## Geometric Terrain Corrections

| **#** | **Item** | **Threshold** **(Minimum) Requirements** | **Target** **(Desired) Requirements** | **Threshold** **Self-Assessment** | **Target** **Self-Assessment** | **Self-Assessment Explanation/ Justification** | **WGCV Comments** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **4.1** | **Geometric Correction Algorithms** | Not required | Metadata references:* A metadata citable peer-reviewed algorithm,
* Technical documentation regarding the implementation of that algorithm expressed as URLs or DOIs
* The sources of ancillary data used to make corrections.
* Resampling method used for geometric processing of the source data.

*Note 1: Examples of technical**documentation can include e.g., an Algorithm, Theoretical Basis Document, a Product User Guide.* | Not required | No | Not provided, not required. | **Not Required at Threshold** |
| **4.2** | **Digital Elevation****Model** | 1. During ortho-rectification, the data provider shall use the same DEM that was used for the radiometric terrain flattening to ensure consistency of the data stack.
2. Provide reference to Digital Elevation Model used for Geometric Terrain Correction.
3. Provide reference to Earth Gravitational Model (EGM) used for Geometric Correction
 | 1. A DEM with comparable or better resolution to the resolution of the output CARD4L product shall be used.
2. Resampling method used for preparation of the DEM.
3. Method used for resampling of EGM.
4. As threshold.
 | Yes | No | <DigitalElevationModel> <DEMReference> <EGMReference> | **Verified at Threshold** |
| **4.3** | **Geometric Accuracy** | An estimate of the absolute localisation error is provided as bias and standard deviation, provided in slant range/azimuth, or Northing/Easting. *Note 1: Can be obtained from corner reflector measurements or mission calibration/ validation results.* *Note 2: Accurate geolocation is a prerequisite to radar processing to correct for terrain. To enable interoperability between radar sensors, absolute accuracy is required.*  | Output product sub-sample accuracy should be less than or equal to 0.1-pixel radial root mean square error (rRMSE).Provide documentation of estimate of absolute localisation error as DOI or URL. | Yes | No | <GeoCorrAccuracy> <NorthernSTDev> <EasternSTDev> <NorthernBias> <EasternBias> in XML | **Verified at Threshold** |
| **4.4** | **Gridding Convention**  | A consistent gridding/sampling frame is used. The origin is chosen to minimise any need for subsequent resampling between multiple products (be they from the same or different providers). This is typically accomplished via a “snap to grid” in relation to the most proximate grid tile in a global system.\*\*\*\* If a product hierarchy of resolutions exists (or is planned), the multiple resolutions should nest within each other (e.g., 12.5m, 25m, 50m, 100m, etc.), and not be disjoint.  | Provide DOI or URL to gridding convention used.When multiple providers share a common map projection, providers are encouraged to standardise the origins of their products among each other.In the case of UTM/UPS coordinates, the upper left corner coordinates should be set to an integer multiple of sample intervals from a 100 km by 100 km grid tile of the Military Grid Reference System's 100k coordinates (“snap to grid”). For products presented in geographic coordinates (latitude and longitude), the origin should be set to an integer multiple of samples in relation to the closest integer degree. | Yes | No | <GriddingConvention> in XML | **Verified at Threshold** |

# Summary Self-Assessment Table – JAXA ALOS-2 PALSAR-2

|  |  | **Threshold** | **Target** |
| --- | --- | --- | --- |
| **1** | **General Metadata** |  |  |
| 1.1 | Traceability | Not required |  |
| 1.2 | Metadata Machine Readability | YES |  |
| 1.3 | Product type | YES |  |
| 1.4 | Document Identifier | YES |  |
| 1.5 | Data Collection Time | YES |  |
| **1.6** | **Source Data Attributes** |  |  |
| 1.6.1 | Source Data Access | YES |  |
| 1.6.2 | Instrument | YES |  |
| 1.6.3 | Source Data Acquisition Time | YES |  |
| 1.6.4 | Source Data Acquisition Parameters | YES |  |
| 1.6.5 | Source Data Orbit Information | YES |  |
| 1.6.6 | Source Data Processing Information | YES |  |
| 1.6.7 | Source Data Image Attributes | YES |  |
| 1.6.8 | Sensor Calibration | Not required |  |
| 1.6.9 | Performance Indicators | YES |  |
| 1.6.10 | Source Data Polarimetric Calibration Matrices | Not required |  |
| 1.6.11 | Mean Faraday Rotation Angle | Not required |  |
| 1.6.12 | Ionosphere Indicator | Not required |  |
| **1.7** | **CARD4L Product Attributes** |  |  |
| 1.7.1 | Product Data Access | YES |  |
| 1.7.2 | Ancillary Data | Not required |  |
| 1.7.3 | Product Sample Spacing | YES |  |
| 1.7.4 | Product Filtering | YES |  |
| 1.7.5 | Product Bounding Box | YES |  |
| 1.7.6 | Product Image Extent | YES |  |
| 1.7.7 | Product Image Size | YES |  |
| 1.7.8 | Product Pixel Coordinate Convention | YES |  |
| 1.7.9 | Product Coordinate Reference System | YES |  |
| **2** | **Per-Pixel Metadata** |  |  |
| 2.1 | Metadata Machine Readability | YES | YES |
| 2.2 | Data Mask Image | YES |  |
| 2.3 | Scattering Area Image | Not required |  |
| 2.4 | Local Incident Angle Image | YES |  |
| 2.5 | Ellipsoidal Incident Angle Image | Not required |  |
| 2.6 | Noise Power Image | Not required |  |
| 2.7 | Gamma-to-Sigma Ratio Image | Not required |  |
| 2.8 | Acquisition ID Image | YES |  |
| 2.9 | Per-Pixel DEM | Not required |  |
| **3** | **Radiometric Terrain Corrected Measurements** |  |  |
| 3.1 | Backscatter Measurements | YES |  |
| 3.2 | Scaling Conversion | YES |  |
| 3.3 | Noise Removal | YES |  |
| 3.4 | Radiometric Terrain Correction Algorithms | YES |  |
| 3.5 | Radiometric Accuracy | Not required |  |
| **4** | **Geometric Terrain Corrections** |  |  |
| 4.1 | Geometric Correction Algorithms | Not required |  |
| 4.2 | Digital Elevation Model | YES |  |
| 4.3 | Geometric Accuracy | YES |  |
| 4.4 | Gridding Convention | YES |  |